

## Memorandum

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Date: March 9, 2009  
To: Sam Tobias  
Fond du Lac County Planning/Parks Department  
From: Caroline Burger, PE  
Joe Hanson, EIT  
AECOM  
Subject: **Fond du Lac County Stormwater Pollution Analysis**  
**Fond du Lac County, Wisconsin**  
**AECOM Project No. 106421**

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### Background / Scope of Work

The analysis described in this memorandum report was conducted in partial fulfillment of the Fond du Lac County Municipal Separate Storm Sewer System (MS4) General Permit. This report documents the stormwater pollution analysis conducted for the area of the Fond du Lac County Facilities and highways regulated under the MS4 permit. The permit requires an estimate of the annual stormwater pollution loadings (sediment and phosphorus) for all storm sewer outfalls that meet the regulatory definition of an "MS4". This pollution loading analysis establishes the base pollution load and the pollution reduction resulting from the existing stormwater best management practices (BMPs) in the County.

A portion of the Fond du Lac County MS4 regulated highways are within the City of Fond du Lac's municipal boundary. The City of Fond du Lac completed a citywide stormwater management plan in June 2006. The City has implemented many of the BMPs recommended in the plan to date; and some of those BMPs treat County land. This memorandum summarizes the County's base load. It then shows the reductions from both the County and City stormwater BMPs.

There are five figures at the end of this memo showing relevant information to the modeling effort:

Figure 1: Fond du Lac County Highway Map: This map shows all of the County highways that fall under the MS4 permit and that were modeled for this project. The highways are located within the Fond du Lac urbanized boundary. Note: the analysis also included some highways on "urban lands" outside of the urbanized boundary.

Figures 2-5: Fond du Lac County Facility Maps: These maps show the four Fond du Lac County facility sites: Fairgrounds, Golf Course, Airport, and the UW-Fond du Lac Campus, that fall under the MS4 permit and that were modeled for this project. Each map shows the drainage basins and source areas used during the modeling effort.

## Summary of Methods

The analysis used the Windows™ version of an urban pollution loading model “Source Loading and Management Model” (WinSLAMM) to model annual pollutant loadings under the following two scenarios:

- 1) Base Conditions: October 1, 2004, land use conditions with no BMPs applied.
- 2) Existing Conditions: October 1, 2004, land use conditions with existing BMPs implemented as of January 2009. The existing BMPs are described later in this memorandum.
- 3) Future Conditions: October 1, 2004, land use conditions with the existing and the proposed BMPs.

The policies and procedures set forth by the Wisconsin Department of Natural Resources (WDNR) to analyze developed urban areas were followed throughout the process. These policies can be found at the WDNR website: <http://www.dnr.state.wi.us/runoff/stormwater/muni.htm>

It should also be noted that the analysis conducted for Fond du Lac County highways followed the current procedures being conducted by the Wisconsin Department of Transportation (WDOT) for analysis of the state highway system in compliance with Trans 401. These policies are being reviewed by the WDNR and WDOT at this time.

## Area of Analysis

All highway ROW lands within the City of Fond du Lac urbanized area boundary and lands of County facilities as of October 1, 2004, were analyzed with the exceptions as described below. The following list summarizes the lands excluded from the analysis in accordance with WDNR policies:

- All city, town, state street right-of-ways adjacent to the County facilities
- All undeveloped lands of 5 acres or more
- All lands zoned as agriculture, and under agricultural use
- County properties with no MS4 qualified system

## Input Information

This analysis was conducted in two phases: The first phase established the base and existing loads for the four County facilities with MS4 permits. The second phase analyzed the base, existing, and proposed loads for the County MS4 highway ROW. Different approaches were taken in terms of setting up and executing each phase. The differences in the two approaches are described below.

### *Phase I – County Facilities*

The following Fond du Lac County facilities were analyzed:

- County Fairgrounds
- County Golf Course (Rolling Meadows)
- County Airport

- UW-Fond du Lac Campus

A GIS database was created characterizing in terms of urban stormwater pollution, the following information:

- Parcels of County owned lands (provided by Fond du Lac County)
- Hydrologic soil groups (based on USDA NRCS soil data)
- Drainage basins for County facility sites delineated by AECOM.
- Source area conditions as of October 2004 assigned by AECOM and verified by aerial images

WinSLAMM “dat” files were created specifically to represent each delineated drainage basin of the facility area. Each “dat” file included surface area values and descriptions for each “source area” feature within the drainage basin. Source areas in WinSLAMM consist of rooftop, paved/unpaved parking, driveway, sidewalk, and landscaped areas. Table A-1 attached to this memo is a summary of each County facility’s source areas. Each source area was further defined in the WinSLAMM “dat” file based on direct observations.

#### *Phase II – County Highway ROW*

The following highways within the City of Fond du Lac Urbanized Area were analyzed:

- STH 175
- CTH QQ
- CTH H
- CTH UU
- CTH V
- CTH OO
- CTH K
- CTH T
- CTH VV
- CTH W
- USH 151

A GIS database was created characterizing, in terms of urban stormwater pollution generation, the following information:

- Adjacent land use conditions as of October 2004 assigned by AECOM and verified by aerial images
- Hydrologic soil groups (based on USDA NRCS soil data)
- Drainage conditions delineated by County staff
- Existing street sweeping (based on the City of Fond du Lac street sweeping schedule)
- Existing and proposed wet detention pond TSS reduction efficiency (based on the City of Fond du Lac 2006 Citywide Stormwater Management Plan)

WinSLAMM “standard land use” (SLU) files for nine possible land uses were created to represent each section of ROW area. The land uses represented were commercial, freeway, industrial, institutional, open space, and residential.

### Stormwater Model Description

WinSLAMM version 9.3.1 was used to conduct the analysis. The following supporting parameters files were used:

- WisReg – Green Bay Five Year Rainfall.ran
- WI\_GEO01.ppd
- WI\_SL06 Dec06.rsv
- WI\_AVG01.psc
- WI\_DLV01.prr
- WI\_Res and Other Urban Dec06.std
- WI\_Com Inst Indust Dec06.std

### Existing Stormwater BMPs

The three BMPs incorporated into the WinSLAMM analysis are discussed below. Each of the BMPs were modeled for their TSS reduction capabilities.

Grass swale drainage: This refers to grass-lined swales along County roads and serving County facilities, which provide vegetated flow path surfaces. Grass swales have the ability to treat stormwater and allow for stormwater infiltration, whereas the alternative storm sewer system does not. In this case, the swales were categorized by ten different geometric configurations, based on direct observation by AECOM staff. The dynamic infiltration rate for the swales in WinSLAMM was referenced from the WDNR Conservation Practice Standard 1002, using the NRCS hydrologic soil group.

Disconnection: This refers to impervious surfaces, such as sidewalks, roofs, and parking lots, which drain directly onto pervious (vegetated) surfaces and allow for some stormwater infiltration before runoff enters the conveyance system. Directly connected source areas are those impervious surfaces that drain into a stormwater conveyance system without passing over pervious surfaces.

In accordance with WDNR policies, the analyzed base condition uses a fixed percent connection factor for impervious source areas. The analysis was conducted using the standard land use disconnection of 40% for the Campus, Golf Course, and Fairgrounds and 10% for the Airport, for the base condition, which corresponds to WDNR standards. Using aerial photos, storm sewer mapping, and observed site conditions, AECOM determined that a disconnection of 100% would appropriately represent the existing conditions on the Airport site.

For the highway ROW study, it was assumed that all source areas were 100% directly connected because the ROW area is adjacent to the drainage system serving the highway.

Wet detention ponds: These are depressions in the ground surface featuring a permanent pool of standing water. During rainfall events, stormwater enters the detention pond and is treated before being allowed to flow downstream. Wet detention ponds can be fed by both storm sewer and swale drainage systems.

There are ten existing wet detention ponds in the City of Fond du Lac that serve County highway ROW. The TSS reduction efficiency of these BMPs was determined during the 2006 Citywide analysis. This efficiency was applied to the pollution load generated by the County highway ROW.

Future Stormwater BMPs

The 2006 Citywide analysis also included recommended stormwater BMPs needed to reach the City’s 2008 and 2013 permit requirements for stormwater pollution reduction. The proposed future BMP efficiency determined in the Citywide study was applied to the pollution load generated by the county highway ROW. Proposed future BMPs include construction of eight new wet detention ponds and a series of biofilters to serve a watershed with a relatively high pollution load.

**Results**

The results of the WinSLAMM modeling analysis are shown in Table 1. This table shows the annual Total Suspended Solids (TSS) and Total Phosphorous (TP) loadings under the base and existing conditions (see definitions on page one of this memo), for all lands under the County’s MS4 permit. Note: the table shows the TSS control effectiveness for the existing BMPs since TSS is the regulated pollutant in the MS4 permit.

**Table 1  
 Annual Base and Existing Conditions Pollution Loads**

County Facility	Base Conditions		Existing Conditions*		
	TSS Load (tons/yr)	TP Load (lbs/yr)	TSS Load (tons/yr)	Percent TSS Control (%)	TP Load (lbs/yr)
County Fairgrounds	8.8	56.4	8.8	0%	56.4
Rolling Meadows Golf Course	8.9	121.1	1.8	80%	24.2
County Airport	23.4	218.4	14.5	38%	161.1
UW-Fond du Lac Campus	5.2	38.5	3.3	36%	27.8
County Highway Right-of-Way	188.3	925.4	131.2	30%	668.5
<b>Total:</b>	<b>234.6</b>	<b>1,359.7</b>	<b>159.5</b>	<b>32%</b>	<b>937.9</b>

\*Includes reduction from City of Fond du Lac Existing BMPs

The County’s annual base conditions TSS load is 234.6 tons per year. After accounting for the TSS control from the existing County and City BMPs, the existing conditions TSS load is 159.5 tons per year, which represents a TSS reduction of 32%.

### Proposed Management

In 2006, the City of Fond du Lac's Stormwater Management Plan was completed. The methodology and results of this study can be found in the "Citywide Stormwater Management Plan and Ordinance Development" report dated June 2006. As part of this plan, future BMPs were proposed for the City to meet its goal of 40% TSS control. These proposed BMPs include detention ponds, biofilters, and engineered swales. Some of these devices serve County highway runoff.

If an intergovernmental agreement is established, the County can take credit for this TSS control when the BMPs have been constructed. The proposed future BMP efficiency determined in the citywide study was applied to the pollution load generated by the county highway ROW. Table 2 gives a summary of TSS loads for each highway modeled under base, existing, and proposed conditions.

It should be noted that some of the names for the county highways have changed since 2004 and some will change again in 2010. A summary of the base conditions for each of the different names is shown in Table A-2.

**Table 2  
 Pollution Loads for County Highways Right-of-Ways**

2004 Highway Name	Right of Way Area (acres)	Existing Conditions						Proposed Conditions	
		Base Conditions		County BMPs		With County and City BMPs		With County and City BMPs	
		TSS Load (tons/yr)	TP Load (lbs/yr)	TSS Load (tons/yr)	Percent TSS Control (%)	TSS Load (tons/yr)	Percent TSS Control (%)	TSS Load (tons/yr)	Percent TSS Control (%)
CTH H	6.0	2.7	14.1	1.8	32%	1.8	32%	1.8	32%
CTH K	8.5	3.9	21.4	2.5	35%	2.5	35%	2.5	35%
CTH OO	13.1	5.9	32.6	4.1	31%	4.1	31%	4.1	31%
CTH QQ	14.3	5.8	32.2	3.5	39%	3.5	39%	3.5	39%
CTH T	19.8	9.4	49.9	7.6	19%	7.6	20%	5.4	43%
CTH UU	29.8	12.7	62.3	9.8	22%	9.2	27%	8.1	36%
CTH V	33.0	16.5	84.0	12.5	25%	10.2	38%	10.2	38%
CTH VV	48.2	22.6	118.7	16.1	29%	16.1	29%	16.1	29%
CTH W	61.3	28.5	129.1	20.4	28%	17.6	38%	16.2	43%
STH 175	82.1	39.6	174.6	27.3	31%	27.0	32%	20.4	49%
USH 151	90.7	40.8	206.4	38.3	6%	31.7	22%	31.2	24%
<b>Total:</b>	<b>406.8</b>	<b>188.3</b>	<b>925.4</b>	<b>143.9</b>	<b>24%</b>	<b>131.2</b>	<b>30%</b>	<b>119.4</b>	<b>37%</b>

Table 3 summarizes the overall results of the County analysis after incorporation of the City's existing and proposed BMPs.

**Table 3  
 Pollution Load Results for Fond du Lac County**

County Facility	Base TSS Load	Existing Conditions				Proposed Conditions	
		County BMPs		With County and City BMPs		With County and City BMPs	
		TSS Load	Percent TSS Control	TSS Load	Percent TSS Control	TSS Load	Percent TSS Control
	(tons/yr)	(tons/yr)	(%)	(tons/yr)	(%)	(tons/yr)	(%)
County Fairgrounds	8.8	8.8	0%	8.8	0%	8.8	0%
Rolling Meadows Golf Course	8.9	1.8	80%	1.8	80%	1.8	80%
County Airport	23.4	14.5	38%	14.5	38%	14.5	38%
UW-Fond du Lac Campus	5.2	3.3	36%	3.3	36%	3.3	36%
County Highway Right-of-Way	188.3	143.9	24%	131.2	30%	119.4	37%
<b>Total:</b>	<b>234.6</b>	<b>172.2</b>	<b>27%</b>	<b>159.5</b>	<b>32%</b>	<b>147.7</b>	<b>37%</b>

After incorporating the additional BMPs from the 2006 Citywide study, the County still needs to reduce its TSS loading by an additional 6.4 tons per year to achieve a 40% reduction. Since the 40% TSS reduction goal was not met, additional BMPs were investigated.

*Additional BMPs:*

Recommendation #1: City of Fond du Lac BMPs currently treat or will treat runoff from Fond du Lac County. The County should explore obtaining an intergovernmental agreement with the City of Fond du Lac. If this agreement is obtained and approved by the WDNR, the County can take credit for the TSS reduction provided by the City BMPs.

Recommendation #2: The existing conditions analysis in Fond du Lac County shows the highway ROW is responsible for approximately 80% of the TSS load. Generally BMPs are more effective in areas with relatively higher pollution load. Therefore, proposed BMPs will be best applied toward reducing the TSS load from the highway ROW.

As a first step, it is recommended that field infiltration testing along the County highway drainage swales be conducted. The field testing will verify if the default infiltration values referenced from WDNR technical standards are representative of actual conditions. If field testing finds that infiltration rates are in fact higher than the rates required by the WDNR policy, the modeling can

be revised to reflect the field information. The higher infiltration rates may provide additional TSS control from the swales.

Steps for conducting the field infiltration testing are:

1. Using the GIS data generated under this project identify portions of the swale drained highways with similar soils, slopes, and channel geometries.
2. Identify on a map field sampling locations to represent the similar conditions identified in step 1.
3. Review proposed field testing sites and procedures with the WDNR to finalize the testing plan and meet regulatory requirements.
4. Conduct the double-ring infiltration field testing (see procedures available on the WDNR municipal storm water management web site).
5. Using the results of the field testing, re-run WinSLAMM for the County highway system to determine the TSS reduction effectiveness of the swale system.

**Recommendation #3:** If the above recommendation does not result in adequate TSS control to reach the 40% reduction level, then additional BMPs will need to be discussed. This may include further cooperation with the City of Fond du Lac to expand on their BMPs to treat more of the county highway system and/or the construction of a stormwater quality pond at the County Fairgrounds to treat both County and City runoff.

## Conclusions

As stated in the Fond du Lac County MS4 Permit, the County must provide:

***2.7.1** To the maximum extent practicable, implementation of storm water management practices necessary to achieve a 20% reduction in the annual average mass of total suspended solids discharging from the MS4 to surface waters of the state as compared to implementing no storm water management controls, by March 10, 2008. The permittee may elect to meet the 20% total suspended solids standard on a watershed or regional basis by working with other permittee(s) to provide regional treatment that collectively meets the standard.*

*Note: Pursuant to s. NR 151.13(2), Wis. Adm. Code, the total suspended solids reduction requirement increases to 40% by March 10, 2013.*

The stormwater pollution modeling evaluation conducted for Fond du Lac County followed the guidelines provided by the WDNR for compliance with the MS4 Permit. As a result of this evaluation, the following conclusions are made:

1. Accounting for the existing Fond du Lac County BMPs, the County is reducing its stormwater pollution load by 62.5 tons (27%). Therefore, the County has met the TSS reduction requirements of their MS4 Permit for the 2008 goal (20%) but not the 2013 goal (40%).
2. Assuming an intergovernmental agreement is a viable option, after also accounting for the City of Fond du Lac existing BMPs, Fond du Lac County is currently reducing its pollution load by 75.1 tons per year (32%).

3. After accounting for the BMPs proposed by the City of Fond du Lac, the County will be reducing its pollution load by 86.9 tons per year (37%). This reduction still does not meet the TSS reduction 2013 goal (40%).
4. Since the 40% TSS removal goal has not been met, additional BMPs are necessary for Fond du Lac County to gain MS4 compliance. These conceptual BMPs can be discussed after the recommended infiltration testing occurs. If infiltration testing and additional modeling efforts reveal higher TSS control from grassed swales, Fond du Lac County may be closer to the goal of 40% and thus require fewer, or no additional BMPs.
4. Fond du Lac County should review these results with the WDNR to finalize their MS4 permit compliance for the TSS reduction requirements.

**Attachment A: Supporting Documentation**

**Table A-1**  
**Fond du Lac County Facilities**  
**Drainage Basin & Source Area Summary**

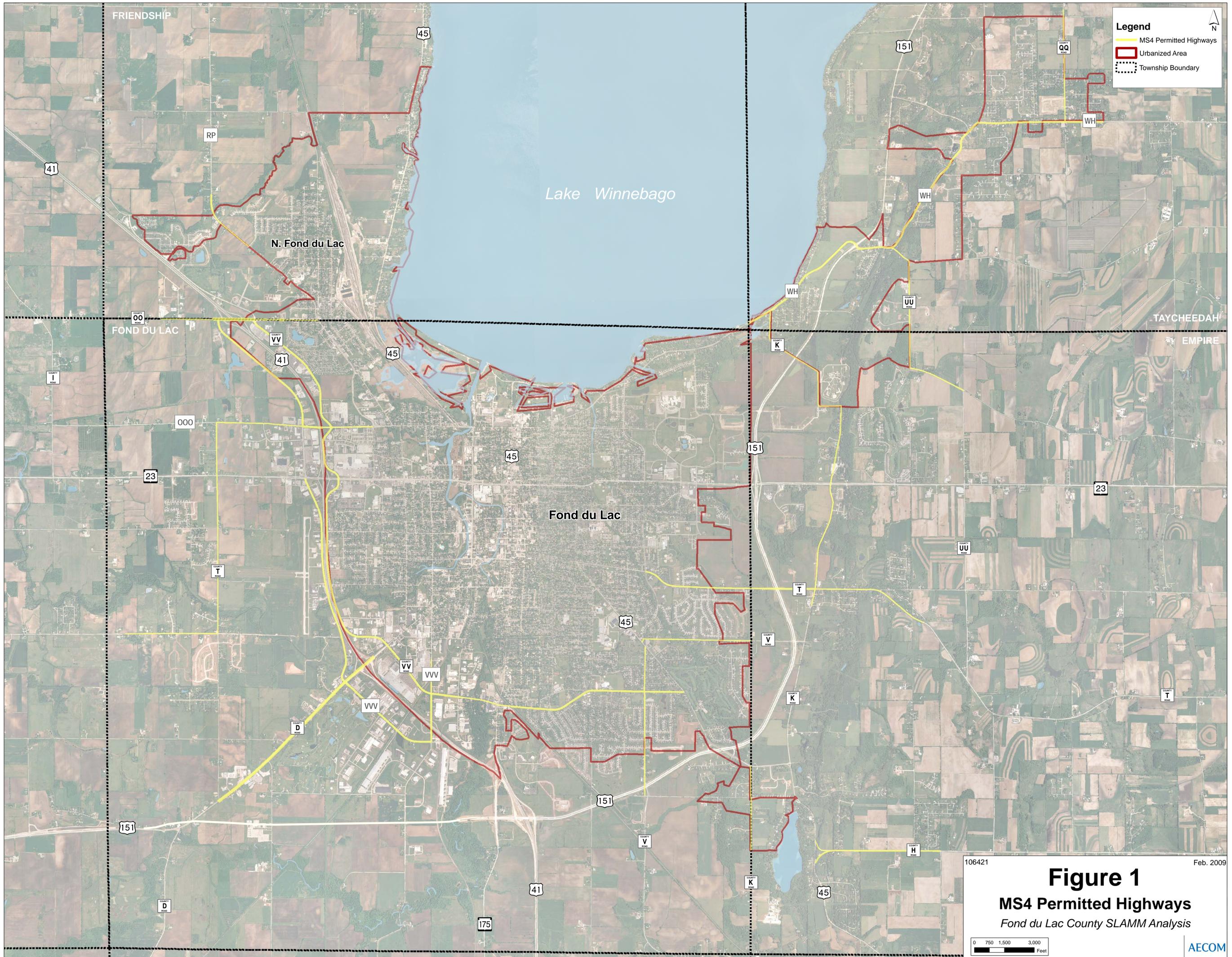
Site ID	Basin ID	Source Area (ACRES)							Total	
		Road	Driveway	Parking	Other Imp	Landscape	Roof	Sidewalk		Pool
Fairgrounds	NA	4.43	7.43	9.45	1.86	41.63	6.73	1.20	0.71	<b>73.42</b>
Site ID	Basin ID	Source Area (ACRES)							Total	
		Road	Driveway	Parking	Other Imp	Landscape	Roof	Sidewalk		Water
Golf Course	NA	0.00	0.23	3.49	0.23	236.38	0.53	5.27	20.15	<b>266.28</b>
Site ID	Basin ID	Source Area (ACRES)							Total	
		Road	Driveway	Parking	Other Imp	Landscape	Roof	Sidewalk		Water
Campus	1	0.12	0.14	0.00	0.00	14.67	0.00	0.00	2.04	16.97
	2	0.00	0.00	0.00	0.00	0.00	0.00	0.74	0.00	0.74
	3	1.20	0.31	5.12	1.30	31.39	2.04	1.22	0.96	43.54
	4	0.00	0.00	0.00	0.00	3.93	1.50	0.62	2.16	8.21
	5	0.00	0.00	1.89	0.00	0.87	0.00	0.11	0.00	2.87
	6	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59
<b>Total</b>		<b>1.92</b>	<b>0.45</b>	<b>7.02</b>	<b>1.30</b>	<b>50.85</b>	<b>3.54</b>	<b>2.69</b>	<b>5.16</b>	<b>72.92</b>
Site ID	Basin ID	Source Area (ACRES)							Total	
		Road	Driveway	Parking	Other Imp	Landscape	Roof	Sidewalk		Water
Airport	1	0.00	8.39	5.97	0.00	86.45	2.89	0.04	0.00	103.74
	2	0.00	4.95	0.00	0.00	9.69	0.00	0.00	0.00	14.64
	3	0.00	3.61	62.10	0.00	0.00	0.00	0.00	0.00	65.71
	4	0.05	0.00	0.00	0.00	13.05	0.00	0.00	0.00	13.10
	5	0.31	10.45	0.00	0.00	52.99	0.25	0.00	0.00	64.00
	6	0.00	9.83	0.00	0.00	37.91	0.00	0.00	0.00	47.74
	7	0.00	0.13	0.00	0.00	12.77	0.03	0.00	0.00	12.93
<b>Total</b>		<b>0.36</b>	<b>37.36</b>	<b>68.07</b>	<b>0.00</b>	<b>212.86</b>	<b>3.17</b>	<b>0.04</b>	<b>0.00</b>	<b>321.86</b>

**Table A-2**  
**Fond du Lac County Highways**  
**Base Conditions by Highway Names**

2004 Highway Name	2008 Highway Name	2010 Highway Name	Right of Way (acres)	TSS (tons/yr)	TP (lbs/yr)
USH 151	OLD 151	CTH WH	3.0	1.4	7.3
CTH OO	Winnebago Dr	Winnebago Dr	5.2	2.4	12.8
STH 175	CTH RP	CTH RP	6.0	2.7	14.1
CTH QQ	CTH QQ	CTH QQ	8.5	3.9	21.4
CTH OO	CTH OO	CTH OO	11.5	3.9	20.6
CTH OO	CTH OOO	CTH OOO	13.1	6.3	28.9
CTH H	CTH H	CTH H	13.1	5.9	32.6
CTH UU	CTH UU	CTH UU	14.3	5.8	32.2
CTH V	CTH V	CTH V	19.8	9.4	49.9
CTH K	CTH K	CTH K	33.0	16.5	84.0
USH 151	CTH D	CTH D	39.4	18.8	85.5
CTH T	CTH T	CTH T	48.2	22.6	118.7
USH 151	CTH WH	CTH WH	48.3	20.6	113.6
CTH VV	CTH VVV	CTH VVV	61.3	28.5	129.1
CTH W	CTH VV	CTH VV	82.1	39.6	174.6
<b>TOTAL:</b>			<b>406.8</b>	<b>188.3</b>	<b>925.4</b>

### **Attachment B: Supporting Figures**

- Figure 1: Fond du Lac County Highway Map
- Figures 2-5: Fond du Lac County Facility Maps



**Legend**

- MS4 Permitted Highways
- Urbanized Area
- Township Boundary

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**Figure 1**  
**MS4 Permitted Highways**  
 Fond du Lac County SLAMM Analysis

0 750 1,500 3,000 Feet

AECOM



**Legend**

County Parcels

**Source Areas**

- DRIVEWAY
- LANDSCAPE
- OTHER IMPERVIOUS
- PARKING
- POOL
- ROAD
- ROOF
- SIDEWALK

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**Figure 2**

**County Fairgrounds  
Fond du Lac, WI**

Fond du Lac County SLAMM Analysis

**AECOM**

0 100 200 Feet



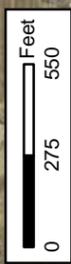
**Legend**

- County Parcels
- Source Areas**
  - DRIVEWAY
  - LANDSCAPE
  - OTHER IMPERVIOUS
  - PARKING
  - ROOF
  - SIDEWALK
  - WATER

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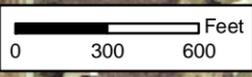
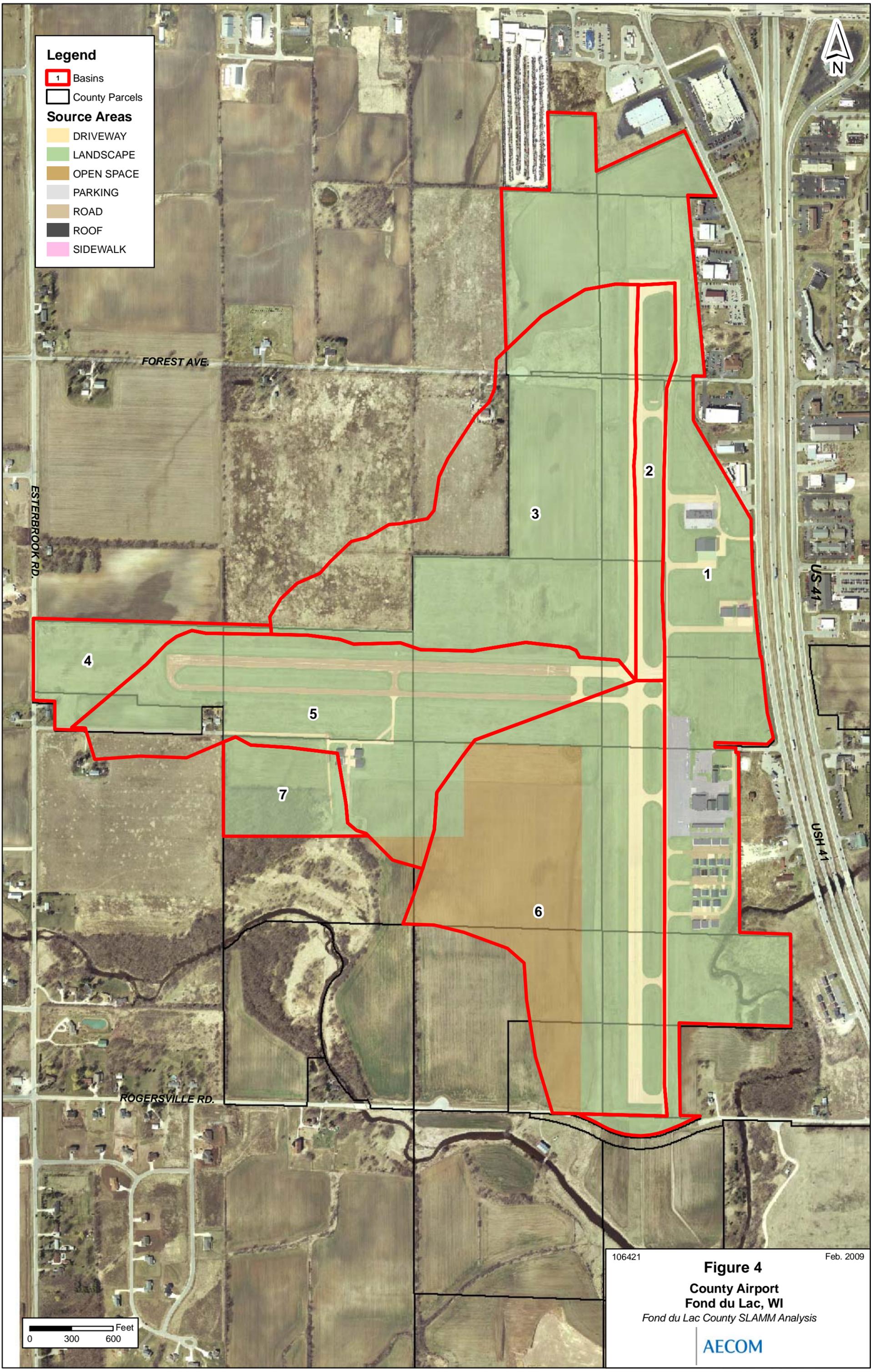
**Figure 3**  
**Rolling Meadows Golf Course**  
**Fond du Lac, WI**  
 Fond du Lac County SLAMM Analysis





**Legend**

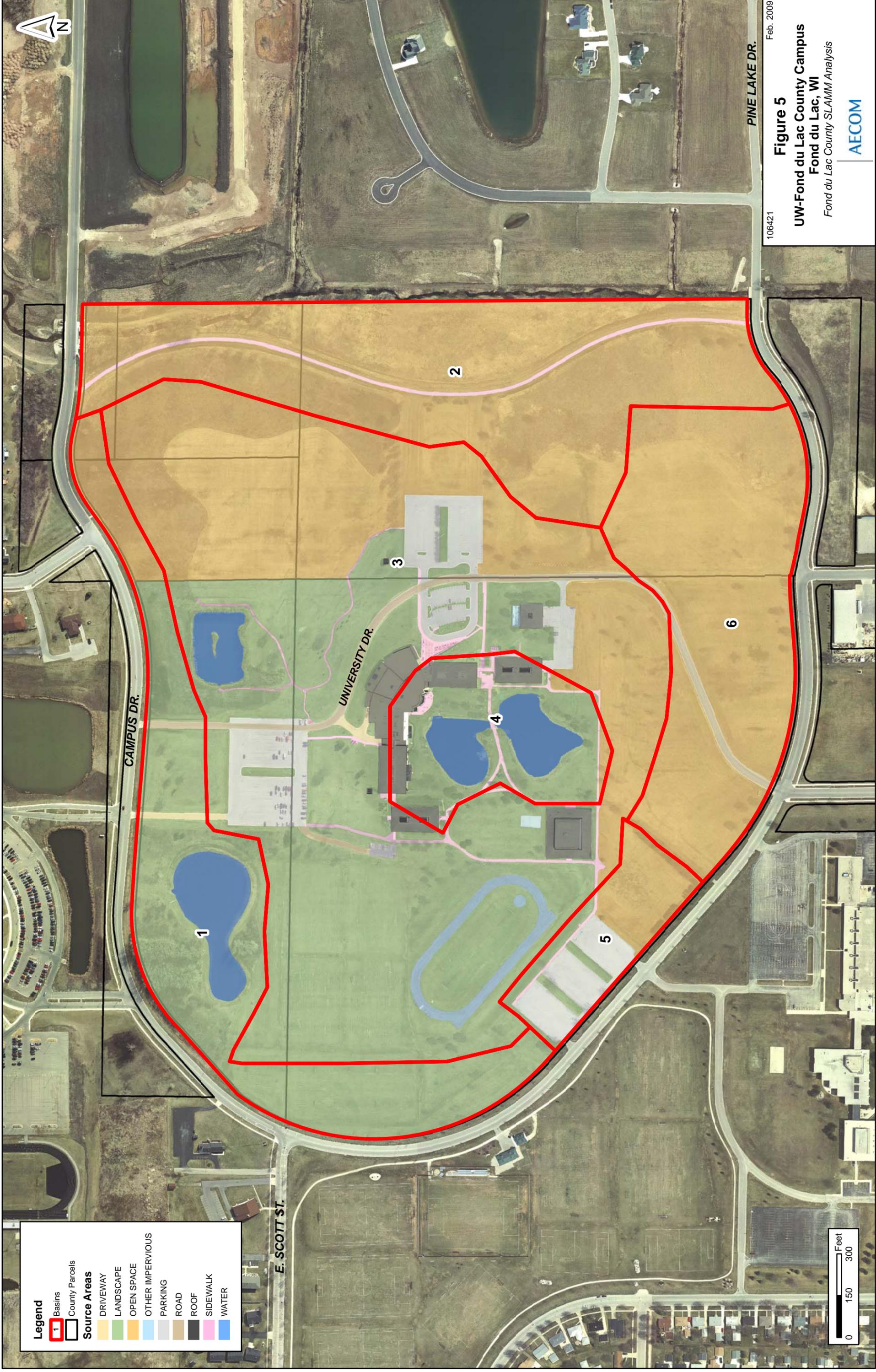
- Basins
- County Parcels
- Source Areas**
- DRIVEWAY
- LANDSCAPE
- OPEN SPACE
- PARKING
- ROAD
- ROOF
- SIDEWALK



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**Figure 4**  
**County Airport**  
**Fond du Lac, WI**  
Fond du Lac County SLAMM Analysis





**Legend**

- 1 Basins
- County Parcels
- Source Areas**
- DRIVEWAY
- LANDSCAPE
- OPEN SPACE
- OTHER IMPERVIOUS
- PARKING
- ROAD
- ROOF
- SIDEWALK
- WATER

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**Figure 5**  
 UW-Fond du Lac County Campus  
 Fond du Lac, WI  
 Fond du Lac County SLAMM Analysis

