

**CITY OF BOULDER  
WATER RESOURCES ADVISORY BOARD  
AGENDA ITEM**

**MEETING DATE: April 15, 2019**

**AGENDA TITLE:** Information Item – Boulder Creek *E. coli* Bacteria Total Maximum Daily Load Regulatory Update

**PRESENTERS:**

Jeff Arthur, Director of Public Works for Utilities  
Candice Owen, Stormwater Quality Supervisor  
Kevin Koryto, Stormwater Quality Engineer

**EXECUTIVE SUMMARY:**

The City of Boulder Utilities Division has been monitoring Boulder Creek water quality for several years with a specific focus on bacteria to address the 2011 State-issued Total Maximum Daily Load (TMDL). Monitoring has focused on many potential contributors of bacteria including: human sources from untreated sewage due to possible illicit connections to the storm sewer system; wildlife inhabitation in the storm sewer system; and the potential for bacteria regeneration in the storm sewer or Boulder Creek system. Bacteria in stormwater is not just a local issue but also a regional and national issue. Difficulties related to this issue include determining the type of bacteria (human or non-human), reducing dry weather flows that carry bacteria in the storm system, and understanding the impacts of urban wildlife on water quality.

This Information Item does not require Water Resource Advisory Board (WRAB) action but is intended to inform WRAB of the status of the TMDL including the city's path forward to identify and mitigate bacteria sources through the implementation of an updated TMDL Implementation Plan.

**BACKGROUND:**

**Boulder Creek Water Quality and Regulatory Requirements**

Under the federal Clean Water Act and State of Colorado Water Quality Control Act, all “waters of the state”, which includes Boulder Creek, are required to comply with numeric water quality standards. In 2006, the Colorado Water Quality Control Division (Division) listed Segment 2b of Boulder Creek (from North Boulder Falls to the confluence with South Boulder Creek) on the 303(d) list for “*impaired waters*” due to high *Escherichia coli* (*E. coli*) bacteria levels. Impaired waters are bodies of water that fail to meet water quality standards set by the State. *E. coli* is an indicator bacteria and most strains are not pathogenic, but it is used to indicate potential fecal contamination.

Once a water body has been listed as impaired, discharges to the water body are subject to the development of a TMDL. The primary objective of a TMDL is to calculate the maximum amount of a pollutant that the water body can assimilate and define what level of pollutant reduction is required to meet the instream water quality standard. City staff developed a third party *E. coli* TMDL which was submitted to the Division and EPA for approval. The TMDL was approved in September 2011. The reach included in the TMDL was reduced to 13<sup>th</sup> Street to the confluence with South Boulder Creek based on additional sampling conducted by the city. The TMDL includes not only the city, but also the University of Colorado, Boulder County and Boulder Valley Public Schools, all of which were assigned a wasteload allocation (WLA) or loading of bacteria allowed to be discharged to the creek and still meet the TMDL.

### **TMDL Data**

Analysis of data collected to support development of the TMDL showed an exceedance of the state water quality standard from the summer into the fall at monitoring sites from 13th Street and downstream. See Figure 1. This period is associated with low flows in the creek and is identified as the target period or critical period (May to October) during which significant *E. coli* load reductions are necessary to meet water quality standards. The TMDL anticipates that meeting the required *E. coli* reductions during the critical period will result in the protection of the state designated uses of the creek at all times.

Monitoring data from nine (9) outfalls, which are part of the city's regulated Municipal Separate Storm Sewer System (MS4), were also incorporated in the TMDL. These outfalls consistently had dry weather flow and were identified as a concern through routine monitoring, and in some cases, citizen complaints. The nine drainages associated with the nine outfalls cover predominately areas within the City and University of Colorado MS4s. See Figure 2. Based on the data gathered at these outfalls, the TMDL provided the percent reductions in *E. coli* concentrations that would need to be implemented at each outfall, by jurisdiction, to meet the bacteria water quality standard.

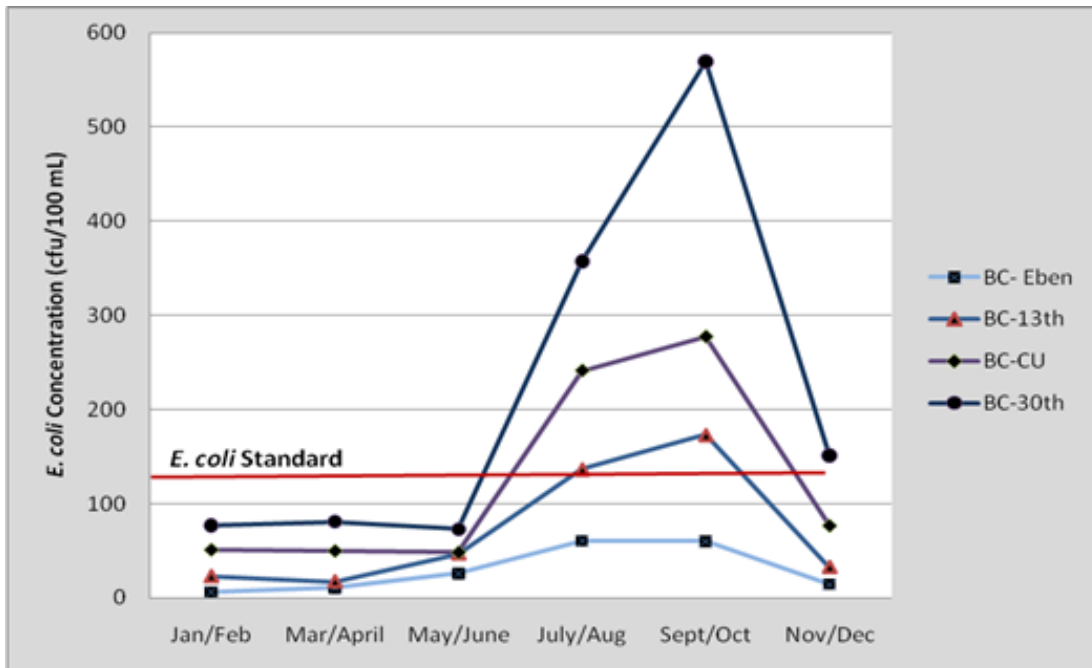


Figure 1 - Geometric mean *E. coli* data from 2004-2010 at four Boulder Creek Segment 2b sampling sites. (Note *E. coli* standard in red (126 cfu/100 mL))

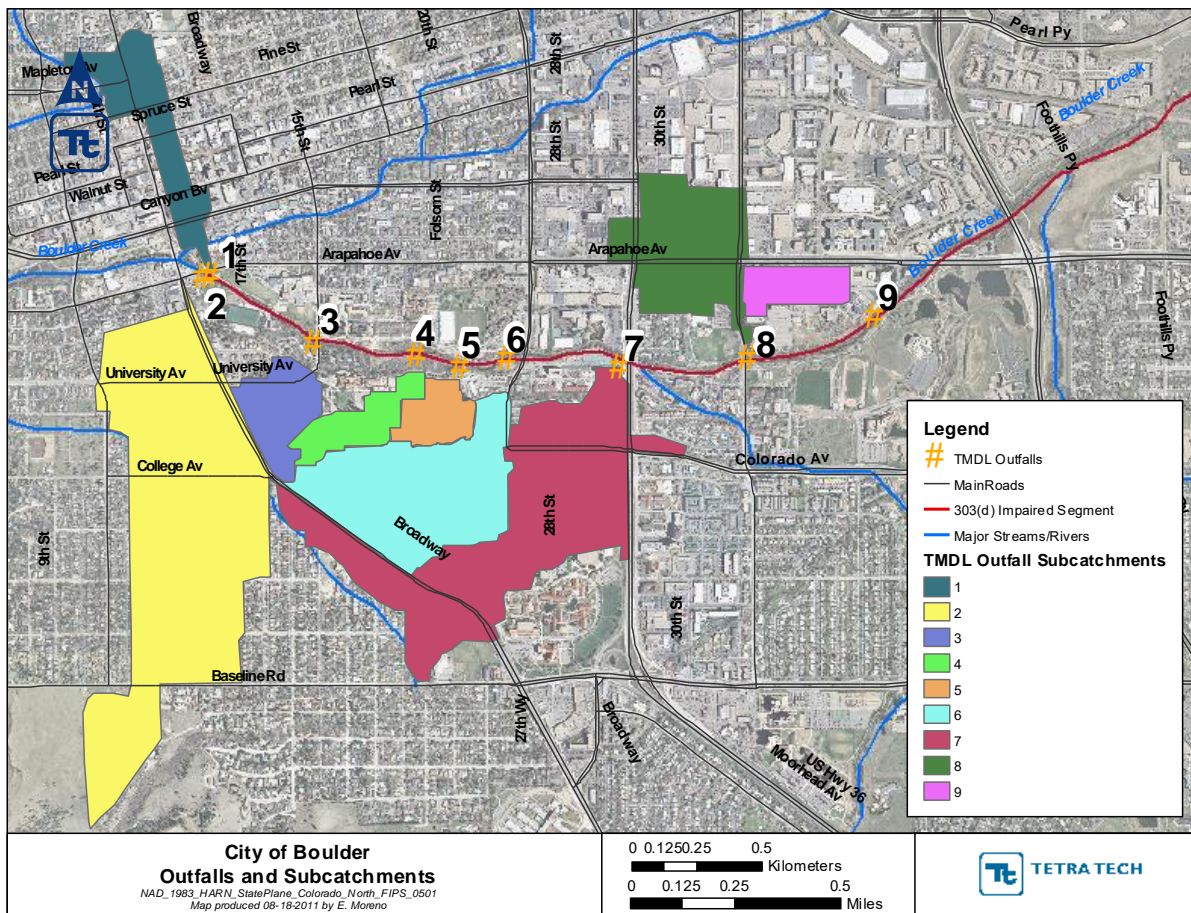


Figure 2 - Boulder Creek *E. coli* TMDL Stormsewer Outfall Locations

## ANALYSIS:

### TMDL Implementation Plan

After approval of the *E. coli* TMDL, city staff developed a TMDL Implementation Plan. A TMDL Implementation Plan is not required under State or Federal regulation but is a useful tool to guide the process of reducing or eliminating bacterial indicators discharged from the city's MS4 and help allocate appropriate resources. The initial Implementation Plan was completed in December 2011 and an updated, more comprehensive, and city specific Implementation Plan will be completed by the end of April 2019.

The original Implementation Plan was an initial attempt to document potential implementation actions that the city could consider moving forward through the Stormwater Quality Program. The Table in Attachment A summarizes the primary activities completed by the City under the original Implementation Plan.

The original Implementation Plan was helpful to initiate actions related to the mitigation of *E. coli*. However, the city determined that the development of an enhanced program that incorporates state of the science recommendations and experiences from other entities who are trying to address similar water quality issues would be beneficial.

### Updated TMDL Implementation Plan Structure

To help guide the TMDL implementation process the updated Implementation Plan includes Compliance Principles and a Sequence of Implementation Activities as defined below.

#### Compliance Principles

Six key principles will guide the city's activities to comply with the WLAs established by the TMDL:

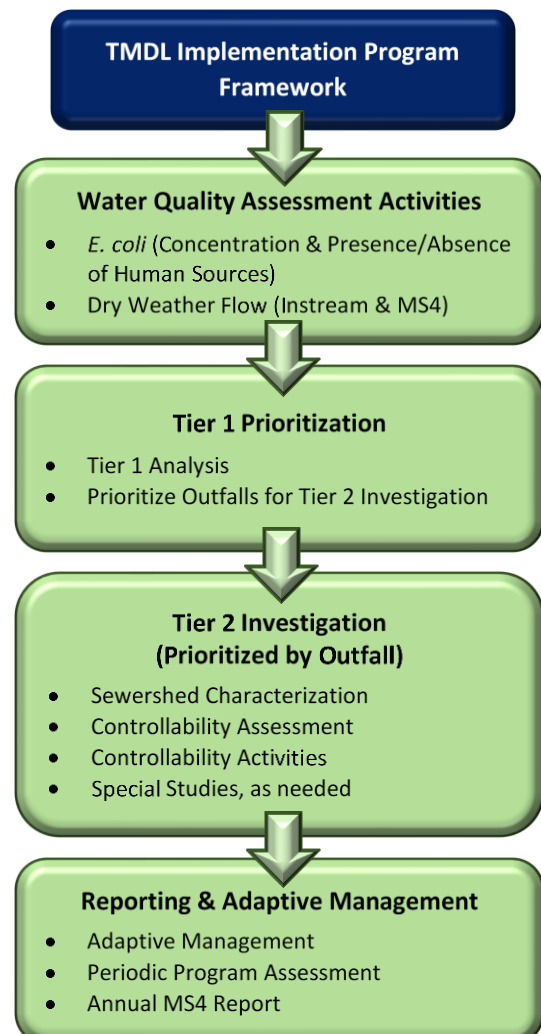
- *Principle 1 - System-wide Compliance Strategy*  
Prioritization of outfalls to focus resource allocation and evaluate the efficacy of reducing bacterial indicator loads from implementation of specific Best Management Practices (BMPs) activities within an MS4 outfall sewershed (outfall drainage area).
- *Principle 2 - Measures of Compliance*  
The TMDL assumes that if all WLAs and LAs are met (city and others included in the TMDL) then Segment 2b will attain the *E. coli* water quality standard, however even if the city mitigates its controllable sources of bacteria the *E. coli* water quality standard may not be attained.
- *Principle 3 - Demonstration of TMDL Compliance Through MS4 Permit*  
The USEPA recommends implementation of a BMP-based approach as the means to comply with WLAs assigned to urban runoff permitted through an MS4 Permit, as long as the defined approach includes clear, specific, and measurable elements that include milestones or other mechanisms to track progress.

- **Principle 4 - Critical Condition**  
The critical condition is the period in time in which the most significant load reductions are needed to make progress towards attainment of water quality standards and protection of the recreational beneficial use.
- **Principle 5 - Mitigation of Controllable Sources of Bacteria**  
Mitigating controllable sources of bacteria, in particular anthropogenic sources such as those attributed to human sources, is the main focus of the Implementation Plan.
- **Principle 6 - Jurisdictional Issues/Responsibilities**  
The city will work collaboratively with the other jurisdictions to reduce bacteria under dry weather flow conditions. However, the city is not responsible for complying with WLAs applicable to other jurisdictions.

### TMDL Implementation Activities

Key implementation activities outlined below build on the Compliance Principles discussed above and will guide City efforts to make progress towards meeting the MS4 WLA.

- **Water Quality Assessment Activities** – Monitoring to gather water quality data to identify priorities and support evaluations of progress towards compliance with the City’s MS4 WLA.
- **Tier 1 Prioritization** – Prioritization of MS4 outfalls that contribute *E. coli* bacteria to the impaired reach. Prioritization will focus on: (1) risk of exposure to human source bacteria; (2) mean dry weather flow; (3) *E. coli* geometric concentration; and (4) risk to recreational activity.
- **Tier 2 Investigation** – Identify suite of *E. coli* bacteria mitigation activities that may be implemented within a sewershed that drains to a Tier 1 prioritized outfall.
- **Reporting and Adaptive Management** – Periodic reporting to (1) demonstrate compliance with this Plan and MS4 Permit requirements; and (2) document progress towards compliance with the WLA. As part of this effort, this Plan may be periodically updated to adapt to changing understanding regarding bacteria sources.



**NEXT STEPS:**

The Stormwater Quality Group anticipates beginning to implement the tasks laid out in the updated Implementation Plan during the Summer of 2019. Activities related to this effort will likely include conducting storm sewershed investigations and data collection in the University Hill Neighborhood. Additional activities in 2019 will include investigation into the best microbial source tracking methods to utilize as part of this investigation.

**ATTACHMENTS:**

**ATTACHMENT A**

Attachment A - Summary of City Activities to Mitigate *E. coli* Under the Initial TMDL Implementation Plan

### Summary of City Activities to Mitigate *E. coli* Under the Initial TMDL Implementation Plan

No.	Program Element	Description/Notes	Status
1	Robust Illicit Discharge Detection and Elimination (IDDE) Response Program	Currently implementing program that responds quickly to sanitary or other instances with potential to discharge <i>E. coli</i> and ensures these are cleaned up appropriately and before they enter Boulder Creek.	Ongoing
2	Continued <i>E. coli</i> Instream and Outfall Monitoring	Continued weekly and monthly monitoring to assess outfall contributions and instream water quality.	Ongoing
3	Slow the Flow Efforts	Facilitates education around reductions in dry weather* flows to the MS4. Dry weather flows* can carry bacteria from various sources in the City directly to stormwater outfalls and into Boulder Creek.	Ongoing
4	“Doo Good” Pet Waste Outreach Program	Program is implemented through the Keep It Clean Partnership. Includes collateral and educational materials to educate pet owners on appropriate pet waste management. Partners include Boulder Valley Humane Society and City Open Space and Mountain Parks.	Ongoing
5	Pet Waste Stations	Continued implementation of pet waste stations along greenways and in City open space areas.	Ongoing
6	MS4 System Cleaning	Appropriately cleaned and inspected MS4 with outfalls to the TMDL segment. Cleaning of storm sewer draining to Boulder Creek was completed in May 2016.	Major efforts 2015-2016; Ongoing
7	Stormwater Masterplan Update	Plan addresses MS4 capacity issues throughout the City, but additionally selects priority locations for water quality improvements.	2016
8	Boulder Creek Sanitary Main Investigation	TVed sanitary mains running under Boulder Creek. Discovered no apparent instances of sanitary mains contributing sewage to the creek.	2016
9	Boulder Creek Outfalls Survey	Conducted a survey at all MS4 outfalls to Boulder Creek. Visually assessed potential illicit discharges and conducted water quality sampling for <i>E. coli</i> , nutrients, and optical brighteners.	2015; 2017; Ongoing
10	Technical Memorandum: Raccoon Storm Drain Access Control - University Hill Sub-Basin Recommendations	Developed report detailing the feasibility and costs associated with installing raccoon proofing measures on storm inlets in “The Hill” area of the city.	2013
11	Marine Street Raccoon-proofing Pilot Study	Installed inlet and outfall grates on one small storm sewer line to determine the impacts on <i>E. coli</i> from raccoons in the system. Observed drastic reductions in <i>E. coli</i> concentrations. A previous WRAB update on this topic is located at the following location: <a href="https://documents.bouldercolorado.gov/WebLink/0/doc/121401/Page1.aspx">https://documents.bouldercolorado.gov/WebLink/0/doc/121401/Page1.aspx</a>	2012

\* Dry weather flows mean that no measurable rainfall has occurred in the area within the previous 72 hours