



**Summary Report**  
of the  
**Norway Dover**  
**Drainage District**  
Mapping and Benefits  
Assessment  
August 18, 2020



Nielsen Madsen & Barber S.C.  
Civil Engineers and Land Surveyors



## **INTRODUCTION**

The following report was prepared by Nielsen Madsen & Barber, S.C. (NMB), at the request of the Racine County Board of Drainage Commissioners on behalf of the Norway Dover Drainage District hereafter referred to as the “District”, to update the existing mapping and benefits of the parcels served by the District. The benefits were calculated using the method approved by the Department of Agriculture, Trade and Consumer Protection (DATCP) which is described in Chapter ATCP 48 of the Wisconsin Administrative Code.

## **NORWAY DOVER DRAINAGE DISTRICT**

The District encompasses parts of six municipalities within Racine County: the Town of Waterford, the Village of Waterford, the Village of Rochester, the Town of Raymond, the Town of Dover and the Town of Norway. The District contains 31,358 acres of land consisting of 4,747 parcels and road right-of-way. The Town of Waterford contains 334 acres and 37 parcels within the District. The Village of Waterford contains 54 acres and 5 parcels within the District. The Village of Rochester contains 891 acres and 192 parcels within the District. The Town of Raymond contains 1,318 acres and 147 parcels within the District. The Town of Dover contains 8,347 acres and 382 parcels within the District. The Town of Norway contains 20,414 acres and 3,982 parcels within the District. The land within the District is predominantly agricultural with areas of low, medium and high-density residential development as well as isolated commercial and manufacturing parcels.

The drainage system within the District includes one branch tile and 23 branch ditches all of which drain to the Wind Lake Canal. The branch ditches, and that portion of Wind Lake Canal that is within the District, add up to a total of 260,717 linear feet (49.38 miles) of drainage way. The single branch tile has a total length of 5,448 linear feet (1.03 miles).

The District is obligated, under Section 88.63 of the State Statutes, to maintain and repair District facilities. The cost of maintenance and repair is assessed based upon the benefits each parcel receives per Section 88.23 of the State Statutes. Property owners are assigned, in part, a proportionate “charge” based on the amount of runoff “generated” by their property.

The amount of runoff a property generates depends on the percent of impervious surface, ground cover / condition, topography and soil type. The total impervious area and percentage of the parcel thereof are the most important factors in generating runoff. Impervious surfaces are defined as solid or semi-solid surfaces that prevent rainfall from infiltrating into the ground thus creating excess “runoff”. Runoff from lands with a high percentage of impervious surfaces is generally in greater quantities and at higher velocities than undeveloped (i.e. agricultural, forest, swamp) lands and typically includes increased pollutant loading.

While undeveloped properties typically generate a fraction of the runoff as compared to developed properties of comparable size, such undeveloped or agricultural

properties contribute to the District-wide storm water runoff that must be managed. The undeveloped property in the District amounts to approximately 75.3% of the total area and is scattered throughout the District.

The District is a separate entity from the six municipalities within its boundary. Rights-of-way owned by the Federal Government, State of Wisconsin and local municipalities make up 0.19%, 0.86% and 1.89%, respectively, of the land within the District boundary. In accordance with ATCP 48.02(5)(b) the District assesses each municipality (including Racine County) directly for their respective road rights-of-way. The County will be assessed for their rights-of-way. However, in accordance with ATCP 48.02(5)(a), lands owned by the State of Wisconsin cannot be assessed unless the land is being used for agricultural purposes. Therefore, WisDOT will not be assessed for their road rights-of-way within the District.

There are several parcels within the District whose boundary extends to the centerline of the adjacent roadway. These parcel owners will be assessed for their entire parcel area, including what extends into the public roadway.

The Wisconsin Department of Natural Resources (WDNR) owns 458 acres of land within the District. The vast majority of this land is within the Town of Norway. The remainder of this land is located in the Village of Rochester and Town of Dover. As with WisDOT, any lands owned by the WDNR are exempt from this assessment unless the land is being leased for farming. There are no parcels owned by the WDNR that appear to be farmed.

## **PARCEL DATABASE**

A database was created which included all parcels within the District boundary. This database was built upon the existing infrastructure developed and maintained by Racine County.

As part of Racine County's Real Estate Description department, the Real Property Lister Division maintains the real estate tax roll for all municipalities within Racine County with the exception of the City of Racine. The County-maintained data applicable to the District's database includes the owner's name, tax key ID number, parcel size, mailing address, land use classification codes and acreages. The "land use" portion of the data originates from the assessors of the municipalities and is of particular importance to the District's database in that it contains a breakdown (by area) of each land use type for each individual parcel.

There are 16 land use classifications within the District. They are as follows:

- (1) High-Density Residential less than 1/3 Acre (G1)
- (2) Medium-Density Residential 1/3 Acre to 1 Acre (G1)
- (3) Low-Density Residential greater than 1 Acre (G1)
- (4) Commercial (G2)
- (5) Manufacturing (G3)
- (6) Agricultural (G4)

- (7) Swamp Land (G5)
- (8) Production Forest Land (G6)
- (9) Agricultural – Improved (G7)
- (10) State (X2)
- (11) County (X3)
- (12) Local / Institutional (X4)
- (13) Agricultural Forest (5M)
- (14) Woodland (W6)
- (15) Managed Forest, Closed (W8)
- (16) Road Right of Way (R/W)

The District also contains several parcels of land with common owners, listed as Condominium, Common Element, Common Area or Outlot. The assessments for these parcels were split equally among the common ownership.

A breakdown by land use of all parcels within the District is shown is as follows:

### Breakdown of Land Use Classification by Area

District-wide Land Use Classification	Land Use Classification Code	Total Area (Acres)	Percentage of Total Area
Residential less than 1/3 Acre (High-Density)	G1	83.45	0.27%
Residential 1/3 Acre to 1 Acre (Medium-Density)	G1	988.30	3.15%
Residential greater than 1 Acre (Low-Density)	G1	3977.80	12.69%
Commercial	G2	466.94	1.49%
Manufacturing	G3	29.21	0.09%
Agricultural	G4	19040.74	60.72%
Swamp/Wasteland	G5	3,562.14	11.36%
Forest Land	5M / G6 / W6 / W8	1,317.99	4.20%
Agricultural - Improved	G7	334.58	1.07%
State	X2	456.94	1.46%
County	X3	73.27	0.23%
Local / Institutional	X4	377.32	1.20%
Common Land	C/E, C/A, Condo, Outlot	26.10	0.08%
Local Road Right of Way	R/W	591.78	1.89%
State Road Right of Way	-	268.74	0.86%
US Road Right of Way	-	58.36	0.19%
District Corridor	-	271.76	0.87%
Undefined / Water Bodies	-	1,190.47	3.80%
	<b>Total</b>	<b>31,357.52</b>	

## **EXISTING BENIFITS ANALYSIS METHODOLOGY**

The District has an existing methodology in place to determine the benefits for each parcel. This analysis was based on parcel runoff which is the product of two factors: parcel area (in acres) and the runoff coefficient as a function of underlying soil composition.

## **PROPOSED BENEFITS ANALYSIS METHODOLOGY**

NMB is proposing to use the same basic method as previous assessments, in which benefit points were determined by parcel size and runoff coefficient, for determining the total benefit points for each parcel. For assessment purposes, the individually calculated runoff amounts were used to determine the total “benefit points” for each parcel. The District has historically assigned a minimum number of benefit points for smaller residential and commercial parcels. These parcels typically contain more improvements and run the risk of suffering higher damages should the District system not be properly maintained. To determine the assessment rate for each parcel, the overall District assessment was divided by the total benefit points for all parcels producing a cost per benefit point. This cost was then multiplied by the total benefit points for each parcel, producing the overall assessment. This method can be utilized uniformly for all developed, undeveloped and agricultural parcels. This method also allows for ease of future benefits analysis updating since changes in the runoff coefficient and parcel size are easily calculated.

The runoff coefficient ranges from 0 to 1 and is the ratio of the amount of rainfall that is not absorbed by the surface to the total amount of rainfall during any given storm event. Parcels which have a larger proportion of “impervious” surface (streets, rooftops, sidewalks, patios, parking lots, driveways and other similar surfaces) will have a larger runoff coefficient than parcels which have a larger proportion of “pervious” surface (lawn, landscaping, agricultural lands and other similar surfaces).

NMB believes that the use of runoff coefficients satisfies the consideration requirements of ATCP 48.08(1)(c) through 48.08(1)(f). These considerations are as follows:

- 48.08(1)(c) – Consider the amount of drainage required by or provided to the assessed land.
- 48.08(1)(d) – Consider the thoroughness and reliability of drainage provided.
- 48.08(1)(e) – Consider the amount and frequency of flooding on the assessed land.
- 48.01(1)(f) – Consider the difficulty of draining the assessed land.

NMB is proposing to use runoff coefficient values as specified by Procedure 13-10-5 of the Wisconsin Department of Transportation’s Facilities Development Manual (FDM). The FDM has standard values for runoff coefficients based on land use, hydrologic soil group and land slope range. The vast majority of the land uses fall under one of these standard runoff coefficient values. However, the FDM does not have standard runoff coefficients for forest, agricultural-improved or swamp /

wasteland. NMB used a commonly accepted average coefficient (0.13) for forested land and used the same value for agricultural-improved as residential greater than 1 acre (0.25). Swamp / wasteland was neglected from the assessment and assigned a runoff coefficient of 0.00 per ATCP 48.06(4). The District corridor was neglected from the assessment per ATCP 48.08(3)(a). The FDM presents options for low intensity and high intensity design storm events. Low intensity design storm events have a 2 to 10 year design recurrence. High intensity design storm events have a 25 to 100 year design recurrence. Since the typical design storm for a study of this nature is a 10 year event, the low intensity option was used for the analysis. Current topographic data for the entire District was unavailable for this analysis. Therefore, an average slope range of 2% to 6% was assumed for the entire District.

Runoff coefficients for the remaining land uses within the District were generated based on individual calculations. This method was employed due to the land uses (and individual parcels) containing substantially different characteristics and levels of imperviousness. The land uses for which these individual runoff coefficients were calculated are commercial, institutional, municipal (County) and the properties with common ownership (condominium, common element, common area and outlots). These parcel specific coefficients were calculated based on percentages of pervious and impervious surface, agricultural use, road right-of-way, forest land and water surface. Impervious surfaces were assigned a runoff coefficient of 0.95 and pervious surfaces were assigned a runoff coefficient of 0.17. Water surfaces were treated the same as swamp / wasteland since water bodies accept runoff rather than generate it.

A breakdown of the District land uses by area and percentage as well as the standard runoff coefficients which were used is as follows:

### Land Use Classifications for which Standard Runoff Coefficients were used

District-wide Land Use Classification	Land Use Classification Code	Total Area (Acres)	Percentage of Total Area	Runoff Coefficient
Residential less than 1/3 Acre (High-Density)	G1	83.45	0.27%	0.51
Residential 1/3 Acre to 1 Acre (Medium-Density)	G1	988.30	3.15%	0.33
Residential greater than 1 Acre (Low-Density)	G1	3977.80	12.69%	0.25
Agricultural	G4	19,040.74	60.74%	0.19
Swamp/Wasteland	G5	3,562.14	11.36%	0.00
Forest Land	G6 / 5M / W6 / W8	1,317.99	4.20%	0.13
Agricultural - Improved	G7	334.58	1.20%	0.25
Local Road Right of Way	R/W	597.78	1.89%	0.61
<b>Total</b>		<b>29,902.78</b>	<b>95.36%</b>	

A breakdown of the District land uses by area and percentage for the individually calculated runoff coefficients is as follows:

**Land Use Classifications for which Individual Runoff Coefficients were Calculated**

District-wide Land Use Classification	Land Use Classification Code	Total Area (Acres)	Percentage of Total Area
Commercial	G2	466.94	1.49%
Common Land	C/E, C/A Condo, Outlot	26.10	0.08%
County	X3	73.27	0.23%
Institutional	X4	377.32	1.20%
<b>Total</b>		<b>943.63</b>	<b>3.01%</b>

**TOWN OF NORWAY SANITARY DISTRICT NO. 1 ASSESSMENT ANALYSIS**

In addition to the runoff produced by lands within the District, the Town of Norway Sanitary District No. 1 (NSD) has a sanitary sewer treatment plant which discharges its treated effluent into the Waubeesee Outlet Channel. Since NSD utilizes District facilities to convey its outfall discharge it is appropriate that they be included in the benefits analysis and receive an appropriate assessment.

In order to calculate an appropriate assessment charge for NSD, their annual discharge into District maintained facilities was compared with the overall runoff from the lands within the District. Annual treatment plant discharges from 2010 to 2019 were provided to NMB by NSD in a transmittal dated July 22, 2020. This information can be found in Appendix “B” of this report. The average annual outflow during the last ten years is 331.25 million gallons.

The average annual precipitation for the District was determined using data from the U.S. Department of Commerce National Oceanic and Atmospheric Administration (NOAA) which maintains climate data including annual precipitation from stations across the country. One of NOAA’s stations is located in the Village of Union Grove, located approximately fifteen miles south-east of the ELSUD facility. Annual precipitation data from 1989 to 2019 for the Union Grove station was used to determine an average annual precipitation for the District. The resulting 30-year average annual precipitation was 34.72 inches

The District is 31,358 acres in area but only 26,334 acres produces runoff. The 5,024 acres which do not produce runoff includes water bodies, District corridors and wetlands. The 26,334 acres which produces runoff includes State and Federal rights-of-way which, although are not being assessed, still produce runoff. The average runoff coefficient for the 26,334 acres which produce runoff is 0.217. The product of the area, the annual rainfall and the average runoff coefficient is the total annual District runoff. Per this calculation procedure, the annual District runoff is

5,415.15 million gallons. When the annual District runoff is added to the 331.25 million gallons of outflow from NSD the total annual flow within District facilities is 5,746.40 gallons. The average annual outflow from NSD is 5.76% of the total flow through the District facilities. Therefore, the Town of Norway Sanitary District No. 1 should be responsible for 5.76% of the overall Norway-Dover Drainage District assessment.



# APPENDIX A

## WISDOT FDM RATIONAL COEFFICIENT TABLE

Facilities Development Manual

Procedure 13-10-5

**Detail A - Runoff Coefficients (C), Rational Formula**

Land Use	Percent Impervious Area	Hydrologic Soil Group											
		A			B			C			D		
		Slope Range Percent			Slope Range Percent			Slope Range Percent			Slope Range Percent		
		0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over
Industrial	90	0.67	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.70
		0.65	0.85	0.86	0.85	0.86	0.86	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	95	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
		0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.89	0.89	0.90
High Density Residential	60	0.47	0.49	0.50	0.48	0.50	0.52	0.49	0.51	0.54	0.51	0.53	0.56
		0.58	0.60	0.61	0.59	0.61	0.64	0.60	0.62	0.66	0.62	0.64	0.69
Med. Density Residential	30	0.25	0.28	0.31	0.27	0.30	0.35	0.30	0.33	0.38	0.33	0.36	0.42
		0.33	0.37	0.40	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
Low Density Residential	15	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.28	0.35
		0.22	0.26	0.29	0.24	0.28	0.34	0.28	0.32	0.40	0.31	0.35	0.46
Agriculture	5	0.08	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
		0.14	0.18	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Open Space	2	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
		0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Freeways & Expressways	70	0.57	0.59	0.60	0.58	0.60	0.61	0.59	0.61	0.63	0.60	0.62	0.64
		0.70	0.71	0.72	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78

**Detail B - Runoff Coefficients for Specific Land Use**

Land Use	Hydrologic Soil Group											
	A			B			C			D		
	Slope Range Percent			Slope Range Percent			Slope Range Percent			Slope Range Percent		
	0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over
Row Crops	.08	.16	.22	.12	.20	.27	.15	.24	.33	.19	.28	.38
	.22	.30	.38	.26	.34	.44	.30	.37	.50	.34	.41	.56
Median Stripurf	.19	.20	.24	.19	.22	.26	.20	.23	.30	.20	.25	.30
	.24	.26	.30	.25	.28	.33	.26	.30	.37	.27	.32	.40
Side Slopeturf			.25			.27			.28			.30
			.32			.34			.36			.38
<b>PAVEMENT</b>												
Asphalt	.70 - .95											
Concrete	.80 - .95											
Brick	.70 - .80											
Drives, Walks	.75 - .85											
Roofs	.75 - .95											
Gravel Roads Shoulders	.40 - .60											

NOTE: The lower C values in each range should be used with the relatively low intensities associated with 2 to 10 year design recurrence intervals whereas the higher C values should be used for intensities associated with the longer 25 to 100 year deign recurrence intervals.

Date August 8, 1997

Figure 2

1 of 1

**APPENDIX B**  
**OUTFLOW DATA RECEIVED FROM TOWN OF NORWAY SANITARY DISTRICT**  
**NO. 1**

**TOWN OF NORWAY SANITARY DISTRICT #1**

6419 Heg Park Road, Wind Lake, WI 53185

Phone: Office 262 895-6400 Plant 262 895-2400 Fax 262 895-2480

# Annual Flow History

**Effluent**

2001	341.3744 M.G.
2002	287.8966 M.G.
2003	248.6569 M.G.
2004	332.5351 M.G.
2005	278.7019 M.G.
2006	424.3857 M.G.
2007	369.5868 M.G.
2008	423.8903 M.G.
2009	369.1925 M.G.
2010	365.9667 M.G.
2011	314.5025 M.G.
2012	244.3105 M.G.
2013	330.7775 M.G.
2014	328.5037 M.G.
2015	287.1085 M.G.
2016	289.5126 M.G.
2017	349.4040 M.G.
2018	369.5415 M.G.
2019	432.8356 M.G.

**Average Annual Discharge ----- 336.2465 M.G.**  
**Average Discharged-----921,223 Gallons Per Day**  
**Water discharged since plant upgrade – 6,388,683,300 Gallons**