Flathead Basin TMDLs Technical Report — Urban Stormwater Sources

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Public Review Draft

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Revision History

Document Name	Revision	Release Date	Revisions
Flathead Basin TMDL Technical Report —Urban Stormwater Sources; Stakeholder Review Draft	1.0	June 16, 2009	Draft was sent to public entities that contributed data and information to the report.
Flathead Basin TMDL Technical Report — Urban Stormwater Sources; Public Review Draft	2.0	March 1, 2010	Received and incorporated comments from Kalispell, Whitefish, and Bigfork

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Foreward

A series of brief technical reports have been prepared by the U.S. Environmental Protection Agency (EPA) in support of an effort by the Montana Department of Environmental Quality (DEQ) and EPA to establish Total Maximum Daily Loads (TMDLs) for nutrients and set up a water quality simulation model for the Flathead Basin. The series includes separate reports covering a broad range of topics including:

- Groundwater Quality and Hydrology
- Urban Stormwater Sources
- Point Source Discharges
- Agriculture/Irrigation
- Timber Harvest
- Forest Fires
- Roads
- Septic Systems
- Lakes and Reservoirs
- Existing and historic water quality in nutrient impaired waters

When combined, these technical reports are intended to define a preliminary conceptual understanding of the current water quality conditions relative to nutrients, sources of nutrients, and the ways in which water and nutrients are transported within the Basin. The information presented in this series of technical reports will be used to inform the modeling and TMDL processes. However, specific details on model setup are not discussed in the technical reports – that information will be included in the forthcoming Modeling Quality Assurance Project Plan (QAPP).

It should be noted that the data and information presented in these reports reflects what was available at the time that the reports were published. It is acknowledged that in some cases, not all data could be compiled by the publication date. Additional information will be incorporated into the modeling and TMDL processes as it becomes available.

1.0 INTRODUCTION

This is one of a series of brief technical reports prepared in support of an effort by the Montana Department of Environmental Quality (DEQ) and U.S. Environmental Protection Agency (EPA) to establish Total Maximum Daily Loads (TMDLs) for nutrients, sediment, and temperature and set up a water quality simulation model for the Flathead Basin. Stormwater is one of many potentially significant sources of pollutants within the Basin that will ultimately be considered in the modeling effort. The purpose of this technical report is to provide a summary of the extent and type of stormwater sources and systems that are located within the Flathead Basin. The results will then be used to inform the modeling and TMDL processes, which will ultimately be used to define, and put into context at the watershed scale, the potential significance of storm water as a source of pollutants in the Flathead Basin.

It should be noted that the focus of this technical report is on stormwater originating from urban point and nonpoint sources, and specifically on the regulated (i.e., MPDES permitted) stormwater sources. Stormwater from urban sources can significantly alter watershed hydrology and water quality, and these sources must be well characterized to ensure that they are properly simulated in the Flathead Basin water quality model. Furthermore, the regulated stormwater sources must be well characterized to calculate existing loads, assign wasteload allocations, and incorporate those loads into stormwater permits per Clean Water Act regulations and EPA guidance (Wayland and Hanlon, 2002). While this document focuses on the urban stormwater sources, EPA acknowledges that the pollutant loads from urban sources may only be a small fraction of the total load from all stormwater sources. Other potential sources of stormwater pollution (e.g., agriculture, roads, timber harvest, fires, etc.) are discussed in separate technical memos.

1.1 Defining Stormwater

Stormwater can be defined as "water runoff that occurs when precipitation from rain or snowmelt flows over the ground," (USEPA, 2003). Stormwater runoff is natural in the environment, but can be exacerbated by impervious surfaces (e.g., parking lots, roads, roofs, etc.) that reduce infiltration and create excessive overland runoff. When stormwater runoff flows into a surface waterbody, the excess flow and pollutant loads can adversely impact beneficial uses (National Research Council, 2008). The following bullets illustrate how stormwater runoff can be detrimental to surface waterbodies:

- Impervious surfaces decrease the amount of infiltration and increase the amount of overland runoff during a storm event. For example, a parking lot decreases infiltration and causes water to flow over the pavement to the nearest point of discharge (e.g., a sewer/pipe, infiltration pond, stream/lake, or other landscape feature).
- As the stormwater runoff flows over the landscape, it can transport or dissolve pollutants that have accumulated over time (EPA, 2003). For example, stormwater runoff from a parking lot may contain excessive levels of oil and grease that have accumulated from vehicles.
- When stormwater runoff reaches a stream or lake, the pollutants contained in the runoff can adversely impact beneficial uses such as fish, aquatic life, recreational, or drinking water uses (Arnold and Gibbons, 1996; Maxted and Shaver, 1994; Schueler, 1994, 1995, 1996). For example, fish may suffer from the toxic effects of excessive metals in stormwater runoff that are otherwise not present in the stream.
- In addition to increased pollutant loads, excessive stormwater flows can impact beneficial uses by altering sediment processes and stream habitat (Shueler, 1996). For example, increased flows may result in excessive scouring which can alter aquatic life habitat.

Other secondary or tertiary impacts may develop because of increased impervious surfaces and its associated stormwater runoff (e.g., altered water tables or changes in flow paths). However, these impacts are outside of the scope of this memo.

1.2 Urban Stormwater Pollutant Concentrations and Yields

Burton and Pitt (2001) summarized the results of various studies that have looked at pollutant concentrations in stormwater runoff, including data from the Nationwide Urban Runoff Program (NURP) (EPA, 1983), Bannerman et al. (1979, 1983), Madison et al. (1979), and Pitt and McLean (1986). Typical stormwater concentrations (median values of multiple studies) are presented in Table 1, and typical land use yields are presented in Table 2. Some site specific stormwater quality data are also available for MPDES permitted cities and facilities in the Flathead watershed and those data are summarized with the facility characterizations in Section 3.0.

Table 1. Summary of pollutant concentrations associated with stormwater runoff (median concentrations).

Parameter	Residential	Mixed	Commercial	Open/ Non urban
BOD_5, mg/L	10	7.8	9.3	—
COD, mg/L	73	65	57	40
TSS, mg/L	101	67	69	70
Total Kjeldahl nitrogen, µg/L	1900	1289	1179	965
NO_2 + NO_3 (as N) µg/L	736	558	572	543
Total Phosphorus, µg/L	383	263	201	121
Soluble P, µg/L	143	56	80	26

From EPA. Results of the Nationwide Urban Runoff Program. Water Planning Division, PB 84-185552, Washington, D.C. December 1983 (as summarized in Burton and Pitt, 2001).

Table 2. Typical Urban Area Pollutant Yields (lb/acre/year or kg/ha/yr)[a] (as summarized in Burton and Pitt, 2001).

Land Use	Total Solids	Sus. Solids	TP	TKN	NH_3	NO_2 +NO_3	BOD_5	COD
Commercial	2100	1000	1.5	6.7	1.9	3.1	62	420
Parking lot	1300	400	0.7	5.1	2	2.9	47	270
High-density residential	670	420	1	4.2	0.8	2	27	170
Medium-density residential	450	250	0.3	2.5	0.5	1.4	13	50
Low-density residential[b]	65	10	0.04	0.3	0.02	0.1	1	7
Freeways	1700	880	0.9	7.9	1.5	4.2	NA[b]	NA
Industrial	670	500	1.3	3.4	0.2	1.3	NA	200
Parks	NA[c]	3	0.03	NA	NA	NA	NA	NA
Shopping center	720	440	0.5	3.1	0.5	1.7	NA	NA

a The difference between lb/acre/year and kg/ha/yr is less than 15%, and the accuracy of the values shown in this table cannot differentiate between such close values.
b The monitored low-density residential areas were drained by grass swales.
c NA = Not available.
Data from Bannerman et al. (1979, 1983); Madison et al. (1979); EPA (1983); Pitt and McLean (1986).

2.0 REGULATORY AUTHORITY

The National Pollutant Discharge Elimination System (NPDES) Stormwater Program states that industrial activities, construction activities, and municipal separate storm sewer systems (MS4) that have stormwater discharges require stormwater permits (40 CFR 122.26). As such, stormwater originating from these sources is considered a point source of pollution. In Montana, the state has regulatory authority over stormwater permits. However, some cities and counties also have more stringent stormwater regulations in addition to those imposed by the state and EPA. The following sections provide a brief summary of the regulatory authorities that exist in the Flathead Lake Basin.

2.1 State of Montana – Stormwater Point Sources

The state of Montana has regulatory authority for all point source discharges to surface waterbodies, including those discharges that are composed of stormwater runoff. The regulations are contained in the Administrative Rules of Montana [ARM] 17.30.1105, and state that:

> (1) Any person who discharges or proposes to discharge stormwater from a point source must obtain coverage under an [Montana Pollution Discharge Elimination System] MPDES general permit or another MPDES permit for discharges:
>
> a. Associated with construction activity;
> b. Associated with industrial activity;
> c. Associated with mining and oil and gas activity;
> d. From small municipal separate storm sewer systems [MS4] that are identified in ARM 17.30.1102 or designated pursuant to ARM 17.30.1107;
> e. For which the department determines that storm water controls are needed based on wasteload allocations that are part of TMDLs that address the pollutants of concern; and
> f. That the department determines are contributing to a violation of a water quality standard or are significant contributors of pollutants to surface waters.

The Montana Department of Environmental Quality's (DEQ) Permitting and Compliance Division has the regulatory authority to issue stormwater permits. The following sections describe the three types of regulated stormwater discharges that are located within the Flathead Lake Basin – construction, industrial, and MS4.

2.1.1 Construction

Storm water discharges associated with construction activities, as defined in ARM 17.30.1102(28)[1], require authorization from Montana DEQ. Montana DEQ's Permitting and Compliance Division issued a General Permit for Storm Water Discharges Associated with Construction Activity (Permit ID MTR100000) on April 16, 2007, and the permit is valid until December 31, 2011. Construction stormwater discharges are typically permitted under the MPDES General Permit.

The General Permit requires the permittee to complete a Notice of Intent (NOI) form and a Stormwater Pollution Prevention Plan (SWPPP) before authorization can be granted. The SWPPP has three primary objectives (1) to assess the characteristics of the site (2) to identify potential sources of pollutants, and (3)

[1]"Storm water discharge associated with construction activity" means a discharge of storm water from construction activities including clearing, grading, and excavation that result in the disturbance of equal to or greater than one acre of total land area. For purposes of these rules, construction activities include clearing, grading, excavation, stockpiling earth materials, and other placement or removal of earth material performed during construction projects. Construction activity includes the disturbance of less than one acre of total land area that is a part of a larger common plan of development or sale if the larger common plan will ultimately disturb one acre or more.

identify BMPs to minimize or eliminate pollutant discharges to state surface waters through stormwater runoff.

The following effluent limitations are imposed by the construction stormwater General Permit:

1. There must be no discharge of process wastewater pollutants to state surface waters.
2. Any discharge to state surface waters must be composed entirely of stormwater. Discharges must consist of water only generated through rainfall precipitation and snowmelt.
3. A discharge of stormwater must not cause or contribute to a violation of water quality standards.

The Montana stormwater regulations for construction sites have the authority to require stormwater monitoring. However, monitoring in the form of sampling and analytical testing is typically not required (Personal Communications, Brian Heckenberger, May 26, 2009).

At the time of this report, there were 205 authorizations to discharge stormwater from construction sites in the Flathead Lake Basin.

2.1.2 Industrial

ARM 17.30.11 requires industrial facilities to obtain a stormwater discharge permit for conveying stormwater runoff from manufacturing, processing, or raw materials storage areas. Two criteria determine whether an industrial facility needs to apply for an industrial stormwater permit: the type of industry and the presence of a storm water discharge to surface waters. Facilities that meet the criteria (defined in ARM 17.30.11) must apply for authorization from Montana DEQ to discharge industrial stormwater. Pursuant to ARM 17.30.1116, discharges composed entirely of stormwater are not regulated as discharges associated with industrial activity if there is no exposure of industrial materials and activities to rain, snow, snowmelt, and/or runoff, and the discharger satisfies the conditions of this Industrial No-Exposure Certification rule (DEQ, 2006).

Montana DEQ's Permitting and Compliance Division issued a General Permit for Storm Water Discharges Associated with Industrial Activity (Permit ID MTR000000) on August 30, 2006, and the permit is valid until December 31, 2011. The General Permit for stormwater runoff from industrial activities requires the permittee to complete an application form and a Stormwater Pollution Prevention Plan (SWPPP) before authorization can be granted. The objective of the SWPPP is to identify sources of potential pollution to stormwater discharges and to select Best Management Practices (BMPs) to reduce discharge of pollutants at the pollutant source and/or to remove pollutants contained in stormwater runoff.

The following effluent limitations are imposed by industrial stormwater General Permit:

1. There must be no discharge of process wastewater pollutants to surface waters.
2. A discharge of stormwater associated with industrial activity may occur based on water generated only through rainfall precipitation and snowmelt.
3. No discharge of stormwater associated with industrial activity shall cause or contribute to a violation of water quality standards.
4. Discharges of stormwater containing pollutants associated with industrial activity covered under this General Permit will be controlled through the development and implementation of a storm water pollution prevention plan (SWPPP). Best management practices identified in the SWPPP must help eliminate or minimize the discharge of pollutants to surface waters.
5. New or increased stormwater discharges associated with industrial activity on or after April 29, 1993 shall not cause degradation as described under ARM 17.30.715(3) and 75-5-301(5)(c)MCA.

The Montana regulations for industrial stormwater runoff require certain facilities to monitor stormwater discharges and report data to Montana DEQ (as defined in Part 3(a)(2) of the General Permit). The type of monitoring depends on the facility – for example, airports are required to monitor oil and grease, COD, ammonia as N, and flow. At the time of this report, there are six facilities that have industrial stormwater discharge permits in the Flathead Basin.

2.1.3 Municipal Separate Storm Sewer Systems (MS4)

The Administrative Rules of Montana (ARM 17.30.1102) defines a municipal separate storm sewer system (MS4) as:

> *A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) that discharges to surface waters and is:(a) owned or operated by the state of Montana, a governmental subdivision of the state, a district, association, or other public body created by or pursuant to Montana law, including special districts such as sewer districts, flood control districts, drainage districts and similar entities, and designated and approved management agencies under section 208 of the federal Clean Water Act, which has jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, and is:(i) designed or used for collecting or conveying storm water;(ii) not a combined sewer; and(iii) not part of a publicly owned treatment works (POTW) as defined in ARM Title 17, chapter 30, subchapter 13.*

EPA groups MS4s into three categories: small, medium, and large. Incorporated places (i.e., cities) and counties meeting EPA's definitions of medium and large MS4 are identified in the NPDES regulations in 40 CFR Part 122, Appendices F through I. At the time of this report, no medium or large MS4s exist in the State of Montana. Cities and other entities that qualify as "small" MS4s are identified by each state, and Montana's criteria for a small MS4 system are defined in ARM 17.30.1102. As defined in the ARM, the only designated small MS4s in the Flathead Lake Basin are within the City of Kalispell's limits (City of Kalispell and Montana Department of Transportation).

The Permitting and Compliance Division at Montana DEQ developed a General Permit for MS4 systems (Permit ID MTR040000), which is valid from November 5, 2004 through December 31, 2009. All small MS4 authorizations in the state are issued based on meeting the requirements in the General Permit. The General Permit requires the permittee to develop a Storm Water Management Program (SWMP) that is designed to reduce the discharge of pollutants from the permitted small MS4 to the maximum extent practicable (MEP), to protect water quality, and to satisfy the appropriate water quality requirements of the Montana Water Quality Act (DEQ, 2004). As defined in the SWMP, the permittee is required to implement six minimum control measures for MS4 systems including: Public Education and Outreach on Storm Water Impacts; Public Involvement/Participation; Illicit Discharge Detection and Elimination; Construction Site Storm Water Runoff Control; Post-Construction Storm Water Management in New Development and Redevelopment; and Pollution Prevention/Good Housekeeping for Municipal Operations.

2.2 State of Montana – Nonpoint Stormwater Sources

The State of Montana has regulatory authority over stormwater originating from subdivisions (i.e., a nonpoint source) through the subdivision permitting process defined in ARM 17.36.2. New subdivisions are required to apply for a permit through DEQ's Subdivision Review program, and as part of that permit, applicants must submit a storm drainage plan that meets the requirements set forth in Circular DEQ-8 – *Montana Standards for Subdivision Storm Drainage*. The permit for the subdivision is then contingent

upon approval of the storm drainage plan. DEQ does not require any follow up monitoring or inspections. No other nonpoint stormwater sources are regulated by the state.

2.3 Counties

Flathead, Lake, and Missoula Counties all have stormwater regulations for subdivisions that are similar to those required by the State of Montana in ARM 17.36.2 and DEQ Circular 8. The county regulations are contained in the following documents:

- Flathead County Development Code – Chapter 4 – Subdivision Regulations
- Flathead County Lake and Lakeshore Protection Regulations
- Subdivision Regulations of Lake County
- Missoula County Subdivision Regulations

None of the counties regulate any other stormwater sources.

2.4 Cities

There are four incorporated cities in the Flathead Lake watershed: Columbia Falls, Kalispell, Polson, and Whitefish. Each of the cities has its own subdivision regulations that require stormwater plans and controls for subdivisions. The regulations are contained in:

- City of Kalispell Subdivision Regulations; City of Kalispell Standards for Design and Construction
- City of Whitefish Municipal Code Title 12 (Subdivision Regulations) and Title 13 (Lake and Lakeshore Protection Regulations).
- City of Columbia Falls Municipal Code Title 17 (Subdivisions)
- City of Polson Development Code Chapter 18

In addition to the subdivision stormwater regulations, the City of Kalispell also regulates stormwater discharges from construction sites. Kalispell adopted Ordinance 1600 in 2007 titled, "Stormwater Discharges Resulting from Construction and Land Disturbance Activities." The ordinance defines the city's Construction Stormwater Management requirements and standards for land disturbance. The ordinance applies to all land disturbances within the City of Kalispell, including those that are less than one acre, and requires land owners to submit a permit and a Stormwater Management Plan to the city before construction begins. The ordinance states that the Stormwater Management Plan shall contain the following items (Kalispell Municipal Code Chapter 23-A):

- A completed Stormwater Management Plan checklist which outlines the project site's Best Management Practices (BMPs)
- A short narrative explaining how the permittee(s) will implement BMPs described on the checklist
- A map of the construction site showing the locations of the BMPs

In 2007, a total of 146 City Construction Stormwater Management Permits were submitted to the Public Works Office (Personal Communications, Susie Turner, City of Kalispell). Those construction sites that are equal to or greater than one acre are also subject to the requirements of Montana's regulations for construction activities (see Section 2.1.1). Prior to 2007, construction activities of less than one acre and their associated stormwater runoff were not regulated by any entity in the Flathead Basin.

The City of Kalispell also provides municipal regulation and enforcement of non-storm water discharges to the city storm drainage system. In May 2008 City Council adopted Ordinance 1634 establishing regulations controlling the introduction of pollutants into the City of Kalispell Municipal Separate Storm Sewer System (MS4). Ordinance 1634 address the following:

- Categories non-stormwater discharges or flows (i.e., illicit discharges) listed in the state general permit.
- Categories occasional incidental non-stormwater discharges (e.g. noncommercial or charity car washes) that will not be addressed as an illicit discharge.
- Outlines provisions prohibiting any individual non-stormwater discharge that is determined to be contributing significant amount of pollutants to the City's stormwater systems.
- Provides enforcement procedures and actions.

3.0 CHARACTERIZATION OF PERMITTED STORMWATER SOURCES

At the time of this report, there are two small MS4s, six industrial facilities, and approximately 205 construction sites with stormwater permits in the Flathead Lake Basin. Locations are shown in Figure 1. The following subsections provide additional information for the permitted stormwater sources.

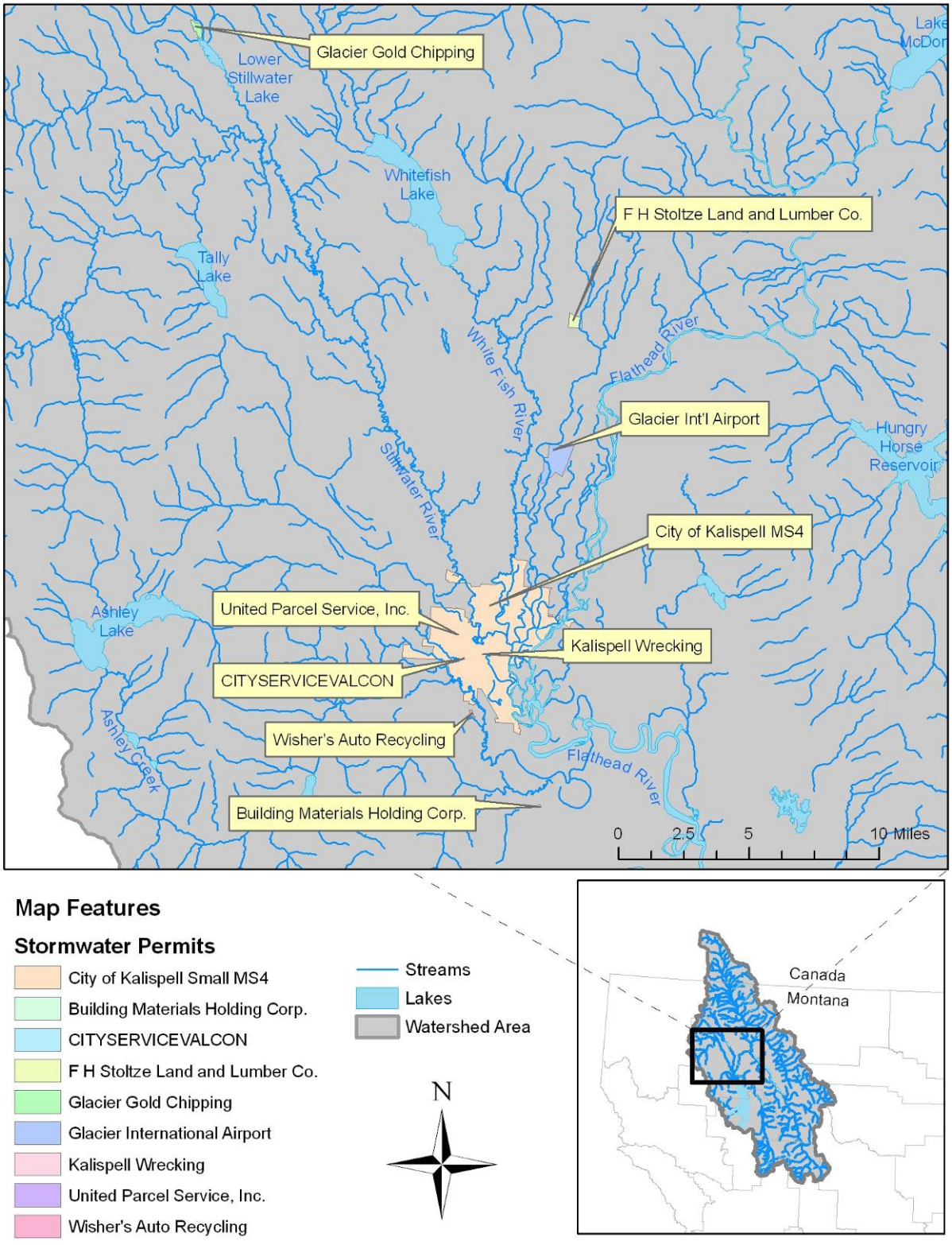

Figure 1. Location of industrial and MS4 permitted entities in the Flathead Lake watershed.

3.1 City of Kalispell and Montana Department of Transportation MS4 (MPDES ID MTR040005)

As stated in Section 2.1.3, the City of Kalispell meets the requirements for a small municipal separate storm sewer system (MS4). The City partnered with the Montana Department of Transportation (MDT) to apply for a MS4 authorization from Montana DEQ. Kalispell's MS4 was authorized on July 17, 2006 and is valid through December 31, 2009 (Permit ID MTR040005). The authorization is based on DEQ's general permit for MS4s (Permit ID MTR040000), and covers the entire incorporated area of Kalispell, and no land outside of the city limits. Per MS4 regulations, the permit is for all stormwater conveyances (e.g., roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, and/or storm drains) that are owned or operated by the City of Kalispell or MDT within the City of Kalispell limits. Discharges are permitted to the Whitefish River, Stillwater River, Ashley Creek, and Spring Creek (only the Stillwater River, Ashley Creek, and Spring Creek for MDT) in Flathead County (DEQ, 2006).

Kalispell's stormwater management program was contacted to help characterize the stormwater infrastructure covered under the MS4 permit. AutoCad and GIS coverages of the city's infrastructure (computer file dated June 2, 2008) were obtained and plotted in a GIS system[2]. Based on the information provided by the city, there are 54 known city owned stormwater outfalls and 81 miles of stormwater pipes and ditches (Figure 2). Two outfalls discharge to the Whitefish River, 23 outfalls to the Stillwater River, 12 outfalls to Ashley Creek, and 17 outfalls to Spring Creek (on the western edge of Kalispell, upstream of the confluence with Ashley Creek). Figure 3 shows which portions of the city drain to which outfalls (created by delineating the stormwater system based on the GIS files provided by the city). The MS4 system drains 4,381 acres of land out of 7,203 acres in the city limits[2].

Montana DEQ requires Kalispell to monitor stormwater runoff at one site that is primarily commercial/ industrial (001A) one that represents primarily residential (002A) runoff. As such, the monitoring locations provide data about stormwater runoff quality at the source, but the data do not necessarily represent the quality of water that reaches a lake or stream (Personal Communications, Brian Heckenberger, Montana DEQ, May 26, 2009). Kalispell's stormwater runoff data are presented in Table 3 for informational purposes only.

The City of Kalispell's 2007 MS4 SWMP Annual Report and the 2008 MS4 SWMP Update document what the City and MDT have accomplished under the SWMP to date and what future activities the co-permittees will conduct. To date, the City and MDT have implemented non-structural, source control management measures to fulfill requirements under the six minimum control measures. The BMPs implemented to date include education, training, operation and maintenance, and policies/ordinances.

[2] At the time of this report, the City of Kalispell is updating their stormwater infrastructure mapping, and the data presented in this report reflect what was available prior to 2008 (Personal Communications, Susie Turner, City of Kalispell, January 7, 2010). This report will be amended when the new data are available.

Table 3. Stormwater discharge monitoring data for the Kalispell MS4 system.

Site	Parameter	Count	Average	Min	Max	Period of Record
001	COD (mg/L)	3	62	22	118	2007-2008
	Copper, total recoverable (µg/L)	3	0.014	0.007	0.027	2007-2008
	Flow rate (cfs)	3	0.104	0.001	0.288	2007-2008
	Lead, total recoverable (µg/L)	3	0.045	0.018	0.080	2007-2008
	Nitrogen, total (as N) (mg/L)	3	1.41	0.66	2.62	2007-2008
	Oil and grease (mg/L)	3	19	15	24	2007-2008
	Phosphorus, total (as P) (mg/L)	3	0.19	0.10	0.34	2007-2008
	Solids, total suspended (mg/L)	3	100	45	167	2007-2008
	Zinc, total recoverable (µg/L)	3	0.174	0.09	0.34	2007-2008
002	COD (mg/L)	3	34	26	49	2007-2008
	Copper, total recoverable (µg/L)	3	0.017	0.005	0.031	2007-2008
	Flow rate (cfs)	2	0.041	0.011	0.072	2007-2008
	Lead, total recoverable (µg/L)	3	0.007	0.001	0.016	2007-2008
	Nitrogen, total (as N) (mg/L)	3	2.22	0.65	4.04	2007-2008
	Oil and grease (mg/L)	2	11	8	13	2007-2008
	Phosphorus, total (as P) (mg/L)	3	0.23	0.07	0.41	2007-2008
	Solids, total suspended (mg/L)	3	392	20	951	2007-2008
	Zinc, total recoverable (µg/L)	2	0.132	0.054	0.21	2007-2008

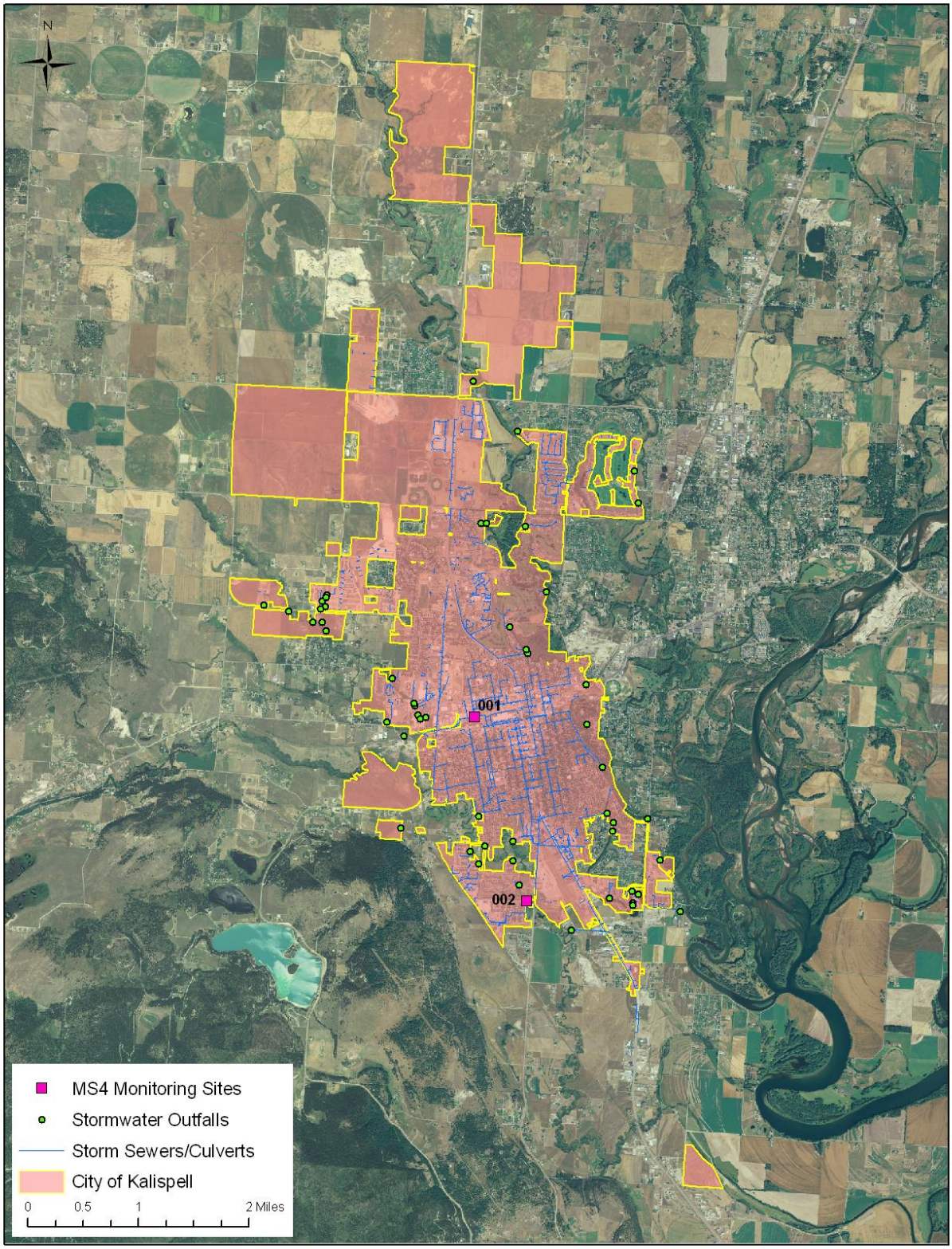

Figure 2. Extent of the Kalispell/MDT MS4 Permit and location of known stormwater outfalls, sewers, and culverts.

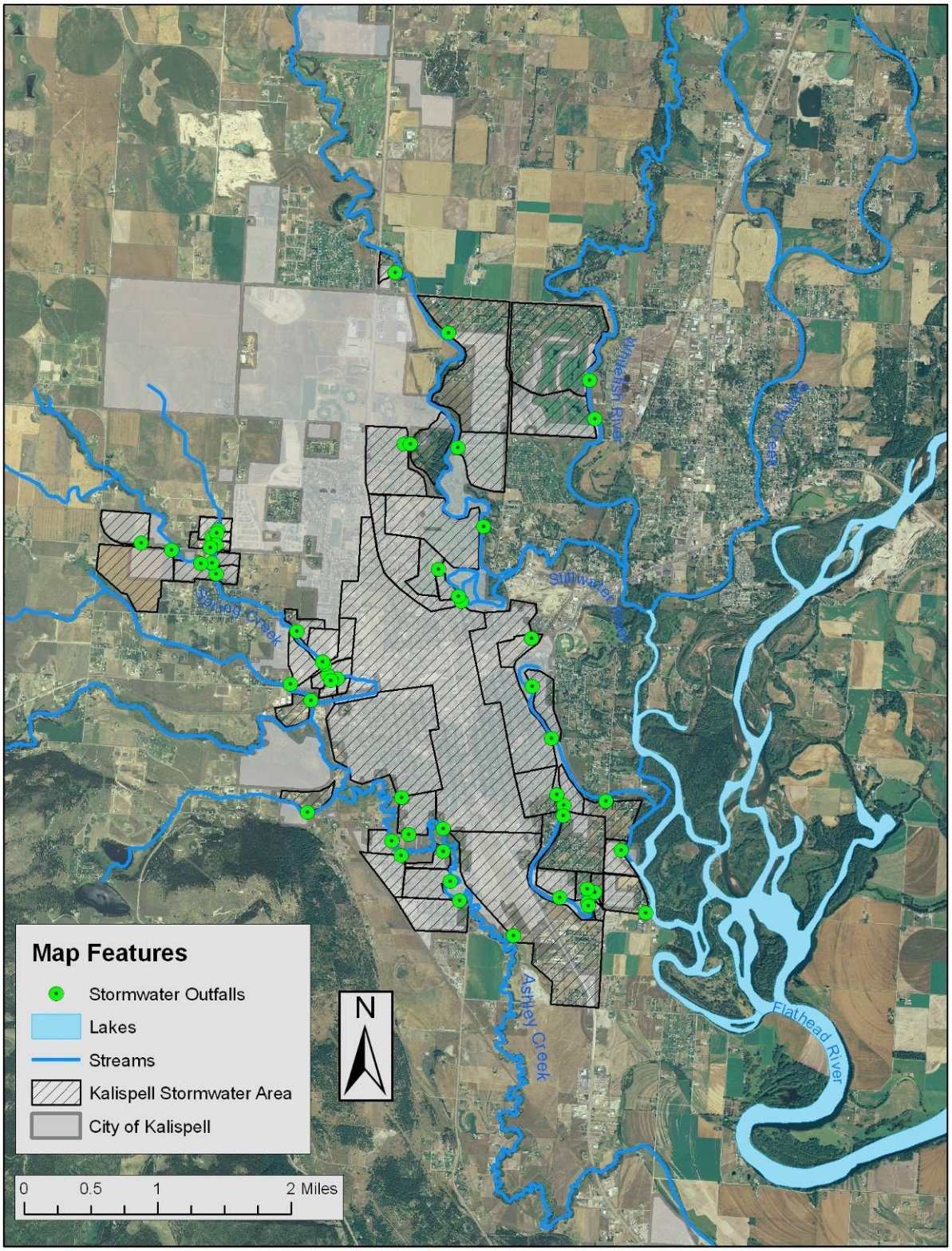

Figure 3. Delineation of areas drained by the Kalispell MS4.

3.2 Industrial Facilities

There are six industrial facilities in the Flathead Basin that have authorization to discharge under Montana's General Permit for Storm Water Discharges Associated with Industrial Activity (MTR000000). A discussion of each industrial facility in the Flathead Basin and the applicable stormwater permit requirements is provided below.

3.2.1 Glacier Park International Airport (MPDES ID MTR000309)

The Glacier Park International (GPI) Airport is located northeast of the City of Kalispell at 4170 Highway 2, and is approximately 1500 acres in size. The facility was constructed in 1942, and consists of two runways, an airline terminal, fueling station, maintenance buildings, car rental facility, airplane hangars, and numerous other small buildings and paved lots to support airport operations (Glacier Park International Airport, 2006).

Stormwater runoff from the airport is complex, with different portions of the facility discharging to eight stormwater retention basins (Glacier Park International Airport, 2006). Also, portions of the facility discharge to ditches with outfalls on Trumbull Creek and an unnamed tributary to Trumbull Creek (Figure 4). The airport Storm Water Pollution Prevention Plan (SWPPP) contains detailed maps showing the routing of stormwater to the basins and outfalls (Glacier Park International Airport, 2006).

Montana DEQ authorized the airport to discharge stormwater (Permit ID MTR000309) on December 18, 2006, with an expiration date of September 30, 2011. The permit requires the facility to perform semi-annual sampling at the stormwater detention basin located west and south of the main terminal building and near the U.S. Customs Building (i.e., Detention Basin) for the following parameters: visual observation of oil and grease; five-day BOD; COD; TSS; pH; and ethylene and propylene glycol. The same parameters are also sampled at Outfall 001 on a semiannual basis. No monitoring is required at the other outfalls or retention basins, as these discharges are not exposed to industrial materials. Table 4 summarizes the available data for the retention basin sampling location (see Figure 4) (obtained from ICIS on December 1, 2008).

Table 4. Stormwater discharge monitoring data for the Glacier Park International Airport.

Site	Parameter	Count	Average	Min	Max	Period of Record
Detention Basin	BOD, 5-day (mg/L)	1	170	170	170	1999
	Ethylene glycol (µg/L)	1	100	100	100	1999
	Flow rate (cfs)	7	0.112	0.029	0.288	2004-2007
	COD (mg/L)	8	222.88	8.00	1060.00	1999-2007
	pH	1	7.10	7.10	7.10	1999.00
	TSS (mg/L)	8	40.375	2	119	1999-2007
Outfall 001	BOD, 5-day (mg/L)	1	3	3	3	1999
	Ethylene glycol (µg/L)	1	10	10	10	1999
	Flow rate (cfs)	8	0.137	0.007	0.360	2004-2008
	COD (mg/L)	9	66.89	5.00	318.00	1999-2008
	pH	1	7.80	7.80	7.80	1999.00
	TSS (mg/L)	9	20.67	1.00	105.00	1999-2008

As part of the stormwater permit, the facility was required to submit a Stormwater Pollution Prevention Plan (Dated August 2006). The plan lists the following potential pollutants that could be present in its stormwater runoff: propylene glycol, glycol, urea, sodium chloride, pesticides, fertilizer, ammonium sulfate, ammonium phosphate, and waste gas, diesel, and oil. To prevent these chemicals from entering waterways, the facility has proposed preventative maintenance and good housekeeping BMPs. These, in addition to the stormwater detention basins, make up the facility's pollution prevention plan.

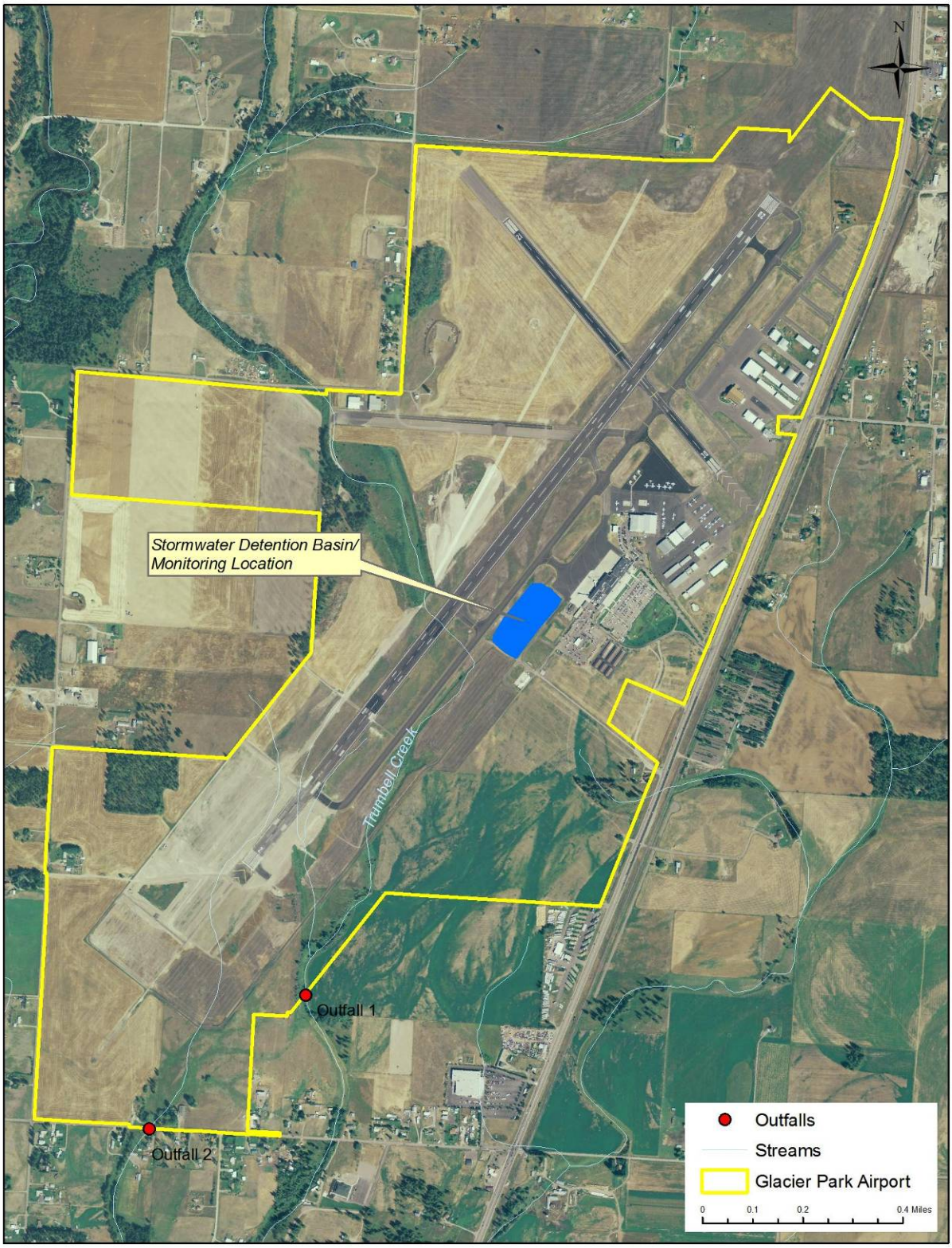

Figure 4. Location of the Glacier Park International airport and stormwater outfalls.

3.2.2 F.H. Stoltze Land and Lumber Co (MPDES ID MTR000019)

The F.H. Stoltze Lumber Mill is located in Flathead County west of the City of Columbia Falls on Half Moon Road. The original mill was constructed in 1923, and numerous rebuilds and upgrades have occurred over time (F.H. Stoltze Land and Lumber, 2008). The plant site consists of administrative offices, a log yard, random length sawmill, dry kilns and planing mill, and is 149 acres in size (F.H. Stoltze Land and Lumber, 2006) (Figure 5).

Stormwater runoff from the site is regulated by Montana DEQ through the MPDES program. Most recently, DEQ authorized the facility to discharge from October 20, 2006 through September 30, 2011 (Permit ID MTR04000019). This type of facility (SIC 2421) is not subject to self-monitoring and reporting requirements under the general stormwater permit. However, one sampling event was reported in ICIS, and the data are summarized in Table 5. Primary pollutants of concern associated with this particular facility includes pH and total suspended solids (TSS) related to the exposure of sawdust, planer shavings, bark, and wood chips at the site.

Table 5. Stormwater discharge monitoring data for the F.H. Stoltze Mill.

Parameter	Count	Value	Date
BOD, 5-day (mg/L)	1	5	1/25/96
COD (mg/L)	1	52	
pH	1	7.7	
TSS (mg/L)	1	46	
Nitrogen, Kjeldahl, total (as N) (mg/L)	1	0.52	
Phosphorus, total (as P) (mg/L)	1	0.95	

The mill's Stormwater Pollution Prevention Plan indicates that there are several stormwater detention basins on the property, and all stormwater flow "follows berms or ditches and flows through and over control devices and eventually can flow into Trumbull Creek," (F.H. Stoltze Land and Lumber, 2006). During the 2005 inspection of the facility, DEQ personnel noted that BMPs consisted of "thick vegetative cover around the periphery of the facility, three detention ponds, and straw bales" (DEQ, 2005). Figure 5 shows the location of the facilities stormwater detention ponds and outfall to Trumbull Creek.

Stormwater BMPs at the plant consist of good housekeeping practices, preventative maintenance, inspections, spill prevention and response plans, berms, detention basins, and grassed drainage ditches (F.H. Stoltze Land and Lumber, 2006).

Figure 5. Location of the F.H. Stoltze lumber mill.

3.2.3 Glacier Gold Chipping (MPDES ID MTR000465)

Glacier Gold Chipping operates a wood chipping facility that is located in Flathead County near the town of Olney, Montana (Figure 6). The facility was constructed in 1993, and has an area of 65 acres including remediated land from an old sawmill and composting site (Glacier Gold Chipping, 2007). Included on site are a timber chipping facility, warehouse storage, stockpiles of dirt, sawdust, and bark, and a sawmill for custom beams. The total impervious area is 10.3 acres (including paved areas and roofs). Stockpiles of dirt, sawdust, bark fines, and wood chips are exposed to stormwater runoff, and could potentially impact nearby surface waterbodies.

Stormwater runoff from the site is regulated by Montana DEQ through the MPDES program. DEQ issued the most recent industrial stormwater permit for October 1, 2006 through September 30, 2011 (Permit ID MTR04000465). This type of facility (SIC 2421 and 2429) is not subject to self-monitoring and reporting requirements under the general stormwater permit, and no recent monitoring data are available. Primary pollutants of concern associated with this particular facility includes pH and total suspended solids (TSS) related to the exposure of sawdust, bark, and wood chips at the site.

Stormwater runoff from the site is diverted to settling ponds before being discharged to either the Stillwater River or Lower Stillwater Lake. Stormwater runoff to Lower Stillwater Lake originates on the west side of the site, either draining directly to a settling pond following the natural slope of the site or to a manmade ditch that directs flow to the settling pond (Glacier Gold Chipping, 2007). Flow from the settling pond to the lake first passes through two layers of silt fence to further trap sediment. Stormwater discharges to the Stillwater River originate from the east side of the site and drains to one of two settling ponds along the east side of the site, with flow from the southeastern part of the site directed to one of the settling ponds by a manmade ditch (Glacier Gold Chipping, 2007). Stormwater leaving the settling ponds toward the river also pass through two layers of silt fence. The SWPPP states that the site drainage design and the BMPs, including the settling ponds and silt fences, will address the pollutants of concern related to the water quality impairments. No stormwater sampling has been conducted at this facility; therefore, there are no existing sampling data available to characterize stormwater-related pollutants from this site.

Figure 6. Location of the Glacier Gold Chipping Facility.

3.2.4 Wisher's Auto Recycling Facility (MPDES ID MTR000251)

Wisher's Auto Recycling Facility is located at 2190 Airport Road in Kalispell (Flathead County). The facility is 20 acres in size, and the construction date is unknown.

Stormwater runoff from the site is regulated by Montana DEQ through the MPDES program. DEQ issued the most recent industrial stormwater permit from October 1, 2006 through September 30, 2011 (Permit ID MTR000251). This type of facility (SIC 5039) is not subject to self-monitoring and reporting requirements under the general stormwater permit, and no recent monitoring data are available. Primary pollutants of concern associated with this facility include total suspended solids (TSS), BOD, COD, oils/grease, and nutrients.

Stormwater runoff from the facility flows towards the south and east to a ditch leaving the facility at the southeast corner (DEQ, 2007). Based on an assessment of local topography and stream networks, there are no perennial streams located near the facility. The nearest perennial stream is Ashley Creek, which is located 1700 feet from the facility.

Figure 7. Location of the Wishers Auto Recycling Facility.

3.2.5 Building Materials Holding Corporation West Truss Facility (MPDES ID MTR000419)

Building Materials Holding Corporation operates a facility for making trusses that is located in Flathead County in the City of Kalispell, Montana (Figure 8). The facility has an area of 6 acres and includes a truss manufacturing shop, saw shop, office, and lumber and truss storage areas. All manufacturing processes occur inside the various shops and are not exposed to stormwater runoff (BMC Truss, 2006). Materials exposed to stormwater runoff include asphalt, concrete, and graveled areas, and a spill-proof concrete bermed fueling area. The construction date of the facility is unknown.

Stormwater runoff from the site is regulated by Montana DEQ through the MPDES program. DEQ issued the most recent industrial stormwater permit from October 1, 2006 through September 30, 2011 (Permit ID MTR000419). This type of facility (SIC 2439) is not subject to self-monitoring and reporting requirements under the general stormwater permit, and no recent monitoring data are available. Primary pollutants of concern associated with this particular facility includes total suspended solids (TSS) related to the exposure of sawdust and dirt.

Stormwater runoff from the site is collected in a series of swales and ditches that eventually discharge to Ashley Creek (located two miles to the north). A perennial slough is located 0.25 miles to the east of the facility, although it is unclear from the SWPPP if the stormwater ditches are connected to the slough. BMPs at the facility include good housekeeping practices such as removal of debris, employee training for spills and cleanup, proper indoor storage of containers (BMC Truss, 2006). No stormwater sampling has been conducted at this facility; therefore, there are no existing sampling data available to characterize stormwater-related pollutants from this site.

Figure 8. Location of the BMC Truss Facility.

3.2.6 United Parcel Service (MPDES ID MTR000447)

The United Parcel Service facility is located at 1151 North Meridian, Kalispell in Flathead County (Figure 9). The facility is 2 acres in size and includes vehicle maintenance and washing areas, as well as an office and paved lot. Pollutants that are potentially exposed to stormwater include solvents, metals, and other vehicle fluids associated with maintenance and washing activities (United Parcel Service, 2006).

Stormwater runoff from the site is regulated by Montana DEQ through the MPDES program. DEQ issued the most recent industrial stormwater permit from October 1, 2006 through September 30, 2011 (Permit ID MTR000447). This type of facility (SIC 4215) is not subject to self-monitoring and reporting requirements under the general stormwater permit, and no recent monitoring data are available. Primary pollutants of concern associated with this particular facility includes total suspended solids (TSS), BOD, COD, oils/grease, solvents, and metals.

Stormwater runoff from the site is collected in two swales that are located parallel to the facility (see Figure 9). The swales discharge to a swale owned by the city of Kalispell that runs along North Meridian Road. The road swale is part of the Kalispell small MS4 system, and is regulated by Kalispell's MS4 permit (see Section 3.1).

Figure 9. Location of the UPS Facility.

3.3 Construction Sites

As stated in Section 2.1.1, construction sites that meet the requirements of ARM 17.30.1102 are required to develop a SWPPP and implement BMPs to reduce erosion. The ICIS database was queried to provide summary statistics for all of the constructions sites that are authorized to discharge stormwater in the Flathead Lake Basin. Data were downloaded on December 2, 2008 and were input into an Access database. The ICIS database contained information on permits authorized between 2002 and 2008, and at the time of the download, there were 1,993 authorizations to discharge under the General Permit for Storm Water Discharges Associated with Construction Activity. Coordinates, receiving waterbody, city, county, and HUC data were assessed for each site to determine which sites were in the Flathead Lake Basin. It is estimated that 188 out of the 1,993 authorizations are located in the basin. However, location information was not always provided, and the estimate is partially based on best professional judgment. Of the 188 sites, 128 (68%) had active permits – the remaining permits were expired or terminated.

In the Flathead Lake Basin, 115 (61%) of the sites had coordinate information, and these sites are displayed in Figure 10. Sites are generally clustered around the cities of Whitefish and Kalispell. However, it appears the there are some positional errors in the data, as several sites plotted in the wilderness areas or in the middle of lakes. Because of the large number of sites, no effort was made at this time to correct site locations or to locate sites with no positional information. Site sizes are available in the individual permits, but no effort was made at this time to obtain that information because of the large number of sites in the basin. Also, No water quality data were available for the sites in the Flathead Lake Basin.

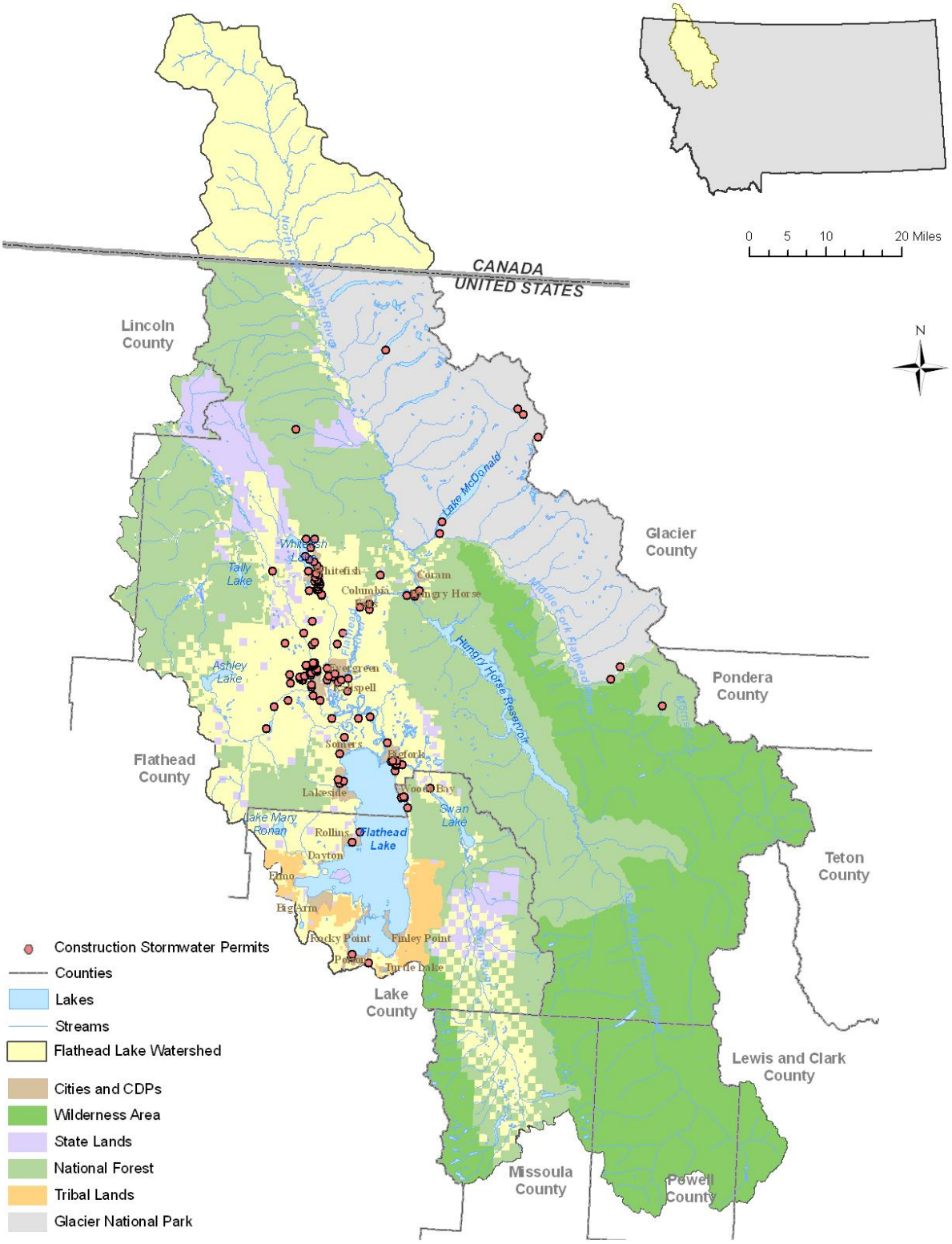

Figure 10. Construction stormwater permits in the Flathead Lake Basin. Note: only sites with coordinates are shown.

4.0 NON-PERMITTED STORMWATER RUNOFF FROM OTHER URBAN AREAS

Stormwater runoff from urban and urbanizing areas and associated land use activities that are not covered under the NPDES Stormwater Program can also contribute pollutant loads. For the purposes of this Technical Report, these unregulated stormwater sources are considered urban nonpoint source runoff. Sources to consider include commercial areas, construction sites less than one acre that are not subject to local ordinances, and municipal and residential areas that fall outside the definition of a regulated small MS4 under the NPDES Phase II program. These areas have impervious surfaces that have the potential to contribute similar pollutants via stormwater runoff as those areas covered under the NPDES Stormwater Program. The following sections summarize the major nonpoint urban stormwater sources in the Flathead Lake Basin.

4.1 City of Whitefish

The City of Whitefish was not classified as a small MS4 community in Montana's Administrative Rules or the General MS4 permit, and therefore the city is not required to have a stormwater permit. However, the city does have a stormwater system consisting of "detention ponds, swales, roadside ditches, pipes, manholes, catch basins, and treatment systems that convey and treat storm runoff from the City of Whitefish and the surrounding area prior to discharge to Whitefish Lake, the Whitefish River, and Cow Creek," (City of Whitefish, 2006). The City's Stormwater System Utility Plan further describes the system as follows:

> *The existing storm drainage collection system is comprised of roadside ditches, catch basins, manholes, pipes and swales located primarily within the central portion of the city. Piping ranges in size from 8 to 42 inches and is comprised mainly of plastic (PVC). Concrete catch basins, inlets, and manholes convey surface runoff to the piping network. Drainage is conveyed to Cow Creek, Whitefish Lake, and the Whitefish River. There are currently fifteen outfalls to the Whitefish River, three outfalls to Whitefish Lake and six outfalls to Cow Creek. The majority of the new development that has occurred since the previous stormwater planning efforts (Robert Peccia & Associates, 1997) does not connect to existing infrastructure within the system and is comprised primarily of detention ponds, and infiltration systems. There are approximately 500 catch basins, 300 manholes, 8,100 lineal feet of 8-inch pipe, 25,000 lineal feet of 12-inch pipe, 2,100 lineal feet of 15-inch pipe, 12,000 lineal feet of 18-inch pipe, 1,900 lineal feet of 21-inch pipe, 7,580 lineal feet of 24-inch pipe, 800 lineal feet of 36-inch pipe and 140 lineal feet of 42-inch pipe in the exiting system.*

There are 14 settling/detention ponds in the stormwater system to store and treat stormwater runoff. These are summarized in Table 6 and shown in Figure 11. There are also 11 other treatment structures ranging from swales to mechanical filters (summarized in Table 7 and Figure 11).

The City provided GIS files of the stormwater system on July 21, 2008. The files contained information on the location, type, and extent of the City owned stormwater system. Using the data in the file, the areas draining to each city owned stormwater outfall or pond were delineated and are shown in Figure 11. In all, the stormwater system collects runoff from 1,249 acres (1.95 sq miles) of land (compared to 2,849 acres within the city limits).

Table 6. City of Whitefish stormwater detention and settling ponds.

Pond	Location	Estimated Capacity or Approx. Dimensions	Type of Inlet Structure	Type of Outlet Structure	Location of Outfall	Maintenance
Pond A	Hospital Pond					City
Pond B	Riverside Pond					Private
Pond C	Riverwood Pond					Private
Pond D	MDT Pond					MDT
Pond E	Mall Pond	1500' x 700'	None	None	No outlet	City
Pond F	MDT Baker Avenue Pond	Unknown	Unknown	None	No outlet	MDT
Pond G	Park Avenue Pond	18,200 cf	2-24" RCP pipes w/ safety grates	Perforated manhole	Cow Creek	City
Pond H	Dairy Queen Pond	Unknown	24" RCP w/ flared end	24" RCP pipe	Whitefish River	City
Pond I	Riverside Park Pond	44,000 cf	1-42" HDPE pipe; 1-18" HDPE pipe	Multiple orifice concrete structure w/36" pipe	Whitefish River	City
Pond J	Mountain Trails Park Pond					City
Pond K	Crestwood Court Pond	70' x 50'	None	None	No Outlet	Private
Pond L	Mountain Harbor Pond	Unknown	Unknown	Unknown	Whitefish Lake	Private
Pond M	Mountain Park Pond	7,000 cf	Trap swale; 8' wide x 1' deep	Multiple orifice concrete outlet w/ 12" CMP overflow	Roadside ditch on Mountain Lion Rd.	Private
Pond N	Willow Brook Pond	70' x 50'	8" PVC pipe	8" PVC pipe	Cow Creek	Private

Source: Whitefish 2005 Stormwater System Utility Plan.

Table 7. City of Whitefish stormwater treatment systems.

Number	Location	Type of System	Project Design Engineer	Year Installed
1	13th Street System	Mechanical filters	Billmayer Eng.	1998
2	Baker Avenue Outfall	Perforated manhole/washed rock outfall	Morrison-Maerle	1999
3	Second Street East	Grassy Swale	Peccia & Assoc.	2000
4	Greenwood Drive	Stormceptor/ grassy swale	HKM	2001
5	Riverpark Subdivision	Stormceptor	Stokes Eng.	2005
6	Kay Beller Park	Perforated manhole/washed rock outfall	Peccia & Assoc.	2002
7	Bay Point Drive	Stormwater Management Filter	Peccia & Assoc.	2001
8	Ramsey Avenue	Vortechs Model 1000	Billmayer Eng.	2002
9	Whitefish Lake Lodge	Stormceptors (privately maintained)	WMW	2005
10	Baker Ave./10th	Perforated manhole/washed rock outfall	WMW	1995
11	Columbia Ave. north of bridge	Perforated manhole/washed rock outfall	WMW	1997

Source: Whitefish 2005 Stormwater System Utility Plan.

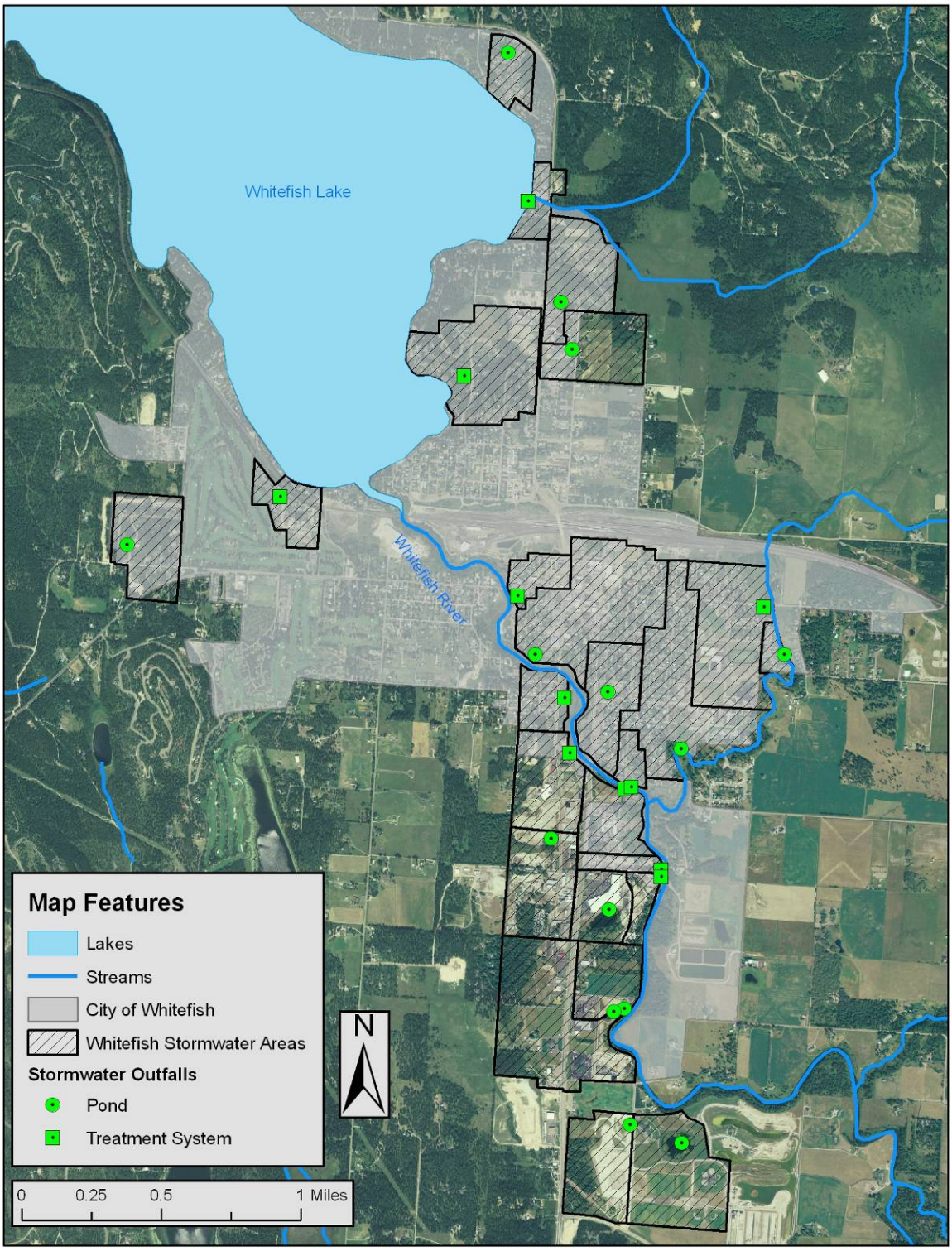

Figure 11. City of Whitefish and location of city owned stormwater treatment and detention systems.

4.2 City of Polson

The City of Polson was not classified as a small MS4 community in Montana's Administrative Rules or the General MS4 permit, and therefore the city is not required to have a stormwater permit. However, the city does have a stormwater sewer system consisting of the following (Personal Communications, Tony Porrazzo, Polson Water and Sewer Superintendant, January 7, 2009):

- A series of laterals installed in the early 1900s that were originally part of a federal irrigation project (40 inch main with multiple laterals). The laterals discharge to a separator/vault treatment system before being discharged to the Flathead River.
- A centralized stormwater sewer system spanning approximately 20 blocks of downtown Polson (approximately 20 percent of the city is sewered). Eleven stormwater outfalls from this system discharge to Flathead Lake (no treatment systems exist).
- Stormwater retention ponds associated with city parks.

A map of the stormwater system and outfalls was not available at the time of this report, but Mr. Porrazzo indicated that a stormwater mapping and engineering study for the city are currently underway (Personal Communications, Tony Porrazzo, Polson Water and Sewer Superintendant, January 7, 2009).

4.3 City of Columbia Falls

The City of Columbia Falls was not classified as a small MS4 community in Montana's Administrative Rules or the General MS4 permit, and therefore the city is not required to have a stormwater permit. However, the city does have a stormwater system consisting of dry wells and detention ponds, none if which have surface water discharges (Personal Communications, Loren Lowry, April 28, 2008). A map of the stormwater system was not available at the time of this report.

4.4 Village of Bigfork

The Village of Bigfork was not classified as a small MS4 community in Montana's Administrative Rules or the General MS4 permit, and therefore the city is not required to have a stormwater permit. However, the city does have a stormwater sewer system that was created in the early 1900s when the city was first settled (Personal Communications, Bill Buxton, Morris and Maerle, May 28, 2008).

A recent report titled "Bigfork Stormwater Facilities Assessment Report" documents the existing stormwater infrastructure in Bigfork (Flathead County, 2009). The report divides Bigfork into 28 subbasins (140 total acres) that have unique stormwater drainage patterns. The subbasins and their discharge locations are described in Table 8.

Table 8. Stormwater subbasins in the Bigfork Village.

SUB-BASIN	DEFINITION	SIZE (ac)	DESIGNATION
FB-1	FLATHEAD BANK	3.61	SW Corner/MK-1
MK-1	MARINA KAY	19.47	Bay/Boat Dock
TR-1	HIGH SCHOOL TRACK	11.85	Closed Basin
GC-1	GRAND DR / COMM ST	8.34	SW Corner/GD-2
SD-1	SCHOOL DISTRICT	0.56	Drywell/GD-2
SD-2	SCHOOL DISTRICT	2.23	Infiltration Facility/GD-2
SD-3	SCHOOL DISTRICT	4.73	Infiltration Facility/GD-2
SD-4	SCHOOL DISTRICT	1.96	GD-1
SD-5	SCHOOL DISTRICT	4.33	SW Corner/GC-1
GD-1	GRAND DRIVE	3.44	Catch Basins to GD2
GD-2	GRAND DRIVE	5.91	Catch Basins to Bay
GD-3	GRAND DRIVE	2.93	Curb Flow to GD2
COM-1	COMMERCE STREET	7.57	South/GD-1 & GD-2
COM-2	COMMERCE STREET	8.01	South/GD-3
BAY-1	FLATHEAD LAKE BAY	3.83	Bay
BAY-2	FLATHEAD LAKE BAY	0.72	Bay
BAY-3	FLATHEAD LAKE BAY	2.52	Bay
BAY-4	FLATHEAD LAKE BAY	1.28	Bay
BAY-5	FLATHEAD LAKE BAY	15.53	Bay
RS-1	RIVER STREET	3.37	Catch Basins to Bay
CAS-1	CASCADE AVE	1.44	Closed Basin
EA-1	ELECTRIC AVENUE	1.24	Drywells/Bay
BSN-1	BRIDGE STREET NORTH	3.35	Catch Basins to River
OC-1	OSBORN CONDO'S	0.8	Drywell/BSN-1
BSS-1	BRIDGE STREET SOUTH	7.05	North/BSS-2
BSS-2	BRIDGE STREET SOUTH	3.87	North/BSS-3
BSS-3	BRIDGE STREET SOUTH	3.67	Culvert to River
PC-1	PACIFIC CORPORATION	6.64	River

Source: Flathead County, 2009.

Each of the subbasins was then grouped into 6 watersheds. Of these 28 sub-basins, 11 contribute to the Grand Drive watershed, 1 contributes to the River Street watershed, 1 contributes to the Electric Avenue watershed, 2 contribute to the Bridge Street North watershed, 3 contribute to the Bridge Street South watershed, and the remaining 10 are identified as "other" sub-basins. Of these "other" sub-basins 2 are closed basins and 8 directly influence the Bigfork Bay or Swan River through routing across private land ownership. Figure 12 shows the subbasins and watersheds. The watersheds and their outfalls are described below (Flathead County, 2009):

- **Grand Drive Watershed:** Is comprised of 11 sub-basins and equates to 50.01 acres. The watershed includes sub-basins GC-1, SD-1, SD-2, SD-3, SD-4, SD-5, GD-1, GD-2, GD-3, COM-1, and COM-2. This watershed discharges to the Bigfork Bay via an existing outfall pipe.
- **River Street Watershed:** Is comprised of one sub-basin and equates to 3.37 acres. The watershed includes only sub-basin RS-1. This watershed discharges to the Bigfork Bay via an existing outfall pipe.
- **Electric Avenue Watershed:** Is comprised of one sub-basin and equates to 1.24 acres. The watershed includes only sub-basin EA-1. It is undetermined how this watershed officially discharges to the Bigfork Bay.
- **Bridge Street North Watershed:** Is comprised of two sub-basins and equates to 4.15 acres. The watershed includes sub-basins BSN-1 and OC-1. This watershed discharges to the Swan River via an existing outfall pipe.

- **Bridge Street South Watershed:** Is comprised of three sub-basins and equates to 14.59 acres. The watershed includes sub-basins BSS-1, BSS-2, and BSS-3. This watershed discharges to the Swan River via an existing outfall pipe.
- **Other:** Technically is not deemed as a watershed, but for the purposes of this report, is used only to account for the remaining sub-basins. The remaining subbasins equate to 66.89 acres and include FB-1, MK-1, TR-1, BAY-1, BAY-2, BAY-3, BAY-4, BAY-5, CAS-1, and PC-1.

Additional information is available in the Assessment Report regarding the specific location and stormwater conveyance for each of the subbasins.

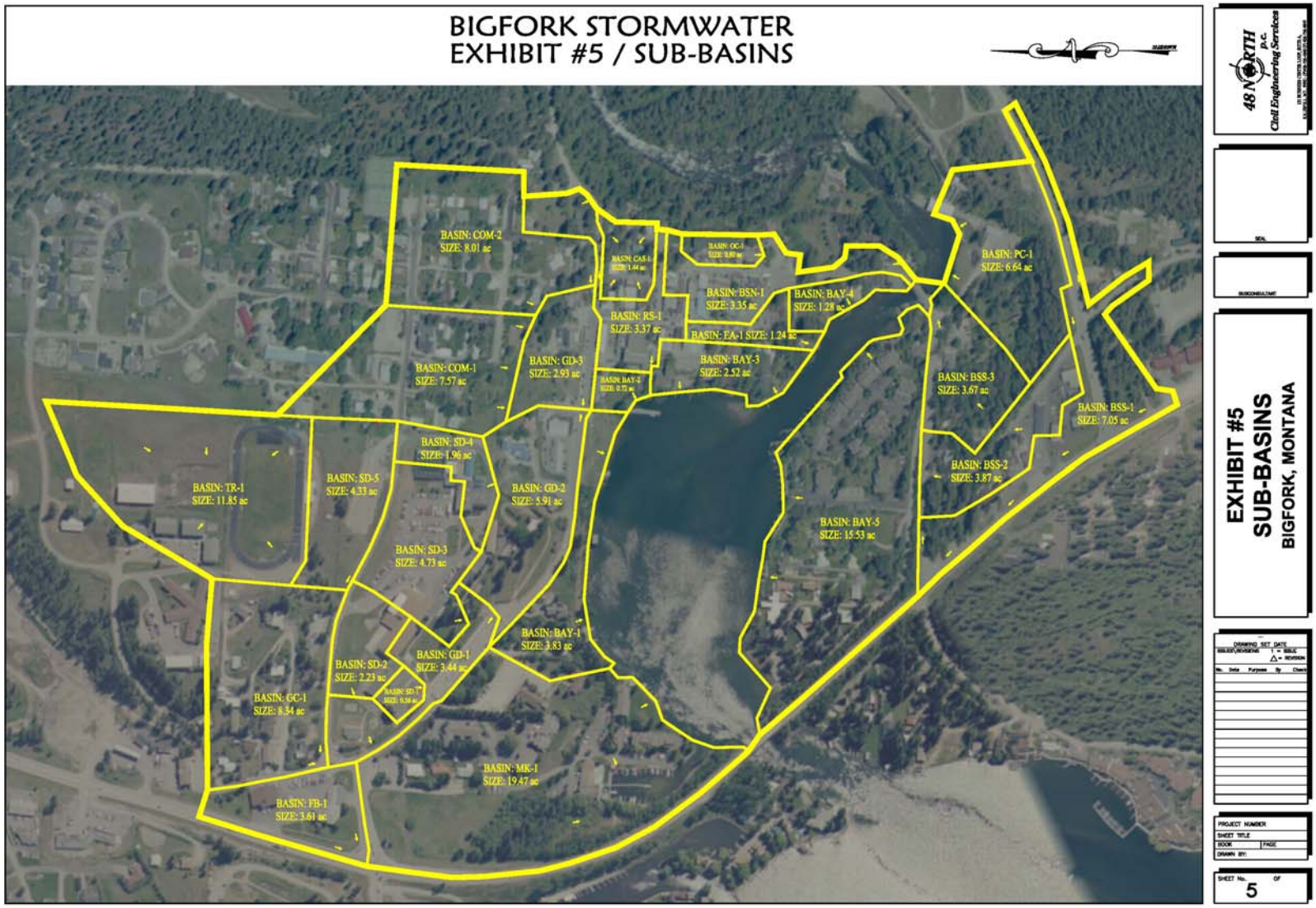

Figure 12. Bigfork Village stormwater subbasins (Flathead County, 2009).

4.5 Montana Department of Transportation

As described in Section 3.1, stormwater runoff associated with roads maintained by the Montana Department of Transportation (MDT) and located within the Kalispell City limits are permitted by the MS4 program. Stormwater runoff and outfalls from this system are described in conjunction with Kalispell's system in Section 3.1. MDT was contacted to obtain information on stormwater runoff from MDT roads located outside of Kalispell and within the Flathead Lake Basin. At the time of this report MDT personnel indicated that stormwater conveyances for individual roads are available as part of road design specifications or erosion control plans for specific projects on file at MDT (Personal Communications, Daniel Ham, Montana Department of Transportation, January 7, 2009). However, all stormwater conveyances from MDT managed roads outside Kalispell City Limits are not currently mapped or summarized in any reports or databases. Additional field verification may be needed to locate and quantify these conveyances.

4.6 Impervious Surfaces

Studies have shown that watersheds having greater than 10 percent impervious surfaces gave degraded biotic integrity in streams and decreased channel stability and fish habitat (Arnold and Gibbons, 1996; Maxted and Shaver, 1994; Schueler, 1995, 1996). Once impervious cover exceeds 20 to 25 percent, nutrient loading begins to exceed background levels (Schueler, 1995).

The 2001 National Land Cover Data (NLCD) GIS coverage of Impervious Surfaces was downloaded and analyzed to determine the amount and location of impervious surfaces in the U.S. portion of the Flathead Lake watershed (http://www.epa.gov/mrlc/nlcd-2001.html). The NLCD classified 30 meter by 30 meter cells with a percent impervious cover of 0 to 100% for each cell (Vogelman et al., 2001). The impervious cover for the central portion of the Flathead Valley is displayed in Figure 13, and the total acres in the entire watershed are summarized in Table 9. It should be noted that that NLCD coverage was based on late 1990s satellite imagery, and there is likely more impervious cover in the basin today. As of the date of the satellite imagery, less than one percent of the Flathead Basin in the U.S. has greater than 10 percent impervious cover. No impervious land use data were available for British Columbia.

Table 9. Impervious land in the Flathead Lake watershed, U.S. portion only.

Percent Impervious Cover	Acres	Percent of Total
0%	4,044,771	97.78%
1-10%	54,468	1.32%
11-25%	17,698	0.43%
26-50%	14,256	0.34%
51-75%	4,195	0.10%
76-100%	1,012	0.02%
Total	4,136,400	100.00%

Source: NLCD 2001

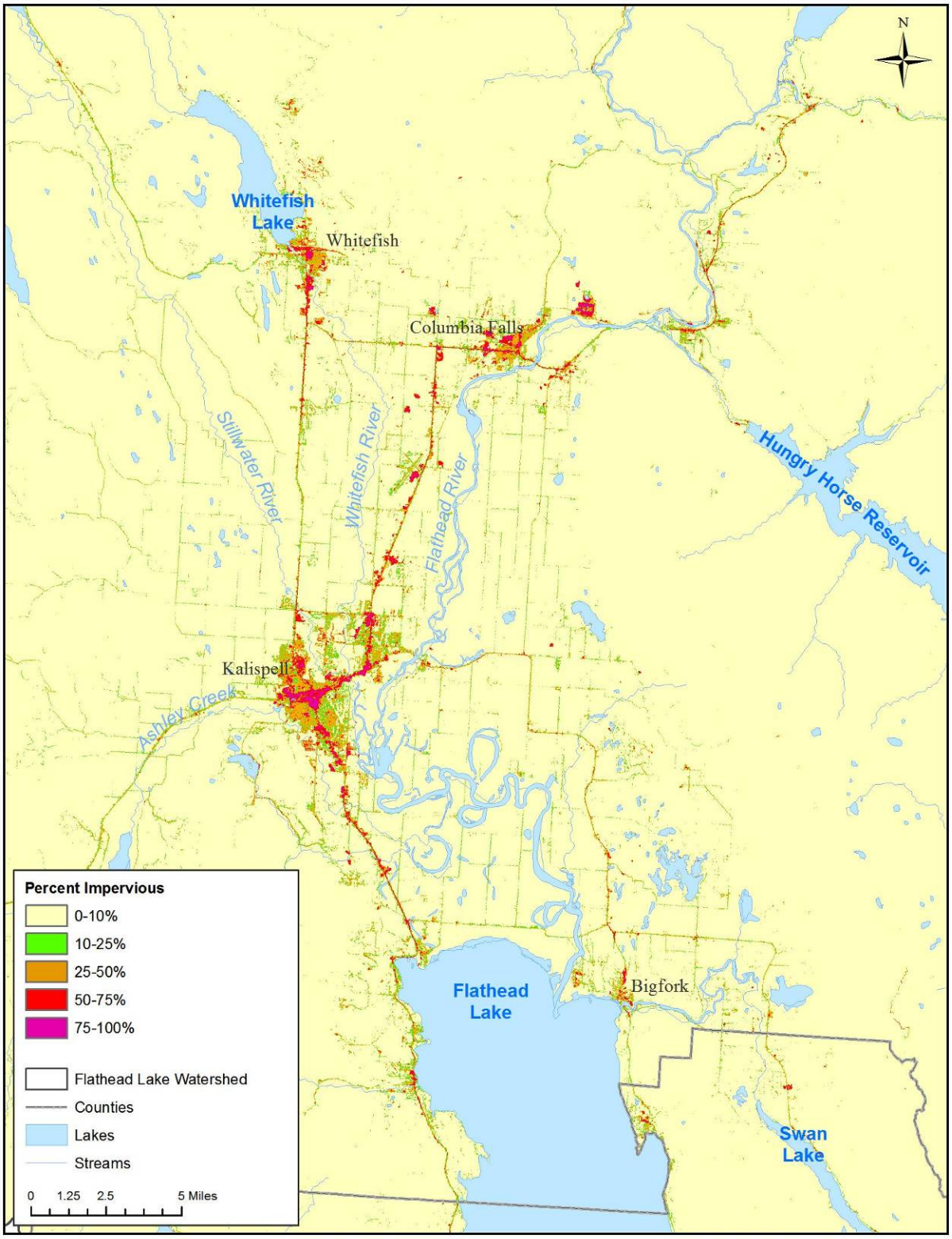

Figure 13. Location of impervious surfaces in the Flathead Lake watershed (Flathead Valley is displayed).

5.0 DATA GAPS

The previous sections provided a summary of the major urban stormwater sources and systems in the Flathead Lake Basin. However, several data gaps remain:

Private Stormwater Collection Systems. The major cities in the Flathead Lake Basin provided information on the type and extent of the city owned stormwater systems in the basin (e.g., storm sewers, detention basins, outfalls, etc.). Information is lacking, however, for smaller villages and other privately owned stormwater systems (e.g., privately owned commercial and residential areas).

Water Chemistry. Little information is available regarding the water chemistry of urban stormwater runoff in the basin. The city of Kalispell and several industrial facilities are required to monitor water chemistry, but the data are not comprehensive enough to describe urban stormwater runoff quality throughout the basin.

Data Currency for Impervious Surfaces. Although recent data and information has been obtained for all of the regulated stormwater facilities in the basin, the analysis of impervious surfaces (Section 4.6) is based on satellite imagery collected in the late 1990's and reported in 2001. Considerable residential and commercial development has occurred since that time.

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