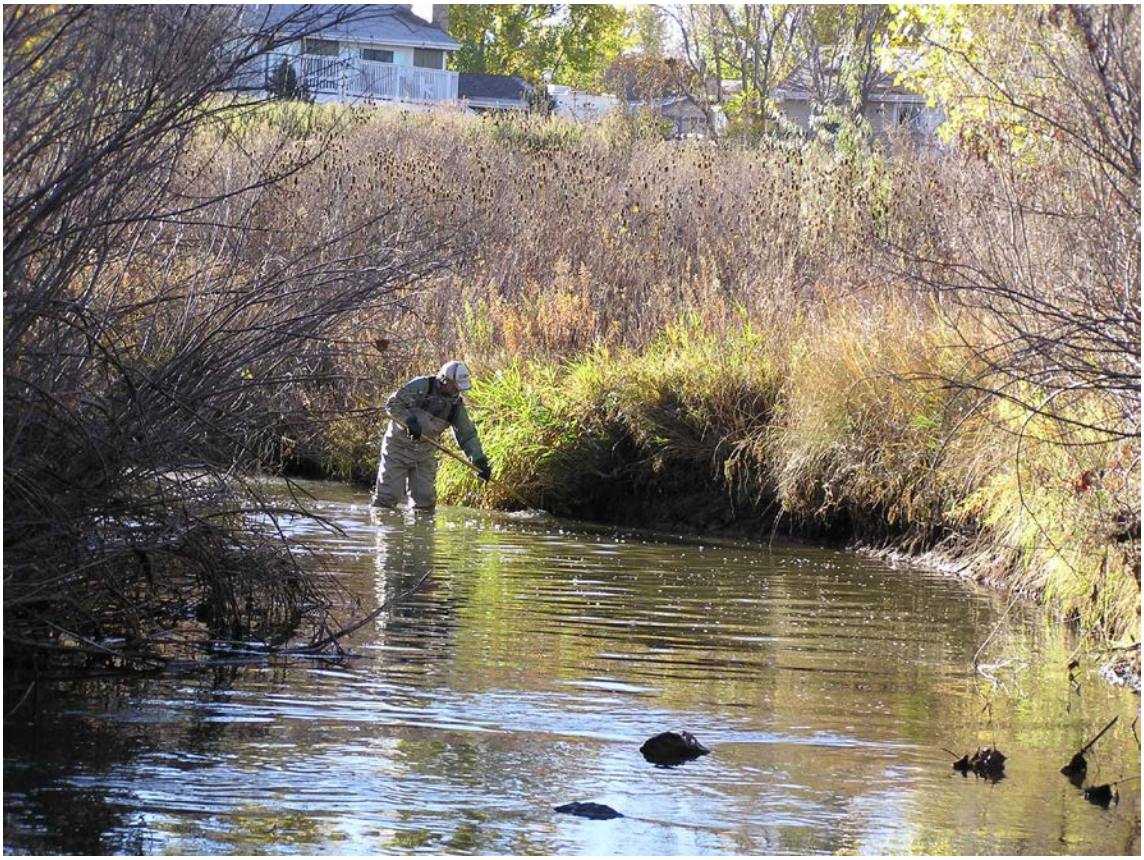
BIG DRY CREEK
ANNUAL WATER QUALITY SUMMARY
FOR 2019



Prepared for the
Big Dry Creek Watershed Association
Board of Directors

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Abbreviations and Acronyms

ac	acute
AEP	annual exceedance probability
BDCWA	Big Dry Creek Watershed Association
BMW	Barr Milton Watershed
CDPHE	Colorado Department of Public Health and Environment
CDPS	Colorado Discharge Permit System
cfs	cubic feet per second
ch	chronic
cfu	colony forming unit
CWQCC	Colorado Water Quality Control Commission
CWQCD	Colorado Water Quality Control Division
DM	daily maximum
DMR	discharge monitoring report
DO	dissolved oxygen
EDAS	Ecological Data Application System
EPA	U.S. Environmental Protection Agency
HBI	Hilsenhoff Biotic Index
HSW	high scoring water
kg	kilograms
MCL	maximum contaminant level
mg/L	milligrams per liter
MG/YR	million gallons per year
MMI	multi-metric index
MPN	most probable number
MS4	municipal separate storm sewer system
MWAT	maximum weekly average temperature
QA/QC	quality assurance/quality control
SAP	sampling and analysis plan
SDI	Shannon Diversity Index
TIN	total inorganic nitrogen
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TOC	total organic carbon
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
UDFCD	Urban Drainage and Flood Control District
µg/L	micrograms per liter
USGS	U.S. Geological Survey
WWTP	wastewater treatment plant

INTRODUCTION AND BACKGROUND

The Big Dry Creek Watershed Association (BDCWA) is a 501(c)(3) non-profit corporation focused on developing a sound scientific understanding of water quality, flow, aquatic life, and habitat conditions in the Big Dry Creek watershed and acting to improve these conditions. To support these objectives, BDCWA implements an instream monitoring program and analyzes results from the program on an annual basis. The monitoring program is described in the *Cooperative Sampling and Analysis Plan for the Mainstem of Big Dry Creek* (SAP), which was reviewed and updated in 2018 and can be obtained from the BDCWA website (www.bigdrycreek.org). The monitoring program is conducted by the City and County of Broomfield, City of Westminster, City of Northglenn, and the City of Thornton. The program includes water quality, flow, and biological monitoring. On an annual basis, data collected under this program are reviewed by the BDCWA Board and uploaded into a master database and then analyzed for compliance with stream standards, for water quality trends, and with regard to other priorities or areas of interest to BDCWA.

Following a brief introduction to the monitoring program and an overview of field conditions during 2019, this report summarizes findings from the 2019 monitoring program, focusing on these primary topics:

- Annual data summary and comparison to stream standards
- Targeted discussion regarding these key water quality constituents:
  - *E. coli*
  - Selected metals (selenium, iron, manganese, arsenic)
  - Chloride and sulfate
  - Nutrients
- Biological monitoring
- Annual flow conditions
- Quality assurance/quality control
- Recommendations and conclusions

Data summaries and statistical analysis appendices supporting these discussions also accompany this report.

OVERVIEW OF MONITORING ACTIVITIES AND FIELD CONDITIONS DURING 2019

During 2019, the City and County of Broomfield and the cities of Northglenn, Thornton, and Westminster (Cities) worked together to collect water quality and flow data along the main stem of Big Dry Creek (Figure 1), consistent with the long-term BDCWA monitoring program, as described in the SAP (BDCWA 2018) and in Table 1. The Cities and BDCWA also helped to fund operation of the U.S. Geological Survey (USGS) gauging station at Westminster behind Front Range Community College.

A conceptual-level understanding of the hydrologic regime for Big Dry Creek is important due to its significant effect on pollutant loading and instream concentrations. For general context, Figure 34 (later in this report) provides a conceptual summary of the key discharges and diversions along the creek, along with the USGS gauging station locations.

Figure 1. Big Dry Creek Watershed Location Map

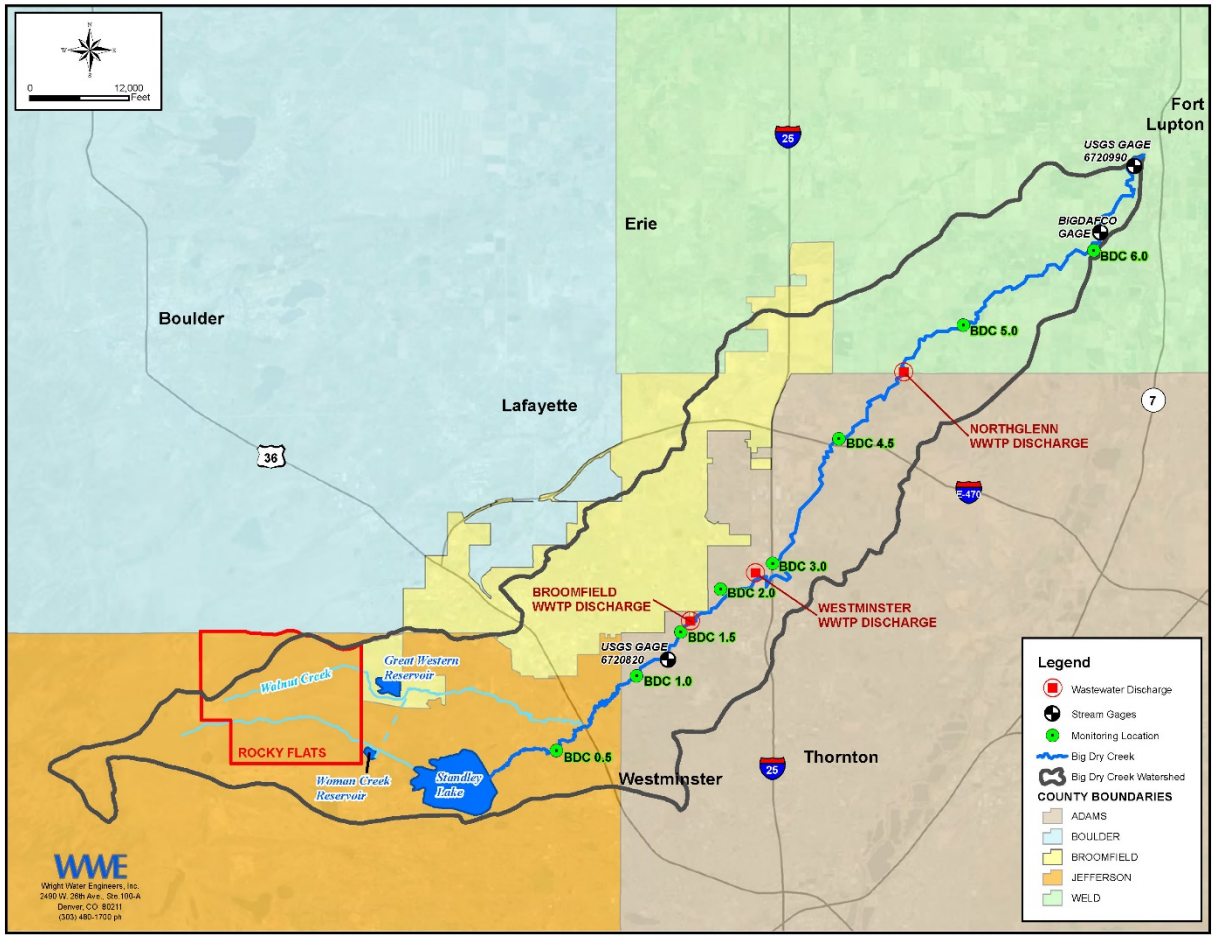


Table 1. Description of Instream Monitoring Locations in 2019

Site	Location/Selection Criteria	Constituents
bdc0.5	Big Dry Creek at Old Wadsworth Ave. Represents background conditions upstream of the WWTP outfalls, and urbanization impacts.	Water Quality, Habitat, Macroinvertebrates, Fish, Flow
bdc1.0	Big Dry Creek at 112th Ave. Represents conditions downstream of the confluence with Walnut Creek and Rocky Flats discharge.	Water Quality, Habitat, Macroinvertebrates, Fish, Flow
bdc1.5	Big Dry Creek at 120th Ave. Represents conditions immediately upstream of Broomfield's WWTP (BWWTP) outfall.	Water Quality, Flow
bdc1.5C	Big Dry Creek downstream of 120th Ave. upstream of the BWWTP. Serves as reference site representing habitat conditions prior to the BWWTP outfall.	Habitat, Macroinvertebrates, Fish
bdc2.0	Big Dry Creek at 128th Ave. Represents conditions downstream of BWWTP and upstream of the Westminster WWTP (WWWTP) outfall.	Water Quality, Habitat, Macroinvertebrates, Fish, Flow
bdc3.0	Big Dry Creek at I-25 Represents conditions downstream of the WWWTP outfall, but upstream of Northglenn.	Water Quality, Habitat, Macroinvertebrates, Fish, Flow
bdc4.5	Big Dry Creek downstream of York St. Represents urban development impacts, agricultural impacts, and background conditions for the Northglenn WWTP (NWWTP). (Replaces bdc4.0; site moved downstream April 2011 for safety reasons)	Water Quality
bdc5.0	Big Dry Creek at Weld County Rd. 4. Represents conditions downstream of the NWWTP, and agricultural influences.	Water Quality, Habitat, Macroinvertebrates, Fish
bdc6.0	Big Dry Creek at Weld County Rd. 23 near the confluence with the S. Platte. Represents conditions just prior to the confluence with the South Platte River (end of Segment 15).	Water Quality
120th & BDC	Big Dry Creek at 120th Avenue. Same approximate location as bdc1.5.	Mercury

During 2019, water quality samples were collected and analyzed for a variety of constituents, resulting in over 2,800 records being added into the BDCWA water quality database. Most metals, boron, and cyanide were monitored on a quarterly basis, with the exception of total recoverable iron which is monitored monthly due to elevated iron in the lower watershed. Mercury is monitored at only one location at 120th Avenue due to the high cost of mercury analysis at sufficiently low detection limits. All other constituents are monitored on a monthly basis. The Big Dry Creek monitoring program is an ambient-based program. The program does not target wet-weather events, but typically includes one or more sampling events associated with precipitation that happen to fall on the designated sampling date.

Table 2 summarizes field conditions during each sampling event, as recorded at various locations in the watershed. Based on information shown in Table 2, Standley Lake releases occurred from June through October. Some of the January and February samples at upstream locations were affected by icy conditions. The May sampling event was affected by a rainfall-runoff event, with precipitation greater than 0.5 inches.

Table 2. Summary of Field Conditions during 2019 Sampling Events

Date	Precip. (inches)[1]	Release (cfs)[1]	Flow (cfs)[2]		Comments
	Standley Lake	Standley Lake	USGS Westminster	USGS Ft. Lupton	
10-Jan-19	0	0	1.56	23.3	No Standley releases this month. BDC 0.5 & 1.0 inaccessible due to ice. No precip. at Standley Lake Dam on sample date.
14-Feb-19	0	0	0.51	27.7	No Standley releases this month. BDC 0.5, 1.0 & 1.5 inaccessible due to ice. No precip. at Standley Lake Dam on sample date.
20-Mar-19	0	0	3.54	29.1	No Standley releases this month. No precip. at Standley Lake Dam on sample date.
17-Apr-19	0	0	2.64	18.3	No Standley releases this month. No precip. at Standley Lake Dam on sample date.
09-May-19	0	0	39.5	82.2	No Standley releases this month. No precip. at Standley Lake Dam on sample date. 0.54" on May 8 at Westminster, 0.3" snow May 9.
13-Jun-19	0.10	24.36	25.9	26.5	Regular Standley releases from 6/10-10/4, average of 21.9 cfs. Standley releasing at 24.36 cfs on sample date. 0.10 inches of precip. at Standley Lake Dam on sample date, no precip. on day prior to sample date.
11-Jul-19	0	19.69	22.3	19.5	Regular Standley releases from 6/10-10/4, average of 21.9 cfs. Standley releasing at 19.69 cfs on sample date. No precip. at Standley Lake Dam on sample date.
08-Aug-19	0	36.43	39.0	49.5	Regular Standley releases from 6/10-10/4, average of 21.9 cfs. Standley releasing 36.43 cfs on sample date. No precip. at Standley Lake Dam on sample date.
19-Sep-19	0	29.84	31.2	45.3	Regular Standley releases from 6/10-10/4, average of 21.9 cfs. Standley releasing at 29.84 cfs on sample date. No precip. at Standley Lake Dam on sample date.
10-Oct-19	0	0	4.67	39.4	Regular Standley releases from 6/10-10/4, average of 21.9 cfs. No Standley releases on sample date. No precip. at Standley Lake Dam on sample date.
14-Nov-19	0	0	1.97	26.8	No Standley releases this month. No precip. at Standley Lake Dam on sample date.
12-Dec-19	0	0	2.91	19.3	No Standley releases this month. BDC 0.5 inaccessible due to ice. No precip. at Standley Lake Dam on sample date.

[1] Standley Lake precipitation and release data recorded at Standley Lake Dam by dam tender.
[2] USGS flow data were obtained from USGS NWIS website for USGS 06720820 Big Dry Creek at Westminster and USGS 06720990 Big Dry Creek at Mouth near Fort Lupton.

APPLICABLE STREAM STANDARDS, DATA SUMMARY, AND STANDARDS ASSESSMENT

In 2020, the CWQCC adopted major changes to stream standards for Segment 1 of Big Dry Creek. These changes applied more stringent designated uses including an upgrade of the stream from Aquatic Life 2 to Aquatic Life 1, upgrade from Potential Recreation to Existing Recreation, and addition of a Water Supply use. Agricultural use standards continue to apply. Big Dry Creek is also identified as a "Use Protected" stream, which means that it is not subject to anti-degradation review.[1]

Table 3 identifies the currently applicable Regulation 38 stream standards for Segment 1 of Big Dry Creek. Attainment of stream standards is evaluated based on comparison of specific statistical values to chronic stream standards and determining whether acute standards are exceeded in any samples. For most constituents, the relevant statistic for comparison to the chronic standard is the 85th percentile value. Exceptions include use of the 50th percentile value for metals with standards in the total recoverable form, the geometric mean[2] for *E. coli*, and the 15th percentile value for dissolved oxygen (DO) and the lower acceptable range for pH. For "interim values" for total phosphorus and total nitrogen, annual median values with an allowable exceedance of no more than once every three years is used. For nitrate, the maximum value is used, with no more than one exceedance every three years. More complex evaluation approaches are required for *E. coli*, selenium, ammonia, and temperature, as described later in this report. (*Note that from a regulatory perspective, five years of data would be used in such a comparison to standards*.)

As part of the 2020 Regulation 38 Rulemaking Hearing, the CWQCC adopted Segment 1 stream standards for chloride, sulfate, dissolved iron, and dissolved manganese that are based on "secondary" drinking water standards developed pursuant to the federal Safe Drinking Water Act. These secondary standards are not health based, but rather are based upon "welfare" impacts such as taste, odor and discoloration of laundry or fixtures. Stream standards for these parameters can either be based on the "table value standards" in Regulation 31, or they can be based on "existing conditions" as of January 1, 2000, with the exception of chloride. Assessment procedures for these constituents are discussed in more detail later in this report.

The time periods evaluated in this report vary, depending on the nature of the water quality and/or regulatory issue. For constituents with current or historic water quality concerns, five to ten years of data may be included in the discussion, whereas for most other constituents, new data collected during 2019 are the primary focus.

[1] For more information on Use Protected and Reviewable designations related to antidegradation requirements in Regulation 31, see 5 CCR 1002-31 Section 31.8 Antidegradation.

[2] The geometric mean is calculated as the nth root of the product of n values. The geometric mean is used for regulatory purposes because it dampens the impact of extremely high or low values, relative to the arithmetic mean.

Table 3. 2020 Regulation 38 Stream Standards for Big Dry Creek

1. Mainstem of Big Dry Creek, including all tributaries and wetlands, from the ~~source~~outlet of Standley Lake to the confluence with the South Platte River~~, except for specific listing in Segments 4a, 4b, 5~~. Walnut Creek, including tributaries and ~~6~~wetlands, from the outlet of Great Western Reservoir to the confluence with Big Dry Creek.

COSPBD01	Classifications
Designation	Agriculture
UP	Aq Life Warm ~~2~~1
	Water Supply
	Recreation ~~P~~E
Qualifiers:	
Other:	

*chlorophyll a (mg/m²)(chronic) = applies only above the facilities listed at 38.5(4).
*Phosphorus(chronic) = applies only above the facilities listed at 38.5(4).
*Selenium(acute) = 19.1 ug/L from 11/1 - 3/31
TVS from 4/1 - 10/31.
Refer to Section 38.6(4)(d).
*Selenium(chronic) = 15 ug/L from 11/1 - 3/31
7.4 ug/L from 4/1 - 10/31.
Refer to Section 38.6(4)(d).
*Uranium(acute) = See 38.5(3) for details.
*Uranium(chronic) = See 38.5(3) for details.

Physical and Biological		
	DM	MWAT
Temperature °C	WS-I	WS-I
	acute	chronic
D.O. (mg/L)	---	5.0
pH	6.5 - 9.0	---
chlorophyll a (mg/m²)	---	150*
E. Coli (per 100 mL)	---	~~205~~126

Inorganic (mg/L)		
	acute	chronic
Ammonia	TVS	TVS
Boron	---	0.75
Chloride	---	~~—~~250
Chlorine	0.019	0.011
Cyanide	0.005	---
Nitrate	~~100~~10	---
Nitrite	---	4.5
Phosphorus	---	0.17*
Sulfate	---	~~—~~WS
Sulfide	---	0.002

Metals (ug/L)		
	acute	chronic
~~Aluminum~~	~~—~~	~~—~~
Arsenic	340	---
Arsenic(T)	---	0.02-10
~~Beryllium~~	~~—~~	
Beryllium(T)	---	100
Cadmium	TVS	TVS
Cadmium(T)	5.0	---
Chromium III	~~TVS~~---	TVS
Chromium III(T)	~~—~~50	~~100~~---
Chromium VI	TVS	TVS
Copper	TVS	TVS
Iron	---	WS
Iron(T)	---	1000
Lead	TVS	TVS
Lead(T)	50	---
Manganese	TVS	TVS/WS
Mercury(T)	---	0.01~~(t)~~
Molybdenum(T)	---	150
Nickel	TVS	TVS
Nickel(T)	---	100
Selenium	---	varies*
Selenium	varies*	---
Silver	TVS	TVS
Uranium	~~—~~varies*	~~—~~varies*
Zinc	TVS	TVS

To calculate hardness-based stream standards, a hardness value of 361 mg/L was used, consistent with the value used by the Colorado Water Quality Control Division (CWQCD) in 2019 wastewater discharge permits for Broomfield, Westminster, and Northglenn. The mean hardness value for the stream as a whole during 2019 was 347 mg/L. Hardness values have a significant effect on certain metals standards. For example, a hardness value of 250 mg/L results in a chronic zinc standard of 271 μg/L, whereas a hardness value of 350 mg/L results in a chronic zinc standard of 362 μg/L (i.e., the higher the hardness value, the less stringent the water quality standard is for certain metals). For purposes of the 303(d) List (which identifies impaired stream segments), the CWQCD uses the mean hardness value associated with the five-year assessment period for assessment of chronic table value standards for metals. Alternatively, a detailed assessment where the chronic table value standard is calculated for each paired hardness/concentration data may also be conducted. The acute table value standards for metals are calculated for each paired hardness/concentration and attainment is determined for each data pair (CWQCD 2019).

In addition to the stream standards and classifications for Big Dry Creek, it is also important to be aware of the 303(d) Listing Methodology, which provides additional information on how impairment decisions are made and how streams can be delisted from being impaired. This methodology is updated every two years.

OVERVIEW OF WATER QUALITY DATA

Table 4 provides a summary of the numbers of samples collected and key summary statistics for each constituent analyzed during 2019 and identifies whether the stream attained the standard for each constituent with an applicable stream standard.

A complete summary of individual sampling event results during 2019 for each monitoring station is provided in Appendix B. Box plots and time series plots were created showing results by location for each constituent analyzed in 2019 and are included in Appendix C. Quality control (QC) samples, collected in accordance with the Big Dry Creek SAP (BDCWA 2018), are provided in Appendix D.

Discharge monitoring report (DMR) data from municipal wastewater treatment plant (WWTP) discharges to Big Dry Creek during 2019 are provided in Appendix E. The DMR samples were collected in accordance with Colorado Discharge Permit System (CDPS) permit requirements and are provided as a courtesy from the City and County of Broomfield, the City of Westminster, and the City of Northglenn to provide supplemental information on the quality of discharges to Big Dry Creek at the time of instream sample collection. Broomfield, Westminster, and Northglenn are permitted to discharge to Big Dry Creek, and all three did so during 2019.

Appendix F provides instream iron monitoring results at two sites on lower Big Dry Creek that are monitored by Metro Wastewater biweekly.

Table 4. Statistical Summary for 2019 Big Dry Creek Data and Comparison to Standards

Statistic	Nbr	Min	Max	Mean	1st Quartile (25th Percentile)	Median (50th Percentile)	3rd Quartile (75th Percentile)	85th Percentile (or 15th / 85th)	Applicable Standard (for most stringent use)	2020 Standard Exceeded?
General (Physical, Biological, Inorganic)										
ALKALINITY (mg/L)	90	53.0	338.0	162.1	115.5	166.0	200.0			
BORON, Total (ug/L)	31	ND	290	146	45	170	240	**255**	750	No
CALCIUM (mg/L)	90	31.2	158.8	91.1	65.3	95.0	112.3			
CHLORIDE (mg/L)	66	46.6	564.0	176.1	104.3	153.7	201.3	**287.5**	250	Yes
CHLOROPHYLL-a, corr (ug/L)	89	ND	24.5	4.8	1.6	2.9	5.9			
CHLOROPHYLL-a, uncor (ug/L)	89	ND	35.1	7.5	3.1	4.9	8.9			
CONDUCTIVITY (uS/cm)	90	312	3206	1497	1053	1447	1963			
CYANIDE, Total (mg/L)	31	ND	**ND**	ND	ND	ND	ND	**ND**	0.005	No
DO (mg/L)	90	6.5	14.2	9.2	8.0	8.9	10.0	**7.6** (15^{th} %)	5 (min)	No
E. coli (MPN/100 mL)	90	11	2420	**226**	111	230	533		126	Yes
HARDNESS (mg/L)	90	108	609	**347**	245	359	440			
MAGNESIUM (mg/L)	90	7.2	54.5	29.1	19.5	30.6	38.3			
pH (SU)	90	5.7	8.3	7.7	7.6	7.7	7.9	**7.5 / 8.0**	6.5-9.0	No
POTASSIUM (mg/L)	90	2.1	12.6	6.6	4.2	6.3	8.7			
SODIUM (mg/L)	90	22.0	451.2	173.0	115.4	155.3	230.9			
SULFATE (mg/L)	66	60	528	255	161	270	335	**386**	250	Yes
TDS (mg/L)	90	185.0	1907.0	908.5	609.8	890.5	1172.3			
TEMPERATURE (°C)	90	-2.7	22.0	8.5	3.4	6.9	13.9		WS-1 Mar-Nov = 24.2(ch), 29.0 (ac) Dec-Feb= 12.1(ch), 24.6 (ac)	NE
TOC (mg/L)	89	2.3	10.2	6.5	5.6	6.9	7.9			
TSS (mg/L)	90	ND	258.0	28.6	9.2	18.6	29.0			
TURBIDITY (NTU)	90	2.8	154.0	19.3	8.8	13.8	18.8			
Nutrients	0									
AMMONIA, Total (mg/L)	90	ND	0.56	0.08	0.03	0.06	0.10		Varies	No
NITROGEN, TOTAL (mg/L)	90	0.3	13.06	4.76	1.34	**4.57**	7.25		2.01	Yes*
NITROGEN, NO3+NO2 (mg/L)	90	0.04	**12.68**	3.97	0.79	3.73	6.14		10	Yes
NITROGEN, NO2 (mg/L)	90	ND	0.28	0.05	0.01	0.04	0.07	**0.08**	4.50	No
PHOSPHORUS, TOTAL (mg/L)	90	0.02	1.21	0.30	0.17	**0.24**	0.36		0.17	Yes*
PHOS., ORTHO AS P (mg/L)	90	ND	1.03	0.14	ND	0.10	0.17			
Metals	0								**(Acute/Chronic)**	
ARSENIC, Trec (ug/L)	31	ND	1.50	0.56	ND	**ND**	1.24			No
CADMIUM, D (ug/L)	31	ND	0.15	0.02	ND	ND	ND	**0.05**	1.1 / 8.4	No
CHROMIUM, D (ug/L)	31	ND	ND	ND	ND	ND	ND	**ND**	Cr-III: 212 / 1,630 Cr-VI: 11 / 16	No
COPPER, D (ug/L)	31	2.72	21.56	5.76	3.77	4.79	5.54	**6.67**	27 / 45	No
IRON, Trec (mg/L)	90	ND	2.50	0.51	0.26	**0.43**	0.65	0.82	1.00	No
LEAD, D (ug/L)	31	ND	0.66	0.18	0.09	0.13	0.22	**0.30**	9.8 / 253	No
MANGANESE, D (ug/L)	31	7.5	426.1	95.7	25.6	49.8	154.8	**193.9**	50	Yes
NICKEL, D (ug/L)	31	0.61	2.82	1.82	1.16	1.87	2.39	**2.52**	154 / 1,387	No
SELENIUM, D (ug/L)	31	0.17	7.44	3.98	1.93	4.32	5.84	6.16	Site-specific	No
SILVER, D (ug/L)	31	ND	0.08	0.00	ND	ND	ND	**ND**	2.9 / 18	No
ZINC, D (ug/L)	31	ND	45.31	12.64	3.02	6.10	20.49	**25.81**	389 / 514	No

Notes: Geometric mean is provided for E. coli instead of arithmetic mean. Table Value Standards (TVS) calculated based on a hardness of 361 mg/L.
Standard Notes: * = not yet applicable; ac/ch = acute/chronic; NE = Not Evaluated; ND = Non-detect; Varies = more complex standard.
Chromium III and VI standards apply; dissolved chromium was non-detect. WS-1 indicates warm water tier 1 temperature standard, but was not evaluated.

Segment 1 (the main stem) of Big Dry Creek is listed on the 2020 303(d) List for Colorado for non-attainment of stream standards for *E. coli* for the entire segment and for total recoverable iron for the portion of the stream below Weld County Road 8 (CWQCC 2020). The iron impairment in the lower watershed is based on data collected by Metro Wastewater Reclamation District (Metro). A brief synopsis of these two known regulatory issues as of 2019 includes:

- E. coli: Big Dry Creek did not meet the E. coli standard during 2019. A Total Maximum Daily Load (TMDL) for E. coli in Big Dry Creek segment COSPBD01 was approved by the U.S. Environmental Protection Agency (EPA) in September 2016. This TMDL was based on a Potential Recreational Contact standard of 205 cfu/100 mL. As a result of the 2020 change to Big Dry Creek Segment 1, this standard is now 126 cfu/100 mL. Special studies to identify sources of E. coli in the watershed are currently underway for the stream reach between Standley Lake and I-25.

- Iron: Although BDCWA's long-term water quality data set shows attainment of the total recoverable iron standard, the portion of Big Dry Creek below Weld County 8 was identified as impaired on the 2016 303(d) List based on data submitted by Metro. The Metro data set is also discussed in this report and summarized in Appendix F.

The 2020 changes to the applicable stream standards for Big Dry Creek result in additional anticipated impairment listings, driven primarily by the addition of Water Supply standards based on identification of alluvial wells used for drinking water in the lower watershed. These impairments are discussed later in the report but include sulfate, chloride, dissolved manganese and nitrate.

Other future impairment concerns include total nitrogen and total phosphorus, which are constituents included in the CWQCC's 10-Year Water Quality Road Map. Currently, interim values for total nitrogen and total phosphorus are exceeded for the portion of the stream segment beginning below the WWTP discharges. A final decision by the CWQCC on application of these instream standards is expected in 2027.

More detailed discussion of these constituents of interest to Big Dry Creek is provided in the remainder of this report. See Appendices B through E for tabular and graphical summaries for 2019 water quality data.

E. COLI

In 2020, the recreational use classification and associated stream standards for *E. coli* changed from a potential primary contact recreation use classification to existing primary contact recreation use, based on the potential for waterplay by children and lack of fencing to preclude access. This change decreased the stream standard for *E. coli* from 205 cfu/100 mL to 126/100 mL. Neither standard is attained for the stream and a TMDL was completed in 2016 for *E. coli* based on the 205 cfu/100 mL standard. This section summarizes the data analysis for *E. coli* and provides a brief summary of the 2016 *E. coli* TMDL.

E. coli Data Summary

BDCWA has 20 years of *E. coli* data collected on a monthly basis at eight instream locations, as well as DMR data from the WWTPs (Tables 5 through 7 and Figures 2 through 4). Standards assessment methods for *E. coli* have changed several times over the years with regard to the duration (timeframe) during which standards are assessed. The 2018 (and 2020) 303(d) Listing Methodology included changes to the *E. coli* assessment method. This method is now based on a 61-day rolling geometric mean for future 303(d) listing and delisting decisions. Five samples within a 61-day period, corresponding to the same time period for which impairment was originally identified, are needed for delisting (CWQCD 2017). Because the BDCWA sampling program is based on a monthly program, only two samples per assessment period are available. For this reason, BDCWA has returned to a seasonal approach for data analysis in this report, dividing the analysis into a recreation season (May-October) and a non-recreation season (November-April). This approach provides six samples for calculation of a geometric mean for each season. The CWQCD also used these seasons in the 2016 *E. coli* TMDL. If sampling results begin to approach attainment of the stream standard, then more frequent sampling may be warranted to demonstrate attainment of the stream standard.

Prior to discussion of findings related to *E. coli*, the following tables and figures are presented:

- Table 5 summarizes *E. coli* data by monitoring location on an annual basis for the entire period of record. Values shaded in red exceed the previous standard of 205 cfu/100 mL and values shaded in yellow are “new” exceedances due to the change in standard to 126 cfu/100 mL. Although annual geometric means are not used by the CWQCD to assess attainment, the tabular summary is still useful for general information regarding trends over time and identifying locations where *E. coli* is persistently elevated.

- Tables 6 and 7 summarize data for the last five years and 2019 only, respectively. Table 6 is useful for showing which seasonal time periods tend to be elevated over time.

- Figure 2 provides boxplots of *E. coli* from 2015-2019 from upstream to downstream to show the range of concentrations at each monitoring location. Figure 3 shows the 2015-2019 geometric mean concentrations from upstream to downstream, and Figure 4

shows the geometric mean of the 2019 concentrations for all monitoring locations on a monthly basis.

Table 5. Annual Geometric Mean Summary of Big Dry Creek *E. coli* Data (MPN/100 mL)

Year	bdc0.5	bdc1.0	bdc1.5	bdc10.0 (Broom. WWTP)[2]	bdc2.0	bdc11.0 (West. WWTP)[2]	bdc3.0 (I-25)	bdc4.5	bdc5.0	bdc6.0
2000	212	151	389	--	574	--	294	500	212	323
2001	477	118	332	215	649	68	387	634	442	510
2002	858	230	363	364	934	16	536	441	451	572
2003 [3]	191	210	293	27	615	24	382	225	249	339
2004	279	181	217	18	346	28	205	187	156	377
2005	152	122	281	26	328	35	204	113	182	301
2006	76	241	316	20	309	48	214	163	179	333
2007	196	177	257	14	324	66	230	231	198	364
2008	266	197	267	10	461	6	439	376	290	380
2009 [4]	61	78	147	5	207	14	251	137	149	197
2010	111	191	193	12	483	16	376	280	235	368
2011	64	228	323	6	622	8	518	537	380	730
2012	267	397	260	7	555	8	544	497	390	545
2013	239	214	292	3	398	10	424	342	272	505
2014	119	269	254	5	323	9	371	410	287	1085
2015	257	251	230	4	311	9	528	415	266	490
2016	207	254	221	5	312	18	358	315	300	536
2017	178	194	217	5	327	19	444	392	349	371
2018	81	89	194	3	277	15	352	273	314	300
2019	163	117	157	2	192	25	490	204	275	350

Notes:

1. Pink-shaded cells exceed the 205 cfu/200 mL stream standard. Yellow-shaded cells exceed the 2020 stream standard of 126 cfu/100 mL.
2. Broom. = Broomfield; West. = Westminster; Northglenn excluded due to historically infrequent discharge to Big Dry Creek. During 2015-2019, Northglenn discharged to Big Dry Creek more frequently; the geometric mean annual DMR values for Northglenn's Discharge were 18 MPN/100 mL in 2015, 9.7 MPN/100 mL in 2016, 4.8 MPN/100 mL in 2017, 5.2 MPN/100 mL in 2018 and 1.9 MPN/100 mL in 2019.
3. For consistency between sampling years, the 2003 weekly samples were converted to monthly geometric means prior to calculating the annual geometric mean for 2003.
4. The 2009-2019 Broomfield and Westminster geometric means are based on Discharge Monitoring Report (DMR) values. The 2000-2008 samples were based on grab samples of the WWTP effluent as part of the synoptic monitoring program. Northglenn's 2015-2019 *E. coli* data are based on DMR values.

Table 6. Seasonal Summary of Instream Big Dry Creek *E. coli* Data for 2015-2019

	Geometric Mean *E. coli* (MPN/100 mL)	
	Recreation Season	Non-recreation Season
Station	May-Oct	Nov-Apr
bdc0.5	335	93
bdc1.0	394	70
bdc1.5	418	122
bdc2.0	406	206
bdc3.0	527	349
bdc4.5	432	258
bdc5.0	470	208
bdc6.0	667	259
All Sites	447	173

Note: Shaded cells exceed the stream standard. Pink-shaded values exceed the 2019 standard of 205 cfu/100 mL and yellow-shaded cells exceed the 2020 stream standard of 126 cfu/100 mL.

Figure 2. Big Dry Creek *E. coli* Boxplots (2015-2019)

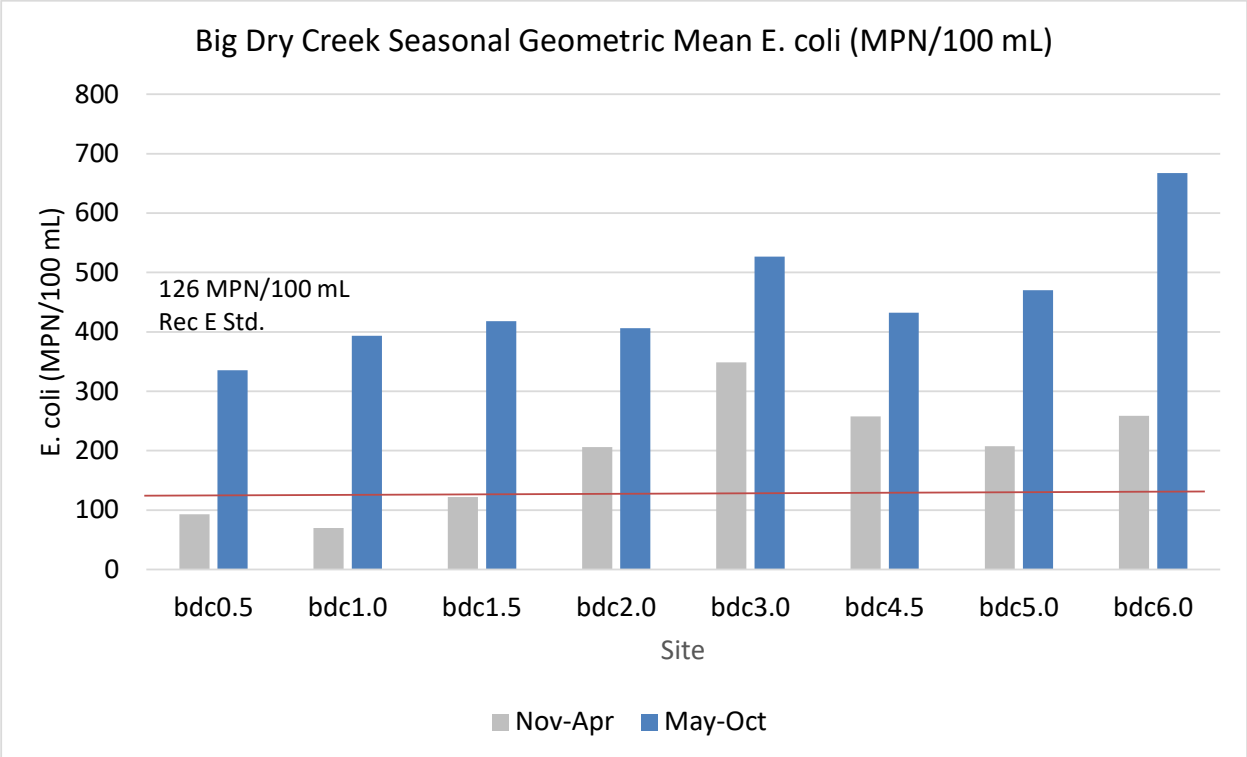
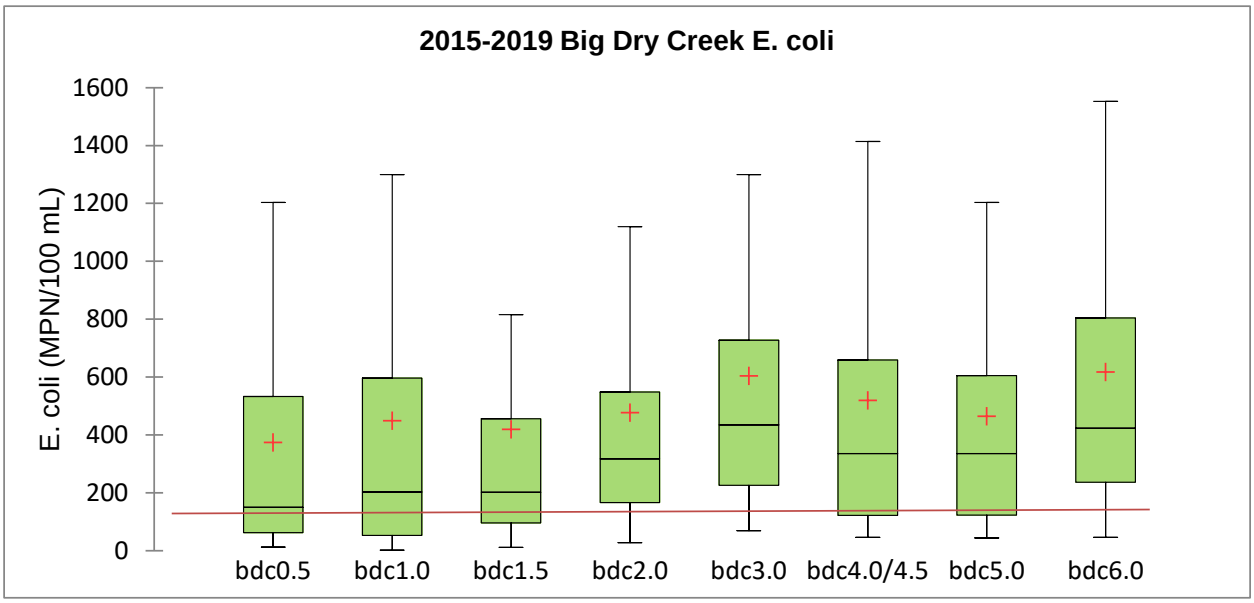


Figure 3. Big Dry Creek *E. coli* Geometric Mean Concentrations (2015-2019)



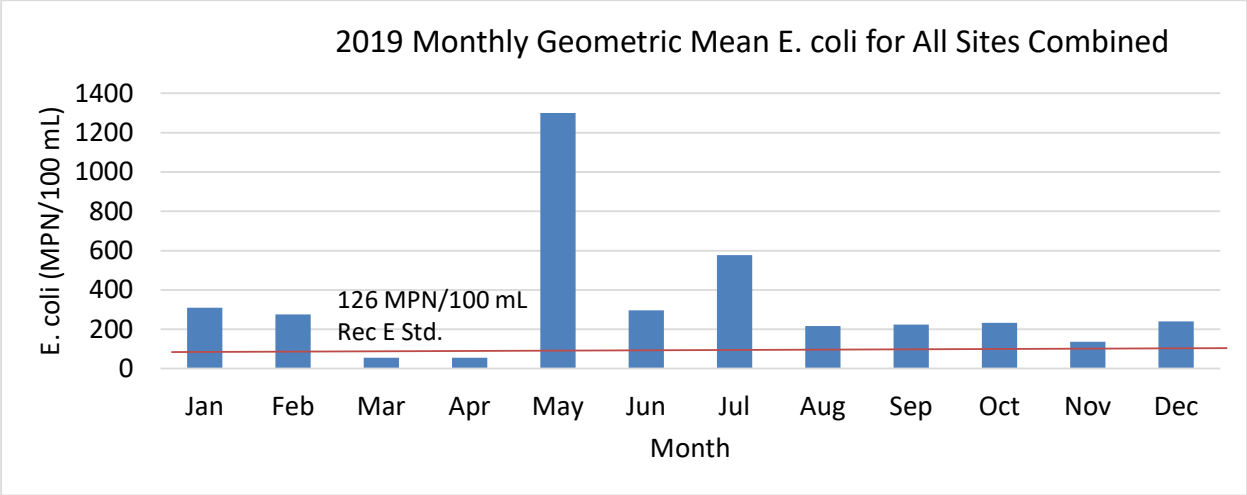
Note: Outliers not displayed for simplicity; at least one value >2,419 MPN/100 mL present at each location.

Table 7. 2019 *E. coli* Data (MPN/100 mL)

Station ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Geomean
bdc0.5	Ice	Ice	86	29	1120	411	548	75	131	206	64	Ice	**163**
bdc1.0	Ice	Ice	15	39	1987	231	548	104	125	78	20	162	**117**
bdc1.5	172	Ice	18	11	1554	387	579	142	122	2420	55	54	**157**
bdc2.0	489	179	28	37	1987	214	411	137	261	261	365	46	**192**
bdc3.0	727	462	229	206	1204	291	461	579	387	222	866	1733	**490**
bdc4.5	489	462	89	46	727	101	261	250	96	129	205	461	**204**
bdc5.0	161	345	119	178	1047	184	921	345	579	112	74	548	**275**
bdc6.0	185	119	55	110	1300	1414	1553	645	548	260	365	261	**350**
Geomean All Sites	310	275	55	55	1301	297	577	217	223	232	137	240	220

Note: Shaded cells exceed the stream standard. Pink-shaded values exceed the 2019 standard of 205 cfu/100 mL and yellow-shaded cells exceed the 2020stream standard of 126 cfu/100 mL.

Figure 4. Big Dry Creek Monthly Geometric Mean *E. coli* 2019 for all Sites



Based on review of the *E. coli* data, the following observations are noteworthy:

- Table 5 indicates the *E. coli* concentrations in 2019 were on the lower end of the range of geometric means that have been observed since about 2010 at most monitoring locations.

- The historic data in Table 5 show significant reductions in the Broomfield WWTP's effluent concentrations following WWTP upgrades and expansion in the 2001-2004 time period. Significant reductions in Westminster's WWTP effluent concentrations are also apparent beginning in 2008, following plant upgrades including UV treatment and other operational changes. Based on review of geometric mean concentrations from 2003-2019, *E. coli* concentrations are consistently the lowest in samples from the Broomfield and Westminster WWTP discharges (Table 5), which are well below the stream standard. This is also true for Northglenn WWTP samples reported for 2015-2019.

- The 2019 data set does not meet stream standards, although the upper sites (bdc0.5, 1.0 & 1.5) attained the standard during a few winter months. Based on field observations and Google Earth aerial photos, cattle are present in and along the stream above bdc6.0 and are hypothesized to contribute to elevated *E. coli* in this portion of the stream.

- For 2015-2019, the highest *E. coli* concentrations for all stations were experienced during the May-October recreation season. Statistically significant seasonal differences in *E. coli* concentrations have been consistently observed, with winter values being significantly lower than summer values (WWE 2012).

- Boxplots of upstream to downstream monitoring locations (Figure 3) show highly variable ranges of *E. coli* concentrations at each monitoring location. Various explanatory relationships between *E. coli* and variables such as flow, temperature, total organic carbon, DO and other variables have been evaluated, but without fully explaining *E. coli* trends (WWE 2009, WWE 2011). Studies are currently underway to identify sources of *E. coli* in the watershed between Standley Lake and I-25.

E. coli TMDL Summary

As part of the TMDL for Big Dry Creek, the CWQCD developed load duration curves for three portions of Big Dry Creek. The segment was divided into three distinct reaches to account for changes in land use, influences from instream flow (diversions, reservoir releases, WWTP contributions, etc.), and location of permitted point sources. The three reaches correspond to Standley Lake to bdc1.5 (bdc0.5 to bdc1.5), from bdc1.5 to 152nd Ave. (bdc2.0 and bdc3.0), and 152nd Avenue to the Weld County Line (bdc4.0 to bdc6.0). These curves are based on data from 2003 through 2014 and are shown in Figures 5 through 7. These figures illustrate that recreation season (May-October) stream loads generally exceed the allowable stream load for *E. coli* during all flow regimes. The TMDL has assigned load reductions needed for each of these three portions of the stream. BDCWA is currently working on a watershed plan update to identify next steps related to the *E. coli* TMDL in terms of source identification and potentially feasible load reductions. These investigations are prioritizing potential human waste sources.

Figure 5. Load Duration Curve for BDC1.5 and the USGS Gauge at Westminster
(Source: CWQCD 2016)

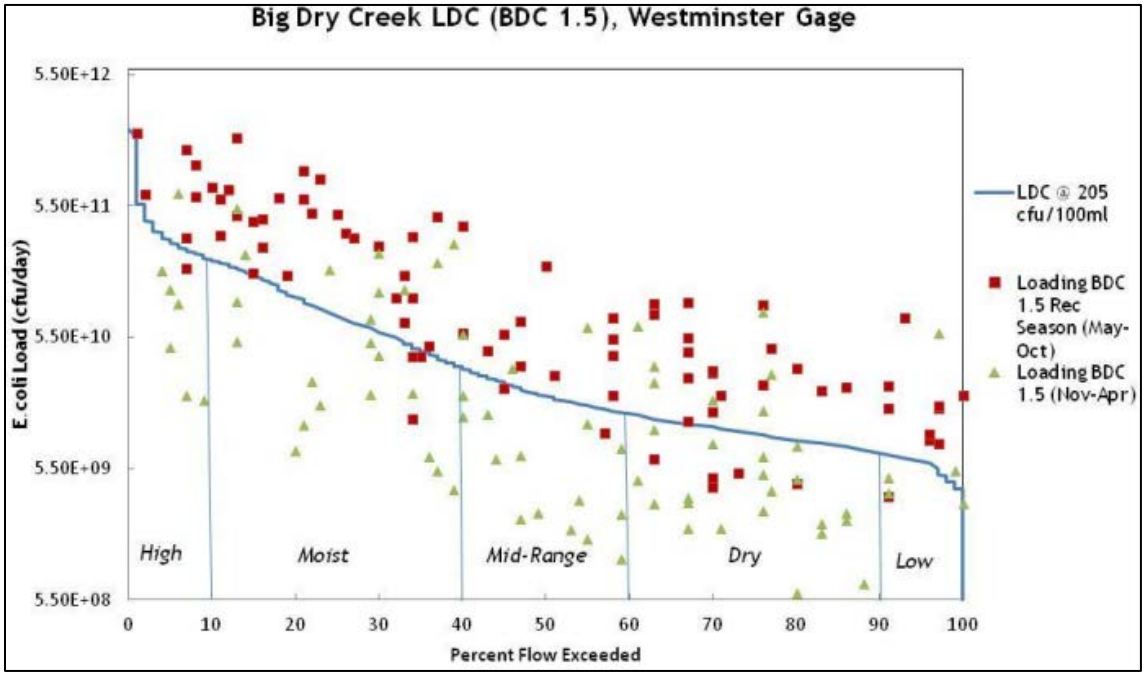


Figure 6. Load Duration Curve for BDC2.0 and the USGS Gauge at Westminster
(Source: CWQCD 2016)

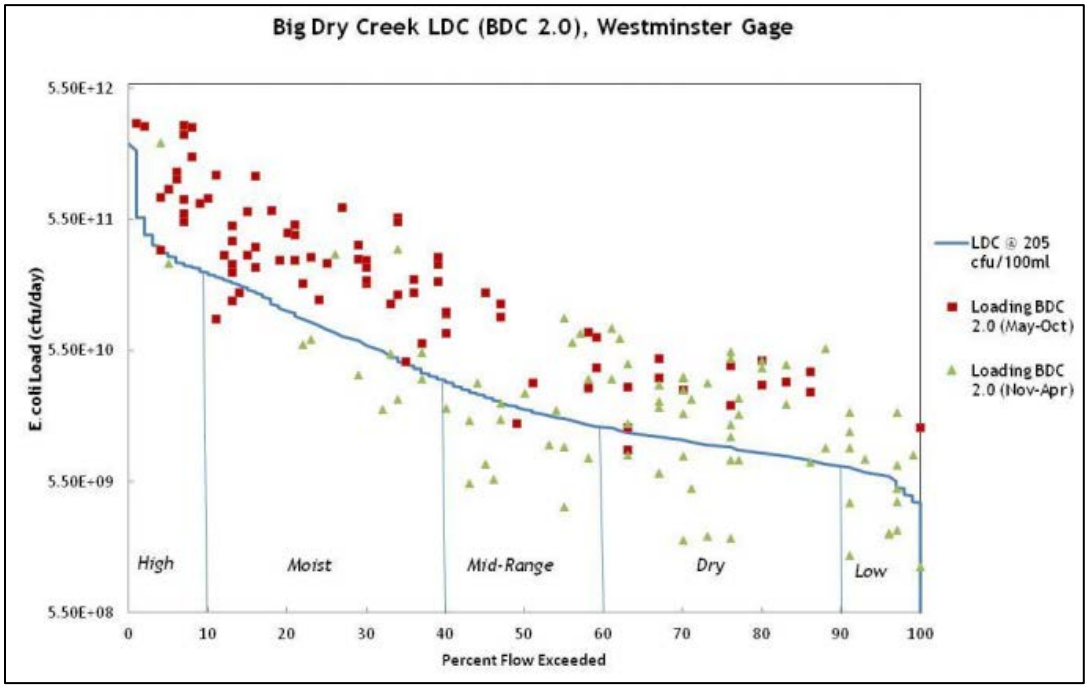
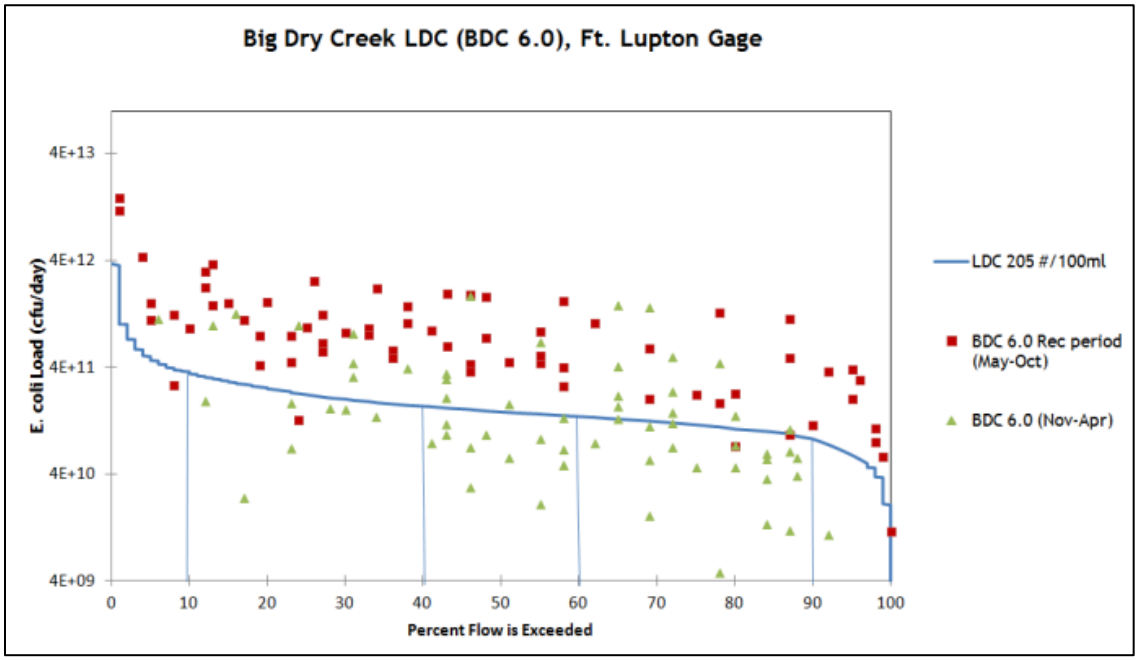


Figure 7. Load Duration Curve for BDC6.0 and the USGS Gauge at Fort Lupton
(Source: CWQCD 2016)



METALS

Big Dry Creek attains most metals standards assigned for protection of aquatic life, including arsenic, cadmium, chromium, copper, lead, manganese, selenium, silver, zinc and mercury. Since 2016, a portion of Big Dry Creek below Weld County Road 8 has been identified as impaired on the 303(d) List for total recoverable iron. In the past, selenium was a metal of concern; however, adoption of a site-specific standard for selenium on Big Dry Creek in 2007 and some changes to assessment methodology for ambient-based standards have resulted in attainment of the selenium standard. In 2020, addition of a Water Supply classification resulted in addition of additional metals standards to the stream segment, including more stringent total recoverable arsenic and dissolved manganese standards and new standards for dissolved iron and total cadmium, lead, and nickel. Dissolved manganese is expected to be a future impairment for Big Dry Creek due to adoption of a Water Supply standard for the stream and is also discussed further.

See Appendices B and C for boxplots and time series plots for Big Dry Creek samples analyzed for metals, with additional information on selenium, iron, manganese and arsenic discussed further below.

Selenium

Elevated selenium concentrations in the upper reach of Big Dry Creek are due to naturally occurring selenium in geologic formations. BDCWA conducted special studies in 2006-2007 to support a site-specific standard. Background on this site-specific standard can be obtained in Regulation 38. The site-specific standard includes irrigation and non-irrigation seasonal standards assessed at three specific monitoring locations: bdc1.5, bdc2.0 and bdc4.0/4.5.[3]

Based on the site-specific selenium standards for Big Dry Creek, the 2019 data set, as well as the data set for the most recent five years (2015 through 2019), attains both the non-irrigation season (winter) and irrigation season (summer) standards for Big Dry Creek, as summarized in Table 8. WWTP grab samples collected during this time period were below chronic and acute stream standards.

[3] In 2015, the CWQCC adopted a formal change to the site-specific selenium standard assessment locations in Regulation 38 because sampling location bdc4.0 was relocated in 2011 for safety reasons and has been replaced with bdc4.5, although both sites may still be used for standards assessment, if needed.

Table 8. Big Dry Creek Selenium Data Summary (2015-2019)

Selenium (µg/L)				
	Irrigation Season		Non-irrigation Season	
	2015-2019 (Apr-Oct)	Reg. 38 Standard	2015-2019 (Nov-Mar)	Reg. 38 Standard
All Sites (85th %)	6.8	N/A	7.7	N/A
bdc1.5, 2.0, 4.5 (85th %)	6.6	7.4 (ch)	9.2	15.0 (ch)
bdc1.5, 2.0, 4.5 (Max)	13.4	18.4 (ac)	13.0	19.1 (ac)

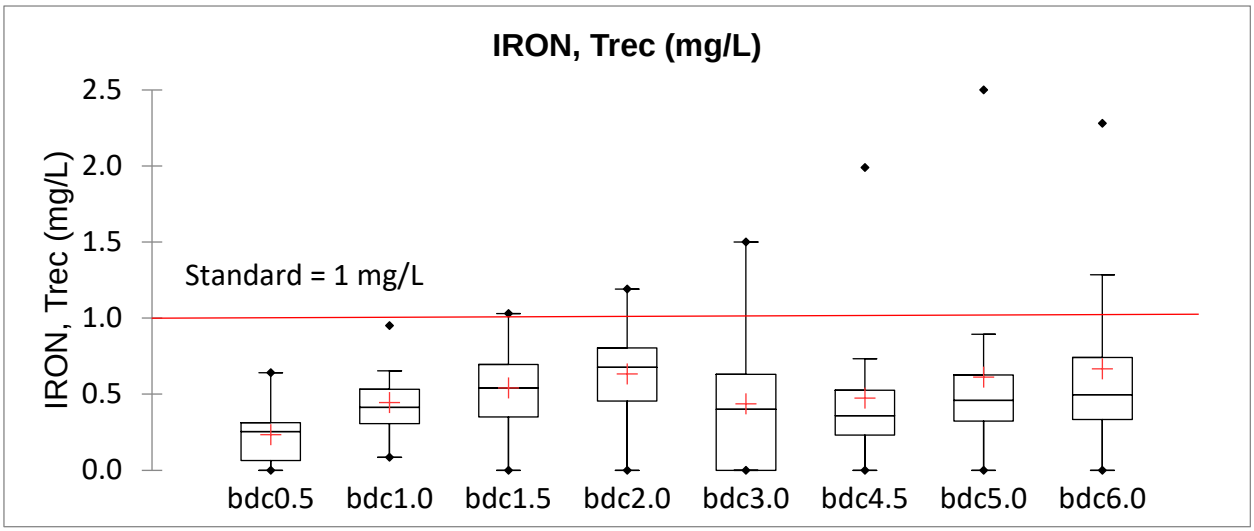
Iron

BDCWA currently monitors total recoverable iron (Figure 8) on a monthly basis, after increasing the sample frequency from quarterly to monthly in May 2018. Big Dry Creek is on the 303(d) List for total recoverable iron due to monitoring conducted by Metro Wastewater twice per month at two locations in the lower watershed. Metro's upstream-most site "BDC-8" is located where Big Dry Creek crosses Weld County Road 8 and has been monitored by Metro since 2007. This site is located in proximity to BDCWA site bdc6.0. Metro's downstream site "BDC" (Figure 9) and is located approximately 30-50 yards upstream of the State Engineer's gauge "Big Dry Creek at Mouth" also known as BIGDAFCO (see Figure 31 for general location). Both of these sites were slightly below the stream standard of 1 mg/L during 2019, with median values of 0.86 mg/L and 0.99 mg/L for BDC-8 and BDC, respectively. Although Big Dry Creek's five-year data set shows attainment of the iron standard, Metro's five-year data set shows impairment.

The expected source of elevated iron is streambank and soil erosion in the watershed. Previous analyses by BDCWA have shown that total iron and TSS are highly correlated, with both concentrations tending to be elevated during storm events.

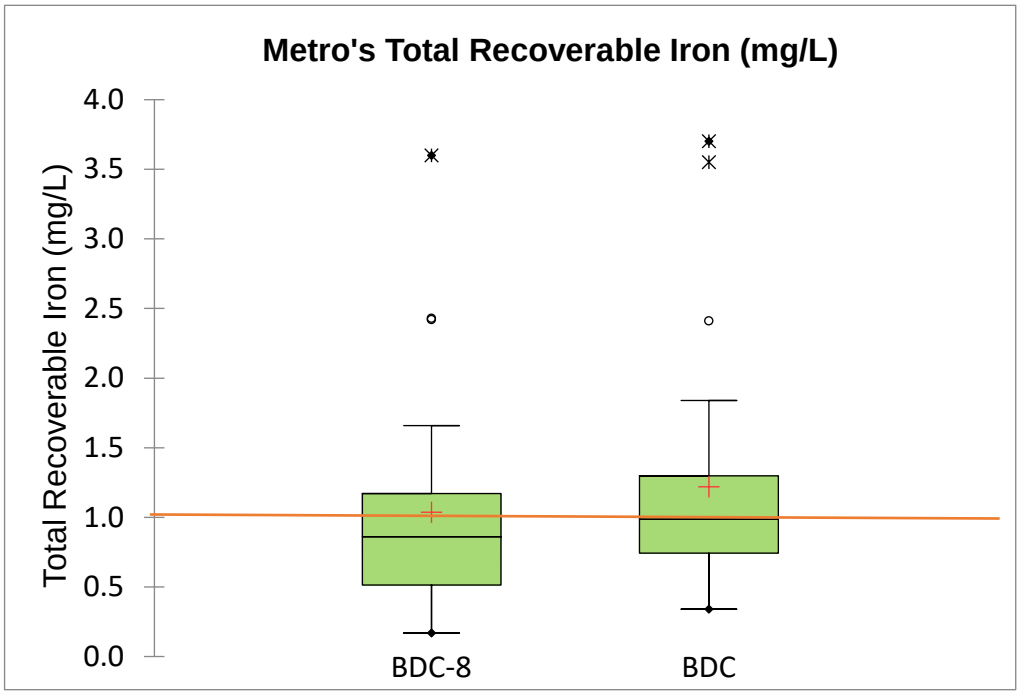
In 2020, a dissolved iron standard of 300 ug/L was added to Big Dry Creek to protect water supply uses. BDCWA does not currently monitor for dissolved iron, but intends to add it to the routine sampling program. Metro's dissolved iron monitoring in the lower watershed indicates instream concentrations of dissolved iron of 62.4 ug/L in 2019, suggesting that the stream is likely to attain the dissolved iron standard. Additionally, review of the CWQCD's existing quality data library for Big Dry Creek shows an existing condition for dissolved iron of 90 ug/L, further indicating that dissolved iron is likely to attain the new stream standard.

Figure 8. BDCWA Monitoring Locations for Total Iron (2019)



Note: total recoverable iron is assessed as a median (50th percentile), which corresponds to the line in the line in the box portion of the boxplot.

Figure 9. Metro Wastewater Monitoring Locations BDC-8 and BDC for Total Iron (2019)



Manganese

In the 2020 Regulation 38 Rulemaking Hearing, the CWQCC adopted a dissolved manganese standard to protect Water Supply uses associated with alluvial wells near Big Dry Creek in the lower watershed. Dissolved manganese standards can be applied as either of the less restrictive of the following two options:

1. existing quality as of January 1, 2000; or

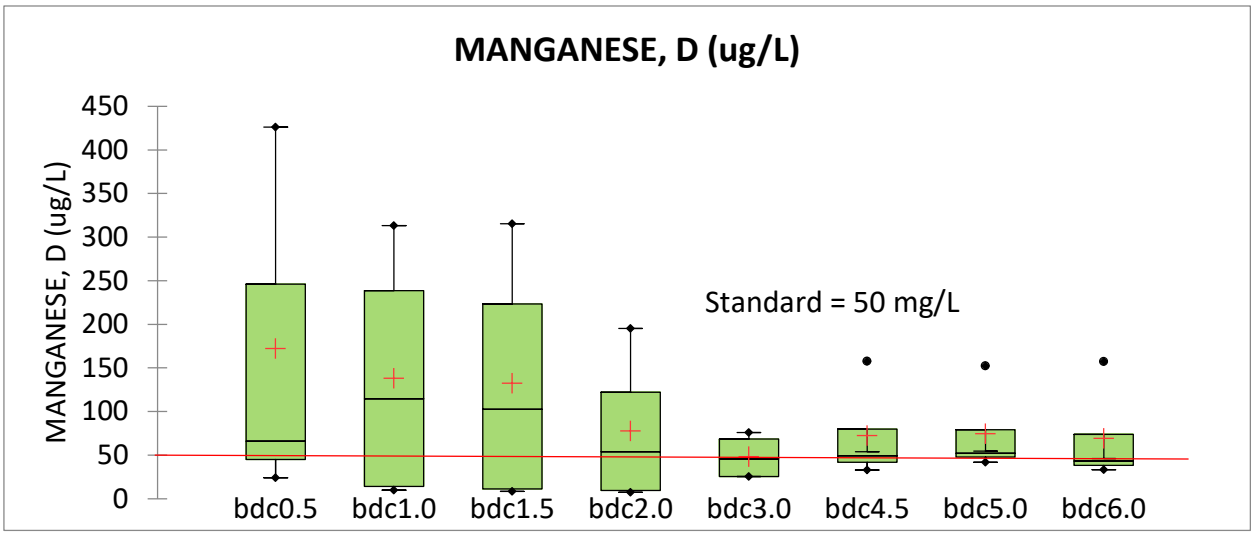
2. a table value criterion of 50 ug/L dissolved manganese.

Based on dissolved manganese in the CWQCD's existing quality library,[4] which does not currently include BDCWA's data set, existing quality for 1995-1999 would be 85 ug/L. Using the entire period of record in the library, the existing quality value would be 78 ug/L. BDCWA's database only includes dissolved manganese for 30 samples in 1999, with an 85th percentile value of 57 ug/L.

The primary cause of the elevated dissolved manganese is thought to be groundwater inflows in the upper watershed. Review of seasonal patterns in Appendix C shows elevated concentrations in the winter, when Standley Lake is not releasing and the stream is dominated by groundwater. This is also the cause of higher variation in the upper watershed, as illustrated by the large ranges in the boxplots for bdc0.5, bdc1.0 and bdc1.5 in Figure 10. The 85th percentile value for dissolved manganese is 194 ug/L for the 2019 Big Dry Creek data set, which exceeds both the underlying standard of 50 ug/L and the existing quality standard as of January 1, 2000.

[4] The CWQCD library is in the process of being updated and the most current working version of the database was provided as a courtesy from the CWQCD on 6/24/2020.

Figure 10. Big Dry Creek 2019 Dissolved Manganese

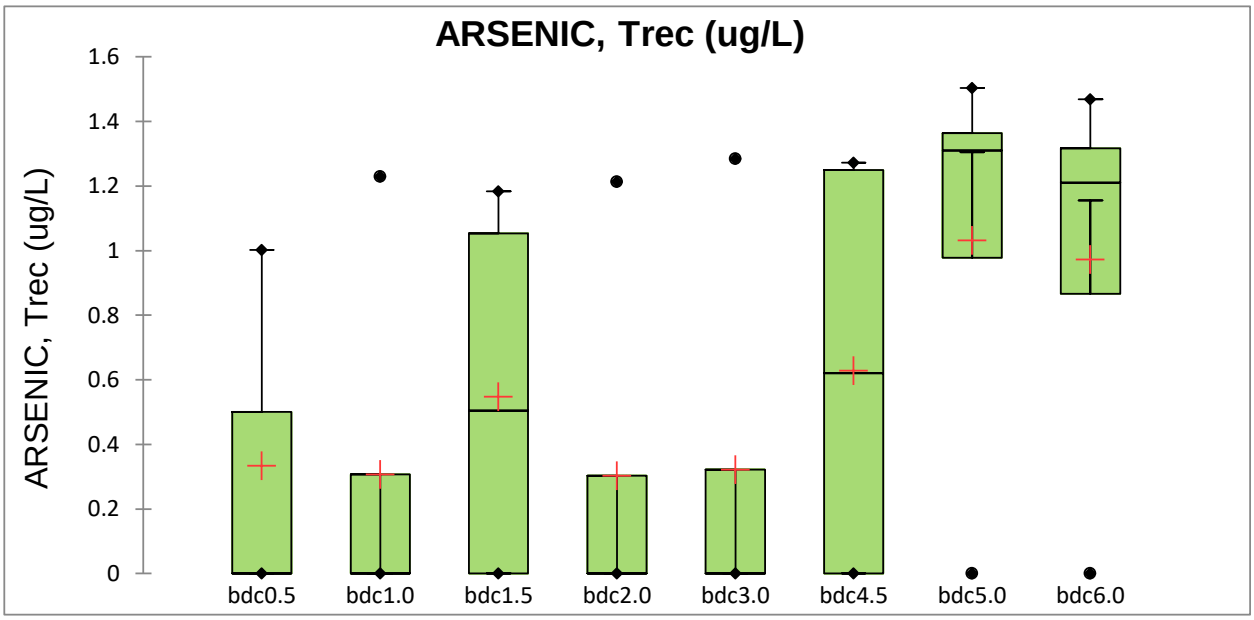


Arsenic

In the 2020 Regulation 38 Rulemaking Hearing, the CWQCC adopted a more stringent total recoverable arsenic standard to protect Water Supply uses associated with alluvial wells near Big Dry Creek. Previously, Big Dry Creek's arsenic standard was much higher at 100 ug/L. The new Water Supply standard is expressed as a hyphenated standard of 0.02-10 ug/L. The first number in the range is a strictly health-based value, based on the CWQCC's established methodology for human health-based standards. The second number in the range (i.e., 10 ug/L) is a maximum contaminant level (MCL), as established under the federal Safe Drinking Water Act, that has been determined to be an upper limit for arsenic in public water supplies, taking treatability and laboratory detection limits into account. Discharge permit effluent limitations are established using the first number in the range as the ambient water quality target, provided that no effluent limitation will require an "end-of-pipe" discharge concentration more restrictive than the second number in the range. Waterbodies are considered in attainment of this standard and not included on the 303(d) List, provided that the existing ambient quality does not exceed the second number in the range (i.e., 10 ug/L).

Big Dry Creek attains the 10 ug/L MCL for total recoverable arsenic and exceeds the 0.02 ug/L underlying target. Thus, the segment would be considered to attain the hyphenated arsenic standard. In the 2020 Regulation 38 Rulemaking Hearing, the CWQCC considered adoption of a more stringent Water + Fish standard of 0.02 ug/L (without the hyphenated 10 ug/L value). Because there was no evidence of fish ingestion for Big Dry Creek meeting the criterion of "fish normally consumed on a recurring basis," the Water + Fish standard was not adopted.

Figure 11. Big Dry Creek 2019 Total Recoverable Arsenic



WATER SUPPLY STANDARDS FOR INORGANIC POLLUTANTS (SULFATE AND CHLORIDE)

In the 2020 Regulation 38 Rulemaking Hearing, the CWQCC adopted sulfate and chloride standards to protect Water Supply uses associated with alluvial wells near Big Dry Creek.

Sulfate

The sulfate standard can be applied as either of the less restrictive of the following two options

1. existing quality as of January 1, 2000; or
2. sulfate at 250 mg/L.

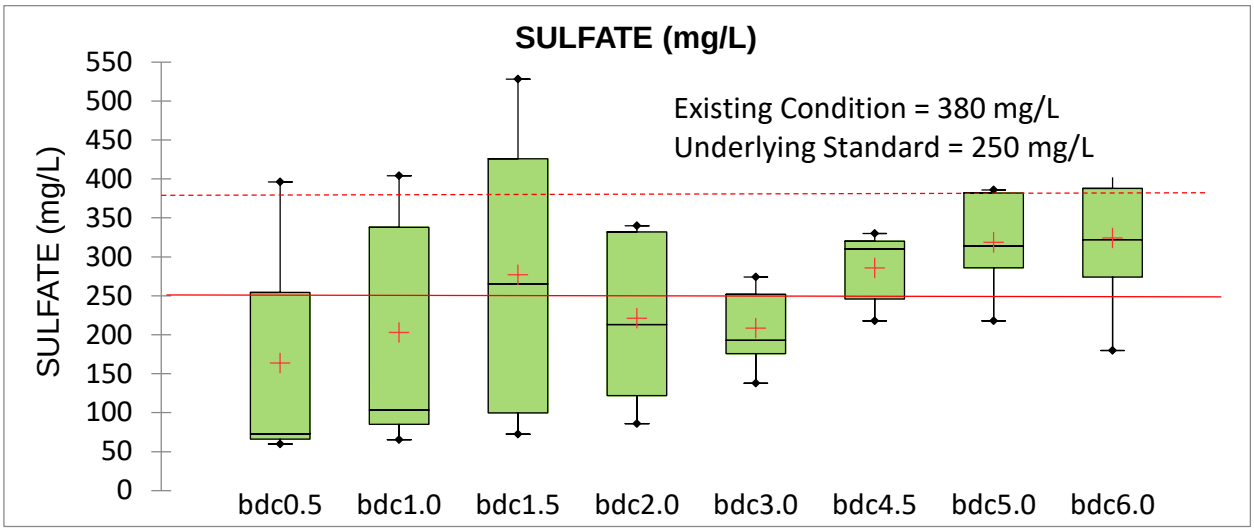
Based on sulfate data in the BDCWA database from 1995-1999, the existing quality standard for sulfate would be 380 mg/L. Based on sulfate in the CWQCD's existing quality library,[5] which does not currently include BDCWA's data set, existing quality for 1995-1999 would be 308 mg/L. Using the entire period of record in the library, existing quality would be 383 mg/L. Based on review of sulfate data, Big Dry Creek would not be expected to attain the sulfate standard.

For sulfate, the 85th percentile value for the overall stream segment is 386 mg/L for 2019, which is greater than BDCWA's existing condition calculation of 380 mg/L. Additionally, the 85th

[5] The CWQCD library is in the process of being updated and the most current working version of the database was provided as a courtesy from the CWQCD on 6/24/2020.

percentile value for the past five years of samples on Big Dry Creek is even higher at 404 mg/L. The primary cause of this issue is seasonally elevated sulfate in the upper portion of the watershed above the WWTP discharges. During time periods when Standley Lake is not releasing flows to the stream, the stream flows are dominated by groundwater, which is high in sulfate (as well as other parameters like chloride, total dissolved solids, selenium, and manganese). Other sources in the lower watershed could potentially include ammonium sulfate fertilizer. A potential solution to this potential standards issue would be to apply the existing condition provision on a sampling location-specific basis. For example, the 85th percentile value for bdc1.5 for 1995-1999 was 555 ug/L. If recent monitoring data for bdc1.5 are compared to historic water quality data as of the January 1, 2000 for bdc1.5, then the standard would be attained. This location-specific comparison technique is not, however, currently included in the 303(d) Listing Methodology.

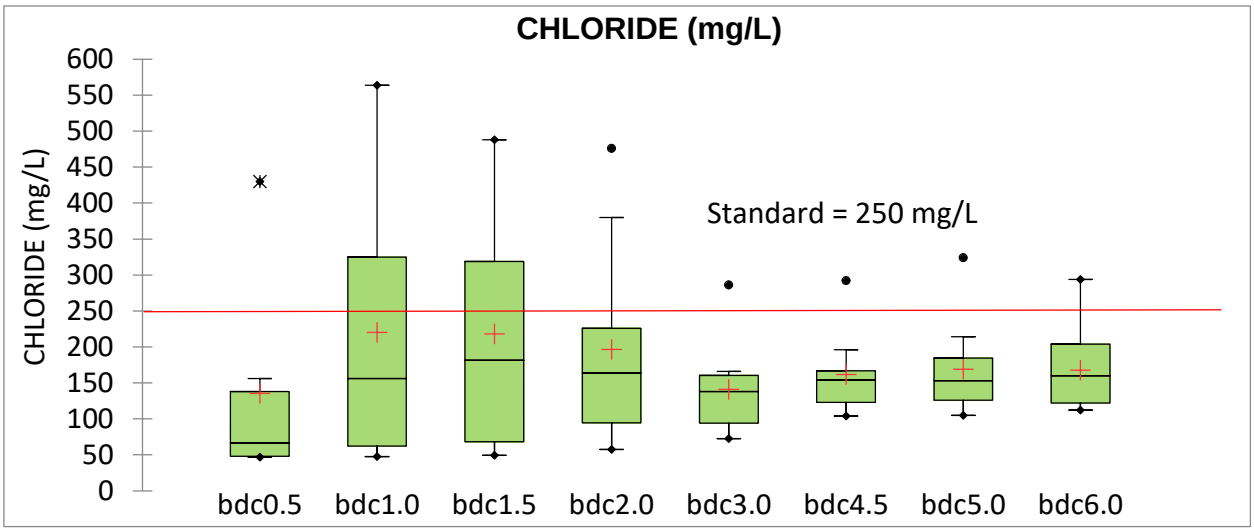
Figure 12. Big Dry Creek 2019 Sulfate



Chloride

The chloride standard added to Big Dry Creek in the 2020 Regulation 38 Rulemaking Hearing is 250 mg/L. For chloride, an existing condition provision is not provided in Regulation 31, so the 250 mg/L standard applies. Big Dry Creek's 2019 85th percentile value for chloride is 288 mg/L, which would exceed the stream standard. As discussed for sulfate, groundwater inflows are expected to be the primary cause of elevated chloride in Big Dry Creek. Evaluation of spatial trends for chloride in 2019 is hampered by several months of missing winter samples due to ice in the upper watershed. Because winter concentrations tend to be higher, the actual results may be skewed lower than they would be if a full set of winter month samples was available. Other sources of chloride such as road deicing chemicals could also contribute to chloride in the watershed, but the spatial and temporal pattern suggests groundwater as a more likely source.

Figure 13. Big Dry Creek 2019 Chloride



NUTRIENTS

Currently applicable nutrient standards for the main stem of Big Dry Creek include ammonia, nitrate and nitrite. In 2012, the CWQCC adopted new interim nutrient criteria for total phosphorus and total nitrogen, which are expected to become effective for the main stem of Big Dry Creek in 2027 (CWQCC 2012, 2017). Additionally, Big Dry Creek has been assigned a Load Allocation in a downstream TMDL for Barr Lake and Milton Reservoir and has been assigned a load reduction target for total phosphorus.

A discussion of ammonia, nitrate and nitrite results, total nitrogen and total phosphorus data for Big Dry Creek are provided below.

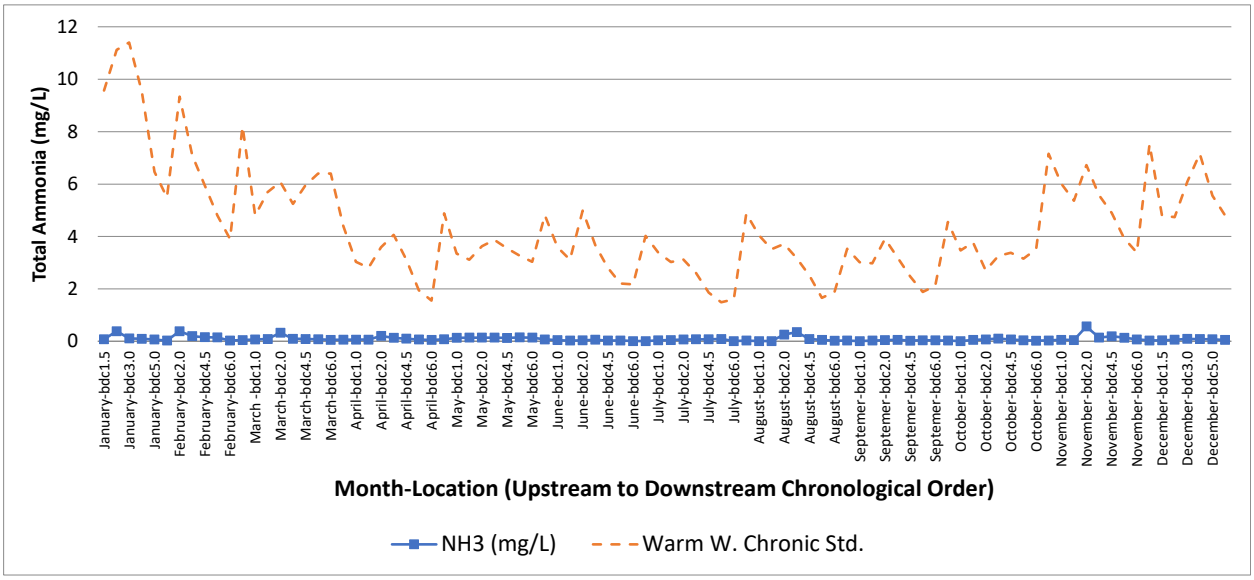
Ammonia

After a five-year transition period from an unionized ammonia standard to a total ammonia standard, a total ammonia standard became effective on Big Dry Creek on January 1, 2012. In 2013, EPA published a revision to the aquatic life criteria for ammonia. Although these criteria have not yet been adopted in Colorado, these criteria can be accessed at EPA's website: http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/ammonia/index.cfm.
As part of Colorado's 10-year Water Quality Road Map, ammonia standards will be revisited in 2027.

Total ammonia concentrations for Big Dry Creek are plotted in Figure 14, along with the chronic standards, which are calculated using a formula based on pH and temperature. During 2019, the stream attained both chronic and acute total ammonia standards. Acute standards are higher

than chronic standards and are not shown in Figure 14 since all results were below chronic standards.

Figure 14. Comparison of Big Dry Creek 2019 Ammonia Data to Chronic Ammonia Standards

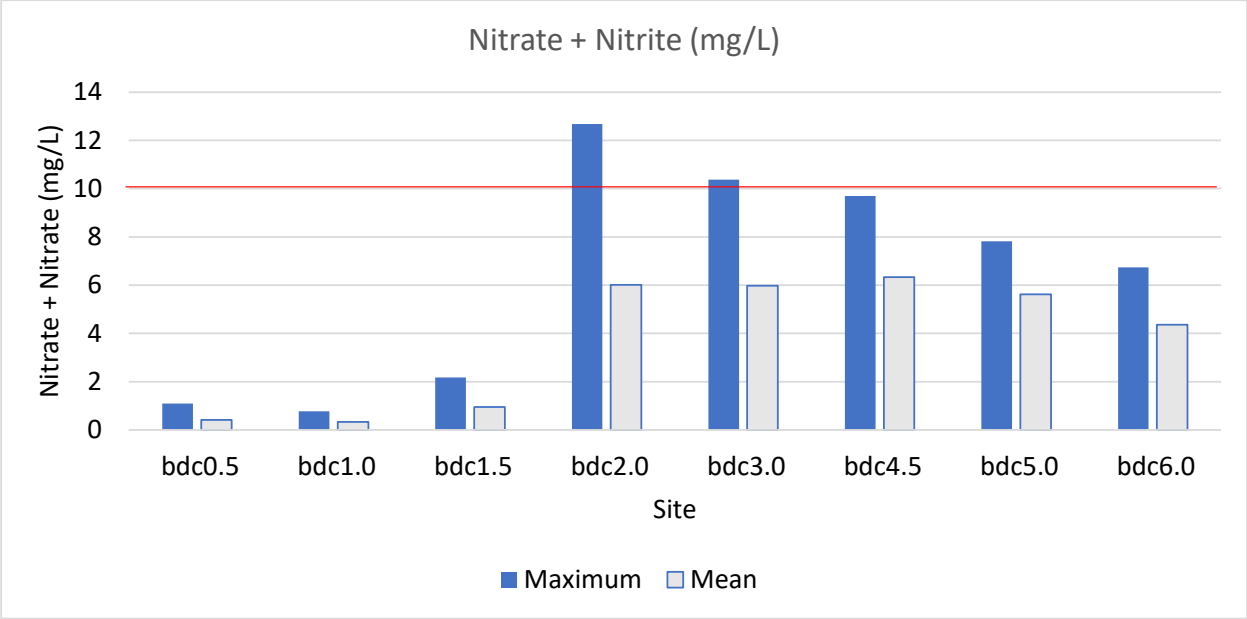


Nitrate and Nitrite

The CWQCC adopted a nitrate standard of 10 mg/L for Big Dry Creek in 2020 for the protection of Water Supply uses, which is a more stringent standard than the previously applicable 100 mg/L for agricultural uses. Big Dry Creek monitors for nitrate+nitrite instead of nitrate; however, the nitrite component is very small. For this reason, nitrate+nitrite results are compared against the 10 mg/L nitrate standard in this report. As shown in Figure 15, Big Dry Creek's instream nitrate+nitrite concentrations are below 10 mg/L at most sampling locations; however, bdc2.0 and bdc3.0 (below the Broomfield and Westminster WWTPs, respectively) have a few nitrate+nitrite results above 10 mg/L, resulting in exceedance of the stream standard. The stream standard is assessed based on the maximum daily value and allows only one exceedance of the 10 mg/L every three years. An increase in instream nitrate concentrations occurs below the WWTP discharges, but gradually decreases in the agricultural area, consistent with the trend for total nitrogen.

Nitrite concentrations at all locations on Big Dry Creek are well below the 4.5 mg/L stream standard, with an 85th percentile value of 0.08 mg/L for 2019.

Figure 15. Big Dry Creek 2019 Nitrate + Nitrite



Colorado's 2012 Nutrient Criteria for Nitrogen and Phosphorus (as updated Dec. 2017)

Nationally, statewide, and locally, control of nutrient loading to streams is a significant regulatory topic. In June 2012, the CWQCC adopted Regulation 85 (Nutrient Management Control) and updated the nutrient portion of Regulation 31 (Colorado Basic Standards). Although many requirements under these regulations originally had a 10-year delay until May 31, 2022, some requirements became effective in 2013. For example, monitoring requirements for municipal WWTPs, a data gap evaluation process for the municipal separate storm sewer (MS4) discharge permit holders, and other requirements, became effective in 2013. Additionally, municipal wastewater dischargers to Big Dry Creek now have compliance plans to attain new discharge permit limits for total phosphorus and total inorganic nitrogen (TIN) in accordance with Regulation 85. Compliance plans allow time to implement upgrades to meet the limits.

As a result of requirements under Regulation 85, BDCWA has developed an instream nutrient monitoring plan, which was implemented in March 2013. Additionally, MS4s in the Big Dry Creek watershed participated in a joint nutrient data gap analysis for stormwater runoff characterization in conjunction with the Colorado Stormwater Council and Urban Drainage and Flood Control District (UDFCD) (WWE et al. 2013). This "data gap analysis" was submitted to and accepted by the CWQCD in fulfillment of the Regulation 85 requirement for MS4s pertaining characterizing nutrients in urban runoff.

Under Regulation 31, interim nutrient "values" were developed that may be applicable to Big Dry Creek in the future.[6] These interim values include:

- Median annual total phosphorus (TP) concentration of 0.17 mg/L, and
- Median annual total nitrogen (TN) concentration of 2.01 mg/L.

Both interim values have a once every five years allowable exceedance frequency. Additionally, streams with recreational uses have a not-to-exceed 150 mg/m^2 chlorophyll-*a* interim value for attached algae. At the June 2015 Regulation 38 Rulemaking Hearing, it was determined that the total phosphorus and chlorophyll-a standards would not apply at this time to the mainstem of Big Dry Creek downstream of Standley Lake, because the lake is filled by ditches that withdraw water downstream of multiple permitted domestic wastewater treatment facilities. These standards may, however, apply in the future after the 2027 rulemaking hearing.

At the October 2017 CWQCC Rulemaking Hearing related to nutrients, the CWQCD presented its 10-year water quality roadmap for pollutants including TN, TP, cadmium, ammonia, selenium, arsenic and temperature. As a result of this hearing, phased adoption of instream TN and TP standards was extended from 2022 to 2027. As part of this decision, a new CWQCC policy, Policy 17-1 Voluntary Incentive Program for Early Nutrient Reductions, was adopted. The Roadmap and Incentives Policy were a result of extensive stakeholder meetings and dialogue through the Water Quality Forum. Among other provisions, the Incentive Program will allow a WWTP to accrue time under a post-2027 compliance schedule through trading or watershed nutrient reductions as part of its nutrient reduction plan. Such opportunities should be further explored as part of the Big Dry Creek Watershed Management Plan update.

The Incentive Program is intended to encourage facilities to make voluntary reductions of nutrients, and in exchange the facility will receive an extended compliance schedule as well as certainty about the year in which the facility will need to meet water quality based effluent limits. An extended compliance schedule means the facility will be given additional time to comply with effluent limits that would be based on water quality standards or variances adopted in 2027 or nutrient-related wasteload allocations.

Big Dry Creek data for nitrogen and phosphorus are discussed further below. Monitoring for chlorophyll-*a* as attached algae has not been conducted for Big Dry Creek to date. Monitoring procedures are not currently well-defined for a stream like Big Dry Creek which has a sandy bottom through much of the watershed.

[6] For consistency with terminology used in Regulation 31, the term interim nutrient "value" has been used, as opposed to criterion or standard. These "values" may be adopted as stream standards in the future but have not been adopted as stream standards on the main stem of Big Dry Creek.

Total Nitrogen

Total nitrogen is calculated based on total Kjeldahl nitrogen (TKN) plus nitrate/nitrite or through direct analysis of total nitrogen. TKN includes organic nitrogen and ammonia. During 2017, BDCWA changed its analysis methodology for total nitrogen from a calculation-based method to a laboratory analysis method (conductimetric persulfate determination of total nitrogen using Timberline analyzer; 4500-N C). Figure 16 provides box plots of total nitrogen from upstream to downstream during 2019, also showing the interim total nitrogen value in Regulation 31 of 2.01 mg/L. Figure 17 provides a matrix of boxplots illustrating total nitrogen trends from 2013 to 2019. Total nitrogen data were not available instream prior to 2013.

Figure 16. Big Dry Creek 2019 Total Nitrogen

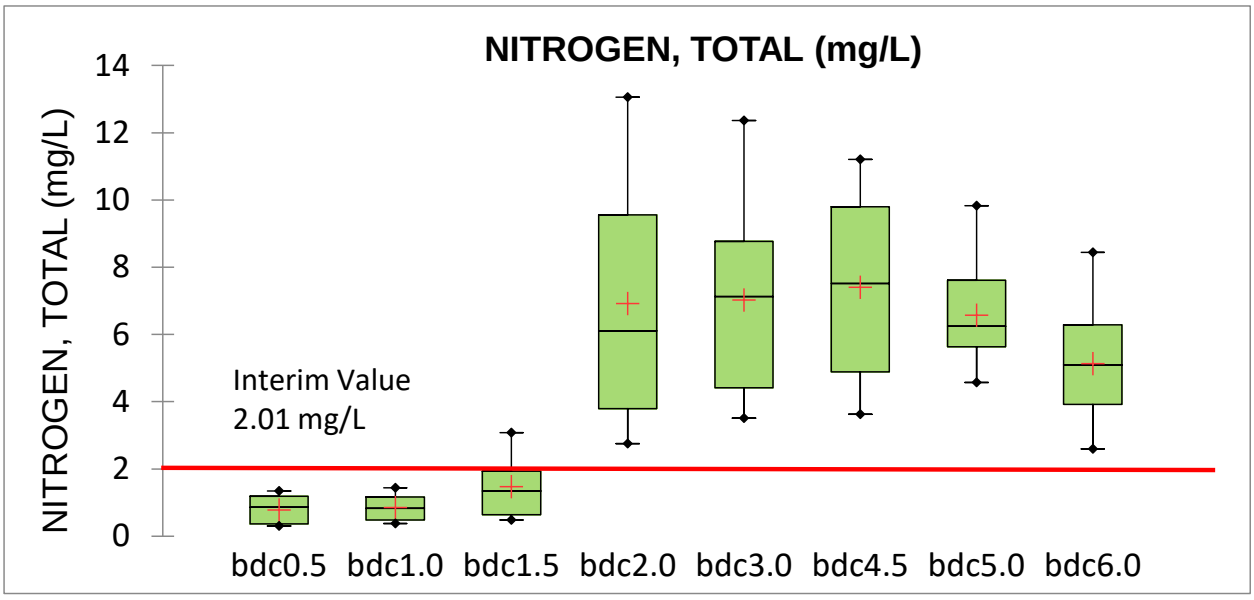
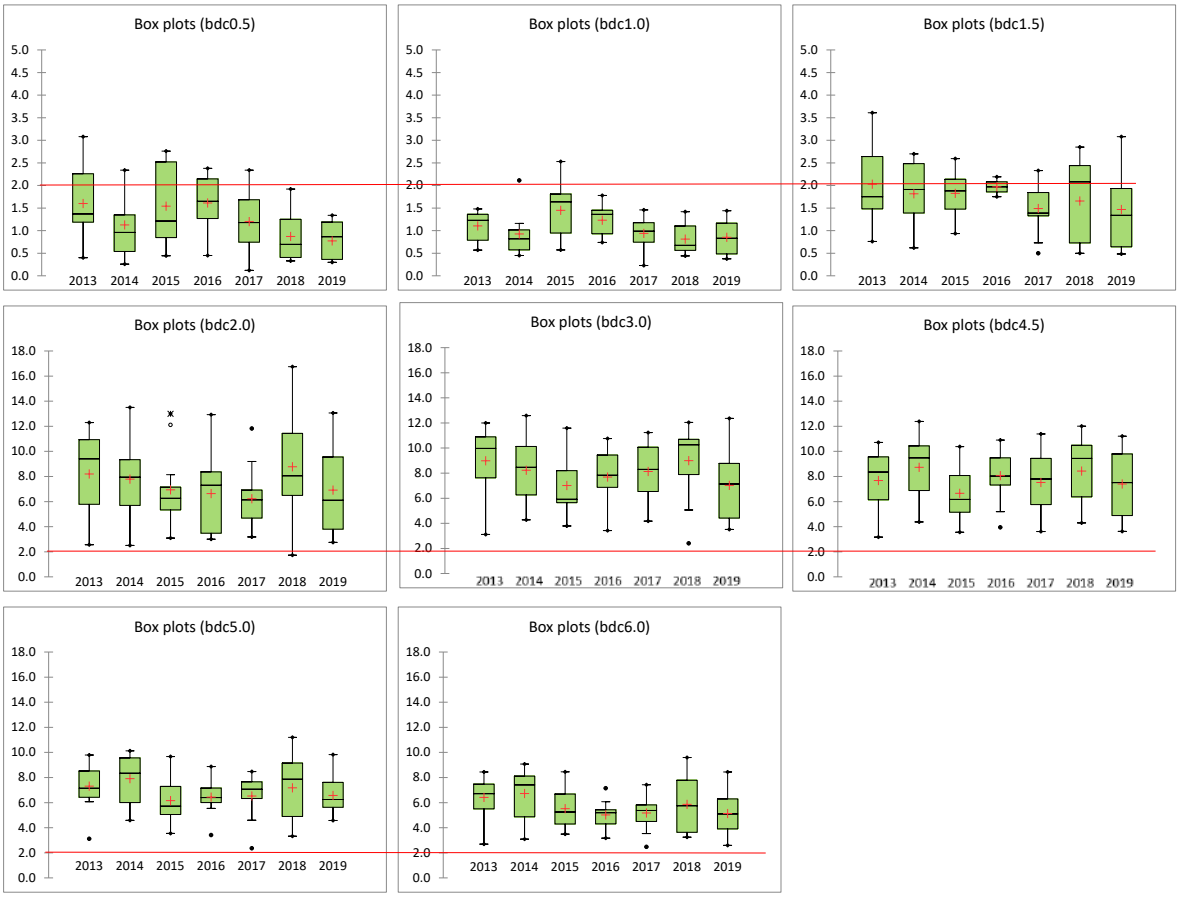


Figure 17. Big Dry Creek Total Nitrogen Trends (2013-2019)



Key observations from Figure 16 include:

- At locations upstream of the WWTP discharges to Big Dry Creek (bdc0.5, bdc1.0 and bdc1.5), the 2019 median total nitrogen values ranged from 0.83 to 1.34 mg/L. This indicates that locations upstream of the WWTPs are likely to meet the interim stream value.
- Below the Broomfield WWTP at bdc2.0, a noticeable increase in total nitrogen concentrations is observed. The 2019 median concentration at bdc2.0 was 6.11 mg/L, exceeding the interim total nitrogen value.
- Below the Westminster WWTP at bdc3.0, the 2019 median total nitrogen concentration was 7.13 mg/L, exceeding the interim total nitrogen value.
- Although total nitrogen concentrations decline in the lower watershed, instream total nitrogen is still well above the interim nitrogen value at all locations downstream from

the WWTP discharges. Dilution from instream flows and natural losses associated with the nitrogen cycle result in lower total nitrogen concentrations downstream.

From Figure 17, there are not clear trends over time at individual monitoring locations from 2013 to 2019, with year-to-year variability present at each location. Upstream to downstream trends for the period of record are similar to those discussed for 2019. In summary, despite WWTP upgrades over the past decade at the Broomfield and Westminster WWTPs, the interim total nitrogen value would not be attained under current conditions in Big Dry Creek from below the Broomfield WWTP discharge to the South Platte River.

Phosphorus

Phosphorus is of interest to BDCWA in two contexts: 1) Colorado's new interim total phosphorus values, and 2) the downstream Barr-Milton TMDL, as discussed below.

Phosphorus in Relation to Colorado's Interim Total Phosphorus Values

Total phosphorus concentrations in Big Dry Creek are of interest with regard to the interim warm water total phosphorus value (0.17 mg/L) adopted by the CWQCC in June 2012. Based on conditions described in nutrient-related criteria in Regulation 31, these interim values are not expected to be adopted as stream standards for the main stem of Big Dry Creek prior to 2027. Nonetheless, it is important to develop an understanding of nutrient conditions in Big Dry Creek with regard to these interim values.

Table 9 and Figure 18 show that Big Dry Creek would have difficulty meeting this interim value from below the Broomfield WWTP to the South Platte River, with the median phosphorus concentration during 2019 ranging from 0.09 to 0.36 mg/L at locations in this reach. Figures 19a-d provide boxplots of annual total phosphorus concentrations over time at selected monitoring locations upstream of the Broomfield WWTP (bdc1.5), below Broomfield's discharge (bdc2.0), below Westminster's discharge (bdc3.0), and in the agricultural area (bdc6.0). These figures show that locations upstream of the Broomfield WWTP can meet the interim total phosphorus value. Significant reductions in total phosphorus are evident beginning in 2010 below Broomfield's discharge. Significant reductions in total phosphorus below Westminster's discharge are evident beginning in 2009. Despite overall phosphorus reductions at both WWTPs (Figure 21 and Figure 22), median annual total phosphorus concentrations instream are still above the interim total phosphorus value from below the Broomfield WWTP to the confluence with the South Platte River.

Figure 18. Big Dry Creek 2019 Total Phosphorus

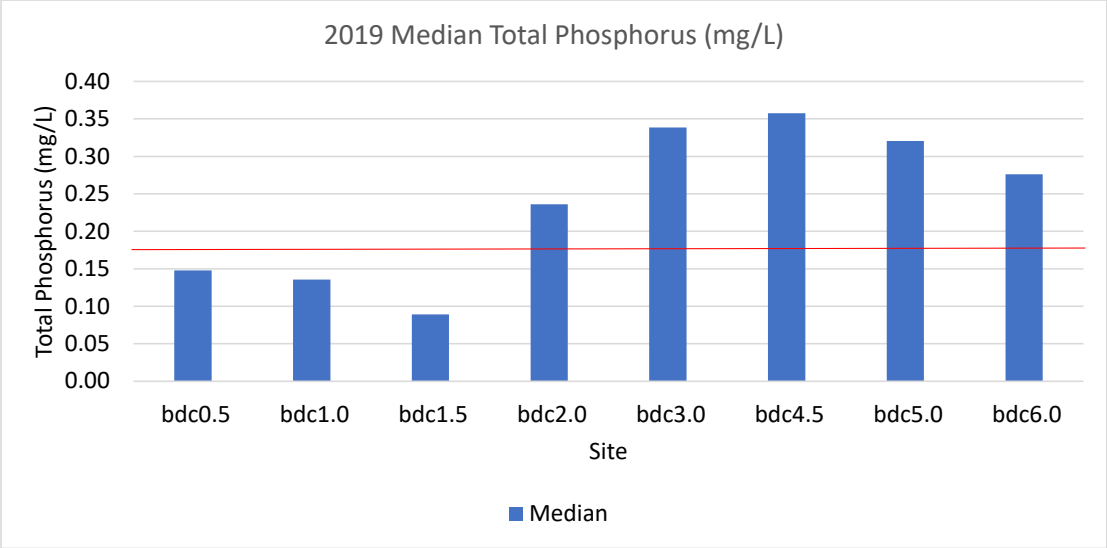
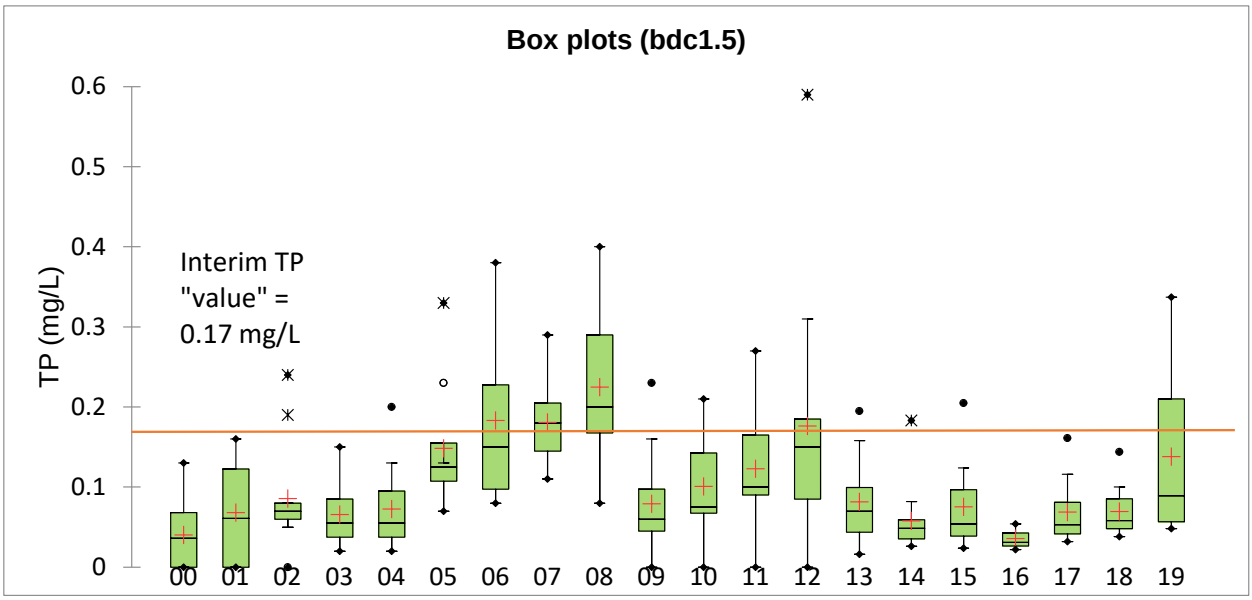


Table 9. Median Annual Total Phosphorus (mg/L) 1999-2019

Year	bdc0.5	bdc1.0	bdc1.5	bdc2.0	bdc3.0	bdc4.0/4.5	bdc5.0	bdc6.0
2000	0.00	0.07	0.04	0.43	1.85	1.60	1.45	1.25
2001	0.00	0.06	0.06	0.47	1.90	1.10	1.20	0.93
2002	0.00	0.06	0.07	1.20	2.25	1.50	1.80	1.60
2003	0.04	0.04	0.05	0.75	2.25	1.55	1.40	1.15
2004	0.04	0.05	0.05	0.23	1.75	1.15	1.10	0.94
2005	0.09	0.12	0.12	1.32	2.54	1.68	1.68	1.40
2006	0.12	0.13	0.15	0.48	2.04	1.38	1.30	1.13
2007	0.12	0.16	0.18	0.85	2.21	1.24	1.29	1.23
2008	0.14	0.23	0.20	0.90	1.73	1.18	1.10	1.22
2009	0.03	0.07	0.06	0.84	0.76	0.57	0.77	0.60
2010	0.06	0.09	0.08	0.13	0.34	0.31	0.33	0.44
2011	0.07	0.10	0.10	0.17	0.55	0.49	0.32	0.49
2012	0.11	0.13	0.15	0.27	0.96	0.85	0.68	0.62
2013	0.04	0.07	0.07	0.27	0.78	0.64	0.52	0.48
2014	0.04	0.04	0.05	0.48	0.52	0.63	0.58	0.53
2015	0.04	0.09	0.05	0.20	0.66	0.50	0.45	0.55
2016	0.04	0.06	0.03	0.21	0.72	0.68	0.56	0.43
2017	0.08	0.06	0.05	0.30	0.99	0.78	0.64	0.55
2018	0.05	0.07	0.06	0.16	0.36	0.46	0.35	0.40
2019	0.15	0.14	0.09	0.24	0.34	0.36	0.32	0.28

Red-shaded cells exceed the interim value of 0.17 mg/L total phosphorus.

Figure 19 (a-d). Total Phosphorus over Time at Selected Big Dry Creek Monitoring Locations



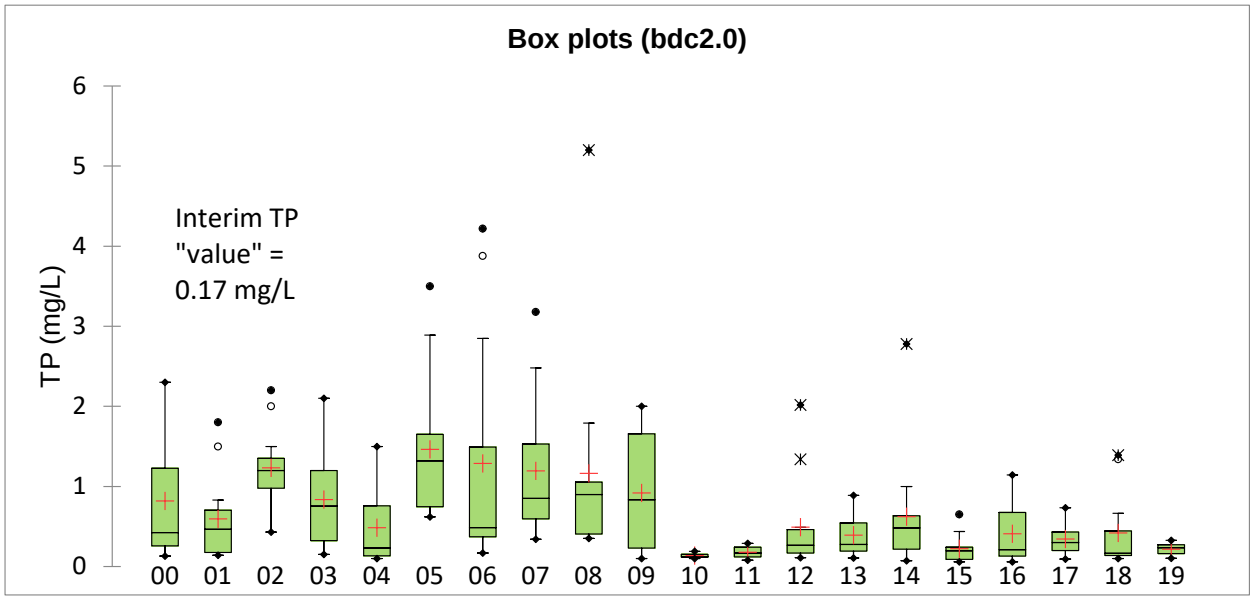
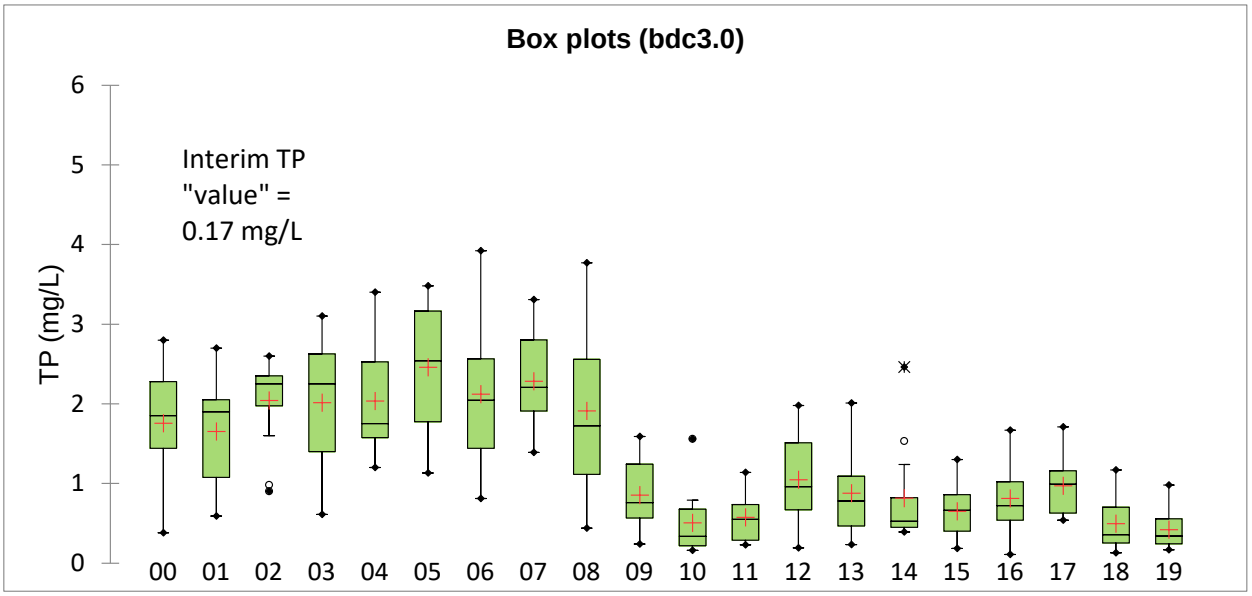


Figure 19 (a-d) (cont). Total Phosphorus over Time at Selected Big Dry Creek Monitoring Locations



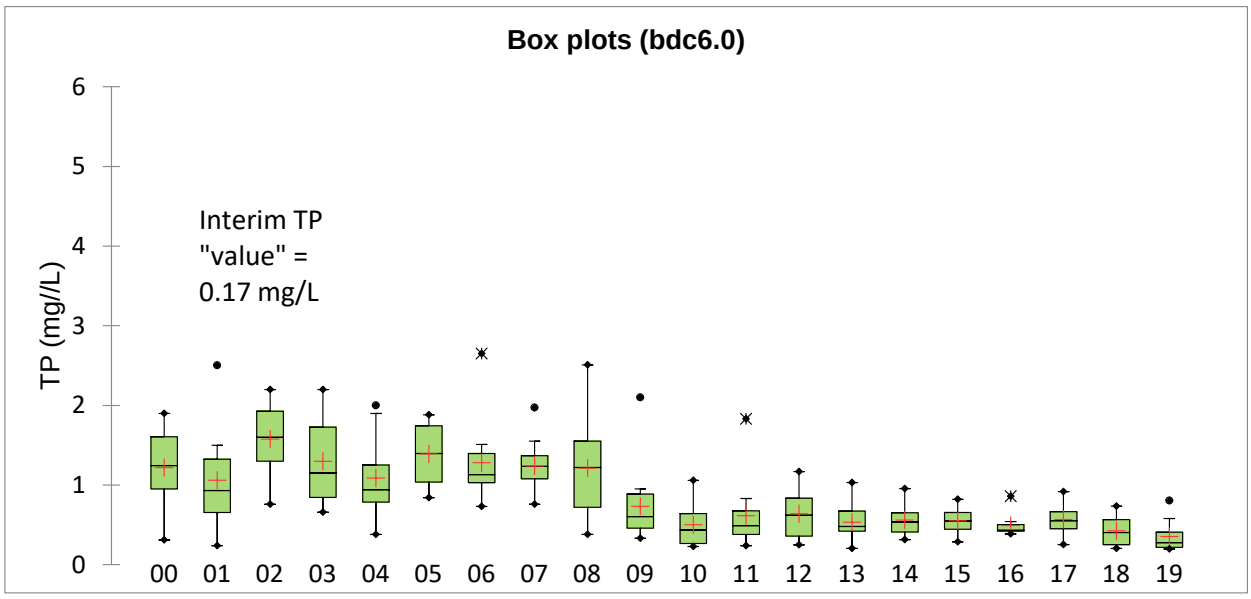


Figure 20. Decreases in Total P Concentrations in Broomfield WWTP Discharge (2002-2019)

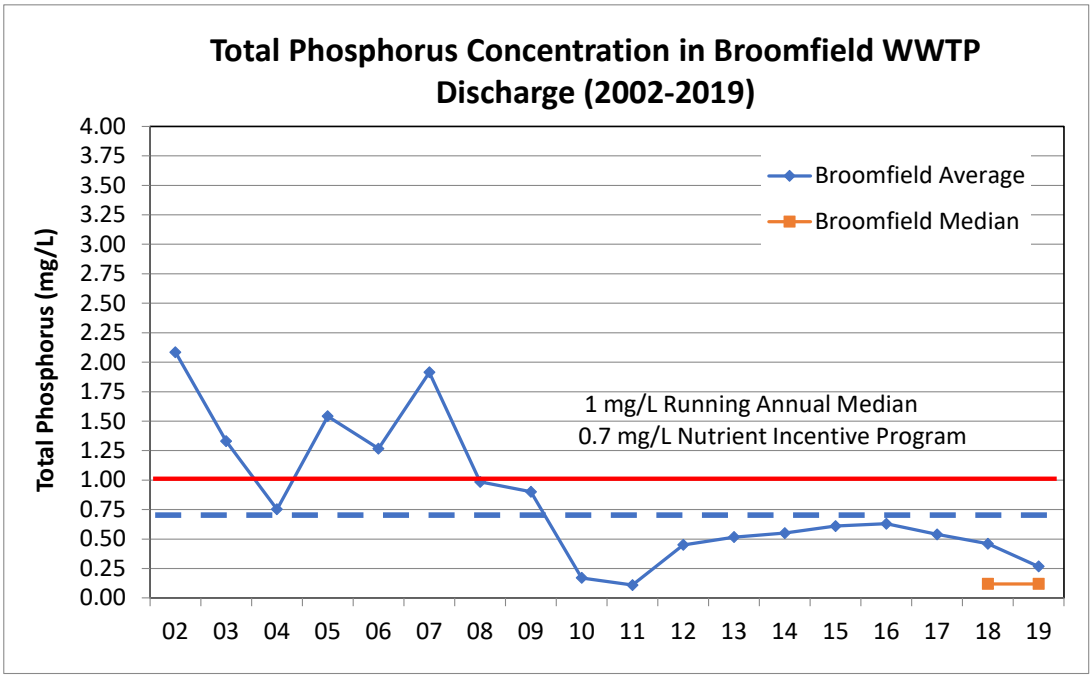


Figure 21. Decreases in Total P Concentrations in Westminster WWTP Discharge (2004-2019)

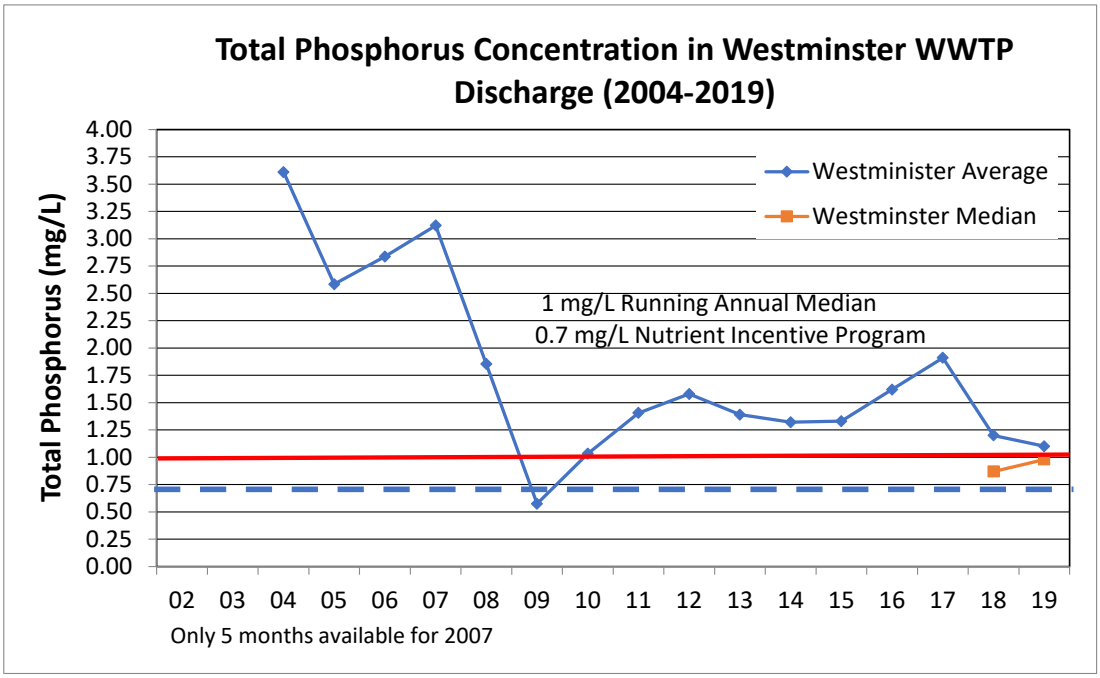


Figure Note: Medians are calculated for the past two years because this statistic forms the basis for accrual of additional compliance schedule time under the Voluntary Nutrient Incentive Program. Both WWTPs attain the 0.7 mg/L total phosphorus target under this program.

Phosphorus in Relation to Barr-Milton TMDL

The Barr-Milton Watershed Association (BMW) is addressing pH exceedances and low dissolved oxygen in the Barr-Milton reservoir system. These pH exceedances and low dissolved oxygen are attributed to excessive algal growth caused by nutrient loading, specifically phosphorus. BMW has established a database for modeling conditions in the reservoirs and has included water quality data from Big Dry Creek, as well as many other tributaries upstream of the Barr-Milton system. BDCWA representatives have participated in various aspects of the BMW effort over the years. In August 2009, AECOM released the final report titled "Watershed and Lake Modeling for a TMDL Evaluation of Barr Lake and Milton Reservoir," which forms the underlying basis for the TMDL.[7] In July 2013, EPA approved the Barr-Milton TMDL for pH and DO, which is focused on controlling phosphorus loads to the reservoirs. In the final TMDL, Big Dry Creek was identified as contributing approximately 5.9 percent of the phosphorus loading to Milton Reservoir. Big Dry Creek has been targeted for a 20 percent total phosphorus load reduction from 2,301 kg/yr down to 1,840 kg/yr (Integral 2011).[8] Because Big Dry Creek is identified as a nonpoint source of loading, "application of BMPs to the greatest extent feasible" is the recommended approach for achieving these reductions.

As a result of the Barr-Milton TMDL process, BDCWA reviewed phosphorus data collected along Big Dry Creek, with primary focus on monitoring station bdc6.0, which is the downstream-most instream monitoring location on Big Dry Creek in the agricultural portion of Weld County. Although instantaneous flow measurements are conducted by BDCWA on a monthly basis, the USGS Fort Lupton gauging station is combined with the bdc6.0 water quality data to estimate loads because the USGS gauge provides a more comprehensive data set. Table 10 and Figure 22 summarize changes in total phosphorus concentrations at bdc6.0 over time, indicating total phosphorus concentration reductions on the order of 73 percent since 2003 and 68 percent since 2004. Total phosphorus load reductions for the overall watershed (based on bdc6.0) over time are also shown in Figure 22. Although phosphorus concentrations remained relatively constant from 2013 to 2017, phosphorus loads varied during that time period due to fluctuating flow

[7] In 2019, BMW began updating this model. BDCWA provided data to the BMW Association to support the model update. With the floods of 2013 and recent phosphorus treatment at Metro Wastewater, phosphorus concentrations in both Barr and Milton Reservoirs are at about half of the 2003-04 concentrations. BMW is also working on calculating recent annual loads from various different sources (Personal Communication with Steve Lundt, April 5, 2019). As of 2020, BMW is still working with modelers to resolve several issues on the model update. The WASP and SWAT models were run against 2013-2017 dataset but did not follow the actual patterns of the empirical (real) data. BMW is attempting to run the models separately to see how they compare to other data points. Over the last four years, BMW have removed over 6,000 carp from Barr Lake. More details are at www.barr-milton.org (Personal Communication with Steve Lundt, June 25, 2020).

[8] This load reduction applies to the portion of the Big Dry Creek load that enters Milton Reservoir, which is a significantly smaller load than occurs at bdc6.0.

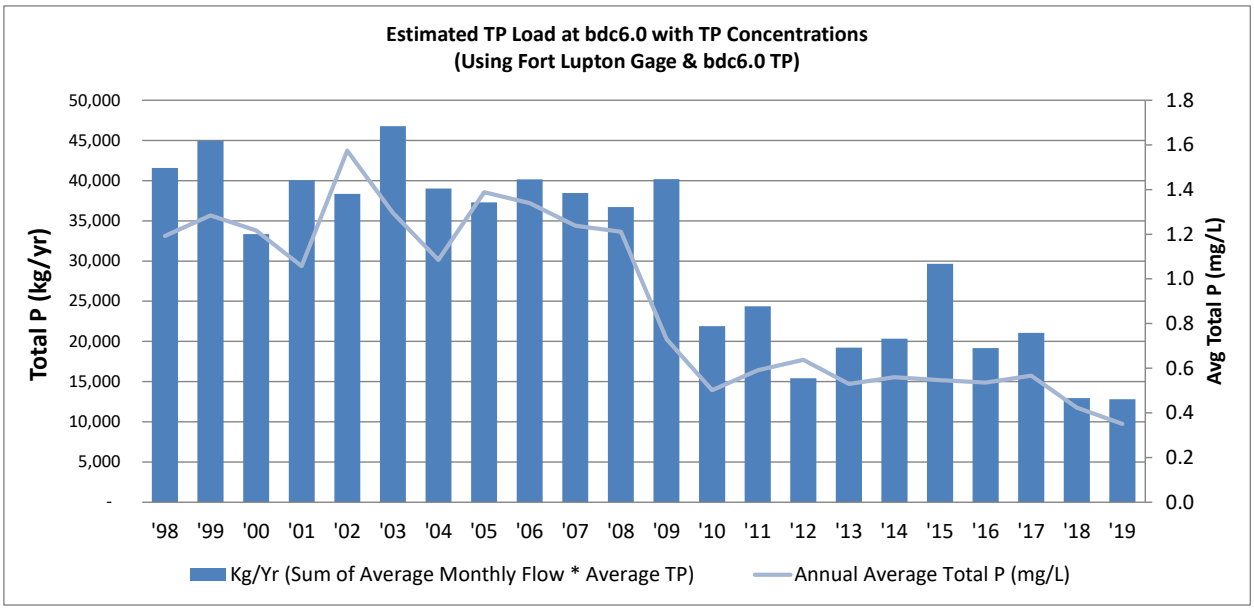
volumes. During 2018-2019, phosphorus loads were similarly low, with both years showing phosphorus concentration reductions during these years.

Table 10. Total Phosphorus Concentrations at bdc6.0 (2003-2019)

Year	No. of Samples	Median	Mean	Min.	Max.	25th Percentile	75th Percentile
2003	12	1.15	1.30	0.66	2.20	0.85	1.73
2004	12	0.94	1.08	0.38	2.00	0.78	1.25
2005	12	1.40	1.39	0.84	1.88	1.04	1.75
2006	11	1.13	1.28	0.73	2.65	1.03	1.39
2007	12	1.23	1.24	0.76	1.97	1.08	1.37
2008	12	1.22	1.21	0.38	2.51	0.72	1.55
2009	12	0.60	0.73	0.33	2.10	0.46	0.89
2010	12	0.44	0.50	0.23	1.06	0.27	0.64
2011	11	0.49	0.62	0.24	1.83	0.38	0.68
2012	12	0.62	0.64	0.25	1.17	0.36	0.84
2013	12	0.48	0.53	0.20	1.03	0.42	0.67
2014	12	0.53	0.56	0.32	0.96	0.41	0.65
2015	12	0.55	0.55	0.29	0.82	0.45	0.66
2016	10	0.43	0.49	0.39	0.86	0.42	0.50
2017	12	0.55	0.57	0.25	0.92	0.45	0.66
2018	12	0.40	0.42	0.21	0.73	0.25	0.57
2019	12	0.28	0.35	0.20	0.80	0.22	0.41
% Reduction in P (mg/L) (2003 - 2019)		**76%**	**73%**				
% Reduction in P (mg/L) (2004 - 2019)		70%	68%				

Note: For 2016 data, May and December total phosphorus results were not available for use in these calculations.

Figure 22. Decreases in Total P Loads at bdc6.0 Plotted with Total P Concentration Data



Note: 2013 load estimate uncertain due to missing flow data following September Flood. The 2016 load estimate is uncertain due to missing phosphorus results for May and December 2016. Estimated phosphorus concentrations were substituted for those months for purposes of an annual load estimate.

Several additional observations related to the volume-related component of phosphorus load reductions include:

- In addition to phosphorus concentration reductions at the Broomfield and Westminster WWTPs, both cities have implemented significant reclaimed water programs, which help to manage nutrient loading to Big Dry Creek. Factors such as population growth and demand for reclaimed water affect volumes discharged. The current and future effects of reclaimed water programs have not been fully evaluated for purposes of this report but are important considerations should more in-depth analysis be conducted related to Big Dry Creek phosphorus loading to the South Platte River.

- Historically, Northglenn has discharged infrequently to Big Dry Creek, however, during 2015 through 2019, Northglenn discharged to Big Dry Creek much more frequently. These discharges represent a new source of phosphorus loads to Big Dry Creek relative to the 2003-2004 baseline conditions used in the Barr Milton TMDL.

- As illustrated in Figure 34 (later in this report), the hydrology of Big Dry Creek is highly managed and complex. Future evaluation of measures to reduce phosphorus loading from Big Dry Creek must consider these complexities. Other hydrology-related considerations include:

- It is important to be aware that bdc6.0 is located upstream from the USGS gauge. Instantaneous flow measurements at bdc6.0 and the average daily flow measurements at the USGS Fort Lupton gauge vary substantially. On average, flows at the USGS gauge are approximately 20 percent higher than measured flows at bdc6.0; however, there is large variation in the magnitude of the difference between individual pairs of flow measurements.

- It is important that the water quality sample location used for modeling Big Dry Creek phosphorus contributions to the South Platte River be located upstream of the Lupton Bottoms ditch discharge to Big Dry Creek. Sampling location bdc6.0 is upstream of Lupton Bottoms, but Metro Wastewater Reclamation District also collects water quality samples below Lupton Bottoms ditch, which may be influenced by South Platte water discharged from the Lupton Bottoms ditch to Big Dry Creek.

TEMPERATURE

The currently applicable classification for temperature standards on Big Dry Creek is Warm Stream Tier I (WS-I), due to the presence of the Johnny darter in some locations in the upper portion of the stream. Attainment of standards is assessed based on comparison of the maximum weekly average temperature (MWAT) and daily maximum (DM) temperature to seasonal temperature standards established for March-November and December-February. Values above these standards are allowed under these conditions:

- The DM may exceed the acute temperature standard once every three years. The DM means the highest two-hour average water temperature recorded during a given 24-hour period.

- The MWAT may exceed the chronic standard once every three years (1E3). The MWAT is calculated as the largest mathematical mean of multiple, equally spaced, daily temperatures over a seven-day consecutive period, with a minimum of three data points spaced equally through the day.

- Values measured during conditions meeting air temperature, low-flow, winter "shoulder season" or "warming event" excursion criteria in Regulation 31 and the 2018 303(d) Listing Methodology are not considered exceedances.

The CWQCD determines whether temperature limits are to be included in permits in accordance with the Basic Standards 31.14(14) "Integration into Discharge Permits." Currently, the municipal WWTP dischargers to Big Dry Creek are required to "report only" under terms of the 2019 permits, but temperature limits are anticipated in the next permit renewals. Additional instream monitoring data have been collected at several instream locations in support of this effort using

HOBO data loggers recording temperature measurements at 15-minute intervals. For a more robust evaluation of temperatures on Big Dry Creek in the vicinities of the WWTP discharges, 15-minute incremental temperature data collected as part of CDPS DMRs for each WWTP should be obtained and reviewed but is beyond the scope of this report.

MACROINVERTEBRATE DATA AND MMI ANALYSIS

BDCWA conducts a biennial macroinvertebrate monitoring program during the month of October in even years. This section provides a summary of multi-metric index (MMI) results for macroinvertebrate data collected in the fall of 2012, 2014, 2016 and 2018 for the aquatic monitoring program on Big Dry Creek. Analysis in this section was provided by Aquatics Associates, Inc., with more detailed information for fish, macroinvertebrates, and habitat available in biennial reports completed by Aquatics Associates (2014, 2019a, 2019b), along with a forthcoming report addressing sampling conducted during 2018.

Background on Aquatic Life Use Attainment Policy 10-1

The CWQCC adopted Policy 10-1 on October 12, 2010 (CWQCC 2010), which provides for the evaluation of the biotic integrity of streams through use of a multi-metric index (MMI) calibrated for the State of Colorado (Jessup 2010). Policy 10-1 was updated on August 7, 2017 (CWQCC 2017) and included a recalibration of the MMI (Jessup and Stribling 2017). This recalibration resulted in a different algorithm used in the CWQCD's Ecological Data Application System (EDAS) to calculate the MMI, as well as different attainment and impairment thresholds for determining attainment and impairment.

EDAS (Version 4.0 CO) was used to calculate MMI and other metrics for the Big Dry Creek analysis summarized below. Application of this method requires the collection and analysis of benthic macroinvertebrate samples according to Policy 10-1 protocols (CWQCC 2017). Use-attainment thresholds have been established for three separate stream biotypes which include Transition (Biotype 1), Mountain (Biotype 2), and Plains & Xeric (Biotype 3). The Big Dry Creek study sites are all designated as Biotype 3 per EDAS. The thresholds for Biotype 3 streams are MMI >42 for use attainment and MMI <29 for impairment. Class 1 streams (Cold or Warm) with MMI scores falling in between the attainment and impairment thresholds require additional analysis using two auxiliary metrics: the Hilsenhoff Biotic Index (HBI) and the Shannon Diversity Index (SDI). Also, MMI scores >51 for Biotype 3 streams indicate a high scoring water (HSW) and any drop in HSW scores of 22 points or more for samples collected 12 or more months apart within a 5-year span of time may indicate impairment. Failure to meet use attainment thresholds for streams in their particular biotype may result in the affected segment(s) being listed as provisionally impaired for aquatic life on the 303(d) List. For differing MMI scores on the same representative segment taken in different calendar years, the most recent MMI score is used in the impairment listing decision. The representative nature of all aquatic life data is to be considered before listing

decisions are made. Clear and convincing evidence is required to show impairment (CWQCC 2018).

Big Dry Creek MMI Results

Results of the MMI analyses for the macroinvertebrate samples collected at the six BDC sites in the fall of 2012, 2014, 2016 and 2018 are presented in Table 11 and Figure 23. The changes to EDAS in 2018 and the new Warm Water 1 stream classification required re-evaluation of historic data presented in previous annual reports; therefore, previous tabulations of these data sets will show different results. As described above, the main difference in evaluation methodology for Class 1 and Class 2 streams is that MMI values between the attainment (MMI = 42) and impairment (MMI = 29) thresholds require evaluation of two auxiliary metrics (the HBI and SDI). If either the SDI is >7.6 or the HBI is < 2.4 for values in the "grey zone", then the stream is considered impaired for aquatic life under Policy 10-1.

All samples for the four years met or were better than the impairment threshold (MMI score of 29) with the exception of bdc5.0 in 2016. No consistent upward or downward trends were noted. All sites attained the HBI and SDI thresholds for these four sampling years.

During 2016, the MMI at bdc5.0 was the lowest on record; however, field observations did not identify unusual conditions that would be contributing to these scores. Preliminary review of the raw data suggested that the score may be due in part to relatively high numbers of aquatic worms (Personal Communication with Tami Schneck, 2017).

Based on the MMI results for the six sampling sites for the four most recent years analyzed, the aquatic macroinvertebrate community in Big Dry Creek is generally healthy and meets MMI use-attainment criteria for Aquatic Life Class 1 warm water streams. Additionally, the long-term data set demonstrates the significant year-to-year variability that can occur at individual sites. Although the last four sampling events show attainment (other than 2016), a retrospective analysis of the effects of a regulatory upgrade of the stream from Aquatic Life Warm 2 to Aquatic Life Warm 1 indicates an increase in frequency of impairment determinations using Policy 10-1 from 4% to 19% for the longer monitoring record.

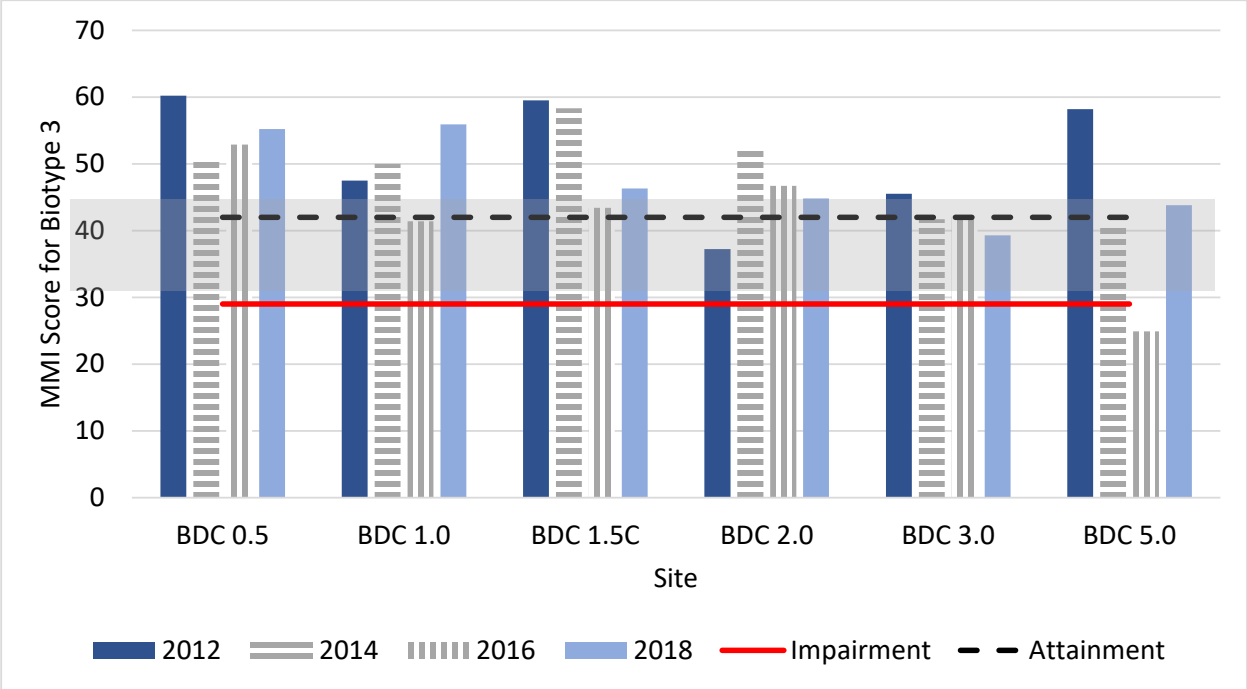
More detailed analysis of the 2018 monitoring is provided by Aquatics Associates and was presented to BDCWA at a public meeting in December 2019. A written report is anticipated later in 2020.

Table 11. Fall MMI Scores for Big Dry Creek Sites (2012-2018)
(Source: Aquatics Associates 2020)

MMI Scores				
Site	**2012**	**2014**	**2016**	**2018**
BDC 0.5	**60.2**	50.9	**52.9**	**55.2**
BDC 1.0	47.5	50	41.4	**55.9**
BDC 1.5C	**59.5**	**58.3**	43.4	46.3
BDC 2.0	37.2	**52.4**	46.7	44.8
BDC 3.0	45.5	41.7	42	39.3
BDC 5.0	**58.2**	41.1	24.9	43.8
SDI Scores				
Site	**2012**	**2014**	**2016**	**2018**
BDC 0.5	4.18	3.58	3.76	3.58
BDC 1.0	3.82	3.69	4.11	4.10
BDC 1.5C	2.99	3.83	3.71	3.44
BDC 2.0	2.84	3.75	3.62	3.74
BDC 3.0	3.54	4.11	3.13	3.73
BDC 5.0	3.76	3.30	2.27	3.56
HBI Scores				
Site	**2012**	**2014**	**2016**	**2018**
BDC 0.5	6.04	5.75	6.21	6.02
BDC 1.0	6.52	6.20	6.17	6.21
BDC 1.5C	6.84	6.90	6.75	7.14
BDC 2.0	7.16	6.47	6.74	7.07
BDC 3.0	8.22	7.25	8.10	7.20
BDC 5.0	6.60	5.73	8.47	6.52

Notes: Red-shaded MMIs are below the impairment threshold. Yellow-shaded cells are between attainment and impairment thresholds and require evaluation of auxiliary metrics for assessment. Bold MMI scores indicate High Scoring Water (MMI >51 for Biotype 3). MMI Impairment threshold for Warm Water Class 1 streams is <22. SDI scores >2.4 and HBI scores <7.6 are thresholds for evaluation of auxiliary metrics for "grey zone" MMI scores.

Figure 23. Biennial Big Dry Creek MMI Scores (2012-2018)



FLOW CONDITIONS

The hydrology of Big Dry Creek is discussed below in terms of: 1) annual streamflows relative to period of record, 2) WWTP discharges, and 3) seasonal variation related to release and diversion patterns.

Stream Flows

Stream gauges are managed by several entities in the watershed. A discussion of USGS gauges and a Colorado Division of Water Resources gauge are discussed further below.

USGS Stream Flow Measurements for 2019

USGS mean daily discharge data for the Westminster and Fort Lupton gauges are shown in Figures 24 and 25. Figures 26 and 27 identify peak stream flows for the period of record at both gauges. Figures 28 and 29 show a comparison of monthly flows at both gauges for selected years and periods of interest. Figure 30 shows the average annual streamflows at both gauges.

During 2019, average daily flows at the Westminster gauge ranged from 0.2 cubic feet per second (cfs) to 126 cfs with an average of 12.2 cfs. Average daily flows for the Fort Lupton gauge data ranged from 7.9 cfs to 158 cfs with an average of 38.1 cfs. Peak flows at both gauges were within historic ranges (Figures 26 and 27).

Figure 24. Mean Daily Discharge at USGS Gauge Big Dry Creek at Westminster, CO

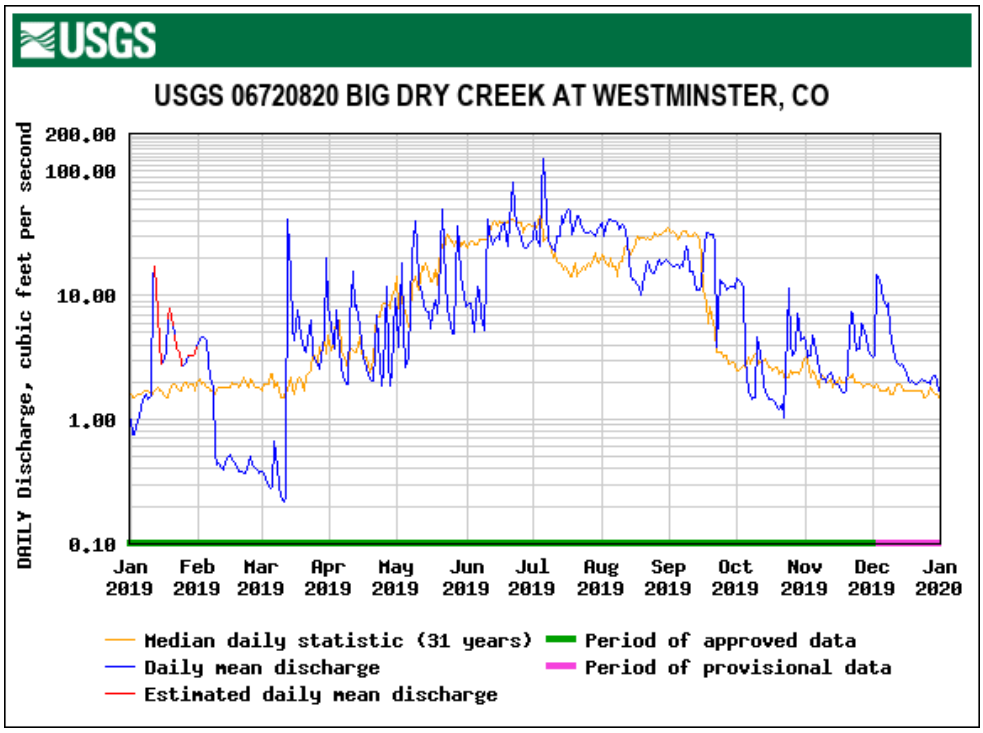


Figure 25. Mean Daily Discharge at USGS Gauge Big Dry Creek at Fort Lupton, CO

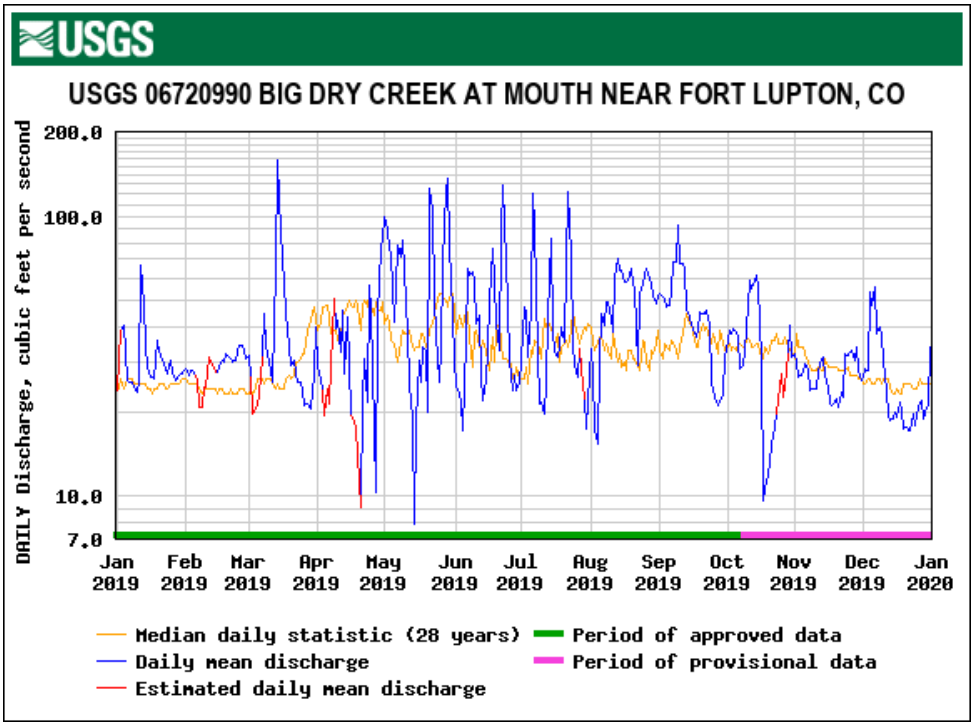


Figure 26. Annual Peak Streamflow at USGS Gauge Big Dry Creek at Westminster

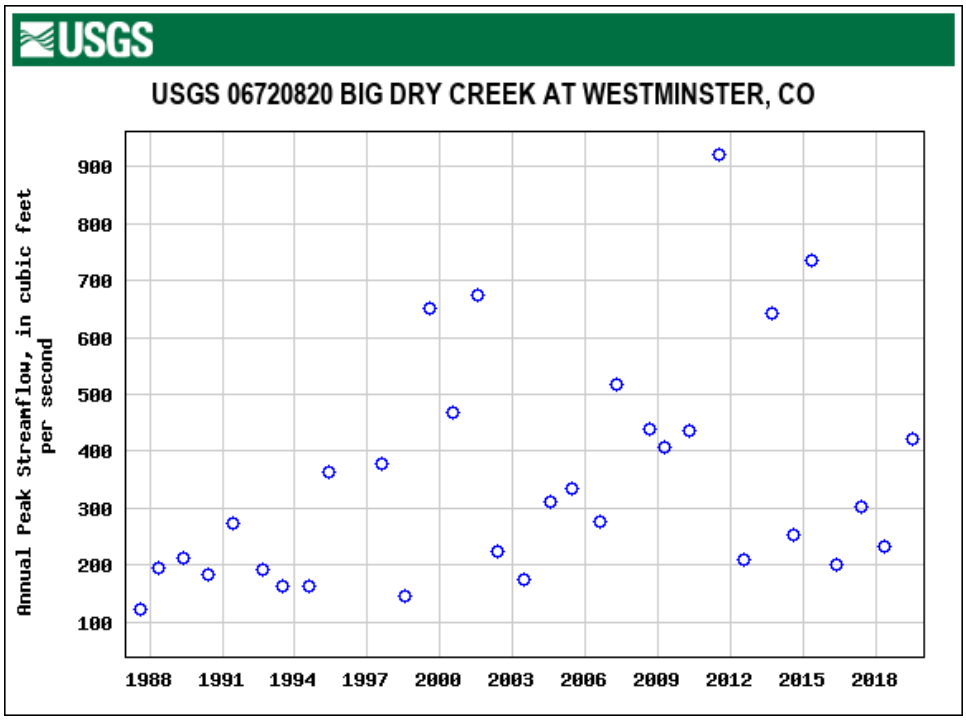


Figure 27. Annual Peak Streamflow at USGS Gauge Big Dry Creek at Fort Lupton

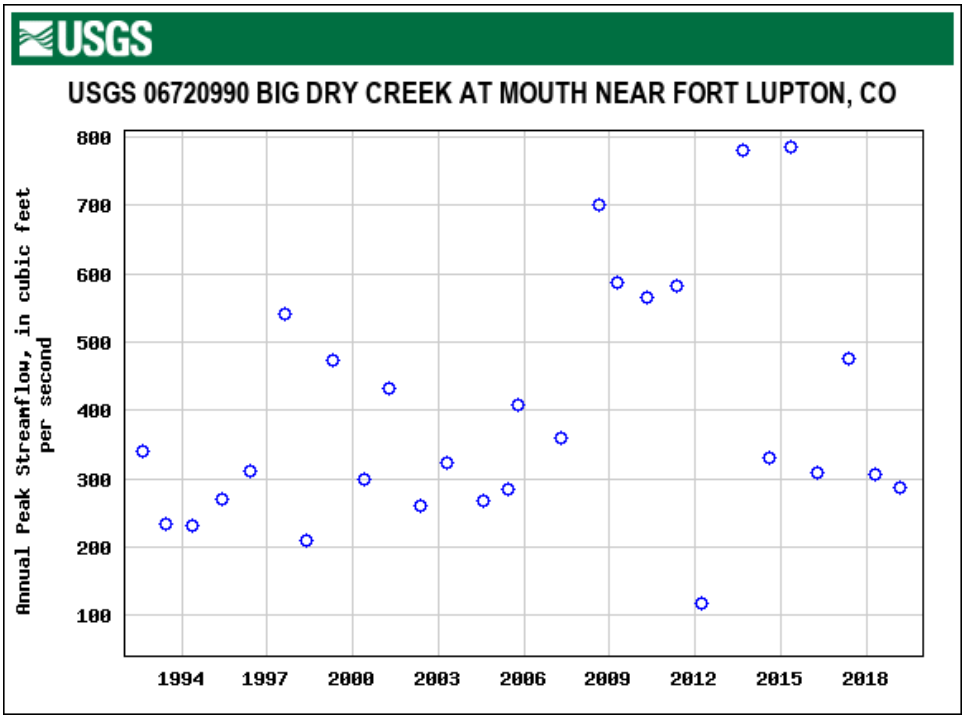


Figure 28. Comparison of Monthly Flows at USGS Westminster Gauge for Selected Years

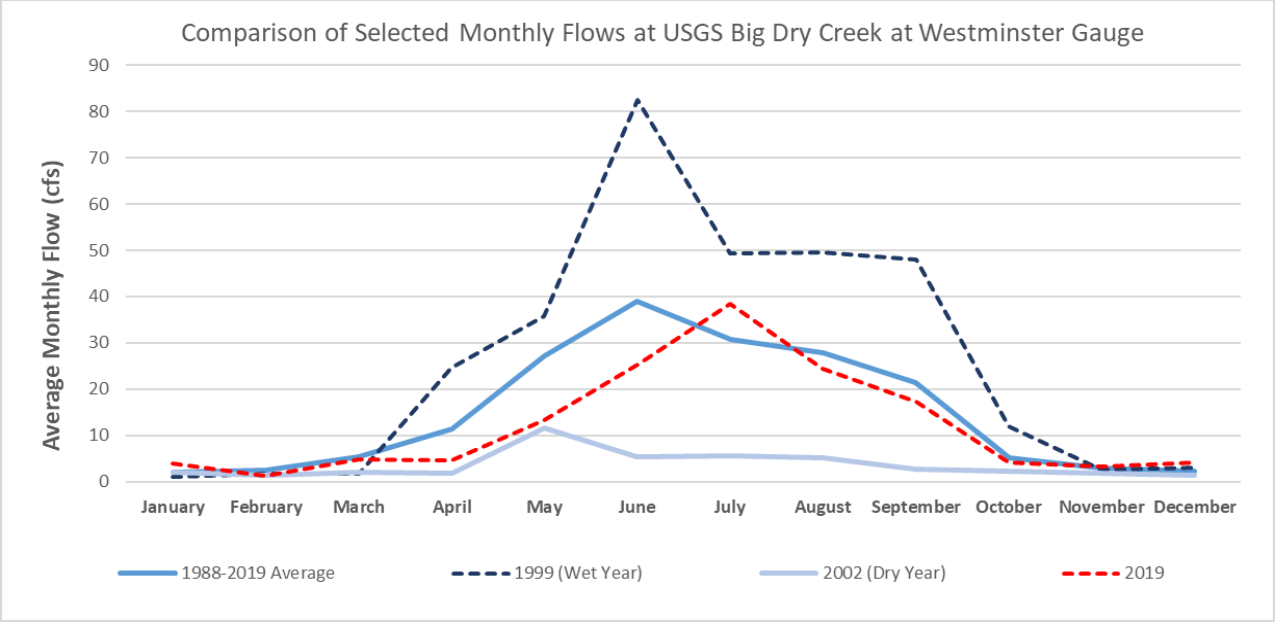


Figure 29. Comparison of Monthly Flows at USGS Fort Lupton Gauge for Selected Years

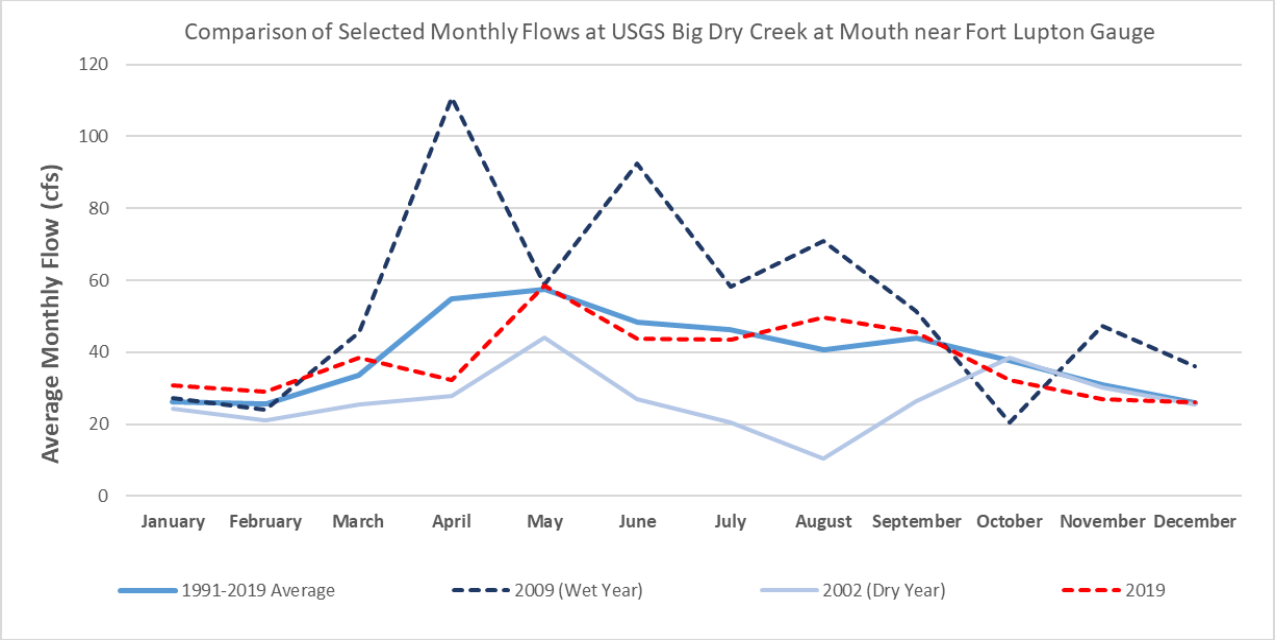
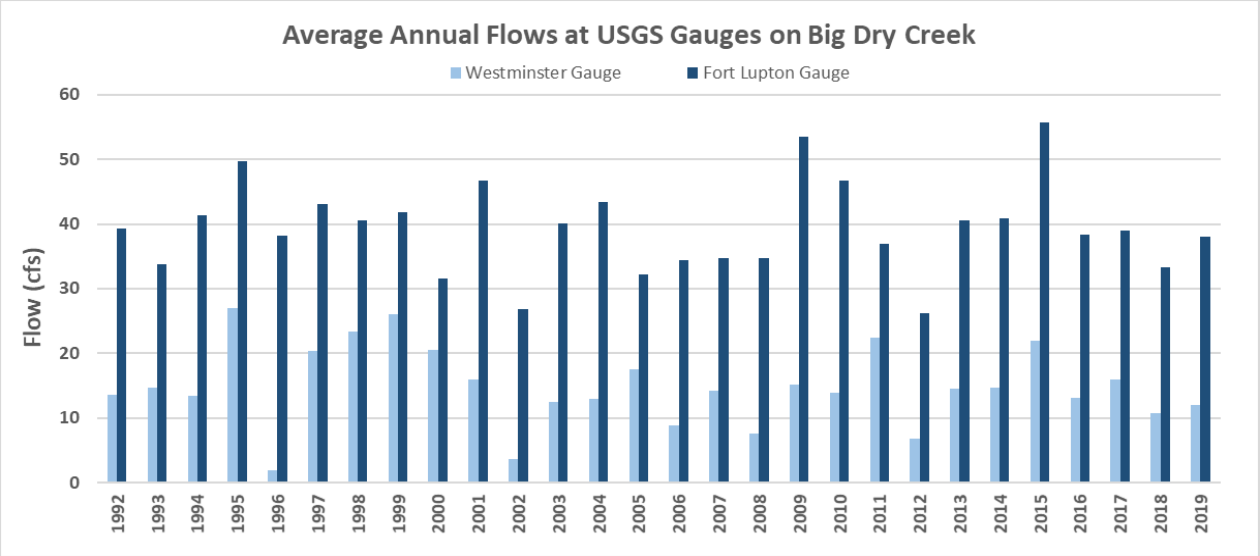


Figure 30. Average Annual Streamflows Measured at USGS Gauges



Note: Some data missing at Ft. Lupton gauge in December 2013 due to ice.

Colorado Division of Water Resources Stream Flow Measurements for 2019

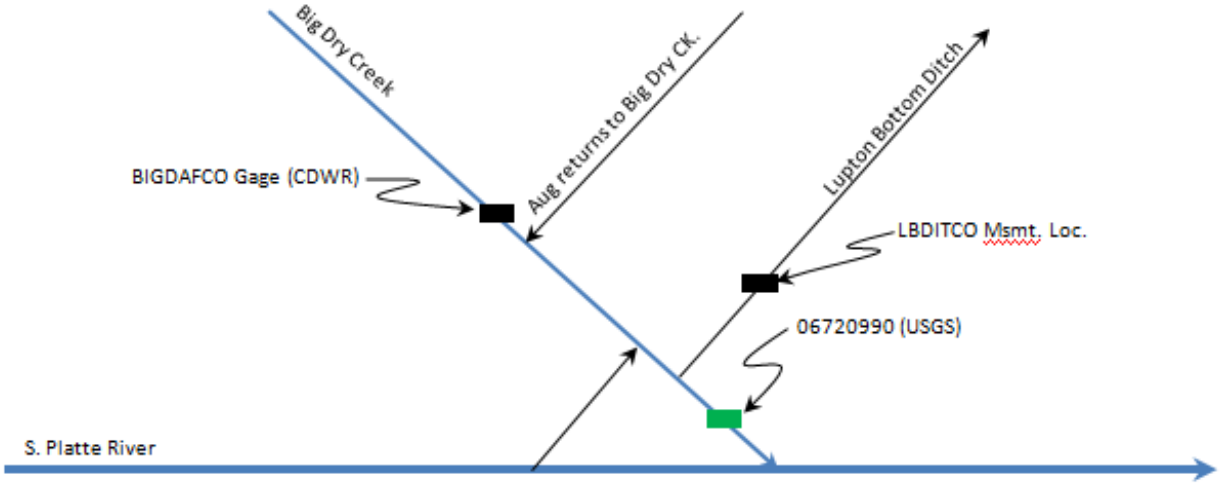
Although BDCWA has historically used the two USGS stream gauges on Big Dry Creek for purposes of analysis in this annual report, other gauge data are available for various locations on Big Dry Creek. These locations include four relatively new (<10 years old) gauges operated by Northern Water, which are still not yet providing routine data. A flood alert gauge was installed by Urban Drainage and Flood Control District near I-25 and Thorn Creek golf course, but it is not calibrated to measure baseflow conditions.

Another gauge is operated by the Colorado Division of Water Resources (CDWR) and is named Big Dry Creek Near Ft. Lupton, CO (BIGDAFCO). BIGDAFCO is located approximately 3.8 stream miles upstream of the USGS's 06720990 Big Dry Creek at Fort Lupton stream gauge.[9] Between the two gauges, several notable hydrologic influences occur (Figure 31), including augmentation returns to Big Dry Creek, a diversion off of the South Platte River to Big Dry Creek and a diversion from Big Dry Creek to the Lupton Bottoms Ditch. Additionally, there are irrigation tail waters accruing to the system in the intervening reach due to irrigation practices as well as percolation return flows from irrigation. The Lupton Bottoms diversion is situated in such a way that it can receive water from both Big Dry Creek and the South Platte River. The Lupton Bottoms Ditch has a diversion structure on the South Platte River which diverts water to Big Dry Creek. Below this confluence point, another diversion structure diverts water from Big Dry Creek into their ditch system. Regardless of the irrigation waters returning to the system between the two gauge sites,

[9] Metro Wastewater's instream monitoring location "BDC" is located 30-50 yards upstream of BIGDAFCO.

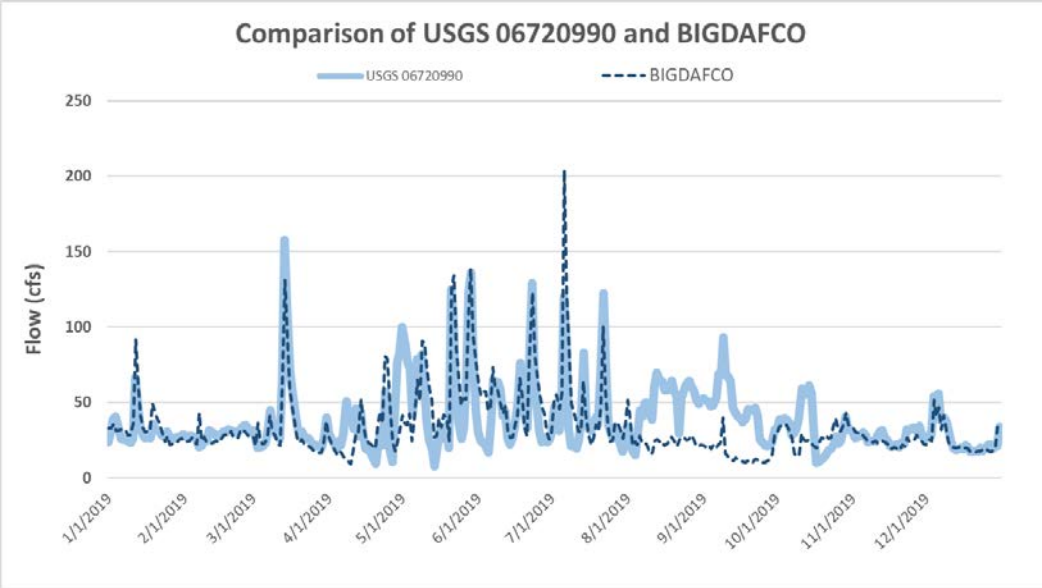
the interactions among the Lupton Bottoms ditch, the South Platte River and Big Dry Creek cause significant and regular differences in flows measured by CDWR and the USGS (Figure 32).[10] (Personal Communication with Russel Stroud, CDWR).

Figure 31. Relationship between BIGDAFCO and USGS 06720990
(Source: Russell Stroud, CDWR)



[10]CDWR recently relocated the BIGDAFCO stream gauge slightly downstream from its historic location. This relocation was done to address several issues including aging infrastructure, damage incurred to the gauge by the 2013 flood event and frequent and regular backwater conditions due to debris as a result of farming and ranching practices in the immediate vicinity of the old gauge location.

Figure 32. Comparison of Colorado Division of Water Resources and USGS Gauge Measurements for 2019



Wastewater Treatment Plant Discharges

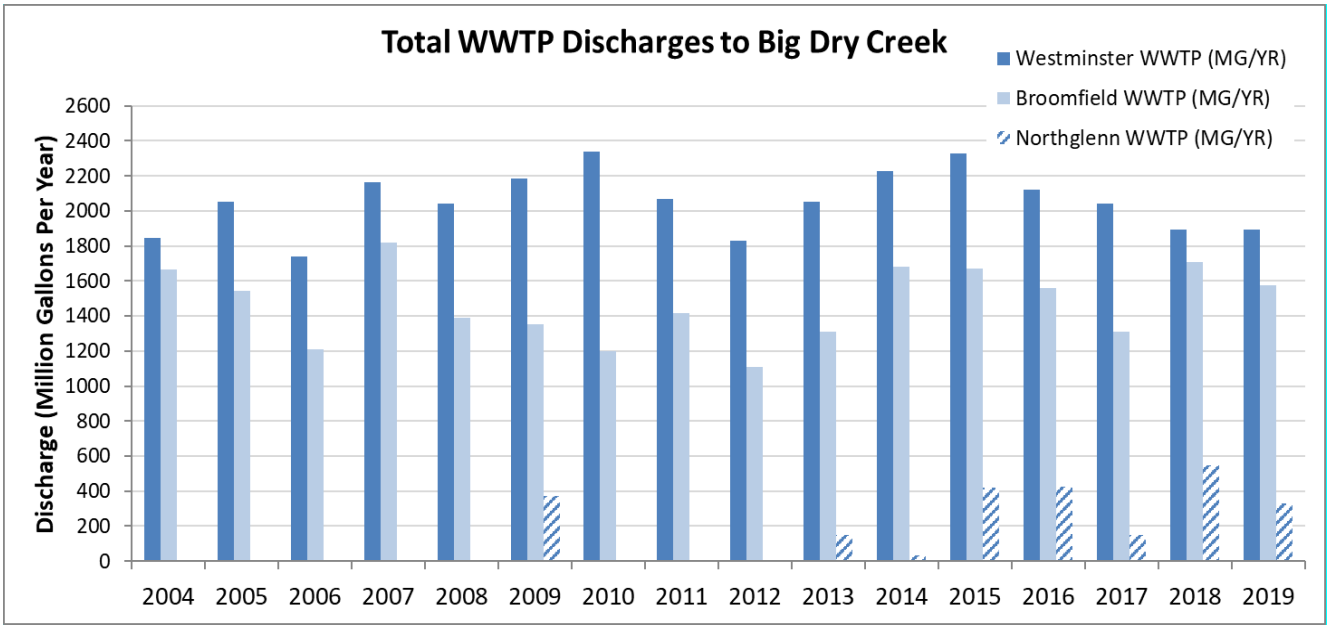
Table 12 and Figure 33 summarize total annual WWTP discharges to Big Dry Creek over time for the Westminster, Broomfield and Northglenn WWTPs since 2004. Through implementation of reclaimed water programs, both Broomfield and Westminster have been working to limit or reduce discharges to Big Dry Creek. The volume of wastewater discharged is a critically important component in determining nutrient loading to the stream. For purposes of the Barr-Milton TMDL load reduction objectives, the year 2004 is the baseline year for measuring progress relative to the TMDL. Thus, volume changes relative to 2004 can affect overall nutrient loading relative to the TMDL.

Table 12. Annual WWTP Discharges to Big Dry Creek

	Westminster WWTP (MG/YR)	Broomfield WWTP (MG/YR)	Northglenn WWTP (MG/YR)
2004	1843	1663	NR
2005	2051	1545	NR
2006	1742	1211	NR
2007	2161	1817	NR
2008	2043	1392	NR
2009	2183	1355	374
2010	2337	1201	0
2011	2070	1418	0
2012	1827	1109	0
2013	2050	1310	151
2014	2229	1681	34
2015	2326	1668	420
2016	2123	1559	423
2017	2039	1309	147
2018	1891	1709	546
2019	1894	1576	331

NR = not reported for purposes of report; historically, Northglenn rarely discharged to Big Dry Creek.

Figure 33. Annual WWTP Discharges to Big Dry Creek



Seasonal Flow Regime

In 2011, an evaluation of Standley Lake discharges, irrigation diversions and WWTP discharges was completed for the 2005-2009 time period (WWE 2011). This evaluation was updated in 2018 as part of the ongoing BDCWA watershed plan update, with flows included through 2017. Figure 34 summarizes the primary hydrologic influences on Big Dry Creek, based on analysis of the most recent five years of data for 2013-2017. This analysis was not updated for purposes of this report, but will be updated periodically to support trend evaluation in the watershed.

Figure 35 and Figure 36 illustrate how sources of flows in the creek vary seasonally. Figure 35 illustrates months when the stream is dominated by releases from Standley Lake. Figure 36 illustrates the relative proportion of wastewater flows in the creek in the lower watershed seasonally. Key observations include:

- Significant seasonal variation in release patterns from Standley Lake is present in accordance with releases for irrigation purposes. During June through September, Standley Lake releases comprise 50 to 75 percent of the flows measured at the USGS Westminster gauge. During April, May and October the percent of instream flow from Standley releases is on the order of 5 to 10 percent of the flows at the Westminster gauge.

- With regard to relative percentages of WWTP discharges, during the winter months of December through March, WWTP flows comprise roughly 50 percent or more of the

flows present at bdc6.0. During the summer and fall months, WWTP flows are on the order of 25 to 40 percent of the flows at bdc6.0.

Variations in dominant sources of water in the creek during different seasons affect water quality conditions in the creek. For example, in the absence of Standley Lake releases, selenium, chloride, dissolved manganese, sulfate, total dissolve solids and other groundwater-related parameters may be elevated in the upper watershed. With regard to nutrient loading, it is important to recognize that winter months are dominated by wastewater contributions and relatively low flow conditions. Summer months have higher flows with lower relative contributions from wastewater.

Figure 34. Hydrologic Influences Affecting the Main Stem of Big Dry Creek

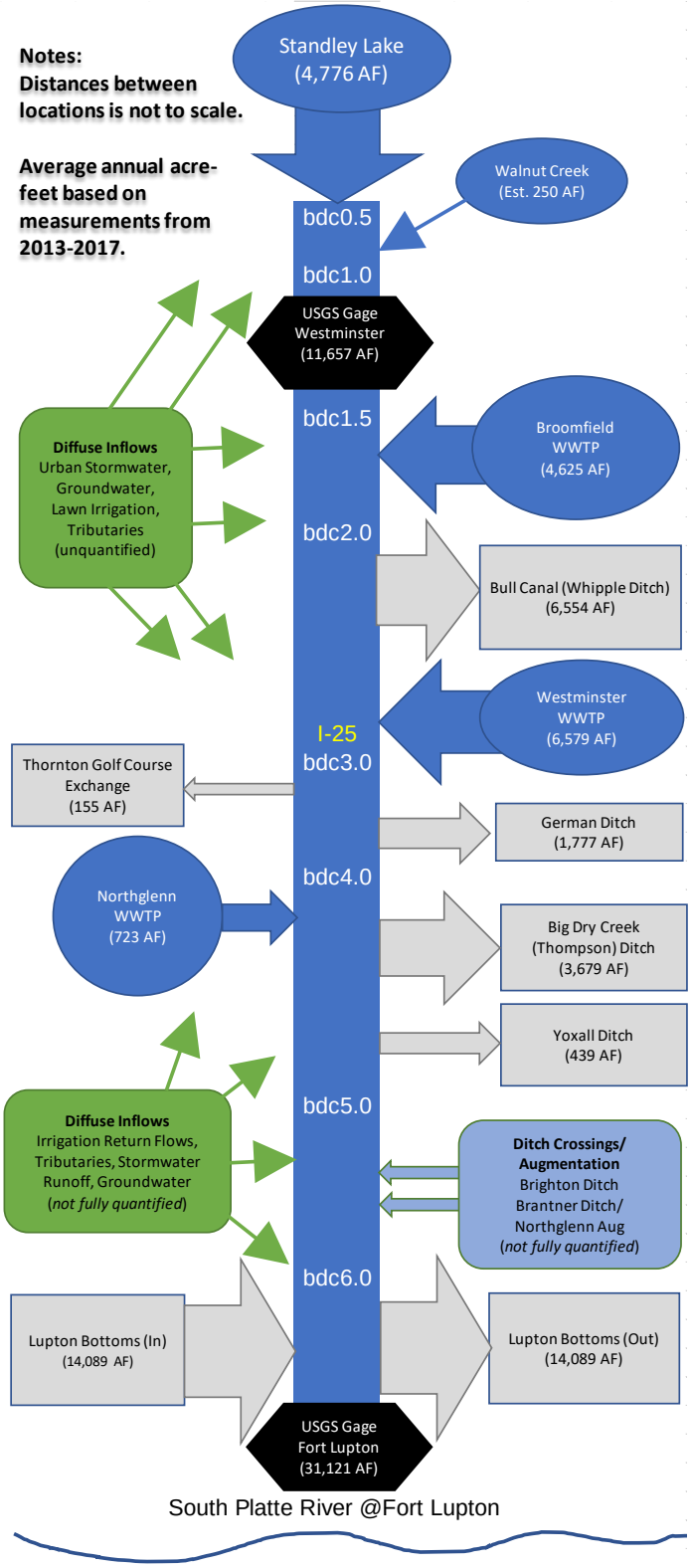


Figure 35. Average Monthly Percentage of Standley Lake Releases Relative to Big Dry Creek Flows at the USGS Westminster Gauge (2013-2017)

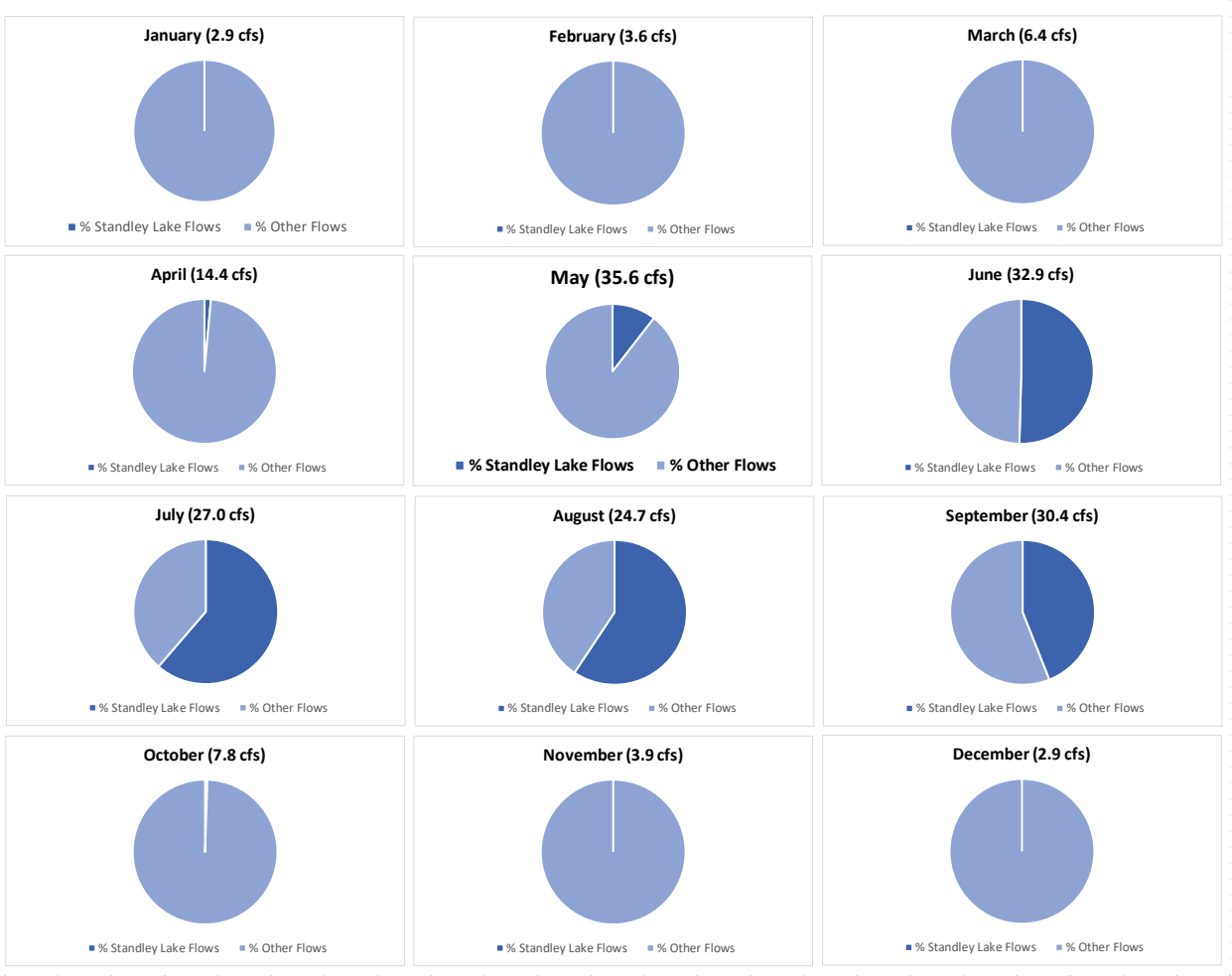
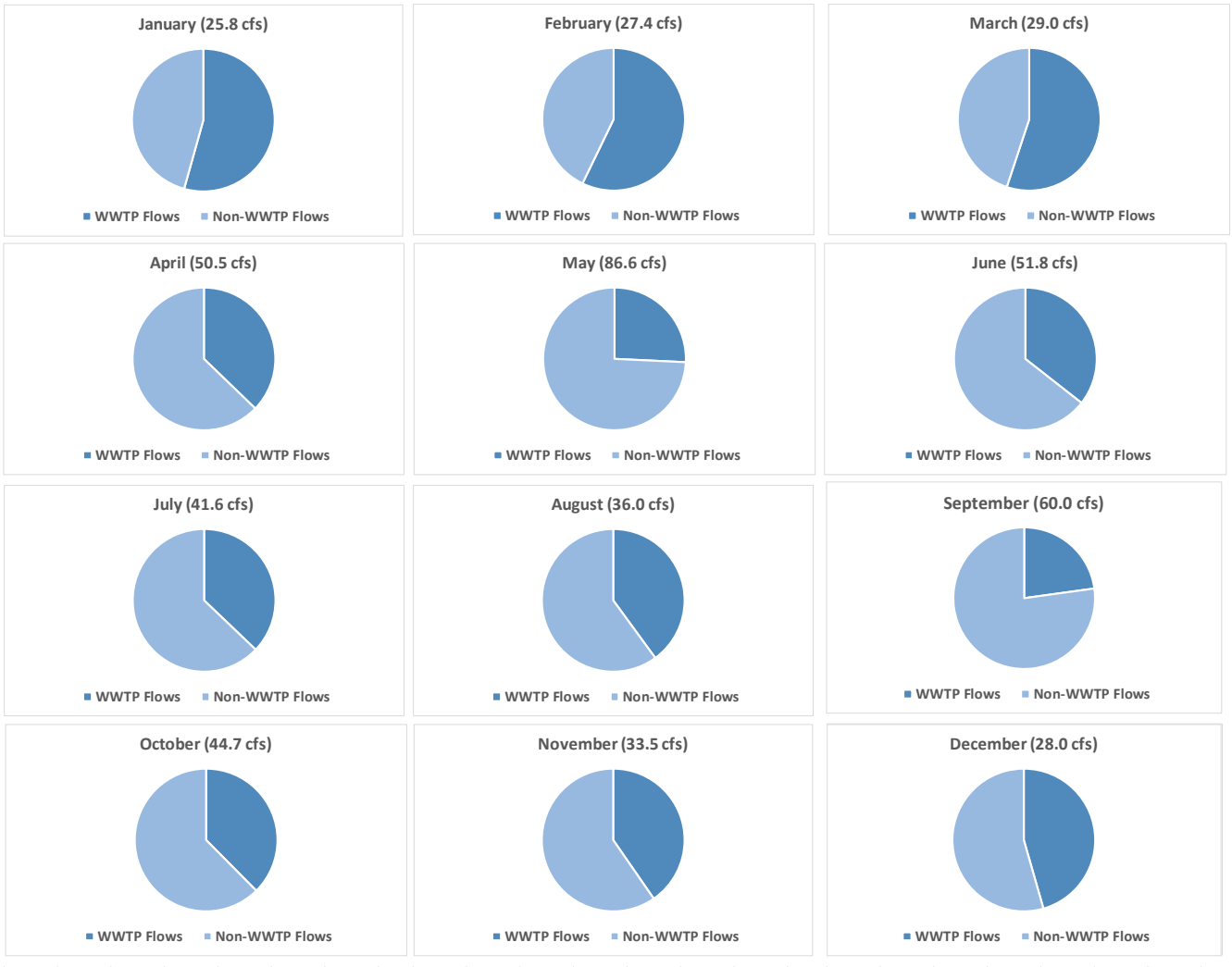


Figure 36. Average Monthly Percentage of Municipal WWTP Releases Relative to Big Dry Creek Flows at the USGS Fort Lupton Gauge (2013-2017)



QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

During 2019, quality assurance/quality control (QA/QC) samples were collected using the guidelines set forth in the Big Dry Creek SAP (BDCWA 2018). Under this program, field blanks and duplicates are collected and analyzed in accordance with Table 13.

Table 13. Field Quality Control Program in Sampling and Analysis Plan

Month	QC Test	Site
March	Field blanks, full set	bdc6.0
	Field duplicates and blanks for nutrients	bdc2.0
June	Field duplicates for Selenium, Dis. and Iron, Trec	bdc1.5
	Field duplicate for *E. coli*	bdc2.0
	Field duplicates for nutrients @bdc2.0	bdc2.0
September	Field duplicates, full set	bdc5.0
	Field blanks and duplicates for nutrients @ bdc2.0	bdc2.0
December	Field duplicates for Selenium, Dis. and Iron, Trec	bdc1.5
	Field duplicate for *E. coli*	bdc2.0
	Field duplicates for nutrients	bdc2.0

Appendix D summarizes analysis of field blank, trip blank, and duplicate samples for 2019. Analysis of relative percent differences (RPD) for the sample duplicates and review of field blanks show acceptable accuracy for most constituents, with these exceptions:

- Elevated field blank result on 9/19/2019 for total phosphorus @ 0.15 mg/L.
- Missing December E. coli field duplicate @bdc2.0.
- Missing June and December total recoverable iron field duplicates @bdc1.5.
- A somewhat high RPD result of 24% for total phosphorus occurred on 6/13/2019 at bdc2.0.

DATA GAPS IN CURRENT MONITORING PROGRAM

Recommendations for additional metals analyses include some additional sample fractions for these metals (in addition to the sample fractions already analyzed):

- Cadmium, Total
- Lead, Total
- Nickel, Total
- Iron, Dissolved

Other constituents with stream standards not analyzed under the monitoring program include sulfide, beryllium, uranium and molybdenum. Additionally, chlorophyll-a as attached periphyton is not currently part of the monitoring program. (Chlorophyll measurements in the water column are, however, part of the monitoring program.) At this time, the BDCWA Board has chosen not to add these constituents to the program.

CONCLUSIONS AND RECOMMENDATIONS

1. Water quality in Big Dry Creek attained stream standards for stream standards applicable in 2019, with the exception of *E. coli* for the entire stream and iron for the reach below Weld County Road 8. For new stream standards assigned in 2020 related to addition of a Water Supply classification, Big Dry Creek is expected to have future attainment issues for sulfate, chloride, nitrate and dissolved manganese.

2. *E. coli* concentrations are elevated at multiple instream locations. *E. coli* concentrations in the WWTP discharges are very low and do not exceed stream standards. As part of the BDCWA Watershed Plan update, additional efforts to identify sources of *E. coli* are needed. The current monitoring program is useful for identifying elevated stream reaches and trends over time but is not sufficient for identifying and mitigating sources of *E. coli.* For this reason, BDCWA and partnering cities have begun a microbial source identification study on the creek.

3. Although total recoverable iron samples collected and analyzed by BDCWA show attainment of the total recoverable iron standard at all monitoring locations, additional data collected by Metro Wastewater in the lower watershed show elevated iron concentrations. For this reason, Big Dry Creek below Weld County Road 8 is listed as impaired on the 2020 303(d) List. Elevated iron concentrations are expected to be due to stream bank and soil erosion in the lower watershed.

4. Sources of sulfate, chloride and dissolved manganese in the watershed include groundwater inflows in the upper watershed, as evidenced by seasonal patterns in the data set. Other sources of sulfate may also be present in the lower watershed. These constituents are secondary drinking water parameters, not related to human health risk. All of these constituents are expected to have exceedances of the stream standards resulting in impairment listing on future 303(d) lists. Further exploration of existing quality conditions as of January 1, 2020 may provide regulatory relief for sulfate.

5. For the most recent five-year analysis period (2015-2019), Big Dry Creek attained its site-specific selenium standard. In 2016, the stream was removed from the 303(d) List of impaired waters.

6. Big Dry Creek exceeds the recently assigned nitrate standard of 10 mg/L for a few sampling events below the Broomfield and Westminster WWTPs. Compliance plans in the 2019 WWTP discharge permits are expected to address this issue.

7. Big Dry Creek does not attain the interim warm water instream nitrogen and phosphorus "interim values" below municipal WWTP discharges (from the Broomfield WWTP to the South Platte River). Although these values are not expected to be adopted as stream standards on the main stem of Big Dry Creek prior to December 31, 2027, addressing nutrient sources on Big Dry Creek should be an increasing area of focus for BDCWA. More stringent CDPS permit limits with compliance schedules have been included in the 2019 permit renewal for the WWTPs. Under the new CWQCC Policy 17-1, a Voluntary Incentive Program for Early Nutrient Reductions was established. The Incentive Program allows enrolled WWTPs to accrue time under a post-2027 compliance schedule through trading or watershed nutrient reductions as part of its nutrient reduction plan. All three of the municipal WWTP dischargers are enrolled in this program.

8. Phosphorus concentrations and loads to Big Dry Creek have decreased over time as a result of treatment plant upgrades at the Broomfield and Westminster WWTPs, along with reuse programs that continue to be implemented at these WWTPs. Despite these improvements, the stream would not meet the interim total phosphorus criteria from below the Broomfield WWTP to the confluence with the South Platte River.

9. Aquatic life monitoring is conducted in even years for Big Dry Creek, so the most recent monitoring results are for 2018. Big Dry Creek does not show impairment of aquatic life uses in 2018, based on calculation of MMI scores in accordance with CWQCC's Aquatic Life Use Attainment Policy 10-1, EDAS Version 4. Scores were calculated at six biological monitoring locations for fall monitoring conducted during 2012, 2014, 2016 and 2018. MMI scores vary substantially, both temporally and spatially.

10. Stream flows were moderate during 2019. Stream flow is a significant factor influencing instream water quality and pollutant loads. WWTP discharges from Northglenn were higher than historic discharges, as were discharges from Broomfield.

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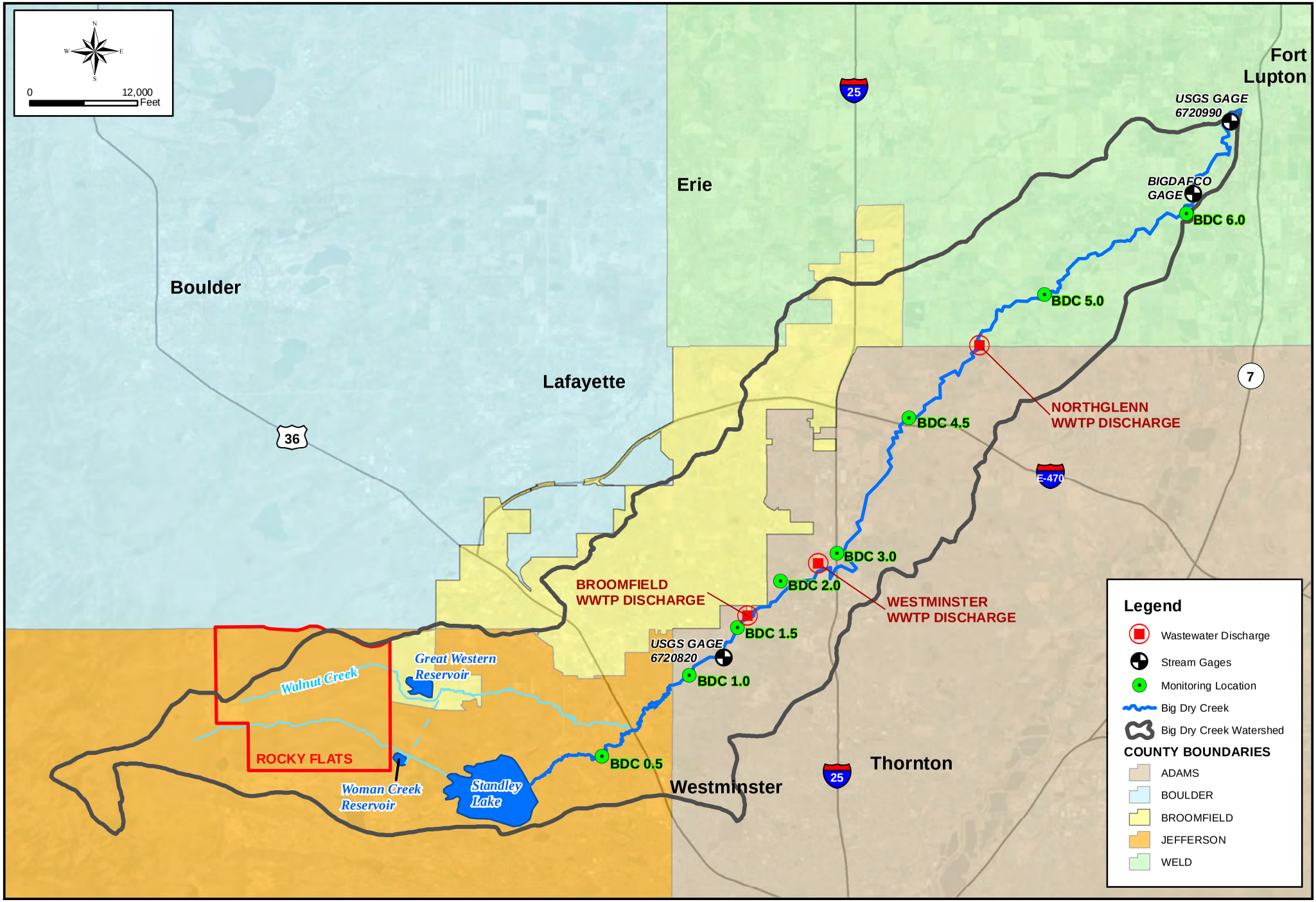
Appendix A. Supplemental Figures



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BIG DRY CREEK WATERSHED - KEY FEATURES AND MONITORING LOCATIONS

BIG DRY CREEK WATERSHED ASSOCIATION

PROJECT NO. 971-179.101

DRAFT FIGURE 1

Appendix B. Big Dry Creek 2019 Instream Sampling Results

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Appendix B
Big Dry Creek 2019 Instream Monthly Sampling Results - General Water Quality and Iron

Activity Start Date	Station ID	ALKALINITY (mg/L)	CALCIUM (mg/L)	MAGNESIUM (mg/L)	POTASSIUM (mg/L)	SODIUM (mg/L)	CHLORIDE (mg/L)	CONDUCTIVITY (uS/cm)	HARDNESS (mg/L)	DO (mg/L)	pH (SU)
10-Jan-19	bdc1.5	295	159	51	3.43	270	284	2386	605	10.42	7.01
10-Jan-19	bdc2.0	193	112	35	7.28	183	177	1950	425	9.07	6.25
10-Jan-19	bdc3.0	151	91	26	10.91	143	138	1296	335	8.03	5.70
10-Jan-19	bdc4.5	164	102	32	9.84	163	154	1466	386	9.24	7.02
10-Jan-19	bdc5.0	182	109	34	9.70	173	159	1566	415	9.92	7.60
10-Jan-19	bdc6.0	202	112	37	8.56	176	160	1650	432	10.49	7.75
14-Feb-19	bdc2.0	204	114	40	7.29	369	476	2630	451	12.21	7.07
14-Feb-19	bdc3.0	156	94	31	10.42	235	286	1952	362	12.02	7.50
14-Feb-19	bdc4.5	166	107	34	10.54	247	292	2021	407	12.61	7.68
14-Feb-19	bdc5.0	191	116	41	10.09	285	324	2256	456	13.58	7.86
14-Feb-19	bdc6.0	209	121	41	9.01	267	294	2227	472	14.19	8.01
20-Mar-19	bdc0.5	232	124	43	4.38	298		2246	487	8.07	7.31
20-Mar-19	bdc1.0	200	119	39	5.93	358		2554	455	8.19	7.86
20-Mar-19	bdc1.5	221	127	41	5.17	352		2627	485	9.02	7.72
20-Mar-19	bdc2.0	180	101	35	7.23	303		2247	396	8.54	7.66
20-Mar-19	bdc3.0	151	84	27	11.81	170		1467	324	9.83	7.79
20-Mar-19	bdc4.5	183	110	35	10.14	216		1796	419	10.05	7.68
20-Mar-19	bdc5.0	200	110	40	9.25	239		1967	440	10.73	7.61
20-Mar-19	bdc6.0	221	117	44	8.11	262		2097	472	10.73	7.61
17-Apr-19	bdc0.5	195	111	45	5.21	345	430	2435	463	7.85	7.49
17-Apr-19	bdc1.0	183	108	39	4.41	316	448	2382	432	8.21	7.84
17-Apr-19	bdc1.5	226	120	45	4.23	330	424	2508	485	8.20	7.90
17-Apr-19	bdc2.0	146	87	30	8.55	192	226	1613	342	7.95	7.70
17-Apr-19	bdc3.0	148	89	27	11.22	153	153	1423	333	7.59	7.58
17-Apr-19	bdc4.5	160	105	31	10.84	169	167	1548	392	8.39	7.82
17-Apr-19	bdc5.0	188	103	37	9.78	195	184	1718	410	9.29	8.15
17-Apr-19	bdc6.0	207	114	41	8.49	213	204	1863	455	9.78	8.29
09-May-19	bdc0.5	83	44	10	3.69	65	85	679	153	10.13	7.36
09-May-19	bdc1.0	103	47	14	3.66	118	156	963	176	9.20	7.76
09-May-19	bdc1.5	111	54	16	3.69	129	164	1055	201	9.11	7.82
09-May-19	bdc2.0	110	50	15	4.48	128	164	1052	188	8.59	7.69
09-May-19	bdc3.0	115	53	17	5.64	132	160	1067	204	9.15	7.63
09-May-19	bdc4.5	123	64	21	5.53	145	162	1169	243	8.88	7.71
09-May-19	bdc5.0	150	78	24	6.88	145	153	1231	293	8.92	7.78
09-May-19	bdc6.0	150	86	27	8.51	161	164	1327	325	8.67	7.84
13-Jun-19	bdc0.5	67	44	9	2.64	32	48	457	150	9.71	7.38
13-Jun-19	bdc1.0	85	50	12	2.69	44	62	580	173	8.78	7.70
13-Jun-19	bdc1.5	89	53	13	2.73	52	68	643	187	9.31	7.82
13-Jun-19	bdc2.0	151	79	24	4.19	95	95	966	297	7.18	7.33
13-Jun-19	bdc3.0	119	69	22	5.09	95	94	958	262	7.89	7.68
13-Jun-19	bdc4.5	174	108	33	6.86	154	146	1464	409	8.40	7.90
13-Jun-19	bdc5.0	171	86	33	8.17	151	134	1447	351	8.90	8.07
13-Jun-19	bdc6.0	167	96	28	7.23	126	122	1298	356	8.28	8.08
11-Jul-19	bdc0.5	92	46	9	2.45	30	48	458	153	8.05	7.59
11-Jul-19	bdc1.0	74	56	12	2.72	45	62	589	189	7.59	7.75
11-Jul-19	bdc1.5	104	61	14	2.83	56	69	663	209	7.48	7.77
11-Jul-19	bdc2.0	110	67	15	4.20	66	80	783	230	6.54	7.61
11-Jul-19	bdc3.0	132	69	19	4.71	85	87	937	251	6.71	7.73
11-Jul-19	bdc4.5	152	93	27	6.18	122	111	1233	342	7.08	7.95
11-Jul-19	bdc5.0	182	100	29	6.44	130	121	1331	368	6.99	8.01
11-Jul-19	bdc6.0	196	95	28	5.51	122	112	2161	351	6.74	7.97
08-Aug-19	bdc0.5	63	40	9	2.61	27	47	416	136	7.84	7.33
08-Aug-19	bdc1.0	64	43	9	2.35	29	48	456	142	7.92	7.54
08-Aug-19	bdc1.5	77	44	10	2.39	34	49	487	150	8.08	7.57
08-Aug-19	bdc2.0	83	46	11	3.70	43	57	573	161	7.47	7.51
08-Aug-19	bdc3.0	114	62	17	4.61	74	73	832	226	6.53	7.54
08-Aug-19	bdc4.5	130	78	22	6.38	102	104	1078	286	6.87	7.68
08-Aug-19	bdc5.0	151	89	26	7.04	115	105	1194	327	7.43	7.95
08-Aug-19	bdc6.0	195	102	31	6.26	135	121	1371	382	7.19	7.87
19-Sep-19	bdc0.5	53	31	7	2.11	22		312	108	7.29	7.55
19-Sep-19	bdc1.0	60	38	9	2.20	29		372	132	8.12	7.76
19-Sep-19	bdc1.5	69	41	10	3.03	35		421	145	8.07	7.79
19-Sep-19	bdc2.0	74	42	12	4.04	47		601	153	7.57	7.48
19-Sep-19	bdc3.0	92	52	19	5.01	77		661	207	7.99	7.67
19-Sep-19	bdc4.5	148	84	29	5.95	135		1107	329	8.61	7.93
19-Sep-19	bdc5.0	171	95	39	11.08	174		1323	398	8.84	8.07
19-Sep-19	bdc6.0	228	124	46	8.72	199		1477	498	9.30	7.99
10-Oct-19	bdc0.5	205	111	29	2.94	137	156	1458	399	8.79	7.90
10-Oct-19	bdc1.0	204	129	39	3.95	185	202	1785	480	8.57	8.09

Appendix B
Big Dry Creek 2019 Instream Monthly Sampling Results - General Water Quality and Iron

Activity Start Date	Station ID	ALKALINITY (mg/L)	CALCIUM (mg/L)	MAGNESIUM (mg/L)	POTASSIUM (mg/L)	SODIUM (mg/L)	CHLORIDE (mg/L)	CONDUCTIVITY (uS/cm)	HARDNESS (mg/L)	DO (mg/L)	pH (SU)
10-Oct-19	bdc1.5	266	144	51	4.26	245	199	2021	571	8.72	8.03
10-Oct-19	bdc2.0	115	69	27	10.57	131	113	1171	282	8.86	8.10
10-Oct-19	bdc3.0	117	65	23	12.57	127	112	1076	258	8.96	7.92
10-Oct-19	bdc4.5	136	79	28	11.76	139	123	1229	313	9.17	8.00
10-Oct-19	bdc5.0	151	87	34	11.59	157	126	1331	355	9.39	8.11
10-Oct-19	bdc6.0	200	99	32	7.90	149	129	1447	377	9.53	8.08
14-Nov-19	bdc0.5	253	132	46	4.70	304		2395	519	9.96	7.49
14-Nov-19	bdc1.0	243	150	51	5.16	451		3206	586	10.45	7.67
14-Nov-19	bdc1.5	272	154	55	4.34	408		3016	609	11.18	7.77
14-Nov-19	bdc2.0	186	131	37	7.56	257		2145	479	10.33	7.56
14-Nov-19	bdc3.0	140	77	26	11.96	163		1320	298	8.98	7.38
14-Nov-19	bdc4.5	168	100	32	9.83	194		1632	384	9.85	7.68
14-Nov-19	bdc5.0	176	103	35	10.15	216		1793	401	10.45	7.89
14-Nov-19	bdc6.0	206	105	37	8.13	218		1811	414	12.12	8.04
12-Dec-19	bdc1.0	244	143	42	4.69	376	564	2902	528	13.44	7.43
12-Dec-19	bdc1.5	338	145	48	4.68	375	488	2819	557	13.09	7.86
12-Dec-19	bdc2.0	218	123	39	6.26	288	380	2301	466	11.68	7.87
12-Dec-19	bdc3.0	166	87	25	9.57	149	166	1447	321	9.62	7.41
12-Dec-19	bdc4.5	188	102	31	8.61	177	196	1645	383	10.63	7.49
12-Dec-19	bdc5.0	230	116	36	8.44	201	214	1826	438	12.25	7.74
12-Dec-19	bdc6.0	234	119	38	7.41	196	204	1854	451	12.94	7.86

Appendix B
Big Dry Creek 2019 Instream Monthly Sampling Results - General Water Quality and Iron

Activity Start Date	Station ID	TEMPERATURE (°C)	CHLOROPHYLL-a, corr (ug/L)	CHLOROPHYLL-a, uncor (ug/L)	E_ coli (MPN/100 mL)	SULFATE (mg/L)	TDS (mg/L)	TOC (mg/L)	TSS (mg/L)	TURBIDITY (NTU)	IRON, Trec (mg/L)
10-Jan-19	bdc1.5	-2.6	0.0	2.0	172	528	1517	5.3	21.8	13.9	0.36
10-Jan-19	bdc2.0	1.8	0.0	1.5	489	336	1024	7.4	29.2	18.6	0.46
10-Jan-19	bdc3.0	4.0	0.0	1.8	727	250	811	8.7	17.2	10.5	0.00
10-Jan-19	bdc4.5	1.4	0.0	1.2	489	310	936	9.0	20.2	13.1	0.32
10-Jan-19	bdc5.0	-0.5	0.0	1.8	161	344	987	7.9	14.8	12.5	0.34
10-Jan-19	bdc6.0	-1.9	0.0	2.4	185	372	1051	7.8	17.6	14.4	0.31
14-Feb-19	bdc2.0	1.3	3.5	5.2	179	340	1520	6.3	16.2	11.7	0.49
14-Feb-19	bdc3.0	4.1	3.5	4.7	462	274	1093	8.0	13.0	8.7	0.00
14-Feb-19	bdc4.5	2.9	3.6	5.3	462	314	1154	9.4	46.2	15.8	0.00
14-Feb-19	bdc5.0	1.8	7.5	10.4	345	382	1320	7.8	28.2	18.9	0.40
14-Feb-19	bdc6.0	1.0	13.3	16.9	119	390	1297	7.3	25.4	17.5	0.34
20-Mar-19	bdc0.5	-2.7	1.3	2.3	86		1420	6.0	0.0	5.4	0.00
20-Mar-19	bdc1.0	-1.3			15		1508	6.1	7.8	8.9	0.28
20-Mar-19	bdc1.5	-1.7	9.1	12.7	18		1574	5.6	19.2	13.8	0.65
20-Mar-19	bdc2.0	0.7	10.4	13.0	28		1338	6.3	6.2	12.6	0.44
20-Mar-19	bdc3.0	4.8	4.2	6.6	229		899	8.6	12.0	8.5	0.00
20-Mar-19	bdc4.5	1.7	4.4	6.7	89		1155	10.2	23.2	15.4	0.38
20-Mar-19	bdc5.0	0.4	6.5	9.2	119		1197	7.9	29.0	23.1	0.52
20-Mar-19	bdc6.0	0.6	8.8	12.5	55		1339	7.3	40.8	32.3	0.60
17-Apr-19	bdc0.5	4.2	6.6	9.5	29	396	1476	6.7	3.6	3.1	0.00
17-Apr-19	bdc1.0	5.4	5.5	8.7	39	328	1397	6.2	0.0	9.1	0.25
17-Apr-19	bdc1.5	5.0	2.8	5.2	11	404	1514	6.2	4.6	5.2	0.00
17-Apr-19	bdc2.0	7.6	4.1	6.6	37	254	985	7.9	6.0	6.6	0.00
17-Apr-19	bdc3.0	8.8	3.2	5.5	206	254	845	8.3	8.0	6.0	0.00
17-Apr-19	bdc4.5	7.1	5.7	9.5	46	324	974	8.4	4.6	3.8	0.00
17-Apr-19	bdc5.0	6.4	12.0	16.7	178	386	1104	8.0	10.2	6.3	0.00
17-Apr-19	bdc6.0	6.6	14.7	20.2	110	420	1197	8.3	7.4	5.2	0.00
09-May-19	bdc0.5	1.3	2.6	4.6	1120	78	368	7.5	10.0	3.1	0.64
09-May-19	bdc1.0	2.1	10.5	17.0	1987	103	550	8.2	38.0	16.7	0.95
09-May-19	bdc1.5	2.2	13.9	20.2	1554	127	602	8.3	60.0	41.5	1.03
09-May-19	bdc2.0	2.9	19.9	27.3	1987	115	604	8.6	100.0	47.3	1.19
09-May-19	bdc3.0	4.2	22.6	33.3	1204	138	633	9.2	136.0	58.8	1.50
09-May-19	bdc4.5	3.9	21.9	33.1	727	246	701	9.7	180.0	80.2	1.99
09-May-19	bdc5.0	4.1	19.0	30.7	1047	218	748	9.5	218.0	132.0	2.50
09-May-19	bdc6.0	3.6	24.5	35.1	1300	180	825	8.6	258.0	154.0	2.28
13-Jun-19	bdc0.5	6.9	2.2	3.1	411	67	310	2.3	7.8	6.4	0.27
13-Jun-19	bdc1.0	7.7	2.9	4.5	231	85	344	3.1	18.2	13.4	0.43
13-Jun-19	bdc1.5	8.4	2.9	6.1	387	99	380	3.3	24.2	18.1	0.86
13-Jun-19	bdc2.0	10.2	2.6	4.9	214	191	627	4.6	19.8	15.9	0.80
13-Jun-19	bdc3.0	12.2	1.6	2.9	291	182	597	5.3	11.0	10.1	0.47
13-Jun-19	bdc4.5	13.1	0.0	1.4	101	330	921	6.5	6.6	6.4	0.27
13-Jun-19	bdc5.0	13.7	0.0	1.8	184	314	911	7.1	6.8	6.4	0.27
13-Jun-19	bdc6.0	14.0	1.9	3.3	1414	272	793	6.2	18.0	13.8	0.39
11-Jul-19	bdc0.5	13.4	4.1	2.8	548	66	274	2.5	2.2	5.5	0.33
11-Jul-19	bdc1.0	13.9	1.9	4.0	548	86	368	3.4	24.4	18.5	0.57
11-Jul-19	bdc1.5	15.9	2.5	5.3	579	100	393	3.6	29.6	24.8	0.68
11-Jul-19	bdc2.0	18.1	2.4	4.2	411	122	478	4.9	37.6	28.6	1.12
11-Jul-19	bdc3.0	19.0	1.6	3.4	461	176	583	5.8	25.8	19.5	0.69
11-Jul-19	bdc4.5	19.8	1.8	3.4	261	267	781	7.9	21.6	16.7	0.50
11-Jul-19	bdc5.0	22.0	4.0	6.1	921	294	849	7.1	44.6	34.3	0.82
11-Jul-19	bdc6.0	21.7	9.0	12.3	1553	274	796	6.3	86.0	65.4	1.16
08-Aug-19	bdc0.5	14.9	1.5	2.0	75	60	255	2.4	3.2	7.3	0.31
08-Aug-19	bdc1.0	15.2	0.0	0.0	104	65	275	2.6	23.2	16.6	0.41
08-Aug-19	bdc1.5	16.9	1.5	3.5	142	73	296	2.7	30.0	18.9	0.53
08-Aug-19	bdc2.0	16.9	2.0	3.9	137	86	340	3.7	36.0	26.2	0.70
08-Aug-19	bdc3.0	19.0	0.0	0.0	579	156	508	5.2	25.2	18.8	0.61
08-Aug-19	bdc4.5	20.4	1.5	3.2	250	218	673	7.4	8.4	10.6	0.34
08-Aug-19	bdc5.0	21.6	5.2	8.9	345	255	764	7.2	26.4	20.3	0.56
08-Aug-19	bdc6.0	21.4	7.5	9.4	645	299	882	6.6	25.6	14.1	0.48
19-Sep-19	bdc0.5	17.1	1.8	4.3	131		185	2.6	18.4	14.3	0.06
19-Sep-19	bdc1.0	16.1	3.0	6.4	125		233	5.6	39.6	30.7	0.09
19-Sep-19	bdc1.5	15.8	2.9	7.8	122		264	2.9	42.8	37.6	0.24
19-Sep-19	bdc2.0	16.5	2.9	6.0	261		308	3.8	47.6	38.8	0.19
19-Sep-19	bdc3.0	16.8	1.6	3.6	387		395	4.2	22.4	21.2	0.08
19-Sep-19	bdc4.5	15.8	0.0	2.0	96		715	5.6	7.2	8.1	0.11
19-Sep-19	bdc5.0	17.0	1.9	4.3	579		852	8.0	18.8	11.8	0.12
19-Sep-19	bdc6.0	17.0	2.0	4.0	548		971	5.8	12.0	10.9	0.12
10-Oct-19	bdc0.5	6.8	0.0	0.0	206	313	928		3.4	3.9	0.25
10-Oct-19	bdc1.0	6.9	15.0	19.0	78	404	1137	6.9	33.8	15.9	0.65

Appendix B
Big Dry Creek 2019 Instream Monthly Sampling Results - General Water Quality and Iron

Activity Start Date	Station ID	TEMPERATURE (°C)	CHLOROPHYLL-a, corr (ug/L)	CHLOROPHYLL-a, uncor (ug/L)	E_ coli (MPN/100 mL)	SULFATE (mg/L)	TDS (mg/L)	TOC (mg/L)	TSS (mg/L)	TURBIDITY (NTU)	IRON, Trec (mg/L)
10-Oct-19	bdc1.5	7.1	6.2	8.3	2420	474	1343	7.4	18.0	16.3	0.71
10-Oct-19	bdc2.0	10.6	0.0	0.0	261	213	719	7.1	28.8	15.5	0.82
10-Oct-19	bdc3.0	11.8	1.9	3.9	222	193	651	8.8	29.2	18.1	1.01
10-Oct-19	bdc4.5	9.5	1.6	3.1	129	243	777	7.2	14.8	15.8	0.73
10-Oct-19	bdc5.0	8.0	4.5	6.0	112	286	836	7.3	9.6	12.2	0.52
10-Oct-19	bdc6.0	6.4	1.4	2.9	260	322	936	6.5	11.6	11.8	0.51
14-Nov-19	bdc0.5	4.0	3.3	4.9	64		1443	5.6	0.0	2.8	0.21
14-Nov-19	bdc1.0	4.0	7.8	10.2	20		1907	5.8	12.0	9.1	0.42
14-Nov-19	bdc1.5	4.5	1.6	2.5	55		1855	5.4	2.6	4.5	0.34
14-Nov-19	bdc2.0	7.0	2.0	3.7	365		1220	7.6	20.0	17.8	0.71
14-Nov-19	bdc3.0	12.2	2.2	4.0	866		796	7.9	21.6	11.3	0.33
14-Nov-19	bdc4.5	10.0	1.2	2.8	205		1019	7.3	10.0	9.4	0.41
14-Nov-19	bdc5.0	9.5	1.1	2.3	74		1119	7.1	7.6	8.8	0.40
14-Nov-19	bdc6.0	8.5	3.4	6.5	365		1153	6.7	15.2	12.2	0.53
12-Dec-19	bdc1.0	2.1	9.6	12.6	162	348	1658	5.6	8.2	6.4	0.39
12-Dec-19	bdc1.5	2.0	5.9	8.1	54	410	1681	5.5	9.0	8.6	0.54
12-Dec-19	bdc2.0	5.4	5.3	8.7	46	332	1370	7.1	12.8	10.8	0.65
12-Dec-19	bdc3.0	10.5	2.2	4.2	1733	252	869	7.6	19.4	10.5	0.54
12-Dec-19	bdc4.5	6.6	1.5	3.8	461	320	1036	7.1	16.8	12.3	0.62
12-Dec-19	bdc5.0	4.6	3.4	5.5	548	386	1149	6.6	28.4	16.6	0.89
12-Dec-19	bdc6.0	3.3	4.9	7.3	261	388	1178	6.3	37.6	24.7	1.28

Appendix B
Big Dry Creek 2019 Sampling Results - Nutrients

Activity Start Date	Station ID	AMMONIA, Total (mg/L)	NITROGEN, TOTAL (mg/L)	NO3+NO2 (mg/L)	NO2 (mg/L)	PHOSPHORUS, TOTAL (mg/L)	PHOSPHORUS, ORTHO AS P (mg/L)
10-Jan-19	bdc1.5	0.070	3.08	2.17	0.02	0.05	0.00
10-Jan-19	bdc2.0	0.380	11.52	9.50	0.11	0.29	0.21
10-Jan-19	bdc3.0	0.100	12.36	9.89	0.05	0.63	0.41
10-Jan-19	bdc4.5	0.090	11.21	8.83	0.08	0.53	0.39
10-Jan-19	bdc5.0	0.060	9.83	7.72	0.10	0.31	0.22
10-Jan-19	bdc6.0	0.020	8.44	6.74	0.05	0.22	0.17
14-Feb-19	bdc2.0	0.380	6.82	5.62	0.11	0.11	0.06
14-Feb-19	bdc3.0	0.190	8.64	7.33	0.09	0.98	0.78
14-Feb-19	bdc4.5	0.150	9.77	7.59	0.18	1.21	1.03
14-Feb-19	bdc5.0	0.140	7.71	6.97	0.22	0.87	0.75
14-Feb-19	bdc6.0	0.020	6.56	6.19	0.07	0.58	0.47
20-Mar-19	bdc0.5	0.040	1.34	1.09	0.01	0.15	0.00
20-Mar-19	bdc1.0	0.060	1.09	0.50	0.01	0.32	0.00
20-Mar-19	bdc1.5	0.080	1.62	1.16	0.01	0.08	0.00
20-Mar-19	bdc2.0	0.320	5.39	4.97	0.07	0.33	0.24
20-Mar-19	bdc3.0	0.090	7.57	7.40	0.03	0.69	0.55
20-Mar-19	bdc4.5	0.080	7.58	7.13	0.05	0.69	0.59
20-Mar-19	bdc5.0	0.070	6.42	6.00	0.08	0.46	0.35
20-Mar-19	bdc6.0	0.050	4.40	4.24	0.02	0.41	0.28
17-Apr-19	bdc0.5	0.053	0.86	0.25	0.00	0.22	0.00
17-Apr-19	bdc1.0	0.056	0.65	0.17	0.00	0.24	0.00
17-Apr-19	bdc1.5	0.056	1.27	0.83	0.00	0.25	0.00
17-Apr-19	bdc2.0	0.199	12.29	11.99	0.28	0.16	0.08
17-Apr-19	bdc3.0	0.127	8.78	8.58	0.06	0.34	0.00
17-Apr-19	bdc4.5	0.094	9.89	9.69	0.06	0.55	0.31
17-Apr-19	bdc5.0	0.059	5.93	5.86	0.06	0.41	0.20
17-Apr-19	bdc6.0	0.044	4.80	4.69	0.07	0.25	0.17
09-May-19	bdc0.5	0.071	0.93	0.44	0.01	0.13	0.00
09-May-19	bdc1.0	0.125	1.29	0.37	0.02	0.18	0.00
09-May-19	bdc1.5	0.132	1.34	0.41	0.02	0.23	0.00
09-May-19	bdc2.0	0.136	3.17	1.99	0.04	0.24	0.00
09-May-19	bdc3.0	0.132	3.90	2.56	0.03	0.53	0.26
09-May-19	bdc4.5	0.123	3.63	2.84	0.08	0.53	0.34
09-May-19	bdc5.0	0.140	5.75	4.47	0.06	0.72	0.32
09-May-19	bdc6.0	0.135	6.20	4.96	0.04	0.80	0.15
13-Jun-19	bdc0.5	0.064	0.36	0.09	0.00	0.18	0.00
13-Jun-19	bdc1.0	0.038	0.44	0.13	0.00	0.19	0.00
13-Jun-19	bdc1.5	0.021	0.57	0.26	0.00	0.13	0.00
13-Jun-19	bdc2.0	0.029	4.46	4.07	0.02	0.24	0.00
13-Jun-19	bdc3.0	0.053	4.61	4.06	0.05	0.17	0.05
13-Jun-19	bdc4.5	0.022	6.08	4.90	0.05	0.31	0.18
13-Jun-19	bdc5.0	0.025	4.96	4.30	0.09	0.29	0.15
13-Jun-19	bdc6.0	0.000	3.58	3.03	0.06	0.42	0.23
11-Jul-19	bdc0.5	0.000	0.39	0.14	0.00	0.48	0.00
11-Jul-19	bdc1.0	0.030	0.62	0.23	0.00	0.24	0.00
11-Jul-19	bdc1.5	0.040	0.72	0.33	0.00	0.34	0.00
11-Jul-19	bdc2.0	0.060	3.96	2.99	0.04	0.28	0.00
11-Jul-19	bdc3.0	0.070	4.59	3.61	0.05	0.34	0.05
11-Jul-19	bdc4.5	0.070	4.91	3.64	0.08	0.41	0.21
11-Jul-19	bdc5.0	0.080	5.27	4.01	0.09	0.37	0.17
11-Jul-19	bdc6.0	0.000	3.33	2.12	0.02	0.39	0.13

Appendix B
Big Dry Creek 2019 Sampling Results - Nutrients

Activity Start Date	Station ID	AMMONIA, Total (mg/L)	NITROGEN, TOTAL (mg/L)	NO3+NO2 (mg/L)	NO2 (mg/L)	PHOSPHORUS, TOTAL (mg/L)	PHOSPHORUS, ORTHO AS P (mg/L)
08-Aug-19	bdc0.5	0.022	0.36	0.16	0.00	0.62	0.00
08-Aug-19	bdc1.0	0.000	0.41	0.18	0.00	0.09	0.00
08-Aug-19	bdc1.5	0.000	0.48	0.25	0.00	0.19	0.00
08-Aug-19	bdc2.0	0.249	2.75	1.99	0.02	0.18	0.00
08-Aug-19	bdc3.0	0.344	3.60	2.52	0.05	0.21	0.05
08-Aug-19	bdc4.5	0.082	4.84	3.81	0.04	0.28	0.13
08-Aug-19	bdc5.0	0.043	4.57	3.66	0.09	0.33	0.18
08-Aug-19	bdc6.0	0.019	2.59	1.92	0.03	0.30	0.16
19-Sep-19	bdc0.5	0.021	0.30	0.04	0.00	0.07	0.00
19-Sep-19	bdc1.0	0.000	0.38	0.08	0.00	0.10	0.00
19-Sep-19	bdc1.5	0.020	0.50	0.19	0.00	0.09	0.00
19-Sep-19	bdc2.0	0.036	3.32	2.90	0.01	0.16	0.00
19-Sep-19	bdc3.0	0.051	3.51	3.12	0.01	0.18	0.06
19-Sep-19	bdc4.5	0.017	4.56	4.20	0.03	0.15	0.08
19-Sep-19	bdc5.0	0.034	6.52	5.60	0.08	0.23	0.15
19-Sep-19	bdc6.0	0.031	4.03	3.42	0.06	0.20	0.14
10-Oct-19	bdc0.5	0.021	1.19	0.74	0.00	0.04	0.00
10-Oct-19	bdc1.0	0.000	1.19	0.45	0.00	0.08	0.00
10-Oct-19	bdc1.5	0.044	2.71	2.02	0.03	0.06	0.00
10-Oct-19	bdc2.0	0.064	13.06	12.68	0.03	0.27	0.16
10-Oct-19	bdc3.0	0.098	11.28	10.37	0.04	0.33	0.16
10-Oct-19	bdc4.5	0.061	9.92	9.42	0.04	0.25	0.14
10-Oct-19	bdc5.0	0.035	8.24	7.82	0.08	0.18	0.09
10-Oct-19	bdc6.0	0.017	5.40	4.97	0.05	0.22	0.14
14-Nov-19	bdc0.5	0.027	1.22	0.78	0.02	0.02	0.00
14-Nov-19	bdc1.0	0.048	1.01	0.40	0.00	0.05	0.00
14-Nov-19	bdc1.5	0.043	1.96	1.50	0.01	0.05	0.00
14-Nov-19	bdc2.0	0.558	8.90	7.35	0.16	0.24	0.17
14-Nov-19	bdc3.0	0.132	8.77	7.12	0.08	0.37	0.17
14-Nov-19	bdc4.5	0.186	9.03	7.80	0.10	0.25	0.17
14-Nov-19	bdc5.0	0.129	7.58	6.22	0.15	0.19	0.15
14-Nov-19	bdc6.0	0.064	6.73	5.87	0.07	0.21	0.16
12-Dec-19	bdc1.0	0.026	1.44	0.77	0.02	0.06	0.00
12-Dec-19	bdc1.5	0.029	1.90	1.41	0.01	0.05	0.00
12-Dec-19	bdc2.0	0.054	7.40	6.16	0.07	0.10	0.00
12-Dec-19	bdc3.0	0.087	6.69	5.19	0.03	0.25	0.12
12-Dec-19	bdc4.5	0.079	7.45	6.10	0.04	0.21	0.11
12-Dec-19	bdc5.0	0.070	6.07	4.74	0.04	0.18	0.11
12-Dec-19	bdc6.0	0.046	5.51	4.17	0.03	0.22	0.11

Appendix B
Big Dry Creek 2019 Sampling Results - Quarterly Metals and Cyanide

Activity Start Date	Station ID	ARSENIC, Trec (ug/L)	BORON, Total (ug/L)	CADMIUM, D (ug/L)	CHROMIUM, D (ug/L)	COPPER, D (ug/L)	LEAD, D (ug/L)	MANGANESE, D (ug/L)	NICKEL, D (ug/L)	SELENIUM, D (ug/L)	SILVER, D (ug/L)	ZINC, D (ug/L)	CYANIDE, Total (mg/L)
20-Mar-19	bdc0.5	1.00	50	0.00	0	7.26	0.00	426.1	1.82	6.2	0	0.0	0
20-Mar-19	bdc1.0	0.00	40	0.00	0	4.19	0.00	313.2	2.10	5.1	0	0.0	0
20-Mar-19	bdc1.5	1.01	140	0.00	0	3.32	0.00	315.5	2.28	7.1	0	0.0	0
20-Mar-19	bdc2.0	0.00	140	0.00	0	5.39	0.00	195.1	2.37	5.6	0	6.1	0
20-Mar-19	bdc3.0	0.00	170	0.00	0	3.86	0.11	76.0	2.37	3.6	0	45.3	0
20-Mar-19	bdc4.5	0.00	210	0.00	0	6.54	0.06	157.7	2.42	5.7	0	28.9	0
20-Mar-19	bdc5.0	0.00	250	0.00	0	3.29	0.06	152.2	2.61	6.1	0	21.0	0
20-Mar-19	bdc6.0	1.16	240	0.00	0	2.72	0.66	157.4	2.82	6.0	0	12.7	0
13-Jun-19	bdc0.5	0.00	0	0.00	0	5.42	0.12	24.2	0.89	0.3	0	4.6	0
13-Jun-19	bdc1.0	0.00	0	0.00	0	5.53	0.08	15.7	0.99	0.7	0	2.8	0
13-Jun-19	bdc1.5	0.00	0	0.00	0	4.25	0.08	12.4	1.03	1.2	0	3.5	0
13-Jun-19	bdc2.0	0.00	130	0.00	0	6.80	0.10	9.9	1.17	6.2	0	5.0	0
13-Jun-19	bdc3.0	0.00	100	0.00	0	4.79	0.14	25.6	1.54	2.3	0	8.2	0
13-Jun-19	bdc4.5	0.00	180	0.06	0	4.68	0.10	44.7	2.37	5.6	0	13.4	0
13-Jun-19	bdc5.0	1.32	200	0.05	0	5.56	0.22	54.6	2.53	3.6	0	20.2	0
13-Jun-19	bdc6.0	1.27	170	0.08	0	5.93	0.23	33.3	2.56	3.1	0	14.4	0
19-Sep-19	bdc0.5	0.00	0	0.00	0	3.52	0.11	66.1	0.61	0.2	0	1.4	0
19-Sep-19	bdc1.0	0.00	0	0.00	0	3.98	0.12	9.9	0.69	0.4	0	1.4	0
19-Sep-19	bdc1.5	0.00	0	0.00	0	16.38	0.54	8.6	0.85	0.8	0	23.4	0
19-Sep-19	bdc2.0	0.00	30	0.00	0	3.95	0.15	7.5	1.05	1.0	0	3.3	0
19-Sep-19	bdc3.0	0.00	60	0.00	0	5.11	0.14	25.6	1.15	1.6	0	5.0	0
19-Sep-19	bdc4.5	1.24	170	0.00	0	3.69	0.12	32.8	1.82	4.3	0	5.9	0
19-Sep-19	bdc5.0	1.50	250	0.00	0	5.51	0.30	49.8	2.56	4.1	0	20.0	0
19-Sep-19	bdc6.0	0.00	290	0.00	0	5.12	0.63	46.1	2.51	4.3	0	20.5	0
12-Dec-19	bdc1.0	1.23	190	0.06	0	21.56	0.14	213.6	2.02	5.5	0	1.5	0
12-Dec-19	bdc1.5	1.18	240	0.00	0	4.85	0.13	192.6	1.87	7.4	0	1.1	0
12-Dec-19	bdc2.0	1.21	230	0.00	0	3.63	0.15	97.7	1.87	7.4	0	5.0	0
12-Dec-19	bdc3.0	1.29	260	0.00	0	4.45	0.30	65.9	1.40	2.8	0	39.0	0
12-Dec-19	bdc4.5	1.27	270	0.15	0	11.21	0.24	53.9	1.66	4.3	0	29.5	0
12-Dec-19	bdc5.0	1.30	260	0.00	0	3.34	0.33	41.7	2.01	4.6	0	28.2	0
12-Dec-19	bdc6.0	1.47	270	0.07	0	2.72	0.21	40.2	2.41	6.2	0	20.5	0

Appendix B

Big Dry Creek 2019 Instream Sampling Results - Mercury

Activity Start Date	Station ID	Mercury, Total (ng/L)
bdc1.5	1/10/2019	1.77
bdc1.5	2/7/2019	1.20
bdc1.5	4/4/2019	1.63
bdc1.5	3/6/2019	0.06
bdc1.5	5/2/2019	0.82
bdc1.5	6/5/2019	3.77
bdc1.5	7/8/2019	8.92
bdc1.5	8/6/2019	6.34
bdc1.5	9/9/2019	9.29
bdc1.5	10/3/2019	1.63
bdc1.5	11/7/2019	2.28
bdc1.5	11/9/2019	2.20
bdc1.5	12/10/2019	0.64

0.01 microgram = 10 nanogram

Appendix C. Boxplots and Time Series Plots for Big Dry Creek 2019 Instream Sampling Program

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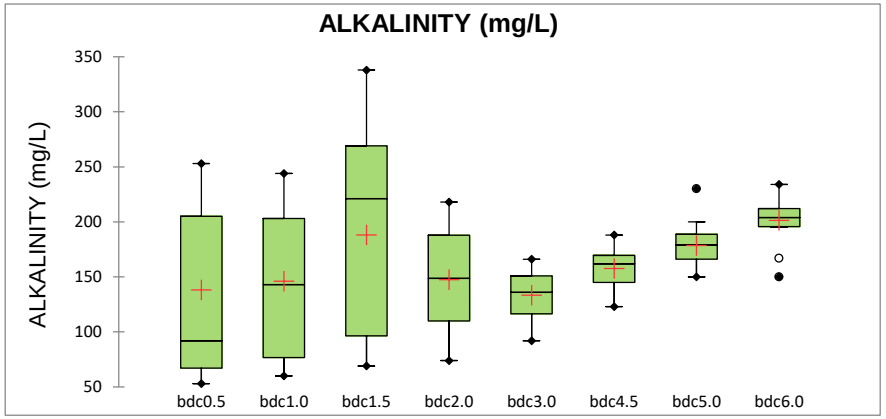
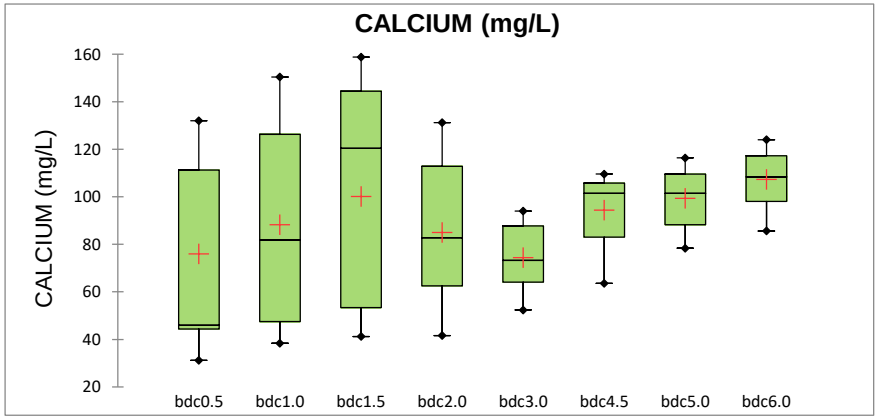
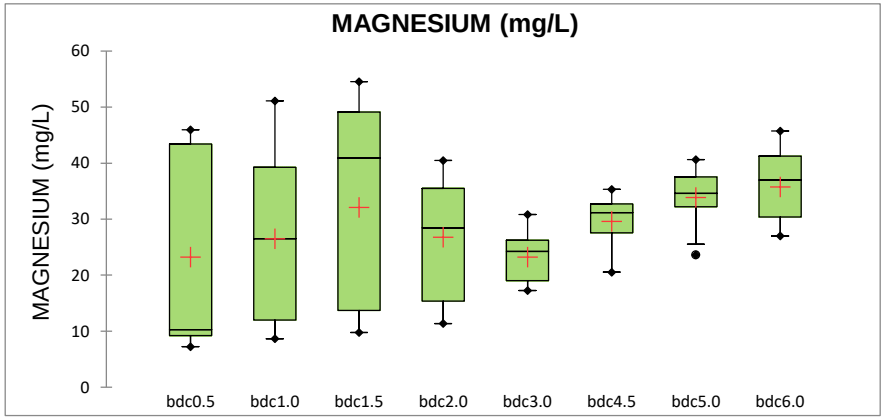
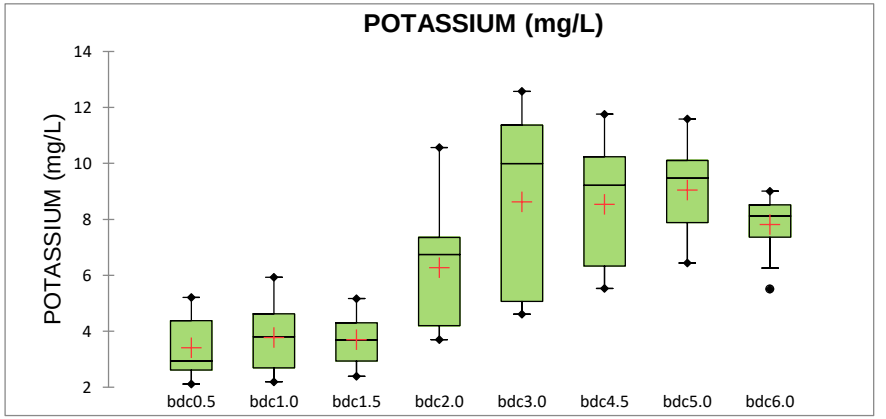
Appendix C

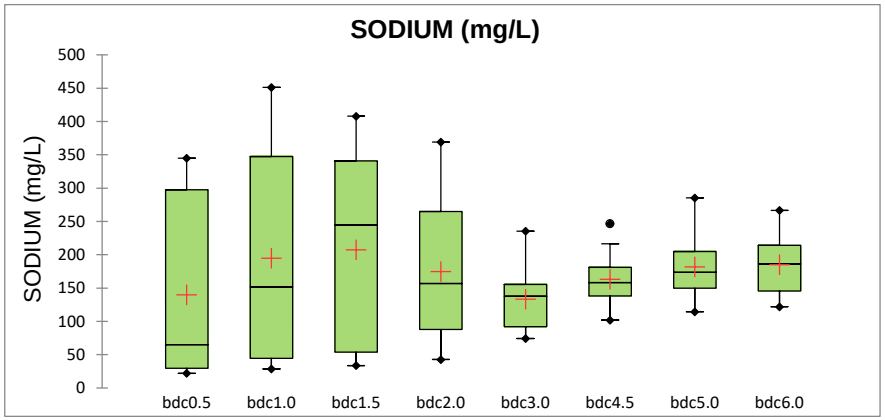
Box Plots for Big Dry Creek for 2019 Instream Monthly Sampling Program - General Water Quality Parameters and Iron

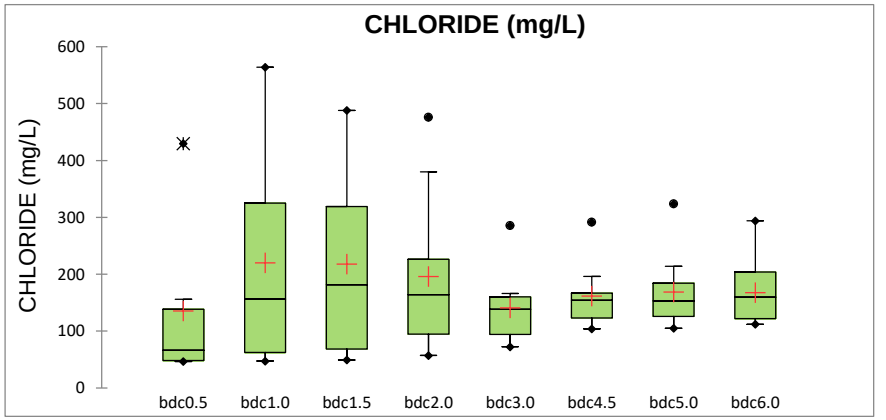






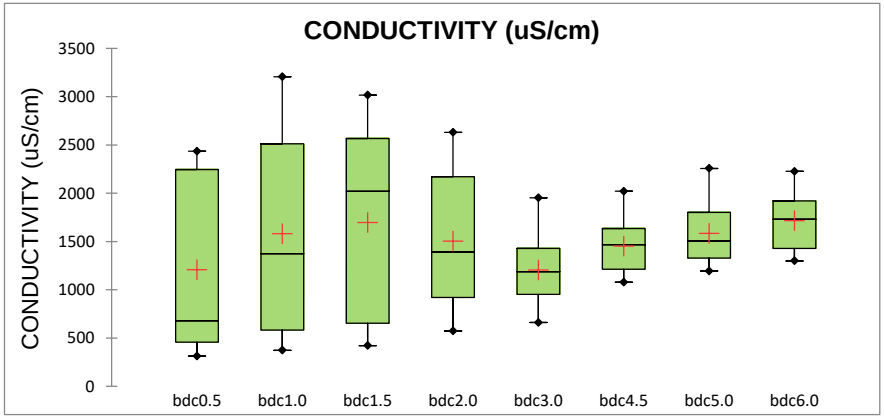


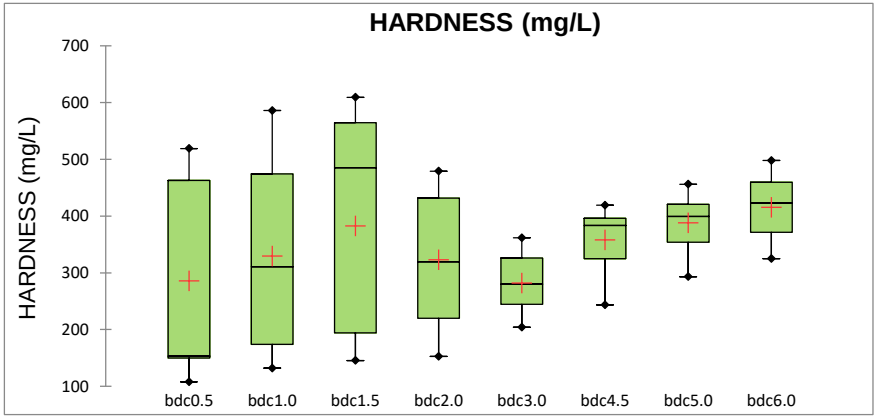


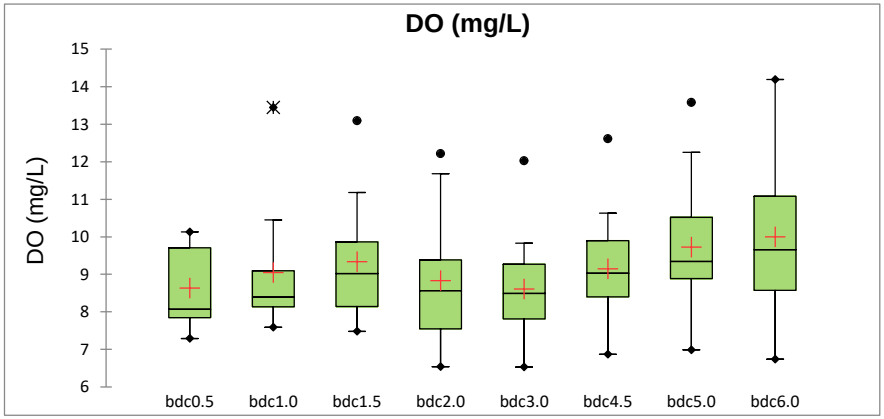


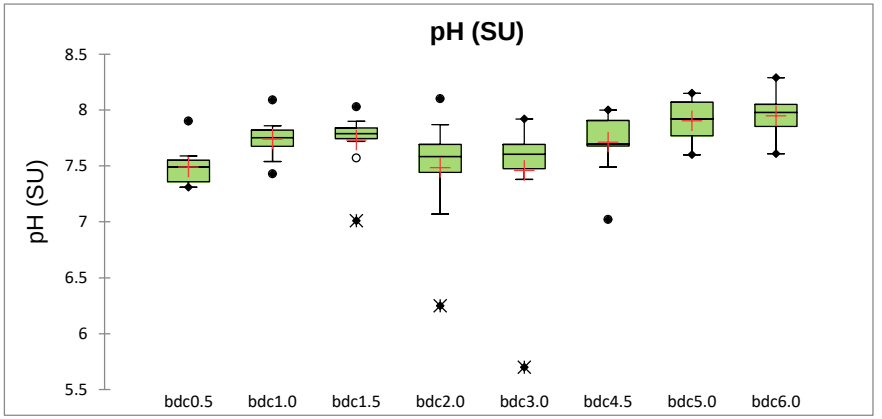
Appendix C

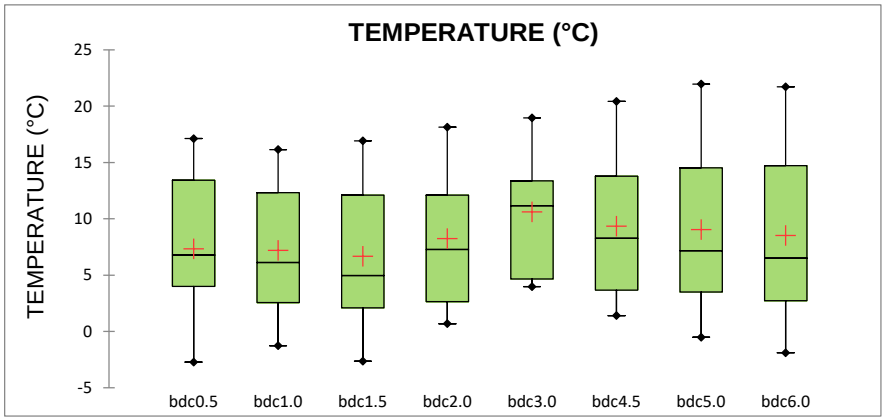
Box Plots for Big Dry Creek for 2019 Instream Monthly Sampling Program - General Water Quality Parameters and Iron

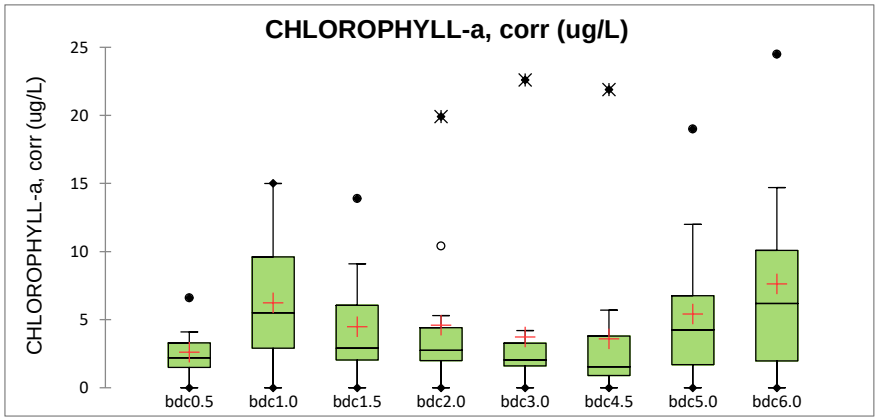






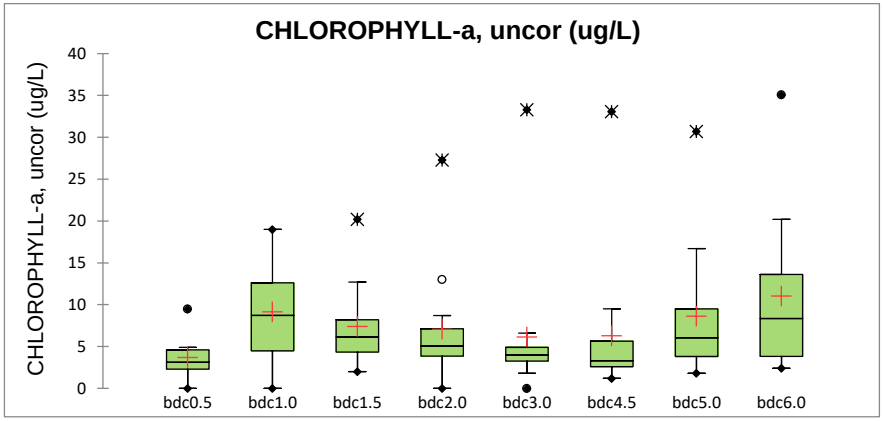


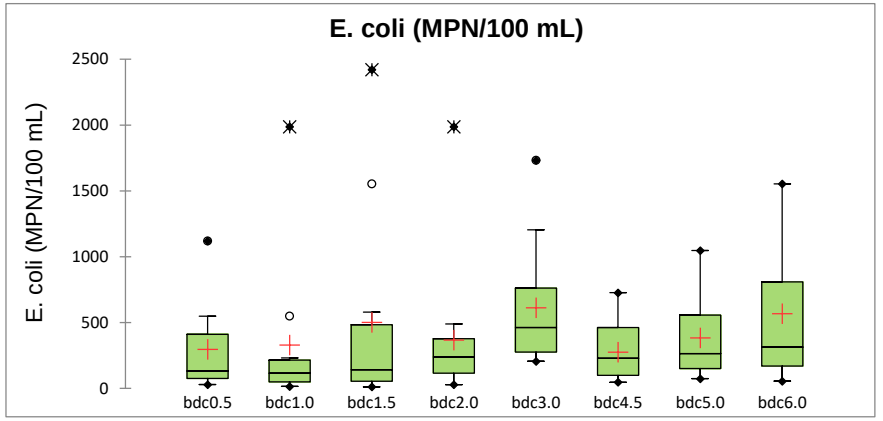


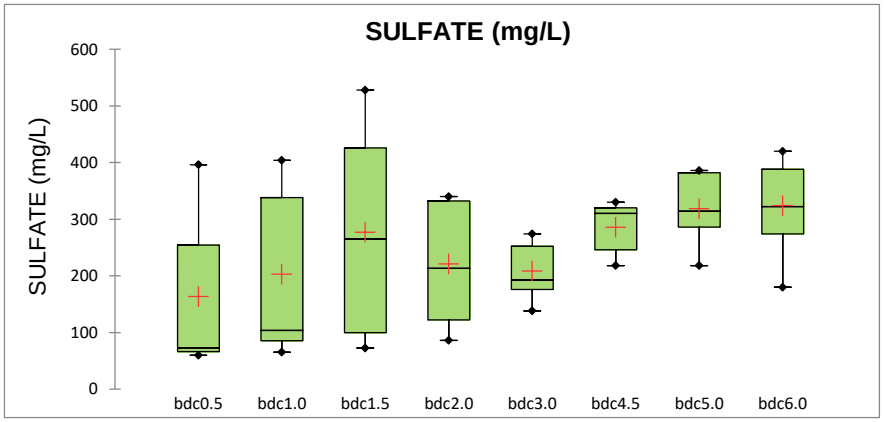


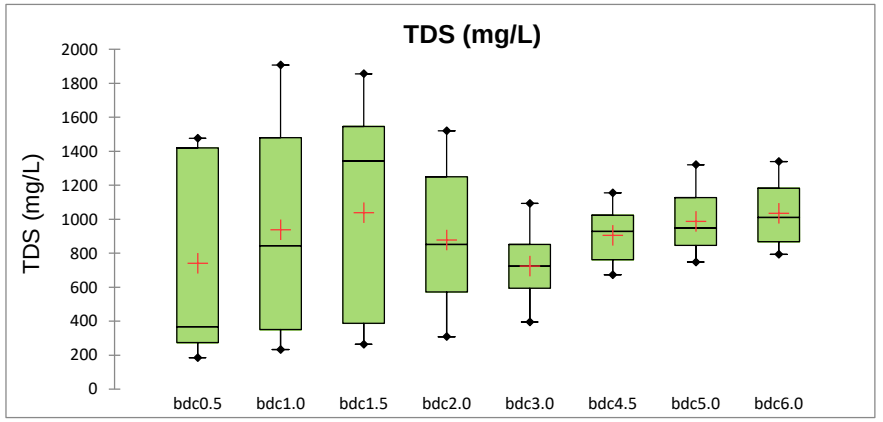
Appendix C

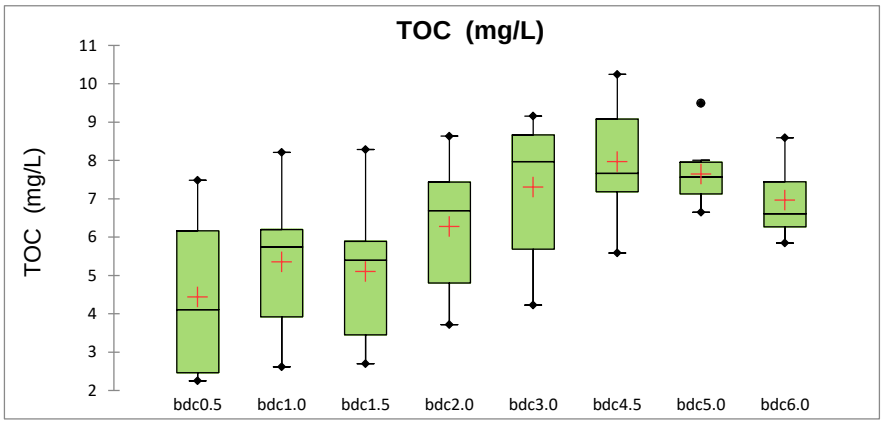
Box Plots for Big Dry Creek for 2019 Instream Monthly Sampling Program - General Water Quality Parameters and Iron

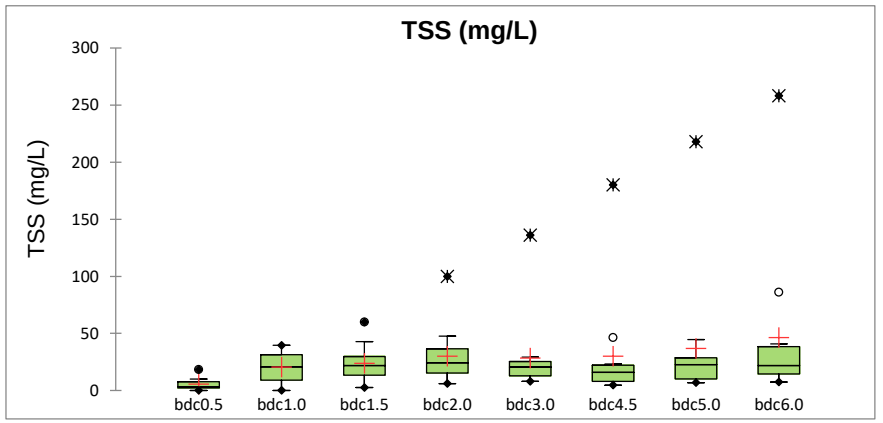






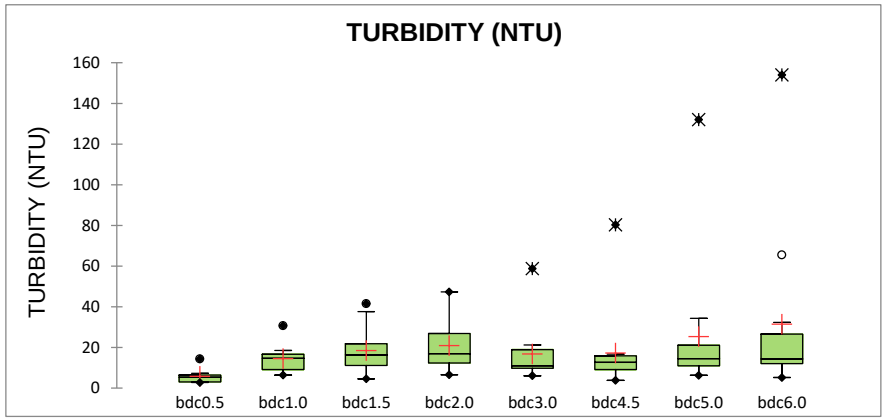


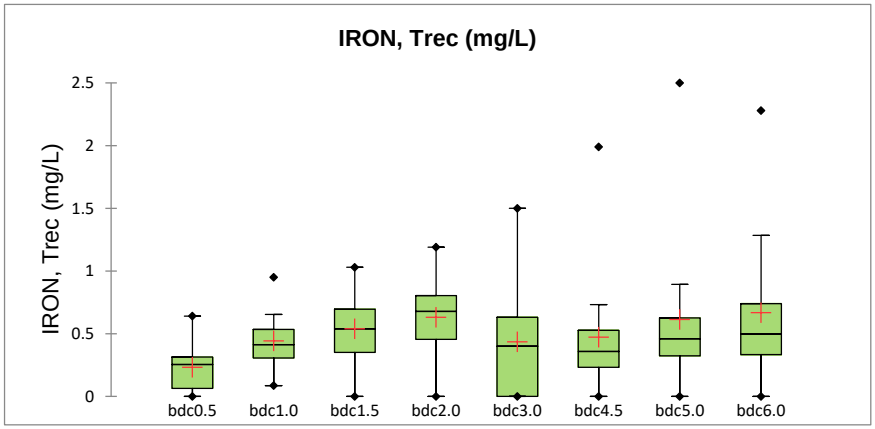




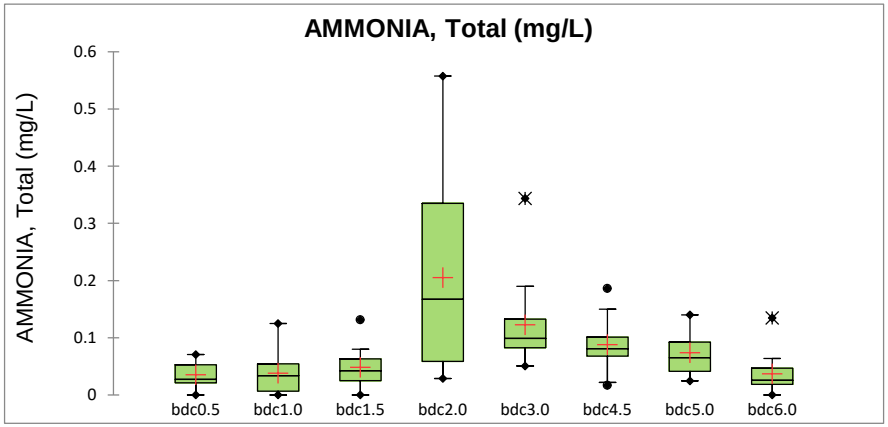
Appendix C

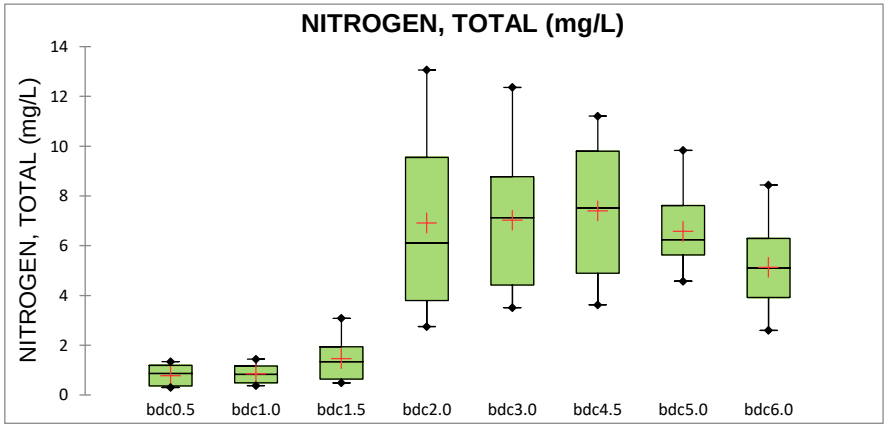
Box Plots for Big Dry Creek for 2019 Instream Monthly Sampling Program - General Water Quality Parameters and Iron

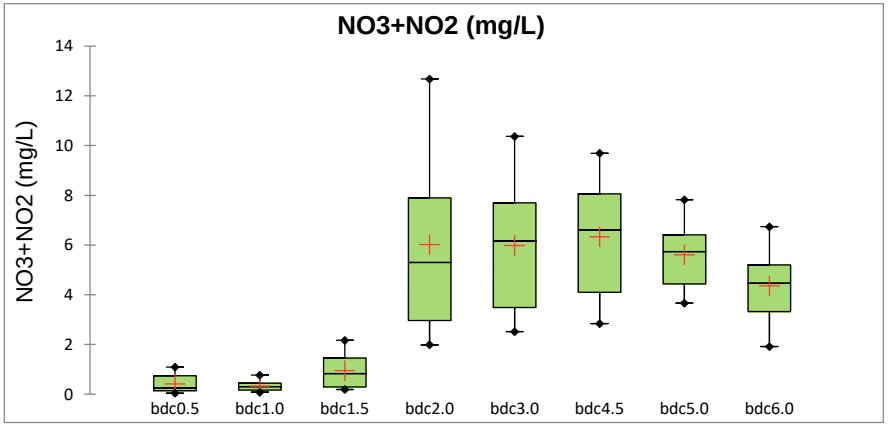


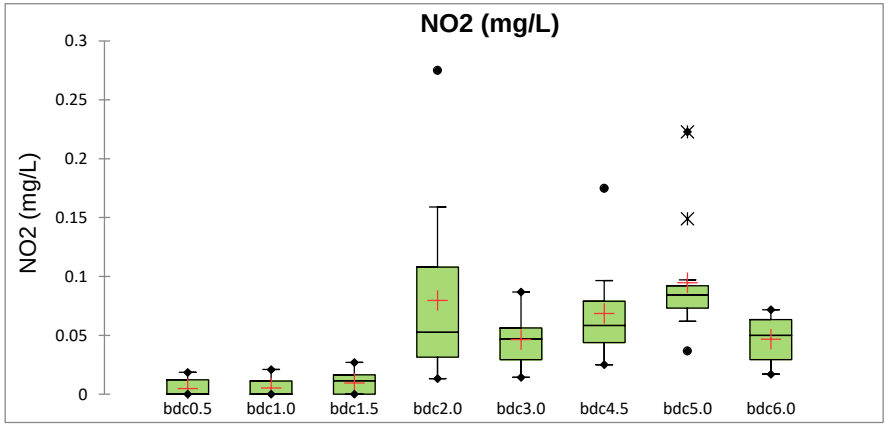


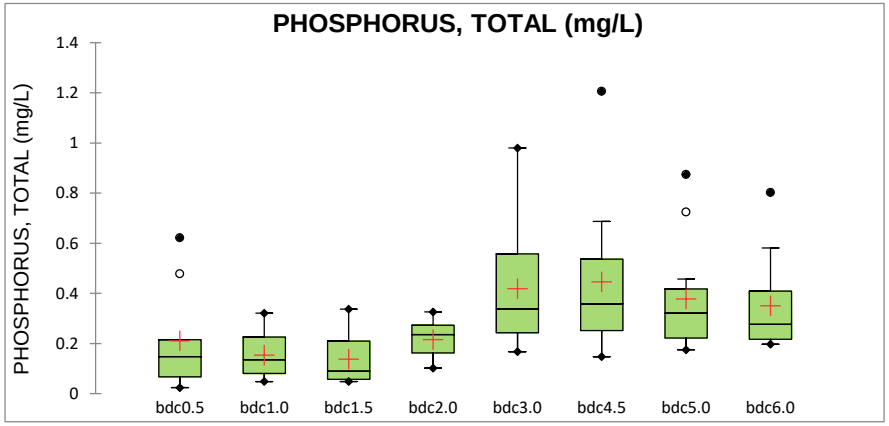
Appendix C
Box Plots for Big Dry Creek for 2019 Instream Sampling Program - Nutrients

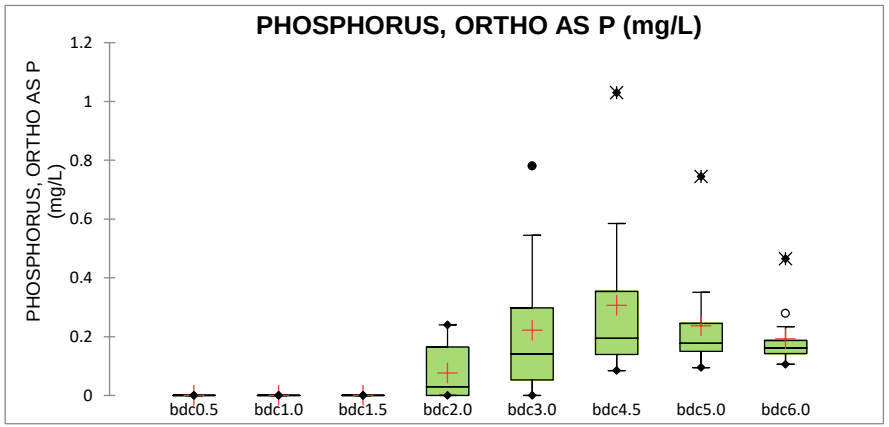


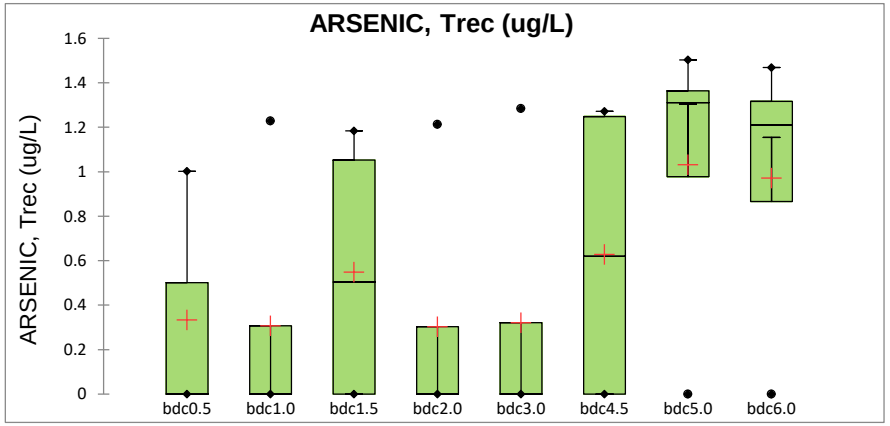


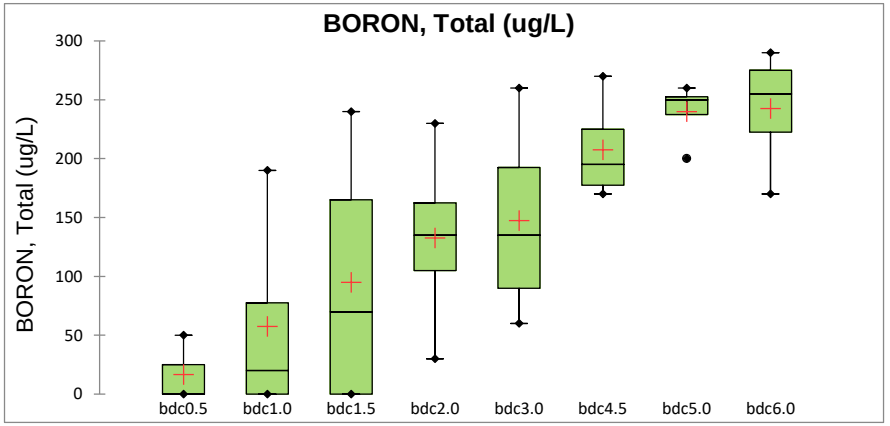


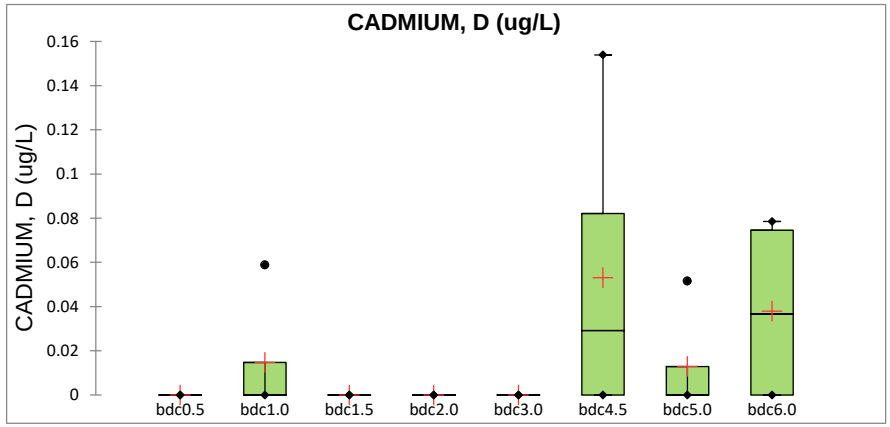


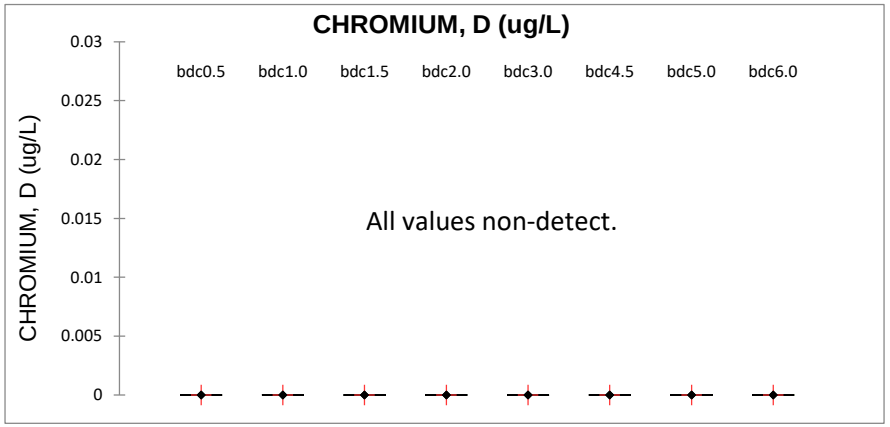


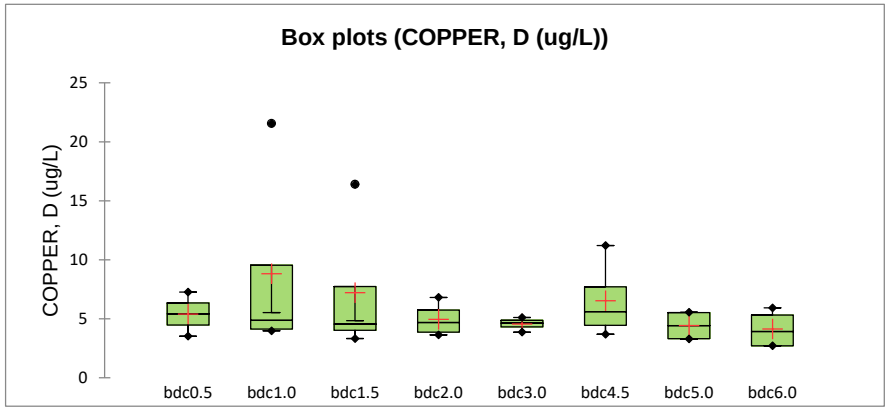


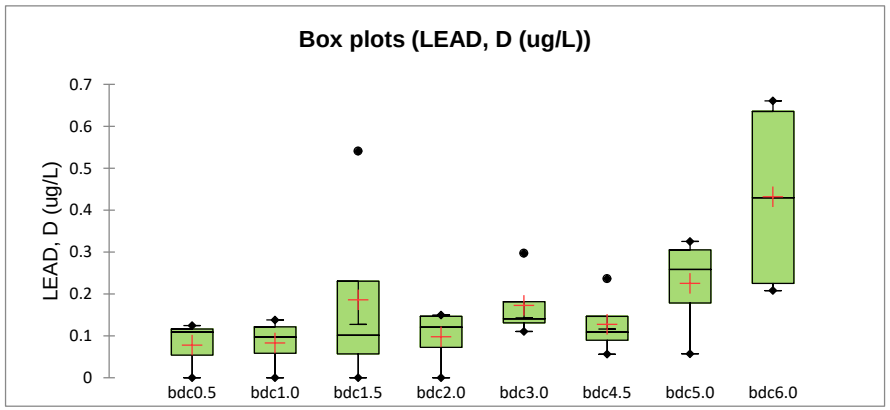

ARSENIC, Trec (ug/L)
ARSENIC, Trec (ug/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
bdc0.5
bdc1.0
bdc1.5
bdc2.0
bdc3.0
bdc4.5
bdc5.0
bdc6.0


BORON, Total (ug/L)
BORON, Total (ug/L)
300
250
200
150
100
50
0
bdc0.5
bdc1.0
bdc1.5
bdc2.0
bdc3.0
bdc4.5
bdc5.0
bdc6.0

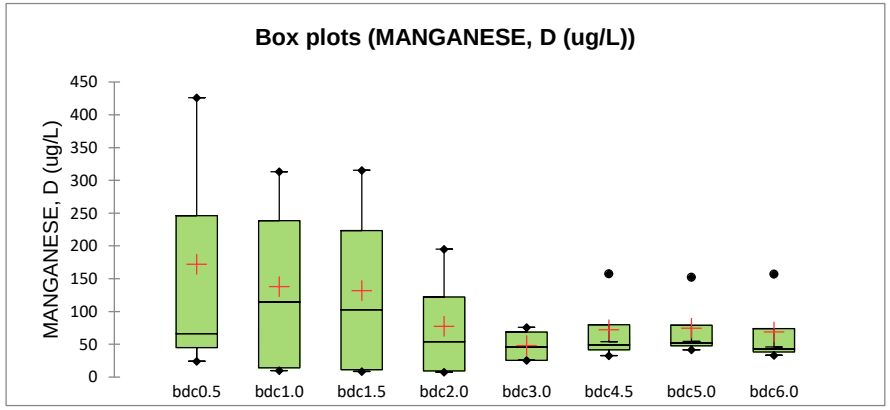

CADMIUM, D (ug/L)
CADMIUM, D (ug/L)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
bdc0.5
bdc1.0
bdc1.5
bdc2.0
bdc3.0
bdc4.5
bdc5.0
bdc6.0

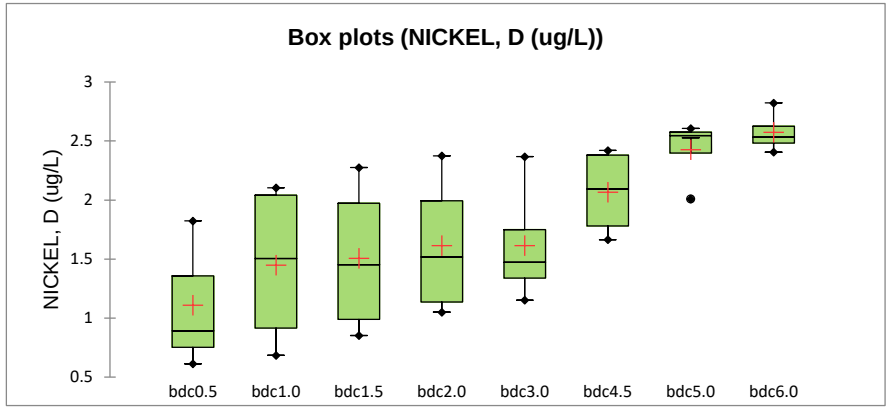

CHROMIUM, D (ug/L)
CHROMIUM, D (ug/L)
0.03
0.025
0.02
0.015
0.01
0.005
0
bdc0.5
bdc1.0
bdc1.5
bdc2.0
bdc3.0
bdc4.5
bdc5.0
bdc6.0
All values non-detect.

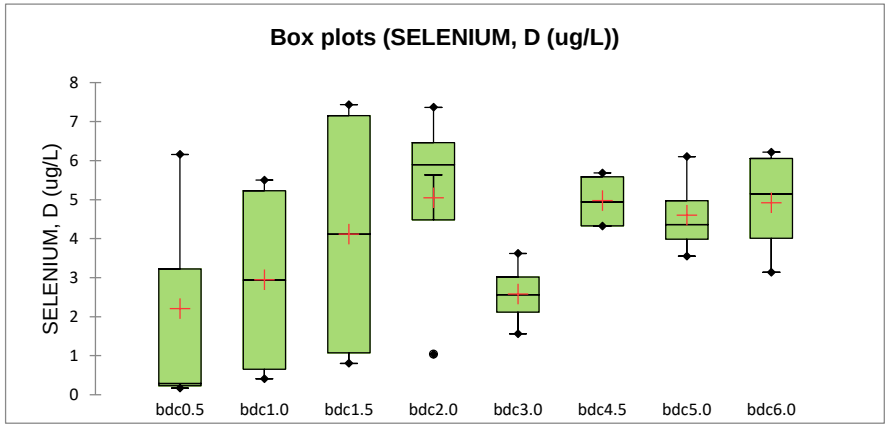

Box plots (COPPER, D (ug/L))
COPPER, D (ug/L)
25
20
15
10
5
0
bdc0.5
bdc1.0
bdc1.5
bdc2.0
bdc3.0
bdc4.5
bdc5.0
bdc6.0

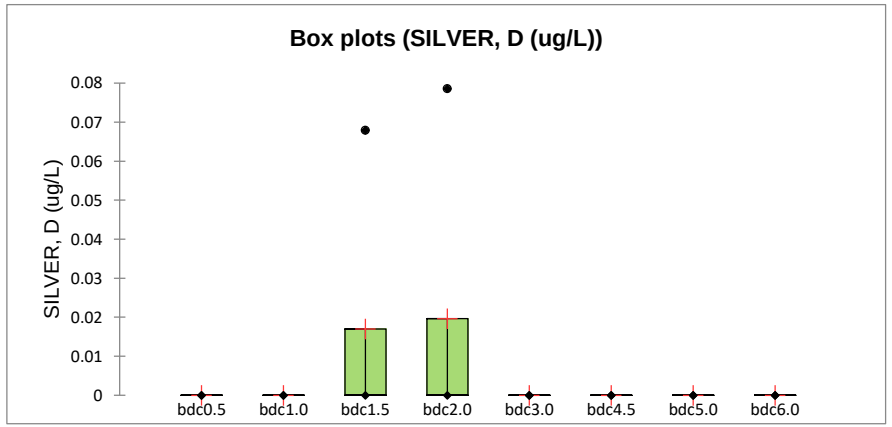

Box plots (LEAD, D (ug/L))
LEAD, D (ug/L)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
bdc0.5
bdc1.0
bdc1.5
bdc2.0
bdc3.0
bdc4.5
bdc5.0
bdc6.0

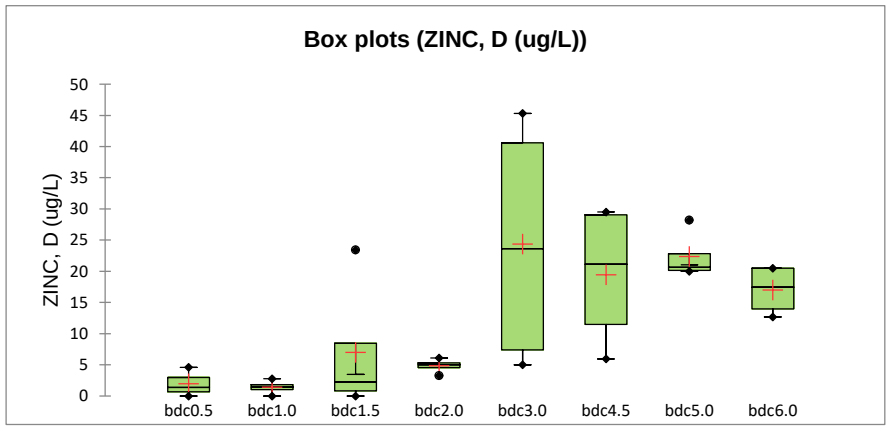
Appendix C
Box Plots for Big Dry Creek for 2019 Instream Sampling Program - Metals

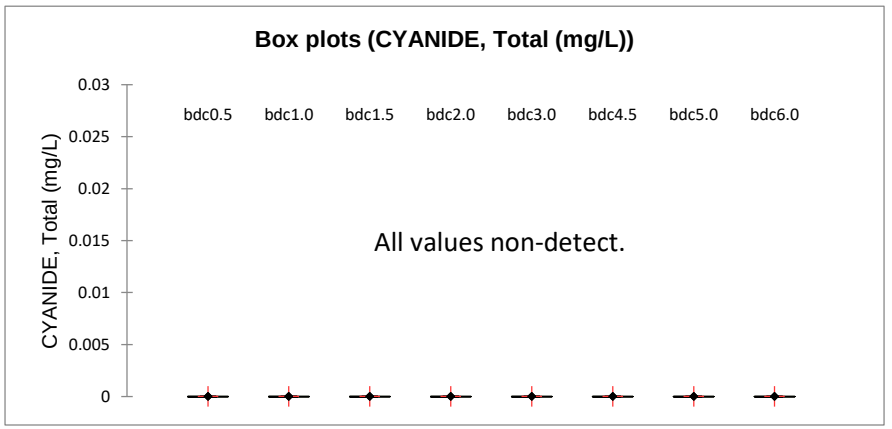






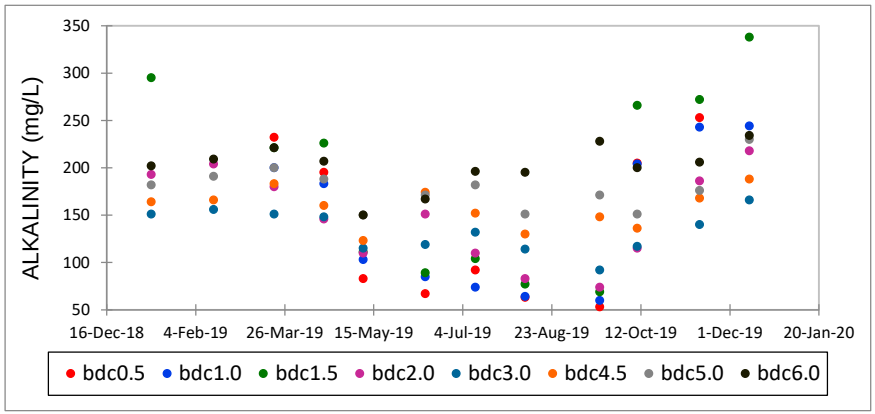


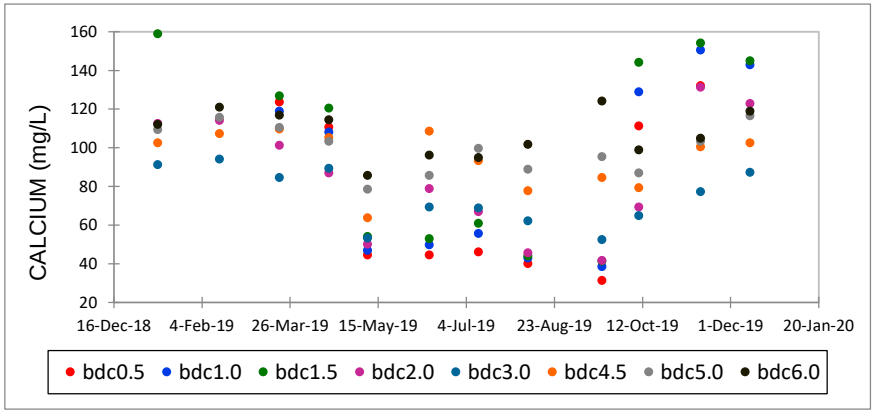


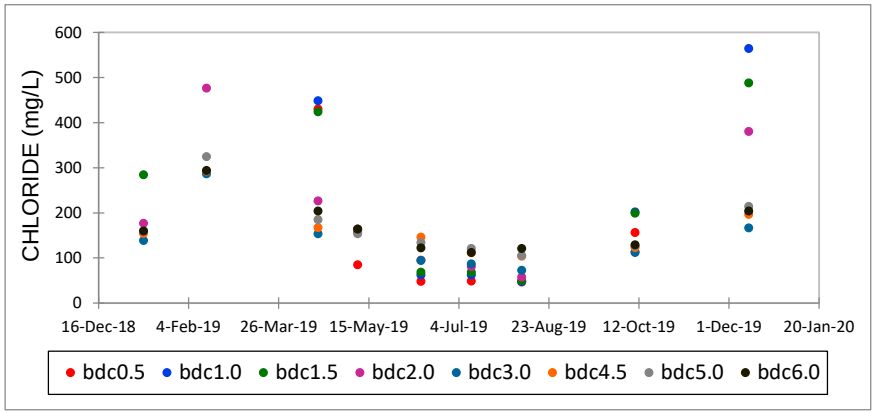


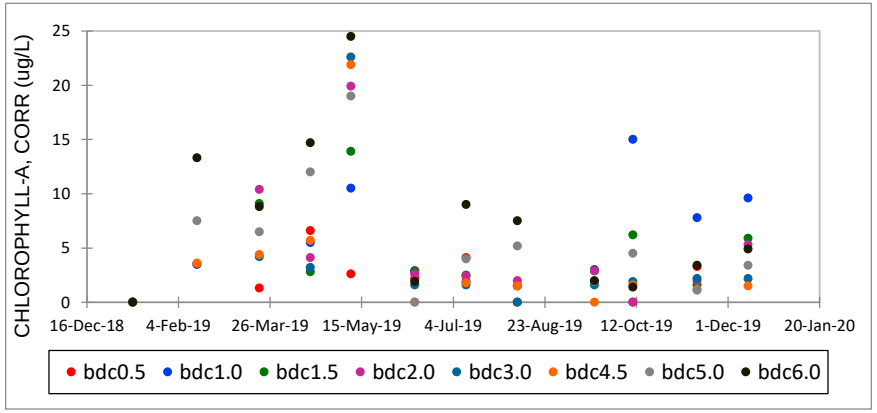
Appendix C

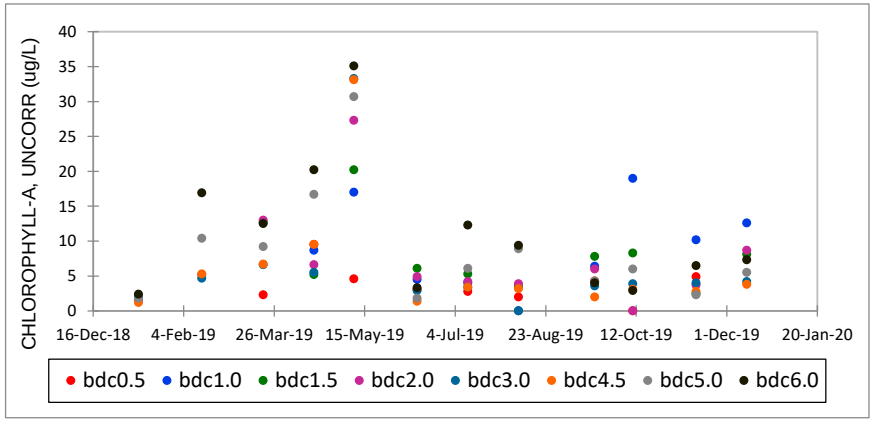
Scatter Plots for Big Dry Creek 2019 Instream Monthly Sampling Program - General Water Quality and Iron

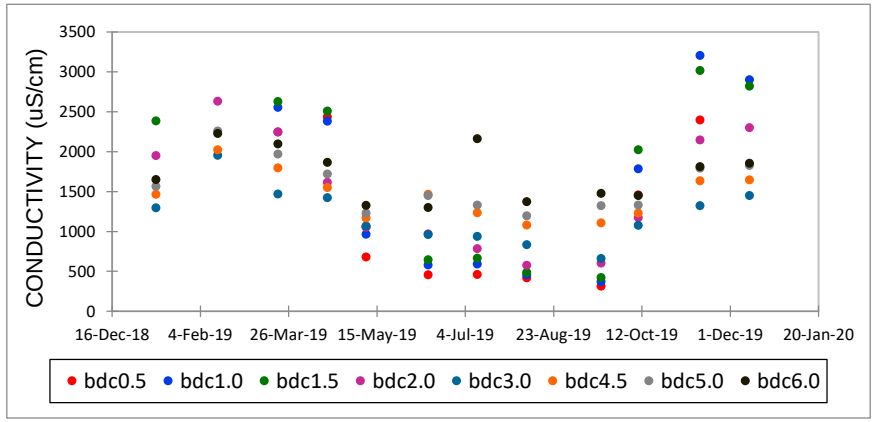


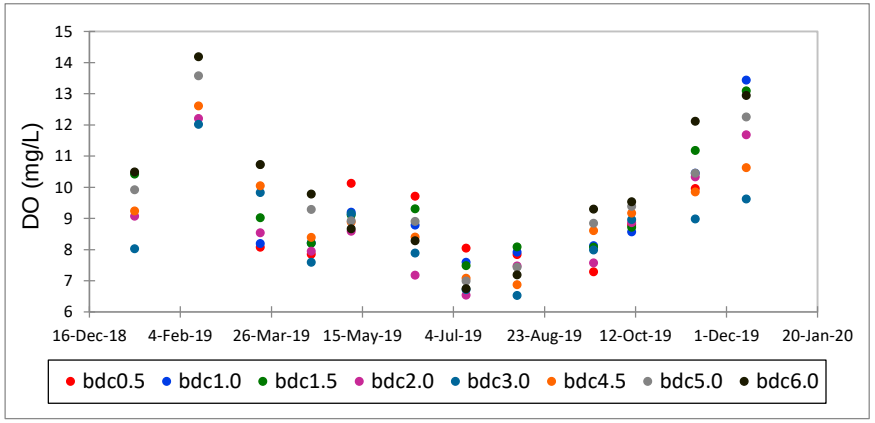


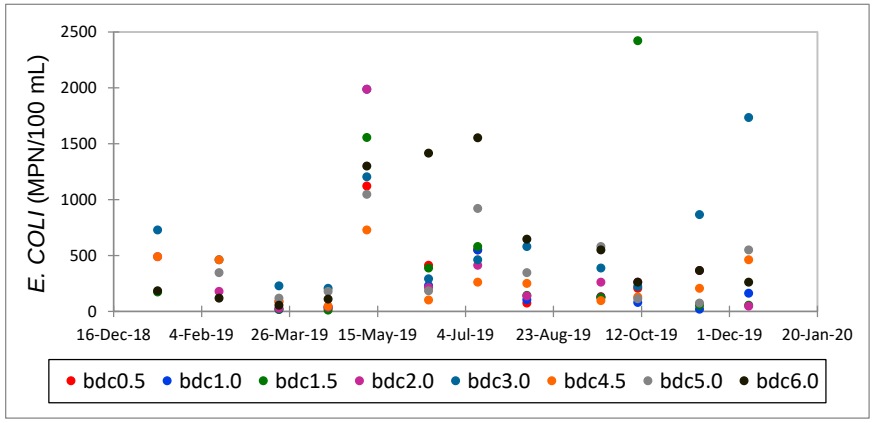


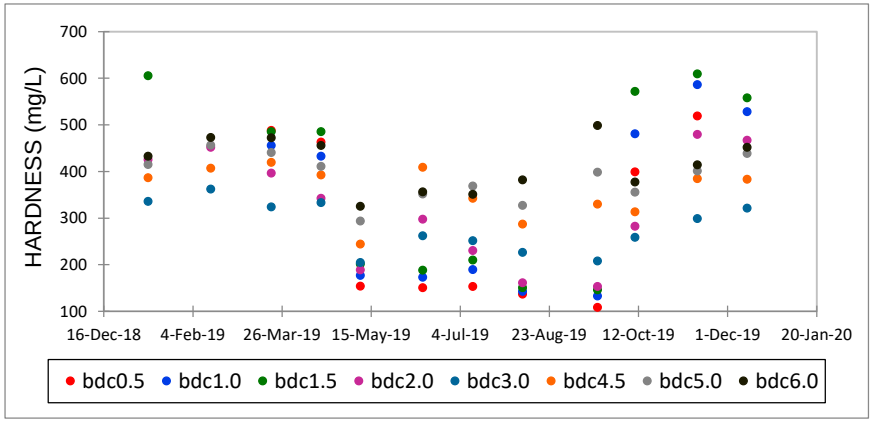


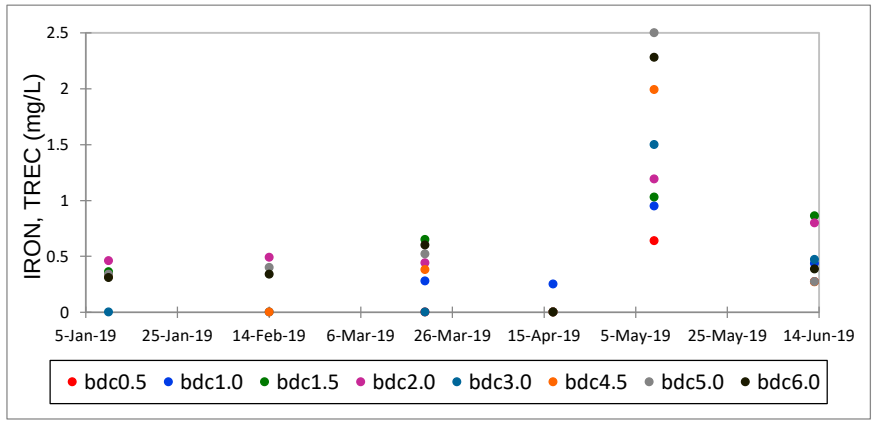


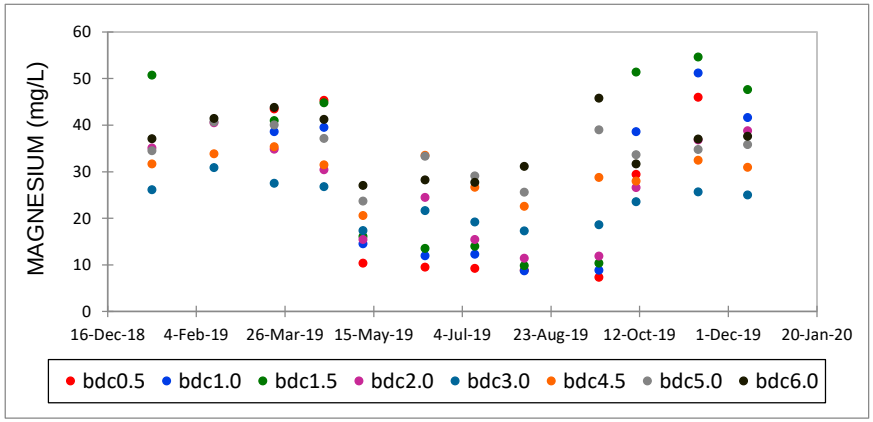


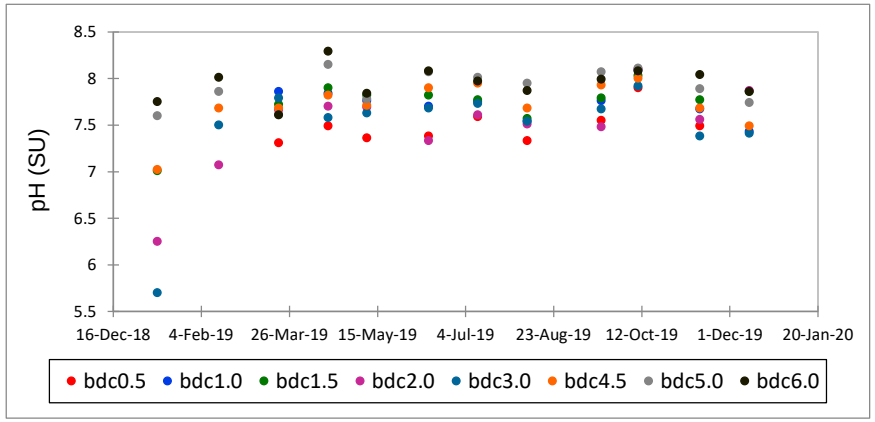

DO (mg/L)
15
14
13
12
11
10
9
8
7
6
16-Dec-18
4-Feb-19
26-Mar-19
15-May-19
4-Jul-19
23-Aug-19
12-Oct-19
1-Dec-19
20-Jan-20
bdc0.5 bdc1.0 bdc1.5 bdc2.0 bdc3.0 bdc4.5 bdc5.0 bdc6.0

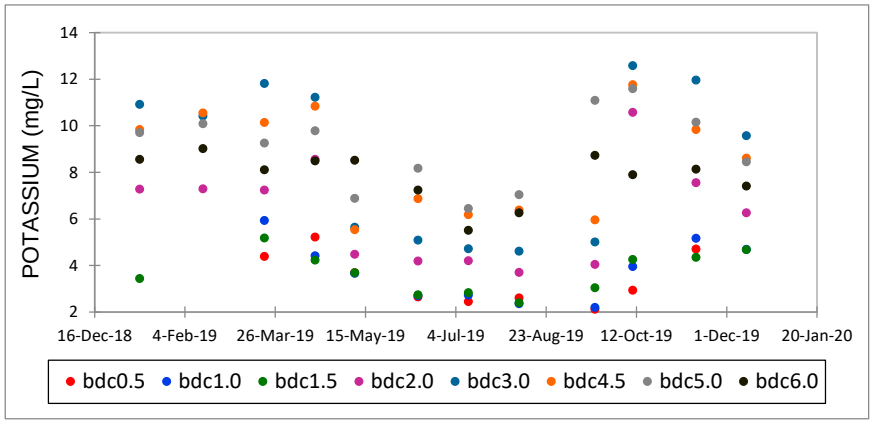

E. COLI (MPN/100 mL)
2500
2000
1500
1000
500
0
16-Dec-18
4-Feb-19
26-Mar-19
15-May-19
4-Jul-19
23-Aug-19
12-Oct-19
1-Dec-19
20-Jan-20
bdc0.5 bdc1.0 bdc1.5 bdc2.0 bdc3.0 bdc4.5 bdc5.0 bdc6.0

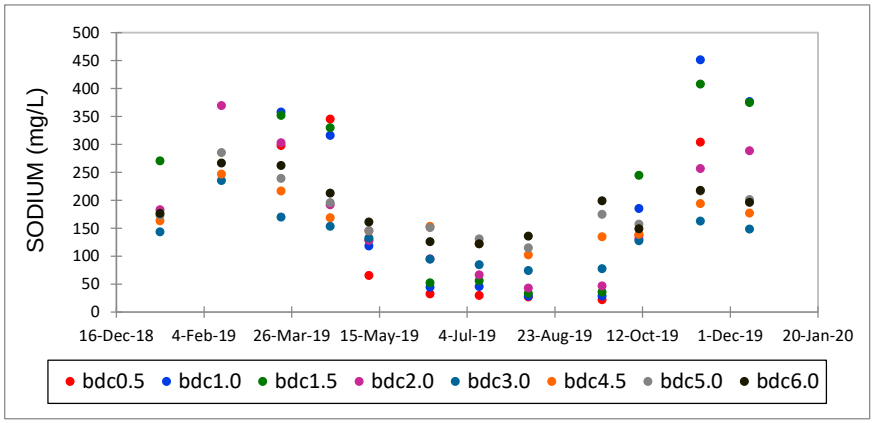

HARDNESS (mg/L)
700
600
500
400
300
200
100
16-Dec-18
4-Feb-19
26-Mar-19
15-May-19
4-Jul-19
23-Aug-19
12-Oct-19
1-Dec-19
20-Jan-20
bdc0.5 bdc1.0 bdc1.5 bdc2.0 bdc3.0 bdc4.5 bdc5.0 bdc6.0

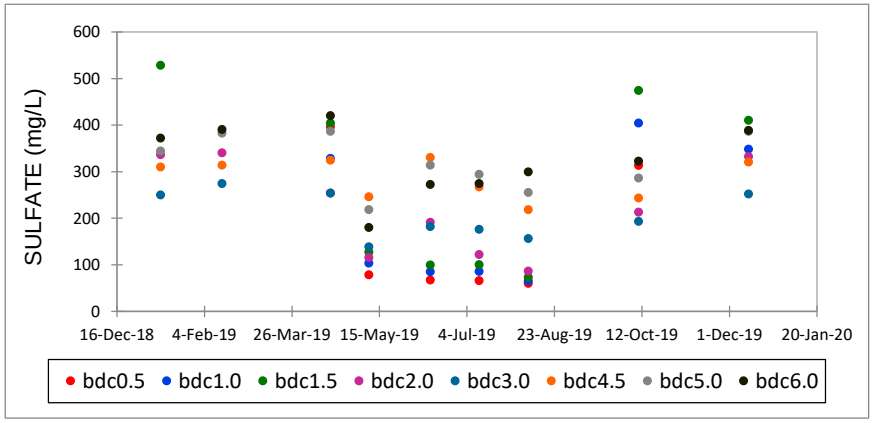

IRON, TREC (mg/L)
2.5
2
1.5
1
0.5
0
5-Jan-19
25-Jan-19
14-Feb-19
6-Mar-19
26-Mar-19
15-Apr-19
5-May-19
25-May-19
14-Jun-19
bdc0.5 bdc1.0 bdc1.5 bdc2.0 bdc3.0 bdc4.5 bdc5.0 bdc6.0

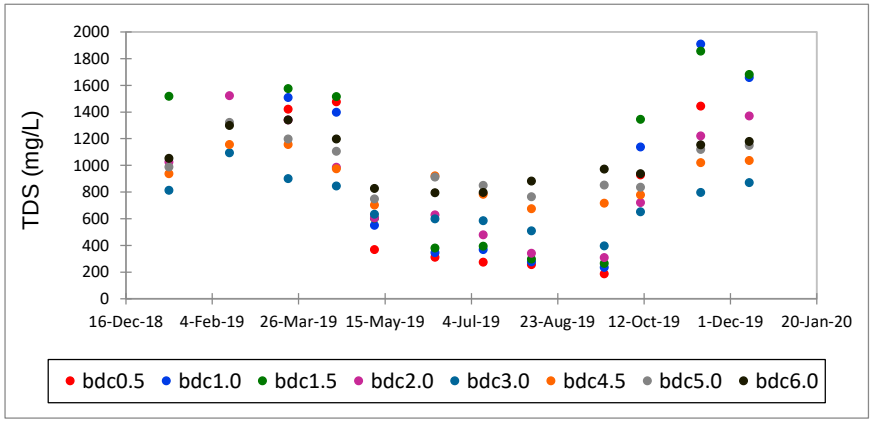

MAGNESIUM (mg/L)
60
50
40
30
20
10
0
16-Dec-18
4-Feb-19
26-Mar-19
15-May-19
4-Jul-19
23-Aug-19
12-Oct-19
1-Dec-19
20-Jan-20
bdc0.5 bdc1.0 bdc1.5 bdc2.0 bdc3.0 bdc4.5 bdc5.0 bdc6.0

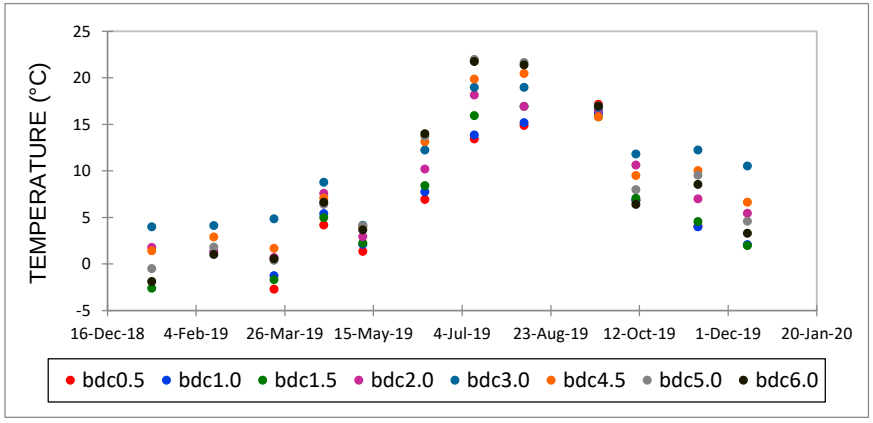

pH (SU)
8.5
8
7.5
7
6.5
6
5.5
16-Dec-18
4-Feb-19
26-Mar-19
15-May-19
4-Jul-19
23-Aug-19
12-Oct-19
1-Dec-19
20-Jan-20
bdc0.5 bdc1.0 bdc1.5 bdc2.0 bdc3.0 bdc4.5 bdc5.0 bdc6.0

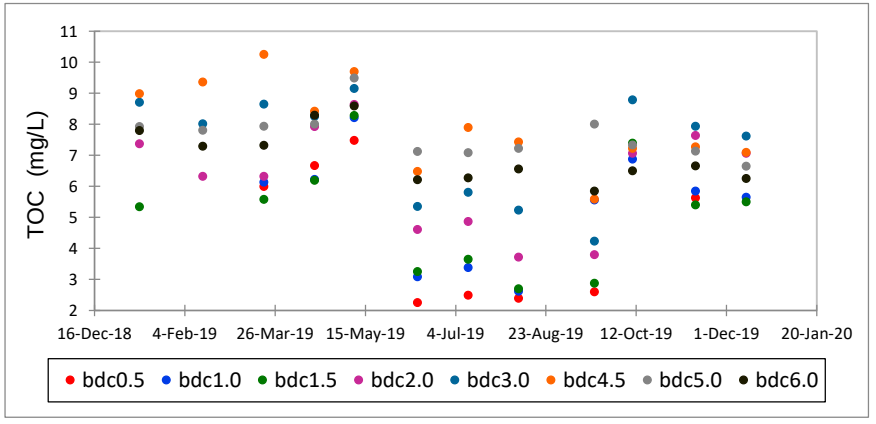

POTASSIUM (mg/L)
14
12
10
8
6
4
2
16-Dec-18
4-Feb-19
26-Mar-19
15-May-19
4-Jul-19
23-Aug-19
12-Oct-19
1-Dec-19
20-Jan-20
bdc0.5 bdc1.0 bdc1.5 bdc2.0 bdc3.0 bdc4.5 bdc5.0 bdc6.0


SODIUM (mg/L)
500
450
400
350
300
250
200
150
100
50
0
16-Dec-18
4-Feb-19
26-Mar-19
15-May-19
4-Jul-19
23-Aug-19
12-Oct-19
1-Dec-19
20-Jan-20
bdc0.5 bdc1.0 bdc1.5 bdc2.0 bdc3.0 bdc4.5 bdc5.0 bdc6.0

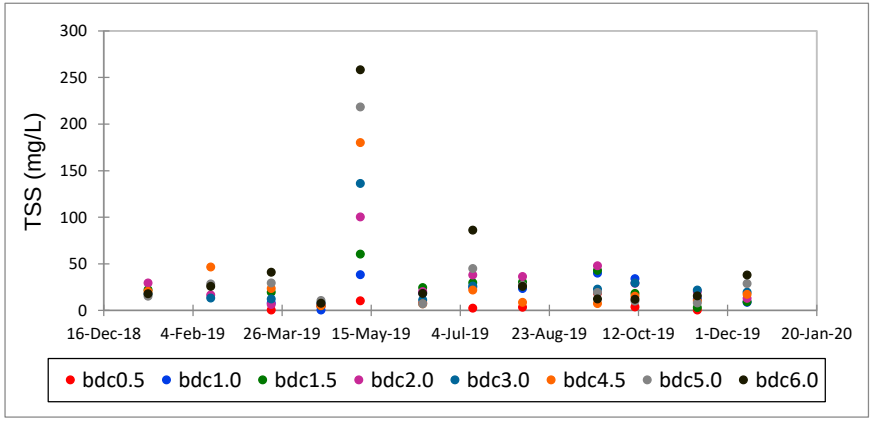

SULFATE (mg/L)
600
500
400
300
200
100
0
16-Dec-18
4-Feb-19
26-Mar-19
15-May-19
4-Jul-19
23-Aug-19
12-Oct-19
1-Dec-19
20-Jan-20
bdc0.5 bdc1.0 bdc1.5 bdc2.0 bdc3.0 bdc4.5 bdc5.0 bdc6.0

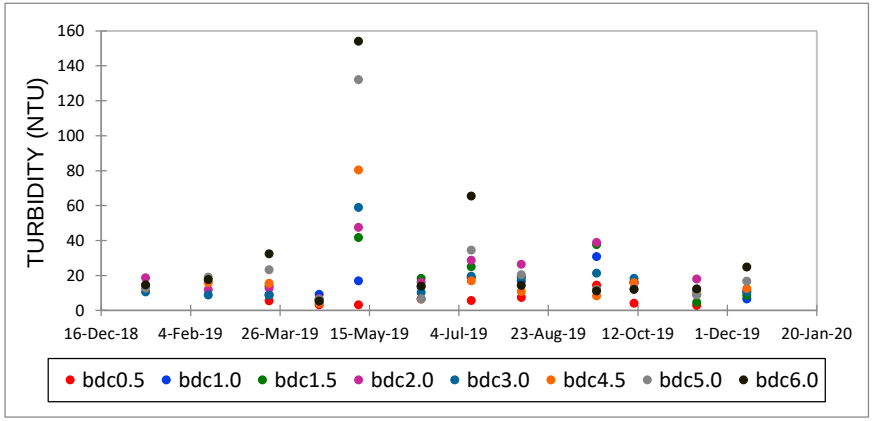

TDS (mg/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
16-Dec-18
4-Feb-19
26-Mar-19
15-May-19
4-Jul-19
23-Aug-19
12-Oct-19
1-Dec-19
20-Jan-20
bdc0.5 bdc1.0 bdc1.5 bdc2.0 bdc3.0 bdc4.5 bdc5.0 bdc6.0


TEMPERATURE (°C)
25
20
15
10
5
0
-5
16-Dec-18
4-Feb-19
26-Mar-19
15-May-19
4-Jul-19
23-Aug-19
12-Oct-19
1-Dec-19
20-Jan-20
bdc0.5 bdc1.0 bdc1.5 bdc2.0 bdc3.0 bdc4.5 bdc5.0 bdc6.0

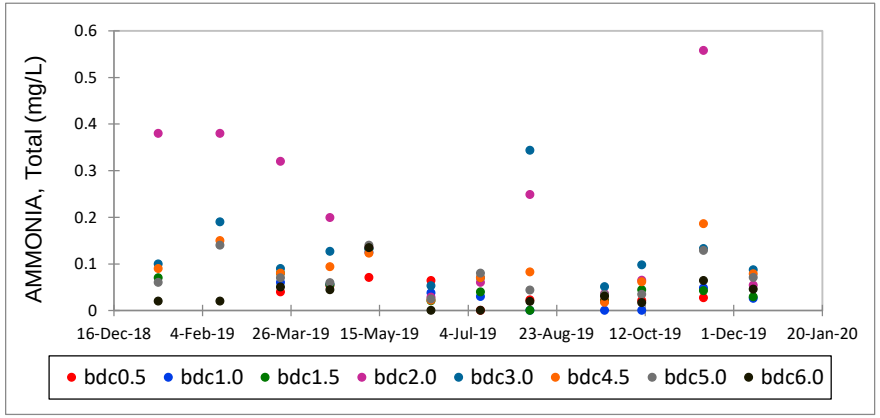

TOC (mg/L)
11
10
9
8
7
6
5
4
3
2
16-Dec-18
4-Feb-19
26-Mar-19
15-May-19
4-Jul-19
23-Aug-19
12-Oct-19
1-Dec-19
20-Jan-20
bdc0.5 bdc1.0 bdc1.5 bdc2.0 bdc3.0 bdc4.5 bdc5.0 bdc6.0

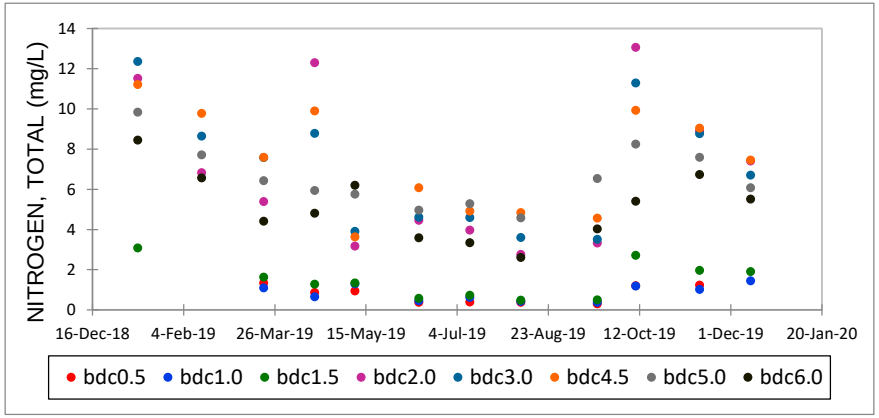
Appendix C
Scatter Plots for Big Dry Creek 2019 Instream Monthly Sampling Program - General Water Quality and Iron

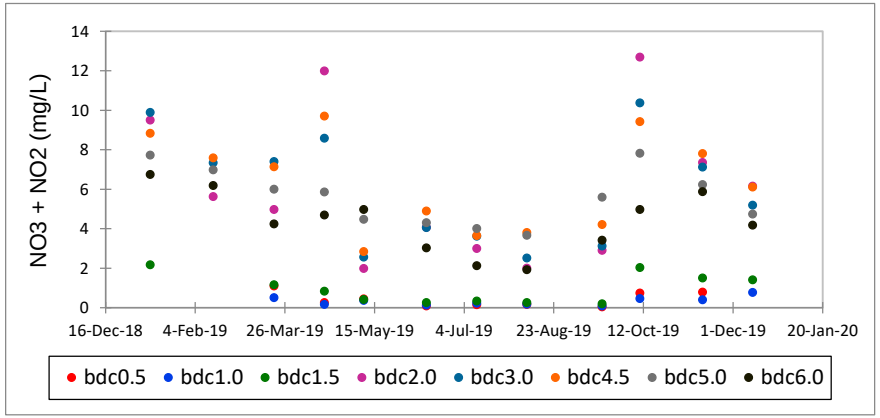


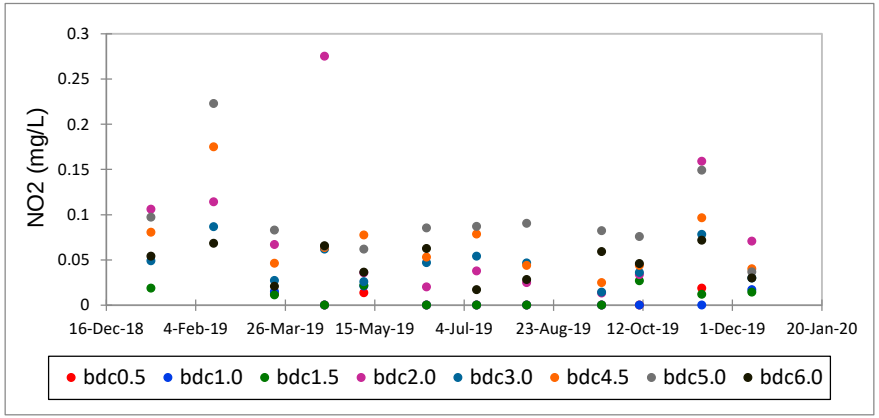


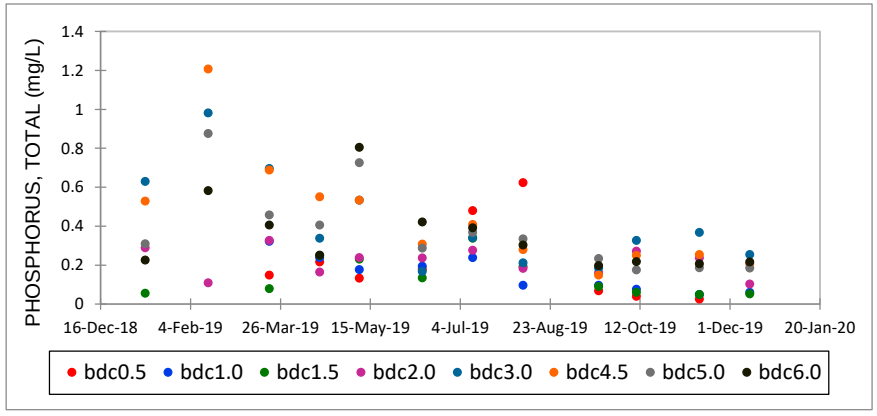
Appendix C
Scatter Plots for Big Dry Creek 2019 Instream Sampling Program - Nutrients

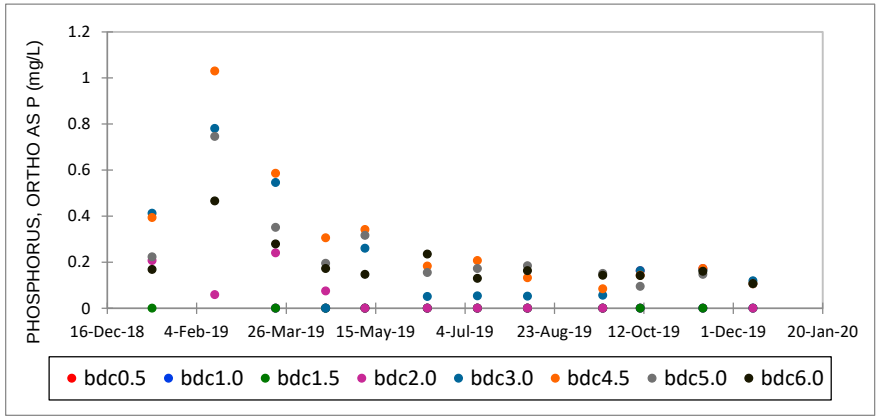




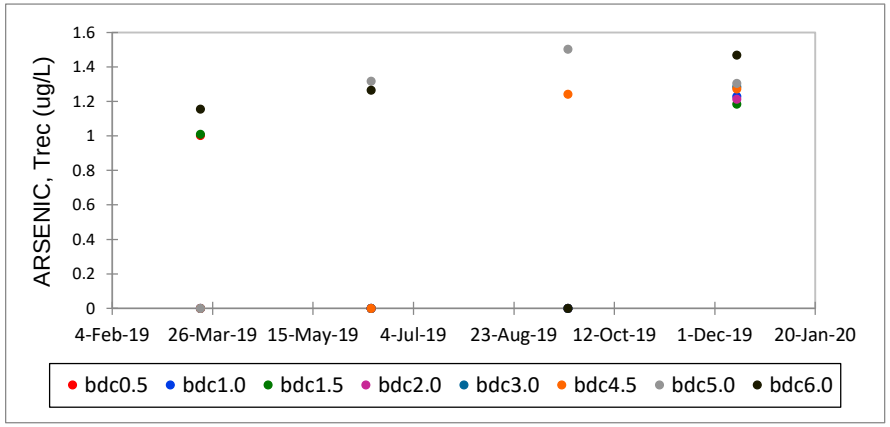


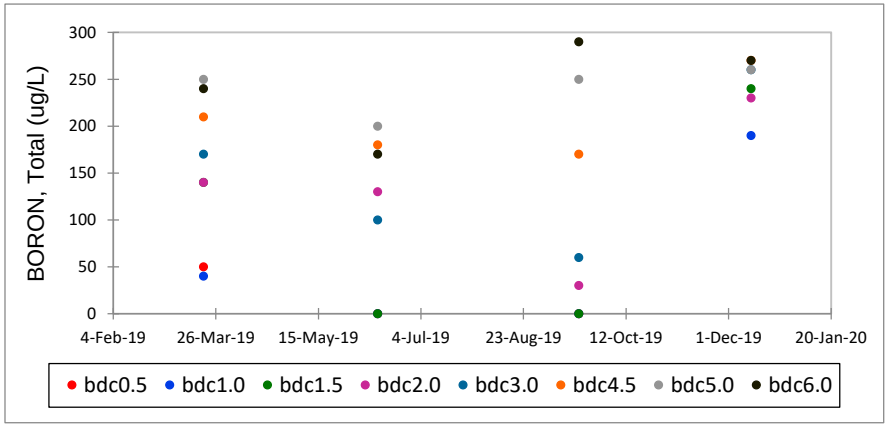


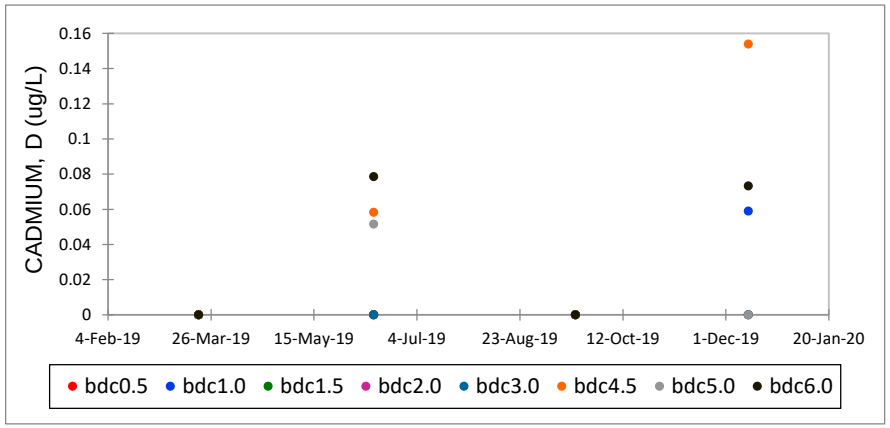


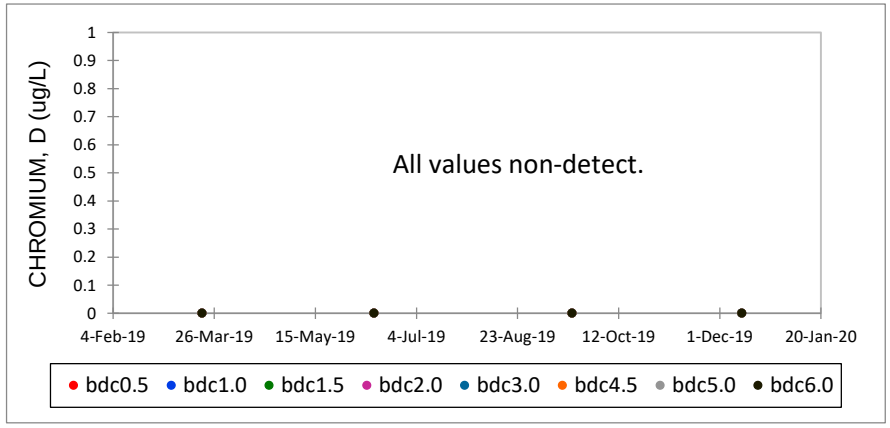


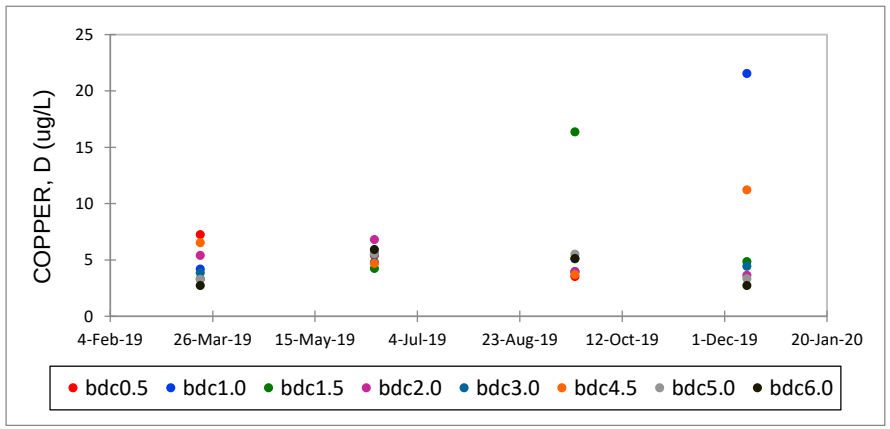
Appendix C
Scatter Plots for Big Dry Creek 2019 Instream Sampling Program - Metals

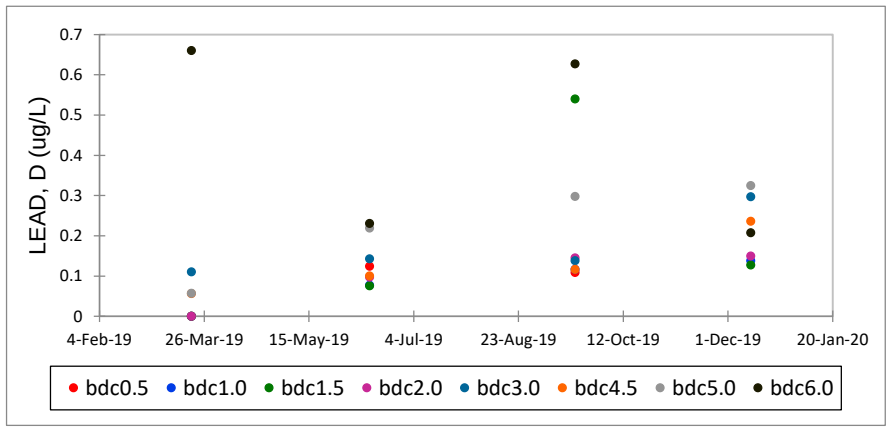




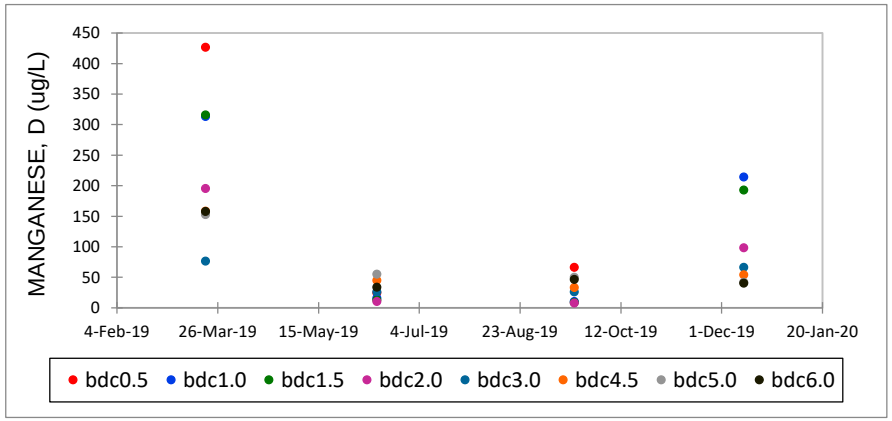


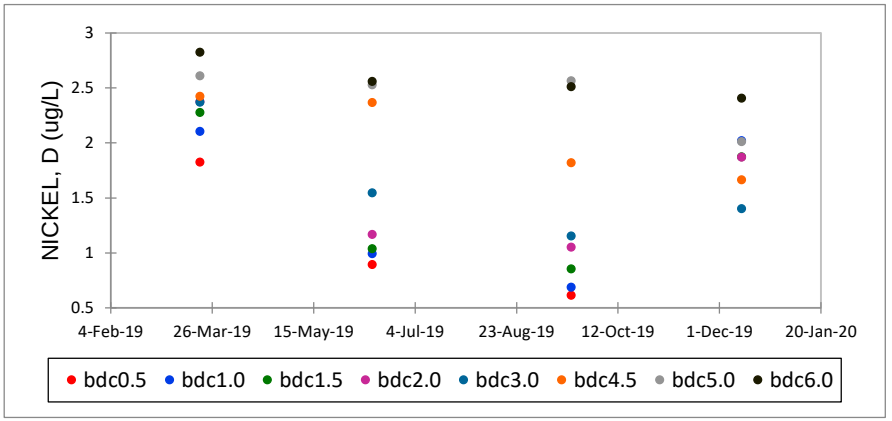


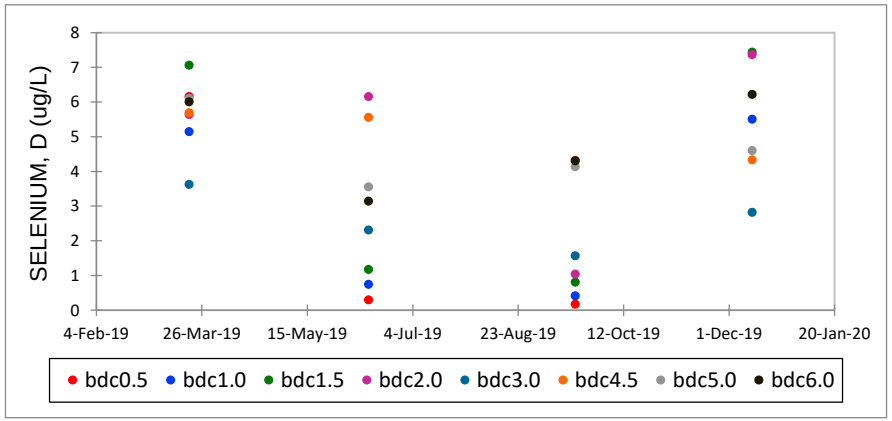


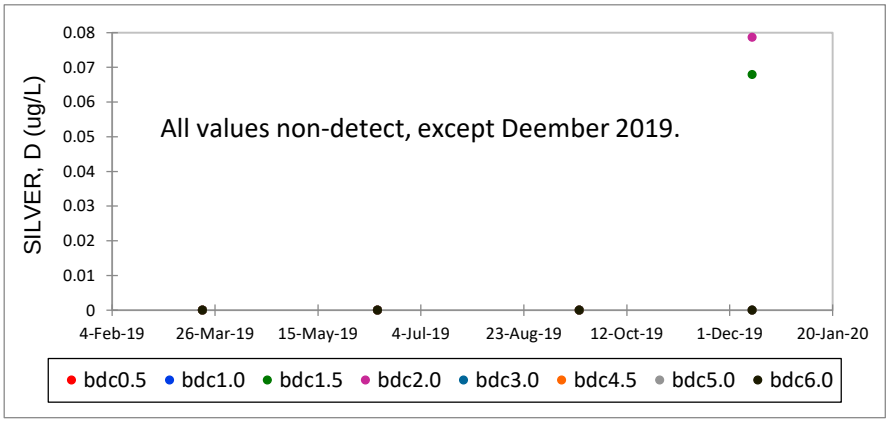


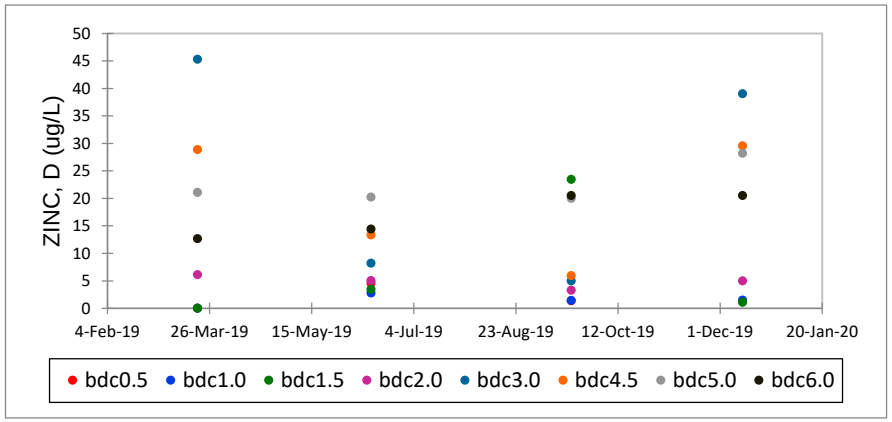
Appendix C
Scatter Plots for Big Dry Creek 2019 Instream Sampling Program - Metals

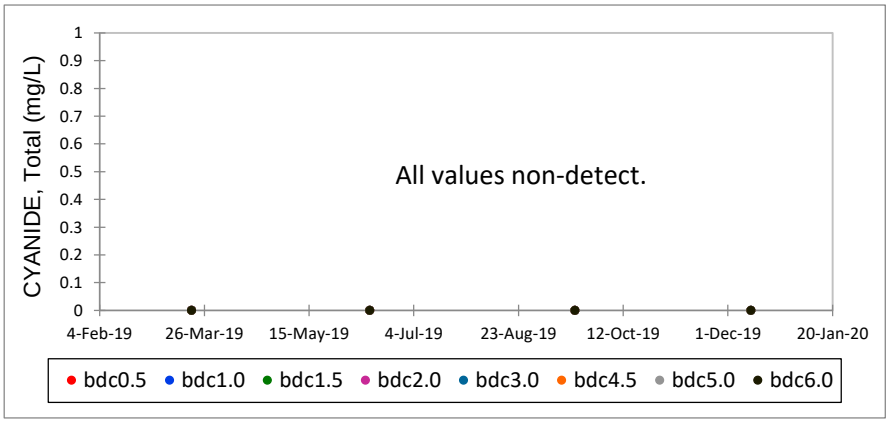




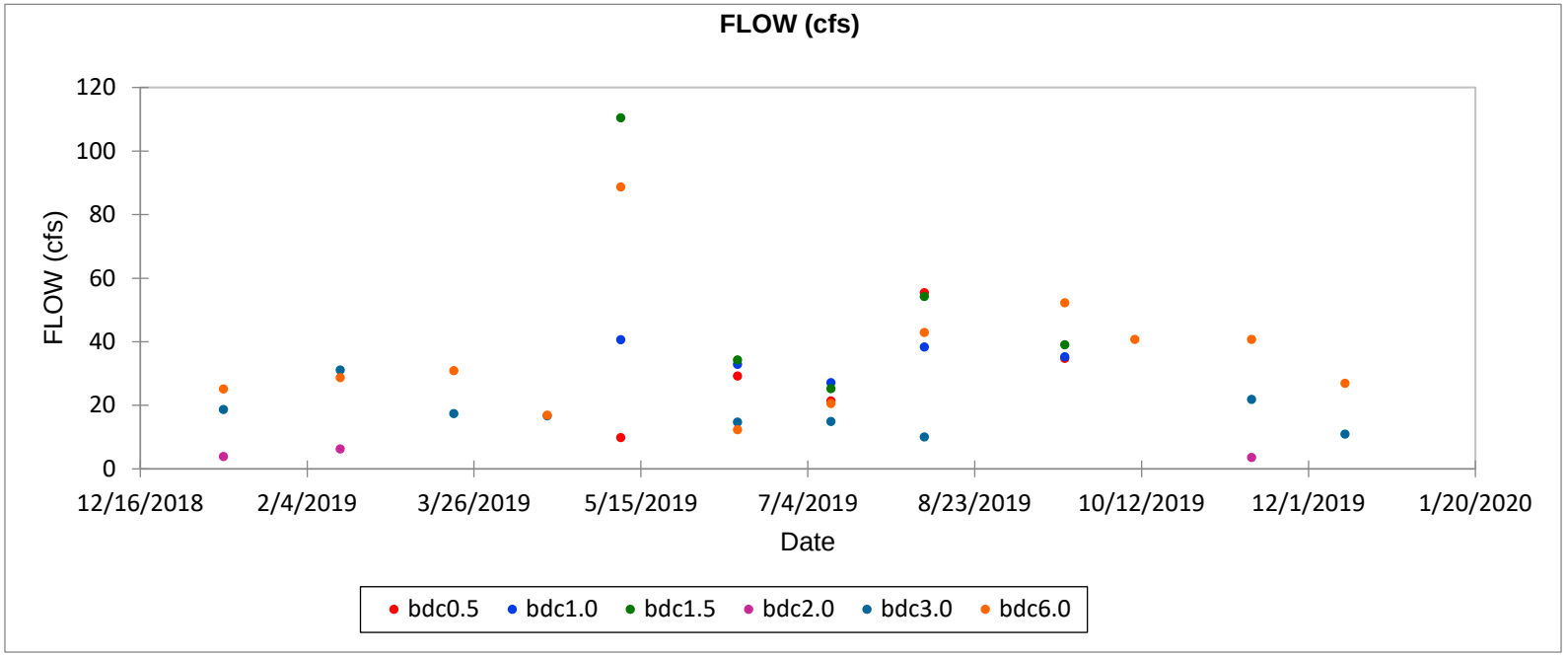








Appendix C
Scatter Plots for Big Dry Creek 2019 Instream Sampling Program - Flow



Appendix D. Big Dry Creek 2019 Quality Control (QC) Samples

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Appendix D. 2019 Big Dry Creek Quality Control Samples: Field Replicates

Station	Date	Analyte	Fraction	Result Value	Qualifier	Result Unit	MDL	RPD
bdc2.0	3/20/2019	Phosphorus	Total	0.33		mg/L	0.01	1%
bdc2.0	3/20/2019	Phosphorus	Total	0.32		mg/L	0.01	
bdc2.0	3/20/2019	NH3	Not Applicable	0.320		mg/L	0.02	5%
bdc2.0	3/20/2019	NH3	Not Applicable	0.290		mg/L	0.02	
bdc2.0	3/20/2019	NO3+NO2	Not Applicable	4.97		mg/L		0%
bdc2.0	3/20/2019	NO3+NO2	Not Applicable	4.94		mg/L		
bdc2.0	3/20/2019	Nitrogen	Total	5.39		mg/L	0.03	1%
bdc2.0	3/20/2019	Nitrogen	Total	5.33		mg/L	0.03	
Station	Date	Analyte	Fraction	Result Value		Result Unit	MDL	RPD
bdc2.0	6/13/2019	Phosphorus	Total	0.24		mg/L	0.01	24%
bdc2.0	6/13/2019	Phosphorus	Total	0.15		mg/L	0.01	
bdc2.0	6/13/2019	NH3	Not Applicable	0.029	J	mg/L	0.02	7%
bdc2.0	6/13/2019	NH3	Not Applicable	0.025	J	mg/L	0.02	
bdc2.0	6/13/2019	NO3+NO2	Not Applicable	4.07		mg/L		0%
bdc2.0	6/13/2019	NO3+NO2	Not Applicable	4.09		mg/L		
bdc2.0	6/13/2019	Nitrogen	Total	4.46		mg/L	0.03	1%
bdc2.0	6/13/2019	Nitrogen	Total	4.40		mg/L	0.03	
bdc1.5	6/13/2019	SELENIUM	Dissolved	0.00		mg/L	0.00	0%
bdc1.5	6/13/2019	SELENIUM	Dissolved	0.00		mg/L	0.00	
bdc2.0	6/13/2019	E. coli	Not Applicable	214.00		MPN/100 mL	1.00	16%
bdc2.0	6/13/2019	E. coli	Not Applicable	155.00		MPN/100 mL	1.00	
Station	Date	Analyte	Fraction	Result Value		Result Unit	MDL	RPD
bdc2.0	12/12/2019	Phosphorus	Total	0.10		mg/L	0.01	4%
bdc2.0	12/12/2019	Phosphorus	Total	0.09		mg/L	0.01	
bdc2.0	12/12/2019	NH3		0.054		mg/L	0.02	8%
bdc2.0	12/12/2019	NH3		0.063		mg/L	0.02	
bdc2.0	12/12/2019	NO3+NO2	Not Applicable	6.16		mg/L		2%
bdc2.0	12/12/2019	NO3+NO2	Not Applicable	6.45		mg/L		
bdc2.0	12/12/2019	Nitrogen	Total	7.40		mg/L	0.03	1%
bdc2.0	12/12/2019	Nitrogen	Total	7.61		mg/L	0.03	
bdc1.5	12/12/2019	SELENIUM	Dissolved	0.01		mg/L	0.00	1%
bdc1.5	12/12/2019	SELENIUM	Dissolved	0.01		mg/L	0.00	
Full Suite								
Station	Date	Analyte	Fraction	Result Value		Result Unit	MDL	RPD
bdc2.0	9/19/2019	NH3		0.024	J	mg/L	0.02	20%
bdc2.0	9/19/2019	NH3		0.036	J	mg/L	0.02	
bdc5.0	9/19/2019	Alkalinity, Total	Total	171.00		mg/L	1.00	0%
bdc5.0	9/19/2019	Alkalinity, Total	Total	171.00		mg/L	1.00	
bdc5.0	9/19/2019	ARSENIC	Total Recoverable	0.00		mg/L	0.00	20%
bdc5.0	9/19/2019	ARSENIC	Total Recoverable	0.00		mg/L	0.00	
bdc5.0	9/19/2019	BORON	Total	0.25		mg/L	0.01	2%
bdc5.0	9/19/2019	BORON	Total	0.26		mg/L	0.01	
bdc5.0	9/19/2019	CADMIUM	Dissolved	0.00		mg/L	0.00	12%
bdc5.0	9/19/2019	CADMIUM	Dissolved	0.00		mg/L	0.00	
bdc5.0	9/19/2019	CALCIUM	Total	96.40		mg/L	1.00	1%
bdc5.0	9/19/2019	CALCIUM	Total	95.20		mg/L	1.00	
bdc5.0	9/19/2019	CARBON, TOTAL ORGANIC	Total	7.76		mg/L	0.25	2%

Appendix D. 2019 Big Dry Creek Quality Control Samples: Field Replicates

Station	Date	Analyte	Fraction	Result Value	Qualifier	Result Unit	MDL	RPD
bdc5.0	9/19/2019	CARBON, TOTAL ORGANIC	Total	8.00		mg/L	0.25	
bdc5.0	9/19/2019	CHLORIDE	Dissolved			mg/L	0.50	N/A
bdc5.0	9/19/2019	CHLORIDE	Dissolved			mg/L	0.50	
bdc5.0	9/19/2019	Chlorophyll-a	Total	4.30		ug/L	1.00	20%
bdc5.0	9/19/2019	Chlorophyll-a	Total	6.40		ug/L	1.00	
bdc5.0	9/19/2019	Chlorophyll-a, corrected	Total	3.50		ug/L	1.00	30%
bdc5.0	9/19/2019	Chlorophyll-a, corrected	Total	1.90		ug/L	1.00	
bdc5.0	9/19/2019	CHROMIUM	Dissolved	0.00		mg/L	0.00	0%
bdc5.0	9/19/2019	CHROMIUM	Dissolved	0.00		mg/L	0.00	
bdc5.0	9/19/2019	Conductivity	Not Applicable	1323.00		uS/cm	0.50	0%
bdc5.0	9/19/2019	Conductivity	Not Applicable	1326.00		uS/cm	0.50	
bdc5.0	9/19/2019	COPPER	Dissolved	0.01		mg/L	0.00	6%
bdc5.0	9/19/2019	COPPER	Dissolved	0.01		mg/L	0.00	
bdc5.0	9/19/2019	Cyanide, Total	Total	0.01		mg/L	0.01	0%
bdc5.0	9/19/2019	Cyanide, Total	Total	0.01		mg/L	0.01	
bdc5.0	9/19/2019	E. coli	Not Applicable	579.00		MPN/100 mL	1.00	3%
bdc5.0	9/19/2019	E. coli	Not Applicable	548.00		MPN/100 mL	1.00	
bdc5.0	9/19/2019	Hardness, Ca,Mg	Total	397.24		mg/L		0%
bdc5.0	9/19/2019	Hardness, Ca,Mg	Total	398.08		mg/L		
bdc5.0	43727	Iron	Total Recoverable	0.12		mg/L	0.01	4%
bdc5.0	43727	Iron	Total Recoverable	0.11		mg/L	0.01	
bdc5.0	9/19/2019	LEAD	Dissolved	0.00		mg/L	0.00	4%
bdc5.0	9/19/2019	LEAD	Dissolved	0.00		mg/L	0.00	
bdc5.0	9/19/2019	Magnesium	Dissolved	38.94		mg/L	0.01	1%
bdc5.0	9/19/2019	Magnesium	Dissolved	38.01		mg/L	0.01	
bdc5.0	9/19/2019	MANGANESE	Dissolved	0.050		mg/L	0.0001	23%
bdc5.0	9/19/2019	MANGANESE	Dissolved	0.079		mg/L	0.0001	
bdc5.0	9/19/2019	NH3	Not Applicable	0.03		mg/L	0.02	6%
bdc5.0	9/19/2019	NH3	Not Applicable	0.04		mg/L	0.02	
bdc5.0	9/19/2019	NICKEL	Dissolved	0.00		mg/L	0.00	17%
bdc5.0	9/19/2019	NICKEL	Dissolved	0.00		mg/L	0.00	
bdc5.0	9/19/2019	Nitrogen	Total	6.41		mg/L	0.03	1%
bdc5.0	9/19/2019	Nitrogen	Total	6.52		mg/L	0.03	
bdc5.0	9/19/2019	Nitrogen, NO2	Dissolved	0.08		mg/L	0.01	1%
bdc5.0	9/19/2019	Nitrogen, NO2	Dissolved	0.08		mg/L	0.01	
bdc5.0	9/19/2019	NO3+NO2	Not Applicable	5.60		mg/L		0%
bdc5.0	9/19/2019	NO3+NO2	Not Applicable	5.60		mg/L		
bdc5.0	9/19/2019	Oxygen, Dissolved	Not Applicable	8.84		mg/L	0.00	0%
bdc5.0	9/19/2019	Oxygen, Dissolved	Not Applicable	8.87		mg/L	0.00	
bdc5.0	9/19/2019	pH	Not Applicable	8.07		su	0.00	0%
bdc5.0	9/19/2019	pH	Not Applicable	8.09		su	0.00	
bdc5.0	9/19/2019	Phosphorus	Total	0.22		mg/L	0.01	2%
bdc5.0	9/19/2019	Phosphorus	Total	0.23		mg/L	0.01	
bdc5.0	9/19/2019	Phoshorus, Ortho-P	Dissolved	0.15		mg/L	0.01	1%
bdc5.0	9/19/2019	Phoshorus, Ortho-P	Dissolved	0.15		mg/L	0.01	
bdc5.0	9/19/2019	Potassium	Dissolved	11.08		mg/L	0.01	6%
bdc5.0	9/19/2019	Potassium	Dissolved	9.83		mg/L	0.01	
bdc5.0	9/19/2019	SELENIUM	Dissolved	0.00		mg/L	0.00	6%

Appendix D. 2019 Big Dry Creek Quality Control Samples: Field Replicates

Station	Date	Analyte	Fraction	Result Value	Qualifier	Result Unit	MDL	RPD
bdc5.0	9/19/2019	SELENIUM	Dissolved	0.00		mg/L	0.00	
bdc5.0	9/19/2019	SILVER	Dissolved	0.00		mg/L	0.00	0%
bdc5.0	9/19/2019	SILVER	Dissolved	0.00		mg/L	0.00	
bdc5.0	9/19/2019	Sodium	Dissolved	174.44		mg/L	0.01	1%
bdc5.0	9/19/2019	Sodium	Dissolved	170.90		mg/L	0.01	
bdc5.0	9/19/2019	SOLIDS, DISSOLVED	Filterable	853.00		mg/L	1.00	0%
bdc5.0	9/19/2019	SOLIDS, DISSOLVED	Filterable	852.00		mg/L	1.00	
bdc5.0	9/19/2019	SULFATE	Dissolved			mg/L	1.00	N/A
bdc5.0	9/19/2019	SULFATE	Dissolved			mg/L	1.00	
bdc5.0	9/19/2019	Temperature	Not Applicable	16.98		°C	0.00	0%
bdc5.0	9/19/2019	Temperature	Not Applicable	17.02		°C	0.00	
bdc5.0	9/19/2019	TSS	Total	17.60		mg/L	2.00	3%
bdc5.0	9/19/2019	TSS	Total	18.80		mg/L	2.00	
bdc5.0	9/19/2019	TURBIDITY	Total	11.80		NTU	0.10	2%
bdc5.0	9/19/2019	TURBIDITY	Total	12.30		NTU	0.10	
bdc5.0	9/19/2019	ZINC	Dissolved	0.01		mg/L	0.00	23%
bdc5.0	9/19/2019	ZINC	Dissolved	0.02		mg/L	0.00	

Appendix D. 2019 Big Dry Creek Quality Control Samples: Field Blanks

Activity Start Date	Characteristic Name	Sample Fraction	Qualifier	Result Value	Unit	Method Detection Limit (MDL)
3/20/2019	Alkalinity, Total	Total		2.00	mg/L	1
3/20/2019	ARSENIC	Total Recoverable	<	0.001	mg/L	0.001
3/20/2019	BORON	Total	<	0.01	mg/L	0.01
3/20/2019	CADMIUM	Dissolved	<	0.00005	mg/L	0.00005
3/20/2019	CALCIUM	Total	<	1	mg/L	1
3/20/2019	CARBON, TOTAL ORGANIC	Total	<	0.25	mg/L	0.25
3/20/2019	CHLORIDE	Dissolved			mg/L	0.5
3/20/2019	Chlorophyll-a	Total	<	1	ug/L	1
3/20/2019	Chlorophyll-a, corrected	Total	<	1	ug/L	1
3/20/2019	CHROMIUM	Dissolved	<	0.0009	mg/L	0.0009
3/20/2019	Conductivity	Not Applicable		4.03	uS/cm	0.5
3/20/2019	COPPER	Dissolved		0.0026	mg/L	0.00008
3/20/2019	Cyanide, Total	Total	<	0.005	mg/L	0.005
3/20/2019	E. coli	Not Applicable	<	1	MPN/100 mL	1
3/20/2019	Hardness, Ca,Mg	Total		0.0000	mg/L	N/A
3/20/2019	IRON	Total Recoverable	<	0.25	mg/L	0.25
3/20/2019	LEAD	Dissolved	<	0.00005	mg/L	0.00005
3/20/2019	MAGNESIUM	Dissolved	<	1	mg/L	1
3/20/2019	MANGANESE	Dissolved		0.0007	mg/L	0.00005
3/20/2019	NH3	Not Applicable	<	0.02	mg/L	0.02
3/20/2019	NICKEL	Dissolved	<	0.00007	mg/L	0.00007
3/20/2019	Nitrogen	Total	<	0.03	mg/L	0.03
3/20/2019	NITROGEN, NITRITE (NO2)	Dissolved	<	0.01	mg/L	0.01
3/20/2019	NO3+NO2	Not Applicable	<	0.02	mg/L	
3/20/2019	Oxygen, Dissolved	Not Applicable		14.81	mg/L	0
3/20/2019	pH	Not Applicable		7.96	su	0
3/20/2019	Phosphorus	Total		0.05	mg/L	0.01
3/20/2019	PHOSPHORUS, ORTHOPHOSPHATE AS P	Dissolved	<	0.05	mg/L	0.01
3/20/2019	POTASSIUM	Dissolved	<	0.5	mg/L	0.5
3/20/2019	SELENIUM	Dissolved	<	0.0001	mg/L	0.0001
3/20/2019	SILVER	Dissolved	<	0.00005	mg/L	0.00005
3/20/2019	SODIUM	Dissolved	<	1	mg/L	1
3/20/2019	SOLIDS, DISSOLVED	Filterable		16.00	mg/L	1
3/20/2019	SULFATE	Dissolved			mg/L	1
3/20/2019	Temperature	Not Applicable		11.32	°C	0
3/20/2019	TSS	Total	<	2	mg/L	2
3/20/2019	TURBIDITY	Total		0.20	NTU	0.1
3/20/2019	ZINC	Dissolved	<	0.0003	mg/L	0.0003
9/19/2019	NH3	Not Applicable	<	0.02	mg/L	0.02

Appendix D. 2019 Big Dry Creek Quality Control Samples: Field Blanks

Activity Start Date	Characteristic Name	Sample Fraction	Qualifier	Result Value	Unit	Method Detection Limit (MDL)
9/19/2019	Nitrogen	Total	<	0.03	mg/L	0.03
9/19/2019	NO3+NO2	Not Applicable	<	0.02	mg/L	
9/19/2019	Phosphorus	Total		0.15	mg/L	0.01
Extra Trip Blanks Not Required in Sampling and Analysis Plan						
1/10/2019	Alkalinity, Total	Total		2	mg/L	1
1/10/2019	Chlorophyll-a	Total	<	1	ug/L	1
1/10/2019	Chlorophyll-a, corrected	Total	<	1	ug/L	1
1/10/2019	E. coli	Not Applicable	<	1	MPN/100 mL	1
2/14/2019	Alkalinity, Total	Total	<	1	mg/L	1
2/14/2019	Chlorophyll-a	Total	<	1	ug/L	1
2/14/2019	Chlorophyll-a, corrected	Total	<	1	ug/L	1
2/14/2019	E. coli	Not Applicable	<	1	MPN/100 mL	1
4/17/2019	Alkalinity, Total	Total		2	mg/L	1
4/17/2019	Chlorophyll-a	Total	<	1	ug/L	1
4/17/2019	Chlorophyll-a, corrected	Total	<	1	ug/L	1
4/17/2019	E. coli	Not Applicable	<	1	MPN/100 mL	1
5/9/2019	Alkalinity, Total	Total		2	mg/L	1
5/9/2019	Chlorophyll-a	Total	<	1	ug/L	1
5/9/2019	Chlorophyll-a, corrected	Total	<	1	ug/L	1
6/13/2019	Alkalinity, Total	Total	<	1	mg/L	1
6/13/2019	Chlorophyll-a	Total	<	1	ug/L	1
6/13/2019	Chlorophyll-a, corrected	Total	<	1	ug/L	1
7/11/2019	Alkalinity, Total	Total		2	mg/L	1
7/11/2019	Chlorophyll-a	Total	<	1	ug/L	1
7/11/2019	Chlorophyll-a, corrected	Total	<	1	ug/L	1
8/8/2019	Alkalinity, Total	Total	<	1	mg/L	1
8/8/2019	Chlorophyll-a	Total	<	1	ug/L	1
8/8/2019	Chlorophyll-a, corrected	Total	<	1	ug/L	1
9/19/2019	Alkalinity, Total	Total	<	1	mg/L	1
9/19/2019	Chlorophyll-a	Total	<	1	ug/L	1
9/19/2019	Chlorophyll-a, corrected	Total	<	1	ug/L	1
10/10/2019	Alkalinity, Total	Total		1	mg/L	1
10/10/2019	Chlorophyll-a	Total	<	1	ug/L	1
10/10/2019	Chlorophyll-a, corrected	Total	<	1	ug/L	1
11/14/2019	Alkalinity, Total	Total	<	1	mg/L	1
11/14/2019	Chlorophyll-a	Total	<	1	ug/L	1

Appendix D. 2019 Big Dry Creek Quality Control Samples: Field Blanks

Activity Start Date	Characteristic Name	Sample Fraction	Qualifier	Result Value	Unit	Method Detection Limit (MDL)
11/14/2019	Chlorophyll-a, corrected	Total	<	1	ug/L	1

Appendix E. 2019 WWTP Discharge Samples for Broomfield, Westminster and Northglenn Collected for CDPS Discharge Monitoring Reports

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Appendix E
2019 Broomfield WWTP Effluent Data

Lab Data Entry Daily Daily 1/1/2019 - 12/31/2019	TSS (mg/L)	cBod 5 (mg/L)	Phos Total P (mg/L)	Ammonia (mg/L)	NO_2 & NO_3 (mg/L)	TKN (mg/L)	TIN1 (mg/L)	TN1 (mg/L)	Alk Tot (mg/L)	Cod Hi Level (mg/L)	Cyanide (ug/L)	*E.coli* (#/100mL)	Flow (MGD)
1/1/2019	1.90	1.70	0.60	0.67	16.60	1.30	17.30	17.90	47.20				0.924
1/2/2019			0.07	0.11	14.30	1.40	14.40	15.70				1.00	1.301
1/3/2019	1.90	1.67	0.06	0.11	14.90	1.70	15.00	16.60				2.00	1.152
1/4/2019			0.06	0.19	15.80	1.80	16.00	17.60					1.139
1/5/2019			0.06	0.22	15.90	1.30	16.10	17.20					1.008
1/6/2019			0.12	0.26	15.20	1.20	15.50	16.40					0.773
1/7/2019			0.06	0.12	14.00	1.20	14.10	15.20				1.00	1.493
1/8/2019	2.00	1.40	0.06	0.12	16.00	0.40	16.10	16.40	56.80	34.00	<4.00	3.10	0.975
1/9/2019			0.42	0.15	17.80	1.50	18.00	19.30					1.492
1/10/2019	4.80	1.63	0.60	0.77	17.30	3.00	18.10	20.30					1.449
1/11/2019			1.12	0.94	17.80	2.20	18.70	20.00					2.055
1/12/2019			0.67	1.08	17.80	2.70	18.90	20.50					1.499
1/13/2019			0.48	0.25	14.70	1.70	15.00	16.40					1.252
1/14/2019			1.14	0.16	14.00	1.60	14.20	15.60				2.00	1.547
1/15/2019	5.00	1.99	0.78	0.41	15.20	2.20	15.60	17.40	54.60			1.00	1.160
1/16/2019			0.51	0.20	16.10	1.30	16.30	17.40					1.351
1/17/2019	4.00	1.30	0.69	0.23	15.20	1.70	15.40	16.90					1.317
1/18/2019			0.32	0.21	16.00	2.00	16.20	18.00					1.662
1/19/2019			0.81	0.72	17.70	2.00	18.40	19.70					1.240
1/20/2019			0.37	0.30	14.90	1.60	15.20	16.50					1.241
1/21/2019			0.38	0.33	13.80	1.00	14.10	14.80					1.375
1/22/2019	3.00	1.24	0.47	0.23	13.50	3.20	13.70	16.70	61.40			2.00	1.329
1/23/2019			0.84	1.02	16.90	4.80	17.90	21.70				6.30	1.358
1/24/2019	3.00	1.41	0.58	0.14	16.20	5.60	16.30	21.80					3.885
1/25/2019			0.24	1.01	15.40	4.70	16.40	20.10					3.278
1/26/2019			0.21	1.11	19.70	3.40	20.80	23.10					1.422
1/27/2019			0.21	0.50	15.60	3.00	16.10	18.60					1.229
1/28/2019			0.35	0.18	13.20	2.40	13.40	15.60				3.10	1.621
1/29/2019	3.00	1.11	0.47	0.80	16.90	3.00	17.70	19.90	46.40			1.00	1.785
1/30/2019			0.25	1.47	16.30	2.10	17.80	18.40					2.657
1/31/2019	3.00	0.79	0.06	0.51	16.90	1.70	17.40	18.60					2.975
2/1/2019			0.26	0.38	16.30	2.10	16.70	18.40					1.354
2/2/2019			0.26	0.89	17.00	2.10	17.90	19.10					1.076
2/3/2019													1.192
2/4/2019												4.10	1.555
2/5/2019	2.00	1.14	0.09	0.42	16.00	2.90	16.40	18.90	49.60			7.50	1.237
2/6/2019													1.213
2/7/2019	2.00	1.22	0.10	0.14	18.70	2.70	18.80	21.40					1.004
2/8/2019													1.281
2/9/2019													1.141
2/10/2019													1.470
2/11/2019	2.00		0.13	0.14	11.90	2.40	12.00	14.30		27.00		1.00	1.355
2/12/2019	2.00	1.39	0.02	0.97	15.80	3.60	16.80	19.40	53.60			4.10	1.299
2/13/2019	2.00		0.13	1.36	18.00	3.20	19.40	21.20		36.00			1.365
2/14/2019	2.00	0.91	0.04	0.43	15.90	2.50	16.30	18.40					1.238
2/15/2019	2.00		0.01	0.20	15.40	1.60	15.60	17.00		33.00			2.469
2/16/2019													5.167
2/17/2019													5.637
2/18/2019													5.586
2/19/2019	2.00	1.00	0.24	0.40	15.70	2.00	16.10	17.70	56.00			1.00	5.497
2/20/2019												1.00	5.626
2/21/2019	3.00	2.27	1.00	0.62	17.90	1.90	18.50	19.80					5.284
2/22/2019													5.557
2/23/2019													5.220
2/24/2019													5.631
2/25/2019												3.10	5.829
2/26/2019	2.00	1.72	0.82	0.20	14.50	1.80	14.70	16.30	65.60			6.20	5.279
2/27/2019													5.276
2/28/2019	2.00	0.99	0.62	0.20	20.40	1.50	20.60	21.90					5.748
3/1/2019			1.86	0.53	18.90	1.60	19.40	20.50					2.368
3/2/2019			1.82	0.56	19.70	1.10	20.30	20.80					0.850
3/3/2019													1.109
3/4/2019												2.00	1.396
3/5/2019	3.00	1.52	1.10	0.16	14.70	2.50	14.90	17.20	57.20			1.00	1.386
3/6/2019													1.621
3/7/2019	2.00	1.23	0.91	0.13	16.80	2.10	16.90	18.90					1.335
3/8/2019													1.351
3/9/2019													1.118
3/10/2019													1.448
3/11/2019												5.20	1.415
3/12/2019	4.00	0.76	0.86	0.16	16.10	1.60	16.30	17.70	49.80	34.00		2.00	1.659
3/13/2019													1.988
3/14/2019	3.00	1.24	0.52	0.13	15.00	1.40	15.10	16.40					2.437
3/15/2019													2.037
3/16/2019													1.825
3/17/2019													1.937
3/18/2019												3.00	1.738
3/19/2019	2.50	1.45	0.46	0.16	13.60	2.40	13.80	16.00	88.00			1.50	1.616
3/20/2019	3.00	1.12	1.03	0.05	16.60	3.50	16.70	20.10					1.721
3/21/2019													1.605
3/22/2019													1.456
3/23/2019													1.198

Appendix E
2019 Broomfield WWTP Effluent Data

Lab Data Entry Daily Daily 1/1/2019 - 12/31/2019	TSS (mg/L)	cBod 5 (mg/L)	Phos Total P (mg/L)	Ammonia (mg/L)	NO_2 & NO_3 (mg/L)	TKN (mg/L)	TIN1 (mg/L)	TN1 (mg/L)	Alk Tot (mg/L)	Cod Hi Level (mg/L)	Cyanide (ug/L)	*E.coli* (#/100mL)	Flow (MGD)
3/24/2019													1.560
3/25/2019	2.00	1.58	0.14	0.31	16.00	1.50	16.30	17.50				2.00	1.141
3/26/2019									77.60			1.00	1.444
3/27/2019	3.00	2.33	0.80	1.40	16.00	3.90	17.40	19.90					1.018
3/28/2019													0.836
3/29/2019													3.053
3/30/2019													5.642
3/31/2019													5.817
4/1/2019	3.00	1.30	0.08	0.12	13.10	2.30	13.20	15.40				3.10	5.839
4/2/2019									69.20			13.40	5.326
4/3/2019	2.00	1.71	0.32	0.12	17.90	3.30	18.00	21.20					4.491
4/4/2019													4.538
4/5/2019													5.540
4/6/2019													5.459
4/7/2019													5.510
4/8/2019												2.00	5.095
4/9/2019	3.00	2.16	0.23	0.05	16.70	2.70	16.80	19.40	57.80	32.00		3.10	5.827
4/10/2019													5.712
4/11/2019	3.00	2.64	0.73	0.12	19.70	3.70	19.80	23.40					6.014
4/12/2019													5.724
4/13/2019													6.039
4/14/2019													5.962
4/15/2019												116.90	5.134
4/16/2019	2.00	1.91	0.08	0.35	13.40	5.00	13.80	18.40	82.00			1.00	4.896
4/17/2019	2.00	1.54	0.06	0.11	15.60	3.90	15.70	19.50					5.349
4/18/2019													5.467
4/19/2019													4.988
4/20/2019													5.763
4/21/2019													5.762
4/22/2019												1.00	5.185
4/23/2019	3.00	1.60	0.07	0.12	16.10	3.70	16.20	19.80	68.20			1.00	4.572
4/24/2019													4.790
4/25/2019	2.00	1.73	0.06	0.11	18.90	1.60	19.00	20.50					3.103
4/26/2019													3.527
4/27/2019													5.429
4/28/2019													5.539
4/29/2019												1.00	4.879
4/30/2019	2.00	<2.00	0.14	0.11	18.30	1.90	18.40	20.20	56.00			1.00	3.942
5/1/2019													5.895
5/2/2019	2.00	1.71	0.04	0.17	18.30	2.20	18.50	20.50					5.145
5/3/2019													5.728
5/4/2019													5.443
5/5/2019													5.690
5/6/2019												3.10	5.741
5/7/2019	2.00	1.74	0.06	0.10	15.30	1.60	15.40	16.90	66.00	28.00	1.40	3.10	4.953
5/8/2019													5.453
5/9/2019	3.00	1.42	0.12	0.17	16.30	2.40	16.50	18.70					5.879
5/10/2019													6.092
5/11/2019													5.950
5/12/2019													6.005
5/13/2019												4.10	5.661
5/14/2019	2.00	1.91	0.06	0.14	15.30	1.20	15.40	16.50	83.00			2.00	4.750
5/15/2019													5.109
5/16/2019	2.00	1.90	0.06	0.10	17.10	1.20	17.20	18.30					4.020
5/17/2019													5.680
5/18/2019													5.659
5/19/2019													5.794
5/20/2019												1.00	5.988
5/21/2019	3.00	1.30	0.02	0.16	13.20	1.80	13.40	15.00	90.60			2.00	7.744
5/22/2019	2.00	1.28	0.04	0.17	12.60	2.10	12.80	14.70					4.106
5/23/2019													6.297
5/24/2019													6.358
5/25/2019													5.889
5/26/2019													5.732
5/27/2019													6.058
5/28/2019	2.57	1.60	0.03	0.18	13.80	2.50	14.00	16.30	93.00			3.10	7.362
5/29/2019												1.00	6.884
5/30/2019	3.00	1.85	0.03	1.21	20.20	4.40	21.40	24.60					6.758
5/31/2019													6.139
6/1/2019													6.049
6/2/2019													6.049
6/3/2019	2.00	1.37	0.03	0.10	12.20	2.80	12.30	15.00				1.00	6.654
6/4/2019	2.00	1.22	0.02	0.12	12.20	2.10	12.30	14.30	109.00			3.00	6.227
6/5/2019													6.512
6/6/2019													6.289
6/7/2019													6.558
6/8/2019													6.146
6/9/2019													6.256
6/10/2019												1.00	6.235
6/11/2019	3.00	1.68	0.02	0.10	14.40	5.70	14.50	20.10	102.00	33.00		3.10	6.184
6/12/2019													6.094
6/13/2019	2.00	1.44	0.03	0.10	16.20	10.60	16.30	26.80					6.082

Appendix E
2019 Broomfield WWTP Effluent Data

Lab Data Entry Daily Daily 1/1/2019 - 12/31/2019	TSS (mg/L)	cBod 5 (mg/L)	Phos Total P (mg/L)	Ammonia (mg/L)	NO_2 & NO_3 (mg/L)	TKN (mg/L)	TIN1 (mg/L)	TN1 (mg/L)	Alk Tot (mg/L)	Cod Hi Level (mg/L)	Cyanide (ug/L)	*E.coli* (#/100mL)	Flow (MGD)
6/14/2019													5.925
6/15/2019													6.066
6/16/2019													6.154
6/17/2019												1.00	6.524
6/18/2019	2.00	1.44	0.06	0.12	14.70	5.30	14.80	20.00	89.00			2.00	6.394
6/19/2019													6.250
6/20/2019	2.00	1.40	0.04	0.08	18.10	2.80	18.20	20.90					6.173
6/21/2019													6.209
6/22/2019													6.936
6/23/2019													6.769
6/24/2019												1.00	6.580
6/25/2019	2.00	2.75	0.13	0.34	14.00	2.60	14.30	16.60	108.00			4.10	6.366
6/26/2019													6.311
6/27/2019	3.00	1.72	0.16	0.29	18.10	2.80	18.40	20.90					6.095
6/28/2019													6.083
6/29/2019													5.935
6/30/2019													6.084
7/1/2019												1.00	6.160
7/2/2019	2.00	2.25	0.11	0.12	13.70	2.70	13.80	16.40	90.60			3.00	6.187
7/3/2019	2.00	1.65	0.02	1.65	16.20	5.50	17.90	21.70					6.082
7/4/2019													5.966
7/5/2019													6.697
7/6/2019													6.848
7/7/2019													6.735
7/8/2019												12.20	6.705
7/9/2019	3.00	2.02	0.12	0.13	12.90	2.40	13.00	15.30	123.00	30.00	<1.00	8.60	6.449
7/10/2019													6.347
7/11/2019	3.00	1.60	0.04	0.13	16.90	5.80	17.00	22.70					5.917
7/12/2019													6.545
7/13/2019													6.058
7/14/2019													6.125
7/15/2019												5.20	6.153
7/16/2019	3.00	2.89	0.12	0.08	12.90	9.20	13.00	22.10	99.00			1.00	6.225
7/17/2019													6.121
7/18/2019	2.00	1.42	0.02	0.11	17.50	3.10	17.60	20.60					6.039
7/19/2019													6.048
7/20/2019													6.128
7/21/2019													6.284
7/22/2019												1.00	7.458
7/23/2019	2.00	2.61	0.02	0.13	14.40	2.90	14.50	17.30	115.00			5.10	6.991
7/24/2019													7.171
7/25/2019	2.00	3.35	0.02	0.26	14.00	3.60	14.30	17.60					6.371
7/26/2019													6.342
7/27/2019													6.051
7/28/2019													6.252
7/29/2019												1.00	6.287
7/30/2019	2.00	3.48	0.03	0.10	13.80	2.10	13.90		103.00			4.10	6.297
7/31/2019													6.745
8/1/2019	3.00	4.77	0.03	0.08	15.00	6.20	15.10	21.20					6.429
8/2/2019													6.397
8/3/2019													5.884
8/4/2019													6.034
8/5/2019												3.00	6.064
8/6/2019	4.00	7.41	0.01	0.03	14.10	1.60	14.10	15.70	92.00	42.00		3.10	5.920
8/7/2019													5.923
8/8/2019	2.00	5.50	0.01	1.33	16.20	2.50	17.50	18.70					6.087
8/9/2019													6.172
8/10/2019													5.969
8/11/2019													6.282
8/12/2019												4.10	6.385
8/13/2019	2.00	6.65	0.05	0.12	13.70	3.00	13.80	16.70	86.00			2.00	6.209
8/14/2019													6.060
8/15/2019	3.00	5.98	0.02	0.14	15.00	9.70	15.10	24.70					6.219
8/16/2019													6.269
8/17/2019													6.209
8/18/2019													6.687
8/19/2019												3.00	6.261
8/20/2019	4.00	6.17	0.06	0.07	13.30	1.30	13.40	14.60	76.20			1.00	5.998
8/21/2019													6.034
8/22/2019	2.00	4.03	0.05	0.17	16.30	4.20	16.50	20.50					6.165
8/23/2019													6.197
8/24/2019													5.830
8/25/2019													6.151
8/26/2019												1.00	6.251
8/27/2019	3.00	5.05	0.02	0.17	12.10	2.80	12.30	14.90	78.00			4.10	6.071
8/28/2019													6.007
8/29/2019	4.00	4.57	0.02	0.18	16.00	3.00	16.20	19.00					6.209
8/30/2019													6.088
8/31/2019													5.807
9/1/2019													5.933
9/2/2019													5.982
9/3/2019	4.00	6.80	0.06	0.19	14.70	3.20	14.90	17.90	71.20			1.00	6.128

Appendix E
2019 Broomfield WWTP Effluent Data

Lab Data Entry Daily Daily 1/1/2019 - 12/31/2019	TSS (mg/L)	cBod 5 (mg/L)	Phos Total P (mg/L)	Ammonia (mg/L)	NO_2 & NO_3 (mg/L)	TKN (mg/L)	TIN1 (mg/L)	TN1 (mg/L)	Alk Tot (mg/L)	Cod Hi Level (mg/L)	Cyanide (ug/L)	*E.coli* (#/100mL)	Flow (MGD)
9/4/2019				0.13								1.00	6.088
9/5/2019	3.00	4.03	0.10	0.16	17.30	4.60	17.50	21.90					6.149
9/6/2019													6.661
9/7/2019													6.311
9/8/2019													6.727
9/9/2019												3.10	6.704
9/10/2019	3.00	5.11	0.09	0.22	12.00	10.20	12.20	22.20	83.00			2.00	6.234
9/11/2019				0.14									6.121
9/12/2019	4.00	1.99	0.04	0.15	13.60	2.20	13.80	15.80					6.166
9/13/2019													5.986
9/14/2019													5.960
9/15/2019													6.429
9/16/2019												1.00	6.194
9/17/2019	4.00	5.30	0.12	0.13	14.60	3.20	14.70	17.80	64.80	35.00		2.00	5.845
9/18/2019				0.13									6.137
9/19/2019	4.00	1.67	0.16	0.24	16.20	4.20	16.40	20.40					6.019
9/20/2019													5.785
9/21/2019													5.829
9/22/2019													6.193
9/23/2019												3.10	6.001
9/24/2019	3.00	4.03	0.14	0.18	15.10	2.10	15.30	17.20	60.80			1.00	6.040
9/25/2019				0.15									5.829
9/26/2019	4.00	1.96	0.17	0.20	17.80	3.70	18.00	21.50					5.796
9/27/2019													5.714
9/28/2019													5.909
9/29/2019													5.865
9/30/2019												2.00	5.896
10/1/2019	3.00	4.64	0.09	0.18	15.80	3.70	16.00	19.50	63.00			1.00	5.870
10/2/2019				0.33	16.20		16.50						5.873
10/3/2019	3.00	2.22	0.06	0.25	15.60	3.70	15.90	19.30					5.571
10/4/2019				0.20	14.60		14.80						5.945
10/5/2019				0.41									5.653
10/6/2019													5.905
10/7/2019				0.17	12.60		12.80					2.00	5.710
10/8/2019	2.00	2.22	0.09	0.19	11.90	1.80	12.10	13.70	78.00	27.00	<1.00	1.00	5.505
10/9/2019				0.17	14.00		14.20						5.905
10/10/2019	3.00	1.79	0.17	0.17	13.70	2.10	13.90	15.80					5.732
10/11/2019				0.16	14.30		14.50						5.528
10/12/2019													5.629
10/13/2019													5.872
10/14/2019				0.15	12.10		12.30					3.00	5.703
10/15/2019	2.00	0.99	0.08	0.16	11.90	1.30	12.10	13.20	76.60			1.00	5.585
10/16/2019				0.14	14.60		14.70						5.652
10/17/2019	2.00	2.00	1.04	0.13	15.90	0.60	16.00	16.50					5.793
10/18/2019				0.23	14.30		14.50						5.619
10/19/2019													5.521
10/20/2019													5.887
10/21/2019				0.69	13.00		13.70					1.00	5.599
10/22/2019	3.00	2.26	0.16	0.18	11.50	2.60	11.70	14.10	77.20			1.00	5.485
10/23/2019				0.15	12.50		12.70						5.649
10/24/2019	3.00	1.58	0.06	0.10	12.10	2.50	12.20	14.60					5.924
10/25/2019				0.09	12.40		12.50						5.692
10/26/2019													5.692
10/27/2019													6.108
10/28/2019				0.53	11.80		12.30					3.10	6.093
10/29/2019	2.00	1.69	0.05	0.17	11.50	2.60	11.70		79.00			1.00	5.406
10/30/2019				0.10	12.80		12.90						5.757
10/31/2019	2.00	2.13	0.04	0.25	10.50	5.50	10.80						5.850
11/1/2019				0.26	13.00		13.30						5.211
11/2/2019				0.18									5.527
11/3/2019				0.32									3.832
11/4/2019	2.00			0.13	14.40		14.50			31.00		2.00	2.666
11/5/2019	2.00	1.64	0.06	0.15	12.70	3.80	12.90	16.50	62.00			4.10	2.371
11/6/2019	1.00			0.11	13.70		13.80						3.794
11/7/2019	1.00	1.77	0.14	1.62	14.30	1.40	15.90	15.70					4.513
11/8/2019	2.00			2.35	16.40		18.80						1.257
11/9/2019				0.49									1.054
11/10/2019				0.15									1.113
11/11/2019				0.17	14.10		14.30						1.330
11/12/2019	3.00	1.94	0.32	0.65	12.80	2.80	13.50	15.60	68.40	23.00		5.20	2.031
11/13/2019				1.37	13.60		15.00					3.10	1.642
11/14/2019	3.00	1.53	0.29	1.86	16.30	1.60	18.20	17.90					1.636
11/15/2019				2.42	17.40		19.80						1.054
11/16/2019				1.22									0.824
11/17/2019				0.61									0.993
11/18/2019				0.13	14.70		14.80					1.00	1.319
11/19/2019	2.00	2.01	0.29	0.14	14.40	2.40	14.50	16.80	63.60			2.00	0.897
11/20/2019				0.20	15.70		15.90						1.213
11/21/2019	3.00	2.28	0.53	0.42	16.50	0.80	16.90	17.30					2.402
11/22/2019				0.33	17.40		17.70						1.068
11/23/2019				0.39									1.081
11/24/2019				0.42									1.332

Appendix E
2019 Broomfield WWTP Effluent Data

Lab Data Entry Daily Daily 1/1/2019 - 12/31/2019	TSS (mg/L)	cBod 5 (mg/L)	Phos Total P (mg/L)	Ammonia (mg/L)	NO_2 & NO_3 (mg/L)	TKN (mg/L)	TIN1 (mg/L)	TN1 (mg/L)	Alk Tot (mg/L)	Cod Hi Level (mg/L)	Cyanide (ug/L)	*E.coli* (#/100mL)	Flow (MGD)
11/25/2019				0.31	15.10		15.40					3.10	1.657
11/26/2019	2.17	2.75	0.09	0.85	15.50	2.80	16.30	18.30	71.00			2.00	1.174
11/27/2019				0.50	17.50		18.00						1.361
11/28/2019	2.00	2.16	0.19	0.49	14.00	2.40	14.50	16.40					1.245
11/29/2019				0.09	13.10		13.20						0.814
11/30/2019				0.04									1.099
12/1/2019													1.376
12/2/2019				0.22	14.70		14.90					5.20	1.827
12/3/2019	3.00	3.05	0.14	0.44	16.10	3.10	16.50	19.20	54.60			2.00	2.068
12/4/2019				0.23	18.50		18.70						2.047
12/5/2019	2.00	2.17	0.14	0.24	19.30	1.50	19.50	20.80					1.996
12/6/2019				0.21	19.70		19.90						1.557
12/7/2019													1.706
12/8/2019													2.251
12/9/2019				0.15	16.00		16.20					2.00	1.698
12/10/2019	2.00	2.61	0.11	0.13	16.40	0.40	16.50	16.80	81.60	39.00		1.00	2.330
12/11/2019				0.14	17.50		17.60	17.50					1.575
12/12/2019	3.00	1.71	0.12	0.14	18.60	0.50	18.70	19.10					1.419
12/13/2019				0.14	19.40		19.50	19.40					2.087
12/14/2019													2.537
12/15/2019													2.171
12/16/2019				0.14	17.50		17.60	17.50				1.00	2.046
12/17/2019	2.00	2.23	0.13	0.15	15.90	1.20	16.10	17.10	58.40			4.10	1.535
12/18/2019	2.00	1.84		0.20	19.00		19.20	19.00					1.637
12/19/2019			0.13	0.68	23.00	0.90	23.70	23.90					1.144
12/20/2019				0.12	19.80		19.90	19.80					1.330
12/21/2019													1.163
12/22/2019													1.317
12/23/2019				0.14	15.40		15.50	15.40				1.00	1.322
12/24/2019			0.10	0.11	15.20	1.30	15.30	16.50	63.80				1.266
12/25/2019	2.00	1.84		0.12	16.40		16.50	16.40					1.038
12/26/2019	2.00	2.24	0.09	0.14	16.00	1.70	16.10	1.70				2.00	0.693
12/27/2019				0.14	16.60		16.70						1.431
12/28/2019													1.168
12/29/2019				0.15								1.00	1.026
12/30/2019	3.00	1.73		0.12	15.30		15.40					2.00	1.398
12/31/2019	3.00	1.84	0.10	0.17	15.70	6.40	15.90	22.10					1.077

Date	Total Influent	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	Big Dry Creek	BigDryCreek	BigDryCreek	BigDryCreek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek
	Flow	Flow	BOD	TSS	pH	E. coli	E. coli	Ammonia	WAD - CN	PD - Cu	PD - Se	Flow	E. coli	E. coli	E. coli	pH	Ammonia	BOD	TSS	WAD - CN	PD - Cu	PD - Se
	MGD	MGD	mg/L	mg/L	SU	MPN/100 mL	MPN/100 mL	mg/L as N	ug/l	ug/l	ug/l	MGD	MPN/100 mL	MPN/100 mL	MPN/100 mL	SU	mg/L as N	mg/L	mg/L	ug/l	ug/l	ug/l
							Grab	Comp. 5xWeek	Composite	Composite	Composite		Grab	Grab	Grab	Grab	Comp. 5xWeek	Composite	Composite	Composite	Composite	Composite
			Weekly	2 X Week	Daily		Grab	Method TMA-001	Weekly	Weekly	Monthly		Weekly	Weekly	Weekly	Daily	Method TMA-001	Weekly	2 x Week	Weekly	Weekly	Monthly
12/30/2018	2.96	1.51			7.09			0.90														
12/31/2018	2.85	1.51			6.91	0	1	0.51														
1/1/2019	2.83	1.51	10.49	7	6.95	5.1	5.1	0.710														
1/2/2019	2.85	1.51			6.95			0.701														
1/3/2019	2.82	1.51	10.1	7	7.04			0.313	<5	3.5	<.8											
1/4/2019	2.82	1.51			6.99																	
1/5/2019	2.94	1.51			7.00																	
1/6/2019	3.10	1.51	9.56	8.2	6.95			1.11														
1/7/2019	2.98	1.51	13.78	10	7.00	2	2	0.747														
1/8/2019	2.86				6.97			0.392	<5	3.3												
1/9/2019	2.84																					
1/10/2019	2.75																					
1/11/2019	2.85																					
1/12/2019	3.05																					
1/13/2019	3.12																					
1/14/2019	2.85																					
1/15/2019	2.87																					
1/16/2019	2.85																					
1/17/2019	2.82																					
1/18/2019	2.84																					
1/19/2019	2.96																					
1/20/2019	3.10	0.76	8.01	4.4	7.00			0.266														
1/21/2019	3.00	1.00			7.23			0.168														
1/22/2019	2.89	1.00	6.66	4.4	6.85	1	1	0.1	<5	5.3												
1/23/2019	2.92	1.00			6.75			0.108														
1/24/2019	2.77	1.00			6.95			0.134														
1/25/2019	2.85	1.00			7.03																	
1/26/2019	3.02	1.00																				
1/27/2019	3.11																					
1/28/2019	2.94																					
1/29/2019	2.90																					
1/30/2019	2.91																					
1/31/2019	2.95																					
2/1/2019																						
2/2/2019																						
2/3/2019																						
2/4/2019																						
2/5/2019																						
2/6/2019																						
2/7/2019																						
2/8/2019																						
2/9/2019																						
2/24/2019	3.11				6.99																	
2/25/2019	2.94		9.58	5.6	6.96	1	1															
2/26/2019	2.90		9.52	6.8	6.91																	
2/27/2019	2.91				6.93																	
2/28/2019	2.95				7.26																	
3/1/2019	2.90				7.19																	
3/2/2019	3.03				7.04																	
3/3/2019	3.21				6.96																	
3/4/2019	2.97			8.8	7.05	126.7	126.7															
3/5/2019	2.84		12.42	8.2	7.05																	
3/6/2019	2.88				7.13																	
3/7/2019	2.85				7.08																	
3/8/2019	2.83				7.14																	
3/9/2019	3.10				7.21																	
3/10/2019	3.13				7.05																	
3/11/2019	2.92		12.33	8.2	7.08	21.10	21.1															
3/12/2019	2.93				7.08																	
3/13/2019	2.82		10.49	5.4	6.93																	
3/14/2019	2.87				7.02																	
3/15/2019	2.85				7.03																	
3/16/2019	3.02				7.11																	
3/17/2019	3.08				7.09																	
3/18/2019	2.99		11.33	5.4	6.92																	
3/19/2019	2.82		11.29	6.6	7.01	23.9	23.9															
3/20/2019	2.93				7.02																	
3/21/2019	2.88				7.02																	
3/22/2019	2.70				7.04																	
3/23/2019	3.02				7.13																	
3/24/2019	3.24				7.02																	
3/25/2019	2.97		7.25	6	7.02	1	1															
3/26/2019	2.93				7.01																	
3/27/2019	2.87				7.04																	
3/28/2019	2.88		8.12	6.6	6.90																	
3/29/2019	2.85				7.04																	
3/30/2019	3.00				7.03																	
3/31/2019	3.27	0.00																				
4/1/2019	3.06	0.00																				
4/2/2019	3.01	0.00																				
4/3/2019	2.98	0.00																				
4/4/2019	3.01	0.00																				
4/5/2019	2.91	0.00																				
4/6/2019	3.11	0.00																				

Date	Total Influent	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	Big Dry Creek	BigDryCreek	BigDryCreek	BigDryCreek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek
	Flow	Flow	BOD	TSS	pH	E. coli	E. coli	Ammonia	WAD - CN	PD - Cu	PD - Se	Flow	E. coli	E. coli	E. coli	pH	Ammonia	BOD	TSS	WAD - CN	PD - Cu	PD - Se
	MGD	MGD	mg/L	mg/L	SU	MPN/100 mL	MPN/100 mL	mg/L as N	ug/l	ug/l	ug/l	MGD	MPN/100 mL	MPN/100 mL	MPN/100 mL	SU	mg/L as N	mg/L	mg/L	ug/l	ug/l	ug/l
							Grab	Comp. 5xWeek	Composite	Composite	Composite		Grab	Grab	Grab	Grab	Comp. 5xWeek	Composite	Composite	Composite	Composite	Composite
			Weekly	2 X Week	Daily		Grab	Weekly	Method TMA-001	Weekly	Weekly	Monthly		Weekly	Weekly	Weekly	Daily	Method TMA-001	Weekly	2 x Week	Weekly	Weekly	Monthly
4/7/2019	3.24	0.00																					
4/8/2019	3.04	0.00																					
4/9/2019	2.91	0.00																					
4/10/2019	3.02	1.05	10.75	9.6	6.94			0.275															
4/11/2019	3.20	1.05	14.23	11.6	7.13	167	167	0.848	<5.0	4.4	1.2												
4/12/2019	3.03	0.35			7.02			0.493															
4/13/2019	3.21	0.33			7.11			0.256															
4/14/2019	3.31	0.35	10.7	6.4	7.14			0.196															
4/15/2019	3.12	1.12	17.79	17.8	7.02	60.50	60.5	0.592															
4/16/2019	3.03	0.13			6.97			1.74															
4/17/2019	3.07	1.08			7.11			0.33															
4/18/2019	2.97	1.08			6.94			2.98	<5.0	3.3													
4/19/2019	3.05	1.08			7.13																		
4/20/2019	3.11	1.08			7.20																		
4/21/2019	3.33	1.09	13.05	9.6	7.19	49.6	49.6	0.543															
4/22/2019	3.03	1.08		11.2	7.06	68.7	68.7	0.329	<5.0	5.7													
4/23/2019	3.10	1.08	14.19		6.99			1.22															
4/24/2019	3.01	1.08			6.96			0.614															
4/25/2019	2.97	1.12			6.96			1.380															
4/26/2019	2.96	1.08			7.02																		
4/27/2019	3.09	1.81			6.94																		
4/28/2019	3.31	1.81		10.2	6.96			0.714															
4/29/2019	3.05	1.81	16.29	9.4	6.96			0.731															
4/30/2019	3.07	1.81			7.05			0.549															
5/1/2019																							
5/2/2019																							
5/3/2019																							
5/4/2019																							
5/5/2019	3.31	3.02	15.88	11.6	6.90			0.975															
5/6/2019	3.08	2.91	15.6	16.8	7.18	4.1	4.1	3.540															
5/7/2019	3.00	2.88	12.06		6.95	5.2	5.2	0.624															
5/8/2019	3.25	3.19			7.03			0.831															
5/9/2019	3.34	3.17			7.01			0.644															
5/10/2019	3.20	2.94			7.17				<5.0	3.8													
5/11/2019	3.34	2.94			7.12																		
5/12/2019	3.41	2.94	11.17	10.2	7.30			0.915															
5/13/2019	3.26	2.96	9.21	8.4	7.07	8.70	8.7	0.724	<5.0	7.5													
5/14/2019	3.19	2.95	11.64		7.10	1.00	1	1.38															
5/15/2019	3.22	2.96			7.38			0.413															
5/16/2019	3.18	2.96			7.28			0.259															
5/17/2019	3.24	2.89			7.17																		
5/18/2019	3.24	2.89			7.45																		
5/19/2019	3.37	2.90	11	20	7.72			0.742															
5/20/2019	3.22	2.86	11	20	7.06				<5.0	5.4													
5/21/2019	3.47	2.85			7.32			2.58															
5/22/2019	3.37	1.35			7.18			0.635															
5/23/2019	3.17	0.65			7.18	9.9	9.9	0.166															
5/24/2019	3.22	0.50			7.02			0.213															
5/25/2019	3.33	0.00																					
5/26/2019	3.33	0.00																					
5/27/2019	3.46	0.00																					
5/28/2019	3.39	0.00																					
5/29/2019	3.34	2.69	15.06	17.3	7.17	16.6	16.6	0.975	<5.0	5.1													
5/30/2019	3.27	2.61	14.45	18.2	7.38	31.1	31.1	0.640															
5/31/2019	3.21	2.60			7.18			1.100															
6/1/2019	3.31	1.40			7.14																		
6/2/2019	3.43	1.40	12.43	11.2	7.52	6.2	6.2	1.35	<5	3.2	1.4												
6/3/2019	3.33	1.20	12.68	11.8	6.95	1	1	0.636															
6/4/2019	3.20	1.05			7.10			1.940															
6/5/2019	3.17	0.00																					
6/6/2019	3.32	0.00																					
6/7/2019	3.22	0.00																					
6/8/2019	3.32	2.99			7.20			0.182															
6/9/2019	3.42	3.00			7.13			1.660															
6/10/2019	3.26	1.04	8.56	9.8	7.58	1.00	1	0.832	<5	25.6													
6/11/2019	3.21	0.59	9.64	7	7.34			0.181															
6/12/2019	3.18	2.17			7.16			0.146															
6/13/2019	3.25	2.70			7.21			0.177															
6/14/2019	3.14	2.90			7.23																		
6/15/2019	3.26	2.90			7.17																		
6/16/2019	3.34	2.90			7.19			0.247															
6/17/2019	3.29	2.91	9.92	7.8	7.16	53.1	53.1	0.487															
6/18/2019	3.13	1.77			7.15			0.12															
6/19/2019	3.19	0.90	8.28	5.6	7.08			0.127	<5	3.1													
6/20/2019	3.18	0.69			6.85			0.110															
6/21/2019	3.16	0.00																					
6/22/2019	3.45	0.00																					
6/23/2019	3.42	0.00																					
6/24/2019	3.29	0.00																					
6/25/2019	3.21	0.00																					
6/26/2019	3.23	0.00																					
6/27/2019	3.20	0.00																					
6/28/2019	3.15	0.00																					

Date	Total Influent	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	Big Dry Creek	BigDryCreek	BigDryCreek	BigDryCreek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek
	Flow	Flow	BOD	TSS	pH	E. coli	E. coli	Ammonia	WAD - CN	PD - Cu	PD - Se	Flow	E. coli	E. coli	E. coli	pH	Ammonia	BOD	TSS	WAD - CN	PD - Cu	PD - Se
	MGD	MGD	mg/L	mg/L	SU	MPN/100 mL	MPN/100 mL	mg/L as N	ug/l	ug/l	ug/l	MGD	MPN/100 mL	MPN/100 mL	MPN/100 mL	SU	mg/L as N	mg/L	mg/L	ug/l	ug/l	ug/l
							Grab	Grab	Composite	Composite	Composite		Grab	Grab	Grab	Grab	Comp. 5xWeek	Composite	Composite	Composite	Composite	Composite
			Weekly	2 X Week	Daily		Weekly	Comp. 5xWeek	Weekly	Weekly	Monthly		Weekly	Weekly	Weekly	Daily	Method TMA-001	Weekly	2 x Week	Weekly	Weekly	Monthly
6/29/2019	3.28	0.00																				
6/30/2019	3.35	0.00																				
7/1/2019	3.22	0.00																				
7/2/2019	3.39	0.00																				
7/3/2019	3.23	0.00																				
7/4/2019	3.33	0.00																				
7/5/2019	3.41	0.00																				
7/6/2019	3.44	0.00																				
7/7/2019	3.54	0.00																				
7/8/2019	3.36	0.00																				
7/9/2019	3.36	0.00																				
7/10/2019	3.27	0.00																				
7/11/2019	3.25	0.00																				
7/12/2019	3.23	0.00																				
7/13/2019	3.32	0.00																				
7/14/2019	3.43	0.65	8.55	5	7.47			0.118														
7/15/2019	3.27	0.65	9.85	5.2	7.14	7.50	7.5	0.174	<5.0	3.4	1.5											
7/16/2019	3.25	0.65			7.25			0.166														
7/17/2019	3.21	0.65			7.03			0.158														
7/18/2019	3.25	0.65			7.02			0.152														
7/19/2019	3.16	0.65			7.03																	
7/20/2019	3.28	1.62			7.04																	
7/21/2019	3.36	1.62	9.37	8.6	7.05			0.135														
7/22/2019	3.30	1.62	13.59	10.6	6.93	30.6	30.6	0.114	<5.0	5.1												
7/23/2019	3.21	1.62			7.15			0.404														
7/24/2019	3.18	1.62			7.45			0.113														
7/25/2019	3.17	1.62			7.10			0.165														
7/26/2019	3.13	1.62			7.22																	
7/27/2019	3.28	1.62			7.25																	
7/28/2019	3.25	1.62	11.21	8.8	7.08			0.255						FALSE								
7/29/2019	3.24	1.62		16.8	7.21	7.5	7.5	0.152	<5.0	7.5				FALSE								
7/30/2019	3.16	1.62			7.19			0.139						FALSE								
7/31/2019	3.15	1.62			7.08			0.714						FALSE								
8/1/2019	3.12	1.62			7.09			0.447						FALSE								
8/2/2019	3.07	1.62			7.09									FALSE								
8/3/2019	3.16	1.62			7.12									FALSE								
8/4/2019	3.32	1.67	12.91	6.2	7.01			0.147						FALSE								
8/5/2019	3.19	1.62		6.4	7.08	8.7	8.7	0.363	<5	4.6	1			FALSE								
8/6/2019	3.18	1.62			7.13	1	1	0.272						FALSE								
8/7/2019	3.12	1.66			7.22			0.257						FALSE								
8/8/2019	3.12	1.62			7.16									FALSE								
8/9/2019	3.11	2.59			7.24			2.690						FALSE								
8/10/2019	3.20	2.59			7.25									FALSE								
8/11/2019	3.33	2.59	10.82	7.8	7.24			2.620						FALSE								
8/12/2019	3.13	2.59		20.6	7.26	3.10	3.1	2.12	<5	4				FALSE								
8/13/2019	3.27	2.93			7.32			0.46						FALSE								
8/14/2019	3.04	2.77			7.25			0.467						FALSE								
8/15/2019	3.06	2.81			7.22			0.592						FALSE								
8/16/2019	3.00	2.77			7.25									FALSE								
8/17/2019	3.15	2.85			7.25									FALSE								
8/18/2019	3.30	3.00			7.27			0.357						FALSE								
8/19/2019	3.02	2.80	9.47	5.6	7.14	4.2	4.2	0.61	<5	4				FALSE								
8/20/2019	3.04	2.89			7.14			0.265				0.646		FALSE		8.66	<0.1					
8/21/2019	3.02	2.94	10.18	4.6	7.07			0.216				0.974	25.4	TRUE	25.4	7.96	<0.1	9.58	13	<5	4.3	0.9
8/22/2019	2.97	2.86			7.16			0.173				0.947		FALSE		8.78	<0.1		10.2			
8/23/2019	2.93	2.83			7.33							0.912		FALSE		8.44	<0.1					
8/24/2019	3.06	2.95			7.36							0.905		FALSE		8.83	<0.1					
8/25/2019	3.22	3.07			7.11			0.153				0.938		FALSE		8.6	<0.1	9.3	8.6			
8/26/2019	3.06	2.92	12.54	7.6	6.98			0.743	<5	2.7		0.458		FALSE		8.16	<0.1	10.06	11	<5	1.9	
8/27/2019	3.03	2.93	10.43	6.8	7.04	1	1	0.178				0.596		FALSE		8.39						
8/28/2019	2.98	2.87			7.06			0.171				1.29	0	TRUE	1	8.31	<0.1					
8/29/2019	2.99	2.87	17.86		7.14			0.168				1.03		FALSE		8.59	<0.1	10.26				
8/30/2019	2.91	2.85			7.33							0.922		FALSE		8.45	<0.1					
8/31/2019	3.05	2.98			7.03							0.96		FALSE		8.8						
9/1/2019	2.97											1.36		FALSE		8.75	0.1					
9/2/2019	3.16											1.55		FALSE		8.78	0.1					
9/3/2019	3.13											1.61	1	TRUE	1	8.58	0.1		8.4			
9/4/2019	2.96											1.73		FALSE		8.77	0.10	9.03	7.4	<5	<0.8	1.2
9/5/2019	2.98											1.76		FALSE		8.53	0.1					
9/6/2019	2.86											1.78		FALSE		8.57						
9/7/2019	3.11											1.76		FALSE		8.57						
9/8/2019	3.19											1.71		FALSE		8.58	0.100					
9/9/2019	3.01											1.75	1	TRUE	1	8.70	0.100					
9/10/2019	2.96											1.72	1	TRUE	1	8.58	0.100	9.19	10.4	<5	1.2	
9/11/2019	2.95											1.68		FALSE		8.67	0.100		6.4			
9/12/2019	2.94											1.69		FALSE		8.50	0.100					
9/13/2019	2.94											1.66		FALSE		8.67						
9/14/2019	2.99											1.21		FALSE		8.34						
9/15/2019	3.21	1.96		5.8	6.97			0.000						FALSE								
9/16/2019	3.01	1.45		7.8	7.04	1.00	1	0	<5	5.8	0.8			FALSE								
9/17/2019	2.98	1.49	13.58		7.01			0						FALSE								
9/18/2019	2.78	1.49			7.10			0.137						FALSE								
9/19/2019	2.93	1.49			7.05			0						FALSE								

Date	Total Influent	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	Big Dry Creek	BigDryCreek	BigDryCreek	BigDryCreek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek
	Flow	Flow	BOD	TSS	pH	E. coli	E. coli	Ammonia	WAD - CN	PD - Cu	PD - Se	Flow	E. coli	E. coli	E. coli	pH	Ammonia	BOD	TSS	WAD - CN	PD - Cu	PD - Se
	MGD	MGD	mg/L	mg/L	SU	MPN/100 mL	MPN/100 mL	mg/L as N	ug/l	ug/l	ug/l	MGD	MPN/100 mL	MPN/100 mL	MPN/100 mL	SU	mg/L as N	mg/L	mg/L	ug/l	ug/l	ug/l
						Grab	Grab	Comp. 5xWeek	Composite	Composite	Composite		Grab	Grab	Grab	Grab	Comp. 5xWeek	Composite	Composite	Composite	Composite	Composite
			Weekly	2 X Week	Daily		Weekly	Method TMA-001	Weekly	Weekly	Monthly		Weekly	Weekly	Weekly	Daily	Method TMA-001	Weekly	2 x Week	Weekly	Weekly	Monthly
9/20/2019	2.78	1.49			7.03									FALSE								
9/21/2019	3.02	1.49			7.37									FALSE								
9/22/2019	3.08	1.49		7	7.00			0.68						FALSE								
9/23/2019	3.05	1.49	6	15.8	6.96	4.2	4.2	1.05	<5	2.5				FALSE								
9/24/2019	2.94	1.49			6.95			0.35						FALSE								
9/25/2019	2.91	1.39			6.93			0.410						FALSE								
9/26/2019	2.93	1.39			7.05			0.270						FALSE								
9/27/2019	2.86	1.39			6.93									FALSE								
9/28/2019	3.02	1.39			7.06									FALSE								
9/29/2019	3.20	1.39			7.01									FALSE								
9/30/2019	2.92	1.39			7.02	1	1							FALSE								
10/1/2019	2.93	1.39	5	7.2	7.03			0.260	<5	3.8	1											
10/2/2019	2.93	1.39			7.22	3.1	3.1	0.260														
10/3/2019	2.88	1.39		4.8	7.09			0.129														
10/4/2019	2.92	1.39	6.9		7.04																	
10/5/2019	3.04	1.39			7.39																	
10/6/2019	3.14	1.39		5.6	7.24			0.140														
10/7/2019	2.96	1.39		5.8	7.04	1	1	0.120														
10/8/2019	2.86	1.39			7.75			0.110														
10/9/2019	2.84	1.39	4		7.13			0.110	<5	3.1												
10/10/2019	2.90	1.40			7.13			0.260														
10/11/2019	2.88	1.39			7.07																	
10/12/2019	2.98	1.39			7.08																	
10/13/2019	3.12	1.39		6.8	6.99			0.250														
10/14/2019	3.02	1.39	5	8	6.97	4.20	4.2	0.160	<5	4.8												
10/15/2019	2.82	1.39			7.03			<0.1														
10/16/2019	2.77	1.04			7.12			0.360														
10/17/2019	2.86	1.08			7.01																	
10/18/2019	2.80	1.39			7.10			0.160														
10/19/2019	2.98	1.39			7.00																	
10/20/2019	3.11	1.29	13.1	9.4	7.00			0.560														
10/21/2019	1.94	1.29	6	8.2	7.00	1	1	1.970	<5	4.6												
10/22/2019	2.85	1.29			7.01			0.700														
10/23/2019	2.80	1.29			6.95			0.120														
10/24/2019	2.88	1.29			6.89			0.710														
10/25/2019	2.77	1.29			7.12																	
10/26/2019	2.94	1.29			7.26																	
10/27/2019	3.08	1.29	9.55	8	7.03			0.260														
10/28/2019	2.94	1.29		7.6	6.93	1	1	0.370														
10/29/2019	2.90	1.29	7.9		7.11			0.400														
10/30/2019	3.21	1.59			7.01			0.380														
10/31/2019	2.78	1.29			7.00			0.610	<5	2.2												
11/1/2019	2.86	0.52			7.27																	
11/2/2019	3.03	0.52			7.01																	
11/3/2019	3.20	0.52		5.4	7.08			0.38														
11/4/2019	3.00	0.52			7.04	2	2	0.880														
11/5/2019	2.86	0.52			7.27			0.260														
11/6/2019	2.80	0.52		7	7.01			0.190	<5	2.6	<0.8											
11/7/2019	2.83	0.52			6.95			0.290														
11/8/2019	2.81	0.52			7.04																	
11/9/2019	2.95	1.36	5		6.85																	
11/10/2019	3.09	0.63			6.91			1.120														
11/11/2019	2.95	0.52			6.94			0.16														
11/12/2019	2.88	1.12	11.93	8.8	7.12			0.15														
11/13/2019	3.04	0.53	9.2	7.8	7.16	1	1	0.15	<5	5.7												
11/14/2019	2.87	0.52			7.21			0.24														
11/15/2019	2.80	0.52			7.23																	
11/16/2019	2.92	0.52			7.13																	
11/17/2019	3.10	0.52			7.02			0.42														
11/18/2019	2.86	0.88	5	7.2	6.99	3.1	3.1	0.63	<5	4.3												
11/19/2019	2.79	0.52			6.99			1.12														
11/20/2019	2.83	0.52	13.37	6.6	7.02			0.270														
11/21/2019	2.81	0.52			7.06			0.570														
11/22/2019	2.78	0.52			7.12																	
11/23/2019	3.04	0.52			6.96																	
11/24/2019	3.09	2.36			6.86																	
11/25/2019	2.76	0.76	9	9.4	6.98	1	1	2.38	<5	4.9												
11/26/2019	2.92	0.52		7.4	6.97			0.510														
11/27/2019	2.95	0.52			6.90			1.580														
11/28/2019	3.01	0.52			6.91			0.250														
11/29/2019	2.78	0.52			6.95			0.550														
11/30/2019	3.01	0.52			7.09																	
12/1/2019	3.12	0.52	8	7	6.99			1.81	<5.0	5.7	<0.80											
12/2/2019	3.04	0.52			6.98			0.40														
12/3/2019	3.06	0.52		7.8	7.17	2	2	1.940														
12/4/2019	3.00	0.00																				
12/5/2019	3.02	0.00																				
12/6/2019	3.01	0.00																				
12/7/2019	3.18	0.00																				
12/8/2019	3.34	0.00																				
12/9/2019	3.08	0.00																				
12/10/2019	3.11	0.00																				
12/11/2019	3.20	0.00																				

Date	Total Influent	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	Big Dry Creek	BigDryCreek	BigDryCreek	BigDryCreek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek	Big Dry Creek
	Flow	Flow	BOD	TSS	pH	E. coli	E. coli	Ammonia	WAD - CN	PD - Cu	PD - Se	Flow	E. coli	E. coli	E. coli	pH	Ammonia	BOD	TSS	WAD - CN	PD - Cu	PD - Se
	MGD	MGD	mg/L	mg/L	SU	MPN/100 mL	MPN/100 mL	mg/L as N	ug/l	ug/l	ug/l	MGD	MPN/100 mL	MPN/100 mL	MPN/100 mL	SU	mg/L as N	mg/L	mg/L	ug/l	ug/l	ug/l
						Grab	Grab	Comp. 5xWeek	Composite	Composite	Composite		Grab	Grab	Grab	Grab	Comp. 5xWeek	Composite	Composite	Composite	Composite	Composite
			Weekly	2 X Week	Daily		Weekly	Method TMA-001	Weekly	Weekly	Monthly		Weekly	Weekly	Weekly	Daily	Method TMA-001	Weekly	2 x Week	Weekly	Weekly	Monthly
12/12/2019	3.15	0.00																				
12/13/2019	3.01	0.00																				
12/14/2019	3.06	0.00																				
12/15/2019	3.35	0.00																				
12/16/2019	3.07	0.00																				
12/17/2019	2.88	0.00																				
12/18/2019	2.92	0.00																				
12/19/2019	2.94	0.00																				
12/20/2019	2.90	0.00																				
12/21/2019	3.15	0.00																				
12/22/2019	3.09	0.00																				
12/23/2019	2.90	0.00																				
12/24/2019	3.04	0.00																				
12/25/2019	2.81	0.00																				
12/26/2019	2.89	0.00																				
12/27/2019	2.95	0.00																				
12/28/2019	2.89	0.00																				
12/29/2019	3.05	0.00																				
12/30/2019	2.94	0.00																				
12/31/2019	3.05	0.00																				

Appendix E

Big Dry Creek 2019 Westminster WWTP Effluent Metals Data

	ANTIMONY	ARSENIC	BERYLLIUM	CADMIUM	CHROMIUM	COPPER		IRON	LEAD	MERCURY	MOLYBDENUM	NICKEL	SELENIUM		SILVER	THALLIUM	ZINC	BORON	CYANIDE	PHENOLS
	(TOTAL)	(TOTAL)	(TOTAL)	(TOTAL)	(TOTAL)	(TOTAL)	(PD)	(TOTAL)	(TOTAL)	(TOTAL)	(TOTAL)	(TOTAL)	(TOTAL)	(PD)	(TOTAL)	(TOTAL)	(TOTAL)	(TOTAL)	(TOTAL)	(TOTAL)
Method Number	200.8	200.8	200.8	200.8	200.8	200.8	200.7	200.7	200.8	1631c	200.8	200.8	200.8		200.8	200.8	200.8	SM4500 B B	SM4500 CN E	420.2
Units	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ng/L)	(ug/L)	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)	(mg/L)	(ug/L)	(ug/L)
1/8/2019	< 1.2	< 0.6	< 0.1	< 0.1	< 1.5	7.9	7.0		0.3		3.1	2.3	2.1	2.1	< 0.1	< 0.2	81	0.18		90
1/9/2019																			< 5	
1/15/2019							7.9							2.1				0.29		
2/5/2019							5.9							2.2				0.23		
2/12/2019							7.0							2.3				0.16		
2/14/2019										1.78										
3/5/2019							5.3							2.4				0.20		
3/12/2019							4.3							2.5				0.24		
4/2/2019	< 1.2	< 0.6	< 0.1	< 0.1	< 1.5	5.9	3.9		0.2		3.6	2.1	2.7	2.7	< 0.1	< 0.2	63	0.18		< 50
4/3/2019																			< 5	
4/9/2019							4.5							2.7				0.21		
5/7/2019							5.8							2.2				0.22		
5/14/2019							5.4							3.3				0.20		
6/4/2019							5.7							3.4				0.22		
6/11/2019							5.8							3.5				0.20		
6/18/2019										2.62										
7/2/2019	< 1.2	< 0.6	< 0.1	< 0.1	< 1.5	7.4	5.3		0.2		4.1	2.4	3.1	3.1	< 0.1	< 0.2	63	0.20		24
7/3/2019																			< 5	
7/9/2019							4.1							3.0				0.27		
7/10/2019										1.44										
8/6/2019							4.1							2.3				0.18		
8/13/2019							6.4							2.6				0.19		
9/3/2019							6.1							2.0				0.18		
9/10/2019							6.5							2.2				0.29		
10/1/2019	< 1.2	< 0.6	< 0.1	< 0.1	2.4		5.5		0.1		2.9	3.4	1.7	1.7	< 0.1	< 0.2	48	0.17		< 15
10/2/2019																			< 5	
10/8/2019							5.6							1.9				0.25		
11/5/2019							7.9							1.5				0.26		
11/12/2019							8.2							1.6				0.28		
11/13/2019										1.79										
12/3/2019							4.7							1.5				0.19		
12/10/2019							3.4							1.8				0.25		

Appendix E

Big Dry Creek 2019 Westminster WWTP Effluent Data

Date	Flow (MGD)	BOD (mg/L)	TSS (mg/L)	E. coli (#/100mL)	NH_3 (Timberline) (mg/L)	NO_2+NO_3 (calc. TIN-NH3) (mg/L)	TIN (Timberline) (mg/L)	TN (Timberline) (mg/L)	T-P (Lachat) (mg/L)	Sodium (mg/L)	Chloride (mg/L)	TDS (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	<	Bromide (mg/L)	Fluoride (mg/L)	Sulfate (mg/L)	NO_2 (mg/L)
1/1/2019	6.210	9.87	12.3		0.39	10.58	10.97													0.2
1/2/2019	6.220	10.70		71.4	0.24	10.01	10.26		0.463											0.18
1/3/2019	6.260			63.8																
1/4/2019	6.350																			
1/5/2019	6.620																			
1/6/2019	6.900	8.84																		0.13
1/7/2019	6.550	8.96		24.6																0.05
1/8/2019	6.200	9.54			0.07	9.72	9.79			103	124		76	17.2	14.1	<	0.25	0.82	164	0.06
1/9/2019	6.130	10.80	13.6		0.08	10.71	10.79													
1/10/2019	6.250		14.4	259.5	0.11	11.73	11.84	13.22	1.39											
1/11/2019	6.530																			
1/12/2019	6.970																			
1/13/2019	7.050		19.4		0.14	10.38	10.52		2.39											0.16
1/14/2019	6.400	10.20	14	36.8	0.1	8.98	9.08													0.07
1/15/2019	6.300	9.99		48.7	0.1	10.34	10.44					608								0.08
1/16/2019	6.280	11.60																		
1/17/2019	6.560																			
1/18/2019	6.330																			
1/19/2019	6.760																			
1/20/2019	6.950	11.80			0.06	10.13	10.19			111	138		61.5	20	15.2	<	0.25	0.85	174	0.11
1/21/2019	6.780	10.70	14	18.3	0.05	8.2	8.25													0.06
1/22/2019	6.300	11.70	24.6	38.9	0.04	8.82	8.86		1.39											0.04
1/23/2019	6.310	10.90																		
1/24/2019	6.040																			
1/25/2019	5.980																			
1/26/2019	6.560																			
1/27/2019	7.040		13.2		0.05	9.89	9.95													0.1
1/28/2019	6.150	9.54	10.6		0.05	9.18	9.23		1.66											0.04
1/29/2019	6.000	9.02		68.9	0.04	10.38	10.42													0.05
1/30/2019	6.240	9.99		71.4																
1/31/2019	6.260																			
2/1/2019	6.220																			
2/2/2019	6.700																			
2/3/2019	7.010		13.4		0.09	11.71	11.8		3.18											0.14
2/4/2019	6.390	8.32	10.8	125.4	0.08	10.73	10.81													0.06
2/5/2019	6.080	8.61		59.1	0.09	11.21	11.3													0.12
2/6/2019	5.820	8.68																		
2/7/2019	5.950																			
2/8/2019	5.820																			
2/9/2019	6.320																			
2/10/2019	6.720																			0.29
2/11/2019	6.200	8.18																		0.09
2/12/2019	6.220	8.20		74.3	0.07	8.99	9.06					631								0.08
2/13/2019	6.390	8.58	10.4		0.2	9.73	9.94													

Appendix E

Big Dry Creek 2019 Westminster WWTP Effluent Data

Date	Flow (MGD)	BOD (mg/L)	TSS (mg/L)	E. coli (#/100mL)	NH_3 (Timberline) (mg/L)	NO_2+NO_3 (calc. TIN-NH3) (mg/L)	TIN (Timberline) (mg/L)	TN (Timberline) (mg/L)	T-P (Lachat) (mg/L)	Sodium (mg/L)	Chloride (mg/L)	TDS (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	<	Bromide (mg/L)	Fluoride (mg/L)	Sulfate (mg/L)	NO_2 (mg/L)
2/14/2019	6.310		10.8	61.3	0.08	10.33	10.41	11.99	2.24											
2/15/2019	6.150																			
2/16/2019	6.260																			
2/17/2019	6.440	7.36	11.4		0.46	9.3	9.76													0.37
2/18/2019	6.260	7.96	11.6	17.1	0.54	8.64	9.18													0.4
2/19/2019	5.920	6.74		83.3	0.25	9.22	9.47		1.73											0.32
2/20/2019	5.900	8.15																		
2/21/2019	5.930																			
2/22/2019	5.840																			
2/23/2019	6.350																			
2/24/2019	6.800				0.37	9.94	10.31													
2/25/2019	5.600			8.6																
2/26/2019	5.940	6.72	10		0.22	8.85	9.07		1.2											0.2
2/27/2019	5.340	7.46	10.8	2	0.5	9.87	10.36													0.32
2/28/2019	4.780	6.93																		0.19
3/1/2019	5.350																			
3/2/2019	5.550																			
3/3/2019	5.780	7.59	10.8		0.44	9.76	10.2		2.47											0.38
3/4/2019	5.340	7.93	11.6	14.3	0.17	8.42	8.59													0.24
3/5/2019	5.320	6.60		20.6	0.13	9.13	9.26													0.2
3/6/2019	5.490	6.86																		
3/7/2019	5.690																			
3/8/2019	5.720																			
3/9/2019	6.140																			
3/10/2019	6.290																			0.2
3/11/2019	5.700	6.44			0.1	8.53	8.63													0.07
3/12/2019	5.620		7	9.6	0.1	9.26	9.35					658								0.05
3/13/2019	5.850	7.02	9.4		0.11	9.58	9.69		1.21											
3/14/2019	6.520			14.6																
3/15/2019	6.140																			
3/16/2019	6.480																			
3/17/2019	6.780	5.45	8.4		0.16	9.59	9.75													
3/18/2019	6.230	5.38		25.3																0.09
3/19/2019	6.100	4.93			0.08	9.63	9.71													0.1
3/20/2019	6.120	5.47	6.4	13.4	0.1	10	10.1	11.66	1.21											0.12
3/21/2019	6.170																			
3/22/2019	6.160																			
3/23/2019	6.400																			
3/24/2019	6.470				0.19	9.05	9.24													0.19
3/25/2019	6.040	3.73	5.6	9.7	0.07	8.17	8.24		0.993											0.06
3/26/2019	5.910	3.36	5.6	3.1	0.08	8.52	8.61													0.07
3/27/2019	6.010	3.53																		
3/28/2019	5.950																			
3/29/2019	5.910																			

Appendix E

Big Dry Creek 2019 Westminster WWTP Effluent Data

Date	Flow (MGD)	BOD (mg/L)	TSS (mg/L)	E. coli (#/100mL)	NH_3 (Timberline) (mg/L)	NO_2+NO_3 (calc. TIN-NH3) (mg/L)	TIN (Timberline) (mg/L)	TN (Timberline) (mg/L)	T-P (Lachat) (mg/L)	Sodium (mg/L)	Chloride (mg/L)	TDS (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	<	Bromide (mg/L)	Fluoride (mg/L)	Sulfate (mg/L)	NO_2 (mg/L)
3/30/2019	6.430																			
3/31/2019	6.680				0.14	9.04	9.18		1.5											0.16
4/1/2019	6.270	3.36		12.1	0.11	8.04	8.15													
4/2/2019	6.170	3.50		14.3	0.08	8.91	8.98			123.1	142		74.3	21.19	13.6	<	0.32	0.88	210	
4/3/2019	6.390	4.08	3.8		0.14	9.64	9.78													0.12
4/4/2019	6.280		4.2																	0.16
4/5/2019	6.320																			
4/6/2019	6.620																			
4/7/2019	6.840	4.48																		0.14
4/8/2019	6.330	3.76			0.09	8.33	8.42													0.07
4/9/2019	6.260	3.75		12.1	0.06	8.83	8.89													0.03
4/10/2019	6.200	4.26	5.4		0.17	9.74	9.91		0.772			697								
4/11/2019	6.370		5.2	9.7																
4/12/2019	6.190																			
4/13/2019	6.660																			
4/14/2019	7.000		7.4							128.2	151		72.7	22.02	13.4	<	0.25	0.88	211	0.06
4/15/2019	6.760	3.90			0.071498	8.168198	8.239696													0.04
4/16/2019	6.500	4.71		14.6	0.103089	9.37177	9.474859													0.04
4/17/2019	6.600	4.50	8.6	7.4	0.103852	10.934521	11.03837	10.8	0.76											
4/18/2019	6.400																			
4/19/2019	5.790																			
4/20/2019	5.830																			
4/21/2019	7.450	4.46	6.2		0.321914	8.503797	8.825711		1.09											0.16
4/22/2019	4.390	3.29	5.4	6.3	0.108221	7.314765	7.422986													0.04
4/23/2019	5.850	3.33			0.085079	8.595523	8.680601													0.06
4/24/2019	5.570	4.03		5.1																
4/25/2019	5.230																			
4/26/2019	5.280																			
4/27/2019	4.410																			
4/28/2019	6.400				0.18	10.92	11.1													0.12
4/29/2019	5.550	4.70	5.2	33.1	0.227367	9.547008	9.774376													0.16
4/30/2019	5.640	4.82	5.8	16	0.086721	10.518979	10.6057		1.25											0.06
5/1/2019	6.250	4.56																		
5/2/2019	5.750																			
5/3/2019	5.850																			
5/4/2019	5.720																			
5/5/2019	5.870																			
5/6/2019	4.870	4.97																		0.15
5/7/2019	5.290	4.42		29.2	0.173404	10.478076	10.65148													0.12
5/8/2019	5.750	5.68	5.8		0.131874	11.689693	11.82157													0.1
5/9/2019	6.060		6.8	18.7	0.05378	11.308897	11.36268	12.02	2.17											
5/10/2019	5.150																			
5/11/2019	6.500																			
5/12/2019	6.690	4.33	7.2		0.111281	10.005461	10.11674													0.11

Appendix E

Big Dry Creek 2019 Westminster WWTP Effluent Data

Date	Flow (MGD)	BOD (mg/L)	TSS (mg/L)	E. coli (#/100mL)	NH_3 (Timberline) (mg/L)	NO_2+NO_3 (calc. TIN-NH3) (mg/L)	TIN (Timberline) (mg/L)	TN (Timberline) (mg/L)	T-P (Lachat) (mg/L)	Sodium (mg/L)	Chloride (mg/L)	TDS (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	<	Bromide (mg/L)	Fluoride (mg/L)	Sulfate (mg/L)	NO_2 (mg/L)
5/13/2019	6.330	4.60		7.4	0.171861	9.610694	9.782555													0.13
5/14/2019	5.610	4.58	5.6	17.5	0.109401	10.258894	10.3683		1.4			580								0.11
5/15/2019	4.680																			
5/16/2019	3.280																			
5/17/2019	3.670																			
5/18/2019	4.540																			
5/19/2019	5.790		8.6		0.118239	10.535714	10.65395		2.14											0.12
5/20/2019	5.860		9.4		0.052304	9.3707	9.423004													0.08
5/21/2019	6.480	6.10		14.5	0.057931	10.036049	10.09398													0.05
5/22/2019	6.680	7.26		24.4																
5/23/2019	6.560	7.18																		
5/24/2019	6.260																			
5/25/2019	5.950																			
5/26/2019	6.240																			
5/27/2019	6.760	7.72	11.8		0.403821	9.412595	9.816416		2.44											0.17
5/28/2019	6.700	7.56	12.6	12.2	0.221356	8.99279	9.214146													0.18
5/29/2019	6.690	8.01		12.2	0.134335	9.5042	9.638535													0.11
5/30/2019	6.030																			
5/31/2019	5.480																			
6/1/2019	4.670																			
6/2/2019	5.600	8.13	11.6		0.293781	9.361018	9.654798													0.19
6/3/2019	4.650	8.52	11.6	29.2	0.226619	8.340715	8.567334													0.19
6/4/2019	4.390	9.00		58.3	0.220021	8.769857	8.989878		1.62											0.18
6/5/2019	3.480	8.70																		
6/6/2019	3.810																			
6/7/2019	4.210																			
6/8/2019	3.930																			
6/9/2019	3.680	8.40																		0.15
6/10/2019	4.700	6.92		35.9																0.05
6/11/2019	3.780	7.05	9.8		0.170246	9.435876	9.606122					609.5								0.18
6/12/2019	3.630	8.69			0.069315	9.834846	9.904161													
6/13/2019	3.050		11.4	17.3	0.055207	10.25094	10.30615	12.47	1.35											
6/14/2019	2.740																			
6/15/2019	3.220																			
6/16/2019	3.180		11.2		0.263337	9.980378	10.24372		0.983											0.15
6/17/2019	3.580	7.80	7.8	24.7	0.074754	9.820195	9.894949													0.09
6/18/2019	4.730	7.77		34.5	0.078818	10.09093	10.16975													0.05
6/19/2019	3.710	7.28																		
6/20/2019	4.020																			
6/21/2019	4.230																			
6/22/2019	5.490																			
6/23/2019	6.130				0.068089	10.138538	10.20663													0.04
6/24/2019	5.570	6.71	7.6	6.3	0.044254	8.861262	8.905515		0.831											0.04
6/25/2019	4.790	6.01	7.2	13.5	0.058619	8.445201	8.50382													0.04

Appendix E

Big Dry Creek 2019 Westminster WWTP Effluent Data

Date	Flow (MGD)	BOD (mg/L)	TSS (mg/L)	E. coli (#/100mL)	NH_3 (Timberline) (mg/L)	NO_2+NO_3 (calc. TIN-NH3) (mg/L)	TIN (Timberline) (mg/L)	TN (Timberline) (mg/L)	T-P (Lachat) (mg/L)	Sodium (mg/L)	Chloride (mg/L)	TDS (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	<	Bromide (mg/L)	Fluoride (mg/L)	Sulfate (mg/L)	NO_2 (mg/L)
6/26/2019	3.350	6.01																		
6/27/2019	3.550																			
6/28/2019	3.480																			
6/29/2019	3.660																			
6/30/2019	3.010	5.39	6.2		0.102312	8.004504	8.106816													0.05
7/1/2019	3.830	4.26	5.6	17.1	0.081842	7.811983	7.893825		0.507											0.03
7/2/2019	3.000	4.55		8.6	0.069269	7.214164	7.283434			126.1	155		77.3	23.2	13.4	<	0.25	1.1	214	0.03
7/3/2019	3.970	5.05																		
7/4/2019	3.500																			
7/5/2019	3.590																			
7/6/2019	5.410																			
7/7/2019	5.650																			0.08
7/8/2019	3.990	6.77																		0.07
7/9/2019	3.490	5.94	5.8	23.8	0.07261	7.478332	7.550942					610.1								0.06
7/10/2019	4.110	7.65			0.578708	7.183493	7.762201													
7/11/2019	3.510		7	17.3	0.09	8.67	8.76	10.67	1.05											
7/12/2019	2.100																			
7/13/2019	2.720																			
7/14/2019	4.050		10.8		0.081728	10.091444	10.17317			121.1	150		75.2	23.48	13.7	<	0.25	1.06	214	0.07
7/15/2019	3.720	6.51	6	15.6	0.083716	9.016695	9.100412													0.06
7/16/2019	3.610	6.48		67	0.072158	9.996778	10.06894		1.4											0.06
7/17/2019	4.330	7.34																		
7/18/2019	3.420																			
7/19/2019	3.000																			
7/20/2019	3.540																			
7/21/2019	4.640	4.75			0.066338	10.626303	10.69264													0.08
7/22/2019	4.990	3.95	5.8	10.9	0.05447	8.995031	9.049501		1.13											0.05
7/23/2019	4.230	3.59	5.2	16.9	0.051692	10.222991	10.27468													0.05
7/24/2019	4.040	3.68																		
7/25/2019	3.460																			
7/26/2019	3.860																			
7/27/2019	2.940																			
7/28/2019	3.630				0.120063	9.555919	9.68		1.25											0.1
7/29/2019	4.310	5.25	7	21.8	0.094957	8.672547	8.767504													0.08
7/30/2019	3.210	5.68	6.6		0.088868	8.84815	8.937018													0.06
7/31/2019	4.470	5.80		37.7																
8/1/2019	4.420																			
8/2/2019	3.870																			
8/3/2019	3.610																			
8/4/2019	4.230																			0.05
8/5/2019	4.350	4.83																		0.06
8/6/2019	3.430	4.68	7.4	24.3	0.130323	9.22295	9.353273													0.07
8/7/2019	3.820	5.26			0.117162	9.763245	9.880408													
8/8/2019	3.430		7.4	35.4	0.101214	10.053292	10.15451	12.29	0.665											

Appendix E

Big Dry Creek 2019 Westminster WWTP Effluent Data

Date	Flow (MGD)	BOD (mg/L)	TSS (mg/L)	E. coli (#/100mL)	NH_3 (Timberline) (mg/L)	NO_2+NO_3 (calc. TIN-NH3) (mg/L)	TIN (Timberline) (mg/L)	TN (Timberline) (mg/L)	T-P (Lachat) (mg/L)	Sodium (mg/L)	Chloride (mg/L)	TDS (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	<	Bromide (mg/L)	Fluoride (mg/L)	Sulfate (mg/L)	NO_2 (mg/L)
8/9/2019	3.400																			
8/10/2019	3.270																			
8/11/2019	3.970		10		0.117954	10.207545	10.3255													0.11
8/12/2019	3.940	5.94		65.7	0.169744	9.013316	9.18306													0.12
8/13/2019	3.630	6.68	9	42.6	0.194164	10.426489	10.62065		0.542			535.9								0.15
8/14/2019	2.880	7.08																		
8/15/2019	2.250																			
8/16/2019	2.210																			
8/17/2019	1.990																			
8/18/2019	2.910	11.40			0.802707	10.064808	10.86752													0.34
8/19/2019	2.930	9.51	16.8	209.8	0.633882	8.317579	8.95146		0.828											0.31
8/20/2019	2.010	10.00	18	290.9	0.803947	9.137507	9.941453													0.34
8/21/2019	3.110																			
8/22/2019	2.630																			
8/23/2019	2.780																			
8/24/2019	1.540																			
8/25/2019	2.550	9.15	19.2		2.308611	8.023894	10.33251		0.981											0.67
8/26/2019	3.490		15.6	70.3	1.490021	9.076467	10.56649													0.82
8/27/2019	2.190	7.66		39.5	0.620795	11.261356	11.88215													0.79
8/28/2019	1.980	8.48																		
8/29/2019	2.090	8.72																		
8/30/2019	1.510																			
8/31/2019	1.780																			
9/1/2019	2.480																			0.1
9/2/2019	3.450	5.70	8.4		0.472854	11.850642	12.3235													0.26
9/3/2019	2.050	5.19	7.2	21.3	0.20011	10.32497	10.52508													0.16
9/4/2019	3.760	10.10		30.9	0.214773	12.220744	12.43552		0.659											
9/5/2019	3.020																			
9/6/2019	2.530																			
9/7/2019	3.090																			
9/8/2019	3.680	9.36	13.1		0.113627	11.08917	11.2028													
9/9/2019	5.020	8.82		39.3	0.14032	9.061709	9.202029													
9/10/2019	3.510	8.61	9.8		0.100133	10.701407	10.80154		0.58			514.6								0.06
9/11/2019	3.260	9.63		44.3																0.05
9/12/2019	2.020																			0.03
9/13/2019	3.310																			
9/14/2019	2.810																			
9/15/2019	2.660																			
9/16/2019	3.470	9.27																		0.03
9/17/2019	2.240	7.90	11.2	13.4	0.11104	11.191092	11.30213													0.03
9/18/2019	1.930	8.66			0.102064	10.411143	10.51321													0.02
9/19/2019	2.630		13.8	24.6	0.077547	10.841239	10.91879	12.68	0.858											
9/20/2019	2.220																			
9/21/2019	3.030																			

Appendix E

Big Dry Creek 2019 Westminster WWTP Effluent Data

Date	Flow (MGD)	BOD (mg/L)	TSS (mg/L)	E. coli (#/100mL)	NH_3 (Timberline) (mg/L)	NO_2+NO_3 (calc. TIN-NH3) (mg/L)	TIN (Timberline) (mg/L)	TN (Timberline) (mg/L)	T-P (Lachat) (mg/L)	Sodium (mg/L)	Chloride (mg/L)	TDS (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	<	Bromide (mg/L)	Fluoride (mg/L)	Sulfate (mg/L)	NO_2 (mg/L)
9/22/2019	2.830	10.10	14.2		0.182267	9.93702	10.11929		0.947											
9/23/2019	3.370	8.67	11.2	47.2	0.079581	9.238977	9.318558													
9/24/2019	2.620	9.54		23.1	0.091007	11.756183	11.84719													
9/25/2019	1.810	10.20																		0.02
9/26/2019	2.910																			0.03
9/27/2019	2.370																			0.04
9/28/2019	1.780																			
9/29/2019	3.580				0.099725	10.862559	10.96228													0.05
9/30/2019	4.000	6.92	8.8	41.9	0.062981	9.230214	9.293195													0.03
10/1/2019	2.630	7.72	10		0.061042	10.768313	10.82936		0.546	95.1	124		57.8	16.12	13.1	<	0.25	0.84	158	
10/2/2019	4.430	7.80		19.9																
10/3/2019	4.360																			
10/4/2019	4.160																			
10/5/2019	4.210																			
10/6/2019	3.840	7.80																		0.05
10/7/2019	4.580	7.56																		0.04
10/8/2019	3.790	7.62			0.070506	9.843516	9.914023					496.4								0.04
10/9/2019	5.260	7.78	7.8	23.1	0.078002	9.743342	9.821344													
10/10/2019	5.830		10.8	40.4	0.0653	10.964903	11.0302	11.62	0.753											
10/11/2019	5.870																			
10/12/2019	6.080																			
10/13/2019	6.620		9.6		0.093683	9.215645	9.309327		0.653	98.5	124		57.1	16.73	13	<	0.25	0.88	158	0.07
10/14/2019	6.310	7.25	8.4	27.5	0.065694	9.204276	9.26997													0.04
10/15/2019	4.800	7.89		33.6	0.062956	9.862063	9.925019													0.03
10/16/2019	4.910	7.40																		
10/17/2019	5.080																			
10/18/2019	5.410																			
10/19/2019	6.110																			
10/20/2019	6.120	6.10	7.6		0.091893	9.397155	9.489048													0.06
10/21/2019	5.150	5.86	4.6	26.5	0.051767	8.275204	8.326971		0.477											0.03
10/22/2019	5.540	5.72		17.3	0.066074	8.7952	8.861274													0.03
10/23/2019	5.920	5.87																		
10/24/2019	6.080																			
10/25/2019	6.370																			
10/26/2019	6.370																			
10/27/2019	6.360				0.078303	8.945808	9.024111													0.08
10/28/2019	6.020	10.40	13.8	36.4	0.030988	8.115571	8.146559													0.04
10/29/2019	5.890	14.50	15.4		0.046247	8.728776	8.775023		0.55											0.04
10/30/2019	5.890	10.80		52.9																
10/31/2019	5.730																			
11/1/2019	6.080																			
11/2/2019	6.330																			
11/3/2019	6.890	9.01	25.2		0.227373	8.386376	8.613749													0.13
11/4/2019	6.340	11.50	25	40.4	0.05743	7.602922	7.660352		0.523											0.06

Appendix E

Big Dry Creek 2019 Westminster WWTP Effluent Data

Date	Flow (MGD)	BOD (mg/L)	TSS (mg/L)	E. coli (#/100mL)	NH_3 (Timberline) (mg/L)	NO_2+NO_3 (calc. TIN-NH3) (mg/L)	TIN (Timberline) (mg/L)	TN (Timberline) (mg/L)	T-P (Lachat) (mg/L)	Sodium (mg/L)	Chloride (mg/L)	TDS (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	<	Bromide (mg/L)	Fluoride (mg/L)	Sulfate (mg/L)	NO_2 (mg/L)
11/5/2019	6.150	10.50		48.1	0.23918	9.03524	9.27442													0.05
11/6/2019	6.260	9.57																		
11/7/2019	6.600																			
11/8/2019	6.450																			
11/9/2019	6.550																			
11/10/2019	6.710	9.06																		0.14
11/11/2019	6.000	11.00		29.8																0.06
11/12/2019	6.120	13.20			0.072639	8.812121	8.88476					500.2								0.04
11/13/2019	6.320	11.70	30		0.027462	9.846377	9.87384													
11/14/2019	6.140		28	98.8	0.038715	9.992235	10.03095	12.71	0.707											
11/15/2019	6.140																			
11/16/2019	6.520																			
11/17/2019	6.820		24.8		0.211951	9.473743	9.685694													
11/18/2019	6.370	7.61	14.4	56.5	0.066156	7.906435	7.97259													0.06
11/19/2019	5.890			29.2	0.062637	8.936813	8.999451		0.419											0.05
11/20/2019	5.700	7.94																		0.05
11/21/2019	5.720																			
11/22/2019	6.000																			
11/23/2019	6.500																			
11/24/2019	6.770		9.6		0.171528	8.344762	8.51629													
11/25/2019	6.090	5.86	8	19.7	0.053926	7.702564	7.75649		0.382											0.06
11/26/2019	6.130	6.34		20.3	0.068021	8.167763	8.235783													0.08
11/27/2019	6.050																			0.07
11/28/2019	6.160																			
11/29/2019	5.900																			
11/30/2019	6.220																			
12/1/2019	6.410	8.86			0.137535	6.896508	7.034043		0.488											0.15
12/2/2019	6.200	7.68	10.8	23.1	0.035162	6.526746	6.561908													0.07
12/3/2019	6.670	6.46	8.8	22.3	0.01755	7.290277	7.307828													0.05
12/4/2019	7.310	7.45																		
12/5/2019	6.500																			
12/6/2019	6.340																			
12/7/2019	6.870																			
12/8/2019	7.350	6.78																		0.14
12/9/2019	6.410	5.96		32.8																0.05
12/10/2019	6.280	4.38			0.040828	7.644033	7.684861					536.3								0.03
12/11/2019	6.430	4.80	5.4		0.028861	6.968476	6.997337													
12/12/2019	6.520		6.6	19.3	0.028652	8.085209	8.113861	9.5	0.284											
12/13/2019	6.390																			
12/14/2019	6.470																			
12/15/2019	6.670		7.4		0.124308	7.285491	7.409799		0.47											0.17
12/16/2019	6.200			39.3																0.04
12/17/2019	6.200	5.19	7	48.7	0.026602	7.717035	7.743636													0.04
12/18/2019	6.240	4.63			0.026758	6.87936	6.906119													

Appendix E

Big Dry Creek 2019 Westminster WWTP Effluent Data

Date	Flow (MGD)	BOD (mg/L)	TSS (mg/L)	E. coli (#/100mL)	NH_3 (Timberline) (mg/L)	NO_2+NO_3 (calc. TIN-NH3) (mg/L)	TIN (Timberline) (mg/L)	TN (Timberline) (mg/L)	T-P (Lachat) (mg/L)	Sodium (mg/L)	Chloride (mg/L)	TDS (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	<	Bromide (mg/L)	Fluoride (mg/L)	Sulfate (mg/L)	NO_2 (mg/L)
12/19/2019	6.270																			
12/20/2019	6.340																			
12/21/2019	6.590																			
12/22/2019	6.680		8		0.327202	7.187795	7.514997													0.32
12/23/2019	6.490		6.4	18.9	0.042455	7.43513	7.477585													0.1
12/24/2019	6.560	5.36			0.091349	7.035874	7.127223		0.4											
12/25/2019	6.040	5.32																		0.17
12/26/2019	6.070			10.1																
12/27/2019	6.090																			
12/28/2019	6.190																			
12/29/2019	6.350				0.185211	7.307074	7.492285													
12/30/2019	6.160		6.8		0.047366	7.711723	7.759089		0.309											
12/31/2019	6.330	5.28			0.106105	6.812505	6.91861													

Appendix F. Metro Wastewater 2019 Sampling on Lower Big Dry Creek

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Appendix F. Metro Wastewater 2019 Iron Sampling on Lower Big Dry Creek

Site	Description	Date	Time	Parameter	Result	Unit	Fraction	MDL	Method Context	Method ID
BDC-8	Big Dry Creek at Weld County Road 8	1/2/2019	10:50	Iron	0.087	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	2/6/2019	10:05	Iron	0.031	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	2/20/2019	10:36	Iron	0.035	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	3/6/2019	10:54	Iron	0.018	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	3/20/2019	11:49	Iron	0.025	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	4/3/2019	10:39	Iron	0.013	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	4/17/2019	10:20	Iron	0.012	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	5/1/2019	10:46	Iron	0.088	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	5/15/2019	10:52	Iron	0.01	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	6/5/2019	10:34	Iron	0.021	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	6/19/2019	11:31	Iron	0.019	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	7/3/2019	10:52	Iron	0.018	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	7/17/2019	10:39	Iron	0.013	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	8/7/2019	10:14	Iron	0.018	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	8/21/2019	10:47	Iron	0.031	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	10/2/2019	11:05	Iron	0.027	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	10/16/2019	10:32	Iron	0.01	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	11/6/2019	11:24	Iron	0.112	mg/L	Dissolved	0.007	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	1/2/2019	10:50	Iron	0.387	mg/L	Total	0.056	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	1/16/2019	10:44	Iron	0.735	mg/L	Total	0.056	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	2/6/2019	10:05	Iron	0.327	mg/L	Total	0.056	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	2/20/2019	10:36	Iron	0.917	mg/L	Total	0.056	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	3/6/2019	10:54	Iron	0.624	mg/L	Total	0.056	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	3/20/2019	11:49	Iron	0.99	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	4/3/2019	10:39	Iron	0.31	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	4/17/2019	10:20	Iron	0.17	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	5/1/2019	10:46	Iron	2.42	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	5/15/2019	10:52	Iron	0.94	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	6/5/2019	10:34	Iron	1.64	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	6/19/2019	11:31	Iron	2.43	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	7/3/2019	10:52	Iron	3.6	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	7/17/2019	10:39	Iron	1.66	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	8/7/2019	10:14	Iron	0.86	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	8/21/2019	10:47	Iron	0.45	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	9/4/2019	11:12	Iron	1.33	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	10/2/2019	11:05	Iron	0.92	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	10/16/2019	10:32	Iron	0.6	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	11/6/2019	11:24	Iron	0.58	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	11/20/2019	10:32	Iron	0.22	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	12/3/2019	9:22	Iron	1.01	mg/L	Total	0.02	USEPA	200.7
BDC-8	Big Dry Creek at Weld County Road 8	12/18/2019	11:06	Iron	0.71	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	1/2/2019	10:20	Iron	0.041	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	2/6/2019	9:53	Iron	0.06	mg/L	Dissolved	0.007	USEPA	200.7

Site	Description	Date	Time	Parameter	Result	Unit	Fraction	MDL	Method Context	Method ID
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	2/20/2019	10:19	Iron	0.058	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	3/6/2019	10:34	Iron	0.023	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	3/20/2019	11:31	Iron	0.017	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	4/3/2019	10:24	Iron	0.01	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	4/17/2019	10:07	Iron	0.035	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	5/1/2019	10:30	Iron	0.066	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	5/15/2019	10:32	Iron	0.03	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	6/5/2019	10:15	Iron	0.064	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	6/19/2019	11:12	Iron	0.026	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	7/3/2019	10:35	Iron	0.02	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	7/17/2019	10:22	Iron	0.024	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	8/7/2019	9:57	Iron	0.21	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	8/21/2019	10:31	Iron	0.028	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	9/18/2019	10:30	Iron	0.027	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	10/2/2019	10:35	Iron	0.057	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	10/16/2019	10:15	Iron	0.024	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	11/6/2019	11:00	Iron	0.048	mg/L	Dissolved	0.007	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	1/2/2019	10:20	Iron	0.362	mg/L	Total	0.056	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	1/16/2019	10:25	Iron	0.883	mg/L	Total	0.056	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	2/6/2019	9:53	Iron	0.43	mg/L	Total	0.056	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	2/20/2019	10:19	Iron	0.695	mg/L	Total	0.056	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	3/6/2019	10:34	Iron	0.77	mg/L	Total	0.056	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	3/20/2019	11:31	Iron	1.01	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	4/3/2019	10:24	Iron	0.46	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	4/17/2019	10:07	Iron	0.94	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	5/1/2019	10:30	Iron	1.28	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	5/15/2019	10:32	Iron	1.47	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	6/5/2019	10:15	Iron	2.41	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	6/19/2019	11:12	Iron	3.7	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	7/3/2019	10:35	Iron	3.55	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	7/17/2019	10:22	Iron	1.84	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	8/7/2019	9:57	Iron	1.32	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	8/21/2019	10:31	Iron	1.16	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	9/4/2019	11:00	Iron	1.29	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	9/18/2019	10:30	Iron	0.94	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	10/2/2019	10:35	Iron	0.96	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	10/16/2019	10:15	Iron	0.48	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	11/6/2019	11:00	Iron	0.76	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	11/20/2019	10:17	Iron	0.34	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	12/3/2019	9:04	Iron	1.18	mg/L	Total	0.02	USEPA	200.7
BDC	Big Dry Creek at Lupton Bottoms Ditch Diversion	12/18/2019	10:46	Iron	1.03	mg/L	Total	0.02	USEPA	200.7