C I T Y O F B O U L D E R
WATER RESOURCES ADVISORY BOARD
INFORMATION ITEM

MEETING DATE: November 18, 2013

AGENDA TITLE: Information Item – Background on Wastewater Collection, Comprehensive Flood and Stormwater Master Plans

PRESENTERS:
Jeff Arthur, Director of Public Works for Utilities
Bob Harberg, Principal Engineer - Utilities
Douglas Sullivan, Engineering Project Manager
Pieter Beyer, Civil Engineer II

This information item presents background information concerning the Comprehensive Flood and Stormwater, the Stormwater and the Wastewater Utility Master Plans. These master plans provide an analysis of the utility infrastructure and improvements needs. The identified needs and their relative importance are the primary basis for prioritizing projects identified in the 6-year Capital Improvement Program (CIP). It is important that WRAB members have an understanding of the analysis approach and master plan recommended project priorities. WRAB has a key role in reviewing staff recommendations and making recommendations to City Council on master plans as well as the annual 6-year CIP budget process.

The flood disaster will likely influence the previously identified master plan based project priorities. Consideration of additional improvements to utility infrastructure designed to mitigate future damages may be warranted.

Maps depicting the location of recommended master plan based improvements, along with the location of flood damages will be available at the meeting for review and discussion.

Staff will be investigating the cause of various damages and reviewing the recommendations of these master plans in preparation for the 2015 budget process. Recommendations will be made regarding any revisions to the previously approved master plan based project priorities along with financing options.

ATTACHMENTS

Attachment A: City Council Agenda Memo – Comprehensive Flood Master Plan 11-16-2004
Attachment B: City Council Agenda Memo – Stormwater Master Plan 06-05-2007

Attachment C: City Council Agenda Memo – Wastewater Utility Master Plan 02-02-2010

C I T Y O F B O U L D E R
CITY COUNCIL AGENDA ITEM

MEETING DATE: November 16, 2004
November 9, 2004

AGENDA TITLE: Consideration of a motion to accept the Comprehensive Flood and Stormwater Utility Master Plan, repeal the Comprehensive Drainage and Utility Master Plan adopted in 1989, affirm, restate and otherwise approve that, for the purposes of Section 11-5-3 B.R.C. 1981, that the following documents comprise the City's "master drainage plans" (1. Stormwater Collection System Master Plan (1984), and 2. the Major Drainageway Planning, Boulder and Adjacent County Drainageways – Phase B (1987)), and direct the city manager to continue to work towards updating the Stormwater Collection System Master Plan (1984) in the near future and continue working on updating plans for major drainageways over time with individual plans for drainageways such as Fourmile Canyon Creek, which is currently inprogress.

PRESENTER/S: Ned Williams, Director of Public Works for Utilities
Bob Harberg, Utilities Planning and Project Management Coordinator
Alan Taylor, Flood Program Manager
Donna Scott, Stormwater Quality Specialist

EXECUTIVE SUMMARY:

The purpose of this agenda item is to brief Council on the Comprehensive Flood and Stormwater Utility Master Plan (CFS) and to provide an opportunity for additional public comment and Council input. CFS was developed as the tool for reviewing and setting the direction for the city's Stormwater and Flood Management Utility. Staff recommends that Council confirm this direction by accepting the CFS Utility Master Plan by consideration of a motion.

The CFS sets the agenda for implementing programs and activities of the city's Stormwater and Flood Management Utility. Unlike other city master plans, CFS does not identify specific Capital Improvement Projects. Rather it provides guiding principles, program elements and action items as summarized in the Executive Summary (Attachment A).

Acceptance of the CFS will allow staff to take immediate action consistent with the following policies:

- Floodplain Mapping Updates – Implement a 10-year cycle for mapping updates and incorporate risk assessments.
- Flood Preparedness – Enhance flood monitoring and prediction and

implement the findings from recent system evaluations.

- Property Acquisition and Floodplain Mitigation – Balance structural with non-structural alternatives to floodplain management. Construct flood mitigation projects as well as proceed with select floodplain property acquisitions.
- Sub-basin Management – Focus on reducing the impact of runoff by focusing on preventive measures to minimize pollution at the source and implementing "Best Management Practices."

Certain policy recommendations made in the CFS require further public review and input as well as review and action from boards and Council before proceeding to action.

- Floodplain Regulations – Consider developing 500-year protection standards for critical facilities; consider "no adverse impact" approach to floodplain management.
- Water Quality Regulations – Update city codes to be compliant with, and where applicable, to exceed state and federal regulations. (Updated code changes are proposed in Agenda Item 3I.)

Some action items identified in the plan have been included for funding in the proposed 2005 Utility Fund submission (and are noted below):

- Public Education and Flood Insurance - Allocate $125,000 annually to fund and staff a flood management program resource center (Action item - $125,000 included in 2005 budget proposal).
- Water Quality - Ensure funding for continued participation in WASH. (WASH funding is included in the 2005 budget proposal.)
- One-time allocation of $250,000 proposed in 2005 budget to update the Stormwater Collection System Master Plan.
- Ongoing funding of $50,000/year to begin an inspection and maintenance program for stormwater quality and existing private on-site detention facilities.
- Ongoing funding of $50,000/year for GIS tool development and system support.

The CFS is intended to replace the Comprehensive Drainage Utility Master Plan (CDUMP) that has been in effect since 1989. The CFS is an advisory document and will not constitute the "master drainage plan" for the purposes of § 11-5-3, B.R.C. 1981. The City's "master drainage plans" for the purposes of 11-5-3 are the *Stormwater Collection System Master Plan* (1984) and the *Major Drainageway Planning, Boulder and Adjacent County Drainageways – Phase B* (1987). The CFS calls for the *Stormwater Collection System Master Plan* to be updated in the near future. Plans for major drainageways will be updated over time with individual plans for drainageways such as Fourmile Canyon Creek (currently in progress.)

The CFS does not in and of itself establish any new funding or regulations. This will be accomplished as separate follow-up actions. Two of these follow-up actions are part of the current (Nov. 16, 2004) Council agenda including the 2005 budget and regulatory changes pertaining to connections and discharges into the stormwater collection system. Other follow-up actions will be submitted to Council for consideration at a later date. For example, the CFS recommends that analysis proceed with the development of a 500-year protection standard for critical facilites in line with federal guidance. If the CFS is accepted by City Council, this analysis would proceed and the results would be provided to various advisory boards and the public before returning to City Council for its final review and consideration.

FISCAL IMPACTS:

There are no fiscal impacts associated specifically with acceptance of the CFS. Recommendations that have fiscal impacts will be considered as part of the annual budget process. The CFS as presented is a "cost constrained" version. The financial approach recommended in the CFS considered evolving regulations, technology and development characteristics. This slower, methodical approach will allow for planning and adapting to these anticipated changes.

OTHER IMPACTS:

The CFS contains recommendations and action items for further consideration which may result in changes to city regulations. Analysis of any changes will include an assessment of possible options, ramifications, potential costs to property owners and an opportunity for public feedback.

BOARD AND COMMISSION FEEDBACK:

The Water Resources Advisory Board (WRAB) reviewed the CFS on May 17, 2004 and unanimously recommended approval of the plan and the associated capital improvements with the following comments and recommendations: (1) the path the city has chosen is a slower, more affordable path and there is a faster path that is a lot more expensive, and (2) there needs to be better coordination between departments on flood issues. (See Attachment B for the summary minutes.)

The Planning Board reviewed the CFS on Oct. 21, 2004 and unanimously recommended to City Council the acceptance of the plan. Planning Board review focused on the following questions:

1. Is the master plan consistent with the goals, policies and growth projections of the Boulder Valley Comprehensive Plan?
2. Does the Master Plan outline the BVCP Service Standards and a plan to meet them into the future?
3. Does the plan/update describe and assess capital needs and a funding plan for them?

The guiding principles of the CFS are consistent with the current goals and policies of the BVCP and the CFS provides a plan to implement these goals. Certain CFS related goals and policies will be reviewed as part of the 2005 BVCP major update process.

PUBLIC FEEDBACK:

A Community Review Group (CRG) was convened to review the analysis and recommendations of the plan through the CFS development process. The group was asked to raise issues or challenges to the information and draft recommendations that staff presented. Input from the CRG is described throughout the CFS document under the "Public Input" section for each recommended program elements.

An Independent Review Panel (IRP) of flood hazard experts met with staff and consultants to review CFS information and draft recommendations. The IRP comments and concerns are reflected throughout the CFS document. A letter from the panel to City Council outlining an overview of its work and recommendations is included in Attachment C.

Members of Plan Boulder County submitted comments regarding the CFS to the Water Resources Advisory Board in April 2004. Revisions to the CFS were made to address these comments, and responses to these comments are presented in Attachment D.

STAFF RECOMMENDATION:

Staff recommends that the City Council adopts a motion to:

1. Accept the Comprehensive Flood and Stormwater Utility Master Plan as presented;
2. Repeal the Comprehensive Drainage Utility Master Plan adopted in 1989;
3. Affirm, restate, and otherwise approve that, for the purposes of Section 11-5-3, B.R.C. 1981, that the following documents comprise the City's "master drainage plans":
    1. The Stormwater Collection System Master Plan (1984);
    2. The Major Drainageway Planning, Boulder and Adjacent County Drainageways – Phase B (1987).
4. Direct the city manager to continue to work towards updating the Stormwater Collection System Master Plan (1984) in the near future and continue working on updating plans for major drainageways over time with individual plans for drainageways such as Fourmile Canyon Creek which is currently in progress.

ANALYSIS:

The CFS attempts to balance programs and activities in the city's Stormwater and Flood Management Utility to satisfy current local interests, accommodate changing trends, philosophies, regulations and standards, ensure maximum effectiveness and cost efficiency, and meet evolving community goals and objectives. A summary of CFS

analyses including proposed guiding principles, program elements and action items is presented in the Executive Summary (Attachment A) and a broad overview is presented below.

Flood Management

The city of Boulder is extremely vulnerable to flash flooding due to its geographical location at the base of the Rocky Mountains. Flash flooding can occur with less than 30 minutes of warning. Recent flash floods along Colorado's Front Range include a 1997 flood in the city of Fort Collins that caused $200 million in damage and claimed five lives. The flood was caused by a storm that dumped 14.5 inches of rain. Storms of this magnitude aren't uncommon along the Front Range; yet 100-year flooding in Boulder can occur with only three inches of rainfall. In 1976, the Big Thompson River flood destroyed over 300 houses and killed 300 people when 12-14 inches of rain fell in the Big Thompson Canyon along Highway 34. The canyon is very similar to the canyons just west of Boulder. Within the city of Boulder's 100-year floodplain, there are thousands of people and approximately 3,600 structures with an assessed valuation of almost $1 billion. CFS includes specific program elements to address flood hazard including emphasis on floodplain mapping updates, risk assessments, flood preparedness, public education and flood insurance.

Over the last 15 years, the city has focused its flood management program efforts by removing structures from high hazard flood areas. Through these efforts 134 of 279 identified high hazard structures have been removed from the regulated high hazard flood zone. This was accomplished based on a combination of major drainageway improvements that narrowed the floodplain and/or the acquisition and physical removal of individual structures. A project that acquired and physically removed 13 multi-family structures (169 units) near Boulder High School is a major example of these efforts. This project also excavated the area north of Boulder Creek (now recreational/sports fields) to improve flood conveyance. CFS proposes to continue these efforts, balancing property acquisition and constructed flood mitigation projects.

Although current flood regulations require protection for flood levels up to 100-year event, there is concern that larger floods such as those experienced in Fort Collins and along the Big Thompson River will cause considerable damage and loss of life. The city currently regulates the 100-year conveyance and high hazard zones. Although floodplain maps identify a 500-year floodplain, this is only for information purposes, and there are currently no regulatory requirements. City Council discussed floodplain regulation issues at a Jan. 29, 2002 study session as documented below:

"Updated floodplain regulations to address redevelopment, critical facilities and storms exceeding 100-year levels were supported subject to the consideration of the results of additional analysis answering the following questions:

1. What would be defined as critical facilities?
2. What is the impact of the 500-year floodplain compared with the 100-year floodplain?

3. How would the regulations be revised to address redevelopment concerns?
4. What impacts would the revised floodplain regulations create?"

One of the action items recommended in the master plan is to proceed to develop ***500-year protection standards for critical facilities*** in line with federal guidance to ensure access to, use of and uninterrupted service for critical facilities such as: fire and police stations; water and sewer treatment plants; utility infrastructure for water, sewer, gas, electric and communications; schools; day care and senior care facilities; hospitals; major roads and bridges; and hazardous material storage. This action item will assess the appropriate level and type of regulation in the 500-year flood zone and will explore whether critical facilities should be held to a higher standard or if these uses should be excluded from the 500-year flood zone. (Note: several critical facilities have recently been constructed in the 500-year floodplain with 500-year flood protection including the Foothills Boulder Community Hospital and the Foothills Housing Development.)

Recent projections indicate that almost five percent of the parcels of land designated with redevelopment potential have greater than 50 percent of their land area within the high hazard or conveyance flood zones. Current city regulations would significantly restrict redevelopment of these parcels. Almost 20 percent of the parcels of land designated with redevelopment potential have greater than 50 percent of their land area within the 100-year floodplain. Current city regulations do not restrict redevelopment of these properties but require suitable flood protection measures. However, these properties would still be subject to flood damage from larger flood events. Many of these parcels which would be impacted by Boulder Creek flooding are located in the Boulder Valley Regional Center and the downtown business area. These issues will be further evaluated as part of the Flood Hazard Land Use Analysis, a joint effort between the Utilities Division and Long Range Planning staff.

The Utility has recently reorganized its activities to provide a point person (Flood Program Manager – Alan Taylor) to manage nonstructural flood management activities including floodplain mapping, risk assessments, floodplain regulations, public education, flood insurance and flood preparedness. Permitting of floodplain development will continue to be managed by Planning and Development Services.

Analyses of the flood management program including proposed guiding principles, program elements and action items are presented in Chapter 3.

<u>Stormwater Quality</u>
In 2001, in response to Federal Clean Water Act requirements, the Colorado Department of Public Health and Environment (CDPHE) expanded its regulations to include regulations for discharges from municipal storm sewer systems for cities with populations less than 100,000 and more than 10,000. The intent of this stormwater permit program is to reduce the amount of pollutants entering streams, lakes and rivers as a result of runoff from residential, commercial, municipal and industrial areas including construction sites. Stormwater permit compliance is based on implementing activities intended to reduce pollutant loading from urbanized areas. Changes to the Boulder

Revised Code (BRC) and Design and Construction Standards (DCS) to ensure that these city regulations are in compliance with our current permit requirements have been proposed by staff and will be considered by City Council on Nov. 16, 2004. CFS proposes a proactive approach to comply with both current and anticipated regulations including sub-basin management.

Water quality in Boulder Creek and its tributaries is a significant concern. The Colorado Department of Public Health and the Environment is considering listing Boulder Creek as an impaired water body for E. coli bacteria contamination. Elevated levels of E. coli have been found in Boulder Creek, west of the city to outside its eastern boundary and again in the segment below the confluence with Coal Creek. E. coli are bacteria found in the intestine of warm blooded animals and are associated with fecal waste. The source of the E. coli contamination in Boulder Creek is unknown. Suspected sources include wildlife (raccoons), domestic pets (dogs) and human waste products. CFS proposes a proactive approach to address this issue including stream enhancement.

Currently, Best Management Practices (BMPs) identified as options in the City's *Design and Construction Standards* (DCS) are geared more toward new development than toward redevelopment. Boulder is predominantly "built-out," and guidelines focused toward new development have limited applicability in denser, redeveloping areas such as the Boulder Valley Regional Center and the downtown business center. Therefore, more innovative solutions need to be applied. Examples of these BMPs include porous pavements, subsurface detention, vegetated landscape filters and hydrodynamic separator devices. CFS proposes that these BMPs be further investigated and considered.

Analyses of the stormwater quality program including proposed guiding principles, program elements and action items are presented in Chapter 4.

Stormwater Drainage

The existing Stormwater Collection System Master Plan provides the city of Boulder with a guide for minor storm (two-year frequency for residential areas and five-year frequency for commercial/ industrial areas) drainage related Capital Improvement Projects (CIP). This 20-year old plan should be updated to include drainage, detention, groundwater and stormwater quality issues. Land use has changed significantly, and the plan should consider planned development and redevelopment activities. Stormwater quality permitting requirements and BMPs should be further assessed and applied to individual sub-basins. CFS recommends that a Stormwater Management Plan be developed to address these issues.

The city has required on-site detention for new developments that increase imperviousness since the early 1970s. On-site detention storage is required for all developments other than individual single-family lots that are not part of a larger development. Most of these facilities are privately owned and maintained. The design of these facilities is reviewed by city staff at the time of application. The facilities are inspected and as-built drawings are now required to be submitted. However, there is currently no follow-up city inspection to assure these facilities are functioning as

originally intended. CFS proposes ongoing inspection of these facilities and further consideration of maintenance requirements.

Groundwater and sump systems create nuisance drainage in the public rights-of-way and potential hazards due to build-ups of slime and ice. Also, groundwater dewatering systems can affect local water wells and wetlands by lowering the groundwater table. Requirements for groundwater extraction and release are loosely defined in current city regulations. CFS proposes that these requirements be further defined.

Analyses of the stormwater drainage program including proposed guiding principles, program elements and action items are presented in Chapter 5.

Program Integration and Implementation

The Stormwater and Flood Management Utility is part of the city's Public Works Department. The organizational structure of the department provides both opportunities for and challenges to integrating various program interests and other multi-objectives. CFS points to a number of opportunities that will be used to integrate program activities by staff.

A significant opportunity for integration with other city objectives is the 2005 major update to the *Boulder Valley Comprehensive Plan* (2000). The update process will provide an opportunity to review land use and zoning designations from the perspective of flood hazard, water quality and drainage issues.

The Greenways Program is currently limited to Boulder Creek and six tributaries including Fourmile Canyon, Wonderland, Goose, Skunk, Bear Canyon and South Boulder Creeks. It is recommended that the Greenways program be expanded to all 15 of the city's major drainageways to provide for better integration of multiple objectives. Analyses of program integration and implementation issues are presented in the Chapter 6.

Alternative Proposals or Options

Although it is recommended the Council accept the CFS Utility Master Plan, Council may choose not to do so and provide direction as to specific chapters, issues or topics that require additional anlaysis and information.

Approved By:

Frank W. Bruno,
City Manager

ATTACHMENTS:

Attachment A: Comprehensive Flood and Stormwater Management Utility Master Plan Executive Summary

Attachment B: Summary Minutes of May 17, 2004 Water Resources Advisory Board Meeting

Attachment C: IRP Final Report from Flood Management Review Process dated April 2, 2004

Attachment D: PLAN Boulder County - Summary of Comments and Responses dated June 22, 2004

Attachment E: CFS Utility Master Plan Document dated October 2004

EXECUTIVE SUMMARY

INTRODUCTION

The Comprehensive Flood and Stormwater Utility Master Plan (CFS) provides a framework for evaluating, developing, and implementing various programs and activities in the within the scope of the available budget. The CFS replaces the 1989 Comprehensive Drainage Utility Master Plan (CDUMP).

The CFS is the result of the periodic need to update programs and activities to satisfy current local interests, accommodate changing trends, philosophies, regulations and standards, ensure maximum effectiveness and cost efficiency, and meet evolving community goals and objectives.

The Stormwater and Flood Management Utility (Utility) is responsible for the administration of the City's flood management, stormwater quality, and stormwater drainage programs. Its responsibilities include:

- Administration and Operations.
- Utility Rates and Finance.
- Program Development and Management.
- System Maintenance and Restoration.
- Flood and Stormwater Regulation and Compliance.
- System Master Planning and Design.
- Public Education and Community Outreach.
- Flood Prediction.
- Stormwater Quality Management.
- Emergency Preparedness and Day-to-Day Operations.
- Capital Improvements and Land Management.

The CFS Utility Plan's main objectives are to address: (1) flash flood hazards; (2) stormwater quality; (3) stormwater drainage; (4) program integration and implementation; and (5) financial considerations.

AREA DESCRIPTION

The Boulder Creek Watershed encompasses some 440 square miles and extends from the Continental Divide to the high plains east of the City. There are 15 major drainageways (or creeks) in Boulder, within which a total of 17 sub-basins have been delineated. The tributary

drainageways all eventually feed to Boulder Creek north of the Valmont Reservoir.

The study area itself is nearly "built out" resulting in a highly urbanized drainage setting. The natural hazards related to stormwater and flood management are particularly complicated by the fact that space is at a premium and that so many structures are within the floodplain.

PUBLIC PROCESS

A Community-Review Group (CRG) was used to provide "real-time" input to the analysis and draft recommendations for the CFS Master Plan. The CRG was created based on the key interests affected by the CFS.

The Independent Review Panel (IRP), a panel of flood hazard experts, also participated in the CFS development process.

The Water Resource Advisory Board (WRAB) met twice in 2003 and discussed key issues and the master plan process.

FLOOD MANAGEMENT

The Flood Management Program is responsible for all programs and activities related to local flooding and the floodplain.

The City of Boulder is extremely vulnerable to flash flooding due to its geographical location at the base of the Rocky Mountains. Within the City of Boulder's 100-year floodplain there are thousands of people and approximately 3,600 structures with an assessed valuation of almost $1 billion.

The City continues to grow through a combination of new development and redevelopment activity. Within the floodplain, these activities pose additional potential for hazards due to flash floods.

Recent projections indicate that almost 5 percent of the parcels of land designated with redevelopment potential have greater than 50 percent of their land area within the high hazard or conveyance flood zones. Current City regulations would significantly restrict redevelopment of these parcels. Almost 20 percent of the parcels of land designated with redevelopment potential have greater than 50 percent of their land area within the 100-year floodplain. Current City regulations do not restrict redevelopment of these properties but require suitable flood protection measures. However, these properties would still be subject to flood damage from larger flood events. Many of these parcels are located in the Boulder Valley Regional Center and the downtown business area which will be impacted by Boulder Creek flooding.

Boulder floodplain policies have not been updated since adoption of the CDUMP. As a result, our local floodplain management program has fallen behind the progression of national and regional trends and philosophies, and the nonstructural floodplain policy objectives outlined in the early years of our floodplain management program have never been fully realized.

Current Program Elements

Current flood management program elements include floodplain mapping, risk assessments, regulations, flood information and insurance, emergency preparedness, property acquisition, and flood mitigation capital improvements.

Guiding Principles

Using national and regional trends and philosophies, current and past local policies, and recommendations from the IRP and CRG as a backdrop for updating Boulder's flood management program, staff is recommending five guiding principles:

1. "Preserve Floodplains."
2. "Be Prepared for Floods."
3. "Help People Protect Themselves from Flood Hazards."
4. "Prevent Adverse Impacts and Unwise Uses in the Floodplain."
5. "Seek to Accommodate Floods, Not Control Them."

Recommended Flood Management Program Elements

Floodplain Mapping Studies Program

Floodplain mapping studies are essential in determining areas where life safety is threatened and damage to property is likely.

A 10-year update cycle coincides with the City's average timeline for updating new citywide topographic, planimetric, and aerial base mapping used for the study purposes.

In-depth analysis of floodplain mapping results can offer insights into the associated risks and levels of hazard inside the floodplain. The expanded hazard information is valuable for enhancing non-structural flood management program activities supported by the community.

Recommendations include:

- Adopt a 10-year update cycle for local floodplain mapping studies.
- Include floodplain risk assessments in all floodplain mapping updates.

Public Education and Flood Insurance

The guiding principle to "help people protect themselves from flood hazards" focuses on educating the public about flooding and providing information and resources the public may access to reduce their own exposure to flooding. Given that Boulder is nearing "build-out," this approach allows the flood management program to reach out and benefit the community at large.

There has been a strong community interest in offering a greater balance of non-structural flood management program activities as part of the overall Stormwater and Flood Management Utility program. These recommendations will serve to help achieve this balance:

- Create a flood management program resource center and program manager.
- Allocate $125,000 annual funding and staff resources for program support.
- Enhance the flood management Web site.
- Pursue an improved Community Rating System (CRS) rating given available resources.
- Research a local flood proofing program.

Flood Preparedness

The guiding principle to "be prepared for floods" focuses on floodplain emergency preparedness. Flood preparedness is a critical element in the City's floodplain management program, considering that more than 15 percent of the community is impacted by floodplains.

The more prepared a community can be with pre-flood preparedness, ongoing monitoring, effective warning systems, trained response, and post-flood recovery, the better chance the risks of flooding may be managed.

Recommendations include:

- Enhance coordination between the Office of Emergency Management and the City of Boulder by taking a more active role in emergency management.
- Continue to enhance flood monitoring and prediction, early warning, and multiple notification measures by implementing the findings in the University of Colorado and recent system evaluations.
- Update and improve the flood response and flood recovery plans to address actions by public officials and actions by residents and members of the public.
- Develop innovative user friendly information materials for the public and residents to follow in the event of a flood.

Floodplain Regulations

Floodplain regulations are land use regulations intended to regulate activities and development in the 100-year floodplain, conveyance zone (or floodway), and high hazard zone. They are designed to provide a mechanism to address life safety and property damage impacts by restricting certain activities and improvements in the floodplain.

The floodplain regulatory revisions include recommendations intended to better address issues of life safety and structural safety:

- Assess the adequacy of ***life safety measures.***
- Address ***floodplain mapping uncertainties.***
- Develop options for ***mitigating new floodplain*** encroachments.
- Develop ***500-year protection standards for critical facilities.***

- Evaluate the adequacy of the ***flood protection elevation for flood proofed structures.***

- Develop ***hazard analysis standards.***

- Seek FEMA approval of engineered foundation standards for crawlspaces.

- Research limited residential flood-proofing options for structures located in lower-risk shallow flooding areas.

- Evaluate the Association of State Floodplain Managers "no adverse impact" approach to floodplain management.

- Seek FEMA and UDFCD acceptance of the City conveyance zone (floodway).

- Seek Boulder County/City of Boulder regulatory consistency.

Property Acquisition and Floodplain Mitigation

The floodplain risk assessments will provide a more detailed framework for evaluating floodplain management and/or mitigation alternatives.

The property acquisition and constructed flood mitigation program has been very successful over the years. However, modern community interests and national trends away from structural drainageway construction have raised questions regarding previous structurally oriented projects that involve significant costs and raise environmental and aesthetic issues.

The following recommendations offer approaches to balance structural and non-structural alternatives:

- Floodplain risk assessments, developed in conjunction with floodplain mapping updates, should be used to identify and quantify life safety and property damage risks to determine appropriate measures for property acquisition and floodplain mitigation.

- A balance of constructed flood mitigation projects (based on risks to life safety and of property damage) and acquisition of property (including removal of associated structures) should be applied to long-term floodplain management and preservation.

- Non-structural alternatives shall be considered and balanced with structural measures for floodplain planning and mitigation activities.

STORMWATER QUALITY

The City's Stormwater Quality Program is responsible for managing local activities to preserve, protect, and enhance water quality affecting Boulder's streams and drainages. The current program has four main components:

- Public Education

- Water Quality Monitoring

- Regulatory Compliance

- Source Control

In 2001, in response to Clean Water Act requirements, Colorado Department of Public Health and the Environment (CDPHE) expanded its regulations to include regulations for discharges from municipal storm sewer systems for cities with populations less than 100,000 and more than 10,000. Stormwater permit compliance is based on implementation of stormwater management programs intended to reduce pollutant loading from urbanized areas.

Water quality in Boulder Creek and its tributaries is a significant concern. The CDPHE is considering listing Boulder Creek as an impaired water body for E. coli bacteria contamination.

Currently, Best Management Practices (BMPs) identified as options in the City's Design and Construction Standards (DCS) are geared more toward new development than toward re-development. Boulder is predominantly "built-out", and guidelines focused toward new development have limited applicability in denser, redeveloping areas such as the Boulder Valley Regional Center and the downtown business center. Therefore, more innovative solutions need to be applied. Examples of these BMPs include porous pavements, subsurface detention, vegetated landscape filters and hydrodynamic separator devices.

Current Program Elements

Current stormwater quality program elements include water quality regulations, sub-basin management and stream enhancement.

Guiding Principles

Recommended stormwater quality guiding principles, based on national trends and current local policies, include:

1. "Preserve Our Streams"
2. " Prevent Adverse Impacts from Stormwater"
3. "Protect and Enhance Our Stream Corridors"

Recommended Stormwater Quality Program Elements

Water Quality Regulations

Implementation of a common approach results in consistency throughout the Boulder Creek watershed and provides more comprehensive, regional protection of water quality.

Continued water quality monitoring of the main stem of Boulder Creek will provide information needed to evaluate the impact of existing and new regulatory requirements such as the Total Maximum Daily Limit (TMDL) and sediment/aquatic life standards.

Recommendations include:

- Update City codes and development standards to meet applicable federal and state regulations. Update City standards to exceed federal and state requirements where appropriate to meet local water quality protection needs.

- Ensure adequate funding for the continued participation in the WASH program and the City's individual requirements for compliance with the City's Stormwater Permit.

- Continue to pursue opportunities to collaborate with other communities to address water quality issues.

- Track upcoming regulatory changes to develop the most cost effective approach to compliance.

- Enhance water quality monitoring program to improve data analysis, program evaluation and compliance tracking.

Sub-basin Management

Sub-basin management focuses on reducing the impact of runoff by focusing on preventive measures to minimize pollution at the source. Recommendations include:

- Research BMPs oriented to redevelopment and existing development in highly urbanized areas such as the Boulder Valley Regional Center and the downtown business center and incorporate appropriate BMPs into City Ordinances and Standards.

- Integrate water quality objectives into the City master planning process, such as updates to the Boulder Valley Comprehensive Plan (BVCP) and the update to the Stormwater Management Plan.

- Examine the stormwater utility rate structure to promote innovative BMPs and investment in public regional BMPs.

- Develop incentive programs to promote BMPs in both residential landscapes and commercial development that are innovative and exceed City requirements.

- Explore the use of subsidies, public-private partnerships, and grant-funding to implement innovative urban BMPs. Consider special improvement districts for targeted areas, such as the Boulder Valley Regional Center and downtown business center.

- Increase the water quality benefits derived from the City's urban forest through support of the City's Urban Forest Program and tree planting programs for parks and other City owned properties. Consider updating regulations and standards to increase tree planting requirements for new development and re-development projects.

- Integrate multiple objectives including water quality enhancement on City-owned land and in decisions regarding future property acquisition.

- Develop GIS tool to prioritize water quality improvement projects for sub-basins using data such as potential pollutant loading, land-use, impervious surface, groundwater recharge and other data, some of which has been developed in the *2000 Boulder Creek Watershed Study.*

- Update development and re-development regulations and standards to expand runoff reduction and water conservation requirements.

Stream Enhancement

Stream enhancement focuses on the stream corridor itself. Stable stream environments are necessary for fish and other aquatic species to survive. Riparian habitat provides a number of water quality and ecosystem functions.

Recommendations include:

- Protect and preserve the watershed's most critical and fragile areas – floodplains. Provide ample flood capacity and freeboard, allowing for increase in riparian vegetation and roughness. Integrate floodplains protection with stream channel enhancement through the major drainageway planning process.
- Expand the *Greenways Master Plan* principals to all tributaries beyond Boulder Creek and the six tributaries currently studied.
- Use balanced approaches to drainage solutions that provide multiple benefits, including the water quality/quantity benefits of preserving the stream corridor and its natural character.
- Avoid hydrologic disconnect between groundwater and surface water in stream channels.
- Implement sub-basin water quality management practices and projects in conjunction with Greenways project implementation.
- Update the *Greenways Design Guidelines* to include measures to stabilize channel erosion and sedimentation, support fish and other aquatic species movement, protect riparian habitat, and other measures to promote stream stability.

STORMWATER DRAINAGE

The City's stormwater collection system consists of a variety of storm sewers and open drainage ditches that collect water and divert the water to major drainageways.

Irrigation ditches collect stormwater in many places in the City. Depending on the amount of rainfall, stormwater flows may exceed the capacity of the ditch and spill from the ditch in an uncontrolled manner.

In the past, the 's emphasis has been to provide structural solutions, such as drainageways and storm sewer facilities, to resolve stormwater and flood management issues. Now, the overall guiding principles are in place to develop a balance of structural and non-structural solutions to these critical programs and activities.

Current Program Elements

Current stormwater drainage program elements include stormwater collection system and planning; design and construction standards; maintenance; detention

and groundwater extraction and release.

Guiding Principles

Guiding principles for the stormwater drainage program component based on national trends and current local policies are proposed as follows:

1. Maintain and Preserve Existing and Natural Drainage Systems."
2. "Reduce and Manage Developed Runoff."
3. "Eliminate Drainage Problems and Nuisances."

Recommended Stormwater Drainage Program Elements

Stormwater Collection System and Planning

The existing Stormwater Collection System Master Plan provides the City of Boulder with a guide for minor storm (2-year frequency for residential areas and 5-year frequency for commercial/ industrial areas) drainage related Capital Improvement Projects (CIP). This 20-year old plan should be updated to include drainage, detention, groundwater and stormwater quality issues. Land use has changed significantly and the plan should consider planned development and redevelopment activities. Stormwater quality permitting requirements and BMPs should be further assessed and applied to individual sub-basins. The following issues should be considered:

- Assess current and future land use and associated imperviousness.
- Update hydrology/hydraulic models.
- Consider groundwater flows when evaluating existing capacity.
- Consider peak flows for the minor and major storm events.
- Limit the post development peak discharge rate to the pre-development discharge rate for single design two-year storm events.
- Separate stormwater drainage from the irrigation ditches.
- Focus on known problem and future development areas.
- Integrate water quality and other multi-objective issues in the updated plan.
- Re-evaluate detention including the possibility of regional detention and increasing existing detention.
- Locate (estimate) the water table throughout the City.
- Re-evaluate remaining projects for necessity and community objectives.
- Re-prioritize recommended projects.
- Review and revise the City's criteria for prioritization.

Design and Construction Standards

The City's Design and Construction Standards (DCS) regulate the design and construction of public infrastructure, improvements, and landscaping within the City's public rights-of-way and public easements. The current standards were last updated November 16, 2000, and need to be consistent with the most current versions of the Urban Drainage and Flood Control District (UDFCD) standards. Stormwater drainage and stormwater quality standards also need to be integrated.

Maintenance

The recommended action items will address the current maintenance issues of frequency and tracking of maintenance activities.

- Integrate above grade facility information associated with the major drainageways into the City's maintenance management system.
- Integrate maintenance performed by the UDFCD into the City's maintenance management system.
- Include project management personnel in the Call-Log database.
- Inspect and remove excessive vegetation and debris along open drainageways on a yearly cycle or as needed based on requests.
- Remove debris from inlets on a 2-year cycle or as needed based on requests.
- Remove silt and sand deposits from manholes and open channels on a 2-year cycle or as needed based on requests.
- Inspect and repair storm sewer pipe on a 2-year cycle or as needed based on requests.
- Clean excessive deposits of sediment within storm sewers on a 2-year cycle or as needed based on requests.

Detention

The City has required on-site detention for new developments since the early 1970s. On-site detention storage is required for all developments other than individual single-family lots that are not part of a larger development. Most of these facilities are privately owned and maintained. The design of these facilities is reviewed by City staff at the time of application. The facilities are inspected and as-built drawings are now required to be submitted. However, there is currently no follow-up City inspection to assure these facilities are functioning as originally intended.

Recommendations for on-site detention include:

- Review each development plan to look for opportunities to increase detention greater than the minimum currently required.
- Integrate water quality BMPs into on-site detention requirements.

- The amount of detention should be based on the degree of redevelopment proposed or an incentive plan, where going above and beyond decreases fees.

Recommendations for existing detention facilities include:

- Determine if additional inspection and maintenance is needed based on the condition assessment of a random sampling of the existing facilities. On-going inspection and maintenance could be accomplished by either the City or private property owners.
- Require property owners to periodically submit an inspection report to the City once every 5 years to certify that the detention facility is functioning as originally designed or there is a plan for improvements.

Groundwater

Groundwater and sump systems create nuisance drainage in the public rights-of-way and potential hazards due to build-up of slime and ice. Also, groundwater de-watering systems can affect local water wells and wetlands by lowering the groundwater table. Requirements for groundwater extraction and release are loosely defined in current City regulations.

The recommended action items will allow for a proactive, rather than reactive, approach to dealing with groundwater issues:

- Identify problem areas and require more precise water table information that considers seasonal fluctuations.
- If the City believes or knows of a problem area, then a mitigation plan should be required prior to permitting.
- If groundwater is not expected but is encountered during construction then a mitigation plan should be required prior to issuing the certificate of occupancy.
- Evaluate the implications of groundwater contamination and further explore existing available soils information.
- Consider groundwater discharge as part of the update to the *Stormwater Collection System Master Plan*.
- Identify problem areas and issues including the effect of groundwater de-watering on local water wells and wetlands.
- Develop mitigation options for specific problem areas based on estimates of additional groundwater flow.

PROGRAM INTEGRATION AND IMPLEMENTATION OPPORTUNITIES

The Stormwater and Flood Management Utility is part of the City's Public Works Department. The organizational structure of the Department provides both

opportunities for and challenges to integrating various program interests and other multi-objectives.

Current Program Elements

The following institutional opportunities for integration are currently defined:

- Annual Budget Process
- Greenways Master Plan and Program
- Project Planning and Approval Process (PPAP)
- Community and Environmental Assessment Process (CEAP)
- Design and Construction Standards (DCS)

Recommendations

Program Integration

This master plan recommends maintaining existing coordination and integration processes. In addition to these existing processes for program integration, this master plan has identified additional opportunities for coordination:

- Board and Council Review and Discussion of CFS Utility Master Plan
- Interactive Web Site
- Stormwater Management Plan
- Major Drainageway Planning
- Design and Construction Standards
- Flood Management Program
- Greenways Program (including update to Greenways Design Guidelines)
- Boulder Valley Comprehensive Plan
- Water Quality Master Plan
- Maintenance Program
- Annual Budget Process

A significant opportunity for integration with other City objectives is the 2005 update to the Boulder Valley Comprehensive Plan. The update process will provide an opportunity to review land use and zoning designations from the perspective of flood hazard, water quality and drainage issues.

A Flood Management Program office will be established to enhance and integrate various program functions and provide a more focused point of contact for other staff and the public. This office will work closely with Planning and Development Services - Floodplain and Wetland Management, which will continue to be the focal point for interactions with the development community.

In addition it is recommended that the Greenways program be expanded to all 15 of the City's major drainageways to provide for better integration of multiple objectives.

These additional opportunities provide a way to integrate various

program interests and other multi-objectives.

Program Implementation

To assure integration with various program interests and other multi-objectives the City will use a multi-disciplined approach and involve staff from appropriate workgroups.

FINANCIAL CONSIDERATIONS

The is an enterprise funded primarily by monthly utility fees. The Utility today receives annual revenues of over $4 million that are applied to operating activities, emergency preparedness, stormwater quality, stormwater maintenance and capital improvements.

In general, existing programs are adequately funded. However, several increases to existing program funding are presented. To support these increases in funding, money will need to be reallocated from the existing budget or a rate increase will be required as follows. The following proposed financial plan will be considered as part of the City's on-going budget process.

Flood Management

It is proposed that annual funding for the on-going flood management program increased from $100,000 to $350,000 per year. This represents a shift to balance structural and non-structural solutions for flood management.

Stormwater Management

It is proposed that:

- A one-time additional funding allocation of $250,000 should be made in the 2005 budget to update the Stormwater Collection System Master Plan.
- Additional annual funding of $50,000 should be allocated to begin an inspection and maintenance program for stormwater quality and existing private on-site detention facilities.
- Additional annual funding of $50,000 should be allocated to GIS tools development and support.

At proposed funding levels it will take many years to achieve the goals of this master plan. The financial approach recommended in this plan considers evolving regulations, technology and development characteristics. A slower, methodical approach will allow for planning and adapting to these anticipated changes.

ATTACHMENT C

Independent Review Panel
Final Report from Flood Management Review Process

April 2, 2004

Dear Mayor Toor and Members of the Boulder City Council:

We are writing today to provide a brief overview of the work of a dedicated set of volunteers who have been in-service to the city of Boulder since 1999, and to provide a recommendation for what we hope will become an operating standard in floodplain master planning and management for the future of Boulder.

In December 1999, Brian Hyde, Mary Fran Myers, Gilbert White, and Ken Wright were appointed to an Independent Review Panel (IRP) to provide oversight and advice on the restudy of the Fourmile Canyon/Wonderland Creek floodplain when the city discovered discrepancies in the existing floodplain mapping, and consequent community-confidence challenges were raised by the citizens living in that corridor. Since then we have provided similar assistance on the restudy of South Boulder Creek and the Comprehensive Flood and Stormwater Master Plan update. During the past five years, we have been joined by other scientists and experts as necessary, including: Dr. Bill Bradley and Dr. Rich Madole, who sat with us in the first two years as we reviewed the alluvial geology for the Fourmile-Wonderland formation. Dr. Jonathon Freidman provided invaluable assistance in reviewing the paleohydrology for South Boulder Creek. Most recently, UDFCD Executive Director Scott Tucker joined the IRP in the review of the Comprehensive Flood and Stormwater (CFS) master plan update.

During this period there have also been national reviews of a number of public flood management policies that are relevant to the Boulder area. For example, the Federal policy with respect to defining property subject to possible 100-year flooding and mandatory Federal flood insurance has been subject to critical evaluation. In recent years, the estimated national annual losses from floods outside the mapped 100-year floodplain have been larger than losses from within the 100-year flood zone, and there are questions as to whether or not the frequency adopted in the national insurance program has increased vulnerability to flood losses. Within the city of Boulder, for example, there are nearly 5300 properties known to be subject to the 500-year flood event.

We have truly enjoyed the opportunity to serve the city of Boulder. As the draft Comprehensive Flood and Stormwater drainage Master Plan moves into the board review process, we feel that we have met our obligations as an independent panel and it is time that we disband as a review group. However, please know that while we will no longer be sitting together as the "IRP," we do wish to be called upon in the event that the City Council has new questions or issues for which we can be of assistance.

We want to leave our work with a summary statement which we recommend guide the future of Boulder's floodplain management practice.

In our 2001 Fourmile Canyon Creek Phase A Report recommendation, we provided a set of directions for staff to include in the Phase B scoping effort. In its most basic form, our recommendation, which is applicable to each of Boulder's 13 creeks/tributaries, suggests that the city of Boulder adopt flood management practices that consider the specific geology, challenges of adjacent development and anticipated flooding for each reach of each stream, and that the full array of non-structural mitigation tools (e.g., education and training, warning devices, and individual property flood-proofing) be given equal weight and consideration to structural applications (e.g., engineered flood-management installations, widened and channelized creeks, dams and floodwalls) so that situation-specific mitigation may be identified and designed to best fit each case.

Thus, we ask that the City Council acknowledge the contribution of five years of professional expertise and opinion by requesting the City Manager to assemble a flood risk management program that gives equal weight to non-structural and structural options and that is tailored to address the needs and resources identified in each particular floodplain.

We also remind the city of the role that citizen education will have in the formulation of the above-described tailored floodplain management system. Boulder must provide comprehensive flood protection education so that our residents can meaningfully participate in the formation of alternatives for their watershed.

Actions which citizens of Boulder should take in response to flood hazards include the following:

1) Effective emergency action every occupant in a floodplain should take, or NOT take, to reduce damages to life and property in the event a public flood warning is issued;
2) What action every property occupant in a floodplain could take in advance of a flood to prevent or reduce losses before a flood occurs;
3) The effect of non-development in the floodplain on potential flood losses;
4) How to implement flood proofing measures;
5) Advantages of; and how to acquire flood insurance.

Again, we want to thank you for involving us in this important work. We have enjoyed the opportunity to serve our community and work on these critical projects.

Members of the IRP since 1999 and for the 2003-2004 CFS Review:

Brian Hyde **Mary Fran Myers**

Gilbert White **Ken Wright**

L. Scott Tucker

ATTACHMENT D

City of Boulder
Comprehensive Flood and Stormwater (CFS)
Utility Master Plan
April 2004 Draft
PLAN Boulder County
Summary of Comments and Responses

June 22, 2004

PLAN-Boulder County urges you to support the draft Comprehensive Flood and Stormwater Utility Master Plan. Among other useful recommendations, it outlines valuable guiding principles for flood and stormwater management and recommends a balanced approach between structural and non-structural options, recognizing the vital role of community education. Notably, it also recognizes the importance of addressing floods greater than 100-year floods by recommending 500-year flood protection for critical facilities.

We recommend three additions to the draft Master Plan:

1. The City should identify a flood management point person (manager, coordinator, ombudsman, etc.) and establish a set location where the public can contact the floodplain management office. Consolidation of the flood management function is necessary to enhance the city's ability to coordinate its flood management responsibilities and to provide a single point of public contact. This flood management point person or persons should have authority to make decisions and be able to draw on resources scattered throughout City departments. The floodplain management office also should be charged with the responsibility of maintaining accurate maps for the 100 and 500-year floodplains.

Response: Utilities Project Manager, Alan Taylor, has been assigned to manage the City's flood management program as outlined in the CFS Utility Master Plan. As the new "flood management program manager," Mr. Taylor will be responsible for facilitating coordination between flood management activities that occur in various work groups that support the Storm Water and Flood Management Utility, including Planning and Development Services, Utilities Maintenance, Storm Water Quality and Utilities Project Management. The flood management program manager will also serve as the point of contact on city-wide flood management issues, such as floodplain mapping and risk assessment studies, floodplain management and mitigation planning, coordinating local responsibilities for the National Flood Insurance Program and Community Rating System, emergency preparedness, and general flood management program operations.

The City is also implementing measures to better establish an improved identify for and access to the flood management program. This effort will clarify public contact

points and locations for various flood management resources such as floodplain mapping information, floodplain development regulation, flood preparedness and education materials, flood insurance information and local efforts in flood management and mitigation. In order to fully serve the public on flood related matters, the City intends to establish user friendly resources that are publicly accessible by telephone, the Internet, regular mail and walk-in customer service at the City office on the 2nd floor of the Park Central Building (1739 Broadway).

2. The city should examine whether upgrading our existing regulations to provide 500-year flood protection for all development is a viable course for the city to pursue. We know that greater than 100-year floods will occur. The energy and money we should spend on preparing for them ahead of time through regulation and public education are small compared to the human and material costs of not doing so once a big flood occurs. We urge that this new Master Plan commit the city to exploring this alternative.

Response: CFS proposes that the flood management program evaluate the effectiveness of the 100-year storm event as the basis for established floodplain regulations. The analysis would be performed subsequent to the adoption of CFS and would provide for a separate public involvement process. It is intended the analysis would address factors including the risk of larger floods and their impact on the community, the uncertainty associated with establishing a regulatory boundary given continued encroachments from allowed development in the floodplain and the emerging statistics that indicate 30-50 percent of flood damages in the United States are occurring in areas outside the 100-year floodplain.

The flood management program plans to perform an analysis of flood hazards and impacts in the 100-year with respect to local land use and development policies. The results are expected to provide an overview and basis for evaluating the effectiveness of flood hazard reduction policies balanced with local land use policies addressing community development and vitality. A component of this analysis involves the definition and protection of critical facilities for 500-year flooding events (as applied to the recent development of the Boulder Foothills Community Hospital).

3. Finally, before this Master Plan goes to City Council for adoption, there should be a more clearly articulated fiscal component, so that the budgetary implications of the Master Plan are acknowledged.

Response: Additional information concerning financial considerations has been added to Chapter 7.

C I T Y O F B O U L D E R
CITY COUNCIL AGENDA ITEM

MEETING DATE: June 5, 2007

AGENDA TITLE: Consideration of a motion accepting the Stormwater Master Plan (SMP) and the associated Boulder Valley Comprehensive Plan (BVCP) master plan summary revisions

PRESENTER/S:
Robert E. Williams, Director of Public Works for Utilities
Robert J. Harberg, Engineering Planning and Project Management Coordinator
Douglas Sullivan, Engineering Project Manager, Presenter

EXECUTIVE SUMMARY:

The Stormwater Master Plan (SMP) is a comprehensive analysis of the city's storm sewers and local drainage systems, and is intended to guide future Stormwater and Flood Management Utility (Utility) decisions. The SMP serves to update the 1984 Stormwater Collection System Master Plan (1984 Plan). The SMP goals include the following:

- Efficiently manage stormwater runoff
- Protect water quality
- Minimize localized flooding impacts

The SMP involved the development of a hydrologic and hydraulic model to evaluate the stormwater collections system's ability to convey the flow associated with the two-year and five-year storm events. The SMP identifies a recommended Capital Improvements Plan (CIP) list for storm sewer conveyance and water quality improvements throughout the city. This project list includes 51 conveyance water quality projects, which are organized into three categories (Tier 1, Tier 2 and Tier 3). Tier 1 projects represent major system deficiencies; Tier 2 projects represent moderate system deficiencies; and Tier 3 projects represent nuisance system deficiencies. There are four Tier 1 problems, 16 Tier 2 problems and 31 Tier 3 problems identified. These potential projects range in cost from $63,000 to $10,700,000. A map of the recommended CIP is shown in the report's Executive Summary, Figure ES-3 (see Attachment A).

In the report's presentation, the water quality problems are integrated with the conveyance problems when they are located in the same vicinity. Additionally, the SMP identifies 12 Water Quality Areas of Concern, which represent the areas of the city responsible for the largest volume of pollutant-loading to the drainageways. The Water Quality Areas of Concern represent potential small capital projects, ranging in cost between $51,000 and $157,000.

The 12 projects have an estimated total cost of approximately $1,000,000 with both the conveyance and water quality problems being addressed:

- Tier 1 = $20,000,000
- Tier 2 = $22,000,000
- Tier 3 = $17,000,000
- WQ = $1,000,000
- Total = $60,000,000

A map of the Water Quality Areas of Concern is shown in the report's Executive Summary, Figure ES-2 (see Attachment A).

STAFF RECOMMENDATION:

Staff recommends that the City Council accept the Stormwater Master Plan and approve the BVCP summary revisions.

COUNCIL FILTER IMPACTS:

- **Economic**: The Tier 1 projects have an economic benefit by reducing flood risk and property damage.
- **Environmental**: The Tier 1 projects provide an environmental benefit by addressing stormwater quality issues at identified problem locations.
- **Social**: The Tier 1 projects have a social benefit by resolving street and flooding issues.

Economic, environmental and social issues are further addressed through the coordination of the projects with Transportation and Greenways projects and are further reviewed through the annual budget process.

FISCAL IMPACTS:

There are no fiscal impacts at this time. The current Stormwater and Flood Management Utility (Stormwater Utility) funding is not adequate to address the SMP recommended projects. Utilities staff is in the process of reviewing the future CIP funding allocation to determine the most effective method to fund the identified projects.

Cash funding for the current Stormwater Utility CIP is $2 - 2.5 million per year. Over the last 17 years, approximately 80% of this funding has been allocated to the major draninageways projects. The primary purpose of the major drainageway focus has been to address life safety and property issues along the city's 15 major drainageways. Major drainageway projects typically include the purchase of properties located in the city's High Hazard Zone, followed by major channel improvements. Two high profile, major drainageway projects completed over the last 20 years include the Bear Creek and Goose Creek Drainage Improvements projects.

Over this same period, only 10% of the Stormwater Utility funding has been allocated to the storm sewer improvements projects. The funding rate for storm sewer projects is approximately $300,000 for the next few years, but increases to $800,000 in 2012. This proposed increase in the CIP is intended to fund the Upper Goose Creek improvements. The number one Tier 1

project is Upper Goose Creek, located between 9th and 19th streets in the vicinity of Balsam and Alpine avenues. Improvements associated with this project are estimated to cost $10,700,000.

There are still many identified threats to life safety and property, as well as opportunities to collaborate as part of the Greenways Program, such that continued emphasis on major drainageway corridors is likely. These corridors include South Boulder Creek, Wonderland Creek, Fourmile Canyon Creek, and Elmer's Twomile Creek as listed in the current Utility CIP.

Staff will evaluate funding options as part of the 2008 budget process and report on these options to the Water Resources Advisory Board (WRAB) in the near future. There are no funding or policy issues associated with the Stormwater Master Plan for the 2008 budget. Utilities staff has identified two potential funding options as a means to fund some of the SMP recommended projects. These options include the following:

1. Reallocate the Stormwater Utility annual funding to shift funds away from the major drainageways to the storm sewers.
2. Increase the Stormwater Utility revenue by increasing monthly rates or issuing a revenue bond.

Utilities staff will complete a cost-benefit analysis of the Tier 1 SMP recommended projects to determine projects values, not only relative to one another, but also relative to the major drainageway projects in an effort to identify priorities for future CIP funding. Utilities staff will continue to evaluate the projects' funding and potential rate impacts during the annual budget process. The recommendations from the Stormwater Master Plan will not have an impact until 2001 or 2012.

BOARD AND COMMISSION FEEDBACK:

The SMP was presented to the Water Resources Advisory Board (WRAB) at the Feb. 26 and April 16, 2007 meetings. The WRAB voted unanimously (5-0) to accept the SMP and recommended that the Planning Board accept the SMP. The SMP was presented to the Planning Board at the May 3 meeting. The BVCP summary revisions were presented to the Planning Board, but not the WRAB. The Planning Board voted unanimously (7-0) to recommend that the City Council accept the SMP and unanimously approved the proposed changes to the BVCP Comprehensive Flood and Stormwater Master Plan Summary contingent on the plan begin accepted by City Council.

PUBLIC FEEDBACK:

Public hearings were hosted by the WRAB and Planning Board. There were no comments from the public at either hearing.

ANALYSIS:

The Stormwater Master Plan represents a comprehensive analysis of the city's stormwater collection system. The SMP included a hydrologic and hydraulic model to assess the system capacity with additional analysis on groundwater, detention facilities and water quality. The SMP identified over 50 potential storm sewer improvement projects and 12 additional projects specifically identified to improve water quality.

Utilities staff is currently in the process of evaluating an approach to fund the higher priority projects. Once a project is identified, Utilities staff would complete the Community and Environmental Assessment Process (CEAP) to determine potential impacts.

Approved By:

_____

Frank W. Bruno,
City Manager

ATTACHMENTS:

Attachment A – Stormwater Master Plan Executive Summary
Attachment B – February 26 WRAB Agenda memo and meeting minutes
Attachment C – April 16 WRAB Agenda memo and meeting minutes
Attachment D – May 3 Planning Board Agenda memo and meeting minutes
Attachment E - BVCP Comprehensive Flood and Stormwater Master Plan Summary

Volume 1 – Final Report

City of Boulder

Stormwater Master Plan

Prepared for

City of Boulder

June 2007

Prepared by

HDR Engineering

Printed on Recycled and Recyclable Paper

Supporting Documents

Several technical memorandums (TMs) were developed through the course of this project. These TMs provide supporting information for the analysis, improvement alternatives and recommendations contained in this report. The supporting documents are summarized below for reference and bound in separate volumes for future use by the City and the engineering community.

Volume 2 – Technical Appendices

Appendix A: Model Input Data Tables, Results Tables and XPSWMM output.

Appendix B: Model Network Mapping

Appendix C: Detailed Cost Estimates

Volume 3 – Hydraulic Technical Memoranda

TM 3.2 Design Storm

TM 4.2 Groundwater Mapping and Future Tasks

TM 5.1 Hydraulic Conceptual Alternatives

TM 5.1b Storm Drain and Canal Separation Alternatives

TM 5.1c Goose Creek Alternatives

TM 5.1d Broadway Improvement Alternatives

Volume 4 – Water Quality Technical Memoranda

TM 3.5 Water Quality Model and Construction Results

TM 3.6.1 Water Quality Analysis Results

TM 3.6.3 Water Quality Recommendations

TM 4.3 BMP Toolbox

Boulder Transit Village Stormwater Analysis

Contents

Section **Page**

Executive Summary **1**

1. Introduction **7**
1.1 Goals and Objectives 7
1.2 Stormwater Planning Process 7
1.3 Previous Studies 8
1.4 Stormwater Management Principles and Policies 8
1.4.1 Guiding Principles 9
1.4.2 Stormwater Management Policies 9

2. Analysis and Problem Identification Criteria **17**
2.1 Study Area 17
2.1.1 Topography 17
2.1.2 Land Use 17
2.1.3 Soils 17
2.1.4 Climate 18
2.2 System Analysis Criteria 18
2.2.1 Design Storms 18
2.2.2 Continuous Simulation Modeling 19
2.2.3 Stormwater Conveyance Elements 19
2.2.4 Landuse and Imperviousness 19
2.3 Problem Identification Criteria 20
2.3.2 Water Quality 21

3. Model Development **23**
3.1 Modeling Approach 23
3.1.1 Data and Basis of Model Construction 23
3.2 Hydrologic and Hydraulic Model 24
3.2.1 Existing Condition Model Construction 24
3.2.2 Model Validation Parameters and Results 28
3.2.3 Future Condition Model Construction 31
3.3 Water Quality Model 31
3.3.1 Model Construction 32

4. System Analysis and Results **35**
4.1 System Description 35
4.1.1 Major Drainageways 35
4.1.2 Irrigation Canals 35
4.1.3 Storm Drains 35
4.2 Storm Drain Problem Identification 35
4.3 Storm Drain Problem Prioritization 36
4.3.1 Criteria and Definitions 36

Section **Page**

4.3.2 Criteria Weights and Ranking 37
4.3.3 Problem Area Priorities....38
4.4 Irrigation Canal Problem Identification....40
4.5 Water Quality Areas of Concern....40
4.5.1 Catchments 40
4.5.2 Outfalls 41

5. System Improvement Recommendations 43
5.1 Hydraulic Alternatives....43
5.1.1 Alternative Development Process 43
5.1.2 Alternative Evaluation Process....44
5.1.3 Upper Goose Creek – Alternative Analysis 44
5.1.4 Canal Separation Conceptual Alternatives 45
5.2 Water Quality Alternatives....46
5.2.1 Alternative Development Process – Water Quality Areas of Concern 46
5.2.2 Alternative Development Process – Boulder Creek Outfalls 46
5.2.3 Alternative Evaluation and Recommendations 47
5.3 Recommended Plan 50
5.3.1 Recommendations – Bear Canyon Creek Subbasin 52
5.3.2 Recommendations – Dry Creek Subbasin....53
5.3.3 Recommendations – Dry Creek No. 2 Subbasin 53
5.3.4 Recommendations – Elmers Twomile Creek Subbasin....54
5.3.5 Recommendations – Fourmile Canyon Creek Subbasin....54
5.3.6 Recommendations – Goose Creek Subbasin....55
5.3.7 Recommendations – Kings Gulch Subbasin 56
5.3.8 Recommendations – Lower Boulder Creek Subbasin 56
5.3.9 Recommendations – Middle Boulder Creek Subbasin....56
5.3.10 Recommendations – Skunk Creek Subbasin....58
5.3.11 Recommendations – Viele Channel Subbasin 59
5.3.12 Recommendations – Wonderland Creek Subbasin 59

6. Capital Improvement Program 60
6.1 Cost Estimating 60
6.2 Implementation Plan 60
6.3 Recommended Plan Fact Sheets....65
6.3.1 Tier 1 Priority Improvements....65
6.3.2 Tier 2 Priority Improvements....70
6.3.3 Tier 3 Priority Improvements....89
6.3.4 Water Quality Specific Projects....91

Section **Page**

List of Figures – Recommended Plan Fact Sheets

GC_02: Upper Goose Creek 66
MBC_10: 18th and Spruce Street 67
MBC_14: Arapahoe and 28th Street 68
DC_01: Gunbarrel – Spine Road, LOOKout and 63rd Systems 69
SC_01: Moorhead and moorhead frontage 70
MBC_04: Lincoln 72
WC_03: Vail and Independence 73
MBC_22: Arapahoe, commerce, and range 74
MBC_20: Parking structure between foothills and 38th 75
DC2_02: Thunderbird, Osage, and Foothills 76
GC_08: Foothills and valmont 78
GC_09: Industrial area near pearl parkway and wonderland creek 79
ETC_01: Broadway and Iris 80
MBC_23: Access rd and 55th st/Pearl and boulder creek 81
DC2_06: Arapahoe/56th street and dry creek 82
SC_02: Euclid and 30th 83
MBC_09: 16th St. 84
GC_04: Folsom, glenwood, & floral 85
GC_01: Broadway, Iris to Balsam 86
BCC_03: Gillaspie and shopping center parking 88
MBC_18: Arapahoe and 30th street 89
MBC_19: Marine avenue and boulder creek 90
LBC_02: Boulder Creek 1,400′ East of 75th Street 91
MBC_16: Boulder Creek & 28th Street 91
LBC_01: Boulder Creek & 75th Street 92
MBC_06: Boulder Creek & East Broadway Street & Arapahoe Avenue 92
MBC_11: Boulder Creek 200′ West of Folsom Street 93
MBC_12: Boulder Creek & Folsom Street 93
MBC_03: Boulder Creek & 9th Street 94
KG_01: Broadway & skunk creek 94
MBC_07: Boulder Creek & 13th Street 95
MBC_05: Boulder Creek & 11th Street 95

Section **Page**

List of Tables

Table ES-1: Tier 1 Hydraulic and Combined Hydraulic/Water Quality CIP Projects 5
Table ES-2: Water Quality Improvement CIP Projects 5
Table 2.2-1 Rainfall Depth-Duration-Frequency Values, NOAA Atlas II 18
Table 3.2-1 Horton Infiltration Parameters 25
Table 3.2-2 Comparison of Impervious Percentages 26
Table 3.2-3 Manning's Roughness Values 27
Table 3.2-4 CUHP Validation Subcatchment Parameters 29
Table 3.2-5 Validation Results: 5-yr, 1-hr, Peak Flow Summary 30
Table 3.2-6 Validation Results: 5-yr, 1-hr, Peak Flow Summary 30
Table 3.2-7 Future Condition Imperviousness by Landuse 31
Table 3.3-1 Event Mean Concentrations (EMC) Values 33
Table 3.3-2 BMP Pollutant Removal Efficiencies 34
Table 3.3-3 Proprietary BMP Locations 34
Table 4.3-1 Problem Prioritization Criteria and Definitions 37
Table 4.3-2 Weighting Criteria 38
Table 4.3-3 Summary of Problem Area Ranking Results 38
Table 4.5-1 Top 12 Pollutant Contributing Outfalls 41
Table 5.2-1 Common Water Quality Area of Concern and Boulder Creek Outfalls 47
Table 5.2-2 TSS Removal and Costs for Recommended BMPs 48
Table 5.2-3 Recommended Water Quality Sites 49
Table 5.3-1 Recommended Plan Project and Problem ID Summary 50
Table 5.3-2 Summary of Recommended Improvements - Bear Canyon Creek Subbasin 52
Table 5.3-3 Summary of Recommended Improvements - Dry Creek Subbasin 53
Table 5.3-4 Summary of Recommended Improvements - Dry Creek No. 2 Subbasin 53
Table 5.3-5 Summary of Recommended Improvements - Elmers Twomile Creek Subbasin 54
Table 5.3-6 Summary of Recommended Improvements - Fourmile Canyon Creek Subbasin 54
Table 5.3-7 Summary of Recommended Improvements - Goose Creek Subbasin 55
Table 5.3-8 Summary of Recommended Improvements - Kings Gulch Subbasin 56
Table 5.3-9 Summary of Recommended Improvements - Lower Boulder Creek Subbasin 56
Table 5.3-10 Summary of Recommended Improvements - Middle Boulder Creek Subbasin 56
Table 5.3-11 Summary of Recommended Improvements - Skunk Creek Subbasin 58
Table 5.3-12 Summary of Recommended Improvements - Viele Channel Subbasin 59
Table 5.3-13 Summary of Recommended Improvements - Wonderland Creek Subbasin 59
Table 6.2-1 Tier 1, Tier 2 and Tier 3 CIP Projects Implementation Plan 60
Table 6.2-2 Water Quality Improvements Implementation Plan 64

GLOSSARY OF TERMS

ac-ft	acre-feet
BMPs	best management practices
BTV	Boulder Transit Village
BVCP	Boulder Valley Comprehensive Plan
CFS	Comprehensive Flood and Stormwater Utility Master Plan
cfs	cubic feet per second
CIP	Capital Improvement Plan
City	the city of Boulder
Cu	copper
CUHP	Colorado urban hydrograph procedure
DCS	design and construction standards
DTM	digital terrain model
EMC	event mean concentration
HGL	hydraulic grade line
lbs/ac/yr	pounds per acre per year
LID	low impact development practices
MDCIA	minimum of directly connected impervious area
mg/L	milligrams per liter
µg/L	micrograms per liter
msl	mean sea level
NOAA	National Oceanic & Atmospheric Administration
NPDES	National pollutant discharge elimination system
NRCS	Natural Resources Conservation Service (formerly the Soil Conservation Service)
P	phosphorous
Pb	lead
Q_{Ratio}	ratio of peak flow capacity to full flow capacity
Q(wq)	water quality design storm peak flow (cfs)
SMP	Stormwater Master Plan
SSURGO	Soil Survey Geographic (database)
SWMM	Stormwater Management Model
TMCC	Two Mile Canyon Creek
TMs	technical memorandums
TSS	total suspended solids
UDFCD	Urban Storm Drainage Criteria Manual
USGS	U.S. Geological Survey
WQIMP	water quality improvement projects
Zn	zinc

Executive Summary

The original 1984 City of Boulder Storm Water Collection System Master Plan is being updated to reflect changes in land use, infrastructure and the regulatory climate as well as anticipated redevelopment within the community. The revised Stormwater Master Plan (SMP) provides the City of Boulder with the necessary planning tools and capital improvement projects to address flood management and water quality within the collector portion of the storm drainage system for the next decade.

The Boulder SMP was developed to replace the 1984 plan with a document that is more inline with present-day problems and opportunities and the City's overarching environmental, economic and social goals. The goal of the Boulder SMP is to proactively manage stormwater runoff to protect water quality and to minimize impacts of localized and downstream flooding by identifying infrastructure improvements for the collection, conveyance and treatment of stormwater runoff from within the City. The SMP prioritizes storm drain and water quality improvements within the City and provides an implementation plan for the construction of conveyance and water quality improvements

Major activities undertaken in the development of the plan include the following:

- Develop system analysis and problem identification criteria,
- Develop hydrologic, hydraulic and water quality models,
- Evaluate the system and rank problem areas,
- Perform alternatives analysis and develop a recommended plan,
- Prepare a capital improvement plan.

Study Area Characterization

The City of Boulder, with a population of approximately 100,000 and an area of nearly 25.5 square miles, is located along the front range of the Rocky Mountains, northwest of Denver, Colorado. Within the City, there are 12 subbasin and 15 major creeks (a.k.a. major drainageways) that generally flow from west to east as they converge on Boulder Creek, which is the main tributary flowing through the City. Runoff from within the City is conveyed to these major drainageways by the City's collector storm drain system and the irrigation canal system.

At present, Boulder is nearly fully built-out with much of the future development expected to occur as site redevelopment. Collectively, the current impervious percentage, assuming 2006 land use conditions, is 32% and is projected to be 34% under the Boulder Valley Comprehensive Plan. However, considering the City's Design and Construction Standards (DCS), the net future condition imperviousness used for this analysis was determined to be 33%,

Planning and Analysis Criteria

A master planning analysis was performed to identify potential collector system stormwater and associated water quality improvements within the City of Boulder. The evaluation was guided by a set of system analysis criteria used to identify conveyance and water quality problem areas and to evaluate potential improvements. These criteria included quantitative assessments of storm drain surcharging, culvert overtopping, channel/canal flooding, structure flooding (buildings, etc) and pollutant loadings. Other system analysis criteria used to support the study

included design storms (2-year, 5-year and water quality), landuse (existing and future conditions) and model boundary conditions.

Analysis Approach

A key element in the master planning process is the development of a hydrologic, hydraulic and water quality model of the natural and man-made stormwater system within the City. The model should be capable of analyzing runoff conditions; predicting flooding risk; estimating comparative pollutant loadings; evaluating existing facilities and infrastructure; and designing proposed improvements. To these ends, the primary objectives of the stormwater analysis were to:

- Construct a model that accurately represents the existing stormwater system within the City's collector system.
- Validate the model to previous studies and regional rainfall-runoff statistics.
- Utilize a land use-based method to estimate runoff under current conditions and incorporate the Boulder Valley Comprehensive Plan to represent future development conditions within the City.
- Evaluate the existing stormwater infrastructure with respect to the system analysis criteria and rank each problem in terms of severity.
- Locate, size and assess the performance of new stormwater management facilities including pipes, detention ponds, surface channel and irrigation canals.
- Locate, size and assess the performance of new water quality facilities based on areas identified in the model that exhibit elevated pollutant concentrations and/or loads.

Limits of Analysis

The focus of the Boulder SMP is the collector storm drainage system, which includes pipe 18" in diameter and larger and primary open channel systems that are not part of the City's major drainageways. To further refine the stormwater conveyance system, two levels of service are provided based on landuse and roadway category. For areas that are mainly residential in land use, the 2-year recurrence interval design storm was used to identify problems in the downstream conveyance system. For areas draining mainly commercial, industrial and collector and arterial roadways, the 5-year event was used. Areas within the city that experience localized flooding (e.g., undersized pipes that are less than 18 inches in diameter; roadside ditches; and clogged catch basins) were not considered as part of this study unless they have been identified by the City as known flooding locations.

Modeling Approach

The modeling approach for the Boulder SMP integrated GIS as a pre- and post-processing tool with an EPA-based Storm Water Management Model (SWMM) as the hydrologic, hydraulic and water quality analysis tool. The analysis software used for the project was XPSWMM which is a proprietary version of EPA-SWMM software that provided an efficient GIS interface that EPA-SWMM does not have at this date. Workflow began in GIS, where the input parameters for the SWMM model were developed. This data was transferred out of GIS to SWMM, for the evaluation of the system hydraulics and water quality. Model results were ultimately brought back into GIS for post processing and storage for future reference by the City.

Landuse and City Development Criteria

Land use is a key factor in assessing stormwater runoff because it affects both the quantity (volume and peak) and quality of water being routed through the stormwater system and natural channels. The effect land use has on water quantity can be generally linked to the amount of

impervious area for a particular land use category. The more impervious the area, the faster the water will be routed to the storm water collection system due to the lower surface roughness of the ground. It will also have an increase in volume since infiltration can not occur through impervious surfaces. Consequently, an area with a higher percentage of impervious surfaces will produce higher peak flows over a shorter period of time than will a similar area with a lower percentage of impervious surfaces.

The future conditions scenario represents a fully developed urban area according to the Boulder Valley Comprehensive Plan, 2006 (BVCP). This scenario represents a worst case scenario from a stormwater perspective because it encompasses the highest level of imperviousness. However, this scenario has also incorporated the City's DCS, which require detention and water quality treatment for all new impervious areas associated with new and re-development projects. As discussed in later sections of this report, the City performed an inventory of existing detention and treatment facilities and it was identified that roughly 78% of all current facilities are adequately functioning (22% have failed). Consequently, to incorporate the DCS, this same facility performance level (78%) was also assumed to occur under future development conditions. To accomplish this, the change in impervious percentage between existing and future conditions was reduced by 78% to account for the detention and treatment facilities that will collectively be built as the city develops and/or re-develops.

Problem Identification

Utilizing the verified SWMM model, runoff, hydraulic, and water quality calculations were completed for two different land use scenarios: existing conditions and future conditions, and three different design storms: the 2- and 5-yr events and the water quality storm. These results were then evaluated with respect the previously noted system analysis criteria to identify specific system deficiencies within the City's collector storm drain system.

Hydraulic Problem Areas and Ranking

Model results for existing conditions indicate that 572 nodes out of 1635 nodes within the model violate one or more of the noted criteria. To better understand the cause and affect of each problem area, a number of these deficient nodes and links were combined together into individual problem locations. This resulted in a total of 51 hydraulic problem locations. Irrigation canal segments were also added to the problem identification list if the corresponding design storm causes the channel to overtop its banks and flood the surrounding area.

Due to the relatively large number of problem locations identified through the modeling and GIS analysis, and due to limitations within the City's capital budget, a ranking was performed on the problem areas to prioritize the conveyance problems. This process resulted in identifying three problem priority levels; Tier 1, Tier 2 and Tier 3 indicating severe, major or minor problem areas, respectively. The process of ranking system problems into tiers utilized a point-based matrix using a weighted criteria approach. Six criteria were used to rank the problem areas. These criteria include: 1) the extent of the problem, 2) the flooded volume, 3) the impact to neighboring structures, 4) the length of under capacity pipe, 5) the confidence in the underlying data and 6) the proximately of the hydraulic problem to water quality areas of concern. The problem prioritization process resulted in five Tier 1 problem areas, 17 Tier 2 problem areas, and 31 Tier 3 problem areas. These problem locations are shown on Figure ES-1.

Water Quality Analysis and Problem Areas

The water quality analysis included two separate approaches to identify problem locations within the collector system: 1) a buildup-washoff analysis using the XPSWMM model to identify water quality areas of concern that produce high pollutant loads and 2) targeted outfall approach focusing on the collector system outfalls to Boulder Creek. The water quality area of concern

approach used the XPSWMM model to identify areas within the City having comparatively higher pollutant concentrations and/or loads. This approach identified 12 locations within the City that were characterized as water quality areas of concern. The Boulder Creek outfall approach identified 17 collector system outfalls that do not currently receive pollution reduction through regional water quality facilities. The water quality areas of concern and Boulder Creek outfall sites are shown on Figure ES-2.

System Improvement Alternatives and Recommendations

Improvement alternatives were developed for the Tier 1 and Tier 2 problem areas and a qualitative assessment identified the preferred alternative for each problem area. The Tier 3 problem areas did not receive an evaluation of different alternatives due to the limited severity of the conveyance problems. Instead, improvements to resolve the Tier 3 problem areas consisted of pipe replacement to increase the system capacity and resolve the conveyance problem.

For the water quality area of concern sites, improvement alternatives were developed to evaluate the optimum improvement for a give site or location. Improvements for the Boulder Creek outfall sites were developed based on the use of proprietary BMPs (a.k.a. water quality manholes) since these types of facilities are best suited for highly urbanized areas as typically found near the collector system outfall top Boulder Creek. A cost/benefit analysis was performed for the improvement water quality improvements at each of the water quality area of concern and Boulder Creek outfall sites. This process identified 18 water quality improvement projects to address the address the water quality area of concern site and the Boulder Creek outfall sites that favorable cost/benefit ratios or that did not rely on future development for project implementation.

The recommended plan for addressing the conveyance and water quality problem areas is a compilation of all hydraulic and water quality improvements developed in this study. Figure ES-3 provides an overview of the recommended plan improvements with corresponding improvement projects IDs. In some instances, the recommended water quality improvements were in close proximity to a hydraulic improvement location and were combined into a single project. Other recommended improvements consist of improvements that separately address water quality or conveyance problems.

Capital Improvement Plan

The goal for this master plan is to manage stormwater, by minimizing impacts on localized and downstream flooding and improving water quality. To these ends, the recommended system improvements were categorized as 1) Hydraulic and Combined Hydraulic/Water Quality projects or 2) Water Quality Improvement projects. These two project categories form the collector system Capital Improvement Plan (CIP).

The implementation plan for the Hydraulic and Combined Hydraulic/Water Quality CIP projects follows the Tier 1, 2 and 3 problem areas. Tier 1 CIP projects are considered high priority improvements as they resolve severe conveyance system problems and in some instances address stormwater quality problems. Tier 1 projects areas are anticipated to a) have a high social benefit by resolving street and property flooding issues, b) have a high economic benefit by reducing flooding risk and property damage, and c) provide an environmental benefit by addressing stormwater quality issues at identified problem locations. Note that not all Tier 1 locations included a water quality problem site and that the overriding criterion for prioritization was resolving flooding issues. Table ES-1 identifies the Tier 1 CIP projects; Tier 2 and 3 projects are identified in Sections 5 and 6 of the main report.

Table ES-1: Tier 1 Hydraulic and Combined Hydraulic/Water Quality CIP Projects

Ranking	Improvement ID	Location	Improvement Type	Capital Cost
1	GC_02	Upper Goose Creek	Pipe Replacement New Storm Drain Channel Improvement	$10,701,000
2	MBC_10	18th and Spruce Street	Pipe Replacement Storm Drain Re-Routing/Extension	$1,577,000
3	MBC_14	Arapahoe and 28th Street	Pipe Replacement Storm Drain Re-Routing/Extension Proprietary BMP	$1,659,000
4	DC_01	Gunbarrel – Spine Road, Lookout and 63rd Systems	Pipe Replacement Storm Drain Re-Routing/Extension Constructed Wetland	$5,694,000

The implementation plan for the Water Quality Improvement (WQIMP) projects were prioritized based on problem severity as identified by pollutant load. The WQIMP category was developed since many of the water quality project sites were not adjacent to hydraulic problem and improvement locations. In addition, many of these WQIMP projects could be defined as a small capital projects since the estimated construction costs are less than $100,000.

Table ES-2: Water Quality Improvement CIP Projects

Improvement ID	Annual TSS Load (pounds)	Location	Capital Cost
WQIMP 2	61,900	Boulder Creek 1,400' East of 75th Street	$104,000
WQIMP 3	56,500	Boulder Creek & 28th Street	$81,000
WQIMP 5	46,200	Boulder Creek & 75th Street	$76,000
WQIMP 6 & WQIMP 9	45,700 & 38,400	Boulder Creek & East Broadway Street & Arapahoe Avenue	$157,000
WQIMP 8	41,500	Boulder Creek 200' West of Folsom Street	$84,000
WQIMP 12	29,000	Boulder Creek & Folsom Street	$78,000
WQIMP 14	24,200	Boulder Creek & 9th Street	$73,000
WQIMP 15	22,800	Broadway & Skunk Creek	$73,000
WQIMP 16	20,300	Boulder Creek & 13th Street	$81,000
WQIMP 18	15,000	Boulder Creek & 11th Street	$51,000

Estimates of capital construction costs included in this plan are considered planning level estimates to be used in developing stormwater capital budget requirements.

C I T Y O F B O U L D E R
CITY COUNCIL AGENDA ITEM

MEETING DATE: February 2, 2010

AGENDA TITLE: Consideration of a motion to accept the Wastewater Utility Master Plan.

PRESENTER/S:
Jane S. Brautigam, City Manager
Paul J. Fetherston, Deputy City Manager
Maureen Rait, Executive Director of Public Works
Robert E. Williams, Director of Public Works for Utilities
Robert J. Harberg, Engineering Planning and Project Management Coordinator
Douglas Sullivan, Engineering Project Manager

EXECUTIVE SUMMARY:

The Wastewater Utility Master Plan (WWUMP) is a comprehensive analysis of the city's wastewater collection and treatment system, associated water quality programs and facilities. It is intended to guide future wastewater utility decisions. The WWUMP serves as the overarching planning document for the wastewater utility and is supported by three primary planning documents:
The Wastewater Collection System (WWCS) Master Plan
The Wastewater Treatment Plant (WWTP) Master Plan
The Water Quality Strategic Plan (WQSP)

The WWUMP provides updated information on the wastewater utility system and a recommended Capital Improvements Program (CIP) project list for wastewater utility improvements over the next 20 years.

The Water Resources Advisory Board (WRAB) accepted the final Wastewater Utility Master Plan by a 5-0 vote at its May 18, 2009 meeting. At its Dec. 17, 2009 meeting, Planning Board voted (6-0) to recommend City Council acceptance of the Wastewater Utility Master Plan and approve the revisions to the BVCP Wastewater Utility Master Plan Summary.

A copy of the Executive Summary of the WWUMP is included as **ATTACHMENT A.** A hard copy of the entire WWUMP document is available in the City Council office and a full electronic version is available on the city's Website at
http://www.bouldercolorado.gov/files/Utilities/wastewater/WWUMP_Fina_Draft_111309.pdf

STAFF RECOMMENDATION:

Suggested Motion Language:
Staff requests council consideration of this matter and action in the form of the following motion:
Motion to accept the Wastewater Utility Master Plan.

COMMUNITY SUSTAINABILITY ASSESSMENTS AND IMPACTS:

- Economic: One of the primary purposes of the WWUMP is to assure that the City of Boulder continues to meet all environmental laws and regulations and avoid consequences by developing appropriate plans for on-going maintenance of the infrastructure and improvements to accommodate probable future growth and regulatory changes. The discharge of pollutants to the environment would expose the city to possible damages, assessments, and restrictions for existing customers and on any new development.

- Environmental: Two of the Wastewater Utility's guiding principles directly address environmental issues: the Protection of Public Heath and Safety, and the Protection of Boulder's Natural Resources and the Environment. The Wastewater Utility 20-year CIP includes numerous projects that ensure that the city is addressing public heath, natural resources and the environment. The 2006-2008 Liquid Stream Upgrades Project was completed to ensure that the WWTP could meet more stringent effluent discharge permit requirements. This project has reduced the effluent ammonia concentration discharged to Boulder Creek from 9 mg/L to 0.5 mg/L (a 95% reduction). This reduction correlates to 1,000 lbs. less ammonia being discharged to Boulder Creek each day. The 2006-2008 Dewatering Improvements project was completed to provide a more efficient biosolids program reducing the volume of biosolids delivered to the land application sites. This project reduced the number of biosolids truck loads from 697 in 2007 to 322 in 2009 - a 54% reduction. This process change reduced the number of biosolids trucks travel by approximately 54,000 miles, and saves over 6,500 gallons of diesel fuel annually. The solar Photovoltaic (PV) facility will provide one megawatt (1,000,000 watts) of green energy in supplying approximately 15% of the WWTP annual power requirements.

- Social: Residents are currently benefiting from the recent WWTP improvements project by the enhanced water quality discharge to Boulder Creek and by the reduction in the number of large trucks on the highway. The new photovoltaic (PV) system at the WWTP will produce "green" power, result in cost savings and will provide educational opportunities at a kiosk located at the WWTP. The PV project will stabilize a portion of the WWTP annual utility bill at a lower rate than is currently being paid, allowing for more accurate utility cost projections on an annual basis. This associated savings can be translated into opportunities for system upgrades and enhanced customer service at the WWTP.

OTHER IMPACTS:

- Fiscal: The WWUMP identifies numerous CIP projects for both the WWTP and the wastewater collection system. These projects are integrated into the Wastewater Utility 20-year CIP to address discharge permit related issues and the replacement and/or rehabilitation of existing infrastructure. Recent WWTP improvements have reduced the cost of biosolids processing and disposal program. Additionally, the WWTP Solar Photovoltaic (PV) facility will be operational in February 2010. This PV facility will provide an additional power supply of one megawatt (1,000,000 watts). The PV facility will provide approximately 15% of the WWTP's overall power requirements and result in an estimated annual savings of approximately $43,000.

BOARD AND COMMISSION FEEDBACK:

Staff presented the draft Wastewater Utility Master Plan (WWUMP) to the Water Resources Advisory Board (WRAB) in March 2009 and presented the final WWUMP in May 2009. The WRAB accepted the final Wastewater Utility Master Plan by a 5-0 vote at the May 18, 2009 meeting.

City staff presented the WWUMP to the Planning Board at its Dec. 17, 2009 meeting. The Planning Board meeting was a public hearing in consideration of:

- A recommendation to City Council concerning the Wastewater Utility Master Plan; and,
- Approval of the Boulder Valley Comprehensive Plan (BVCP) Wastewater Utility Master Plan Summary.

Planning Board voted (6-0) to recommend to City Council acceptance of the Wastewater Utility Master Plan and approve the revisions to the BVCP Wastewater Utility Master Plan Summary, incorporating the staff memorandum dated Dec. 17, 2009.

PUBLIC FEEDBACK:

There was no public feedback at the May 18, 2009 Water Resources Advisory Board meeting or the Dec. 17, 2009 Planning Board meeting.

BACKGROUND:

Boulder's wastewater collection system and the 75th Street WWTP serve residences and businesses within the 26 square-mile Wastewater Utility Service Area (WUSA). Areas outside the WUSA boundary are served by other utility districts or septic systems. Boulder's wastewater collection system currently serves a population of approximately 110,000 residents and 101,000 employees associated with commercial and industrial business. Projected growth is anticipated

to occur primarily through infill and redevelopment projects resulting in an estimated 128,000 residents and 156,000 employees within the WUSA through 2035.

The city's wastewater collection system consists of approximately 362 miles of sanitary sewer pipe ranging in size between 4-inch and 60-inch diameter sewers. The system flows by gravity, with the exception of one sewage lift station and associated force main. The Diagonal Highway Lift Station is located at 5600 Diagonal Highway. The force main associated with the pump station is 12-inches in diameter and approximately 800 feet in length. All sanitary sewer flow is conveyed to the city's 75th Street WWTP located at 4049 N 75th Street.

The 75th Street WWTP has a rated capacity of 25 million gallons per day (mgd). The WWTP serves City of Boulder residences, commercial business, and light industry located within the WUSA. The WWTP has been in operation at its current location since 1968 and has undergone numerous modifications since that time.

The most recent WWTP modification occurred in 2006-2008 when two significant process upgrades were completed at the WWTP. The Liquid Stream Upgrades project was completed to enable the plant to meet more stringent effluent discharge regulations required by the Colorado Department of Public Health and Environment. This project represented a transition in the biological treatment process from a Trickling Filter/Solids Contact process to the Activated Sludge process. The project also increased the plant's hydraulic capacity from 20.5 mgd to 25 mgd. The Solids Processing improvements were completed to provide a more efficient and sustainable solids management program.

The Wastewater Utility Master Plan was developed to serve as an overarching document for the entire Wastewater Utility. The WWUMP addresses the WWTP and collection system CIP projects, as well as Operation and Maintenance programs, and the Water Quality and Environmental Services Program. Utilities staff has previously completed individual master plans for each of the Utility's major components. The WWTP Master Plan was completed in 2007. The Wastewater Collection System Master Plan was completed in 2008 as part of the WWUMP. The Water Quality Strategic Plan was completed in 2009.

ANALYSIS:

Wastewater Utility CIP

The Wastewater Utility Master Plan (WWUMP) includes a comprehensive list of Wastewater Utility projects to be completed during the 20-year planning period. These include wastewater treatment plant capital and maintenance related projects, as well as wastewater collection system capital and maintenance related projects. The 2010-2030 Wastewater Utility Fund CIP has numerous line items identifying various projects for the WWTP and the sanitary sewer collection system. The significant CIP expenditures fall into the following three categories:

- WWTP Capital Projects
- WWTP Rehabilitation Projects
- WWCS Rehabilitation Projects

WWTP Capital Projects

There are five significant WWTP capital projects currently identified in the 20-year CIP. The total cost of these projects (in 2008 dollars) is estimated at $40,000,000. These projects, their estimated escalated cost, and their projected timing are listed below:

- UV Disinfection – $4,400,000 – 2010
- Digester Modifications – $4,000,000 – 2010
- Headworks Improvements – $15,600,000 – 2016
- Phase 2 Improvements (Denitrification & Phosphorus removal) – $15,000,000 – 2020
- Endocrine Disrupting Compounds (EDC's) removal – $19,000,000 – 2030

The Utilities Division has recently completed a WWTP Evaluation project that provided an analysis for a future UV Disinfection to replace the plant's existing gas chlorine system, and modifications to the existing Digester complex and Headworks facility. This analysis presented several process alternatives for the various facilities, their respective estimated costs, and provided recommendations regarding their overall priority.

WWTP Rehabilitation Projects

In addition to the WWTP capital projects listed above, there are numerous WWTP rehabilitation projects identified in the CIP to address the plant's aging infrastructure. These projects are listed in the CIP in years 2016 through 2030, and have a combined cost (in 2008 dollars) of $8,500,000. Utilities staff will continue to review the WWTP Rehabilitation analysis annually to identify the estimated timing for the various rehabilitation projects within the six-year CIP.

WWCS Rehabilitation Projects

Lastly, there are numerous wastewater collection system improvement projects currently identified in the 20-year CIP. These projects were identified in the Wastewater Collection System Master Plan, which was accepted by the WRAB in December 2008. The CIP currently lists four Tier 1 projects (highest priority) and seven Tier 2 projects (second highest priority). The total cost (in 2008 dollars) for these eleven projects is estimated at $28,000,000. The Tier 1 and Tier 2 project groups are listed below with their estimated cost and projecting timing:

- Tier 1 Projects – $5,000,000 – 2016 through 2021
- Tier 2 Projects – $23,000,000 – 2021 through 2030

MATRIX OF INVESTMENT OPTIONS:

The WWUMP presents the following three investment options based on different levels of funding:

- Fiscally Constrained Plan
- Action Plan
- Vision Plan

Fiscally Constrained Plan

The Fiscally Constrained Plan reflects an investment strategy which assumes a Wastewater Utility Fund rate increase of zero percent (0%) in 2010, and a three percent (3%) annual increase

in years 2011 through 2030. Under the Fiscally Constrained Plan, there are numerous programs and projects that would be either eliminated or have reduced funding. These include the following:

- Either the UV Disinfection or the Digester Modifications project (both scheduled for construction in 2010) would need to be eliminated from the 20-year CIP
- The 2016 Headworks Improvements project would be eliminated from the 20-year CIP
- The 2020 Phase 2 Improvements project (Nutrient Removal) would be eliminated from the 20-year CIP
    - This project would likely be required to address CDPHE permit issues
- The 2030 Endocrine Disrupting Compounds (EDC) removal project would be eliminated from the 20-year CIP
    - This project would likely be required to address CDPHE permit issues
- The WWTP Rehabilitation funding would be eliminated from the 20-year CIP
- The Wastewater Collection System Replacement projects (Tier 1 and Tier 2) would be eliminated from the 20-year CIP
- The Sanitary Sewer System Rehabilitation funding would be eliminated from the 20-year CIP
- Future budget supplementals would be eliminated from the 20-year CIP

Action Plan

The Action Plan reflects an investment strategy that assumes an annual Wastewater Utility Fund rate increase of four percent (4%) in years 2016 through 2030, with the following exceptions. The Action Plan will follow the recommended six-year (2010-2015) CIP, which includes the following rate increases: 2010 = 0%, 2011-2012 = 3%, 2013 = 4%, and 2014-2015 = 6%. There is one period of increased funding that is necessary to maintain a positive fund balance in 2030. Two consecutive years (2019 and 2020) of nine percent (9%) rate increases would be required to fund the Nutrient Removal project. Under the Action Plan, there are a few programs and projects that would be either eliminated or have reduced funding. These include the following:

- The 2030 Endocrine Disrupting Compounds (EDC) removal project would be eliminated from the 20-year CIP
    - This project would likely be required to address CDPHE permit issues
- The Wastewater Collection System Replacement projects (Tier 2) would be eliminated from the 20-year CIP

Vision Plan

The Vision Plan reflects an investment strategy that assumes an annual Wastewater Utility Fund rate increase of four percent (4%) in years 2011 through 2030 with the following exceptions. There are three periods of increased funding necessary to maintain a positive fund balance in 2030. Two consecutive years (2014 and 2015) of eight percent (8%) rate increases would be required to fund the Headworks Improvements project. Two consecutive years (2019 and 2020) of eight percent (8%) rate increases would be required to fund the Nutrient Removal Improvements project. Two consecutive years (2029 and 2030) of eight percent (8%) rate increases would be required to fund the EDC Removal Project. Under the Vision Plan, there are no programs that would have reduced funding.

Rate Increases needed to fund Investment Strategy Options

The table below presents the three different levels of potential Wastewater Utility rate increases needed to fund corresponding investments in the six-year CIP. The proposed annual rate increase is presented on a yearly basis through the city's budget process to the Water Resources Advisory Board and City Council for review and consideration.

Investment Strategy	2010	2011	2012	2013	2014	2015
Fiscally Constrained	0%	3%	3%	3%	3%	3%
Action	0%	3%	3%	4%	6%	6%
Vision	0%	4%	4%	4%	8%	8%

Approved By:

_____

Jane S. Brautigam,
City Manager

ATTACHMENTS:

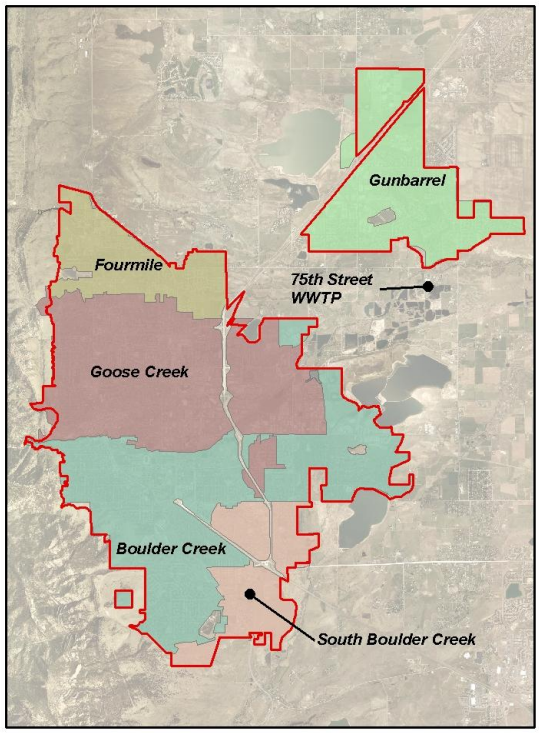
A – WWUMP Executive Summary

EXECUTIVE SUMMARY

Introduction

The Wastewater Utility Master Plan (WWUMP) is the overarching planning document that is intended to present key issues, programs, projects and associated budgets for the collection system, wastewater treatment plant and water quality programs. The WWUMP is supported by three primary planning documents for the Wastewater Utility: the Wastewater Collection System Master Plan (WWCSMP), the Wastewater Treatment Plant Master Plan (WWTPMP), and the Water Quality Strategic Plan (WQSP).

Boulder's wastewater collection system and the 75th Street WWTP serve residences and businesses within the 26 sq. mile Wastewater Utility Service Area (WUSA). Areas outside the WUSA boundary are served by other utility districts or septic systems. Boulder's wastewater collection system currently serves a population of approximately 110,000 people and 101,000 employees associated with commercial and industrial business. Projected growth is anticipated to occur primarily through in-fill and redevelopment projects resulting in an estimated 128,000 people and 156,000 employees within the WUSA.



Boulder's Wastewater Utility Service Area encompasses 26 sq.mi. and contains five interceptor sewer basins

A series of guiding principles were used to define the planning process for the Utility. These guiding principles are based on Boulder's planning approach to community sustainability through evaluating social, environmental and economic impacts associated with various program and projects within the city. Specifically, the three guiding principles for the WWUMP are:

- Protect Public Health and Safety
- Protect Boulder's Natural Resources and the Environment
- Maximize the use of the Wastewater Utility's Funds

Wastewater Treatment Plant Master Plan

The Wastewater Treatment Plan Master Plan (WWTPMP) documents past decisions, the current facility, and presents the approach that has been used to reach decisions on process selection and introduce some future decisions that will be facing the utility. To continue to provide the level of service required by federal regulations and match the expectations of the community presented in the BVCP Goals, ongoing improvements to the treatment facility are necessary.

The WWTP was upgraded in 2008 to meet future wastewater treatment capacity demands and new ammonia-nitrogen limits that were incorporated in the CDPS permit. The upgrades included improvements to both the liquid stream treatment and solids dewatering processes (Phase 1). The current treatment capacity is 25.0 million gallons per day (mgd) on a maximum month basis and provides adequate capacity to meet population growth past 2025 (the current average annual flow rate is approximately 15 mgd). The Phase 1 improvements also kept the future total nitrogen discharge at or below the current level. The solids dewatering process improvements increased solids from the liquid stream treatment process and reduced the volume of dewatered solids that must be transported from the WWTP site.

Phase 1B construction, currently planned for 2010-2011, will include a UV disinfection system, solids stabilization (anaerobic digester) improvements, and possibly improvements to the headworks facility. Phase 2 construction, scheduled for 2020, includes expansion of the bioreactor with improvements to biologically remove nitrate and phosphorus.

WWTP Evaluation

Even though the City of Boulder recently completed $45 million in major improvements to the liquid and solids handling processes at the 75th Street Wastewater Treatment Plant, new discharge permit requirements are expected in 2010 and will require bringing the entire facility up to the same level of treatment capacity. As such, the City is currently in the process of evaluating the WWTP's treatment process capabilities – specifically focusing on the following three areas:

- Evaluate the plant's anaerobic digestion process (capacity, mixing, heating, etc.) and recommend improvements to provide greater capacity and operational stability.
- Evaluate UV disinfection alternatives to replace the existing gas chlorine and sulfur dioxide systems.
- Evaluate the WWTP's ability to meet the City's upcoming CDPHE permit effluent.

The WWTP Evaluation project was completed in October 2009. The evaluation included recommendations at various plant processes including the following:

- A new UV (ultraviolet) Disinfection system to replace the gaseous chlorine and sulfur dioxide systems.
- New digester mixing to replace the existing gas mixing system.
- Headworks improvements including bar screen replacement, grit conveyance, and screenings and grit removal.

The City is in the process of selecting an engineering consultant to provide the design services. The design is scheduled for 2010, with an anticipated construction bid in late 2010 or early 2011. The construction is estimated at $8,000,000 to $9,000,000.

Future WWTP Modifications

Discharge permit limits are revisited every five years, and it is anticipated that some level of TIN and phosphorus removal may be required by future discharge permits. Additionally, the Boulder WWTP may be required to remove microconstituents. Microconstituents include very small particles such as endocrine disrupting compounds and disinfection byproducts. Other future projects identified in the CIP include modifications to, or the replacement of the Headworks facility.

Wastewater Collection System Master Plan

The WWCSMP is a comprehensive planning document that assesses the conveyance capacity of Boulder's sanitary sewer system and identifies recommendations with associated capital cost estimates to resolve conveyance capacity deficiencies.

Collection System Analysis

The purposes of the conveyance system analysis were to 1) document the analysis of the existing collection system during dry weather and wet weather flows and 2) to identify and characterize hydraulic capacity issues. By analyzing the existing collection system under existing and buildout flow conditions, problem areas were identified for both land use scenarios.

The primary source of data that was used for the collection system hydraulic model and analysis was Boulder's sanitary sewer Geographic Information System (GIS) layers for manholes and sewer pipes. The collection system pipes with identified capacity limitations, established from

the model results, were examined to identify likely hydraulic issues under the various flow scenarios. There are a total of 138 pipes in the analyzed collection system with hydraulic deficiencies identified. A detailed problem identification and characterization process was completed to better understand the nature and extent of these problems. The hydraulic problems were separated into two categories: Type A and Type B. Type A problems consisted of a series of under capacity pipes that were hydraulically connected to one another. Type B problems are isolated hydraulic restrictions that are not hydraulically connected to other problem locations or series of problem pipes.

Recommended Collection System Improvements

The recommended system improvements were developed to resolve the existing and future capacity issues are shown on the following figure. This figure includes both improvements that address Type A and Type B problems.

The recommended improvements were grouped in three tiers to establish implementation priority:

- Tier 1 projects address Type A problems and have the highest priority;
- Tier 2 projects also address Type A problems but have lower priority compared to Tier 1;
- Tier 3 projects address Type B problems which have the lowest priority.

The improvement priorities were assigned based on a number of qualitative factors including the flow conditions in which they occur (existing versus future), extent of the problem, potential for sanitary sewer overflows (SSOs) and service lateral backups, ease of constructability, and relative benefit over other improvement projects. The resulting implementation priorities and associated estimates of capital construction cost are shown in the following table.

Improvement Priority	Capital Construction Cost
Tier I	$4,977,000
Tier II	$22,664,000
Tier III	$2,296,000
	$29,937,000

Collection System Operations and Maintenance

The WWCSMP project team reviewed the collection system operations and maintenance (O&M) procedures. The purpose of this O&M procedure was to review the current state of collection system O&M practices and evaluate potential increases in service levels due to trends

in the regulatory environment in the western United States. In addition, the 2008 QualServe peer review program and self assessment survey evaluated the Utility's overall performance, efficiency and customer service as well as maintaining industry best management practices.

Both the QualServ program and the WWCSMP O&M review found that the Gravity System's Maintenance group operates and maintains the collection system such that it continues to provide a high level of service to its existing customers.

Collection System Rehabilitation Budgeting

Boulder developed a methodology for determining the mileage and cost of the 20-year CIP for rehabilitating wastewater pipes and manholes. This methodology was based on spreadsheet model that characterized pipe failure as a function of time to assist in forecasting long-term budgetary needs for rehabilitation of sanitary sewer pipe. This analysis resulted in a recommendation for an annual manhole and sewer pipe rehabilitation budget of $850,000. This methodology was given an independent review which recommended that an annual sewer rehabilitation budget of $500,000 would be adequate for the 20-year planning period.

Water Quality Strategic Plan

The Water Quality Strategic Plan (WQSP) has been developed, and will be implemented by the City's Water Quality and Environmental Services (WQES) Group within the city of Boulder Public Works, Utilities Division. The Industrial Pretreatment (IPT) and Laboratory Services programs are included in this WQSP as they are directly related to the wastewater utility planning effort.

The purpose of the WQSP is to develop clear and concise water quality goals, develop recommendations and performance measures to achieve these goals, and provide a process to address current and future water quality challenges. The WQES Group is funded through the city's Water, Wastewater, and Stormwater enterprise funds and supports the Utilities Division water services with seven programs.

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.

WQSP 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:

- 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 2010.
- 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.
- 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.
- 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.

Industrial Pretreatment Program

The City's IPT program is part of the Public Works, Utilities, Water WQES Group. The WQES Group serves as an in-house technical resource for Utilities and other City departments to help maintain compliance with various levels of regulations. The current, primary purpose of the city of Boulder IPT program is to control or limit the discharge of toxic or hazardous waste into the sanitary sewers and thus the City's 75th Street WWTP. The primary objectives of the IPT program are described as follows:

- To prevent the introduction of pollutants into the city of Boulder wastewater collection and treatment system that could interfere with plant operation.

- To prevent the pass-through of untreated pollutants into Boulder Creek.
- To improve recycling capabilities of sludge.
- To protect the general health and safety of wastewater treatment plant workers and downstream users.
- To encourage pollution prevention as a feasible alternative to treatment and disposal.

IPT Gaps, Deficiencies and Recommendations

In addition to the ongoing responsibilities of the IPT Program, special studies and/or additional programs are necessary to further characterize industrial and commercial discharges to the city's sanitary sewer system sources, support compliance with WWTP discharge permit requirements and collect data and information in preparation for future regulatory requirements. The following programs or studies should be evaluated and modified or initiated as necessary.

- Fats, Oil and Grease Program
  - Evaluate potential modifications to the existing FOG program and regulations.
- Industrial Waste Survey
  - Consider initiating a comprehensive industrial waste surveys.
- Business Inventory Mailing
  - Send out business questionnaires to determine if targeted businesses continue to be non-significant or move into a significant industrial user category.

Wastewater and Environmental Laboratory Program

The WEL Program currently provides broader support for the WWTP including biosolids analysis, field services including water quality monitoring and management of the laboratory information management system (LIMS) and database system. WEL program responsibilities will continue to expand as increasingly complex and interrelated water quality regulations develop.

WEL Program Gaps, Deficiencies and Recommendations

In addition to the ongoing responsibilities of the WEL Program, special studies and/or additional programs are necessary to further characterize WWTP performance, characterize water quality conditions in Boulder Creek and provide compliance support for State and Federal regulations. It is recommended that the following programs or studies should be evaluated and modified or initiated as necessary.

- Evaluate Laboratory Size and Function
  - Perform Business Case Evaluation on the Wastewater and Environmental Laboratory Program
- Staffing Analysis

- Review staffing levels compared to other municipalities.
- Laboratory Maintenance
  - Ongoing funding for equipment replacement and laboratory upgrades

Wastewater Utility CIP

The Wastewater Utility Master Plan (WWUMP) includes a comprehensive list of Wastewater Utility projects to be completed during the 20-year planning period. These include wastewater treatment plant capital and maintenance related projects, as well as wastewater collection system capital and maintenance related projects. The 2010-2030 Wastewater Utility Fund CIP has numerous line items identifying various projects for the WWTP and the sanitary sewer collection system. The significant CIP expenditures and Water Quality Strategic Plan (WQSP) funding fall into the following categories:

- WWTP Capital Projects
- WWTP Rehabilitation Projects
- WWCS Rehabilitation Projects
- WQSP Funding

WWTP Capital Projects

There are five (5) significant WWTP capital projects currently identified in the 20-yr CIP. The total cost of these projects (in 2008 dollars) is estimated at $40,000,000. These projects, their estimated escalated cost, and their projected timing are listed below:

- UV Disinfection – $4,400,000 – 2010
- Digester Modifications – $4,000,000 – 2010
- Headworks Improvements – $15,600,000 – 2016
- Phase 2 Improvements (Denitrification & Phosphorus removal) – $15,000,000 – 2020
- Endocrine Disrupting Compounds (EDC's) removal – $19,000,000 – 2030

Utilities staff is currently completing a WWTP Evaluation project which is an analysis of the UV Disinfection, Digester Modifications, and Headworks Improvements projects. This analysis will present several process alternatives for the various facilities, their respective estimated costs, and will provide a recommendation regarding their overall priority.

WWTP Rehabilitation Projects

In addition to the WWTP capital projects listed above, there are numerous WWTP rehabilitation projects identified in the CIP to address the plant's aging infrastructure. These projects are listed in the CIP in years 2016 through 2030, and have a combined cost (in 2008

dollars) of $8,500,000. Utilities staff will continue to review the WWTP Rehabilitation analysis annually to identify the estimated timing for the various rehabilitation projects within the 6-year CIP.

WWCS Rehabilitation Projects

Lastly, there are numerous wastewater collection system improvement projects currently identified in the 20-yr CIP. These projects were identified in the Wastewater Collection System Master Plan which was accepted by the WRAB in December 2008. The CIP currently lists four (4) Tier 1 projects (highest priority) and seven (7) Tier 2 projects (second highest priority). The total cost (in 2008 dollars) for these eleven projects is estimated at $28,000,000. The Tier 1 and Tier 2 project groups are listed below with their estimated cost and projecting timing:

- Tier 1 Projects – $5,000,000 – 2016 through 2021
- Tier 2 Projects – $23,000,000 – 2021 through 2030

WQSP Funding

The Water Quality Strategic Plan (WQSP) is implemented by the Water Quality and Environmental Services (WQES) Group. This include recommendations associated with the Water Quality Strategic Plan, Industrial Pretreatment Program and Wastewater and Environmental Laboratory Program. These recommendations provide a strategy that focuses on maintaining and operating existing programs and planning for future regulations and their implications on City regulatory requirements.

The WQSP elements, including Industrial Pretreatment, Wastewater Environmental Laboratory and associated capital projects, are currently being approached in the following funding manor. It should be noted that this element of the WWUMP plan is more of an opportunistic program such that if funds are available, some recommendations can be moved forward as described in the Action Plan recommendations within the WQSP document.

- WQSP Recommendations
    - Requires a $50,000 one-time investment, a $94,000 on-going adjustment to base, and an additional 1.0 FTE.
- Industrial Pretreatment Program
    - Requires a $30,000 one-time investment.
- Wastewater and Environmental Laboratory Program
    - Requires a $30,000 one-time investment and $30,000 ongoing adjustment to base plus 0.5 FTE
- Near Term Capital Improvements

- Requires a $196,000 one-time investment plus an ongoing $124,000 adjustment to base and an additional 1.5 FTE

Investment Program Options

Boulder's Wastewater Utility is financed through an enterprise fund through monthly payments from the city's rate payers. The Wastewater Utility addresses projects both at the WWTP and also in the wastewater collection system. The funding is allocated to a variety of projects and programs according to the facilities' greatest needs. City staff prioritizes the various projects in planning level studies and evaluations, and then identifies the projects and their associated schedule and fee in the CIP.

The WWUMP presents three Utility investment programs based on different levels of funding including the following:

- Fiscally Constrained Plan
- Action Plan
- Vision Plan

These programs implement the policy direction of the WWUMP at the three funding levels.

Fiscally Constrained Plan

The Fiscally Constrained Program reflects an investment strategy which assumes a Wastewater Utility Fund rate increase of two percent (2%) in 2010, and a three percent (3%) annual increase in years 2011 through 2030. Under the Fiscally Constrained program, there are numerous programs and projects which would be either eliminated or have reduced funding. These include the following:

- Either the UV Disinfection or the Digester Modifications project (both scheduled for construction in 2010) would need to be eliminated from the 20-year CIP
- The 2016 Headworks Improvements project would be eliminated from the 20-year CIP
- The 2020 Phase 2 Improvements project (Nutrient Removal) would be eliminated from the 20-year CIP
  - This project would likely be required to address CDPHE permit issues
- The 2030 Endocrine Disrupting Compounds (EDC) removal project would be eliminated from the 20-year CIP
  - This project would likely be required to address CDPHE permit issues
- The WWTP Rehabilitation funding would be eliminated from the 20-year CIP
- The Wastewater Collection System Replacement projects (Tier 1 and Tier 2) would be eliminated from the 20-year CIP

- The Sanitary Sewer System Rehabilitation funding would be eliminated from the 20-year CIP
- Future budget supplementals would be eliminated from the 20-year CIP

Action Plan

The Action Program reflects an investment strategy which assumes an annual Wastewater Utility Fund rate increase of four percent (4%) in years 2016 through 2030, with the following exceptions. The Action Plan will follow the recommended 6-year (2010-2015) CIP which includes the following rate increases: 2010=2%, 2011-2012=3%, 2013=4%, and 2014-1015=6%. There is one period of increased funding which is necessary to maintain a positive fund balance in 2030. Two consecutive years (2019 and 2020) of nine percent (9%) rate increases would be required to fund the Nutrient Removal project. Under the Action Plan, there are a few programs and projects which would be either eliminated or have reduced funding. These include the following:

- The 2030 Endocrine Disrupting Compounds (EDC) removal project would be eliminated from the 20-year CIP
  - This project would likely be required to address CDPHE permit issues
- The Wastewater Collection System Replacement projects (Tier 2) would be eliminated from the 20-year CIP

Vision Plan

The Vision Program reflects an investment strategy which assumes an annual Wastewater Utility Fund rate increase of four percent (4%) in years 2010 through 2030 with the following exceptions. There are three periods of increased funding necessary to maintain a positive fund balance in 2030. Two consecutive years (2014 and 2015) of eight percent (8%) rate increases would be required to fund the Headworks Improvements project. Two consecutive years (2019 and 2020) of eight percent (8%) rate increases would be required to fund the Nutrient removal Improvements project. Two consecutive years (2029 and 2030) of eight percent (8%) rate increases would be required to fund the EDC removal project. Under the Vision Plan, there are no programs that would have reduced funding.