2011 Data Report

June 13, 2011

Prepared by
Tony Langowski (Evergreen Metropolitan District)
And
RNC Consulting LLC

Bear Creek Watershed Association
1529 South Telluride St
Aurora, CO 80017

Manager: Russell N Clayshulte
303-751-7144
rclayshulte@earthlink.net
www.bearcreekwatershed.org

TABLE OF CONTENTS

BCWA Sampling Program....1
- **BCWA Monitoring Site Characterizations 1**
- **P1 - Bear Creek Reservoir Monitoring Program.... 2**
  - **P1 Data Results.... 7**
- **P3 - Stream Monitoring Program 7**
  - **Purpose.... 7**
  - **Stream Monitoring and Sampling Data.... 10**
  - **Weather (local) 11**
  - **Gaging Station Stream Flows.... 11**

Association Data Record 11
- **Data Management.... 11**
- **Depositories 12**
- **2011 Association Data.... 12**
  - **P1 monitoring program 12**
  - **P3 Monitoring Program.... 12**
  - **Special Data Reports of Historic Data.... 12**
  - **2011 Association Excel Spreadsheets and Technical Memorandums Posted to Website 12**
- **Electronic Transfers WQCD/ Depositories 12**

P2 – 2011 Supplemental Sampling of Restoration Projects.... 13
- **Coyote Gulch.... 13**

P4 – 2011 Supporting Watershed Study Efforts.... 14
- **Special Flow Study.... 14**
- **Macroinvertebrate Assessment.... 15**
- **CDOW Fish Survey Bear Creek.... 16**
- **Kerr/Swede Gulch Summary Data.... 17**
  - **Segment 5 Bear Creek.... 17**
  - **Segment 5 Water Quality Standards.... 17**
- **2011 Bear Creek Park Recreational Uses.... 19**
- **Bear Creek Reservoir Sediment Study 20**

P3-Summary Bear Creek Watershed 2011 Monitoring Data 21
- **Overview 21**
  - **Sampling and Monitoring Program Notes.... 21**
  - **Temperature Compliance.... 21**
    - ***Segment 8 (Site 36) and Segment 7 (Sites 37 and 38).... 23***
    - ***Segment 3 (Site 25) 23***
    - ***Segment 1a (Sites 1a, 2, 3a).... 23***
    - ***Segment 1d (Sites 4b, 4c and 4d).... 24***
    - ***Segment 1e (Sites 5, 7, 8a, 9, 12, and 13a).... 24***
    - ***Segment 1b (Sites 15a and 27b).... 24***
    - ***Segment 5 (Sites 26, 35 and 50).... 24***
    - ***Segment 6a (Sites 16a and 18).... 24***
    - ***Segment 6b (Site 19) 24***
    - ***Segment 10 (Sites 39a, 39b, 39c, and 39d).... 24***
    - ***Wastewater treatment plant effluents.... 24***
  - **Water Quality Compliance.... 25**
    - ***Segment 8 (Site 36) 26***
    - ***Segment 7 (Sites 37 and 38).... 26***

Segment 3 (Site 25) *26*
Segment 1a (Sites 1a and 3a) *26*
Segment 1d (Sites 4a, 4b, 4c, 4d and 4e) *26*
Segment 1e (Sites 5, 7, 8a, 9, 12, 13a and 14a) *27*
Segment 1b (Sites 15a, 27a and 27b) *27*
Segment 5 (Site 35) *27*
Segment 6a (Site 18) *27*
Segment 6b (Site 19) *27*
Segment 10 (Site 39a, 39b, 39c, 39d) *27*
Summary **27**
Temperature Compliance **27**
Water Quality Compliance **28**
Watershed Monitoring **29**
WWTP Effluent Temperature and Water Quality **29**
Other Small Treatment Facilities **31**
Bear Creek Stream Segments **32**
Segments 7 and 8 (Mt Evans Wilderness) **32**
Segment 1a (Above Evergreen Lake) **33**
Segment 1d (Evergreen Lake) **35**
Segment 1e (Mainstem below Evergreen Lake and Above Harriman Diversion) **39**
Segment 1b (Below Harriman Diversion) **43**
Segment 3 (Vance Creek) **44**
Segment 5 (Cub Creek) **45**
Genesee Reservoir **47**
(Segment 6a South Turkey Creek) **50**
Segment 6b (North Turkey Creek) **52**
Segment 2 ..... **54**
USGS Stream Flow Data Tables **55**
Weather Data **63**
Stream Flow vs. Local Weather **63**

LIST OF TABLES

Table 1 **Routine Monitoring Parameters** **5**
Table 2 **Methods and detection limits for laboratory analyses.** **5**
Table 3 **BCWA Monitoring Sites** **8**
Table 4 **Wastewater Treatment Plants and Parameters** **11**
Table 5 **Average and total pounds pre month at monitoring sites as base load** **13**
Table 6 **Annual Available Total Phosphorus Trade Pounds** **14**
Table 7 **2011 Bear Creek Watershed Stream Flow Data** **15**
Table 8 **2011 Macroinvertebrate Summary** **15**
Table 9 **2011 Fishery Data** **16**
Table 10 **Kerr/Swede Gulch Sampling** **18**
Table 11 **E. coli Geometric Mean Summary** **19**
Table 12 **Recreation Uses Based on Sample day Counts** **20**
Table 13 **2010 and 2011 Total Phosphorus Results** **20**
Table 14 **Bear Creek Watershed 2011 Temperature Compliance by Segment** **22**
Table 15 **Number of Temperature Measurements** **23**
Table 16 **WWTP Number of Temperature Measurements 2011** **24**
Table 17 **WWTP Logger summary 2011** **25**

Table 18 Bear Creek Watershed 2011 Water Quality Compliance by Segment 25
Table 19 Evergreen Metropolitan District (Site 20) 29
Table 20 West Jefferson County Metropolitan District (Site 21) 29
Table 21 Kittredge Sanitation and Water District (Site 22) 30
Table 22 Genesee Water and Sanitation District (Site 23) 30
Table 23 Town of Morrison (Site 24) 31
Table 24 Tiny Town Effluent Summary 31
Table 25 Brook Forest Inn Effluent Summary 32
Table 26 Bear Creek Cabins Effluent Summary 32
Table 27 Summit Lake Site 36 (In Summit Lake near outlet) Segment 8 32
Table 28 Summit Lake Site 37 Segment 7 33
Table 29 Summit Lake Site 38 (Bear Creek at Bear Tracks) Segment 7 33
Table 30 Segment 1a Summary 33
Table 31 Lost & Found (Singin' River Ranch-Site 1a) 34
Table 32 Above Evergreen Lake, at Clear Creek County line (Site 2) 34
Table 33 Above Evergreen Lake, at CDOW site (Site 3a) 35
Table 34 Evergreen Lake, 0.5 meters down, near dam (Site 4a) 36
Table 35 Evergreen Lake, 1.0m below surface, near dam (Site 4b) 36
Table 36 Evergreen Lake, 1.5m below surface, near dam (Site 4c) 37
Table 37 Evergreen Lake, 2.0m below surface, near dam (Site 4d) 37
Table 38 Evergreen Lake, 2.5m below surface, near dam (Site 4e) 38
Table 39 Segment 1e Summary 39
Table 40 Downtown Evergreen, at CDOW site (Site 5) 39
Table 41 Bear Creek Cabins (Site 8a) 40
Table 42 O'Fallon Park (Site 9) 41
Table 43 Lair o' the Bear (Site 12) 41
Table 44 Idledale (Shady Lane-Site 13a) 42
Table 45 West End of Morrison (Site 14a) 42
Table 46 Segment 1b Summary 43
Table 47 Bear Creek in Bear Creek Park, at the USGS gage (Site 15a) 43
Table 48 Bear Creek, Above Ward Ditch (Site 27a) 43
Table 49 Bear Creek below Ward Ditch (site 27b) 44
Table 50 Mt. Evans Wilderness Drainage, Vance Creek (Site 25) 44
Table 51 Segment 5 Summary 45
Table 52 Little Cub Creek, above Bear Creek confluence (Site 26) 45
Table 53 Little Cub Creek above Brook Forest Inn (Site 35) 46
Table 54 Cub Creek Park on Little Cub Creek (site 50) 46
Table 55 Genesee Reservoir 0.5 meters from surface (site 39a) 47
Table 56 Genesee Reservoir 1.0 meters from surface (site 39b) 48
Table 57 Genesee Reservoir 2.5 meters from surface (site 39e) 49
Table 58 Genesee Reservoir 3.0 meters from surface (site 39f) 49
Table 59 Segment 6a Summary 50
Table 60 Turkey Creek within Bear Creek Park, near Maint. Bldg. (Site 16a) 51
Table 61 Aspen Park Metropolitan District, South Turkey Creek (Site 18) 51
Table 62 Conifer Metropolitan District, North Turkey Creek (Site19) 52
Table 63 2011 May Bear Creek Evergreen vs. Historic Bear Creek Flow 55
Table 64 2011 June Bear Creek Evergreen vs. Historic Bear Creek Flow 56
Table 65 2011 July Bear Creek Evergreen vs. Historic Bear Creek Flow 57
Table 66 2011 August Bear Creek Evergreen vs. Historic Bear Creek Flow 57
Table 67 2011 September Bear Creek Evergreen vs. Historic Bear Creek Flow 58
Table 68 2011 May Bear Creek Morrison vs. Historic Bear Creek Flow 59

Table 69 2011 June Bear Creek Morrison vs. Historic Bear Creek Flow 60
Table 70 2011 July Bear Creek Morrison vs. Historic Bear Creek Flow 60
Table 71 2011 August Bear Creek Morrison vs. Historic Bear Creek Flow 61
Table 72 2011 September Bear Creek Morrison vs. Historic Bear Creek Flow 62
Table 73 Weather Data May-September 2011 Summary 63
Table 74 2011 Weather Data vs. Historical Weather Data (50 years 1961-2011) 63
Table 75 2011 May Bear Creek Evergreen vs. Weather Data 63
Table 76 2011 June Bear Creek Evergreen vs. Weather Data 64
Table 77 2011 July Bear Creek Evergreen vs. Weather Data 65
Table 78 2011August Bear Creek Evergreen vs. Weather Data 66
Table 79 2011 September Bear Creek Evergreen vs. Weather Data 67

List of Figures

Figure 1 Bear Creek Watershed 1
Figure 2 Bear Creek Reservoir with Sampling Stations 4
Figure 3 Bear Creek Park with BCWA Sampling Sites 4
Figure 4 Bear Creek Watershed Sampling locations (Not all labels shown) 6
Figure 5 Coyote Gulch Sampling Points and Restoration Drop Structures 13
Figure 6 Average Annual Pounds of Total Phosphorus Reaching Reservoir 14
Figure 7 Kerr/Swede Gulch Sample Locations 17
Figure 8 2011 E. coli Counts by Month 19
Figure 9 Major recreational uses by Month 20

BCWA Sampling Program

A generally continuous collection of surface quality data began in 1990 for the Bear Creek Watershed (Figure 1) and at Bear Creek Reservoir (Figure 2). Data collection includes specific chemical, physical and biological parameters. Data is collected monthly and bi-monthly at Bear Creek Reservoir and along Turkey Creek and Bear Creek, and in the watershed from July to September. The Association meets water quality data sampling and analyses objectives established in the Bear Creek Reservoir Control Regulation # 74 and as contained in an annually updated watershed sampling procedure memorandum (Bear Creek Watershed Association Surface Water Monitoring Program Version 2010.02, BCWA).

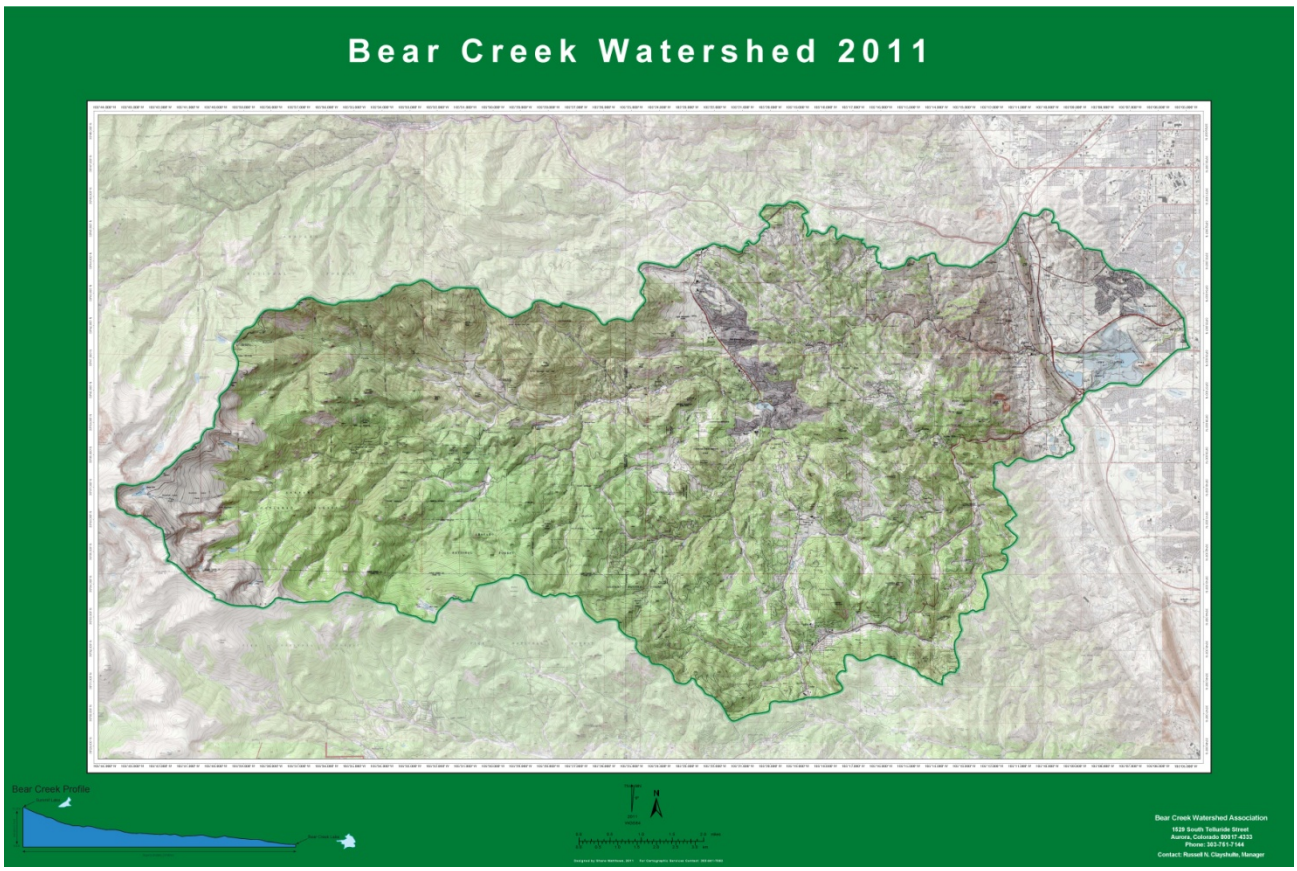

Figure 1 Bear Creek Watershed

BCWA Monitoring Site Characterizations

The Bear Creek Watershed Association maintains four types of monitoring efforts to characterize water and environmental quality within the Bear Creek Watershed*:*

1. P1- Routine water quality monitoring at Bear Creek Reservoir (multiple vertical stations), Turkey Creek inflow to reservoir, Bear Creek inflow to reservoir, and reservoir discharge into lower Bear Creek. The P1 sites are long-term monitoring sites consistent with the intent of the monitoring program outlined in the Bear Creek Reservoir Control Regulation.

2. P2- Supplemental sampling of restoration or other project specific sites (e.g., Coyote Gulch in cooperation with the City of Lakewood). These types of monitoring efforts are for limited duration and for specific parameters of interest.

3. P3- Watershed surface water monitoring along Bear Creek and Turkey Creek drainages for site-specific

characterizations (e.g., temperature trends, nutrient loading, flow studies). These are interim and long-term monitoring sites for watershed characterizations

4. P4- Supplemental environmental characterizations of Bear Creek watershed including, but not limited to macroinvertebrates, flow analysis, habitat characterizations, fishery evaluations, system productivity, or other environmental factors that potentially affect fisheries or watershed health.

P1 - Bear Creek Reservoir Monitoring Program

The follow monitoring plan sections detail the 2011 reservoir and watershed monitoring programs as approved by the BCWA Board and accepted by the Water Quality Control Division staff (WQCD). This monitoring plan remains consistent with the quality assurance goals of the previously adopted Association QAPP (Bear Creek Watershed Association, 2006). However, this monitoring plan is the working version. The 2011 monitoring program version 2011.01 adapted from the last version of the 2010.03 monitoring plan. The 2010 monitoring program included changes to Bear Creek Control Regulation #74 and updated standards and classifications in Regulation #38.

Changes, updates, major continuation studies and monitoring program elements of the 2011 monitoring program include:

- Additional temperature probes for new stream segments. Temperature data loggers in Bear Creek Segment 1b above and below the Ward Ditch. Logger location on Cub Creek near Brookforest Inn, site 35 and lower Cub Creek, site 50. Include these sites for seasonal chemistry.

- Temperature Logger profile of Bear Creek Reservoir at Site 40 will begin in January 2011 with buoy placement and probes attached at ice-off (April-December, first week): ½ m, 1m, 1 ½m, and 2m. Field probe measurements year-round at site 40 with profile interval of ½ m, 1m, 1 ½m, 2m, 2 ½m, 3m, 3 ½ m, 4m, 5m, 6m, 7m, 8m, 9m, 10m, and 11m. Similar profile pattern used at other reservoir sites.

- Temperature Logger profile for Genesee Reservoir with single chemistry set taken off dam face with profile interval of: ½ m, 1m, 1 ½m, and 2m. Field probe measurements during July, August and September off dam face with profile interval of ½ m, 1m, 1 ½m, 2m, 2 ½m, 3m, 3 ½ m, 4m, 5m, and 10m.

- Temperature Logger profile for Evergreen Lake at ice-off (April-May) through November 1: ½ m, 1m, 1 ½m, and 2m. Field probe measurements during July, August and September at ½ m, 1m, 1 ½m, 2m, 2 ½m, 3m, 3 ½ m, 4m, 5m, and 6m.

- Maintain all other existing temperature data logger locations and seasonal monitoring periods with temperature logger placement adjust to temperature seasons as shown in Appendix C.

- Recognize growing season for data collection as July, August and September. Adjust watershed chemistry analyses to focus primarily on the period of July to September. Additional chemistry data maybe collected on an as needed basis.

- Monitoring sites maintained for Summit Lake in the Mount Evans Wilderness (segment 8), in upper segment 7 below Summit Lake and middle segment 7 at Bear Tracks for the July, August and September months. The Bear Tracks monitoring station is a reference station and is proposed for fishery, Macroinvertebrate, and habitat surveys in 2011.

- Increase monitoring for Evergreen Lake chemistry to obtain samples at -1 meter and +1 meter in water column, and adjust position of temperature data loggers in water column. Track temperature against new standard and DO compliance in central pool of Evergreen Lake. No Association ammonia and TIN monitoring for Evergreen Lake. Included Evergreen Lake in the high quality water study for drinking

water reservoirs. Association will collect data consistent with protection of a major drinking water supply system.

- Total nitrogen sampling for Summit lake (Site 37), segment 7 (Site 36), Bear Tracks (Site 38),below Bear Creek Reservoir at Site 45, Bear Creek Reservoir from May through November at the surface and bottom sites (sites 40a and 40c), inputs into the reservoir at sites 15a and 16a will be included in the 2011 monitoring program.

- Added stream staff gages at Singing River, Brookforest Inn, Little Cub at Mouth, Bear Creek Cabins and Turkey Creek. Daily and weekly reading taken at gages and compared against field measurements of flow to produce flow curves. Looking to expand program in 2011 and include more citizen involvement.

- Work with the City of Lakewood to closely monitor dissolved oxygen in water column and adjust the operation of the reservoir aeration system on a weekly basis to maintain DO standards, while minimizing aeration operations. This requires addition vertical probe sampling in the July to September period to monitor DO levels in the water column at site 40.

- Continue sediment and nutrient internal loading studies in Bear Creek Reservoir.

- Maintain photographic points for critical segments and conditions. Document dewatering of Bear Creek Segment 1b below both the Arnett-Harriman and Ward ditches.

- Continue special study of E. coli on Kerr/Swede Gulches. E. coli sampled year-round from 2010-2015 with field data and nutrient sampling from April-October.

- Continue special study on Coyote Gulch.

The routine monitoring program (P1) focuses on Turkey Creek drainage and Bear Creek drainage inputs and discharge from Bear Creek Reservoir (Figure 2) into lower Bear Creek with a central pool characterization of the reservoir near the dam (BCWA site 40). In Figure 2, the outlet structure is near BCWA site 41 with Bear Creek inflow near BCWA site 44 and Turkey Creek inflow near BCWA site 43. The reservoir chemistry and biological characterization occurs at BCWA site 40. Vertical probe samples for specific conductance, temperature, dissolved Oxygen, and pH are measured at ½ and 1-meter intervals at all reservoir sites. The current monitoring program optimizes data generation to evaluate reservoir inflow loading, tropic state changes within the reservoir, and reservoir outflow; while minimizing monitoring cost. The aeration sites are visible in Figure 2. Monitoring stations within Bear Creek Park are shown in Figure 3. A map of partial sampling sites and wastewater treatment plant locations is shown in Figure 4.

The Association measures flow in Bear Creek and Turkey Creek during sampling events. The Association also estimates discharge flows from Bear Creek reservoir for sampling events. The U.S. Army Corps of Engineers maintains records of flow inputs and discharge for the reservoir system.

The four 2011 P1 routine watershed-monitoring stations, including the reservoir station, are:

1. Mainstem of Turkey Creek prior to discharge into Bear Creek Reservoir, within Bear Creek Park, adjacent to the City of Lakewood Maintenance Yard;

2. Mainstem of Bear Creek prior to discharge into Bear Creek Reservoir, within Bear Creek Park, adjacent to the bridge at the western edge of the park;

3. Tail-water discharge from Bear Creek Reservoir in the concrete channel that starts the lower Bear Creek; and

4. Bear Creek Reservoir, center of main pool and supplemental vertical profile stations 40, 41, 42, 43, and 44

Figure 2 Bear Creek Reservoir with Sampling Stations

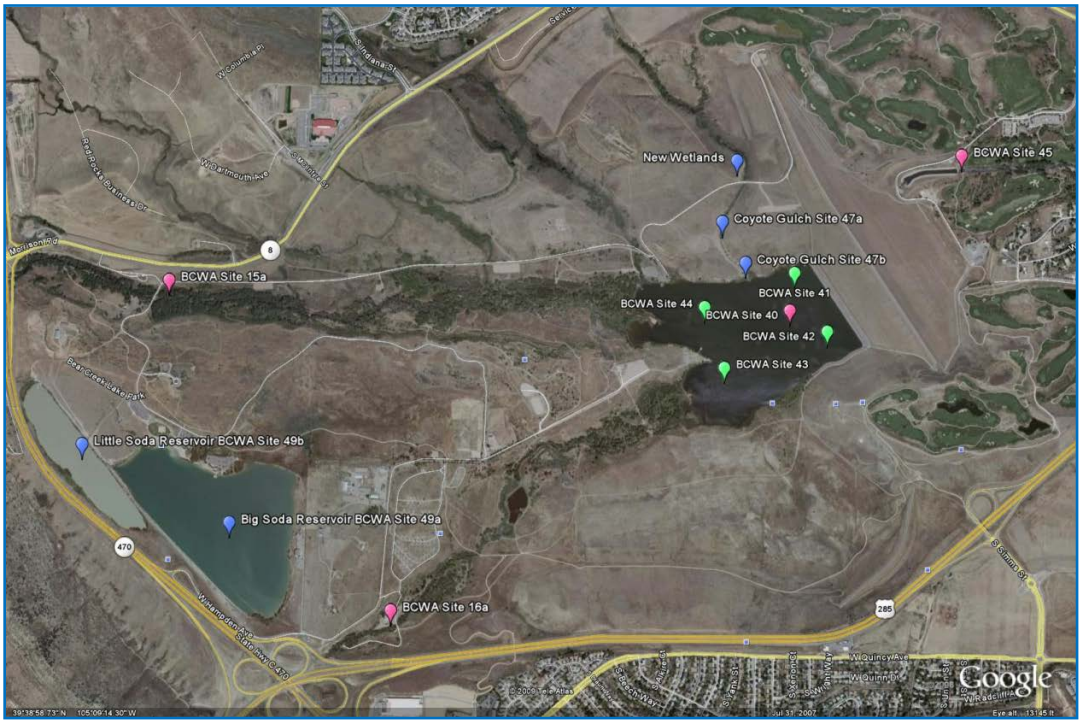

Figure 3 Bear Creek Park with BCWA Sampling Sites

Table 1 lists water quality monitoring parameters for the P1 sampling sites. Table 2 shows methods of analyses and detection limits. Laboratory analyses are performed by GEI Consultants, Inc. / Chadwick

Ecological Division. Samples delivered to GEI Consultants, Inc. / Chadwick Ecological Division within 1 hour of final sample collection. The phytoplankton samples are a composite of the top 1-meter of the water column. Reservoir bottom samples taken at about 9 meters depth, which is + 1m above the bottom. Care is taken to not disturb the bottom sediments where the sample is collected. The top samples represent a composite water sample from -0.75m to -1.25m, as collected in a vertical Van Dorn sampler.

Table 1 Routine Monitoring Parameters

Parameter (units)	Bear &Turkey Creek Inflows, Site 15a and 16a	Reservoir Sites	Reservoir Outflow, Site 45
Physical/Field			
Flow/ Discharge (cu m/s)	X		X
Specific Conductance (umhos/cm)	X	(Profiles at sites 40, 41, 42, 43, and 44)	X
Secchi (meters)		(Sites 40, 41, 42, 43, and 44	
Dissolved Oxygen (mg/l)	X	(Profile sites 40, 41, 42, 43, and 44)	X
Temperature (C)	X (Data Loggers)	(Profile at sites 40, 41, 42, 43, and 44)	X
Total Suspended Sediments (mg/l)	X	(Site 40; laboratory)	X
Turbidity (NTU)	X	X (-1m)	X
pH (standard unit)	X	(Profile at sites 40, 41, 42, 43, and 44)	X
Biological (Site 40 only)			
Chlorophyll a (ug/l)		X (-1m)	
Phytoplankton (July, August, September only; six sample sets)		(top 1-meter water column, a composite)	
Nutrients (Reservoir Site 40 only)			
Nitrate + Nitrite (ug/l)	X	X (top, lower)	X
Total Dissolved Phosphorus (ug/l)	X	X (top, lower)	X
Total Phosphorus (ug/l)	X	X (top, lower)	X
Total Nitrogen	X	X (top, lower), May-Nov	X

Table 2 Methods and detection limits for laboratory analyses.

Analyte	Method*	Detection limit
Total Suspended Solids	2540 D	4 mg/L
Total Dissolved Solids	2540 C	4 mg/L
Chlorophyll	10200 H (modified)	0.1 mg/m3
Orthophosphate	4500-P G	2 µg/L
Total Phosphorus	4500-P G	2 µg/L
Nitrate+Nitrite	4500-NO3 I	2 µg/L
Total Nitrogen	4500 TN	2 ug/l

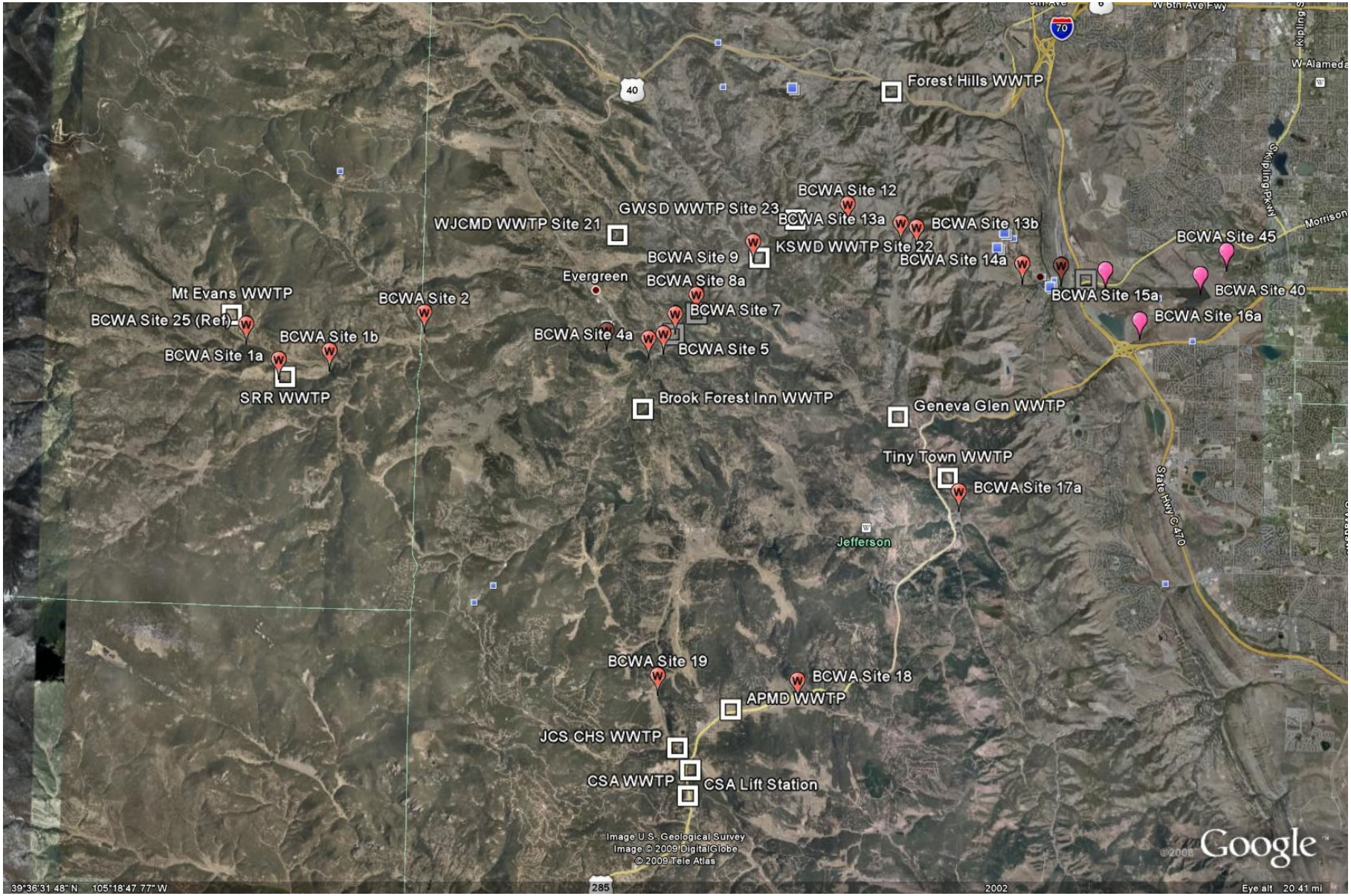

Figure 4 Bear Creek Watershed Sampling locations (Not all labels shown)

P1 Data Results

The monitoring plan is detailed in the *Bear Creek 2011 Sample Plan Version 2011.01*, which is posted on the Association website monitoring page at www.bearcreekwatershed.org. The monitoring plan is reviewed annually and updated as appropriate. The Water Quality Control Division staff reviews the annual monitoring plan (generally in December) and proposes changes as appropriate. The dual review is consistent with the requirements of the *Bear Creek Control Regulation*. The 2011 data results are contained in the *2011 Bear Creek Master Spreadsheet* posted on the Association website monitoring page. Monthly summary reports are provided to the Association Board and these data files are also posted to the website. Selected data and a summary of the water quality management program is presented in the *2011 BCWA Annual Report WQCC (BCWA,* May 2011*)*, which also posted with previous Association annual reports.

P3 - Stream Monitoring Program

Purpose

The Association conducts special stream and lake monitoring programs within the Bear Creek Watershed including Bear Creek and Turkey Creek Drainages (North and South Turkey Creek). The monitoring plan is detailed in the *Bear Creek 2011 Sample Plan Version 2011.01*, which is posted on the Association website monitoring page at www.bearcreekwatershed.org. The monitoring year divides into a warm-season period with more intense sampling and a cold-season period, designed to provide minimal winter and spring data. This data report summarizes temperature and water quality monitoring data, sampling results obtained from in-stream locations, and data from five-wastewater treatment plant (WWTP) effluents. The complete 2011 Cold-season and Warm-season water quality data set is an electronic data summary report and spreadsheet.

The program is a cooperative effort between the Association and the five larger wastewater treatment plant dischargers: Evergreen Metropolitan District (EMD), West Jefferson County Metropolitan District (WJCMD), Kittredge Sanitation and Water District (KSWD), Genesee Water and Sanitation District (GWSD), and the Town of Morrison. This warm-season 2011 monitoring program began April-May 2011 with completion in September-October 2011. The in-stream monitoring program provides more detailed water quality information specifically for temperature, pH, dissolved oxygen, specific conductance, total ammonia, nitrate+nitrite, dissolved phosphorus, and total phosphorous, with calculated total inorganic nitrogen in Bear Creek watershed streams.

The Cold-season temperature monitoring program collected data from limited in-stream watershed locations, including the eight identified Colorado Division of Wildlife (CDOW) fish survey sites, and the five “larger” wastewater plant dischargers to Bear Creek. During the cold-season no chemical or biological monitoring or sampling was performed at any of the watershed locations.

The 2011 Warm-season sampling and monitoring program collected data from 36 locations (including the five wastewater treatment plants-WWTP) within the Watershed. The Program included the eight identified Colorado Division of Wildlife (CDOW) fish survey sites.

Monitoring for pH, dissolved oxygen, temperature and specific conductance was performed monthly at watershed locations, including the five WWTPs. Sampling for Total Ammonia, Nitrate+Nitrite, (calculated Total Organic Nitrogen), Dissolved Phosphorus and Total Phosphorous was performed coincidentally with monthly monitoring. Chemical and biological samples analyzed by GEI Consultants/Chadwick Ecological Consultants, Inc. in Littleton, Colorado. WWTP effluent data tables summarize monthly process control sheets and results of permit- and non-permit required effluent analyses collected by dischargers.

Flow data summarizes the two flow gages located on Bear Creek. These locations include above Evergreen Lake and above Morrison. Manual flow measurements performed at watershed locations through the program period. Weather data from the reporting station located at the EMD WWTP collected, analyzed and summarized. Table 3 lists sampling and monitoring sites utilized in 2011 program.

Table 3 BCWA Monitoring Sites

Site ID	Site Location by Stream Segment	2011April-October		2011-12 Cold Season Nov-Mar	Reference
		Data Logger	Chemistry	Data Logger	Site
Segment 1a					
Site 1a	Above Singin' River Ranch complex	x	x		R
Site 2	Above Evergreen Lake at Clear Creek County line	x			
Site 3a	Above Evergreen Lake at CDOW Site	x	x	x	
Segment 1b					
Site 15a	Bear Creek Segment 1b at the USGS gaging station within Bear Creek Park	x	x	x	R
Site 27a	Morrison above Ward Ditch	x			
Site 27bc	Morrison Below Ward Ditch	x			
Site 24	Morrison WWTP Eff	x	x	x	
Segment 1c					
Site 40	Bear Creek Reservoir	x	x	x	R
Segment 1d					
Site 4a	Evergreen Lake Surface, profile station	x			R
Site 4b	Evergreen Lake Profile Station, 1.5m	x	x		
Site 4e	Evergreen Lake Profile Station, 4.5m	x	x		
Segment 1e					
Site 5	Above EMD WWTP, at CDOW downtown site	x	x	x	R
Site 8a	Bear Creek Cabins at CDOW Site	x	x	x	
Site 9	O'Fallon Park, west end at CDOW Site	x	x	x	
Site 12	Lair o' the Bear Park, at CDOW site	x	x	x	
Site 13a	Below Idledale, Shady Lane CDOW site	x	x	x	
Site 14a	Morrison Park west end at CDOW Site	x	x	x	R
Site 20	EMD WWTP Eff	x	x	x	
Site 21	WJCMD WWTP Eff	x	x	x	
Site 22	KSWD WWTP Eff	x	x	x	
Site 23	GWSD WWTP Eff	x	x	x	
Segment 2					
Site 45	Lower Bear Creek, below reservoir concrete trace/ weir (Plunge pool)	x	x	x	R
Segment 3					
Site 25	Vance Creek (Mt. Evans Wilderness)	x	x		R
Segment 4a					
Site 47a	Upper Coyote Gulch		x		
Site 47b	Lower Coyote Gulch, reservoir		x		R
Segment 5					
Site 26	Cub Creek, Upstream of Hwy 73 bridge, south of EMD WTP	x			
Site 50	Cub Creek, Upstream Cub Creek Park	x	x		R
Site 35	Cub Creek @ Brookforest Inn	x	x		R
Segment 6a					
Site 16a	Turkey Creek within Bear Creek Park at old USGS gage	x	x	x	R
Site 18	South Turkey Creek Aspen Park	x	x		

Site ID	Site Location by Stream Segment	2011April-October		2011-12 Cold Season Nov-Mar	Reference
		Data Logger	Chemistry	Data Logger	Site
	Metropolitan District				
Segment 6b					
Site 19	North Turkey Creek Flying J Ranch Bridge	x	x		R
Segments 7 and 8					
Site 37	Summit Lake outfall, Mainstem from Lake at first ripples (Segment 7)		x		R
Site 36	Summit Lake outfall (Mount Evans Wilderness) (Segment 8)		x		R
Site 38	Bear Creek at Bear Tracks, Bridge (Segment 7)		x		R
Segment 10					
Site 39	Genesee Reservoir Profile	x	x		R

Monthly measurements performed in the morning and began at approximately 08:00 in Evergreen Lake. Measurements recorded with an YSI Professional hand-held meter. The meter utilizes a multi-probe sensor, capable of measuring pH, Temperature, Dissolved Oxygen and Specific Conductance simultaneously. Measurements are logged, retained in the on-board computer, and then manually downloaded. Typically, the logged data manually downloaded by viewing each file and transcribing data onto monthly Logsheets. The data was entered into a spreadsheet. Prior to the program, the meter was calibrated by certified technicians. Prior to each monitoring event, the meter was calibrated for each parameter, using a purchased calibration solution for specific conductance and purchased pH buffers (two-point calibration, 7.00 and 10.01). All calibrations were documented on a Calibration Logsheet.

Fresh batteries installed in the meter at the start of the program and batteries replaced when the observed battery charge reached 50%. Flow measurements were performed coincidentally with monthly sampling and monitoring. A Global Water flow probe Model FP101 was used and values obtained were combined with stream width and depth measurements to calculate estimated streamflow.

Monthly sampling for Total Ammonia, Nitrate+Nitrite and Total Phosphorous was performed concurrently with monthly monitoring at 20 locations. The monthly sampling and monitoring was also coordinated with permit sampling performed by the WWTPs discharging into Bear Creek. The reason for this coordinated effort was to attempt to provide a water quality "snapshot" of Bear Creek at that point in time.

WWTP effluent Total Ammonia, Nitrate, Nitrite and Total Phosphorous samples are analyzed by treatment plant laboratories: EMD, WJCMD and KSWD plant effluents were analyzed by EMD personnel, as typically done for CPDES permit reporting. EMD personnel utilize the EPA-approved Method 4500-NH3 D. ammonia selective electrode, *Standard Methods for the Analysis of Water and Wastewater, 21st Edition* for Total Ammonia analysis, EPA-approved HACH Method 8190 (equivalent to Method 4500-P B, 5 & P E Total Phosphorous, *Standard Methods for the Analysis of Water and Wastewater, 20th Edition)* for Total Phosphorous and HACH Method 8039, cadmium reduction method for Nitrate analysis. Total Phosphorous and Nitrate analyses were performed with the HACH 2010 spectrophotometer. Similarly, GWSD WWTP personnel analyzed plant effluent per approved methods: For Total Ammonia, Method 417 E., *Standard Methods for the Analysis of Water and Wastewater, 16th Edition;* Total Phosphorous, HACH Method 8048, Nitrate HACH Method 8039 and Nitrate HACH Method 8153. Total Phosphorous, Nitrate and Nitrite analyses were performed with the HACH 2010 spectrophotometer. The Town of Morrison utilizes an outside analytical laboratory for effluent testing of Total Ammonia and Total Phosphorous.

Stream Monitoring and Sampling Data

Monthly stream monitoring and sampling data tabulated into datasets. Data was retrieved from the YSI memory shortly after each monitoring event. Data are transcribed onto logsheets and subsequently entered onto Excel spreadsheets. Each monitoring group (watershed stream Sites and WWTP effluents) has an individual folder, with one spreadsheet and multiple worksheets of data. Minimum, maximum, average and standard deviation analyses were performed on this (and mostly all) data.

Programmable temperature dataloggers measure and record watershed stream and WWTP effluent temperatures every thirty minutes. The loggers used in the Program are Onset Computer Corporation brand, HOBO H8 and model Water Temp Pro v2 (U22) programmable dataloggers. Prior to the start of the monitoring program, all model dataloggers were returned to Onset for a NIST (National Institute of Standards and Technology) one-point certification and a 'tune-up'. The one-point certification was performed against calibration standards at 20°C. The 'tune-up' consists of a new battery and quality control testing, assuring the dataloggers meet manufacturer's operating specifications. This process occurs every spring, prior to the start of the special stream monitoring program. The Association maintains a fact sheet with temperature monitoring protocols, as included in the Association annual report.

The dataloggers were programmed for measurements every thirty minutes at an office computer equipped with the Onset software. At this frequency, the memory capacity is approximately 165 days for the H8 series logger and 905 days for the U22 (Water Temp Pro) series logger. The Association employs newer models with delayed-start capabilities. Logsheets were utilized to record the exact time of deployment and retrieval of all units, so that erroneous measurements (measurements recorded out of water) could be omitted during the data evaluation process.

The U22 series loggers were utilized in all watershed stream locations. These loggers were downloaded to a shuttle device. Occasionally, the download process occurred precisely at the measurement instance and a measurement was lost. There are no watertight cases required for the U22 model loggers. The date and deployment time for all loggers is noted on a logsheet. After downloading the last logger in the Watershed, the laptop and shuttles are transported to the desktop computer with the Onset software at the EMD Administration office. The logger data is transferred from the laptop and from the shuttles to the desktop. The shuttles are connected to the computer via a download cable, and data on the shuttles are individually downloaded into separate program files.

30-minute datalogger temperature measurements were exported from the Onset Computer software into Excel spreadsheets. Each download of temperature data is treated as a file in the Onset software. Once the Onset file formats had been exported and saved as separate Excel files, the Excel spreadsheets for each location were combined into one Excel spreadsheet with multiple worksheets. Therefore, each Excel file contains multiple worksheets, one for each separate download of data, and a summary worksheet. The master dataset spreadsheet contains separate worksheets for each Site in the watershed, displaying all temperature datalogger values and statistical analysis, as well as sampling and monitoring data and statistics.

The date and time recorded on the Launch/Retrieval Logsheet were used to eliminate erroneous temperature measurements prior to data analysis. The majority of these erroneous measurements were eliminated by utilizing the shuttle devices to field-download data. Occasionally, the field download process occurred exactly at the time of a measurement, and an erroneous value was recorded or missed. These were also removed from the raw data prior to analysis. Once in a spreadsheet format, the data was evaluated against the underlying standard Weekly Average Temperature (WAT) criteria, against the underlying standard Daily Maximum Temperature (DM) criteria and against the Maximum Weekly Average Temperature (MWAT) criteria. Percentages of compliance were calculated. Weekly Average Temperatures were determined by calculating the mean temperature of seven consecutive days of data beginning with either April or May or the first day of data collection. Any lack of data collection resulting in a data gap of one day or more, required that the seven-day period begin anew. Maximum Weekly Average Temperatures were determined by evaluating the calculated Weekly Average Temperatures. Daily Maximum values were obtained by calculating the average temperature of a two-hour period beginning with the first temperature recorded, and

determining the maximum value from each day. Again, any lack of data collection resulting in a data gap more than two hours, required that the two-hour calculation period begin anew. In most cases, there were four measurements in a two-hour period.

Since there are five, "larger" wastewater treatment facilities that discharge into Bear Creek (four into Segment 1e and one into Segment 1b), an effort was undertaken to analyze effluent parameters that would be consequential to the receiving waters. Table 4 lists the parameters of concern (Effluent Flow, Temperature, Dissolved Oxygen, pH, Total Ammonia, Nitrate, Nitrite (GWSD only), and Total Phosphorous) that were collected and analyzed. Only data that typically comprises daily Process Control and permit-mandated monitoring was reviewed. In prior years, the same data was collected and combined with monitoring and measurements taken in Bear Creek. This combined data was introduced to separate temperature, dissolved oxygen models to document existing effects, and predict possible outcomes of specific scenarios.

Table 4 Wastewater Treatment Plants and Parameters

WWTP	Parameters
EMD	Flow, pH, Temperature (Temp), Dissolved Oxygen (DO); Total Ammonia (NH3), Nitrate (NO3), Nitrite (NO2), Total Phosphorous (TP); Total Inorganic Nitrogen (TIN), Temp Datalogger (logger)
WJCMD	Flow, pH, Temp, DO, NH3, NO3, NO2, TIN, TP, logger
KSWD	Flow, pH, Temp, DO, NH3, NO3, NO2, TIN, TP, logger
GWSD	Flow, pH, Temp, DO, NH3, NO3, NO2, TIN, TP, logger
Morrison	Flow, pH, Temp, DO, NH3, TP, logger

The sampling and monitoring portion of the program was coordinated with the permit required effluent sampling. This occurred on Thursdays during the program.

Weather (local)

A National Weather Service Cooperative Reporting Station Number 052790 is maintained at the EMD WWTP. Daily high and low air temperatures and precipitation are recorded and transmitted monthly to the National Weather Service. Weather data was tabulated and correlated with Bear Creek stream flows (obtained at the USGS gage above Evergreen Lake) for the Program. Weather data collected during the program period was compared to the available historical weather records, obtained at the NWS High Plains Climate Center.

Gaging Station Stream Flows

A USGS stream gage (USGS 06710385) maintains a location above Evergreen Lake, near the CDOW fish survey site. The gage location is adjacent to the Denver Mountain Parks golf course and restaurant (Keys on the Green) parking lot. The second gaging station is located below the temperature datalogger location ID MORR10, above the town of Morrison, just west of the Highway 8 Bridge over Bear Creek. This station (BCMORCO 06710500) is maintained by the US Army Corps of Engineers and the Colorado Division of Water Resources. Weekly stream flow graphs were printed from both stations and filed for record. Monthly average daily flows from both gages exported to a spreadsheet for comparison with historical data.

There were 26 years of historical record available for the gage above Evergreen Lake (October 1984 through September 2011). For the gage located in Morrison, there were 91 years of historical USGS record available. Although flow records began at this location in 1899, the most complete data record exists from 1919 through 2007. For the USGS gage within Bear Creek Lake Park, there were 23 years of record. Historic records obtained from the USGS National Water Information system website.

Association Data Record

Data Management

Large quantities of varied data were collected during the Program: Monthly stream monitoring and sampling, laboratory results, thirty-minute temperature measurements from dataloggers, wastewater

treatment plant effluent process control and permit monitoring data (from five treatment plants), weather statistics and stream flows comprise raw data. All data are stored on an office computer, using Microsoft Office XP Professional software. The majority of the data resides in and analyses occurred in Excel spreadsheet format. Data nightly backed up to a server.

Depositories

The Association data is located at two different locations. Watershed data collected with the assistance of EMD staff is maintained on computer systems at the EMD offices. All raw watershed data electronically forwarded from EMD staff to the Manager for data summary and analyses. RNC Consulting LLC maintains all monitoring data for all Association monitoring programs. Data is kept on a computer with daily back-up to an external hard drive. Additionally, a back-up set of data is kept on data discs.

2011 Association Data

P1 monitoring program

The P1 monitoring program is contained in a spreadsheet titled *Bear Creek Reservoir 2011Master Spreadsheet*. The spreadsheet contains all data analyses. Copies of the spreadsheet distributed to Association membership, WQCD staff and interested parties in March 2012 after approval from the Association Board (Bear Creek Association March 2012).

P3 Monitoring Program

The P3 monitoring program is contained in a spreadsheet titled *Bear Creek Watershed Data Summary 2011*. This spreadsheet is too large to post on the Association Website and is only available from disc or Thumb-drive. The file contains the complete watershed field data, including QA/QC temperature data and field chemistry; along with Association data processing.

Special Data Reports of Historic Data

A specialized Temperature spreadsheet contains all temperature data from 1997-2011 for Bear Creek Reservoir and the Bear Creek and Turkey Creek monitoring sites (Bear Creek Association March 2012). Other summary spreadsheets include: A spreadsheet of available total inorganic nitrogen (TIN) data for P1 sites (2000-2009) and selected watershed sites in 2007; a summary spreadsheet of all high altitude data; and a summary spreadsheet of Bear Creek Reservoir aeration operations.

2011 Association Excel Spreadsheets and Technical Memorandums Posted to Website

1. Bear Creek Reservoir 2011 Master Spreadsheet (February 2011)
2. 2011 Watershed Data Report summary
3. Bear Creek Watershed Association Surface Water Monitoring Program Version 2011.01
4. 2011 macroinvertebrate spreadsheet (raw data WQCD)
5. Macroinvertebrate spreadsheet summary (all years)
6. 2011 Fishery Master and 2011 DOW Raw Fishery Data
7. 2011 flow Study Technical Memorandum
8. Coyote Gulch master spreadsheet and 2011 Summary report Technical Memorandum
9. Site master spreadsheet
10. Site Master Maps Series (Google Earth Maps)
11. 2011 Recreational Uses Technical Memorandum
12. 2011 Aeration Study Technical Memorandum
13. BCWA 2011 Kerr/Swede Summary Technical Memorandum
14. BCWA 2011 Bear Creek Reservoir Sediment Study Technical Memorandum
15. BCWA High Elevation Field Data Summary
16. High Quality Evergreen Lake data Summary

Electronic Transfers WQCD/ Depositories

1. Spreadsheet watershed QA/QC spreadsheet data only (WQCD - 4); depositories (2)

2. Spreadsheet watershed QA/QC spreadsheet with summary information and standard analyses (WQCD - 2); depositories (2)

3. Temperature record (WQCD - 2); depositories (2);

4. WQCC annual report, 2010 Data Report; (WQCD - 2), depositories (2)

P2 – 2011 Supplemental Sampling of Restoration Projects

Coyote Gulch

The Association samples Coyote Gulch at two-sites on a monthly basis (Figure 5). This paired sample design is characterizing the nutrient reduction (Total phosphorus and Nitrate-nitrogen) from an erosion restoration project. The Association also gathers field parameter data for temperature, pH, dissolved oxygen, and specific conductance. The Association monitors flow to make loading estimates. This restoration project is a potential Association trading project, which will be based on a 5-year post-construction data set. The Association produces a summary report in January of each year for the previous year's data (Technical Memorandum 2011.01 –Coyote Gulch 2011 Data Summary, BCWA). Table 5 shows summary loading data for pre-construction compared with post-construction restoration. The project has reduced the base-load of total phosphorus reaching Bear Creek Reservoir (Figure 6). Table 6 summaries the available trade pounds.

Figure 5 Coyote Gulch Sampling Points and Restoration Drop Structures

Table 5 Average and total pounds pre month at monitoring sites as base load

		Monthly Average Loading Pounds By Year			
		Reservoir		Above Project	
		Nitrate	T Phos	Nitrate	T Phos
Pre-construction	**2006-2007**	200.7	20.0		
Post-Construction	**2007-2008**	128.7	4.4	160.9	5.2
	2009*	142.0	6.7	185.9	8.9
	2010*	203.7	8.1	222.3	8.5

2011*	103.0	6.1	163.9	7.0
	Loading Pounds After Stable			
	Reservoir		**Above Project**	
	Nitrate	**T. Phos**	**Nitrate**	**T Phos**
Total Pounds	**7,383**	**518**	**9,025**	**579**
Average	**164**	**12**	**201**	**13**
Median	**88**	**5**	**137**	**6**
2009*/2010*/2011* average loadings per year excludes April storm loadings				

Table 6 **Annual Available Total Phosphorus Trade Pounds**

Total Phosphorus Trade Pounds				
	Total Base Flow		Trade Ration Pounds	
	Monthly	Annual	Monthly	Annual
Average	6.3	75.9	6.8	**81.8**
Median	6.4	76.5	6.8	**81.5**
Monthly TRP=PC Base Load-TBF Monthly Pounds/2				
The base trade ratio is 2:1 for Association Trade Projects				
Base Flows Exclude April Storm Loadings				
Annual Trade Pounds Available = 81.8 pounds Total Phosphors				

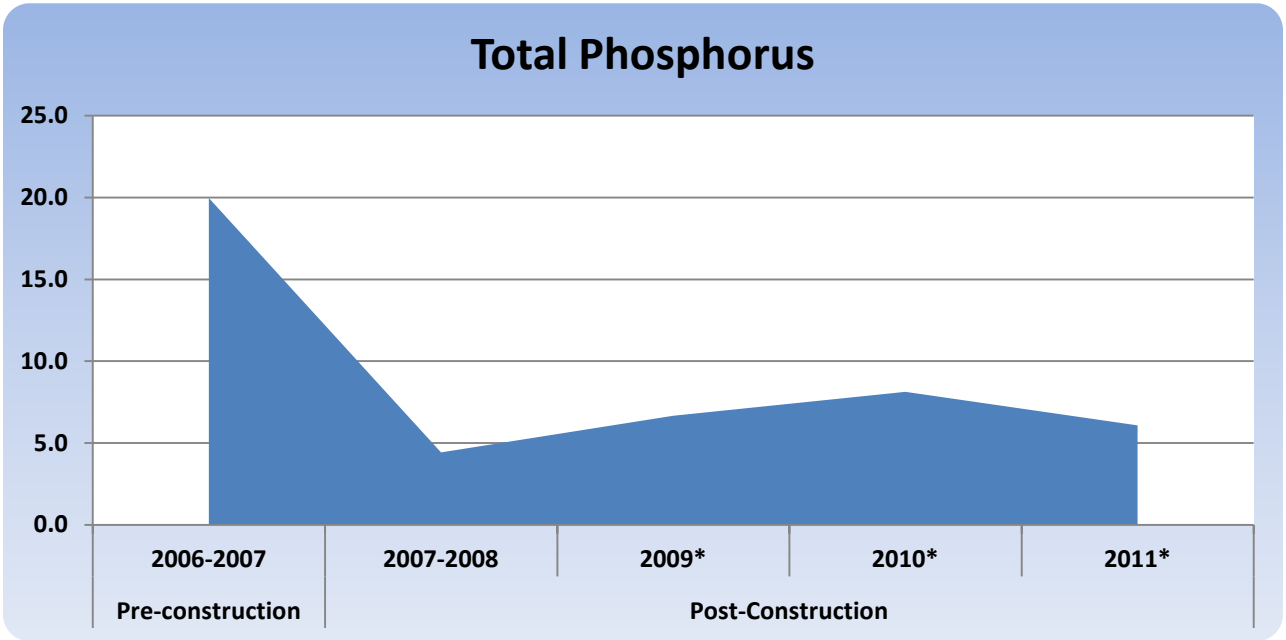

Figure 6 **Average Annual Pounds of Total Phosphorus Reaching Reservoir**

P4 – 2011 Supporting Watershed Study Efforts

Special Flow Study

A portable velocity meter spot checked estimated flows at CDOW fish survey sites (Table 7). The flow measurements match closely with the USGS measured flows at Keys on the Green and Morrison. The flow drop from Morrison Park to Bear Creek Park is due to diversion at the Harriman Ditch.

Table 7 2011 Bear Creek Watershed Stream Flow Data

Site ID	Site Location by Stream Segment	Flow cfs		
		7/18/2011	8/11/2011	9/8/2011
Segment 1a				
Site 1a	Above Lost and Found (Singin' River Ranch) complex	42.7	20.8	24.8
Site 3a	Above Evergreen Lake at CDOW Site	43	26	35
Segment 1e				
Site 5	Above EMD WWTP, at CDOW downtown site	67	26.5	40.1
Site 8a	Bear Creek Cabins at CDOW Site	47	30.3	45.7
Site 9	O'Fallon Park, west end at CDOW Site	42.2	29.7	36.9
Site 12	Lair o' the Bear Park, at CDOW site	54.5	23.6	41.2
Site 13a	Below Idledale, Shady Lane at CDOW site	63.6	34	49.1
Site 14a	Morrison Park west end of town, at CDOW Site	59.3	20.9	43.3
Segment 3				
Site 25	Vance Creek (Mt. Evans Wilderness drainage)	0.32	2.48	4.8
Segment 5				
Site 35	Cub Creek, Upstream @ Brookforest Inn	2.64	0.54	0.4
Site 50	Cub Creek, Upstream of Cub Creek Park	3.49	1.6	0.62
Site 26	Cub Creek Mouth	4.12	2.4	0.87
Segment 6a				
Site 18	South Turkey Creek Aspen Park Metropolitan District	0.21	0.1	0.03
Segment 6b				
Site 19	North Turkey Creek Flying J Ranch Bridge	1.5	0.6	0.72
Segments 7 and 8				
Site 37	Bear Creek, Mainstem from Lake 1/4 mile downstream (Segment 7)	2.9	3.2	4.5
Site 36	Summit Lake outfall (Mount Evans Wilderness) (Segment 8)	2.5	2.9	1.5
Site 38	Bear Creek at Bear Tracks, Bridge (Segment 7)	29.8	20.2	16.8

Macroinvertebrate Assessment

The macroinvertebrate integrity of Bear Creek is under assessment. Macroinvertebrate samples collected at the 8 CDOW fish survey sites along Bear Creek: Morrison (west end), Idledale, Lair o' the Bear Park, O' Fallon Park, Bear Creek Cabins, Main Street Evergreen (across from the Little Bear), above Evergreen Lake upstream of the USGS gaging station, and at Bear Tracks. Table 8 summarizes Macroinvertebrate data. The cooperative macroinvertebrate sampling was done by the Association on September 19, 2011 at the DOW fish survey locations with analyze done by the WQCD. Sample collection done by the state timed-kick net methodology protocol. Annual macroinvertebrate samples collected in the fall at fish survey sites with a target of a five-year data set. The processed species indexes will help establish expected conditions. The Association has a raw data file available on the web site.

Table 8 2011 Macroinvertebrate Summary

Macroinvertebrate September 19, 2011

StationID	WaterbodyName	Location	MMI_	O/E_p>half	TotalTax_
122	Bear Creek	above Morrison Park	74.5	1.099992	28
122a	Bear Creek	at Lair of the Bear Park	56.4	0.859761	31
122a	Bear Creek	at Lair of the Bear Park	50.3	0.859761	22
122b	Bear Creek	at O'Fallon Park	45.5	0.811097	22
122C	Bear Creek	at Baker Bridge (Idledale)	57.1	0.869389	22

Macroinvertebrate September 19, 2011

StationID	WaterbodyName	Location	MMI_	O/E_p>half	TotalTax_
5762	Bear Creek	below Evergreen	51.1	0.889943	32
5763	Bear Creek	at Little Bear	42.9	1.06665	26
5764	Bear Creek	at Key of the Green GC [moved u/s ~75 yds]	45.3	0.936533	31
5768B	Bear Creek	on the Bear Tracks trail in Mount Evans Wilderness	55.5	0.859957	21

CDOW Fish Survey Bear Creek

CDOW conducted their annual fish survey at eight locations September 2011 (Table 9). The survey included six historic sites and two additional sites. The added fishery survey sites were upstream of Evergreen Lake near Keys-on-the Green restaurant, and in the upper portion of the watershed at Bear Tracks.

There are complete fishery data surveys from five fish monitoring stations prior to 2005 (1991, 1994, 1999, 2002, 2003, 2004, and 2005). In 2005 and into future survey years there are seven to eight fish monitoring stations and CDOW will strive to monitor all fish survey sites each year to produce, at a minimum, a five-year complete record from 2005-2011. There are partial survey year records (2-4 fish monitoring sites) for 1988, 1989, 1990, 1987, 2000, and 2001). While these partial data years provide valuable information, caution must be used to extrapolate this data over the "Stream Reach". However, this data characterizes fishery behavior at specific locations in the "Stream Reach".

Table 9 2011 Fishery Data

Station	Standardized Average Width (ft)	Species	2011			
			No./Acre	lb/Acre	No./Acre >12cm	lb/Acre >12cm
Dedisse Park	**33**	Brown	1271	72	592	70
		Rainbow	57	7	18	4
		TOTAL	1328	79	610	74
Downtown Evergreen	**34**	Brown	488	130	470	130
		Rainbow	175	43	116	42
		TOTAL	663	173	586	172
Bear Creek Cabins	**32**	Brown	954	92	426	91
		Rainbow	146	26	102	26
		TOTAL	1100	118	528	117
O'Fallon Park	**31**	Brown	1990	176	762	168
		Rainbow	38	8	38	8
		TOTAL	2028	184	800	176
Lair O' the Bear	**29**	Brown	1367	175	787	173
		Rainbow	86	19	83	19
		TOTAL	1453	194	870	192
Idledale	**25**	Brown	1356	171	781	169
		Rainbow	66	24	62	24
		TOTAL	1422	195	843	193
Morrison	**30**	Brown	994	114	479	97
		Rainbow	125	10	34	8
		TOTAL	1119	124	513	105
			No./Acre	**lb/Acre**	**No./Acre >85 mm**	**lb/Acre >85 mm**
Bear Tracks	**15**	Brook Trout (Total)	470	36	291	33

Kerr/Swede Gulch Summary Data

Swede Gulch is listed on the 303(d) list as a low priority for E. coli. There is a discrepancy in the naming of the Swede/Kerr Gulch system. The United States Geological Survey maps used by the Division suggest that the mainstem is Swede Gulch. The Colorado Department of Transportation has maintained for decades an informational sign at the mouth of the gulch listing the gulch as Kerr Gulch. The locals also have identified the mainstem as Kerr Gulch with Swede Gulch as an upstream tributary. As such, the mainstem is Kerr/Swede Gulch with the western gulch upstream of the upper confluence as Kerr Gulch and the eastern tributary as Swede Gulch (Figure 7). The Division and Association agree this area maybe a good candidate to understand the impact of septic systems to the water quality in tributaries.

The Division and Association agree there is a water quality problem that requires further investigation. The Association commits to a 5-years monitoring program to evaluate E. coli on Kerr/Swede Gulch (confluence with Bear Creek, below confluence of Swede Gulch and just upstream of confluence on Kerr Gulch) and lower Swede Gulch. The Association will monitor E. coli at 4-sites (Figure 7) from January (provided winter flows) through December over a 5-year period. The Association will also collect data for temperature, pH, specific conductance and Dissolved Oxygen using the field probe.

Table 10 summarizes the 2011 data collected for Kerr/Swede Gulch study. Figure 8 shows the plotted E. coli results. Table 11 shows the geo-metric mean data. There is no exceedance of the E. coli standard within the system during 2011. The complete results of the study are shown in Technical memorandum 2011.02, BCWA March 6, 2012.

Segment 5 Bear Creek

Swede, Kerr, Sawmill, Troublesome, and Cold Springs Gulches, and mainstem of Cub Creek from the source to the confluence with Bear Creek.

Segment 5 Water Quality Standards

- Temperature =TVS(CS-II) ^{o}C; April-October =18.2 (MWAT)/23.8 (DM) ^{o}C; November-March =9.0 (MWAT)/13.0 (DM) ^{o}C
- D.O.=6.0 mg/l; D.O.(sp)=7.0 mg/l
- pH=6.5-9.0
- E. Coli=126/100ml (Measured as a geometric mean of data)

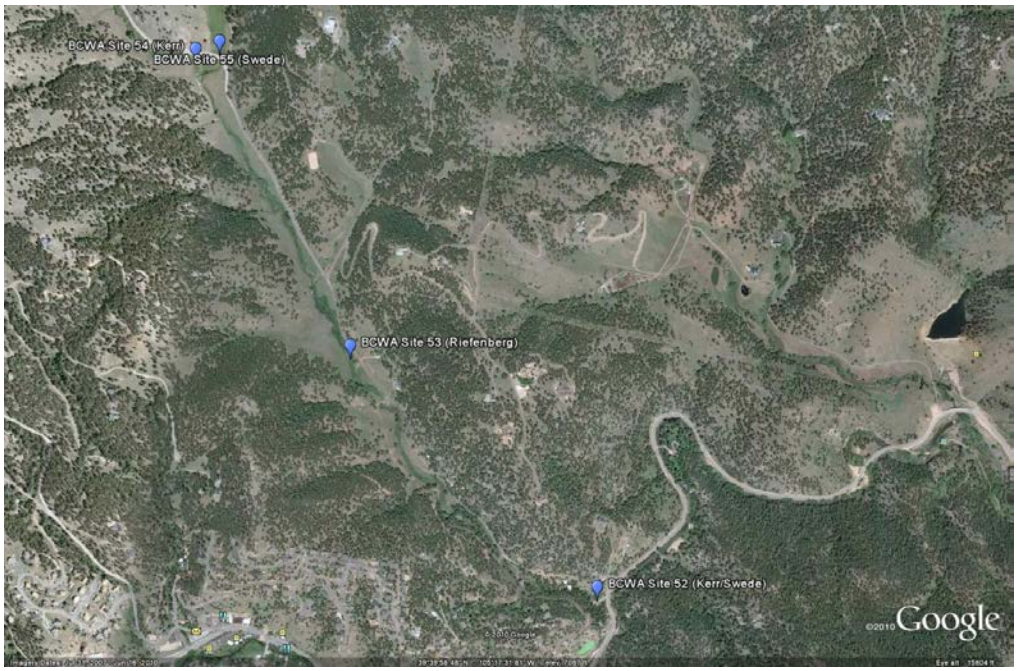

Figure 7 Kerr/Swede Gulch Sample Locations

Table 10 Kerr/Swede Gulch Sampling

BCWA Site	Time	Temp (C)	pH	SC (ms/cm)	DO (mg/l)	E. Coli (Cells/100ml)
1/25/2011						
Site 52 - Confluence	9:14	-0.1	8.39	0.767	10.47	6
Site 53 - Riefenberg	9:41	-0.1	7.94	0.773	9.63	4
Site 54 - Kerr	10:04	0	7.86	0.805	8.56	15
Site 55 - Swede	9:56	0.1	7.99	0.867	9.02	12
2/22/2011						
Site 52 - Confluence	9:45	-0.1	8.57	0.877	7.87	43
Site 53 - Riefenberg	10:05	0.0	7.92	0.885	10.25	25
Site 54 - Kerr	10:32	0.0	7.81	0.878	10.26	19
Site 55 - Swede	10:25	0.4	7.64	0.924	10.01	20
3/28/2011						
Site 52 - Confluence	12:00	4.1	7.85	0.789	6.91	1
Site 53 - Riefenberg	12:12	5.3	7.89	0.81	11.52	1
Site 54 - Kerr	12:28	5.7	7.97	0.81	11.37	7
Site 55 - Swede	12:22	4.9	7.66	0.88	11.28	1
4/27/2011						
Site 52 - Confluence	10:08	3.9	7.6	0.84	10.89	1
Site 53 - Riefenberg	10:22	4.9	7.72	0.83	10.91	1
Site 54 - Kerr	10:32	5.6	7.7	0.83	10.57	5
Site 55 - Swede	10:30	6.1	7.51	0.88	9.88	1
5/23/2011						
Site 52 - Confluence	12:20	9.3	8.63	0.79	8.83	19
Site 53 - Riefenberg	12:30	9.8	8.3	0.77	8.39	12
Site 54 - Kerr	12:50	9.5	8.23	0.176	7.11	26
Site 55 - Swede	12:42	9.7	8.05	0.75	8.14	1
6/16/2011						
Site 52 - Confluence	11:00	13.3	8.56	0.84	7.69	11
Site 53 - Riefenberg	11:10	14.7	8.5	0.84	7.26	13
Site 54 - Kerr	11:26	15.4	8.46	0.83	6.46	1
Site 55 - Swede	11:20	165	8.4	0.93	6.42	3
7/25/2011						
Site 52 - Confluence	12:59	18.3	8.5	0.84	7.31	10
Site 53 - Riefenberg	1:14	18.5	8.4	0.83	7.05	2
Site 54 - Kerr	1:32	19.1	8.28	0.87	6.36	2
Site 55 - Swede	1:27	21.4	8.27	0.85	6.14	2
8/23/2011						
Site 52 - Confluence	11:35	14.9	8.34	0.69	7.72	44
Site 53 - Riefenberg	11:48	15.5	8.3	0.7	6.93	15
Site 54 - Kerr	12:05	16.6	8.27	0.7	7.19	1
Site 55 - Swede	12:00	17.5	8.25	0.127	6.77	8
9/26/2011						
Site 52 - Confluence	1:05	11.8	8.22	0.83	8.2	20
Site 53 - Riefenberg	1:18	13.3	8.12	0.82	7.97	112
Site 54 - Kerr	1:34	15.7	8.13	0.78	6.53	4
Site 55 - Swede	1:30	13.6	8.09	0.491	7.47	4
10/25/2011						
Site 52 - Confluence	9:55	4.3	8.39	0.762	10.61	6
Site 53 - Riefenberg	10:10	5	8.65	0.777	10.05	1
Site 54 - Kerr	10:23	5.3	8.47	0.786	9.51	7
Site 55 - Swede	10:18	5.3	8.51	0.773	9.49	1

BCWA Site	Time	Temp (C)	pH	SC (ms/cm)	DO (mg/l)	E. Coli (Cells/100ml)
11/28/2011						
Site 52 - Confluence	12:12	2.2	8.43	0.832	12.08	1
Site 53 - Riefenberg	12:30	1.9	8.07	0.818	11.7	1
Site 54 - Kerr	12:49	0.1	7.99	0.803	11.62	7
Site 55 - Swede	12:44	2.3	7.97	0.836	11.17	6
12/28/2011						
Site 52 - Confluence	13:20	1.2	8.19	0.833	10.8	1
Site 53 - Riefenberg	13:35	0.7	8.1	0.82	10.98	1
Site 54 - Kerr	13:57	0	8.38	0.826	10.75	1
Site 55 - Swede	13:51	0.6	8.23	0.825	10.92	1

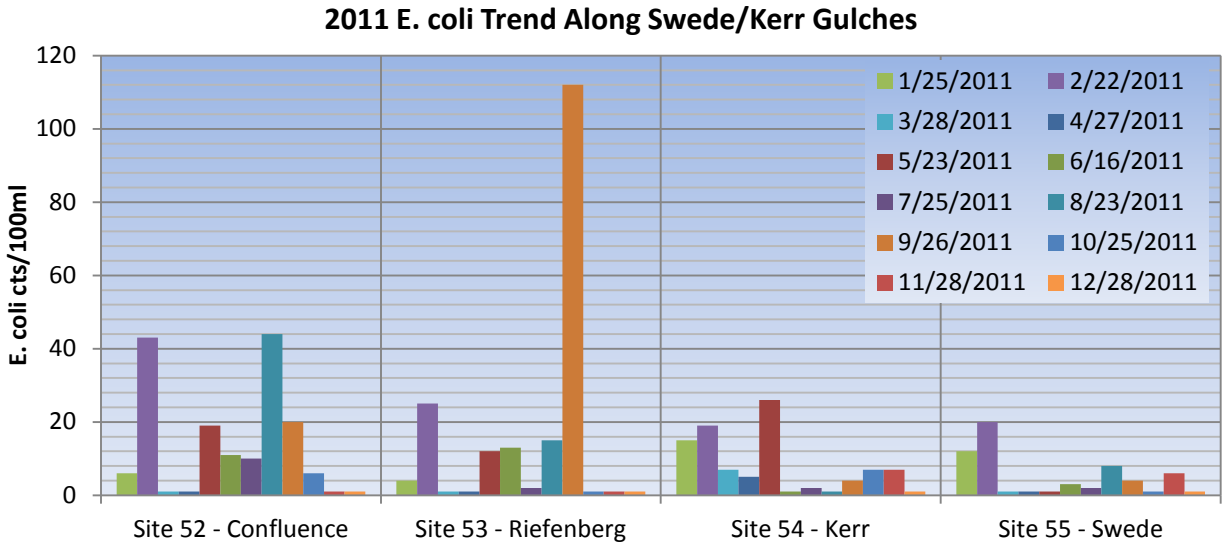

Figure 8 2011 E. coli Counts by Month

Table 11 E. coli Geometric Mean Summary

E. coli Summary, Geometric Mean									
BCWA Site	2010	2011							
	May-Dec	J-D (Annual)	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sep-Oct	Nov-Dec	May-Oct
	n=36	n=48	n=8	n=8	n=8	n=8	n=8	n=8	n=24/6
Sites 52-53			14	2	6	5	6	2	6
Site 52 - Confluence	10	6							15
Site 53 - Riefenberg	13	4							9
Site 54 - Kerr	16	5							3
Site 55 - Swede	11	3							2

Note -There is no exceedance of the E. coli standard with the system

2011 Bear Creek Park Recreational Uses

The Association collects limited data on recreational uses within Bear Creek Park during the monitoring events. Tables 12 predict recreational use estimates based on a 4-hour count. Figures 9 show major recreational uses predicted for typical week-days. Recreational uses in the Park increase dramatically on week-ends.

Table 12 Recreation Uses Based on Sample day Counts

Recreational Uses	Week-day - 1/2 Day estimates														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Jul	Aug	Aug	Sep	Sep	Oct	Nov	Dec
Archery	2	7	4	1	3	3	6	4	6	9	4	6	0	0	1
Walking/ Running	29	33	27	14	26	29	44	47	4	28	19	28	16	19	34
dogs, leash	8	6	5	2	2	6	3	3	0	4	6	3	2	0	1
dogs, no leash	3	2	8	1	4	4	2	9	1	5	2	2	3	1	6
Bicycle	6	11	31	9	57	69	31	47	6	58	50	44	51	8	22
Horseback Riding	1	3	1	1	1	21	9	12	19	15	3	20	0	0	0
Stable Horses	0	0	0	16	32	26	26	26	13	15	16	14	0	0	0
Total Horses	1	3	1	17	33	47	35	38	32	30	19	34	0	0	0
Fishing	23	17	42	26	37	60	19	27	6	22	28	26	29	24	15
Boats BCR	0	0	2	2	3	7	12	13	4	9	2	5	4	0	0
Camping	0	0	0	0	16	30	27	26	16	15	22	14	5	0	0
Beach	0	0	0	0	4	50	100	110	135	125	2	1	0	0	0
Canoe/Sailboard (Soda)	0	0	0	0	1	4	3	6	5	9	2	1	0	0	0
Ski School training	0	0	0	0	0	1	2	3	4	6	2	0	0	0	0

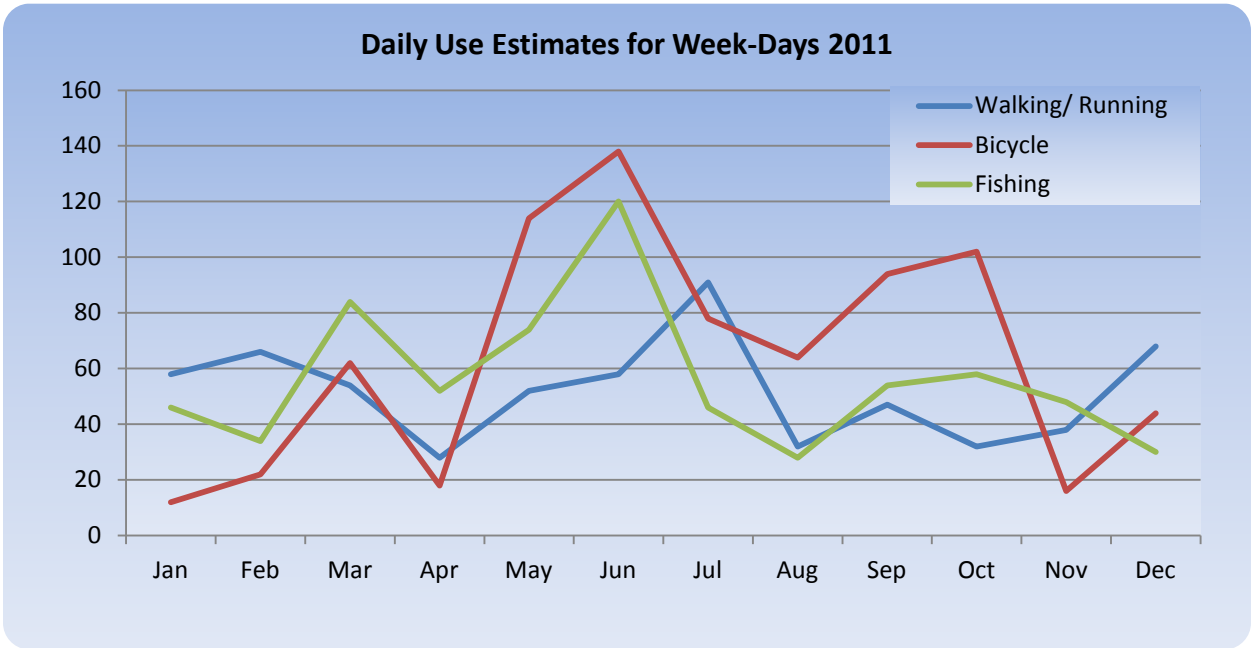

Figure 9 Major recreational uses by Month

Bear Creek Reservoir Sediment Study

The Bear Creek reservoir special sediment study is summarized in technical memorandum 2011.07, BCWA October 11, 2011. Table 13 summarizes the total phosphorus data.

Table 13 2010 and 2011 Total Phosphorus Results

Transect	Sample	2011 mgP/kg Mud	2010 mgP/kg Mud
Bear Creek Transect	SedBC01	2.42	2.64
	SedBC02	4.37	6.43
	SedBC03	6.11	4.12
	SedBC04	2.75	5.32

Transect	Sample	2011 mgP/kg Mud	2010 mgP/kg Mud
	SedBC05	5.21	3.50
	SedBC06	1.08	4.09
Pelican Point Transect	SedPel07	4.14	5.39
	SedPel08	3.39	7.47
	SedPel09	11.50	6.25
	SedPel10	2.20	3.13
	SedPel11	6.86	7.71
Turkey Creek Transect	SedTC12	0.52	2.69
	SedTC13	3.22	1.74
	SedTC14	8.11	7.32
	SedTC15	8.15	6.99
	SedTC16	1.91	5.76
	SedTC17	3.18	8.16
	Average	4.42	5.22
	Stan dev	2.91	2.02
	t-test	0.12	

P3-Summary Bear Creek Watershed 2011 Monitoring Data

Overview

Sampling and Monitoring Program Notes

Data organization reflects the Colorado Water Quality Control Division's segmentation and water quality standards to waterbodies in the Bear Creek Watershed per Regulation 38. Sampling and monitoring data is presented for the calendar year, compared to applicable water quality standards. Site numbers identify exact locations, but are grouped into respective segments, with segment summary tables at the beginning of a segment group. All data collected is presented in table form, with summary analyses.

Temperature data loggers that were in stream segments since January 1, 2011 were replaced with other loggers that had already returned from the manufacture after being recalibrated and recertified in early February ready to begin collecting data at 30-min intervals. The additional loggers were sent to the manufacturer for annual recalibration and recertification. The loggers were returned to sites and programmed to begin data collection at 30-minute intervals on the days that they were placed at the sites. All loggers were removed and data downloaded after September 30. WWTP loggers and selected stream loggers were repositioned at their sites and data collection resumed.

Stream and lake sampling and monitoring data, including pH, Temperature, Dissolved Oxygen, Specific Conductance, Ammonia, Nitrate+Nitrite, Total Inorganic Nitrogen (calculated), Total Nitrogen, Dissolved Phosphorus, Total Phosphorous, and Total Suspended Solids were collected from July through September, at 26 sites. Stream and lake temperature data loggers were used at 33 sites, including the Evergreen Lake profile station, the Genesee reservoir profile station, and the Bear Creek Reservoir profile station, excluding the five WWTPs. Eight selected Sites collected data logger temperatures from January 1 through November 17. The twenty-five remaining sites collected temperature data from April through September and May through October. Manual flows were measured at 20 sites in the watershed during the July to September timeframe.

Temperature Compliance

The Cold- and Warm-season timeframe was redefined by the adoption Regulation 38, which assigned calendar dates by Segment for cold-season and warm season regarding water quality standards for temperature. For this reporting format, the Cold-season program is defined as approximately November to March, depending on specific stream segments. Regarding temperature data loggers, Cold-season locations included sites in all segments excluding segment 1c, 1d, segment 5, and segment 10, situated from above

Evergreen Lake to below the outfall of Bear Creek Lake in the Bear Creek Watershed. Segment 1a (Sites 1a, 2, 3a), Segment 1b (Site 15a), Segment 1e (Sites 5, 8a, 9, 12, 13a,), Segment 2 (Site 45), Segment 3 (Site 25), Segment 6a (Site 16a), and Segment 16b (Site 19) comprise the Cold-season locations for temperature data loggers. It is worth mentioning that many of these sites only recorded data during the shoulder season the month before the warm season began. The program began in early November 2010 and ended in December of 2011. The data presented in this report reflects the temperature measurements collected from January 1 through December 31, 2011. (This change represents the revision of reporting data collected in a calendar year broken into cold and warm seasons).

The Warm-season program locations included twenty-nine sites in Bear Creek Segments 1a, 1b, 1c, 1d, 1e, 2, 3, 5, 7 and 10 (including four total at the Evergreen Lake profile station, four total at the Genesee Reservoir profile station, and 4 total at the Bear Creek Reservoir profile station), and three sites in Turkey Creek Segments 6a and 6b, for a total of thirty-two. Additionally, the five major wastewater treatment plants discharging into Segment 1e (EMD, WJCMD, KSWD, GWSD) and 1b (Morrison) were monitored. The 2011 Warm-season program for temperature data collection began on April 1, May 1, and June 1, and concluded on September 30 and October 31 depending on the segment.

Temperature compliance, as compared to water quality standards, is presented by segment, roughly progressing from the upper reaches of the watershed to lower (Table 14, compliance summary; Table 15 number of measurements). Some sites only have temperature data collection during the Warm-season, while other sites have data loggers almost throughout the year.

391,490 individual temperature data points were obtained from the thirty-three data logger sites within the watershed. The evaluating criteria used to determine potential impairment of stream temperature is detailed in the tables below, specific to segment. There were 1121 weekly averages calculated for the program period. 97,841 two-hour blocks were averaged and 8,082 Daily Maximum values were calculated. 86,980 individual temperature data points were obtained from the five data loggers located in the WWTP effluents that discharge into Bear Creek Segments 1e and 1b. Recognizing that only site 24, Morrison WWTP has temperature permit limits, a data summary consisting of number of measurements and calculations, Weekly Average and Daily Average temperatures are presented.

Table 14 Bear Creek Watershed 2011 Temperature Compliance by Segment

	Cold-season		Warm Season	
Segment 3	**9°C WAT**	**13°C DM**	**17°C WAT**	**21.2°C DM**
# Exceedances	0	12	0	0
% Compliance	100%	87.37%	100%	100%
Segment 1a	**9°C WAT**	**13°C DM**	**17°C WAT**	**21.2°C DM**
# Exceedances	2	13	0	1
% Compliance	95.00%	95.71%	100%	99.75%
Segment 1d	**9.0°C WAT**	**13.0°C DM**	**18.2°C WAT**	**23.8°C DM**
# Exceedances	N/A	N/A	6	0
% Compliance	N/A	N/A	95.00%	100%
Segment 1e	**9°C WAT**	**13°C DM**	**19.3°C WAT**	**23.8°C DM**
# Exceedances	0	0	0	0
% Compliance	100%	100%	100%	100%
Segment 1b	**9°C WAT**	**13°C DM**	**19.3°C WAT**	**23.8°C DM**
# Exceedances	0	0	4	1
% Compliance	100%	100%	95.40%	99.84%
Segment 5	**9°C WAT**	**13°C DM**	**18.2°C WAT**	**23.8°C DM**
# Exceedances	0	0	0	0
% Compliance	100%	100%	100%	100%
Segment 6a	**9°C WAT**	**13°C DM**	**18.2°C WAT**	**23.8°C DM**
# Exceedances	0	0	0	0

% Compliance	100%	100%	100%	100%
Segment 6b	**9°C WAT**	**13°C DM**	**17°C WAT**	**21.2°C DM**
# Exceedances	0	12	0	5
% Compliance	100%	87.37%	100%	95.90%
Segment 10	**9°C WAT**	**13°C DM**	**17°C WAT**	**21.2°C DM**
# Exceedances	N/A	N/A	42	37
% Compliance	N/A	N/A	67.19%	95.98%
Segment 7	**9°C WAT**	**13°C DM**	**17°C WAT**	**21.2°C DM**
# Exceedances	0	0	0	0
% Compliance	100%	100%	100%	100%
Segment 2	**13.7°C WAT**	**14.3°C DM**	**27.5°C WAT**	**28.6°C DM**
# Exceedances	0	0	0	0
% Compliance	100%	100%	100%	100%
Segment 1c	**9°C WAT**	**13°C DM**	**24.0°C WAT**	**26.0°C DM**
# Exceedances	N/A	N/A	3	27
% Compliance	N/A	N/A	97.92%	97.37%

NA-Indicates no logger data obtained.

Table 15 Number of Temperature Measurements

2011 Total Number of Measurements (Off- and Growing seasons)				
	# 30-min. Temps.	**# Calculated WAT**	**# 2-Hr. Avgs. For DM calculation**	**# Calculated DM**
Segment 3	10441	29	2610	217
Segment 1a	34044	97	8496	708
Segment 1d	40824	120	10204	848
Segment 1e	76707	211	19172	1540
Segment 1b	42088	123	10519	874
Segment 1c	49520	144	12376	1028
Segment 2	16335	51	4083	340
Segment 7	7174	20	1793	149
Segment 5	33057	95	8264	687
Segment 6a	26608	74	6651	554
Segment 6b	10436	29	2609	217
Segment 10	44256	128	11064	920
Watershed totals	**391490**	**1121**	**97841**	**8082**

Segment 8 (Site 36) and Segment 7 (Sites 37 and 38)

- 100% of Cold and Warm season temperatures limits complied with stream standards in segment 7. No temperature loggers were placed in segment 8.

Segment 3 (Site 25)

- All cold and warm season temperatures complied with the standards except for the cold season DM which complied 87.37% of the time. All exceedances occurred during the shoulder period.

Segment 1a (Sites 1a, 2, 3a)

- 95% of the recorded temperature values complied with the 9°C Weekly Average Temperature (WAT) standard Oct 1 through May 31.
- 95.77% of the recorded temperature values complied with the 13°C Daily Maximum (DM) Temperature standard for Oct 1 through May 31.
- 100% of the recorded temperature values complied with the 17.0°C Weekly Average Temperature (WAT) standard June 1 through September 30.

- 99.75% of the recorded temperature values complied with the 21.2°C Daily Maximum (DM) temperature standard for June 1 through September 30.

Segment 1d (Sites 4b, 4c and 4d)

- 95% of the recorded temperature values complied with the 18.2°C Weekly Average Temperature (WAT) standards for CLL designation.
- 100% of the recorded temperature values complied with the 23.8°C Daily Maximum (DM) Temperature standards for CLL designation.

Segment 1e (Sites 5, 7, 8a, 9, 12, and 13a)

- All cold season temperatures complied with the standards.
- All Warm season temperatures complied with the stream standards.
- Site 14a temperature logger malfunctioned and therefore the data was not useable for the 2011 reporting process.

Segment 1b (Sites 15a and 27b)

- 80% of the recorded temperature values complied with the 9.0°C Weekly Average Temperature (WAT) for the cold season.
- 98.96% of the recorded temperature values complied with the 13.0°C Daily Maximum (DM) temperature standards for the cold season.
- 95% of the temperatures complied with the 19.3°C Weekly Average Temperature (WAT) for the warm season.
- 99.84% of the temperatures complied for the 23.8°C Daily Maximum (DM) temperature standard for the warm season.

Segment 5 (Sites 26, 35 and 50)

- All cold and warm season temperatures complied with the standards.

Segment 6a (Sites 16a and 18)

- All cold and warm season temperatures complied with the standards.

Segment 6b (Site 19)

- 87.37% of the temperatures complied with the cold season DM standard.
- 96% of the temperatures complied with the warm season DM standard.
- All other temperatures complied with all other standards.

Segment 10 (Sites 39a, 39b, 39c, and 39d)

- 67% of the temperatures complied with the warm season WAT standard.
- 96% of the temperatures complied with the warm season DM standard.

Wastewater treatment plant effluents

While Morrison WWTP is the only treatment plant with a temperature limit in there permit, all five wastewater treatment plants, datalogger measurements have been analyzed and summarized in Tables 16 and 17 using the representative segment standard that the wastewater treatment facility discharges into.

Table 16 WWTP Number of Temperature Measurements 2011

	# 30-min. measurements	# Calculated WAT	# Daily Max
EMD WWTP	17418	50	362
WJCMD WWTP	17422	50	362
KSWD WWTP	17418	50	363
GWSD WWTP	17419	49	363
Morrison WWTP	17303	49	359
Totals (Jan 1-Dec. 31)	**86980**	**248**	**1809**

Table 17 WWTP Logger summary 2011

	Cold-season		Growing Season	
Segment 1e	**9°C WAT**	**13°C DM**	**19.3°C WAT**	**23.8°C DM**
# Exceedances	45	79	13	0
% Compliance	43.75%	86.92%	89.08%	100%
Segment 1b	**9°C WAT**	**13°C DM**	**19.3°C WAT**	**23.8°C DM**
# Exceedances	11	4	8	0
% Compliance	45.00%	97.30%	72.41%	100%

Water Quality Compliance

Water quality compliance was determined by sampling and monitoring selected sites during the Growing season timeframe (Table 18). pH, Dissolved Oxygen, Ammonia and Nitrate measurements were compared to water quality standards to determine compliance. During the September 9, 2011 sampling and monitoring session on Evergreen Lake a dissolved oxygen exceedance was calculated taking the average dissolved oxygen of the top 2-meters. This resulted in a 91.66% compliance for dissolved oxygen as it pertains to the stream and lake standards. Similarly the sampling and monitoring sessions on July 18, 2011 and September 8, 2011 showed exceedances on Genesee Reservoir for dissolved oxygen, corresponding to a 83.33% compliance. Dissolved oxygen exceedances also occurred in segment 6a on the July 18, 2011 and August 11, 2011 sampling and monitoring dates resulting in a 33.33% compliance. Other water quality exceedances that occurred in the 2011 sampling and monitoring program were pH related in segment 8 on July 17, 2011, resulting in a 66.66% compliance and Segment 7 at site 38b on July 17, 2011, resulting in an 83.33% compliance.

Table 18 Bear Creek Watershed 2011 Water Quality Compliance by Segment

	Stream Std. pH (6.5-9 SU)	Stream Std. DO (6.0 mg/L 2-meter avg.)	Stream Std. NH3-N ug/L (TVS)	Stream Std. NO3-N (10,000ug/L)*
Segment 8				
# Exceedances	1	0		0
# Measurements	3	3	3	3
% Compliance	66.66%	100%		100%
Segment 7				
# Exceedances	1	0		0
# Measurements	6	6	6	6
% Compliance	83.33%	100%		100%
Segment 3				
# Exceedances	0	0		0
# Measurements	3	3	3	3
% Compliance	100%	100%		100%
Segment 1a				
# Exceedances	0	0		0
# Measurements	6	6	6	6
% Compliance	100%	100%		100%
Segment 1d				
# Exceedances	0	1		0
# Measurements	30	12	6	6
% Compliance	100%	91.66%		100%
Segment 1e				
# Exceedances	0	0		0
# Measurements	18	18	18	18
% Compliance	100%	100%		100%
Segment 1b	No Sites in Segment 1b were sampled or monitored			
Segment 5				

	Stream Std. pH (6.5-9 SU)	Stream Std. DO (6.0 mg/L 2-meter avg.)	Stream Std. NH3-N ug/L (TVS)	Stream Std. NO3-N (10,000ug/L)*
# Exceedances	0	0		0
# Measurements	6	6	6	6
% Compliance	100%	100%		100%
Segment 6a				
# Exceedances	0	2		0
# Measurements	3	3	3	3
% Compliance	100%	33.33%		100%
Segment 6b				
# Exceedances	0	0		0
# Measurements	3	3	3	3
% Compliance	100%	100%		100%
Segment 10				
# Exceedances	0	2		0
# Measurements	22	12	6	6
% Compliance	100%	83.33%		100%

*- Samples were analyzed for NO3+NO2-N but compared to the Nitrate water quality standard of 10 mg/L.

Segment 8 (Site 36)

- 66.66% of the measured pH complied with water quality standards and 100% DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 7 (Sites 37 and 38)

- **Site 37:** 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.
- **Site 38:** 66.66% of the measured pH complied to the water quality standards and, 100% DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 3 (Site 25)

- 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 1a (Sites 1a and 3a)

- **(Sites 1a and 3a)** 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 1d (Sites 4a, 4b, 4c, 4d and 4e)

- 100% of the measured pH values and 93.33% of the calculated DO values from the profile station complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 1e (Sites 5, 7, 8a, 9, 12, 13a and 14a)

- **All Sites:** 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 1b (Sites 15a, 27a and 27b)

- None of these three sites were sampled or monitored.

Segment 5 (Site 35)

- 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 6a (Site 18)

- 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 6b (Site 19)

- 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 10 (Site 39a, 39b, 39c, 39d)

- 83.33% of the measured DO values complied with the adopted water quality standards and, 100% of the pH values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Summary

Temperature Compliance

Segments 1a, 1b, 1c, 1d, 1e, 2, 3, 5, 7, 10, and Turkey Creek Segments 6a and 6b showed little impairment during both the Cold- and Warm Seasons. Comparisons with adopted temperature standards resulted in 93.93% compliance for the WAT and 98.61% compliance for the DM calculated for the calendar year throughout the Watershed, utilizing the 85th%-tile qualifier. Comparisons with adopted temperature standards for the Warm season resulted in 94.82% compliance for the calculated WAT and 99.06% compliance for the calculated DM. A comparison with the adopted temperature standards for the cold season resulted in 95.77% compliance for the calculated WAT and 98.22% compliance for the calculated DM, the monitored locations of the Watershed, utilizing the 85th%-tile qualifier. A comprehensive temperature data collection effort spanning January through December, summarized in 391,490 30-minute measurements at thirty-two in-stream/lake Sites throughout the Watershed, excluding the WWTP facilities, provided the data for analyses.

The evaluation of the entirety of temperature datalogger measurements recorded during the calendar year at thirty-two sites in the Watershed from Mt. Evans Wilderness to just below Bear Creek Lake in Morrison and Turkey Creek do not indicate that a problem exists, either man-induced or natural, when compared to water quality standards. Compliance exceedance issues occurred in segments 1a (cold and warm season), 1b (cold and warm season), 1d (warm season), 3(cold season), 6b (cold and warm season), and 10(warm season).

Wastewater plant discharges into Bear Creek did not cause temperature impairment. A comprehensive temperature data collection effort from January through December, summarized in 86,980 30-minute measurements in five wastewater treatment plant effluents that discharge into Bear Creek Segment 1e and 1b, showed no evidence of thermal pollution. Although only one of the five WWTPs that discharge into Segments 1e and 1b have temperature limits, the resulted data collected and presented do not indicate evidence of impairment due to temperature.

Water Quality Compliance

Segments 3, 1a, 1d, 1e, 1b, 5 and Turkey Creek Segments 6a and 6b showed little water quality impairment. A total of three monthly sampling and monitoring events occurred from July through September at twenty-six Sites throughout the watershed. 65 measurements of pH and 62 measurements of DO were performed at these Sites. 98% compliance for pH and 93% compliance for Dissolved Oxygen were achieved. 52 samples were analyzed for Total Ammonia and 53 samples were analyzed for Nitrate+Nitrite. Sampling results show 100% compliance with Total Ammonia, TVS and 100% compliance with Nitrate water quality standards. (Stream samples were analyzed for Nitrate+Nitrite, but compared to Nitrate water quality standards.) There are no stream standards for Total Phosphorous; however 53 samples were analyzed for Total Phosphorous.

Wastewater plant discharges into Bear Creek result in no evidence of water quality impairment. 100% of the wastewater plant effluent pH and 100% of effluent Ammonia values met permit limits, while 100% Total Phosphorous met permit effluent limits as well. Five of the five wastewater treatment plants met discharge limits stated in their Colorado Discharge Pollutant Elimination System (CDPES) permit for pH, Total Phosphorous and Total Ammonia during 2011. There were no permit violations reported for any of the parameters from 5 wastewater treatment plants in 2011. Wastewater treatment plant effluents had no detrimental effect on the water quality of Segment 1e and 1b. There were no observed impairment issues or temperature issues in the Watershed due to wastewater plant effluents during the Program.

Bear Creek stream flows were lower than historic averages from May through September. Bear Creek stream flows tracked during May through September, on daily average at the gage above Evergreen Lake, were somewhat to significantly lower than the historic daily average in May through September. The stream gage above Morrison followed the Evergreen gage values. The stream flows remained well below to slightly below monthly historic averages. Only 4 days in July and 3 days in August exceeded historic average flows. A surprising factor in the 2011 Program was the lack of snow pack to aid in the runoff and the wetter than average summer in terms of inches of rainfall in July.

Weather and climate in the May through September timeframe were approximately average to below average as compared to historic averages. Measurably more precipitation was noticed verses historic averages in May and July, but decreased slightly in June and August, and was right around average in September. Due to the monthly average maximum temperatures being slightly higher to the historic averages in June, July, and August and the low precipitation amounts in June, and September may have been a contributing factor in some of the Daily Maximum and MWAT exceedances that we noticed this warm season.

The Average Monthly Mean temperatures were approximately equal to historical data for May through September. The Average Monthly Maximum temperatures were approximately equal to historical averages for May through September. However, the Average Daily Minimum temperatures were slightly higher or equal to historical averages in all months. The Average Monthly Maximum temperatures were the highest in June and September, which coincided with the lower precipitation levels in these months. The Average Monthly temperatures were unremarkable. It is worth noting that even during and after significant precipitation events, higher stream flows were not noticed.

Weather records and stream gage readings closest to Segment 1a indicate that significantly higher Average Daily Minimum temperatures and significantly lower stream flows were most likely the major contributing factors to the WAT and DM exceedances throughout the warm season.

Watershed Monitoring

WWTP Effluent Temperature and Water Quality

The Process Control and permit sampling and monitoring summaries in the tables below are annual summaries, from January through December. Datalogger temperature measurements of plant effluent were obtained at the identical frequency of the in-stream dataloggers (30-minute intervals) during a study period of January 1 through December 31, broken into a cold and warm season per the listing requirements. The tables are listed in a downstream direction, as the effluents enter Bear Creek, from the EMD WWTP to the Morrison WWTP. Test results for Ammonia, Nitrate, Nitrite and Phosphorous are provided by the wastewater treatment plant laboratories for EMD, WJCMD, KSWD and GWSD and are represented in ug/L. TIN was determined as the sum of Ammonia, Nitrate and Nitrite. Averaged pH values are for statistical analyses only. The town of Morrison utilizes a contract laboratory for analyses.

Table 19 Evergreen Metropolitan District (Site 20)

EMD WWTP Effluent Summary 2011									
2011 Process Control and Permit Sampling and Monitoring									
Parameter	pH, SU	Temp, °C	D. O., mg/L	Total NH3-N, ug/L	NO3-N, ug/L	NO2-N, ug/L	TIN, ug/L	Total P, ug/L	Flow, MGD
Min	6.55	7.00	2.89	15.1	2200	6	2557.8	10	0.16
Max	7.35	20.80	6.60	8300	11200	30	11206	800	0.72
Avg	6.72	12.90	4.50	108	3965	13.5	4203.7	100	0.45
Std. Dev.	6.76	13.69	4.67	856.57	4660.83	17.33	4860.49	135.46	0.46
Measurements	0.16	4.31	0.69	1759.61	2460.78	9.02	2382.35	152.74	0.06
Exceedances	0			0				0	

Effluent Datalogger Temperature Summary: Cold Season/Warm Season 2011						
All Temperatures in °C	30-Min Temp. COLD/WARM		Daily Avg. Temp. COLD/WARM		Weekly Avg. Temp. COLD/WARM	
Min	6.9	9.7	7.0	9.8	7.3	9.7
Max	15.0	20.8	14.8	20.6	14.2	20.7
Avg	9.6	16.3	9.6	16.3	9.6	16.3
Std. Dev.	9.1	17.2	9.1	17.3	8.8	17.3
Measurements	1.9	3.3	1.9	3.3	2.0	3.3

[Datalogger ID: EMD5 GPS Coordinates: 39.6376°N, 105.3150°W; Sampling/monitoring site is the EMD WWTP effluent. The datalogger in the UV channel just upstream of the outfall. Effluent flows directly from the UV building to Bear Creek.] Notes: Discharge permit limits for Total Ammonia (NH3-N), in ug/L are as follows: Jan.-10,100, Feb.-6500, Mar.-6400, Apr.-5300, May-5800 June-8200 July-8000 Aug.-6400 Sept.-5200; Oct.-4200; Nov.-5900; Dec.-4700; pH 6.5-9.0

Table 20 West Jefferson County Metropolitan District (Site 21)

WJCMD WWTP Effluent Summary 2011									
2011 Process Control and Permit Sampling and Monitoring									
Parameter	pH, SU	Temp, °C	D. O., mg/L	Total NH3-N, ug/L	NO3-N, ug/L	NO2-N, ug/L	TIN, ug/L	Total P, ug/L	Flow, MGD
Min	6.50	8.90	0.78	20.1	8	10	412.6	20	0.30
Max	7.18	19.20	5.10	5130	1700	1860	5291	550	0.62
Avg	6.74	13.69	3.12	549.65	181.75	586.50	1305.72	153.92	0.44
Std. Dev.	0.12	3.29	0.42	1019.79	465.59	534.21	1292.63	93.93	0.06
Measurements	260	244	245	52	12	12	12	52	365
Exceedances	0			0				0	

Effluent Datalogger Temperature Summary Cold/Warm Seasons 2011			
All Temperatures in °C	30-Min Temp. COLD/WARM	Daily Avg.Temp. COLD/WARM	Weekly Avg. Temp. COLD/WARM

Min	0.72	5.1	8.07	10.2	8.43	10.4
Max	14.82	19.6	14.67	19.2	14.13	19.1
Avg	10.43	15.5	10.43	15.5	10.45	15.5
Std. Dev.	1.77	2.8	1.65	2.8	1.69	2.8
Measurements	7247	10175	151	211	20	30

[Datalogger ID: WJ6 GPS Coordinates: 39.6621°N, 105.3351°W; Sampling/monitoring site is the WJCMD WWTP effluent. The datalogger was located in the end of the abandoned chlorine contact chamber. (Disinfection currently occurs by UV radiation.) The effluent flows into a ditch and joins Troublesome Gulch just outside the plant boundary. Troublesome Gulch flows to Kittredge and combines with Bear Creek at the west end of Kittredge.] Notes: Discharge permit limits for Total Ammonia (NH3-N), in ug/L are as follows: Jan.-13,300, Feb.-9,000, Mar.-13,000, Apr.-8,000, May-10,000 June-12,600 July-13,000 Aug.-10,700 Sept.-8,400; Oct.-6,500; Nov.-8,500; Dec.-6,300; pH 6.5-9.0

Table 21 Kittredge Sanitation and Water District (Site 22)

KSWD WWTP Effluent Summary 2011									
2011 Process Control and Permit Sampling and Monitoring									
Parameter	pH, SU	Temp, °C	D. O., mg/L	Total NH3-N, ug/L	NO3-N, ug/L	NO2-N, ug/L	TIN, ug/L	Total P, ug/L	Flow, MGD
Min	6.62	2.20	0.56	105	600	65	2669	50	0.03
Max	8.24	20.10	8.53	3880	8760	325	10616	430	0.10
Avg	6.86	11.39	3.75	1501.92	218.21	182.83	6430.58	218.21	0.05
Std. Dev.	0.14	5.49	2.17	922.72	95.43	69.10	2258.52	95.43	0.01
Measurements	247	201	201	51	28	12	12	28	365
Exceedances	0			0				0	

Effluent Datalogger Temperature Summary Cold/Warm Seasons 2011						
All Temperatures in °C	30-Min Temp. COLD/WARM		Daily Avg.Temp. COLD/WARM		Weekly Avg. Temp. COLD /WARM	
Min	1.89	8.1	2.09	8.5	2.45	10.5
Max	11.01	19.8	10.87	19.3	10.50	19.2
Avg	5.10	14.8	5.10	14.8	4.94	15.0
Std. Dev.	2.34	3.0	2.32	3.0	2.00	2.8
Measurements	7244	10174	151	212	20	30

[Datalogger ID: KSWD8 GPS Coordinates: 39.6585°N, 105.2868°W; Sampling/monitoring site is the KSWD WWTP effluent. The datalogger was located near the flow-measuring flume, just upstream of the outfall. Effluent flows from the datalogger location under Highway 74 to the outfall in Bear Creek.] Notes: Discharge permit limits for Total Ammonia (NH3-N), in ug/L are as follows: Jan.-10,100, Feb.-4,500, Mar.-5,300, Apr. 3,600, May-5,500 June-5,200 July-7,700 Aug.-5,500 Sept.-3,300; Oct.-2,600; Nov.-5,900; Dec.-4,700; pH 6.5-9.0

Table 22 Genesee Water and Sanitation District (Site 23)

GWSD WWTP Effluent Summary 2011									
2011 Process Control and Permit Sampling and Monitoring									
Parameter	pH, SU	Temp, °C	D. O., mg/L	Total NH3-N, ug/L	NO3-N, ug/L	NO2-N, ug/L	TIN, ug/L	Total P, ug/L	Flow, MGD
Min	6.61	7.00	3.10	38	130	2100	180	120	0.13
Max	7.50	20.00	11.20	2736	4800	3300	6500	890	0.38
Avg	7.04	14.38	8.47	243.21	2319.42	2712.50	3063.82	376.92	0.26
Std. Dev.	0.17	3.31	1.22	393.35	1044.03	491.01	1379.92	173.13	0.02
Measurements	364	364	364	52	52	8	52	52	365
Exceedances	0			0				0	
Effluent Datalogger Temperature Summary COLD/WARM Seasons 2011									

All Temperatures in °C	30-Min Temp. COLD/WARM		Daily Avg.Temp. COLD/WARM		Weekly Avg. Temp. COLD/WARM	
Min	9.81	11.1	9.97	11.2	10.00	11.4
Max	16.56	20.6	16.40	20.5	16.09	20.5
Avg	12.04	16.7	12.04	16.7	12.07	16.7
Std. Dev.	1.78	2.9	1.78	2.9	1.83	2.9
Measurements	7246	10173	151	212	20	29

[Datalogger ID: GWSD9A GPS Coordinates: 39.6732°N, 105.2712°W; Sampling/monitoring site is the GWSD WWTP effluent. The datalogger was located in a wet well, just upstream of the outfall at the plant. Effluent flows from the datalogger location into a drainage, down to and under Highway 74 at the west end of Lair o' the Bear Park, and into Bear Creek.] Notes: Discharge permit limits for Total Ammonia (NH3-N), in ug/L are as follows: Jan.-13,300, Feb.-8,000, Mar.-8,500, Apr.-7,200, May-8,300 June-12,600 July-13,000 Aug.-10,700 Sept.-8,400; Oct.-6,500; Nov.-8,500; Dec.-6,300; pH 6.5-9.0

Table 23 Town of Morrison (Site 24)

Morrison WWTP Effluent Summary 2011					
2011Process Control and Permit Sampling and Monitoring					
Parameter	pH, SU	Temp, °C	Total NH3-N, ug/L	Total P, ug/L	Flow, MGD
Min	6.53	5.90	60	120	0.04
Max	7.85	24.50	6320	840	0.14
Avg	7.14	15.71	502.24	457.35	0.07
Std. Dev.	0.25	4.98	949.38	193.15	0.02
Measurements	365	365	49	49	365
Exceedances	0		0	0	

Effluent Datalogger Temperature Summary COLD/WARM Seasons 2011						
All Temperatures in °C	30-Min Temp. COLD/WARM		Daily Avg.Temp. COLD/WARM		Weekly Avg. Temp. COLD/WARM	
Min	6.18	11.6	6.38	11.9	7.00	12.7
Max	23.38	23.2	14.03	22.9	13.03	22.7
Avg	9.78	17.9	9.79	17.9	9.74	18.0
Std. Dev.	1.72	3.0	1.70	3.0	1.62	3.0
Measurements	7133	10170	148	211	20	29

[Datalogger ID: MORR12 GPS Coordinates: 39.6541°N, 105.1796°W; Sampling/monitoring site is the GWSD WWTP effluent. The datalogger was located in a wet well, just upstream of the outfall at the plant. Effluent flows from the datalogger location into a drainage, down to and under Highway 74 at the west end of Lair o' the Bear Park, and into Bear Creek.] Notes: Discharge permit limits for Total Ammonia (NH3-N), in ug/L are as follows: Jan.-10,000, Feb.-8,600, Mar.-10,000, Apr.-10,000, May-8,600 June-20,000 July-30,000 Aug.-28,000 Sept.-28,000; Oct.-16,000; Nov.-14,000; Dec.-10,000; pH 6.5-9.0

Other Small Treatment Facilities

Table 24 Tiny Town Effluent Summary

TINY TOWN WWTP Effluent Summary 2011			
2011 Process Control and Permit Sampling and Monitoring			
Parameter	pH, SU	Total P, ug/L	Flow, MGD
Min	7.72	0.16	0.00049
Max	8.27	1	0.0008
Avg	7.92	0.47	0.00
Std. Dev.	0.21	0.32	0.00
Measurements	4	4	4
Exceedances	0	0	

Table 25 Brook Forest Inn Effluent Summary

BROOK FOREST INN WWTP Effluent Summary 2011				
2011 Process Control and Permit Sampling and Monitoring				
Parameter	pH, SU	Temp, °C	Total P, ug/L	Flow, MGD
Min	7.24		0.14	0.000513
Max	7.91		0.98	0.00128
Avg	7.64		0.38	0.00
Std. Dev.	0.18		0.31	0.00
Measurements	12		12	12
Exceedances	0		0	

Table 26 Bear Creek Cabins Effluent Summary

BEAR CREEK CABINS WWTP Effluent Summary 2011					
2011 Process Control and Permit Sampling and Monitoring					
Parameter	pH, SU	Temp, °C	Total NH3-N, ug/L	Total P, ug/L	Flow, MGD
Min	6.96	8	3.12	0.24	0.000108
Max	8.37	16.9	34	1.2	0.000564
Avg	7.68	12.55	15.19	0.60	0.00
Std. Dev.	0.33	3.05	9.75	0.29	0.00
Measurements	12	12	12	12	12
Exceedances	0			1	

Bear Creek Stream Segments

Sampling and monitoring was performed by Evergreen Metropolitan District personnel and watershed associates. Laboratory analyses were performed by a contract facility. A summary table for each Segment is presented before individual Site tables in that Segment. When there is only one Site per Segment, the summary table is omitted. Sites where only Warm Season temperature data exists have Cold-season portions of the table blacked out.

The following applies to all Segment Data tables: Existing stream standards: Table Value Standard (TVS) for Total Ammonia (NH3-N), chronic; 10 mg/L (10,000 ug/L) Nitrate (NO3-N), chronic; pH 6.5-9.0 SU; DO 6.0 mg/L; TIN was determined as the sum of Ammonia and Nitrate+Nitrite. Threshold to Evaluate Potential Temperature Impairment: WAT (Weekly Average Temperature), DM (Daily Maximum Temperature), Segment-specific; 2-HR Avg. Temperature data are calculations used to evaluate against DM.

Segments 7 and 8 (Mt Evans Wilderness)

Table 27 Summit Lake Site 36 (In Summit Lake near outlet) Segment 8

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011									
Monthly Parameter	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L	TN, ug/L
Min	5.88	6.1	6.75	0.019	9	2	11	3	97
Max	8.89	9.9	8.32	0.029	35	37	72	7	214
Avg	7.69	8.51	7.76	0.03	18.33	16.00	34.33	5.00	167.67
Std. Dev.	1.30	1.71	0.72	0.00	11.81	15.12	26.89	1.63	50.77
Measurements	3	3	3	3	3	3	3	3	3

[Monitoring station GPS Coordinates: 39.5979 °N, 105.6411 °W; Sampling /monitoring site is in Summit Lake, near outlet.]

Table 28 Summit Lake Site 37 Segment 7

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011									
Monthly Parameter	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L	TN, ug/L
Min	7.45	5.62	7.02	0.019	9	16	25	5	161
Max	7.63	11.15	8.05	0.025	22	103	125	13	254
Avg	7.53	8.82	7.50	0.02	15.00	52.00	67	9.67	218
Std. Dev.	0.07	2.34	0.42	0.00	5.35	37.07	42.36	3.40	40.77
Measurements	3	3	3	3	3	3	3	3	3

[Monitoring station GPS Coordinates: 39.5955 °N, 105.6334 °W; Sampling /monitoring site is in Bear Creek, downstream of outlet from Summit Lake.]

Table 29 Summit Lake Site 38 (Bear Creek at Bear Tracks) Segment 7

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011									
Monthly Parameter	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L	TN, ug/L
Min	6.18	7.18	8.27	0.024	11	92	103	5	197
Max	7.77	10.4	9.13	0.042	14	103	117	6	199
Avg	6.96	9.05	8.63	0.03	12.33	97.67	110	5.33	198
Std. Dev.	0.65	1.37	0.36	0.01	1.25	4.50	5.72	0.47	0.82
Measurements	3	3	3	3	3	3	3	3	3

[Monitoring station GPS Coordinates: 39.6159 °N, 105.5377 °W; Sampling /monitoring site is in Bear Creek, at bear tracks, in Mt. Evans Wilderness.]

Segment 1a (Above Evergreen Lake)

Table 30 Segment 1a Summary

Segment 1a Sampling/Monitoring Summary 2011								
Monthly Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.23	8.3	7.67	0.048	4	40	54	6
Max	7.84	14.6	8.72	0.59	14	75	83	28
Avg	7.55	10.72	8.19	0.21	10.67	57.33	68.00	16.33
Std. Dev.	0.21	1.98	0.41	0.22	3.54	11.06	10.44	8.60
Measurements	6	6	6	6	6	6	6	6

Segment 1a Datalogger Temperature Summary 2011								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASONS		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 Stream DM (21.2°C)
Min	-0.1	-0.03	0.0	-0.1	0.0	4.95	-0.03	4.49
Max	16.8	21.29	9.4	16.6	16.6	16.2	21.3	21.3
Avg	3.6	12.22	3.5	3.6	5.5	12.26	12.22	14.88
Measurements	14624	19420		3642	303	57	4854	405
# 9°C WAT exceeded			2					
% Compliance WAT			95%					
# 13°C DM exceeded					13			
% Compliance DM					95.71%			
# 17°C WAT exceeded						0		

% Compliance WAT					100%		
# 21.2°C DM exceeded							1
% Compliance DM							99.75%

Table 31 Lost & Found (Singin' River Ranch-Site 1a)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.23	8.3	8	0.048	8	59	72	6
Max	7.56	11.5	8.72	0.45	13	75	83	28
Avg	7.40	9.87	8.33	0.19	11.33	66.33	77.67	14.67
Std. Dev.	0.13	1.31	0.30	0.19	2.36	6.60	4.50	9.57
Measurements	3	3	3	3	3	3	3	3

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. Cold/Warm Season		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 Stream DM (21.2°C)
Min	-0.1	5.7	2.2	0.0	2.9	9.2	5.7	9.8
Max	13.4	16.3	6.5	13.0	13.0	13.3	16.1	16.1
Avg	4.6	11.9	4.2	4.6	7.3	12.0	11.9	13.8
Std. Dev.	2.9	2.1	1.4	2.9	2.8	1.3	2.1	1.6
Measurements	2928	4827	8	732	61	14	1206	100
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					1			
% Compliance DM					98.36%			
# 17°C WAT exceeded						0		
% Compliance WAT						100%		
# 21.2°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: L&F GPS Coordinates: 39.6234 °N, 105.4451 °W; Sampling /monitoring site is in Bear Creek, above Lost & Found (old Singin' River Ranch)]

Table 32 Above Evergreen Lake, at Clear Creek County line (Site 2)

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONs		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Min	-0.03	0.0	0.59	-0.03	0.51	4.9	0.0	4.5
Max	12.87	20.3	8.83	12.56	12.56	15.3	20.2	20.2
Avg	3.58	11.1	3.99	3.59	5.92	11.1	11.1	14.2
Std. Dev.	3.36	4.3	2.81	3.35	3.57	3.6	4.3	3.6
Measurements	2282	8784	6	570	47	26	2196	183
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			

Datalogger Temperature Data 2011							
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONs	Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
% Compliance DM				100%			
# 17°C WAT exceeded					0		
% Compliance WAT					100%		
# 21.2°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: ALKCC GPS Coordinates: 39.6368 °N, 105.3972 °W; Datalogger site in Bear Creek near the Clear Creek County line, on Upper Bear Creek Road.]

Table 33 Above Evergreen Lake, at CDOW site (Site 3a)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.49	9.7	7.67	0.051	4	40	54	12
Max	7.84	14.6	8.69	0.59	14	55	62	28
Avg.	7.7	11.57	8.06	0.23	10	48.33	58.33	18
Std. Dev.	0.15	2.16	0.45	0.25	4.32	6.24	3.30	7.12
Measurements	3	3	3	3	3	3	3	3

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASONS		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 Stream DM (21.2°C)
Min	-0.1	5.4	0.0	-0.1	0.0	10.2	5.5	11.3
Max	16.8	21.3	9.4	16.6	16.6	16.2	21.3	21.3
Avg	3.3	14.1	3.2	3.4	4.8	14.2	14.1	16.8
Std. Dev.	3.9	2.9	3.3	3.9	4.9	2.0	2.9	2.5
Measurements	9414	5809	26	2340	195	17	1452	122
# 9°C WAT exceeded			2					
% Compliance WAT			92.31%					
# 13°C DM exceeded					12			
% Compliance DM					93.85%			
# 17°C WAT exceeded						0		
% Compliance WAT						100%		
# 21.2°C DM exceeded								1
% Compliance DM								99%

[Monitoring station/Datalogger ID: ALKDOW GPS Coordinates: 39.6331 °N, 105.3372 °W; Sampling /monitoring site in Bear Creek above Evergreen Lake, at the CDOW fish survey site.]

Segment 1d (Evergreen Lake)

Sites 4a-4j comprises a profile monitoring station in Evergreen Lake. During the study period, sampling and monitoring were performed monthly at the individual Site locations at this profile station. This data is presented below. Also during the study period, temperature data collected with dataloggers at the individual Site locations were analyzed and compared to state water quality standards.

Table 34 Evergreen Lake, 0.5 meters down, near dam (Site 4a)

3 Monthly Sampling/3 Monitoring Events July1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.67	14.52	6.39	0.037				
Max	8.56	20.2	6.89	0.071				
Avg	8.13	18.07	6.57	0.06				
Std. Dev.	0.36	2.53	0.22	0.01				
Measurements	3	3	3	3				

Datalogger Temperature Summary 2011							
All Temperatures in °C	30-Min Temp. WARM SEASON	Jan 1-Mar 31 Stream Std. WAT (9°C)	Jan 1-Mar 31 2-Hr Avg. Temp.	Jan 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Dec. 31 Stream Std. WAT (19.3°C)	Apr 1-Dec 31 2-HR Avg. Temp.	Apr 1-Dec 31 Stream DM (23.8°C)
Min	3.51				5.59	3.54	4.35
Max	21.63				18.76	21.37	21.37
Avg	13.63				13.75	13.63	14.45
Measurements	10206				30	2551	212
# 18.2°C WAT exceeded					6		
% Compliance WAT					80%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: EMD2A GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, on the surface, near the EMD WTP intake.] N/A* indicates temp. readings not taken. N/A** Indicates no sampling at this location.

Table 35 Evergreen Lake, 1.0m below surface, near dam (Site 4b)

3 Monthly Sampling/3 Monitoring Events July 1-Sept 30, 2011										
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	TN ug/L	Total P, ug/L	Total Dissolved P Ug/L
Min	7.57	14.16	5.48	0.037	17	10	29	238	5	2
Max	8.57	18.7	6.59	0.071	46	37	60	301	19	6
Avg	8.02	16.95	6.04	0.06	28.67	19.67	48.33	262	11.67	4
Std. Dev.	0.41	2.00	0.45	0.01	12.50	12.28	13.77	27.82	5.73	2
Measurements	3	3	3	3	3	3	3	3	3	2

Datalogger Temperature Summary 2011							
All Temperatures in °C	30-Min Temp. WARM SEASON	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	3.59				5.57	3.63	4.15
Max	20.75				17.99	20.46	20.46
Avg	13.21				13.32	13.21	14.06
Measurements	10206				30	2551	212
# 18.2°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: EMD2B GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, 1.5m below surface, near the EMD WTP intake.]

Table 36 Evergreen Lake, 1.5m below surface, near dam (Site 4c)

0 Monthly Sampling/3 Monitoring Events July1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.48	13.95	5.49	0.038				
Max	8.56	17.4	6.59	0.071				
Avg	7.92	16.15	6.15	0.06				
Std. Dev.	0.46	1.56	0.48	0.01				
Measurements	3	3	3	3				

Datalogger Temperature Summary 2011							
All Temperatures in °C	30-Min Temp. WARM SEASON	Jan 1-Mar 31 Stream Std. WAT (9°C)	Jan 1-Mar 31 2-Hr Avg. Temp.	Jan 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Dec. 31 Stream Std. WAT (19.3°C)	Apr 1-Dec 31 2-HR Avg. Temp.	Apr 1-Dec 31 Stream DM (23.8°C)
Min	3.56				5.50	3.61	4.11
Max	20.06				17.25	19.02	19.02
Avg	12.70				12.81	12.70	13.41
Measurements	10206				30	2551	212
# 18.2°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: EMD2C GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, 2.5m below the surface, near the EMD WTP intake.]

Table 37 Evergreen Lake, 2.0m below surface, near dam (Site 4d)

0 Monthly Sampling/3 Monitoring Events July1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.35	13.69	5.27	0.039				
Max	8.58	16.5	6.48	0.071				
Avg	7.84	15.46	5.88	0.06				
Std. Dev.	0.53	1.26	0.49	0.01				
Measurements	3	3	3	3				

Datalogger Temperature Summary 2011							
All Temperatures in °C	30-Min Temp. WARM SEASON	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	3.56				5.43	3.60	4.08
Max	18.89				16.58	18.59	18.59
Avg	12.11				12.21	12.11	12.67
Measurements	10206				30	2551	212
# 18.2°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: EMD2D GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, 3.5m below the surface, near the EMD WTP intake.]

Table 38 Evergreen Lake, 2.5m below surface, near dam (Site 4e)

Monthly Parameter	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm
Min	7.14	13.52	4.92	0.039
Max	8.58	16.2	6.12	0.071
Avg	7.74	15.04	5.38	0.05
Std. Dev.	0.61	1.12	0.53	0.01
Measurements	3	3	3	3

[Monitoring station/Datalogger ID: EMD4E GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, 2.5m below the surface, near the EMD WTP intake.]

Evergreen Lake, 3.0m below surface, near dam (Site 4f)

Monthly Parameter	**pH, SU**	**Temp, °C**	**D. O., mg/L**	**Sp. Cd., mS/cm**
Min	6.97	13.22	4.22	0.04
Max	8.78	15.8	4.88	0.074
Avg	7.72	14.61	4.45	0.06
Std. Dev.	0.77	1.06	0.31	0.01
Measurements	3	3	3	3

[Monitoring station/Datalogger ID: EMD4f GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, 3.0m below the surface, near the EMD WTP intake.]

Evergreen Lake, 3.5m below surface, near dam (Site 4g)

Monthly Parameter	**pH, SU**	**Temp, °C**	**D. O., mg/L**	**Sp. Cd., mS/cm**
Min	6.87	13.22	2.56	0.04
Max	8.78	15.2	4.22	0.074
Avg	7.62	14.21	3.14	0.06
Std. Dev.	0.83	0.81	0.77	0.02
Measurements	3	3	3	3

Monitoring station/Datalogger ID: EMD4g GPS Coordinates: 39.6314 □N, 105.3231 in Evergreen Lake near the dam, 3.5m below the surface, near the EMD WTP intake.]

Evergreen Lake, 4.0m below surface, near dam (Site 4h)

Monthly Parameter	**pH, SU**	**Temp, °C**	**D. O., mg/L**	**Sp. Cd., mS/cm**
Min	6.82	13.11	0.12	0.072
Max	8.71	14.4	4.54	0.46
Avg	7.51	13.70	2.08	0.20
Std. Dev.	0.85	0.53	1.84	0.18
Measurements	3	3	3	3

Monitoring station/Datalogger ID: EMD4h GPS Coordinates: 39.6314 □N, 105.3231 in Evergreen Lake near the dam, 4.0m below the surface, near the EMD WTP intake.]

Evergreen Lake, 5.0m below surface, near dam (Site 4i)

0 Monthly Sampling/3 Monitoring Events July1-Sept 30, 2011										
Monthly Parameter	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO 2-N, ug/L	TIN, ug/L	TN ug/L	Total P, Ug/L	Total Dissolved P Ug/L
Min	6.7	11.8	0.07	0.082	16	6	22	351	18	5
Max	8.66	12.86	2.97	0.57	240	18	258	586	24	6
Avg	7.39	12.42	1.04	0.25	165.00	10.33	175.33	432.33	21.33	5.50
Std. Dev.	0.90	0.45	1.36	0.23	105.36	5.44	108.53	108.72	2.49	0.50
Measurements	3	3	3	3	3	3	3	3	3	2

Monitoring station/Datalogger ID: EMD4i GPS Coordinates: 39.6314 □N, 105.3231 in Evergreen Lake near the dam, 5.0m below the surface, near the EMD WTP intake.]

Evergreen Lake, 6.0m below surface, near dam (Site 4j)

Monthly Parameter	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm
Min	6.75	10.9	0.03	0.095
Max	8.6	11.88	0.09	0.164
Avg	7.42	11.36	0.06	0.12
Std. Dev.	0.84	0.40	0.02	0.03
Measurements	3	3	3	3

Monitoring station/Datalogger ID: EMD4j GPS Coordinates: 39.6314 □N, 105.3231 |
in Evergreen Lake near the dam, 6.0m below the surface, near the EMD WTP intake.]

Segment 1e (Mainstem below Evergreen Lake and Above Harriman Diversion)

Table 39 Segment 1e Summary

Segment 1e Sampling/Monitoring Summary 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.22	14.59	6.63	0.05	9	15	52	7
Max	8.37	20.7	7.87	0.89	40	325	348	149
Avg	7.94	17.12	7.19	0.19	21.11	146.50	167.61	39.11
Std. Dev.	0.29	2.07	0.33	0.23	9.89	64.49	64.17	37.15
Measurements	18	18	18	18	18	18	18	18

Segment 1e Datalogger Temperature Summary 2011								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASON		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	-0.14	0.5	-0.03	-0.09	-0.09	5.8	0.5	3.5
Max	10.96	23.9	4.66	10.79	10.79	19.1	23.8	23.8
Avg	1.78	13.2	1.64	1.78	2.99	13.4	13.2	15.5
Measurements	25452	51256	70	6359	527	141	12813	1013
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

Table 40 Downtown Evergreen, at CDOW site (Site 5)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.22	14.73	6.63	0.066	15	15	52	7
Max	7.88	18.3	7.51	0.78	40	70	85	20
Avg	7.65	16.84	7.04	0.31	27.00	37.00	64.00	15.33
Std. Dev.	0.30	1.53	0.36	0.33	10.23	23.76	14.90	5.91
Measurements	3	3	3	3	3	3	3	3

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASON		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.09	4.4	0.54	-0.09	0.63	6.5	4.4	5.4
Max	6.84	21.5	3.92	6.60	6.60	18.7	21.2	21.2
Avg	2.09	13.3	1.96	2.09	2.76	13.5	13.3	14.3
Std. Dev.	1.35	4.4	1.16	1.35	1.52	4.1	4.4	4.3
Measurements	5113	10272	14	1278	106	30	2568	214
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: LTLBAR GPS Coordinates: 39.6327 °N, 105.3183 °W; Sampling /monitoring site in Bear Creek near the west end of public parking lot, across from the Little Bear, CDOW fish survey site.]

Table 41 Bear Creek Cabins (Site 8a)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.56	15.12	6.98	0.05	13	143	156	11
Max	8.02	19	7.35	0.89	38	325	348	26
Avg	7.85	17.14	7.16	0.35	24.67	213.67	238.33	18.67
Std. Dev.	0.21	1.59	0.15	0.38	10.27	79.67	80.73	6.13
Measurements	3	3	3	3	3	3	3	3

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.14	3.0	0.30	-0.09	-0.09	6.8	3.1	7.2
Max	9.73	21.6	4.47	9.37	9.37	18.9	21.4	21.4
Avg	2.17	13.4	2.07	2.17	4.11	14.2	13.4	16.2
Std. Dev.	1.98	4.5	1.49	1.97	2.58	4.4	4.5	4.0
Measurements	5112	10223	14	1277	106	22	2555	159
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: BCCDOW GPS Coordinates: 39.6425°N, 105.3084°W; Sampling/ monitoring site at bridge above the Bear Creek Cabins WWTP effluent discharge, at the CDOW fish survey site.]

Table 42 O'Fallon Park (Site 9)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.69	14.59	6.98	0.089	9	149	158	12
Max	8.2	19.2	7.48	0.13	37	182	219	149
Avg	7.99	16.83	7.16	0.11	22.00	160.33	182.33	64.67
Std. Dev.	0.22	1.88	0.23	0.02	11.52	15.33	26.39	60.25
Measurements	3	3	3	3	3	3	3	3

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.09	1.0	-0.03	-0.05	-0.03	6.4	1.1	4.9
Max	10.49	23.2	4.33	10.33	10.33	18.7	23.0	23.0
Avg	1.64	13.1	1.55	1.64	3.33	13.3	13.1	16.1
Std. Dev.	2.11	4.8	1.49	2.10	3.08	4.3	4.8	4.4
Measurements	5000	10272	14	1250	103	30	2568	214
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: OFPDOW GPS Coordinates: 39.6564°N, 105.2917°W; Sampling/ monitoring site north side of the creek above ETU restoration site, at the CDOW fish survey site.]

Table 43 Lair o' the Bear (Site 12)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.9	14.65	6.91	0.084	9	161	170	18
Max	8.29	20	7.64	0.117	23	189	212	79
Avg	8.12	17.08	7.26	0.10	16.67	172.33	189.00	42.33
Std. Dev.	0.16	2.21	0.30	0.01	5.79	12.04	17.38	26.39
Measurements	3	3	3	3	3	3	3	3

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASON		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	-0.1	0.5	0.0	-0.1	0.0	2.4	6.3	0.5
Max	8.7	22.9	4.4	8.7	8.7	19.5	18.8	22.8
Avg	1.5	12.9	1.3	1.5	2.2	12.9	13.0	12.9
Std. Dev.	1.9	4.9	1.4	1.9	2.3	4.5	4.2	4.9
Measurements	5114	10217	14	1277	106	212	29	2554
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			

% Compliance DM				100%			
# 19.3°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: LOBDOW GPS Coordinates: 39.6672°N, 105.2687°W; Sampling/ monitoring site in Bear Creek at the end of main path to Bear Creek from the parking lot, at the CDOW fish survey site.]

Table 44 Idledale (Shady Lane-Site 13a)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.78	14.83	6.93	0.108	11	134	145	22
Max	8.25	20.7	7.59	0.145	22	167	183	61
Avg	8.02	17.48	7.20	0.12	16.33	149.00	165.33	38.00
Std. Dev.	0.19	2.43	0.28	0.02	4.50	13.64	15.63	16.67
Measurements	3	3	3	3	3	3	3	3

Datalogger Temperature Data 2010								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31. 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	0.0	0.5	0.0	0.0	0.0	5.8	0.6	4.3
Max	11.0	23.9	4.7	10.8	10.8	19.1	23.8	23.8
Avg	1.5	13.2	1.3	1.5	2.5	13.3	13.2	15.7
Std. Dev.	2.1	5.0	1.6	2.1	3.0	4.4	5.0	4.8
Measurements	5113	10272	14	1277	106	30	2568	214
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: IDLE GPS Coordinates: 39.6621°N, 105.2406°W; Sampling/ monitoring site in Bear Creek at the CDOW fish survey site.]

Table 45 West End of Morrison (Site 14a)

5 Monthly Sampling/Monitoring Events May 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.53	14.59	6.75	0.108	9	133	151	13
Max	8.37	20.6	7.87	0.153	33	158	191	111
Avg	8.00	17.33	7.33	0.12	20.00	146.67	166.67	55.67
Std. Dev.	0.35	2.48	0.46	0.02	9.90	10.34	17.44	41.00
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2011								

[Monitoring station/Datalogger ID: MORR10 GPS Coordinates: 39.6529°N, 105.2003°W; Sampling/ monitoring site west end of Morrison, at the gated bridge to Denver Mountain parks Headquarters, at the CDOW fish survey site.]

Segment 1b (Below Harriman Diversion)

Table 46 Segment 1b Summary

Segment 1b Datalogger Temperature Summary 2011								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	-0.2	-0.31	-0.1	-0.2	-0.1	4.58	-0.26	2.47
Max	12.8	26.04	6.2	12.6	12.6	19.58	25.62	25.62
Avg	2.3	13.38	2.1	2.3	3.9	13.39	13.38	15.33
Measurements	11425	30663	36	2855	237	87	7664	637
# 9°C WAT exceeded			11					
% Compliance WAT			80%					
# 13°C DM exceeded					4			
% Compliance DM					98.96%			
# 19.3°C WAT exceeded						4		
% Compliance WAT						95%		
# 23.8°C DM exceeded								1
% Compliance DM								99.84%

Table 47 Bear Creek in Bear Creek Park, at the USGS gage (Site 15a)

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.1	0.9	0.0	-0.1	-0.1	4.6	0.9	4.5
Max	12.8	23.0	6.2	12.6	12.6	19.6	22.9	22.9
Avg	2.0	13.6	2.0	2.0	3.5	13.2	13.6	15.6
Std. Dev.	2.5	4.8	2.0	2.5	3.2	4.5	4.8	4.5
Measurements	6113	10219	22	1527	127	27	2554	213
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						2		
% Compliance WAT						93%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: MORR11 GPS Coordinates: 39.6522 °N, 105.1731 °W; Monitoring site in Bear Creek near USGS gage in Bear Creek Park.]

Table 48 Bear Creek, Above Ward Ditch (Site 27a)

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONS Temp.		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	-0.2	-0.3	-0.1	-0.2	-0.1	5.6	-0.3	2.5
Max	9.4	26.0	5.1	9.1	9.1	19.2	25.6	25.6
Avg	2.5	13.2	2.1	2.5	4.2	13.4	13.2	15.0
Std. Dev.	2.7	4.8	2.0	2.7	3.2	4.4	4.8	4.9
Measurements	2656	10222	7	664	55	30	2555	212
# 19.3°C WAT exceeded			0			0		

Datalogger Temperature Data 2011							
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONS Temp.	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
% Compliance WAT		100%			100%		
# 23.8°C DM exceeded				0			1
% Compliance DM				100%			99.53%

[Monitoring station/Datalogger ID: (Above Ward) GPS Coordinates: 39.6518 °N, 105.1854 °W; Monitoring site in Bear Creek above Ward Ditch gate, east of Morrison.]

Table 49 Bear Creek below Ward Ditch (site 27b)

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONS Temp.		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	0.0	0.4	0.1	0.0	0.1	5.8	0.4	3.0
Max	9.8	23.1	5.3	9.6	9.6	19.3	23.0	23.0
Avg	2.7	13.3	2.3	2.7	4.5	13.5	13.3	15.4
Std. Dev.	2.7	4.9	2.0	2.7	3.2	4.4	4.9	4.7
Measurements	2656	10222	7	664	55	30	2555	212
# 19.3°C WAT exceeded			0			2		
% Compliance WAT			100%			93%		
# 23.8°C DM exceeded					0			0
% Compliance DM					100%			100%

Segment 3 (Vance Creek)

Table 50 Mt. Evans Wilderness Drainage, Vance Creek (Site 25)

5 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.6	9.23	7.66	0.054	3	3	6	3
Max	7.77	13	8.48	0.072	13	29	42	20
Avg	7.71	10.64	7.94	0.07	8.33	13.67	22.00	12.67
Std. Dev.	0.08	1.68	0.38	0.01	4.11	11.12	14.97	7.13
Measurements	3	3	3	3	3	3	3	3

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASON		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Min	-0.1	4.0	2.2	0.0	0.1	9.1	4.1	10.7
Max	16.6	20.4	8.3	16.2	16.2	14.8	20.3	20.3
Avg	5.2	12.7	5.3	5.2	8.7	12.8	12.7	16.1
Std. Dev.	3.6	3.1	1.7	3.5	3.7	1.8	3.1	2.4
Measurements	4585		12	1146	95	17	1464	122
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					12			
% Compliance DM					87.37%			
# 17°C WAT						0		

exceeded							
% Compliance WAT					100%		
# 21.2°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: ALKMEL GPS Coordinates: 39.6322°N, 105.4558°W; Sampling/ monitoring site in Vance Creek.]

Segment 5 (Cub Creek)

Table 51 Segment 5 Summary

Segment 5 Sampling/Monitoring Summary 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.64	11.34	6.47	0.107	4	237	251	11
Max	8.64	19.7	7.98	0.4	23	463	470	74
Avg	8.03	15.25	7.14	0.21	14.67	355.33	370	29.17
Std. Dev.	0.37	2.78	0.57	0.10	7.16	79.23	75.36	20.79
Measurements	6	6	6	6	6	6	6	6

Segment 5 Datalogger Temperature Summary 2011								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASON		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (18.2°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.12	-0.12	-0.06	-0.10	-0.06	1.21	-0.09	0.21
Max	7.52	23.55	1.82	7.12	7.12	16.09	20.73	20.73
Avg	0.65	9.50	0.62	0.65	1.74	9.65	9.50	12.30
Measurements	2577	30480	6	644	52	89	7620	635
# 18.2°C WAT exceeded						0		
% Compliance WAT					0	100%		
# 23.8°C DM exceeded					100%			0
% Compliance DM								100%

Table 52 Little Cub Creek, above Bear Creek confluence (Site 26)

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASON		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (18.2°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.1	-0.1		-0.1	0.0	3.8	-0.1	0.7
Max	3.6	20.9		3.5	3.5	16.1	20.7	20.7
Avg	0.6	10.3		0.6	1.4	10.5	10.3	13.2
Std. Dev.	1.1	4.9		1.1	1.5	4.2	4.8	4.5
Measurements	168	10272		42	3	30	2568	214
# 18.2°C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded					0			0
% Compliance DM					100%			100%

[Monitoring station/Datalogger ID: LTLCUB GPS Coordinates: 39.6312°N, 105.3221°W; Sampling/ monitoring site in Little Cub Creek above Bear Creek confluence.]

Table 53 Little Cub Creek above Brook Forest Inn (Site 35)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011									
Monthly Parameter Results	pH, SU		Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.64		11.34	6.64	0.107	7	292	310	11
Max	7.81		16.9	7.83	0.4	23	463	470	21
Avg	7.70		14.15	7.12	0.21	16.00	361.00	377.00	16.33
Std. Dev.	0.08		2.27	0.51	0.13	6.68	73.61	67.86	4.11
Measurements	3		3	3	3	3	3	3	3
Datalogger Temperature Data 2011									
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASON.		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (18.2°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)	
Min	-0.1	-0.1		-0.1	-0.1	1.2	-0.1	0.2	
Max	2.4	23.5		2.3	2.3	13.3	20.6	20.6	
Avg	0.2	8.0		0.2	0.7	8.1	8.0	10.5	
Std. Dev.	0.6	4.7		0.6	1.1	4.2	4.7	4.9	
Measurements	165	9936		41	3	29	2484	207	
# 18.2°C WAT exceeded						0			
% Compliance WAT						100%			
# 23.8°C DM exceeded					0			0	
% Compliance DM					100%			100%	

[Monitoring station/Datalogger ID: (ABFI) GPS Coordinates: 39.5795°N, 105.3817°W; Sampling/ monitoring site in Little Cub Creek above Brook Forest Inn WWTP discharge.]

Table 54 Cub Creek Park on Little Cub Creek (site 50)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011									
Monthly Parameter Results	pH, SU		Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	8.03		12.84	6.47	0.167	4	237	251	23
Max	8.64		19.7	7.98	0.234	22	439	443	74
Avg	8.35		16.35	7.16	0.21	13.33	349.67	363	42
Std. Dev.	0.25		2.80	0.62	0.03	7.36	84.10	81.58	22.76
Measurements	3		3	3	3	3	3	3	3
Datalogger Temperature Data 2011									
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASON		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)	
Min	-0.1	-0.1	-0.1	-0.1	0.0	3.6	-0.1	0.7	
Max	7.5	20.5	1.8	7.1	7.1	15.7	20.2	20.2	
Avg	0.7	10.1	0.6	0.7	1.8	10.3	10.1	13.2	
Std. Dev.	1.4	4.9	0.8	1.4	2.3	4.2	4.9	4.6	
Measurements	2244	10272	6	561	46	30	2568	214	
# 9°C WAT exceeded			0						
% Compliance WAT			100%						
# 13°C DM exceeded					0				
% Compliance DM					100%				
# 17°C WAT exceeded						0			

% Compliance WAT					100%		
# 21.2°C DM exceeded							0
% Compliance DM							100%

Genesee Reservoir

Segment 10 Sampling/Monitoring Summary 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.2	17.05	3.24	0.115	22	97	131	2
Max	8.68	21.3	6.65	0.159	42	176	207	12
Avg	7.89	18.32	4.70	0.15	31.83	145.17	177.00	7.67
Std. Dev.	0.54	1.34	1.15	0.02	5.87	31.23	31.49	3.45
Measurements	22	22	22	13	6	6	6	6

Segment 10 Datalogger Temperature Summary 2011							
All Temperatures in °C	30-Min Temp. WARM SEASON	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	5.23				7.15	5.25	5.59
Max	23.14				21.44	22.82	22.82
Avg	14.16				14.40	14.16	14.60
Measurements	44256				128	11064	920
# 9°C WAT exceeded							
% Compliance WAT							
# 13°C DM exceeded							
% Compliance DM							
# 19.3°C WAT exceeded					42		
% Compliance WAT					67%		
# 23.8°C DM exceeded							37
% Compliance DM							96%

Table 55 Genesee Reservoir 0.5 meters from surface (site 39a)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.83	17.86	4.29	0.088				
Max	8.52	21.3	6.58	0.159				
Avg	8.27	19.59	5.42	0.12				
Std. Dev.	0.31	1.40	0.94	0.03				
Measurements	3	3	3	3				

Temperature Summary 2011

All Temperatures in °C	30MinTemp. Warm Season	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Min	5.3	7.2	5.3	5.8
Max	23.1	21.4	22.8	22.8
Avg	14.6	14.9	14.6	15.3
Std. Dev.	4.7	4.5	4.7	4.8

All Temperatures in °C	30MinTemp. Warm Season	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Measurements	11064	32	2766	230
# 17°C WAT exceeded		12		
% Compliance WAT		63%		
# 21.2°C DM exceeded				23
% Compliance DM				90%

Table 56 Genesee Reservoir 1.0 meters from surface (site 39b)

3 Monthly Sampling/Monitoring Events July1- September 30, 2011

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.49	17.2	3.75	0.088	22	97	131	2
Max	8.52	21.3	6.25	0.158	34	176	207	11
Avg	8.17	19.33	5.13	0.12	29.00	143.33	172.33	6.67
Std. Dev.	0.48	1.68	1.04	0.03	5.10	33.67	31.38	3.68
Measurements	3	3	3	3	3	3	3	3

2011 Temperature Summary

Temperatures °C	30-Min Temp. WARM SEASONS	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Min	5.2	7.2	5.3	5.8
Max	22.3	21.1	22.1	22.1
Avg	14.4	14.7	14.4	14.9
Std. Dev.	4.6	4.4	4.6	4.6
Measurements	11064	32	2766	230
# 17°C WAT exceeded		11		
% Compliance WAT		66%		
# 21.2°C DM exceeded				14
% Compliance DM				94%

Genesee Reservoir 1.5 meters from surface (site 39c)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.43	17.14	3.7	0.088				
Max	8.54	20.6	6.65	0.158				
Avg	8.16	18.98	5.10	0.12				
Std. Dev.	0.52	1.42	1.21	0.03				
Measurements	3	3	3	3				

Temperature Summary 2011

All Temperatures in °C	30MinTemp. Warm Season	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Min	5.3	7.2	5.3	5.7
Max	21.5	20.6	21.2	21.2
Avg	14.1	14.3	14.1	14.4
Std. Dev.	4.3	4.1	4.3	4.3
Measurements	11064	32	2766	230
# 17°C WAT exceeded		10		
% Compliance WAT		69%		
# 21.2°C DM exceeded				0
% Compliance DM				100%

Genesee Reservoir 2.0 meters from surface (site 39d)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.36	17.1	3.64	0.088				
Max	8.68	19.1	6.61	0.158				
Avg	8.18	18.30	5.38	0.12				
Std. Dev.	0.58	0.86	1.26	0.03				
Measurements	3	3	3	3				

Temperature Summary 2011

All Temperatures in °C	30MinTemp. Warm Season	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Min	5.3	7.2	5.3	5.6
Max	20.0	19.3	19.7	19.7
Avg	13.5	13.7	13.5	13.8
Std. Dev.	4.0	3.8	4.0	4.0
Measurements	11064	32	2766	230
# 17°C WAT exceeded		9		
% Compliance WAT		72%		
# 21.2°C DM exceeded				0
% Compliance DM				100%

Table 57 Genesee Reservoir 2.5 meters from surface (site 39e)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.33	17.09	3.76	0.088				
Max	8.29	18.6	6.42	0.158				
Avg	7.81	17.845	5.09	0.123				
Std. Dev.	0.48	0.755	1.33	0.035				
Measurements	2	2	2	2				

Table 58 Genesee Reservoir 3.0 meters from surface (site 39f)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.27	17.08	3.68	0.088				
Max	7.95	18.3	5.15	0.158				
Avg	7.61	17.69	4.415	0.123				
Std. Dev.	0.34	0.61	0.735	0.035				
Measurements	2	2	2	2				

Genesee Reservoir 3.5 meters from surface (site 39g)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.22	17.07	3.73	0.088				
Max	7.86	18	5.08	0.158				
Avg	7.54	17.535	4.405	0.123				
Std. Dev.	0.32	0.465	0.675	0.035				
Measurements	2	2	2	2				

Genesee Reservoir 4.0 meters from surface (site 39h)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.21	17.07	3.48	0.088				
Max	7.65	17.5	3.85	0.158				
Avg	7.43	17.285	3.665	0.123				
Std. Dev.	0.22	0.215	0.185	0.035				
Measurements	2	2	2	2				

Genesee Reservoir 5.0 meters from surface (site 39i)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.2	17.05	3.24	0.088	31	107	138	5
Max	7.37	17.1	3.3	0.158	42	171	205	12
Avg	7.29	17.08	3.27	0.12	34.67	147.00	181.67	8.67
Std. Dev.	0.09	0.03	0.03	0.04	5.19	28.47	30.90	2.87
Measurements	2	2	2	2	3	3	3	3

Turkey Creek Stream Segments
(Segment 6a South Turkey Creek)

Table 59 Segment 6a Summary

Segment 6a Sampling/Monitoring Summary 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.68	12.25	4.84	0.87	11	9	20	27
Max	7.76	21.20	6.99	0.97	27	78	95	42
Avg	7.72	16.15	5.60	0.94	18.33	45.33	63.67	32.67
Std. Dev.	0.03	3.74	0.98	0.05	6.60	28.29	31.84	6.65
Measurements	3	3	3	3	3	3	3	3

Datalogger Temperature Summary 2011								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (18.2°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-7.38	-0.1	-1.15	-7.02	-0.36	2.3	-0.1	1.3
Max	13.14	22.9	7.56	12.35	12.35	17.9	22.8	22.8
Avg	2.95	11.6	2.88	2.95	4.75	11.5	11.6	13.7
Measurements	8363	20490	23	2090	173	57	5122	427
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 18.2°C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

Table 60 Turkey Creek within Bear Creek Park, near Maint. Bldg. (Site 16a)

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (18.2°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.1	3.9	1.5	-0.1	0.0	8.0	3.9	8.0
Max	11.1	20.9	7.6	10.9	10.9	17.9	20.9	20.9
Avg	3.9	13.2	3.8	3.9	5.1	12.9	13.2	14.7
Std. Dev.	2.2	3.6	1.7	2.2	2.3	3.4	3.6	3.3
Measurements	6118	10218	17	1529	127	27	2554	213
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 18.2°C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: TURK2 GPS Coordinates: 39.6394°N, 105.161°W; Sampling/ monitoring site in Turkey Creek, inside Bear Creek Lake Park, at the maintenance shop site.]

Table 61 Aspen Park Metropolitan District, South Turkey Creek (Site 18)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.68	12.25	4.84	0.87	11	9	20	27
Max	7.76	21.2	6.99	0.97	27	78	95	42
Avg	7.72	16.15	5.60	0.94	18.33	45.33	63.67	32.67
Std. Dev.	0.03	3.74	0.98	0.05	6.60	28.29	31.84	6.65
Measurements	3	3	3	3	3	3	3	3

Datalogger Temperature Data 2011							
All Temperatures in °C	30-Min Temp. Warm Season	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (18.2°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.1				2.3	-0.1	1.3
Max	22.9				17.5	22.8	22.8
Avg	10.1				10.2	10.1	12.6
Std. Dev.	5.5				4.9	5.5	5.4
Measurements	10272				30	2568	214
# 18.2°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: APMD1 GPS Coordinates: 39.5461°N, 105.2708°W; Sampling/ monitoring site in South Turkey Creek downstream of the APMD WWTP.]

Segment 6b (North Turkey Creek)

Table 62 Conifer Metropolitan District, North Turkey Creek (Site19)

5 Monthly Sampling/Monitoring Events July 1-Sept 30, 2011								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.87	13.88	6.21	0.134	8	76	102	4
Max	8.13	21.3	7.68	0.585	26	235	248	16
Avg	8.00	17.13	6.77	0.39	15.67	170.33	186	10
Std. Dev.	0.11	3.10	0.65	0.19	7.59	68.22	61.60	4.90
Measurements	3	3	3	3	3	3	3	3

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. Cold/ Warm Seasons		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Min	-0.1	3.3	1.9	-0.1	-0.1	9.4	3.4	10.4
Max	16.8	22.4	9.0	16.5	16.5	15.5	22.1	22.1
Avg	4.3	13.0	4.3	4.3	8.5	13.1	13.0	17.2
Std. Dev.	3.8	3.6	2.0	3.8	3.6	2.1	3.6	2.7
Measurements	4580	5856	12	1145	95	17	1464	122
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					12			
% Compliance DM					87.37%			
# 17°C WAT exceeded						0		
% Compliance WAT						100%		
# 21.2°C DM exceeded								5
% Compliance DM								96%

Segment 1c: Bear Creek Reservoir Temperature Summary 2011

Segment 1c Datalogger Temperature Summary 2011								
All Temperatures in °C	30-Min Temp. WARM SEASON		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min		2.32				3.32	2.48	2.99
Max		24.73				23.47	24.57	24.57
Avg		15.30				15.59	15.30	15.70
Measurements		49520				144	12376	1028
# 9°C WAT exceeded								
% Compliance WAT								
# 13°C DM exceeded								
% Compliance DM								
# 23.3°C WAT exceeded						3		
% Compliance WAT						98%		
# 23.8°C DM exceeded								27
% Compliance DM								97%

Site 40T (0.5) Bear Creek Reservoir profile Station

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. WARM SEASONs		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (23.3°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (23.8°C)
Min		2.3				3.3	2.5	3.0
Max		24.7				23.5	24.6	24.6
Avg		15.4				15.7	15.4	15.9
Std. Dev.		6.2				6.0	6.2	6.3
Measurements		12380				36	3094	257
# 9°C WAT exceeded								
% Compliance WAT								
# 13°C DM exceeded								
% Compliance DM								
# 23.3C WAT exceeded						1		
% Compliance WAT						97%		
# 23.8°C DM exceeded								14
% Compliance DM								95%

[Monitoring station/Datalogger ID: 40T (0.5) GPS Coordinates: 39° 39’06.27”N 105°08’30.60”W; Sampling/ monitoring site in Bear Creek Reservoir by dam at profile station.]

Site 40T (1.0) Bear Creek Reservoir profile Station

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. WARM SEASONs		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (23.3°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (23.8°C)
Min		2.6				3.4	2.7	3.1
Max		24.4				23.4	24.1	24.1
Avg		15.3				15.6	15.3	15.8
Std. Dev.		6.2				5.9	6.2	6.2
Measurements		12380				36	3094	257
# 9°C WAT exceeded								
% Compliance WAT								
# 13°C DM exceeded								
% Compliance DM								
# 23.3C WAT exceeded						1		
% Compliance WAT						97%		
# 23.8°C DM exceeded								7
% Compliance DM								97%

[Monitoring station/Datalogger ID: 40T (1.0) GPS Coordinates: 39° 39’06.27”N 105°08’30.60”W; Sampling/ monitoring site in Bear Creek Reservoir by dam at profile station.]

Site 40T (1.5) Bear Creek Reservoir profile Station

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. WARM SEASONs		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (23.3°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (23.8°C)
Min		2.7				3.4	2.8	3.1
Max		24.1				23.3	24.0	24.0

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. WARM SEASONs		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (23.3°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (23.8°C)
Avg		15.3				15.6	15.3	15.6
Std. Dev.		6.14				5.90	6.14	6.17
Measurements		12380				36	3094	257
# 9°C WAT exceeded								
% Compliance WAT								
# 13°C DM exceeded								
% Compliance DM								
# 23.3C WAT exceeded						1		
% Compliance WAT						97%		
# 23.8°C DM exceeded								3
% Compliance DM								99%

[Monitoring station/Datalogger ID: 40T (1.5) GPS Coordinates: 39° 39'06.27"N 105°08'30.60"W; Sampling/ monitoring site in Bear Creek Reservoir by dam at profile station.]

Site 40T (2.0) Bear Creek Reservoir profile Station

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. WARM SEASONs		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (23.3°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (23.8°C)
Min		2.8				3.4	2.9	3.1
Max		24.0				23.3	23.9	23.9
Avg		15.2				15.5	15.2	15.5
Std. Dev.		6.1				5.9	6.1	6.2
Measurements		12380				36	3094	257
# 9°C WAT exceeded								
% Compliance WAT								
# 13°C DM exceeded								
% Compliance DM								
# 23.3C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded								3
% Compliance DM								99%

[Monitoring station/Datalogger ID: 40T (2.0) GPS Coordinates: 39° 39'06.27"N 105°08'30.60"W; Sampling/ monitoring site in Bear Creek Reservoir by dam at profile station.]

Segment 2

Site 45 Below Bear Creek Reservoir Trace weir in Bear Creek

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. WARM SEASONs		Oct 1-May 31 Stream Std. WAT (13.7°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (14.3°C)	June 1-Sept 30 Stream Std. WAT (27.5°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (28.6°C)
Min	1.7	3.6	3.1	1.8	2.8	5.4	3.7	5.1
Max	10.9	24.7	7.7	10.9	10.9	23.3	24.7	24.7
Avg	4.8	15.7	4.7	4.8	5.9	16.4	15.7	17.0
Std. Dev.	1.9	5.8	1.6	1.9	2.0	5.3	5.8	5.7

Datalogger Temperature Data 2011								
All Temperatures in °C	30-Min Temp. WARM SEASONs		Oct 1-May 31 Stream Std. WAT (13.7°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (14.3°C)	June 1-Sept 30 Stream Std. WAT (27.5°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (28.6°C)
Measurements	4675	11660	13	1168	97	38	2915	243
# 13.7°C WAT exceeded			0					
% Compliance WAT			100%					
# 14.3°C DM exceeded					0			
% Compliance DM					100%			
# 27.5°C WAT exceeded						0		
% Compliance WAT						100%		
# 28.6°C DM exceeded								0
% Compliance DM								100%

USGS Stream Flow Data Tables

During the Program, stream flows for Bear Creek were tracked using three gaging stations. The stations are the USGS station above Evergreen Lake (Segment 1a), the DWR/U.S. Army COE station above Morrison (Segment 1e) and the USGS station within Bear Creek Lake Park (Segment 1b). Weekly downloads of flow graphs were printed to document flows. Downloads were obtained at www.waterdata.usgs.gov. The available historic record for the gage above Evergreen Lake is 25 years. The available historic record for the gage above Morrison is 90 years (1899-2006— however, permanent reliable data was recorded from 1919). The available historic record for the USGS gage in Bear Creek Lake Park is 25 years. NOTE: Operation of this gage was discontinued on September 30, 2009. For the 2009 Program period, historical Minimum, Maximum and Average were calculated. A Deviation from Historic averages was also calculated; however, when both the Minimum and Maximum values for Deviation from Historic were negative, these values are interchanged to reflect the desired interpretation.

Table 63 2011 May Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) May 2011	Historic Daily Mean Flow (cfs) 25 Years for May	Deviation from Historic Flow (cfs)
1	12	60	-48
2	11	66	-55
3	11	69	-58
4	12	66	-54
5	12	70	-58
6	12	63	-51
7	13	57	-44
8	16	60	-44
9	17	55	-38
10	17	52	-35
11	20	51	-31
12	17	52	-35
13	19	46	-27
14	24	51	-27
15	19	50	-31
16	20	69	-49
17	27	63	-36
18	27	64	-37
19	30	68	-38
20	28	77	-49
21	28	84	-56
22	32	87	-55

Date	Daily Mean Flow (cfs) May 2011	Historic Daily Mean Flow (cfs) 25 Years for May	Deviation from Historic Flow (cfs)
23	34	86	-52
24	37	80	-43
25	32	78	-46
26	32	80	-48
27	36	77	-41
28	38	75	-37
29	38	86	-48
30	45	75	-30
31	35	72	-37
MIN	11	46	-58
MAX	45	87	-27
AVG	24.23	67.39	-43.16

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W

Table 64 2011 June Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) June 2011	Historic Daily Mean Flow (cfs) 25 Years for June	Deviation from Historic Flow (cfs)
1	35	79	
2	37	79	-44
3	45	78	-42
4	38	93	-33
5	40	129	-55
6	41	120	-89
7	43	118	-79
8	38	115	-75
9	38	143	-77
10	37	140	-105
11	36	118	-103
12	34	115	-82
13	30	120	-81
14	31	119	-90
15	31	122	-88
16	31	121	-91
17	31	130	-90
18	31	130	-99
19	29	130	-99
20	83	147	-101
21	55	126	-64
22	39	116	-71
23	36	112	-77
24	34	109	-76
25	32	105	-75
26	31	102	-73
27	31	98	-71
28	33	94	-67
29	32	93	-61
30	34	91	-61
MIN	29	78	-105
MAX	83	147	-33
AVG	37.20	113.07	-75.87

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W

Table 65 2011 July Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) July 2011	Historic Daily Mean Flow (cfs) 25 Years for July	Deviation from Historic Flow (cfs)
1	36	91	-55
2	33	85	-52
3	33	80	-47
4	31	86	-55
5	31	88	-57
6	37	91	-54
7	35	103	-68
8	61	88	-27
9	46	89	-43
10	61	81	-20
11	57	75	-18
12	91	71	20
13	81	68	13
14	93	67	26
15	64	70	-6
16	52	68	-16
17	48	71	-23
18	43	78	-35
19	52	72	-20
20	57	67	-10
21	45	68	-23
22	40	69	-29
23	36	74	-38
24	34	70	-36
25	33	59	-26
26	37	56	-19
27	46	51	-5
28	49	47	2
29	41	45	-4
30	39	43	-4
31	34	42	-8
MIN	31	42	-68
MAX	93	103	26
AVG	47.61	71.39	-23.77

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W

Table 66 2011 August Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) August 2011	Historic Daily Mean Flow (cfs) 25 Years for August	Deviation from Historic Flow (cfs)
1	34	41	-7
2	36	40	-4
3	62	40	22
4	42	39	3
5	43	38	5
6	35	35	0
7	31	35	-4
8	29	38	-9
9	28	37	-9
10	26	36	-10
11	26	35	-9

Date	Daily Mean Flow (cfs) August 2011	Historic Daily Mean Flow (cfs) 25 Years for August	Deviation from Historic Flow (cfs)
12	25	34	-9
13	24	35	-11
14	25	32	-7
15	26	30	-4
16	24	28	-4
17	26	28	-2
18	22	29	-7
19	21	29	-8
20	24	30	-6
21	24	31	-7
22	23	31	-8
23	23	61	-38
24	20	49	-29
25	20	36	-16
26	21	64	-43
27	23	41	-18
28	33	35	-2
29	25	36	-11
30	22	34	-12
31	20	45	-25
MIN	20	28	-43
MAX	62	64	22
AVG	27.84	37.16	-9.32

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W

Table 67 2011 September Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) September 2011	Historic Daily Mean Flow (cfs) 25 Years for September	Deviation from Historic Flow (cfs)
1	19	43	-24
2	18	42	-24
3	17	35	-18
4	17	33	-16
5	17	31	-14
6	17	31	-14
7	25	33	-8
8	32	35	-3
9	25	32	-7
10	22	29	-7
11	21	28	-7
12	20	28	-8
13	19	28	-9
14	20	26	-6
15	35	26	9
16	29	27	2
17	25	26	-1
18	23	25	-2
19	21	25	-4
20	20	24	-4
21	20	24	-4
22	19	25	-6

Date	Daily Mean Flow (cfs) September 2011	Historic Daily Mean Flow (cfs) 25 Years for September	Deviation from Historic Flow (cfs)
23	19	26	-7
24	18	25	-7
25	18	24	-6
26	18	25	-7
27	17	24	-7
28	17	24	-7
29	17	26	-9
30	17	29	-12
MIN	17	24	-24
MAX	35	43	9
AVG	20.73	28.63	-7.90

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W

Table 68 2011 May Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) May 2011	Historic Daily Mean Flow (cfs) 91 Years for May	Deviation from Historic Flow (cfs)
1	14.4	72	-57.6
2	13.2	73	-59.8
3	11.6	73	-61.4
4	10.6	71	-60.4
5	10.7	76	-65.3
6	11.5	71	-59.5
7	11.4	67	-55.6
8	12.6	71	-58.4
9	14.4	67	-52.6
10	15	64	-49
11	25.5	61	-35.5
12	25.1	60	-34.9
13	22.9	58	-35.1
14	26.2	59	-32.8
15	25.6	61	-35.4
16	23	86	-63
17	27.1	78	-50.9
18	31.2	76	-44.8
19	46.9	75	-28.1
20	42.5	81	-38.5
21	38.5	90	-51.5
22	38.4	92	-53.6
23	40.4	92	-51.6
24	45.7	85	-39.3
25	42.5	84	-41.5
26	39.9	85	-45.1
27	39.2	82	-42.8
28	41.1	81	-39.9
29	41.2	102	-60.8
30	45.5	85	-39.5
31	36.2	80	-43.8
MIN	10.6	58	-65.3
MAX	46.9	102	-28.1
AVG	28.06	76.06	-48.00

USGS 06710500 GPS Coordinates: 39.6530°N, 105.1950°W

Table 69 2011 June Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) June 2011	Historic Daily Mean Flow (cfs) 25 Years for June	Deviation from Historic Flow (cfs)
1	35.2	84	-48.8
2	36.2	85	-48.8
3	40	82	-42
4	37.3	84	-46.7
5	36.2	126	-89.8
6	36.8	117	-80.2
7	38.3	117	-78.7
8	33.8	112	-78.2
9	34.6	136	-101.4
10	35.8	182	-146.2
11	32.2	134	-101.8
12	31.8	126	-94.2
13	27.4	128	-100.6
14	27.3	130	-102.7
15	26.9	128	-101.1
16	25.2	123	-97.8
17	27.7	128	-100.3
18	30.5	132	-101.5
19	25.1	128	-102.9
20	88.9	149	-60.1
21	60.1	126	-65.9
22	40.7	112	-71.3
23	35.3	107	-71.7
24	32.3	100	-67.7
25	27.6	97	-69.4
26	26.8	94	-67.2
27	25.9	94	-68.1
28	27.1	86	-58.9
29	25.8	85	-59.2
30	27.2	84	-56.8
MIN	25.1	82	-146.2
MAX	88.9	182	-42
AVG	34.53	113.87	-79.33

USGS 06710500 GPS Coordinates: 39.6530°N, 105.1950°W

Table 70 2011 July Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) July 2011	Historic Daily Mean Flow (cfs) 25 Years for July	Deviation from Historic Flow (cfs)
1	31.6	82	-50.4
2	27.5	78	-50.5
3	26.6	73	-46.4
4	25.1	75	-49.9
5	24.6	80	-55.4
6	30.4	82	-51.6
7	30.2	110	-79.8
8	50.2	90	-39.8
9	53.2	88	-34.8
10	56.1	80	-23.9
11	56.9	76	-19.1

Date	Daily Mean Flow (cfs) July 2011	Historic Daily Mean Flow (cfs) 25 Years for July	Deviation from Historic Flow (cfs)
12	75.3	71	4.3
13	80.1	68	12.1
14	95	67	28
15	72.1	70	2.1
16	57.3	67	-9.7
17	53.3	70	-16.7
18	48.5	77	-28.5
19	57	73	-16
20	68.4	68	0.4
21	53	67	-14
22	46.7	67	-20.3
23	36.9	66	-29.1
24	35.3	72	-36.7
25	34.8	64	-29.2
26	36.7	60	-23.3
27	52.7	59	-6.3
28	47.9	52	-4.1
29	43.4	49	-5.6
30	37.2	46	-8.8
31	34.7	43	-8.3
MIN	24.6	43	-79.8
MAX	95	110	28
AVG	47.70	70.65	-22.95

USGS 06710500 GPS Coordinates: 39.6530°N, 105.1950°W

Table 71 2011 August Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) August 2011	Historic Daily Mean Flow (cfs) 25 Years for August	Deviation from Historic Flow (cfs)
1	32	44	-12
2	36.2	43	-6.8
3	57.4	44	13.4
4	51.1	42	9.1
5	47	42	5
6	35.5	37	-1.5
7	31.7	35	-3.3
8	27.5	37	-9.5
9	26.1	38	-11.9
10	25.5	37	-11.5
11	24.1	34	-9.9
12	23.5	33	-9.5
13	20.6	37	-16.4
14	22.1	31	-8.9
15	22.4	30	-7.6
16	22.5	28	-5.5
17	24.3	27	-2.7
18	21.6	28	-6.4
19	19.7	28	-8.3
20	21.3	28	-6.7
21	23.1	30	-6.9
22	22.1	28	-5.9
23	22	62	-40

24	18.6	56	-37.4
25	17.6	34	-16.4
26	19.7	58	-38.3
27	19.5	43	-23.5
28	38.2	33	5.2
29	39.4	33	6.4
30	21	32	-11
31	19.5	40	-20.5
MIN	17.6	27	-40
MAX	57.4	62	13.4
AVG	27.51	37.16	-9.65

USGS 06710500 GPS Coordinates: 39.6530°N, 105.1950°W

Table 72 2011 September Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) September 2011	Historic Daily Mean Flow (cfs) 25 Years for September	Deviation from Historic Flow (cfs)
1	15.6	39	-23.4
2	15.8	41	-25.2
3	15.7	34	-18.3
4	15.6	30	-14.4
5	15.6	30	-14.4
6	14.8	29	-14.2
7	20.4	31	-10.6
8	33.7	32	1.7
9	24.5	33	-8.5
10	20.7	30	-9.3
11	17.5	27	-9.5
12	18.3	25	-6.7
13	17.4	28	-10.6
14	18.7	27	-8.3
15	42.3	25	17.3
16	35.7	25	10.7
17	26.8	25	1.8
18	25	23	2
19	20.6	23	-2.4
20	20.6	24	-3.4
21	19.3	22	-2.7
22	20.8	22	-1.2
23	17.9	23	-5.1
24	18.2	23	-4.8
25	17.4	23	-5.6
26	17.4	22	-4.6
27	16.8	23	-6.2
28	16	23	-7
29	16.2	25	-8.8
30	16.2	29	-12.8
MIN	14.8	22	-25.2
MAX	42.3	41	17.3
AVG	20.38	27.20	-6.82

USGS 06710500 GPS Coordinates: 39.6530°N, 105.1950°W

Weather Data

Local weather data was documented at the Evergreen Metropolitan District's WWTP. The plant has been operating the National Weather Service reporting station since EMD assumed operations of the plant in 1974. Online historical records however, are available from 1961 through 2006. Historical weather data obtained from the National Oceanographic and Atmospheric Administration/National Weather Service, High Plains Climate Center.

Maximum and minimum air temperature values along with precipitation measurements recorded each morning. Daily readings entered into a NWS software program. Local weather statistics are summarized, comparing 2011 monthly maximum, minimum and mean air temperatures and monthly precipitation to 47-year (1961-2011) historical data.

Table 73 Weather Data May-September 2011 Summary

Monthly Weather Data	May 2011	June 2011	July 2011	August 2011	September 2011
Air Temp Low Max (°F)	49	51	55	53	51
Air Temp High Max (°F)	78	88	90	90	88
Air Temp High Avg (°F)	58	76	82	83	71
Total Precip (in.)	3.41	1.75	4.87	1.19	1.41
Days of Precip.	11	3	17	8	8

Table 74 2011 Weather Data vs. Historical Weather Data (50 years 1961-2011)

	Avg Daily Min (°F)	Avg Daily Max (°F)	Avg Mon. Mean (°F)	Precip (in.)
May 2011	33.39	57.87	45.63	3.41
May Hist	33.9	65.2	49.6	2.57
% Deviation	99%	89%	92%	133%
June 2011	41.8	76.27	59.03	1.75
June Hist	41.1	75.3	58.2	2.14
% Deviation	102%	101%	101%	82%
July 2010	48.87	82.03	66.5	4.87
July Hist	46.8	81.6	64.2	2.23
% Deviation	104%	101%	104%	218%
August 2010	48.42	83.16	65.79	1.19
August Hist	45.3	79.3	62.4	2.31
% Deviation	107%	105%	105%	52%
Sept. 2010	38.83	70.63	54.73	1.41
Sept. Hist	37.1	72.1	54.6	1.47
% Deviation	105%	98%	100%	96%

Stream Flow vs. Local Weather

Stream flows, as measured at the USGS gage above Evergreen Lake, were compared to local weather observations obtained from the NWS reporting station located at the EMD WWTP. The following tables illustrate the relationship between high air temperatures and measured precipitation, and their effect on stream flows measured above Evergreen Lake.

Table 75 2011 May Bear Creek Evergreen vs. Weather Data

Date	May 2011 Daily Mean Flow (cfs)	May 2011 Daily Air Max Temp (°F)	May 2011 Precip. (in.)
1	14.4	40	
2	13.2	40	0.01

Date	May 2011 Daily Mean Flow (cfs)	May 2011 Daily Air Max Temp (°F)	May 2011 Precip. (in.)
3	11.6	43	
4	10.6	61	
5	10.7	60	
6	11.5	65	
7	11.4	71	
8	12.6	77	
9	14.4	78	
10	15	73	
11	25.5	66	0.64
12	25.1	39	0.72
13	22.9	49	T
14	26.2	59	
15	25.6	40	0.01
16	23	38	T
17	27.1	59	
18	31.2	62	0.13
19	46.9	50	1.03
20	42.5	39	0.51
21	38.5	51	0.05
22	38.4	63	T
23	40.4	68	T
24	45.7	63	0.15
25	42.5	49	0.15
26	39.9	59	T
27	39.2	69	
28	41.1	64	
29	41.2	57	0.01
30	45.5	73	
31	36.2	69	
MIN	10.6	38	0.01
MAX	46.9	78	1.03
AVG	28.06	57.87	0.31
TOTAL			3.41

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W Daily Mean flows were obtained from the USGS gaging station above Evergreen Lake. Weather data obtained from the NWS reporting station located at the EMD WWTP.

Table 76 2011 June Bear Creek Evergreen vs. Weather Data

Date	June 2011 Daily Mean Flow (cfs)	June 2011 Daily Max Air Temp (°F)	June 2011 Precip (in.)
1	35.2	73	
2	36.2	81	
3	40	82	
4	37.3	66	
5	36.2	72	
6	36.8	81	
7	38.3	85	
8	33.8	81	
9	34.6	70	
10	35.8	61	
11	32.2	70	
12	31.8	77	

Date	June 2011 Daily Mean Flow (cfs)	June 2011 Daily Max Air Temp (°F)	June 2011 Precip (in.)
13	27.4	81	
14	27.3	74	
15	26.9	77	
16	25.2	82	
17	27.7	79	T
18	30.5	65	0.13
19	25.1	76	
20	88.9	70	1.54
21	60.1	58	0.08
22	40.7	73	
23	35.3	77	
24	32.3	83	
25	27.6	82	
26	26.8	79	
27	25.9	85	
28	27.1	73	
29	25.8	88	
30	27.2	87	
MIN	25.1	58	0.08
MAX	88.9	88	1.54
AVG	34.53	76	0.58
TOTAL			1.75

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W Daily Mean flows were obtained from the USGS gaging station above Evergreen Lake. Weather data obtained from the NWS reporting station located at the EMD WWTP.

Table 77 2011 July Bear Creek Evergreen vs. Weather Data

Date	July 2011 Daily Mean Flow (cfs)	July 2011 Daily Max Air Temp (°F)	July 2011 Precip (in.)
1	31.6	83	0.17
2	27.5	80	
3	26.6	77	
4	25.1	87	
5	24.6	90	
6	30.4	80	0.15
7	30.2	76	0.04
8	50.2	78	0.41
9	53.2	85	0.32
10	56.1	76	0.16
11	56.9	77	0.12
12	75.3	76	0.34
13	80.1	Not Recorded	0.52
14	95	79	0.39
15	72.1	79	0.49
16	57.3	82	
17	53.3	84	0.08
18	48.5	88	
19	57	86	
20	68.4	86	1.04
21	53	83	0.22
22	46.7	81	0.05
23	36.9	87	

Date	July 2011 Daily Mean Flow (cfs)	July 2011 Daily Max Air Temp (°F)	July 2011 Precip (in.)
24	35.3	86	
25	34.8	85	
26	36.7	84	T
27	52.7	80	0.33
28	47.9	80	T
29	43.4	79	0.04
30	37.2	81	
31	34.7	86	
MIN	24.6	76	0.04
MAX	95	90	1.04
AVG	47.70	82	0.29
TOTAL			4.87

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W Daily Mean flows were obtained from the USGS gaging station above Evergreen Lake. Weather data obtained from the NWS reporting station located at the EMD WWTP.

- Data Missing Not Recorded

Table 78 2011August Bear Creek Evergreen vs. Weather Data

Date	August 2011 Daily Mean Flow (cfs)	August 2011 Daily Max Air Temp (ºF)	August 2011 Precip (in.)
1	32	88	
2	36.2	84	
3	57.4	76	0.2
4	51.1	80	0.11
5	47	76	
6	35.5	83	
7	31.7	84	
8	27.5	88	
9	26.1	86	
10	25.5	88	
11	24.1	79	
12	23.5	87	
13	20.6	79	
14	22.1	81	
15	22.4	83	0.03
16	22.5	84	
17	24.3	79	
18	21.6	84	
19	19.7	87	
20	21.3	82	0.13
21	23.1	79	
22	22.1	84	0.02
23	22	84	T
24	18.6	90	
25	17.6	87	T
26	19.7	88	0.14
27	19.5	81	
28	38.2	85	0.5
29	39.4	84	
30	21	78	
31	19.5	80	0.06
MIN	17.6	76	0.02

Date	August 2011 Daily Mean Flow (cfs)	August 2011 Daily Max Air Temp (ºF)	August 2011 Precip (in.)
MAX	57.4	90	0.5
AVG	27.51	83.16	0.15
TOTAL			1.19

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W Daily Mean flows were obtained from the USGS gaging station above Evergreen Lake. Weather data obtained from the NWS reporting station located at the EMD WWTP.

Table 79 2011 September Bear Creek Evergreen vs. Weather Data

Date	September 2011 Daily Mean Flow (cfs)	September 2011 Daily Max Air Temp (ºF)	September 2011 Precip (in.)
1	15.6	88	
2	15.8	87	
3	15.7	78	0.2
4	15.6	63	
5	15.6	70	
6	14.8	80	
7	20.4	69	0.07
8	33.7	52	0.42
9	24.5	66	
10	20.7	69	T
11	17.5	70	
12	18.3	75	
13	17.4	75	0.01
14	18.7	72	
15	42.3	53	0.61
16	35.7	57	0.06
17	26.8	68	0.02
18	25	66	0.02
19	20.6	72	
20	20.6	74	
21	19.3	58	
22	20.8	58	
23	17.9	71	
24	18.2	75	
25	17.4	77	
26	17.4	77	
27	16.8	80	
28	16	76	
29	16.2	83	
30	16.2	60	
MIN	14.8	52	0.01
MAX	42.3	88	0.61
AVG	20.38	70.63	0.18
TOTAL			1.41

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W Daily Mean flows were obtained from the USGS gaging station above Evergreen Lake. Weather data obtained from the NWS reporting station located at the EMD WWTP.