



**COLORADO**  
Division of Reclamation,  
Mining and Safety  
Department of Natural Resources

1313 Sherman Street, Room 215  
Denver, CO 80203

January 24, 2019

J. Curtis Marvel  
Brannan Sand and Gravel Company, L.L.C  
2500 E. Brannan Way  
Denver, CO 80229

RE: Trout Valley Ranch; DRMS File No. M-2016-080; Findings of Mercury Investigation

Dear Mr. Marvel,

On February 13, 2018, the Division of Reclamation, Mining and Safety (Division) received a citizen complaint which alleged mining operations in the vicinity of the towns of Alma and Fairplay, Colorado were discharging mercury into the Middle Fork of the South Platte River (South Platte River). A copy of the citizen complaint was forwarded to you on February 20, 2018. Following the receipt of the citizen complaint, the Division partnered with the Colorado Department of Public Health and Environment (CDPHE) and Colorado Parks and Wildlife to investigate potential mercury contamination of the South Platte River. A detailed report with the findings of the investigation was prepared by CDPHE and has been attached to this letter.

The investigation determined there was no evidence to indicate that mercury was being mobilized from the mining operations in the vicinity of Alma and Fairplay, Colorado. Therefore, the Division has concluded your mining operation is in compliance with applicable federal and Colorado water quality laws and regulations, as required by Rule 3.1.6(1)(b). No additional actions will be taken by the Division or the other agencies involved in the investigation at this time.

If you have any questions, please contact me at (303)866-3567 ext. 8116.

Sincerely,

Michael A. Cunningham  
Senior Environmental Protection Specialist

Enclosure: Analysis of Fish Mercury Data Report

CC: Russ Means, DRMS  
Elliott Russell, DRMS  
Alex Schatz, Brannan Sand and Gravel Company



## Analysis of fish mercury data

### Park County - Middle Fork S. Platte River watershed

#### Fish consumption program technical advisory committee

January 4, 2019



**COLORADO**  
Department of Public  
Health & Environment

In February 2018, Save South Park, a citizen coalition, submitted a formal complaint to the Division of Reclamation Mining and Safety alleging that gold, sand and gravel mines near the towns of Alma and Fairplay, Park County, Colorado were discharging mercury into the Middle Fork of the South Platte River. The mining division has permitted several mines in the area, but none of the permits allow for the use of mercury for gold recovery. However, it is possible that the mine operations were encountering and mobilizing mercury used in historic mining in the area.

In April 2018, DRMS presented the details of the complaint submitted by Save South Park to staff from the Department of Public Health and Environment and Colorado Parks and Wildlife. The three agencies developed a plan to investigate mercury in the affected watershed. Instead of directly measuring mercury concentrations in the water, the initial study (discussed here) focused on an examination of mercury levels in aquatic organisms. There were several reasons for this plan of action:

- Mercury is most bioavailable (and therefore, toxic) to humans and aquatic organisms in an organic form (as methyl mercury) that is typically found in sediment and organisms and not in water.
- Mercury in surface water tends to occur at low levels that are not detectable by routine monitoring conducted by the department's Laboratory Services Division.
- Resources were readily available to address levels of mercury in aquatic organisms through the department's fish consumption advisory program.

**Table 1. Sampling locations.**

Sample location	Sample position relative to mines	Latitude	Longitude
Montgomery Reach	Upstream on Middle Fork of the S. Platte	39.352004	-106.069148
Fairplay Upstream	Downstream on Middle Fork of the S. Platte	39.225100	-106.006284
Fairplay Beach	Downstream on Middle Fork of the S. Platte	39.222664	-106.003538
Spinney Mountain Reservoir	On-channel reservoir approximately 25 miles downstream	38.981261	-105.638492

Colorado Parks and Wildlife prepared a sampling plan that is included as Appendix A. Fisheries biologists collected fish (and crayfish, not discussed here) over the summer of 2018 from three Middle Fork of the South Platte River locations, as well as from Spinney Mountain Reservoir (Table 1, Figure 1). The river sites were located up and down-stream of the mining activity to determine whether any differences in fish tissue mercury concentrations could be related to the release of mercury from the mines. The reservoir is located approximately 25 miles downstream of the mining activity, but has the highest potential for transformation of the elemental mercury historically used in gold mining into the

much more bioavailable (and, therefore, toxic) methyl-mercury. Additionally, the fish program had historic data from this reservoir to compare levels prior to this recent mining activity near Fairplay and Alma.

The fish species and number at each site varied depending upon the fishery composition at each location. Brown trout were collected at each of the four sites, along with brook trout, rainbow trout, and northern pike at varying sites (Table 2). A portion of skin- and scale-free muscle filet tissue was extracted from each fish for sample analysis. Crayfish samples were not analyzed, primarily due to a lack of statewide data for comparison. Each fish sample was individually analyzed for total mercury on a wet weight basis using EPA method 7473 by the Department of Public Health and Environment Laboratory Services Division.

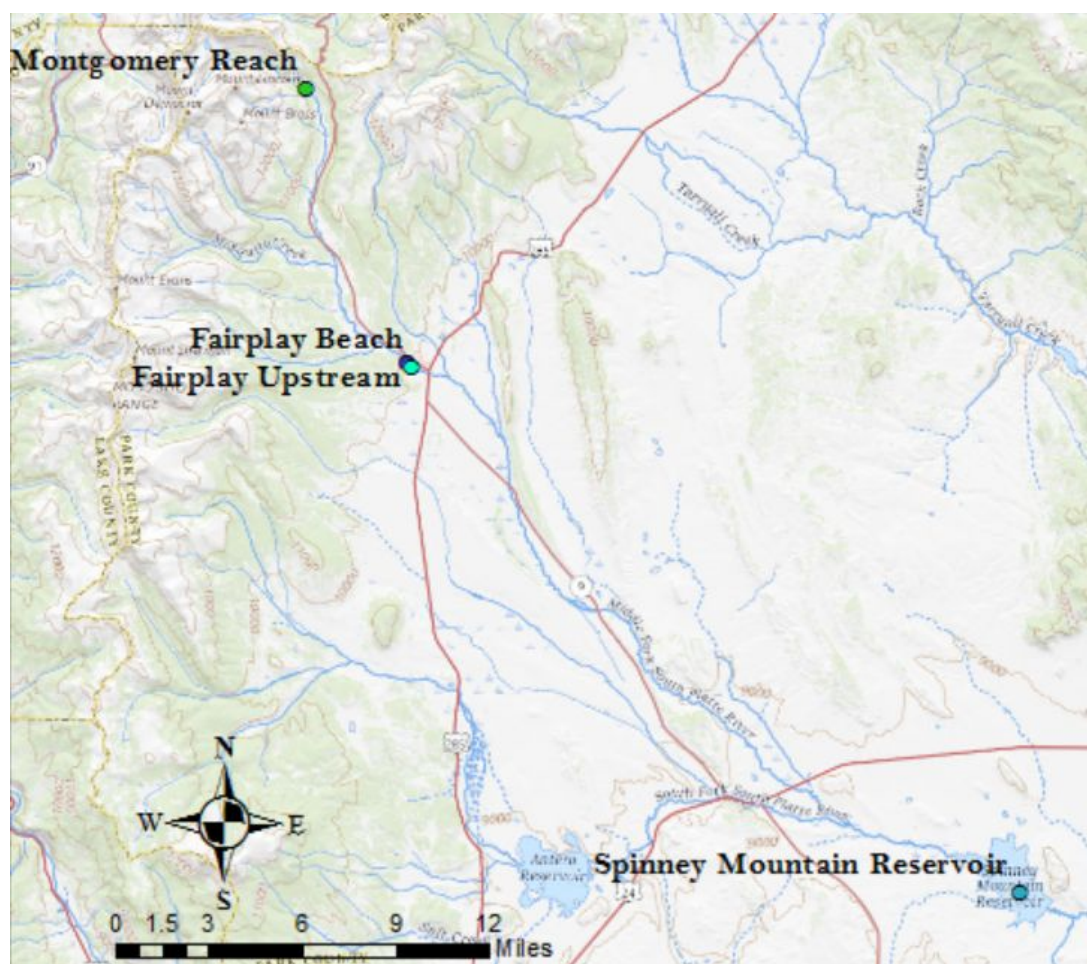


Figure 1. A map showing the four sampling locations along the Middle Fork of the South Platte River.

**Table 2. Fish species and numbers of samples collected at each Park County sampling location.**

Species	Sample location			
	Montgomery Reach	Fairplay Upstream	Fairplay Beach	Spinney Mountain Reservoir
Brook trout	18			
Brown trout	6	15	5	3
Northern pike				5
Rainbow trout				5
<b>Total</b>	<b>24</b>	<b>15</b>	<b>5</b>	<b>13</b>

Mercury levels in the Park County fish ranged from below detection limit (0.01 mg/kg) to 0.26 mg/kg. Mercury levels tended to follow expected trophic patterns (eg., highest levels in predatory Northern Pike). Also, levels were generally higher in fish collected from the reservoir, which was expected because the anoxic areas of lakes and reservoirs tend to provide the “perfect storm” of anoxic conditions (little to no oxygen) and anaerobic bacteria to produce methyl mercury which is highly bioavailable and readily bioaccumulates into fish tissue.

**Table 3. Mean (range) mercury concentrations in the fish collected from Park County in 2018.**

Species	Sample location			
	Montgomery Reach	Fairplay Upstream	Fairplay Beach	Spinney Mountain Reservoir
Brook trout	0.07 (0.03-0.19)			
Brown trout	0.06 (0.03-0.09)	0.04 (BDL*-0.08)	0.02 (BDL-0.03)	0.11 (0.06-0.21)
Northern pike				0.23 (0.16-0.26)
Rainbow trout				0.09 (0.04-0.18)

\* BDL = Below detection limit of 0.01 mg/kg

If the claim that mercury was being released into the waterways from the mining activity near Fairplay and Alma were true, we might also reasonably expect one or more of the following to be true:

- Fish collected downstream of the mining activity (at the two Fairplay sites) will show higher levels of mercury than fish collected upstream of the mining (at the Montgomery Reach site) due to increased exposure to mercury downstream of the mines.
- Fish collected from the mining impacted area will show elevated levels of mercury relative to fish collected statewide.
- Fish collected at Spinney Mountain Reservoir in 2018 will show elevated levels of mercury compared to fish collected prior to recent mining activities from the same reservoir.

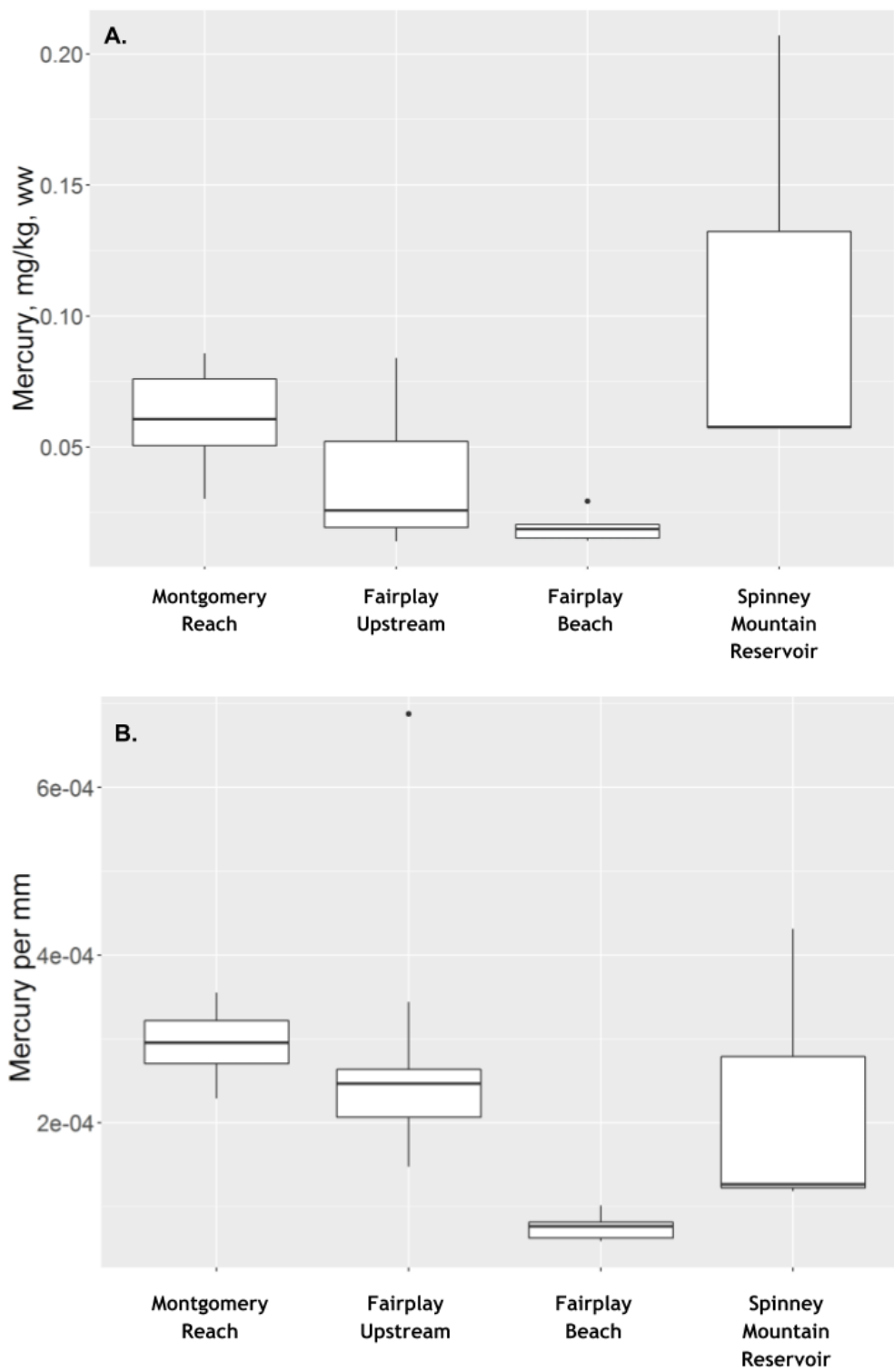
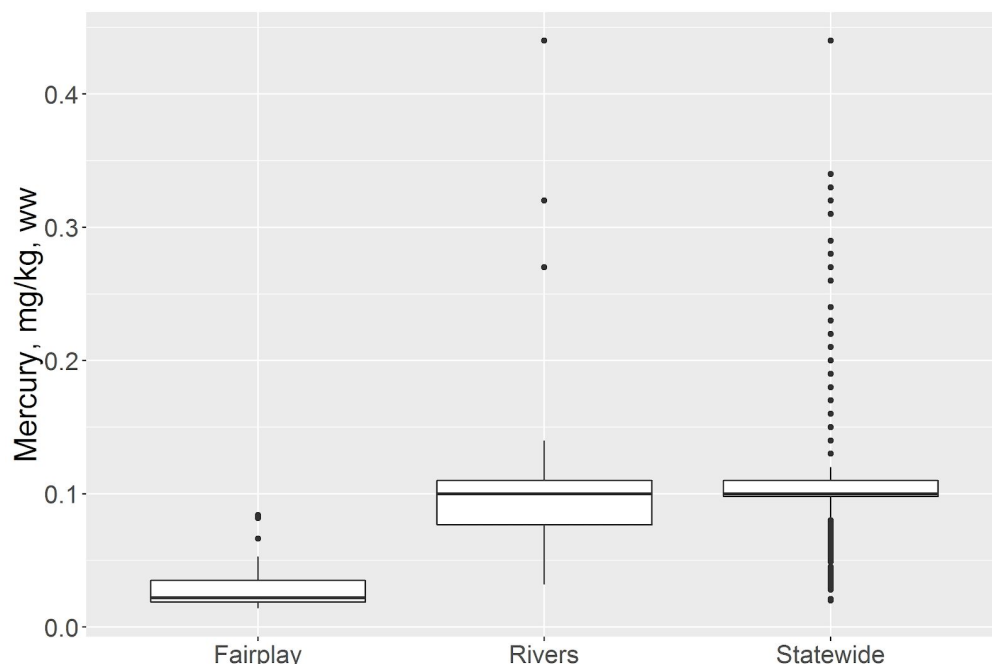


Figure 2. Boxplots of (A) mercury concentrations and (B) concentration normalized to fish length in brown trout at all four Park County sampling sites.

However, none of these hypotheses were supported by the data. When we compare mercury levels in brown trout (the only species collected both above and below the mining activity), we see lower levels in the fish collected downstream of the mines (Figure 2A)<sup>1</sup>. Because mercury accumulates over time, we used length as a proxy for fish age to understand whether fish age (or length) influenced the trend in the data. However, when we normalized the mercury concentration in each fish to its length (Figure 2B), we still see a similar relationship between the median mercury values upstream and downstream, although average values were not statistically different<sup>2</sup>. Overall, brown trout mercury levels were not elevated downstream of the mines as compared to the same species collected upstream.

It stands to reason that legacy mining activity in the vicinity of Montgomery Reservoir and/or conditions which promote transformation of mercury from inorganic to organic forms in the reservoir are contributing to elevated levels at the upstream site. However, the mercury levels in brown trout at the Fairplay site are lower than the levels measured in that species at all river sites and all waterbodies statewide (Figure 3)<sup>3</sup>. Therefore, based on the data collected in this study, we see no evidence of increased bioaccumulation of mercury in fish downstream of the mining activity.



**Figure 3. Boxplots of mercury concentration in brown trout at the two downstream sites (Fairplay), at all river sites statewide and at all waterbodies statewide. The statewide data is from the fish consumption advisory program database, 2004-2015.**

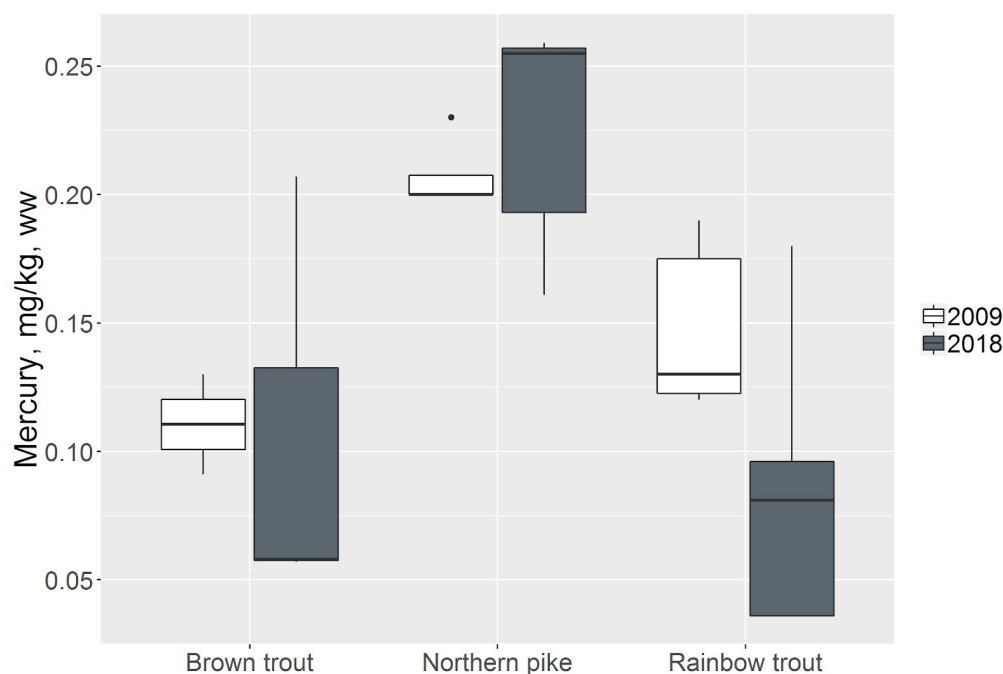
<sup>1</sup> Mean mercury in brown trout collected downstream of mines (2 Fairplay sites combined) is significantly less than mean mercury in brown trout collected Montgomery Reach upstream (permutation test,  $p=0.0003$ ); Median mercury levels were also significantly lower downstream than upstream (Wilcoxon rank-sum test,  $p=0.005$ ).

<sup>2</sup> Median ratio of mercury to length was lower downstream than upstream (Wilcoxon rank-sum test,  $p=0.014$ ), but mean levels were not significantly different (permutation test,  $p=0.22$ ).

<sup>3</sup> Mean mercury levels in Fairplay brown trout is significantly different from brown trout in rivers and all waterbodies statewide (permutation test,  $p=0.0001$ ).

Because the mercury typically used in mining activities is inorganic and is not readily taken up by fish and other organisms, it is possible that the effects of additional mercury to the system may not be evident at the river ecosystem near the mining activity. Therefore, we also measured levels of mercury in fish from Spinney Mountain Reservoir. The mercury levels for brown trout, northern pike, and rainbow trout collected from the reservoir fall within the lower half of the range of mercury levels measured for those species statewide (data available upon request). When we compare the current levels in the fish to the levels measured in 2009, we see no significant increases in mercury levels (Figure 4)<sup>4</sup>. So, we see no evidence of increased mercury bioaccumulation in Spinney Mountain Reservoir that could result from increased mercury to the system from mining in the area.

In summary, we examined mercury levels in a relatively small number of fish from locations above and below the mining activity alleged with release of mercury into the Middle South Fork of the Platte River near Alma, Park County Colorado. We see no evidence of increased mercury levels in the fish downstream of the mining activity as compared to fish upstream of the mines or levels in fish statewide. We also see no evidence of increasing mercury levels in the fish at Spinney Mountain Reservoir, where we would expect the highest potential for bioaccumulation.



**Figure 4. Boxplots of mercury concentration in brown trout, northern pike, and rainbow trout collected from Spinney Mountain Reservoir in 2009 (light bars) and 2018 (dark bars). The 2009 data is from the fish consumption advisory program database.**

<sup>4</sup> Mean mercury levels in brown trout, northern pike, and rainbow trout are not higher in 2018 than they were in 2009 (permutation test,  $p=0.6$ ,  $0.3$ , and  $0.9$ ).



## APPENDIX A

### Middle Fork South Platte & Spinney Mountain Reservoir Mercury Sampling Plan 2018

**Issue statement:** A formal complaint was sent to Division of Reclamation Mining and Safety (DRMS) alleging that gold, sand and gravel mines near the towns of Alma and Fairplay, CO were discharging mercury into the Middle Fork of the South Platte River. None of the permitted mines were licensed to use mercury for gold recovery, but it is possible they were encountering and mobilizing mercury used in historic mining in the area.

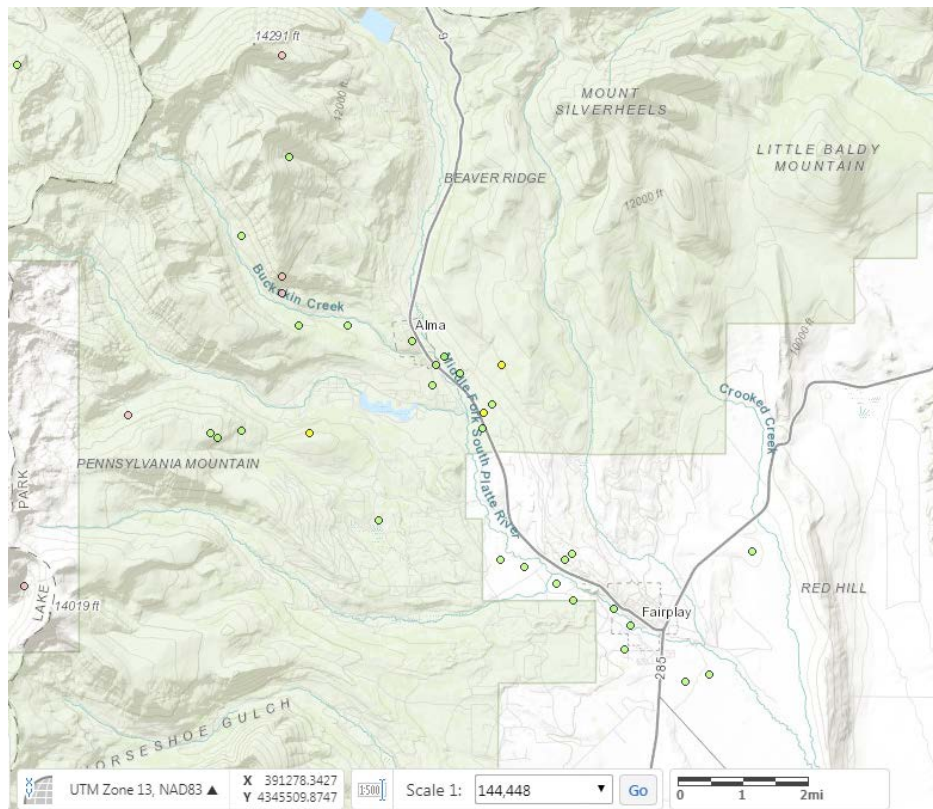


Figure 1. Map of facilities permitted by DRMS.

**Study objectives:** This is a preliminary sampling plan to compare mercury concentrations in biota upstream and downstream of the mining activity in Alma and Fairplay, and before and after recent mining activity. Mercury concentrations have not been previously sampled in the Middle Fork of the South Platte, so fish and crayfish samples will be collected upstream and downstream of mining activity. Mercury concentrations in fish were collected from Spinney Mountain Reservoir in 2009, prior to recent gold mining activity. Fish in Spinney Mountain Reservoir will be sampled to determine if mercury concentrations have significantly increased.

Water sampling is not being pursued at this time because mercury is difficult to accurately sample in water, and may not detect mercury if aqueous concentrations are highly variable, and sampling happens to occur when concentrations are low.



This investigation will determine if mercury levels are elevated, and pose to health risk to humans consuming fish or crayfish. The results of this study cannot be used to determine the source of the mercury. Therefore, additional investigations may be needed if elevated mercury concentrations are documented in this preliminary study.

**Sample Locations:** Five locations in three general areas were selected for collection (Figure 2, Table 1).

- **Upstream:** The reach of the Middle Fork South Platte below Montgomery Reservoir and Columbia Reservoir will represent conditions upstream of current mining activity around Alma and Fairplay.
- **Downstream:** The reach of the Middle Fork South Platte above Fairplay beach and Fairplay beach are downstream of most current mining activities. This area is also downstream of historic mining, which could also be a source of mercury.
- **Downstream Lake:** Spinney Mountain Reservoir is downstream of all mining activity, has the highest potential for transformation of elemental mercury into the more bioavailable methylmercury, and has fish-tissue mercury data collected prior to recent placer mining near Alma and Fairplay (Table 2).

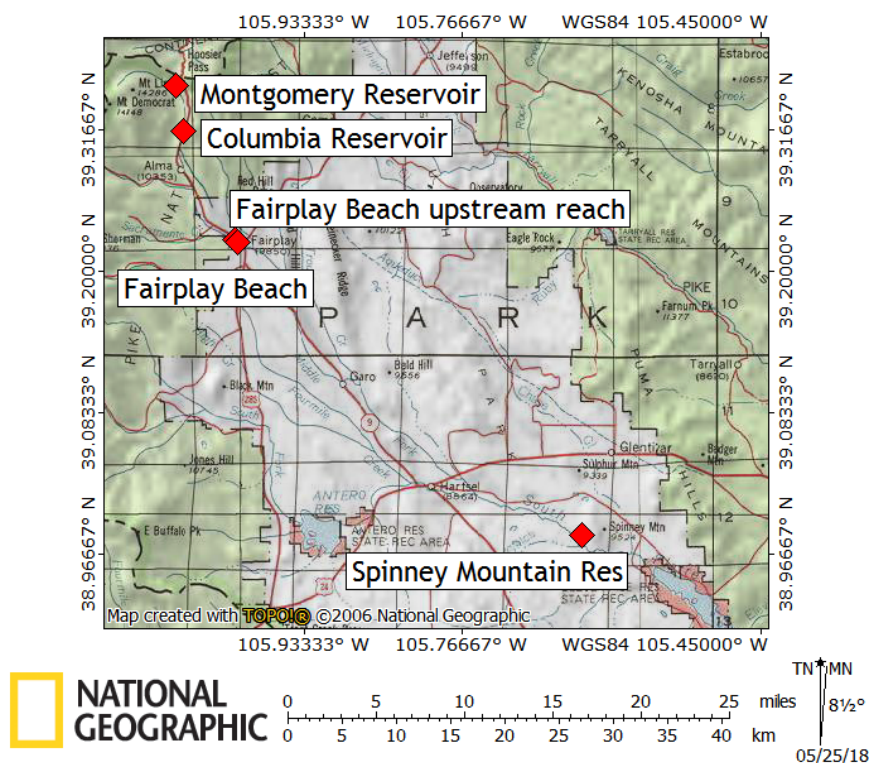


Figure 2. Map of all sampling sites.

Sample type	Site Description	latitude	longitude	UTM X	UTM Y
upstream	Montgomery Reach	39.352004	-106.069148	407880	4356385
Upstream	Columbia Reservoir	39.314587	-106.060772	408553	4352224
Downstream	Fairplay Beach upstream reach	39.225100	-106.006284	413140	4342239
Downstream	Fairplay Beach	39.222664	-106.003538	413374	4341966
Downstream &	Spinney Mountain Reservoir	38.981261	-105.638492	444697	4314891

Before/After					
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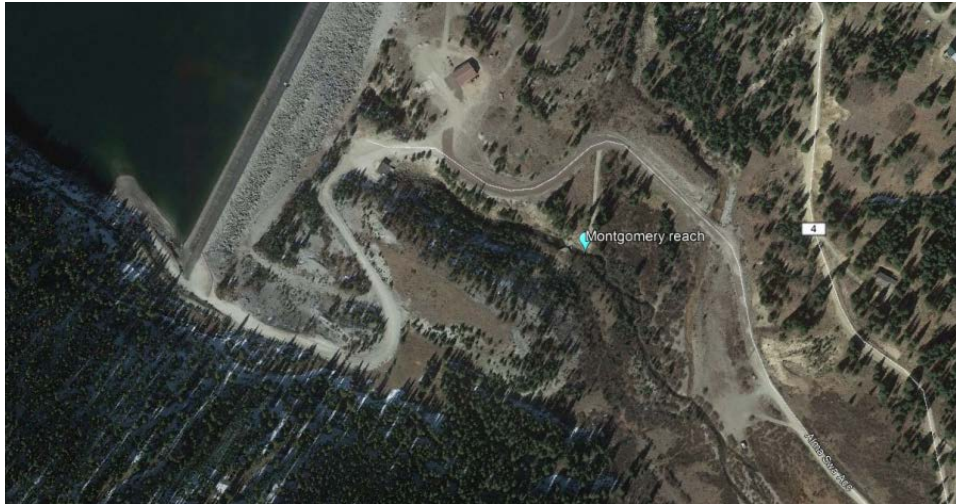


Figure 3. Map of upstream site M. Fk. So. Platte Montgomery Reach.



Figure 4. Upstream site Columbia Reservoir.



Figure 5. Downstream sites at Fairplay Beach.



Figure 6. Far downstream site, Spinney Mountain Reservoir.

Table 2. Spinney Mountain Reservoir mercury results 6/9/2009				
Species	Number of Fish	Sample Type	Length (in)	Mercury ppm
BROWN TROUT	1	Fillet	18	0.09
BROWN TROUT	1	Fillet	19	0.13
NORTHERN PIKE	3	Fillet- composite	18	0.20
NORTHERN PIKE	1	Fillet	32	0.23
RAINBOW TROUT	2	Fillet- composite	19	0.13
RAINBOW TROUT	2	Fillet- composite	19	0.19



RAINBOW TROUT	2	Fillet- composite	20	0.12
Site-specific advisory threshold				0.30

Target organisms: Fish and crayfish were selected as target organisms for the following reasons:

- mercury is bioaccumulative, therefore evidence of elevated mercury is most easily detected in aquatic biota,
- humans are most likely to be exposed to mercury through consumption of fish or crayfish
- fish and crayfish tissue represent an average exposure over time. This makes it possible to detect mercury exposure that is continuous or intermittent.

Organisms will be collected by Colorado Parks and Wildlife at sites that contain their preferred habitat and are conducive for sampling (Table 3). For stream sites, trout are the top predators and both large and juvenile trout will be targeted for collection. For small ponds, both trout and crayfish will be targeted. For Spinney Mountain Reservoir, large pike (top predator), large trout, and crayfish will be targeted.

Table 3. Site Location and maximum sample size					
sample	Site Description	Large trout	Large Pike	Juvenile trout	Crayfish
upstream	Montgomery Reach	5		10	
Upstream	Columbia Reservoir				10
Downstream	Fairplay Beach upstream reach	5			
Downstream	Fairplay Beach			10	10
Downstream & Before/After	Spinney Mountain Reservoir	10 (5 brown/5 rainbow)	5		10

Fish and crayfish may be collected using a variety of methods (Table 4).

- Trout: Both large and juvenile trout will be targeted for sampling. Large trout are likely to be consumed by humans, and are likely to have the higher level of mercury given their age (longer exposure) and ability to eat higher on the food chain. However, large trout are highly mobile, and may represent mercury exposure over a large stretch of river. Juvenile trout are less likely to be eaten by humans, are likely to have lower levels of mercury, but are less mobile and will be more representative of local mercury levels.
- Pike: Large pike are likely to have the highest mercury concentrations since they are top predators, and are likely to be consumed by humans.
- Crayfish: Crayfish may be consumed by humans, and are the least mobile. Therefore, they are most representative of local mercury concentrations.

Table 4. Target organisms and collection methods	
Organism	Collection Method
Pike	Gill net
Large trout streams	Gill net
Large trout lake	Gill net
Juvenile trout streams	Backpack electroshocker
crayfish	Crayfish pot

*Sample Analysis:* Samples will be analyzed by Water Quality Control Division at the Laboratory Services Division of Colorado Department of Public Health and Environment. Smaller organisms may be composited prior to analysis to ensure there is sufficient sample size for testing. Composites samples will not mix species, and preference will be given to compositing organisms of similar size.