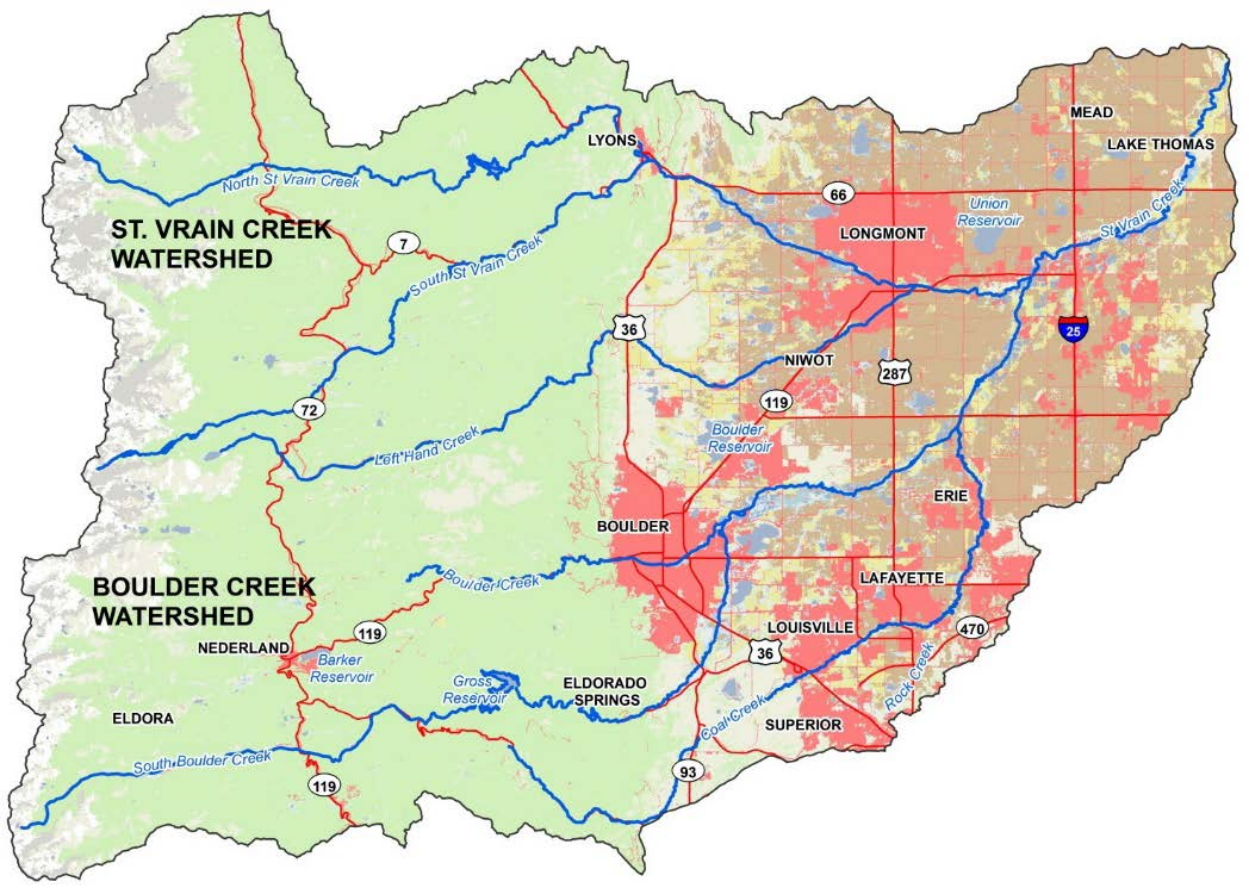
# Boulder Creek and St. Vrain Creek Watersheds Annual Water Quality Analysis for 2015




**Prepared for**
**Keep It Clean Partnership**

**Prepared by**
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**Report Preparation**

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# Executive Summary

In 2014, the Keep It Clean Partnership (KICP) developed the *Boulder Creek and St. Vrain Creek Coordinated Watershed Monitoring Framework* ("Monitoring Plan"), providing improved coordination of multiple independent monitoring efforts being conducted in the watershed. This report is the second joint water quality analysis report resulting from the Monitoring Plan and provides a summary of flow and field conditions during 2015, water quality analysis, a limited summary of biological monitoring results, and conclusions and recommendations for future monitoring and reporting efforts. The primary water quality parameters discussed in this report include nutrients and *E. coli*, with limited discussion of arsenic, selenium and copper, along with several general water quality indicators (e.g., total suspended solids, dissolved oxygen, pH). Key findings from analysis of the 2015 data include:

- ***E. coli***: All stream segments evaluated in this report exceed *E. coli* standards during 2015, except South Boulder Creek. Additional source identification of *E. coli* through targeted monitoring is recommended. Boulder Creek between 13th Street and the confluence with South Boulder Creek is included in an *E. coli* Total Maximum Daily Load (TMDL), which drives additional regulatory requirements under Municipal Separate Storm Sewer System (MS4) permits.
- **Total Phosphorus**: In June 2015, the Water Quality Control Commission adopted total phosphorus standards for multiple stream segments in the Boulder Creek/St. Vrain Creek basin. These standards apply above wastewater treatment plant (WWTP) discharges and are attained on all segments evaluated in this report. Below WWTP discharges, these standards do not yet apply; however, no stream segments evaluated in this report would be expected to attain these "interim values" for total phosphorus under current conditions.
- **Total Nitrogen**: Above WWTP discharges, the streams in the watershed attain the "interim values" for total nitrogen that were developed in Regulation 31 in 2012. Below WWTP discharges, no stream segments evaluated in this report would be expected to attain the "interim values" for total nitrogen under current conditions.
- **Total Recoverable Arsenic**: Although temporary modifications have been adopted for segments with "water + fish" standards for total recoverable arsenic through December 31, 2021, available data collected for Boulder Creek and South Boulder Creek indicate that the stringent 0.02 µg/L standard is not attainable at any monitoring location. Less stringent stream standards for arsenic apply to other segments in the watershed.
- **Selenium**: Rock Creek and the portion of Coal Creek below Rock Creek are identified as impaired for elevated selenium based on River Watch data. It is recommended that additional monitoring be conducted to better characterize selenium in these areas and that a site-specific standard potentially be proposed in the future.
- **Aquatic Life**: Based on biological monitoring results for 2015, significant improvement in aquatic life conditions has occurred throughout the watershed at most locations, particularly relative to post-flood conditions in 2013. Based on 2015 results, only one location on Coal Creek qualifies as impaired; however, several streams are listed as provisionally impaired on the 2016 303(d) List.

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# 1.0 Introduction

The overall St. Vrain Creek watershed (8-digit hydrologic unit code [HUC] = 10190005) covers approximately 980 square miles and includes many governmental jurisdictions and water-related organizations (e.g., conservancy districts). Streams in the watershed include Boulder Creek, South Boulder Creek, Coal Creek, Rock Creek, Left Hand Creek, St. Vrain Creek and many smaller tributaries. Multiple local governments and organizations conduct instream water quality, biological and flow monitoring in various parts of the watershed. In 2014, the Keep It Clean Partnership (KICP) developed the *Boulder Creek and St. Vrain Creek Coordinated Watershed Monitoring Framework* ("Monitoring Plan") for the following purposes:

- To provide better coordination of existing multi-jurisdictional monitoring efforts,
- To provide consolidated documentation of the monitoring that is occurring in the watershed,
- To provide guidance for standardized field procedures and analytical methods, and
- To identify and recommend additional monitoring to fill data gaps to support progress toward attainment of stream standards.

Due to the size of the watershed, the remote nature of the upper basin locations, and varying levels of participation among governmental jurisdictions, the Monitoring Plan cannot practically address all stream reaches. The Monitoring Plan is designed to address key water quality parameters, flow, and biological conditions at selected locations in the watershed where supported by local jurisdictions. These locations generally span the western edge of the urbanized portion of the watershed eastward to I-25. The scope of the Monitoring Plan is limited to flowing streams, although both the City of Boulder and the City of Longmont also monitor lakes and reservoirs. This report provides an overview of the Monitoring Plan and scope of the analysis, a summary of flow and field conditions during 2015, water quality analysis, a limited summary of biological monitoring results, and conclusions and recommendations for future monitoring and reporting efforts. Because of differences in the breadth of the monitoring programs conducted by various jurisdictions, this report focuses primarily on several general water chemistry parameters, nutrients, *E. coli,* arsenic and selenium, based on the priorities identified by the KICP. Additionally, selected findings from biological monitoring conducted by Timberline Aquatics on Boulder Creek, South Boulder Creek, Coal Creek, Rock Creek, Left Hand Creek and St. Vrain Creek for KICP municipalities are provided.

Appendix A provides maps identifying monitoring locations, and Appendices B through D provide tabular and graphical summary statistics supporting the analysis. Appendix E provides a summary of designated uses and stream standard adopted for streams in the basin in Regulation 38, and Appendix F provides stream segments identified as impaired on the currently applicable "303(d) List." Appendix G provides Quality Assurance/Quality Control results, and Appendix H provides a list of stream restoration projects being implemented in the watershed as part of response and recovery from the September 2013 flood under the Natural Resources Conservation Service (NRCS) Emergency Watershed Protection Program.

# 2.0 Overview of Monitoring Program and Scope of Analysis

The *Boulder Creek and St. Vrain Creek Coordinated Watershed Monitoring Framework* (KICP and WWE 2014) is an on-going, voluntary, ambient-based program that is independently managed and implemented by each participating jurisdiction (Table 1). The Monitoring Plan is focused on developing a coordinated baseline for the overall watershed. In the future, monitoring objectives and activities may be added to assess measureable results from implementation of structural or non-structural best management practices (BMPs) in the watershed.

Table 2 summarizes the primary monitoring locations included in this annual report, Table 3 summarizes municipal wastewater treatment plant (WWTP) locations, and Table 4 summarizes the monitoring program analytes and frequencies.

The overall basin monitoring program includes these general components:

- **Water quality monitoring:** Water quality monitoring includes instream sample collection during ambient conditions. This includes voluntary programs as well as samples collected to meet Regulation 85 requirements.[1]

- **Flow measurements**: Two types of flow measurements are conducted (or retrieved) as part of this monitoring program. The first includes continuous daily flow measurements conducted at fixed, long-term gauges shown on Figure A-1 in Appendix A. These gauges and associated data are maintained by the U.S. Geological Survey (USGS) (see http://waterdata.usgs.gov/usa/nwis/sw) or the Colorado Division of Water Resources (DWR) (see http://cdss.state.co.us/onlineTools/Pages/StreamflowStations.aspx). Additionally, One-Rain gauge sites used in early alert flood warning systems may be used to supplement flow data; however, data downloads are restricted to subscribers and have not been included in this report. The second type of flow monitoring includes instantaneous flow monitoring with hand-held monitoring equipment, which is used to supplement fixed gauge data in key areas. Manual flow monitoring is conducted only when it is safe for field staff to enter the stream. Chapter 3 provides a summary of streamflow conditions for the USGS, DWR, and the municipally-operated stream gauge at Coal Creek (which was formerly a USGS gauge).

- **Biological Monitoring**: Biological monitoring is conducted in the spring and fall for portions of Boulder Creek, South Boulder Creek, Coal Creek, Rock Creek, St. Vrain Creek, and Left Hand Creek. Detailed annual reports on these monitoring efforts are provided by Timberline Aquatics; however, a subset of the biological monitoring results is also provided in this report. The information contained in this report is limited to data needed to assess attainment of Colorado Policy 10-1 for aquatic life (e.g., multi-metric index [MMI] and associated metrics).

[1] Regulation 85 is Colorado's Nutrients Management Control Regulation, which establishes discharge permit limits and/or monitoring requirements for point sources and other provisions for nonpoint sources.

**Table 1. Summary of Routine Instream Monitoring Programs in the Basin**

| General Waterbody | Program Description | Primary Monitoring Plan |
|---|---|---|
| **Boulder Creek and Tributaries (from headwaters to below Coal Creek); Reservoirs—upper source water sites, Barker Reservoir, Boulder Reservoir; Dry Creek/Little Dry Creek** | Extensive program including nutrients, fecal indicator bacteria, metals, and other physical constituents; flow; and biological monitoring. Sampling frequencies vary by waterbody. Main stem monitored monthly. | City of Boulder, Boulder Creek Monitoring Program, Prepared by the City of Boulder Department of Public Works Utilities Division Water Quality and Environmental Services. May 2012. Updated June 2014. |
| **Rock Creek/Coal Creek** | Monthly monitoring for TP, TKN, NO3/NO2, TN, TP and flow. Also pH, temperature, hardness, fecal indicator bacteria. Biological monitoring. | Regulation 85 Nutrient Sampling and Analysis Plan (separate plans for Lafayette, Superior, Louisville, Erie), 2013. |
| **St. Vrain Creek (vicinity of Longmont); Left Hand Creek (@ conf. w/ St. Vrain) Selected ditches: Dry Creek, Spring Gulch #1, Spring Gulch #2, Oligarchy Ditch** | Extensive program including nutrients, fecal indicator bacteria, metals, and other physical constituents; flow; and biological monitoring. Sampling frequencies vary by waterbody. Monthly monitoring for TP, TKN, NO3/NO2, TN, TP and flow. | Regulation 85 Nutrient Sampling and Analysis Plan, City of Longmont, Public Works and Natural Resources Division of Environmental Services, CDPS Permit No. CO-0026671, February 2013. |
| **Monitoring Conducted in Watershed by Others (Non-KICP Partners)** | | |
| **Boulder Creek above and below Boulder Supply Canal; Left Hand Creek above and below Boulder Feeder Canal; St. Vrain Creek above and below St. Vrain Supply Canal (+ other ditches/reservoirs)** | Extensive program including nutrients, metals, and other physical constituents; flow, and biological monitoring. Sampling frequencies vary by waterbody. | Standard Operating Procedures for Northern Water's Water Quality Monitoring Programs. Northern Water, June 2014. |
| **Multiple Stream Segments** | Multiple parameters at varying frequencies | River Watch QAPP |
| **Multiple Stream Segments** | Multiple parameters at varying frequencies | Water Quality Control Division QAPP |

Note: Table 1 describes overall monitoring programs conducted by entities in the watershed. Data evaluated in this report focus on selected constituents addressed in monitoring conducted by KICP partner programs.

**Table 2. KICP Water Quality Instream Monitoring Locations in 2015 Analysis[2]**

| Plot ID | Instream Monitoring Location Description | Stream Name | Stream Segment | Data Provider |
|---|---|---|---|---|
| BC-Can | Pool area at Anderson Ditch headgate | Boulder Creek | BC-2b | City of Boulder |
| BC-CU | Under foot bridge connecting Folsom Field with dirt parking lot to the north | Boulder Creek | BC-2b | City of Boulder |
| BC-61 | Just West of 61st Street bridge | Boulder Creek | BC-9 | City of Boulder |
| BC-aWWTP | Under bridge at 75th Street western side | Boulder Creek | BC-9 | City of Boulder |
| BC-aDC | At diversion channel | Boulder Creek | BC-9 | City of Boulder |
| BC-95 | Downstream of Lower Boulder Ditch headgate 0.87 miles below BC-aDC sample site | Boulder Creek | BC-9 | City of Boulder |
| BC-107 | Bridge at 107th Street | Boulder Creek | BC-9 | City of Boulder |
| BC-bCC | Bridge where Boulder Creek goes under East County Line Road 2.13 miles below BC-Ken site. | Boulder Creek | BC-10 | City of Boulder |
| SBC-3.5 | Open Space at McGuinn Ditch gate (*merged with SBC-4 in analysis*) | South Boulder Creek | BC-4b | City of Boulder |
| CC-Ken | Bridge where Coal Creek goes under Kenosha Rd. 0.89 miles upstream from Boulder Creek confluence. | Coal Creek | BC-7b | City of Boulder |
| 9-BC | Boulder Creek above the North Erie WWTP discharge | Boulder Creek | BC-10 | Erie |
| 10-BC | Boulder Creek below the North Erie WWTP discharge | Boulder Creek | BC-10 | Erie |
| 11-BC | Boulder Creek Gauge 06730500 | Boulder Creek | BC-10 | Erie |
| 1-CC | Coal Creek above the Louisville WWTP discharge | Coal Creek | BC-7b | Louisville |
| 2-CC | Coal Creek below the Louisville WWTP discharge | Coal Creek | BC-7b | Louisville |
| 3-CC | Coal Creek above the confluence with Rock Creek | Coal Creek | BC-7b | Lafayette |
| 6-CC | Coal Creek above the Lafayette WWTP discharge | Coal Creek | BC-7b | Lafayette |
| 7-CC | Coal Creek below the Lafayette WWTP discharge | Coal Creek | BC-7b | Lafayette |
| 4-RC | Rock Creek above the Superior WWTP discharge | Rock Creek | BC-8 | Superior |
| 5-RC | Rock Creek above the confluence with Coal Creek | Rock Creek | BC-8 | Superior |
| M9.5-SV | M-9.5, St. Vrain @ N. 75th St | St. Vrain Creek | SV-3 | Longmont |
| M8.9-SV | St. Vrain @ Golden Ponds, M-9 | St. Vrain Creek | SV-3 | Longmont |
| M8.4-SV | St Vrain @ Below Boston Ave, M-8.4 | St. Vrain Creek | SV-3 | Longmont |
| M8.2-SV | St Vrain @ Pratt Parkway, M-8.2 | St. Vrain Creek | SV-3 | Longmont |
| M8-SV | St. Vrain @ Above Effluent M-8 | St. Vrain Creek | SV-3 | Longmont |
| T-Eff | WWTP effluent channel where it enters the St. Vrain; combined with the roadside ditch flow. | St. Vrain Creek | NA/ Ditch | Longmont |
| M7-SV | M-7, St. Vrain @ 119 | St. Vrain Creek | SV-3 | Longmont |
| M6-SV | St. Vrain at County Line Rd., M-6 | St. Vrain Creek | SV-3 | Longmont |
| T11-LH | Left Hand Creek @ St. Vrain,T-11 | Left Hand Creek | SV-5 | Longmont |

[2] Additional monitoring is also conducted in the watershed. Locations in Table 2 are the sites selected for analysis for purposes of this report. Sites M9.5-SV, M8.4-SV and M8.2-SV are included in this report but were not included in the KICP Monitoring Plan Version 1.1.

| Plot ID | Instream Monitoring Location Description | Stream Name | Stream Segment | Data Provider |
|---|---|---|---|---|
| **KICP Sites Not Monitored during 2015** | | | | |
| 0-CC | Above urbanized area on Coal Creek | Coal Creek | BC-7b | Louisville |
| M4-SV | St. Vrain above Boulder Creek Confluence | St. Vrain Creek | SV-3 | Longmont |
| LH-95 | Left Hand Creek @ 95th | Left Hand Creek | SV-5 | Longmont |

WWTP discharge data have also been provided, at least for nutrients, to support the analysis in this report. The municipal WWTP discharges are summarized in Table 3.

**Table 3. WWTP Discharges**

| KICP Sample ID | WWTP | Stream (Receiving Water) | CDPS Permit | Comment |
|---|---|---|---|---|
| A-CC | Louisville | Coal Creek | CO0023078 | Farthest upstream WWTP discharge to Coal Creek. |
| B-RC | Superior | Rock Creek | CO0043010 | Discharges to Rock Creek, which flows into Coal Creek between the Louisville and Lafayette discharges. |
| C-CC | Lafayette | Coal Creek | CO0023124 | Farthest downstream WWTP discharging to Coal Creek. |
| E-BC | Erie | Boulder Creek | CO0045926 | This location is for Erie's North WWTF. Erie's South WWTF is not currently in operation, but is identified as "D-CC," and discharged to Coal Creek. |
| WWTF Eff | Boulder | Boulder Creek | CO0024147 | Identified by Boulder as "manhole" monitoring location for 75th Street WWTF. |
| Long-Eff (or WWTP-LGMT) | Longmont | St. Vrain Creek | CO0026671 | This is the compliance monitoring location for Longmont's WWTP. The monitoring location "T-Eff" is also mostly WWTP effluent, but is combined with flows in a roadside ditch. |

[1]Long-Eff will be referred to as WWTP-LGMT in future annual reports.

**Table 4. 2015 KICP Monitoring Program Analytes**

| Parameter | Frequency | Method Detection Limit (MDL) |
|---|---|---|
| pH | monthly | 1 SU |
| DO | monthly | 0.1 mg/L |
| Temperature | monthly | -15°C |
| Conductivity | monthly | 0.1 mmhos/cm |
| Hardness, Total as CaCO3 | monthly | 1 mg/L |
| Alkalinity, Total | monthly | 1 mg/L |
| Flow | monthly (inst. meters); daily @ gauges | Stream dependent |
| *E. coli* | monthly | 1 MPN/100 mL |
| TSS | monthly | 2 mg/L |
| NH3, as N | monthly | 50 µg/L |
| NO3+NO2, as N | monthly | 20 µg/L |
| TKN, as N | monthly | 100 µg/L |
| TN, as N | monthly | 100 µg/L |
| TIN, as N | monthly | NA |
| TP, as P | monthly | 10 µg/L |
| Benthic monitoring* | twice per year, spring and fall | |
| Metals: (1) As, (2) Se, (3) Metals w/stream stds. | TBD (min. quarterly) | varies |

*Benthic monitoring discussed in this report is limited to parameters needed to assess attainment with Aquatic Life Policy 10-1.

Other data sets that could be integrated into this report in the future include River Watch, Northern Colorado Water Conservancy District, rotational basin monitoring conducted by the Water Quality Control Division (Division), Denver Water and additional routine monitoring by the KICP at other locations in the watershed. Examples of other data and special studies that may be of interest to KICP include:

- City of Boulder's source water monitoring program that includes streams and reservoirs in the upper basin of Boulder Creek, as well as monitoring for Barker Reservoir and Boulder Reservoir and tributaries.
- City of Longmont's monitoring for several reservoirs, ditches and creeks. These data are included in the database, but are not analyzed in this report.
- The Division's routine rotational monitoring or special monitoring in the basin. During 2015, the Division monitored two locations on Boulder Creek and additional monitoring by the Division is anticipated in 2017.

- River Water monitoring program. River Watch volunteers conducted monitoring in several areas of the watershed, primarily Gamble Gulch and the upper portion of Left Hand Creek basin. Samples were also collected on Coal Creek, Boulder Creek, St. Vrain Creek and South Boulder Creek. The Left Hand Watershed Oversight Group (LWOG) completed a summary analysis of River Watch data collected in the upper portion of the Left Hand Creek basin in 2016. This report can be accessed at: http://www.keepitcleanpartnership.org/wp-content/uploads/partner-pdfs/LeftHandWQreport2016.pdf.

- Northern Colorado Water Conservancy District's routine monitoring program.

- The City of Boulder's special monitoring program for neonicotinoids.

- Supplemental *E. coli* monitoring programs being conducted by the cities of Lafayette, Louisville and Boulder.

- Boulder County Parks and Open Space's targeted monitoring program for agricultural sites and practices (limited data).

# 3.0 Summary of Annual Flow Data and Pertinent Field Conditions

During 2015, stream flow was measured at the gauge locations in Table 5. Figures 1 through 9 provide the 2015 hydrographs at these locations, with the format differing slightly depending on whether the site is managed by the USGS, the DWR or others. Varying periods of record are available for each gauge. A few observations from review of these hydrographs and precipitation data at the National Oceanic and Atmospheric Administration/National Weather Service (NOAA/NWS) Cooperative Site in Boulder include:

- The NOAA/NWS site in Boulder provides precipitation data that were screened for significant storm events during 2015. Based on this review, the only instream sampling event expected to be influenced by rainfall runoff was on May 19, 2016 due to a 1.35-inch storm event. May was also the rainiest month overall during 2015, with the largest storm event of the year recorded earlier in the month at 1.64 inches on May 9.
- Spring runoff peaked in early June for most streams in each basin.
- Streamflows during 2015 were higher than the historic median during spring runoff for basins with available data for comparison.

The most common use of flow data by watershed projects is pollutant load calculations, which are essential to TMDL development and implementation. Flow is an important variable to record along with water quality data because it has significant influence on pollutant loading to the stream and instream concentrations. Flow data helps to underscore the relative importance of various point and nonpoint sources by developing a relationship between water quality variables and discharge. Higher than normal flows can dilute wastewater contributions from WWTPs, but they can also impact the stability of the stream channel, the size and quantity of bed material, sediment transport rates, and pollutant transport rates from urban and agricultural land uses. Low flows can have significant impact on variables such as water temperature and fish habitat.

The Boulder Creek and St. Vrain Creek watersheds continue to recover from the flood that occurred in September 2013. Field conditions that may affect 2015 data relative to this event include channel instability, denuded vegetation on banks and other long-term impacts from the September 2013 flood.

**Table 5. Stream Gauges with 2015 Data Retrieved**

| USGS ID | DWR or Other Name | Description |
|---|---|---|
| 06727000 | BOCOROCO | Boulder Creek Near Orodell |
| 06730200 | BOCNORCO | Boulder Creek at North 75th Street |
| 06729500 | BOCELSCO | South Boulder Creek Near Eldorado Springs |
| 06730500 | BOCLONCO | Boulder Creek at Mouth Near Longmont |
| 06724970 | LEFTHOCO | Left Hand Creek at Hover Road Near Longmont |
| N/A | SVCLOPCO | St. Vrain Creek Below Ken Pratt Blvd. at Longmont, CO |
| 06725450 | SVCBLOCO[1] | St. Vrain Creek Below Longmont [Damaged by Flood] (USGS calculates as Gauge 06730525 – Gauge 06730500) |
| 06730525 | SVCBBCCO | St. Vrain Creek Below Boulder Creek at HWY 119 Near Longmont |
| 06730400 | COALOUCO | COC-1 Louisville Gauge, no longer managed by USGS/DWR |

[1]This site was severely damaged by flood waters on September 12, 2013. Instead of replacing this gauge in the same location, a new gauge was installed downstream of Boulder Creek at Hwy 119, 06730525. A calculated Mean Daily Discharge (06730525 - 06730500) is made available after data at both sites have been verified. (Source: http://waterdata.usgs.gov/nwis/uv?site_no=06725450).

**Figure 1. Boulder Creek near Orodell 2015 Hydrograph**

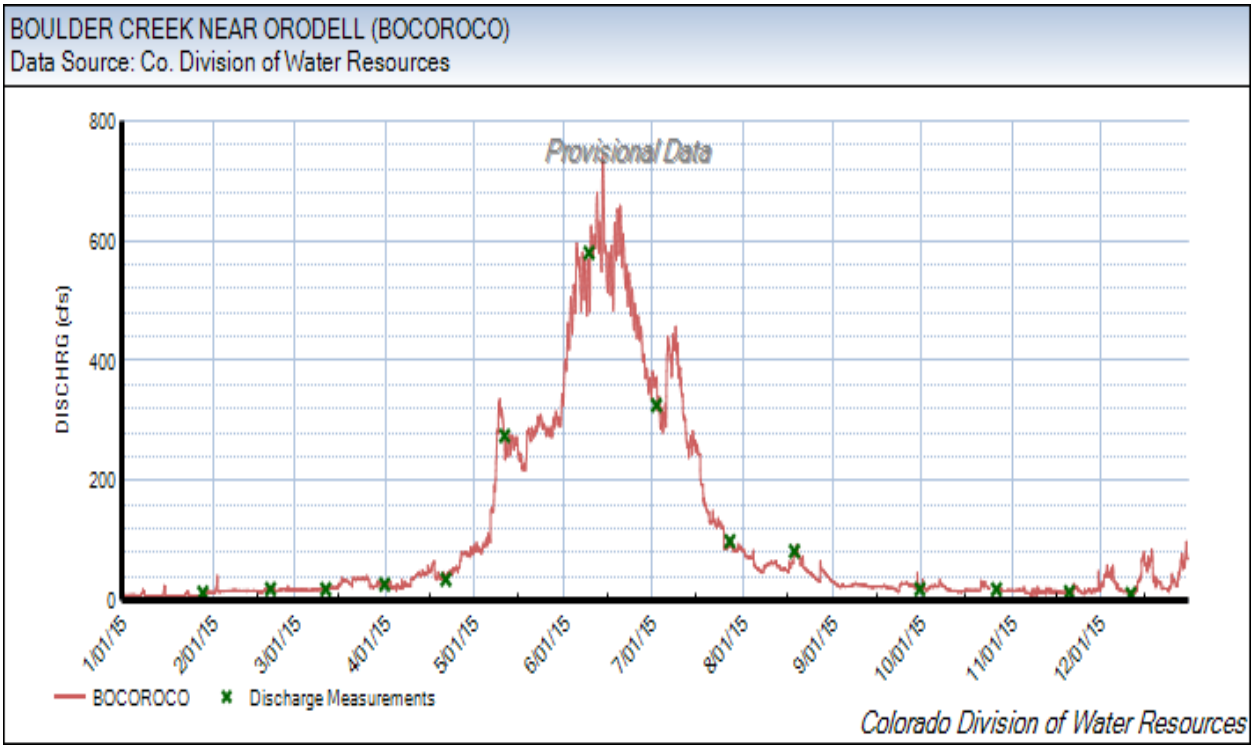



**Figure 2. South Boulder Creek near Eldorado Springs 2015 Hydrograph**

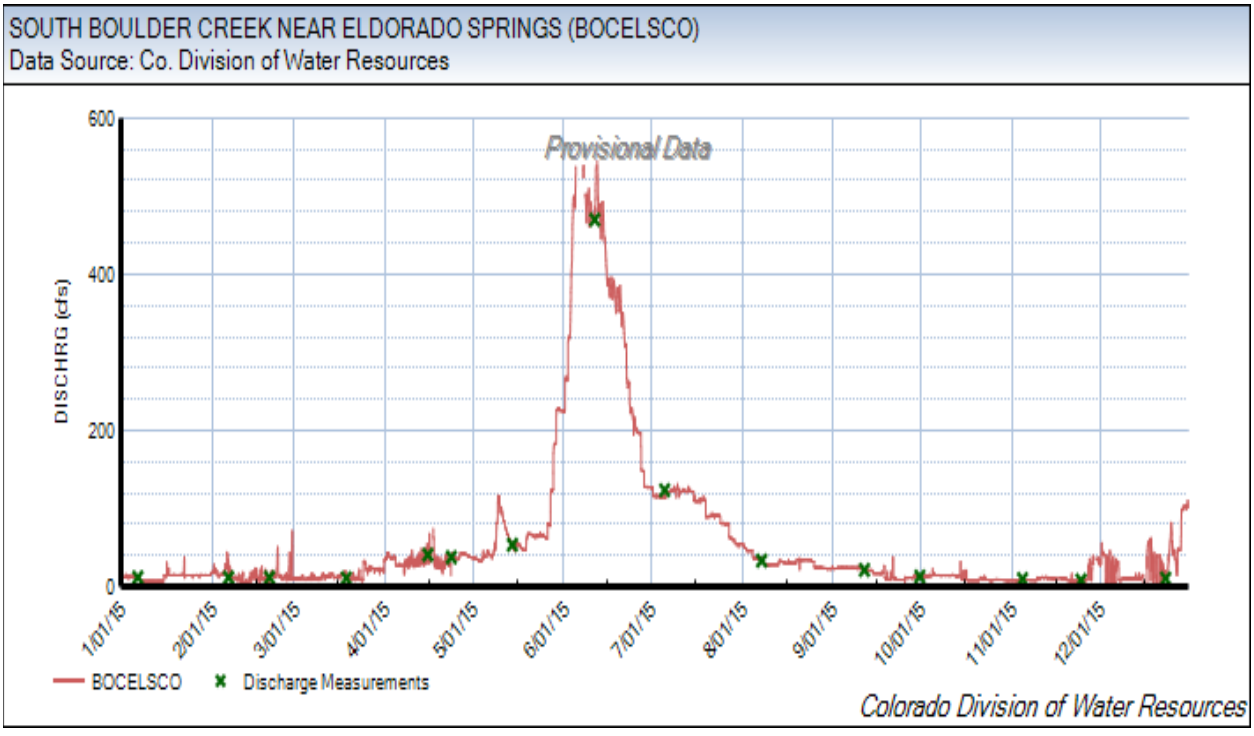


**Figure 3. Boulder Creek at North 75th Street 2015 Hydrograph**

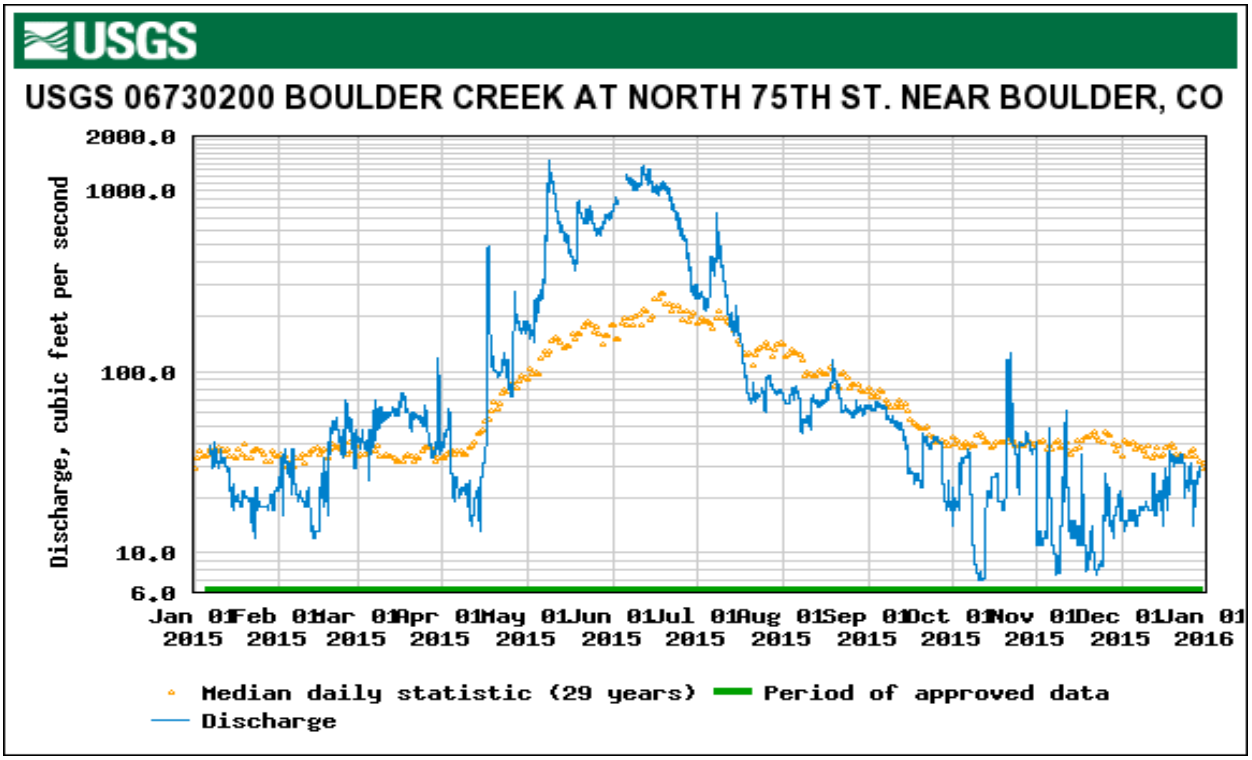



**Figure 4. Boulder Creek at Mouth near Longmont 2015 Hydrograph**

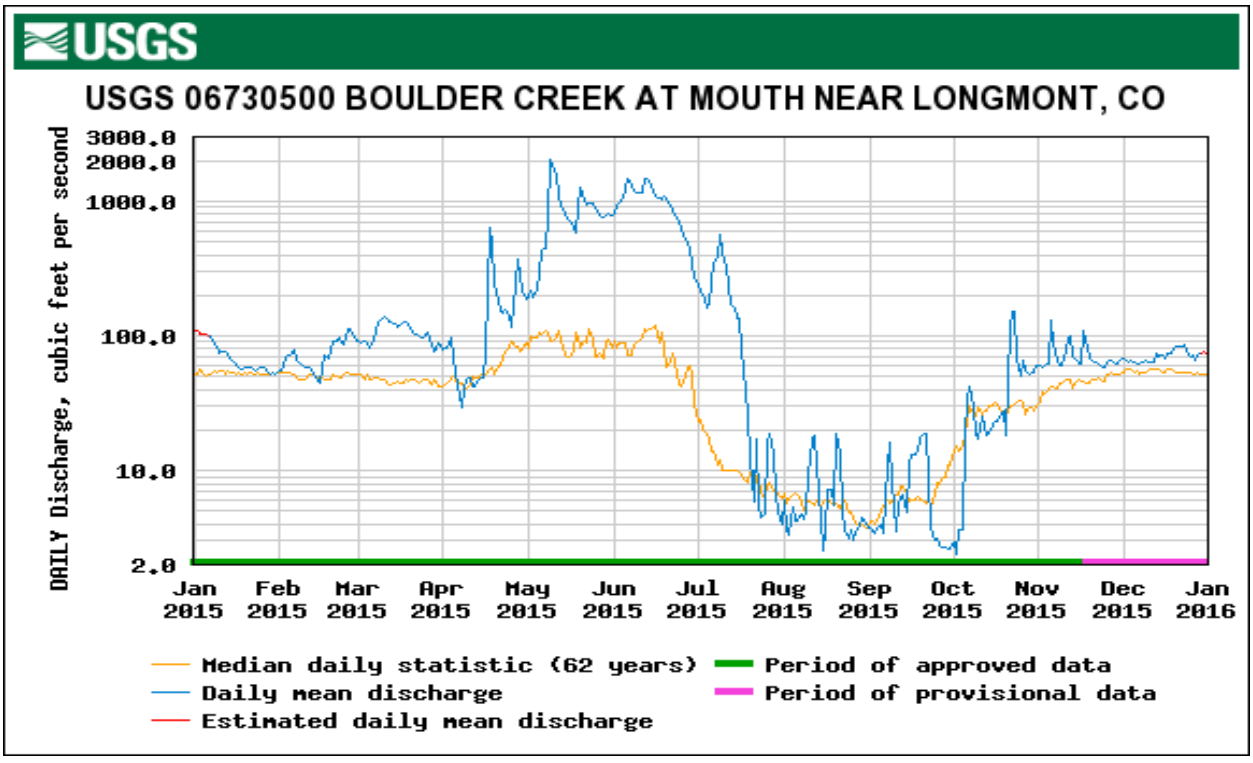


**Figure 5. Left Hand Creek at Hover Road near Longmont 2015 Hydrograph**

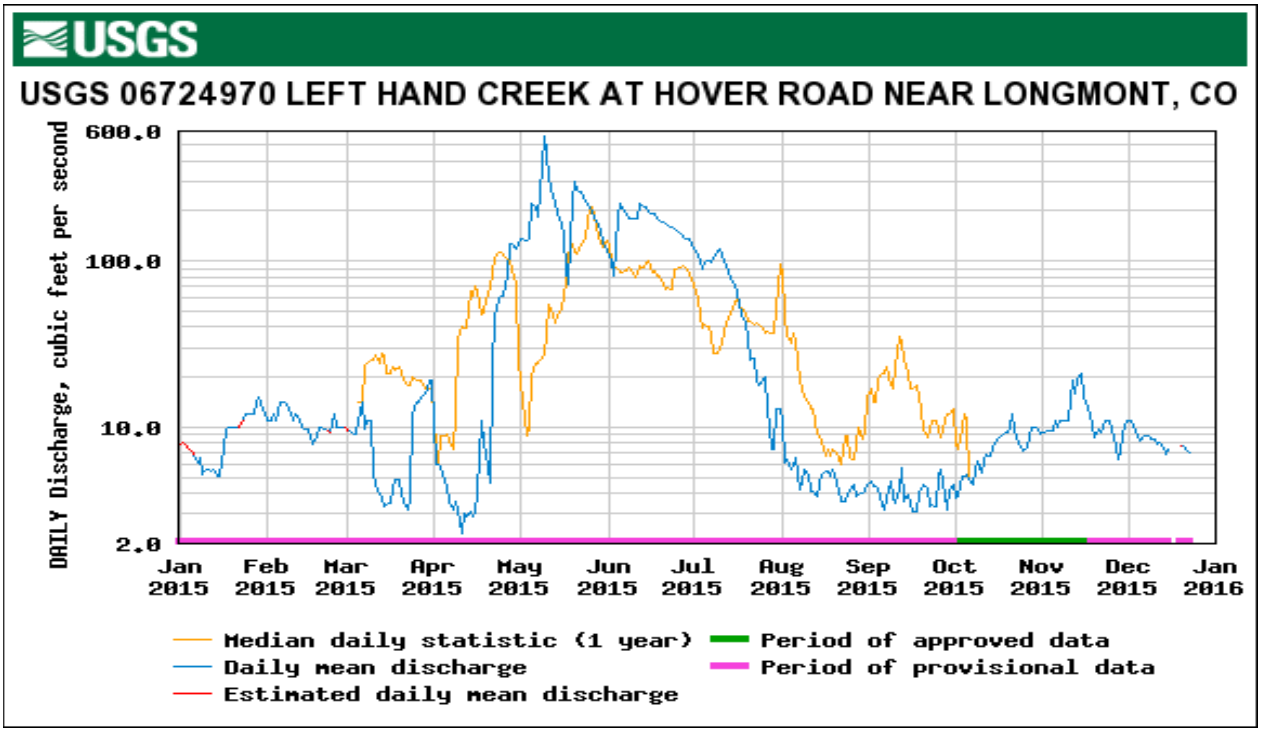



**Figure 6. St. Vrain Creek below Longmont (Historic Hydrograph)**

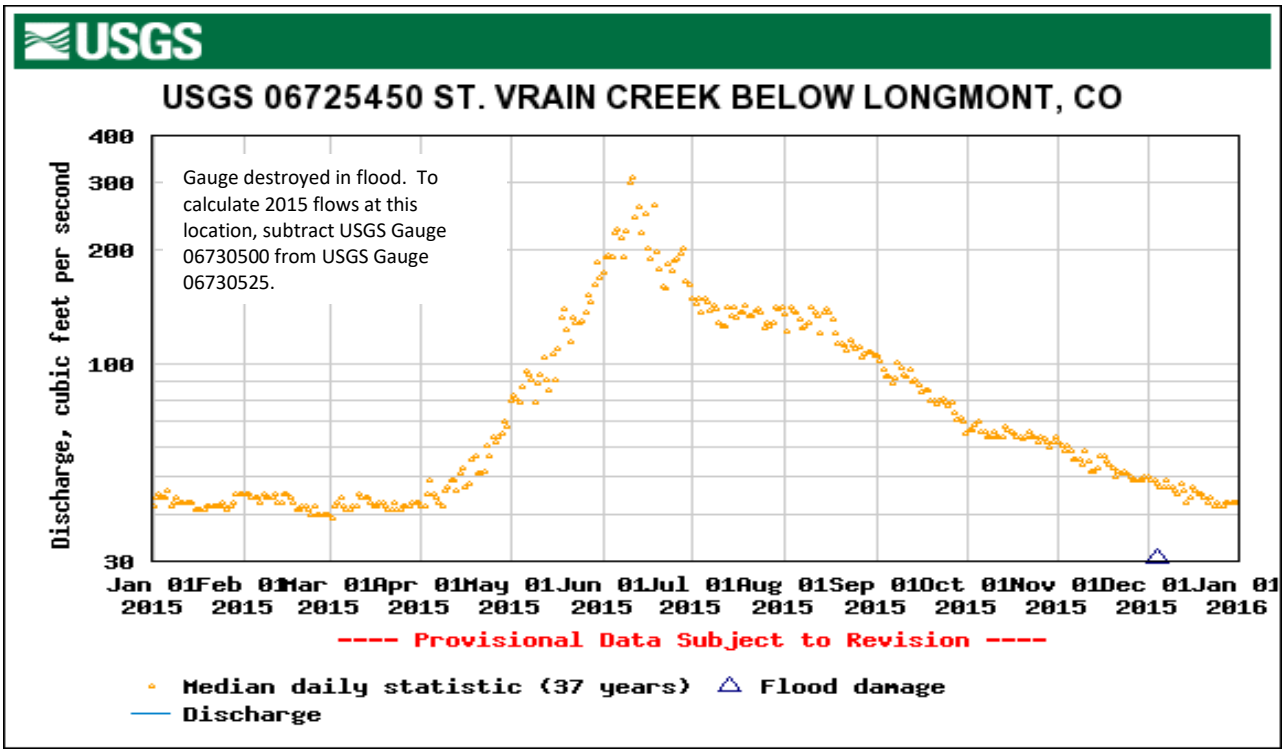


**Figure 7. St. Vrain Creek below Boulder Creek at Hwy 119 Near Longmont 2015 Hydrograph**

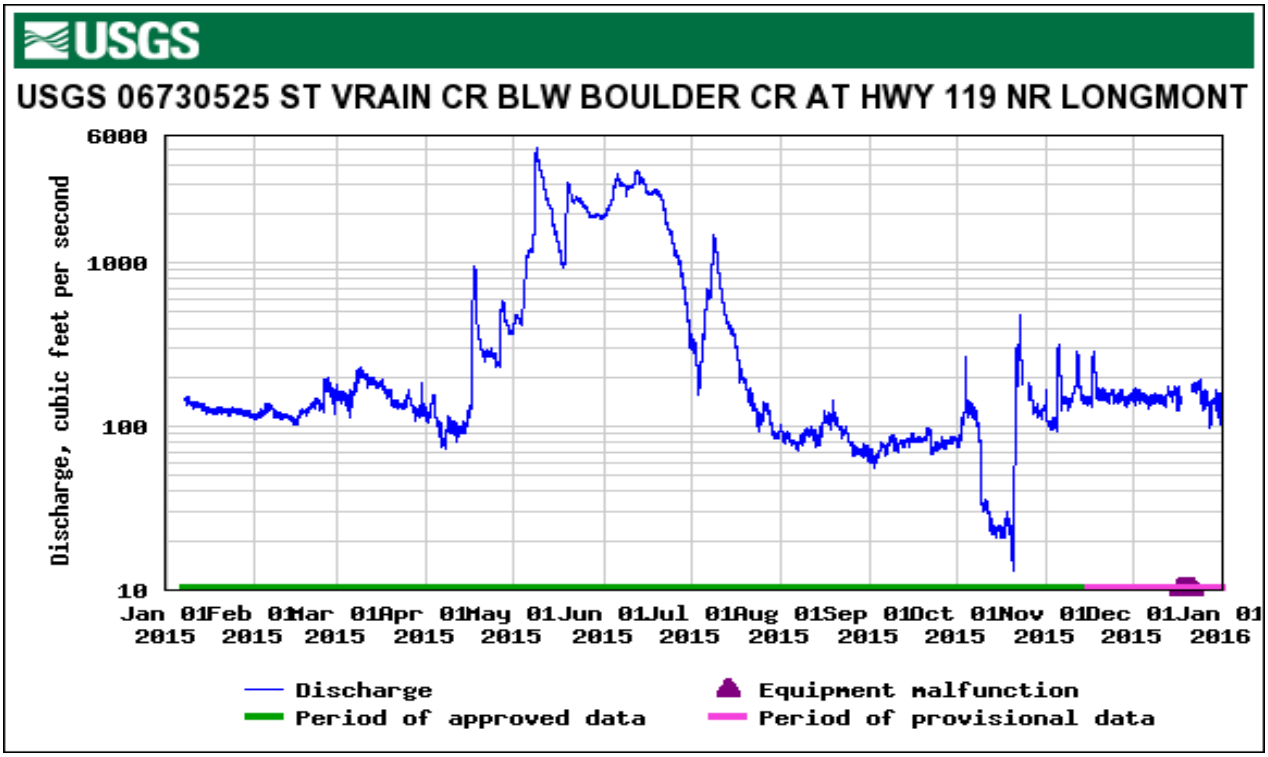



**Figure 8. St. Vrain Creek below Ken Pratt Blvd at Longmont 2015 Hydrograph**

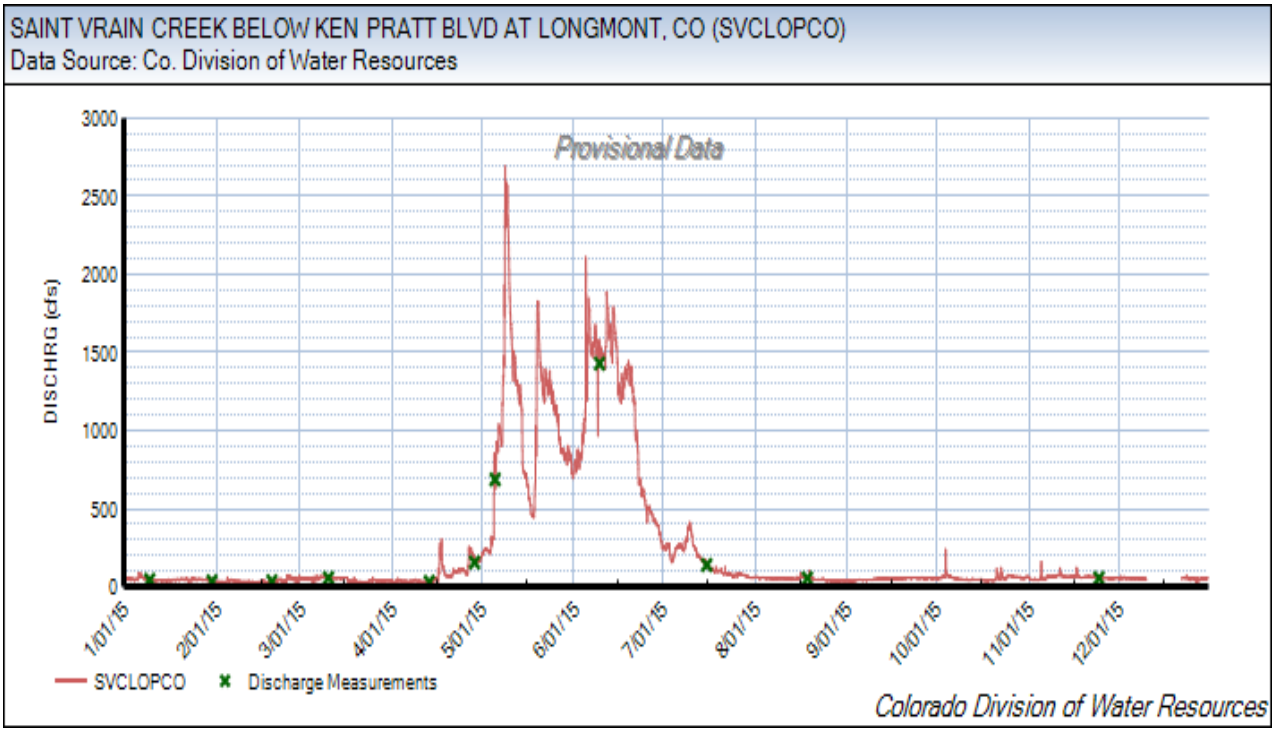
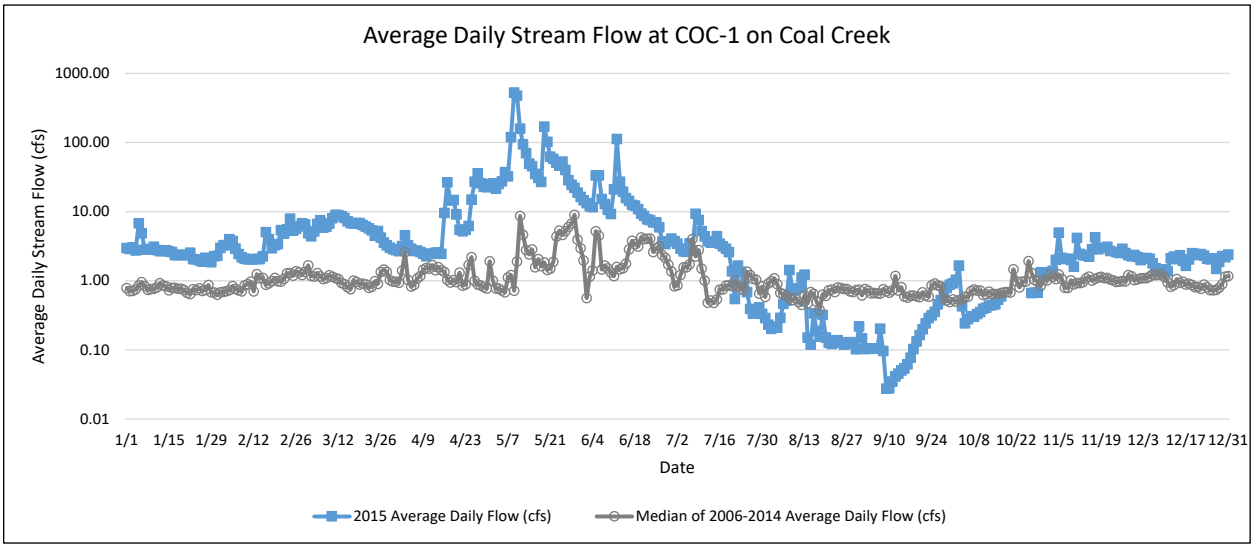


**Figure 9. Coal Creek at Louisville (COC-1) 2015 Hydrograph**



# 4.0 Water Quality Analysis

A brief overview of the statistical methods used in this analysis is provided, followed by a brief overview of selected stream standards assessment methodologies relevant to this report and a discussion of findings for general water chemistry, nutrients, *E. coli*, and selected metals for certain streams by basin. Appendices B through D provide statistical summaries and data plots.

## STATISTICAL CHARACTERIZATION METHODS

Tabulations of basic summary statistics are provided in Appendix B, including measures of central tendency and range of the data, along with several other statistical parameters, as described in Table 6. For purposes of descriptive statistics and plots, zero was substituted for non-detects to be consistent with standards assessment procedures used by the Division. In the event that more advanced trend analysis or hypothesis testing is conducted in future reports, an alternative substitution method may be considered (e.g., one-half of the detection limit, other advanced methods). This report is limited to statistical characterization and does not include formal hypothesis testing and trend analysis, given that this is only the second year of the KICP coordinated monitoring program.

**Table 6. Overview of Descriptive Statistics Provided in Appendices**

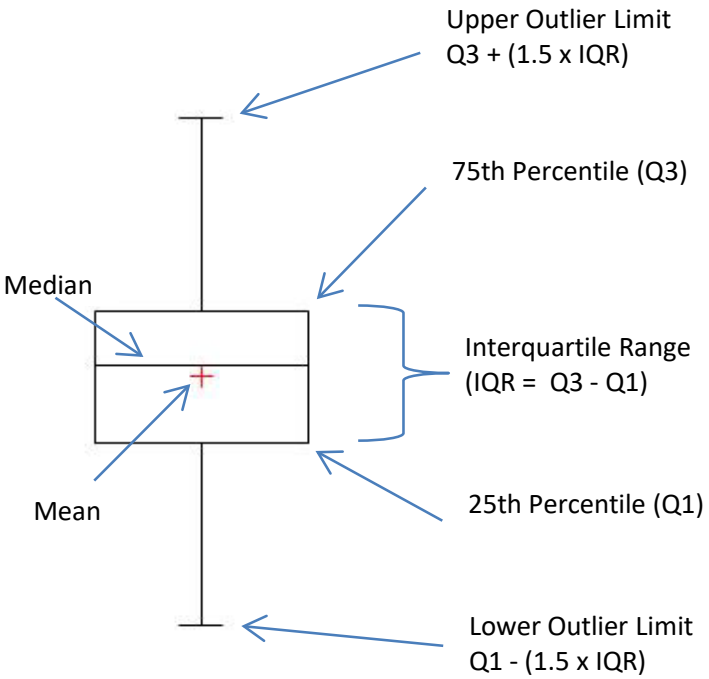
| Parameter | Brief Description |
|---|---|
| Number of observations | The number of values analyzed (n). Statistics based on few samples should be used with caution. |
| Minimum | The minimum of the series analyzed. |
| Maximum | The maximum of the series analyzed. |
| 1st quartile | The first quartile (Q1) is defined as the value for which 25% of the values are less. Corresponds to the "floor" of a boxplot. |
| Median | The median (Q2) is the $50^{th}$ percentile value for the data set that corresponds to the mid-line of a boxplot. This is a non-parametric estimate of central tendency that does not require the assumption of normally distributed data. |
| 3rd quartile | The third quartile (Q3) is defined as the value for which 75% of the values are less. Corresponds to the "roof" of a boxplot. |
| Mean | The mean of the sample is the arithmetic average. This is a parametric estimate of central tendency that requires the assumption of normally distributed data. |
| Standard deviation | A measure of how widely values are dispersed from the average (mean) value. |
| Geometric mean | A type of average, defined as the $n^{th}$ root of the product of n values. (Used for assessment of *E. coli* standard compliance.) |

Graphical representations of water quality data are often useful for identifying potential spatial and temporal water quality trends. Appendices C and D provide boxplots and time series plots of the data provided in 2015. Descriptions of the plots include:

- **Boxplots**: The legend in Figure 10 provides a key for interpreting boxplots, which are useful for depicting both the central tendencies (e.g., mean and median) of data sets, as well as the range of concentrations observed. Each boxplot provides a graphical representation of the 1st quartile (Q1 or 25th percentile), median (50th percentile), and 3rd quartile (Q3 or 75th percentile) data values at a specific monitoring location displayed together as a box with horizontal line at the median. Additionally, the mean is displayed with a red "+." Lastly, the plot includes the upper and lower limits (i.e., the ends of the "whiskers") beyond which values are considered anomalous. The ends of the whiskers represent the following: a) lower limit: = Q1 – 1.5 (Q3 – Q1) and 2) upper limit: Q3 + 1.5 (Q3 – Q1). Boxplots are provided in Appendix C for the KICP Monitoring Plan data set.

- **Time Series Plots**: Time series plots provide a graphical representation of data over time. The x-axis identifies sample dates and the y-axis provides quantitative values for those sample dates. Time series plots are particularly useful for identifying potential repeating seasonal patterns over time, or identifying whether multiple sample locations behave similarly or differently over time. Time series plots are provided in Appendix D for the KICP Monitoring Plan data set.

**Figure 10. Boxplot Legend**



## OVERVIEW OF STREAM STANDARDS ASSESSMENT METHODOLOGY

Independent and proactive assessment of water quality data to determine whether streams attain Colorado water quality standards is an important aspect of the annual data review process. It provides an opportunity for local governments to identify potential water quality impairments and collect additional data prior to formal assessment by the Division for the 303(d) List of Impaired Waters. A complete assessment of water quality standards has not been completed for stream segments in this report because the analysis is limited to a subset of parameters on each stream segment. A full description of the Division's standards assessment methodology is beyond the scope of this report, but can be accessed in *Colorado Listing Methodology: 2016 303(d) List* (Division 2015). This methodology is typically reviewed and refined on a biannual basis, so it should be checked for changes prior to completing each annual report. A few key aspects of the assessment methodology for general reference for purposes of constituents discussed in this report for streams include:

- The most recent five years of data are typically used for purposes of standards assessment.
- For assessment of chronic standards, the 85$^{th}$ percentile value for the data set is typically compared to the standard, with the exception of metals with standards in the total form. In those cases (e.g., iron, arsenic), the 50$^{th}$ percentile value is used.
- For assessment of acute standards, more than one exceedance of an acute standard over three years is considered an impairment.
- For *E. coli*, the bimonthly geometric mean is compared to the standard. Exceedance of the standard during one bimonthly assessment period is considered an impairment. Evaluation of the *E. coli* standard is based on multiple fixed two-month intervals. The evaluation intervals are January/February, March/April, May/June, July/August, September/October, and November/December. A sample size of five or more is required for assessment of the two-month intervals. Data are assessed yearly if adequate data from each two-month interval are available. If adequate data are not available to make an attainment decision using yearly data, then the Division will assess *E. coli* data for that two-month interval over the entire period of record (i.e., combing several years of data for each bimonthly increment).
- If evaluation of a data set for an entire segment does not indicate impairment, but specific location(s) within the segment consistently exceed acute or chronic standards, the specific portion of the segment may be listed as impaired.
- Water supply standards (e.g., nitrate, arsenic) are assessed along the entire segment for those segments where a water supply use has been adopted, regardless of whether or not there is a point of intake identified on the stream.

- For dissolved oxygen (DO), the 15th percentile value should not be less than the stream standard.
- For pH, the 15th percentile value should not be less than the lower pH range for the standard and the 85th percentile value should not be greater than the upper pH range.
- Temperature and ammonia standards evaluation requires more complex assessment techniques, which are described in the 2016 303(d) Listing Methodology (Division 2015).
- For purposes of standards assessment, non-detects are replaced with zeros, per Division policy. *E. coli* is an exception to this rule, with non-detects replaced with one to enable calculation of geometric means.
- If less than four samples are available, then the data set is not adequate to draw conclusions regarding impairment. In cases where less than four samples are available but impairment is indicated by available data, then the Division may list the segment on the Monitoring and Evaluation List until additional data can be collected.
- In 2012, Colorado adopted "interim nutrient values," which currently may be adopted as standards for stream segments upstream of WWTPs for total phosphorus and chlorophyll-a, but will also apply to segments downstream in the future (after May 31, 2022). For total nitrogen, interim values may be adopted after May 31, 2017 upstream of WWTPs and for other segments after May 31, 2022. For streams, total nitrogen, total phosphorus, and chlorophyll-*a* are evaluated based on comparison of annual median concentrations to the standard, which can be exceeded once every five years. (Additional assessment methods are in place for lakes and reservoirs.) In the June 2015 Rulemaking Hearing for Regulation 38, total phosphorus and chlorophyll-a standards were adopted for several stream segments in the watershed, including Boulder Creek Segment 2b, South Boulder Creek Segment 4b, Rock Creek (Boulder Creek Segment 8), and Left Hand Creek (Saint Vrain Segment 5), as described further in Appendix E.

## SUMMARY OF 2016 303(D) LISTINGS

In December 2015, the Water Quality Control Commission (Commission) held a hearing to update Colorado's 303(d) List of impaired waters. Appendix F provides a summary of all of the stream segments in the Boulder Creek and St. Vrain watersheds that are identified as impaired or on the state's 2016 Monitoring and Evaluation List. Table 7 provides a summary of the subset of segments that are within the boundaries of this annual report (i.e., have monitoring stations included in this report).

**Table 7. 2016 303(d) and Monitoring Evaluation (M&E) List for Selected Stream Segments**

| WBID | Description | Portion | M&E | 303(d) | Priority |
|---|---|---|---|---|---|
| **Boulder Creek Segments** | | | | | |
| COSPBO02b | Boulder Creek, from below the confluence with North Boulder Creek to above the confluence with South Boulder Creek | all | | As (*also TMDL for E. coli*) | L |
| COSPBO04b | Mainstem of South Boulder Creek, including all tributaries from the outlet of Gross Reservoir to South Boulder Road | all | | Cu, As | H/L |
| COSPBO07b | Coal Creek, HWY 36 to Boulder Creek | all | Aquatic Life | *E. coli* | H |
| COSPBO07b | Coal Creek, HWY 36 to Boulder Creek | Below Confluence of Rock Creek | | Se | M |
| COSPBO08 | All tribs to South Boulder Creek and all tribs to Coal Creek | Rock Creek | *E. coli* | Se | L |
| COSPBO09 | Mainstem of Boulder Creek, from South Boulder Creek to Coal Creek | all | | As, *E. coli* (July to October) | L/H |
| COSPBO09 | Mainstem of Boulder Creek, from South Boulder Creek to Coal Creek | From 107th Street to the confluence with Coal Creek | | Aquatic Life (provisional) | L |
| COSPBO10 | Boulder Creek, Coal Creek to St. Vrain Creek | all | | *E. coli*, pH, As | H/H/L |
| **St. Vrain Segments** | | | | | |
| COSPSV03 | St. Vrain Creek, Hygiene Rd. to S. Platte River | all | | *E. coli* | H |
| COSPSV05 | Mainstem of Left Hand Creek, including all tributaries and wetlands from Highway 36 to the confluence with St. Vrain Creek. | all | | Cu | M |

## FINDINGS FOR GENERAL WATER QUALITY CONSTITUENTS BY BASIN

The Monitoring Plan includes several general water quality parameters that can be useful in trend analysis and/or that are also needed for calculating certain standards. These include pH, dissolved oxygen (DO), temperature, conductivity, hardness, alkalinity and total suspended solids (TSS). For example, pH and temperature are needed for calculating ammonia standards and hardness is needed to calculate table value standards for various metals. Tabular statistics, boxplots and time series plots for these general water quality constituents are provided in Appendices B through D. General observations from the review of these water quality data are provided by basin below, although formal hypothesis testing for trend analysis has not been conducted for purposes of this report.

### Boulder Creek and South Boulder Creek

The Boulder Creek monitoring locations addressed in this report span from Canyon Road (BC-Can) to above the confluence with the St. Vrain (11-BC). The City of Boulder monitors the stream at various locations through the City of Boulder to below the confluence with Coal Creek. The Town of Erie monitors Boulder Creek in the lower portion of stream between Coal Creek and St. Vrain Creek. Boulder's 75$^{th}$ Street WWTP discharges to the stream in the vicinity of 75$^{th}$ Street and Erie's WWTP discharges to Boulder Creek downstream of Coal Creek. The City of Boulder also monitors South Boulder Creek in the open space area upstream of Highway 36 (SBC-3.5/4). The long-term South Boulder Creek monitoring location is named SBC-3.5, but an alternative location named SBC-4 has been monitored following the September 2013 flood. These two locations have been combined into one location representing open space for purposes of this report.

*Boulder Creek in the City of Boulder.*

Key observations regarding general water chemistry for Boulder Creek during 2015 include:

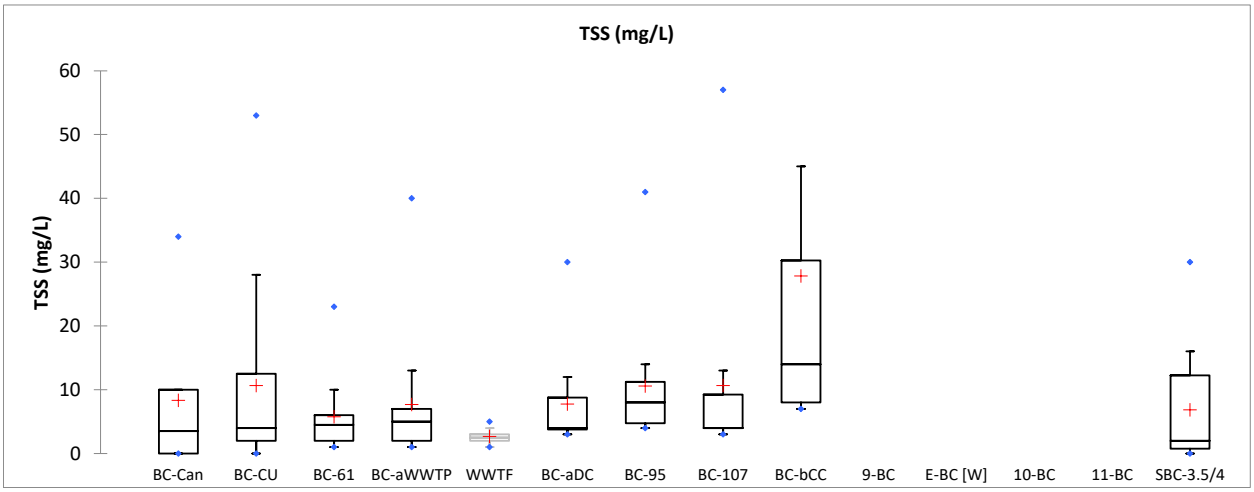
- For Boulder Creek, alkalinity, conductivity, hardness, pH and temperature generally increase from upstream to downstream, consistent with previous published analyses (e.g., Murphy 2006) and annual analysis by the City of Boulder (City of Boulder and WWE 2013; 2015). Concentrations of these parameters at the South Boulder Creek monitoring location (SBC3.5/4) are relatively similar to the upstream portion of Boulder Creek at site BC-Can.

- The range of DO concentrations present at monitoring locations on Boulder Creek and South Boulder Creek attain the stream standards of 5 to 7 mg/L. Higher DO is better, and the stream standard varies by segment, depending on location and spawning conditions.

- TSS concentrations on Boulder Creek were low (typically < 30 mg/L), although a few elevated values occurred in response to the May 19, 2015 storm event. Higher concentrations typically occur during spring runoff and during storm events (City of Boulder and WWE 2015). Coal Creek has higher TSS concentrations than upstream locations on Boulder Creek and influences TSS concentrations in Boulder Creek below the confluence with Coal Creek (BC-bCC), as summarized in Figure 11.

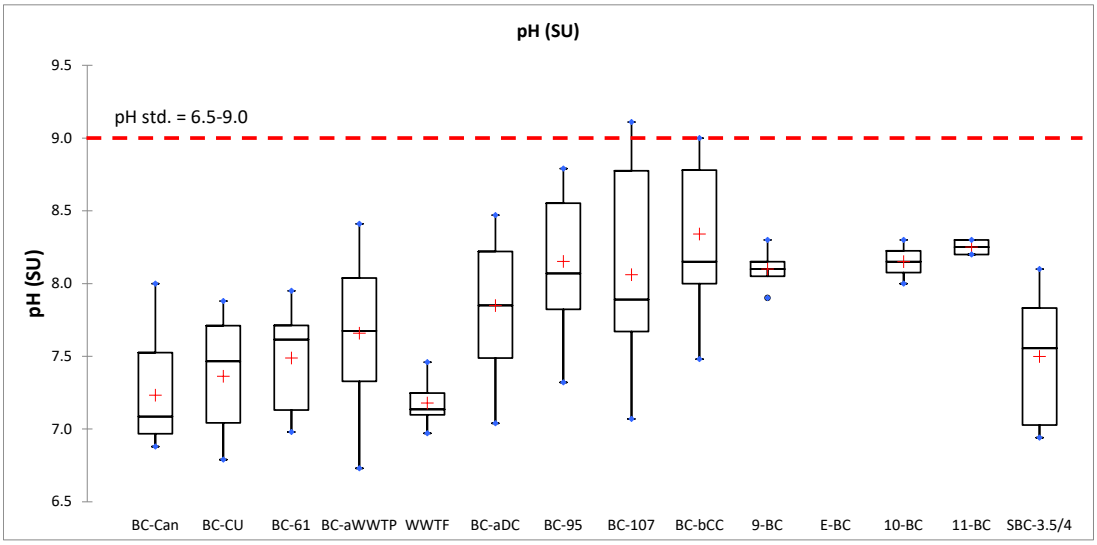
- The pH standard for Boulder Creek is based on an allowable range of 6.5 to 9.0. Boulder Creek Segment 10 is listed on the 2016 303(d) List as impaired due to elevated pH. During 2015, most locations on Boulder Creek consistently attained the pH standard, with only one sample measurement at BC-107 exceeding 9.0 on November 24, 2015 (Figure 12). The pH levels are typically slightly higher in the winter (Boulder and WWE 2015).

**Figure 11. 2015 Boulder Creek Total Suspended Solids**




Note: If no boxplot is shown for a site, then TSS data were not provided for that sampling location.

**Figure 12. 2015 Boulder Creek pH**




## Coal Creek and Rock Creek

Coal Creek monitoring locations addressed in this report span from the vicinity of Empire Road above Louisville's WWTP to Kenosha Road near the confluence with Boulder Creek. Rock Creek is also monitored above and below Superior's WWTP discharge. Rock Creek joins Coal Creek above the Lafayette's WWTP. There are three municipal WWTPs actively discharging to these streams: Louisville and Lafayette discharge to Coal Creek and Superior discharges to Rock Creek. Historically, Erie's South WWTP also discharged to Coal Creek, but Erie is now utilizing its North WWTP, which discharges to Boulder Creek.

The coordinated instream monitoring program on Coal Creek and Rock Creek is relatively new, so not all parameters were consistently monitored during 2015, which limits the ability to draw conclusions regarding upstream to downstream trends. As the monitoring program matures, additional trending should be feasible in future annual reports.

Key observations regarding general water chemistry for Coal Creek and Rock Creek during 2015 include:

- The pH values measured on Coal Creek ranged from 7.1 to 8.6 and attained applicable stream standards for pH. The pH values on Rock Creek ranged from 7.8 to 11.6, with an 85$^{th}$ percentile value of 8.6, which attains the upper pH standard.
- Most locations monitored on Coal Creek and Rock Creek had relatively normal[3] alkalinity ranges (e.g., 190 to 270 mg/L at various monitoring locations), except for 1-CC. Although

[3] Alkalinity ranging between 100 and 250 mg/L is considered normal for surface waters. Levels greater than 250 mg/L are considered high. Levels between 25 and 400 mg/L are generally beneficial for aquatic life (Weiner 2008).

only four samples were collected during September to December 2015 at 1-CC (near Empire Road), the mean alkalinity was much higher at 425 mg/L.

*Coal Creek.*

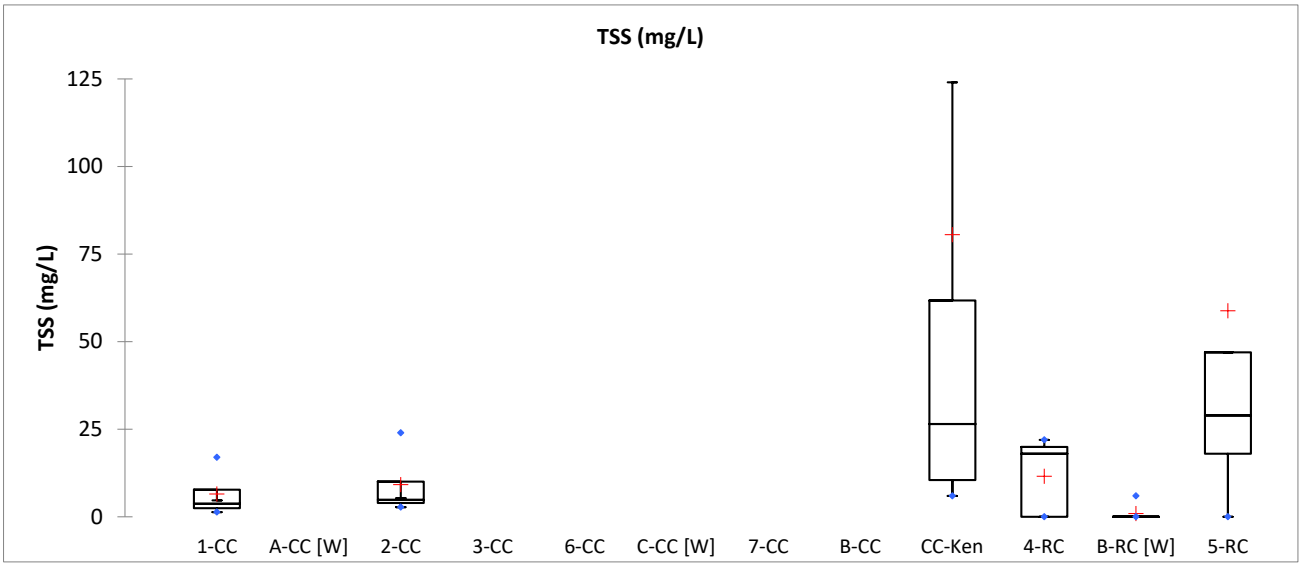
- Coal Creek and Rock Creek have relatively high hardness, with Coal Creek above Rock Creek averaging 277 mg/L, Rock Creek averaging 318 mg/L, and Coal Creek below the confluence averaging approximately 346 mg/L. These relatively high hardness values result in less stringent hardness-based metals standards than those calculated for Boulder Creek and South Boulder Creek.

- The conductivity of Coal Creek generally increases in an upstream to downstream direction and appears to be particularly influenced by high conductivity from Rock Creek. The average conductivity for Rock Creek above Coal Creek was 1429 umhos/cm and the average conductivity for Coal Creek above the confluence with Boulder Creek was 1148 umhos/cm.

- The DO standard for Coal Creek and Rock Creek is 5 mg/L. All locations sampled on Coal Creek attained this standard and most locations on Rock Creek attained the standard. One sample collected from Rock Creek below the Superior WWTP discharge on December 15 dipped below 5 mg/L, but the stream overall attained the standard during 2015. DO in the stream was also relatively low above the Superior WWTP discharge on the same date, so this condition is likely not caused by the WWTP discharge.

- TSS data were monitored at inconsistent sample frequencies for a few monitoring locations on Coal Creek (i.e., 1-CC, 2-CC, and CC-Ken). TSS concentrations prior to the confluence with Boulder Creek (CC-Ken) ranged from 1 to 558 mg/L, with the 558 mg/L result influenced by the May 19 precipitation event. TSS concentrations measured for Rock Creek ranged from non-detect to 277 mg/L, with the 277 mg/L result also likely influenced by earlier storm events in May. Figure 13 shows the range of TSS concentrations in Coal Creek above the confluence with Rock Creek. In future annual reports, more detailed trend analysis could be conducted if TSS data were collected at more monitoring locations. When reviewing Figure 13, CC-Ken is the only instream location with 12 monthly sampling events.

**Figure 13. 2015 Coal Creek Total Suspended Solids**




## St. Vrain Creek and Left Hand Creek

St. Vrain Creek monitoring locations addressed in this report span from the western urbanized boundary of Longmont at North 75th Street to County Line Road (M6-SV) prior to the confluence with Boulder Creek. An additional monitoring location immediately above the confluence (M4-SV) has also been monitored by Longmont in the past, but has been discontinued temporarily due to damage from the September 2013 flood. Left Hand Creek enters St. Vrain Creek below Longmont's WWTP discharge and was monitored above the confluence during 2015. Two locations monitored by Longmont are associated with Longmont's WWTP discharge: the effluent itself (identified as WWTF-Long) and a location that monitors the effluent comingled with a roadside ditch prior to discharge to the St. Vrain (identified as T-Eff).

*St. Vrain Creek is gradually recovering from the 2013 flood.*

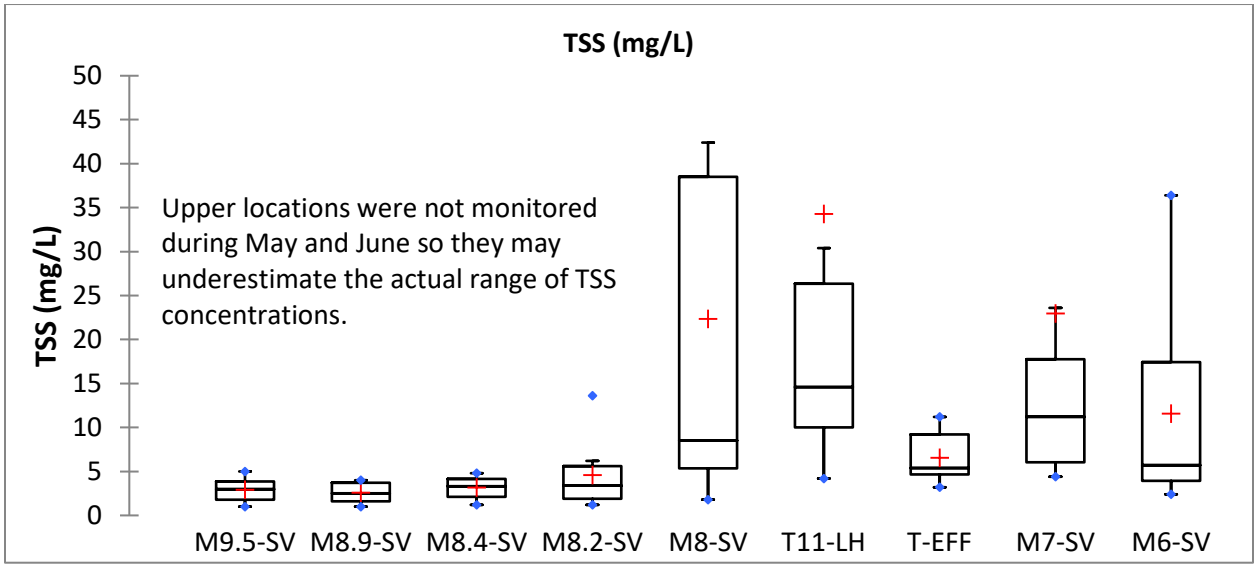
Key observations regarding general water chemistry for St. Vrain Creek and Left Hand Creek (above the confluence with St. Vrain Creek) during 2015 include:

- Alkalinity, conductivity, and hardness generally increase in an upstream to downstream direction; however, the Longmont WWTP discharge appears to "reset" the alkalinity and hardness concentrations by temporarily decreasing values after which the increasing trend for downstream sites begins again.

- All pH values for St. Vrain Creek and Left Hand Creek monitoring locations attain stream standards of 6.5 to 9.0. All DO values attain the DO standard of 5.0.

- TSS concentrations in St. Vrain Creek are relatively low (averaging < 20-30 mg/L) for most sites. TSS concentrations for Left Hand Creek averaged 34 mg/L (Figure 14). TSS concentrations in Left Hand Creek were lower in 2015 than in 2014, which may indicate that Left Hand Creek is becoming more stable following the 2013 flood. Elevated TSS occurred on May 20 at several sample locations in response to a storm event on May 19. Upstream to downstream trending is not appropriate for the 2015 data set because of unequal seasonal distribution of sampling events. (The upper locations did not include the spring storm events or spring runoff during May.)

**Figure 14. 2015 St. Vrain Creek and Left Hand Creek Total Suspended Solids**




Note: On May 20 following the May 19 precipitation event, locations M8-SV, T11-LH and M7-SV had TSS results ranging from 95 to 206 mg/L, which are not shown on the plot.

## FINDINGS FOR SELECTED NUTRIENTS BY BASIN

Nutrients are of interest for each basin due to current and future water quality regulations and the communities' desire to maintain healthy aquatic life and aesthetically pleasing conditions in streams. Excessive nutrient concentrations can lead to undesirable algae and other vegetative growth, adversely affecting aquatic life and aesthetics.

Currently, stream standards for ammonia, nitrate and nitrite have been adopted for each stream segment in Regulation 38, but additional nutrient "interim values" for total nitrogen and total phosphorus, as well as chlorophyll-*a*, will be added in the future in accordance with Regulation 31. Technology-based WWTP effluent limits for total inorganic nitrogen (TIN) and total phosphorus for WWTP discharges will be applied under Regulation 85, with most WWTPs receiving compliance schedules to allow time to implement treatment upgrades. The following nutrients are discussed in this section and will be of increasing interest to the municipalities:

- Phosphorus (total phosphorus)
- Nitrogen (total Kjeldahl nitrogen [TKN], nitrate, nitrite, ammonia, total nitrogen)

The "interim values" adopted in Regulation 31 for total nitrogen, total phosphorus and chlorophyll-*a* are summarized in Table 8. Chlorophyll-*a* (as attached algae) is not part of the current Monitoring Plan, so is not discussed further in this 2015 report. Interim values vary for cold water and warm water streams, with more stringent values for cold water streams. Appendix E provides a summary of stream standards adopted for various stream segments in the basin, including various nutrient standards adopted in the June 2015 Regulation 38 Rulemaking Hearing.

**Table 8. "Interim Values" for Total Nitrogen, Total Phosphorus and Chlorophyll-*a***

| Analyte | Cold Water "Interim Value" | Warm Water "Interim Value" |
|---|---|---|
| Total Phosphorus | 0.11 mg/L | 0.17 mg/L |
| Total Nitrogen | 1.25 mg/L | 2.01 mg/L |
| Chlorophyll-*a* | 150 mg/m$^2$ | 150 mg/m$^2$ |
| **Nutrients:** Interim values for phosphorus and nitrogen in streams are assessed based on comparison of annual median to standard. Allowable exceedance frequency is once every five years.<br>**Chlorophyll-*a*:** Chlorophyll-*a* is measured as maximum attached algae and is assessed during July 1-September 30 as a "not to exceed" value. | | |

As additional background on water quality standards for nutrients:

- The cold water total phosphorus standard of 0.11 mg/L now applies to the upper sites on Boulder Creek (Boulder Creek Segment 2b) and South Boulder Creek (Boulder Creek Segment 4b). The warm water phosphorus standard of 0.17 mg/L applies to Rock Creek above the Superior discharge (Boulder Creek Segment 8) and to Left Hand Creek (St. Vrain

Creek Segment 5). Although these standards only apply above WWTP discharges, these standards will potentially be applied downstream of WWTP discharges after May 31, 2022.

- As summarized in Table 8, new total nitrogen "interim values" were adopted under Regulation 31. These values can be applied no sooner than May 31, 2017 and may be applied after May 31, 2022. (Total nitrogen standards were not proposed for any of the stream segments in the June 2015 Regulation 38 hearing.) Total nitrogen is the sum of nitrate/nitrite and TKN.

- There is no standard for TKN, but it is an important component of total nitrogen. TKN represents organic nitrogen plus ammonia. To calculate total nitrogen, TKN is added to nitrate/nitrite.

- A nitrate standard of 10 mg/L is in place on streams with water supply use designations (Boulder Creek, South Boulder Creek, Coal Creek, Left Hand Creek). The Division adopted a new water supply use classification for Coal Creek in the June 2015 Regulation 38 hearing. For stream segments such as Rock Creek and St. Vrain Creek with agricultural use but no water supply designation, a standard of 100 mg/L applies.

- A nitrite standard of 0.05 mg/L for protection of aquatic life is also in place for the cold-water stream segments. For the warm water stream segments, the nitrite standard is ten times higher at 0.5 mg/L.

- Ammonia standards are adopted for protection of aquatic life and are calculated based on temperature and pH, in accordance with the aquatic life classification adopted for the segment in Regulation 38.

Tables 9 and 10 summarize the total nitrogen and total phosphorus data provided in support of this 2015 water quality analysis.

**Table 9. 2015 Total Phosphorus (mg/L) Data**

| Sample Location | No. | Min | Max | 25th% | Median | 75th% | Mean | Std. Dev. |
|---|---|---|---|---|---|---|---|---|
| **BOULDER CREEK** | | | | | | | | |
| BC-Can | 12 | ND | ND | ND | **ND** | ND | ND | ND |
| BC-CU | 12 | ND | 0.15 | ND | **ND** | ND | 0.03 | 0.06 |
| BC-61 | 12 | ND | 0.15 | ND | **ND** | ND | 0.02 | 0.05 |
| BC-aWWTP | 12 | ND | 0.19 | ND | **ND** | ND | 0.02 | 0.05 |
| WWTF Eff **[W]** | 12 | 1.35 | 3.55 | 1.88 | **2.40** | 2.75 | 2.34 | 0.67 |
| BC-aDC | 12 | 0.12 | 1.84 | 0.56 | **0.99** | 1.28 | 0.94 | 0.51 |
| BC-95 | 12 | ND | 1.40 | 0.44 | **0.76** | 1.17 | 0.77 | 0.46 |
| BC-107 | 12 | 0.16 | 1.30 | 0.48 | **0.61** | 1.19 | 0.76 | 0.43 |
| BC-bCC | 12 | 0.16 | 1.18 | 0.43 | **0.61** | 0.90 | 0.66 | 0.33 |
| 9-BC | 12 | 0.13 | 1.13 | 0.38 | **0.87** | 1.02 | 0.70 | 0.37 |
| E-BC **[W]** | 12 | 0.13 | 0.56 | 0.16 | **0.20** | 0.24 | 0.23 | 0.12 |
| 10-BC | 12 | 0.01 | 1.00 | 0.36 | **0.83** | 0.95 | 0.65 | 0.35 |
| 11-BC | 12 | 0.15 | 0.99 | 0.27 | **0.71** | 0.91 | 0.61 | 0.33 |
| **SOUTH BOULDER CREEK** | | | | | | | | |
| SBC-3.5/4 | 12 | ND | ND | ND | **ND** | ND | ND | ND |
| **COAL CREEK / ROCK CREEK** | | | | | | | | |
| 1-CC | 12 | ND | 0.09 | ND | **0.02** | 0.02 | 0.02 | 0.03 |
| A-CC **[W]** | 12 | 0.12 | 2.30 | 0.49 | **1.15** | 1.83 | 1.15 | 0.77 |
| 2-CC | 9 | ND | 1.60 | 0.12 | **0.17** | 0.42 | 0.36 | 0.49 |
| 3-CC | 12 | 0.06 | 1.20 | 0.16 | **0.29** | 0.66 | 0.41 | 0.35 |
| 6-CC | 12 | 0.10 | 0.53 | 0.15 | **0.37** | 0.49 | 0.32 | 0.18 |
| C-CC **[W]** | 12 | 1.90 | 3.80 | 2.08 | **2.30** | 2.65 | 2.43 | 0.53 |
| 7-CC | 12 | 0.36 | 0.95 | 0.49 | **0.56** | 0.80 | 0.62 | 0.19 |
| 8-CC | 12 | 0.35 | 1.02 | 0.61 | **0.68** | 0.86 | 0.71 | 0.18 |
| CC-Ken | 12 | 0.38 | 1.24 | 0.62 | **0.73** | 0.84 | 0.77 | 0.25 |
| 4-RC | 9 | 0.04 | 2.26 | 0.08 | **0.10** | 0.90 | 0.64 | 0.92 |
| B-RC **[W]** | 12 | 2.02 | 4.06 | 2.22 | **2.74** | 2.80 | 2.66 | 0.56 |
| 5-RC | 12 | 0.14 | 0.82 | 0.22 | **0.43** | 0.48 | 0.39 | 0.20 |
| **ST. VRAIN / LEFT HAND CREEK** | | | | | | | | |
| M9.5-SV | 8 | ND | 0.02 | 0.01 | **0.02** | 0.02 | 0.02 | 0.01 |
| M8.9-SV | 8 | 0.01 | 0.05 | 0.01 | **0.02** | 0.03 | 0.02 | 0.01 |
| M8.4-SV | 8 | 0.01 | 0.04 | 0.01 | **0.02** | 0.03 | 0.02 | 0.01 |
| M8.2-SV | 8 | 0.01 | 0.06 | 0.01 | **0.02** | 0.03 | 0.03 | 0.02 |
| M8-SV | 12 | 0.02 | 0.15 | 0.02 | **0.03** | 0.06 | 0.05 | 0.04 |
| T11-LH | 12 | 0.02 | 0.45 | 0.03 | **0.05** | 0.08 | 0.11 | 0.15 |
| Long-Eff **[W]** | 12 | 0.76 | 3.42 | 1.30 | **2.49** | 2.96 | 2.25 | 0.93 |
| T-EFF | 12 | 0.35 | 3.91 | 0.96 | **2.54** | 2.99 | 2.21 | 1.19 |
| M7-SV | 12 | 0.08 | 1.40 | 0.35 | **0.52** | 0.82 | 0.60 | 0.39 |
| M6-SV | 8 | 0.18 | 1.37 | 0.40 | **0.49** | 0.69 | 0.60 | 0.36 |

Notes: Wastewater discharge sample locations are designated by [W]. T-EFF is the Longmont WWTP effluent channel combined with roadside ditch flow where it enters the St. Vrain. ND = non-detect. Detection limits vary by data provider and are provided in the KICP water quality database.

**Table 10. 2015 Total Nitrogen (mg/L) Data**

| Sample Location | No. | Min | Max | 25th% | Median | 75th% | Mean | Std. Dev. |
|---|---|---|---|---|---|---|---|---|
| **BOULDER CREEK** | | | | | | | | |
| BC-Can | 12 | ND | 1.03 | ND | **0.32** | 0.76 | 0.39 | 0.42 |
| BC-CU | 12 | ND | 1.53 | ND | **ND** | 0.79 | 0.37 | 0.58 |
| BC-61 | 12 | ND | 1.39 | 0.31 | **0.77** | 1.05 | 0.67 | 0.46 |
| BC-aWWTP | 12 | ND | 1.29 | ND | **0.23** | 0.82 | 0.41 | 0.47 |
| WWTF Eff **[W]** | 12 | 6.86 | 18.32 | 9.34 | **12.95** | 14.34 | 12.29 | 3.57 |
| BC-aDC | 12 | 0.73 | 8.56 | 3.98 | **4.92** | 5.83 | 4.69 | 2.13 |
| BC-95 | 12 | 0.91 | 6.59 | 3.17 | **4.05** | 5.29 | 3.98 | 1.81 |
| BC-107 | 12 | ND | 7.27 | 3.53 | **4.57** | 4.99 | 4.20 | 2.07 |
| BC-bCC | 12 | 0.83 | 8.44 | 3.78 | **4.99** | 6.22 | 4.73 | 2.17 |
| 9-BC | 12 | 1.16 | 7.50 | 2.47 | **5.05** | 6.83 | 4.65 | 2.45 |
| E-BC **[W]** | 12 | 7.46 | 15.60 | 12.97 | **13.91** | 14.76 | 13.48 | 2.22 |
| 10-BC | 12 | 1.03 | 7.50 | 2.30 | **4.71** | 6.82 | 4.50 | 2.43 |
| 11-BC | 12 | 0.85 | 7.00 | 1.86 | **4.21** | 5.98 | 3.97 | 2.28 |
| **SOUTH BOULDER CREEK** | | | | | | | | |
| SBC-3.5/4 | 11 | ND | 0.88 | ND | **ND** | 0.14 | 0.16 | 0.31 |
| **COAL CREEK / ROCK CREEK** | | | | | | | | |
| 1-CC | 12 | 0.61 | 1.50 | 0.68 | **0.75** | 0.89 | 0.82 | 0.25 |
| A-CC **[W]** | 12 | 4.30 | 19.20 | 7.58 | **9.95** | 12.88 | 10.79 | 4.60 |
| 2-CC | 9 | 1.20 | 15.00 | 2.30 | **4.40** | 9.10 | 6.04 | 4.70 |
| 3-CC | 12 | 1.31 | 7.68 | 3.91 | **4.60** | 5.37 | 4.52 | 1.91 |
| 6-CC | 12 | 1.85 | 6.64 | 3.32 | **3.75** | 4.82 | 4.07 | 1.43 |
| C-CC **[W]** | 12 | 19.40 | 33.20 | 23.85 | **26.15** | 31.07 | 26.74 | 4.49 |
| 7-CC | 12 | 3.20 | 11.29 | 6.55 | **7.25** | 8.02 | 7.34 | 2.14 |
| 8-CC | 12 | 2.25 | 9.90 | 7.56 | **8.41** | 8.89 | 7.64 | 2.23 |
| CC-Ken | 12 | 2.89 | 11.17 | 4.94 | **6.46** | 8.42 | 6.66 | 2.64 |
| 4-RC | 9 | 0.74 | 23.00 | 1.34 | **2.72** | 8.16 | 7.22 | 9.10 |
| B-RC **[W]** | 12 | 13.13 | 24.92 | 17.40 | **22.73** | 23.93 | 20.94 | 3.91 |
| 5-RC | 12 | 2.24 | 8.87 | 2.93 | **4.29** | 5.59 | 4.70 | 2.30 |
| **ST. VRAIN / LEFT HAND CREEK** | | | | | | | | |
| M8-SV | 12 | 0.21 | 1.39 | 0.76 | **0.99** | 1.02 | 0.89 | 0.31 |
| T11-LH | 12 | 0.13 | 2.37 | 0.62 | **0.75** | 0.91 | 0.86 | 0.55 |
| Long-Eff **[W]** | 12 | 14.60 | 19.60 | 15.59 | **16.97** | 18.69 | 17.16 | 1.74 |
| M7-SV | 12 | 1.09 | 7.70 | 3.00 | **3.46** | 4.73 | 3.92 | 2.09 |

Note: wastewater discharge sample locations are designated by [W]. ND = non-detect, indicating that one or more analytes used in the TN calculation (e.g., NO3/NO2, TKN) was below detection limits. Detection limits for each analyte are provided in the KICP water quality database.

**Boulder Creek and South Boulder Creek**

Boulder Creek monitoring data for nutrients included in this report extends from Canyon Road (BC-Can) to the USGS gauging station near the confluence with St. Vrain Creek (11-BC). This long stream reach includes Boulder's 75th Street WWTP discharge, Coal Creek flows (which are influenced by Louisville, Lafayette and Superior WWTP discharges), and Erie's North WWTP discharge shown as E-BC [W]. The first location on Boulder Creek below the confluence with Coal Creek is identified as BC-bCC. South Boulder Creek enters Boulder Creek above BC-61, but is shown at the downstream end of the graphs on the x-axis. Key findings related to nutrients for Boulder Creek and South Boulder Creek include:

- As would be expected, nutrient concentrations for South Boulder Creek are very low (often below detection limits) and would attain the new total phosphorus standard (0.11 µg/L) adopted for this segment, the nitrate standard, and the potential future total nitrogen standard ("interim value").

- Upstream of Boulder's 75th Street WWTP, Boulder Creek also has low nutrient concentrations and would be expected to attain existing and potential future nutrient standards for total phosphorus, total nitrogen and nitrate.

- Downstream of Boulder's 75th Street WWTP, a significant increase in total phosphorus is present as shown on Figure 15 that would exceed interim values for total phosphorus. From BC-aDC to the confluence with the St. Vrain Creek, median total phosphorus concentrations remain elevated. Erie's WWTP discharge is comparable to the interim value for total phosphorus and an instream response from Erie's discharge is not apparent, based on review of Figure 15.

- Downstream of Boulder's 75th Street WWTP, a significant increase in total nitrogen and nitrate are present as shown on Figure 16a-b that would exceed interim values for total nitrogen, but attain the existing water supply standard for nitrate of 10 mg/L. Total nitrogen and nitrate concentrations remain relatively constant below Boulder's 75th Street discharge. Erie's WWTP discharge does not appear to significantly influence the instream total nitrogen and nitrate concentrations. Although Boulder's and Erie's WWTP discharge concentrations for total nitrogen are comparable, Erie's permitted discharge volume (1.5 million gallons per day [MGD]) is much smaller than Boulder's permitted capacity (25 MGD); therefore, the instream nitrogen response is less apparent.

- Attainment of ammonia standards is not evaluated in this report due to the varying standards resulting from calculations based on a pH and temperature based equation, but Table 10 and Figure 16c generally indicate a minimal instream response to ammonia discharges from the Boulder WWTP. Instream increases in ammonia occur below Coal Creek and the Erie WWTP. An additional observation of interest is the slight increase in ammonia at BC-61. This observation was also noted in the 2014 data set.

**Figure 15. 2015 Boulder Creek and South Boulder Creek Total Phosphorus**

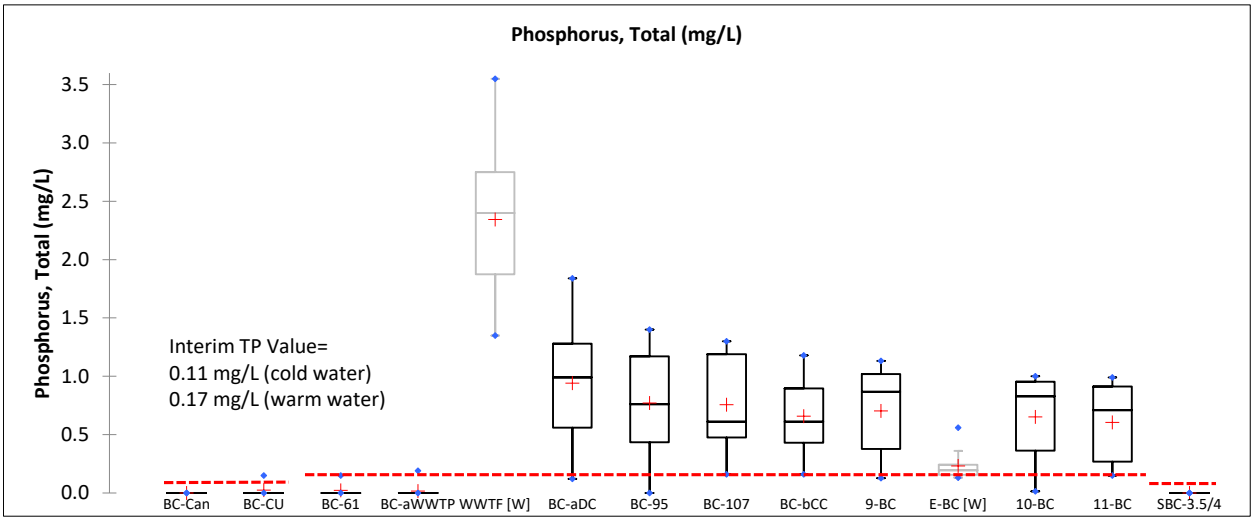
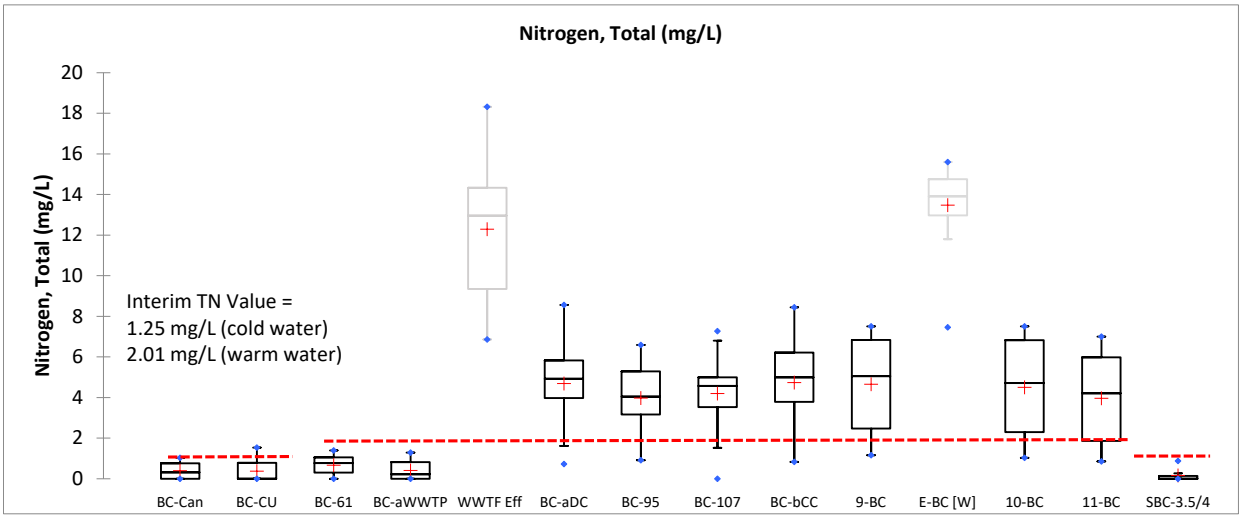
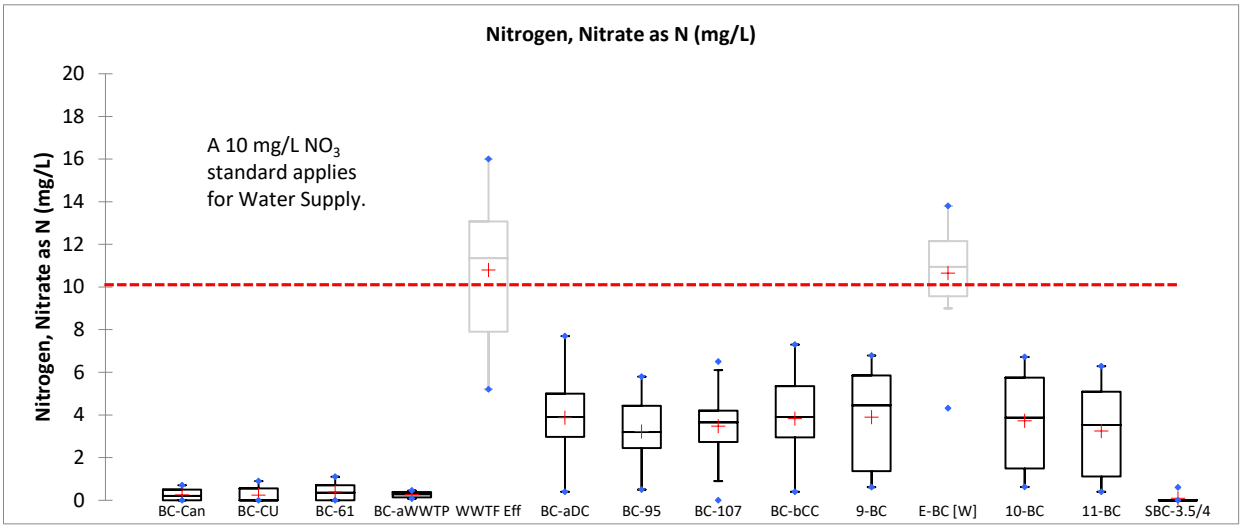
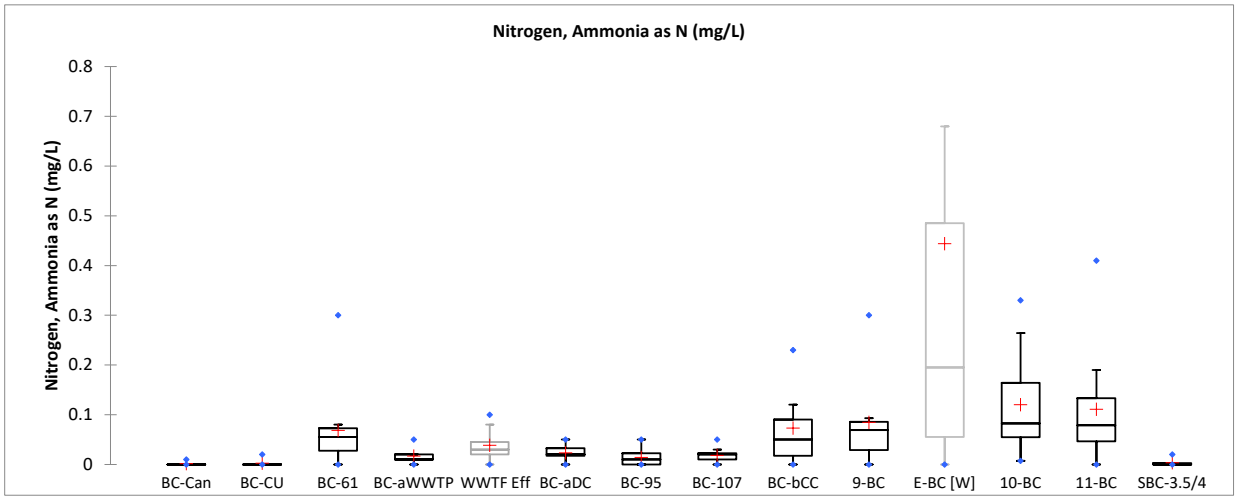


**Figure 16 a-c. 2015 Boulder Creek and South Boulder Creek Nitrogen**




One elevated ammonia value (2.14 ug/L at E-BC [W]) is not displayed on the graph.

### Coal Creek and Rock Creek

Nutrient data are available for both Coal Creek and Rock Creek at various monitoring locations. Louisville (A-CC[W]), Superior (B-RC[W]), and Lafayette (C-CC[W]) also provided WWTP effluent sample results for nutrients which are shown in light grey on Figures 17 and 18. Key findings related to nutrients for Rock Creek and Coal Creek include:

- As would be expected, instream concentrations of total phosphorus, total nitrogen, and nitrate increase below each WWTP discharge.

- The total phosphorus standard does not currently apply to Coal Creek below Highway 36 but the 2015 data indicate that Coal Creek would likely have difficulty meeting the interim value for total phosphorus upstream of the confluence with Rock Creek. It also appears that Rock Creek would have difficulty meeting the interim total phosphorus value both above and below the Superior WWTP discharge. A total phosphorus standard of 0.17 mg/L now applies to Rock Creek above the WWTP discharge.

- For total nitrogen and nitrate, an instream response to WWTP discharges is evident. The only location on Coal Creek and Rock Creek that would be expected to attain a potential future total nitrogen standard of 2.01 mg/L is upstream of the Louisville discharge at 1-CC. Some assimilation of nitrogen on Coal Creek occurs between the Louisville discharge and Rock Creek. An increase in nitrate between sites 7-CC and 8-CC is also suggested, but may be due to sources other than WWTP discharges. Two instream monitoring locations, 2-CC and 7-CC, had one value each that exceed the 10 mg/L nitrate standard adopted in the June 2015 Regulation 38 Rulemaking Hearing (the nitrate standard decreased from 100 mg/L to 10 mg/L due to the addition of a water supply use for this segment). Overall, the stream segment attains the nitrate standard.

- Attainment of ammonia standards is not evaluated in this report due to the varying standards resulting from calculations based on a pH and temperature based equation, but Table 10 and Figure 18c generally indicate ammonia concentrations are somewhat higher below the WWTP discharges. Several temporarily elevated ammonia concentrations also occurred during 2015.

**Figure 17. 2015 Coal Creek and Rock Creek Total Phosphorus**

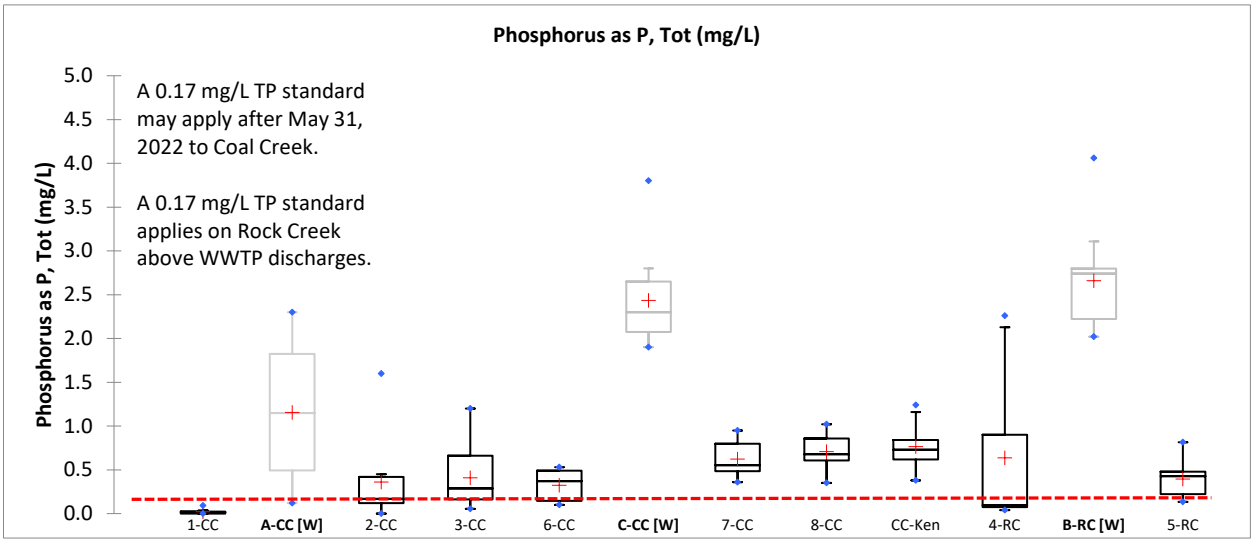
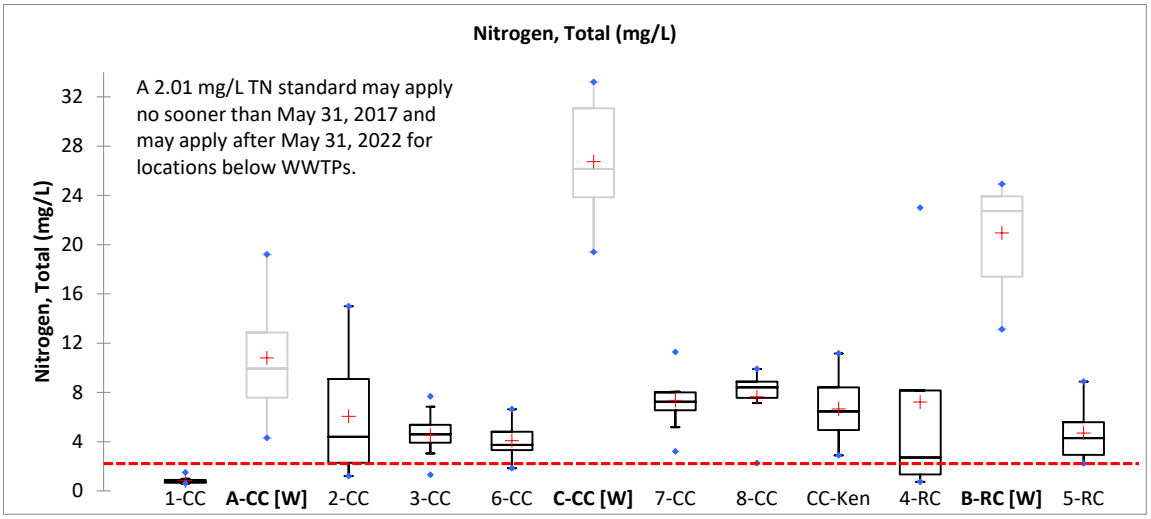
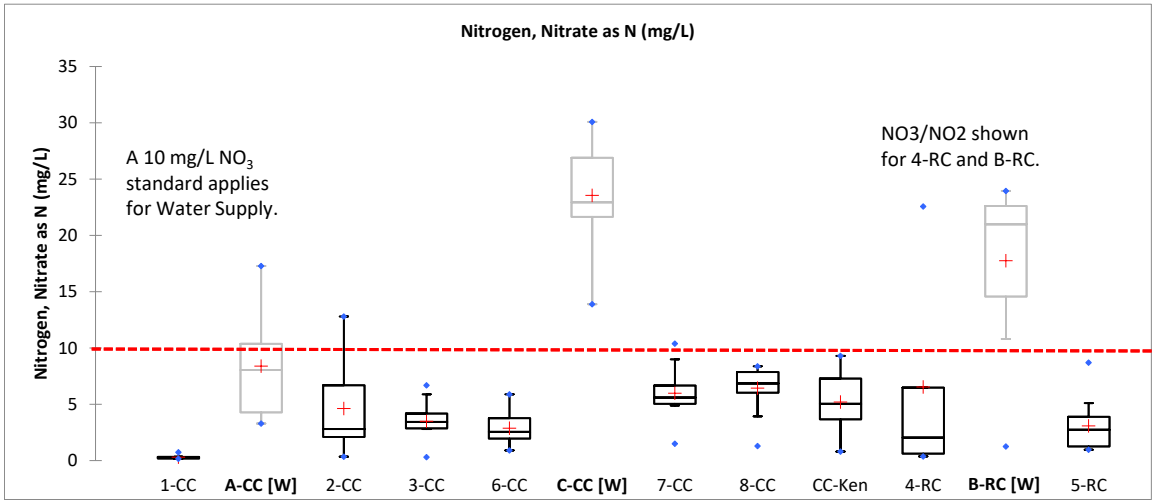
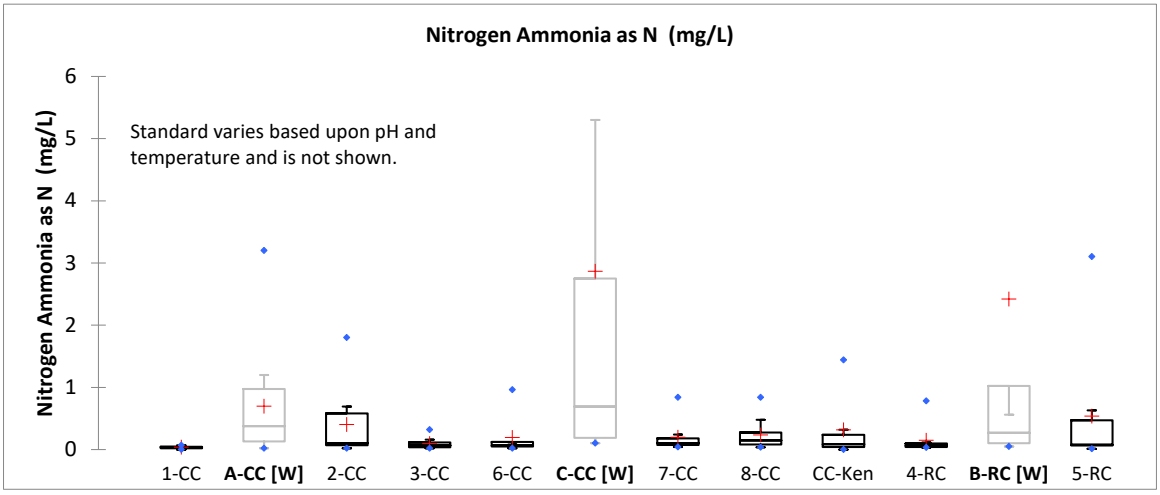


**Figure 18 a-c. 2015 Coal Creek and Rock Creek Nitrogen**



### St. Vrain Creek and Left Hand Creek

St. Vrain Creek and Left Hand Creek monitoring data for nutrients extend from the western boundary of Longmont's urbanized area to the confluence with Boulder Creek. Data are also provided for Left Hand Creek near its confluence with St. Vrain Creek (T11-LH) and for Longmont's WWTP discharge to St. Vrain Creek comingled with roadside ditch water (T-Eff) and the Longmont discharge (Long-Eff). Key findings related to nutrients for St. Vrain Creek and the portion of Left Hand Creek near the confluence include:

- Total phosphorus, total nitrogen, nitrate/nitrite and ammonia concentrations generally remain consistent from the upstream to downstream direction for St. Vrain Creek until reaching the WWTP. Instream phosphorus, total nitrogen, and nitrate/nitrite concentrations increase below the Longmont WWTP discharge. In general, nutrient concentrations for Left Hand Creek are relatively comparable to nutrient concentrations in St. Vrain Creek above the WWTP discharge.

- Left Hand Creek (T11-LH) has a median total phosphorus concentration of 0.05 mg/L, which would meet the warm water standard for total phosphorus of 0.17 mg/L adopted in June 2015.

- Upstream of Longmont's WWTP, St. Vrain Creek has low nutrient concentrations and would be expected to attain existing and future proposed standards for total phosphorus, total nitrogen and nitrate.

- Downstream of Longmont's WWTP, a significant increase in total phosphorus is present as shown on Figure 19 that would exceed interim warm water values for total phosphorus of 0.17 mg/L.

- Downstream of Longmont's WWTP, a significant increase in total nitrogen and nitrate is present as shown on Figures 20a-b that would exceed the interim warm water value for total nitrogen (2.01 mg/L), but would attain the existing agricultural use standard for nitrate of 100 mg/L. Left Hand Creek has a median total nitrogen concentration of 0.75 mg/L, which would meet the warm water interim value of 2.01 mg/L for total nitrogen, which may be applied in the future.

- Attainment of ammonia standards is not evaluated in this report due to the varying standards resulting from calculations based on a pH and temperature based equation, but Table 10 and Figure 20c generally indicate that instream concentrations of ammonia at M8-SV (above the Longmont WWTP discharge and the confluence with Left Hand Creek) are similar to concentrations below the WWTP discharge at M7-SV and M6-SV.

**Figure 19. 2015 St. Vrain Creek and Left Hand Creek Total Phosphorus**

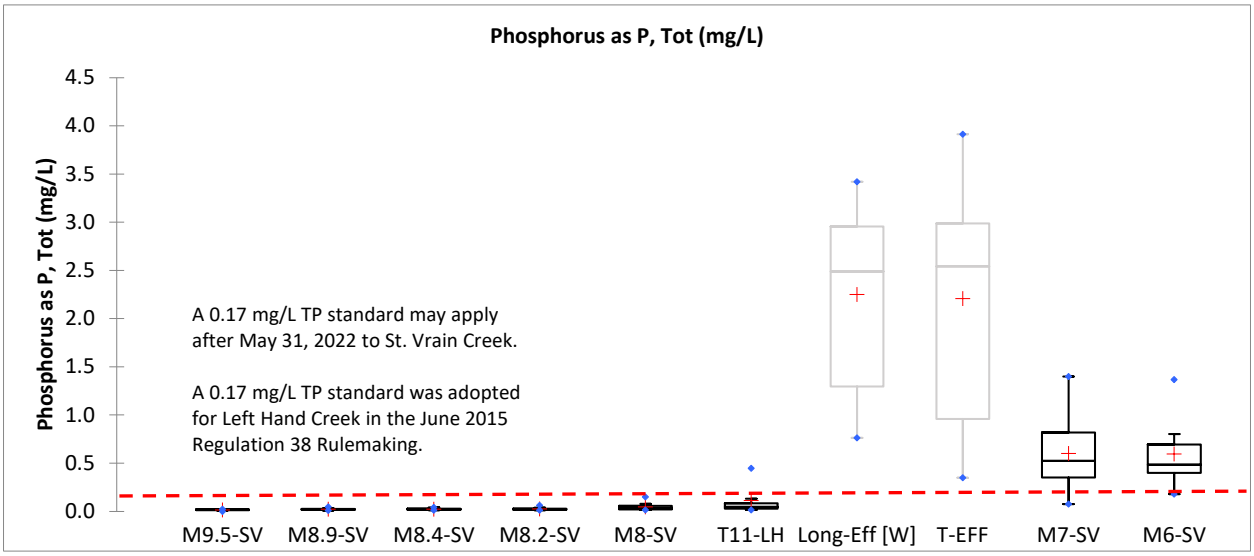
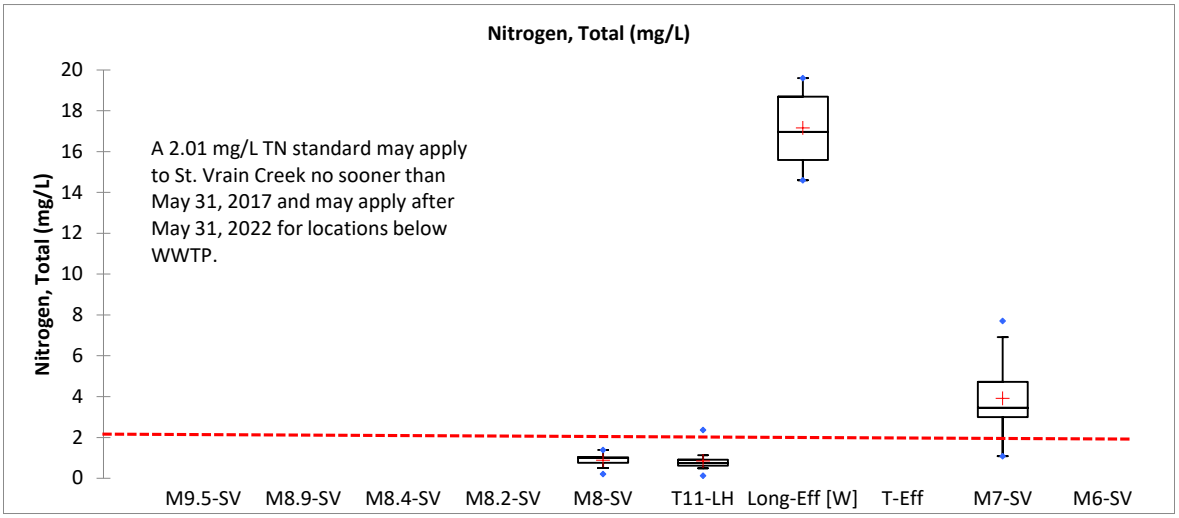
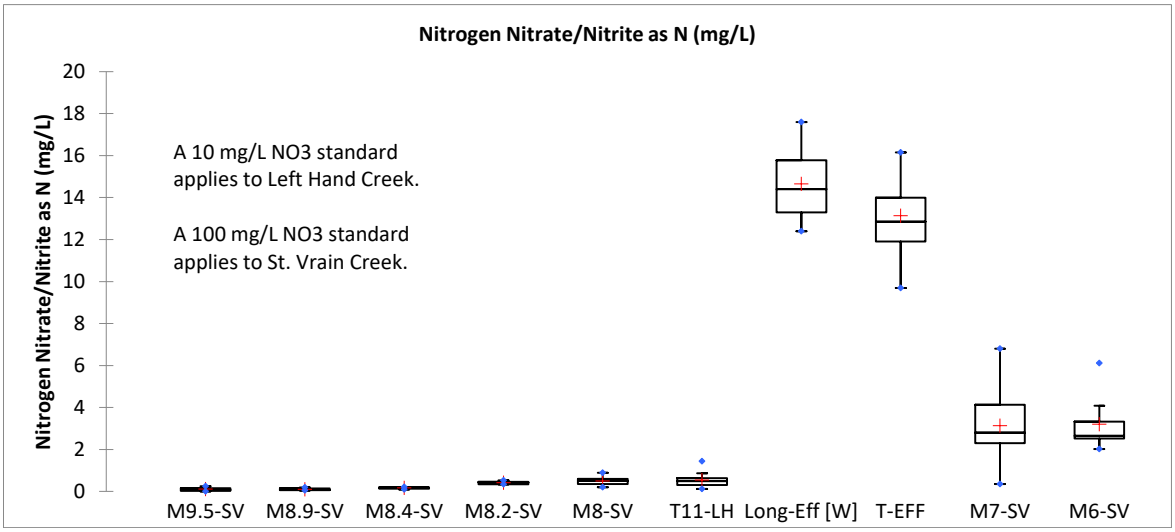
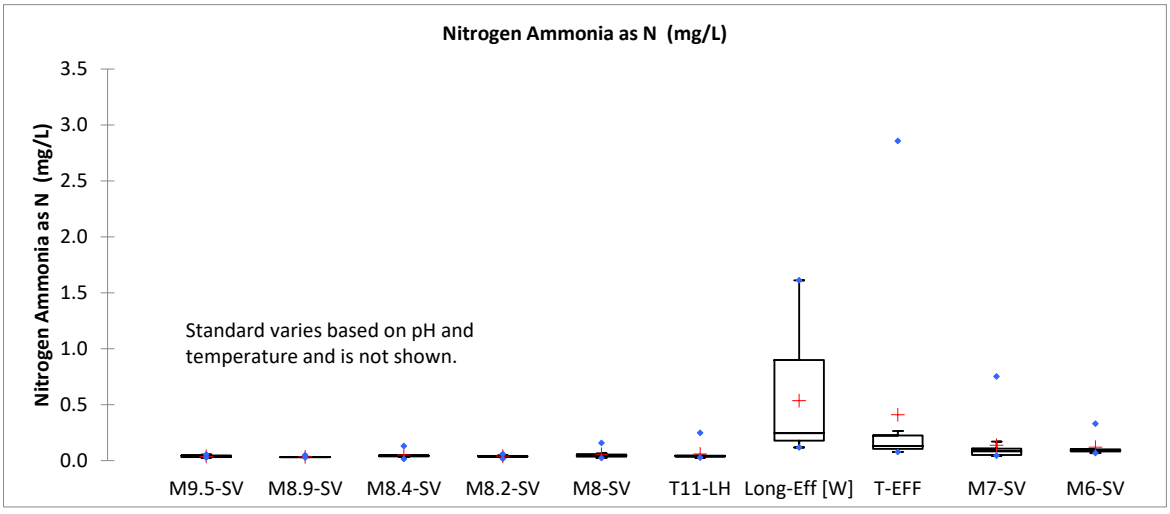


**Figure 20 a-c. 2015 St. Vrain Creek and Left Hand Creek Nitrogen**



## FINDINGS FOR *E. COLI* BY BASIN

Many urban streams in Colorado exceed primary contact recreational water quality criteria for *E. coli* in portions of the stream during various times of the year, particularly during warm summer and fall months. Most modern WWTPs provide effective disinfection through ultraviolet (UV) disinfection or chlorination, so treated municipal effluent is not typically the cause of exceedances in urban areas (although leaking sanitary infrastructure may be a contributor in some areas).

Attainment of *E. coli* standards is sensitive to assessment methodology because of the highly variable nature of *E. coli*, which can span an order of magnitude or more between adjacent locations on the same sampling date, as well as between closely spaced sampling dates at the same location. For this reason, it is important to understand the current assessment procedure applied by the Division (Division 2015) in assessing recreational use attainment (see call-out box).

### *E. coli* Standards Assessment Method

Evaluation of the Colorado *E. coli* stream standard is based on multiple fixed two-month intervals. The evaluation intervals are January/February, March/April, May/June, July/August, September/October, and November/December. A sample size of five or more is required for assessment of the two-month intervals. The primary contact recreation standard is 126 cfu/100 mL. Data are assessed yearly if adequate data from each two-month interval are available. If adequate data are not available to make an attainment decision using yearly data, then the Division will assess *E. coli* data for that two-month interval over the entire period of record (i.e., combing several years of data for each bimonthly increment).

If evaluation of a data set for an entire segment does not indicate impairment, but specific location(s) within the segment consistently exceed acute or chronic standards, the specific portion of the segment may be listed.

Consistent with other voluntary instream monitoring programs along the Front Range, each municipality's *E. coli* data set includes one sample per month or quarter, which does not result in a sample size of five or more samples per bimonthly evaluation period. As a result, the period of record (presumed to be the most recent five years) would be evaluated for each bimonthly period to assess whether *E. coli* standards are attained by stream segment, and potentially by individual monitoring locations with a segment. Because of the sample size limitations in the annual data set, two broad analysis subgroupings have been used for purposes of the analysis in this report. These groupings are identified as recreation season (May-October) and non-recreation season (November-April). Evaluation of a longer term data set is needed to draw statistically significant conclusions. This analysis approach is less stringent that the bimonthly assessment procedure used for standards assessment, so the findings in this section should not be interpreted as a regulatory evaluation.

**Boulder Creek and South Boulder Creek**

An *E. coli* Total Maximum Daily Load (TMDL) was completed in 2011 for the portion of Boulder Creek Segment 2b from 13th Street to the confluence with South Boulder Creek, focusing on urban sources typically associated with the storm sewer system (Tetra Tech 2011a). (Note: this reach of stream includes monitoring location BC-CU.) Continued instream monitoring of *E. coli* is important to assess progress towards TMDL goals and to assess the effectiveness of measures identified in the TMDL Implementation Plan (Tetra Tech 2011b). Although the TMDL focuses on a portion of Segment 2b, other portions of the stream are also affected by elevated *E. coli* concentrations. Segments 9 and 10 of Boulder Creek are now listed on the 2016 303(d) List as impaired for *E. coli*. The impairment for Segment 9 is limited to July through October.

Table 11 provides seasonal geometric mean *E. coli* concentrations according to non-recreational (N-Rec, November-April) and recreational (Rec, May-October) seasons. Figures 21 and 22 provide upstream to downstream *E. coli* plots according to non-recreational and recreational seasons during 2015.

During 2015, the recreation season geometric mean concentrations exceeded 126/100 mL at BC-CU, BC-aDC, and BC-bCC. Only two samples per season were available for 9-BC, 10-BC, and 11-BC; therefore, the seasonal geometric mean is insufficient to assess whether the standard is exceeded at those locations. None of the sampling locations had values exceeding the upper quantitation limit of 2420 MPN/100 mL. BC-Can was the only instream site that did not exceed stream standards for any samples during 2015, and it is located upstream of the TMDL on Boulder Creek. *E. coli* concentrations in the Boulder WWTF discharge are consistently well below stream standards.

One interesting observation is that although South Boulder Creek attains stream standards, several elevated *E. coli* concentrations are present during February, March and particularly following the runoff event in May (1,986 MPN/100 mL). Cattle grazing occurs along South Boulder Creek generally from December through May. Several pastures are located in the area between Highway 93 north to South Boulder Road. Most of the livestock grazing takes place between February and May.

## Table 11. 2015 Boulder Creek and South Boulder Creek Seasonal *E. coli* Data

| Sampling Location | Season | No. of Samples | Geometric mean | Minimum | Maximum |
|---|---|---|---|---|---|
| BC-Can | N-Rec | 6 | 11 | 2 | 46 |
| BC-Can | Rec | 6 | 40 | 27 | 57 |
| BC-CU | N-Rec | 6 | 66 | 24 | 214 |
| BC-CU | Rec | 6 | 233 | 46 | 517 |
| BC-61 | N-Rec | 6 | 35 | 15 | 91 |
| BC-61 | Rec | 6 | 79 | 13 | 1300 |
| BC-aWWTP | N-Rec | 6 | 29 | 11 | 67 |
| BC-aWWTP | Rec | 6 | 76 | 27 | 1553 |
| WWTF Eff | N-Rec | 6 | 12 | 6 | 22 |
| WWTF Eff | Rec | 6 | 19 | 2 | 60 |
| BC-aDC | N-Rec | 6 | 51 | 19 | 88 |
| BC-aDC | Rec | 6 | 166 | 65 | 1414 |
| BC-107 | N-Rec | 6 | 27 | 10 | 57 |
| BC-107 | Rec | 6 | 67 | 5 | 1046 |
| BC-bCC | N-Rec | 6 | 28 | 11 | 66 |
| BC-bCC | Rec | 6 | 131 | 27 | 921 |
| 9-BC | N-Rec | 2 | 66 | 57 | 77 |
| 9-BC | Rec | 2 | 115 | 70 | 190 |
| 10-BC | N-Rec | 2 | 41 | 28 | 61 |
| 10-BC | Rec | 2 | 111 | 34 | 365 |
| 11-BC | N-Rec | 2 | 47 | 28 | 79 |
| 11-BC | Rec | 2 | 219 | 147 | 325 |
| SBC-3.5/4 | N-Rec | 6 | 41 | 10 | 249 |
| SBC-3.5/4 | Rec | 6 | 90 | 14 | 1986 |

Notes: N-Rec = November to April; Rec = May to October. Bimonthly assessment periods used by the Division for regulatory purposes are Jan-Feb, Mar-Apr, May-Jun, Jul-Aug, Sept-Oct, and Nov-Dec.

**Figure 21. 2015 Boulder Creek and South Boulder Creek Non-Recreation Season *E. coli***

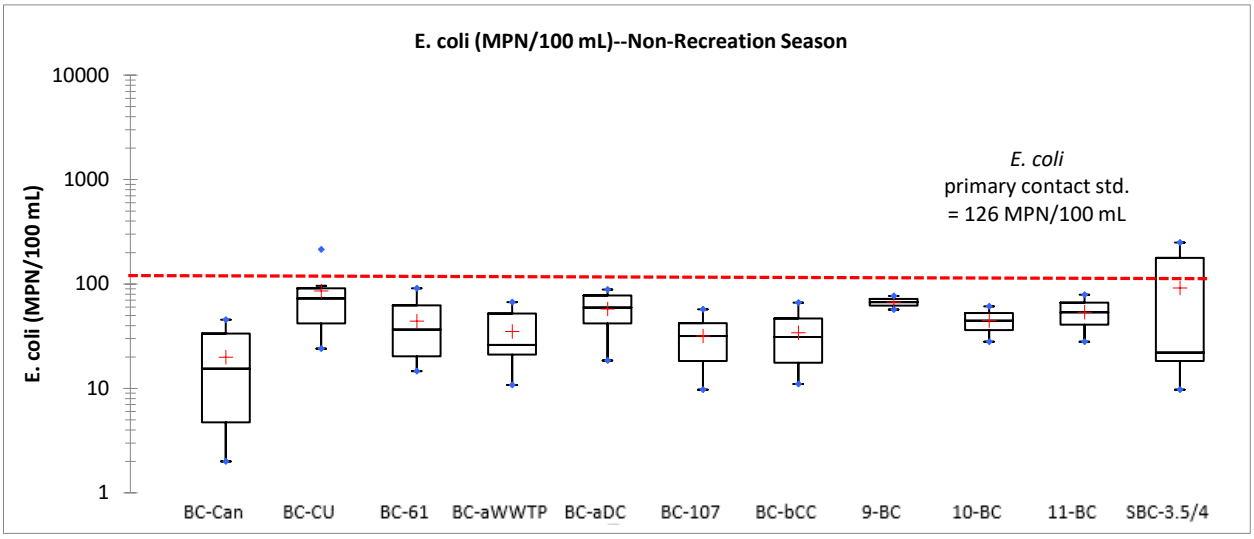
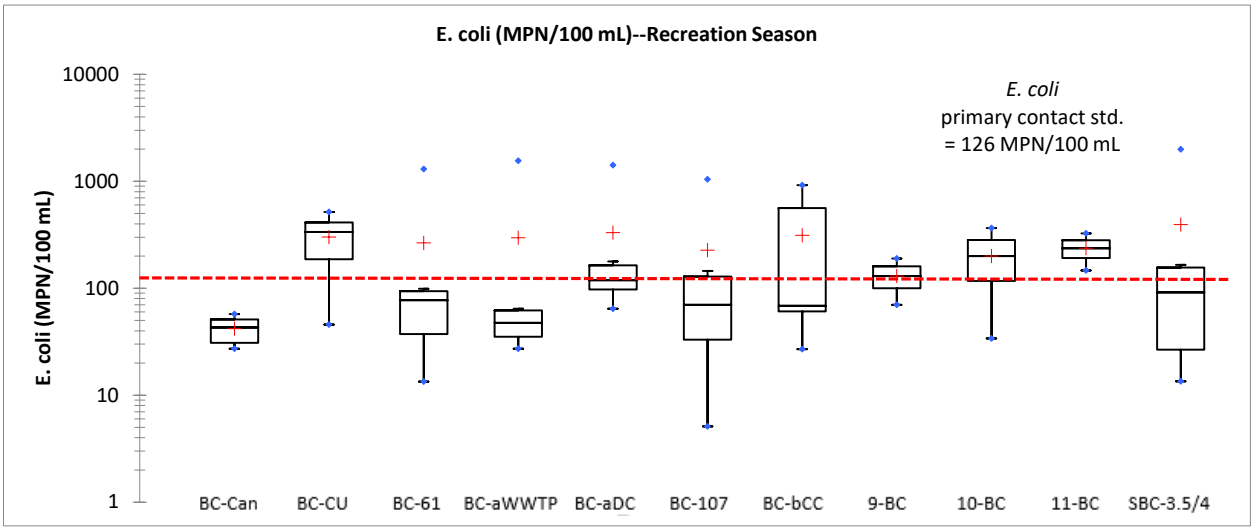



**Figure 22. 2015 Boulder Creek and South Boulder Creek Recreation Season *E. coli***



## Coal Creek and Rock Creek

Table 12 summarizes *E. coli* data available for Rock Creek and Coal Creek and shows that most locations within Coal Creek exceeded water quality standards during both the recreation and non-recreation season. Coal Creek is listed as impaired on the 2016 303(d) list and Rock Creek is identified in need of additional monitoring and evaluation to determine impairment for *E. coli*. Figures 23 and 24 provide upstream to downstream *E. coli* plots according to non-recreational and recreational seasons during 2015.

Unlike Boulder Creek, St. Vrain Creek and Rock Creek, which only experience *E. coli* exceedances during the recreation season, Coal Creek exceeded the *E. coli* standard during the non-recreation season at all locations except CC-Ken during 2015. Identifying the cause of these exceedances is a potential issue for investigation in the future. Available data for the WWTP discharges to these streams indicated that treated municipal effluent is not the likely cause of impairment to these streams; however, only limited data for WWTP discharges were provided for this analysis.

**Table 12. 2015 Coal Creek and Rock Creek Seasonal *E. coli* Data**

| Sampling Location | Season | No. of Samples | Geometric Mean | Minimum | Maximum |
|---|---|---|---|---|---|
| 1-CC | N-Rec | 6 | 251 | 43 | 722 |
| 1-CC | Rec | 6 | 521 | 345 | 866 |
| A-CC | Rec | 1 | 10 | 10 | 10 |
| 2-CC | N-Rec | 6 | 219 | 65 | 613 |
| 2-CC | Rec | 6 | 273 | 101 | 908 |
| 3-CC | N-Rec | 6 | 153 | 46 | 879 |
| 3-CC | Rec | 6 | 185 | 61 | 649 |
| 6-CC | N-Rec | 6 | 172 | 61 | 387 |
| 6-CC | Rec | 6 | 618 | 291 | 2420 |
| 7-CC | N-Rec | 6 | 131 | 78 | 313 |
| 7-CC | Rec | 6 | 382 | 179 | 921 |
| CC-Ken | N-Rec | 6 | 69 | 36 | 260 |
| CC-Ken | Rec | 6 | 258 | 66 | 2420 |
| 4-RC | N-Rec | 3 | 21 | 6 | 96 |
| 4-RC | Rec | 6 | 124 | 20 | 731 |
| B-RC | N-Rec | 6 | 3 | ND | 20 |
| B-RC | Rec | 6 | ND | ND | ND |
| 5-RC | N-Rec | 6 | 101 | 21 | 276 |
| 5-RC | Rec | 6 | 411 | 161 | 1727 |

Note: Past summary statistics and boxplots for *E. coli* data for the 2007-2014 time period were tabulated on a bimonthly basis as part of a special monitoring program. These results also showed elevated *E. coli* at multiple monitoring locations, as discussed in the Annual Water Quality Analysis for 2014 (WWE 2015).

**Figure 23. 2015 Coal Creek and Rock Creek Non-Recreation Season *E. coli***

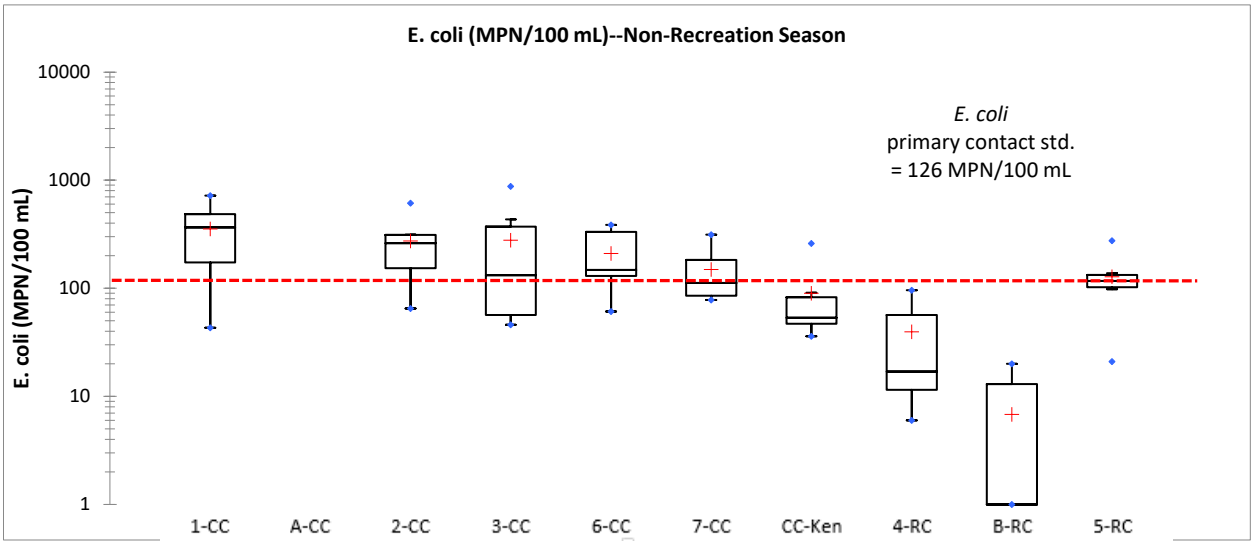
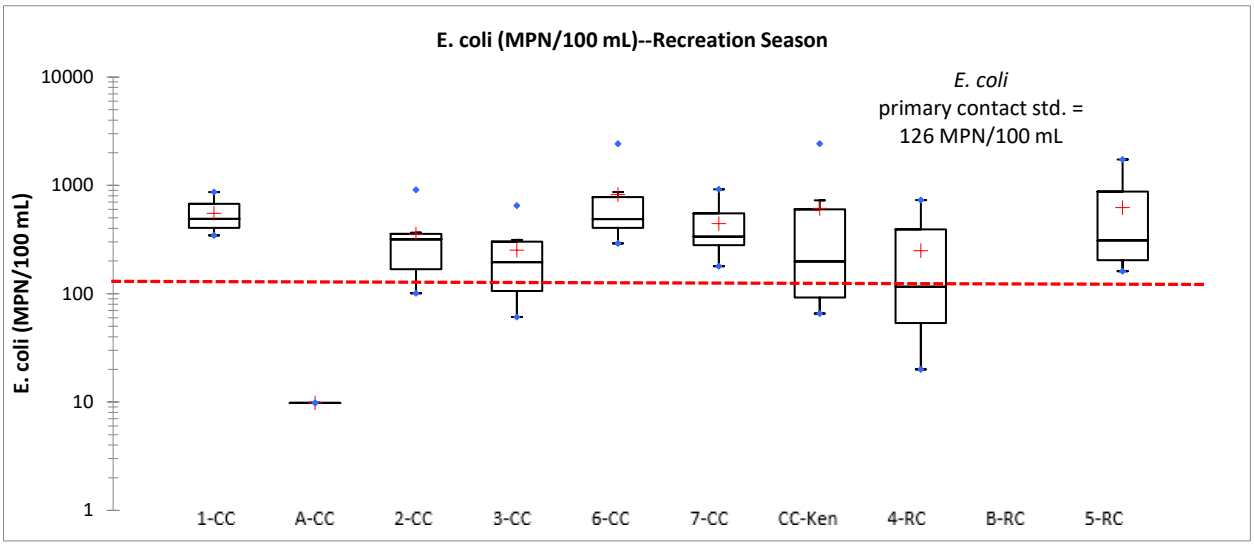



**Figure 24. 2015 Coal Creek and Rock Creek Recreation Season *E. coli***



### St. Vrain Creek and Left Hand Creek

St. Vrain Creek is listed on the 2016 303(d) List as impaired for *E. coli*. Table 13 summarizes *E. coli* data available for St. Vrain Creek and Left Hand Creek, and Figures 25 and 26 provide upstream to downstream *E. coli* plots according to non-recreational and recreational seasons during 2015. The table and figures show that all locations within both creeks met water quality standards during the non-recreation season but experienced some exceedances during the recreation season.

The geometric mean *E. coli* concentration exceeded the stream standard at the M8.9-SV, M8-SV, T11-LH, and M7-SV monitoring locations during the recreation season. Less than five seasonal samples are available during 2015 for several locations, so conclusions regarding the data set for 2015 are limited. Discharges from the Longmont WWTP, as represented by location T-Eff, which contains combined roadside ditch drainage and WWTP effluent, are consistently low and well below the stream standard.

The pattern of exceedances of the *E. coli* standard for St. Vrain Creek and Left Hand Creek do not indicate a specific hot spot or upstream to downstream trend; therefore, identification of the causes of elevated *E. coli* would require additional monitoring at a finer spatial resolution and for a longer period of record to draw conclusions or form and evaluate hypotheses about sources.

## Table 13. 2015 Left Hand Creek and St. Vrain Creek Seasonal *E. coli* Data

| Sampling Location | Season | No. of Samples | Geometric mean | Minimum | Maximum |
|---|---|---|---|---|---|
| M9.5-SV | N-Rec | 3 | 32 | 8 | 387 |
| M9.5-SV | Rec | 4 | 77 | 36 | 105 |
| M8.9-SV | N-Rec | 3 | 28 | 16 | 75 |
| M8.9-SV | Rec | 4 | 135 | 38 | 461 |
| M8.4-SV | N-Rec | 3 | 23 | 12 | 53 |
| M8.4-SV | Rec | 4 | 87 | 66 | 158 |
| M8.2-SV | N-Rec | 3 | 44 | 23 | 84 |
| M8.2-SV | Rec | 4 | 120 | 99 | 133 |
| M8-SV | N-Rec | 6 | 80 | 33 | 411 |
| M8-SV | Rec | 6 | 167 | 72 | 260 |
| T11-LH | N-Rec | 6 | 53 | 7 | 921 |
| T11-LH | Rec | 6 | 163 | 105 | 345 |
| T-EFF | N-Rec | 6 | 31 | 13 | 128 |
| T-EFF | Rec | 6 | 51 | 32 | 84 |
| M7-SV | N-Rec | 6 | 113 | 56 | 313 |
| M7-SV | Rec | 6 | 178 | 66 | 435 |
| M6-SV | N-Rec | 4 | 117 | 28 | 416 |
| M6-SV | Rec | 4 | 121 | 71 | 272 |

**Figure 25. 2015 Left Hand Creek and St. Vrain Creek Non-Recreation Season *E. coli***

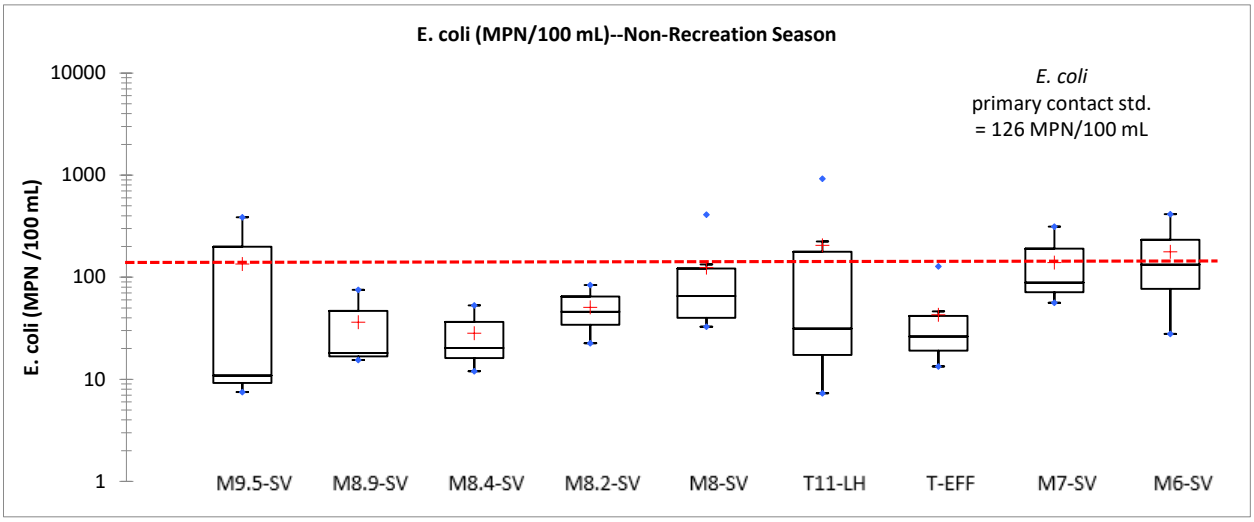
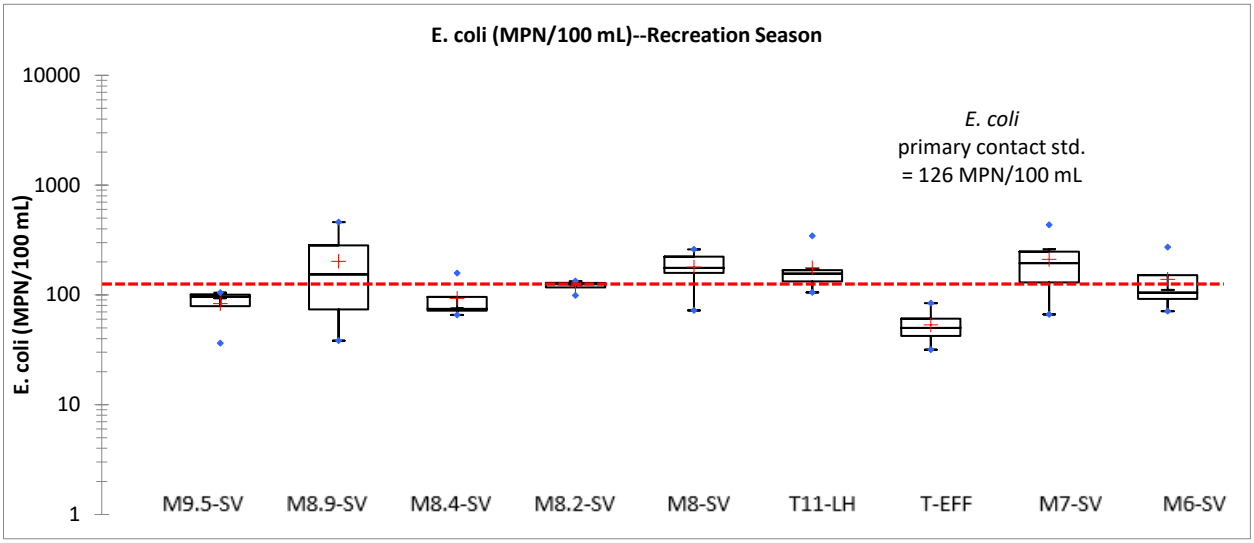



**Figure 26. 2015 Left Hand Creek and St. Vrain Creek Recreation Season *E. coli***



## FINDINGS FOR SELECTED METALS

For the most part, metals are beyond the scope of the coordinated Monitoring Plan and this report; however, both the City of Boulder and City of Longmont monitor metals routinely so several metals of potential regulatory interest are discussed in this report for these data sets, including:

- Total recoverable arsenic for all stream segments with data.
- Dissolved selenium for Rock Creek and Coal Creek (based on River Watch data).
- Dissolved copper for South Boulder Creek and Left Hand Creek.

### Arsenic

Total recoverable arsenic is discussed briefly below since monitoring data were available for several segments. Figures 27 and 28 provide results for total recoverable arsenic on Boulder Creek and St. Vrain Creek.

Several different arsenic standards are in place in the basin, depending on the designated use of the stream. For example, the chronic total recoverable arsenic standards for each segment evaluated are:

- Boulder Creek and South Boulder Creek: 0.02 µg/L, with temporary modification at ambient condition through 12/31/2021.[4] This standard is based on "water + fish," where water supply and fish ingestion are designated uses.
- Coal Creek: 0.02-10 µg/L, which is a hyphenated standard for water supply uses that allows permitted dischargers to meet a 10 µg/L limit and allows stream standard assessment against the 10 µg/L limit. This is a new, more stringent standard for Coal Creek, as adopted by the Division in the June 2015 Regulation 38 rulemaking hearing.
- Rock Creek: 100 µg/L for protection of agricultural uses.
- St. Vrain Creek: 7.6 µg/L for fish ingestion.
- Left Hand Creek: 0.02-10 µg/L, which is a hyphenated standard for water supply uses that allows permitted dischargers to meet a 10 µg/L limit.

[4] In Colorado, stream segments designated for water supply or "water + fish" have extremely low total arsenic standards of 0.02 µg/L. Because these standards are so low that they are not attainable in many parts of Colorado, the Commission has adopted temporary modifications to instream arsenic standards where "water + fish" criteria apply and when there is a discharge to the stream segment that cannot comply with corresponding effluent limits.

In the context of these stream standards, key findings regarding total recoverable arsenic concentrations in the basin include:

- Median arsenic concentrations on Boulder Creek ranged from 0.45 to 1.59 µg/L (Figure 27). The median South Boulder Creek concentration was 0.26 µg/L. Because of the temporary modification to the 0.02 µg/L standard, the stream is identified as a low priority for TMDL development. However, these results, which are significantly elevated relative to the underlying standard, reiterate the importance of actively participating in the Regulation 31 Basic Standards work group process where this standard is being reevaluated.

- Arsenic data for Coal Creek were limited to two samples collected at two monitoring locations: 1-CC (0.51 µg/L) and 2-CC (0.42 µg/L). These results are below the 10 µg/L threshold for designation as impaired under the hyphenated standard (even though the results exceed the 0.02 µg/L). No results were provided for Rock Creek.

- Arsenic concentrations on St. Vrain Creek generally increase in an upstream to downstream direction (Figure 28), and Left Hand Creek has higher total arsenic than St. Vrain Creek. Arsenic in the Longmont WWTP discharges was comparable to arsenic at the upstream-most monitoring location on St. Vrain Creek. Median arsenic concentrations at all locations are well below 7.6 µg/L on St. Vrain Creek.

- Left Hand Creek arsenic concentrations range from 0.6 to 4.0 µg/L, with a median concentration of 1.0 µg/L, which exceeds the assigned standard of 0.02 µg/L, but is below the 10 µg/L threshold for designation as impaired.

**Figure 27. 2015 Total Recoverable Arsenic for Boulder Creek and South Boulder Creek**

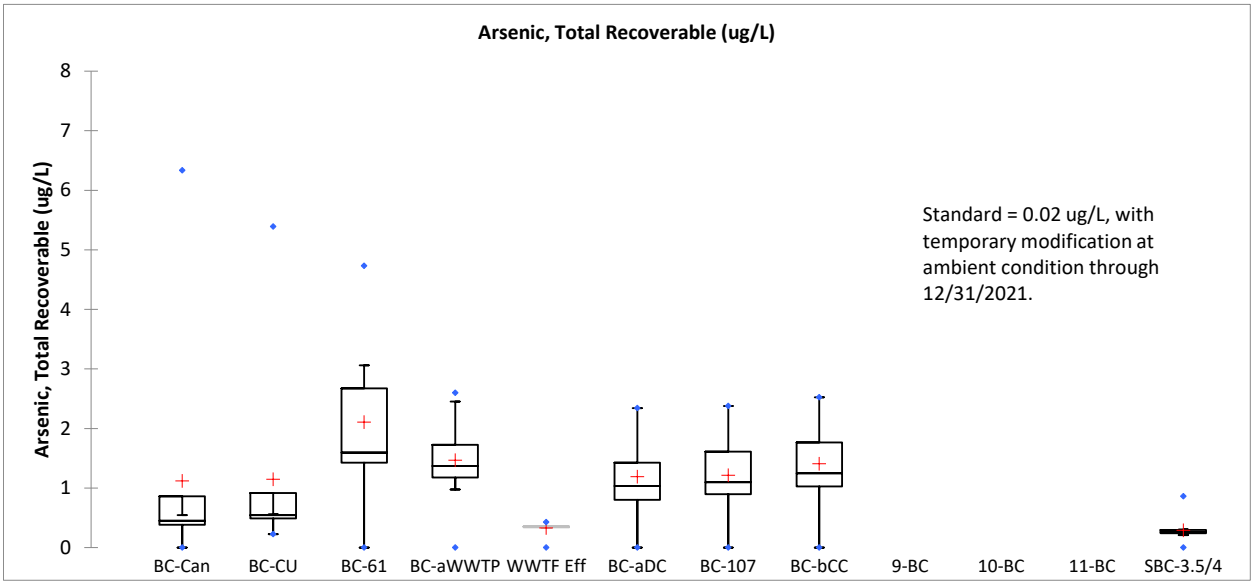
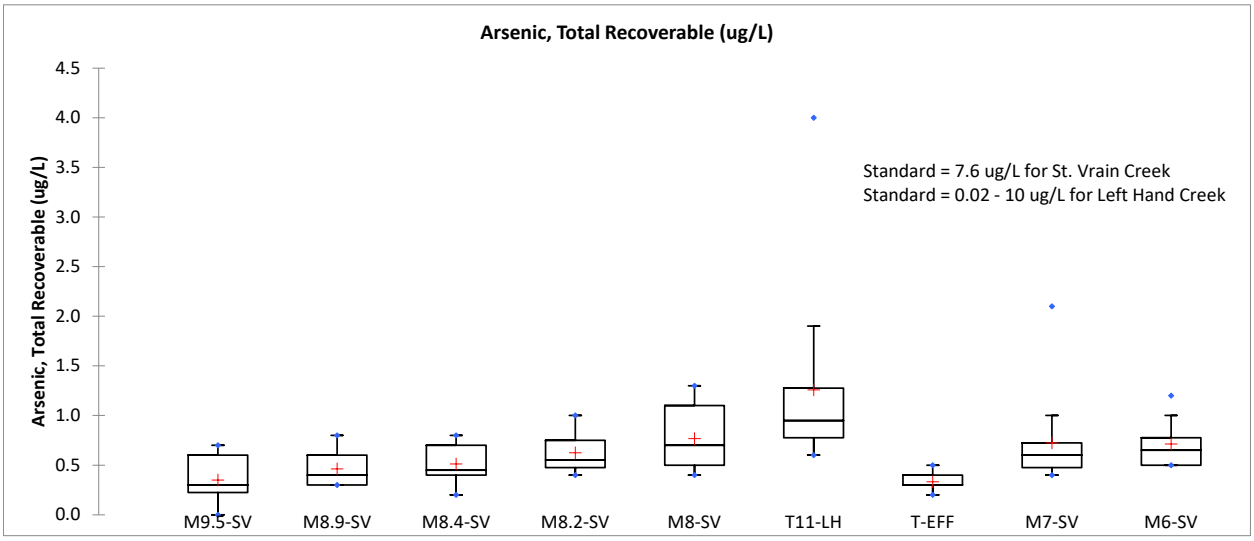


**Figure 28. 2015 Total Recoverable Arsenic for St. Vrain Creek and Left Hand Creek**




## Selenium

Rock Creek and Coal Creek below Rock Creek were placed on the 2016 303(d) List based on data collected by the River Watch program. The data forming the basis of these listings are shown in Figures 29 and 30. The 85$^{th}$ percentile value for selenium at Coal Creek below Rock Creek for this data set is 5.8 µg/L (n = 28). For Rock Creek, the 85$^{th}$ percentile value is 9.67 µg/L (n = 8). The underlying chronic standard is 4.6 µg/L. This segment has a temporary modification for selenium set at the current condition through December 31, 2020.

**Figure 29. Selenium at Coal Creek below the Confluence with Rock Creek**

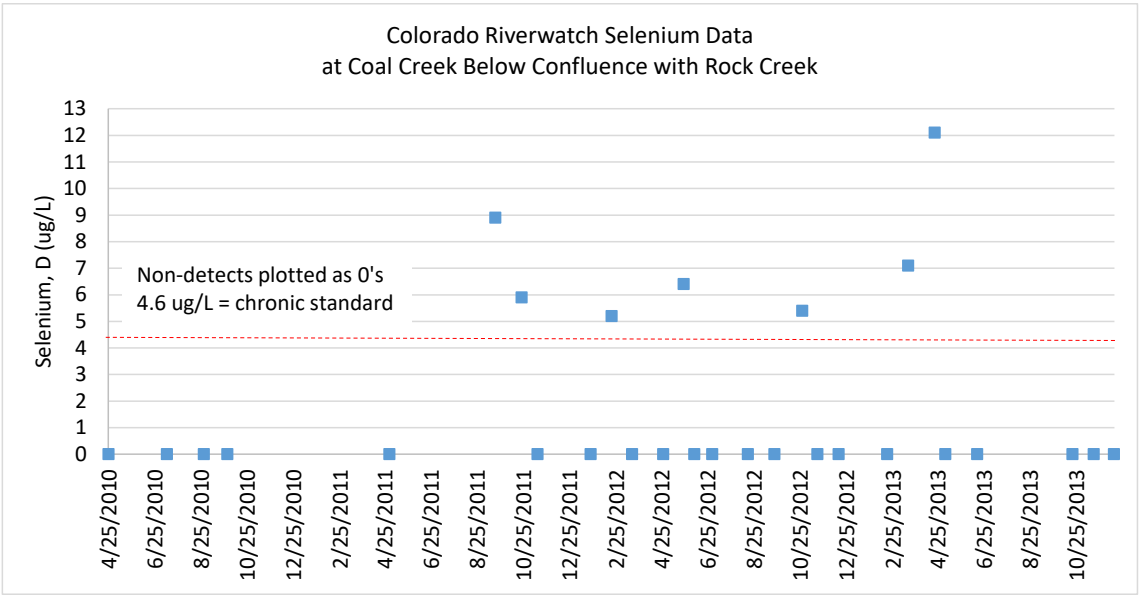
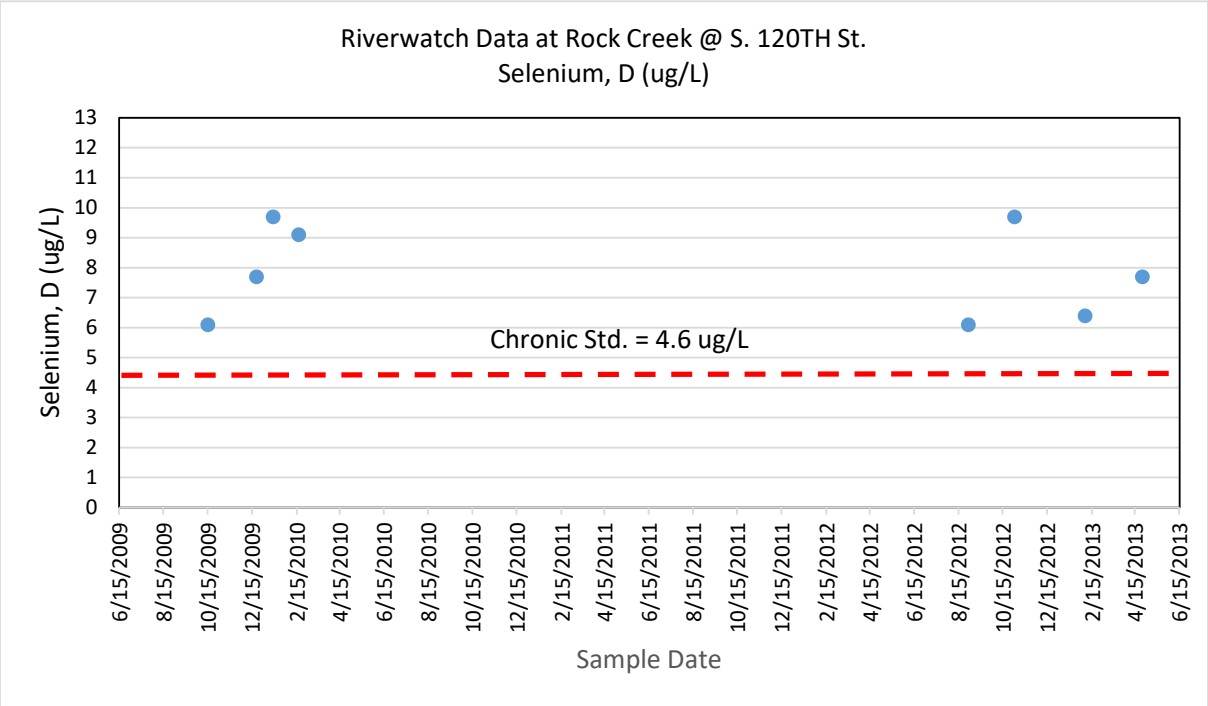


**Figure 30. Selenium at Rock Creek at 120th Street**




## Copper

South Boulder Creek and Left Hand Creek are both listed as impaired for dissolved copper on the 2016 303(d) List. Both of these streams have mining-related impacts in their headwaters with TMDLs developed for the upstream segments for a variety of metals, as discussed in the Boulder Creek/St. Vrain Watershed-Based Plan (319 Plan) completed in 2015 (KICP and WWE 2015).

The South Boulder Creek listing is due to exceedances of the acute standard at two locations above Eldorado Springs. The chronic standard, calculated as 2.94 µg/L for the 2016 303(d) list, is attained; however, six exceedances of the acute standard occurred, with one exceedance in Eldorado Canyon, and five at the South Boulder Diversion Canal (as monitored by Denver Water).

For Left Hand Creek, the listing is also due to exceedances of the acute copper standard. The chronic standard of 5.23 µg/L is attained and the acute standard of 7.43 µg/L is exceeded for eight samples. The majority of these results were measured by River Watch at the Haldi Intake between 2009 and 2013.

For both South Boulder Creek and Left Hand Creek, the segment portions with copper impairment are upstream of the Monitoring Plan focus area for purposes of this report.

# 5.0 Biological Monitoring

On behalf of local governments in the watershed, Timberline Aquatics conducts biological monitoring of Boulder Creek and South Boulder Creek, Coal Creek and Rock Creek and St. Vrain Creek and Left Hand Creek. The monitoring is conducted using comparable methods for all of the streams, as described in the individual biological monitoring reports for each basin. Monitoring locations are shown in Appendix A. The summary below highlights key findings from the latest report for each stream, focusing primarily on comparison of the multi-metric index (MMI) scores to thresholds for various aquatic life biotypes defined in *Policy 10-1, Aquatic Life Use Attainment, Methodology to Determine Use Attainment for Rivers and Streams* (WQCD 2010). Policy 10-1 should be referenced for more detailed guidance on the interpretation of MMI scores.

As a brief overview of Policy 10-1, the location of macroinvertebrate sample sites results in assignment of one of three biotypes for the MMI assessments, as summarized in Table 14. Biotype site class is a function of three environmental variables: EPA Level IV ecoregion, site elevation, and stream slope (Policy 10-1, Appendix A). The thresholds that determine attainment or impairment are different for each biotype. Higher MMI scores are better than low scores. When an MMI score falls between the attainment and impairment thresholds identified in Table 14, additional evaluation using supplemental thresholds based on the Hilsenhoff Biotic Index (HBI) and the Shannon Diversity Index (SDI) (Table 15) are required for "Class 1" aquatic life, as described in Regulation 38 (see Appendix E). For the HBI, lower values are better. For the SDI, higher values are better. If a Class 1 site fails to meet the criteria shown in Table 15 for either auxiliary metric, the site will be considered impaired. Auxiliary metrics are not applicable to Class 2 waters (CDPHE 2010). The only Class 1 streams evaluated in this report are Boulder Creek, South Boulder Creek and St. Vrain Creek. (Auxiliary metrics do not apply to the segments of Coal Creek, Rock Creek and Left Hand Creek included in this report.)

**Table 14. Policy 10-1 MMI Thresholds**

| Biotype | Description | Attainment Threshold | Impairment Threshold |
|---|---|---|---|
| 1 | Transition | >52 | 42 |
| 2 | Mountains | >50 | 42 |
| 3 | Plains & Xeric | >37 | 22 |

**Table 15. Policy 10-1 Supplemental Evaluation Thresholds**

| Biotype | Description | Hilsenhoff Biotic Index | Shannon Diversity Index |
|---|---|---|---|
| 1 | Transition | <5.4 | >2.4 |
| 2 | Mountains | <5.1 | >3.0 |
| 3 | Plains & Xeric | <7.7 | >2.5 |

All locations discussed in this report are located in either Biotype 1 or Biotype 3. Biotype 1 (Transition Zone) includes lower mountain areas of the Colorado Front Range downstream to the lower boundary of the "Front Range Fans." Biotype 3 (Plains) ranges from the eastern border of the "Front Range Fans" to the eastern border of Colorado. Both ecoregion and stream elevation are used to determine which biotype is appropriate, with the elevation of 5085 feet serving as the dividing threshold between Biotype 1 and Biotype 3. The Division has acknowledged that where uncertainty exists regarding the transitional boundaries between biotypes, the MMI for the adjacent biotype may be used to help determine the status of the aquatic life use. This additional analysis may be conducted under two circumstances:

1. At sites in Level IV Ecoregion 21c where the biotype assignment along a waterbody varies between Biotypes 1 and 2 because the stream slope fluctuates above and below 0.04. This situation typically occurs when stream slopes are slightly greater than or less than 0.04 along the gradient of a waterbody resulting in varying site classifications or biotypes.

2. At sites that encompass the physical border between two different Level IV Ecoregions or elevation zone boundaries used in the biotype classification. This results in a predicted site classification in one biotype, but is narrowly adjacent to another biotype. In such cases, sites may be represented by characteristics shared by more than one biotype.

For these circumstances, the Division states that "MMIs for each of the adjacent biotypes shall be investigated and used in the assessment." This new procedure has not yet been applied to 303(d) listings to date, but may be a consideration for Boulder Creek above Coal Creek (BC-aCC) in the future, potentially resulting in this site being evaluated against Biotype 3 criteria.

For in-depth discussion of biological findings for each stream segment, the Timberline Aquatics annual reports for each basin should be reviewed. The remainder of this chapter provides MMI, HBI and SDI summaries, as well as EPT[5] scores, which are provided for general reference, but not discussed in this report.

## BOULDER CREEK AND SOUTH BOULDER CREEK

For Boulder Creek and South Boulder Creek, sites were strategically established at specific locations to assist in the evaluation of aquatic conditions. These sites include:

- BC-CAN: the furthest upstream site on Boulder Creek upstream of most urban development, serving as a reference site with relatively low anthropogenic influences.

- BC-28: within the City of Boulder, used to evaluate potential impacts of urban runoff.

[5] The EPT index an index of water quality based on the abundance of three pollution-sensitive orders of macroinvertebrates relative to the abundance of a hardy species of macroinvertebrate. It is calculated as the sum of the number of *Ephemeroptera*, *Plecoptera*, and *Trichoptera* divided by the total number of midges (*Diptera: Chironomid*).

- BC-55: located further downstream on Boulder Creek and used to assess recovery that may occur downstream from the City of Boulder, but upstream of the 75th Street WWTP. This site is also below the confluence with South Boulder Creek.

- BC-aWWTP: located immediately upstream of Boulder's 75th Street WWTP to evaluate changes in habitat that have been observed at that location.

Four sites downstream of the WWTP provide information on the influence of WWTP effluent and potential recovery, including:

- BC-aDC: located on Boulder Creek 2.4 river miles (RM) (3.9 km) downstream of the WWTP.

- BC-95: located on Boulder Creek 3.2 RM (5.1 km) below the WWTP.

- BC-107: located on Boulder Creek approximately 4.7 RM (7.5 km) downstream of the WWTP.

- BC-aCC: established on Boulder Creek in 2012, farther downstream in a stream reach with possible impacts from nutrients.

South Boulder Creek monitoring is conducted for this location:

- SBC-OS: located on South Boulder Creek upstream of most urban development, serving as a reference site with relatively low anthropogenic influences. (South Boulder Creek flows into Boulder Creek between BC-Can and BC-55.)

Boulder Creek from 107th Avenue to the confluence with Coal Creek was identified as provisionally impaired for aquatic life on the 2016 303(d) List. However, Table 16 indicates that the 2015 MMI scores show attainment of aquatic life use for all monitoring locations on Boulder Creek and South Boulder Creek. Significant recovery of aquatic life following the 2013 flood impacts is evident at most of the sites.

## Table 16. Boulder Creek and South Boulder Creek MMI Scores

| Date | BC-CAN | BC-28 | BC-55 | BC-aWWTP | BC-aDC | BC-95 | BC-107 | BC-aCC[2] | SBC-OS |
|---|---|---|---|---|---|---|---|---|---|
| 23-Sep-10 | 76.2 | 78.0 | 50.7 | 67.3 | 57.7 | 52.2 | NA | NA | 76.0 |
| 29-Sep-11 | 73.6 | 84.8 | 79.5 | 74.7 | 52.8 | 61.8 | 53.8 | NA | 72.6 |
| 28-Sep-12 | 73.5 | 63.5 | 70.4 | 62.8 | 42.4 | 43.3 | **37.0** | **40.2** | 78.8 |
| 25-Oct-13 | 68.3 | 75.5 | 0[1] | **45.5** | **40.2** | **40.0** | **35.2** | **35.4** | 71.0 |
| 26-Oct-14 | 73.2 | 67.6 | 84.4 | 79.4 | 53.3 | 62.5 | 58.4 | **44** (Biotype 1) or 46.2 (Biotype 3) | 80.6 |
| 24-Sep-15 | 76.8 | 75.2 | 86.1 | 77.2 | 65.6 | 62.7 | 69.7 | 59.1 | 74.6 |

Pink-shaded cells with bold font indicate impairments. Grey-shaded cells are MMI scores between attainment and impairment thresholds.

[1]The substrate at BC-55 was completely covered with sand in October 2013, providing no colonizable substrate after the flood. No invertebrates were present at this site during 2013 sampling.

[2]BC-aCC may be more appropriately classified as Biotype 3. Timberline Aquatics has suggested that for BC-aCC, a Biotype 3 classification is expected to be more appropriate than Biotype 1. Timberline Aquatics recalculated the MMI score for this location as Biotype 3 for the 2014 results, with a resulting MMI score of 46.2 which attains the Biotype 3 threshold (Personal Communication with Dave Rees, June 2015).

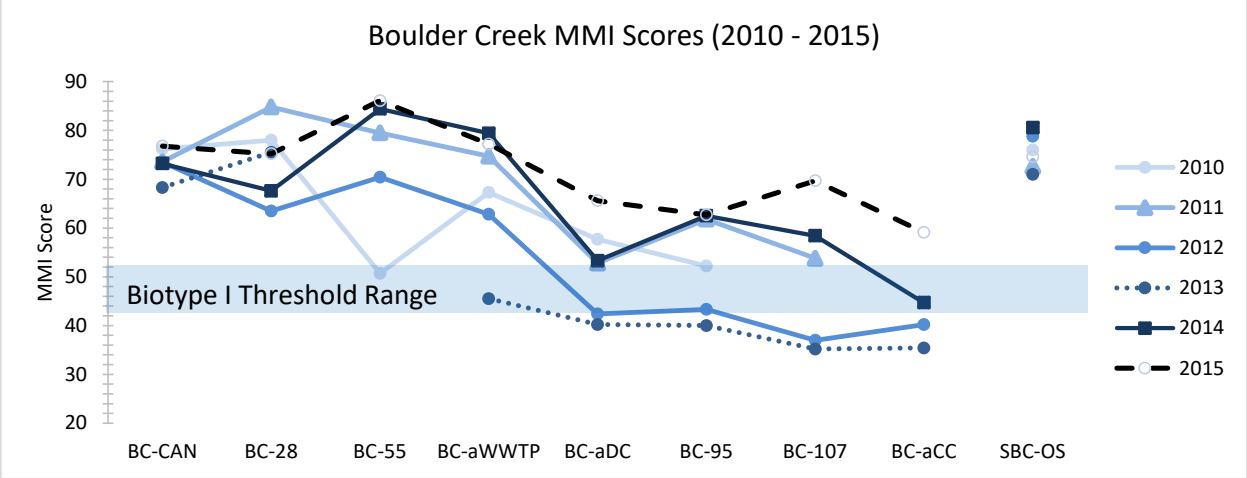
## Table 17. Boulder Creek and South Boulder Creek EPT, Diversity Index and HBI Scores

| Date | BC-CAN* | BC-28 | BC-55 | BC-aWWTP* | BC-aDC* | BC-95* | BC-107* | BC-aCC | SBC-OS |
|---|---|---|---|---|---|---|---|---|---|
| EPT Scores | | | | | | | | | |
| 23-Sep-10 | 23 | 14 | 12 | 14 | 10 | 10 | NA | NA | 22 |
| 29-Sep-11 | 17 | 19 | 14 | 13 | 8 | 8 | 6 | NA | 21 |
| 28-Sep-12 | 18 | 10 | 14 | 13 | 6 | 9 | 6 | 4 | 20 |
| 25-Oct-13 | 12 | 14 | NA | 8 | 6 | 5 | 7 | 7 | 18 |
| 26-Oct-14 | 18 | - | 18 | 19 | 17 | 8 | 10 | 8 | 8 |
| 24-Sep-15 | 18 | - | 24 | 18 | 17 | 12 | 13 | 12 | 29 |
| Shannon Diversity Index Scores | | | | | | | | | |
| 23-Sep-10 | 3.40 | 3.07 | 2.70 | 2.72 | 2.86 | 2.67 | NA | NA | 3.99 |
| 29-Sep-11 | 3.19 | 3.23 | 2.39 | 2.90 | 2.83 | 2.78 | 2.80 | NA | 3.01 |
| 28-Sep-12 | 2.80 | 3.15 | 3.46 | 2.50 | 3.12 | 2.82 | 2.35 | 2.52 | 3.77 |
| 25-Oct-13 | 2.61 | 2.96 | NA | 2.48 | 2.54 | 2.82 | 2.66 | 2.47 | 2.47 |
| 26-Oct-14 | 3.17 | 4.29 | 2.62 | 3.16 | 3.16 | 3.19 | 2.72 | 2.57 | 3.56 |
| 24-Sep-15 | 3.33 | 3.73 | 2.11 | 2.89 | 3.18 | 3.38 | 2.60 | 3.26 | 3.87 |
| HBI Scores | | | | | | | | | |
| 23-Sep-10 | 3.22 | 3.80 | 5.96 | 5.97 | 4.64 | 4.74 | NA | NA | 3.43 |
| 29-Sep-11 | 2.09 | 3.66 | 3.91 | 4.61 | 4.81 | 5.06 | 5.02 | NA | 4.60 |
| 28-Sep-12 | 3.60 | 4.22 | 5.22 | 6.01 | 4.93 | 5.64 | 7.41 | 6.51 | 2.69 |
| 25-Oct-13 | 3.56 | 3.64 | NA | 4.79 | 4.11 | 5.86 | 4.23 | 5.53 | 3.38 |
| 26-Oct-14 | 2.01 | 4.22 | 4.23 | 4.70 | 4.70 | 5.33 | 5.83 | 5.70 | 3.33 |
| 24-Sep-15 | 2.33 | 3.53 | 3.98 | 4.87 | 4.37 | 5.33 | 4.70 | 5.47 | 2.83 |

*Also an active water quality monitoring location.

Pink-shaded cells do not attain target thresholds for Biotype 1.

**Figure 31. Boulder Creek and South Boulder Creek MMI Scores (2010-2015)**




Note: graph does not show the "0" MMI score for BC-55 following the September 2013 flood.

## COAL CREEK AND ROCK CREEK

Coal Creek is included on the 2016 Monitoring and Evaluation List due to potential impairment of aquatic life uses. Five biological monitoring locations are included for Coal Creek and Rock Creek. These sites are located in Aquatic Life Class 2 segments and include these monitoring locations:

- CC-EMP: the "reference site" upstream of the effluent discharge from the WWTP for the City of Louisville.
- CC-OSB: 0.4 km downstream of site CC-EMP, intended to evaluate the potential influence of the Louisville WWTP.
- RC-120: on Rock Creek, approximately 1 km upstream of its confluence with Coal Creek, downstream of Superior WWTP.
- CC-AP: on Coal Creek: downstream of the confluence with Rock Creek, influenced by effluent from Lafayette WWTP and Rock Creek.
- CC-CLR: on Coal Creek, downstream of Erie WWTP, influenced by effluent from all four municipalities (although Erie has been discharging from the North Erie WWTP to Boulder Creek instead of Coal Creek).

Each of these locations is classified as Biotype 1. Coal Creek from Highway 36 to the confluence with Boulder Creek is listed on the 2016 Monitoring and Evaluation list. Site CC-OSB on Coal Creek would be considered impaired based on comparison of the 2015 MMI scores to the MMI thresholds. Most of the sites showed decreases in MMI scores following the September 2013 flood; however, the 2014 and 2015 MMI scores showed significant recovery of the aquatic life at

most of these sites, with the exception of CC-OSB. The 2015 MMI scores were the highest recorded during 2010-2015, with the exception of CC-OSB. Interestingly, the downstream-most site on Coal Creek has the highest (best) MMI score for the stream. Rock Creek MMI results were above (better than) the impairment threshold, but below the attainment threshold.

Timberline Aquatics (2013) noted that the relatively low MMI scores are likely influenced by the spring-fed nature of Coal Creek and Rock Creek which may have inadvertently influenced components of the MMI that are intended to represent responses to changes in water quality. The unique physical parameters (temperature, dissolved oxygen, etc.) that are typically found near the origin of spring-fed streams may contribute to the structure and function of macroinvertebrate communities in a way that negatively influences the MMI. These types of physical environmental changes may partially explain the relatively low MMI scores at the upstream sites (e.g., CC-EMP) on Coal Creek and gradual improvement in a downstream direction (Timberline Aquatics 2013).

The intermittent, spring-fed nature of these two effluent-dominated streams requires consideration when evaluating the status of aquatic life in Coal Creek and Rock Creek. The macroinvertebrate communities present in these streams depend on effluent discharged to provide stable aquatic habitat. The reference site in this study (CC-EMP) was selected because it was upstream of most potential perturbations and maintained enough groundwater to achieve permanent flow. At other locations, these streams rely on effluent discharge to maintain permanent flows through stream reaches that coincide with areas of urban development. Because of the intermittent nature of these streams, there is little opportunity for colonization from upstream macroinvertebrate populations in Coal Creek or Rock Creek. Aquatic life communities in these unique streams are substantially limited by the natural, intermittent, pre-existing conditions (Timberline Aquatics 2013).

**Table 18. Coal Creek and Rock Creek MMI Scores**

| Date | CC-EMP | CC-OSB | RC-120 | CC-AP | CC-CLR |
|---|---|---|---|---|---|
| 22-Sep-10 | **38.1** | 42.2 | **38.6** | 44.1 | 50.1 |
| 28-Sep-11 | **39.8** | **37.4** | **36.0** | 51.4 | 49.7 |
| 27-Sep-12 | 43.7 | **33.6** | **22.5** | 42.2 | 53.6 |
| 26-Oct-13 | **24.5** | **32.3** | **24.1** | **38.1** | **36.6** |
| 28-Sep-14 | 47.8 | **31.5** | **36.0** | 51.3 | 53.4 |
| 23-Sep-15 | 48.2 | **27.3** | 44.6 | 54.4 | 58.9 |

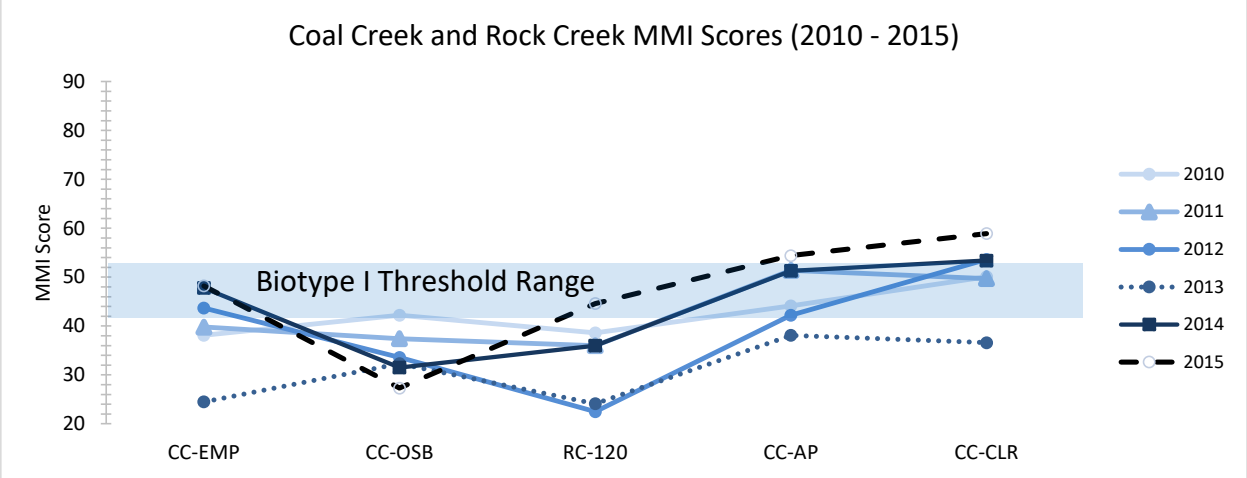
Pink-shaded cells with bold font indicate impairments. Grey-shaded cells are MMI scores between attainment and impairment thresholds.

**Table 19. Coal Creek and Rock Creek EPT, Diversity Index and HBI Scores**

| Date | CC-EMP | CC-OSB | RC-120 | CC-AP | CC-CLR |
|---|---|---|---|---|---|
| EPT Scores | | | | | |
| 22-Sep-10 | 6 | 7 | 8 | 9 | 8 |
| 28-Sep-11 | 6 | 4 | 8 | 9 | 8 |
| 27-Sep-12 | 6 | 2 | 6 | 6 | 10 |
| 26-Oct-13 | 4 | 6 | 4 | 7 | 10 |
| 28-Sep-14 | 9 | 5 | 7 | 10 | 9 |
| 23-Sep-15 | 10 | 6 | 8 | 10 | 10 |
| Shannon Diversity Index Scores | | | | | |
| 22-Sep-10 | 2.23 | 2.02 | 3.42 | 3.11 | 2.56 |
| 28-Sep-11 | 1.97 | 1.76 | 3.35 | 3.35 | 2.79 |
| 27-Sep-12 | 2.32 | 1.30 | 2.59 | 2.68 | 2.58 |
| 26-Oct-13 | 2.76 | 2.91 | 1.99 | 2.70 | 2.46 |
| 28-Sep-14 | 2.70 | 2.71 | 2.48 | 2.82 | 2.61 |
| 23-Sep-15 | 2.58 | 2.50 | 2.53 | 2.63 | 2.67 |
| HBI Scores | | | | | |
| 22-Sep-10 | 6.29 | 6.48 | 5.92 | 5.12 | 4.64 |
| 28-Sep-11 | 6.27 | 6.86 | 5.77 | 5.66 | 4.77 |
| 27-Sep-12 | 6.65 | 6.69 | 6.79 | 5.97 | 5.24 |
| 26-Oct-13 | 6.73 | 6.51 | 6.37 | 6.47 | 5.95 |
| 28-Sep-14 | 6.08 | 5.97 | 5.73 | 5.53 | 4.86 |
| 23-Sep-15 | 6.13 | 5.84 | 5.25 | 5.77 | 4.97 |

Note: Diversity and HBI scores are not required to be evaluated to assess aquatic life use attainment for Class 2 streams.

**Figure 32. Coal Creek and Rock Creek MMI Scores (2010-2015)**



## ST. VRAIN CREEK AND LEFT HAND CREEK

Biological monitoring is conducted at six monitoring locations on St. Vrain Creek, and Left Hand Creek.[6] These sites, which are all classified as Aquatic Life Class 1 segments, include:

- SVC-75: farthest upstream site was added in 2013 to serve as a new reference site on St. Vrain Creek upstream of urban influences.
- SVC-M9: upstream site on St. Vrain Creek is used to provide reference information upstream of urban influences.
- SVC-M8: site within the City of Longmont is used to assess potential impacts from urban runoff.
- SVC-M6: site is located on St. Vrain Creek downstream of the Longmont WWTP and is used to measure the influence of treated effluent in combination with urban runoff. This location is also located below the confluence with Left Hand Creek.
- SVC-M4: site is the farthest downstream site on St. Vrain Creek and was established to evaluate potential recovery downstream of the city. This site has been abandoned due to flood impacts.
- LH-95: new site on Left Hand Creek at 95th Street upstream of urbanized area.
- LHC-1: site on Left Hand Creek is located approximately 300 m upstream of its confluence with St. Vrain Creek and is used to evaluate the contributions and influence of Left Hand Creek on St. Vrain Creek.

During 2015, all MMI scores for St. Vrain Creek and Left Hand Creek attained the MMI threshold (Table 20). Most sites showed significant improvements in MMI scores relative to several previous years that showed impairment based on MMI scores. Although the St. Vrain Creek and Left Hand Creek sites are evaluated as Biotype 1, it is noteworthy that all of these sites are located in Biotype 3 elevation range (below 5085 feet) with the exception of SVC-75.

[6] A special study location on Spring Gulch (SG-2) is also monitored, but it is not included in this report since it is not part of the long-term monitoring program.

## Table 20. St. Vrain and Left Hand Creek MMI Scores

| Date | SVC-75 | SVC-M9 | SVC-M8 | SVC-M6 | SVC-M4 | LHC-95 | LHC-1 |
|---|---|---|---|---|---|---|---|
| WQ Cross-Ref | M9.5-SV | M8.9-SV | M8-SV | M6-SV | M4-SV | | T11-SV |
| 22-Sep-10 | - | 62.5 | 58.2 | **27.2** | **41.5** | - | **46.9** |
| 28-Sep-11 | - | 62.3 | 59.1 | 46.2 | 44.0 | - | 43.8 |
| 27-Sep-12 | - | 63.2 | 44.5 | **23.3** | **36.9** | - | **31.6** |
| 28-Oct-13 | - | 51.0 | 51.4 | **39.4** | **30.6** | - | **43.8** |
| 2-Oct-14 | 82.9 | 47.1 | 51.4 | 43.9 | 54.9 | - | 46.6 |
| 28-Sep-15 | 82.9 | 81.5 | 52.5 | 53.0 | - | 58.2 | 57.4 |

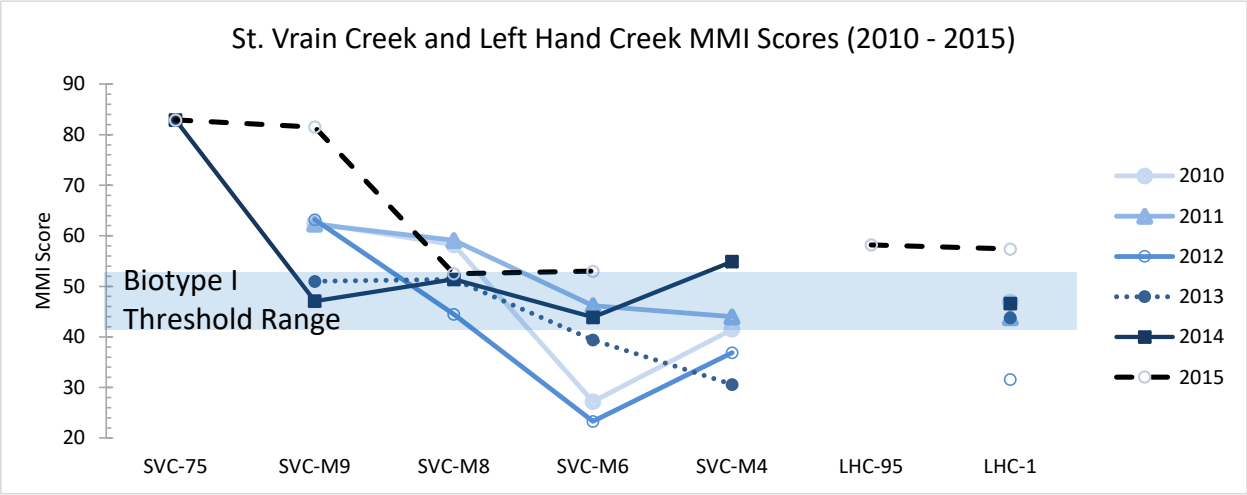
Pink-shaded cells with bold font indicate impairments. Grey-shaded cells are MMI scores between attainment and impairment thresholds.
Note: all sites on St. Vrain and Left Hand Creek are below elevation 5085 ft with the exception of SVC-75.

## Table 21. St. Vrain and Left Hand Creek EPT, Diversity Index and HBI Scores

| Date | SVC-75 | SVC-M9 | SVC-M8 | SVC-M6 | SVC-M4 | LHC-95 | LHC-1 |
|---|---|---|---|---|---|---|---|
| | EPT Scores | | | | | | |
| 22-Sep-10 | - | 14 | 14 | 10 | 7 | - | 8 |
| 28-Sep-11 | - | 11 | 8 | 7 | 7 | - | 8 |
| 27-Sep-12 | - | 10 | 8 | 9 | 7 | - | 3 |
| 28-Oct-13 | - | 9 | 13 | 8 | 6 | - | 6 |
| 2-Oct-14 | 20 | 9 | 10 | 10 | 8 | - | 7 |
| 28-Sep-15 | 20 | 20 | 13 | 14 | - | 10 | 8 |
| | Shannon Diversity Index Scores | | | | | | |
| 22-Sep-10 | - | 2.65 | 2.81 | 2.43 | 3.05 | | 3.5 |
| 28-Sep-11 | - | 2.19 | 2.25 | 2.95 | 2.16 | | 2.59 |
| 27-Sep-12 | - | 1.99 | 1.7 | 2.63 | 2.84 | | 2.65 |
| 28-Oct-13 | - | 2.23 | 3.08 | 2.69 | 2 | | 3.11 |
| 2-Oct-14 | 2.74 | 2.81 | 2.58 | 2.71 | 3.3 | | 1.31 |
| 28-Sep-15 | 2.67 | 2.66 | 2.57 | 2.98 | - | 2.87 | 3.47 |
| | HBI Scores | | | | | | |
| 22-Sep-10 | - | 3.9 | 5.15 | 5.49 | 5.12 | - | 6.49 |
| 28-Sep-11 | - | 4.9 | 4.73 | 4.37 | 4.95 | - | 6.83 |
| 27-Sep-12 | - | 5.36 | 6.56 | 5.93 | 5.68 | - | 7.41 |
| 28-Oct-13 | - | 4.58 | 5.42 | 4.96 | 4.13 | - | 5.11 |
| 2-Oct-14 | 3.67 | 4.41 | 5.72 | 4.19 | 4.88 | - | 3.54 |
| 28-Sep-15 | 3.96 | 3.8 | 6.06 | 4.51 | - | 4.81 | 4.62 |

Pink-shaded cells do not meet thresholds for SDI and HBI.

**Figure 33. St. Vrain and Left Hand Creek MMI Scores (2010-2015)**



# 6.0 QA/QC Analysis

Field replicates and field blanks were recommended in the 2015 Monitoring Plan at the frequencies recommended in Table 22. These frequencies have not yet been fully implemented by all of the participating communities. Therefore, the discussion below is limited to the available quality assurance data submitted during 2015. Key observations include:

- Data provided by the City of Boulder included two analytical results for field blanks for phosphorus. Both results for these field blanks showed values below detection limits.
- Data provided by Lafayette included 14 analytical results for field blanks for *E. coli,* nitrate/nitrite, nitrate, ammonia and TKN. The majority of these results were non-detect, with only two samples showing very low detections.
- Data provided by Longmont included 120 analytical results for field blanks. The majority of these results were non-detect or below the method reporting limit (RL).
- Longmont and Lafayette provided field replicate samples for selected parameters, as summarized in Appendix G. Relative percent difference (RPD) calculations for field replicates were within acceptable ranges for most parameters. Longmont's replicate results for ammonia had three samples pairs that exceeded the RPD target and were above the laboratory reporting limit. One sample pair for TKN exceeded RPD objectives in Lafayette's sampling program.

**Table 22. Recommended Field Quality Control Samples**

| QC Sample | Data Quality Indicator | Collection Frequency (recommended)[1] | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|
| **Field Blank Sample** | Bias Due to Sample Contamination | 5% of samples (1 per 20 samples) | < Reporting Limit | Investigate and eliminate sources of contamination; flag suspect data (e.g., "B" qualifier) |
| **Field Replicate Sample** | Precision | 5% of samples (1 per 20 samples) | For concentrations > Reporting Limit, <25% Relative Percent Difference[2] | Investigate and eliminate cause (e.g., inconsistent field techniques and sample processing, lab error); request re-analysis of sample; flag suspect data |

[1]If the recommended frequency is infeasible, it is highly recommend that, at a minimum, one set of field duplicates and one set of field blanks should be collected by each sampling program per year.
[2]For *E. coli*, log-transformed data are used for relative percent difference calculations.

# 7.0 Conclusions Regarding Current and Future Regulatory Issues

Based on the analysis completed in this report and analyses conducted by others, current regulatory issues for the Boulder Creek and St. Vrain Creek basin include:

- *E. coli*: All segments evaluated in this report exceed *E. coli* standards during 2015, with the exception of South Boulder Creek. The portion of Boulder Creek between 13th Street to the confluence with South Boulder Creek is included in an *E. coli* TMDL, which drives additional regulatory requirements under MS4 permits.
- pH: Boulder Creek Segment 10 is identified as impaired for elevated pH on the 2016 303(d) List. During 2015, pH at monitoring locations in this segment attained standards.
- Selenium: Rock Creek and the portion of Coal Creek below Rock Creek are identified as impaired for elevated selenium based on River Watch data. It is recommended that additional monitoring be conducted to better characterize selenium in these areas and that a site-specific standard potentially be proposed in the future.
- Copper: The upper portion of South Boulder Creek and Left Hand Creek basins are identified as impaired for copper on the 2016 303(d) List. These impairments are located at sampling locations outside of the KICP Monitoring Plan area.
- Aquatic Life: Based on biological monitoring results for 2015, significant improvement in aquatic life conditions has occurred throughout the watershed at most locations, particularly relative to post-flood conditions in 2013. Based on 2015 results, only one location on Coal Creek qualifies as impaired; however, several streams are listed as provisionally impaired on the 2016 303(d) List.

Future regulatory issues include:

- Total Phosphorus: Below WWTP discharges, no stream segments evaluated in this report would be expected to attain the “interim values” adopted in Regulation 31 in 2012.
- Total Nitrogen: Below WWTP discharges, no stream segments evaluated in this report would be expected to attain the “interim values” adopted in Regulation 31 in 2012.
- Total Recoverable Arsenic: Although temporary modifications have been adopted for segments with “water + fish” standards for total recoverable arsenic through December 31, 2021, available data collected for Boulder Creek and South Boulder Creek indicate that the stringent 0.02 µg/L standard is not attainable at any monitoring location.
- Temperature: Based on a proposal from the City of Boulder, the Commission adopted a temporary modification for temperature during December to February on Segment 9 of Boulder Creek due to difficulty meeting the winter “shoulder season” standard for temperature. This temporary modification expires December 31, 2020.

# 8.0 Recommendations

This annual water quality report continues to support efforts to coordinate monitoring and interpretation of water quality conditions in the overall St. Vrain Basin and identifying general water quality trends (at least spatially). This section provides recommendations for improvements to the Monitoring Plan, annual data compilation process, and general recommendations for water quality improvements and enhancements. Most of these recommendations are similar to those provided in the Annual Water Quality Analysis for 2014.

Recommended modifications to the Monitoring Plan include:

- In order to address controllable *E. coli* sources to the streams, a more refined monitoring program (both temporally and spatially) is needed for *E. coli*. Recommendations for monitoring to further refine understanding of sources of *E. coli* have been provided in the Boulder Creek/St. Vrain Watershed-Based Plan (KICP and WWE 2015).

- Two additional monitoring locations have been identified to reflect instream conditions upstream of urbanized conditions. These include: 1) Coal Creek near (or upstream of) Highway 36 and 2) Left Hand Creek (LH-95) near the USGS gauge at Hover (LEFTHOCO). Because Coal Creek is segmented between 7a and 7b at Highway 36, the Coal Creek station should be located near Highway 36, but upstream of urbanization. Biological monitoring began at LH-95 during 2015, but water quality data have not yet been collected at this site.

- Clarify that a log-transformed procedure will be followed for relative percent difference calculations for *E. coli* QC analyses.

- Review Appendix A and B monitoring locations and nomenclature for consistency with this annual report and update tables and maps, as needed. Update the preferred nomenclature for the Longmont WWTP discharge to WWTP-LGMT. Add the new Colorado Division of Water Resources monitoring location SVCHGICO to the list of retrieved stream gauges for St. Vrain Creek.

- Conduct a joint meeting of field and laboratory staff among participating communities to continue to improve consistency and efficiency in implementation of the Monitoring Plan.

Recommendations to increase efficiency in the data analysis and compilation process based on lessons learned in 2015 include several simple suggestions:

- Continue to clearly specify that WWTP data should be provided as part of the data submission (at least for Regulation 85 nutrients) to improve consistency in graphic representations of the data and provide better insight into pollutant sources that may be influencing instream water quality.

- Continue to clearly communicate with data providers regarding data format and desired data submission timeline. When working with database outputs and "batch" statistical analysis, it is most efficient to have a complete data set submitted in one standardized file, as opposed to several submissions.
- Consistent sample location names and clearly identified sample location names should be used to avoid misinterpretation of the sample location. For example "upstream" and "downstream" identifiers should be replaced with the standardized KICP monitoring location name.
- Clearly identify whether the data being provided is also being provided by another entity. For example, the Coal Creek cities share monitoring location 11-BC and it only needs to be provided once.

Recommendations for water quality enhancements and improvements:

- At this time, the recommendations of basin master plans in response to the September 2013 flood are considered highest priority, combined with gradual upgrades to WWTP treatment processes to reduce nutrients to meet Regulation 85 requirements.
- Continued implementation of construction and post-construction stormwater quality BMPs following the recommendations of Volume 3 of the Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual* is generally recommended, particularly in MS4 permit covered areas. Because of the general nature of this water quality analysis, more detailed recommendations are not appropriate at this time. As a general recommendation for bacteria, practices that provide runoff volume reduction through infiltration and/or filtration (e.g., sand filter, bioretention) are expected to be most beneficial for bacteria reduction. Although wet ponds with permanent pools may also help to reduce bacteria concentrations, water rights and space constraints often preclude their use for new developments and redevelopments in Colorado.
- Work with Boulder County Parks and Open Space to identify opportunities for implementation of agricultural BMPs. For agricultural areas, pollutant loading is affected by practices already in place on specific parcels. Some parcels may have significant opportunity for improvements, whereas others may already be implementing agricultural BMPs. An inventory of practices in place for various agricultural parcels has not been completed for purposes of this annual water quality report, but have been summarized in the Boulder Creek/St. Vrain Watershed-Based Plan (KICP and WWE 2015). KICP is also coordinating with Boulder County Parks and Open Space with regard to a water quality monitoring program that is being developed to assess the effectiveness of various practices implemented on County lands.
- Encourage participation of agricultural producers (particularly on County land) in the Rocky Mountain National Park Early Warning System project to reduce ammonia emissions during certain weather conditions (see http://www.rmwarningsystem.com).

# References


City of Boulder and Wright Water Engineers, Inc. 2013. *City of Boulder Water Quality Report: 2011 and Baseline.* August.

City of Boulder and Wright Water Engineers, Inc. 2015. *Boulder Creek and St. Vrain Creek Water Quality Analysis for 2012-2013.*

Colorado's Decision Support Systems website http://cdss.state.co.us/onlineTools/Pages/StreamflowStations.aspx, accessed March 16, 2016.

Colorado Department of Public Health & Environment, Water Quality Control Commission. 2010. *Aquatic Life Use Attainment Methodology to Determine Use Attainment for Rivers and Streams*. Policy Statement 10-1. October 12, 2010.

Colorado Department of Public Health & Environment, Water Quality Control Division. 2015. *Section 303(d) Listing Methodology 2016 Listing Cycle*. March 10, 2015.

Colorado Department of Public Health and Environment, Colorado Water Quality Control Commission. 2015. Final Action Tables for Regulation 38 Stream Classifications and Water Quality Standards. June 30, 2015.

Colorado Department of Public Health and Environment, Water Quality Control Commission. 2016. *Regulation No. 31 - The Basic Standards and Methodologies for Surface Water. 5 CCR 1002-31.* Amended (amended 5/9/16, effective 6/30/16).

Colorado Department of Public Health and Environment, Water Quality Control Commission. 2016. 5 CCR 1002-93. *Regulation #93, Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List.*

Earth System Research Laboratory: Physical Sciences Division website http://www.esrl.noaa.gov/psd/boulder/data.daily.html#Aug14, accessed March 16, 2016.

Keep It Clean Partnership and Wright Water Engineers, 2015. Boulder Creek and St. Vrain Creek Watershed-Based Plan.

Left Hand Watershed Oversight Group (LWOG), 2016. Status Report on Water Quality Monitoring. February.

Murphy, S. 2006. State of the Watershed: Water Quality of Boulder Creek, Colorado. *U.S. Geological Survey Circular 1284*. Prepared in cooperation with the City of Boulder, Colorado.

NOAA Earth System Research Laboratory website http://www.esrl.noaa.gov/psd/data/, accessed March 16, 2016.

Rocky Mountain National Park Early Warning System website: http://www.rmwarningsystem.com/ReducingAmmoniaEmissions.aspx , accessed March 16, 2016.

Tetra Tech. 2011a. *Boulder Creek, Colorado Segment 2b: From 13th Street to the Confluence with South Boulder Creek Total Maximum Daily Load Escherichia coli.* Prepared for City of Boulder, Colorado and State of Colorado Department of Public Health and Environment and U.S. Environmental Protection Agency, Region VIII. February 7.

Tetra Tech. 2011b. *Boulder Creek, Colorado Segment 2b: From 13th Street to the Confluence with South Boulder Creek Total Maximum Daily Load Escherichia coli Implementation Plan.* Prepared for City of Boulder, Colorado and State of Colorado Department of Public Health and Environment and U.S. Environmental Protection Agency, Region VIII.

Timberline Aquatics. 2013. *Summary Report, Benthic Macroinvertebrate Biomonitoring Program, Boulder Creek, Colorado 2012*. Prepared for City of Boulder Water Quality Services.

Timberline Aquatics. 2016. Personal communication with Dave Rees, transmittal of Excel spreadsheet summaries of MMI, EPT, HBI and SDI statistics calculated for Boulder Creek and St. Vrain Creek monitoring locations.

U.S Geological Survey (USGS) Surface Water Data for the Nation website: http://waterdata.usgs.gov/usa/nwis/sw, accessed March 16, 2016.

Weiner, E. 2008. *Applications of Environmental Aquatic Chemistry*. Second Edition CRC Press.

Wright Water Engineers, Inc., 2014. *Boulder Creek and St. Vrain Creek Coordinated Watershed Monitoring Framework.* Prepared for Keep It Clean Partnership.

Wright Water Engineers, Inc., 2015. *Boulder Creek and St. Vrain Creek Annual Water Quality Analysis for 2014.* Prepared for Keep It Clean Partnership.

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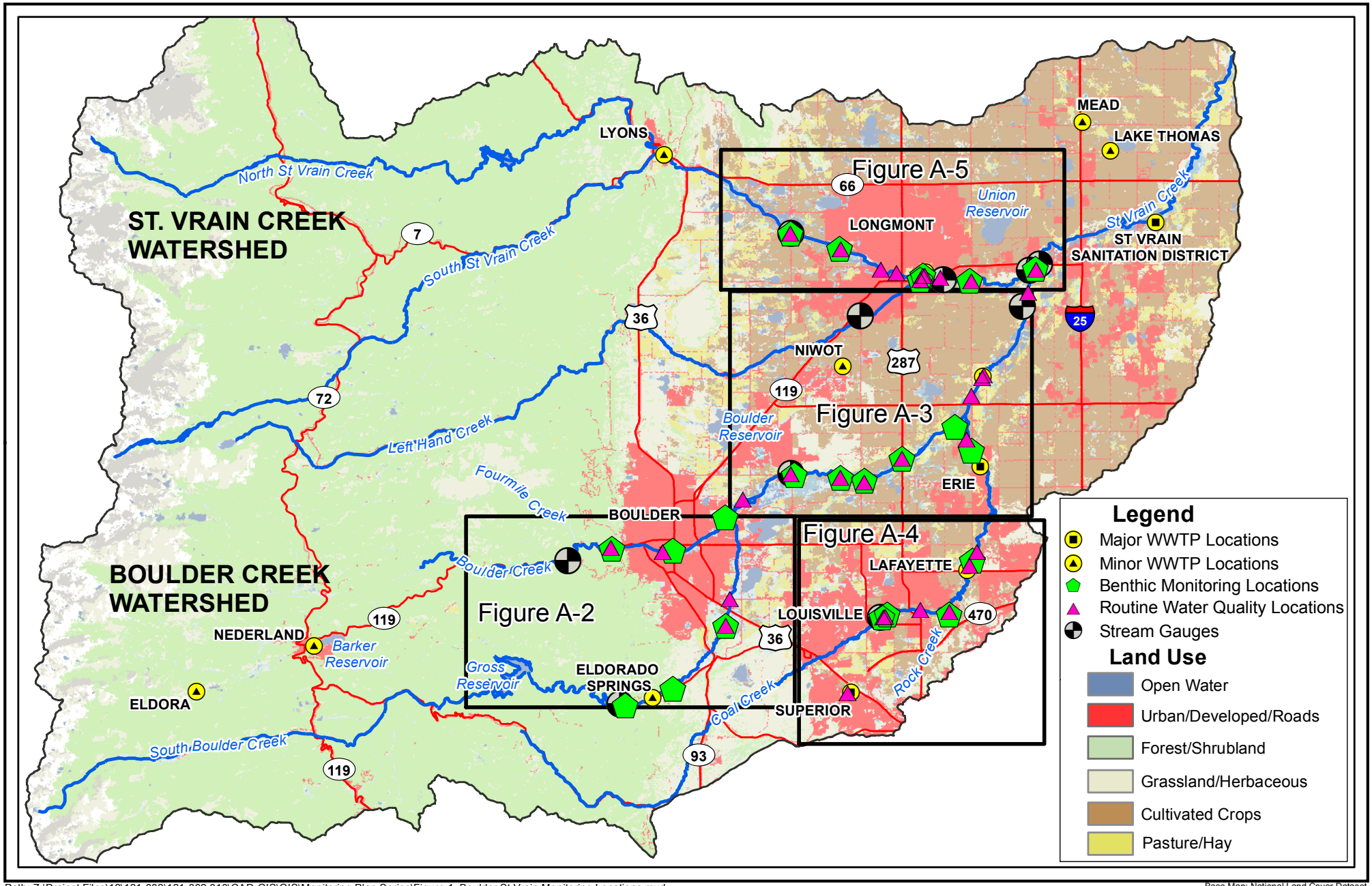
# Appendix A. Monitoring Location Maps




Path: Z:\Project Files\12\121-002\121-002.010\CAD-GIS\GIS\Monitoring Plan Series\Figure 1_Boulder St Vrain Monitoring Locations.mxd

Base Map: National Land Cover Dataset

WWE
WRIGHT WATER ENGINEERS, INC.
2490 W 26TH AVE 100A
DENVER, CO. 80211
(303) 480-1700

# ST. VRAIN-BOULDER WATERSHED

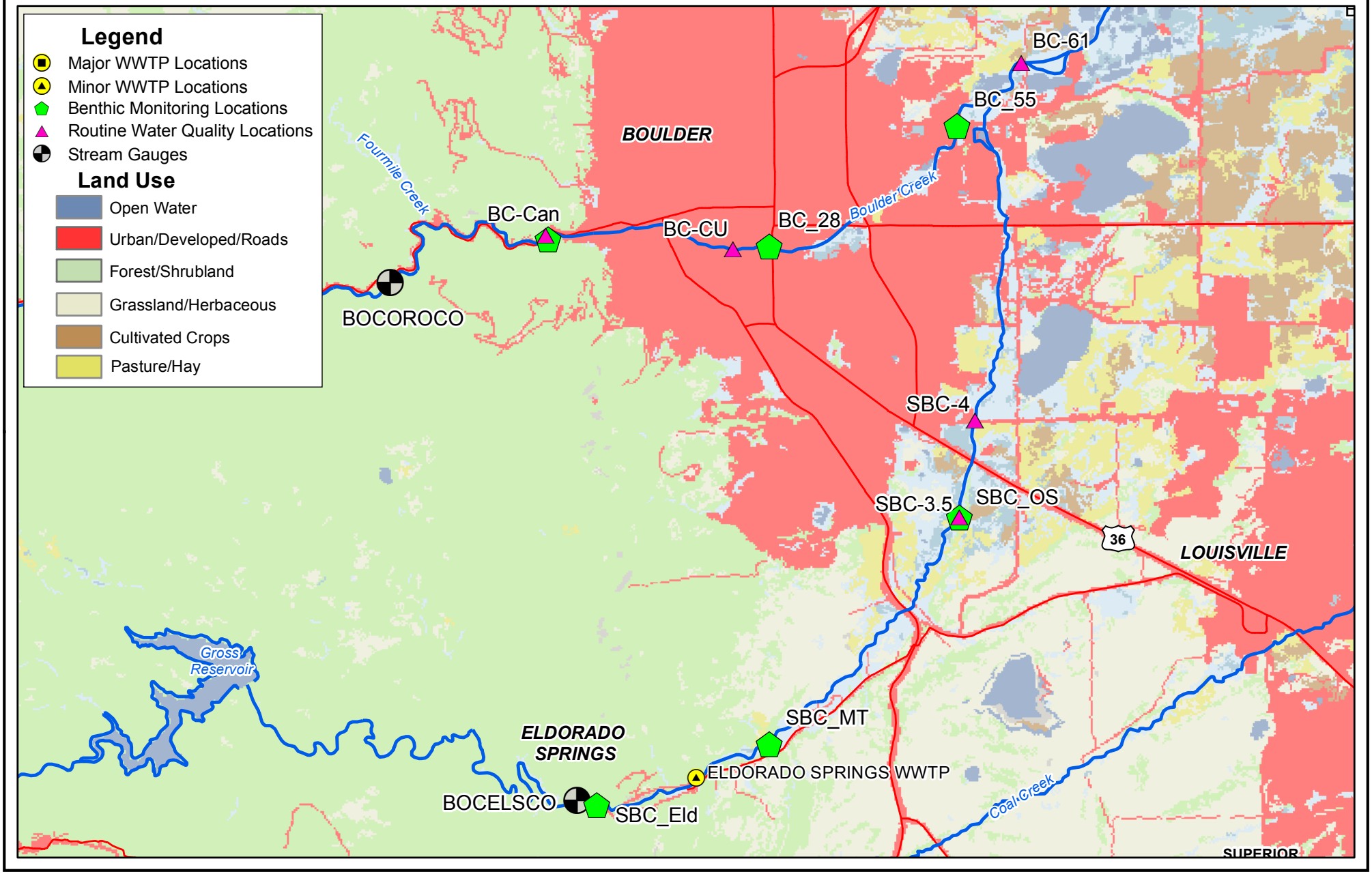
## JOINT MONITORING PLAN LOCATIONS

N
W E
S

0 1.5 3 6
Miles

PROJECT NO. 121-002.010

FIGURE A-1




Path: Z:\Project Files\12\121-002\121-002.010\CAD-GIS\GIS\Monitoring Plan Series\Figure 2A_Boulder Monitoring Locations.mxd

Base Map: National Land Cover Dataset

WWE
WRIGHT WATER ENGINEERS, INC.
2490 W 26TH AVE 100A
DENVER, CO. 80211
(303) 480-1700

# BOULDER CREEK WATERSHED

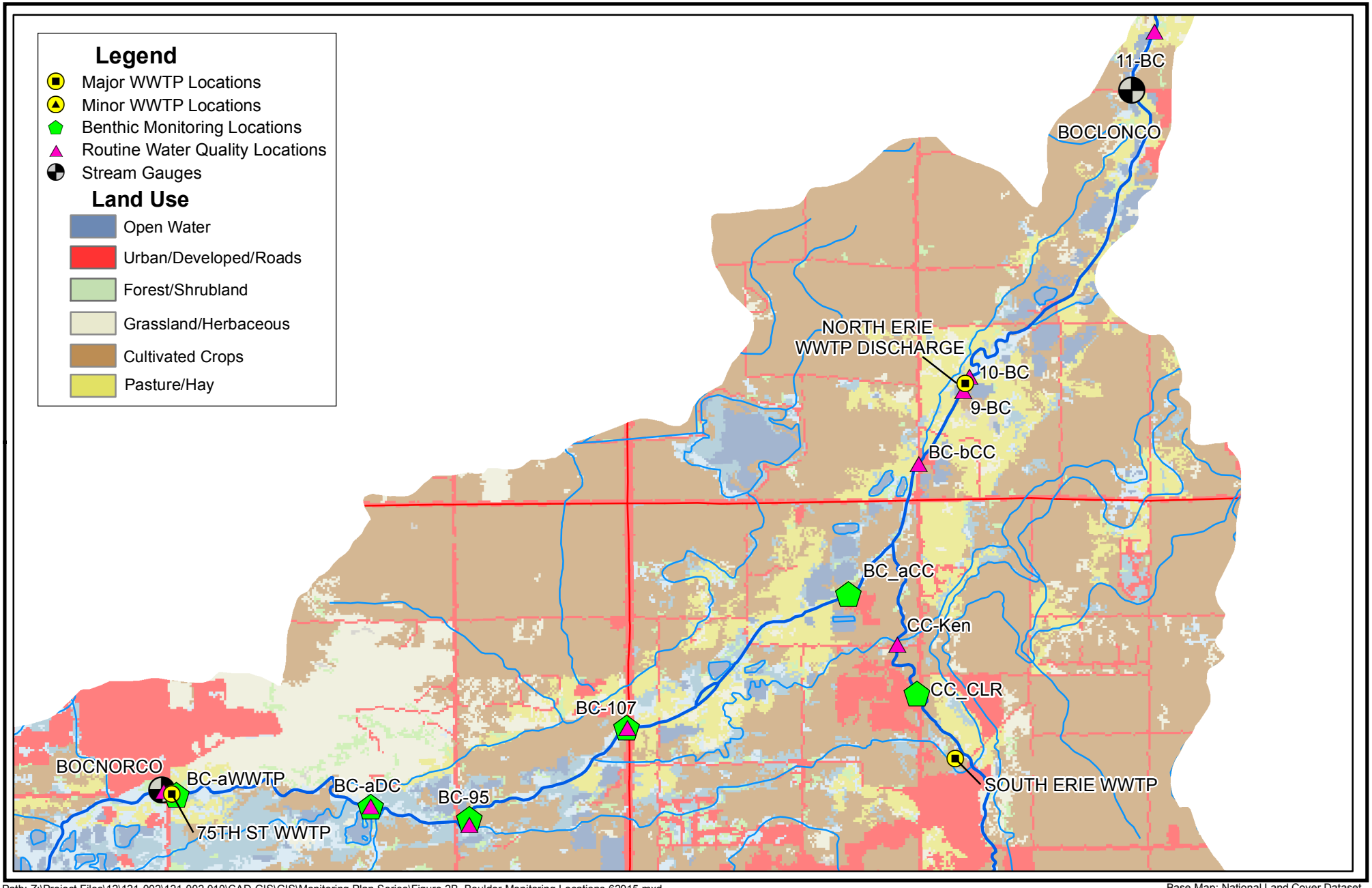
## JOINT MONITORING PLAN LOCATIONS

N W E S

0 0.375 0.75 1.5
Miles

PROJECT NO. 121-002.010

FIGURE A-2




Path: Z:\Project Files\12\121-002\121-002.010\CAD-GIS\GIS\Monitoring Plan Series\Figure 2B_Boulder Monitoring Locations 62915.mxd

Base Map: National Land Cover Dataset

WWE
WRIGHT WATER ENGINEERS, INC.
2490 W 26TH AVE 100A
DENVER, CO. 80211
(303) 480-1700

# BOULDER CREEK WATERSHED

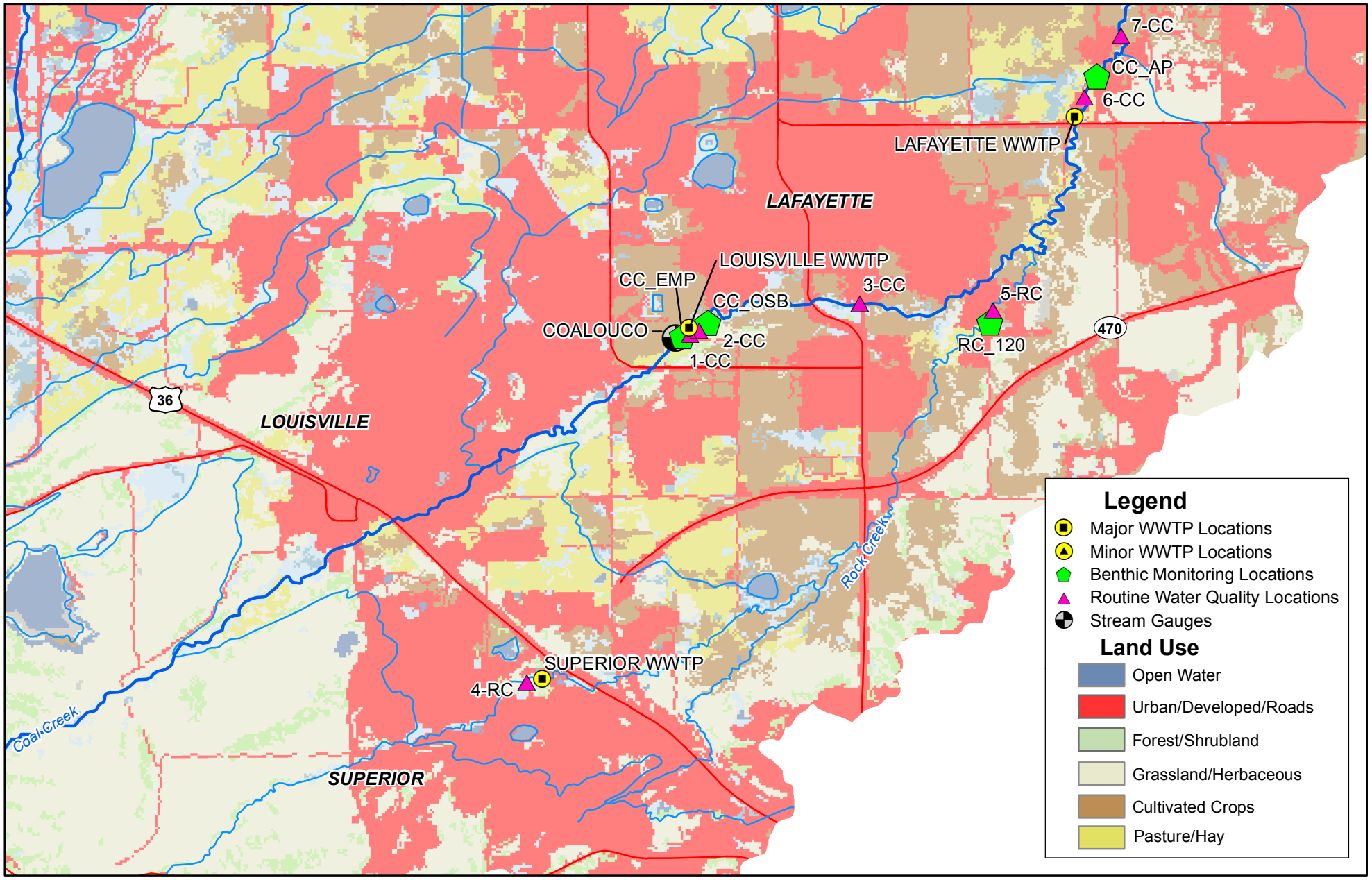
## JOINT MONITORING PLAN LOCATIONS

N W E S

0 0.375 0.75 1.5
Miles

PROJECT NO. 121-002.010

FIGURE A-3




Path: Z:\Project Files\12\121-002\121-002.010\CAD-GIS\GIS\Monitoring Plan Series\Figure 2C_Boulder Monitoring Locations 62915.mxd

Base Map: National Land Cover Dataset

WWE
WRIGHT WATER ENGINEERS, INC.
2490 W 26TH AVE 100A
DENVER, CO. 80211
(303) 480-1700

# BOULDER CREEK WATERSHED

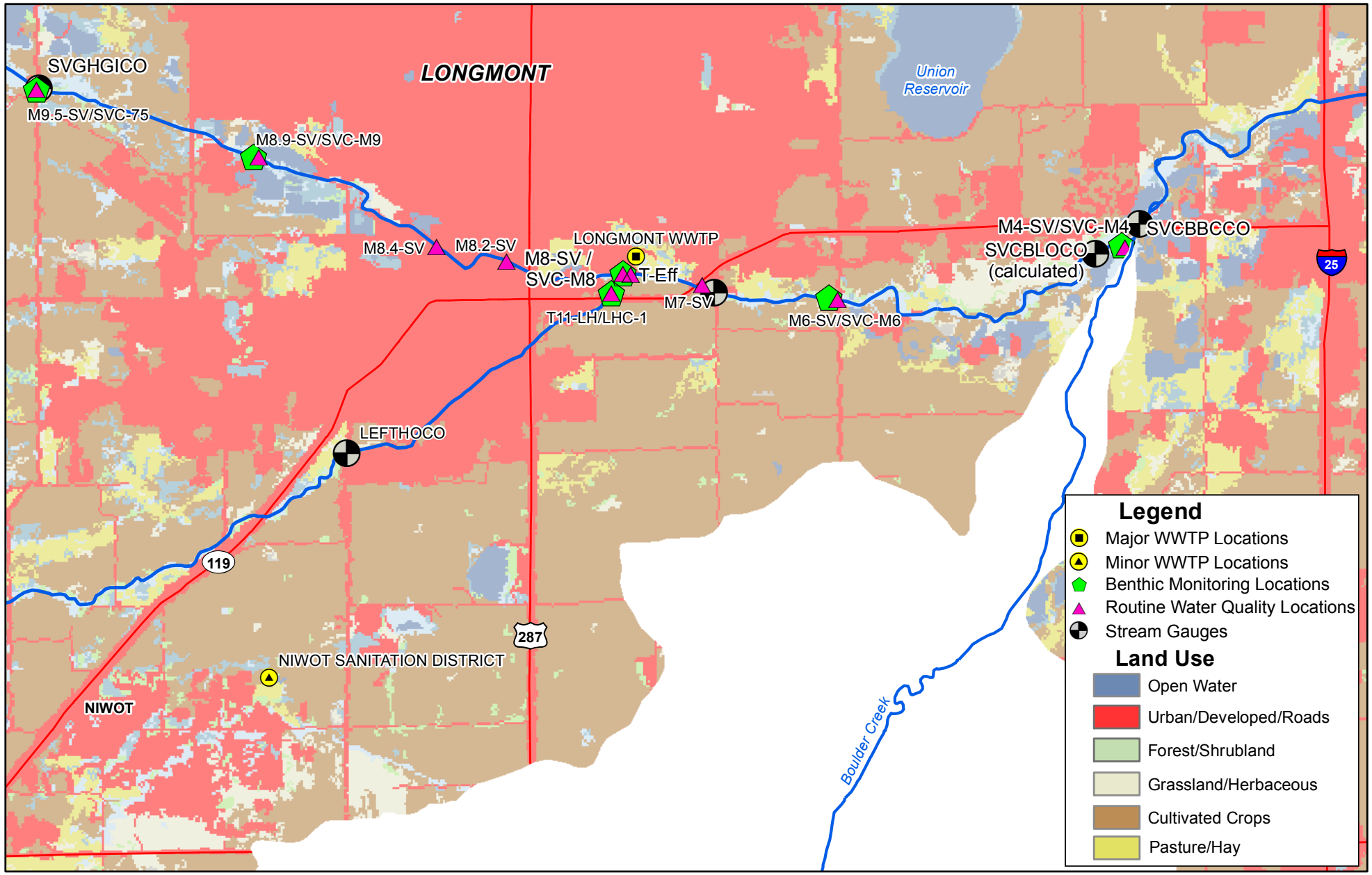
## JOINT MONITORING PLAN LOCATIONS

N W E S

0 0.375 0.75 1.5
Miles

PROJECT NO. 121-002.010

FIGURE A-4




Path: Z:\Project Files\12\121-002\121-002.010\CAD-GIS\GIS\Monitoring Plan Series\Figure 3_St Vrain Monitoring Locations.mxd

Base Map: National Land Cover Dataset

WWE
WRIGHT WATER ENGINEERS, INC.
2490 W 26TH AVE 100A
DENVER, CO. 80211
(303) 480-1700

# ST. VRAIN CREEK WATERSHED

## JOINT MONITORING PLAN LOCATIONS

N W E S

0 0.25 0.5 1
Miles

PROJECT NO. 121-002.010

FIGURE A-5

## 2014 KICP Cooperative Monitoring Program Locations

| Plot_ID | Instream Monitoring Location Description | Stream Name | Data Provider | DD_Lat | DD_Long | Flow Monitoring Type (or closest gauge) | Anticipated Monthly Sample Date |
|---|---|---|---|---|---|---|---|
| BC-Can | Pool area at Anderson Ditch head gate | Boulder Creek | City of Boulder | 40.0132 | -105.3015 | USGS 06727000 aka BOCOROCO; BOULDER CREEK NEAR ORODELL, CO | Second Tuesday of month |
| BC-CU | Under foot bridge connecting Folsom Field with dirt parking lot to the North | Boulder Creek | City of Boulder | 40.0111 | -105.2661 | | Second Tuesday of month |
| BC-61 | Just West of 61st St. bridge | Boulder Creek | City of Boulder | 40.0381 | -105.2116 | | Second Tuesday of month |
| BC-aWWTP | Under bridge at 75th St. Western side | Boulder Creek | City of Boulder | 40.0515 | -105.178611 | USGS 06730200 aka BOCNORCO; BOULDER CREEK AT NORTH 75TH ST. NEAR BOULDER, CO | Second Tuesday of month |
| BC-aDC | above Dry Creek | Boulder Creek | City of Boulder | 40.0495 | -105.14485 | Flow Meter | Second Tuesday of month |
| BC-95 | Downstream of Lower Boulder Ditch headgate 0.87 miles below BC-aDC sample site. | Boulder Creek | City of Boulder | 40.0472 | -105.1288 | | Second Tuesday of month |
| BC-107 | Bridge at 107th Street | Boulder Creek | City of Boulder | 40.0592 | -105.1030 | | Second Tuesday of month |
| BC-bCC | Bridge where Boulder Creek goes under East County Line Road 2.13 miles below BC-Ken sample site. | Boulder Creek | City of Boulder | 40.0921 | -105.0553 | | Second Tuesday of month |
| SBC-3.5 | Open Space at McGuinn Ditch gate | South Boulder Creek | City of Boulder | 39.9722 | -105.2236 | USGS 06729500 aka BOCELSCO; SOUTH BOULDER CREEK NEAR ELDORADO SPRINGS, CO | Second Tuesday of month |
| CC-Ken | Bridge where Coal Creek goes under Kenosha Rd. 0.89 miles upstream from Boulder Creek confluence. | Coal Creek | City of Boulder | 40.0695 | -105.0590 | | Second Tuesday of month |
| 9-BC | Boulder Creek above the North Erie WWTP discharge | Boulder Creek | Erie | 40.1012 | -105.0480 | | 1st week of month |
| 10-BC | Boulder Creek below the North Erie WWTP discharge | Boulder Creek | Erie | 40.1030 | -105.0470 | | 1st week of month |
| 11-BC | Boulder Creek Gage 06730500 | Boulder Creek | Erie | 40.1522 | -105.0144 | USGS 06730500 aka BOCLONCO; BOULDER CREEK AT MOUTH NEAR LONGMONT, CO | 1st week of month |
| 1-CC | Coal Creek above the Lousiville WWTP discharge | Coal Creek | Louisville | 39.9761 | -105.1164 | USGS 06730400 aka COALOUCO; COAL CREEK NEAR LOUISVILLE, CO; aka COC-1 | 1st week of month |
| 2-CC | Coal Creek below the Lousiville WWTP discharge | Coal Creek | Louisville | 39.9765 | -105.1160 | | 1st week of month |
| 3-CC | Coal Creek above the confluence with Rock Creek | Coal Creek | Lafayette | 39.9799 | -105.0909 | | 1st week of month |
| 6-CC | Coal Creek above the Lafayette WWTP discharge | Coal Creek | Lafayette | 40.0032 | -105.0574 | | 1st week of month |
| 7-CC | Coal Creek below the Lafayette WWTP | Coal Creek | Lafayette | 40.0103 | -105.0519 | | 1st week of month |
| 4-RC | Rock Creek above the Superior WWTP discharge | Rock Creek | Superior | 39.9369 | -105.1377 | | 1st week of month |
| 5-RC | Rock Creek above the confluence with Coal Creek | Rock Creek | Superior | 39.9790 | -105.0711 | | 1st week of month |
| T11-LH | T-11, Lefthand Creek @ St Vrain | Left Hand Creek | Longmont | 40.1551 | -105.0874 | Flow Meter | 3rd Week of Month |
| M8.9-SV | M-8.9, St Vrain @ Golden Ponds | St. Vrain Creek | Longmont | 40.1693 | -105.1442 | Flow Meter | 3rd Week of Month |
| M8-SV | M-8, St Vrain @ Above Effluent | St. Vrain Creek | Longmont | 40.1553 | -105.0878 | Flow Meter | 3rd Week of Month |
| M7-SV | M-7, St Vrain @ 119 | St. Vrain Creek | Longmont | 40.1530 | -105.0741 | SAINT VRAIN CREEK BELOW KEN PRATT BLVD AT LONGMONT, CO (SVCLOPCO); also use flow meter | 3rd Week of Month |
| M4-SV | M-4, St Vrain @ Above Boulder Creek Confluence | St. Vrain Creek | Longmont | 40.1582 | -105.0108 | Flow Meter; (historic data from damaged gauge is USGS 06725450 ST. VRAIN CREEK BELOW LONGMONT, CO or SVBLOCO on the CDWR webpage) | 3rd Week of Month |
| **Planned Additions** | | | | | | | |
| 0-CC | Location above urbanized area | Coal Creek | Superior | 39.94 | -105.192778 | No flow gauge. WQ site may be added in the future. Approximate location. | 1st week of month |
| LH-HOV | Left Hand Creek at Hover Gauge | Left Hand Creek | Longmont | 40.134278 | -105.130819 | USGS 06724970 aka LEFTHOCO; LEFT HAND CREEK AT HOVER ROAD NEAR LONGMONT, CO. WQ site may be added in the future. Approximate location. | 3rd Week of Month |

**Notes:**

Samples are also collected at WWTP discharges, ideally corresponding to instream sample date.
Additional routine monitoring is also conducted by others; this table is limited to KICP monitoring locations.

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# Appendix B. Tabular Summary Statistics

| Statistic | No. of Samples | Minimum | Maximum | 1st Quartile | Median | 3rd Quartile | Mean | Standard Deviation | Geometric Mean (for *E. coli*) |
|---|---|---|---|---|---|---|---|---|---|
| Alkalinity (mg/L)\|BC-Can | 12 | 21 | 56 | 28 | 39 | 45 | 38 | 11 | |
| Alkalinity (mg/L)\|BC-CU | 12 | 23 | 59 | 39 | 45 | 50 | 43 | 11 | |
| Alkalinity (mg/L)\|BC-61 | 12 | 27 | 110 | 62 | 74 | 87 | 73 | 23 | |
| Alkalinity (mg/L)\|BC-aWWTP | 12 | 29 | 128 | 70 | 87 | 97 | 82 | 26 | |
| Alkalinity (mg/L)\|WWTF Eff | 12 | 85 | 144 | 98 | 111 | 129 | 113 | 20 | |
| Alkalinity (mg/L)\|BC-aDC | 12 | 37 | 123 | 85 | 95 | 98 | 90 | 22 | |
| Alkalinity (mg/L)\|BC-107 | 12 | 31 | 140 | 84 | 109 | 124 | 98 | 35 | |
| Alkalinity (mg/L)\|BC-bCC | 12 | 56 | 225 | 129 | 162 | 189 | 157 | 50 | |
| Alkalinity (mg/L)\|SBC-3.5/4 | 12 | 23 | 58 | 26 | 32 | 42 | 35 | 11 | |
| Conductivity (umhos/cm)\|BC-Can | 12 | 62 | 241 | 79 | 134 | 168 | 133 | 55 | |
| Conductivity (umhos/cm)\|BC-CU | 12 | 68 | 277 | 140 | 189 | 217 | 178 | 66 | |
| Conductivity (umhos/cm)\|BC-61 | 12 | 95 | 562 | 242 | 343 | 504 | 360 | 156 | |
| Conductivity (umhos/cm)\|BC-aWWTP | 12 | 104 | 603 | 330 | 382 | 547 | 403 | 159 | |
| Conductivity (umhos/cm)\|WWTF Eff | 12 | 576 | 1063 | 698 | 737 | 807 | 778 | 149 | |
| Conductivity (umhos/cm)\|BC-aDC | 12 | 153 | 712 | 470 | 519 | 609 | 505 | 158 | |
| Conductivity (umhos/cm)\|BC-95 | 12 | 7 | 729 | 364 | 515 | 571 | 459 | 213 | |
| Conductivity (umhos/cm)\|BC-107 | 12 | 165 | 750 | 473 | 577 | 655 | 545 | 172 | |
| Conductivity (umhos/cm)\|BC-bCC | 12 | 241 | 1438 | 620 | 816 | 978 | 796 | 321 | |
| Conductivity (umhos/cm)\|9-BC | 4 | 8 | 1043 | 591 | 808 | 883 | 667 | 453 | |
| Conductivity (umhos/cm)\|10-BC | 4 | 8 | 1045 | 603 | 838 | 917 | 682 | 461 | |
| Conductivity (umhos/cm)\|11-BC | 4 | 8 | 1605 | 635 | 990 | 1253 | 898 | 671 | |
| Conductivity (umhos/cm)\|SBC-3.5/4 | 12 | 70 | 184 | 79 | 100 | 150 | 115 | 41 | |
| DO (mg/L)\|BC-Can | 12 | 9.1 | 13.3 | 10.9 | 12.2 | 12.6 | 11.7 | 1.4 | |
| DO (mg/L)\|BC-CU | 12 | 7.4 | 13.2 | 10.2 | 11.4 | 12.5 | 11.1 | 1.7 | |
| DO (mg/L)\|BC-61 | 12 | 7.5 | 13.2 | 8.8 | 10.2 | 11.4 | 10.1 | 1.8 | |
| DO (mg/L)\|BC-aWWTP | 12 | 8.6 | 12.2 | 10.1 | 11.0 | 11.6 | 10.7 | 1.2 | |
| DO (mg/L)\|WWTF Eff | 12 | 7.0 | 10.7 | 7.9 | 9.2 | 9.9 | 8.9 | 1.2 | |
| DO (mg/L)\|BC-aDC | 12 | 9.1 | 15.1 | 10.3 | 11.2 | 11.6 | 11.4 | 1.8 | |
| DO (mg/L)\|BC-95 | 12 | 9.2 | 15.7 | 10.7 | 10.9 | 11.4 | 11.5 | 2.0 | |
| DO (mg/L)\|BC-107 | 11 | 7.7 | 15.0 | 9.7 | 10.9 | 11.5 | 10.8 | 2.1 | |
| DO (mg/L)\|BC-bCC | 10 | 6.9 | 16.4 | 11.1 | 12.4 | 13.9 | 12.3 | 2.8 | |
| DO (mg/L)\|9-BC | 4 | 7.6 | 11.1 | 9.0 | 9.7 | 10.2 | 9.5 | 1.4 | |
| DO (mg/L)\|10-BC | 4 | 7.3 | 11.1 | 7.9 | 8.4 | 9.3 | 8.8 | 1.6 | |
| DO (mg/L)\|11-BC | 4 | 8.7 | 13.8 | 9.9 | 10.6 | 11.6 | 10.9 | 2.1 | |
| DO (mg/L)\|SBC-3.5/4 | 12 | 9.4 | 13.3 | 10.2 | 11.4 | 12.4 | 11.2 | 1.3 | |
| Hardness, Total as CaCO3 (mg/L)\|BC-Can | 12 | 23 | 98 | 34 | 50 | 65 | 52 | 22 | |
| Hardness, Total as CaCO3 (mg/L)\|BC-CU | 12 | 26 | 104 | 53 | 73 | 82 | 67 | 23 | |
| Hardness, Total as CaCO3 (mg/L)\|BC-61 | 12 | 34 | 186 | 93 | 129 | 168 | 126 | 48 | |
| Hardness, Total as CaCO3 (mg/L)\|BC-aWWTP | 12 | 38 | 233 | 130 | 159 | 200 | 156 | 59 | |
| Hardness, Total as CaCO3 (mg/L)\|BC-aDC | 12 | 51 | 254 | 158 | 201 | 227 | 186 | 59 | |
| Hardness, Total as CaCO3 (mg/L)\|BC-107 | 12 | 56 | 291 | 190 | 235 | 264 | 215 | 71 | |
| Hardness, Total as CaCO3 (mg/L)\|BC-bCC | 12 | 78 | 380 | 243 | 283 | 342 | 273 | 88 | |
| Hardness, Total as CaCO3 (mg/L)\|SBC-3.5/4 | 12 | 31 | 91 | 35 | 41 | 58 | 48 | 18 | |
| pH (SU)\|BC-Can | 12 | 6.9 | 8.0 | 7.0 | 7.1 | 7.5 | 7.2 | 0.4 | |
| pH (SU)\|BC-CU | 12 | 6.8 | 7.9 | 7.0 | 7.5 | 7.7 | 7.4 | 0.4 | |
| pH (SU)\|BC-61 | 12 | 7.0 | 8.0 | 7.1 | 7.6 | 7.7 | 7.5 | 0.4 | |
| pH (SU)\|BC-aWWTP | 12 | 6.7 | 8.4 | 7.3 | 7.7 | 8.0 | 7.7 | 0.5 | |
| pH (SU)\|WWTF Eff | 12 | 7.0 | 7.5 | 7.1 | 7.1 | 7.2 | 7.2 | 0.1 | |
| pH (SU)\|BC-aDC | 12 | 7.0 | 8.5 | 7.5 | 7.9 | 8.2 | 7.8 | 0.4 | |
| pH (SU)\|BC-95 | 12 | 7.3 | 8.8 | 7.8 | 8.1 | 8.6 | 8.2 | 0.5 | |
| pH (SU)\|BC-107 | 12 | 7.1 | 9.1 | 7.7 | 7.9 | 8.8 | 8.1 | 0.7 | |
| pH (SU)\|BC-bCC | 11 | 7.5 | 9.0 | 8.0 | 8.2 | 8.8 | 8.3 | 0.5 | |
| pH (SU)\|9-BC | 4 | 7.9 | 8.3 | 8.1 | 8.1 | 8.2 | 8.1 | 0.2 | |
| pH (SU)\|10-BC | 4 | 8.0 | 8.3 | 8.1 | 8.2 | 8.2 | 8.2 | 0.1 | |
| pH (SU)\|11-BC | 4 | 8.2 | 8.3 | 8.2 | 8.3 | 8.3 | 8.3 | 0.1 | |
| pH (SU)\|SBC-3.5/4 | 12 | 6.9 | 8.1 | 7.0 | 7.6 | 7.8 | 7.5 | 0.4 | |
| Temperature (deg C)\|BC-Can | 12 | 0.4 | 14.6 | 0.9 | 5.9 | 11.2 | 6.7 | 5.6 | |
| Temperature (deg C)\|BC-CU | 11 | 0.4 | 15.3 | 1.4 | 6.1 | 12.6 | 7.4 | 6.1 | |
| Temperature (deg C)\|BC-61 | 12 | 2.8 | 20.6 | 5.1 | 9.6 | 14.6 | 10.1 | 5.9 | |
| Temperature (deg C)\|BC-aWWTP | 12 | 2.3 | 22.4 | 4.5 | 9.9 | 15.3 | 10.8 | 7.0 | |
| Temperature (deg C)\|WWTF Eff | 12 | 13.0 | 21.8 | 14.2 | 16.0 | 19.8 | 16.8 | 3.3 | |
| Temperature (deg C)\|BC-aDC | 12 | 7.7 | 22.7 | 10.0 | 12.2 | 17.7 | 13.8 | 5.3 | |
| Temperature (deg C)\|BC-95 | 12 | 7.2 | 22.9 | 9.6 | 12.0 | 17.2 | 13.4 | 5.4 | |
| Temperature (deg C)\|BC-107 | 12 | 6.8 | 22.9 | 9.4 | 12.3 | 20.4 | 13.9 | 6.0 | |
| Temperature (deg C)\|BC-bCC | 11 | 4.3 | 23.1 | 8.3 | 14.1 | 18.6 | 13.6 | 6.5 | |
| Temperature (deg C)\|9-BC | 4 | 3.1 | 19.3 | 9.3 | 13.7 | 16.9 | 12.5 | 7.0 | |
| Temperature (deg C)\|10-BC | 4 | 3.8 | 21.4 | 9.2 | 13.2 | 16.9 | 12.9 | 7.4 | |
| Temperature (deg C)\|11-BC | 4 | 3.4 | 21.9 | 9.0 | 13.1 | 16.9 | 12.9 | 7.8 | |
| Temperature (deg C)\|SBC-3.5/4 | 12 | 0.1 | 15.2 | 4.1 | 8.8 | 11.2 | 8.3 | 4.6 | |
| E. coli (MPN/100 mL)\|BC-Can | 12 | 2 | 57 | 18 | 33 | 46 | 31 | 19 | 21 |
| E. coli (MPN/100 mL)\|BC-CU | 12 | 24 | 517 | 64 | 118 | 330 | 193 | 171 | 125 |
| E. coli (MPN/100 mL)\|BC-61 | 12 | 13 | 1300 | 22 | 55 | 82 | 155 | 362 | 53 |

| Statistic | No. of Samples | Minimum | Maximum | 1st Quartile | Median | 3rd Quartile | Mean | Standard Deviation | Geometric Mean (for *E. coli*) |
|---|---|---|---|---|---|---|---|---|---|
| E. coli (MPN/100 mL)\|BC-aWWTP | 12 | 11 | 1553 | 27 | 37 | 61 | 165 | 437 | 47 |
| E. coli (MPN/100 mL)\|WWTF Eff | 12 | 2 | 60 | 10 | 16 | 26 | 22 | 18 | 15 |
| E. coli (MPN/100 mL)\|BC-aDC | 12 | 19 | 1414 | 62 | 85 | 119 | 194 | 386 | 92 |
| E. coli (MPN/100 mL)\|BC-107 | 12 | 5 | 1046 | 21 | 42 | 66 | 129 | 291 | 42 |
| E. coli (MPN/100 mL)\|BC-bCC | 12 | 11 | 921 | 27 | 54 | 68 | 173 | 308 | 61 |
| E. coli (MPN/100 mL)\|9-BC | 4 | 57 | 190 | 67 | 74 | 105 | 99 | 62 | 87 |
| E. coli (MPN/100 mL)\|10-BC | 4 | 28 | 365 | 33 | 48 | 137 | 122 | 163 | 68 |
| E. coli (MPN/100 mL)\|11-BC | 4 | 28 | 325 | 66 | 113 | 192 | 145 | 130 | 101 |
| E. coli (MPN/100 mL)\|SBC-3.5/4 | 12 | 10 | 1986 | 18 | 40 | 181 | 243 | 556 | 61 |
| TSS (mg/L)\|BC-Can | 12 | 0.0 | 34.0 | 0.0 | 3.5 | 10.0 | 8.3 | 11.7 | |
| TSS (mg/L)\|BC-CU | 12 | 0.0 | 53.0 | 2.0 | 4.0 | 12.5 | 10.7 | 15.5 | |
| TSS (mg/L)\|BC-61 | 12 | 1.0 | 23.0 | 2.0 | 4.5 | 6.0 | 5.8 | 6.0 | |
| TSS (mg/L)\|BC-aWWTP | 12 | 1.0 | 40.0 | 2.0 | 5.0 | 7.0 | 7.7 | 10.7 | |
| TSS (mg/L)\|WWTF Eff | 12 | 1.0 | 5.0 | 2.0 | 2.5 | 3.0 | 2.7 | 1.1 | |
| TSS (mg/L)\|BC-aDC | 12 | 3.0 | 30.0 | 3.8 | 4.0 | 8.8 | 7.8 | 7.7 | |
| TSS (mg/L)\|BC-95 | 12 | 4.0 | 41.0 | 4.8 | 8.0 | 11.3 | 10.6 | 10.2 | |
| TSS (mg/L)\|BC-107 | 12 | 3.0 | 57.0 | 4.0 | 4.0 | 9.3 | 10.7 | 15.3 | |
| TSS (mg/L)\|BC-bCC | 12 | 7.0 | 138.0 | 8.0 | 14.0 | 30.3 | 27.8 | 36.8 | |
| TSS (mg/L)\|SBC-3.5/4 | 12 | 0.0 | 30.0 | 0.8 | 2.0 | 12.3 | 6.8 | 9.3 | |
| Nitrogen Ammonia as N (mg/L)\|BC-Can | 12 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Nitrogen Ammonia as N (mg/L)\|BC-CU | 12 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | |
| Nitrogen Ammonia as N (mg/L)\|BC-61 | 12 | 0.00 | 0.30 | 0.03 | 0.06 | 0.07 | 0.07 | 0.08 | |
| Nitrogen Ammonia as N (mg/L)\|BC-aWWTP | 12 | 0.00 | 0.05 | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 | |
| Nitrogen Ammonia as N (mg/L)\|WWTF Eff | 12 | 0.00 | 0.10 | 0.02 | 0.03 | 0.05 | 0.04 | 0.03 | |
| Nitrogen Ammonia as N (mg/L)\|BC-aDC | 12 | 0.00 | 0.05 | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 | |
| Nitrogen Ammonia as N (mg/L)\|BC-95 | 12 | 0.00 | 0.05 | 0.00 | 0.01 | 0.02 | 0.01 | 0.02 | |
| Nitrogen Ammonia as N (mg/L)\|BC-107 | 12 | 0.00 | 0.05 | 0.01 | 0.02 | 0.02 | 0.02 | 0.01 | |
| Nitrogen Ammonia as N (mg/L)\|BC-bCC | 12 | 0.00 | 0.23 | 0.02 | 0.05 | 0.09 | 0.07 | 0.08 | |
| Nitrogen Ammonia as N (mg/L)\|9-BC | 12 | 0.00 | 0.30 | 0.03 | 0.07 | 0.09 | 0.08 | 0.09 | |
| Nitrogen Ammonia as N (mg/L)\|E-BC | 12 | 0.00 | 2.14 | 0.06 | 0.20 | 0.49 | 0.44 | 0.64 | |
| Nitrogen Ammonia as N (mg/L)\|10-BC | 12 | 0.01 | 0.33 | 0.05 | 0.08 | 0.16 | 0.12 | 0.10 | |
| Nitrogen Ammonia as N (mg/L)\|11-BC | 12 | 0.00 | 0.41 | 0.05 | 0.08 | 0.13 | 0.11 | 0.11 | |
| Nitrogen Ammonia as N (mg/L)\|SBC-3.5/4 | 12 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | |
| Nitrogen Nitrate as N [Hach] (mg/L)\|BC-Can | 12 | 0.00 | 0.70 | 0.00 | 0.20 | 0.50 | 0.25 | 0.27 | |
| Nitrogen Nitrate as N [Hach] (mg/L)\|BC-CU | 12 | 0.00 | 0.90 | 0.00 | 0.00 | 0.55 | 0.23 | 0.36 | |
| Nitrogen Nitrate as N [Hach] (mg/L)\|BC-61 | 12 | 0.00 | 1.10 | 0.00 | 0.35 | 0.70 | 0.38 | 0.40 | |
| Nitrogen Nitrate as N [Hach] (mg/L)\|BC-aWWTP | 12 | 0.00 | 1.00 | 0.00 | 0.00 | 0.53 | 0.23 | 0.36 | |
| Nitrogen Nitrate as N (mg/L)\|BC-aWWTP | 12 | 0.08 | 0.45 | 0.13 | 0.28 | 0.38 | 0.26 | 0.14 | |
| Nitrogen Nitrate as N [Hach] (mg/L)\|WWTF Eff | 12 | 5.20 | 16.00 | 7.90 | 11.35 | 13.08 | 10.80 | 3.51 | |
| Nitrogen Nitrate as N [Hach] (mg/L)\|BC-aDC | 12 | 0.40 | 7.70 | 2.98 | 3.90 | 5.00 | 3.88 | 2.02 | |
| Nitrogen Nitrate as N [Hach] (mg/L)\|BC-95 | 12 | 0.50 | 5.80 | 2.45 | 3.20 | 4.43 | 3.23 | 1.73 | |
| Nitrogen Nitrate as N [Hach] (mg/L)\|BC-107 | 12 | 0.00 | 6.50 | 2.73 | 3.65 | 4.20 | 3.48 | 1.92 | |
| Nitrogen Nitrate as N [Hach] (mg/L)\|BC-bCC | 12 | 0.40 | 7.30 | 2.95 | 3.90 | 5.35 | 3.83 | 2.06 | |
| Nitrogen Nitrate as N (mg/L)\|9-BC | 12 | 0.61 | 6.79 | 1.36 | 4.46 | 5.85 | 3.89 | 2.34 | |
| Nitrogen Nitrate as N (mg/L)\|E-BC | 12 | 4.31 | 13.80 | 9.57 | 10.94 | 12.16 | 10.64 | 2.49 | |
| Nitrogen Nitrate as N (mg/L)\|10-BC | 12 | 0.62 | 6.72 | 1.49 | 3.87 | 5.75 | 3.72 | 2.23 | |
| Nitrogen Nitrate as N (mg/L)\|11-BC | 12 | 0.40 | 6.29 | 1.12 | 3.53 | 5.09 | 3.25 | 2.21 | |
| Nitrogen Nitrate as N [Hach] (mg/L)\|SBC-3.5/4 | 12 | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.08 | 0.20 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|BC-Can | 12 | 0.00 | 0.70 | 0.00 | 0.20 | 0.50 | 0.25 | 0.27 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|BC-CU | 12 | 0.00 | 0.90 | 0.00 | 0.00 | 0.55 | 0.23 | 0.35 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|BC-61 | 12 | 0.00 | 1.10 | 0.00 | 0.35 | 0.70 | 0.39 | 0.40 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|BC-aWWTP | 12 | 0.08 | 0.46 | 0.13 | 0.28 | 0.38 | 0.26 | 0.14 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|WWTF Eff | 12 | 5.22 | 16.01 | 7.99 | 11.39 | 13.09 | 10.82 | 3.50 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|BC-aDC | 12 | 0.40 | 7.71 | 2.99 | 3.94 | 5.01 | 3.89 | 2.02 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|BC-95 | 12 | 0.50 | 5.81 | 2.46 | 3.21 | 4.44 | 3.24 | 1.73 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|BC-107 | 12 | 0.00 | 6.52 | 2.75 | 3.65 | 4.22 | 3.49 | 1.93 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|BC-bCC | 12 | 0.40 | 7.42 | 2.97 | 3.95 | 5.37 | 3.86 | 2.09 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|9-BC | 12 | 0.61 | 6.79 | 1.36 | 4.46 | 5.85 | 3.89 | 2.34 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|E-BC | 12 | 4.55 | 13.85 | 10.00 | 11.30 | 12.22 | 10.85 | 2.43 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|10-BC | 12 | 0.62 | 6.72 | 1.49 | 3.87 | 5.88 | 3.76 | 2.28 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|11-BC | 12 | 0.40 | 6.29 | 1.12 | 3.53 | 5.09 | 3.25 | 2.21 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|SBC-3.5/4 | 12 | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.08 | 0.20 | |
| Nitrogen Nitrite as N (mg/L)\|BC-Can | 12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Nitrogen Nitrite as N (mg/L)\|BC-CU | 12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Nitrogen Nitrite as N (mg/L)\|BC-61 | 12 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Nitrogen Nitrite as N (mg/L)\|BC-aWWTP | 12 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Nitrogen Nitrite as N (mg/L)\|WWTF Eff | 12 | 0.00 | 0.11 | 0.01 | 0.01 | 0.01 | 0.02 | 0.03 | |
| Nitrogen Nitrite as N (mg/L)\|BC-aDC | 12 | 0.00 | 0.05 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | |
| Nitrogen Nitrite as N (mg/L)\|BC-95 | 12 | 0.00 | 0.04 | 0.00 | 0.01 | 0.02 | 0.01 | 0.01 | |
| Nitrogen Nitrite as N (mg/L)\|BC-107 | 12 | 0.00 | 0.05 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | |
| Nitrogen Nitrite as N (mg/L)\|BC-bCC | 12 | 0.00 | 0.12 | 0.01 | 0.03 | 0.04 | 0.03 | 0.03 | |
| Nitrogen Nitrite as N (mg/L)\|9-BC | 12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |

| Statistic | No. of Samples | Minimum | Maximum | 1st Quartile | Median | 3rd Quartile | Mean | Standard Deviation | Geometric Mean (for *E. coli*) |
|---|---|---|---|---|---|---|---|---|---|
| Nitrogen Nitrite as N (mg/L)\|E-BC | 12 | 0.00 | 0.61 | 0.06 | 0.14 | 0.33 | 0.21 | 0.21 | |
| Nitrogen Nitrite as N (mg/L)\|10-BC | 12 | 0.00 | 0.44 | 0.00 | 0.00 | 0.00 | 0.04 | 0.13 | |
| Nitrogen Nitrite as N (mg/L)\|11-BC | 12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Nitrogen Nitrite as N (mg/L)\|SBC-3.5/4 | 12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Nitrogen TKN (mg/L)\|BC-Can | 12 | 0.14 | 0.38 | 0.19 | 0.24 | 0.27 | 0.24 | 0.08 | |
| Nitrogen TKN (mg/L)\|BC-CU | 11 | 0.17 | 0.83 | 0.20 | 0.24 | 0.30 | 0.31 | 0.19 | |
| Nitrogen TKN (mg/L)\|BC-61 | 12 | 0.17 | 0.51 | 0.30 | 0.33 | 0.37 | 0.34 | 0.08 | |
| Nitrogen TKN (mg/L)\|BC-aWWTP | 12 | 0.17 | 0.50 | 0.29 | 0.30 | 0.37 | 0.33 | 0.09 | |
| Nitrogen TKN (mg/L)\|WWTF Eff | 12 | 0.96 | 2.31 | 1.24 | 1.39 | 1.67 | 1.46 | 0.38 | |
| Nitrogen TKN (mg/L)\|BC-aDC | 12 | 0.33 | 1.09 | 0.75 | 0.83 | 0.88 | 0.80 | 0.20 | |
| Nitrogen TKN (mg/L)\|BC-95 | 12 | 0.41 | 1.07 | 0.64 | 0.75 | 0.84 | 0.74 | 0.17 | |
| Nitrogen TKN (mg/L)\|BC-107 | 12 | 0.41 | 1.14 | 0.64 | 0.72 | 0.84 | 0.74 | 0.18 | |
| Nitrogen TKN (mg/L)\|BC-bCC | 12 | 0.43 | 1.06 | 0.82 | 0.89 | 1.02 | 0.87 | 0.18 | |
| Nitrogen TKN (mg/L)\|9-BC | 12 | 0.12 | 1.30 | 0.57 | 0.75 | 0.89 | 0.75 | 0.35 | |
| Nitrogen TKN (mg/L)\|E-BC | 12 | 1.70 | 4.00 | 2.10 | 2.20 | 3.13 | 2.63 | 0.77 | |
| Nitrogen TKN (mg/L)\|10-BC | 12 | 0.07 | 1.30 | 0.48 | 0.83 | 0.93 | 0.74 | 0.36 | |
| Nitrogen TKN (mg/L)\|11-BC | 12 | 0.13 | 1.28 | 0.48 | 0.79 | 0.95 | 0.72 | 0.38 | |
| Nitrogen TKN (mg/L)\|SBC-3.5/4 | 11 | 0.14 | 0.60 | 0.21 | 0.25 | 0.28 | 0.26 | 0.12 | |
| Nitrogen Total (mg/L)\|BC-Can | 12 | 0.00 | 1.03 | 0.00 | 0.32 | 0.76 | 0.39 | 0.42 | |
| Nitrogen Total (mg/L)\|BC-CU | 12 | 0.00 | 1.53 | 0.00 | 0.00 | 0.79 | 0.37 | 0.58 | |
| Nitrogen Total (mg/L)\|BC-61 | 12 | 0.00 | 1.39 | 0.31 | 0.77 | 1.05 | 0.67 | 0.46 | |
| Nitrogen Total (mg/L)\|BC-aWWTP | 12 | 0.00 | 1.29 | 0.00 | 0.23 | 0.82 | 0.41 | 0.47 | |
| Nitrogen Total (mg/L)\|WWTF Eff | 12 | 6.86 | 18.32 | 9.34 | 12.95 | 14.34 | 12.29 | 3.57 | |
| Nitrogen Total (mg/L)\|BC-aDC | 12 | 0.73 | 8.56 | 3.98 | 4.92 | 5.83 | 4.69 | 2.13 | |
| Nitrogen Total (mg/L)\|BC-95 | 12 | 0.91 | 6.59 | 3.17 | 4.05 | 5.29 | 3.98 | 1.81 | |
| Nitrogen Total (mg/L)\|BC-107 | 12 | 0.00 | 7.27 | 3.53 | 4.57 | 4.99 | 4.20 | 2.07 | |
| Nitrogen Total (mg/L)\|BC-bCC | 12 | 0.83 | 8.44 | 3.78 | 4.99 | 6.22 | 4.73 | 2.17 | |
| Nitrogen Total (mg/L)\|9-BC | 12 | 1.16 | 7.50 | 2.47 | 5.05 | 6.83 | 4.65 | 2.45 | |
| Nitrogen Total (mg/L)\|E-BC | 12 | 7.46 | 15.60 | 12.97 | 13.91 | 14.76 | 13.48 | 2.22 | |
| Nitrogen Total (mg/L)\|10-BC | 12 | 1.03 | 7.50 | 2.30 | 4.71 | 6.82 | 4.50 | 2.43 | |
| Nitrogen Total (mg/L)\|11-BC | 12 | 0.85 | 7.00 | 1.86 | 4.21 | 5.98 | 3.97 | 2.28 | |
| Nitrogen Total (mg/L)\|SBC-3.5/4 | 11 | 0.00 | 0.88 | 0.00 | 0.00 | 0.14 | 0.16 | 0.31 | |
| Nitrogen Total Inorganic (mg/L)\|BC-Can | 12 | 0.00 | 0.70 | 0.00 | 0.20 | 0.50 | 0.25 | 0.27 | |
| Nitrogen Total Inorganic (mg/L)\|BC-CU | 12 | 0.00 | 0.90 | 0.00 | 0.00 | 0.56 | 0.23 | 0.36 | |
| Nitrogen Total Inorganic (mg/L)\|BC-61 | 12 | 0.00 | 1.40 | 0.00 | 0.41 | 0.78 | 0.44 | 0.46 | |
| Nitrogen Total Inorganic (mg/L)\|BC-aWWTP | 12 | 0.00 | 1.02 | 0.00 | 0.00 | 0.55 | 0.24 | 0.37 | |
| Nitrogen Total Inorganic (mg/L)\|WWTF Eff | 12 | 5.25 | 16.07 | 8.05 | 11.44 | 13.12 | 10.86 | 3.50 | |
| Nitrogen Total Inorganic (mg/L)\|BC-aDC | 12 | 0.40 | 7.73 | 3.01 | 3.97 | 5.02 | 3.91 | 2.02 | |
| Nitrogen Total Inorganic (mg/L)\|BC-95 | 12 | 0.50 | 5.81 | 2.46 | 3.21 | 4.45 | 3.25 | 1.73 | |
| Nitrogen Total Inorganic (mg/L)\|BC-107 | 12 | 0.00 | 6.55 | 2.77 | 3.67 | 4.24 | 3.51 | 1.93 | |
| Nitrogen Total Inorganic (mg/L)\|BC-bCC | 12 | 0.42 | 7.65 | 3.03 | 3.98 | 5.40 | 3.93 | 2.11 | |
| Nitrogen Total Inorganic (mg/L)\|9-BC | 12 | 0.67 | 6.87 | 1.40 | 4.62 | 5.86 | 3.98 | 2.35 | |
| Nitrogen Total Inorganic (mg/L)\|E-BC | 12 | 4.83 | 13.94 | 10.72 | 11.90 | 12.28 | 11.30 | 2.38 | |
| Nitrogen Total Inorganic (mg/L)\|10-BC | 12 | 0.84 | 6.80 | 1.55 | 3.96 | 5.91 | 3.88 | 2.29 | |
| Nitrogen Total Inorganic (mg/L)\|11-BC | 12 | 0.44 | 6.34 | 1.22 | 3.63 | 5.38 | 3.36 | 2.23 | |
| Nitrogen Total Inorganic (mg/L)\|SBC-3.5/4 | 12 | 0.00 | 0.61 | 0.00 | 0.00 | 0.00 | 0.09 | 0.20 | |
| Phosphorus as P, Tot (mg/L)\|BC-Can | 12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Phosphorus as P, Tot (mg/L)\|BC-CU | 12 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.03 | 0.06 | |
| Phosphorus as P, Tot (mg/L)\|BC-61 | 12 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.02 | 0.05 | |
| Phosphorus as P, Tot (mg/L)\|BC-aWWTP | 12 | 0.00 | 0.19 | 0.00 | 0.00 | 0.00 | 0.02 | 0.05 | |
| Phosphorus as P, Tot (mg/L)\|WWTF Eff | 12 | 1.35 | 3.55 | 1.88 | 2.40 | 2.75 | 2.34 | 0.67 | |
| Phosphorus as P, Tot (mg/L)\|BC-aDC | 12 | 0.12 | 1.84 | 0.56 | 0.99 | 1.28 | 0.94 | 0.51 | |
| Phosphorus as P, Tot (mg/L)\|BC-95 | 12 | 0.00 | 1.40 | 0.44 | 0.76 | 1.17 | 0.77 | 0.46 | |
| Phosphorus as P, Tot (mg/L)\|BC-107 | 12 | 0.16 | 1.30 | 0.48 | 0.61 | 1.19 | 0.76 | 0.43 | |
| Phosphorus as P, Tot (mg/L)\|BC-bCC | 12 | 0.16 | 1.18 | 0.43 | 0.61 | 0.90 | 0.66 | 0.33 | |
| Phosphorus as P, Tot (mg/L)\|9-BC | 12 | 0.13 | 1.13 | 0.38 | 0.87 | 1.02 | 0.70 | 0.37 | |
| Phosphorus as P, Tot (mg/L)\|E-BC | 12 | 0.13 | 0.56 | 0.16 | 0.20 | 0.24 | 0.23 | 0.12 | |
| Phosphorus as P, Tot (mg/L)\|10-BC | 12 | 0.01 | 1.00 | 0.36 | 0.83 | 0.95 | 0.65 | 0.35 | |
| Phosphorus as P, Tot (mg/L)\|11-BC | 12 | 0.15 | 0.99 | 0.27 | 0.71 | 0.91 | 0.61 | 0.33 | |
| Phosphorus as P, Tot (mg/L)\|SBC-3.5/4 | 12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Phosphorus as P, Tot (**ug/L**)\|BC-aWWTP | 12 | 0.00 | 122.37 | 22.66 | 29.92 | 45.22 | 37.53 | 30.76 | |
| Arsenic, T (ug/L)\|BC-Can | 12 | 0.00 | 6.33 | 0.39 | 0.45 | 0.86 | 1.12 | 1.75 | |
| Arsenic, T (ug/L)\|BC-CU | 12 | 0.23 | 5.39 | 0.49 | 0.54 | 0.92 | 1.15 | 1.47 | |
| Arsenic, T (ug/L)\|BC-61 | 12 | 0.00 | 4.73 | 1.43 | 1.59 | 2.68 | 2.10 | 1.43 | |
| Arsenic, T (ug/L)\|BC-aWWTP | 12 | 0.00 | 2.60 | 1.18 | 1.37 | 1.73 | 1.47 | 0.71 | |
| Arsenic, T (ug/L)\|WWTF Eff | 12 | 0.00 | 0.43 | 0.34 | 0.35 | 0.36 | 0.33 | 0.11 | |
| Arsenic, T (ug/L)\|BC-aDC | 12 | 0.00 | 2.34 | 0.80 | 1.04 | 1.43 | 1.19 | 0.65 | |
| Arsenic, T (ug/L)\|BC-107 | 12 | 0.00 | 2.38 | 0.90 | 1.10 | 1.61 | 1.21 | 0.63 | |
| Arsenic, T (ug/L)\|BC-bCC | 12 | 0.00 | 2.52 | 1.03 | 1.25 | 1.77 | 1.40 | 0.73 | |
| Arsenic, T (ug/L)\|SBC-3.5/4 | 12 | 0.00 | 0.86 | 0.24 | 0.26 | 0.30 | 0.29 | 0.20 | |

| Statistic | No. of Samples | Minimum | Maximum | 1st Quartile | Median | 3rd Quartile | Mean | Standard Deviation | Geometric Mean (for *E. coli*) |
|---|---|---|---|---|---|---|---|---|---|
| Selenium, D (ug/L)\|BC-Can | 12 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.01 | 0.04 | |
| Selenium, D (ug/L)\|BC-CU | 12 | 0.00 | 0.79 | 0.00 | 0.00 | 0.03 | 0.09 | 0.23 | |
| Selenium, D (ug/L)\|BC-61 | 12 | 0.00 | 0.24 | 0.00 | 0.00 | 0.04 | 0.05 | 0.09 | |
| Selenium, D (ug/L)\|BC-aWWTP | 12 | 0.00 | 0.57 | 0.00 | 0.41 | 0.52 | 0.29 | 0.26 | |
| Selenium, D (ug/L)\|WWTF Eff | 12 | 0.83 | 2.43 | 1.01 | 1.05 | 1.59 | 1.35 | 0.55 | |
| Selenium, D (ug/L)\|BC-aDC | 12 | 0.00 | 0.85 | 0.59 | 0.70 | 0.75 | 0.63 | 0.22 | |
| Selenium, D (ug/L)\|BC-107 | 12 | 0.00 | 0.89 | 0.64 | 0.73 | 0.82 | 0.66 | 0.25 | |
| Selenium, D (ug/L)\|BC-bCC | 12 | 0.46 | 2.49 | 1.30 | 1.57 | 2.09 | 1.61 | 0.62 | |
| Selenium, D (ug/L)\|SBC-3.5/4 | 12 | 0.00 | 0.19 | 0.00 | 0.00 | 0.00 | 0.03 | 0.06 | |
| Discharge (MGD)\|E-BC | 12 | 1.2 | 1.5 | 1.2 | 1.3 | 1.4 | 1.3 | 0.1 | |
| Discharge (MGD)\|11-BC | 12 | 63.0 | 2150.0 | 105.3 | 121.0 | 266.5 | 410.5 | 635.3 | |
| Stream Flow (cfs)\|BC-aWWTP | 12 | 9.8 | 1010.0 | 20.0 | 54.0 | 85.5 | 183.7 | 329.9 | |
| Stream Flow (cfs)\|BC-aDC | 12 | 34.1 | 1048.0 | 44.6 | 55.1 | 116.0 | 206.6 | 340.1 | |

| Statistic | No. of Samples | Minimum | Maximum | 1st Quartile | Median | 3rd Quartile | Mean | Standard Deviation | Geometric Mean (for *E. coli*) |
|---|---|---|---|---|---|---|---|---|---|
| Alkalinity (mg/L)\|1-CC | 4 | 320 | 600 | 350 | 390 | 465 | 425 | 124 | |
| Alkalinity (mg/L)\|2-CC | 4 | 160 | 360 | 190 | 230 | 285 | 245 | 87 | |
| Alkalinity (mg/L)\|3-CC | 12 | 120 | 342 | 201 | 214 | 244 | 223 | 59 | |
| Alkalinity (mg/L)\|6-CC | 12 | 137 | 360 | 253 | 257 | 308 | 267 | 57 | |
| Alkalinity (mg/L)\|7-CC | 12 | 137 | 308 | 231 | 266 | 278 | 253 | 50 | |
| Alkalinity (mg/L)\|CC-Ken | 12 | 113 | 261 | 200 | 247 | 252 | 222 | 45 | |
| Alkalinity (mg/L)\|4-RC | 9 | 102 | 264 | 149 | 219 | 224 | 193 | 55 | |
| Alkalinity (mg/L)\|5-RC | 12 | 160 | 312 | 235 | 254 | 291 | 254 | 45 | |
| Conductivity (umhos/cm)\|1-CC | 6 | 271 | 1436 | 550 | 1063 | 1129 | 894 | 460 | |
| Conductivity (umhos/cm)\|2-CC | 6 | 298 | 820 | 505 | 726 | 780 | 633 | 212 | |
| Conductivity (umhos/cm)\|3-CC | 12 | 329 | 1081 | 637 | 889 | 955 | 805 | 236 | |
| Conductivity (umhos/cm)\|6-CC | 12 | 711 | 2070 | 1064 | 1268 | 1352 | 1278 | 373 | |
| Conductivity (umhos/cm)\|7-CC | 12 | 753 | 1907 | 1005 | 1276 | 1347 | 1242 | 315 | |
| Conductivity (umhos/cm)\|CC-Ken | 12 | 564 | 1717 | 1075 | 1176 | 1221 | 1148 | 275 | |
| Conductivity (umhos/cm)\|4-RC | 9 | 381 | 1975 | 536 | 1111 | 1146 | 1043 | 540 | |
| Conductivity (umhos/cm)\|5-RC | 12 | 775 | 2940 | 1196 | 1349 | 1542 | 1430 | 560 | |
| DO (mg/L)\|1-CC | 3 | 7.4 | 12.3 | 7.4 | 7.4 | 9.9 | 9.0 | 2.8 | |
| DO (mg/L)\|2-CC | 3 | 5.2 | 8.3 | 5.5 | 5.9 | 7.1 | 6.5 | 1.6 | |
| DO (mg/L)\|CC-Ken | 11 | 7.8 | 13.0 | 9.6 | 9.8 | 10.5 | 10.1 | 1.3 | |
| DO (mg/L)\|4-RC | 9 | 5.4 | 12.8 | 7.1 | 9.7 | 11.3 | 9.2 | 2.7 | |
| DO (mg/L)\|5-RC | 9 | 4.1 | 12.5 | 7.1 | 9.5 | 10.7 | 9.2 | 2.7 | |
| Hardness, Total as CaCO3 (mg/L)\|1-CC | 1 | 322 | 322 | 322 | 322 | 322 | 322 | | |
| Hardness, Total as CaCO3 (mg/L)\|2-CC | 1 | 175 | 175 | 175 | 175 | 175 | 175 | | |
| Hardness, Total as CaCO3 (mg/L)\|3-CC | 12 | 120 | 360 | 266 | 291 | 312 | 277 | 68 | |
| Hardness, Total as CaCO3 (mg/L)\|6-CC | 12 | 171 | 445 | 342 | 360 | 398 | 352 | 75 | |
| Hardness, Total as CaCO3 (mg/L)\|7-CC | 12 | 188 | 428 | 338 | 351 | 364 | 340 | 63 | |
| Hardness, Total as CaCO3 (mg/L)\|4-RC | 9 | 125 | 367 | 183 | 300 | 330 | 265 | 91 | |
| Hardness, Total as CaCO3 (mg/L)\|5-RC | 12 | 193 | 459 | 360 | 394 | 416 | 372 | 79 | |
| pH (SU)\|1-CC | 7 | 7.9 | 8.5 | 8.0 | 8.1 | 8.3 | 8.1 | 0.3 | |
| pH (SU)\|A-CC | 9 | 7.1 | 7.4 | 7.1 | 7.3 | 7.3 | 7.2 | 0.1 | |
| pH (SU)\|2-CC | 7 | 7.5 | 8.1 | 7.5 | 7.7 | 7.8 | 7.7 | 0.2 | |
| pH (SU)\|3-CC | 12 | 7.9 | 8.2 | 8.1 | 8.1 | 8.1 | 8.1 | 0.1 | |
| pH (SU)\|6-CC | 12 | 7.8 | 8.5 | 8.0 | 8.1 | 8.1 | 8.1 | 0.2 | |
| pH (SU)\|7-CC | 11 | 7.5 | 8.2 | 8.0 | 8.1 | 8.2 | 8.0 | 0.2 | |
| pH (SU)\|CC-Ken | 12 | 7.4 | 8.6 | 7.9 | 8.0 | 8.3 | 8.0 | 0.4 | |
| pH (SU)\|4-RC | 9 | 7.8 | 10.9 | 8.1 | 8.5 | 8.6 | 8.7 | 0.9 | |
| pH (SU)\|B-RC | 12 | 6.9 | 7.9 | 7.0 | 7.1 | 7.4 | 7.2 | 0.3 | |
| pH (SU)\|5-RC | 12 | 8.0 | 11.6 | 8.0 | 8.1 | 8.2 | 8.4 | 1.0 | |
| Temperature (deg C)\|1-CC | 7 | 6.5 | 16.2 | 10.7 | 10.7 | 14.1 | 11.8 | 3.3 | |
| Temperature (deg C)\|A-CC | 9 | 16.3 | 21.6 | 16.8 | 19.4 | 20.5 | 18.9 | 2.0 | |
| Temperature (deg C)\|2-CC | 7 | 10.3 | 21.1 | 13.2 | 14.6 | 17.7 | 15.4 | 3.7 | |
| Temperature (deg C)\|3-CC | 12 | 0.0 | 21.3 | 4.4 | 11.1 | 15.7 | 10.9 | 7.2 | |
| Temperature (deg C)\|6-CC | 12 | 0.4 | 21.1 | 5.6 | 11.9 | 16.9 | 11.2 | 6.6 | |
| Temperature (deg C)\|7-CC | 12 | 0.3 | 21.7 | 6.7 | 12.0 | 17.2 | 11.6 | 7.1 | |
| Temperature (deg C)\|CC-Ken | 11 | 4.4 | 20.4 | 9.1 | 13.4 | 18.9 | 13.5 | 5.6 | |
| Temperature (deg C)\|4-RC | 9 | 0.9 | 21.6 | 13.0 | 13.3 | 15.7 | 13.6 | 6.2 | |
| Temperature (deg C)\|B-RC | 12 | 13.2 | 21.6 | 14.8 | 17.8 | 20.7 | 17.7 | 3.1 | |
| Temperature (deg C)\|5-RC | 12 | 0.1 | 19.7 | 3.8 | 12.4 | 16.6 | 10.6 | 7.2 | |
| E. coli (MPN/100 mL)\|1-CC | 12 | 43 | 866 | 345 | 424 | 568 | 453 | 241 | 362 |
| E. coli (MPN/100 mL)\|A-CC | 1 | 10 | 10 | 10 | 10 | 10 | 10 | | 10 |
| E. coli (MPN/100 mL)\|2-CC | 12 | 65 | 908 | 131 | 308 | 335 | 315 | 240 | 244 |
| E. coli (MPN/100 mL)\|3-CC | 12 | 46 | 879 | 80 | 149 | 344 | 266 | 266 | 168 |
| E. coli (MPN/100 mL)\|6-CC | 12 | 61 | 2420 | 157 | 387 | 472 | 517 | 638 | 326 |
| E. coli (MPN/100 mL)\|7-CC | 12 | 78 | 921 | 120 | 237 | 326 | 296 | 249 | 223 |
| E. coli (MPN/100 mL)\|CC-Ken | 12 | 36 | 2420 | 56 | 78 | 234 | 351 | 679 | 134 |
| E. coli (MPN/100 mL)\|4-RC | 9 | 6 | 731 | 20 | 94 | 138 | 180 | 252 | 69 |
| E. coli (MPN/100 mL)\|B-RC | 12 | 0 | 20 | 0 | 0 | 0 | 3 | 7 | |
| E. coli (MPN/100 mL)\|5-RC | 12 | 21 | 1727 | 118 | 166 | 306 | 376 | 504 | 204 |
| TSS (mg/L)\|1-CC | 4 | 1.4 | 17.0 | 2.5 | 3.8 | 7.8 | 6.5 | 7.1 | |
| TSS (mg/L)\|2-CC | 4 | 2.8 | 24.0 | 4.0 | 4.9 | 10.1 | 9.2 | 10.0 | |
| TSS (mg/L)\|CC-Ken | 12 | 6.0 | 558.0 | 10.5 | 26.5 | 61.8 | 80.5 | 155.6 | |
| TSS (mg/L)\|4-RC | 9 | 0.0 | 22.0 | 0.0 | 18.0 | 20.0 | 11.6 | 9.8 | |
| TSS (mg/L)\|B-RC | 12 | 0.0 | 6.0 | 0.0 | 0.0 | 0.0 | 0.9 | 2.2 | |
| TSS (mg/L)\|5-RC | 9 | 0.0 | 277.0 | 18.0 | 29.0 | 47.0 | 58.8 | 86.9 | |
| Nitrogen Ammonia as N (mg/L)\|1-CC | 12 | 0.00 | 0.07 | 0.02 | 0.03 | 0.05 | 0.03 | 0.02 | |
| Nitrogen Ammonia as N (mg/L)\|A-CC | 12 | 0.02 | 3.20 | 0.13 | 0.38 | 0.97 | 0.69 | 0.89 | |
| Nitrogen Ammonia as N (mg/L)\|2-CC | 9 | 0.02 | 1.80 | 0.07 | 0.10 | 0.58 | 0.40 | 0.58 | |

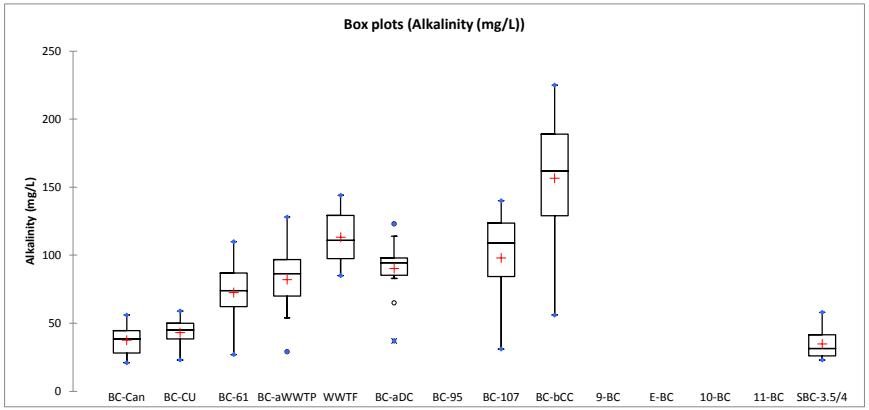
| Statistic | No. of Samples | Minimum | Maximum | 1st Quartile | Median | 3rd Quartile | Mean | Standard Deviation | Geometric Mean (for *E. coli*) |
|---|---|---|---|---|---|---|---|---|---|
| Nitrogen Ammonia as N (mg/L)\|3-CC | 12 | 0.02 | 0.32 | 0.04 | 0.07 | 0.11 | 0.09 | 0.08 | |
| Nitrogen Ammonia as N (mg/L)\|6-CC | 12 | 0.02 | 0.96 | 0.05 | 0.07 | 0.12 | 0.19 | 0.29 | |
| Nitrogen Ammonia as N (mg/L)\|C-CC | 12 | 0.10 | 16.30 | 0.19 | 0.69 | 2.75 | 2.86 | 4.81 | |
| Nitrogen Ammonia as N (mg/L)\|7-CC | 12 | 0.04 | 0.84 | 0.07 | 0.10 | 0.18 | 0.19 | 0.23 | |
| Nitrogen Ammonia as N (mg/L)\|8-CC | 12 | 0.03 | 0.84 | 0.08 | 0.15 | 0.27 | 0.23 | 0.24 | |
| Nitrogen Ammonia as N (mg/L)\|CC-Ken | 12 | 0.00 | 1.44 | 0.04 | 0.09 | 0.24 | 0.32 | 0.50 | |
| Nitrogen Ammonia as N (mg/L)\|4-RC | 9 | 0.03 | 0.78 | 0.04 | 0.06 | 0.10 | 0.15 | 0.24 | |
| Nitrogen Ammonia as N (mg/L)\|B-RC | 12 | 0.05 | 20.92 | 0.10 | 0.27 | 1.02 | 2.42 | 5.94 | |
| Nitrogen Ammonia as N (mg/L)\|5-RC | 12 | 0.01 | 3.10 | 0.06 | 0.08 | 0.47 | 0.54 | 0.94 | |
| Nitrogen Nitrate as N (mg/L)\|1-CC | 12 | 0.16 | 0.74 | 0.19 | 0.25 | 0.33 | 0.32 | 0.19 | |
| Nitrogen Nitrate as N (mg/L)\|A-CC | 12 | 3.30 | 17.30 | 4.28 | 8.05 | 10.38 | 8.41 | 5.01 | |
| Nitrogen Nitrate as N (mg/L)\|2-CC | 9 | 0.35 | 12.80 | 2.10 | 2.80 | 6.70 | 4.63 | 4.17 | |
| Nitrogen Nitrate as N (mg/L)\|3-CC | 12 | 0.31 | 6.70 | 2.88 | 3.45 | 4.18 | 3.50 | 1.83 | |
| Nitrogen Nitrate as N (mg/L)\|6-CC | 12 | 0.90 | 5.90 | 1.95 | 2.55 | 3.78 | 2.89 | 1.36 | |
| Nitrogen Nitrate as N (mg/L)\|C-CC | 12 | 13.90 | 30.10 | 21.65 | 22.95 | 26.90 | 23.56 | 4.65 | |
| Nitrogen Nitrate as N (mg/L)\|7-CC | 12 | 1.50 | 10.40 | 5.05 | 5.60 | 6.68 | 6.00 | 2.23 | |
| Nitrogen Nitrate as N (mg/L)\|8-CC | 12 | 1.30 | 8.39 | 6.03 | 6.87 | 7.86 | 6.44 | 2.08 | |
| Nitrogen Nitrate as N [Hach] (mg/L)\|CC-Ken | 12 | 0.80 | 9.30 | 3.68 | 5.05 | 7.30 | 5.22 | 2.55 | |
| Nitrogen Nitrate as N (mg/L)\|5-RC | 12 | 0.98 | 8.70 | 1.25 | 2.75 | 3.90 | 3.10 | 2.27 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|1-CC | 12 | 0.16 | 0.75 | 0.19 | 0.26 | 0.35 | 0.33 | 0.19 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|A-CC | 12 | 3.60 | 17.40 | 4.35 | 8.30 | 10.55 | 8.57 | 4.98 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|2-CC | 9 | 0.35 | 12.90 | 2.20 | 2.90 | 6.90 | 4.75 | 4.19 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|3-CC | 12 | 0.31 | 6.70 | 3.00 | 3.55 | 4.25 | 3.57 | 1.82 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|6-CC | 12 | 0.90 | 5.90 | 1.95 | 2.65 | 3.78 | 2.92 | 1.37 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|C-CC | 12 | 15.00 | 30.20 | 22.35 | 23.80 | 27.08 | 24.02 | 4.40 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|7-CC | 12 | 1.50 | 10.40 | 5.10 | 5.70 | 6.68 | 6.03 | 2.21 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|8-CC | 12 | 1.30 | 8.39 | 6.03 | 6.90 | 7.86 | 6.45 | 2.09 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|CC-Ken | 12 | 0.82 | 9.32 | 3.72 | 5.18 | 7.38 | 5.30 | 2.59 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|4-RC | 9 | 0.38 | 22.58 | 0.62 | 2.05 | 6.48 | 6.54 | 9.26 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|B-RC | 12 | 1.27 | 23.96 | 14.57 | 20.99 | 22.62 | 17.77 | 6.88 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|5-RC | 12 | 0.95 | 7.59 | 1.64 | 2.18 | 4.51 | 3.12 | 2.04 | |
| Nitrogen Nitrite as N (mg/L)\|1-CC | 12 | 0.00 | 0.08 | 0.00 | 0.00 | 0.01 | 0.01 | 0.03 | |
| Nitrogen Nitrite as N (mg/L)\|A-CC | 12 | 0.00 | 0.40 | 0.08 | 0.11 | 0.25 | 0.16 | 0.13 | |
| Nitrogen Nitrite as N (mg/L)\|2-CC | 9 | 0.00 | 0.42 | 0.05 | 0.08 | 0.23 | 0.13 | 0.14 | |
| Nitrogen Nitrite as N (mg/L)\|3-CC | 12 | 0.00 | 0.20 | 0.01 | 0.06 | 0.12 | 0.07 | 0.07 | |
| Nitrogen Nitrite as N (mg/L)\|6-CC | 12 | 0.00 | 0.11 | 0.00 | 0.00 | 0.04 | 0.03 | 0.04 | |
| Nitrogen Nitrite as N (mg/L)\|C-CC | 12 | 0.00 | 1.80 | 0.09 | 0.20 | 0.56 | 0.45 | 0.57 | |
| Nitrogen Nitrite as N (mg/L)\|7-CC | 12 | 0.00 | 0.21 | 0.00 | 0.03 | 0.05 | 0.05 | 0.06 | |
| Nitrogen Nitrite as N (mg/L)\|8-CC | 12 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | |
| Nitrogen Nitrite as N (mg/L)\|CC-Ken | 12 | 0.01 | 0.22 | 0.03 | 0.05 | 0.12 | 0.08 | 0.07 | |
| Nitrogen Nitrite as N (mg/L)\|5-RC | 12 | 0.00 | 0.34 | 0.00 | 0.00 | 0.04 | 0.04 | 0.10 | |
| Nitrogen TKN (mg/L)\|1-CC | 12 | 0.05 | 0.77 | 0.39 | 0.47 | 0.62 | 0.49 | 0.21 | |
| Nitrogen TKN (mg/L)\|A-CC | 12 | 0.46 | 5.40 | 1.23 | 1.90 | 2.88 | 2.23 | 1.36 | |
| Nitrogen TKN (mg/L)\|2-CC | 9 | 0.11 | 2.50 | 0.62 | 1.10 | 2.10 | 1.29 | 0.85 | |
| Nitrogen TKN (mg/L)\|3-CC | 12 | 0.05 | 1.50 | 0.85 | 0.99 | 1.20 | 0.95 | 0.37 | |
| Nitrogen TKN (mg/L)\|6-CC | 12 | 0.05 | 1.70 | 0.93 | 1.15 | 1.63 | 1.16 | 0.50 | |
| Nitrogen TKN (mg/L)\|C-CC | 12 | 0.00 | 10.20 | 0.00 | 1.28 | 3.13 | 2.72 | 3.75 | |
| Nitrogen TKN (mg/L)\|7-CC | 12 | 0.08 | 2.00 | 1.12 | 1.40 | 1.63 | 1.31 | 0.51 | |
| Nitrogen TKN (mg/L)\|8-CC | 12 | 0.20 | 2.35 | 0.89 | 1.04 | 1.58 | 1.20 | 0.68 | |
| Nitrogen TKN (mg/L)\|CC-Ken | 12 | 0.74 | 2.41 | 0.91 | 1.20 | 1.58 | 1.36 | 0.59 | |
| Nitrogen TKN (mg/L)\|4-RC | 12 | 0.00 | 1.70 | 0.52 | 0.67 | 0.83 | 0.69 | 0.40 | |
| Nitrogen TKN (mg/L)\|B-RC | 12 | 0.00 | 23.30 | 0.18 | 0.70 | 2.10 | 3.16 | 6.58 | |
| Nitrogen TKN (mg/L)\|5-RC | 12 | 0.71 | 4.10 | 0.92 | 1.32 | 1.76 | 1.62 | 0.99 | |
| Nitrogen Total (mg/L)\|1-CC | 12 | 0.61 | 1.50 | 0.68 | 0.75 | 0.89 | 0.82 | 0.25 | |
| Nitrogen Total (mg/L)\|A-CC | 12 | 4.30 | 19.20 | 7.58 | 9.95 | 12.88 | 10.79 | 4.60 | |
| Nitrogen Total (mg/L)\|2-CC | 9 | 1.20 | 15.00 | 2.30 | 4.40 | 9.10 | 6.04 | 4.70 | |
| Nitrogen Total (mg/L)\|3-CC | 12 | 1.31 | 7.68 | 3.91 | 4.60 | 5.37 | 4.52 | 1.91 | |
| Nitrogen Total (mg/L)\|6-CC | 12 | 1.85 | 6.64 | 3.32 | 3.75 | 4.82 | 4.07 | 1.43 | |
| Nitrogen Total (mg/L)\|C-CC | 12 | 19.40 | 33.20 | 23.85 | 26.15 | 31.07 | 26.74 | 4.49 | |
| Nitrogen Total (mg/L)\|7-CC | 12 | 3.20 | 11.29 | 6.55 | 7.25 | 8.02 | 7.34 | 2.14 | |
| Nitrogen Total (mg/L)\|8-CC | 12 | 2.25 | 9.90 | 7.56 | 8.41 | 8.89 | 7.64 | 2.23 | |
| Nitrogen Total (mg/L)\|CC-Ken | 12 | 2.89 | 11.17 | 4.94 | 6.46 | 8.42 | 6.66 | 2.64 | |
| Nitrogen Total (mg/L)\|4-RC | 9 | 0.74 | 23.00 | 1.34 | 2.72 | 8.16 | 7.22 | 9.10 | |
| Nitrogen Total (mg/L)\|B-RC | 12 | 13.13 | 24.92 | 17.40 | 22.73 | 23.93 | 20.94 | 3.91 | |
| Nitrogen Total (mg/L)\|5-RC | 12 | 2.24 | 8.87 | 2.93 | 4.29 | 5.59 | 4.70 | 2.30 | |
| Nitrogen Total Inorganic (mg/L)\|1-CC | 12 | 0.2 | 0.8 | 0.2 | 0.3 | 0.4 | 0.4 | 0.2 | |
| Nitrogen Total Inorganic (mg/L)\|A-CC | 12 | 4.0 | 17.6 | 5.5 | 8.5 | 11.0 | 9.3 | 4.6 | |

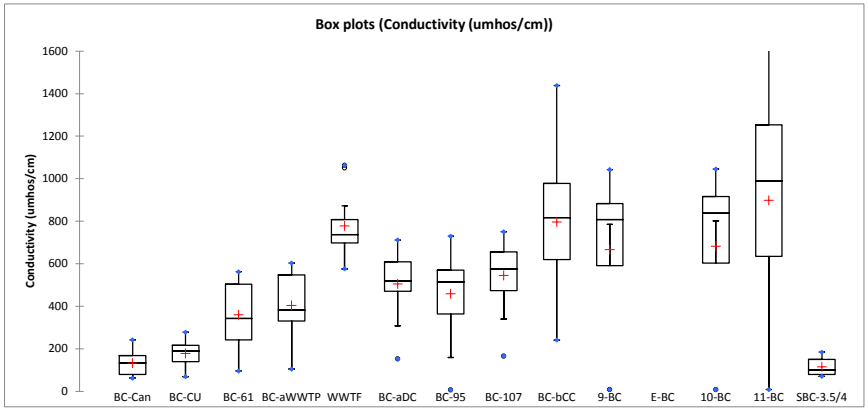
| Statistic | No. of Samples | Minimum | Maximum | 1st Quartile | Median | 3rd Quartile | Mean | Standard Deviation | Geometric Mean (for *E. coli*) |
|---|---|---|---|---|---|---|---|---|---|
| Nitrogen Total Inorganic (mg/L)\|2-CC | 9 | 0.4 | 12.9 | 2.5 | 4.7 | 7.5 | 5.1 | 4.1 | |
| Nitrogen Total Inorganic (mg/L)\|3-CC | 12 | 0.3 | 6.8 | 3.1 | 3.6 | 4.4 | 3.7 | 1.8 | |
| Nitrogen Total Inorganic (mg/L)\|6-CC | 12 | 1.0 | 5.9 | 2.0 | 2.7 | 4.1 | 3.1 | 1.5 | |
| Nitrogen Total Inorganic (mg/L)\|C-CC | 12 | 21.0 | 39.3 | 22.6 | 25.9 | 30.2 | 26.9 | 5.4 | |
| Nitrogen Total Inorganic (mg/L)\|7-CC | 12 | 1.6 | 10.4 | 5.2 | 6.0 | 7.0 | 6.2 | 2.2 | |
| Nitrogen Total Inorganic (mg/L)\|8-CC | 12 | 1.5 | 8.9 | 6.3 | 7.1 | 8.0 | 6.7 | 2.1 | |
| Nitrogen Total Inorganic (mg/L)\|CC-Ken | 12 | 0.9 | 10.3 | 3.9 | 5.5 | 7.5 | 5.6 | 2.8 | |
| Nitrogen Total Inorganic (mg/L)\|4-RC | 9 | 0.5 | 23.0 | 0.7 | 2.1 | 7.3 | 6.7 | 9.3 | |
| Nitrogen Total Inorganic (mg/L)\|B-RC | 12 | 12.3 | 24.0 | 16.5 | 22.4 | 23.0 | 20.1 | 4.1 | |
| Nitrogen Total Inorganic (mg/L)\|5-RC | 12 | 1.0 | 8.0 | 1.7 | 3.2 | 4.8 | 3.7 | 2.4 | |
| Phosphorus as P, Tot (mg/L)\|1-CC | 12 | 0.00 | 0.09 | 0.00 | 0.02 | 0.02 | 0.02 | 0.03 | |
| Phosphorus as P, Tot (mg/L)\|A-CC | 12 | 0.12 | 2.30 | 0.49 | 1.15 | 1.83 | 1.15 | 0.77 | |
| Phosphorus as P, Tot (mg/L)\|2-CC | 9 | 0.00 | 1.60 | 0.12 | 0.17 | 0.42 | 0.36 | 0.49 | |
| Phosphorus as P, Tot (mg/L)\|3-CC | 12 | 0.06 | 1.20 | 0.16 | 0.29 | 0.66 | 0.41 | 0.35 | |
| Phosphorus as P, Tot (mg/L)\|6-CC | 12 | 0.10 | 0.53 | 0.15 | 0.37 | 0.49 | 0.32 | 0.18 | |
| Phosphorus as P, Tot (mg/L)\|C-CC | 12 | 1.90 | 3.80 | 2.08 | 2.30 | 2.65 | 2.43 | 0.53 | |
| Phosphorus as P, Tot (mg/L)\|7-CC | 12 | 0.36 | 0.95 | 0.49 | 0.56 | 0.80 | 0.62 | 0.19 | |
| Phosphorus as P, Tot (mg/L)\|8-CC | 12 | 0.35 | 1.02 | 0.61 | 0.68 | 0.86 | 0.71 | 0.18 | |
| Phosphorus as P, Tot (mg/L)\|CC-Ken | 12 | 0.38 | 1.24 | 0.62 | 0.73 | 0.84 | 0.77 | 0.25 | |
| Phosphorus as P, Tot (mg/L)\|4-RC | 9 | 0.04 | 2.26 | 0.08 | 0.10 | 0.90 | 0.64 | 0.92 | |
| Phosphorus as P, Tot (mg/L)\|B-RC | 12 | 2.02 | 4.06 | 2.22 | 2.74 | 2.80 | 2.66 | 0.56 | |
| Phosphorus as P, Tot (mg/L)\|5-RC | 12 | 0.14 | 0.82 | 0.22 | 0.43 | 0.48 | 0.39 | 0.20 | |
| Arsenic, T (mg/L)\|1-CC | 1 | 0.510 | 0.510 | 0.510 | 0.510 | 0.510 | 0.510 | | |
| Arsenic, T (mg/L)\|2-CC | 1 | 0.420 | 0.420 | 0.420 | 0.420 | 0.420 | 0.420 | | |
| Discharge (MGD)\|A-CC | 9 | 1.3 | 2.5 | 1.5 | 1.7 | 2.1 | 1.8 | 0.5 | |
| Discharge (MGD)\|C-CC | 9 | 2.0 | 2.8 | 2.1 | 2.2 | 2.4 | 2.3 | 0.3 | |
| Discharge (MGD)\|B-RC | 365 | 0.0 | 2.0 | 0.3 | 0.7 | 1.0 | 0.7 | 0.4 | |

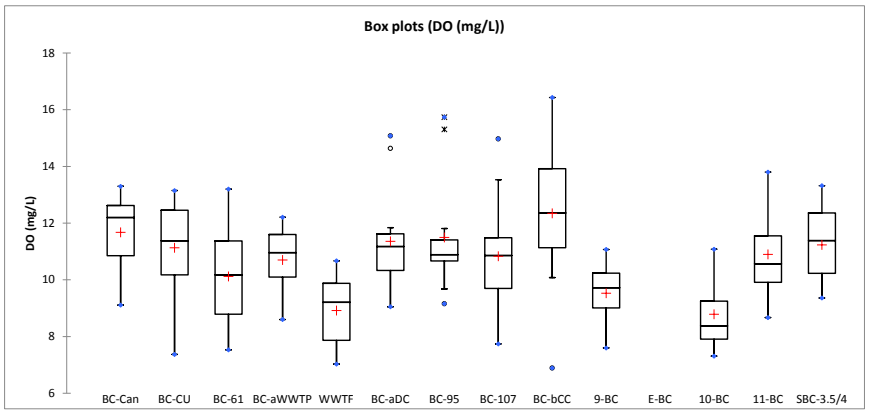
| Sample | No. of Samples | Minimum | Maximum | 1st Quartile | Median | 3rd Quartile | Mean | Standard Deviation | Geometric Mean (for *E. coli*) |
|---|---|---|---|---|---|---|---|---|---|
| Alkalinity (mg/L)\|M9.5-SV | 8 | 52 | 110 | 65 | 73 | 83 | 77 | 19 | |
| Alkalinity (mg/L)\|M8.9-SV | 8 | 64 | 118 | 73 | 81 | 100 | 87 | 20 | |
| Alkalinity (mg/L)\|M8.4-SV | 8 | 80 | 158 | 88 | 105 | 128 | 112 | 29 | |
| Alkalinity (mg/L)\|M8.2-SV | 8 | 116 | 189 | 125 | 133 | 166 | 144 | 27 | |
| Alkalinity (mg/L)\|M8-SV | 12 | 30 | 213 | 99 | 128 | 139 | 121 | 50 | |
| Alkalinity (mg/L)\|T11-LH | 12 | 39 | 307 | 137 | 192 | 223 | 174 | 79 | |
| Alkalinity (mg/L)\|T-EFF | 12 | 85 | 166 | 99 | 104 | 114 | 109 | 22 | |
| Alkalinity (mg/L)\|M7-SV | 12 | 36 | 175 | 120 | 134 | 142 | 125 | 42 | |
| Alkalinity (mg/L)\|M6-SV | 8 | 121 | 195 | 131 | 146 | 174 | 153 | 28 | |
| Conductivity (umhos/cm)\|M9.5-SV | 8 | 232 | 403 | 248 | 271 | 344 | 295 | 64 | |
| Conductivity (umhos/cm)\|M8.9-SV | 8 | 238 | 431 | 284 | 310 | 354 | 323 | 62 | |
| Conductivity (umhos/cm)\|M8.4-SV | 8 | 332 | 660 | 381 | 468 | 570 | 480 | 120 | |
| Conductivity (umhos/cm)\|M8.2-SV | 8 | 588 | 1170 | 616 | 730 | 866 | 775 | 196 | |
| Conductivity (umhos/cm)\|M8-SV | 12 | 138 | 1050 | 552 | 686 | 816 | 664 | 274 | |
| Conductivity (umhos/cm)\|T11-LH | 12 | 162 | 1223 | 571 | 741 | 876 | 689 | 307 | |
| Conductivity (umhos/cm)\|T-EFF | 12 | 755 | 1216 | 801 | 815 | 881 | 876 | 137 | |
| Conductivity (umhos/cm)\|M7-SV | 12 | 172 | 947 | 631 | 771 | 846 | 693 | 243 | |
| Conductivity (umhos/cm)\|M6-SV | 8 | 632 | 1027 | 677 | 798 | 948 | 812 | 155 | |
| DO (mg/L)\|M9.5-SV | 8 | 7.1 | 13.7 | 7.9 | 9.3 | 11.1 | 9.7 | 2.3 | |
| DO (mg/L)\|M8.9-SV | 8 | 7.5 | 14.2 | 7.9 | 9.3 | 10.7 | 9.8 | 2.4 | |
| DO (mg/L)\|M8.4-SV | 8 | 7.8 | 13.2 | 8.5 | 9.9 | 10.8 | 10.0 | 1.9 | |
| DO (mg/L)\|M8.2-SV | 8 | 7.9 | 13.1 | 8.4 | 9.9 | 10.9 | 10.0 | 2.0 | |
| DO (mg/L)\|M8-SV | 12 | 7.5 | 13.9 | 9.8 | 10.7 | 11.9 | 10.8 | 1.7 | |
| DO (mg/L)\|T11-LH | 12 | 7.4 | 13.1 | 8.7 | 9.8 | 11.0 | 9.9 | 1.8 | |
| DO (mg/L)\|T-EFF | 12 | 1.9 | 8.0 | 4.0 | 5.4 | 7.3 | 5.3 | 2.0 | |
| DO (mg/L)\|M7-SV | 12 | 7.6 | 13.1 | 8.7 | 9.9 | 11.1 | 9.9 | 1.8 | |
| DO (mg/L)\|M6-SV | 8 | 7.5 | 13.6 | 7.6 | 9.7 | 10.4 | 9.6 | 2.1 | |
| Hardness, Total as CaCO3 (mg/L)\|M9.5-SV | 8 | 89 | 183 | 104 | 110 | 145 | 125 | 34 | |
| Hardness, Total as CaCO3 (mg/L)\|M8.9-SV | 8 | 101 | 187 | 117 | 125 | 146 | 135 | 29 | |
| Hardness, Total as CaCO3 (mg/L)\|M8.4-SV | 8 | 132 | 275 | 154 | 171 | 216 | 189 | 52 | |
| Hardness, Total as CaCO3 (mg/L)\|M8.2-SV | 8 | 226 | 475 | 243 | 301 | 348 | 311 | 83 | |
| Hardness, Total as CaCO3 (mg/L)\|M8-SV | 12 | 67 | 436 | 226 | 260 | 310 | 264 | 107 | |
| Hardness, Total as CaCO3 (mg/L)\|T11-LH | 12 | 56 | 542 | 240 | 328 | 390 | 303 | 139 | |
| Hardness, Total as CaCO3 (mg/L)\|T-EFF | 12 | 190 | 408 | 205 | 211 | 259 | 242 | 63 | |
| Hardness, Total as CaCO3 (mg/L)\|M7-SV | 12 | 66 | 347 | 234 | 278 | 300 | 253 | 85 | |
| Hardness, Total as CaCO3 (mg/L)\|M6-SV | 8 | 241 | 390 | 250 | 301 | 372 | 310 | 63 | |
| pH (SU)\|M9.5-SV | 8 | 7.1 | 8.3 | 7.3 | 7.6 | 8.0 | 7.6 | 0.5 | |
| pH (SU)\|M8.9-SV | 8 | 7.1 | 8.3 | 7.3 | 7.6 | 7.8 | 7.6 | 0.4 | |
| pH (SU)\|M8.4-SV | 8 | 7.3 | 8.4 | 7.8 | 8.0 | 8.1 | 7.9 | 0.4 | |
| pH (SU)\|M8.2-SV | 8 | 7.4 | 8.4 | 7.7 | 7.8 | 7.9 | 7.9 | 0.3 | |
| pH (SU)\|M8-SV | 12 | 7.3 | 8.5 | 7.7 | 8.1 | 8.4 | 8.0 | 0.4 | |
| pH (SU)\|T11-LH | 12 | 7.3 | 8.3 | 7.7 | 7.8 | 8.3 | 7.9 | 0.4 | |
| pH (SU)\|T-EFF | 12 | 6.5 | 7.9 | 6.6 | 6.8 | 7.2 | 6.9 | 0.4 | |
| pH (SU)\|M7-SV | 12 | 6.9 | 8.0 | 7.1 | 7.6 | 7.7 | 7.5 | 0.4 | |
| pH (SU)\|M6-SV | 8 | 7.3 | 8.1 | 7.5 | 7.8 | 7.9 | 7.7 | 0.3 | |
| Temperature (deg C)\|M9.5-SV | 8 | 0.0 | 19.7 | 7.0 | 13.6 | 19.2 | 12.3 | 7.4 | |
| Temperature (deg C)\|M8.9-SV | 8 | 0.0 | 20.6 | 7.2 | 13.4 | 18.5 | 12.3 | 7.5 | |
| Temperature (deg C)\|M8.4-SV | 8 | 0.5 | 20.1 | 8.8 | 13.8 | 18.0 | 12.6 | 6.8 | |
| Temperature (deg C)\|M8.2-SV | 8 | 0.9 | 19.2 | 8.9 | 12.9 | 17.3 | 12.2 | 6.3 | |
| Temperature (deg C)\|M8-SV | 12 | 0.4 | 22.3 | 5.9 | 12.8 | 16.0 | 11.6 | 7.3 | |
| Temperature (deg C)\|T11-LH | 12 | -0.1 | 22.3 | 6.2 | 11.4 | 16.8 | 11.4 | 7.1 | |
| Temperature (deg C)\|T-EFF | 12 | 12.9 | 21.8 | 14.6 | 16.8 | 20.3 | 17.2 | 3.3 | |
| Temperature (deg C)\|M7-SV | 12 | 4.1 | 20.0 | 6.8 | 10.7 | 16.4 | 11.5 | 6.0 | |
| Temperature (deg C)\|M6-SV | 8 | 4.8 | 20.3 | 8.9 | 13.3 | 18.1 | 13.2 | 5.9 | |
| E. coli (MPN/100 mL)\|M9.5-SV | 7 | 8 | 387 | 24 | 93 | 102 | 106 | 131 | 53 |
| E. coli (MPN/100 mL)\|M8.9-SV | 7 | 16 | 461 | 28 | 75 | 154 | 131 | 162 | 69 |
| E. coli (MPN/100 mL)\|M8.4-SV | 7 | 12 | 158 | 37 | 66 | 75 | 65 | 48 | 50 |
| E. coli (MPN/100 mL)\|M8.2-SV | 7 | 23 | 133 | 65 | 99 | 125 | 91 | 43 | 78 |
| E. coli (MPN/100 mL)\|M8-SV | 12 | 33 | 411 | 65 | 144 | 194 | 152 | 112 | 116 |
| E. coli (MPN/100 mL)\|T11-LH | 12 | 7 | 921 | 35 | 140 | 185 | 191 | 250 | 93 |
| E. coli (MPN/100 mL)\|T-EFF | 12 | 13 | 128 | 27 | 44 | 56 | 48 | 32 | 40 |
| E. coli (MPN/100 mL)\|M7-SV | 12 | 56 | 435 | 72 | 146 | 229 | 175 | 118 | 142 |
| E. coli (MPN/100 mL)\|M6-SV | 8 | 28 | 416 | 88 | 105 | 197 | 158 | 128 | 119 |
| TSS (mg/L)\|M9.5-SV | 8 | 1.0 | 5.0 | 1.8 | 3.0 | 3.8 | 2.9 | 1.5 | |
| TSS (mg/L)\|M8.9-SV | 8 | 1.0 | 4.0 | 1.6 | 2.5 | 3.7 | 2.6 | 1.2 | |
| TSS (mg/L)\|M8.4-SV | 8 | 1.2 | 4.8 | 2.1 | 3.3 | 4.1 | 3.2 | 1.3 | |
| TSS (mg/L)\|M8.2-SV | 8 | 1.2 | 13.6 | 1.9 | 3.4 | 5.6 | 4.6 | 4.1 | |
| TSS (mg/L)\|M8-SV | 12 | 1.8 | 95.0 | 5.3 | 8.5 | 38.5 | 22.4 | 27.5 | |
| TSS (mg/L)\|T11-LH | 12 | 4.2 | 206.0 | 10.0 | 14.6 | 26.3 | 34.3 | 56.1 | |
| TSS (mg/L)\|T-EFF | 12 | 3.2 | 11.2 | 4.6 | 5.4 | 9.2 | 6.5 | 2.9 | |
| TSS (mg/L)\|M7-SV | 12 | 4.4 | 127.0 | 6.0 | 11.2 | 17.8 | 23.0 | 34.5 | |

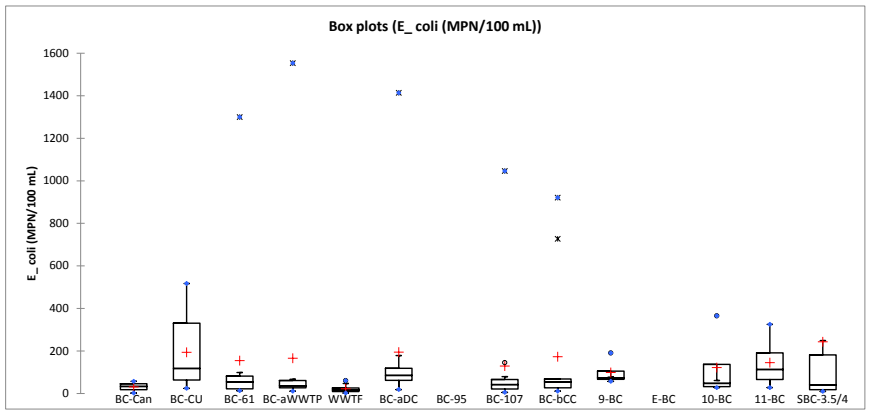
| Sample | No. of Samples | Minimum | Maximum | 1st Quartile | Median | 3rd Quartile | Mean | Standard Deviation | Geometric Mean (for *E. coli*) |
|---|---|---|---|---|---|---|---|---|---|
| TSS (mg/L)\|M6-SV | 8 | 2.4 | 36.4 | 3.9 | 5.7 | 17.4 | 11.6 | 11.8 | |
| Nitrogen Ammonia as N (mg/L)\|M9.5-SV | 8 | 0.03 | 0.05 | 0.03 | 0.03 | 0.05 | 0.04 | 0.01 | |
| Nitrogen Ammonia as N (mg/L)\|M8.9-SV | 8 | 0.03 | 0.05 | 0.03 | 0.03 | 0.03 | 0.03 | 0.01 | |
| Nitrogen Ammonia as N (mg/L)\|M8.4-SV | 8 | 0.01 | 0.13 | 0.04 | 0.04 | 0.05 | 0.05 | 0.03 | |
| Nitrogen Ammonia as N (mg/L)\|M8.2-SV | 8 | 0.02 | 0.06 | 0.03 | 0.04 | 0.04 | 0.04 | 0.01 | |
| Nitrogen Ammonia as N (mg/L)\|M8-SV | 12 | 0.02 | 0.16 | 0.03 | 0.04 | 0.05 | 0.06 | 0.04 | |
| Nitrogen Ammonia as N (mg/L)\|T11-LH | 12 | 0.03 | 0.25 | 0.03 | 0.04 | 0.04 | 0.06 | 0.06 | |
| Nitrogen Ammonia as N (mg/L)\|Long-Eff | 12 | 0.12 | 1.61 | 0.18 | 0.25 | 0.90 | 0.53 | 0.50 | |
| Nitrogen Ammonia as N (mg/L)\|T-EFF | 12 | 0.08 | 2.86 | 0.10 | 0.13 | 0.22 | 0.41 | 0.79 | |
| Nitrogen Ammonia as N (mg/L)\|M7-SV | 12 | 0.04 | 0.75 | 0.05 | 0.08 | 0.11 | 0.14 | 0.20 | |
| Nitrogen Ammonia as N (mg/L)\|M6-SV | 8 | 0.07 | 0.33 | 0.08 | 0.09 | 0.10 | 0.12 | 0.09 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|M9.5-SV | 8 | 0.01 | 0.25 | 0.03 | 0.08 | 0.16 | 0.10 | 0.09 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|M8.9-SV | 8 | 0.05 | 0.19 | 0.06 | 0.08 | 0.15 | 0.10 | 0.06 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|M8.4-SV | 8 | 0.10 | 0.22 | 0.13 | 0.18 | 0.19 | 0.16 | 0.05 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|M8.2-SV | 8 | 0.34 | 0.53 | 0.34 | 0.42 | 0.45 | 0.42 | 0.08 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|M8-SV | 12 | 0.20 | 0.89 | 0.35 | 0.51 | 0.60 | 0.49 | 0.20 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|T11-LH | 12 | 0.13 | 1.43 | 0.31 | 0.50 | 0.63 | 0.54 | 0.35 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|Long-Eff | 12 | 12.40 | 17.60 | 13.30 | 14.40 | 15.78 | 14.64 | 1.75 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|T-EFF | 12 | 9.69 | 16.15 | 11.90 | 12.85 | 13.99 | 13.14 | 1.89 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|M7-SV | 12 | 0.35 | 6.80 | 2.30 | 2.80 | 4.13 | 3.13 | 1.91 | |
| Nitrogen Nitrate/Nitrite as N (mg/L)\|M6-SV | 8 | 2.02 | 6.11 | 2.52 | 2.65 | 3.32 | 3.20 | 1.32 | |
| Nitrogen TKN (mg/L)\|M8-SV | 12 | 0.00 | 0.63 | 0.35 | 0.45 | 0.53 | 0.40 | 0.21 | |
| Nitrogen TKN (mg/L)\|T11-LH | 12 | 0.00 | 0.93 | 0.15 | 0.27 | 0.48 | 0.32 | 0.28 | |
| Nitrogen TKN (mg/L)\|Long-Eff | 12 | 1.10 | 4.24 | 1.96 | 2.42 | 2.96 | 2.52 | 0.93 | |
| Nitrogen TKN (mg/L)\|M7-SV | 12 | 0.49 | 1.66 | 0.60 | 0.69 | 0.88 | 0.79 | 0.31 | |
| Nitrogen Total (mg/L)\|M8-SV | 12 | 0.21 | 1.39 | 0.76 | 0.99 | 1.02 | 0.89 | 0.31 | |
| Nitrogen Total (mg/L)\|T11-LH | 12 | 0.13 | 2.37 | 0.62 | 0.75 | 0.91 | 0.86 | 0.55 | |
| Nitrogen Total (mg/L)\|Long-Eff | 12 | 14.60 | 19.60 | 15.59 | 16.97 | 18.69 | 17.16 | 1.74 | |
| Nitrogen Total (mg/L)\|M7-SV | 12 | 1.09 | 7.70 | 3.00 | 3.46 | 4.73 | 3.92 | 2.09 | |
| Nitrogen Total Inorganic (mg/L)\|M9.5-SV | 8 | 0.04 | 0.27 | 0.07 | 0.12 | 0.20 | 0.14 | 0.09 | |
| Nitrogen Total Inorganic (mg/L)\|M8.9-SV | 8 | 0.08 | 0.23 | 0.09 | 0.11 | 0.18 | 0.13 | 0.06 | |
| Nitrogen Total Inorganic (mg/L)\|M8.4-SV | 8 | 0.14 | 0.26 | 0.20 | 0.22 | 0.23 | 0.21 | 0.04 | |
| Nitrogen Total Inorganic (mg/L)\|M8.2-SV | 8 | 0.36 | 0.57 | 0.38 | 0.46 | 0.50 | 0.46 | 0.08 | |
| Nitrogen Total Inorganic (mg/L)\|M8-SV | 12 | 0.25 | 0.93 | 0.40 | 0.58 | 0.63 | 0.55 | 0.18 | |
| Nitrogen Total Inorganic (mg/L)\|T11-LH | 12 | 0.16 | 1.47 | 0.43 | 0.53 | 0.67 | 0.60 | 0.34 | |
| Nitrogen Total Inorganic (mg/L)\|Long-Eff | 12 | 12.54 | 18.21 | 14.12 | 14.68 | 16.07 | 15.18 | 1.77 | |
| Nitrogen Total Inorganic (mg/L)\|T-EFF | 12 | 9.77 | 18.10 | 12.41 | 13.08 | 14.26 | 13.54 | 2.27 | |
| Nitrogen Total Inorganic (mg/L)\|M7-SV | 12 | 0.48 | 6.90 | 2.35 | 2.88 | 4.20 | 3.27 | 1.99 | |
| Nitrogen Total Inorganic (mg/L)\|M6-SV | 8 | 2.08 | 6.20 | 2.64 | 2.74 | 3.47 | 3.32 | 1.35 | |
| Phosphorus as P, Tot (mg/L)\|M9.5-SV | 8 | 0.00 | 0.02 | 0.01 | 0.02 | 0.02 | 0.02 | 0.01 | |
| Phosphorus as P, Tot (mg/L)\|M8.9-SV | 8 | 0.01 | 0.05 | 0.01 | 0.02 | 0.03 | 0.02 | 0.01 | |
| Phosphorus as P, Tot (mg/L)\|M8.4-SV | 8 | 0.01 | 0.04 | 0.01 | 0.02 | 0.03 | 0.02 | 0.01 | |
| Phosphorus as P, Tot (mg/L)\|M8.2-SV | 8 | 0.01 | 0.06 | 0.01 | 0.02 | 0.03 | 0.03 | 0.02 | |
| Phosphorus as P, Tot (mg/L)\|M8-SV | 12 | 0.02 | 0.15 | 0.02 | 0.03 | 0.06 | 0.05 | 0.04 | |
| Phosphorus as P, Tot (mg/L)\|T11-LH | 12 | 0.02 | 0.45 | 0.03 | 0.05 | 0.08 | 0.11 | 0.15 | |
| Phosphorus as P, Tot (mg/L)\|Long-Eff | 12 | 0.76 | 3.42 | 1.30 | 2.49 | 2.96 | 2.25 | 0.93 | |
| Phosphorus as P, Tot (mg/L)\|T-EFF | 12 | 0.35 | 3.91 | 0.96 | 2.54 | 2.99 | 2.21 | 1.19 | |
| Phosphorus as P, Tot (mg/L)\|M7-SV | 12 | 0.08 | 1.40 | 0.35 | 0.52 | 0.82 | 0.60 | 0.39 | |
| Phosphorus as P, Tot (mg/L)\|M6-SV | 8 | 0.18 | 1.37 | 0.40 | 0.49 | 0.69 | 0.60 | 0.36 | |
| Arsenic, T (ug/L)\|M9.5-SV | 8 | 0.00 | 0.70 | 0.23 | 0.30 | 0.60 | 0.35 | 0.27 | |
| Arsenic, T (ug/L)\|M8.9-SV | 8 | 0.30 | 0.80 | 0.30 | 0.40 | 0.60 | 0.46 | 0.19 | |
| Arsenic, T (ug/L)\|M8.4-SV | 8 | 0.20 | 0.80 | 0.40 | 0.45 | 0.70 | 0.51 | 0.20 | |
| Arsenic, T (ug/L)\|M8.2-SV | 8 | 0.40 | 1.00 | 0.48 | 0.55 | 0.75 | 0.63 | 0.23 | |
| Arsenic, T (ug/L)\|M8-SV | 12 | 0.40 | 1.30 | 0.50 | 0.70 | 1.10 | 0.77 | 0.33 | |
| Arsenic, T (ug/L)\|T11-LH | 12 | 0.60 | 4.00 | 0.78 | 0.95 | 1.28 | 1.26 | 0.94 | |
| Arsenic, T (ug/L)\|T-EFF | 12 | 0.20 | 0.50 | 0.30 | 0.30 | 0.40 | 0.33 | 0.10 | |
| Arsenic, T (ug/L)\|M7-SV | 12 | 0.40 | 2.10 | 0.48 | 0.60 | 0.73 | 0.73 | 0.47 | |
| Arsenic, T (ug/L)\|M6-SV | 8 | 0.50 | 1.20 | 0.50 | 0.65 | 0.78 | 0.71 | 0.26 | |
| Stream Flow (cfs)\|M9.5-SV | 7 | 2.4 | 19.6 | 5.5 | 15.3 | 17.8 | 12.0 | 7.3 | |
| Stream Flow (cfs)\|M8.9-SV | 8 | 5.9 | 31.1 | 12.0 | 17.0 | 26.2 | 18.1 | 9.3 | |
| Stream Flow (cfs)\|M8.4-SV | 8 | 9.4 | 37.4 | 13.7 | 20.2 | 27.1 | 21.5 | 10.5 | |
| Stream Flow (cfs)\|M8.2-SV | 8 | 11.5 | 40.0 | 15.5 | 27.1 | 34.4 | 25.8 | 11.1 | |
| Stream Flow (cfs)\|M8-SV | 6 | 18.5 | 62.8 | 21.6 | 30.4 | 32.9 | 32.4 | 16.2 | |
| Stream Flow (cfs)\|T11-LH | 10 | 4.6 | 30.0 | 9.7 | 13.0 | 19.0 | 14.9 | 8.4 | |
| Stream Flow (cfs)\|T-EFF | 12 | 7.1 | 14.1 | 11.2 | 12.4 | 13.4 | 12.0 | 1.9 | |
| Stream Flow (cfs)\|M7-SV | 11 | 40.2 | 1590.0 | 51.5 | 59.2 | 96.9 | 241.4 | 466.4 | |
| Stream Flow (cfs)\|M6-SV | 7 | 43.9 | 99.8 | 55.5 | 65.4 | 88.4 | 71.0 | 21.2 | |

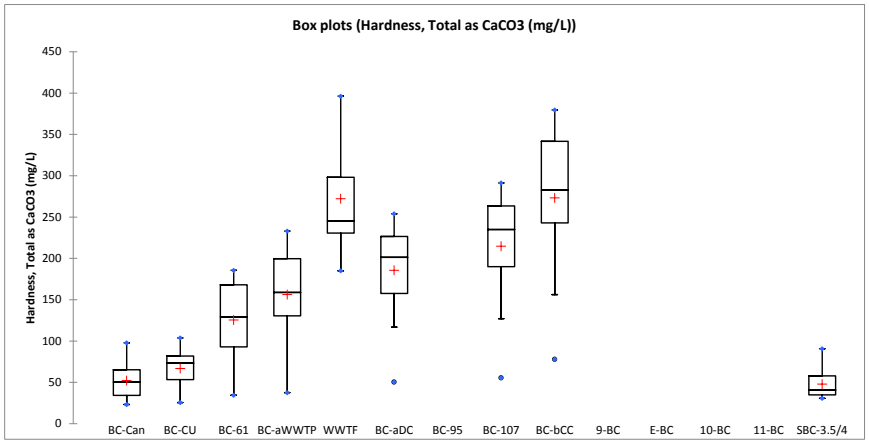
# Appendix C. Boxplots

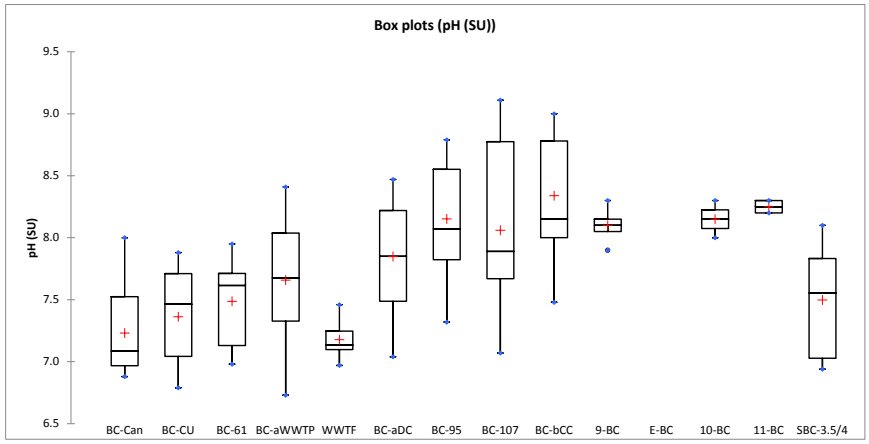

Box plots (Alkalinity (mg/L))
Alkalinity (mg/L)
0
50
100
150
200
250
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

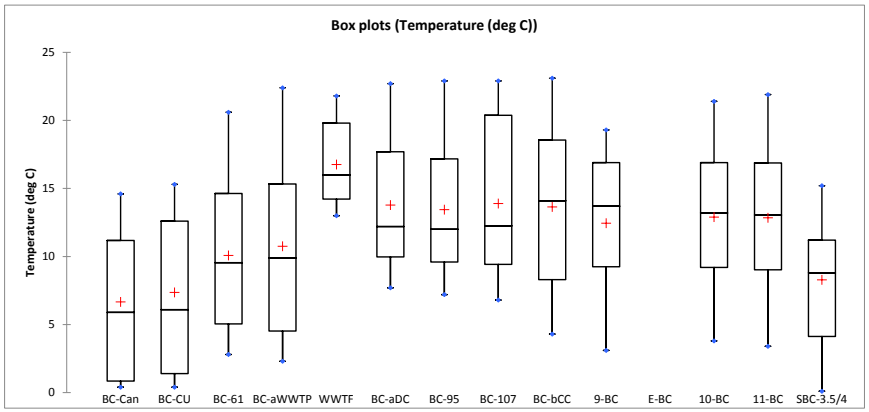

Box plots (Conductivity (umhos/cm))
Conductivity (umhos/cm)
0
200
400
600
800
1000
1200
1400
1600
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

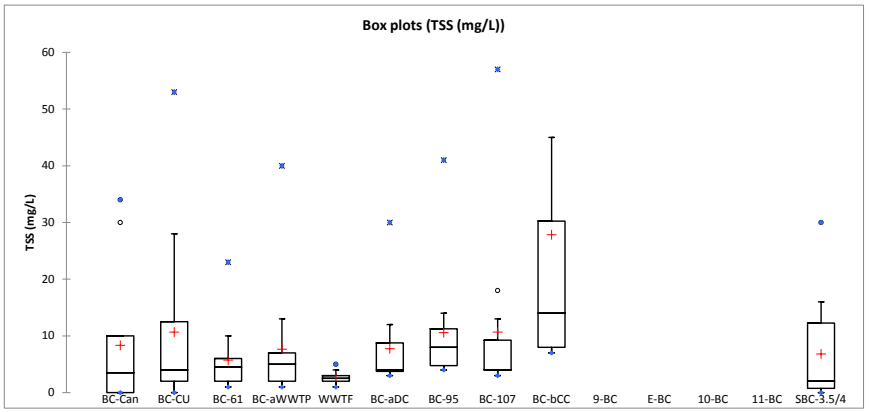

Box plots (DO (mg/L))
DO (mg/L)
6
8
10
12
14
16
18
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

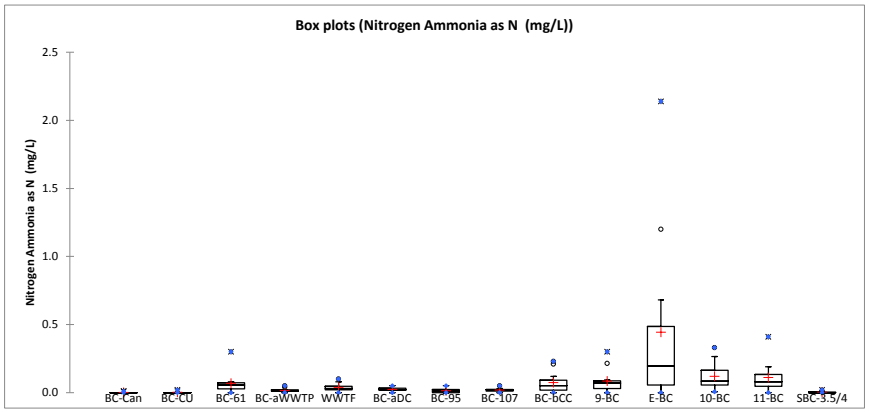

Box plots (E_ coli (MPN/100 mL))
E_ coli (MPN/100 mL)
0
200
400
600
800
1000
1200
1400
1600
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

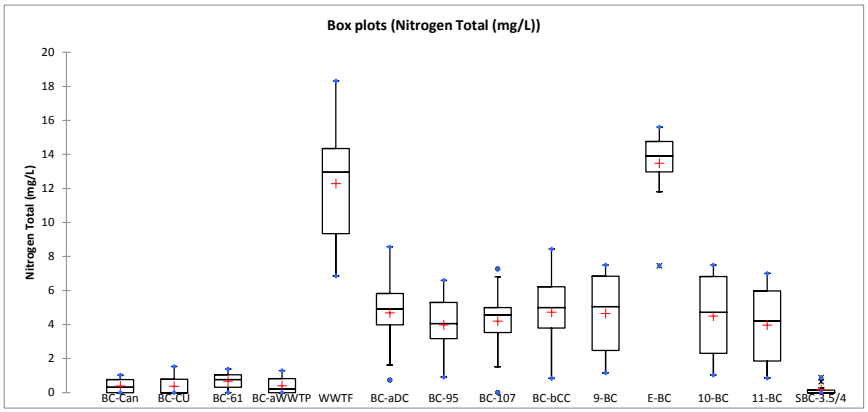

Box plots (Hardness, Total as CaCO3 (mg/L))
Hardness, Total as CaCO3 (mg/L)
0
50
100
150
200
250
300
350
400
450
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

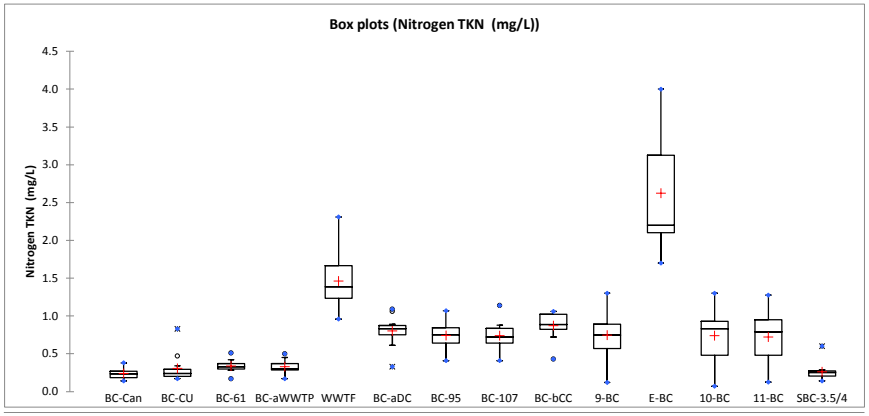

Box plots (pH (SU))
pH (SU)
6.5
7.0
7.5
8.0
8.5
9.0
9.5
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

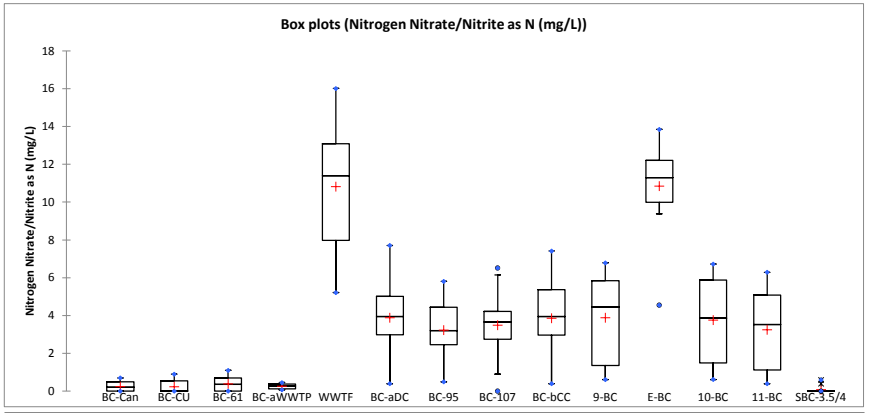

Box plots (Temperature (deg C))
Temperature (deg C)
0
5
10
15
20
25
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

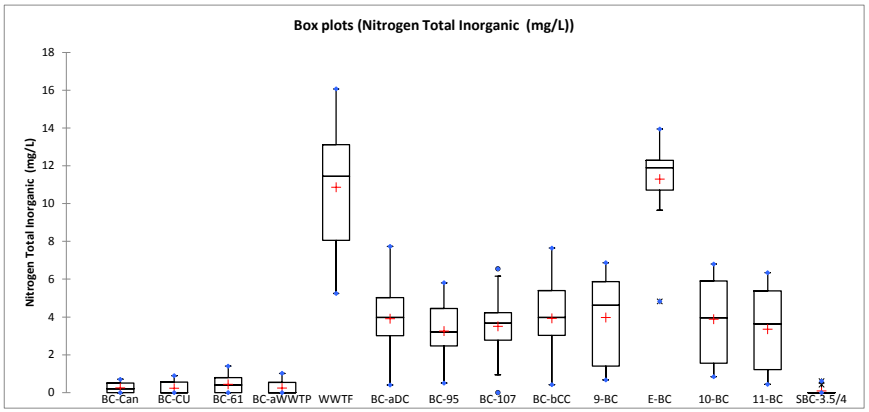

Box plots (TSS (mg/L))
TSS (mg/L)
0
10
20
30
40
50
60
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

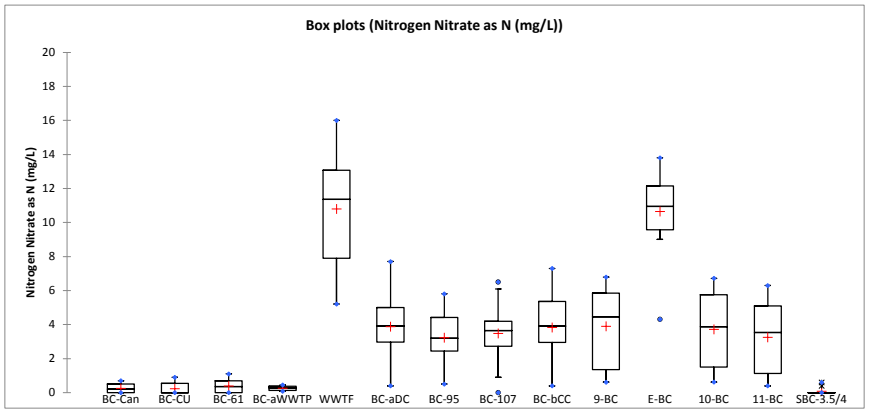

Box plots (Nitrogen Ammonia as N (mg/L))
Nitrogen Ammonia as N (mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

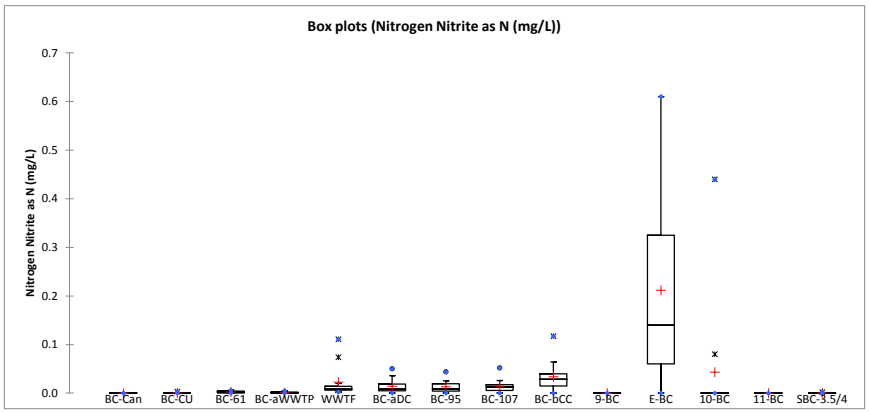

Box plots (Nitrogen Total (mg/L))
Nitrogen Total (mg/L)
0
2
4
6
8
10
12
14
16
18
20
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

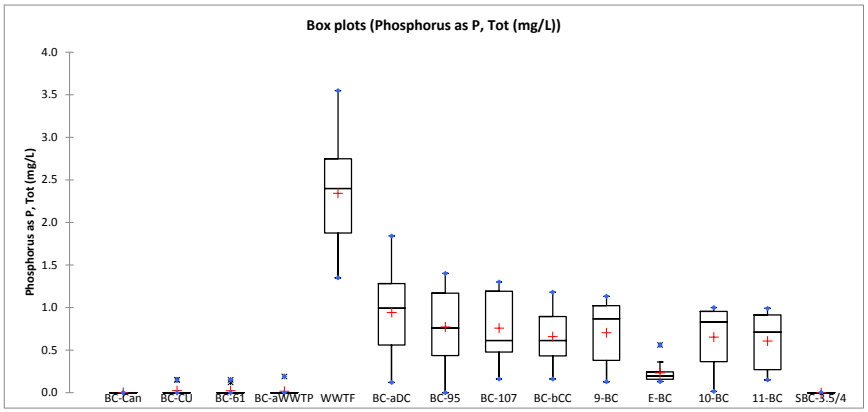

Box plots (Nitrogen TKN (mg/L))
Nitrogen TKN (mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

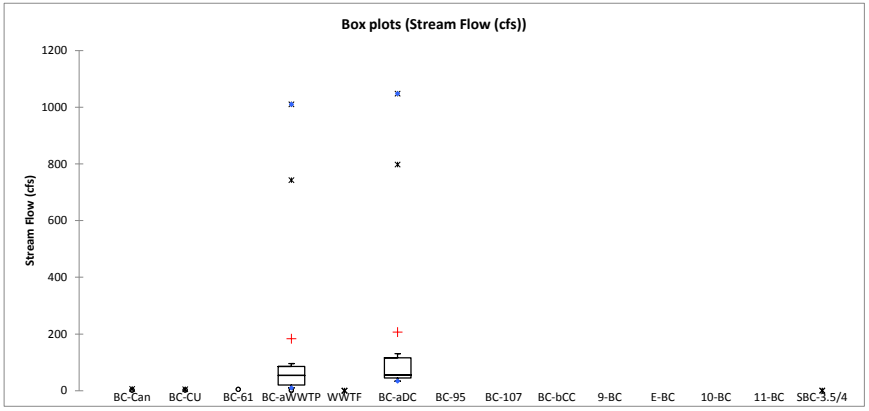

Box plots (Nitrogen Nitrate/Nitrite as N (mg/L))
Nitrogen Nitrate/Nitrite as N (mg/L)
0
2
4
6
8
10
12
14
16
18
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

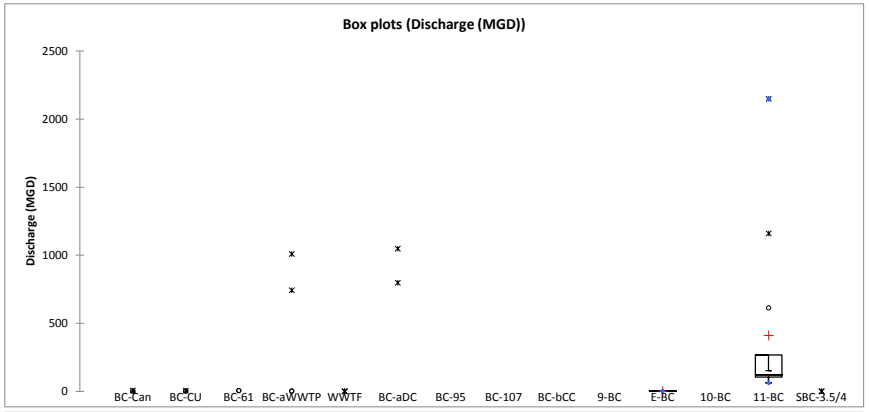

Box plots (Nitrogen Total Inorganic (mg/L))
Nitrogen Total Inorganic (mg/L)
0
2
4
6
8
10
12
14
16
18
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

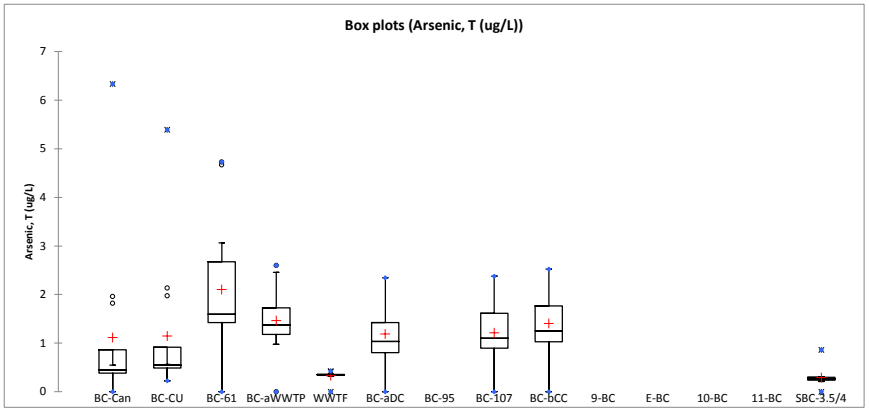

Box plots (Nitrogen Nitrate as N (mg/L))
Nitrogen Nitrate as N (mg/L)
0
2
4
6
8
10
12
14
16
18
20
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

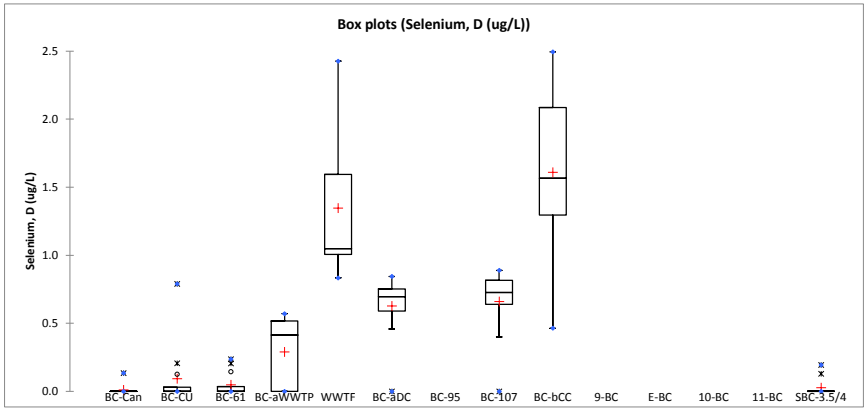

Box plots (Nitrogen Nitrite as N (mg/L))
Nitrogen Nitrite as N (mg/L)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

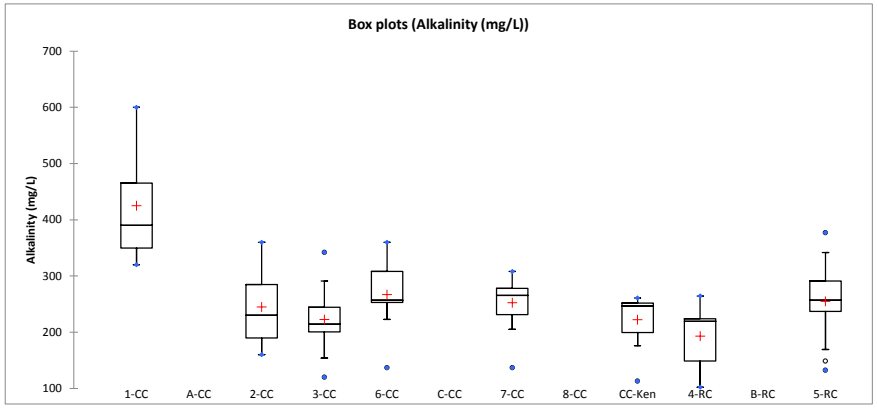

Box plots (Phosphorus as P, Tot (mg/L))
Phosphorus as P, Tot (mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

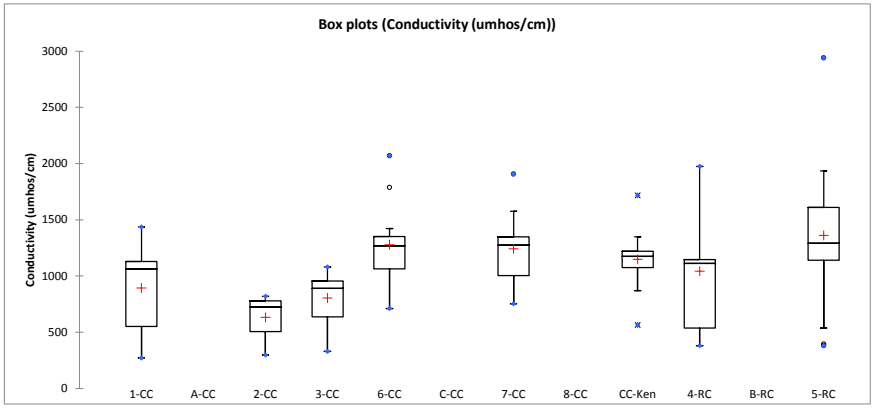

Box plots (Stream Flow (cfs))
Stream Flow (cfs)
0
200
400
600
800
1000
1200
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

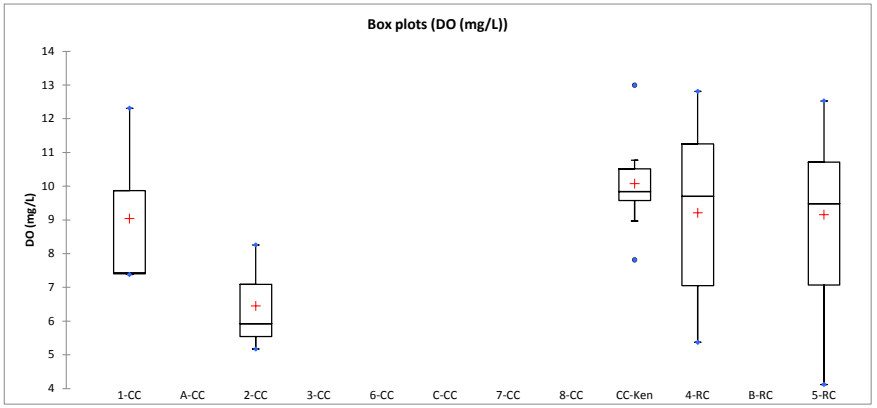

Box plots (Discharge (MGD))
Discharge (MGD)
0
500
1000
1500
2000
2500
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

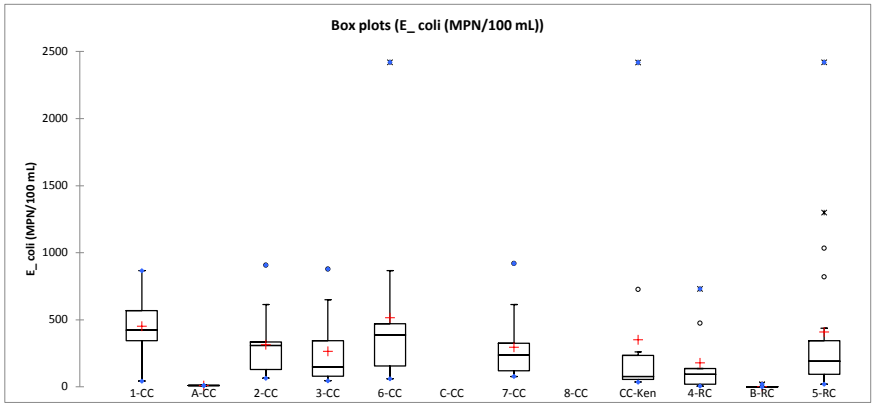

Box plots (Arsenic, T (ug/L))
Arsenic, T (ug/L)
0
1
2
3
4
5
6
7
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

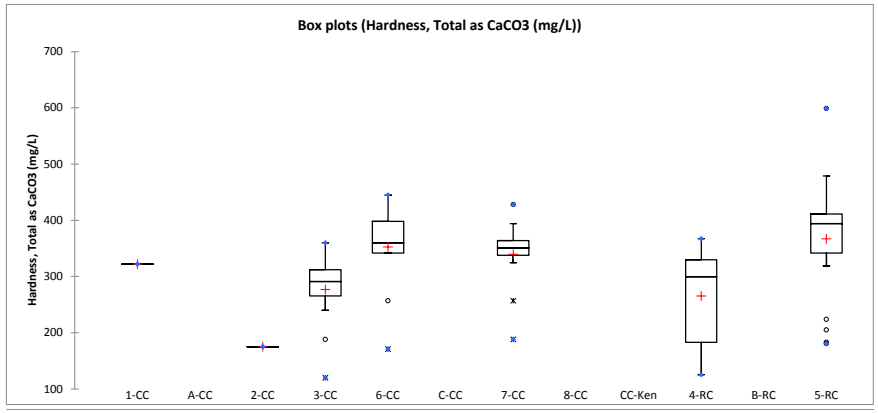

Box plots (Selenium, D (ug/L))
Selenium, D (ug/L)
0.0
0.5
1.0
1.5
2.0
2.5
BC-Can
BC-CU
BC-61
BC-aWWTP
WWTF
BC-aDC
BC-95
BC-107
BC-bCC
9-BC
E-BC
10-BC
11-BC
SBC-3.5/4

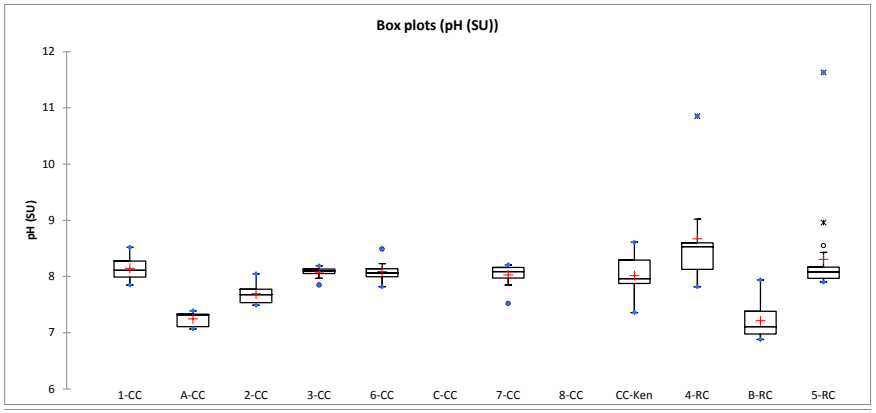

Box plots (Alkalinity (mg/L))
Alkalinity (mg/L)
700
600
500
400
300
200
100
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

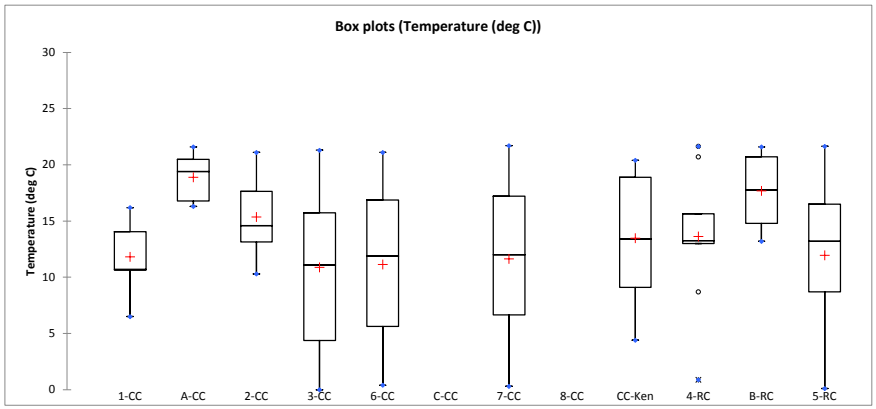

Box plots (Conductivity (umhos/cm))
Conductivity (umhos/cm)
3000
2500
2000
1500
1000
500
0
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

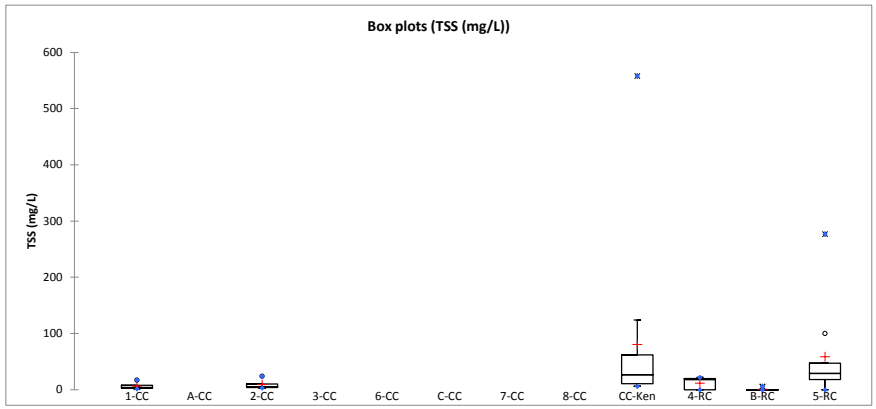

Box plots (DO (mg/L))
DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

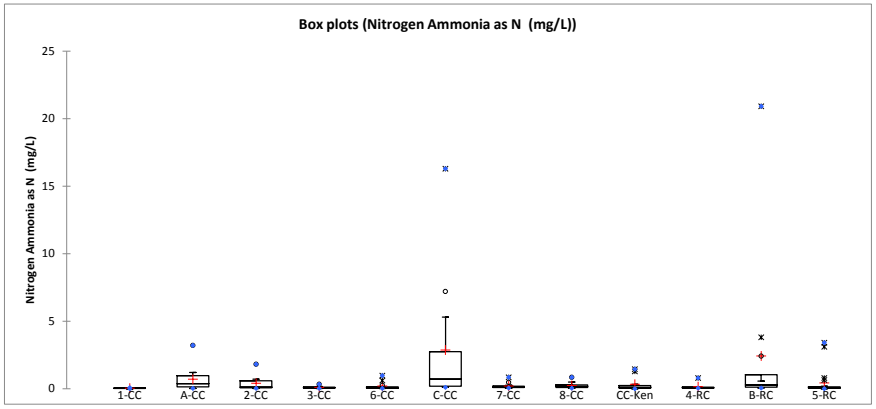

Box plots (E_ coli (MPN/100 mL))
E_ coli (MPN/100 mL)
2500
2000
1500
1000
500
0
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

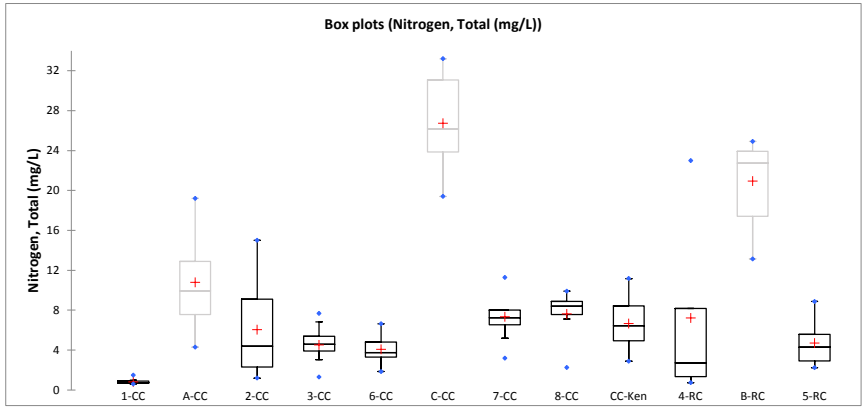

Box plots (Hardness, Total as CaCO3 (mg/L))
Hardness, Total as CaCO3 (mg/L)
700
600
500
400
300
200
100
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

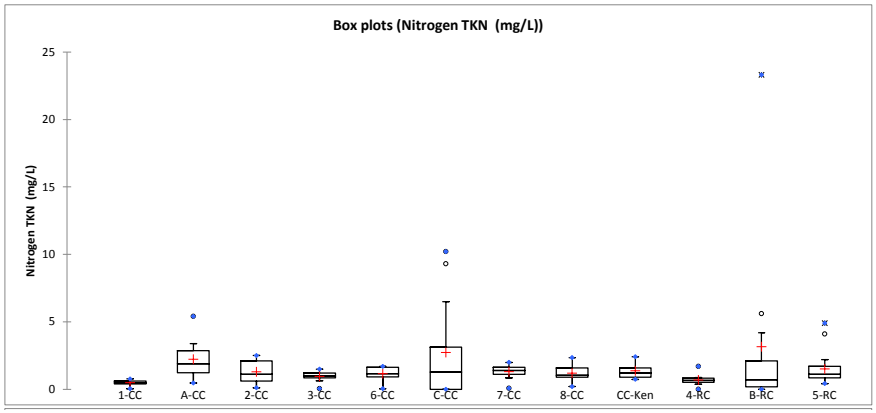

Box plots (pH (SU))
pH (SU)
12
11
10
9
8
7
6
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

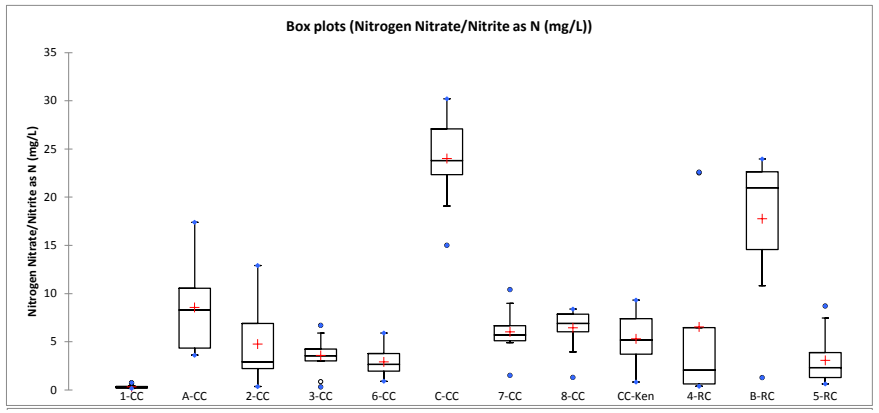

Box plots (Temperature (deg C))
Temperature (deg C)
0
5
10
15
20
25
30
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

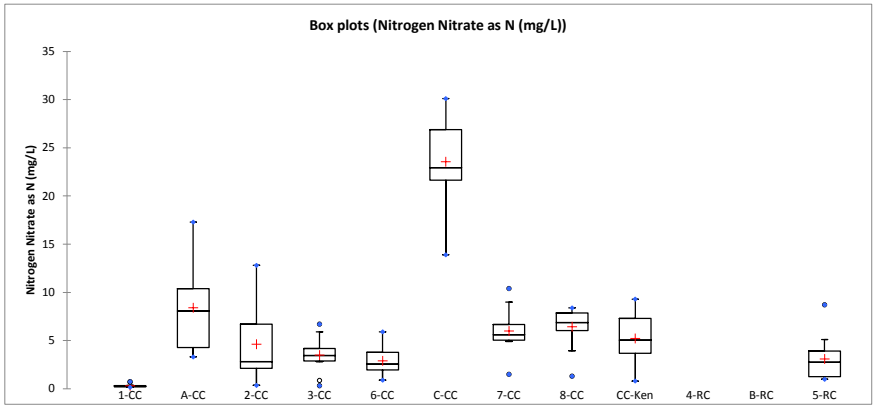

Box plots (TSS (mg/L))
TSS (mg/L)
0
100
200
300
400
500
600
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

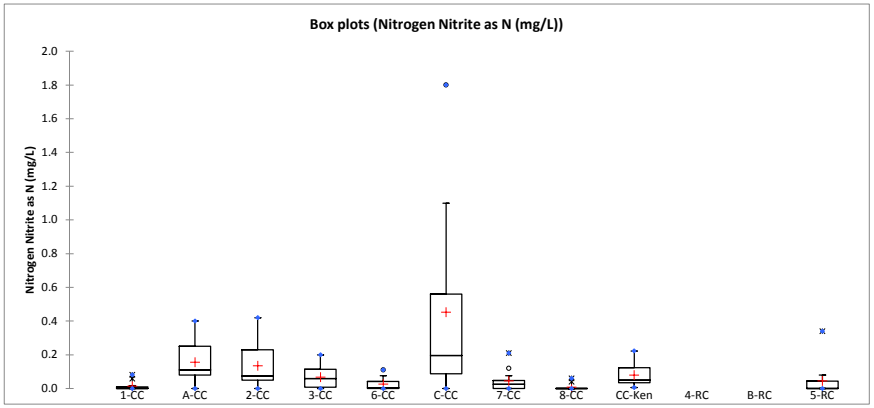

Box plots (Nitrogen Ammonia as N (mg/L))
Nitrogen Ammonia as N (mg/L)
0
5
10
15
20
25
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

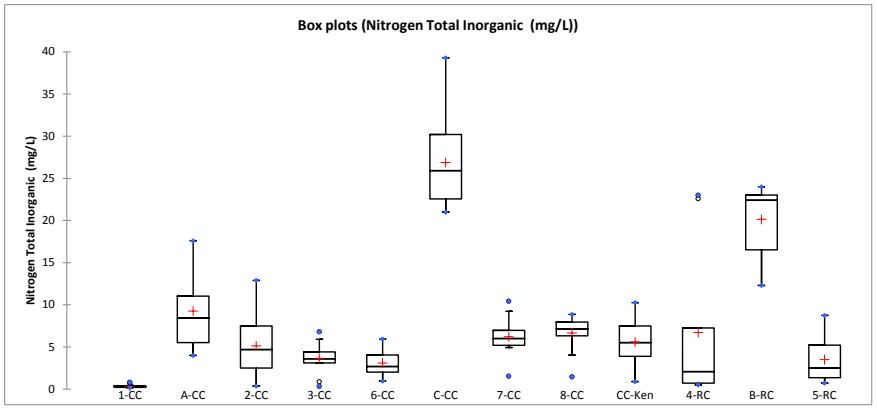

Box plots (Nitrogen, Total (mg/L))
Nitrogen, Total (mg/L)
0
4
8
12
16
20
24
28
32
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

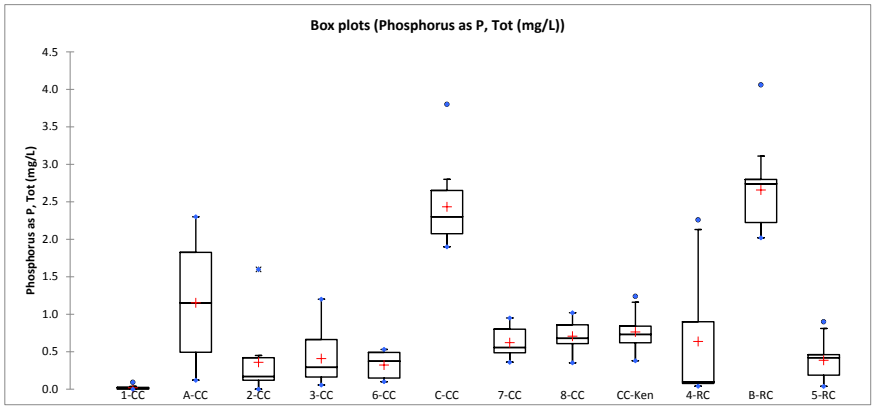

Box plots (Nitrogen TKN (mg/L))
Nitrogen TKN (mg/L)
0
5
10
15
20
25
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

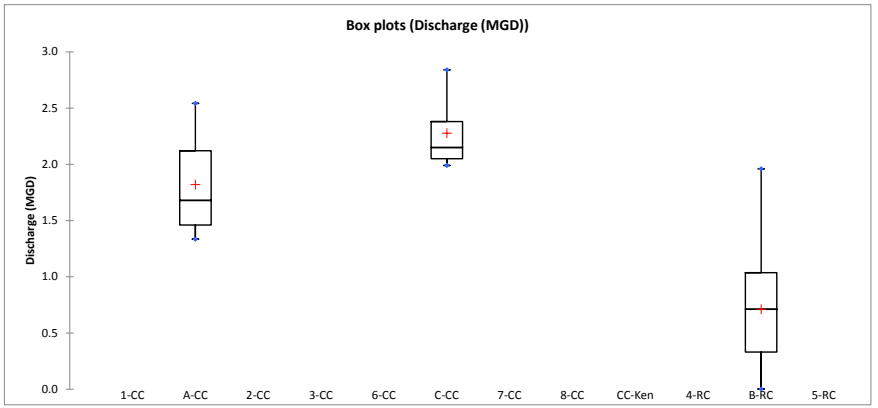

Box plots (Nitrogen Nitrate/Nitrite as N (mg/L))
Nitrogen Nitrate/Nitrite as N (mg/L)
0
5
10
15
20
25
30
35
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

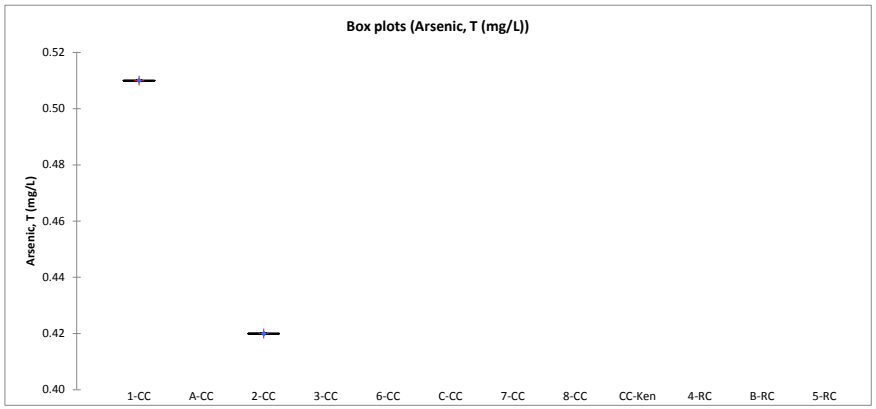

Box plots (Nitrogen Nitrate as N (mg/L))
Nitrogen Nitrate as N (mg/L)
0
5
10
15
20
25
30
35
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

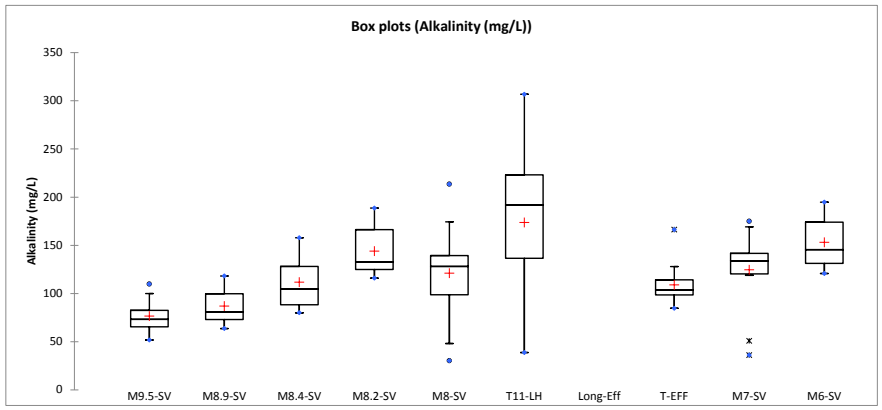

Box plots (Nitrogen Nitrite as N (mg/L))
Nitrogen Nitrite as N (mg/L)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

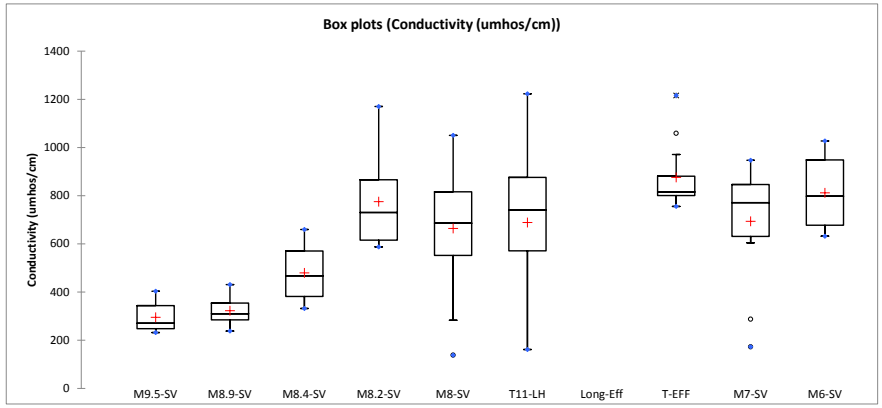

Box plots (Nitrogen Total Inorganic (mg/L))
Nitrogen Total Inorganic (mg/L)
0
5
10
15
20
25
30
35
40
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

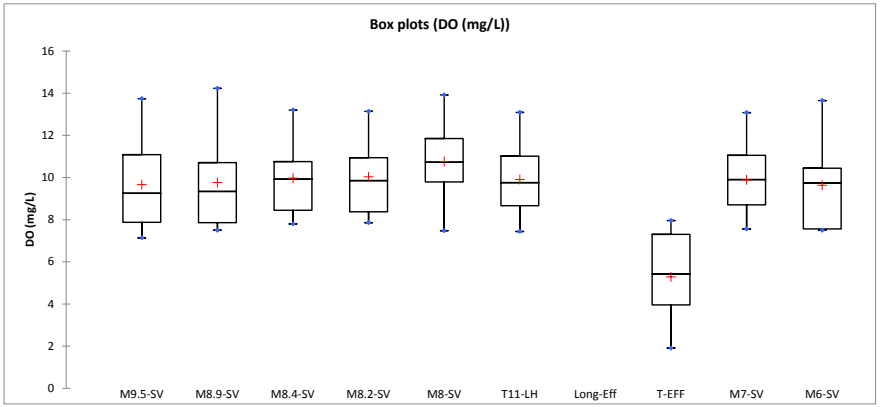

Box plots (Phosphorus as P, Tot (mg/L))
Phosphorus as P, Tot (mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

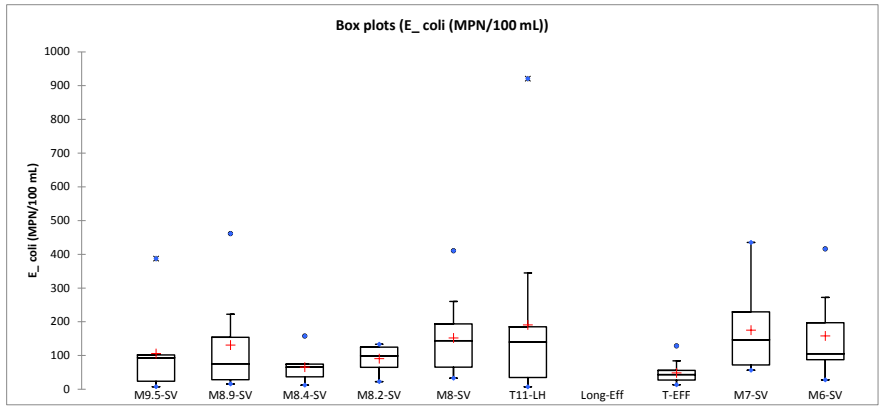

Box plots (Discharge (MGD))
Discharge (MGD)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

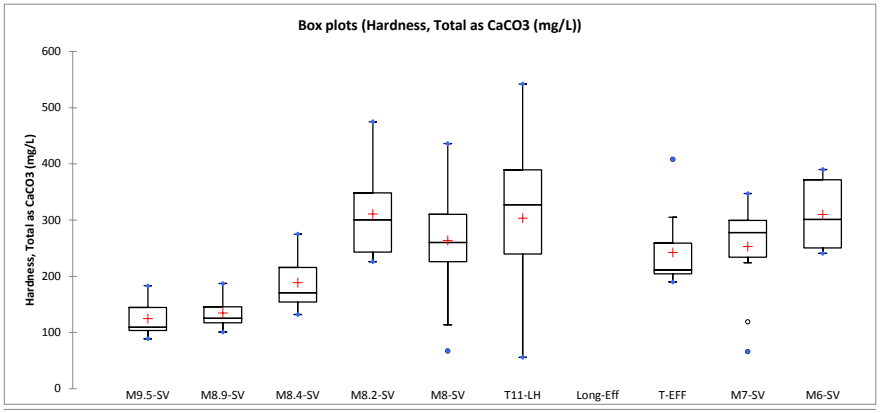

Box plots (Arsenic, T (mg/L))
Arsenic, T (mg/L)
0.40
0.42
0.44
0.46
0.48
0.50
0.52
1-CC
A-CC
2-CC
3-CC
6-CC
C-CC
7-CC
8-CC
CC-Ken
4-RC
B-RC
5-RC

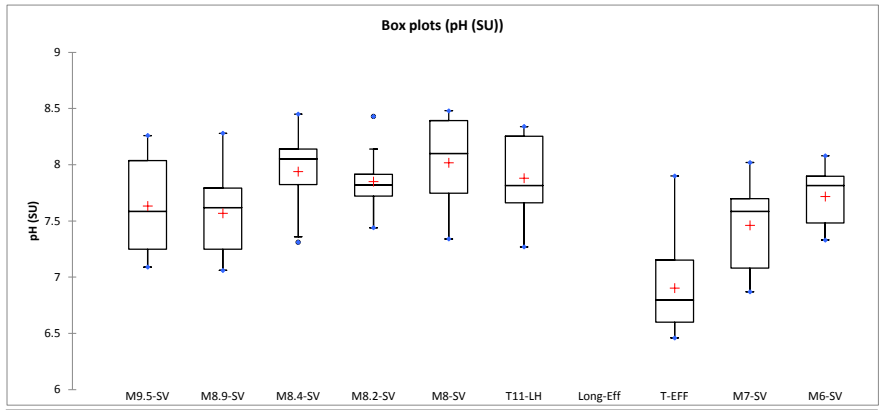

Box plots (Alkalinity (mg/L))
Alkalinity (mg/L)
0
50
100
150
200
250
300
350
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV

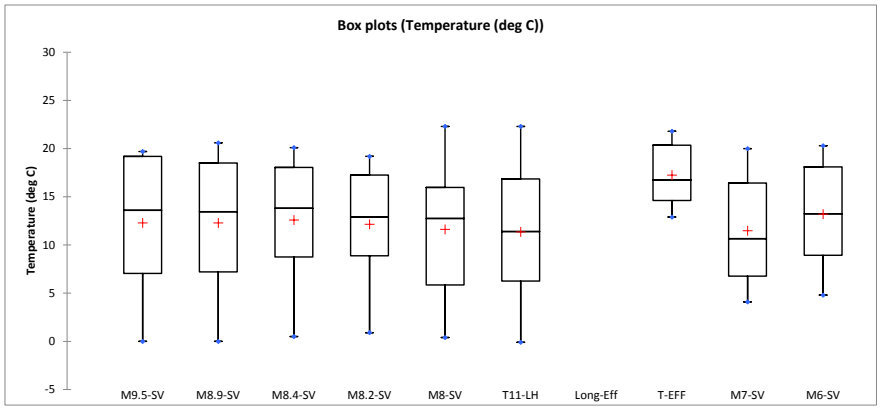

Box plots (Conductivity (umhos/cm))
Conductivity (umhos/cm)
0
200
400
600
800
1000
1200
1400
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV

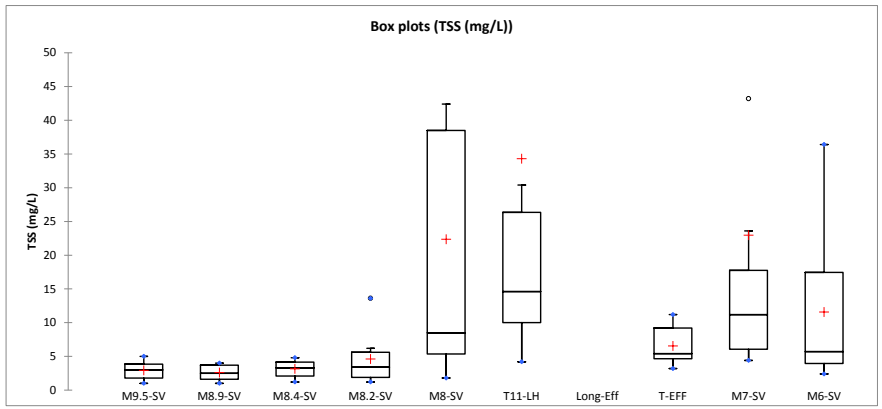

Box plots (DO (mg/L))
DO (mg/L)
0
2
4
6
8
10
12
14
16
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV

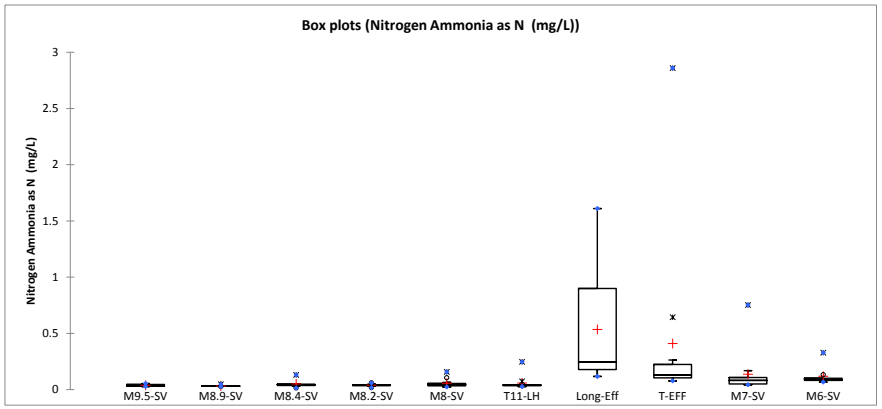

Box plots (E_ coli (MPN/100 mL))
E_ coli (MPN/100 mL)
0
100
200
300
400
500
600
700
800
900
1000
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV

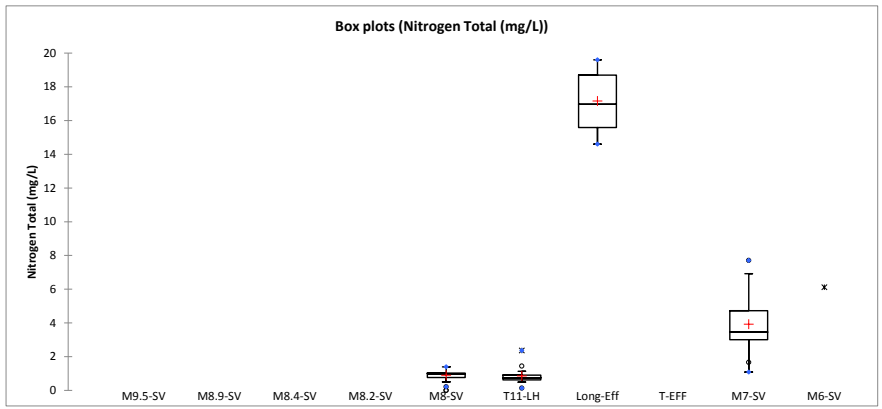

Box plots (Hardness, Total as CaCO3 (mg/L))
Hardness, Total as CaCO3 (mg/L)
0
100
200
300
400
500
600
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV

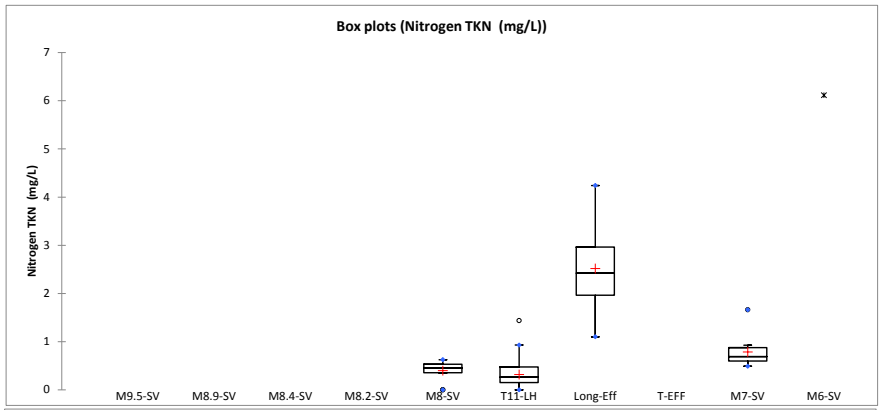

Box plots (pH (SU))
pH (SU)
6
6.5
7
7.5
8
8.5
9
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV

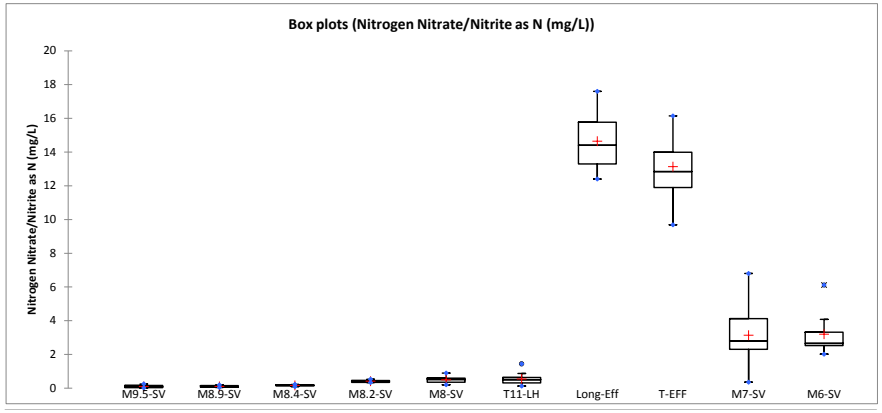

Box plots (Temperature (deg C))
Temperature (deg C)
30
25
20
15
10
5
0
-5
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV

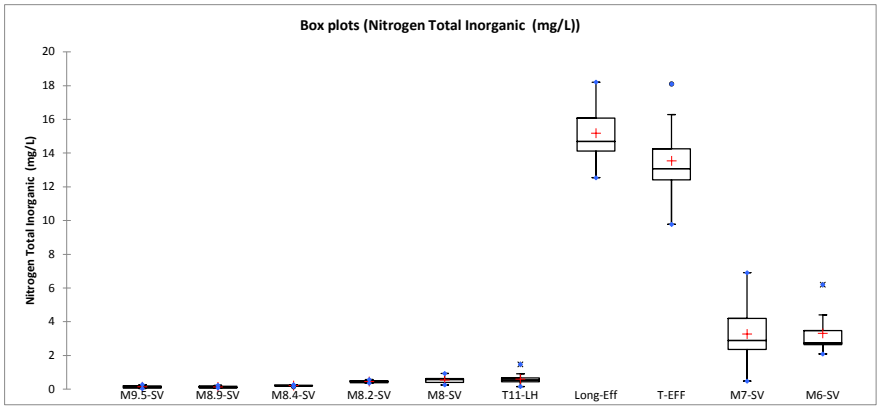

Box plots (TSS (mg/L))
TSS (mg/L)
50
45
40
35
30
25
20
15
10
5
0
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV

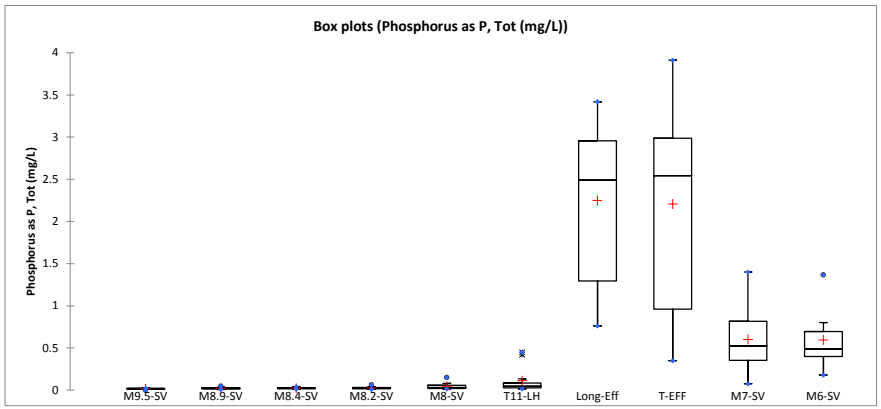

Box plots (Nitrogen Ammonia as N (mg/L))
Nitrogen Ammonia as N (mg/L)
3
2.5
2
1.5
1
0.5
0
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV

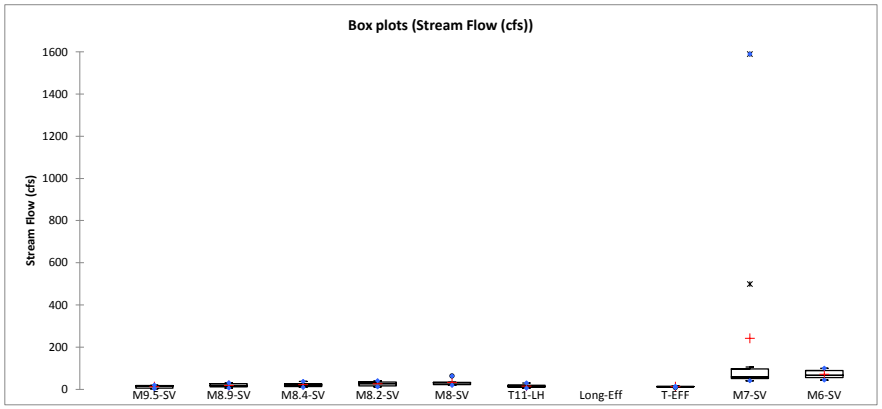

Box plots (Nitrogen Total (mg/L))
Nitrogen Total (mg/L)
20
18
16
14
12
10
8
6
4
2
0
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV

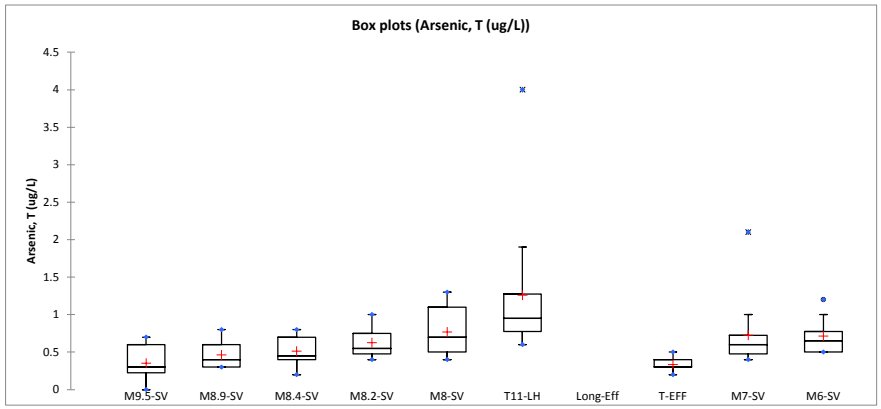

Box plots (Nitrogen TKN (mg/L))
Nitrogen TKN (mg/L)
7
6
5
4
3
2
1
0
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV


Box plots (Nitrogen Nitrate/Nitrite as N (mg/L))
Nitrogen Nitrate/Nitrite as N (mg/L)
20
18
16
14
12
10
8
6
4
2
0
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV


Box plots (Nitrogen Total Inorganic (mg/L))
Nitrogen Total Inorganic (mg/L)
0
2
4
6
8
10
12
14
16
18
20
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV


Box plots (Phosphorus as P, Tot (mg/L))
Phosphorus as P, Tot (mg/L)
0
0.5
1
1.5
2
2.5
3
3.5
4
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV


Box plots (Stream Flow (cfs))
Stream Flow (cfs)
0
200
400
600
800
1000
1200
1400
1600
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV


Box plots (Arsenic, T (ug/L))
Arsenic, T (ug/L)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
M9.5-SV
M8.9-SV
M8.4-SV
M8.2-SV
M8-SV
T11-LH
Long-Eff
T-EFF
M7-SV
M6-SV

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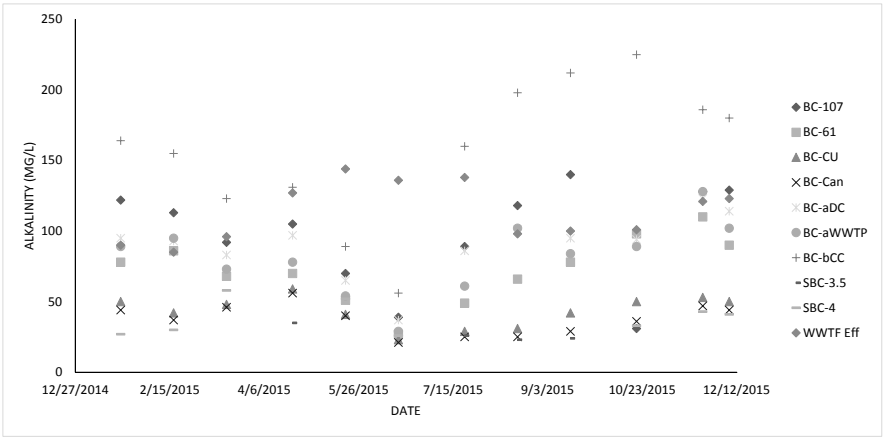
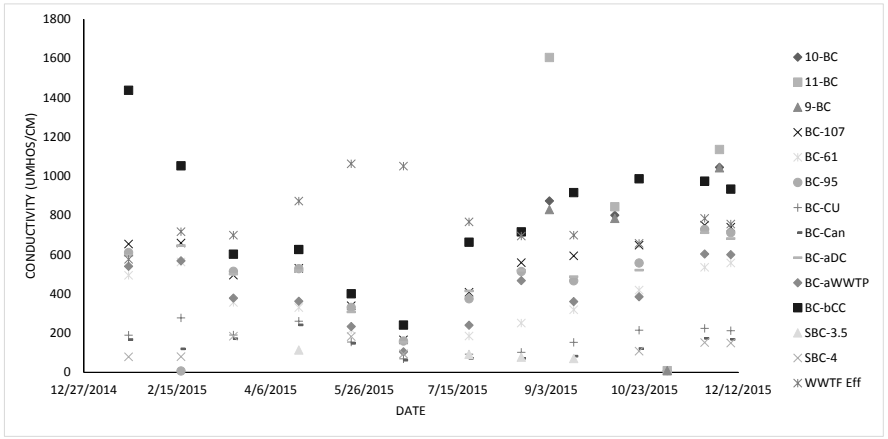
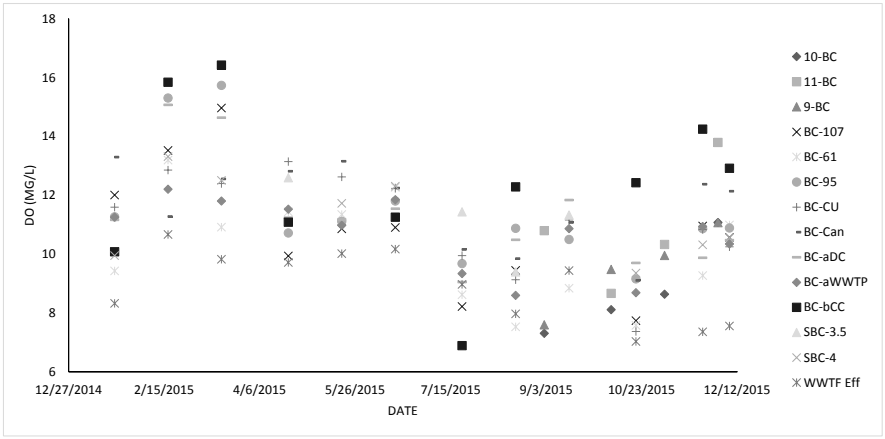
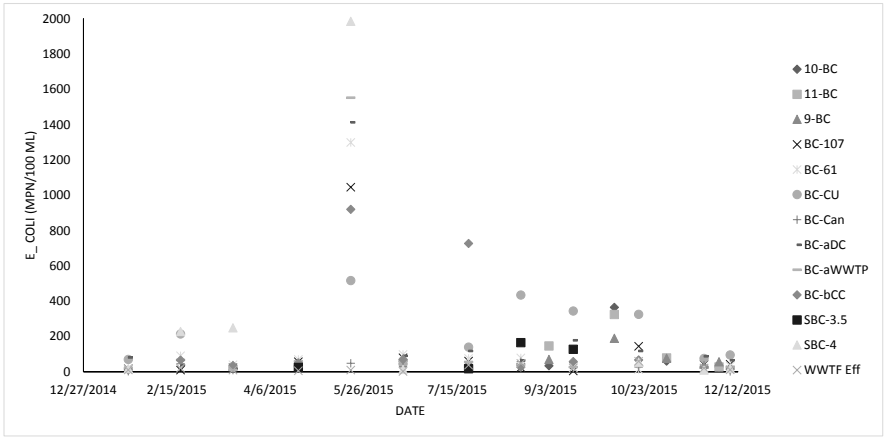
# Appendix D. Time Series Plots

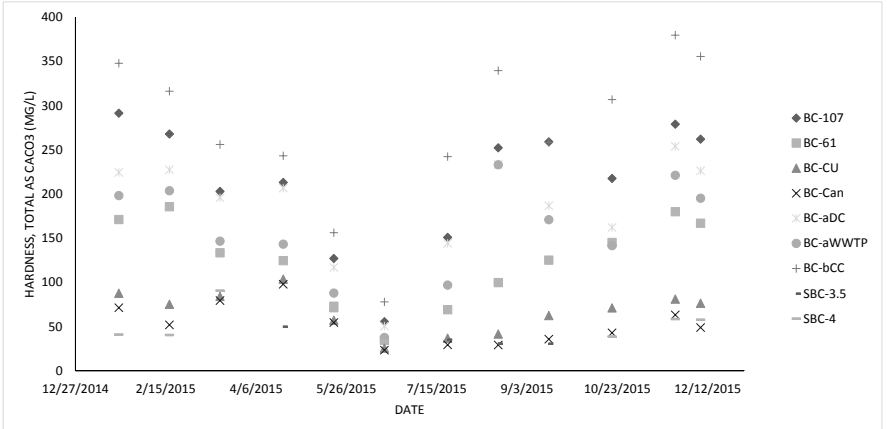
Appendix D1
Time Series Plots for Boulder Creek / South Boulder Creek 2015 Instream Sampling Program

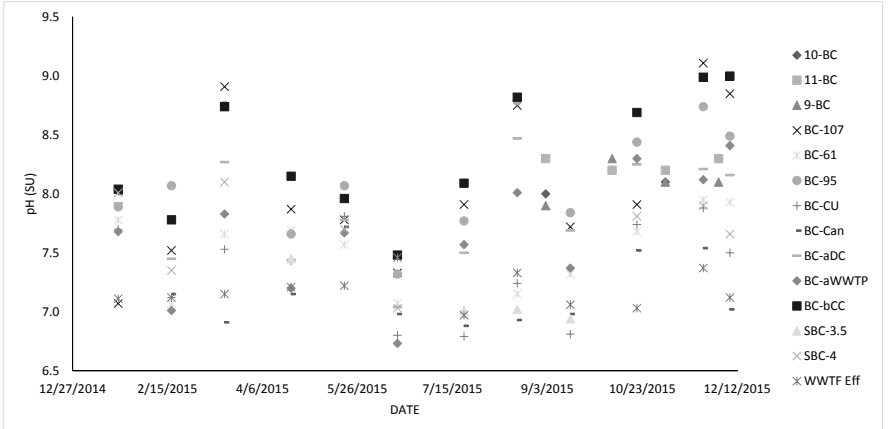


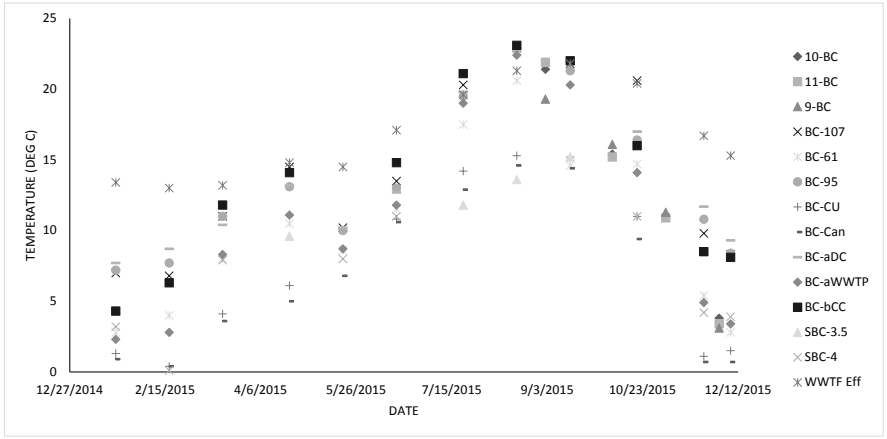



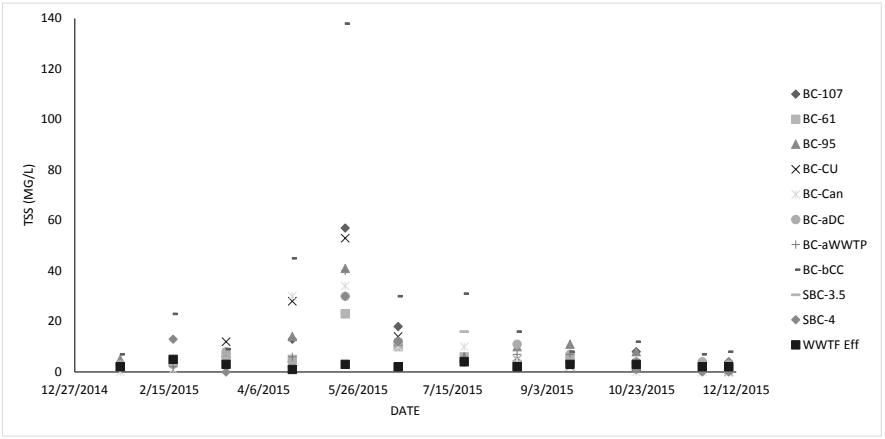



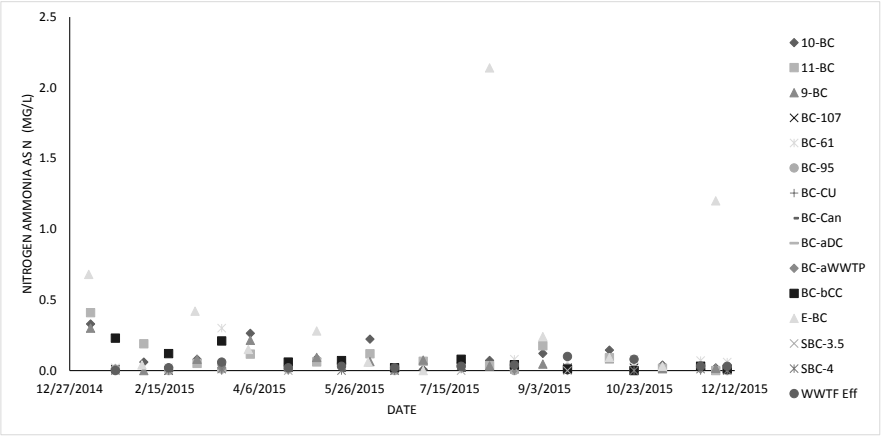



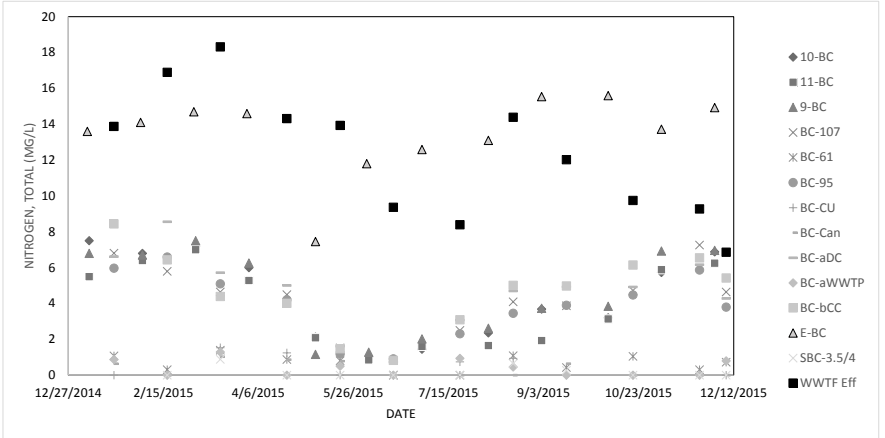



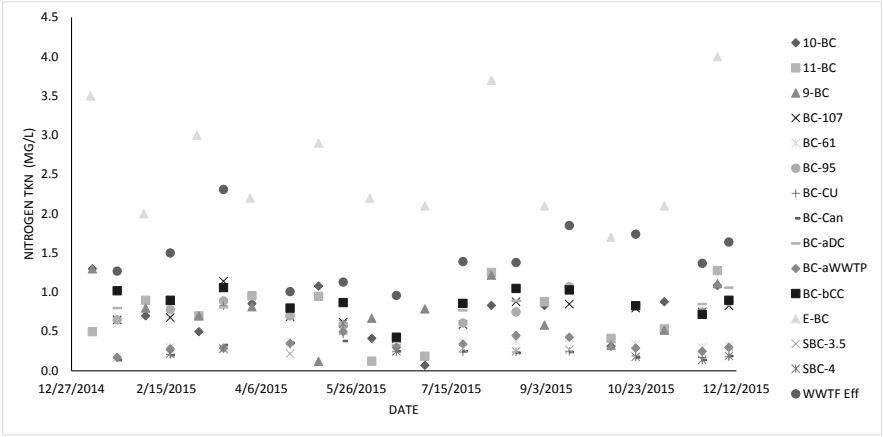



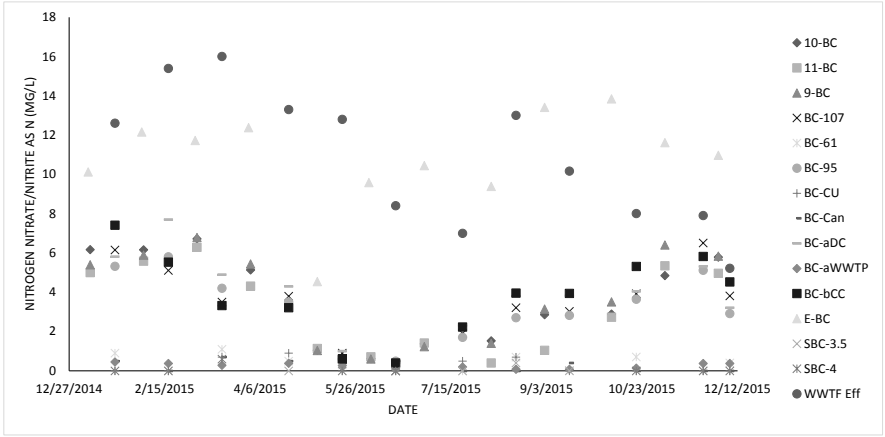

TEMPERATURE (DEG C)
DATE
10-BC
11-BC
9-BC
BC-107
BC-61
BC-95
BC-CU
BC-Can
BC-aDC
BC-aWWTP
BC-bCC
SBC-3.5
SBC-4
WWTF Eff

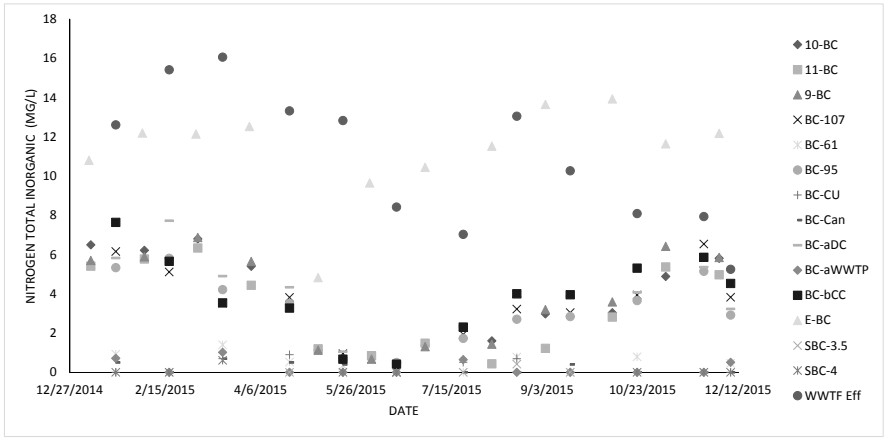

TSS (MG/L)
DATE
BC-107
BC-61
BC-95
BC-CU
BC-Can
BC-aDC
BC-aWWTP
BC-bCC
SBC-3.5
SBC-4
WWTF Eff

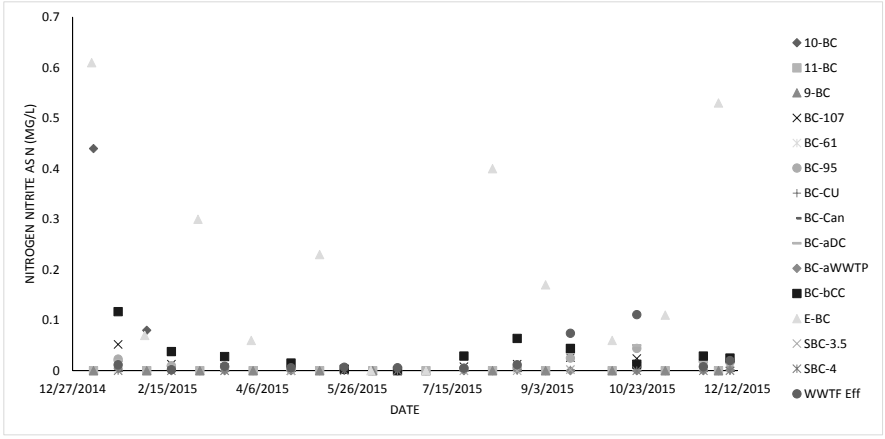

NITROGEN AMMONIA AS N (MG/L)
DATE
10-BC
11-BC
9-BC
BC-107
BC-61
BC-95
BC-CU
BC-Can
BC-aDC
BC-aWWTP
BC-bCC
E-BC
SBC-3.5
SBC-4
WWTF Eff

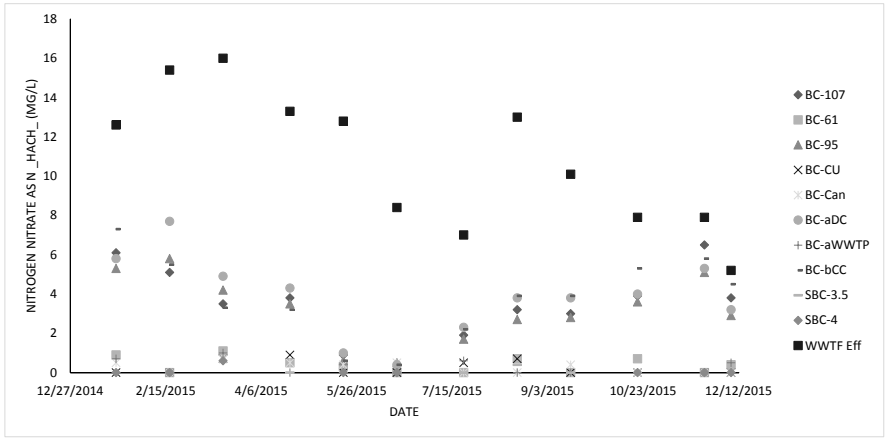

NITROGEN, TOTAL (MG/L)
DATE
10-BC
11-BC
9-BC
BC-107
BC-61
BC-95
BC-CU
BC-Can
BC-aDC
BC-aWWTP
BC-bCC
E-BC
SBC-3.5/4
WWTF Eff

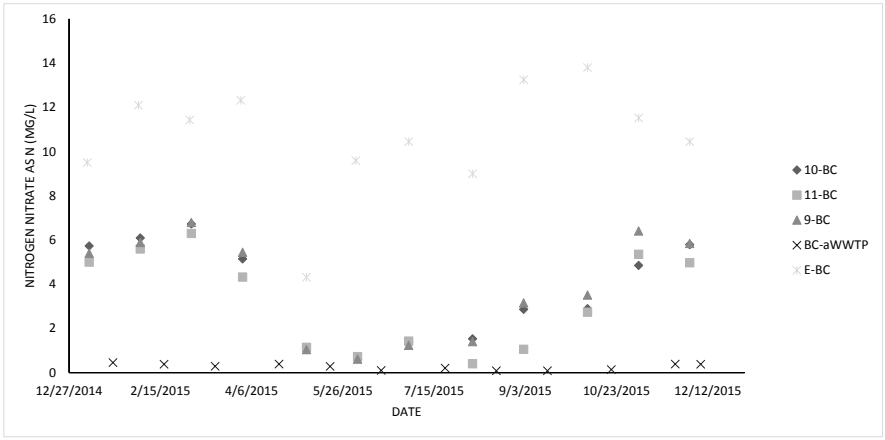

NITROGEN TKN (MG/L)
DATE
10-BC
11-BC
9-BC
BC-107
BC-61
BC-95
BC-CU
BC-Can
BC-aDC
BC-aWWTP
BC-bCC
E-BC
SBC-3.5
SBC-4
WWTF Eff

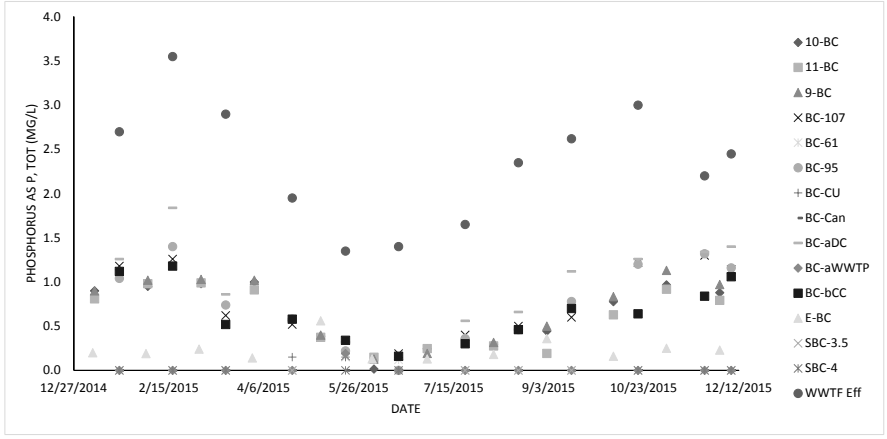

NITROGEN NITRATE/NITRITE AS N (MG/L)
DATE
10-BC
11-BC
9-BC
BC-107
BC-61
BC-95
BC-CU
BC-Can
BC-aDC
BC-aWWTP
BC-bCC
E-BC
SBC-3.5
SBC-4
WWTF Eff

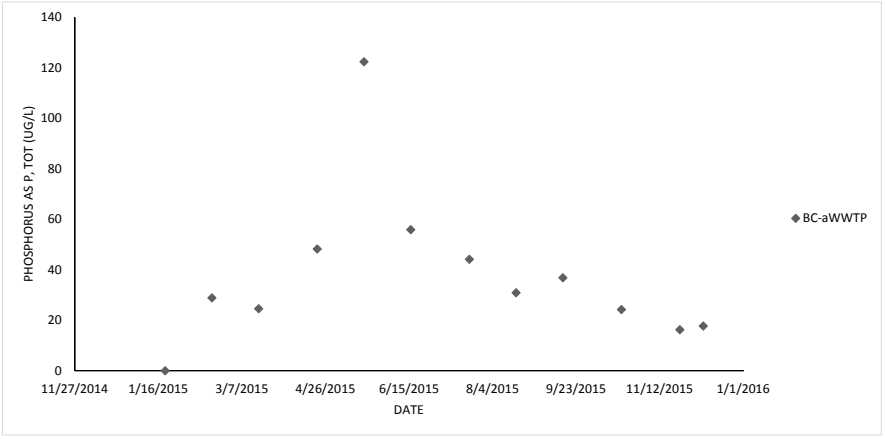

NITROGEN TOTAL INORGANIC (MG/L)
DATE
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
10-BC
11-BC
9-BC
BC-107
BC-61
BC-95
BC-CU
BC-Can
BC-aDC
BC-aWWTP
BC-bCC
E-BC
SBC-3.5
SBC-4
WWTF Eff

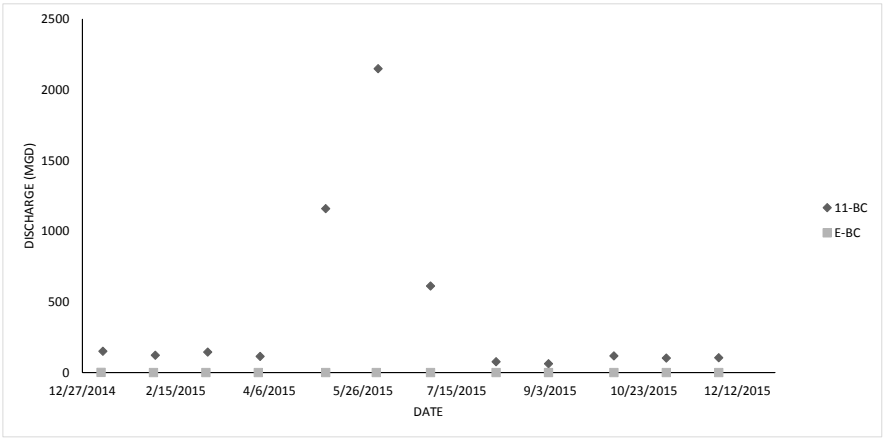

NITROGEN NITRITE AS N (MG/L)
DATE
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
10-BC
11-BC
9-BC
BC-107
BC-61
BC-95
BC-CU
BC-Can
BC-aDC
BC-aWWTP
BC-bCC
E-BC
SBC-3.5
SBC-4
WWTF Eff

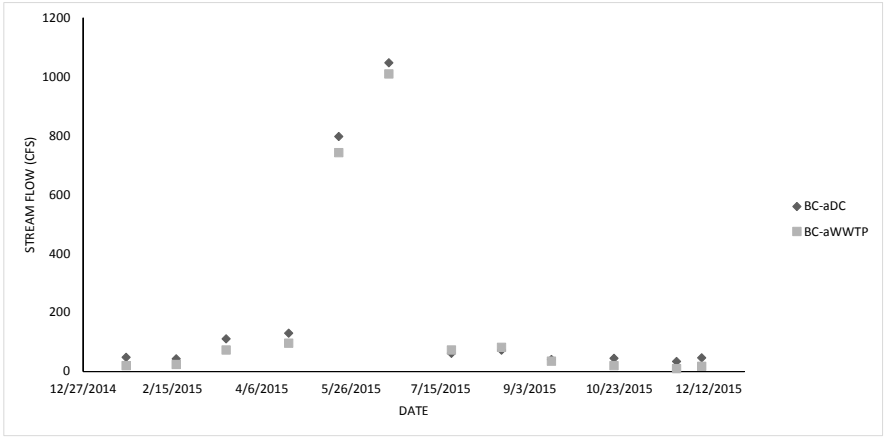

NITROGEN NITRATE AS N _HACH_ (MG/L)
DATE
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
BC-107
BC-61
BC-95
BC-CU
BC-Can
BC-aDC
BC-aWWTP
BC-bCC
SBC-3.5
SBC-4
WWTF Eff

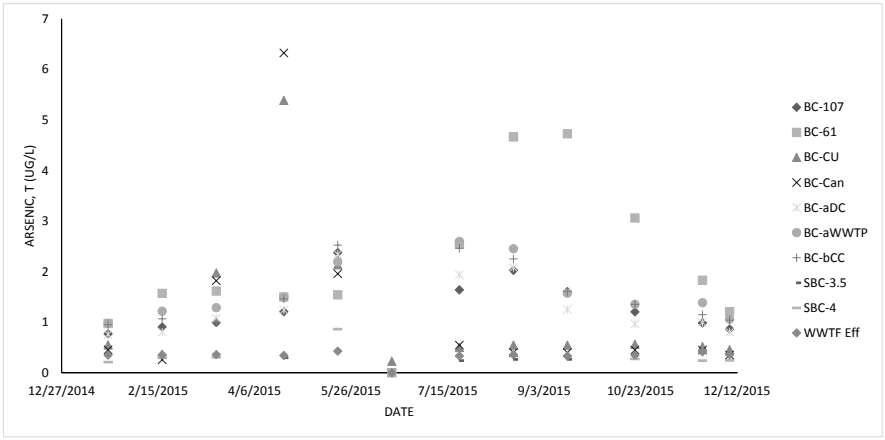

NITROGEN NITRATE AS N (MG/L)
DATE
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
10-BC
11-BC
9-BC
BC-aWWTP
E-BC

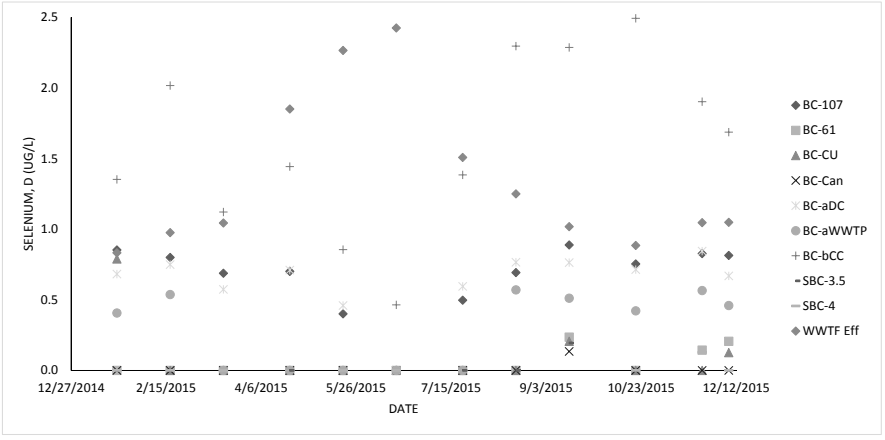

PHOSPHORUS AS P, TOT (MG/L)
DATE
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
10-BC
11-BC
9-BC
BC-107
BC-61
BC-95
BC-CU
BC-Can
BC-aDC
BC-aWWTP
BC-bCC
E-BC
SBC-3.5
SBC-4
WWTF Eff

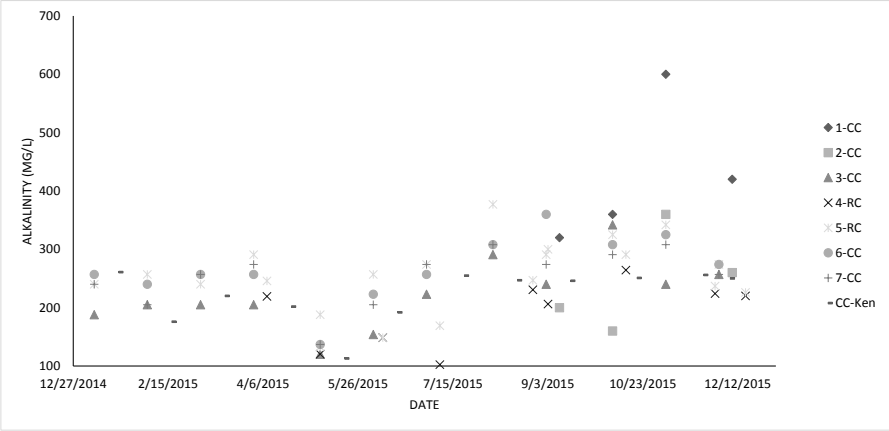

PHOSPHORUS AS P, TOT (UG/L)
DATE
11/27/2014
1/16/2015
3/7/2015
4/26/2015
6/15/2015
8/4/2015
9/23/2015
11/12/2015
1/1/2016
BC-aWWTP

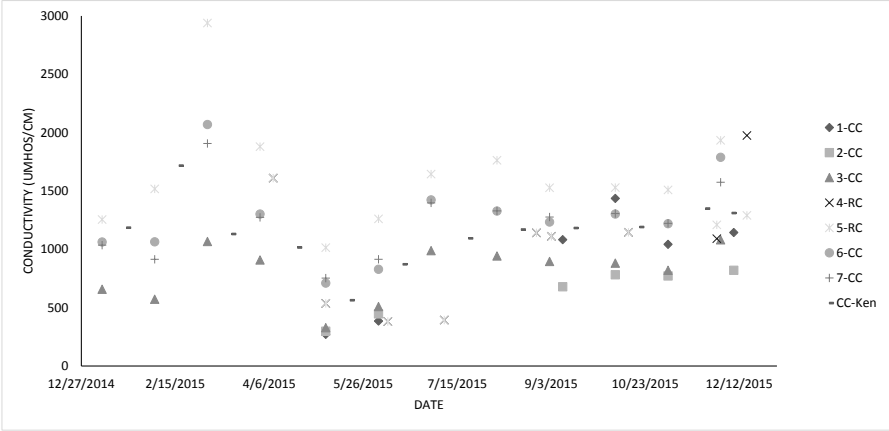

DISCHARGE (MGD)
2500
2000
1500
1000
500
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
11-BC
E-BC

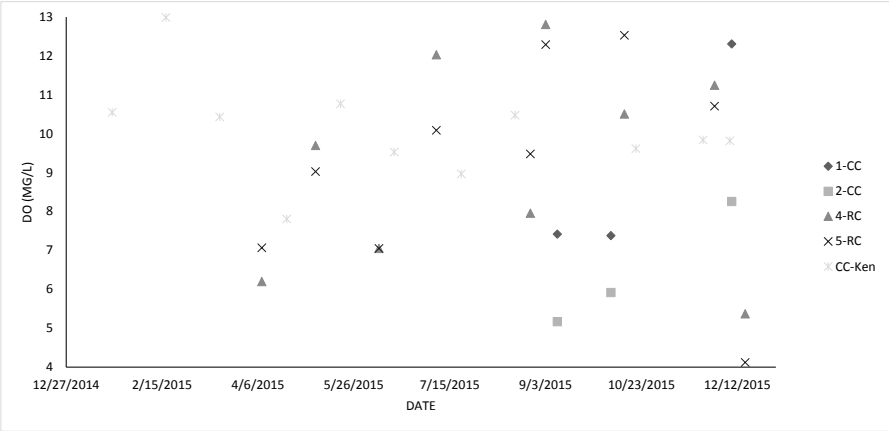

STREAM FLOW (CFS)
1200
1000
800
600
400
200
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
BC-aDC
BC-aWWTP

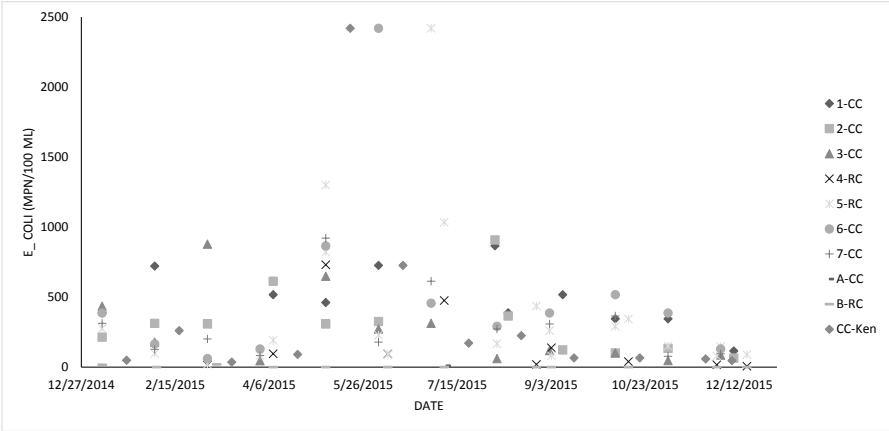

ARSENIC, T (UG/L)
7
6
5
4
3
2
1
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
BC-107
BC-61
BC-CU
BC-Can
BC-aDC
BC-aWWTP
BC-bCC
SBC-3.5
SBC-4
WWTF Eff

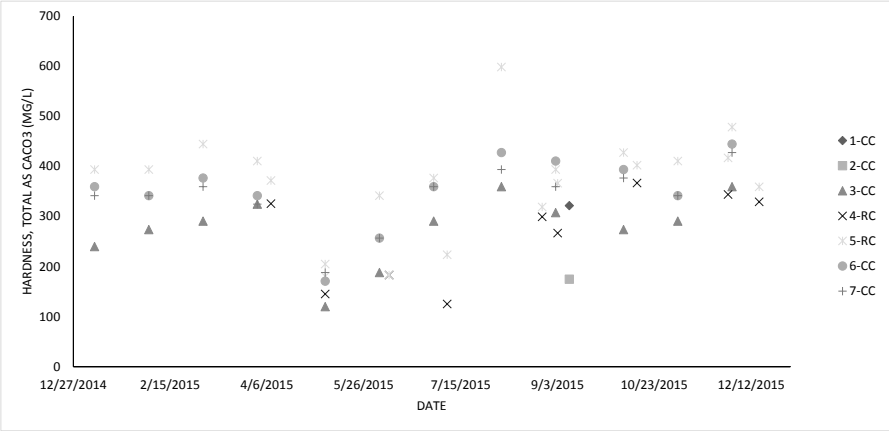

SELENIUM, D (UG/L)
2.5
2.0
1.5
1.0
0.5
0.0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
BC-107
BC-61
BC-CU
BC-Can
BC-aDC
BC-aWWTP
BC-bCC
SBC-3.5
SBC-4
WWTF Eff

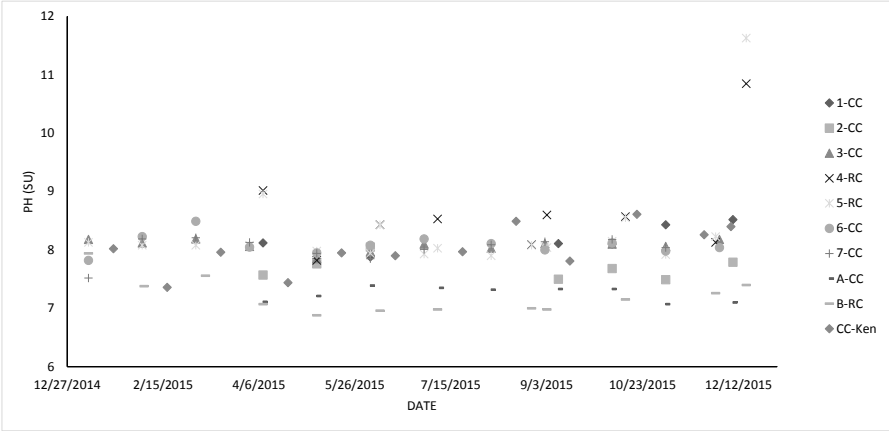

ALKALINITY (MG/L)
700
600
500
400
300
200
100
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
1-CC
2-CC
3-CC
4-RC
5-RC
6-CC
7-CC
CC-Ken

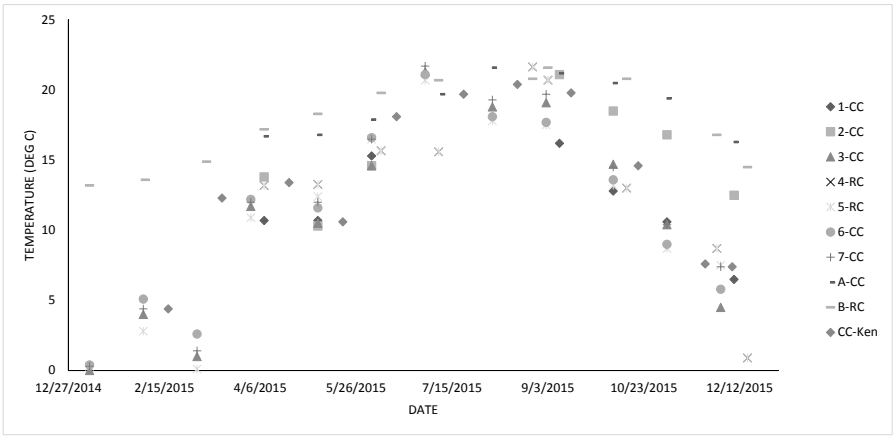

CONDUCTIVITY (UMHOS/CM)
3000
2500
2000
1500
1000
500
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
1-CC
2-CC
3-CC
4-RC
5-RC
6-CC
7-CC
CC-Ken

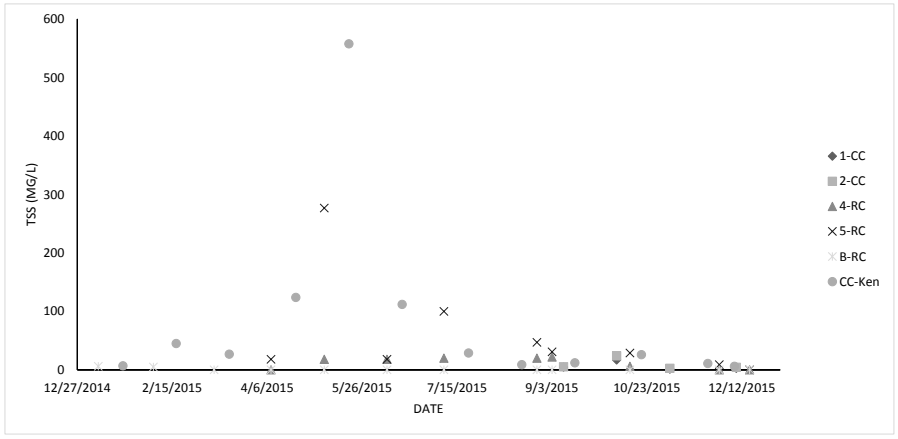

DO (MG/L)
13
12
11
10
9
8
7
6
5
4
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
1-CC
2-CC
4-RC
5-RC
CC-Ken

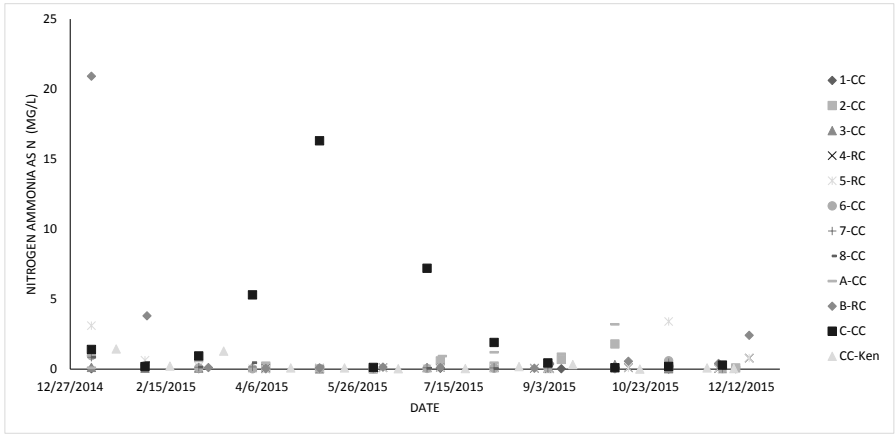

E_ COLI (MPN/100 ML)
2500
2000
1500
1000
500
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
1-CC
2-CC
3-CC
4-RC
5-RC
6-CC
7-CC
A-CC
B-RC
CC-Ken

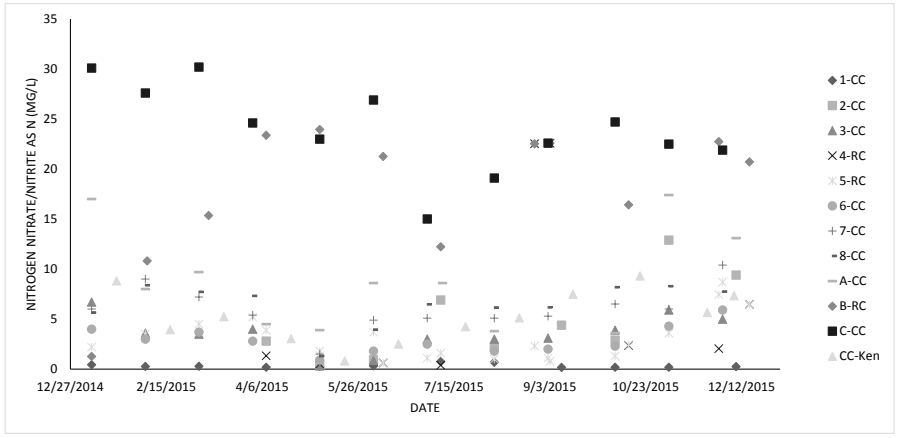

HARDNESS, TOTAL AS CACO3 (MG/L)
700
600
500
400
300
200
100
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
1-CC
2-CC
3-CC
4-RC
5-RC
6-CC
7-CC

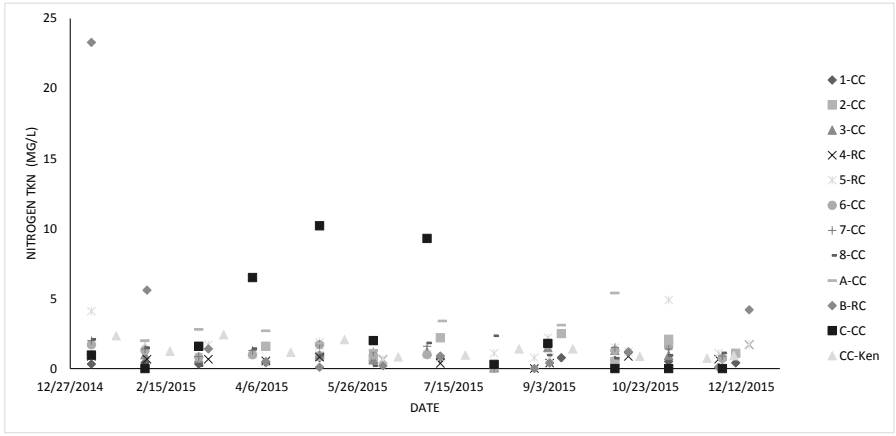

PH (SU)
12
11
10
9
8
7
6
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
1-CC
2-CC
3-CC
4-RC
5-RC
6-CC
7-CC
A-CC
B-RC
CC-Ken

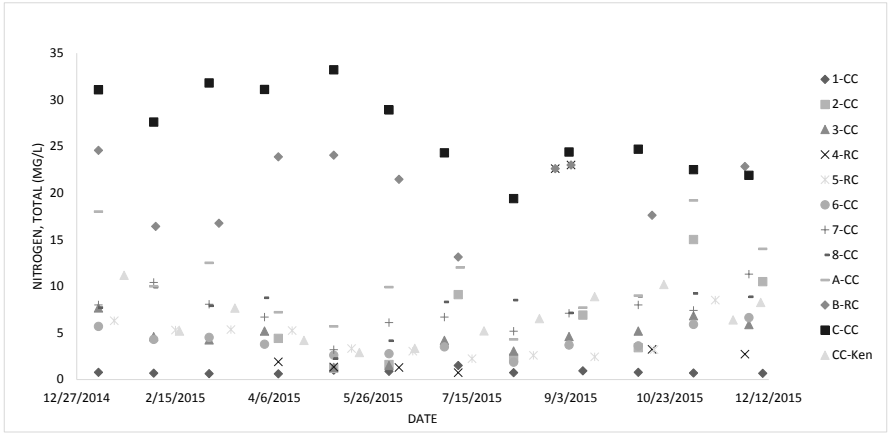

TEMPERATURE (DEG C)
25
20
15
10
5
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
1-CC
2-CC
3-CC
4-RC
5-RC
6-CC
7-CC
A-CC
B-RC
CC-Ken

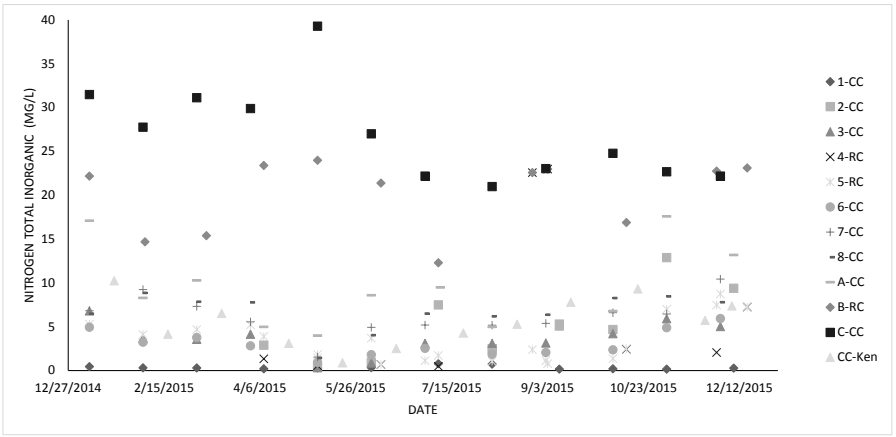

TSS (MG/L)
600
500
400
300
200
100
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
1-CC
2-CC
4-RC
5-RC
B-RC
CC-Ken

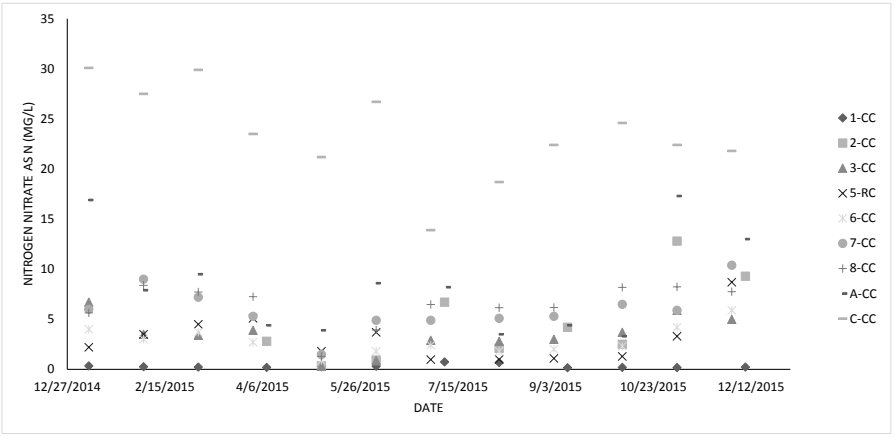

NITROGEN AMMONIA AS N (MG/L)
25
20
15
10
5
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
1-CC
2-CC
3-CC
4-RC
5-RC
6-CC
7-CC
8-CC
A-CC
B-RC
C-CC
CC-Ken

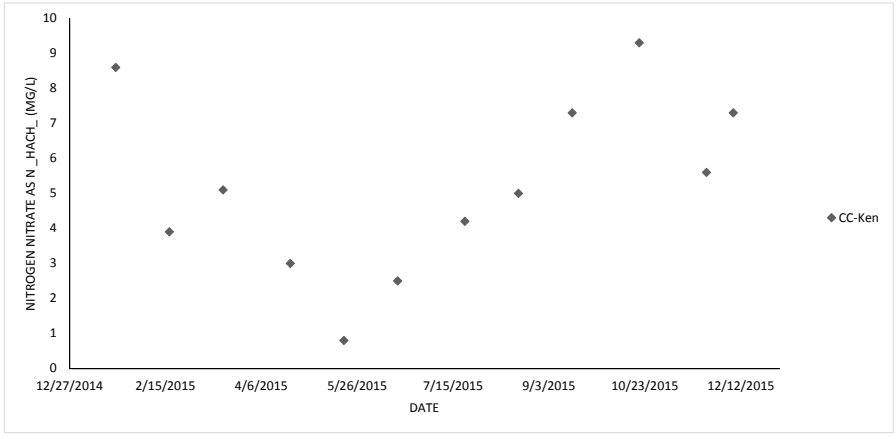

NITROGEN NITRATE/NITRITE AS N (MG/L)
35
30
25
20
15
10
5
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
1-CC
2-CC
3-CC
4-RC
5-RC
6-CC
7-CC
8-CC
A-CC
B-RC
C-CC
CC-Ken

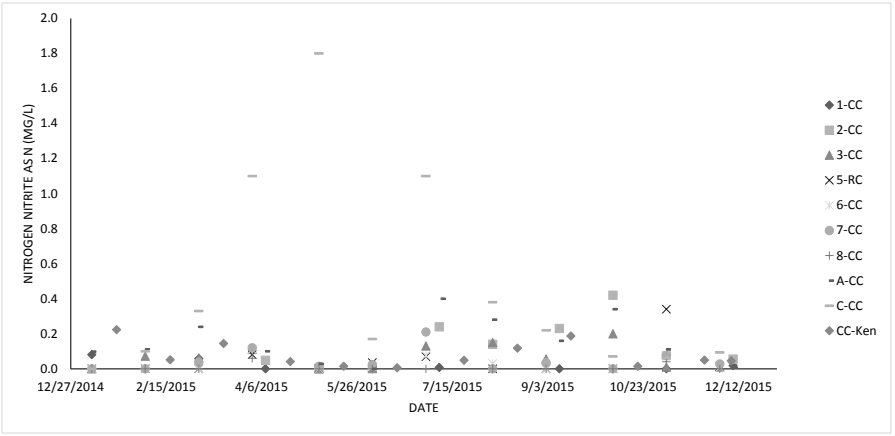

NITROGEN TKN (MG/L)
25
20
15
10
5
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
1-CC
2-CC
3-CC
4-RC
5-RC
6-CC
7-CC
8-CC
A-CC
B-RC
C-CC
CC-Ken

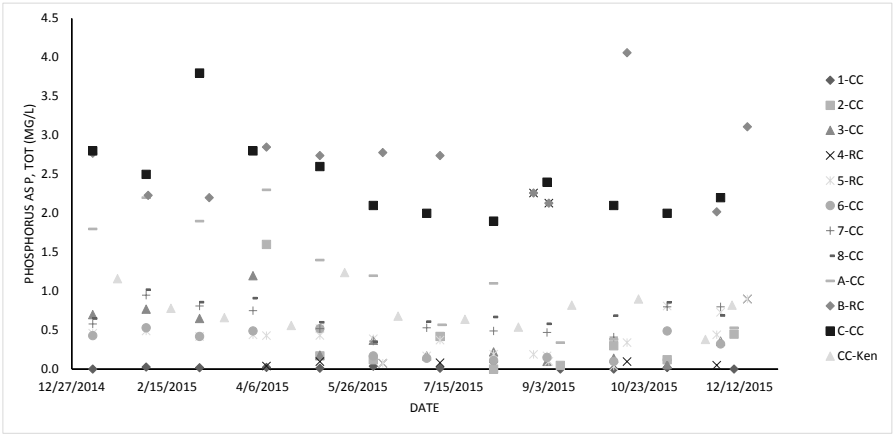

NITROGEN, TOTAL (MG/L)
35
30
25
20
15
10
5
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
1-CC
2-CC
3-CC
4-RC
5-RC
6-CC
7-CC
8-CC
A-CC
B-RC
C-CC
CC-Ken

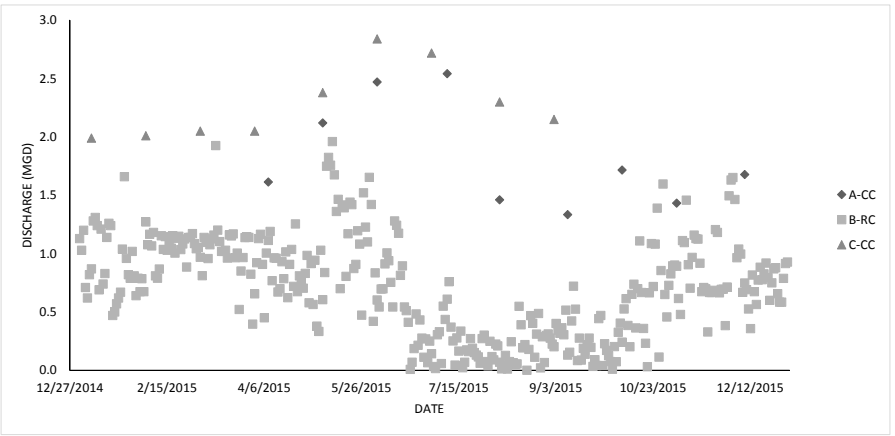

NITROGEN TOTAL INORGANIC (MG/L)
DATE
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
1-CC
2-CC
3-CC
4-RC
5-RC
6-CC
7-CC
8-CC
A-CC
B-RC
C-CC
CC-Ken

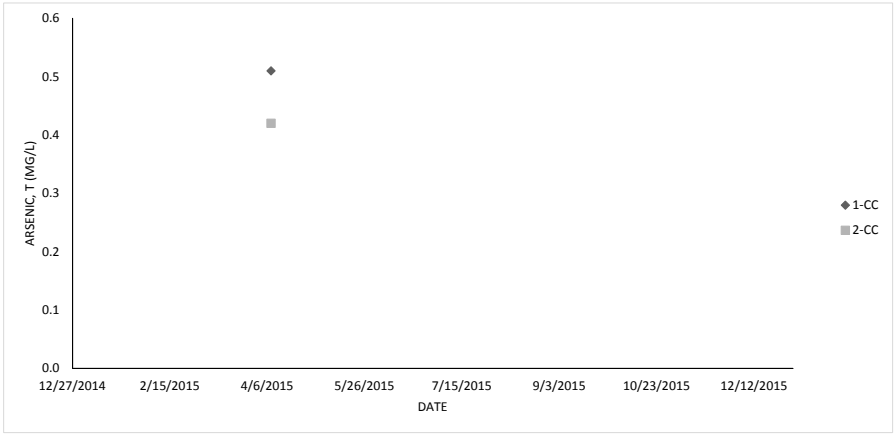

NITROGEN NITRATE AS N (MG/L)
DATE
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
1-CC
2-CC
3-CC
5-RC
6-CC
7-CC
8-CC
A-CC
C-CC

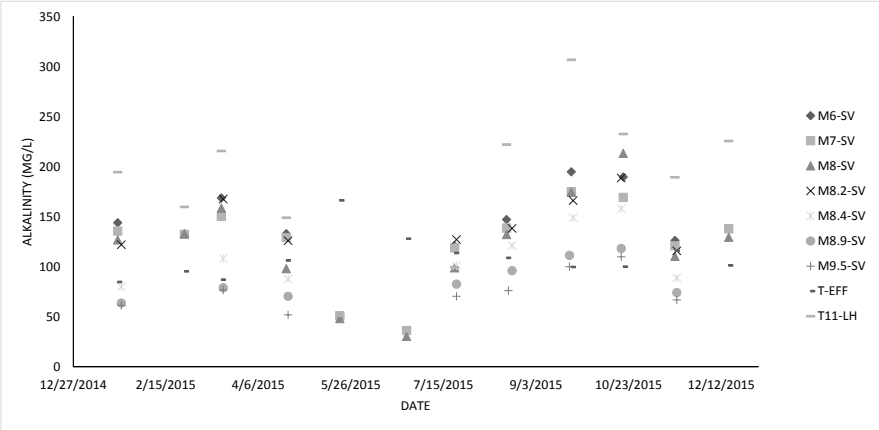

NITROGEN NITRATE AS N _HACH_ (MG/L)
DATE
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
CC-Ken

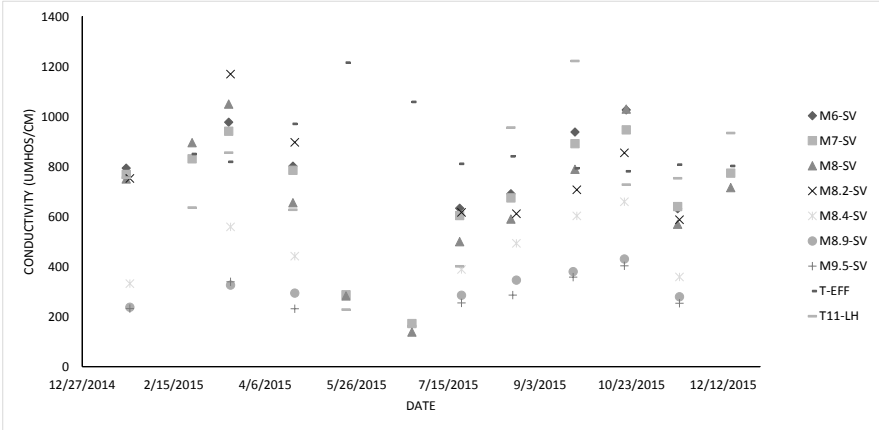

NITROGEN NITRITE AS N (MG/L)
DATE
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
1-CC
2-CC
3-CC
5-RC
6-CC
7-CC
8-CC
A-CC
C-CC
CC-Ken

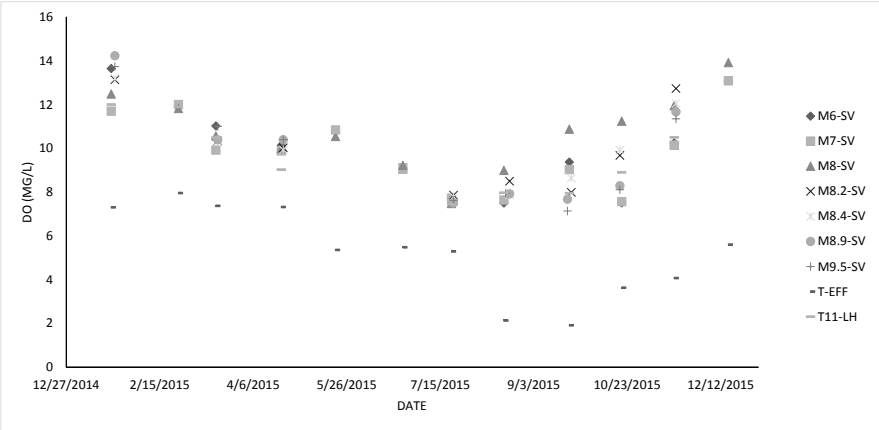

PHOSPHORUS AS P, TOT (MG/L)
DATE
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
1-CC
2-CC
3-CC
4-RC
5-RC
6-CC
7-CC
8-CC
A-CC
B-RC
C-CC
CC-Ken

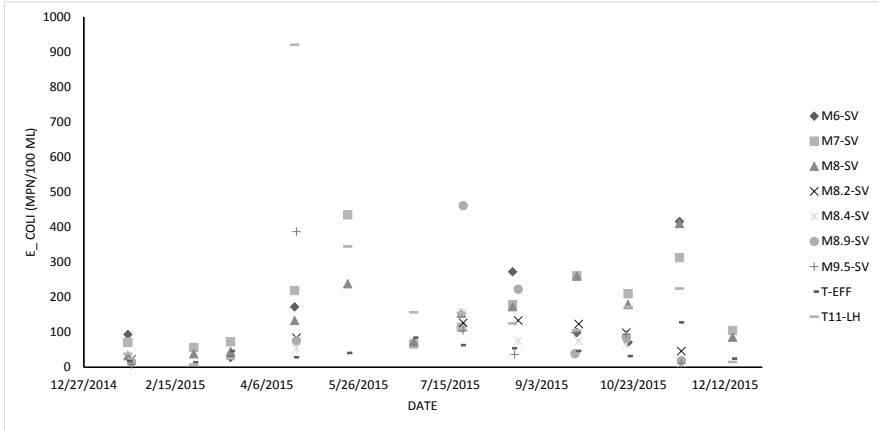

DISCHARGE (MGD)
DATE
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
A-CC
B-RC
C-CC

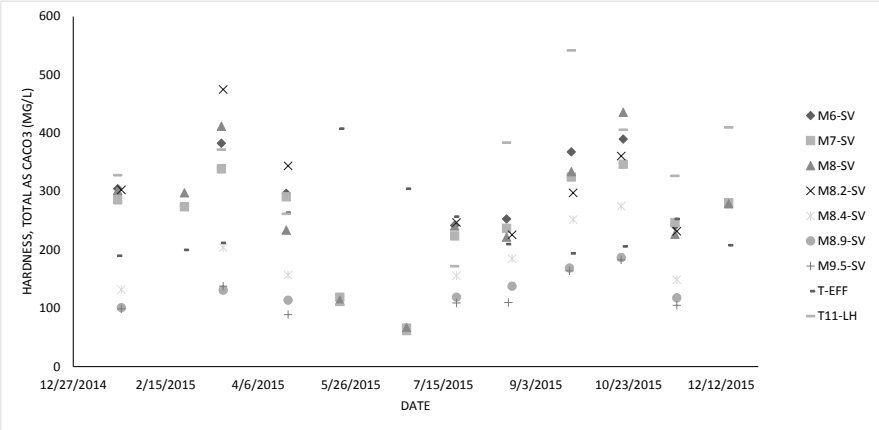

0.6
0.5
0.4
0.3
0.2
0.1
0.0
ARSENIC, T (MG/L)
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
1-CC
2-CC

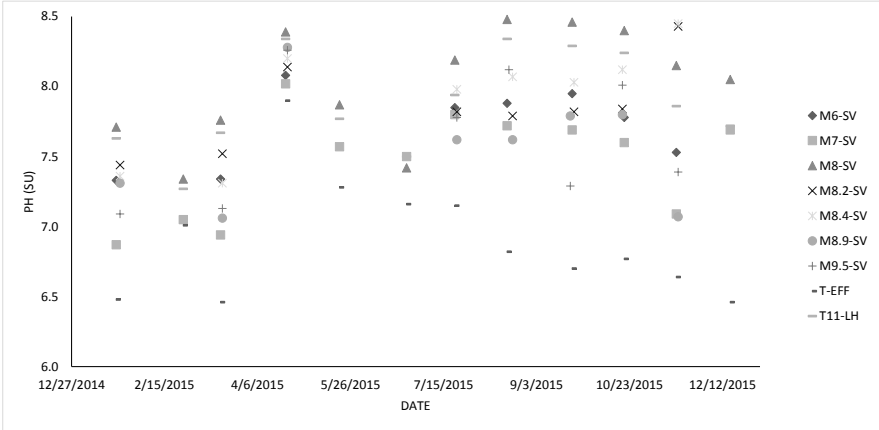

ALKALINITY (MG/L)
350
300
250
200
150
100
50
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH

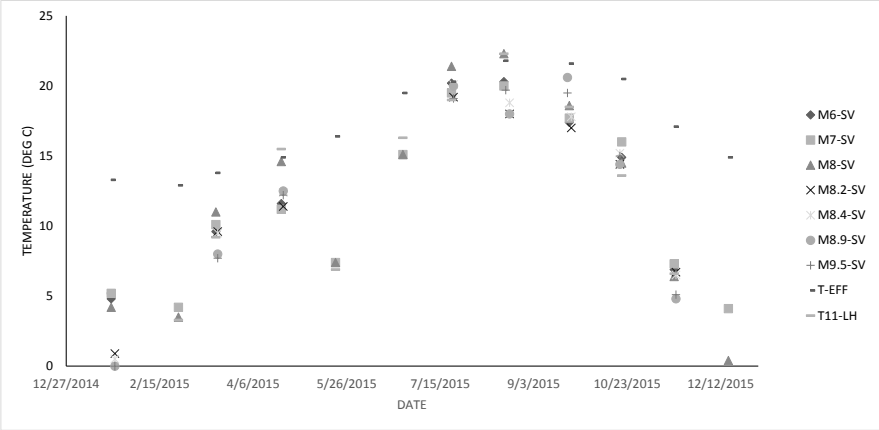

CONDUCTIVITY (UMHOS/CM)
1400
1200
1000
800
600
400
200
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH

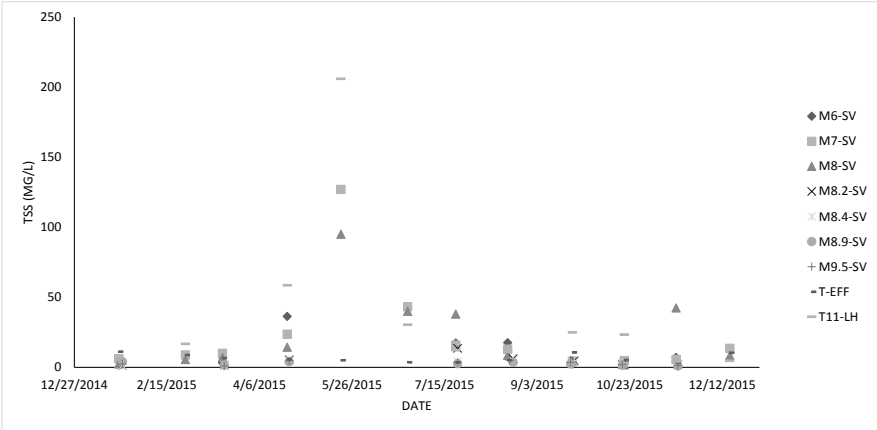

DO (MG/L)
16
14
12
10
8
6
4
2
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH

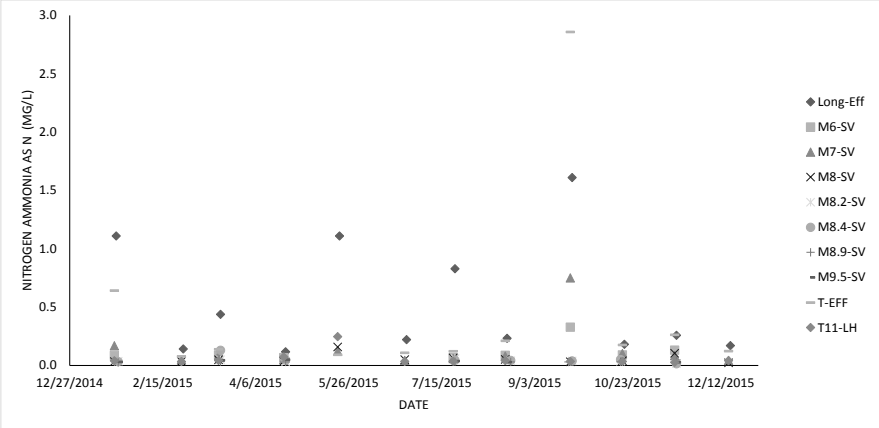

E_ COLI (MPN/100 ML)
1000
900
800
700
600
500
400
300
200
100
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH

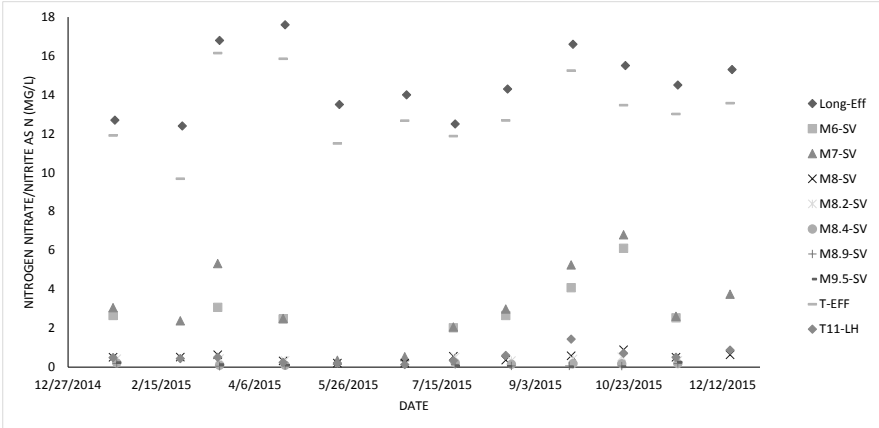

HARDNESS, TOTAL AS CACO3 (MG/L)
600
500
400
300
200
100
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH

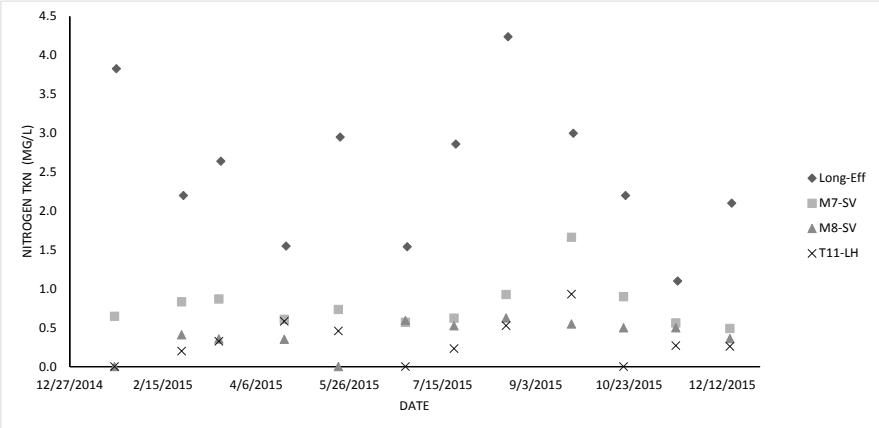

PH (SU)
8.5
8.0
7.5
7.0
6.5
6.0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH

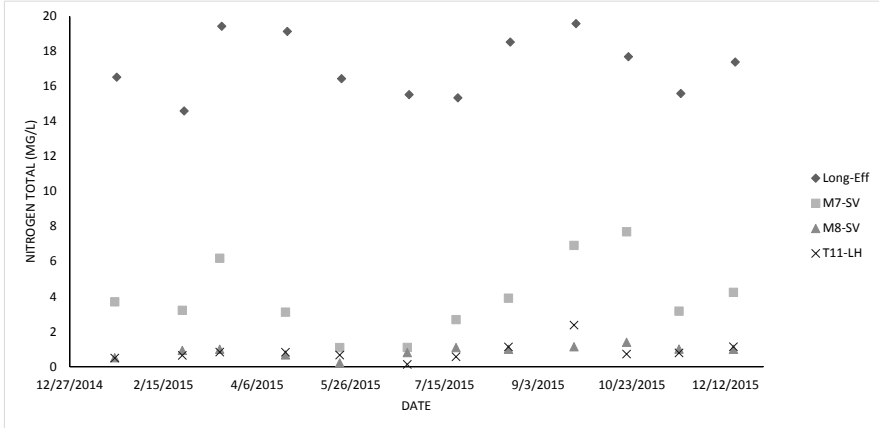

TEMPERATURE (DEG C)
25
20
15
10
5
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH

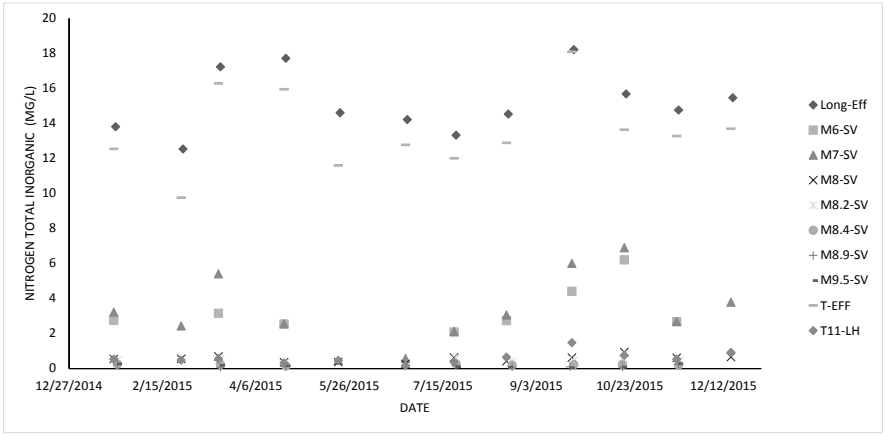

TSS (MG/L)
250
200
150
100
50
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH

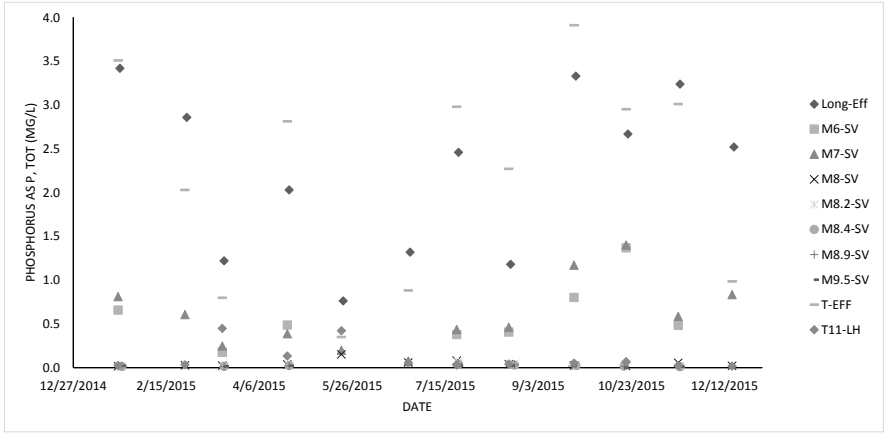

NITROGEN AMMONIA AS N (MG/L)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
Long-Eff
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH

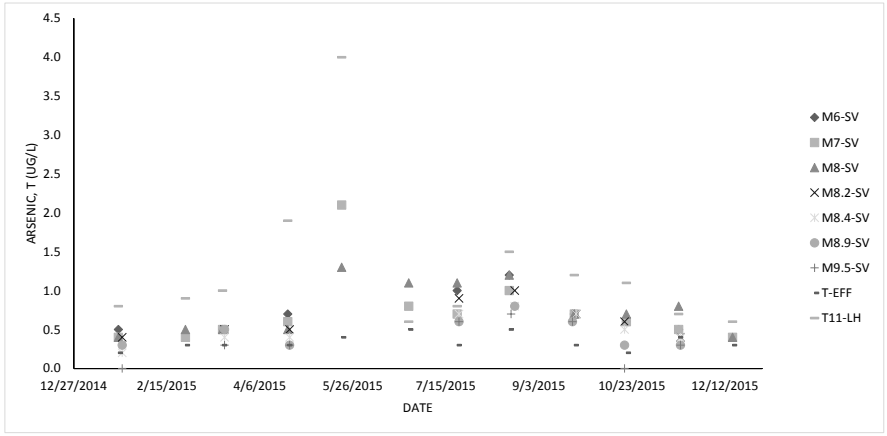

NITROGEN NITRATE/NITRITE AS N (MG/L)
18
16
14
12
10
8
6
4
2
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
Long-Eff
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH

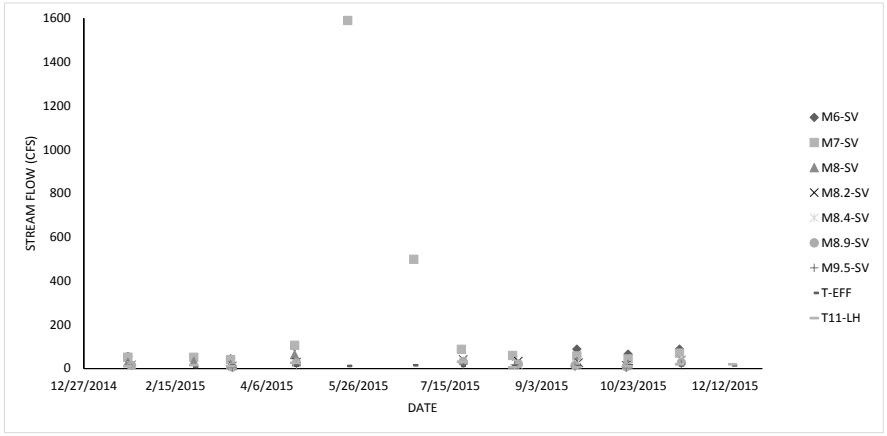

NITROGEN TKN (MG/L)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
Long-Eff
M7-SV
M8-SV
T11-LH


NITROGEN TOTAL (MG/L)
20
18
16
14
12
10
8
6
4
2
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
Long-Eff
M7-SV
M8-SV
T11-LH


NITROGEN TOTAL INORGANIC (MG/L)
20
18
16
14
12
10
8
6
4
2
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
Long-Eff
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH


PHOSPHORUS AS P, TOT (MG/L)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
Long-Eff
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH


ARSENIC, T (UG/L)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH


STREAM FLOW (CFS)
1600
1400
1200
1000
800
600
400
200
0
12/27/2014
2/15/2015
4/6/2015
5/26/2015
7/15/2015
9/3/2015
10/23/2015
12/12/2015
DATE
M6-SV
M7-SV
M8-SV
M8.2-SV
M8.4-SV
M8.9-SV
M9.5-SV
T-EFF
T11-LH

# Appendix E. Regulation 38 Stream Standards for Boulder Creek and St. Vrain Creek

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## Boulder Creek Basin

1. All tributaries to Boulder Creek, including all wetlands, within the Indian Peaks and James Peak Wilderness Areas.

| COSPBO01 | Classifications |
|---|---|
| **Designation** | Agriculture |
| OW | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):

Arsenic(chronic) = hybrid

Expiration Date of 12/31/2021

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | CS-I | CS-I |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150 |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.11 |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS(tr) | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS(tr) |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

2a. Mainstem of Boulder Creek, including all tributaries and wetlands, from the boundary of the Indian Peaks Wilderness Area to a point immediately below the confluence with North Boulder Creek, except for the specific listings in Segment 3.

| COSPBO02A | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):

Arsenic(chronic) = hybrid

Expiration Date of 12/31/2021

*chlorophyll a (mg/m$^2$)(chronic) = applies only above the facilities listed at 38.5(4).
*Phosphorus(chronic) = applies only above the facilities listed at 38.5(4).

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | CS-I | CS-I |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150* |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.11* |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS(tr) | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS(tr) |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## Boulder Creek Basin

2b. Mainstem of Boulder Creek, including all tributaries and wetlands, from a point immediately below the confluence with North Boulder Creek to a point immediately above the confluence with South Boulder Creek.

| COSPBO02B | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):

Arsenic(chronic) = hybrid

Expiration Date of 12/31/2021

*chlorophyll a ($mg/m^2$)(chronic) = applies only above the facilities listed at 38.5(4).
*Phosphorus(chronic) = applies only above the facilities listed at 38.5(4).

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | CS-II | CS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a ($mg/m^2$) | --- | 150* |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.11* |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS(tr) | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS(tr) |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

3. Mainstem of Middle Boulder Creek, including all tributaries and wetlands, from the source to the outlet of Barker Reservoir, except for specific listings in Segment 1.

| COSPBO03 | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):

Arsenic(chronic) = hybrid

Expiration Date of 12/31/2021

*chlorophyll a ($mg/m^2$)(chronic) = applies only above the facilities listed at 38.5(4).
*Phosphorus(chronic) = applies only above the facilities listed at 38.5(4).

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | CS-I | CS-I |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a ($mg/m^2$) | --- | 150* |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.11* |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS(tr) | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS(tr) |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## Boulder Creek Basin

4a. Mainstem of South Boulder Creek, including all tributaries and wetlands, from the source to the outlet of Gross Reservoir except for specific listings in Segment 1.

| COSPBO04A | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):
Arsenic(chronic) = hybrid
Expiration Date of 12/31/2021

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | CS-I | CS-I |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150 |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.11 |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS(tr) | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | 100(T) |
| Nickel | --- | TVS |
| Selenium | TVS | TVS |
| Silver | TVS | TVS(tr) |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

4b. Mainstem of South Boulder Creek, including all tributaries and wetlands, from the outlet of Gross Reservoir to South Boulder Road, except for specific listings in Segments 4c and 4d.

| COSPBO04B | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):
Arsenic(chronic) = hybrid
Expiration Date of 12/31/2021

*chlorophyll a (mg/m$^2$)(chronic) = applies only above the facilities listed at 38.5(4).
*Phosphorus(chronic) = applies only above the facilities listed at 38.5(4).

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | CS-II | CS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150* |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.11* |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS(tr) | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS(tr) |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## Boulder Creek Basin

4c. Mainstem of Cowdrey Drainage from the source below Cowdrey Reservoir #2 to the Davidson Ditch.

| COSPBO04C | Classifications |
|---|---|
| **Designation** | Agriculture |
| UP | Aq Life Warm 2 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | WS-II | WS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150 |
| E. Coli (per 100 mL) | --- | 126 |
| **Inorganic (mg/L)** | | |
| | **acute** | **chronic** |
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | 0.17 |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

4d. Mainstem of Cowdrey Drainage from immediately downstream of the Davidson Ditch to the confluence with South Boulder Creek.

| COSPBO04D | Classifications |
|---|---|
| **Designation** | Agriculture |
| UP | Aq Life Warm 2 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | WS-II | WS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150 |
| E. Coli (per 100 mL) | --- | 126 |
| **Inorganic (mg/L)** | | |
| | **acute** | **chronic** |
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | 0.17 |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## Boulder Creek Basin

5. Mainstem of South Boulder Creek from South Boulder Road to the confluence with Boulder Creek.

| COSPBO05 | Classifications |
|---|---|
| Designation | Agriculture |
| Reviewable | Aq Life Warm 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):
Arsenic(chronic) = hybrid
Expiration Date of 12/31/2021

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | WS-II | WS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | --- |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

6. Mainstem of Coal Creek, including all tributaries and wetlands, from the source to Highway 93.

| COSPBO06 | Classifications |
|---|---|
| Designation | Agriculture |
| Reviewable | Aq Life Cold 2 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | CS-II | CS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150 |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.11 |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02-10(T) [A] |
| Beryllium | --- | --- |
| Cadmium | TVS(tr) | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS(tr) |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## Boulder Creek Basin

7a. Mainstem of Coal Creek from Highway 93 to Highway 36 (Boulder Turnpike).

| COSPBO07A | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Warm 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):
Arsenic(chronic) = hybrid
Expiration Date of 12/31/2021

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | WS-II | WS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150 |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | 0.17 |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

7b. Mainstem of Coal Creek from Highway 36 to the confluence with Boulder Creek.

| COSPBO07B | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Warm 2 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | WS-II | WS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | --- |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02-10(T) [A] |
| Beryllium | --- | --- |
| Cadmium | TVS | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## Boulder Creek Basin

8. All tributaries to South Boulder Creek, including all wetlands from South Boulder Road to the confluence with Boulder Creek and all tributaries to Coal Creek, including all wetlands from Highway 93 to the confluence with Boulder Creek.

| COSPBO08 | Classifications |
|---|---|
| **Designation** | Agriculture |
| UP | Aq Life Warm 2 |
| | Recreation E |

**Qualifiers:**

**Other:**

Temporary Modification(s):

Selenium(chronic) = current condition

Expiration Date of 12/31/2020

*chlorophyll a (mg/m$^2$)(chronic) = applies only above the facilities listed at 38.5(4).
*Phosphorus(chronic) = applies only above the facilities listed at 38.5(4).

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | WS-II | WS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150* |
| E. Coli (per 100 mL) | --- | 126 |
| **Inorganic (mg/L)** | | |
| | **acute** | **chronic** |
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | --- |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 100 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | 0.17* |
| Sulfate | --- | --- |
| Sulfide | --- | 0.002 |

| Metals (ug/L) | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 100(T) |
| Beryllium | --- | --- |
| Cadmium | TVS | TVS |
| Chromium III | TVS | TVS |
| Chromium III | --- | 100(T) |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | 1000(T) |
| Iron | --- | --- |
| Lead | TVS | TVS |
| Manganese | TVS | TVS |
| Manganese | --- | --- |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Selenium | TVS | TVS |
| Silver | TVS | TVS |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

9. Mainstem of Boulder Creek from a point immediately above the confluence with South Boulder Creek to the confluence with Coal Creek.

| COSPBO09 | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Warm 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):

Arsenic(chronic) = hybrid

Expiration Date of 12/31/2021

temperature(DM/MWAT) = current condition 12/1 - 2/29

Expiration Date of 12/31/2020

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | WS-II | WS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |
| **Inorganic (mg/L)** | | |
| | **acute** | **chronic** |
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | --- |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## Boulder Creek Basin

10. Mainstem of Boulder Creek from the confluence with Coal Creek to the confluence with St. Vrain Creek.

| COSPBO10 | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Warm 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):
Arsenic(chronic) = hybrid
Expiration Date of 12/31/2021

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | WS-II | WS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |
| **Inorganic (mg/L)** | | |
| | **acute** | **chronic** |
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | --- |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

11. All tributaries to Boulder Creek, including all wetlands from a point immediately above the confluence with South Boulder Creek to the confluence with St. Vrain Creek, except for specific listings in Segments 5, 7a and 7b.

| COSPBO11 | Classifications |
|---|---|
| **Designation** | Agriculture |
| UP | Aq Life Warm 2 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | WS-II | WS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |
| **Inorganic (mg/L)** | | |
| | **acute** | **chronic** |
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | --- |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## Boulder Creek Basin

12. Deleted.

| COSPBO12 | Classifications |
|---|---|
| Designation | |
| Qualifiers: | |
| Other: | |

| Physical and Biological | DM | MWAT |
|---|---|---|
| | | |

| | acute | chronic |
|---|---|---|
| | | |

| Inorganic (mg/L) | | |
|---|---|---|
| | acute | chronic |
| | | |

| Metals (ug/L) | acute | chronic |
|---|---|---|
| | | |

13. All lakes and reservoirs tributary to Boulder Creek that are within the boundary of the Indian Peaks and James Peak Wilderness Areas.

| COSPBO13 | Classifications |
|---|---|
| Designation | Agriculture |
| OW | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |
| Qualifiers: | |
| Other: | |

*chlorophyll a (ug/L)(chronic) = applies only to lakes and reservoirs larger than 25 acres surface area.
*Phosphorus(chronic) = applies only to lakes and reservoirs larger than 25 acres surface area.

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | CL | CL |
| | acute | chronic |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (ug/L) | --- | 8* |
| E. Coli (per 100 mL) | --- | 126 |

| Inorganic (mg/L) | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.025* |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## Boulder Creek Basin

14. All lakes and reservoirs tributary to Boulder Creek from the source to a point immediately above the South Boulder Creek confluence, except as specified in Segment 13. This segment includes Barker and Lakewood Reservoir.

| COSPBO14 | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |
| | DUWS* |

**Qualifiers:**

**Other:**

Temporary Modification(s):

Arsenic(chronic) = hybrid

Expiration Date of 12/31/2021

*chlorophyll a (ug/L)(chronic) = applies only above the facilities listed at 38.5(4), applies only to lakes and reservoirs larger than 25 acres surface area.
*Classification: DUWS applies to Lakewood Reservoir only.
*Phosphorus(chronic) = applies only above the facilities listed at 38.5(4), applies only to lakes and reservoirs larger than 25 acres surface area.

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | CL,CLL | CL,CLL |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (ug/L) | --- | 8* |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.025* |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS(tr) | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS(tr) |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

15. All lakes and reservoirs tributary to South Boulder Creek from the source to Highway 93. All lakes and reservoirs tributary to Coal Creek from the source to Highway 93 except for specific listings in segments 13 and 18.

| COSPBO15 | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Cold 2 |
| | Recreation E |
| | Water Supply |
| | DUWS* |

**Qualifiers:**

**Other:**

*chlorophyll a (ug/L)(chronic) = applies only above the facilities listed at 38.5(4), applies only to lakes and reservoirs larger than 25 acres surface area.
*Classification: DUWS applies to Kossler Lake only.
*Phosphorus(chronic) = applies only above the facilities listed at 38.5(4), applies only to lakes and reservoirs larger than 25 acres surface area.

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | CL | CL |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (ug/L) | --- | 8* |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.025* |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02-10(T) |
| Beryllium | --- | --- |
| Cadmium | TVS(tr) | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS(tr) |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## Boulder Creek Basin

16. All lakes and reservoirs tributary to South Boulder Creek system from Highway 93 to the confluence with Boulder Creek. All lakes and reservoirs tributary to Coal Creek system from Highway 93 to the confluence with Boulder Creek.

| COSPBO16 | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Warm 2 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | WL | WL |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (ug/L) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |
| **Inorganic (mg/L)** | | |
| | **acute** | **chronic** |
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | --- |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

17. All lakes and reservoirs tributary to Boulder Creek from a point immediately below the confluence with South Boulder Creek to the confluence with St. Vrain Creek, except as specified in Segments 15 and 16.

| COSPBO17 | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Warm 2 |
| | Recreation E |
| | Water Supply |
| | DUWS* |

**Qualifiers:**

**Water + Fish Standards**

**Other:**

*Classification: DUWS applies to Baseline, Marshall, Thomas and Waneka Reservoirs only.

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | WL | WL |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (ug/L) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |
| **Inorganic (mg/L)** | | |
| | **acute** | **chronic** |
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | --- |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## Boulder Creek Basin

18. Gross Reservior.

| COSPBO18 | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

*chlorophyll a (ug/L)(chronic) = applies only above the facilities listed at 38.5(4), applies only to lakes and reservoirs larger than 25 acres surface area.
*Phosphorus(chronic) = applies only above the facilities listed at 38.5(4), applies only to lakes and reservoirs larger than 25 acres surface area.

**Physical and Biological**

| | | DM | MWAT |
|---|---|---|---|
| Temperature °C | 1/1 - 3/31 | CLL | CLL |
| Temperature °C | 4/1 - 12/31 | CLL | 19.4 |

| | acute | chronic |
|---|---|---|
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (ug/L) | --- | 8* |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.025* |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS(tr) | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS(tr) |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## St. Vrain Creek Basin

1. All tributaries to St. Vrain Creek, including all wetlands, which are within the Indian Peaks Wilderness Area and Rocky Mountain National Park.

| COSPSV01 | Classifications |
|---|---|
| Designation | Agriculture |
| OW | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):

Arsenic(chronic) = hybrid

Expiration Date of 12/31/2021

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | CS-I | CS-I |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150 |
| E. Coli (per 100 mL) | --- | 126 |

| Inorganic (mg/L) | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.11 |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

2a. Mainstem of St. Vrain Creek, including all tributaries and wetlands, from the boundary of the Indian Peaks Wilderness Area and Rocky Mountain National Park to the eastern boundary of Roosevelt National Forest.

| COSPSV02A | Classifications |
|---|---|
| Designation | Agriculture |
| Reviewable | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):

Arsenic(chronic) = hybrid

Expiration Date of 12/31/2021

*chlorophyll a (mg/m$^2$)(chronic) = applies only above the facilities listed at 38.5(4).
*Phosphorus(chronic) = applies only above the facilities listed at 38.5(4).

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | CS-I | CS-I |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150* |
| E. Coli (per 100 mL) | --- | 126 |

| Inorganic (mg/L) | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.11* |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## St. Vrain Creek Basin

2b. Mainstem of St. Vrain Creek, including all tributaries and wetlands, from the eastern boundary of Roosevelt National Forest to Hygiene Road.

| COSPSV02B | Classifications |
|---|---|
| Designation | Agriculture |
| Reviewable | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):

Arsenic(chronic) = hybrid

Expiration Date of 12/31/2021

*chlorophyll a (mg/m$^2$)(chronic) = applies only above the facilities listed at 38.5(4).
*Phosphorus(chronic) = applies only above the facilities listed at 38.5(4).

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | CS-II | CS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150* |
| E. Coli (per 100 mL) | --- | 126 |

| Inorganic (mg/L) | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.11* |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

3. Mainstem of St. Vrain Creek from Hygiene Road to the confluence with the South Platte River.

| COSPSV03 | Classifications |
|---|---|
| Designation | Agriculture |
| Reviewable | Aq Life Warm 1 |
| | Recreation E |

**Qualifiers:**

**Other:**

| 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/m$^2$) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |

| Inorganic (mg/L) | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | --- |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 100 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | --- |
| Sulfate | --- | --- |
| Sulfide | --- | 0.002 |

| Metals (ug/L) | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 7.6(T) |
| Beryllium | --- | --- |
| Cadmium | TVS | TVS |
| Chromium III | TVS | TVS |
| Chromium III | --- | 100(T) |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Manganese | TVS | TVS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Selenium | TVS | TVS |
| Silver | TVS | TVS |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## St. Vrain Creek Basin

4a. Mainstem of Left Hand Creek, including all tributaries and wetlands, from the source to a point immediately below the confluence with James Creek, except for specific listings in Segment 4b.

| COSPSV04A | Classifications |
|---|---|
| **Designation** | Agriculture |
| UP | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | CS-I | CS-I |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150 |
| E. Coli (per 100 mL) | --- | 126 |

| Inorganic (mg/L) | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.11 |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

4b. Mainstem of James Creek, including all tributaries and wetlands, from the source to the confluence with Left Hand Creek.

| COSPSV04B | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):
Arsenic(chronic) = hybrid
Expiration Date of 12/31/2021

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | CS-I | CS-I |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150 |
| E. Coli (per 100 mL) | --- | 126 |

| Inorganic (mg/L) | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.11 |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## St. Vrain Creek Basin

4c. Mainstem of Left Hand Creek, including all tributaries and wetlands, from a point immediately below the confluence with James Creek to Highway 36.

| COSPSV04C | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):
Arsenic(chronic) = hybrid
Expiration Date of 12/31/2021

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | CS-II | CS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | 150 |
| E. Coli (per 100 mL) | --- | 126 |

| Inorganic (mg/L) | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.11 |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

5. Mainstem of Left Hand Creek, including all tributaries and wetlands from Highway 36 to the confluence with St. Vrain Creek.

| COSPSV05 | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Warm 2 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

| 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/m$^2$) | --- | 150 |
| E. Coli (per 100 mL) | --- | 126 |

| Inorganic (mg/L) | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | 0.17 |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## St. Vrain Creek Basin

6. All tributaries to St. Vrain Creek, including wetlands from Hygiene Road to the confluence with the South Platte River, except for specific listings in the Boulder Creek subbasin and in Segments 4a, 4b, 4c and 5.

| COSPSV06 | Classifications |
|---|---|
| **Designation** | Agriculture |
| UP | Aq Life Warm 2 |
| | Recreation E |
| **Qualifiers:** | |
| **Other:** | |

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | WS-II | WS-II |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (mg/m$^2$) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |
| **Inorganic (mg/L)** | | |
| | **acute** | **chronic** |
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | --- |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 100 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | --- |
| Sulfate | --- | --- |
| Sulfide | --- | 0.002 |

| Metals (ug/L) | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 100(T) |
| Beryllium | --- | --- |
| Cadmium | TVS | TVS |
| Chromium III | TVS | TVS |
| Chromium III | --- | 100(T) |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Manganese | TVS | TVS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Selenium | TVS | TVS |
| Silver | TVS | TVS |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

7. Boulder Reservoir, Coot Lake, Left Hand Valley Reservoir and Spurgeon Reservoir.

| COSPSV07 | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Warm 1 |
| | Recreation E |
| | Water Supply |
| | DUWS* |
| **Qualifiers:** | |
| **Other:** | |
| Temporary Modification(s): | |
| Arsenic(chronic) = hybrid | |
| Expiration Date of 12/31/2021 | |
| *Classification: DUWS applies to Boulder, Spurgeon and Left Hand Valley Reservoirs only. | |

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | WL | WL |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (ug/L) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |
| **Inorganic (mg/L)** | | |
| | **acute** | **chronic** |
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | --- |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## St. Vrain Creek Basin

8. All lakes and reservoirs tributary to St. Vrain Creek that are within the boundary of the Indian Peaks Wilderness Area and Rocky Mountain National Park.

| COSPSV08 | Classifications |
|---|---|
| **Designation** | Agriculture |
| OW | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | CL | CL |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (ug/L) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | --- |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS(tr) | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS(tr) |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

9. All lakes and reservoirs tributary to St. Vrain Creek from sources to Hygiene Road, including Button Rock Reservoir, except as specified in Segment 8.

| COSPSV09 | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

Temporary Modification(s):
Arsenic(chronic) = hybrid
Expiration Date of 12/31/2021

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | CL,CLL | CL,CLL |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (ug/L) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | --- |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS(tr) | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS(tr) |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## St. Vrain Creek Basin

10. All lakes and reservoirs tributary to Left Hand Creek from sources to Highway 36.

| COSPSV10 | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Cold 1 |
| | Recreation E |
| | Water Supply |
| | DUWS* |

**Qualifiers:**

**Other:**

*chlorophyll a (ug/L)(chronic) = applies only above the facilities listed at 38.5(4), applies only to lakes and reservoirs larger than 25 acres surface area.
*Classification: DUWS applies to Joder Reservoir only.
*Phosphorus(chronic) = applies only above the facilities listed at 38.5(4), applies only to lakes and reservoirs larger than 25 acres surface area.

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | CL | CL |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 6.0 |
| D.O. (spawning) | --- | 7.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (ug/L) | --- | 8* |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.05 |
| Phosphorus | --- | 0.025* |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS(tr) | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS(tr) |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

11. Barbour Ponds.

| COSPSV11 | Classifications |
|---|---|
| **Designation** | Agriculture |
| Reviewable | Aq Life Warm 1 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Other:**

**Physical and Biological**

| | DM | MWAT |
|---|---|---|
| Temperature °C | WL | WL |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (ug/L) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |

**Inorganic (mg/L)**

| | acute | chronic |
|---|---|---|
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | --- |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

**Metals (ug/L)**

| | acute | chronic |
|---|---|---|
| Aluminum | --- | --- |
| Arsenic | 340 | 0.02(T) |
| Beryllium | --- | --- |
| Cadmium | TVS | TVS |
| Cadmium | 5.0(T) | --- |
| Chromium III | 50(T) | TVS |
| Chromium VI | TVS | TVS |
| Copper | TVS | TVS |
| Iron | --- | WS |
| Iron | --- | 1000(T) |
| Lead | TVS | TVS |
| Lead | 50(T) | --- |
| Manganese | TVS | TVS |
| Manganese | --- | WS |
| Mercury | --- | 0.01(t) |
| Molybdenum | --- | 150(T) |
| Nickel | TVS | TVS |
| Nickel | --- | 100(T) |
| Selenium | TVS | TVS |
| Silver | TVS | TVS |
| Uranium | --- | --- |
| Zinc | TVS | TVS |

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

# REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS
## St. Vrain Creek Basin

12. All lakes and reservoirs tributary to Left Hand Creek from Highway 36 to the confluence with St. Vrain Creek, except as specified in Segment 7.

| COSPSV12 | Classifications |
|---|---|
| Designation | Agriculture |
| Reviewable | Aq Life Warm 2 |
| | Recreation E |
| | Water Supply |

**Qualifiers:**

**Water + Fish Standards**

**Other:**

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | WL | WL |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (ug/L) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |
| **Inorganic (mg/L)** | | |
| | **acute** | **chronic** |
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | --- |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

13. All lakes and reservoirs tributary to St. Vrain Creek from Hygiene Road to the confluence with the South Platte River, except as specified in Segments 7, 10, 11 and 12.

| COSPSV13 | Classifications |
|---|---|
| Designation | Agriculture |
| Reviewable | Aq Life Warm 2 |
| | Recreation E |
| | Water Supply |
| | DUWS* |

**Qualifiers:**

**Other:**

*Classification: DUWS applies to Burch lake only.

| Physical and Biological | DM | MWAT |
|---|---|---|
| Temperature °C | WL | WL |
| | **acute** | **chronic** |
| D.O. (mg/L) | --- | 5.0 |
| pH | 6.5 - 9.0 | --- |
| chlorophyll a (ug/L) | --- | --- |
| E. Coli (per 100 mL) | --- | 126 |
| **Inorganic (mg/L)** | | |
| | **acute** | **chronic** |
| Ammonia | TVS | TVS |
| Boron | --- | 0.75 |
| Chloride | --- | 250 |
| Chlorine | 0.019 | 0.011 |
| Cyanide | 0.005 | --- |
| Nitrate | 10 | --- |
| Nitrite | --- | 0.5 |
| Phosphorus | --- | --- |
| Sulfate | --- | WS |
| Sulfide | --- | 0.002 |

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

All metals are dissolved unless otherwise noted.
T = total recoverable
t = total
tr = trout

D.O. = dissolved oxygen
DM = daily maximum
MWAT = maximum weekly average temperature
See 38.6 for details on TVS, TVS(tr), WS, temperature standards.

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# Appendix F. 2016 303(d) List for Boulder Creek/ St. Vrain Creek Watershed

**Appendix F. Boulder Creek and St. Vrain Creek Stream Segments Listed on the 2016 303(d) List and Monitoring and Evaluation List**

| WBID | Description | Portion | M&E | 303(d) | Priority |
|---|---|---|---|---|---|
| **Boulder Creek Watershed** | | | | | |
| COSPBO02a | Mainstem of Boulder Creek, from the boundary of the Indian Peaks Wilderness Area to a point immediately below the confluence with North Boulder Creek | all | | As | L |
| COSPBO02a | Mainstem of Boulder Creek, including all tributaries from the boundary of the Indian Peaks Wilderness Area to North Boulder Creek | North Boulder Creek from Caribou Creek to the confluence with Como Creek | Fe(Dis) | Cu | H |
| COSPBO02a | Mainstem of Boulder Creek, including all tributaries from the boundary of the Indian Peaks Wilderness Area to North Boulder Creek | Como Creek to the confluence of North Boulder Creek | | Fe(Trec), Fe(Dis) | H/L |
| COSPBO02a | Mainstem of Boulder Creek, including all tributaries from the boundary of the Indian Peaks Wilderness Area to North Boulder Creek | North Boulder Creek to Confluence of Caribou Creek | | Cu, Pb | H |
| COSPBO02a | Mainstem of Boulder Creek, including all tributaries from the boundary of the Indian Peaks Wilderness Area to North Boulder Creek | Middle Boulder Creek from the outlet of Barker Reservoir to Longitude: -105.475577° Latitude: 39.971275° | Mn | Aquatic Life (provisional) | L |
| COSPBO02b | Boulder Creek, from below the confluence with North Boulder Creek to above the confluence with South Boulder Creek | all | | As | L |
| COSPBO03 | Mainstem of Middle Boulder Creek from source to the outlet of Barker Reservoir | all | | As | L |
| COSPBO03 | Mainstem of Middle Boulder Creek from source to the outlet of Barker Reservoir | Middle Boulder Creek | | Aquatic Life (provisional) | L |
| COSPBO04a | Mainstem of South Boulder Creek, including all tributaries from the source to the outlet of Gross Reservoir | all | | Cu | H |
| COSPBO04b | Mainstem of South Boulder Creek, including all tributaries from the outlet of Gross Reservoir to South Boulder Road | all | | Cu, As | H/L |
| COSPBO07a | Mainstem of Coal Creek from Highway 93 to Highway 36 | all | | Aquatic Life (provisional) | H |
| COSPBO07b | Coal Creek, HWY 36 to Boulder Creek | all | Aquatic Life | *E. coli* | H |
| COSPBO07b | Coal Creek, HWY 36 to Boulder Creek | Below Confluence of Rock Creek | | Se | M |
| COSPBO08 | All tribs to South Boulder Creek and all tribs to Coal Creek | Rock Creek | E. Coli | Se | L |
| COSPBO09 | Mainstem of Boulder Creek, from South Boulder Creek to Coal Creek | all | | As, *E. coli* (July to October) | L/H |
| COSPBO09 | Mainstem of Boulder Creek, from South Boulder Creek to Coal Creek | From 107th Street to the confluence with Coal Creek | | Aquatic Life (provisional) | L |
| COSPBO10 | Boulder Creek, Coal Creek to St. Vrain Creek | all | | *E. coli* , pH, As | H/H/L |
| COSPBO14 | Lakes and reservoirs tributary to Boulder Creek from source to South Boulder Creek. | Barker Reservoir | Mn, Fe(dis), Ag | Cu, As | H/L |
| COSPBO18 | Gross Reservoir | all | Aquatic Life Use (Hg Fish Tissue) | | |
| **St. Vrain Creek Watershed** | | | | | |
| COSPSV02b | St. Vrain Creek, RMNP to Hygiene Road | all | Ag | Temperature, As | H/L |
| COSPSV02b | St. Vrain Creek, RMNP to Hygiene Road | South Saint Vrain Creek from just below its confluence with Red Hill Gulch to its confluence with North Saint Vrain Creek. | | Cu | H |
| COSPSV03 | St. Vrain Creek, Hygiene Rd. to S. Platte River | all | | *E. coli* | H |
| COSPSV04a | Left Hand Creek, from source to blw confluence with James Creek | (Hwy 72 to James Ck); | Mn | | |
| COSPSV05 | Mainstem of Left Hand Creek, including all tributaries and wetlands from Highway 36 to the confluence with St. Vrain Creek. | Lefthand Creek below US 36 to a point above the Lefthand Feeder Canal | | Mn, pH | L/H |
| COSPSV05 | Mainstem of Left Hand Creek, including all tributaries and wetlands from Highway 36 to the confluence with St. Vrain Creek. | all | | Cu | M |
| COSPSV06 | Tributaries to the St Vrain River | all | | Mn | L |
| COSPSV06 | Tributaries to the St Vrain River | Dry Creek | | Se | M |
| COSPSV06 | Tributaries to the St Vrain River | Boulder Reservoir | | *E. coli* | H |
| COSPSV07 | Boulder Reservoir, Coot Lake, and Left Hand Valley Reservoir | Boulder Reservoir | | As | L |

# Appendix G. Quality Assurance / Quality Control

| Common Name | Data Provider | Plot_ID | Date | Routine | Replicate | Relative % Difference |
|---|---|---|---|---|---|---|
| Alkalinity (mg/L) | Longmont | M9.5-SV | 22-Jan-15 | 61.21 | 63.52 | 4% |
| Alkalinity (mg/L) | Longmont | M9.5-SV | 19-Aug-15 | 76.11 | 82.17 | 7% |
| Alkalinity (mg/L) | Longmont | M8.9-SV | 19-Oct-15 | 118.20 | 120.80 | 2% |
| Alkalinity (mg/L) | Longmont | M8.4-SV | 22-Jul-15 | 100.90 | 125.00 | 19% |
| Alkalinity (mg/L) | Longmont | M8.2-SV | 22-Apr-15 | 126.00 | 125.70 | 0% |
| Alkalinity (mg/L) | Longmont | M8.2-SV | 23-Sep-15 | 166.00 | 164.80 | 1% |
| Alkalinity (mg/L) | Longmont | T11-LH | 20-May-15 | 50.95 | 51.01 | 0% |
| Alkalinity (mg/L) | Longmont | T-EFF | 25-Jun-15 | 128.00 | 125.50 | 2% |
| Alkalinity (mg/L) | Longmont | T-EFF | 16-Dec-15 | 101.20 | 105.00 | 4% |
| Alkalinity (mg/L) | Longmont | M7-SV | 25-Feb-15 | 132.30 | 132.20 | 0% |
| Alkalinity (mg/L) | Longmont | M6-SV | 17-Mar-15 | 168.80 | 168.50 | 0% |
| Alkalinity (mg/L) | Longmont | M6-SV | 17-Nov-15 | 126.10 | 125.70 | 0% |
| Conductivity (umhos/cm) | Longmont | M9.5-SV | 22-Jan-15 | 232.50 | 235.40 | 1% |
| Conductivity (umhos/cm) | Longmont | M9.5-SV | 19-Aug-15 | 286.55 | 301.80 | 5% |
| Conductivity (umhos/cm) | Longmont | M8.9-SV | 19-Oct-15 | 431.01 | 434.66 | 1% |
| Conductivity (umhos/cm) | Longmont | M8.4-SV | 22-Jul-15 | 389.12 | 596.08 | 35% |
| Conductivity (umhos/cm) | Longmont | M8.2-SV | 22-Apr-15 | 897.39 | 922.21 | 3% |
| Conductivity (umhos/cm) | Longmont | M8.2-SV | 23-Sep-15 | 707.77 | 717.17 | 1% |
| Conductivity (umhos/cm) | Longmont | T11-LH | 20-May-15 | 228.60 | 231.30 | 1% |
| Conductivity (umhos/cm) | Longmont | T-EFF | 25-Jun-15 | 1058.95 | 1062.30 | 0% |
| Conductivity (umhos/cm) | Longmont | T-EFF | 16-Dec-15 | 803.05 | 814.18 | 1% |
| Conductivity (umhos/cm) | Longmont | M7-SV | 25-Feb-15 | 831.04 | 815.72 | 2% |
| Conductivity (umhos/cm) | Longmont | M6-SV | 17-Mar-15 | 977.48 | 975.98 | 0% |
| Conductivity (umhos/cm) | Longmont | M6-SV | 17-Nov-15 | 631.95 | 649.85 | 3% |
| Hardness, Total as CaCO3 (mg/L) | Longmont | M9.5-SV | 22-Jan-15 | 99.00 | 102.00 | 3% |
| Hardness, Total as CaCO3 (mg/L) | Longmont | M9.5-SV | 19-Aug-15 | 110.00 | 117.00 | 6% |
| Hardness, Total as CaCO3 (mg/L) | Longmont | M8.9-SV | 19-Oct-15 | 187.00 | 191.00 | 2% |
| Hardness, Total as CaCO3 (mg/L) | Longmont | M8.4-SV | 22-Jul-15 | 156.00 | 157.00 | 1% |
| Hardness, Total as CaCO3 (mg/L) | Longmont | M8.2-SV | 22-Apr-15 | 344.00 | 344.00 | 0% |
| Hardness, Total as CaCO3 (mg/L) | Longmont | M8.2-SV | 23-Sep-15 | 298.00 | 292.00 | 2% |
| Hardness, Total as CaCO3 (mg/L) | Longmont | T11-LH | 20-May-15 | 106.00 | 104.00 | 2% |
| Hardness, Total as CaCO3 (mg/L) | Longmont | T-EFF | 25-Jun-15 | 305.00 | 300.00 | 2% |
| Hardness, Total as CaCO3 (mg/L) | Longmont | T-EFF | 16-Dec-15 | 208.00 | 210.00 | 1% |
| Hardness, Total as CaCO3 (mg/L) | Longmont | M7-SV | 25-Feb-15 | 274.00 | 273.00 | 0% |
| Hardness, Total as CaCO3 (mg/L) | Longmont | M6-SV | 17-Mar-15 | 383.00 | 374.00 | 2% |
| Hardness, Total as CaCO3 (mg/L) | Longmont | M6-SV | 17-Nov-15 | 241.00 | 243.00 | 1% |
| E. coli (MPN/100 mL) | Lafayette | 3-CC | 04-Nov-15 | 47.00 | 78.00 | 12% |
| E. coli (MPN/100 mL) | Lafayette | 6-CC | 05-Aug-15 | 291.00 | 272.00 | 1% |
| E. coli (MPN/100 mL) | Lafayette | 7-CC | 06-May-15 | 921.00 | 980.00 | 1% |
| E. coli (MPN/100 mL) | Lafayette | 5-RC | 04-Feb-15 | 98.00 | 128.00 | 6% |
| E. coli (MPN/100 mL) | Longmont | M9.5-SV | 22-Jan-15 | 7.50 | 4.10 | 36% |
| E. coli (MPN/100 mL) | Longmont | M9.5-SV | 19-Aug-15 | 36.40 | 40.40 | 3% |
| E. coli (MPN/100 mL) | Longmont | M8.9-SV | 19-Oct-15 | 85.70 | 58.10 | 9% |
| E. coli (MPN/100 mL) | Longmont | M8.4-SV | 22-Jul-15 | 157.60 | 235.90 | 8% |
| E. coli (MPN/100 mL) | Longmont | M8.2-SV | 22-Apr-15 | 83.90 | 98.80 | 4% |
| E. coli (MPN/100 mL) | Longmont | M8.2-SV | 23-Sep-15 | 123.40 | 67.00 | 14% |
| E. coli (MPN/100 mL) | Longmont | T11-LH | 20-May-15 | 344.80 | 290.90 | 3% |
| E. coli (MPN/100 mL) | Longmont | T-EFF | 25-Jun-15 | 84.20 | 78.00 | 2% |
| E. coli (MPN/100 mL) | Longmont | T-EFF | 16-Dec-15 | 24.30 | 13.20 | 21% |
| E. coli (MPN/100 mL) | Longmont | M7-SV | 25-Feb-15 | 56.30 | 62.00 | 2% |
| E. coli (MPN/100 mL) | Longmont | M6-SV | 17-Mar-15 | 27.90 | 25.30 | 3% |
| E. coli (MPN/100 mL) | Longmont | M6-SV | 17-Nov-15 | 416.00 | 410.60 | 0% |
| TSS (mg/L) | Longmont | M9.5-SV | 22-Jan-15 | 2.40 | 2.80 | 14% |
| TSS (mg/L) | Longmont | M9.5-SV | 19-Aug-15 | 5.00 | 4.60 | 9% |
| TSS (mg/L) | Longmont | M8.9-SV | 19-Oct-15 | 1.60 | 1.40 | 14% |
| TSS (mg/L) | Longmont | M8.4-SV | 22-Jul-15 | 4.00 | 4.40 | 9% |
| TSS (mg/L) | Longmont | M8.2-SV | 22-Apr-15 | 5.40 | 4.60 | 17% |
| TSS (mg/L) | Longmont | M8.2-SV | 23-Sep-15 | 4.60 | 3.80 | 21% |
| TSS (mg/L) | Longmont | T11-LH | 20-May-15 | 206.00 | 252.00 | 18% |
| TSS (mg/L) | Longmont | T-EFF | 25-Jun-15 | 3.60 | 3.80 | 5% |
| TSS (mg/L) | Longmont | T-EFF | 16-Dec-15 | 10.40 | 10.40 | 0% |
| TSS (mg/L) | Longmont | M7-SV | 25-Feb-15 | 8.80 | 8.40 | 5% |
| TSS (mg/L) | Longmont | M6-SV | 17-Mar-15 | 3.20 | 4.60 | 30% |
| TSS (mg/L) | Longmont | M6-SV | 17-Nov-15 | 7.00 | 7.00 | 0% |
| Nitrogen Ammonia as N (mg/L) | Lafayette | 3-CC | 04-Nov-15 | 0.02 | 0.02 | 0% |
| Nitrogen Ammonia as N (mg/L) | Lafayette | 6-CC | 05-Aug-15 | 0.06 | 0.07 | 14% |

| Common Name | Data Provider | Plot_ID | Date | Routine | Replicate | Relative % Difference |
|---|---|---|---|---|---|---|
| Nitrogen Ammonia as N (mg/L) | Longmont | M9.5-SV | 22-Jan-15 | 0.03 | 0.03 | 15% |
| Nitrogen Ammonia as N (mg/L) | Longmont | M9.5-SV | 19-Aug-15 | 0.03 | 0.03 | 8% |
| Nitrogen Ammonia as N (mg/L) | Longmont | M8.9-SV | 19-Oct-15 | 0.03 | 0.03 | 4% |
| Nitrogen Ammonia as N (mg/L) | Longmont | M8.4-SV | 22-Jul-15 | 0.04 | 0.05 | 3% |
| Nitrogen Ammonia as N (mg/L) | Longmont | M8.2-SV | 22-Apr-15 | 0.03 | 0.04 | 13% |
| Nitrogen Ammonia as N (mg/L) | Longmont | M8.2-SV | 23-Sep-15 | 0.04 | 0.03 | 30% |
| Nitrogen Ammonia as N (mg/L) | Longmont | T11-LH | 20-May-15 | 0.25 | 0.11 | 131% |
| Nitrogen Ammonia as N (mg/L) | Longmont | T-EFF | 25-Jun-15 | 0.11 | 0.12 | 6% |
| Nitrogen Ammonia as N (mg/L) | Longmont | T-EFF | 16-Dec-15 | 0.12 | 0.10 | 21% |
| Nitrogen Ammonia as N (mg/L) | Longmont | M7-SV | 25-Feb-15 | 0.05 | 0.05 | 4% |
| Nitrogen Ammonia as N (mg/L) | Longmont | M6-SV | 17-Mar-15 | 0.09 | 0.07 | 34% |
| Nitrogen Ammonia as N (mg/L) | Longmont | M6-SV | 17-Nov-15 | 0.13 | 0.07 | 92% |
| Nitrogen Nitrate as N (mg/L) | Lafayette | 3-CC | 04-Nov-15 | 5.90 | 5.90 | 0% |
| Nitrogen Nitrate as N (mg/L) | Lafayette | 6-CC | 05-Aug-15 | 1.80 | 1.80 | 0% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Lafayette | 3-CC | 04-Nov-15 | 5.90 | 5.90 | 0% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Lafayette | 6-CC | 05-Aug-15 | 1.80 | 1.80 | 0% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Longmont | M9.5-SV | 22-Jan-15 | 0.23 | 0.23 | 0% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Longmont | M9.5-SV | 19-Aug-15 | 0.03 | 0.01 | 137% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Longmont | M8.9-SV | 19-Oct-15 | 0.05 | 0.05 | 9% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Longmont | M8.4-SV | 22-Jul-15 | 0.22 | 0.22 | 1% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Longmont | M8.2-SV | 22-Apr-15 | 0.34 | 0.33 | 2% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Longmont | M8.2-SV | 23-Sep-15 | 0.42 | 0.42 | 0% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Longmont | T11-LH | 20-May-15 | 0.21 | 0.21 | 2% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Longmont | T-EFF | 25-Jun-15 | 12.67 | 13.14 | 4% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Longmont | T-EFF | 16-Dec-15 | 13.57 | 13.26 | 2% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Longmont | M7-SV | 25-Feb-15 | 2.38 | 2.46 | 3% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Longmont | M6-SV | 17-Mar-15 | 3.07 | 3.05 | 1% |
| Nitrogen Nitrate/Nitrite as N (mg/L) | Longmont | M6-SV | 17-Nov-15 | 2.54 | 2.51 | 1% |
| Nitrogen Nitrite as N (mg/L) | Lafayette | 3-CC | 04-Nov-15 | 0.01 | 0.01 | 1% |
| Nitrogen Nitrite as N (mg/L) | Lafayette | 6-CC | 05-Aug-15 | 0.03 | 0.02 | 82% |
| Nitrogen TKN (mg/L) | Lafayette | 3-CC | 04-Nov-15 | 0.94 | 1.10 | 15% |
| Nitrogen TKN (mg/L) | Lafayette | 6-CC | 05-Aug-15 | 0.05 | 0.18 | 71% |
| Nitrogen TKN (mg/L) | Longmont | M7-SV | 25-Feb-15 | 0.83 | 0.83 | 0% |
| Nitrogen Total (mg/L) | Lafayette | 3-CC | 04-Nov-15 | 6.84 | 7.00 | 2% |
| Nitrogen Total (mg/L) | Lafayette | 6-CC | 05-Aug-15 | 1.85 | 1.98 | 6% |
| Nitrogen Total Inorganic (mg/L) | Lafayette | 3-CC | 04-Nov-15 | 5.92 | 5.92 | 0% |
| Nitrogen Total Inorganic (mg/L) | Lafayette | 6-CC | 05-Aug-15 | 1.86 | 1.87 | 1% |
| Phosphorus as P, Tot (mg/L) | Lafayette | 3-CC | 04-Nov-15 | 0.06 | 0.07 | 21% |
| Phosphorus as P, Tot (mg/L) | Lafayette | 6-CC | 05-Aug-15 | 0.11 | 0.11 | 0% |
| Phosphorus as P, Tot (mg/L) | Longmont | M9.5-SV | 22-Jan-15 | 0.02 | 0.02 | 9% |
| Phosphorus as P, Tot (mg/L) | Longmont | M9.5-SV | 19-Aug-15 | 0.02 | 0.02 | 1% |
| Phosphorus as P, Tot (mg/L) | Longmont | M8.9-SV | 19-Oct-15 | 0.01 | 0.01 | 7% |
| Phosphorus as P, Tot (mg/L) | Longmont | M8.4-SV | 22-Jul-15 | 0.04 | 0.04 | 0% |
| Phosphorus as P, Tot (mg/L) | Longmont | M8.2-SV | 22-Apr-15 | 0.02 | 0.03 | 1% |
| Phosphorus as P, Tot (mg/L) | Longmont | M8.2-SV | 23-Sep-15 | 0.03 | 0.03 | 0% |
| Phosphorus as P, Tot (mg/L) | Longmont | T11-LH | 20-May-15 | 0.42 | 0.49 | 13% |
| Phosphorus as P, Tot (mg/L) | Longmont | T-EFF | 25-Jun-15 | 0.88 | 0.85 | 4% |
| Phosphorus as P, Tot (mg/L) | Longmont | T-EFF | 16-Dec-15 | 3.22 | 3.28 | 2% |
| Phosphorus as P, Tot (mg/L) | Longmont | M7-SV | 25-Feb-15 | 0.61 | 0.61 | 0% |
| Phosphorus as P, Tot (mg/L) | Longmont | M6-SV | 17-Mar-15 | 0.18 | 0.18 | 2% |
| Phosphorus as P, Tot (mg/L) | Longmont | M6-SV | 17-Nov-15 | 0.48 | 0.48 | 1% |
| Arsenic, T (ug/L) | Longmont | M9.5-SV | 22-Jan-15 | 0.00 | 0.30 | Not Calc. |
| Arsenic, T (ug/L) | Longmont | M9.5-SV | 19-Aug-15 | 0.70 | 1.00 | 30% |
| Arsenic, T (ug/L) | Longmont | M8.9-SV | 19-Oct-15 | 0.30 | 0.50 | 40% |
| Arsenic, T (ug/L) | Longmont | M8.4-SV | 22-Jul-15 | 0.70 | 0.70 | 0% |
| Arsenic, T (ug/L) | Longmont | M8.2-SV | 22-Apr-15 | 0.50 | 0.50 | 0% |
| Arsenic, T (ug/L) | Longmont | M8.2-SV | 23-Sep-15 | 0.70 | 0.70 | 0% |
| Arsenic, T (ug/L) | Longmont | T11-LH | 20-May-15 | 4.00 | 3.90 | 3% |
| Arsenic, T (ug/L) | Longmont | T-EFF | 25-Jun-15 | 0.50 | 0.40 | 25% |
| Arsenic, T (ug/L) | Longmont | T-EFF | 16-Dec-15 | 0.30 | 0.20 | 50% |
| Arsenic, T (ug/L) | Longmont | M7-SV | 25-Feb-15 | 0.40 | 0.50 | 20% |
| Arsenic, T (ug/L) | Longmont | M6-SV | 17-Mar-15 | 0.50 | 0.50 | 0% |
| Arsenic, T (ug/L) | Longmont | M6-SV | 17-Nov-15 | 0.50 | 0.60 | 17% |

Note: *E. coli* evaluated using a log-transformed procedure to calculate the RPD.

Appendix G2
Quality Assurance / Quality Control - Field Blanks

| Common Name | Date | Data Provider | Field Blank Result |
|---|---|---|---|
| Alkalinity (mg/L) | 1/20/2015 | Longmont | 1.49 |
| Alkalinity (mg/L) | 2/25/2015 | Longmont | 1.72 |
| Alkalinity (mg/L) | 3/17/2015 | Longmont | 1.52 |
| Alkalinity (mg/L) | 4/21/2015 | Longmont | 1.60 |
| Alkalinity (mg/L) | 5/20/2015 | Longmont | 1.65 |
| Alkalinity (mg/L) | 6/25/2015 | Longmont | 2.07 |
| Alkalinity (mg/L) | 7/21/2015 | Longmont | 1.89 |
| Alkalinity (mg/L) | 8/18/2015 | Longmont | 1.64 |
| Alkalinity (mg/L) | 9/22/2015 | Longmont | 1.53 |
| Alkalinity (mg/L) | 10/20/2015 | Longmont | 1.69 |
| Alkalinity (mg/L) | 11/17/2015 | Longmont | 1.44 |
| Alkalinity (mg/L) | 12/16/2015 | Longmont | 1.58 |
| Conductivity (umhos/cm) | 1/20/2015 | Longmont | 1.95 |
| Conductivity (umhos/cm) | 2/25/2015 | Longmont | 2.21 |
| Conductivity (umhos/cm) | 3/17/2015 | Longmont | 1.30 |
| Conductivity (umhos/cm) | 4/21/2015 | Longmont | 1.49 |
| Conductivity (umhos/cm) | 5/20/2015 | Longmont | 2.46 |
| Conductivity (umhos/cm) | 6/25/2015 | Longmont | 1.63 |
| Conductivity (umhos/cm) | 7/21/2015 | Longmont | 0.98 |
| Conductivity (umhos/cm) | 8/18/2015 | Longmont | 1.31 |
| Conductivity (umhos/cm) | 9/22/2015 | Longmont | 1.63 |
| Conductivity (umhos/cm) | 10/20/2015 | Longmont | 0.86 |
| Conductivity (umhos/cm) | 11/17/2015 | Longmont | 1.03 |
| Conductivity (umhos/cm) | 12/16/2015 | Longmont | 0.87 |
| Hardness, Total as CaCO3 (mg/L) | 1/20/2015 | Longmont | Non-detect |
| Hardness, Total as CaCO3 (mg/L) | 2/25/2015 | Longmont | 1.70 |
| Hardness, Total as CaCO3 (mg/L) | 3/17/2015 | Longmont | 1.20 |
| Hardness, Total as CaCO3 (mg/L) | 4/21/2015 | Longmont | Non-detect |
| Hardness, Total as CaCO3 (mg/L) | 5/20/2015 | Longmont | 0.82 |
| Hardness, Total as CaCO3 (mg/L) | 6/25/2015 | Longmont | 0.82 |
| Hardness, Total as CaCO3 (mg/L) | 7/21/2015 | Longmont | Non-detect |
| Hardness, Total as CaCO3 (mg/L) | 8/18/2015 | Longmont | Non-detect |
| Hardness, Total as CaCO3 (mg/L) | 9/22/2015 | Longmont | Non-detect |
| Hardness, Total as CaCO3 (mg/L) | 10/20/2015 | Longmont | Non-detect |
| Hardness, Total as CaCO3 (mg/L) | 11/17/2015 | Longmont | 0.82 |
| Hardness, Total as CaCO3 (mg/L) | 12/16/2015 | Longmont | 1.24 |
| E. coli (MPN/100 mL) | 2/4/2015 | Lafayette | Non-detect |
| E. coli (MPN/100 mL) | 5/6/2015 | Lafayette | Non-detect |
| E. coli (MPN/100 mL) | 8/5/2015 | Lafayette | Non-detect |
| E. coli (MPN/100 mL) | 11/4/2015 | Lafayette | Non-detect |
| E. coli (MPN/100 mL) | 1/20/2015 | Longmont | Non-detect |
| E. coli (MPN/100 mL) | 2/25/2015 | Longmont | Non-detect |
| E. coli (MPN/100 mL) | 3/17/2015 | Longmont | Non-detect |
| E. coli (MPN/100 mL) | 4/21/2015 | Longmont | Non-detect |
| E. coli (MPN/100 mL) | 5/20/2015 | Longmont | Non-detect |
| E. coli (MPN/100 mL) | 6/25/2015 | Longmont | Non-detect |
| E. coli (MPN/100 mL) | 7/21/2015 | Longmont | Non-detect |
| E. coli (MPN/100 mL) | 8/18/2015 | Longmont | Non-detect |
| E. coli (MPN/100 mL) | 9/22/2015 | Longmont | Non-detect |
| E. coli (MPN/100 mL) | 10/20/2015 | Longmont | Non-detect |
| E. coli (MPN/100 mL) | 11/17/2015 | Longmont | Non-detect |
| E. coli (MPN/100 mL) | 12/16/2015 | Longmont | Non-detect |

Appendix G2
Quality Assurance / Quality Control - Field Blanks

| Common Name | Date | Data Provider | Field Blank Result |
|---|---|---|---|
| TSS (mg/L) | 1/20/2015 | Longmont | Non-detect |
| TSS (mg/L) | 2/25/2015 | Longmont | Non-detect |
| TSS (mg/L) | 3/17/2015 | Longmont | 0.20 |
| TSS (mg/L) | 4/21/2015 | Longmont | Non-detect |
| TSS (mg/L) | 5/20/2015 | Longmont | Non-detect |
| TSS (mg/L) | 6/25/2015 | Longmont | Non-detect |
| TSS (mg/L) | 7/21/2015 | Longmont | Non-detect |
| TSS (mg/L) | 8/18/2015 | Longmont | Non-detect |
| TSS (mg/L) | 9/22/2015 | Longmont | Non-detect |
| TSS (mg/L) | 10/20/2015 | Longmont | Non-detect |
| TSS (mg/L) | 11/17/2015 | Longmont | Non-detect |
| TSS (mg/L) | 12/16/2015 | Longmont | Non-detect |
| Nitrogen Ammonia as N (mg/L) | 8/5/2015 | Lafayette | 0.04 |
| Nitrogen Ammonia as N (mg/L) | 11/4/2015 | Lafayette | Non-detect |
| Nitrogen Ammonia as N (mg/L) | 1/20/2015 | Longmont | 0.02 |
| Nitrogen Ammonia as N (mg/L) | 2/25/2015 | Longmont | 0.01 |
| Nitrogen Ammonia as N (mg/L) | 3/17/2015 | Longmont | 0.01 |
| Nitrogen Ammonia as N (mg/L) | 4/21/2015 | Longmont | 0.01 |
| Nitrogen Ammonia as N (mg/L) | 5/20/2015 | Longmont | Non-detect |
| Nitrogen Ammonia as N (mg/L) | 6/25/2015 | Longmont | Non-detect |
| Nitrogen Ammonia as N (mg/L) | 7/21/2015 | Longmont | 0.01 |
| Nitrogen Ammonia as N (mg/L) | 8/18/2015 | Longmont | 0.01 |
| Nitrogen Ammonia as N (mg/L) | 9/22/2015 | Longmont | 0.01 |
| Nitrogen Ammonia as N (mg/L) | 10/20/2015 | Longmont | 0.02 |
| Nitrogen Ammonia as N (mg/L) | 11/17/2015 | Longmont | 0.01 |
| Nitrogen Ammonia as N (mg/L) | 12/16/2015 | Longmont | 0.01 |
| Nitrogen Nitrate as N (mg/L) | 8/5/2015 | Lafayette | Non-detect |
| Nitrogen Nitrate as N (mg/L) | 11/4/2015 | Lafayette | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 8/5/2015 | Lafayette | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 11/4/2015 | Lafayette | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 1/20/2015 | Longmont | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 2/25/2015 | Longmont | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 3/17/2015 | Longmont | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 4/21/2015 | Longmont | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 5/20/2015 | Longmont | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 6/25/2015 | Longmont | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 7/21/2015 | Longmont | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 8/18/2015 | Longmont | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 9/22/2015 | Longmont | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 10/20/2015 | Longmont | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 11/17/2015 | Longmont | Non-detect |
| Nitrogen Nitrate/Nitrite as N (mg/L) | 12/16/2015 | Longmont | Non-detect |
| Nitrogen Nitrite as N (mg/L) | 8/5/2015 | Lafayette | Non-detect |
| Nitrogen Nitrite as N (mg/L) | 11/4/2015 | Lafayette | Non-detect |
| Nitrogen TKN (mg/L) | 8/5/2015 | Lafayette | 0.07 |
| Nitrogen TKN (mg/L) | 11/4/2015 | Lafayette | Non-detect |
| Nitrogen TKN (mg/L) | 1/20/2015 | Longmont | Non-detect |
| Nitrogen TKN (mg/L) | 2/25/2015 | Longmont | 0.36 |
| Nitrogen TKN (mg/L) | 3/17/2015 | Longmont | 0.19 |
| Nitrogen TKN (mg/L) | 4/21/2015 | Longmont | Non-detect |
| Nitrogen TKN (mg/L) | 5/20/2015 | Longmont | 0.29 |
| Nitrogen TKN (mg/L) | 6/25/2015 | Longmont | Non-detect |

Appendix G2
Quality Assurance / Quality Control - Field Blanks

| Common Name | Date | Data Provider | Field Blank Result |
|---|---|---|---|
| Nitrogen TKN (mg/L) | 7/21/2015 | Longmont | Non-detect |
| Nitrogen TKN (mg/L) | 8/18/2015 | Longmont | Non-detect |
| Nitrogen TKN (mg/L) | 9/22/2015 | Longmont | Non-detect |
| Nitrogen TKN (mg/L) | 10/20/2015 | Longmont | Non-detect |
| Nitrogen TKN (mg/L) | 11/17/2015 | Longmont | Non-detect |
| Nitrogen TKN (mg/L) | 12/16/2015 | Longmont | Non-detect |
| Phosphorus as P, Tot (mg/L) | 8/5/2015 | City of Boulder | Non-detect |
| Phosphorus as P, Tot (mg/L) | 11/4/2015 | City of Boulder | Non-detect |
| Phosphorus as P, Tot (mg/L) | 1/20/2015 | Longmont | Non-detect |
| Phosphorus as P, Tot (mg/L) | 2/25/2015 | Longmont | Non-detect |
| Phosphorus as P, Tot (mg/L) | 3/17/2015 | Longmont | Non-detect |
| Phosphorus as P, Tot (mg/L) | 4/21/2015 | Longmont | Non-detect |
| Phosphorus as P, Tot (mg/L) | 5/20/2015 | Longmont | Non-detect |
| Phosphorus as P, Tot (mg/L) | 6/25/2015 | Longmont | Non-detect |
| Phosphorus as P, Tot (mg/L) | 7/21/2015 | Longmont | 0.01 |
| Phosphorus as P, Tot (mg/L) | 8/18/2015 | Longmont | Non-detect |
| Phosphorus as P, Tot (mg/L) | 9/22/2015 | Longmont | Non-detect |
| Phosphorus as P, Tot (mg/L) | 10/20/2015 | Longmont | Non-detect |
| Phosphorus as P, Tot (mg/L) | 11/17/2015 | Longmont | Non-detect |
| Phosphorus as P, Tot (mg/L) | 12/16/2015 | Longmont | Non-detect |
| Arsenic, T (ug/L) | 1/20/2015 | Longmont | Non-detect |
| Arsenic, T (ug/L) | 2/25/2015 | Longmont | Non-detect |
| Arsenic, T (ug/L) | 3/17/2015 | Longmont | Non-detect |
| Arsenic, T (ug/L) | 4/21/2015 | Longmont | Non-detect |
| Arsenic, T (ug/L) | 5/20/2015 | Longmont | Non-detect |
| Arsenic, T (ug/L) | 6/25/2015 | Longmont | Non-detect |
| Arsenic, T (ug/L) | 7/21/2015 | Longmont | Non-detect |
| Arsenic, T (ug/L) | 8/18/2015 | Longmont | Non-detect |
| Arsenic, T (ug/L) | 9/22/2015 | Longmont | Non-detect |
| Arsenic, T (ug/L) | 10/20/2015 | Longmont | Non-detect |
| Arsenic, T (ug/L) | 11/17/2015 | Longmont | Non-detect |
| Arsenic, T (ug/L) | 12/16/2015 | Longmont | Non-detect |

# Appendix H. List of Stream Restoration Projects in Response to 2013 Flood

**Appendix H**
**Stream Rehabilitation/Restoration Project List**

| Watershed | DSR | Project | Organization Implementing | Estimated Construction Start Date* | Organization Completing 30% Design | Estimated 30% Design Completion Date* |
|---|---|---|---|---|---|---|
| Fourmile | Fourmile Creek | Project 2- Ingram Gulch | Fourmile Watershed Coalition | Nov-2016 | Fourmile Watershed Coalition | Jun-2016 |
| Fourmile | Fourmile Creek | Project 3- Wallstreet | Fourmile Watershed Coalition | Dec-2016 | Boulder County | Jun-2016 |
| Fourmile | N/A | Upper Fourmile | Boulder County | Dec-2016 | Boulder County | Jun-2016 |
| Fourmile | Fourmile Creek | Project 1- Poorman | Boulder County | Dec-2016 | Boulder County | Jul-2016 |
| Fourmile | Fourmile Creek | Project 2- Ingram Gulch (Gold Run portion) | Boulder County | Jan-2017 | Boulder County | Jul-2016 |
| Fourmile | Fire Station | Project 1- Fire Station | Fourmile Fire District | Nov-2016 | Fourmile Fire District | 16-Jun |
| Fourmile | N/A | Logan Mill Reveg | Fourmile Watershed Coalition | Nov-2017 | Fourmile Watershed Coalition | 16-Jul |
| Fourmile | N/A | Fourmile Creek Bank Protection | Fourmile Watershed Coalition | Oct-2016 | Fourmile Watershed Coalition | 16-Aug |
| Fourmile | N/A | Lower Fourmile- Black Swan | Fourmile Watershed Coalition | 2017 | Boulder County | Jul-2016 |
| Fourmile Canyon Creek | Wagon Wheel Gap Road | Project 1- Wagon Wheel Gap Road | Boulder County | Dec-2016 | Boulder County | May-2016 |
| Left Hand | James Creek | Project 1- Lower James Creek | Boulder County | Nov-2016 | LWOG | Jun-2016 |
| Left Hand | James Creek | Project 2- Mill Street | Boulder County | Nov-2016 | LWOG | Jun-2016 |
| Left Hand | James Creek | Project 3- Fike | Boulder County | Nov-2016 | Boulder County | Jun-2016 |
| Left Hand | James Creek | Project 4- Blowout | Boulder County | Nov-2016 | Boulder County | Jun-2016 |
| Left Hand | Plains | Project 9- Beilins Hock | Boulder County | Sep 2016-January 2017 | Boulder County | July - September 2016 |
| Left Hand | N/A | James Creek Reach 17 | Boulder County | Nov-2016 | Boulder County | Jun-2016 |
| Left Hand | N/A | Geer Canyon | Boulder County | Not provided | Boulder County | Not provided |
| Left Hand | N/A | Left Hand Creek Revegetation | Boulder County | Mar-2017 | Boulder County | Sep-2016 |
| Left Hand | N/A | Brewbaker | Boulder County | Not provided | Boulder County | Not provided |
| Left Hand | Plains | Project 1- N. 41st St Bridge | LWOG | Sep 2016-January 2017 | LWOG | July - September 2016 |
| Left Hand | Plains | Project 2- Haystack Golf Course | LWOG | Sep 2016-January 2017 | LWOG | July - September 2016 |
| Left Hand | Plains | Project 3- N.63rd Street Bridge | LWOG | Sep 2016-January 2017 | LWOG | July - September 2016 |
| Left Hand | Plains | Project 4- Nimbus Bridge | LWOG | Sep 2016-January 2017 | LWOG | July - September 2016 |
| Left Hand | Plains | Project 5- N. 73rd Street | LWOG | Sep 2016-January 2017 | LWOG | July - September 2016 |
| Left Hand | Plains | Project 6- Deutschteig | LWOG | Sep 2016-January 2017 | LWOG | July - September 2016 |
| Left Hand | Plains | Project 7- N. 81st St Bridge | LWOG | Sep 2016-January 2017 | LWOG | July - September 2016 |
| Left Hand | Plains | Project 8- Airport Rd Bridge | LWOG | Sep 2016-January 2017 | LWOG | July - September 2016 |
| Left Hand | Streamcrest | Project 1- Ranch | LWOG | Sep 2016-January 2017 | LWOG | July - September 2016 |
| Left Hand | Streamcrest | Project 2- Streamcrest | LWOG | Sep 2016-January 2017 | LWOG | July - September 2016 |
| Left Hand | Streamcrest | Project 3- Lefthand CD | LWOG | Sep 2016-January 2017 | LWOG | July - September 2016 |
| Left Hand | Upper Left Hand Creek | Upper Left Hand Creek | LWOG | Sep 2016-January 2017 | LWOG | July - September 2016 |
| Little Thompson | Reach 1-4 | Project 3- North 83rd St. Bridge | LTWC | Oct-2016 | LTWC | Sep-2016 |
| Little Thompson | Reach 1-4 | Project 4- Parrish Ranch | LTWC | unknown yet | LTWC | unknown yet |
| St.Vrain | S. St. Vrain- Reach 4B | Project 1- S. St. Vrain 1 (Hall) | Boulder County | Jan-17 | Boulder County | Sep-2016 |
| St.Vrain | S. St. Vrain- Reach 4B | Project 2- S. St. Vrain 2 (Triangle) | Boulder County | Jan-17 | Boulder County | Sep-2016 |
| St.Vrain | Breaches- Reach 3 | Project 1- Breaches | Boulder County | Jan-17 | Boulder County | Sep-2016 |
| St.Vrain | N/A | Hall | Boulder County | Not provided | Boulder County | Sep-2016 |
| St.Vrain | S. St. Vrain- Reach 4B | Project 3- S. St. Vrain 3 | Lyons | Nov-16 | Lyons | Sep-2016 |
| St.Vrain | McConnell- Reach 4C | Project 1- McConnell | Lyons | undetermined | Lyons | undetermined |
| St.Vrain | Apple Valley- Reach 4A | Project 1- Apple Valley | SVCC | Aug-2017 | SVCC | Dec-2016 |

*Design and construction dates are estimates and are subject to change.

Note:

This list is all of the stream restoration/rehabilitation projects that are funded under the NRCS Emergency Watershed Protection program, Phase 2.

There are three other projects in Fourmile (lower Fourmile bank stabilization, Logan Mill revegetation, upper portion of lower Fourmile stream rehabilitation) and two in Left Hand (Airport Road, 63rd Street)