Section 6.0
TMDL LOAD ALLOCATION

A TMDL is the maximum loading of a pollutant that a waterbody can assimilate and still meet State water quality standards. The numeric targets for the Trail Creek *E. coli* TMDL are a monthly geometric mean standard of 125 cfu/100mL and a maximum daily standard of 235 cfu/100mL. Typically, loading assessments are completed at critical waterbody conditions (e.g., point source WLA are typically completed at low-flow, summer conditions). Based on the source assessment and watershed modeling, *E. coli* levels in Trail Creek are present during both dry and wet weather conditions and, therefore, low-flow critical conditions are not necessarily appropriate for developing the TMDL. The critical conditions for determining the *E. coli* TMDL are varied and the year 2000 modeling period was used, which represents a range of both dry and wet weather conditions. In addition, seasonality must be incorporated into the TMDL and this is accomplished with the year 2000 modeling period, which ranges from January to December 2000 (winter, spring, summer and fall).

TMDLs for most pollutants are developed on a mass loading basis (e.g., BOD allocations to point and nonpoint sources in units of pounds/day). For *E. coli*, a mass loading approach is not suitable and, therefore, a concentration based approach is used as recommended by the USEPA (USEPA, 2001). This concept is presented below as stated in the USEPA document *"Protocol for Developing Pathogen TMDLs"*.

> "For most pollutants, TMDLs are expressed on a mass loading basis (e.g., pounds per day). For fecal indicators, however, TMDLs can be expressed in terms of organism counts (or resulting concentration), in accordance with 40 CFR 130.2(i): 'TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure,' and NPDES regulations at 40 CFR 122.45(f): 'All pollutants limited in permits shall have limitations … expressed in terms of mass except … pollutants which cannot appropriately be expressed by mass.' "

Therefore, the Trail Creek TMDL was developed on a concentration basis so that *E. coli* levels throughout the watershed will meet the State monthly geometric mean standard of 125 #/100mL and maximum daily standard of 235 cfu/100mL.

In order to meet the TMDL concentrations (125 and 235 cfu/100mL), continued operation of the four point sources in the watershed in accordance with their IDEM NPDES permits (125 cfu/100mL monthly geometric mean and 235 cfu/100mL daily maximum) at their permitted effluent flow will meet the WLA component of the *E. coli* TMDL for Trail Creek. The permitted flow for the Michigan City Sanitary Station is 12 MGD, for Friendly Acres Mobile Home Park is 0.015 MGD, for Autumn Creek Mobile Home Park is 0.010 MGD, and for Indian Springs Subdivision is 0.018 MGD. Any violations of their permits and, therefore, violation of the TMDL will be handled through IDEM permitting groups and DMR reporting requirements. Typically, these point sources operate at *E. coli* levels less than the TMDL concentrations and, therefore, will provide an additional level of protection. Continued efforts by the Michigan City Sanitary District to implement their LTCP will minimize and eventually eliminate CSO discharges of *E. coli* to Trail Creek. The LTCP has been reviewed by IDEM, and Michigan City is currently in the process of responding to their comments.

Similarly, nonpoint sources in the watershed will need to meet the TMDL concentrations (125 and 235 cfu/100mL) in order for Trail Creek to be in compliance with State *E. coli* standards. Since nonpoint source loads are rainfall runoff driven, an initial estimate of the nonpoint source LA component of the TMDL was assigned a runoff concentration of *E. coli* at the maximum daily standard of 235 cfu/100mL. The base flow LA component of the nonpoint sources (i.e., the continuous loading component) was assigned an *E. coli* concentration of 125 cfu/100mL. The resulting instream *E. coli* concentrations due to the WLA and LA described above is presented in Figures 6-1a through d, which present the resulting *E. coli* concentrations at the calibration stations in the Main, West and East Branches of Trail Creek.

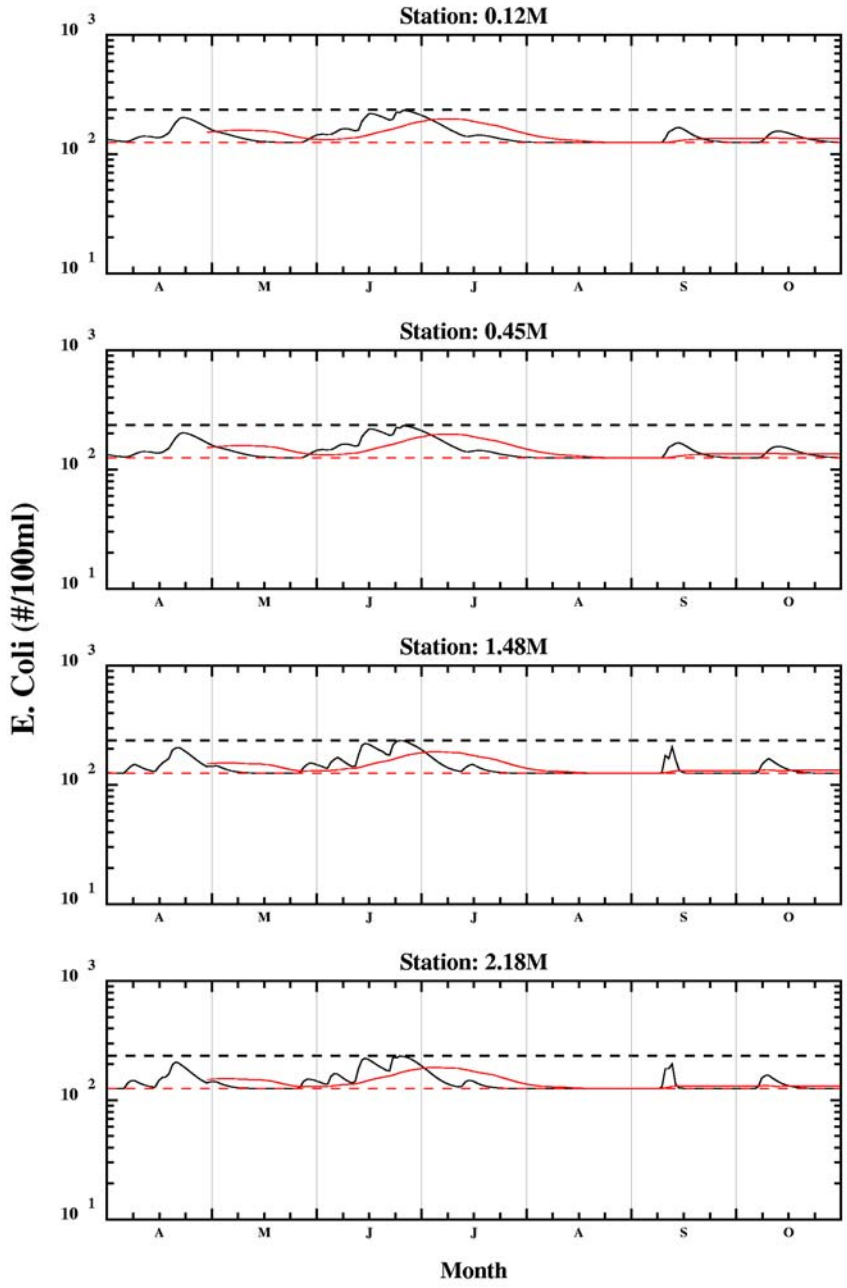

Figure 6-1a. Trail Creek E Coli Model and Data Comparison, Year 2000

(— — Max STD - - Geo Mean STD —— Daily Model Output —— 30-day Geo Mean of Model Output)

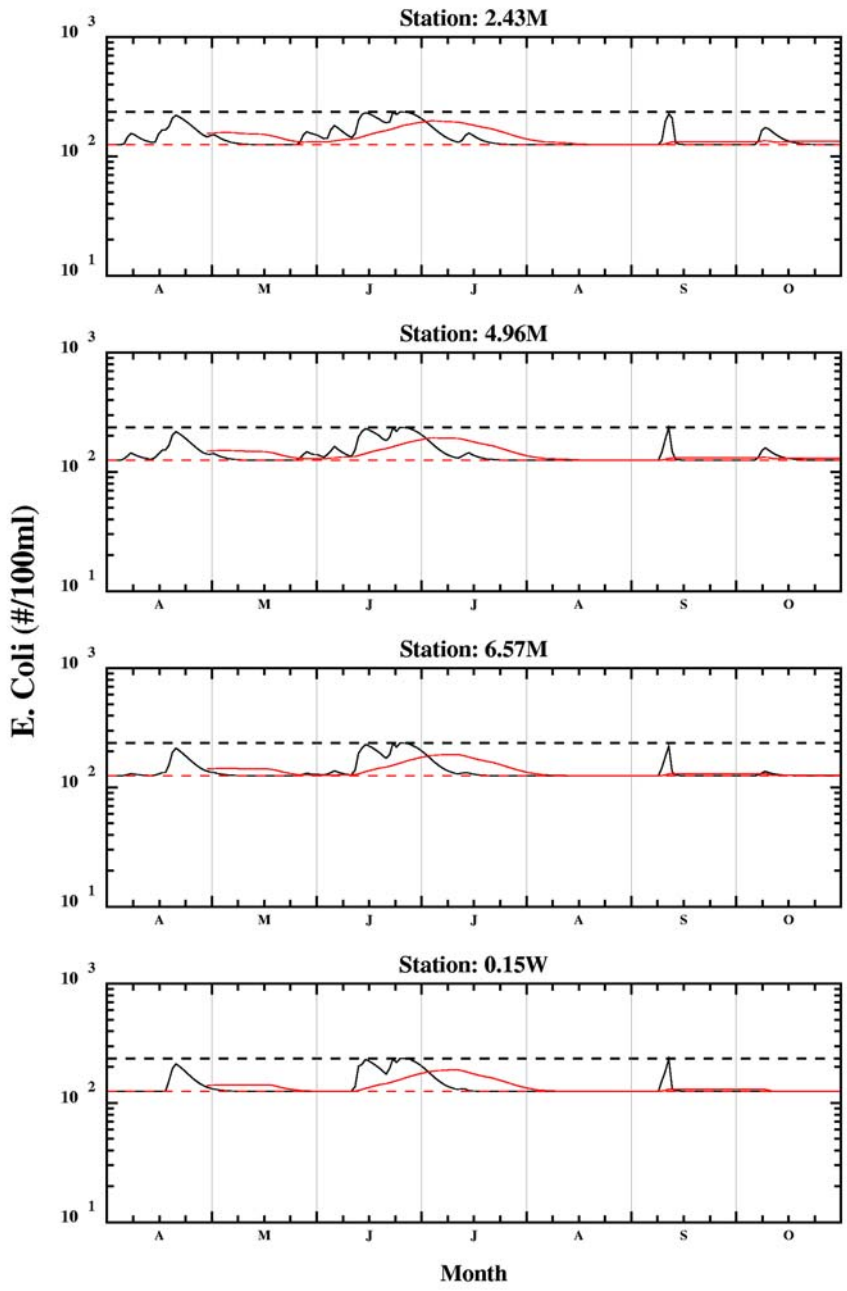

Figure 6-1b. Trail Creek E Coli Model and Data Comparison, Year 2000

(— — Max STD - - Geo Mean STD —— Daily Model Output —— 30-day Geo Mean of Model Output)

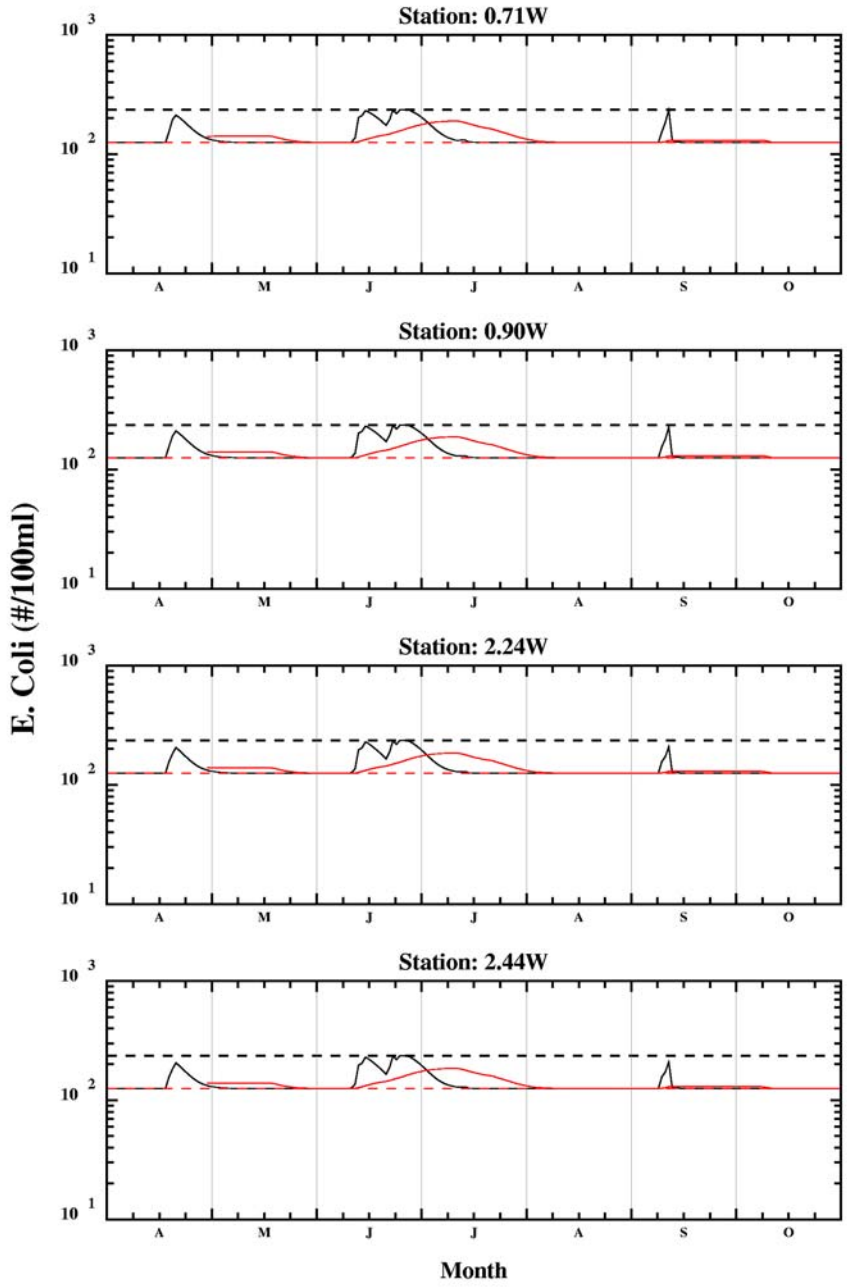

Figure 6-1c. Trail Creek E Coli Model and Data Comparison, Year 2000

(— — Max STD — — Geo Mean STD —— Daily Model Output —— 30-day Geo Mean of Model Output)

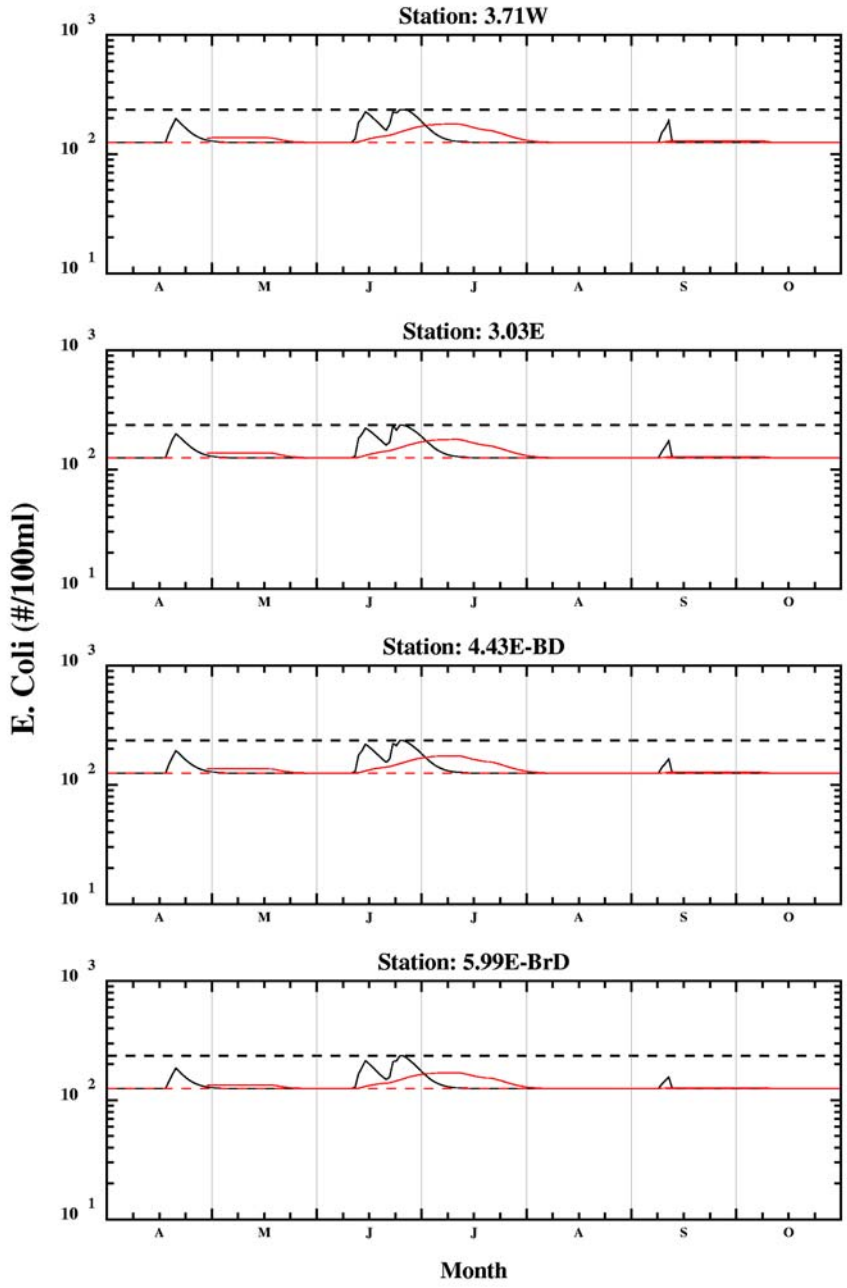

Figure 6-1d. Trail Creek E Coli Model and Data Comparison, Year 2000

(— — Max STD — — Geo Mean STD —— Daily Model Output —— 30-day Geo Mean of Model Output)

As presented, the maximum daily *E. coli* standard of 235 cfu/100mL is attained with these load allocations but the monthly geometric mean standard is still violated at a number of stations.

An additional (final) LA was developed that assigned a nonpoint source runoff E. Coli concentration of 125 cfu/100mL. The resulting calculated instream E. Coli concentrations for this additional LA is presented in Figures 6-2a through 6-2d and represents the final E. Coli LA for Trail Creek.

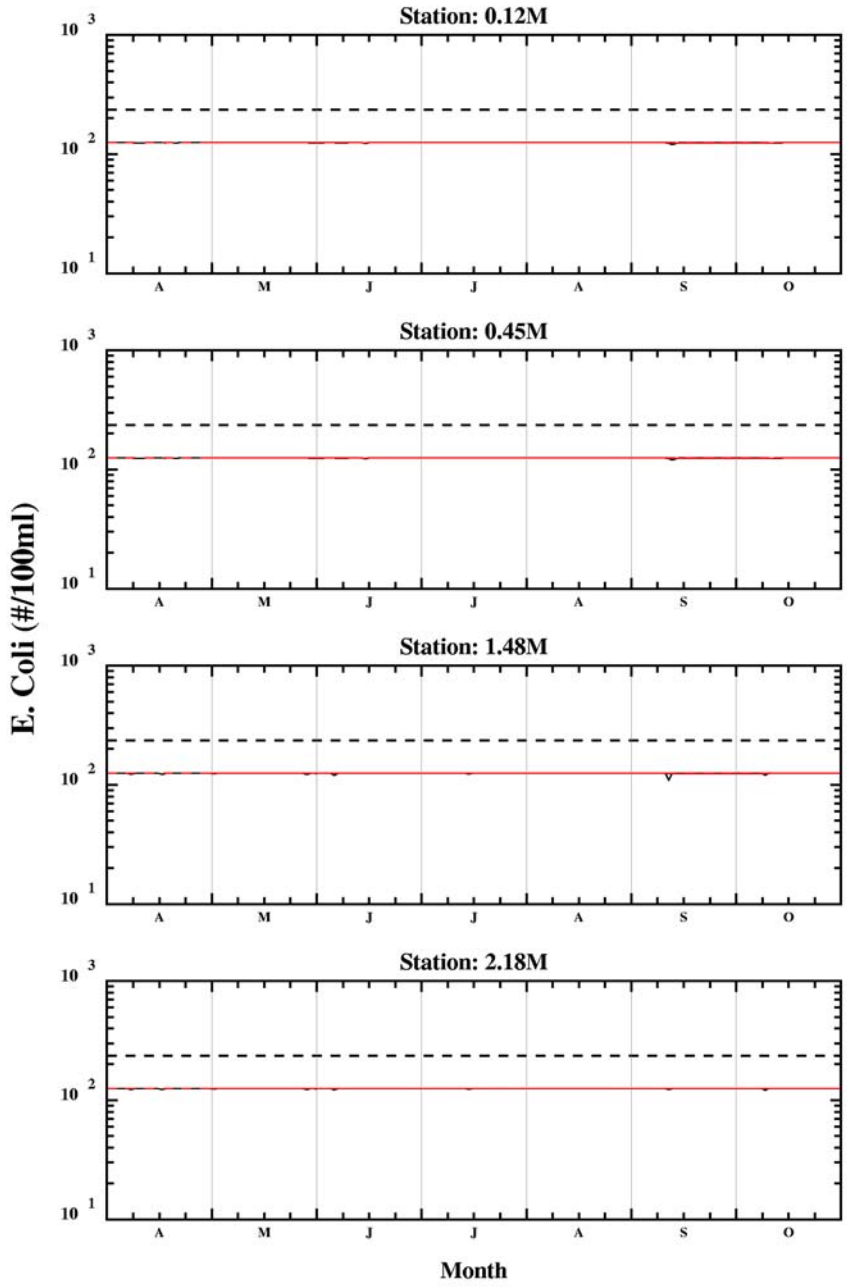

Figure 6-2a. Trail Creek E Coli Model and Data Comparison, Year 2000

(— — Max STD — — Geo Mean STD —— Daily Model Output —— 30-day Geo Mean of Model Output)

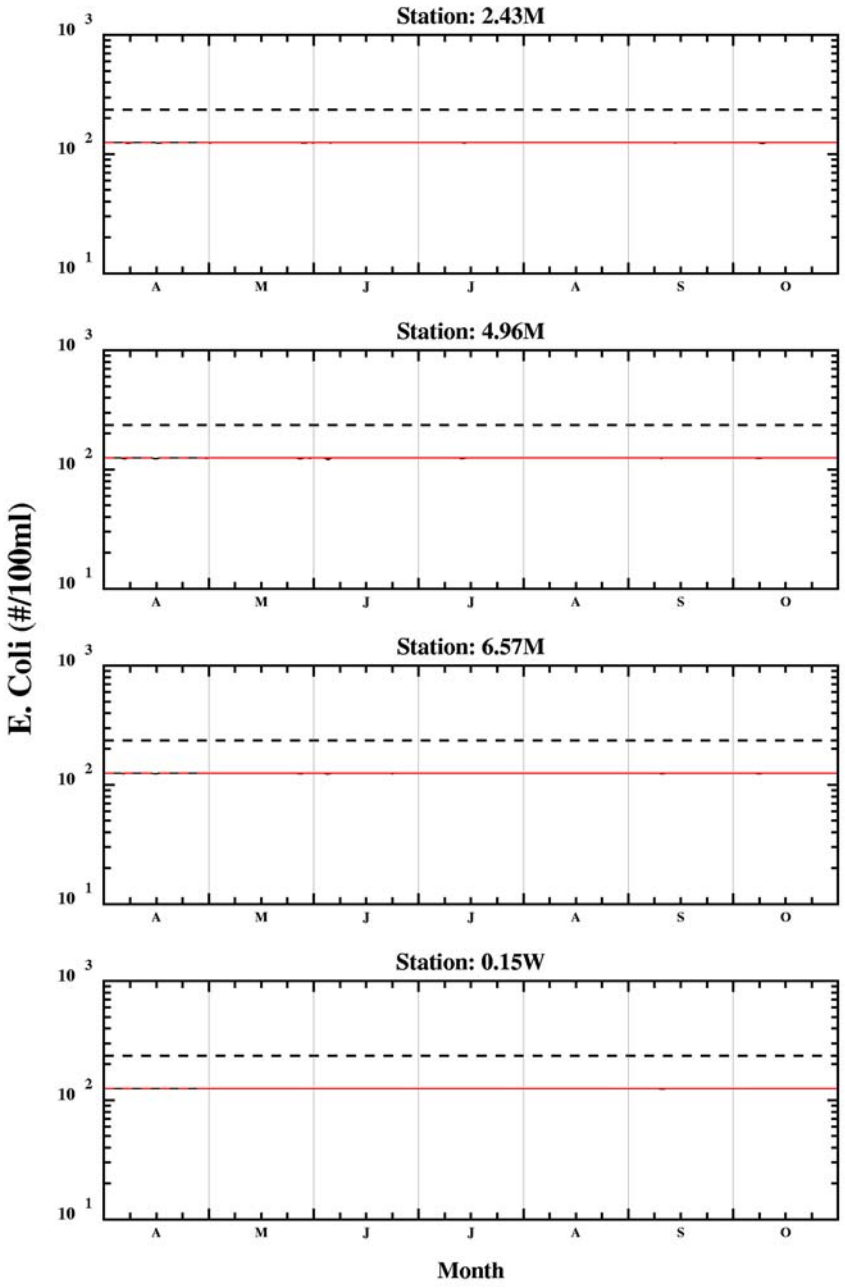

Figure 6-2b. Trail Creek E Coli Model and Data Comparison, Year 2000

(— — Max STD — — Geo Mean STD —— Daily Model Output —— 30-day Geo Mean of Model Output)

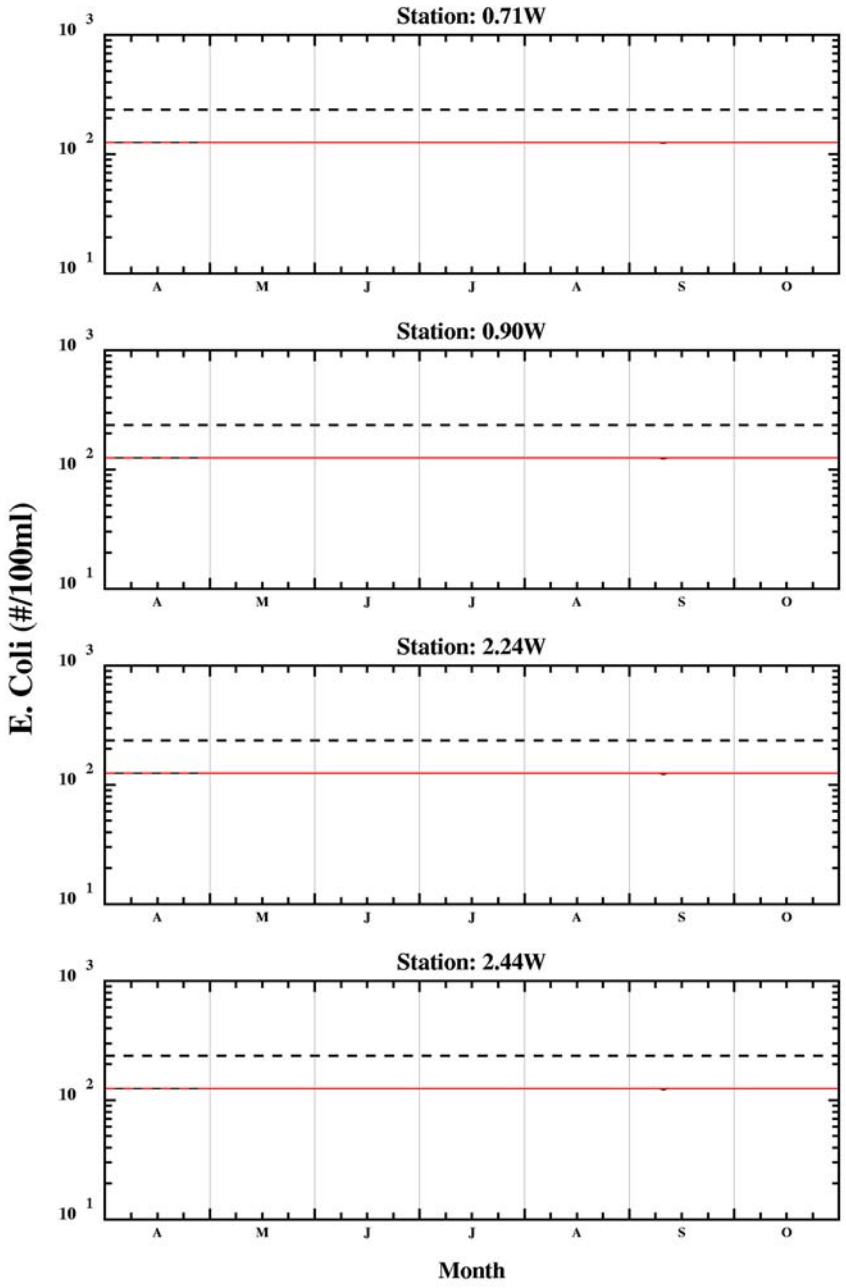

Figure 6-2c. Trail Creek E Coli Model and Data Comparison, Year 2000

(— — Max STD — — Geo Mean STD —— Daily Model Output —— 30-day Geo Mean of Model Output)

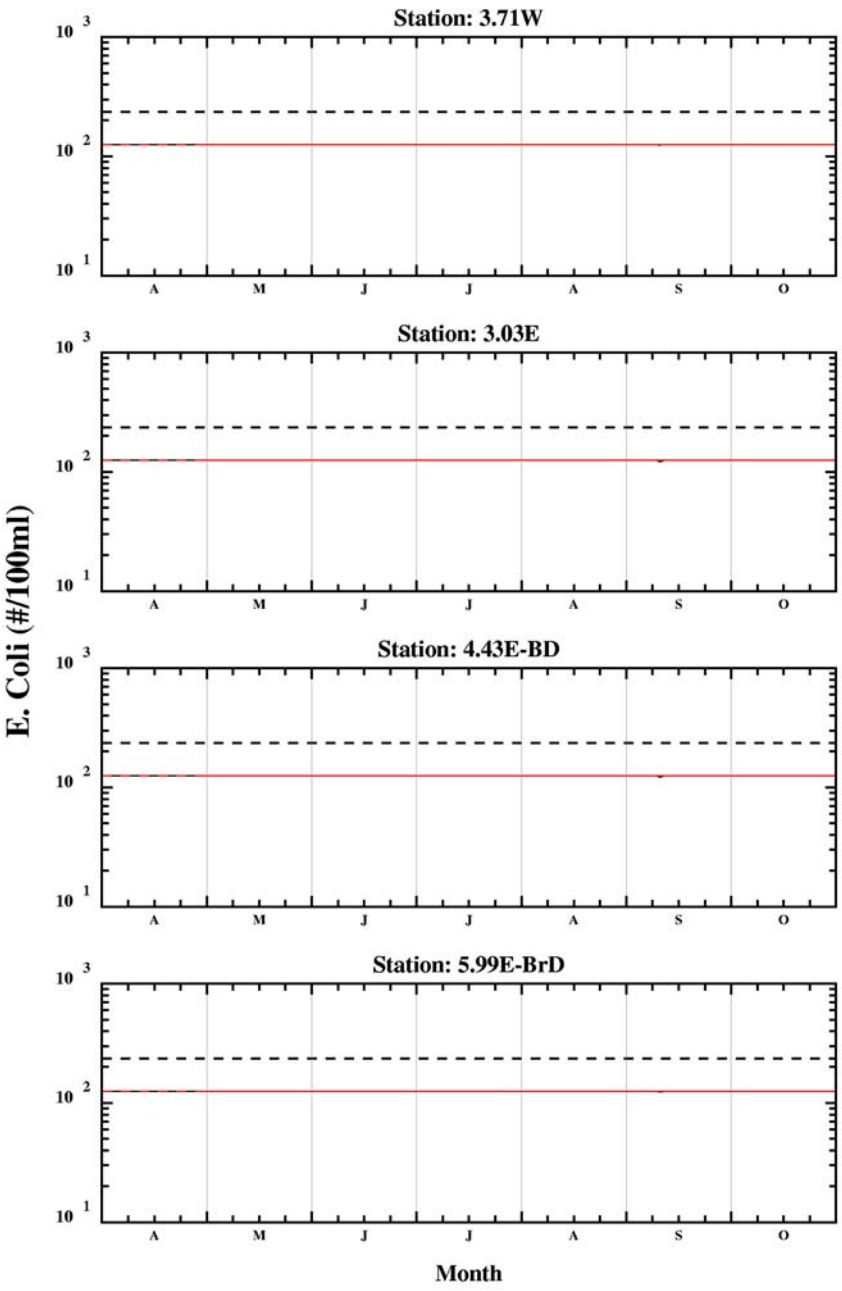

Figure 6-2d. Trail Creek E Coli Model and Data Comparison, Year 2000

(— — Max STD — — Geo Mean STD —— Daily Model Output —— 30-day Geo Mean of Model Output)

The resulting TMDL for this additional LA results in attainment of both the daily maximum and monthly geometric mean standards in Trail Creek. This final TMDL requires an *E. coli* nonpoint source LA of 125 cfu/100mL for all sources. Tables 6-1 and 6-2 present the final WLA and LA in counts/day that meet the TMDL concentrations of a monthly geometric mean of 125 cfu/100mL and daily maximum of 235 cfu/100mL during the recreational season of April to October. A summary of the total WLA and LA for the final TMDL is presented in Table 6-3.

The required MOS is incorporated into the TMDL analysis implicitly. TMDL rules allow for an explicit MOS (i.e., expressed in the TMDL as a portion of the allocations) or an implicit MOS (i.e., incorporated through conservative assumptions in the analysis). The implicit MOS was used because a conservative die-off rate was assigned as zero for the allocation model allocations, which accounts for uncertainty in the model. That is, the calibration and validation modeling was completed using E. Coli die-off rate of 1.5/day and the MOS was incorporated into the TMDL by using a die-off rate of zero for all the model allocation runs.

Table 6-1. Point Source *E. coli* WLA (cfu/day)

Month	Mich. City Sanitary Station	Friendly Acres MHP	Autumn Creek MHP	Indian Springs Subdivision
Apr	5.68×10^{10}	6.81×10^{8}	1.18×10^{8}	1.18×10^{8}
May	5.68×10^{10}	6.81×10^{8}	1.18×10^{8}	1.18×10^{8}
Jun	5.68×10^{10}	6.81×10^{8}	1.18×10^{8}	1.18×10^{8}
Jul	5.68×10^{10}	6.81×10^{8}	1.18×10^{8}	1.18×10^{8}
Aug	5.68×10^{10}	6.81×10^{8}	1.18×10^{8}	1.18×10^{8}
Sep	5.68×10^{10}	6.81×10^{8}	1.18×10^{8}	1.18×10^{8}
Oct	5.68×10^{10}	6.81×10^{8}	1.18×10^{8}	1.18×10^{8}

Table 6-2. Nonpoint Source *E. coli* LA (cfu/day)

Month	East Branch	West Branch	Main Branch	Baseflow	Total
Apr	1.36×10^{10}	1.42×10^{10}	5.50×10^{10}	9.18×10^{10}	1.75×10^{11}
May	3.38×10^{8}	3.98×10^{8}	1.17×10^{10}	9.18×10^{10}	1.04×10^{11}
Jun	1.18×10^{11}	1.30×10^{11}	1.51×10^{11}	9.18×10^{10}	4.91×10^{11}
Jul	1.08×10^{10}	1.16×10^{10}	1.45×10^{10}	9.18×10^{10}	1.29×10^{11}
Aug	1.69×10^{5}	1.82×10^{5}	1.68×10^{7}	9.18×10^{10}	9.18×10^{10}
Sep	2.49×10^{9}	4.57×10^{9}	1.04×10^{10}	9.18×10^{10}	1.09×10^{11}
Oct	4.53×10^{3}	9.73×10^{3}	1.68×10^{10}	9.18×10^{10}	1.09×10^{11}

Table 6-3. Trail Creek TMDL *E. coli* WLA & LA (cfu/day)			
Month	**Total WLA**	**Total LA**	**TMDL**
Apr	5.72×10^{10}	1.75×10^{11}	2.32×10^{11}
May	5.72×10^{10}	1.04×10^{11}	1.61×10^{11}
Jun	5.72×10^{10}	4.91×10^{11}	5.48×10^{11}
Jul	5.72×10^{10}	1.29×10^{11}	1.86×10^{11}
Aug	5.72×10^{10}	9.18×10^{10}	1.49×10^{11}
Sep	5.72×10^{10}	1.09×10^{11}	1.66×10^{11}
Oct	5.72×10^{10}	1.09×10^{11}	1.66×10^{11}

Monitoring and Reasonable Assurance

In order to investigate the effectiveness of the allocations in meeting the Trail Creek TMDL continued monitoring in the watershed for *E. coli* is recommended. The monitoring program should be designed to provide good spatial coverage of the watershed but also be aimed at obtaining data during dry and wet weather conditions. In addition, storm event monitoring should also be completed to better define nonpoint source loadings in the watershed.

For the permitted point sources in the watershed, IDEM NPDES permitting and monitoring requirements will provide the necessary reasonable assurance that these sources are not contributing to violations of State *E. coli* standards. For the nonpoint sources, State storm water regulations and land application permits should also provide these necessary reasonable assurance for these potential types of nonpoint sources. The other nonpoint sources will need to be monitored locally for implementation of BMPs or in providing access to watershed grants to assist in reducing nonpoint sources to meet the LA developed under this TMDL. The Unity/Michigan City Sanitary District has received a 319 grant for use in the Trail Creek E. Coli TMDL.

The only monitoring currently performed in the Trail Creek watershed is conducted by the Michigan City Sanitary District. The Sanitary District monitors *E. coli*, water temperature, flow and precipitation on a weekly basis at one location upstream and one location downstream of the WWTP outfall, as well as the plant effluent. In addition, IDEM will conduct water quality monitoring in the Trail Creek watershed, as part of their Basin Rotation Monitoring program, in 2005.

The Michigan City Sanitary District has received funding from the IDEM Section 319 Grant Program to update the Trail Creek Watershed Plan. One of the major objectives of the proposed Trail Creek Watershed Plan is to develop specific goals, strategies and actions that will eventually lead to a reduction of *E. coli* concentrations in Trail Creek.