

# Ecological Health of the River Systems

## Water Quality

The West Fork Gallatin River Watershed Total Maximum Daily Loads (TMDLs) and Framework Watershed Water Quality Improvement Plan completed in 2010 identifies the maximum amount of a pollutant a water body can receive and still meet water quality standards. Within the West Fork Gallatin River watershed, three streams have been identified as impaired, including the Middle Fork West Fork Gallatin River, South Fork West Fork Gallatin River, and West Fork Gallatin River (**Table 1**). In addition to establishing TMDLs, the 2010 TMDL document includes an assessment of road densities, traction sand application, riparian buffer conditions, instream habitat conditions, and fish passage through culverts. Ongoing water quality monitoring conducted by the Gallatin River Task Force has identified the following spatial trends: nitrogen and chloride are elevated in the Middle Fork West Fork Gallatin River and West Fork Gallatin River, while algae growth is elevated in the Middle Fork West Fork Gallatin River, South Fork West Fork Gallatin River, and West Fork Gallatin River. Seasonal trends identified by the Gallatin River Task Force indicate that chloride is highest pre-snowmelt (March/April), turbidity is highest at runoff, nitrate is highest in the winter, and *E. coli* is highest in the summer. Wastewater has been identified as a major source of nitrogen in summer and winter, while soil and atmospheric sources of nitrogen are predominant during spring runoff. In the summer, biological uptake by algae masks nitrogen concentrations. Recent research conducted by Montana State University indicates there is a significant diurnal fluctuation of nitrogen, with concentrations lowest during the day when algae are photosynthesizing and using nitrogen. Outside of the West Fork Gallatin River watershed, many streams have not been assessed and conditions aren't known.

**Table 1. Percent Reductions in Pollutant Loading Required by TMDL**

Stream Segment	Nitrate+Nitrite	Total Nitrogen	E. coli	Sediment
Middle Fork West Fork Gallatin River	33%	n/a	55%	29%
South Fork West Fork Gallatin River	0%*	n/a	n/a	0%**
West Fork Gallatin River	33%	36%	n/a	0%**

\*Current nitrate+nitrite load not calculated; total load allocations developed

\*\*Current estimated total sediment load equals total allowable sediment load; percent reductions required for sediment loads from roads, streambank erosion and upland erosion

## Stormwater

During the West Fork Gallatin River watershed TMDL assessment, four sub-watershed drainage areas within the Mountain Village and Meadow Village were delineated in GIS using color aerial imagery. The Mountain Village was divided into two stormwater source areas, with the area draining directly into Lake Levinsky (LL) examined separately from the area that drains into the Middle Fork West Fork Gallatin River (MFWF). The Meadow Village was divided into two stormwater source areas, with the portion located to the north of the Big Sky Spur Road draining into the West Fork Gallatin River (WF) and the portion located to the south of the Big Sky Spur Road draining into the South Fork West Fork Gallatin River (SFWF).

**Table 2. Sub-watershed Stormwater Source Areas**

GIS Delineated Areas	Mountain Village (MFWF)	Mountain Village (LL)	Meadow Village (WF)	Meadow Village (SFWF)
Total Area (acres)	341	155	409	240
Developed Area (acres)	93	88	60	98

## Wetland and Riparian Areas

The primary public source of wetland information is the National Wetland Inventory (NWI) created by the U.S. Fish and Wildlife Service, which provides geospatial information on wetland extent, type and change using remote sensing techniques. In addition, many wetlands in the Big Sky area have been mapped on-the-ground within areas where development is occurring. During the TMDL process, riparian buffer conditions were assessed using National Agricultural Imagery Program (NAIP) color imagery from 2005 for several streams in the West Fork Gallatin River watershed and classified as healthy (good), moderately disturbed (fair), or heavily disturbed (poor) (**Table 3**). An aerial assessment of the mainstem Gallatin River was conducted in 2005 using aerial imagery from 1999. The recently completed *Gallatin Canyon River Access Site Assessment* (RESPEC 2015) also documents areas where riparian vegetation has been degraded along the Gallatin River due to recreational use, while also identifying sites where traction sand has a direct pathway into the Gallatin River.

**Table 3. Riparian Buffer Health**

Stream Segment	Good	Fair	Poor
Middle Fork West Fork Gallatin River	15%	84%	1%
Beehive Creek	60%	40%	0%
North Fork West Fork Gallatin River	71%	29%	0%
Muddy Creek	77%	19%	4%
Third Yellow Mule Creek	73%	27%	0%
Second Yellow Mule Creek	44%	56%	0%
First Yellow Mule Creek	79%	21%	0%
South Fork West Fork Gallatin River	44%	54%	2%
West Fork Gallatin River	14%	61%	25%

## Fisheries

Fisheries monitoring on the mainstem Gallatin River conducted above (Porcupine Section) and below the confluence of the West Fork Gallatin River (Jack Smith Section) indicates that rainbow trout populations double downstream of the confluence with the West Fork Gallatin River. Fisheries monitoring also indicates that rainbow trout populations have been increasing over the past 30 years. There is a significant amount of upwelling near the confluence with the West Fork Gallatin River, which provides increased streamflow and more stable temperatures. Mild nutrient enrichment contributed from the West Fork Gallatin River may also play a role in increased rainbow trout densities downstream of the West Fork. Westslope cutthroat are still found in the upper Gallatin River watershed, including the upper South Fork West Fork Gallatin River watershed, the Gallatin River mainstem and Porcupine Creek in the Big Sky area. While westslope cutthroat inhabit about 25% of the system, only 3% are considered non-hybridized and contain over 90% cutthroat genes.

## Precipitation

Annual precipitation data is collected at the Natural Resource Conservation Service (NRCS) Lone Mountain SNOTEL site and the Western Region Climate Center (WRCC) Big Sky 3 S (COOP) site.

## Streamflow

Streamflow monitoring has been conducted at four sites within the West Fork Gallatin River watershed by the Gallatin River Task Force since 2006 and on the mainstem of the Gallatin River since 1889 by the U.S Geological Survey.