Stormwater Quality Assessment

Village of Belleville, Wisconsin

MSA Project No. 00372021

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1.0 EXECUTIVE SUMMARY

This report documents the findings of a study conducted to determine the total suspended solids (TSS) reduction achieved by the Village of Belleville's existing storm infrastructure and street sweeping program, and identify alternatives for achieving additional TSS reductions. Communities with a municipal separate storm sewer system (MS4) regulated by a Municipal Wisconsin Pollutant Discharge Elimination System (WPDES) Permit are required to achieve a 20% reduction in total suspended solids in runoff that enters waters of the state as compared to no controls by 2008, and a 40% reduction by March 10, 2013. It has been suggested by the WDNR that communities located within the Rock River Basin TMDL area should also meet these requirements. The Village of Belleville is not a WPDES regulated MS4, nor is it located within the Rock River TMDL; therefore it is not required to meet either of these standards at this time. However, as the Village is spending millions of dollars to dredge and restore Lake Belle View, it is in their best interest to keep as much sediment as possible from reaching the lake, both to protect their investment and to preserve the economic and social benefits of being lake community.

Note that the water quality modeling done for this report was performed to most accurately represent the *actual* amount of suspended solids generated within Village limits and attenuated by Best Management Practices (BMPs). Under a municipal WPDES permit, some municipal areas are exempt from coverage, and credit is not allowed for pollutant attenuation achieved by some BMPs. Thus, if the Village becomes regulated by a municipal WPDES permit in the future, the water quality calculations should be revised to conform to WDNR protocol for regulated WPDES communities.

The findings of this study are taken from a detailed water quality model of the Village created using P8 Version 3.4 software. The model was used to evaluate the Village's TSS load and the TSS reduction provided by 16 existing stormwater management structural BMPs under current and possible future retrofitted conditions. Additionally, a WinSLAMM Version 9.4 model was used to evaluate the Village's current street sweeping program. This study found the following:

Village of Belleville
Total Suspended Solids Reduction Performance
Existing and Possible Future Retrofit Conditions

	Existing (tons/yr)	**Retrofit Scenario 1[2]**	**Retrofit Scenario 2[3]**
No Controls Annual Load	87.8 tons/yr	87.8 tons/yr	87.8 tons/yr
TSS Removed by Street Sweeping[1]	1.6 tons/yr	1.4 tons/yr	1.2 tons/yr
Additional TSS Removed by Structural BMPs	8.4 tons/yr	20.3 tons/yr	25.2 tons/yr
Total TSS Removed	10.0 tons/yr	21.7 tons/yr	26.4 tons/yr
TSS Reduction Rate	**11.3%**	**24.7%**	**30.1%**

1. Per WDNR direction, no TSS removal by street sweeping in areas served by a more effective structure BMP was counted.
2. Retrofit nine existing dry ponds and three existing wet ponds into wet ponds with a three foot deep permanent pool.
3. Retrofit scenario two, plus re-routing of 34.7-acre watershed north of Fifth Avenue through Federal Industries Pond.

2.0 INTRODUCTION

The Village of Belleville received a UNPS grant to evaluate and improve various aspects of their stormwater infrastructure, programs, financing, education and regulations. Included in the scope of activities covered by the grant is an evaluation of the effectiveness of the Village's existing infrastructure and street sweeping program for removing TSS in runoff entering waters of the state, as compared to no controls, and evaluating alternatives for increasing TSS removal.

The Village of Belleville is not currently regulated by a Phase II WPDES municipal permit under NR216.07(6)(b) and NR151.13. If, however, the Village were required to obtain and Phase II WPDES municipal permit at some future time, then it will be required to achieve a 40% reduction in total suspended solids in runoff that enters waters of the state, as compared to no controls by March 10, 2013. It has been suggested by the WDNR that communities located within the Rock River Basin TMDL area should also meet these requirements. The Village of Belleville is not a WPDES regulated MS4, nor is it located within the Rock River TMDL; therefore it is not required to meet either of these standards at this time. However, as the Village is right now spending millions of dollars to dredge and restore Lake Belle View, it is in their best interest to keep as much sediment as possible from reaching the lake, both to protect their investment and to preserve the economic and social benefits of being lake community.

Note that this study evaluated the *actual* TSS load generated within Village limits and attenuated by Village infrastructure and sweeping. If the Village were to fall under WPDES Phase II regulation, the model would have to be re-run to evaluate the regulated area only, since only certain areas within the Village would fall under this regulation, and only certain BMPs would be eligible for credit towards meeting this regulation.

3.0 WATER QUALITY MODELING

The findings of this study are taken from a detailed P8 Urban Catchment Model Version 3.4 of the Village's stormwater management system. P8 is a WDNR approved model recommended for use in determining TSS removal rates from stormwater management practices for assessment of compliance with WPDES requirements (see notation NR216.07(6)(b) – "The department believes that computer modeling is the most efficient and cost effective method for calculating pollutant loads. Pollutant loading models such as SLAMM, P8 or equivalent methodology may be used to evaluate the efficiency of the design in reducing total suspended solids"). 'P8' abbreviates "Program for Predicting Polluting Particle Passage Through Pits, Puddles, and Ponds."

The P8 model predicts the generation and transport of pollutants in stormwater runoff from urban watersheds. Continuous water-balance and mass-balance calculations driven by hourly rainfall and daily air temperature time-series data are performed on the stormwater management system. P8 was initially calibrated to runoff quality and particle settling velocity data collected under the EPA's Nationwide Urban Runoff Program. Subsequent calibrations were developed for Wisconsin urban watersheds. Input data required by P8 for each model application describe watersheds, devices (BMPs), sediment particle classes, and water quality components.

TSS reduction achieved through street sweeping was estimated using the WinSLAMM model. 'WinSLAMM' abbreviates "Source Loading and Management Model [for Windows]" Like P8, WinSLAMM is a WDNR approved model recommended for use in determining TSS removal rates from

stormwater management practices. The reason WinSLAMM was used for modeling of street sweeping practices is that it is much more flexible in its application of different types (efficiencies) of street sweepers and allows the implementation of a parking ban during periods of sweeping. The street sweeping efficiency predicted by WinSLAMM was applied as a percentage reduction to the TSS loads predicted by P8 to watersheds not treated by a more efficient structural BMP (detention pond).

3.1 CLIMATIC DATA

P8 simulations are driven by hourly rainfall and mean daily air temperature. The WDNR requires the use of an 'average year's' data for rainfall and temperature in all water quality assessments. The WDNR has determined that the climate record for the Madison gauging station in 1981 represents the best available data representing a 'typical year'. The WDNR and the P8 author have provided specific guidance in the application of this data; specifically, the model should be solved from September 1, 1980 through September 30, 1981, however, data should only be kept from October 1, 1980 onwards (this allows the model to normalize prior to actual simulations).

It has been determined by the USGS and WDNR that a single year's simulation does not fairly represent the impact of street sweeping. Accordingly, a second rainfall record consisting of five consecutive years' data must be used in the WinSLAMM street sweeping analysis. For Belleville, the rainfall gauge was again the Madison rainfall gauge. The model was solved from January 2, 1990 to December 31, 1984, with the "winter season range" set from December 2 through March 12. The winter season range is the period of time over which rainfall record is excluded each year; the initial street dirt loading at the end of the winter season is then automatically calculated based on USGS measured street dirt load from several types of streets.

3.2 MODEL POLLUTANT LOADINGS

Pollutant loading files required by the P8 model include a *Particle Class File*.

- The *Particle Class File* allows the P8 model to determine the weight and size distribution of particulate solids loadings in runoff. Particle classes are defined according to land use types and reflect factors controlling watershed export of TSS particles. For impervious areas the particle class relates accumulation and wash off parameters; for pervious surfaces the particle class relates fixed runoff concentrations. Particle class affects street-sweeping efficiency and effectiveness of structural management practices.

Pollutant loading files required by the WinSLAMM model include a *Pollutant Probability Distribution File, Runoff Coefficient File, Particulate Solids Concentration File, Particulate Residue Reduction File, and a Street Delivery Parameter File.*

- The *Pollutant Probability Distribution File* describes the pollutant loading from different source areas (land use types). This data is based upon actual pollutant loading collected from the study area or region.

- The *Runoff Coefficient File* describes parameters specific to different source areas (land use types) that determine the runoff volumes resulting from rainfall events of different depth.

- The *Particulate Solids Concentration File* contains parameters allowing the WinSLAMM model to determine the weight of particulate solids loadings resulting from runoff events of different volumes. The particulate solids concentration file includes data measured by the USGS from source areas including residential, commercial, and industrial rooftops; residential lawns; residential driveways; residential, commercial and industrial streets; commercial and industrial parking lots; freeways; and undeveloped areas.

- The *Particulate Residue Reduction File* describes the fraction of total particulates that remains within the drainage system after rainfall events and so do not reach the system outfall.

- The *Street Delivery Parameter File* contains data describing the fraction of total particulates that do not reach the outfall during a rain event, for different rain depths and street textures.

3.3 MODEL PARAMETER FILES

The following model parameter files were entered into the P8 models for evaluation of the Village of Belleville's stormwater management system.

Particle Class File - ***NURP50.par***

The following model parameter files were entered into the WinSLAMM model for evaluation of the Village of Belleville's street sweeping practices.

Rainfall Files -	***WisReg - Madison WI 1981.RAN***
	WisReg - MadisonFive Year Rainfall.RAN
Pollutant Probability Distribution File -	***WI_GEO01.ppd***
Runoff Coefficient File -	***WI_SL06 Dec06.rsv***
Particulate Solids Concentration File -	***Wi_avg01.psc***
Particulate Residue Delivery File -	***Wi_dlv01.prr***
Street Delivery File:	
Residential/Other -	***WI_Res and Other Urban Dec06.std***
Institutional/Commercial/Industrial -	***WI_Com Inst Indust Dec06.std***
Freeway -	***Freeway Dec06.std***

3.4 WATERSHEDS, LAND USES, SOURCE AREAS, AND SOIL TYPES.

Watersheds are the sources of runoff and TSS particles simulated by the programs.

For P8, the necessary input data includes drainage area, impervious fraction, depression storage, SCS Runoff Curve Number (RCN) for pervious areas, percent of impervious area

served by street sweepers, and street sweeping frequency. The model simulates runoff and TSS generation from pervious and impervious surfaces; although impervious surfaces produce substantially more TSS and runoff than do pervious surfaces. Values for depression storage were set to standard default values in the model.

P8 Input data was developed for 133 watersheds using Village GIS data. Each watershed has a unique set of characteristics which translates either directly or implicitly into the input parameters for the models. These five characteristics include:

- The device into which runoff is routed in the P8 model
- The hydrologic soil group (HSG) of the underlying soil
- Whether the watershed lies within or outside the Village
- The land use and/or impervious area use within the watershed
- The acreage of the watershed

Table B-1 titled 'Model Land Use' in Appendix B lists these watersheds and their characteristics.

For WinSLAMM, the necessary input data includes *land uses* and *source areas*. WinSLAMM is capable of modeling only one watershed at a time containing up to six discrete *land uses*; residential, institutional, commercial, industrial, freeway, and other urban areas. Each land use contains specific runoff and pollutant *source areas* including roofs, paved parking/storage areas, unpaved parking/storage areas, playground, driveways, sidewalks/walks, street areas, landscaped areas (small and large), undeveloped areas, isolated/water body area, other pervious areas and impervious areas (directly connected and indirectly connected. Each source area is further categorized by *soil type*, including sand, silt, and clay soil types. It is necessary to manually enter surface area (acres) for each source area within each land use within the watershed to be evaluated.

3.5 WATER QUALITY MANAGEMENT PRACTICES

Devices are structural elements of the stormwater drainage and management system that provide collection, storage, and/or treatment of stormwater. Devices include dry and wet storage basins, infiltration basins, swales, buffers, pipes, and flow splitters. All devices modeled by this study were treated as 'general' devices and were defined within the model by a user-defined rating curve that correlated water depth to volume of storage and discharge rate out of the device. Note that to accurately model wet ponds as "general devices," the P8 model was started 13 months (rather than one month) before the first "keep date", to allow time for the permanent pool to fill with water and function as a wet pond (per Panuska, personal communication).

P8 modeling of existing conditions encompassed 16 constructed stormwater devices, including wet ponds, dry ponds, and infiltration devices, within the Village's stormwater drainage system. For the reasons discussed in section 4.5.2 of this report, however, TSS reductions achieved by dry ponds were not counted.

Device geometry was taken from one of three primary sources:

- the Village GIS database including detailed 2-foot contour interval topographic maps

and aerial photos
- construction plans from various development and reconstruction projects, and
- device outlet structure information taken from field inspections conducted by MSA in 2010.

The full geometric configuration of all 16 devices is fully described in a HydroCAD hydrologic model of the Village's stormwater management system that was developed independently of this study and is not documented here.

WinSLAMM allows for assignation of water quality management practices for individual source areas within a land use type, land use types within a single watershed, within the drainage system serving the watershed, or at the point of discharge of the watershed. Each structural management practice must be defined according to its specific geometry, including storage volume, outlet configuration, infiltration rate, etc. Non-structural management practices such as street sweeping must be defined according to the type and frequency of activity.

The WinSLAMM modeling completed for this study included only street sweeping as a management practice. Street sweeping is a management practice applied at the *land use* level within the WinSLAMM model. Structural management practices such as ponds or other 'end-of-pipe' structural management practices were not modeled using WinSLAMM.

4.0 APPLICATION OF WATER QUALITY MODELS

At this time, the Village is not regulated by a Phase II WPDES permit, and regulation is not anticipated in the foreseeable future. Thus, the TSS reduction evaluation documented in this study includes the entire area within the corporate limits of the Village of Belleville, rather than just the area that would be regulated under such a permit. However, if at some future time, the Village is regulated, the P8 and SLAMM modeling should be re-run for the regulated area only. The WDNR has provided very specific guidance in the application of water quality models for the assessment of compliance with the TSS reductions required by NR151 and NR216. This guidance is documented in a June 16, 2005 memorandum from Gordon Stevenson and Eric Rortvedt, titled, "Developed Urban Areas and the 20% and 40% TSS Reductions." This memorandum is included in its entirety in Appendix C of this report and documents several key issues regarding the determination of the regulated areas within the corporate limits of a municipality regulated by a Phase II WPDES under NR216.07(6)(b) and NR151.13.

4.1 MODEL STUDY LIMITS

The water quality modeling study area extends from the upstream edge of watersheds draining into the Village, but stops at the Village limits for watersheds draining out of the Village. Figure 3 in Appendix A shows the limits of the project study area. Note that while the P8 modeling encompasses the entire study area, the WinSLAMM model only includes areas within Village limits, as areas outside the Village are not swept.

The area included in the study limits is described in the following table:

Village of Belleville
Water Quality Model Study Area

Description	Area (acres)
Village Limits	1,267
Study Area Limits	1,647
Land Use Area Modeled[1]	1,432

[1]*Study area limits excluding Lake Belle View and the Sugar River*

4.2 MODEL LAND USE

P8 requires data for directly connected and unconnected impervious area as a primary input parameter. The following impervious area relationships to land use relationships were applied for this study:

- All single-family and multi-family residential parcels were assigned an average impervious percent, based on the average impervious area for residential parcels calculated using the Village's stormwater utility data. According to this data, residential parcels are 27% impervious on average; it was assumed that two-thirds of these impervious surfaces are directly connected, and that the remaining one-third are unconnected.
- Non-residential parcel impervious area was determined using actual imperviousness, as measured for the Village's stormwater utility. All non-residential impervious area was assumed to be directly connected.
- All roadway rights-of-way were assumed to consist of 64% directly connected impervious area, 12% unconnected impervious area, and 24% pervious area.
- All bike rights-of-way were assumed to be 50% directly connected impervious area, and 50% pervious area.
- Farmsteads were assumed to be 27% unconnected impervious area, and 73% pervious.

Figure 1 in Appendix A illustrates the land use data developed for P8 modeling.

WinSLAMM requires data for source areas as a primary input parameter. WinSLAMM can analyze an urban drainage area with up to six different land uses with 16 sources areas per land use. Each source area (such as turf, roofs, parking, playgrounds, streets) is further classified according to their runoff behavior (for example, whether roofs are flat or pitched, and whether they drain directly to the drainage system or drain onto sandy or clayey soils).

Since data with this level of specificity is not typically available at a municipal or watershed scale, the WinSLAMM model comes with *Standard Land Use Files* (SLU files) which describe the distribution of source areas within a particular land use type.

These files have been prepared by the authors of the WinSLAMM model based on studies of Wisconsin communities. The Standard land use files listed in the table below have been approved by the WDNR for use in Wisconsin with WinSLAMM version 9.4.

WDNR APPROVED SLAMM STANDARD LAND USE FILES

Land Use Class	Standard Land Use File
Residential	• Duplex • High density residential with alleys • High density residential without alleys • High rise residential • Low density residential • Medium density residential • Mobile homes • Multi-family residential • Suburban residential
Commercial	• Downtown commercial • Strip commercial • Office park
Industrial	• Light industrial • Medium industrial
Institutional	• Hospital • School • General institutional
Other Urban	• Cemetery • Airport • Open • Parks
Freeways	• Freeways

The land use classifications in the Village Zoning Map and stormwater utility parcel database do not correspond directly with the available WinSLAMM standard land use files. To accommodate this, each land use classification was correlated to the closest appropriate standard land use type. To ensure consistency when assigning an area a standard land use category, the following table was created for guidance. Figure 2 in Appendix A defines which areas are assigned which land use.

Village of Belleville Land Use Mapping Correlation to WinSLAMM Standard Land Uses

Village of Belleville Land Use	WinSLAMM Standard Land Use Type
Commercial properties including downtown, strip malls and office Buildings	Strip Commercial
Parcels classified as utilities and public works facilities. Also includes storage and distribution buildings, including warehouses and wholesalers.	Light Industrial
Manufacturing businesses such as lumber yards, auto salvage yards junk yards, grain elevators, ag coops, oil tank farms, coal and salt storage areas and areas for bulk storage of fertilizers.	Medium Industrial
Areas currently developed and dedicated as parks and/or public open space. Includes golf courses, parks, athletic fields and cemeteries.	Parks
Includes areas currently classified as forest, farmstead, ag, vacant, pasture and woods	Undeveloped
Duplexes and multi-family residential	Multi-Family Residential
Single-Family Residential	Single-Family Residential
Schools, churches, etc.	Institutional

4.3 SOIL CLASSIFICATIONS

One of the five watershed characteristics previously discussed is the underlying soil type. WinSLAMM requires that the soil for all land uses be classified by soil texture as *sand, silt, or clay*. P8, on the other hand, requires that the soil for all land uses be classified by HSG as *Group A, Group B, Group C, or Group D*. The table below identifies the correlation of this parameter between the two models.

Correlation of Soil Texture to Hydrologic Soil Group

Soil Texture (WinSLAMM)	Hydrologic Soil Group (P8)
Sand	Group A
Silt	Group B
Clay	Group C & D

Figures 3 and 4, respectively, in Appendix A show the distribution of hydrologic soil groups and soil textures and within the study area, that was used as the basis for P8 and SLAMM modeling.

4.4 STREET SWEEPING

4.4.1 Existing Program

TSS reduction achieved through street sweeping was estimated using the WinSLAMM model. The street sweeping efficiency predicted by WinSLAMM was used as an input to the P8 model in place of P8's own internal street sweeping routine. P8 was then solved to determine the combined TSS removal of street sweeping and structural BMPs (ponds).

Street sweeping frequency data was provided by the Village of Belleville street department. According to the department, the entire Village is swept twice each spring, and twice each fall with a mechanical sweeper. In addition to these four Village-wide sweeps, the "catch basin area" (outlined on Figures 2 and 4) is swept three times during the summer. The Village street sweeping program information provided by the Public Works Department is summarized in the following table.

Village of Belleville
Existing Street Sweeping Schedule

	Village	**"Catch Basin" Area**
Late March/Early April	Swept Once	Swept Once
Late April/Early May	Swept Once	Swept Once
June through August	Not Swept	Swept Monthly
Mid-October	Swept Once	Swept Once
3rd week of November	Swept Once	Swept Once

4.4.2 Possible Enhanced Program

WinSLAMM is capable of modeling both mechanical and high-efficiency (vacuum) street sweeping. Sweeping intervals may be altered and sweeping may be evaluated with and without parking restrictions. Parking restrictions assume that cars are not allowed to park on streets on days when sweeping is to occur. A number of enhanced sweeping programs were evaluated as a possible cost-effective means of attenuating the City's TSS load.

4.4.3 Modeling Methodology

Per WDNR modeling protocols, street sweeping model simulations spanned the entire 'non-winter' season - which is March 12 through December 2 for Dane and Green Counties. Also, since the WDNR and USGS have determined that *"a single year (does) not fairly represent the impact of street cleaning, (so) a series of rainfall files (5 consecutive years) must be used..."* all street sweeping modeling scenarios were run for a period of five consecutive years.

The reason for the aforementioned policy is that the WDNR found that identical street sweeping programs provided substantially different TSS reduction rates depending on the

annual rainfall record simulated, and the start and end date of the sweeping occurrences. It is speculated by the authors of the WinSLAMM model that this is the result of interactions between the randomness of rainfall events and the fixed schedule of sweeping. For example, if one rainfall record has comparatively more rainfall events on Mondays while street sweeping occurs consistently on Tuesdays then many of the pollutants that would be captured by the sweeper will have been washed off by the previous day's rainfall. On the other hand, if rainfalls occur more commonly at the end of the week, then the Tuesday sweeping schedule will capture comparatively more sediment, as there will be more 'dry' days of accumulation prior to the sweeping event. By running five years of rainfall data through the model it was felt that the impact of the randomness of rainfall occurrences would be minimized.

4.5 STRUCTURAL BMPs

4.5.1 Existing BMPs

There are currently 16 structural stormwater devices within the Village of Belleville's storm water management system. The location of these BMPs and their watersheds can be seen on Figure 5 in Appendix A (note that there are fourteen BMP locations shown on Figure 5; this is because in two locations -Ace Hardware and Chalet Ski & Patio Warehouse - there are two BMPs). The storage volume and outlet configuration for each of these devices was obtained from construction plans (when available) and field inspection by MSA staff (for devices that had no construction plans available). The location of each BMP was identified in GIS and the drainage area tributary to each device was delineated. The land use and soil characteristics of each BMP drainage area was determined by intersecting the land use-soil type and BMP drainage area shapefiles in GIS, and summing the area of each land use and soil type within each drainage area. This information was used to create three P8 models (due to the software's limitation on the number of devices in a single model), which collectively covered the entire Village. Output from the P8 models for each pond is summarized in Table B-2 in Appendix B.

4.5.2 Opportunities for BMP Retrofits

According to the WDNR, the TSS removal efficiency calculated by P8 is inaccurate for dry ponds, and for wet ponds with a permanent pool less than 3 feet deep, since P8 does not account for scour or particle re-suspension. No TSS removal credit is allowed by the WDNR for dry ponds, and ponds with a permanent pool less than 3' deep are allowed a straight-line efficiency reduction such that a basin with 1.5-foot permanent pool gets 1/2 the TSS removal credit that a 3 foot deep permanent pool would. It is for this reason that the dry detention ponds in the summary tables included in the appendix show no trapped load and 0% for treatment efficiency.

However, dry ponds can be deepened and converted into wet basins in order to obtain the full treatment credit projected by P8. Thus, the Village could decrease the amount of TSS discharged in runoff into Lake Belle View and the Sugar River, by converting existing dry ponds and shallow wet ponds, into wet ponds with a 3' deep permanent pool.

Another cost-effective retrofitting opportunity would be to re-route the storm sewer that runs

along Fifth Avenue, and drains the 34.7 acre watershed to the north, into the Federal Industries pond. This would result in the delivery of an additional 5.1 tons of TSS into the pond for attenuation. Re-routing this previously untreated watershed into a Federal Industries pond would increase the benefit of retrofitting this pond, and decrease the TSS load discharge from the Village storm sewer system into Lake Belle View.

5.0 FINDINGS AND DISCUSSION

5.1 MODEL RESULTS

The table below documents the estimated performance of the Village's existing stormwater management system at removing TSS from the regulated areas within the Village, under existing and possible future retrofit conditions.

Village of Belleville
Total Suspended Solids Reduction Performance

	Existing (tons/yr)	**Retrofit Scenario 1**	**Retrofit Scenario 2**
No Controls Annual Load	87.8 tons/yr	87.8 tons/yr	87.8 tons/yr
TSS Removed by Street Sweeping	1.6 tons/yr	1.4 tons/yr	1.2 tons/yr
Additional TSS Removed by Structural BMPs[1]	8.4 tons/yr	20.3 tons/yr	25.2 tons/yr
Total TSS Removed	10.0 tons/yr	21.7 tons/yr	26.4 tons/yr
TSS Reduction Rate	**11.3%**	**24.7%**	**30.1%**

Note that when determining the TSS per WDNR direction, in any give drainage area, only the TSS removal achieved by the most effective BMP serving that area can be counted. Because the particle size fraction of the sediment collected by street sweeping and pond detention is similar, doing otherwise would results in "double-counting" the removal of a particular TSS particle size fraction. Therefore, in the table above, TSS removal by street sweeping is not counted in drainage areas served by a move effective BMP. *It is admitted that this approach is not as rigorous as it could be; however, it is a reasonably valid method of combining model results given the limitations of the WinSLAMM model and the translation of WinSLAMM results into the P8 model. This approach has been used at the direction of WDNR staff (Hartsook, personal communication).*

In addition, the TSS load delivered to Village storm sewer outfalls under existing conditions has been calculated, and is illustrated in Figure 6.

5.2 STREET SWEEPING EFFICIENCY

5.2.1 Existing Program

The existing street sweeping program achieves a 2.01% TSS reduction Village-wide; this value a weighted average of the efficiency achieved in the catch basin and non-catch basin area, as summarized in the Table below.

Village of Belleville
Existing Street Sweeping Program
TSS Reduction Performance

	Reduction (%)
Non- Catch Basin Area	**1.97%**
Catch Basin Area	**2.33%**
Village-Wide Weighted Average	**2.01%**

5.2.2 Possible Future Expanded Program

The reduction of TSS in runoff that could be achieved by street sweeping, if the Village were to expand its street sweeping program, either by increasing the frequency of sweeping, instituting parking controls that prohibit street parking during sweeping, and/or using a vacuum sweeper instead of broom sweeper, ranges from 5.1% to 20.0%, and is summarized in the following Table.

Village of Belleville
Reduction of TSS in runoff achieved by
Enhanced Street Sweeping Programs

	Mechanical Sweeping		**Vacuum Sweeping**	
Sweeping Frequency	**No Parking Controls**	**With Parking Controls**	**Parking Controls**	**With Parking Controls**
Every 8 wks	5.1%		5.6%	
Every 4 wks	5.3%		7.4%	
Every 2 wks	5.8%	8.2%	10.2%	14.9%
Every Week	6.9%	9.4%	14.2%	20.0%

5.3 STRUCTURAL BMP PERFORMANCE

5.3.1 Existing BMPs

P8 modeling of the 16 existing structural BMPs show that together, the existing ponds are capable of removing 9.6% of the Village's annual TSS load.

Table B-2 in Appendix B documents the TSS reductions achieved by each individual existing structural BMPs.

5.3.2 Possible Future BMP Retrofits

To investigate opportunities for additional TSS removal, we evaluated the effectiveness of retrofitting the Village's nine existing dry ponds, and three existing wet ponds less than three feet deep. Additionally, the effectiveness of re-routing the untreated watershed north of Fifth Avenue through a retrofitted Federal Industries pond was also evaluated. Together, the retrofitted ponds are capable of removing 23.1% under scenario 1 (retrofit all ponds) and 28.7% under scenario 2 (retrofit all ponds and re-route the 34.7 acre watershed north of Fifth Avenue through Federal Industries Pond). Table B-2 in Appendix B documents the TSS reductions achieved by each individual retrofitted BMP.

Note that prior to retrofitting any BMP that was not permitted by the WDNR as a stormwater facility at the time of construction, the Village should investigate whether the device is considered a regulated wetland by the WDNR and/or USACOE.

6.0 RECOMMENDATIONS

With its current management practices, the Village of Belleville achieves a 11.3% reduction in TSS discharged from its storm sewer system. The Village is currently not a regulated WPDES community, nor is it part of the Rock River TDML. Therefore no change to the current street sweeping programs nor the retrofit of additional structural stormwater management practices is required at this time.

However, as the Village is spending millions of dollars on the dredging and restoration of Lake Belle View, Village staff, residents, and officials have an interest in keeping as much sediment as possible from reaching the lake. To that end, it makes sense to minimize TSS discharged in runoff from the Village storm sewer system to the extent possible, particularly from storm outfalls that discharge directly into the lake. Therefore, highest priority recommendation of this report is to convert the existing Federal Industries pond into a wet pond, and re-route runoff from the 34.7-acre watershed north of Fifth Avenue into the retrofit pond. This alone would decrease the amount of TSS discharge in runoff from the Village storm sewer system in the Lake by 5.1 tons/year, or 5.8% of the generated load.

Additionally, to further reduce the amount of TSS in runoff discharged into the lake, it is recommended that the Village enhance its current street sweeping program. Specifically, it is recommended that:

- the Village consider purchasing of a vacuum street sweeping when the time comes to replace its existing street sweeper;
- the Village restrict on-street parking during street sweeping, to enhance sweeping effectiveness; and

- the Village increase the frequency of street sweeping to monthly, bi-monthly or weekly, especially in areas that drain directly to the lake, and in watersheds that are not served by another BMP, such as a pond or biofilter.

Finally, it is recommended that the Village consider the other 11 retrofit opportunities evaluated in this report, and implement these retrofits as funds become available. The total estimated cost for implementing all recommended pond retrofits is $303,000, as summarized in the following table below. Detailed cost estimates for each proposed retrofit can be found in Appendix D.

Village of Belleville
Pond Retrofit Cost Estimates

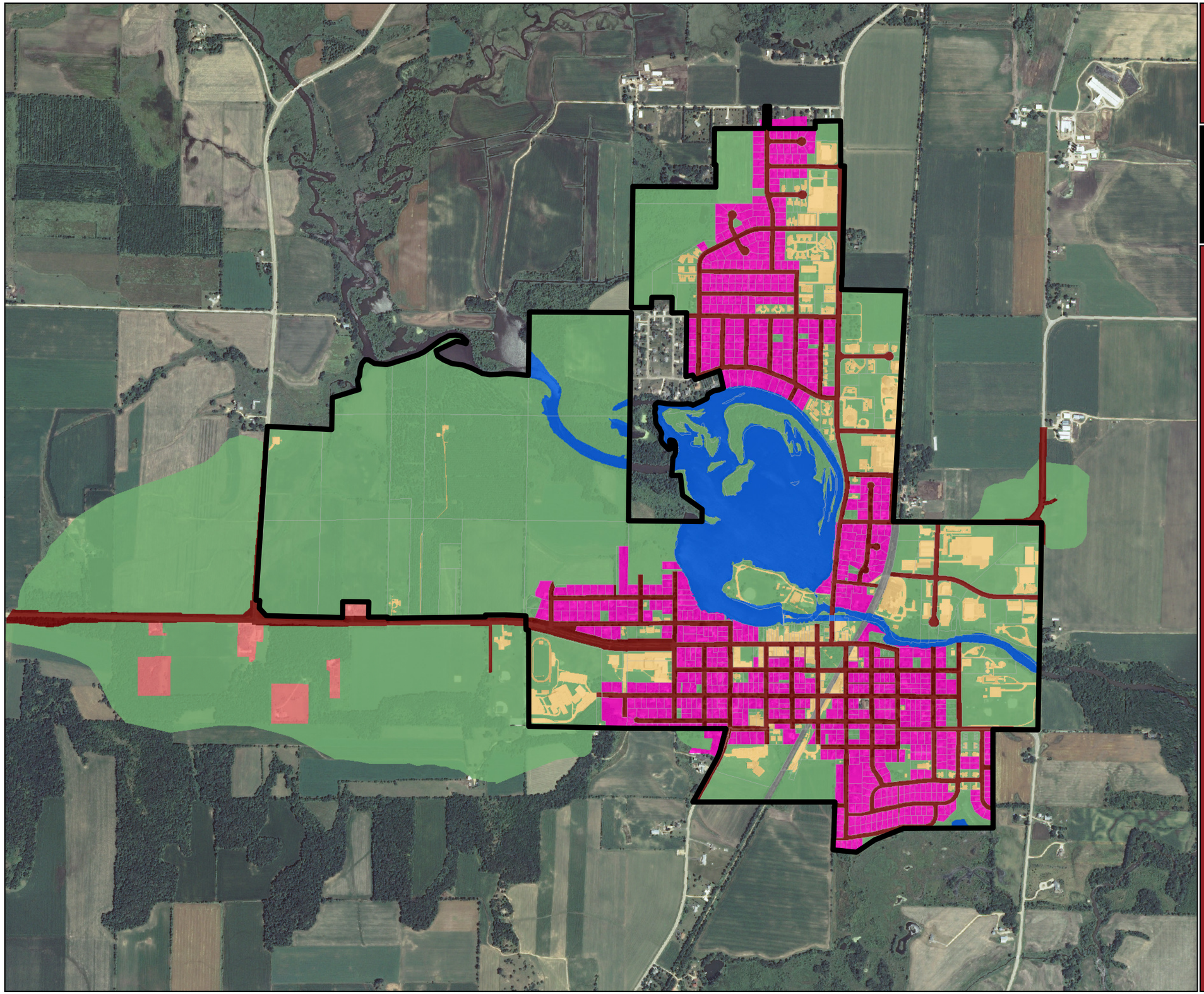
Pond Name	**Estimate Retrofit Cost**
Ace Hardware	$16,400
Chalet Ski & Patio Warehouse	$23,732
Custom Craft Vinyl	$24,105
Duluth Trading	$17,891
Federal Industries*	$67,948
Greenview Place - East	$53,229
Greenview Place - West	$17,256
High School	$17,363
Industrial Park Lot 14	$11,678
North & West of Bowlevard	$8,721
St. Francis North	$30,359
St. Francis South	$14,528

Appendix A

Figures

P8 Model
Land Use

Village of Belleville
Dane/Green County, WI



Legend

Corporate Limits

P8 Land Use

- Impervious
- Pervious
- Right-Of-Way
- Right-Of-Way, Bike
- Residential
- Farmstead
- Water

FIGURE 1

0 435 870 1,740 2,610 3,480 Feet

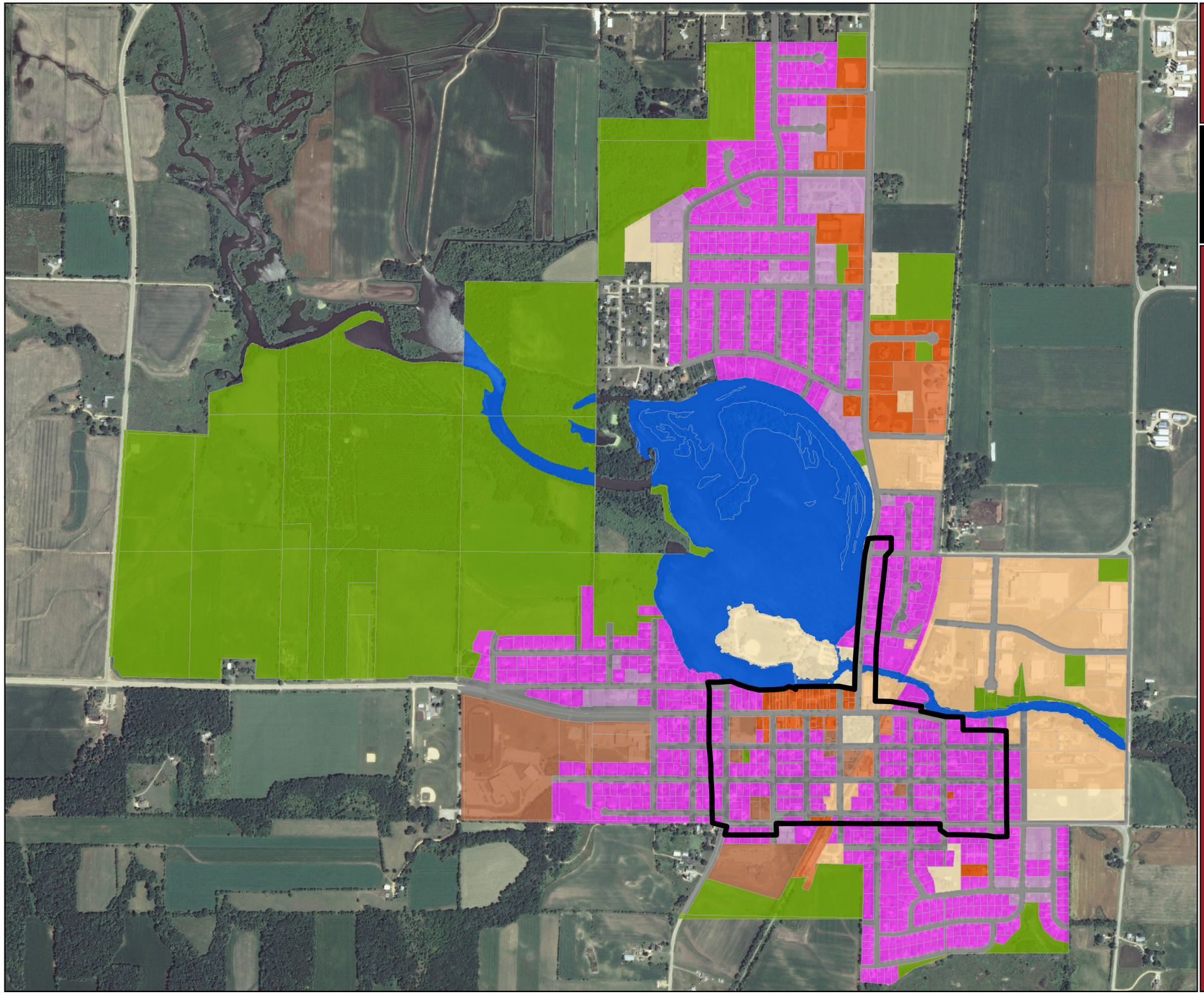
Sources:
- Base data provided by Dane County
- 2008 NAIP Ortho

Drafted - ADH, Date - 07-22-10

MSA PROFESSIONAL SERVICES

SLAMM Land Use Categories

Village of Belleville
Dane/Green County, WI



Legend

Catch Basin Sweeping Area

WinSLAMM SLU LAND USE

NON-RESIDENTIAL

- PARK
- STRIP COMMERCIAL
- INSTITUTIONAL
- LIGHT INDUSTRIAL
- MEDIUM INDUSTRIAL

RESIDENTIAL

- MULTI-FAMILY
- SINGLE-FAMILY

UNDEVELOPED/ROW

- UNDEVELOPED
- WATER/ISLAND
- RIGHT-OF-WAY

FIGURE 2

0 335 670 1,340 2,010 2,680 Feet

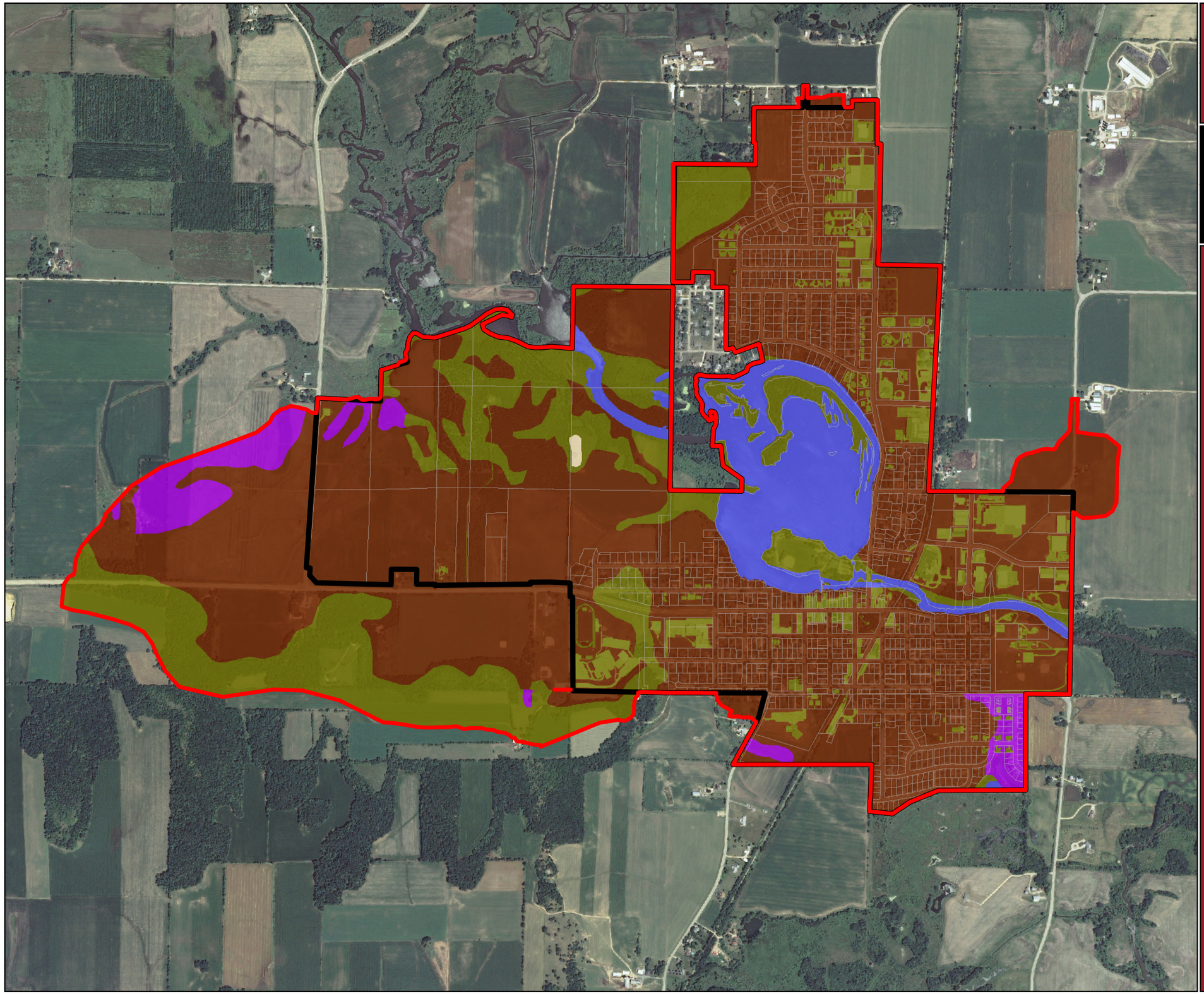
Sources:
- Base data provided by Dane County
- 2008 NAIP Ortho

Drafted - ADH, Date - 07-22-10

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL
DEVELOPMENT • ENVIRONMENTAL

Hydrologic Soil Group (HSG)

Village of Belleville
Dane/Green County, WI



Legend

- Study Area Limits
- Corporate Limits

Hydrologic Soil Group

- A
- B
- C
- D
- W

FIGURE 3

0 445 890 1,780 2,670 3,560 Feet

Sources:
- Base data provided by Dane County
- 2008 NAIP Ortho

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MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL
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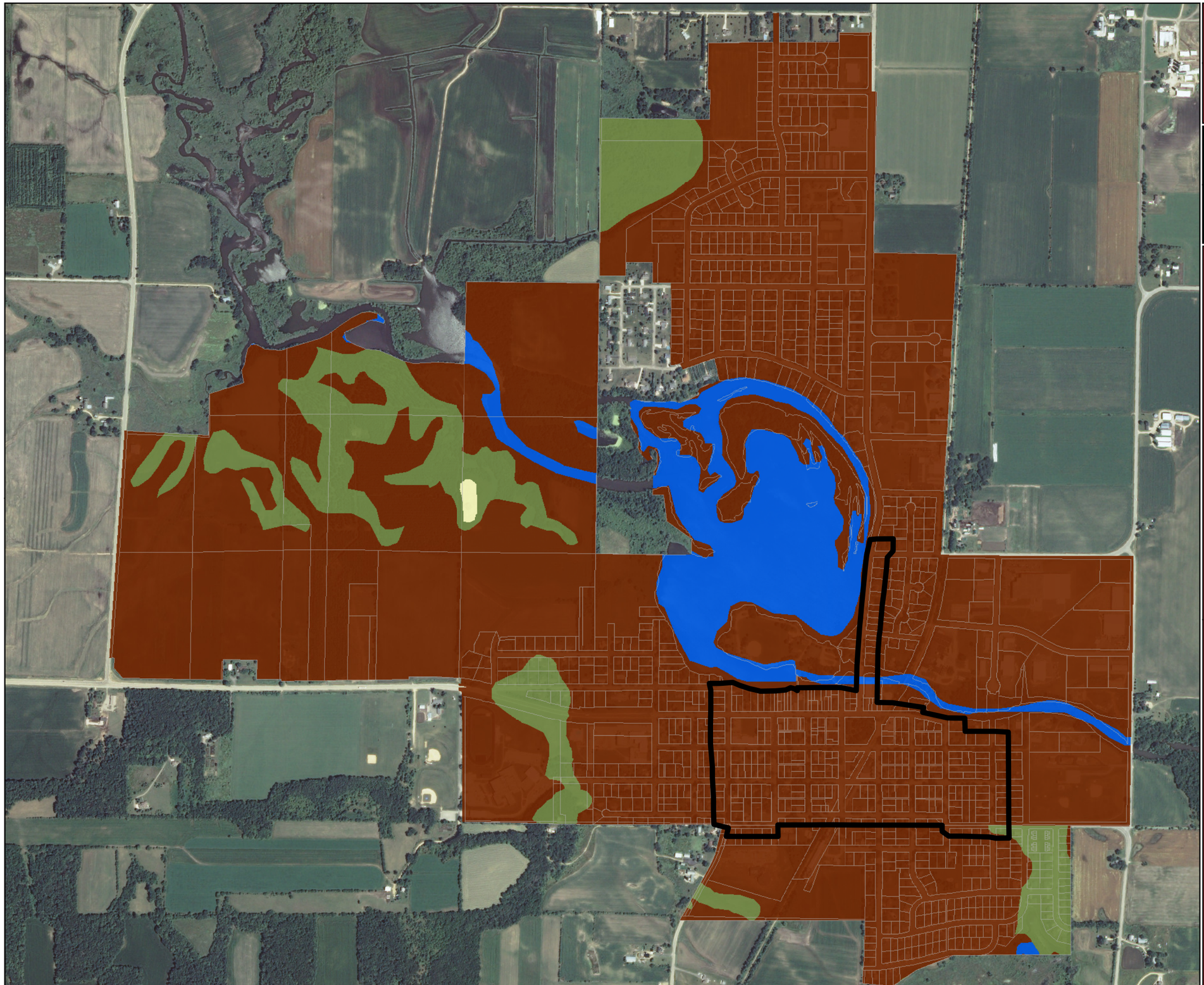
SLAMM Soil Texture Categories

Village of Belleville
Dane/Green County, WI



Legend

Catch Basin Sweeping Area

SOIL TEXTURE

- SAND
- SILT
- CLAY
- WATER

FIGURE 4

0 325 650 1,300 1,950 2,600 Feet

Sources:
- Base data provided by Dane County
- 2008 NAIP Ortho

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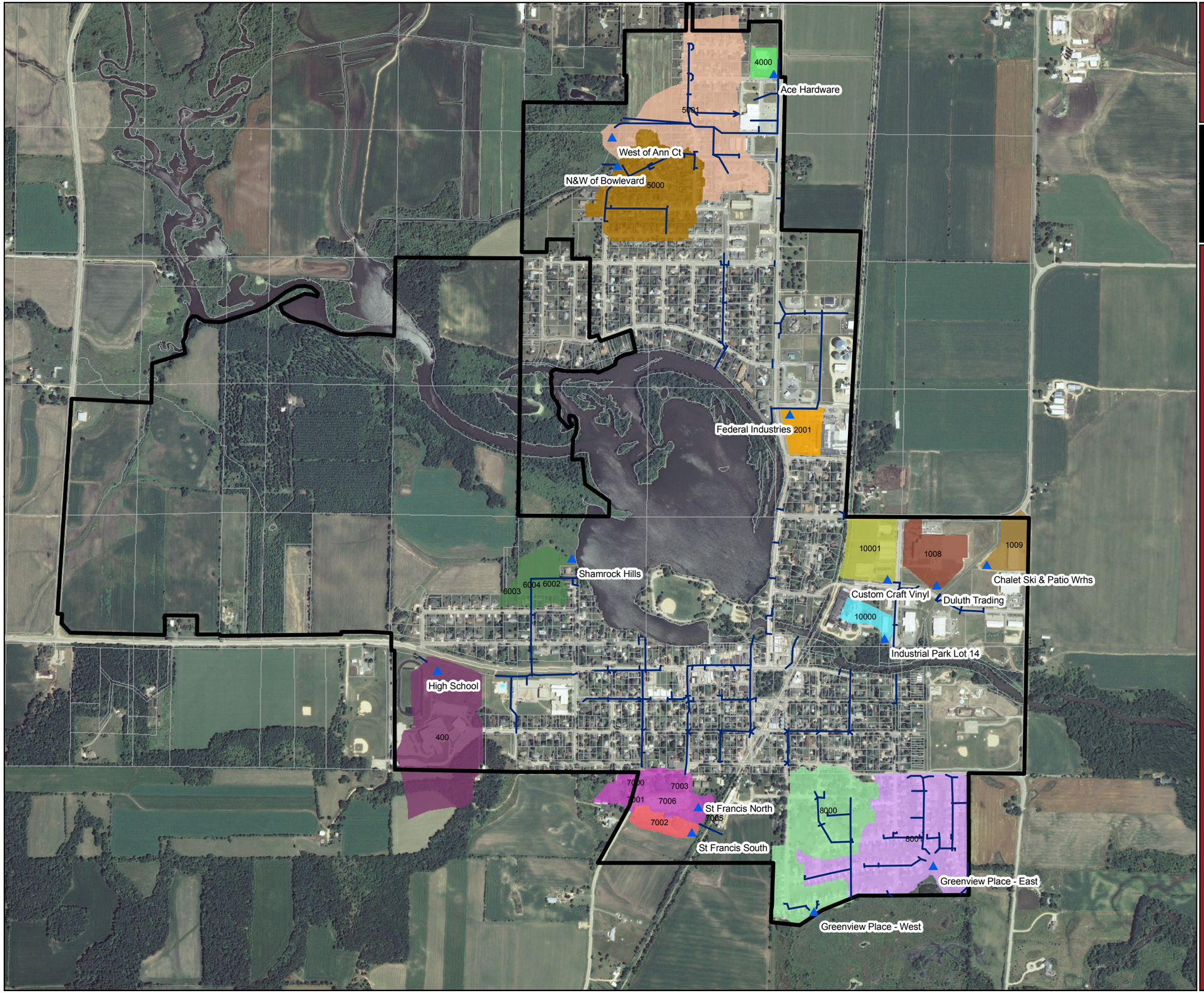
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL
DEVELOPMENT • ENVIRONMENTAL

Existing BMP Locations and Drainage Areas

Village of Belleville
Dane/Green County, WI



Legend

- Ponds
- Storm Sewer
- Corporate Limits

FIGURE 5

0 350 700 1,400 2,100 2,800 Feet

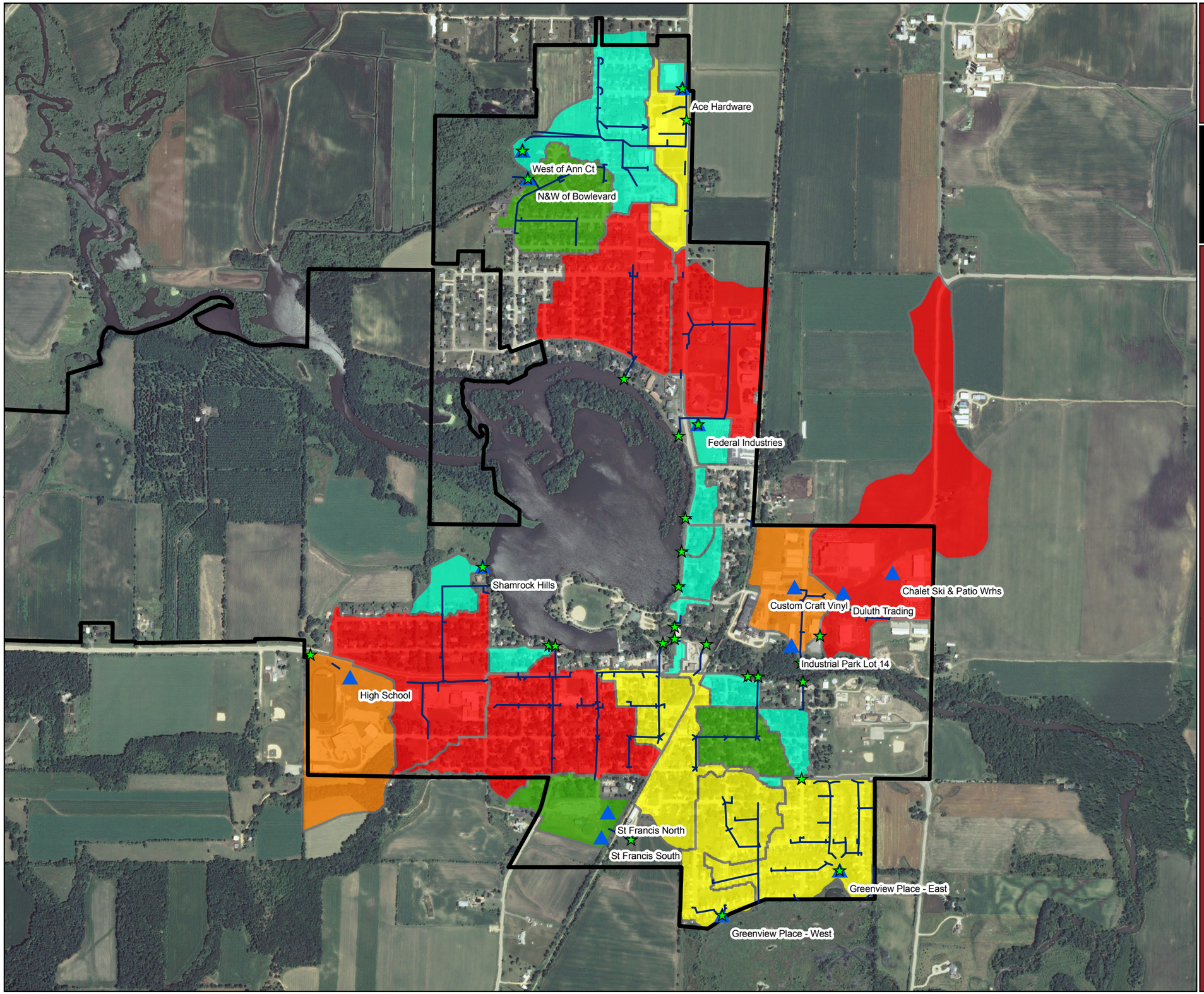
Sources:
- Base data provided by Dane County
- 2008 NAIP Ortho

Drafted - ADH Date - 06-28-10

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL DEVELOPMENT • ENVIRONMENTAL

Annual TSS Load Delivery (tons/yr)

Village of Belleville
Dane/Green County, WI



Legend

- Discharge Location
- Ponds
- Storm Sewer
- Corporate Limits

Existing Annual TSS Load (Tons)

- 0 - 1.00
- 1.01 - 2.00
- 2.01 - 3.00
- 3.01 - 5.00
- 5.01 - 7.00

FIGURE 6

0 345 690 1,380 2,070 2,760 Feet

Sources:
- Base data provided by Dane County
- 2008 NAIP Ortho

Drafted - ADH Date - 06-28-10

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL
DEVELOPMENT • ENVIRONMENTAL

Appendix B

Tables

Table B-2 Annual TSS Attenuation Achieved by Belleville Ponds Under Existing and Enhnaced Conditions

			Existing			Enhanced #1			Enhanced #2		
	Device Type	Permanent Pool Depth	Load Received (tons/yr)	Load Trapped (tons/yr)	% Red	Load Received (tons/yr)	Load Trapped (tons/yr)	% Red	Load Received (tons/yr)	Load Trapped (tons/yr)	% Red
Duluth Trading	Dry Pond	-	1.92	0.00	0.0%	1.92	1.40	72.8%			
Industrial Park Lot 14	Dry Pond	-	0.61	0.00	0.0%	0.61	0.42	69.8%			
Custom Craft Vinyl	Dry Pond	-	1.86	0.00	0.0%	1.86	1.48	79.4%			
Chalet Ski & Patio Warehouse	Dry Pond	-	0.55	0.00	0.0%	0.55	0.41	75.0%			
Chalet Ski & Patio Warehouse	Biofilter	-	0.55	0.32	59.0%	0.14	0.03	20.4%			
Greenview Place - East	Wet Pond	1.5'	4.31	2.02	46.87%	4.31	4.04	93.7%			
Greenview Place - West	Dry Pond	-	2.78	0.00	0.00%	2.78	2.16	77.7%			
St. Francis South	Dry Pond	-	0.18	0.00	0.00%	0.18	0.16	89.2%			
St. Francis North	Dry Pond	-	1.32	0.00	0.00%	1.32	1.12	85.1%			
Ace Hardware	Dry Pond	-	0.66	0.00	0.00%	0.66	0.52	79.7%			
Ace Hardware	Biofilter	-	0.65	0.59	89.63%	0.13	0.09	69.5%			
High School	Dry Pond	-	2.99	0.00	0.00%	2.99	2.21	73.7%			
Federal Industries	Dry Pond	-	0.44	0.00	0.0%	0.44	0.43	99.0%	5.66	5.10	90.2%
North & West of Bowlevard	Wet Pond	2'	2.92	1.17	40.2%	2.92	1.76	60.3%			
West of Ann Ct	Wet Pond	3'	4.12	3.97	96.4%	4.12	3.97	411.6%			
Shamrock Hills	Wet Pond	3'	0.32	0.29	90.4%	0.32	0.29	32.0%			

Table B-1. P8 Model Land Use Input Data by Watershed

Watershed	Total Area (acres)	Directly Connected Impervious Area (acres)	Indirectly Connected Impervious Area (acres)	Pervious Area (acres)	Pervious Area RCN
10000-V	2.8	1.6	0.0	1.2	70.0
10001-V	8.1	2.9	0.0	5.2	70.0
10002-V	8.3	4.1	0.4	3.8	70.0
1001-OUT	14.5	1.0	0.2	13.3	70.0
1001-V	0.0	0.0	0.0	0.0	70.0
1002-OUT	10.8	1.4	0.3	9.2	70.0
1003-V	3.8	1.7	0.1	2.1	70.0
1004-V	2.2	0.2	0.0	2.0	70.0
1005-OUT	0.1	0.0	0.0	0.0	70.0
1005-V	3.7	0.7	0.0	3.0	70.0
1006-OUT	0.0	0.0	0.0	0.0	70.0
1006-V	0.8	0.1	0.0	0.7	70.0
1007-V	2.6	0.7	0.0	2.0	70.0
1008-V	7.5	5.0	0.0	2.5	70.0
1009-OUT	0.3	0.2	0.0	0.1	70.0
1009-V	4.4	1.2	0.1	3.2	70.0
1010-V	6.7	2.4	0.1	4.2	70.6
10-OUT	60.4	0.4	1.6	58.4	76.2
11000-V	4.3	1.8	0.4	2.2	70.0
11-OUT	3.4	0.3	0.1	3.1	81.4
12000-V	12.4	4.2	1.2	7.0	70.0
12-OUT	29.7	3.1	0.6	26.0	70.0
13000-V	5.5	1.8	0.5	3.2	70.0
15000-V	1.2	0.5	0.1	0.6	70.3
15-V	0.9	0.0	0.0	0.9	77.0
16000-V	14.1	6.2	1.1	6.8	70.0
1-OUT	87.4	2.8	0.5	84.1	74.1
2000-V	33.7	13.4	0.7	19.6	70.0
2001-V	4.3	1.1	0.0	3.2	70.0
2002-V	3.2	1.0	0.2	2.0	70.0
2003-V	5.0	1.5	0.5	3.1	70.0
2004-V	2.0	0.6	0.2	1.2	70.0
200-V	38.4	0.2	0.0	38.2	76.5
201-V	16.1	0.0	0.0	16.1	77.8
202-V	11.7	0.0	0.0	11.7	78.6
203-OUT	34.5	1.5	0.1	32.9	76.5
203-V	0.0	0.0	0.0	0.0	70.0
204-OUT	2.7	0.0	0.0	2.7	77.4
204-V	5.5	1.5	0.1	3.9	70.2
205-OUT	1.3	0.7	0.1	0.5	70.0
205-V	56.0	1.3	0.5	54.2	70.7
2-OUT	1.9	1.2	0.2	0.5	70.0
2-V	62.6	0.8	0.0	61.8	72.6
3000-V	37.3	13.0	3.1	21.2	70.0
300-OUT	1.9	1.2	0.2	0.5	70.0
300-V	1.4	0.0	0.0	1.4	70.0
301-V	2.4	0.0	0.0	2.4	70.0
302-V	3.7	0.0	0.0	3.7	70.1
303-V	0.4	0.0	0.0	0.4	70.0
304-V	0.1	0.0	0.0	0.1	70.0
305-V	0.3	0.0	0.0	0.3	70.0
306-V	3.1	0.0	0.0	3.1	70.0
307-V	1.5	0.0	0.0	1.5	70.0
308-V	2.5	0.0	0.0	2.5	70.9
309-V	7.1	0.0	0.0	7.1	76.6
310-V	7.3	0.0	0.0	7.3	71.3
311-V	2.0	0.0	0.0	2.0	70.0
312-V	1.4	0.0	0.0	1.4	70.0
313-OUT	3.1	1.1	0.5	1.5	70.0
313-V	37.6	0.0	0.0	37.6	70.0
314-V	1.4	0.0	0.0	1.4	70.0
315-V	2.3	0.0	0.0	2.3	70.0
316-V	2.7	0.0	0.0	2.7	71.8
317-OUT	0.4	0.0	0.0	0.3	74.4
317-V	11.8	0.2	0.0	11.7	72.4
318-V	1.8	0.0	0.0	1.8	75.1
319-V	3.9	0.0	0.0	3.9	72.1
320-V	1.7	0.0	0.0	1.7	71.0

Watershed	Total Area (acres)	Directly Connected Impervious Area (acres)	Indirectly Connected Impervious Area (acres)	Pervious Area (acres)	Pervious Area RCN
3-V	0.2	0.0	0.0	0.2	70.0
4000-V	2.0	1.7	0.0	0.2	70.0
4001-V	14.0	7.9	0.3	5.7	70.0
400-OUT	6.7	0.0	0.0	6.7	79.6
400-V	19.8	7.0	0.0	12.8	73.6
5000-V	22.5	7.2	2.1	13.2	70.0
5001-OUT	1.8	0.3	0.2	1.3	70.0
5001-V	31.6	9.9	1.8	19.8	70.7
5002-V	36.1	4.3	1.1	30.7	75.6
6000-V	1.5	0.6	0.2	0.8	70.0
6001-V	0.9	0.4	0.1	0.5	70.0
6002-V	3.7	0.2	0.1	3.4	70.0
6003-V	1.2	0.2	0.1	0.9	70.0
6004-V	2.5	0.4	0.1	2.0	70.0
6007-OUT	1.5	0.0	0.0	1.5	70.0
6007-V	9.3	3.1	0.9	5.4	70.2
6008-V	3.4	1.2	0.3	1.9	70.0
6009-V	0.1	0.1	0.0	0.0	70.0
6010-V	5.0	1.8	0.5	2.7	70.0
6011-V	7.4	2.8	0.6	4.0	70.0
6012-V	3.4	1.1	0.3	2.0	70.0
6013-V	1.0	0.4	0.1	0.6	70.0
6014-V	4.4	1.8	0.4	2.2	70.0
6015-V	1.5	0.7	0.1	0.6	70.0
6016-OUT	0.0	0.0	0.0	0.0	83.0
6016-V	35.2	14.1	2.5	18.5	74.7
6017-V	7.6	3.1	0.6	3.9	70.0
6018a-V	12.3	5.0	1.0	6.3	70.0
6018b-V	8.9	4.5	0.5	3.9	70.0
6-OUT	4.0	0.5	0.1	3.4	79.2
7000-OUT	2.3	0.3	0.2	1.9	70.0
7000-V	2.1	0.9	0.2	1.0	70.0
7001-V	0.2	0.1	0.0	0.1	70.0
7002-V	3.1	0.4	0.0	2.7	70.0
7003-V	1.1	0.3	0.1	0.7	70.0
7004-V	1.1	0.0	0.0	1.1	70.0
7005-V	1.4	0.1	0.0	1.4	70.0
7006-V	2.7	1.6	0.0	1.1	70.0
7-OUT	19.0	1.4	0.3	17.2	82.5
8000-V	25.4	6.8	2.2	16.4	70.0
8001-V	34.3	10.2	2.7	21.4	74.0
8-OUT	65.9	0.6	2.8	62.4	77.7
9001-V	9.3	2.6	0.5	6.2	70.0
9002-V	0.1	0.1	0.0	0.0	70.0
9004-V	0.5	0.3	0.0	0.2	70.0
9005-V	0.4	0.2	0.0	0.2	70.0
9006-V	0.2	0.1	0.0	0.0	70.0
9007-V	0.4	0.1	0.0	0.2	70.0
9008-V	0.1	0.1	0.0	0.0	70.0
9009-V	0.1	0.1	0.0	0.0	70.0
9010-V	0.2	0.1	0.0	0.1	70.0
9011-V	0.1	0.1	0.0	0.0	70.3
9012-V	0.2	0.1	0.0	0.0	70.0
9013-V	1.3	1.1	0.1	0.2	70.0
9014-V	0.3	0.2	0.0	0.1	70.0
9015-V	0.2	0.1	0.0	0.1	70.0
9016-V	0.0	0.0	0.0	0.0	70.0
9017-V	0.8	0.5	0.1	0.3	70.0
9018-V	0.6	0.3	0.1	0.2	70.0
9019-V	2.6	1.0	0.2	1.4	70.0
901-V	265.1	25.2	2.9	237.0	76.1
9020-V	0.2	0.1	0.0	0.0	70.0
9021-V	0.6	0.3	0.1	0.2	70.0
9022-V	0.2	0.1	0.0	0.1	70.0
9-OUT	26.6	0.2	0.0	26.4	74.2

Appendix C

WDNR Modeling Guidance

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: June 6, 2005

TO: Regional Water Leaders, Basin Leader & Experts
Storm Water Permit Staff (via Email)

FROM: Russ Rasmussen, Director
Bureau of Watershed Management

SUBJECT: Developed Urban Areas and the 20% and 40% TSS Reductions
Sections NR 151.13(2) and NR 216.07(6), Wis. Adm. Code

This document is intended solely as guidance, and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

Issue

Under s. NR 151.13 (2), Wis. Adm. Code, a municipality subject to the municipal storm water permit requirements of subch. I of ch. NR 216, Wis. Adm. Code, must, to the maximum extent practicable, implement a 20% and a 40% reduction in total suspended solids in runoff that enters waters of the state as compared to no controls, by March 10, 2008 and March 10, 2013, respectively. Staff who work with affected municipalities need guidance on what areas under the municipalities' jurisdictions will be included in this requirement. They also need to know what is meant by "no controls" and "with controls", and what methods are acceptable for making these calculations.

Discussion

Chapter NR 216, Wis. Adm. Code, is the implementation code for the developed urban area performance standard. Applicability for permit coverage purposes is dictated by s. NR 216.02, Wis. Adm. Code. Under this provision, owners or operators of the following municipal separate storm sewer systems (MS4s) are required to obtain coverage under a WPDES municipal storm water permit:

- MS4s serving populations of 100,000 or more.
- Previously notified owners or operators of municipal separate storm sewer systems.
- MS4s within urbanized areas as identified by EPA.
- MS4s serving populations over 10,000 unless exempted by DNR.

"MS4" means a conveyance or system of conveyances, including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, constructed channels or storm drains, which meets all the following criteria:

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- Owned or operated by a municipality.
- Designed or used for collecting or conveying storm water.
- Not a combined sewer conveying both sanitary and storm water.
- Not part of a publicly owned wastewater treatment works that provides secondary or more stringent treatment.

Under s. NR 216.07(6)(a), Wis. Adm. Code, a municipality must develop a stormwater management program to achieve compliance with the developed urban area performance standard (s. NR 151.12(2), Wis. Adm. Code). Developed areas are generally those that were not subject to the post-construction performance standards (s. NR 151.12 or NR 151.24, Wis. Adm. Code). The total suspended solids control requirements of s. NR 151.13(2)(b)1.b. and 2., Wis. Adm. Code, may be achieved on an individual municipal basis. Control does not have to apply uniformly across the municipality. The control may also be applied on a regional basis by involving several municipalities.

A municipality is required under s. NR 216.07(6)(b), Wis. Adm. Code, to provide an assessment of the actions taken to comply with the performance standards. This assessment may take the form of an annual progress report. The initial assessment must include a pollutant-loading analysis using a model such as SLAMM, P8 or equivalent methodology that is approved by the department. At a minimum, a pollutant-loading analysis must be conducted for total suspended solids and phosphorus. A model would not be run again after the initial assessment unless significant management changes occurred that should be accounted for, or the progress report indicates a re-run is necessary.

DNR Guidance

To comply with the code, the developed urban area must be modeled under a "no control" condition and a "with controls" condition. The 20% and 40% TSS reductions are assessed against the "no control" condition for the entire area served by the MS4 as defined below. They are not applied uniformly across the municipality, nor are they applied drainage area by drainage area within the municipal boundary. In most cases however, a calculation drainage basin by drainage basin will be used to determine the total loading and the achieved reductions.

Areas Required to be Included in the Calculations

A municipality must include the following areas when calculating compliance with the developed urban area standard (s. NR 151.13, Wis. Adm. Code):

1. Any developed area that was not subject to the post-construction performance standards of s. NR 151.12 or 151.24, Wis. Adm. Code, that went into effect October 1, 2004 and that drains to the MS4 owned or operated by the municipality.
2. Any area covered by an NOI submitted prior to October 1, 2004 where development is still underway. The pollutant load shall be based on full build out. If it is known that the future development of some parcels may require compliance with s. NR 151.12 or NR 151.24, Wis. Adm. Code, then these areas may be excluded from the calculation.
3. Any undeveloped (in-fill) areas under 5 acres. These areas must be modeled as fully developed, with a land use similar to the properties around them.
4. For municipalities with large areas of agricultural lands separating areas of development, only the areas within the urbanized area as defined by the U.S. Census Bureau.

5. Non-manufacturing areas of industrial facilities such as customer or employee parking lots. (The manufacturing, outside storage and vehicle maintenance areas of these industrial facilities are covered under a subch. II of ch. NR 216, Wis. Adm. Code, industrial permit.)
6. Any industry that has certified a condition of "no exposure" in accordance with s. NR 216.21(3), Wis. Adm. Code.
7. Any developed urban area where it is already established that the area will be annexed by the municipality prior to March 10, 2008. There must be an agreement with the municipality that will be losing the area, to prevent double counting.

Areas Prohibited from Inclusion in the Calculations

Areas and loadings that shall not be included:

1. Lands zoned for agricultural use and operating as such.
2. Pollutant loadings from an upstream MS4 (independent of whether it is regulated under a ch. NR 216, Wis. Adm. Code, permit)
3. Any internally drained area with natural infiltration. (This does not included engineered or constructed infiltration areas.) However, an internally drained area that discharges to a karst feature is not likely to be receiving adequate treatment prior to any contact with the groundwater. The municipality is encouraged to look at this area for possible treatment options.
4. Undeveloped land parcels over 5 acres within the municipality. These areas will be subject to s. NR 151.12 or 151.24, Wis. Adm. Code, when developed.

Optional Areas to Include in the Calculations

Areas a municipality may, but is not required to, include in the developed urban area load calculation:

1. Property that drains to *waters of the state* without passing through the permittee's MS4. Waters of the state include surface water, wetlands and groundwater and has the meaning given in s. 283.01(20), Stats. Waters of the state may overlap with the definition of MS4. For this purpose, if a waterway meets the definition of an MS4 it will be regulated as an MS4. The definition for MS4 is given in s. NR 216.002(17), Wis. Adm. Code. The significant language in that definition is whether or not the municipality owns or operates the drainage way (i.e., maintains, has easement access for work, etc.). For example, when a "stream" is designed or used for collecting or conveying storm water such as flowing through a municipally owned or operated culvert or bridge restriction, that "stream" is part of the MS4.
2. Any area that discharges to an adjacent municipality's MS4 (Municipality B) without passing through the jurisdictional municipality's MS4 (Municipality A). Municipality B that receives the discharge into their MS4 may choose to be responsible for this area from Municipality A. If Municipality B has a treatment device that serves a portion of A as well as a portion of B, then the practice must be modeled as receiving loads from both areas, independent of who carries the responsibility for the area.
3. Industrial facilities subject to a permit under subch. II of ch. NR 216, Wis. Adm. Code. This exclusion covers the facilities that are required to have permit coverage. Contact the regional stormwater specialist or central office to get a list of permitted facilities within a municipality.
    - The industrial NR 216 permit covers areas with industrial materials and activities, specifically areas with manufacturing, vehicle maintenance, storage of materials, etc.

A municipality may include any of the areas identified above in their developed urban area as part of their load calculation provided the areas are not prohibited from inclusion in the calculation. If they choose to include an area, it must be included in both the "no controls" and "with controls" condition. Inclusion of areas they choose to be responsible for will allow them to take credit for any of those areas that may have

controls in place. For example, if an industrial park would have been excluded because all the industries in the industrial park have an NR 216 industrial permit, but the municipality chooses to keep this area in their "no controls" area, then any best management practices existing or built to serve the industrial park can be included in the "with controls" scenario.

Model Inputs

Model Version:
To model the TSS load in the area served by the MS4 the municipality must select a model that can track particle distribution. Such models include SLAMM and P8. In general, a municipality must use the most current version of a model that is available at the time of the analysis. However, a municipality may use an earlier version of a model if it was previously used to calculate loads in the municipality and these loads were documented in a stormwater management plan, database, or other report. The most current versions of SLAMM and P8 will be accessible through the DNR website with links to the authors. A summary of past versions and the changes made with each SLAMM update will also be posted. The DNR has recently received a grant to help upgrade P8 to a Windows format.

As part of the reporting process, the municipality must identify which version it is using. It must use the same version for both the "no controls" scenario and the "with controls" scenario. If an older version of the model is used, this may mean that as the model is updated a municipality cannot take credit for some practices that are only available in the most recent models. In order to take credit for practices that are in recent versions of the models, both the "no controls" and "with controls" scenario must be run with the latest model. A municipality must run all drainage basins in the developed urban area with the same model and model version.

"No control"
The "no controls" condition can be based on the standard land use files for different land uses in SLAMM. This assumes certain default parameter files, an assumed level of disconnection and an assumed distribution of road smoothness. For the drainage system, the default will be curb and gutter (even if the drainage system is currently swale drainage), in fair condition. For "no controls" there will be no recognition of street sweeping, catch basin cleaning, swale drainage, or the existence of any engineered best management practices. These practices and facilities will be accounted for under the "with controls" condition. A municipality is not required to use the standard land use files if it has surveyed the land uses in its developed urban area and has "real" source area data on which to base the input files.

"With controls"
The "with controls" condition is applied to the developed urban area with the inclusion of the practices and facilities (existing and proposed). Modeling is a means to confirm a device's efficiency for the conditions found in Wisconsin. If the model cannot predict efficiencies for certain practices that the municipality identifies as water quality practices, then a literature review must be conducted to estimate the reduction value. However, proprietary devices that utilize settling as their means of solids reduction should be modeled as catch basins with sumps. The efficiency of proprietary devices that utilize filtration as a means of solids reduction cannot currently be modeled using SLAMM.

Practices on private property that drain to an MS4 can be included in the "with controls" scenario for a municipality, if the municipality is able to ensure that the practice will continue to be maintained. The efficiency of the practice on private property must be modeled using the best information the municipality

can obtain on the design of the practice. For example, permanent pool area is not sufficient information to know the pollutant reduction efficiency of a wet detention basin even if it matches the area requirements identified in Technical Standard 1001 Wet Detention Basin for an 80% reduction. Information on the depth of the sediment storage layer and the outlet design are critical features that determine whether a detention pond is providing 80% TSS reduction.

As information on proprietary practices or new stormwater designs becomes available through monitoring, the model will be adjusted to reflect changes in efficiency.

Again, future versions of the model can be used to evaluate the "with controls" condition, but only if the "no controls" scenario is also run with the new version.

Further clarifications

- If a portion of a municipality's MS4 drains to a stormwater treatment facility in an adjacent municipality, the municipality generating the load will not receive any treatment credit unless there is an inter-municipal agreement for maintenance of the BMP. This contract must be in writing with signatures from both municipalities at the time of the evaluation.
- The model results will be the basis for determining compliance with the permit for "no controls" and "with controls" TSS load. No credit will be given for implementation of ordinances or information and education programs.
- For reporting purposes, the pollutant load must be summarized as the cumulative total for the developed urban area served by the MS4. Additionally pollutant loads for grouped drainage areas as modeled shall also be reported. Drainage areas may be grouped at the discretion of the modeler for such reasons as to emphasize higher priority areas, balance model development with targeting or for cost-effectiveness.

Approved By:

Gordon Stevenson, Chief
Runoff Management Section

Eric S. Rortvedt
Storm Water Program Coordinator

Appendix D

BMP Retrofit
Cost Estimates

Village of Belleville
Proposed Water Quality Pond - Duluth Trading
 # BMP Alternative

Item	Description	Unit	Unit Price	Quantity	Extension	
1)	Excavation	CY	$7.50	387.2	$2,904.00	
2)	Erosion Control	LS	$1,500.00	1.0	$1,500.00	
3)	Street Restoration	SY	$20.00	0.0	$0.00	
4)	Clay Liner	SF	$1.25	3,484.8	$4,356.00	
5)	Re-Stabilization	SY	$1.00	387.2	$387.20	
	DIRECT COST SUBTOTAL				$9,147.20	
	Unexpected Design Details		30%		$2,744.16	$25,000 Cap
	* Engineering Costs		15%		$6,000.00	$6,000 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$17,891.36	
	TOTAL CONCEPTUAL COST ESTIMATE (2010-$s)				**$17,891.36**	

Notes:
* Engineering Cost to include: Survey, Property Investigation, Design, Plans & Specs, and Construction Management.

Village of Belleville
Proposed Water Quality Pond - Industrial Park Lot 14
 # BMP Alternative

Item	Description	Unit	Unit Price	Quantity	Extension	
1)	Excavation	CY	$7.50	145.2	$1,089.00	
2)	Erosion Control	LS	$1,500.00	1.0	$1,500.00	
3)	Clay Liner	SF	$1.25	1,306.8	$1,633.50	
4)	Street Restoration	SY	$20.00	0.0	$0.00	
5)	Re-Stabilization	SY	$1.00	145.2	$145.20	
	DIRECT COST SUBTOTAL				$4,367.70	
	Unexpected Design Details		30%		$1,310.31	$25,000 Cap
	* Engineering Costs		15%		$6,000.00	$4,500 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$11,678.01	
	TOTAL CONCEPTUAL COST ESTIMATE (2010-$s)				**$11,678.01**	

Notes:
* Engineering Cost to include: Survey, Property Investigation, Design, Plans & Specs, and Construction Management.

Village of Belleville
Proposed Water Quality Pond - Custom Craft Vinyl
 # BMP Alternative

Item	Description	Unit	Unit Price	Quantity	Extension	
1)	Excavation	CY	$7.50	629.2	$4,719.00	
2)	Erosion Control	LS	$1,500.00	1.0	$1,500.00	
3)	Clay Liner	SF	$1.25	5,662.8	$7,078.50	
4)	Street Restoration	SY	$20.00	0.0	$0.00	
5)	Re-Stabilization	SY	$1.00	629.2	$629.20	
	DIRECT COST SUBTOTAL				$13,926.70	
	Unexpected Design Details		30%		$4,178.01	$25,000 Cap
	* Engineering Costs		15%		$6,000.00	$4,500 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$24,104.71	
	TOTAL CONCEPTUAL COST ESTIMATE (2010-$s)				**$24,104.71**	

Notes:
* Engineering Cost to include: Survey, Property Investigation, Design, Plans & Specs, and Construction Management.

Village of Belleville
Proposed Water Quality Pond - Chalet Ski & Patio Warehouse
 # BMP Alternative

Item	Description	Unit	Unit Price	Quantity	Extension	
1)	Excavation	CY	$7.50	614.7	$4,610.10	
2)	Erosion Control	LS	$1,500.00	1.0	$1,500.00	
3)	Clay Liner	SF	$1.25	5,532.1	$6,915.15	
4)	Street Restoration	SY	$20.00	0.0	$0.00	
5)	Re-Stabilization	SY	$1.00	614.7	$614.68	
	DIRECT COST SUBTOTAL				$13,639.93	
	Unexpected Design Details		30%		$4,091.98	$25,000 Cap
	* Engineering Costs		15%		$6,000.00	$4,500 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$23,731.91	
	TOTAL CONCEPTUAL COST ESTIMATE (2010-$s)				**$23,731.91**	

Notes:
* Engineering Cost to include: Survey, Property Investigation, Design, Plans & Specs, and Construction Management.

Village of Belleville
Proposed Water Quality Pond - Greenview Place East
 # BMP Alternative

Item	Description	Unit	Unit Price	Quantity	Extension	
1)	Excavation	CY	$7.50	3,666.3	$27,497.25	
2)	Erosion Control	LS	$1,500.00	1.0	$1,500.00	
3)	Clay Liner	SF	$1.25	0.0	$0.00	
4)	Street Restoration	SY	$20.00	0.0	$0.00	
5)	Re-Stabilization	SY	$1.00	7,332.6	$7,332.60	
	DIRECT COST SUBTOTAL				$36,329.85	
	Unexpected Design Details		30%		$10,898.96	$25,000 Cap
	* Engineering Costs		15%		$6,000.00	$4,500 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$53,228.81	
	TOTAL CONCEPTUAL COST ESTIMATE (2010-$s)				**$53,228.81**	

Notes:
* Engineering Cost to include: Survey, Property Investigation, Design, Plans & Specs, and Construction Management.

Village of Belleville
Proposed Water Quality Pond - Greenview Place West
 # BMP Alternative

Item	Description	Unit	Unit Price	Quantity	Extension	
1)	Excavation	CY	$7.50	842.2	$6,316.20	
2)	Erosion Control	LS	$1,500.00	1.0	$1,500.00	
3)	Clay Liner	SF	$1.25	0.0	$0.00	
4)	Street Restoration	SY	$20.00	0.0	$0.00	
5)	Re-Stabilization	SY	$1.00	842.2	$842.16	
	DIRECT COST SUBTOTAL				$8,658.36	
	Unexpected Design Details		30%		$2,597.51	$25,000 Cap
	* Engineering Costs		15%		$6,000.00	$4,500 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$17,255.87	
	TOTAL CONCEPTUAL COST ESTIMATE (2010-$s)				**$17,255.87**	

Notes:
* Engineering Cost to include: Survey, Property Investigation, Design, Plans & Specs, and Construction Management.

Village of Belleville
Proposed Water Quality Pond - St. Francis, South
 # BMP Alternative

Item	Description	Unit	Unit Price	Quantity	Extension	
1)	Excavation	CY	$7.50	595.3	$4,464.90	
2)	Erosion Control	LS	$1,500.00	1.0	$1,500.00	
3)	Clay Liner	SF	$1.25	0.0	$0.00	
4)	Street Restoration	SY	$20.00	0.0	$0.00	
5)	Re-Stabilization	SY	$1.00	595.3	$595.32	
	DIRECT COST SUBTOTAL				$6,560.22	
	Unexpected Design Details		30%		$1,968.07	$25,000 Cap
	* Engineering Costs		15%		$6,000.00	$4,500 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$14,528.29	
	TOTAL CONCEPTUAL COST ESTIMATE (2010-$s)				**$14,528.29**	

Notes:
* Engineering Cost to include: Survey, Property Investigation, Design, Plans & Specs, and Construction Management.

Village of Belleville
Proposed Water Quality Pond - St. Francis, North
 # BMP Alternative

Item	Description	Unit	Unit Price	Quantity	Extension	
1)	Excavation	CY	$7.50	2,028.0	$15,209.70	
2)	Erosion Control	LS	$1,500.00	1.0	$1,500.00	
3)	Clay Liner	SF	$1.25	0.0	$0.00	
4)	Street Restoration	SY	$20.00	0.0	$0.00	
5)	Re-Stabilization	SY	$1.00	2,028.0	$2,027.96	
	DIRECT COST SUBTOTAL				$18,737.66	
	Unexpected Design Details		30%		$5,621.30	$25,000 Cap
	* Engineering Costs		15%		$6,000.00	$4,500 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$30,358.96	
	TOTAL CONCEPTUAL COST ESTIMATE (2010-$s)				**$30,358.96**	

Notes:
* Engineering Cost to include: Survey, Property Investigation, Design, Plans & Specs, and Construction Management.

Village of Belleville
Proposed Water Quality Pond - Ace Hardware
 # BMP Alternative

Item	Description	Unit	Unit Price	Quantity	Extension	
1)	Excavation	CY	$7.50	329.1	$2,468.40	
2)	Erosion Control	LS	$1,500.00	1.0	$1,500.00	
3)	Clay Liner	SF	$1.25	2,962.1	$3,702.60	
4)	Street Restoration	SY	$20.00	0.0	$0.00	
5)	Re-Stabilization	SY	$1.00	329.1	$329.12	
	DIRECT COST SUBTOTAL				$8,000.12	
	Unexpected Design Details		30%		$2,400.04	$25,000 Cap
	* Engineering Costs		15%		$6,000.00	$4,500 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$16,400.16	
	TOTAL CONCEPTUAL COST ESTIMATE (2010-$s)				**$16,400.16**	

Notes:
* Engineering Cost to include: Survey, Property Investigation, Design, Plans & Specs, and Construction Management.

Village of Belleville
Proposed Water Quality Pond - High School
 # BMP Alternative

Item	Description	Unit	Unit Price	Quantity	Extension	
1)	Excavation	CY	$7.50	851.8	$6,388.80	
2)	Erosion Control	LS	$1,500.00	1.0	$1,500.00	
3)	Clay Liner	SF	$1.25	0.0	$0.00	
4)	Street Restoration	SY	$20.00	0.0	$0.00	
5)	Re-Stabilization	SY	$1.00	851.8	$851.84	
	DIRECT COST SUBTOTAL				$8,740.64	
	Unexpected Design Details		30%		$2,622.19	$25,000 Cap
	* Engineering Costs		15%		$6,000.00	$4,500 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$17,362.83	
	TOTAL CONCEPTUAL COST ESTIMATE (2010-$s)				**$17,362.83**	

Notes:
* Engineering Cost to include: Survey, Property Investigation, Design, Plans & Specs, and Construction Management.

Village of Belleville
Proposed Water Quality Pond - Federal Industries (includes wet pond retrofit and re-routing of Fifth Avenue Storm Sewer)
 # BMP Alternative

Item	Description	Unit	Unit Price	Quantity	Extension	
1)	Excavation	CY	$7.50	2,962.1	$22,215.60	
2)	RCP Cost and Installation	LF	$40.00	100.0	$4,000.00	
3)	Outlet Structure	EA	$2,000.00	1.0	$2,000.00	
4)	Inlet Structure	EA	$2,000.00	1.0	$2,000.00	
5)	Erosion Control	LS	$2,500.00	1.0	$2,500.00	
6)	Clay Liner	SF	$1.25	7,666.6	$9,583.20	
7)	Street Restoration	SY	$20.00	80.0	$1,600.00	
8)	Re-Stabilization	SY	$1.00	2,962.1	$2,962.08	
	DIRECT COST SUBTOTAL				$46,860.88	
	Unexpected Design Details		30%		$14,058.26	$25,000 Cap
	* Engineering Costs		15%		$7,029.13	$4,500 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$67,948.28	
	TOTAL CONCEPTUAL COST ESTIMATE (2010-$s)				**$67,948.28**	

Notes:
* Engineering Cost to include: Survey, Property Investigation, Design, Plans & Specs, and Construction Management.

Village of Belleville
Proposed Water Quality Pond - North & West of Bowlevard
 # BMP Alternative

Item	Description	Unit	Unit Price	Quantity	Extension	
1)	Excavation	CY	$7.50	56.5	$423.50	
2)	RCP Cost and Installation	LF	$40.00	0.0	$0.00	
3)	Outlet Structure	EA	$2,000.00	0.0	$0.00	
4)	Erosion Control	LS	$1,500.00	1.0	$1,500.00	
5)	Street Restoration	SY	$20.00	0.0	$0.00	
6)	Re-Stabilization	SY	$1.00	169.4	$169.40	
	DIRECT COST SUBTOTAL				$2,092.90	
	Unexpected Design Details		30%		$627.87	$25,000 Cap
	* Engineering Costs		15%		$6,000.00	$4,500 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$8,720.77	
	TOTAL CONCEPTUAL COST ESTIMATE (2010-$s)				**$8,720.77**	

Notes:
* Engineering Cost to include: Survey, Property Investigation, Design, Plans & Specs, and Construction Management.