Watershed Characterization

Stillwater River TMDL Planning Area

Prepared for:

Montana Department of
ENVIRONMENTAL QUALITY

Prepared by:
RIVER DESIGN GROUP, INC.
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WHITEFISH, MT 59937

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WATERSHED CHARACTERIZATION

This section of the Stillwater River watershed TMDL and water quality restoration plan provides general background information about the watershed, and sets the stage for a later discussion of water quality problems, and the underlying historical, current and projected future causes of impairment. It is designed to put the subject waterbodies into context of the watershed in which they occur.

2.1 Location

The Stillwater TMDL Planning Area (STPA) encompasses a geographic area of approximately 640 square miles (409,320 acres). The watershed originates in the Whitefish Mountains to the east and the Salish Mountains to the west. The lower terminus of the watershed is the Flathead River near Kalispell, Montana (Map 2-1). Most of the STPA is located within Flathead County, Montana. A small portion of the STPA is located within Lincoln County, Montana.

2.2 Impaired Streams

There are eight 303(d)-list waterbodies in the STPA, including East Spring Creek (lower), East Spring Creek (upper), Hand Creek, Sinclair Creek, Logan Creek (above Tally Lake), Sheppard Creek, Stillwater River (from Logan Creek to mouth), and Stillwater Slough (Map 2-1 and Table 2-1). The Stillwater River upstream from the Logan Creek confluence is not included on the 303(d)-list. The 303(d)-list status of these streams is summarized in Table 2-2.

Table 2-1. Drainage area and percent of the total watershed area for 303(d)-list streams and non-303(d)-list tributaries in the Stillwater River drainage (NRIS, 2005a).

Subwatershed	Drainage Area (mi^2)	Percent of Total Watershed Area
Upper East Spring Creek	34.8	5.4
Lower East Spring Creek	3.3	0.5
Hand Creek	12. 9	2.0
Sinclair Creek	1.2	0.2
Logan Creek	63.9	10.0
Sheppard Creek	37.5	5.9
Stillwater River (downstream from Logan Creek confluence to mouth)	129.3	20.2
Stillwater Slough	1.2	0.2
Non- 303(d)-list Tributaries	355.5	55.6
Total	**639.6**	**100.0**

Throughout Section 2.0, watershed characteristics are presented for the Stillwater River watershed excluding the Whitefish River watershed as the Whitefish River and its tributaries are being evaluated under a separate TMDL planning area.

Table 2-2. Impaired Streams on the Montana 303(d)-list Within the Stillwater TMDL Project Area (NRIS, 2002).

Sub-Drainage Name, Waterbody Number	Use Class	Year Listed	Cold-water Fishery	Aquatic Life	Recreation (Swimmable)	Industry	Agriculture	Drinking Water
East Spring Creek (lower) MT76P003_062	B1	1996	P	P	P	X	X	P
		2004	F	F	F	F	F	F
East Spring Creek (upper) MT76P003_061	B1	1996	P	P	P	X	X	P
		2004	F	F	F	F	F	F
Hand Creek MT76P001_060	B1	1996	L	L	L	L	L	L
		2004	X	X	X	X	X	X
Sinclair Creek MT76P001_040	B1	1996	L	L	L	L	L	L
		2004	X	X	P	X	X	X
Logan Creek MT76P001_030	B1	1996	P	P	X	X	X	X
		2004	P	P	F	F	F	X
Sheppard Creek MT76P001_050	B1	1996	L	L	L	L	L	L
		2004	X	X	F	F	F	X
Stillwater River MT76P001_010	B2	1996	P	P	P	X	X	P
		2004	P	P	F	F	F	N
Stillwater Slough MT76P001_070	B1	1996	L	L	L	L	L	L
		2004	X	X	X	X	X	X

Definitions for Table 1: Impairment Status

N= Non-support of Beneficial Use.
T = Threatened support for Beneficial Use.
P = Partial support of Beneficial Use.
X = Sufficient Credible Data not available
F = Full support of Beneficial Use.
L = Not Listed

2.3 Topography and Relief

Map 2-2 displays topography in the STPA (NRIS, 2005a). The Rocky Mountain Trench is the dominant topographic feature influencing the Stillwater River basin. The trench is a 1,000 mile long narrow depression extending from the Yukon Territory south to Montana. In the focus area, the trench is bordered by the Salish Mountains to the west, and the Whitefish Range to the east (Coffin et al., 1971). Mountains bordering the trench are comprised of metasediments of the Belt Supergroup, while the valley is filled to various depths with materials derived from the Belt parent rock. The Stillwater River enters the trench near Stryker and flows southeast to the Flathead River. Elevations in the Stillwater drainage range from 7,340 feet on Stryker Mountain at the watershed divide, to 2,980 feet at the confluence of the Stillwater River with the Flathead River.

2.4 Land Ownership

The U.S. Forest Service is the primary land manager in the Stillwater River drainage (Map 2-3). Managing most of the western portion of the watershed, the Forest Service administers 59% of the drainage (Table 2-3). Private land holdings total 22% of the watershed. Private holdings are scattered throughout the drainage with most of the private lands held in the southeastern quadrant of the watershed. Private lands border the Stillwater River over nearly the entire length of the impaired focus reach. Landownership by 303d-list waterbody is included in Table 2-4.

Table 2-3. Land ownership/management within the STPA (NRIS, 2005b).

Owner or Administrator	Acres	Sq. Miles	% of Total
U.S. Forest Service	24,0654	376.02	58.8
Private	89,352	139.61	21.8
Montana State Trust lands - DNRC	61,704	96.41	15.1
Plum Creek Timber lands	12,343	19.29	3.0
Waterbodies	3,732	5.83	0.9
Montana Fish, Wildlife, and Parks	1,535	2.40	0.4
Total	409,320	639.57	100

Table 2-4. Distribution of land ownership/management in the 303(d)-list STPA tributaries (acres) (NRIS, 2005b).

Watershed	U.S.F.S.	Private	DNRC	Plum Creek	Water-bodies	MFWP	Total
East Spring Creek (lower)	0	2,083	0	0	0	8	2,091
East Spring Creek (upper)	2,422	19,759	0	43	14	0	22,238
Hand Creek	7,975	0	0	250	22	0	8,247
Sinclair Creek	673	83	0	0	0	0	756
Logan Creek	33,687	2,849	1,429	2,943	0	0	40,908
Sheppard Creek	22,251	1,168	0	573	0	0	23,992
Stillwater River (Logan Cr. to mouth)	18,454	51,219	10,442	224	881	1,527	82,747
Stillwater Slough	0	780	2	0	0	0	782
All Other Stillwater River Drainage Area	155,171	11,411	49,830	8,309	2,814	0	227,535
Total	240,654	89,352	61,704	12,343	3,732	1,535	409,320

2.5 Population

Stryker, Olney, Halfmoon, Evergreen, Whitefish, and Kalispell comprise the primary population centers in the Stillwater drainage (Map 2-4) (NRIS, 2001). The majority of the watershed is uninhabited or inhabited at very low levels (2 to 20 people per square mile). Areas with higher densities tend to be in the southern portion of the drainage.

Where population densities are greatest, channel modifications and ground water impairment are likewise more common.

2.6 Land Use and Land Cover

Land use patterns in the Stillwater River basin were determined using the USGS National Land Cover Dataset (NLCD) (NRIS, 2000). The NLCD is comprised of 21 land cover categories based on 1992 Landsat imagery at a resolution of 30 meters (Map 2-5).

Silviculture is the primary land use in the watershed by land area. Agricultural crop and pasture land are the secondary land uses in the Stillwater drainage. Residential and urban development is concentrated along river and lake corridors, with the majority of the development associated with Kalispell. Forestry activities are common in the subwatersheds, especially in the western portion of the Stillwater drainage. Most of the land use categories in the drainage individually comprise less than 1 percent of the overall drainage area (Table 2-5).

Table 2-5. Land use and land cover within the STPA (NRIS, 2000).

Classification	Acres	Sq. Miles	Percent
Evergreen Forest	346,208	541.0	84.6
Deciduous Forest	486	0.8	0.1
Mixed Forest	3,968	6.2	1.0
Exposed Rock	690	1.1	0.2
Lake, Reservoir, Wetland, or Stream/Canal	4,613	7.2	1.1
Brush Rangeland	2,309	3.6	0.6
Grass Rangeland	571	0.9	0.1
Mixed Rangeland	6,688	10.4	1.6
Crop/Pasture	37,815	59.1	9.2
Commercial or Industrial	1,053	1.6	0.3
Residential, Transportation, or Utilities	3,808	5.9	0.9
Mine/Quarry	267	0.4	0.1
Other	845	1.4	0.2
Total	**409,319**	**639.6**	**100.0**

2.7 Geology

Metasedimentary rocks exposed in the basin belong to the Belt Supergroup of Precambrian age (Map 2-6) (Coffin et al., 1971). Metasedimentary rocks yield water to wells through fractures, typically yielding less than 10 gpm. Unconsolidated glacial deposits (till) are widely distributed in the Stillwater basin. The composition of the till ranges from clay- and silt-sized particles to large boulders. Where Precambrian outcrops prevail, the unconsolidated deposits are dominated by coarser particles. With distance from such outcrops, glacial deposits are frequently characterized by finer materials. Well yields are largely influenced by the glacial till composition, as till dominated by clay and silts impede the downward movement of surface water into underlying aquifers and increase the saturation of overlying more permeable deposits (Coffin et al., 1971).

Glacial outwash (included under the Glacial category on Map 2-6), material derived from the erosion of glacial till by melt water, forms the coarse-grained deposits comprising terraces in the Stillwater drainage. Outwash sorting is a function of the distance between the material's origin and location at the time of settling. Outwash in the headwaters of the Stillwater basin tends to be more heterogeneous than lower in the basin where outwash is defined by more-homogeneous deposits sorted over a greater distance.

Alluvium, material eroded from older rocks and deposited by streams and rivers, is prevalent in the basin. The composition of the alluvium depends on the origin of the eroded material, often times differing between and within subwatersheds as a function of eroded parent materials. Alluvium permeability is dependent on the composition of the parent material and the frequency of clay- and silt-sized particles in the alluvium.

2.8 Soils

Soils in Stillwater River watershed have been inventoried as part of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal Agencies, State agencies including the Agricultural Experiment Stations, and local agencies (Map 2-7) (NRCS, 2005). The correlation of the soils was conducted by the Natural Resources Conservation Service in consultation with the Forest Service. Field work in the Stillwater River drainage was performed in the period 1971-1982. Additional soil investigations were conducted in 1978 on the Stillwater State Forest by the Department of Natural Resources and Conservation Division of Forestry.

Glaciers occupied the Rocky Mountain Trench repeatedly during the Pleistocene Epoch. As the last ice moved southward down the trench, hard Precambrian rocks were ground and polished. Unconsolidated rocks in the trench were partly removed and ground up to form a mixture of sandy clay and cobbles, referred to as "till". Underlying the ice, the till was mounded into streamlined drumlin-shaped hills on the floor of the trench and plastered against the lower walls. After reaching its southern limit, the ice front began to recede northward (Coffin et al., 1971). A principal recessional moraine was deposited in the vicinity of the town of Stryker, on the divide between the Stillwater and Tobacco Rivers (Alden, 1953). Glacial meltwater carried some of the till southward, sorting and depositing it as outwash in the Stillwater valley and as deltaic deposits in the waters of glacial Lake Missoula. Deltaic deposits laid down by the Stillwater River during the last ice retreat interfingered with fine-grained lake-bottom deposits at an altitude of approximately 3,000 feet. Water from melting ice formed smaller lakes in the Good and Logan Creek valleys and deposited outwash west of Lower Stillwater Lake.

Glacier activity, local geology, topographic relief, and climate played a significant role in determining the character and spatial extent of soils in the Stillwater River drainage. Zones of higher elevation (e.g. 2,500 – 5,500 ft amsl) consist of soils formed in calcareous, compact glacial till. Moraines, or glacial drift deposits, are the dominant landform features. Two dominant soils are observed including Andeptic Cryoboralfs-Andic cryochrepts complex, and silty till Andeptic cryoboralfs.

Soils in the valley bottoms of the main Stillwater River, Logan Creek, and Good Creek drainages are formed in alluvium and are underlain by stratified deposits of sand, silt, and gravel (Table 2-6). One major concern of watershed management is protection of streambanks and channels. Erosion can be severe following displacement of riparian vegetation or direct impacts including improperly design stream crossings. Changes to the channel morphology can result in large contributions of fine sediment to stream channels. Maintaining adequate vegetated buffers along major stream courses is recommended to maintain the integrity of water quality.

Table 2-6. Major soil series within the STPA (NRCS, 2005).

Soils Type ID	Map Unit Name	Acres	Sq. Miles	% of Watershed
1	Andeptic Cryoboralfs, silty till substratum	37,649	58.8	9.2
2	Andeptic Cryoboralfs, silty till substratum, calcareous	44,896	10.1	11.0
3	Andeptic Cryoboralfs-Andic Cryochrepts complex	77,463	121.0	18.9
4	Andic Cryochrepts, glaciated mountain ridges	20,524	32.1	5.0
5	Andic Cryochrepts, glaciated mountain slopes	24,252	37.9	5.9
6	Andic Cryochrepts, moraines, dense, brittle substratum	10,295	16.1	2.5
7	Aquepts, lacustrine substratum	10,418	16.3	2.5
8	Dystric Cryochrepts	18,924	29.6	4.6
9	Dystric Eutrochrepts, till substratum	9,138	14.3	2.2
10	Glossic Cryoboralfs, lacustrine substratum	10,120	15.8	2.5
11	Typic Eutroboralfs, silty till substratum	10,204	15.9	2.5
12	Map units constituting less than 2% of watershed area	135,437	212.6	33.1
	Total	409,320	639.9	100.0

2.8.1 Soil K-Factor

The Universal Soil Loss Equation (USLE) K-factor is a measure of a soil's inherent susceptibility to erosion by rainfall and runoff. Values of K range from 0 to 1 with higher numbers indicative of greater erodibility.

Soils high in clay have low K values, about 0.05 to 0.15, because they are resistant to detachment. Coarse textured soils such as sandy soils have low K values, about 0.05 to 0.2, because of low potential for runoff, even though these soils are easily detached. Medium textured soils, such as the silt loam soils, have moderate K values, about 0.25 to 0.4, because they are moderately susceptible to detachment and they produce moderate runoff. Soils having high silt content are the most erodible of all soils. They are easily detached and tend to crust and produce high rates of runoff. Values of K for these soils are usually greater than 0.4 (Michigan State University, 2002). The values shown in Table 2-7 are weighted surface soil K-factors; no other depths were considered. The values are weighted by component percent of each soil mapping unit polygon. The soil erosion K-factor was moderate throughout most of the planning area, with 78% of the area characterized by K-factors in the 0.3 – 0.4 range, and 13% characterized by K-factors in the 0.2 – 0.3 range. Table 2-8 presents the distribution of soil K-Factor in the 303(d)-list tributaries of the STPA.

Table 2-7. Soil erosion K-factor within the STPA (NRIS, 2003).

Weighted USLE K Factor	Acres	Sq. Mi.	% of Watershed
0.00 – 0.09	25,170	39.3	6.1
0.10 – 0.19	1,970	3.1	0.5
0.20 – 0.29	52,007	81.3	12.7
0.30 – 0.39	320,969	501.5	78.4
0.40 – 0.49	9,203	14.4	2.2
Total	409,320	639.6	100

Table 2-8. Distribution of soil K-Factor in the 303(d)-list STPA tributaries (acres) (NRIS, 2003).

Watersheds	0.00 – 0.09	0.10 – 0.19	0.20 – 0.29	0.30 – 0.39	0.40 – 0.49	Total
East Spring Creek (lower)	0	0	1,595	496	0	2,091
East Spring Creek (upper)	7,997	217	4,362	9540	142	22,258
Hand Creek	25	0	3	8219	0	8,247
Sinclair Creek	0	0	0	756	0	756
Logan Creek	22	0	727	40,139	20	40,908
Sheppard Creek	1	0	5	23,986	0	23,993
Stillwater River (Logan Cr. to mouth)	5,071	1,495	11,838	63,123	1,222	82,749
Stillwater Slough	228	20	99	375	0	782
All Other Stillwater River Drainage Area	11,767	238	33,377	174,336	7,819	227,536
Total	25,171	1,970	52,007	320,969	9,203	409,320

2.9 Climate

The climate of the Stillwater River drainage is primarily influenced by the Salish Mountains located to the west of the study area. The Salish Mountains partially shield the Stillwater basin from west-migrating storms, creating a rain shadow over the basin. Storms advancing northward and following the Rocky Mountain Trench influence the climatology of the Stillwater drainage, creating a climate characterized by cold, humid winters and warm, dry summers. Temperature and precipitation data collected from three weather stations from 1971 to 2000, suggest a climatological gradient from the headwaters to mouth of the Stillwater River (Table 2-9) (NOAA, 2000). Climagraphs illustrate temperature-precipitation relationships at the three climatological stations in the drainage (Figure 2-1 to Figure 2-3).

Table 2-9. Average annual air temperature (°F), average snowfall, and precipitation recorded at three locations in the Stillwater River drainage from 1971-2000 (NOAA, 2000).

	Average Annual Air Temperature (°F)				
Weather Station Location	Minimum	Mean	Maximum	Ave. Snowfall (Inches)	Precipitation (inches)
Olney	26.5	39.8	53	120.2	22.7
Whitefish	30.4	42.5	54.5	74.0	21.1
Kalispell	30.5	42.6	54.6	62.2	17.2

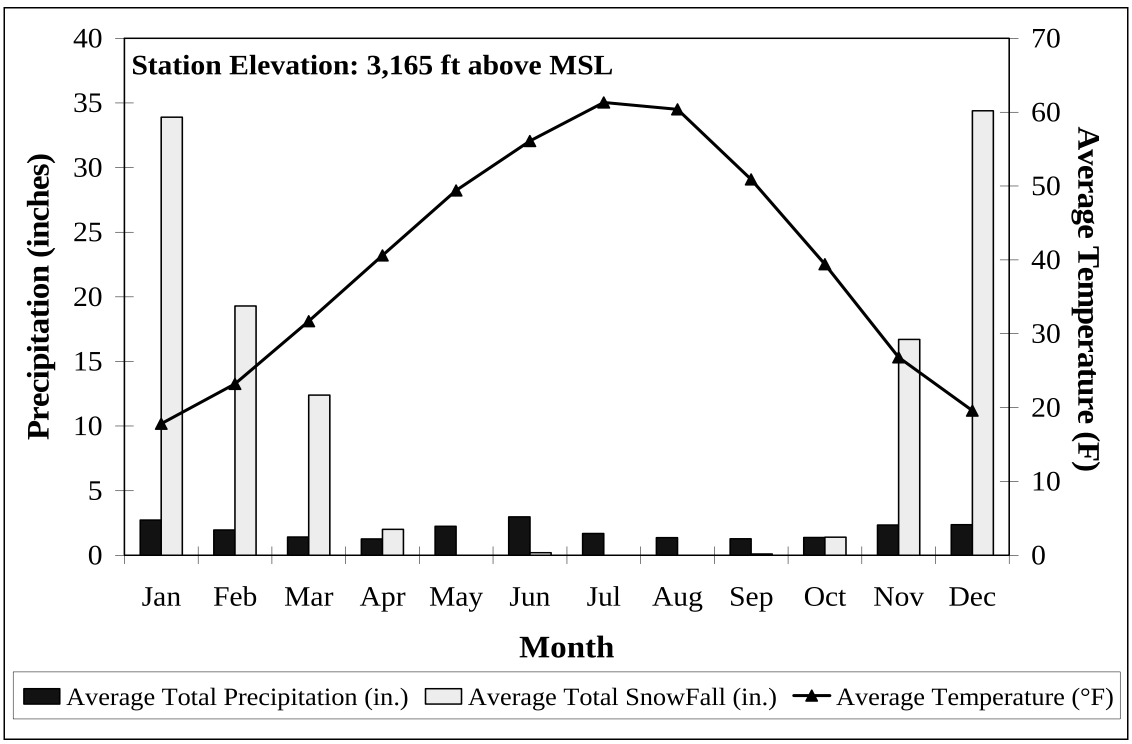

Figure 2-1. The Olney climate station (246218) for the Stillwater River.

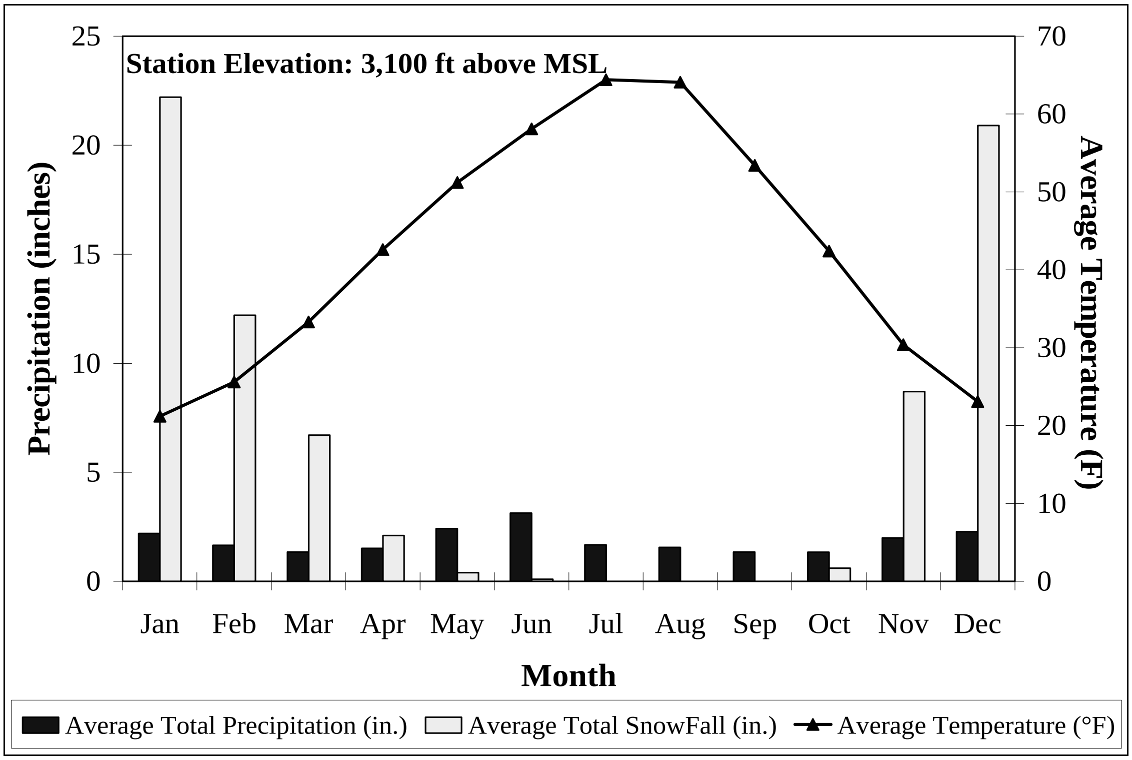

Figure 2-2. The Whitefish climate station (248902) for the Stillwater River.

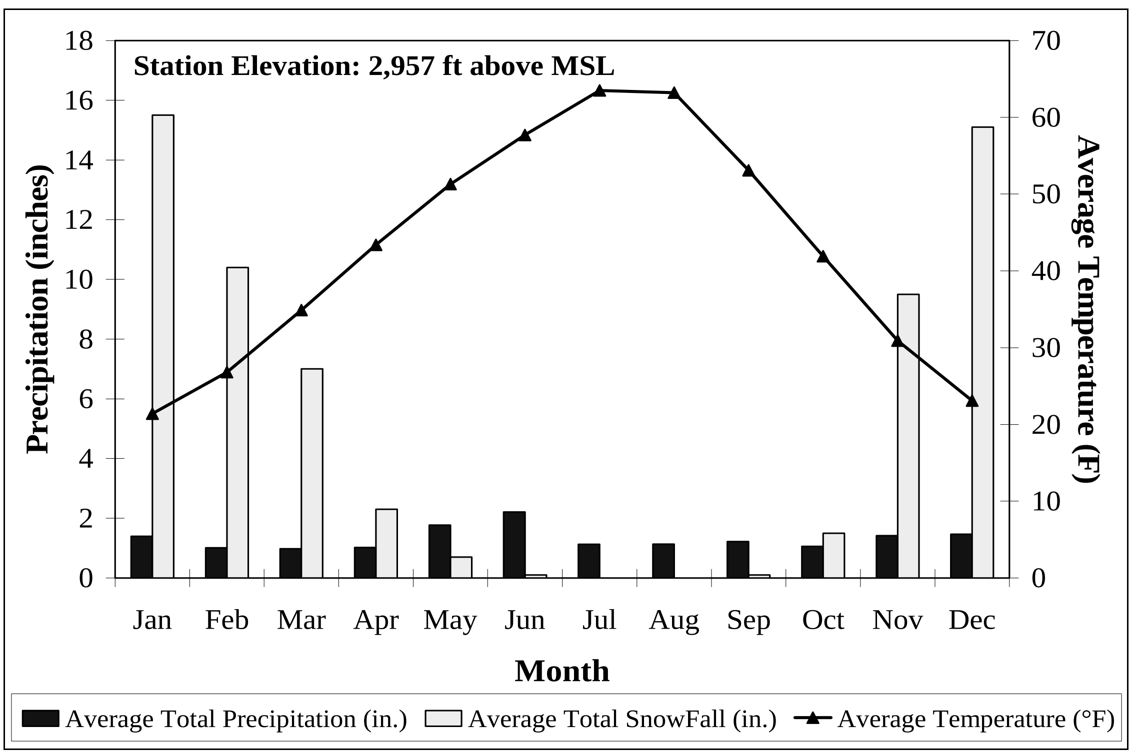

Figure 2-3. The Kalispell climate station (244558) for the Stillwater River.

2.10 Hydrology

2.10.1 USGS Stream Gaging

The U.S. Geological Station (USGS) has operated several gaging stations in the STPA (Table 2-10) (USGS, 2006). Currently, the USGS operates a stream flow gage station (#12365000) 16.2 miles upstream from the mouth of the Stillwater River (USGS, 2006). The USGS recorded monthly river discharge between October and November 1930. A water-stage recorder installed downstream from the Spring Prairie Road Bridge has been in operation since December 1930. The gage station operational period of record includes December 1930 through September 1950, October 1972 to September 1985, and 1986 to present. The Stillwater River hydrograph is driven by snowmelt runoff with the majority of the discharge occurring between April and August (Figure 2-4). The maximum recorded discharge was 4,570 cfs on May 18, 1997 (Figure 2-5). The minimum discharge was 17 cfs on August 17, 1992.

Table 2-10. USGS stream gages in the STPA (USGS, 2006).

Station Number	Station Name	Drainage Area (Sq. Miles)	Period of Record (Calendar Year)
12365000	Stillwater River at Whitefish, MT	524 mi^2	1930 - Current
12365500	Stillwater River at Kalispell, MT	338 mi^2	1906 - 1930
12363920	Stillwater River at Olney, MT	146 mi^2	1972 - 1982
12364000	Logan Creek at Tally Lake near Whitefish, MT	183 mi^2	1931 - 1947
12364500	Logan Creek near Whitefish, MT	199 mi^2	1931

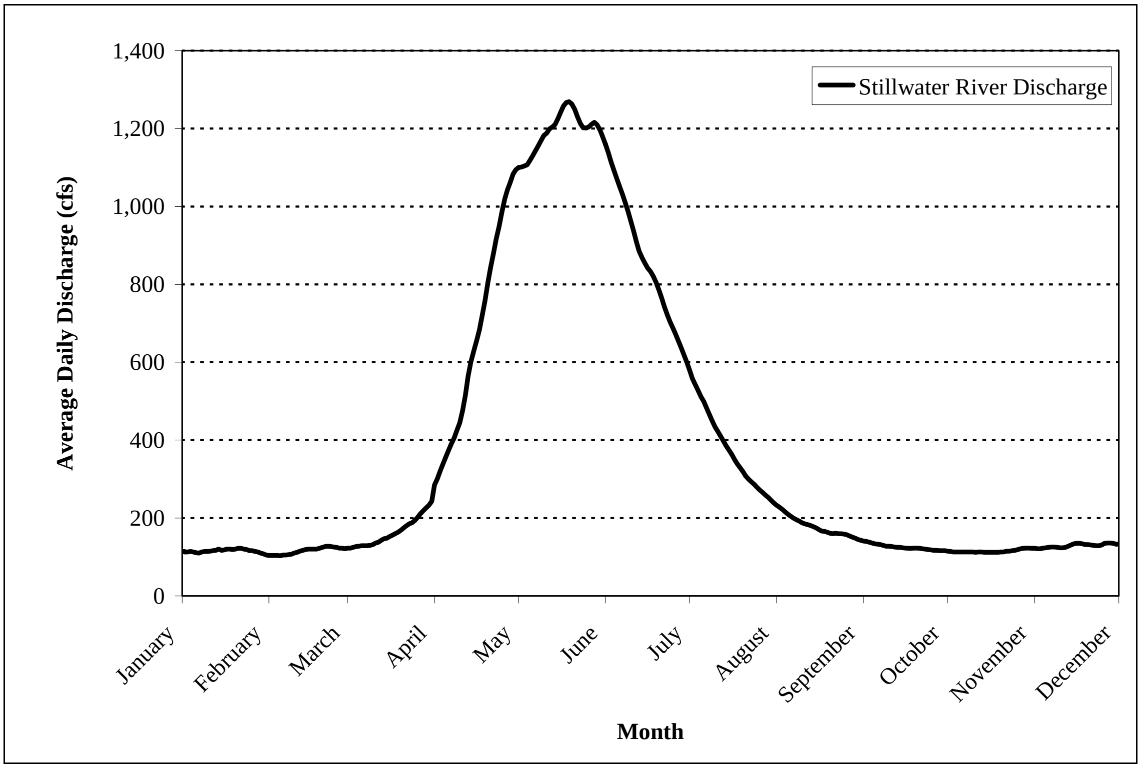

Figure 2-4. Average daily flows measured at the USGS gage at river mile 16.2 on the Stillwater River. Data are based on the 49 year period of record (USGS, 2006)**.**

2.10.2 USGS Discharge Estimates

A log-Pearson Type III distribution was completed for the 50 year period of record (Table 2-11). Because the gage station is located at river mile 16.2, the flood frequency analysis is based on the 524 square mile watershed upstream of the gage station rather than the entire 820 square mile watershed (USGS, 2002). High magnitude flood events have occurred in the Stillwater River watershed over the past 20 years, most notably in 1991 (2,950 cfs), 1996 (3,680 cfs), and 1997 (4,570 cfs).

Table 2-11. The Stillwater River flood frequency for the USGS gaging station #12365000 (USGS, 2006).

Recurrence Interval (Years)	Measured from Peak Discharge Record (cfs)
$Q_{1.25}$	957
Q_2	1,590
Q_5	2,510
Q_{10}	3,130
Q_{25}	3,900
Q_{50}	4,470
Q_{100}	5,030

2.10.3 Stillwater State Forest Stream Gaging

The Montana Department of Natural Resources has established stream gaging stations on Chepat Creek and Lower Fitzsimmons Creek on the Stillwater State Forest (STSF). The streams are headwater tributaries to the Stillwater River. Discharge and nutrient measurements are concentrated during the summer and are discontinuous. Discharge measurement descriptive statistics are presented in Table 2-12 and Table 2-13.

Table 2-12. Discharge descriptive statistics for Lower Fitzsimmons Creek, tributary to the Stillwater River (STSF, 2003).

Month	n	Range	Minimum	Maximum	Mean	Std. Deviation
April	29	81.6	3.5	85.1	35.6	18.3
May	93	326.8	19.7	346.5	100.3	56.1
June	81	269.4	27.5	296.9	105.9	52.2
July	37	89.5	9.3	98.8	41.5	23.8
August	19	36.5	3.1	39.6	15.5	7.9

Table 2-13. Discharge descriptive statistics for Chepat Creek, tributary to the Stillwater River (STSF, 2003).

Month	n	Range	Minimum	Maximum	Mean	Std. Deviation
April	32	24.8	0.2	25.0	5.3	4.8
May	92	48.4	1.9	50.3	15.3	10.4
June	79	38.6	2.6	41.2	14.3	9.2
July	35	11.1	1.5	12.6	4.7	3.1
August	20	10.1	0.7	10.8	2.9	2.5

2.10.4 Groundwater

Groundwater flow to the Stillwater River contributes a moderate proportion of water to the total stream flow. Because much of the watershed is underlain by slightly permeable glacial till and Precambrian rocks, precipitation is briefly retained in soils prior to discharging to the Stillwater River and its tributaries. Outwash and alluvium deposits contribute relatively large volumes of water to streams in the basin, sustaining base flows during dry periods. As an example, tributary inflows to the Stillwater River accounted for only 13 percent (measured at Olney) and 18 percent (measured northwest of Kalispell) of the Stillwater's instantaneous discharge (Coffin et al., 1971). The importance of groundwater recharge for sustaining Stillwater River flows was apparent at least in the early 1970s.

2.10.5 Water Use

Map 2-8 and Table 2-14 display the registered water use categories in the Stillwater River drainage. Pumps are the most common point of diversion. Irrigation is the most common point of use.

Table 2-14. Irrigation source categories and counts for the Stillwater River drainage (NRIS, 2006a; NRIS, 2006b; NRIS, 2006c).

Source Layer	Feature	Miles	Count
NHD Flowline	Canal/Ditch	3.27	
NHD Flowline	Pipeline - Siphon	0.45	
Public Water Supply	Surface Water Public Water Source – Stillwater Bar		1
Mountain Dams	Skyles Lake Dam	1	
POD	Bucket		2
POD	Dam		8
POD	Dike		6
POD	Ditch		1
POD	Flowing		5
POD	Fueled pump		3
POD	Headgate		17
POD	Headgate with Ditch or Pipeline/Flood and Dike	1	
POD	Infiltration Gallery		2
POD	Instream		15
POD	Livestock Direct from Source		96
POD	Multiple		11
POD	Other Diversion		9
POD	Pipeline - Siphon		11
POD	Pit		7
POD	Pump		362
POD	Pump/Headgate with Ditch or Pipeline	2	
POD	Sump		1
POD	Unknown		6
Points of Use	Irrigation		570

POD: point of diversion

2.11 Channel Morphology

The Stillwater River drains land types influenced by forest management, agriculture and grazing, and residential and industrial development. Several documents were reviewed to evaluate river corridor conditions. Example reviewed documents included USFS EIS documents, NRCS assessments, and water quality sampling reports.

The stream morphology of the mainstem Stillwater River changes along a longitudinal gradient from the headwaters to the Stillwater River's confluence with the Flathead River. The primary tributaries draining to the Stillwater River, exhibit multiple stream types (Rosgen, 1994). Tributary stream morphologies reflect the varied geologies and valley characteristics of the individual tributaries.

Headwater Streams to Duck Lake

As the headwater streams, Russky Creek, Chepat Creek, Fitzsimmons Creek, and numerous other smaller tributaries join the mainstem Stillwater River, the river is classified as a Rosgen B stream type (moderately steep channel slope with a narrow floodplain paralleling the channel). With a flattening of the valley and channel gradient, the river evolves from a Rosgen B to a Rosgen C stream type (flatter channel slope with a more expansive floodplain) down-valley from the town of Stryker, Montana. The Stillwater River becomes more sinuous and has a broader meander pattern across the widening valley floor and transitions to a Rosgen E stream type (flat slope, narrow and deep channel with a broad floodplain). Large wetland complexes and a highly sinuous meander pattern suggest the depositional nature of the Stillwater River from upstream of the Sunday Creek confluence, downstream to Duck Lake.

Duck Lake to Lower Stillwater Lake

The river flows through Duck Lake and Upper Stillwater Lake before emerging as a Rosgen B stream type with Rosgen C stream type inclusions prior to flowing into Lower Stillwater Lake. The steeper, higher energy channel contrasts with the low gradient channel that emerges downstream from Lower Stillwater Lake. Above Lower Stillwater Lake the river leaves the confined valley reach, and begins to meander within the widening valley bottom. Rosgen C stream type inclusions comprise abbreviated sections in the reach of the Stillwater River between Upper and Lower Stillwater Lakes. Three woody debris jams and multiple off-channel habitats suggest the role of woody debris in the creation and maintenance of diverse aquatic habitats in the meandering reach.

Lower Stillwater Lake to the Flathead River

Three reaches were identified in the portion of the Stillwater River extending from the outlet of Lower Stillwater Lake to the mouth of the Stillwater River. The three primary reaches correspond with a similar study completed in 1981 that investigated channel and floodplain conditions on the Stillwater River (USDA, 1981). The three reaches include the *reference reach* (Lower Stillwater Lake downstream to the Logan Creek confluence), the *agricultural reach* (Logan Creek confluence downstream to the Reserve Street Bridge), and the *residential/urban reach* (Reserve Street Bridge downstream to the Flathead River).

The Stillwater River maintains characteristics of Rosgen E and Rosgen F (deep channel confined by adjacent terraces with little or no floodplain) stream types. Channel-floodplain connectivity is the primary feature determining the appropriate stream type in the study reach. Unconfined portions of the study reach with substantial floodplain available to the river during flood events are classified as Rosgen E stream types. Reaches with limited floodplain availability and characterized by channel confinement within high terraces are classified as Rosgen F stream types.

***Reference Reach*: Lower Stillwater Lake to the Logan Creek Confluence**

From the Lower Stillwater Lake outlet downstream to north of the Martin Camp Road, the Stillwater River is classified as a Rosgen C stream type. Upstream and downstream of Martin Camp Road, the Stillwater River maintains a sinuous channel pattern, low bank height ratio, high channel-floodplain connectivity, and a dense riparian community, attributes typical of a Rosgen E stream type. The river is able to access the adjacent floodplain during high frequency, low magnitude flood events. Floodplain access promotes floodwater dissipation and sediment deposition. In-stream water velocities and resultant bank erosion rates are reduced by the available floodplain surface. The channel slope is 0.37 percent. This initial reach in the focus study area provides a valuable reference condition to compare the remaining two downstream reaches.

***Agricultural Reach*: Logan Creek Confluence to the Reserve Street Bridge**

Downstream of the Logan Creek confluence, the Stillwater River is classified as an impaired waterbody (MDEQ, 2002). The river broadens and slows and the channel slope decreases to 0.01 percent. Land uses adjacent to the riparian zone are more intensive in the second reach of the study area. Riparian vegetation displacement for agriculture, grazing, and rural development is common. Portions of the river appear to have been straightened for improved land use efficiency. Although the tortuous sinuosity suggests a dynamic channel capable of migrating across its accessible floodplain, much of the Stillwater River in this reach is confined between banks exceeding 20 ft to 40 ft in height. Bank erosion and mass failures are common. The channel in this reach is characterized by a Rosgen F stream type based on the separation of the river from its adjacent floodplain.

***Residential/Urban Reach*: Reserve Street Bridge to the Flathead River**

The *residential/urban reach* begins at the West Reserve Drive Bridge and extends to the Stillwater River’s confluence with the Flathead River. The residential/urban reach is defined by the residential and commercial/industrial urban corridor bordering both sides of the Stillwater River. Channel straightening, riparian vegetation removal and replacement, intensive land uses, and floodplain abandonment have modified the river corridor. Sediment delivered from the *agricultural reach* is evident in the *residential/urban reach*, as fine sediment, poor water quality, and impaired aquatic habitat persist throughout the reach (USDA, 1981).

2.12 Septic System Density

Table 2-15 includes the number of septic systems in the STPS waterbodies (Map 2-9). Septic system data were generated using the 2000 Census information and assumes there is a statewide density of 2.5 persons per installed septic tank. Three hazard levels were applied including (DEQ, 2004):

> **High Hazard** >300 septic systems (750 persons) per square mile.
> **Medium Hazard** 50 (125 persons) to 300 septic systems per square mile.
> **Low Hazard** <50 septic systems (125 persons) per square mile.

Table 2-15. Distribution of septic systems in the 303(d)-list STPA tributaries (Flathead County, 2006).

Watershed	Number of Septic Systems	Septic System Density (# per sq. mile)	% of Total
East Spring Creek (lower)	138	42	4.7
East Spring Creek (upper)	827	24	27.9
Hand Creek	0	0	0.0
Sinclair Creek	2	2	0.1
Logan Creek	4	0	0.1
Sheppard Creek	11	0	0.4
Stillwater River (from Logan Cr. to mouth)	1,748	12	59.1
Stillwater Slough	153	125	5.2
All Other Stillwater River Drainage Area	77	0	2.6
Total	2,960	4.6	100

Stillwater Slough, East Spring Creek (lower), and East Spring Creek (upper) have the highest densities of septic systems in the watershed. These streams are in the more developed and populated area of the lower watershed.

2.13 U.S. Army Corps of Engineers 404 Permits and MPDES Permits

U.S. Army Corps of Engineers 404 permits are required by the Clean Water Act for any activity that involves discharge, or placement of dredged or fill material into the waters of the United States, including wetlands. U.S. Army Corps of Engineers 404 Permits issued for the STPA are summarized in Tables 2-16 and 2-17 and Map 2-10. Montana Pollutant Discharge Elimination System (MPDES) permits are included in Table 2-18 and also shown on Map 2-10.

Table 2-16. Distribution of USACE 404 Permits in the 303(d)-list STPA waterbodies (NRIS, 2005).

Watershed	Number of Permits	% of Total
East Spring Creek (lower)	8	17.4
East Spring Creek (upper)	4	8.7
Hand Creek	0	0
Sinclair Creek	0	0
Logan Creek	2	4.3
Sheppard Creek	2	4.3
Stillwater River (Logan Cr. to mouth)	17	37.0
Stillwater Slough	2	4.3
All Other Stillwater River Drainage Area	11	23.9
Total	46	100

Table 2-17. Description of USACE 404 Permits in the STPA (NRIS, 2005).

Map ID #	Permit Action ID	Remark	Action Location
1	130001144		Skyles Lake
2	130001237		East Spring Creek
3	199016176	Habitat Improvement	Oettiker Creek
4	199016177	Habitat Structures	Lost Creek
5	199016181	Habitat Improvement	Swaney Creek
6	199016182	Habitat Structures	Logan Creek
7	199016464	Residential Development	Wetlands
8	199016514	Bank Stabilization	East Spring Creek
9	199170420		East Spring Creek
10	199290405	Parking Lot	Wetlands
11	199290423	Pipe Across Creek	Good Creek
12	199290443	Fill Low Areas	Wetlands
13	199290566		Stillwater River Wetlands
14	199390150	Fill Depression on Residential Lot	Unnamed Depression
15	199390520	Widen US Highway 2	Unnamed Wetlands
16	199390590	8” Water Line Crossing	Spring Creek East
17	199390625	Bridge Repair	Stillwater River
18	199490028	Bridge and Bank Stabilization	Good Creek
19	199490488	Trout Pond	Unnamed Wetlands
20	199490610	Dam Repair	Lower Stillwater Lake
21	199590125	Pond Construction	Pond off the Stillwater River
22	199590141	Water Main Installation	Unnamed
23	199590161		Skyles Lake
24	199590301	Road and Culvert Crossing	Potter Creek
25	199590458	Bank Stabilization	Stillwater River
26	199690185	Contain Flow of 3 Springs in One Pond	Pond

Table 2-17. Description of USACE 404 Permits in the STPA (NRIS, 2005).

Map ID #	Permit Action ID	Remark	Action Location
27	199690561	Bank Repair	Stillwater River
28	199790301	Bank Stabilization to Protect 2 Homes and Park	Stillwater River
29	199790425	Drug Rehab Facility Road Elevation to Prevent Flooding	Sheppard Creek
30	199790709	Bank Stabilization	Stillwater River
31	199790836	Construct Road Across Wetland	Unnamed tributary of Garnier Creek
32	199790870	City Placing Rock Riprap Along Riverbank to Protect Golf Course	Stillwater River
33	199890052	Riprap	Stillwater River
34	199890303	Man-made Pond	man-made pond
35	199890562	Remove Old Gas Line and Bore New One	Spring Creek
36	199890773	Riprap at Stormwater Outfall	Stillwater River
37	199890803	Wildlife Pond	Martin Creek
38	199990007	Construct Outfall at Structure	Stillwater River
39	199610049		Stillwater River
40	199890648		Stillwater River
41	199990620	Culvert Crossing Ditch for Home Access	Unknown
42	130001237		East Spring Creek
43	199170183	New Rail Alignment	Wetlands
44	199100007	Repair Outlet Structure	Unnamed Creek
45	200090537		Woodland Creek
46	200090687	Berm and Pond in Upland, Only Fill is Small Amount for Control Outfall	Martin Creek
47	200290048	Vibrating Plow to Install Cable	Stillwater River
48	200290073		Stillwater River
49	200290534	Restore Fish Passage Up Creek on Private Land	Alexander Creek
50	200290577		Stillwater River
51	200390111		Wetland
52	200390371		Dog Creek

Table 2-18. MPDES permits in the Stillwater Drainage.

Map #	Wastewater Permit Type	Permit Name	Description	MPDES ID
1	Municipal	Whitefish (WTP) 001	Water Treatment Plant	MT0030414
2	Municipal	Sleeping Buffalo Health Resort Inc	Facultative Sewage Lagoon	MTG580031
3	Storm Water	FH Stoltze Land & Lumber Co	Storm Water – Industrial	MTR000019
4	Storm Water	Flathead Municipal Airport	Storm Water – Industrial	MTR000309
5	Concentrated Animal Feeding Operation	Hedstrom Dairy	Concentrated Animal Feeding	MTG010046

Table 2-18. MPDES permits in the Stillwater Drainage.

Map #	Wastewater Permit Type	Permit Name	Description	MPDES ID
6	Storm Water	Kalispell Wrecking	Storm Water – Industrial	MTR000367

2.14 Ecoregion

The Stillwater River drainage lies within the Northern Rockies Level III ecoregion (sub-regions Stillwater-Swan Woodland Valley and Flathead Valley). Nutrient levels in the watershed are best compared to nutrient guidelines for the Northern Rockies and Canadian Rockies (EPA, 2000).

2.15 Fish

The Stillwater River fish community was originally comprised of eight native species, with bull trout *Salvelinus confluentus,* and westslope cutthroat trout *Oncorhynchus clarki lewisi* the dominant piscivores (Table 2-19). Fish species introductions in the greater Upper Flathead Basin have increased the number of species in the Stillwater River. Introduced species (e.g. northern pike *Esox lucius*) and native species more tolerant of the degraded aquatic environment (e.g. northern pikeminnow *Ptychocheilus oregonensis*) persist throughout the mainstem Stillwater River.

Table 2-19. Native and introduced fish species inhabiting streams of the Flathead River drainage. The listed species are believed to inhabit the Stillwater River drainage. Approximate introduction dates taken from MDEQ (2001).

Native Fish Species	Introduced Fish Species
Bull trout	Rainbow trout (1914)
Westslope cutthroat trout	Brown trout (1989-Unauthorized Introduction)
Longnose sucker	Brook trout (1913)
Largescale sucker	Northern pike (1960-Illegal Introduction)
Northern pikeminnow	Kokanee (1916)
Redside shiner	
Sculpin	
Peamouth chub	

Bull trout, a federally listed threatened species (USDI, 1998a), and westslope cutthrout trout recognized by the State of Montana as a Species of Special Concern (Roedel, 1999), are less numerous today than they were historically in the Stillwater and Whitefish Rivers. Anecdotal accounts indicate that the two species were more abundant in the watershed prior to timber harvest, log drives, and the construction of on-stream splash dams that blocked and isolated migratory spawning populations. Aggressive harvesting of fluvial and adfluvial bull trout and westslope cutthroat trout at splash dams on the Stillwater River rapidly depressed bull trout and cutthroat trout populations (USDI, 2001). A 1937 report noted bull trout widely distributed in the Stillwater watershed, including Sunday Creek, Good Creek, Martin Creek, and Griffin Creek, none of which currently support bull trout populations (cited in USDA, 1998b). Bull trout are generally considered to be absent from the lower rivers and are no longer connected with the Flathead Lake adfluvial population (USDA, 1998b).

The introduction of several fish species has also impacted the native fish community through competition, predation, and hybridization. Introduced fishes of particular concern include rainbow trout *Oncorhynchus mykiss*, brook trout *Salvelinus fontinalis*, lake trout *Salvelinus namaycush*, and northern pike. Remnant bull trout populations likely continue to persist at extremely depressed levels in Tally Lake and the Stillwater Lakes. Well-established lake trout and northern pike populations likely suppress disjunct adfluvial bull trout populations inhabiting these lakes (USDI, 2001).

Fish population estimates have been conducted by Montana Fish, Wildlife & Parks on a 150 m section of the Upper Stillwater River since 1991. Population estimates suggest an increasing (though not statistically significant) trend in the bull trout population size in the sample reach (Table 2-20). A similar though less dramatic increase in the westslope cutthroat trout population was also noted (Table 2-21). The increasing population trends may be explained by more stringent species protection programs, reductions in extractive land use practices that historically degraded aquatic habitat, and/or more favorable environmental conditions.

Table 2-20. Bull trout population estimates from the Upper Stillwater River 150 m sampling section.

Year	Population Estimate	Density Estimate for Age I and Older Bull Trout (#/100 m^2)
1991	24	1.5
1996	20	1.2
1997	23	1.4
1998	25	1.7
1999	10	0.7
2000	31	2.1
2001	98	6.8
2002	100	6.7

Table 2-21. Westslope cutthroat trout population estimates from the Upper Stillwater River 150 m sampling section.

Year	Population Estimate	Density Estimate for Age I and Older WCT (#/100 m^2)
1991	5	0.3
1996	49	3.0
1997	47	2.9
1998	53	3.6
1999	49	3.3

Table 2-21. Westslope cutthroat trout population estimates from the Upper Stillwater River 150 m sampling section.

Year	Population Estimate	Density Estimate for Age I and Older WCT (#/100 m^2)
2000	77	5.2
2001	44	3.1
2002	113	7.6

Surveys on Good Creek found fish communities dominated by brook trout, with brook trout outnumbering westslope cutthroat trout 122 to 20 on Good Creek (MFWP, 2001). These results suggest the poor condition of westslope cutthroat and bull trout populations throughout their historical range in the Stillwater River watershed. Similar disparities were noted by the USFS on other tributaries on the Flathead and Kootenai National Forests. Fish surveys within the Logan Creek drainage suggest a similar decline of native cutthroat trout and an inverse increase in brook trout populations. At present, westslope cutthroat trout are abundant in 1.1% of the Logan Creek drainage and are absent in 54.8% (USDA, 2003).

2.16 Vegetative Cover

Vegetation classification within the STPA was derived from the University of Montana's (1998) Gap Analysis Project. Table 2-6 presents the distribution of vegetation classes within the 303(d)-list watersheds in the STPA. The STPA is dominated by Mixed Mesic Forest (29.1%) and Mixed Subalpine Forest (18.4%). No other category accounts for more than 7% of the watershed area. Vegetation classes are depicted on Map 2-11.

Table 2-22. Vegetation classification (GAP) within the STPA (University of Montana, 1998).

Description	Acres	Sq. Mi.	% of STPA
Agricultural Lands – Dry	16,269	25.4	4.0
Low/Moderate Cover Grasslands	9,607	15.0	2.4
Montane Parklands and Subalpine Meadows	12,424	19.4	3.0
Mixed Mesic Shrubs	9,087	14.2	2.2
Mixed Broadleaf Forest	10,644	16.6	2.6
Lodgepole Pine	28,046	43.8	6.9
Douglas-fir	19,941	31.2	4.9
Douglas-fir/Lodgepole Pine	27,393	42.8	6.7
Mixed Whitebark Pine Forest	11,577	18.1	2.8
Mixed Subalpine Forest	75,456	117.9	18.4
Mixed Mesic Forest	118,922	185.8	29.1
Mixed Barren Sites	16,341	25.5	4.0
Vegetation classes constituting <2% of watershed area	53,671	83.9	13.1
Total	409,378	639.7	100.0

APPENDIX A
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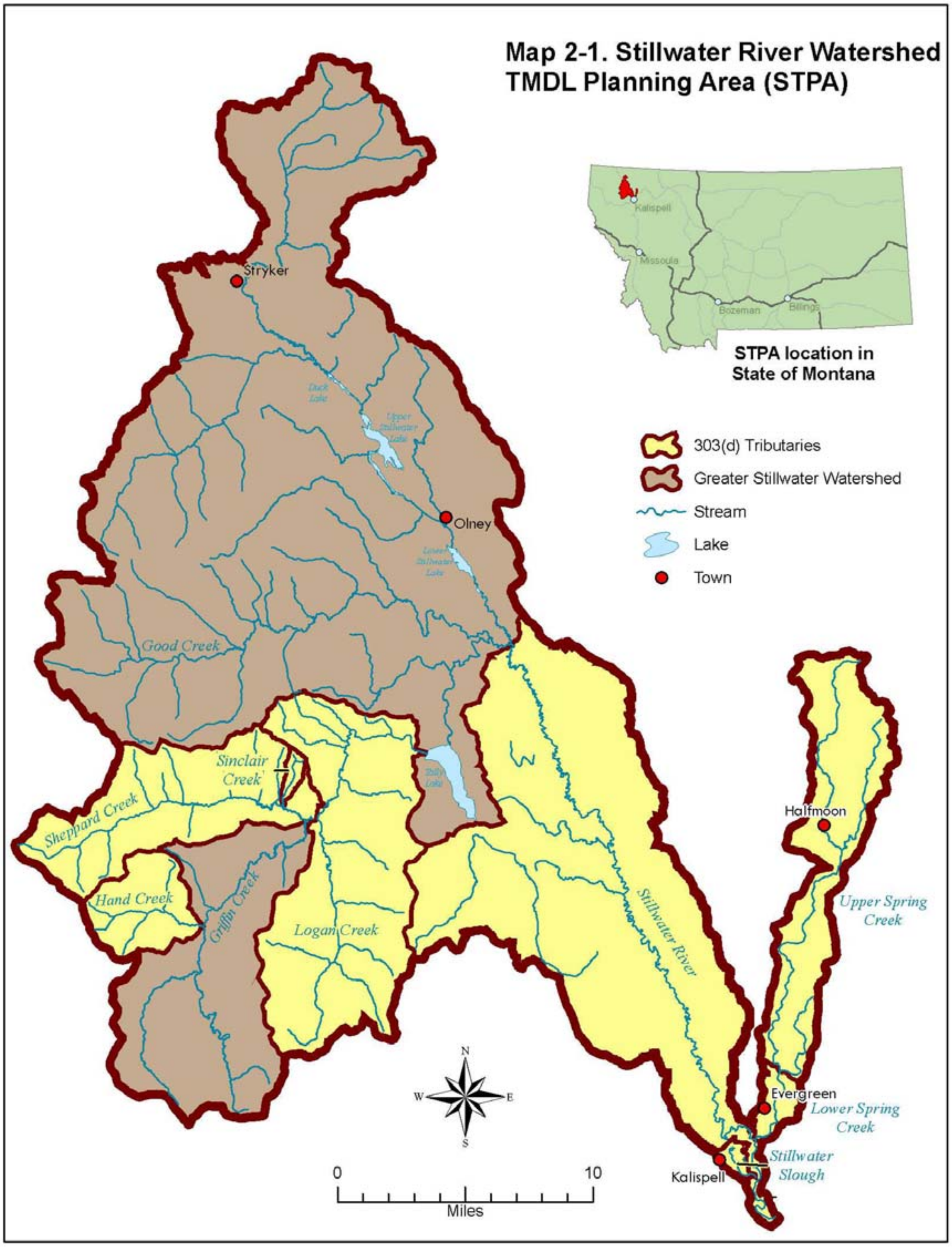
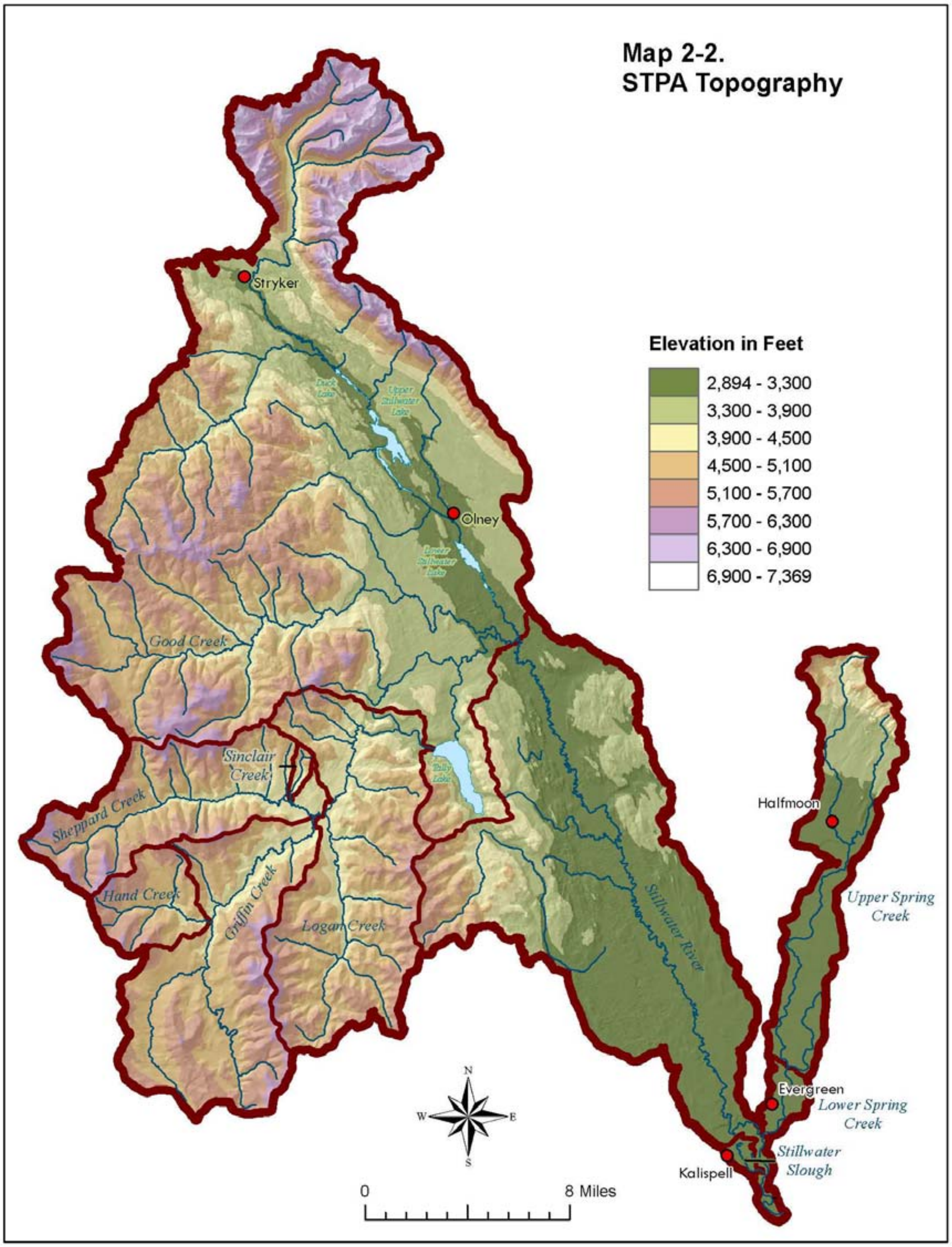
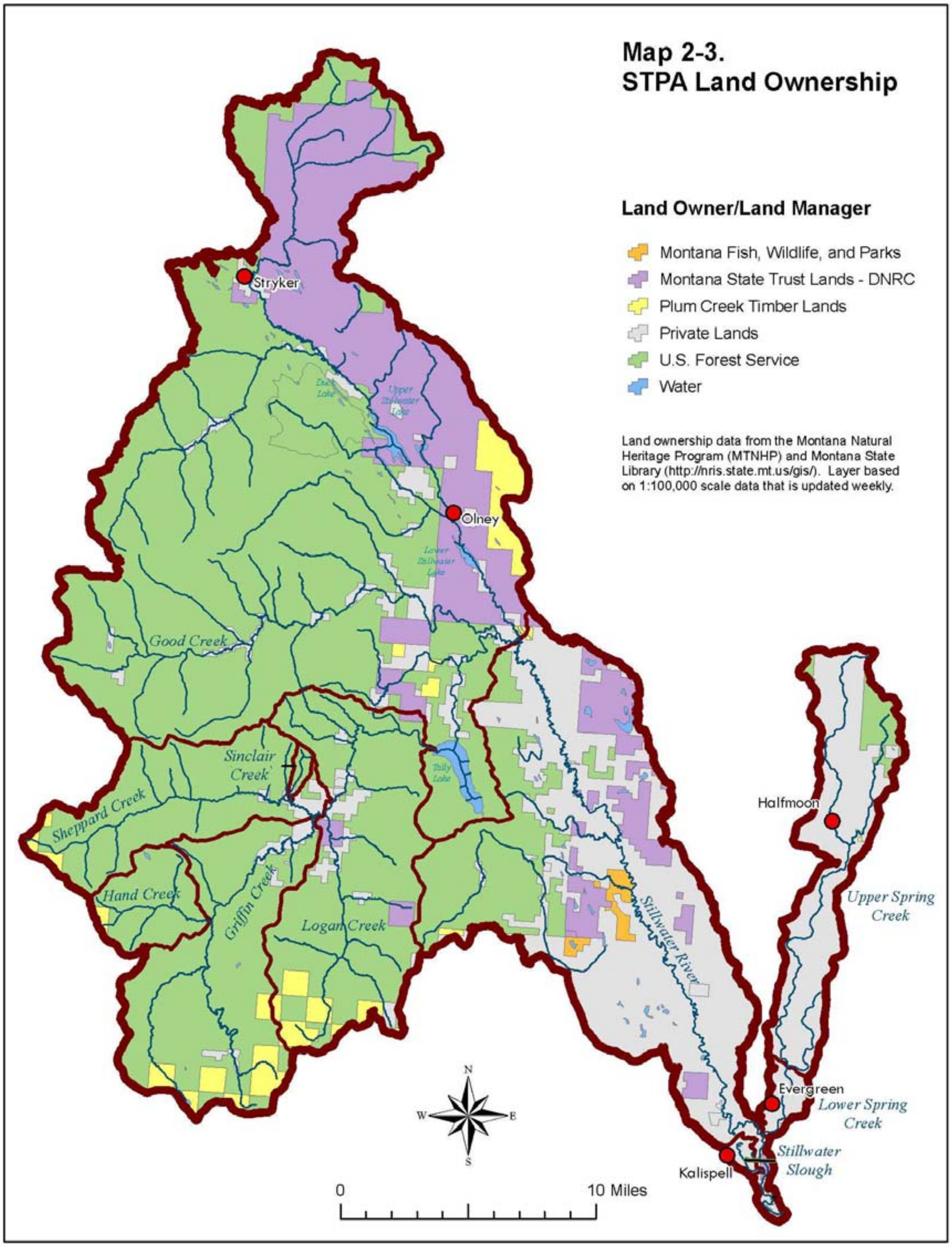
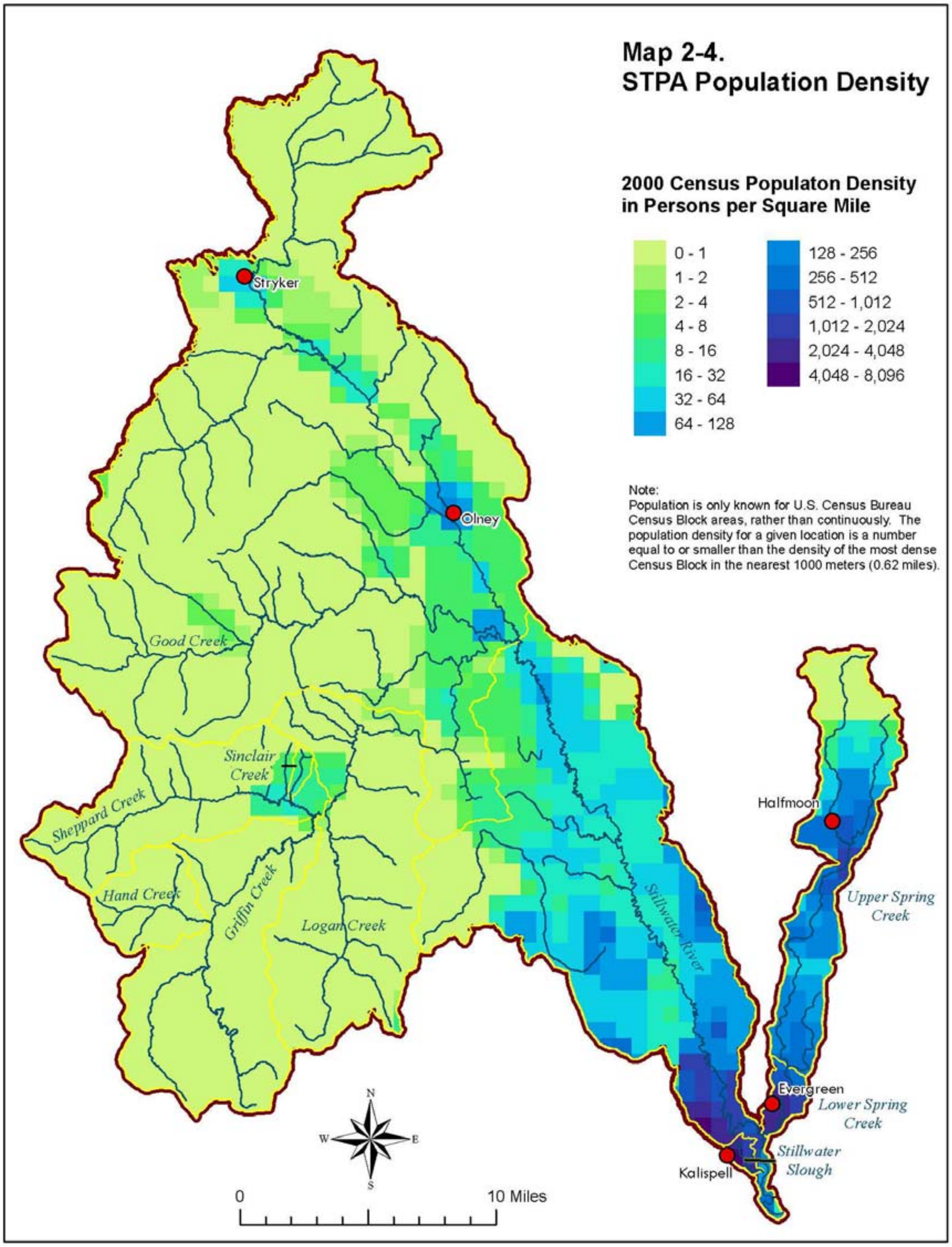
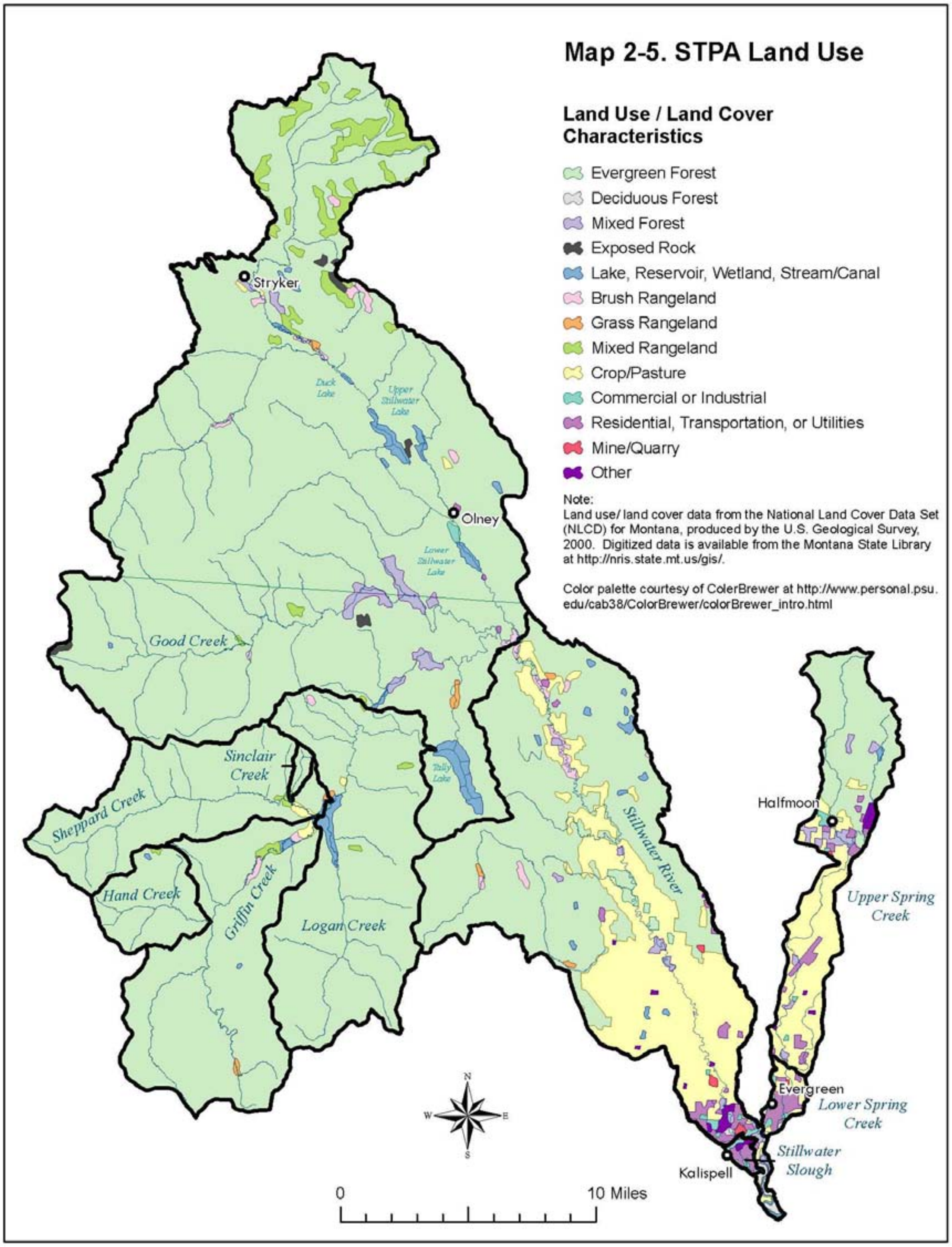
APPENDIX B
GIS MAPS

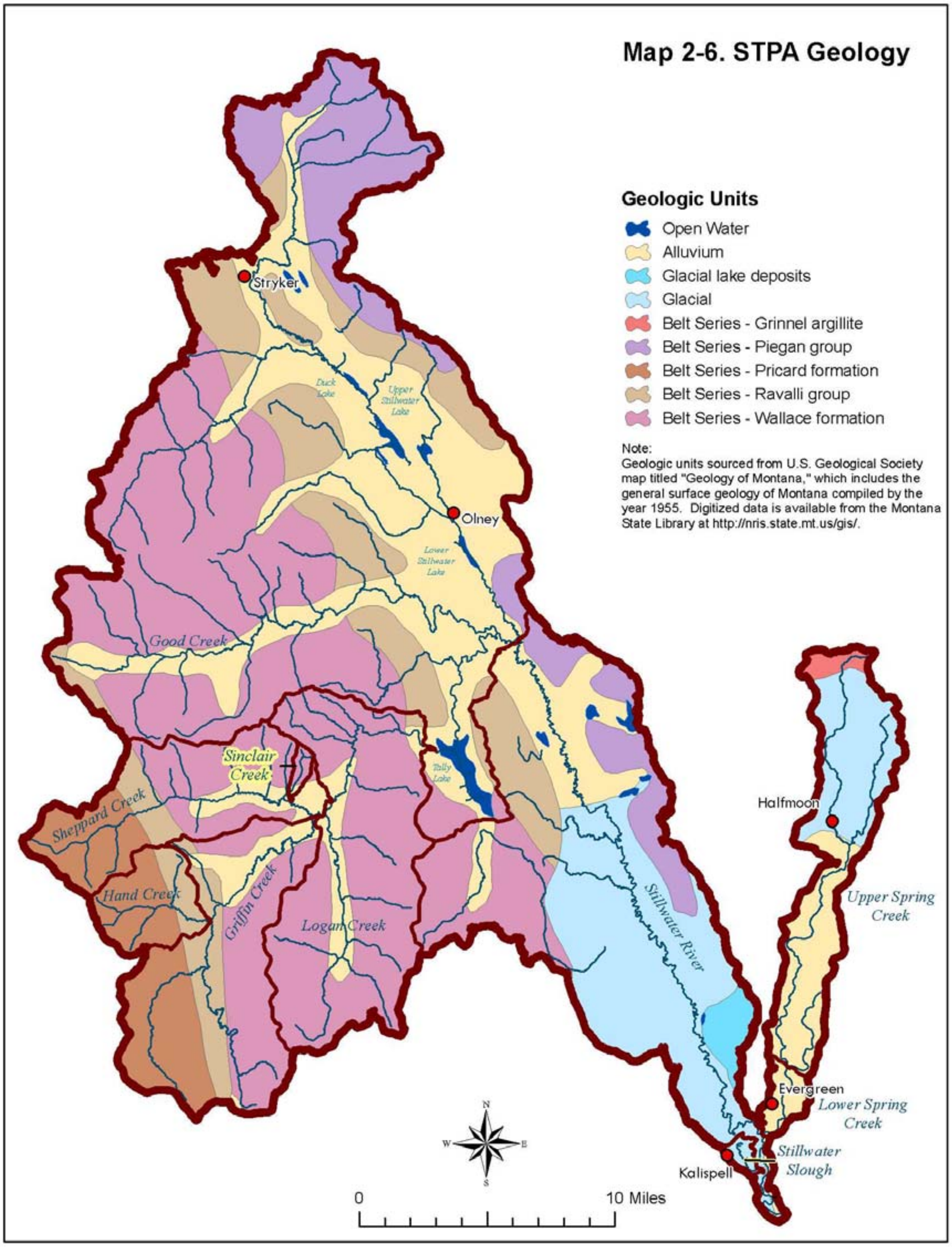

Map 2-1. Stillwater River Watershed
TMDL Planning Area (STPA)
STPA location in
State of Montana
Kalispell
Missoula
Bozeman
Billings
303(d) Tributaries
Greater Stillwater Watershed
Stream
Lake
Town
Stryker
Olney
Good Creek
Sinclair
Creek
Sheppard Creek
Hand Creek
Griffin Creek
Logan Creek
Stillwater River
Halfmoon
Upper Spring
Creek
Evergreen
Lower Spring
Creek
Stillwater
Slough
Kalispell
N
S
E
W
0
10
Miles

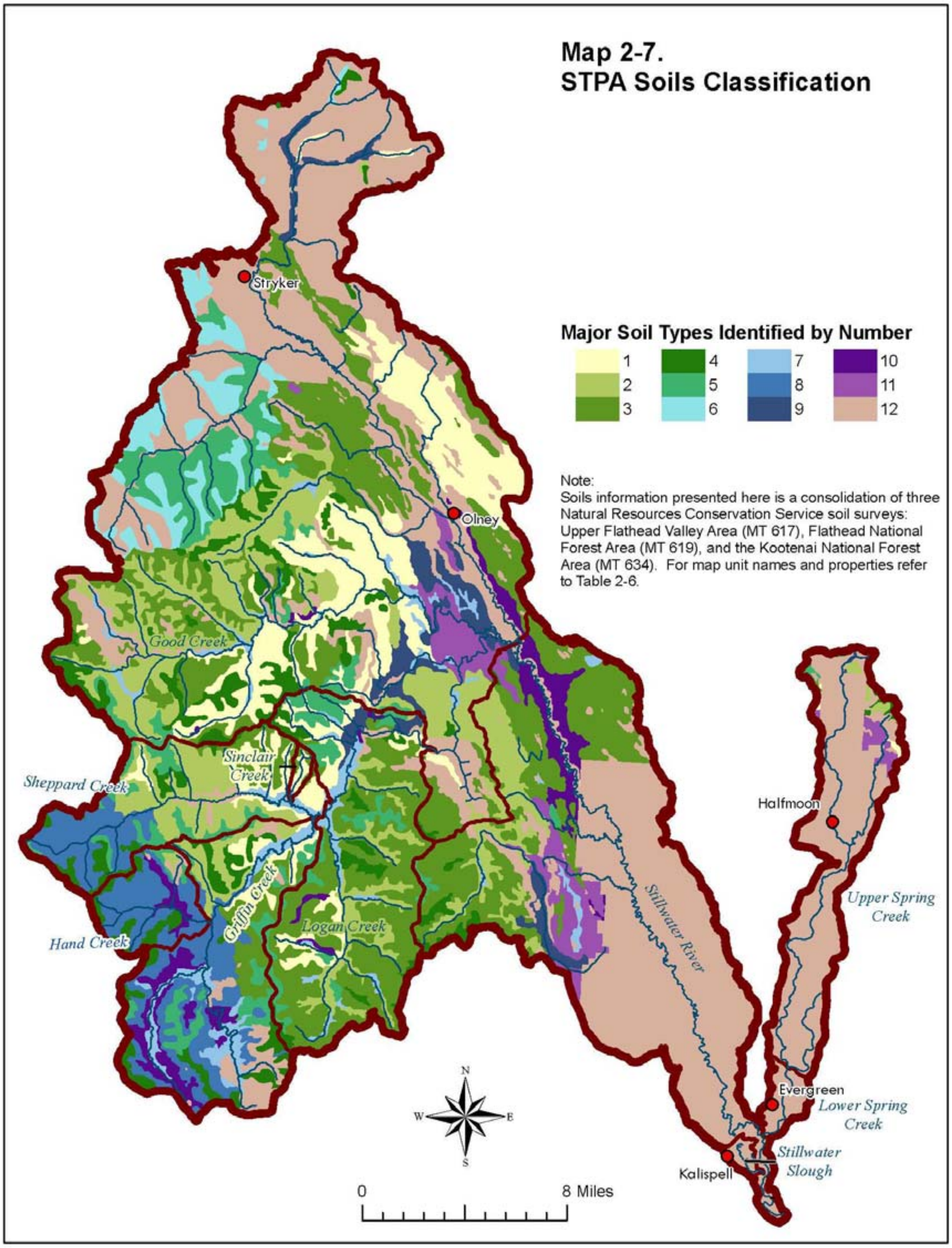

Map 2-2.
STPA Topography
Elevation in Feet
2,894 - 3,300
3,300 - 3,900
3,900 - 4,500
4,500 - 5,100
5,100 - 5,700
5,700 - 6,300
6,300 - 6,900
6,900 - 7,369
Stryker
Olney
Good Creek
Sinclair Creek
Sheppard Creek
Hand Creek
Griffin Creek
Logan Creek
Stillwater River
Halfmoon
Upper Spring Creek
Evergreen
Lower Spring Creek
Stillwater Slough
Kalispell
0
8 Miles

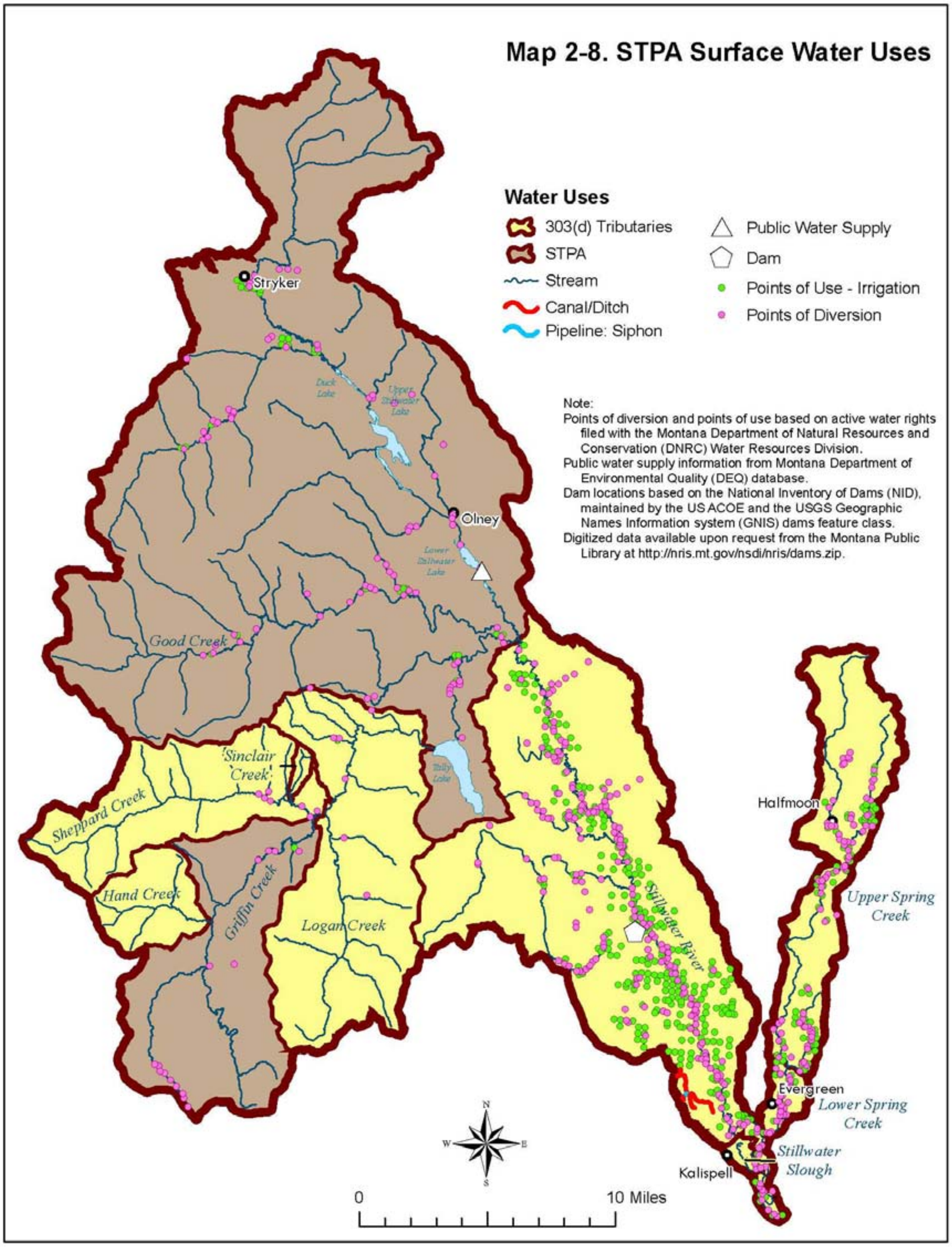

Map 2-3.
STPA Land Ownership
Land Owner/Land Manager
Montana Fish, Wildlife, and Parks
Montana State Trust Lands - DNRC
Plum Creek Timber Lands
Private Lands
U.S. Forest Service
Water
Land ownership data from the Montana Natural Heritage Program (MTNHP) and Montana State Library (http://nris.state.mt.us/gis/). Layer based on 1:100,000 scale data that is updated weekly.
Stryker
Olney
Good Creek
Sinclair Creek
Sheppard Creek
Hand Creek
Griffin Creek
Logan Creek
Stillwater River
Halfmoon
Upper Spring Creek
Evergreen
Lower Spring Creek
Stillwater Slough
Kalispell
0
10 Miles
N
S
E
W

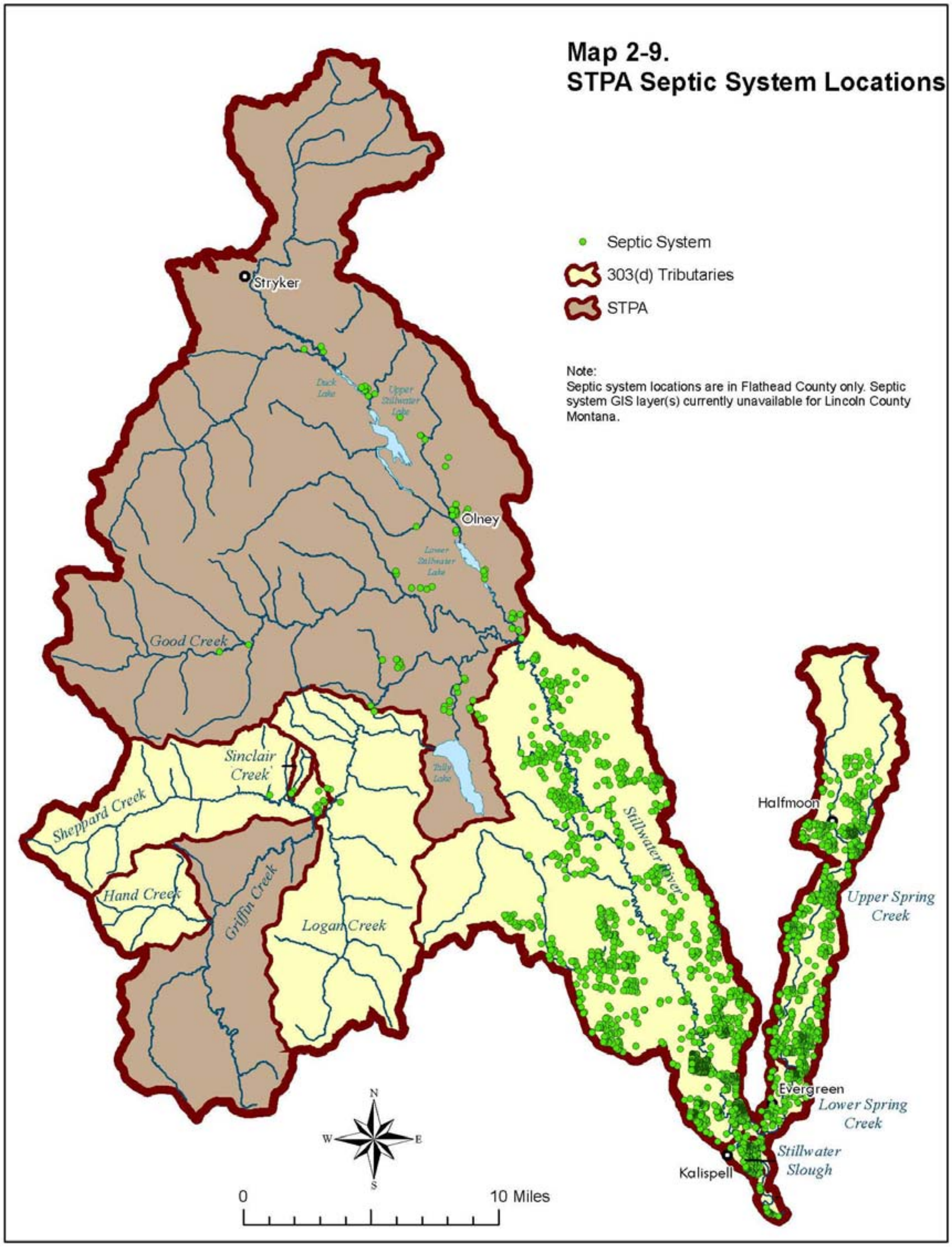

Map 2-4.
STPA Population Density
2000 Census Populaton Density
in Persons per Square Mile
0 - 1
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64 - 128
128 - 256
256 - 512
512 - 1,012
1,012 - 2,024
2,024 - 4,048
4,048 - 8,096
Note:
Population is only known for U.S. Census Bureau Census Block areas, rather than continuously. The population density for a given location is a number equal to or smaller than the density of the most dense Census Block in the nearest 1000 meters (0.62 miles).
Stryker
Olney
Good Creek
Sinclair Creek
Sheppard Creek
Hand Creek
Griffin Creek
Logan Creek
Stillwater River
Halfmoon
Upper Spring Creek
Evergreen
Lower Spring Creek
Stillwater Slough
Kalispell
N
S
E
W
0
10 Miles


Map 2-5. STPA Land Use
Land Use / Land Cover Characteristics
Evergreen Forest
Deciduous Forest
Mixed Forest
Exposed Rock
Lake, Reservoir, Wetland, Stream/Canal
Brush Rangeland
Grass Rangeland
Mixed Rangeland
Crop/Pasture
Commercial or Industrial
Residential, Transportation, or Utilities
Mine/Quarry
Other
Note:
Land use/ land cover data from the National Land Cover Data Set (NLCD) for Montana, produced by the U.S. Geological Survey, 2000. Digitized data is available from the Montana State Library at http://nris.state.mt.us/gis/.
Color palette courtesy of ColerBrewer at http://www.personal.psu.edu/cab38/ColorBrewer/colorBrewer_intro.html
Stryker
Olney
Good Creek
Sinclair Creek
Sheppard Creek
Hand Creek
Griffin Creek
Logan Creek
Stillwater River
Halfmoon
Upper Spring Creek
Evergreen
Lower Spring Creek
Stillwater Slough
Kalispell
0
10 Miles


Map 2-6. STPA Geology
Geologic Units
Open Water
Alluvium
Glacial lake deposits
Glacial
Belt Series - Grinnel argillite
Belt Series - Piegan group
Belt Series - Pricard formation
Belt Series - Ravalli group
Belt Series - Wallace formation
Note:
Geologic units sourced from U.S. Geological Society map titled "Geology of Montana," which includes the general surface geology of Montana compiled by the year 1955. Digitized data is available from the Montana State Library at http://nris.state.mt.us/gis/.
Stryker
Olney
Halfmoon
Evergreen
Kalispell
Good Creek
Sinclair Creek
Sheppard Creek
Hand Creek
Griffin Creek
Logan Creek
Stillwater River
Upper Spring Creek
Lower Spring Creek
Stillwater Slough
0
10 Miles


Map 2-7.
STPA Soils Classification
Major Soil Types Identified by Number
1
2
3
4
5
6
7
8
9
10
11
12
Note:
Soils information presented here is a consolidation of three Natural Resources Conservation Service soil surveys: Upper Flathead Valley Area (MT 617), Flathead National Forest Area (MT 619), and the Kootenai National Forest Area (MT 634). For map unit names and properties refer to Table 2-6.
Stryker
Olney
Good Creek
Sinclair Creek
Sheppard Creek
Griffin Creek
Logan Creek
Hand Creek
Stillwater River
Halfmoon
Upper Spring Creek
Evergreen
Lower Spring Creek
Stillwater Slough
Kalispell
N
S
E
W
0
8 Miles


Map 2-8. STPA Surface Water Uses
Water Uses
303(d) Tributaries
STPA
Stream
Canal/Ditch
Pipeline: Siphon
Public Water Supply
Dam
Points of Use - Irrigation
Points of Diversion
Note:
Points of diversion and points of use based on active water rights filed with the Montana Department of Natural Resources and Conservation (DNRC) Water Resources Division.
Public water supply information from Montana Department of Environmental Quality (DEQ) database.
Dam locations based on the National Inventory of Dams (NID), maintained by the US ACOE and the USGS Geographic Names Information system (GNIS) dams feature class.
Digitized data available upon request from the Montana Public Library at http://nris.mt.gov/nsdi/nris/dams.zip.
Stryker
Olney
Good Creek
Sinclair Creek
Sheppard Creek
Hand Creek
Griffin Creek
Logan Creek
Stillwater River
Halfmoon
Upper Spring Creek
Evergreen
Lower Spring Creek
Stillwater Slough
Kalispell
N
S
E
W
0
10 Miles


Map 2-9.
STPA Septic System Locations
Septic System
303(d) Tributaries
STPA
Note:
Septic system locations are in Flathead County only. Septic system GIS layer(s) currently unavailable for Lincoln County Montana.
Stryker
Olney
Good Creek
Sinclair Creek
Sheppard Creek
Hand Creek
Griffin Creek
Logan Creek
Stillwater River
Halfmoon
Upper Spring Creek
Evergreen
Lower Spring Creek
Stillwater Slough
Kalispell
0
10 Miles
N
S
E
W

Map 2-10.
STPA U.S. Army Corps of Engineers Sec. 404 Permits

● ACOE 404 Permits

■ Waste Water Permit

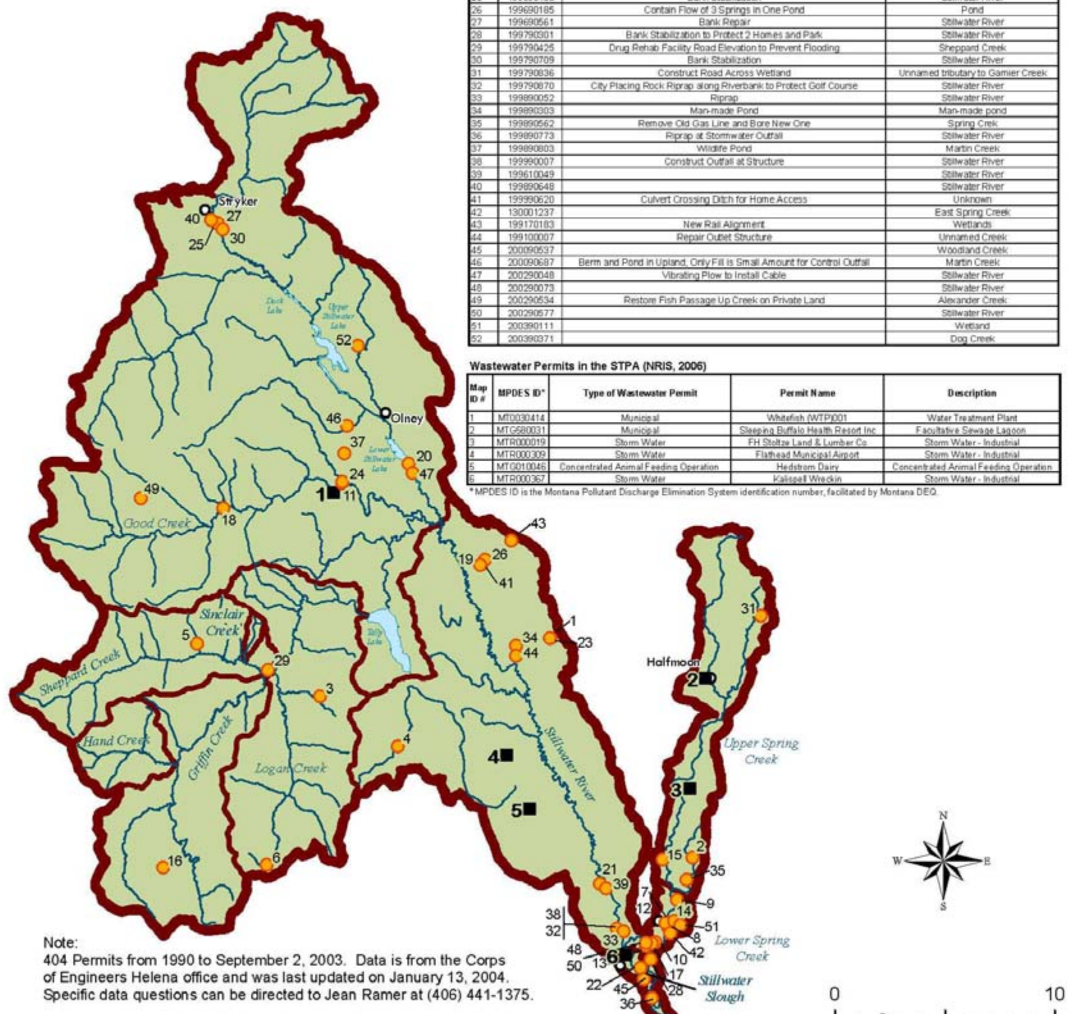
U.S. Army Corps of Engineers 404 Permits in the STPA (NRIS, 2005)

Map ID #	Permit Action ID	Remark	Action Location
1	130001144		Skyles Lake
2	130001237		East Spring Creek
3	199016176	Habitat Improvement	Oettiker Creek
4	199016177	Habitat Structures	Lost Creek
5	199016181	Habitat Improvement	Swaney Creek
6	199016182	Habitat Structures	Logan Creek
7	199016464	Residential Development	Wetlands
8	199016514	Bank Stabilization	East Spring Creek
9	199170420		East Spring Creek
10	199290405	Parking Lot	Wetlands
11	199290423	Pipe Across Creek	Good Creek
12	199290443	Fill Low Areas	Wetlands
13	199290566		Stillwater River Wetlands
14	199390150	Fill Depression on Residential Lot	Unnamed Depression
15	199390520	Widen US Highway 2	Unnamed Wetlands
16	199390590	8" Water Line Crossing	East Spring Creek
17	199390625	Bridge Repair	Stillwater River
18	199490028	Bridge and Bank Stabilization	Good Creek
19	199490488	Trout Pond	Unnamed Wetlands
20	199490610	Dam Repair	Lower Stillwater Lake
21	199590125	Pond Construction	Pond of the Stillwater River
22	199590141	Water Main Installation	Unnamed
23	199590161		Skyles Lake
24	199590301	Road and Culvert Crossing	Potter Creek
25	199590458	Bank Stabilization	Stillwater River
26	199690185	Contain Flow of 3 Springs in One Pond	Pond
27	199690561	Bank Repair	Stillwater River
28	199790301	Bank Stabilization to Protect 2 Homes and Park	Stillwater River
29	199790425	Drug Rehab Facility Road Elevation to Prevent Flooding	Sheppard Creek
30	199790709	Bank Stabilization	Stillwater River
31	199790836	Construct Road Across Wetland	Unnamed tributary to Garnier Creek
32	199790870	City Placing Rock Riprap along Riverbank to Protect Golf Course	Stillwater River
33	199890052	Riprap	Stillwater River
34	199890303	Man-made Pond	Man-made pond
35	199890562	Remove Old Gas Line and Bore New One	Spring Crek
36	199890773	Riprap at Stormwater Outfall	Stillwater River
37	199890803	Wildlife Pond	Martin Creek
38	199990007	Construct Outfall at Structure	Stillwater River
39	199610049		Stillwater River
40	199890648		Stillwater River
41	199990620	Culvert Crossing Ditch for Home Access	Unknown
42	130001237		East Spring Creek
43	199170183	New Rail Alignment	Wetlands
44	199100007	Repair Outlet Structure	Unnamed Creek
45	200090537		Woodland Creek
46	200090687	Berm and Pond in Upland, Only Fill is Small Amount for Control Outfall	Martin Creek
47	200290048	Vibrating Plow to Install Cable	Stillwater River
48	200290073		Stillwater River
49	200290534	Restore Fish Passage Up Creek on Private Land	Alexander Creek
50	200290577		Stillwater River
51	200390111		Wetland
52	200390371		Dog Creek

Wastewater Permits in the STPA (NRIS, 2006)

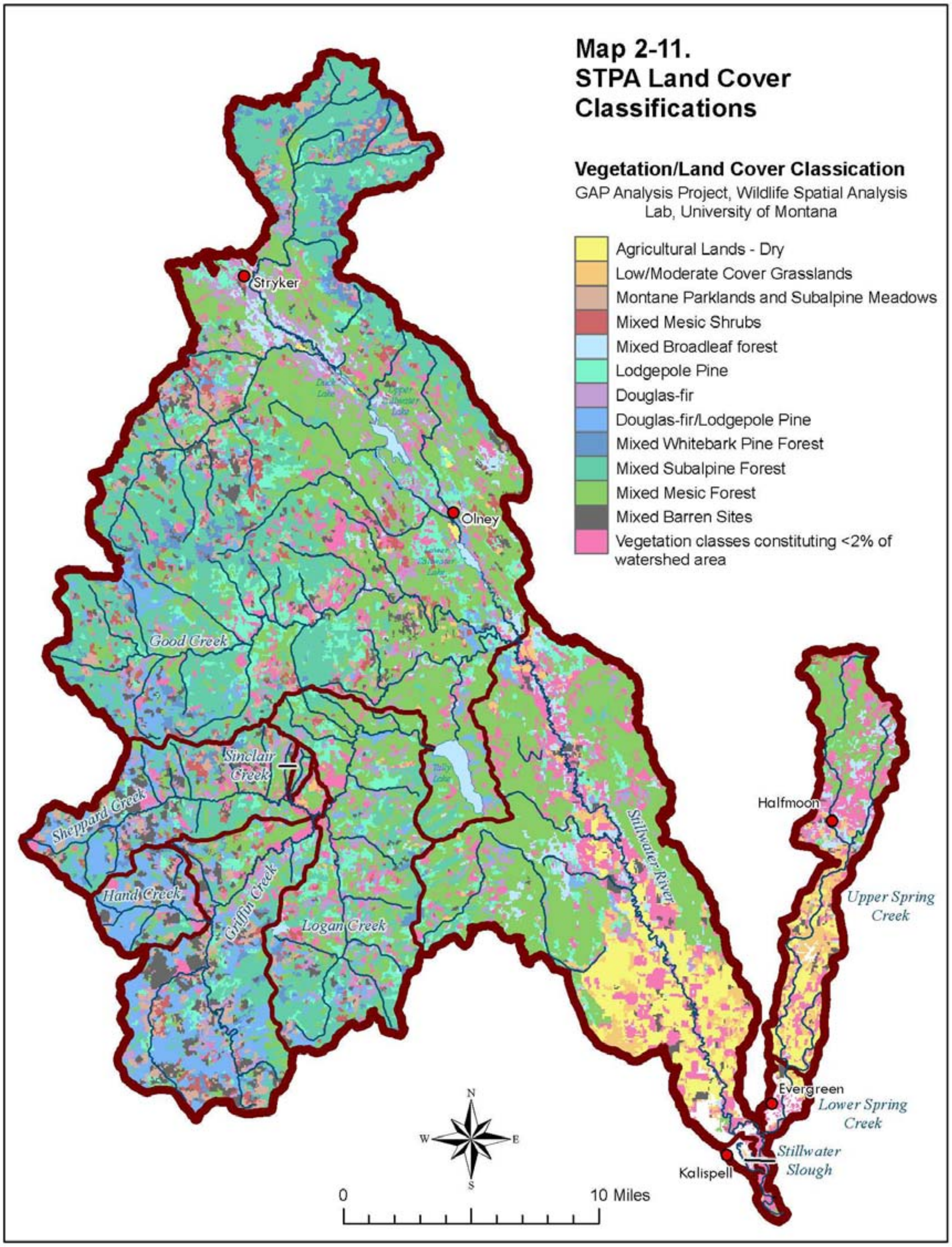
Map ID #	MPDES ID*	Type of Wastewater Permit	Permit Name	Description
1	MT0030414	Municipal	Whitefish (WTP)001	Water Treatment Plant
2	MTG580031	Municipal	Sleeping Buffalo Health Resort Inc	Facultative Sewage Lagoon
3	MTR000019	Storm Water	FH Stoltze Land & Lumber Co	Storm Water - Industrial
4	MTR000309	Storm Water	Flathead Municipal Airport	Storm Water - Industrial
5	MTG010046	Concentrated Animal Feeding Operation	Hedstrom Dairy	Concentrated Animal Feeding Operation
6	MTR000367	Storm Water	Kalispell Wreckin	Storm Water - Industrial

*MPDES ID is the Montana Pollutant Discharge Elimination System identification number, facilitated by Montana DEQ.



Note:
404 Permits from 1990 to September 2, 2003. Data is from the Corps of Engineers Helena office and was last updated on January 13, 2004. Specific data questions can be directed to Jean Ramer at (406) 441-1375.

Wastewater Permits from Montana Department of Environmental Quality. Digitized data is available from Montana State Library at http://www.nris.state.mt.gov/gis/.



Map 2-11.
STPA Land Cover Classifications
Vegetation/Land Cover Classication
GAP Analysis Project, Wildlife Spatial Analysis Lab, University of Montana
Agricultural Lands - Dry
Low/Moderate Cover Grasslands
Montane Parklands and Subalpine Meadows
Mixed Mesic Shrubs
Mixed Broadleaf forest
Lodgepole Pine
Douglas-fir
Douglas-fir/Lodgepole Pine
Mixed Whitebark Pine Forest
Mixed Subalpine Forest
Mixed Mesic Forest
Mixed Barren Sites
Vegetation classes constituting <2% of watershed area
Stryker
Olney
Good Creek
Sinclair Creek
Sheppard Creek
Hand Creek
Griffin Creek
Logan Creek
Stillwater River
Halfmoon
Upper Spring Creek
Evergreen
Lower Spring Creek
Stillwater Slough
Kalispell
N
W
E
S
0
10 Miles