

APPENDIX F - DETAILED SOURCE ASSESSMENT AND DATA REVIEW

TABLE OF CONTENTS

F.1 Un-named Creek (MT76G006_010*)	F-3
Detailed Mining History	F-3
Ontario Mine.....	F-3
Data Review by Pollutant.....	F-3
F.2 Monarch Creek (MT76G004_060)	F-5
Detailed Mining History	F-5
Monarch Mine	F-5
Data Review by Pollutant.....	F-5
F.3 Ontario Creek (MT76G004_130).....	F-7
Detailed Mining History	F-7
Hard Luck Mine	F-7
Data Review by Pollutant.....	F-7
F.4 Sally Ann Creek (MT76G004_055)	F-8
Detailed Mining History	F-8
Telegraph Mine	F-8
Data Review by Pollutant.....	F-8
F.5 O’Keefe Creek (MT76G004_054)	F-9
Detailed Mining History	F-9
Sure Thing Mine	F-9
Data Review by Pollutant.....	F-9
F.6 Telegraph Creek, Upper Segment (MT76G004_051).....	F-10
Detailed Mining History	F-10
Lilly/Orphan Boy Mine	F-10
Third Term Mine	F-10
Julia Mine	F-11
Anna R/Hattie M Mine.....	F-11
Hub Camp Mine	F-11
Viking Mine	F-11
Unnamed Mine 8N6W6ABDB.....	F-11
Data Review by Pollutant.....	F-12
F.7 Telegraph Creek, Lower Segment (MT76G004_052).....	F-13

Detailed Mining History	F-13
Data Review by Pollutant.....	F-13
F.8 American Gulch Creek (MT76G004_079)	F-14
Detailed Mining History	F-14
Data Review by Pollutant.....	F-14
F.9 Dog Creek, Upper Segment (MT76G004_071).....	F-15
Detailed Mining History	F-15
Bald Butte Mine	F-15
Devon/Sterling and Albion Mine.....	F-15
Data Review by Pollutant.....	F-15
F.10 Lower Dog Creek (MT76G004_072).....	F-16
Detailed Mining History	F-16
Data Review by Pollutant.....	F-16
F.11 Little Blackfoot River, Upper Segment (MT76G004_020).....	F-17
Detailed Mining History	F-17
Charter Oak Mine.....	F-17
Kimball Mine	F-17
Golden Anchor Mine	F-18
Mountain View Mine	F-18
Data Review by Pollutant.....	F-18
F.12 Little Blackfoot River, Lower Segment (MT76G004_010).....	F-20
Detailed Mining History	F-20
Victory/Evening Star Mine	F-20
Data Review by Pollutant.....	F-20

F.1 UN-NAMED CREEK (MT76G006_010*)

DETAILED MINING HISTORY

Ontario Mine

The Ontario Mine is located mostly on private land with a small portion on the Helena National Forest and was one of the most prolific mines in the Elliston District. The mine worked a vein deposit that contained pyrite (a mineral known to promote the formation of acid mine drainage) producing lead, silver, gold and copper from 1890-1940 (Olsen, 2004). Until recently, the site consisted of ruined buildings, a discharging adit and a waste rock pile on private property and another discharging adit and lesser amounts of waste rock on National Forest lands. A key feature on both sides of the property line was a 150 feet wide tailings pile that extended 3,400 feet from the mill to Ontario Creek, with a major deposit at the confluence (Pioneer Technical Services, Inc., 1993). Tailings in the creek were additionally deposited at least another 1,500 feet downstream and were over 10 feet thick in some places (Hargrave, et al., 1998). The source of Un-named Creek is the upper discharging adit (Pioneer Technical Services, Inc., 1993). No high flow data is available for Un-named Creek but since the adit discharge supplies a substantial portion of the streamflow, conditions are assumed to be relatively constant throughout the year. In 2003, the USFS reclaimed mine-impacted land on Forest Service property (Tetra Tech, 2006). Two years later the DEQ AML program addressed the affected private property. The 2005 operation removed bare tailings piles and rock-lined the adit drainage channel; but DEQ AML did not treat or stop the adit discharge and the tailings that had naturally revegetated were left in place (Olsen, 2004). Efforts to reclaim Ontario Mine have not convincingly reduced metals concentrations in the creek; the highest cadmium concentration in the last 16 years was collected in 2008, after reclamation.

DATA REVIEW BY POLLUTANT

Arsenic

Un-named Creek is listed as impaired by arsenic on the 2010 303(d) List. Out of nine recent surface water samples, seven exceeded the human health standard and two samples exceeded the chronic aquatic life standard (22%). Because more than 10% of the samples exceeded the chronic aquatic life standard and the human health standard was exceeded, arsenic water quality targets were not met. Additionally, a sediment sample collected by DEQ in 2008 identified arsenic concentrations at levels nearly 350 times the supplemental indicator value. Based on target and supplemental indicator value exceedances, an arsenic TMDL was developed for Un-named Creek.

Cadmium

Un-named Creek is listed as impaired by cadmium on the 2010 303(d) List. Out of nine recent surface water samples, three exceeded the human health standard and all nine (100%) exceeded both standards of aquatic life. Because more than 10% of the samples exceeded the chronic aquatic life standard, concentrations were more than two times the acute aquatic life standard and the human health standard was exceeded, cadmium water quality targets were not met. Stream sediments collected in 2008 tested below the supplementary indicator value. Based on target exceedances, a cadmium TMDL was developed for Un-named Creek.

Copper

Un-named Creek is listed as impaired by copper on the 2010 303(d) List. Out of nine recent surface water samples, all nine (100%) greatly exceeded both standards of aquatic life. The highest recorded

copper concentration was 36 times more elevated than the acute aquatic life standard value. Because more than 10% of the samples exceeded the chronic aquatic life standard and concentrations were more than two times the acute aquatic life standard, copper water quality targets were not met. Stream sediments collected in 2008 tested below the supplementary indicator value. Based on target exceedances, a copper TMDL was developed for Un-named Creek.

Iron

Un-named Creek is not listed as impaired by iron on the 2010 303(d) List, however recent data provide evidence of iron as a cause of water quality impairment. Out of nine recent surface water samples, four (44%) exceeded the chronic aquatic life standard. Widespread iron deposits were observed in the rock-lined channel substrate during recent DEQ sampling. Because more than 10% of the samples exceeded the chronic aquatic life standard, iron water quality targets were not met. Additionally, although iron PELs also have not been established, a stream sediment sample collected in 2008 contained a staggering 242,000 µg/g of iron, which is nearly five times greater than the maximum value measured in other sediment samples throughout the Little Blackfoot watershed. Based on target exceedances, an iron TMDL was developed for Un-named Creek.

Lead

Un-named Creek is listed as impaired by lead on the 2010 303(d) List. Out of nine recent surface water samples, eight exceeded the chronic aquatic life standard (89%) and seven exceeded the human health standard. Because more than 10% of the samples exceeded the chronic aquatic life standard, concentrations were more than two times the acute aquatic life standard and the human health standard was exceeded, lead water quality targets were not met. Additionally, a sediment sample collected by DEQ in 2008 identified arsenic concentrations at levels more than three times the supplemental indicator value. Based on target and supplemental indicator value exceedances, a lead TMDL was developed for Un-named Creek.

Mercury

Un-named Creek is listed as impaired by mercury on the 2010 303(d) List. Out of five recent surface water samples, all five tested below the detection limit for mercury. However, only one of these samples can be used for TMDL development determinations because the other four had detection limits equal to the human health standard (0.05 µg/L) and unless detection limits are below the water quality standard, exceedances cannot be determined. Mercury was found to be below detection in the single sample with an acceptable detection limit (0.005 µg/L). Even though recent data depicts Un-named Creek as potentially attaining mercury water quality targets, because there is only one acceptable surface water sample and because human-related metals sources are present in the watershed, a mercury TMDL was developed. Additional monitoring for mercury is recommended.

pH

Un-named Creek is listed as impaired by pH on the 2010 303(d) List. All eight samples of Un-named Creek displayed severely acidic pH values. The lowest recorded pH value was 3.1, the highest was 5.4 and the median was 3.9. Other streams in the Little Blackfoot River TPA sampled in the watershed upstream of most mining influences exhibited more neutral pH levels. Additionally, the Ontario Mine worked a vein deposit containing pyrite, a mineral known to promote acid mine drainage (Olsen, 2004). It is therefore assumed that Un-named Creek's pH is depressed from natural background levels due to acid mine drainage associated with the Ontario Mine but because setting a daily load for pH is not practical and the reclamation activities needed to meet metals TMDLs should also address the sources causing pH impairment, metals TMDLs will act as a surrogate for a pH TMDL.

Zinc

Un-named Creek is listed as impaired by zinc on the 2010 303(d) List. Out of nine recent surface water samples, all nine (100%) exceeded both standards of aquatic life and one sample exceeded the human health standard. Even the lowest zinc concentration exceeded the acute aquatic life standard by a factor of six. Because more than 10% of the samples exceeded the chronic aquatic life standard, concentrations were more than two times the acute aquatic life standard and the human health standard was exceeded, zinc water quality targets were not met. Stream sediments collected in 2008 tested slightly below the secondary indicative value (245 µg/g vs. 315 µg/g). Based on target exceedances, a zinc TMDL was developed for Un-named Creek.

F.2 MONARCH CREEK (MT76G004_060)

DETAILED MINING HISTORY

Monarch Mine

The Monarch Mine is an inactive lode mine on DEQ's priority abandoned mines list located in the Helena National Forest on the northeast aspect of Bison Mountain. Monarch Mine was one of the most productive mines in the area operating from 1894 to 1909, with subsequent sporadic activity as recent as 1995 (Hargrave, et al., 1998). The site consists of a collapsed mill building, an open but locked adit, another adit that is caved-in but discharging and approximately 0.75 acres of well-vegetated tailings noticeable only by the presence of ferric-hydroxide-stained pools between the mill and creek (Hargrave, et al., 1998). A 1989 DEQ visual assessment observed "yellow boy" but the phenomenon has not been noted since (Montana Department of Environmental Quality, 2010). The discharging adit and a spring emerging out of a tailings pile exceed metals standards when tested by MBMG in 1995. At that time, Monarch Creek had no exceedances, although concentrations were higher in the sample downstream of the mine (Hargrave, et al., 1998). The MBMG report also found pyrite, a mineral known to promote the formation of acid mine drainage, present in the veins of Monarch Mine (Hargrave, et al., 1998).

DATA REVIEW BY POLLUTANT

Arsenic

Monarch Creek is listed as impaired by arsenic on the 2010 303(d) List. Out of eight recent surface water samples, none exceeded water quality standards. Instead, all samples tested below the 3 µg/L detection limit. A DEQ 2004 formal reassessment of Monarch Creek found arsenic in stream sediment to be slightly elevated (23.6 µg/g vs. 17 µg/g PEL) but did not observe any effects to the benthic fauna (Montana Department of Environmental Quality, 2010). The reassessment concluded that although no surface water targets were exceeded, potential metals sources existed, and the stream remained listed for metals until more data could be collected to prove otherwise. When DEQ sampled Monarch Creek in 2008 and 2009, the findings were similar to the 2004 assessment; no surface water exceedances for arsenic but both sediment samples (19 µg/g and 22 µg/g) exceeded the supplemental indicator value. Because no recent samples exceeded arsenic water quality targets, no TMDL was developed and the 303(d) listing status for arsenic will be formally reevaluated by DEQ in the future.

Copper

Monarch Creek is listed as impaired by copper on the 2010 303(d) List. Out of eight recent surface water samples, two (25%) exceeded the chronic aquatic life standard. All copper samples collected during low

flow time periods were below detection. Because more than 10% of the samples exceeded the chronic aquatic life standard, copper water quality targets were not met. Stream sediments collected in 2004, 2008 and 2009 tested below the supplementary indicator value. Based on target exceedances, a copper TMDL was developed for Monarch Creek.

Lead

Monarch Creek is listed as impaired by lead on the 2010 303(d) List. Out of eight recent surface water samples, two (25%) exceeded the chronic aquatic life standard and both occurred during high flow conditions. All lead samples collected during low flow time periods were below detection. Because more than 10% of the samples exceeded the chronic aquatic life standard, lead water quality targets were not met. Additionally, two out of three sediment samples identified lead concentrations at levels exceeding the supplemental indicator value. Based on target and supplemental indicator value exceedances, a lead TMDL was developed for Monarch Creek.

Mercury

Monarch Creek is listed as impaired by mercury on the 2010 303(d) List. Out of six recent surface water samples, all six tested below the detection limit for mercury. However, only one of these samples can be used for TMDL development determinations because the other five had detection limits equal to the human health standard (0.05 µg/L) and unless detection limits are below the water quality standard, exceedances cannot be determined. Mercury was found to be below detection in the single sample with an acceptable detection limit (0.005 µg/L). Even though recent data depicts Monarch Creek as potentially attaining mercury water quality targets, because there is only one acceptable surface water sample and because human-related metals sources are present in the watershed, a mercury TMDL was developed. Additional monitoring for mercury is recommended.

pH

Monarch Creek is listed as impaired by pH on the 2010 303(d) List. All eight samples of Monarch Creek displayed acidic pH values. The lowest recorded pH value was 4.96, the highest was 7.45 and the median was 5.92. There was no noticeable pattern in the pH data in regard to seasonality or flow conditions. Other streams in the Little Blackfoot River TPA sampled in the watershed upstream of most mining influences exhibited more neutral pH levels. DEQ's 2004 reassessment of Monarch Creek found small concentrations of common constituents present in the stream resulting in a low buffering capacity (Montana Department of Environmental Quality, 2010). Additionally, the Monarch Mine worked a vein deposit containing pyrite, a mineral known to promote acid mine drainage (Olsen, 2004). It is therefore assumed that Monarch Creek's pH is depressed from natural background levels due to acid mine drainage associated with the Monarch Mine but because setting a daily load for pH is not practical and the reclamation activities needed to meet metals TMDLs should also address the sources causing pH impairment, metals TMDLs will act as a surrogate for a pH TMDL.

Selenium

Monarch Creek is listed as impaired by selenium on the 2010 303(d) List. Out of eight recent surface water samples, none exceeded water quality targets. Instead, seven samples (88%) tested below detection and the remaining sample had a minimally detectable selenium concentration of 1 µg/L. Concentrations were low during both flow conditions. While there were no surface water target exceedances, one of the three sediment samples did exceed the supplemental indicator value. Because no recent samples exceeded selenium water quality targets, no TMDL was developed and the 303(d) listing status for selenium will be formally reevaluated by DEQ in the future.

F.3 ONTARIO CREEK (MT76G004_130)

DETAILED MINING HISTORY

Hard Luck Mine

The Hard Luck Mine is an inactive lode mine on DEQ's priority abandoned mines list located in the Helena National Forest. The disturbed 0.3 acre site is situated 1,000 feet from Ontario Creek upstream of the confluence with Monarch Creek (Pioneer Technical Services, Inc., 1993). Operation dates and production records for Hard Luck Mine could not be found. A 1993 visit by Pioneer Technical Services identified three waste rock two adits and one building on site but did not collect any samples. At that time, the discharge from one adit was being piped around the waste rock dump but investigators noted the diversion system could be improved. The Hard Luck Mine was visited a few years later by MBMG which found the site to be dry (Hargrave, et al., 1998).

DATA REVIEW BY POLLUTANT

Cadmium

Ontario Creek is not listed as impaired by cadmium on the 2010 303(d) List, however recent data provide evidence of cadmium as a cause of water quality impairment. Out of nine recent surface water samples, two (22%) exceeded the chronic aquatic life standard. Both exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard and one sample was more than two times the acute aquatic life standard, cadmium water quality targets were not met. Additionally, two out of three sediment samples identified cadmium concentrations at levels exceeding the supplemental indicator value. Based on target and supplemental indicator value exceedances, a cadmium TMDL was developed for Ontario Creek.

Copper

Ontario Creek is not listed as impaired by copper on the 2010 303(d) List, however recent data provide evidence of copper as a cause of water quality impairment. Out of nine recent surface water samples, three (33%) exceeded the chronic aquatic life standard. All exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard, copper water quality targets were not met. Stream sediments collected in 2008 and 2009 tested below the supplementary indicator value. Based on target exceedances, a copper TMDL was developed for Ontario Creek.

Lead

Ontario Creek is not listed as impaired by lead on the 2010 303(d) List, however recent data provide evidence of lead as a cause of water quality impairment. Out of nine recent surface water samples, three (33%) exceeded the chronic aquatic life standard. All lead samples collected during low flow time periods were below detection. Because more than 10% of the samples exceeded the chronic aquatic life standard, lead water quality targets were not met. Additionally, two out of three sediment samples identified lead concentrations at levels exceeding the supplemental indicator value. Based on target and supplemental indicator value exceedances, a lead TMDL was developed for Ontario Creek.

F.4 SALLY ANN CREEK (MT76G004_055)

DETAILED MINING HISTORY

Telegraph Mine

The Telegraph Mine is an inactive lode mine on DEQ's priority abandoned mines list located in the Helena National Forest. Historic placer mining is also evident. The disturbed half acre site is located directly adjacent to Tenmile-Telegraph Creek Road and near Bryan Creek, a seasonally flowing tributary to Sally Ann Creek (Pioneer Technical Services, Inc., 1993). An investigation into the site history by MBMG found the mine and mill active from 1927 to 1934, producing 30 tons of ore. The site consists of a collapsed, discharging adit on the north side of the road and a stamp mill, small cabin and tailings on the south side. An unnamed spring emerges near the mill and flows through a mixture of waste rock, tailings and native material before flowing into Bryan Creek. The unnamed tributary and the adit discharge tested very acidic and had high concentrations of metals when the MBMG collected samples in 1995 (Hargrave, et al., 1998). No samples were collected on Bryan Creek at that time because it was dry. In 2005, the USFS removed waste material from the site (Ihle, Beth, personal communication 2008).

DATA REVIEW BY POLLUTANT

Cadmium

Sally Ann Creek is not listed as impaired by cadmium on the 2010 303(d) List, however recent data provide evidence of cadmium as a cause of water quality impairment. Out of six recent surface water samples, two (33%) exceeded the chronic aquatic life standard. Both exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard and two samples were more than two times the acute aquatic life standard, cadmium water quality targets were not met. Additionally, one out of two sediment samples identified cadmium concentrations at levels exceeding the supplemental indicator value. Based on target and supplemental indicator value exceedances, a cadmium TMDL was developed for Sally Ann Creek.

Copper

Sally Ann Creek is not listed as impaired by copper on the 2010 303(d) List, however recent data provide evidence of copper as a cause of water quality impairment. Out of six recent surface water samples, three (50%) exceeded the chronic aquatic life standard. All exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard, copper water quality targets were not met. Stream sediments collected in 2008 and 2009 tested below the supplementary indicator value. Based on target exceedances, a copper TMDL was developed for Sally Ann Creek.

Zinc

Sally Ann Creek is not listed as impaired by zinc on the 2010 303(d) List, however recent data provide evidence of zinc as a cause of water quality impairment. Out of six recent surface water samples, two (33%) exceeded both standards of aquatic life. Both exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard, zinc water quality targets were not met. Additionally, one out of two sediment samples identified zinc concentrations at levels exceeding the supplemental indicator value. Based on target and supplemental indicator value exceedances, a zinc TMDL was developed for Sally Ann Creek.

F.5 O'KEEFE CREEK (MT76G004_054)

DETAILED MINING HISTORY

Sure Thing Mine

The Sure Thing Mine is an inactive lode mine on DEQ's priority abandoned mines list located on mixed private/public ownership. The Sure Thing Mine is situated on the northeast aspect of O'Keefe Mountain and roughly 1,700 feet from O'Keefe Creek. While it was mostly an exploratory mine, records show that gold, silver and lead were produced from 1902 to 1947 (Pioneer Technical Services, Inc., 1993). The site consists of numerous highly acidic seeps and a discharging adit flows through a pile of tailings and waste rock (Pioneer Technical Services, Inc., 1993). Starting in 2001 the Sure Thing Mine was the site of a four year field demonstration investigating the effectiveness of using sulfate-reducing bacteria to mitigate the impacts of acid mine drainage. The study found metals concentrations in the adit discharge were reduced and pH increased, but after the study period the treatment system was removed (Nordwick, 2008a).

O'Keefe Creek/Copper King Mine

The O'Keefe Creek/Copper King Mine is an inactive lode mine adjacent to O'Keefe Creek located on private property surrounded by the Helena National Forest. MBMG visited the area in 1995 and noted no evidence of stressed vegetation but the mine was not inspected due to its location on private property. At that time the mine was still active and water samples collected from O'Keefe Creek exhibited acceptable water quality despite noticing mine wastes in contact with the stream and several impoundments (Hargrave, et al., 1998).

DATA REVIEW BY POLLUTANT

Cadmium

O'Keefe Creek is not listed as impaired by cadmium on the 2010 303(d) List, however recent data provide evidence of cadmium as a cause of water quality impairment. Out of four recent surface water samples, two (50%) exceeded the chronic aquatic life standard and one exceeded the acute aquatic life standard. All exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard and one sample was more than two times the acute aquatic life standard, cadmium water quality targets were not met. Additionally, a sediment sample collected by DEQ in 2008 identified cadmium concentrations at levels eight times the supplemental indicator value. Based on target and supplemental indicator value exceedances, a cadmium TMDL was developed for O'Keefe Creek.

Copper

O'Keefe Creek is not listed as impaired by copper on the 2010 303(d) List, however recent data provide evidence of copper as a cause of water quality impairment. Out of four recent surface water samples, two (50%) exceeded both standards of aquatic life. Both exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard, copper water quality targets were not met. Stream sediments collected in 2008 tested below the supplementary indicator value. Based on target exceedances, a copper TMDL was developed for O'Keefe Creek.

Zinc

O’Keefe Creek is not listed as impaired by zinc on the 2010 303(d) List, however recent data provide evidence of zinc as a cause of water quality impairment. Out of four recent surface water samples, three (75%) exceeded both standards of aquatic life. Exceedances occurred during both flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard, zinc water quality targets were not met. Additionally, a stream sediment sample collected by DEQ in 2008 identified zinc concentrations at levels eight times the supplemental indicator value. Based on target and supplemental indicator value exceedances, a zinc TMDL was developed for O’Keefe Creek.

F.6 TELEGRAPH CREEK, UPPER SEGMENT (MT76G004_051)

DETAILED MINING HISTORY

Lilly/Orphan Boy Mine

The Lilly/Orphan Boy Mine is an inactive lode mine on DEQ’s priority abandoned mines list located on private property surrounded by the Helena National Forest. The mine was active intermittently from 1934 to 1968. Over those years 1,228 tons of ore were produced yielding mostly lead and zinc (Hargrave, et al., 1998). The 1½ acre site is comprised of a 250-foot shaft, three adits and three waste rock piles containing approximately 2,430 yd³ of waste rock (Tetra Tech, 2009). These features parallel Telegraph Creek with one waste rock pile spanning the creek bottom. Starting in 1994 the Lilly/Orphan Boy Mine was the site of a ten year field demonstration investigating the effectiveness of using sulfate-reducing bacteria to mitigate the impacts of acid mine drainage. The study found metals concentrations in the adit discharge were reduced and pH increased, but after the study period the treatment system was removed (Nordwick, 2008b). DEQ’s AML Program recently completed a reclamation investigation assessing conditions and detailing the site’s potential for reclamation (Tetra Tech, 2009). Phase II of the report, in which a detailed engineering and cost analysis is performed, is forthcoming (Clark, P., personal communication 2010). While inventorying abandoned mines in 1995, the MBMG collected water samples that had numerous exceedances and revealed noticeable increases of metals concentrations downstream of the disturbed site (Hargrave, et al., 1998).

Third Term Mine

The Third Term Mine is an inactive lode mine on DEQ’s priority abandoned mines list located in the Helena National Forest. The mine site lies adjacent to Little Flume Gulch, which flows into Flume Gulch and eventually Telegraph Creek. According to production records, the mine was active in the 1950’s and worked a vein deposit that contained pyrite (a mineral known to promote the formation of acid mine drainage) producing 50 tons of ore (Hargrave, et al., 1998; Pioneer Technical Services, Inc., 1993). In 1993 the adit tunnel was backfilled and the surrounding slope was regarded by DEQ AML (Clark, P., personal communication 2010). However, two years later the adit had subsided (Hargrave, et al., 1998). At that time MBMG observed the reclaimed area was lacking soils or vegetation but described the waste rock as resistant to erosion; also, the stream vicinity appeared clear of waste material and supported vegetation (Hargrave, et al., 1998). In an attempt to explain the numerous surface water exceedances observed, the MBMG report stated that the adit, despite lacking surface flow, was likely discharging subterraneously through coarse material into Little Flume Gulch. Mercury concentrations in Little Flume Gulch exceeded the human health standard in 1993 (0.24 µg/L vs. 0.05 µg/L) but were below detection in 1995; but since the 1995 detection limit (0.1 µg/L) was above the standard, exceedances at that time

cannot be determined (Hargrave, et al., 1998; Pioneer Technical Services, Inc., 1993). In 2005, the USFS removed waste material from the site (Ihle, Beth, personal communication 2008). Third Term Mine is a potential source for lower Telegraph Creek's mercury listing and because the lowest sample site on upper Telegraph Creek did not capture inputs from Flume Gulch, additional monitoring is recommended.

Julia Mine

The Julia Mine is an inactive load mine on DEQ's priority abandoned mines list located in the Helena National Forest on the ridge above Booth Gulch. The disturbed 0.5 acre site lies roughly 1.5 miles southwest of Telegraph Creek. Initial operations started in 1905 but the facility was heavily developed in 1911 to house numerous buildings and include two adits and one mine shaft (Pardee and Schrader, 1933). An estimated 10,700 yards of waste rock sit at the site (Pioneer Technical Services, Inc., 1993).

Anna R/Hattie M Mine

The Anna R/Hattie M Mine is an inactive load mine on DEQ's priority abandoned mine list located ½ mile downstream from the Lily/Orphan Boy Mine site and 500 feet from Telegraph Creek. The disturbed 0.17 acre site consists of a mine shaft, 2,200 cubic yards of waste rock and two caved adits; one of which had flow that was highly acidic and had elevated cadmium concentrations when sampled in 1993 (Pioneer Technical Services, Inc., 1993). A small mill structure is also present although all tailings appear to have been removed from the site (Pioneer Technical Services, Inc., 1993).

Hub Camp Mine

The Hub Camp Mine is an inactive load mine which has been investigated for its environmental impacts but is not on DEQ's priority abandoned mine list. It is located several hundred feet north of Telegraph Creek on Helena National Forest property. The Hub Camp Mine operated from around 1937 to 1948 and yielded 52 tons of ore (Hargrave, et al., 1998). When the site was visited by MBMG in 1995, it consisted of two caved-in adits, numerous waste rock piles and several dilapidated structures; water flowed from one adit, over a pile of waste material and eventually disappeared into the ground before reaching Telegraph Creek. The waste rock was well vegetated and samples from the adit discharge met all applicable standards (Hargrave, et al., 1998). In 2005, the USFS removed waste material from the site (Ihle, Beth, personal communication 2008).

Viking Mine

The Viking Mine is an inactive load mine which has been investigated for its environmental impacts but is not on DEQ's priority abandoned mine list. It is located on Forest Service property near Moose Gulch. A caved adit, a dilapidated metal building, an ore bin and multiple waste rock piles were observed at the site in 1995 by MBMG. The adit discharge, which reentered the waste dump, was fairly acidic and exceeded standards for six metals. The dumps appeared stable and soils below the affected area showed no visible mining impacts (Hargrave, et al., 1998). In 2005, the USFS removed waste material from the site (Ihle, Beth, personal communication 2008).

Unnamed Mine 8N6W6ABDB

Unnamed Mine 8N6W6ABDB is an inactive load mine which has been investigated for its environmental impacts but is not on DEQ's priority abandoned mine list. It is located in the same drainage as the Viking Mine on patented land surrounded by the Helena National Forest. The site has a waste rock dump and

one caved adit discharging into a small pond and then flowing into Moose Gulch. Samples collected by MBMG in 1995 showed no visible impact to soils, and the water quality of the stream into which the adit was discharging met all applicable standards (Hargrave, et al., 1998).

DATA REVIEW BY POLLUTANT

Arsenic

Upper Telegraph Creek is listed as impaired by arsenic on the 2010 303(d) List. Out of eight recent surface water samples, one exceeded the human health standard. The exceedance occurred during low flow, directly below the Lily/Orphan Boy waste rock pile. Because the human health standard was exceeded, arsenic water quality targets were not met. Additionally, sediment samples collected by DEQ in 2008 and 2009 identified arsenic concentrations at levels 28 times the supplemental indicator value. Based on target and supplemental indicator value exceedances, an arsenic TMDL was developed for the upper segment of Telegraph Creek.

Beryllium

Upper Telegraph Creek is listed as impaired by beryllium on the 2010 303(d) List. Out of four recent surface water samples, all four tested below the detection limit for beryllium. Concentrations were low regardless of flow condition. Even though recent data depicts upper Telegraph Creek as potentially attaining beryllium water quality targets, because there is only four surface water samples and because human-related metals sources are present in the watershed, a beryllium TMDL was developed.

Cadmium

Upper Telegraph Creek is listed as impaired by cadmium on the 2010 303(d) List. Out of eight recent surface water samples, five (63%) exceeded the chronic aquatic life standard and one exceeded the acute aquatic life standard by a factor of six. Because more than 10% of the samples exceeded the chronic aquatic life standard and one sample was more than two times the acute aquatic life standard, cadmium water quality targets were not met. Additionally, sediment samples collected by DEQ in 2008 and 2009 identified cadmium concentrations at levels 20 times the supplemental indicator value. Based on target and supplemental indicator value exceedances, a cadmium TMDL was developed for upper Telegraph Creek.

Copper

Upper Telegraph Creek is listed as impaired by copper on the 2010 303(d) List. Out of eight recent surface water samples, three (38%) exceeded both standards of aquatic life. All exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard, copper water quality targets were not met. Stream sediments collected in 2008 and 2009 tested slightly below the secondary indicatory value (188 µg/g vs. 197 µg/g). Based on target exceedances, a copper TMDL was developed for upper Telegraph Creek.

Iron

Upper Telegraph Creek is listed as impaired by iron on the 2010 303(d) List. Out of eight recent surface water samples, none exceeded water quality targets. Samples were collected over a two year period, over both flow conditions at four different sites. Because no recent samples exceeded iron water quality targets, no TMDL was developed and the 303(d) listing status for iron will be formally reevaluated by DEQ in the future.

Lead

Upper Telegraph Creek is not listed as impaired by lead on the 2010 303(d) List, however recent data provide evidence that lead is a cause of water quality impairment. Out of six recent surface water samples, three (50%) exceeded the chronic aquatic life standard. All samples collected during high flow conditions exceeded standards while all samples collected during low flow were below detection for lead. Because more than 10% of the samples exceeded the chronic aquatic life standard, lead water quality targets were not met. Additionally, one of three sediment samples collected by DEQ in 2008 and 2009 exceeded the supplemental indicator value. Based on target and supplemental indicator value exceedances, a lead TMDL was developed for the upper segment of Telegraph Creek.

Zinc

Upper Telegraph Creek is listed as impaired by zinc on the 2010 303(d) List. Out of eight recent surface water samples, five (63%) exceeded both aquatic life standards and one exceeded the acute aquatic life standard by a factor of 16. Because more than 10% of the samples exceeded the chronic aquatic life standard and one sample was more than two times the acute aquatic life standard, zinc water quality targets were not met. Additionally, all three sediment samples collected by DEQ in 2008 and 2009 exceeded the secondary indicator value by more than double. Based on target and supplemental indicator value exceedances, a zinc TMDL was developed for the upper segment of Telegraph Creek.

F.7 TELEGRAPH CREEK, LOWER SEGMENT (MT76G004_052)

DETAILED MINING HISTORY

No known mining occurred in the lower Telegraph Creek basin.

DATA REVIEW BY POLLUTANT

Cadmium

Lower Telegraph Creek is not listed as impaired by cadmium on the 2010 303(d) List, however recent data provide evidence that cadmium is a cause of water quality impairment. Out of four recent surface water samples, two (50%) exceeded the chronic aquatic life standard. All samples collected during high flow conditions exceeded standards while all samples collected during low flow were at or below the detection limit. Because more than 10% of the samples exceeded the chronic aquatic life standard, cadmium water quality targets were not met. Additionally, stream sediments collected in 2008 exceeded the supplementary indicator value. Based on target and supplemental indicator value exceedances, a cadmium TMDL was developed for the lower segment of Telegraph Creek.

Copper

Lower Telegraph Creek is not listed as impaired by copper on the 2010 303(d) List, however recent data provide evidence that copper is a cause of water quality impairment. Out of four recent surface water samples, two (50%) exceeded both aquatic life standards. All exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard, copper water quality targets were not met. Stream sediments collected in 2008 tested below the supplementary indicator value. Based on target exceedances, a copper TMDL was developed for the lower segment of Telegraph Creek.

Lead

Lower Telegraph Creek is listed as impaired by lead on the 2010 303(d) List. Out of four recent surface water samples, two (50%) exceeded the chronic aquatic life standards. All samples collected during high flow conditions exceeded standards while all samples collected during low flow were below the detection limit. Because more than 10% of the samples exceeded the chronic aquatic life standard, lead water quality targets were not met. Stream sediments collected in 2008 tested slightly below the secondary indicator value (88 µg/g vs. 91.3 µg/g). Based on target exceedances, a lead TMDL was developed for the lower segment of Telegraph Creek.

Mercury

Lower Telegraph Creek is listed as impaired by mercury on the 2010 303(d) List. Out of four recent surface water samples, all four tested below the detection limit for mercury. However, only one of these samples can be used for TMDL development determinations because the other three had detection limits equal to the human health standard (0.05 µg/L) and unless detection limits are below the water quality standard, exceedances cannot be determined. Mercury was found to be below detection in the single sample with an acceptable detection limit (0.005 µg/L). Even though recent data depicts Monarch Creek as potentially attaining mercury water quality targets, because there is only one acceptable surface water sample and because human-related metals sources are present in the watershed, a mercury TMDL was developed. Additional monitoring for mercury is recommended.

Zinc

Lower Telegraph Creek is not listed as impaired by zinc on the 2010 303(d) List, however recent data provide evidence that zinc is a cause of water quality impairment. Out of four recent surface water samples, two (50%) exceeded both standards of aquatic life. All exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard, zinc water quality targets were not met. Additionally, stream sediments collected in 2008 exceeded the supplementary indicator value. Based on target and supplemental indicator value exceedances, a zinc TMDL was developed for the lower segment of Telegraph Creek.

F.8 AMERICAN GULCH CREEK (MT76G004_079)

DETAILED MINING HISTORY

While abandoned mine databases lack detailed descriptions of mines in the American Gulch Creek basin, at least five are known to exist: Carbonate Marysville, Neenan, NE SE Section 10, Pine Ridge and Un-named 11N06W10CADD. Additional monitoring is recommended to better characterize influences from these mine, especially because most mines are located in the headwaters but the only sample site established on American Gulch Creek was near the mouth.

DATA REVIEW BY POLLUTANT

Arsenic

American Gulch Creek is not listed as impaired by arsenic on the 2010 303(d) List, however recent data provide evidence that arsenic is a cause of water quality impairment. Out of four recent surface water samples, all four exceed the human health standard. Exceedances occurred during both flow conditions. Because the human health standard was exceeded, arsenic water quality targets were not met. Additionally, stream sediments samples collected in 2008 identified arsenic concentrations at levels

nearly four times the supplemental indicator value. Based on target and supplemental indicator value exceedances, an arsenic TMDL was developed for the American Gulch Creek.

F.9 DOG CREEK, UPPER SEGMENT (MT76G004_071)

DETAILED MINING HISTORY

Bald Butte Mine

The Bald Butte Mine is an inactive lode mine on DEQ's priority abandoned mines list located on land managed by the BLM and USFS. The mine produced gold, silver, zinc, and lead from 1902 until 1943. In 2010, DEQ started a three year reclamation project on the Bald Butte Mine aimed at limiting the mobility of contaminants. Prior to reclamation, the Bald Butte Mine site consisted of four waste rock piles, a mill foundation, a fenced shaft, and six tailings piles; all of which were located within the Dog Creek floodplain. At the height of operations, the site also included a 200-ton cyanide plant and a 40-stamp mill (Olympus Technical Services, Inc., 2004). Reclamation plans call for transporting 140,300 cubic yards of mine waste from the two sites to a nearby repository on BLM land to prevent further erosion and migration of the contaminants. In 2010, the first year of project operations, roughly 40,000 cubic yards of material was removed (Opp, Steve, personal communication 2011). A site investigation performed as part of the reclamation plan extensively sampled stream sediments for metals and consistently found arsenic, cadmium, copper, lead, mercury and zinc more than double the supplemental indicator value (Olympus Technical Services, Inc., 2004).

Devon/Sterling and Albion Mine

The Devon/Sterling and Albion Mine is a cluster of inactive mines which are part of the Bald Butte reclamation planning area. Located just upstream of the Bald Butte Mine along an unnamed tributary to Dog Creek, the site had two adits, one of which was discharging on a site visit in the fall of 2003 (Olympus Technical Services, Inc., 2004). Additionally, a perennial stream ran through one waste rock pile and flowed past the toe of two other piles. The amount mine waste to be removed from the Devon/Sterling and Albion Mine is included in the estimate for Bald Butte and will be transported to the same repository.

DATA REVIEW BY POLLUTANT

Arsenic

Upper Dog Creek is listed as impaired by arsenic on the 2010 303(d) List. Out of 12 recent surface water samples, eight (67%) exceeded the human health standard. All of the non-exceedance samples were collected upstream of the Bald Butte Millsite. Because the human health standard was exceeded, arsenic water quality targets were not met. Additionally, sediment samples identified arsenic concentrations as much as 57 times the supplemental indicator value. Based on target and supplemental indicator value exceedances, an arsenic TMDL was developed for the upper segment of Dog Creek.

Cadmium

Upper Dog Creek is not listed as impaired by cadmium on the 2010 303(d) List, however recent data provide evidence that cadmium is a cause of water quality impairment. Out of 12 recent surface water samples, eight (67%) exceeded the chronic aquatic life standard. Because more than 10% of the samples exceeded the chronic aquatic life standard, cadmium water quality targets were not met. Additionally,

sediment samples identified cadmium concentrations as much as eight times the supplemental indicator value. Based on target and supplemental indicator value exceedances, a cadmium TMDL was developed for the upper segment of Dog Creek.

Copper

Upper Dog Creek is not listed as impaired by copper on the 2010 303(d) List, however recent data provide evidence that copper is a cause of water quality impairment. Out of nine recent surface water samples, three (33%) exceeded the chronic aquatic life standard. All exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard, copper water quality targets were not met. Additionally, sediment samples identified copper concentrations as much as five times the supplemental indicator value. Based on target and supplemental indicator value exceedances, a copper TMDL was developed for the upper segment of Dog Creek.

Lead

Upper Dog Creek is listed as impaired by lead on the 2010 303(d) List. Out of 12 recent surface water samples, 11 (92%) exceeded the chronic aquatic life standard and one sample exceeded the human health standard. Exceedances were observed during both flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard and the human health standard was exceeded, lead water quality targets were not met. Additionally, sediment samples identified lead concentrations as much as 30 times the supplemental indicator value. Based on target and supplemental indicator value exceedances, a lead TMDL was developed for the upper segment of Dog Creek.

Zinc

Upper Dog Creek is listed as impaired by zinc on the 2010 303(d) List. Out of 12 recent surface water samples, two (17%) exceeded both standards of aquatic life. Both exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard and a sample was more than two times the acute aquatic life standard, zinc water quality targets were not met. Additionally, sediment samples identified lead concentrations as much as 12 times the supplemental indicator value. Based on target and supplemental indicator value exceedances, a zinc TMDL was developed for the upper segment of Dog Creek.

F.10 LOWER DOG CREEK (MT76G004_072)

DETAILED MINING HISTORY

While abandoned mine databases lack detailed descriptions of mines unique to the lower Dog Creek basin, an estimated 15 are known to exist. Information on historic mining in the upper Dog Creek basin is provided in **Section F.9**. Additional monitoring is recommended to better characterize influences from specific mines.

DATA REVIEW BY POLLUTANT

Copper

Lower Dog Creek is not listed as impaired by copper on the 2010 303(d) List, however recent data provide evidence that copper is a cause of water quality impairment. Out of four recent surface water samples, two (50%) exceeded the chronic aquatic life standard. Both exceedances occurred during high

flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard, copper water quality targets were not met. Stream sediments collected in 2008 tested below the supplementary indicator value. Based on target exceedances, a copper TMDL was developed for lower Dog Creek.

Lead

Lower Dog Creek is not listed as impaired by lead on the 2010 303(d) List, however recent data provide evidence that lead is a cause of water quality impairment. Out of four recent surface water samples, two (50%) exceeded the chronic aquatic life standard. Both exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard, copper water quality targets were not met. Additionally, stream sediments collected in 2008 exceeded the supplementary indicator value. Based on target and supplemental indicator value exceedances, a lead TMDL was developed for lower Dog Creek.

F.11 LITTLE BLACKFOOT RIVER, UPPER SEGMENT (MT76G004_020)

DETAILED MINING HISTORY

Charter Oak Mine

The Charter Oak Mine is an inactive lead mine on DEQ's priority abandoned mines list located in the Helena National Forest adjacent to the Little Blackfoot River. Around 9,000 tons of ore was processed at Charter Oak from 1916 to 1966 (Hargrave, et al., 1998; Pioneer Technical Services, Inc., 1993). Productivity peaked during World War II to the extent that the federal government designated Charter Oak a strategic metals mine (USDA Forest Service, 2007). For years after mining ceased, the site consisted six or more adits, extensive mill tailings, numerous barrels of waste oil and acid, and several small buildings surrounding a mill (Pioneer Technical Services, Inc., 1993). During site visits in the early 1990's by Pioneer Technical Services, USFS and MBMG, it was noted that two of the adits were discharging towards the Little Blackfoot River and one adit had an extremely low pH discharge with several metal standard exceedances (Hargrave, et al., 1998; Pioneer Technical Services, Inc., 1993). In 1993, DEQ AML found numerous barrels of chemicals/solvents, including empty sodium cyanide (NaCN) barrels, and sprayer equipment most likely used for CN⁻ application at the site (Pioneer Technical Services, Inc., 1993). While the Charter Oak Mine is the most likely cause of cyanide impairment for the upper Little Blackfoot River, USFS samples collected in the spring of 2010 from a beaver pond near the base of the mill area and from one of the discharging adits detected no trace of cyanide (Oaks, Hans, personal communication 2011). Despite the poor water quality of the adits and a portion of the tailings being submerged by the river, the Little Blackfoot River below the Charter Oak Mine did not exceed metals standards when sampled in 1995 (Hargrave, et al., 1998). From 1996 through 1998, the USFS removed hazardous substances, placed waste rock and tailings in an onsite repository work, performed adit work and stabilized buildings (USDA Forest Service, 2007; Ihle, Beth, personal communication 2008). In 2001 the Charter Oak Mine was listed on the National Register of Historic Places and it is currently open to the public for interpretative tours on select summer weekends. Water quality samples collected after reclamation still had many metals exceedances.

Kimball Mine

The Kimball Mine is an inactive lead mine on DEQ's priority abandoned mines list located in the Helena National Forest adjacent to the Little Blackfoot River. The site lies on a hillside, separated from the river

by a ¼ mile wide, well vegetated floodplain (Pioneer Technical Services, Inc., 1993). Operation dates and production records could not be found for the Kimball Mine, however until recently the area contained two caved adits and several large coalescing waste rock dumps that extend into the floodplain (Hargrave, et al., 1998). In 2006, the USFS removed waste material from the site (Ihle, Beth, personal communication 2008). The MBMG did not collect any water samples when they visited in 1995, because there was no surface water at the site and it appeared the adits never discharge. Sediment samples were collected, and showed the waste rock contained high concentrations of arsenic, lead and pyrite, a mineral known to promote the formation of acid mine drainage (Hargrave, et al., 1998). MBMG also witnessed evidence of erosion occurring in the fine-grained waste rock pile in the floodplain.

Golden Anchor Mine

The Golden Anchor Mine is an inactive load mine on DEQ's priority abandoned mines list located in the Helena National Forest near an un-named tributary to the Little Blackfoot River and only 1,500 feet from the Kimball Mine. Alternative reports refer to the Golden Anchor Millsite as the Big Dick Mill. The mill was active intermittently from 1902 to 1954 processing 16,200 tons of ore that contained lead, silver, gold, copper and zinc (Hargrave, et al., 1998). A large mill building, several smaller cabins and a large bunkhouse remain at the site. Before the USFS removed waste material from the site in 2006, waste rock and tailings extended along the stream for over 450 feet (Hargrave, et al., 1998; Ihle, Beth, personal communication 2008). Samples collected in 1995 by MBMG, of the un-named stream above and below the mill actually showed that concentrations of most metals constituents were lower in the downstream sample indicating the tailings have little impact on water quality (Hargrave, et al., 1998). After the Golden Anchor mine closed, it was plugged with an earthen core and water backed up behind the plug for years until it eventually blew out in November 2008. The bright orange-colored water carved a waist-deep channel, stained trees almost five feet off the ground and discolored water that could be seen three miles downstream in the Little Blackfoot River (Byron, 11/28/2008; Byron, 12/4/2008). The blow out flushed high concentrations of metals downstream, but water samples collected by USFS and DEQ showed the spike was temporary (Byron, 1/17/2009). There was a concern for bull trout, but no fish-kills were observed.

Mountain View Mine

The Mountain View Mine is an inactive load mine on DEQ's priority abandoned mines list located in the same un-named tributary drainage to the Little Blackfoot River as the Golden Anchor Mill. No historical operation dates or production details could be found for the site. The Mountain View Mine consisted of one open adit, two caved adits and two waste rock piles when DEQ AML investigated the site in 1993. At that time, the stream was dry upstream of the mine site and the discharging adit, which flowed under waste rock, was the source of the un-named tributary (Pioneer Technical Services, Inc., 1993). The Forest Service collected surface water data in 1995 just below the waste rock pile that exceeded numerous metals standards. In 2006, the USFS removed waste material from the site (Ihle, Beth, personal communication 2008).

DATA REVIEW BY POLLUTANT

Arsenic

The upper segment of the Little Blackfoot River is listed as impaired by arsenic on the 2010 303(d) List. Out of 20 recent surface water samples, five (25%) exceeded the human health standard. All of the samples collected upstream of the Ontario Creek confluence were below detection. Because the human health standard was exceeded, arsenic water quality targets were not met. Additionally, sediment

samples identified arsenic concentrations as much as 11 times the supplemental indicator value. Based on target and supplemental indicator value exceedances, an arsenic TMDL was developed for the upper segment of the Little Blackfoot River.

Cadmium

The upper segment of the Little Blackfoot River is not listed as impaired by cadmium on the 2010 303(d) List, however recent data provide evidence that cadmium is a cause of water quality impairment. Out of 20 recent surface water samples, four exceeded the chronic aquatic life standard and one sample was nearly 2.5 times the acute aquatic life standard. All exceedances occurred during high flow conditions and every sample that did not exceed standards did not detect cadmium. Because more than 10% of the samples exceeded the chronic aquatic life standard and one sample was more than two times the acute aquatic life standard, cadmium water quality targets were not met. Stream sediments collected in 2008 tested below the supplementary indicator value. Based on target exceedances, a cadmium TMDL was developed the upper segment of the Little Blackfoot River.

Copper

The upper segment of the Little Blackfoot River is not listed as impaired by copper on the 2010 303(d) List, however recent data provide evidence that copper is a cause of water quality impairment. Of the 20 recent surface water samples, three (12%) exceeded both standards of aquatic life. All exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard, copper water quality targets were not met. Stream sediments collected in 2008 tested below the supplementary indicator value. Based on target exceedances, a copper TMDL was developed the upper segment of the Little Blackfoot River.

Cyanide

The upper segment of the Little Blackfoot River is listed as impaired by cyanide on the 2010 303(d) List. Out of eight recent surface water samples, one (13%) exceeded both standards of aquatic life. All samples tested below detection except a field replicate whose paired sample was did not detect cadmium. However, because the analysis method for detecting cyanide sometimes biases lower than actual readings, the replicate sample will replace the original in this instance to be conservative. Because more than 10% of the samples exceeded the chronic aquatic life standard, cyanide water quality targets were not met. Based on target exceedances, a cyanide TMDL was developed for the upper segment of the Little Blackfoot River.

Lead

The upper segment of the Little Blackfoot River is not listed as impaired by lead on the 2010 303(d) List, however recent data provide evidence that lead is a cause of water quality impairment. Out of 20 recent surface water samples, six (30%) exceeded the chronic aquatic life standard and one exceeded the human health standard. All exceedances occurred during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard and one sample exceeded the human health standard, lead water quality targets were not met. Additionally, stream sediments collected in 2008 exceeded the supplementary indicator value. Based on target and supplemental indicator value exceedances, a lead TMDL was developed for the upper segment of the Little Blackfoot River.

F.12 LITTLE BLACKFOOT RIVER, LOWER SEGMENT (MT76G004_010)

DETAILED MINING HISTORY

Victory/Evening Star Mine

The Victory/Evening Star Mine is an inactive load mine on DEQ's priority abandoned mines list located near Ophir Creek, a tributary to the Little Blackfoot River's lower segment. The mill building is on patented land but tailings have been deposited along the floodplain of Ophir Creek extending into Forest Service property. Most mine workings are well away from the floodplain and those that were near the creek did not appear to be actively eroding when MBMG visited the site in 1995 (Hargrave, et al., 1998). At that time none of the adits were discharging and surface water samples of Ophir Creek could not be collected upstream of the mine site because flow was subterranean. The water re-surfaced in a pond near the mine site and a sample was collected just downstream that had no metal exceedances (Hargrave, et al., 1998). The MBMG assessment also noted that recreation is somewhat popular in the area, and although most of the buildings are not a liability because they have already collapsed, there is an open mine shaft on site (Hargrave, et al., 1998).

DATA REVIEW BY POLLUTANT

Arsenic

The lower segment of the Little Blackfoot River is not listed as impaired by arsenic on the 2010 303(d) List, however recent data provide evidence that arsenic is a cause of water quality impairment. Out of 34 recent surface water samples, three exceeded the human health standard. All exceedances occurred during high flow conditions. Because the human health standard was exceeded, arsenic water quality targets were not met. Additionally, sediment samples identified arsenic concentrations as much as four times the supplemental indicator value. Based on target and supplemental indicator value exceedances, an arsenic TMDL was developed for the lower segment of the Little Blackfoot River.

Copper

The lower segment of the Little Blackfoot River is listed as impaired by copper on the 2010 303(d) List. Out of 34 recent surface water samples, three (9%) exceeded the chronic aquatic life standard and two exceeded the acute aquatic life standard. However none of the acute exceedances were more than twice the standard. Because less than 10% of the samples exceeded the chronic aquatic life standard, and no samples exceeded twice the acute aquatic life standard or the human health standard, all copper water quality targets were met. Additionally, all four stream sediment samples tested below the supplementary indicator value. Because no recent samples exceeded copper water quality targets, no TMDL was developed and the 303(d) listing status for copper will be formally reevaluated by DEQ in the future.

Lead

The lower segment of the Little Blackfoot River is listed as impaired by lead on the 2010 303(d) List. Out of 34 recent surface water samples, six (18%) exceeded the chronic aquatic life standard. Five of the six exceedances were collected during high flow conditions. Because more than 10% of the samples exceeded the chronic aquatic life standard, lead water quality targets were not met. One of three stream sediment samples exceeded the supplementary indicator value. Based on target and supplemental indicator value exceedances, a copper TMDL was developed for the lower segment of the Little Blackfoot River.

F.13 REFERENCES

Byron, E. 11/28/2008. Biologists Checking Fish Following Mine Blowout. *Helena Independent Record*

----- 12/4/2008. Water Worries. *Helena Independent Record*

----- 1/17/2009. DEQ Awaiting Results From Mine Blowout. *Helena Independent Record*

Clark, P. 2010. Personal Communication. Peter Brumm, EPA.

Hargrave, P., T. B. Bowler, J. D. Lonn, J. P. Madison, J. J. Metesh, and R. Wintergerst. 1998. Abandoned-Inactive Mines of the Blackfoot-Little Blackfoot River Drainages, Helena National Forest, Montana Bureau of Mines and Geology. Report Open File Report 368.

Ihle, Beth. 2008. Personal Communication. Lisa Kusnierz.

Montana Department of Environmental Quality. 2010. Integrated 305(b)/303(d) Water Quality Report. http://www.deq.mt.gov/CWAIC/wq_reps.aspx?yr=2010qryld=10815.

Nordwick, S. 2008a. Final Report - An Integrated, Passive Biological Treatment System. U.S. Environmental Protection Agency. Report Mine Waste Technology Program, Activity III, Project 16.

----- 2008b. Final Report- In Situ Source Control of Acid Generation Using Sulfate-Reducing Bacteria. U.S. Environmental Protection Agency. Report Mine Waste Technology Program, Activity III, Project 3.

Oaks, Hans. 2011. Personal Communication. Peter Brumm.

Olsen, L. J. 2004. Plant-Metal Interactions in a Natural and Remediated High Elevation Metal-Contaminated Wetland. Masters Thesis.: Montana State University.

Olympus Technical Services, Inc. 2004. Expanded Engineering Evaluation/Cost Analysis for the Bald Butte Millsite and Devon/Sterling and Albion Mine Sites. Helena, MT: Montana Department of Environmental Quality, Remediation Division, Mine Waste Cleanup Bureau.

Opp, Steve. 2011. Personal Communication. Peter Brumm.

Pardee, J. T. and F. C. Schrader. 1933. Metalliferous Deposits of the Greater Helena Mining Region, Montana. <http://www.deq.mt.gov/abandonedmines/linkdocs/157tech.mcp>. Accessed 11/8/11 A.D.

Pioneer Technical Services, Inc. 1993. Abandoned Hardrock Mine Priority Sites Project Report, Park County (Emigrant District) Through Powell County (Ophir District).

Tetra Tech. 2006. Final Construction Report for the Ontario Mine and Millsite Reclamation Project. Helena, MT: Montana Department of Environmental Quality, Mine Waste Cleanup Bureau.

----- 2009. Reclamation Investigation for the Lilly/Orphan Boy Mine Site. Helena, MT: Montana Department of Environmental Quality Remediation Division, Mine Waste Cleanup Bureau.

USDA Forest Service. 2007. Historic Mining on the Helena National Forest: A Brief Synopsis. Helena, MT: United States Forest Service.

http://www.fs.fed.us/r1/helena/resources/heritage_resources/mining_history.shtml. Accessed 11/7/11 A.D.