Big Hole River Watershed TMDL Implementation Evaluation - DRAFT

June 2026

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French Creek, Big Hole Watershed, MT
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A draft version of the document was sent to stakeholders for review and input. The involvement of all reviewers led to improvements in this document and is greatly appreciated.

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ACRONYMS AND UNITS OF MEASURE

°C	degrees Celsius
°F	degrees Fahrenheit
AFS	American Fisheries Society (Montana Chapter)
AU	Assessment Unit
BCD	Beaverhead Conservation District
BDNF	Beaverhead-Deerlodge National Forest
BLM	United States Bureau of Land Management
BMP	Best Management Practices
BHRF	Big Hole River Foundation
BHWC	Big Hole Watershed Committee
CCAA	Candidate Conservation Agreement with Assurances
cfs	cubic feet per second
CWA	Clean Water Act
DEQ	Department of Environmental Quality (Montana)
DLVCD	Deer Lodge Valley Conservation District
DMP	Drought Management Plan
DNRC	Department of Natural Resources and Conservation (Montana)
FFIP	Future Fisheries Improvement Program
FLBS-MMW	Flathead Lake Bio Station – Monitoring Montana Waters
FWP	Fish, Wildlife & Parks (Montana)
GGTU	George Grant Chapter of Trout Unlimited
HUC	hydrologic unit code
LRMP	Land and Resource Management Plan
MCA	Montana Code Annotated
mg/L	milligrams per liter
MIM	Multiple Indicator Monitoring
MTF	Montana Trout Foundation
NFWF	National Fish and Wildlife Foundation
NPSW	Nonpoint Source and Wetlands
NRCS	Natural Resources Conservation Service
NRDP	Natural Resource Damage Program (Montana)
PIBO	PacFish/InFish Biological Opinion
RA	Resource Area
RRA	Remediation and Restoration Areas
SMSP	Southwest Montana Sagebrush Partnership
TIE	TMDL Implementation Evaluation
TMDL	total maximum daily load
TNC	The Nature Conservancy
TPA	TMDL Planning Area
TSF	Trought and Salmon Foundation
TU	Trout Unlimited
USFS	United States Forest Service
USGS	United States Geological Survey
WCS	Wildlife Conservation Society
WET	Water & Environmental Technologies

WRP	Watershed Restoration Plan

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DOCUMENT SUMMARY

As required by Montana state law and the federal Clean Water Act (CWA), the Montana Department of Environmental Quality (DEQ) develops total maximum daily loads (TMDLs) for waterbodies impaired by a pollutant. TMDLs provide water quality goals and criteria for impaired waterbodies to attain water quality standards. In the 2006 list of impaired waters, or 303(d) list, DEQ determined that streams in the Big Hole River watershed did not support one or more of their aquatic life beneficial uses, cold-water fisheries, drinking water, primary contact recreation, and agriculture beneficial uses. In 2009, the "Upper and North Fork Big Hole River Planning Area TMDLs and Framework Water Quality Restoration Approach" and the "Middle and Lower Big Hole River Planning Area TMDLs and Water Quality Improvement Plan" documents were published and provide TMDLs for the impaired waterbodies listed in **Table DS-1** (Montana DEQ 2009a, 2009b). This TMDL implementation evaluation (TIE) document covers all TMDLs provided in the TMDL documents which include temperature, sediment, metals, and nutrients pollutant groups for the 3 segments of the Big Hole River mainstem and 45 of its tributaries.

The Big Hole River watershed (hydrologic unit code [HUC] 10020004) encompasses approximately 1,786,146 acres (2,791 square miles) in Beaverhead, Deer Lodge, Silver Bow, and Madison counties in southwest Montana. The mainstem of the Big Hole River flows through the towns of Wisdom, Fishtrap, Dewey, Divide, Melrose, and Glen, Montana. Land use in the watershed consists of agricultural operations, several small communities, silviculture, historical mining activities, and remediation of historical mining practices.

In watersheds with approved TMDL documents, DEQ periodically reviews the progress of restoration efforts, the progress toward meeting TMDL water quality goals, and documents the results in what is called a TIE document. This Big Hole TIE provides information as well as recommendations for potential next steps to address water quality impairments.

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Pollutant Group(s)	Non-pollutant(s)[1]
Middle and Lower Big Hole[3]	**Big Hole River**, Divide Creek to mouth (Jefferson River)[3]	MT41D001_010	Temperature	Temperature	N/A
	Big Hole River, Pintlar Creek to Divide Creek[3]	MT41D001_020	Temperature, Sediment, Copper, Lead	Temperature, Sediment, Metals	Alteration in stream-side or littoral vegetative covers[1a], Physical substrate habitat alterations[1a]
Upper and North Fork Big Hole[2]	**Big Hole River**, headwaters to Pintlar Creek[2]	MT41D001_030	Temperature, Sediment	Temperature, Sediment	Alteration in stream-side or littoral vegetative cover[1a], Flow regime modification[1b]
	Birch Creek, headwaters to National Forest Boundary[3]	MT41D002_090	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a], Physical substrate habitat alterations[1a]
	Birch Creek, National Forest Boundary to mouth (Big Hole River)[3]	MT41D002_100	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers, Physical substrate habitat alterations[1a], Other anthropogenic substrate alterations[1a]

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Pollutant Group(s)	Non-pollutant(s)[1]
	California Creek, headwaters to mouth (French Creek-Deep Creek)[3]	MT41D003_070	Sediment, Arsenic, Copper	Sediment, Metals	Turbidity[1a], Alteration in stream-side or littoral vegetative covers[1a], Other anthropogenic substrate alterations[1a], Physical substrate habitat alterations[1a]
	Camp Creek, headwaters to mouth (Big Hole River)[3]	MT41D002_020	Sediment, Total Nitrogen, Total Phosphorus	Sediment, Nutrients	Alteration in stream-side or littoral vegetative covers[1a]
	Corral Creek, headwaters to mouth (Deep Creek)[3]	MT41D003_130	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a], Physical substrate habitat alterations[1a]
	Deep Creek, headwaters to mouth (Big Hole River)[3]	MT41D003_040	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a]
	Delano Creek, headwaters to mouth (Jerry Creek)[3]	MT41D003_030	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a]

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Pollutant Group(s)	Non-pollutant(s)[1]
	Divide Creek, headwaters to mouth (Big Hole River)[3]	MT41D002_040	Temperature, Sediment, Total Nitrogen, Total Phosphorus	Temperature, Sediment, Nutrients	Alteration in stream-side or littoral vegetative covers[1a], Total Kjeldahl Nitrogen (TKN)[1c]
Upper and North Fork Big Hole[2]	**Doolittle Creek**, headwaters to mouth (Big Hole River)[2]	MT41D004_220	Sediment	Sediment	Alterations in stream-side or littoral vegetative covers[1a]
Middle and Lower Big Hole[3]	**Elkhorn Creek**, headwaters to mouth (Jacobson Creek)[3]	MT41D003_220	Sediment, Arsenic, Cadmium, Copper, Lead, Zinc	Sediment, Metals	N/A
	Fishtrap Creek, confluence of West & Middle Forks to mouth (Big Hole River)[3]	MT41D003_160	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a]
Upper and North Fork Big Hole[2]	**Fox Creek**, headwaters to mouth (Governor Creek)[2]	MT41D004_170	Sediment	Sediment	N/A

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Pollutant Group(s)	Non-pollutant(s)[1]
	Francis Creek, headwaters to mouth (Steel Creek)[2]	MT41D004_200	Sediment, Total Nitrogen, Total Phosphorus	Sediment, Nutrients	Alteration in stream-side or littoral vegetative covers[1a]
Middle and Lower Big Hole[3]	**French Creek**, headwaters to mouth (Deep Creek)[3]	MT41D003_050	Sediment, Arsenic, Copper	Sediment, Metals	N/A
	Gold Creek, headwaters to mouth (Wise River)[3]	MT41D003_230	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a]
Upper and North Fork Big Hole[2]	**Governor Creek**, headwaters to mouth (Warm Springs Creek)[2]	MT41D004_150	Sediment	Sediment	Physical substrate habitat alterations[1a], Other anthropogenic substrate alterations[1a]
Middle and Lower Big Hole[3]	**Grose Creek**, headwaters to mouth (Big Hole River)[3]	MT41D002_060	Sediment, Total Nitrogen, Total Phosphorus	Sediment, Nutrients	Alteration in stream-side or littoral vegetative covers[1a]
	Jerry Creek, headwaters to mouth (Big Hole River)[3]	MT41D003_020	Sediment, Copper	Sediment, Metals	Alteration in stream-side or littoral vegetative covers[1a], Physical substrate habitat alterations[1a]

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Pollutant Group(s)	Non-pollutant(s)[1]
Upper and North Fork Big Hole[2]	**Johnson Creek**, headwaters to mouth (North Fork Big Hole River)[2]	MT41D004_030	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a]
	Joseph Creek, headwaters to mouth (Trail Creek)[2]	MT41D004_090	Sediment	Sediment	Physical substrate habitat alterations[1a]
Middle and Lower Big Hole[3]	**Lost Creek**, headwaters to mouth (Lost Creek Canal/Ditch), T4S R9W S15[3]	MT41D002_180	Sediment, Arsenic, Total Nitrogen, Total Phosphorus	Sediment, Metals, Nutrients	Alteration in stream-side or littoral vegetative covers[1a]
Upper and North Fork Big Hole[2]	**McVey Creek**, headwaters to mouth (Big Hole River)[2]	MT41D004_210	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a]
	Miner Creek, headwaters to mouth (Big Hole River)[2]	MT41D004_140	Sediment	Sediment	N/A

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Pollutant Group(s)	Non-pollutant(s)[1]
Middle and Lower Big Hole[3]	**Moose Creek**, headwaters to mouth (Big Hole River at Maiden Rock)[3]	MT41D002_050	Sediment	Sediment	N/A
Upper and North Fork Big Hole[2]	**Mussigbrod Creek**, headwaters to mouth (North Fork Big Hole River)[2]	MT41D004_020	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a], Physical substrate habitat alterations[1a], Other anthropogenic substrate alterations[1a]
	North Fork Big Hole River, headwaters to mouth (Big Hole River)[2]	MT41D004_010	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a]
Middle and Lower Big Hole[3]	**Oregon Creek**, headwaters to mouth (California Creek-French Creek-Deep Creek)[3]	MT41D003_080	Sediment, Arsenic, Copper	Sediment, Metals	Alteration in stream-side or littoral vegetative covers[1a], Physical substrate habitat alterations[1a], Other anthropogenic substrate alterations[1a]

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Pollutant Group(s)	Non-pollutant(s)[1]
	Pattengail Creek, headwaters to mouth (Wise River)[3]	MT41D003_210	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a], Physical substrate habitat alterations[1a]
Upper and North Fork Big Hole[2]	**Pine Creek**, headwaters to mouth (Andrus Creek)[2]	MT41D004_160	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a]
Middle and Lower Big Hole[3]	**Rochester Creek**, headwaters to mouth (Big Hole River), T3S R6W S29[3]	MT41D002_160	Sediment, Arsenic, Copper, Lead, Mercury	Sediment, Metals	Physical substrate habitat alterations[1a]
Upper and North Fork Big Hole[2]	**Rock Creek**, headwaters to mouth (Big Hole River)[2]	MT41D004_120	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a], Physical substrate habitat alterations[1a]
	Ruby Creek, headwaters to mouth (North Fork Big Hole River)[2]	MT41D004_100	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a], Physical substrate habitat alterations[1a]

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Pollutant Group(s)	Non-pollutant(s)[1]
Middle and Lower Big Hole[3]	**Sawlog Creek**, headwaters to mouth (Big Hole River)[3]	MT41D004_230	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a]
	Sevenmile Creek, headwaters to mouth (Deep Creek)[3]	MT41D003_110	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a]
	Sixmile Creek, headwaters to mouth (California Creek)[3]	MT41D003_090	Sediment	Sediment	Physical substrate habitat alterations[1a]
	Soap Creek, headwaters to mouth (Big Hole River), T2S R9W S10[3]	MT41D002_140	Sediment, Total Nitrogen, Total Phosphorus	Sediment, Nutrients	Alteration in stream-side or littoral vegetative covers[1a]
Upper and North Fork Big Hole[2]	**Steel Creek**, headwaters to mouth (Big Hole River)[2]	MT41D004_190	Sediment, Total Nitrogen, Total Phosphorus	Sediment, Nutrients	Alteration in stream-side or littoral vegetative covers[1a], Physical substrate habitat alterations[1a], Other anthropogenic substrate alterations[1a]

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Pollutant Group(s)	Non-pollutant(s)[1]
	Swamp Creek, headwaters to mouth (Big Hole River)[2]	MT41D004_110	Sediment	Sediment	Alteration in stream-side or littoral vegetative covers[1a]
	Tie Creek, headwaters to mouth (North Fork Big Hole River)[2]	MT41D004_060	Sediment	Sediment	Physical substrate habitat alterations[1a]
	Trail Creek, headwaters to Joseph Creek[2]	MT41D004_070	Sediment	Sediment	Physical substrate habitat alterations[1a]
	Trail Creek, Joseph Creek to mouth (North Fork Big Hole River)[2]	MT41D004_080	Sediment	Sediment	Physical substrate habitat alterations[1a]
Middle and Lower Big Hole[3]	**Trapper Creek**, headwaters to mouth (Big Hole River)[3]	MT41D002_010	Sediment, Arsenic, Cadmium, Copper, Lead, Zinc	Sediment, Metals	Alteration in stream-side or littoral vegetative covers[1a], Physical substrate habitat alterations[1a]

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Pollutant Group(s)	Non-pollutant(s)[1]
	Wickiup Creek, headwaters to mouth (Camp Creek), T2S R8W S1[3]	MT41D002_120	Copper	Metals	N/A
	Wise River, headwaters to mouth (Big Hole River)[3]	MT41D003_200	Sediment, Cadmium, Copper, Lead	Sediment, Metals	Alteration in stream-side or littoral vegetative covers[1a], Physical substrate habitat alterations[1a]

[1] Indicates an impairment cause is a "non-pollutant" which has been addressed by a TMDL.
[1a]Addressed by sediment TMDL.
[1b]Addressed by temperature TMDL.
[1c]Addressed by total nitrogen TMDL.
[2] Upper and North Fork Big Hole River Planning Area TMDLs and Framework Water Quality Restoration Approach
[3] Middle and Lower Big Hole River Planning Area TMDLs and Water Quality Improvement Plan

Conservation groups and local, state, and federal agencies have implemented reasonable land, soil, and water conservation practices called for in the Upper and North Fork Big Hole River and Middle and Lower Big Hole River TMDL documents. These organizations have developed DEQ approved Watershed Restoration Plans, conducted watershed assessments, and pre-restoration planning and study activities; implemented riparian and channel restoration, irrigation improvement, and culvert-to-bridge conversion projects; and conducted water quality monitoring since TMDL publication. See **Table DS-2** for an estimate of activities that have occurred within the TMDL planning areas (TPAs).

Table DS-2. Activities summary for the Big Hole River watershed

Waterbodies/Segments with TMDLs Where:	Total[1]
Planning has occurred	47
Outreach and education have taken place	47
Monitoring has occurred	21
On-the-ground restoration work has occurred	23
No activity has taken place	0
Fish habitat/passage improvements have been made[2]	13
Additional impacts have been observed	0

[1]Due to the large amount of stakeholder involvement, project information provided, and its completeness, these totals reflect an *estimate* of what has been completed within the watershed. For an accurate reporting of activities that have been completed, readers should review all reports referenced in this document.

[2]While fish habitat/passage restoration work is important for the many fish populations in the Big Hole watershed, these projects do not directly impact water quality, nor the pollutants being evaluated in this TIE, so they have been tallied separately.

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1.0 PURPOSE OF A TMDL IMPLEMENTATION EVALUATION

In watersheds with approved TMDL documents, DEQ periodically reviews the progress of restoration efforts, the progress toward meeting TMDL water quality goals, and documents the results in what is called a TMDL implementation evaluation (TIE) document. TIEs provide specific recommendations for the waters subject to the TMDL that identify needed restoration projects, monitoring, or recommended reassessment.

This TIE is an evaluation of the progress toward meeting the water quality goals of the Upper and North Fork Big Hole River Planning Area and Framework Water Quality Restoration Approach and the Middle and Lower Big Hole Planning Area TMDLs and Water Quality Improvement Plan, as well as an evaluation of the success of on-the-ground efforts to address the water quality impairments and DEQ's recommendations for potential next steps for addressing those impairments (DEQ 2009a, DEQ 2009b).

The purpose of a TIE is to document the following:

- Progress made toward restoring water quality to the applicable water quality standards.
- Status of the TMDL's recommended reasonable land, soil, and water conservation practices.
- Suggest additional monitoring to help evaluate progress toward attainment of beneficial uses and/or establish existing water quality conditions.
- Constructive feedback to those pursuing water quality improvements:
    - Acknowledge water quality restoration activities that have or are taking place
    - Identify water quality success stories in Montana
    - Provide additional guidance or suggestions for best management practices (BMP) implementation and extent of activities necessary to meet one or more TMDLs
- Suggest TMDL document update requirements and/or other TMDL document improvement recommendations, if necessary.

Conclusions of a TIE should be one of the three specific conclusions identified in §75-5-703(9), MCA:

a. The implementation of a new or improved phase of voluntary reasonable land, soil, and water conservation practices is necessary.
b. Water quality is improving but a specified time is needed for compliance with water quality standards.
c. Revisions to the TMDL are necessary to achieve applicable water quality standards.

2.0 DESCRIPTION OF THE BIG HOLE RIVER WATERSHED

The Big Hole River watershed (HUC 10020004) encompasses approximately 1,786,146 acres (2,791 square miles) in Beaverhead, Deer Lodge, Silver Bow, and Madison counties in southwest Montana. The watershed is comprised of four TMDL Planning Areas (TPAs): the North Fork Big Hole, Upper Big Hole, Middle Big Hole, and Lower Big Hole, **Figure D-1**. The mainstem of the Big Hole River flows through the towns of Wisdom, Fishtrap, Dewey, Divide, Melrose, and Glen, Montana. Land use in the watershed consists of agricultural operations, several small communities, silviculture, historical mining activities, and remediation of historical mining practices. Land ownership consists of federal, private, and state lands. Approximately 58.6% of the land is managed by the Beaverhead-Deerlodge National Forest (BDNF), 26.3% is privately owned, 9.4% is managed by the Bureau of Land Management (BLM), 3.4% is managed by the state of Montana, and 2.2% is managed by Montana Fish, Wildlife & Parks (FWP). Land

cover in the northern, western, and central extent is primarily conifer-dominated forest and woodland (xeric-mesic) with some mining and resource extraction. The dominant land cover in the eastern extent is sagebrush steppe with some agriculture lands. The northern and western extents are separated from the central extent by a mix of agriculture, wet meadow, and sagebrush steppe.

3.0 IMPAIRMENTS ADDRESSED IN THIS DOCUMENT

A total of 91 TMDLs were written addressing 93 pollutant impairments and 62 non pollutant impairments for 47 waterbody segments in the Big Hole watershed. The main pollutant sources include:

- Sedimentation from upland erosion, unpaved roads, road traction sanding, and streambank erosion resulting in altering aquatic insect communities, reducing fish spawning success, filling pool habitat, and increasing levels of turbidity, **Figure D-1**.
- Nutrients from accelerated bank erosion from livestock, reduced riparian filtering from livestock grazing and browsing, fertilizer applications, and areas of upland vegetation reduction from livestock grazing resulting in excess algae growth**, Figure D-2**.
- Metals from historic mining activities, including abandoned mines and fallout from the Anaconda Smelter, resulting in potentially toxic, carcinogenic, or bioconcentrating effects on biota and chronic and acute effects in animals and humans, **Figure D-3**.
- Thermal impacts from sparse riparian cover, channel widening, and reduced flow due to irrigation withdrawals causing stress to fish during warm summer days, **Figure D-4**.

TMDLs have been developed for the Big Hole River watershed for various pollutant-waterbody combinations. The impairments, pollutant sources, and the associated TMDLs are listed in **Table 3-1**. As each pollutant is linked to a source(s), each significant source may need to be addressed before waterbodies can achieve water quality standards. Some sources will be left unaddressed due to complicating factors such as land ownership, lack of funding, lack of interest, etc.

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Impairments Addressed by TMDL(s)	Sources
Middle and Lower Big Hole[3]	**Big Hole River**, Divide Creek to mouth (Jefferson River)[3]	MT41D001_010	Temperature	Thermal Impacts	Lack of riparian vegetation shade; Inefficient irrigation during summertime; Wide stream channels
	Big Hole River, Pintlar Creek to Divide Creek[3]	MT41D001_020	Temperature	Thermal Impacts	Reduced stream bank canopy; Inefficient irrigation during summertime; Wide stream channels
			Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing; Unpaved roads
			Copper, Lead	Cu, Pb	Abandoned mines; Placer mining; Atmospheric deposition from Anaconda smelter via watersheds in the French Creek drainage
Upper and North Fork Big Hole[2]	**Big Hole River**, headwaters to Pintlar Creek[2]	MT41D001_030	Temperature	Thermal Impacts, Flow Alterations[1]	Lack of riparian vegetation shade; Lower summertime stream flow; Overly wide and less complex stream channel
			Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment; Unpaved roads
Middle and Lower Big Hole[3]	**Birch Creek**, headwaters to National Forest Boundary[3]	MT41D002_090	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Unpaved roads

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Impairments Addressed by TMDL(s)	Sources
	Birch Creek, National Forest Boundary to mouth (Big Hole River)[3]	MT41D002_100	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
	California Creek, headwaters to mouth (French Creek-Deep Creek)[3]	MT41D003_070	Sediment	Sedimentation/siltation, Habitat Alterations[1], Other (Turbidity)[1]	Upland sediment from grazing; Upland sediment from Anaconda smelter fallout; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
			Arsenic, Copper	As, Cu	Placer mining; Atmospheric deposition from Anaconda smelter
	Camp Creek, headwaters to mouth (Big Hole River)[3]	MT41D002_020	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
			Total Nitrogen, Total Phosphorus	TN, TP	Rangeland grazing; Domestic animal waste; Upland forest areas; Bank erosion; Irrigated hay and pastureland
	Corral Creek, headwaters to mouth (Deep Creek)[3]	MT41D003_130	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
	Deep Creek, headwaters to mouth (Big Hole River)[3]	MT41D003_040	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Impairments Addressed by TMDL(s)	Sources
	Delano Creek, headwaters to mouth (Jerry Creek)[3]	MT41D003_030	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
	Divide Creek, headwaters to mouth (Big Hole River)[3]	MT41D002_040	Temperature	Thermal Impacts	Lack of riparian vegetation shade
			Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing; Unpaved roads
			Total Nitrogen, Total Phosphorus	TN, TP	Rangeland grazing; Domestic animal waste; Upland forest areas; Bank erosion; Irrigated hay and pastureland
Upper and North Fork Big Hole[2]	**Doolittle Creek**, headwaters to mouth (Big Hole River)[2]	MT41D004_220	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing
Middle and Lower Big Hole[3]	**Elkhorn Creek**, headwaters to mouth (Jacobson Creek)[3]	MT41D003_220	Sediment	Sedimentation/siltation	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
			Arsenic, Cadmium, Copper, Lead, Zinc	As, Cd, Cu, Pb, Zn	Abandoned mines
	Fishtrap Creek, confluence of West & Middle Forks to mouth (Big Hole River)[3]	MT41D003_160	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Impairments Addressed by TMDL(s)	Sources
Upper and North Fork Big Hole[2]	**Fox Creek**, headwaters to mouth (Governor Creek)[2]	MT41D004_170	Sediment	Sedimentation/siltation	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing
	Francis Creek, headwaters to mouth (Steel Creek)[2]	MT41D004_200	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing; Unpaved roads
			Total Nitrogen, Total Phosphorus	TN, TP	Upland forest areas; Upland livestock grazing; Eroding banks; Irrigated hay and pastureland
Middle and Lower Big Hole[3]	**French Creek**, headwaters to mouth (Deep Creek)[3]	MT41D003_050	Sediment	Sedimentation/siltation	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
			Arsenic, Copper	As, Cu	Abandoned mines; Placer mining; Atmospheric deposition from Anaconda smelter
	Gold Creek, headwaters to mouth (Wise River)[3]	MT41D003_230	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition
Upper and North Fork Big Hole[2]	**Governor Creek**, headwaters to mouth (Warm Springs Creek)[2]	MT41D004_150	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing; Unpaved roads
Middle and Lower Big Hole[3]	**Grose Creek**, headwaters to mouth (Big Hole River)[3]	MT41D002_060	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing; Unpaved roads

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Impairments Addressed by TMDL(s)	Sources
			Total Nitrogen, Total Phosphorus	TN, TP	Rangeland grazing; Domestic animal waste; Upland forest areas; Bank erosion; Irrigated hay and pastureland
	Jerry Creek, headwaters to mouth (Big Hole River)[3]	MT41D003_020	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
			Copper	Cu	Abandoned mines
Upper and North Fork Big Hole[2]	**Johnson Creek**, headwaters to mouth (North Fork Big Hole River)[2]	MT41D004_030	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing
	Joseph Creek, headwaters to mouth (Trail Creek)[2]	MT41D004_090	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition
Middle and Lower Big Hole[3]	**Lost Creek**, headwaters to mouth (Lost Creek Canal/Ditch), T4S R9W S15[3]	MT41D002_180	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
			Total Nitrogen, Total Phosphorus	TN, TP	Rangeland grazing; Domestic animal waste; Upland forest areas; Bank erosion; Irrigated hay and pastureland
			Arsenic	As	Abandoned mines

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Impairments Addressed by TMDL(s)	Sources
Upper and North Fork Big Hole[2]	**McVey Creek**, headwaters to mouth (Big Hole River)[2]	MT41D004_210	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing
	Miner Creek, headwaters to mouth (Big Hole River)[2]	MT41D004_140	Sediment	Sedimentation/siltation	Upland sediment from grazing
Middle and Lower Big Hole[3]	**Moose Creek**, headwaters to mouth (Big Hole River at Maiden Rock)[3]	MT41D002_050	Sediment	Sedimentation/siltation	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
Upper and North Fork Big Hole[2]	**Mussigbrod Creek**, headwaters to mouth (North Fork Big Hole River)[2]	MT41D004_020	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing
	North Fork Big Hole River, headwaters to mouth (Big Hole River)[2]	MT41D004_010	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing; Unpaved roads
Middle and Lower Big Hole[3]	**Oregon Creek**, headwaters to mouth (California Creek-French Creek-Deep Creek)[3]	MT41D003_080	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
			Arsenic, Copper	As, Cu	Placer mining; Atmospheric deposition from Anaconda smelter

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Impairments Addressed by TMDL(s)	Sources
	Pattengail Creek, headwaters to mouth (Wise River)[3]	MT41D003_210	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
Upper and North Fork Big Hole[2]	**Pine Creek**, headwaters to mouth (Andrus Creek)[2]	MT41D004_160	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing
Middle and Lower Big Hole[3]	**Rochester Creek**, headwaters to mouth (Big Hole River), T3S R6W S29[3]	MT41D002_160	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
			Arsenic, Copper, Lead, Mercury	As, Cu, Pb, Hg	Abandoned mines
Upper and North Fork Big Hole[2]	**Rock Creek**, headwaters to mouth (Big Hole River)[2]	MT41D004_120	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing; Unpaved roads
	Ruby Creek, headwaters to mouth (North Fork Big Hole River)[2]	MT41D004_100	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing
Middle and Lower Big Hole[3]	**Sawlog Creek**, headwaters to mouth (Big Hole River)[3]	MT41D004_230	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Impairments Addressed by TMDL(s)	Sources
	Sevenmile Creek, headwaters to mouth (Deep Creek)[3]	MT41D003_110	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
	Sixmile Creek, headwaters to mouth (California Creek)[3]	MT41D003_090	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
	Soap Creek, headwaters to mouth (Big Hole River), T2S R9W S10[3]	MT41D002_140	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
			Total Nitrogen, Total Phosphorus	TN, TP	Rangeland grazing; Domestic animal waste; Upland forest areas; Bank erosion; Irrigated hay and pastureland
Upper and North Fork Big Hole[2]	**Steel Creek**, headwaters to mouth (Big Hole River)[2]	MT41D004_190	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing
			Total Nitrogen, Total Phosphorus	TN, TP	Upland forest areas; Upland livestock grazing; Eroding banks; Irrigated hay and pastureland
	Swamp Creek, headwaters to mouth (Big Hole River)[2]	MT41D004_110	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Impairments Addressed by TMDL(s)	Sources
	Tie Creek, headwaters to mouth (North Fork Big Hole River)[2]	MT41D004_060	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing
	Trail Creek, headwaters to Joseph Creek[2]	MT41D004_070	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition
	Trail Creek, Joseph Creek to mouth (North Fork Big Hole River)[2]	MT41D004_080	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Eroding banks needing sustainable riparian zone vegetative condition; Upland sediment from grazing; Unpaved roads
Middle and Lower Big Hole[3]	**Trapper Creek**, headwaters to mouth (Big Hole River)[3]	MT41D002_010	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads
			Arsenic, Cadmium, Copper, Lead, Zinc	As, Cd, Cu, Pb, Zn	Abandoned mines
	Wickiup Creek, headwaters to mouth (Camp Creek), T2S R8W S1[3]	MT41D002_120	Copper	Cu	Abandoned mines
	Wise River, headwaters to mouth (Big Hole River)[3]	MT41D003_200	Sediment	Sedimentation/siltation, Habitat Alterations[1]	Upland sediment from grazing; Eroding banks needing sustainable riparian zone vegetative condition; Unpaved roads

TMDL Document	Waterbody	Assessment Unit ID	TMDL(s)	Impairments Addressed by TMDL(s)	Sources
			Cadmium, Copper, Lead	Cd, Cu, Pb	Abandoned mines

[1] Indicates an impairment cause is a "non-pollutant" which has been addressed by a TMDL.
[2]Upper and North Fork Big Hole River Planning Area TMDLs and Framework Water Quality Restoration Approach
[3]Middle and Lower Big Hole River Planning Area TMDLs and Water Quality Improvement Plan

4.0 TMDL DOCUMENT-RECOMMENDED ACTIVITIES

The Upper & North Fork Big Hole River and Middle & Lower Big Hole River TMDL documents outline some of the actions that may be necessary to reduce pollution to acceptable levels (see Section 10.3 of the Upper & North Fork TMDL document; Section 9.4 and 10.3 of the Middle & Lower TMDL document). Specific restoration and monitoring activities recommended within the Upper & North Fork Big Hole River and Middle & Lower Big Hole River TMDL documents are summarized in **Table 4-1**. The documents note that streamside riparian restoration and long-term riparian zone management are key to sediment, thermal, and nutrient load reductions in the Big Hole watershed.

Table 4-1. Upper & North Fork Big Hole River and Middle & Lower Big Hole TMDLs recommended restoration and monitoring activities

TMDL Pollutant Group	Recommended Restoration Activity	Recommended Monitoring Activity
Temperature	• Achievement of stream channel and streamside vegetation conditions equaling reference area conditions. • Improve streamside grazing management to promote native shrub growth. • Irrigation efficiency projects and stock water management to promote instream flows during summer months.	• In-stream temperature, percent shade cover, stream bank vegetation measures, streamflow, and irrigation water use monitoring
Sediment	• Streamside riparian vegetation and channel restoration. • Long-term riparian zone vegetation management. • Livestock grazing management, vegetation planting, and livestock fencing in riparian zones. • Unpaved road erosion control near streams.	*Monitoring of Grazing BMPs* • Seasonal monitoring during grazing season using riparian grazing use indicators (e.g., streambank alteration, riparian browse, and riparian stubble height at bank and "key area") • Photo point monitoring of stream conditions • Vegetation surveys and greenline method • Channel cross-section survey with pebble count and sediment core samples • Aquatic macroinvertebrate sampling • Pool quality (i.e., spawning habitat) • EMAP/Riparian assessment *Monitoring of Road BMPs* • Rapid inventory to document improvements and condition • Fish passage and culvert condition inventory • Monitor streambed fine sediment and sediment routing to stream (silt traps) below specific problem areas
Metals	• Revegetation and limited shrub planting in affected soils. • Prevent waste rock and tailings materials/sediment from migrating into adjacent surface waters.	• Monitoring for heavy metals, pH, and TSS in water column at high and low flow above and below mine sites. Monitoring should include

Table 4-1. Upper & North Fork Big Hole River and Middle & Lower Big Hole TMDLs recommended restoration and monitoring activities

TMDL Pollutant Group	Recommended Restoration Activity	Recommended Monitoring Activity
	• Reduce or eliminate runoff and discharges of sediment and/or heavy metals contamination to adjacent surface and ground waters. • Identify, prioritize, and select response and restoration actions based on a comprehensive source assessment and streamlined risk analysis of mine sites.	periphyton and macroinvertebrates at low flow on a regular interval. • Greenline survey, including bank stability, shrub regeneration, and bare ground every 3 years.
Nutrients	• Improve streamside grazing management practices to promote native shrub growth. • Develop off-stream watering for livestock. • Improve management of irrigation systems and fertilizer applications to reduce nutrient inputs to surface and ground water. • Incorporate streamside vegetation buffers to irrigated croplands and confined animal feeding areas. • Reduction of sediment delivery from eroding streambanks and unpaved roads paralleling streams.	*Monitoring of Grazing BMPs* • Seasonal monitoring during grazing season using riparian grazing use indicators (e.g., streambank alteration, riparian browse, and riparian stubble height at bank and "key area") • Photo point monitoring of stream conditions • Vegetation surveys and greenline method • Channel cross-section survey with pebble count and sediment core samples • Aquatic macroinvertebrate sampling • Pool quality (i.e., spawning habitat) • EMAP/Riparian assessment *Monitoring of Road BMPs* • Rapid inventory to document improvements and condition • Fish passage and culvert condition inventory • Monitor streambed fine sediment and sediment routing to stream (silt traps) below specific problem areas

5.0 INDICATORS OF PROGRESS

Addressing water quality impairments requires planning, outreach and education, and on-the-ground projects, guided by monitoring as identified in the TMDL document. In preparing the Big Hole TIE, DEQ staff reached out to a wide variety of local, state, and federal entities known to be involved in these efforts. From these contacts, DEQ compiled indicators of progress towards achieving Upper & North Fork Big Hole River and Middle & Lower Big Hole River TMDL targets which generally fall into one of three major categories:

- Planning
- TMDL Implementation/restoration
- Monitoring

The Big Hole River watershed has an extensive history of grassroots efforts to protect and restore water quality in the mainstem Big Hole River and its tributaries. This section provides an overview of activities that have occurred since both Big Hole TMDL documents were published in 2009. Many projects have been funded by multiple sources over multiple funding years which made it difficult to determine a definitive count of activities. It is important to also note, however, that these indicators did not account for the many decisions that watershed residents have made on their own, without public recognition, to implement practices that reduce temperature, sediment, nutrient, and metals pollution. An activities summary for the Big Hole River watershed is provided in **Table 5-1** below. The remainder of this document section is organized by the three indicators of progress categories for the Big Hole River watershed.

Table 5-1. Activities summary for the Big Hole River watershed

Waterbodies/Segments with TMDLs Where:	Total[1]
Planning has occurred	47
Outreach and education have taken place	47
Monitoring has occurred	21
On-the-ground restoration work has occurred	23
No activity has taken place	0
Fish habitat/passage improvements have been made[2]	13
Additional impacts have been observed	0

[1]Due to the large amount of stakeholder involvement, project information provided, and its completeness, these totals reflect an *estimate* of what has been completed within the watershed. For an accurate reporting of activities that have been completed, readers should review all reports referenced in this document.
[2]While fish habitat/passage restoration work is important for the many fish populations in the Big Hole watershed, these projects do not directly impact water quality, nor the pollutants being evaluated in this TIE, so they have been tallied separately.

5.1 PLANNING PROGRESS

There are many plans and programs in place that address water quality improvements in the Big Hole River watershed and TMDL planning areas. It is important to note that planning efforts in the Big Hole TMDL planning areas were initiated prior to publication of the TMDL documents in 2009 to address

drought conditions and cold-water fisheries concerns. These efforts include formation of the Big Hole Watershed Committee (BHWC) in 1995 and the Big Hole River Foundation (Save Wild Trout as of 2025) in 1988, development of the Big Hole River Drought Management Plan in 1997 by Montana Fish, Wildlife & Parks, Montana Department of Natural Resources and Conservation, and the United States Fish and Wildlife Service – Montana Partners for Fish and Wildlife (BHWC 2024), implementation of the Statewide Fisheries Management Plan developed by Montana Fish, Wildlife & Parks in 2013 (FWP 2023b), the implementation of the Candidate Conservation Agreement with Assurances in 2006 for the protection of Arctic Grayling, and the Future Fisheries Improvement Program enacted in 1995 by FWP. All of these planning efforts will be further discussed in the subsections below.

5.1.1 Big Hole Watershed Committee Planning Efforts

The BHWC is a watershed group dedicated to the conservation of the Big Hole River and surrounding watershed that fosters sustainability through education, management, and restoration. The BHWC manages multiple plans for water quality improvement in the Big Hole River watershed.

One type of these plans is known as a Watershed Restoration Plan (WRP). A WRP is a document that identifies opportunities throughout a watershed to reach management objectives and obtain improved water quality for the watershed. Watershed Restoration Plans can help communities identify its natural resource management goals, and will focus on streams that have been identified by DEQ as impaired or those that can be protected (Kunard 2017).

Plans include:

- Big Hole River, Montana Watershed Restoration Plan, Part I: Upper & North Fork Big Hole Watershed (BHWC 2012). Accepted by DEQ December 2012.
- Big Hole River, Montana Watershed Restoration Plan, Part II: Middle & Lower Big Hole Watershed (BHWC 2013). Accepted by DEQ September 2013.
- Big Hole River Drought Management Plan (BHWC 2024). Latest version published in 2024, first developed in 1997.
- Big Hole Watershed Drought Resilience Plan (BHWC 2019). Published in 2019.

The BHWC received a WaterSMART grant in 2024 through the Bureau of Reclamation Cooperative Watershed Management Program to update their watershed restoration plan. The BHWC will be focusing on the 13 HUC-10 watersheds and combining the Big Hole River, Montana Watershed Restoration Plans Part I and Part II as part of this effort.

The BHWC in conjunction with FWP has also undertaken numerous resource management/planning efforts throughout the Big Hole watershed. Many of these efforts are related to drought management, water quantity, and fish habitat and passage.

5.1.2 Montana Fish, Wildlife & Parks Planning Efforts

Montana FWP manages two programs that impact the Big Hole River watershed and implement projects that overlap with TMDL recommendations:

- The Future Fisheries Improvement Program (FFIP) supports the Statewide Fisheries Management Plan by providing grants for the “enhancement of spawning streams and other habitat, and to improve the natural reproduction and growth of wild fish populations.” Projects funded by FFIP must accomplish one or more goals of the program for funding and include effectiveness monitoring requirements (FWP 2022).

- The Candidate Conservation Agreement with Assurances is an agreement between the U.S. Fish and Wildlife Service and FWP for the protection of Arctic Grayling (*Thymallus arcticus*) in the Missouri River Basin upstream of Great Falls, MT (FWP 2023a). The agreements are site-specific and provide for the development of conservation strategies on private land, including monitoring plans. Landowners located along the Big Hole River headwaters to just upstream of Dickie Bridge are eligible to enroll.

5.1.3 Big Hole River Foundation (Save Wild Trout) Planning Efforts

The Big Hole River Foundation (BHRF), founded in 1988, is a science-based organization that works to protect the Big Hole River watershed through water quality monitoring, education outreach, and advocacy. Their mission is to protect, conserve, and enhance the free-flowing Big Hole River and its unique culture, fisheries, and wildlife. In 2025, the Big Hole River Foundation became Save Wild Trout.

The BHRF established a long-term water quality monitoring program in 2020. They are part of DEQ's Volunteer Monitoring Lab Analysis Support Program and are working to evaluate current nutrient and sediment conditions throughout the Big Hole watershed and develop a baseline for future water quality work. They have a DEQ approved sampling and analysis plan for their water quality monitoring program that covers the Big Hole River, Deep Creek, Wise River, and North Fork Big Hole River (BHRF 2024).

5.1.4 United States Forest Service – Beaverhead-Deerlodge National Forest Planning Efforts

The United States Forest Service (USFS) Beaverhead-Deerlodge National Forest (BDNF) periodically revises the Beaverhead-Deerlodge National Forest Land and Resource Management Plan (LRMP) (USFS 2009b) which includes actions for the protection and improvement of water quality in the Big Hole River watershed and identified priority watersheds. The LRMP was first published in 1986 and the latest revision was published in 2009. The BDNF has published multiple watershed assessments in support of the LRMP findings that serve to guide restoration projects in the watershed. Watershed assessments are produced at the (third-code HUC) HUC 6 scale and publications of relevance to this TIE are the Seymour, Sullivan, and Deep Creeks Watershed Assessment (USFS 2012), Fleecer Mountains Watershed Assessment (USFS 2009a), and Birch Creek, Willow Creek, and Lost Creek Watershed Assessment (USFS 2008).

The USFS also has numerous projects planned for 2025, 2026, and 2027, as described in **Table 5-2**.

Table 5-2. USFS planned projects in the Big Hole watershed

Year Planned	Location	Project Type
2025	Springs that feed Van Houten Lake	Riparian fencing
	Saginaw Creek	Beaver dam analog installation
	Englebaugh Creek	
	Tributaries to Governor Creek	
	Trail Creek	
	Pintler Creek in Pintler Meadows	Low tech stream restoration
	Doolittle Creek	Pipe replacement
	Pintler Creek to Tenmile Creek	Road decommissioning

Table 5-2. USFS planned projects in the Big Hole watershed

Year Planned	Location	Project Type
	Grouse Creek	Best management practice work for fire scars
	Moose Creek drainage	Large scale beaver dam analog projects
	Cherry Creek	Trail restoration
2026	Skinner Meadows	Road removal
	Dark Horse Creek	Replace road crossing
	Ruby Creek	Bridge replacement
2027	Skinner Meadows	Move road

5.1.5 Bureau of Land Management – Dillon and Butte Field Offices Planning Efforts

The Bureau of Land Management (BLM) Dillon and Butte Field Offices conduct watershed assessments for BLM holdings in the Big Hole River watershed and provide recommendations for improvement and monitoring plans in alignment with TMDL recommendations. These assessments evaluate land for conformance to rangeland health standards and document opportunities for more efficient administration and management of BLM lands. The Dillon Field Office has published the Upper Big Hole Watershed Assessment (BLM 2009), East Pioneers Watershed Assessment (BLM 2019a), Beaverhead West Watershed Assessment (BLM 2007), Rochester Watershed Environmental Assessment (BLM 2019b), and the Sage Creek Watershed Environmental Assessment (BLM 2016). The Butte Field Office also develops more site-specific assessments, Land Health Evaluation Reports, which are focused on specific BLM allotments. Land Health Evaluation Reports have been published for the following allotments that have TMDLs: Deep Creek, Jerry Creek, Moose Creek AMP (Big Hole River), Moose Creek non-AMP (Big Hole River), Charcoal Mountain (Big Hole River), Dickie (Big Hole River), and East Pioneer (Birch, Willow, and Lost Creeks) (BHWC 2013).

5.2 IMPLEMENTATION/RESTORATION PROGRESS

Below is a summary of the significant implementation and restoration activities that have occurred since publication of the TMDLs in 2009. Due to numerous entities involved in single projects, projects that span funding cycles and sources, and differing project names across entities, it was difficult to get an accurate count of individual projects. In some cases, multiple projects have been grouped as single projects as the available information indicates they may be related or can be generalized for simplicity.

5.2.1 Big Hole Watershed Committee Projects

The BHWC and partners have implemented several large restoration projects in the Big Hole River watershed to address sediment, temperature, and metal TMDLs:

- Elkhorn Creek, Mine, and Mill reclamation involving BHWC, Natural Resources Conservation Service (NRCS), DEQ, USFS, Montana Department of Natural Resources and Conservation (DNRC), Beaverhead Conservation District, Bureau of Reclamation, Flathead Lake Biological Station – Monitoring Montana Waters, and FWP
- Placer mining reclamation activities on French Creek-French Gulch-Moose Creek, California Creek, Oregon Creek implementing channel restoration and revegetation. These were extensive projects involving BHWC, NRCS, DEQ, DNRC, George Grant Chapter of Trout Unlimited, Trout

Unlimited, FWP, Deer Lodge Valley Conservation District, Wildlife Conservation Society, Patagonia World Trout Initiative, Montana Trout Foundation, American Fisheries Society Montana Chapter, and Natural Resource Damage Program.

- Eastern Pioneers low-tech project-based restoration on Trapper and Lost Creeks, Browns Gulch involving BHWC, The Nature Conservancy, Southwest Montana Sagebrush Partnership (SMSP), National Fish and Wildlife Foundation, BLM, and Youth Employment Program - Dillon
- Sage Springs wetland restoration involving BHWC, SMSP, FWP, Trout and Salmon Foundation and private landowners

BHWC has also completed numerous smaller projects involving streambank/sedimentation, wetlands/mesic restoration, irrigation and stockwater, and fish passage projects.

5.2.3 United States Forest Service – Beaverhead-Deerlodge National Forest Projects

The USFS has completed five projects related to road obliteration, closure, and decommissioning in restoration key watersheds on Greenhorn Creek, Cottonwood Creek, Middle Fork Rock Creek, and Warm Springs Creek. Of these, Rock Creek and Warm Springs Creek are the only ones impaired for sediment. For a more detailed list of work performed in these restoration key watersheds see the 2021 Biennial Monitoring Evaluation Report for the Beaverhead-Deerlodge National Forest, Table 17 (USFS, 2021).

5.2.2 Montana Fish, Wildlife & Parks Projects

In 2020, the French Creek Streambank Restoration Project was completed by FWP within the Mount Haggin Wildlife Management Area. The project restored 21 streambanks with excessive lateral erosion. This project was designed to enhance the aquatic habitat for Arctic grayling and Westslope cutthroat trout and facilitate the expansion of wildlife riparian habitat.

There has also been an abundance of restoration projects implemented through the Future Fisheries Improvement Program (FFIP) and Candidate Conservation Agreement with Assurances (CCAA) programs. These projects primarily address temperature and sediment TMDLs as they are geared towards protection of cold-water fisheries and include riparian restoration and fencing, channel restoration, irrigation efficiencies, and culvert to bridge conversion projects. **Table 5-3** provides the approximate count of these projects implemented since 2009 for the identified waterbodies.

Table 5-3. Summary of FFIP and CCAA projects.

Waterbody & AU ID	Project Type	FFIP Project Count[1,2]	CCAA Project Count[1,2]
Big Hole River, Divide Creek to mouth (Jefferson River) MT41D001_010	Riparian Fencing	1	ND
	Channel Restoration	(1)	
	Irrigation Efficiencies	1	
	Off-Channel Stockwater		
	Restoration		
Big Hole River, Pintlar Creek to Divide Creek MT41D001_020	Riparian Fencing	(1)	(2)
	Channel Restoration	ND	(1)
	Culvert to Bridge		
	Irrigation Efficiencies		(9)
	Off-Channel Stockwater		(1)

Table 5-3. Summary of FFIP and CCAA projects.

Waterbody & AU ID	Project Type	FFIP Project Count[1,2]	CCAA Project Count[1,2]
	Riparian Restoration	1	ND
Big Hole River, headwaters to Pintlar Creek MT41D001_030	Riparian Restoration	2	
	Irrigation Efficiencies	1 (2)	22
	Channel Restoration	ND	22 (1)
	Riparian Fencing	2	13 (3)
	Off-Channel Stockwater	1	15 (3)
	Culvert to Bridge	ND	2 (3)
	Streambank Restoration	1	ND
	Flow Enhancement	2	
Moose Creek, headwaters to mouth (Big Hole River at Maiden Rock) MT41D002_050	Riparian Fencing	2	ND
Deep Creek, headwaters to mouth (Big Hole River) MT41D003_040	Riparian Fencing	1	1 (1)
	Irrigation Efficiencies	ND	1
	Off-Channel Stockwater	2	
	Channel Restoration	1	ND
French Creek, headwaters to mouth (Deep Creek) MT41D003_050	Riparian Fencing		1
	Riparian Restoration	2	ND
	Channel Restoration	5	1
	Off-Channel Stockwater	ND	
Fishtrap Creek, confluence of West & Middle Forks to mouth (Big Hole River) MT41D003_160	Irrigation Efficiencies		6 (4)
	Riparian Fencing		(3)
	Off-Channel Stockwater	1	ND
	Pool Habitat Enhancement		
Fishtrap Creek, confluence of West & Middle Forks to mouth (Big Hole River) MT41D003_160 **North Fork Big Hole River**, headwaters to mouth (Big Hole River) MT41D004_010	Culvert to Bridge	ND	1
	Irrigation Efficiencies		1 (1)
	Channel Restoration		2 (2)
Fishtrap Creek, confluence of West &	Riparian Fencing	ND	2 (1)
	Off-Channel Stockwater		(1)
	Irrigation Efficiencies		1

Table 5-3. Summary of FFIP and CCAA projects.

Waterbody & AU ID	Project Type	FFIP Project Count[1,2]	CCAA Project Count[1,2]
Middle Forks to mouth (Big Hole River) MT41D003_160 **North Fork Big Hole River**, headwaters to mouth (Big Hole River) MT41D004_010 **Ruby Creek**, headwaters to mouth (North Fork Big Hole River) MT41D004_100 **Swamp Creek**, headwaters to mouth (Big Hole River) MT41D004_110	Off-Channel Stockwater		1
Ruby Creek, headwaters to mouth (North Fork Big Hole River) MT41D004_100	Irrigation Efficiencies	1	12
	Riparian Fencing	ND	4
North Fork Big Hole River, headwaters to mouth (Big Hole River) MT41D004_010 **Swamp Creek**, headwaters to mouth (Big Hole River) MT41D004_110 **Ruby Creek**, headwaters to mouth (North Fork Big Hole River) MT41D004_100 **Rock Creek**, headwaters to mouth (Big Hole River) MT41Doo4_120 **Miner Creek**, headwaters to mouth (Big Hole River) MT41D004_140	Off-Channel Stockwater		9
	Culvert to Bridge		4
	Channel Restoration	1	2
	Riparian Fencing	ND	4
	Irrigation Efficiencies	ND	15

Table 5-3. Summary of FFIP and CCAA projects.

Waterbody & AU ID	Project Type	FFIP Project Count[1,2]	CCAA Project Count[1,2]
Ruby Creek, headwaters to mouth (North Fork Big Hole River) MT41D004_100 **Rock Creek**, headwaters to mouth (Big Hole River) MT41D004_120	Off-Channel Stockwater		6
Swamp Creek, headwaters to mouth (Big Hole River) MT41D004_110 **Miner Creek**, headwaters to mouth (Big Hole River) MT41D004_140 **Rock Creek**, headwaters to mouth (Big Hole River) MT41D004_120	Riparian Fencing	ND	2 (3)
	Irrigation Efficiencies		5
	Channel Restoration		2
	Off-Channel Stockwater		1 (1)
Rock Creek, headwaters to mouth (Big Hole River) MT41D004_120 **Governor Creek**, headwaters to mouth (Warm Springs Creek) MT41D004_150 **Warm Springs Creek**, headwaters to mouth (Big Hole River) MT41D004_180	Culvert to Bridge	ND	2 (4)
	Riparian Fencing		1 (2)
	Culvert to Bridge		2
	Riparian Fencing		4
Governor Creek, headwaters to mouth (Warm Springs Creek) MT41D004_150	Irrigation Efficiencies	ND	1
	Off-Channel Stockwater		3
	Riparian Fencing		2
	Channel Restoration		4

Table 5-3. Summary of FFIP and CCAA projects.

Waterbody & AU ID	Project Type	FFIP Project Count[1,2]	CCAA Project Count[1,2]
Warm Springs Creek, headwaters to mouth (Big Hole River) MT41D004_180 **Steel Creek**, headwaters to mouth (Big Hole River) MT41D004_190 **McVey Creek**, headwaters to mouth (Big Hole River) MT41D004_210	Irrigation Efficiencies		3 (1)
Steel Creek, headwaters to mouth (Big Hole River)	Off-Channel Stockwater	ND	3
	Riparian Fencing	1	1
	Culvert to Bridge		ND
	Irrigation Efficiencies	ND	2

[1]ND: None documented.
[2]() Indicates number of project(s) that occurred on unassessed or unimpaired tributary(ies) to the listed waterbody and may provide positive impacts to the listed waterbody.

5.2.3 Montana Department of Environmental Quality §319 Funded Projects

Section 319 of the Clean Water Act provides federal funding to address nonpoint source pollution. Under §319, states and tribes receive grant money to support locally led voluntary activities to reduce nonpoint source water pollution. **Table 5-4** identifies projects that received §319 funding in the Big Hole River watershed.

Table 5-4. Federal 319 Grants awarded in the Big Hole River watershed

319 Contract Number	Project Name	Project Sponsor	Funding Year	Project Description	Feet of Stream Channel Restored /Wetland Acres
209061	Big Hole Restoration, Planning and Education	Big Hole Watershed Committee	2009	Culvert replacements on Governor Creek	N/A
210109	Big Hole Restoration, Planning and Education		2010	Irrigation diversion improvement project on Wise River tributary	

Table 5-4. Federal 319 Grants awarded in the Big Hole River watershed

319 Contract Number	Project Name	Project Sponsor	Funding Year	Project Description	Feet of Stream Channel Restored /Wetland Acres
211081	Big Hole Restoration, Planning and Education		2011	Irrigation diversion improvement project on Wise River tributary	
214009	California Creek Restoration Project		2014	Restoration of California Creek	8,000/8
216003	French and Moose Creek Restoration		2015	Placer mining reclamation and restoration of French and Moose Creeks	13,665/15
218018	French Creek Restoration		2018	Placer mining reclamation and restoration of French Creek	4,000/7
219015	Oregon Creek Sediment Catchment and Wetland Creation		2019	Stream restoration of Oregon Creek	1,400/4
221022	Upper Oregon Creek Restoration		2021	Stream restoration of Oregon Creek	600/11
223002	Smith Sage Springs Restoration Project		2022	Smith Sage Springs wetland restoration, floodplain reconnection, and increasing baseflow to North Fork Big Hole River	450/4.5
211075	Corder Ditch Abandonment	Craighead Institute	2011	Corder Ditch abandonment removing 2.5 miles of irrigation ditch along the Big Hole River.	N/A

N/A = Not applicable

5.3 MONITORING PROGRESS

Monitoring in the Big Hole River watershed has been conducted as required by contract requirements associated with project funding, such as Section 319 grants; part of USFS, BLM, NRCS, and other agency watershed plans and assessments; and by volunteer organizations such as the BHRF. Monitoring efforts and various studies pertinent to the TMDLs addressed in this document will be discussed.

5.3.1 Temperature Monitoring

Temperature TMDLs were developed for the Lower, Middle, and Upper Big Hole River and Divide Creek (**Table 3-1**). Since TMDL recommendations included reducing stream temperatures on tributaries to the impaired streams, monitoring on tributaries will be included in this discussion.

Temperature related monitoring has been occurring as part of the Big Hole River Drought Management Plan since the 1990s. In this effort, temperature and stream flow data has been collected on the mainstem Big Hole River United States Geological Survey (USGS) gages (https://waterdata.usgs.gov/mt/nwis/rt) and DNRC gages (https://gis.dnrc.mt.gov/apps/stage/gage-report) (**Table 5-5**), data is available through their respective websites.

Table 5-5. Summary of USGS and DNRC Big Hole watershed gage stations measuring temperature

Waterbody	Assessment Unit ID	Gage Name	Gage Number
Big Hole River, Divide Creek to mouth (Jefferson River)	MT41D001_010	Big Hole River @ Maiden Rock near Divide, MT	USGS 06025250
		Big Hole River near Melrose, MT	USGS 06025500
		Big Hole River near Glen, MT	USGS 06026210
		Big Hole River below Hamilton Ditch near Twin Bridges, MT	USGS 06026420
Big Hole River, Pintlar Creek to Divide Creek	MT41D001_020	Big Hole River below Mudd Creek near Wisdom, MT	USGS 06024540
		Big Hole River near Wise River, MT	USGS 06024580[1]
		Big Hole River near Wise River, MT	DNRC 41D 08000
		Big Hole River below Big Lake Creek at Wisdom, MT	USGS 06024450
		Big Hole River above Jackson, MT	DNRC 41D 01000
		Big Hole River above Spring Creek near Jackson, MT	DNRC 41D 02000

Table 5-5. Summary of USGS and DNRC Big Hole watershed gage stations measuring temperature

Waterbody	Assessment Unit ID	Gage Name	Gage Number
		Big Hole River at Miner Creek near Jackson, MT	DNRC 41D 05000
Deep Creek, headwaters to mouth (Big Hole River)	MT41D003_040	Deep Creek near Wise River, MT	DNRC 41D 07700
Wise River, headwaters to mouth (Big Hole River)	MT41D003_200	Wise River near mouth	DNRC 41D 07900
		Wise River below Pattengail Creek confluence	DNRC 41D 07850[1]

[1]Gage is no longer active.

Montana FWP has also collected water temperature data in the Big Hole watershed annually since 2007 at 10 monitoring locations along both the mainstem and tributaries of the Big Hole River (FWP 2006). Mainstem sites included Saginaw Bridge, Miner Lakes Road at the confluence with Miner Creek, Wisdom Bridge, and Dickie Bridge. Tributary sites included Governor Creek, Miner Creek, Rock Creek, Steel Creek, and Deep Creek. Stream temperature data was collected at 60-minute intervals from May through October.

The USFS PacFish/InFish Biological Opinion (PIBO) monitoring program evaluates stream and riparian habitat status to evaluate effectiveness of conservation strategies identified by the USFS. The USFS has 82 PIBO sites within the watershed, six of these are on the North Fork Big Hole River and 12 are on impaired tributaries to the Big Hole River. Temperature was monitored at PIBO sites intermittently from 2006 through 2018. The PIBO temperature data is a summary of hourly stream temperature data from July 15 through August 31 with a max value of 48 days.

In 2020, the BHRF established an annual long-term water quality monitoring program at seven sites spanning the length of the Big Hole River and three sites on major tributaries from April to October (BHRF 2024). Of these sites, five are located within assessment units with temperature TMDLs; Big Hole near Twin Bridges, Big Hole at Kalsta Bridge, Big Hole at Maiden Rock, Big Hole at Mudd Creek Bridge, and Big Hole at Wisdom. As part of this data collection effort, field parameters, including temperature were measured. Data was submitted to the Water Quality Portal (found at: https://www.waterqualitydata.us/) as part of DEQ's Volunteer Monitoring Lab Analysis Support Program.

5.3.2 Sediment Monitoring

In 2019, Montana Natural Resource Damage Program (NRDP) contracted Water & Environmental Technologies (WET) to conduct UAV (drone) restoration progress monitoring within the Mount Haggin Remediation and Restoration Areas (WET 2020). While sediment parameters were not directly measured, this aerial monitoring was designed to help quantify and qualify the effectiveness of restoration activities and their ability to reduce copper and heavy metal mobilization. Ground control surveys, upland vegetation flights, and gully flights were compared against 2018 baseline topography and land cover models to quantify restoration progress to date. Additionally, WET quantified sediment

captured in dozer basins (depressions and berms created during surface shaping) and gully structures between 2018 and 2019 (WET 2020).

After several restoration projects, land management changes, and BMP implementation, the BHWC in coordination with DEQ's Nonpoint Source & Wetlands Section (NPSW) conducted a sediment and sediment-related survey within the French Creek watershed in 2021 to evaluate the success of the work that occurred to support instream and riparian habitat improvements and identify further restoration or management interventions needed (Hanson, 2022). A full sediment assessment was conducted on the five most downstream sites: French Creek, California Creek, Oregon Creek, Sixmile Creek, and American Creek (Table 2; Trum 2021). The full sediment survey included collection of percent riffle fines, percent pool tail fines, residual pool depth, pool frequency, width-to-depth ratios, entrenchment ratios, and site photos. A rapid sediment survey was conducted on an additional 12 upstream sites (Table 3; Trum 2021). The rapid sediment survey included collection of percent riffle fines, width-to-depth ratio, entrenchment ratio, and site photos. Data was compared to the water quality targets established in the Middle and Lower Big Hole TMDL. Based on these results, DEQ worked with BHWC to determine next steps with the ultimate goal of removal of these waterbodies from the state's list of impaired waters for sedimentation/siltation.

The USFS Beaverhead-Deerlodge National Forest established a PIBO monitoring program and Biennial Monitoring Evaluation Reporting (BMER) in 1999 which is used to monitor the implementation and effectiveness of fish strategies. PIBO evaluates stream and riparian attributes and collects effectiveness monitoring data for over 2,225 sites. There are 104 Integrator sites on the Beaverhead-Deerlodge National Forest. Integrator sites are the most downstream segment within a randomly selected Interior Columbia Basin Ecosystem Management Project (ICBEMP) 6th field hydrologic unit that has less than 3% gradient, no tributaries, and no beaver activity when sites are established. These BMER reports contain tables which summarize trends in sediment data (D50 Median Substrate Size and Percent Fine Sediment <6mm) collected through the PIBO monitoring program. The USFS Beaverhead-Deerlodge National Forest PIBO monitoring program and BMER compiled habitat data for 18 waterbodies that are impaired for sediment and six tributaries to waterbodies with a sediment impairment in the Big Hole watershed (USFS 2021).

In 2018 and 2022 the BLM Dillon Field Office conducted Multiple Indicator Monitoring (MIM) on various reaches of Camp Creek. MIM monitoring involved collection of streambank stability, streambank cover, and pool frequency data. Additional MIM monitoring at these sites is tentatively planned for 2025. In 2013 BLM collected cumulative width-to-depth ratios on Camp Creek. In 2022 BLM conducted a Dillon Resource Area (RA) Riparian Inventory at five reaches on Camp Creek and one on the Big Hole River which involved the collection of bankfull width and depths, entrenchment ratios, and a vegetation and soils/hydrology rating. The vegetation and soil/hydrology included parameters such as percent of streambank with active lateral cutting, percent of streambank altered by human-caused disturbances, percent of streambank with a deep binding root mass, and percent of streambank with pugging and/or hummocking.

5.3.3 Nutrient Monitoring

In 2020, the Big Hole River Foundation established an annual long-term water quality monitoring program at seven sites spanning the length of the Big Hole River and three sites on major tributaries from April to October (BHRF 2024). None of these sites are located within assessment units with nutrient TMDLs nor are they tributaries to a nutrient impaired stream. As part of this data collection

effort, nutrient samples were collected at all sites. Data was submitted to the Water Quality Portal (found at: https://www.waterqualitydata.us/) as part of DEQ's Volunteer Monitoring Lab Analysis Support Program.

5.3.4 Metals Monitoring

Montana DEQ has collected data at stream reference sites to establish reference conditions for various parameters. Reference sites help DEQ interpret, develop, and refine water quality standards. DEQ has had a network of stream reference sites since 1992. Starting in 2000, sampling has occurred every year. While sampling sites remain the same, not every site is sampled every year (DEQ 2020). The streams in the Big Hole watershed that are reference sites and the years they have been sampled are LaMarche Creek (2013 and 2019), Seymour Creek (2013 and 2019), Willow Creek (2012, 2013, 2017, and 2019), Little Lake Creek (2013), and Pintler Creek (2013).

In Fall 2021 DEQ started to collect data as part of the Metals Pilot Project in response to the 2018 EPA proposal that states adopt a new aluminum water quality criterion (DEQ 2025). The project has evolved to include copper as well. 105 sites are sampled per month during three time periods: March - April, May - June, and September - October. The two sites on the Big Hole River are at the Kalsta bridge and the Fishtrap Creek fishing access site (FAS) which were sampled in 2023, 2024, and 2025.

Between 2020 and 2021, the Big Hole Watershed Committee conducted water quality monitoring to support site characterization studies and provide data-driven information for aquatic resource restoration planning. In particular, the BHWC has been investigating water quality and acid mine drainage issues at abandoned mine lands near the Elkhorn Mine & Mill in the Pioneer Mountains (BHWC 2021). Monitoring occurred at two above-ground acid mine drainage seeps and 14 surface water locations within Elkhorn Creek. Data was submitted to the Water Quality Portal (found at: https://www.waterqualitydata.us/) as part of DEQ's Volunteer Monitoring Lab Analysis Support Program.

5.3.4 §319 Project Effectiveness Reviews

DEQ's Nonpoint Source and Wetlands (NPSW) Section conducted project effectiveness reviews (PERs) for the California Creek Restoration Project and the French Creek and Moose Creek Restoration Project in 2025. PERs are a way for the department to assess the performance of BMPs installed for §319 funded projects.

The California Creek Restoration Project PER evaluated 19 individual projects while the French Creek and Moose Creek Restoration Project PER evaluated 10 individual projects of varying types. The various ratings from these individual projects are then aggregated to determine an overall rating for the project. The overall rating includes categories such as condition of the floodplain, condition of riparian vegetation, condition of streambanks, and condition of stream channel in addition to comments on each these categories, see **Section 5.4.5**.

5.4 DATA EVALUATION

The following subsections provide an evaluation of the data has been collected in the Big Hole River watershed since completion of the 2009 TMDL documents.

5.4.1 Temperature Data Evaluation

In developing the 2009 TMDLs, a temperature model was used to determine if Montana's water quality standards for temperature were being met. The model used monitoring data including stream flows and physical conditions of the waterbodies. This resulted in temperature targets that allow for meeting either the water quality standards *or* all the surrogate targets identified for the waterbody. In-stream temperature monitoring and predictive modeling indicated that naturally occurring stream temperatures in the Big Hole River are greater than 66.5°F (19.17°C), therefore, the maximum allowable increase due to unmitigated human causes would be 0.5°F (0.23°C).

The TMDL documents utilized surrogate-based temperature TMDL and allocation approaches. The temperature impaired segments were evaluated against the applicable surrogate(s) as identified in the TMDL. The surrogates are:

- Percent change in riparian cover, including canopy density measured over the stream and understory shrub cover along the green line;
- Percent reduction in bankfull width to depth ratio of Upper Big Hole River channel geometry;
- Reduction in warm water irrigation return flows via adaptive management approach; and
- Increase instream flow volume due to voluntary reasonable irrigation water management practices. This item is not a target for the temperature TMDLs, rather an assimilative capacity surrogate.

There is insufficient monitoring data to evaluate project effectiveness relative to these surrogates and DEQ is unable to make an evaluation regarding impacts to surface water temperature currently. The following sections contain a review of monitoring work and restoration work that has the potential to impact one or more of these surrogates, and therefore temperature.

While many entities have collected temperature data within the Big Hole watershed that is useful for other project needs, long-term temperature data sets are needed to evaluate temperature trends over time. USGS gages represent the only long-term datasets for the Big Hole watershed and will be used for this data evaluation.

5.4.1.1 Big Hole River Drought Management Plan

The Big Hole River Drought Management Plan (BHWC 2024) provides triggers for voluntary conservation activities, fishing restrictions, and river closures due to low flow and/or high temperature using data from five USGS gages and one DNRC gage on the mainstem Big Hole River. The river is divided into five sections for this purpose:

- Section I, Saginaw Bridge on Skinner Meadows Road to mouth of the North Fork of the Big Hole River (roughly aligns with the Upper Big Hole TMDL Planning Area (TPA), USGS gage #06024450)
- Section II, North Fork Big Hole River mouth to Dickie Bridge (roughly aligns with the Middle Big Hole TPA, DNRC gage# 41D 08000)
- Section III, Dickie Bridge to FWP Maiden Rock FAS (roughly aligns with the Middle Big Hole TPA, USGS gage #06025250)
- Section IV, Dickie Bridge to FWP Maiden Rock FAS to Tony Schoonen FAS (roughly aligns with the Lower Big Hole TPA, USGS gage #06026210 [Glen gage] and USGS gage #0602550 [Melrose gage])
- Section V, Tony Schoonen FAS to confluence with Jefferson River (roughly aligns with the Lower Big Hole TPA, USGS gage #06026420)

Maximum temperatures that met or exceeded the trigger value of 23°C for sections I, II, IV, and V typically occurred June through August from 2012-2024. From 2009 (TMDL development) to 2011, there were no exceedances for any sections; in contrast, 2024 saw the most exceedances **Appendix B, Figures B-7 – B-12**. Temperature trigger exceedances were not observed for section III while section V had the most, see **Table 5-6** for the number of times sections met hoot-owl fishing restriction requirements; daily maximum temperatures $\geq$ 23°C for three consecutive days.

Table 5-6. Number of times hoot-owl fishing restriction requirements met

River Section	# of Years with Data	Total # of Exceedances	Average Exceedances/Year
I	16	17	1.1
II	8	8	1.0
III	11	0	0.0
IV (Glen)		13	1.2
IV (Melrose)	16	8	0.5
V		40	2.5

A review of mean discharge data showed that sections I, II, IV, and V met the prepare for conservation, conservation, and FWP river closure triggers for three or more years since TMDL development, see **Table 5-7**. Section III has only met the prepare for conservation and conservation triggers for three or more years, see **Appendix B, Figures B-1 – B-6**. Mean discharge has decreased from 2009-2024 which is consistent with increased irrigation withdrawals and increasing maximum temperatures which will be further discussed in **Section 5.4.1.2**.

Table 5-7. Number of times discharge trigger requirements were met

	Prepare for Conservation Trigger		Conservation Trigger		FWP River Closure	
River Section	# of Exceedances	Percent Exceedances (%)	# of Exceedances	Percent Exceedances (%)	# of Exceedances	Percent Exceedances (%)
I	383	11.2	192	5.6	47	1.4
II	293	20.3	200	13.8	72	5.0
III	317	9.3	97	2.8	0	0
IV (Glen)	352	10.3	171	5.0	37	1.1
IV (Melrose)	432	11.6	181	4.9	26	0.07
V	864	29.4	678	23.0	512	17.4

5.4.1.2 USGS Melrose Gage Trends

The 2009 TMDL modeled streamflow and water temperature in the Big Hole River using data from the USGS Melrose gage #0602550. While a new temperature model will not be run, a long-term temperature trend analysis of the Melrose gage was completed using methods outlined in Isaak et al., 2012. Due to various data restrictions, the temperature trend analysis was confined to the spring and summer months; arguably, the more important seasons when doing a temperature trend analysis due to minimum and maximum temperature extremes.

A temperature trend analysis revealed an increase in minimum and maximum weekly temperatures for both spring and summer since 1996 when the gage was brought online, **Appendix B**, **Figures B-13 – B-**

14. Spring months saw an increase in maximum and minimum temperatures of 0.09°C/decade and 0.06°C/decade, respectively. Summer months saw an increase in maximum and minimum temperatures of 0.25°C/decade and 0.13°C/decade, respectively.

Since agriculture remains the primary land use within the watershed, leading to increased irrigation withdrawals, it is important to evaluate stream flows and their relation to temperature trends. Streamflow depletion due to irrigation withdrawals can lead to increased water temperatures since a lesser volume of generally shallower water will heat up more quickly from incoming solar radiation (DEQ 2009b). Greater daily fluctuations in temperature can also be expected when flows are low. **Appendix B**, **Figures B-15 – B-17** show a decrease in spring, summer, and fall discharge over the past ~100 years of 16.9 cubic feet per second (cfs)/decade, 22.2 cfs/decade, and 4.6 cfs/decade, respectively. Comparing these discharge decreases to the observed temperature increases indicates that reduced flows are still having an impact on stream temperatures.

5.4.2 Sediment Data Evaluation

5.4.2.1 USFS Beaverhead-Deerlodge National Forest PIBO Monitoring

The USFS BDNF PacFish/InFish Biological Opinion (PIBO) monitoring program compiled habitat data for 11 waterbodies that are impaired for sediment in the Big Hole watershed (USFS 2021). **Table B-1** compares the % pool tail fines < 6mm, width-to-depth ratio, pool frequency, and macroinvertebrates data to the targets established in the TMDLs.

TMDL water quality targets for the width-to-depth ratio are based on the USFS channel morphology reference dataset from the Greater Yellowstone Area and BDNF. The 75th percentile was calculated from the reference dataset for each Rosgen stream type and is the basis for sediment water quality targets in the TMDL documents (DEQ 2009b). Rosgen stream types were not included in the 2006-2023 PIBO dataset received from the USFS BDNF. DEQ determined Rosgen stream types from the USFS sampling photos and aerial imagery. All reaches were determined to be Rosgen C type streams.

Targets for pool spacing established in both the Middle and Lower Big Hole and Upper and North Fork Big Hole TMDLs are expressed as frequency of pools to median bankfull width per reach, while current DEQ practices express pool frequency as pools per mile. Using similar stream morphology characteristics: ecoregion, confinement, potential Rosgen stream type, Strahler stream order, and gradient, it was determined that targets from the Bitterroot Temperature and Tributary Sediment Total Maximum Daily Loads and Framework Water Quality Improvement Plan were suitable for comparison for Mussigbrod Creek (DEQ 2011). Not all of these parameters were available for the other sites. Therefore, these streams do not have a suitable target value for evaluation.

The % pool tail fines < 6mm presented in **Table B-1** show that only two sites, Birch Creek and Jerry Creek, had no exceedances throughout the years they were sampled; all other sites had at least one exceedance. Doolittle Creek, Mussigbrod Creek, Rock Creek, and Wise River sites have exceeded the water quality target all years they have been sampled. Birch Creek, Doolittle Creek, Johnson Creek, Moose Creek, Rock Creek, Ruby Creek, and Wise River sites have an overall increase in % pool tail fines < 6mm throughout the years they were sampled.

All sites met the water quality target for width-to-depth ratio and show no definitive increasing/decreasing trends.

As discussed above, the only reach that could be evaluated for pool frequency was Mussigbrod Creek. Mussigbrod Creek did not meet the water quality target in 2010 but did in 2015. There is not enough data to determine overall trends in pool frequency for this site.

Two sites met the appropriate River Invertebrate Prediction and Classification System (RIVPACS) scores for macroinvertebrates, Fox Creek and Rock Creek established in the Upper & North Fork and Middle & Lower Big Hole River TMDL documents (DEQ 2009a, 2009b). All other sites did not meet the RIVPACS scores in at least one sampling event. Most sites show a decrease in RIVPACS scores indicating macroinvertebrate metrics are on the decline.

5.4.2.2 Big Hole Watershed Committee French Creek Drainage Restoration

The BHWC has made significant progress in restoring the French Creek Drainage since 2013. Stream channel reconstruction has been completed on French Creek, French Gulch and Moose Creek, Oregon Creek, and California Creek. Projects focused on neutralizing upland sediment gullies, floodplain riparian planting, enriching deep pool and woody debris habitat, removal of placer tailings, and placement of beaver damn analogs (BHWC 2017, 2018, 2020a, 2020b). Bank erosion hazard index (BEHI) monitoring was used to determine sediment load reductions.

BEHI monitoring, while following DEQ protocols, is inconsistent with methods used in the Big Hole TMDL documents and the data cannot be compared. While the estimated sediment load reductions show significant improvement for these project areas, they do not provide an estimated sediment load reduction for the whole stream. Therefore, there is insufficient data to determine the impact these projects have had on the impaired waterbodies.

In 2021, post-restoration monitoring was conducted in the French Creek drainage (Hanson 2022). Width-to-depth ratios, entrenchment ratios, and riffle percent fines less than 2mm were collected at 15 sites along California Creek, Oregon Creek, Sixmile Creek, French Creek, and American Creek, see **Table B-3**. One site along French Creek (FRNC04-01) exceeded the width-to-depth ratio target. All sample sites exceed both the entrenchment ratio and riffle percent fines less than 2mm targets. It is likely that more time will be needed for the effects of the restoration work to be observed.

Together, the French Gulch and Moose Creek watersheds comprise 65% of the total drainage area of French Creek (BHWC 2018). In 2017, the BHWC collected post-restoration sediment data at five sites in the French Gulch area and on Moose Creek and habitat data at 17 sites. Results are shown in **Table B-4** and **Table B-3**, respectively. Only two exceedances of the width-to-depth ratio target were observed at the French Gulch 4 and Moose Creek sites. Pool tail fines less than 6mm exceeded the target value of less than 14% at all French Gulch sites. All sites for which habitat data was collected did not meet the understory shrub cover target of $\geq$ 48% shrub cover.

Another useful tool in determining the impact of restoration work is pre- and post-restoration project photos. **Figures B-28 – B-32** show pre- and post-restoration photo points for various projects demonstrating the benefits of restoration work.

Installation of beaver damn analogues on California Creek has decreased water velocity slowing down channel erosion and has given the stream better access to its floodplain, see **Figure B-28**. The establishment of a more defined channel to prevent sheet flow on California Creek and the addition of beaver dam analogues to slow water velocity can be seen in **Figure B-29**.

Figure B-30 shows French Gulch and Moose Creek project riparian plantings that provide bank stability and in turn prevent bank erosion. **Figure B-31** show the French Creek channel moved further from eroding slopes and additional meandering which helps slow erosion and the deposit of sediments. Seed planting on slopes in the Lower French Creek area helps prevent sediment contributions to the creek, **Figure B-32**.

5.4.2.3 Bureau of Land Management

In 2013, the BLM Dillon Field Office collected cumulative width and depth measurements at one site on Camp Creek. The width-to-depth ratio was 7.3; the Lower Big Hole TPA width-to-depth ratio target is >5.1. Therefore, this site on Camp Creek is meeting the TMDL target.

In 2018 and 2022, the BLM Dillon Field Office collected multiple indicator monitoring (MIM) data along Camp Creek which aimed to evaluate streambank and stream conditions, see **Table 5-8**. While there is no pool frequency target value suitable for comparison (see **Section 5.4.2.1**), the pools/mile did not change from 2018 to 2022. Streambank stability significantly improved from 2018 to 2022 as did streambank cover, both of which are important factors in preventing streambank erosion.

Table 5-8. 2018 and 2022 Camp Creek BLM MIM monitoring results

Site	Year	Streambank Stability (%)	Streambank Cover (%)	Pool Frequency (pools/mile)
Camp Creek	2018	48	81	14
	2022	91	99	14

In 2022, the BLM Dillon Field Office also conducted a Dillon Riparian Inventory at six sites on Camp Creek which takes a more qualitative approach in assessing streambank and riparian zone health, see **Table 5-9**.

Table 5-9. 2022 BLM Dillon RA Riparian Inventory on Camp Creek

Site	Reach	W/D Ratio	Entrenchment Ratio	% of Streambank with Active Lateral Cutting	% of Streambank Altered by Human-Caused Disturbances	% of Streambank with a Deep Binding Root Mass	% of Streambank with Pugging and/or Hummocking
Camp Creek	550 Upper	6.0	1.1	≤ 5%	5%	≥ 85%	≤ 5%
	550 Lower	3.0	N/A[1]		3%		
	551	2.73			5%		15-24%
	552	3.0	13.3		7%		≤ 5%
	BHMR-5	3.0	N/A[1]		2%		
Big Hole River	45 & 46	142.8			6%		

[1]N/A indicates the data was not available.

Two reaches, 550 Upper and 45 & 46, met the Lower Big Hole TPA width-to-depth ratio target of >5.1. Entrenchment ratios were only available for two of the sites, 550 Upper and 552. However, without the Rosgen Stream Classification for these specific reaches, a suitable target cannot be determined.

Streambank assessments included an evaluation of lateral cutting, human-caused disturbances, deep binding root mass, and pugging and/or hummocking. At all six sites, less than 5% of the streambanks had active lateral cutting and $\geq$ 85% of streambanks had a deep binding root mass. A deep binding root mass contributes to streambank stability and helps prevent erosion.

Only one site, 551, had greater than 5% of streambanks with pugging and/or hummocking. All sites had less than 10% of streambanks altered by human-caused disturbances. The most commonly observed human-caused disturbances were grazing, roads, recreation, and mining.

5.4.3 Nutrients Data Evaluation

Nutrient monitoring was conducted by the BHRF from 2020 – present, see **Appendix B**, **Figures B-18 – B27**. Data outside of July 1 – September 30 were excluded from this analysis because the TMDL targets are set for the algal growing season. Nutrient TMDL targets in the Upper & North Fork and Middle & Lower Big Hole River TMDL documents were based on the narrative standard. Total nitrogen and total phosphorus targets for the Upper & North Fork Big Hole River TMDL are 0.320 mg/L and 0.049 mg/L, respectively. Total nitrogen and total phosphorus targets for the Middle & Lower Big Hole River are < 0.320 mg/L and < 0.048 mg/L, respectively. All NO_2+NO_3 as N results were an order of magnitude lower than the TMDL target of 0.100 mg/L for all years of sampling for the Middle Big Hole and Lower Big Hole TPAs. The Upper and North Fork Big Hole River Planning Area TMDLs do not provide a target for NO_2+NO_3 as N, however, results were an order of magnitude lower than that of the target established in the Middle and Lower Big Hole TMDLs.

Most total phosphorus results elevated above the TMDL target were observed in the furthest upstream sites. Total phosphorus concentrations improve and remain below the TMDL targets starting in the Middle Big Hole TPA to the furthest downstream sites. A site-by-site review of total phosphorus concentrations did not reveal any trends.

Total nitrogen results elevated above the TMDL target were more prevalent than total phosphorus. A site-by-site and watershed review of total nitrogen concentrations did not reveal any trends. Most sites established by the BHRF are located upstream of waterbodies with nutrient TMDLs, making it unlikely that target exceedances found at these sites are due to the confluence of nutrient impaired streams with the Big Hole River.

The sites established by the BHRF are not located within assessment units with nutrient TMDLs nor are they tributaries to a nutrient impaired stream; as a result, there is insufficient data to evaluate the impaired waterbodies. Nevertheless, the data that has been collected by the BHRF provides a look at nutrient trends along the mainstem of the Big Hole River.

5.4.4 Metals Data Evaluation

5.4.4.1 Big Hole Watershed Committee Elkhorn Creek Post-Restoration Monitoring

After extensive restoration work by the BHWC to address the impacts of historic mining operations on Elkhorn Creek, metals monitoring was conducted in 2020 and2021 to evaluate the effectiveness of the projects. The Middle and Lower Big Hole Planning Area TMDLs and Water Quality Improvement Plan (DEQ 2009b) established metals targets based on the numeric water quality criteria established in Montana Circular DEQ-7 (DEQ 2019).

No exceedances of the human health standards (drinking water beneficial use) were observed. **Table 5-10** presents the summary of metals data collected on Elkhorn Creek post-restoration. There are aquatic life standard exceedances for zinc and copper that are still occurring. All arsenic samples were below the aquatic life standard in addition to most copper samples. Although Elkhorn Creek was listed for cadmium, no data has been collected.

Table 5-10. Summary of Elkhorn Creek post-restoration monitoring results.

Metals:	As	Cu	Pb	Zn
Sample Date Range	2020-2021			
Number of Samples	61			
Number of High Flow Samples	14	14	15	14
Percent of High Flow Samples	22.95	22.95	24.59	22.95
Number of Samples ≥2x the Acute Standard	0	41	0	8
Number of Acute Exceedances	0	47	0	42
Number of Chronic Exceedances	0	50	2	42
Acute Exceedance Rate (%)	0.00	77.05	0.00	68.85
Chronic Exceedance Rate (%)	0.00	81.97	3.28	68.85

5.4.4.2 DEQ Metals Monitoring

Monitoring results from the DEQ Metals Pilot Project (2023) and Reference Project (2012, 2017, 2019) showed no exceedances of the acute, chronic, or human health standards for any of the metals that were sampled. This is most likely due to the low number of samples that have been collected ranging from one to seven samples. Further sampling would be needed to properly evaluate the status of metals impairments at sites from both of these projects.

5.4.5 §319 Project Effectiveness Review Data Evaluation

PERs were conducted by DEQ for the California Creek Restoration Project and the French Creek and Moose Creek Restoration Project in Fall 2025. Categories evaluated included the condition of the floodplain, condition of riparian vegetation, condition of streambanks, and condition of stream channel.

The California Creek Restoration Project floodplain overall condition was rated poor. The evaluation showed that the creek was still incised to the point where very little of the floodplain is accessible.

However, the valley is tight, therefore there are only three to four areas that could be considered floodplain, only one of which the stream had access to. Improvement recommendations included transplanting willows to spur growth and plugging the upland check dams. It was noted that adding or expanding targeted beaver dam analogues could increase floodplain access.

The overall riparian condition was rated good. There was very little noxious weed cover. However, it was noted that the woody riparian area does seem well established for 10 years having passed since project completion. Live take planting could help this project along. The overall stream channel condition was rated fair. The stream goes subsurface and so it appears that there would not be any fish habitat in this stream. Streambank condition was rated good. There were only a few spots where there were exposed banks. However, it was noted that most of the streambank cover was grasses which do not provide a deep binding root mass to stabilize the banks.

The French Creek and Mosse Creek restoration project floodplain condition was rated excellent. It was found that there was adequate floodplain access throughout the whole reach. It was recommended that there be educational materials produced to help minimize camping impacts in the area.

The overall riparian vegetation condition was rated excellent. It was noted that the top to bottom vegetation looked excellent and was mostly composed of all native species and a few non-native species. There was good diversity in the plants which ranged from wetland to upland species.

The overall stream channel condition was rated excellent. It was found that there was excellent stream structure and diversity and that the floodplain connection for the whole project is excellent. The overall streambank condition was rated excellent. The majority of banks were fully vegetated with no evidence of erosion and only near the bottom of the project is there stream widening.

The results of the California Creek Restoration Project and French and Moose Creek Project PERs are shown in **Table 5-11**.

Table 5-11 §319 PER project ratings.

Project	Assessment Unit ID(s)	Condition of Streambanks	Condition of Floodplain	Condition of Riparian Vegetation	Condition of Stream Channel
California Creek Restoration Project	MT41D003_070	Good	Poor	Fair	Fair
French Creek and Moose Creek Restoration	MT41D003_050 MT41D002_050	Excellent			

*These ratings are for the overall project, not the smaller individual projects that were conducted (e.g., individual BMPs).

6.0 CONCLUSIONS AND RECOMMENDATIONS

Below are specific recommendations to address temperature, sediment, nutrients, and metals pollutant reductions from the more prevalent sources in the Big Hole River watershed. Refer to the conclusions summary table for a complete list of recommendations (**Appendix A**, **Table A-1**).

6.1 TEMPERATURE

Shortly after TMDL completion 2009 – 2011 there were no exceedances of the hoot-owl fishing restriction trigger value in the Big Hole River Drought Management Plan (DMP); in contrast, 2024 had the most exceedances. This aligns with the temperature trend analysis conducted for the USGS Melrose gage that shows temperatures on the Big Hole River have been increasing within the last several years. Further exacerbating the issue are decreasing flows; a review of mean discharge data showed that triggers in the DMP are being met more frequently.

More long-term datasets will be needed to further evaluate the temperatures in the Big Hole River watershed. In the meantime, BMPs should be focused on:

- Addressing tributaries where cooler streams enter the Big Hole River,
- Irrigation efficiencies. Irrigation has an influence on groundwater, which, in turn, influences surface water conditions (Montana DEQ 2009b), and
- Increasing riparian shade

It is recommended that entities revisit the TMDL document recommendations summarized in **Table 4-1** to determine what the best approaches are for addressing the temperature impairments.

6.2 SEDIMENT

The waterbodies with sediment TMDLs can be summarized in four groups:

- Recommend monitoring be conducted,
- No known restoration/limited restoration and limited monitoring has occurred,
- Limited restoration and no known monitoring has occurred, and
- No known restoration and no known monitoring has occurred

There are a total of 45 waterbodies with sediment TMDLs in the Big Hole River watershed, of these, eight have had extensive restoration work completed and/or sufficient BMPs installed. It is recommended that monitoring be conducted to assess the status of the impairment on these waterbodies: California Creek, Elkhorn Creek, French Creek, Lost Creek, Oregon Creek, Trail Creek headwaters to Joseph Creek, Trail Creek Joseph Creek to mouth, and Trapper Creek.

Six waterbodies have had no restoration work conducted but have had some monitoring conducted: Birch Creek headwaters to Pintlar Creek, Doolittle Creek, Fox Creek, Mussigbrod Creek, Ruby Creek, Sixmile Creek, and Wise River. Four waterbodies have had limited restoration work conducted and some monitoring conducted: Jerry Creek, Johnson Creek, Moose Creek, and Rock Creek. All of these waterbodies have been sampled as part of the USFS PIBO monitoring program and are sampled on a rotational basis with the exception of Sixmile Creek which was sampled by BHWC in 2021. The width-to-depth water quality target was met on all waterbodies.

Pool tail fines impact fish spawning and the macroinvertebrate community. The percent pool tail fines < 6mm was the most frequently exceeded TMDL target next to macroinvertebrates. It is recommended that restoration projects focus on the BMPs listed in **Table 4-1**. Due to there being several years in between sampling events, and not all necessary stream morphology data being collected, it is difficult to discern any trends in the data. It is recommended that after further restoration work has been completed, entities that conduct monitoring review the requirements of the Western Montana Sediment Assessment Method: Considerations, Physical and Biological Parameters, and Decision Making (DEQ 2013).

Ten of the waterbodies have had limited restoration work and no known monitoring conducted: Big Hole River Pintlar Creek to Divide Creek, Big Hole River headwaters to Pintlar Creek, Deep Creek, Delano Creek, Divide Creek, Fishtrap Creek, Governor Creek, Grose Creek, McVey Creek, and Swamp Creek. Further restoration work is needed on these waterbodies. All of these waterbodies list grazing as one of the largest sources and some list roads as well. Future restoration projects should focus on riparian fencing, riparian restoration, off-channel stockwater projects, other grazing management BMPs, and road decommissioning/BMPs.

Sixteen of the waterbodies have had known no restoration and no known monitoring conducted: Birch Creek National Forest Boundary to mouth, Camp Creek, Corral Creek, Francis Creek, Gold Creek, Joseph Creek, Miner Creek, North Fork Big Hole River, Pattengail Creek, Pine Creek, Rochester Creek, Sawlog Creek, Sevenmile Creek, Soap Creek, Steel Creek, and Tie Creek. All of these waterbodies list grazing as a major source. It is recommended that restoration work focuses on riparian fencing, riparian restoration, off-channel stockwater projects, and other grazing management BMPs. After restoration projects have been implemented, and enough time has passed for them to have an observable effect, monitoring should be conducted to determine the status of the impairment.

After reviewing all of the restoration and monitoring work that has been conducted on the waterbodies with sediment TMDLs, it is evident that the majority of work has been conducted in the French Gulch area. As a result of this extensive restoration work and sediment monitoring that has occurred on French Creek, Montana DEQ will be conducting reassessment monitoring in September 2026. An increased focus on restoration and monitoring in other tributaries is needed.

6.3 NUTRIENTS

Restoration and BMP work conducted within the watershed has primarily focused on addressing sediment and metals impairments. While a reduction of sediment delivery from roads and eroding streambanks is a component of the nutrient reduction restoration plan, they do not address the primary source. Few projects have been completed that address the crop and livestock agriculture which is the primary source of nutrients within the watershed. It is recommended that entities begin to implement the recommendations in the Middle and Lower Big Hole River TMDL document (Montana DEQ 2009b) and the Upper and North Fork Big Hole River TMDL document (Montana DEQ 2009a), see **Table 4-1**. In addition, most of the nutrient monitoring has occurred on the mainstem Big Hole River and little data is available for the tributaries.

It is recommended that nutrient monitoring be conducted on nutrient impaired streams to gain a better understanding of current nutrient levels . As BMPs become implemented on these impaired waterbodies, additional monitoring should be conducted to assess their effectiveness.

6.4 METALS

Of the 11 waterbodies with metals TMDLs seven have had no known restoration work occur: Big Hole River Pintlar Creek to Divide Creek, Jerry Creek, Lost Creek, Rochester Creek, Trapper Creek, Wickiup Creek, and Wise River. There are several high-priority abandoned mines on these waterbodies or on tributaries to these waterbodies that have yet to be addressed. Reductions in metals loading can be achieved through the remediation of these abandoned mines and associated waste rock/tailing (DEQ 2009b).

Four of the 11 waterbodies with metals TMDLs have had extensive restoration work completed on them or on tributaries to them: California Creek, Elkhorn Creek, French Creek, and Oregon Creek. A sufficient amount of time has passed since restoration on California Creek, French Creek, and Oregon Creek for there to be observable effects. It is recommended that these waterbodies be monitored to determine the status of the impairment.

Elkhorn Creek has seen the most restoration work occur that has addressed the priority abandoned mine, Old Elkhorn Mine. In 2021 monitoring was conducted by BHWC in conjunction with DEQ. Monitoring results indicate that arsenic and lead met the aquatic life and human health standards. Montana DEQ reassessed the metals impairments on Elkhorn Creek and delisted arsenic and lead in the 2022/2024 Integrated Report. Data suggests that more time is needed for copper and zinc to meet the aquatic life and human health standards, in the meantime monitoring for these metals should continue. Cadmium data has not been collected and monitoring should begin to determine the status of this impairment.

6.5 §319 PROJECT EFFECTIVENESS REVIEWS

The department acknowledges that California Creek is a narrow valley and creating a larger riparian area may not be feasible. However, if more work is done in this area the department recommends the following based off the PER.

The results of the California Creek Restoration Project PER showed that additional maintenance may be needed to improve waterbody conditions. Based on the ratings in **Table 5-11**, the condition of the floodplain needs to be improved through BMPs that give the stream more access to its floodplain. While there were numerous plantings conducted as part of this project, based on their growth and health, additional plantings may be necessary. Lastly, development of fish habitat could help improve the stream channel.

The results of the French Creek and Moose Creek Project PER showed that the BMPs have been effective, and the watershed has improved. There are no recommendations based off the results of this PER.

7.0 INFORMATION SOURCES

7.1 COMMUNICATION SOURCES

A number of individuals provided information in support of TIE development. A significant amount of information to support this document was gathered through personal conversations with individuals from other agencies and non-governmental organizations working in the watershed. Their names and associations are listed in **Table 7-1** and a more exhaustive list is provided in **Appendix C**, **Table C-1**.

Table 7-1. Big Hole watershed contacts

Name	Title	Organization
Brian Wheeler	Executive Director	Save Wild Trout
Danika Holmes	Regional Water Planner	DNRC
Dustin Crowe	Assistant Field Manager	BLM - Dillon
Kaitlin Boren	Hydrologist	DNRC
Katelin Killoy	Riparian Ecologist	MT FWP – CCAA
Michelle McGree	Future Fisheries Coordinator	MT FWP – FFIP
Paul Hutchinson	Fishery Biologist	BLM – Dillon Field Office
Pedro Marques	Executive Director	BHWC

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APPENDIX A – CONCLUSIONS SUMMARY TABLE

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Big Hole River, Divide Creek to mouth (Jefferson River)	MT41D001_010	Thermal Impacts	a	• **Known restoration work:** ○ FFIP 2021: Wetlands planting/mesic restoration was conducted. ○ FFIP 2010: One irrigation efficiency project was completed. • **Justification:** ○ Long-term continuous data sets are required to properly evaluate temperature trends in the Big Hole watershed; currently only the USGS has collected long-term continuous data sets that can be evaluated. ○ Insufficient continuous data available to evaluate conditions/trends. ○ Long-term temperature trends indicate water temperatures are increasing while long-term discharge trends indicate flow is decreasing, exacerbating the issue. ○ Dewatering issues have led to increased summer temperatures. ○ Inefficient irrigation during summertime is the only source that has been partially addressed that is listed in **Table 3-1**. ○ Further restoration work is needed to achieve the TMDL targets. • **Recommendations:** ○ Recommend increased focus on restoration work that addresses increased riparian shade and irrigation efficiency projects, particularly between Melrose and Glen due to heavy irrigation and domestic water withdrawals. ○ Recommend increased continuous temperature monitoring on impaired segment once further restoration work is completed.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Big Hole River, Pintlar Creek to Divide Creek	MT41D001_020	Thermal Impacts	a	• **Known restoration projects:** o CCAA: Nine irrigation efficiency projects were completed. • **Justification:** o Long-term continuous data sets are required to properly evaluate temperature trends in the Big Hole watershed; currently only the USGS has collected long-term continuous data sets that can be evaluated. o Insufficient continuous data available to evaluate conditions/trends. o Long-term temperature trends indicate water temperatures are increasing while long-term discharge trends indicate flow is decreasing, exacerbating the issue. o Inefficient irrigation during summertime is the only source that has been partially addressed that is listed in **Table 3-1**. o Further restoration work is needed to achieve the TMDL targets. • **Recommendations:** o Recommend increased focus on restoration work that addresses increased riparian shade and continues to address irrigation efficiency projects. o Recommend increased continuous temperature monitoring on impaired segments once further restoration work is completed.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** o FFIP 2007: Riparian fencing and restoration was conducted. o CCAA: Off-channel stockwater work was completed. • **Justification:** o Limited restoration and no known monitoring has occurred in this AU related to the sediment impairment. o No data available to evaluate conditions/trends. o Further restoration work is needed to achieve the TMDL targets. o The sources listed in **Table 3-1** have not been addressed. • **Recommendations:** o Additional restoration projects should continue to focus on off-channel stockwater projects, riparian fencing, riparian restoration, livestock grazing management, irrigation efficiency projects, and road erosion control near the stream. o Other BMPs that should be implemented are summarized in **Table 4-1**; see the Middle and Lower Big Hole TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Metals	a	• **Justification:** ○ No known restoration work has been completed within this AU to address the metals impairment; there has been some on tributaries with abandoned mines: the French Creek drainage, Wise River, Deep Creek, and Jerry Creek. ○ The BHWC has completed restoration work at the Old Elkhorn mine which is listed as a priority abandoned mine for this AU in the Middle and Lower Big Hole TMDL document. ○ The only source not addressed that is listed in **Table 3-1** is the atmospheric deposition from the Anaconda smelter via watersheds in the French Creek drainage. ○ No known metals monitoring has been completed within this AU. ○ No data available to evaluate conditions/trends. • **Recommendations:** ○ Additional restoration projects should focus on addressing the atmospheric deposition from the Anaconda smelter by revegetating affected soils, reducing or eliminating runoff and discharges of sediment and/or heavy metals contamination to adjacent surface and ground waters. ○ Continue following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Big Hole River, headwaters to Pintlar Creek	MT41D001_030	Thermal Impacts, Flow Alterations[2]	a	• **Known restoration projects:** ○ CCAA: 22 irrigation efficiency projects completed. ○ FFIP: One riparian restoration project and one irrigation efficiency project was completed. • **Justification:** ○ Long-term continuous data sets are required to properly evaluate temperature trends in the Big Hole watershed; currently only the USGS has collected long-term data sets that can be evaluated. ○ Insufficient continuous data available to evaluate conditions/trends. ○ Long-term temperature trends indicate water temperatures are increasing while long-term discharge trends indicate flow is decreasing, exacerbating the issue. ○ The two sources not being addressed in **Table 3-1** are lack of riparian vegetation shade and overly wide and less complex stream channel. ○ Further restoration work is needed to achieve the TMDL targets. • **Recommendations:** ○ Recommend increased and continued focus on restoration work that addresses increased riparian shade and irrigation efficiency projects. ○ Recommend increased continuous temperature monitoring on impaired segment once further restoration work is completed.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** o FFIP: One off-channel stockwater project and one riparian fencing project was completed. o CCAA: One off-channel stockwater project was completed. • **Justification:** o Limited restoration and no known monitoring has occurred in this AU related to the sediment impairment. o No data available to evaluate conditions/trends. o Additional restorative efforts are needed. o The sources in **Table 3-1** have not been fully addressed. • **Recommendations:** o Additional restoration projects should continue to focus on riparian zone vegetation management, riparian restoration, and unpaved road erosion control near streams. o Other BMPs that should be implemented are summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Birch Creek, headwaters to National Forest Boundary	MT41D002_090	Sedimentation, Habitat Alterations[2]	a	• **Known monitoring:** ○ USFS PIBO monitoring conducted in 2008, 2013, 2018, and 2023, see **Table B-1**. • **Justification:** ○ USFS PIBO monitoring indicated that Birch Creek meets the percent pool tail fines < 6mm, width-to-depth ratio, and all but the 2013 macroinvertebrate water quality targets. ○ Further long-term monitoring is needed to gain a better understanding of the condition of this AU. ○ No known restoration and limited monitoring has occurred within this AU related to the sediment impairment. ○ Insufficient data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been fully addressed. • **Recommendations:** ○ Restoration should focus on addressing riparian fencing, off-channel stockwater, riparian restoration, livestock grazing management, and unpaved road erosion control near streams. ○ Continue to follow TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Birch Creek, National Forest Boundary to mouth (Big Hole River)	MT41D002_100	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known restoration and monitoring has occurred within this AU related to the sediment impairment. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been fully addressed. • **Recommendations:** ○ Further restoration work should address riparian fencing, off-channel stockwater projects, riparian restoration, riparian zone vegetation management, livestock grazing management, and unpaved road erosion control near streams. ○ Recommend continuing following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

California Creek, headwaters to mouth (French Creek-Deep Creek)	MT41D003_070	Sedimentation, Habitat Alterations[2], Other (Turbidity)[2]	b*	• **Known restoration projects:** ○ BHWC 2017: > 300 beaver dam analogs installed. ○ BHWC 2017: 12 acres of upland sediment gullies neutralized. ○ BHWC 2017: > 8 acres of floodplain supplemented with riparian plantings. ○ BHWC 2014: Streambank/sedimentation work occurred on North California Creek. ○ BHWC 2012: Streambank/sedimentation work occurred in the Cabbage Gulch area. • **Known monitoring:** ○ BHWC collected sediment related data in 2017 and 2021 after restoration activities were completed, see **Table B-3** and **B-4**. • **Justification:** ○ 2021 post-restoration monitoring showed that all sites met the width-to-depth ratio water quality target. ○ 2021 post-restoration monitoring also indicated that all sites exceeded the entrenchment ratio and percent riffles < 2mm water quality targets. ○ It is likely that in 2021 the restoration efforts did not have enough time to have an effect, sufficient time has passed now for restoration work to have observable effects. • **Recommendations:** ○ Any additional restoration projects should continue to focus on riparian fencing, riparian restoration, off-channel stockwater projects, and unpaved road erosion control near streams. ○ Other BMPs that should be implemented are summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
				○ Monitoring should be conducted to evaluate if the restoration work has had sufficient time to take effect. ○ Recommend performing sediment monitoring consistently to allow for comparisons between data sets (DEQ 2013). ○ Entities that will conduct monitoring should review the requirements of the Draft Montana DEQ Western Montana Sediment Assessment Method: Considerations, Physical and Biological Parameters, and Decision Making (DEQ 2013).

		Metals	b*	• **Known restoration projects:**
				  ○ BHWC 2020: Engineered check dam controls installed at top of watershed in steep gullies. Aerially fertilized and planted 12 acres of denuded uplands and installed multiple check dams to reduce upland sediment runoff into California Creek.
				  ○ BHWC 2017: Restored channel and riparian conditions on over two miles of California Creek with 300 beaver mimicry structures and thousands of plantings. Removed failed culvert and reconstructed 50 feet of streambank. Annual maintenance added another 150 structures.
				  ○ BHWC 2015: 6 Engineered controls installed on ephemeral gullies.
				
				• **Justification:**
				  ○ Extensive stream restoration and revegetation in addition to removal of placer mining tailings was conducted on Oregon Creek, a tributary to California Creek with known abandoned mines.
				  ○ The restoration work that was conducted by the BHWC was completed in 2017, enough time has passed to allow for the restoration work to have an impact.
				  ○ No known monitoring has occurred related to the metals impairment.
				  ○ No data available to evaluate conditions/trends.
				
				• **Recommendations:**
				  ○ Recommend that metals monitoring be conducted to evaluate if the restoration work has had sufficient time to take effect.
				  ○ Entities that will conduct monitoring should review the requirements of the Montana DEQ Metals Assessment Method (DEQ 2012).

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Camp Creek, headwaters to mouth (Big Hole River)	MT41D002_020	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known restoration or sediment monitoring has occurred in this AU related to the sediment impairment. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. ○ Recommend reviewing and implementing the TMDL recommendations summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Nutrients	a	• **Justification:** ○ No known nutrient related restoration or monitoring has occurred in this AU. ○ Nutrient monitoring has only occurred on mainstem Big Hole River sites. ○ Restoration projects completed within the Big Hole watershed have been primarily geared towards addressing the metals and sediment impairments. ○ The sources in **Table 3-1** have not been addressed. ○ No data available to evaluate conditions/trends. • **Recommendations:** ○ Restoration should focus on addressing the sources of nutrients in the watershed (i.e., grazing management, riparian fencing, streamside vegetation buffers to irrigated croplands and confined animal feeding areas, etc.), see **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Corral Creek, headwaters to mouth (Deep Creek)	MT41D003_130	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known sediment restoration or monitoring has occurred in this AU. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. ○ Recommend reviewing and implementing the TMDL recommendations summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Deep Creek, headwaters to mouth (Big Hole River)	MT41D003_040	Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** o FFIP 2007: Stockwater wells project completed. • **Justification:** o Limited restoration and no known sediment monitoring has occurred in this AU. o The sources in **Table 3-1** need to be addressed further. o No data available to evaluate conditions/trends. • **Recommendations:** o Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. o Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Delano Creek, headwaters to mouth (Jerry Creek)	MT41D003_030	Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** o FFIP 2015: Road improvement project completed. • **Justification:** o Limited restoration and no known sediment monitoring has occurred in this AU. o The sources in **Table 3-1** need to be addressed further. o No data available to evaluate conditions/trends. • **Recommendations:** o Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. o Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Divide Creek, headwaters to mouth (Big Hole River)	MT41D002_040	Thermal Impacts	a	• **Justification:** ○ Long-term continuous data sets are required to properly evaluate temperature trends in the Big Hole watershed; currently only the USGS has collected long-term data sets that can be evaluated. ○ Insufficient data available for estimating conditions/trends. ○ Long-term temperature trends indicate water temperatures are increasing while long-term discharge trends indicate flow is decreasing, exacerbating the issue. ○ Restoration projects completed within the Big Hole watershed have been primarily geared towards addressing the metals and sediment impairments. ○ Addressing sediment impairments can have an impact on stream temperatures, but further restoration work is needed to achieve the TMDL targets. ○ The source listed in **Table 3-1** has not been addressed. • **Recommendations:** ○ Recommend an increased focus on restoration work that addresses riparian shade. ○ Recommend increased temperature monitoring on impaired segment once further restoration work is completed

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** o BHWC 2020: One stream/floodplain restoration project was completed. o BHWC 2019: Two streambank/sedimentation projects were completed. • **Justification:** o Limited sediment related restoration and no known monitoring has occurred in this AU. o No data available to evaluate conditions/trends. o The sources in **Table 3-1** need to be addressed further. • **Recommendations:** o Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. o Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Nutrients	a	• **Justification:** ○ No known nutrient related restoration or monitoring has occurred in this AU. ○ Nutrient monitoring has only occurred on mainstem Big Hole River sites. ○ Restoration projects completed within the Big Hole watershed have been primarily geared towards addressing the sediment impairment. ○ Sediment related restoration projects do have the ability to limit phosphorus inputs into the stream. ○ The sources in **Table 3-1** have not been addressed. ○ No data available to evaluate conditions/trends. • **Recommendations:** ○ Restoration should focus on addressing the sources of nutrients in the watershed (i.e., grazing management, riparian fencing, and fertilizer application, etc.), see **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Recommend monitoring for nutrients on impaired segments after further restoration work has been completed.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Doolittle Creek, headwaters to mouth (Big Hole River)	MT41D004_220	Sedimentation, Habitat Alterations[2]	a	• **Known monitoring:** ○ USFS PIBO monitoring conducted in 2008, 2010, 2015, and 2020, see **Table B-1**. • **Justification:** ○ No known restoration and limited monitoring has occurred within this AU. ○ USFS PIBO monitoring indicated that Doolittle Creek exceeded the percent pool tail fines < 6mm water quality target three times. There is an overall increasing trend in percent pool tail fines < 6mm. ○ USFS PIBO monitoring indicated that all width-to-depth ratio and all but the 2010 and 2015 macroinvertebrate water quality targets were met. ○ Further long-term monitoring is needed to gain a better understanding of the condition of this AU. ○ Insufficient data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on streambank stabilization, riparian fencing, riparian restoration, off-channel stockwater projects, and livestock grazing management. ○ Recommend continuing following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Elkhorn Creek, headwaters to mouth (Jacobson Creek)	MT41D003_220	Sedimentation	a	• **Justification:** ○ No known sediment related monitoring has occurred in this AU. ○ Insufficient data exists to estimate conditions/trends. ○ The sources in **Table 3-1** need to be addressed further. ○ Extensive restoration has occurred addressing the Old Elkhorn Mine. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. ○ Recommend continuing reviewing and implementing the TMDL recommendations summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Monitoring should be conducted to determine the status of this impairment since one of the major sources has been addressed. ○ Recommend performing sediment monitoring consistently to allow for comparisons between data sets (DEQ 2013). ○ Entities that will conduct monitoring should review the requirements of the Draft Montana DEQ Western Montana Sediment Assessment Method: Considerations, Physical and Biological Parameters, and Decision Making (DEQ 2013).

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Metals	b	• **Known restoration projects:** o Extensive restoration work has been conducted by the BHWC that has addressed the sources of metals (abandoned mines) in Elkhorn Creek. • **Known monitoring:** o In 2020-2021 monitoring conducted in conjunction with DEQ, see **Table 5-10**. • **Justification:** o Cadmium data has not been collected at this site, therefore, no determination can be made. o Copper and zinc continue to exceed the acute and chronic exceedance rates for the aquatic life beneficial use. o The 2020-2021 monitoring indicated that arsenic and lead had met the aquatic life and human health standards. o The primary source of metals has been addressed. • **Recommendations:** o It is recommended that DEQ reassess the arsenic and lead listings for this segment. o It is likely that given more time, copper and zinc can be evaluated for delisting; recommend monitoring for these metals should continue. o Recommend that cadmium should be monitored prior to reassessment to evaluate the status of the impairment. o Entities that will conduct monitoring should review the requirements of the Montana DEQ Metals Assessment Method (DEQ 2012).

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Fishtrap Creek, confluence of West & Middle Forks to mouth (Big Hole River)	MT41D003_160	Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** o FFIP 2007: Off-channel stockwater wells were completed. • **Justification:** o Limited restoration and no known monitoring has occurred in this AU related to sediment. o The sources in **Table 3-1** have not been addressed. o No data available to estimate conditions/trends. • **Recommendations:** o Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. o Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Fox Creek, headwaters to mouth (Governor Creek)	MT41D004_170	Sedimentation	a	• **Known monitoring:** ○ USFS PIBO monitoring conducted in 2006, 2011, 2016, and 2023, see **Table B-1**. • **Justification:** ○ No known restoration and limited monitoring has occurred within this AU related to sediment. ○ USFS PIBO monitoring indicated that Fox Creek exceeded the pool tail fines < 6mm water quality target once in 2006 before TMDL completion. ○ USFS PIBO monitoring indicated width-to-depth ratio and all but the 2016 macroinvertebrate water quality targets were met. ○ The sources in **Table 3-1** have not been addressed. ○ Insufficient data available to evaluate conditions/trends. • **Recommendations:** ○ Restoration should focus on streambank stabilization, riparian fencing, riparian restoration, off-channel stockwater projects, and livestock grazing management. ○ Recommend continuing following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Francis Creek, headwaters to mouth (Steel Creek)	MT41D004_200	Sedimentation, Habitat Alterations[2]	a	• **Justification:** o No known sediment related restoration or monitoring has occurred in this AU. o The sources in **Table 3-1** have not been addressed. o No data available to evaluate conditions/trends. • **Recommendations:** o Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. o Recommend reviewing and implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Nutrients	a	• **Justification:** ○ Nutrient monitoring has only occurred on mainstem Big Hole River sites. ○ Restoration projects completed within the Big Hole watershed have been primarily geared towards addressing the sediment impairment. ○ Sediment related restoration projects do have the ability to limit phosphorus inputs into the stream. ○ The sources in **Table 3-1** have not been addressed. ○ Insufficient data available to evaluate conditions/trends. • **Recommendations:** ○ Restoration should focus on addressing the sources of nutrients in the watershed (i.e., livestock grazing management, silviculture practices, riparian fencing, etc.). ○ Additional restoration efforts are needed prior to conducting monitoring.

French Creek, headwaters to mouth (Deep Creek)	MT41D003_050	Sedimentation	b	• **Known restoration projects:** ○ FFIP 2020: Lower French Creek riparian restoration completed. ○ FFIP 2019: Channel reconstruction completed. ○ BHWC 2020: ~4,000 feet of stream channel constructed away from the largest sediment source in the drainage, 1,023 feet of willow-staked streambanks, 26 fish pool habitats, 16 engineered woody debris habitats, and 7 acres of reconstructed floodplain. ○ BHWC 2019: Lower French Creek streambank/sedimentation project completed. ○ BHWC 2017: French Gulch mine reclamation completed. ○ FFIP 2016: One riparian fencing and one channel restoration project completed. ○ FFIP 2015: One channel relocation and one channel restoration project completed. • **Known monitoring:** ○ BHWC conducted post-restoration monitoring in 2017 and 2021, see **Table B-3**, and **B-4**. • **Justification:** ○ 2017 post-restoration monitoring indicated that one site exceeded the width-to-depth ratio and all sites exceeded the pool tail fines < 6mm water quality targets. ○ 2021 post-restoration monitoring indicated that one site exceeded the width-to-depth ratio water quality target. ○ 2021 post-restoration monitoring also indicated that all sites exceeded the entrenchment ratio and percent riffles < 2mm water quality targets. ○ BHWC monitoring also indicate that none of the sampling sites met the understory shrub cover water quality target, **Table B-2**.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
				○ Extensive restoration work has been conducted in the French Creek watershed. ○ Sufficient time has passed since initial post-restoration monitoring for restoration to have an observable effect. • **Recommendations:** ○ Recommend DEQ reassess this AU for sediment. ○ Recommend performing sediment monitoring consistently to allow for comparisons between data sets (DEQ 2013). ○ Entities that will conduct monitoring should review the requirements of the Draft Montana DEQ Western Montana Sediment Assessment Method: Considerations, Physical and Biological Parameters, and Decision Making (DEQ 2013).

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Metals	b	• **Known restoration projects:** o BHWC 2021: Mesic area restoration to stop headcutting of meadow habitat along one mile of ephemeral draw. o BWHC 2019: Restored 4,000 feet of lower French Creek by relocating portions of the channel and increasing wetlands habitat. o BHWC 2017: Restored over 7,400 feet channelized reaches of French Gulch and Moose Creek impacted by historical placer mining. o MDT 2014: Relocated a section of Mill Creek Road (569) that was running through riparian habitat to an upland bench from upstream of Moose Creek to a bridge across French Creek. • **Justification:** o California Creek and Oregon Creek, tributaries to French Creek with abandoned mines, have undergone extensive restoration. o Enough time has passed since restoration work was completed for there to be observable effects. • **Recommendations:** o Recommend monitoring be conducted to determine if enough time has passed since restoration for it to have an observable effect. o Entities that will conduct monitoring should review the requirements of the Montana DEQ Metals Assessment Method (DEQ 2012).

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Gold Creek, headwaters to mouth (Wise River)	MT41D003_230	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known restoration or monitoring has occurred in this AU related to sediment. ○ The sources in **Table 3-1** have not been addressed. ○ No data available to evaluate conditions/trends. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, and livestock grazing management. ○ Recommend reviewing and implementing the TMDL recommendations summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Governor Creek, headwaters to mouth (Warm Springs Creek)	MT41D004_150	Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** o BHWC 2010: Stream/floodplain restoration project completed. • **Justification:** o The sources in **Table 3-1** need to be addressed further. o Limited restoration and no known sediment monitoring has occurred in this AU. o No data available to evaluate conditions/trends. • **Recommendations:** o Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. o Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Grose Creek, headwaters to mouth (Big Hole River)	MT41D002_060	Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** o BHWC: Smith Sage Springs stream/floodplain restoration conducted. • **Justification:** o Limited sediment related restoration and no known sediment monitoring has occurred related to the sediment impairment. o No data available to evaluate conditions/trends. o The sources in **Table 3-1** need to be addressed further. • **Recommendations:** o Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. o Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Nutrients	a	• **Justification:** ○ Nutrient monitoring has only occurred on mainstem Big Hole River sites. ○ Restoration projects completed within the Big Hole watershed have been primarily geared towards addressing the sediment impairment. ○ Sediment related restoration projects do have the ability to limit phosphorus inputs into the stream. ○ Insufficient data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on addressing the sources of nutrients in the watershed (i.e., livestock grazing management, riparian fencing, fertilizer application, silviculture practices, etc.), see **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Jerry Creek, headwaters to mouth (Big Hole River)	MT41D003_020	Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** ○ USFS 2015: Unnamed tributary Aquatic Organism Passage Program road improvement. • **Known monitoring:** ○ USFS PIBO monitoring in 2007, 2012, 2017, and 2022, see **Table B-1**. • **Justification:** ○ USFS PIBO monitoring indicated that Jerry Creek met the percent pool tail fines < 6mm, width-to-depth ratio, and all but the 2007 macroinvertebrate water quality targets. ○ Insufficient data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. ○ Recommend continuing following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Metals	a	• **Justification:** ○ No restoration work has occurred that addresses the sources of metals (abandoned mines) within this assessment unit. ○ Moores Creek is a tributary that has abandoned mines, but has had no restoration work conducted. ○ The sources in **Table 3-1** have not been addressed. ○ No data available to evaluate conditions/trends. • **Recommendations:** ○ Restoration should focus on addressing the abandoned mines. ○ Recommend following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Johnson Creek, headwaters to mouth (North Fork Big Hole River)	MT41D004_030	Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** o 2014 FFIP: Riparian fencing project completed. • **Known monitoring:** o USFS PIBO monitoring conducted in 2008 and 2013, see **Table B-1**. • **Justification:** o The percent pool tail fines < 6mm water quality target was exceeded once in 2008. o The width-to-depth ratio and macroinvertebrate water quality targets were met both years this AU was sampled. o Insufficient data available to evaluate conditions/trends. o Limited restoration work has been conducted within this AU. o The sources in **Table 3-1** need to be addressed further. • **Recommendations:** o Restoration work should focus on riparian fencing, riparian restoration, off-channel stockwater projects, and livestock grazing management. o Recommend continuing following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Joseph Creek, headwaters to mouth (Trail Creek)	MT41D004_090	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known restoration or monitoring has occurred in this AU related to sediment. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration work should focus on streamside riparian vegetation and long-term riparian zone vegetation management. ○ Recommend reviewing and implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Lost Creek, headwaters to mouth (Lost Creek Canal/Ditch), T4S R9W S15	MT41D002_180	Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** o BHWC: Installed 120 low-tech process-based restoration (LTPBR) structures over four reaches in the Eastern Pioneers (including Lost Creek). • **Justification:** o The LTPBR structures were designed to reduce water velocities, in turn capturing sediment, aggrading the channel, and elevating the water table. o No known sediment related monitoring has occurred. o No data available to evaluate conditions/trends. o The sources in **Table 3-1** need to be addressed further. • **Recommendations:** o Any further restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. o Recommend reviewing and implementing the TMDL recommendations summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Monitoring should be conducted to determine if the LTPBR has had an observable effect. o Recommend performing sediment monitoring consistently to allow for comparisons between data sets (DEQ 2013) after restoration work has been completed. o Entities that will conduct monitoring should review the requirement of the Montana DEQ Western Montana Sediment Assessment Method: Considerations, Physical and Biological Parameters, and Decision Making (DEQ 2013).

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Nutrients	a	• **Justification:** ○ No known nutrient related restoration or monitoring has occurred in this AU. ○ Nutrient monitoring has only occurred on mainstem Big Hole River sites. ○ Restoration projects completed within the Big Hole watershed have been primarily geared towards addressing the sediment impairment. ○ Sediment related restoration projects do have the ability to limit phosphorus inputs into the stream. ○ Insufficient data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on addressing the sources of nutrients in the watershed (i.e., livestock grazing management, riparian fencing, fertilizer application, silviculture practices, etc.), see **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Metals	a	• **Justification:** o While restoration work has occurred within the watershed, it has been geared towards sediment and not the metals impairment. o The primary source of metals (Tungsten Millsite) has not been addressed. o No data available to evaluate conditions/trends. • **Recommendations:** o Recommend abandoned mine restoration at the Tungsten Millsite to address the metals impairment. o Recommend following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
McVey Creek, headwaters to mouth (Big Hole River)	MT41D004_210	Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** o FFIP 2013: Riparian fencing project completed. • **Justification:** o Limited restoration and no known sediment monitoring has occurred in this AU. o The sources in **Table 3-1** need to be addressed further. o No data available to evaluate conditions/trends. • **Recommendations:** o Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, and livestock grazing management. o Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Miner Creek, headwaters to mouth (Big Hole River)	MT41D004_140	Sedimentation	a	• **Justification:** o No known restoration or monitoring has occurred in this AU related to sediment. o The sources in **Table 3-1** have not been addressed. o No data available to evaluate conditions/trends. • **Recommendations:** o Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, and livestock grazing management. o Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Moose Creek, headwaters to mouth (Big Hole River at Maiden Rock)	MT41D002_050	Sedimentation	a	• **Known restoration projects:** o BHWC 2017: Wetlands/mesic restoration project conducted. o FFIP 2015: Riparian fencing project completed. o FFIP 2013: Riparian fencing project completed. • **Known monitoring:** o USFS PIBO monitoring conducted in 2010 and 2015, see **Table B-1**. o BHWC post-restoration sediment monitoring conducted in 2017, see **Table B-4**. • **Justification:** o USFS PIBO monitoring indicated that there has been an increase in percent pool tail fines < 6mm above the water quality target from 2010 to 2015. Both macroinvertebrate samples did not meet the water quality target. o USFS PIBO monitoring indicated there were no exceedances of the width-to-depth ratio water quality target. o BHWC monitoring showed that Moose Creek exceeded the width-to-depth water quality target but met the percent pool tail fines < 6mm water quality target. o BHWC monitoring also showed that none of the sampling sites met the understory shrub cover water quality target, **Table B-2**. o Insufficient data available to evaluate conditions/trends. o The sources in **Table 3-1** need to be addressed further. • **Recommendations:** o Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. o Recommend continuing following TMDL recommended restoration and monitoring activities summarized in **Table 4-**

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
				1; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Mussigbrod Creek, headwaters to mouth (North Fork Big Hole River)	MT41D004_020	Sedimentation, Habitat Alterations[2]	a	• **Known monitoring:** o USFS PIBO monitoring conducted in 2010 and 2015, see **Table B-1**. • **Justification:** o USFS PIBO monitoring indicated that Mussigbrod Creek exceeded the percent pool tail fines < 6mm water quality target both years it was sampled, however, it was trending downwards. o The width-to-depth water quality target was not exceeded. o The pool frequency water quality target was exceeded in 2010 but not 2015, indicating a positive upward trend. o Macroinvertebrate water quality targets were exceeded in 2015. o No known restoration work or recent monitoring has occurred in this AU related to sediment. o No data available to evaluate conditions/trends. o The sources in **Table 3-1** have not been addressed. • **Recommendations:** o Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and long-term riparian zone vegetation management. o Recommend continuing following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
North Fork Big Hole River, headwaters to mouth (Big Hole River)	MT41D004_010	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known sediment related restoration or monitoring has occurred in this AU. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. ○ Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Oregon Creek, headwaters to mouth (California Creek-French Creek-Deep Creek)	MT41D003_080	Sedimentation, Habitat Alterations[2]	b*	• **Known restoration projects:** ○ BHWC 2021: Upper Oregon Creek erosion control and stream/floodplain restoration completed. ○ BHWC 2018: 1,400 feet of stream channel reconstructed, 4 acres of treated floodplain accessible to the stream, 8 machine-made floodplain enhancement structures (detention ridges) installed, and > 5,050 willows and whips planted on the streambanks. ○ BHWC 2017: Wetlands/mesic restoration project completed. • **Known monitoring:** ○ BHWC post-restoration sediment related monitoring occurred in 2021, see **Table B-3**. • **Justification:** ○ BHWC post-restoration monitoring showed all width-to-depth measurements met the water quality target. ○ Monitoring also indicated that two of the three Oregon Creek sites and all three sites exceeded the entrenchment ratio and percent riffle < 2mm water quality targets, respectively. ○ Recent monitoring has not been conducted. ○ Sufficient time has passed since the restoration work was completed. • **Recommendations:** ○ Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Recommend further monitoring be conducted to determine if enough time has passed since restoration for it to have observable effects.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
				○ Recommend performing sediment monitoring consistently to allow for comparisons between data sets (DEQ 2013) after restoration work has been completed. ○ Recommend entities that will conduct monitoring review the requirement of the Montana DEQ Western Montana Sediment Assessment Method: Considerations, Physical and Biological Parameters, and Decision Making (DEQ 2013).

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Metals	b*	• **Known restoration projects:** o BHWC 2022: Addressed upland sediment runoff from denuded hillslopes and reconstruct degraded section of upper Oregon Creek. o BHWC 2019: Reconstructed 1,400 feet of stream channel historically channelized by placer mine activity. Created four acres of floodplain including floodplain spanning "detention ridges" to slow flows and trap sediment. o FWP 2019: Purchased 2 private land parcels (400 acres total) at the upper reaches of Oregon Creek. • **Justification:** o Enough time has passed since restoration work was completed for there to be observable effects. o No known metals monitoring has occurred. o No data available to evaluate conditions/trends. • **Recommendations:** o Recommend continuing to follow TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Metals monitoring should be conducted to determine if enough time has passed since restoration efforts were completed for them to have an observable effect. o Entities that will conduct monitoring should review the requirements of the Montana DEQ Metals Assessment Method (DEQ 2012).

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Pattengail Creek, headwaters to mouth (Wise River)	MT41D003_210	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known restoration or monitoring has occurred in this AU related to sediment. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. ○ Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Pine Creek, headwaters to mouth (Andrus Creek)	MT41D004_160	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known restoration or monitoring has occurred in this AU related to sediment. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1**have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and long-term riparian zone vegetation management. ○ Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Rochester Creek, headwaters to mouth (Big Hole River), T3S R6W S29	MT41D002_160	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known restoration or monitoring has occurred in this AU related to the sediment impairment. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. ○ Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Metals	a	• **Justification:** ○ No known restoration work has occurred that addresses the sources of metals (abandoned mines) within this assessment unit. ○ No data available to evaluate conditions/trends. ○ Priority abandoned mines listed in the Upper and North Fork Big Hole TMDL document that need to be addressed are Watseca Mine and the Thistle Mine tailings. • **Recommendations:** ○ Restoration should focus on abandoned mine restoration at the Watseca Mine and the Thistle Mine tailings to address the metals impairment. ○ Recommend following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Upper and North Fork Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Rock Creek, headwaters to mouth (Big Hole River)	MT41D004_120	Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** o FFIP 2018: Realignment/channel restoration completed. o USFS 2010: Three Aquatic Organism Passage road improvement projects completed. • **Known monitoring:** o USFS PIBO monitoring was conducted in 2008, 2013, 2018, and 2023, see **Table B-1**. • **Justification:** o USFS PIBO monitoring showed that the percent pool tail fines < 6mm water quality target was exceeded all four years it was sampled. o There were no exceedances of the width-to-depth ratio or macroinvertebrate water quality targets. o Insufficient data available to evaluate conditions/trends. o Limited known restoration work has occurred in this AU. o The sources in **Table 3-1** need to be addressed further. • **Recommendations:** o Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. o Recommend continuing following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Ruby Creek, headwaters to mouth (North Fork Big Hole River)	MT41D004_100	Sedimentation, Habitat Alterations[2]	a	• **Known monitoring:** ○ USFS PIBO monitoring was conducted in 2008 and 2013, see **Table B-1**. • **Justification:** ○ USFS PIBO monitoring showed that the percent pool tail fines < 6mm and macroinvertebrate water quality targets were exceeded in 2013. ○ The width-to-depth ratio water quality target was not exceeded. ○ No known restoration work has occurred in this AU related to the sediment impairment. ○ Insufficient data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and long-term riparian zone vegetation management. ○ Recommend continuing following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Sawlog Creek, headwaters to mouth (Big Hole River)	MT41D004_230	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known restoration or monitoring has occurred in this AU related to sediment. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. ○ Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Sevenmile Creek, headwaters to mouth (Deep Creek)	MT41D003_110	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known restoration or monitoring has occurred in this AU related to sediment. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. ○ Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Sixmile Creek, headwaters to mouth (California Creek)	MT41D003_090	Sedimentation, Habitat Alterations[2]	a	• **Known monitoring:** ○ BHWC post-restoration sediment related monitoring occurred in 2021, see **Table B-3**. • **Justification:** ○ BHWC post-restoration monitoring showed that all three sampling locations exceeded the entrenchment ratio and percent riffle < 2mm water quality targets. ○ The width-to-depth ratio water quality target was not exceeded. ○ No known restoration work has occurred within this AU. ○ Insufficient data available to evaluate conditions/trends. ○ The sources in **Table 3-1** need to be addressed further. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. ○ Recommend continuing following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Soap Creek, headwaters to mouth (Big Hole River), T2S R9W S10	MT41D002_140	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known restoration or monitoring has occurred related to the sediment impairment. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. ○ Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Nutrients	a	• **Justification:** ○ Nutrient monitoring has only occurred on mainstem Big Hole River sites. ○ Restoration projects completed within the Big Hole watershed have been primarily geared towards addressing the sediment impairment. ○ Sediment related restoration projects do have the ability to limit phosphorus inputs into the stream. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on addressing the sources of nutrients in the watershed (i.e., livestock grazing management, riparian fencing, fertilizer application, silviculture practices, etc.). ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Steel Creek, headwaters to mouth (Big Hole River)	MT41D004_190	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known restoration or monitoring has occurred related to the sediment impairment. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and long-term riparian zone vegetation management. ○ Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Nutrients	a	• **Known restoration projects:** o FFIP: One riparian fencing project was completed. o CCAA: One riparian fencing project and three off-channel stockwater projects were completed. • **Justification:** o Nutrient monitoring has only occurred on mainstem Big Hole River sites. o Restoration projects completed within the Big Hole watershed have been primarily geared towards addressing the sediment impairment. o Sediment related restoration projects do have the ability to limit phosphorus inputs into the stream. o No data available to evaluate conditions/trends o The sources in **Table 3-1** need to be addressed further. • **Recommendations:** o Restoration should focus on addressing the sources of nutrients in the watershed (i.e., livestock grazing management, riparian fencing, fertilizer application, silviculture practices, etc.). o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Swamp Creek, headwaters to mouth (Big Hole River)	MT41D004_110	Sedimentation, Habitat Alterations[2]	a	• **Known restoration projects:** o FFIP 2007: Swamp Creek riparian fencing project completed. • **Justification:** o Limited restoration and no known monitoring has occurred in this AU related to the sediment impairment. o No data available to evaluate conditions/trends. o The sources in **Table 3-1** need to be addressed further. • **Recommendations:** o Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and long-term riparian zone vegetation management. o Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Tie Creek, headwaters to mouth (North Fork Big Hole River)	MT41D004_060	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known restoration or monitoring has occurred in this AU related to the sediment impairment. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and long-term riparian zone vegetation management. ○ Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration efforts are needed prior to conducting monitoring.
Trail Creek, headwaters to Joseph Creek	MT41D004_070	Sedimentation, Habitat Alterations[2]	a	• **Justification:** ○ No known restoration and no known monitoring has occurred in this AU related to the sediment impairment. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** need to be addressed further. • **Recommendations:** ○ Restoration should focus on riparian restoration and long-term riparian zone vegetation management. ○ Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Trail Creek, Joseph Creek to mouth (North Fork Big Hole River)	MT41D004_080	Sedimentation, Habitat Alterations[2]	b	• **Justification:** o Limited restoration and no known monitoring has occurred in this AU related to the sediment impairment. o The sediment sources are roads, historical grazing, and recovering harvested forest lands; these have not been addressed. o No data available to evaluate conditions/trends. • **Recommendations:** o Any further restoration should focus on continued grazing exclusion, riparian fencing, riparian restoration, off-channel stockwater projects, and unpaved road erosion control near streams. o Recommend reviewing and continuing implementing the TMDL recommendations summarized in **Table 4-1**; see the Upper and North Fork Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Given that there has been a grazing exclusion since 2000 and the historic logging ended in the 1980s, sufficient time has passed for restoration efforts to have an observable impact. o Recommend monitoring be conducted to determine if enough time has passed since restoration for it to have observable effects. o Recommend performing sediment monitoring consistently to allow for comparisons between data sets (DEQ 2013). o Recommend entities that will conduct monitoring review the requirement of the Montana DEQ Western Montana Sediment Assessment Method: Considerations, Physical and Biological Parameters, and Decision Making (DEQ 2013).

Trapper Creek, headwaters to mouth (Big Hole River)	MT41D002_010	Sedimentation, Habitat Alterations[2]	b	• **Known restoration projects:**
				  ○ BHWC installed 120 low-tech process-based restoration (LTPBR) structures over four reaches in the Eastern Pioneers (including Lost Creek). The LTPBR structures were designed to reduce water velocities, in turn capturing sediment, aggrading the channel, and elevating the water table.
				• **Known monitoring:**
				  ○ USFS PIBO monitoring was conducted in 2007, 2012, 2017, and 2022, see **Table B-1**.
				• **Justification:**
				  ○ USFS PIBO monitoring showed that the percent pool tail fines < 6mm water quality target was exceeded in 2007 and 2017 and that the macroinvertebrate water quality target was exceeded in 2012.
				  ○ There were no exceedances of the width-to-depth ratio water quality target.
				  ○ No recent monitoring has occurred related to the sediment impairment.
				  ○ Insufficient data available to evaluate conditions/trends.
				  ○ Enough restoration work has been conducted to have an effect on sediment loads to the creek.
				• **Recommendations:**
				  ○ Any further restoration should focus on riparian fencing, riparian restoration, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams.
				  ○ Recommend continuing following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
				○ Recommend conducting monitoring to determine if restoration work has had enough time to have an observable effect. ○ Recommend performing sediment monitoring consistently to allow for comparisons between data sets (DEQ 2013). ○ Recommend entities that will conduct monitoring review the requirement of the Montana DEQ Western Montana Sediment Assessment Method: Considerations, Physical and Biological Parameters, and Decision Making (DEQ 2013).
		Metals	a	• **Justification:** ○ No known restoration work has occurred that addresses the sources of metals (abandoned mines) within this assessment unit. ○ No data available to evaluate conditions/trends. • **Recommendations:** ○ Recommend focusing restoration efforts on priority abandoned mines listed in the Middle and Lower Big Hole Planning Area TMDL document; Trapper Mine, Silver King Mine, Lower and Upper Cleve Mine, and True Blue Mine located in the headwaters. ○ Recommend following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. ○ Additional restoration work is needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Wickiup Creek, headwaters to mouth (Camp Creek), T2S R8W S1	MT41D002_120	Metals	a	• **Justification:** o No known restoration work has occurred that addresses the sources of metals (abandoned mines) within this assessment unit. o No data available to evaluate conditions/trends. • **Recommendations:** o Recommend restoration work at the priority abandoned mine listed in the Middle and Lower Big Hole Planning Area TMDLs and Water Quality Improvement Plan, the Clipper Mine. o Recommend following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities. o Additional restoration efforts are needed prior to conducting monitoring.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
Wise River, headwaters to mouth (Big Hole River)	MT41D003_200	Sedimentation, Habitat Alterations[2]	a	• **Known monitoring:** ○ USFS PIBO monitoring conducted in 2008, 2013, 2018, and 2023. • **Justification:** ○ USFS PIBO monitoring showed that the percent pool tail fines < 6mm water quality target was exceeded all years it was sampled. ○ The macroinvertebrate water quality target was exceeded in 2013. ○ The width-to-depth ratio water quality target was not exceeded. ○ No known restoration work has occurred within this AU related to the sediment impairment. ○ No data available to evaluate conditions/trends. ○ The sources in **Table 3-1** have not been addressed. • **Recommendations:** ○ Restoration should focus on riparian fencing, riparian planting, off-channel stockwater projects, livestock grazing management, and unpaved road erosion control near streams. ○ Recommend continuing following TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities.

Table A-1. Conclusions summary

Waterbody	AU ID	Pollutant Group(s)	Conclusion[1]	Justification/Recommendations
		Metals	a	• **Justification:** ○ No restoration work has occurred that addresses the sources of metals (abandoned mines) within this AU. ○ No data available to evaluate conditions/trends. ○ The priority abandoned mine listed in the Middle and Lower Big Hole TMDL document is the Old Elkhorn Mine. ○ Extensive restoration work has been conducted by the BHWC that has addressed the sources of metals (abandoned mines) in Elkhorn Creek, a tributary to the Wise River. • **Recommendations:** ○ Restoration should focus on the additional abandoned mines. ○ Recommend continuing to follow TMDL recommended restoration and monitoring activities summarized in **Table 4-1**; see the Middle and Lower Big Hole River TMDL document for a more detailed list of recommended implementation activities.

[1]Conclusions are limited to one of the three specific conclusions identified in 75-5-703(9), MCA or "N/A". In this column, the possible conclusions will be denoted by individual letters as described below:

a. The implementation of a new or improved phase of voluntary reasonable land, soil, and water conservation practices is necessary.
b. Water quality is improving but a specified time is needed for compliance with water quality standards.
c. Revisions to the TMDL are necessary to achieve applicable water quality standards.

N/A – In instances where insufficient data exists to draw a defensible conclusion of a, b, or c identified above, "N/A" may be used.

[2] Indicates an impairment cause is a "non-pollutant" which has been addressed by a TMDL.

[3]b* indicates that sufficient restoration work has been completed but a specified time is needed to conduct monitoring to determine the status of the impairment.

APPENDIX B – DATA

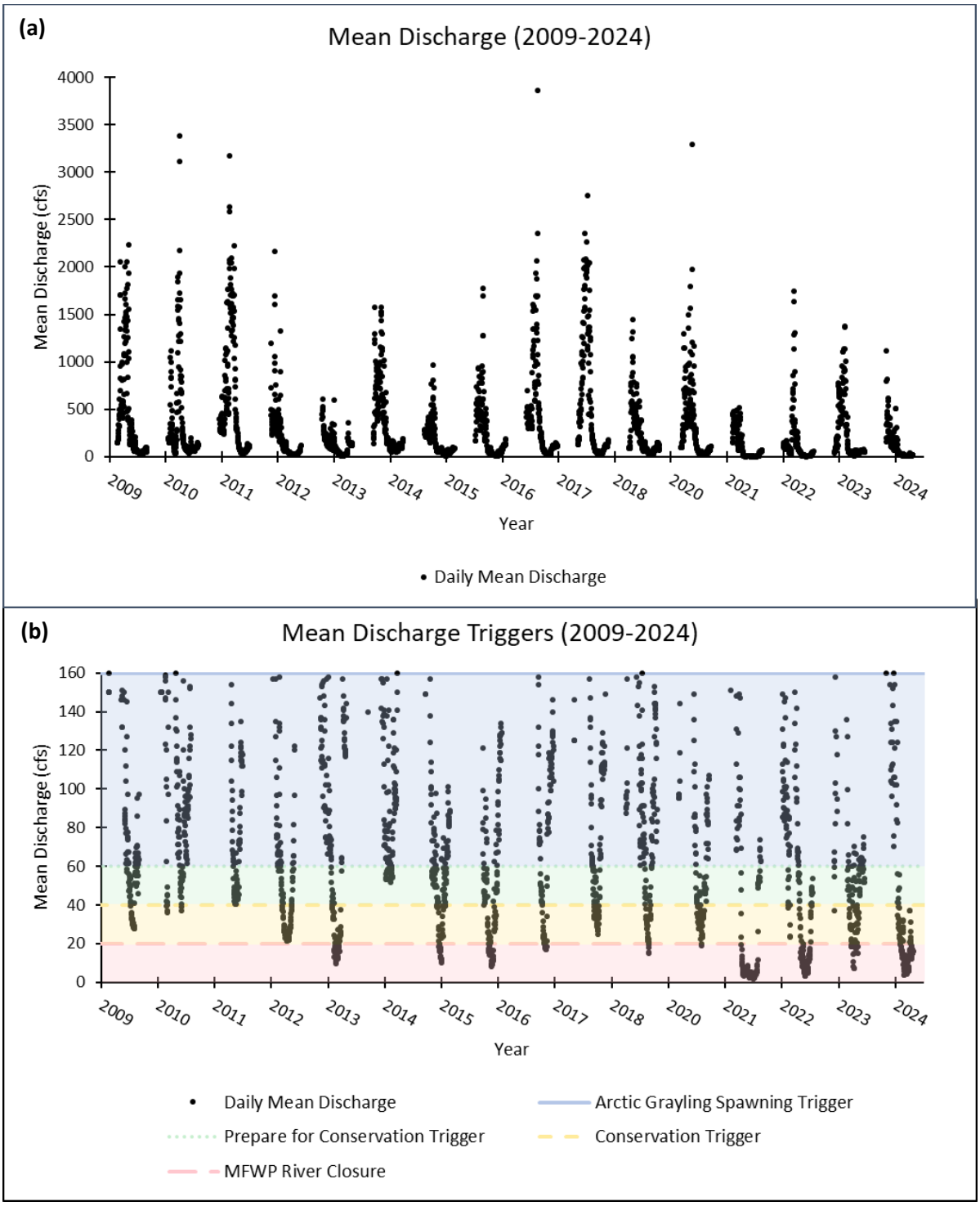

Figure B-1. Daily mean discharge at USGS gage #06024450. (a) Daily mean discharge from 2009-2024. **(b)** Daily mean discharge values that meet the mean discharge triggers outlined in the Big Hole River Drought Management Plan.

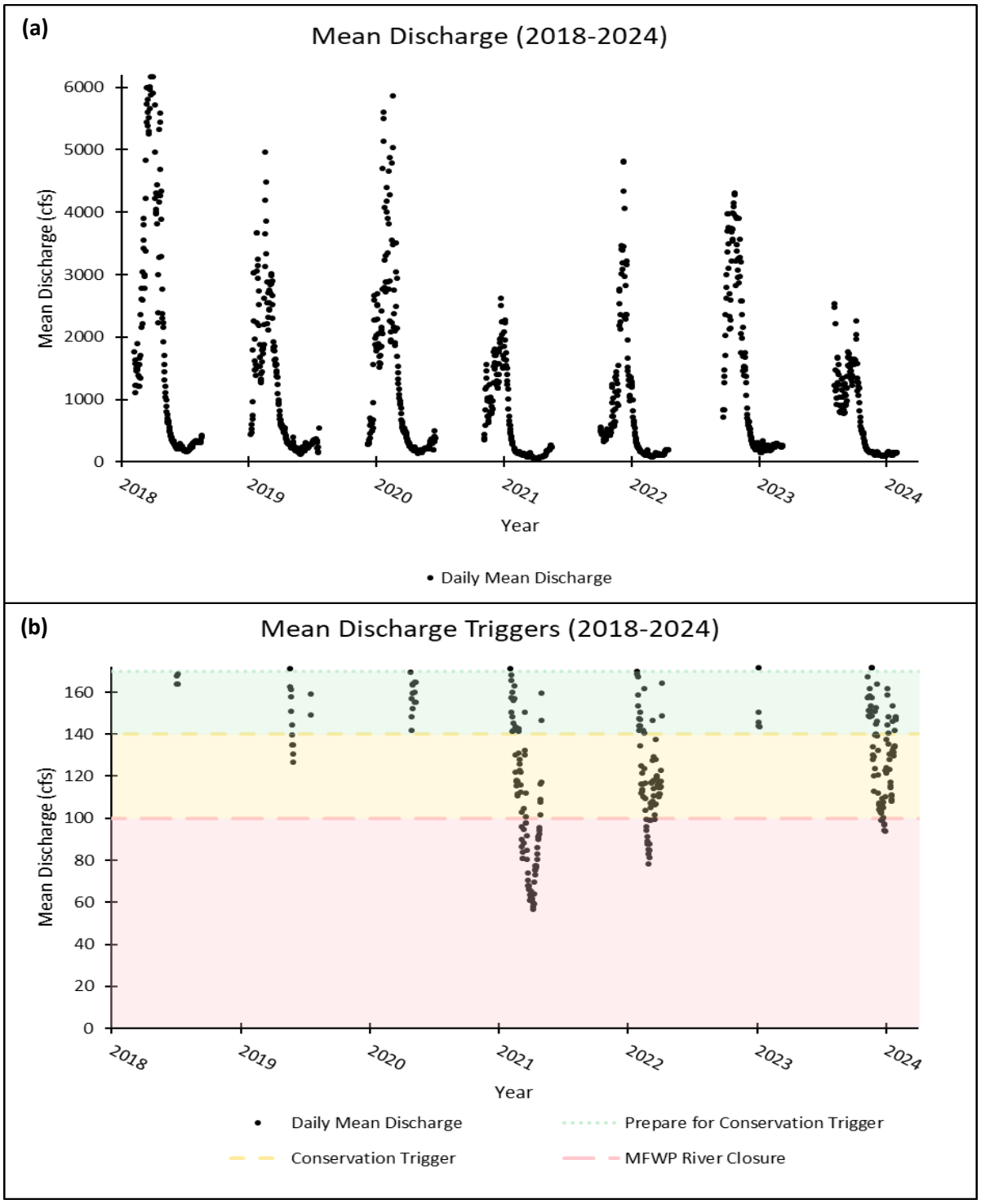

Figure B-2. Daily mean discharge at DNRC gage #41D 08000. (a) Daily mean discharge from 2018-2024 **(b)** Daily mean discharge values that meet the mean discharge triggers outlined in the Big Hole River Drought Management Plan.

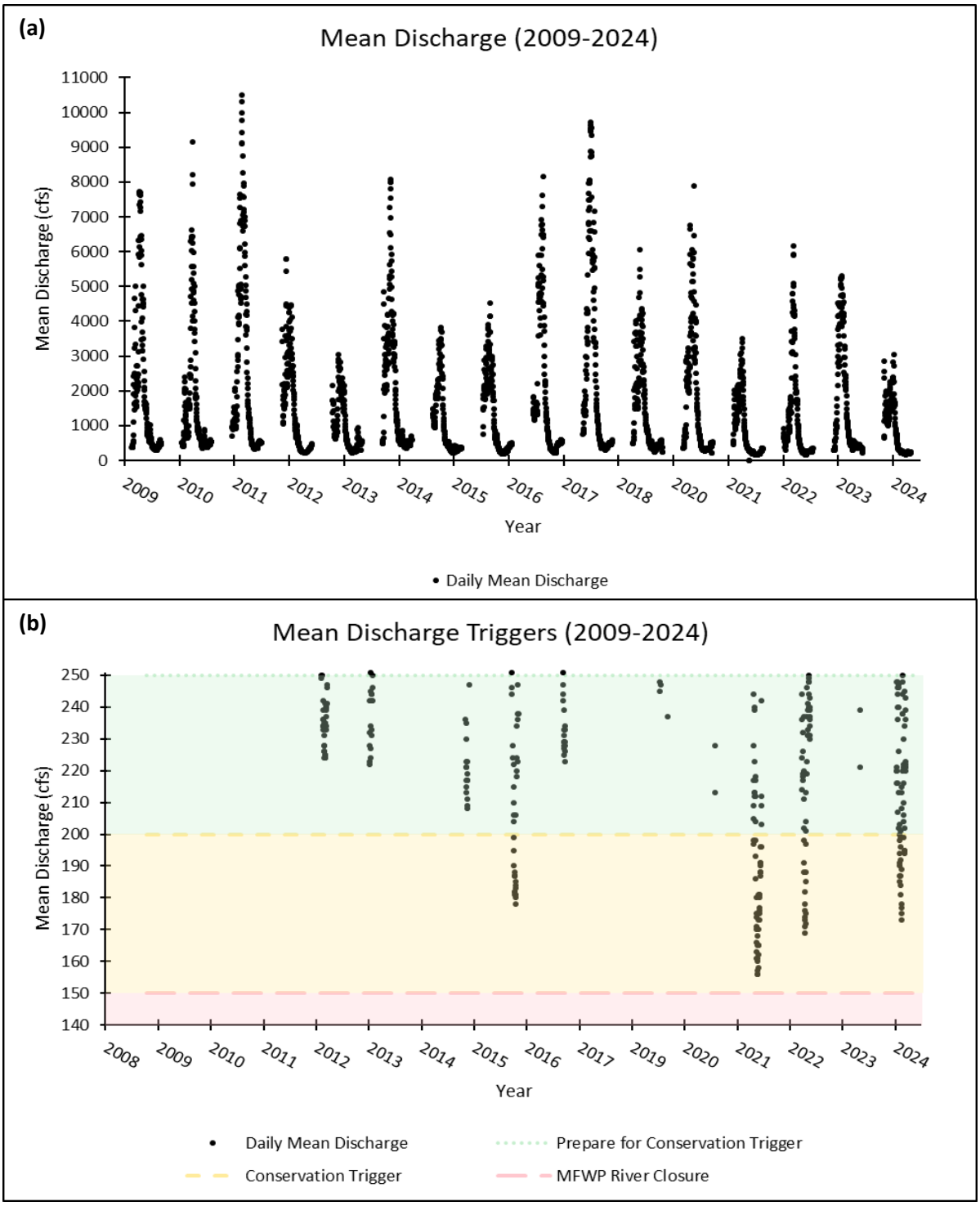

Figure B-3. Daily mean discharge at USGS gage #06025250. (a) Daily mean discharge from 2009-2024 **(b)** Daily mean discharge values that meet the mean discharge triggers outlined in the Big Hole River Drought Management Plan.

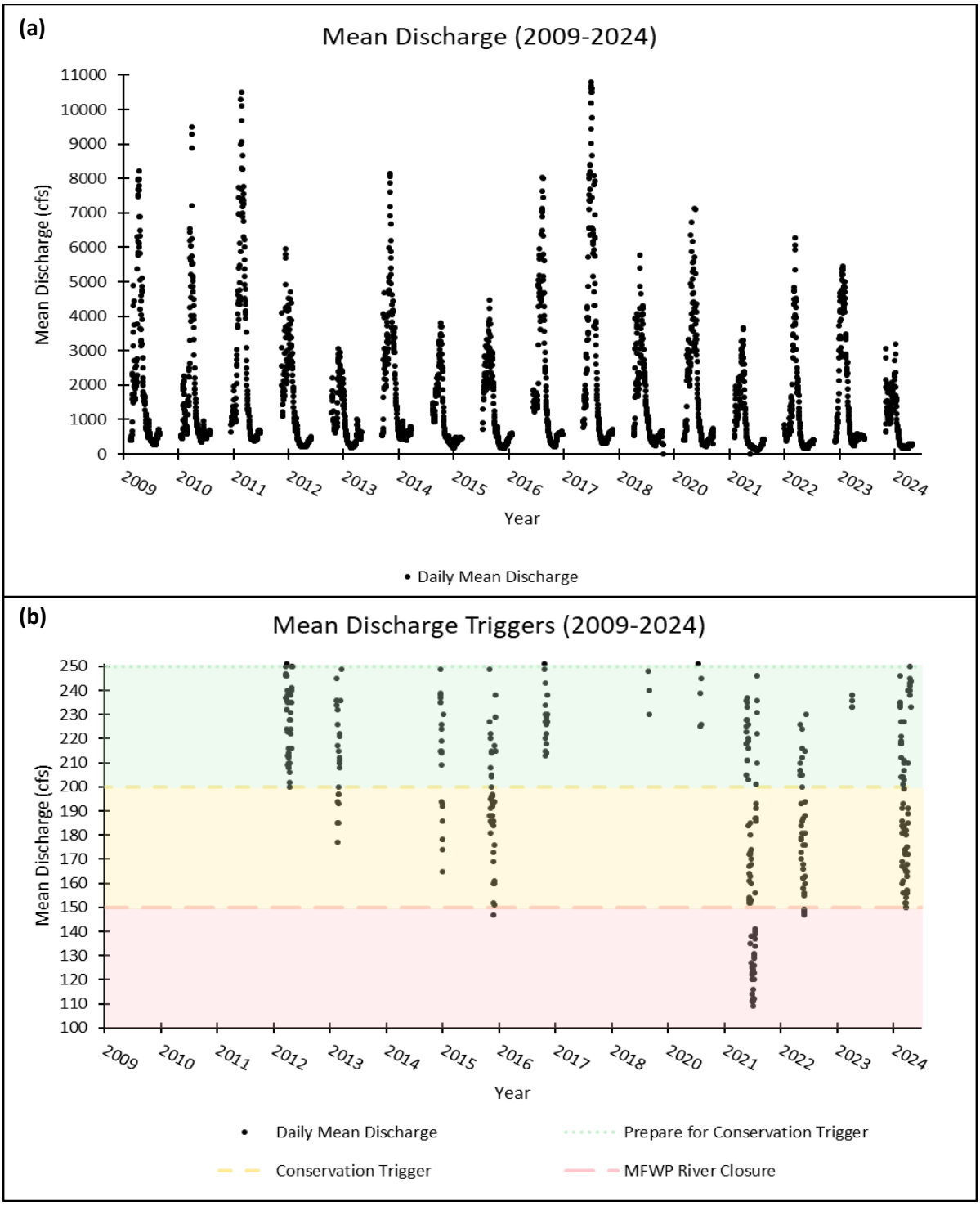

Figure B-4. Daily mean discharge at USGS gage #06026210. (a) Daily mean discharge from 2009-2024 **(b)** Daily mean discharge values that meet the mean discharge triggers outlined in the Big Hole River Drought Management Plan.

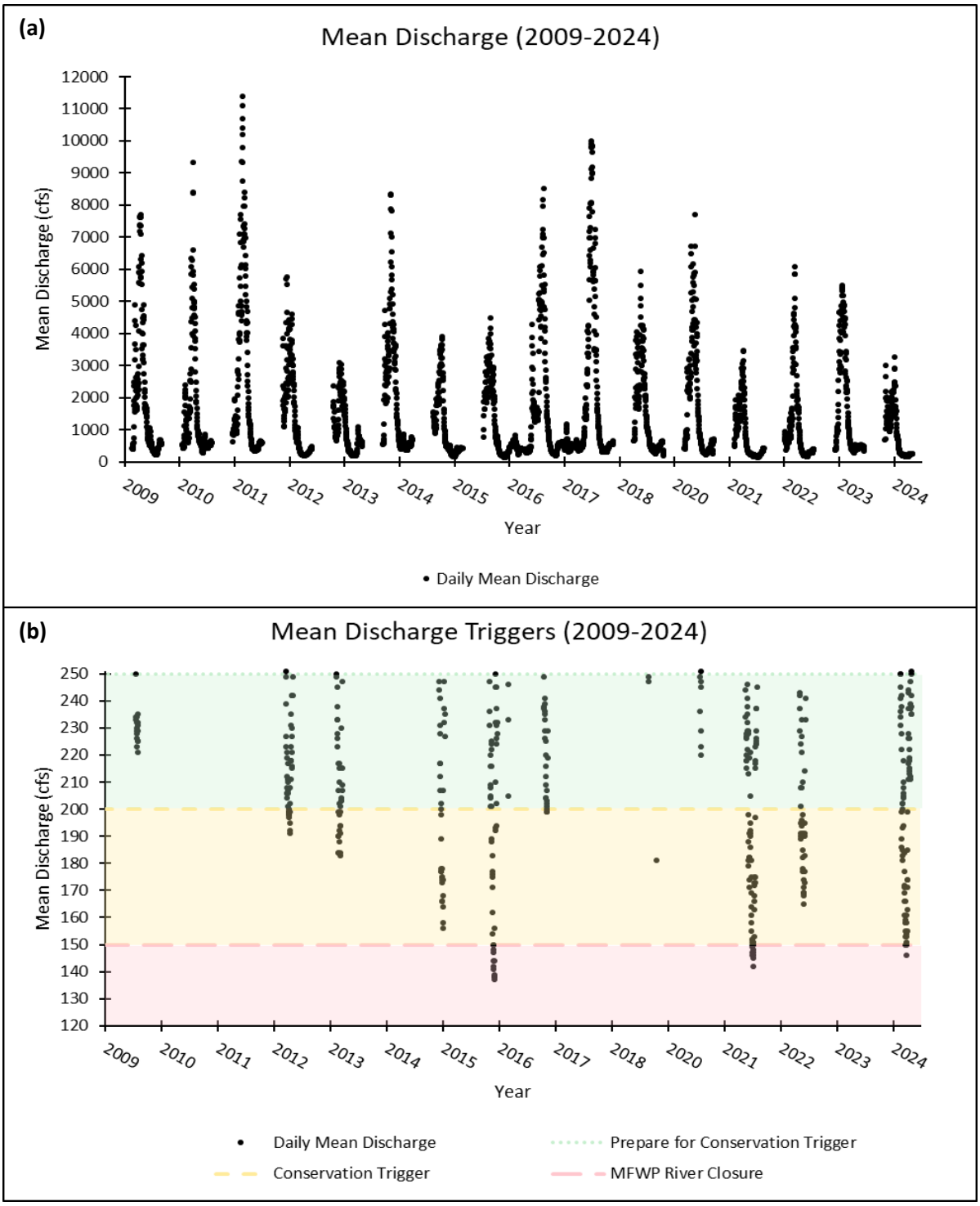

Figure B-5. Daily mean discharge at USGS gage #06026210. (a) Daily mean discharge from 2009-2024 **(b)** Daily mean discharge values that meet the mean discharge triggers outlined in the Big Hole River Drought Management Plan.

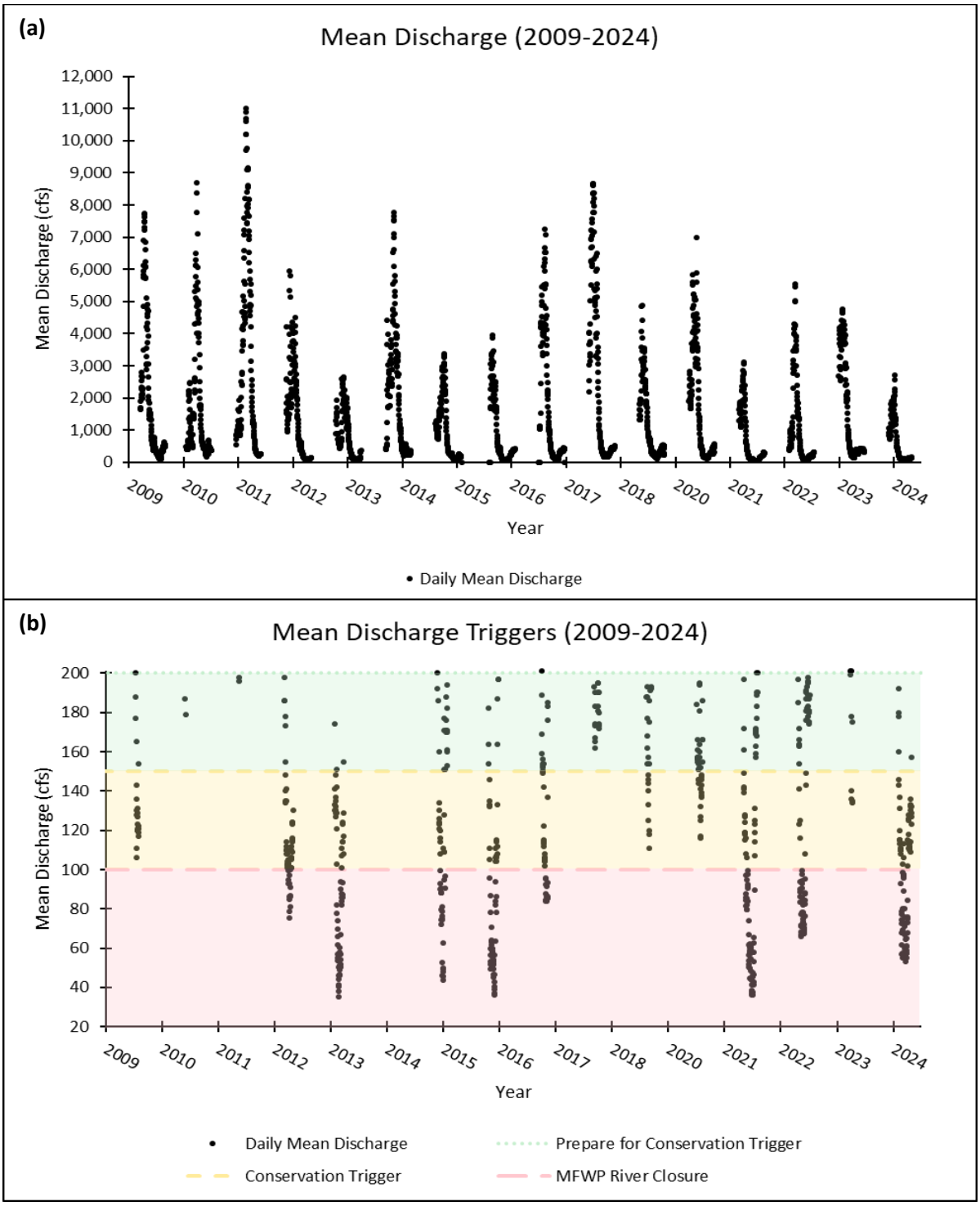

Figure B-6. Daily mean discharge at USGS gage #06026420. (a) Daily mean discharge from 2009-2024 **(b)** Daily mean discharge values that meet the mean discharge triggers outlined in the Big Hole River Drought Management Plan.

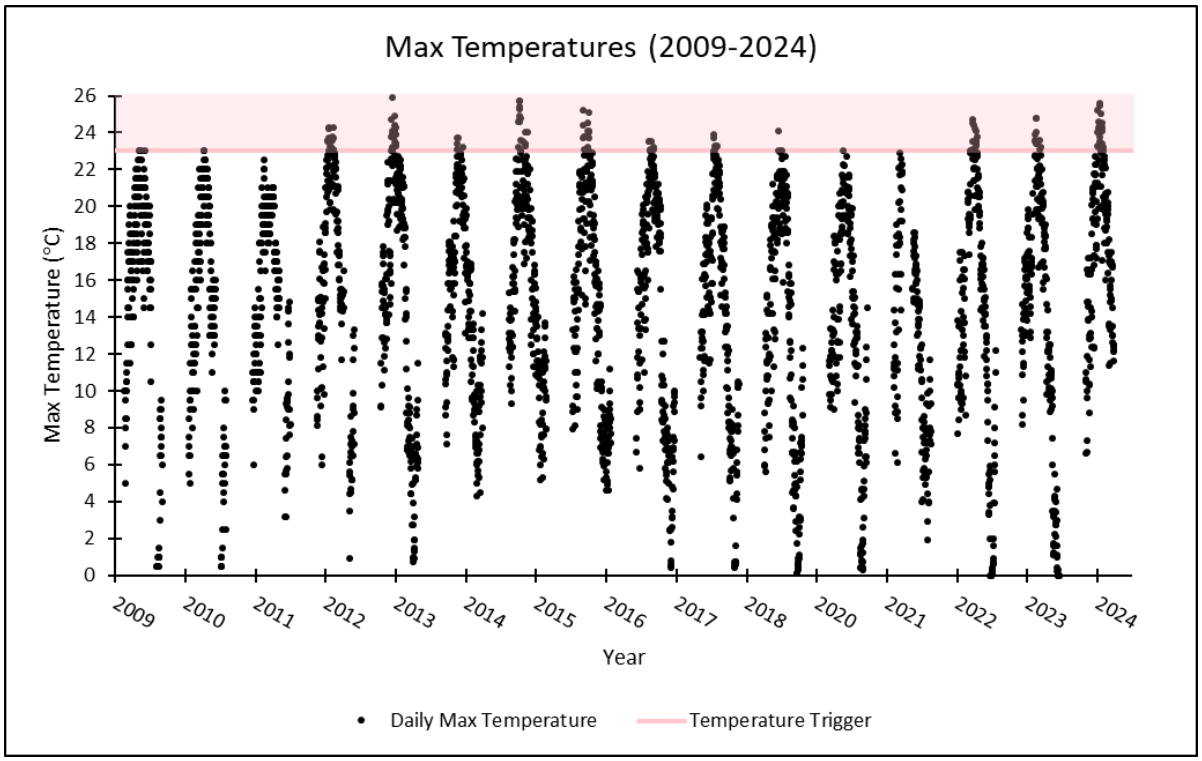

Figure B-7. Daily maximum temperatures at USGS gage #06024450.

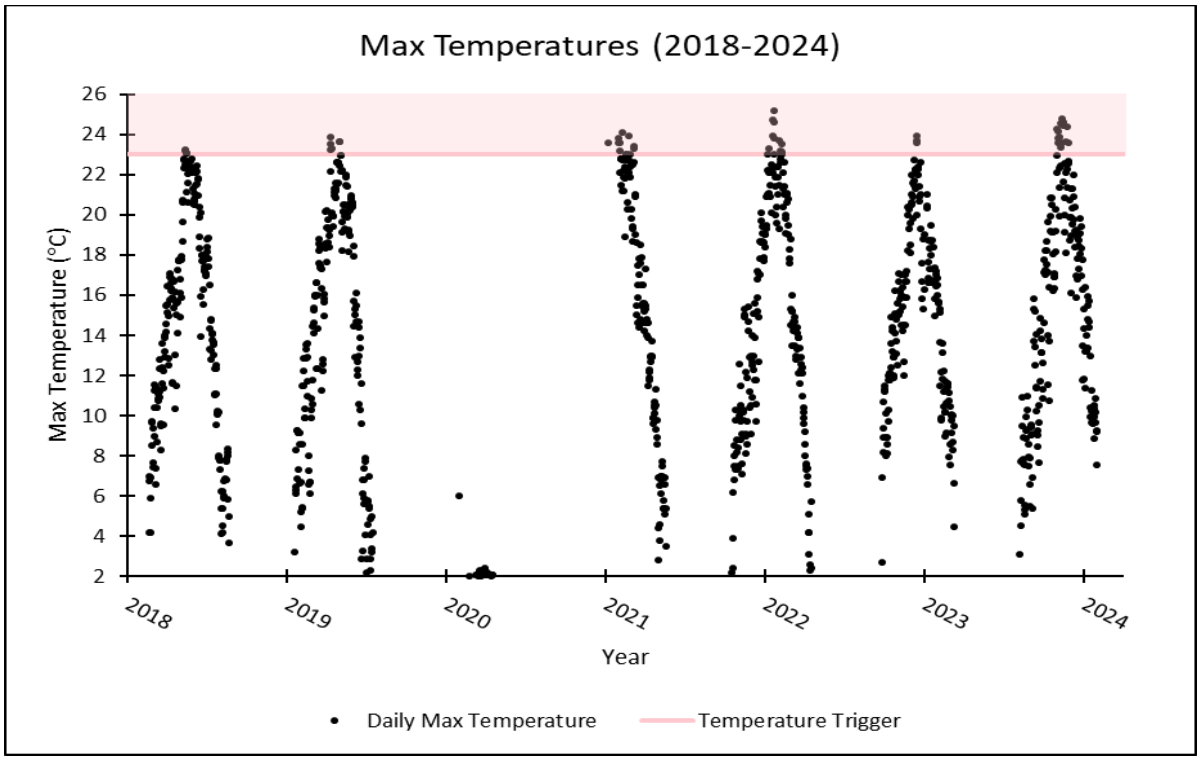

Figure B-8. Daily maximum temperatures at DNRC gage #41D 08000.

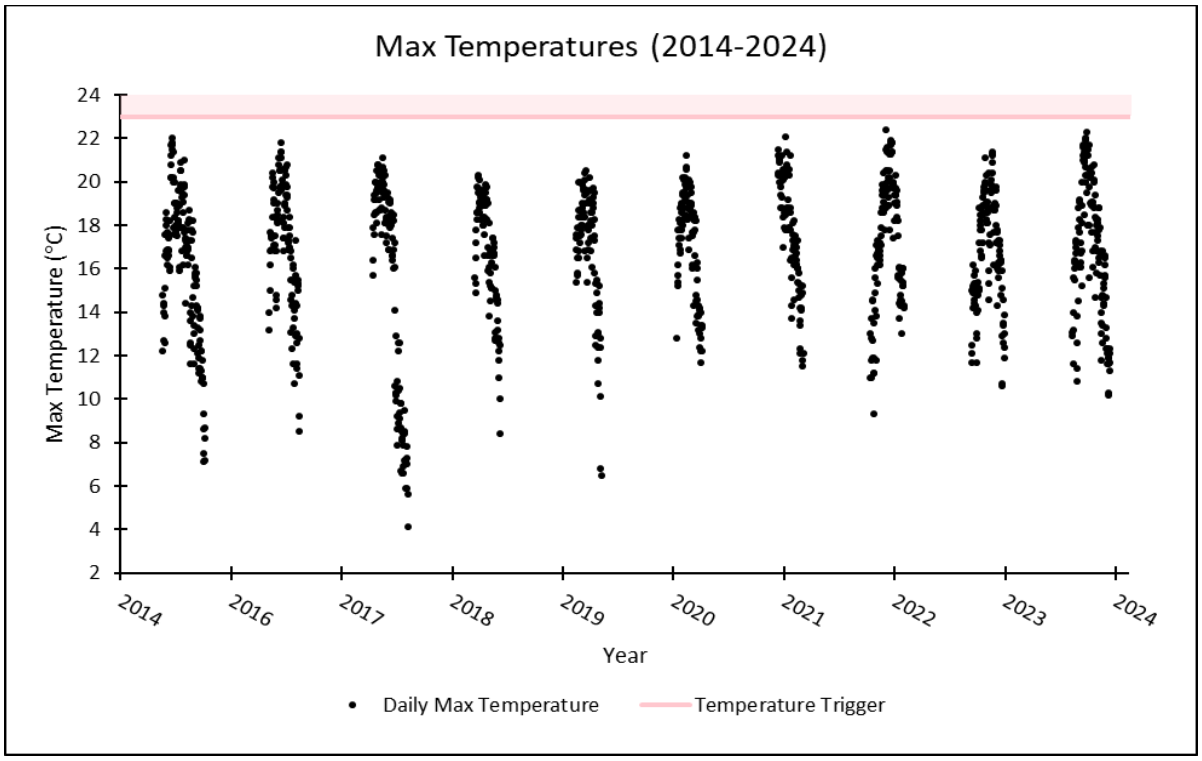

Figure B-9. Daily maximum temperatures at USGS gage #06025250.

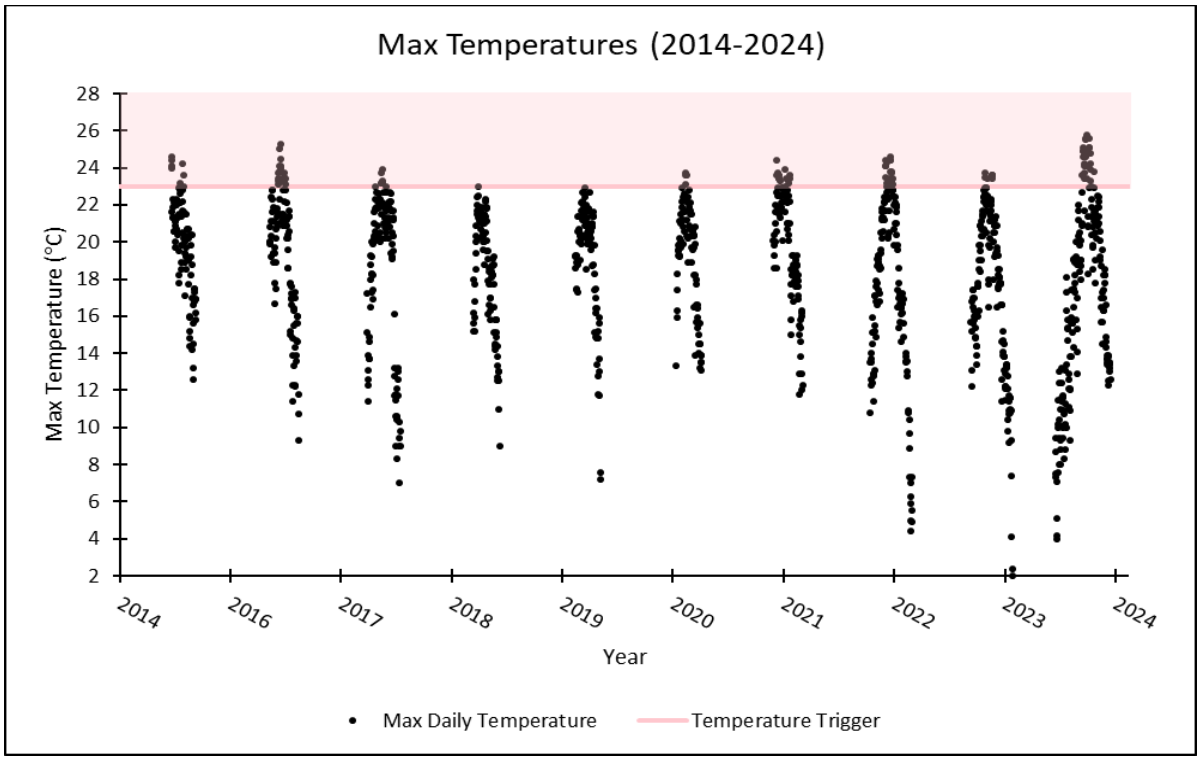

Figure B-10. Daily maximum temperatures at USGS gage #06026210.

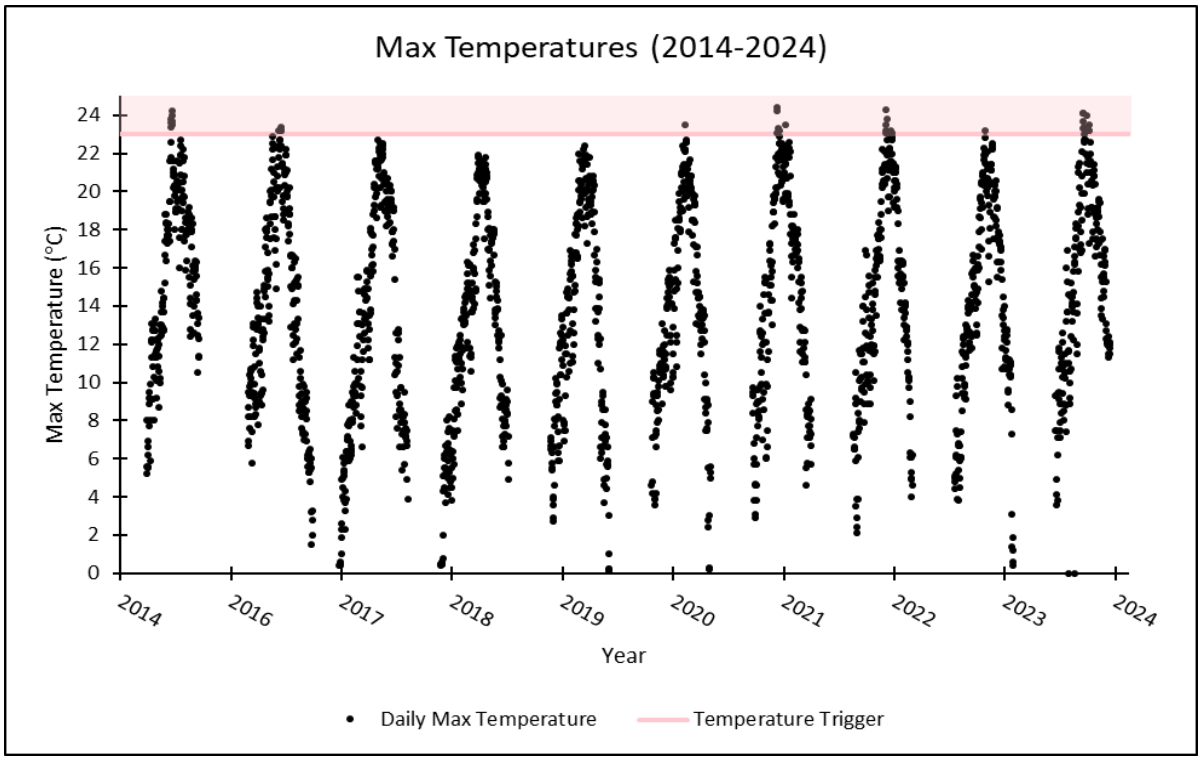

Figure B-11. Daily maximum temperatures at USGS gage #0602550.

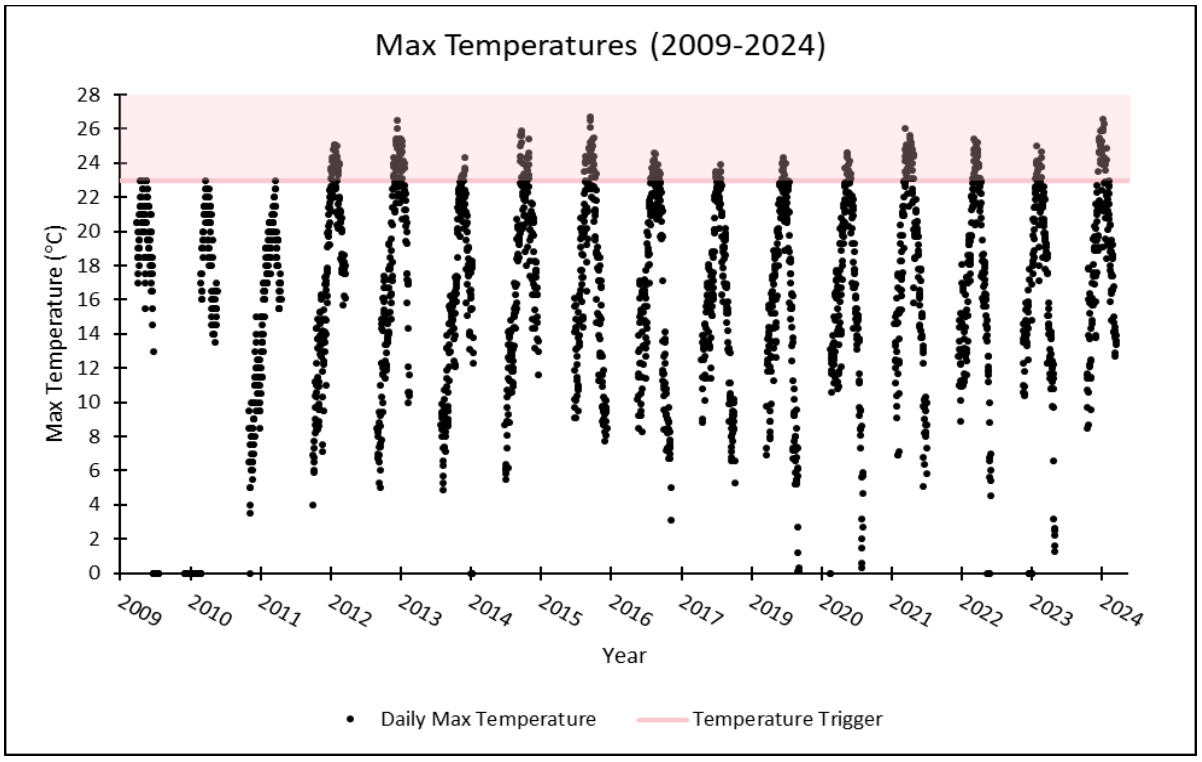

Figure B-12. Daily maximum temperatures at USGS gage #06026420.

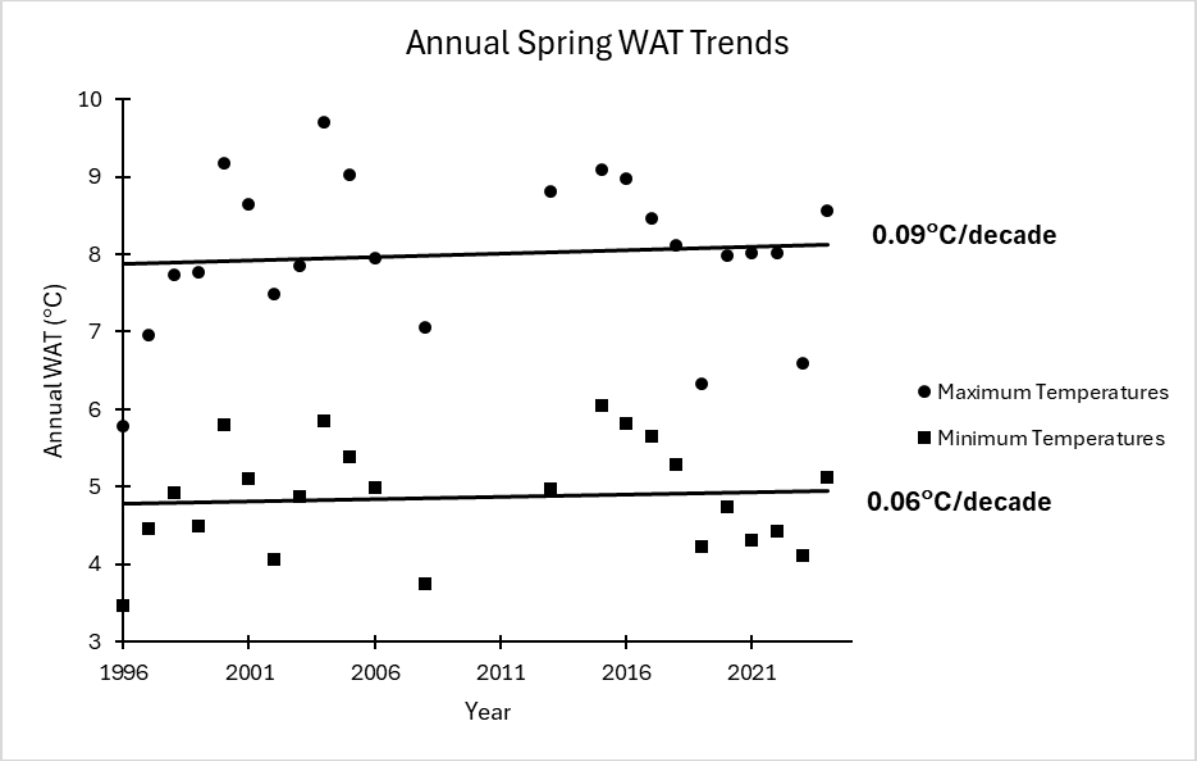

Figure B-13. Annual Spring weekly average temperature trends (1996-2024).

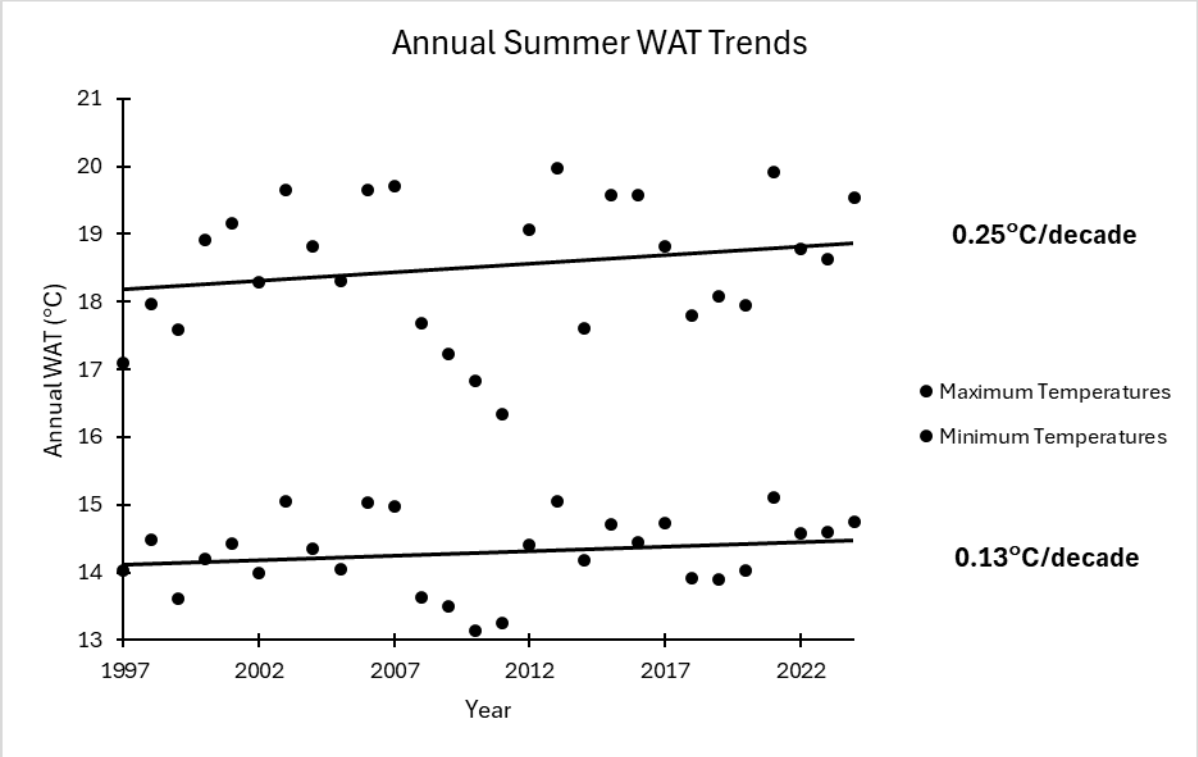

Figure B-14. Annual Summer weekly average temperature trends (1996-2024).

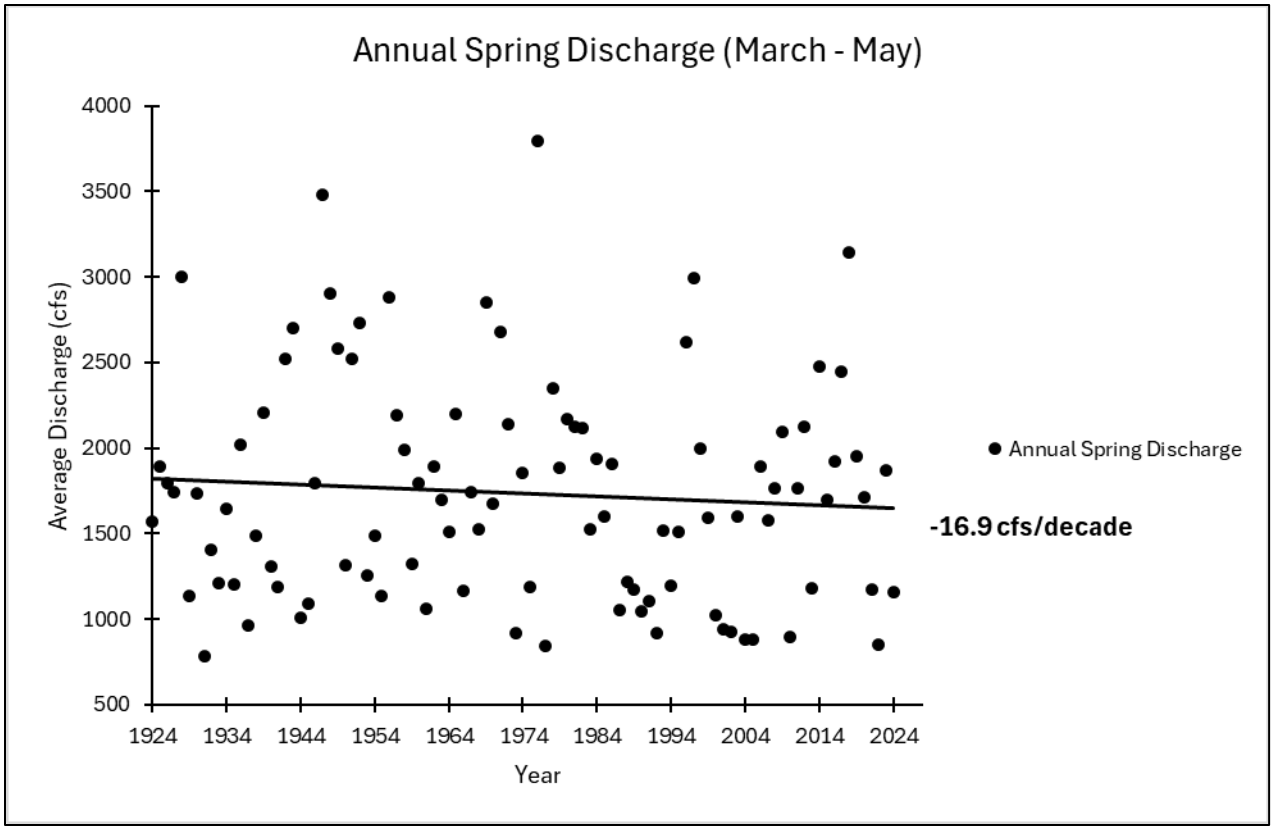

Figure B-15. Annual Spring discharge trends (1924-2024).

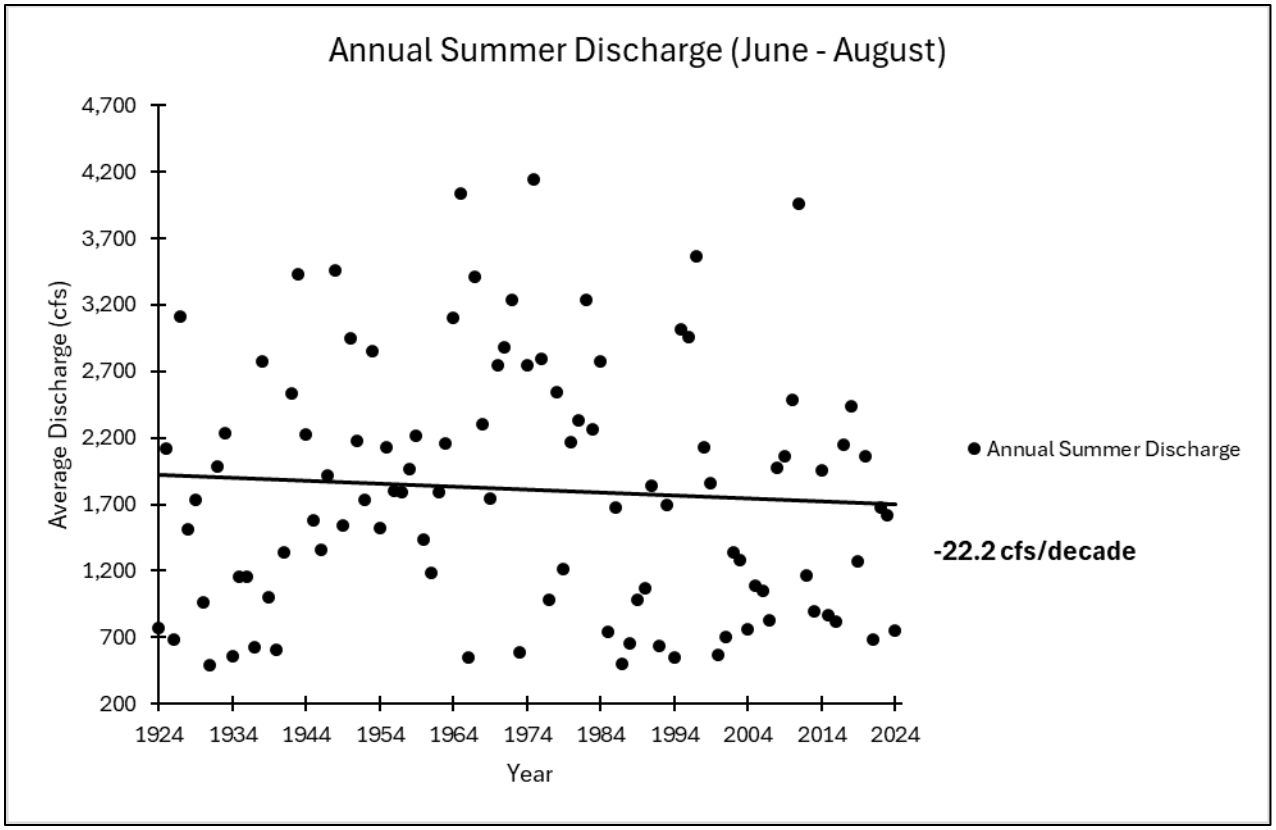

Figure B-16. Annual Summer discharge trends (1924-2024).

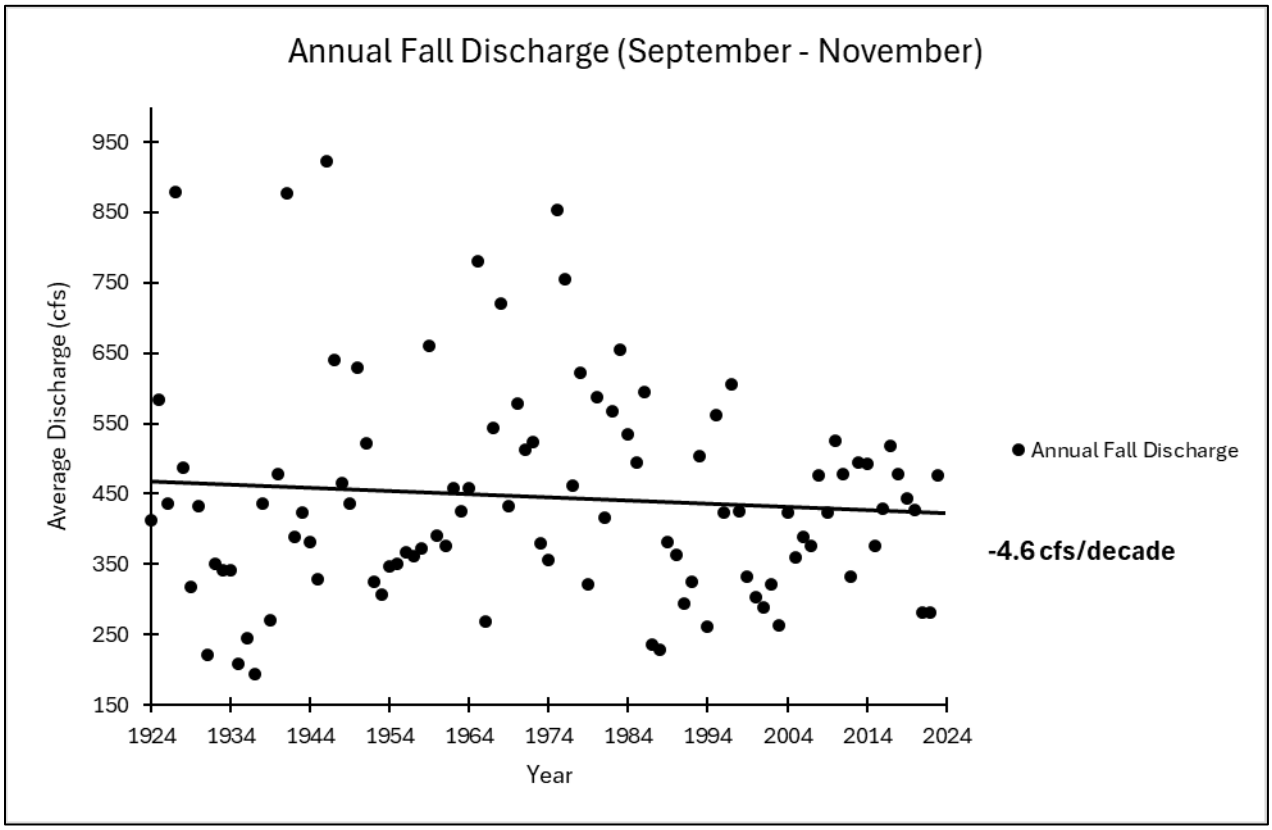

Figure B-17. Annual Fall discharge trends (1923-2023).

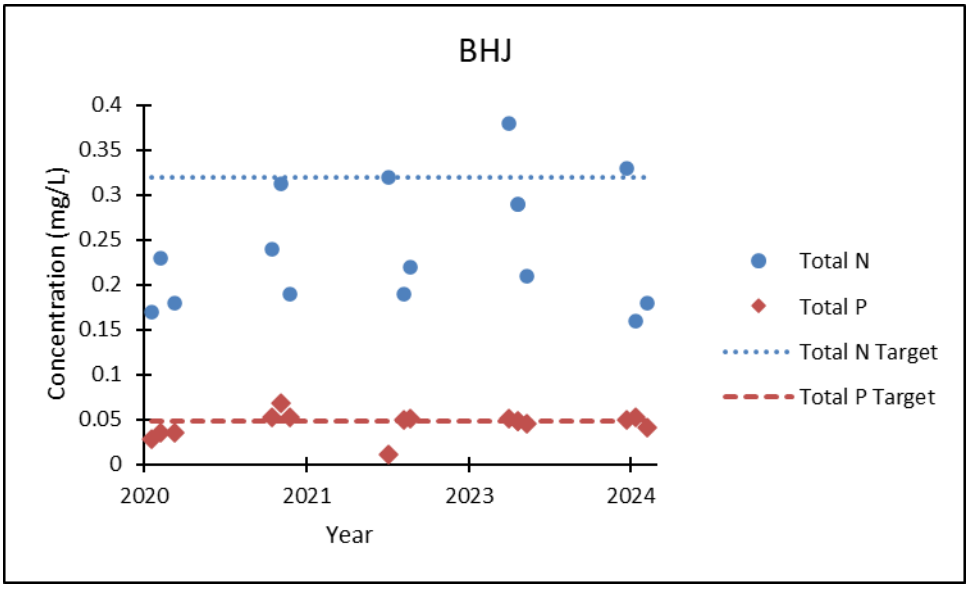

Figure B-18. Big Hole at Jackson nutrient concentrations compared to TMDL targets.

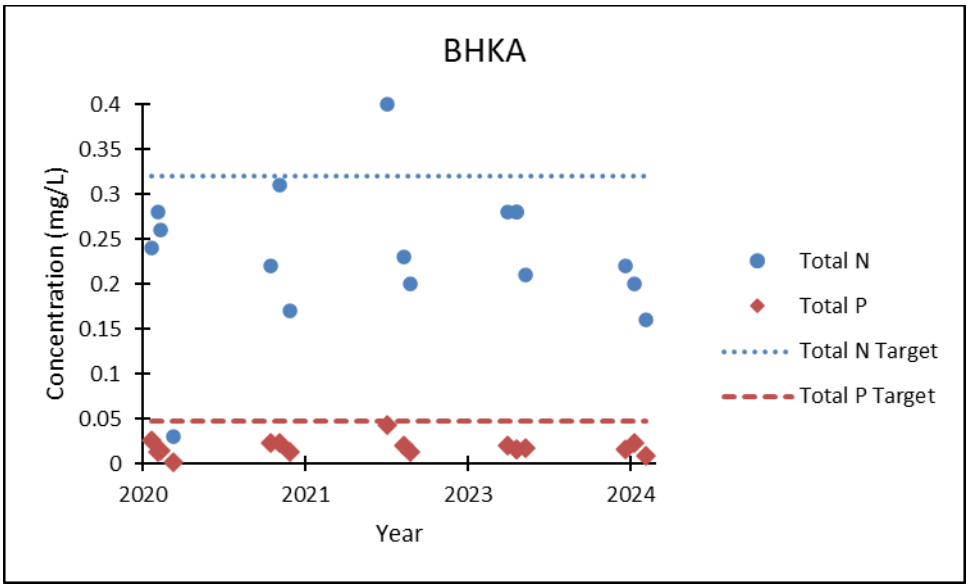

Figure B-19. Big Hole at Kalsta Bridge nutrient concentrations compared to TMDL targets.

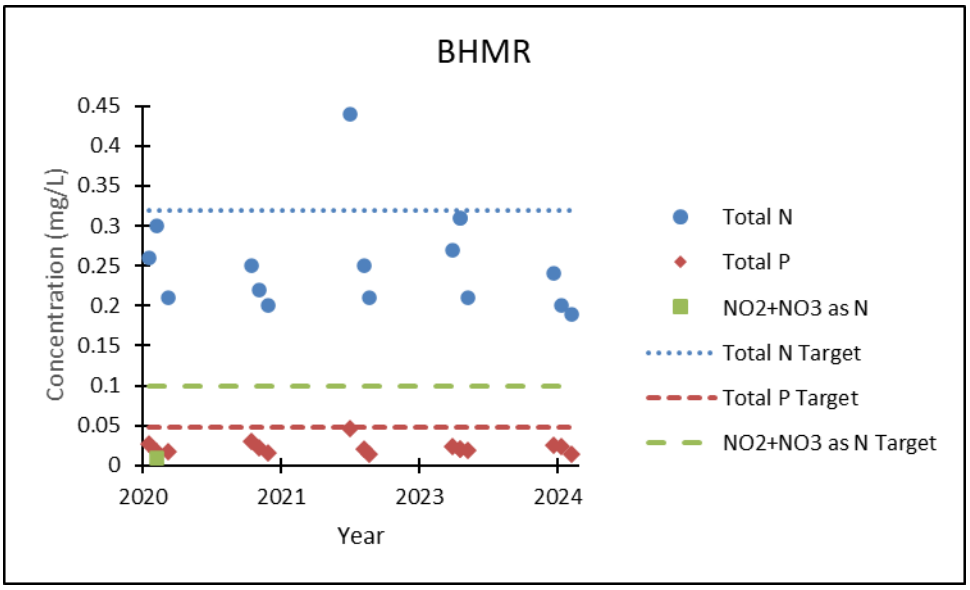

Figure B-20. Big Hole at Maiden Rock nutrient concentrations compared to TMDL targets.

[1]All NO_2+NO_3 as N results < 0.01 mg/L were excluded from this analysis.

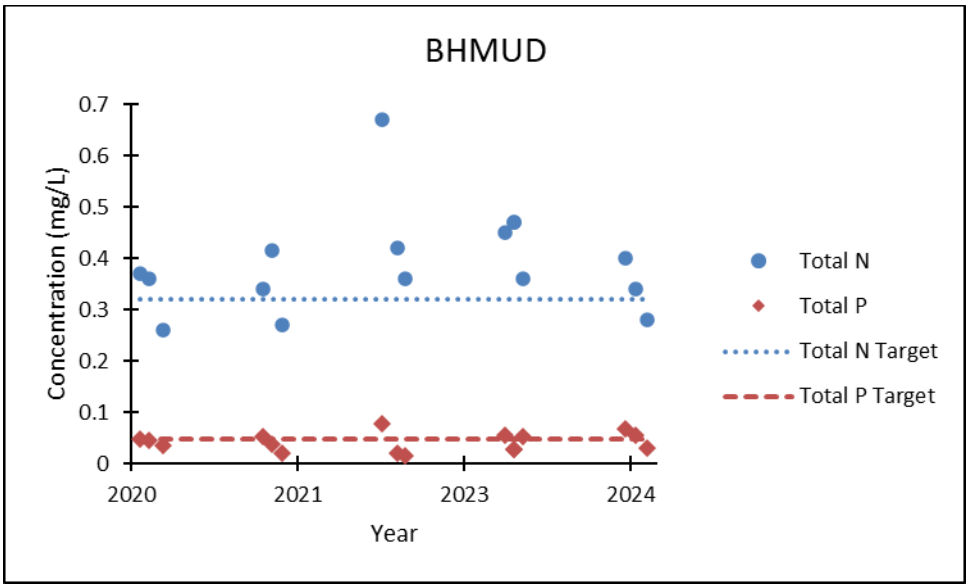

Figure B-21. Big Hole at Mudd Creek Bridge nutrient concentrations compared to TMDL targets.
[1]All NO_2+NO_3 as N results < 0.01 mg/L were excluded from this analysis.

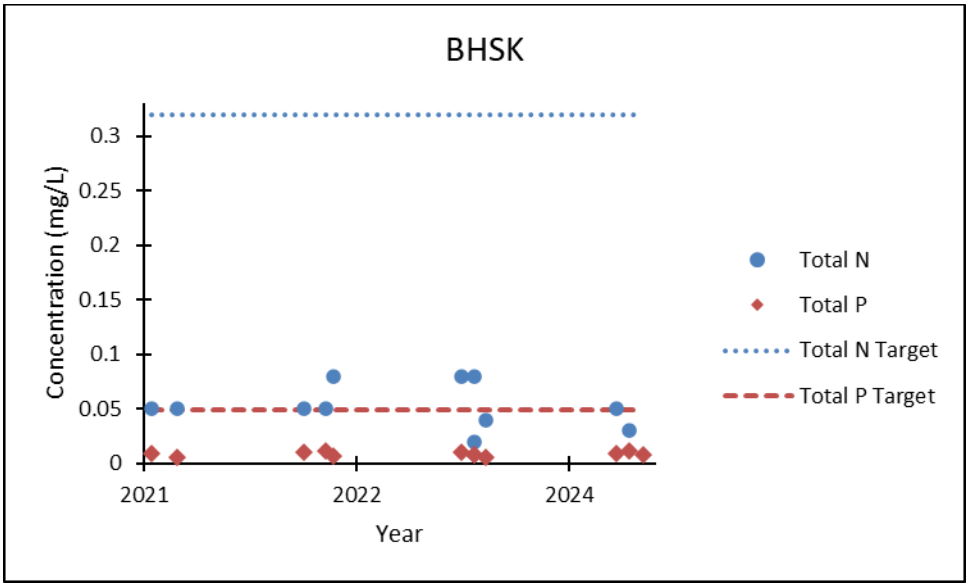

Figure B-22. Big Hole at Skinner Meadows nutrient concentrations compared to TMDL targets.
[1]Total nitrogen results < 0.04 mg/L were excluded from this analysis.

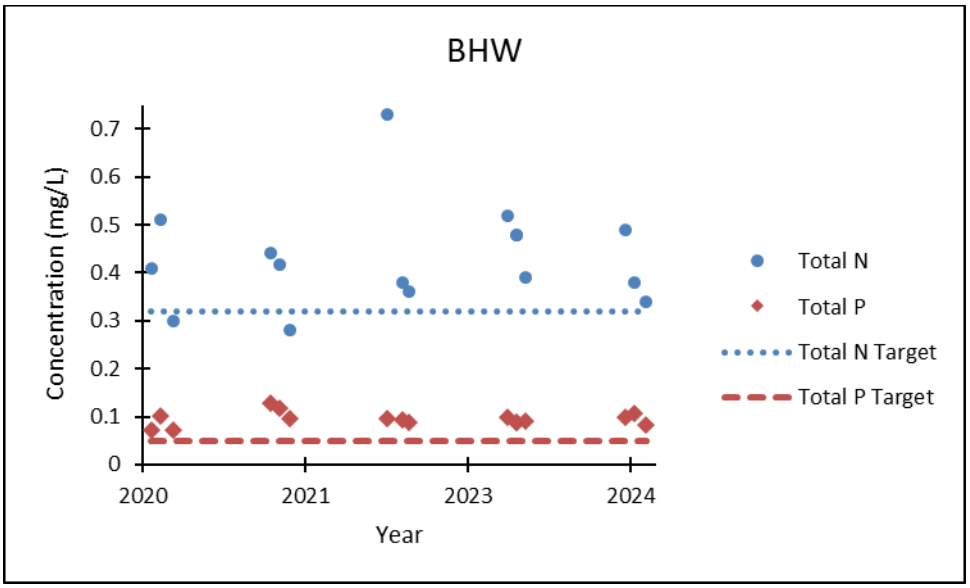

Figure B-23. Big Hole at Wisdom nutrient concentrations compared to TMDL targets.

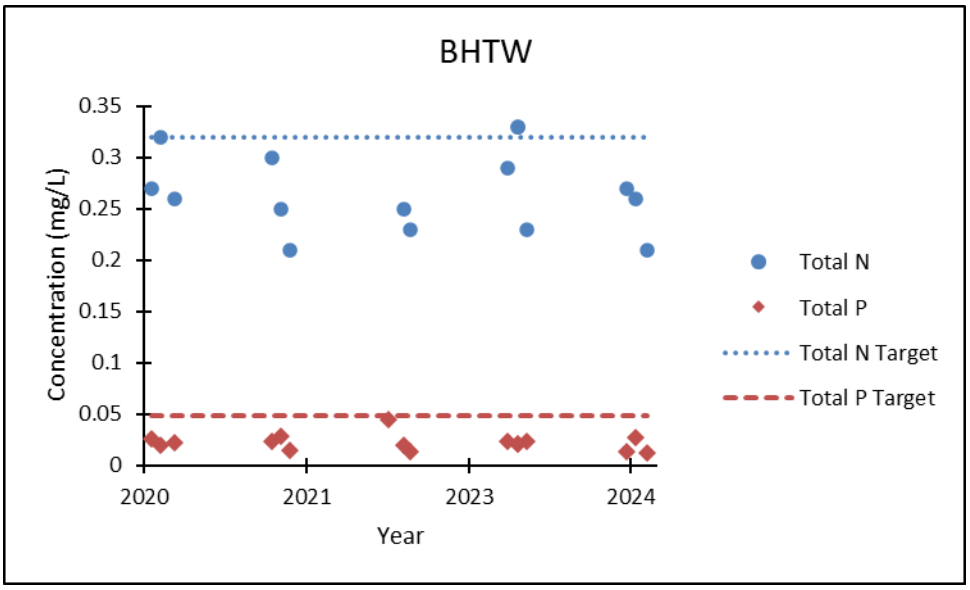

Figure B-24. Big Hole near Twin Bridges nutrient concentrations compared to TMDL targets.

[1]All NO_2+NO_3 as N results < 0.01 mg/L were excluded from this analysis.

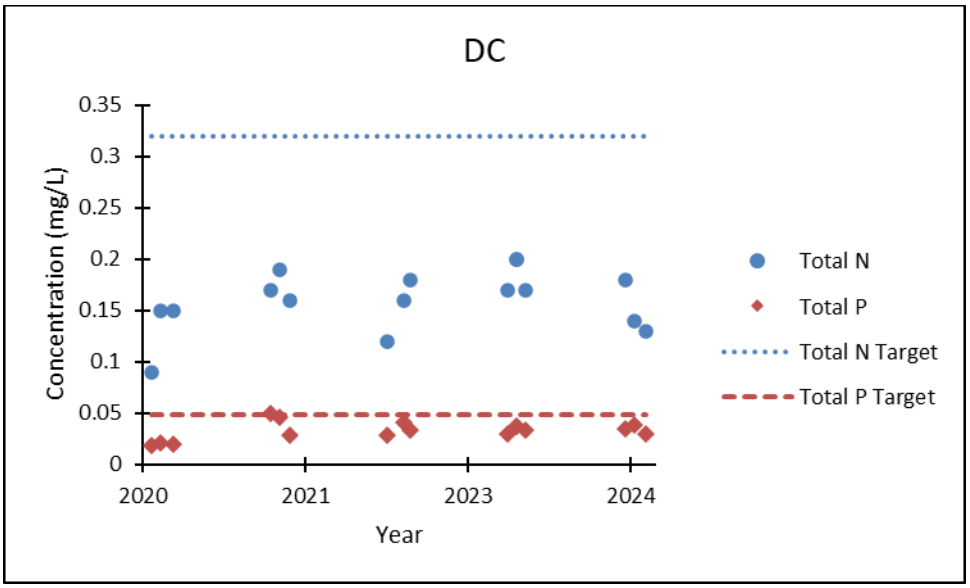

Figure B-25. Deep Creek on BLM land nutrient concentrations compared to TMDL targets.
[1]All NO_2+NO_3 as N results < 0.01 mg/L were excluded from this analysis.

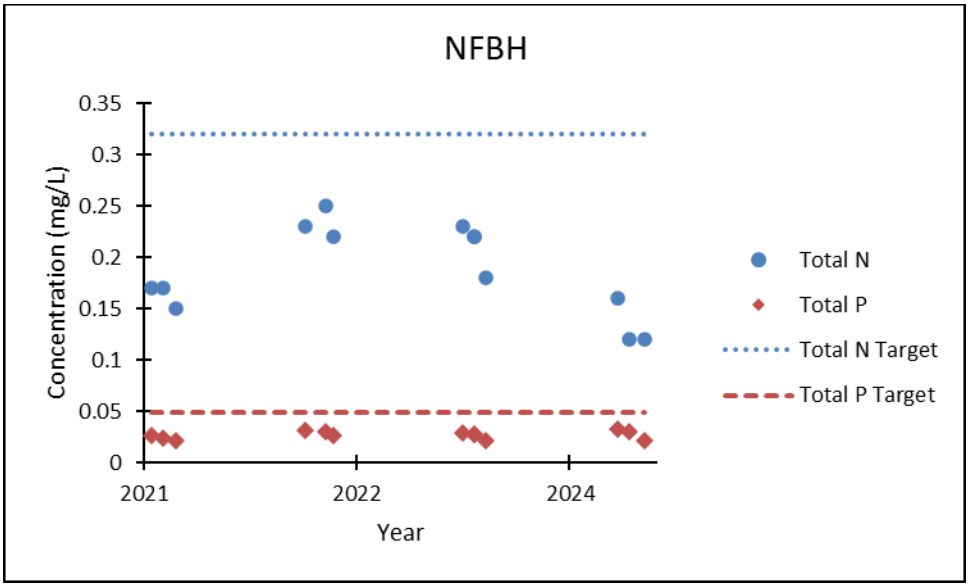

Figure B-26. North Fork Big Hole near Wisdom nutrient concentrations compared to TMDL targets.

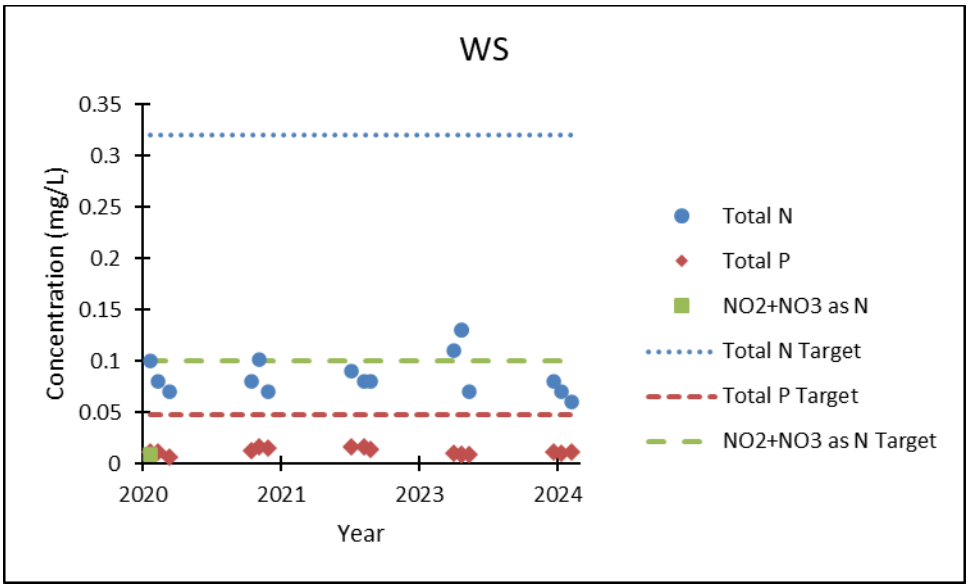

Figure B-27. Wise River near confluence nutrient concentrations compared to TMDL targets.

[1]All NO_2+NO_3 as N results < 0.01 mg/L were excluded from this analysis.

Table B-1. USFS PIBO data

Waterbody/AU ID	FS PIBO Site ID	Year	% Pool Tail Fines < 6mm	W/D Ratio	Pool Frequency (pools/mile)	Macroinvertebrates
Birch Creek, headwaters to national forest boundary MT41D002_090	2619	2008	7.42	20.87	NA[2]	1.19
		2013	10.67	17.96		**0.74**[3d]
		2018	10.33	67.1		ND[1]
		2023	ND[1]	23.48		
Doolittle Creek, headwaters to mouth (Big Hole River) MT41D004_220	2676	2008	**33.23**[4a]	14.4		1.17
		2010	**48.11**[4a]	10.24		**0.64**[6]
		2015	ND[1]	7.9		
		2020	**82.7**[4a]	14.29		ND[1]
Fox Creek, headwaters to mouth (Governor Creek) MT41D004_170	1938	2006	**23.37**[4a]	14.77		0.90
		2011	1.61	8.51		0.98
		2016	3.3	8.19		**0.75**
		2023	3.6	10.15		ND[1]
Jerry Creek, headwaters to mouth (Big Hole River) MT41D003_020	2265	2007	5.93	25.29		**0.63**[3d]
		2012	2.33	16.48		0.98
		2017	2.27	17.55		
		2022	4.67	21.59		ND[1]
Johnson Creek, headwaters to mouth (Big Hole River) MT41D001_020	2678	2008	3.89	21		1.00
		2013	**18.3**[5a]	15.81		0.91
Moose Creek, headwaters to mouth (Big Hole at Maiden Rock) MT41D002_050	2973	2010	13.48	11.2		**0.31**[3d]
		2015	**21.02**[3a]			**0.54**[3d]
Mussigbrod Creek, headwaters to mouth MT41D004_020	2989	2010	**33.67**[5a]	11.25	**48.8**[3c]	ND[1]
		2015	**18.47**[5a]	12.23	106.7	**0.59**[6]
Rock Creek, headwaters to mouth (Big Hole River) MT41D004_120	2661	2008	**89.79**[4a]	12.97	NA[2]	1.06
		2013	**76.66**[4a]	12.4		0.91
		2018	**63.88**[4a]	11.88		ND[1]
		2023	**93.71**[4a]	13.4		
Ruby Creek, headwaters to	2655	2008	10.87	13.96		1.06
		2013	**23.38**[5a]	12.72		**0.66**[6]

Table B-1. USFS PIBO data

Waterbody/AU ID	FS PIBO Site ID	Year	% Pool Tail Fines < 6mm	W/D Ratio	Pool Frequency (pools/mile)	Macroinvertebrates
mouth (North Fork Big Hole River) MT41D004_100						
Trapper Creek, headwaters to mouth (Big Hole River) MT41D002_010	2196	2007	**19.06**[3a]	29.97		1.02
		2012	6.38	20.28		**0.73**[3d]
		2017	**14.21**[3a]	15.29		1.24
		2022	13.93	23.65		ND[1]
Wise River, headwaters to mouth (Big Hole River) MT41D003_200	2648	2008	**25.42**[3a]	14.94		
		2013	**22.41**[3a]	12.49		**0.70**[3d]
		2018	ND[1]	11.84		ND[1]
		2023	**66.64**[3a]	10.65		

[1]ND indicates no data was available.
[2]NA indicates there was no target for comparison.
[3]Bolded results exceed the Middle and Lower Big Hole TPA water quality targets:
[a]% pool tail fines < 6mm: <14%
[b]W/D ratio: > 5.1
[c]Pool frequency: 84 pools/mile
[d]RIVPACS: >0.80
[4]Bolded results exceed the Upper Big Hole TPA water quality targets:
[a]% pool tail fines < 6mm: < 22%
[b]W/D ratio: ≤ 26
[5]Bolded results exceed the North Fork Big Hole TPA water quality targets:
[a]% pool tail fines < 6mm: ≤ 11%
[b]W/D ratio: ≤ 28
[6]Bolded results exceed Upper and North Fork Big Hole TPA macroinvertebrate target of 1.2>RIVPACS>0.80
[7]Tributary to sediment impaired stream

Table B-2. French Gulch and Moose Creek riparian greenline assessment

Reach	Understory Shrubs Cover (%)[1]
M1	**25**
M2	**20**
M3	**0**
FG1-1	
FG1-2	
FG1-3	**10**
FG2-1	**0**
FG2-2	**10**
FG2-3	**5**
FG3-1	**20**
FG3-2	**5**
FG4-1	**10**

Table B-2. French Gulch and Moose Creek riparian greenline assessment

Reach	Understory Shrubs Cover (%)[1]
FG4-2	**5**
FG4-3	**0**
FG5-1	**5**
FG5-2	**15**
FG5-3	**20**

[1]Bolded results fall below the supplemental indicator target for understory shrub cover of ≥ 48%.
[2]Table adapted from BHWC, 2018.

Table B-3. 2021 French Creek drainage sediment site data post-restoration

Site	Latitude	Longitude	Rosgen Stream Type	W/D Ratio[2]	Entrenchment Ratio[3]	Riffle % < 2mm[4]
CALIO4_01	45.95808	-113.03782	C4	17.3	**14.2**	**20.3**
CALIO5_01	46.00044	-112.96808	B3/4	9.9	**1.9**	**18.3**
OREG04-01	45.98366	-113.00733		14.8	**3.5**	**23.5**
SIXM06_03	45.99482	-113.0349	B3	13.3	**2.0**	**16.3**
SIXM06_01	45.97836	-113.02627		10.2	**23.0**	**30.2**
FRNC06_06	45.926284	-113.089666	C3	19.5	**12.0**	**21.9**
AMER03_01	45.946	-112.9542	B4	14.2	**64.0**	**22.0**
AMER05_01	45.97563	-113.0229	B3	9.6	**17.6**	**23.3**
FRNC04_01	45.9579	-113.01787		**22.8**	**7.6**	**35.6**
FRNC05_01	45.95388	-113.03477		11.2	**32.0**	**22.7**
FRNC06_03	45.94759	-113.05323	C3	22.0	**12.5**	**25.3**
FRNC06_04	45.93952	-113.07604		15.1	**17.7**	**34.4**
OREG02_01	46.01117	-113.00124	A4	7.9	NA	**46.2**
OREG04_02	45.99319	-113.00161	B3	9.4	**11.3**	**45.5**
SIXM03_01	46.00803	-113.03873	B4	11.2		**18.1**

[1]Results in bold exceed the water quality target.
[2]Width-to-depth ratio targets: C4=20, B3=15, C3=31, B4=17, and A=10.
[3]Entrenchment ratio targets: C4=14.1, B=1.8, C3=5.1, A=NA
[4]Riffle % < 2mm targets: 13%
[5]Table adapted from Hanson, 2022.

Table B-4. 2017 French Gulch and Moose Creek post-restoration monitoring data

Site	W/D Ratio[1]	Pool Tail Fines <6mm (%)[2]
French Gulch 1	8.78	**26**
French Gulch 2	8.60	**28**
French Gulch 3	7.92	**25**
French Gulch 4	**4.81**	
French Gulch 5	6.44	**32**
Moose Creek	**4.96**	12

[1]Bolded results do not meet the water quality target for W/D ratio: > 5.1
[2]Bolded results do not meet the water quality target for % pool tail fines < 6mm: <14%
[3]Table adapted from BHWC, 2018.

Figure B-28. California Creek pre- (2015) and post-restoration (2017) photos.

Figure B-29. California Creek pre- (2015) and post-restoration (2017) photos.

Figure B-30. French Gulch and Moose Creek pre- (2016) and post-restoration (2017) photos.

Figure B-31. French Creek pre- (2019) and post-restoration (2020) photos.

Figure B-32. Lower French Creek pre- and post-restoration photos.

APPENDIX C – WATERSHED CONTACTS

Table C-1. Big Hole River watershed contacts

Entity Name	Contact Name	Contact Title
Beaverhead Conservation District	Tom Miller	Supervisor
Big Hole Watershed Committee	Pedro Marques	Executive Director
Bureau of Land Management – Dillon Field Office	Alden Shallcross	State Lead Montana / Dakotas Aquatic Habitat Management Program
	Dustin Crowe	Assistant Field Manager
	Helen Sladek	Hydrologist
	Paul Hutchinson	Fishery Biologist
Bureau of Land Management – Miles City Field Office	Christina Stuart	Fish Biologist
George Grant Chapter of Trout Unlimited	Forrest Jay	President
Montana Association of Conservation Districts	N/A	N/A
Montana Department of Environmental Quality – Abandoned Mine Lands	Jason Rappe	Abandoned Mine Lands and Construction Section Supervisor
	Jorri Dyer	Abandoned Mine Lands and Construction Section Supervisor
Montana Fish, Wildlife & Parks	Jarrett Payne	Plant Ecologist – Wildlife Division
	Jim Olsen	Big Hole Fisheries Biologist
	Katelin Killoy	Riparian Ecologist for the Arctic Grayling CCAA Programs
	Michael Duncan	Region 3 Fisheries Program Manager
	Michelle McGree	Future Fisheries Coordinator
Montana Department of Natural Resources and Conservation	Autumn Coleman	Resource Development Bureau Chief
	Danika Holmes	Regional Water Planner – Upper Missouri River Basin
	Heidi Folnagy-Anderson	Business Analyst
	Kaitlin Boren	Hydrologist
	Lindsay Volpe	Renewable Resource Grant and Loan Program Manager
Montana Department of Transportation	Larry Urban	Wetland Mitigation Specialist
Montana Natural Resources Conservation Service	Kyle Tackett	Acting State Conservationist
Montana Technological University	Christopher Gammons	Professor, Department of Geological Engineering
	Paul Helfrich	PhD Student
	Robert Pal	Professor - Ecology
Montana Watershed Coordination Council	Terri Nichols	Watershed Programs Manager

Table C-1. Big Hole River watershed contacts

Entity Name	Contact Name	Contact Title
National Resource Damage Program	Ray Vinkey	Environmental Science Specialist
Ruby Valley Conservation District	Audra Bell	Stewardship Director
Save Wild Trout	Brian Wheeler	Executive Director
United States Fish & Wildlife Service	James Magee	Fish and Wildlife Biologist
United States Forest Service – Beaverhead-Deerlodge National Forest	Allison Landro	Environmental Coordinator
	Kevin Weinner	Hydrologist
	Jennifer Mickelson	Watershed Program Manager
	Sonny Thornborrow	Physical Scientist

APPENDIX D – MAPS

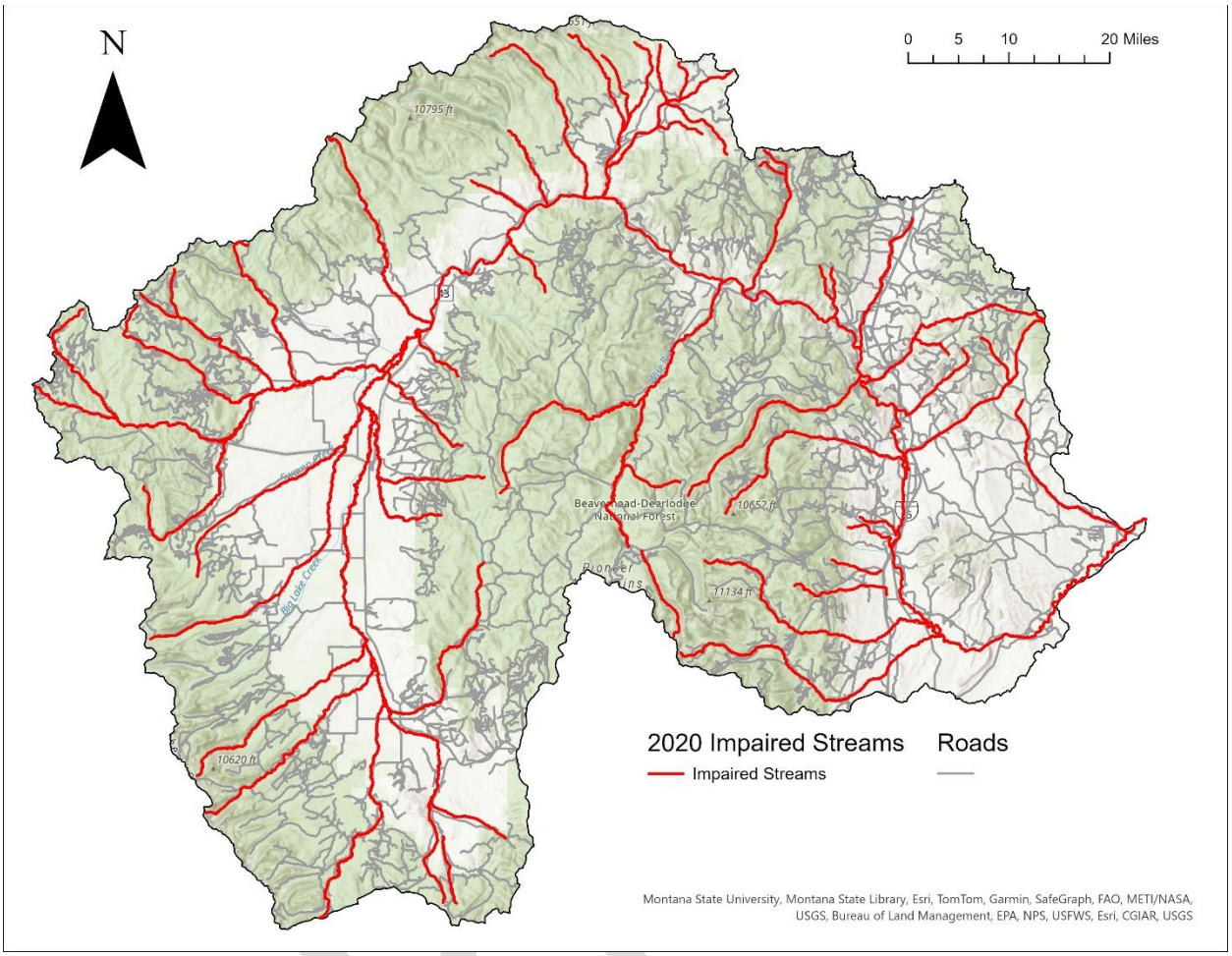

Figure D-1. Road systems in the Big Hole River watershed.

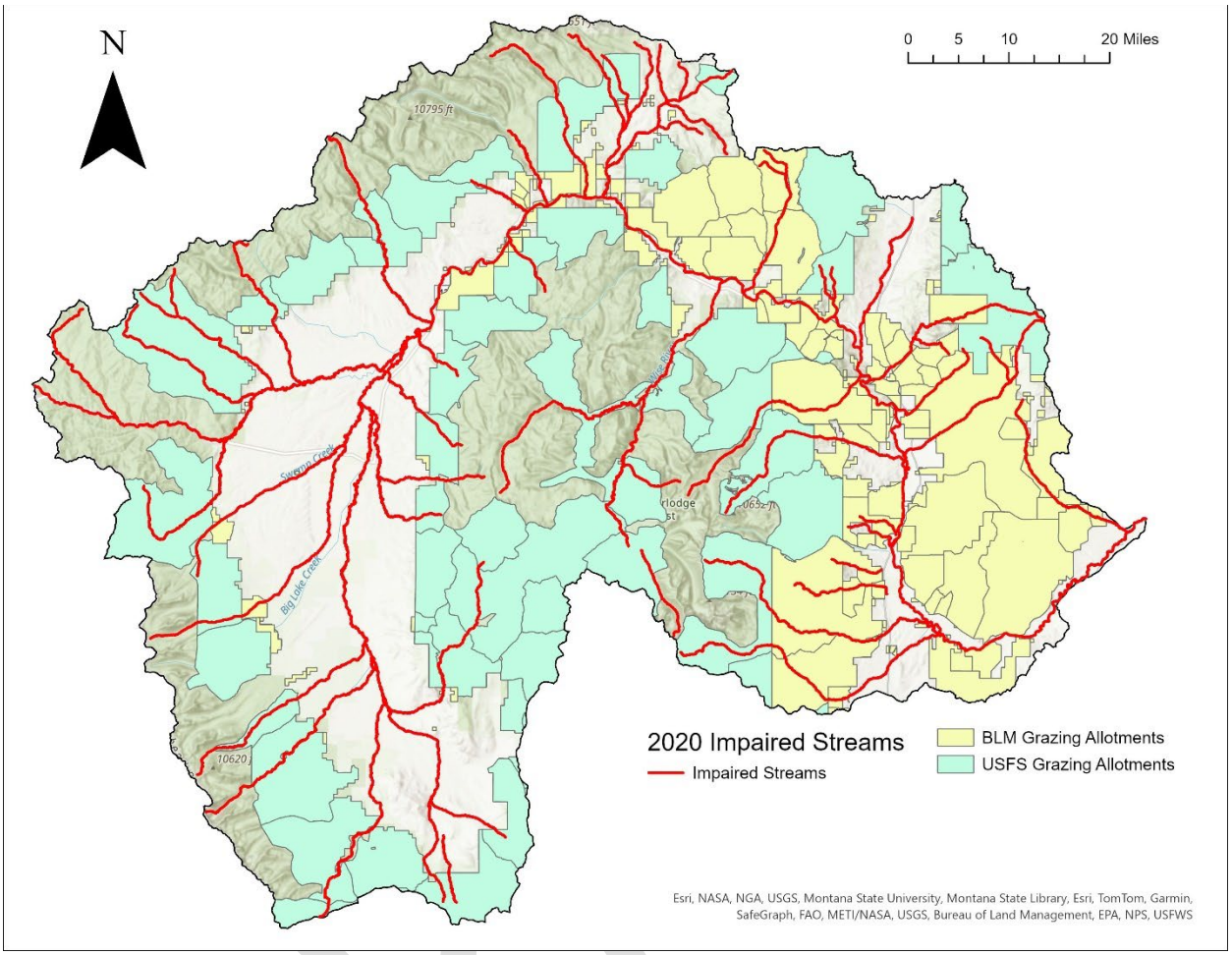

Figure D-2. Grazing allotments in the Big Hole River watershed.

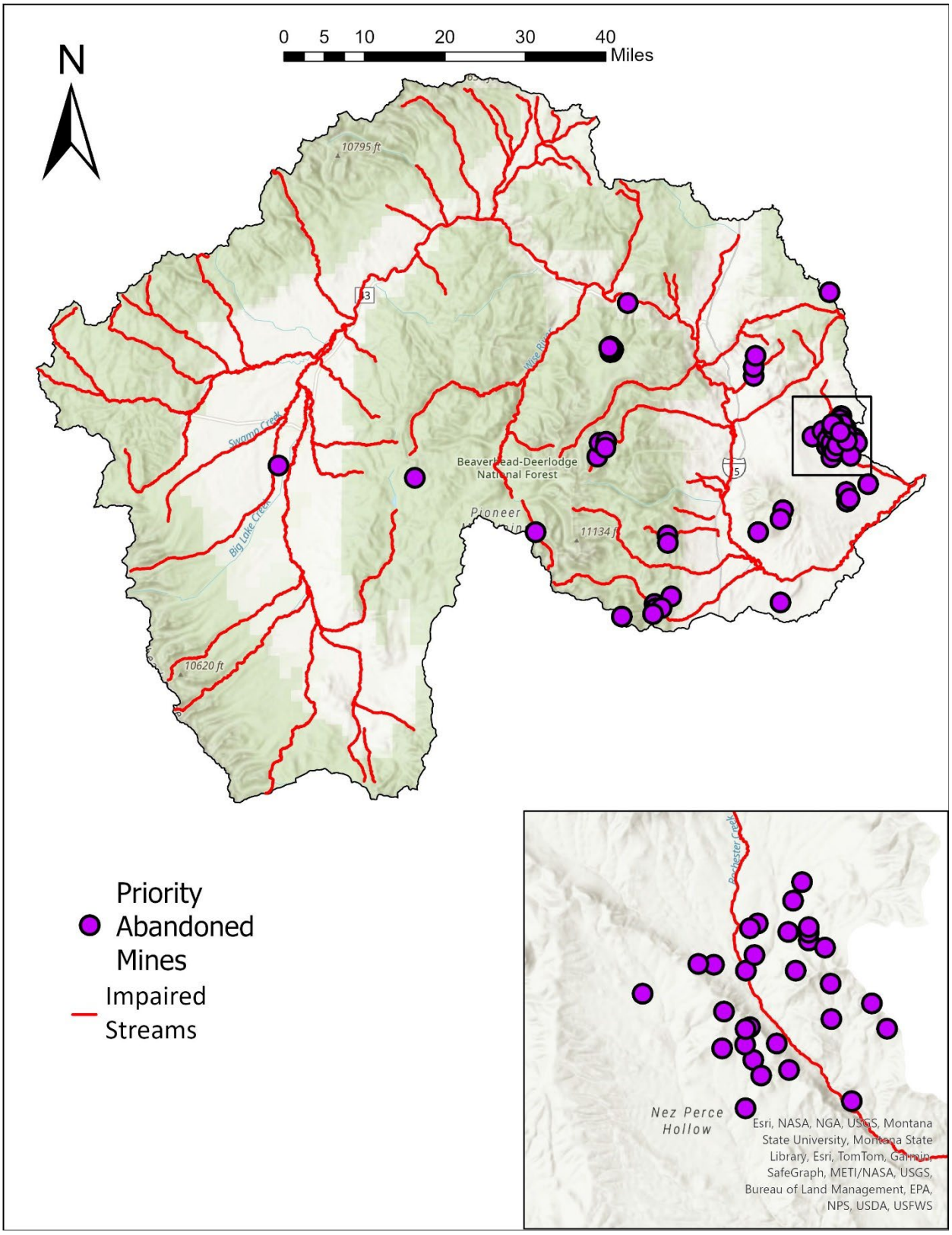

Figure D-3. Abandoned in the Big Hole River watershed.

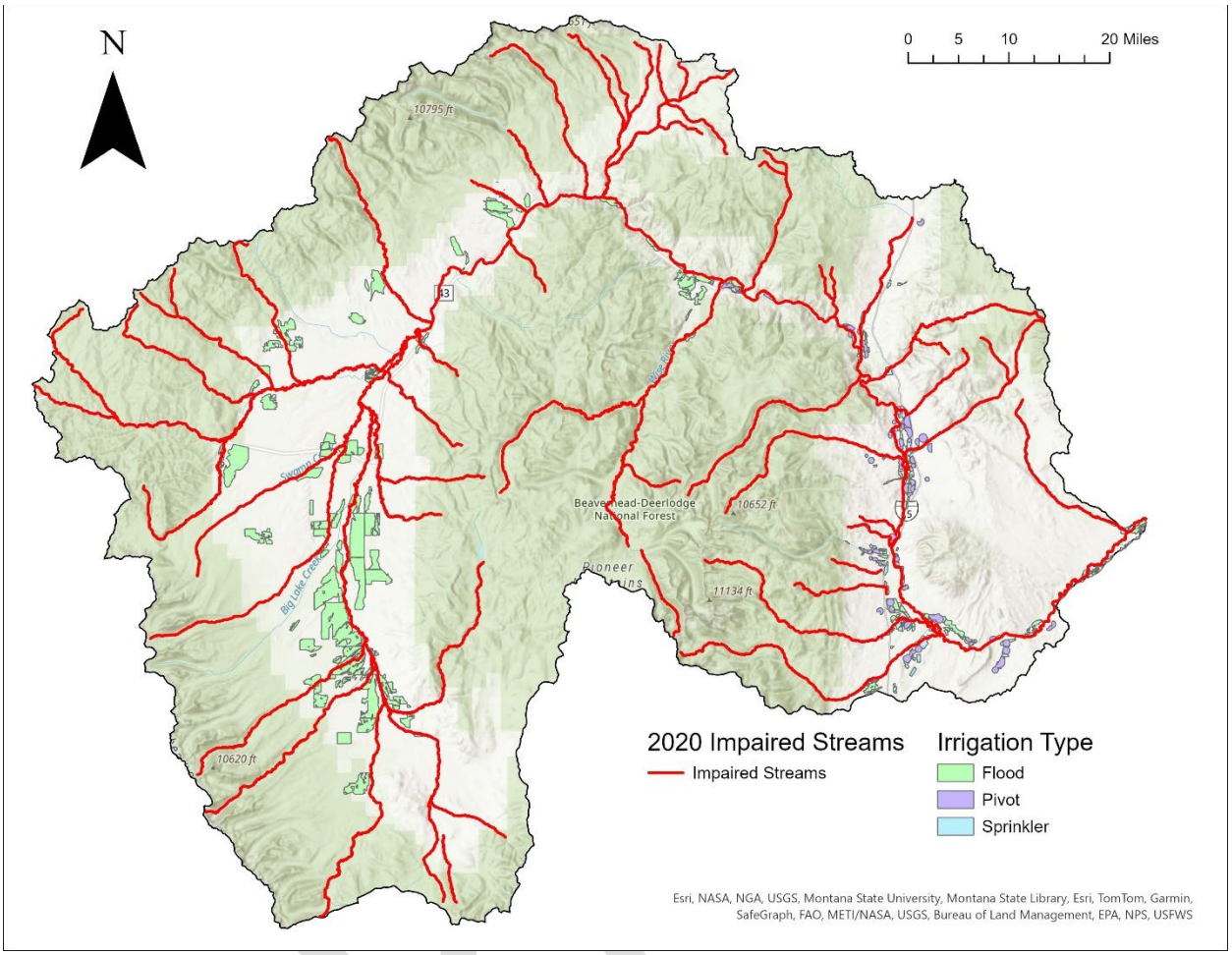

Figure D-4. Irrigation systems and types in the Big Hole River watershed.