# Ashley Creek Watershed Characterization

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# Acronym List

| | |
|---|---|
| HRA | Hazard Reduction Agreement |
| TMDL | total maximum daily load |
| TRS | township, range, section |
| USGS | U.S. Geological Survey (U.S. Department of the Interior) |
| WWTP | wastewater treatment plant |

# Units of Measure

| | |
|---|---|
| cfs | cubic feet per second |
| ° F | degrees Fahrenehit |
| feet AMSL | feet above mean sea level |
| mg/L | milligram per liter |

# 1.0 INTRODUCTION

This document provides a general overview of the physical and social characteristics of the Ashley Creek watershed. Watershed characterization maps are presented in **Appendix A**.

# 2.0 PHYSICAL CHARACTERISTICS

The following information describes the physical characteristics of the Ashley Creek watershed.

## 2.1 LOCATION

The Ashley Creek watershed encompasses an area of 324 square miles immediately west of the city of Kalispell. The stream network has a total length of 177 miles and is dominated by four streams: Ashley, Mount, Truman and Bales, and four lakes: Ashley, Lone, Monroe and Smith. Ashley Creek becomes a fourth order stream below the confluence with Mount Creek. Ashley Creek flows from the Smith Valley into the greater Flathead Valley. It flows into the city of Kalispell and discharges to the mainstem of the Flathead River about 15 miles upstream from Flathead Lake. A location map is provided in **Map A-1** in **Appendix A**.

## 2.2 TOPOGRAPHY

Elevations in the Ashley Creek watershed range from 6,760 feet above mean sea level (AMSL) along the southern watershed divide down to 2,890 feet AMSL where Ashley Creek discharges into the Flathead River near Kalispell. The outlet of Ashley Lake forms Ashley Creek, the elevation at which is 3,950 feet AMSL. Elevation is mapped in **Map A-2** in **Appendix A**.

## 2.3 GEOLOGY

The geology of the Ashley Creek watershed consists mostly of Belt Series rocks, which comprises approximately 74 percent of the watershed. Alluvium and glacial formations cover the bulk of the remaining area, with a localized area of glacial lake deposits surrounding Ashley Lake (**Table 2-1**). Geologic unit rock types are shown in **Map A-3** in **Appendix A** based on a 1:500,000 scale geologic map of the state digitized by Raines and Johnson (1996).

**Table 2-1. Geology of the Ashley Creek Watershed**

| Generalized Rock Type | Percentage of Watershed |
|---|---|
| Belt Series – Walace formation | 43% |
| Belt Series – Ravalli group | 18% |
| Belt Series – Piegan group | 13% |
| Alluvium | 12% |
| Glacial | 10% |
| Glacial lake deposits | 3% |

## 2.4 SOILS

The Soil Survey Geographic (SSURGO) database, developed by the Natural Resource Conservation Service (NRCS 2013), was used to evaluate soil properties in the Ashley Creek watershed. **Map A-4** in **Appendix A** depicts coverage of the seven soil orders within the watershed. Soil orders, the broadest level of soil taxonomy, combine soils into units with similar attributes. Soils of the same order typically share properties because they were formed under similar scenarios. Investigating the distribution of soil orders in the project area can help explain soil behavior and potential effects to water quality.

Alfisols cover about half of the Ashley Creek watershed (**Table 2-2**) and are moderately leached, yet productive soils that can be susceptible to erosion if their surface litter is removed (Brady and Weil, 2002). Inceptisols cover about a third of the watershed and are known for having only a slight degree of weathering and soil development. This is because they are considered geologically young, having only been exposed after the most recent glaciation. Mollisols are considered agriculturally productive soils and typically form under grasslands with humus-rich surface horizons; mollisol coverage closely follows the cultivated crops and pasture land uses shown on **Maps A-17** and **A-19** in **Appendix A**.

**Table 2-2. Soil Orders in the Ashley Creek Watershed**

| Order | Area (Acres) | Relative Area (Percent) |
|---|---|---|
| Alfisols | 103,334 | 49.8% |
| Inceptisols | 68,261 | 32.9% |
| Mollisols | 24,243 | 11.7% |
| *Null* | 5,266 | 2.5% |
| Histosols | 2,824 | 1.4% |
| Andisols | 1,672 | 0.8% |
| Entisols | 1,373 | 0.7% |
| Aridisols | 582 | 0.3% |

A soil's susceptibility to erosion is a property especially relevant to total maximum daily load (TMDL) projects when reviewing upland loading sources. Erodibility is mapped in **Map A-5** in **Appendix A** using the K-factor from the Universal Soil Loss Equation (Wischmeier and Smith, 1978). The K-factor is an inherent property of the soil that is independent of rainfall, slope, vegetation cover, and management differences. Values range from 0 to 1, with a greater value corresponding to a greater potential for erosion. Soil erodibility is assigned to the following ranges: low (0.0-0.2), moderate-low (0.21-0.30) and moderate-high (0.31-0.40). Values of > 0.4 are considered highly susceptible to erosion. The majority of the project area has highly susceptibility soils (66%; **Table 2-3**). The next two ratings, moderate-low susceptibility (16%) and moderate-high susceptibility (11%), cover most of the remaining area. Only 5% of the classified area is considered low-susceptibility.

**Table 2-3. Erodibility of Soils in the Ashley Creek Watershed**

| K-factor | Area (Acres) | Relative Area (Percent) |
|---|---|---|
| Null | 5,316 | 3% |
| Low | 10,572 | 5% |
| Moderate-low | 32,833 | 16% |
| Moderate-high | 22,750 | 11% |
| High | 136,084 | 66% |

Slope is another factor that affects erosion and thus warrants consideration during the TMDL process. **Map A-6** in **Appendix A** shows slopes calculated from the 30-meter National Elevation Dataset. Slopes in the planning area vary from 0 – 10% in the flat valley bottoms to over 40% in the steepest mountains and ravines.

Hydrologic Soil Group also affects erosion, as it relates to the drainage properties of the soil. Group A soils, which only constitute 3% of the area (**Table 2-4** below and **Map A-7** in **Appendix A**), have low runoff potential and high infiltration rates. Group B and C soils, which have moderate and low infiltration rates, respectively, combine to make up 87% of the soils in the watershed. The remaining unclassified soils belong in Group D, which exhibit the highest potential for runoff.

**Table 2-4. Hydrologic Soil Groups in the Ashley Creek Watershed**

| Hydrologic Soil Group | Area (Acres) | Relative Area (Percent) |
|---|---|---|
| A | 6,063 | 3% |
| B | 98,881 | 48% |
| C | 81,196 | 39% |
| D | 15,320 | 7% |
| Not reported/available | 6,095 | 3% |

## 2.5 Surface Water

As described in Section 2.1, the Ashley Creek watershed is composed of four principal streams and four principal lakes. Ashley Creek, the largest stream in the watershed, flows from Ashley Lake, the largest lake in the watershed, south through Lone Lake and then Lake Monroe. Ashley Creek then flows northeast through Smith Lake, which has a large wetland complex, toward Kalispell. After Spring Creek joins Ashley Creek in Kalispell, Ashley Creek flows south and southeast before flowing due east at its confluence with the Flathead River. Foy Lake, Middle Foy Lake, and Lower Foy Lake are in the lower Ashley Creek subwatershed but are off-channel lakes.

Ashley Lake is the largest lake and the only regulated lake in the Ashley Creek watershed. It is fed by a number of small tributaries, including Fish Creek. According to the National Hydrography Dataset, the surface area of Ashley Lake is 2,812 acres with a perimeter of 16.0 miles, which is significantly larger than Smith Lake (442 acres, 6.2 mile perimeter), which is the second largest lake in the watershed. Approximately 21,388 acres drain to Ashley Lake, and its maximum depth is 225 feet (Ellis and Craft 2008).

Ashley Lake discharges to Ashley Creek at a slide gate dam (MT01163) that was constructed in 1928 to provide irrigation storage for downstream users.The dam is constructed of earth fill and is 10 feet high, 20 feet wide, and the outlet works for the dam consists of three 4.5 foot wide slide gates in concrete bays (**Figure 2-1**). The lake and dam are managed by Montana Department of Fish, Wildlife and Parks. Normal pool storage is 17,522 acre-feet and maximum storage is 25,476 acre-feet. The average outflow is 13.8 cubic feet per second (cfs) and peak flows occur during the spring and early summer (**Figure 2-2**).

**Figure 2-1. Ashley Lake Dam Outlet Structure**

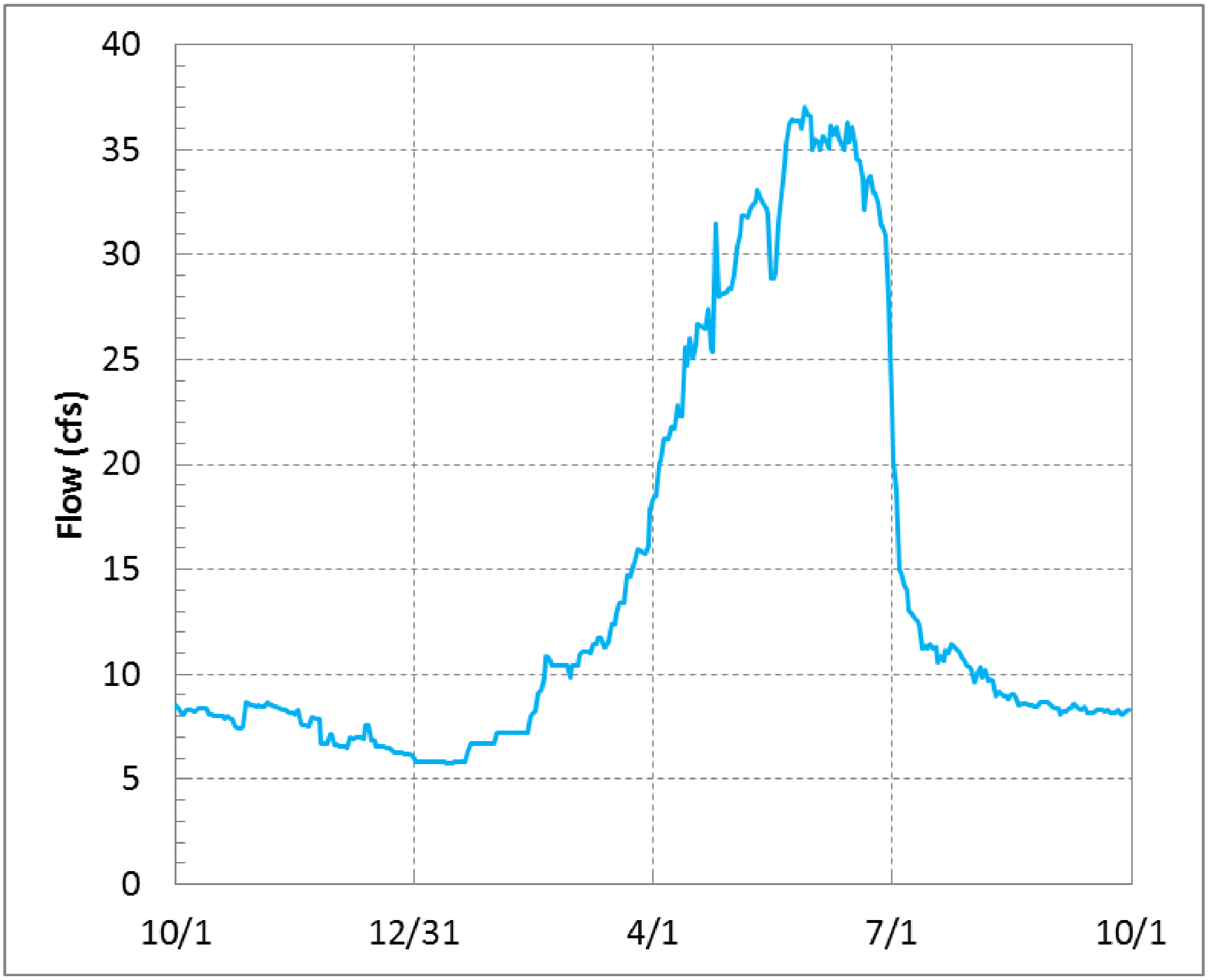


**Figure 2-2. Average Daily Discharge at the Outlet of Ashley Lake**

The U.S. Geological Survey (USGS) has established three gaging stations and water quality sites in the Ashley Creek watershed. Information on all stations is listed in **Table 2-5**. No active, continuously recording gages are in the watershed.

**Table 2-5. USGS Stations in the Ashley Creek Watershed**

| Site Name | USGS Gage Number | Period of Record |
|---|---|---|
| Ashley Creek near Kila, MT | 12367000 | 1916 |
| Ashley Creek near Kalispell, MT | 12367500 | 1931-1974 |
| Ashley Creek at Kalispell, MT | 12367800 | 2007-2008 (instantaneous) |

Data from Ashley Creek near Kalispell indicate flows most often peak during May, when flows are consistently greater than 100 cfs. From September through February, flows were typically less than 10 cfs. This peak high flow pattern is typical of snowmelt dominated systems in Montana. The low flows are affected by the continuously discharging Kalispell WWTP. The average daily discharge for this site is displayed in **Figure 2-3**.

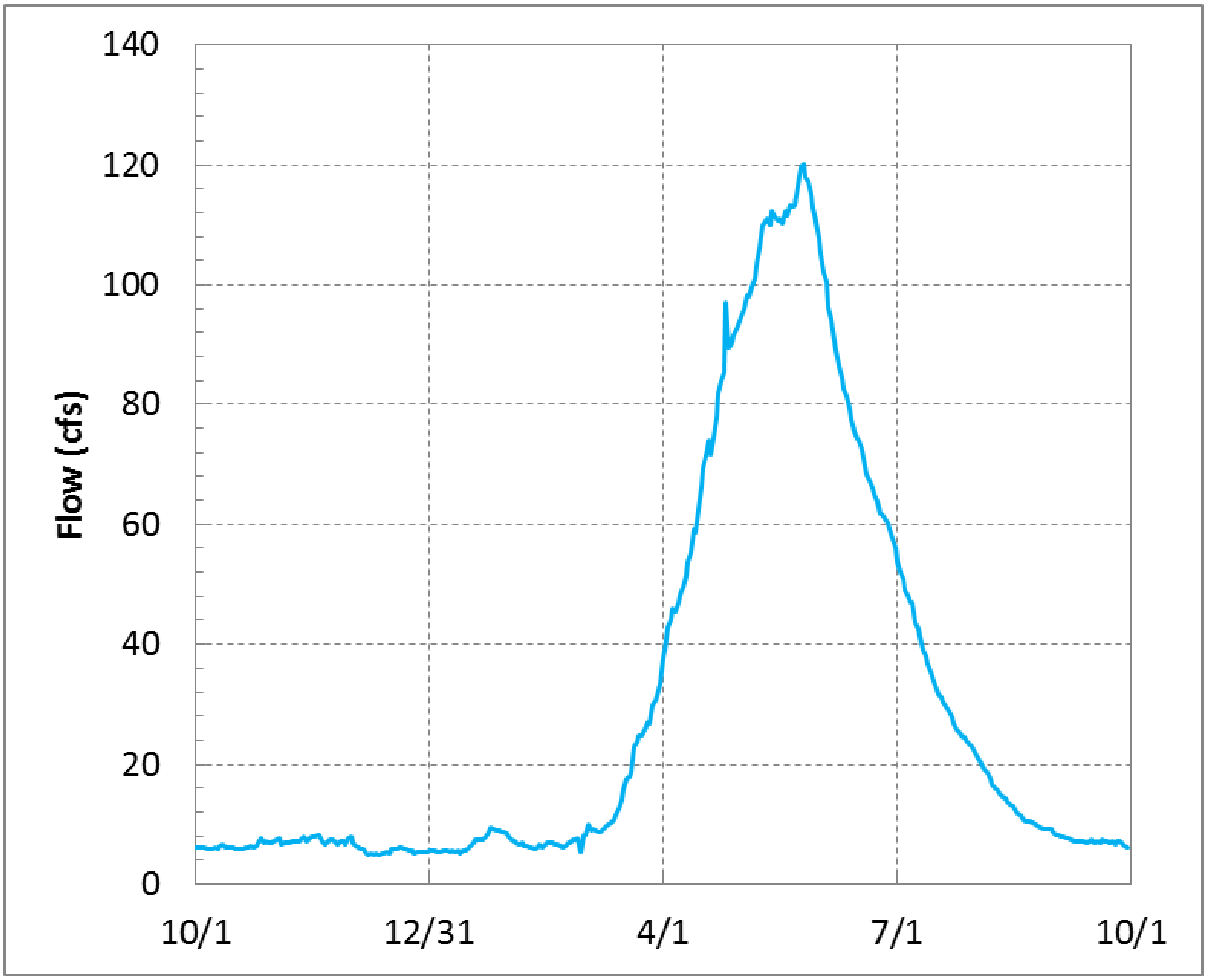


**Figure 2-3. Average Daily Discharge USGS Gage 12367500 (1931-1974)**

## 2.6 GROUNDWATER

LaFave et al. (2004) divided the Flathead Basin into 11 subareas as shown in **Map A-8** in **Appendix A**. The Smith Subarea, extending from Ashley Lake and covering much of the valley portion of the watershed, is drained by Ashley Creek which flows east towards Kalispell. Shallow aquifers in the subarea are located near Smith Lake, Ashley Lake, and Marion.

There were 680 wells in the Smith subarea in 2004, sixty percent of which were installed after 1990. Most of the wells are in bedrock and shallow alluvium and are sensitive to surface contamination because water moves quickly through the bedrock cracks and fractures and the shallow aquifers are unconfined. Nitrate concentrations from five samples in the Smith subarea were low, with a maximum recorded sample at 0.35 mg/L (LaFave et al., 2004).

The Kalispell subarea is located in the lower portion of the watershed, roughly bounded on the west by Highway 93. The Lake Delta aquifer is located within the portion of the Kalispell subarea that lies within the Ashley Creek watershed. The delta aquifer consists of fine- to medium-grained sand, and is bordered by the Flathead River and Flathead Lake. Groundwater flow direction is controlled by seasonal stages in the Flathead River and Flathead Lake and generally will be from the aquifer to the river and lake when lake and river levels are low, and from the lake and river into the aquifer when lake and river levels are high (LaFave et al., 2004). Nitrate concentrations in groundwater of the Kalispell subarea are generally low.

## 2.7 CLIMATE

There are three weather stations near the Ashley Creek watershed with sufficient periods of record to develop an analysis of climate (National Climactic Data Center stations 248902, 242104, and 240775, as shown in **Map A-9** in **Appendix A)**. Station 242104, in Creston, Montana, is the nearest and is discussed here.

Station 242104 is at an elevation of 2,940 feet AMSL), compared to the Ashley Creek watershed, which ranges in elevation from approximately 2,900 to 6,770 feet AMSL. Average annual precipitation is 19.8 inches with the greatest amounts falling in May and June (**Figure 2-4**). Average maximum temperatures occur in July and August and are 79.8° Fahrenheit (°F) and 79.6° F, respectively.

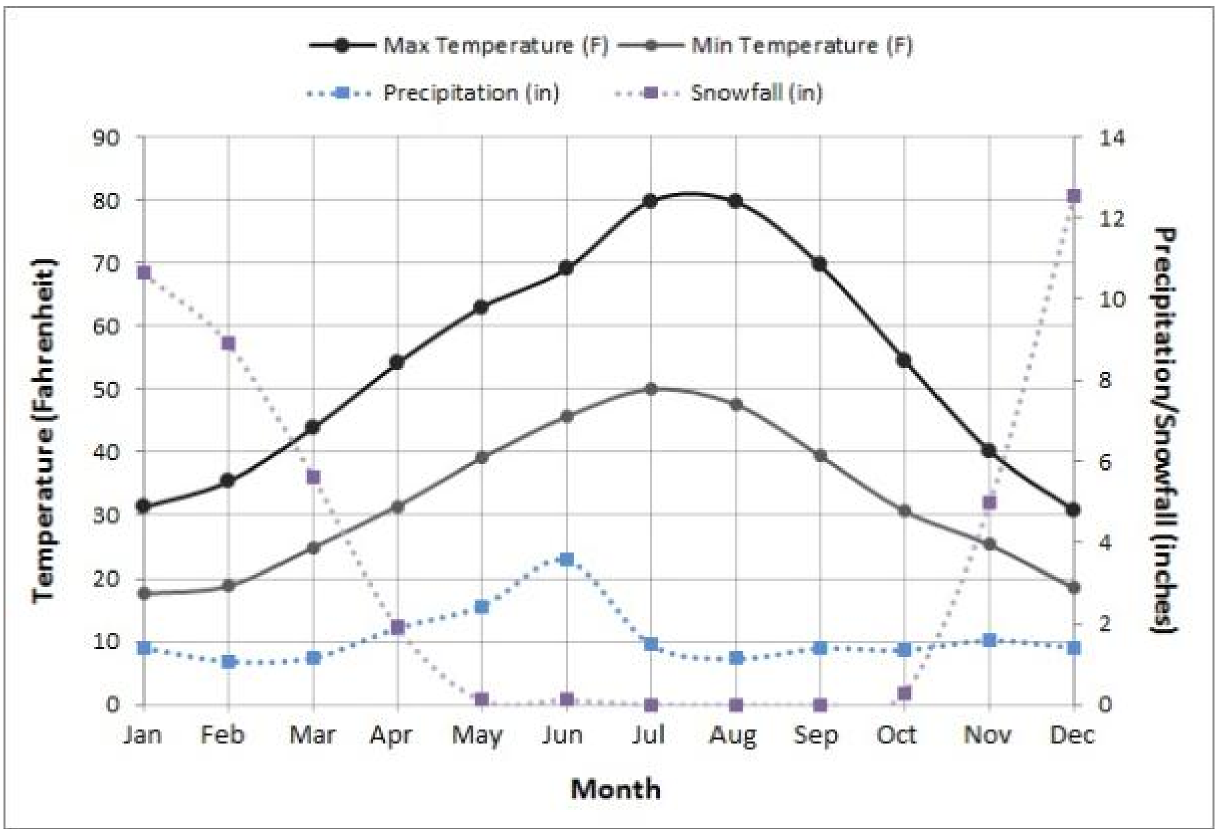


**Figure 2-4. Monthly Average Temperatures and Precipitation at Creston, MT (242104)**

Average annual precipitation for the time period 1981-2010 is mapped on **Map A-10** in **Appendix A**; isolines are included on **Map A-11** using data provided by Oregon State University's Parameter-Elevation Regressions on Independent Slopes Model (PRISM). This model uses point measurements of climate data and a digital elevation model to extrapolate climatic conditions across the landscape. Precipitation in the Ashley Creek watershed varies from 15 inches a year in the valley up to 28 inches in the headwaters regions. Precipitation trends follow elevation with most moisture falling in the mountains and the quantity gradually decreasing downhill. The mean annual precipitation over the whole watershed is 20 inches.

# 3.0 ECOLOGICAL CHARACTERISTICS

The following information describes the ecological characteristics of the Ashley Creek watershed.

## 3.1 ECOREGION

Ecoregions denote areas where the type, quality, and quantity of environmental resources are similar. The classification incorporates a wide array of disciplines including geology, physiography, vegetation, climate, soils, land use, wildlife and hydrology. Ecoregions are organized into four hierarchical levels. Level I is the coarsest, dividing North American into 15 regions; level IV is the most refined, dividing Montana into 76 regions. **Table 2-7** contains information on the distribution of level III and IV ecoregions in the Ashley Creek watershed. **Map A-14** in **Appendix A** displays the spatial extent of level IV ecoregions. The entire watershed falls within the Northern Rockies level III ecoregion and over 82% is classified as the Salish Mountains level IV ecoregion. The Salish Mountains ecoregion is forested and underlain by Precambrian Belt rocks. Average precipitation is about 20 to 50 inches per year. The broad, intermontane Flathead Valley and Stillwater-Swan Wooded Valley ecoregions occupy the lower valley portion of the watershed, are underlain by glacial deposits, lake sediments, and alluvium and receive less precipitation.

**Table 3-1. Level IV Ecoregions in the Ashley Creek Watershed**

| Level III Ecoregion | Level IV Ecoregion | Area (Acres) | Area (Square Miles) | Relative Area (Percent) |
|---|---|---|---|---|
| Northern Rockies | Salish Mountains | 170,727 | 267 | 82% |
| | Stillwater Swan Wooded Valley | 10,480 | 16 | 5% |
| | Flathead Valley | 26,374 | 41 | 13% |

## 3.2 AQUATIC LIFE

According to the Montana Fisheries Information System (M-FISH) (2014), native fish species present in Ashley Creek include largescale sucker, mountain whitefish, northern pike minnow, peamouth, redside shiner, sculpin, and slimy sculpin. Introduced species include brook trout, northern pike, rainbow trout, westslope-rainbow hydrids, and yellow perch. Ashley Lake also contains non-native Kokanee salmon.

The current distribution of fish populations is very different than historic times (U.S. Forest Service, 2012). Non-native species currently dominate the ecosystem. Brook trout are widespread and common throughout the watershed and have basically filled the niche previously occupied by cutthroat trout. Rainbow trout are present in low numbers in Ashley Creek and spawn in upper Ashley Creek near a waterfall, which provides a natural barrier to upstream fish movement just below Monroe Lake. Northern pike and yellow perch dominate Smith Lake, but native peamouth, pikeminnow, and Longnose suckers still exist.

Cutthroat trout have greatly declined. The migratory life form is extirpated and only two isolated resident populations remain. One population is in Upper Truman Creek in the headwaters of Mount Creek, upstream of a diversion dam (U.S. Forest Service, 2012). Historically, bull trout were never present in the analysis area and Ashley Creek is not within a designated core bull trout area (Montana Fisheries Information System, 2014).

## 3.3 FIRES

Fire is a natural part of the ecosystem in the Ashley Creek watershed and many species have evolved to exist with the disturbance. Fire perimeters in the watershed from 1919-2008 were obtained from the U.S. Forest Service (Flathead National Forest) and the Montana Department of Natural Resources. Only one fire occurred during the period of record. The burn occurred in the Truman Creek subwatershed in 1990 and covered 160.7 acres (**Map A-13** in **Appendix A**).

# 4.0 Social Profile

The following information describes the social profile of the Ashley Creek watershed.

## 4.1 Population

Using densities of 2010 census blocks, there are 26,445 people living within the Ashley Creek watershed. Highest population densities are in the eastern portion of the watershed where Ashley Creek flows through the city limits of Kalispell. The upper portions of the watershed are sparsely populated. The population density of the watershed is mapped on **Map A-14** in **Appendix A**.

## 4.2 Transportation Network

U.S. Route 2 is the chief transportation route in the Ashley Creek watershed, roughly paralleling Ashley Creek for much of its length. There are 206, 268, and 378 miles of primary, secondary, and unpaved roads in the Ashley Creek watershed, respectively. The transportation network in the watershed is shown in **Map A-15** in **Appendix A.**

## 4.3 Land Ownership

Public land ownership information was provided by the Montana Natural Heritage Program (2011) and the extent of private timber lands was identified using the 2009 Montana Cadastral. Ownership is mostly private (77%). Plum Creek Timber Company is the largest, single private land owner (**Table 4-1** below and **Map A-16** in **Appendix A**). The U.S. Forest Service is the largest, single public land owner.

**Table 4-1. Land Ownership in the Ashley Creek Watershed**

| Land Owner | Area (Acres) | Area (Square Miles) | Relative Area (Percent) |
|---|---|---|---|
| Private Ownership | 113,553 | 177.4 | 54.7% |
| Plum Creek Timber Company | 44,964 | 70.3 | 21.7% |
| US Forest Service | 35,081 | 54.8 | 16.9% |
| Montana State Trust Lands | 8,388 | 13.1 | 4.0% |
| Water | 2,945 | 4.6 | 1.4% |
| US Fish and Wildlife Service | 1,451 | 2.3 | 0.7% |
| Water - private | 941 | 1.5 | 0.5% |
| Montana Fish, Wildlife, and Parks | 217 | 0.3 | 0.1% |
| Montana Department of Transportation | 23 | <0.1 | <0.1% |
| City Government | 18 | <0.1 | <0.1% |
| **Total** | **207,581** | **324.4** | **100%** |

## 4.4 Land Cover and Land Use

Land cover within the planning area is dominated by evergreen forests as indicated in **Table 4-2**. The second most common land cover is shrub. These two categories account for over 84% of the total area. Agricultural lands (i.e., pasture/hay and cultivated crops) dominate the Spring Creek valley and valley bottom of Ashley Creek below the confluence with Spring Creek. Rural residential development occupies much of the privately owned valley bottom of Ashley Creek and the lower portions of the major tributaries. Residential development also surrounds a number of the lakes within the watershed, particularly Ashley and Foy Lakes. Land cover is mapped on **Map A-17** in **Appendix A** using the 2006 National Land Cover Database.

**Table 4-2. Land Cover and Land Use in the Ashley Creek Watershed**

| Land Use | Area (Acres) | Relative Area (Percent) |
|---|---|---|
| Open Water | 3,854 | 1.9% |
| Developed | 7,385 | 3.6% |
| Barren Land | 28 | <0.1% |
| Deciduous Forest | 258 | 0.1% |
| Evergreen Forest | 122,186 | 58.9% |
| Mixed Forest | 1 | <0.1% |
| Shrub | 50,153 | 24.2% |
| Herbaceous/Grassland | 10,095 | 4.9% |
| Pasture/Hay | 5,079 | 2.5% |
| Cultivated Crops | 4,976 | 2.4% |
| Woody Wetlands | 701 | 0.3% |
| Emergent Herbaceous Wetlands | 2,866 | 1.4% |

## 4.5 Timber Harvest

Intensive and non-intensive timber harvest has occurred in the Ashly Creek watershed (**Map A-18** in **Appendix A**). Timber harvest data were obtained from the Montana Department of Natural Resources and Conservation (DNRC) and the U.S. Forest Service in 2008 and 2012. A total of 4,160 acres of harvest occurred on DNRC lands between 1983 and 2012; 2,714 acres were intensive harvest and 1,446 acres were non-intensive harvest. The U.S. Forest Service provided stand unit data for the Flathead National Forest. A total of 5,656 acres were harvested: 2,188 acres were intensive harvest (pre-commercial thinning, commercial thinning, improvement cuts, and shelterwood establishment cuts) and 3,468 acres were non-intensive harvest (liberation and sanitation [salvage]). The locations of timber harvests are shown in **Map A-18** in **Appendix A** and summaries of the land areas harvested are in **Table 4-3**.

**Table 4-3. Timber Harvest (acres) in the Ashley Creek Watershed**

| Subwatershed | DNRC | U.S. Forest Service | Total |
|---|---|---|---|
| Ashley Creek, upper | 3,252 | 4,979 | 8,231 |
| Ashley Creek, middle | 602 | 81 | 683 |
| Spring Creek | 0 | 0 | 0 |
| Ashley Creek, lower | 306 | 596 | 902 |
| ***Total*** | **4,160** | **5,656** | **9,816** |

DNRC = Montana Department of Natural Resources and Conservation.
Timber harvest areas are reported in acres.

Timber harvest data from private lands were limited. Data from the Hazard Reduction Agreements (HRAs) filed with DNRC were obtained directly from DNRC in 2008 and 2012. The HRAs contain the township, range, and section (TRS) of the forest stands that were harvested. While all HRA's include the TRS at minimum, some HRAs provided additional information (e.g., quarter-section, lot number). None of the additional locational data are georeferenced but the TRS can be plotted spatially.

The Ashley Creek watershed is contained within 386 sections[1]. Of these 386 sections, timber harvest on private lands has occurred within portions of 358 sections. No timber harvests occurred on private land in 28 sections, which are mostly in the upper Ashley Creek subwatershed. Between 2008 and 2012, harvests on private land occurred in the upper (23 sections), middle (38 sections), and lower (15 sections) subwatersheds.

[1] The border of the Ashley Creek watershed passes through 103 sections; thus, only portions of these 103 sections are within the Ashley Creek watershed. As the exact locations of timber harvests within a section are unknown, it is possible that harvests that occurred within these 103 sections were outside of the Ashley Creek watershed but are valuated as if they were within the Ashley Creek watershed.

# 5.0 REFERENCES

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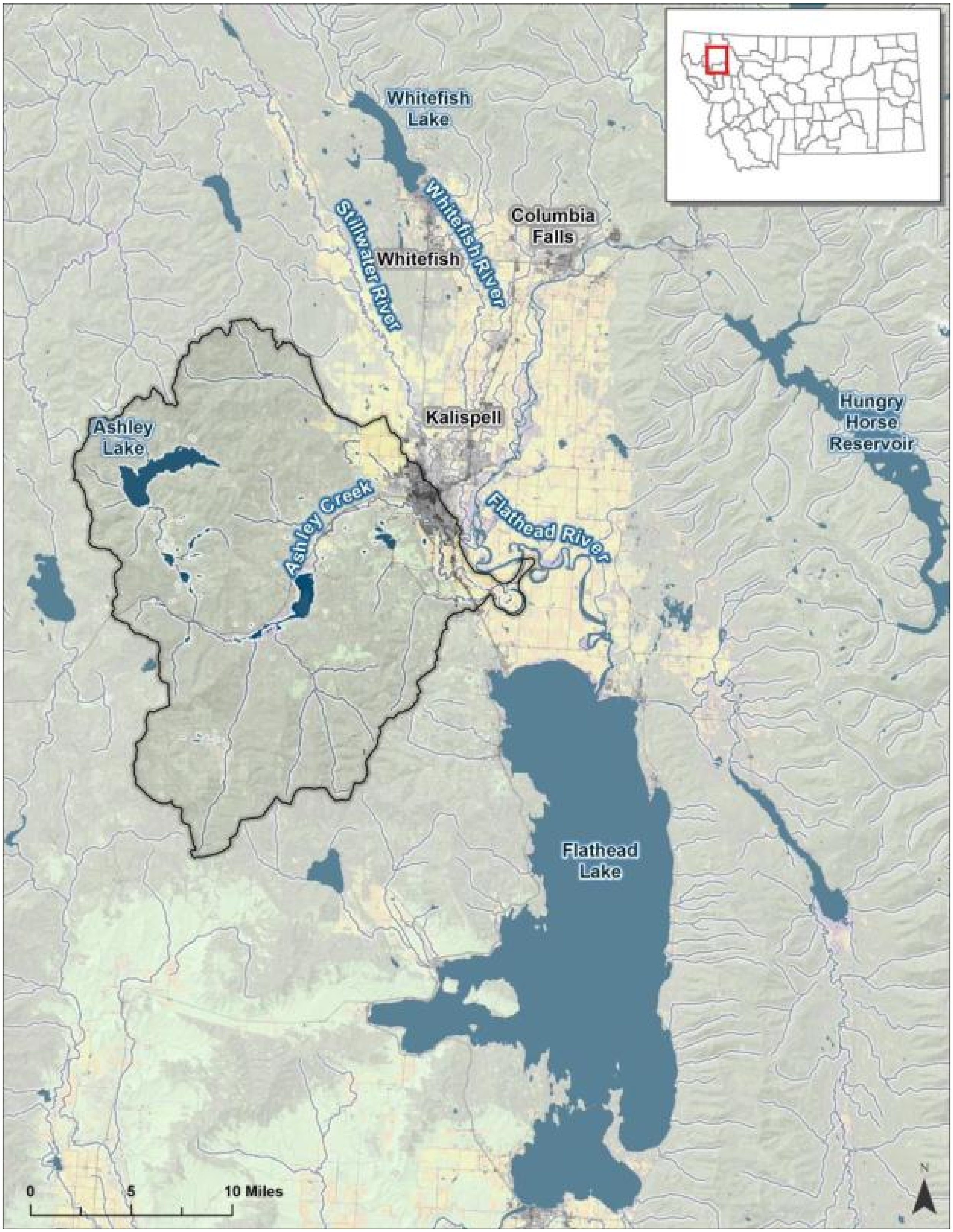
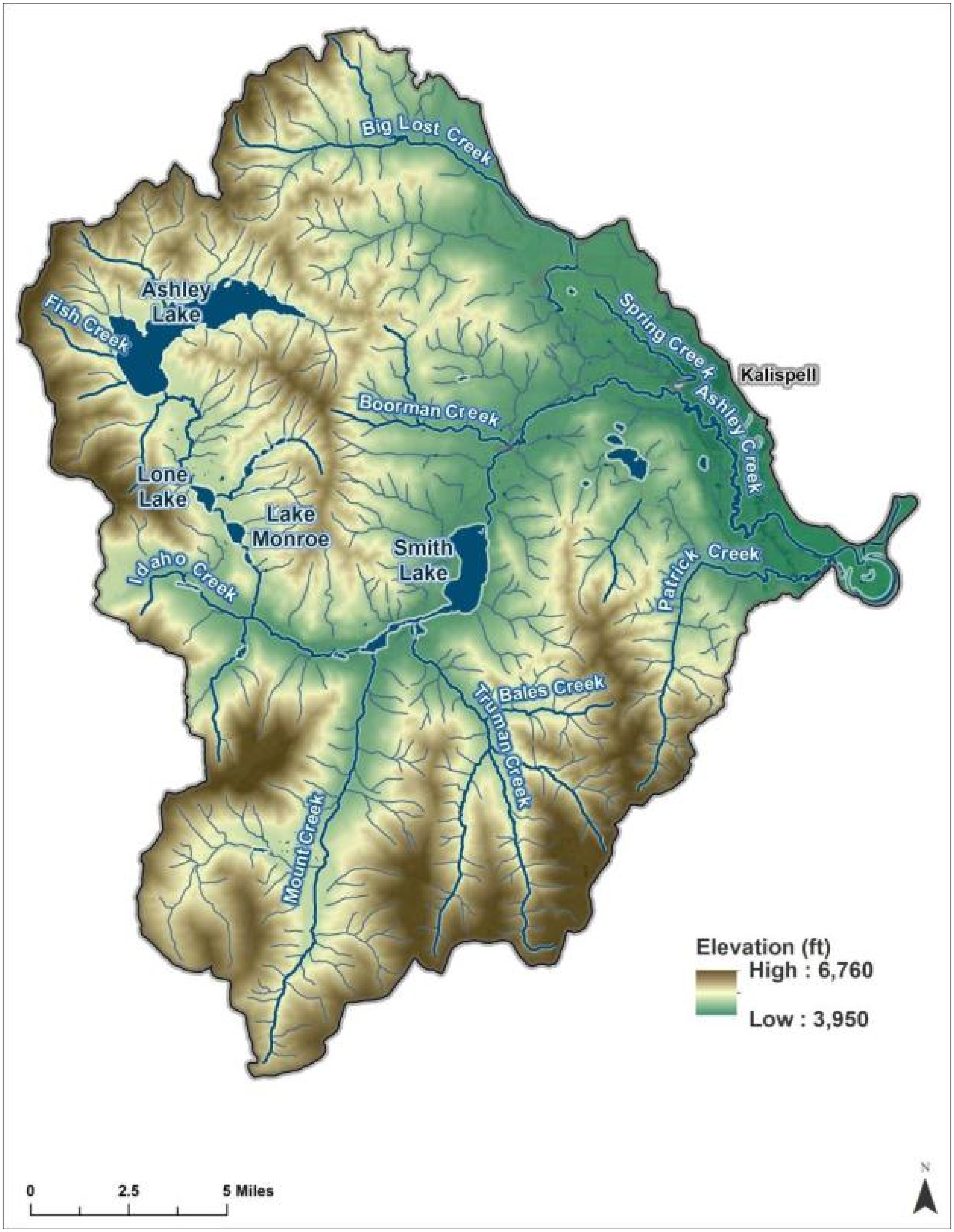
# APPENDIX A – WATERSHED CHARACTERIZATION MAPS

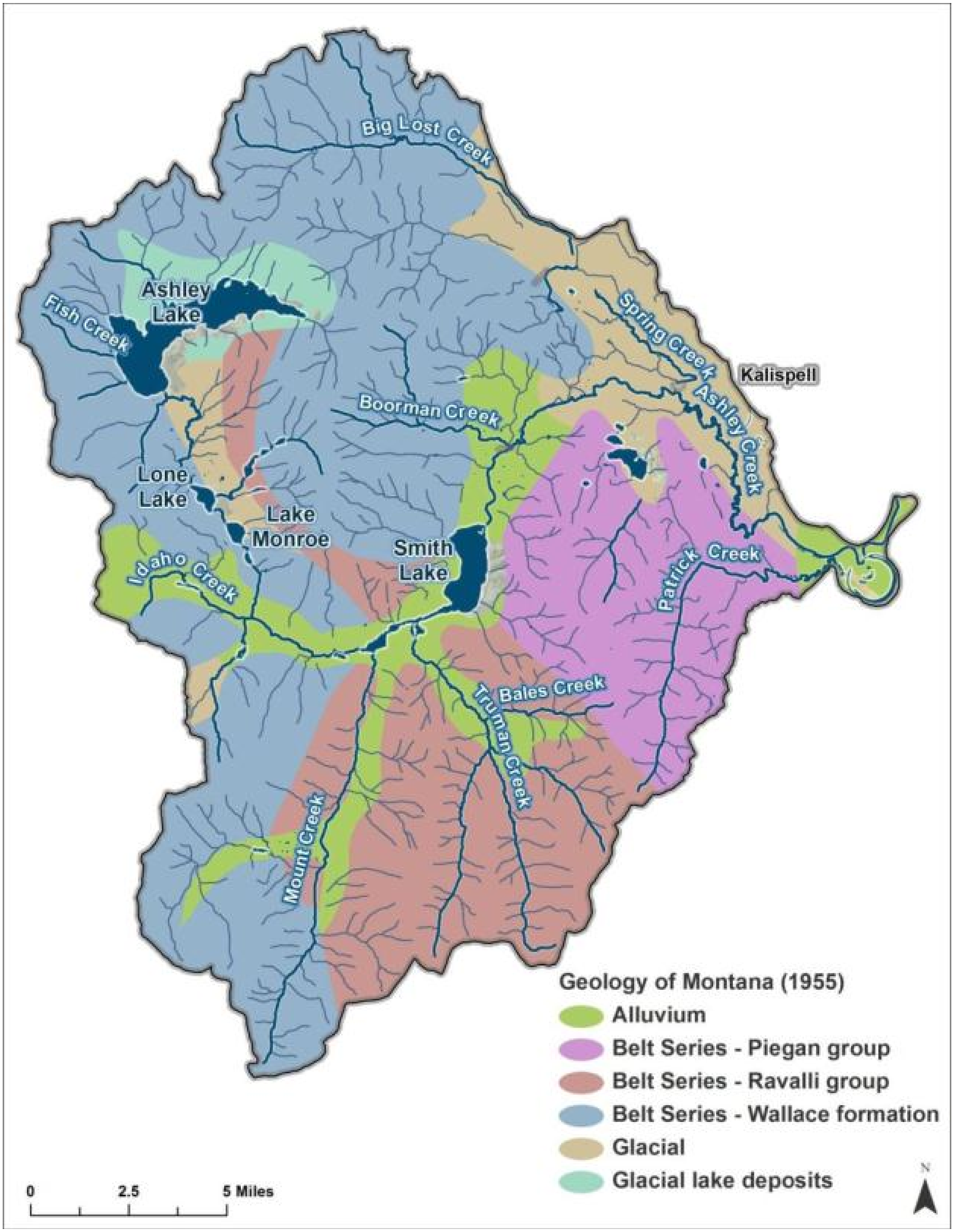
## Maps



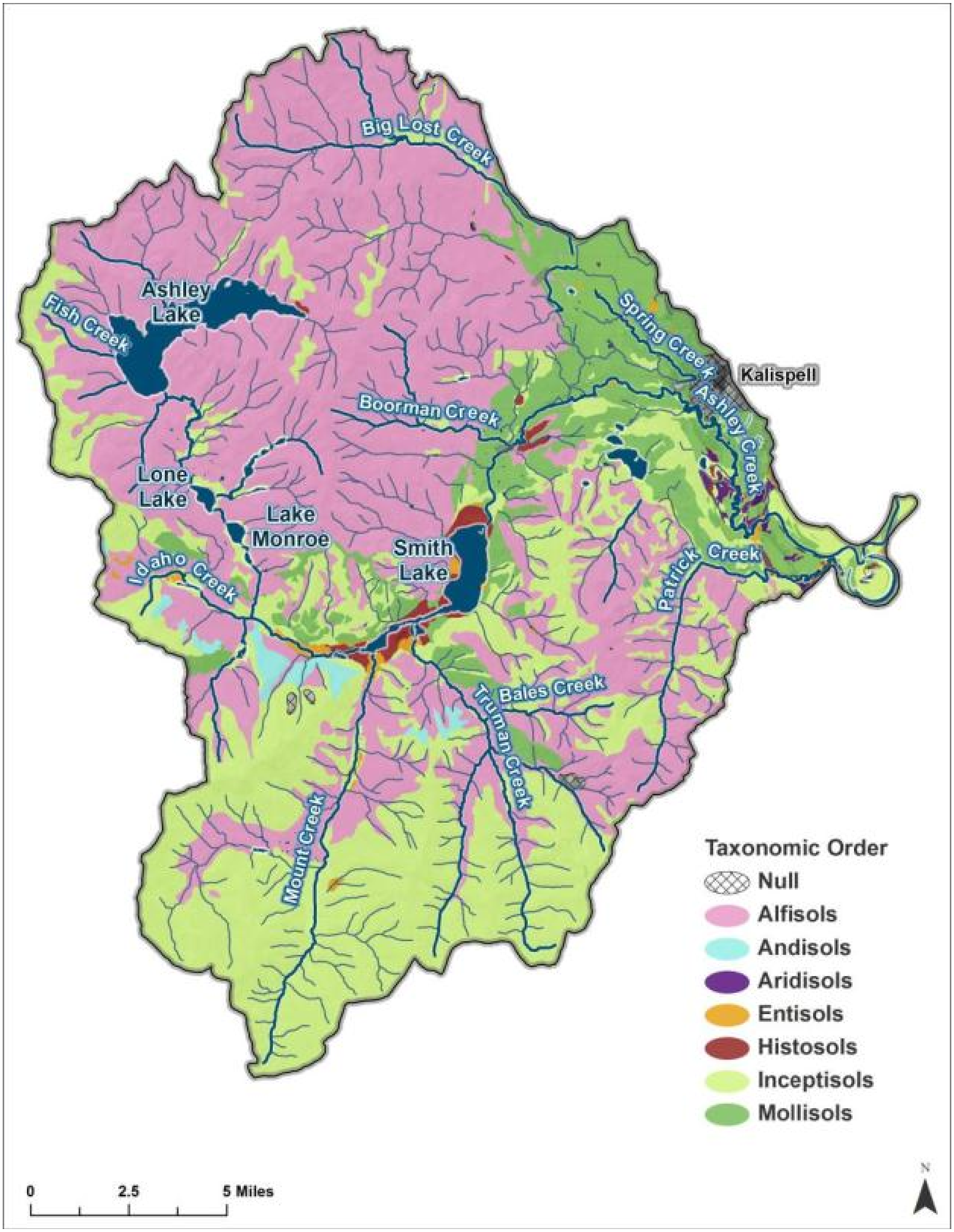

**Map A-1. Ashley Creek Watershed**



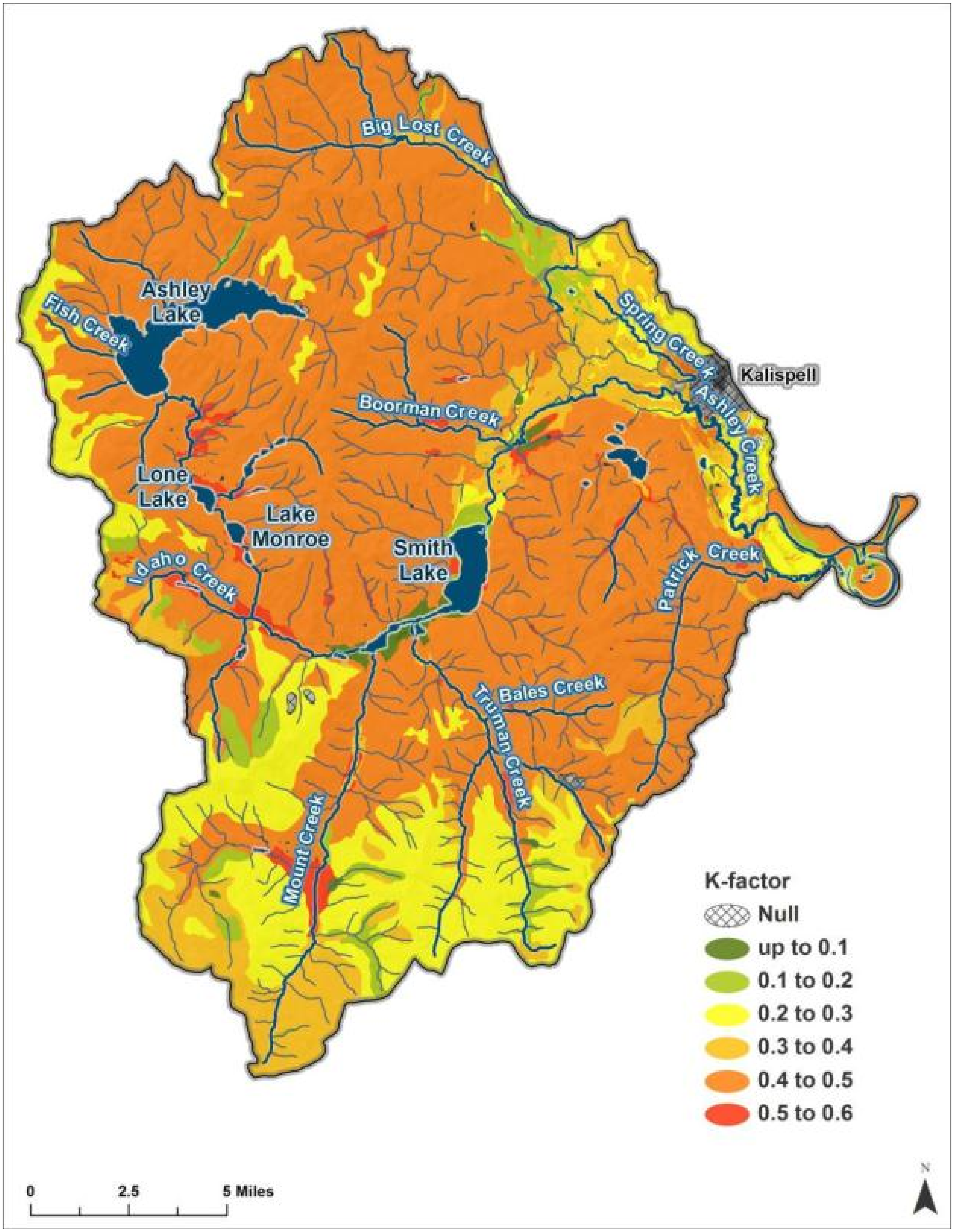

Map A-2. Elevation in the Ashley Creek Watershed



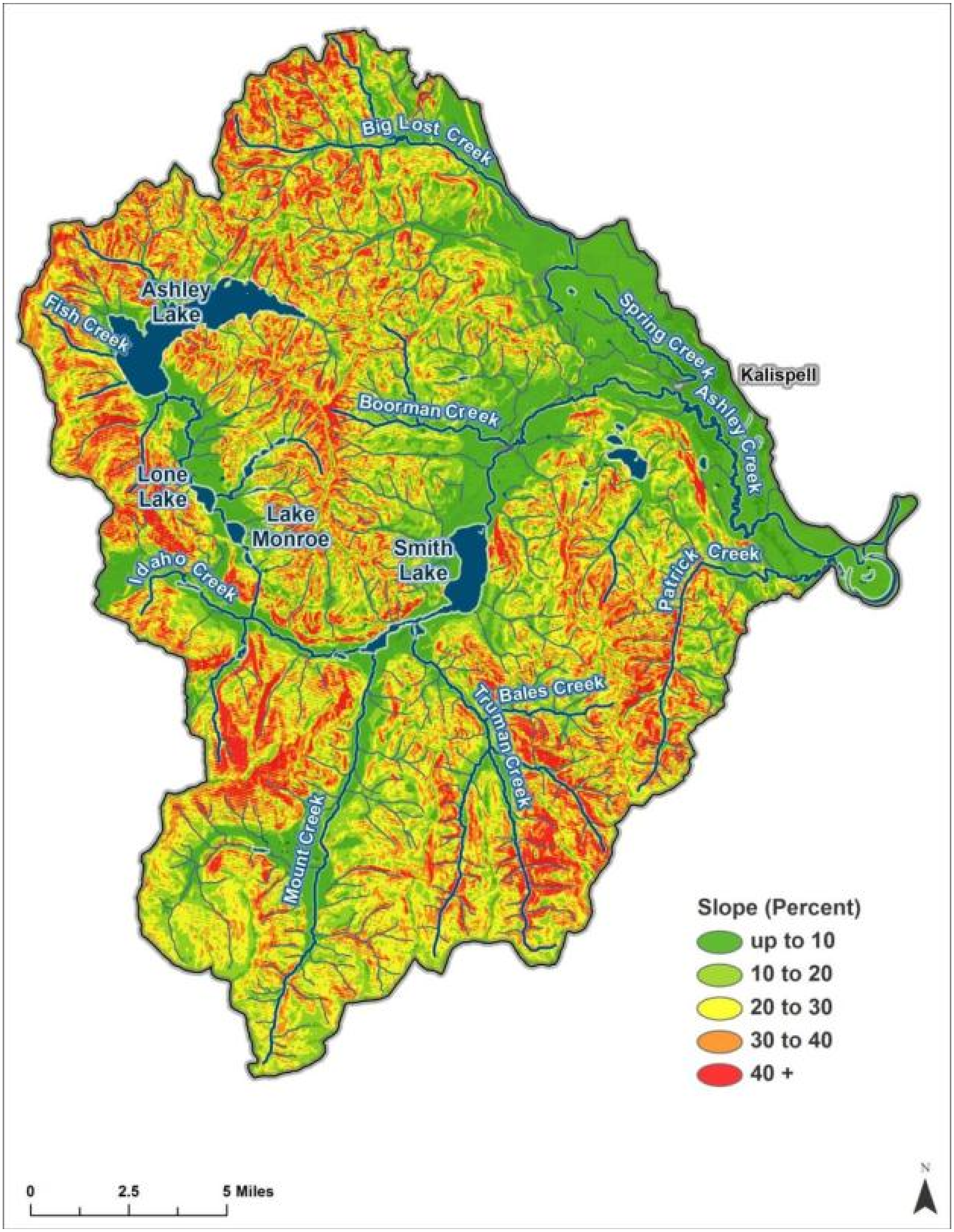

**Map A-3. Geology of the Ashley Creek Watershed**



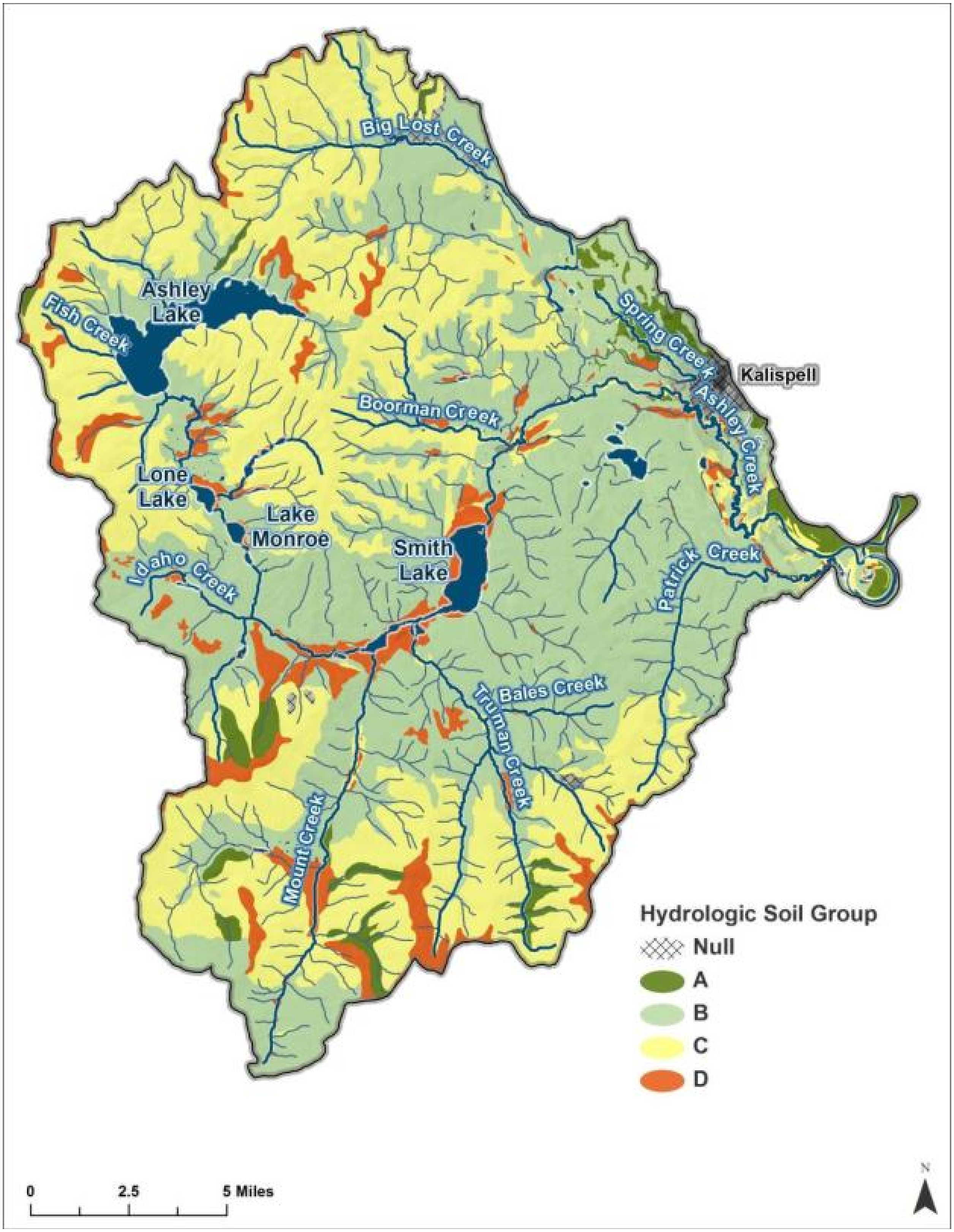

**Map A-4. Soil Orders in the Ashley Creek Watershed**




**Map A-5. Erodibility of Soils in the Ashley Creek Watershed**



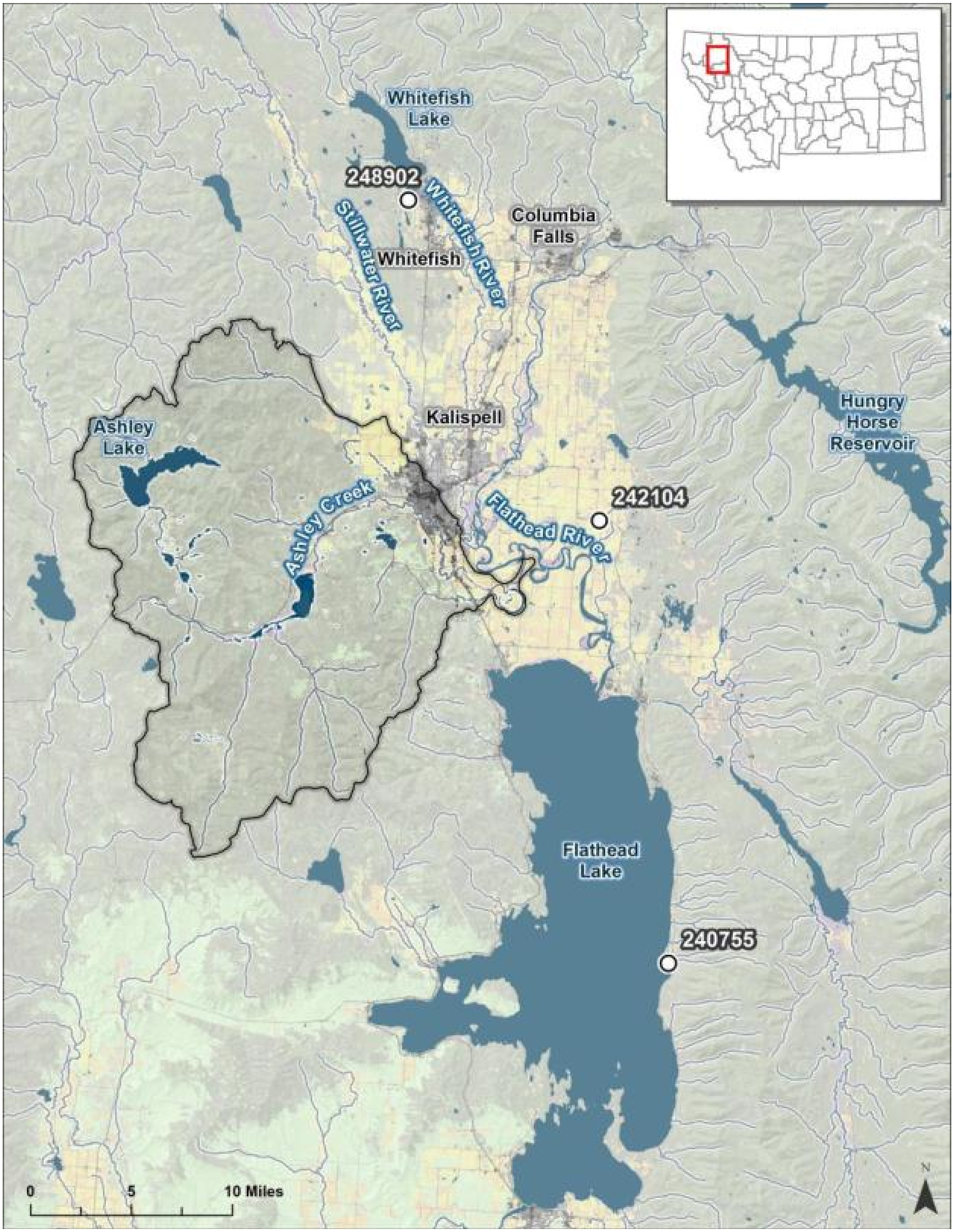

**Map A-6. Slope in the Ashley Creek Watershed**



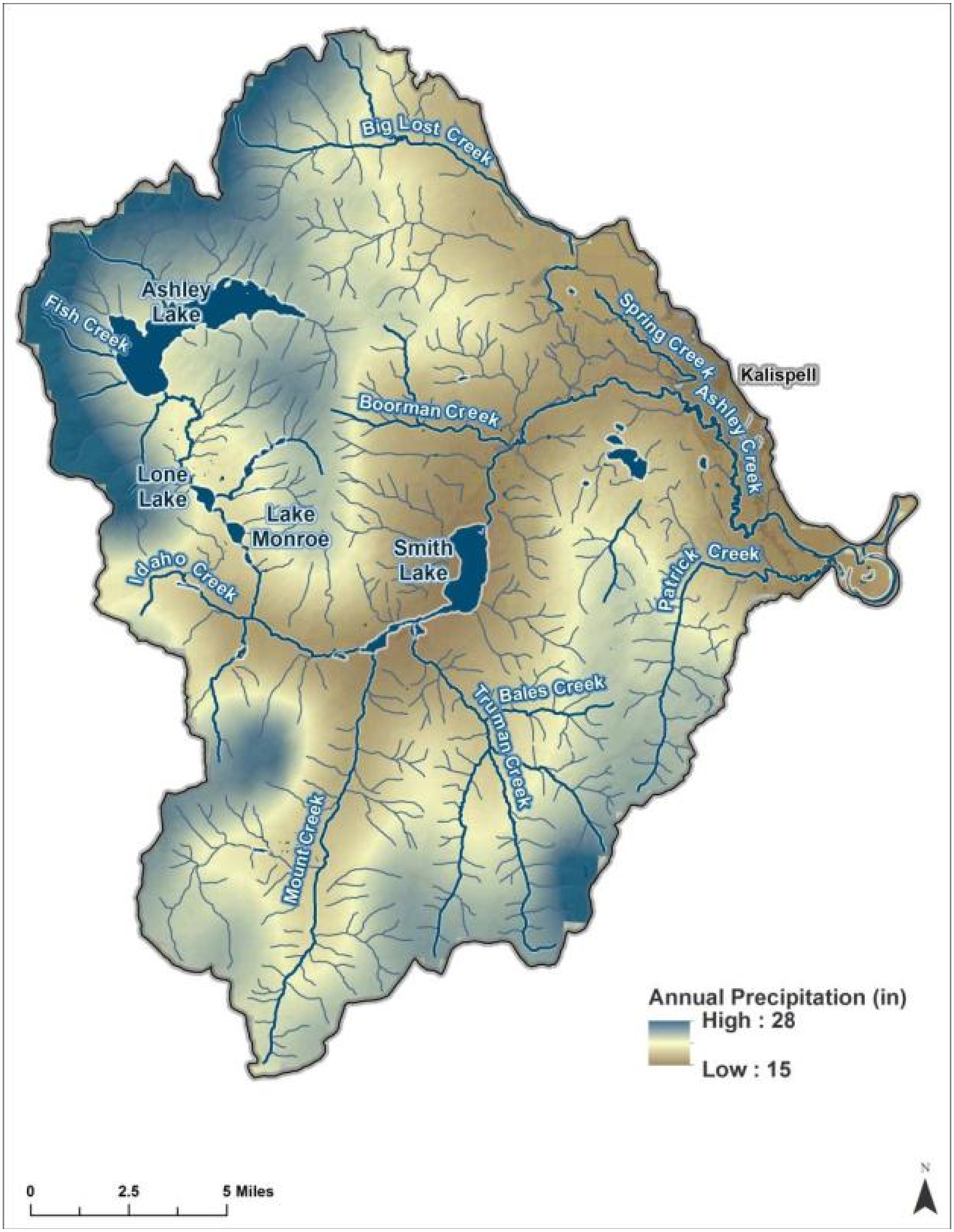

**Map A-7. Hydrologic Soil Groups in the Ashley Creek Watershed**


Source: LaFave et al. (2004).

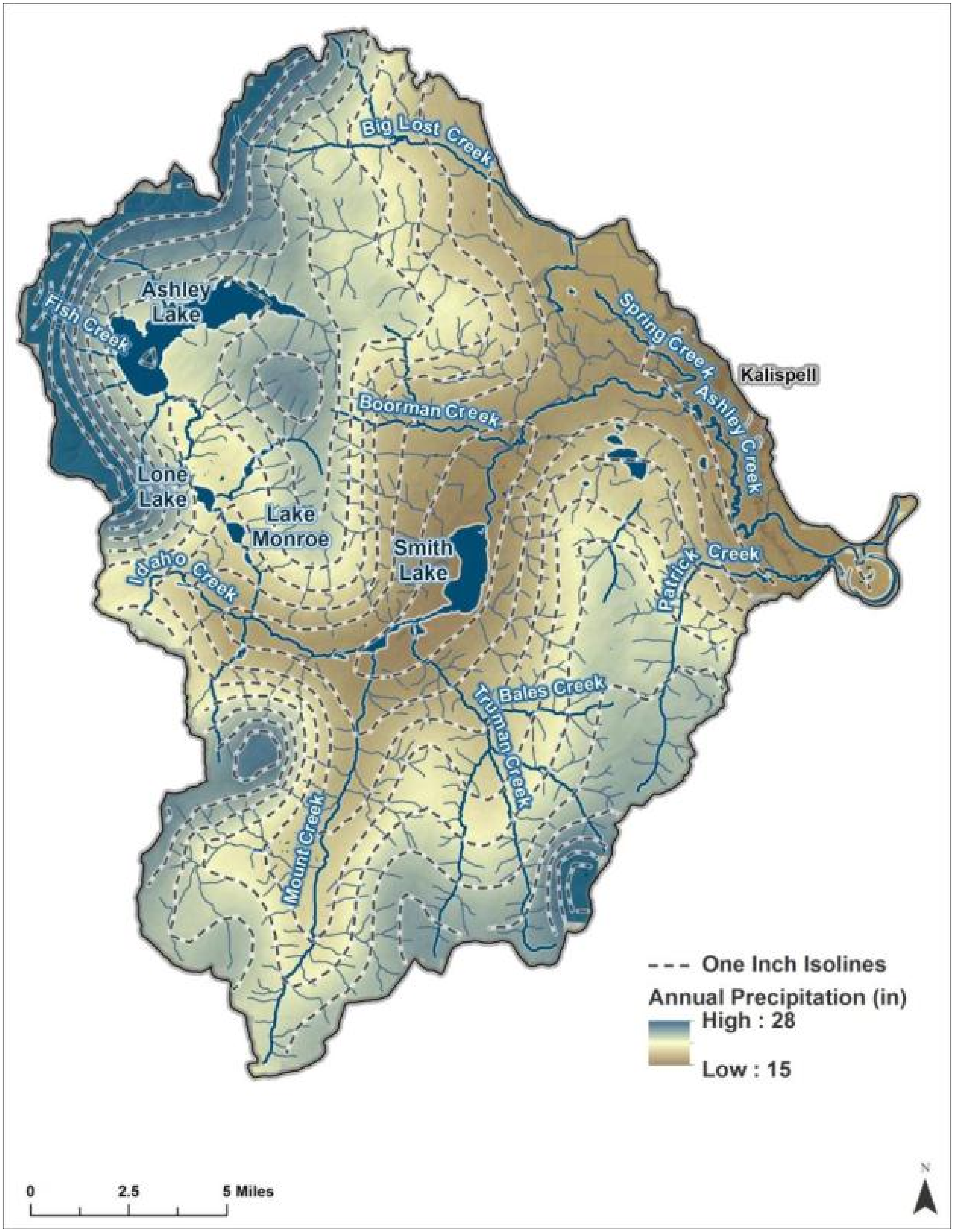
**Map A-8. The 11 Hydrogeologic Subareas in the Flathead Lake Groundwater Study Area**



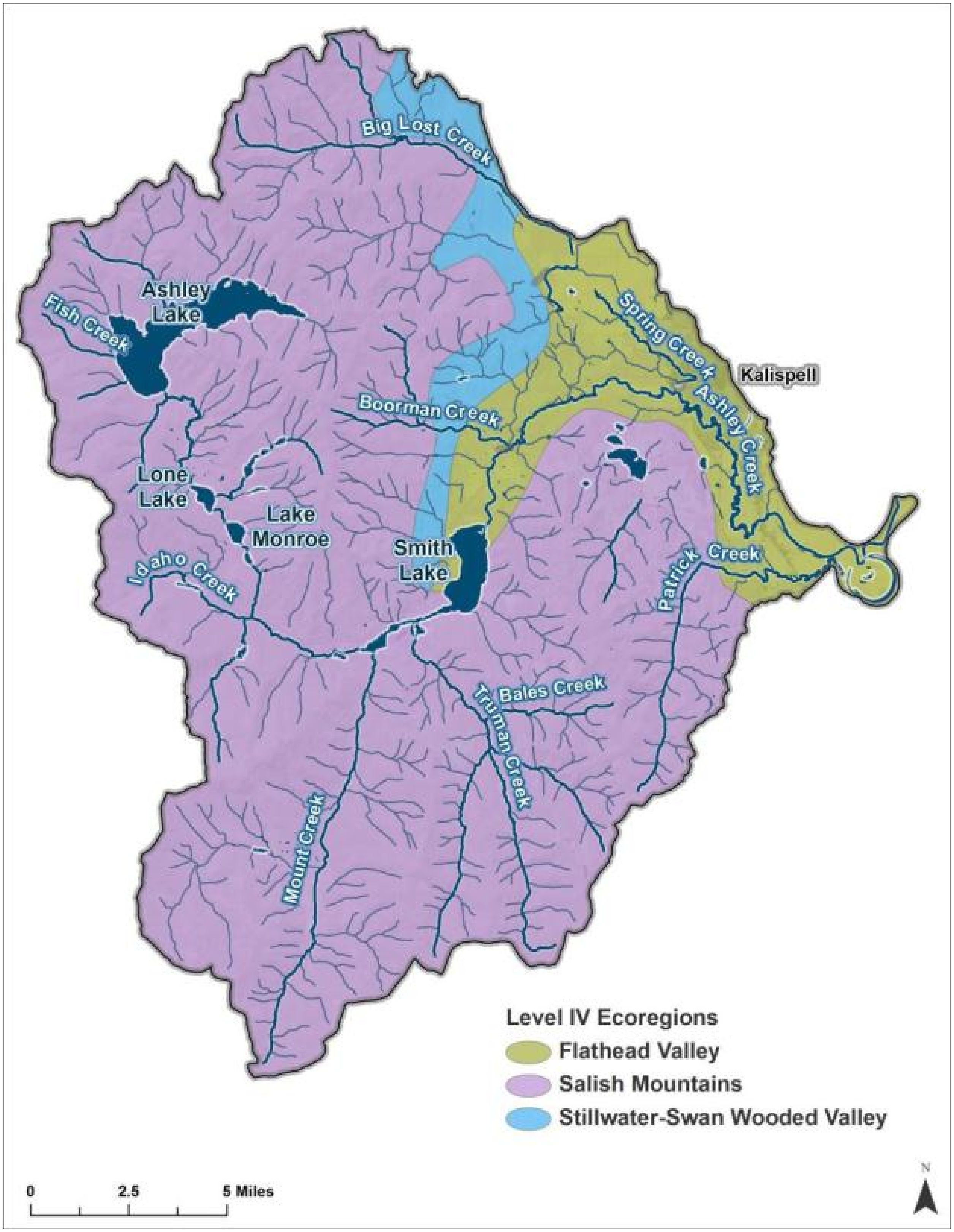

**Map A-9. Weather Stations near the Ashley Creek Watershed**



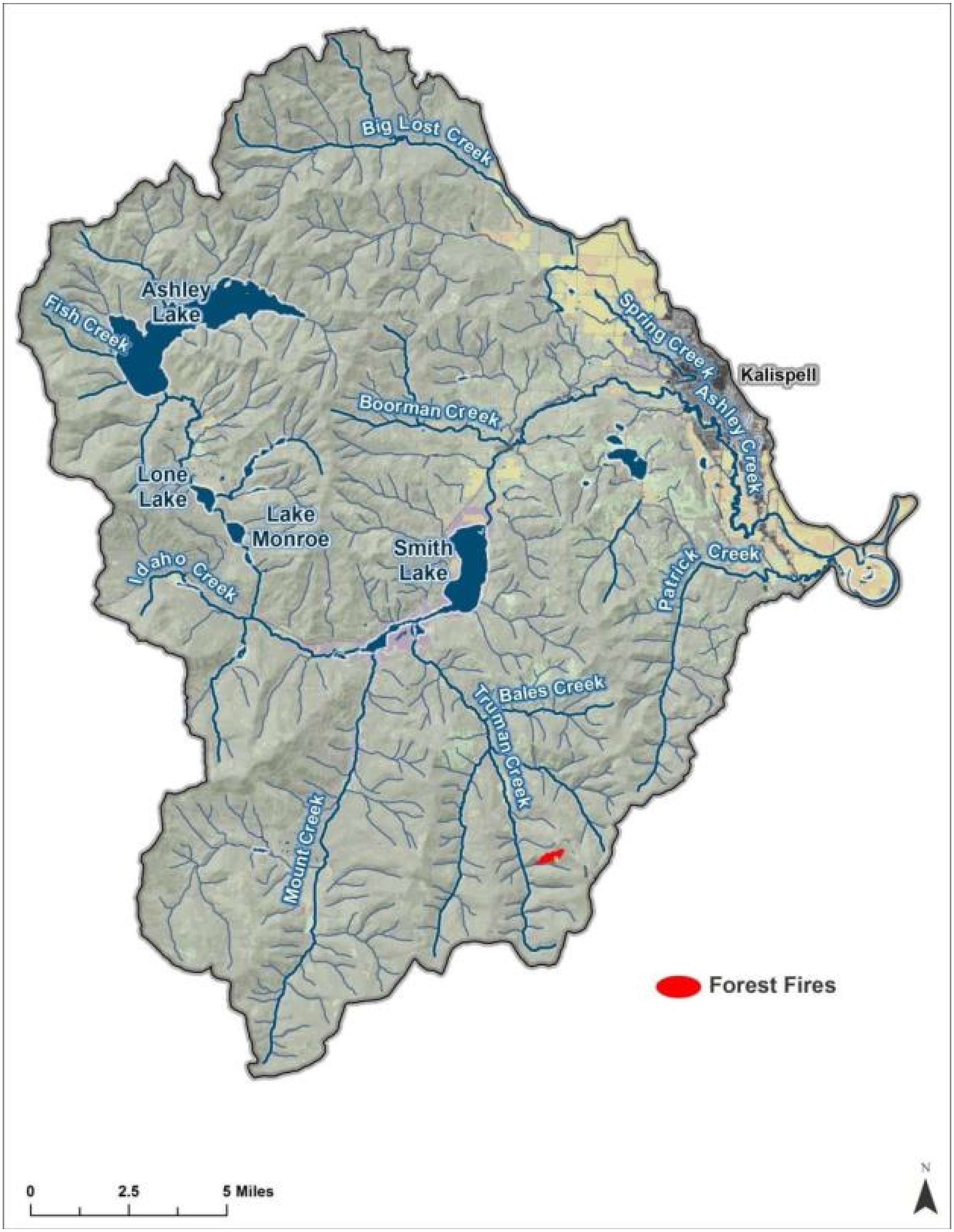

**Map A-10. Annual Precipitation in the Ashley Creek Watershed**



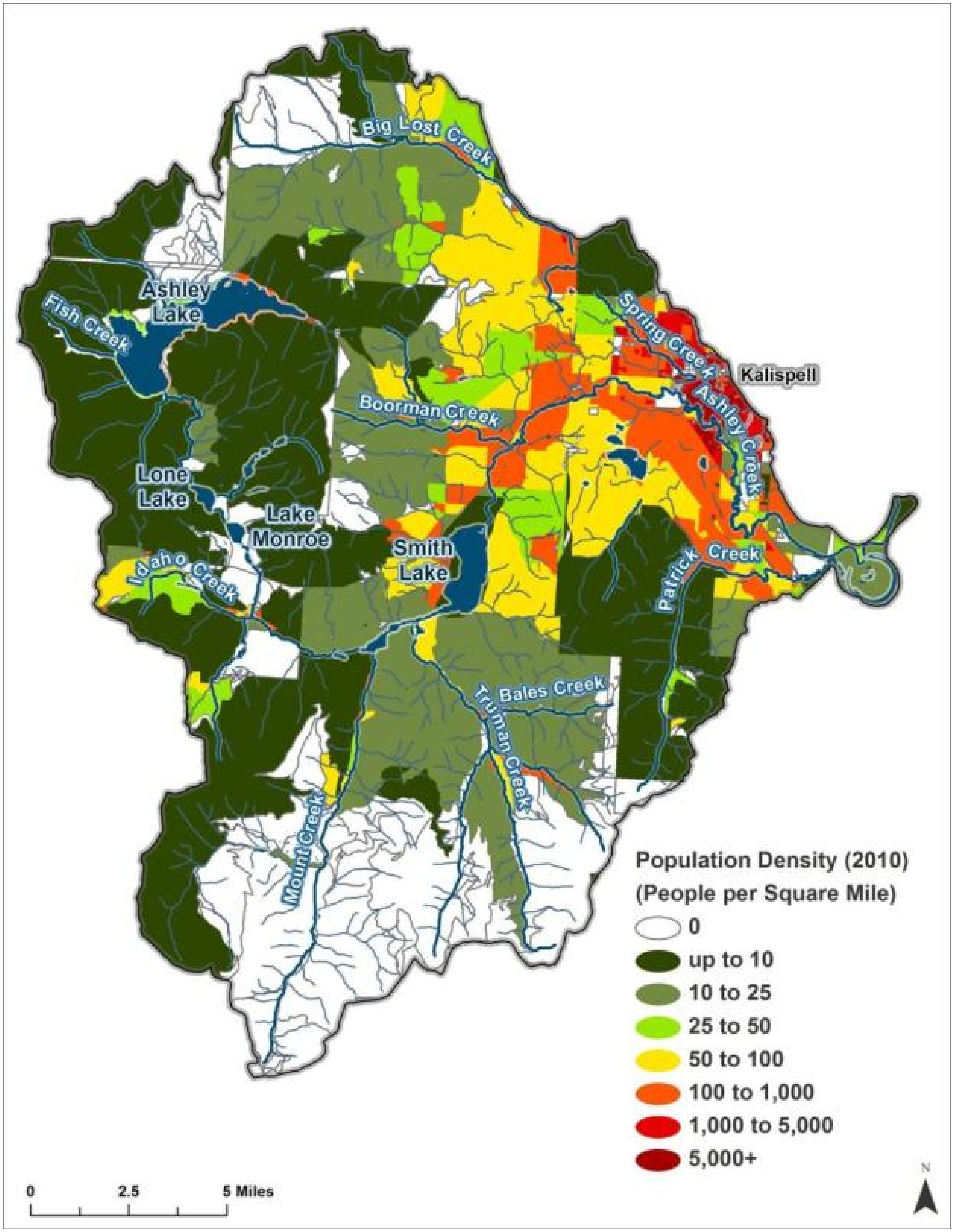

**Map A-11. Annual Precipitation with Isolines in the Ashley Creek Watershed**




**Map A-12. Level IV Ecoregions in the Ashley Creek Watershed**

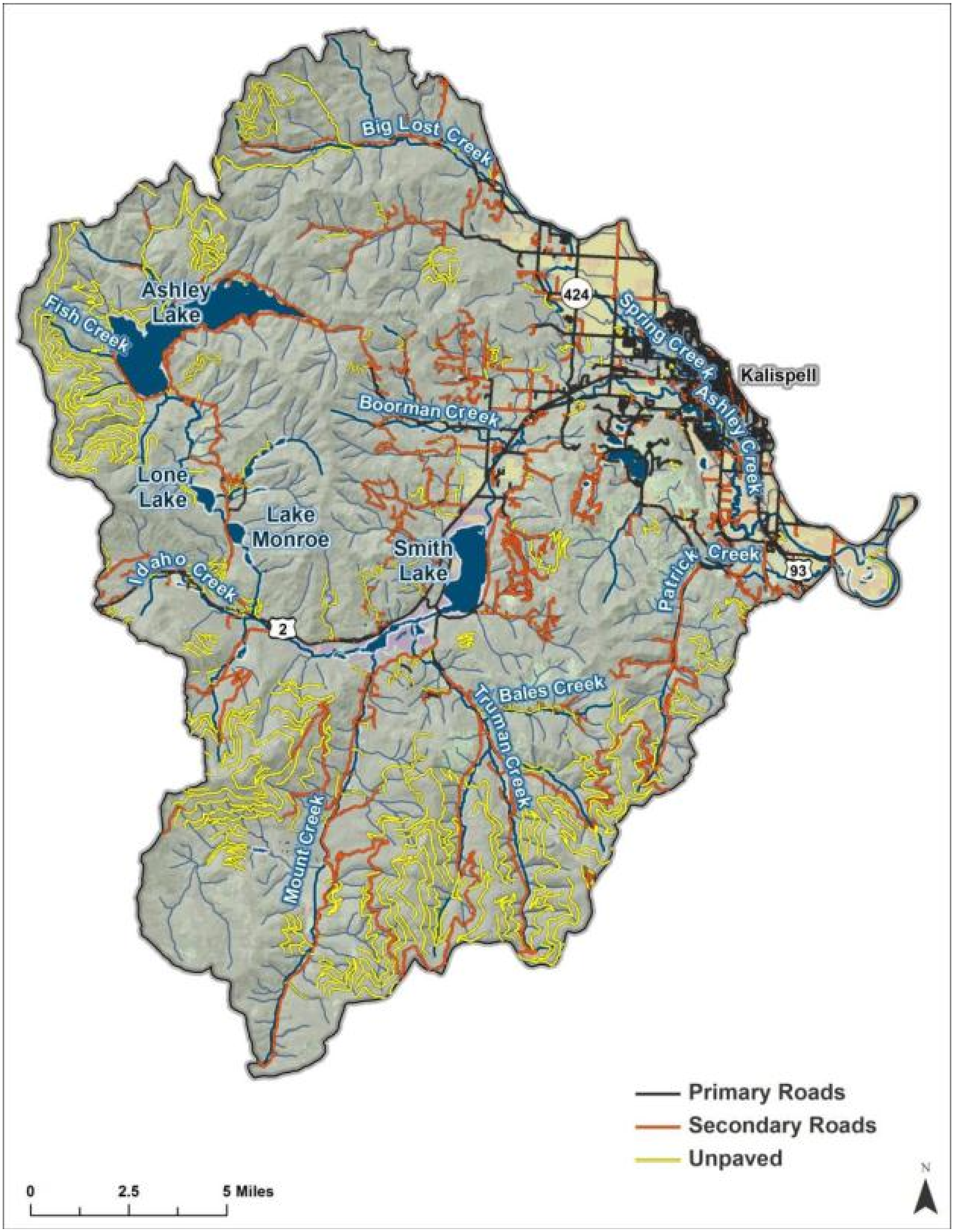



**Map A-13. Forest Fire in the Ashley Creek Watershed**

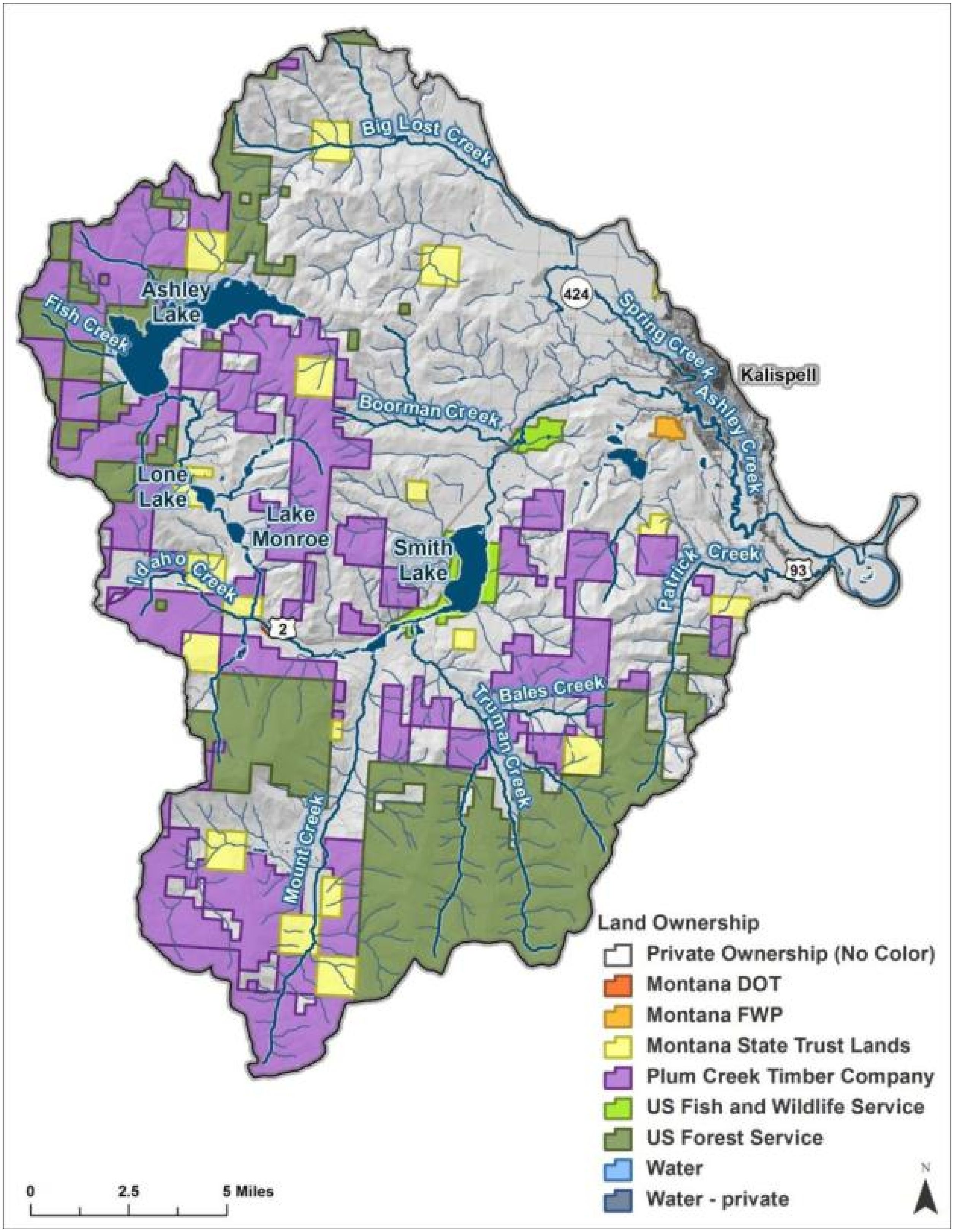



*Source:* U.S. Census Bureau, 2010

**Map A-14. Population Density in the Ashley Creek Watershed**

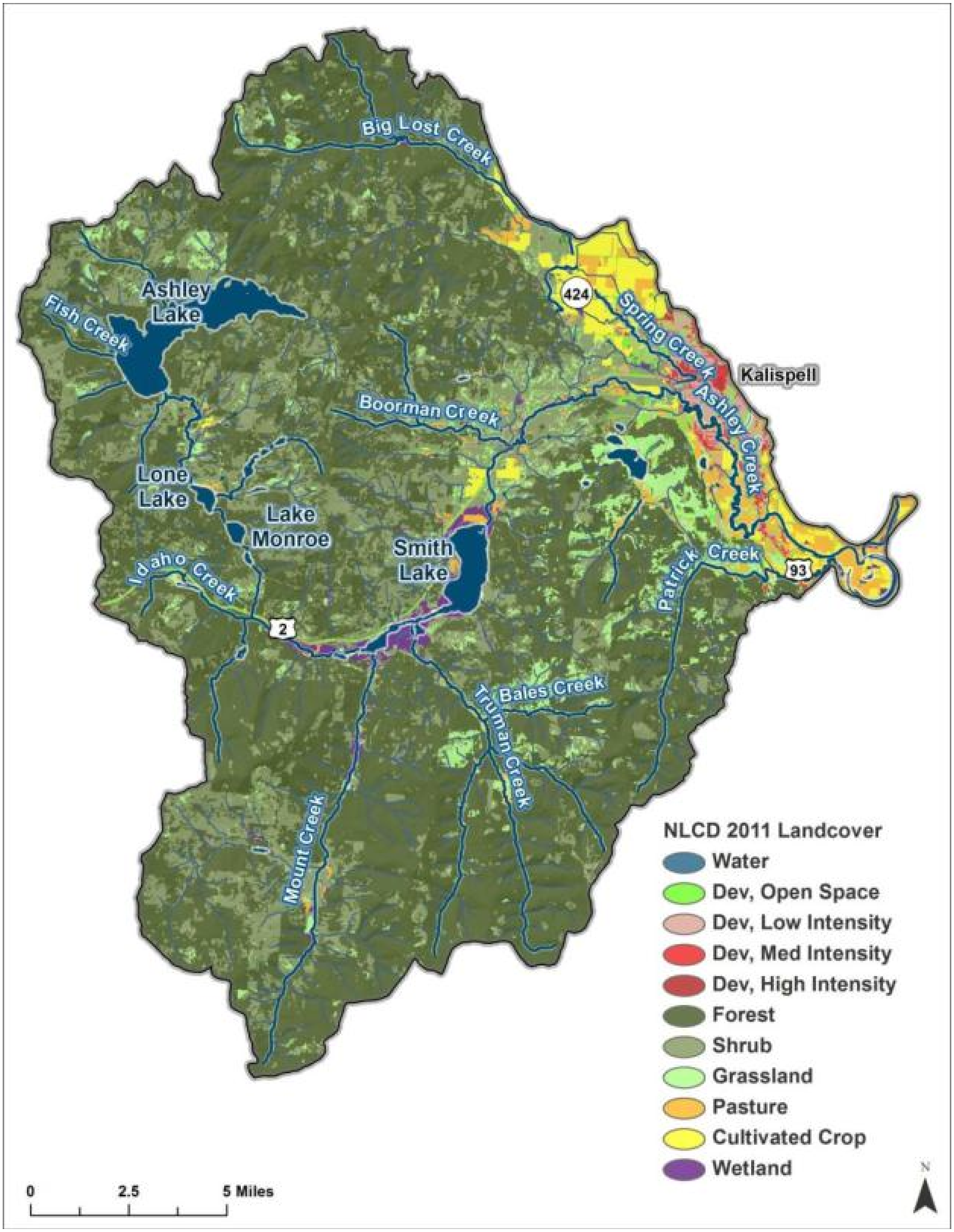



**Map A-15. Road Network in the Ashley Creek Watershed**

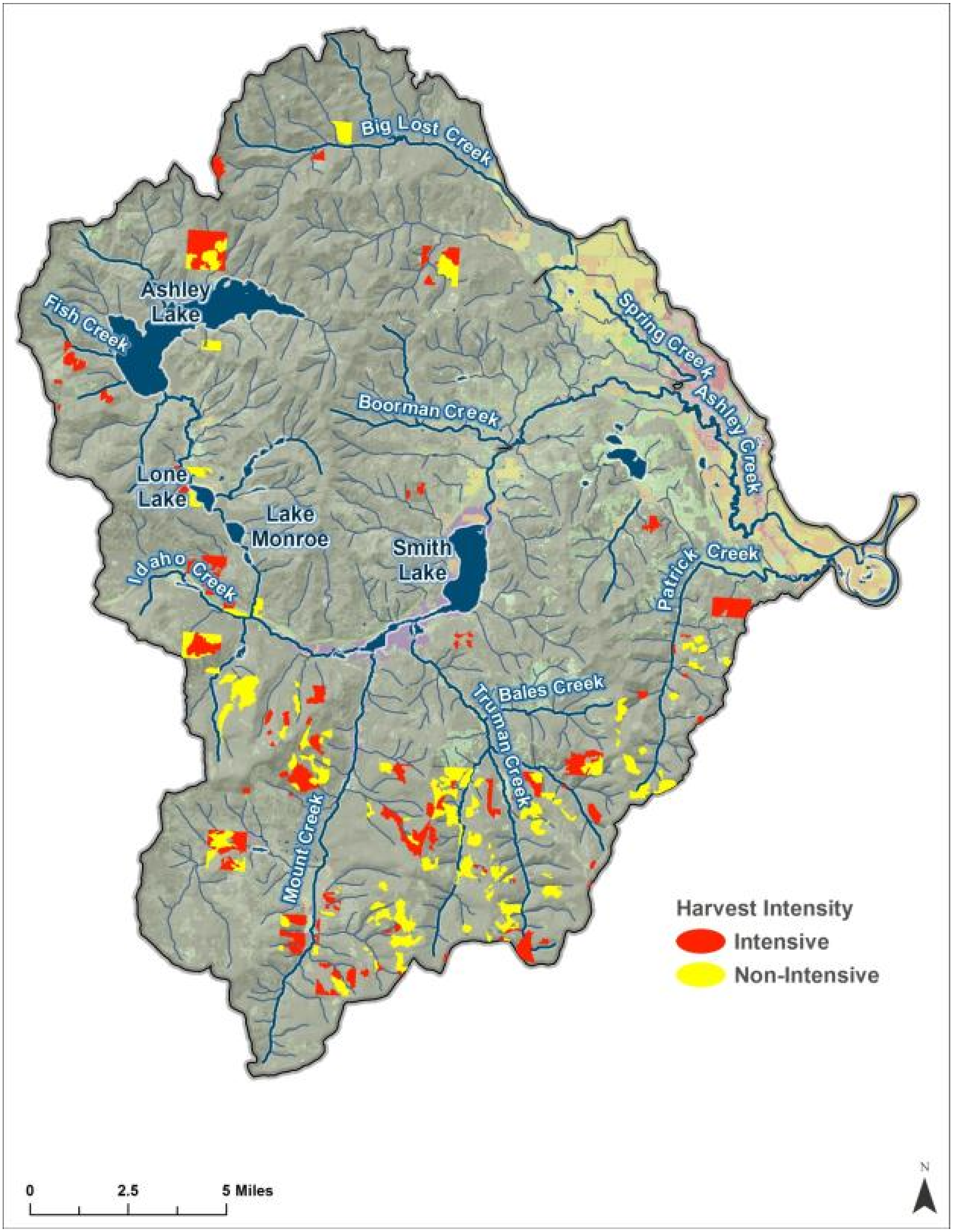



*Source:* Montana Natural Heritage Program, 2008

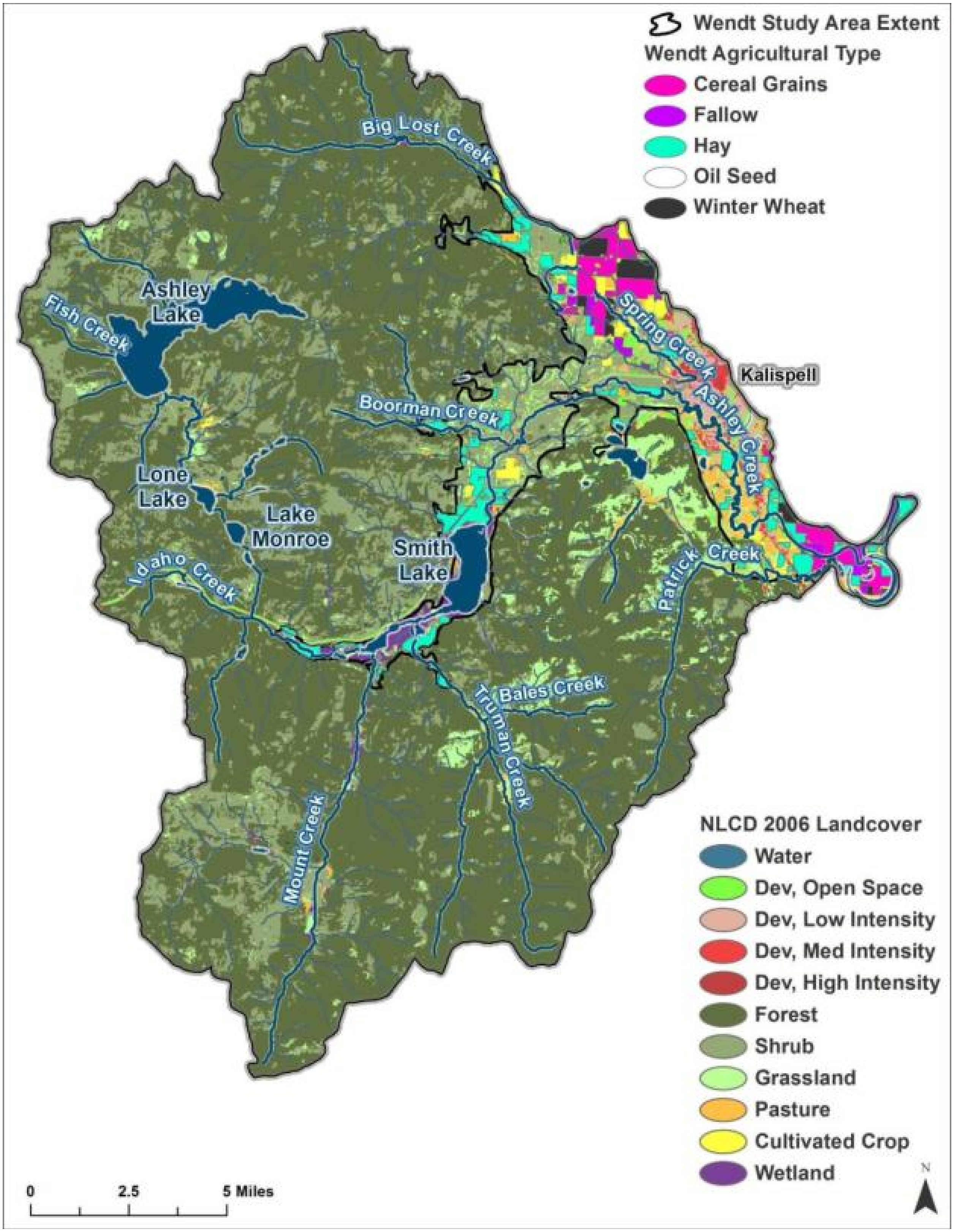
**Map A-16. Land Ownership in the Ashley Creek Watershed**




**Map A-17. Land Cover and Land Use in the Ashley Creek Watershed**




**Map A-18. Timber Harvest in the Ashley Creek Watershed**




**Map A-19. Agriculture in the Ashley Creek Watershed**