Guide to 2017 Water Quality Monitoring Results from the Animas River at Rotary Park

Please keep in mind these results are from one location along the Durango stretch of the Animas River and are not representative of other reaches of the Animas River.
In 2017, Mountain Studies Institute (MSI) continued a water quality monitoring program on the Animas River at Rotary Park in Durango, CO.

- MSI collected 21 water quality samples from May through August of 2017, capturing river conditions when river recreation was at its peak.

- MSI expedited laboratory analysis of samples to get water quality results to the public as quickly as possible.
Animas River at Rotary Park in Durango, CO from March to August 2017

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<thead>
<tr>
<th>Mar 15</th>
<th>April 14</th>
<th>May 2</th>
<th>May 9</th>
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<tr>
<th>May 16</th>
<th>May 23</th>
<th>May 30</th>
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<tr>
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<th>July 3</th>
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<tr>
<th>July 10</th>
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<th>Aug 2</th>
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<th>Aug 15</th>
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Click through the following pages to learn about the results from MSI’s 2017 Animas River water quality monitoring.

We will address the following questions:

- How did metal concentrations in 2017 compare to water quality benchmarks?
- Was Animas River water quality in 2017 any different than previous years?
- Do metal concentrations in the Animas River correlate with other water quality parameters such as flow, pH, conductivity, and turbidity?
We will start by using an example of one metal, total zinc, from the Animas River at Rotary Park in Durango, Colorado.
Metal concentration in micrograms per liter (ug/L), log scale, is on the vertical axis.
Grey diamonds = Historic River Watch samples from the Animas River – 2002 to 2014
Orange diamonds = Samples collected during the Gold King Mine release (August 6 to August 9, 2015)
Blue diamonds = Samples collected in 2015 after the Gold King Mine release (August 10 to October 26, 2015)
Red diamonds = Sample collected in 2016 from February through November
Yellow diamonds = Sample collected in 2017 from March through August
Question = How did zinc concentrations in 2017 compare to concentrations during the 2015 Gold King Mine release?
**Question** = How did zinc concentrations in 2017 compare to concentrations during the 2015 Gold King Mine release?

**Answer** = 2017 concentrations were *less than* concentrations observed at the peak of the Gold King Mine release.
Now let’s look at how zinc concentrations in 2017 compared to water quality benchmarks set by the state of Colorado and the Federal Government.
Environmental Protection Agency – Recreational Screening Level

*Set to protect use of the Animas River for recreation*

*Protective of users who accidentally swallow river water (swimmers, rafters, tubers) or users who intentionally ingest river water (backpackers, overnight river users)*
Colorado Department of Public Health and Environment (CDPHE) – Drinking Water Supply Standard

Set to protect use of the Animas River for domestic drinking water supply
Total Zinc, Animas River at Durango, CO: 2002-2017

Colorado Department of Public Health and Environment (CDPHE) – Agriculture Standard

Set to protect agricultural use of the Animas River – irrigation and livestock watering
Question: How did total Zinc concentrations in 2017 compare to water quality benchmarks?
Question: How did total Zinc concentrations in 2017 compare to water quality benchmarks?

Answer: In 2017, total zinc concentrations were at levels considered safe for Recreation, Agriculture, and Drinking Water Supply (metal concentrations were below water quality benchmarks).
We looked at total zinc, but what about other metals?

Flip to the following pages for a summary of how other metals compared to water quality benchmarks in 2017.
First, what metals did MSI test for in 2017?

Aluminum (Al), Copper (Cu), Iron (Fe), Lead (Pb), Zinc (Zn)

Total and dissolved metals

MSI analyzed for the total and dissolved fraction of metals. Why? The pH of water is the main driver of whether a metal is present in a dissolved state or a solid particulate state. This is important because metals are generally more bioavailable and toxic to aquatic life in a dissolved state.
Did metal concentrations in 2017 at Rotary Park surpass water quality benchmarks?

- **Recreation**: No
- **Agriculture**: No
- **Domestic Water Supply**: No
- **Aquatic Life**: Yes:
  - **Acute**: Al
  - **Chronic**: *Aluminum was close to surpassing*

*Safe Levels: Al<sub>d</sub> Cu<sub>t+d</sub> Fe<sub>t+d</sub> Pb<sub>t+d</sub> Zn<sub>t+d</sub>*

t=total; d=dissolved
What else did the 2017 water quality monitoring reveal?
Was Animas River water quality in 2017 any different than previous years?
One way to answer this question is to visually compare the distribution of zinc concentrations in 2017 to the distribution of zinc concentrations that have occurred historically.
The distributions look somewhat similar. A more decisive way to answer this question is to use statistical analysis.
Was Animas River water quality in 2017 any different than previous years?

Statistical analysis indicated that metal concentrations in the Durango stretch of the Animas River were not significantly higher in 2017 than in previous years.

Most metal concentrations at Rotary Park in 2017 were consistent with previous years, but dissolved copper and total zinc were lower in 2017 than in previous years.
Metals and Other Water Quality Parameters
Metals and Other Water Quality Parameters

In 2016 and 2017, concentrations of several metals correlated at a statistically significant level with discharge, turbidity, pH, and conductivity.

For example, when river discharge (volume/time) increased, the following metals increased:

\[ \text{Al}_t, \text{Cu}_{t+d}, \text{Fe}_t, \text{Pb}_t, \text{Zn}_t \]

When turbidity (cloudiness of water) increased, the following metals increased:

\[ \text{Al}_t, \text{Cu}_{t+d}, \text{Fe}_t, \text{Pb}_t, \text{Zn}_t \]

t=total; d=dissolved
Metals and other water quality parameters

When pH (measure of acidity) decreased, the following metals increased:

When conductivity (ability to conduct electricity) decreased, the following metals increased:
So What?
Should I be concerned?
In 2017, MSI detected low levels of metals in the Animas River at Rotary Park.

So, what does that mean?
The good news is:

In 2017, metal concentrations from the Durango stretch of the Animas River were at levels considered **SAFE** for:

- Recreation
- Domestic Water Supply
- Agriculture
It does not appear that Animas River metal concentrations at Rotary Park in 2017 were any higher than previous years (2002-2014).

We did detect elevated metal concentrations during spring runoff when turbidity and discharge rose, and conductivity and pH dropped. However, the elevated levels of metals observed in the Durango stretch of the Animas River during spring runoff were not high enough to pose a threat to human health.
Should I be concerned?

But, there were some concerns:

In 2016 and 2017, concentrations of aluminum and iron approached levels that could be harmful to aquatic life. These elevated levels occurred during spring runoff and were lower in late summer. High levels of aluminum and iron are not unprecedented, and are consistent with levels observed in previous years.

It is important to note that there are large natural sources of aluminum and iron in the Animas River watershed that are not related to mining activities.

Mountain Studies Institute, Colorado Parks and Wildlife, Southern Ute Indian Tribe, and other organizations will continue to monitor aquatic life to assess overall river health.
So...Should I be concerned?

We know that metal contamination from natural sources and mine-related sources have negatively impacted water quality of the Animas River for over a hundred years.

Some of the water quality data from 2017 have been encouraging – we have no indication of any threat to human health from Animas River water (please also refer to the San Juan Basin Health Department, an authority for guidance on human health concerns related to the Animas River: http://sjbpublichealth.org), but the data do raise some concerns for aquatic life in the Durango stretch of the Animas River. These concerns can only be addressed by continued monitoring of water quality and aquatic life.
If you are interested in diving deeper into the data on your own or exploring technical details, visit The Mountain Studies Institute online at: 

www.MountainStudies.org/animasriver

...or check out the following pages for graphs of more metals.
*The recreational screening level represents the level at which no adverse health effects are expected to occur in humans consuming 2 L of water per day, from the Animas, orally, for 64 days each year for a total of 30 years.

*Colorado Department of Public Health and the Environment (CDPHE) standards based on Colorado surface water quality classifications and Reg. 31 and 34. Standards vary with water hardness and are plotted here using an average water hardness of the Animas River at this location, 200 mg/L.

Note: 2002-2014 data is River Watch data from the Animas River at the fish hatchery in Durango, CO. 2015-2017 data is Mountain Studies Institute data from the Animas River at Rotary Park in Durango, CO.
**Dissolved Aluminum, Animas River at Durango, CO: 2002-2017**

- **EPA Surface Water Recreational Screening Level (170,000 μg/L)**
- **Historic River Watch samples (2002-2014)**
- **2015 Gold King Mine release samples (8/6/15 - 8/9/15)**
- **2015 Post-Gold King Mine release samples (8/10/15 - 10/26/15)**
- **2016 samples (Feb-Nov)**
- **2017 samples (March-Aug)**
- **Samples with concentrations below Method Detection Limit**

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Note: 2002 - 2014 data is River Watch data from the Animas River at the fish hatchery in Durango, CO. 2015-17 data is Mountain Studies Institute data from the Animas River at Rotary Park in Durango, CO.
Total Copper, Animas River at Durango, CO: 2002-2017

- **EPA Surface Water Recreational Screening Level (6,700 µg/L)**
- **CDPHE Domestic Water Supply Maximum Contaminant Level 30-Day Exposure (1,000 µg/L)**
- **CDPHE Agriculture Standard 30-Day Exposure (200 µg/L)**

**Historic River Watch samples (2002-2014)**

- **2015 Gold King Mine release samples (8/6/15 - 8/9/15)**
- **2015 Post-Gold King Mine release samples (8/10/15 - 10/26/15)**
- **2016 samples (Feb-Nov)**
- **2017 samples**

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**Colorado Department of Public Health and Environment (CDPHE) standards based on Colorado surface water quality classifications and Reg. 31 and 34.

Note: 2002 - 2014 data is River Watch data from the Animas River at the fish hatchery in Durango, CO. 2015-17 data is Mountain Studies Institute data from the Animas River at Rotary Park in Durango, CO.
Dissolved Copper, Animas River at Durango, CO: 2002-2017

- EPA Surface Water Recreational Screening Level (6,700 μg/L)*
- CDPHE Acute Standard for Aquatic Life, based on average hardness~
- CDPHE Chronic Standard for Aquatic Life, based on average hardness~
  - Historic River Watch samples (2002-2014)
  - 2015 Post-Gold King Mine release samples (8/10/15 - 10/26/15)
  - 2016 samples (Feb-Nov)
  - 2017 samples (March-Aug)
  - Samples with concentrations below Method Detection Limit

* The recreational screening level represents the level at which no adverse health effects are expected to occur in humans consuming 2L of water per day, from the Animas, orally, for 64 days each year for a total of 30 years.
~Colorado Department of Public Health and the Environment (CDPHE) standards based on Colorado surface water quality classifications and Reg. 31 and 34. Standards vary with water hardness and are plotted here using an average water hardness of the Animas River at this location, 208 mg/L.

Note: 2002 - 2014 data is River Watch data from the Animas River at the fish hatchery in Durango, CO. 2015-17 data is Mountain Studies Institute data from the Animas River at Rotary Park in Durango, CO.
Total Iron, Animas River at Durango, CO: 2002-2017

- EPA Surface Water Recreational Screening Level (120,000 µg/L)*
- CDPHE Chronic Standard for Aquatic Life (1,000 µg/L, Total)**
- Historic River Watch samples (2002-2014)
- 2015 Post-Gold King Mine release samples (8/10/15 - 10/26/15)
- 2016 samples (Feb-Nov)
- 2017 samples (March-Aug)
- Samples with concentrations below Method Detection Limit

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Note: 2002 - 2014 data is River Watch data from the Animas River at the fish hatchery in Durango, CO. 2015-17 data is Mountain Studies Institute data from the Animas River at Rotary Park in Durango, CO.
Dissolved Iron, Animas River at Durango, CO: 2002-2017

- EPA Surface Water Recreational Screening Level (120,000 µg/L)*
- CDPHE Domestic Water Supply Maximum Contaminant Level 30-Day Exposure (300 µg/L, Dissolved)**
- Historic River Watch samples (2002-2014)
- 2015 Post-Gold King Mine release samples (8/10/15 - 10/26/15)
- 2016 samples (Feb-Nov)
- 2017 samples (March-Aug)
- Samples with concentrations below Method Detection Limit

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*Colorado Department of Public Health and the Environment (CDPHE) standards based on Colorado surface water quality classifications and Reg. 31 and 33.

Note: 2002 - 2014 data is River Watch data from the Animas River at the fish hatchery in Durango, CO. 2015-17 data is Mountain Studies Institute data from the Animas River at Rotary Park in Durango, CO.
Dissolved Lead, Animas River at Durango, CO: 2002-2017

- EPA Surface Water Recreational Screening Level (200 µg/L)*
- CDPHE Acute Standard for Aquatic Life, based on average hardness**
- CDPHE Chronic Standard for Aquatic Life, based on average hardness**
- Historic River Watch samples (2002-2014)
- 2015 Post-Gold King Mine release samples (8/10/15 - 10/26/15)
- 2016 samples (Feb-Nov)
- 2017 samples (March-Aug)
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Note: 2002 - 2014 data is River Watch data from the Animas River at the fish hatchery in Durango, CO. 2015-17 data is Mountain Studies Institute data from the Animas River at Rotary Park in Durango, CO.
Total Zinc, Animas River at Durango, CO: 2002-2017

- **EPA Surface Water Recreational Screening Level (50,000 µg/L)**
- **CDPHE Domestic Water Supply Maximum Contaminant Level 30-Day Exposure (5,000 µg/L)**
- **CDPHE Agriculture Standard 30-Day Exposure (2,000 µg/L)**
- **Historic River Watch samples (2002-2014)**
- **2015 Gold King Mine release samples (8/6/15 - 8/9/15)**
- **2015 Post-Gold King Mine release samples (8/10/15 - 10/26/15)**
- **2016 samples (Feb-Nov)**
- **2017 samples (March-Aug)**
- **Samples with concentrations below Method Detection Limit**

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Dissolved Zinc, Animas River at Durango, CO: 2002-2017

- EPA Surface Water Recreational Screening Level (50,000 µg/L)*
- CDPHE Acute Standard for Aquatic Life, based on average hardness~
- CDPHE Chronic Standard for Aquatic Life, based on average hardness~
  - Historic River Watch samples (2002-2014)
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