



# Chatfield Watershed Authority

*The Chatfield Watershed Authority promotes protection of water quality in the Chatfield Watershed for recreation, fisheries, drinking water supplies, and other beneficial uses.*



*photos from the 1965 flood*



# CHATFIELD WATERSHED AUTHORITY

## 2009 ANNUAL REPORT

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### *IN MEMORY*

THIS REPORT IS DEDICATED TO CHATFIELD WATERSHED AUTHORITY BOARD MEMBER AND  
COLORADO WATER QUALITY LEADER



PAUL GRUNDEMANN (1949-2010)

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## EXECUTIVE SUMMARY

The Chatfield Watershed 2009 Annual Report provides the Water Quality Control Commission (Commission) an update on the status of Chatfield Reservoir water quality and watershed health as well as a review of the Chatfield Watershed Authority (Authority) progress towards achieving water quality standards in 2009.

Control Regulation No. 73 changed substantially in 2009. The Commission adopted new water quality standards for Chatfield Reservoir, including;

- Changing the chlorophyll-a goal to a standard of 10- $\mu\text{g/L}$ ,
- Adopting a total phosphorus (TP) standard of 30- $\mu\text{g/L}$ ,
- Introducing attainment thresholds for chlorophyll-a of 11.2- $\mu\text{g/L}$  and total phosphorus of 35- $\mu\text{g/L}$ , and,
- Reducing the total maximum annual load (TMAL) by approximately 60% to 19,600 pounds/year.

The growing season (July through September) TP concentration of 18.33- $\mu\text{g/L}$  was less than the 30- $\mu\text{g/L}$  reservoir standard. The TMAL was met at 11,049 pounds with 135,032 acre feet (ac-ft) of flow. Each of the Publicly Owned Treatment Works (POTWs) discharged below their wasteload allocations, well below the 7,533 pound limit at 2,719 pounds. In addition, best management practices (BMPs) are being implemented in the basin with the intent of providing beneficial effects which reduce phosphorus loads to Chatfield Reservoir. However, the growing season chlorophyll-a of 13.11- $\mu\text{g/L}$  was more than the new 10- $\mu\text{g/L}$  standard established by the Commission to meet beneficial uses and greater than the 11.2- $\mu\text{g/L}$  attainment threshold.

The Authority carefully tracked the correlation of chlorophyll-a to TP, following the analysis completed by Dr. William Lewis as part of the Rulemaking Hearing. In 2009, chlorophyll-a was only weakly correlated with TP, with a regression analysis ( $R^2$ ) value of only 0.0151. Curiously, the highest chlorophyll-a measurement was in September, while the highest total phosphorus (TP) measurement was in October. Investigating the relationship between chlorophyll-a and other variables in the reservoir will be the subject of future efforts.

Funding of the Authority's efforts to protect water quality in the Chatfield Basin and meet the requirements of the Control Regulation remains of critical importance. The Authority prides itself on fulfilling its mission and obligations while employing lean operational practices. As a voluntary and non-profit agency, the Authority relies on member dues, volunteerism from members and supporters, leveraging of funding opportunities, and grant funding.

The recent economic downturn has impacted watershed stakeholders and members alike, further highlighting the need to maintain careful fiscal controls. The resignation of Lockheed Martin from the Authority has negatively impacted revenues. Projected additional revenue declines for 2010 require that the Authority continue to employ strategic options for long-term sustainable funding.

The Authority has identified priority nonpoint source controls within a list of capital projects, identified in Table EX-1. These projects cannot be funded under existing revenue sources and

levels, and require development of alternative funding sources as noted above and partnerships.

<b>Table EX-1. Proposed Capital Projects Requiring Funding</b>	
<b>1</b>	<b>Construct nonpoint source projects in the Plum Creek and South Platte River watershed in conjunction with wetlands enhancement and trail corridor</b> In coordination with stakeholders like the Chatfield Conservation Network and GOCO design and implement projects along the Plum Creek riparian corridor that restore the stream, wetlands habitat, and aquatic habitat while improving water quality.
<b>2</b>	<b>Sediment control and streambank stabilization along East Plum Creek</b> In coordination with municipal jurisdictions, identify stormwater improvements along reaches of Plum Creek that are highly erosive and require streambank stabilization. Existing streambank stabilization projects in Castle Rock have already been identified within the watershed. Engineering design techniques and green approaches can be utilized to strengthen streambanks while providing water quality enhancement.
<b>3</b>	<b>Enhance wetlands habitat and trail corridor along Plum Creek</b> In coordination with the Chatfield Conservation Network, identify key reaches of Plum Creek slated for conservation.
<b>4</b>	<b>Implement livestock and stable management projects to control livestock wastes from entering waterways</b> In conjunction with USDA NRCS, implement demonstration projects with agricultural users in the study area. Manure management is a key component of the project.
<b>5</b>	<b>Implement West Plum Creek ecosystem improvements</b> Install drop structures, stabilize stream reaches and create pools that promote fisheries habitat and reduce sediment and nutrient load.
<b>6</b>	<b>Pine beetle management</b> Implement watershed management strategies to stabilize disturbed areas. Stabilize disturbed areas with vegetation. Consider use of check dams in tributaries along South Platte River in conjunction with re-vegetation where sediment control may be particularly significant.
<b>7</b>	<b>Convert ISDS to conventional sewer along the US 85 corridor</b> The US 85 corridor has a proliferation of ISDS, many of which were constructed in the early 1900's and are located in the Plum Creek alluvium. Conversion of ISDS to conventional sewer would reduce NPS loads from ISDS. Douglas County has spearheaded a wastewater study that evaluated options to improve water quality through the elimination of ISDS in the study area. The process recommended funding and alignment options to convey wastewater to existing treatment facilities in the watershed.
<b>Special Studies Requiring Funding</b>	
<b>1</b>	<b>Conduct water quality monitoring and data collection to quantify phosphorus removal effectiveness of nonpoint source structures</b> Implement water quality monitoring network for nonpoint source [stormwater] improvements, upstream and downstream of improvements.
<b>2</b>	<b>Install shallow groundwater monitoring wells</b> Conduct groundwater sampling program to characterize flow and quality (profiling nutrient content) at specific locations in watershed. A monitoring well network, installed along Plum Creek and the South Platte River, will determine groundwater flows and nutrient transport associated with that alluvial groundwater column.
<b>3</b>	<b>Quantify ISDS impact on water quality and nutrient loading</b> As part of this study, the attenuation of wastewater flows from ISDS in the sensitive areas of the basin would be identified. Groundwater and surface water sampling will take place at locations upstream and downstream of concentrated ISDS locations to determine ISDS impact to water quality throughout the watershed.
<b>4</b>	<b>Evaluate in-lake treatment options for Chatfield Reservoir</b> An evaluation of in-lake treatment technologies and costs will be conducted to support attainment of the water quality standards and uses.
<b>5</b>	<b>Characterize watershed and pollutant sources.</b> A thorough watershed characterization will be conducted along with identification of pollutant sources. Watershed hydrology data (flow, precipitation, temperature, solar radiation) shall be summarized to support watershed model efforts. A GIS tool will be developed that that will provide a basis for future watershed modeling tools.
<b>6</b>	<b>Conduct a feasibility study of nutrient removal from point sources.</b> A study shall be conducted to determine the cost and water quality benefits of removing a pound of phosphorous for each entity having a wasteload allocation in the watershed.

<b>7</b>	<p><b>Characterize watershed hydrology</b>  Watershed hydrology data is presently obtained from the US Army Corps of Engineers (flow, precipitation, temperature, solar radiation). As part of this study, additional watershed hydrology data from the watershed shall be summarized to support watershed model efforts.</p>
<b>8</b>	<p><b>Water quality monitoring to understand fate and transport issues.</b>  Routine water quality monitoring is insufficient. Currently only one location is monitored in each of the two sub-watershed locations at Plum Creek upstream of the Reservoir and South Platte River upstream of the Reservoir. Additional data collection from the upper reaches of the sub-watersheds is needed to understand the fate and transport of nutrients. Additional water quality sampling and analyses shall be conducted to determine nutrient fate and transport ratios and calibrate watershed water quality models that need to be developed for use in TMAL development and implementation (see description of watershed and reservoir models needed under “Models and Predictive Tools # 1, below)</p>
<b>Models and Predictive Tools Requiring Funding</b>	
<b>1</b>	<p><b>Develop a watershed loading model for simulating pollutant loading to the Reservoir.</b>  As part of this modeling effort the fate and transport of both nutrients and sediment in the watershed will be incorporated. The watershed model will feed data into the hydrodynamic reservoir model which has already been developed as part of the Chatfield Reallocation Study. A through watershed model will be developed to pin point locations with heavy runoff events that exhibit a higher potential for soil erosion and nutrient transport. This model will assist in the determination of location for nonpoint source projects in the watershed. The selected watershed loading model should strive to predict nitrogen, phosphorus and suspended solids loading on a seasonal basis. The selected model should also be constructed so that multiple calibration locations can be simultaneously considered.</p>

In 2009 the Authority requested Section 319 grant funding to leverage dollars from other sources for the purpose of implementing water quality priorities in the Chatfield Watershed. Because the South Platte Basin is a Section 319 funding priority in 2009 we are hopeful that two project proposals under consideration are awarded grants;

- Development of a Chatfield Watershed Plan that comports with US EPA criteria for qualifying for subsequent grant funding, and
- Design and construction of stream restoration improvements along East Plum Creek.

Cost-savings will be also realized through the streamlining of the 2010 Annual Report to match the formatting and detail of the annual Authority brochure. The report will continue to meet reporting requirements of Control Regulation No. 73. In addition, the Authority’s limited annual financial resources can be leveraged through continued volunteer efforts, stewardship in the Chatfield Watershed, and implementation of short-term and long-term funding strategies. These measures will support the Authority’s mission to promote protection of water quality in the Chatfield Watershed for recreation, fisheries, drinking water supplies, and other beneficial uses.

## 1.0 INTRODUCTION

The mission of the Chatfield Watershed Authority is:

*“... to promote protection of water quality in the Chatfield Watershed for recreation, fisheries, drinking water supplies, and other beneficial uses by protecting water quality”.*

### Purpose

The purpose of the 2009 Annual Report is to provide a status update on water quality in Chatfield Reservoir and its watershed, highlighting information required by Control Regulation #73, including;

- Compliance with the watershed regulatory framework,
- Results from monitoring activities,
- Point source loadings, permit compliance, trades, and wastewater treatment facilities,
- Nonpoint source control efforts, load reductions, and management strategies, and
- Recommendations for improving water quality.

The Authority activities described in this report are part of an integrated water quality management and implementation program to protect or attain established water quality standards and beneficial uses within the Chatfield Watershed.

Authority members are as diverse as the over 300 square mile watershed and its varied land uses, including representatives of counties, municipalities, special districts, state and federal agencies, industrial complexes, retreats and special facilities (Table 1-1).





**Table 1-1. Summary of Authority and Associate Members**

Counties	Towns & Communities	Special Districts	Industry & Agencies	Non Profit & Special Interest
Jefferson	City of Littleton	Plum Creek Wastewater Authority	Lockheed Martin Space Systems Company ( <b>Not a POTW</b> )	Ponderosa Retreat & Conference Center ( <b>Not a POTW</b> )
Douglas	Town of Castle Rock	Castle Pines Metro District	Denver Water	Sacred Heart Retreat ( <b>Not a POTW</b> )
	Town of Larkspur	Centennial Water & Sanitation District	U.S. Army Corps of Engineers	Coalition for the Upper South Platte
	Town of Louviers	Dominion Water & Sanitation District	Tri-County Health Department	Highlands Ranch Law Enforcement Training Facility ( <b>Not a POTW</b> )
	Town of Sedalia	Sedalia Water & Sanitation District	Water Quality Control Division	
	City of Castle Pines North	Louviers Water and Sanitation District	Denver Regional Council of Governments	
		Roxborough Water and Sanitation District	Colorado Department of Parks and Outdoor Recreation - Chatfield State Park	
		Jackson Creek Ranch Metro District	Colorado Division of Wildlife	
		Perry Park Water & Sanitation District		
		South Santa Fe Metro District		

\* List includes Authority members pursuant to the *Memorandum of Understanding for Establishing a Management Agency in the Chatfield Watershed* in addition to associate members

The Chatfield Watershed (Figure 1-1) includes Plum Creek, Deer Creek, Massey Draw, and the portion of the South Platte River from Strontia Springs Reservoir to Chatfield Reservoir. The Chatfield Watershed includes those areas tributary to the Plum Creek drainage or directly connected to the Chatfield Reservoir, namely, all portions of Plum Creek and its tributaries (including segments 8, 9, 10a, 10b, 11a, 11b, 12 and 13) and the South Platte River downstream of Strontia Springs Reservoir outfall (including segments 6a, 6b, and 7).

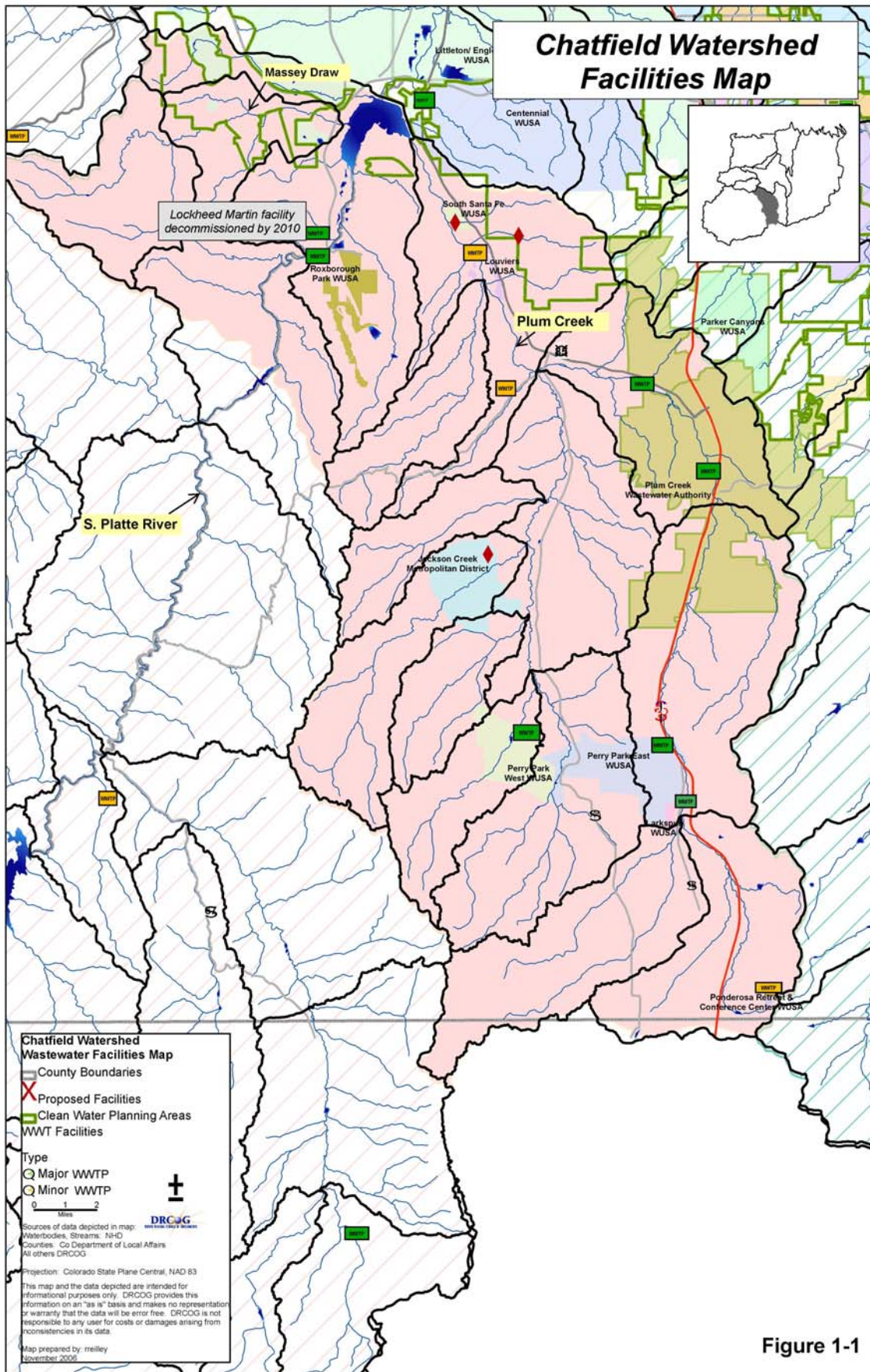


Figure 1-1

## 2.0 RESERVOIR REGULATORY FRAMEWORK

In January 2009, the Commission completed a rulemaking hearing to consider revisions to water quality standards in the Chatfield Basin, specifically, Regulations #38 and #73. Table 2-1 summarizes new water quality requirements that the Commission adopted.

<b>Table 2-1. Total Phosphorus and Chlorophyll-a Compliance (Growing Season)</b>	
	<b>Newly Promulgated Standards (2009)</b>
<b>TP Standard (Growing Season)</b>	30 µg/L
<b>Chlorophyll-a Standard (Growing season)</b>	10 µg/L
<b>Exceedance Frequency</b>	1 in 5 years
<b>Years of Seasonal Record</b>	1983-2009
<b>Percent of Historical Seasonal Compliance to the New Phosphorus Standard</b>	77%
<b>Percent of Historical Seasonal Compliance to the New Chlorophyll-a Standard</b>	85%
<b>TMAL = 19,600 lbs (Median flow of 100,860 af/yr)</b>	

A TP growing season (July-September) standard of 30-µg/L (with an assessment threshold of 35-µg/L for TP) was adopted. The growing season chlorophyll-a goal was changed to a standard of 10-µg/L (with an assessment threshold of 11.2-µg/L). Each new water quality standard allows an exceedance frequency of 1 in 5 years. Assessment threshold values were introduced in terms of attainment criteria for the Reservoir. The Commission also adopted a revised TMAL of 19,600 lbs/year at a median flow of 100,860 acre-feet/year. The Commission adopted language that existing wasteload allocations would remain unchanged, and be controlling limits for discharge permits, until there is development of the revised TMAL. Activities to support the TMAL development would be based on the availability of funds. Until revisions to meet the new TMAL have been adopted by the Commission and Division, the existing TMAL allocations among sources, shown in Table 2-2, remain in effect.

<b>Table 2-2. TMAL Total Phosphorus Allocations Distributed Among Sources</b>	
<b>Allocation Type</b>	<b>Total Phosphorus Pounds/Year</b>
Chatfield Watershed	40,894
Reservoir Base-Load	13,400
Background Sources	19,961
Wasteload Allocation (Point Sources) <sup>1</sup>	7,533
Upper South Platte River Watershed <sup>2</sup>	17,930
Reservoir Base-Load	6,000
Background Sources	11,842
Summit County Wasteload Allocation	88
<b>TOTAL<sup>3</sup></b>	<b>58,824</b>

Notes:

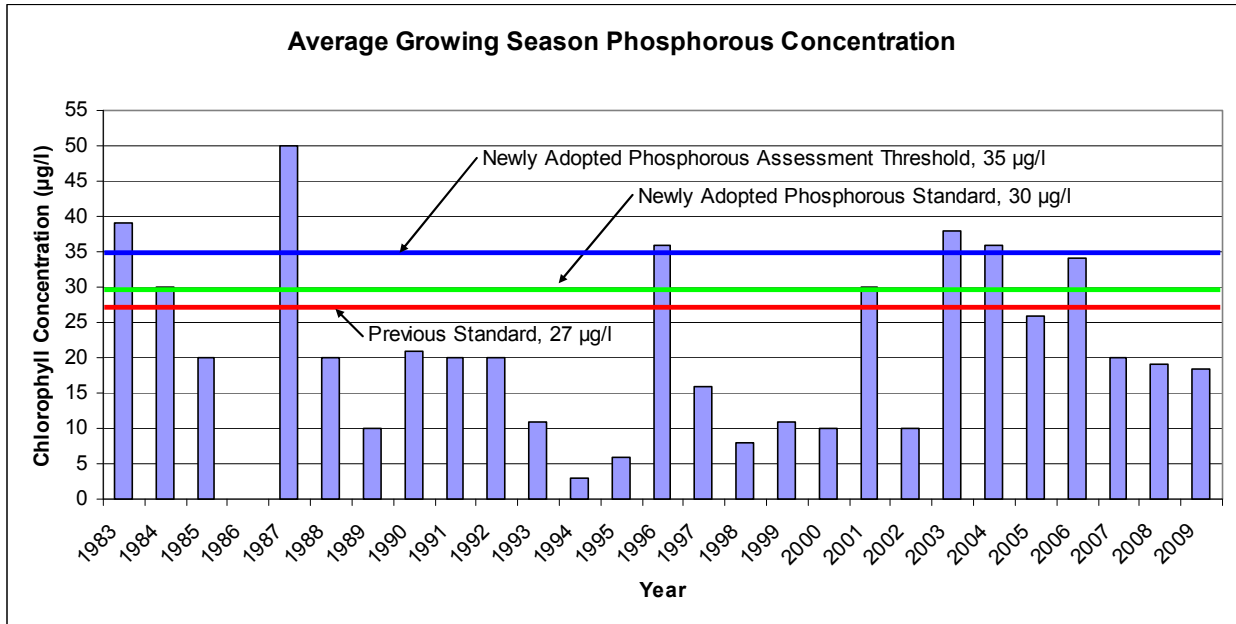
1. Point source discharge permit holders and regulated stormwater permittees who are in compliance with their permit limits and terms for a constituent will not have those limits or terms modified prior to any future adjustment of classifications or standards by the Commission to the extent any observed water quality standards exceedances are attributable to other factors, such as wildfires that are beyond the control of the permit holders.
2. Loadings from the Upper South Platte River watershed include all point sources upstream of the Strontia Springs Reservoir outfall, including 88 pounds of phosphorus per year from wastewater originating in Summit County and discharged directly into the Roberts Tunnel, and all nonpoint sources above the Strontia Springs Reservoir outfall.
3. While the TMAL total phosphorus poundage allocation formula remains unchanged, the amount of total phosphorus assigned to the Chatfield Watershed is reduced because of approved nonpoint source to point source trades.

## **2.1 Compliance with the Water Quality Standards**

Historically, the growing season mean TP concentrations have ranged between 3-µg/L to 50-µg/L and averaged 22-µg/L during the 26 year period of record (Figure 2-1). TP in the Reservoir for the 2009 growing season average was 18.3-µg/L, in compliance with the newly promulgated 30 µg/L TP standard. As summarized in Table 2-1, the 2009 TP standard, with an exceedance frequency of 1-in-5 years has been attained 77% of the time. The attainment criteria 35-µg/L TP standard, with an exceedance frequency of 1-in-5 years, has met the standard 81% of the time. A comparison of historical data and the TP attainment criteria of 35-µg/L indicate five exceedances during the 25 years of record.

As shown on Figure 2-2, the 2009 growing season chlorophyll-a of 13.1µg/L exceeds the new water quality standard of 10 µg/L and indicates an increase from prior years; however, the 1 in 5 year exceedance criteria has been attained. An evaluation of 2009 data (Figure 2-3) does not indicate a good correlation between TP and chlorophyll-a ( $R^2 = .0151$ ). This is contrary to the basis of the new standard which is founded on a stronger correlation between TP and chlorophyll-a. The Authority maintains that the reservoir chlorophyll-a concentration is only weakly correlated to TP with an  $R^2$  value of 0.0151.

**Figure 2-1. Seasonal Total Phosphorus Compliance (1983 - 2009)**



**Figure 2-2. Seasonal Chlorophyll-a Compliance (1983 – 2009)**

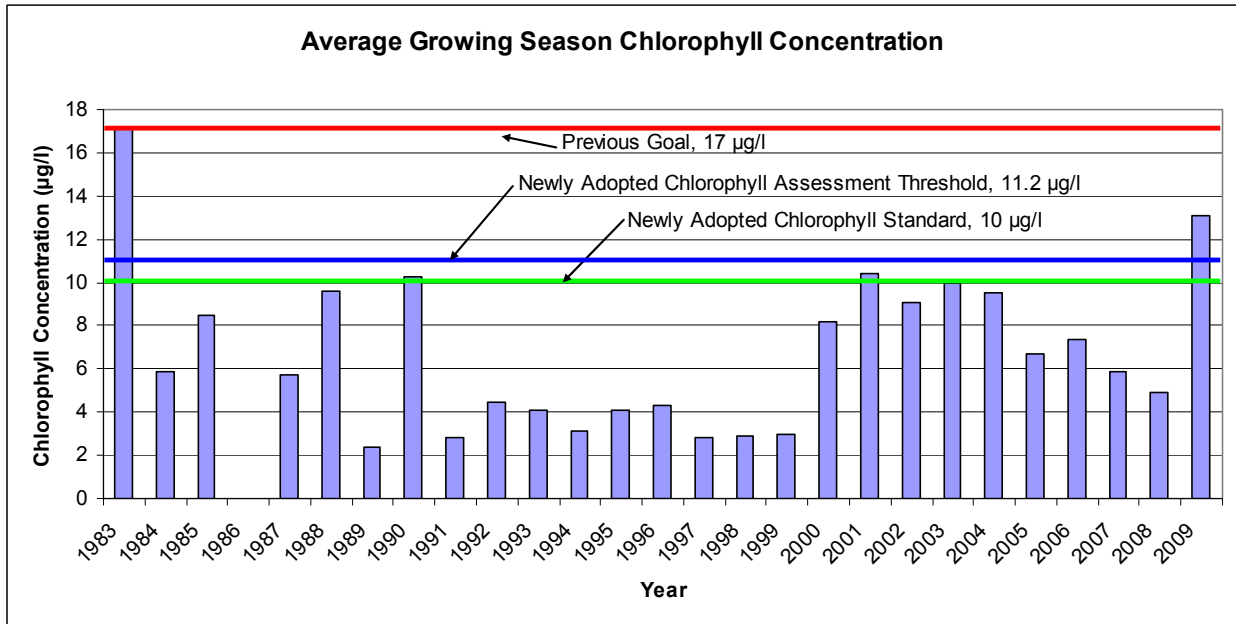
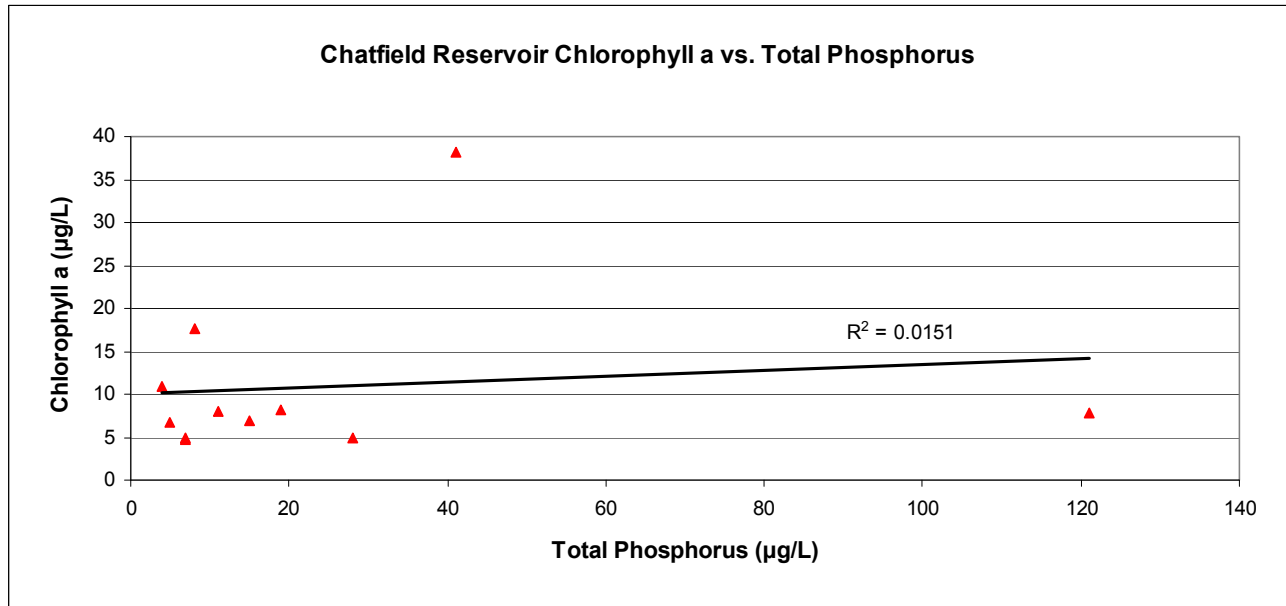


Figure 2-3. 2009 Chlorophyll-a vs. Total Phosphorus



### 2.1.1 Total Phosphorus Loading

Annual measured flows and calculated loads from the South Platte and Plum Creek are summarized in Table 2-3. In 2009, the TP load to the reservoir from all inflow sources, including alluvial flow and precipitation was calculated at 11,049 pounds. This is below the newly promulgated TMAL of 19,600 pounds. Inflows to Chatfield Reservoir were less than previous years, estimated at 135,032 acre-feet/year. While Plum Creek comprised approximately 20% of the inflow to the reservoir, it contributed an estimated 67% of the TP load to the reservoir. The South Platte River contributed 76% of the inflow and 24% of the TP load (Figure 2-3). Typically, snowmelt and stormwater runoff events, which are nonpoint source events, contribute a large portion of the total annual load. In 2009, NPS contributed 73% of the total load. Appendix B provides the detail summary of the load calculations and data used. As described in Section 4.0, all POTWs were below their respective wasteload allocations.

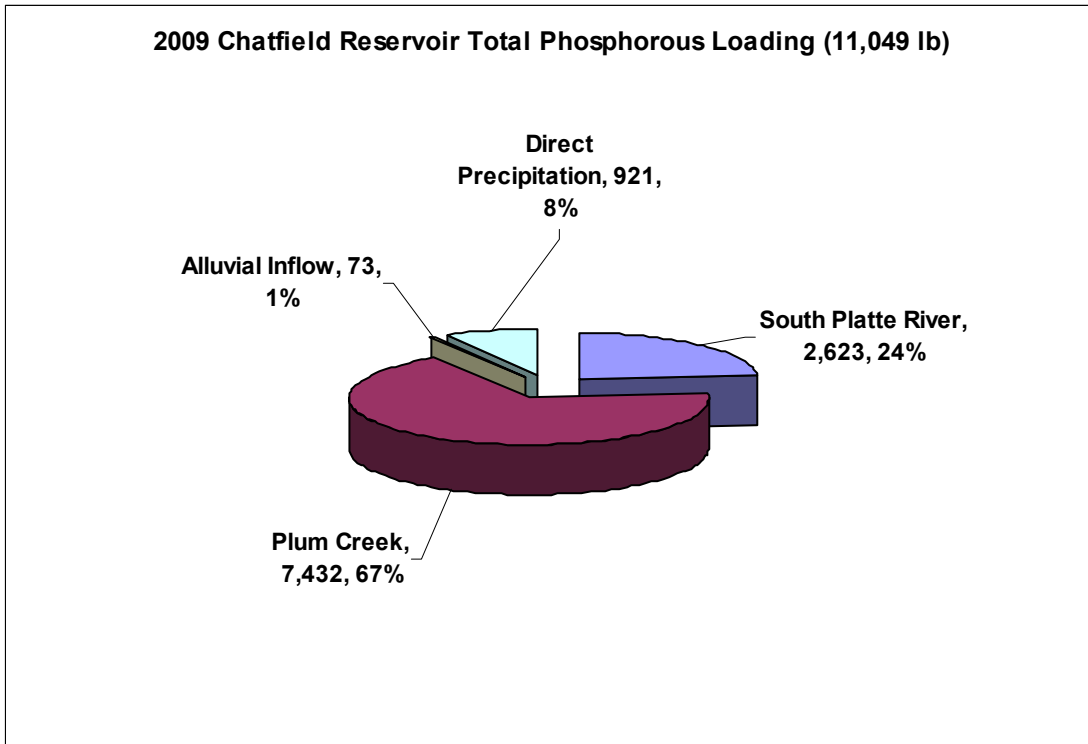
Table 2-3. Total Phosphorus Loading and TMAP Compliance

Annual	Total Volume (acre-ft)	TP Load to Reservoir from South Platte and Plum Creek			In-Lake TP Growing Season Conc. (µg/L) <sup>1</sup>
		Reservoir TP Load (lbs)	South Platte TP Load (lbs)	Plum Creek TP Load (lbs)	
1983	-	-	-	-	39
1984	-	-	-	-	30
1985	-	-	-	-	20
1986	116,996	15,900	9,412	4,261	-
1987	270,468	50,201	22,664	21,366	50
1988	122,351	26,693	6,153	14,277	20
1989	100,690	12,342	8,924	1,368	10
1990	80,666	11,181	6,233	4,022	21
1991	74,113	10,848	4,949	3,906	20
1992	78,306	14,169	3,487	6,580	20
1993	70,621	9,832	4,286	2,688	11
1994	74,847	11,544	4,293	4,752	3
1995	336,345	52,471	33,201	12,226	6
1996	82,408	9,511	6,252	1,108	36
1997	120,653	16,596	10,541	4,793	16
1998	177,849	39,586	12,580	21,281	8
1999	242,221	46,691	21,685	24,155	11
2000	88,223	13,886	6,075	5,620	10
2001	67,072	10,360	3,438	4,505	30
2002	36,464	3,506	1,618	1,019	10
2003	68,742	13,778	4,596	7,695	38
2004	69,339	12,527	4,701	4,732	36
2005	107,785	25,202	8,431	16,065	26
2006	89,786	13,540	9,734	3,170	34
2007	288,680	56,077	33,822	21,515	20
2008	117,631	14,566	10,022	3,960	19
2009	135,032	10,055 <sup>2</sup>	2,623	7,432	18.3
Average	125,720	20,878	9,988	8,437	22

<sup>1</sup> - Values are calculated from the entire water column.

<sup>2</sup> - Value does not include alluvial flow or precipitation data.

**Figure 2-4. 2009 Total Phosphorus Load to Chatfield Reservoir**



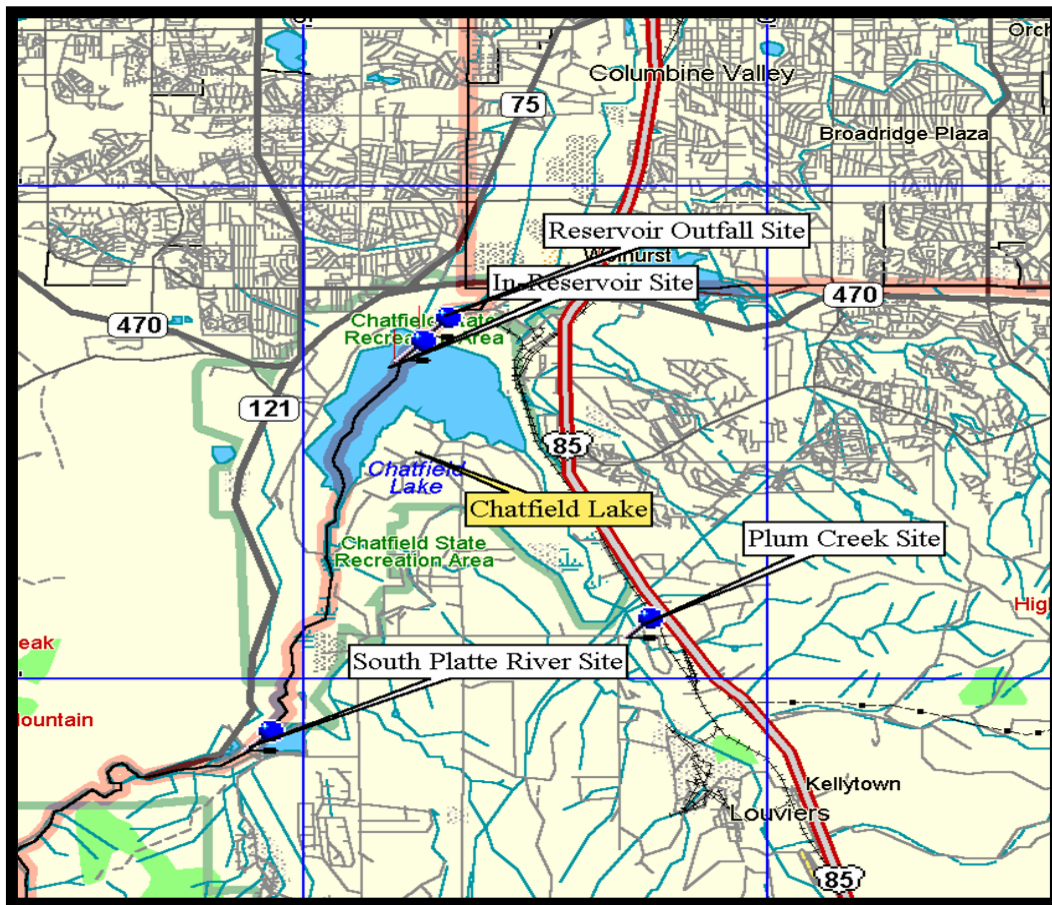


### 3.0 MONITORING PROGRAM

In 2009, as a cost saving measure to provide high quality data, Authority member Denver Water graciously agreed to collect and analyze the water quality monitoring data for the Authority, including sampling of the reservoir, South Platte River and Plum Creek. Figure 3-1 depicts surface water sampling sites in the Chatfield watershed. To measure the variability in changing sampling personnel and laboratories, the Authority contracted with GEI to analyze split samples from the Reservoir during the growing season. The Authority has full confidence in the quality and reliability of Denver Water and will no longer continue to collect duplicate samples.

As in prior years, the monitoring parameters for this program were selected to maximize the use of available financial resources while still meeting the objectives of the monitoring program. The constituents monitored, frequency of monitoring, and monitoring sites were all developed in concert with, and previously approved by, the WQCD. The water quality monitoring program samples selected constituents at two inflow stations (South Platte River at Waterton and Plum Creek at Titan Road), an outfall station (South Platte River below Chatfield) and within Chatfield Reservoir. Other ungaged inflows to the reservoir include Deer Creek and Massey Draw, direct surface runoff, direct precipitation and alluvial inflow. Selected constituents sampled and frequencies are summarized in Table 3-1. Sampling data can be found at the Authority's website, [www.chatfieldwatershedauthority.org](http://www.chatfieldwatershedauthority.org).

Figure 3-1. Chatfield Watershed Sampling Sites



<b>Table 3-1. Constituents Sampled and Frequency</b>		
<b>Constituent</b>	<b>Monthly Frequency</b>	<b>Notes</b>
<b>Reservoir Monitoring</b>		
Temperature, Degrees C	X	Collected at one meter intervals through entire water column; bimonthly samples during growing season.
Field pH (s.u.)	X	Collected at one meter intervals through entire water column; bimonthly samples during growing season
Specific Conductance (uS/cm)	X	Collected at one meter intervals through entire water column; bimonthly samples during growing season.
Dissolved Oxygen, mg/L	X	Collected at one meter intervals through entire water column; bimonthly during growing season.
Phytoplankton	X	Twice monthly during growing season
Chlorophyll-a, ug/L	X	Twice monthly during growing season
Secchi Depth, meters	X	Twice monthly during growing season
Alkalinity, mg/L	X	Twice monthly during growing season
Total Phosphorus, mg/L	X	Twice monthly during growing season
Ortho Phosphorus, mg/L	X	Twice monthly during growing season
Nitrite + Nitrate-nitrogen, mg/L	X	Twice monthly during growing season
Ammonia Nitrogen, mg/L	X	Twice monthly during growing season
Total Nitrogen, mg/L	X	Twice monthly during growing season
<b>Watershed Monitoring</b>		
Instantaneous Flow (Rivers & Streams), cfs	X	
Temperature, Degrees C	X	
Field pH (s.u.)	X	
Specific Conductance (uS/cm)	X	
Dissolved Oxygen, mg/L	X	
Alkalinity, mg/L	X	
Total Phosphorus, mg/L	X	
Ortho Phosphorus, mg/L	X	
Nitrite + Nitrate-nitrogen, mg/L	X	
Ammonia Nitrogen, mg/L	X	
Total Nitrogen, mg/L	X	

### 3.1 Chatfield Reservoir

The in-reservoir monitoring characterizes Chatfield Reservoir chemical and biological quality. Reservoir monitoring is conducted at one reservoir location for both depth-specific samples and vertical profiles for the basic water quality parameters.

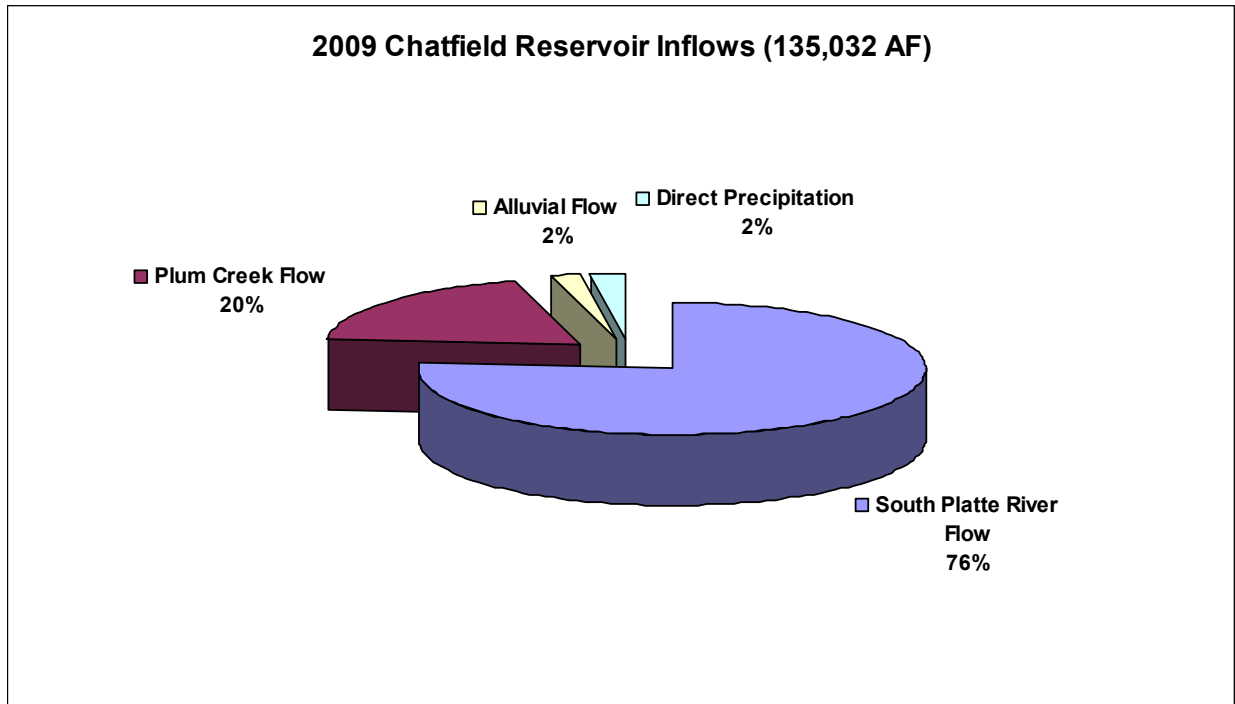
Vertical profile sampling is conducted to determine seasonal stratification of the reservoir. The water column samples are collected from three depths: the bottom one meter of the water column, the mid-euphotic zone (as determined from Secchi-depth readings) and the top one-meter of the water column. Chlorophyll-a is analyzed only from the top one-meter of the water column using an integrated sample.

### 3.2 South Platte and Plum Creek

The South Platte River and Plum Creek are the two gaged surface inflows to Chatfield Reservoir and primary sources of water to the reservoir. As shown in Table 3-2, approximately 76% of the inflow to Chatfield Reservoir in 2009 is the South Platte River. Plum Creek, contributed approximately 20% of the inflow to the reservoir. The monitoring locations include the South Platte River at Waterton (Colorado Division of Water Resources, historically reported stream flows at USGS station 06708000) and Plum Creek at Titan Road near Louviers (USGS station 06709530). Other ungaged inflows to the reservoir include Deer Creek and Massey Draw, direct surface runoff, direct precipitation, and alluvial inflow.

<b>Table 3-2. 2009 Chatfield Reservoir Inflows</b>		
<b>Source</b>	<b>Flow (AF)</b>	<b>Percent of Total</b>
South Platte River	103,013	76%
Plum Creek	26,414	20%
Alluvial Inflow	2,684	2%
Direct Precipitation	2,921	2%
<b>Total</b>	<b>135,032</b>	<b>100%</b>

Figure 3-2. Chatfield Reservoir Inflows



No direct flow measurements are made at inflow sites; rather, discharge values are obtained from the appropriate data sources (Colorado Division of Water Resources or the USGS, respectively) for the two inflow sites. Other residual inflow contributions include two small ungaged tributaries (Deer Creek and Massey Draw), direct surface runoff, direct precipitation, and alluvial inflow.

### 3.3 Other Source Areas

The Authority has historically administered water quality monitoring programs in other source areas (i.e. near reclamation aspects of the Hayman Burn area and along Massey Draw where stream stabilization and water quality improvements were constructed) where grant funding was made available for monitoring. However, more recently grant funding has not been secured and this aspect of the program for the monitoring or characterization of water quality in other source areas has been greatly reduced. In 2009, Authority members volunteered in-kind services to continue monitoring activities along sections of Massey Draw, where Section 319 and local funds were leveraged to support stabilization of the channel and stream restoration constructed in 2005. Monitoring in Massey Draw is important to determine effects of stormwater conditions on downstream water quality. Due to recent changes in water rights being diverted upstream and additional flows through South Massey Draw, the sampling locations are being re-evaluated to appropriately measure the effectiveness of the Massey Draw water quality enhancements.

## 4.0 POINT SOURCE DISCHARGERS

There are eight operational wastewater treatment facilities in the Chatfield watershed, all which discharge to Plum Creek or its tributaries. The total annual wasteload for point source phosphorus (among all permitted dischargers) in the Chatfield Watershed is 7,533 lbs/year.

### 4.1 Wasteload Allocation

In 2009, recorded TP discharges were 2,719 pounds or about 36% of the allowable total discharge poundage (Table 4-1). All actively reporting dischargers were in compliance with their established wasteload allocations. Wasteload allocations for Sacred Heart and the Centennial Law Enforcement Training Center were received pursuant to the Authority Trading Guidelines (Guidelines) and point to point source trades were completed pursuant to the Guidelines. Monthly contributions of phosphorus discharged by each wastewater treatment facility are provided in Table 4-2.

**Table 4-1. Summary of 2009 Phosphorus Wasteload Contribution**

Allocation Sources	Wasteload Allocation (Pounds per Year)	2009 Point Source Total Pounds
Plum Creek Wastewater Authority	4,256	2,524
Perry Park Water and Sanitation District: Waucondah	365	101
Perry Park Water and Sanitation District: Sageport	73	52.70
Lockheed Martin Space Systems Company	1,005	20.84
Town of Larkspur	231	15.70
Centennial Law Enforcement Foundation	30 <sup>5</sup>	4.60
Ponderosa Center	75 <sup>3</sup>	No Discharge <sup>1</sup>
Louviers Water and Sanitation District	122	0
Roxborough Water and Sanitation District	1,218	No Discharge <sup>1</sup>
Jackson Creek Metropolitan District	50 <sup>4</sup>	No Discharge <sup>1</sup>
Sacred Heart Retreat	15 <sup>2</sup>	No Discharge <sup>1</sup>
South Santa Fe Metro District	21 <sup>6</sup>	No Discharge <sup>1</sup>
Reserve/Emergency Pool	52	Not Used
<b>Total Phosphorus Wasteload</b>	<b>7,533</b>	<b>2,719</b>

1. No discharge data or monitoring program not established by permit.
2. Sacred Heart water quality credits were secured via a point-point source trade in accordance with Authority Trading Guidelines for a five-year phosphorous allocation of 15 pounds for inclusion in discharge permit; obtained from Roxborough Water and Sanitation District/Dominion.
3. Ponderosa Center water quality credits are subject to approval of a trade pursuant to the Authority Trading Guidelines.
4. Jackson Creek Metropolitan District received point source allocations through trades pursuant to the Authority Trading Guidelines. Jackson Creek has a transfer agreement of 50 pounds with Roxborough Water and Sanitation District.
5. Centennial Law Enforcement Foundation water quality credits were secured via a point-point source trade from Centennial Water and Sanitation District and pursuant to the Authority Trading Guidelines.
6. South Santa Fe Metropolitan District received a point source allocation of 21 pounds through a trade pursuant to the Authority Trading Guidelines; water quality credits are subject to completing a trade project pursuant to the Trading Guidelines.

**Table 4-2. 2009 Summary of Monthly Point Source Phosphorous Loading**

Month	Town of Larkspur (lbs/month)	Perry Park Water and Sanitation District: Waucondah (lbs/month)	Perry Park Water and Sanitation District: Sageport (lbs/month)	Plum Creek Wastewater Authority (lbs/month)	Louviers Water and Sanitation District (lbs/month)	Roxborough Park Water and Sanitation District (lbs/month)	Lockheed Martin Space Systems Company (lbs/month)	Ponderosa Center (lbs/month)	Centennial Law Enforcement Foundation (lbs/month)	Sacred Heart Retreat (lbs/month)
January	0.60	18.91	5.83	260	0	0	0.94	0	0.29	0
February	0.33	7.29	9.36	244	0	0	1.56	0	0.31	0
March	0.26	10.60	8.75	222	0	0	0.85	0	0.41	0
April	0.48	8.23	4.60	224	0	0	1.48	0	0.42	0
May	1.43	6.08	4.58	194	0	0	2.59	0	0.45	0
June	2.11	6.94	2.30	181	0	0	4.44	0	0.31	0
July	2.88	5.01	3.53	202	0	0	1.74	0	0.43	0
August	0.98	6.43	2.49	120	0	0	1.03	0	0.47	0
September	0.72	9.19	2.43	209	0	0	1.07	0	0.40	0
October	3.80	6.94	2.12	208	0	0	2.35	0	0.51	0
November	1.19	6.17	2.63	237	0	0	1.62	0	0.31	0
December	0.89	8.83	4.09	222	0	0	1.18	0	0.30	0
<b>Total Annual Phosphorus Discharge (pounds)</b>	<b>15.7</b>	<b>101</b>	<b>52.7</b>	<b>2,524</b>	<b>0</b>	<b>0</b>	<b>20.84</b>	<b>0</b>	<b>4.6</b>	<b>0</b>

Note: Total annual phosphorous values are rounded.

#### 4.1.1 Compliance with Permits

Point source dischargers are responsible for monitoring their effluent discharges for compliance with their individual permits and compliance with Regulation #73. Every discharger in the Chatfield Watershed with a TP allocation fully complied with their TP concentration limits and TP wasteload allocation in 2009. Summary of actual discharge monitoring data for each permit (average monthly TP concentration, flow, and monthly wasteload) are provided in Appendix C. However, one discharge does not have a wasteload allocation and does not monitor TP discharge, as explained below

**Bell Mountain Ranch Metropolitan District - Water Treatment Discharge** – Bell Mountain Ranch Metropolitan District, located south of Castle Rock, treats Denver basin aquifer groundwater from the Arapahoe formation for drinking water supply purposes. Backwash from the water treatment plant is discharged into a tributary to East Plum Creek. The discharge amount permitted is 28,000 gallons per day but there is presently no phosphorus allocation for the discharge. Historic data indicate elevated phosphorus concentrations of the discharge and Bell Mountain does not have a wasteload allocation or phosphorus credits. Over the past two years, the Authority has recommended that Bell Mountain Ranch Metropolitan District secure a phosphorus allocation via the Trading Guidelines. Bell Mountain representatives have attended Authority meetings in 2009 to describe their concerns with securing a wasteload allocation, but have not made any efforts towards compliance. The Authority remains concerned that no phosphorus allocation has been obtained to date.

#### 4.2 Trades

Regulation 73 authorizes trading for point-to-point source trades and point-to-nonpoint source trades. The goal of the Trading Program is to ensure that trades involving nonpoint sources have a net water quality benefit for the Chatfield Reservoir. All Authority approvals

of trade credits and alternative arrangements are subject to review and confirmation by the Commission.

Point sources have used four mechanisms to obtain additional phosphorus wasteload allocations:

- Nonpoint source to point source trades (Jackson Creek Ranch; South Santa Fe Metropolitan District, Ponderosa Retreat Center and Law Enforcement Center).
- Point source to point source transfers (Approved transfer from Roxborough to Jackson Creek Ranch; temporary trade from Lockheed Martin to Plum Creek Metropolitan District, temporary transfer from Roxborough/Dominion to Sacred Heart, and temporary transfer from Centennial Water and Sanitation District to the Law Enforcement Training Facility).
- Alternative treatment arrangements for phosphorus reductions (Application of effluent at agronomic rates – Larkspur).
- Reserve/emergency pool allocations (Ponderosa Retreat Center and Sacred Heart Retreat).

Two point to point source transfers were submitted to the Authority for review and approval in 2009, including:

- Temporary transfer from Centennial Water and Sanitation District to the Law Enforcement Training Facility – 30 pounds
- Temporary transfer from Roxborough/Dominion to Sacred Heart – 15 pounds

We anticipate trading activity in 2010, addressing the phosphorus wasteload allocations for Bell Mountain Ranch.

#### **4.3 Site Location Approval and Wastewater Plan Amendments**

No site approval applications or plan amendments were submitted in 2009.

## 5.0 NONPOINT LOADING AND SOURCES

The largest contributor of phosphorous loading to the Chatfield Reservoir is nonpoint sources. In 2009, nonpoint sources contributed 73% of the total phosphorous load. Controlling nonpoint sources is critical to preserving water quality. This section describes activities undertaken in 2009 to control nonpoint sources of phosphorus loading.

### 5.1 Nonpoint Source Reductions in the Watershed

- **Douglas County** – Douglas County provides various open space tours and events including the “*Spring Up the Creek Event*” for Plum Creek. Douglas County also maintains an extensive erosion control program. The county updated their Erosion Control Manual and Drainage Criteria Manual to provide greater emphasis on water quality. While the county has not determined the TP poundage reduction from the county erosion control program, ongoing enforcement efforts ensure that BMPs are maintained. The county has implemented extensive fire recovery activities for the Hayman burn, which reduce stormwater impacts from the fire.
- **Jefferson County** – The Massey Draw Project, a Section 319 project sponsored by the Authority, Lockheed Martin, Jefferson County, and UDFCD, is a stream restoration project that was completed in 2005. The project incorporated bank stabilization and creation of wetlands for a portion of the draw that experiences severe erosion and resulting deposition of sediment into Chatfield Reservoir.

Jefferson County also maintains an erosion and sediment control program as part of their MS4 permit. The county maintains a small-site erosion control manual that explains the basic principles of erosion control and illustrates techniques to control sediment from small development sites.

Jefferson County has also presented their stormwater management program at two public events to reach a diverse audience. A stormwater article was published in the County’s e-newsletter. The county also participates in the Rooney Road Recycling Center for household chemical waste drop off.

- **City of Littleton** – The City of Littleton has implemented several nonpoint source projects in the watershed targeted to reduce TP loads by 45% to 55%. Examples of pollutant reduction facilities include several detention ponds and wetland areas at the Chatfield Green development. In addition, every fall the city recycles leaves. In the past 14 years, the city has recycled more than 9,000 cubic yards of leaves and 1,600 tires. The leaves are recycled and mixed with soil amendment products and offered to citizens or used in city gardens. The city also recycles Christmas trees each January and provides that mulch to citizens as well.

Littleton partners with the City of Englewood to host the annual Household Hazardous Waste Roundup every fall. On two Saturdays, residents of each city are allowed to drop off oil-based paint, paint thinner, herbicides, pesticides, motor



oil, gasoline, antifreeze, batteries and more. A \$20 co-payment is charged just to cover the costs to safely dispose of the products. Keeping hazardous wastes from getting into waterways that drain into Chatfield Reservoir preserves the reservoir's water quality.

- **Town of Castle Rock** – Castle Rock has a proactive public education program that addresses nonpoint source pollution including awareness on phosphorus. Every year, the Town partners with other local agencies to issue monthly public awareness advertisements, such as the one shown below, in the local newspaper to educate residents and business owners on key water quality issues. Additionally, the Town conducted presentations in local schools to



## Fertilizer: arch enemy of waterways.

Streams, lakes and reservoirs don't need it. Your lawn may not need it either. Fertilizer, like other products that serve a necessary purpose, can become a problem if misused. Most lawn fertilizers contain nitrogen, phosphorus and potassium represented by a three-number string on the front of the bag. Nutrient needs vary from lawn to lawn and can only be determined by testing the soil. If over applied, excess nutrients not needed by plants are carried by rain and washed to the nearest waterway causing excess algae growth that uses up vital oxygen for fish. Please take the time to have your soil tested to determine your lawn's needs. This simple, small change in your lawn care, makes a huge difference not only to the health of your lawn but also to your nearby rivers, creeks and lakes.

Local stormwater agencies, including participants of the Douglas County Stormwater Co-op Group, SPLASH and SEMSWA, are teaming together to bring you this message. We take this so seriously that we posted this ad rather than send you more garbage in the mail. One thing is clear: our creeks, rivers and lakes depend on you.

THIS STORMWATER MESSAGE BROUGHT TO YOU BY



Visit [www.onethingisclear.org](http://www.onethingisclear.org) to:

- Report accidental and illegal dumping to your local agency
- Search local volunteer events • Find more helpful tips

**28-0-3**

Protect your waterways. Know what you are applying and test your soil prior to using fertilizers. Contact the Colorado State University Extension at 970-491-5061 to have your soil tested.

Colorado Community Newspapers agree: Please recycle this newspaper responsibly and partner with our communities for a better tomorrow.

Ad campaign creative donated by the Town of Castle Rock Utilities Department, Stormwater Division.

educate students on water quality issues surrounding the Chatfield and Cherry Creek Watersheds. The Town held the annual "Spring Up the Creek" trash collection day and Household Chemical Roundup event to provide the public opportunities to properly dispose of harmful and nutrient-rich

substances. Through routine inspections of outfall systems, various illicit discharges were detected and remediated to protect water quality.

The Town adopted Erosion Control and Drainage Criteria Manuals from Douglas County in an effort to provide consistent regulations within the watershed. The Town enforces erosion control requirements on all land disturbing activities from land development to single-family lot construction. The Town utilizes a pilot process under the construction runoff program to test BMPs not identified in the Town's criteria to keep up with the developing industry. All development and redevelopment is required to implement post-construction best management practices to prevent or reduce pollutants in stormwater runoff. The Town has completed drainageway master plans for several of its tributaries that provide guidelines and requirements for addressing downstream impacts to the natural system due to development. Grade control projects were begun in 2009 on Sellars Gulch and Tributary D to East Plum Creek that reduce sediment and nutrient transport along the improved channels tributary to Chatfield Reservoir. Projects are planned for implementation in the next two years along East Plum Creek that will provide further channel and water quality improvements within the Chatfield Watershed.

- **Roxborough Water and Sanitation District** – Roxborough has a runoff detention system that reduces the amount of nonpoint source TP reaching adjacent waters. In addition, Roxborough is a sponsor of the Douglas County Household Chemical Roundup Program, the results of which are discussed below.
- **Tri-County Health Department** – The Tri-County Health Department leads the Douglas County Household Chemical Roundup Program which provides residents with an opportunity to dispose of hazardous chemicals from their homes in a safe, legal, and environmentally responsible way, providing an outlet for wastes that might otherwise end up in creeks, stormwater systems, sanitary sewers and septic systems, or be disposed of illegally on others' property. Plum Creek Wastewater Authority and Centennial Water and Sanitation District participate in this program, also. Throughout the year, the program provides information to the public about ways to reduce the generation of household hazardous waste, including ways to recycle and dispose of items that should not be poured down the drain or put in the trash.

In 2009, the program operated three, one-day Household Chemical Roundup events to collect household hazardous wastes from residents of Douglas County. A total of 1,900 vehicles participated in the Roundups, collecting waste from an estimated 2,185 households. Over 84 tons of hazardous materials were collected, including 4,818 gallons of hazardous liquids (oil, antifreeze, flammable liquids, and reactive chemicals), 11,085 pounds of pesticides, 405 pounds of mercury-containing devices and mercury-contaminated waste, and more than 66 tons of paint and paint products. In addition, 545 tires, 435 gas cylinders, and 539 automotive batteries were also recycled. The Household Chemical Roundup Program will continue to operate three events in 2010.

The Colorado Department of Public Health and Environment (CDPHE) has recently begun a pilot program for the disposal of unused and unwanted household medications.

- **Colorado Department of Transportation** – CDOT inspects BMPs daily for their active construction sites. Monthly BMP inspections are completed on all active and inactive projects and include water quality testing. CDOT BMPs include grass lined channels, channel grading, rip rap on culvert outlets, rip rap protected concrete weirs, rip rap lined channels (Figure 5-1), and water quality detention ponds (Figure 5-2). CDOT calculated that its BMPs kept 36 tons of sediment out of Plum Creek and Chatfield Reservoir in 2009.



*Figure 5-1 – CDOT Riprap along Plum Creek under the I-25 Bridge*

## **5.2 Stormwater Permit Requirements**

Colorado stormwater permit program requires all governmental and private organizations to control stormwater runoff. Stormwater runoff is rainfall or snowmelt that runs over the land surface potentially carrying pollutants into streams and lakes. A major focus of the stormwater permit is erosion control to reduce sediment (and materials attached to sediment, such as phosphorus) from reaching streams and rivers. Pet waste, excess lawn fertilizer, motor oil, cigarette butts, and trash can result in polluted stormwater runoff.

The program to permit municipal stormwater discharges has been implemented in two phases, with the second phase being most applicable to the Authority.

In response to federal stormwater rules (commonly referred to as Phase I and II rules) the state has implemented a permitting program for municipal separate storm sewer systems (MS4s). Phase I and II MS4s in the Chatfield Basin include:

- Douglas County
- Jefferson County
- Town of Castle Rock
- City of Littleton
- Castle Pines Metropolitan District
- Colorado Department of Transportation

Unlike wastewater treatment facilities or industrial dischargers, MS4s do not have end-of-pipe effluent limits included in their permits. Instead, MS4 permits are based on requirements to develop programs that meet six minimum control measures, and many of these programs involve the implementation of best management practices in order to



*Figure 5-2 – CDOT detention pond that drains into Plum Creek assisted to keep approximately 36 tons of sediment out of Plum Creek*

reduce pollutants discharged to the maximum extent practicable. The six minimum control measures Phase II permittees are required to meet include:

1. Public education and outreach on stormwater impacts
2. Public participation and involvement
3. Detection and elimination of illicit connections and discharges
4. Construction site stormwater runoff control
5. Post-construction stormwater management in development and redevelopment
6. Pollution prevention/good housekeeping for municipal operations

Table 5-1 summarizes information about the 2009 Phase II MS4 activities in the Chatfield watershed.

**Table 5-1. Summary of MS4 Programs for Inspections, Enforcement Actions and Education Outreach**

Land Use Agency	Permit Inspection Actions	Permit Enforcement Actions	Education & Outreach Programs
Douglas County	Illicit discharges: N/A Inspections Construction: 619 Inspections Post-Construction: 42 Inspections	Illicit discharges: 37 Construction: 316 Post-construction: 0	<ul style="list-style-type: none"> <li>▪ Various Open Space tours and events.</li> <li>▪ Spring up the Creek event for Plum Creek.</li> </ul>
Jefferson County	Illicit discharges: 4 Inspections Construction: 2004 Inspections Post-Construction: 19 Inspections	Illicit discharges: 3 Construction: 232 Post-construction: 0	<ul style="list-style-type: none"> <li>▪ Presentation of our stormwater management program with inter-active booths at two public events to reach a diverse audience.</li> <li>▪ Stormwater article was published in County's e-newsletter.</li> <li>▪ Participated in Rooney Road Recycling Center for household chemical waste drop off.</li> </ul>
Castle Rock	Illicit discharges: 229 outfall; 11 hotline response inspections  Construction: 1096 inspections (GESC) and 1113 inspections for single-family residential (DESC)  Post-Construction: 404 O&M inspections	Illicit discharges: 7 enforcement actions  Construction: 697 notices of non-compliance issued, 3 stop work orders  Post-construction: no enforcement actions	<ul style="list-style-type: none"> <li>▪ (12) Monthly Ads on Stormwater topics</li> <li>▪ 4/30/09 workshop, Elementary school classroom</li> <li>▪ 5/16/09 Creek Clean-up</li> <li>▪ 6/1/09 National Trails Day booth</li> <li>▪ 9/12/09 Household Chemical Roundup</li> </ul>

Land Use Agency	Permit Inspection Actions	Permit Enforcement Actions	Education & Outreach Programs
Castle Pines Metropolitan District	Illicit discharges: 0 Inspections Construction: 0 Inspections Post-Construction: 0 Inspections	Illicit discharges: 0 Construction: 0 Post-construction: 0	<ul style="list-style-type: none"> <li>▪ Operations In-house Train.</li> <li>▪ Clean the Stream Event Plum Creek and TCR</li> <li>▪ Presentation with Diorama for Pre-School Children</li> </ul>
City of Littleton	Illicit discharges: 18 Inspections Construction: 18 Inspections Post-Construction: 3 Inspections	Illicit discharges: 2 verbal Construction: 0 Post-construction: 0	<ul style="list-style-type: none"> <li>▪ Monthly newspaper ads</li> <li>▪ 3 Littleton Report articles</li> <li>▪ Western Welcome week and World Water Monitoring Day information booth</li> </ul> Numerous handouts

### **5.3 Water Quality Review of Land Use Applications**

The Authority is a referral agency in the land use application process and as such, provides review and comments on potential water quality impacts associated with land development. In 2009 the Authority reviewed several land use applications from referral agencies providing a thoughtful water quality review of applications and review comments. Included in projects for which formal comments were prepared are Douglas County Zoning Resolution, Sedalia Recycling Center, Sterling Ranch Planned Development, and the Good Samaritan Cleanup of Abandoned Hard Rock Mines Act of 2009, The Meadows Dog Park in Castle Rock, and a Recreational Vehicle Storage Site Improvement Plan in Douglas County in the Kelly Town area. Additionally, the Authority provided formal comments on proposed general permits and rationale for minimal industrial discharges (MINDI permits).

## 6.0 RECOMMENDATIONS FOR IMPROVING WATER QUALITY

Studies, water quality enhancement projects, and more funding are needed to improve water quality and meet regulatory requirements. As a non-profit watershed association, the Chatfield Watershed Authority will continue to forge a balance between the extent of water quality improvements and their associated costs, balancing the cost of preserving water quality and the reasonableness of the costs to watershed residents and businesses.

### 6.1 Funding Needed

In 2009, the biggest obstacle preventing the Authority from implementing more projects to improve water quality continues to be funding. The Authority is at a critical financial juncture because new water quality improvements need critical funding and funding resources are becoming more limited, particularly with the recent resignation of one of the Authority's largest industrial members, Lockheed Martin. In 2010 the Authority will embark on developing a sustainable funding strategy which identifies a path for long term funding to implement programs aimed to preserve water quality. However, in the short term, the Authority has implemented or is requesting the following measures to address funding shortfalls.

**Section 319 Grant Applications.** The Authority has applied for two Section 319 grants and is hopeful that this funding cycle, with its focus on the South Platte basin, will result in additional funding that can be leveraged with watershed partners providing in-kind and cost match. We believe the challenges that prevented the Authority from accepting a \$15,000 Section 319 grant from the US EPA in 2008 have been resolved as Authority member Town of Castle Rock has agreed to be the fiscal agent of the grants which may be awarded to the Authority and provide the required \$1 million insurance policy to indemnify the State of Colorado which were too onerous for the Authority's budget.

**Board Member Assistance and Volunteerism.** The Authority continues to rely considerably on other Board members to assist in providing in-kind support to help leverage work with limited financial resources (i.e. watershed monitoring program implemented by Denver Water; Massey Draw water quality sampling conducted by Plum Creek Wastewater Authority and Centennial Water and Sanitation District, accounting work donated by the Plum Creek Wastewater Authority). This is in addition to member dues that are assessed annually.

**Streamlined Annual Reporting in 2010.** As one of our future cost saving measures, the Authority proposes to streamline the 2010 Annual Report to provide information in accordance with Control Regulation No. 73 but in a more concise reporting format similar to our annual Authority brochure.

### 6.2 Special Projects and Studies Identified to Preserve Water Quality

Following the January 2009 rulemaking hearing, the Authority brainstormed and identified various studies and water quality enhancement projects to address water quality in the

watershed. Table 6-1 provides more detail on the suggested studies and project needs. Adequate funding will help the Authority meet watershed and water quality goals.

**Table 6-1. List of Special Projects and Studies**

<b>Implementation of Special Projects</b>		<b>Process</b>
1	Construct nonpoint source projects in the Plum Creek and South Platte River watershed in conjunction with wetlands enhancement and trail corridor.	In coordination with Chatfield stakeholders like the Chatfield Conservation Network, design and implement projects along the Plum Creek riparian corridor that restore the stream, wetlands habitat, and aquatic habitat while improving water quality. These projects are contemplated along priority corridor lands in coordination with the Chatfield Conservation Network.
2	Sediment control and streambank stabilization along East Plum Creek.	In coordination with municipal jurisdictions, identify stormwater improvements along reaches of Plum Creek that are highly erosive and require streambank stabilization. Existing streambank stabilization projects in Castle Rock have already been identified within the watershed. Engineering design techniques and green approaches can be utilized to strengthen streambanks while providing water quality enhancement.
3	Enhance wetlands habitat and trail corridor along Plum Creek	In coordination with the Chatfield Conservation Network, Chatfield Reallocation/Water Users, CWCB, and U.S. Army Corps of Engineers, identify key reaches of Plum Creek slated for conservation and wetlands enhancement.
4	Implement livestock and stable management projects to control livestock wastes from entering waterbody	Implementation of pilot projects with agricultural users in the study area. Manure management is a key component of the project.
5	Implement West Plum Creek ecosystem improvements	Install drop structures, stabilize stream reaches and create pools that promote fisheries habitat and reduce sediment and nutrient load.
6	Pine beetle management; Implementation of watershed management strategies to stabilize disturbed areas.	Stabilize disturbed areas with vegetation. Consider use of check dams in tributaries along South Platte River in conjunction with re-vegetation where sediment control may be particularly significant.
7	Convert ISDS to conventional sewer along the US 85 corridor. The US 85 corridor has a proliferation of ISDS, many located within the riparian zone so conversion of ISDS to conventional sewer would reduce NPS loads from ISDS, many which were constructed in the 1900's and are located in the Plum Creek alluvium. Douglas County is spearheading a wastewater study that is evaluating options to improve water quality through the elimination of ISDS in the study area.	In coordination with Douglas County, this process would include funding for final design of the preferred options; funding for installation of a collection system in the Town of Sedalia, South Santa Fe Commerce Center, Law Enforcement Training Center, and Titan Road Industrial Park. Funding would also be needed to construct the 14-mile interceptor sewer along the US 85 corridor and treatment facilities.
<b>Special Studies</b>		<b>Process</b>
1	Conduct water quality monitoring and data collection to quantify phosphorus removal effectiveness of nonpoint source structures	Implement water quality monitoring network for nonpoint source [stormwater] improvements, upstream and downstream of improvements.

2	Install shallow groundwater monitoring wells; conduct groundwater sampling program to characterize flow and quality (profiling nutrient content) at specific locations in watershed	A monitoring well network, installed along Plum Creek and the South Platte River, will determine groundwater flows and nutrient transport associated with that alluvial groundwater column.
3	Quantify ISDS impact on water quality and nutrient loading; As part of this study, the attenuation of wastewater flows from ISDS in the sensitive areas of the basin would be identified.	Groundwater and surface water sampling will take place at locations upstream and downstream of concentrated ISDS locations to determine ISDS impact to water quality throughout the watershed. This study could be in conjunction with Special Study #2 above.
4	Evaluate in-lake treatment options for Chatfield Reservoir	An evaluation of in-lake treatment technologies and costs will be conducted to support attainment of the water quality standards and uses.
5	Characterize watershed and pollutant sources.	A thorough watershed characterization will be conducted along with identification of pollutant sources. Watershed hydrology data (flow, precipitation, temperature, solar radiation) shall be summarized to support watershed model efforts. A GIS tool will be developed that that will provide a basis for future watershed modeling tools.
6	Conduct a feasibility study of nutrient removal from point sources.	A study shall be conducted to determine the cost and water quality benefits of removing a pound of phosphorous for each entity having a wasteload allocation in the watershed.
7	Characterize watershed hydrology	Watershed hydrology data is presently obtained from the US Army Corps of Engineers (flow, precipitation, temperature, solar radiation). As part of this study, additional watershed hydrology data from the watershed shall be summarized to support watershed model efforts.
8	Additional water quality monitoring is needed to better understand fate and transport issues. Routine water quality monitoring is insufficient. Currently only one location is monitored in each of the two sub-watershed locations at Plum Creek upstream of the Reservoir and South Platte River upstream of the Reservoir. Additional data collection from the upper reaches of the sub-watersheds is needed to understand the fate and transport of nutrients.	Additional water quality sampling and analyses shall be conducted to determine nutrient fate and transport ratios and calibrate watershed water quality models that need to be developed for use in TMAL development and implementation (see description of watershed and reservoir models needed under "Models and Predictive Tools # 1, below)
<b>Models and Predictive Tools</b>		<b>Process</b>
1	Develop a watershed loading model for simulating pollutant loading to the reservoir. As part of this modeling effort the fate and transport of both nutrients and sediment in the watershed will be incorporated. The watershed model will feed data into the hydrodynamic reservoir model which has already been developed as part of the Chatfield Re-allocation Study.	A through watershed model shall be developed to pin point locations with heavy runoff events that exhibit a higher potential for soil erosion and nutrient transport. This model will assist in the determination of location for nonpoint source projects in the watershed. The selected watershed loading model should strive to predict nitrogen, phosphorus and suspended solids loading on a seasonal basis. The selected model should also be constructed so that multiple calibration locations can be simultaneously considered.



### **6.3 Future Issues on the Horizon**

The overarching challenge for the Authority into the future will be to manage the impacts from land use changes on water quality with funding constraints. The Authority is committed to being a proactive partner and implementing improvements in the basin targeted towards phosphorus reduction and watershed health. We believe some of our 2010 activities will support long term funding and water quality

#### *6.3.1 Public Outreach and the 2010 Chatfield Summit*

The Authority is planning its first watershed event, the Chatfield Summit, on June 16, 2010, at the Botanic Gardens near Chatfield Reservoir. The Summit will allow for an exchange of information about activities in the Chatfield watershed that effect water quality among stakeholders, build relationships and explore synergistic possibilities for cooperation, and identify collaborative opportunities and projects to improve water quality and watershed health. We are very enthused about the new watershed partners we will meet and the opportunities to work collaboratively with other agencies to address water quality and watershed health. In addition to the showcase event of the Summit, the Authority is aggressively pursuing other opportunities to make presentations to citizen groups and organizations. We recognize that the public isn't going to value or support the important work of the Authority if they don't know about it. Be sure to check our web page, [www.chatfieldwatershedauthority.org](http://www.chatfieldwatershedauthority.org) for the latest information about outreach efforts.

#### *6.3.2 Implementing Additional Nonpoint Source Control Strategies*

With additional funding, or commitment on grant requests, the Authority can make great strides in targeting the most effective controls to reduce phosphorus. Projects like those summarized in Table 6-1 will go a long way to improve water quality, reduce sediment and phosphorus loading in the watershed and reservoir while providing a riparian habitat amenity.

#### *6.3.3 Conversion of ISDS to Conventional Wastewater Collection and Treatment along the US 85 Corridor in the Chatfield Watershed*

A long-standing water quality priority of the Authority has been the need to convert individual sewage disposal systems (ISDS) in proximity to key tributaries, streams and rivers to conventional wastewater treatment wherever feasible and environmentally prudent. In 2009, Douglas County completed a study to address wastewater solutions along the US 85 Corridor located in the Chatfield Watershed. The study's goal is to improve water quality along the US 85 Corridor through the elimination of ISDS with consideration of centralized wastewater collection and treatment solutions to enhance water quality and promote reuse. Recognizing the importance of water resources in the Chatfield Watershed, coupled with the reliance on surface water and alluvial groundwater for drinking water and the nonpoint source controls needed to meet the phosphorus requirements in the control regulation, conversion of aged ISDS systems makes good water quality sense. This effort compliments the Commission's ISDS steering committee recommendations.

Private public partnerships are being considered as potential funding options. A new water infrastructure funding advocacy group called the "Water Infrastructure Network of

Colorado”, or “WIN-Colorado” may also provide additional funding options for water infrastructure needs to convert ISDS to sewer service. The Authority will continue coordinating with Douglas County in an effort to improve water quality in the Plum Creek basin and promote the conversion of ISDS in and along the US 85 Corridor to make regional wastewater treatment and reuse in this growing area of the watershed a reality.

APPENDIX A  
POINT SOURCE DISCHARGER TABLES

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## Appendix A

### 2009 Monthly Flow, Phosphorus Concentration, and Loading from Select Water Treatment Plants in the Chatfield Watershed

#### *Town of Larkspur*

<i>Month</i>	<i>Total Montly Flow (million gal)</i>	<i>Average Monthly Total Phosphorus Concentration (mg/L)</i>	<i>Total Phosphorus Discharge (pounds)</i>
January	0.48	0.15	0.60
February	0.40	0.10	0.33
March	0.39	0.08	0.26
April	0.58	0.10	0.48
May	0.45	0.38	1.43
June	0.59	0.43	2.11
July	0.72	0.48	2.88
August	0.39	0.30	0.98
September	0.35	0.25	0.72
October	0.46	1.00	3.80
November	0.40	0.36	1.19
December	0.43	0.25	0.89
	<u><i>Total Discharge (million gal/year)</i></u>	<u><i>Annual Average (mg/L)</i></u>	<u><i>Total Discharge (pounds/year)</i></u>
	<b>5.62</b>	<b>0.32</b>	<b>15.67</b>

Note: Statistics are rounded.

#### *Perry Park Water and Sanitation District: Waucondah*

<i>Month</i>	<i>Total Montly Flow (million gal)</i>	<i>Average Monthly Total Phosphorus Concentration (mg/L)</i>	<i>Total Phosphorus Discharge (pounds)</i>
January	4.93	0.46	18.91
February	4.37	0.20	7.29
March	5.08	0.25	10.60
April	4.94	0.20	8.23
May	4.86	0.15	6.08
June	4.62	0.18	6.94
July	4.62	0.13	5.01
August	4.82	0.16	6.43
September	4.79	0.23	9.19
October	4.90	0.17	6.94
November	4.62	0.16	6.17
December	4.60	0.23	8.83
	<u><i>Total Discharge (million gal/year)</i></u>	<u><i>Annual Average (mg/L)</i></u>	<u><i>Total Discharge (pounds/year)</i></u>
	<b>57.15</b>	<b>0.21</b>	<b>100.62</b>

Note: Statistics are rounded.

**Perry Park Water and Sanitation District: Sageport**

<b>Month</b>	<b>Total Montly Flow (million gal)</b>	<b>Average Monthly Total Phosphorus Concentration (mg/L)</b>	<b>Total Phosphorus Discharge (pounds)</b>
January	1.55	0.45	5.83
February	1.40	0.80	9.36
March	1.54	0.68	8.75
April	1.49	0.37	4.60
May	1.57	0.35	4.58
June	1.53	0.18	2.30
July	1.57	0.27	3.53
August	1.36	0.22	2.49
September	1.62	0.18	2.43
October	1.69	0.15	2.12
November	1.58	0.20	2.63
December	1.63	0.30	4.09
	<b><u>Total Discharge (million gal/year)</u></b>	<b><u>Annual Average (mg/L)</u></b>	<b><u>Total Discharge (pounds/year)</u></b>
	<b>18.54</b>	<b>0.35</b>	<b>52.71</b>

Note: Statistics are rounded.

**Louviers Water and Sanitation District**

<b>Month</b>	<b>Total Montly Flow (million gal)</b>	<b>Average Monthly Total Phosphorus Concentration (mg/L)</b>	<b>Total Phosphorus Discharge (pounds)</b>
January			0.0
February			0.0
March			0.0
April			0.0
May	0.74	0.0	0.0
June	0.75	0.0	0.0
July	0.71	0.0	0.0
August	0.26	0.0	0.0
September	0.08	0.0	0.0
October			0.0
November			0.0
December			0.0
	<b><u>Total Discharge (million gal/year)</u></b>	<b><u>Annual Average (mg/L)*</u></b>	<b><u>Total Discharge (pounds/year)</u></b>
	<b>2.55</b>	<b>0.0</b>	<b>0.0</b>

Note: Statistics are rounded.

\* = Zeros are not included in annual average concentration calculation.

**Roxborough Park Water and Sanitation District**

<b>Month</b>	<b>Total Montly Flow (million gal)</b>	<b>Average Monthly Total Phosphorus Concentration (mg/L)</b>	<b>Total Phosphorus Discharge (pounds)</b>
January	0.0	0.0	0.0
February	0.0	0.0	0.0
March	0.0	0.0	0.0
April	0.0	0.0	0.0
May	0.0	0.0	0.0
June	0.0	0.0	0.0
July	0.0	0.0	0.0
August	0.0	0.0	0.0
September	0.0	0.0	0.0
October	0.0	0.0	0.0
November	0.0	0.0	0.0
December	0.0	0.0	0.0
	<b><u>Total Discharge (million gal/year)</u></b>	<b><u>Annual Average (mg/L)</u></b>	<b><u>Total Discharge (pounds/year)</u></b>
	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>

Note: Statistics are rounded.

\* = Zeros are not included in annual average concentration calculation.

**Lockheed Martin Space Systems Company**

<b>Month</b>	<b>Total Montly Flow (million gal)</b>	<b>Average Monthly Total Phosphorus Concentration (mg/L)</b>	<b>Total Phosphorus Discharge (pounds)</b>
January	2.13	0.05	0.94
February	1.70	0.11	1.56
March	2.05	0.05	0.85
April	3.55	0.05	1.48
May	3.10	0.10	2.59
June	3.55	0.15	4.44
July	2.61	0.08	1.74
August	2.37	0.05	1.03
September	2.10	0.06	1.07
October	2.34	0.12	2.35
November	2.81	0.07	1.62
December	2.72	0.05	1.18
	<b><u>Total Discharge (million gal/year)</u></b>	<b><u>Annual Average (mg/L)</u></b>	<b><u>Total Discharge (pounds/year)</u></b>
	<b>31.03</b>	<b>0.08</b>	<b>20.84</b>

Note: Statistics are rounded.

**Law Enforcement Foundation**

<i>Month</i>	<i>Total Montly Flow (million gal)</i>	<i>Average Monthly Total Phosphorus Concentration (mg/L)</i>	<i>Total Phosphorus Discharge (pounds)</i>
January	0.03	1.35	0.29
February	0.03	1.35	0.31
March	0.04	1.35	0.41
April	0.04	1.35	0.42
May	0.04	1.35	0.45
June	0.03	1.35	0.31
July	0.04	1.35	0.43
August	0.04	1.35	0.47
September	0.04	1.35	0.40
October	0.05	1.35	0.51
November	0.03	1.35	0.31
December	0.03	1.35	0.30
	<u><i>Total Discharge (million gal/year)</i></u>	<u><i>Annual Average (mg/L)</i></u>	<u><i>Total Discharge (pounds/year)</i></u>
	0.41	1.35	4.63

Note: Statistics are rounded.

**Plum Creek Wastewater Authority**

<i>Month</i>	<i>Total Montly Flow (million gal)</i>	<i>Average Monthly Total Phosphorus Concentration (mg/L)</i>	<i>Total Monthly Reuse Flow (million gal)</i>	<i>Reuse Average Monthly Total Phosphorus Concentration (mg/L)</i>	<i>TP Net Dischg (pounds)</i>
January	125.15	0.25	0.29	0.26	260.31
February	107.63	0.28	3.48	0.26	243.80
March	102.81	0.30	14.54	0.29	222.06
April	120.42	0.23	4.33	0.20	223.78
May	103.13	0.28	25.37	0.22	194.29
June	106.39	0.25	22.05	0.22	181.37
July	107.59	0.27	24.05	0.20	202.16
August	85.25	0.31	38.93	0.31	119.75
September	102.83	0.30	19.85	0.29	209.27
October	113.96	0.24	9.27	0.26	208.00
November	120.94	0.24	2.52	0.22	237.44
December	126.75	0.21	0.00	0.31	221.99
	<u><i>Total Discharge (million gal/year)</i></u>	<u><i>Annual Average (mg/L)</i></u>	<u><i>Total Discharge (million gallons/year)</i></u>	<u><i>Annual Average (mg/L)</i></u>	<u><i>Total Discharge (pounds/year)</i></u>
	1,322.85	0.26	160.91	0.25	2524.22

Note: Statistics are rounded.

APPENDIX B

CD – WATER QUALITY DATA FOR CHATFIELD  
WATERSHED

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(SUBMITTED TO THE WATER QUALITY CONTROL DIVISION, AVAILABLE UPON REQUEST)