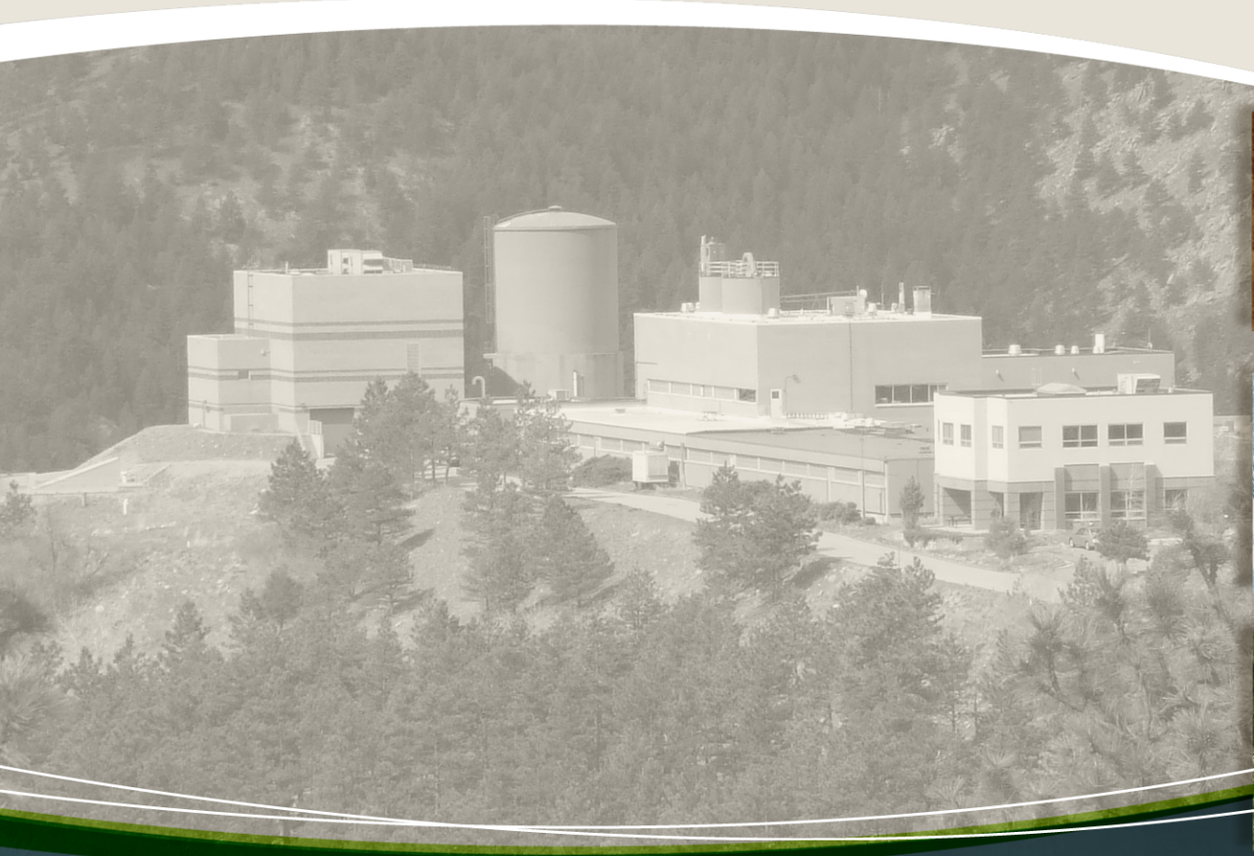
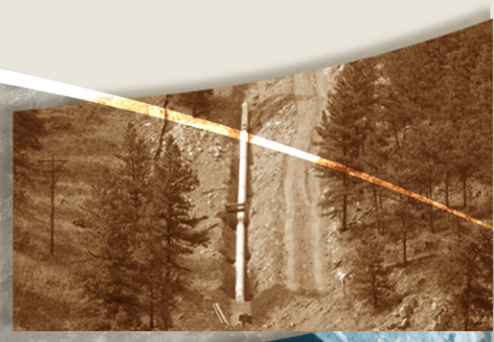
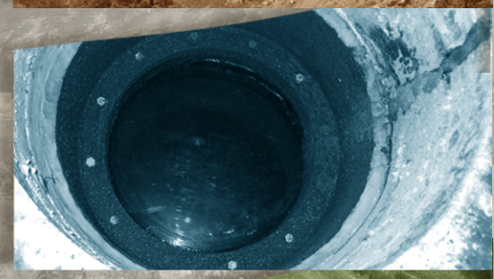
PREPARED FOR
CITY OF BOULDER

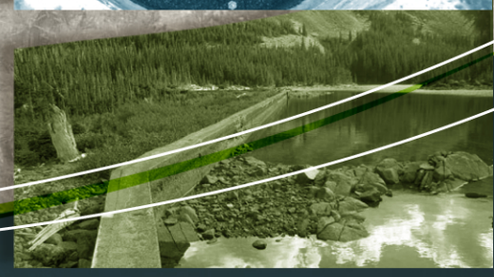
Executive Summary

OCTOBER 2011









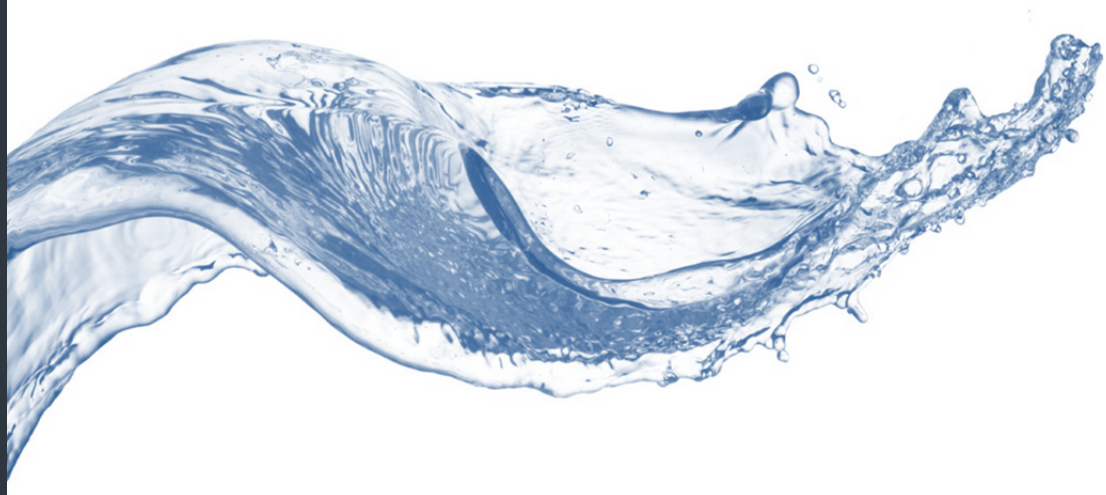
WUMP VOLUME 1

MWH®
BUILDING A BETTER WORLD

VolumeOne

City of Boulder

Executive Summary



October 2011

FINAL

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Acknowledgements

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1 Executive Summary

1.1 Volume 1 – Introduction

The City of Boulder's Water Utility is responsible for managing, storing, treating, monitoring, and delivering safe, potable water to the citizens of Boulder. The scope of responsibility ranges from sourcewater high in the mountains, to the drinking water that is delivered at the customer's tap. The Water Utility operates, maintains and manages land and facilities necessary for providing the City with potable water, as well as managing related environmental programs such as the Boulder Creek Instream Flow Program. The City of Boulder's staff has recognized that, to provide sufficient water system capacity and exceptional water quality, a plan must be developed to ensure Water Utility needs for maintenance and capital projects are being met in a fiscally responsible manner.

In the past the City of Boulder has had multiple master plans for each division of the Water Utility. The separation of these master plans and associated capital improvement plans (CIPs) made it difficult to prioritize and fund projects over the entire Water Fund. This year, the City developed a consolidated master plan with a consolidated CIP, which represents a shift from planning for individual parts of the water utility toward coordinated planning amongst the different groups. This consolidation included reports and CIPs for source water, water treatment, and the distribution system. Thus the overall Water Utility Master Plan (WUMP) was developed and is contained within 6 volumes. The volumes are:

- Volume 1 – Executive Summary
- Volume 2 – General Planning
- Volume 3 – Water Quality Strategic Plan
- Volume 4 – Source Water Master Plan
- Volume 5 – Treated Water Master Plan
- Volume 6 – Consolidated Capital Improvements Plan

This Executive Summary includes a brief summary of each of these volumes and the public approval process.

1.2 Public Approval Process

The Water Utility Master Plan (WUMP) was discussed by the Water Resources Advisory Board (WRAB) at multiple meetings, and on May 16, 2011, the WRAB approved (5-0) the acceptance of the WUMP as follows:

> *Motion: Given the fact that WRAB is concerned about underinvestment and deferred maintenance in the City's water utility infrastructure, WRAB recommends acceptance of the WUMP as provided with the provision that the WRAB would like to strongly recommend the action plan be amended to provide a minimum of 60 percent, and would favor raising it up to 75 percent of the predicted level of asset replacement.*
>
> *Vote: 5:0 – motion passes*

The city's Planning Board discussed the WUMP at its July 21, 2011 meeting and recommended acceptance (6-0) of the WUMP based on the following motion:

> *On a motion by M. Young, seconded by D. Powell, the Planning Board (6-0, A. Brockett absent) recommended acceptance of the WUMP to the City Council and approved the proposed Boulder Valley Comprehensive Plan WUMP Master Plan Summary.*

The Boulder City Council accepted the WUMP at its September 6, 2011 meeting on a 7-0 vote.

1.3 Volume 2 – General Planning

The General Planning volume provides an overview of the City of Boulder's water system and the planning information that is relevant to the entire water utility, including population and water use projections used in both the Source Water Master Plan and Treated Water Master Plan (Volumes 4 and 5 respectively). It also summarizes the history of the Water Utility to present day.

1.3.1 History

The City of Boulder has been providing a municipal water supply since 1875. From that time to the present, the City has provided its citizens with a safe, reliable water supply and has continuously looked into the future to prepare for future needs. The early history was focused on supply development and infrastructure expansion. Subsequent years focused on water conservation, hydroelectric development, protection of the developed water sources, and rehabilitation of existing infrastructure. Many senior water rights were established and acquired by the City early in its development which, when combined with later water rights and facilities acquisitions, will provide a reliable supply for the City's projected needs until buildout of its Comprehensive Plan area. Recent decades focused on growth management for the City, metering and rate structures, and a significant investment in treatment to provide safe, clean water to the City.

1.3.2 Water System Overview

Generally, the City's water system consists of source water, water treatment, and distribution system components described below.

The City gets its source water from several locations on the East Slope and West Slope. Water treatment for the City occurs at two water treatment facilities, the Betasso WTF located west of the City near Sugarloaf Mountain and the Boulder Reservoir WTF located off of 63rd Street near the Boulder Reservoir.

East Slope source water supplies are derived from the Boulder Creek Basin. Middle Boulder Creek and Barker Reservoir supplies are delivered to the Betasso Water Treatment Facility (WTF) through the Barker system pipelines. North Boulder Creek and Silver Lake Watershed reservoir supplies are carried to Betasso WTF through the Silver Lake Pipeline and the Lakewood Pipeline. Limited amounts of main Boulder Creek water can be delivered through Farmers Ditch to the Boulder Reservoir WTF.

A large portion of the City's water supplies are diverted on the Western Slope and delivered from the Colorado-Big Thompson (CBT) Project and Windy Gap Project, which are both operated by the Northern Colorado Water Conservancy District (NCWCD). Boulder receives Western Slope water at the Boulder Reservoir WTF via CBT facilities including Carter Lake, the Boulder Feeder Canal and Boulder Reservoir. At present, direct Western Slope deliveries to Boulder can only be made from April through October of each year due to winter operating limitations on the Boulder Feeder Canal. Western Slope deliveries can also be stored in Boulder Reservoir for winter use by the City at Boulder Reservoir WTF or exchanged for additional storage or diversions at the City's upper Boulder Creek facilities.

The Betasso WTF was originally constructed in 1964. It was upgraded in 1978 with a design capacity of about 46 million gallons per day (MGD). However, seasonal water quality and treatment issues have limited this capacity. The Boulder Reservoir WTF was originally constructed in 1971 to provide summer peaking capacity and to treat water from the C-BT and Windy Gap projects. It is now routinely operated on a year-round basis in order to help manage the Boulder Creek water supplies and was upgraded in 2010 to provide a firm capacity of 16 MGD. The facility can treat water from the Boulder Feeder Canal or from Boulder Reservoir.

The water distribution system consists of a grid of approximately 460 miles of interconnected pipes varying in size from 4 to 30 inches. Most of the piping was installed in the 1950s through the 1970s and was typically cast iron pipe and ductile iron pipe. Service area elevations range from 5,750 feet on the west side of the City to 5,150 feet in the eastern section. Due to this large elevation differential, the system is divided into three pressure zones to keep water pressures within practical limits. Zone 1 serves areas generally below an elevation of 5,270 feet, Zone 2 serves areas between 5,270 and 5,450 feet and Zone 3 serves areas above an elevation of 5,450 feet. Excess water pressure that develops in each zone as water is delivered from the Betasso WTF is reduced by pressure reducing valves and four small hydroelectric facilities. There are seven pressure-regulating stations in the system that regulate pressure and flow between pressure zones or into storage tanks. Water from the Boulder Reservoir WTF is pumped to Zone 1 and can be delivered to Zones 2 and Zone 3 by pump stations. There are four booster pumping stations in the system, as well as a pumping station at the Boulder Reservoir WTF. Finally, the distribution system includes six covered tanks for system storage, each ranging in capacity from 2.0 million gallons (MG) to 9.5 MG, with a total storage capacity of approximately 40 MG.

The water system also includes hydroelectric plants (hydros) that the City operates on four of its raw water transmission pipelines, Lakewood, Betasso, Boulder Canyon, and Silver Lake, two of its treated water transmission pipelines, Orodell and Sunshine, and two within the treated water distribution system at Kohler and Maxwell Reservoirs. Electricity generated at these hydros is sold to Xcel Energy.

1.3.3 Planning Approach and Assumptions

The Boulder Valley Comprehensive Plan (BVCP) sets a course for the future growth and development of the City and the lands just outside the City's boundaries. The plan is jointly adopted by the City of Boulder and Boulder County. The BVCP defines three planning areas within the Boulder Valley, one within the City limits, one that is planned to be annexed by the City in the future, and those parts out of the City limits that are within Boulder County. Only the first two planning areas were included in the study area.

At buildout, the City is expected to have 130,000 residents and an employment population of 165,230. Land use information, consistent with the BVCP was provided by the City Planning Department. Land use for buildout conditions, is very similar to current land use, with only a few areas expected to change

1.3.4 Laws, Policies, Goals and Criteria

The City of Boulder is required to comply with all federal and state laws. The Safe Drinking Water Act (SDWA) is the primary federal law that regulates public drinking water supplies. The Colorado Department of Public Health and Environment's (CDPHE's) Safe Drinking Water program implements the SDWA in Colorado and provides the basis for the state requirements.

Water rights are administered through the Colorado Water Law. Boulder owns a diverse portfolio of water rights and water delivery contracts, which allow the City to use water both from the local Boulder Creek basin and from tributaries of the Colorado River to provide municipal water supply.

The State Constitution and City Code also dictate the requirements for fees, connections, water right allocation, and taps into water mains.

Since 1970, the City and Boulder County have jointly adopted a comprehensive plan that guides land use decisions in the Boulder Valley. The facilities and services section of the BVCP establishes policies linking growth to service standards and provisions found in the WUMP and other master plans. The BVCP is intended to provide overarching guidance to City departments via their master plans, which feeds into business planning and the Capital Improvement Program.

The Utilities Division's mission is to provide quality water services, as desired by the community, in a manner which emphasizes efficient management of fiscal and natural resources, and protects human and environmental health.

The overarching goals that have been established for the City are as follows. Further goals set for each area of the utility are included in Volume 2.

a. Provide safe and high quality drinking water
b. Minimize interruptions to the delivery of water
c. Operate cost effectively
d. Consider other community goals in operating the water utility
e. Provide informative and responsive customer service
f. Foster communication and coordination among water utility staff in different locations

Water provided by the City serves a variety of purposes ranging from those uses that require an assured supply such as drinking water and firefighting, to those uses that can tolerate occasional restrictions, such as lawn irrigation and car washing. It is recognized that no municipal water supply can ever be 100 percent reliable against all risk factors and that the economic and environmental opportunity costs of reducing the risks of occasional water shortages are significant. For this reason, reliability criteria for the source water system have been established as follows:

- For those water uses deemed essential to the maintenance of basic public health, safety and welfare such as indoor domestic, commercial, industrial uses and firefighting uses, the City shall make every effort to ensure reliability of supply against droughts with occurrence intervals of up to1,000 years.

- For the increment of water use needed to provide continued viability of outdoor lawns and gardens, the City shall make every effort to ensure reliability of supply against droughts with

occurrence intervals of up to 100 years. (Continued viability of outdoor lawns and gardens has been interpreted to mean that sufficient water will be provided to avoid significant death of landscape vegetation, but trees, shrubs and lawns may experience stress or dormancy.)

- For the increment of water needed to fully satisfy all municipal water needs, the City shall make every effort to ensure reliability of supply against droughts with occurrence intervals of up to 20 years.

The City's Drought Plan (2003, 2004, and 2009 revisions) includes four drought stages associated with increasing levels of water shortage severity. Drought stages will be declared based on relevant factors, including a review of a drought trigger formula specific to Boulder's water system. Drought response measures appropriate to each drought stage are contained in the 2009 revision of the Drought Plan. Water budget reductions will be used as a primary tool at each drought stage.

- **Stage 1: Moderate**, expected to occur once every 20 to 50 years on average, reduce overall municipal water use by 8%, emphasis on wise water use.

- **Stage 2: Serious**, expected to occur once every 50 to 100 years on average, reduce overall municipal water use by 14%, surcharges and fines to eliminate wasteful use, more water use limitations such as decreased lawn irrigation.

- **Stage 3: Severe**, expected to occur once every 100 to 1,000 years on average, reduce overall municipal water use by 22%, measures to reduce excessive water use, outdoor use limitations with some loss of lawns, shrubs and minor trees.

- **Stage 4: Extreme**, expected to occur less often than once in a 1,000 year period, reduce overall municipal water use by 40%, implement measures to eliminate most outdoor and non-essential water use.

The City's efforts to maintain a diverse water supply, from both the east and west slopes, reduces the effects on water delivery from droughts or emergencies occurring in any one source watershed. The City has modeled the source system for both current environmental conditions and a range of climate change scenarios. Without considering emergencies such as wildfires or a transmission system failure, the City is expected to meet the reliability criteria for current climatic conditions. Boulder would meet the most critical 100-year and 1000-year reliability criteria in all but one of eighteen climate scenarios modeled. The less significant 20-year criteria resulted in more frequent episodes of "nuisance level" minor water use reductions in one-third of the modeled climate change scenarios.

Reliability criteria have also been established for delivery of treated water. The reliability criterion of meeting all water demands with the exception of once in 20 years is the same for the source water and treated water system. However, the frequency of water use restrictions for essential uses and outdoor water use differ from those for the source water system in recognition of the additional vulnerability of treated water system components:

a. The City will ensure the delivery of the water required to satisfy essential needs including the maintenance of basic public health, safety and welfare such as indoor domestic, commercial and industrial uses and fire fighting uses, except for droughts and system failures having a frequency of no more than once in 100 years. *The average winter consumption plus a fire-flow reserve demand is established as a measure of this demand.*

b. The City will ensure delivery of the water required to provide for the continued viability of exterior landscaping, except for droughts and system failures having a frequency of no more than once in 50 years. *The following method is used to establish a measure of this demand:*

ELD = AWC + 0.65 * (PMD - AWC) where:

ELD = Exterior Landscaping Demand
AWC = Average Winter Consumption
PMD = Peak Month Demand

As an alternative, 75 percent of the peak month demand may be established as a measure of this demand.

c. The City will ensure delivery of the water required to fully satisfy all uses, except for droughts and system failures having a frequency of no more than once in 20 years. *The peak hour demand or the peak day demand plus a fire-flow reserve demand is established as a measure of this demand.*

Other goals and design criteria have been established and are summarized in Volume 2.

1.3.5 Water Use

This section discusses historical water use, baseline water use (for the period 1994 to 1996), current water use, peaking factors, and projected water use.

Water use followed an increasing trend from the early 1970s until 2000. The drought of the 2002 resulted in lower total water use, and levels have remained similar since 2002. Although outdoor water use can vary greatly from year to year based on weather conditions, indoor water use in the last few years has been similar to usage in the 1980s. This suggests that permanent structural changes have been made, such as the installation of water efficient toilets and appliances. Outdoor water use has fluctuated since the drought of 2002 and it is not clear if outdoor water conservation noted during the drought year will be permanent.

Baseline water use was established in the Water Conservation Futures Study, 1999 based on 1994 – 1996 water use. This resulted in 22,446 acre-ft used across the City at a population of 107,665, resulting in a baseline usage of 186 gallons per capita per day (gpcd). Projected water usage established in the Water Conservation Futures Study is based on historical water usage, planned population and employment and conservation goals adopted by City Council in 2000. The conservation goals, which are applied to the baseline water usage, are as follows:

- A 22 percent reduction in per-meter use for the single-family residential sector
- A 26 percent reduction in per meter use for multifamily residential sector
- A 14 percent reduction in per meter use for the commercial/industrial sector
- A one percent reduction in overall municipal use
- A 15 percent reduction in losses

The baseline was set at 186 gpcd, the conservation goal set at 149 gpcd, and the current use was calculated to be 147 gpcd. The current usage is based on 2006-2009 water use data and a population of 113,100 and correlates to an average of 18,587 acre-ft per year. This shows that the City has essentially achieved the conservation goals established in 2000.

Peaking Factors were also established. **Table 1-1** presents a summary of the planning period peaking factors used for evaluation and analysis throughout the master plan.

Table 1-1. Planning Period Peaking Factors

Period	Peaking Factor[1]				
	2010	2015	2025	2035	Buildout
Minimum Day	0.6	0.6	0.6	0.6	0.6
Minimum Month	0.6	0.6	0.6	0.6	0.6
Peak Month	2.0	2.0	2.0	2.0	2.0
Peak Day	2.6	2.6	2.6	2.6	2.6
Peak Hour	3.6	3.6	3.6	3.6	3.6
[1] To be multiplied by average daily flow (ADF) to obtain flow value					

Table 1-2 presents a summary of the planning period flow rates based on the peaking factors from **Table 1-1**.

Table 1-2. Planning Period Flows

Period	Flow (MGD)				
	2010	2015	2025	2035	Buildout
Minimum Day	10.1	10.3	10.8	11.4	12.8
Minimum Month	10.1	10.3	10.8	11.4	12.8
Average Day	16.8	17.2	18.0	19.0	21.4
Peak Month	33.6	34.4	36.0	38.0	42.8
Peak Day	43.7	44.7	46.8	49.4	55.6
Peak Hour	60.5	61.9	64.8	68.4	77.0

1.3.6 Water Conservation

Water conservation will continue to be an important area of focus for the City of Boulder. The City currently monitors and plans for improvements through the following:

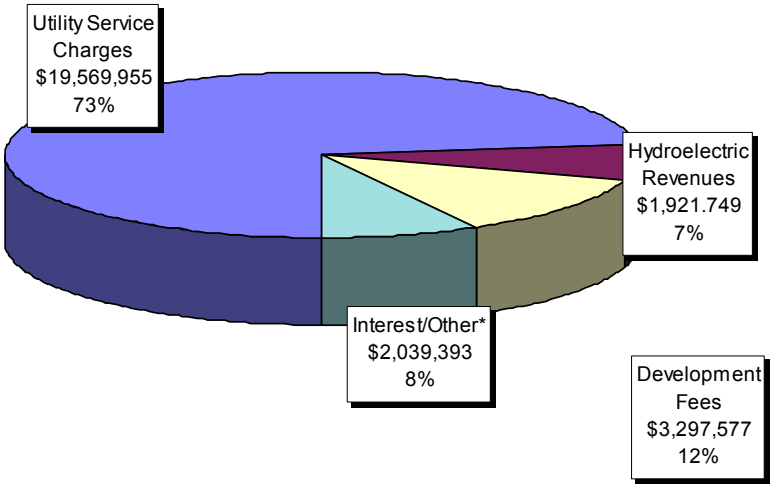
- Water Conservation Future Study
- Water Conservation Goals
- Rates Structure
- Water Conservation Plan
- Rebates
- Center for Resource Conservation
- Public Information and Outreach

An overarching goal for future Water Conservation Program efforts is to tailor water conservation to the City's unique water system and focus on the nexus between water and energy conservation, and to support water related environmental enhancements. At the tap level, this will include a re-evaluation of current programs to align them with stated goals. On a planning level this will include Water Conservation Program support for using less west slope water supplied through the Colorado Big Thompson and Windy Gap projects which minimize energy intensive west slope to east slope water transfers and help conserve westslope water. Water conservation measures that support maximizing raw water use from the Boulder Creek watershed will also be considered to support additional hydroelectric power generation throughout the City's system. It should be recognized that future water conservation measures of this kind may be limited due to the City's water rights, structure of the raw water system and location of water treatment facilities.

1.3.7 Finance

The Water Utility is funded primarily through monthly user fees which account for approximately 73% of annual water revenues. Other significant revenue is derived from plant investment fees, interest on investments, sale of hydroelectric power and bond proceeds. The average uses of funds are depicted in the **Figure 1-1** below.

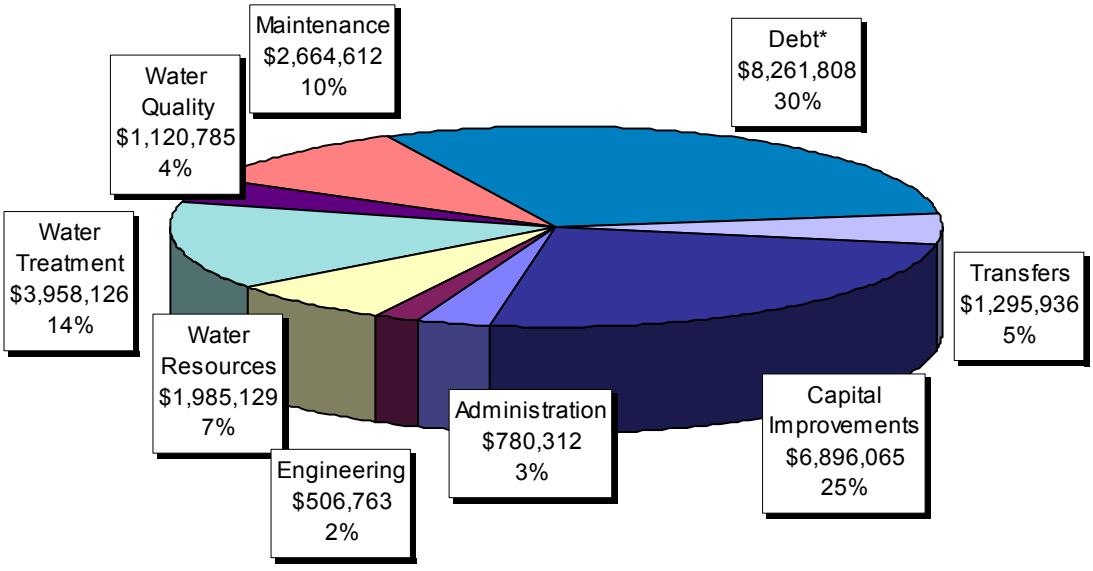
Figure 1-1. Average 2006-2009 Sources of Funds ($26,828,674)



*Excludes 2006 Lakewood Settlement of $19.5 million, and 2007 Bond refunding of $25.9 million

The water utility, which is predominantly self-supported by user charges, is established as an enterprise fund designed to separately finance and account for its facilities and services. The average uses of funds by facility and service are depicted in the **Figure 1-2** below.

Figure 1-2. Average 2006-2009 Uses of Funds ($27,469,536)



Utility assets are compiled and updated periodically to support financial reporting requirements. The total replacement cost less depreciation of Water Utility assets as of 2007 was $1,591 billion.

This City's fiscal year coincides with the calendar year. Annually staff prepares a six-year planning spreadsheet that includes projected revenues and expenditures for both operations and capital projects. Any future needed increases in monthly utility rates or bond issuances are identified. For the upcoming fiscal year a detailed budget is also prepared.

The Water Utility may issue revenue bonds for major capital projects and improvements. City Council can approve the issuance of bonds without voter approval. Revenues from both the City's Water and Wastewater Utilities are typically cross-pledged for repayment of any bonds issued for the Water Utility.

Net revenues (total gross revenues minus operating expenditures) before debt service shall be at least equal to 1.25 times its debt payment requirements on an annual basis. These debt service coverage requirements are established as part of the utility's bond covenants. The current ratings for the Water and Wastewater Utility revenue bonds are Aa1 from Moody's and AAA from Standard and Poor's. These are excellent ratings for this type of bond in Colorado.

The water utility maintains a 25% operating reserve and a separate capital reserve. The amount of the capital reserve is based on the minimum annual renewal replacement costs for capital. The capital reserves are initially set at $2,000,000 for the Water Utility.

The debt associated with several large bonds will be paid off during the next 10 years as indicated in Table 1-3 below. This includes most of the debt service associated with the Windy Gap project. The total debt annual service associated with the retirement of these bond obligations exceeds $7 million. This provides an opportunity for the Water Utility to fund several large capital projects without increasing water rates substantially. Possible projects include the Carter Lake Pipeline and Hydro, Barker Dam Outlet and Hydro and rehabilitation and improvements to the Betasso WTF.

Table 1-3. Outstanding Bonds

Project	Outstanding Principal as of 12/2010	Year bonds paid off
Imp. to the Boulder Reservoir Water Treatment Facility	$4,540,000	2016
Misc projects: Silver Lake Pipeline, Betasso Water Treatment Facility, Automated Meter Reading and Caribou Ranch	$17,910,000	2019
Reconstruction and Replacement of Lakewood Raw Water Pipeline	$18,705,000	2021

1.3.8 Administration

The Water Utility is administered by the City's Public Works Department – Utilities Division.

Primary work groups in the Water Utility include:

- Water Resources and Hydroelectric Operations
- Water Treatment Operations
- Water Quality and Environmental Services
- Utilities Planning and Project Management
- Utilities System Maintenance

Other work groups in the Public Works Department that support the Water Utility include:

- Information Resources
- Finance and Analysis (includes Utility Billing)
- Engineering Review
- Asset Management

The Water Utility is currently staffed with approximately 75 full time equivalent (FTE) positions. This does not include positions that support the Water Utility in different Divisions and Departments.The staffing level is competitive based on information from the American Water Works Benchmarking study. The City has participated in the American Water Works Association (AWWA) benchmarking studies for several years. The current publication used for comparison purposes is the 2009 Benchmarking Report which contains data collected from nearly 350 utilities. Each performance indicator within this report is presented using median-range charts. AWWA provides summary statistics of industry data which includes the median, 25th percentile, and 75th percentile values. In most cases, Boulder's Water Utility falls within the 25th to 75th percentile range.

It is important that the City of Boulder continue to devote resources to workforce planning. While existing staffing levels and distributions are appropriate for the City's needs, several factors in today's labor market are converging to create significant problems in the utility workforce. A mass exodus of utility employees is expected to occur due to retirement in the next 10 years and fewer U.S. college graduates are earning science or technical degrees than ever before, despite the fact that utilities are understaffed most particularly in engineer and operator positions.

1.3.9 Metering and Billing

The City has installed meters on all accounts in the City. The City has a meter testing program in place and tests meters 3 inches and larger according to AWWA policy. In 2006, the City initiated the replacement of existing transponders using new technology that allow customers to read their meters with water monitors.

Utility Billing manages approximately 29,000 billing accounts for the approximately 113,000 residents that live within and immediately surrounding the City limits. Meters are read via radio frequency once a month and uploaded into the billing system for bill generation.

A website allows customers to view account information, select ebills instead of paper bills and make a payment by credit card. As of November 2010, the City has 3,000 registered users and processes over 1,000 credit card payments a month.

During the next transponder replacement cycle, currently scheduled for the 2019-2024 time frame, an advanced metering infrastructure (AMI) should be considered. AMI is the term used to represent the networking technology supporting real time metering capabilities. Metering data is logged and made available to consumers via the internet. The data can be used for a variety of purposes including water usage profiling, time of use billing, demand forecasting and response feedback, leak detection, flow monitoring, water conservation enforcement and remote shutoff.

1.4 Volume 3 – Water Quality Strategic Plan

Boulder Creek is a well-loved recreational, aesthetic and natural asset in the City of Boulder (Boulder). Boulder Creek and its' tributaries are vital for providing drinking water, agricultural irrigation water, aquatic habitat, recreation, and power generation, and water quality determines the suitability of water for most of these uses. Water quality in the Boulder Creek Watershed is affected by natural factors such as geology, climate, and human-caused factors, such as wastewater effluent, runoff from roads and urbanized areas, agricultural practices, and atmospheric contaminants. The relative effect of these factors on water quality has changed over time and will continue to shift as population and urbanization increase and more demands are placed on our water resources. Poor water quality and the destruction of stream habitats can lead to the decline and degradation of this valuable resource and protective measures need to be taken. The Water Quality Strategic Plan (WQSP) outlines actions to protect and preserve Boulder's water resources.

1.4.1 Purpose of the Water Quality Strategic Plan

The WQSP is the first planning effort to address water quality policies and priorities for Boulder. The purpose of the WQSP is to develop clear and concise water quality goals, develop strategies and performance measures to achieve these goals, and provide a process to address current and future water quality challenges. The WQSP is a five-year plan that supports many of the principles and policies of the BVCP. The WQSP is designed to fit within the broader framework of the BVCP, which provides the overall policy direction for planning decisions within the Boulder Valley, including protection of water resources. The WQSP activities will be implemented by the City of Boulder's (City's) Water Quality and Environmental Services (WQES) Group, which is part of the Public Works, Utilities Division.

1.4.2 Water Quality Goals

Water quality goals were developed using an inventory of existing water quality goal statements found in the City's master plans, policies, and regulations, starting with the BVCP. From this exercise, five goal statements were developed and include:

- Provide safe and high quality drinking water.
- Manage pollutants from wastewater and other point-sources.
- Manage pollutants from stormwater and other non-point sources.
- Protect, preserve and restore natural water systems.
- Conserve water resources.

1.4.3 Recommendations

The recommendations developed for the WQSP are based primarily on the objective of adopting citywide water quality goals, and integrating these goals into planning and policy instruments. In addition, the recommendations address strategies to meet an unprecedented number of new or proposed federal and state water quality regulations. The recommendations include:

- **Recommendation 1:** Evaluate and update policies in the Boulder Valley Comprehensive Plan to incorporate water quality goals. WQES staff will review and recommend updates to the BVCP to ensure incorporation of water quality goals. The BVCP is scheduled to be updated in 2011.

- **Recommendation 2:** Perform analyses on City plans, policies and projects to identify gaps in meeting water quality goals. WQES staff will review relevant plans, policies, and projects, such as master plans, design and construction standards, and the Boulder Revised Code to: 1) ensure that the City complies with all state and federal laws and regulations on water quality and environmental protections; and, 2) meet water quality goals.

- **Recommendation 3:** Develop annual work plans and water quality reports. Annual work plans and reports will be developed for each of the seven WQES Group programs. These programs include: Stormwater Quality, Water Quality Education, Water Conservation, Industrial Pretreatment, Drinking Water Quality, Water Quality Planning and Laboratory Services. Staff will use the work plans to direct program activities specific to the WQSP goals.

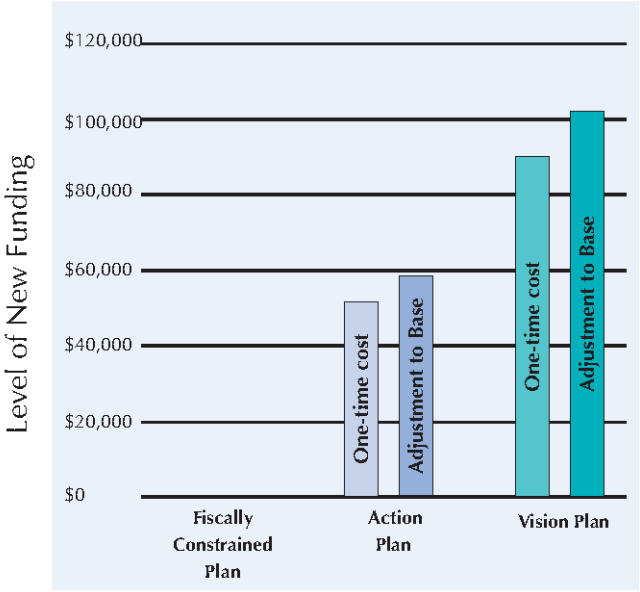
- **Recommendation 4:** Prepare for future water quality regulations. WQES staff will prepare for future water quality regulations, ensure regulatory compliance, and incorporate capital improvement requirements needed to meet regulations in the City's budget planning process.

1.4.4 Investment Plan and Funding Options

The WQSP will be implemented primarily by the WQES Group. The investment program is based on annual operating budgets for WQES programs, and does not include capital improvement projects. Implementation options are presented at three funding levels, according to the City's Business Plan process, and includes Fiscally Constrained, Action, and Vision plans. **Figure 1-3** summarizes the funding plans.

The most significant challenge the WQES Group faces in implementing the WQSP is preparing for new water quality regulations. The WQSP identifies the funding gap between the Fiscally Constrained Plan and the Action Plan.

Figure 1-3. Funding Plans



1.5 Volume 4 – Source Water Master Plan

The Source Water Master Plan (SWMP) is intended to be a foundation document that will allow informed decision-making regarding one of the City's most important assets, its water supplies. Boulder's founders recognized the importance of a reliable water supply and began developing a water supply system for the growing city in the late 1800's. Careful planning for the City's future water needs now can help assure that future Boulder citizens also inherit a reliable and sufficient water supply. The SWMP documents the current status of the City's water resources and raw water facilities and defines issues to be addressed to provide for the City's future water supply needs. The SWMP and its recommended projects and programs

provide a framework for sustainable management of the City's source waters so that future water supply needs are met through drought periods without violating adopted reliability criteria.

Past and current studies predict that as long as current supply and drought management strategies remain in place, the City will have enough water in the future, even with climate change and predicted population increases. While staff intends to keep a close eye on future climate change science and water supply modeling, the adequacy of the City's source water supplies meant that the focus of the SWMP did not need to be, "Where does the City find more water?" Instead, the focus was on the future steps and considerations needed to manage the existing source water system, including its aging infrastructure.

The SWMP contains two volumes. The first volume provides a summary level of detail aimed at a general audience. Volume 1 is consistent with other City master plans and planning documents in terms of format, content and level of detail. The second volume contains much more detail on background, system management, issues and recommendations. Volume 2 provides the details necessary for future execution of programs and projects. Volume 2 also documents critical system information in one place in a way that has never been done before, which will be valuable to current and future staff. The second volume is prepared more for an audience having or desiring detailed institutional knowledge of the source water system.

The recommendations from the SWMP can be divided into three general categories:

1. Policy – recommendations for changing or implementing new policies to address overarching source water supply management and strategy issues
2. Facilities Improvements – recommendations for improvements to address physical infrastructure needs in the source water system
3. Studies and Plans – recommendations for studies, environmental enhancements and other staff efforts to address a specific issue or informational need

A summary of these recommendations is presented in the following sections.

1.5.1 Policy Recommendations

The five source water policy recommendations are as follows:

Increase System Flexibility (1) – Pursue "no-regrets" actions that would increase system reliability and flexibility in a way that provides value to the community and is sustainable for the future. No-regrets actions would be considered good now and still good if things change in the future. They would be actions that can be taken without unnecessary impacts to water rates. An example of a no-regrets action is continuing to develop hydro power potential in an environmentally responsible manner where opportunities exist within the City's water system.

Reaffirm Reliability Criteria (2) – The Community Study Group (CSG) (2008) recommended revisiting public support for the current water supply reliability criteria policy, which expresses the City's goals for water supply during droughts of varying recurrence intervals. It was further recommended that in order to effectively define community preferences, the reliability criteria need to be refined to define the embedded quantitative assumptions concerning indoor and outdoor water use. The current reliability criteria employ qualitative standards without defining the quantity of water necessary to meet those standards.

Formalize Policy for Use of Conserved Water (3) – The CSG (2008) desired policy clarification on the intended uses for water made available by the City's water conservation efforts. Are we conserving water now to ensure that there will be sufficient supply available to support population and employment at buildout? Does the community's water conservation translate directly to long-term increased streamflow

or water available for other non-municipal uses? A clear understanding should be developed for why we currently conserve water during non-drought years.

Develop Source Water Protection Policy (4) – The policy directive for this topic would be to actively pursue protection of the City's source water quality in collaboration with other entities. Issues to be addressed might include wildland fire hazard mitigation, point and non-point source pollution and nuisance aquatic species.

Stop Pursuing Sale of Windy Gap Units (5) – Given uncertainties in future water yields due to potential climate change and other currently indefinable factors, policy direction concerning retention of the remaining Windy Gap units should be reevaluated and updated. Staff recommends not pursuing any further sales of the City's remaining Windy Gap units until a reevaluation of the yield and utilities of this water is completed unless more attractive alternative water supply opportunities arise.

1.5.2 Facility Improvements

Facility improvements recommended in the SWMP were broken into two categories, those with an estimated cost over $50,000 categorized as capital improvement projects and those with an estimated cost under $50,000 categorized as minor projects that would be funded out of operating budgets. Since the SWMP completion, some of the improvement recommendations have been modified slightly based on new information and some improvements have been initiated. The recommended projects are summarized below by water source and facility/structure with those with an estimated cost under $50,000 indicated in *italics*:

North Boulder Creek

- Green Lake #2 evaluation of dam structure and study to determine the best method and likely cost for repairs followed by completion of the structural maintenance project
- Albion Dam evaluation of dam structure and study to determine the best method and likely cost for repairs or potential dam raise followed by subsequent liner, crest, and spillway repair/dam raising project
- Island Dam minor repairs, including patches on upstream face and splash wall around high water mark
- Miscellaneous watershed valve replacements in two phases, years 1-6 and years 7-20
- Lakewood pipeline ongoing maintenance recommended in the 5th inspection report
- *Repair non-functional outlet slide gate at Green Lake #1*
- *Albion Dam staff gage, pressure transducer and valve house platform*
- *Install generator at Silver Lake Dam for valve actuation and lighting*
- *Silver Lake Dam low flow bypass repair*
- *Silver Lake residence SCADA tie in and roof replacement (including Bunk House)*
- *Install control panel with portable generator to actuate valves at Goose Dam*
- *Provide new instream flow gage installation at Sherwood Creek*
- *Redesign current instream flow recording upstream of Lakewood to measure low flows*

Middle Boulder Creek

- Skyscraper Dam evaluation and gate replacement
- Skyscraper reservoir lining and spillway repair
- Purchase a residence within sight of Barker Dam for improved access and response time
- Fund advanced treatment at the Nederland WWTF for protection of Barker Reservoir water quality
- Add a hydropower unit at the toe of Barker Dam (Hannah Barker Hydro)

- Replace Barker Dam outlet works
- Barker Dam anchor grout repair
- Obtain FERC exemption for Boulder Canyon Hydro Project and USFS land use authorization for Barker Gravity Line
- Prepare and execute land exchange with USFS for Barker Gravity Line lands
- Repairs to Barker Gravity Line in two phases addressing critical needs in phase 1 and less critical needs in phase 2
- Kossler Reservoir Main Dam repairs including replacement of degraded upstream face concrete panels and dam stabilization
- Miscellaneous Kossler Reservoir minor repairs
- Kossler Reservoir outlet repairs to address water downstream of road and concrete damage
- Kossler bypass connecting the Barker Gravity Line to Boulder Canyon Hydro Penstock
- Boulder Canyon Hydro Penstock evaluation followed by replacement if required
- Boulder Canyon Hydro replacement with appropriately sized unit
- *Barker Dam floodgate conduit inspection*
- *Install high water alarms upstream of Orodell*
- *Armor Barker Gravity Line outlet to Kossler Reservoir to prevent further erosion*

Colorado River

- Boulder Feeder Canal stormwater diversions to divert stormwater outfalls over the canal (two phases)
- Carter Lake pipeline from Carter Lake to Boulder Reservoir
- Hydropower unit on Carter Lake Pipeline
- Low pressure pipeline from Boulder Reservoir to mouth of Boulder Canyon for Farmer's Ditch exchange potential
- Line Wittemyer ponds to use for exchanges
- Restore Farmers Ditch capacity to increase City's diversion capabilities

Other

- *Develop raw water irrigation systems for City properties where feasible.*

1.5.3 Studies and Programs

The SWMP recommended a number of studies and programs. The studies and programs recommended are summarized below by water source.

North Boulder Creek

- Evaluate Lakewood Dam and report on the longitudinal cracks observed in 2001

Middle Boulder Creek

- Implement FERC Part 12D inspection report recommendations
- Collaborate with other entities to prepare a community watershed wildland fire protection plan

South Boulder Creek

- Assist the Open Space and Mountain Parks Department in developing an approach and organizational structure to provide instream flows
- Explore options for additional use of Utilities assets within a comprehensive City program for improved instream flows

Colorado River

- Continue to monitor developments on the Colorado River Compact. If the State study is inadequate, move ahead with other interested parties to conduct a study of West Slope climate change impacts and mitigation options
- Take immediate action to prevent or delay introduction of zebra and quagga mussels to Boulder Reservoir by iproving oversight on recreation and coordinating with NCWCD
- Continue involvement in Boulder Feeder Canal trail design to reduce potential impacts to the water supply
- Work with the Parks and Recreation department regarding planning for recreational uses on Boulder Reservoir
- Take an active role in NCWCD's activities to proactively protect the quality of West Slope water supplies

System-Wide

- Complete a source water emergency plan
- Update water demand projections based on BVCP and changes in demographic/water use projections
- Complete modeling to define the level of reliability resulting from updated demand projections, water conservation savings and supply projections
- Update water use and conservation studies/update 2003 drought plan
- Explore the pros and cons of long-term commitments to non-municipal water uses
- Update acquatic habitat studies to assess effectiveness of current instream flow program and, if needed evaluate options for providing enhanced habitat in sufficient detail to identify impacts, costs, and benefits
- Evaluate environmentally and economically feasible hydroelectric sites within the water transmission system
- Develop a maintenance plan and corresponding maintenance logs for each water source to document daily and seasonal operations and maintenance needs
- Evaluate the balance in reliance on East Slope and West Slope supplies and determine if a change in the blance would cause a need for new water supplies at build-out

1.6 Volume 5 – Treated Water Master Plan

The Treated Water Master Plan (TWMP) is intended to be a comprehensive summary of the City of Boulder's (City's) treated water system, including the Betasso Water Treatment Facility (BWTF), the Boulder Reservoir Water Treatment Plant (BRWTF), and the associated treated water storage and distribution facilities. The purpose of the TWMP is to describe and document the City's treated water system, provide an evaluation of the current conditions, and offer recommendations for improvements. The TWMP and its recommendations provide a framework for the management of the City's treated water systems in order to ensure reliable and safe treated water supply for the citizens of Boulder.

1.6.1 Betasso Water Treatment Facility (BWTF)

The following is a summary of conclusions from the evaluation of the BWTF as documented in Volume 5:

1. The BWTF currently has the capability to treat a peak flow of approximately 40 MGD to the level required to meet current regulatory requirements. Capacity is limited by the flocculation and filtration processes. All other processes have capacities equal to or greater than 50 MGD and process piping has the hydraulic capacity to convey 50 MGD without restriction.

2. Performance data suggests that actual sedimentation capacity is less than the theoretical value due to poor flocculation, possibly poor coagulation and the less than optimum sedimentation basin configuration.

3. Performance data suggests that the actual filtration capacity may be less than the design value of 5 gpm/ft^2; due to low Unit Filter Run Volume (UFRV), particularly in filters 1-4 and during periods of high color. The actual cause(s) of the low UFRV and the corresponding capacity limitation at the BWTF is likely a combination of one or more issues and requires further study for a conclusive determination.

4. To go beyond the current sustainable plant flow, the UFRV of filters 1 through 4 and for the period of high color needs to be increased.

5. The operations staff has done well to manage the operation of the plant during challenge conditions, to produce high quality treated water, and to shift the treated water production to the BRWTF when the existing capabilities of the BWTF are reached.

6. The lagoons are at their capacity for storing the dilute sludge from the sedimentation basins. A thickening process would help to reduce the sludge volume significantly.

7. Filters 1 through 4 were constructed at a different time than filters 5 through 8 and as a result they may have different underdrain systems, which could account for some of the differences in UFRV between the filters. In addition, some of the fines may have been removed in filters 1 through 4 during the episodes of air entrainment, which now have been resolved.

8. Filters 1 through 4 have been in operation longer than what filters 5 through 8 have been. Being in operation for a longer period of time provides more of an opportunity for the underdrains to become clogged with mineral deposits.

9. Improvements in the pumped-diffusion mixing of coagulants will improve the downstream flocculation, sedimentation and filtration processes.

10. Improving the filterability of the floc formed through the treatment for color removal will have a marked improvement on the overall treated water production as color has to be removed from the source water about 25% of the time.

11. The City has determined that they do not plan on closing any of the waste impoundments at the BWTF.

The following recommendations are made based on these conclusions:

1.6.1.1 Studies

1. Perform a series of bench-, pilot-, and plant scale tests to evaluate plant performance at flows near the desired capacity of 46 MGD to investigate the reported pretreatment problems and to verify the maximum filter hydraulic loading rate.

2. Perform an inspection of the filter underdrains in Filter Nos. 1 and 5 to check for clogged passages.

3. Perform a grain-size distribution and sieve analysis of the media in Filter Nos. 1 and 5 to determine and compare characteristics of the media.

4. Investigate options for combined influent flow measurement and review existing flow measurement devices to confirm installation and calibration.

5. Pilot studies should be performed on thickening options for the residuals from the sedimentation basins.

6. Develop viable workforce strategy that includes appropriate succession planning and knowledge transfer.

7. The City should perform sampling and testing of waste streams flowing into the waste impoundments at the BWTF to determine type of impoundment and if improvements are needed. The results of this study should include recommended improvements and suggest a timeline for inclusion in either the capital improvements or operations and maintenance budget.

8. Investigate changes or other systems that could improve operational ease of the lime feed system.

9. Investigate cost of converting from fluorosilicic acid to sodium fluorosilicate to reduce trace contaminants.

1.6.1.2 Capital Improvements

1. Improve performance of the pumped-diffusion mixer by adding either a VFD on pump or a flow control valve and providing an additional coagulant feed point in the pump header immediately upstream of the spray nozzle.

2. Improve the residuals thickening, dewatering, and drying process by constructing two new gravity thickeners to thicken the suspended solids coming from the sedimentation basins and installing a mechanical dewatering facility to treat the float from the DAF and gravity thickeners. This may be best accomplished through two projects: thickening and dewatering.

3. Pending the results of the plant-scale testing and the recommended plant capacity evaluation, decide whether to: 1) install flocculation/sedimentation basin baffling and equipment rehabilitation, or to 2) retrofit new flocculation facilities and lamella plate sedimentation system in existing basins.

4. Rehabilitate filter gallery including valve and actuator replacement and repainting of gallery piping.

5. Add more standby generator capacity. The current capacity is maximized.

6. Tie chemical feed control to SCADA.

7. Upgrade chemical storage facilities.

8. Add residual aluminum analyzer.

9. Upgrade on-line instrumentation and SCADA reports.

1.6.2 Boulder Reservoir Water Treatment Facility (BRWTF) at 63rd Street

The following is a summary of conclusions from the evaluation of the BWTF as documented in Volume 5:

1. Significant improvements have been recently implemented to increase the treatment capacity to 16 MGD firm and 20 MGD peak.

2. Remote operation of the facility has been discussed, but current instrumentation and controls would need to be greatly enhanced to allow this to occur.

3. The facility currently relies on a single power feed from the local electric utility company.

4. All water must be pumped into the distribution system by six constant speed high service pumps that are incapable of achieving design rated capacities and exhibit evidence of cavitation.

5. The City has determined that they do not plan on closing any of the waste impoundments at the BRWTF.

6. The reliability of BRWTF coming online and running at full capacity due to an unexpected shutdown at BWTF needs to be tested and evaluated

The following recommendations are made based on these conclusions:

1.6.2.1 Studies

1. Evaluate the existing BRWTF filters and re-evaluate adding filter to waste capability and backwash pretreatment options.

2. A study should be conducted to accurately define the problems with the high service pumps, explore alternative pump styles and/or configurations, and perform a net present worth analysis to determine if the cost associated with the installation of VFD's can be justified.

3. The City should perform sampling and testing of waste streams flowing into the waste impoundments at the BRWTF to determine type of impoundment and if improvements are needed. The new lagoons should be evaluated to determine the structural integrity of basins and to determine if site drainage issues exist. The results of this study should include recommended improvements and suggest a timeline for inclusion in either the capital improvements or operations and maintenance budget.

4. Monitor the effect of the new carbonic acid feed system as related to TOC removal

5. Continue to monitor for presence of bluegreen algae in Boulder Reservoir for taste and odor concerns. The City may wish to initiate a study to determine preventative and/or treatment options to mitigate the issues related to the presence of bluegreens.

6. Commence a study to evaluate and recommend alternatives for redundant or back up power to BRWTF.

7. Create standard operating procedures for unexpected shutdowns at BWTF. Also, create schedule for testing the functionality of the treatment plant and distribution system components under various outage conditions.

8. Develop viable workforce strategy that includes appropriate succession planning and knowledge transfer.

1.6.2.2 Capital Improvements

1. Improve raw water delivery intake at the BFC, including a new access way and platform and new automated self-cleaning screen to alleviate safety concerns.

2. Based on the results of filter studies, rehabilitate filters, including the replacement and updating of internals, media, valves, actuators, filter control consoles, and instrumentation. The concrete walls are also in need of being recoated.

3. Automate chemical systems for improved treatment process performance and more efficient use of chemicals.

4. Improve process instrumentation and control for better process monitoring and potential unmanned operation of BRWTF.

5. Miscellaneous security improvements defined by the Vulnerability Assessment should be reviewed and implemented as necessary.

6. Improve chemical mixing at the filter effluent post flume.

1.6.3 Treated Water Distribution System

The following is a summary of conclusions from the evaluation of the treated water distribution system as documented in Volume 5.

The City should continue to implement a proactive pipeline replacement program at a rate of $2,100,000 in 2008 dollars for the water distribution pipe. This should be sufficient to maintain the current service level, as defined by the number of water main breaks, over the next decade. The replacement program is coordinated with the Transportation Division street overlay and reconstruction program. The City should develop a similar program for the larger diameter water transmission pipe. Although the City is not currently experiencing problems with these pipes, some of the pipes are over 50 years old and may start to fail. Additional research regarding the characteristics of these pipes should be initiated followed by field inspection.

Five different system failure scenarios were modeled to understand how the City of Boulder could meet demand during a variety of failure conditions.

The five scenarios were:

1. BWTF out of service with minimum day demands being met entirely from the BRWTF through pump stations

2. Sunshine pipeline out of service with maximum month demands being met from the BRWTF and BWTF through the Canyon pipeline only, in combination with the Iris, Cherryvale, Maxwell and Kohler pump stations, hydroelectric facilities, and PRVs as needed.

3. BRWTF out of service with maximum month demands being met entirely from the BWTF through the Maxwell, Kohler, Iris, and Cherryvale hydroelectric facilities and PRVs as needed.

4. Canyon pipeline out of service with maximum day demands being met from the BRWTF and the BWTF through the Sunshine Pipeline only, in combination with the Iris, Cherryvale, Maxwell, Kohler, Iris, and Cherryvale hydroelectric facilities and PRVs as needed.

5. Sunshine pipeline and BRWTF out of service with minimum day demands being met from the BWTF through the Canyon Pipeline only and the Maxwell, Kohler, Iris, and Cherryvale hydroelectric facilities and PRVs as needed.

Model results from each scenario were compared against the reliability criteria to determine how well the system was able to meet demand while maintaining level of service under each scenario. For all system failure scenarios, the City's water distribution system is able to meet the demand condition without dramatically impacting level of service within the distribution system.

Recommendations for future studies and capital improvements include:

1.6.3.1 Studies

1. Inspect hydroelectric generating facilities and pressure reducing valve (PRV) stations and develop repair procedures

2. Study results of new distribution system monitoring.

3. Additional pressure and flow metering throughout the system is also recommended to confirm operational strategies and model accuracy. C-factor modeling is also recommended to determine the roughness in key pipes in the distribution system.

4. There are some locations with pressures from the hydraulic model below 40 psi. Each of these should be investigated further to evaluate whether improvements need to be made to address these deficiencies.

5. There are some locations with fire flow capacities from the hydraulic model below 1500 gpm. Each of these should be investigated further to evaluate whether improvements need to be made to address these deficiencies.

6. Develop a risk-based approach to the pipeline replacement program to prioritize facility replacement.

7. Staffing needs need to be evaluated and methods for knowledge retention developed with much of the workforce retiring over the next several years.

1.6.3.2 Capital Improvements

1. GIS/UMMS development to ensure the documentation system is up to date.

2. Minor repairs to the hydroelectric generating facilities, and PRV stations

3. Install level sensors and improve mixing at storage water reservoirs

4. The results of the 2010 CDPHE Sanitary Survey requires minor improvements to the storage reservoirs

5. The results of the MWH structural evaluation recommends improvements to the storage reservoirs, PRVs, and Hydroelectric Facilities. These evaluations are included in the TWMP.

6. Install online monitoring of chlorine residual, turbidity, and pH in key points in the distribution system

1.6.4 Water Quality Regulations

Federal and state drinking water standards have developed and expanded over the past 100 years as knowledge of the health effects of contaminants has increased and the treatment technology to control contaminants has improved. The principal driving force behind development of drinking water standards and regulations is protection of public health. Below are future regulations that may impact the City of Boulder's Water Utility.

1.6.5 Future Water Quality Regulations

The new or revised regulations that the City needs to keep informed about include:

- **Contaminant Candidate List 3 (CCL3) –** is the list of potential contaminants that may be regulated by the SDWA under the next round of legislation.
- **Third Unregulated Contaminant Monitoring Rule (UCMR3) –** the City of Boulder is part of the 4,800 utilities across the country that will monitor 24 of the target contaminants in the CCL3.
- **Revised Total Coliform Rule –** the City of Boulder already monitors total coliform and chlorine.The revisions require public water systems that are vulnerable to microbial contamination to identify and fix problems.
- **Revised Lead and Copper Rule –** will be revised in the spring of 2012 and will likely revise the current sample tiers, change lead service line replacement requirements, and require additional sampling at schools and child **care facilities.**
- **Endocrine Disrupting Compounds and Pharmaceuticals and Personal Care Products (PCPs) –** Although currently there are no federal regulations specific to endocrine disrupting compounds (EDCs) and most PCPs in the U.S, some are being considered for the UCMR3.
- **Algal Toxins –** specifically blue-green algae (cyanobacteria) are a contaminant of concern because of their ability to release harmful toxins that can contaminate drinking water supplies.
- **Nitrosamines –** the City participated in the monitoring of 6 nitrosamines as part of UCMR2 and none were detected. The USEPA is evaluating whether or not these will need to be monitored in the future.
- **Carcinogens –** the USEPA is considering a new strategy to tighten restrictions on four waterborne compounds that can cause cancer: tetrachloroethylene (PCE), trichloroethylene (TCE), acrylamide, and epichlorohydrin.
- **New Drinking Water Strategy –** the USEPA announced in early 2010 that a new drinking water strategy is being developed to address a range of drinking water quality concerns and is expected to streamline and accelerate the regulatory development process.
- **Disinfection Byproducts (DBPs) –** since new regulations in October 2005 the City has met the TTHM or HAA_5 limits, but if they are lowered significantly in the future, the City may not be able to comply.

1.6.6 Additional State of Colorado and County Regulations

The City needs to meet the following State of Colorado or County Regulations and monitor any changes associated with them:

- Cross Connection Control Policy
- Waste Impoundment Regulations
- Residuals Disposal
- Technologically Enhanced Naturally Occurring Radioactive Materials (TENORMs)

1.6.7 Asset Management

Asset Management has become an important process for the City of Boulder to estimate and justify the overall renewal and replacement CIP and maintenance budgets in a strategic, defensible manner. Through a variety of recent asset management projects, including this one, the City is establishing a foundation of understanding on which it can build a more proactive asset management program to better strategically manage its water infrastructure, prioritize improvements, and maintain the value of its water asset base investment while maintaining the levels of service its customers expect. Asset management recommendations were broken down into near-term and long-term recommendations as follows:

Near-term recommendations for the City's existing asset management approach include:

- Migrating asset data into one database driven application for more robust asset management capabilities.
- Establishing a data framework to have a clear and consistent asset hierarchy and asset registry.
- Incorporating the consequence of failure analysis to enhance the condition-based analysis of this task to strive for an enhanced asset renewal forecast that is risk-based.
- Establish a process to enable and support ongoing and regular updating of data, scores, and overall asset management strategy.

Longer term recommendations for the City's asset management strategy include:

- Efficiently **assess** its asset management capabilities against industry best practices across strategy, people, processes, data, tools, and performance to identify "quick win" improvements to attain stakeholder buy-in and chart a roadmap to improvement across these areas.
- Develop an ongoing, **programmatic approach** to asset management to drive more proactive asset strategy throughout the organization in a coordinated manner and realize benefits associated with more defensible renewal budgets and utility performance.
- Create an overarching **vision and guiding policies** and a plan to communicate them to attain staff buy-in, understanding, and coordinated and useful contributions to better asset management.
- Identify the targeted **levels of service to customers** that the City idealizes through enhanced asset management and associated performance metrics to help steer priorities and decisions related to the ongoing maintenance, repair, and replacement of assets.
- Structure a **data framework** to have a clear and consistent asset hierarchy and asset register, communicable throughout the organization, that can be used to consistently structure and

organize asset data, as well as enable better data version control, completeness, utilization, and integration in and between software platforms including UMMS, GIS, and CAD.

- Apply a proactive **risk based** approach to renewal forecasting across vertical and horizontal assets to consider the criticality of assets in addition to just their condition for repair or replacement across all asset groups.

- Analyze the City's **key enterprise IT systems**, including those for the UMMS, financial management, CIS, GIS, document management system and other key technology as well as their current use, performance, and objectives. Determine the best tools, processes, and integration to meet the needs and visions of the City across its asset base and consider an overall asset management platform tool and dashboard.

- Establish **business processes** to enable and support ongoing enhanced asset management, regular updating of condition/risk scores, and an overall asset management strategy.

- **Roll-in climate adaptation planning** and vulnerability assessment of source water asset and others into risk based asset management planning.

1.7 Volume 6 – Capital Improvement Projects

The purpose of this Volume is to prepare a consolidated prioritized capital improvements plan (CIP) from the CIP recommendations included in the WQSP, the SWMP, and the TWMP.

1.7.1 Consolidated CIP Development Approach

The capital improvements program (CIP) list is generated to ensure that the City of Boulder is consistently meeting regulatory requirements, providing good customer service, and maintaining infrastructure assets in a sound, functioning condition. The City has decided to consolidate the CIPs developed from different operating groups into a single CIP such that overall available funding is spent wisely and prioritizations are considered in the context of the water utility as a whole across all divisions. The development of a consolidated CIP, as part this WUMP, represents a shift from previous planning efforts for individual parts of the water utility toward a more coordinated and integrated planning approach. These coordinated operational efforts have resulted in a more holistic view of the entire water supply system from watershed to customer tap and the interdependent relationships of the various system components that impacts capital and operations planning. It is this understanding of the interdependent relationships and how each part affects the whole that ultimately allows for the desired outcome, proper prioritization of projects across the entire water utility. It is anticipated that the consolidated CIP developed in this WUMP will be revised as part of the regular CIP revision process as collaboration efforts and understanding continue to increase across the water utility.

1.7.2 Budget Process and Assumptions

1.7.2.1 Budgeting Process

The first year's program in the CIP is adopted by the City Council as the Capital Budget, as a counterpart to the annual Operating Budget. Even though fiscal resources are appropriated only in the first year of the CIP, the succeeding five years of the CIP are important in providing a long-term plan for setting spending priorities, scheduling projects in a logical sequence, and coordinating and targeting CIP projects for all City departments. Each year the CIP is updated by adding a new sixth year of capital improvement projects. Adjustments are made to costs and revenues forecasted the previous year. Changes may also

be made to the year(s) in which a project is scheduled, reflecting changes in fiscal conditions and changes in overall funding priorities. New capital projects may be added or deleted based on new facility needs identified in updated or new City master plans, area plans, or studies. Capital improvements also may be on-going line items to address continual capital needs.

The CIP schedules the necessary capital projects to ensure maintenance of an adequate range of urban services over the 20-year planning period reflected in this plan.

1.7.2.2 Budgeting Assumptions

The planning period inflation rate for budgeting purposes is assumed to be 3% per year. This assumption is based on historic records of the Engineering News Record (ENR) Cost Index for Denver. The ENR index is deemed to represent cost factors affecting the replacement cost of the city's water utility infrastructure assets. The ENR index has escalated at a normalized rate of over 3 percent per year for the last 10 (3.42%), 20 (3.72%) and 30 (3.90%) year periods of time. It is anticipated these trends will continue in the future. The assumed rate of inflation should be reviewed annually and adjusted as appropriate.

Fiscal constraints for CIP projects are directly tied to the operating and non-operating funding sources of the Water Utility Fund. The Water Utility Fund is composed of the following sources of funds:

Table 1-4. Funding Sources

Operating	Non-Operating
• Sale of Water to General Customers • Projected Rate increase • Bulk/Irrigation Water Sales • Hydroelectric Revenue • Miscellaneous Operating Revenues	• Plant Investment Fees • Connection Charges • Special Assessments • State & Federal Grants • Interest of Investments • Rent, assessments, and other miscellaneous revenues • Sale of Real Estate – Yards Masterplan • Transfer from General Fund – Fire training center • Projected Bond Proceeds

The breakdown of the funds is shown in **Figure 1-1** in Section 1.2.7 above.

For planning purposes, the City of Boulder has separated the list of capital improvements into three funding level categories: Fiscally Constrained, Action, Vision. These categories were established to fit different levels of fiscal budgets created using different sets of funding assumptions. The first budget level, fiscally constrained, is generally governed by conservative assumptions with respect to rate increases, water sales revenues, hydropower revenues, plant investment fees, and grant funding. The second budget level, action, is based on less conservative assumptions such as rate increases that may exceed projected inflation rates and increased plant investment fees and/or connection charges. The third budget level, Vision, is typically based on very aggressive funding assumptions.

1.7.3 Categorization and Prioritization of Projects

In order to prepare this first CIP that consolidates projects from the source water, water treatment and distribution system, each of the projects on the CIP list were categorized and prioritized. This was accomplished through a series of workshops and discussions. Consultants and staff worked together to select prioritization criteria and weighting factors. Prioritization criteria included the following:

1. Does the project improve health and/or safety concerns?
2. Does the project provide compliance with regulations?
3. Does the project improve customer service (water quality, service pressure, etc.), or increase reliability?
4. Does the project reduce life cycle costs, improve operational efficiency, or improve sustainability? Is it an opportunity to collaborate with other City projects and utility providers?

City staff considered all of the criteria to have equal importance or weighting. City staff members then evaluated each of the projects against the evaluation criteria and provided a funding priority in accordance with the three funding level categories for each project as follows:

1 = Fiscally Constrained

2 = Action

3 = Vision

The funding prioritization of projects is a quick means to segregate projects by need and level of importance based on the evaluation criteria. Each project was ranked high, medium and low against each of the four evaluation criteria by City staff representing each of the "stakeholder" departments including treatment, distribution, project management, and water quality to help determine an initial funding priority. The projects in the Source Water Master Plan were prioritized during execution of that planning project and their prioritization was preserved when City staff combined/integrated those projects with the prioritized TWMP projects.

The consolidated CIP with initial project prioritization and associated costs was presented for discussion, revision, and refinement. Following several iterations of refinement that included identifying projects more appropriately funded from utility department operations and maintenance (O&M) budgets rather than the CIP budget, the consolidated water utility project list was updated to differentiate between capital and O&M projects and approved.

1.7.4 Water Utility CIP

1.7.4.1 Consolidated Water Utility Projects List

The entire consolidated water utility projects list (capital and O&M) is presented in Table 6-1 of Volume 6 – Consolidated Capital Improvements Plan. The table is organized by funding priority and includes the planned funding source and funding year based on the consolidated CIP recommended. Many of the O&M projects included in the list have a funding priority and funding source established but the funding year remains to be determined (TBD) pending annual operating budget performance in the upcoming years.

1.7.4.2 Consolidated CIP

A consolidated CIP for each of the fiscally constrained, action, and vision funding level budget categories was developed by City staff in accordance with the following general approach for "fitting" projects within the available funding associated with each funding level budget.

- Projects with a funding priority of "1" were fitted as early as possible in the planning horizon followed by funding priority "2" and "3" projects.

- Large projects and groups of smaller projects were consolidated and grouped into projects that the City plans to issue bonds for. For example, a 10-year bond issuance cycle has been established for each of the Betasso Water Treatment Facility (BWTF) and Boulder Reservoir Water Treatment Facility (BRWTF) to account for anticipated upgrades and renewal/replacement needs. The 10-year cycle for BWTF includes the years 2016 and 2026 in this planning period while the 10-year cycle for the BRWTF includes the years 2020 and 2030. Funding priority "3" projects were generally pushed to the latter of the two bond projects for each facility.

- Because specific projects identified on the consolidated projects list, regardless of funding priority are generally considered more important than the more generalized renewal/replacement projects coming from the asset management spreadsheets, the specific projects were provided funding in each of the three funding level budgets. As a result "fitting" projects to the three funding level budgets (Fiscally Constrained, Action, and Vision) was accomplished by adjusting the percentage of renewal/replacement project costs included in each funding level budget. Renewal/replacement project costs were included at 10%, 75%, and 100% of the values derived from the asset management spreadsheets in the Fiscally Constrained, Action, and Vision budgets respectively. Historically, the City has found that the asset management spreadsheets are providing costs for complete replacement of the asset and that renewal and rehabilitation techniques and approaches have allowed the City to manage renewal and replacement of assets in the range of 50%-75% of the costs indicated in the asset management spreadsheets.

Output from the spreadsheets used by City staff to develop each of the funding level budgets and corresponding CIP is included in Appendix A of Volume 6 – Consolidated Capital Improvements Plan.

1.7.5 CIP Recommendations

1.7.5.1 Current WUMP

Based on the consolidated spreadsheet output for each of the funding level categories, adoption of the Action Plan CIP budget is recommended. The Action Plan funding level strikes a balance between undesirable rate increases and having sufficient funding to maintain the City's high service standards and reliability criteria in existing areas of service while planning for and accommodating regulatory driven and growth related service requirements. The Action Plan CIP funds nearly all of the projects identified throughout the master planning process in the 20-year planning period in accordance with their current funding priority while providing an adequate level of funding for asset renewal/replacement in accordance with the City's historical experience. Project funding priorities should continue to be evaluated on an annual basis to ensure funding priorities continue to be aligned with actual needs throughout the duration of the planning period. City staff will continue to monitor and refine asset replacement analysis and adjust the actual replacement rate within a 60%-75% range as part of the annual budget process. Asset replacement at 75% of the predicted level has been used to formulate the 2012-2017 CIP budget.

1.7.5.2 Future CIP Planning

For future CIP planning, MWH recommends that the City of Boulder develop a more formalized and documented capital projects needs identification and evaluation process that provides for a life cycle cost and return on investment analysis of proposed capital projects. The formalized process should include a needs identification/capital project request form with data fields linked to a CIP database that should be included as a component of the City's overall asset management program. The process framework should also include a "fast track" or higher priority ranking for projects identified as having short return on investment periods (i.e., < 5-years).

MWH further recommends that the City of Boulder begin to implement a risk based methodology that incorporates both condition analysis and criticality assessments to assist in quantifying capital project prioritization. Such a quantifiable prioritization process will help move from a top down CIP process toward more of a bottom up CIP process. The data from the risk based condition and criticality evaluation also facilitates additional proactive O&M processes. This risk based methodology should be incorporated into the standard capital project request form process as condition and criticality data are acquired.

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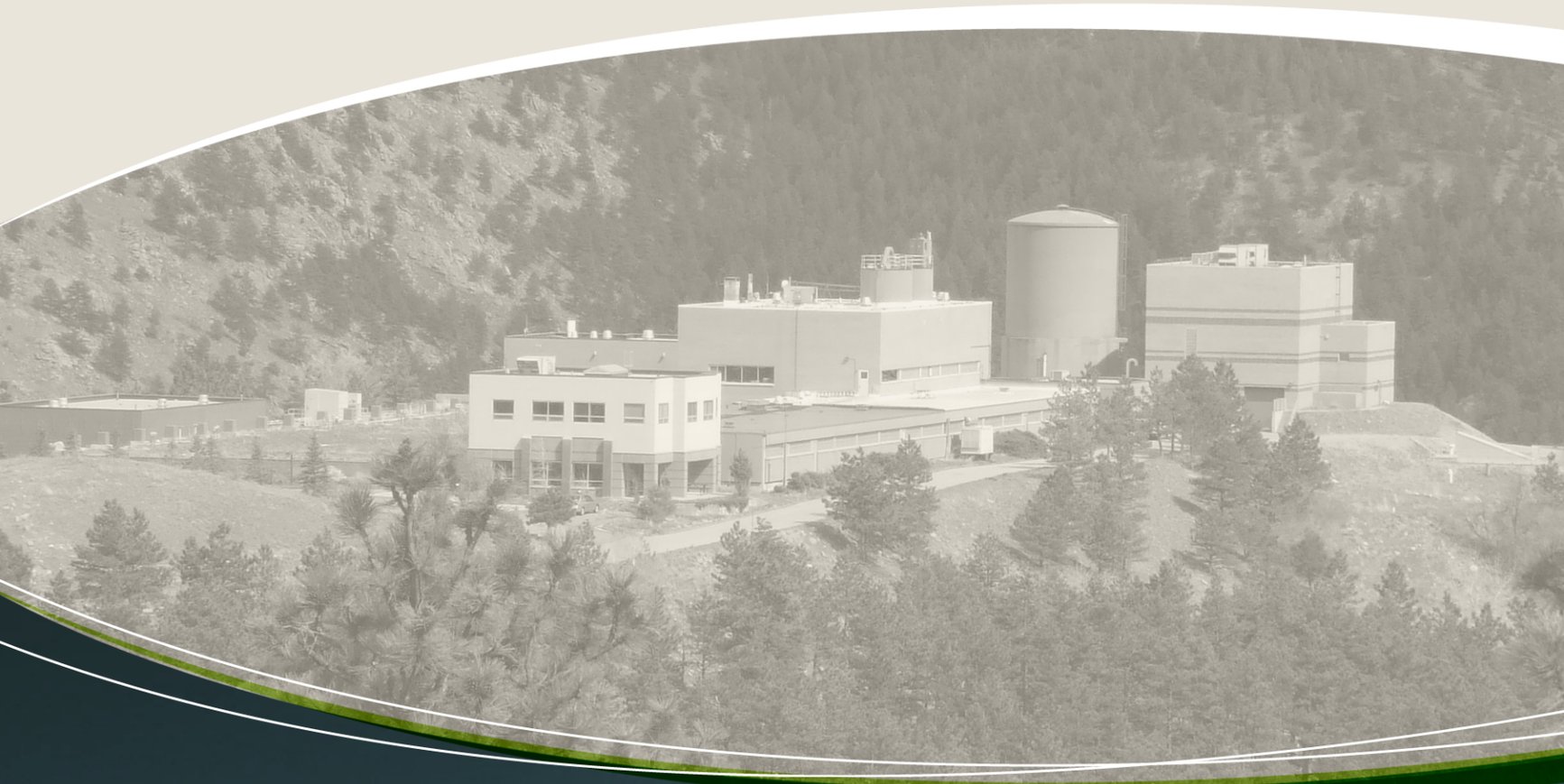

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