



October 4, 2018

Memo from Mountain Studies Institute

Continued 416 Fire water quality monitoring results from Hermosa Creek and Animas River

Dear Community Partners:

Mountain Studies Institute (MSI), an independent nonprofit research center, investigates water quality issues along the Animas River and has a tradition of responding to community concerns related to changes in the watershed. During the summer of 2018, the 416 Fire burned 54,000 acres in the San Juan National Forest, primarily in the Hermosa Creek drainage north of Durango, CO. Recent runoff events and debris flows have occurred within the 416 burn area, creating concern in southwest Colorado communities about the resulting impacts to water quality and aquatic life. Ash and sediment delivered from the burn area have been evident in changes in color, discharge, turbidity, and reports of fish kills in Hermosa Creek and the Animas River. The frequency of debris flows and runoff events from the 416 burn area is effectively illustrated by turbidity measured by the USGS gauge on the Animas River in Durango (Figure 1, see following pages). MSI collected water quality samples from Hermosa Creek and the Animas River at Rotary Park in Durango to characterize the anticipated water quality impacts from these events. Since mid-June, MSI has collected samples during several precipitation events as well as during stable weather conditions.

Samples were analyzed by Green Analytical Laboratory in Durango, Colorado for the following analytes: *suspended sediment concentration, dissolved organic carbon, nitrite/nitrate as N, total Kjeldhal nitrogen, total phosphate, hardness, total mercury, and total and dissolved concentrations of aluminum, iron, lead, and manganese.*

Table 1 illustrates our water quality results (see the following pages). The highlighted color represents a gradient of each water quality parameter across all dates and sites from high (orange) to low (green).

Notable observations:

- It is clear that water quality deteriorated in Hermosa Creek and the Animas River immediately following precipitation events that caused runoff from the 416 burn area. All water quality parameters were elevated after precipitation events compared to observations during stable weather conditions.
 - Debris flows, flood events, and the mobilization of sediment, nutrients, metals, and organic materials are commonly observed after wildfires.
 - Please note that these events (and the corresponding level of contaminants) are discrete, temporary occurrences. Although aquatic life are unable to avoid these events, our communities can mitigate temporary reductions in water quality. For example, the City of Durango does not intake water from the Animas River during periods when precipitation events cause runoff from the 416 burn area that could adversely affect water quality.
- The highest concentration of nearly every water quality parameter was observed at Hermosa Creek after precipitation events that occurred on 7/16 and 7/24. These events caused debris flows, flooding, and closure of local roads.



- Following precipitation events, several water quality parameters temporarily reached levels of concern for aquatic life. Concentrations of suspended sediment could have been high enough to inhibit fish gill function and smother habitat of benthic macroinvertebrates. Levels of aluminum, iron, and mercury in samples from the Animas River at Rotary Park and Hermosa Creek surpassed Colorado Department of Public Health and the Environment water quality standards protective of aquatic life (see charts in Appendix A).
 - For example, the concentration of total aluminum observed in the Animas River at Rotary Park on July 25th was 37 times higher than the acute standard set to protect aquatic life from brief, short-term exposure and 260 times higher than the chronic standard set to protect aquatic life from persistent, long-term exposure.
 - MSI is currently working to further understand whether the observed levels of aluminum are potentially toxic to aquatic life. We'll share those results when they are available.
- Observations of Animas River water quality should be interpreted within the context of the historic low flows in the Animas River associated with the current drought (Figure 2). It is possible that contributions of deteriorated water quality from Hermosa Creek had a greater impact on the Animas River during 2018's low flow conditions than if the Animas River were flowing at flows closer to average.
- Were the observed post-416 water quality parameters levels unprecedented for Hermosa Creek and the Animas River? Our ability to answer this question is reliant on the existence of water quality data collected in previous years prior to the 416 Fire. There is limited historical storm event water quality data available from Hermosa Creek, and thus, it is difficult to know if the post-fire conditions were unprecedented. For the Animas River at Rotary Park, we can compare the post-fire levels of aluminum, iron, lead, and manganese to historical observations over the past decade from MSI and the Colorado River Watch program. Although we do not have enough post-416 Fire data yet to conduct statistical analysis, it is clear that during storm events following the 416 Fire, we have documented unprecedently high levels of aluminum, iron, and manganese in the Animas River at Rotary Park (Appendix A).

We hope that these observations are useful to our community partners. We believe that these initial results demonstrate a need for continued monitoring downstream of the 416 Fire. While the high concentrations of some parameters and recent fish kills are alarming, it is important to note that research from other wildfires suggest that water quality and aquatic life can recover quickly following wildfire (see results of post-West Fork Complex Fire monitoring by Rio Grande Watershed Emergency Action Team: <https://www.rweact.org/>).

Please let us know if we can provide you with additional information.

Scott Roberts

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Hermosa Creek on July 24, 2018



Animas River at Rotary Park on July 25, 2018

Turbidity, Animas River at Durango, CO (USGS): June-July, 2018 and photos illustrating a subset of MSI sampling dates

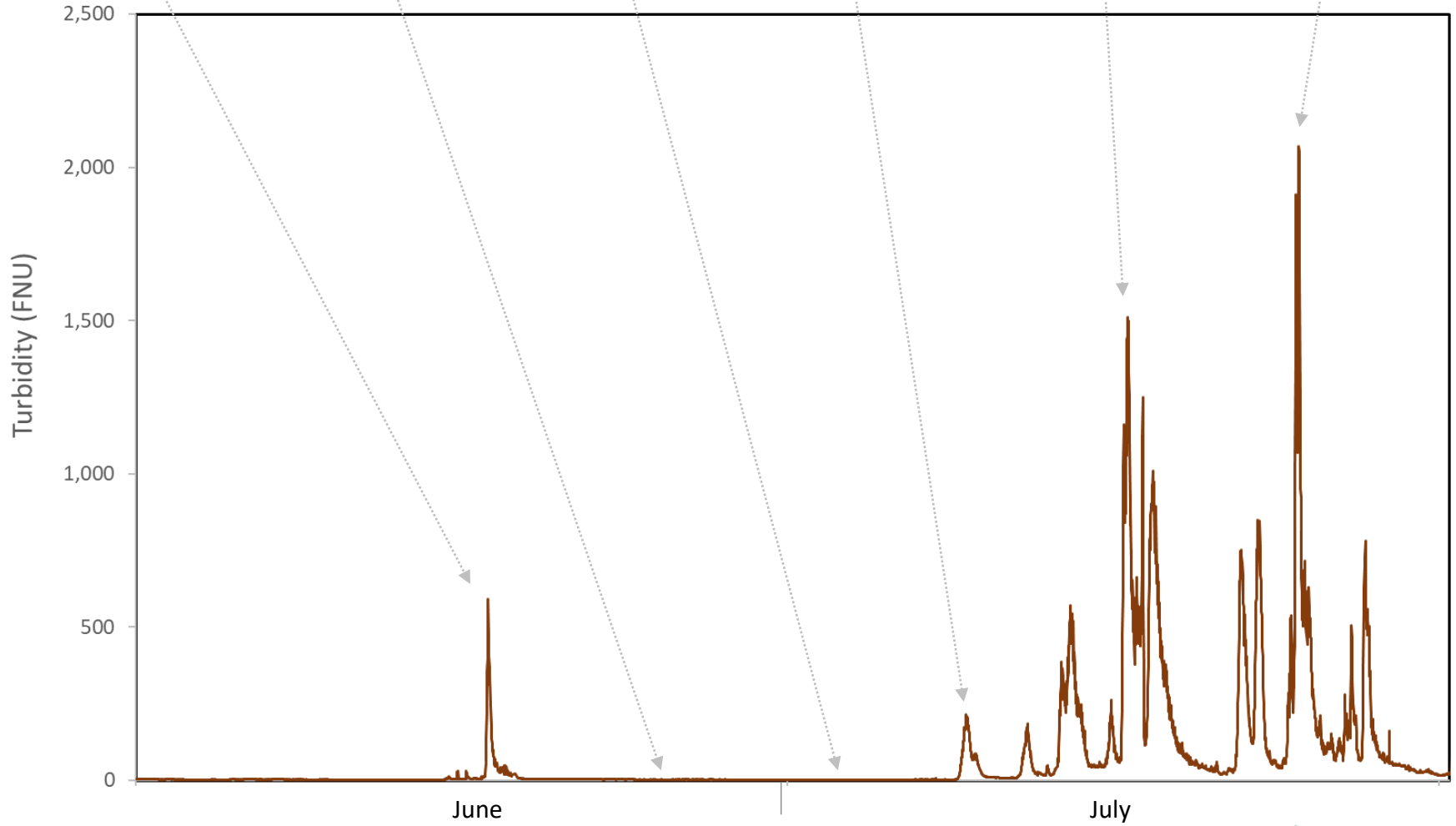









Figure 1

Water Quality Parameters (ug/L)	June 17-18 		June 25-26 		July 5 		July 7 		July 9-10 		July 16-17 		July 24-25 	
	Hermosa 6/17	Animas 6/18	Hermosa 6/25	Animas 6/25	Hermosa 7/5	Animas 7/5	Hermosa 7/7	Animas 7/7	Hermosa 7/9	Animas 7/10	Hermosa 7/16	Animas 7/17	Hermosa 7/24	Animas 7/25
Suspended Sediment Concentration	12,300,000	89,600	2,000	2,000	2,000	5,200	153,000	3,200	4,560,000	154,000	244,000,000	3,000,000	188,000,000	17,100,000
Dissolved Organic Carbon	101,000	2,040	67	702	641	1,030	1,640	1,090	47,000	10,800	165,000	41,000	3,440	36,200
Nitrite/Nitrate as N	32	80	9.0	9.0	9.0	9.0	48	9.0	62	9.0	34	85	485	551
Nitrogen, Total Kjeldhal	67,400	1,670	133	133	133	133	995	133	36,400	3,840	16,000	66,000	537,000	79,200
Phosphate (PO4), Total	56,600	645	34	49	307	34	909	34	52,300	1,930	5,530	38,000	208,000	106,000
Phosphate as P, Total	18,400	210	11	11	55	55	296	11	17,000	630	1,800	12,400	67,900	34,600
Aluminum, total	304,000	3,340	155	124	144	173	3,710	110	89,300	4,270	2,130,000	260,000	2,560,000	374,000
Aluminum, dissolved	80	86	78	25	74	25	116	25	321	25	57	25	25	25
Iron, total	335,000	3,260	17	266	167	408	4,280	303	71,800	3,350	1,710,000	248,000	2,510,000	471,000
Iron, dissolved	99	28	28	28	28	28	28	28	178	28	72	58	28	28
Lead, total	561	10	0.1	1.4	0.1	3.3	14	1.9	171	8.8	6,060	734	4,510	885
Lead, dissolved	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.60	0.02
Manganese, total	8,720	213	29	100	84	139	467	99	8,920	305	141,000	14,800	110,000	13,800
Manganese, dissolved	546	18	68	64	78	46	120	34	253	372	1,030	928	3,720	550
Mercury, total	0.40	-	0.03	0.03	0.03	0.03	0.03	0.03	0.20	0.03	5.30	0.40	6.20	0.70

Notes:

Color indicates the gradient of each water quality parameter across all dates and sites from high (orange) to low (green)

Samples with concentrations below the method detection limit are reported at the detection limit

Blue raincloud icon denotes that the precipitation events that caused runoff from the 416 burn area

Yellow sun icons denotes sampling that occurred during stable weather conditions



Table 1

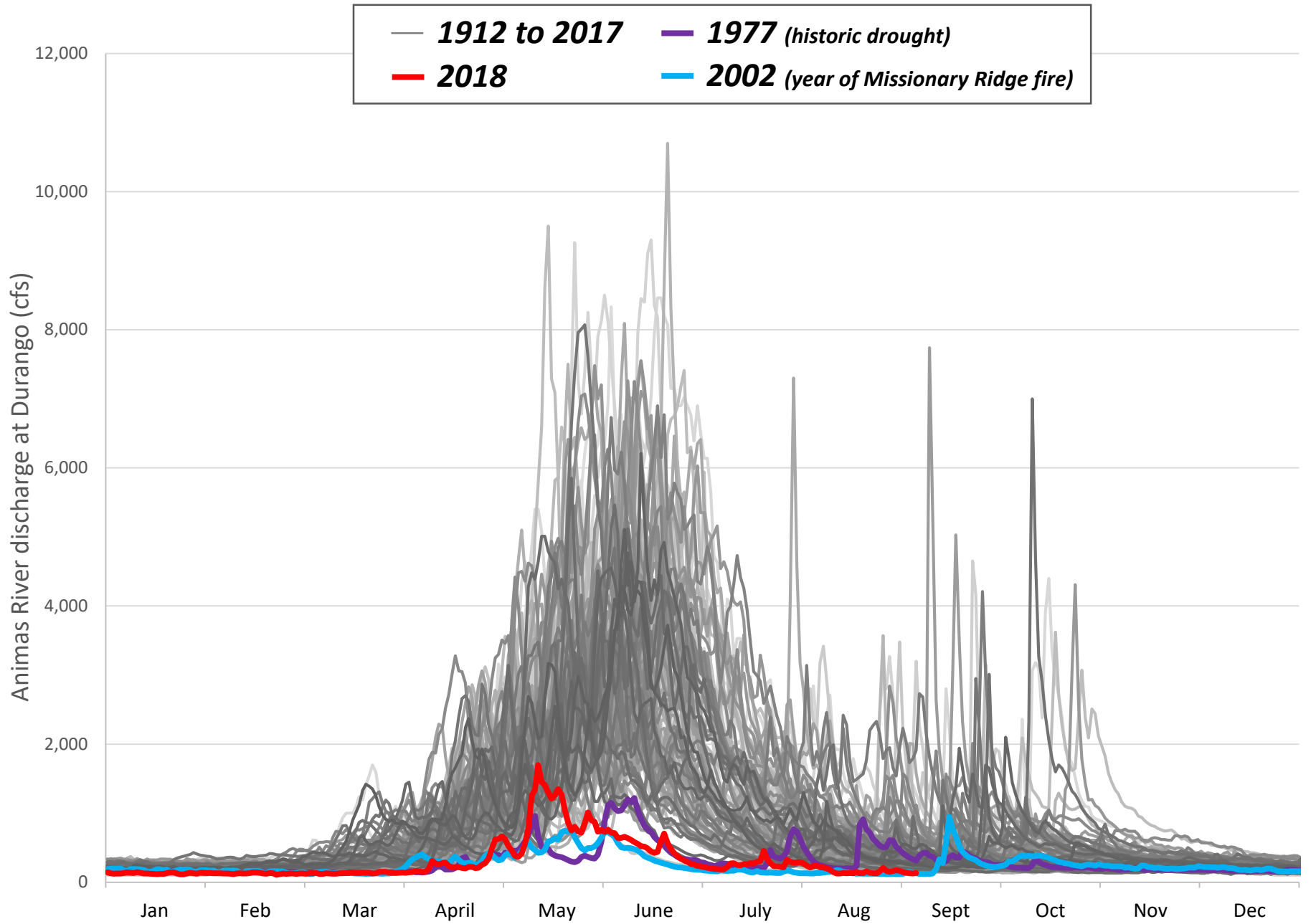
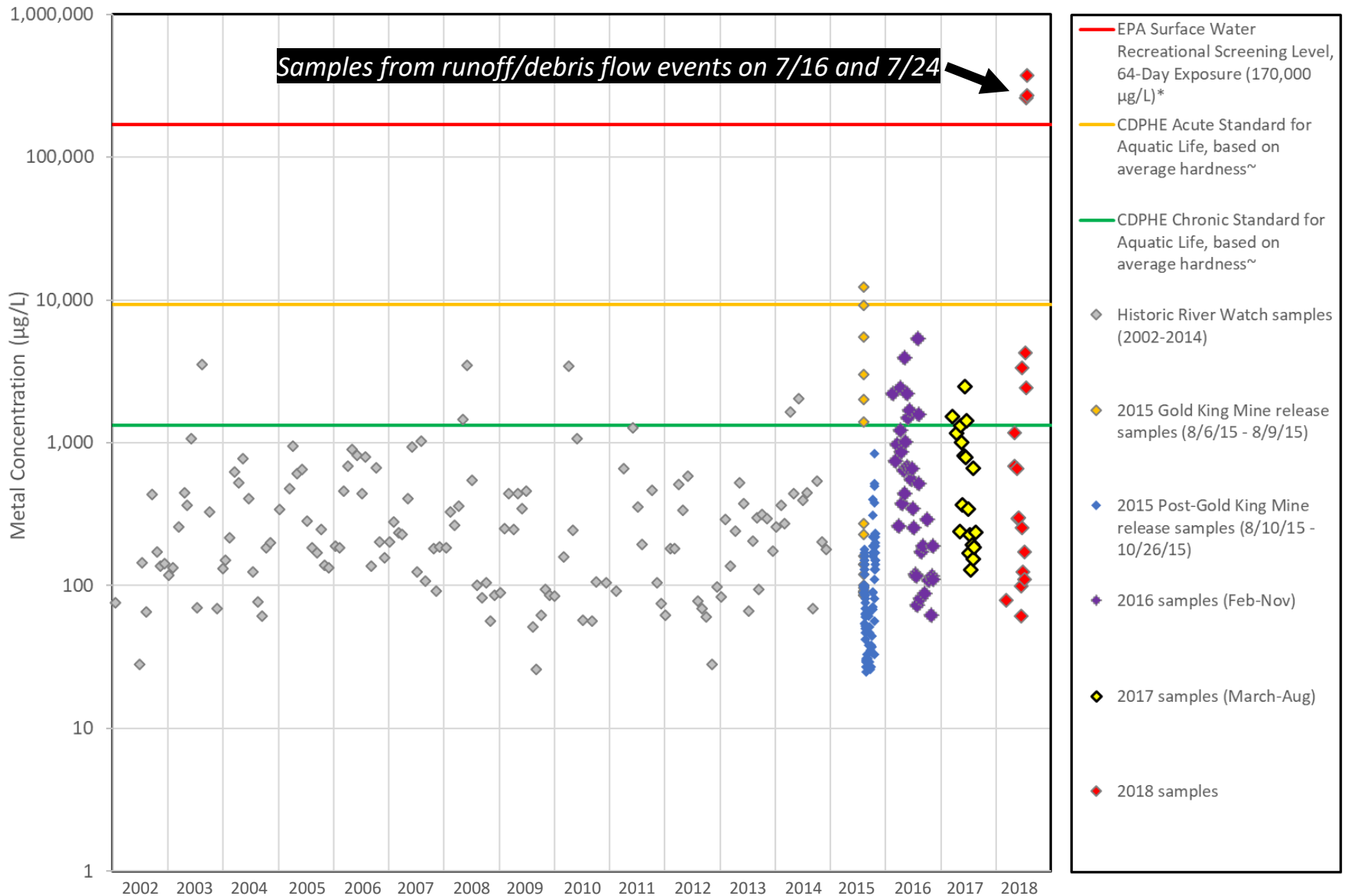


Figure 2

Appendix A: Water quality in Hermosa Creek and the Animas River at Rotary Park following the 416-Fire in context of historic observations and Colorado Department of Public Health and the Environment (CPDHE) water quality standards

Total Aluminum, Animas River at Durango, CO: 2002-2018

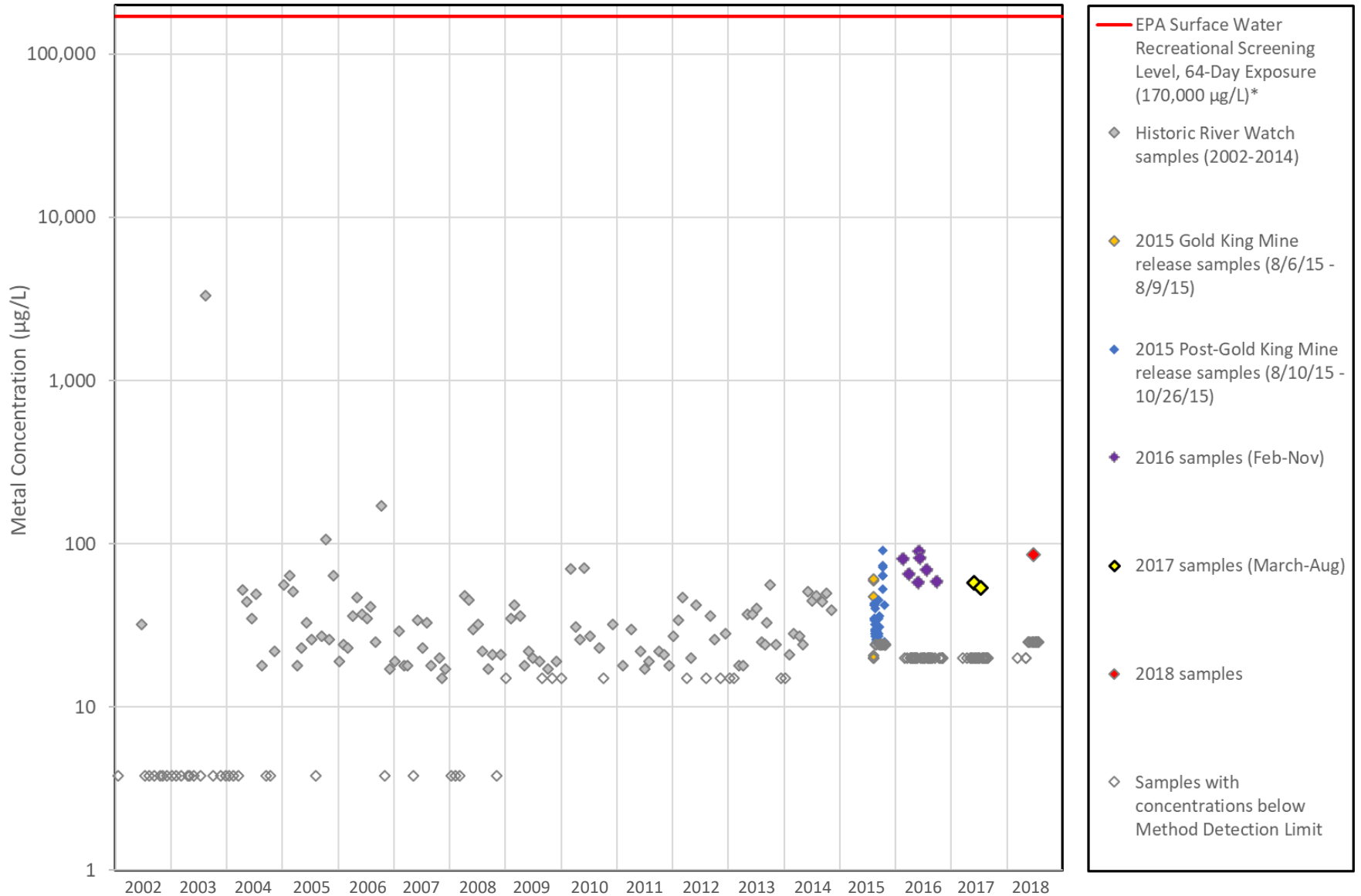


* The recreational screening level represents the level at which no adverse health effects are expected to occur in humans consuming 2L of water per day, from the Animas, orally, for 64 days each year for a total of 30 years.

~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.

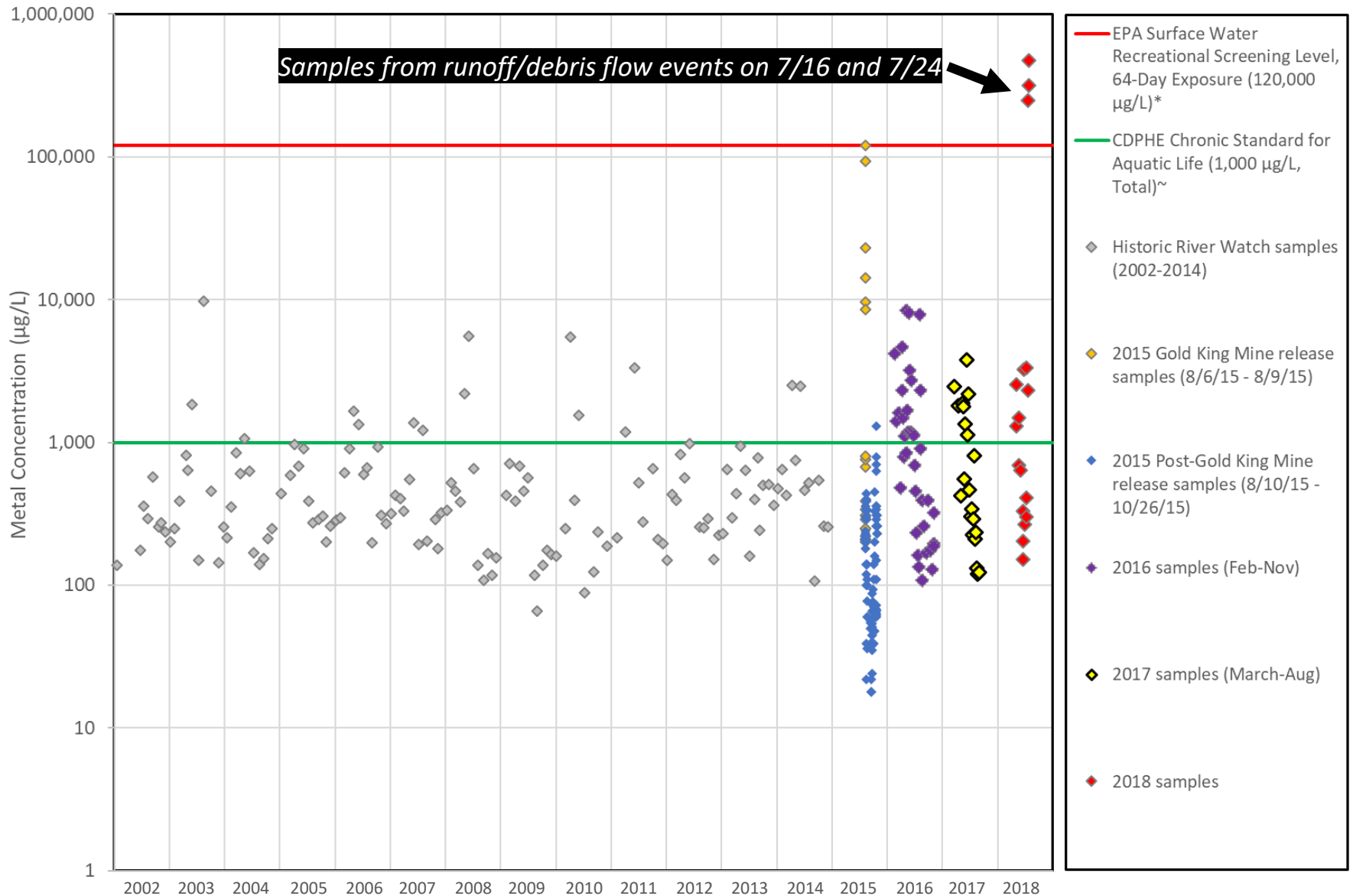
Note: 2002 - 2014 data is River Watch data from the Animas River at the fish hatchery in Durango, CO. 2015-18 data is Mountain Studies Institute data from the Animas River at Rotary Park in Durango, CO

Dissolved Aluminum, Animas River at Durango, CO: 2002-2018



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Total Iron, Animas River at Durango, CO: 2002-2018

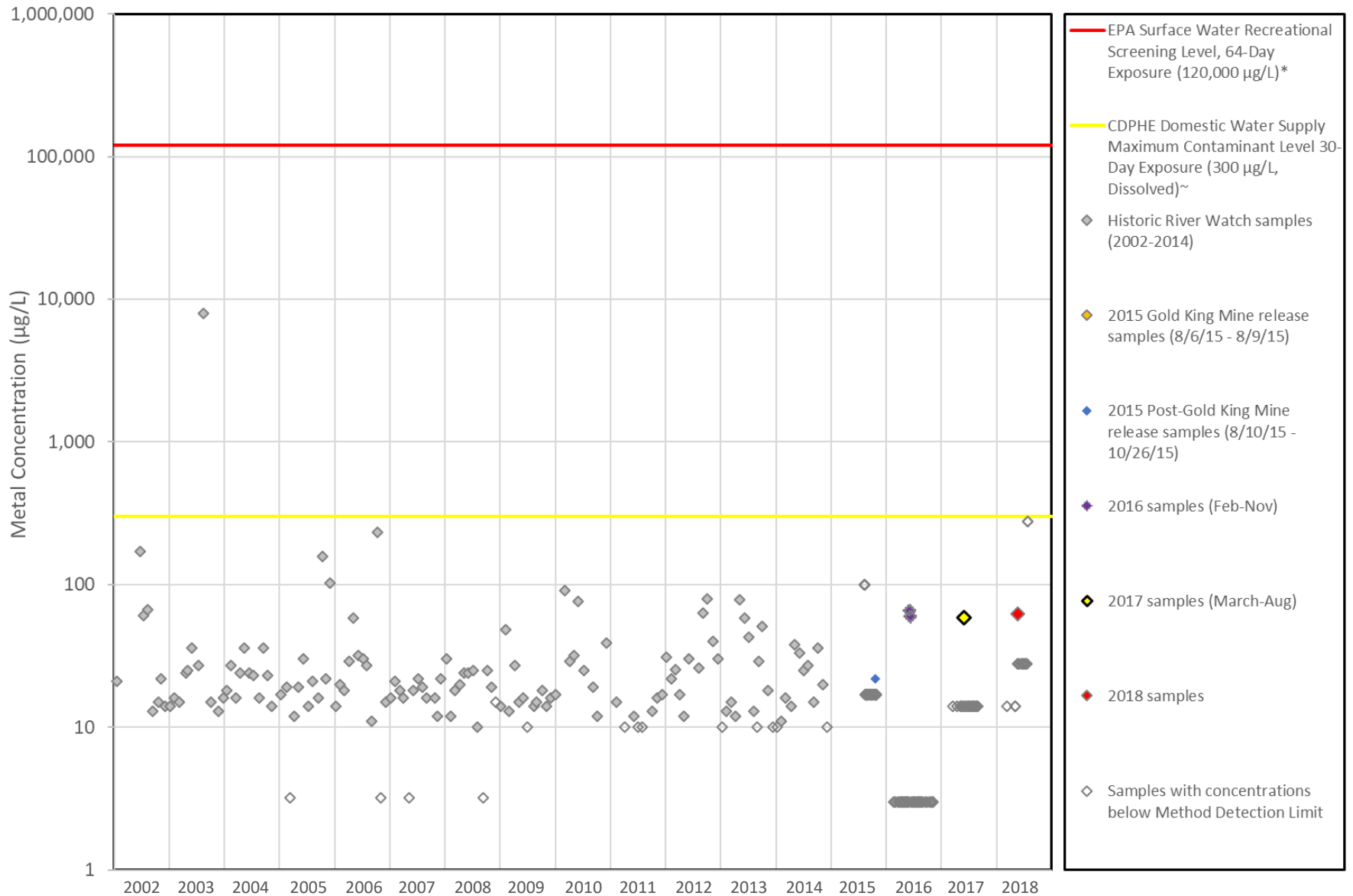


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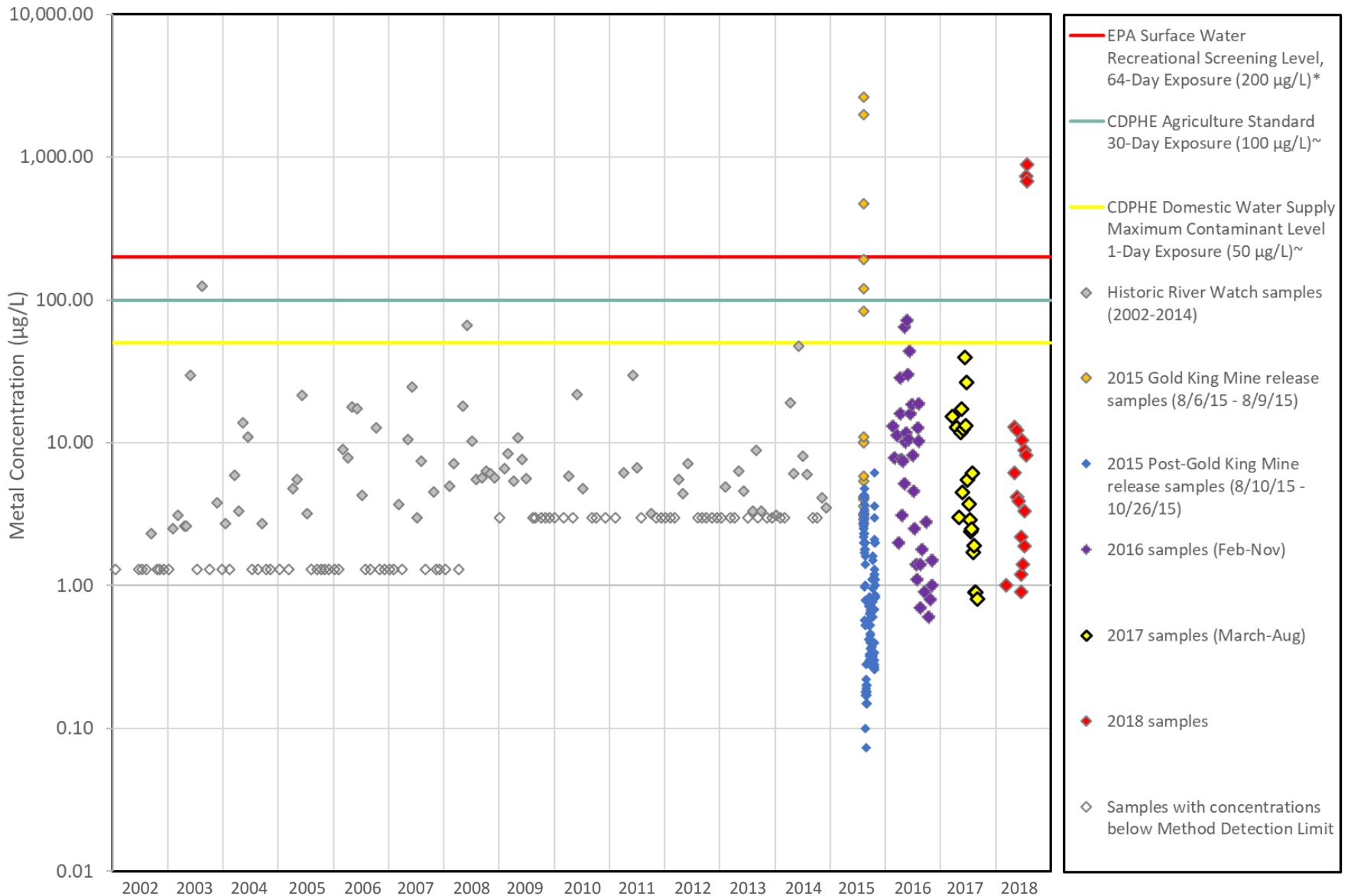
Note: 2002 - 2014 data is River Watch data from the Animas River at the fish hatchery in Durango, CO. 2015-18 data is Mountain Studies Institute data from the Animas River at Rotary Park in Durango, CO

Dissolved Iron, Animas River at Durango, CO: 2002-2018



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Total Lead, Animas River at Durango, CO: 2002-2018

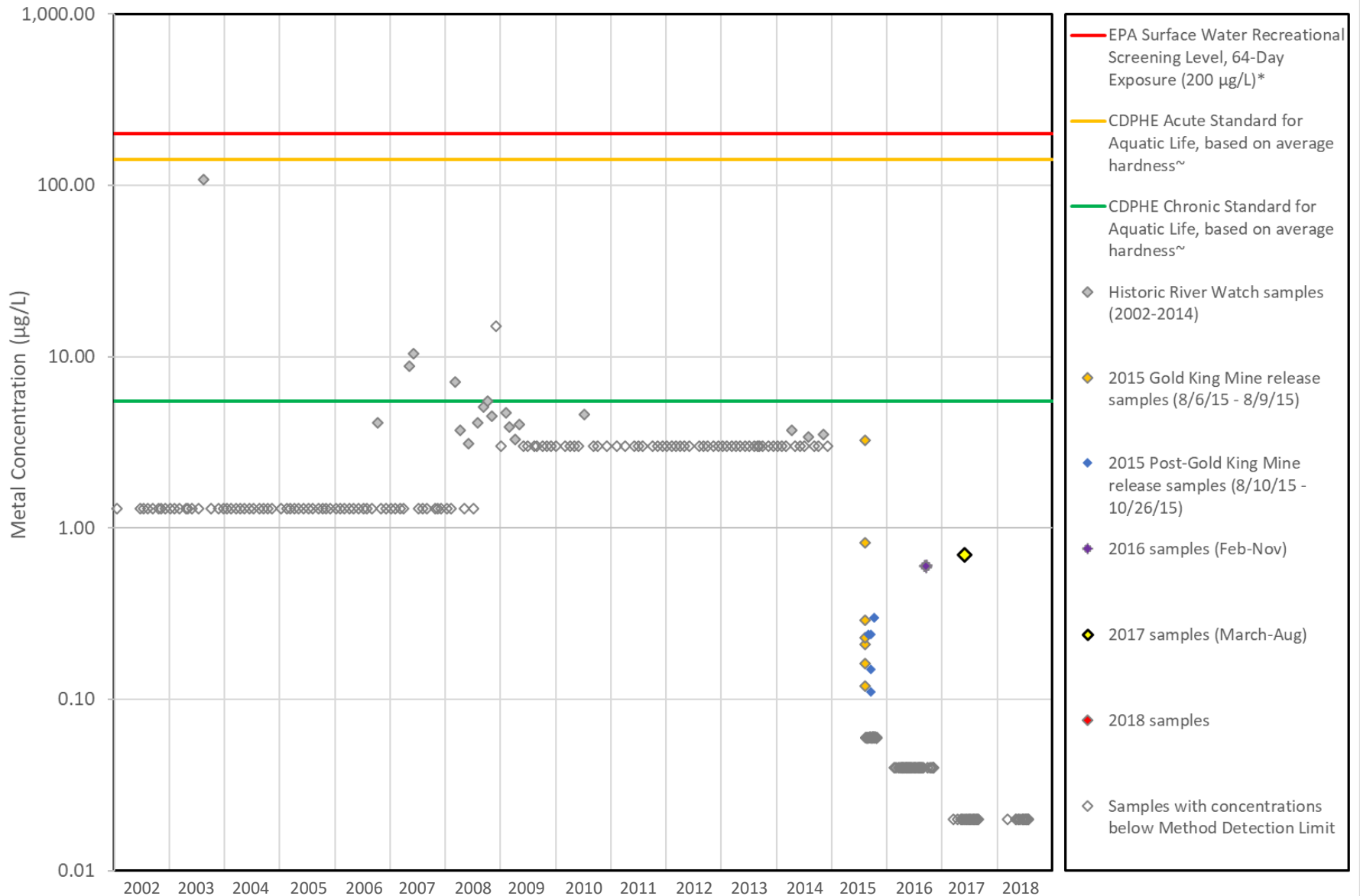


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Dissolved Lead, Animas River at Durango, CO: 2002-2018

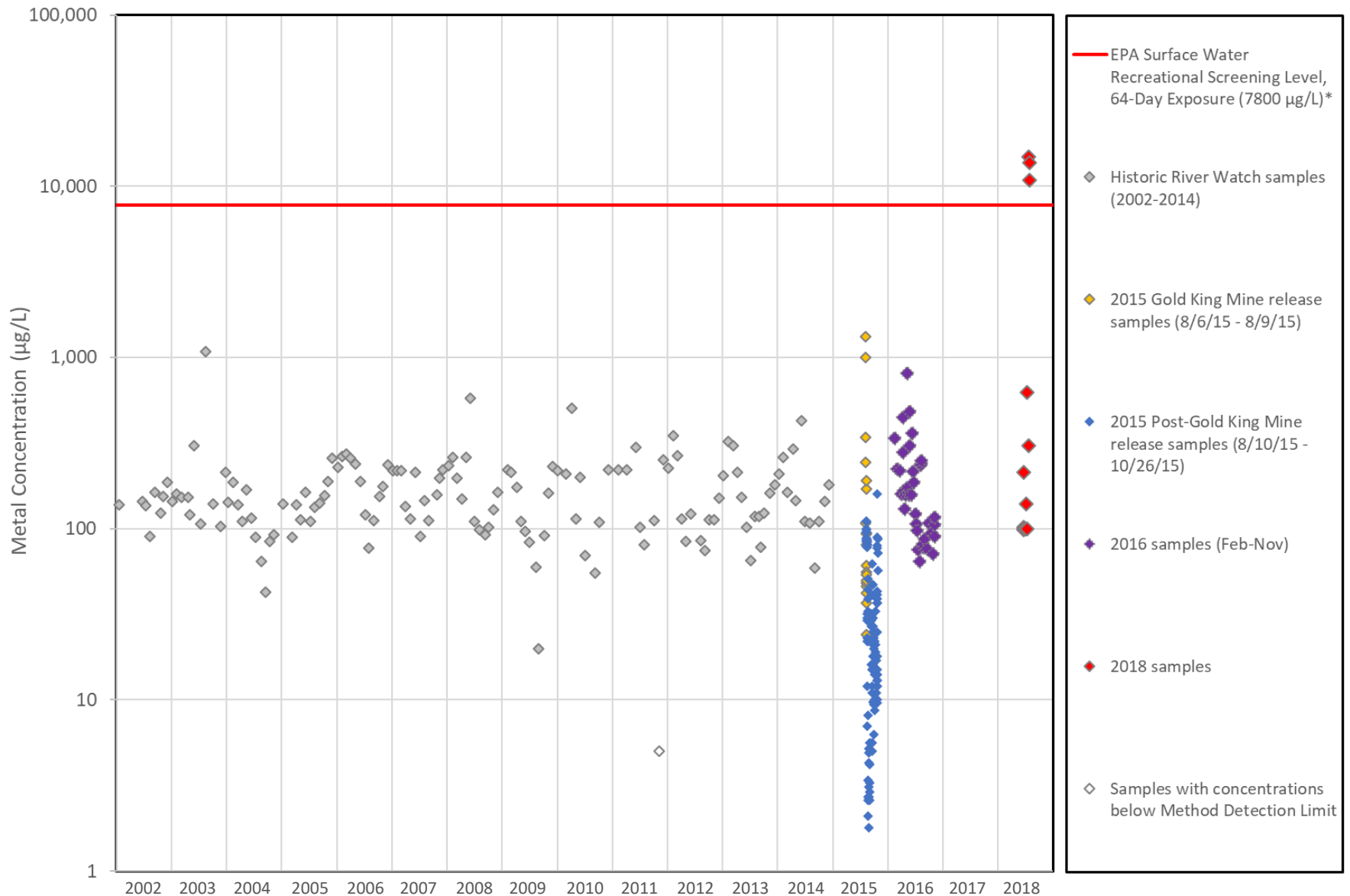


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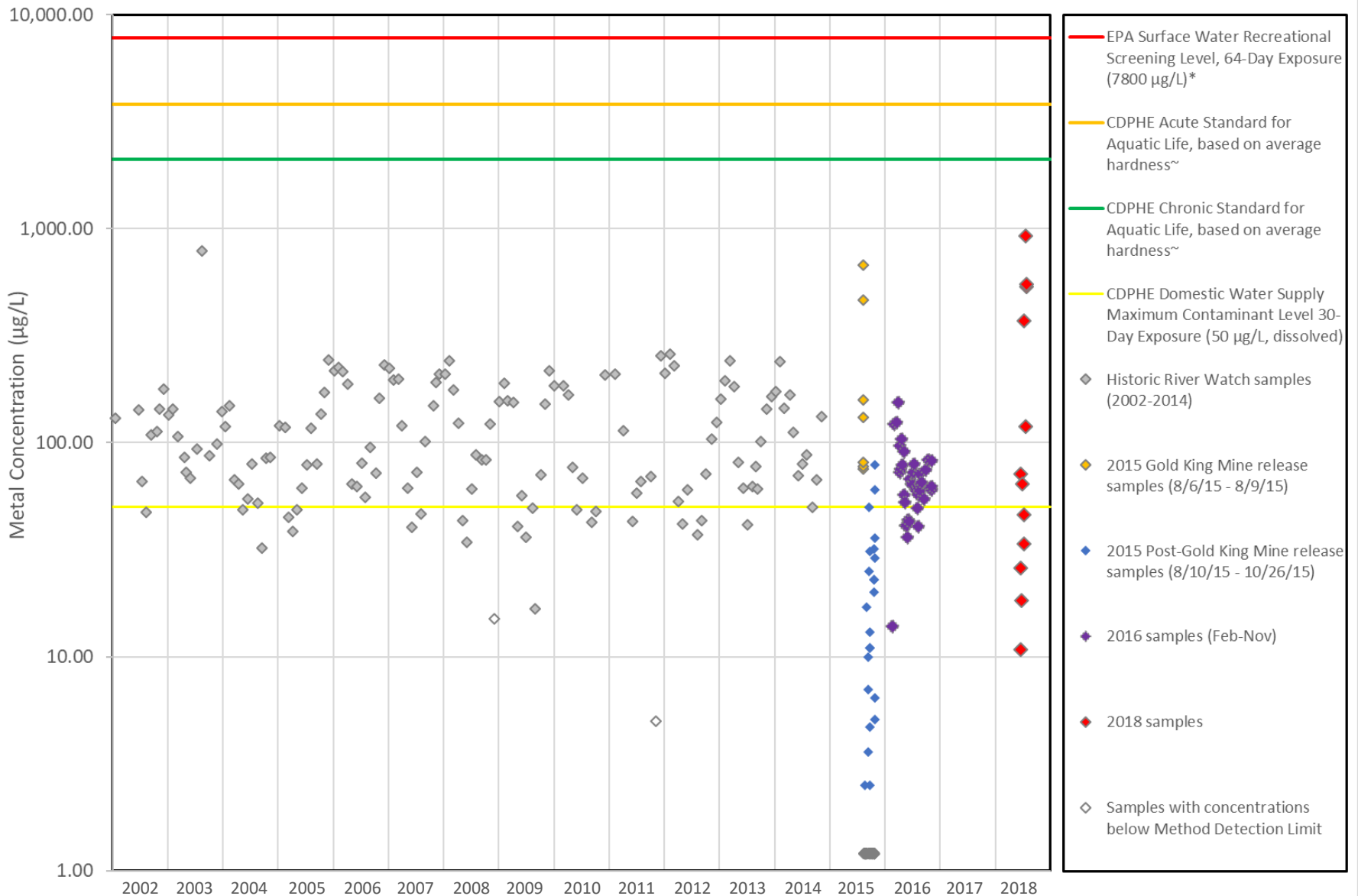
Note: 2002 - 2014 data is River Watch data from the Animas River at the fish hatchery in Durango, CO. 2015-18 data is Mountain Studies Institute data from the Animas River at Rotary Park in Durango, CO

Total Manganese, Animas River at Durango, CO: 2002-2018



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 Note: 2002 - 2014 data is River Watch data from the Animas River at the fish hatchery in Durango, CO. 2015-18 data is Mountain Studies Institute data from the Animas River at Rotary Park in Durango, CO

Dissolved Manganese, Animas River at Durango, CO: 2002-2018

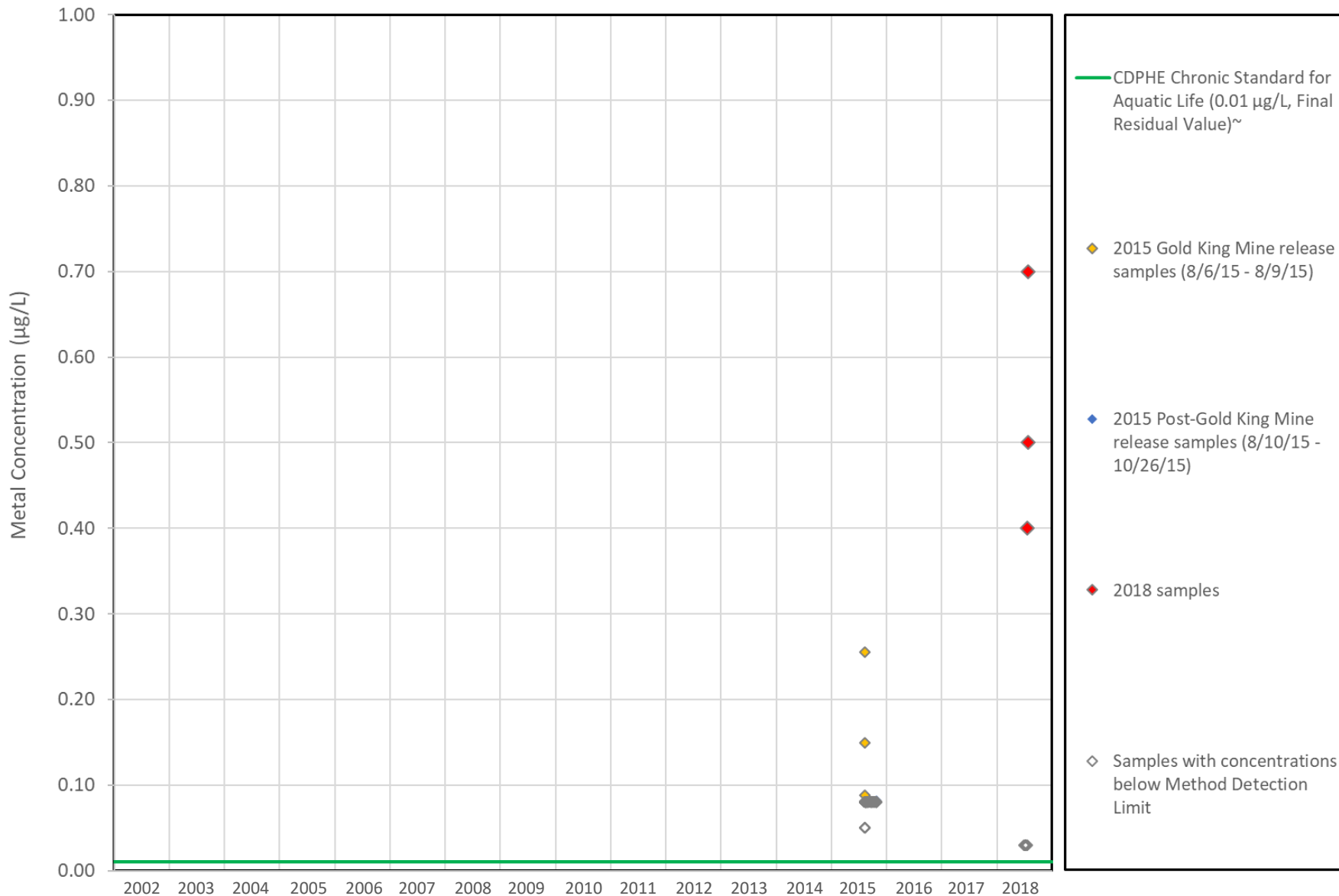


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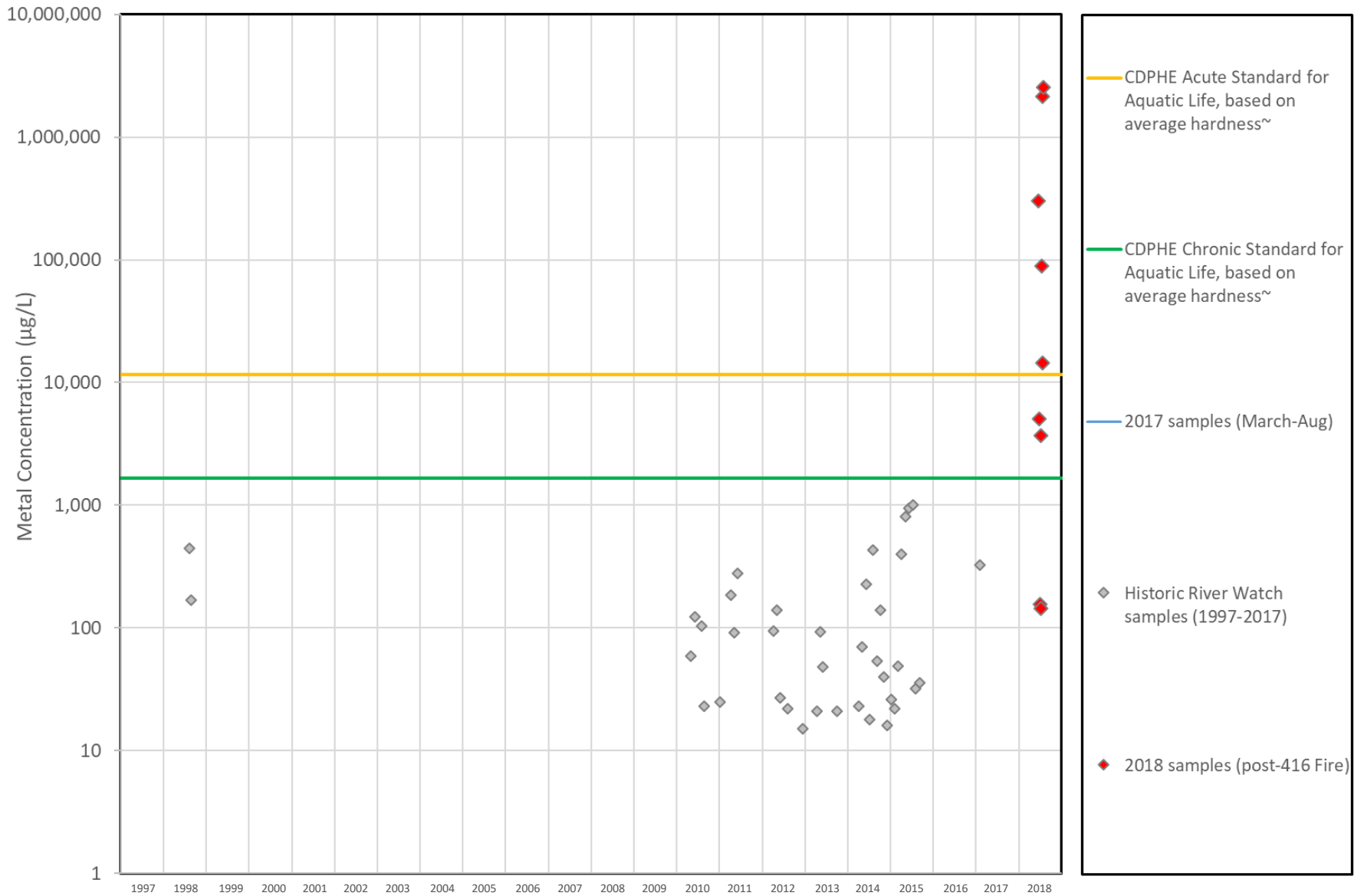
Total Mercury, Animas River at Durango, CO: 2002-2018



~Colorado Department of Public Health and the Environment (CDPHE) standards based on Colorado surface water quality classifications and Reg. 31 and 34. The mercury chronic standard for aquatic life is based on the final residue value (FRV) of 0.01 µg/L, which is the maximum allowed concentration of total mercury in the water that will present bioaccumulation of methylmercury in edible fish tissue. In waters supporting fish with a potential for human consumption, the chronic standard for mercury can be assessed as a 30-day average.

Note: River Watch data does not include mercury as a water quality parameter, so 2002 - 2014 data is unavailable. 2015-18 data is Mountain Studies Institute data from the Animas River at Rotary Park in Durango, CO.

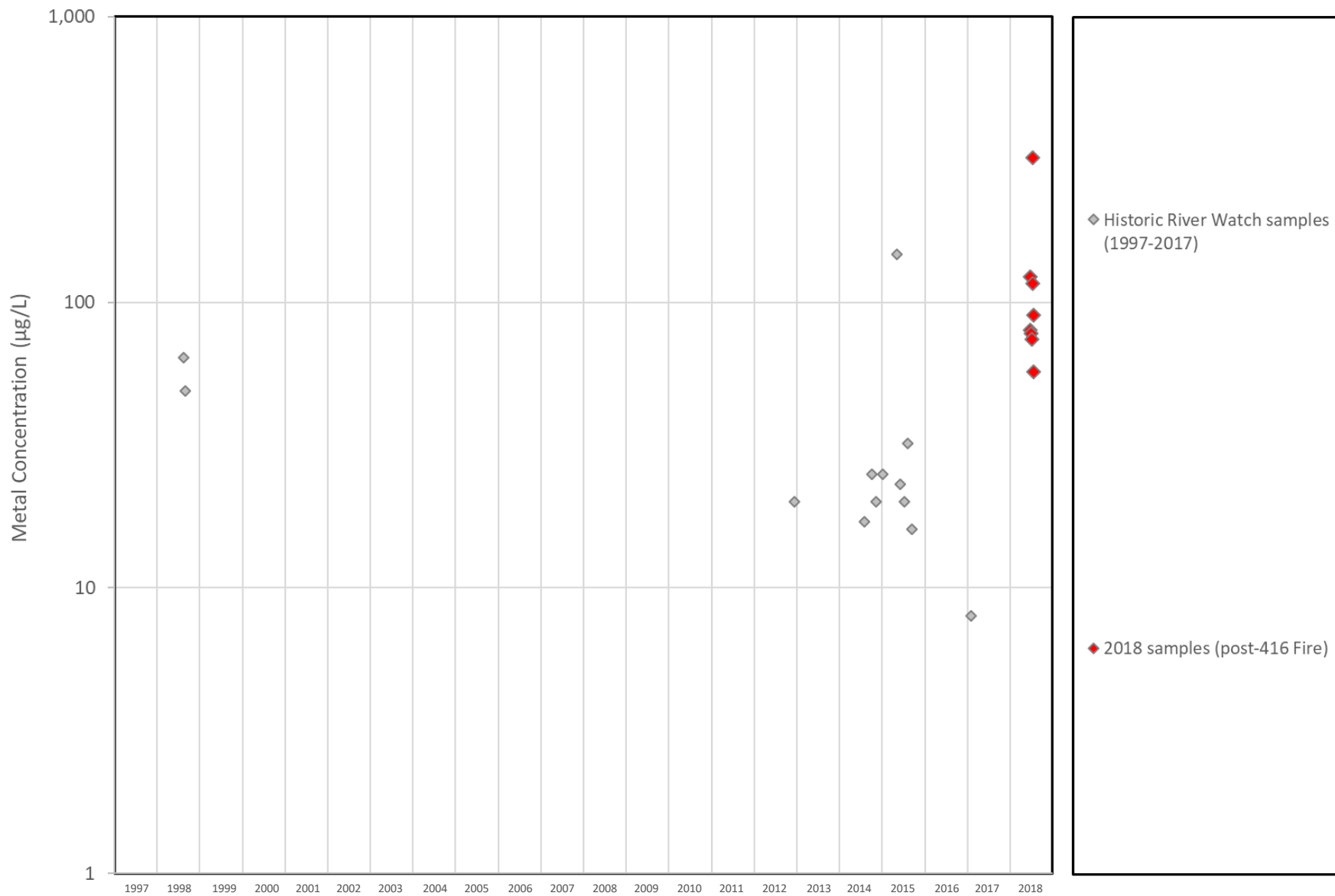
Total Aluminum, Hermosa Creek: 1997-2018



~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 Hermosa Creek at this location, 245 mg/L.

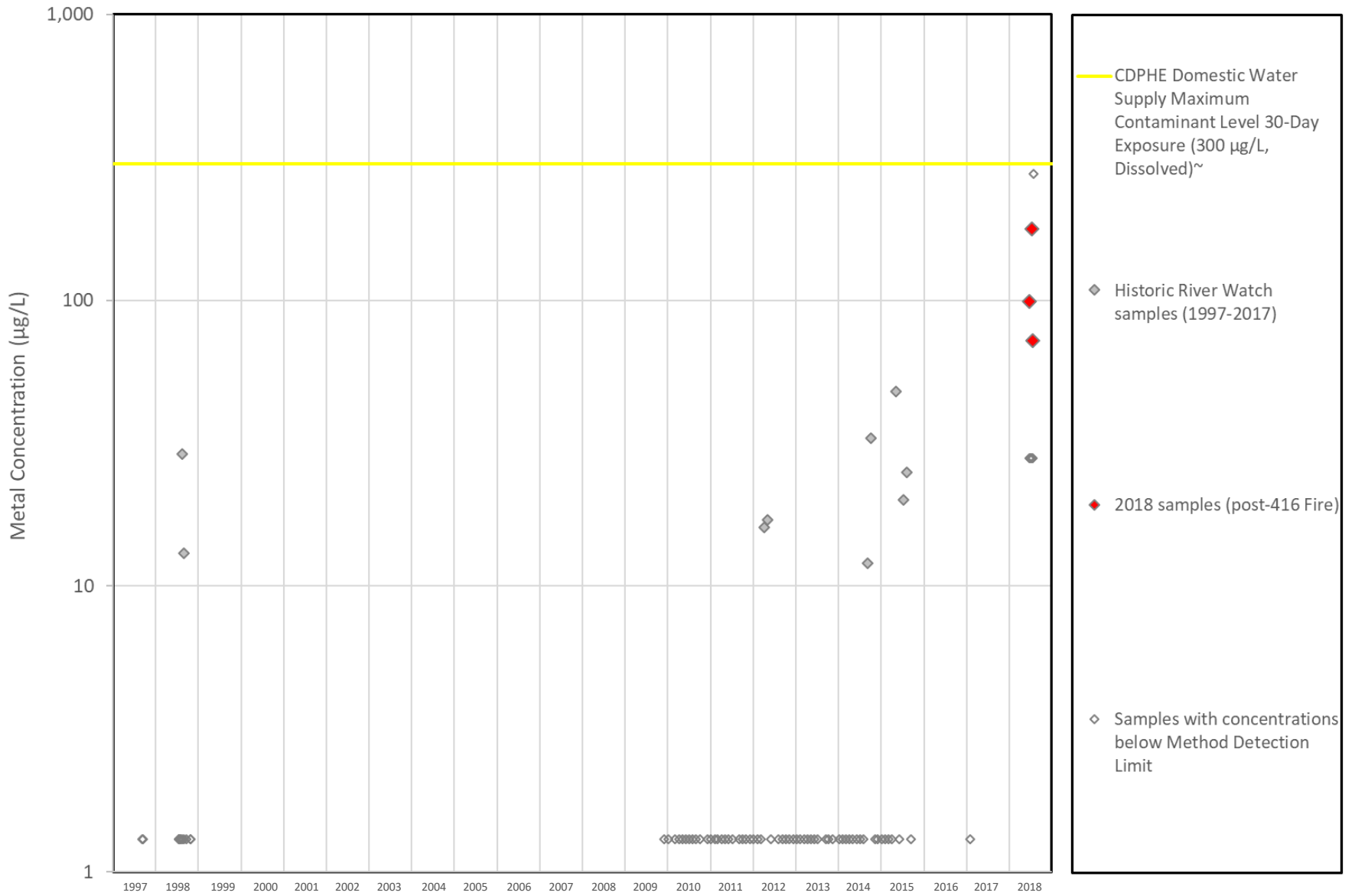
Note: 1997-2017 data is River Watch data from Hermosa Creek. 2018 data is Mountain Studies Institute data.

Dissolved Aluminum, Hermosa Creek: 1997-2018



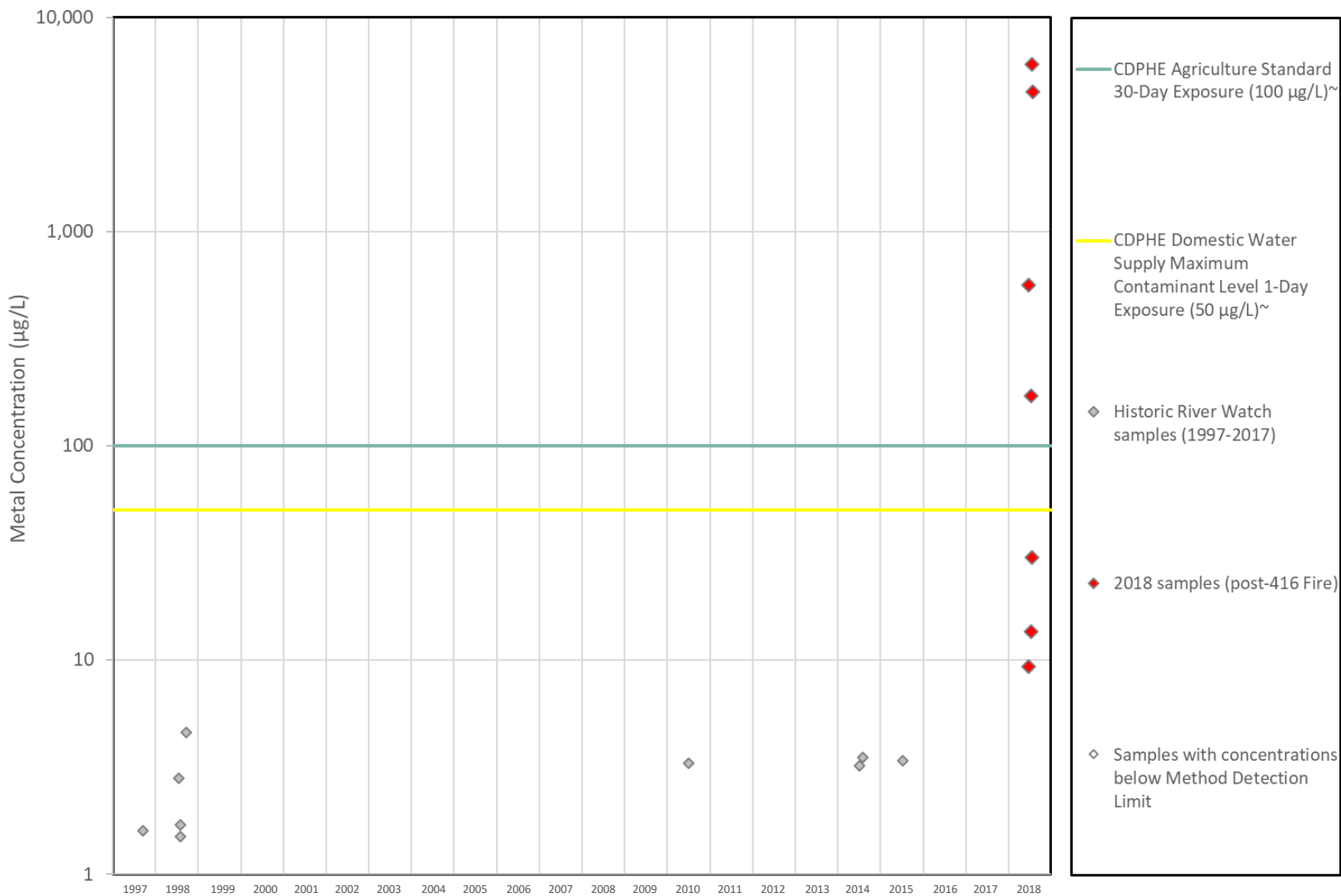
Note: 1997-2017 data is River Watch data from Hermosa Creek. 2018 data is Mountain Studies Institute data.

Dissolved Iron, Hermosa Creek: 1997-2018



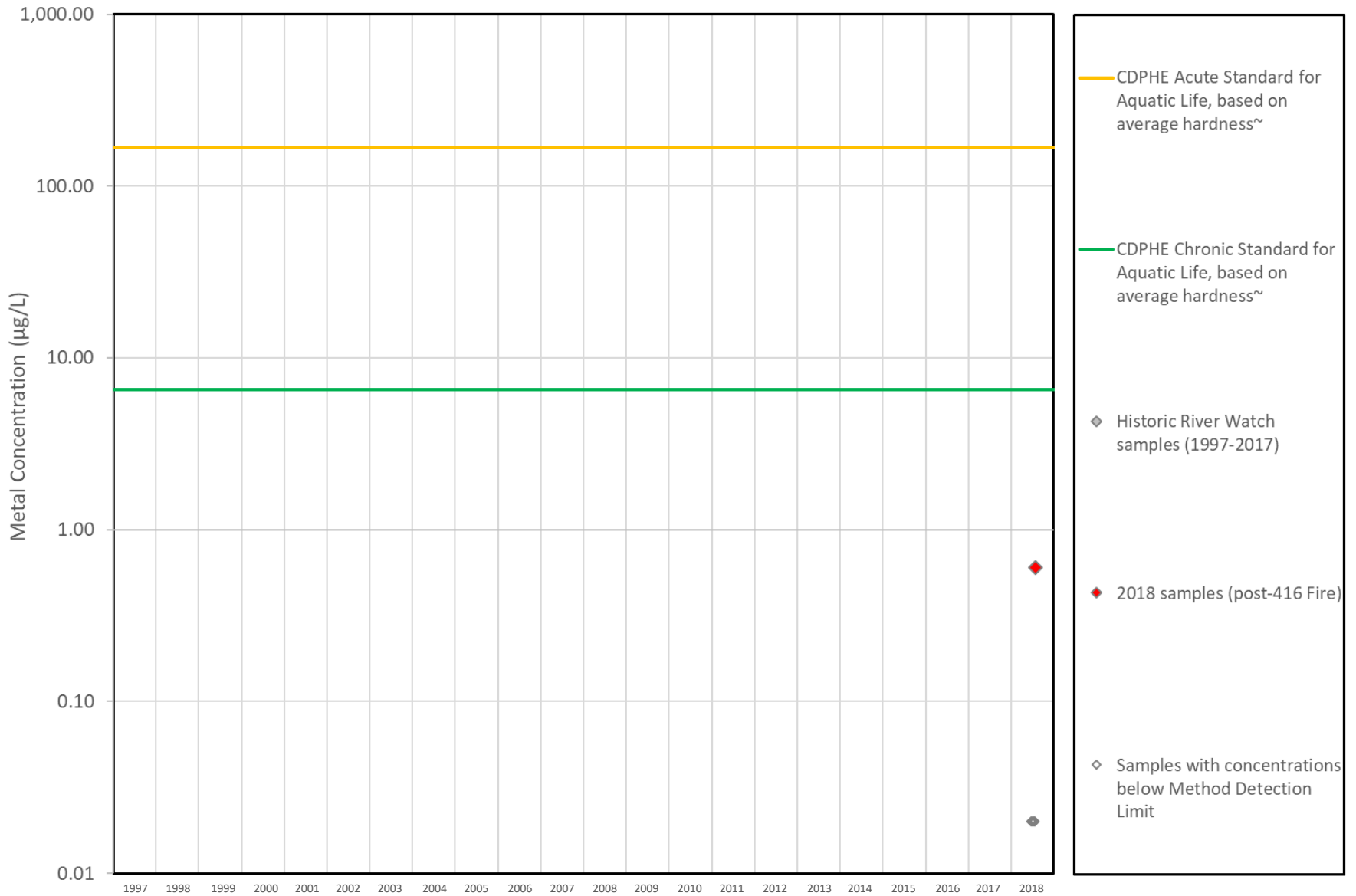
Note: 1997-2017 data is River Watch data from Hermosa Creek. 2018 data is Mountain Studies Institute data.

Total Lead, Hermosa Creek: 1997-2018



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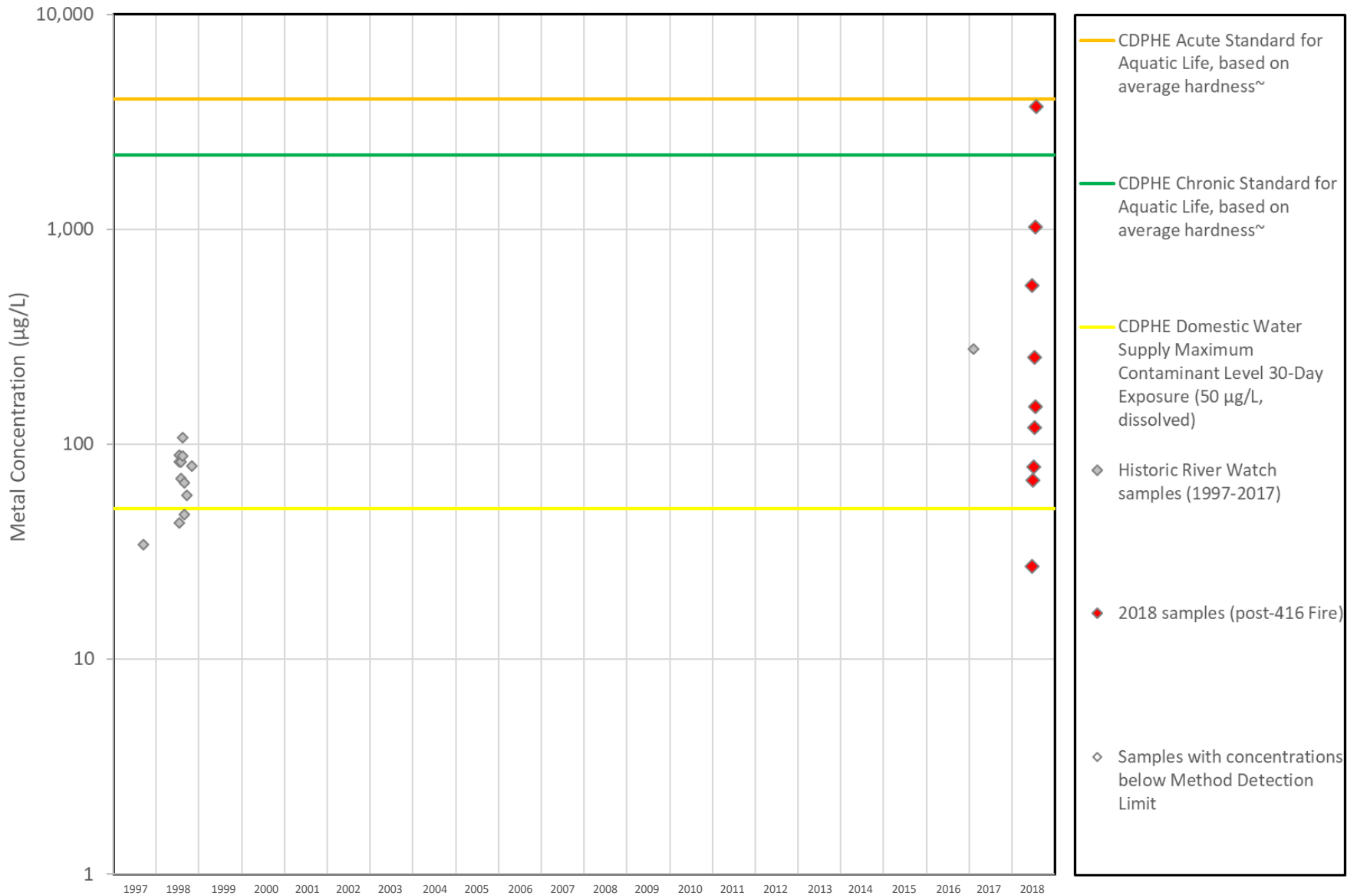
Dissolved Lead, Hermosa Creek: 1997-2018



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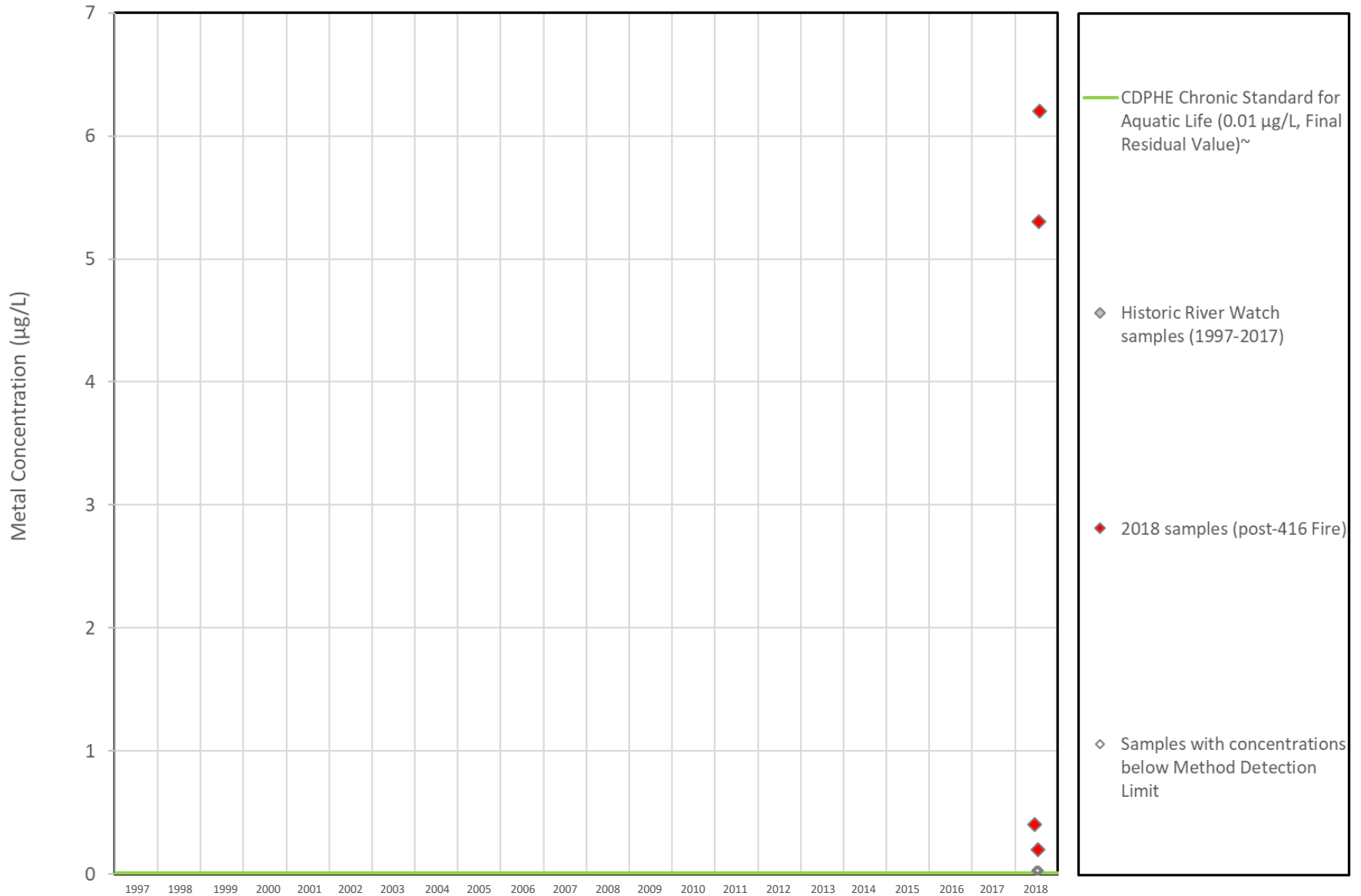
Dissolved Manganese, Hermosa Creek: 1997-2018



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Note: 1997-2017 data is River Watch data from Hermosa Creek. 2018 data is Mountain Studies Institute data.

Total Mercury, Hermosa Creek: 1997-2018



[~]Colorado Department of Public Health and the Environment (CDPHE) standards based on Colorado surface water quality classifications and Reg. 31 and 34. The mercury chronic standard for aquatic life is based on the final residue value (FRV) of 0.01 $\mu\text{g/L}$, which is the maximum allowed concentration of total mercury in the water that will present bioaccumulation of methylmercury in edible fish tissue. In waters supporting fish with a potential for human consumption, the chronic standard for mercury can be assessed as a 30-day average.

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