

AECOM

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Memorandum

Date: June 16, 2009

To: Carl Rasmussen, UW Stevens Point
Don Popoff, P.E., Director of Public Works, City of Stevens Point

From: Kurt Schoen, P.E., P.H.
Joe Hanson, EIT

Subject: **University of Wisconsin – Stevens Point: Urban Stormwater
Pollution Loading Analysis
Stevens Point, Wisconsin
AECOM Project No. 105408**

Background/Scope of Work

The analysis described in this memorandum was conducted in partial fulfillment of the University of Wisconsin-Stevens Point (UWSP) Campus Municipal Separate Storm Sewer System (MS4) General Permit. This report documents the stormwater pollution analysis conducted for the area of the UWSP campus 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) on the campus.

The analysis used the Windows™ version of an urban pollution loading model "Source Loading and Management Model" (WinSLAMM) to model annual pollution 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 the BMPs as of January 2009 applied. The existing BMPs are described later in this memorandum.

If under scenario 2, the existing BMPs were not sufficient to meet the required 20 percent and 40 percent Total Suspended Solids (TSS) reduction requirements, additional BMPs would be evaluated to achieve this goal.

Summary of Methods for Pollution Loading Model – Base and Existing Conditions

This section summarizes the analysis conducted for UWSP to determine the base conditions pollution load and the amount of pollution load reduction currently being achieved by UWSP's existing BMPs. The pollution loads are established using the policies and procedures set forth by the Wisconsin Department of Natural Resources (WDNR) to analyze pollution loading in 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>.

Pollution Loading Model Input Information

A GIS database was created characterizing the UWSP campus in terms of urban stormwater pollution generation. Information in the database includes:

1. Subbasin delineations (delineations by campus staff)
2. Hydrologic soil groups (USDA NRCS soil data)
3. Land use conditions as of October 2004
4. Biofilter locations (provided by campus staff)
5. Connected or disconnected impervious surfaces (based on storm sewer mapping)

Note: Campus staff delineated drainage basins captured by the university storm sewers, primarily directly connected impervious roofs and parking lots. All campus areas not draining into storm sewers were grouped into several subbasins by AECOM. This process was reviewed with Brad Johnson, WDNR West Central Region Stormwater Specialist.

Area of Analysis

All of the lands within the campus boundary of UWSP 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:

1. Undeveloped land greater than 5 acres (the entire Schmeckle Reserve).
2. City of Stevens Point owned right-of-way for all streets intersecting and surrounding the campus lands.

Stormwater Model Description

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

1. WisReg – Madison Five year Rainfall.ran WI_GEO01.ppd
2. WI_SL06 Dec06.rsv
3. WI_AVG01.psc
4. WI_DLV01.prr
5. WI_Res and Other Urban Dec06.std
6. WI_Com Inst Indust Dec06.std

WinSLAMM data files were created specifically to represent each source area present on the campus. Source areas in WinSLAMM consist of rooftop, parking, driveway, sidewalk, and

landscaped areas. The different source areas and their coverage on the campus are shown on Figure 1 following this memorandum. The source areas present on the UWSP campus are summarized by drainage basin in Table A-1.

Existing Stormwater BMPs

UWSP currently has two types of existing BMPs in place. These practices are:

1. Biofilters
2. Disconnected impervious source areas

The existing BMPs are described below.

1. **Biofilters:** Biofilters are specially constructed landscaped depressions in the ground surface. During rain events, stormwater enters the biofilter and soaks into an area with a mixture of sand, compost and top soil before being allowed to either infiltrate into the ground or exit through one or more under drain pipes. Biofilters also feature landscaping of various plant species which contribute with aesthetic value and enhance the infiltration rate of the soil.

UWSP has constructed biofilters during renovations in recent years. In addition to the newly constructed facilities, some of these treatment devices service lands that were fully or partially developed prior to October 1, 2004. The pollution control from these existing developed lands was applied to the equivalent land area as of October 1, 2004. The pollution control effectiveness of three biofilter areas was modeled using data provided by UWSP. Another biofilter area, Parking Lot R, was designed by AECOM. Therefore, a designed efficiency of 92 percent TSS removal was used for this analysis. A summary of the biofilter characteristics used for input into the WinSLAMM model is found in Table 1.

Table 1 Biofilter Characteristics for Modeling Purposes				
BMP	Contributing Drainage Area (acres)	Total Bottom Surface Area (sq ft)	Total Depth (feet)	Outlet Structure
Parking Lot R Biofilter	3.3	2,865	1.6	4" dia underdrain & 5' wide broad-crested weir
Schmeckle Visitors Center Lot Biofilter	0.5	50	6.0	62' long broad-crested weir
Building 1 Biofilter	2.5	135	1.7	18" vertical stand pipe & 5 wide broad-crested weir
Building 40 Biofilter	0.4	312	1.0	5' wide broad-crested weir

Note: With the exception of the Parking Lot R biofilter (designed by AECOM), all biofilter characteristics for modeling purposes were provided by UWSP staff. The Parking Lot R biofilter project is scheduled for construction during the summer of 2009.

2. **Disconnection:** This refers to impervious surfaces, such as rooftops or 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 used a fixed connection factor for impervious source areas. Upon investigation of the UWSP campus and based on feedback from campus staff, it was estimated that certain drainage basins on the campus had a higher degree of “disconnection” than the fixed base condition. Thus the higher disconnection factor was taken into account when modeling the campus under the existing managed condition.

The BMPs on campus were modeled for the TSS reduction capabilities.

The approximate locations of the existing BMPs are shown on Figure 2. The BMPs were modeled to determine the pollution reduction of the load generated by contributing drainage areas under the October 1, 2004, land use conditions.

Table 2 BMP Descriptions and Drainage Area Characteristics							
Location	BMP Type	Site Description	Subbasin Name	BMP Drainage Area	Total BMP Drainage Area	BMP Surface Area	Treatment Efficiency
				(acres)	(acres)	(sq. ft.)	(%)
Portage St. & Phillips St.	Biofilter	Parking Lot R	71	3.33	3.33	2,865	92
North Point Dr.	Biofilter	Schmeekle Visitors Center Lot	3	0.51	0.51	50	95
College Ave.	Biofilter	Building 1	81	2.46	2.46	135	79
Briggs St.	Biofilter	Building 40	72	0.39	0.39	312	88

Results - Base and Existing Conditions

The results of the WinSLAMM modeling analysis are shown in Table 3. This table shows the annual TSS and Total Phosphorus (TP) loadings under the base and existing conditions (see definitions on page one of this memo).

Table 3 Annual Base and Existing Conditions Pollution Loads					
Scenario	TSS Load (tons/yr)	BMP Reduction			TP Load (lbs/yr)
		Individual (tons/yr)	Individual (%)	Cumulative (%)	
Base Conditions	17.0	0.0	0.0	0.0	107
Adding disconnection	16.0	1.0	5.8	5.8	99
Counting existing biofiltration	15.8	0.2	0.5	6.3	98
Sum of Existing Conditions	15.8	1.2	----	6.3	98
Adding Parking Lot R biofiltration	14.8	1.0	6.6	12.9	94
Expected Conditions, Fall 2009	14.8	2.2	----	12.9	94

The campus annual base conditions TSS load is 17.0 tons per year. After accounting for the TSS control from the existing BMPs analyzed, the existing conditions TSS load is 15.8 tons per year, which represents a TSS reduction of 6.3 percent. The Parking Lot R biofilters have been designed and approved; construction is planned for the summer of 2009. With the operation of these new biofilters, the campus expected conditions TSS load will be 14.8 tons per year, which represents a TSS reduction of 12.9 percent.

Two figures showing information relevant to the modeling effort can be found at the end of this memo:

1. Figure 1: UWSP campus WinSLAMM Source Area Map: These maps divide the campus into three areas and show the source areas for each drainage system within the modeled campus area that was used in the WinSLAMM input (data) files.
2. Figure 2: Existing Best Management Practices: These maps divide the campus into three areas and show the approximate locations of the existing BMPs and the current campus parcel boundaries.

Proposed Management

Since the existing BMPs do not achieve the 20 percent or 40 percent TSS control required under the MS4 permit, additional stormwater BMPs were investigated. The campus needs to reduce its TSS loading by an additional 2.2 tons per year to achieve a 20 percent reduction and 5.8 tons per year to achieve a 40 percent reduction.

Load per Source Area

The first step in determining the location and size of the proposed BMPs is to conduct an analysis that characterizes the project area based on relative pollution load generation. BMPs that are applied to areas with a relatively large pollution load are generally more cost effective.

The no-controls condition pollution loading for each impervious source area identified on the UWSP campus was calculated. The cumulative load for each impervious source area is listed in

Table 4. Note: There are other pervious source areas not shown on Table 4 which account for the base loading difference between 17.0 and 14.6 tons/yr.

Table 4 Sediment (TSS) Loading by Source Area		
Source Area	Area (acres)	TSS Load (tons / yr)
Roof	20.8	1.9
Parking Lot	29.4	9.9
Driveway	1.8	0.7
Sidewalk	9.9	2.0

As shown in the table, parking lots account for the highest sediment loading for impervious surfaces on campus. Sidewalks account for the next highest sediment loading on campus. Even if 100 percent of the sediment from rooftops and sidewalks were treated, the 40 percent reduction goal (reduce the sediment load by an additional 5.8 tons/yr) could not be achieved.

Therefore, the conceptual application of new best management practices would be best used in treatment of the parking lot runoff. Because the parking lots are scattered throughout the campus, a centralized treatment approach (wet detention ponds) was deemed to be not feasible.

UWSP has previously added biofilters to existing parking lots during reconstruction projects. It is recommended that the campus continue this practice until the 40 percent TSS reduction goal has been met. Table 5 shows the pollution control results that these proposed biofilters would yield when applied to certain parking lots. The table includes a list of some of the existing parking lots that have not yet been reconstructed to feature biofilter treatment devices.

Table 5: Proposed Best Management Practices: Pollution Control

Parking Lot ID	Area (acres)	Proposed Treatment	TSS Base Load (tons/yr)	TSS Control (tons/yr)	Cumulative TSS Control (tons/yr)	Cumulative Percent TSS Control (%)
R	3.33	Biofilter	1.20	1.00	1.00	13%
Q	7.18	Biofilter	2.44	2.20	3.20	25%
P	2.91	Biofilter	0.99	0.89	4.09	30%
X	2.47	Biofilter	0.84	0.76	4.84	35%
J	2.31	Biofilter	0.79	0.71	5.55	39%
T	1.53	Biofilter	0.52	0.47	6.02	42%
W	1.22	Biofilter	0.41	0.37	6.39	44%
E	0.96	Biofilter	0.33	0.29	6.69	46%
H	0.67	Biofilter	0.23	0.21	6.89	47%
Z	0.64	Biofilter	0.22	0.20	7.09	48%
D	0.58	Biofilter	0.20	0.18	7.26	49%
Total:	23.80		8.16	7.26	7.26	

As shown in Table 5, the proposed biofilter treatment of the parking lots listed would provide an additional 7.26 tons of TSS control per year, which exceeds the 40 percent goal of 5.8 tons. The first parking lot listed in Table 5 is Parking Lot R which is scheduled for reconstruction in the

summer of 2009. The table shows the treatment of parking lot areas beyond the 40 percent goal so that UWSP can choose an appropriate combination of parking lots to reconstruct.

Conclusions

As stated in the UWSP MS4 Permit, the campus 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 the UWSP 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. After accounting for all of the existing BMPs, UWSP is currently reducing its pollution load by about 1.2 tons of TSS per year (a 6.3% reduction). Therefore, the campus has not met the TSS reduction requirements of their MS4 Permit for the 2008 goal (20 percent). The 2013 goal (40 percent) also has not been met.
2. Since both the 20 and 40 percent TSS removal goals have not been met, additional best management practices are necessary for UWSP to gain MS4 compliance. Proposed BMPs include new biofilter design and construction to treat approximately 15 acres of existing parking lots.
3. The UWSP 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
 Drainage Basin & Source Area Summary**

BASIN ID	TOTAL ACRES	DRIVEWAY	OTHER_IMPERVIOUS	OTHER_PERVIOUS	PARKING	SIDEWALK	LANDSCAPE	ROOF
2	3.02	0.05	0.00	0.00	0.07	0.00	2.79	0.12
3	0.51	0.00	0.00	0.00	0.51	0.00	0.00	0.00
4	5.24	0.01	0.00	0.00	4.33	0.02	0.70	0.17
5	1.17	0.01	0.00	0.00	0.20	0.00	0.10	0.86
6	12.84	0.01	0.00	12.65	0.10	0.00	0.08	0.00
7	0.71	0.00	0.00	0.00	0.00	0.14	0.33	0.24
8	0.46	0.00	0.17	0.24	0.00	0.06	0.00	0.00
9	0.59	0.00	0.00	0.09	0.08	0.05	0.11	0.27
10	10.96	0.01	0.01	3.51	0.04	0.60	6.80	0.00
11	0.10	0.00	0.00	0.10	0.00	0.01	0.00	0.00
12	6.90	0.00	1.02	5.65	0.01	0.07	0.14	0.02
13	0.61	0.12	0.00	0.08	0.30	0.01	0.10	0.00
14	0.76	0.00	0.00	0.00	0.00	0.09	0.67	0.00
15	0.50	0.00	0.00	0.00	0.00	0.07	0.19	0.24
16	0.40	0.00	0.00	0.00	0.00	0.08	0.32	0.00
17	2.24	0.05	0.00	0.01	0.04	0.43	1.47	0.24
18	0.46	0.00	0.00	0.00	0.00	0.06	0.16	0.24
19	0.18	0.00	0.00	0.00	0.00	0.02	0.16	0.00
20	3.04	0.01	0.00	0.00	2.73	0.00	0.13	0.17
21	0.70	0.10	0.00	0.00	0.00	0.00	0.60	0.00
22	1.87	0.14	0.00	0.00	0.00	0.19	0.82	0.71
23	0.42	0.00	0.00	0.00	0.00	0.02	0.18	0.21
24	3.58	0.00	0.00	1.18	0.00	0.66	1.50	0.24
25	1.24	0.00	0.97	0.19	0.00	0.00	0.07	0.00
26	5.15	0.18	0.02	4.63	0.00	0.10	0.21	0.01
27	2.46	0.00	0.59	0.00	0.25	0.28	1.34	0.00
28	0.60	0.00	0.00	0.00	0.00	0.03	0.31	0.27
29	0.50	0.10	0.00	0.00	0.00	0.03	0.37	0.00
30	3.64	0.03	0.00	0.18	3.33	0.00	0.11	0.00
31	3.97	0.00	0.00	0.07	3.90	0.00	0.00	0.00
32	1.40	0.16	0.00	0.00	0.00	0.22	0.78	0.24
33	0.86	0.00	0.00	0.00	0.00	0.13	0.49	0.24
34	0.31	0.00	0.00	0.00	0.00	0.06	0.25	0.00
35	0.77	0.00	0.00	0.00	0.01	0.06	0.33	0.37
36	1.67	0.11	0.00	0.00	0.00	0.12	1.44	0.00
37	0.44	0.00	0.00	0.00	0.00	0.03	0.17	0.24
38	0.51	0.00	0.00	0.00	0.00	0.03	0.23	0.24
39	1.90	0.17	0.00	0.04	0.00	0.05	0.32	1.33
40	1.99	0.01	0.00	0.00	1.62	0.13	0.23	0.00
41	0.59	0.11	0.00	0.10	0.32	0.03	0.03	0.00
42	1.17	0.01	0.00	0.00	0.00	0.15	0.61	0.39
43	0.78	0.00	0.00	0.00	0.37	0.00	0.02	0.39

**Table A-1 (cont.)
 Drainage Basin & Source Area Summary**

BASIN ID	TOTAL ACRES	DRIVEWAY	OTHER IMPERVIOUS	OTHER PERVIOUS	PARKING	SIDEWALK	LANDSCAPE	ROOF
47	0.89	0.00	0.00	0.00	0.00	0.07	0.17	0.65
48	0.44	0.00	0.00	0.00	0.31	0.04	0.09	0.00
49	0.20	0.00	0.00	0.00	0.00	0.00	0.20	0.00
50	0.33	0.00	0.00	0.00	0.02	0.02	0.28	0.00
51	0.07	0.00	0.00	0.00	0.00	0.03	0.04	0.00
52	0.18	0.00	0.00	0.00	0.00	0.04	0.14	0.00
53	1.47	0.00	0.00	0.00	1.23	0.01	0.24	0.00
54	1.57	0.00	0.00	0.00	0.41	0.08	0.36	0.73
55	1.11	0.00	0.00	0.00	0.05	0.20	0.85	0.01
56	2.25	0.00	0.00	0.00	0.01	0.69	1.51	0.04
57	0.37	0.00	0.00	0.00	0.00	0.01	0.06	0.30
58	0.86	0.00	0.00	0.00	0.21	0.06	0.08	0.51
59	1.47	0.01	0.00	0.00	0.50	0.22	0.21	0.53
60	1.01	0.00	0.00	0.00	0.01	0.12	0.14	0.73
61	1.23	0.03	0.00	0.00	1.02	0.00	0.17	0.00
62	2.74	0.17	0.00	0.00	0.04	0.74	1.77	0.02
63	8.60	0.11	0.00	0.00	0.80	2.02	1.89	3.77
64	0.34	0.00	0.00	0.00	0.00	0.00	0.01	0.33
65	0.20	0.00	0.00	0.00	0.00	0.02	0.18	0.00
66	0.94	0.01	0.00	0.00	0.65	0.04	0.06	0.18
67	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.01
68	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.01
69	0.38	0.00	0.00	0.00	0.02	0.02	0.19	0.14
70	2.49	0.00	0.00	0.00	0.27	0.35	0.45	1.41
71	3.33	0.00	0.00	0.00	3.33	0.00	0.00	0.00
72	0.39	0.00	0.00	0.00	0.21	0.07	0.11	0.01
73	0.14	0.00	0.00	0.00	0.00	0.03	0.10	0.00
74	0.40	0.00	0.00	0.00	0.00	0.02	0.10	0.27
75	0.15	0.00	0.00	0.00	0.00	0.01	0.12	0.02
76	1.69	0.01	0.00	0.00	0.32	0.34	0.60	0.43
77	0.64	0.00	0.00	0.00	0.00	0.05	0.20	0.39
78	0.09	0.00	0.00	0.00	0.00	0.00	0.09	0.00
79	0.28	0.01	0.00	0.00	0.13	0.02	0.12	0.00
80	0.37	0.00	0.00	0.00	0.26	0.01	0.10	0.00
81	2.46	0.00	0.00	0.00	0.00	0.17	2.18	0.11
82	0.56	0.01	0.00	0.00	0.04	0.06	0.45	0.01
83	0.32	0.00	0.00	0.00	0.01	0.04	0.04	0.23
84	1.33	0.00	0.00	0.00	0.04	0.06	1.22	0.01
85	1.62	0.01	0.00	0.00	1.20	0.00	0.40	0.00
86	0.21	0.00	0.00	0.00	0.00	0.00	0.04	0.16
TOTAL	134.04	1.80	2.78	28.70	29.42	9.91	40.64	20.79

Attachment B: Supporting Figures

- Figure-1: UWSP Campus Map showing SLAMM Source Areas
 - 1A: North Campus
 - 1B: South Campus
 - 1C: Schmeckle Reserve Visitor Center
- Figure-2: UWSP Campus Map showing Existing BMP Locations
 - 2A: North Campus
 - 2B: South Campus
 - 2C: Schmeckle Reserve Visitor Center
- Figure-3: UWSP Campus Map showing Potential BMP Treatment Areas
 - 3A: North Campus
 - 3B: South Campus

Legend

Storm Sewer

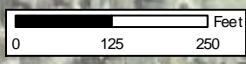
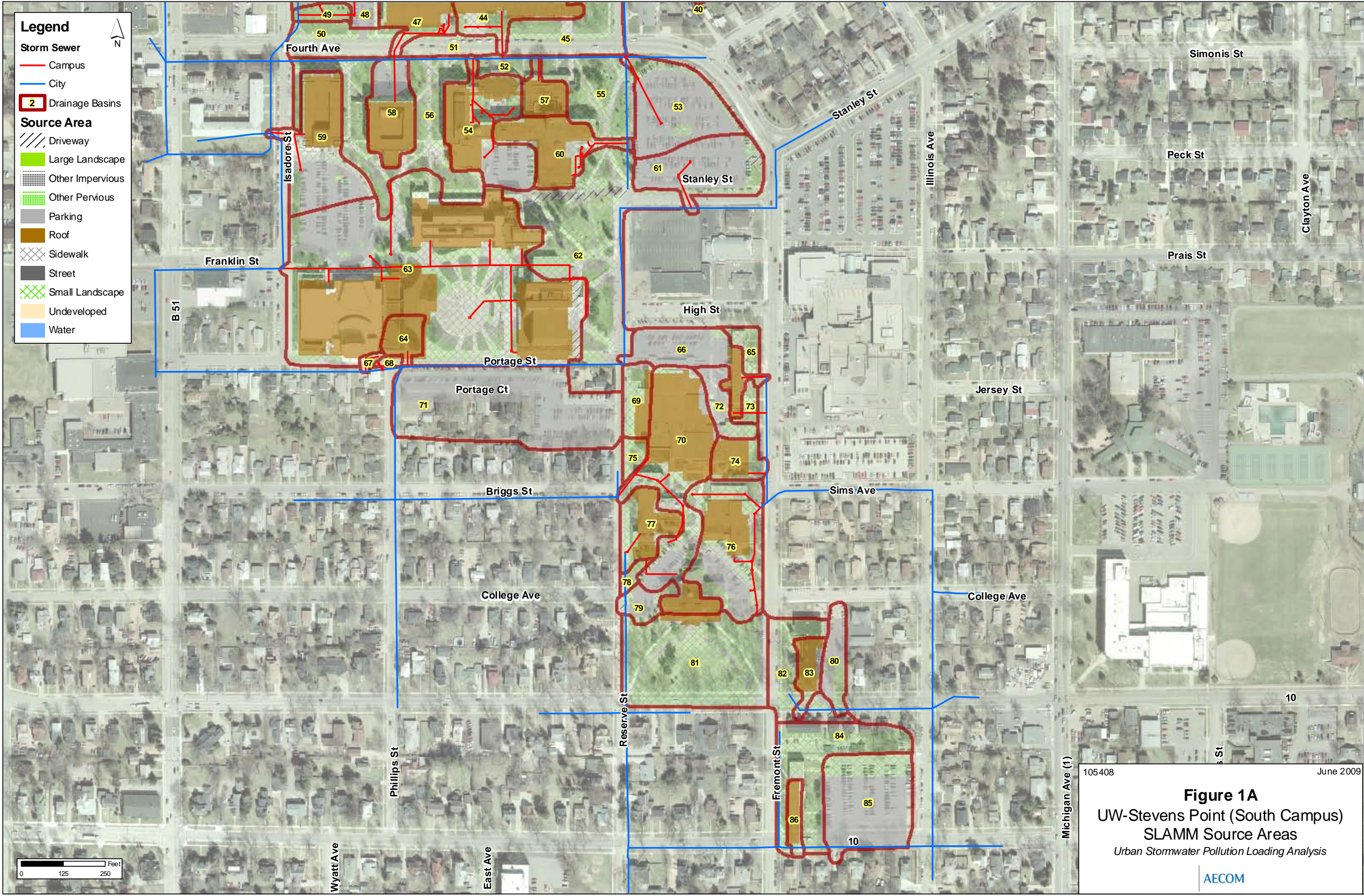
- Campus (Red line)
- City (Blue line)

Drainage Basins

- 2 (Red outline)

Source Area

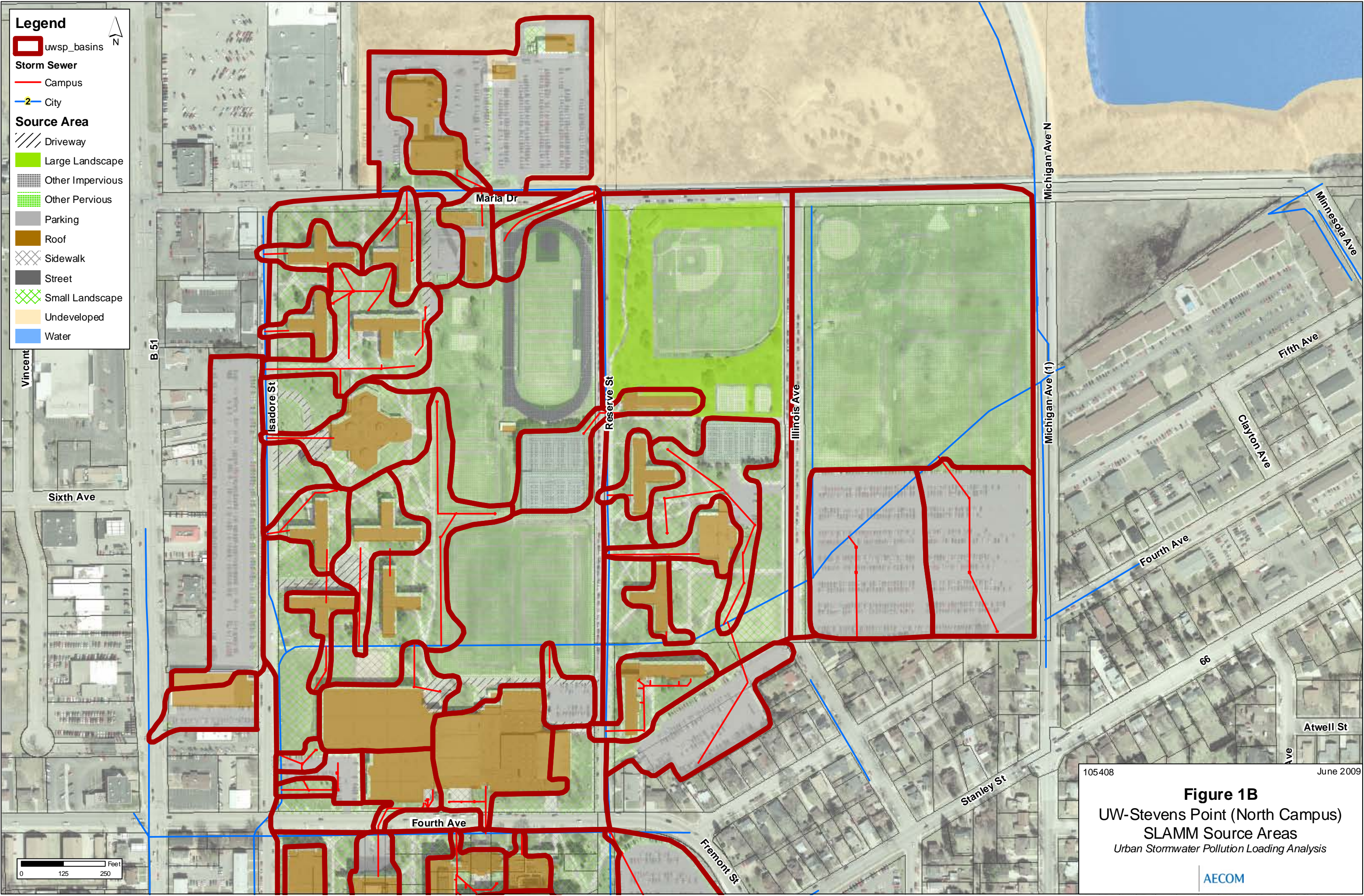
- Driveway (Diagonal lines)
- Large Landscape (Green)
- Other Impervious (Grey grid)
- Other Pervious (Green grid)
- Parking (Grey)
- Roof (Brown)
- Sidewalk (Cross-hatch)
- Street (Black)
- Small Landscape (Green cross-hatch)
- Undeveloped (Light orange)
- Water (Blue)



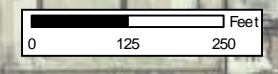
105408 June 2009

Figure 1A
 UW-Stevens Point (South Campus)
 SLAMM Source Areas
 Urban Stormwater Pollution Loading Analysis

AECOM



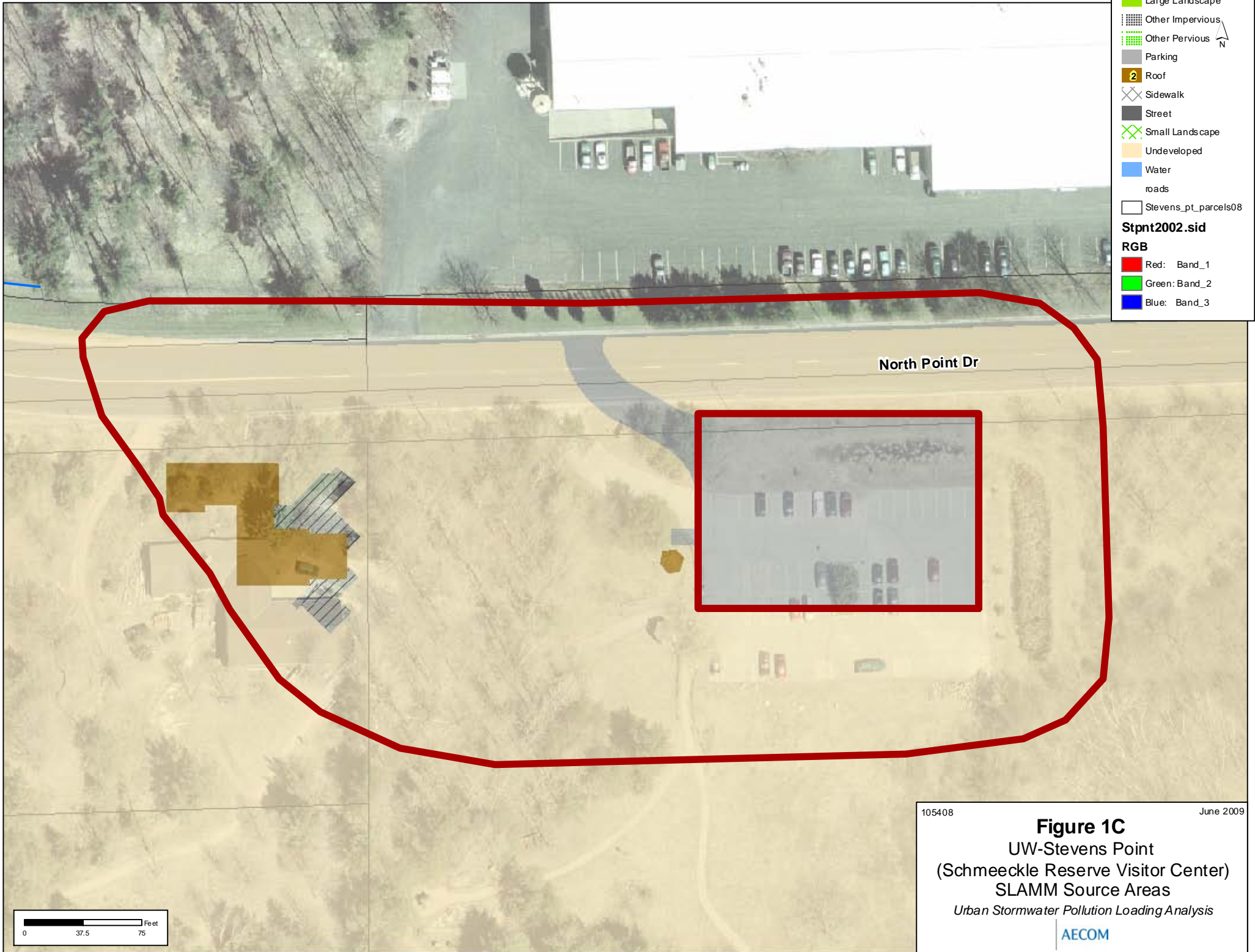
- Legend**
- uwsp_basins
 - Storm Sewer**
 - Campus
 - City
 - Source Area**
 - Driveway
 - Large Landscape
 - Other Impervious
 - Other Pervious
 - Parking
 - Roof
 - Sidewalk
 - Street
 - Small Landscape
 - Undeveloped
 - Water

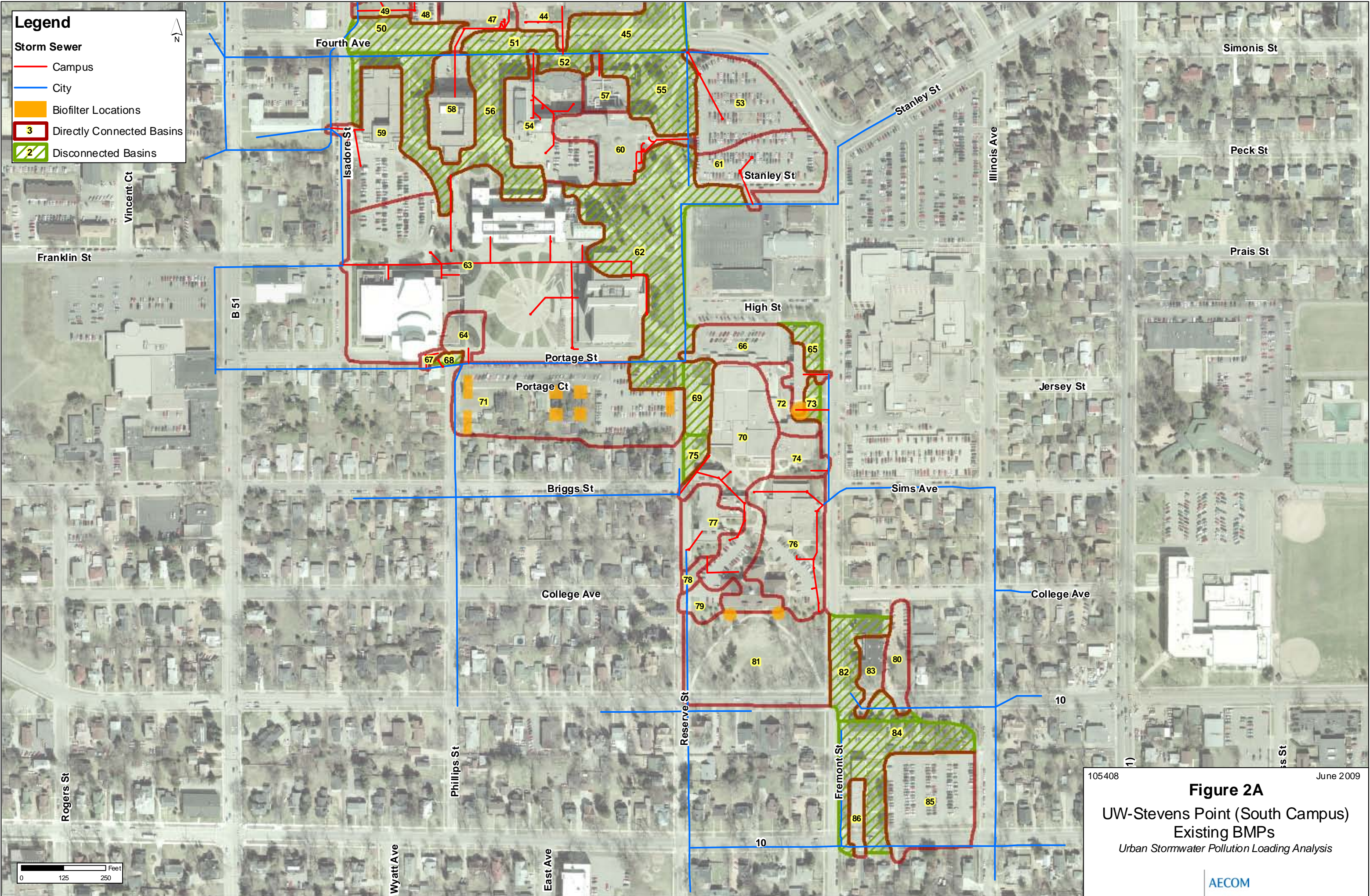


105408 June 2009

Figure 1B
 UW-Stevens Point (North Campus)
 SLAMM Source Areas
 Urban Stormwater Pollution Loading Analysis

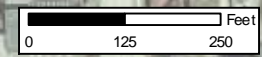
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Legend

- Storm Sewer
 - Campus
 - City
- Biofilter Locations
- 3 Directly Connected Basins
- 2 Disconnected Basins



105408 June 2009

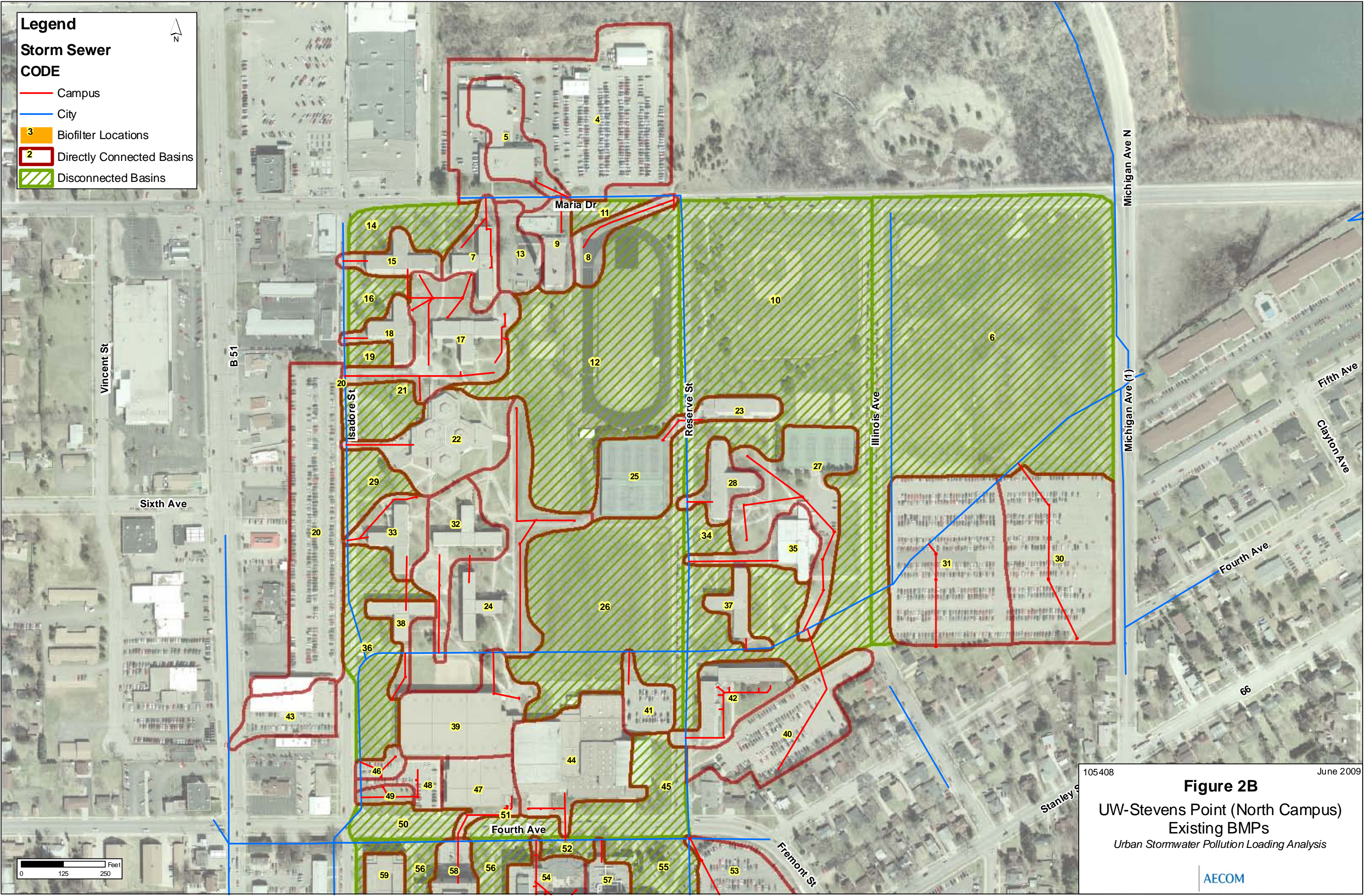
Figure 2A
 UW-Stevens Point (South Campus)
 Existing BMPs
 Urban Stormwater Pollution Loading Analysis

AECOM

Legend

Storm Sewer CODE

- Campus
- City
- 3 Biofilter Locations
- 2 Directly Connected Basins
- Disconnected Basins



105408 June 2009

Figure 2B
 UW-Stevens Point (North Campus)
 Existing BMPs
 Urban Stormwater Pollution Loading Analysis

AECOM



Legend

Storm Sewer

- Campus
- City

- Directly Connected Basins
- 3 Disconnected Basins
- 2 Biofilter Location

North Point Dr

3

2

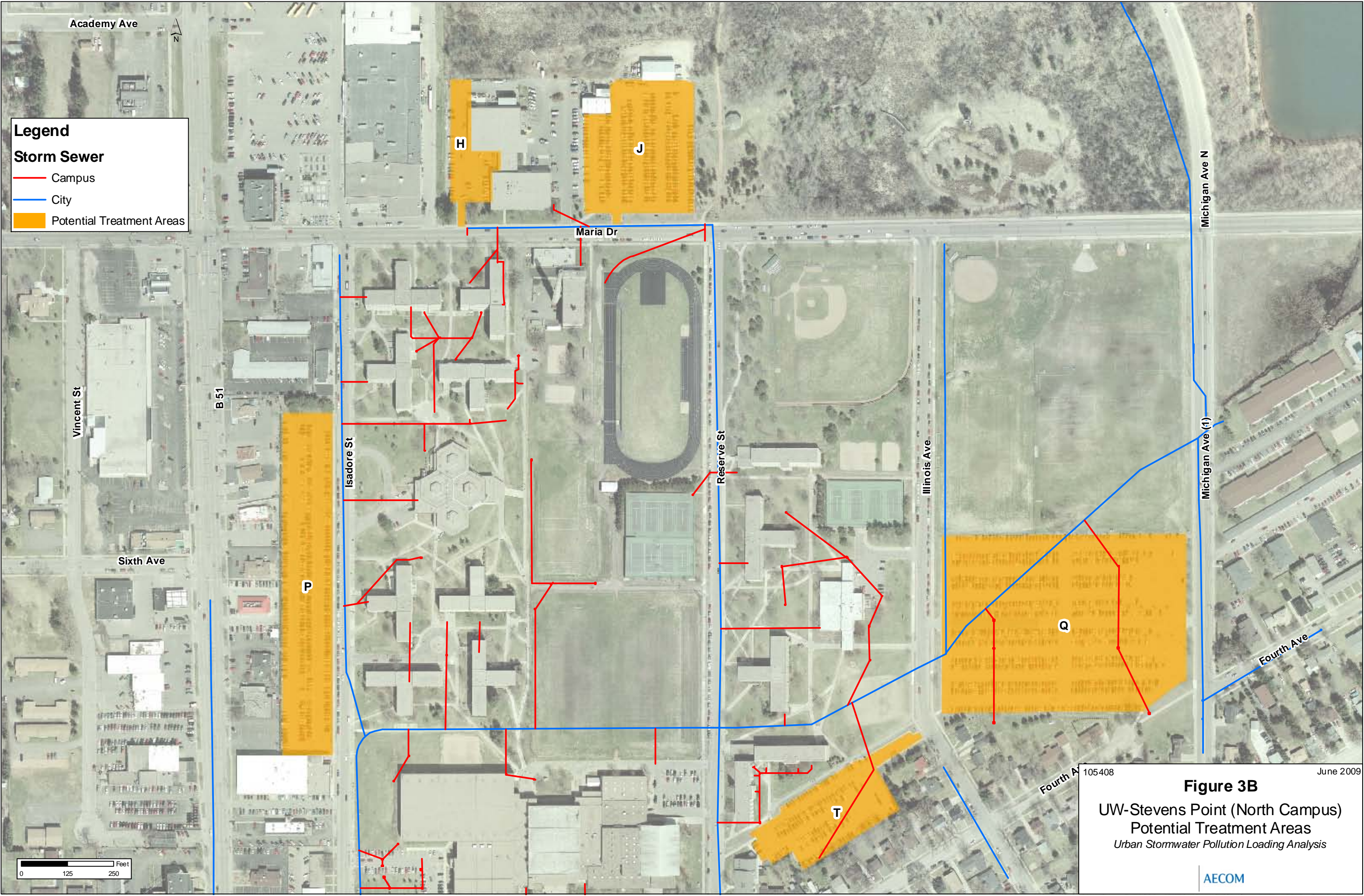
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Figure 2C
 UW-Stevens Point
 (Schmeckle Reserve Visitor Center)
 Existing BMPs

Urban Stormwater Pollution Loading Analysis

AECOM

0 37.5 75 Feet



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Figure 3B
 UW-Stevens Point (North Campus)
 Potential Treatment Areas
 Urban Stormwater Pollution Loading Analysis

AECOM