NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

CONCEPTUAL DESIGN REPORT

PREPARED JULY 2017

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July 14, 2017

Mr. Eric Weiss, P.E., CFM
City of Greeley
Stormwater Division Manager
1001 9th Avenue
Greeley, CO 80631

RE: North Greeley and Downtown Basin Storm Drainage Master Plan

Dear Mr. Weis:

ICON Engineering, Inc. is pleased to submit the Final Conceptual Design Report for the North Greeley and Downtown Basin Storm Drainage Master Plan. The North Greeley and Downtown Basin is a highly urbanized basin, generally bounded by the Cache La Poudre River on the north, U.S. Highway 85 Bypass to the east, Reservoir Road to the south and 23rd Avenue to the east.

We believe this report and project website (https://iconengineering.github.io/maps/greeley/ngd-update/) will provide a solid framework to assist in prioritizing storm drain improvements to ease flooding concerns throughout the basin.

Once again, we would like to acknowledge the projects team's assistance in the preparation of this study. This report could not have been prepared without input from yourself, and other staff members at the City of Greeley.

We appreciate the opportunity to prepare this report and look forward to working with you on future projects.

Sincerely,

ICON ENGINEERING, Inc.

Craig D. Jacobson, P.E., CFM
Principal, Project Manager

Jeremy K. Deischer, EI
Project Engineer

TABLE OF CONTENTS

ES Executive Summary 1
ES 1.0 Purpose and Objective 1
ES 2.0 Planning Process 1
ES 3.0 Project Area Description 1
ES 3.1 Project Area Hydrology 1
ES 3.2 Project Area Hydraulics 3
ES 4.0 Alternative Analysis 3
ES 5.0 Master Plan 3
ES 5.1 Master Plan Description 3
ES 5.2 Prioritization 5
1.0 Introduction 10
1.1 Authorization 10
1.2 Purpose and Scope 10
1.3 Planning Process 10
1.4 Mapping and Survey 10
1.5 Data Collection 11
1.6 Acknowledgements 11
2.0 Study Area Description 12
2.1 Project Area 12
2.2 Land use 12
2.3 Outfall Descriptions 12
2.3.1 Greeley No. 3 Canal Outfalls 12
2.3.2 Cache La Poudre River Outfalls 13
3.0 Hydrologic Analysis 17
3.1 Overview 17
3.2 Colorado Urban Hydrograph Procedure 17
3.3 Design Rainfall 17
3.4 Subwatershed Characteristics 17
3.4.1 Subwatershed Delineation 17
3.4.2 Watershed Imperviousness 17
3.4.3 Length, Centroid Distance, Slope 18
3.4.4 Depression Losses 18
3.4.5 Infiltration 18
3.5 Hydrograph Routing 18
3.5.1 Roughness Coefficient 18
3.5.2 Conveyance Elements 18
3.5.3 Detention Facilities 18
3.5.4 Flow Diversions 18
3.5.5 Cache La Poudre River Tailwater Conditions 18
3.6 Previous Studies 19
3.7 Results of Analysis 19
4.0 Hydraulic Analysis 22
4.1 Previous Analysis 22
4.2 Evaluation of Existing Facilities 22
4.2.1 Flo-2D Model Development 22
4.2.2 Greeley No. 3 Canal - Unsteady State HEC-RAS Modeling 22
4.3 Flood Hazards 22
4.3.1 16th Avenue Court / 14th Avenue / 1st Street Outfall Flood Hazards 23
4.3.2 7th Avenue Outfall Flood Hazards 23
4.3.3 13th Street / 2nd Avenue Outfall Flood Hazards 23
5.0 Alternative Analysis 25
5.1 Alternative Development Process 25
5.2 Criteria and Constraints 25
5.3 Alternative Categories 25
5.4 Alternative Hydraulics 26
5.5 Alternative Costs 26
5.6 Alternative Plans 26
5.6.1 Minimum Initial Storm Conveyance Alternative 26
5.6.2 Minimum Initial Storm Conveyance with Detention Alternative 29
5.6.3 Canal Interception / Downtown Mitigation Alternative 30
5.6.4 Greeley No. 3 Canal Base Flow Separation Alternative 30
5.6.5 Volume Reduction Alternatives 31
5.6.6 Parkway Alternative 32
5.6.7 Alternative Plan Hydraulic Results Comparison 33
5.6.8 Alternative Plan Cost Estimates Comparison 33

5.7 Benefit Cost Analysis 37
5.8 Qualitative Evaluation Procedure 38
6.0 Recommended Plan 44
6.1 Plan Description 44
6.2 Water Quality Impacts 44
6.3 Operations and Maintenance 44
6.4 Environmental and Safety Assessment 44
7.0 Conceptual Design 46
7.1 Plan Development Overview 46
7.1.1 General Recommendations 46
7.1.2 Conceptual Design Cost Estimates 46
7.1.3 Railroad Tunneling Assessment 46
7.1.4 Utility Research 48
7.2 Greeley No. 3 Canal Spill Comparison 48
7.3 Benefit Cost Analysis 48
7.4 Outfall Systems Plan Description 48
7.4.1 23rd Avenue Outfall 49
7.4.2 22nd Avenue Outfall 50
7.4.3 16th Avenue Outfall 51
7.4.4 14th Avenue Upstream Outfall 52
7.4.5 12th Avenue Outfall 53
7.4.6 16th Street Outfall 54
7.4.7 17th Street Outfall 55
7.4.8 16th Avenue Court Outfall 56
7.4.9 14th Avenue Outfall 57
7.4.10 1st Street Outfall 60
7.4.11 5th Street Outfall 62
7.4.12 7th Street Outfall 63
7.4.13 9th Street Outfall 65
7.4.14 11th Street Outfall 66
7.4.15 12th Street Outfall 67
7.4.16 Highway 85 Outfall 71
7.5 Prioritization and Phasing 74
7.5.1 High Prioritization 74
7.5.2 Medium Prioritization 74
7.5.3 Low Prioritization 75
7.6 Water Quality Impacts 76
7.7 Operations and Maintenance 76
7.8 Environmental and Safety Assessment 76
8.0 References 79

Tables

Table ES- 1: Project Participants 1
Table ES- 2: Master Plan Costs 8
Table 1-1: Data Collected 11
Table 1-2: Project Participants 11
Table 2-1: Land Use Description 12
Table 2-2: Zoning Classification 12
Table 3-1: 1- and 6-hr Rainfall Depth 17
Table 3-2: Peak Flow Comparison 20
Table 3-3: Hydrology Results Upstream of Greeley No. 3 Canal 21
Table 3-4: Existing Detention Basin Capacity 21
Table 3-5: Hydrology Results Downstream of Greeley No. 3 Canal 21
Table 4-1: Existing Facilities Inventory Upstream of Greeley No. 3 Canal 24
Table 4-2: Existing Facilities Inventory Downstream of Greeley No. 3 Canal 24
Table 5-1: Design Storm Frequency 25
Table 5-2: Alternative Pre-Screening Matrix 25
Table 5-3: Runoff Volume using LID Techniques 31
Table 5-4: Impact of DCIA on Total Watershed Runoff 32
Table 5-5: Greeley No. 3 Canal Spill Comparison 33
Table 5-6: Alternative Plan Cost Estimate Summary 33
Table 5-7: Minimum Initial Storm Conveyance Cost Estimate 34
Table 5-8: Minimum Initial Storm Conveyance with Detention Cost Estimate 35
Table 5-9: Canal Interception / Downtown Mitigation Cost Estimate 36
Table 5-10: Canal Baseflow Separation Cost Estimate 36
Table 5-11: BCA Structure Classification 37
Table 5-12: Parcels with Inundated Structures 37
Table 5-13: Calculated Damages to Structures 38
Table 5-14: Benefit Cost Analysis 38
Table 6-1: Recommended Plan Cost Estimate 44
Table 7-1: Lithos Engineering Railroad Jacked Box Trenchless Tunneling Crossings 47
Table 7-2: Selected Plan Greeley No. 3 Spill Comparison 48
Table 7-3: Parcels with Inundated Structures 48
Table 7-4: Calculated Damages to Structures 48
Table 7-5: Benefit Cost Analysis 48
Table 7-6: 23rd Avenue Outfall Cost Estimate 49
Table 7-7: 22nd Avenue Outfall Cost Estimate 50
Table 7-8: 16th Avenue Outfall Cost Estimate 51
Table 7-9: 14th Avenue Upstream Outfall Cost Estimate 52
Table 7-10: 12th Avenue Outfall Cost Estimate 53
Table 7-11: 16th Street Outfall Cost Estimate 54
Table 7-12: 17th Street Outfall Cost Estimate 55
Table 7-13: 16th Avenue Court Outfall Cost Estimate 56
Table 7-14: 14th Avenue Outfall - 4th, 5th, and 8th Street Collectors Cost Estimate 57
Table 7-15: 14th Avenue Outfall - Trunk Line Cost Estimate 59
Table 7-16: 1st Street Outfall Cost Estimate 60
Table 7-17: 5th Street Outfall Cost Estimate 62
Table 7-18: 7th Street Outfall Cost Estimate 63
Table 7-19: 9th Street Outfall Cost Estimate 65
Table 7-20: 11th Street Outfall Cost Estimate 66
Table 7-21: 12th Street Outfall - Trunk Line Cost Estimate 67
Table 7-22: 12th Street Outfall – Interceptor West of Great Western and UPRR Cost Estimate 69
Table 7-23: 12th Street Outfall – Interceptor East of Great Western and UPRR Cost Estimate 70
Table 7-24: Highway 85 Outfall Cost Estimate 71
Table 7-25: Master Plan Cost Estimate Summary 72
Table 7-26: Conceptual Design Phasing Cost Estimates 78

Figures

Figure ES- 1: Watershed Map 2
Figure ES- 2: Master Plan Schematic 9
Figure 2-1: Watershed Map 15
Figure 2-2: Outfall Map 16
Figure 3-1: HEC-22 Table 7-3 19
Figure 3-2: Peak Flow Comparison 20
Figure 5-1: Implementation of LID Techniques 31
Figure 5-2: Impact of DCIA on Total Watershed Runoff 32
Figure 5-3: Initial Storm Conveyance Minimum Level of Improvement 39
Figure 5-4: Minimum Initial Storm Conveyance Alternative 40
Figure 5-5: Minimum Conveyance & Detention Alternative 41
Figure 5-6: Canal Interception / Downtown Mitigation Alternative 42
Figure 5-7: Canal Baseflow Separation Alternative 43
Figure 6-1: Recommended Plan 45
Figure 7-1: Master Plan Schematic 73
Figure 7-2: Phasing of Master Plan Improvements 77

Appendices

APPENDIX A - PROJECT CORRESPONDENCE

APPENDIX B - HYDROLOGIC ANALYSIS

APPENDIX C - ALTERNATIVE ANALYSIS

APPENDIX D - CONCEPTUAL DESIGN INFORMATION

APPENDIX E - RAILROAD TUNNELING ASSESSMENT

APPENDIX F - MASTER PLAN MAP

APPENDIX G - MASTER PLAN PROFILES

ES EXECUTIVE SUMMARY

ES 1.0 PURPOSE AND OBJECTIVE

The purpose of this project is to develop a storm drainage master plan to be used by the City of Greeley as a guideline for future storm drainage improvements within the North Greeley and Downtown Basin. This study developed new design flows; analyzed the existing storm drain system; identified problem areas; developed alternatives to mitigate flooding hazards; and provides a preliminary design for the major storm drainage outfalls.

ES 2.0 PLANNING PROCESS

The planning process to update the Storm Drainage Master Plan for the North Greeley and Downtown Basin began by reviewing the previous studies within the basin. The original Comprehensive Drainage Plan for the North Greeley and Downtown Basin was completed in 1974. The study was updated in 1997 and most recently in 2005 (References 1 & 4).

Several progress meetings were held throughout the project duration. A complete list of the progress meetings can be found in 1.3. Meeting minutes for all of the meetings can be found in Appendix A. On January 28, 2016 a public meeting was held at the Ice Haus to gather community input regarding the baseline hydrology and problem areas throughout the basin.

The team members who were involved with this study are listed in the table below:

Table ES- 1: Project Participants

	Representing	Title
Eric Weis, P.E.	City of Greeley	Stormwater Division Manager
Heather Seitz, P.E., LEED AP	City of Greeley	Stormwater Capital Projects Engineer
Craig Jacobson, P.E., CFM	ICON Engineering, Inc.	Project Manager
Jeremy Deischer, EI	ICON Engineering, Inc.	Project Engineer
Eben Dennis	ICON Engineering, Inc.	GIS Coordinator

ES 3.0 PROJECT AREA DESCRIPTION

The North Greeley and Downtown Basin, generally slopes from the south near the University of Northern Colorado campus north to the Cache La Poudre River. The watershed is generally bounded by the Cache La Poudre River on the north, U.S. Highway 85 Bypass to the east, Reservoir Road to the south and 23rd Avenue to the west. Due to the development in the watershed over the past decades there is not a well-defined, central, major drainageway path throughout the basin. With exception to smaller drainageways, such as Glenmere Draw, storm runoff is generally conveyed through undersized storm drain systems and overland in streets and through private properties. Approximately 90 percent of the watershed is currently developed. The watershed ranges in elevation from approximately 4850 feet at the southwest end of the basin near the water storage facilities at 23rd Avenue and Reservoir Road to 4610 feet at the Cache La Poudre River.

The Greeley No. 3 Canal bisects the watershed, flowing northwest to southeast. In addition to conveying irrigation flows, the canal intercepts stormwater runoff from the south portion of the watershed. The canal lacks the capacity to convey stormwater runoff, overtopping the downstream (north) bank in several locations contributing to flooding in the commercial district. Several overflow spillway structures have been constructed at locations along the canal in order to manage flooding and formalize overtopping locations. There are, however, areas where canal flows spill in an uncontrolled manner during larger storm events.

Upstream of the Greeley No. 3 Canal the basin consists of a variety of development types including: primary and secondary schools, the University of Northern Colorado Campus, Banner Health North Colorado Medical Center, park and open space area near Glenmere Lake, single- and multi-family housing, and commercial development.

Downstream of the Greeley No. 3 Canal, the basin consists of residential and high density commercial development. There are recreational facilities north of the Great Western Railroad at Island Grove Regional Park. Runoff from the North Greeley and Downtown Basin collects in the Cache La Poudre River which continues flowing in a southeast direction before it confluences with the South Platte River.

Five detention facilities, all upstream of the Greeley No. 3 Canal, were considered as flood control facilities in this study. The facilities which were included in the hydrologic analysis were: Glenmere Lake, Moon Pond Basin, Maple Elementary School Basin, and Luther Park East and West Basins.

A watershed map highlighting features throughout the watershed can be found in Figure ES- 1: Watershed Map.

ES 3.1 PROJECT AREA HYDROLOGY

A new hydrologic model was prepared for the North Greeley and Downtown Basin. The model provides updated hydrology for the 2-, 5-, 10-, 50-, and 100-year storm frequencies. The Colorado Urban Hydrograph Procedure 2005 version 2.0.0 (CUHP) was used to develop runoff hydrographs for each subwatershed. Subwatershed hydrographs were then routed using the EPA Stormwater Management Model version 5.1.010 (SWMM) to determine discharge at each design point.

A recalibration effort for CUHP was ongoing during the development of this study. CUHP version 2.0.0 was released after the DRAFT Alternative Analysis Report was completed with version 1.4.4. After discussing the differences in the updated version of CUHP with Urban Drainage and Flood Control District (UDFCD) and City staff it was decided to update the study to CUHP version 2.0.0. The recalibration effort of CUHP included updating rainfall values from NOAA Atlas 2 Volume III to NOAA 14. NOAA 14 incorporated rainfall data collected since the release of NOAA Atlas 2 Volume III in 1973. Further discussion on the differences in hydrology can be found in 3.2 Colorado Urban Hydrograph Procedure.

Throughout the watershed tabular diversion curves were developed using FLO-2D to more accurately represent diversion of flow at street intersection. FLO-2D is a two-dimensional model well suited to simulating surface water flow in urbanized areas.

NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

FIGURE ES-1 - WATERSHED MAP

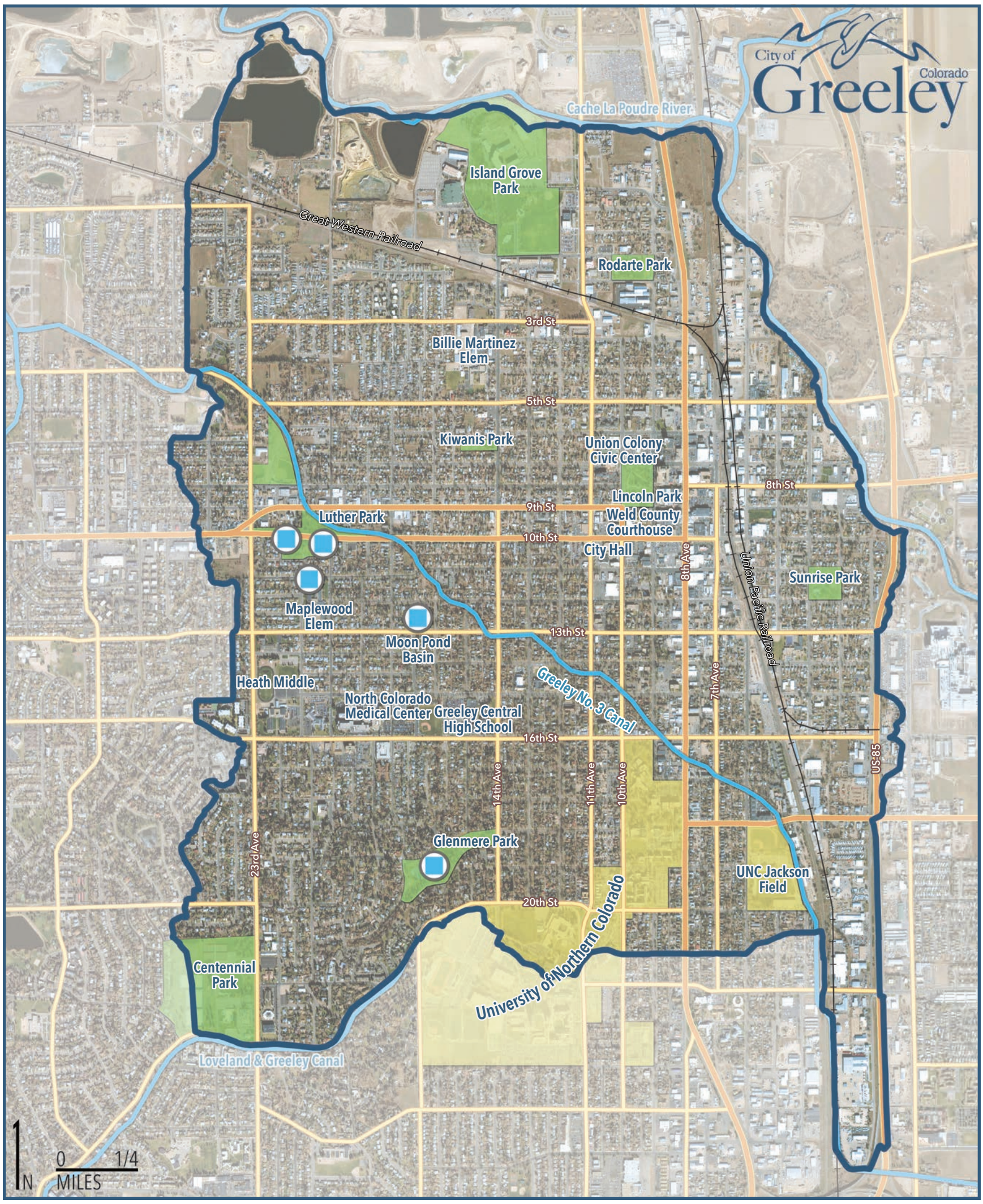
ICON ENGINEERING, INC.

Watershed Boundary

Existing Detention Basin

Park

Univ. of Northern Colorado



ES 3.2 PROJECT AREA HYDRAULICS

The information in the previous 2005 Comprehensive Drainage Plan study was used to help identify flood hazards throughout the North Greeley and Downtown Basin. The previous report identified that the existing storm drain system was designed to convey the 5-year and smaller events. With revisions in hydrology since the 1977 study, the existing storm drain capacity now only conveys the 2-year and smaller event in most areas within the watershed. The limited capacity of the storm drains leads to ponding and overtopping of the street crown in many street intersections, especially downstream of the Greeley No. 3 Canal. The limited capacity of the existing storm drain system is magnified by the spill flows from the Greeley No. 3 Canal contributing to the downstream watersheds.

The hydraulic model used for the Greeley No. 3 Canal was originally developed as part of the 1996 Comprehensive Drainage Plan. The model was updated during the 2005 Comprehensive Drainage Plan incorporating improvements along the canal since the 1996 study. These improvements included bank improvements along the canal and constructing formalized spill locations at 7th Avenue, 8th Avenue, 12th Avenue, 15th Avenue, and 19th Avenue.

ES 4.0 ALTERNATIVE ANALYSIS

The Alternative Analysis phase of the project developed flood mitigation solutions for the identified problem areas. Goals for mitigation focused on providing storm drain improvements to, at a minimum, meet the drainage criteria for the City of Greeley and to reduce flooding on insurable structures. The current City criteria states storm drains should be sized to convey the initial storm based on zoning classification. For residential areas, the initial storm is the 2-year design storm. The 5-year design storm is considered the initial storm for commercial, business, and industrial areas. The initial storm for downtown business areas is the 10-year design storm. Regional detention facilities were considered to reduce the size and cost of the required storm drain infrastructure downstream. Priority was also given to separating base flows from the Greeley No. 3 Canal, spills from the canal are a significant contributor to downstream flooding. Finally, the alternative development process reviewed the benefits in implementing Low-Impact-Development (LID) practices along with a holistic review for flood protection through major open channel corridors.

Design criteria and alternative category selection was reviewed at periodic progress meetings with City of Greeley Staff. Further discussion of each alternative plan is provided in 5.0 Alternative Analysis, along with review of project benefits and costs for applicable option.

ES 5.0 MASTER PLAN

The selected plan for the basin was chosen based on input from city staff, qualitative evaluation, cost versus benefit analysis, and the impact each alternative would have on public safety. The selected plan included proposed infrastructure associated with the Greeley No. 3 Canal Base Flow Separation Alternative, with a few modifications. In addition to the infrastructure of Alternative 4, the selected plan also proposes detention basins at Luther Park North, northwest of 2nd Street and 11th Avenue, and improving the existing detention basin at Maplewood Elementary.

The storm drain improvements proposed in the Greeley No. 3 Canal Base Flow Separation Alternative will ensure the North Greely and Downtown Basin meets current City criteria to drain the initial storm basin-wide. Several outfalls are proposed to provide a level of protection greater than the City's minimum criteria in an effort to protect important building such as schools, emergency services, and government buildings. The infrastructure proposed in the Canal Base Flow Separation Alternative was also selected over other alternatives due to the increased level of protection the alternative provides around the Greeley No. 3 Canal. The proposed improvements will help separate up to the 10-year design flow from spilling into the canal, thus leading to a reduction of spill flow from the canal downstream, which is a significant contributor to downstream flooding. In addition to the storm drainage improvements, water quality basins have also been proposed at the downstream end of 14th Avenue Outfall, 1st Street Outfall, 7th Street Outfall, and 12th Street Outfall. These proposed basins will enhance the stormwater water quality for each major outfall before water is discharged into the Cache La Poudre River.

A conceptual design schematic is provided in Figure ES- 2. A more detailed conceptual design map and profiles can be found in Appendix E and Appendix F, respectively. Cost estimates for each outfall system can be found in Table ES- 2.

In addition to the implementation of this selected plan, this study also recommends the City of Greeley consider the following:

- That new land development activities, significant redevelopment activities, and publicly funded projects, provide, to the maximum extent practicable, runoff volume control practices (i.e., minimize directly connected impervious areas and employ infiltrating BMPs) whenever site conditions permit.
- Require that all BMPs for all new development, redevelopment, and publicly funded projects provide to the maximum extent practicable a Water Quality Capture Volume (WQCV) as recommended in the Urban Storm Drainage Criteria Manual – Volume 3, after accounting for volume reductions achieved using volume control practices.
- Amend the City of Greeley Design Criteria and Construction Specifications Storm Drainage Volume II and adopt NOAA 14 rainfall values and CUHP v.2.0 as the current standard citywide, replacing the outdated NOAA Atlas 2 and CUHP v.1.4.4.

ES 5.1 MASTER PLAN DESCRIPTION

ES 5.1.1 23RD AVENUE OUTFALL

The proposed 23rd Avenue Outfall extends from 18th Street north to 11th Street where the system turns northeast and outfalls into Luther Park West. The proposed interceptor system is comprised of pipes ranging in diameter from 18 to 42 inches. The proposed storm drain will generally follow the alignment of the existing storm drain system and increase the amount of stormwater the system will convey. The 23rd Avenue Outfall will help reduce flooding hazards around Heath Middle School.

ES 5.1.2 22ND AVENUE OUTFALL

The proposed 22nd Avenue Outfall extends north from 13th Street to Maplewood Elementary. The proposed improvements are comprised of laterals and collectors and will mitigate flood hazards around Maplewood Elementary. Improving the detention basin at Maplewood Elementary will reduce the size of the storm drain infrastructure required downstream. The storm drain system continues north from Maplewood Elementary along 22nd Avenue into the existing Luther Park West detention basin. The proposed collector system ranges in pipe diameter from 18 to 36 inches.

ES 5.1.3 16TH AVENUE OUTFALL

The 16th Avenue Outfall is proposed to collect flow along 16th Street, turning north at 16th Avenue Court to 13th Street. The proposed storm drain continues east to the Greeley No. 3 Canal. The improved storm drain system will mitigate flooding hazards around Banner Health North Colorado Medical Center. The 16th Avenue Outfall will also improve the level of service of the existing Moon Pond detention basin. Moon Pond, as currently configured, is undersized and easily overwhelmed, overtopping and flooding the surrounding private properties during larger storm events. Inflow to Moon Pond will be limited to prevent overtopping of the detention basin during storms up to a 10-year design storm. The proposed storm drain system continues east passing underneath the Greeley No. 3 Canal and discharging into the 12th Street Outfall. The proposed interceptor system ranges in pipe diameter from 18 to 60 inches.

ES 5.1.4 14TH AVENUE UPSTREAM OUTFALL

The 14th Avenue Upstream Outfall will replace the existing undersized storm drain that intercepts flow along 16th Street and continues northeast through private property. The proposed storm drain system would mitigate flooding hazards around Greeley Central High School and convey the stormwater north along 14th Avenue. The storm drain is proposed to pass underneath the Greeley No. 3 Canal and discharge into the 12th Street Outfall. The proposed interceptor system ranges in pipe diameter from 18 to 42 inches.

The existing 16th Street Outfall is proposed to remain in service from 15th Street to the Greeley No. 3 Canal. This storm drain intercepts local stormwater between 13th and 14th Avenue.

ES 5.1.5 12TH AVENUE OUTFALL

The 12th Avenue Outfall is proposed to collect minor flows along 12th Avenue from 20th Street to the Greeley No. 3 Canal. The outfall would pass underneath the Greeley No. 3 Canal and eventually discharge into the 12th Street Outfall. The proposed collector system ranges in pipe diameter from 18 to 36 inches.

ES 5.1.6 16TH STREET OUTFALL

The proposed 16th Street Outfall intercepts flow along 10th Avenue, turning east at 16th Street and discharge into a lateral of the 12th Street Outfall after passing underneath the Greeley No. 3 Canal. The storm drain improvements will mitigate flooding hazards on the University of Northern Colorado Campus and help replace the existing undersized clay pipe storm drain in 17th Street that passes through the University of Northern Colorado Campus. This proposed collector system ranges in pipe diameter from 18 to 30 inches.

ES 5.1.7 17TH STREET OUTFALL

The 17th Street Outfall is proposed to collect flow along 8th Avenue on the east side of the University of Northern Colorado Campus. This system, in conjunction with the 16th Street Outfall, would replace the undersized clay pipe storm drain system in 17th Street. At 17th Street the storm drain would turn east, pass underneath the Greeley No. 3 Canal, and discharge into the 12th Street Outfall. The proposed interceptor system ranges in pipe diameter from 18 to 42 inches.

ES 5.1.8 16TH AVENUE COURT OUTFALL

The 16th Avenue Court Outfall storm drain system replaces the undersized existing system, generally following the alignment of the current outfall. This outfall intercepts flow south of the Great Western Railroad and would require crossing the Great Western Railroad. After crossing the Great Western Railroad, the storm drain conveys stormwater north and outfalls into the existing storm drain location, into the pond west of the Greeley Stampede. The proposed interceptor system ranges in pipe diameter from 18 to 42 inches.

ES 5.1.9 14TH AVENUE OUTFALL

The 14th Avenue Outfall watershed is generally bounded by the Cache La Poudre River to the north, 14th Avenue to the east, 10th Street to the south, and the Greeley No. 3 Canal to the west. The proposed 14th Avenue Outfall conveys stormwater north to the outfall location east of the Greeley Stampede. Improvements to the outlet structures at Luther Park West and East are proposed in addition to a new detention basin north of 10th Street, called Luther Park North. The new detention basin and the improvements to the existing basins will reduce the spill flow into the Greeley No. 3 Canal. After passing through the detention basins, the proposed storm drain pass underneath the Greeley No. 3 Canal, collecting flow along 9th Street before turning north along 14th Avenue. The proposed storm drain will cross the Great Western Railroad north of 2nd Street. The storm drain continues north after crossing the Great Western Railroad into Island Grove Park towards the Greeley Stampede. A basin is proposed east of the Greeley Stampede to improve the water quality before discharging into the Cache La Poudre River. The trunk system ranges in pipe diameter from 18 to 54 inches. Box culverts range in size from 6 foot wide by 4 foot tall to 12 foot wide by 5 foot tall.

Several collectors systems in 4th, 5th, and 8th Street extend west of 14th Avenue to replace the current undersized storm drain system in the residential neighborhoods. These collector systems range in pipe diameter from 18 to 36 inches.

Several sanitary sewers conflict with the storm drain improvements along 9th Street and 14th Avenue. These storm sewers would require extensive relocation or conflict vaults to allow both systems to maintain their current alignment.

ES 5.1.10 1ST STREET OUTFALL

The 1st Street Outfall is generally bounded by the Cache La Poudre River to the north and east, 5th Street to the south, and 13th Avenue to the west. The system is comprised of laterals south of A Street, west on A Street, and north of A Street. A new detention basin is proposed on the undeveloped parcel northwest of 2nd Street and 11th Avenue to reduce the infrastructure required to convey flow downstream. The proposed improvements east along 3rd Street removes the storm drain system from private property as the existing system is currently aligned. The outfall will require a crossing of the Great Western Railroad at 9th Avenue. The proposed improvements to the 1st Street Outfall will require crossing 8th Avenue and Union Pacific Railroad (UPRR) before the outfall location into Cache La Poudre River. Downstream of the UPRR Railroad a water quality basin is proposed to improve water quality before discharging the stormwater runoff into the Cache La Poudre River. The proposed interceptor system ranges in pipe diameter from 18 to 48 inches. Proposed box culverts range in size from 9 foot wide by 4 foot high to 10 foot wide by 4 foot high.

ES 5.1.11 5TH STREET OUTFALL

The 5th Street outfall extends west from the Cache La Poudre River along 5th Street to 6th Avenue. The proposed improvements will replace the existing undersized storm drain. The proposed collector system ranges in pipe diameter from 18 to 30 inches.

ES 5.1.12 7TH STREET OUTFALL

The 7th Street Outfall Watershed is bounded generally by 5th Street to the north, the Cache La Poudre River to the east, 11th Street to the South, and 14th Avenue to the west. The outfall is responsible for conveying flow from the commercial district north of 11th Street east to the Cache La Poudre River. The 7th Street Outfall intercepts flow from as far west as 14th Avenue and 10th Street to the east along 10th Street. The improvements to the storm drain will require a crossing of the Great Western Railroad and UPRR. At 3rd Avenue a water quality basin is proposed to improve water quality before discharging the stormwater runoff into the Cache La Poudre River. The proposed trunk system ranges in pipe diameter from 18 to 60 inches. Box culverts range from 6 foot wide by 4 foot high to 12 foot wide by 4 foot wide along the proposed trunk system.

Several sanitary sewers will need to be relocated as part of the storm drain outfall improvements.

ES 5.1.13 9TH STREET OUTFALL

The 9th Street Outfall replaces the existing undersized storm drain outfall and generally follows the same alignment north along 5th Avenue turning east at 9th Street to the Cache La Poudre River. Easement acquisition is proposed along 9th Street east of 3rd Avenue to the outfall into the Cache La Poudre River. The proposed collector system varies in pipe diameter from 18 to 36 inches.

Significant sanitary crossings are present along the proposed alignment near 3rd and 4th Avenue.

ES 5.1.14 11TH STREET OUTFALL

The proposed 11th Street Outfall intercepts stormwater from the Sunrise neighborhood along 11th Street. The outfall will connect to the existing storm drain in 2nd Avenue. At 2nd Avenue the storm drain turns north discharging into the Cache La Poudre River north of 10th Street. The proposed lateral system is comprised of pipes 18 inches in diameter.

ES 5.1.15 12TH STREET OUTFALL

The 12th Street Outfall watershed is generally bounded by 11th Street to the north, Highway 85 on the east, 16th Street to the south, and the Greeley No. 3 Canal to the west. The proposed outfall will convey flows east along 12th Street crossing both the Great Western and UPRR and across Highway 85. A water quality basin is proposed east of 1st Avenue on the LePrino Foods property to increase the water quality of the stormwater runoff before discharging into the Cache La Poudre River.

The proposed improvements will intercept flow that is currently conveyed by the undersized 13th Street / 2nd Avenue Outfall. The outfall intercepts flows from laterals south of 12th Street both west and east of the railroad crossing.

The 12th Street Outfall intercepts the following outfall systems from upstream of the Greeley No. 3 Canal: 14th Avenue Outfall, 12th Avenue Outfall, 16th Street Outfall, and 17th Street Outfall. The existing undersized railroad crossing at 13th Street is proposed to be abandoned. The existing storm drain will be replaced to convey stormwater to the single railroad crossing at 12th Street.

Easement acquisition will be required on the LePrino Foods property to construction the storm drain outfall and water quality facility. A splitter structure will be located upstream of the water quality basin to divert flows into the proposed water quality basin. Flows in excess of the water quality basin max storage will continue in the storm drain discharging into the Cache La Poudre River. The proposed trunk system ranges in pipe diameter from 18 to 36 inches. Box culverts range from 6 foot wide by 4 foot high to 16 foot wide by 6 foot high.

Sanitary sewers conflicts exist at 3rd, 7th and 8th Avenue along the proposed alignment will likely require relocation.

ES 5.1.16 HIGHWAY 85 OUTFALL

The Highway 85 Outfall conveys flow north along Highway 85 from the southernmost portion of the watershed to the Cache La Poudre River. The proposed outfall generally follows the existing alignment and requires crossing Highway 85 at 18th Street. The crossing structure at 15th Street controls the amount of flow that is conveyed north along the outfall path staying within the basin. Any flows in excess of this crossing will divert east out of the watershed. The Highway 85 Outfall flows into the 12th Street outfall north of 13th Street. The proposed interceptor system varies in pipe diameter from 18 to 60 inches.

ES 5.2 PRIORITIZATION

The proposed improvements in the selected plan represent a significant financial investment to the North Greeley and Downtown Basin. Replacing storm drain systems throughout the basin to meet current criteria will need to be implemented in phases over a period of time when funding becomes available.

In general, drainage improvements should be constructed from downstream to upstream to avoid any adverse impacts. No adverse impacts would be expected from implementing the outfall systems separately. In general, the trunk line of any outfall system should be constructed before any laterals to ensure downstream capacity is met.

Upstream improvements were prioritized assuming downstream outfall trunk lines (7th Street, 12th Street, 14th Avenue) were in place.

Proposed improvements were ranked based on: effectiveness in mitigating flood hazards, feasibility of construction, and performance of existing storm drain systems in the vicinity of each project.

Prioritization and costs of each outfall is shown in Table ES- 2. More detail on prioritization can be found in 7.5.

ES 5.2.1 HIGH PRIORITIZATION

Projects with high prioritization will have the most significant impact on mitigating flooding hazards on insurable structures in the basin. Each of the projects classified as high priority will protect their tributary area up to the 10-year design storm. As funds become available these projects should be prioritized in order to mitigate flooding hazards to the maximize extent possible.

12th Street Outfall: The implementation of the 12th Street Outfall will have the largest impact on mitigating flooding hazards on insurable structures in the basin. The proposed trunk line along 12th Street downstream of the Greeley No. 3 Canal protects structures north of 12th Street intercepting uncontrolled spills flow from the Greeley No. 3

Canal. The current storm drain system is overwhelmed by the spills flows and surface flooding continues north into the commercial district in the 7th Street Outfall Watershed. Construction of the 12th Street Outfall will also provide the required infrastructure for other outfalls such as 12th Street Outfall West Interceptor, 12th Street Outfall East Interceptor, and 16th Avenue outfall to drain into. Structures that will benefit from implementing the 12th Street Outfall include City Hall, Weld County Courthouse, City of Greeley Public Works Office among numerous others.

7th Street Outfall: Construction of the 7th Street Outfall will mitigate flooding hazards throughout the commercial district. It is recommended that the 12th Street Outfall be constructed before the 7th Street Outfall to ensure uncontrolled spill flow from the Greeley No. 3 Canal is intercepted prior, or the 7th Street Outfall would function less effectively. The 7th Street Outfall will provide additional protection for structures in the commercial district around Lincoln Park, including Union Colony Civic Center, among numerous others.

12th Street Outfall West Interceptor: The 12th Street Outfall West Interceptor will provide additional protection to the 12th Street Outfall watershed. South of 12th Street the proposed components of the 12th Street Outfall West Interceptor will intercept local stormwater runoff and spill flow from the Greeley No. 3 Canal. The 12th Street Outfall West Interceptor should be constructed soon after the 12th Street Outfall in order to maximize the return on investment made in the construction of the 12th Street Outfall. The 12th Street Outfall should precede any portions of the 12th Street Outfall West Interceptor so there is suitable infrastructure downstream for the improvements to drain into.

16th Avenue Outfall: Upstream of the Greeley No. 3 Canal the highest priority project should be the 16th Avenue Outfall. The outfall has the largest tributary area of any upstream outfall and mitigates flooding hazards on Banner Health North Colorado Medical Center and Moon Pond. The 16th Avenue Outfall requires the proposed improvements of the 12th Street Outfall to be in place at the Greeley No. 3 Canal for the runoff to drain into downstream.

16th Street Outfall: The 16th Street Outfall will mitigate flooding hazards on the University of Northern Colorado Campus. The proposed improvements will allow the City to abandon the existing clay pipe 17th Street Outfall that runs underneath the University of Northern Colorado Campus. The 16th Street Outfall requires the infrastructure from the 12th Street Outfall and a portion of the 12th Street Outfall West Interceptor to be in place to drain into.

ES 5.2.2 MEDIUM PRIORITIZATION

Outfall improvements with medium priority are still vital to mitigate flooding hazards throughout the basin.

14th Avenue Outfall: The 14th Avenue Outfall will help mitigate flooding hazards downstream of the Greeley No. 3 Canal west of 14th Avenue including around Billy Martinez Elementary School. The 14th Avenue Outfall should be constructed prior to the 22nd Avenue Outfall or the 23rd Avenue Outfall to avoid adverse impacts.

14th Avenue Outfall Collector: The 14th Avenue Outfall Collector will mitigate flooding in residential areas west of 14th Avenue. The proposed improvements will increase the capacity of the storm drain west of 14th Avenue to convey the 2-year design flow. The 14th Avenue Outfall Collector should be prioritized soon after the 14th Avenue Outfall to maximize the return on investment to the 14th Avenue Outfall. The 14th Avenue Collector requires the 14th Avenue Outfall to already be in place for stormwater runoff to drain into.

22nd Avenue Outfall: The 22nd Avenue Outfall will mitigate flooding hazards on Maplewood Elementary School and residential areas near 13th Street and 22nd Avenue. The 14th Avenue Outfall including improvements to the outlet structure at Luther Park West should be constructed prior to the 22nd Avenue Outfall to avoid any adverse impacts.

12th Street Outfall East Interceptor: The 12th Street Outfall East Interceptor will mitigate flooding hazards on the residential and industrial areas south of 12th Street east of Great Western and Union Pacific Railroads. The 12th Street Outfall and 12th Street Outfall West Interceptor should be constructed prior to the 12th Street Outfall East Interceptor to minimize the amount of canal spill flow that overtops the railroads to the east. The 12th Street Outfall East Interceptor requires the 12th Street Outfall to be constructed to discharge stormwater runoff into.

12th Avenue Outfall: The 12th Avenue Outfall mitigates flooding hazards in residential areas along 12th Street from 20th Avenue to the Greeley No. 3 Canal. The 12th Avenue Outfall requires the 12th Street Outfall and portions of the 12th Street Outfall West Interceptor to be constructed to discharge into as the system passes underneath the Greeley No. 3 Canal.

17th Street Outfall: The 17th Street Outfall will provide additional protection to the east side of the University of Northern Colorado Campus along 8th Avenue. The proposed improvements will help replace the existing clay pipe system in 17th Street that currently passes underneath the University of Northern Colorado Campus. The 12th Street Outfall and portions of the 12th Street Outfall West Interceptor will be required before the 17th Outfall can be constructed.

ES 5.2.3 LOW PRIORITIZATION

Improvements downstream of the Greeley No. 3 Canal classified as low priority are isolated in nature and can be implemented at any time without adverse impacts to other outfall systems. Improvements upstream of the Greeley No. 3 Canal are dependent on downstream infrastructure being in place at the time of construction.

5th Street Outfall: The 5th Street Outfall will mitigate flooding hazards on industrial areas north of 6th Street and east of Great Western and Union Pacific Railroads. If constructed before the 12th Street Outfall and 7th Street Outfall it would also minimally help mitigate flooding from spill flow from the Greeley No. 3 Canal. The 5th Street Outfall is not dependent on any other outfall system and could be implemented at any time.

9th Street Outfall: The 9th Street Outfall will mitigate flooding hazards in residential and industrial areas along 9th Street from 5th Avenue to the Cache La Poudre River. The 9th Street Outfall is not dependent on any other outfall improvement being in place and can be implemented at any time.

16th Avenue Court Outfall: The 16th Avenue Court Outfall will mitigate residential flooding hazards west of 16th Avenue north of 4th Street in the northwest corner of the watershed. The 16th Avenue Court Outfall is isolated and can be implemented at any time.

11th Street Outfall: The 11th Street Outfall will mitigate residential flooding hazards along 11th Street from 5th Avenue to 2nd Avenue. The 11th Street Outfall is proposed to tie into the existing 13th Street / 2nd Avenue Outfall and may cause adverse impacts if the 12th Street Outfall is not in place at the time of construction.

1st Street Outfall: The 1st Street Outfall will mitigate flooding hazards on residential and industrial structures north of 5th Street, east of 14th Avenue in the northeast portion of the watershed. If the 14th Avenue Outfall, 12th Street

Outfall, and 7th Street Outfall aren't in place the 1st Street Outfall will intercept some spill flow from other watersheds. The 1st Street Outfall is not dependent on any other outfall and can be implemented at any time.

Highway 85 Outfall: The Highway 85 Outfall will mitigate flooding hazards in the southeastern most portion of the basin. The 12th Street Outfall is required to be in place before the Highway 85 Outfall can be constructed and drain into the 12th Street outfall.

14th Avenue Upstream Outfall: The 14th Avenue Upstream Outfall will mitigate flooding hazards on residential properties in the central portion of the upstream watershed. The proposed improvements will also mitigate flooding hazards on Greeley Central High School. The proposed improvements will relocate the storm drain into City of Greeley right-of-way allowing easier maintenance of the outfall into the future. The 14th Avenue Upstream Outfall is proposed to drain into the 16th Avenue Outfall before crossing the Greeley No.3 Canal into the 12th Street Outfall. Implementing the 16th Avenue Outfall will also reduce the area tributary to the 14th Avenue Upstream Outfall.

23rd Avenue Outfall: The 23rd Avenue Outfall will mitigate flooding hazards on commercial and residential properties in the western most section of the upstream watershed. The storm drain improvements will also mitigate flooding hazards on Heath Middle School that the existing storm drain is not capable of. The 23rd Avenue Outfall will increase the discharge into Luther Park West and should be implemented after the 14th Avenue Outfall has been constructed.

Table ES- 2: Master Plan Costs

Conceptual Design Cost Estimate Summary - Upstream of Greeley No. 3 Canal

Priority	REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
High	16th Ave. Outfall	$ 3,123,327	$ -	$ 468,499	$ 156,166	$ 312,333	$ 780,832	$ 4,841,157	$ 3,220	$ 112,699
	16th St. Outfall	$ 690,178	$ -	$ 103,527	$ 34,509	$ 34,509	$ 172,545	$ 1,069,777	$ 910	$ 31,850
Medium	22nd Ave. Outfall	$ 646,986	$ -	$ 97,048	$ 32,349	$ 64,699	$ 161,747	$ 1,002,829	$ 2,679	$ 93,764
	12th Ave. Outfall	$ 1,187,442	$ -	$ 178,116	$ 59,372	$ 118,744	$ 296,861	$ 1,840,535	$ 1,448	$ 50,680
	17th St. Outfall	$ 502,867	$ -	$ 75,430	$ 25,143	$ 50,287	$ 125,717	$ 779,444	$ 555	$ 19,425
Low	14th Ave. US Outfall	$ 919,521	$ -	$ 137,928	$ 45,976	$ 91,952	$ 229,880	$ 1,425,257	$ 1,005	$ 35,175
	23rd Ave. Outfall	$ 1,410,223	$ -	$ 211,533	$ 70,511	$ 141,022	$ 352,556	$ 2,185,845	$ 1,513	$ 52,955
Total		$ 8,480,544	$ -	$ 1,272,081	$ 424,026	$ 813,546	$ 2,120,138	$ 13,144,844	$ 11,330	$ 396,548

Conceptual Design Cost Estimate Summary - Downstream of Greeley No. 3 Canal

Priority	REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
High	12th St. Outfall Trunk	$ 21,930,902	$ 257,644	$ 3,289,635	$ 1,096,545	$ 2,193,090	$ 5,482,726	$ 34,250,542	$ 9,138	$ 319,827
	7th St. Outfall	$ 14,400,809	$ 425,605	$ 2,160,121	$ 720,040	$ 1,440,081	$ 3,600,202	$ 22,746,858	$ 11,091	$ 388,182
	12th St. Outfall West Interceptor	$ 5,989,383	$ -	$ 898,407	$ 299,469	$ 598,938	$ 1,497,346	$ 9,283,543	$ 4,028	$ 140,979
Medium	14th Ave. Outfall Trunk	$ 15,881,084	$ -	$ 2,382,163	$ 794,054	$ 1,588,108	$ 3,970,271	$ 24,615,680	$ 11,072	$ 387,517
	14th Ave. Outfall Collector	$ 1,709,647	$ 9,628	$ 256,447	$ 85,482	$ 170,965	$ 427,412	$ 2,659,581	$ 2,229	$ 78,014
	12th St. Outfall East Interceptor	$ 1,534,252	$ -	$ 230,138	$ 76,713	$ 153,425	$ 383,563	$ 2,378,091	$ 1,683	$ 58,904
Low	5th St. Outfall	$ 360,123	$ -	$ 54,018	$ 18,006	$ 36,012	$ 90,031	$ 558,190	$ 432	$ 15,120
	9th St. Outfall	$ 444,078	$ 6,325	$ 66,612	$ 22,204	$ 44,408	$ 111,020	$ 694,647	$ 629	$ 22,015
	16th Ave. Ct. Outfall	$ 1,704,187	$ 55,275	$ 255,628	$ 85,209	$ 170,419	$ 426,047	$ 2,696,765	$ 1,240	$ 43,400
	11th St. Outfall	$ 290,406	$ -	$ 43,561	$ 14,520	$ 29,041	$ 72,602	$ 450,130	$ 418	$ 14,630
	1st St. Outfall	$ 11,411,347	$ 482,543	$ 1,711,702	$ 570,567	$ 1,141,135	$ 2,852,837	$ 18,170,131	$ 18,057	$ 631,989
	Hwy 85 Outfall	$ 2,210,050	$ -	$ 331,508	$ 110,503	$ 221,005	$ 552,513	$ 3,425,579	$ 1,972	$ 61,967
Total		$ 77,866,268	$ 1,237,020	$ 11,679,940	$ 3,893,312	$ 7,786,627	$ 19,466,570	$ 121,929,737	$ 61,989	$ 2,162,544

NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

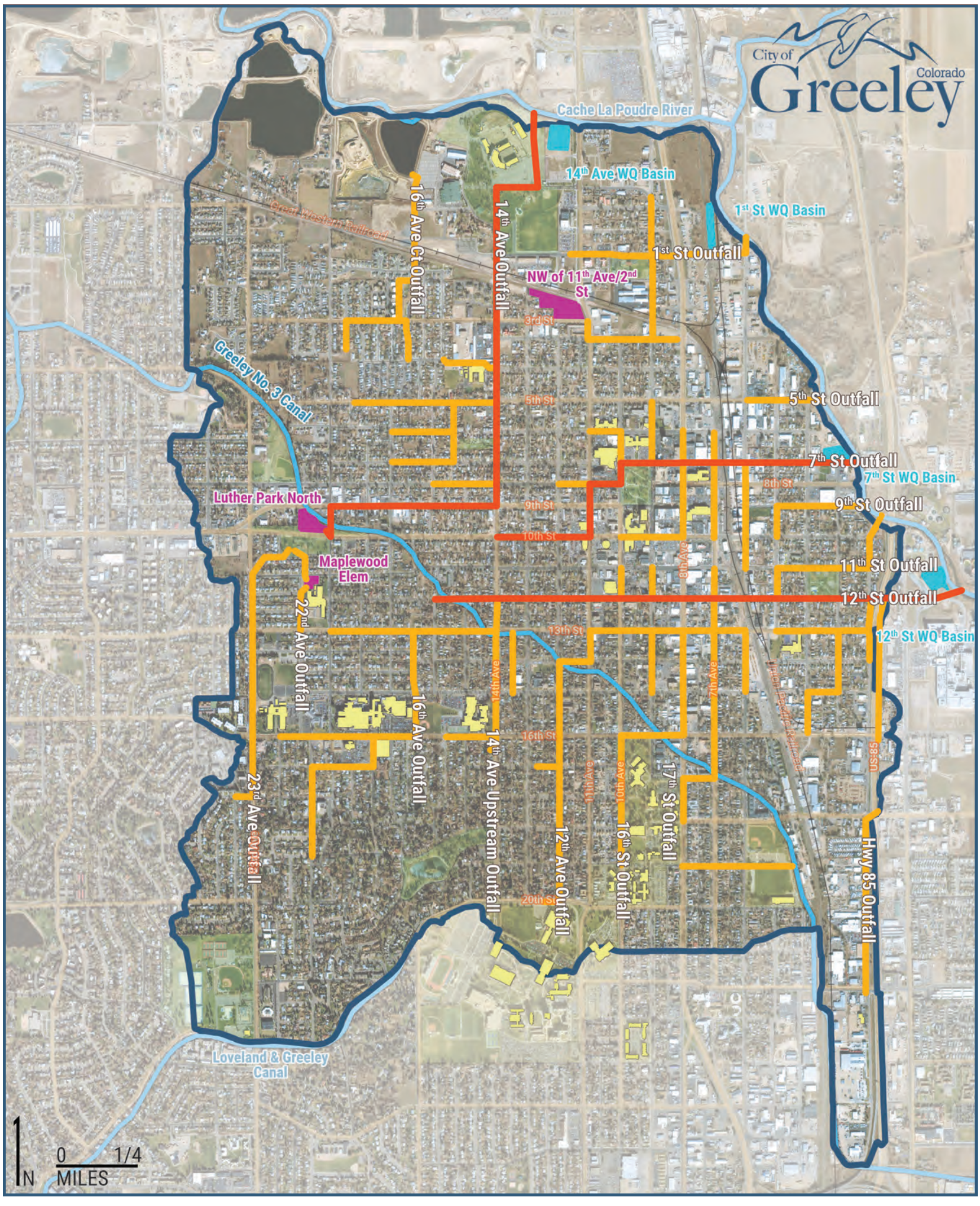
FIGURE ES-2 - MASTER PLAN SCHEMATIC
MARCH 2017

ICONENGINEERING, INC.

- Watershed Boundary
- Park
- Univ. of Northern Colorado
- Important Structure

Location	Outfall	Flood Storage (Ac-ft)	Est. Surface Area (Ac.)
Luther Park North	14th Avenue	4.0	3.0
Maplewood Elementary	22nd Avenue	2.2	1.0
NW of 11th Ave/2nd St	1st Street	12.6	5.2
14th Ave WQ Basin	14th Avenue	8.1	3.4
1st Street WQ Basin	1st Street	5.0	2.3
7th Street WQ Basin	7th Street	5.8	1.9
12th Street WQ Basin	12th Street	6.6	5.8

- Main Trunk
- Lateral
- Detention Basin
- Water Quality Basin



1.0 INTRODUCTION

1.1 AUTHORIZATION

This study was authorized by the City of Greeley on May 6th 2015 under RFP #FG15-01-023.

1.2 PURPOSE AND SCOPE

The focus of the study is to produce a comprehensive storm drainage master plan to:

- Quantify stormwater runoff and quantity
- Identify potential flood hazards and problem areas within the watershed
- Identify and prioritize capital improvement projects to reduce flood frequency and risk
- Recommended improvement to water quality
- Guide redevelopment within the Downtown and North Greeley Basin

The original Comprehensive Drainage Plan for the North Greeley and Downtown Basin was completed in 1974. The study was updated in 1997 and most recently in 2005(References 1 & 4).

The following is a summary of the scope of work for this study:

- Data Collection and Review
- Baseline Hydrology and Hydraulics
    - Compare current city rainfall criteria with NOAA Atlas 14
    - Develop a basin-wide two-dimensional hydrodynamic model to estimate general flow paths within the watershed.
    - Define individual subwatershed boundaries
    - Develop hydrologic models for the 2-, 5-, 10-, 50-, and 100-year return period storms subject to the following guidelines:
        - Use the Colorado Urban Hydrograph Procedure (CUHP) to generate basin runoff hydrographs
        - Use the Environment Protection Agency Storm Water Management Model (EPA SWMM) to route the individual hydrographs
        - Evaluate the performance of existing storm drain infrastructure 30 inches or greater in size
        - Use two-dimensional hydrodynamic modeling to determine diversion curves at intersections or other urban features
    - Review existing inlet capacity throughout the watershed
    - Confirm inflows and outflows to the Greeley No. 3 Canal using updated hydrology with the existing U.S. Army Corps of Engineers' HEC-RAS (HEC-RAS) model developed as part of prior studies
    - Identify residual flood potential within the basin using a two-dimensional hydrodynamic model such as FLO-2D
- Alternatives Analysis
    - Identify existing and potential future potential drainage and water quality problems along outfall paths
    - Identify existing wetland and riparian zones along the outfall paths
    - Develop and evaluate alternative plans on an outfall-by-outfall basis to reduce flooding potential on insurable structures and provide regional water quality treatment
    - Identify areas that would remain prone to residual flooding following the implementation of the proposed alternative
    - Estimate benefits of flood reduction on insurable structures
- Conceptual Design
    - The selected plan shall be refined to a 20% design level
    - Baseline hydrology information to be subsequently updated to reflect the conceptual design.
    - Identify a Phasing and Prioritization Plan for improvements

1.3 PLANNING PROCESS

Progress meetings were held at various stages throughout the project. A summary of these meetings can be found below:

- April 14, 2015: Project Kickoff Meeting
- June 9, 2015: Progress Meeting - Baseline Hydrology and Hydraulics Update
- July 13, 2015: Outreach Meeting
- September 3, 2015: Progress Meeting - Baseline Hydrology and Hydraulics Update
- October 28, 2015: Progress Meeting - Baseline Hydrology and Hydraulics Update
- December 3, 2015 Progress Meeting - Baseline Hydrology and Hydraulics Update
- January 5, 2016 Progress Conference Call - Baseline Hydrology and Hydraulics Update
- January 19, 2016 Progress Meeting - Alternatives Kickoff / Review Baseline Hydrology Comments
- January 28, 2016 Public Meeting
- March 14, 2016 Progress Meeting – Alternative Analysis Update
- April 7, 2016 Progress Conference Call – Alternative Analysis Update
- May 2, 2016 Progress Meeting– Alternative Analysis Update
- August 22, 2016 Progress Meeting – Conceptual Design Kickoff Meeting
- February 6, 2017 Progress Conference Call – Conceptual Design Update

Minutes from progress meetings along with correspondence from the electronic mailing lists and public meetings can be found in Appendix A.

1.4 MAPPING AND SURVEY

Basemap Geographic Information System (GIS) layers received from the City of Greeley included:

- Building Footprints
- Land Use (Asphalt/Concrete, Gravel/Hard packed Earth)
- Utilities
    - Non-pot: Lift Stations, Lines, Valves
    - North Weld: Water Lines, Water Meters
    - Sewer: Line, Manhole

  - Stormwater: Culvert, Inlet, Main, Manhole,
  - Water Hydrants: Line, Valves
- Parcel information
- Roads, Street Centerlines
- Zoning

One foot interval contours were generated from LiDAR project mapping. Project mapping was based on Federal Emergency Management Agency (FEMA) 2013 Post-flood LiDAR mapping with the following attributes and is equivalent to 1-foot contour interval topographic mapping:

Name: 2013 South Platte River Flood Area 1
Collection Date: Fall 2013 – Spring 2014
Vertical Accuracy: 9.25 cm RMSE
Point Spacing: 0.7 m
Vertical Datum: NAVD88
Horizontal Datum: NAD83

Survey data for storm drain and sanitary sewers collected as part of the original 2005 Comprehensive Drainage Plan were projected from the NAD 1927 horizontal datum to the NAD 1983 HARN Colorado State Plane North horizontal datum. The vertical datum was also updated from NGVD 29 to NAVD 88 datum using an adjustment factor of +2.9 feet. This adjustment factor was determined using VERTCON – North American Vertical Datum Conversion and benchmarks within the City of Greeley Control Network.

As part of this study King Surveyors also gathered survey information for the hydrologic detention facilities considered for this study as well as surveying additional storm drain manholes that were not surveyed previously. King Surveyors information was gathered on NAD83 horizontal datum and the NAVD88 vertical datum

1.5 DATA COLLECTION

Two prior Comprehensive Drainage Plans for the North Greeley and Downtown Basin were reviewed as part of this study. Both of the previous studies were provided by the City of Greeley. A summary of the reports can be found below:

Table 1-1: Data Collected

Document Title	Date	Author
Comprehensive Drainage Plan Update City of Greeley - Downtown & North Greeley Basin - Project Notebook	May 1996	Lidstone & Anderson, Inc.
Comprehensive Drainage Plan City of Greeley - Downtown and North Greeley Basin	December 1996	Lidstone & Anderson, Inc.
Comprehensive Drainage Plan - Downtown and North Greeley Basin Final Report	January 2005	Anderson Consulting Engineers, Inc.
Comprehensive Drainage Plan - Downtown and North Greeley Basin Project Notebook	January 2005	Anderson Consulting Engineers, Inc.

The unsteady flow model HEC-RAS model for the Greeley No. 3 Canal, developed as part of the 2005 study, was carried forward for use in the current master plan. All other information was only used for references to past information.

1.6 ACKNOWLEDGEMENTS

The team members who were involved with this study are listed in the table below:

Table 1-2: Project Participants

	Representing	Title
Eric Weis, P.E.	City of Greeley	Stormwater Division Manager
Heather Seitz, P.E., LEED AP	City of Greeley	Stormwater Capital Projects Engineer
Craig Jacobson, P.E., CFM	ICON Engineering, Inc.	Project Manager
Jeremy Deischer, EI	ICON Engineering, Inc.	Project Engineer
Eben Dennis	ICON Engineering, Inc.	GIS Coordinator

2.0 STUDY AREA DESCRIPTION

2.1 PROJECT AREA

The North Greeley and Downtown Basin, approximately 5.2 square miles in drainage area, generally slopes from the south near the University of Northern Colorado campus north to the Cache La Poudre River. The watershed is generally bounded by the Cache La Poudre River on the north, U.S. Highway 85 Bypass to the east, Reservoir Road to the south and 23rd Avenue to the west. Due to past development of the watershed, there is not a well-defined, central, major drainageway path and with exception to smaller drainageways, such as Glenmere Draw, storm runoff is generally conveyed overland or through undersized conveyance systems. Approximately 90 percent of the watershed is developed. The watershed ranges in elevation from approximately 4850 feet at the southwest end of the basin near the water storage facilities at 23rd Avenue and Reservoir Road to 4610 feet at the Cache La Poudre River.

Bisecting the watershed is the Greeley No. 3 Canal, which flows from northwest to southeast through the watershed. In addition to conveying irrigation flows, the canal intercepts stormwater runoff from upstream of the canal. Due to a lack of conveyance capacity in the canal, flow overtops the downstream (north) bank in several locations contributing to flooding in the commercial district. Several overflow spillway structures have been constructed at locations along the canal in order to manage flooding and formalize overtopping locations. There are, however, areas where canal flows spill in an uncontrolled manner during larger storm events.

Upstream of the Greeley No. 3 Canal the basin consists of a variety of development types including: primary and secondary schools, the University of Northern Colorado Campus, Banner Health North Colorado Medical Center, park and open space area near Glenmere Lake, single- and multi-family housing, and commercial development.

Downstream of the Greeley No. 3 Canal, the basin consists of residential and high density commercial development. There are recreational facilities north of the Great Western Railroad at Island Grove Regional Park. Runoff from the North Greeley and Downtown Basin collects in the Cache La Poudre River which continues flowing in a southeast direction before it confluences with the South Platte River.

The flood control performance of five detention facilities, all upstream of the Greeley No. 3 Canal, were considered in this study. The facilities which were included in the hydrologic analysis were: Glenmere Lake, Moon Pond Basin, Maple Elementary School Basin, and Luther Park East and West Basins.

A watershed map highlighting features throughout the watershed can be found in Figure 2-1: Watershed Map.

2.2 LAND USE

The majority of the Downtown and North Greeley watershed is comprised of Type A soils as defined by the Natural Resources Conservation Service (NRCS). Type B and Type D soils are also present within the watershed. A soil map of the watershed can be found in Appendix B.

Land use parameters were obtained using GIS shapefiles provided by the City of Greeley. Impervious values for each land use designation (gravel, paved parking, sidewalk, etc.) were selected using Table 6-3 of the Urban Storm Drainage Criteria Manual (USDCM) and can be seen in Table 2-1: Land Use Description (Reference 6). In several areas downstream of the Greeley No. 3 Canal, adjustments were made to increase imperviousness based on zoning classification to assume fully developed conditions for undeveloped locations. The impervious values chosen for each zoning classification can be found in Table 2-2: Zoning Classification.

Imperviousness for each subwatershed was computed using the area weighted average of each land use type using GIS. The entire study area is approximately 53 percent impervious. Impervious values are shown for the watershed on the impervious map in Appendix B

Table 2-1: Land Use Description

Land Use	Percent Impervious (%)
Grass	5
Trail	40
Unpaved Driveway	40
Unpaved Parking	40
Unpaved Road or Shoulder	40
Building	90
Concrete Pad	90
Driveway	90
Sidewalk	90
Paved Parking	100
Paved Road	100
Paved Shoulder	100
Water	100

Table 2-2: Zoning Classification

Zoning Classification	Dwelling per acre	Percent Impervious (%)
Residental - Low Density	3 - 5	45
Residental - Medium Density	5 - 10	60
Residental - High Density	10 - 20	75
Industrial - Light	--	80
Industrial - Medium	--	85

2.3 OUTFALL DESCRIPTIONS

Outfalls within the watershed were categorized based on their spatial location whether the outfall discharges into the Greeley No. 3 Canal or to the Cache La Poudre River.

An inventory of all major storm drainage structures can be found in Table 4-1 and Table 4-2.

An outfall map can be found in Figure 2-2 and on the interactive map in Appendix B.

2.3.1 GREELEY NO. 3 CANAL OUTFALLS

2.3.1.1 19TH STREET OUTFALL

The 19th Street outfall, starting east of Glenmere Lake, carries stormwater from Elbow Lane east to the Greeley No. 3 Canal. The storm drain system consists of clay pipe from the upstream end of the system to 8th Avenue, ranging in size from 10 to 27 inches. At 8th Avenue the pipe system transitions to a 27 inch reinforced concrete pipe (RCP). Flows south of 19th Street are collected in laterals and conveyed north into the 19th Street Outfall system in 6th, 8th

and 9th Avenue. The storm drain system runs under the Jackson Field Sports Complex before discharging into the Greeley No. 3 Canal.

2.3.1.2 17TH STREET OUTFALL

The 17th Street outfall conveys flow east along 17th Street from 13th Avenue to the outfall northeast of 7th Avenue. This storm drain system is comprised of clay pipe ranging in size from 18 to 24 inches. The storm drain passes underneath the University of Northern Colorado (UNC) Skinner Music Library. Local flow from the UNC campus is intercepted and conveyed in laterals to the 17th Street system upstream of 8th Avenue. The 17th Street outfall should be video inspected to ensure the clay pipe system has maintained its integrity as long as it remains in service.

2.3.1.3 GLENMERE DRAW

Glenmere Draw begins north of 22nd Street between 19th and 21st Avenue flowing in generally a north-east direction until it outfalls into the 16th Street Outfall at the intersection of 16th Street and 14th Avenue. The open channel sections consist of two distinct channel types separated by Glenmere Lake.

Upstream of Glenmere Lake the draw is overwhelmingly comprised of a densely vegetated natural channel at approximately a one percent longitudinal slope. Culverts at 19th Avenue and Lakeside Drive convey flow underneath the roadways. Downstream of Lakeside Drive the channel transitions into a trapezoidal grass lined channel with gently side slopes before discharging into Glenmere Lake.

Glenmere Draw Upstream of Glenmere Lake

Glenmere Draw Downstream of Glenmere Lake

Downstream of the Glenmere Lake outlet, flow is conveyed through a grass lined trapezoidal channel. The channel continues through the park to Glenmere Lake East at a longitudinal slope of approximately 1.5 percent. An overflow spillway at the outlet of Glenmere Lake East regulates the water surface level with the lake. Downstream of Glenmere Lake East the channel turns north at the Glenmere Boulevard street crossing.

As Glenmere Draw continues north, it crosses several residential properties. Buildings and other private development encroach upon the Draw in this area, severely limiting the capacity of the channel. The channel is conveyed underneath 17th and 18th Street through a 30 inch culvert before the flow is intercepted by the 16th Street outfall through a 36 inch RCP at the intersection of 14th Avenue and 16th Street.

2.3.1.4 16TH STREET OUTFALL

The 16th Street storm drain system begins at 21st Avenue and 16th Street intercepting local flow along 16th Avenue until 14th Avenue. The Glenmere Lake Outfall confluences with the 16th Street Outfall at 14th Avenue where the system turns to the northeast continuing between 13th and 14th Avenue north until its outfall into the Greeley No. 3 Canal just south of 13th Street.

This system gradually increases in size from 24 inches at 21st Avenue to 30 inches at 14th Avenue, then transitioning to a 36 inch RCP which intercepts the Glenmere Lake outfall discharge at 14th Avenue. Local flows collected from Greeley Central High School are intercepted by the 16th Street Outfall at 15th Street.

2.3.1.5 23RD AVENUE OUTFALL

The 23rd Avenue storm drain outfall originates at 18th Street where an 18 inch RCP conveys the flow north. The system increases in size to 33 inches at 11th Street when the system turns northeast following 22nd Avenue Court to 10th Street Road. At 10th Street Road the system heads east to the outfall into the Luther Park West detention basin. The primary outlet in Luther Park West convey flow north under 10th Street discharging into the Greeley No. 3 Canal south of 9th Street. Flows exceeding the capacity of Luther Park West spill east along 10th Street. This overflow splits, diverting into the Luther Park East Detention Basin and north across 10th Street in the canal. Flows in excess of the capacity of Luther Park East Detention Basin will spill east along 10th Street to a formalized structure discharging into the canal west of 18th Avenue.

2.3.2 CACHE LA POUDRE RIVER OUTFALLS

2.3.2.1 13TH STREET / 2ND AVENUE OUTFALL

The 13th Street storm drain intercepts stormwater beginning upstream of 14th Avenue, and following 13th Street until the system turns north at 2nd Avenue, through the outfall into the Cache La Poudre River just west of Highway 85. The system gradually increases in size from a 15 inch to 48 inches before the outfall into the river. The system intercepts laterals at nearly every intersection from 10th Avenue to 2nd Avenue.

2.3.2.2 9TH STREET OUTFALL

The 9th Street storm drain system collects local stormwater along 5th Avenue east of the Union Pacific Railroad (UPRR) from 12th Street to 9th Street. The system turns at 9th Street until it outfalls with the Cache La Poudre River. The capacity of the system is limited by the 15 inch pipe that conveys the flow downstream of 10th Street. Upstream of 10th Street the pipe system consists of an 18 inch and 24 inch pipes.

2.3.2.3 7TH STREET OUTFALL

The 7th Street storm drain outfall conveys flow from the commercial district to the Cache La Poudre River. The system intercepts flow from as far west as 14th Avenue, as far north as 5th Street, and as far south as 13th Street. The 7th Street outfall collects local stormwater flows west of 10th Avenue before passing through the Union Colony Civic Center property in a 27 inch VCP continuing along 7th Street north of Lincoln Park. From the intersection of 11th Avenue to 8th Avenue the pipe system increases in size from 27 to 48 inches. Several major laterals are tributary to the 7th Street Outfall including laterals at: 10th Street, 12th Street, and 8th Avenue. At each of the lateral interception

locations, the 7th Avenue system nominally increases in size; however the system lacks capacity for both the incoming lateral flow and local runoff.

Downstream of the 8th Avenue lateral, the pipe system is conveyed in a 48 inch RCP before the system passes underneath the Union Pacific Railroad. East of the railroad the system intercepts flow from a lateral in 6th Avenue. The system continues east where the storm drain system outfalls into the Cache La Poudre River east of 3rd Avenue.

2.3.2.4 1ST STREET OUTFALL

The 1st Street outfall begins intercepting flow along 2nd Street east of 14th Avenue. The system intercepts flow from the laterals in 11th and 12th Avenue. An 18 inch pipe conveys flow east, crossing 11th Ave where the system combines with a lateral in 10th Avenue. These two laterals (18 inch and 15 inch) combine north of the 10th Avenue and 3rd Street intersection into an 18 inch pipe which conveys flow north underneath the Great Western Railroad.

Downstream of the railroad crossing the system flows east along 2nd street before turning north east of 8th Avenue. At 1st street the system turns east towards the outfall with the Cache La Poudre River. The 1st Street outfall pipe system increases in size to 20 inches at 1st Avenue, and later increasing to a 24 inch outfall east of the Union Pacific Railroad before the outfall with the Cache La Poudre River.

2.3.2.5 9TH AVENUE OUTFALL

The 9th Avenue storm drain system collects flow from the southeast portion of Island Grove Park, continues along A Street, and intercepts flow from the area around Rodarte Park before turning north at 9th Avenue. Downstream of 9th Avenue and A Street the 18 inch pipe system does not increase in size and lacks additional capacity to convey flow from both laterals and local runoff before the outfall to the Cache La Poudre River.

2.3.2.6 14TH AVENUE OUTFALL

The 14th Avenue storm system conveys flow along 14th Avenue underneath the Great Western Railroad through Island Grove Park, and to the outfall with the Cache La Poudre River west of 11th Avenue. The system begins along 9th Street as an 18 inch RCP increasing in size to 66 inches at 2nd Street. Laterals along 8th, 7th, and 5th are intercepted by the 14th Avenue system before passing under the Great Western Railroad. The system lacks capacity downstream of 8th Street to convey the flow in the 30 inch pipe in addition to intercepting an additional 30 inch lateral from 8th Street, and local runoff. The 33 inch lateral along 15th Avenue Court, north of 6th Street, confluences with a 21 inch pipe segment in 5th Street; however it is also limited in capacity by the 21 inch pipe that continues downstream of 15th Avenue Court to the 14th Avenue storm drain system. The outfall of the 66 inch RCP into the Cache La Poudre River is located west of 11th Avenue, just east of the Greeley Stampede.

2.3.2.7 16TH AVENUE COURT OUTFALL

The 16th Avenue outfall intercepts flow north of 4th Street, up to 21st Avenue on the west and 16th Avenue on the east. The storm drain system ranges in size from 12 inches to 42 inches to south of the Great Western Railroad. A 42 inch pipe conveys the stormwater north underneath the railroad, then outfalls into the pond to the west of Island Grove Park.

NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

FIGURE 2-1 - WATERSHED MAP

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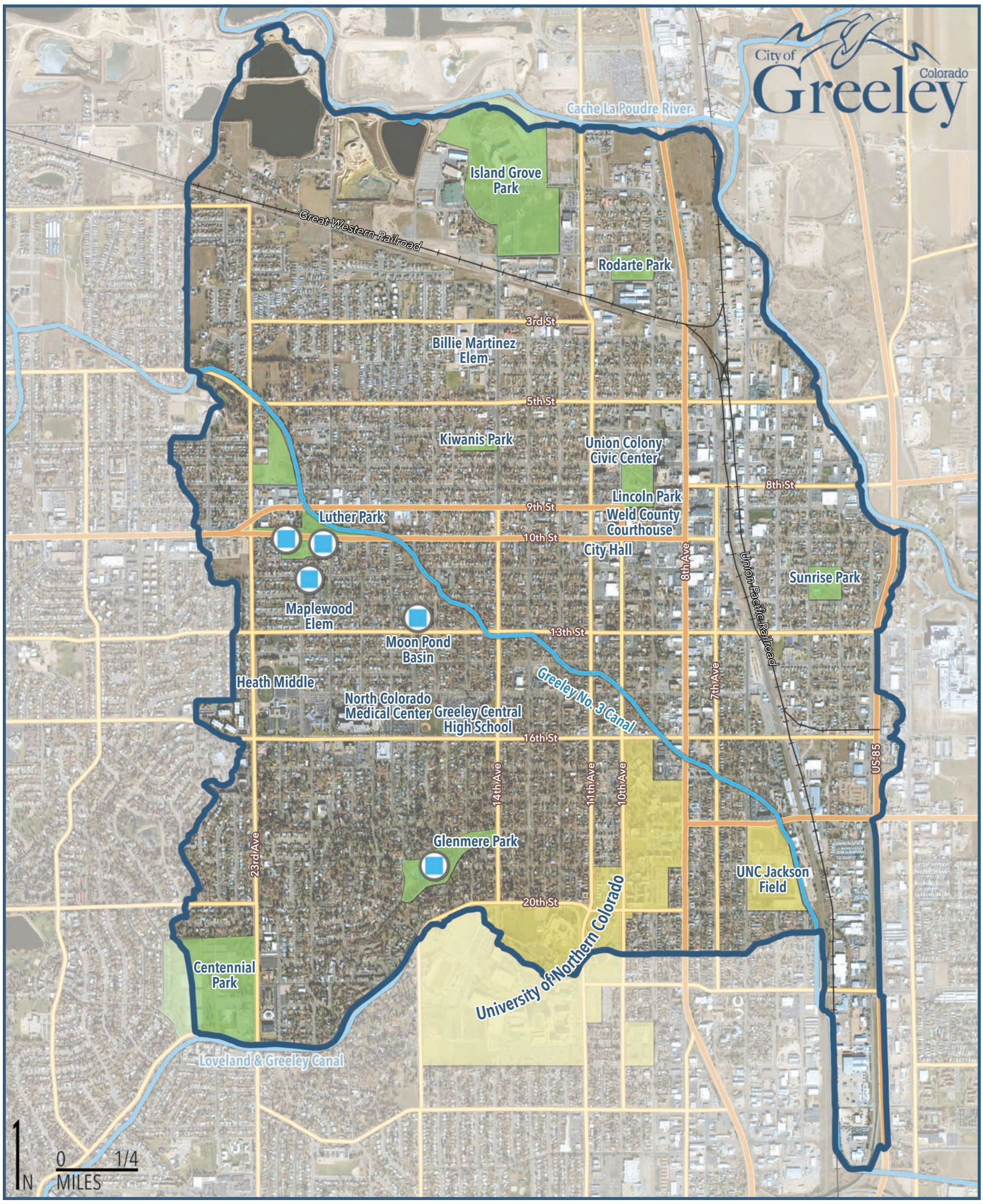
Watershed Boundary

Existing Detention Basin

Park

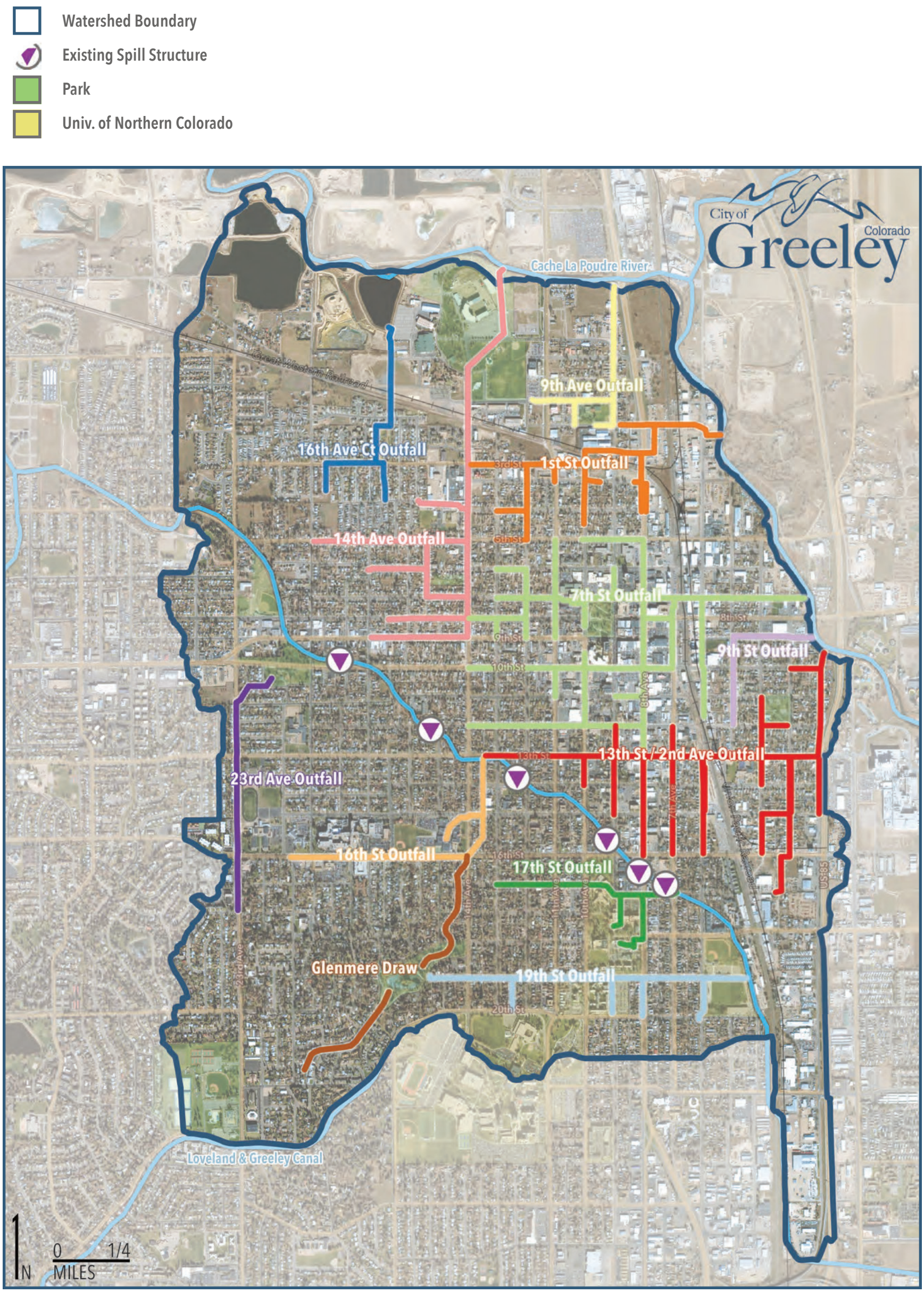
Univ. of Northern Colorado



NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

FIGURE 2-2 - OUTFALL MAP

ICON ENGINEERING, INC.



3.0 HYDROLOGIC ANALYSIS

3.1 OVERVIEW

A new hydrologic model was prepared for the North Greeley and Downtown Basin. The model provides updated hydrology for the 2-, 5-, 10-, 50-, and 100-year storm frequencies. The Colorado Urban Hydrograph Procedure 2005 version 2.0.0 (CUHP) was used to develop runoff hydrographs for each subwatershed. Subwatershed hydrographs were then routed using the EPA Stormwater Management Model version 5.1.010 (SWMM) to determine discharge at each design point.

During the development of this study a recalibration effort was ongoing for CUHP. After completing the DRAFT Alternative Analysis Report with CUHP version 1.4.4, version 2.0.0 of CUHP was released. After discussing the updates of CUHP with UDFCD and City staff it was decided to update the study to CUHP version 2.0.0. The hydrology model used is discussed in further detail in 3.2 Colorado Urban Hydrograph Procedure.

Due to the level of subwatershed discretization, one minute time step between computations was used in CUHP.

In general, the hydrologic model included storm drain pipes 30 inches or greater; however exceptions for pipes smaller than 30 inches were made when the flow in the storm drain systems diverted flow in a different direction than the topographic street flow conveyance.

Many areas were identified where flow splits changed routing direction, particularly downstream of the Greeley No. 3 Canal in the commercial district. These areas were refined to include tabular flow diversions within the SWMM model. The tabular diversion curves were based on a comparison of inflow and outflow using FLO-2D software. FLO-2D is a two-dimensional hydrodynamic model particularly well suited to simulating complex surface water flow such as is found in urbanized areas. These diversions are further explained in 3.5.4 Flow Diversions.

Tailwater elevations for outfall nodes into the Cache La Poudre River were used based on a 2-year water surface level in the Cache La Poudre River. Further information can be found in 3.5.5 Cache La Poudre River Tailwater Conditions.

3.2 COLORADO URBAN HYDROGRAPH PROCEDURE

The Colorado Urban Hydrograph Procedure translates a watershed's response from rainfall into a runoff hydrograph that reflects peak runoff rates, volumes, and timing. CUHP is an evolution of the Snyder unit hydrograph calibrated to the Colorado Front Range using data collected by the U.S. Geological Survey beginning in 1969 (Reference 9). The 1982 version of CUHP was developed using data collected at seven sites along the Front Range. The current version of CUHP developed empirical relationship between the input hyetograph and observed output flow using data from 30 sites, representing a full range of land uses (Reference 9). UDFCD commissioned a calibration effort after experiencing higher than anticipated peak flows in their planning studies. The recalibration study recommended updating CUHP to better match gage data and update rainfall values from NOAA Atlas 2 to NOAA Atlas 14. Version CUHP v.2.0.0 was released in September of 2016 and was found to have less error than CUHP v.1.4.4 when compared to recorded rainfall and corresponding runoff (Reference 9).

All previous studies for the North Greeley and Downtown Basin used prior versions of CUHP, EPA SWMM, and NOAA Atlas 2 rainfall values.

3.3 DESIGN RAINFALL

One- and six-hour rainfall depths were obtained from NOAA Atlas 14 Point Precipitation Frequency Data Server for the Greeley UNC station.

Table 3-1: 1- and 6-hr Rainfall Depth

Return Period	1-Hr Rainfall Depth (in)	6-Hr Rainfall Depth (in)
2-yr	0.72	1.08
5-yr	1.13	1.67
10-yr	1.41	2.07
50-yr	2.27	3.32
100-yr	2.73	3.98

Areal adjustments were not applied due to the lack of a contiguous basin exceeding the threshold of five square miles. Two hour rainfall distributions were generated in the CUHP software from the one – and six-hour rainfall depths.

Complete rainfall distributions are provided in Appendix B.

3.4 SUBWATERSHED CHARACTERISTICS

Subwatershed characteristics for each basin are further described below and can be found in Appendix B.

3.4.1 SUBWATERSHED DELINEATION

The North Greeley and Downtown Basin was delineated into 299 subwatersheds encompassing 5.2 square miles. 111 of the subwatersheds are located upstream of the Greeley No. 3 Canal, with the remaining 188 located downstream. Subwatersheds ranged in size from 0.7 acres to 69.8 acres with the average basin size approximately 11 acres.

3.4.2 WATERSHED IMPERVIOUSNESS

Characterizations of subwatershed imperviousness were obtained using GIS shapefiles provided by the City of Greeley. Impervious values for each land use designation were selected using Table 6-3 of the Urban Storm Drainage Criteria Manual (USDCM) and can be seen in Table 2-1: Land Use Description. In several areas downstream of the Greeley No. 3 Canal, adjustments were made to increase imperviousness based on zoning classification to assume fully developed conditions for undeveloped locations. The impervious values chosen for each zoning classification can be found in Table 2-2: Zoning Classification.

Imperviousness for each subwatershed was computed with GIS software using the area weighted average of each land use type. The entire study area is approximately 53 percent impervious. Subwatershed imperviousness varied from 8.7 percent to 93.9 percent impervious throughout the study area.

Impervious values are shown for the watershed on the impervious map in Appendix B.

3.4.3 LENGTH, CENTROID DISTANCE, SLOPE

CUHP parameters such as subwatershed length, distance to centroid, and slopes were derived for each subwatershed using topographic data. Slopes were computed using the length-weighted, corrected average slope from Equation 6-7 and Figure 6-4 (USDCM).

3.4.4 DEPRESSION LOSSES

Depression storage loss was determined based on Table 6-6 from the USDCM. Aerial imagery was used to examine each subwatershed. Values from the previous Comprehensive Drainage Plan were evaluated and maintained at 0.35 for pervious areas and 0.1 for impervious areas.

3.4.5 INFILTRATION

Soil data for the watershed was obtained from Natural Resources Conservation Service (NRCS) web soil survey. Each soil classification is assigned a map unit symbol based on the soil characteristics. Map unit symbols categorization is then summarized into one of the four major soil types ranging from Type A representing well-draining soils, to Type D representing poorly-draining soils. These soil types are each assigned parameters for use in Horton's infiltration equation. Horton's infiltration equation initially infiltrates a high amount of runoff early in the storm, eventually decaying to a steady state constant value. Horton's infiltration method was found to provide a balance between simplicity and a reasonable physical description of the infiltration process for CUHP (USDCM).

The watershed predominantly contains Type A soil, but areas of Type B, and Type D soil are also present. Table 6-7 of the USDCM provides Horton's infiltration parameters for each soil type. As an example, Type A soils have an initial infiltration of 5.0 inches per hour, a final infiltration rate of 1.0 inches per hour, and a decay coefficient of 0.0007. Soil parameters were averaged on an area weighted basis for subwatersheds that contained multiple soil types.

It should be noted the previous 2005 Comprehensive Drainage Plan identified the watershed primarily consisting of Type B soils.

3.5 HYDROGRAPH ROUTING

A constant inflow was applied at the headwaters of the Glenmere Draw to account for discharge originating from the Loveland and Greeley Canal, located south of the basin. This contributing flow was estimated using a full pipe capacity of the existing 18 inch reinforced concrete pipe (RCP) lateral, entering Glenmere Draw north of 22nd Street between 19th and 21st Avenue. The Loveland and Greeley Canal was estimated to contribute 13 cubic feet per second (cfs) at this location.

3.5.1 ROUGHNESS COEFFICIENT

Roughness coefficients (Manning's n) for SWMM routing were selected using Table MD-1 from USDCM. Following UDFCD guidance the values were then increased by 25% to better represent modeling conditions when using EPA SWMM.

3.5.2 CONVEYANCE ELEMENTS

Several conduit types were utilized to convey individual subwatershed hydrographs to design points. Trapezoidal channels were typically used for the open channel sections surrounding Glenmere Lake based on existing contour data. Closed circular conduits were assigned to storm drain infrastructure, based on City of Greeley's GIS map information, and supplemented by field data from King Surveyors. Irregular cross sections were developed to represent typical street cross sections of varying widths, to convey surface flow. Cross sections for six street sections were used, representing street widths of: thirty, forty, fifty, fifty five, sixty, and seventy five-foot sections.

A SWMM routing schematic can be found on the interactive map, located in Appendix B.

3.5.3 DETENTION FACILITIES

Glenmere Lake, Moon Pond Basin, Maple Elementary School Basin, and the Luther Park East and West Basins were all included in the SWMM hydrologic models as storage facilities. Storage volumes for each facility were estimated from the topographic mapping. Release rates were estimated from orifice and weir calculations reflecting existing outlet structure configurations. Survey information from King Surveyors was used for invert elevations of outlet pipes as well as spillway overtopping elevations to define outlet release rates. Storage and discharge curves for all the detention basins included in the hydrologic model are provided in Appendix B.

Inadvertent storage behind roadways and railroad embankments were not included in the hydrologic models as the City cannot adequately ensure that the current detention volumes or characteristics will remain. Any future development on these privately owned parcels would disrupt the detention volume relationship altering the hydrologic modeling. Several of these inadvertent storage locations had been included in past modeling efforts.

3.5.4 FLOW DIVERSIONS

Throughout the watershed tabular diversion curves were developed using FLO-2D to more accurately represent diversion of flow at street intersections. Separate FLO-2D models were created for each diversion location using a 5-foot grid cell size. A range of discharges was applied to the surface to generate the tabular rating curves used in the SWMM models. Exhibits for each of these diversion curves, including the flow diversion rating tables can be found in Appendix B.

3.5.5 CACHE LA POUDRE RIVER TAILWATER CONDITIONS

Due to the size of the North Greeley and Downtown watershed, tailwater elevations along the Cache La Poudre River were determined using HEC-22, Table 7.3 seen in Figure 3-1. Table 7.3 considers the probability of two hydrologic events occurring on the Cache La Poudre River and in the North Greeley and Downtown watershed at the same time to adequately determine the tailwater elevation. In this case, the area ratio of the Cache La Poudre River / North Greeley watersheds is approximately 360:1. Therefore, for a 10-year design, a 2-year tailwater on the Cache La Poudre River would be appropriate. For a 100-year design, Table 7.3 indicates a 10-year tailwater would be appropriate.

Table 7-3. Frequencies for Coincidental Occurrence.				
Area Ratio	Frequencies for Coincidental Occurrence			
	10-Year Design		100-Year Design	
	Main Stream	Tributary	Main Stream	Tributary
10,000 to 1	1 10	10 1	2 100	100 2
1,000 to 1	2 10	10 2	10 100	100 10
100 to 1	5 10	10 5	25 100	100 25
10 to 1	10 10	10 10	50 100	100 50
1 to 1	10 10	10 10	100 100	100 100

Figure 3-1: HEC-22 Table 7-3

Tailwater elevations for outfall nodes were determined using FEMA's preliminary Risk MAP analysis for the Cache La Poudre River. The HEC-RAS hydraulic modeling for this analysis, provided by the City of Greeley, included discharges for the 10-, 25-, 50-, 100-, and 500-year rainfall events. Since this model did not include a 2-year analysis, a logarithmic trendline was developed in order to extrapolate the 2-year discharge. Extrapolation of this trendline resulted in a 2-year flow of approximately 1,900 cfs, and a 5-year flow of approximately 2,800 cfs. These discharges were then used in the Risk MAP model to determine tailwater elevations at each outfall.

3.6 PREVIOUS STUDIES

Several inadvertent storage areas upstream of the Great Western Railroad were considered detention facilities in the 2005 study. As discussed above, these areas were not included in the hydrologic analysis for the current study. Since the City is unable to provide adequate assurance of the detention volumes, release structure characteristics, or long-term maintenance of the ponding areas upstream of the railroad along the 16th Avenue Court outfall and north of 3rd Avenue and 10th Street, an analysis of the detention provided at these locations is not included in this study.

3.7 RESULTS OF ANALYSIS

Peak discharges and inflow volumes for the 2-, 5-, 10-, 50-, and 100-year storm event for all design points can be found in Appendix B .

A summary of peak flows at key design points throughout the watershed are shown in Table 3-3 and Table 3-5.

Due to the level of discretization of the subwatersheds in this study, comparisons between this and 2005 Comprehensive Drainage Plan were not equivalent when comparing tributary area for each design point. Figure 3-2 presents discharge comparisons to the 2005 Comprehensive Drainage Plan for spill flows from the Greeley No. 3 Canal and at outfalls into the Cache La Poudre River, or east out of the watershed.

In general, the updated study notes a reduction in peak flows and volume across the watershed when comparing to the 2005 Comprehensive Drainage Plan. Due to the variations in the shape of the runoff hydrograph using CUHP v.2.0, peak flows were significantly reduced across the watershed. When directly comparing the 100-year peak discharges at the outfall points, flows are reduced by approximately 2068 cfs, or 27% of the 2005 discharges. Although peak flows were significantly reduced from past studies, runoff volume at outfall locations were only approximately 8% lower than the 2005 volumes.

The reduction in discharge and volume is predominately related to the change in hydrology model used and variations in subwatershed routing throughout the watershed. The routing variations included the use of a 2-dimensional modeling as a guide and overtopping evaluations of the railroads. Soil classification also differed between the two studies, with the current study documenting a higher degree of Type A soils, thus increasing overall infiltration capacity.

Detention Basins included in the hydrologic analysis are presented in Table 3-4. Approximate capacity was estimated for each basin to determine the storm frequency in which the detention basin would overtop.

NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

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FIGURE 3-2 - PEAK FLOW COMPARISON

Location	2005 Comprehensive Plan 2-yr	5-yr	10-yr	50-yr	100-yr	2016 Watershed Update 2-yr	5-yr	10-yr	50-yr	100-yr
1 23rd Ave & 5th St	0	0	0	2	3	0	0	0	0	0
2 5th St & 6th St	0	0	0	24	33	0	0	0	20	45
3 6th St & 9th St	0	0	0	30	54	0	0	0	0	0
4 9th St & 18th Ave	3	14	29	182	217	5	8	13	180	282
5 10th St & 12th St	99	256	348	708	832	23	45	83	304	431
6 12th St & 13th St	95	226	309	646	853	53	72	93	264	358
7 13th Ave & 11th Ave	72	121	148	295	383	50	67	87	193	267
8 11th Ave & 15th St	10	54	76	154	177	0	1	11	55	77
9 15th St & 8th Ave	97	140	161	248	285	62	74	86	133	156
10 8th Ave & 18th St	53	94	111	173	192	27	35	46	105	139
11 East of UNC Physical Plant	0	24	48	146	183	0	0	0	18	52
12 Upstream of 22nd St	64	103	117	160	172	36	45	45	118	144
13 22nd St & US Hwy 85 Bypass	14	16	17	18	18	16	16	16	17	17
14 NW Corner of Study	111	199	252	424	479	58	90	124	259	333
15 Gravel Ponds West of Island Grove Park	53	108	132	237	275	54	70	96	191	243
16 14th Avenue System	221	289	323	467	518	124	138	160	274	334
17 1st Street Outfall Area	221	433	548	952	1198	132	219	404	1503	2298
18 7th-9th Street	344	734	1018	2360	2895	139	161	194	345	424
19 2nd Avenue Outfall	331	594	749	1434	1696	100	119	155	342	476
20 Hwy 85 Bypass Channel	142	220	263	433	495	24	24	25	29	30
21 Outfall East of Study Boundary	---	---	---	---	---	149	231	325	900	1351

12 Design Point

Watershed Boundary

Existing Detention Basin

Park

Univ. of Northern Colorado

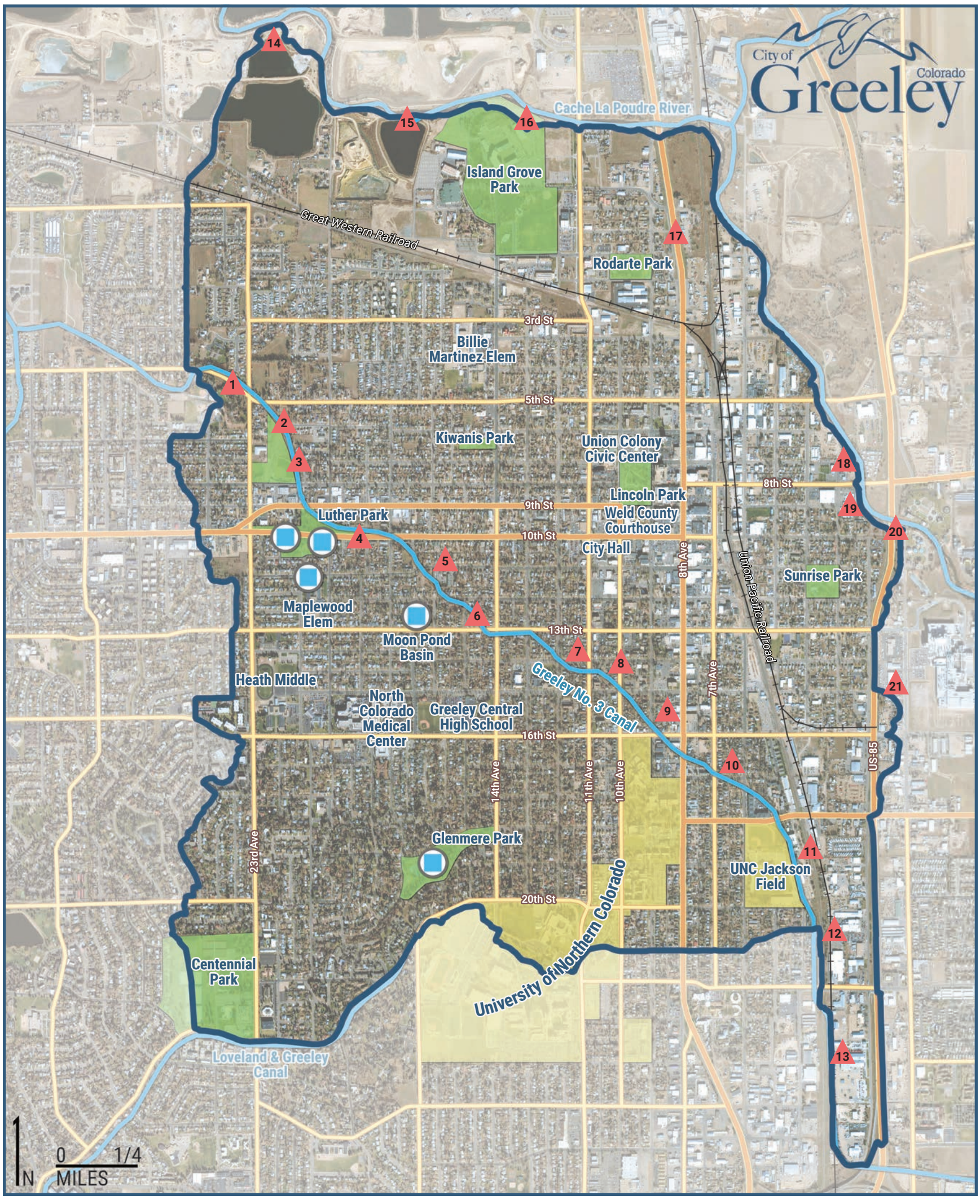


Table 3-3: Hydrology Results Upstream of Greeley No. 3 Canal

Upstream of Greeley No. 3 Ditch		Peak Discharge (cfs)				
Outfall	Street Intersection	2-yr	5-yr	10-yr	50-yr	100-yr
19th Street Outfall	10th Ave	19	21	22	32	38
	8th Ave	34	38	42	57	66
	6th Ave	39	42	42	41	41
	Outfall into Poudre River	11	14	18	35	53
17th Street Outfall	10th Ave	30	33	35	60	77
	8th Ave	33	39	47	86	101
	7th Ave	32	38	47	86	101
	Outfall into Greeley No. 3 Ditch	37	46	56	108	132
Glenmere Lake Channel	19th Ave	49	62	77	165	223
	Lakeside Drive	62	79	101	226	311
	Glenmere Lake	68	87	111	254	352
	Glenmere Blvd	31	38	46	79	96
	18th St	31	38	46	79	96
	17th St	31	38	46	79	96
16th Street Outfall	16th Ave Ct	40	56	77	198	268
	14th Ave	66	77	92	168	217
	14th St	75	77	78	84	85
	Outfall into Greeley No. 3 Ditch	62	62	62	62	62
17th Ave & 13th St		33	56	89	275	381
21st Ave & 13th St		25	36	52	122	158
23rd Avenue	16th St	20	27	36	92	127
	13th St	21	30	41	101	141
	22nd Ave Ct	25	36	49	127	175

Table 3-4: Existing Detention Basin Capacity

Detention Basin	100-yr Peak Inflow (cfs)	100-yr Peak Release (cfs)	Maxium Available Storage (Ac-ft)	Approx. Capacity (yr)
Glenmere Lake	352	91	13.3	< 50-yr
Moon Pond Basin	388	388	1.4	< 2-yr
Luther Park East	114	114	1.0	< 5-yr
Luther Park West	140	127	2.7	< 10-yr
Maple Elementary School	10	1	0.7	< 50-yr

Table 3-5: Hydrology Results Downstream of Greeley No. 3 Canal

Downstream of Greeley No. 3 Ditch		Peak Discharge (cfs)				
Outfall	Street Intersection	2-yr	5-yr	10-yr	50-yr	100-yr
13th Street / 2nd Ave Outfall	13th St & 11th Ave	48	63	83	186	256
	13th St & 9th Ave	27	30	36	67	85
	13th St & 7th Ave	123	165	214	551	798
	13th St & 4th Ave	84	99	131	248	326
	13th St & 2nd Ave	91	103	137	275	370
	2nd Ave & 11th St	96	110	141	293	402
	2nd Ave & 10th St	47	50	56	83	104
	Outfall into Poudre River	48	51	57	86	108
Overtopping of Union Pacific Railroad South of 13th Street		129	194	268	746	1109
Flow leaving watershed to east from Highway 85 Bypass Channel		145	227	321	896	1347
9th Street Outfall	5th Ave	8	10	11	16	19
	3rd Ave	26	33	44	99	120
	Outfall into Poudre River	27	35	46	106	130
7th Street Outfall	11th Avenue	74	127	200	685	1030
	10th Ave	51	79	116	385	602
	9th Ave	53	82	122	404	632
	8th Ave	83	83	82	82	82
	7th Ave	99	113	116	121	124
	6th Ave	100	100	100	100	100
	4th Ave	41	42	42	43	45
	Outfall into Poudre River	40	41	42	42	42
	8th Ave & 8th St	55	65	72	104	121
	8th Ave & 10th St	40	45	47	56	61
1st Street Outfall	11th Ave & 2nd St	30	84	183	752	1142
	10th Ave & 3rd St	8	11	14	32	43
	8th Ave & 3rd St	2	2	2	2	2
	8th Ave & 2nd St	14	17	21	43	55
	8th Ave & 1st St	28	28	28	28	28
	Outfall into Poudre River	6	6	6	6	6
8th Ave overtopping N of 1st St		40	83	198	858	1337
9th Avenue Outfall	11th Ave & A St	12	18	26	56	71
	9th Ave & A St	48	96	206	827	1260
	9th Ave & C St	9	11	14	27	36
	9th Ave & D St	22	30	41	89	115
	Outfall into Poudre River	3	3	3	3	3
14th Avenue Outfall	9th St	37	64	98	374	589
	8th St	28	32	48	210	344
	7th St	30	31	31	47	69
	5th St	59	74	89	195	303
	2nd St	69	90	114	172	203
	Before C&S RR Crossing	91	136	192	417	543
	A St	98	118	126	171	188
	Island Grove Park North of D St	115	124	139	224	268
	Outfall into Poudre River	93	93	93	93	93
16th Avenue Ct. Outfall	2nd St	14	16	18	28	35
	Great Western RR Crossing	52	74	104	261	348
	Outfall into Pond River	32	32	32	32	32

4.0 HYDRAULIC ANALYSIS

4.1 PREVIOUS ANALYSIS

The information in the previous 2005 Comprehensive Drainage Plan study was used to help identify flood hazards throughout the North Greeley and Downtown Basin. The previous report identifies that the existing storm drain system was designed to convey the 5-year and smaller events, although due to revisions in hydrology since the 1977 study, the existing storm drain capacity only conveys the 2-year and smaller event in most areas within the watershed. The limited capacity of the storm drains leads to ponding and overtopping of the crown in many street intersections, especially downstream of the Greeley No. 3 Canal. The limited storm drain capacity is magnified by the spill flows from the Greeley No. 3 Canal contributing to the downstream watersheds.

The findings in the 2005 Comprehensive Plan are consistent with the evaluation of storm drain infrastructure associated with this study. The majority of existing infrastructure does not meet a 2-year design storm conveyance capacity.

4.2 EVALUATION OF EXISTING FACILITIES

Existing storm drain infrastructure was evaluated to determine the approximate design storm frequency. A summary of existing infrastructure can be seen in Table 4-1 and Table 4-2. The level of discretization involved in this study led to a decrease of design peak flow at some downstream storm drain design points. This is a result of the street topography not coinciding with the storm drain alignment. Flows in excess of the storm drain capacity are conveyed in a different direction than the storm drain reducing the peak flow at the downstream design point.

FLO-2D software is a two-dimensional flood routing model that was used to identify residual flood potential with the watershed. FLO-2D simulates channel flow, unconfined overland flow and street flow over complex topography. The model uses the full dynamic wave momentum equation and a central finite difference routing scheme with eight potential flow directions to predict the progression of a floodwave over a system of square grid elements. The development of the FLO-2D model is further discussed below in 4.2.1 .

The unsteady state HEC-RAS model for the Greeley No. 3 Canal was also used to determine the spill flow locations along the canal in which flow overtops the bank and contributes to the downstream watershed. The inflow locations into the canal were updated based on the current hydrologic analysis associated with this study. Similarly, spills from the canal to the lower basin were exported from HEC-RAS to SWMM to continue the hydrologic evaluation. Additional discussion regarding the No. 3 Canal is presented in 4.2.2 , below.

4.2.1 FLO-2D MODEL DEVELOPMENT

20-foot by 20-foot grid cells were used to maximize the precision in identifying flooding potential throughout the watershed. Elevations for each grid cell were computed through FLO-2D by interpolating the project LiDAR data, outlined in 1.4 Building obstructions were incorporated into the FLO-2D model based on the building footprints GIS information provided by the City of Greeley.

Individual subwatershed hydrographs were taken from the hydrology model (CUHP) and applied to the FLO-2D surface. Each hydrograph was applied at a single FLO-2D grid cell where the majority of discharges were expected to converge for each subwatershed. The existing storm drain system was accounted for in the hydraulic analysis by subtracting the pipe capacity directly from each of the subwatershed hydrographs in relation to the residual capacity following inflow from upstream subwatersheds in the same pipe network. Inlet capacity was also considered when evaluating pipe capacity at each subwatershed design point.

Separate FLO-2D models were used to distinguish the flooding potential both upstream and downstream of the Greeley No. 3 Canal. Spill flows from the Greeley No. 3 Canal were also applied to the FLO-2D model downstream of the No. 3 Canal as inflow hydrographs at each spill location. The results from the FLO-2D analysis for the 10- and 100-year events, is available in Appendix B .

4.2.2 GREELEY NO. 3 CANAL - UNSTEADY STATE HEC-RAS MODELING

An existing unsteady state hydraulic model was used to analyze the Greeley No. 3 Canal. This model was originally developed as part of the 1996 Comprehensive Drainage Plan, updated during the 2005 Comprehensive Drainage Plan. The original model was developed in HEC-2 and was updated to HEC-RAS 3.1.2 as part of the 2005 study. The 2005 study used all the geometric information gathered as part of the 1996 Comprehensive Drainage Plan and also incorporated improvements along the canal since the completion of the 1996 study. These improvements included bank improvements along the canal and constructing formalized spill locations at 7th Avenue, 8th Avenue, 12th Avenue, 15th Avenue, and 19th Avenue.

The model extends from just downstream of the Clarkson Spill Structure to just upstream of Highway 85. Inflows to the North Greeley and Downtown basin at the Clarkson Spill Structure were established based upon the findings in the 2006 Greeley No. 3 Ditch Final Summary Hydraulics Report (Reference 8) which reviewed the automated assembly for the Clarkson Spill Structure. The 2006 report identified that during the 100-year event, up to 110 cfs would bypass the spill structure and continue east into the North Greeley and Downtown Basin study area. Therefore, a constant inflow hydrograph of 110 cfs was applied downstream of the Clarkson Spill Structure in the unsteady flow HEC-RAS model. No other geometric data from past models were altered as part of the analysis; however the HEC-RAS model was updated to version 4.1.0. It should also be noted that due to instabilities in the unsteady modeling towards the downstream end of the study, the initial flow condition (i.e. warm up flows) were reduced to 100 cfs which achieved model stability.

Inflow hydrographs were applied in the HEC-RAS model according to the updated hydrologic routing of the upstream watershed. Lateral weirs placed along the downstream embankment defined spill flow locations which were incorporated into the downstream hydrologic model as inflow hydrographs. Current results for the Greeley No. 3 Canal spills and a comparison to the past study is presented in Figure 3-2: Peak Flow Comparison.

4.3 FLOOD HAZARDS

FLO-2D uses the full dynamic wave momentum equation when computing flow depth at each cell in the study area. This computational methodology accounts for the storage capacity of each topographic depression which attenuates flows as they traverse the watershed downstream. This floodplain storage is not accounted for in the SWMM model which is computed using a kinematic wave approach. This difference in modeling approach leads to discrepancies when comparing design peak flows from the SWMM model and the inundation limits shown in the hydraulic analysis. Inundation limits are shown on the interactive map for both the 10- and 100-year event and can be found in Appendix B .

Existing capacity for each outfall system was estimated from normal depth calculations given each pipe slope. The existing storm drain infrastructure generally lacks the capacity to adequately convey the 2-year storm event.

A summary of the existing infrastructure conveyance capacity can be found in Table 4-1 and Table 4-2. As mentioned previously, due to the discretization of the watershed and routing of street overflows, peak discharge does not always increase downstream in a pipe system.

4.3.1 16TH AVENUE COURT / 14TH AVENUE / 1ST STREET OUTFALL FLOOD HAZARDS

Flows that are not intercepted by the 16th Avenue Court Outfall pipe system are conveyed through curb and gutter eventually ponding against the Great Western Railroad. These flows continue east along the railroad embankment to the 14th Avenue street crossing. Flows comingle with surface flows along 14th Avenue, where flows divert the east to 13th Avenue. Flows continue east along the railroad ponding again in an inadvertent storage area northwest of 11th Avenue and 2nd Street. Flows overtop 11th Avenue east to another inadvertent storage area north of 10th Avenue and 3rd Street. Flow along 10th Avenue converges with other flows north of 3rd Street. The flows create a pond that eventually overtops the Great Western Railroad to the north. This spill flow continues northeast overtopping 8th Avenue and the Union Pacific Railroad before the outfall into the Cache La Poudre River.

The FLO-2D inundation mapping shows a maximum water depth of approximate five feet in some of these inadvertent storage areas before water overtops the storage area and continues along the flow path. The FLO-2D modeling shows inundation of several structures occurs along this flow path, including residential homes at the area of 13th Avenue and 2nd Street.

4.3.2 7TH AVENUE OUTFALL FLOOD HAZARDS

The majority of buildings in the commercial district from 7th to 9th Street east of the Union Colony Civic Center are inundated due to the lack of conveyance capacity of the existing storm drain infrastructure. Some of the street flows west of 10th Avenue exceeding the capacity of the storm drain divert north along 10th Avenue, leaving the 7th Avenue Outfall watershed. Flows east of 10th Avenue continue along 6th, 7th, and 8th Street where overtopping of the Union Pacific Railroad occurs at several locations. Spilt flows along 10th Avenue continue north contributing to the 1st Street Outfall system.

4.3.3 13TH STREET / 2ND AVENUE OUTFALL FLOOD HAZARDS

Flows east of 14th Avenue that are not intercepted by the storm drain are generally directed in a southeast flow path to the intersection of 6th Avenue and 13th Street. Although some overtopping of the Union Pacific Railroad does occur north of 13th Street, the majority of overtopping of the railroad occurs east of 6th Avenue south of 13th Street. Overtopping flows continue southeast until the water sumps and begins to contribute flow to the Highway 85 Bypass Channel. The capacity of the Highway 85 Bypass Channel is limited at 15th Street when the channel is intercepted by a 40 inch closed conduit. Flows in excess of this pipe capacity will divert east out of the study limits.

Table 4-1: Existing Facilities Inventory Upstream of Greeley No. 3 Canal

Upstream of Greeley No. 3 Ditch					Peak Discharge (cfs)				
Outfall	Street Intersection	Pipe Size	Approximate Pipe Capacity (cfs)	Approximate Return Period	2-yr	5-yr	10-yr	50-yr	100-yr
19th Street Outfall	10th Ave	27"	23	< 50-yr	19	21	22	32	38
	8th Ave	27"	36	< 5-yr	34	38	42	57	66
	6th Ave	27"	36	< 5-yr	39	42	42	41	41
17th Street Outfall	10th Ave	24"	23	< 2-yr	30	33	35	60	77
	8th Ave	24"	23	< 2-yr	33	39	47	86	101
16th Street Outfall	16th Ave Ct.	33"	31	< 2-yr	40	56	77	198	268
	14th Ave.	36"	68	< 5-yr	66	77	92	168	217
	14th St.	36"	62	< 2-yr	75	77	78	84	85
23rd Avenue	13th St	30"	32	< 10-yr	21	30	41	101	141
	22nd Ave Ct	33"	70	< 50-yr	25	36	49	127	175

Table 4-2: Existing Facilities Inventory Downstream of Greeley No. 3 Canal

Downstream of Greeley No. 3 Ditch					Peak Discharge (cfs)				
Outfall	Street Intersection	Pipe Size	Approximate Pipe Capacity (cfs)	Approximate Return Period	2-yr	5-yr	10-yr	50-yr	100-yr
13th Street / 2nd Ave Outfall	13th St & 11th Ave	18"	8	< 2-yr	48	63	83	186	256
	13th St & 9th Ave	48"	120	> 100-yr	27	30	36	67	85
	13th St & 7th Ave	48"	63	< 2-yr	123	165	214	551	798
	13th St & 4th Ave	48"	62	< 2-yr	84	99	131	248	326
	13th St & 2nd Ave	48"	57	< 2-yr	91	103	137	275	370
	2nd Ave & 11th St	48"	41	< 2-yr	96	110	141	293	402
	2nd Ave & 10th St	48"	86	< 100-yr	47	50	56	83	104
9th Street Outfall	5th Ave	15"	5	< 2-yr	8	10	11	16	19
	3rd Ave	18"	4	< 2-yr	26	33	44	99	120
7th Street Outfall	11th Avenue	27"	20	< 2-yr	74	127	200	685	1030
	10th Ave	30"	18	< 2-yr	51	79	116	385	602
	9th Ave	36"	33	< 2-yr	53	82	122	404	632
	8th Ave	48"	75	< 2-yr	83	83	82	82	82
	7th Ave	48"	88	< 2-yr	99	113	116	121	124
	6th Ave	48"	110	> 100-yr	100	100	100	100	100
	4th Ave	48"	103	> 100-yr	41	42	42	43	45
8th Ave & 8th St		40"	40	< 2-yr	55	65	72	104	121
8th Ave & 10th St		36"	17	< 2-yr	40	45	47	56	61
1st Street Outfall	11th Ave & 2nd St	18"	9	< 2-yr	30	84	183	752	1142
	10th Ave & 3rd St	15"	3	< 2-yr	8	11	14	32	43
	8th Ave & 3rd St	15"	3	< 2-yr	2	2	2	2	2
	8th Ave & 2nd St	15"	4	< 2-yr	14	17	21	43	55
	8th Ave & 1st St	20"	6	< 2-yr	28	28	28	28	28
9th Avenue Outfall	11th Ave & A St	18"	3	< 2-yr	12	18	26	56	71
	9th Ave & A St	18"	3	< 2-yr	48	96	206	827	1260
	9th Ave & C St	18"	3	< 2-yr	9	11	14	27	36
	9th Ave & D St	18"	3	< 2-yr	22	30	41	89	115
14th Avenue Outfall	9th St	30"	17	< 2-yr	37	64	98	374	589
	8th St	36"	27	< 2-yr	28	32	48	210	344
	7th St	48"	58	< 100-yr	30	31	31	47	69
	5th St	54"	95	< 50-yr	59	74	89	195	303
	2nd St	66"	95	< 10-yr	69	90	114	172	203
	Before GW RR Crossing	66"	97	< 5-yr	91	136	192	417	543
	A St	66"	87	< 2-yr	98	118	126	171	188
	Island Grove Park North of D St	66"	87	< 2-yr	115	124	139	224	268
16th Avenue Ct. Outfall	2nd St	30"	24	< 50-yr	14	16	18	28	35
	GW Railroad Crossing	36"	32	< 2-yr	52	74	104	261	348

5.0 ALTERNATIVE ANALYSIS

5.1 ALTERNATIVE DEVELOPMENT PROCESS

An Alternative Analysis was completed to develop flood mitigation solutions for the problem areas identified in the previous section. Goals for mitigation focused on providing a minimum of storm drainage capacity meeting currently defined drainage criteria for the City of Greeley and developing solutions to reduce flooding on insurable structures. Consideration was also given to reducing infrastructure sizing and costs by incorporating regional detention, where applicable, and separating base flows from the Greeley No. 3 Canal, a significant contributor to downstream flood challenges. Finally, the alternative development process reviewed the benefits in implementing Low-Impact-Development (LID) practices along with a holistic review for flood protection through open channel means.

Design criteria and alternative category selection was reviewed at periodic progress meetings with City of Greeley Staff. Further discussion of each alternative plan is provided below, along with review of project benefits and costs for applicable option.

5.2 CRITERIA AND CONSTRAINTS

As noted above, goals for the baseline alternative plan was to provide storm drainage capacity to meeting currently defined drainage criteria set forth in the *City of Greeley Design Criteria and Construction Specifications Storm Drainage Volume II* (Reference 3) for the initial storm. Initial storm frequencies varied throughout the watershed based on City of Greeley zoning designation. The three categories used to define the minimum conveyance can be seen in Figure 5-3 and below in Table 5-1.

Table 5-1: Design Storm Frequency

Classification	Initial Storm Frequency	Major Storm Frequency
Residential	2-yr	100-yr
Commercial, Business & Industrial	5-yr	100-yr
Downtown Business Area, Airport Terminals and Industrial	10-yr	100-yr

For all alternatives, any outfall system that intercepted stormwater near a critical facility, or otherwise important structure including a school, hospital, government building, was sized to convey a minimum of the 10-year design flow regardless of the zoning classification.

For initial evaluations, detention alternatives were limited to a maximum of five feet of depth, with a minimum of one foot of freeboard at maximum capacity.

Railroad tunneling alternatives were assumed to have a minimum 5 foot of cover from the top of track rail.

5.3 ALTERNATIVE CATEGORIES

For each outfall system, multiple alternatives were evaluated in the initial screening process including:

- Improve storm drain infrastructure to convey initial storm runoff
- Improve storm drain infrastructure to the initial storm, and provide detention facilities to reduce infrastructure costs where applicable
- Provide protection to important structures by intercepting runoff exceeding the initial storm runoff
- Separate stormwater runoff base flows from the Greeley No. 3 Canal
- Development of a parkway style improvement with open channel conveyance
- Combination of alternatives
- Reducing runoff volume through the implementation of Low Impact Development (LID) techniques

Alternative Categories were reviewed with City Staff to determine feasibility of carrying them forward. It was decided costs would not be developed for the LID Implementation Alternatives or Parkway Alternatives given limited feasibility in implementation and constructability.

Table 5-2: Alternative Pre-Screening Matrix

Scenario	Constructability	Ability to Implement	Mitigates Flooding Hazards
Alternative 1 - Minimum Initial Storm Conveyance	Requires the least amount of construction of the alternatives	The majority of construction will occur within City ROW.	Flooding hazards associated with the initial storm would be mitigated
Alternative 2 - Minimum Initial Storm Conveyance with Detention	Requires additional construction of detention facilities	Some parcel acquisition will be required for proposed detention facilities	Due to the proposed detention facilities, flood hazards associated with the initial storm would be mitigated with smaller infrastructure
Alternative 3 - Canal Interception / Downtown Mitigation	Requires significantly larger infrastructure	Majority of construction will occur within City ROW but would require more closures due to the increase in infrastructure size. This alternative would also have more associated cost than previous alternatives	Flooding hazards along 7th Street Outfall and 12th Street would be mitigated to the 100-yr design flow level
Alternative 4 - Canal Base flow Separation	Requires larger infrastructure and additional crossings	Requires additional closure of roads due to infrastructure crossing the Canal	Flooding hazards would be mitigated to the 10-year design flow level for most of the downstream watershed
Alternative 5 - LID Implementation	Several LID techniques could be constructed within existing City ROW	Although existing City ROW contains the space required for streets with LID techniques, this alternative requires implementing LID techniques across the entire watershed	Although peak flow and total volume would be reduced, flooding hazards would not be significantly impacted
Alternative 6 - Parkway	Construction of open channel in roadway corridors will be difficult	Requires significant realigning of traffic patterns including multiple bridge crossings and removing access from existing streets	The parkway alternative would intercept all spill flow from the west at 14th Ave. and all spill flow from the south at 12th St.

Least Feasible — Most Feasible

5.4 ALTERNATIVE HYDRAULICS

Each alternative was modeled using SWMM to determine the pipe sizes necessary to meet the desired alternative criteria. The unsteady state HEC-RAS model was used to estimate the amount of spill flow from the Greeley No. 3 Canal for each alternative. The reduction in flooding potential throughout the basin was evaluated for all design storm frequencies using FLO-2D.

5.5 ALTERNATIVE COSTS

Alternative cost estimates were developed using UDFCD's master planning cost estimating spreadsheet UD-MP COST, version 2.2. 2012 unit cost values were adjusted to present value using the Colorado Construction Cost Index 2015 Fourth Quarter Report. A rolling four-quarter inflation rate of 1.2847 was used to adjust unit costs. A summary of unit costs can be found in Appendix C.

Operation and Maintenance was also included within the UD MP Cost worksheet. A minimum level-of-service for manhole and inlet maintenance was assumed to occur once every five years. The minimum level-of-service for maintenance on detention basins and water quality facilities was assumed to occur every other year.

Inlet quantities were calculated assuming an inlet interception capacity of 2 cfs for each inlet.

Costs for Water Quality Basins were estimated using the Complete-in-Place detention facility unit costs based on the necessary Acre-feet of Water Quality Capture Volume (WQCV) for each outfall.

Right of way easement costs were calculated from Weld County Assessor's information. Easement / ROW acquisition amounts were calculated as a percentage of the total actual land value. A detailed parcel assessment was completed by Foster Valuation LLC for the inadvertent detention area northwest of 11th Avenue and 2nd Street. This detailed cost estimate has superseded the Weld County Assessor's information in the cost estimates.

Dewatering, Traffic Control and Utility Coordination / Relocation were assigned based on the following percentages of capital costs: Dewatering (1%), Traffic Control (5%), Utility Coordination / Relocation (10%).

Special items that were added to the UD-MP COST spreadsheet include:

- Asphalt Patch: $50 / S.Y. (Pipes with diameter 42 inches and smaller)
- Asphalt Repaving: $40 / S.Y. (Pipes with diameter greater than 42 inches)
- Railroad Boring: $4500 / L.F. cell (An equivalent flow area of circular pipes were calculated to convey the design flow under railroads and Highway 85. This cost will be refined during conceptual design.)
- Water Line Lowering: $5000 / EA

No alterations were made to default values calculated as a percent of Capital Improvement Costs, such as Engineering, Legal/Administrative, Contract Administration/Construction Management, and Contingency.

5.6 ALTERNATIVE PLANS

5.6.1 MINIMUM INITIAL STORM CONVEYANCE ALTERNATIVE

The Minimum Initial Storm Conveyance Plan proposes to increase the capacity of the storm drain infrastructure to convey the initial storm design flow. The initial storm varies throughout the watershed based on the zoning classification found in Table 2-2 and Figure 5-3. An overview of this alternative can be found in Figure 5-4 and a more detailed schematic is included in Appendix C.

5.6.1.1 23RD AVENUE OUTFALL

The 23rd Avenue Outfall intercepts flow from a tributary area of approximately 110 acres and runs from 18th Street north along 23rd Avenue until the outfall into Luther Park West Detention Basin. The outfall system is designed to convey the 10-year design storm downstream of 16th Street in order to mitigate flooding hazards around Heath Middle School. The existing undersized infrastructure will be replaced with RCP ranging in size from 18 inches to 42 inches. The 100-yr peak flow in the storm drain system before the outfall into Luther Park West is approximately 89 cfs. There are both sanitary sewer and water line conflicts along this outfall alignment.

5.6.1.2 22ND AVENUE OUTFALL

The 22nd Avenue Outfall intercepts a tributary area of approximately 52 acres from 13th Street and 22nd Avenue, running north along 22nd Avenue before discharging into Luther Park West Detention Basin. This outfall helps mitigate some of the flooding at Maplewood Elementary School, and is sized to be a 10-year storm drain system. The existing detention basin at Maplewood that currently discharges onto 11th Street would be connected to the storm drain system. This storm drain system varies in size from 24 inches to 30 inches at pipe slopes between one and one and a half percent. The 100-year peak discharge into Luther Park West from the 22nd Avenue Outfall storm drain is approximately 44 cfs. There is an existing sanitary sewer between 11th Street and 12th Street and multiple water lines along the proposed alignment.

5.6.1.3 16TH AVENUE OUTFALL

The 16th Avenue Outfall has a tributary area of approximately 212 acres and is generally bounded by 13th Street on the north, 16th Avenue on the east, Glenmere Lake on the south, and 23rd Avenue to the west. The system is comprised of several laterals including one west on 13th Street, and one south of 16th Street. The storm drain system intercepts flow currently contributing to Moon Pond, which is significantly undersized. This system replaces the majority of the existing undersized 16th Street Outfall.

The lateral south of 16th Street intercepts a 2-year design flow at 21st Avenue and Glenfair Road conveying flow north to 16th Street. This lateral ranges in pipe size from 18 inches to 24 inches at a pipe slope of 1.5 to 2 percent. The 100-year peak flow of this system at 16th Street is approximately 28 cfs. There are multiple sanitary sewer and water line crossings along the proposed alignment before discharging into the 16th Avenue trunk line.

The lateral west along 13th Street, sized for a 2-year design storm, ranges in size from 18 inches to 24 inches at pipe slopes of approximately 1.5 percent. There is a sanitary sewer line along the north side of 13th Street that should be avoided as well as a water line at 21st Avenue. The 100-year peak discharge into the 16th Avenue trunk line is approximately 24 cfs.

The 16th Avenue trunk line will replace the existing undersized storm drain in 16th Street. The proposed alignment begins at 22nd Avenue following 16th Street west to 16th Avenue Court. The system will intercept the lateral south of 16th street at 18th Avenue. There is an existing sanitary sewer in the east bound lanes of 16th Street that should be avoided. The system turns north at 16th Avenue Court continuing along the east side of 16th Avenue Court to avoid the existing sanitary system to 13th Street. Several water lines will require lowering along 16th Avenue Court. At 13th

Street, the system intercepts the lateral west of 13th Street before turning north along 16th Avenue until the outfall into the Greeley No. 3 Canal. There are several sanitary crossings north of 13th Street that will have to avoided or relocated. An alternative alignment for this outfall is to continue the outfall along 13th Street to 15th Avenue. This would increase the overall length of the system but reduces the sanitary sewer conflicts.

The entirety of the trunk line is sized to convey a 10-year design flow to mitigate flooding hazards on Banner Health Medical Center. Throughout the trunk line, pipe sizes range from 24 inches at the upstream end to 60 inches along 16th Avenue Court at varying pipe slopes. The 100-year peak flow at the outfall of the system is approximately 162 cfs.

5.6.1.4 14TH AVENUE UPSTREAM OUTFALL

The 14th Avenue Outfall upstream of the Greeley No. 3 Canal intercepts a tributary area of approximately 100 acres. The outfall system is designed to convey the 10-year flow to mitigate flow damages on Greeley Central High School. The system replaces the undersized infrastructure of the existing 16th Street outfall system east of the proposed 16th Avenue Outfall. The outfall system runs east along 16th Street before continuing north on 14th Avenue. Flow from Glenmere Draw is intercepted into the 14th Avenue Outfall at the intersection of 14th Avenue and 16th Street.

Pipes sizes vary throughout from 18 inches to 48 inches at slopes from 0.5 percent to 2 percent. The 100-year peak discharge into the Greeley No. 3 Canal from the outfall system is approximately 89 cfs.

The existing 16th Street Outfall 36" pipe is proposed to remain in service from 15th Street to the Greeley No. 3 Canal to intercept local stormwater runoff. The existing outfall will have a 100-year peak flow of 30 cfs.

5.6.1.5 12TH AVENUE OUTFALL

The 12th Avenue Outfall has a 2-year design storm capacity extending from 20th Street north along 12th Avenue to the Greeley No. 3 Canal. The outfall has a tributary area of 146 acres ranging in diameter size from 18 inches to 36 inches. The 100-year peak flow from this outfall into the Greeley No. 3 Canal is approximately 72 cfs. An existing sanitary sewer runs along the east side of 12th Avenue in addition to multiple water line conflicts along the proposed alignment.

5.6.1.6 16TH STREET OUTFALL

The 16th Street Outfall intercepts flow along 10th Avenue from 19th Street to 16th Street. At 16th Street the storm drain system turns east to the discharge location into the Greeley No. 3 Canal. This outfall system in addition to the 17th Street Outfall will replace the existing 17th Street clay pipe system. The outfall is a 10-year system to help mitigate flooding hazards on the University of Northern Colorado Campus ranging in size from 18 inches to 30 inches. The 100-year peak discharge from the outfall system into the Greeley No. 3 Canal is 44 cfs. A sanitary sewer runs along the west side of 10th Avenue and water lines also run along the proposed alignment.

5.6.1.7 17TH STREET OUTFALL

The 17th Street Outfall intercepts flow east of the University of Northern Colorado Campus conveying flow north along 8th Avenue. At 17th Street the storm drain system turns east before the outfall into the Greeley No. 3 Canal. A 24 inch pipe will convey the design flow with pipe slopes varying between 1 and 2 percent. The 100-year peak discharge from this outfall into the Greeley No. 3 Canal is 20 cfs. The proposed alignment crosses a sanitary sewer on 17th Street between 7th and 8th Avenue in addition to several water lines.

5.6.1.8 16TH AVENUE COURT OUTFALL

The 16th Avenue Court Outfall improves the existing storm drain capacity to convey the 2-year design discharge. The outfall has a tributary area of 205 acres. The proposed system collects flow south of 2nd Street, along 17th Avenue and 20th Avenue Court, before continuing north to the Great Western Railroad. Pipes upstream of the Great Western Railroad vary in size from 18 inches to 42 inches. Due to the small change in grade over the entire outfall system, pipe south of the Great Western Railroad are limited to 0.2 to 0.5 percent. A 54 inch RCP pipe is proposed to be tunneled under the Great Western Railroad continuing north along 17th Avenue at a 0.5 percent slope until discharging where the existing system outfalls, into the pond west of the Greeley Stampede. Multiple water line and sanitary sewer conflicts exist along the proposed alignment.

5.6.1.9 14TH AVENUE OUTFALL

The 14th Avenue Outfall is comprised of storm drain system to convey the 2-, 5-, and 10-year design discharge. The system has a tributary area of 386 acres and is generally bounded by the Cache La Poudre River to the north, 14th Avenue to the east, 10th Street to the south, and the Greeley No. 3 Canal to the west. This outfall system will require a significant tunneling operation at the Great Western Railroad north of 2nd Street. A significant increase in infrastructure is required for the 14th Avenue Outfall compared to upstream outfalls. This is due to the restrictions in pipe slope as the system nears the Cache La Poudre River. The 14th Avenue Outfall has laterals along 4th, 5th, 8th, 9th Streets.

The 9th Street lateral, designed to convey the 5-year design discharge, proposes a 36 inch at 0.3 percent slope from 18th Avenue to 14th Avenue. The 100-year peak discharge from this lateral into the 14th Avenue storm drain system is 32 cfs. There are two sanitary sewer crossings along the proposed alignment as well as multiple water line conflicts along the proposed alignments.

The 8th Street lateral, a 2-year capacity system, proposes a 24 inch RCP at 0.5 percent slope from 16th Avenue to 14th Avenue. The 100-year peak discharge from the 8th Street Lateral is 14 cfs. There is a sanitary sewer along the north side of 8th Street that should be avoided, and water lines in conflict with the proposed alignment.

The 5th Street lateral, designed as a 2-year capacity storm drain system, collects flow generally bounded by 15th Avenue Court on the east, 7th Street on the south, Greeley Canal No. 3 on the west, and 5th Street to the north. Due to a lack in grade change in this area, pipe slopes are limited to 0.2 to 0.5 percent with pipes ranging from 24 inches to 36 inches. Flows south of 6th Street are collected and conveyed to 15th Avenue Court where the system turns north and intercepts a lateral along 6th Street. The pipe system continues north to 5th Street where it meets a lateral along 5th Street conveying flow east to the 14th Avenue trunk line. The 100-year peak discharge from the storm drain system into the 14th Avenue trunk line is 42 cfs.

The 4th Street lateral proposes to increase the existing storm drain capacity that collects local neighborhood flow east of the 16th Avenue Court Outfall in order to accommodate a 2-year design flow. The existing storm drain passes through Billie Martinez Elementary School property so an easement cost has been included for the new proposed

storm alignment. Upgrading the pipe system to an 18 inch pipe at 0.5 percent slope will convey the 2-year design flow.

The 14th Avenue trunk line begins at 9th Street continuing north until it discharges into the Cache La Poudre River. From 9th Street to 5th Street pipes ranging from 42 inches to 48 inches will convey the 5-year design flow at 0.2 percent. To help mitigate flooding near Billie Martinez Elementary School, the 14th Avenue trunk downstream of 5th Street was designed to convey a 10-year design flow. Limited by a pipe slope of 0.2 percent to meet the necessary ground cover, an 7 foot by 5 foot box culvert is needed to convey the 10-year design flow downstream of 5th Street. At the Great Western Railroad a crossing structure equivalent to a 10 foot by 5 foot box culvert is required and will need to be tunneled under the railroad. Downstream of the Great Western Railroad, pipe slope is limited to 0.1 percent creates the need for a 12 foot x 4 foot box culvert to convey the 10-yr design flow. At the outfall at the Cache La Poudre River, the 14th Avenue Outfall is an 11 foot x 5 foot culverts, discharging a 100-year peak discharge in the storm drain of 295 cfs.

An 8.1 Acre-foot water quality capture volume (WQCV) facility is proposed at the downstream end of the outfall to treat the discharge before the water enters the Cache La Poudre River.

5.6.1.10 1ST STREET OUTFALL

The 1st Street Outfall is generally bounded by the Cache La Poudre River to the north and east, 5th Street to the south, and 13th Avenue to the west, has a tributary area of 290 acres. The entire outfall system is designed to convey a 5-year design flow. The system is comprised of laterals south of A Street, west on A Street, and north of A Street. The change in grade within the 1st Street Outfall area significantly impacts the required infrastructure size as the main outfall path is limited to 0.1 percent slope. The outfall path is proposed to move one block north from the existing 1st Street location to A Street due to the significant amount of sanitary sewer conflicts along 1st Street.

The lateral south of A Street conveys flow east from 11th Avenue and 2nd Street to the intersection of 9th Avenue and 3rd Street where the system turns north along 9th Avenue. The proposed improvements east along 3rd Street removes the storm drain system from private property as the existing system is currently aligned, but requires a pipe slope of 0.1 percent given the additional length the system is required to extend. The minimal pipe slope requires pipes ranging from 18 inches to 54 inches. A 54 inch RCP is needed to be tunneled under the Great Western Railroad. Multiple sanitary and water line utilities exist along the proposed alignment. The lateral south of A Street has a 100-year peak discharge into the 1st Street Outfall of 77 cfs.

The lateral west on A Street conveys flow east on A Street from 11th Avenue to 9th Avenue. This lateral requires a 36 inch RCP at 0.3 percent slope contributing a 100-year peak discharge into the 1st Street Outfall of approximately 32 cfs. There are several sanitary and water line crossings that will need to be avoided or relocated with the proposed improvements.

The lateral north of A Street ranges in diameter from 42 inches to 48 inches contributing 40 cfs into the 1st Street Outfall during the 100-year design storm.

The 1st Street Outfall from 9th Avenue and A Street conveys flow east to the Cache La Poudre River. The outfall system is limited to a 0.1 percent slope to pass under 8th Avenue and the Union Pacific Railroad with adequate cover. A crossing structure equivalent to a 10 foot by 4 foot box culvert is required to convey the design discharge under 8th Avenue and Union Pacific Railroad. The 100-year peak discharge from the 1st Street Outfall system into the Cache La Poudre River is 188 cfs.

A 5.0 Acre-foot WQCV basin is proposed at the downstream end of the outfall before the water discharges into the Cache La Poudre River.

5.6.1.11 5TH STREET OUTFALL

The 5th Street outfall has a tributary area of 74 acres and was sized to convey the 5-year design flow. The outfall extends west from the Cache La Poudre River along 5th Street to 6th Avenue. Pipes varying from 18 inches to 30 inches at slopes between 0.5 and 1.0 percent are required to convey the design discharge. There are sanitary and water line crossings along the proposed alignment.

5.6.1.12 7TH STREET OUTFALL

The 7th Street Outfall's tributary area is bounded generally by 5th Street to the north, the Cache La Poudre River to the east, 11th Street to the South, and 14th Avenue to the west. The outfall has a tributary area of 300 Acres and is responsible for conveying flow from the commercial district north of 11th Street. The majority of the outfall system is sized to convey the 10-year design flow but does include some 2-year and 5-year design flow conveyance laterals at the upstream end of the 8th Avenue lateral. Due to the significant amount of utilities present and the amount of roadway disruption required due to the infrastructure size, it is unlikely the final alignment of the lateral collecting flow from the south will be along 10th Street or 8th Avenue.

The southern lateral of the 7th Street Outfall intercepts flow east on 10th Street from 14th Avenue to 8th Avenue. Pipe slopes are limited to 0.2 percent along 10th Street and will require pipe sizes ranging from a 48 inch RCP to a 9 foot by 5 foot box culvert at 8th Avenue. Pipe slopes gradually increase as the lateral turns north along 8th Avenue, ranging from 0.3 to 0.4 percent requiring a 9 foot by 4 foot box culvert to convey the 10-year design discharge.

The 7th Street trunk conveys flow east from 12th Avenue around the Union Colony Civic Center along 7th Street to the Cache La Poudre River. Pipes range in size from 24 inches along smaller laterals to 60 inches along 7th Street from 10th Avenue to 8th Avenue. A box culvert is required downstream of 8th Avenue to convey the 10-year design flow. This will increase the conveyance system in size from a 9 foot by 4 foot box culvert to an 11 foot by 5 foot box culvert at the outfall location into the Cache La Poudre River. A tunneling structure equivalent to a 9 foot by 4 foot box culvert is required to convey the design flow underneath the railroad. The majority of the trunk line is limited in pipe slope to 0.3 percent. There are numerous water line conflicts along the trunk line in addition to several sanitary sewer conflicts near the outfall.

A 5.8 Acre-foot WQCV basin is proposed to treat the outfall discharge before the water enters the Cache La Poudre River.

5.6.1.13 9TH STREET OUTFALL

The 9th Street Outfall has a tributary area of 31 acres. A proposed 5-year design flow is conveyed through pipes ranging in size from 18 inches to 30 inches. There are sanitary crossings near 4th Avenue and at 3rd Avenue that will need to be avoided as well as several water lines conflicts along the proposed alignment. The 9th Street Outfall has a 100-year peak discharge of 25 cfs into the Cache La Poudre River.

5.6.1.14 11TH STREET OUTFALL

The 11th Street Outfall is sized to convey a 2-year design flow from 5th Avenue east to 2nd Avenue. This outfall has a tributary area of approximately 30 acres and requires pipes ranging in size from 18 inches to 30 inches. At 12th Avenue the 11th Street Outfall is proposed to tie into the existing outfall along 2nd Avenue which follows 2nd Avenue north to the Cache La Poudre River. There are multiple water line conflicts along the proposed alignment in addition to a sanitary sewer crossing at 3rd Avenue.

5.6.1.15 12TH STREET OUTFALL

The 12th Street Outfall, generally bounded by 11th Street to the north, Highway 85 on the east, 16th Street to the south, and the Greeley No. 3 Canal to the west and has a tributary area of 337 acres. The proposed outfall will convey flows east along 12th Street across Highway 85 before discharging into the Cache La Poudre River, intercepting flow that is currently conveyed by the undersized 13th Street / 2nd Avenue Outfall. The outfall intercepts flows from laterals south of 12th Street both west and east of the railroad crossing.

The lateral west of the railroad, designed to convey the 5-year design flow, contains pipes ranging in size from 36 inches to 60 inches. Pipe slopes vary from 0.25 percent to 1.2 percent. The system is proposed to disconnect the 13th Street Outfall in order to minimize the number of railroad crossings and use a 9 foot by 5 foot box culvert to convey the lateral flow north along 7th Avenue. Numerous water line and sanitary crossing exist along the proposed alignment.

The lateral east of the railroad is designed to convey the 5-year design flow and generally follows the alignment of the existing storm drain system. A 36 inch RCP is proposed from 4th Avenue and 16th Street to convey flow north to 15th Street where the system runs east along 15th Street to 3rd Avenue. The system turns north at 3rd Avenue and is conveyed to the existing 13th Street Outfall. The existing 13th Street Outfall collects the lateral at 3rd Avenue, intercepting another lateral at 2nd Avenue before turning north along 2nd Avenue to the 7th Street Outfall trunk line. The lateral east of the railroad had a 100-year peak discharge into the 12th Street outfall of approximately 23 cfs. There are several water line conflicts and sanitary crossings along 3rd Avenue between 14th and 15th Street and between 13th and 14th Street.

The 12th Street trunk extends from the Cache La Poudre River west to 14th Avenue. Pipes slopes range from 0.3 to 0.5 percent along the trunk line. The trunk line and associated laterals consist of pipes ranging in diameter from 24 inches to 60 inches upstream of 10th Avenue. Downstream of 10th Avenue, box culverts are required to convey the 10-year design flow ranging in size from a 6 foot by 4 foot to twin 8 foot by 5 foot box culverts at the outfall into the Cache La Poudre River. A crossing structure equivalent to a 10 foot by 5 foot box culverts will require tunneling under the railroad. The lateral west of the railroad is intercepted by the trunk line at 7th Avenue and the lateral east of the railroad is intercepted by the trunk line at 2nd Avenue. An equivalent crossing structure of twin 8 foot by 5 foot box culverts is required to convey the flow underneath Highway 85. There are several sanitary crossings along the trunk line at 3rd, 7th, 8th, 9th, and 11th Avenue and numerous water lines along the proposed improvements.

A 6.6 Acre-foot WQCV is proposed on the east side of Highway 85 to treat the discharge before the water is released into the Cache La Poudre River.

5.6.1.16 HIGHWAY 85 OUTFALL

The Highway 85 Outfall conveys flow north along Highway 85 from the southernmost portion of the watershed to the Cache La Poudre River. This outfall is sized to convey the 5-year design flow and includes tunneling a 42" RCP under Highway 85 at 18th Street to convey flows from the west side of Highway 85 to the east. This proposed alternative increases the existing pipe to a 54 inch RCP that intercepts flow at 15th Street and conveys flow north along Highway 85, day lighting north of 12th Street. This structure at 15th Street controls the flow that the Highway 85 Outfall system contributes to offsite basins. Any flow not intercepted by the structure at 15th Street will divert east out of the North Greeley and Downtown Basin.

5.6.2 MINIMUM INITIAL STORM CONVEYANCE WITH DETENTION ALTERNATIVE

The Minimum Initial Storm Conveyance with Detention Alternative proposes detention basins at key locations throughout the watershed to reduce downstream infrastructure and increase water quality throughout the watershed. Detention basins were limited to a maximum depth of 5-feet. Several areas were not considered for detention after considering property acquisition and difficulty of construction including Lincoln Park and areas along the Union Pacific Railroad.

An overview of this alternative can be found in Figure 5-5, and a detailed schematic of this alternative is included in Appendix C.

The FLO-2D flooding depths associated with the Minimum Initial Storm Conveyance Alternative were carried forward to this alternative. The Minimum Initial Storm Conveyance with Detention Alternative would reduce the required infrastructure to reduce the same extent of flooding hazard as the Minimum Initial Storm Conveyance Alternative.

All WQCV basins proposed in the Minimum Initial Storm Conveyance Alternative are included in this alternative.

5.6.2.1 22ND AVENUE OUTFALL

Increasing the footprint of the existing Maplewood Detention Basin could provide a maximum storage capacity of 4.6 Acre-feet without requiring any property acquisition. The proposed improvements would reduce the infrastructure from Maplewood Elementary to Luther Park West Detention Basin from a 30 inch diameter RCP to an 18 inch RCP.

The property north of 10th Street near Luther Park provides another opportunity to implement detention within the watershed without requiring property acquisition. The proposed detention basin north of Luther Park wouldn't reduce the size of any infrastructure downstream as it discharges into the Greeley No. 3 Canal, but this detention basin would reduce the amount of spill flow from the Greeley No. 3 Canal and provide water quality to stormwater runoff before entering the canal. The proposed detention basin provides a maximum storage capacity of 3.7 Acre-feet. There is an existing stormceptor in the area of the proposed detention in Luther Park North Detention Basin that would need to be relocated or reconstructed if this alternative was selected.

5.6.2.2 16TH AVENUE OUTFALL

The addition of a detention basin at the baseball field west of Greeley Central High School would reduce the infrastructure required downstream of 15th Street from a 48 inch diameter RCP to a 36 inch RCP. The proposed

detention basin would have a maximum storage capacity of 8.5 Acre-feet and could be designed to minimally impact the use of the baseball field.

The proposed improvements to the Moon Pond detention basin would require property acquisition, but eliminates the need for a box culvert along 16th Avenue, conveying the design flow from Moon Pond to the Greeley No. 3 Canal through a 42 inch RCP. The improved detention facility also reduces spill flow from the Greeley No. 3 Canal. The proposed detention area has a maximum storage capacity of 4.3 Acre-feet.

5.6.2.3 14TH AVENUE OUTFALL

The acquisition of two undeveloped private parcels west of 14th Avenue and south of the Great Western Railroad would provide the opportunity to detain local runoff and spill flow from the west, reducing the structure required to be tunneled under the Great Western Railroad. These two parcels would provide a maximum storage capacity of 3.3 Acre-feet, reducing the tunnel crossing structure from an equivalent 10 foot by 4 foot box culvert structure to a crossing structure equivalent to 9 foot by 4 foot box culverts. The conveyance system gradually increases in size as flow is intercepted downstream until the outfall with the Cache La Poudre River through an 11 foot by 5 foot box culvert. The 8.1 Acre-foot WQCV basin proposed in the Minimum Initial Storm Conveyance Alternative is included in this alternative.

5.6.2.4 1ST STREET OUTFALL

At the northwest corner of 11th Avenue and 2nd Street an undeveloped private parcels provides a great opportunity to implement detention and downsize downstream infrastructure. Formalizing the storage at this location, which already serves as inadvertent storage, reduces the size of infrastructure necessary to convey the design flow downstream. The proposed detention basin has a maximum storage capacity of 12.6 Acre-feet, reducing the infrastructure required to convey the design flow from a 48 inch RCP to an 18 inch RCP along 3rd Street. The proposed detention reduces this structure north along 9th Avenue from a 54 inch to a 42 inch RCP. Although this alternative would require parcel acquisition, the reduction in infrastructure results in an overall reduction in project cost when compared to the Minimum Initial Storm Conveyance Alternative. The 5.0 Acre-foot WQCV basin proposed in the Minimum Initial Storm Conveyance Alternative is included in this alternative.

5.6.3 CANAL INTERCEPTION / DOWNTOWN MITIGATION ALTERNATIVE

The Canal Interception / Downtown Mitigation Alternative provides 100-year protection to the commercial district, intercepting the 100-year design flow along the 7th Street and 12th Street Outfalls. Spill flow from the Greeley No. 3 Canal in addition to local runoff will be intercepted by the two proposed 100-year outfalls.

The infrastructure required is described below and an overall alternative schematic can be seen in Figure 5-6. A more detailed schematic of this alternative is included in Appendix C..

All WQCV basins proposed in the Minimum Initial Storm Conveyance Alternative are included in this alternative.

5.6.3.1 7TH STREET OUTFALL

The Canal Interception / Downtown Mitigation alternative requires the infrastructure of the 7th Street outfall to convey the 100-year design flow east of 11th Avenue for both the trunk line and the lateral to the south along 8th Avenue and 10th Street.

A pipe slope restriction of 0.2 percent on the southern lateral results in a double cell 11 foot by 5 foot box culvert to convey the design flow along 10th Street from 11th Avenue to 8th Avenue. After turning north on 8th Avenue the pipe slope can be increased to vary between 0.3 and 0.4 percent, requiring a double 9 foot by 5 foot box culvert to convey the 100-year discharge. The southern lateral of the 7th Street Outfall contributes approximately 680 cfs to the trunk line at 8th Avenue. As mentioned in the Minimum Initial Storm Conveyance Alternative, the proposed alignment was selected to determine the necessary structure size and does not represent the specific alignment that would be constructed.

Intercepting the 100-year design flow requires box culverts to extend west of Union Colony Civic Center to 12th Avenue. Box Culvert structures are necessary along the entire trunk line to convey the 100-year flow. A 12 foot by 5 foot box culvert conveys the 100-year design flow at a pipe slope of 0.3 percent from 10th Avenue to 8th Avenue where the trunk line intercepts the southern lateral. Conveying the 100-year design flow will require a crossing structure equivalent to a triple cell 10 foot by 5 foot box culvert at the railroad crossing. Conveying the flow east on 7th Street, from 6th Avenue to 4th Avenue, the pipe slope is limited to 0.3 percent, requiring a triple cell 12 foot by 5 foot culvert structure to convey the 100-year peak flow of approximately 1185 cfs. Downstream of 4th Avenue to the Cache La Poudre River the pipe slope is limited to 0.2 percent requiring a triple cell 11 foot by 6 foot box culvert.

5.6.3.2 12TH STREET OUTFALL

The 12th Street Outfall intercepts and conveys the 100-year design flow for the entire trunk line, traveling from the Cache La Poudre River upstream to 14th Avenue. A box culvert structure varying in size from an 8 foot by 4 foot culvert to twin 12 foot by 5 foot culverts convey the design flow to the railroad crossing. To convey the 100-year peak flow of 1051 cfs under the railroad, a tunneling structure equivalent to a twin 12 foot by 6 foot box culvert will be necessary. Box culvert sizes gradually increase in size downstream of the railroad crossing to Highway 85 where a structure equivalent to a three cell 12 foot by 5 foot culvert will be required to convey the 100-year peak flow of 1280 cfs underneath Highway 85 before the outfall into the Cache La Poudre River.

5.6.4 GREELEY NO. 3 CANAL BASE FLOW SEPARATION ALTERNATIVE

The Canal Base Flow Separation Alternative proposes to separate the 10-year design flow from the Greeley No. 3 Canal by intercepting the flow upstream of the Canal and conveying it to the major storm drain systems downstream of the canal. The separation of base flow leads to a significant reduction of spill flow from the Greeley No. 3 Canal but requires the majority of the downstream infrastructure to be upsized to convey the 10-year flow. Differences between the Minimum Initial Storm Conveyance Alternative and this alternative are described below and an overall schematic can be found in Figure 5-7. A more detailed schematic can be found in Appendix C.

5.6.4.1 14TH AVENUE OUTFALL

The Greeley No. 3 Canal Base Flow Separation Alternative proposes to extend the 14th Avenue Outfall upstream along 9th Street to intercept the 10-year design flow from Luther Park. The proposed 48 inch RCP will convey flow from Luther Park to 14th Avenue and 9th Street. The proposed alternative increases the conveyance capacity of the entire trunk line of 14th Avenue to convey the 10-year design flow. To convey the 10-year design flow, box culverts are required for the entire length of the 9th Street lateral as well as the 14th Avenue Outfall trunk line. Box culvert sizes range from 6 foot by 4 foot at 9th Street and 17th Avenue Park to an 11 foot by 4 foot just upstream of the Great

Western Railroad crossing. Downstream of the Great Western Railroad the outfall system is limited to a 0.1 percent slope requiring a structure equivalent to an 11 foot by 5 foot box culvert to convey the 100-year design flow of 275 cfs underneath the railroad. The outfall system gradually increases in size downstream of the railroad until the outfall discharges into the Cache La Poudre River through a 12 foot by 6 foot box culvert.

5.6.4.2 12TH STREET OUTFALL

Several laterals along the 12th Street Outfall have also extended upstream to separate the base flow from the Greeley No. 3 Canal. Upstream flow from the following outfalls is proposed to be intercepted and conveyed to the 12th Street Outfall: 16th Avenue Outfall, 14th Avenue Outfall, 12th Avenue Outfall, 16th Street Outfall, and the 17th Street Outfall.

The lateral west of the railroad intercepts the 12th Avenue Outfall, 16th Street Outfall, and 17th Street Outfall. Intercepting the 10-year design flow upstream of the canal requires a significant amount of the lateral west of the railroad infrastructure to be upsized in order to convey the 10-year design flow to the 12th Street Outfall trunk line. A 48 inch RCP pipe conveys the 10-year design flow from the 12th Avenue Outfall downstream to 13th Street and 8th Avenue. A 36 inch RCP pipe conveys the 16th Street Outfall along 16th Street turning north on 8th Avenue. The 17th Street Outfall is conveyed through a 36 inch RCP north along 6th Avenue before turning west on 13th Street. A 10 foot by 5 foot box culvert is required to convey the 330 cfs from the lateral west of the railroad to the 12th Street Outfall trunk line.

The 16th Avenue and 14th Avenue Outfalls are intercepted by box culvert structures and conveyed to the 12th Street Outfall at 14th Avenue. Downstream of 14th Avenue, box culverts increase from 8 foot by 4 foot culverts to an 11 foot by 4 foot culvert just upstream of 7th Avenue where the trunk line intercepts the lateral west of the railroad. The Greeley No. 3 Canal Base Flow Separation Alternative will require a structure tunneled under the railroad equivalent to twin 10 foot by 4 foot box culverts to convey the 10-year design flow of 593 cfs. Downstream of the railroad crossing the outfall system gradually increases until Highway 85 where a crossing structure equivalent to twin 10 foot by 5 foot box culverts are necessary to convey the 10-year design flow of 764 cfs.

5.6.5 VOLUME REDUCTION ALTERNATIVES

Two scenarios were developed to evaluate the impact of implementing LID techniques to reduce peak flows and total runoff volume.

The 6th Avenue corridor was modeled to determine the effect of implementing LID techniques within City of Greeley right-of-way. The existing right-of-way provides opportunity to implement LID techniques, reducing the imperviousness of the watershed, while still meeting all roadway criteria. Impervious values were revised to reflect the increase of pervious surface within the watershed.

Implementing LID techniques promotes additional infiltration and longer conveyance times, decreasing both peak runoff and total runoff volume. LID techniques that could be implemented within the watershed include bio retention, grass swales, porous pavements, and porous landscape detention. This scenario was modeled using the Directly Connected Impervious Area (DCIA) level 2 option within CU-HP. Results from a sample subwatershed can be seen below and additional subwatershed results can be seen in Appendix C.

Table 5-3: Runoff Volume using LID Techniques

Scenario	% Imp	Peak Flow (cfs)	Total Runoff (Ac-ft)	Volume Reduction (%)
Existing	70.8	36	1.793	
Pervious	59.6	30	1.589	-11%
Pervious + Swale Conveyance	59.6	28	1.452	-21%

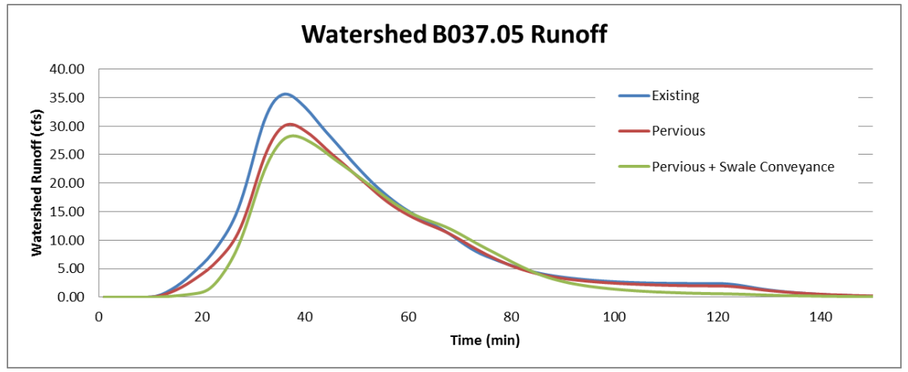


Figure 5-1: Implementation of LID Techniques

All subwatersheds were modeled using the DCIA level 2 option, simulating the impact of implementing LID techniques throughout the entire watershed. The results of this analysis can be found below in Table 5-4 and Figure 5-2. While implementing LID techniques does not have a significant impact on the major storm frequencies, reducing the total runoff volume for the 50-, and 100-year design storms less than 10 percent, implementing LID techniques across the entire watershed can have a major impact on frequent storms, reducing total volume by over 20 percent for the 5-year storms and as much as 37 percent for the 2-year storm. This could significantly reduce drainage infrastructure needs, or expand the reach of planned infrastructure capacity. Challenges in globally implementing LID lie within the time required to consistently implement these strategies and political coordination between City entities and property owners. Regardless, it is recommended that LID strategies be implemented where feasible and evaluated on a site by site basis when redevelopment or transportation project occur.

Table 5-4: Impact of DCIA on Total Watershed Runoff

Design Storm	Existing Conditions Volume (Ac-ft)	DCIA Level 2 Volume (Ac-ft)	Volume Reduction
2-yr	137.66	86.36	37%
5-yr	222.47	174.46	22%
10-yr	277.82	235.91	15%
50-yr	480.70	449.81	6%
100-yr	565.42	537.49	5%

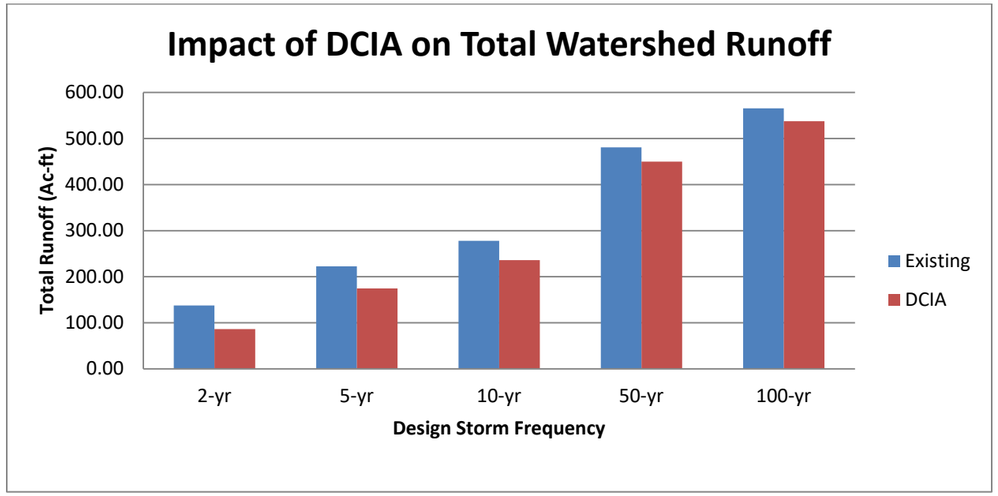


Figure 5-2: Impact of DCIA on Total Watershed Runoff

5.6.6 PARKWAY ALTERNATIVE

The Parkway Alternative was developed to review feasibility in implementing a large scale flood control channel to increase flood management with in the North Greeley and Downtown Basin. This alternative proposes two open channel alignments extending from the Greeley No. 3 Canal, one north along 14th Avenue and the other east along 12th Street. From a conveyance standpoint, the proposed drainageways will collect and convey discharge up to the 100-year levels from the upstream watershed, prior to the flood flows entering downtown. The channel would also have the potential to manage extended peak flows from the canal. In addition to flood conveyance, the parkway option would potentially define an open space trail corridor between the No. 3 Canal and the Cache La Poudre River. Challenges with this option are that it would take strong political will and support to implement. The 14th Avenue parkway would require acquisition of property associated with 109 individual parcels, 97 privately owned. The 13th Street parkway requires acquisition impacting an additional 126 privately owned parcels. An exhibit of the approximate extents of a parkway alternative can be found in Appendix C. For this study, this alternative was not pursed beyond this concept. Due to the many challenges with implementation, effect on land use, transportation, and potential utility conflicts, future feasibly studies would need to be pursued to more formally define the best conveyance alignment, project costs, economic, and social benefits of pursuing this type of project.

5.6.7 ALTERNATIVE PLAN HYDRAULIC RESULTS COMPARISON

The magnitude of the spill flow from the Greeley No. 3 Canal was evaluated for each alternative. It was identified that the implementation of Alternative 1 as defined by the models, has the potential to change the distribution of flows entering and exiting the canal. These changes can be attributed to timing and locational changes to inflow hydrographs entering the canal from changes in the storm drainage infrastructure. Design in this manner will need to give further consideration to canal spill changes and manage adverse through collection systems and spill control improvements. In comparison, by separating base flows form the No. 3 Canal, Alternative 4 shows a significant reduction in spill flow as the majority of flow upstream of the canal is conveyed through additional storm drain infrastructure to downstream outfall systems and not discharged as significantly into the canal.

Table 5-5: Greeley No. 3 Canal Spill Comparison

Location	2005 Master Plan					2016 Existing Conditions					Alternative 1					Alternative 2					Alternative 4				
	02-yr	05-yr	10-yr	50-yr	100-yr	02-yr	05-yr	10-yr	50-yr	100-yr	02-yr	05-yr	10-yr	50-yr	100-yr	02-yr	05-yr	10-yr	50-yr	100-yr	02-yr	05-yr	10-yr	50-yr	100-yr
23rd Ave. & 5th St.	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5th St. & 6th St.	0	0	0	24	33	0	0	0	20	45	0	0	0	20	44	0	0	0	16	38	0	0	0	17	50
6th St. & 9th St.	0	0	0	30	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37
9th St. & 18th Ave.	3	14	29	182	217	5	8	13	180	292	4	8	23	196	284	4	7	14	103	228	0	1	4	32	113
10th St. & 12th St.	99	256	348	708	832	23	45	83	304	431	46	77	119	326	444	33	47	65	185	342	0	2	8	137	242
12th St. & 13th Ave	95	226	309	646	853	53	72	93	264	358	59	76	94	240	337	55	67	82	185	281	13	20	26	88	122
13th Ave. & 11th Ave.	72	121	148	295	383	50	67	87	193	267	58	77	98	207	282	53	72	94	208	283	23	28	33	114	194
11th Ave. & 15th St.	10	54	76	154	177	0	1	11	55	77	0	6	16	56	78	0	4	15	56	78	0	0	0	21	45
15th St. & 8th Ave.	97	140	161	248	285	62	74	86	133	156	65	76	86	128	153	63	75	85	128	153	54	54	54	78	98
8th Ave. & 18th St.	53	94	111	173	192	27	35	46	105	139	18	24	33	88	124	18	24	32	88	125	17	17	17	45	62
East of UNC Physical Plant	0	24	48	146	183	0	0	0	18	52	0	0	0	17	45	0	0	0	17	46	0	0	0	6	31
Upstream of 22nd St.	64	103	117	160	172	36	45	57	118	144	19	31	43	108	135	18	30	43	108	135	11	21	32	100	130
22nd Street & U.S. Highway 85 Bypass	14	16	17	18	18	16	16	16	17	17	16	16	16	16	17	16	16	16	16	17	16	16	16	16	17

5.6.8 ALTERNATIVE PLAN COST ESTIMATES COMPARISON

A comparison of total project cost for each alternative can be found below. A detailed cost breakdown of each alternative plan can be found in Table 5-7 through Table 5-10.

Table 5-6: Alternative Plan Cost Estimate Summary

Alternative Plan	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	50-YEAR O&M COST
Alternative 1 - Minimum Initial Storm Conveyance	$ 73,202,625	$ 5,051,656	$ 10,980,392	$ 3,660,128	$ 7,320,267	$ 18,300,658	$ 118,515,726	$ 1,398,720
Alternative 2 - Minimum Initial Storm Conveyance with Detention	$ 70,956,457	$ 5,051,656	$ 10,643,467	$ 3,547,820	$ 7,095,650	$ 17,739,116	$ 115,034,166	$ 1,398,720
Alternative 3 - Canal Interception / Downtown Mitigation	$ 128,150,062	$ 5,051,656	$ 19,222,508	$ 6,407,500	$ 12,815,009	$ 32,037,520	$ 203,684,255	$ 1,696,707
Alternative 4 - Greeley No. 3 Canal Base flow Separation	$ 88,138,662	$ 5,051,656	$ 13,220,800	$ 4,406,932	$ 8,813,871	$ 22,034,668	$ 141,666,589	$ 1,394,660

Table 5-7: Minimum Initial Storm Conveyance Cost Estimate

Alternative 1 Upstream - Minimum Initial Storm Conveyance

REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
23rd Ave. Outfall	$ 1,433,531	$ -	$ 215,030	$ 71,677	$ 143,353	$ 358,383	$ 2,221,974	$ 563	$ 19,705
22nd Ave. Outfall	$ 525,349	$ -	$ 78,802	$ 26,267	$ 52,535	$ 131,337	$ 814,290	$ 320	$ 11,200
16th Ave. Outfall	$ 2,926,161	$ -	$ 438,924	$ 146,308	$ 292,616	$ 731,540	$ 4,535,549	$ 1,242	$ 43,470
14th Ave. US Outfall	$ 952,119	$ -	$ 142,818	$ 47,606	$ 95,212	$ 238,030	$ 1,475,785	$ 435	$ 15,225
12th Ave. Outfall	$ 1,684,315	$ -	$ 252,647	$ 84,216	$ 168,432	$ 421,079	$ 2,610,689	$ 550	$ 19,250
16th St. Outfall	$ 704,066	$ -	$ 105,610	$ 35,203	$ 70,407	$ 176,017	$ 1,091,303	$ 346	$ 12,110
17th St. Outfall	$ 432,402	$ -	$ 64,860	$ 21,620	$ 43,240	$ 108,101	$ 670,223	$ 256	$ 8,960
Total	$ 8,657,943	$ -	$ 1,298,691	$ 432,897	$ 865,795	$ 2,164,487	$ 13,419,813	$ 3,712	$ 129,920

Alternative 1 Downstream - Minimum Initial Storm Conveyance

REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
16th Ave. Ct. Outfall	$ 1,968,363	$ 55,739	$ 295,255	$ 98,418	$ 196,837	$ 492,091	$ 3,106,703	$ 320	$ 11,200
14th Ave. Outfall	$ 2,139,847	$ 9,665	$ 320,977	$ 106,992	$ 213,986	$ 534,962	$ 3,326,429	$ 769	$ 26,915
14th Ave. Outfall Trunk	$ 10,132,668	$ 204,414	$ 1,519,900	$ 506,633	$ 1,013,267	$ 2,533,167	$ 15,910,049	$ 9,038	$ 316,327
1st St. Outfall	$ 11,168,053	$ 482,543	$ 1,675,208	$ 558,402	$ 1,116,806	$ 2,792,013	$ 17,793,025	$ 6,162	$ 215,668
5th St. Outfall	$ 366,075	$ -	$ 54,911	$ 18,304	$ 36,608	$ 91,519	$ 567,417	$ 192	$ 6,720
7th St. Outfall	$ 9,399,107	$ 1,455,165	$ 1,409,865	$ 469,955	$ 939,911	$ 2,349,777	$ 16,023,780	$ 7,395	$ 258,823
7th St. Outfall - 8th Ave.	$ 4,648,585	$ -	$ 697,288	$ 232,429	$ 464,859	$ 1,162,146	$ 7,205,307	$ 1,037	$ 36,295
9th St. Outfall	$ 451,419	$ 6,325	$ 67,713	$ 22,571	$ 45,142	$ 112,855	$ 706,025	$ 243	$ 8,505
11th St. Outfall	$ 295,207	$ -	$ 44,281	$ 14,760	$ 29,521	$ 73,802	$ 457,571	$ 128	$ 4,480
12th St. Outfall	$ 5,152,026	$ -	$ 772,804	$ 257,601	$ 515,202	$ 1,288,006	$ 7,985,639	$ 2,598	$ 90,929
12th St. Outfall Trunk	$ 16,400,369	$ 2,837,805	$ 2,460,055	$ 820,018	$ 1,640,037	$ 4,100,092	$ 28,258,376	$ 7,474	$ 261,588
Hwy 85 Outfall	$ 2,422,963	$ -	$ 363,444	$ 121,148	$ 242,296	$ 605,741	$ 3,755,592	$ 627	$ 31,350
Total	$ 64,544,682	$ 5,051,656	$ 9,681,701	$ 3,227,231	$ 6,454,472	$ 16,136,171	$ 105,095,913	$ 35,983.00	$ 1,268,800.00

Table 5-8: Minimum Initial Storm Conveyance with Detention Cost Estimate

Alternative 2 Upstream - Minimum Conveyance with Detention

REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
23rd Ave. Outfall	$ 1,433,531	$ -	$ 215,030	$ 71,677	$ 143,353	$ 358,383	$ 2,221,974	$ 563	$ 19,705
22nd Ave. Outfall	$ 525,349	$ -	$ 78,802	$ 26,267	$ 52,535	$ 131,337	$ 814,290	$ 320	$ 11,200
16th Ave. Outfall	$ 2,926,161	$ -	$ 438,924	$ 146,308	$ 292,616	$ 731,540	$ 4,535,549	$ 1,242	$ 43,470
14th Ave. US Outfall	$ 952,119	$ -	$ 142,818	$ 47,606	$ 95,212	$ 238,030	$ 1,475,785	$ 435	$ 15,225
12th Ave. Outfall	$ 1,684,315	$ -	$ 252,647	$ 84,216	$ 168,432	$ 421,079	$ 2,610,689	$ 550	$ 19,250
16th St. Outfall	$ 704,066	$ -	$ 105,610	$ 35,203	$ 70,407	$ 176,017	$ 1,091,303	$ 346	$ 12,110
17th St. Outfall	$ 432,402	$ -	$ 64,860	$ 21,620	$ 43,240	$ 108,101	$ 670,223	$ 256	$ 8,960
Total	$ 8,657,943	$ -	$ 1,298,691	$ 432,897	$ 865,795	$ 2,164,487	$ 13,419,813	$ 3,712	$ 129,920

Alternative 2 Downstream - Minimum Conveyance with Detention

REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
16th Ave. Ct. Outfall	$ 1,968,363	$ 55,739	$ 295,255	$ 98,418	$ 196,837	$ 492,091	$ 3,106,703	$ 320	$ 11,200
14th Ave. Outfall	$ 2,115,477	$ 9,665	$ 317,322	$ 105,774	$ 211,549	$ 528,869	$ 3,288,656	$ 769	$ 26,915
14th Ave. Outfall Trunk	$ 10,132,668	$ 204,414	$ 1,519,900	$ 506,633	$ 1,013,267	$ 2,533,167	$ 15,910,049	$ 9,038	$ 316,327
1st St. Outfall	$ 8,946,255	$ 482,543	$ 1,341,938	$ 447,312	$ 894,626	$ 2,236,564	$ 14,349,238	$ 6,162	$ 215,668
5th St. Outfall	$ 366,075	$ -	$ 54,911	$ 18,304	$ 36,608	$ 91,519	$ 567,417	$ 192	$ 6,720
7th St. Outfall	$ 9,399,107	$ 1,455,165	$ 1,409,865	$ 469,955	$ 939,911	$ 2,349,777	$ 16,023,780	$ 7,395	$ 258,823
7th St. Outfall - 8th Ave.	$ 4,648,585	$ -	$ 697,288	$ 232,429	$ 464,859	$ 1,162,146	$ 7,205,307	$ 1,037	$ 36,295
9th St. Outfall	$ 451,419	$ 6,325	$ 67,713	$ 22,571	$ 45,142	$ 112,855	$ 706,025	$ 243	$ 8,505
11th St. Outfall	$ 295,207	$ -	$ 44,281	$ 14,760	$ 29,521	$ 73,802	$ 457,571	$ 128	$ 4,480
12th St. Outfall	$ 5,152,026	$ -	$ 772,804	$ 257,601	$ 515,202	$ 1,288,006	$ 7,985,639	$ 2,598	$ 90,929
12th St. Outfall Trunk	$ 16,400,369	$ 2,837,805	$ 2,460,055	$ 820,018	$ 1,640,037	$ 4,100,092	$ 28,258,376	$ 7,474	$ 261,588
Hwy 85 Outfall	$ 2,422,963	$ -	$ 363,444	$ 121,148	$ 242,296	$ 605,741	$ 3,755,592	$ 627	$ 31,350
Total	$ 62,298,514	$ 5,051,656	$ 9,344,776	$ 3,114,923	$ 6,229,855	$ 15,574,629	$ 101,614,353	$ 35,983.00	$ 1,268,800.00

Table 5-9: Canal Interception / Downtown Mitigation Cost Estimate

Alternative 3 Downstream - Canal Interception / Downtown Mitigation

REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
16th Ave. Ct. Outfall	$ 1,968,363	$ 55,739	$ 295,255	$ 98,418	$ 196,837	$ 492,091	$ 3,106,703	$ 320	$ 11,200
14th Ave. Outfall	$ 2,139,847	$ 9,665	$ 320,977	$ 106,992	$ 213,986	$ 534,962	$ 3,326,429	$ 769	$ 26,915
14th Ave. Outfall Trunk	$ 10,132,668	$ 204,414	$ 1,519,900	$ 506,633	$ 1,013,267	$ 2,533,167	$ 15,910,049	$ 9,038	$ 316,327
1st St. Outfall	$ 11,168,053	$ 482,543	$ 1,675,208	$ 558,402	$ 1,116,806	$ 2,792,013	$ 17,793,025	$ 6,162	$ 215,668
5th St. Outfall	$ 366,075	$ -	$ 54,911	$ 18,304	$ 36,608	$ 91,519	$ 567,417	$ 192	$ 6,720
7th St. Outfall	$ 26,734,042	$ 1,455,165	$ 4,010,105	$ 1,336,701	$ 2,673,404	$ 6,683,512	$ 42,892,929	$ 10,622	$ 371,767
7th St. Outfall - 8th Ave.	$ 14,192,421	$ -	$ 2,128,863	$ 709,621	$ 1,419,242	$ 3,548,105	$ 21,998,252	$ 3,661	$ 128,134
9th St. Outfall	$ 451,419	$ 6,325	$ 67,713	$ 22,571	$ 45,142	$ 112,855	$ 706,025	$ 243	$ 8,505
11th St. Outfall	$ 295,207	$ -	$ 44,281	$ 14,760	$ 29,521	$ 73,802	$ 457,571	$ 128	$ 4,480
12th St. Outfall	$ 8,317,587	$ -	$ 1,247,639	$ 415,879	$ 831,758	$ 2,079,397	$ 12,892,260	$ 2,854	$ 99,889
12th St. Outfall Trunk	$ 41,303,474	$ 2,837,805	$ 6,195,521	$ 2,065,174	$ 4,130,347	$ 10,325,869	$ 66,858,190	$ 9,881	$ 345,832
Hwy 85 Outfall	$ 2,422,963	$ -	$ 363,444	$ 121,148	$ 242,296	$ 605,741	$ 3,755,592	$ 627	$ 31,350
Total	$ 119,492,119	$ 5,051,656	$ 17,923,817	$ 5,974,603	$ 11,949,214	$ 29,873,033	$ 190,264,442	$ 44,497.00	$ 1,566,787.00

Table 5-10: Canal Baseflow Separation Cost Estimate

Alternative 4 Downstream - Greeley No. 3 Canal Baseflow Separation

REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
16th Ave. Ct. Outfall	$ 1,968,363	$ 55,739	$ 295,255	$ 98,418	$ 196,837	$ 492,091	$ 3,106,703	$ 320	$ 11,200
14th Ave. Outfall	$ 4,739,086	$ 9,665	$ 710,864	$ 236,955	$ 473,909	$ 1,184,772	$ 7,355,251	$ 973	$ 34,055
14th Ave. Outfall Trunk	$ 12,623,805	$ 204,414	$ 1,893,571	$ 631,190	$ 1,262,381	$ 3,155,951	$ 19,771,312	$ 9,000	$ 314,997
1st St. Outfall	$ 11,168,053	$ 482,543	$ 1,675,208	$ 558,402	$ 1,116,806	$ 2,792,013	$ 17,793,025	$ 6,162	$ 215,668
5th St. Outfall	$ 366,075	$ -	$ 54,911	$ 18,304	$ 36,608	$ 91,519	$ 567,417	$ 192	$ 6,720
7th St. Outfall	$ 9,399,107	$ 1,455,165	$ 1,409,865	$ 469,955	$ 939,911	$ 2,349,777	$ 16,023,780	$ 7,395	$ 258,823
7th St. Outfall - 8th Ave.	$ 4,648,585	$ -	$ 697,288	$ 232,429	$ 464,859	$ 1,162,146	$ 7,205,307	$ 1,037	$ 36,295
9th St. Outfall	$ 451,419	$ 6,325	$ 67,713	$ 22,571	$ 45,142	$ 112,855	$ 706,025	$ 243	$ 8,505
11th St. Outfall	$ 295,207	$ -	$ 44,281	$ 14,760	$ 29,521	$ 73,802	$ 457,571	$ 128	$ 4,480
12th St. Outfall	$ 7,506,220	$ -	$ 1,125,934	$ 375,311	$ 750,622	$ 1,876,555	$ 11,634,642	$ 2,687	$ 94,044
12th St. Outfall Trunk	$ 23,891,836	$ 2,837,805	$ 3,583,775	$ 1,194,592	$ 2,389,184	$ 5,972,959	$ 39,870,151	$ 7,103	$ 248,603
Hwy 85 Outfall	$ 2,422,963	$ -	$ 363,444	$ 121,148	$ 242,296	$ 605,741	$ 3,755,592	$ 627	$ 31,350
Total	$ 79,480,719	$ 5,051,656	$ 11,922,109	$ 3,974,035	$ 7,948,076	$ 19,870,181	$ 128,246,776	$ 35,867.00	$ 1,264,740.00

5.7 BENEFIT COST ANALYSIS

A benefit cost analysis was completed to determine the potential benefits of implementing each alternative. For this analysis, existing buildings within the flood hazard zones were classified as Residential, Commercial, and Downtown when calculating first floor elevations. Through discussions within City staff, for the purposes of the analysis, residential first floor elevations were assumed 12 inches above the structures lowest adjacent grade, with commercial structures were assumed to reside 6 inches above. Flooding depths for structures in the commercial district remained at ground level for the analysis.

Seventeen damage curves, including eight residential, and nine non-residential structure classifications were used from FEMA's Benefit Cost Analysis 5.2.1 software to compute damage values. The BCA curves for non-residential structures were also adjusted to account for commercial and downtown buildings with basements, a common flooding problem in Greeley. Since the standard BCA curves do not provide damages for non-residential structures with basements, damage curves for basements were extrapolated from equivalent residential curves. A complete list of the damage curves used in the benefit cost analysis can be found in Appendix C.

Structure values were obtained from the Weld County GIS Parcel Layer. Content value within each structure were selected based on FEMA guidance and are calculated as a percentage of total structure values. A standard FEMA value of seven percent was used for the discount rate along with a project useful lifetime of 50 years were used when computing present value of damages.

Buildings were only considered in the analysis if shown to be inundated by the FLO-2D flooding extends for each equivalent flood frequency, project alternative, or existing flood conditions. Building footprints with less than 400 square feet were assumed to be accessory structures and also removed from the flooding depth analysis.

An Excel spreadsheet was created to simulate FEMA's calculations of benefit-cost ratio. As mentioned above, FEMA's damage curves for structures and damage curves for contents of the structures were extrapolated to include all flood return intervals, 2-, 5-, 10-, 50-, and 100-year. All flood return intervals were accounted for when computing annualized losses for each structure. Annualized losses were converted to present value of damages to include damages incurred over the entire lifetime of the project.

Table 5-11: BCA Structure Classification

Building No.	Damage Curve	Content Value (% of Structure Value)
1	One Story, No Basement	50%
2	One Story, With Basement	50%
3	Split Level No Basement	50%
4	Split Level With Basement	50%
5	Two Or More Levels No Basement	50%
6	Two Or More Levels With Basement	50%
7	Mobile Home	50%
8	Apartment	50%
9	Schools	100%
10	Medical Offices	150%
11	Warehouse Non-Refrig	100%
12	Industrial Light	100%
13	Office One-Story	100%
14	Recreation	50%
15	Non-Fast Food	100%
16	Retail-Clothing	100%
17	Church	100%

Table 5-12: Parcels with Inundated Structures

Scenario	Number of Parcels with Inundated Structures 2-yr	Number of Parcels with Inundated Structures 5-yr	Number of Parcels with Inundated Structures 10-yr	Number of Parcels with Inundated Structures 50-yr	Number of Parcels with Inundated Structures 100-yr
Existing Conditions	1433	1694	1965	2683	2824
Alternative 1 - Minimum Initial Storm Conveyance	893	1037	1237	2380	2752
Alternative 2 - Minimum Initial Storm Conveyance w/ Detention	886	1037	1205	2279	2699
Alternative 3 - Canal Interception / Downtown Mitigation	783	908	1091	2074	2441
Alternative 4 - Canal Base Flow Separation	693	799	957	1938	2447

Table 5-13: Calculated Damages to Structures

Scenario	2-yr Damanges	5-yr Damages	10-yr Damages	50-yr Damages	100-yr Damages
Existing Conditions	$ 41,747,086	$ 94,913,145	$ 104,052,137	$ 158,301,579	$ 166,318,496
Alternative 1 - Minimum Initial Storm Conveyance	$ 17,870,677	$ 24,154,234	$ 29,526,646	$ 108,247,122	$ 161,925,821
Alternative 2 - Minimum Initial Storm Conveyance w/ Detention	$ 17,717,567	$ 24,154,234	$ 28,816,497	$ 105,591,748	$ 159,647,521
Alternative 3 - Canal Interception / Downtown Mitigation	$ 12,421,822	$ 16,335,676	$ 20,208,366	$ 91,034,841	$ 143,229,532
Alternative 4 - Canal Base Flow Separation	$ 13,482,323	$ 17,702,404	$ 20,781,130	$ 94,996,877	$ 152,258,972

Table 5-14: Benefit Cost Analysis

Scenario	Present Value of Damages over Project Life	Benefits of Alternative	Alternative Cost	Benefit - Cost Ratio
Existing Conditions	$ 610,375,718	--	--	--
Alternative 1 - Minimum Initial Storm Conveyance	$ 241,083,226	$ 369,292,492	$ 119,914,446	3.1
Alternative 2 - Minimum Initial Storm Conveyance w/ Detention	$ 237,763,508	$ 372,612,210	$ 116,432,886	3.2
Alternative 3 - Canal Interception / Downtown Mitigation	$ 182,089,424	$ 428,286,294	$ 205,380,962	2.1
Alternative 4 - Canal Base Flow Separation	$ 193,098,317	$ 417,277,401	$ 143,061,249	2.9

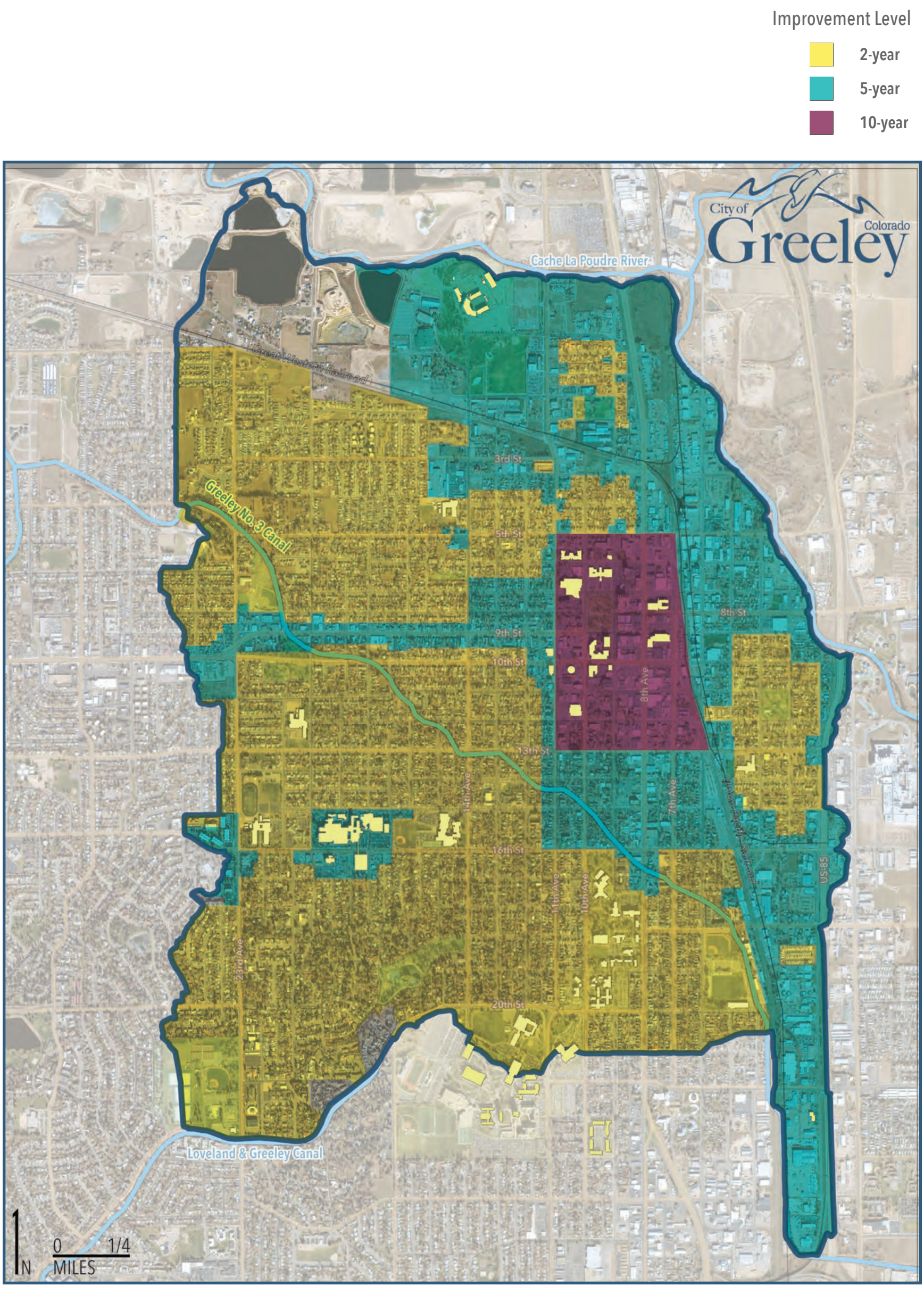
5.8 QUALITATIVE EVALUATION PROCEDURE

Alternatives were evaluated qualitatively based on mitigating flood hazards, improving public safety, enhancing water quality, and cost effectiveness. Overall, all of the alternative plans provided positive benefits in reducing flood hazard and flood risk; however, these benefits were mostly observed for more frequent storm events, as none of them were very effective in removing buildings from the 100-year flood extent. Alternative 1 provided the most cost effective solution conveying the initial storm through each of the proposed outfalls. Alternative 2 mitigates the same extent of flood damage as Alternative 1 and has the additional benefit of incorporating water quality at each of the proposed detention facilities with only a slightly higher cost than Alternative 1. However, by planning additional outfalls into the Greeley No. 3 Canal, presents challenges and without careful planning, there is a potential to change the manner in which the spills from the canal currently occur. Alternative 3 provides the highest level of public safety of any alternative by intercepting and conveying the 100-year design flows in the commercial district; however this alternative has a lesser degree of construction feasibility given the larger pipe requirements. Alternative 4 also promotes a high degree of public safety near the Greeley No. 3 Canal by conveying the 10-year design flow downstream into the storm drain outfalls.

NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

FIGURE 5-3 - INITIAL STORM CONVEYANCE IMPROVEMENT LEVEL

ICON ENGINEERING, INC.



NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

FIGURE 5-4 - MINIMUM INITIAL STORM CONVEYANCE ALTERNATIVE

ICONENGINEERING, INC.

- Watershed Boundary
- Park
- Univ. of Northern Colorado
- Important Structure

Location	Max Storage (Ac-ft)
14th Ave WQ Basin	8.1
1st Street WQ Basin	5.0
7th Street WQ Basin	5.8
12th Street WQ Basin	6.6

Improvement Level

- 2-year
- 5-year
- 10-year
- Existing
- Water Quality Basin

NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

FIGURE 5-5 - MINIMUM CONVEYANCE & DETENTION ALTERNATIVE

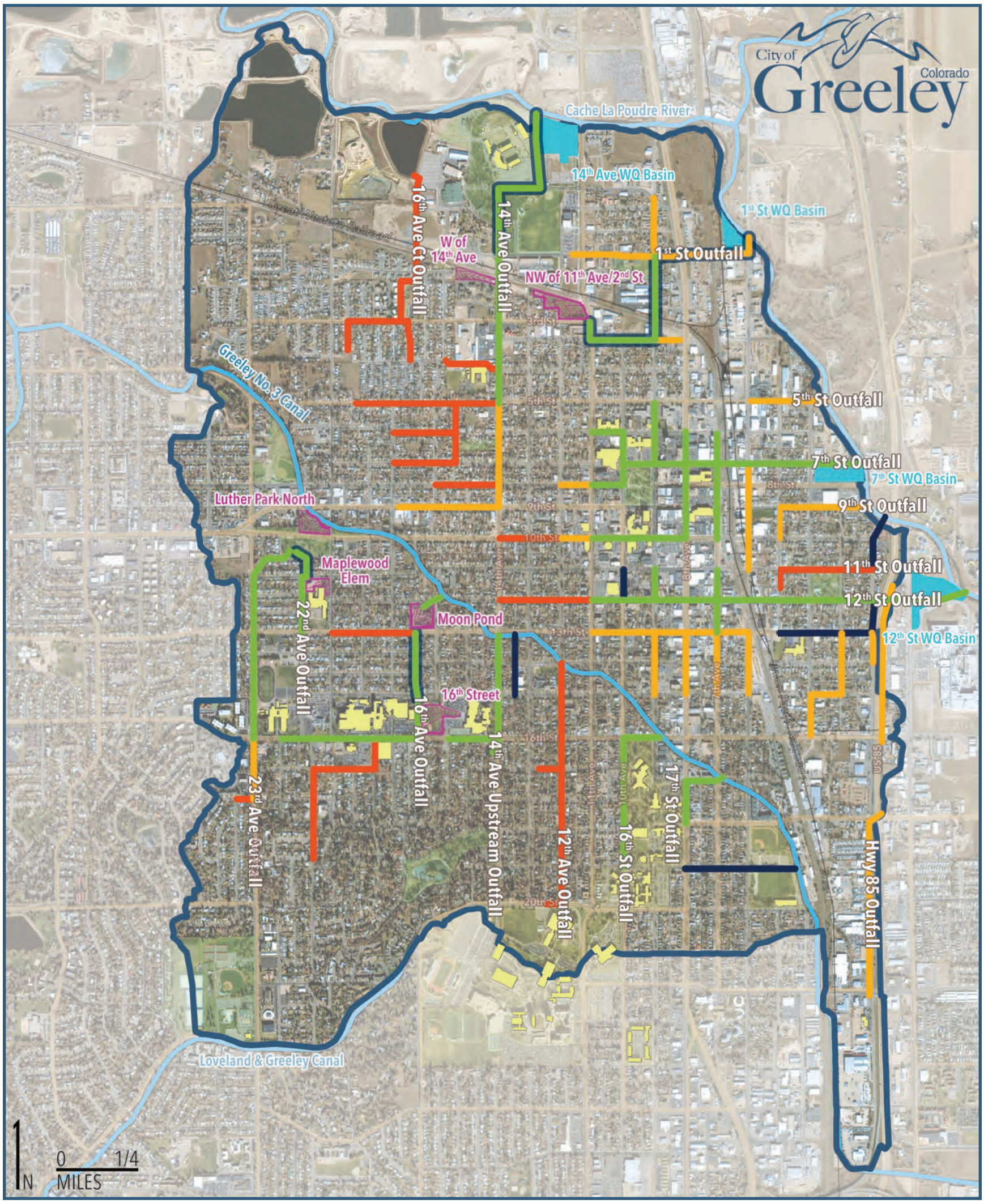
ICONENGINEERING, INC.

- Watershed Boundary
- Park
- Univ. of Northern Colorado
- Important Structure

Location	Max Storage (Ac-ft)
Luther Park North	3.7
Maplewood Elementary	4.6
Moon Pond	4.3
16th Street	8.5
West of 14th Ave	3.3
NW of 11th Ave/2nd St	12.6
14th Ave WQ Basin	8.1
1st Street WQ Basin	5.0
7th Street WQ Basin	5.8
12th Street WQ Basin	6.6

Improvement Level

- 2-year
- 5-year
- 10-year
- Existing
- Grading
- Reduced w/ Detention
- Water Quality Basin



NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

ICONENGINEERING, INC.

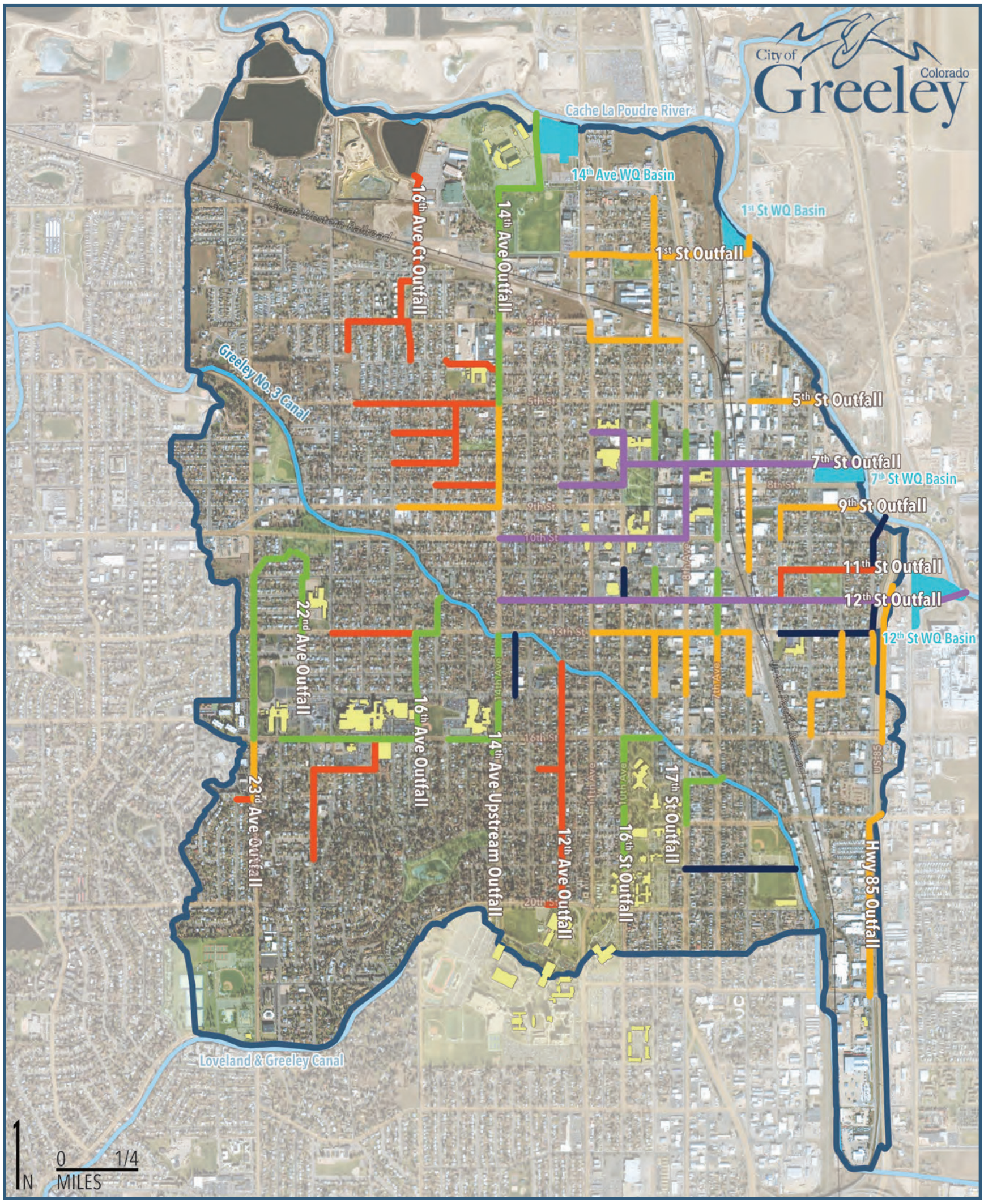
FIGURE 5-6 - CANAL INTERCEPTION / DOWNTOWN MITIGATION ALTERNATIVE

- Watershed Boundary
- Park
- Univ. of Northern Colorado
- Important Structure

Location	Max Storage (Ac-ft)
14th Ave WQ Basin	8.1
1st Street WQ Basin	5.0
7th Street WQ Basin	5.8
12th Street WQ Basin	6.6

Improvement Level

- 2-year
- 5-year
- 10-year
- 100-year
- Existing
- Water Quality Basin



NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

FIGURE 5-7 - CANAL BASEFLOW SEPARATION ALTERNATIVE

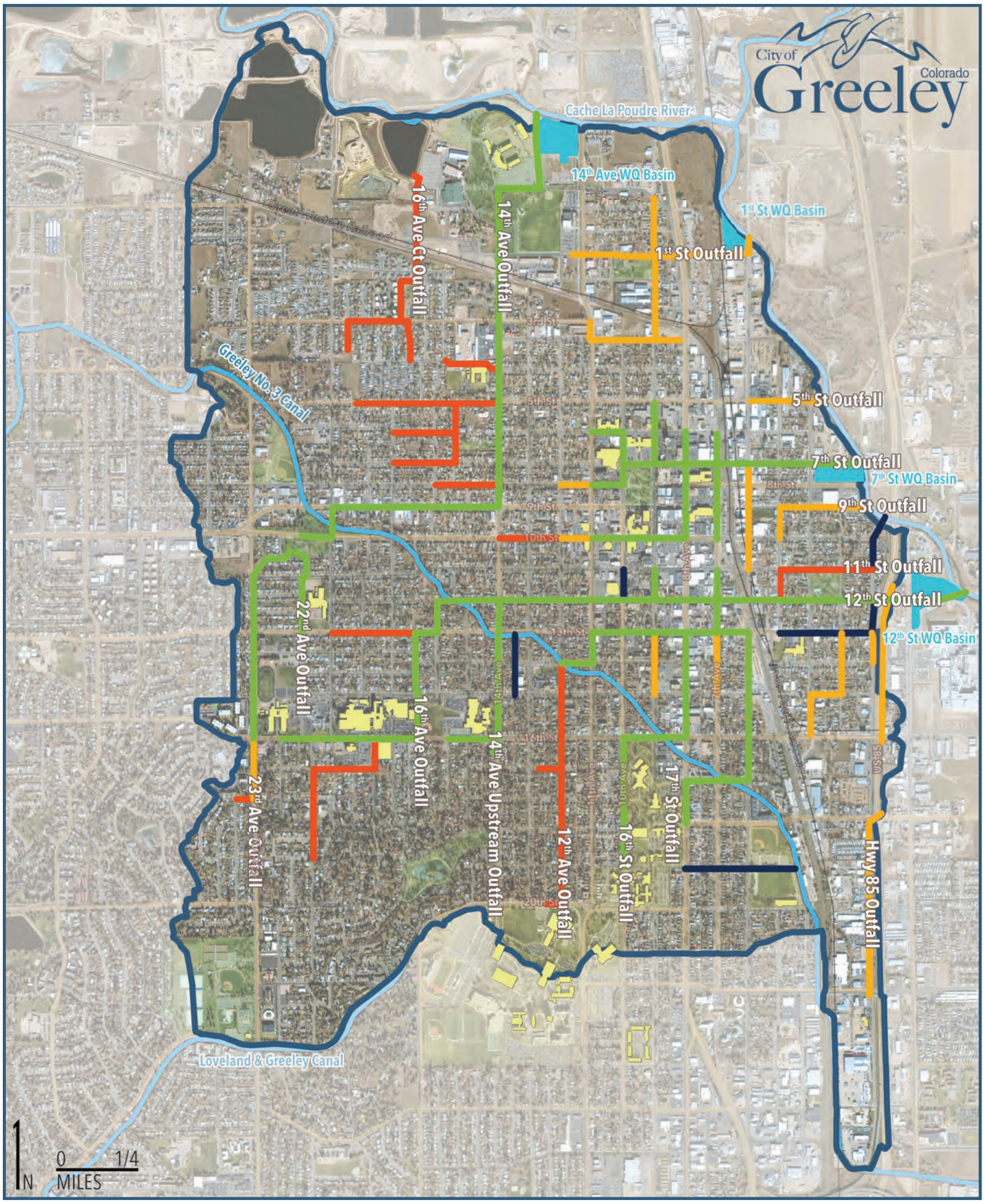
ICONENGINEERING, INC.

- Watershed Boundary
- Park
- Univ. of Northern Colorado
- Important Structure

Location	Max Storage (Ac-ft)
14th Ave WQ Basin	8.1
1st Street WQ Basin	5.0
7th Street WQ Basin	5.8
12th Street WQ Basin	6.6

Improvement Level

- 2-year
- 5-year
- 10-year
- Existing
- Water Quality Basin



6.0 RECOMMENDED PLAN

6.1 PLAN DESCRIPTION

The recommended plan for the North Greeley and Downtown Basin is Alternative 4. Although the costs are slightly higher than the more baseline alternatives, this option balances public safety needs with conveyance requirements, and lessens the risk associated with the use of the Greeley No.3 Canal as a stormwater system. Given the nominal cost difference between Alternatives 1 and 2, it is also recommended that for the conceptual design, Alternative 4 incorporates feasible locations for detention and water quality throughout the watershed as a means of reducing discharges and associated infrastructure. The improvements associated with Alternative 4 are described in 5.6.4 .

6.2 WATER QUALITY IMPACTS

The recommended plan includes water quality appurtenances in all proposed detention basins in addition to the dedicated water quality facilities at the downstream end of the 14th Avenue, 1st Street Outfall, 7th Street Outfall, and 12th Street Outfall. Accounting for the Water Quality Capture Volume in all detention facilities and dedicated water quality facilities will enhance the quality of water entering the Cache La Poudre River by removing any floating debris, removing sediment, and provide an opportunity to incorporate wetland plantings or riparian areas.

In addition to the water quality capture volume facilities, water quality can be improved throughout the watershed by implementing LID techniques as redevelopment occurs within the watershed or as opportunities become available.

6.3 OPERATIONS AND MAINTENANCE

The recommended plan includes the installation of storm drain infrastructure, requiring maintenance for both the inlets and manholes. Proposed detention basins and water quality facilities will also require additional maintenance. This increase in maintenance cost will be offset by the reduction in damages to roads and infrastructure caused by nuisance level flooding.

6.4 ENVIRONMENTAL AND SAFETY ASSESSMENT

The recommended plan positively affects the North Greeley and Downtown Basin by increasing the public safety from flood threats throughout the watershed and enhancing the environmental impacts of the watershed through the implementation of water quality facilities.

Table 6-1: Recommended Plan Cost Estimate

Recommended Plan - Upstream

REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
23rd Ave. Outfall	$ 1,433,531	$ -	$ 215,030	$ 71,677	$ 143,353	$ 358,383	$ 2,221,974	$ 563	$ 19,705
22nd Ave. Outfall	$ 525,349	$ -	$ 78,802	$ 26,267	$ 52,535	$ 131,337	$ 814,290	$ 320	$ 11,200
16th Ave. Outfall	$ 2,926,161	$ -	$ 438,924	$ 146,308	$ 292,616	$ 731,540	$ 4,535,549	$ 1,242	$ 43,470
14th Ave. US Outfall	$ 952,119	$ -	$ 142,818	$ 47,606	$ 95,212	$ 238,030	$ 1,475,785	$ 435	$ 15,225
12th Ave. Outfall	$ 1,684,315	$ -	$ 252,647	$ 84,216	$ 168,432	$ 421,079	$ 2,610,689	$ 550	$ 19,250
16th St. Outfall	$ 704,066	$ -	$ 105,610	$ 35,203	$ 70,407	$ 176,017	$ 1,091,303	$ 346	$ 12,110
17th St. Outfall	$ 432,402	$ -	$ 64,860	$ 21,620	$ 43,240	$ 108,101	$ 670,223	$ 256	$ 8,960
Total	$ 8,657,943	$ -	$ 1,298,691	$ 432,897	$ 865,795	$ 2,164,487	$ 13,419,813	$ 3,712	$ 129,920

Recommended Plan - Downstream

REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
16th Ave. Ct. Outfall	$ 1,968,363	$ 55,739	$ 295,255	$ 98,418	$ 196,837	$ 492,091	$ 3,106,703	$ 320	$ 11,200
14th Ave. Outfall	$ 2,139,847	$ 9,665	$ 320,977	$ 106,992	$ 213,986	$ 534,962	$ 3,326,429	$ 769	$ 26,915
14th Ave. Outfall Trunk	$ 10,132,668	$ 204,414	$ 1,519,900	$ 506,633	$ 1,013,267	$ 2,533,167	$ 15,910,049	$ 9,038	$ 316,327
1st St. Outfall	$ 11,168,053	$ 482,543	$ 1,675,208	$ 558,402	$ 1,116,806	$ 2,792,013	$ 17,793,025	$ 6,162	$ 215,668
5th St. Outfall	$ 366,075	$ -	$ 54,911	$ 18,304	$ 36,608	$ 91,519	$ 567,417	$ 192	$ 6,720
7th St. Outfall	$ 9,399,107	$ 1,455,165	$ 1,409,865	$ 469,955	$ 939,911	$ 2,349,777	$ 16,023,780	$ 7,395	$ 258,823
7th St. Outfall - 8th Ave.	$ 4,648,585	$ -	$ 697,288	$ 232,429	$ 464,859	$ 1,162,146	$ 7,205,307	$ 1,037	$ 36,295
9th St. Outfall	$ 451,419	$ 6,325	$ 67,713	$ 22,571	$ 45,142	$ 112,855	$ 706,025	$ 243	$ 8,505
11th St. Outfall	$ 295,207	$ -	$ 44,281	$ 14,760	$ 29,521	$ 73,802	$ 457,571	$ 128	$ 4,480
12th St. Outfall	$ 5,152,026	$ -	$ 772,804	$ 257,601	$ 515,202	$ 1,288,006	$ 7,985,639	$ 2,598	$ 90,929
12th St. Outfall Trunk	$ 16,400,369	$ 2,837,805	$ 2,460,055	$ 820,018	$ 1,640,037	$ 4,100,092	$ 28,258,376	$ 7,474	$ 261,588
Hwy 85 Outfall	$ 2,422,963	$ -	$ 363,444	$ 121,148	$ 242,296	$ 605,741	$ 3,755,592	$ 627	$ 31,350
Total	$ 64,544,682	$ 5,051,656	$ 9,681,701	$ 3,227,231	$ 6,454,472	$ 16,136,171	$ 105,095,913	$ 35,983.00	$ 1,268,800.00

NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

FIGURE 6-1 - RECOMMENDED PLAN

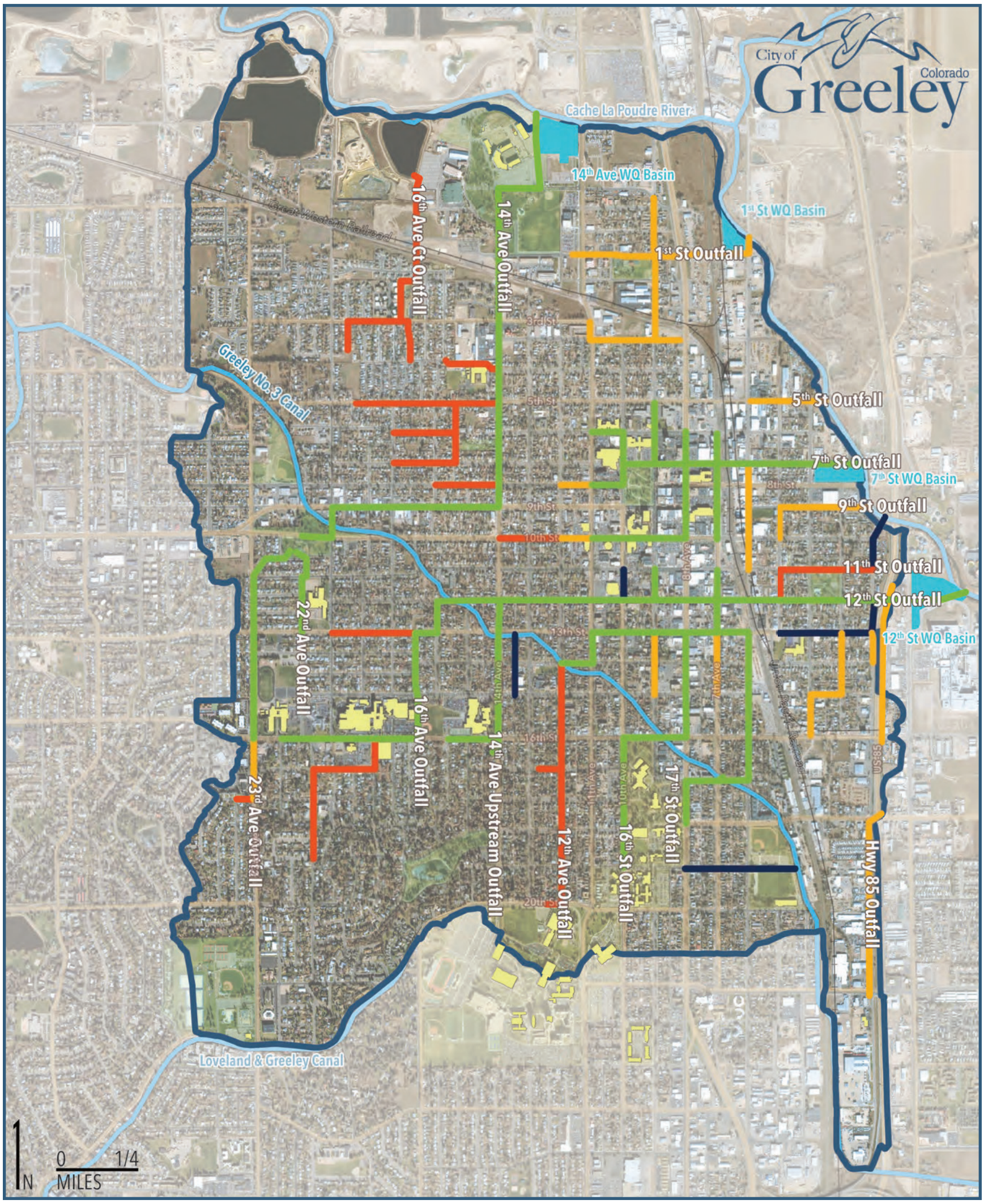
ICONENGINEERING, INC.

- Watershed Boundary
- Park
- Univ. of Northern Colorado
- Important Structure

Location	Max Storage (Ac-ft)
14th Ave WQ Basin	8.1
1st Street WQ Basin	5.0
7th Street WQ Basin	5.8
12th Street WQ Basin	6.6

Improvement Level

- 2-year
- 5-year
- 10-year
- Existing
- Water Quality Basin



7.0 CONCEPTUAL DESIGN

7.1 PLAN DEVELOPMENT OVERVIEW

The selected plan for the North Greeley and Downtown Basin meets the goals set forth by this study with input provided by City staff. The selected plan presents a combination of Alternative 4 – Greeley No. 3 Canal Baseflow Separation and the detention facilities proposed in Alternative 2. The detention areas at 16th Street, Moon Pond, and west of 14th Avenue were omitted after determining they did not present overall cost savings considering property acquisition costs and the cost of construction of these facilities.

7.1.1 GENERAL RECOMMENDATIONS

In addition to the implementation of this selected plan, this study also recommends the City of Greeley consider the following:

- That new land development activities, significant redevelopment activities, and publicly funded projects, provide, to the maximum extent practicable, runoff volume control practices (i.e., minimize directly connected impervious areas and employ infiltrating BMPs) whenever site conditions permit.
- Require that all BMPs for all new development, redevelopment, and publicly funded projects provide to the maximum extent practicable a Water Quality Capture Volume (WQCV) as recommended in the Urban Storm Drainage Criteria Manual – Volume 3, after accounting for volume reductions achieved using volume control practices.
- Amend the City of Greeley Design Criteria and Construction Specifications Storm Drainage Volume II and adopt NOAA 14 rainfall values and CUHP v.2.0 as the current standard citywide, replacing the outdated NOAA Atlas 2 and CUHP v.1.4.4.

7.1.2 CONCEPTUAL DESIGN COST ESTIMATES

Conceptual cost estimates were developed using UDFCD's master planning cost estimating spreadsheet UD-MP COST, version 2.2. 2012 unit cost values were adjusted to present value using the Colorado Construction Cost Index 2016 Fourth Quarter Report. A rolling four-quarter inflation rate of 1.1914 was used to adjust unit costs. A summary of unit costs can be found in Appendix D.

In addition to the UD-MP COST, Lithos Engineering assisted ICON in preparing cost estimates for railroad tunneling projects at 14th Avenue, 7th Street, and 12th Street in addition to a tunneling crossing of Highway 85 at 12th Street. During final design of these improvements, other design options, such as open cut installation and/or "shoefly" connections may become more practical upon further discussions with each associated review agency. Cost estimates within this plan reflect tunneling at all crossings under the assumptions that tunneling present a more conservative estimate.

Operation and Maintenance was also included within the UD MP Cost worksheet. Culvert, manhole, and inlet maintenance was assumed to occur once every five years. Maintenance on detention basins and water quality facilities was assumed to occur every other year.

Inlet quantities were calculated assuming an inlet interception capacity of 2 cfs for each inlet.

Costs for Water Quality Basins were estimated using the Complete-in-Place detention facility unit costs based on the necessary acre-feet of Water Quality Capture Volume (WQCV) for each outfall.

Right of way easement costs were calculated from property values obtained from Zillow.com in February 2017. Easement / ROW acquisition amounts were calculated as a percentage of the total property value. A detailed parcel assessment was completed by Foster Valuation LLC for the inadvertent detention area northwest of 11th Avenue and 2nd Street. This detailed cost estimate has superseded the information from Zillow.com in the cost estimates at this location.

Dewatering, Traffic Control and Utility Coordination / Relocation were assigned based on the following percentages of capital costs: Dewatering (1%), Traffic Control (5%), Utility Coordination / Relocation (5%).

During conceptual design, sanitary sewer relocation cost were itemized for each outfall. As a result, Utility Coordination / Relocation cost was lowered from the 10 percent used during the alternative analysis to 5 percent.

Special items that were added to the UD-MP COST spreadsheet include:

- Asphalt Patch: $50 / S.Y. (Pipes with diameter 42 inches and smaller)
- Asphalt Repaving: $40 / S.Y. (Pipes with diameter greater than 42 inches)
- Water Line Lowering: $5000 / EA
- Sanitary Sewer Relocation: $75 / LF and $5000 / Manhole
- Railroad Boring: $4500 / L.F. cell (An equivalent flow area of circular pipes were calculated to convey the design flow under railroads and Highway 85. This estimate was used for locations not estimated by Lithos)

No alterations were made to default values calculated as a percent of Capital Improvement Costs, such as Engineering, Legal/Administrative, Contract Administration/Construction Management, and Contingency.

7.1.3 RAILROAD TUNNELING ASSESSMENT

In order to convey storm water to the Cache la Poudre River from the commercial district, it is necessary to cross several railroad tracks and Highway 85. It is likely that these crossings will need to be constructed using trenchless technology. Icon retained Lithos Engineering (Lithos) to prepare a master plan level opinion of probable construction cost for each of four proposed trenchless crossings.

Trenchless construction using reinforced concrete boxes (RCBC) is a technology that has been employed throughout the United States for decades. Despite this long history, jacked boxes are rare in the Colorado Front Range, mostly due to lack of local contractor experience. Experience dictates that most often proposed jacked boxes get switched to pipes either in the design phase or during the bidding phase by the contractor. Therefore, a bid suitable history is unavailable for this type of construction in the local area. However, aside from the shape of the excavation, which creates some unique challenges, jacked box installation is not significantly different from jacked pipe operations.

In order to gain a sense of the construction costs and challenges, Lithos 1) spoke with contractors who had performed jacked box construction elsewhere in the country, 2) talked with contractors who had bid jacked box tunnels in the Denver area and subsequently "value engineered" them to be jacked pipes, and 3) spoke with a manufacturer who designs and builds shields and jacking frames for rectangular boxes. Lithos' OPCC are based on these references, our understanding of the geologic conditions obtained from borings on previous projects in the

general area, and our experience with the underground construction industry in general. Additionally, the costs below are than typical trenchless projects to reflect the risk of using either an inexperienced local contractor or bringing in an out-of-state contractor to perform the work.

The following assumptions were made when preparing the cost estimates:

The dimensions of each crossing are as follows:

- 14th Avenue Outfall – Great Western Railroad Crossing - 11 foot x 4 foot RCBC - 130 feet
- 7th Street Outfall – Great Western and Union Pacific Railroad Crossing - 8 foot by 4 foot RCBC - 180 feet
- 12th Street Outfall – Great Western and Union Pacific Railroad Crossing - 13 foot by 5 foot RCBC - 200 feet
- 12th Street Outfall – Hwy 85 Crossing – 12 foot by 6 foot RCBC - 160 feet

Dewatering will be necessary at each shaft location and along the length of each crossing.

Permeation grouting:

- Ground improvement, in this case, permeation grouting will be necessary along the length of each crossing
- The cost of permeation grouting is a significant contributor to the overall costs. We feel the grouting is necessary due to the shallow amount of cover and the anticipated granular nature of the soils. The grouting will help to create a stable excavation face as well as reduce potential for surface settlement.

Launching and receiving shafts:

- Each shaft will be extended two feet below the bottom of the RBC.
- Launch shaft dimensions are 20 x 22 feet.
- Receiving shaft dimensions are 18 x 12 feet.
- Ground support will utilize trench boxes
- A designed reinforced concrete thrust block will be necessary in each launch shaft
- An unreinforced concrete floor or mud mat will be required in each launch shaft

Guide rails:

- Guide rails will be required and will consist of 12-inch diameter steel pipe filled with concrete will be installed prior to box jacking to act as guides for the box as it is advanced.
- The guide rails will be installed using a guided pilot tube and auger boring.

Shield and jacking frame adapter:

- The cost of the leading-edge shield and jacking frame adapter plate is included in each estimate.
- The shield will be composed of steel sheeting and will have removable sand shelves. Dimensions will be at least one inch larger on all sides than the outside dimensions of the RCBC.
- Since the boxes are all of different sizes and the work is anticipated to be bid as separate projects, it will be necessary to manufacture new equipment each crossing.

RCBC Materials:

• Cost estimates for box culvert were obtained specifically for jacking applications and to meet Railroad E-80 loading requirements.

- 14th Avenue Outfall – RR Crossing $1,400
- 7th Street Outfall – RR Crossing $850
- 12th Street Outfall – RR Crossing $1,800
- 12th Street Outfall – Hwy 85 Crossing $1,810

Tunnel Excavation:

- Ground excavation will be by hand equipment as well as a modified mini excavator
- Due to the length of the crossings, 2 intermediate jacking stations are assumed to be needed for each crossing.
- Water-bentonite lubrication will be injected between the ground and the RCBC to help reduce frictional forces.

Contact Grouting:

- Post installation, cementitious grout will be injected through preinstalled ports in the RCBC to fill the space between the ground and the RCBC.
- Contact grouting will reduce long term settlement of the ground surface.

Railroad:

- A railroad flagman is assumed to be onsite full time at $1,800/day during guide rail installation, tunnel excavation, and contact grouting.
- We have assumed that settlement will occur beyond the allowable limits of the railroad and that track releveling will be necessary
- A railroad flagman is not included in the Hwy 85 crossing.

The entire tunneling assessment including an itemized cost estimates for each tunneling location can be found in Appendix E.

Table 7-1: Lithos Engineering Railroad Jacked Box Trenchless Tunneling Crossings

Crossing	Crossing Structure	Total Cost
14th Avenue Outfall - Great Western Railroad Crossing	11 foot x 4 foot RCBC	$ 2,628,903
7th Street Outfall - Great Western and Union Pacific Railroad Crossing	8 foot by 4 foot RCBC	$ 3,080,252
12th Street Outfall - Great Western and Union Pacific Railroad Crossing	13 foot by 5 foot RCBC	$ 3,564,463
12th Street Outfall - Highway 85 Crossing	12 foot by 6 foot RCBC	$ 2,994,919

7.1.4 UTILITY RESEARCH

As part of the development of this plan, utility companies were contacted to try to obtain known utility conflicts along the proposed alignments. The following companies responded to the inquiry:

- Atmos Energy: Provided schematic
- Century Link: Conflicts throughout project area but project area too large to be able to provide a schematic. Information for 12th Street east of the Great Western and Union Pacific Railroad Crossings was provided.
- City of Greeley – Sanitary: Depths of sanitary sewer obtained from City of Greeley shapefile.
- City of Greeley – Water: Alignment from City of Greeley shapefile at an assumed depth of 4.5 feet.
- Comcast: Provided schematic
- Extraction Oil & Gas: Did not believe any conflicts present within the project area
- Level 3 Communications: Provided schematic
- Noble Energy: No conflicts within the project area
- PDC Energy: No conflicts within the project area
- Sunrise Community Health: Description of utilities provided
- XCEL Energy: Provided schematic
- Zayo: Provided schematic

7.2 GREELEY NO. 3 CANAL SPILL COMPARISON

The unsteady state HEC-RAS model, as described in 4.2.2 was updated to compare the impacts of the selected plan to existing conditions spill flows. In all cases, spill flows from the canal are reduced with the proposed improvement plan.

Table 7-2: Selected Plan Greeley No. 3 Spill Comparison

Location	Existing Conditions					Conceptual Design				
	02-yr	05-yr	10-yr	50-yr	100-yr	02-yr	05-yr	10-yr	50-yr	100-yr
23rd Ave. & 5th St.	0	0	0	0	0	0	0	0	0	0
5th St. & 6th St.	0	0	0	20	45	0	0	0	8	33
6th St. & 9th St.	0	0	0	0	0	0	0	0	0	0
9th St. & 18th Ave.	5	8	13	180	292	0	0	1	107	204
10th St. & 12th St.	23	45	83	304	431	0	0	2	133	249
12th St. & 13th Ave	53	72	93	264	358	9	14	21	87	128
13th Ave. & 11th Ave.	50	67	87	193	267	21	25	30	112	193
11th Ave. & 15th St.	0	1	11	55	77	0	0	0	20	43
15th St. & 8th Ave.	62	74	86	133	156	54	54	54	78	95
8th Ave. & 18th St.	27	35	46	105	139	17	17	17	45	61
East of UNC Physical Plant	0	0	0	18	52	0	0	0	6	31
Upstream of 22nd St.	36	45	57	118	144	11	20	32	101	130
22nd Street & U.S. Highway 85 Bypass	16	16	16	17	17	16	16	16	16	16

7.3 BENEFIT COST ANALYSIS

The benefit cost analysis, as described in 5.7 , was also updated to reflect the implementation of the selected plan. The proposed detention basin at Luther Park North, sized for the 10-year design storm, attenuates peak flows upstream of the Greeley No. 3 Canal. This attenuation in peak flow in the 14th Avenue Outfall results in a reduction in project cost due to downsizing of infrastructure compared to Alternative 4. The changes in routing associated with the detention facilities change the stormwater inflow locations into the Greeley No. 3 Canal, causing variations in spill flow locations out of the Greeley No. 3 Canal. The variances in spill flow locations resulted in more parcels with structures being inundated in the less frequent design storms (50-, 100-yr) but less damage incurred basin wide.

Table 7-3: Parcels with Inundated Structures

	Number of Parcels with Inundated Structures				
Scenario	2-yr	5-yr	10-yr	50-yr	100-yr
Existing Conditions	1433	1694	1965	2683	2824
Selected Plan	763	891	1064	2311	2811

Table 7-4: Calculated Damages to Structures

Scenario	2-yr Damanges	5-yr Damages	10-yr Damages	50-yr Damages	100-yr Damages
Existing Conditions	$ 41,747,086	$ 94,913,145	$ 104,052,137	$ 158,301,579	$ 166,318,496
Selected Plan	$ 15,179,438	$ 20,022,344	$ 22,880,148	$ 81,132,132	$ 137,140,717

Table 7-5: Benefit Cost Analysis

Scenario	Present Value of Damages over Project Life	Benefits of Alternative	Selected Plan Cost	Benefit - Cost Ratio
Existing Conditions	$ 610,375,718	--	--	--
Selected Plan	$ 193,881,917	$ 416,493,801	$ 137,633,673	3.0

7.4 OUTFALL SYSTEMS PLAN DESCRIPTION

Conceptual design drawings have been prepared for the following outfall systems: 22nd Avenue, 14th Avenue, 7th Street, 16th Avenue, and 12th Street. 22nd Avenue Outfall and 16th Avenue Court Outfall were included due to their proximity of the major outfall systems. The design drawings show the preliminary profiles for each of the outfall systems, along with approximate locations of sanitary sewer and other known utilities. Utilities shown on the plan and profiles have not been field verified and should be further investigated during final design. Preliminary grading for the detention and the water quality facilities have also been shown on the conceptual design plans.

Conceptual design plan and profiles can be found in Appendix F and Appendix G respectively. A description of all the outfalls can be found below.

7.4.1 23RD AVENUE OUTFALL

The 23rd Avenue Outfall intercepts flow from a tributary area of approximately 110 acres and runs from 18th Street north along 23rd Avenue until the outfall into Luther Park West Detention Basin. The proposed outfall system is designed to convey the 5-year design flow of 20 cfs from 18th Street to 16th Street. Downstream of 16th street the capacity of the storm drain is increased to convey the 10-year design flow of 38 cfs in order to mitigate flooding hazards around Heath Middle School and continue to the outfall location in Luther Park West. The existing undersized infrastructure will be replaced with RCP ranging in size from 18 inches to 42 inches. The 10-year design flow at the outfall location into Luther Park West is approximately 62 cfs.

There are both sanitary sewer and water line conflicts along this outfall alignment. No relocation of sanitary sewers are anticipated as part of the proposed improvements.

Click here to view 23rd Avenue Outfall Map

Table 7-6: 23rd Avenue Outfall Cost Estimate

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains					
Circular Pipes					
Diameter (in)	**Length (ft)**	**No. of Barrels**			
18-inch	300	1	300	L.F.	$69.00	$20,700.00
24-inch	1000	1	1000	L.F.	$92.00	$92,000.00
36-inch	1850	1	1850	L.F.	$139.00	$257,150.00
42-inch	800	1	800	L.F.	$162.00	$129,600.00
36-inch	800	1	800	L.F.	$139.00	$111,200.00
18-inch	50	30	1500	L.F.	$69.00	$103,500.00
Flare End Sections					
Diameter (in)	**Applicable**	**No. of Barrels**			
36-inch	Yes	1	1	EA	$2,068.00	$2,068.00
Manholes and Inlets					
Manhole, 4' Dia. (Pipe Dia. < 36")			4	EA	$3,726.00	$14,904.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			10	EA	$5,010.00	$50,100.00
Storm Inlet, Type R/Type 14, 5-foot			30	EA	$5,910.00	$177,300.00
Special Items (User Defined)					
Asphalt Patch	**<----User Defined Items**		3139	S.Y.	$50.00	$156,950.00
Waterline Lowering	**<----User Defined Items**		10	EA	$5,000.00	$50,000.00

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$958,522.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$206,950.00
Subtotal Capital Improvement Costs				**$1,165,472.00**
Additional Capital Improvement Costs				
Dewatering	$11,654.72	L.S.		$11,655.00
Mobilization	5%			$58,274.00
Traffic Control	$58,273.60	L.S.		$58,274.00
Utility Coordination/Relocation	$58,273.60	L.S.		$58,274.00
Stormwater Management/Erosion Control	5%			$58,274.00
Subtotal Additional Capital Improvement Costs				**$244,751.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$211,533.00
Legal/Administrative	5%			$70,511.00
Contract Admin/Construction Management	10%			$141,022.00
Contingency	25%			$352,556.00
Subtotal Other Costs				**$775,622.00**
Total Capital Improvement Costs				**$2,185,845.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	4750	L.F.	$1.00	$950.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	44	EA	$64.00	$563.00
Total Annual Operation and Maintenance Cost				**$1,513.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$52,955.00**

7.4.2 22ND AVENUE OUTFALL

The 22nd Avenue Outfall intercepts a tributary area of approximately 52 acres from 13th Street and 22nd Avenue, running north along 22nd Avenue at a pipe slope of 0.75 percent. The proposed storm drain will convey the 10-year design flow of 20 cfs to help mitigate flooding hazards near Maplewood Elementary School. Improvement to the existing Maplewood Elementary Detention Basin has also been proposed to reduce the peak discharge downstream. The improved detention basin is proposed to provide a maximum storage of 1.0 Ac-ft. during the 10-year design storm.

Downstream of Maplewood Elementary, the storm drain improvements convey the 10-year design flow of 11 cfs in a 24 inch RCP north along 22nd Avenue, varying in slope from 1.0 to 1.5 percent. North of 10th Street Road the storm drain system outfalls into the Luther Park West Detention Basin where it is proposed to be intercepted by the 14th Avenue Outfall. The 10-year design flow into Luther Park West from the proposed 22nd Avenue Outfall storm drain is approximately 11 cfs.

An existing sanitary sewer passes underneath the proposed improvements to Maplewood Elementary detention basin but is not anticipated to require relocation between 11th Street and 12th Street. Multiple water lines require lowering as part of the proposed storm drain improvements.

Click here to view 22nd Avenue Outfall Map

Click here to view 22nd Avenue Outfall Profile

Table 7-7: 22nd Avenue Outfall Cost Estimate

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains					
Circular Pipes					
Diameter (in)	**Length (ft)**	**No. of Barrels**			
30-inch	320	1	320	L.F.	$116.00	$37,120.00
30-inch	360	1	360	L.F.	$116.00	$41,760.00
30-inch	50	1	50	L.F.	$116.00	$5,800.00
24-inch	280	1	280	L.F.	$92.00	$25,760.00
24-inch	185	1	185	L.F.	$92.00	$17,020.00
18-inch	50	19	950	L.F.	$69.00	$65,550.00
Flare End Sections					
Diameter (in)	**Applicable**	**No. of Barrels**			
30-inch	Yes	1	1	EA	$2,017.00	$2,017.00
24-inch	Yes	1	1	EA	$1,246.00	$1,246.00
Manholes and Inlets					
Manhole, 4' Dia. (Pipe Dia. < 36")			6	EA	$3,726.00	$22,356.00
Storm Inlet, Type R/Type 14, 5-foot			19	EA	$5,910.00	$112,290.00
Detention/Water Quality Facilities					
Detention (Complete-in-Place)					
Detention Facility 1 (Complete-in-Place)			2	AC-FT	$58,582.00	$128,880.00
Special Items (User Defined)					
Asphalt Patch	**<----User Defined Items**		898	S.Y.	$50.00	$44,900.00
Waterline Lowering	**<----User Defined Items**		6	EA	$5,000.00	$30,000.00

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$330,919.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$128,880.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$74,900.00
Subtotal Capital Improvement Costs				**$534,699.00**
Additional Capital Improvement Costs				
Dewatering	$5,346.99	L.S.		$5,347.00
Mobilization	5%			$26,735.00
Traffic Control	$26,734.95	L.S.		$26,735.00
Utility Coordination/Relocation	$26,734.95	L.S.		$26,735.00
Stormwater Management/Erosion Control	5%			$26,735.00
Subtotal Additional Capital Improvement Costs				**$112,287.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$97,048.00
Legal/Administrative	5%			$32,349.00
Contract Admin/Construction Management	10%			$64,699.00
Contingency	25%			$161,747.00
Subtotal Other Costs				**$355,843.00**
Total Capital Improvement Costs				**$1,002,829.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	1195	L.F.	$1.00	$239.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	25	EA	$64.00	$320.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal,	2.2	ACRE	$1,927.00	$2,120.00

7.4.3 16TH AVENUE OUTFALL

The 16th Avenue Outfall has a tributary area of approximately 212 acres and is generally bounded by 13th Street on the north, 16th Avenue on the east, Glenmere Lake on the south, and 23rd Avenue to the west. The system is comprised of several collectors including one west on 13th Street, and one south of 16th Street. The storm drain system intercepts flow currently contributing to Moon Pond, which is significantly undersized. This system replaces the majority of the existing 16th Street Outfall which is currently undersized.

South of 16th Street, a collector is proposed to intercept the 2-year design flow of 5 cfs near 21st Avenue and Glenfair Road, conveying flow north to 16th Street before redirecting east along 17th Street. This collector ranges in size from an 18 inch to 24 inch RCP with pipe slopes ranging from 1.5 to 2 percent. The 2-year design flow of the proposed storm drain at 16th Street is approximately 15 cfs.

Several water lines and sanitary sewer conflict with the proposed alignment. Lowering of water line conflicts will be required but no sanitary sewer crossings are anticipated to require relocation as part of the proposed project.

The collector west along 13th Street, sized for a 2-year design storm of approximately 18 cfs, ranges in size from an 18 inch to 24 inch RCP, with pipe slopes of approximately 1.5 percent. There is a sanitary sewer line located along the north side of 13th Street, which should be avoided as well as an existing water line at 21st Avenue.

The 16th Avenue Outfall interceptor will replace the existing storm drain in 16th Street, mitigating flooding hazards near Banner Health North Colorado Medical Center. The proposed alignment begins at 22nd Avenue, and follows 16th Street east to 16th Avenue Court. The system along 16th Street ranges in size from a 24 inch to 42 inches RCP, with slopes ranging between 1.0 and 1.5 percent. The 10-year design flow of the 16th Avenue Outfall upstream of 18th is 12 cfs. At 18th Avenue the storm drain system will intercept the collector south of 16th street. There is an existing sanitary sewer located in the east bound travel lanes of 16th Street that should be avoided with these improvements. At 16th Avenue Court, the proposed system turns north, continuing along the east side of 16th Avenue Court to 13th Street. Pipe size ranges from 42 inch to 48 inch RCP, with slopes ranging between 1 and 2 percent. The 10-year design flow of the storm drain just south of 13th Street is 104 cfs. Although the existing sanitary system is mostly avoided, several water lines will require lowering along 16th Avenue Court.

At 13th Street, flow would be limited to 25 cfs into Moon Pond to increase functionality, without overtopping, up to the 10-year level. Flows in excess of Moon Pond capacity are proposed to be conveyed east along 13th Street prior to crossing the Greeley No. 3 Canal. The crossing of the Greeley No. 3 Canal requires a new 54 inch RCP to convey the 10-year design flow of 127 cfs. After crossing the Greeley No. 3 Canal, the system continues north on 14th Avenue where the system outfalls into the 12th Street Outfall trunk line. Pipes along this stretch increase in size from a 54 inch RCP to 60 inch along 13th Street, with pipe slopes ranging from 0.5 to 2.0 percent.

Click here to view 16th Avenue Outfall Map

Click here to view 16th Avenue Outfall Profile

Table 7-8: 16th Avenue Outfall Cost Estimate

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	**Length (ft)**	**No. of Barrels**				
18-inch	1450	1	1450	L.F.	$69.00	$100,050.00
24-inch	3704	1	3704	L.F.	$92.00	$340,768.00
30-inch	900	1	900	L.F.	$116.00	$104,400.00
42-inch	1865	1	1865	L.F.	$162.00	$302,130.00
48-inch	475	1	475	L.F.	$185.00	$87,875.00
54-inch	565	1	565	L.F.	$277.00	$156,505.00
60-inch	805	1	805	L.F.	$308.00	$247,940.00
18-inch	50	66	3300	L.F.	$69.00	$227,700.00
Flare End Sections						
Diameter (in)	**Applicable**	**No. of Barrels**				
24-inch	Yes	1	1	EA	$1,246.00	$1,246.00
Manholes and Inlets						
Manhole, 4' Dia. (Pipe Dia. < 36")			18	EA	$3,726.00	$67,068.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			8	EA	$5,010.00	$40,080.00
Manhole, 6' Dia. (Pipe Dia. = 48")			1	EA	$5,524.00	$5,524.00
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			6	EA	$15,416.00	$92,496.00
Storm Inlet, Type R/Type 14, 5-foot			66	EA	$5,910.00	$390,060.00
Special Items (User Defined)						
Aspahalt Repave	**<----User Defined Items**		1073	S.Y.	$40.00	$42,920.00
Aspahalt Patch	**<----User Defined Items**		5590	S.Y.	$50.00	$279,500.00
Waterline Lowering	**<----User Defined Items**		19	EA	$5,000.00	$95,000.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$2,163,842.00
Concrete Box Culverts			$0.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$0.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$417,420.00
Subtotal Capital Improvement Costs			**$2,581,262.00**
Additional Capital Improvement Costs			
Dewatering	$25,812.62	L.S.	$25,813.00
Mobilization	5%		$129,063.00
Traffic Control	$129,063.10	L.S.	$129,063.00
Utility Coordination/Relocation	$129,063.10	L.S.	$129,063.00
Stormwater Management/Erosion Control	5%		$129,063.00
Subtotal Additional Capital Improvement Costs			**$542,065.00**
Land Acquisition Costs			
ROW/Easements			$0.00
Subtotal Land Acquisition Costs			**$0.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$468,499.00
Legal/Administrative	5%		$156,166.00
Contract Admin/Construction Management	10%		$312,333.00
Contingency	25%		$780,832.00
Subtotal Other Costs			**$1,717,830.00**
Total Capital Improvement Costs			**$4,841,157.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	9764	L.F.	$1.00	$1,953.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	99	EA	$64.00	$1,267.00
Total Annual Operation and Maintenance Cost				**$3,220.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$112,699.00**

7.4.4 14TH AVENUE UPSTREAM OUTFALL

The 14th Avenue Outfall upstream of the Greeley No. 3 Canal intercepts a tributary area of approximately 100 acres. The outfall system is designed to convey the 10-year flow to mitigate flooding damages on Greeley Central High School. The system replaces the undersized infrastructure of the existing 16th Street outfall system. The proposed outfall system runs east along 16th Street before turning north on 14th Avenue, where flow from Glenmere Draw is intercepted near the intersection of 14th Avenue and 16th Street. From there, the storm drain is proposed to continue north underneath the Greeley No. 3 Canal in a 36 inch RCP. North of the Greeley No. 3 Canal, the storm drain system outfalls into the 12th Street Outfall. Pipes sizes vary throughout from an 18 inch RCP to a 42 inch RCP with slopes ranging from 0.5 percent to 3 percent. The 10-year design flow into the 12th Street Outfall is 67 cfs.

The existing sanitary sewer, located in the northbound lanes of 14th Avenue should be avoided wit this alignment; however, several waterline conflicts exist and will require lowering or relocation.

The existing 16th Street Outfall (36 inch RCP) is proposed to remain in service from 15th Street to the Greeley No. 3 Canal to intercept local stormwater runoff. The existing outfall will have a 100-year peak flow of 30 cfs.

Click here to view 14th Avenue Outfall Map

Table 7-9: 14th Avenue Upstream Outfall Cost Estimate

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	**Length (ft)**	**No. of Barrels**				
18-inch	350	1	350	L.F.	$69.00	$24,150.00
18-inch	520	1	520	L.F.	$69.00	$35,880.00
36-inch	230	1	230	L.F.	$139.00	$31,970.00
42-inch	700	1	700	L.F.	$162.00	$113,400.00
42-inch	550	1	550	L.F.	$162.00	$89,100.00
42-inch	500	1	500	L.F.	$162.00	$81,000.00
18-inch	50	25	1250	L.F.	$69.00	$86,250.00
Flare End Sections						
Diameter (in)	**Applicable**	**No. of Barrels**				
36-inch	Yes	1	1	EA	$2,068.00	$2,068.00
Manholes and Inlets						
Manhole, 4' Dia. (Pipe Dia. < 36")			3	EA	$3,726.00	$11,178.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			4	EA	$5,010.00	$20,040.00
Manhole, 6' Dia. (Pipe Dia. = 48")			2	EA	$5,524.00	$11,048.00
Storm Inlet, Type R/Type 14, 5-foot			25	EA	$5,910.00	$147,750.00
Special Items (User Defined)						
Asphalt Repave	**<----User Defined Items**		370	S.Y.	$40.00	$14,800.00
Asphalt Patch	**<----User Defined Items**		1426	S.Y.	$50.00	$71,300.00
Waterline Lowering	**<----User Defined Items**		4	EA	$5,000.00	$20,000.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$653,834.00
Concrete Box Culverts			$0.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$0.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$106,100.00
Subtotal Capital Improvement Costs			**$759,934.00**
Additional Capital Improvement Costs			
Dewatering	$7,599.34	L.S.	$7,599.00
Mobilization	5%		$37,997.00
Traffic Control	$37,996.70	L.S.	$37,997.00
Utility Coordination/Relocation	$37,996.70	L.S.	$37,997.00
Stormwater Management/Erosion Control	5%		$37,997.00
Subtotal Additional Capital Improvement Costs			**$159,587.00**
Land Acquisition Costs			
ROW/Easements			$0.00
Subtotal Land Acquisition Costs			**$0.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$137,928.00
Legal/Administrative	5%		$45,976.00
Contract Admin/Construction Management	10%		$91,952.00
Contingency	25%		$229,880.00
Subtotal Other Costs			**$505,736.00**
Total Capital Improvement Costs			**$1,425,257.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	2850	L.F.	$1.00	$570.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	34	EA	$64.00	$435.00
Total Annual Operation and Maintenance Cost				**$1,005.00**

7.4.5 12TH AVENUE OUTFALL

The 12th Avenue Outfall has a 2-year design capacity extending from 20th Street, north along 12th Avenue, to the Greeley No. 3 Canal. The outfall has a tributary area of 146 acres and ranges in size from 18 inches to 36 inches. The storm drain passes underneath the Greeley No. 3 Canal and is intercepted by the 12th Street Outfall, west of the Great Western and Union Pacific Railroads. The 2-year design flow for the 12th Street Outfall is approximately 44 cfs. For reference, the 100-year peak flow contributing to the downstream outfall is approximately 91 cfs.

The existing sanitary sewer along the east side of 12th Avenue and several laterals crossing the proposed storm drain alignment at Cranford Place, 17th Street, 16th Street and 15th Street should be avoided. No sanitary relocations are anticipated to be required as part of the proposed improvements; however, multiple water lines will require lowering.

Click here to view 12th Avenue Outfall Map

Table 7-10: 12th Avenue Outfall Cost Estimate

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains					
Circular Pipes					
Diameter (in)	Length (ft)	No. of Barrels			
18-inch	360	1	360	L.F.	$69.00	$24,840.00
24-inch	1330	1	1330	L.F.	$92.00	$122,360.00
30-inch	1600	1	1600	L.F.	$116.00	$185,600.00
36-inch	1200	1	1200	L.F.	$139.00	$166,800.00
18-inch	50	28	1400	L.F.	$69.00	$96,600.00
Manholes and Inlets						
Manhole, 4' Dia. (Pipe Dia. < 36")			11	EA	$3,726.00	$40,986.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			4	EA	$5,010.00	$20,040.00
Storm Inlet, Type R/Type 14, 5-foot			28	EA	$5,910.00	$165,480.00
Special Items (User Defined)						
Asphalt Patch	<----User Defined Items		2373	S.Y.	$50.00	$118,650.00
Waterline Lowering	<----User Defined Items		8	EA	$5,000.00	$40,000.00

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$822,706.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$158,650.00
Subtotal Capital Improvement Costs				**$981,356.00**
Additional Capital Improvement Costs				
Dewatering	$9,813.56	L.S.		$9,814.00
Mobilization	5%			$49,068.00
Traffic Control	$49,067.80	L.S.		$49,068.00
Utility Coordination/Relocation	$49,067.80	L.S.		$49,068.00
Stormwater Management/Erosion Control	5%			$49,068.00
Subtotal Additional Capital Improvement Costs				**$206,086.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$178,116.00
Legal/Administrative	5%			$59,372.00
Contract Admin/Construction Management	10%			$118,744.00
Contingency	25%			$296,861.00
Subtotal Other Costs				**$653,093.00**
Total Capital Improvement Costs				**$1,840,535.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	4490	L.F.	$1.00	$898.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	43	EA	$64.00	$550.00
Total Annual Operation and Maintenance Cost				**$1,448.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$50,680.00**

7.4.6 16TH STREET OUTFALL

The 16th Street Outfall intercepts flow along 10th Avenue from 19th Street to 16th Street. At 16th Street, the storm drain system turns east, crosses the Greeley No. 3 Canal, and discharges into the 12th Street Outfall, west of the Great Western and Union Pacific Railroads. This outfall system, in addition to the 17th Street Outfall, will replace the existing 17th Street clay pipe storm drain. The proposed outfall ranges in size from a 18 inch to 30 inch RCP and has been sized to convey the 10-year discharge of 27 cfs to help mitigate flooding hazards near the University of Northern Colorado Campus.

The existing sanitary sewer along the west side of 10th Avenue should be avoided with the proposed improvements. The proposed alignment crosses but is not anticipated to require relocation of the sanitary sewer in 9th Avenue. Water lines require lowering as part of the proposed storm drain improvements.

Click here to view 16th Street Outfall Map

Table 7-11: 16th Street Outfall Cost Estimate

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains					
Circular Pipes					
Diameter (in)	**Length (ft)**	**No. of Barrels**			
18-inch	1120	1	1120	L.F.	$69.00	$77,280.00
24-inch	600	1	600	L.F.	$92.00	$55,200.00
30-inch	1100	1	1100	L.F.	$116.00	$127,600.00
18-inch	50	18	900	L.F.	$69.00	$62,100.00
Manholes and Inlets					
Manhole, 4' Dia. (Pipe Dia. < 36")		9	EA	$3,726.00	$33,534.00
Storm Inlet, Type R/Type 14, 5-foot		18	EA	$5,910.00	$106,380.00
Special Items (User Defined)					
Asphalt Patch	**<----User Defined Items**	1566	S.Y.	$50.00	$78,300.00
Waterline Lowering	**<----User Defined Items**	6	EA	$5,000.00	$30,000.00

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$462,094.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$108,300.00
Subtotal Capital Improvement Costs				**$570,394.00**
Additional Capital Improvement Costs				
Dewatering	$5,703.94	L.S.		$5,704.00
Mobilization	5%			$28,520.00
Traffic Control	$28,519.70	L.S.		$28,520.00
Utility Coordination/Relocation	$28,519.70	L.S.		$28,520.00
Stormwater Management/Erosion Control	5%			$28,520.00
Subtotal Additional Capital Improvement Costs				**$119,784.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$103,527.00
Legal/Administrative	5%			$34,509.00
Contract Admin/Construction Management	10%			$69,018.00
Contingency	25%			$172,545.00
Subtotal Other Costs				**$379,599.00**
Total Capital Improvement Costs				**$1,069,777.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	2820	L.F.	$1.00	$564.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	27	EA	$64.00	$346.00
Total Annual Operation and Maintenance Cost				**$910.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$31,850.00**

7.4.7 17TH STREET OUTFALL

The 17th Street Outfall intercepts flow east of the University of Northern Colorado Campus, conveying flow north along 8th Avenue. At 17th Street the storm drain system turns east before passing underneath the Greeley No. 3 Canal and contributing flow to the 12th Street Outfall, west of the Great Western and Union Pacific Railroads. The proposed system is sized for a 10-year design storm. Pipes range in size from a 24 inch RCP to 42 inch RCP, with slopes varying between 1 and 2 percent. The 10-year design flow of the 17th Street Outfall is approximately 17 cfs.

A sanitary conflict between 7th and 8th Avenue will require relocation to the east. Several water lines require lowering with the proposed improvements. The proposed alignment crosses a sanitary sewer on 17th Street between 7th and 8th Avenue, in addition to several water lines.

Click here to view 17th Street Outfall Map

Table 7-12: 17th Street Outfall Cost Estimate

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains					
Circular Pipes					
Diameter (in)	**Length (ft)**	**No. of Barrels**			
24-inch	700	1	700	L.F.	$92.00	$64,400.00
36-inch	600	1	600	L.F.	$139.00	$83,400.00
42-inch	130	1	130	L.F.	$162.00	$21,060.00
18-inch	50	15	750	L.F.	$69.00	$51,750.00
Manholes and Inlets						
Manhole, 4' Dia. (Pipe Dia. < 36")			6	EA	$3,726.00	$22,356.00
Storm Inlet, Type R/Type 14, 5-foot			15	EA	$5,910.00	$88,650.00
Special Items (User Defined)						
Asphalt Patch	**<----User Defined Items**		767	S.Y.	$50.00	$38,350.00
Waterline Lowering	**<----User Defined Items**		4	EA	$5,000.00	$20,000.00
Sanitary Sewer Relocation (Pipe)	**<----User Defined Items**		275	LF	$75.00	$20,625.00
Sanitary Sewer Relocation (Manhole)	**<----User Defined Items**		1	EA	$5,000.00	$5,000.00

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$331,616.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$83,975.00
Subtotal Capital Improvement Costs				**$415,591.00**
Additional Capital Improvement Costs				
Dewatering	$4,155.91	L.S.		$4,156.00
Mobilization	5%			$20,780.00
Traffic Control	$20,779.55	L.S.		$20,780.00
Utility Coordination/Relocation	$20,779.55	L.S.		$20,780.00
Stormwater Management/Erosion Control	5%			$20,780.00
Subtotal Additional Capital Improvement Costs				**$87,276.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$75,430.00
Legal/Administrative	5%			$25,143.00
Contract Admin/Construction Management	10%			$50,287.00
Contingency	25%			$125,717.00
Subtotal Other Costs				**$276,577.00**
Total Capital Improvement Costs				**$779,444.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	1430	L.F.	$1.00	$286.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	21	EA	$64.00	$269.00
Total Annual Operation and Maintenance Cost				**$555.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$19,425.00**

7.4.8 16TH AVENUE COURT OUTFALL

The 16th Avenue Court Outfall improves the existing storm drain capacity to convey the 2-year design discharge. The outfall has a tributary area of 205 acres. The proposed system collects flow south of 2nd Street, along 17th Avenue and 20th Avenue Court, before continuing north to the Great Western Railroad. Pipes upstream of the Great Western Railroad vary in size from 18 inches to 42 inches. Due to the small change in grade over the entire outfall system, pipes south of the Great Western Railroad are limited to 0.2 to 0.5 percent. A 54 inch RCP is proposed to be tunneled under the Great Western Railroad, continuing north along 17th Avenue, until discharging where the existing system outfalls into the pond west of the Greeley Stampede.

A sanitary sewer conflict along 17th Avenue will require relocation. The proposed relocation extends the sanitary sewer north to the existing sanitary sewer in 17th Avenue. The proposed improvements require the lowering of water lines along the storm drain alignment.

Click here to view 16th Avenue Court Outfall Map

Table 7-13: 16th Avenue Court Outfall Cost Estimate

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	**Length (ft)**	**No. of Barrels**				
18-inch	760	1	760	L.F.	$69.00	$52,440.00
30-inch	2585	1	2585	L.F.	$116.00	$299,860.00
42-inch	1255	1	1255	L.F.	$162.00	$203,310.00
18-inch	50	9	450	L.F.	$69.00	$31,050.00
Manholes and Inlets						
Manhole, 4' Dia. (Pipe Dia. < 36")			10	EA	$3,726.00	$37,260.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			6	EA	$5,010.00	$30,060.00
Storm Inlet, Type R/Type 14, 5-foot			9	EA	$5,910.00	$53,190.00
Special Items (User Defined)						
Asphalt Patch	**<----User Defined Items**		1938	S.Y.	$50.00	$96,900.00
Railroad Boring	**<----User Defined Items**		120	L.F.	$4,500.00	$540,000.00
Waterline Lowering	**<----User Defined Items**		9	EA	$5,000.00	$45,000.00
Sanitary Sewer Relocation (Pipe)	**<----User Defined Items**		170	LF	$75.00	$12,750.00
Sanitary Sewer Relocation (MH)	**<----User Defined Items**		1	EA	$5,000.00	$5,000.00
Land Acquisition						
Easement/ROW Acquisition			0.56	ACRE	$98,706.22	$55,275.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$707,170.00
Concrete Box Culverts			$0.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$0.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$699,650.00
Subtotal Capital Improvement Costs			**$1,406,820.00**
Additional Capital Improvement Costs			
Dewatering	$16,002.94	L.S.	$16,003.00
Mobilization	5%		$70,341.00
Traffic Control	$70,341.00	L.S.	$70,341.00
Utility Coordination/Relocation	$70,341.00	L.S.	$70,341.00
Stormwater Management/Erosion Control	5%		$70,341.00
Subtotal Additional Capital Improvement Costs			**$297,367.00**
Land Acquisition Costs			
ROW/Easements			$55,275.00
Subtotal Land Acquisition Costs			**$55,275.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$255,628.00
Legal/Administrative	5%		$85,209.00
Contract Admin/Construction Management	10%		$170,419.00
Contingency	25%		$426,047.00
Subtotal Other Costs			**$937,303.00**
Total Capital Improvement Costs			**$2,696,765.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	4600	L.F.	$1.00	$920.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	25	EA	$64.00	$320.00
Total Annual Operation and Maintenance Cost				**$1,240.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$43,400.00**

7.4.9 14TH AVENUE OUTFALL

The 14th Avenue Outfall is comprised of storm drain system to convey flows up to the 10-year design discharge. The system has a tributary area of approximately 386 acres and is generally bounded by the Cache La Poudre River to the north, 14th Avenue to the east, 10th Street to the south, and the Greeley No. 3 Canal to the west. This outfall system will require a new crossing at the Great Western Railroad, north of 2nd Street. A significant increase in infrastructure is required for the 14th Avenue Outfall compared to the prior outfalls, located upstream of the Greeley No. 3 Canal. This is due to increased flow rates, but also restrictions in pipe slope as the system nears the Cache La Poudre River. Flow from Luther Park North, upstream of the Greeley No. 3 Canal, is conveyed to the 14th Avenue Outfall trunk along 9th Street. Additional collectors intercept stormwater runoff along 4th, 5th, and 8th Streets.

Cost estimates for the collector system entering the 14th Avenue Outfall have been separated from the trunk line, below. Lithos Engineering prepared a cost estimate for the crossing of the Great Western Railroad.

7.4.9.1 14TH AVENUE OUTFALL – 4TH, 5TH, AND 8TH STREET COLLECTORS

The 4th Street Collector increases the existing storm drain capacity that collects local neighborhood flow, east of the 16th Avenue Court Outfall, up to the 2-year design flow of 3 cfs. An 18 inch RCP, at a 0.5 percent slope has been proposed. Since, the existing storm drain passes alongside Billie Martinez Elementary School property, an easement cost has also been included for the new storm drain alignment.

The 5th Street Collector has 2-year capacity and collects flow generally bounded by 15th Avenue Court on the east, 7th Street on the south, Greeley Canal No. 3 on the west, and 5th Street to the north. Due to a lack in grade change in this area, pipe slopes are limited to 0.2 to 0.5 percent, with pipes ranging from 24 inches to 36 inches in diameter. Flow south of 6th Street is collected and conveyed to 15th Avenue Court, where the existing storm drain redirects north, conveying the 2-year design flow of 7 cfs. The pipe system continues north to 5th Street where it intersects a collector along 5th Street conveying flow east to the 14th Avenue trunk line. The 2-year design flow into the 14th Avenue trunk is 26 cfs.

The 8th Street Collector has a 2-year capacity of 8 cfs, and consists of a 24 inch RCP at 0.5 percent slope from 16th Avenue to 14th Avenue.

Relocation of a sanitary sewer west of 14th Avenue will be required with the proposed improvements. The relocation of the sanitary south along 14th Avenue should be implemented during the proposed 14th Avenue trunk line project. Several water lines are in conflict and will required adjustment.

Click here to view 14th Avenue Outfall – 4th, 5th, and 8th Street Collectors Map

Table 7-14: 14th Avenue Outfall - 4th, 5th, and 8th Street Collectors Cost Estimate

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	**Length (ft)**	**No. of Barrels**				
18-inch	1580	1	1580	L.F.	$69.00	$109,020.00
24-inch	2160	1	2160	L.F.	$92.00	$198,720.00
30-inch	1464	1	1464	L.F.	$116.00	$169,824.00
36-inch	690	1	690	L.F.	$139.00	$95,910.00
18-inch	50	53	2650	L.F.	$69.00	$182,850.00
Manholes and Inlets						
Manhole, 4' Dia. (Pipe Dia. < 36")			26	EA	$3,726.00	$96,876.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			3	EA	$5,010.00	$15,030.00
Storm Inlet, Type R/Type 14, 5-foot			53	EA	$5,910.00	$313,230.00
Special Items (User Defined)						
Asphalt Patch	**<----User Defined Items**		3151	S.Y.	$50.00	$157,550.00
Waterline Lowering	**<----User Defined Items**		11	EA	$5,000.00	$55,000.00
Asphalt Repave	**<----User Defined Items**		473	S.Y.	$40.00	$18,920.00
Land Acquisition						
Easement/ROW Acquisition			0.38	ACRE	$25,337.99	$9,628.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$1,181,460.00
Concrete Box Culverts			$0.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$0.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$231,470.00
Subtotal Capital Improvement Costs			**$1,412,930.00**
Additional Capital Improvement Costs			
Dewatering	$14,129.30	L.S.	$14,129.00
Mobilization	5%		$70,647.00
Traffic Control	$70,646.50	L.S.	$70,647.00
Utility Coordination/Relocation	$70,646.50	L.S.	$70,647.00
Stormwater Management/Erosion Control	5%		$70,647.00
Subtotal Additional Capital Improvement Costs			**$296,717.00**
Land Acquisition Costs			
ROW/Easements			$9,628.00
Subtotal Land Acquisition Costs			**$9,628.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$256,447.00
Legal/Administrative	5%		$85,482.00
Contract Admin/Construction Management	10%		$170,965.00
Contingency	25%		$427,412.00
Subtotal Other Costs			**$940,306.00**
Total Capital Improvement Costs			**$2,659,581.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	5894	L.F.	$1.00	$1,179.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	82	EA	$64.00	$1,050.00
Total Annual Operation and Maintenance Cost				**$2,229.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$78,014.00**

7.4.9.2 14TH AVENUE OUTFALL – TRUNK LINE

The 14th Avenue Outfall trunk line conveys flow from Luther Park West underneath the Greeley No. 3 Canal, east along 9th Street, north along 14th Avenue before discharging into the Cache La Poudre River.

At the upstream end of the 14th Avenue Outfall new outlet structures at Luther Park West and Luther Park East detention basins will be connect the existing detention facilities to a new proposed detention basin, located north of 10th Street, referred to as the Luther Park North detention basin. Improving the outlet structures at Luther Park West and East will increase their capacity to convey the 10-year storm without overtopping onto 10th Street. The proposed Luther Park North detention basin has a maximum storage capacity of 4.0 Acre-feet.

A 30 inch RCP is proposed to convey up to the 10-year discharge of 46 cfs from Luther Park North, across the Greeley No. 3 Canal, to 9th Street. Pipe slope varies from approximately 1.5 to 3 percent. From 19th Avenue to 18th Avenue, a 48 inch RCP is proposed at a 0.3 percent slope to convey the 10-year design flow. Limited by a pipe slope of 0.15 percent downstream of 18th Avenue, a 6 foot by 4 foot reinforced concrete box culvert (RCBC) is proposed to convey the 10-year design flow of approximately 61 cfs. The proposed storm drain continues east to 14th Avenue redirecting north along 14th Avenue. Ground cover restricts the pipe slope to 0.15 percent from 9th Street to 5th Street. Just upstream of intercepting the 5th Street Collector, the 10-year design flow is 98 cfs. At 5th Street the 14th Avenue Outfall intercepts the 5th Street Collector, increasing the drainage infrastructure to a 9 foot x 4 foot RCBC. The storm drain system continues to gradually increase in the downstream direction with an 11 foot by 4 foot RCBC crossing of the Great Western Railroad. Lithos prepared a cost estimate for a trenchless crossing of the Great Western Railroad. The cost estimate for this trenchless crossing of the railroad is 2.628 million dollars. More information about the railroad crossing can be found in 7.1.3 Railroad Tunneling Assessment. Downstream of the Great Western Railroad, ground cover further restricts the pipe slope to 0.12 percent increasing the box culvert to a 12 foot by 5 foot RCBC near the Greeley Stampede and outfall into the Cache La Poudre River.

An 8.1 acre-foot water quality basin has been proposed at the downstream end of the 14th Avenue Outfall near the Cache La Poudre River north of D Street and west of 11th Avenue. For this design, a splitter structure near the Greeley Stampede will divert flows up to the 2-year event of 132 cfs into the pond for treatment prior to exiting into the river. Flows in excess of the 2-year design flow will continue directly to the Cache La Poudre River.

Sanitary sewers conflicts are present along the proposed alignment at North Park Avenue, north of 2nd Street, 2nd Street, 3rd Street, 6th Street, south of 6th Street, south of 7th Street, 8th Street, south of 8th Street, 16th Avenue, and west of 16th Avenue. Proposed relocations are noted on the conceptual design map.

The sanitary sewer north of 2nd Street is proposed to the south where a sanitary sewer conflict vault will be required to cross the proposed storm drain at 3rd Street. The 5th Street sanitary sewer is proposed to be relocated to the north along the westbound lanes of 14th Avenue to the crossing at 3rd Street described above. Another conflict vault is also proposed at 8th Street. The sanitary sewers currently crossing 14th Avenue at 6th Street, south of 6th Street, south of 7th Street, and south of 8th Street are proposed to be relocation to a new conflict vault at 8th Street. A sanitary conflict along the 5th Street Lateral is proposed to be relocated south along 14th Avenue to the 8th Street bypass vault. Finally, the sanitary conflict at 16th Avenue is proposed to be resolved either through a new conflict vault, or relocating the sanitary sewer along 9th Street to the existing sanitary sewer crossing south of 8th Street.

Numerous conflicts with water lines are also present along the proposed 14th Avenue Outfall alignment and will require lowering or relocations.

Click here to view 14th Avenue Outfall Map

Click here to view 14th Avenue Outfall Profile

Table 7-15: 14th Avenue Outfall - Trunk Line Cost Estimate

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	**Length (ft)**	**No. of Barrels**				
18-inch	140	1	140	L.F.	$69.00	$9,660.00
30-inch	550	1	550	L.F.	$116.00	$63,800.00
30-inch	210	1	210	L.F.	$116.00	$24,360.00
36-inch	500	1	500	L.F.	$139.00	$69,500.00
48-inch	500	1	500	L.F.	$185.00	$92,500.00
54-inch	33	1	33	L.F.	$277.00	$9,141.00
18-inch	50	75	3750	L.F.	$69.00	$258,750.00
Flare End Sections						
Diameter (in)	**Applicable**	**No. of Barrels**				
18-inch	Yes	1	2	EA	$1,182.00	$2,364.00
30-inch	Yes	1	2	EA	$2,017.00	$4,034.00
30-inch	Yes	1	1	EA	$2,017.00	$2,017.00
Headwalls						
Diameter (in)	**Applicable**	**No. of Barrels**				
54-inch	Yes	1	1	EA	$1,843.52	$1,844.00
Wingwalls (includes concrete apron)						
Diameter (in)		**No. of Barrels**				
54-inch		1	1	EA	$11,271.99	$11,272.00
Manholes and Inlets						
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			19	EA	$15,416.00	$292,904.00
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			2	EA	$19,271.00	$38,542.00
Storm Inlet, Type R/Type 14, 5-foot			75	EA	$5,910.00	$443,250.00
Concrete Box Culverts						
Box Culvert Pipe						
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**			
6	4	1	3191	L.F.	$699.12	$2,230,682.00
9	4	1	500	L.F.	$878.76	$439,378.00
10	4	1	1144	L.F.	$938.56	$1,073,756.00
11	4	1	540	L.F.	$999.36	$539,654.00
12	4	1	2115	L.F.	$1,059.16	$2,240,126.00
12	5	1	935	L.F.	$1,199.54	$1,121,566.00
Headwall and Toewalls						
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**				
12	1	14.00	1	EA	$1,303.89	$1,304.00
Wingwalls (includes wingwalls on either side of channel and concrete apron)						
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**				
12	5	1	1	EA	$12,088.88	$12,088.90
Detention/Water Quality Facilities						
Detention (Complete-in-Place)						
Detention Facility 1 (Complete-in-Place)			8	AC-FT	$58,582.00	$472,464.00
Detention Facility 2 (Complete-in-Place)			4	AC-FT	$58,582.00	$234,328.00
Landscaping and Maintenance Improvements						
Trail/Path, Concrete (10' Width)			150	L.F.	$57.00	$8,550.00
Special Items (User Defined)						
Asphalt Repave	**<----User Defined Items**		6826	S.Y.	$50.00	$341,300.00
Waterline Lowering	**<----User Defined Items**		12	EA	$5,000.00	$60,000.00
Great Western RR Crossing	**<----User Defined Items**		130	L.F.	$20,222.33	$2,628,903.00
Sanitary Sewer Relocation (Pipe)	**<----User Defined Items**		2731	LF	$75.00	$204,825.00
Sanitary Sewer Relocation (MH)	**<----User Defined Items**		13	EA	$5,000.00	$65,000.00
Sanitary Sewer Conflict Vault	**<----User Defined Items**		3	EA	$30,000.00	$90,000.00
Diversion Junction Box	**<----User Defined Items**		1	EA	$37,000.00	$37,000.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$1,323,938.00
Concrete Box Culverts			$7,658,555.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$706,792.00
Removals			$0.00
Landscaping and Maintenance Improvements			$8,550.00
Special Items (User Defined)			$3,427,028.00
Subtotal Capital Improvement Costs			**$13,124,863.00**
Additional Capital Improvement Costs			
Dewatering	$131,248.63	L.S.	$131,249.00
Mobilization	5%		$656,243.00
Traffic Control	$656,243.15	L.S.	$656,243.00
Utility Coordination/Relocation	$656,243.15	L.S.	$656,243.00
Stormwater Management/Erosion Control	5%		$656,243.00
Subtotal Additional Capital Improvement Costs			**$2,756,221.00**
Land Acquisition Costs			
ROW/Easements			$0.00
Subtotal Land Acquisition Costs			**$0.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$2,382,163.00
Legal/Administrative	5%		$794,054.00
Contract Admin/Construction Management	10%		$1,588,108.00
Contingency	25%		$3,970,271.00
Subtotal Other Costs			**$8,734,596.00**
Total Capital Improvement Costs			**$24,615,680.00**

7.4.10 1ST STREET OUTFALL

The 1st Street Outfall has a tributary area of 290 acres and is generally bounded by the Cache La Poudre River to the north and east, 5th Street to the south, and 13th Avenue to the west. The entire outfall system is designed to convey a 5-year design flow. The system is comprised of laterals south of A Street, west on A Street, and north of A Street. The change in grade within the 1st Street Outfall area significantly impacts the required infrastructure size as the main outfall path is limited to approximately a 0.1 percent slope. The outfall path is proposed to move one block north from the existing 1st Street location, to A Street, due to the abundance of sanitary sewer conflicts along 1st Street.

A detention facility has been proposed north of 2nd Street to provide a maximum storage volume of 1.4 Acre-feet during the 5-year design storm. The detention facility will reduce the infrastructure required to convey the design flow east along 3rd Street to a 24 inch RCP. The storm drain continues east on 3rd Street to the intersection of 9th Avenue and 3rd Street where the system turns north along 9th Avenue. The proposed improvements east along 3rd Street removes the storm drain system from private property, as the existing system is currently aligned, but reduces the pipe slope to approximately 0.1 percent for the additional length required. The minimal pipe slope requires pipes ranging from 18 inches to 42 inches in diameter. A 42 inch RCP is proposed to be tunneled under the Great Western Railroad. The 5-year design discharge into the 1st Street Outfall is approximately 30 cfs. Ground cover along 3rd Street restricts pipe depth of the proposed improvement, requiring a sanitary conflict vault at 3rd Street and 9th Avenue. Several water lines will require lowering with the proposed improvements.

The lateral west on A Street conveys flow east from 11th Avenue to 9th Avenue. This lateral requires a 36 inch RCP at 0.3 percent slope, contributing approximately 18 cfs into the 1st Street Outfall during the 5-year event. The proposed improvements require several water line crossings to be lowered with the proposed improvements but no sanitary sewer relocations are anticipated.

The lateral north of A Street, a 42 inch RCP, contributes approximately 27 cfs into the 1st Street Outfall during the 5-year event. Several sanitary conflicts will need to be avoided with the proposed improvements. The restriction in ground cover along the proposed alignment requires a sanitary conflict vault at B Street.

Overall, the 1st Street Outfall, extending from 9th Avenue and A Street, conveys flow east to the Cache La Poudre River. The outfall system is limited to a 0.1 percent slope to pass below 8th Avenue and the Union Pacific Railroad with adequate cover. A crossing structure equivalent to a 10 foot by 4 foot box culvert is required to convey the design discharge at this location. The 5-year peak discharge from the 1st Street Outfall system into the Cache La Poudre River is approximately 120 cfs. The proposed improvements require lowering of several water lines with the proposed storm drain infrastructure. A sanitary conflict vault is required in 9th Avenue at A Street.

Downstream of the UPRR Railroad crossing, a water quality basin has been proposed to detain up to 5.0 Acre-feet. As with the other locations, a splitter structure is also proposed to discharge flows to the pond. Flows in excess of the 2-year design discharge of 82 cfs will bypass the water quality basin and discharge directly into the Cache La Poudre River.

Click here to view 1st Street Outfall Map

Table 7-16: 1st Street Outfall Cost Estimate

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	Length (ft)	No. of Barrels				
24-inch	1590	1	1590	L.F.	$92.00	$146,280.00
30-inch	975	1	975	L.F.	$116.00	$113,100.00
36-inch	1410	1	1410	L.F.	$139.00	$195,990.00
42-inch	880	1	880	L.F.	$162.00	$142,560.00
48-inch	50	1	50	L.F.	$185.00	$9,250.00
18-inch	50	63	3150	L.F.	$69.00	$217,350.00
Flare End Sections						
Diameter (in)	Applicable	No. of Barrels				
24-inch	Yes	1	1	EA	$1,246.00	$1,246.00
48-inch	Yes	1	1	EA	$2,646.00	$2,646.00
Manholes and Inlets						
Manhole, 4' Dia. (Pipe Dia. < 36")			4	EA	$3,726.00	$14,904.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			6	EA	$5,010.00	$30,060.00
Manhole, 6' Dia. (Pipe Dia. = 48")			3	EA	$5,524.00	$16,572.00
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			15	EA	$15,416.00	$231,240.00
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			1	EA	$19,271.00	$19,271.00
Storm Inlet, Type R/Type 14, 5-foot			78	EA	$5,910.00	$460,980.00
Concrete Box Culverts						
Box Culvert Pipe						
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)			
9	4	1	400	L.F.	$878.76	$351,502.00
10	4	1	350	L.F.	$938.56	$328,495.00
10	4	1	820	L.F.	$938.56	$769,617.00
Headwall and Toewalls						
Individual Box Span (ft)	No. of Barrels	Total Span (ft)				
10	1	12.00	1	EA	$1,124.82	$1,125.00
Wingwalls (includes wingwalls on either side of channel and concrete apron)						
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels				
10	4	1	1	EA	$8,908.47	$8,908.50
Detention/Water Quality Facilities						
Detention (Complete-in-Place)						
Detention Facility 1 (Complete-in-Place)			12	AC-FT	$58,582.00	$702,984.00
Detention Facility 2 (Complete-in-Place)			5	AC-FT	$58,582.00	$291,445.00
Special Items (User Defined)						
Asphalt Repave	<----User Defined Items		2711	S.Y.	$40.00	$108,440.00
Asphalt Patch	<----User Defined Items		1198	S.Y.	$50.00	$59,900.00
Waterline Lowering	<----User Defined Items		8	EA	$5,000.00	$40,000.00
RR Boring	<----User Defined Items		160	LF	$4,500.00	$720,000.00
RR Boring (Hwy 85)	<----User Defined Items		640	L.F.	$4,500.00	$2,880,000.00
RR Boring (UPRR)	<----User Defined Items		320	LF	$4,500.00	$1,440,000.00
Diversion Junction Box	<----User Defined Items		1	EA	$37,000.00	$37,000.00
Sanitary Sewer Conflict Vault	<----User Defined Items		3	EA	$30,000.00	$90,000.00
Land Acquisition						
Easement/ROW Acquisition			3.34	ACRE	$144,474.00	$482,543.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$1,601,449.00
Concrete Box Culverts			$1,459,648.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$994,429.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$5,375,340.00
Subtotal Capital Improvement Costs			**$9,430,866.00**
Additional Capital Improvement Costs			
Dewatering	$94,308.66	L.S.	$94,309.00
Mobilization	5%		$471,543.00
Traffic Control	$471,543.30	L.S.	$471,543.00
Utility Coordination/Relocation	$471,543.30	L.S.	$471,543.00
Stormwater Management/Erosion Control	5%		$471,543.00
Subtotal Additional Capital Improvement Costs			**$1,980,481.00**
Land Acquisition Costs			
ROW/Easements			$482,543.00
Subtotal Land Acquisition Costs			**$482,543.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$1,711,702.00
Legal/Administrative	5%		$570,567.00
Contract Admin/Construction Management	10%		$1,141,135.00
Contingency	25%		$2,852,837.00
Subtotal Other Costs			**$6,276,241.00**
Total Capital Improvement Costs			**$18,170,131.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	6475	L.F.	$1.00	$1,295.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	107	EA	$64.00	$1,370.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal,	15.975	ACRE	$1,927.00	$15,392.00
Total Annual Operation and Maintenance Cost				**$18,057.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$631,989.00**

7.4.11 5TH STREET OUTFALL

The 5th Street Outfall has a tributary area of 74 acres and is sized to convey the 5-year design flow. The outfall extends west from the Cache La Poudre River along 5th Street to 6th Avenue. Pipes varying in size from 18 inches to 30 inches in diameter at slopes between 0.5 and 1.0 percent convey the 5-year design flow of 18 cfs.

No relocation of sanitary sewers are anticipated as part of the proposed improvements. Lowering of waterlines will be required at 4th and 5th Avenue.

Click here to view 5th Street Outfall Map

Table 7-17: 5th Street Outfall Cost Estimate

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	**Length (ft)**	**No. of Barrels**				
24-inch	800	1	800	L.F.	$92.00	$73,600.00
30-inch	400	1	400	L.F.	$116.00	$46,400.00
18-inch	50	11	550	L.F.	$69.00	$37,950.00
Flare End Sections						
Diameter (in)	**Applicable**	**No. of Barrels**				
30-inch	Yes	1	1	EA	$2,017.00	$2,017.00
Manholes and Inlets						
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			3	EA	$5,010.00	$15,030.00
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			1	EA	$15,416.00	$15,416.00
Storm Inlet, Type R/Type 14, 5-foot			11	EA	$5,910.00	$65,010.00
Special Items (User Defined)						
Asphalt Patch	**<----User Defined Items**		644	S.Y.	$50.00	$32,200.00
Waterline Lowering	**<----User Defined Items**		2	EA	$5,000.00	$10,000.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$255,423.00
Concrete Box Culverts			$0.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$0.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$42,200.00
Subtotal Capital Improvement Costs			**$297,623.00**
Additional Capital Improvement Costs			
Dewatering	$2,976.23	L.S.	$2,976.00
Mobilization	5%		$14,881.00
Traffic Control	$14,881.15	L.S.	$14,881.00
Utility Coordination/Relocation	$14,881.15	L.S.	$14,881.00
Stormwater Management/Erosion Control	5%		$14,881.00
Subtotal Additional Capital Improvement Costs			**$62,500.00**
Land Acquisition Costs			
ROW/Easements			$0.00
Subtotal Land Acquisition Costs			**$0.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$54,018.00
Legal/Administrative	5%		$18,006.00
Contract Admin/Construction Management	10%		$36,012.00
Contingency	25%		$90,031.00
Subtotal Other Costs			**$198,067.00**
Total Capital Improvement Costs			**$558,190.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	1200	L.F.	$1.00	$240.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	15	EA	$64.00	$192.00
Total Annual Operation and Maintenance Cost				**$432.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$15,120.00**

7.4.12 7TH STREET OUTFALL

The 7th Street Outfall's tributary area is generally bounded by 5th Street to the north, the Cache La Poudre River to the east, 11th Street to the South, and 14th Avenue to the west. The outfall has a tributary area of 300 Acres and is responsible for conveying flow from the commercial district, north of 11th Street. The majority of the outfall system is sized to convey the 10-year design flow but does include 2-year and 5-year laterals.

The 7th Street Outfall intercepts flow east along 10th Street from the 14th Avenue and 10th Street intersection. In order to avoid a conflict with the 21 inch sanitary sewer located south of the Union Colony Civic Center in 8th Street, pipe slopes are limited and as flat as 0.1 percent in areas. The storm drain gradually increases in size from a 42 inch RCP to a 6 foot by 4 foot RCBC at the sanitary crossing. Downstream of the sanitary crossing the storm drain turns north along 10th Avenue before redirecting east on 7th Street. The 10-year design flow at 10th Avenue and 7th Street is approximately 110 cfs. The 7th Street Outfall increases to an 8 foot by 4 foot RCBC after intercepting the lateral in 8th Avenue. From 10th Avenue to 5th Avenue the box culverts are proposed at a 0.5 percent slope. A crossing structure equivalent to an 8 foot by 4 foot RCBC is required to convey the 10-year design flow of approximately 230 cfs at the railroad crossing. Lithos prepared a cost estimate for a trenchless crossing of the Union Pacific and Great Western Railroads. The cost estimate for this trenchless crossing of the railroad crossings is 3.080 million dollars. More information about the railroad crossing can be found in 7.1.3 Railroad Tunneling Assessment.

Downstream of 5th Avenue to the outfall into the Cache La Poudre River pipe slope is limited to 0.3 percent. The restriction in pipe slope and additional interception of flow requires the 7th Street storm drain to gradually increase to a 12 foot by 4 foot box culvert at the outfall location. At the outfall with the Cache La Poudre River, the proposed storm drain will convey design flow of 250 cfs during a 10-yr event.

A 5.8 Acre-foot water quality basin is proposed at the downstream end of the 7th Street Outfall. As with the other locations, a splitter structure has been proposed to divert flows up to the 2-year design flow of 146 cfs into the water quality pond. Flows in excess of the 2-year design flow will remain in the storm drain system and outfall directly into the Cache La Poudre River.

There are numerous water line conflicts along the proposed alignment. Sanitary sewers along 11th Avenue will have to be relocated to the sanitary sewer in 8th Street as part of the proposed improvements. The sanitary sewer between 8th and 9th Street will have to be relocated as part of the proposed 8th Avenue Lateral improvements. Two existing sanitary sewers (21 inches and 27 inches in diameter, respectively) located near the outfall into the Cache La Poudre River are not anticipated to be relocated with the improvements. A 14 inch sanitary sewer near the proposed water quality basin will need to be relocated or abandoned as part of the project.

Click here to view 7th Street Outfall Map

Click here to view 7th Street Outfall Profile

Table 7-18: 7th Street Outfall Cost Estimate

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains					
Circular Pipes					
Diameter (in)	Length (ft)	No. of Barrels			
18-inch	1940	1	1940	L.F.	$69.00	$133,860.00
24-inch	2620	1	2620	L.F.	$92.00	$241,040.00
30-inch	860	1	860	L.F.	$116.00	$99,760.00
42-inch	1515	1	1515	L.F.	$162.00	$245,430.00
54-inch	500	1	500	L.F.	$277.00	$138,500.00
60-inch	60	1	60	L.F.	$308.00	$18,480.00
18-inch	50	162	8100	L.F.	$69.00	$558,900.00
Headwalls						
Diameter (in)	Applicable	No. of Barrels				
60-inch	Yes	1	1	EA	$2,047.85	$2,048.00
Wingwalls (includes concrete apron)						
Diameter (in)		No. of Barrels				
60-inch		1	1	EA	$11,460.50	$11,461.00
Manholes and Inlets						
Manhole, 4' Dia. (Pipe Dia. < 36")		20	EA	$3,726.00	$74,520.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42")		11	EA	$5,010.00	$55,110.00
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)		32	EA	$15,416.00	$493,312.00
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)		1	EA	$19,271.00	$19,271.00
Storm Inlet, Type R/Type 14, 5-foot		162	EA	$5,910.00	$957,420.00
Concrete Box Culverts					
Box Culvert Pipe					
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)			
6	4	1	3204	L.F.	$699.12	$2,239,771.00
7	4	1	500	L.F.	$758.92	$379,461.00
8	4	1	765	L.F.	$819.72	$627,089.00
10	4	1	540	L.F.	$938.56	$506,821.00
12	4	1	785	L.F.	$1,059.16	$831,441.00
Detention/Water Quality Facilities						
Detention (Complete-in-Place)						
Detention Facility 1 (Complete-in-Place)		6	AC-FT	$58,582.00	$336,847.00
Special Items (User Defined)						
Asphalt Repave	<----User Defined Items	8310	S.Y.	$40.00	$332,400.00
Asphalt Patch	<----User Defined Items	3396	S.Y.	$50.00	$169,800.00
Waterline Lowering	<----User Defined Items	32	EA	$5,000.00	$160,000.00
Great Western and UPRR Crossing	<----User Defined Items	180	LF	$17,112.51	$3,080,252.00
Sanitary Sewer Relocations (Pipe)	<----User Defined Items	1420	LF	$75.00	$106,500.00
Sanitary Sewer Relocations (MH)	<----User Defined Items	9	EA	$5,000.00	$45,000.00
Diversion Junction Box	<----User Defined Items	1	EA	$37,000.00	$37,000.00
Land Acquisition					
Easement/ROW Acquisition		5.87	ACRE	$72,505.11	$425,605.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$3,049,112.00
Concrete Box Culverts			$4,584,583.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$336,847.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$3,930,952.00
Subtotal Capital Improvement Costs			**$11,901,494.00**
Additional Capital Improvement Costs			
Dewatering	$119,014.94	L.S.	$119,015.00
Mobilization	5%		$595,075.00
Traffic Control	$595,074.70	L.S.	$595,075.00
Utility Coordination/Relocation	$595,074.70	L.S.	$595,075.00
Stormwater Management/Erosion Control	5%		$595,075.00
Subtotal Additional Capital Improvement Costs			**$2,499,315.00**
Land Acquisition Costs			
ROW/Easements			$425,605.00
Subtotal Land Acquisition Costs			**$425,605.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$2,160,121.00
Legal/Administrative	5%		$720,040.00
Contract Admin/Construction Management	10%		$1,440,081.00
Contingency	25%		$3,600,202.00
Subtotal Other Costs			**$7,920,444.00**
Total Capital Improvement Costs			**$22,746,858.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	13289	L.F.	$1.00	$2,658.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	226	EA	$64.00	$2,893.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal	5.75	ACRE	$1,927.00	$5,540.00
Total Annual Operation and Maintenance Cost				**$11,091.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$388,182.00**

7.4.13 9TH STREET OUTFALL

The 9th Street Outfall has a tributary area of 31 acres. The proposed storm drain will convey the 5-year design flow of 19 cfs through pipes ranging in size from 18 inches to 30 inches in diameter. Easement acquisition is proposed along 9th Street east of 3rd Avenue to the outfall into the Cache La Poudre River.

Sanitary crossings are present along the proposed alignment but no relocation is anticipated to be necessary near 4th Avenue and at 3rd Avenue. Several water lines require lowering will require adjustment along the proposed alignment.

Click here to view 9th Street Outfall Map

Table 7-19: 9th Street Outfall Cost Estimate

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	**Length (ft)**	**No. of Barrels**				
18-inch	570	1	570	L.F.	$69.00	$39,330.00
18-inch	1000	1	1000	L.F.	$69.00	$69,000.00
36-inch	360	1	360	L.F.	$139.00	$50,040.00
18-inch	50	12	600	L.F.	$69.00	$41,400.00
Flare End Sections						
Diameter (in)	**Applicable**	**No. of Barrels**				
36-inch	Yes	1	1	EA	$2,068.00	$2,068.00
Manholes and Inlets						
Manhole, 4' Dia. (Pipe Dia. < 36")			5	EA	$3,726.00	$18,630.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			2	EA	$5,010.00	$10,020.00
Storm Inlet, Type R/Type 14, 5-foot			12	EA	$5,910.00	$70,920.00
Special Items (User Defined)						
Asphalt Patch	**<----User Defined Items**		1012	S.Y.	$50.00	$50,600.00
Waterline Lowering	**<----User Defined Items**		3	EA	$5,000.00	$15,000.00
Land Acquisition						
Easement/ROW Acquisition			0.14	ACRE	$43,987.24	$6,325.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$301,408.00
Concrete Box Culverts			$0.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$0.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$65,600.00
Subtotal Capital Improvement Costs			**$367,008.00**
Additional Capital Improvement Costs			
Dewatering	$3,670.08	L.S.	$3,670.00
Mobilization	5%		$18,350.00
Traffic Control	$18,350.40	L.S.	$18,350.00
Utility Coordination/Relocation	$18,350.40	L.S.	$18,350.00
Stormwater Management/Erosion Control	5%		$18,350.00
Subtotal Additional Capital Improvement Costs			**$77,070.00**
Land Acquisition Costs			
ROW/Easements			$6,325.00
Subtotal Land Acquisition Costs			**$6,325.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$66,612.00
Legal/Administrative	5%		$22,204.00
Contract Admin/Construction Management	10%		$44,408.00
Contingency	25%		$111,020.00
Subtotal Other Costs			**$244,244.00**
Total Capital Improvement Costs			**$694,647.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	1930	L.F.	$1.00	$386.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	19	EA	$64.00	$243.00
Total Annual Operation and Maintenance Cost				**$629.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$22,015.00**

7.4.14 11TH STREET OUTFALL

The 11th Street Outfall, designed to convey the 2-year design flow, will intercept stormwater runoff from 5th Avenue east to 2nd Avenue. This outfall has a tributary area of approximately 30 acres and requires pipes 18 inches in diameter. At 12th Avenue the 11th Street Outfall is proposed to tie into the existing outfall along 2nd Avenue, which follows 2nd Avenue north to the Cache La Poudre River.

There are multiple water line conflicts along the proposed alignment to be adjusted with the storm drain improvements. No sanitary sewer relocation is anticipated to be required.

Click here to view 11th Street Outfall Map

Table 7-20: 11th Street Outfall Cost Estimate

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	**Length (ft)**	**No. of Barrels**				
18-inch	850	1	850	L.F.	$69.00	$58,650.00
18-inch	600	1	600	L.F.	$69.00	$41,400.00
18-inch	490	1	490	L.F.	$69.00	$33,810.00
Manholes and Inlets						
Manhole, 4' Dia. (Pipe Dia. < 36")			6	EA	$3,726.00	$22,356.00
Storm Inlet, Type R/Type 14, 5-foot			4	EA	$5,910.00	$23,640.00
Special Items (User Defined)						
Asphalt Patch	**<----User Defined Items**		903	S.Y.	$50.00	$45,150.00
Waterline Lowering	**<----User Defined Items**		3	EA	$5,000.00	$15,000.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$179,856.00
Concrete Box Culverts			$0.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$0.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$60,150.00
Subtotal Capital Improvement Costs			**$240,006.00**
Additional Capital Improvement Costs			
Dewatering	$2,400.06	L.S.	$2,400.00
Mobilization	5%		$12,000.00
Traffic Control	$12,000.30	L.S.	$12,000.00
Utility Coordination/Relocation	$12,000.30	L.S.	$12,000.00
Stormwater Management/Erosion Control	5%		$12,000.00
Subtotal Additional Capital Improvement Costs			**$50,400.00**
Land Acquisition Costs			
ROW/Easements			$0.00
Subtotal Land Acquisition Costs			**$0.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$43,561.00
Legal/Administrative	5%		$14,520.00
Contract Admin/Construction Management	10%		$29,041.00
Contingency	25%		$72,602.00
Subtotal Other Costs			**$159,724.00**
Total Capital Improvement Costs			**$450,130.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	1450	L.F.	$1.00	$290.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	10	EA	$64.00	$128.00
Total Annual Operation and Maintenance Cost				**$418.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$14,630.00**

7.4.15 12TH STREET OUTFALL

The 12th Street Outfall is generally bounded by 11th Street to the north, Highway 85 on the east, 16th Street to the south, and the Greeley No. 3 Canal to the west. The outfall has a tributary area of approximately 337 acres. The proposed outfall will convey flows east along 12th Street and across Highway 85 before discharging into the Cache La Poudre River. The 12th Street Outfall intercepts flow that is currently conveyed by the existing 13th Street / 2nd Avenue Outfall. The outfall also intercepts flows from laterals south of 12th Street both west and east of the Great Western and Union Pacific Railroad.

The 12th Street trunk line was separated from the laterals for estimating the cost of each component.

7.4.15.1 12TH STREET OUTFALL – TRUNK LINE

The 14th Avenue Outfall is intercepted by the 12th Street Outfall after passing underneath the Greeley No. 3 Canal and continuing north on 14th Avenue to 12th Street. West of 14th Avenue, along 12th Street, a 30 inch RCP storm drain is proposed to tie into the existing Moon Pond outlet. This storm drain will intercept the discharge from Moon Pond that currently discharges into the Greeley No. 3 Canal.

From 14th Avenue to 11th Avenue, a 7 foot by 4 foot RCBC conveys the 10-year design flow at a slope of approximately 0.65 percent. Downstream of 11th Avenue the pipe slope is limited to 0.3 percent requiring that the outfall increase in size to a 9 foot by 4 foot RCBC. The storm drain gradually increases in size to 8 foot by 5 foot just upstream of 7th Avenue, where the trunk line intercepts the lateral west of the railroad. A structure equivalent to a 13 foot by 5 foot box culvert is required to convey the 10-year design flow of 600 cfs underneath the Great Western and Union Pacific Railroad crossing. Lithos provided a cost estimate for the crossing with the Union Pacific and Great Western Railroad. The trenchless crossing of the railroad was estimated to be 3.564 million dollars. More information about the railroad crossing can be found in 7.1.3 Railroad Tunneling Assessment. East of the railroad, as the storm drain nears the Cache La Poudre River, the proposed slope flattens to 0.3 percent, requiring a 13 foot by 6 foot box culvert through the Sunrise neighborhood. Just upstream of the crossing of Highway 85 the 12th Street Outfall intercepts the lateral east of the railroad. A structure equivalent to a 12 foot by 6 foot box culvert is required to convey the 10-year design flow of 670 cfs flows underneath Highway 85. Lithos estimated the cost of this crossing to be 2.994 million dollars. More information about the trenchless railroad crossing can be found in 7.1.3 Railroad Tunneling Assessment. A 16 foot by 6 foot RCBC conveys flow to the Cache La Poudre River.

A 6.6 Acre-foot water quality basin is proposed at the downstream end of the 12th Street Outfall. As with the other locations, a splitter structure has been proposed to divert flows up to the 2-year design flow into the water quality pond. Flows in excess of the 2-year design flow will remain in the storm drain system and outfall directly into the Cache La Poudre River.

Sanitary sewers conflicts exist at 1st, 3rd, 7th and 8th Avenue along the proposed alignment. These conflicts will require relocation of the sewer lines in these areas.

Numerous water lines along 12th Street will need to be lowered as part of the selected plan.

Click here to view 12th Street Outfall Map

Click here to view 12th Street Outfall Profile

Table 7-21: 12th Street Outfall - Trunk Line Cost Estimate

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains					
Circular Pipes					
Diameter (in)	Length (ft)	No. of Barrels			
30-inch	225	1	225	L.F.	$116.00	$26,100.00
36-inch	500	1	500	L.F.	$139.00	$69,500.00
36-inch	30	1	30	L.F.	$139.00	$4,170.00
18-inch	475	1	475	L.F.	$69.00	$32,775.00
24-inch	500	1	500	L.F.	$92.00	$46,000.00
18-inch	50	35	1750	L.F.	$69.00	$120,750.00
Manholes and Inlets					
Manhole, 4' Dia. (Pipe Dia. < 36")		6	EA	$3,726.00	$22,356.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42")		2	EA	$5,010.00	$10,020.00
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)		22	EA	$15,416.00	$339,152.00
Storm Inlet, Type R/Type 14, 5-foot		42	EA	$5,910.00	$248,220.00
Concrete Box Culverts					
Box Culvert Pipe					
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)			
6	4	1	485	L.F.	$699.12	$339,073.00
7	4	1	1514	L.F.	$758.92	$1,149,008.00
9	4	1	1000	L.F.	$878.76	$878,755.00
10	4	1	500	L.F.	$938.56	$469,279.00
8	5	1	525	L.F.	$868.86	$456,150.00
13	6	1	1930	L.F.	$1,490.55	$2,876,761.00
14	6	1	415	L.F.	$1,641.19	$681,093.00
8	5	1	150	L.F.	$868.86	$130,329.00
16	6	1	1287	L.F.	$2,048.95	$2,636,995.00
Headwall and Toewalls					
Individual Box Span (ft)	No. of Barrels	Total Span (ft)			
8	1	10.00	1	EA	$880.35	$880.00
16	1	18.00	1	EA	$1,761.03	$1,761.00
Wingwalls (includes wingwalls on either side of channel and concrete apron)					
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels			
8	5	1	1	EA	$11,083.48	$11,083.50
16	6	1	1	EA	$16,295.59	$16,295.60
Detention/Water Quality Facilities					
Detention (Complete-in-Place)					
Detention Facility 1 (Complete-in-Place)		7	AC-FT	$58,582.00	$385,938.00
Special Items (User Defined)					
Asphalt Repave	<----User Defined Items	8119	S.Y.	$40.00	$324,760.00
Waterline Lowering	<----User Defined Items	17	EA	$5,000.00	$85,000.00
Great Western and UPRR Tunneling Crossing	<----User Defined Items	200	LF	$17,822.32	$3,564,463.00
Highway 85 Tunneling Crossing	<----User Defined Items	160	LF	$18,718.24	$2,994,919.00
Asphalt Patch	<----User Defined Items	495	S.Y.	$50.00	$24,750.00
Sanitary Sewer Relocation (Pipe)	<----User Defined Items	1085	LF	$75.00	$81,375.00
Sanitary Sewer Relocation (MH)	<----User Defined Items	6	EA	$5,000.00	$30,000.00
Diversion Junction Box	<----User Defined Items	1	EA	$37,000.00	$37,000.00
Sanitary Sewer Conflict Vault	<----User Defined Items	1	EA	$30,000.00	$30,000.00
Land Acquisition					
Easement/ROW Acquisition		10.01	ACRE	$25,738.66	$257,644.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$919,043.00
Concrete Box Culverts			$9,647,463.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$385,938.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$7,172,267.00
Subtotal Capital Improvement Costs			**$18,124,711.00**
Additional Capital Improvement Costs			
Dewatering	$181,247.11	L.S.	$181,247.00
Mobilization	5%		$906,236.00
Traffic Control	$906,235.55	L.S.	$906,236.00
Utility Coordination/Relocation	$906,235.55	L.S.	$906,236.00
Stormwater Management/Erosion Control	5%		$906,236.00
Subtotal Additional Capital Improvement Costs			**$3,806,191.00**
Land Acquisition Costs			
ROW/Easements			$257,644.00
Subtotal Land Acquisition Costs			**$257,644.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$3,289,635.00
Legal/Administrative	5%		$1,096,545.00
Contract Admin/Construction Management	10%		$2,193,090.00
Contingency	25%		$5,482,726.00
Subtotal Other Costs			**$12,061,996.00**
Total Capital Improvement Costs			**$34,250,542.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	9536	L.F.	$1.00	$1,907.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	69	EA	$64.00	$883.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal,	6.588	ACRE	$1,927.00	$6,348.00
Total Annual Operation and Maintenance Cost				**$9,138.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$319,827.00**

7.4.15.2 12TH STREET OUTFALL – INTERCEPTOR WEST OF GREAT WESTERN AND UNION PACIFIC RAILROADS

Several collectors and interceptors south of 12th Street and west of the Great Western and Union Pacific Railroad connect to the 12th Street Outfall. The 12th Avenue Outfall, 16th Street Outfall, and 17th Street Outfall are all proposed to convey the 10-year design flow underneath the Greeley No. 3 Canal and converge at 7th Avenue where the outfall turns north along 12th Street.

Downstream of the Greeley No. 3 Canal, the 12th Avenue Outfall is conveyed along 11th Avenue to 13th Street through a 48 inch RCP. A 54 inch RCP continues east along 13th Street gradually increasing in size to a 60 inch RCP after intercepting the lateral in 9th Avenue. The 9th Avenue storm drain lateral intercepts the 5-year design flow from 15th Street to 13th Street.

The 16th Street Outfall conveys the 10-year design discharge of 27 cfs underneath the Greeley No. 3 Canal through a 36 inch RCP. The storm drain turns and continues north at 8th Avenue gradually increasing in size until the 48 inch RCP connects with the storm drain in 13th Street.

To minimize the number of the Great Western and Union Pacific Railroad crossings, the lateral in 6th Avenue is proposed to turn west to 7th Avenue before turning north and confluencing with the 12th Street Outfall trunk line.

The 17th Street Outfall continues east from crossing the Greeley No. 3 Canal to 6th Avenue. The discharge is conveyed in a 36 inch RCP at a 0.5 percent slope. The storm drain system turns north at 7th Avenue and continues to 15th Street. From 15th Street north to 12th Street the proposed storm drain gradually increases in size to a 7 foot by 3 RCBC with pipe slopes varying between 0.25 and 2 percent. The 10-year design flow just upstream of 13th Street is 63 cfs.

An 11 foot by 5 foot RCBC at a 0.3 percent slope is proposed to convey the 10-year design discharge of 350 cfs into the 12th Street Outfall trunk line.

Sanitary sewers conflicts exist at 8th Avenue and 14th Street along the proposed alignment. These conflicts will require relocation of the sewer lines at these locations

Click here to view 12th Street Outfall – Interceptor West of Great Western and Union Pacific Railroads Map

Table 7-22: 12th Street Outfall – Interceptor West of Great Western and UPRR Cost Estimate

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains					
Circular Pipes					
Diameter (in)	Length (ft)	No. of Barrels			
30-inch	384	1	384	L.F.	$116.00	$44,544.00
36-inch	2910	1	2910	L.F.	$139.00	$404,490.00
42-inch	1506	1	1506	L.F.	$162.00	$243,972.00
48-inch	2395	1	2395	L.F.	$185.00	$443,075.00
54-inch	1500	1	1500	L.F.	$277.00	$415,500.00
60-inch	500	1	500	L.F.	$308.00	$154,000.00
18-inch	50	98	4900	L.F.	$69.00	$338,100.00
Manholes and Inlets						
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			23	EA	$5,010.00	$115,230.00
Manhole, 6' Dia. (Pipe Dia. = 48")			9	EA	$5,524.00	$49,716.00
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			19	EA	$15,416.00	$292,904.00
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			4	EA	$19,271.00	$77,084.00
Storm Inlet, Type R/Type 14, 5-foot			91	EA	$5,910.00	$537,810.00
Concrete Box Culverts						
Box Culvert Pipe						
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)			
8	4	1	500	L.F.	$819.72	$409,862.00
10	5	1	520	L.F.	$1,046.05	$543,948.00
6	3	1	578	L.F.	$639.32	$369,654.00
Special Items (User Defined)						
Asphalt Repave	<----User Defined Items		3796	S.Y.	$40.00	$151,840.00
Asphalt Patch	<----User Defined Items		3196	S.Y.	$50.00	$159,800.00
Waterline Lowering	<----User Defined Items		15	EA	$5,000.00	$75,000.00
Sanitary Sewer Relocation (Pipe)	<----User Defined Items		1245	LF	$75.00	$93,375.00
Sanitary Sewer Relocation (MH)	<----User Defined Items		6	EA	$5,000.00	$30,000.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$3,116,425.00
Concrete Box Culverts			$1,323,464.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$0.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$510,015.00
Subtotal Capital Improvement Costs			**$4,949,904.00**
Additional Capital Improvement Costs			
Dewatering	$49,499.04	L.S.	$49,499.00
Mobilization	5%		$247,495.00
Traffic Control	$247,495.20	L.S.	$247,495.00
Utility Coordination/Relocation	$247,495.20	L.S.	$247,495.00
Stormwater Management/Erosion Control	5%		$247,495.00
Subtotal Additional Capital Improvement Costs			**$1,039,479.00**
Land Acquisition Costs			
ROW/Easements			$0.00
Subtotal Land Acquisition Costs			**$0.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$898,407.00
Legal/Administrative	5%		$299,469.00
Contract Admin/Construction Management	10%		$598,938.00
Contingency	25%		$1,497,346.00
Subtotal Other Costs			**$3,294,160.00**
Total Capital Improvement Costs			**$9,283,543.00**

7.4.15.3 12TH STREET OUTFALL – INTERCEPTOR EAST OF GREAT WESTERN AND UNION PACIFIC RAILROADS

The lateral east of the Great Western and Union Pacific Railroads railroad is designed to convey the 5-year design flow and generally follows the alignment of the existing storm drain system. A 36 inch RCP is proposed to convey flow north from 4th Avenue and 16th Street to 15th Street where the system runs east along 15th Street to 2nd Avenue. In order to avoid a conflict with the sanitary sewer in 3rd Avenue, pipe slopes are limited to 0.15 percent upstream of 3rd Avenue. The proposed storm drain improvements turns north at 2nd Avenue conveying the 5-year design flow of 55 cfs to the 12th Street trunk line at a pipe slope of 0.4 percent.

There are several sanitary sewer crossings along 3rd Avenue but none are anticipated to need relocation.

Click here to view 12th Street Outfall – Interceptor East of Great Western and Union Pacific Railroads Map

Table 7-23: 12th Street Outfall – Interceptor East of Great Western and UPRR Cost Estimate

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains					
Circular Pipes					
Diameter (in)	**Length (ft)**	**No. of Barrels**			
18-inch	500	1	500	L.F.	$69.00	$34,500.00
24-inch	1000	1	1000	L.F.	$92.00	$92,000.00
30-inch	500	1	500	L.F.	$116.00	$58,000.00
36-inch	1480	1	1480	L.F.	$139.00	$205,720.00
42-inch	1160	1	1160	L.F.	$162.00	$187,920.00
18-inch	50	73	3650	L.F.	$69.00	$251,850.00
Manholes and Inlets					
Manhole, 4' Dia. (Pipe Dia. < 36")			6	EA	$3,726.00	$22,356.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			10	EA	$5,010.00	$50,100.00
Storm Inlet, Type R/Type 14, 5-foot			43	EA	$5,910.00	$254,130.00
Special Items (User Defined)					
Asphalt Patch	**<----User Defined Items**		1628	S.Y.	$50.00	$81,400.00
Waterline Lowering	**<----User Defined Items**		6	EA	$5,000.00	$30,000.00

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$1,156,576.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$111,400.00
Subtotal Capital Improvement Costs				**$1,267,976.00**
Additional Capital Improvement Costs				
Dewatering	$12,679.76	L.S.		$12,680.00
Mobilization	5%			$63,399.00
Traffic Control	$63,398.80	L.S.		$63,399.00
Utility Coordination/Relocation	$63,398.80	L.S.		$63,399.00
Stormwater Management/Erosion Control	5%			$63,399.00
Subtotal Additional Capital Improvement Costs				**$266,276.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$230,138.00
Legal/Administrative	5%			$76,713.00
Contract Admin/Construction Management	10%			$153,425.00
Contingency	25%			$383,563.00
Subtotal Other Costs				**$843,839.00**
Total Capital Improvement Costs				**$2,378,091.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	4640	L.F.	$1.00	$928.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	59	EA	$64.00	$755.00
Total Annual Operation and Maintenance Cost				**$1,683.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$58,904.00**

7.4.16 HIGHWAY 85 OUTFALL

The Highway 85 Outfall conveys flow north along Highway 85 from the southernmost portion of the watershed to the Cache La Poudre River. This outfall is sized to convey the 5-year design flow of 86 cfs and includes tunneling a 42 inch RCP under Highway 85 at 18th Street to convey flows from the west side of Highway 85 to the east. The proposed system increases the existing 40 inch RCP to a 54 inch RCP in order to convey flow north from 15th Street along Highway 85, to the outfall location into the 12th Street Outfall trunk line. Similar to the current conditions, the new culvert at 15th Street will regulate flow between the Highway 85 Outfall and overflow to offsite basins. Any flow not intercepted by the culvert will divert east out of the North Greeley and Downtown Basin. Costs for maintenance were included for the open channel portion of the outfall between 18th Street and 16th Street.

Click here to view Highway 85 Outfall Map

Table 7-24: Highway 85 Outfall Cost Estimate

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains					
Circular Pipes					
Diameter (in)	**Length (ft)**	**No. of Barrels**			
42-inch	3000	1	3000	L.F.	$150.00	$450,000.00
54-inch	1620	1	1620	L.F.	$257.00	$416,340.00
18-inch	50	34	1700	L.F.	$64.00	$108,800.00
Flare End Sections					
Diameter (in)	**Applicable**	**No. of Barrels**			
42-inch	Yes	1	2	EA	$2,025.00	$4,050.00
Headwalls					
Diameter (in)	**Applicable**	**No. of Barrels**			
54-inch	Yes	1	2	EA	$1,724.80	$3,450.00
Wingwalls (includes concrete apron)					
Diameter (in)		**No. of Barrels**			
54-inch		1	2	EA	$10,499.26	$20,999.00
Manholes and Inlets					
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			15	EA	$4,646.00	$69,690.00
Storm Inlet, Type R/Type 14, 5-foot			34	EA	$5,480.00	$186,320.00
Special Items (User Defined)					
Asphalt Repave	**<----User Defined Items**		2421	SY	$40.00	$96,840.00
Waterline Lowering	**<----User Defined Items**		4	EA	$5,000.00	$20,000.00
Highway Boring	**<----User Defined Items**		100	LF	$4,500.00	$450,000.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$1,259,649.00
Concrete Box Culverts			$0.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$0.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$566,840.00
Subtotal Capital Improvement Costs			**$1,826,489.00**
Additional Capital Improvement Costs			
Dewatering	$18,264.89	L.S.	$18,265.00
Mobilization	5%		$91,324.00
Traffic Control	$91,324.45	L.S.	$91,324.00
Utility Coordination/Relocation	$91,324.45	L.S.	$91,324.00
Stormwater Management/Erosion Control	5%		$91,324.00
Subtotal Additional Capital Improvement Costs			**$383,561.00**
Land Acquisition Costs			
ROW/Easements			$0.00
Subtotal Land Acquisition Costs			**$0.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$331,508.00
Legal/Administrative	5%		$110,503.00
Contract Admin/Construction Management	10%		$221,005.00
Contingency	25%		$552,513.00
Subtotal Other Costs			**$1,215,529.00**
Total Capital Improvement Costs			**$3,425,579.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	4620	L.F.	$1.00	$924.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	49	EA	$60.00	$588.00
Channel Maintenance (e.g. sediment & debris removal, erosion, tree & weed removal, etc.)	1150	L.F.	$2.00	$460.00

Table 7-25: Master Plan Cost Estimate Summary

Conceptual Design Cost Estimate Summary - Upstream of Greeley No. 3 Canal

Priority	REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
High	16th Ave. Outfall	$ 3,123,327	$ -	$ 468,499	$ 156,166	$ 312,333	$ 780,832	$ 4,841,157	$ 3,220	$ 112,699
	16th St. Outfall	$ 690,178	$ -	$ 103,527	$ 34,509	$ 34,509	$ 172,545	$ 1,069,777	$ 910	$ 31,850
Medium	22nd Ave. Outfall	$ 646,986	$ -	$ 97,048	$ 32,349	$ 64,699	$ 161,747	$ 1,002,829	$ 2,679	$ 93,764
	12th Ave. Outfall	$ 1,187,442	$ -	$ 178,116	$ 59,372	$ 118,744	$ 296,861	$ 1,840,535	$ 1,448	$ 50,680
	17th St. Outfall	$ 502,867	$ -	$ 75,430	$ 25,143	$ 50,287	$ 125,717	$ 779,444	$ 555	$ 19,425
Low	14th Ave. US Outfall	$ 919,521	$ -	$ 137,928	$ 45,976	$ 91,952	$ 229,880	$ 1,425,257	$ 1,005	$ 35,175
	23rd Ave. Outfall	$ 1,410,223	$ -	$ 211,533	$ 70,511	$ 141,022	$ 352,556	$ 2,185,845	$ 1,513	$ 52,955
Total		$ 8,480,544	$ -	$ 1,272,081	$ 424,026	$ 813,546	$ 2,120,138	$ 13,144,844	$ 11,330	$ 396,548

Conceptual Design Cost Estimate Summary - Downstream of Greeley No. 3 Canal

Priority	REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
High	12th St. Outfall Trunk	$ 21,930,902	$ 257,644	$ 3,289,635	$ 1,096,545	$ 2,193,090	$ 5,482,726	$ 34,250,542	$ 9,138	$ 319,827
	7th St. Outfall	$ 14,400,809	$ 425,605	$ 2,160,121	$ 720,040	$ 1,440,081	$ 3,600,202	$ 22,746,858	$ 11,091	$ 388,182
	12th St. Outfall West Interceptor	$ 5,989,383	$ -	$ 898,407	$ 299,469	$ 598,938	$ 1,497,346	$ 9,283,543	$ 4,028	$ 140,979
Medium	14th Ave. Outfall Trunk	$ 15,881,084	$ -	$ 2,382,163	$ 794,054	$ 1,588,108	$ 3,970,271	$ 24,615,680	$ 11,072	$ 387,517
	14th Ave. Outfall Collector	$ 1,709,647	$ 9,628	$ 256,447	$ 85,482	$ 170,965	$ 427,412	$ 2,659,581	$ 2,229	$ 78,014
	12th St. Outfall East Interceptor	$ 1,534,252	$ -	$ 230,138	$ 76,713	$ 153,425	$ 383,563	$ 2,378,091	$ 1,683	$ 58,904
Low	5th St. Outfall	$ 360,123	$ -	$ 54,018	$ 18,006	$ 36,012	$ 90,031	$ 558,190	$ 432	$ 15,120
	9th St. Outfall	$ 444,078	$ 6,325	$ 66,612	$ 22,204	$ 44,408	$ 111,020	$ 694,647	$ 629	$ 22,015
	16th Ave. Ct. Outfall	$ 1,704,187	$ 55,275	$ 255,628	$ 85,209	$ 170,419	$ 426,047	$ 2,696,765	$ 1,240	$ 43,400
	11th St. Outfall	$ 290,406	$ -	$ 43,561	$ 14,520	$ 29,041	$ 72,602	$ 450,130	$ 418	$ 14,630
	1st St. Outfall	$ 11,411,347	$ 482,543	$ 1,711,702	$ 570,567	$ 1,141,135	$ 2,852,837	$ 18,170,131	$ 18,057	$ 631,989
	Hwy 85 Outfall	$ 2,210,050	$ -	$ 331,508	$ 110,503	$ 221,005	$ 552,513	$ 3,425,579	$ 1,972	$ 61,967
Total		$ 77,866,268	$ 1,237,020	$ 11,679,940	$ 3,893,312	$ 7,786,627	$ 19,466,570	$ 121,929,737	$ 61,989	$ 2,162,544

NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

FIGURE 7-1 - MASTER PLAN SCHEMATIC
MARCH 2017

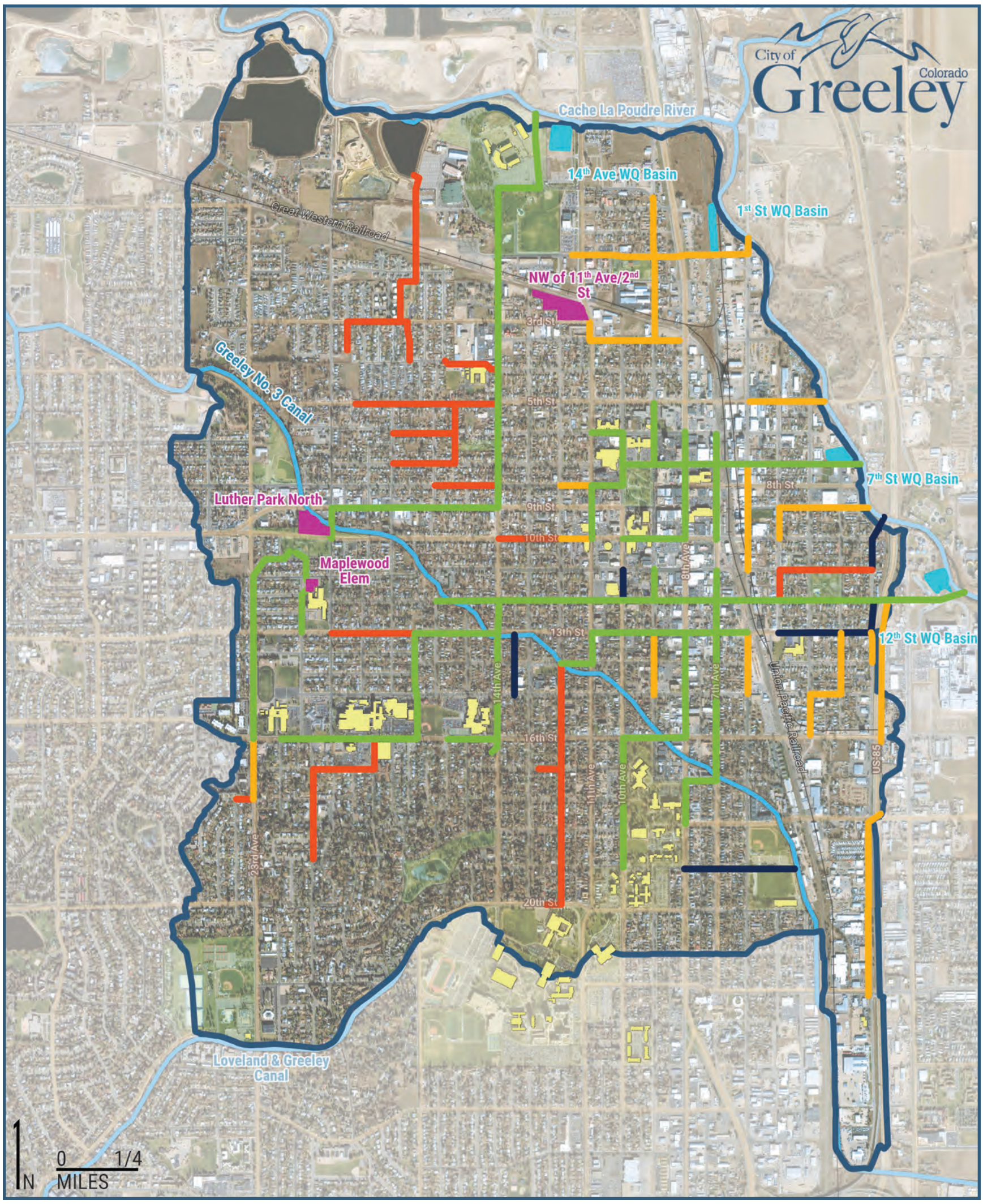
ICONENGINEERING, INC.

- Watershed Boundary
- Park
- Univ. of Northern Colorado
- Important Structure

Location	Outfall	Max Storage (Ac-ft)
Luther Park North	22nd Avenue	4.0
Maplewood Elementary	22nd Avenue	2.2
NW of 11th Ave/2nd St	1st Street	12.6
14th Ave WQ Basin	14th Avenue	8.1
1st Street WQ Basin	1st Street	5.0
7th Street WQ Basin	7th Street	5.8
12th Street WQ Basin	12th Street	6.6

Improvement Level

- 2-year
- 5-year
- 10-year
- Existing
- Detention Pond
- Water Quality Basin



7.5 PRIORITIZATION AND PHASING

The proposed improvements in the selected plan represent a significant financial investment to the North Greeley and Downtown Basin. Replacing storm drain systems throughout the basin to meet current criteria will need to be implemented in phases over a period of time when funding becomes available.

In general, drainage improvements should be constructed from downstream to upstream to avoid any adverse impacts. No adverse impacts would be expected from implementing the outfall systems separately. In general, the trunk line of any outfall system should be constructed before any laterals to ensure downstream capacity is met.

Upstream improvements were prioritized assuming downstream outfall trunk lines (7th Street, 12th Street, 14th Avenue) were in place.

Proposed improvements were ranked based on: effectiveness in mitigating flood hazards, feasibility of construction, and performance of existing storm drain systems in the vicinity of each project.

Prioritization and costs of each outfall is shown in Table 7-25.

7.5.1 HIGH PRIORITIZATION

Projects with high prioritization will have the most significant impact on mitigating flooding hazards on insurable structures in the basin. Each of the projects classified as high priority will protect their tributary area up to the 10-year design storm. As funds become available these projects should be prioritized in order to mitigate flooding hazards to the maximize extent possible.

12th Street Outfall: The implementation of the 12th Street Outfall will have the largest impact on mitigating flooding hazards on insurable structures in the basin. The proposed trunk line along 12th Street downstream of the Greeley No. 3 Canal protects structures north of 12th Street intercepting uncontrolled spills flow from the Greeley No. 3 Canal. The current storm drain system is overwhelmed by the spills flows and surface flooding continues north into the commercial district in the 7th Street Outfall Watershed. Construction of the 12th Street Outfall will also provide the required infrastructure for other outfalls such as 12th Street Outfall West Interceptor, 12th Street Outfall East Interceptor, and 16th Avenue outfall to drain into. Structures that will benefit from implementing the 12th Street Outfall include City Hall, Weld County Courthouse, City of Greeley Public Works Office among numerous others.

The 12th Street Outfall will require significant infrastructure crossings of the Great Western and Union Pacific Railroad and U.S. Hwy 85. The proposed water quality basin at the downstream end of the watershed will require land acquisition and will enhance the water quality before the stormwater runoff is discharged into the Cache La Poudre River.

7th Street Outfall: Construction of the 7th Street Outfall will mitigate flooding hazards throughout the commercial district. It is recommended that the 12th Street Outfall be constructed before the 7th Street Outfall to ensure uncontrolled spill flow from the Greeley No. 3 Canal is intercepted prior, or the 7th Street Outfall would function less effectively. The 7th Street Outfall will provide additional protection for structures in the commercial district around Lincoln Park, including Union Colony Civic Center, among numerous others.

The 7th Street Outfall requires the smallest infrastructure of any outfall trunk line. The proposed improvements will replace existing undersized storm drain infrastructure to ensure the commercial district meets existing City criteria of draining the initial storm, the 10-year design storm for commercial areas. Several large sanitary sewers at the downstream end of the outfall do not need to be relocated but will increase the difficultly of construction. The water quality basin at the downstream end of the outfall treats the stormwater before discharging into the Cache La Poudre River.

12th Street Outfall West Interceptor: The 12th Street Outfall West Interceptor will provide additional protection to the 12th Street Outfall watershed. South of 12th Street the proposed components of the 12th Street Outfall West Interceptor will intercept local stormwater runoff and spill flow from the Greeley No. 3 Canal. The 12th Street Outfall West Interceptor should be constructed soon after the 12th Street Outfall in order to maximize the return on investment made in the construction of the 12th Street Outfall. The 12th Street Outfall should precede any portions of the 12th Street Outfall West Interceptor so there is suitable infrastructure downstream for the improvements to drain into.

The proposed interceptor west of the Great Western and Union Pacific Railroad crossings will help collect uncontrolled spill flows from the Greeley No. 3 Canal before the flows get to the 12th Street Outfall trunk line. Several sanitary sewer relocations are required and increase the difficulty of implementing the proposed improvements. It is recommended that the 12th Street Outfall West Interceptor be constructed soon after the 12th Street Outfall trunk line in order to maximize the performance and the return on investment of building the 12th Street Outfall trunk line.

16th Avenue Outfall: Upstream of the Greeley No. 3 Canal the highest priority project should be the 16th Avenue Outfall. The outfall has the largest tributary area of any upstream outfall and mitigates flooding hazards on Banner Health North Colorado Medical Center and Moon Pond. The 16th Avenue Outfall requires the proposed improvements of the 12th Street Outfall to be in place at the Greeley No. 3 Canal for the runoff to drain into downstream.

Upstream of the Greeley No. 3 Canal, the proposed 16th Avenue Outfall mitigates flooding hazard on Banner Health North Colorado Medical Center, and improves the level of service of the existing Moon Pond detention basin without requiring any property acquisition. The 16th Avenue Outfall will require crossing the Greeley No. 3 Canal before tying into the 12th Street Outfall trunk line. Although there would be disruption in 16th Street during construction, this outfall should be prioritized with the long term protection it will provide.

16th Street Outfall: The 16th Street Outfall will mitigate flooding hazards on the University of Northern Colorado Campus. The proposed improvements will allow the City to abandon the existing clay pipe 17th Street Outfall that runs underneath the University of Northern Colorado Campus. The 16th Street Outfall requires the infrastructure from the 12th Street Outfall and a portion of the 12th Street Outfall West Interceptor to be in place to drain into.

The 16th Street Outfall will intercept flows up to the 10-year design storm that pose flooding hazards to the University of Northern Colorado Campus. The proposed improvements will allow the City to abandon the existing 17th Street clay storm drain that runs underneath the University of Northern Colorado Campus.

7.5.2 MEDIUM PRIORITIZATION

Outfall improvements with medium priority are still vital to mitigate flooding hazards throughout the basin.

14th Avenue Outfall: The 14th Avenue Outfall will help mitigate flooding hazards downstream of the Greeley No. 3 Canal west of 14th Avenue including around Billy Martinez Elementary School. The 14th Avenue Outfall should be constructed prior to the 22nd Avenue Outfall or the 23rd Avenue Outfall to avoid adverse impacts.

The proposed improvements to 14th Avenue will be the most difficult trunk line to implement given the limitation of pipe slopes along the entire outfall system. The implementation of the 14th Avenue Outfall requires numerous sanitary sewer relocations and conflict vaults to be placed along the proposed alignment. The 14th Avenue Outfall proposes a new detention basin at Luther Park North, reducing the spill flows from the Greeley No. 3 Canal and the stormwater infrastructure required downstream. At the downstream end of the watershed a basin will enhance the water quality of the stormwater runoff before it is discharged into the Cache La Poudre River.

14th Avenue Outfall Collector: The 14th Avenue Outfall Collector will mitigate flooding in residential areas west of 14th Avenue. The proposed improvements will increase the capacity of the storm drain west of 14th Avenue to convey the 2-year design flow. The 14th Avenue Outfall Collector should be prioritized soon after the 14th Avenue Outfall to maximize the return on investment to the 14th Avenue Outfall. The 14th Avenue Collector requires the 14th Avenue Outfall to already be in place for stormwater runoff to drain into.

The 14th Avenue Outfall Collector will replace the existing undersized storm drain west of 14th Avenue. The 14th Avenue Outfall Collector should be a priority to construct once the 14th Avenue Outfall trunk line is in place in order to maximize the performance and amount of water the 14th Avenue trunk line will convey.

22nd Avenue Outfall: The 22nd Avenue Outfall will mitigate flooding hazards on Maplewood Elementary School and residential areas near 13th Street and 22nd Avenue. The 14th Avenue Outfall including improvements to the outlet structure at Luther Park West should be constructed prior to the 22nd Avenue Outfall to avoid any adverse impacts.

The proposed 22nd Avenue Outfall mitigates flooding hazard on Maplewood Elementary School. The outfall discharges into the proposed improved detention basin at Maplewood Elementary School. This outfall should be prioritized above others given no storm drains are currently present along the proposed alignment and the important facility the improvements would protect.

12th Street Outfall East Interceptor: The 12th Street Outfall East Interceptor will mitigate flooding hazards on the residential and industrial areas south of 12th Street east of Great Western and Union Pacific Railroads. The 12th Street Outfall and 12th Street Outfall West Interceptor should be constructed prior to the 12th Street Outfall East Interceptor to minimize the amount of canal spill flow that overtops the railroads to the east. The 12th Street Outfall East Interceptor requires the 12th Street Outfall to be constructed to discharge stormwater runoff into.

The 12th Street Outfall East Interceptor will collect flow east of the Great Western and Union Pacific Railroads. The proposed improvements will intercept the 5-year design storm, south of 12th Street. The 12th Street Outfall West Interceptor should be implemented before the East Interceptor to help mitigate the existing flooding hazards that currently spill east over the Great Western and Union Pacific Railroad.

12th Avenue Outfall: The 12th Avenue Outfall mitigates flooding hazards in residential areas along 12th Street from 20th Avenue to the Greeley No. 3 Canal. The 12th Avenue Outfall requires the 12th Street Outfall and portions of the 12th Street Outfall West Interceptor to be constructed to discharge into as the system passes underneath the Greeley No. 3 Canal.

The 12th Avenue Outfall will mitigate residential flooding hazards from the University of Northern Colorado Campus at 20th Street to the Greeley No. 3 canal. Although the storm drain improvements will only provide a 2-year design storm level of protection, there are currently no storm drains along the proposed alignment and the proposed improvements would mitigate frequent flooding in the streets.

17th Street Outfall: The 17th Street Outfall will provide additional protection to the east side of the University of Northern Colorado Campus along 8th Avenue. The proposed improvements will help replace the existing clay pipe system in 17th Street that currently passes underneath the University of Northern Colorado Campus. The 12th Street Outfall and portions of the 12th Street Outfall West Interceptor will be required before the 17th Outfall can be constructed.

The 17th Street Outfall will mitigate flooding hazards to the east side of the University of Northern Colorado Campus. The proposed improvements will allow the City to abandon the 17th Street clay storm drain that currently runs underneath the University of Northern Colorado Campus and intercepts flow east of the campus.

7.5.3 LOW PRIORITIZATION

Improvements downstream of the Greeley No. 3 Canal classified as low priority are isolated in nature and can be implemented at any time without adverse impacts to other outfall systems. Improvements upstream of the Greeley No. 3 Canal are dependent on downstream infrastructure being in place at the time of construction.

5th Street Outfall: The 5th Street Outfall will mitigate flooding hazards on industrial areas north of 6th Street and east of Great Western and Union Pacific Railroads. If constructed before the 12th Street Outfall and 7th Street Outfall it would also minimally help mitigate flooding from spill flow from the Greeley No. 3 Canal. The 5th Street Outfall is not dependent on any other outfall system and could be implemented at any time.

The 5th Street Outfall Collector system will replace the existing undersized storm drain in 5th Street. Constructing the 7th Street Outfall will mitigate flooding hazards within the 5th Street Outfall watershed by intercepting flows before they spill over the Great Western and Union Pacific Railroad.

9th Street Outfall: The 9th Street Outfall will mitigate flooding hazards in residential and industrial areas along 9th Street from 5th Avenue to the Cache La Poudre River. The 9th Street Outfall is not dependent on any other outfall improvement being in place and can be implemented at any time.

The 9th Street Outfall Collector system will mitigate flooding hazards between the 7th Street and 11th Street Outfall watersheds. The proposed improvements will replace the existing undersized storm drain. The required property acquisition near the outfall and numerous utility conflicts will increase the difficulty to construct this outfall.

16th Avenue Court Outfall: The 16th Avenue Court Outfall will mitigate residential flooding hazards west of 16th Avenue north of 4th Street in the northwest corner of the watershed. The 16th Avenue Court Outfall is isolated and can be implemented at any time.

The proposed 16th Avenue Court Outfall will replace the existing undersized storm drain system. The limitation of pipe slopes along the proposed improvements will increase the difficulty to construct the proposed improvements.

11th Street Outfall: The 11th Street Outfall will mitigate residential flooding hazards along 11th Street from 5th Avenue to 2nd Avenue. The 11th Street Outfall is proposed to tie into the existing 13th Street / 2nd Avenue Outfall and may cause adverse impacts if the 12th Street Outfall is not in place at the time of construction.

The 11th Street Outfall will protect the neighborhood up to a 2-year design flow and tie into the existing 13th Street / 2nd Avenue Outfall.

1st Street Outfall: The 1st Street Outfall will mitigate flooding hazards on residential and industrial structures north of 5th Street, east of 14th Avenue in the northeast portion of the watershed. If the 14th Avenue Outfall, 12th Street Outfall, and 7th Street Outfall aren't in place the 1st Street Outfall will intercept some spill flow from other watersheds. The 1st Street Outfall is not dependent on any other outfall and can be implemented at any time.

The 1st Street Outfall will be the most difficult improvement to implement given the limitation of pipe slopes along the entire outfall system. The limitation in pipe slopes requires larger infrastructure to provide the protection of the initial, the 5-year design storm for this outfall. The proposed improvements will require sanitary sewer relocation and conflict vaults and crossing the Union Pacific Railroad, further increasing the difficulty of construction. The proposed detention basin northwest of 2nd Street and 11th Avenue will require property acquisition but allows the City to formalize the existing inadvertent storage area.

Highway 85 Outfall: The Highway 85 Outfall will mitigate flooding hazards in the southeastern most portion of the basin. The 12th Street Outfall is required to be in place before the Highway 85 Outfall can be constructed and drain into the 12th Street outfall.

The Highway 85 Outfall requires a significant investment to upsize the stormwater infrastructure to provide protection to the southeast portion of the watershed. The proposed improvements include improving the crossing underneath US Hwy 85 to convey the stormwater runoff to the east side. Constructing the proposed 12th Street Outfall will reduce the magnitude of flows that overtop the Great Western and Union Pacific Railroad and contribute to flooding in the Highway 85 Outfall watershed.

14th Avenue Upstream Outfall: The 14th Avenue Upstream Outfall will mitigate flooding hazards on residential properties in the central portion of the upstream watershed. The proposed improvements will also mitigate flooding hazards on Greeley Central High School. The proposed improvements will relocate the storm drain into City of Greeley right-of-way allowing easier maintenance of the outfall into the future. The 14th Avenue Upstream Outfall is proposed to drain into the 16th Avenue Outfall before crossing the Greeley No.3 Canal into the 12th Street Outfall. Implementing the 16th Avenue Outfall will also reduce the area tributary to the 14th Avenue Upstream Outfall.

The proposed 14th Avenue Upstream Outfall will allow the City to abandon portions of the existing 14th Avenue Outfall that is contained on private property and relocate the storm drain back into the right of way. Construction of the 16th Avenue Outfall will reduce the flow tributary to the 14th Avenue Upstream Outfall.

23rd Avenue Outfall: The 23rd Avenue Outfall will mitigate flooding hazards on commercial and residential properties in the western most section of the upstream watershed. The storm drain improvements will also mitigate flooding hazards on Heath Middle School that the existing storm drain is not capable of. The 23rd Avenue Outfall will increase the discharge into Luther Park West and should be implemented after the 14th Avenue Outfall has been constructed.

The 23rd Avenue Outfall will replace the existing undersized storm drain in 23rd Avenue. Although the existing storm drain does not meet the current City criteria other outfalls should be prioritized since there already is stormwater infrastructure in place.

7.6 WATER QUALITY IMPACTS

The selected plan proposes new facilities to increase the water quality of stormwater runoff before discharging into the Cache La Poudre River.

7.7 OPERATIONS AND MAINTENANCE

Maintenance costs were included in the detailed cost estimates for sediment and debris removal and structural repairs for manholes and inlets once every five years. Maintenance costs for the detention and water quality facilities which include sediment and debris removal, structural repairs, tree and weed removal was assumed to occur every other year.

7.8 ENVIRONMENTAL AND SAFETY ASSESSMENT

Throughout the past decades, development within the North Greeley and Downtown Basin has replaced any open channel conveyance with an undersized storm drain system. The only open channel conveyance that still exists within the basin is Glenmere Draw. Without implementing a plan similar to 5.6.6 Parkway Alternative there are very little opportunities to increase open channel conveyance within the basin. While the selected plan does not reintroduce any open channel conveyance to the watershed, water quality will be improved treating the stormwater runoff in the proposed detention and water quality facilities.

The study area was assessed for potential isolated wetlands, jurisdictional wetlands, and other waters of the U.S. At the time of the assessment, the National Wetland Inventory mapping showed no wetlands, riparian areas, FWS refuges or historic wetland areas present along any alignment of the storm drain improvements. Two areas delineated as Freshwater Forested/Shrubs Wetlands are present north of 5th Street, east of 8th Avenue near the 1st Street Outfall watershed. No improvements are proposed in these areas.

Prior to work being performed on outfalls to the Cache La Poudre River, it is recommended that a wetland delineation be conducted and a report should be submitted to the U.S. Corps of Engineers (Corps) for its review. The Corps will determine what permitting approach is appropriate for each project undertaken. These types of activities may meet criteria for authorization under the Clean Water Act Section 404Nationwide Permit (NWP) system. However, if channel realignment is involved in the bank stabilization, the activity may not fall under a NWP. For activities that do not meet NWP criteria, individual permits would be required. Individual permits can take from 6 to 9 months to receive after application submittal.

Corvus Environmental Consulting LLC completed an environmental assessment in December 2016 as part of the 9th Street Outfall project. The study noted the presence of palustrine emergent persistent, wetlands that consist of a narrow reed canarygrass. The reed canarygrass community is present along the lower slopes of the Cache La Poudre River bank.

The implementation of the selected plan will increase public safety within the watershed by reduce the frequency of flooding with the potential to damage buildings and property within the watershed.

NORTH GREELEY & DOWNTOWN STORM DRAINAGE MASTER PLAN

FIGURE 7-2 - PHASING OF MASTER PLAN IMPROVEMENTS

ICON ENGINEERING, INC.

Phase
- A
- B
- C
- D
- E
- F
- G

- Watershed Boundary
- Park
- Univ. of Northern Colorado
- Important Structure

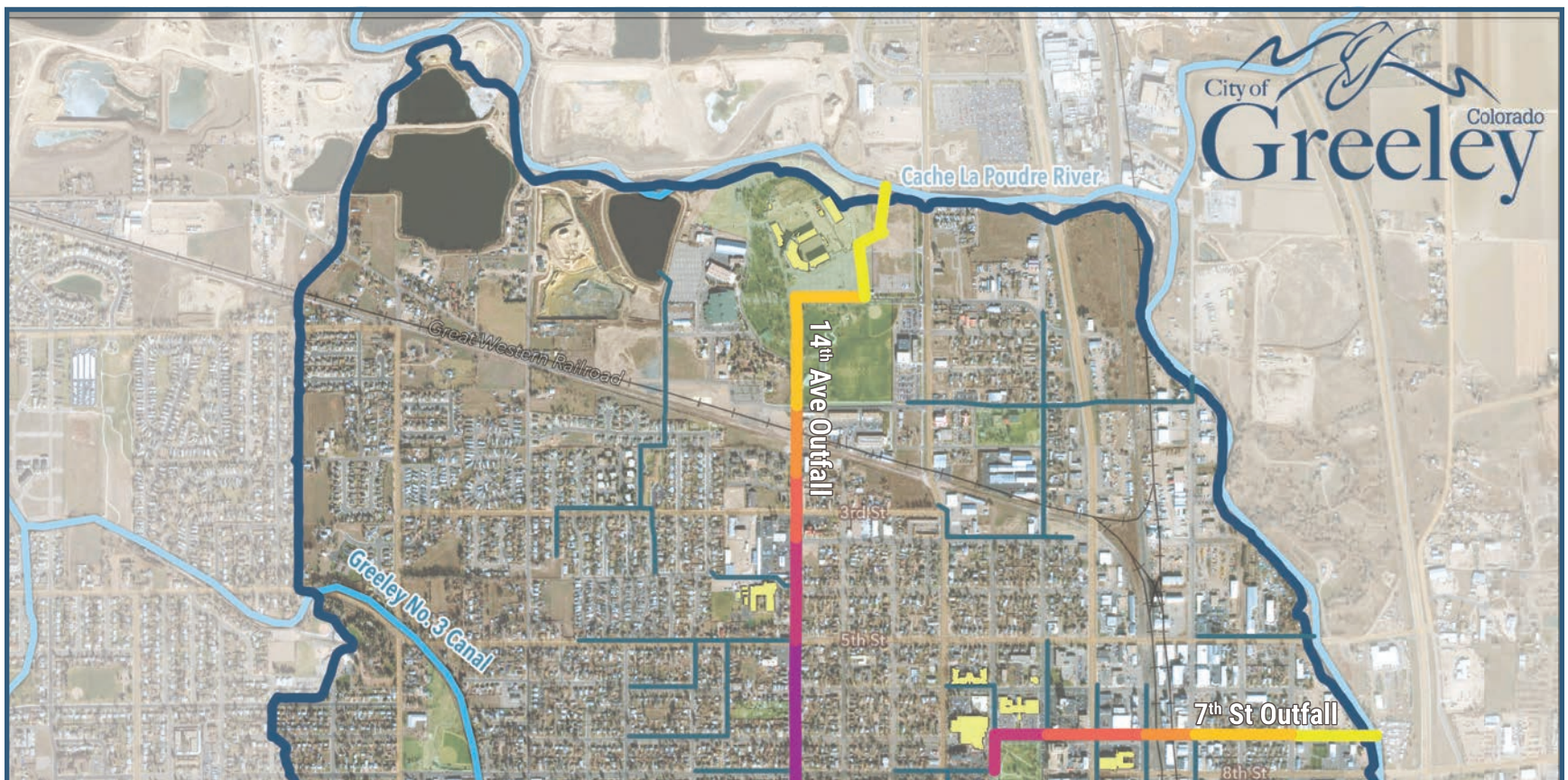


Table 7-26: Conceptual Design Phasing Cost Estimates

12th Street Outfall Phasing

REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
Phase A	$ 2,652,178	$ 206,044	$ 397,827	$ 132,609	$ 265,218	$ 663,045	$ 4,316,921	$ 6,639	$ 232,363
Phase B	$ 4,863,787	$ 51,600	$ 729,568	$ 243,189	$ 486,379	$ 1,215,947	$ 7,590,470	$ 154	$ 5,390
Phase C	$ 2,064,965	$ -	$ 309,745	$ 103,248	$ 206,497	$ 516,241	$ 3,200,696	$ 330	$ 11,550
Phase D	$ 1,779,689	$ -	$ 266,953	$ 88,984	$ 177,969	$ 444,922	$ 2,758,517	$ 235	$ 8,225
Phase E	$ 5,001,108	$ -	$ 750,166	$ 250,055	$ 500,111	$ 1,250,277	$ 7,751,717	$ 89	$ 3,115
Phase F	$ 1,412,533	$ -	$ 211,880	$ 70,627	$ 141,253	$ 353,133	$ 2,189,426	$ 295	$ 10,325
Phase G	$ 1,270,774	$ -	$ 190,616	$ 63,539	$ 127,077	$ 317,694	$ 1,969,700	$ 328	$ 11,480

7th Street Outfall Phasing

REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
Phase A	$ 1,698,132	$ 425,605	$ 254,720	$ 84,907	$ 169,813	$ 424,533	$ 3,057,710	$ 5,850	$ 204,748
Phase B	$ 1,318,611	$ -	$ 197,792	$ 65,931	$ 131,861	$ 329,653	$ 2,043,848	$ 323	$ 11,305
Phase C	$ 4,099,471	$ -	$ 614,921	$ 204,974	$ 409,947	$ 1,024,868	$ 6,354,181	$ 130	$ 4,550
Phase D	$ 1,045,070	$ -	$ 156,761	$ 52,254	$ 104,507	$ 261,268	$ 1,619,860	$ 290	$ 10,150
Phase E	$ 928,487	$ -	$ 139,273	$ 46,424	$ 92,849	$ 232,122	$ 1,439,155	$ 280	$ 9,800

14th Avenue Outfall Phasing

REACH	CAPITAL	EASEMENT / ROW	ENGINEERING	LEGAL / ADMINISTRATIVE	CONTRACT ADMIN/CM	CONTINGENCY	TOTAL CAPITAL COST	ANNUAL O&M COST	50-YEAR O&M COST
Phase A	$ 2,743,600	$ -	$ 411,540	$ 137,180	$ 274,360	$ 685,900	$ 4,252,580	$ 8,323	$ 291,302
Phase B	$ 2,892,020	$ -	$ 433,803	$ 144,601	$ 289,202	$ 723,005	$ 4,482,631	$ 672	$ 23,520
Phase C	$ 4,031,839	$ -	$ 604,776	$ 201,592	$ 403,184	$ 1,007,960	$ 6,249,351	$ 210	$ 7,350
Phase D	$ 1,018,456	$ -	$ 152,768	$ 50,923	$ 101,846	$ 254,614	$ 1,578,607	$ 257	$ 8,995
Phase E	$ 1,576,379	$ -	$ 236,457	$ 78,819	$ 157,638	$ 394,095	$ 2,443,388	$ 412	$ 14,420
Phase F	$ 1,917,417	$ -	$ 287,613	$ 95,871	$ 191,742	$ 479,354	$ 2,971,997	$ 517	$ 18,095

8.0 REFERENCES

1) Anderson Consulting Engineers, Inc. (2005) City of Greeley Comprehensive Drainage Plan Downtown and North Greeley Basin Final Report
2) Anderson Consulting Engineers, Inc. (2005) City of Greeley Comprehensive Drainage Plan Downtown and North Greeley Basin Project Notebook
3) City of Greeley Public Works (2007 Addendum June 2008), Design Criteria and Construction Specifications Storm Drainage Volume II
4) Lidstone & Anderson, Inc. (1996) Comprehensive Drainage Plan City of Greeley Downtown and North Greeley Basin
5) Lidstone & Anderson, Inc. (1996) Comprehensive Drainage Plan Update City of Greeley Downtown and North Greeley Basin Project Notebook
6) Urban Drainage and Flood Control District (2016) Urban Storm Drainage Criteria Manual Volume 1 and 2
7) NOAA (1973) Precipitation-Frequency Atlas of the Western United States
8) Anderson Consulting Engineers, Inc. (2006) City of Greeley Comprehensive Drainage Plan Greeley No. 3 Ditch Final Summary Hydraulics Report
9) Urban Drainage and Flood Control District (2016) CUHP_Users_Manual_2016-09-09

APPENDIX A - PROJECT CORRESPONDENCE

MINUTES

ATTENDANCE:

Eric Weis	City of Greeley
Craig Jacobson	ICON
Terry Martin	ICON

1) COMMUNICATION

- The meeting kicked off with a discussion of communication and meeting strategies for the project. Eric suggested a combination of monthly face-to-face and online meetings. Craig mentioned that the scope assumed one meeting per month, alternating between online and face-to-face meetings. Eric was supportive of that strategy.
- Regarding stakeholder outreach and communication, Eric said he will get ICON a list of project stakeholders. In addition, Greeley's Community Engagement Officer (CEO) is available to help coordinate stakeholder outreach.

2) PROJECT SCOPE REVIEW:

a) Data Collection

- The City has fiber maps for their traffic control network, Eric will be able to send that information to ICON. ICON has layers for storm sewer, water, sanitary sewer, and impervious area. The impervious area layer includes streets, sidewalks, driveways, and buildings, in addition to a 'dense earth' layer, which could be considered nearly impervious.
- Only one land use condition will be considered for the hydrology, since the basin is completely developed. However, Eric mentioned that parcels within the Urban Renewal Area are allowed to pave their lots without stormwater mitigation, as long as the impervious amount doesn't increase by 50% over the original imperviousness. The City has a separate GIS layer for this information. ICON will review this data and make recommendations as to the impervious values used for this area. Eric would like to review these assumptions before finalizing the hydrology.
- ICON was able to download the 2013 post-flood FEMA LiDAR mapping, and presented a base map including utilities and 10' contour mapping. Eric mentioned that this LiDAR data set did not include breaklines, so the contour data could be more accurate. For this basin, it is unlikely that addition of this information would have a large outcome on the project. However, Craig mentioned that ICON can do some spot checks on the data to determine its accuracy, and that spot checks will be done (either by a surveyor or ICON staff) in any questionable areas.
- ICON's base map included a December 2014 aerial photo from Digital Globe, rather than the DRCOG mapping. This is a subscription service that ICON uses for current aerial photography. The photo is also stored locally on ICON's server.
- According to Eric, the City's detention pond information is spotty at best. The Moon Pond is the only formal detention area the City has built, and there are no as-builts. Luther Pond was previously an irrigation pond that the City converted to a park and detention area. Glenmere Park contains 2 ponds in series – the lower pond is actually inadvertent detention, which Eric said could be taken into account if flow rates are affected by this detention volume. Craig mentioned that at a minimum, ICON would do a field survey of the pond outlet structures. ICON will review the LiDAR contours to determine if they are sufficient for pond modeling.
- The original watershed boundaries were developed by Anderson Consulting as part of the previous master plan study. ICON will take these watersheds into account, but the general goal for this study is a more detailed watershed network, so it is likely the basins will vary from the previous study.
- Previous master plan information included manhole coordinates and invert information. By doing a simple coordinate conversion – adding 1,000,000 to the northing and easting – ICON was able to get relatively close to existing manholes shown in the aerial photo. ICON will massage this data to get a closer match to help reduce required survey. Craig mentioned that King Surveying may be able to provide a ground/grid factor to tighten up this data.
- Eric mentioned that some of the data was assembled on NAVD27/NGVD29 datum and projection. He said that Atkins Engineering is working on a DFIRM for the Poudre River, and they were able to translate this information into State Plane/NAVD88. He said they may be willing to provide a coordinate conversion.
- Regarding utility mapping, Eric said he can provide a list of contacts. Craig said ICON would start by contacting the local utilities to request existing utility information within the watershed boundary.

b) Hydrology & Hydraulics

- Eric said he has a very low level of confidence that the previous modeling matches the mapping, regarding SWMM elements, and that ICON should be careful when referring to the previous modeling. It was decided that starting from scratch on the modeling would be the best plan; however, the previous models may contain useful information on detention areas.
- Once the basins have been delineated, ICON will prepare a preliminary rain-on-grid FLO2D model to determine design points and inflow/outflow locations within the watershed to confirm the basin boundaries.
- Craig also recommended a split watershed approach to the Greeley No. 3 ditch. Generally, one model will be used for areas upstream of the ditch to identify inflow locations. The unsteady flow HEC-RAS model will identify outflow points and discharges, and a second FLO2D model will incorporate these outflow hydrographs downstream of the canal.
- The existing pipe flows will be calculated in SWMM. Eric pointed out that the 10-year water surface elevation on the Poudre River is relatively high, and will definitely have a large impact on the pipe flow estimates. HEC-22 will be used to determine the Poudre tailwater level. It was generally assumed this would result in using the 10-year WSEL on the Poudre for 100-year SWMM tailwater conditions.
- Eric said that profiles of the existing storm sewers would not be required.

c) Alternatives Analysis

- The main goal of the alternatives analysis is to reduce flooding levels on structures. Eric pointed out that this plan probably won't be able to target a single return period for flood protection, due to the large discharges expected and it may be difficult to convey anything over the 10-year discharge underground.
- Craig said that kinematic wave routing will be used for alternative sizing, and dynamic wave routing will be used to confirm the effectiveness and function of larger outfall systems.
- The City would like to improve the Glenmere Park area. Eric said this stream is a very important asset to the local neighborhood, and there will be a lot of public interest in this area. He anticipated improvements to the low-flow channel as well as a crusher

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fines trail. Some of the existing vegetation also should be considered for removal. This area is most likely the main area in the City that will likely require environmental assessment and/or permitting. He would also like to confirm the quality of habitat in the area, as residents have noted varying degree of wildlife. Craig mentioned that ERO is part of the project team. Generally, they are scoped for an office review and "windsheld" type analysis of the basin. They may need to evaluate this area in more detail.

- Glenmere Creek is the only natural stream in this watershed. Eric mentioned that the City has discussed trying to restore the natural flow path of the stream. Required property acquisition would be a very difficult challenge for the City.
- Craig said he mentioned the bootlegger tunnels to ERO, and they will look into the issue to see if these are historically designated structures. Eric would like some general spec language in the report on what to do if these structures are encountered. Craig is hoping the report will be able to identify where these tunnels are most likely to exist, in order to help determine what areas should be avoided for underground conveyance.
- Craig also spoke with ICON's tunneling consultant, Brierly and Associates. They will become involved later in the alternatives analysis, after potential tunneling locations have been determined. Soil boring should be sufficient for tunneling recommendations, since test pits would be so deep as to be very expensive to dig.
- For the benefit/cost analysis (BCA), Eric said they would like to follow the FEMA method as close as possible, so if the BCA's come back positive, they can submit to FEMA for hazard mitigation. Craig mentioned the HAZUS program follows the FEMA formats, and may be useful in this case. In addition, ICON created customized spreadsheets for a previous project that were very useful, and that would be easily converted to a FEMA format if necessary. Eric thought this might be a useful concept for this project.
- For the report format, Eric said this report doesn't have to be an EPLAN per UDFCD standards, and he is open to a custom format to fit the needs of this project. Some users will prefer a hard copy, so any online format should be easily printable. After some discussion, it was decided that the main document will be the website, but a printable version will also most likely be required.
- For now, ICON will format and host the website, but they will work with the City to get the site incorporated into the City's website. ICON will start with the template that was used for the recent Milliken Master Plan.

3) PRESENTATIONS:

- For the City council meetings, Eric said that ICON will not need to present to City council, but he will need help preparing exhibits for the council meetings.
- Three public meetings are expected. One at the end of hydrology and problem identification, one near the end of alternatives analysis, and potentially one after a selected plan has been identified. The City's Community Engagement Officer will also help with outreach for these meetings.
- ICON included DHM design to help with meeting graphics and outreach. Eric said the Community Engagement Office is anxious to help with outreach for this project.

KICK-OFF MEETING
NORTH GREELEY AND DOWNTOWN MASTER PLAN
CITY OF GREELEY
APRIL 14, 2015 AT 1:30 PM

MINUTES

4) SCHEDULE

- It was decided that Tuesdays are generally good meeting days. Craig expects to meet in about a month, in approximately mid-May, for the first progress meeting.

- END OF MEETING--

To the best of my knowledge, these minutes are a factual account of the business conducted, the discussions that took place, and the decisions that were reached at the subject meeting. Please direct any exceptions to these minutes in writing to the undersigned within ten (10) days of the issue date appearing herein.

Minutes prepared by:

Terry Martin — 2015-04-15

ICON Engineering, Inc. — Date

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North Greeley and Downtown Basin Master Plan
Progress Meeting
June 9, 2015 2:00 PM
City of Greeley

Minutes

Attendance: Eric Weis, City of Greeley
Craig Jacobson, ICON Engineering
Terry Martin, ICON Engineering

1. **Review of Items from Kickoff Meeting**
   - Craig mentioned that ICON had prepared meeting minutes from the kickoff meeting and would include them in an email with this meeting's minutes.
   - Regarding reoccurring meetings, it was agreed that approximately half of the meetings would be held face-to-face, with the other half via an online/conference call meeting setup. Meetings will be help approximately at monthly intervals.
   - The project schedule was also briefly reviewed. Craig pointed out that the notice to proceed was provided approximately one month after the date initially identified by the City. ICON did not foresee this as an issue at this time. The schedule will be reviewed at progress meetings.

2. **Survey & Data Collection**
   - Craig outlined the tasks performed to-date for the project.
   - The LiDAR topography was assembled, in addition to GIS layers provided by the City. This included layers for streets, impervious areas, dense earth, storm and sanitary mapping, and zoning.
   - ICON also scanned the previous master plan, including the sanitary and storm sewer manhole information surveyed as part of the previous plan.
   - Optical Character Recognition (OCR) was performed on the sanitary and storm sewer manhole scans in order to create spreadsheets of this information for GIS.
   - ICON was able to import the sanitary and storm sewer manhole survey data into GIS. The data was projected from the NAD27 datum to NAD83 to match ground locations. The vertical datum was also converted from NGVD29 to NAVD88. A datum conversion of 2.9 feet was used based on City Benchmark 120. Craig confirmed that this was reasonable with King Surveyors.
   - Craig mentioned that the 2.9 foot datum conversion appeared to work relatively well; however, some manhole rim elevations were +/- 0.5' compared to LiDAR point data. The project team agreed that this was likely within the mapping tolerances of the LiDAR and would suffice for the master plan.
   - At this point, Eric mentioned that the NGS benchmarks have previously compared more favorably to the LiDAR; however, given the comparisons were +/-, everyone agreed that the original conversion was reasonable.
   - The detention pond surveys are scheduled for June 24. This timeframe is in-line with ICON's progress on the hydrologic modeling.
   - ICON presented a comparison between the existing surveys collected from the original master plan and other storm lines, larger than 30" within the basin. Eric will check and see if the two northern lines along 14th and 17th Streets had record drawings or design plans available. The larger line into Luther Park likely was not required based on the watershed orientation.
   - Craig asked about the limits of the Urban Renewal Area, which were not included in the zoning layer. Eric will send this information over. For these areas, it was decided that the existing imperviousness would be increased by 50% to account for future redevelopment potential.
   - Eric has a list of utility contacts that he will provide once the team is closer to conceptual design.

3. **Hydrology Development**
   - Craig displayed a GIS workmap for the watershed, which included Greeley's GIS information as well as work completed to date. The watershed delineations south of the No. 3 Ditch were reviewed. Eric discussed a specific problem area near Centennial Park. An existing bubbler inlet intercepts flows from a low point in 23rd Avenue and discharges onto 21st Street Road. Discharges in this area have contributed to damaged pavement and flooding on 21st Avenue.
   - ICON described that the current watershed delineations were made in several steps.
     - The original watersheds were digitized from the previous master plan delineation;
     - These watersheds were corrected based on current LiDAR mapping topography.
     - The watersheds were subdivided further to account for the urban landscape and pipe diversions. Maximum watershed sizes were around the 40 acre threshold established at the onset of the project.
   - ICON displayed rain-on-grid FLO-2D analyses completed for both the 10- and 100-year storm events. For this analysis, 25' cells were used. Analyses were initially completed neglecting infiltration. For these cases, flooding was extensive and difficult to interpolate for the hydrologic model. A second set of models were developed to include infiltration based on SCS curve numbers. These results generated more refined flow paths for main collection points in the basin.
   - Eric mentioned that the FLO-2D results will make good instructional material for council members.

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- Craig explained that the FLO-2D will be updated with more detail after the CUHP/SWMM modeling is completed. For now, the rain-on-grid models can be used as a tool to help guide watershed design points and major diversions within the system.
- A conversation on regarding rainfall for CUHP ensued. It was noted that in recent years, the NOAA Atlas rainfall had been updated. In general, rainfall decreased by up to 20% for the lower return periods, such as the 2- and 10-year events, but only by approximately 2% for larger events such as the 100-year event. With the change, the City was questioning how this would translate into runoff rates and volumes, or how it may impact the planning study.
- It was discussed that at this point in time, the UDFCD has not adopted the new rainfall amounts. It was believed that the NOAA data was not consistent with the data collected by the District over that period of time. Eric mentioned that NOAA has a much more robust set of rainfall gages, which may have skewed the data downward, compared to the set of gages in the UDFCD boundary alone.
- ICON will prepare a summary memorandum with a recommendation to either maintain the existing rainfall currently adopted by the City of Greeley, or to change to NOAA's current recommendations. ICON will review UDFCD's position paper on the rainfall, and obtain opinions from other northern Colorado communities including the City of Fort Collins and City of Loveland.

4. Outreach & Website

- The Community Engagement Officer was not in attendance for today's meeting, but the team reviewed some general concepts for outreach. Craig provided a list of bullet points prepared by DHM Consulting for project outreach. This list also included potential project stakeholders.
- Eric mentioned that typically, the City use websites, social media, flyers (where permitted), and ads in the local newspaper, which can be expensive, for outreach. He also mentioned that he wants to limit the direct mailings due to cost, but they would target nearby homeowners who may be affected by certain projects.
- Eric mentioned that he would make personal phone calls to stakeholder groups, as well.
- Craig reviewed sample project websites that ICON has used for past and ongoing projects. The team agreed that a similar site would make for a good starting point for this project.
- There was some discussion regarding web hosting and development. Craig mentioned that the site could be hosted by ICON through their current web hosting service, or through a separate, low cost, service which would also give Greeley the ability to edit the web page directly. Eric mentioned that a joined location would be preferential. ICON will send on information regarding the site to determine if it would be a possibility to use within the City's system.

- Eric would like to have the project team meet with the CEO's office to begin planning the outreach effort during the week of 6/22, if possible. He will coordinate this meeting.

5. Action Items

- ICON will continue developing the watershed hydrology;
- ICON will collect survey information at the detention ponds;
- ICON will prepare a Draft website for review;
- Eric will provide limits of the urban renewal area;
- Eric will look into as-built or record drawing information for the existing storm sewers at 14th and 17th Streets;
- Eric will coordinate the meeting with the CEO. ICON will include DHM Design in the meeting.

- END OF MEETING--

To the best of my knowledge, these minutes are a factual account of the business conducted, the discussions that took place, and the decisions that were reached at the subject meeting. Please direct any exceptions to these minutes in writing to the undersigned within ten (10) days of the issue date appearing herein.

Minutes prepared by:

Terry Martin — 2015-06-10

ICON Engineering, Inc. — Date

North Greeley and Downtown Basin Master Plan
Progress Meeting
September 3, 2015

Conference Call
Meeting Minutes

Attendees:	Eric Weis,	City of Greeley
	Craig Jacobson,	ICON Engineering, Inc.
	Terry Martin,	ICON Engineering, Inc.
	Jeremy Deischer,	ICON Engineering, Inc.

- The team discussed the land use GIS files provided by Greeley and Eric explained how the city originally assessed their stormwater fee based on the impervious value associated with each parcel. ICON explained the land use data provided by the city had been assigned impervious values based on Table RO-3 of the Urban Storm Drainage Criteria Manual. The hard packed earth GIS layer was discussed in further detail and Eric decided to assign the recommended value of 40% in areas of well-draining soils (Type A/B) but possibly to increase this value in area of poorly-draining soils. Jeremy noted the NRCS web soil survey showed Type A and B soils upstream of the No. 3 Ditch but there were some Type D soils downstream of the No. 3 Ditch.
- The team discussed whether to include the urban renewal zone when determining the imperviousness for subwatersheds. Eric explained the urban renewal zone allowed property owners an automatic waiver when increasing the impervious value up to 50 percent from existing conditions. Eric noted the urban renewal zone should not be accounted for in the basin hydrology but the report should include text explaining the ramifications that allowing this development to occur without requiring onsite detention.
- ICON reviewed the storm survey information that had been conducted as part of the previous study. ICON has already projected this data to NAD83 horizontal datum and raised to the NAVD88 datum using benchmarks in the City of Greeley Control Network. Several areas along 17th St., 19th St., and 23rd Ave. required survey to be included in the hydrologic model as none of these areas were included with existing survey. Some of these pipe systems did not meet the 30 inches in diameter criteria to be included in the hydrology model but exceptions were made for pipe systems that diverted flow in a different direction than the street flow direction. ICON will coordinate with King Surveyors to get the survey scheduled and incorporated into the hydrologic model.
- Craig described the team's approach to creating diversion curves to be used within the SWMM model. Each of these areas would have a FLO-2D model run with a range of steady state flows to determine flow splits at street intersections to be used in the hydrologic model. An exhibit will be made for each diversion area to be included in the appendix of the report.
- Craig reviewed the preliminary rainfall memo recommending that Greeley maintain the current city rainfall criteria. The team discussed the reasons UDFCD mentioned in their memo for not adopting NOAA 14 rainfall values. Jeremy had also spoken to community officials in Fort Collins and the City of Loveland and neither of those communities had plans to adopt NOAA 14 rainfall values. Eric expressed his concern on the continuous record of the data in NOAA 14 noting the inconsistent operating period of the rain gage at the University of Northern Colorado campus.
- Craig described the teams approach to calibrating the CUHP model. The largest continuous basin upstream of the No. 3 Ditch would be developed and compared through several scenarios to determine if calibration was necessary given the discretization of the watershed in this study.
    - Scenario 1: CUHP for individual subwatershed hydrology routing using EPA SWMM
    - Scenario 2: CUHP for the largest contiguous watershed
    - Scenario 3: SWMM for the runoff model using the one contiguous watershed with an overland flow length of 300 feet. This length was chosen due to the nature of the urbanized watershed and previous modeling techniques ICON has used in Fort Collins.
    - Scenario 4: SWMM for the runoff model transforming the irregular natural watershed to a rectangular cascading plane basin using watershed shape factors as described in Dr. Guo's *Application of Kinematic Wave Cascading Plane to Irregular Watershed*.
- Eric described his preferences about the outreach website in this study. ICON will develop and host the project website separate from the stormwater page on Greeley's website. A link will be provided on the stormwater page to direct people to the project website. ICON will use the existing Greeley website color scheme to maintain consistency for the project website.

- END OF MEETING--

To the best of my knowledge, these minutes are a factual account of the business conducted, the discussions that took place, and the decisions that were reached at the subject meeting. Please direct any exceptions to these minutes in writing to the undersigned within ten (10) days of the issue date appearing herein. Failure to do so will constitute acceptance of these minutes as statements of fact in which you concur.

Minutes prepared by: Jeremy Deischer

Jeremy Deischer
ICON Engineering, Inc.

September 7, 2015

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North Greeley and Downtown Basin Master Plan
October 28, 2015

City of Greeley Public Works Department
Meeting Minutes

Attendees:	Eric Weis,	City of Greeley
	Heather Seitz,	City of Greeley
	Craig Jacobsen,	ICON Engineering
	Terry Martin,	ICON Engineering
	Jeremy Deischer	ICON Engineering

ICON updated the project team on the progress of the master plan:

Follow up items from the September 3 Conference Call:

- Craig reviewed the exhibit ICON sent to King Surveyors showing the manholes in which information was needed to finalize the hydrology model upstream of the canal. The survey has been completed and incorporated into the hydrology model at this time.
- Craig noted that through discussions with Shea Thomas at UDFCD, UDFCD was considering changes in calibration approach for basins with a high level of discretization in the CUHP/SWMM models. In the last meeting, it was suggested that the reasonableness of the CUHP results for the North Greeley and Downtown Basin be compared with UDFCD's current approach and determine if further calibration was needed. ICON developed several scenarios to review results and determine if calibration was needed. As suggested by UDFCD, results from the discretized watershed were compared with the largest contiguous basin, in this case a 386 acre watershed located upstream of the No.3 Ditch. The following scenarios were reviewed:
    - The first scenario presented the results from the discretization model (sub-basins and routing), without detention.
    - The second scenario involved developing basin parameters for a singular 386 acre watershed in CUHP.
    - The final two scenarios utilized the kinematic wave cascading plane method in EPA-SWMM and general approach used in areas such as Fort Collins for basin width determination (300' overland flow length in urbanized watersheds).

  In summary, the result of this analysis confirmed close correlation between the discretized CUHP/SWMM model and contiguous watershed basin from both a discharge and runoff volume perspective. Reasonable correlation was also made utilizing the cascading plane methodology. In the end it was agreed that further calibration would not be needed. ICON also noted that they discussed their finding with Shea Thomas. Shea generally agreed that for the size of basin compared, and urban nature of the basin, the results may be reasonable.
- Craig presented a draft memorandum discussing recommendations related to the City's current rainfall criteria and current values from NOAA 14. During past discussions with the City, both the City and ICON had agreed not to revise the City's rainfall to reflect NOAA 14 based on discussions with adjacent communities and documentation presented by UDFCD. Craig noted that in assembling the memorandum, ICON also confirmed current NOAA 14 90% confidence interval values. ICON was surprised to find that the City's rainfall values fell outside of the NOAA 14 upper confidence limits and wanted to present that to the City. ICON was not able to confirm the confidence interval analysis from NOAA Atlas 2 Volume III, which the current city rainfall criteria was based. In their memorandum, UDFCD indicated overlapping confidence intervals between the two NOAA sources. Through further discussion, Eric discussed disconnects in the monitoring of rainfall within the City and was more comfortable maintaining the existing city rainfall criteria from public safety and design of infrastructure perspective, similar to the recommendations original made by UDFCD. ICON will revise the memorandum to reflect this.

Current Discussion Items:

- The survey information provided by King Surveyors has been incorporated into the hydrology model. As discussed previously with the project team, storm sewer diversions were included in areas that flow was diverted from the street flow path.
- Jeremy explained several areas were analyzed using FLO-2D to generate tabular rating curves to be used within the hydrology model. An exhibit of each area would be included in the appendix of the report detailing the area, and the rating curve used in the SWMM model.
- Due to the level of discretizing basins in this study, comparison areas were difficult to find to compare results of the study to previous studies. The detention ponds that were analyzed in the previous study (Glenmere, Luther Park West, Luther Park East) were compared in addition to 2 design points that were similarly routed between the studies. The comparison showed that the previous study had slightly higher peak flows at the design points but the total inflow volumes were very similar. The one design point that had a drastic difference in both peak flow and volume was Luther Park West. The previous study did not accounted for any pipe flow or street flow along 23rd Ave which led to previous study underestimating the amount of contributing flow to the pond.
- Jeremy detailed the process to generate surface flow hydrographs for the FLO-2D hydraulic model. A FLO-2D / SWMM integrated model is not feasible due to the size of the watershed so the basin hydrographs were modified to account for the pipe flow throughout the basin. The results of the FLO-2D analysis showed several areas in which additional diversions may be necessary in the SWMM model to accurately represent the split flows throughout the basins.
- Craig asked if the report for the Greeley No. 3 ditch HEC-RAS unsteady state hydraulic model was available. ICON had previously received a report but it appeared to cover the area upstream of the master plan area. The city would try to locate a report for which the current modeling was based.
- Craig inquired if there were any structures built along the canal since the updating of the HEC-RAS model in 2006. The team discussed the Jackson Gate structure east of 1st Ave which was built following 2006. The extent of the HEC-RAS model was examined and it was determined that the Jackson Gate structure was outside of the model extents. The downstream limit of the HEC-RAS canal model is U.S. Hwy 85. Eric asked to examine the cross sections of the canal to verify there weren't any interpolated cross sections along the canal. If there were any interpolated cross sections the city would like additional survey to be performed in these areas.

- The progress on the remaining areas for the watershed hydrology was discussed. Craig noted that the modeling of basins downstream of the canal were currently at approximately 60-65% complete.
- Eric asked about the schedule and when a hydrology report section would be available for review. Craig noted that with a later notice to proceed and the complexity encountered, the study was a bit behind schedule. ICON is anticipating submitting the DRAFT Hydrology/Hydraulics report section to the city in mid to late December depending on direction regarding the No. 3 Ditch.
- ICON will provide and updated schedule with the meeting minutes.

ACTION ITEMS:

1. ICON will finalize the rainfall memo reflecting comments from this meeting.
2. ICON will present the background to the City to determine if any additional survey or work would be required.
3. ICON will provide the city with an updated project schedule.
4. The city will provide any updated reports found on the Greeley No. 3 ditch.
5. The city will provide ICON As-Built documents for the 14th Ave outfall storm system.

-- END OF MEETING--

To the best of my knowledge, these minutes are a factual account of the business conducted, the discussions that took place, and the decisions that were reached at the subject meeting. Please direct any exceptions to these minutes in writing to the undersigned within ten (10) days of the issue date appearing herein. Failure to do so will constitute acceptance of these minutes as statements of fact in which you concur.

Minutes prepared by: Jeremy Deischer

Jeremy Deischer
ICON Engineering, Inc.

October 29, 2015

North Greeley and Downtown Basin Master Plan
Progress Meeting
December 3, 2015 10 A.M.

Conference Call

Meeting Minutes

Attendees:	Eric Weiss,	City of Greeley
	Heather Seitz,	City of Greeley
	Craig Jacobson,	ICON Engineering
	Terry Martin,	ICON Engineering
	Jeremy Deischer,	ICON Engineering

Upstream Hydrology Update:

- Since the last progress meeting, a split flow has been incorporate into the SWMM model around the hospital diverting flow north along 16th Avenue Court into Moon Pond. The hydrologic model has also been revised at Luther Park to incorporate: the flow split at 10th Street and 23rd Avenue, overtopping flows from Luther Park West contributing to Luther Park East, and flows overtopping Luther Park East into the Greeley No. 3 Ditch.
- The Greeley-Loveland Canal has been accounted for in the hydrologic model through a constant inflow into the Glenmere Channel just downstream of 22nd Street. The constant inflow was estimated using an 18" RCP using the ground slope to calculate pipe capacity.

No. 3 Ditch Modeling Update:

- Craig described the history of the Greeley No. 3 Ditch unsteady state HEC-RAS model. The 2005 Anderson study imported the data used in the 1996 Comprehensive Plan for the North Greeley and Downtown Basin canal model. Formal spill structures built after the 1996 Comprehensive Plan were incorporated into geometry data in the Anderson model but the canal was not resurveyed as part of the Anderson study.
- ICON has updated the Anderson model to the latest version of HEC-RAS adding inflow hydrographs from the SWMM model at the outfall locations. The model was run with existing geometry. Hydrographs of the lateral weir spill flows were exported from the HEC-RAS model and applied as inflow hydrographs in the downstream of the canal SWMM model. Compared to the previous study, the updated hydrology led to a decrease in spill flow from the canal. ICON noted results were able to be exported and could be viewed through the 3D cross section view, but the team was encountering an error when trying to view the profile data.
- Craig noted that no inflow hydrographs had been applied to the Greeley No. 3 Ditch from the Central Greeley Basin as part of the Anderson study. The Central Greeley Basin is located south of the Downtown Basin study extents. There is the possibility that flows contributing to the canal from the Central Basin would overtop the canal and contribute flow to the Downtown Basin. The City did not believe there was an existing study for the Central Basin so Eric directed the team not to account for any Central Basin flows and those flows would be evaluated during a future master plan for the Central Basin.

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Downstream Hydrology Update:

- Jeremy overviewed the progress of the downstream hydrology update. Basin delineation and subwatershed routing for the downstream portion of the basin is complete. Similar to the upstream model, diversions were included in areas where the possibility of flow separating at street intersections appeared possible.
- The team discussed a few areas in which pipes smaller than 30" would be included in the SWMM model when the pipe directed flow contrary to the street topography. ICON is currently assuming a 0.5% pipe slope computed from the conduit outlet at the Poudre River upstream through the pipe network.
- The team reviewed the storm drain system in some of the downtown basins which appear to be looped. Eric directed the team not to micro-model the storm drain system and to view these areas as sinks and direct the runoff in the ultimate direction of flow.

Downstream Hydraulic Analysis:

- Jeremy summarized the results of a FLO-2D model for the downstream watershed. A separate model was run only containing spill flows from the Greeley No. 3 Ditch. ICON is currently in the process of modifying the individual subwatershed hydrographs to account for the storm drain system capacity and subsequently applying the surface flow hydrographs to the FLO-2D model.

Items to Review:

- Jeremy outlined a discrepancy between the City of Greeley Stormwater GIS shapefile and what was observed on the aerial imagery with respect to the Highway 85 Bypass Channel downstream of 14th Street. The City's GIS shapefile shows a 40" conduit which daylights further upstream than the current aerial shows. Eric would investigate the discrepancy and report back to the project team.
- The extent of the study on the eastern boundary was discussed whether to include the 1st Avenue storm drain system east of the Highway 85 Bypass Channel. Eric directed the team to only include flows contributing to the Bypass Channel and not to include the 1st Avenue system in the current study.
- Several areas downstream of the canal were identified as potential areas for future development. These areas have a residential zoning classification but lack existing development. Eric directed ICON in areas where there is no existing development, but zoning classification provides the possibility of future development to consider the area fully developed when calculating the subwatershed imperviousness.
- Discrepancies were found in isolated areas when examining the City of Greeley GIS Impervious shapefile. In some areas that appear to be hard packed earth the GIS shapefile classified these areas as paved parking leading to an increase of subwatershed impervious. Eric explained to the team the impervious shapefile is used when determining stormwater fees and no changes should be made to the classifications.
- Several detention facilities were observed in the lower portion of the watershed. Through the Weld County Assessors interface ICON determined some of these detention facilities were on parcels owned by the City of Greeley. ICON will provide the City with a list of parcel information to investigate whether the City maintains these facilities and should be included in the hydrologic modeling. Several inadvertent storage areas along the railroad will be included in the parcel information delivered to the city as possible areas to evaluate while developing the alternatives.
- Craig inquired what the best source of information would be when determining tailwater conditions along the Poudre River. Eric noted he had a draft of the updated RiskMAP but the study did not contain a 2-yr frequency for the Poudre River. Eric will provide the draft report to ICON to evaluate whether the information can be extrapolate to the 2-year event.

Outreach:

- Eric informed the project team Greeley is undergoing a drastic change in their outreach approach and now outreach will be handled at a program level. The City is leaning towards hosting a website for the study on their system and not use the website ICON assembled.
- Heather provided ICON with a sample of survey questions to gather information for residents within the North Greeley and Downtown Basin about local drainage problems. Several different methods of collecting responses on the study were discussed: including the survey within the interactive comment map on the project website, including the survey within a utility bill, collecting responses at a public meeting, and collecting the responses remotely through an iPad. ICON will review the responses with Mark Wilcox of DHM Design and provide feedback to the City.

Schedule:

- ICON will submit the DRAFT Hydraulics and Hydrology Report to the City for review by December 23.

ACTION ITEMS:

1. Eric will investigate the improvements to the Highway 85 Bypass Channel downstream of 14th Street.
2. ICON will provide a list of parcel information on possible detention facilities to consider for this study.
3. Eric will provide the draft RiskMAP report to ICON
4. Eric will provide the construction As-Built for the 14th Avenue storm drain system.

- END OF MEETING--

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Minutes prepared by: Jeremy Deischer

Jeremy Deischer
ICON Engineering, Inc.

December 3, 2015

North Greeley and Downtown Basin
Progress Meeting
January 6, 2016 2:00 PM

Conference Call

Meeting Minutes

Attendees:	Eric Weiss,	City of Greeley
	Heather Seitz,	City of Greeley
	Craig Jacobson,	ICON Engineering
	Terry Martin,	ICON Engineering
	Jeremy Deischer,	ICON Engineering

Initial Comments on the Baseline Hydrology and Hydraulics DRAFT Submittal:

- Eric commented the FLO-2D Diversion Exhibits in the Appendix were difficult to distinguish the direction of flow for each diversion. Eric asked if the velocity vector from the FLO-2D Hydraulic model could be sent to the city to assist during the review. Craig explained a layer was missing that identified the primary and diverted direction of flow. ICON will send an example of the corrected exhibit along with the velocity vector layer to the City for review.
- Eric noted the decrease in peak flow in comparison to the previous study throughout the watershed. The discretization of this study made comparisons to prior studies difficult but ICON will investigate the discrepancy further and add text to the report clarifying the differences and the steps taken to investigate.

FLO-2D Inundation Mapping:

- Craig reviewed the FLO-2D inundation mapping presented in the submitted draft report. He described the kinematic approach of the SWMM model not accounting for any storage within the watershed while the dynamic FLO-2D model attenuates flows in sump locations. The attenuation of flow throughout the watershed led to differences when comparing the inundation limits from FLO-2D and the SWMM design flows in areas in the downstream portions of the watershed. The team discussed the possibility of applying steady state inflow hydrographs in the FLO-2D model to eliminate the attenuation of flow which would show inundation limits of the peak flow from the SWMM model at each design location.
- Eric described how he viewed FLO-2D as a tool to identify problem areas throughout the watershed and was not concerned with the peak flows correlating. Craig agreed with this approach pointing out SWMM's kinematic wave modeling as a conservative approach for the future potential of flows in the design locations and not necessarily showing where the flows are conveyed in the existing conditions.

Utility Contacts:

- Craig inquired about contacts the City of Greeley has with utility companies to assist in coordination for the project. Heather will provide the team with a list of contacts for known utilities.

Outreach

- The team discussed the decisions made after the last progress meetings for the project website. The City of Greeley will build the website for the project so it can be hosted by the City's website after the completion of the project. ICON will host the interactive comment map separately and will provide a link for the project website. Comments were provided on the City's questionnaire to gather public input and responses will be provided by the City to ICON on a weekly or as needed basis.

Schedule

- Heather informed the project team of a public meeting in early February for other projects in the downtown area. She believed the best approach to gather input for the master plan was to group the study with the other meetings.
- The team will meet in Greeley on Jan. 19 to discuss comments on the DRAFT Baseline Hydrology and Hydraulics Report.

- END OF MEETING--

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Minutes prepared by: Jeremy Deischer

Jeremy Deischer
ICON Engineering, Inc.

January 7, 2016

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North Greeley and Downtown Basin Master Plan
Progress Meeting
January 19, 2016

City of Greeley Public Works Department
Meeting Minutes

Attendees:	Eric Weiss,	City of Greeley
	Heather Seitz,	City of Greeley
	Craig Jacobson,	ICON Engineering
	Terry Martin,	ICON Engineering
	Jeremy Deischer,	ICON Engineering

The team discussed comments provided by the City of Greeley that warranted discussion before finalizing the Baseline Hydrology and Hydraulics Report.

a) ICON clarified the historical infrastructure mentioned in the Purpose and Scope section of the report is referring to historical tunnels and not any existing infrastructure that would be classified as historic structures. ERO will be utilized to identify any cultural obstacles found during the project. Eric informed the team he believed any historic tunnels were located north of 10th Street in the old downtown area. For clarification the historic infrastructure item will be removed from the purpose of scope in the report text.

b) Eric wondered if the resolution of the project LiDAR mapping could be translated to an X contour on a Y scale. Craig will investigate whether there was a better way to describe the LiDAR resolution than currently presented in the master plan.

c) ICON clarified there weren't many subwatersheds close to the minimum size listed in the report of 0.7 acres. Eric asked if the result was reasonable, and Craig responded that due to the small size of the basin, the result was not significant enough to impact the results, and he felt comfortable with the subwatershed as it is.

d) The team discussed the use of 0.1 inches for depression losses in the CUHP modeling. The team selected the 0.1 value to help maintain consistency to the previous Comprehensive Drainage Plan (CDP) and the value reflects the paved areas within the watershed.

e) Eric detailed how Greeley and Loveland Canal sometimes is used to discharge water from the water storage tanks upstream of Glenmere Draw. During these conditions the pipe would be flowing under pressure, exceeding the ground slope capacity of the pipe assumed in the draft report. The team agreed discharging of the pool water wasn't likely to occur coincidently with the 100-year storm to consider the pressure flow. The assumption of ground slope full pipe capacity would be carried forward throughout the study.

f) Jeremy clarified none of the diversion curves that were utilized in the SWMM Hydrology model would change if an unsteady state approach was used. The report will remove steady state from the description of the FLO-2D modeling.

g) Craig noted the figure in the report comparing the peak flows between the current study and the previous CDP did not include all the outfalls within the study and was just at key locations identified in the previous report. Jeremy explained ICON investigated the differences in peak flow and total inflow volume between this study and the 2005 CDP through several different methods. ICON first compared the peak flow and total inflow volume for all outfalls into the Poudre River. While both peak flow and total volume were lower than the previous study, they compared more favorably than the design points shown in the figure in the draft report. ICON then compared the land use values used in the previous CDP to determine if the reduction in peak flow and volume were correlated to the different land use data used. Comparing the total watershed impervious found the different land use data to produce extremely similar percent impervious values. ICON then converted all subwatersheds containing Type A soils to reflect infiltration characteristics of the Type B soil used in the previous CDP. The reduction in infiltration resulted in the total inflow volume comparing very favorably to the previous study. The team agreed to maintain the updated soil information but add report text describing the differences between the studies is largely caused by the updated soil information.

h) Jeremy reviewed Eric's comment of the peak outflows for the detention basins not being displayed in the hydrologic summary table. The table listing the peak inflow and outflows of the detention basins will be moved from section 4.0 to section 3.0.

i) The comment of discussing the tables in the order they appear will be resolving by moving the table mentioned in item h.

j) The team discussed the Clarkson Spill Structure and how much flow the structure would contribute to the Greeley No.3 Canal at the upstream end of the study area. ICON had maintained the normal irrigation flow assumption from the previous study of 70-cfs downstream of the Clarkson Spill Structure. The team looked into the updated modeling of the canal upstream of the Clarkson Spill Structure, which showed a tabular rating table for the spill structure passing 110-cfs downstream into our project area. ICON will update the canal model to assume 110-cfs entering the watershed from the Clarkson Spill Structure and model the spill flows accordingly.

k) ICON clarified the uniform lateral inflow hydrograph called out in the report text was the modeling option used within the HEC-RAS model. The Uniform Lateral Hydrograph modeling technique allows the team to evenly distribute an inflow hydrograph along several cross sections in the HEC-RAS model.

l) Matt Simpson provided a comment to identify the spill flow locations from the canal more clearly. Jeremy described a canal spill map that would be included in the final submittal as well as further detail added to the interactive map to assist identifying spill flow locations.

m) Jeremy clarified the 'approximate capacity' of the detention basins listed in the table described what storm event frequency would overtop the detention basin. The report will be clarified to explain the approximate capacity in further detail.

n) The team discussed the best way to enhance the interactive map. ICON developed a project website which includes all elements of the interactive map eliminating the problem of the overlapping labels. The interactive map will remain in the Appendix to provide a static reference to project elements but will include information that the project

site is available. At the conclusion of the project, ICON will provide shape files to the City of Greeley to be uploaded to their GIS online service so the information will be available after the conclusion of the project.

o) The team decided the SWMM Input / Output would not be included in the report appendix. All of the report and output files for each flow frequency will be provided digitally at the end of the project.

p) Jeremy explained the naming convention that was used when developing the hydrologic model. A description of the process used to determine element names will be added as part of the TDSN. Elements that correspond to storm drain infrastructure will have a description added in the SWMM model to help assist future users of the model.

q) The team discussed the input and output file format for the FLO-2D modeling. The team tabled discussions of what the final deliverables will be until closer towards the end of the project.

r) This comment was discussed as part of agenda item g. No conversion to Type B soils would be made to the watershed as the NRCS soil data used for this project was updated in 2014.

s) Craig explained at this time only the 10% and 1% annual exceedance frequency events had been modeled with FLO-2D. These frequencies were chosen to assist the team in identifying problem areas throughout the watershed. If the other frequencies were determined to be able to assist the team they would be completed at that time.

Problem Area Identification:

- Craig gave an overview of the problem area identification approach for the watershed. ICON used a combination of the FLO-2D inundation mapping and the SWMM Hydrology model to identify several critical facilities and major flow paths to advert flooding damages when developing alternatives. Eric and Heather informed the team on the future plans for the downtown area with the relocation of town hall, the fire station, and the addition of a convention center. The convention center area was identified as being a high priority when evaluating alternatives.

Approach to MP Improvements:

- Craig detailed the approach ICON will take to evaluate possible alternatives. ICON will evaluate the proposed improvements from the previous CDP to determine current feasibility before developing new alternatives for the watershed. Eric noted the constructability of any proposed improvements should be paramount when developing the alternatives.

Utility Contact Update:

- Craig stated the team has begun coordinating with utility companies to gather all possible information.

Outreach:

- Craig inquired on the status of the project website. Heather informed the team the format and content for the website were being developed.

- Heather updated the team that a draft of the outreach survey had been created with question logic enabling people to only answer the questions that applied to them. The IT group will provide tablets for people to fill out the survey while at next week's public meeting.
- Heather showed the team a logo that was developed to help with branding throughout the multiple outlets of outreach.

Schedule:

- The team discussed preparation for the public meeting January 28, 2016. Craig will prepare the content for the presentation using the City of Greeley PowerPoint template that Heather will provide. The presentation will be fifteen minutes and provide an introduction to the project, a brief review of the hydrology, give the schedule timeframe for the project, display the general flowpaths for the watershed, display the inundation limits and provide a link to the website and survey. Craig will send the PowerPoint presentation to Heather and Eric by Monday. ICON will also prepare a couple 24" x 36" display boards for the public meeting to provide more detail about the project.
- ICON will revise the report and submit the final Hydrology and Hydraulics Report as soon as all comments have been addressed.

- END OF MEETING--

To the best of my knowledge, these minutes are a factual account of the business conducted, the discussions that took place, and the decisions that were reached at the subject meeting. Please direct any exceptions to these minutes in writing to the undersigned within ten (10) days of the issue date appearing herein. Failure to do so will constitute acceptance of these minutes as statements of fact in which you concur.

Minutes prepared by: Jeremy Deischer

Jeremy Deischer — January 21, 2016
ICON Engineering, Inc.

North Greeley and Downtown Basin Master Plan
Progress Meeting
March 14, 2016 1:00 PM

City of Greeley Public Works Department
Meeting Minutes

Attendees:	Eric Weiss,	City of Greeley
	Heather Seitz,	City of Greeley
	Craig Jacobson,	ICON Engineering
	Terry Martin,	ICON Engineering
	Jeremy Deischer,	ICON Engineering

Alternative Development Process

- The team reviewed structures ICON had preliminary identified as critical facilities. After some discussion it was decided buildings would be categorized into four separate categorizes: critical facilities, important structures, residences, and industrial / commercial. Separating structures into categories will allow the project to weight alternatives that propose mitigate flooding on specific structures.
- ICON reviewed the steps taken to identify the impacts of implementing different thresholds of improvements. Subwatershed runoff hydrographs for the 2-, 5-, and 10-year design storms were subtracted from the 100-year hydrograph to identify the residual flooding if different levels of protection were implemented across the watershed. The analysis used a threshold of 3 inches of depth for an impacted structure and showed approximately a linear trend of structures removed for each level of protection. Eric asked if ICON had evaluated 6 inches of depth as the threshold for an inundated structure. ICON had not evaluated that threshold but ICON will add a 6 inch threshold for inundated structures as part of the analysis.
- Craig outlined the different possibilities of improving and upsizing the existing storm drain system or leaving the existing system in place and adding additional storm conveyance through new alignments. This included leaving the 13th Street Outfall in place and adding additional conveyance along 11th or 12th Street and crossing Highway 85 before the system would outfall into the Poudre.
- Eric discussed the criteria the team would use to evaluate each Alternative Plan:
  - Structures Removed: The criteria of structures removed will be weighted based upon the category that the structure resides in, as outlined above.
  - Feasibility / Constructability: Several factors will be included when determining the feasibility including sanitary crossings, whether the outfall is in the downtown area, proximity to railroad crossings or Highway 85, and the pipe cover of the outfall system near the Poudre River.
  - FEMA BCA Tool: Benefit-Cost Analysis will be provided as final criteria but will not be included during the initial selection process.
- The team discussed the possibility of including a parkway for either the Greeley No. 3 Canal or another major drainageway path as an alternative plan. While any Parkway alternative is not likely to be feasible due to the large acquisition cost, ICON will evaluate a parkway alternative for the City to review.

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Alternative Categories

a) Minimum Criteria
- Based upon the City of Greeley GIS Zoning information, each storm drain outfall was categorized whether it intercepted flow from a residential, business / commercial or downtown business area. Each storm drain outfall will convey the minimum initial storm as defined in the City of Greeley Storm Drainage Design Criteria Manual. Storm drains within residential areas will convey a 2-year design storm, business / commercial storm drains will convey the 5-year design storm, and downtown business areas will convey a 10-year design storm. Areas around critical facilities will convey the 10-year design storm regardless of the zoning to provide additional protection.

b) Minimum Initial Storm Conveyance with Detention
- This alternative evaluates the feasibility of detention basins in addition to the minimum criteria alternative. Detention facilities upstream and downstream of the Greeley No. 3 Canal will be evaluated to determine the possible reduction in design flow possible at each location. At each proposed location, the maximum depth of water will be limited to 5-feet. Several areas were eliminated from consideration for detention facilities including Lincoln Park and areas along the Union Pacific Railroad.

c) Canal Spill Interception / Downtown Mitigation
- The purpose of this alternative is to protect the downtown area to the maximum extent possible by intercepting the 100-year design flow along 7th Street and 13th Street. These two outfall paths will intercept the majority of the flow overtopping the Greeley No. 3 Canal inundating structures downstream of the canal.

d) Base Flow Separation at Canal
- This alternative encourages separation of flow from the Greeley No. 3 Canal up to a 10-year design flow. The separation of base flow will lead to a reduction of flow overtopping the canal but requires more stormwater infrastructure to convey flow from the canal to existing outfalls.

e) Volume Reduction Alternatives
- The final alternative plan was developed to evaluate the impact of LID techniques in reducing the total runoff volume. Several scenarios of the 6th Avenue watershed from 12th Street north to 7th Avenue were modeled to determine the possible volume reduction.
  - The first scenario investigated existing roadway width, which is currently much larger than City of Greeley criteria, to determine area that could be used for LID techniques. A new impervious value was computed for each subwatershed assuming the reduction in street width and the implementation of a pervious surface within the City of Greeley Right-of-Way. The decrease in watershed imperviousness led to an approximate 10% reduction in total volume for the 100-year design storm.
  - The next scenario involved modeling the pervious area developed in the first scenario as the conveyance path, draining the subwatershed runoff to the grass swale. This scenario led to an additional 10% reduction in total runoff volume for the 100-year design storm.

- Eric noted that the maintenance cost associated with the grass swale could be problematic as a viable alternative for the City. He also identified pervious pavers as an alternative in downtown areas to maintain on street parking. ICON will evaluate the reduction in runoff volume using pervious pavers along 12th Avenue. The master plan will not evaluate LID techniques for the entire watershed but rather evaluate specific areas and provide recommendations to encourage LID implementation as opportunities presents itself and as the watershed redevelops.
- The City asked ICON to include all possible ancillary benefits of LID implementation in the report, quantifying the benefits when possible.

Outreach / Website

- Eric informed the team the Baseline Hydrology and Hydraulics Report has been uploaded to the project website.

Schedule

- The next progress meeting will be held on Wednesday April 6.

- END OF MEETING--

To the best of my knowledge, these minutes are a factual account of the business conducted, the discussions that took place, and the decisions that were reached at the subject meeting. Please direct any exceptions to these minutes in writing to the undersigned within ten (10) days of the issue date appearing herein. Failure to do so will constitute acceptance of these minutes as statements of fact in which you concur.

Minutes prepared by: Jeremy Deischer

Jeremy Deischer
ICON Engineering, Inc.

March 15, 2016

North Greeley and Downtown Basin Storm Drainage Master Plan
Progress Meeting
April 7, 2016 1:00PM

Conference Call
Meeting Minutes

Attendees:	Eric Weis,	City of Greeley
	Craig Jacobson,	ICON Engineering
	Jeremy Deischer,	ICON Engineering

- The team discussed several outstanding action items:
  - During the previous meeting ICON had reported the number of structures inundated by the FLO-2D analysis. ICON had used a threshold of 3” or greater to distinguish an inundated structure. Eric had asked ICON to perform the same type of analysis using a threshold of 6”. For the existing conditions the number of inundated structures was reduced from 4058 using the 3” threshold to 2854 structures using a threshold of 6”.
  - Eric will provide ICON a GIS layer that contains buildings that should be categorized as critical facilities / important structures.

Alternative Plans:

- The team discussed the alternative evaluation process. The minimum conveyance criteria alternative was the first alternative, reflecting storm sewer conveyance for the initial storm, as defined Greeley’s criteria manual for applicable zoning locations. The storm drain system will be sized using the SWMM design flow to avoid accounting for any inadvertent storage throughout the watershed. The selected plan will be optimized using FLO-2D to determine the amount of inundation that can be removed by altering the selected plan pipe size.
- ICON reviewed the maximum available detention for each of the areas identified for detention at the previous meeting. At this time, the maximum storage capacity for each facility was calculated using a maximum water depth of 5 feet. ICON had not yet compared the downstream benefit of the added detention, this will be completed over the coming weeks.
- Eric informed ICON there is new development occurring near the Great Western Railroad east of 11th Avenue. The detention alternative in this area is not feasible and will not be pursued further.
- Volume Reduction Alternative
  - ICON discussed the development of the 12th Ave. volume reduction alternative discussed at the last meeting. The Low Impact Development (LID) modeling techniques available in EPA SWMM would require the team to develop a new hydrology model. Eric directed the team to provide general recommendations of volume reduction techniques in the master plan but not pursue developing new hydrology in SWMM to use the available LID techniques. Craig suggested ICON use the options within CU-HP by changing the level of DCIA, to maintain existing hydrology and evaluate the reduction of volume if LID was implemented along 12th

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Avenue. These results will be extrapolated for the study area to estimate benefits of LID function.

- Downtown Parkway Alternative
    - ICON displayed the initial alignment of the parkway along 9th Street and 11th Avenue confluencing around Lincoln Park continuing along 7th Street to the Poudre River. Eric informed the team the 11th Avenue alignment or passing through Lincoln Park wasn't a feasible alignment. The team discussed possible alternatives to the alignment and the overall feasibility of the alternative due to the property acquisition required. Craig discussed the possibility of changing the channel design to minimize the right of way acquisition cost that would be required. Based on this feedback, ICON will provide the City with a more feasible, schematic layout, identifying ROW needs for this option. The City will review it and decide if it should be pursued further.

BCA:

- The team discussed the best way to approach using benefit-cost software to evaluate alternatives throughout the watershed. The team decided to use supplemental spreadsheets developed by ICON that simulate the analysis of FEMA's BCA software. The FEMA BCA software will be used for the elements of the selected plan that the spreadsheet analysis determined to have the highest benefit to cost ratio.
- For evaluation of alternatives the team decided to use the following assumptions for finished floor elevations.
    - Residential: 12" above lowest adjacent grade
    - Commercial / Industrial: 6" above lowest adjacent grade
    - Downtown Business: Lowest adjacent grade

Schedule

- The next progress meeting to review alternative development will be held in Greeley on April 28th. Following that meeting ICON will engage Lithos for initial cost estimates to include in the Alternatives Analysis report and submit the Draft Alternative Analysis Report to the City of Greeley for review on May 27th.
- Draft bullet items will be submitted to the City for the more feasible alternatives by May 20th.

- END OF MEETING--

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Minutes prepared by: Jeremy Deischer

Jeremy Deischer
ICON Engineering, Inc.

April, 8 2016

North Greeley and Downtown Basin Master Plan
Progress Meeting
May 2, 2016 11:00 AM

City of Greeley Public Works Department
Meeting Minutes

Attendees:	Eric Weiss,	City of Greeley
	Heather Seitz,	City of Greeley
	Craig Jacobson,	ICON Engineering
	Jeremy Deischer,	ICON Engineering

Alternative Development Process

ICON described the assumption made while developing costs for each alternative using the UD-MP-Cost workbook.

Asphalt	$ 50	S.Y.
Railroad Boring	$ 4,500	L.F. /cell (Min. 80 ft. per cell)
Water Line Relocate	$ 5,000	EA
Dewatering	1%	of Total Capital Improvement Costs
Traffic Control	2%	
Utility Coordination / Relocation	10%	
Mobilization	5%	UDFCD Default Values
Engineering	15%	
Legal / Admin	5%	
Contract Admin	10%	
Contingency	25%	

Eric noted that for pipes 42" in diameter and larger the majority of the street would be repaved and should reflect a more representative cost of repaving at approximately $38 per square yard instead of the asphalt patching cost of $50 per square yard.

The notation for the water line relocate will be changed to lowering of water line.

The team discussed screening criteria that was used when eliminating alternative plans. The report text will discuss the screening criteria used when developing alternative plans.

Alternative Plans

Alternative 1 – Minimum Conveyance Criteria Alternative

- ICON reviewed the development of Alternative 1 including the stormwater infrastructure size needed to increase the watershed to convey the initial storm which varies based on zoning designation. The FLO-2D analysis of Alternative 1 which will be used to calculate benefit cost for each alternative was also reviewed.
- The team discussed the alignments of the 12th Street and 7th Street storm drain system. Eric described the difficulty of constructing the 12th Street alignment given the access requirements of the firehouse. He also illustrated the 10th Street / 8th Avenue alignment could pose issues with the amount of traffic involved along those corridors in combined with the extent of utilities in the area. Craig explained these alignments would be refined once a selected plan had been created.

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- Eric noted that any railroad crossings should assume a minimum cover of 5 feet from bottom of rail when evaluating boring alternatives.

Alternative 2 – Minimum Conveyance Criteria & Detention Alternative

- The team reviewed several sites in which proposed detention was modeled to determine the impact of detention within the watershed. These sites included: Luther Park North, Maplewood Elementary School, 16th Street, Moon Pond, 14th Avenue, and 2nd Street.
- All detention areas were combined into one detention scenario to evaluate the maximum effect detention could have within the watershed. Luther Park North and Maplewood will be separated into different models to determine the impact of implementing the detention separately.
- Eric informed the team of a storm scepter located in the area north of Luther Park that would need to be included in cost estimates of the proposed detention area.
- Eric noted there was a proposed development of the parcel evaluated for detention at 2nd Street. ICON will investigate a more refined land value for the parcels involved in the proposed detention than the values included in the Weld County assessor's

Alternative 3 – Canal Interception / Downtown Mitigation Alternative

- The increase in stormwater infrastructure size associated with the 100-year conveyance along the 12th Street and 7th Street outfalls was reviewed.

Alternative 4 – Canal Baseflow Separation Alternative

- ICON provided an overview of the infrastructure required for Alternative 4 and the resulting residual flooding. Alternative 4 was designed to separate the 10-year design flow from the Greeley No. 3 Canal.

Alternative 5 – Volume Reduction Alternative

- Subwatersheds were modeled to simulate implementing LID techniques on all subwatersheds, decreasing the total watershed runoff volume. This analysis was performed by modeling a Directly Connected Impervious Areas (DCIA) level of 2 within the hydrology model. Implementing the LID techniques reduced the 10-yr runoff volume to an existing conditions 5-yr level but did not have a significant reduction on major events.

Alternative 6 – Parkway Alternative

- The parkway alternative was revised to follow the 14th Ave north from the Greeley No. 3 Canal and 13th Street east. This alternative was deemed infeasible due to the property acquisition, and reconfiguration of travel lanes necessary to implement these improvements throughout the downtown area.

Schedule

- ICON will provide refined cost estimates for one storm drain trunk line to the City by May 20 to include in the City's future budget.
- ICON will submit the Draft Alternative Analysis Report to the City for review by the end of May.

Action Items

- ICON will look into acquiring a more accurate land value for the parcels associated with the 2nd Street detention.
- ICON will provide the City of Greeley the cost estimate for one trunk line to assist with budget planning by May 20.
- ICON will submit the Draft Alternative Analysis Report by the end of May.

- END OF MEETING--

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Minutes prepared by: Jeremy Deischer

Jeremy Deischer
ICON Engineering, Inc.

May 3, 2016

North Greeley and Downtown Basin Master Plan
Progress Meeting
May 5, 2015 9:00 AM

City of Greeley Public Works Department
Meeting Minutes

Attendees:	*Eric Weis,*	*City of Greeley*
	Heather Seitz,	*City of Greeley*
	Craig Jacobson,	*ICON Engineering Inc.*
	Jeremy Deischer,	*ICON Engineering Inc.*

Review of Recommended Plan / Alternative Analysis Report

- The City will provide ICON editorial comments on the Alternative Analysis Report when they have been compiled into the comment document spreadsheet.

Review of Benefit Cost Analysis

- The team reviewed the impact that the higher frequency storms (2-, 5-yr) had on the benefit-cost analysis. The City has not experienced the damages in the Downtown Basin that the design storms of these frequencies were producing. ICON removed the 2-yr and 5-yr design storms from the analysis and the benefit-cost were still around 1.0.

Conceptual Design

- The team discussed how the Conceptual Design would be presented. The storm drain network will be separated into outfalls and laterals to designate the major outfall systems and contributing laterals.
- Given the extent of the proposed storm drain alignments, only the major outfall systems will be refined to an approximate 20% design level.
- Each phase will be given a different name to differentiate the projects within an outfall system.
- The proposed detention facilities in Alternative 2 will be incorporated into the Conceptual Design.
    - Property acquisition cost estimates will be obtained from Zillow instead of using Weld County Assessor values.
- The options for construction at the railroad crossings were discussed in further detail. Craig suggested bringing Lithos Engineering and San Engineering to the next progress meeting for their opinion on tunneling or open cut options for constructing the railroad crossings.

Other Items

- Craig informed the City about UDFCD developing a new version of the Colorado Urban Hydrograph Procedure (CU-HP) workbook. The updated version has not been released but will incorporate NOAA 14 rainfall values. Several different options were discussed about whether to revisit the use NOAA 14 rainfall values in this study now that UDFCD is incorporating these values into their hydrology model. The team decided that ICON would rerun the NOAA 14 rainfall values in the CUHP model and determine the impact on the proposed infrastructure for Alternative 4 and decide whether the hydrology section of the report would be revised, the new rainfall would be carried forward into the conceptual design but the hydrology section would be left as is, or the team would proceed into conceptual design with the existing rainfall and flow rates.

Schedule:

- The team discussed when to hold the next public meeting. Heather will investigate whether there are any other events for the downtown area which could incorporate the master plan into their meeting.
- The team discussed the different options for presenting to council. Eric suggested the best format to allow interaction with the council would be a breakfast session which would include a presentation less than 30 minutes. The Conceptual Design Report would be presented at this session.

- END OF MEETING--

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Minutes prepared by: Jeremy Deischer

Jeremy Deischer
ICON Engineering, Inc.

August 24, 2016

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North Greeley and Downtown Basin Storm Drainage Master Plan
Progress Meeting
February 6, 2017

Conference Call

Meeting Minutes

Attendees:	*Eric Weis,*	*City of Greeley*
	Heather Seitz,	*City of Greeley*
	Craig Jacobson,	*ICON Engineering Inc.*
	Jeremy Deischer,	*ICON Engineering Inc.*

Update on Revised Hydrology

Craig reviewed the results of the updated analysis using CUHP v.2.0. The revised analysis updated existing conditions and all four alternatives.

- In general the revised hydrology led to a reduction of approximately 20 percent in peak discharge.
- The revised alternative analysis showed a reduction in alternative cost of all four alternatives of approximately 60 million dollars. Craig pointed out the 14th Avenue Outfall was the most impacted outfall with a significant reduction of the infrastructure required to meet the design criteria.
- The benefits of the alternatives in adverted damages stayed approximately the same from the previous analysis. This led to an increase in the benefit cost ratio with the significant reduction in alternative costs.
- The team decided the revised CUHP v.2.0 discharges will be the only discharges noted within the report. Text will be added to discuss the change in the hydrologic method when comparing to previous reports.

Elements of Selected Plan

The team discussed the elements that will be incorporated into the Conceptual Design.

- The Conceptual Design will include the Canal Baseflow Separation Alternative alignment, the detention proposed in Alternative 2 and the WQCV basin at each outfall.
- ICON will evaluate the impact the proposed Moon Pond and 16th Street detention has on the Alternative 4 infrastructure along 12th Street. ICON will report these findings back to the City to decide which detention facilities will be included in the Conceptual Design.
- A comment Eric provided on the WQCV exhibit for the 12th Street Outfall was discussed in further detail. For the WQCV basins a splitter structure will be constructed within the storm drain outfall to allow low flows (~2 yr) to discharge into the WQCV basin while allowing high flows to bypass the WQCV basin and outfall directly into the Poudre River.
- Craig discussed the design elevation of the outfall systems into the Poudre River. In general, ICON tried to stay approximately two feet above surveyed invert of the Poudre River. Eric agreed this was an acceptable approach. The team also discussed the outlet structure of each outfall in further detail. Eric did not want a trash rack on the outlet into the Poudre River and would prefer the outlet structure to be submerged during larger events. Once the outfall profiles were determined, ICON would review the potential backwater effects from the Poudre River to determine if the backwater would introduce ponding beyond the existing Poudre River floodplain limits.
- The team discussed the naming convention of phasing of an outfall system. The City would like the outfall systems broken up into different phases to distinguish when segments of the outfall have been completed.
- Craig updated the City about the progress of obtaining cost estimates for tunneling underneath the railroads. ICON has been in contact with Lithos regarding the cost estimates for tunneling underneath the railroad. Lithos will provide site specific cost estimates for each of the major outfalls once ICON provides profiles of the proposed improvements. The team discussed alternatives to tunneling under the railroad such as open cut installation and a railroad shoefly. Only the tunneling costs will be included in the Conceptual Design Report since they will be the most conservative. Eric informed the team any storm drain improvements underneath the Greeley No. 3 Canal should propose an open cut installation during the winter. He also asked for Lithos to include text about the risks involved tunneling under the railroad.
- Jeremy reviewed the information the team had obtained from the dry utility companies. For the sanitary sewer information, ICON is using the depths contained in the City's GIS shapefile for the manholes that were not surveyed in the previous master plan. Eric offered to have someone with the City verify the depths of a few (~10) key sanitary sewer manholes if needed.

Conceptual Design Format

- The team discussed the typical EPLAN Map and Profile format. It was decided the general EPLAN format would be followed but consideration would be taken into the Easy to Print Maps and Profiles as user friendly as possible.

City's Editorial Comments on Previously Submitted Alternative Analysis

- The City will provide ICON their comments on the Alternative Analysis Report to incorporate in the DRAFT Conceptual Design Report

Schedule

- ICON will submit the DRAFT Conceptual Design Report to the City at the end of February or early March.

- END OF MEETING--

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Minutes prepared by: Jeremy Deischer

Jeremy Deischer
ICON Engineering, Inc.

February 7, 2017

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From: Jeremy Deischer
To: Eric Weis; Heather Seitz
Cc: Craig Jacobson
Subject: NGD Storm Drainage Master Plan - Evaluation of 12th Street Outfall Detention Basins
Date: Wednesday, February 15, 2017 8:24:00 AM
Attachments: image001.png
image002.png

Good morning Eric and Heather,

Following our last meeting we looked at several alternatives to determine the benefit of detention on the 12th Street Outfall. We analyzed four different scenarios: no detention along the 12th Street Outfall, 16th Street and Moon Pond implemented separately, and the combination of both detention facilities.

The Alt 4 – No Detention Scenario is the Canal Baseflow Separation Alternative from the Alternative Analysis Report. This scenario conveys the 10-year discharge with no additional detention at Moon Pond or 16th Street.

The Alt 4 – 16th Street Detention Scenario includes the proposed detention at 16th Street and leaves Moon Pond in its existing configuration. Providing detention at 16th Street would require the reconstruction of the existing ballfield and the relocation of a sanitary sewer that currently runs through the ballfield. The inflow to Moon Pond was limited in this scenario to prevent any overtopping of Moon Pond with the existing outlet structure during a 10-year event.

The Alt 4 – Moon Pond Detention Scenario requires the acquisition of 12 properties. In addition to acquiring the properties there are multiple sanitary sewer lines running in the alley north of Moon Pond, and in 16th Avenue just east of Moon Pond that would need to be relocated. Property acquisition costs for Moon Pond were obtained from Zillow.

Below is a comparison of the 10-year peak flow and the storm drain infrastructure required for the 12th Street Outfall for each of the scenarios. The conceptual costs for each alternative has also been included. We spoke with Mark Wilcox of DHM Design to get an approximate cost estimate to reconstruct the baseball field at 16th Street which we are estimating at 2 million dollars. The tunneling costs still reflect the equivalent number of circular pipes to convey the flow at the initial estimate of $4,500 per linear foot. The cost estimates below do not reflect any sanitary sewer relocations that would be necessary.

Although the detention does have an slight impact on the infrastructure size along 12th Street the reduction in pipe size are probably not enough to improve the feasibility of implementation. Additionally, the detention alternative doesn't provide any cost savings when compared to the Alt 4 – No Detention Scenario. Since there isn't a cost benefit to implementing the detention facilities we aren't recommending either of the detention facilities be included in the conceptual design and proceed with the Alt 4 – No Detention Scenario for the Conceptual Design.

Do either of you have any thoughts?

		Alt 4 - No Detention		Alt 4 - 16th St. Detention		Alt 4 - Moon Pond Detention		Alt 4 - Both Detention Facilities	
Key Design Points	SWMM Element	10-yr Flow	Infrastructure	10-yr Flow	Infrastructure	10-yr Flow	Infrastructure	10-yr Flow	Infrastructure
16th Ave Ct at 15th St.	L917.1_pipe	105	4 ft.	42	3 ft.	105	4 ft.	42	3 ft
16th Ave Ct at 13th St.	L017.5_pipe	149	4 ft.	84	3 ft.	149	--	84	--
Greeley No. 3 Canal	L_12thSt	150	4.5 ft.	69	3.5 ft.	84	3.5 ft.	22	2.5 ft.
14th Ave	L029.02	226	6 ft. x 5 ft.	162	5.5 ft.	172	5.5 ft.	114	5 ft.
11th Ave.	L931.02	235	6 ft. x 5 ft.	169	6 ft. x 5 ft.	179	6 ft. x 5 ft.	120	5.5 ft.
10th Ave.	L831.01	247	8 ft. x 5 ft.	175	6 ft. x 5 ft.	185	7 ft. x 5 ft.	127	5.5 ft.
7th Ave.	L936.26	592	13 ft. x 6 ft.	498	11 ft. x 6 ft.	521	12 ft. x 6 ft.	460	12 ft. x 5 ft.
RR Crossing	L236.26	593	13 ft. x 5 ft.	498	11 ft. x 5 ft.	521	12 ft. x 5 ft.	460	10 ft. x 5 ft.
6th Ave.	L236.07	592	13 ft. x 6 ft.	498	11 ft. x 6 ft.	521	11 ft. x 6 ft.	460	10 ft. x 6 ft.
US 85 Crossing	L836.11	677	12 ft. x 6 ft.	583	10 ft. x 6 ft.	608	11 ft. x 6 ft.	546	10 ft. x 6 ft.
DS of US 85	L000	677	14 ft. x 6 ft.	583	13 ft. x 6 ft.	608	13 ft. x 6 ft.	546	12 ft. x 6 ft.

Alternative	Property Acquisiton	US Infrastructure	DS Infrastructure	Total Capital Cost	Total Project Cost
Alt 4 - No Detention	$ -	$ 4,323,760	$ 29,748,840	$ 34,072,600	$ 34,072,600
Alt 4 - 16th St. Detention	$ -	$ 9,079,552	$ 25,805,533	$ 34,885,085	$ 34,885,085
Alt 4 - Moon Pond Detention	$ 2,545,792	$ 4,706,587	$ 27,094,003	$ 31,800,590	$ 34,346,382
Alt 4 - Both Detention Facilities	$ 2,545,792	$ 9,380,104	$ 23,657,104	$ 33,037,208	$ 35,583,000

Jeremy Deischer, EI
Project Engineer
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APPENDIX B - HYDROLOGIC ANALYSIS

Greeley No. 3 Canal XS
Study Area
Greeley No. 3 Canal
Greeley No. 3 Canal 100-yr Peak Spill

Node Type

DIVIDER
JUNCTION
OUTFALL
STORAGE
Routing Elements
Subwatershed

Basin ID
Area (ac)
Impervy (%)

Outfall System

13th St / 2nd Ave Outfall
14th Avenue Outfall
16th Avenue Court Outfall
16th Street Outfall
17th Street Outfall
19th Street Outfall
1st Street Outfalll
23rd Avenue Outfall
7th Street Outfall
9th Avenue Outfall
9th Street Outfall
Glenmere Draw

Contour

Major (5-, 10-ft)
Minor (1-ft)

Flow Depth

0" - 3"
3" - 6"
6" - 12"
1' - 1.5'
1.5' - 3'
3' - 4.5'
4.5' - 6'
> 6'

Land Use

Grass - 5%
Gravel - 40%
Residental Low - 45%
Residental Medium - 60%
Residental High - 75%
Industrial Light - 80%
Industrial Medium - 85%
Rooftops / Concrete - 90%
Asphalt - 100%

NRCS Soil Classification

A
B
D
BORROW PITS; WATER

North Greeley and Downtown Storm Drainage Master Plan
Interactive Map

City of Greeley Colorado

ICON ENGINEERING, INC.

Interactive Map (Select Below)

Study Area Map
Hydrology SWMM Routing Map
Subwatershed Map
10-yr Inundation Map
Soils Map
100-yr Inundation Map
Land Use Map
Canal Spill

Contours (Select Below)
ON
OFF

Street Labels (Select Below)
ON
OFF

Layer Control Instructions

The Map Controls set the visibility of the layers automatically for the selected map. Additional layer control is available through the "Layers" Navigation Panel which can be accessed from the View Menu under Navigation Panels. In the Panel, the visibility of layers and layer groups can be changed by clicking the square left of the layer/group. An eye in the square indicates that the layer is on. An empty square indicates that the layer is off. Layer groups can be expanded and reduced by clicking the +/- symbol left of the layer/group.

This information is also online at:

http://iconengineering.github.io/greeley/ngd-map/

N W E S

0 0.25 0.5 Miles

CU-HP Rainfall Distribution

2 yr 1-hr Point Rainfall = 0.72 in		5 yr 1-hr Point Rainfall = 1.13 in		10 yr 1-hr Point Rainfall = 1.41 in		50 yr 1-hr Point Rainfall = 2.27 in		100 yr 1-hr Point Rainfall = 2.73 in	
Time (min)	Depth (in)	Time (min)	Depth (in)	Time (min)	Depth (in)	Time (min)	Depth (in)	Time (min)	Depth (in)
5	0.01	5	0.02	5	0.03	5	0.03	5	0.03
10	0.03	10	0.04	10	0.05	10	0.08	10	0.08
15	0.06	15	0.10	15	0.12	15	0.11	15	0.13
20	0.12	20	0.17	20	0.21	20	0.18	20	0.22
25	0.18	25	0.28	25	0.35	25	0.34	25	0.38
30	0.10	30	0.15	30	0.17	30	0.57	30	0.68
35	0.05	35	0.07	35	0.08	35	0.27	35	0.38
40	0.04	40	0.05	40	0.06	40	0.18	40	0.22
45	0.02	45	0.04	45	0.05	45	0.11	45	0.17
50	0.02	50	0.04	50	0.05	50	0.11	50	0.14
55	0.02	55	0.03	55	0.05	55	0.07	55	0.11
60	0.02	60	0.03	60	0.05	60	0.07	60	0.11
65	0.02	65	0.03	65	0.05	65	0.07	65	0.11
70	0.01	70	0.03	70	0.05	70	0.05	70	0.05
75	0.01	75	0.03	75	0.05	75	0.05	75	0.05
80	0.01	80	0.02	80	0.04	80	0.04	80	0.03
85	0.01	85	0.02	85	0.03	85	0.04	85	0.03
90	0.01	90	0.02	90	0.03	90	0.03	90	0.03
95	0.01	95	0.02	95	0.03	95	0.03	95	0.03
100	0.01	100	0.02	100	0.03	100	0.03	100	0.03
105	0.01	105	0.02	105	0.03	105	0.03	105	0.03
110	0.01	110	0.02	110	0.03	110	0.03	110	0.03
115	0.01	115	0.02	115	0.02	115	0.03	115	0.03
120	0.01	120	0.01	120	0.02	120	0.03	120	0.03

CUHP Input Parameters

								Depression Losses (in)		Horton's Infiltration Parameters		
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (mi^2)	Length to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)
B001.1	J001.1	GreeleyRainfall	0.0256	0.1490	0.1973	0.017	60.8	0.35	0.1	5.0	0.0	1.0
B001.2	J001.2	GreeleyRainfall	0.0169	0.1236	0.1955	0.019	29.9	0.35	0.1	5.0	0.0	1.0
B001.3	J001.3	GreeleyRainfall	0.0192	0.1650	0.2917	0.020	38.9	0.35	0.1	5.0	0.0	1.0
B002.1	J002.1	GreeleyRainfall	0.0501	0.1860	0.3357	0.015	50.2	0.35	0.1	5.0	0.0	1.0
B002.10	J002.10	GreeleyRainfall	0.0134	0.0859	0.1695	0.008	55.1	0.35	0.1	3.3	0.0	0.7
B002.11	J002.11	GreeleyRainfall	0.0073	0.1109	0.1982	0.029	39.0	0.35	0.1	5.0	0.0	1.0
B002.2	J002.2	GreeleyRainfall	0.0347	0.2057	0.3155	0.014	55.8	0.35	0.1	5.0	0.0	1.0
B002.3	J002.3	GreeleyRainfall	0.0184	0.0704	0.1887	0.028	50.9	0.35	0.1	5.0	0.0	1.0
B002.4	J002.4	GreeleyRainfall	0.0144	0.0726	0.1446	0.025	47.0	0.35	0.1	5.0	0.0	1.0
B002.5	J002.5	GreeleyRainfall	0.0200	0.1462	0.3350	0.023	60.0	0.35	0.1	5.0	0.0	1.0
B002.6	J002.6	GreeleyRainfall	0.0176	0.0781	0.2195	0.029	37.6	0.35	0.1	5.0	0.0	1.0
B002.7	J002.7	GreeleyRainfall	0.0134	0.1229	0.2614	0.023	34.6	0.35	0.1	5.0	0.0	1.0
B002.8	J002.8	GreeleyRainfall	0.0214	0.1200	0.2765	0.029	38.6	0.35	0.1	5.0	0.0	1.0
B002.9	J002.9	GreeleyRainfall	0.0126	0.0808	0.1530	0.046	34.9	0.35	0.1	5.0	0.0	1.0
B003.1	J003.1	GreeleyRainfall	0.0244	0.1284	0.2731	0.016	34.6	0.35	0.1	5.0	0.0	1.0
B003.2	J003.2	GreeleyRainfall	0.0053	0.0975	0.1623	0.025	58.6	0.35	0.1	5.0	0.0	1.0
B003.3	J003.3	GreeleyRainfall	0.0370	0.2323	0.4416	0.020	44.4	0.35	0.1	5.0	0.0	1.0
B003.4	J003.4	GreeleyRainfall	0.0257	0.1076	0.3536	0.025	42.7	0.35	0.1	4.9	0.0	0.9
B003.6	J003.6	GreeleyRainfall	0.0174	0.1365	0.2673	0.014	71.6	0.35	0.1	4.6	0.0	0.7
B003.7	J003.7	GreeleyRainfall	0.0207	0.1138	0.2711	0.028	45.3	0.35	0.1	4.5	0.0	0.6
B003.8	J003.8	GreeleyRainfall	0.0040	0.1048	0.1807	0.011	53.8	0.35	0.1	5.0	0.0	1.0
B004.1	J004.1	GreeleyRainfall	0.0280	0.1555	0.2969	0.025	40.1	0.35	0.1	5.0	0.0	1.0
B004.2	J004.2	GreeleyRainfall	0.0043	0.0745	0.1435	0.017	41.8	0.35	0.1	4.5	0.0	0.6
B004.3	J004.3	GreeleyRainfall	0.0053	0.0891	0.1283	0.034	45.5	0.35	0.1	5.0	0.0	1.0
B004.4	J004.4	GreeleyRainfall	0.0331	0.2064	0.4245	0.026	46.1	0.35	0.1	4.8	0.0	0.8
B004.5	J004.5	GreeleyRainfall	0.0175	0.1317	0.2207	0.018	77.9	0.35	0.1	4.5	0.0	0.6
B004.6	J004.6	GreeleyRainfall	0.0547	0.2640	0.5600	0.025	51.1	0.35	0.1	4.7	0.0	0.8
B004.7	J004.7	GreeleyRainfall	0.0413	0.2945	0.5070	0.021	40.2	0.35	0.1	4.7	0.0	0.8
B004.8	J004.8	GreeleyRainfall	0.0259	0.1991	0.3964	0.024	42.3	0.35	0.1	4.7	0.0	0.8
B005.1	J005.1	GreeleyRainfall	0.0160	0.1463	0.3398	0.023	46.2	0.35	0.1	5.0	0.0	1.0
B005.2	J005.2	GreeleyRainfall	0.0210	0.0716	0.2039	0.029	36.6	0.35	0.1	5.0	0.0	1.0
B005.3	J005.3	GreeleyRainfall	0.0513	0.1753	0.3777	0.021	42.9	0.35	0.1	4.9	0.0	0.9
B006.1	J006.1	GreeleyRainfall	0.0540	0.1070	0.2586	0.017	42.6	0.35	0.1	5.0	0.0	1.0
B006.2	J006.2	GreeleyRainfall	0.0214	0.1411	0.2909	0.020	46.7	0.35	0.1	5.0	0.0	1.0
B006.3	J006.3	GreeleyRainfall	0.0213	0.1376	0.2869	0.018	47.5	0.35	0.1	5.0	0.0	1.0
B006.4	J006.4	GreeleyRainfall	0.0107	0.1014	0.1890	0.012	52.8	0.35	0.1	5.0	0.0	1.0
B006.5	J006.5	GreeleyRainfall	0.0107	0.0994	0.1918	0.024	53.7	0.35	0.1	5.0	0.0	1.0
B007.1	J007.1	GreeleyRainfall	0.0090	0.0894	0.1759	0.016	49.5	0.35	0.1	5.0	0.0	1.0
B007.2	J007.2	GreeleyRainfall	0.0073	0.0860	0.1769	0.016	45.7	0.35	0.1	5.0	0.0	1.0
B007.3	J007.3	GreeleyRainfall	0.0090	0.0908	0.1789	0.015	52.5	0.35	0.1	5.0	0.0	1.0
B007.4	J007.4	GreeleyRainfall	0.0090	0.0902	0.1788	0.014	50.1	0.35	0.1	5.0	0.0	1.0
B007.5	J007.5	GreeleyRainfall	0.0088	0.0895	0.1702	0.014	47.0	0.35	0.1	5.0	0.0	1.0
B007.6	J007.6	GreeleyRainfall	0.0090	0.0848	0.1745	0.012	56.2	0.35	0.1	5.0	0.0	1.0

CUHP Input Parameters

								Depression Losses (in)		Horton's Infiltration Parameters		
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (mi^2)	Length to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)
B007.7	J007.7	GreeleyRainfall	0.0090	0.0903	0.1760	0.013	51.4	0.35	0.1	5.0	0.0	1.0
B007.8	J007.8	GreeleyRainfall	0.0088	0.0867	0.1686	0.014	50.5	0.35	0.1	5.0	0.0	1.0
B007.9	J007.9	GreeleyRainfall	0.0025	0.0480	0.1051	0.017	50.7	0.35	0.1	5.0	0.0	1.0
B008.1	J008.1	GreeleyRainfall	0.0210	0.1561	0.2440	0.038	58.9	0.35	0.1	5.0	0.0	1.0
B008.2	J008.2	GreeleyRainfall	0.0124	0.1026	0.2028	0.012	49.3	0.35	0.1	5.0	0.0	1.0
B009.1	J009.1	GreeleyRainfall	0.0200	0.2129	0.3473	0.027	56.8	0.35	0.1	5.0	0.0	1.0
B009.2	J009.2	GreeleyRainfall	0.0250	0.1468	0.2963	0.017	61.4	0.35	0.1	5.0	0.0	1.0
B010.1	J010.1	GreeleyRainfall	0.0271	0.1625	0.2979	0.015	50.3	0.35	0.1	5.0	0.0	1.0
B010.2	J010.2	GreeleyRainfall	0.0216	0.1426	0.3528	0.011	52.3	0.35	0.1	5.0	0.0	1.0
B010.3	J010.3	GreeleyRainfall	0.0202	0.1069	0.1998	0.026	33.5	0.35	0.1	5.0	0.0	1.0
B010.4	J010.4	GreeleyRainfall	0.0129	0.1186	0.1833	0.025	47.6	0.35	0.1	5.0	0.0	1.0
B010.5	J010.5	GreeleyRainfall	0.0026	0.0440	0.0521	0.022	40.2	0.35	0.1	5.0	0.0	1.0
B010.6	J010.6	GreeleyRainfall	0.0195	0.0910	0.1972	0.021	33.6	0.35	0.1	5.0	0.0	1.0
B011.1	J011.1	GreeleyRainfall	0.0124	0.1097	0.1737	0.026	52.8	0.35	0.1	5.0	0.0	1.0
B011.2	J011.2	GreeleyRainfall	0.0199	0.1029	0.2428	0.015	60.7	0.35	0.1	5.0	0.0	1.0
B011.3	J011.3	GreeleyRainfall	0.0163	0.1227	0.2095	0.015	52.3	0.35	0.1	5.0	0.0	1.0
B011.4	J011.4	GreeleyRainfall	0.0170	0.0520	0.1747	0.019	36.8	0.35	0.1	5.0	0.0	1.0
B012.1	J012.1	GreeleyRainfall	0.0484	0.2236	0.3995	0.019	47.6	0.35	0.1	5.0	0.0	1.0
B012.2	J012.2	GreeleyRainfall	0.0071	0.0655	0.1376	0.034	77.8	0.35	0.1	5.0	0.0	1.0
B013.1	J013.1	GreeleyRainfall	0.0198	0.1412	0.2823	0.014	61.4	0.35	0.1	5.0	0.0	1.0
B013.2	J013.2	GreeleyRainfall	0.0177	0.2386	0.3166	0.025	46.3	0.35	0.1	5.0	0.0	1.0
B013.3	J013.3	GreeleyRainfall	0.0101	0.0847	0.1587	0.022	60.8	0.35	0.1	5.0	0.0	1.0
B013.4	J013.4	GreeleyRainfall	0.0080	0.0824	0.1663	0.024	52.8	0.35	0.1	5.0	0.0	1.0
B014.1	J014.1	GreeleyRainfall	0.0124	0.0979	0.2012	0.023	58.0	0.35	0.1	5.0	0.0	1.0
B014.2	J014.2	GreeleyRainfall	0.0032	0.0398	0.0609	0.022	60.8	0.35	0.1	5.0	0.0	1.0
B014.3	J014.3	GreeleyRainfall	0.0069	0.0383	0.0851	0.033	56.5	0.35	0.1	5.0	0.0	1.0
B015.1	J015.1	GreeleyRainfall	0.0128	0.1153	0.1688	0.015	48.2	0.35	0.1	5.0	0.0	1.0
B015.2	J015.2	GreeleyRainfall	0.0092	0.0884	0.1738	0.017	62.4	0.35	0.1	5.0	0.0	1.0
B015.3	J015.3	GreeleyRainfall	0.0089	0.1156	0.1309	0.009	49.3	0.35	0.1	5.0	0.0	1.0
B015.4	J015.4	GreeleyRainfall	0.0056	0.0251	0.0905	0.017	44.6	0.35	0.1	5.0	0.0	1.0
B015.5	J015.5	GreeleyRainfall	0.0124	0.1031	0.1654	0.021	62.5	0.35	0.1	5.0	0.0	1.0
B015.6	J015.6	GreeleyRainfall	0.0067	0.0828	0.1580	0.016	49.9	0.35	0.1	5.0	0.0	1.0
B015.7	J015.7	GreeleyRainfall	0.0214	0.1516	0.2971	0.018	51.5	0.35	0.1	5.0	0.0	1.0
B016.1	J016.1	GreeleyRainfall	0.0232	0.1537	0.3605	0.009	68.9	0.35	0.1	4.6	0.0	0.7
B016.2	J016.2	GreeleyRainfall	0.0182	0.1367	0.2706	0.019	49.6	0.35	0.1	4.9	0.0	0.9
B016.3	J016.3	GreeleyRainfall	0.0175	0.1161	0.2449	0.023	48.9	0.35	0.1	5.0	0.0	1.0
B016.4	J016.4	GreeleyRainfall	0.0026	0.0495	0.0827	0.031	48.0	0.35	0.1	5.0	0.0	1.0
B017.1	J017.1	GreeleyRainfall	0.0346	0.1944	0.3655	0.014	74.9	0.35	0.1	4.5	0.0	0.6
B017.10	J017.10	GreeleyRainfall	0.0034	0.1088	0.1641	0.015	38.5	0.35	0.1	5.0	0.0	1.0
B017.11	J017.11	GreeleyRainfall	0.0113	0.0996	0.1461	0.028	38.3	0.35	0.1	5.0	0.0	1.0
B017.12	J017.12	GreeleyRainfall	0.0078	0.1157	0.2861	0.018	47.9	0.35	0.1	4.9	0.0	0.9
B017.2	J017.2	GreeleyRainfall	0.0100	0.0970	0.1232	0.019	28.2	0.35	0.1	4.5	0.0	0.6
B017.3	J017.3	GreeleyRainfall	0.0180	0.1355	0.2666	0.011	55.0	0.35	0.1	4.5	0.0	0.6

CUHP Input Parameters

								Depression Losses (in)		Horton's Infiltration Parameters		
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (mi^2)	Length to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)
B017.4	J017.4	GreeleyRainfall	0.0174	0.1208	0.2467	0.014	54.7	0.35	0.1	4.5	0.0	0.6
B017.5	J017.5	GreeleyRainfall	0.0254	0.1568	0.3073	0.009	54.4	0.35	0.1	4.8	0.0	0.8
B017.6	J017.6	GreeleyRainfall	0.0250	0.2045	0.3497	0.025	44.3	0.35	0.1	4.7	0.0	0.8
B017.7	J017.7	GreeleyRainfall	0.0097	0.0713	0.1522	0.027	43.8	0.35	0.1	5.0	0.0	1.0
B017.8	J017.8	GreeleyRainfall	0.0201	0.1349	0.2986	0.019	42.4	0.35	0.1	4.9	0.0	0.9
B017.9	J017.9	GreeleyRainfall	0.0149	0.1400	0.2005	0.018	49.6	0.35	0.1	4.9	0.0	0.9
B018.1	J018.1	GreeleyRainfall	0.0476	0.2328	0.4614	0.014	48.0	0.35	0.1	4.5	0.0	0.6
B018.2	J018.2	GreeleyRainfall	0.0296	0.2059	0.3821	0.015	59.2	0.35	0.1	4.5	0.0	0.6
B019.1	J019.1	GreeleyRainfall	0.0307	0.2391	0.3611	0.013	57.9	0.35	0.1	4.5	0.0	0.6
B020.1	J020.1	GreeleyRainfall	0.0260	0.1489	0.2963	0.013	54.8	0.35	0.1	4.5	0.0	0.6
B020.2	J020.2	GreeleyRainfall	0.0097	0.0630	0.1299	0.019	41.3	0.35	0.1	4.7	0.0	0.8
B020.3	J020.3	GreeleyRainfall	0.0075	0.0766	0.1780	0.014	40.5	0.35	0.1	4.5	0.0	0.6
B020.4	J020.4	GreeleyRainfall	0.0067	0.1047	0.2248	0.013	46.9	0.35	0.1	4.5	0.0	0.6
B020.5	J020.5	GreeleyRainfall	0.0028	0.0641	0.1579	0.015	48.9	0.35	0.1	4.5	0.0	0.6
B021.1	J021.1	GreeleyRainfall	0.0210	0.1191	0.2196	0.024	44.6	0.35	0.1	4.7	0.0	0.7
B021.4	J021.4	GreeleyRainfall	0.0125	0.0884	0.1892	0.010	62.4	0.35	0.1	4.5	0.0	0.6
B021.5	J021.5	GreeleyRainfall	0.0123	0.1240	0.2020	0.011	51.8	0.35	0.1	4.5	0.0	0.6
B021.2	J021.2	GreeleyRainfall	0.0147	0.1241	0.2417	0.023	39.5	0.35	0.1	4.9	0.0	0.9
B021.3	J021.3	GreeleyRainfall	0.0116	0.0857	0.1825	0.022	80.2	0.35	0.1	4.9	0.0	0.9
B020.7	J020.7	GreeleyRainfall	0.0035	0.0405	0.1024	0.020	23.6	0.35	0.1	5.0	0.0	1.0
B022.2	J022.2	GreeleyRainfall	0.0195	0.1685	0.2812	0.010	48.6	0.35	0.1	4.5	0.0	0.6
B022.3	J022.3	GreeleyRainfall	0.0155	0.1332	0.2915	0.007	53.2	0.35	0.1	4.5	0.0	0.6
B022.4	J022.4	GreeleyRainfall	0.0251	0.2082	0.2544	0.011	32.0	0.35	0.1	4.8	0.0	0.8
B022.1	J022.1	GreeleyRainfall	0.0268	0.0662	0.1940	0.022	26.5	0.35	0.1	4.9	0.0	0.9
B020.6	J020.6	GreeleyRainfall	0.0278	0.1408	0.2888	0.014	40.6	0.35	0.1	4.5	0.0	0.6
B023.01	J023.01	GreeleyRainfall	0.0421	0.2081	0.3978	0.004	33.4	0.35	0.1	3.9	0.0	0.6
B023.02	J023.02	GreeleyRainfall	0.0080	0.0446	0.0976	0.014	33.0	0.35	0.1	4.1	0.0	0.8
B023.03	J023.03	GreeleyRainfall	0.0443	0.1215	0.2788	0.006	44.1	0.35	0.1	3.6	0.0	0.7
B023.04	J023.04	GreeleyRainfall	0.0603	0.1484	0.3705	0.004	45.1	0.35	0.1	4.4	0.0	0.6
B023.05	J023.05	GreeleyRainfall	0.0505	0.1373	0.2732	0.016	51.6	0.35	0.1	3.2	0.0	0.5
B024.01	J024.01	GreeleyRainfall	0.0582	0.1099	0.4174	0.006	43.3	0.35	0.1	4.7	0.0	0.9
B024.02	J024.02	GreeleyRainfall	0.0167	0.0546	0.1857	0.003	59.3	0.35	0.1	5.0	0.0	1.0
B024.03	J024.03	GreeleyRainfall	0.0138	0.0573	0.1859	0.003	54.1	0.35	0.1	5.0	0.0	1.0
B024.04	J024.04	GreeleyRainfall	0.0343	0.0854	0.2974	0.003	54.5	0.35	0.1	4.6	0.0	0.7
B025.01	J025.01	GreeleyRainfall	0.0230	0.1026	0.2941	0.008	51.0	0.35	0.1	5.0	0.0	1.0
B025.02	J025.02	GreeleyRainfall	0.0140	0.1065	0.1976	0.004	50.6	0.35	0.1	5.0	0.0	1.0
B025.03	J025.03	GreeleyRainfall	0.0139	0.1535	0.2563	0.003	77.1	0.35	0.1	5.0	0.0	1.0
B025.04	J025.04	GreeleyRainfall	0.0056	0.0179	0.1045	0.007	50.3	0.35	0.1	5.0	0.0	1.0
B026.01	J026.01	GreeleyRainfall	0.0059	0.0253	0.0824	0.008	87.9	0.35	0.1	5.0	0.0	1.0
B026.02	J026.02	GreeleyRainfall	0.0157	0.0219	0.1599	0.005	62.1	0.35	0.1	5.0	0.0	1.0
B026.03	J026.03	GreeleyRainfall	0.0490	0.1837	0.4048	0.003	49.9	0.35	0.1	5.0	0.0	1.0
B026.04	J026.04	GreeleyRainfall	0.0500	0.2172	0.4712	0.004	46.5	0.35	0.1	4.6	0.0	0.8
B026.05	J026.05	GreeleyRainfall	0.0085	0.0373	0.1056	0.014	44.3	0.35	0.1	4.8	0.0	0.8

CUHP Input Parameters

								Depression Losses (in)		Horton's Infiltration Parameters		
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (mi^2)	Length to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)
B027.01	J027.01	GreeleyRainfall	0.0127	0.0248	0.1589	0.004	45.3	0.35	0.1	5.0	0.0	1.0
B027.02	J027.02	GreeleyRainfall	0.0124	0.0436	0.1139	0.004	44.3	0.35	0.1	5.0	0.0	1.0
B027.03	J027.03	GreeleyRainfall	0.0261	0.1094	0.2822	0.007	51.7	0.35	0.1	5.0	0.0	1.0
B027.04	J027.04	GreeleyRainfall	0.0048	0.0526	0.1154	0.001	60.2	0.35	0.1	5.0	0.0	1.0
B027.05	J027.05	GreeleyRainfall	0.0038	0.0324	0.0787	0.003	55.8	0.35	0.1	5.0	0.0	1.0
B027.06	J027.06	GreeleyRainfall	0.0077	0.1958	0.3615	0.005	51.8	0.35	0.1	5.0	0.0	1.0
B027.07	J027.07	GreeleyRainfall	0.0130	0.0786	0.1577	0.003	51.2	0.35	0.1	5.0	0.0	1.0
B027.08	J027.08	GreeleyRainfall	0.0326	0.1651	0.4220	0.010	58.3	0.35	0.1	5.0	0.0	1.0
B027.09	J027.09	GreeleyRainfall	0.0206	0.0931	0.2306	0.004	54.3	0.35	0.1	5.0	0.0	1.0
B027.10	J027.10	GreeleyRainfall	0.0133	0.0779	0.1845	0.007	62.9	0.35	0.1	5.0	0.0	1.0
B027.11	J027.11	GreeleyRainfall	0.0259	0.1120	0.2596	0.015	68.0	0.35	0.1	5.0	0.0	1.0
B027.12	J027.12	GreeleyRainfall	0.0063	0.0563	0.0974	0.008	56.6	0.35	0.1	5.0	0.0	1.0
B027.13	J027.13	GreeleyRainfall	0.0198	0.0607	0.1914	0.002	44.2	0.35	0.1	5.0	0.0	1.0
B027.14	J027.14	GreeleyRainfall	0.0097	0.0567	0.1049	0.003	45.1	0.35	0.1	5.0	0.0	1.0
B027.15	J027.15	GreeleyRainfall	0.0099	0.0792	0.1885	0.004	49.0	0.35	0.1	5.0	0.0	1.0
B027.16	J027.16	GreeleyRainfall	0.0087	0.0593	0.1223	0.023	43.0	0.35	0.1	5.0	0.0	1.0
B029.01	J029.01	GreeleyRainfall	0.0481	0.2099	0.3438	0.012	48.6	0.35	0.1	5.0	0.0	1.0
B029.02	J029.02	GreeleyRainfall	0.0095	0.0473	0.1058	0.019	47.6	0.35	0.1	5.0	0.0	1.0
B030.01	J030.01	GreeleyRainfall	0.0087	0.0293	0.1154	0.008	79.5	0.35	0.1	5.0	0.0	1.0
B030.02	J030.02	GreeleyRainfall	0.0626	0.1235	0.3461	0.002	58.8	0.35	0.1	5.0	0.0	1.0
B030.03	J030.03	GreeleyRainfall	0.0131	0.0593	0.1851	0.002	59.1	0.35	0.1	5.0	0.0	1.0
B030.04	J030.04	GreeleyRainfall	0.0108	0.0494	0.1545	0.002	70.5	0.35	0.1	5.0	0.0	1.0
B030.05	J030.05	GreeleyRainfall	0.0209	0.1280	0.1846	0.003	68.5	0.35	0.1	5.0	0.0	1.0
B030.06	J030.06	GreeleyRainfall	0.0072	0.0312	0.0936	0.003	84.8	0.35	0.1	5.0	0.0	1.0
B030.07	J030.07	GreeleyRainfall	0.0040	0.0457	0.1280	0.001	86.3	0.35	0.1	5.0	0.0	1.0
B030.08	J030.08	GreeleyRainfall	0.0055	0.0487	0.1639	0.002	81.8	0.35	0.1	5.0	0.0	1.0
B030.09	J030.09	GreeleyRainfall	0.0027	0.0299	0.0751	0.002	88.6	0.35	0.1	5.0	0.0	1.0
B030.10	J030.10	GreeleyRainfall	0.0034	0.0349	0.0836	0.005	84.0	0.35	0.1	5.0	0.0	1.0
B030.11	J030.11	GreeleyRainfall	0.0067	0.0438	0.1524	0.001	83.6	0.35	0.1	5.0	0.0	1.0
B030.12	J030.12	GreeleyRainfall	0.0090	0.0418	0.1672	0.005	73.9	0.35	0.1	5.0	0.0	1.0
B030.13	J030.13	GreeleyRainfall	0.0070	0.0774	0.1106	0.005	58.2	0.35	0.1	5.0	0.0	1.0
B030.14	J030.14	GreeleyRainfall	0.0091	0.0657	0.1294	0.008	52.3	0.35	0.1	5.0	0.0	1.0
B030.15	J030.15	GreeleyRainfall	0.0090	0.0889	0.1567	0.015	51.7	0.35	0.1	5.0	0.0	1.0
B030.16	J030.16	GreeleyRainfall	0.0060	0.0594	0.0972	0.004	51.6	0.35	0.1	5.0	0.0	1.0
B030.17	J030.17	GreeleyRainfall	0.0080	0.0510	0.1670	0.007	52.8	0.35	0.1	5.0	0.0	1.0
B030.18	J030.18	GreeleyRainfall	0.0090	0.0906	0.1584	0.010	48.9	0.35	0.1	5.0	0.0	1.0
B030.19	J030.19	GreeleyRainfall	0.0092	0.0893	0.1248	0.012	53.2	0.35	0.1	5.0	0.0	1.0
B031.01	J031.01	GreeleyRainfall	0.0089	0.0680	0.1544	0.006	89.3	0.35	0.1	5.0	0.0	1.0
B031.02	J031.02	GreeleyRainfall	0.0090	0.0626	0.1315	0.013	54.3	0.35	0.1	5.0	0.0	1.0
B031.03	J031.03	GreeleyRainfall	0.0090	0.0614	0.1277	0.019	51.5	0.35	0.1	5.0	0.0	1.0
B031.04	J031.04	GreeleyRainfall	0.0114	0.0688	0.1420	0.016	54.1	0.35	0.1	5.0	0.0	1.0
B031.05	J031.05	GreeleyRainfall	0.0090	0.0709	0.1459	0.018	53.3	0.35	0.1	5.0	0.0	1.0
B031.06	J031.06	GreeleyRainfall	0.0034	0.0314	0.0860	0.023	55.2	0.35	0.1	5.0	0.0	1.0

CUHP Input Parameters

								Depression Losses (in)		Horton's Infiltration Parameters		
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (mi^2)	Length to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)
B032.01	J032.01	GreeleyRainfall	0.0092	0.0763	0.1572	0.004	73.8	0.35	0.1	5.0	0.0	1.0
B032.02	J032.02	GreeleyRainfall	0.0089	0.0599	0.1451	0.014	69.5	0.35	0.1	5.0	0.0	1.0
B032.03	J032.03	GreeleyRainfall	0.0092	0.0823	0.1481	0.011	62.0	0.35	0.1	5.0	0.0	1.0
B032.04	J032.04	GreeleyRainfall	0.0150	0.0822	0.1753	0.016	58.2	0.35	0.1	5.0	0.0	1.0
B032.05	J032.05	GreeleyRainfall	0.0090	0.0587	0.1312	0.017	68.8	0.35	0.1	5.0	0.0	1.0
B032.06	J032.06	GreeleyRainfall	0.0090	0.0644	0.1394	0.019	61.2	0.35	0.1	5.0	0.0	1.0
B032.07	J032.07	GreeleyRainfall	0.0090	0.0717	0.1537	0.009	71.6	0.35	0.1	5.0	0.0	1.0
B032.08	J032.08	GreeleyRainfall	0.0092	0.0743	0.1470	0.014	78.7	0.35	0.1	5.0	0.0	1.0
B032.09	J032.09	GreeleyRainfall	0.0151	0.0798	0.1742	0.017	78.6	0.35	0.1	5.0	0.0	1.0
B032.10	J032.10	GreeleyRainfall	0.0055	0.0544	0.0763	0.024	49.2	0.35	0.1	5.0	0.0	1.0
B033.01	J033.01	GreeleyRainfall	0.0296	0.1413	0.2687	0.012	53.2	0.35	0.1	5.0	0.0	1.0
B033.02	J033.02	GreeleyRainfall	0.0120	0.0843	0.1526	0.029	44.3	0.35	0.1	5.0	0.0	1.0
B033.03	J033.03	GreeleyRainfall	0.0085	0.0695	0.1102	0.022	54.4	0.35	0.1	5.0	0.0	1.0
B034.01	J034.01	GreeleyRainfall	0.0181	0.1332	0.4155	0.006	35.5	0.35	0.1	5.0	0.0	1.0
B035.01	J035.01	GreeleyRainfall	0.0240	0.0701	0.1580	0.007	44.0	0.35	0.1	4.8	0.0	0.9
B035.02	J035.02	GreeleyRainfall	0.0395	0.1663	0.3158	0.013	57.4	0.35	0.1	4.9	0.0	0.9
B035.03	J035.03	GreeleyRainfall	0.0946	0.2354	0.6002	0.008	58.8	0.35	0.1	4.9	0.0	0.9
B035.04	J035.04	GreeleyRainfall	0.0813	0.2423	0.5539	0.006	64.0	0.35	0.1	4.9	0.0	0.9
B035.05	J035.05	GreeleyRainfall	0.0106	0.0634	0.2214	0.003	69.8	0.35	0.1	4.7	0.0	0.8
B036.01	J036.01	GreeleyRainfall	0.0050	0.0685	0.1318	0.003	30.2	0.35	0.1	3.1	0.0	0.5
B036.02	J036.02	GreeleyRainfall	0.0061	0.0515	0.1540	0.007	55.5	0.35	0.1	4.5	0.0	0.7
B036.03	J036.03	GreeleyRainfall	0.0087	0.0590	0.1195	0.015	52.3	0.35	0.1	4.9	0.0	0.9
B036.04	J036.04	GreeleyRainfall	0.0054	0.0429	0.0853	0.008	58.4	0.35	0.1	5.0	0.0	1.0
B036.05	J036.05	GreeleyRainfall	0.0088	0.0708	0.1317	0.003	51.6	0.35	0.1	5.0	0.0	1.0
B036.06	J036.06	GreeleyRainfall	0.0052	0.0685	0.1105	0.006	53.9	0.35	0.1	5.0	0.0	1.0
B036.07	J036.07	GreeleyRainfall	0.0070	0.0443	0.0942	0.007	53.2	0.35	0.1	5.0	0.0	1.0
B036.08	J036.08	GreeleyRainfall	0.0123	0.1091	0.2378	0.011	44.7	0.35	0.1	3.9	0.0	0.6
B036.09	J036.09	GreeleyRainfall	0.0102	0.0461	0.1128	0.013	48.6	0.35	0.1	4.5	0.0	0.6
B036.10	J036.10	GreeleyRainfall	0.0059	0.0351	0.0859	0.011	45.3	0.35	0.1	4.5	0.0	0.6
B036.11	J036.11	GreeleyRainfall	0.0059	0.0171	0.0887	0.003	65.0	0.35	0.1	4.5	0.0	0.6
B036.12	J036.12	GreeleyRainfall	0.0141	0.0363	0.1591	0.005	51.4	0.35	0.1	4.5	0.0	0.6
B036.13	J036.13	GreeleyRainfall	0.0108	0.1085	0.2102	0.003	64.0	0.35	0.1	4.8	0.0	0.8
B036.14	J036.14	GreeleyRainfall	0.0048	0.0583	0.1504	0.001	68.1	0.35	0.1	4.7	0.0	0.8
B036.15	J036.15	GreeleyRainfall	0.0011	0.0272	0.0670	0.003	67.2	0.35	0.1	4.9	0.0	0.9
B036.16	J036.16	GreeleyRainfall	0.0016	0.0294	0.0654	0.002	61.6	0.35	0.1	4.9	0.0	0.9
B036.17	J036.17	GreeleyRainfall	0.0032	0.0318	0.1032	0.004	73.1	0.35	0.1	5.0	0.0	1.0
B036.18	J036.18	GreeleyRainfall	0.0048	0.0334	0.0823	0.007	44.9	0.35	0.1	5.0	0.0	1.0
B036.19	J036.19	GreeleyRainfall	0.0037	0.0437	0.1131	0.005	28.5	0.35	0.1	4.5	0.0	0.6
B036.20	J036.20	GreeleyRainfall	0.0058	0.0362	0.0800	0.008	49.8	0.35	0.1	4.5	0.0	0.6
B036.21	J036.21	GreeleyRainfall	0.0067	0.0665	0.1037	0.005	54.5	0.35	0.1	4.5	0.0	0.6
B036.22	J036.22	GreeleyRainfall	0.0099	0.0582	0.1216	0.006	48.9	0.35	0.1	4.5	0.0	0.6
B036.23	J036.23	GreeleyRainfall	0.0213	0.0664	0.1473	0.007	58.7	0.35	0.1	4.5	0.0	0.6
B036.24	J036.24	GreeleyRainfall	0.0073	0.0488	0.0915	0.004	56.7	0.35	0.1	4.5	0.0	0.6

CUHP Input Parameters

								Depression Losses (in)		Horton's Infiltration Parameters		
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (mi^2)	Length to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)
B036.25	J036.25	GreeleyRainfall	0.0329	0.0409	0.1940	0.004	48.9	0.35	0.1	4.8	0.0	0.8
B036.26	J036.26	GreeleyRainfall	0.0295	0.0665	0.1791	0.004	70.5	0.35	0.1	5.0	0.0	1.0
B036.27	J036.27	GreeleyRainfall	0.0089	0.0742	0.1145	0.008	62.8	0.35	0.1	5.0	0.0	1.0
B036.28	J036.28	GreeleyRainfall	0.0092	0.0807	0.1628	0.004	52.6	0.35	0.1	5.0	0.0	1.0
B036.29	J036.29	GreeleyRainfall	0.0123	0.0763	0.1613	0.015	49.2	0.35	0.1	5.0	0.0	1.0
B036.30	J036.30	GreeleyRainfall	0.0090	0.0619	0.1272	0.004	82.6	0.35	0.1	5.0	0.0	1.0
B036.31	J036.31	GreeleyRainfall	0.0091	0.0726	0.1465	0.009	76.2	0.35	0.1	5.0	0.0	1.0
B036.32	J036.32	GreeleyRainfall	0.0124	0.1025	0.1988	0.013	76.7	0.35	0.1	5.0	0.0	1.0
B036.33	J036.33	GreeleyRainfall	0.0212	0.1797	0.2343	0.002	60.3	0.35	0.1	5.0	0.0	1.0
B036.34	J036.34	GreeleyRainfall	0.0206	0.0893	0.1721	0.004	49.5	0.35	0.1	5.0	0.0	1.0
B036.35	J036.35	GreeleyRainfall	0.0038	0.0809	0.1766	0.015	20.0	0.35	0.1	3.1	0.0	0.5
B036.36	J036.36	GreeleyRainfall	0.0034	0.0695	0.1185	0.010	63.6	0.35	0.1	4.5	0.0	0.6
B036.37	J036.37	GreeleyRainfall	0.0086	0.0580	0.1239	0.007	53.4	0.35	0.1	4.5	0.0	0.6
B037.01	J037.01	GreeleyRainfall	0.0180	0.0885	0.2660	0.005	52.4	0.35	0.1	3.5	0.0	0.6
B037.02	J037.02	GreeleyRainfall	0.0067	0.0157	0.1073	0.013	72.6	0.35	0.1	3.0	0.0	0.5
B037.03	J037.03	GreeleyRainfall	0.0051	0.0391	0.1287	0.004	59.4	0.35	0.1	4.3	0.0	0.8
B037.04	J037.04	GreeleyRainfall	0.0147	0.0843	0.2021	0.009	63.4	0.35	0.1	5.0	0.0	1.0
B037.05	J037.05	GreeleyRainfall	0.0149	0.0787	0.2308	0.005	70.8	0.35	0.1	5.0	0.0	1.0
B037.06	J037.06	GreeleyRainfall	0.0046	0.0494	0.0977	0.003	56.6	0.35	0.1	5.0	0.0	1.0
B037.07	J037.07	GreeleyRainfall	0.0030	0.0321	0.0632	0.016	45.6	0.35	0.1	5.0	0.0	1.0
B037.08	J037.08	GreeleyRainfall	0.0060	0.0205	0.0981	0.009	54.4	0.35	0.1	3.0	0.0	0.5
B037.09	J037.09	GreeleyRainfall	0.0257	0.0808	0.2745	0.009	59.3	0.35	0.1	4.3	0.0	0.8
B037.10	J037.10	GreeleyRainfall	0.0138	0.1055	0.2521	0.008	61.3	0.35	0.1	4.8	0.0	0.9
B037.11	J037.11	GreeleyRainfall	0.0076	0.0661	0.1277	0.006	77.1	0.35	0.1	5.0	0.0	1.0
B037.12	J037.12	GreeleyRainfall	0.0127	0.1019	0.2446	0.007	59.9	0.35	0.1	4.5	0.0	0.9
B038.01	J038.01	GreeleyRainfall	0.0095	0.0364	0.1266	0.006	74.0	0.35	0.1	5.0	0.0	1.0
B038.02	J038.02	GreeleyRainfall	0.0086	0.0524	0.1600	0.003	73.0	0.35	0.1	5.0	0.0	1.0
B038.03	J038.03	GreeleyRainfall	0.0085	0.1034	0.1912	0.002	65.5	0.35	0.1	5.0	0.0	1.0
B038.04	J038.04	GreeleyRainfall	0.0076	0.0316	0.1043	0.006	63.8	0.35	0.1	5.0	0.0	1.0
B038.05	J038.05	GreeleyRainfall	0.0090	0.0749	0.1217	0.004	93.7	0.35	0.1	5.0	0.0	1.0
B038.06	J038.06	GreeleyRainfall	0.0090	0.0414	0.1616	0.003	87.4	0.35	0.1	5.0	0.0	1.0
B038.07	J038.07	GreeleyRainfall	0.0085	0.0572	0.1259	0.006	74.1	0.35	0.1	5.0	0.0	1.0
B038.08	J038.08	GreeleyRainfall	0.0193	0.0764	0.2152	0.005	87.4	0.35	0.1	5.0	0.0	1.0
B038.09	J038.09	GreeleyRainfall	0.0090	0.0414	0.1284	0.006	85.1	0.35	0.1	5.0	0.0	1.0
B038.10	J038.10	GreeleyRainfall	0.0062	0.0825	0.1740	0.003	62.5	0.35	0.1	5.0	0.0	1.0
B038.11	J038.11	GreeleyRainfall	0.0083	0.0530	0.1246	0.004	85.9	0.35	0.1	5.0	0.0	1.0
B038.12	J038.12	GreeleyRainfall	0.0077	0.0403	0.1148	0.007	88.6	0.35	0.1	5.0	0.0	1.0
B038.13	J038.13	GreeleyRainfall	0.0059	0.0425	0.0891	0.007	91.5	0.35	0.1	5.0	0.0	1.0
B038.14	J038.14	GreeleyRainfall	0.0089	0.0665	0.1145	0.004	89.3	0.35	0.1	5.0	0.0	1.0
B038.15	J038.15	GreeleyRainfall	0.0091	0.0673	0.1324	0.004	79.6	0.35	0.1	5.0	0.0	1.0
B038.16	J038.16	GreeleyRainfall	0.0090	0.0819	0.1580	0.003	81.5	0.35	0.1	5.0	0.0	1.0
B038.17	J038.17	GreeleyRainfall	0.0123	0.0477	0.1449	0.009	36.6	0.35	0.1	5.0	0.0	1.0
B038.18	J038.18	GreeleyRainfall	0.0023	0.0252	0.0713	0.006	72.8	0.35	0.1	5.0	0.0	1.0

CUHP Input Parameters

								Depression Losses (in)		Horton's Infiltration Parameters		
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (mi^2)	Length to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)
B038.19	J038.19	GreeleyRainfall	0.0039	0.0391	0.0937	0.007	64.7	0.35	0.1	5.0	0.0	1.0
B038.20	J038.20	GreeleyRainfall	0.0050	0.0479	0.1139	0.002	93.9	0.35	0.1	5.0	0.0	1.0
B038.21	J038.21	GreeleyRainfall	0.0118	0.0426	0.1605	0.005	71.8	0.35	0.1	5.0	0.0	1.0
B038.22	J038.22	GreeleyRainfall	0.0054	0.0517	0.1054	0.004	54.4	0.35	0.1	5.0	0.0	1.0
B039.01	J039.01	GreeleyRainfall	0.0105	0.0780	0.1610	0.010	59.7	0.35	0.1	3.1	0.0	0.5
B039.02	J039.02	GreeleyRainfall	0.0213	0.0618	0.1483	0.007	54.9	0.35	0.1	4.9	0.0	1.0
B039.03	J039.03	GreeleyRainfall	0.0579	0.2581	0.4359	0.004	58.2	0.35	0.1	4.9	0.0	1.0
B039.04	J039.04	GreeleyRainfall	0.0146	0.0691	0.1976	0.008	74.9	0.35	0.1	3.0	0.0	0.5
B039.05	J039.05	GreeleyRainfall	0.0189	0.1161	0.2059	0.008	54.8	0.35	0.1	4.9	0.0	1.0
B039.06	J039.06	GreeleyRainfall	0.0030	0.0445	0.1012	0.013	59.7	0.35	0.1	3.0	0.0	0.5
B039.07	J039.07	GreeleyRainfall	0.0241	0.1109	0.2848	0.005	61.7	0.35	0.1	4.7	0.0	0.9
B039.08	J039.08	GreeleyRainfall	0.0098	0.0545	0.1166	0.016	50.8	0.35	0.1	4.7	0.0	0.9
B039.09	J039.09	GreeleyRainfall	0.0090	0.0673	0.1317	0.004	53.4	0.35	0.1	5.0	0.0	1.0
B040.01	J040.01	GreeleyRainfall	0.0277	0.1138	0.2587	0.004	15.1	0.35	0.1	3.1	0.0	0.5
B040.02	J040.02	GreeleyRainfall	0.0155	0.1120	0.1726	0.005	28.1	0.35	0.1	4.9	0.0	1.0
B040.03	J040.03	GreeleyRainfall	0.0158	0.0389	0.1972	0.010	40.8	0.35	0.1	3.5	0.0	0.6
B040.04	J040.04	GreeleyRainfall	0.0360	0.2251	0.4174	0.003	31.0	0.35	0.1	3.2	0.0	0.6
B040.05	J040.05	GreeleyRainfall	0.0085	0.0852	0.1746	0.009	54.5	0.35	0.1	3.0	0.0	0.5
B040.06	J040.06	GreeleyRainfall	0.0080	0.0452	0.1319	0.015	8.7	0.35	0.1	3.1	0.0	0.5
B040.07	J040.07	GreeleyRainfall	0.0705	0.1426	0.2941	0.010	53.0	0.35	0.1	3.4	0.0	0.6
B040.08	J040.08	GreeleyRainfall	0.0108	0.0389	0.1189	0.014	59.7	0.35	0.1	5.0	0.0	1.0
B040.09	J040.09	GreeleyRainfall	0.0338	0.1475	0.3502	0.006	66.1	0.35	0.1	4.6	0.0	0.9
B041.01	J041.01	GreeleyRainfall	0.0518	0.1378	0.3122	0.004	49.0	0.35	0.1	3.1	0.0	0.5
B041.02	J041.02	GreeleyRainfall	0.0230	0.1117	0.1801	0.005	55.9	0.35	0.1	4.9	0.0	1.0
B041.03	J041.03	GreeleyRainfall	0.0034	0.0246	0.0726	0.010	54.4	0.35	0.1	5.0	0.0	1.0
B041.04	J041.04	GreeleyRainfall	0.0081	0.0420	0.1202	0.003	46.9	0.35	0.1	4.7	0.0	0.9
B041.05	J041.05	GreeleyRainfall	0.0160	0.0938	0.1578	0.004	62.3	0.35	0.1	3.2	0.0	0.5
B041.06	J041.06	GreeleyRainfall	0.0525	0.0802	0.2318	0.006	58.2	0.35	0.1	3.4	0.0	0.6
B041.07	J041.07	GreeleyRainfall	0.0064	0.0714	0.1765	0.011	46.9	0.35	0.1	3.2	0.0	0.6
B042.01	J042.01	GreeleyRainfall	0.0630	0.1833	0.3427	0.003	50.5	0.35	0.1	3.0	0.0	0.5
B042.02	J042.02	GreeleyRainfall	0.0317	0.1190	0.3873	0.005	61.2	0.35	0.1	4.2	0.0	0.8
B042.03	J042.03	GreeleyRainfall	0.0136	0.0485	0.1309	0.005	40.1	0.35	0.1	3.0	0.0	0.5
B042.04	J042.04	GreeleyRainfall	0.0120	0.0378	0.1257	0.004	50.5	0.35	0.1	3.0	0.0	0.5
B042.05	J042.05	GreeleyRainfall	0.0255	0.1490	0.2941	0.003	29.8	0.35	0.1	3.0	0.0	0.5
B042.06	J042.06	GreeleyRainfall	0.0392	0.0831	0.2676	0.004	52.0	0.35	0.1	3.1	0.0	0.5
B042.07	J042.07	GreeleyRainfall	0.0141	0.0167	0.1374	0.007	65.2	0.35	0.1	3.4	0.0	0.6
B043.01	J043.01	GreeleyRainfall	0.1091	0.0574	0.3438	0.002	43.0	0.35	0.1	1.9	0.0	0.4
B043.02	J043.02	GreeleyRainfall	0.0348	0.2661	0.4850	0.005	41.2	0.35	0.1	4.5	0.0	0.9
B044.01	J044.01	GreeleyRainfall	0.0277	0.0317	0.2301	0.004	54.2	0.35	0.1	0.4	0.0	0.1
B044.02	J044.02	GreeleyRainfall	0.1085	0.0865	0.3367	0.002	56.1	0.35	0.1	1.5	0.0	0.2
B044.03	J044.03	GreeleyRainfall	0.0344	0.1106	0.2509	0.011	23.5	0.35	0.1	4.0	0.0	0.7

Node Peak Flows (cfs)

Node	Node Type	2yr	5yr	10yr	50yr	100yr
GLENMERE	STORAGE	68	87	111	254	352
GreeleyLovelandCanal	JUNCTION	13	13	13	13	13
J001.1	JUNCTION	9	12	16	33	44
J001.2	JUNCTION	12	17	22	52	72
J001.3	JUNCTION	2	3	4	11	17
J002.1	JUNCTION	25	29	34	62	80
J002.10	JUNCTION	65	83	106	239	329
J002.11	JUNCTION	1	1	2	4	6
J002.2	DIVIDER	21	27	36	85	116
J002.3	JUNCTION	49	62	77	165	223
J002.4	JUNCTION	4	5	7	17	23
J002.5	JUNCTION	54	68	85	184	249
J002.6	JUNCTION	60	76	96	212	290
J002.7	JUNCTION	1	2	2	7	11
J002.8	JUNCTION	62	79	101	226	311
J002.9	JUNCTION	2	3	4	10	15
J003.1	JUNCTION	2	4	5	14	21
J003.2	JUNCTION	2	3	3	8	10
J003.3	JUNCTION	10	13	18	47	67
J003.4	JUNCTION	14	19	26	69	98
J003.6	DIVIDER	20	27	36	92	127
J003.7	JUNCTION	9	12	17	43	57
J003.8	JUNCTION	1	1	1	3	4
J004.1	JUNCTION	4	6	8	21	30
J004.2	JUNCTION	11	16	22	58	78
J004.3	JUNCTION	1	1	2	5	6
J004.4	JUNCTION	13	18	24	65	88
J004.5	JUNCTION	30	42	57	146	197
J004.6	DIVIDER	40	56	77	198	268
J004.7	DIVIDER	36	43	47	69	80
J004.8	JUNCTION	4	6	8	22	29
J005.1	DIVIDER	3	3	5	11	16
J005.2	JUNCTION	31	38	46	79	96
J005.3	DIVIDER	66	77	92	168	217
J006.1	JUNCTION	13	17	23	58	83
J006.2	DIVIDER	19	25	34	86	122
J006.3	JUNCTION	4	6	7	18	25
J006.4	JUNCTION	2	3	4	10	13
J006.5	DIVIDER	21	22	22	28	32
J007.1	JUNCTION	2	3	3	8	11
J007.2	DIVIDER	3	4	6	13	19
J007.3	JUNCTION	2	3	4	8	11
J007.4	JUNCTION	2	3	3	8	11
J007.5	JUNCTION	2	2	3	7	10
J007.6	JUNCTION	2	3	4	9	12
J007.7	JUNCTION	2	3	3	8	11
J007.8	JUNCTION	2	3	3	8	11
J007.9	JUNCTION	1	1	1	7	13
J008.1	JUNCTION	7	9	12	26	34
J008.2	DIVIDER	10	13	16	36	49
J009.1	DIVIDER	19	21	22	32	38
J009.2	DIVIDER	34	38	42	57	66
J010.1	DIVIDER	8	12	18	52	73
J010.2	DIVIDER	5	6	8	18	24
J010.3	JUNCTION	2	3	5	14	21
J010.4	JUNCTION	3	4	5	12	16
J010.5	JUNCTION	1	1	1	2	3
J010.6	JUNCTION	2	3	5	14	20
J011.1	JUNCTION	3	4	6	13	26
J011.2	JUNCTION	7	9	12	24	32
J011.3	JUNCTION	11	15	18	35	53
J011.4	JUNCTION	3	4	6	16	23
J012.1	DIVIDER	33	39	47	86	101
J012.2	JUNCTION	4	5	7	13	16
J013.1	JUNCTION	6	8	10	30	43
J013.2	JUNCTION	3	3	5	11	16
J013.3	DIVIDER	30	33	35	60	77
J013.4	JUNCTION	10	13	17	47	66
J014.1	JUNCTION	4	5	7	14	19
J014.2	JUNCTION	1	2	2	5	7
J014.3	JUNCTION	3	4	5	11	15
J015.1	DIVIDER	75	80	81	87	88
J015.2	DIVIDER	75	77	78	84	85
J015.3	JUNCTION	2	2	3	7	10
J015.4	JUNCTION	2	2	3	7	10
J015.5	JUNCTION	5	6	8	16	22
J015.6	JUNCTION	1	2	2	6	8
J015.7	JUNCTION	5	6	8	19	26
J016.1	DIVIDER	7	19	36	125	186
J016.2	JUNCTION	4	13	31	128	192
J016.3	JUNCTION	4	5	7	16	23
J016.4	JUNCTION	1	1	1	3	4
J017.1	JUNCTION	15	20	26	51	64
J017.10	JUNCTION	0	0	1	1	2
J017.11	JUNCTION	2	2	3	9	13
J017.12	JUNCTION	1	2	2	6	8
J017.2	JUNCTION	1	2	3	9	12
J017.3	JUNCTION	5	6	9	21	27
J017.4	JUNCTION	9	13	19	42	54
J017.5	JUNCTION	33	56	89	275	381
J017.6	JUNCTION	4	6	8	22	29
J017.7	JUNCTION	2	3	4	9	13
J017.8	JUNCTION	3	4	6	17	23
J017.9	JUNCTION	8	12	15	26	33
J018.1	JUNCTION	9	14	20	48	63
J018.2	JUNCTION	8	11	16	34	44
J019.1	DIVIDER	21	30	41	101	141
J020.1	JUNCTION	16	23	33	79	102
J020.2	JUNCTION	2	3	4	12	16
J020.3	JUNCTION	1	2	3	7	10
J020.4	JUNCTION	25	36	51	119	154
J020.5	JUNCTION	1	1	1	3	3
J020.6	DIVIDER	25	36	49	127	175
J020.7	JUNCTION	0	0	0	2	2
J021.1	JUNCTION	5	7	10	25	33
J021.2	JUNCTION	2	3	4	11	16
J021.3	JUNCTION	6	9	11	21	26
J021.4	JUNCTION	4	6	8	17	22
J021.5	JUNCTION	3	4	6	13	17
J022.1	JUNCTION	3	4	6	22	32
J022.2	JUNCTION	4	5	8	19	24
J022.3	JUNCTION	3	5	7	15	19
J022.4	JUNCTION	2	3	4	14	20
J023.01	JUNCTION	10	15	24	68	92
J023.02	JUNCTION	1	2	3	8	12
J023.03	JUNCTION	9	13	20	50	66
J023.04	JUNCTION	23	35	52	127	167
J023.05	JUNCTION	17	26	38	81	104
J024.01	JUNCTION	17	26	38	108	151
J024.02	DIVIDER	14	16	18	28	35
J024.03	DIVIDER	8	13	19	51	68
J024.04	DIVIDER	9	13	18	42	54
J025.01	JUNCTION	5	7	9	20	28
J025.02	DIVIDER	5	10	17	55	76
J025.03	JUNCTION	4	5	7	13	17
J025.04	JUNCTION	21	43	73	232	322
J026.01	JUNCTION	5	6	8	14	17
J026.02	JUNCTION	8	10	13	27	36
J026.03	DIVIDER	59	74	89	195	303
J026.04	JUNCTION	7	10	14	37	51
J026.05	DIVIDER	2	3	4	21	37
J027.01	DIVIDER	31	34	36	52	78
J027.02	DIVIDER	17	23	31	78	132
J027.03	JUNCTION	7	10	13	42	78
J027.04	DIVIDER	30	31	31	47	69
J027.05	DIVIDER	3	4	5	12	17
J027.06	JUNCTION	2	3	4	9	13
J027.07	DIVIDER	28	32	48	210	344

Node Peak Flows (cfs)

Node	Node Type	2yr	5yr	10yr	50yr	100yr
J027.08	DIVIDER	8	11	14	30	40
J027.09	DIVIDER	37	64	98	374	589
J027.10	JUNCTION	14	20	29	201	327
J027.11	JUNCTION	11	16	24	194	316
J027.12	JUNCTION	2	3	3	7	10
J027.13	JUNCTION	13	17	23	64	114
J027.14	JUNCTION	10	14	19	54	98
J027.15	DIVIDER	3	4	6	15	21
J027.16	JUNCTION	2	3	3	9	12
J029.01	DIVIDER	56	83	122	370	526
J029.02	DIVIDER	55	75	98	279	380
J030.01	JUNCTION	6	8	10	18	23
J030.02	JUNCTION	17	22	28	62	83
J030.03	DIVIDER	55	109	183	673	1022
J030.04	JUNCTION	10	15	20	52	92
J030.05	JUNCTION	56	101	164	594	887
J030.06	JUNCTION	5	6	8	14	18
J030.07	JUNCTION	2	2	3	5	6
J030.08	JUNCTION	2	3	4	7	8
J030.09	JUNCTION	1	2	2	4	5
J030.10	JUNCTION	2	3	3	6	7
J030.11	JUNCTION	3	4	5	9	11
J030.12	JUNCTION	4	5	7	13	17
J030.13	JUNCTION	2	2	3	7	9
J030.14	DIVIDER	51	73	106	318	465
J030.15	DIVIDER	2	3	4	15	24
J030.16	JUNCTION	1	2	2	5	7
J030.17	DIVIDER	68	99	145	451	634
J030.18	JUNCTION	33	55	85	275	372
J030.19	JUNCTION	2	3	4	10	13
J031.01	DIVIDER	5	7	10	31	46
J031.02	DIVIDER	37	52	65	120	151
J031.03	JUNCTION	3	4	5	11	15
J031.04	DIVIDER	48	63	83	186	256
J031.05	JUNCTION	3	3	5	10	14
J031.06	DIVIDER	51	62	72	112	134
J032.01	JUNCTION	3	5	6	11	15
J032.02	JUNCTION	4	5	7	14	18
J032.03	JUNCTION	3	4	5	11	15
J032.04	DIVIDER	21	28	49	168	242
J032.05	DIVIDER	27	30	36	67	85
J032.06	JUNCTION	4	5	6	13	17
J032.07	JUNCTION	4	5	6	12	16
J032.08	JUNCTION	5	6	8	15	19
J032.09	DIVIDER	61	76	91	154	187
J032.10	DIVIDER	39	47	54	82	98

Node	Node Type	2yr	5yr	10yr	50yr	100yr
J033.01	JUNCTION	38	49	63	149	221
J033.02	JUNCTION	5	9	16	59	83
J033.03	JUNCTION	25	30	36	64	82
J034.01	JUNCTION	36	45	57	134	196
J035.01	JUNCTION	130	198	275	764	1144
J035.02	JUNCTION	133	202	281	820	1268
J035.03	DIVIDER	39	53	69	159	216
J035.04	JUNCTION	27	35	44	93	122
J035.05	JUNCTION	167	248	343	916	1365
J036.01	JUNCTION	0	1	1	3	4
J036.02	DIVIDER	47	50	56	83	104
J036.03	JUNCTION	5	8	12	36	55
J036.04	JUNCTION	3	5	9	28	43
J036.05	JUNCTION	2	2	3	7	10
J036.06	JUNCTION	1	2	2	5	6
J036.07	DIVIDER	10	17	29	47	53
J036.08	JUNCTION	53	68	98	255	368
J036.09	JUNCTION	3	5	7	17	22
J036.10	JUNCTION	4	6	10	26	34
J036.11	DIVIDER	91	103	137	275	370
J036.12	DIVIDER	84	99	131	248	326
J036.13	DIVIDER	77	94	123	234	305
J036.14	JUNCTION	1	2	2	4	6
J036.15	JUNCTION	7	15	27	50	60
J036.16	JUNCTION	0	1	1	2	2
J036.17	JUNCTION	1	2	2	4	5
J036.18	JUNCTION	1	1	2	5	7
J036.19	DIVIDER	4	6	8	19	25
J036.20	JUNCTION	2	3	4	9	12
J036.21	JUNCTION	2	3	4	8	11
J036.22	DIVIDER	6	8	10	17	21
J036.23	DIVIDER	9	13	18	37	48
J036.24	DIVIDER	6	11	19	52	69
J036.25	DIVIDER	10	15	20	50	67
J036.26	JUNCTION	15	19	25	48	63
J036.27	JUNCTION	3	4	5	11	15
J036.28	JUNCTION	2	2	3	7	10
J036.29	JUNCTION	3	4	5	13	18
J036.30	DIVIDER	32	45	58	128	170
J036.31	JUNCTION	4	6	7	14	17
J036.32	JUNCTION	6	7	9	18	23
J036.33	JUNCTION	4	6	7	16	21
J036.34	DIVIDER	73	77	93	175	231
J036.35	JUNCTION	24	24	25	29	30
J036.36	JUNCTION	1	1	2	4	5
J036.37	DIVIDER	168	249	344	920	1371

Node	Node Type	2yr	5yr	10yr	50yr	100yr
J037.01	JUNCTION	4	6	9	20	26
J037.02	JUNCTION	54	66	83	164	212
J037.03	JUNCTION	1	2	3	6	8
J037.04	JUNCTION	5	7	9	18	24
J037.05	DIVIDER	16	33	49	122	156
J037.06	DIVIDER	2	3	4	10	18
J037.07	DIVIDER	1	1	1	3	5
J037.08	JUNCTION	3	4	6	12	15
J037.09	DIVIDER	26	33	44	99	120
J037.10	JUNCTION	4	5	6	14	18
J037.11	JUNCTION	3	5	6	11	14
J037.12	JUNCTION	3	4	6	13	17
J038.01	JUNCTION	5	7	9	16	21
J038.02	JUNCTION	3	4	6	11	14
J038.03	DIVIDER	2	3	3	7	9
J038.04	DIVIDER	3	5	6	14	19
J038.05	JUNCTION	5	7	9	16	20
J038.06	JUNCTION	5	7	9	15	19
J038.07	JUNCTION	4	5	7	13	16
J038.08	DIVIDER	11	15	21	43	51
J038.09	DIVIDER	6	8	9	17	22
J038.10	DIVIDER	1	2	2	5	7
J038.11	JUNCTION	5	6	8	14	18
J038.12	JUNCTION	5	7	9	15	19
J038.13	JUNCTION	4	6	7	12	15
J038.14	JUNCTION	5	7	9	15	19
J038.15	JUNCTION	4	6	7	14	17
J038.16	JUNCTION	4	5	6	12	15
J038.17	JUNCTION	2	3	4	10	15
J038.18	JUNCTION	1	1	2	4	5
J038.19	JUNCTION	2	2	3	5	7
J038.20	JUNCTION	3	4	5	8	10
J038.21	DIVIDER	20	53	96	390	633
J038.22	JUNCTION	1	2	2	6	12
J039.01	JUNCTION	22	77	177	751	1144
J039.02	JUNCTION	8	42	99	332	464
J039.03	DIVIDER	30	84	183	752	1142
J039.04	JUNCTION	30	88	192	783	1190
J039.05	JUNCTION	5	6	8	19	25
J039.06	JUNCTION	8	12	16	37	49
J039.07	DIVIDER	9	12	15	34	46
J039.08	JUNCTION	3	4	6	13	18
J039.09	JUNCTION	2	3	4	8	11
J040.01	JUNCTION	2	5	8	23	31
J040.02	DIVIDER	40	83	198	858	1337
J040.03	JUNCTION	26	28	32	50	59

Node Peak Flows (cfs)

Node	Node Type	2yr	5yr	10yr	50yr	100yr
J040.02	DIVIDER	95	338	487	1358	1765
J040.04	DIVIDER	80	122	245	972	1474
J040.05	JUNCTION	2	3	5	10	13
J040.06	JUNCTION	0	1	2	7	9
J040.07	JUNCTION	25	35	51	112	144
J040.08	JUNCTION	5	6	8	17	23
J040.09	JUNCTION	20	53	100	409	667
J041.01	DIVIDER	22	30	41	89	115
J041.02	DIVIDER	9	11	14	27	36
J041.03	DIVIDER	19	28	40	89	117
J041.04	JUNCTION	47	94	204	839	1298
J041.05	DIVIDER	60	102	217	874	1350
J041.06	JUNCTION	23	33	46	96	123
J041.07	DIVIDER	1	2	3	7	9
J042.01	JUNCTION	15	23	33	72	92
J042.02	JUNCTION	9	12	16	36	47
J042.03	JUNCTION	3	5	8	18	24
J042.04	JUNCTION	4	6	9	19	25
J042.05	JUNCTION	2	4	6	16	21
J042.06	JUNCTION	12	18	26	56	71
J042.07	JUNCTION	9	12	17	35	43
J043.01	JUNCTION	30	43	66	160	212
J043.02	JUNCTION	6	6	8	19	26
J044.01	JUNCTION	14	22	29	55	69
J044.02	JUNCTION	42	67	92	196	253
J044.03	JUNCTION	3	4	8	26	36
J605.4	DIVIDER	39	43	47	69	80
J624.01	JUNCTION	23	35	52	126	167
J629.01	DIVIDER	69	103	152	506	710
J636.30	DIVIDER	50	66	83	157	197
J643.01	JUNCTION	32	32	32	32	32
J705.3	JUNCTION	31	38	46	79	96
J711.2	JUNCTION	13	19	27	66	82
J720.2	DIVIDER	0	3	14	74	112
J721.1	JUNCTION	0	0	11	89	113
J724.01	JUNCTION	34	34	34	34	34
J725.01	JUNCTION	0	39	95	320	446
J729.01	JUNCTION	16	30	56	230	332
J730.05	JUNCTION	36	67	116	451	686
J731.01	DIVIDER	0	0	3	141	240
J736.08	DIVIDER	55	69	100	253	361
J736.22	JUNCTION	1	1	1	1	1
J736.26	DIVIDER	14	24	41	99	114
J736.28	JUNCTION	79	125	176	531	782
J736.30	DIVIDER	116	158	207	545	792
J736.33	JUNCTION	129	194	268	746	1109

Node	Node Type	2yr	5yr	10yr	50yr	100yr
J737.10	DIVIDER	8	10	11	16	19
J738.05	JUNCTION	19	50	92	381	616
J738.11	DIVIDER	56	87	129	412	640
J738.14	DIVIDER	17	21	27	88	118
J738.15	DIVIDER	65	100	148	426	609
J743.01	JUNCTION	32	32	32	32	32
J804.1	DIVIDER	9	12	17	46	64
J805.3	JUNCTION	31	38	46	79	96
J809.2	JUNCTION	1	5	10	24	34
J817.6	DIVIDER	26	46	80	280	388
J817.9	DIVIDER	13	21	32	90	118
J820.2	DIVIDER	0	0	11	89	113
J820.4	JUNCTION	25	36	52	122	158
J821.1	JUNCTION	25	36	49	70	70
J824.01	JUNCTION	14	15	18	26	26
J825.01	DIVIDER	91	136	192	417	543
J826.02	DIVIDER	0	0	0	100	210
J826.03	DIVIDER	24	33	44	112	181
J827.11	JUNCTION	0	0	0	147	254
J829.01	JUNCTION	13	25	41	101	131
J830.05	DIVIDER	40	74	110	332	472
J830.15	DIVIDER	0	0	3	21	35
J830.18	JUNCTION	2	2	2	2	2
J831.01	DIVIDER	18	23	44	182	281
J831.02	DIVIDER	35	50	63	124	165
J832.06	DIVIDER	4	5	6	13	17
J832.07	DIVIDER	101	130	160	299	417
J834.01	JUNCTION	36	45	56	117	144
J836.05	JUNCTION	6	7	7	11	14
J836.08	JUNCTION	4	4	4	4	4
J836.11	DIVIDER	91	103	137	275	370
J836.22	JUNCTION	1	1	1	1	1
J836.26	DIVIDER	64	109	164	543	801
J836.28	DIVIDER	26	33	40	77	100
J836.30	JUNCTION	5	5	5	5	5
J836.33	DIVIDER	123	165	214	551	798
J837.04	DIVIDER	102	108	109	111	116
J837.06	DIVIDER	2	3	4	10	18
J837.10	JUNCTION	77	90	111	201	244
J838.05	DIVIDER	1	2	4	12	17
J838.07	DIVIDER	99	113	116	121	124
J838.08	JUNCTION	10	25	40	103	131
J838.11	JUNCTION	44	43	43	43	43
J838.12	JUNCTION	1	1	2	4	5
J838.14	DIVIDER	40	45	47	56	61
J838.15	DIVIDER	64	98	145	418	598

Node	Node Type	2yr	5yr	10yr	50yr	100yr
J838.20	DIVIDER	54	85	119	391	521
J840.02	JUNCTION	80	121	243	962	1457
J842.04	JUNCTION	5	5	5	5	5
J843.02	JUNCTION	32	32	32	32	32
J902.2	JUNCTION	12	16	18	32	43
J902.3	JUNCTION	33	40	52	114	153
J904.1	JUNCTION	5	7	10	25	36
J904.6	DIVIDER	11	28	48	169	239
J905.2	JUNCTION	30	37	44	75	91
J905.3	DIVIDER	31	38	46	79	96
J906.2	JUNCTION	9	15	25	82	122
J906.3	JUNCTION	15	23	36	109	160
J907.3	JUNCTION	19	29	43	127	183
J907.4	DIVIDER	26	37	55	150	213
J907.5	JUNCTION	10	22	41	146	214
J909.1	JUNCTION	16	16	16	16	16
J909.2	DIVIDER	8	8	8	8	8
J910.1	JUNCTION	7	12	18	61	89
J910.2	JUNCTION	35	35	35	35	35
J910.3	DIVIDER	39	42	42	41	41
J911.2	JUNCTION	32	38	47	86	101
J912.1	DIVIDER	1	5	9	24	34
J915.1	JUNCTION	5	14	16	21	31
J915.2	JUNCTION	19	30	29	41	55
J917.1	JUNCTION	20	38	63	211	297
J917.6	JUNCTION	33	56	89	275	381
J917.9	JUNCTION	13	21	32	91	118
J920.2	DIVIDER	25	36	52	122	158
J920.4	JUNCTION	16	23	33	79	103
J920.6	DIVIDER	0	0	0	61	110
J921.1	JUNCTION	25	36	49	70	70
J922.3	JUNCTION	4	6	8	42	81
J923.02	OUTFALL	1	2	3	8	12
J924.01	DIVIDER	52	74	104	261	348
J925.01	DIVIDER	69	90	114	172	203
J926.01	DIVIDER	64	79	96	126	130
J926.02	DIVIDER	63	78	95	205	315
J926.03	DIVIDER	24	33	46	112	181
J927.03	JUNCTION	2	3	4	25	52
J927.07	DIVIDER	1	5	21	183	317
J927.08	JUNCTION	0	0	0	0	0
J927.09	DIVIDER	21	48	82	358	572
J927.11	JUNCTION	0	0	0	107	187
J929.01	JUNCTION	13	25	41	100	124
J929.02	JUNCTION	53	72	89	153	183
J930.01	DIVIDER	51	79	116	385	602

Node Peak Flows (cfs)

Node	Node Type	2yr	5yr	10yr	50yr	100yr
J930.02	DIVIDER	74	127	200	685	1030
J930.04	JUNCTION	9	13	17	44	80
J930.05	DIVIDER	18	29	43	138	206
J930.08	JUNCTION	69	99	133	385	499
J930.12	DIVIDER	75	107	142	344	471
J930.15	DIVIDER	7	10	14	31	45
J931.01	DIVIDER	0	0	2	80	104
J931.02	DIVIDER	41	56	69	130	171
J931.03	DIVIDER	39	54	74	177	247
J931.04	JUNCTION	0	5	16	84	137
J932.03	DIVIDER	7	14	35	154	228
J932.04	JUNCTION	4	5	15	67	94
J932.06	DIVIDER	8	10	11	17	22
J932.07	DIVIDER	65	81	98	173	212
J932.10	JUNCTION	38	45	52	77	90
J933.01	JUNCTION	0	0	0	0	1
J933.02	JUNCTION	3	7	13	49	69
J933.03	JUNCTION	24	28	33	56	69
J934.01	JUNCTION	35	44	55	128	186
J935.04	JUNCTION	11	13	14	17	17
J935.05	JUNCTION	39	53	69	101	101
J936.01	JUNCTION	47	50	55	83	93
J936.05	DIVIDER	7	9	12	27	40
J936.08	DIVIDER	96	110	141	293	402
J936.11	DIVIDER	6	11	19	52	69
J936.12	JUNCTION	7	7	7	7	7
J936.23	DIVIDER	5	8	13	33	43
J936.25	DIVIDER	128	193	268	742	1102
J936.26	DIVIDER	25	43	83	325	458
J936.28	DIVIDER	33	47	62	142	190
J936.31	DIVIDER	29	35	42	80	102
J936.33	DIVIDER	23	33	47	130	180
J936.35	JUNCTION	25	26	26	29	29
J937.02	DIVIDER	39	39	40	43	45
J937.03	DIVIDER	41	42	42	43	45
J937.04	JUNCTION	100	100	100	100	100
J937.05	DIVIDER	2	2	2	2	2
J937.09	DIVIDER	70	85	109	214	266
J937.10	JUNCTION	77	91	111	201	244
J937.12	DIVIDER	82	98	121	227	279
J938.03	JUNCTION	2	2	2	2	2
J938.05	DIVIDER	10	14	17	29	36
J938.07	DIVIDER	83	83	82	82	82
J938.08	DIVIDER	15	28	40	97	122
J938.09	DIVIDER	0	1	2	10	15
J938.11	DIVIDER	55	65	72	104	121
J938.12	DIVIDER	45	53	59	84	97
J938.13	DIVIDER	41	47	51	66	75
J938.14	DIVIDER	69	99	134	387	503
J938.15	DIVIDER	65	99	146	420	599
J938.16	DIVIDER	53	88	139	466	679
J938.17	DIVIDER	53	82	122	404	632
J938.20	DIVIDER	54	85	120	392	521
J938.21	JUNCTION	17	49	92	386	629
J939.03	JUNCTION	23	50	88	400	638
J939.04	DIVIDER	32	88	189	763	1156
J939.05	DIVIDER	8	11	14	32	43
J939.07	JUNCTION	2	2	2	2	2
J939.19	JUNCTION	0	0	4	111	175
J940.01	JUNCTION	1	2	3	7	9
J940.02	DIVIDER	24	24	24	24	24
J940.03	DIVIDER	28	28	28	28	28
J940.04	JUNCTION	6	6	6	6	6
J940.09	JUNCTION	16	49	93	390	637
J941.02	JUNCTION	19	28	40	54	54
J941.05	DIVIDER	14	17	21	43	55
J941.06	DIVIDER	48	96	206	827	1260
J942.01	DIVIDER	115	124	139	224	268
J942.02	DIVIDER	98	118	126	171	188
J942.03	JUNCTION	30	45	66	181	240
J942.04	DIVIDER	6	9	14	33	43
J943.02	DIVIDER	35	35	34	33	33
LAT02152	JUNCTION	3	3	3	3	4
LAT02699	JUNCTION	13	13	13	13	14
LAT03348	JUNCTION	0	0	0	0	0
LAT04824	JUNCTION	36	45	57	118	144
LAT05377	JUNCTION	0	0	0	0	0
LAT06068	JUNCTION	0	0	0	16	48
LAT06149	JUNCTION	0	0	0	1	4
LAT07379	JUNCTION	0	0	0	0	1
LAT07389	JUNCTION	0	0	0	0	0
LAT07676	JUNCTION	0	0	0	0	0
LAT08206	JUNCTION	3	6	11	40	55
LAT08257	JUNCTION	1	2	3	10	14
LAT08378	JUNCTION	24	28	33	53	63
LAT08553	JUNCTION	0	0	0	2	6
LAT08967	JUNCTION	24	29	34	56	66
LAT09685	JUNCTION	38	45	52	76	88
LAT09716	JUNCTION	0	0	0	1	2
LAT10698	JUNCTION	0	0	0	10	19
LAT10900	JUNCTION	0	1	10	42	54
LAT10921	JUNCTION	0	0	1	3	4
LAT11032	JUNCTION	0	0	2	7	9
LAT11229	JUNCTION	0	5	15	62	85
LAT11434	JUNCTION	0	0	0	16	43
LAT11462	JUNCTION	0	0	0	0	1
LAT11661	JUNCTION	50	62	71	99	110
LAT11890	JUNCTION	0	0	0	10	19
LAT12512	JUNCTION	0	0	0	42	69
LAT12707	JUNCTION	0	0	4	51	68
LAT12732	JUNCTION	0	0	0	1	1
LAT12859	JUNCTION	0	0	0	12	21
LAT12939	JUNCTION	0	0	0	6	16
LAT13414	JUNCTION	0	0	0	0	0
LAT13444	JUNCTION	0	0	0	0	0
LAT13499	JUNCTION	21	27	31	49	57
LAT13628	JUNCTION	32	46	58	105	126
LAT14160	JUNCTION	13	24	39	122	168
LAT14208	JUNCTION	3	6	10	32	44
LAT14445	JUNCTION	0	0	7	72	114
LAT14465	JUNCTION	0	0	0	5	7
LAT14836	JUNCTION	0	0	0	1	6
LAT14921	JUNCTION	1	3	6	21	28
LAT14936	JUNCTION	4	7	10	21	25
LAT15104	JUNCTION	2	5	10	32	40
LAT15595	JUNCTION	5	8	13	32	38
LAT15699	JUNCTION	0	0	0	0	0
LAT15930	JUNCTION	0	0	0	25	42
LAT16157	JUNCTION	0	0	0	16	26
LAT16485	JUNCTION	0	0	0	30	59
LAT16687	JUNCTION	0	0	0	76	125
LAT16728	JUNCTION	0	0	0	1	2
LAT16949	JUNCTION	0	0	0	0	0
LAT18178	JUNCTION	0	0	0	6	19
LAT18572	JUNCTION	0	0	0	14	26
LUTHER_PARK_EAST	STORAGE	14	18	24	81	114
LUTHER_PARK_WEST	STORAGE	29	41	56	117	140
MAPLE_ELEMENTARY	STORAGE	1	2	3	7	10
MOON_POND	STORAGE	34	57	91	280	388
O100	OUTFALL	2	3	4	14	20
O105	OUTFALL	9	13	19	54	74
O110	OUTFALL	3	4	6	13	17
O115	OUTFALL	6	9	11	21	26
O120	OUTFALL	20	23	26	64	108
O125	OUTFALL	2	2	12	102	141
O130	OUTFALL	8	13	22	76	104
O135	OUTFALL	2	2	3	9	13
O140	OUTFALL	32	54	91	316	439

Node Peak Flows (cfs)

Node	Node Type	2yr	5yr	10yr	50yr	100yr
O145	OUTFALL	2	3	4	9	13
O146	OUTFALL	1	1	1	3	4
O150	OUTFALL	8	16	34	139	206
O155	OUTFALL	62	62	62	62	62
O160	OUTFALL	18	28	30	48	64
O165	OUTFALL	2	2	3	7	10
O170	OUTFALL	13	27	47	163	238
O175	OUTFALL	6	8	10	22	29
O180	OUTFALL	1	2	2	5	7
O185	OUTFALL	3	4	5	11	15
O186	OUTFALL	11	16	21	58	82
O190	OUTFALL	4	5	7	13	16
O195	OUTFALL	37	46	56	108	132
O200	OUTFALL	3	4	6	16	23
O205	OUTFALL	11	14	18	35	53
O210	OUTFALL	39	40	41	47	54
O215	OUTFALL	12	19	27	87	127
O399	OUTFALL	54	70	96	191	243
O400	OUTFALL	93	93	93	93	93
O405	OUTFALL	30	45	66	181	240
O410	OUTFALL	3	3	3	3	3
O415	OUTFALL	81	125	247	976	1481
O416	OUTFALL	6	6	6	6	6
O417	OUTFALL	25	35	51	112	144
O420	OUTFALL	20	53	100	409	667
O425	OUTFALL	4	6	9	20	26
O430	OUTFALL	40	41	42	42	42
O431	OUTFALL	54	66	83	163	212
O432	OUTFALL	14	14	14	14	14
O435	OUTFALL	27	35	46	106	130
O440	OUTFALL	48	51	57	86	108
O445	OUTFALL	53	68	98	255	368
O450	OUTFALL	24	24	25	29	30
O455	OUTFALL	4	4	4	4	4
O460	OUTFALL	145	227	321	896	1347

Node Peak Flows (cfs)

Node	Node Type	2yr	5yr	10yr	50yr	100yr
GreeleyLovelandCanal	JUNCTION	26.4	26.4	26.4	26.4	26.4
GLENMERE	STORAGE	33.1	35.0	37.1	46.3	52.8
J001.1	JUNCTION	0.6	0.9	1.1	2.1	2.7
J001.2	JUNCTION	1.0	1.4	1.9	3.9	5.3
J001.3	JUNCTION	0.3	0.4	0.5	1.1	1.5
J002.1	JUNCTION	27.3	27.7	28.1	29.8	31.0
J002.10	JUNCTION	30.7	32.2	34.4	43.0	48.8
J002.11	JUNCTION	0.1	0.1	0.2	0.4	0.6
J002.2	DIVIDER	1.8	2.5	3.2	6.5	8.8
J002.3	JUNCTION	29.4	30.6	31.9	37.4	41.4
J002.4	JUNCTION	0.3	0.3	0.5	0.9	1.3
J002.5	JUNCTION	29.8	31.0	32.5	39.0	43.3
J002.6	JUNCTION	30.3	31.6	33.4	40.8	46.0
J002.7	JUNCTION	0.1	0.2	0.3	0.7	1.0
J002.8	JUNCTION	30.4	31.9	33.8	42.0	47.6
J002.9	JUNCTION	0.1	0.2	0.3	0.6	0.9
J003.1	JUNCTION	0.3	0.4	0.5	1.2	1.8
J003.2	JUNCTION	0.2	0.3	0.4	0.7	0.9
J003.3	JUNCTION	1.1	1.5	2.0	4.3	6.0
J003.4	JUNCTION	1.5	2.1	2.7	6.0	8.4
J003.6	DIVIDER	2.0	2.8	3.7	7.9	10.7
J003.7	JUNCTION	0.9	1.2	1.7	3.6	4.7
J003.8	JUNCTION	0.1	0.1	0.1	0.3	0.4
J004.1	JUNCTION	0.4	0.5	0.7	1.6	2.2
J004.2	JUNCTION	1.1	1.6	2.2	4.8	6.4
J004.3	JUNCTION	0.1	0.1	0.2	0.3	0.5
J004.4	JUNCTION	1.3	1.8	2.5	5.6	7.6
J004.5	JUNCTION	3.0	4.2	5.7	12.3	16.4
J004.6	DIVIDER	4.1	5.8	7.8	16.8	22.5
J004.7	DIVIDER	4.5	5.7	6.8	9.6	11.1
J004.8	JUNCTION	0.4	0.6	0.8	2.0	2.7
J005.1	DIVIDER	0.3	0.4	0.5	1.0	1.4
J005.2	JUNCTION	30.0	31.9	34.1	44.2	51.6
J005.3	DIVIDER	35.0	38.7	42.3	57.4	67.2
J006.1	JUNCTION	0.8	1.1	1.5	3.2	4.5
J006.2	DIVIDER	1.5	2.0	2.7	5.6	7.7
J006.3	JUNCTION	0.4	0.5	0.7	1.4	1.9
J006.4	JUNCTION	0.2	0.3	0.4	0.8	1.0
J006.5	DIVIDER	1.7	2.2	2.6	3.3	3.7
J007.1	JUNCTION	0.2	0.2	0.3	0.6	0.8
J007.2	DIVIDER	0.3	0.4	0.5	1.1	1.5
J007.3	JUNCTION	0.2	0.2	0.3	0.6	0.9
J007.4	JUNCTION	0.2	0.2	0.3	0.6	0.8
J007.5	JUNCTION	0.2	0.2	0.3	0.6	0.8
J007.6	JUNCTION	0.2	0.3	0.4	0.7	0.9
J007.7	JUNCTION	0.2	0.2	0.3	0.6	0.8
J007.8	JUNCTION	0.2	0.2	0.3	0.6	0.8
J007.9	JUNCTION	0.0	0.1	0.1	0.3	0.7
J008.1	JUNCTION	0.5	0.7	0.9	1.7	2.2
J008.2	DIVIDER	0.7	1.0	1.3	2.5	3.3
J009.1	DIVIDER	2.0	2.5	2.9	3.9	4.4
J009.2	DIVIDER	3.3	4.2	5.0	6.5	7.3
J010.1	DIVIDER	0.6	0.9	1.3	3.3	4.7
J010.2	DIVIDER	0.5	0.7	0.9	1.6	2.1
J010.3	JUNCTION	0.2	0.3	0.4	1.0	1.4
J010.4	JUNCTION	0.2	0.3	0.4	0.8	1.1
J010.5	JUNCTION	0.0	0.1	0.1	0.1	0.2
J010.6	JUNCTION	0.2	0.3	0.4	1.0	1.4
J011.1	JUNCTION	0.3	0.3	0.5	0.9	1.4
J011.2	JUNCTION	0.5	0.7	0.9	1.6	2.1
J011.3	JUNCTION	0.7	1.1	1.5	2.8	3.8
J011.4	JUNCTION	0.2	0.3	0.4	0.9	1.3
J012.1	DIVIDER	3.2	4.1	5.1	8.0	9.7
J012.2	JUNCTION	0.2	0.3	0.4	0.7	0.9
J013.1	JUNCTION	0.5	0.7	0.9	2.1	3.1
J013.2	JUNCTION	0.3	0.4	0.6	1.1	1.5
J013.3	DIVIDER	2.5	3.2	3.9	6.0	7.2
J013.4	JUNCTION	0.4	0.7	1.0	3.0	4.4
J014.1	JUNCTION	0.3	0.4	0.5	1.0	1.3
J014.1	JUNCTION	0.3	0.4	0.5	1.0	1.3
J014.2	JUNCTION	0.1	0.1	0.1	0.3	0.3
J014.3	JUNCTION	0.2	0.2	0.3	0.5	0.7
J015.1	DIVIDER	35.9	39.0	41.4	47.0	51.2
J015.2	DIVIDER	36.2	39.0	40.8	46.3	50.0
J015.3	JUNCTION	0.2	0.2	0.3	0.6	0.8
J015.4	JUNCTION	0.1	0.1	0.2	0.3	0.5
J015.5	JUNCTION	0.3	0.4	0.6	1.0	1.3
J015.6	JUNCTION	0.1	0.2	0.2	0.5	0.6
J015.7	JUNCTION	0.4	0.6	0.8	1.5	2.0
J016.1	DIVIDER	0.7	2.0	4.1	15.7	22.8
J016.2	JUNCTION	0.3	1.2	3.2	14.9	22.0
J016.3	JUNCTION	0.3	0.4	0.6	1.2	1.6
J016.4	JUNCTION	0.0	0.1	0.1	0.2	0.2
J017.1	JUNCTION	1.1	1.6	2.1	3.8	4.7
J017.10	JUNCTION	0.0	0.1	0.1	0.2	0.3
J017.11	JUNCTION	0.1	0.2	0.3	0.6	0.9
J017.12	JUNCTION	0.1	0.2	0.3	0.6	0.8
J017.2	JUNCTION	0.1	0.2	0.3	0.7	1.0
J017.3	JUNCTION	0.4	0.6	0.8	1.7	2.2
J017.4	JUNCTION	0.8	1.1	1.6	3.3	4.3
J017.5	JUNCTION	2.8	4.6	7.1	20.1	28.3
J017.6	JUNCTION	0.4	0.6	0.8	1.9	2.6
J017.7	JUNCTION	0.2	0.2	0.3	0.6	0.8
J017.8	JUNCTION	0.3	0.4	0.6	1.4	1.9
J017.9	JUNCTION	0.8	1.2	1.9	3.2	3.8
J017.9	JUNCTION	0.8	1.2	1.9	3.2	3.7
J018.1	JUNCTION	0.9	1.3	1.9	4.2	5.6
J018.2	JUNCTION	0.7	1.0	1.4	2.9	3.7
J019.1	DIVIDER	2.3	3.2	4.3	9.0	12.1
J020.1	JUNCTION	1.5	2.2	3.1	6.7	8.7
J020.2	JUNCTION	0.1	0.2	0.3	0.7	1.0
J020.3	JUNCTION	0.1	0.2	0.3	0.6	0.8
J020.4	JUNCTION	2.5	3.6	5.1	10.8	14.0
J020.5	JUNCTION	0.1	0.1	0.1	0.3	0.3
J020.6	DIVIDER	2.7	3.8	5.3	11.4	15.3
J020.7	JUNCTION	0.0	0.0	0.0	0.1	0.2
J021.1	JUNCTION	0.4	0.5	0.7	1.7	2.3
J021.2	JUNCTION	0.2	0.3	0.4	0.9	1.3
J021.3	JUNCTION	0.4	0.5	0.7	1.2	1.6
J021.4	JUNCTION	0.3	0.5	0.6	1.2	1.6
J021.5	JUNCTION	0.3	0.4	0.5	1.1	1.5
J022.1	JUNCTION	0.2	0.3	0.4	1.4	2.1
J022.2	JUNCTION	0.4	0.6	0.8	1.7	2.3
J022.3	JUNCTION	0.3	0.5	0.7	1.4	1.9
J022.4	JUNCTION	0.3	0.4	0.5	1.5	2.2
J023.01	JUNCTION	1.4	2.0	3.0	7.1	9.5
J023.02	JUNCTION	0.1	0.1	0.2	0.5	0.7
J023.03	JUNCTION	0.8	1.1	1.6	3.6	4.8
J023.04	JUNCTION	2.3	3.3	4.8	10.2	13.3
J023.05	JUNCTION	1.1	1.6	2.3	4.8	6.2
J024.01	JUNCTION	2.3	3.3	4.7	11.1	15.1
J024.02	DIVIDER	1.4	1.8	2.1	2.8	3.3
J024.03	DIVIDER	0.6	1.0	1.5	3.6	4.8
J024.04	DIVIDER	0.8	1.1	1.4	3.0	4.0
J025.01	JUNCTION	0.5	0.6	0.8	1.6	2.1
J025.02	DIVIDER	0.3	0.7	1.1	3.6	5.2
J025.03	JUNCTION	0.5	0.6	0.8	1.4	1.7
J025.04	JUNCTION	1.1	2.8	5.5	17.6	25.1
J026.01	JUNCTION	0.2	0.3	0.4	0.7	0.8
J026.02	JUNCTION	0.4	0.5	0.7	1.3	1.7
J026.03	DIVIDER	8.7	11.1	13.7	24.6	33.1
J026.04	JUNCTION	0.9	1.3	1.7	3.9	5.4
J026.05	DIVIDER	0.1	0.2	0.3	1.2	2.3
J027.01	DIVIDER	4.8	5.7	6.6	9.3	11.4
J027.02	DIVIDER	1.9	2.6	3.4	7.5	11.1
J027.03	JUNCTION	0.7	0.9	1.2	3.1	5.3
J027.04	DIVIDER	4.6	5.5	6.2	8.5	10.3
J027.05	DIVIDER	0.4	0.5	0.7	1.4	1.8

Node Peak Flows (cfs)

Node	Node Type	2yr	5yr	10yr	50yr	100yr
J027.06	JUNCTION	0.3	0.4	0.5	1.1	1.4
J027.07	DIVIDER	4.4	5.4	7.1	21.1	31.3
J027.08	DIVIDER	0.8	1.0	1.3	2.5	3.3
J027.09	DIVIDER	4.9	7.7	11.9	37.4	54.0
J027.10	JUNCTION	1.5	2.2	3.4	16.2	25.4
J027.11	JUNCTION	1.1	1.8	2.8	15.0	24.0
J027.12	JUNCTION	0.1	0.2	0.2	0.5	0.6
J027.13	JUNCTION	1.3	1.8	2.4	5.6	8.7
J027.14	JUNCTION	1.0	1.4	1.8	4.4	7.1
J027.15	DIVIDER	0.3	0.4	0.6	1.2	1.6
J027.16	JUNCTION	0.1	0.2	0.2	0.5	0.7
J029.01	DIVIDER	8.0	11.6	16.8	38.1	51.2
J029.02	DIVIDER	9.1	12.6	16.7	34.1	45.1
J030.01	JUNCTION	0.3	0.4	0.5	0.9	1.1
J030.02	JUNCTION	1.5	2.0	2.6	4.9	6.4
J030.03	DIVIDER	4.4	9.9	18.2	63.2	91.8
J030.04	JUNCTION	1.8	2.4	3.2	6.4	8.7
J030.05	JUNCTION	5.8	10.7	18.0	58.0	82.9
J030.06	JUNCTION	0.3	0.4	0.5	0.8	1.0
J030.07	JUNCTION	0.1	0.2	0.3	0.4	0.5
J030.08	JUNCTION	0.2	0.3	0.3	0.6	0.7
J030.09	JUNCTION	0.1	0.1	0.2	0.3	0.4
J030.10	JUNCTION	0.1	0.2	0.2	0.4	0.5
J030.11	JUNCTION	0.2	0.3	0.4	0.7	0.9
J030.12	JUNCTION	0.3	0.4	0.5	0.9	1.1
J030.13	JUNCTION	0.2	0.2	0.3	0.5	0.7
J030.14	DIVIDER	7.1	10.4	14.7	33.1	44.8
J030.15	DIVIDER	0.2	0.2	0.4	1.0	1.6
J030.16	JUNCTION	0.1	0.2	0.2	0.4	0.6
J030.17	DIVIDER	9.3	13.9	19.9	46.3	62.6
J030.18	JUNCTION	4.0	6.7	10.3	27.0	36.5
J030.19	JUNCTION	0.2	0.3	0.3	0.7	0.9
J031.01	DIVIDER	0.4	0.6	1.0	2.4	3.3
J031.02	DIVIDER	6.3	8.6	10.9	16.9	20.3
J031.03	JUNCTION	0.2	0.2	0.3	0.6	0.8
J031.04	DIVIDER	12.3	14.6	17.1	25.6	31.0
J031.05	JUNCTION	0.2	0.3	0.3	0.7	0.9
J031.06	DIVIDER	13.1	15.4	17.6	22.8	25.7
J032.01	JUNCTION	0.3	0.4	0.5	0.9	1.1
J032.02	JUNCTION	0.3	0.3	0.4	0.8	1.0
J032.03	JUNCTION	0.2	0.3	0.4	0.8	1.0
J032.04	DIVIDER	6.4	7.1	8.4	15.5	20.4
J032.05	DIVIDER	9.5	9.9	10.6	12.9	14.3
J032.06	JUNCTION	0.2	0.3	0.4	0.7	1.0
J032.07	JUNCTION	0.3	0.4	0.5	0.8	1.1
J032.08	JUNCTION	0.3	0.4	0.5	0.9	1.2
J032.09	DIVIDER	13.2	15.6	17.9	23.8	27.1
J032.10	DIVIDER	9.5	10.9	12.2	15.3	17.1
J033.01	JUNCTION	3.6	5.2	7.1	13.9	18.8
J033.02	JUNCTION	0.3	0.6	1.1	3.7	5.3
J033.03	JUNCTION	4.6	5.4	6.2	8.4	9.8
J034.01	JUNCTION	3.0	4.4	6.0	11.7	15.9
J035.01	JUNCTION	16.4	25.9	36.5	79.8	108.6
J035.02	JUNCTION	17.4	27.1	38.1	86.5	120.3
J035.03	DIVIDER	6.1	8.0	10.1	17.8	22.6
J035.04	JUNCTION	3.7	4.8	6.0	9.9	12.2
J035.05	JUNCTION	23.8	35.6	48.8	102.2	136.9
J036.01	JUNCTION	0.1	0.1	0.2	0.4	0.5
J036.02	DIVIDER	19.9	20.7	21.6	23.7	25.0
J036.03	JUNCTION	0.5	0.9	1.3	2.8	3.9
J036.04	JUNCTION	0.3	0.6	0.9	2.1	3.0
J036.05	JUNCTION	0.2	0.2	0.3	0.6	0.8
J036.06	JUNCTION	0.1	0.1	0.2	0.4	0.5
J036.07	DIVIDER	1.3	2.1	3.3	6.5	7.6
J036.08	JUNCTION	8.9	11.8	16.3	32.8	42.7
J036.09	JUNCTION	0.2	0.3	0.4	0.9	1.2
J036.10	JUNCTION	0.2	0.4	0.6	1.6	2.2
J036.11	DIVIDER	28.5	31.6	36.2	51.2	59.8
J036.12	DIVIDER	28.0	30.7	34.7	47.9	55.2
J036.13	DIVIDER	26.7	29.2	32.8	45.1	52.2
J036.14	JUNCTION	0.1	0.2	0.2	0.5	0.6
J036.15	JUNCTION	0.7	1.5	2.7	6.0	7.2
J036.16	JUNCTION	0.0	0.1	0.1	0.1	0.2
J036.17	JUNCTION	0.1	0.1	0.2	0.3	0.4
J036.18	JUNCTION	0.1	0.1	0.1	0.3	0.4
J036.19	DIVIDER	0.3	0.4	0.6	1.4	1.9
J036.20	JUNCTION	0.1	0.2	0.2	0.5	0.7
J036.21	JUNCTION	0.2	0.2	0.3	0.6	0.8
J036.22	DIVIDER	0.6	0.7	0.9	1.5	1.7
J036.23	DIVIDER	0.5	0.7	1.0	2.1	2.6
J036.24	DIVIDER	0.3	0.6	1.0	2.8	3.8
J036.25	DIVIDER	0.9	1.1	1.4	2.9	3.8
J036.26	JUNCTION	0.9	1.2	1.5	2.7	3.5
J036.27	JUNCTION	0.2	0.3	0.4	0.7	1.0
J036.28	JUNCTION	0.2	0.3	0.3	0.7	0.9
J036.29	JUNCTION	0.2	0.3	0.4	0.8	1.1
J036.30	DIVIDER	5.6	7.0	8.5	13.2	16.2
J036.31	JUNCTION	0.3	0.4	0.5	0.9	1.1
J036.32	JUNCTION	0.4	0.5	0.7	1.2	1.6
J036.33	JUNCTION	0.5	0.7	0.9	1.7	2.2
J036.34	DIVIDER	25.5	27.1	29.4	37.7	43.0
J036.35	JUNCTION	6.8	7.4	7.9	9.0	9.6
J036.36	JUNCTION	0.1	0.1	0.2	0.3	0.4
J036.37	DIVIDER	24.0	35.9	49.1	102.8	138.1
J037.01	JUNCTION	0.4	0.6	0.8	1.7	2.2
J037.02	JUNCTION	6.8	8.8	10.7	15.9	19.0
J037.03	JUNCTION	0.1	0.2	0.2	0.5	0.6
J037.04	JUNCTION	0.4	0.5	0.7	1.2	1.6
J037.05	DIVIDER	1.0	1.9	3.0	6.8	9.0
J037.06	DIVIDER	0.2	0.3	0.4	0.8	1.1
J037.07	DIVIDER	0.1	0.1	0.1	0.2	0.3
J037.08	JUNCTION	0.1	0.2	0.3	0.6	0.7
J037.09	DIVIDER	3.4	4.4	5.4	8.8	10.7
J037.10	JUNCTION	0.3	0.5	0.6	1.2	1.5
J037.11	JUNCTION	0.2	0.3	0.4	0.8	1.0
J037.12	JUNCTION	0.3	0.4	0.6	1.1	1.4
J038.01	JUNCTION	0.3	0.4	0.5	0.9	1.2
J038.02	JUNCTION	0.3	0.4	0.5	0.8	1.0
J038.03	DIVIDER	0.2	0.3	0.4	0.7	1.0
J038.04	DIVIDER	0.2	0.3	0.4	1.0	1.4
J038.05	JUNCTION	0.4	0.5	0.6	1.1	1.3
J038.06	JUNCTION	0.3	0.5	0.6	1.0	1.2
J038.07	JUNCTION	0.3	0.4	0.5	0.8	1.0
J038.08	DIVIDER	0.7	1.0	1.3	2.4	3.1
J038.09	DIVIDER	0.3	0.4	0.6	1.0	1.2
J038.10	DIVIDER	0.2	0.2	0.3	0.5	0.7
J038.11	JUNCTION	0.3	0.4	0.5	0.9	1.1
J038.12	JUNCTION	0.3	0.4	0.5	0.9	1.1
J038.13	JUNCTION	0.2	0.3	0.4	0.7	0.8
J038.14	JUNCTION	0.3	0.5	0.6	1.0	1.2
J038.15	JUNCTION	0.3	0.4	0.5	0.9	1.2
J038.16	JUNCTION	0.3	0.4	0.5	0.9	1.2
J038.17	JUNCTION	0.1	0.2	0.3	0.6	0.9
J038.18	JUNCTION	0.1	0.1	0.1	0.2	0.3
J038.19	JUNCTION	0.1	0.1	0.2	0.3	0.4
J038.20	JUNCTION	0.2	0.3	0.4	0.6	0.7
J038.21	DIVIDER	1.8	5.1	9.9	36.5	54.9
J038.22	JUNCTION	0.1	0.2	0.2	0.4	0.6
J039.01	JUNCTION	1.9	6.5	15.0	64.7	97.0
J039.02	JUNCTION	0.5	2.1	6.1	26.1	37.4
J039.03	DIVIDER	3.5	8.3	16.8	66.3	98.2
J039.04	JUNCTION	3.9	9.1	18.1	70.0	103.1
J039.05	JUNCTION	0.4	0.6	0.7	1.4	1.9
J039.06	JUNCTION	0.6	0.9	1.3	2.7	3.7
J039.07	DIVIDER	0.8	1.1	1.4	2.7	3.6
J039.08	JUNCTION	0.2	0.3	0.3	0.7	1.0
J039.09	JUNCTION	0.2	0.3	0.3	0.6	0.9
J040.01	JUNCTION	0.3	0.5	0.9	2.6	3.5

Node Peak Flows (cfs)

Node	Node Type	2yr	5yr	10yr	50yr	100yr
J040.02	DIVIDER	3.0	9.2	19.6	79.5	118.8
J040.03	JUNCTION	4.5	5.2	6.1	8.0	8.9
J040.04	DIVIDER	9.3	17.5	30.4	97.9	140.2
J040.05	JUNCTION	0.2	0.3	0.4	0.8	1.1
J040.06	JUNCTION	0.0	0.1	0.2	0.5	0.8
J040.07	JUNCTION	1.5	2.2	3.1	6.5	8.5
J040.08	JUNCTION	0.3	0.4	0.5	0.9	1.1
J040.09	JUNCTION	2.3	5.9	11.0	39.3	58.9
J041.01	DIVIDER	2.3	3.1	4.1	7.5	9.6
J041.02	DIVIDER	1.2	1.5	1.8	2.7	3.3
J041.03	DIVIDER	1.7	2.4	3.3	6.8	8.9
J041.04	JUNCTION	5.6	11.7	22.0	79.8	117.5
J041.05	DIVIDER	6.9	13.5	24.4	84.7	123.7
J041.06	JUNCTION	1.3	1.8	2.5	5.1	6.5
J041.07	DIVIDER	0.1	0.2	0.3	0.6	0.8
J042.01	JUNCTION	1.3	2.0	2.9	6.0	7.8
J042.02	JUNCTION	0.8	1.1	1.4	2.9	3.8
J042.03	JUNCTION	0.2	0.4	0.5	1.2	1.6
J042.04	JUNCTION	0.3	0.4	0.6	1.2	1.5
J042.05	JUNCTION	0.3	0.5	0.8	2.1	2.8
J042.06	JUNCTION	0.9	1.3	1.8	3.8	4.8
J042.07	JUNCTION	0.4	0.5	0.7	1.4	1.8
J043.01	JUNCTION	1.8	2.7	4.0	9.3	12.3
J043.02	JUNCTION	0.7	1.0	1.3	2.7	3.7
J044.01	JUNCTION	0.7	1.2	1.6	3.0	3.8
J044.02	JUNCTION	3.0	4.8	6.8	13.9	17.9
J044.03	JUNCTION	0.3	0.4	0.7	2.2	3.2
J605.4	DIVIDER	4.6	5.7	6.8	9.6	11.1
J624.01	JUNCTION	2.3	3.3	4.8	10.2	13.3
J629.01	DIVIDER	9.7	14.5	20.9	50.9	69.7
J636.30	DIVIDER	6.4	8.8	11.2	17.7	21.4
J643.01	JUNCTION	5.0	5.7	6.2	6.8	7.0
J705.3	JUNCTION	29.9	31.9	34.1	44.2	51.6
J711.2	JUNCTION	0.5	1.1	1.8	4.4	6.0
J720.2	DIVIDER	0.0	0.1	0.9	5.6	8.6
J721.1	JUNCTION	0.0	0.0	0.6	6.4	9.0
J724.01	JUNCTION	5.1	5.8	6.3	6.9	7.2
J725.01	JUNCTION	0.0	1.5	5.2	24.4	35.3
J729.01	JUNCTION	1.4	2.8	5.0	17.5	25.4
J730.05	JUNCTION	3.8	7.1	12.3	43.6	62.9
J731.01	DIVIDER	0.0	0.0	0.0	5.9	11.4
J736.08	DIVIDER	9.8	12.7	17.1	33.4	43.0
J736.22	JUNCTION	0.3	0.3	0.4	0.4	0.4
J736.26	DIVIDER	1.6	2.8	4.5	10.8	13.3
J736.28	JUNCTION	10.0	16.3	23.4	52.2	70.9
J736.30	DIVIDER	29.6	35.6	42.7	70.0	88.4
J736.33	JUNCTION	15.7	24.7	34.7	75.8	103.1
J737.10	DIVIDER	1.4	1.6	1.8	2.3	2.7
J738.05	JUNCTION	1.1	4.2	8.7	34.4	52.2
J738.11	DIVIDER	9.6	13.8	19.1	45.4	63.8
J738.14	DIVIDER	4.9	5.5	6.3	11.0	14.0
J738.15	DIVIDER	10.6	14.9	20.6	43.3	57.7
J743.01	JUNCTION	5.0	5.7	6.2	6.8	7.0
J804.1	DIVIDER	0.9	1.3	1.7	3.9	5.4
J805.3	JUNCTION	29.8	31.6	34.1	44.2	51.2
J809.2	JUNCTION	0.0	0.1	0.3	1.3	1.9
J817.6	DIVIDER	3.0	4.8	7.4	20.7	29.1
J817.9	DIVIDER	1.3	2.1	3.6	9.0	11.6
J820.2	DIVIDER	0.0	0.0	0.6	6.4	9.1
J820.4	JUNCTION	2.6	3.7	5.2	11.0	14.3
J821.1	JUNCTION	2.7	3.8	5.3	8.8	9.6
J824.01	JUNCTION	1.4	1.8	2.1	2.7	3.0
J825.01	DIVIDER	11.6	16.7	23.0	45.1	57.1
J826.02	DIVIDER	0.0	0.0	0.0	6.2	13.7
J826.03	DIVIDER	2.8	3.9	5.1	11.5	16.6
J827.11	JUNCTION	0.0	0.0	0.0	8.7	16.3
J829.01	JUNCTION	1.2	2.3	4.3	10.5	13.1
J830.05	DIVIDER	4.2	7.8	12.7	35.0	47.6
J830.15	DIVIDER	0.0	0.0	0.1	1.0	1.8
J830.18	JUNCTION	0.9	0.9	0.9	0.9	0.9
J831.01	DIVIDER	4.0	4.7	6.0	13.7	19.6
J831.02	DIVIDER	6.0	8.2	10.4	16.5	20.3
J832.06	DIVIDER	0.2	0.3	0.4	0.7	1.0
J832.07	DIVIDER	25.3	29.9	34.7	48.8	57.7
J834.01	JUNCTION	2.7	4.1	5.5	10.3	12.8
J836.05	JUNCTION	1.1	1.4	1.6	2.1	2.4
J836.08	JUNCTION	1.1	1.3	1.4	1.7	1.8
J836.11	DIVIDER	28.5	31.6	36.2	51.2	59.8
J836.22	JUNCTION	0.3	0.3	0.4	0.4	0.4
J836.26	DIVIDER	7.5	13.0	19.9	49.4	68.4
J836.28	DIVIDER	3.8	4.7	5.6	8.4	10.1
J836.30	JUNCTION	2.1	2.2	2.2	2.3	2.3
J836.33	DIVIDER	31.6	37.7	45.1	72.7	91.4
J837.04	DIVIDER	23.1	26.3	28.9	32.5	34.7
J837.06	DIVIDER	0.1	0.2	0.3	0.7	1.0
J837.10	JUNCTION	10.4	13.1	15.6	21.8	25.1
J838.05	DIVIDER	0.0	0.1	0.1	0.7	1.0
J838.07	DIVIDER	22.3	26.1	29.2	33.1	35.0
J838.08	JUNCTION	0.3	1.0	1.9	5.2	6.9
J838.11	JUNCTION	12.2	13.4	14.6	16.0	16.8
J838.12	JUNCTION	0.1	0.1	0.1	0.2	0.3
J838.14	DIVIDER	11.0	12.7	14.1	16.3	17.3
J838.15	DIVIDER	10.3	14.5	20.0	42.3	56.5
J838.20	DIVIDER	6.9	10.6	15.1	36.8	49.4
J840.02	JUNCTION	8.9	16.7	29.2	94.8	136.2
J842.04	JUNCTION	0.5	0.7	0.9	1.1	1.2
J843.02	JUNCTION	5.0	5.7	6.2	6.8	7.0
J902.2	JUNCTION	1.1	1.5	1.8	3.0	3.7
J902.3	JUNCTION	28.0	28.7	29.5	33.4	35.9
J904.1	JUNCTION	0.5	0.7	0.9	1.9	2.7
J904.6	DIVIDER	0.3	1.3	2.8	11.4	16.9
J905.2	JUNCTION	29.7	31.6	33.8	43.0	49.4
J905.3	DIVIDER	29.7	31.6	34.1	44.2	51.2
J906.2	JUNCTION	0.2	0.5	1.0	4.0	6.4
J906.3	JUNCTION	0.8	1.3	2.1	6.2	9.3
J907.3	JUNCTION	1.2	1.8	2.7	7.5	11.0
J907.4	DIVIDER	1.8	2.7	3.9	9.7	13.7
J907.5	JUNCTION	0.4	1.0	1.9	7.9	12.2
J909.1	JUNCTION	1.5	1.9	2.1	2.4	2.4
J909.2	DIVIDER	0.7	0.9	1.0	1.1	1.2
J910.1	JUNCTION	0.5	0.8	1.2	3.6	5.5
J910.2	JUNCTION	3.3	4.1	4.6	5.2	5.4
J910.3	DIVIDER	3.8	4.7	5.5	6.4	6.6
J911.2	JUNCTION	3.2	4.1	5.1	8.0	9.7
J912.1	DIVIDER	0.0	0.1	0.4	1.3	1.9
J915.1	JUNCTION	0.1	0.7	1.0	1.9	2.7
J915.2	JUNCTION	0.9	2.4	3.1	5.2	6.9
J917.1	JUNCTION	1.5	2.7	4.5	14.7	21.2
J917.6	JUNCTION	2.8	4.6	7.1	20.1	28.3
J917.9	JUNCTION	1.3	2.1	3.6	9.0	11.6
J920.2	DIVIDER	2.6	3.7	5.2	11.0	14.3
J920.4	JUNCTION	1.6	2.4	3.4	7.3	9.5
J920.6	DIVIDER	0.0	0.0	0.0	2.6	5.6
J921.1	JUNCTION	2.7	3.8	5.3	8.8	9.6
J922.3	JUNCTION	0.3	0.5	0.6	2.3	4.4
J923.02	OUTFALL	0.1	0.1	0.2	0.5	0.7
J924.01	DIVIDER	6.0	8.4	11.6	24.2	31.6
J925.01	DIVIDER	10.1	13.2	16.7	25.9	29.8
J926.01	DIVIDER	9.5	12.2	14.9	20.9	23.0
J926.02	DIVIDER	9.3	11.9	14.6	26.2	35.3
J926.03	DIVIDER	2.8	3.9	5.1	11.5	16.5
J927.03	JUNCTION	0.1	0.2	0.2	1.3	2.9
J927.07	DIVIDER	0.0	0.1	1.1	14.1	23.7
J927.08	JUNCTION	0.0	0.0	0.0	0.0	0.0
J927.09	DIVIDER	1.5	3.7	7.5	32.5	48.5
J927.11	JUNCTION	0.0	0.0	0.0	6.2	11.8
J929.01	JUNCTION	1.2	2.3	4.3	10.5	12.9
J929.02	JUNCTION	8.7	12.1	15.9	25.7	30.6

Node Peak Flows (cfs)

Node	Node Type	2yr	5yr	10yr	50yr	100yr
J930.01	DIVIDER	8.0	11.8	16.7	41.4	58.9
J930.02	DIVIDER	9.1	15.2	23.8	69.4	97.9
J930.04	JUNCTION	1.5	2.0	2.7	5.4	7.4
J930.05	DIVIDER	1.3	2.8	4.7	13.1	18.6
J930.08	JUNCTION	12.2	16.6	21.8	43.0	55.2
J930.12	DIVIDER	13.0	17.8	23.3	42.7	54.0
J930.15	DIVIDER	2.1	2.4	2.8	4.1	5.0
J931.01	DIVIDER	0.0	0.0	0.0	4.0	6.3
J931.02	DIVIDER	8.9	11.1	13.3	19.5	23.2
J931.03	DIVIDER	8.0	10.3	12.8	21.2	26.8
J931.04	JUNCTION	0.0	0.2	0.8	4.5	7.5
J932.03	DIVIDER	0.6	1.1	2.3	9.1	13.9
J932.04	JUNCTION	0.3	0.4	0.9	3.9	5.9
J932.06	DIVIDER	2.7	2.7	2.8	3.2	3.4
J932.07	DIVIDER	13.7	16.2	18.7	25.2	28.9
J932.10	JUNCTION	9.4	10.7	11.9	14.9	16.5
J933.01	JUNCTION	0.0	0.0	0.0	0.0	0.0
J933.02	JUNCTION	0.1	0.4	0.7	2.9	4.3
J933.03	JUNCTION	4.4	5.2	5.9	7.8	8.9
J934.01	JUNCTION	2.8	4.1	5.6	10.8	14.6
J935.04	JUNCTION	1.5	1.9	2.1	2.6	2.8
J935.05	JUNCTION	6.1	8.0	10.1	14.5	15.3
J936.01	JUNCTION	19.9	20.7	21.6	23.7	24.6
J936.05	DIVIDER	1.3	1.7	2.1	3.3	4.1
J936.08	DIVIDER	29.0	32.2	37.1	53.7	63.2
J936.11	DIVIDER	0.3	0.6	1.0	2.8	3.8
J936.12	JUNCTION	0.6	0.7	0.8	0.9	0.9
J936.23	DIVIDER	0.1	0.3	0.5	1.5	2.1
J936.25	DIVIDER	15.8	24.8	35.0	75.8	103.1
J936.26	DIVIDER	3.0	5.0	8.5	27.1	38.4
J936.28	DIVIDER	4.8	6.3	7.9	13.4	16.8
J936.31	DIVIDER	5.0	6.0	6.9	9.6	11.3
J936.33	DIVIDER	3.0	4.0	5.3	10.8	14.4
J936.35	JUNCTION	6.8	7.3	7.8	8.7	9.2
J937.02	DIVIDER	13.5	14.9	16.2	18.1	19.2
J937.03	DIVIDER	13.5	14.9	16.2	18.1	19.2
J937.04	JUNCTION	22.7	25.8	28.2	31.3	32.8
J937.05	DIVIDER	0.2	0.3	0.3	0.3	0.3
J937.09	DIVIDER	8.1	10.6	13.1	19.9	23.6
J937.10	JUNCTION	10.4	13.1	15.6	21.8	25.1
J937.12	DIVIDER	11.1	14.0	16.8	24.1	28.1
J938.03	JUNCTION	0.2	0.3	0.3	0.4	0.4
J938.05	DIVIDER	0.9	1.2	1.4	2.3	2.8
J938.07	DIVIDER	20.7	23.2	25.3	28.2	29.8
J938.08	DIVIDER	0.6	1.6	2.5	5.4	7.0
J938.09	DIVIDER	0.0	0.0	0.0	0.3	0.5

Node	Node Type	2yr	5yr	10yr	50yr	100yr
J938.11	DIVIDER	12.6	14.8	16.6	20.0	21.7
J938.12	DIVIDER	11.6	13.6	15.2	18.1	19.5
J938.13	DIVIDER	11.3	13.1	14.5	17.0	18.2
J938.14	DIVIDER	12.3	16.8	22.0	43.3	55.5
J938.15	DIVIDER	11.0	15.3	20.7	43.0	57.4
J938.16	DIVIDER	6.4	10.6	16.4	42.0	58.9
J938.17	DIVIDER	8.7	12.8	18.0	44.2	62.3
J938.20	DIVIDER	7.1	10.8	15.3	36.8	49.7
J938.21	JUNCTION	1.1	4.3	8.9	35.3	53.7
J939.03	JUNCTION	1.7	4.3	8.3	35.9	54.9
J939.04	DIVIDER	4.2	9.1	17.8	67.8	100.0
J939.05	DIVIDER	0.6	0.8	1.1	2.2	2.9
J939.07	JUNCTION	0.3	0.3	0.3	0.3	0.3
J939.19	JUNCTION	0.0	0.0	0.1	7.3	12.6
J940.01	JUNCTION	0.1	0.2	0.3	0.6	0.7
J940.02	DIVIDER	4.5	5.2	5.9	6.6	6.8
J940.03	DIVIDER	5.6	6.3	7.1	7.9	8.2
J940.04	JUNCTION	1.4	1.5	1.7	1.8	1.9
J940.09	JUNCTION	1.4	4.6	9.4	36.2	54.9
J941.02	JUNCTION	1.7	2.4	3.3	5.6	6.1
J941.05	DIVIDER	1.9	2.3	2.8	4.4	5.3
J941.06	DIVIDER	6.1	12.3	22.6	78.9	114.8
J942.01	DIVIDER	15.2	20.3	24.5	34.4	39.6
J942.02	DIVIDER	12.8	16.9	19.9	25.1	27.4
J942.03	JUNCTION	1.8	4.8	7.9	18.1	23.7
J942.04	DIVIDER	0.5	0.9	1.4	3.3	4.3
J943.02	DIVIDER	5.1	5.8	6.3	6.9	7.2
LAT02152	JUNCTION	0.3	0.4	0.4	0.5	0.6
LAT02699	JUNCTION	1.2	1.4	1.7	2.1	2.2
LAT03348	JUNCTION	0.0	0.0	0.0	0.0	0.0
LAT04824	JUNCTION	2.7	4.1	5.5	10.2	12.8
LAT05377	JUNCTION	0.0	0.0	0.0	0.0	0.0
LAT06068	JUNCTION	0.0	0.0	0.0	0.4	1.5
LAT06149	JUNCTION	0.0	0.0	0.0	0.0	0.1
LAT07379	JUNCTION	0.0	0.0	0.0	0.0	0.0
LAT07389	JUNCTION	0.0	0.0	0.0	0.0	0.0
LAT07676	JUNCTION	0.0	0.0	0.0	0.0	0.0
LAT08206	JUNCTION	0.1	0.3	0.6	2.3	3.4
LAT08257	JUNCTION	0.0	0.1	0.2	0.6	0.9
LAT08378	JUNCTION	4.4	5.2	5.9	7.7	8.7
LAT08553	JUNCTION	0.0	0.0	0.0	0.0	0.2
LAT08967	JUNCTION	5.6	6.4	7.2	9.3	10.5
LAT09685	JUNCTION	9.4	10.7	11.9	14.9	16.5
LAT09716	JUNCTION	0.0	0.0	0.0	0.0	0.1
LAT10698	JUNCTION	0.0	0.0	0.0	0.3	0.7
LAT10900	JUNCTION	0.0	0.0	0.3	2.5	3.6

Node	Node Type	2yr	5yr	10yr	50yr	100yr
LAT10921	JUNCTION	0.0	0.0	0.0	0.2	0.3
LAT11032	JUNCTION	0.0	0.0	0.1	0.4	0.6
LAT11229	JUNCTION	0.0	0.2	0.7	3.7	5.5
LAT11434	JUNCTION	0.0	0.0	0.0	0.3	1.4
LAT11462	JUNCTION	0.0	0.0	0.0	0.0	0.0
LAT11661	JUNCTION	13.0	15.3	17.4	22.2	24.6
LAT11890	JUNCTION	0.0	0.0	0.0	0.3	0.8
LAT12512	JUNCTION	0.0	0.0	0.0	2.3	4.3
LAT12707	JUNCTION	0.0	0.0	0.1	3.8	5.7
LAT12732	JUNCTION	0.0	0.0	0.0	0.1	0.1
LAT12859	JUNCTION	0.0	0.0	0.0	0.7	1.5
LAT12939	JUNCTION	0.0	0.0	0.0	0.3	0.9
LAT13414	JUNCTION	0.0	0.0	0.0	0.0	0.0
LAT13444	JUNCTION	0.0	0.0	0.0	0.0	0.0
LAT13499	JUNCTION	4.0	5.2	6.5	9.4	10.9
LAT13628	JUNCTION	4.8	6.9	9.5	16.3	19.7
LAT14160	JUNCTION	1.1	2.2	3.8	10.5	14.4
LAT14208	JUNCTION	0.3	0.6	1.0	2.7	3.7
LAT14445	JUNCTION	0.0	0.0	0.3	4.1	6.9
LAT14465	JUNCTION	0.0	0.0	0.0	0.3	0.5
LAT14836	JUNCTION	0.0	0.0	0.0	0.0	0.2
LAT14921	JUNCTION	0.0	0.2	0.4	1.9	2.4
LAT14936	JUNCTION	0.3	0.6	1.0	2.4	2.9
LAT15104	JUNCTION	0.1	0.4	0.9	3.0	3.8
LAT15595	JUNCTION	0.4	0.8	1.5	4.1	4.8
LAT15699	JUNCTION	0.0	0.0	0.0	0.0	0.0
LAT15930	JUNCTION	0.0	0.0	0.0	1.2	2.5
LAT16157	JUNCTION	0.0	0.0	0.0	1.2	1.9
LAT16485	JUNCTION	0.0	0.0	0.0	1.5	3.3
LAT16687	JUNCTION	0.0	0.0	0.0	4.7	8.4
LAT16728	JUNCTION	0.0	0.0	0.0	0.0	0.1
LAT16949	JUNCTION	0.0	0.0	0.0	0.0	0.0
LAT18178	JUNCTION	0.0	0.0	0.0	0.1	0.8
LAT18572	JUNCTION	0.0	0.0	0.0	0.6	1.4
LUTHER_PARK_EAST	STORAGE	1.4	1.9	2.7	7.7	10.7
LUTHER_PARK_WEST	STORAGE	3.1	4.4	6.0	12.1	14.8
MAPLE_ELEMENTARY	STORAGE	0.1	0.2	0.3	0.6	0.8
MOON_POND	STORAGE	3.0	4.8	7.4	20.7	29.1
O100	OUTFALL	0.3	0.4	0.5	1.5	2.2
O105	OUTFALL	0.9	1.4	1.9	4.5	6.2
O110	OUTFALL	0.3	0.4	0.5	1.1	1.5
O115	OUTFALL	0.4	0.5	0.7	1.2	1.6
O120	OUTFALL	3.7	5.1	6.5	8.9	11.4
O125	OUTFALL	1.4	1.9	2.5	9.3	13.0
O130	OUTFALL	0.9	1.3	2.3	7.0	9.5
O135	OUTFALL	0.1	0.2	0.3	0.6	0.9

Node Peak Flows (cfs)

Node	Node Type	2yr	5yr	10yr	50yr	100yr
O140	OUTFALL	3.7	5.8	8.7	24.0	33.8
O145	OUTFALL	0.2	0.2	0.3	0.6	0.8
O146	OUTFALL	0.0	0.1	0.1	0.2	0.2
O150	OUTFALL	0.7	1.6	3.8	16.0	23.6
O155	OUTFALL	35.3	37.1	38.7	43.0	45.7
O160	OUTFALL	1.0	2.6	3.4	5.9	7.7
O165	OUTFALL	0.1	0.1	0.2	0.3	0.5
O170	OUTFALL	0.9	1.5	2.7	9.4	14.2
O175	OUTFALL	0.4	0.6	0.8	1.5	2.0
O180	OUTFALL	0.1	0.1	0.1	0.3	0.3
O185	OUTFALL	0.2	0.2	0.3	0.5	0.7
O186	OUTFALL	0.7	1.1	1.6	4.1	5.9
O190	OUTFALL	0.2	0.3	0.4	0.7	0.9
O195	OUTFALL	3.7	4.8	6.0	9.6	11.8
O200	OUTFALL	0.2	0.3	0.4	0.9	1.3
O205	OUTFALL	0.7	1.1	1.5	2.8	3.8
O210	OUTFALL	4.0	4.8	5.5	6.6	7.2
O215	OUTFALL	1.0	1.4	2.0	5.6	8.3
O399	OUTFALL	6.8	8.3	10.2	16.0	19.3
O400	OUTFALL	14.2	16.8	18.7	21.1	22.1
O405	OUTFALL	1.8	4.8	7.9	18.1	23.7
O410	OUTFALL	0.7	0.8	0.9	1.0	1.0
O415	OUTFALL	9.5	17.8	31.0	98.8	141.5
O416	OUTFALL	1.4	1.5	1.7	1.8	1.9
O417	OUTFALL	1.5	2.2	3.1	6.5	8.5
O420	OUTFALL	2.3	5.9	11.0	39.3	58.9
O425	OUTFALL	0.4	0.6	0.8	1.7	2.2
O430	OUTFALL	13.5	14.9	16.2	18.0	19.0
O431	OUTFALL	6.8	8.8	10.8	15.9	19.0
O432	OUTFALL	3.0	3.4	3.7	4.2	4.5
O435	OUTFALL	3.5	4.6	5.7	9.4	11.4
O440	OUTFALL	19.9	20.8	21.8	24.1	25.6
O445	OUTFALL	8.9	11.8	16.3	32.8	42.7
O450	OUTFALL	6.8	7.4	7.9	9.0	9.6
O455	OUTFALL	1.1	1.3	1.4	1.7	1.8
O460	OUTFALL	17.4	28.8	41.7	94.5	129.2

Detention Rating Curves

Moon Pond Basin			
Stage	Surface Area	Storage	Discharge
(ft)	(ft^2)	(Ac-ft)	(cfs)
4687.5	0	0.00	0.00
4688	691	0.01	0.74
4689	2074	0.02	0.97
4690	6333	0.02	2.68
4691	9437	0.03	**
4692	12139	0.54	**
4692.6	13758	0.73	3.98
4693	14838	0.85	10.88
4694	18077	1.23	**
4694.3	19417	1.36	47.56
4695	22543	1.69	88.63
4696	22543	2.21	693.98

Overtopping Elevation: 4694.3

Luther Park East			
Stage	Surface Area	Storage	Discharge[1]
(ft)	(ft^2)	(Ac-ft)	(cfs)
4688	0	0.00	--
4689	3318	0.05	--
4690	6636	0.10	--
4691	13520	0.33	--
4692	19723	0.71	--
4692.6	21852	1.00	--
4693	23271	1.20	--
4694	34584	1.86	--
4695	34584	2.66	--

1 - Discharge curve generated using pipe and weir overflow routing elements (Overtopping Elev: 4692.6)

Glenmere Lake			
Stage	Surface Area	Storage	Discharge
(ft)	(ft^2)	(Ac-ft)	(cfs)
4751.01	0	0.00	0.00
4753.5	73479	2.80	0.00
4755.9	144302	5.51	48.90
4755.91	144597	5.52	48.98
4756	147253	5.62	56.50
4757	169241	9.25	70.36
4758	184920	13.32	84.23
4759	201062	17.75	98.09
4759.7	201062	20.98	107.80
4760	201062	22.37	317.90
4761	201062	26.98	1992.60

Overtopping Elevation: 4759.7

Maple Elementary			
Stage	Surface Area	Storage	Discharge
(ft)	(ft^2)	(Ac-ft)	(cfs)
4707.2	0	0.00	0.00
4708	6530	0.04	0.50
4709	22333	0.35	0.70
4709.5	28868	0.65	0.80
4710	35403	1.01	5.10
4711	35403	1.82	354.90

Overtopping Elevation: 4709.5

Luther Park West			
Stage	Surface Area	Storage	Discharge[1]
(ft)	(ft^2)	(Ac-ft)	(cfs)
4691.9	0	0.00	--
4692	297	0.00	--
4693	3272	0.05	--
4694	6247	0.10	--
4695	17072	0.36	--
4696	26999	0.86	--
4697	38149	1.60	--
4698	49690	2.61	--
4698.1	50780	2.66	--
4699	60594	3.87	--
4700	70359	5.37	--

1 - Discharge curve generated using pipe and weir overflow routing elements (Overtopping Elev: 4698.1)

NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 1 - 21ST STREET RD. & 21ST AVE

FLOW DEPTH

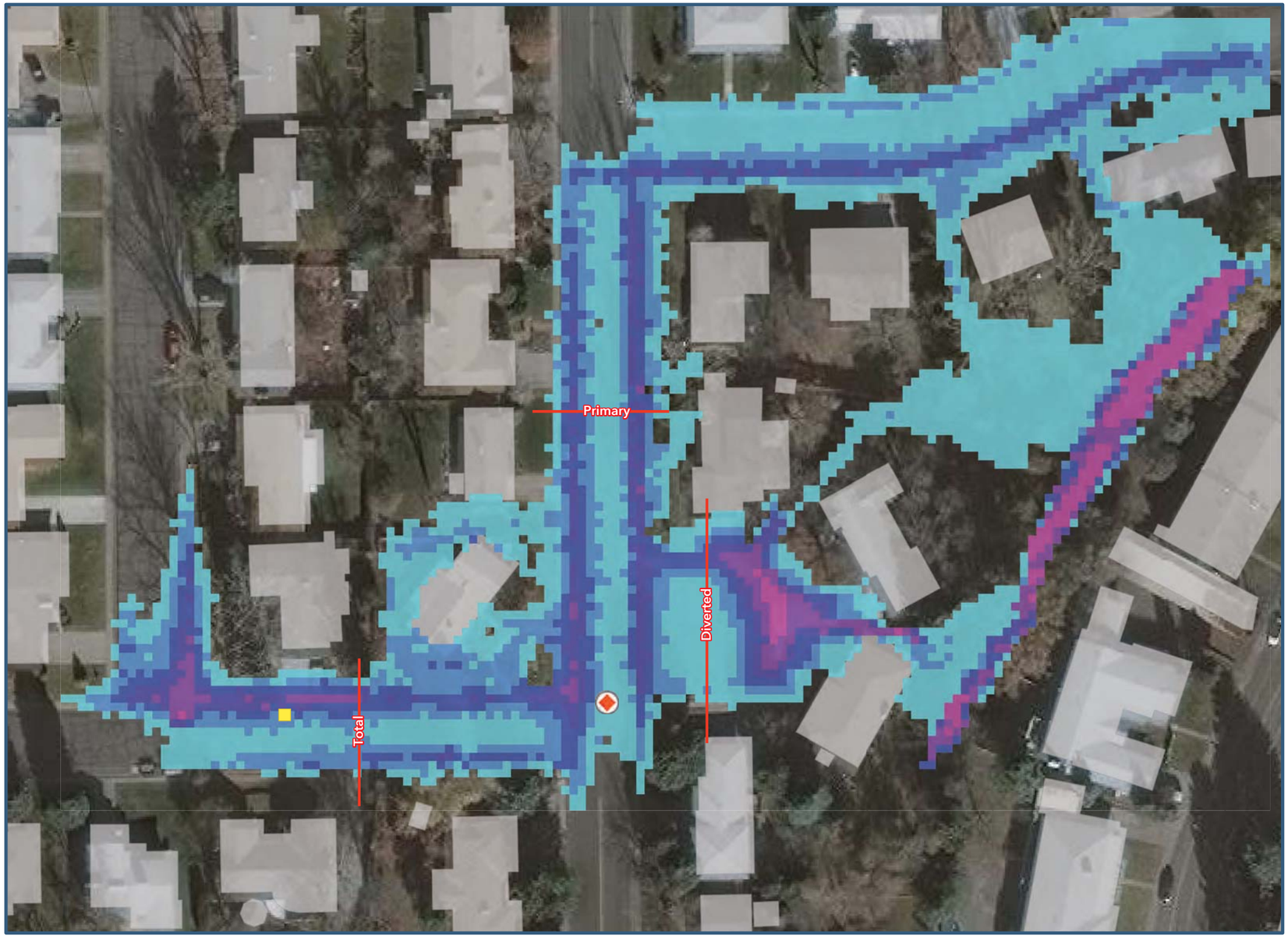
0" 3" 6" 9" 12" 1.5' 3'+

INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW

DIVERSION ELEMENT J002.2

100-YR INFLOW: 220 cfs

Total Inflow	Diverted Inflow
0	0
25	10
50	29
75	46
100	63
150	95
200	125
250	150



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NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 2 - 16TH ST & 16TH AVE CT

FLOW DEPTH

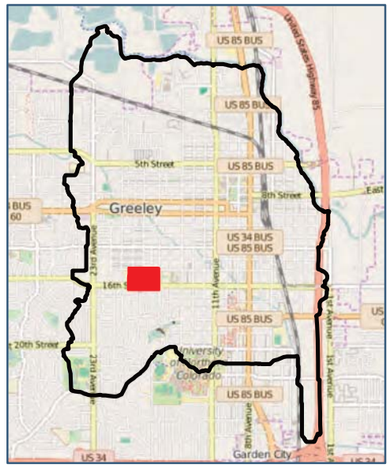
0" 3" 6" 9" 12" 1.5' 3'+

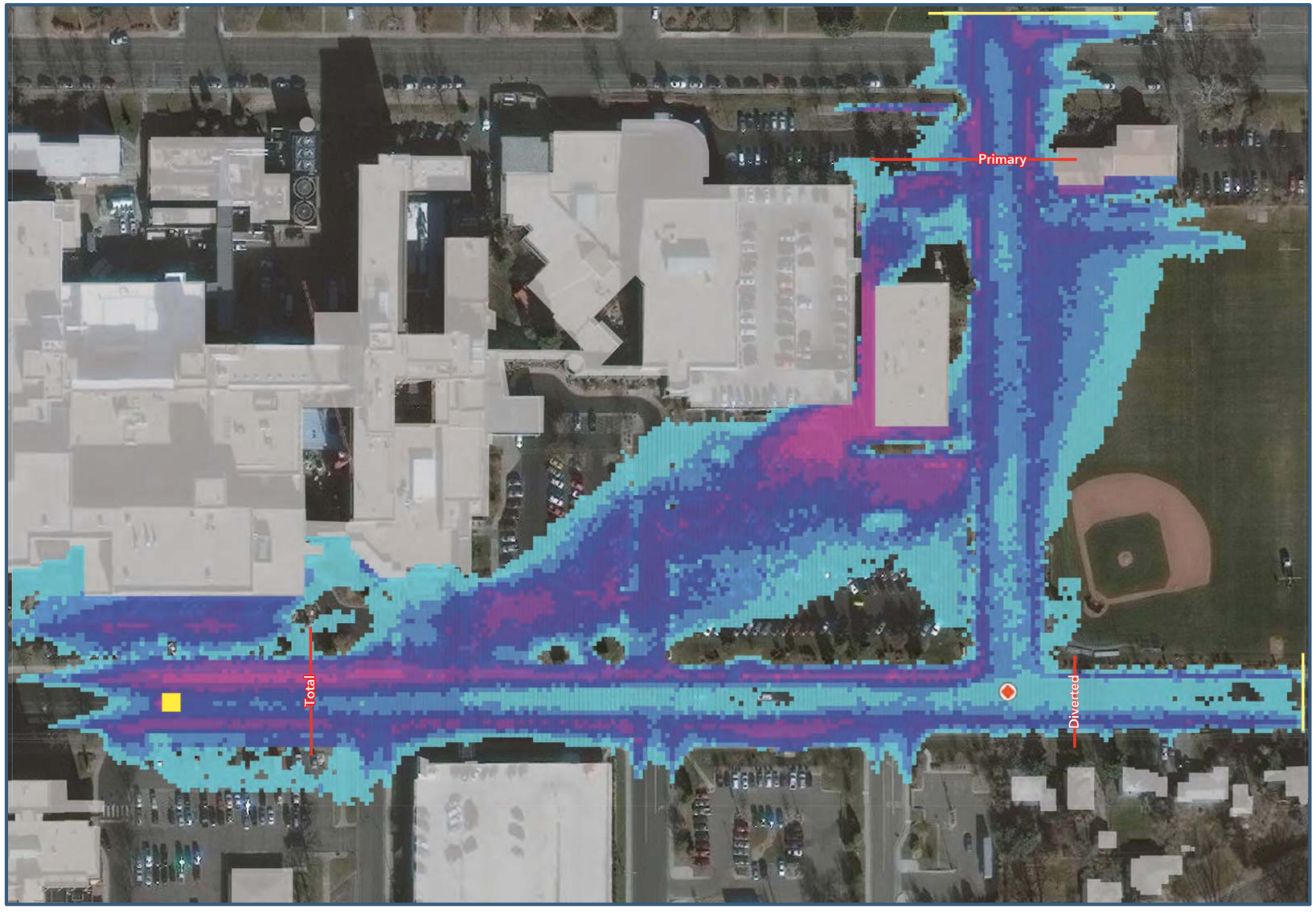
INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW

DIVERSION ELEMENT J904.6

100-YR INFLOW: 345 cfs

Total Inflow	Diverted Inflow
0	0
25	7
50	9
75	10
100	10
150	11
200	12
250	12
350	14





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NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 3 - 16TH ST & 23RD AVE

FLOW DEPTH

0" 3" 6" 9" 12" 1.5' 3'+

INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW

DIVERSION ELEMENT J003.6

100-YR INFLOW: 196 cfs

Total Inflow	Diverted Inflow
0	0
25	6
50	11
75	17
100	22
150	30
200	37
250	45
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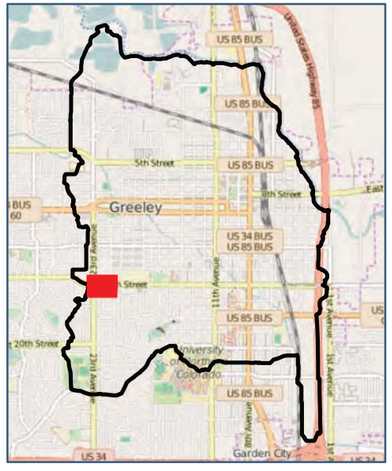

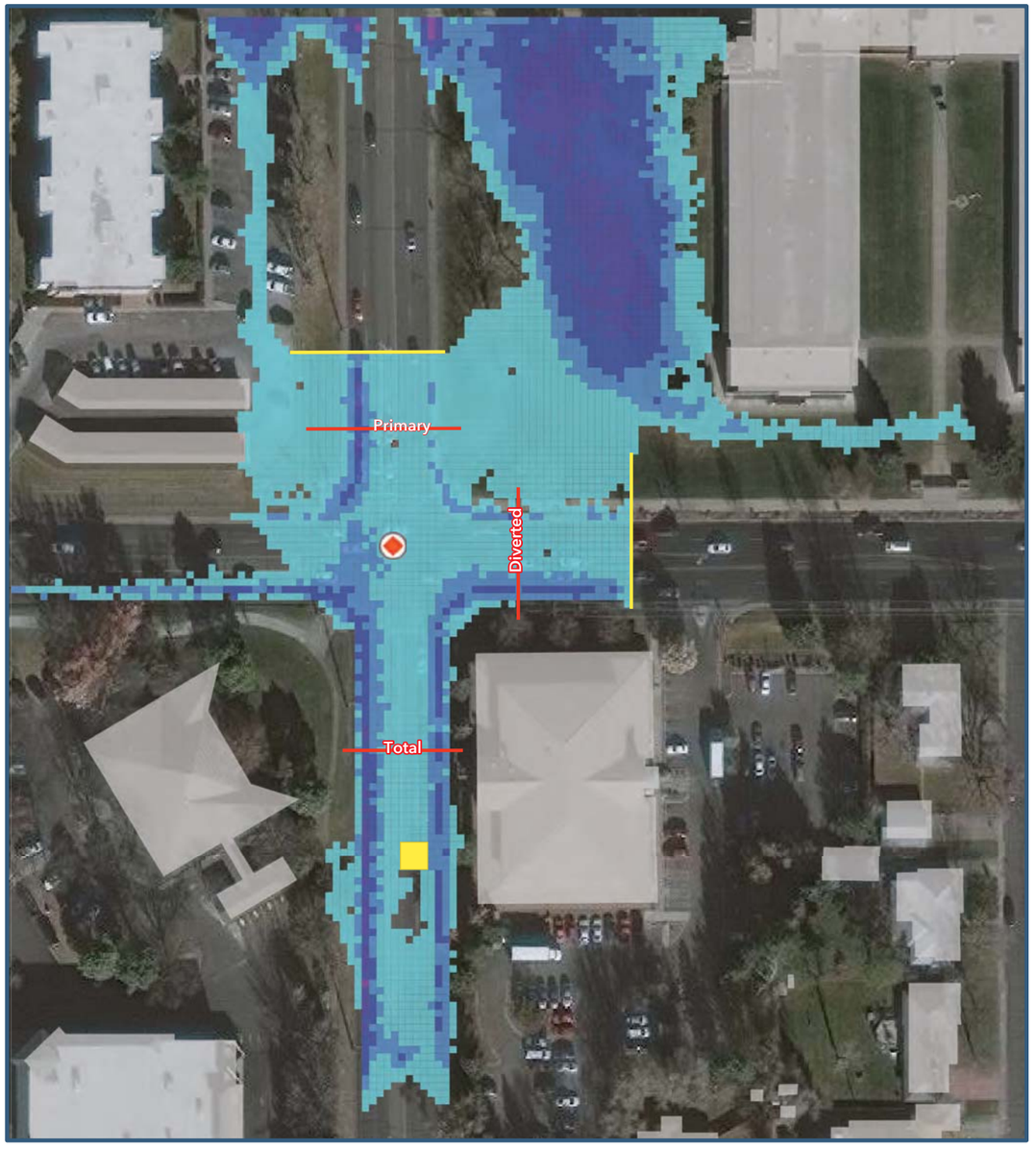

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NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 4 - 17TH ST & 21ST AVE

FLOW DEPTH

0" 3" 6" 9" 12" 1.5' 3'+

INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW

DIVERSION ELEMENT J804.1

100-YR INFLOW: 70 cfs

Total Inflow	Diverted Inflow
0	0
25	20
50	38
75	56
100	70
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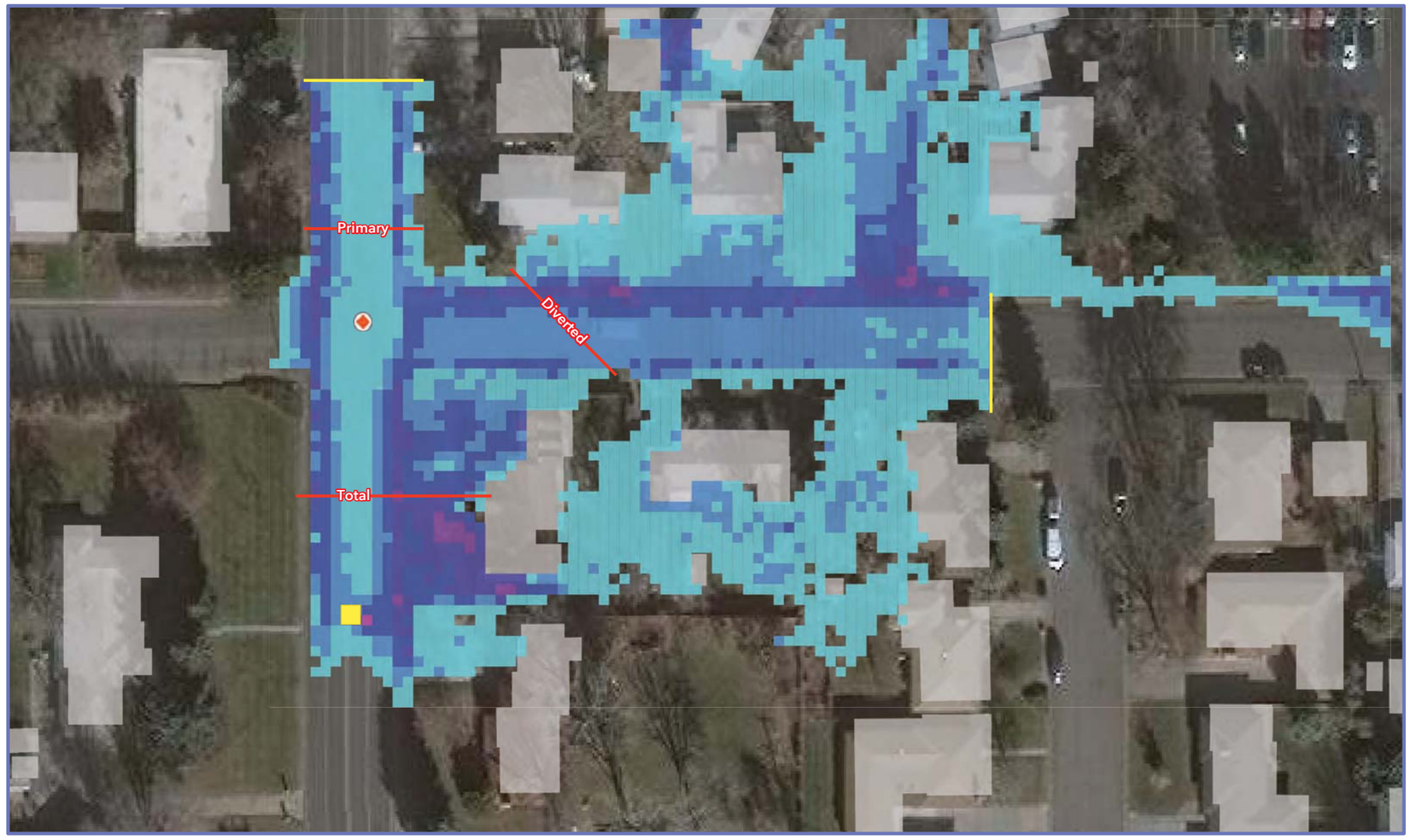

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NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 5 - 18TH ST & S 8TH AVE

FLOW DEPTH

0" 3" 6" 9" 12" 1.5' 3'+

INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW

DIVERSION ELEMENT J912.1
100-YR INFLOW: 52 cfs

Total Inflow	Diverted Inflow
0	0
24	0
49	25
73	37
96	50
140	76
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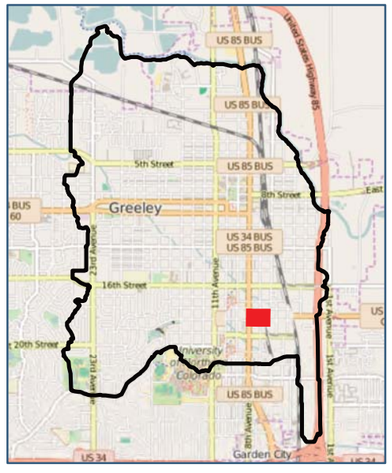

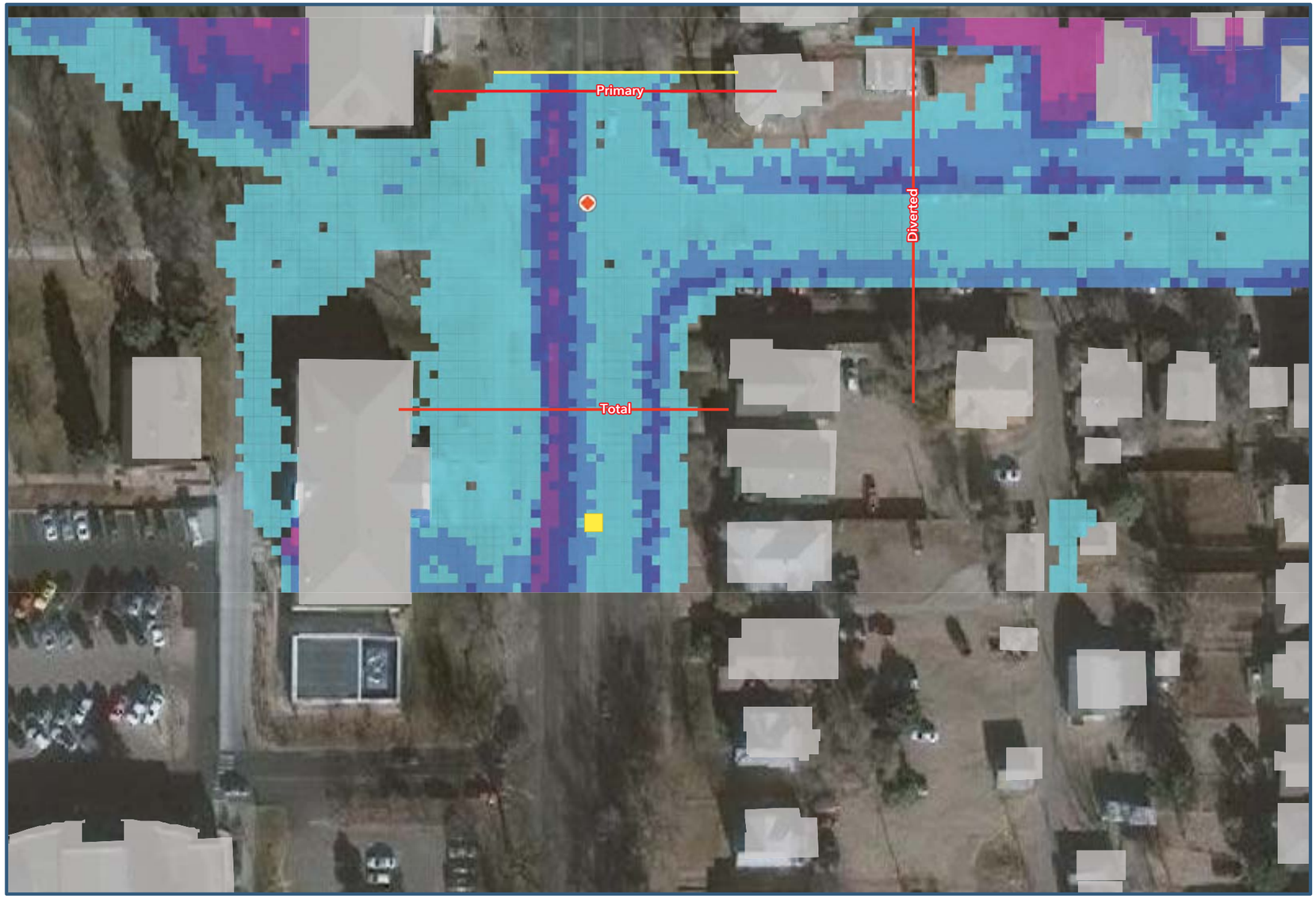

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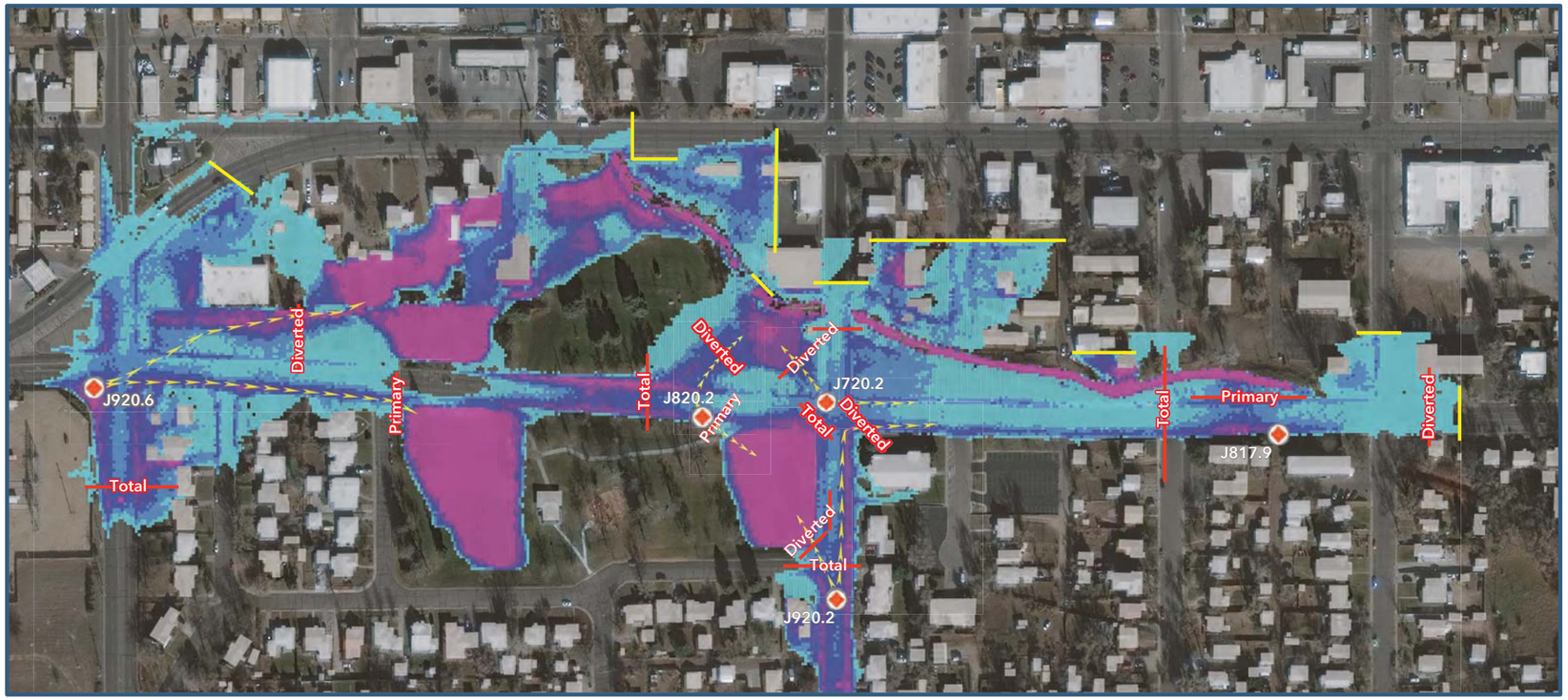
NORTH GREELEY & DOWNTOWN MASTER PLAN

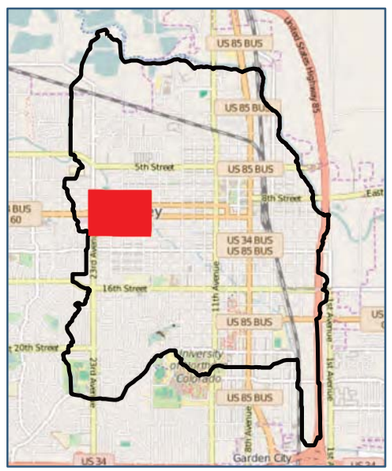
FLO-2D DIVERSION CURVE
AREA 6 - 10TH ST & 21ST AVE

FLOW DEPTH

0" 3" 6" 9" 12" 1.5' 3'+

INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW





DIVERSION ELEMENT J920.6	
100-YR INFLOW: 183 cfs	
Total Inflow	Diverted Inflow
0	0
25	8
50	20
75	38
100	54
150	93
200	133
250	175
300	219

DIVERSION ELEMENT J820.2	
100-YR INFLOW: 127 cfs	
Total Inflow	Diverted Inflow
0	0
25	16
50	38
75	58
98	78
145	120
198	162
250	205
275	240

DIVERSION ELEMENT J720.2	
100-YR INFLOW: 175 cfs	
Total Inflow	Diverted Inflow
0	0
13	3
29	10
46	21
73	33
119	54
162	77
192	98
239	120

DIVERSION ELEMENT J817.9	
100-YR INFLOW: 156 cfs	
Total Inflow	Diverted Inflow
0	0
25	10
50	12
75	14
100	15
150	17
200	20
250	22
300	24

ICON ENGINEERING, INC.

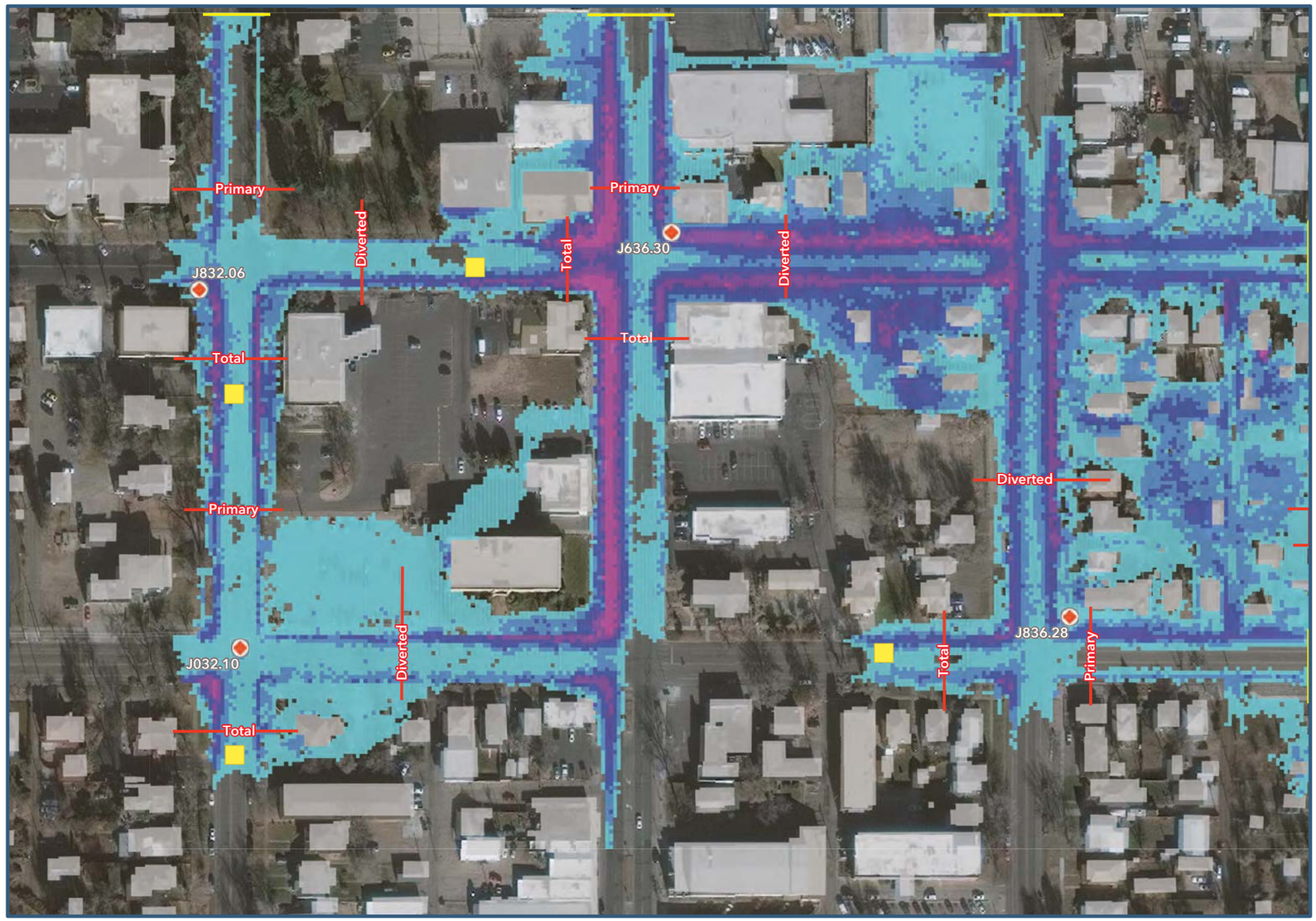
NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 20 - 14TH ST & 8TH AVE

FLOW DEPTH

0" 3" 6" 9" 12" 1.5' 3'+

INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW



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DIVERSION ELEMENT J836.28	
100-YR INFLOW: 119 cfs	
Total Inflow	Diverted Inflow
0	0
22	11
38	18
71	28
135	50
180	71

DIVERSION ELEMENT J832.06	
100-YR INFLOW: 23 cfs	
Total Inflow	Diverted Inflow
0	0
18	11
32	24
60	50
115	98
165	135

DIVERSION ELEMENT J636.30	
100-YR INFLOW: 187 cfs	
Total Inflow	Diverted Inflow
0	0
35	11
48	12
93	32
168	80
251	135

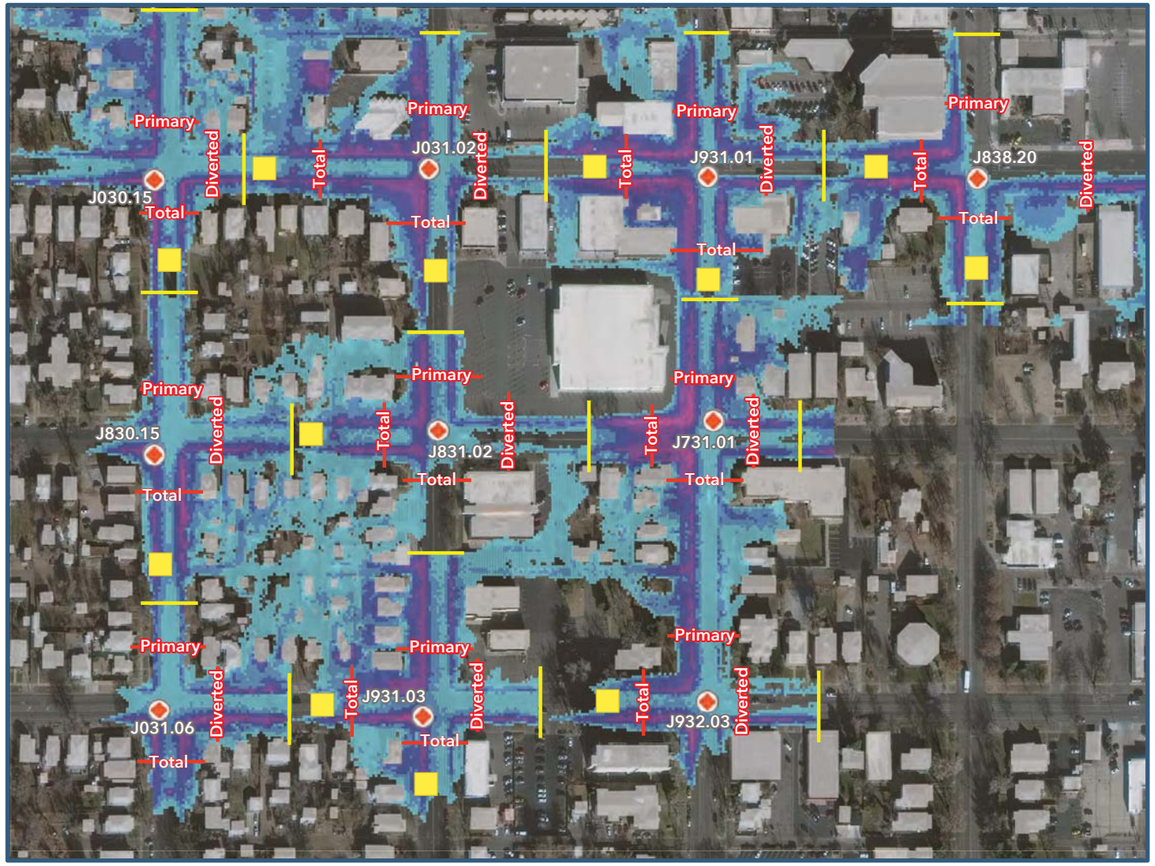
NORTH GREELEY & DOWNTOWN MASTER PLAN

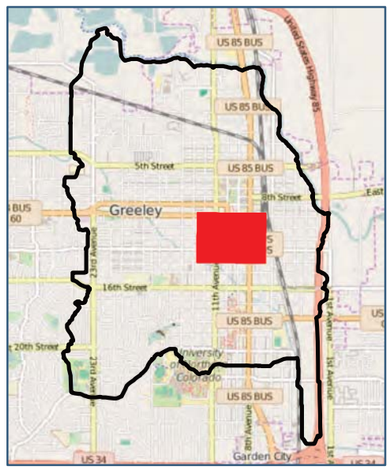
FLO-2D DIVERSION CURVE
AREA 21 - 13TH ST & 11TH AVE

FLOW DEPTH

0" 3" 6" 9" 12" 1.5' 3'+

INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW





ICONENGINEERING, INC.

DIVERSION ELEMENT J031.06	
100-YR INFLOW: 169 cfs	
Total Inflow	Diverted Inflow
0	0
50	4
100	15
250	86
495	242

DIVERSION ELEMENT J830.15	
100-YR INFLOW: 616 cfs	
Total Inflow	Diverted Inflow
0	0
54	33
106	82
262	195
500	345

DIVERSION ELEMENT J030.15	
100-YR INFLOW: 35 cfs	
Total Inflow	Diverted Inflow
0	0
70	31
100	47
317	154
660	270

DIVERSION ELEMENT J931.03	
100-YR INFLOW: 350 cfs	
Total Inflow	Diverted Inflow
0	0
50	9
96	30
225	106
420	217

DIVERSION ELEMENT J831.02	
100-YR INFLOW: 225 cfs	
Total Inflow	Diverted Inflow
0	0
50	0
101	9
281	84
600	261

DIVERSION ELEMENT J031.02	
100-YR INFLOW: 193 cfs	
Total Inflow	Diverted Inflow
0	0
28	0
50	2
104	15
199	50

DIVERSION ELEMENT J932.03	
100-YR INFLOW: 297 cfs	
Total Inflow	Diverted Inflow
0	0
50	16
100	24
250	48
470	110

DIVERSION ELEMENT J731.01	
100-YR INFLOW: 331 cfs	
Total Inflow	Diverted Inflow
0	0
53	9
113	40
293	175
535	350

DIVERSION ELEMENT J931.01	
100-YR INFLOW:128 cfs	
Total Inflow	Diverted Inflow
0	0
33	1
65	10
145	47
295	100

DIVERSION ELEMENT J838.20	
100-YR INFLOW: 648 cfs	
Total Inflow	Diverted Inflow
0	0
20	0
40	2
115	12
750	150

NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 22 - 6TH ST & 9TH AVE

FLOW DEPTH

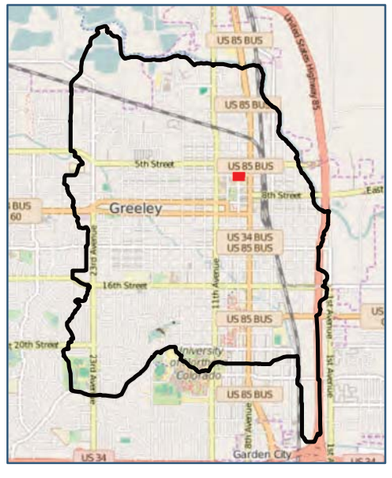
0" 3" 6" 9" 12" 1.5' 3'+

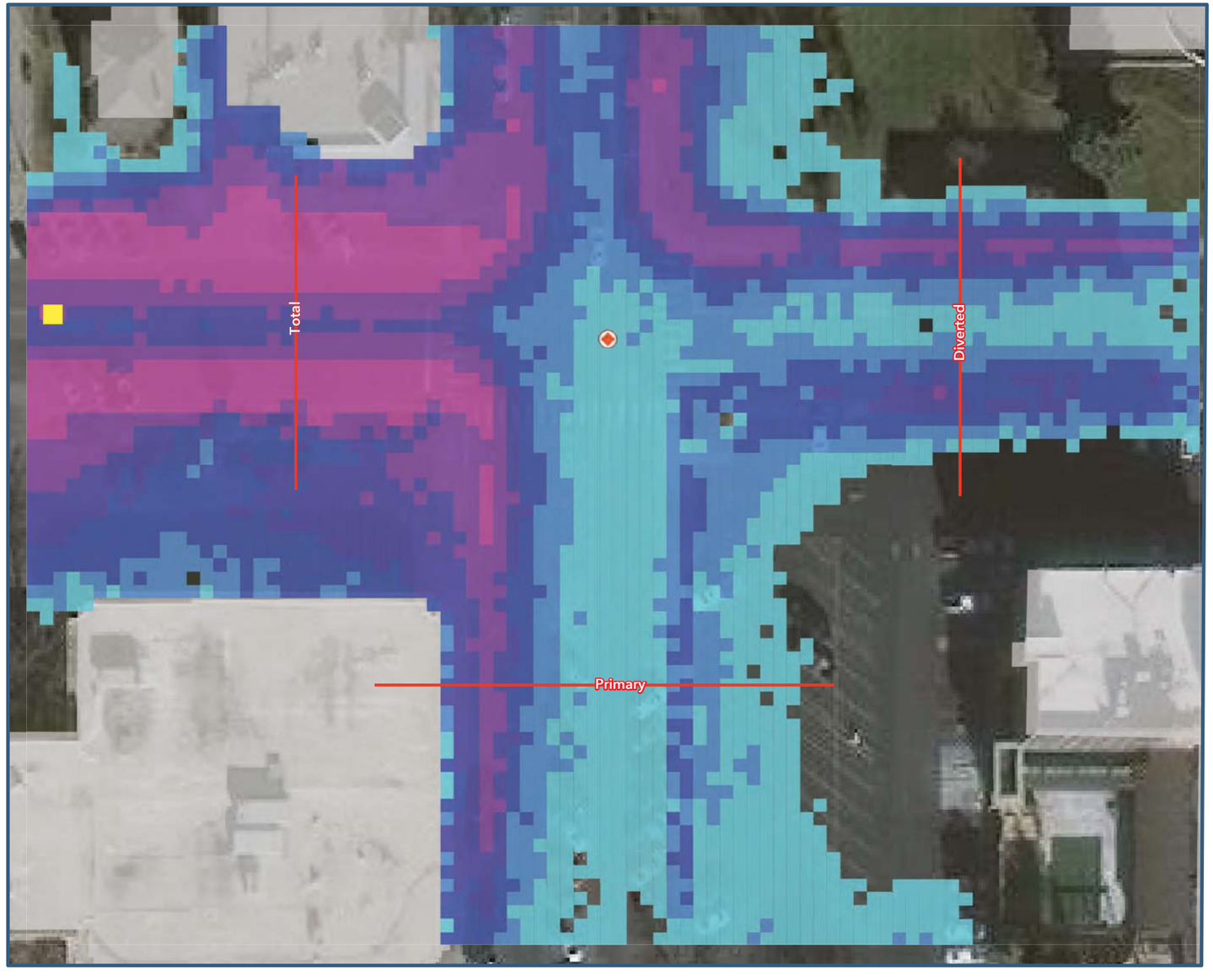
INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW

DIVERSION ELEMENT J838.05

100-YR INFLOW: 23 cfs

Total Inflow	Diverted Inflow
0	0
25	1
50	4
75	7
100	9
150	15
200	23
250	32
300	40





ICONENGINEERING, INC.

NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 23 - 8TH ST & 3RD AVE

FLOW DEPTH

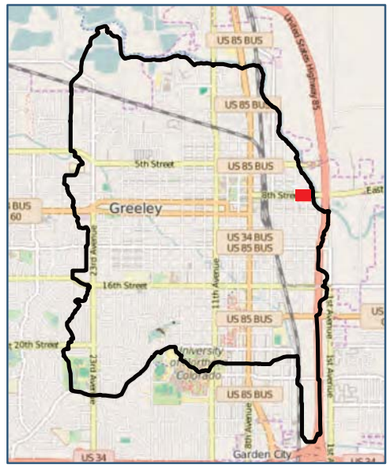
0" 3" 6" 9" 12" 1.5' 3'+

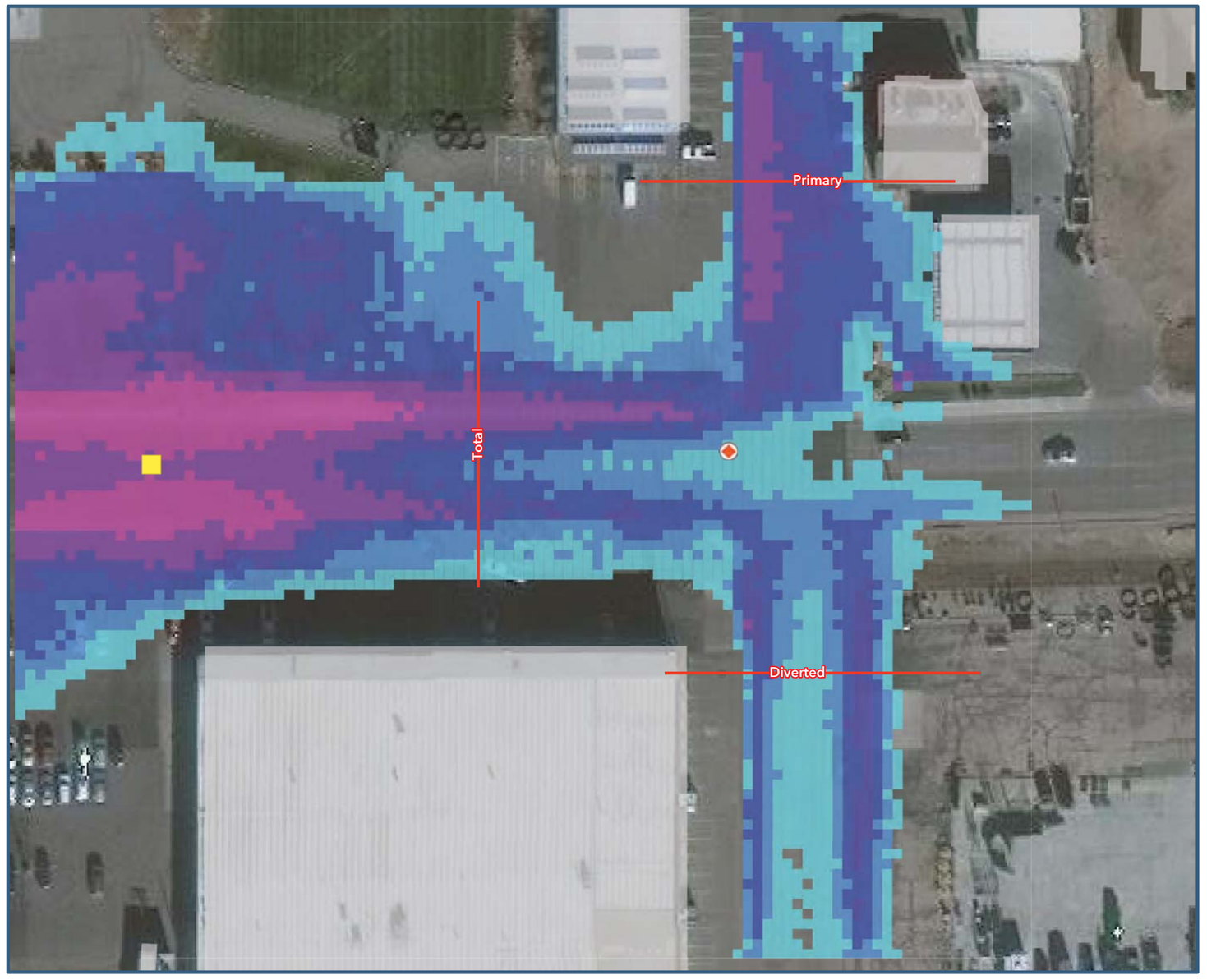
INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW

DIVERSION ELEMENT J937.09

100-YR INFLOW: 388 cfs

Total Inflow	Diverted Inflow
0	0
25	3
50	10
75	18
100	25
150	44
200	60
250	70
300	85





ICON ENGINEERING, INC.

NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 24 - 7TH ST & 18TH AVE

FLOW DEPTH

0" 3" 6" 9" 12" 1.5' 3'+

INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW

DIVERSION ELEMENT J027.15

100-YR INFLOW: 30 cfs

Total Inflow	Diverted Inflow
0	0
50	22
100	44
200	85
300	125
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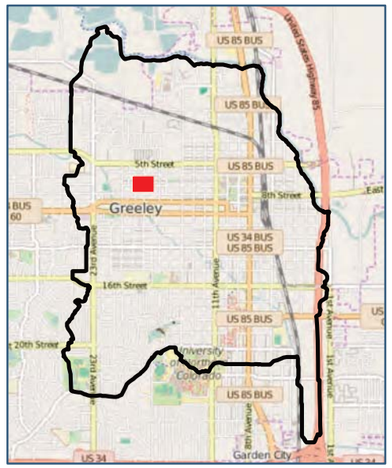
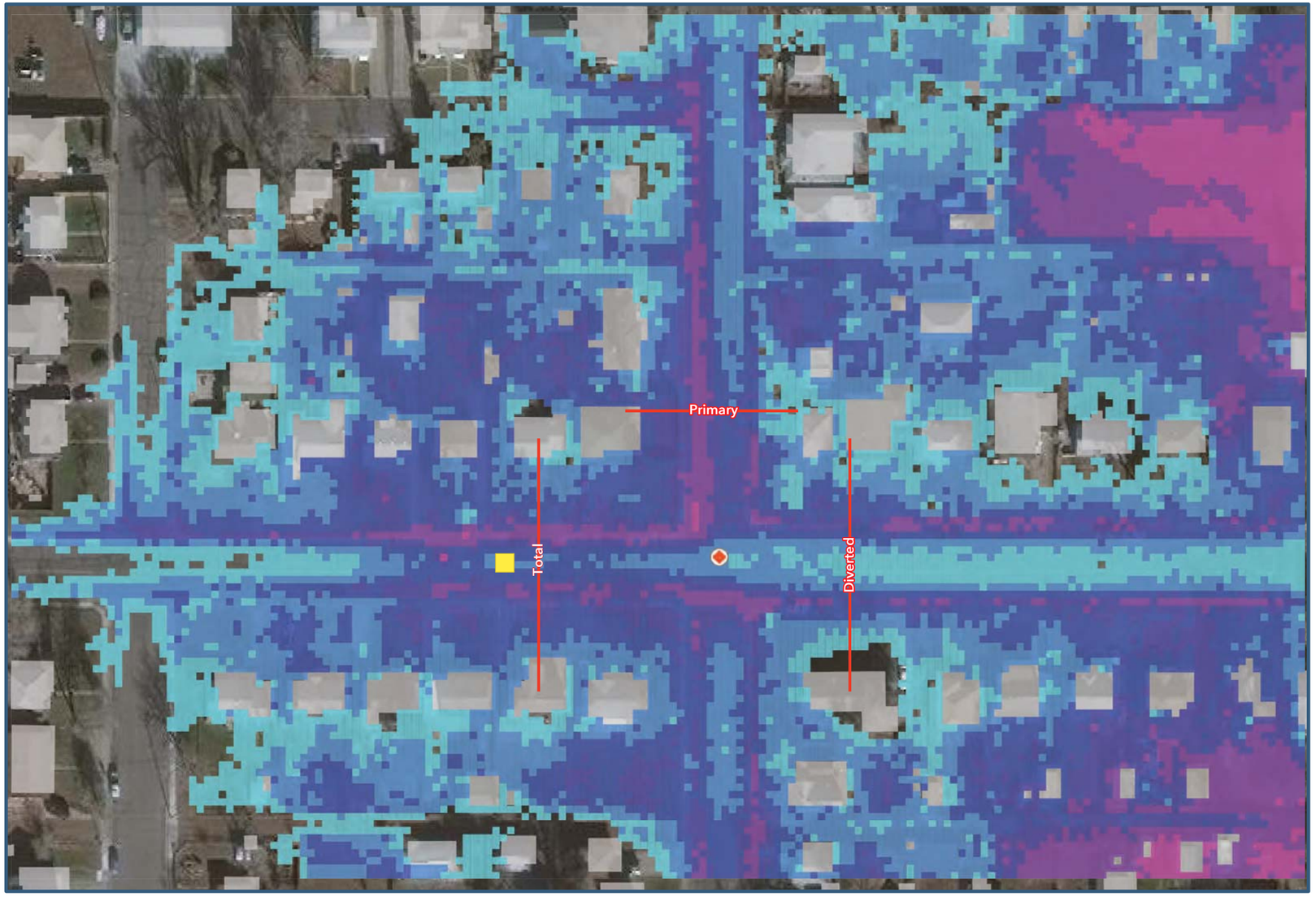




ICONENGINEERING, INC.

NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 25 - 5TH ST & 21ST AVE

FLOW DEPTH

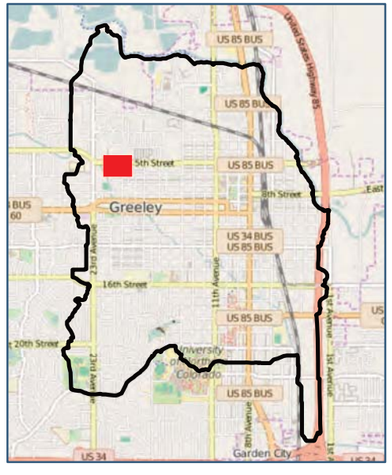
0" 3" 6" 9" 12" 1.5' 3'+

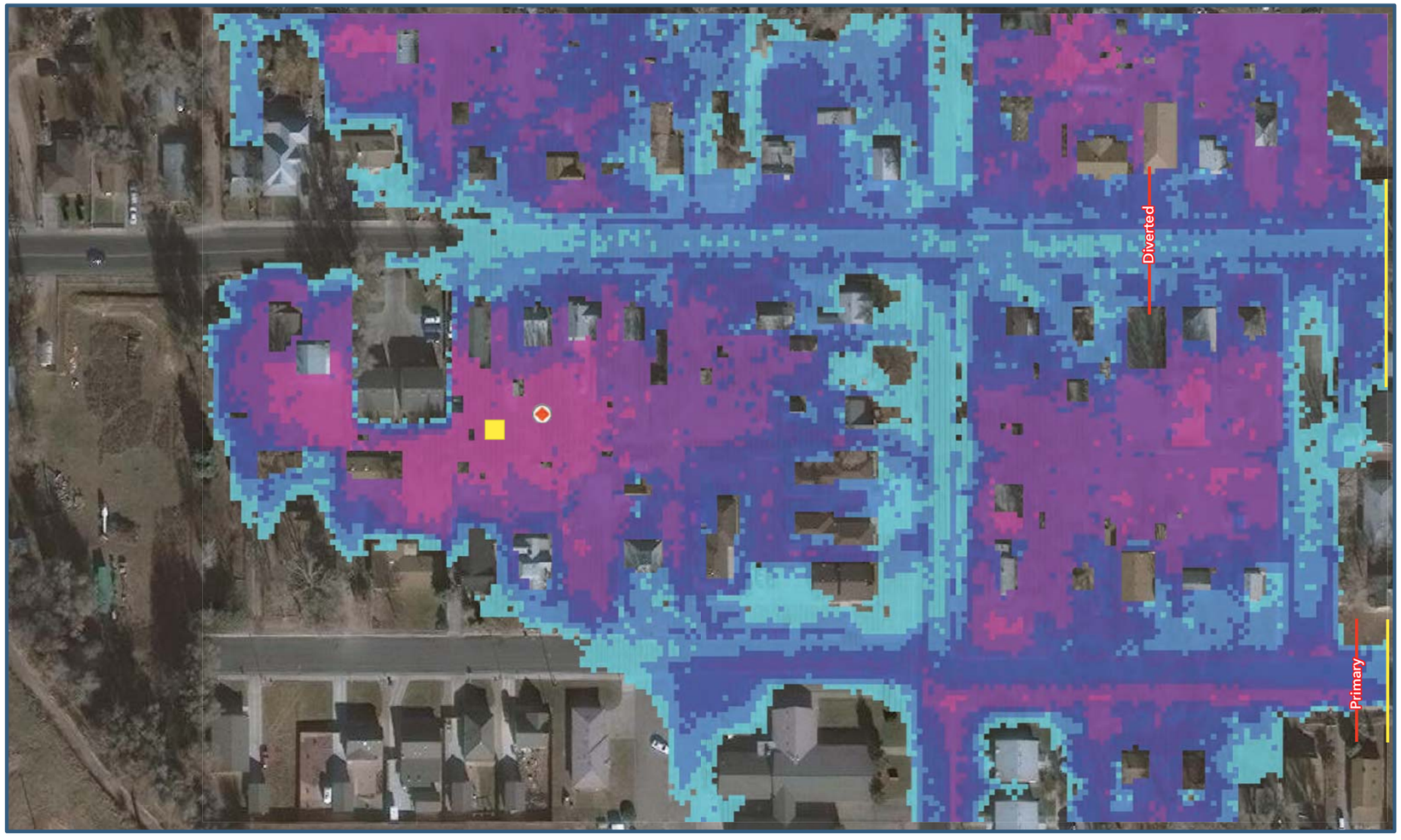
INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW

DIVERSION ELEMENT J026.05

100-YR INFLOW: 36 cfs

Total Inflow	Diverted Inflow
0	0
25	2
50	6
75	13
100	20
150	33
200	48
250	60
300	80





ICON ENGINEERING, INC.

NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 26 - 10TH ST & 13TH AVE

FLOW DEPTH

0" 3" 6" 9" 12" 1.5' 3'+

INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW

DIVERSION ELEMENT J629.01

100-YR INFLOW: 1042 cfs

Total Inflow	Diverted Inflow
0	0
50	18
87	44
190	105
390	215
725	370
1400	650
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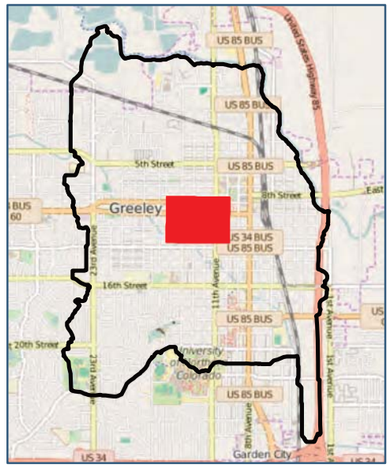


DIVERSION ELEMENT J029.01

100-YR INFLOW: 775 cfs

Total Inflow	Diverted Inflow
0	0
25	6
99	37
225	100
400	190
700	320
---	---

DIVERSION ELEMENT J030.17

100-YR INFLOW: 917 cfs

Total Inflow	Diverted Inflow
0	0
30	9
64	18
150	47
275	90
500	170
950	270

DIVERSION ELEMENT J030.14

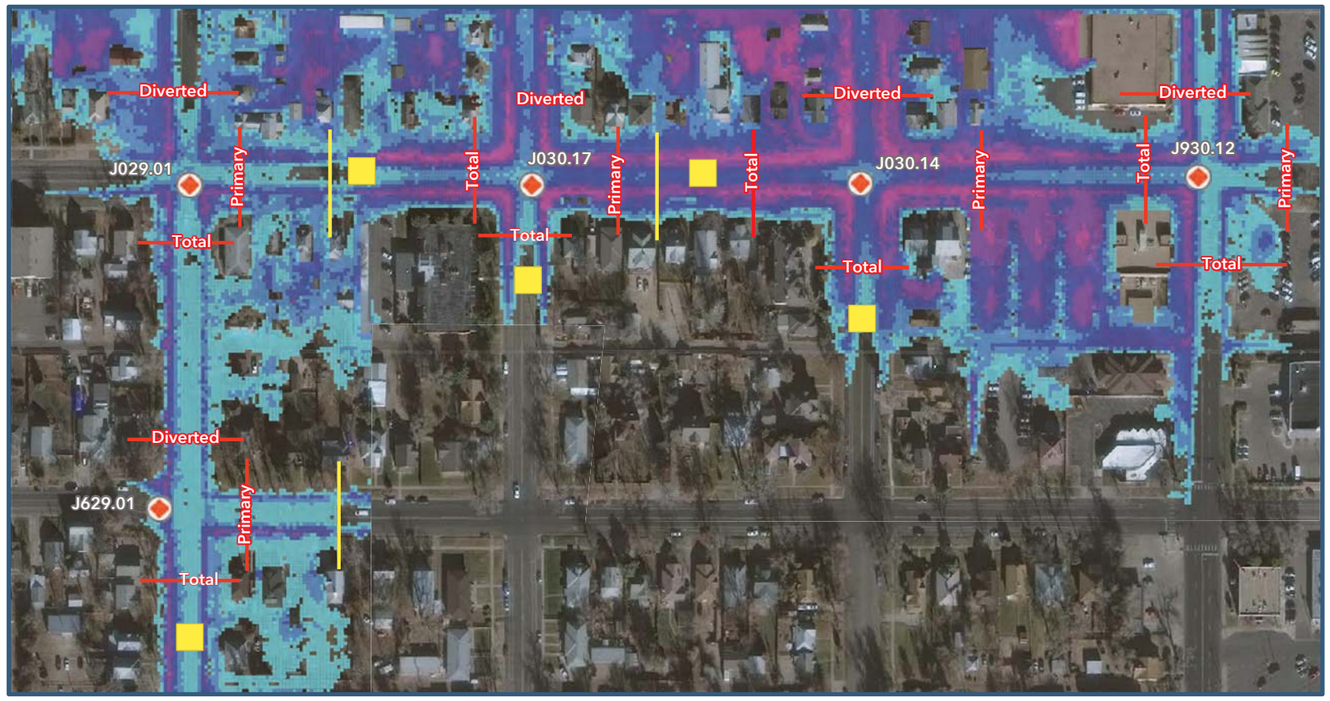
100-YR INFLOW: 696 cfs

Total Inflow	Diverted Inflow
0	0
25	0
52	15
130	35
260	75
500	150
950	225

DIVERSION ELEMENT J930.12

100-YR INFLOW: 689 cfs

Total Inflow	Diverted Inflow
0	0
15	1
40	5
110	13
210	25
425	45
950	325



ICONENGINEERING, INC.

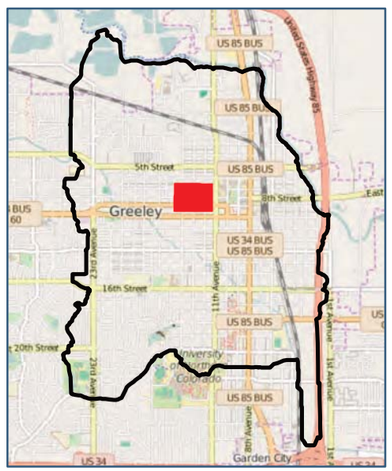
NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 27 - 9TH ST & 14TH AVE

FLOW DEPTH

0" 3" 6" 9" 12" 1.5' 3'+

INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW



DIVERSION ELEMENT J927.09

100-YR INFLOW: 766 cfs

Total Inflow	Diverted Inflow
0	0
22	0
40	0
105	26
200	78
475	230
1000	525

DIVERSION ELEMENT J927.07

100-YR INFLOW: 443 cfs

Total Inflow	Diverted Inflow
0	0
23	0
50	2
115	7
250	20
450	50
1200	140

DIVERSION ELEMENT J830.05

100-YR INFLOW: 616 cfs

Total Inflow	Diverted Inflow
0	0
26	2
47	5
115	15
225	30
425	65
850	130

DIVERSION ELEMENT J930.05

100-YR INFLOW: 269 cfs

Total Inflow	Diverted Inflow
0	0
38	0
70	3
170	12
310	27
600	70
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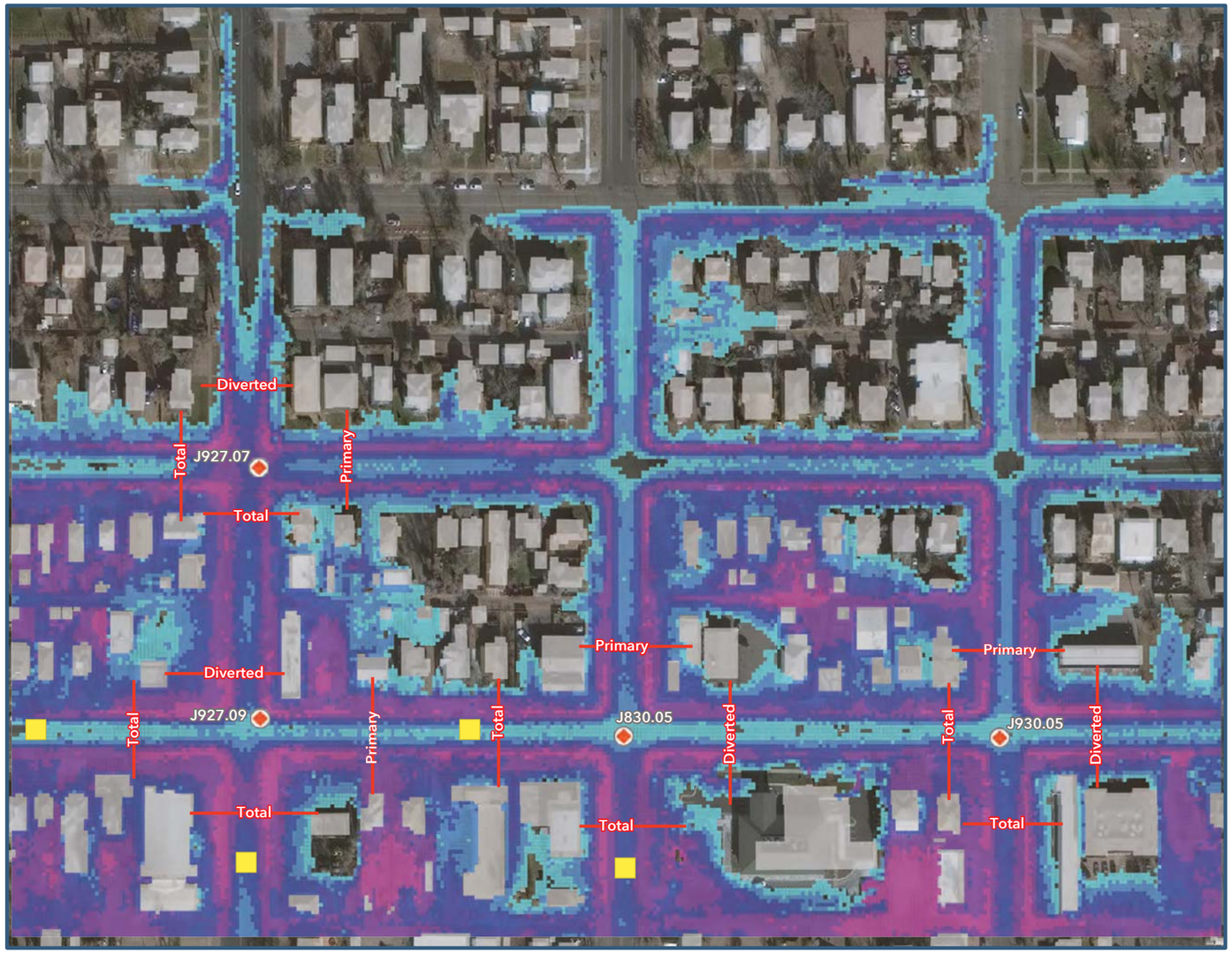


ICONENGINEERING, INC.

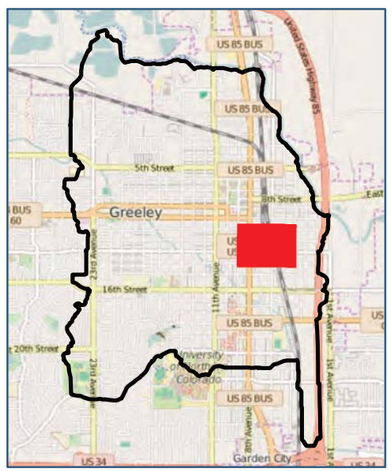
NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 28 - 13TH ST & 8TH AVE

FLOW DEPTH

0" 3" 6" 9" 12" 1.5' 3'+

INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW



DIVERSION ELEMENT J938.16

100-YR INFLOW: 847 cfs

Total Inflow	Diverted Inflow
0	0
50	23
95	47
215	145
410	290
825	575

DIVERSION ELEMENT J936.26

100-YR INFLOW: 562 cfs

Total Inflow	Diverted Inflow
0	0
45	25
85	42
190	75
325	70
650	190

DIVERSION ELEMENT J736.26

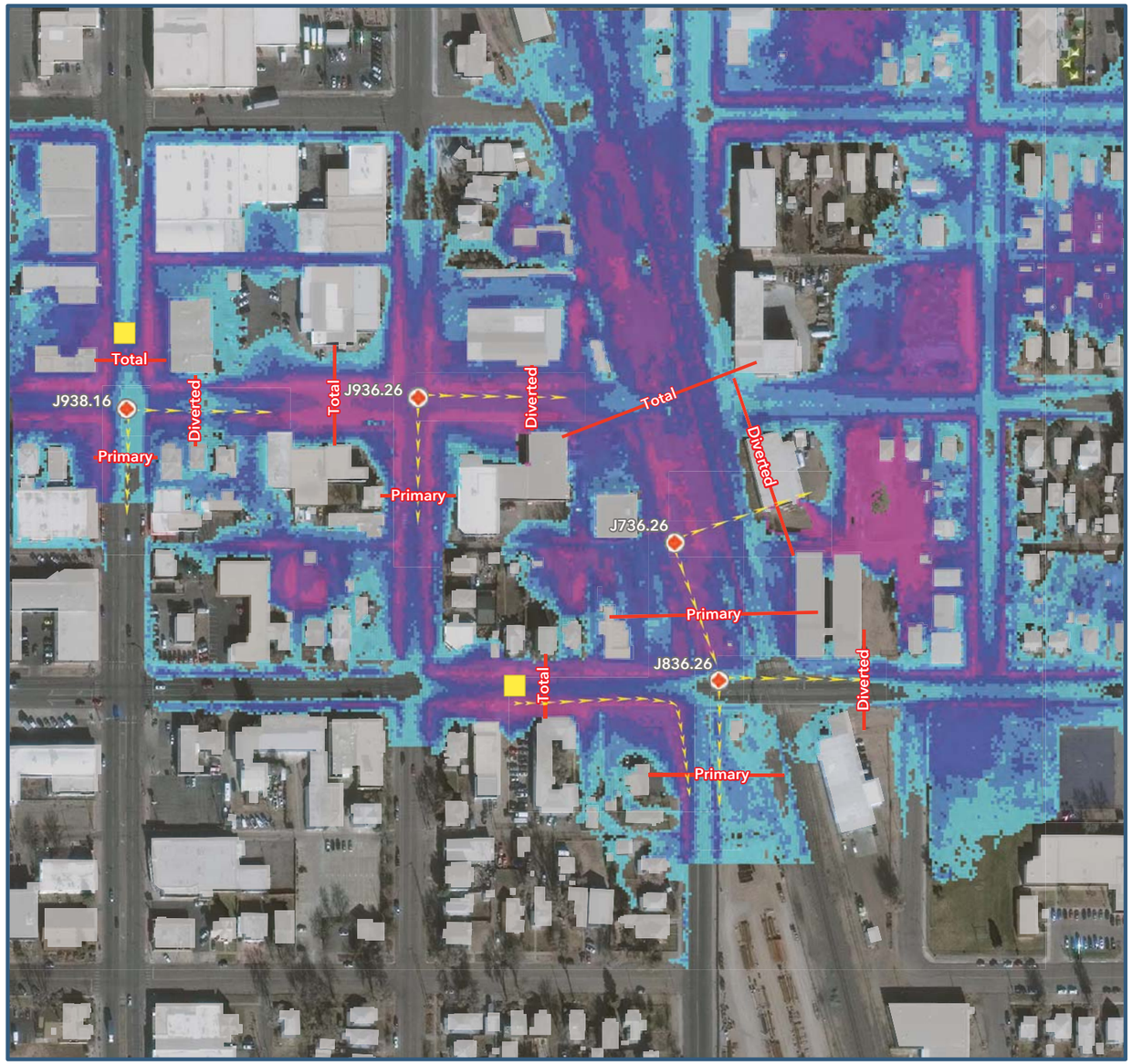
100-YR INFLOW: 125 cfs

Total Inflow	Diverted Inflow
0	0
49	33
85	40
170	62
250	190
1090	280

DIVERSION ELEMENT J836.26

100-YR INFLOW: 957 cfs

Total Inflow	Diverted Inflow
0	0
24	1
43	2
95	7
180	30
900	180



ICONENGINEERING, INC.

NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 29 - 6TH ST & 11TH AVE

FLOW DEPTH

0" 3" 6" 9" 12" 1.5' 3'+

INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW

DIVERSION ELEMENT J030.03

100-YR INFLOW: 1446 cfs

Total Inflow	Diverted Inflow
0	0
16	5
32	12
102	47
245	120
520	250
1550	650
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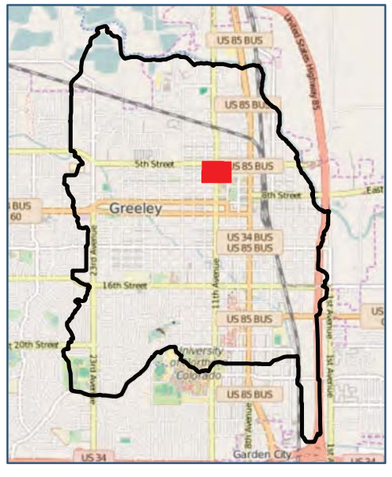

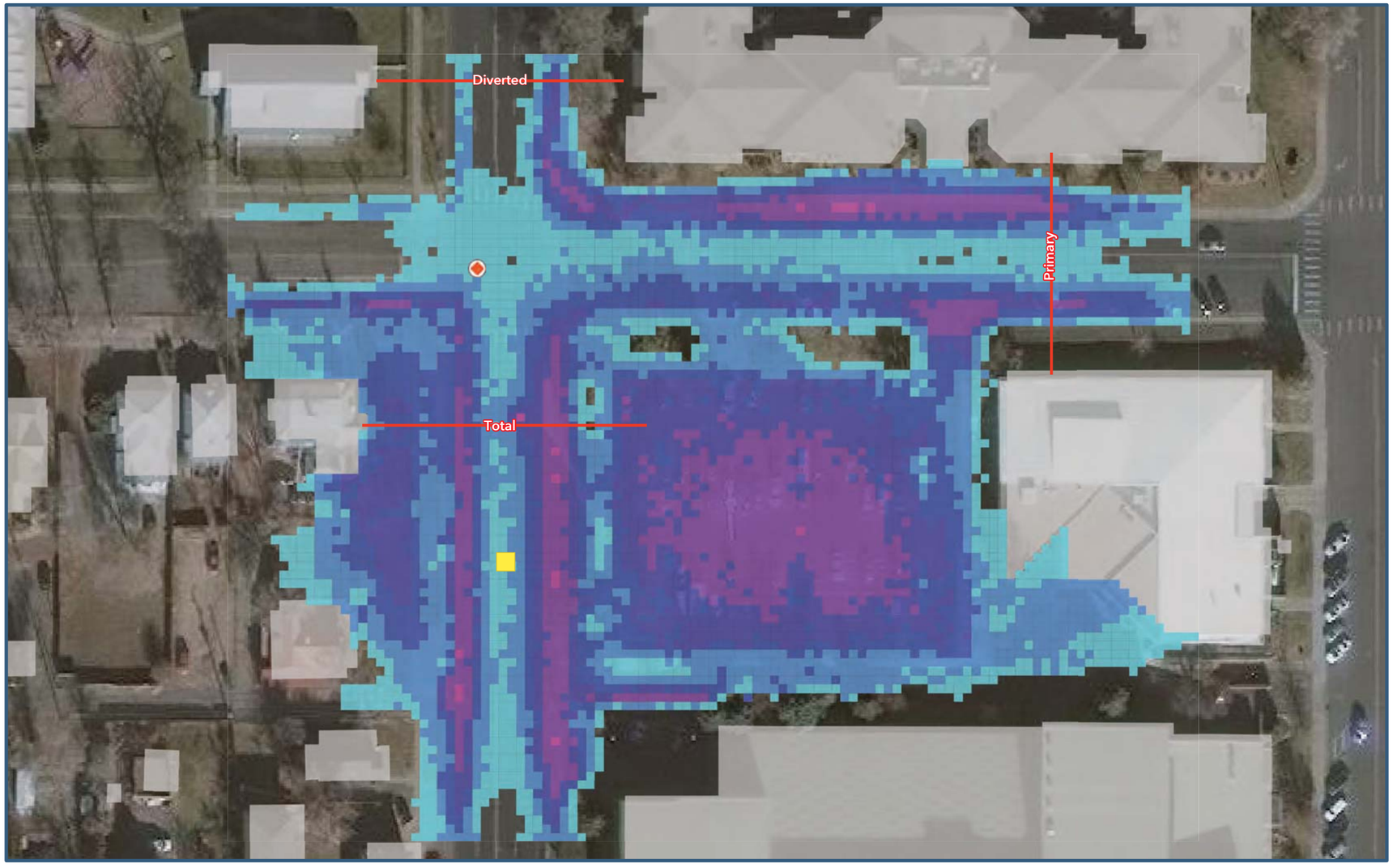

ICON ENGINEERING, INC.

NORTH GREELEY & DOWNTOWN MASTER PLAN

FLO-2D DIVERSION CURVE
AREA 30 - 14TH AVE & 4TH ST

FLOW DEPTH

0" 3" 6" 9" 12" 1.5' 3'+

INFLOW POINT
CROSS SECTION
DIVERSION ELEMENT
OUTFLOW

DIVERSION ELEMENT J826.02

100-YR INFLOW: 314 cfs

Total Inflow	Diverted Inflow
0	0
100	2
250	15
500	75
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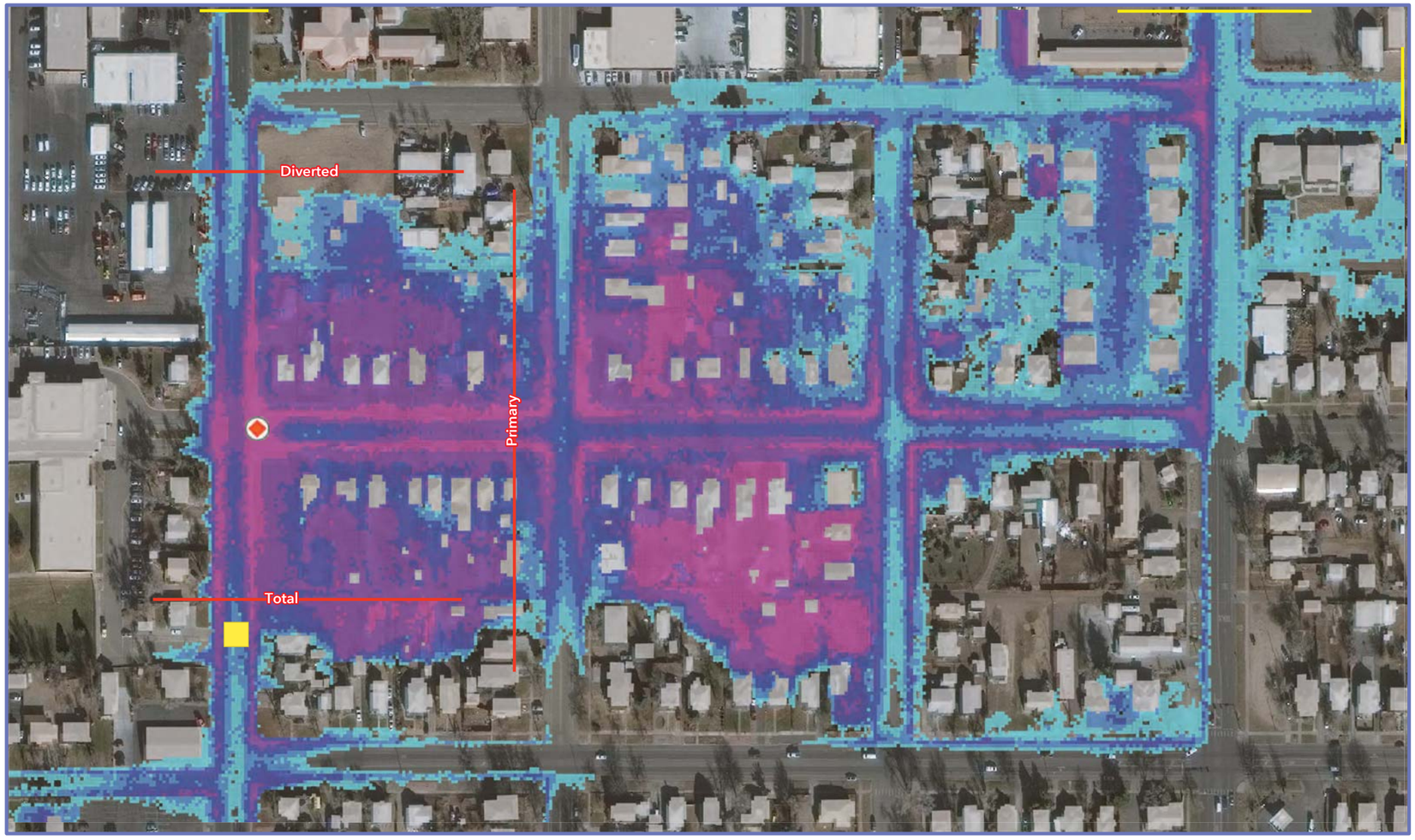
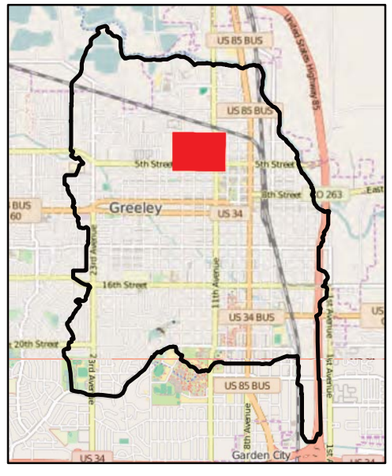
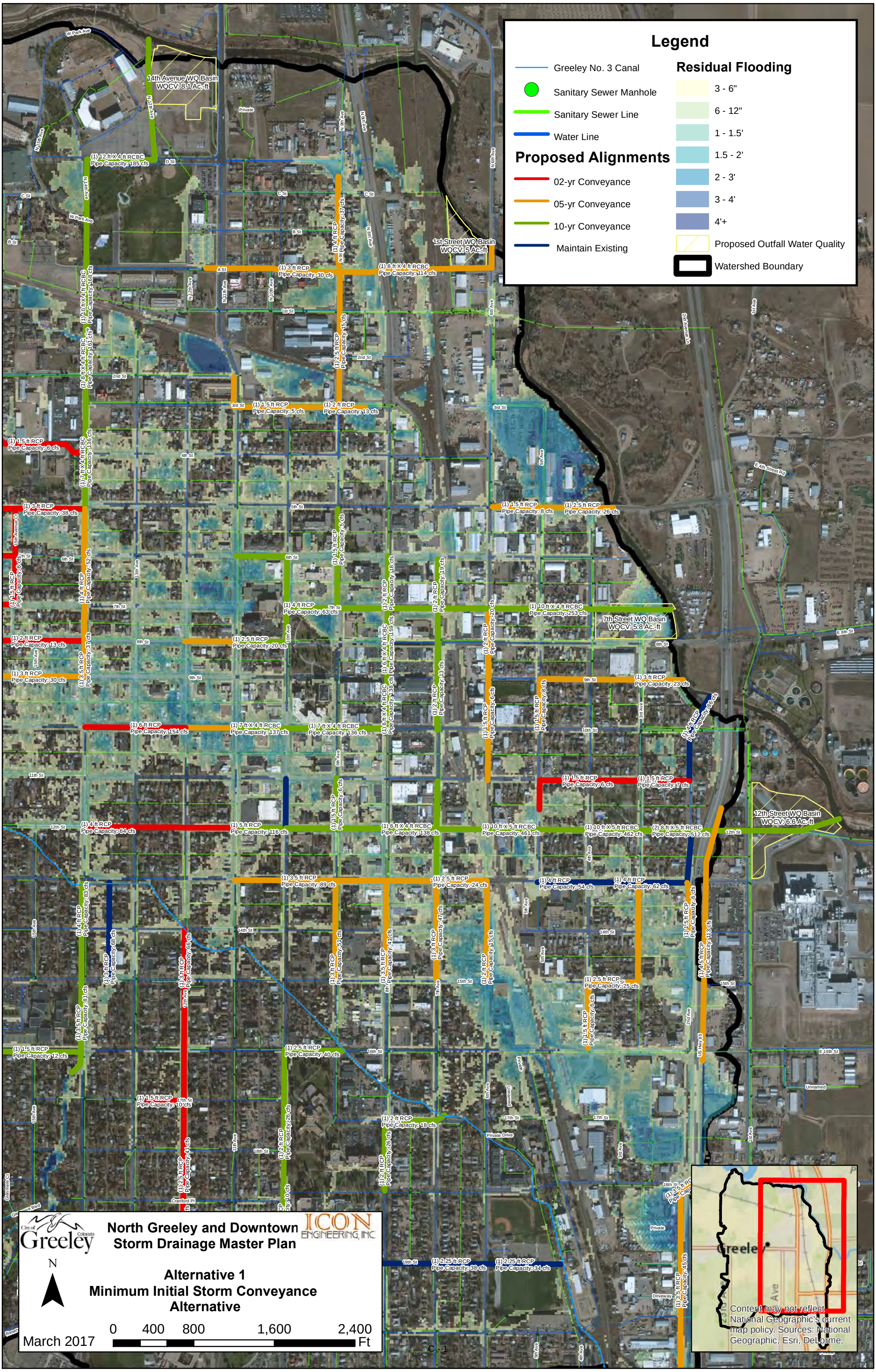
---	---
---	---
---	---





ICON ENGINEERING, INC.

APPENDIX C - ALTERNATIVE ANALYSIS


Legend
Greeley No. 3 Canal
Sanitary Sewer Manhole
Sanitary Sewer Line
Water Line
Proposed Alignments
02-yr Conveyance
05-yr Conveyance
10-yr Conveyance
Maintain Existing
Residual Flooding
3 - 6"
6 - 12"
1 - 1.5'
1.5 - 2'
2 - 3'
3 - 4'
4'+
Proposed Outfall Water Quality
Watershed Boundary
14th Avenue WQ Basin
WQCV: 8.1 Ac.-ft
1st Street WQ Basin
WQCV: 5 Ac.-ft
7th Street WQ Basin
WQCV: 5.8 Ac.-ft
12th Street WQ Basin
WQCV: 6.6 Ac.-ft
(1) 12 ft X 4 ft RCBC
Pipe Capacity: 185 cfs
(1) 8 ft X 4 ft RCBC
Pipe Capacity: 114 cfs
(1) 3 ft RCP
Pipe Capacity: 30 cfs
(1) 4 ft RCP
Pipe Capacity: 37 cfs
(1) 10 ft X 4 ft RCBC
Pipe Capacity: 168 cfs
(1) 8 ft X 4 ft RCBC
Pipe Capacity: 161 cfs
(1) 2.5 ft RCP
Pipe Capacity: 15 cfs
(1) 1.5 ft RCP
Pipe Capacity: 5 cfs
(1) 2 ft RCP
Pipe Capacity: 13 cfs
(1) 1.5 ft RCP
Pipe Capacity: 6 cfs
(1) 7 ft X 4 ft RCBC
Pipe Capacity: 136 cfs
(1) 3 ft RCP
Pipe Capacity: 38 cfs
(1) 4 ft RCP
Pipe Capacity: 52 cfs
(1) 3.5 ft RCP
Pipe Capacity: 37 cfs
(1) 2 ft RCP
Pipe Capacity: 20 cfs
(1) 6 ft RCP
Pipe Capacity: 154 cfs
(1) 7 ft X 4 ft RCBC
Pipe Capacity: 137 cfs
(1) 7 ft X 4 ft RCBC
Pipe Capacity: 136 cfs
(1) 1.5 ft RCP
Pipe Capacity: 8 cfs
(1) 2.5 ft RCP
Pipe Capacity: 26 cfs
(1) 2 ft RCP
Pipe Capacity: 63 cfs
(1) 2 ft RCP
Pipe Capacity: 18 cfs
(1) 2 ft RCP
Pipe Capacity: 19 cfs
(1) 10 ft X 4 ft RCBC
Pipe Capacity: 253 cfs
(1) 3 ft RCP
Pipe Capacity: 23 cfs
(1) 1.5 ft RCP
Pipe Capacity: 6 cfs
(1) 1.5 ft RCP
Pipe Capacity: 7 cfs
(1) 4 ft RCP
Pipe Capacity: 64 cfs
(1) 5 ft RCP
Pipe Capacity: 116 cfs
(1) 6 ft X 4 ft RCBC
Pipe Capacity: 138 cfs
(1) 10 ft X 5 ft RCBC
Pipe Capacity: 461 cfs
(1) 10 ft X 5 ft RCBC
Pipe Capacity: 462 cfs
(2) 8 ft X 5 ft RCBC
Pipe Capacity: 512 cfs
(1) 3.5 ft RCP
Pipe Capacity: 89 cfs
(1) 2.5 ft RCP
Pipe Capacity: 24 cfs
(1) 4 ft RCP
Pipe Capacity: 54 cfs
(1) 4 ft RCP
Pipe Capacity: 62 cfs
(1) 4 ft RCP
Pipe Capacity: 83 cfs
(1) 3 ft RCP
Pipe Capacity: 68 cfs
(1) 3.5 ft RCP
Pipe Capacity: 81 cfs
(1) 3 ft RCP
Pipe Capacity: 66 cfs
(1) 3 ft RCP
Pipe Capacity: 51 cfs
(1) 3.5 ft RCP
Pipe Capacity: 41 cfs
(1) 3 ft RCP
Pipe Capacity: 47 cfs
(1) 2 ft RCP
Pipe Capacity: 15 cfs
(1) 2.5 ft RCP
Pipe Capacity: 25 cfs
(1) 1.5 ft RCP
Pipe Capacity: 6 cfs
(1) 1.5 ft RCP
Pipe Capacity: 113 cfs
(1) 1.5 ft RCP
Pipe Capacity: 12 cfs
(1) 2.5 ft RCP
Pipe Capacity: 40 cfs
(1) 1.5 ft RCP
Pipe Capacity: 10 cfs
(1) 2.5 ft RCP
Pipe Capacity: 41 cfs
(1) 2 ft RCP
Pipe Capacity: 26 cfs
(1) 2 ft RCP
Pipe Capacity: 18 cfs
(1) 2 ft RCP
Pipe Capacity: 26 cfs
(1) 2.25 ft RCP
Pipe Capacity: 38 cfs
(1) 2.25 ft RCP
Pipe Capacity: 34 cfs
(1) 3.5 ft RCP
Pipe Capacity: 45 cfs
W Park Ave
N 14th Ave
N 12th Ave
Private
N 9th Ave
N 8th Ave
C St
D St
B St
A St
1st St
2nd St
3rd St
4th St
5th St
6th St
7th St
8th St
9th St
10th St
11th St
12th St
14th St
15th St
16th St
17th St
18th St
19th St
N 11th Ave
N 10th Ave
6th Ave
2nd Avenue Ln
1st Ave
E 4th Street Rd
5th Ave
15th Avenue Ct
13th Ave
10th Ave
15th Ave
9th Ave
3rd Ave
4th Ave
2nd Ave
12th Ave
11th Ave
Glenmere Ct
Cranford Pl
Private Drive
Driveway
US Hwy 85
E 8th St
E 16th St
Unnamed
Greeley
City of Greeley Colorado
ICON ENGINEERING, INC
North Greeley and Downtown
Storm Drainage Master Plan
N
Alternative 1
Minimum Initial Storm Conveyance
Alternative
0 400 800 1,600 2,400
Ft
March 2017
C - 1
Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme,

Legend

- Greeley No. 3 Canal
- Sanitary Sewer Manhole
- Sanitary Sewer Line
- Water Line

Proposed Alignments

- 02-yr Conveyance
- 05-yr Conveyance
- 10-yr Cinveyance
- Maintain Existing

Residual Flooding

- 3 - 6"
- 6 - 12"
- 1 - 1.5'
- 1.5 - 2'
- 2 - 3'
- 3 - 4'
- 4'+
- Proposed Outfall Water Quality
- Watershed Boundary

(1) 3.5 ft RCP Pipe Capacity: 62 cfs

(1) 3.5 ft RCP Pipe Capacity: 58 cfs

(1) 2.5 ft RCP Pipe Capacity: 23 cfs

(1) 2.5 ft RCP Pipe Capacity: 24 cfs

(1) 2.5 ft RCP Pipe Capacity: 15 cfs

(1) 11 ft X 5 ft RCBC Pipe Capacity: 232 cfs

14th Avenue WQ Basin WQCV: 8.1 Ac.-ft

(1) 12 ft X 4 ft RCBC Pipe Capacity: 185 cfs

(1) 10 ft X 4 ft RCBC Pipe Capacity: 168 cfs

(1) 8 ft X 4 ft RCBC Pipe Capacity: 161 cfs

(1) 1.5 ft RCP Pipe Capacity: 6 cfs

(1) 7 ft X 4 ft RCBC Pipe Capacity: 136 cfs

(1) 2 ft RCP Pipe Capacity: 13 cfs

(1) 3 ft RCP Pipe Capacity: 38 cfs

(1) 2.5 ft RCP Pipe Capacity: 24 cfs

(1) 2 ft RCP Pipe Capacity: 10 cfs

(1) 1.5 ft RCP Pipe Capacity: 6 cfs

(1) 4 ft RCP Pipe Capacity: 52 cfs

(1) 1.5 ft RCP Pipe Capacity: 4 cfs

(1) 2 ft RCP Pipe Capacity: 8 cfs

(1) 2 ft RCP Pipe Capacity: 13 cfs

(1) 3.5 ft RCP Pipe Capacity: 37 cfs

(1) 2.5 ft RCP Pipe Capacity: 18 cfs

(1) 3 ft RCP Pipe Capacity: 30 cfs

(1) 2 ft RCP Pipe Capacity: 13 cfs

(1) 3 ft RCP Pipe Capacity: 38 cfs

City of Greeley, Colorado

North Greeley and Downtown Storm Drainage Master Plan

ICON ENGINEERING, INC

N

Alternative 1
Minimum Initial Storm Conveyance Alternative

0 250 500 1,000 1,500 Ft

March 2017

Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme,

Legend

- Greeley No. 3 Canal
- Sanitary Sewer Manhole
- Sanitary Sewer Line
- Water Line

Proposed Alignments

- 02-yr Conveyance
- 05-yr Conveyance
- 10-yr Conveyance
- Maintain Existing

Residual Flooding

- 3 - 6"
- 6 - 12"
- 1 - 1.5'
- 1.5 - 2'
- 2 - 3'
- 3 - 4'
- 4'+
- Proposed Outfall Water Quality
- Watershed Boundary

(1) 3 ft RCP Pipe Capacity: 30 cfs
(1) 4 ft RCP Pipe Capacity: 52 cfs
(1) 6 ft RCP Pipe Capacity: 154 cfs
(1) 5.5 ft RCP Pipe Capacity: 122 cfs
(1) 7 ft X 4 ft RCBC Pipe Capacity: 137 cfs
(1) 7 ft X 4 ft RCBC Pipe Capacity: 136 cfs
(1) 4 ft RCP Pipe Capacity: 64 cfs
(1) 3.5 ft RCP Pipe Capacity: 81 cfs
(1) 3.5 ft RCP Pipe Capacity: 100 cfs
(1) 5 ft RCP Pipe Capacity: 116 cfs
(1) 2 ft RCP Pipe Capacity: 26 cfs
(1) 1.5 ft RCP Pipe Capacity: 6 cfs
(1) 6 ft X 4 ft RCBC Pipe Capacity: 138 cfs
(1) 6 ft X 4 ft RCBC Pipe Capacity: 137 cfs
(1) 6 ft X 4 ft RCBC Pipe Capacity: 138 cfs
(1) 10 ft X 5 ft RCBC Pipe Capacity: 461 cfs
(1) 9 ft X 5 ft RCBC Pipe Capacity: 313 cfs
(1) 3.5 ft RCP Pipe Capacity: 83 cfs
(1) 3.5 ft RCP Pipe Capacity: 89 cfs
(1) 4.5 ft RCP Pipe Capacity: 164 cfs
(1) 5 ft RCP Pipe Capacity: 191 cfs
(1) 2.5 ft RCP Pipe Capacity: 24 cfs
(1) 4 ft RCP Pipe Capacity: 54 cfs
(1) 4 ft RCP Pipe Capacity: 83 cfs
(1) 3 ft RCP Pipe Capacity: 57 cfs
(1) 3 ft RCP Pipe Capacity: 74 cfs
(1) 3 ft RCP Pipe Capacity: 68 cfs
(1) 3.5 ft RCP Pipe Capacity: 76 cfs
(1) 3 ft RCP Pipe Capacity: 64 cfs
(1) 3.5 ft RCP Pipe Capacity: 47 cfs
(1) 2.5 ft RCP Pipe Capacity: 28 cfs
(1) 3 ft RCP Pipe Capacity: 66 cfs
(1) 3 ft RCP Pipe Capacity: 51 cfs
(1) 3.5 ft RCP Pipe Capacity: 41 cfs
(1) 2 ft RCP Pipe Capacity: 15 cfs
(1) 3.5 ft RCP Pipe Capacity: 61 cfs
(1) 1.5 ft RCP Pipe Capacity: 12 cfs
(1) 2.5 ft RCP Pipe Capacity: 40 cfs
(1) 2.5 ft RCP Pipe Capacity: 41 cfs
(1) 2.5 ft RCP Pipe Capacity: 40 cfs
(1) 2 ft RCP Pipe Capacity: 26 cfs
(1) 2 ft RCP Pipe Capacity: 18 cfs
(1) 2 ft RCP Pipe Capacity: 26 cfs
(1) 2.5 ft RCP Pipe Capacity: 41 cfs
(1) 1.5 ft RCP Pipe Capacity: 10 cfs
(1) 2 ft RCP Pipe Capacity: 23 cfs
(1) 2 ft RCP Pipe Capacity: 26 cfs
(1) 2.25 ft RCP Pipe Capacity: 33 cfs
(1) 2.25 ft RCP Pipe Capacity: 38 cfs
(1) 2.25 ft RCP Pipe Capacity: 34 cfs

9th St, 11th St, 12th St, 14th St, 15th St, 16th St, 17th St, 18th St, 19th St, 20th St, 22nd St
11th Ave, 12th Ave, 13th Ave, 14th Ave, 9th Ave, 10th Ave, 7th Ave, 6th Ave, 5th Ave, 4th Ave
Glenmere Blvd, Glenmere Rd, Lakeside Dr, Cranford Pl, Unnamed, Private, Private Drive

City of Greeley, Colorado

North Greeley and Downtown Storm Drainage Master Plan

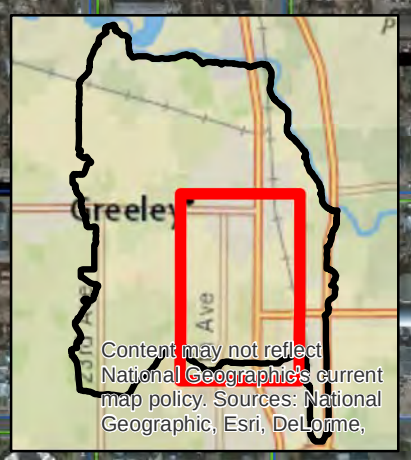
ICON ENGINEERING, INC

N

Alternative 1
Minimum Initial Storm Conveyance Alternative

0 250 500 1,000 1,500 Ft

March 2017



Legend

- Greeley No. 3 Canal
- Sanitary Sewer Manhole
- Sanitary Sewer Line
- Water Line
- Watershed Boundary

Proposed Alignments

- 02-yr Conveyance
- 05-yr Conveyance
- 10-yr Conveyance
- Maintain Existing

100-yr Residual Flooding

- 3 - 6"
- 6 - 12"
- 1 - 1.5'
- 1.5 - 2'
- 2 - 3'
- 3 - 4'
- 4'+

Proposed Detention Basins

- Major Contour
- Minor Contour

(1) 1.5 ft RCP Pipe Capacity: 4 cfs

(1) 1.5 ft RCP Pipe Capacity: 6 cfs

(1) 4 ft RCP Pipe Capacity: 52 cfs

(1) 2 ft RCP Pipe Capacity: 13 cfs

(1) 3.5 ft RCP Pipe Capacity: 37 cfs

(1) 2.5 ft RCP Pipe Capacity: 18 cfs

(1) 3 ft RCP Pipe Capacity: 30 cfs

(1) 4 ft RCP Pipe Capacity: 52 cfs

(1) 1.5 ft RCP Pipe Capacity: 11 cfs

(1) 3.5 ft RCP Pipe Capacity: 73 cfs

(1) 2 ft RCP Pipe Capacity: 19 cfs

(1) 4 ft RCP Pipe Capacity: 64 cfs

(1) 2 ft RCP Pipe Capacity: 23 cfs

(1) 4.5 ft RCP Pipe Capacity: 105 cfs

(1) 3 ft RCP Pipe Capacity: 67 cfs

(1) 3 ft RCP Pipe Capacity: 57 cfs

(1) 3 ft RCP Pipe Capacity: 68 cfs

(1) 3 ft RCP Pipe Capacity: 61 cfs

(1) 3.5 ft RCP Pipe Capacity: 81 cfs

(1) 2 ft RCP Pipe Capacity: 22 cfs

(1) 3.5 ft RCP Pipe Capacity: 80 cfs

(1) 1.5 ft RCP Pipe Capacity: 12 cfs

(1) 2 ft RCP Pipe Capacity: 22 cfs

(1) 2 ft RCP Pipe Capacity: 26 cfs

(1) 1.5 ft RCP Pipe Capacity: 12 cfs

City of Greeley, Colorado

North Greeley and Downtown Storm Drainage Master Plan

ICON ENGINEERING, INC

N

Alternative 1
Minimum Initial Storm Conveyance Alternative

0 250 500 1,000 1,500 Ft

March 2017

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Legend

- Greeley No. 3 Canal
- Sanitary Sewer Manhole
- Sanitary Sewer Line
- Water Line
- Proposed Outfall Water Quality
- Watershed Boundary

Proposed Alignments

- 02-yr Conveyance
- 05-yr Conveyance
- 10-yr Conveyance
- Maintain Existing

100-yr Residual Flooding

- 3 - 6"
- 6 - 12"
- 1 - 1.5'
- 1.5 - 2'
- 2 - 3'
- 3 - 4'
- 4'+

Proposed Detention Basins

- Major Contour
- Minor Contour

14th Avenue WQ Basin
WQCV: 8.1 Ac.-ft

(1) 12 ft X 4 ft RCBC
Pipe Capactiy: 185 cfs

(1) 10 ft X 4 ft RCBC
Pipe Capacity: 168 cfs

NW of 11th Avenue &
2nd Street
Max Capacity: 12.6 Ac-ft

(1) 3 ft RCP
Pipe Capacity: 30 cfs

(1) 4 ft RCP
Pipe Capacity: 37 cfs

(1) 8 ft X 4 ft RCBC
Pipe Capactiy: 114 cfs

1st Street WQ Basin
WQCV: 5 Ac.-ft

(1) 2.5 ft RCP
Pipe Capacity: 15 cfs

(1) 1.5 ft RCP
Pipe Capacity: 5 cfs

(1) 2 ft RCP
Pipe Capacity: 13 cfs

(1) 7 ft X 4 ft RCBC
Pipe Capacity: 136 cfs

(1) 3 ft RCP
Pipe Capacity: 38 cfs

(1) 4 ft RCP
Pipe Capacity: 52 cfs

(1) 3.5 ft RCP
Pipe Capacity: 37 cfs

(1) 1.5 ft RCP
Pipe Capacity: 5 cfs

(1) 4 ft RCP
Pipe Capacity: 63 cfs

(1) 2 ft RCP
Pipe Capacity: 19 cfs

(1) 2.5 ft RCP
Pipe Capacity: 20 cfs

(1) 6 ft X 4 ft RCBC
Pipe Capacity: 159 cfs

(1) 2 ft RCP
Pipe Capacity: 13 cfs

(1) 10 ft X 4 ft RCBC
Pipe Capactiy: 253 cfs

7th Street WQ Basin
WQCV: 5.8 Ac.-ft

(1) 2 ft RCP
Pipe Capacity: 20 cfs

(1) 1.5 ft RCP
Pipe Capacity: 6 cfs

(1) 1.5 ft RCP
Pipe Capacity: 8 cfs

(1) 2.5 ft RCP
Pipe Capacity: 26 cfs

(1) 3 ft RCP
Pipe Capacity: 23 cfs

(1) 4 ft RCP
Pipe Capacity: 86 cfs

(1) 6 ft RCP
Pipe Capacity: 154 cfs

(1) 7 ft X 4 ft RCBC
Pipe Capactiy: 137 cfs

(1) 7 ft X 4 ft RCBC
Pipe Capactiy: 136 cfs

(1) 1.5 ft RCP
Pipe Capacity: 6 cfs

(1) 1.5 ft RCP
Pipe Capacity: 7 cfs

12th Street WQ Basin
WQCV: 6.6 Ac.-ft

(1) 4 ft RCP
Pipe Capacity: 64 cfs

(1) 5 ft RCP
Pipe Capacity: 116 cfs

(1) 6 ft X 4 ft RCBC
Pipe Capacity: 137 cfs

(1) 10 ft X 5 ft RCBC
Pipe Capactiy: 461 cfs

(2) 8 ft X 5 ft RCBC
Pipe Capactiy: 512 cfs

(1) 3.5 ft RCP
Pipe Capacity: 89 cfs

(1) 9 ft X 5 ft RCBC
Pipe Capacity: 313 cfs

(1) 2.5 ft RCP
Pipe Capacity: 24 cfs

(1) 4 ft RCP
Pipe Capacity: 62 cfs

(1) 4 ft RCP
Pipe Capacity: 83 cfs

(1) 3 ft RCP
Pipe Capacity: 68 cfs

(1) 3.5 ft RCP
Pipe Capacity: 81 cfs

(1) 3 ft RCP
Pipe Capacity: 66 cfs

(1) 3 ft RCP
Pipe Capacity: 51 cfs

(1) 3.5 ft RCP
Pipe Capacity: 41 cfs

(1) 3 ft RCP
Pipe Capacity: 47 cfs

(1) 2.5 ft RCP
Pipe Capacity: 28 cfs

(1) 2.5 ft RCP
Pipe Capacity: 25 cfs

(1) 45 ft RCP
Pipe Capacity: 113 cfs

(1) 2.5 ft RCP
Pipe Capacity: 40 cfs

(1) 1.5 ft RCP
Pipe Capacity: 10 cfs

(1) 2.5 ft RCP
Pipe Capacity: 41 cfs

(1) 2 ft RCP
Pipe Capacity: 26 cfs

(1) 2 ft RCP
Pipe Capacity: 18 cfs

(1) 3.5 ft RCP
Pipe Capacity: 45 cfs

(1) 2.25 ft RCP
Pipe Capacity: 33 cfs

(1) 2.25 ft RCP
Pipe Capacity: 34 cfs

W Park Ave
N 14th Ave
N 15th Ave
D St
C St
B St
1st St
2nd St
3rd St
4th St
6th St
7th St
8th St
9th St
10th St
11th St
12th St
14th St
15th St
16th St
17th St
18th St
N 9th Ave
N 8th Ave
N 6th Ave
N 10th Ave
6th Ave
5th Ave
4th Ave
3rd Ave
2nd Ave
1st Ave
13th Ave
12th Ave
11th Ave
10th Ave
9th Ave
8th Ave
7th Ave
15th Ave
US Hwy 85
E 4th Street Rd
E 8th St
E 16th St
Private
Unnamed
Private Drive
Driveway
Glenmere Blvd
Elbow Ln

City of Greeley Colorado

ICON ENGINEERING, INC

North Greeley and Downtown Storm Drainage Master Plan

N

Alternative 2
Minimum Initial Storm Conveyance with Detention Alternative

0 400 800 1,600 2,400 Ft

March 2017

Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme,

Legend

- Greeley No. 3 Canal
- Sanitary Sewer Manhole
- Sanitary Sewer Line
- Water Line
- Proposed Outfall Water Quality
- Watershed Boundary

Proposed Alignments

- 02-yr Conveyance
- 05-yr Conveyance
- 10-yr Conveyance
- Maintain Existing

100-yr Residual Flooding

- 3 - 6"
- 6 - 12"
- 1 - 1.5'
- 1.5 - 2'
- 2 - 3'
- 3 - 4'
- 4'+

Proposed Detention Basins

- Major Contour
- Minor Contour

(1) 3.5 ft RCP Pipe Capacity: 62 cfs

(1) 3.5 ft RCP Pipe Capacity: 58 cfs

(1) 2.5 ft RCP Pipe Capacity: 23 cfs

(1) 2.5 ft RCP Pipe Capacity: 24 cfs

(1) 2.5 ft RCP Pipe Capacity: 15 cfs

(1) 11 ft X 5 ft RCBC Pipe Capacity: 232 cfs

14th Avenue WQ Basin
WQCV: 8.1 Ac.-ft

(1) 12 ft X 4 ft RCBC Pipe Capacity: 185 cfs

West of 14th Avenue
Max Capacity: 3.3 Ac-ft

(1) 10 ft X 4 ft RCBC Pipe Capacity: 168 cfs

(1) 8 ft X 4 ft RCBC Pipe Capacity: 161 cfs

(1) 1.5 ft RCP Pipe Capacity: 6 cfs

(1) 7 ft X 4 ft RCBC Pipe Capacity: 136 cfs

(1) 2 ft RCP Pipe Capacity: 13 cfs

(1) 3 ft RCP Pipe Capacity: 38 cfs

(1) 2.5 ft RCP Pipe Capacity: 24 cfs

(1) 2 ft RCP Pipe Capacity: 10 cfs

(1) 1.5 ft RCP Pipe Capacity: 4 cfs

(1) 2 ft RCP Pipe Capacity: 8 cfs

(1) 4 ft RCP Pipe Capacity: 52 cfs

(1) 2 ft RCP Pipe Capacity: 13 cfs

(1) 3.5 ft RCP Pipe Capacity: 37 cfs

(1) 2.5 ft RCP Pipe Capacity: 18 cfs

(1) 3 ft RCP Pipe Capacity: 30 cfs

(1) 1.5 ft RCP Pipe Capacity: 6 cfs

(1) 2 ft RCP Pipe Capacity: 13 cfs

(1) 3 ft RCP Pipe Capacity: 38 cfs

City of Greeley, Colorado

North Greeley and Downtown Storm Drainage Master Plan

ICON ENGINEERING, INC

N

Alternative 2
Minimum Initial Storm Conveyance with Detention Alternative

0 250 500 1,000 1,500 Ft

March 2017

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Legend

- Greeley No. 3 Canal
- Sanitary Sewer Manhole
- Sanitary Sewer Line
- Water Line
- Proposed Outfall Water Quality
- Watershed Boundary

Proposed Alignments

- 02-yr Conveyance
- 05-yr Conveyance
- 10-yr Conveyance
- Maintain Existing

100-yr Residual Flooding

- 3 - 6"
- 6 - 12"
- 1 - 1.5'
- 1.5 - 2'
- 2 - 3'
- 3 - 4'
- 4'+

Proposed Detention Basins

- Major Contour
- Minor Contour

Luther Park North Detention Basin
Max Capacity: 3.7 Ac-ft

Maplewood Elementary Detention Basin
Max Capacity: 4.6 Ac-ft

Moon Pond Detention Basin
Max Capacity 4.3 Ac-Ft

16th Street Detention Basin
Max Capacity 8.5 Ac-Ft

(1) 1.5 ft RCP Pipe Capacity: 11 cfs
(1) 3.5 ft RCP Pipe Capacity: 73 cfs
(1) 2 ft RCP Pipe Capacity: 19 cfs
(1) 4 ft RCP Pipe Capacity: 52 cfs
(1) 1.5 ft RCP Pipe Capacity: 105 cfs
(1) 4 ft RCP Pipe Capacity: 64 cfs
(1) 2 ft RCP Pipe Capacity: 23 cfs
(1) 2 ft RCP Pipe Capacity: 22 cfs
(1) 3 ft RCP Pipe Capacity: 67 cfs
(1) 4 ft RCP Pipe Capacity: 83 cfs
(1) 3 ft RCP Pipe Capacity: 74 cfs
(1) 3 ft RCP Pipe Capacity: 57 cfs
(1) 3 ft RCP Pipe Capacity: 68 cfs
(1) 3 ft RCP Pipe Capacity: 61 cfs
(1) 3 ft RCP Pipe Capacity: 53 cfs
(1) 3.5 ft RCP Pipe Capacity: 81 cfs
(1) 2 ft RCP Pipe Capacity: 22 cfs
(1) 3.5 ft RCP Pipe Capacity: 80 cfs
(1) 1.5 ft RCP Pipe Capacity: 12 cfs
(1) 2 ft RCP Pipe Capacity: 26 cfs
(1) 2 ft RCP Pipe Capacity: 18 cfs
(1) 1.5 ft RCP Pipe Capacity: 11 cfs
(1) 1.5 ft RCP Pipe Capacity: 12 cfs

City of Greeley, Colorado

North Greeley and Downtown Storm Drainage Master Plan

ICON ENGINEERING, INC

N

Alternative 2
Minimum Initial Storm Conveyance with Detention Alternative

0 250 500 1,000 1,500 Ft

March 2017

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Legend

- Greeley No. 3 Canal
- Sanitary Sewer Manhole
- Sanitary Sewer Line
- Water Line

Proposed Alignments

- 002-yr Conveyance
- 005-yr Conveyance
- 010-yr Conveyance
- 100-yr Conveyance
- Maintain Existing

100-yr Residual Flooding

- 3 - 6"
- 6 - 12"
- 1 - 1.5'
- 1.5 - 2'
- 2 - 3'
- 3 - 4'
- 4'+
- Proposed Outfall Water Quality
- Watershed Boundary

14th Avenue WQ Basin
WQCV: 8.1 Ac.-ft

(2) 10 ft X 5 ft RCBC
Pipe Capacity: 716 cfs

(1) 9 ft X 4 ft RCBC
Pipe Capacity: 131 cfs

(1) 10 ft X 4 ft RCBC
Pipe Capacity: 149 cfs

1st Street WQ Basin
WQCV: 5 Ac.-ft

(1) 3.5 ft RCP
Pipe Capacity: 26 cfs

(1) 4.5 ft RCP
Pipe Capacity : 71 cfs

(1) 7 ft X 4 ft RCBC
Pipe Capacity: 136 cfs

(1) 2 ft RCP
Pipe Capacity : 20 cfs

(1) 1.5 ft RCP
Pipe Capacity : 8 cfs

(1) 4 ft RCP
Pipe Capacity : 52 cfs

(1) 5 ft RCP
Pipe Capacity : 115 cfs

(1) 2 ft RCP
Pipe Capacity : 18 cfs

(1) 10 ft X 5 ft RCBC
Pipe Capacity: 358 cfs

(1) 3.5 ft RCP
Pipe Capacity : 93 cfs

(1) 12 ft X 5 ft RCBC
Pipe Capacity: 450 cfs

7th Street WQ Basin
WQCV: 5.8 Ac.-ft

(1) 2 ft RCP
Pipe Capacity : 13 cfs

(2) 11 ft X 5 ft RCBC
Pipe Capacity: 654 cfs

(1) 1.5 ft RCP
Pipe Capacity: 6 cfs

(1) 1.5 ft RCP
Pipe Capacity: 8 cfs

(1) 4.5 ft RCP
Pipe Capacity : 164 cfs

(1) 11 ft X 5 ft RCBC
Pipe Capacity: 329 cfs

(2) 10 ft X 5 ft RCBC
Pipe Capacity: 582 cfs

(2) 11 ft X 5 ft RCBC
Pipe Capacity: 651 cfs

(1) 3 ft RCP
Pipe Capacity: 23 cfs

(1) 1.5 ft RCP
Pipe Capacity : 6 cfs

(1) 4 ft RCP
Pipe Capacity : 41 cfs

(1) 1.5 ft RCP
Pipe Capacity : 7 cfs

(2) 8 ft X 5 ft RCBC
Pipe Capacity: 542 cfs

(1) 8 ft X 4 ft RCBC
Pipe Capacity: 358 cfs

(2) 12 ft X 5 ft RCBC
Pipe Capacity: 1153 cfs

(3) 10 ft X 5 ft RCBC
Pipe Capacity: 1359 cfs

12th Street WQ Basin
WQCV: 6.6 Ac.-ft

(1) 3.5 ft RCP
Pipe Capacity : 76 cfs

(1) 1.5 ft RCP
Pipe Capacity : 6 cfs

(1) 4 ft RCP
Pipe Capacity : 62 cfs

(1) 4 ft RCP
Pipe Capacity : 83 cfs

(1) 3 ft RCP
Pipe Capacity : 68 cfs

(1) 3.5 ft RCP
Pipe Capacity : 81 cfs

(1) 3 ft RCP
Pipe Capacity : 51 cfs

(1) 3 ft RCP
Pipe Capacity : 47 cfs

(1) 3 ft RCP
Pipe Capacity : 40 cfs

(1) 2.5 ft RCP
Pipe Capacity : 24 cfs

(1) 3 ft RCP
Pipe Capacity : 38 cfs

(1) 4 ft RCP
Pipe Capacity : 37 cfs

(1) 2.5 ft RCP
Pipe Capacity : 40 cfs

(1) 2 ft RCP
Pipe Capacity : 26 cfs

(1) 1 ft RCP
Pipe Capacity : 4 cfs

(1) 2.25 ft RCP
Pipe Capacity : 34 cfs

(1) 3 ft RCP
Pipe Capacity : 30 cfs

City of Greeley, Colorado

North Greeley and Downtown Storm Drainage Master Plan

ICON ENGINEERING, INC

N

Alternative 3
Canal Interception / Downtown Mitigation Alternative

0 400 800 1,600 2,400 Ft

March 2017

Legend

- Greeley No. 3 Canal
- Sanitary Sewer Manhole
- Sanitary Sewer Line
- Water Line

Proposed Alignments

- 02-yr Conveyance
- 05-yr Conveyance
- 10-yr Conveyance
- Maintain Existing

100-yr Residual Flooding

- 3 - 6"
- 6 - 12"
- 1 - 1.5'
- 1.5 - 2'
- 2 - 3'
- 3 - 4'
- 4'+
- Proposed Outfall Water Quality
- Watershed Boundary

14th Avenue WQ Basin
WQCV: 8.1 Ac.-ft

(1) 12 ft X 5 ft RCBC
Pipe Capacity: 257 cfs

1st Street WQ Basin
WQCV: 5 Ac.-ft

(1) 9 ft X 4 ft RCBC
Pipe Capacity: 131 cfs

(1) 10 ft X 4 ft RCBC
Pipe Capacity: 149 cfs

(1) 4.5 ft RCP
Pipe Capacity: 71 cfs

(1) 11 ft X 4 ft RCBC
Pipe Capacity: 236 cfs

(1) 4 ft RCP
Pipe Capacity : 37 cfs

(1) 2 ft RCP
Pipe Capacity : 13 cfs

(1) 10 ft X 4 ft RCBC
Pipe Capacity: 211 cfs

(1) 8 ft X 4 ft RCBC
Pipe Capacity: 161 cfs

(1) 3.5 ft RCP
Pipe Capacity: 45 cfs

(1) 9 ft X 4 ft RCBC
Pipe Capacity: 288 cfs

(1) 12 ft X 4 ft RCBC
Pipe Capacity: 313 cfs

7th Street WQ Basin
WQCV: 5.8 Ac.-ft

(1) 1.5 ft RCP
Pipe Capacity : 8 cfs

(1) 2.5 ft RCP
Pipe Capacity : 26 cfs

(1) 2.5 ft RCP
Pipe Capacity : 18 cfs

(1) 8 ft X 4 ft RCBC
Pipe Capacity: 228 cfs

(1) 2 ft RCP
Pipe Capacity: 13 cfs

(1) 6 ft X 4 ft RCBC
Pipe Capacity: 113 cfs

(1) 1.5 ft RCP
Pipe Capacity: 6 cfs

(1) 1.5 ft RCP
Pipe Capacity: 8 cfs

(1) 3 ft RCP
Pipe Capacity : 23 cfs

(1) 4 ft RCP
Pipe Capacity : 52 cfs

(1) 5.5 ft RCP
Pipe Capacity : 122 cfs

(1) 9 ft X 4 ft RCBC
Pipe Capacity: 184 cfs

(1) 4 ft RCP
Pipe Capacity: 41 cfs

(1) 1.5 ft RCP
Pipe Capacity : 6 cfs

12th Street WQ Basin
WQCV: 6.6 Ac.-ft

(1) 8 ft X 4 ft RCBC
Pipe Capacity: 253 cfs

(1) 10 ft X 4 ft RCBC
Pipe Capacity: 258 cfs

(1) 11 ft X 4 ft RCBC
Pipe Capacity: 288 cfs

(2) 10 ft X 4 ft RCBC
Pipe Capacity: 666 cfs

(2) 8 ft X 5 ft RCBC
Pipe Capacity: 699 cfs

(1) 4 ft RCP
Pipe Capacity: 83 cfs

(1) 4 ft RCP
Pipe Capacity: 70 cfs

(1) 4 ft RCP
Pipe Capacity : 128 cfs

(1) 3.5 ft RCP
Pipe Capacity : 58 cfs

(1) 4 ft RCP
Pipe Capacity : 62 cfs

(1) 3 ft RCP
Pipe Capacity: 68 cfs

(1) 3 ft RCP
Pipe Capacity : 51 cfs

(1) 3 ft RCP
Pipe Capacity: 38 cfs

(1) 3 ft RCP
Pipe Capacity : 38 cfs

(1) 4.5 ft RCP
Pipe Capacity: 113 cfs

(1) 3.5 ft RCP
Pipe Capacity: 81 cfs

(1) 2.5 ft RCP
Pipe Capacity : 63 cfs

(1) 2.5 ft RCP
Pipe Capacity: 47 cfs

(1) 2.5 ft RCP
Pipe Capacity: 23 cfs

(1) 2.25 ft RCP
Pipe Capacity : 34 cfs

(1) 3.5 ft RCP
Pipe Capacity: 45 cfs

North Greeley and Downtown Storm Drainage Master Plan

Alternative 4
Canal Base Flow Separation Alternative

City of Greeley, Colorado

ICON ENGINEERING, INC

N

0 400 800 1,600 2,400 Ft

March 2017

Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme,

Legend

Greeley No. 3 Canal

Sanitary Sewer Manhole

Sanitary Sewer Line

Water Line

Proposed Alignments

02-yr Conveyance

05-yr Conveyance

10-yr Conveyance

Maintain Existing

100-yr Residual Flooding

3 - 6"

6 - 12"

1 - 1.5'

1.5 - 2'

2 - 3'

3 - 4'

4'+

Proposed Outfall Water Quality

Watershed Boundary

(1) 12 ft X 6 ft RCBC
Pipe Capacity: 336 cfs

14th Avenue WQ Basin
WQCV: 8.1 Ac.-ft

(1) 3.5 ft RCP
Pipe Capacity: 62 cfs

(1) 3.5 ft RCP
Pipe Capacity: 58 cfs

(1) 12 ft X 5 ft RCBC
Pipe Capacity: 257 cfs

(1) 11 ft X 5 ft RCBC
Pipe Capacity: 261 cfs

(1) 2.5 ft RCP
Pipe Capacity: 24 cfs

(1) 2.5 ft RCP
Pipe Capacity : 15 cfs

(1) 1.5 ft RCP
Pipe Capacity : 6 cfs

(1) 11 ft X 4 ft RCBC
Pipe Capacity: 235 cfs

(1) 10 ft X 4 ft RCBC
Pipe Capacity: 211 cfs

(1) 2 ft RCP
Pipe Capacity : 13 cfs

(1) 3 ft RCP
Pipe Capacity : 38 cfs

(1) 2.5 ft RCP
Pipe Capacity : 18 cfs

(1) 8 ft X 4 ft RCBC
Pipe Capacity: 161 cfs

(1) 1.5 ft RCP
Pipe Capacity : 4 cfs

(1) 2 ft RCP
Pipe Capacity : 8 cfs

(1) 7 ft X 4 ft RCBC
Pipe Capacity: 137 cfs

(1) 2 ft RCP
Pipe Capacity : 13 cfs

(1) 4 ft RCP
Pipe Capacity : 124 cfs

(1) 6 ft X 4 ft RCBC
Pipe Capacity: 138 cfs

City of Greeley, Colorado

ICON ENGINEERING, INC

North Greeley and Downtown Storm Drainage Master Plan

Alternative 4
Canal Base Flow Separation Alternative

N

0 250 500 1,000 1,500 Ft

March 2017

Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme,

Legend

- Study Area
- Parkway Extents
- Greeley No. 3 Canal
- Required Acquistion
- Sanitary Sewer Manhole
- Sanitary Sewer Line
- Water Line

City of Greeley Colorado

ICON ENGINEERING, INC

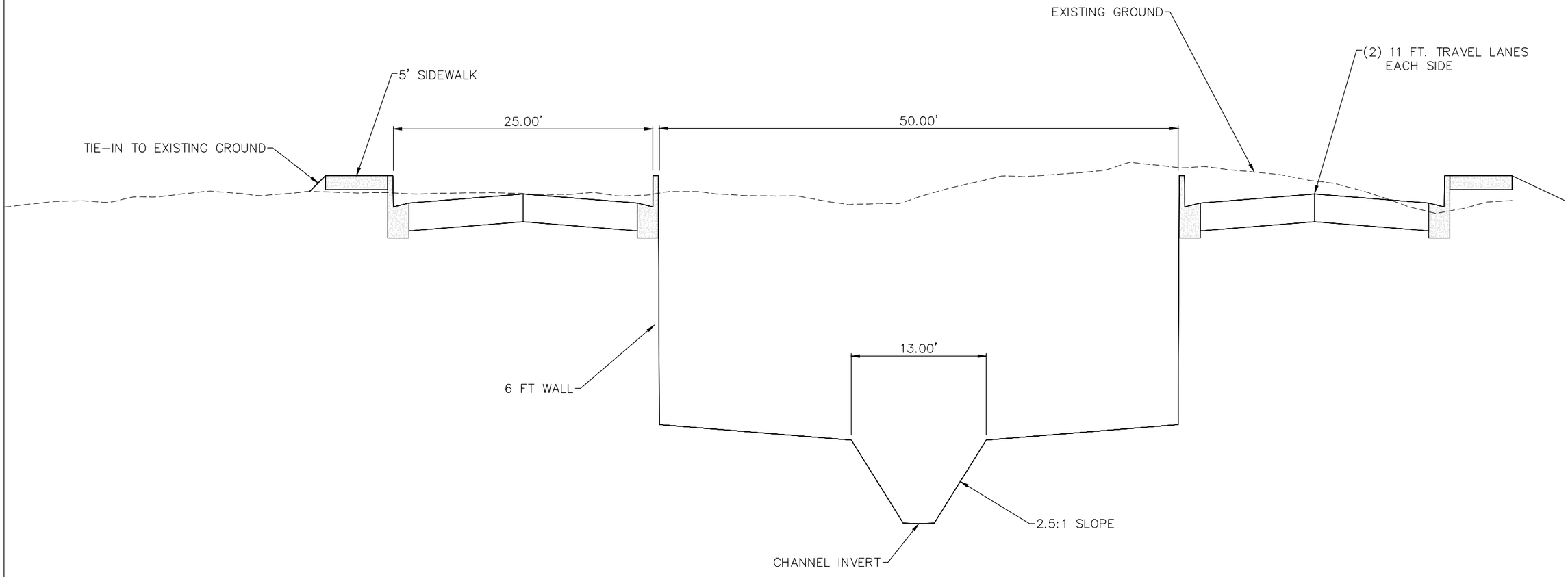
North Greeley and Downtown Storm Drainage Master Plan

Alternative 6
Parkway Alternative

0 500 1,000 2,000 3,000 Ft

June 2016

PARKWAY ALTERNATIVE CROSS SECTION (TYP.)



14TH AVENUE PARKWAY Q-100: 1600 CFS
13TH STREET PARKWAY Q-100: 1450 CFS

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	1st St, Outfall
REACH :	9thAveNofASt
JURISDICTION :	City of Greeley
REACH ID:	1stSt-Reach9thAveNofASt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
42-inch	160	1	160	L.F.	$162,00	$25.920,00	L041,01
48-inch	750	1	750	L.F.	$185,00	$138.750,00	L041,02
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			1	EA	$5.010,00	$5.010,00	
Manhole, 6' Dia, (Pipe Dia, = 48")			3	EA	$5.524,00	$16.572,00	
Storm Inlet, Type R/Type 14, 5-foot			15	EA	$5.910,00	$88.650,00	
Special Items (User Defined)							
Asphalt Repave	**<----User Defined Items**		593	S.Y.	$40,00	$23.720,00	
Asphalt Patch	**<----User Defined Items**		103	S.Y.	$50,00	$5.150,00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$274.902,00	
Concrete Box Culverts						$0,00	
Hydraulic Structures						$0,00	
Channel Improvements						$0,00	
Detention/Water Quality Facilities						$0,00	
Removals						$0,00	
Landscaping and Maintenance Improvements						$0,00	
Special Items (User Defined)						$28.870,00	
Subtotal Capital Improvement Costs						**$303,772,00**	
Additional Capital Improvement Costs							
Dewatering			$3.037,72	L.S.		$3.038,00	
Mobilization			5%			$15.189,00	
Traffic Control			$6.075,44	L.S.		$6.075,00	
Utility Coordination/Relocation			$30.377,20	L.S.		$30.377,00	
Stormwater Management/Erosion Control			5%			$15.189,00	
Subtotal Additional Capital Improvement Costs						**$69,868,00**	
Land Acquisition Costs							
ROW/Easements						$0,00	
Subtotal Land Acquisition Costs						**$0,00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$56.046,00	
Legal/Administrative			5%			$18.682,00	
Contract Admin/Construction Management			10%			$37.364,00	
Contingency			25%			$93.410,00	
Subtotal Other Costs						**$205,502,00**	
Total Capital Improvement Costs						**$579,142,00**	

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	19	EA	$64,00	$243,00
Total Annual Operation and Maintenance Cost				**$243.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$8,505.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	1st St, Outfall
REACH :	9thAveSouthofASt
JURISDICTION :	City of Greeley
REACH ID:	1stSt-Reach9thAveSouthofASt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
48-inch	780	1	780	L.F.	$185,00	$144.300,00	L039,03
24-inch	400	1	400	L.F.	$92,00	$36.800,00	L039,07
54-inch	500	1	500	L.F.	$277,00	$138.500,00	L939,05
54-inch	1260	1	1260	L.F.	$277,00	$349.020,00	L839,05
18-inch	50	34	1700	L.F.	$69,00	$117.300,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			1	EA	$3.726,00	$3.726,00	
Manhole, 6' Dia, (Pipe Dia, = 48")			4	EA	$5.524,00	$22.096,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			3	EA	$15.416,00	$46.248,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			1	EA	$19.271,00	$19.271,00	
Storm Inlet, Type R/Type 14, 5-foot			34	EA	$5.910,00	$200.940,00	
Special Items (User Defined)							
Asphalt Repave	**<----User Defined Items**		1979	S.Y.	$40,00	$79.160,00	
Asphalt Patch	**<----User Defined Items**		207	S.Y.	$50,00	$10.350,00	
Waterline Lowering	**<----User Defined Items**		8	EA	$5.000,00	$40.000,00	
RR Boring	**<----User Defined Items**		160	LF	$4.500,00	$720.000,00	2 - 48" Boring (80 LF per cell)

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$1.078.201,00	
Concrete Box Culverts						$0,00	
Hydraulic Structures						$0,00	
Channel Improvements						$0,00	
Detention/Water Quality Facilities						$0,00	
Removals						$0,00	
Landscaping and Maintenance Improvements						$0,00	
Special Items (User Defined)						$849.510,00	
Subtotal Capital Improvement Costs						**$1,927,711,00**	
Additional Capital Improvement Costs							
Dewatering			$19.277,11	L.S.		$19.277,00	
Mobilization			5%			$96.386,00	
Traffic Control			$38.554,22	L.S.		$38.554,00	
Utility Coordination/Relocation			$192.771,10	L.S.		$192.771,00	
Stormwater Management/Erosion Control			5%			$96.386,00	
Subtotal Additional Capital Improvement Costs						**$443,374,00**	
Land Acquisition Costs							
ROW/Easements						$0,00	
Subtotal Land Acquisition Costs						**$0,00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$355.663,00	
Legal/Administrative			5%			$118.554,00	
Contract Admin/Construction Management			10%			$237.109,00	
Contingency			25%			$592.771,00	
Subtotal Other Costs						**$1,304,097,00**	
Total Capital Improvement Costs						**$3,675,182,00**	

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	43	EA	$64,00	$550,00
Total Annual Operation and Maintenance Cost				**$550.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$19,250.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 1st St, Outfall
REACH : ASt
JURISDICTION : City of Greeley
REACH ID: 1stSt-ReachASt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	1410	1	1410	L.F.	$139,00	$195.990,00	L042,06_pipe
18-inch	50	29	1450	L.F.	$69,00	$100.050,00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			15	EA	$15.416,00	$231.240,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			1	EA	$19.271,00	$19.271,00	
Storm Inlet, Type R/Type 14, 5-foot			29	EA	$5.910,00	$171.390,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
9	4	1	400	L.F.	$878,76	$351.502,00	L941,06
10	4	1	350	L.F.	$938,56	$328.495,00	L9003
10	4	1	820	L.F.	$938,56	$769.617,00	L9001
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
10	1	12,00	1	EA	$1.124,82	$1,125,00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
10	4	1	1	EA	$8.908,47	$8.908,50	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			5	AC-FT	$58.582,00	$291.445,00	WQCV
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		370	S.Y.	$40,00	$14.800,00	
Asphalt Patch	<----User Defined Items		888	S.Y.	$50,00	$44.400,00	
RR Boring (Hwy 85)	<----User Defined Items		640	L.F.	$4.500,00	$2.880.000,00	4 - 48" 160 L.F. per cell
RR Boring (UPRR)	<----User Defined Items		320	LF	$4.500,00	$1.440.000,00	4 - 48" 80 L.F. per cell
Land Acquisition							
Easement/ROW Acquisition			3,34	ACRE	$144.474,00	$482.543,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$717.941,00
Concrete Box Culverts				$1.459.648,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$291.445,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$4.379.200,00
Subtotal Capital Improvement Costs				**$6.848.234.00**
Additional Capital Improvement Costs				
Dewatering	$68.482,34	L.S.		$68.482,00
Mobilization	5%			$342.412,00
Traffic Control	$136.964,68	L.S.		$136.965,00
Utility Coordination/Relocation	$684.823,40	L.S.		$684.823,00
Stormwater Management/Erosion Control	5%			$342.412,00
Subtotal Additional Capital Improvement Costs				**$1.575.094.00**
Land Acquisition Costs				
ROW/Easements				$482.543,00
Subtotal Land Acquisition Costs				**$482.543.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$1.263.499,00
Legal/Administrative	5%			$421.166,00
Contract Admin/Construction Management	10%			$842.333,00
Contingency	25%			$2.105.832,00
Subtotal Other Costs				**$4.632.830.00**
Total Capital Improvement Costs				**$13.538.701,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	45	EA	$64,00	$576,00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, struc	4,975	ACRE	$1.927,00	$4.793,00
Total Annual Operation and Maintenance Cost				**$5,369,00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$187.913.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 5th St, Outfall
REACH : 5thSt
JURISDICTION : City of Greeley
REACH ID: 5thSt-Reach5thSt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	800	1	800	L.F.	$92,00	$73.600,00	L940,09_pipe
30-inch	400	1	400	L.F.	$116,00	$46.400,00	L040,09_pipe
18-inch	50	11	550	L.F.	$69,00	$37.950,00	Inlet Laterals
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
30-inch	Yes	1	1	EA	$2.017,00	$2.017,00	Outfall into Poudre
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			3	EA	$5.010,00	$15.030,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			1	EA	$15.416,00	$15.416,00	
Storm Inlet, Type R/Type 14, 5-foot			11	EA	$5.910,00	$65.010,00	
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items			S.Y.	$40,00	$0,00	
Asphalt Patch	<----User Defined Items		644	S.Y.	$50,00	$32.200,00	
Waterline Lowering	<----User Defined Items		2	EA	$5.000,00	$10.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$255.423,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$42.200,00
Subtotal Capital Improvement Costs				**$297.623,00**
Additional Capital Improvement Costs				
Dewatering	$2.976,23	L.S.		$2.976,00
Mobilization	5%			$14.881,00
Traffic Control	$5.952,46	L.S.		$5.952,00
Utility Coordination/Relocation	$29.762,30	L.S.		$29.762,00
Stormwater Management/Erosion Control	5%			$14.881,00
Subtotal Additional Capital Improvement Costs				**$68,452.00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$54.911,00
Legal/Administrative	5%			$18.304,00
Contract Admin/Construction Management	10%			$36.608,00
Contingency	25%			$91.519,00
Subtotal Other Costs				**$201.342.00**
Total Capital Improvement Costs				**$567,417.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	15	EA	$64,00	$192,00
Total Annual Operation and Maintenance Cost				**$192.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$6,720.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 7th St_Outfall - 8th Ave.
REACH : 7thSt_8thAve
JURISDICTION : City of Greeley
REACH ID: 7th St_8thAve-Reach7thSt_8thAve Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
48-inch	500	1	500	L.F.	$185,00	$92.500,00	L029,01_pipe
54-inch	500	1	500	L.F.	$277,00	$138.500,00	L030,17_pipe
66-inch	500	1	500	L.F.	$339,00	$169.500,00	L030,14_pipe
18-inch	50	64	3200	L.F.	$69,00	$220.800,00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			16	EA	$15.416,00	$246.656,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			1	EA	$19.271,00	$19.271,00	
Storm Inlet, Type R/Type 14, 5-foot			64	EA	$5.910,00	$378.240,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
9	4	1	500	L.F.	$878,76	$439.378,00	L930,12_pipe
9	4	1	540	L.F.	$878,76	$474.528,00	L930,08_pipe
9	4	1	470	L.F.	$878,76	$413.015,00	L938,14
8	4	1	250	L.F.	$819,72	$204.931,00	L838,14
8	4	1	240	L.F.	$819,72	$196.734,00	L938,13
8	4	1	350	L.F.	$819,72	$286.903,00	L938,12
8	4	1	360	L.F.	$819,72	$295.101,00	L938,11
Special Items (User Defined)							
Asphalt Repave	<---User Defined Items		3832	S.Y.	$40,00	$153.280,00	
Waterline Lowering	<---User Defined Items		10	EA	$5.000,00	$50.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$1.265.467,00
Concrete Box Culverts				$2.310.590,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$203.280,00
Subtotal Capital Improvement Costs				**$3.779.337,00**
Additional Capital Improvement Costs				
Dewatering	$37.793,37	L.S.		$37.793,00
Mobilization	5%			$188.967,00
Traffic Control	$75.586,74	L.S.		$75.587,00
Utility Coordination/Relocation	$377.933,70	L.S.		$377.934,00
Stormwater Management/Erosion Control	5%			$188.967,00
Subtotal Additional Capital Improvement Costs				**$869.248,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$697.288,00
Legal/Administrative	5%			$232.429,00
Contract Admin/Construction Management	10%			$464.859,00
Contingency	25%			$1.162.146,00
Subtotal Other Costs				**$2.556.722,00**
Total Capital Improvement Costs				**$7,205,307.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	81	EA	$64,00	$1.037,00
Total Annual Operation and Maintenance Cost				**$1,037.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$36,295,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 7th St_Outfall
REACH : 7thSt_Trunk
JURISDICTION : City of Greeley
REACH ID: 7th St-Reach7thSt_Trunk Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
48-inch	500	1	500	L.F.	$185,00	$92.500,00	L930,01
60-inch	500	1	500	L.F.	$308,00	$154.000,00	L938,17
18-inch	50	28	1400	L.F.	$69,00	$96.600,00	
Manholes and Inlets							
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			16	EA	$15.416,00	$246.656,00	
Storm Inlet, Type R/Type 14, 5-foot			28	EA	$5.910,00	$165.480,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
9	4	1	500	L.F.	$878,76	$439.378,00	L738,11
9	4	1	500	L.F.	$878,76	$439.378,00	L938,07
9	4	1	400	L.F.	$878,76	$351.502,00	L838,07
12	4	1	400	L.F.	$1.059,16	$423.664,00	L937,04
12	4	1	615	L.F.	$1.059,16	$651.384,00	L837,04
11	5	1	500	L.F.	$1.123,05	$561.523,00	L937,03
11	5	1	250	L.F.	$1.123,05	$280.761,00	L937,02
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
11	1	13,00	1	EA	$1.218,56	$1.219,00	Outfall into Poudre
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
11	5	1	1	EA	$11.837,53	$11.837,50	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			6	AC-FT	$58.582,00	$336.847,00	WQCV
Special Items (User Defined)							
Asphalt Repave	<---User Defined Items		3783	S.Y.	$50,00	$189.150,00	
Waterline lowering	<---User Defined Items		6	EA	$5.000,00	$30.000,00	
RR Boring	<---User Defined Items		300	LF	$4.500,00	$1.350.000,00	3 - 48" Parallel
Land Acquisition							
Easement/ROW Acquisition			6,10	ACRE	$238.551,61	$1.455.165,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$755.236,00
Concrete Box Culverts				$3.160.647,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$336.847,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$1.569.150,00
Subtotal Capital Improvement Costs				**$5.821.880,00**
Additional Capital Improvement Costs				
Dewatering	$58.218,80	L.S.		$58.219,00
Mobilization	5%			$291.094,00
Traffic Control	$116.437,60	L.S.		$116.438,00
Utility Coordination/Relocation	$582.188,00	L.S.		$582.188,00
Stormwater Management/Erosion Control	5%			$291.094,00
Subtotal Additional Capital Improvement Costs				**$1.339.033,00**
Land Acquisition Costs				
ROW/Easements				$1.455.165,00
Subtotal Land Acquisition Costs				**$1.455.165,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$1.074.137,00
Legal/Administrative	5%			$358.046,00
Contract Admin/Construction Management	10%			$716.091,00
Contingency	25%			$1.790.228,00
Subtotal Other Costs				**$3.938.502,00**
Total Capital Improvement Costs				**$12,554,580.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	44	EA	$64,00	$563,00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, struc	5,75	ACRE	$1.927,00	$5.540,00
Total Annual Operation and Maintenance Cost				**$6,103.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$213,603.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7th St. Outfall
REACH :	Lateral_6thAve
JURISDICTION :	City of Greeley
REACH ID:	7th St-ReachLateral_6thAve

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	510	1	510	L.F.	$69,00	$35.190,00	L037,07
18-inch	845	1	845	L.F.	$69,00	$58.305,00	L937,05
24-inch	340	1	340	L.F.	$92,00	$31.280,00	L037,05
18-inch	50	6	300	L.F.	$69,00	$20.700,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			7	EA	$3.726,00	$26.082,00	
StormInlet, Type R/Type 14, 5-foot			6	EA	$5.910,00	$35.460,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		859	S.Y.	$50,00	$42.950,00	
Waterline Lowering'	<---User Defined Items		3	EA	$5.000,00	$15.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$207.017,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$57.950,00
Subtotal Capital Improvement Costs				**$264.967,00**
Additional Capital Improvement Costs				
Dewatering	$2.649,67	L.S.		$2.650,00
Mobilization	5%			$13.248,00
Traffic Control	$5.299,34	L.S.		$5.299,00
Utility Coordination/Relocation	$26.496,70	L.S.		$26.497,00
Stormwater Management/Erosion Control	5%			$13.248,00
Subtotal Additional Capital Improvement Costs				**$60.942,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$48.886,00
Legal/Administrative	5%			$16.295,00
Contract Admin/Construction Management	10%			$32.591,00
Contingency	25%			$81.477,00
Subtotal Other Costs				**$179.249,00**
Total Capital Improvement Costs				**$505,158.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	13	EA	$64,00	$166,00
Total Annual Operation and Maintenance Cost				**$166.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$5,810.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7th St. Outfall
REACH :	Lateral_7thAve_N
JURISDICTION :	City of Greeley
REACH ID:	7th St-ReachLateral_7thAve_N

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	500	1	500	L.F.	$92,00	$46.000,00	L038,21
18-inch	50	10	500	L.F.	$69,00	$34.500,00	Inlet Laterals
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			2	EA	$5.010,00	$10.020,00	
StormInlet, Type R/Type 14, 5-foot			10	EA	$5.910,00	$59.100,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		254	S.Y.	$50,00	$12.700,00	
Waterline Lowering	<---User Defined Items		1	EA	$5.000,00	$5.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$149.620,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$17.700,00
Subtotal Capital Improvement Costs				**$167,320,00**
Additional Capital Improvement Costs				
Dewatering	$1.673,20	L.S.		$1.673,00
Mobilization	5%			$8.366,00
Traffic Control	$3.346,40	L.S.		$3.346,00
Utility Coordination/Relocation	$16.732,00	L.S.		$16.732,00
Stormwater Management/Erosion Control	5%			$8.366,00
Subtotal Additional Capital Improvement Costs				**$38.483,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$30.870,00
Legal/Administrative	5%			$10.290,00
Contract Admin/Construction Management	10%			$20.580,00
Contingency	25%			$51.451,00
Subtotal Other Costs				**$113.191,00**
Total Capital Improvement Costs				**$318,994,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	12	EA	$64,00	$154,00
Total Annual Operation and Maintenance Cost				**$154.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$5,390.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7th St. Outfall
REACH :	Lateral_7thAve_S
JURISDICTION :	City of Greeley
REACH ID:	7th St-ReachLateral_7thAve_S Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	860	1	860	L.F.	$92,00	$79.120,00	L038,09
30-inch	360	1	360	L.F.	$116,00	$41.760,00	L938,08
18-inch	50	15	750	L.F.	$69,00	$51.750,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			5	EA	$3,726,00	$18.630,00	
StormInlet, Type R/Type 14, 5-foot			15	EA	$5,910,00	$88.650,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		653	S.Y.	$50,00	$32.650,00	
Waterline Lowering	<---User Defined Items		3	EA	$5.000,00	$15.000,00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$279.910,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$47.650,00
Subtotal Capital Improvement Costs				**$327.560,00**
Additional Capital Improvement Costs				
Dewatering	$3.275,60	L.S.		$3.276,00
Mobilization	5%			$16.378,00
Traffic Control	$6.551,20	L.S.		$6.551,00
Utility Coordination/Relocation	$32.756,00	L.S.		$32.756,00
Stormwater Management/Erosion Control	5%			$16.378,00
Subtotal Additional Capital Improvement Costs				**$75.339,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$60.435,00
Legal/Administrative	5%			$20.145,00
Contract Admin/Construction Management	10%			$40.290,00
Contingency	25%			$100.725,00
Subtotal Other Costs				**$221.595,00**
Total Capital Improvement Costs				**$624.494,00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	20	EA	$64,00	$256,00
Total Annual Operation and Maintenance Cost				**$256.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$8,960.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7th St. Outfall
REACH :	Lateral_8thAve_N
JURISDICTION :	City of Greeley
REACH ID:	7th St-ReachLateral_8thAve_N Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	520	1	520	L.F.	$92,00	$47.840,00	L938,05
18-inch	50	8	400	L.F.	$69,00	$27.600,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			2	EA	$3,726,00	$7.452,00	
StormInlet, Type R/Type 14, 5-foot			8	EA	$5,910,00	$47.280,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		308	SY	$50,00	$15.400,00	
Waterline Lowering	<---User Defined Items		1	EA	$5.000,00	$5.000,00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$130.172,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$20.400,00
Subtotal Capital Improvement Costs				**$150.572,00**
Additional Capital Improvement Costs				
Dewatering	$1.505,72	L.S.		$1.506,00
Mobilization	5%			$7.529,00
Traffic Control	$3.011,44	L.S.		$3.011,00
Utility Coordination/Relocation	$15.057,20	L.S.		$15.057,00
Stormwater Management/Erosion Control	5%			$7.529,00
Subtotal Additional Capital Improvement Costs				**$34.632,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$27.781,00
Legal/Administrative	5%			$9.260,00
Contract Admin/Construction Management	10%			$18.520,00
Contingency	25%			$46.301,00
Subtotal Other Costs				**$101.862,00**
Total Capital Improvement Costs				**$287,066.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	10	EA	$64,00	$128,00
Total Annual Operation and Maintenance Cost				**$128.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$4,480.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7th St. Outfall
REACH :	Lateral_9thAve
JURISDICTION :	City of Greeley
REACH ID:	7th St-ReachLateral_9thAve Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	585	1	585	L.F.	$69,00	$40.365,00	L038,03
24-inch	400	1	400	L.F.	$92,00	$36.800,00	L038,04
18-inch	50	5	250	L.F.	$69,00	$17.250,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			4	EA	$3.726,00	$14.904,00	
StormInlet, Type R/Type 14, 5-foot			5	EA	$5.910,00	$29.550,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		500	SY	$50,00	$25.000,00	
Waterline Lowering	<---User Defined Items		3	EA	$5.000,00	$15.000,00	

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains		$138.869,00	
Concrete Box Culverts		$0,00	
Hydraulic Structures		$0,00	
Channel Improvements		$0,00	
Detention/Water Quality Facilities		$0,00	
Removals		$0,00	
Landscaping and Maintenance Improvements		$0,00	
Special Items (User Defined)		$40.000,00	
Subtotal Capital Improvement Costs		**$178.869,00**	
Additional Capital Improvement Costs			
Dewatering	$1.788,69 L.S.	$1.789,00	
Mobilization	5%	$8.943,00	
Traffic Control	$3.577,38 L.S.	$3.577,00	
Utility Coordination/Relocation	$17.886,90 L.S.	$17.887,00	
Stormwater Management/Erosion Control	5%	$8.943,00	
Subtotal Additional Capital Improvement Costs		**$41.139,00**	
Land Acquisition Costs			
ROW/Easements		$0,00	
Subtotal Land Acquisition Costs		**$0,00**	
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%	$33.001,00	
Legal/Administrative	5%	$11.000,00	
Contract Admin/Construction Management	10%	$22.001,00	
Contingency	25%	$55.002,00	
Subtotal Other Costs		**$121.004,00**	
Total Capital Improvement Costs		**$341.012,00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	9	EA	$64,00	$115,00	
Total Annual Operation and Maintenance Cost				**$115.00**	
Effective Interest Rate				1,50%	
Total Operation and Maintenance Costs Over 50 Years				**$4.025.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7th St. Outfall
REACH :	Lateral_11thAve_N
JURISDICTION :	City of Greeley
REACH ID:	7th St-ReachLateral_11thAve_N Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
42-inch	1015	1	1015	L.F.	$162,00	$164.430,00	L030,03_pipe
18-inch	50	17	850	L.F.	$69,00	$58.650,00	Inlet Lateral
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			6	EA	$5.010,00	$30.060,00	
StormInlet, Type R/Type 14, 5-foot			17	EA	$5.910,00	$100.470,00	
Special Items (User Defined)							
Asphalt Repave	<---User Defined Items		695	SY	$40,00	$27.800,00	
Waterline Lowering	<---User Defined Items		2	EA	$5.000,00	$10.000,00	

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains					$353.610,00	
Concrete Box Culverts					$0,00	
Hydraulic Structures					$0,00	
Channel Improvements					$0,00	
Detention/Water Quality Facilities					$0,00	
Removals					$0,00	
Landscaping and Maintenance Improvements					$0,00	
Special Items (User Defined)					$37.800,00	
Subtotal Capital Improvement Costs					**$391.410,00**	
Additional Capital Improvement Costs						
Dewatering	$3.914,10	L.S.			$3.914,00	
Mobilization	5%				$19.571,00	
Traffic Control	$7.828,20	L.S.			$7.828,00	
Utility Coordination/Relocation	$39.141,00	L.S.			$39.141,00	
Stormwater Management/Erosion Control	5%				$19.571,00	
Subtotal Additional Capital Improvement Costs					**$90.025,00**	
Land Acquisition Costs						
ROW/Easements					$0,00	
Subtotal Land Acquisition Costs					**$0.00**	
Other Costs (percentage of Capital Improvement Costs)						
Engineering	15%				$72.215,00	
Legal/Administrative	5%				$24.072,00	
Contract Admin/Construction Management	10%				$48.144,00	
Contingency	25%				$120.359,00	
Subtotal Other Costs					**$264.790.00**	
Total Capital Improvement Costs					**$746,225.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	23	EA	$64,00	$294,00	
Total Annual Operation and Maintenance Cost				**$294.00**	
Effective Interest Rate				1,50%	
Total Operation and Maintenance Costs Over 50 Years				**$10,290.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7th St_Outfall
REACH :	Lateral_11thAve_S
JURISDICTION :	City of Greeley
REACH ID:	7th St-ReachLateral_11thAve_S

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
30-inch	500	1	500	L.F.	$116,00	$58.000,00	L030,05_pipe
36-inch	850	1	850	L.F.	$139,00	$118.150,00	L030,04_pipe
18-inch	50	9	450	L.F.	$69,00	$31.050,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			2	EA	$3.726,00	$7.452,00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			3	EA	$5.010,00	$15.030,00	
Storm Inlet, Type R/Type 14, 5-foot			9	EA	$5.910,00	$53.190,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		822	SY	$50,00	$41.100,00	
Waterline Lowering	<---User Defined Items		3	EA	$5.000,00	$15.000,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$282.872,00
Concrete Box Culverts					$0,00
Hydraulic Structures					$0,00
Channel Improvements					$0,00
Detention/Water Quality Facilities					$0,00
Removals					$0,00
Landscaping and Maintenance Improvements					$0,00
Special Items (User Defined)					$56.100,00
Subtotal Capital Improvement Costs					**$338.972,00**
Additional Capital Improvement Costs					
Dewatering		$3.389,72	L.S.		$3.390,00
Mobilization		5%			$16.949,00
Traffic Control		$6.779,44	L.S.		$6.779,00
Utility Coordination/Relocation		$33.897,20	L.S.		$33.897,00
Stormwater Management/Erosion Control		5%			$16.949,00
Subtotal Additional Capital Improvement Costs					**$77.964,00**
Land Acquisition Costs					
ROW/Easements					$0,00
Subtotal Land Acquisition Costs					**$0,00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$62.540,00
Legal/Administrative		5%			$20.847,00
Contract Admin/Construction Management		10%			$41.694,00
Contingency		25%			$104.234,00
Subtotal Other Costs					**$229.315,00**
Total Capital Improvement Costs					**$646,251.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	14	EA	$64,00	$179,00
Total Annual Operation and Maintenance Cost				**$179.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$6,265.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	9th St_Outfall
REACH :	9thSt
JURISDICTION :	City of Greeley
REACH ID:	9th St-Reach9thSt

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	570	1	570	L.F.	$69,00	$39.330,00	L936,05
18-inch	1000	1	1000	L.F.	$69,00	$69.000,00	L737,10
36-inch	360	1	360	L.F.	$139,00	$50.040,00	L037,09
18-inch	50	12	600	L.F.	$69,00	$41.400,00	Inlet Laterals
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
36-inch	Yes	1	1	EA	$2.068,00	$2.068,00	
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			5	EA	$3.726,00	$18.630,00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			2	EA	$5.010,00	$10.020,00	
Storm Inlet, Type R/Type 14, 5-foot			12	EA	$5.910,00	$70.920,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		1012	S.Y.	$50,00	$50.600,00	
Waterline Lowering	<---User Defined Items		3	EA	$5.000,00	$15.000,00	
Land Acquisition							
Easement/ROW Acquisition			0,14	ACRE	$43.987,24	$6.325,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$301.408,00
Concrete Box Culverts					$0,00
Hydraulic Structures					$0,00
Channel Improvements					$0,00
Detention/Water Quality Facilities					$0,00
Removals					$0,00
Landscaping and Maintenance Improvements					$0,00
Special Items (User Defined)					$65.600,00
Subtotal Capital Improvement Costs					**$367.008,00**
Additional Capital Improvement Costs					
Dewatering		$3.670,08	L.S.		$3.670,00
Mobilization		5%			$18.350,00
Traffic Control		$7.340,16	L.S.		$7.340,00
Utility Coordination/Relocation		$36.700,80	L.S.		$36.701,00
Stormwater Management/Erosion Control		5%			$18.350,00
Subtotal Additional Capital Improvement Costs					**$84.411,00**
Land Acquisition Costs					
ROW/Easements					$6.325,00
Subtotal Land Acquisition Costs					**$6.325,00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$67.713,00
Legal/Administrative		5%			$22.571,00
Contract Admin/Construction Management		10%			$45.142,00
Contingency		25%			$112.855,00
Subtotal Other Costs					**$248.281,00**
Total Capital Improvement Costs					**$706,025,00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	19	EA	$64,00	$243,00
Total Annual Operation and Maintenance Cost				**$243.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$8,505.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 11th St, Outfall
REACH : 11thSt
JURISDICTION : City of Greeley
REACH ID: 11th St-Reach11thSt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	850	1	850	L.F.	$69,00	$58.650,00	L036,06
18-inch	600	1	600	L.F.	$69,00	$41.400,00	L036,17_pipe
18-inch	490	1	490	L.F.	$69,00	$33.810,00	L036,10
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			6	EA	$3.726,00	$22.356,00	
Storm Inlet, Type R/Type 14, 5-foot			4	EA	$5.910,00	$23.640,00	
Special Items (User Defined)							
Asphalt Patch	**<----User Defined Items**		903	S.Y.	$50,00	$45.150,00	
Waterline Lowering	**<----User Defined Items**		3	EA	$5.000,00	$15.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$179.856,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$60.150,00
Subtotal Capital Improvement Costs				**$240.006,00**
Additional Capital Improvement Costs				
Dewatering	$2.400,06	L.S.		$2.400,00
Mobilization	5%			$12.000,00
Traffic Control	$4.800,12	L.S.		$4.800,00
Utility Coordination/Relocation	$24.000,60	L.S.		$24.001,00
Stormwater Management/Erosion Control	5%			$12.000,00
Subtotal Additional Capital Improvement Costs				**$55.201,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$44.281,00
Legal/Administrative	5%			$14.760,00
Contract Admin/Construction Management	10%			$29.521,00
Contingency	25%			$73.802,00
Subtotal Other Costs				**$162.364,00**
Total Capital Improvement Costs				**$457,571,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	10	EA	$64,00	$128,00
Total Annual Operation and Maintenance Cost				**$128.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$4,480.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 12th Ave, Outfall
REACH : 12thAve
JURISDICTION : City of Greeley
REACH ID: 12thAve-Reach12thAve Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
24-inch	930	1	930	L.F.	$92,00	$85.560,00	L006,1_pipe
24-inch	400	1	400	L.F.	$92,00	$36.800,00	L906,2_pipe
30-inch	800	1	800	L.F.	$116,00	$92.800,00	L906,3_pipe
30-inch	400	1	400	L.F.	$116,00	$46.400,00	L907,3_pipe
18-inch	360	1	360	L.F.	$69,00	$24.840,00	L007,2_pipe
30-inch	400	1	400	L.F.	$116,00	$46.400,00	L907,4_pipe
36-inch	1200	1	1200	L.F.	$139,00	$166.800,00	L907,5_pipe
18-inch	50	28	1400	L.F.	$69,00	$96.600,00	Inlet Laterals
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
36-inch	Yes	1	1	EA	$2.068,00	$2.068,00	Outfall into Greeley No. 3 Canal
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			11	EA	$3.726,00	$40.986,00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			4	EA	$5.010,00	$20.040,00	
Storm Inlet, Type R/Type 14, 5-foot			28	EA	$5.910,00	$165.480,00	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			7	AC-FT	$58.582,00	$385.938,00	
Special Items (User Defined)							
Asphalt Patch	**<----User Defined Items**		2373	S.Y.	$50,00	$118.650,00	
Waterline Lowering	**<----User Defined Items**		8	EA	$5.000,00	$40.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$824.774,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$385.938,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$158.650,00
Subtotal Capital Improvement Costs				**$1,369,362,00**
Additional Capital Improvement Costs				
Dewatering	$13.693,62	L.S.		$13.694,00
Mobilization	5%			$68.468,00
Traffic Control	$27.387,24	L.S.		$27.387,00
Utility Coordination/Relocation	$136.936,20	L.S.		$136.936,00
Stormwater Management/Erosion Control	5%			$68.468,00
Subtotal Additional Capital Improvement Costs				**$314,953,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$252.647,00
Legal/Administrative	5%			$84.216,00
Contract Admin/Construction Management	10%			$168.432,00
Contingency	25%			$421.079,00
Subtotal Other Costs				**$926,374,00**
Total Capital Improvement Costs				**$2,610,689.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	43	EA	$64,00	$550,00
Total Annual Operation and Maintenance Cost				**$550.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$19,250.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St, Outfall Trunk
REACH :	12thSt_Trunk
JURISDICTION :	City of Greeley
REACH ID:	12thSt_Trunk-Reach12thSt_Trunk Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
48-inch	490	1	490	L.F.	$185,00	$90.650,00	L029,02
42-inch	510	1	510	L.F.	$162,00	$82.620,00	L830,18
42-inch	500	1	500	L.F.	$162,00	$81.000,00	L930,15
60-inch	500	1	500	L.F.	$308,00	$154.000,00	L931,02
18-inch	50	59	2950	L.F.	$69,00	$203.550,00	Inlet Laterals
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			4	EA	$5.010,00	$20.040,00	
Manhole, 6' Dia, (Pipe Dia, = 48")			4	EA	$5.524,00	$22.096,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			20	EA	$15.416,00	$308.320,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			1	EA	$19.271,00	$19.271,00	
Storm Inlet, Type R/Type 14, 5-foot			59	EA	$5.910,00	$348.690,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
6	4	1	500	L.F.	$699,12	$349.560,00	L831,01
6	4	1	500	L.F.	$699,12	$349.560,00	L838,15
6	4	1	500	L.F.	$699,12	$349.560,00	L738,15
10	5	1	700	L.F.	$1.046,05	$732.238,00	L936,26
10	5	1	700	L.F.	$1.046,05	$732.238,00	L036,07
10	5	1	490	L.F.	$1.046,05	$512.566,00	L036,15
8	5	2	510	L.F.	$1.737,72	$886.235,00	L036,19
8	5	2	1330	L.F.	$1.737,72	$2.311.162,00	L836,11
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
8	2	19,00	1	EA	$1.672,67	$1.673,00	Outfall into Poudre
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
8	5	2	1	EA	$13.345,63	$13.345,60	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			7	AC-FT	$58.582,00	$385.938,00	WQCV
Special Items (User Defined)							
Asphalt Repave	**<----User Defined Items**		8858	S.Y.	$40,00	$354.320,00	
Waterline Lowering	**<----User Defined Items**		15	EA	$5.000,00	$75.000,00	
RR Boring	**<----User Defined Items**		300	LF	$4.500,00	$1.350.000,00	3 - 60" (100 LF each)
Hwy 85 Boring	**<----User Defined Items**		800	LF	$4.500,00	$3.600.000,00	5 - 60" (160 LF each)
Land Acquisition							
Easement/ROW Acquisition			7,56	ACRE	$375.371,00	$2.837.805,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$1.330.237,00
Concrete Box Culverts				$6.238.138,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$385.938,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$5.379.320,00
Subtotal Capital Improvement Costs				**$13.333.633.00**
Additional Capital Improvement Costs				
Dewatering	$133.336,33	L.S.		$133.336,00
Mobilization	5%			$666.682,00
Traffic Control	$266.672,66	L.S.		$266.673,00
Utility Coordination/Relocation	$1.333.363,30	L.S.		$1.333.363,00
Stormwater Management/Erosion Control	5%			$666.682,00
Subtotal Additional Capital Improvement Costs				**$3.066.736.00**
Land Acquisition Costs				
ROW/Easements				$2.837.805,00
Subtotal Land Acquisition Costs				**$2.837.805.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$2.460.055,00
Legal/Administrative	5%			$820.018,00
Contract Admin/Construction Management	10%			$1.640.037,00
Contingency	25%			$4.100.092,00
Subtotal Other Costs				**$9.020.202.00**
Total Capital Improvement Costs				**$28.258.376,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	88	EA	$64,00	$1.126,00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, struc	6,588	ACRE	$1.927,00	$6.348,00
Total Annual Operation and Maintenance Cost				**$7.474,00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$261.588,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St, Outfall
REACH :	LateralsNof12th
JURISDICTION :	City of Greeley
REACH ID:	12thSt-ReachLateralsNof12th Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	475	1	475	L.F.	$69,00	$32.775,00	L038,10
18-inch	500	1	500	L.F.	$69,00	$34.500,00	L938,20
18-inch	50	5	250	L.F.	$69,00	$17.250,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			4	EA	$3.726,00	$14.904,00	
Storm Inlet, Type R/Type 14, 5-foot			5	EA	$5.910,00	$29.550,00	
Special Items (User Defined)							
Asphalt Patch	**<----User Defined Items**		451	S.Y.	$40,00	$18.040,00	
Waterline Lowering	**<----User Defined Items**		2	EA	$5.000,00	$10.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$128.979,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$28.040,00
Subtotal Capital Improvement Costs				**$157.019,00**
Additional Capital Improvement Costs				
Dewatering	$1.570,19	L.S.		$1.570,00
Mobilization	5%			$7.851,00
Traffic Control	$3.140,38	L.S.		$3.140,00
Utility Coordination/Relocation	$15.701,90	L.S.		$15.702,00
Stormwater Management/Erosion Control	5%			$7.851,00
Subtotal Additional Capital Improvement Costs				**$36.114,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$28.970,00
Legal/Administrative	5%			$9.657,00
Contract Admin/Construction Management	10%			$19.313,00
Contingency	25%			$48.283,00
Subtotal Other Costs				**$106.223.00**
Total Capital Improvement Costs				**$299,356,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	9	EA	$64,00	$115,00
Total Annual Operation and Maintenance Cost				**$115.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$4.025.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St, Outfall
REACH :	STribEofRR
JURISDICTION :	City of Greeley
REACH ID:	12thSt-ReachSTribEofRR

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
36-inch	660	1	660	L.F.	$139,00	$91.740,00	L936,25
36-inch	500	1	500	L.F.	$139,00	$69.500,00	L036,25
36-inch	500	1	500	L.F.	$139,00	$69.500,00	L036,23
42-inch	500	1	500	L.F.	$162,00	$81.000,00	L036,22
18-inch	480	1	480	L.F.	$69,00	$33.120,00	L036,24
18-inch	50	33	1650	L.F.	$69,00	$113.850,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			2	EA	$3.726,00	$7.452,00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			9	EA	$5.010,00	$45.090,00	
Storm Inlet, Type R/Type 14, 5-foot			33	EA	$5.910,00	$195.030,00	
Special Items (User Defined)							
Asphalt Repave	**<---User Defined Items**		1628	S.Y.	$40,00	$65.120,00	
Waterline Lowering	**<---User Defined Items**		4	EA	$5.000,00	$20.000,00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$706.282,00	
Concrete Box Culverts						$0,00	
Hydraulic Structures						$0,00	
Channel Improvements						$0,00	
Detention/Water Quality Facilities						$0,00	
Removals						$0,00	
Landscaping and Maintenance Improvements						$0,00	
Special Items (User Defined)						$85.120,00	
Subtotal Capital Improvement Costs						**$791.402,00**	
Additional Capital Improvement Costs							
Dewatering			$7.914,02	L.S.		$7.914,00	
Mobilization			5%			$39.570,00	
Traffic Control			$15.828,04	L.S.		$15.828,00	
Utility Coordination/Relocation			$79.140,20	L.S.		$79.140,00	
Stormwater Management/Erosion Control			5%			$39.570,00	
Subtotal Additional Capital Improvement Costs						**$182.022,00**	
Land Acquisition Costs							
ROW/Easements						$0,00	
Subtotal Land Acquisition Costs						**$0,00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$146.014,00	
Legal/Administrative			5%			$48.671,00	
Contract Admin/Construction Management			10%			$97.342,00	
Contingency			25%			$243.356,00	
Subtotal Other Costs						**$535.383,00**	
Total Capital Improvement Costs						**$1,508,807.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	44	EA	$64,00	$563,00	
Total Annual Operation and Maintenance Cost				**$563.00**	
Effective Interest Rate				1,50%	
Total Operation and Maintenance Costs Over 50 Years				**$19,705.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St, Outfall
REACH :	STribWofRR
JURISDICTION :	City of Greeley
REACH ID:	12thSt-ReachSTribWofRR

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
42-inch	490	1	490	L.F.	$162,00	$79.380,00	L031,04
42-inch	510	1	510	L.F.	$162,00	$82.620,00	L032,04
36-inch	505	1	505	L.F.	$139,00	$70.195,00	L032,10
42-inch	500	1	500	L.F.	$162,00	$81.000,00	L932,06
54-inch	500	1	500	L.F.	$277,00	$138.500,00	L032,05
42-inch	510	1	510	L.F.	$162,00	$82.620,00	L032,09
36-inch	485	1	485	L.F.	$139,00	$67.415,00	L932,07
60-inch	500	1	500	L.F.	$308,00	$154.000,00	L832,07
36-inch	500	1	500	L.F.	$139,00	$69.500,00	L936,31
36-inch	500	1	500	L.F.	$139,00	$69.500,00	L036,30
24-inch	500	1	500	L.F.	$92,00	$46.000,00	L936,33
30-inch	500	1	500	L.F.	$116,00	$58.000,00	L936,28
30-inch	500	1	500	L.F.	$116,00	$58.000,00	L836,33
36-inch	500	1	500	L.F.	$139,00	$69.500,00	L836,30
18-inch	50	117	5850	L.F.	$69,00	$403.650,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			6	EA	$3.726,00	$22.356,00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			21	EA	$5.010,00	$105.210,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			4	EA	$15.416,00	$61.664,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			2	EA	$19.271,00	$38.542,00	
Storm Inlet, Type R/Type 14, 5-foot			117	EA	$5.910,00	$691.470,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
9	5	1	520	L.F.	$957,26	$497.777,00	L736,30
Special Items (User Defined)							
Asphalt Repave	**<---User Defined Items**		3778	S.Y.	$40,00	$151.120,00	
Asphalt Patch	**<---User Defined Items**		1344	EA	$50,00	$67.200,00	
Waterline Lowering	**<---User Defined Items**		15	EA	$5.000,00	$75.000,00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$2.449.122,00	
Concrete Box Culverts						$497.777,00	
Hydraulic Structures						$0,00	
Channel Improvements						$0,00	
Detention/Water Quality Facilities						$0,00	
Removals						$0,00	
Landscaping and Maintenance Improvements						$0,00	
Special Items (User Defined)						$293.320,00	
Subtotal Capital Improvement Costs						**$3,240,219.00**	
Additional Capital Improvement Costs							
Dewatering			$32.402,19	L.S.		$32.402,00	
Mobilization			5%			$162.011,00	
Traffic Control			$64.804,38	L.S.		$64.804,00	
Utility Coordination/Relocation			$324.021,90	L.S.		$324.022,00	
Stormwater Management/Erosion Control			5%			$162.011,00	
Subtotal Additional Capital Improvement Costs						**$745.250,00**	
Land Acquisition Costs							
ROW/Easements						$0,00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$597.820,00	
Legal/Administrative			5%			$199.273,00	
Contract Admin/Construction Management			10%			$398.547,00	
Contingency			25%			$996.367,00	
Subtotal Other Costs						**$2,192,007.00**	
Total Capital Improvement Costs						**$6,177,476.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	150	EA	$64,00	$1.920,00	
Total Annual Operation and Maintenance Cost				**$1,920.00**	
Effective Interest Rate				1,50%	
Total Operation and Maintenance Costs Over 50 Years				**$67,199,00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. Outfall
REACH :	Lateral_4thSt
JURISDICTION :	City of Greeley
REACH ID:	14thAve-ReachLateral_4thSt

Jeremy Deischer | DATE : | 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	910	1	910	L.F.	$69,00	$62.790,00	4th Street Lateral, L025,02
18-inch	50	2	100	L.F.	$69,00	$6.900,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			5	EA	$3.726,00	$18.630,00	
Storm Inlet, Type R/Type 14, 5-foot			2	EA	$5.910,00	$11.820,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		421	S.Y.	$50,00	$21.050,00	
Land Acquisition							
Easement/ROW Acquisition			0,38	ACRE	$25.337,99	$9.665,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs						
Pipe Culverts and Storm Drains						$100.140,00
Concrete Box Culverts						$0,00
Hydraulic Structures						$0,00
Channel Improvements						$0,00
Detention/Water Quality Facilities						$0,00
Removals						$0,00
Landscaping and Maintenance Improvements						$0,00
Special Items (User Defined)						$21.050,00
Subtotal Capital Improvement Costs						**$121.190,00**
Additional Capital Improvement Costs						
Dewatering			$1.211,90	L.S.		$1.212,00
Mobilization			5%			$6.060,00
Traffic Control			$2.423,80	L.S.		$2.424,00
Utility Coordination/Relocation			$12.119,00	L.S.		$12.119,00
Stormwater Management/Erosion Control			5%			$6.060,00
Subtotal Additional Capital Improvement Costs						**$27.875,00**
Land Acquisition Costs						
ROW/Easements						$9.665,00
Subtotal Land Acquisition Costs						**$9.665,00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$22.360,00
Legal/Administrative			5%			$7.453,00
Contract Admin/Construction Management			10%			$14.907,00
Contingency			25%			$37.266,00
Subtotal Other Costs						**$81.986,00**
Total Capital Improvement Costs						**$240.716,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	7	EA	$64,00	$90,00
Total Annual Operation and Maintenance Cost				**$90,00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$3.150,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. Outfall
REACH :	Lateral_5thSt
JURISDICTION :	City of Greeley
REACH ID:	14thAve-ReachLateral_5thSt

Jeremy Deischer | DATE : | 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	670	1	670	L.F.	$69,00	$46.230,00	L027,15_pipe
24-inch	330	1	330	L.F.	$92,00	$30.360,00	L027,06_pipe
30-inch	480	1	480	L.F.	$116,00	$55.680,00	L027,05
30-inch	590	1	590	L.F.	$116,00	$68.440,00	L027,14_pipe
30-inch	1600	1	1600	L.F.	$116,00	$185.600,00	L026,04_pipe
36-inch	400	1	400	L.F.	$139,00	$55.600,00	L027,13_pipe
36-inch	470	1	470	L.F.	$139,00	$65.330,00	L027,02
42-inch	690	1	690	L.F.	$162,00	$111.780,00	L926,03
18-inch	50	15	750	L.F.	$69,00	$51.750,00	
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			12	EA	$3.726,00	$44.712,00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			2	EA	$5.010,00	$10.020,00	
Storm Inlet, Type R/Type 14, 5-foot			15	EA	$5.910,00	$88.650,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		3158	S.Y.	$50,00	$157.900,00	
Waterline Lowering	<---User Defined Items		9	EA	$5.000,00	$45.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs						
Pipe Culverts and Storm Drains						$814.152,00
Concrete Box Culverts						$0,00
Hydraulic Structures						$0,00
Channel Improvements						$0,00
Detention/Water Quality Facilities						$0,00
Removals						$0,00
Landscaping and Maintenance Improvements						$0,00
Special Items (User Defined)						$202.900,00
Subtotal Capital Improvement Costs						**$1.017.052,00**
Additional Capital Improvement Costs						
Dewatering			$10.170,52	L.S.		$10.171,00
Mobilization			5%			$50.853,00
Traffic Control			$20.341,04	L.S.		$20.341,00
Utility Coordination/Relocation			$101.705,20	L.S.		$101.705,00
Stormwater Management/Erosion Control			5%			$50.853,00
Subtotal Additional Capital Improvement Costs						**$233.923,00**
Land Acquisition Costs						
ROW/Easements						$0,00
Subtotal Land Acquisition Costs						**$0,00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$187.646,00
Legal/Administrative			5%			$62.549,00
Contract Admin/Construction Management			10%			$125.098,00
Contingency			25%			$312.744,00
Subtotal Other Costs						**$688.037,00**
Total Capital Improvement Costs						**$1.939.012,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	29	EA	$64,00	$371,00
Total Annual Operation and Maintenance Cost				**$371,00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$12.985,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave, Outfall
REACH :	Lateral_8thSt
JURISDICTION :	City of Greeley
REACH ID:	14thAve-ReachLateral_8thSt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	1000	1	1000	L.F.	$92.00	$92,000.00	L027,08
18-inch	50	4	200	L.F.	$69.00	$13,800.00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			3	EA	$3,726.00	$11,178.00	
StormInlet, Type R/Type 14, 5-foot			4	EA	$5,910.00	$23,640.00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		520	S.Y.	$50.00	$26,000.00	
Waterline Lowering	<----User Defined Items		2	EA	$5,000.00	$10,000.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$140,618.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$0.00
Detention/Water Quality Facilities					$0.00
Removals					$0.00
Landscaping and Maintenance Improvements					$0.00
Special Items (User Defined)					$36,000.00
Subtotal Capital Improvement Costs					**$176,618.00**
Additional Capital Improvement Costs					
Dewatering			$1,766.18	L.S.	$1,766.00
Mobilization			5%		$8,831.00
Traffic Control			$3,532.36	L.S.	$3,532.00
Utility Coordination/Relocation			$17,661.80	L.S.	$17,662.00
Stormwater Management/Erosion Control			5%		$8,831.00
Subtotal Additional Capital Improvement Costs					**$40,622.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering			15%		$32,586.00
Legal/Administrative			5%		$10,862.00
Contract Admin/Construction Management			10%		$21,724.00
Contingency			25%		$54,310.00
Subtotal Other Costs					**$119,482.00**
Total Capital Improvement Costs					**$336,722.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	7	EA	$64.00	$90.00
Total Annual Operation and Maintenance Cost				**$90.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$3,150.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave, Outfall
REACH :	Lateral_9thSt
JURISDICTION :	City of Greeley
REACH ID:	14thAve-ReachLateral_9thSt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	670	1	670	L.F.	$139.00	$93,130.00	L027,11_pipe
36-inch	1000	1	1000	L.F.	$139.00	$139,000.00	L027,10_pipe
18-inch	50	12	600	L.F.	$69.00	$41,400.00	Inlet Laterals
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			5	EA	$5,010.00	$25,050.00	
StormInlet, Type R/Type 14, 5-foot			12	EA	$5,910.00	$70,920.00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		1007	S.Y.	$50.00	$50,350.00	
Waterline Lowering	<----User Defined Items		1	EA	$5,000.00	$5,000.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$369,500.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$0.00
Detention/Water Quality Facilities					$0.00
Removals					$0.00
Landscaping and Maintenance Improvements					$0.00
Special Items (User Defined)					$55,350.00
Subtotal Capital Improvement Costs					**$424,850.00**
Additional Capital Improvement Costs					
Dewatering			$4,248.50	L.S.	$4,249.00
Mobilization			5%		$21,243.00
Traffic Control			$8,497.00	L.S.	$8,497.00
Utility Coordination/Relocation			$42,485.00	L.S.	$42,485.00
Stormwater Management/Erosion Control			5%		$21,243.00
Subtotal Additional Capital Improvement Costs					**$97,717.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering			15%		$78,385.00
Legal/Administrative			5%		$26,128.00
Contract Admin/Construction Management			10%		$52,257.00
Contingency			25%		$130,642.00
Subtotal Other Costs					**$287,412.00**
Total Capital Improvement Costs					**$809,979.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	17	EA	$64.00	$218.00
Total Annual Operation and Maintenance Cost				**$218.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$7,630.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. Outfall Trunk
REACH :	14thAveTrunk
JURISDICTION :	City of Greeley
REACH ID:	14thAveTrunk-Reach14thAveTrunk Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
42-inch	350	1	350	L.F.	$162,00	$56.700,00	L027,09
48-inch	360	1	360	L.F.	$185,00	$66.600,00	L027,07
48-inch	400	1	400	L.F.	$185,00	$74.000,00	L027,04
48-inch	550	1	550	L.F.	$185,00	$101.750,00	L027,01
18-inch	50	75	3750	L.F.	$69,00	$258.750,00	Inlet Laterals
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			1	EA	$5.010,00	$5.010,00	
Manhole, 6' Dia, (Pipe Dia, = 48")			4	EA	$5.524,00	$22.096,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			17	EA	$15,416,00	$262.072,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			2	EA	$19.271,00	$38.542,00	
Storm Inlet, Type R/Type 14, 5-foot			75	EA	$5.910,00	$443.250,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
7	4	1	530	L.F.	$758,92	$402.229,00	L026,03
7	4	1	530	L.F.	$758,92	$402.229,00	L926,02
7	4	1	280	L.F.	$758,92	$212.498,00	L926,01
8	4	1	340	L.F.	$819,72	$278.706,00	L925,01
10	4	1	850	L.F.	$938,56	$797.773,00	L825,01
12	4	1	1510	L.F.	$1.059,16	$1.599.333,00	L942,02
11	5	1	960	L.F.	$1.123,05	$1.078.123,00	L942,01
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
11	1	13,00	1	EA	$1.218,56	$1.219,00	Outfall into Poudre
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
11	5	1	1	EA	$11.837,53	$11.837,50	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			8	AC-FT	$58.582,00	$472.464,00	WQCV for 14th Avenue Outfall
Special Items (User Defined)							
Asphalt Repave	**<---User Defined Items**		6069	S.Y.	$40,00	$242.760,00	
Waterline Lowering	**<---User Defined Items**		12	EA	$5.000,00	$60.000,00	
Railroad Boring	**<---User Defined Items**		300	LF	$4.500,00	$1.350.000,00	3 - 60" parallel closed face borings
Land Acquisition							
Easement/ROW Acquisition			9,30	ACRE	$21.980,00	$204.414,00	WQCV

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$1.328.770,00
Concrete Box Culverts				$4.783.948,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$472.464,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$1.652.760,00
Subtotal Capital Improvement Costs				**$8,237,942.00**
Additional Capital Improvement Costs				
Dewatering	$82.379,42	L.S.		$82.379,00
Mobilization	5%			$411.897,00
Traffic Control	$164.758,84	L.S.		$164.759,00
Utility Coordination/Relocation	$823.794,20	L.S.		$823.794,00
Stormwater Management/Erosion Control	5%			$411.897,00
Subtotal Additional Capital Improvement Costs				**$1,894,726.00**
Land Acquisition Costs				
ROW/Easements				$204.414,00
Subtotal Land Acquisition Costs				**$204,414.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$1.519.900,00
Legal/Administrative	5%			$506.633,00
Contract Admin/Construction Management	10%			$1.013.267,00
Contingency	25%			$2.533.167,00
Subtotal Other Costs				**$5,572,967.00**
Total Capital Improvement Costs				**$15,910,049.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	99	EA	$64,00	$1.267,00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, struc	8,065	ACRE	$1.927,00	$7.771,00
Total Annual Operation and Maintenance Cost				**$9,038,00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$316,327.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. US Outfall
REACH :	14thAveUS
JURISDICTION :	City of Greeley
REACH ID:	14thAveUS-Reach14thAveUS Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	350	1	350	L.F.	$69,00	$24.150,00	L004,7
18-inch	520	1	520	L.F.	$69,00	$35.880,00	L605,4
36-inch	230	1	230	L.F.	$139,00	$31.970,00	L905,3
42-inch	700	1	700	L.F.	$162,00	$113.400,00	L005,3_pipe
42-inch	550	1	550	L.F.	$162,00	$89.100,00	L016,1_pipe
48-inch	500	1	500	L.F.	$185,00	$92.500,00	L016,2_pipe
18-inch	50	25	1250	L.F.	$69,00	$86.250,00	Inlet Laterals
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
36-inch	Yes	1	1	EA	$2.068,00	$2.068,00	Interception from Glenmere Draw
48-inch	Yes	1	1	EA	$2.646,00	$2.646,00	
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			3	EA	$3.726,00	$11.178,00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			4	EA	$5.010,00	$20.040,00	
Manhole, 6' Dia, (Pipe Dia, = 48")			2	EA	$5.524,00	$11.048,00	
Storm Inlet, Type R/Type 14, 5-foot			25	EA	$5.910,00	$147.750,00	
Special Items (User Defined)							
Asphalt Repave	**<---User Defined Items**		370	S.Y.	$40,00	$14.800,00	
Asphalt Patch	**<---User Defined Items**		1426	S.Y.	$50,00	$71.300,00	
Waterline Lowering	**<---User Defined Items**		4	EA	$5.000,00	$20.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$667.980,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$106.100,00
Subtotal Capital Improvement Costs				**$774.080,00**
Additional Capital Improvement Costs				
Dewatering	$7.740,80	L.S.		$7.741,00
Mobilization	5%			$38.704,00
Traffic Control	$15.481,60	L.S.		$15.482,00
Utility Coordination/Relocation	$77.408,00	L.S.		$77.408,00
Stormwater Management/Erosion Control	5%			$38.704,00
Subtotal Additional Capital Improvement Costs				**$178,039.00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$142.818,00
Legal/Administrative	5%			$47.606,00
Contract Admin/Construction Management	10%			$95.212,00
Contingency	25%			$238.030,00
Subtotal Other Costs				**$523,666.00**
Total Capital Improvement Costs				**$1,475,785.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	34	EA	$64,00	$435,00
Total Annual Operation and Maintenance Cost				**$435.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$15,225.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	16th Ave. Ct. Outfall
REACH :	17thAve
JURISDICTION :	City of Greeley
REACH ID:	16thAveCt-Reach17thAve Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	760	1	760	L.F.	$69,00	$52.440,00	L024,03
18-inch	50	2	100	L.F.	$69,00	$6.900,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			4	EA	$3,726,00	$14.904,00	
Storm Inlet, Type R/Type 14, 5-foot			2	EA	$5,910,00	$11.820,00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		380	S.Y.	$50,00	$19.000,00	
Waterline Lowering	<----User Defined Items		1	EA	$5.000,00	$5.000,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$86.064,00
Concrete Box Culverts					$0,00
Hydraulic Structures					$0,00
Channel Improvements					$0,00
Detention/Water Quality Facilities					$0,00
Removals					$0,00
Landscaping and Maintenance Improvements					$0,00
Special Items (User Defined)					$24.000,00
Subtotal Capital Improvement Costs					**$110.064,00**
Additional Capital Improvement Costs					
Dewatering		$1.100,64	L.S.		$1.101,00
Mobilization		5%			$5.503,00
Traffic Control		$2.201,28	L.S.		$2.201,00
Utility Coordination/Relocation		$11.006,40	L.S.		$11.006,00
Stormwater Management/Erosion Control		5%			$5.503,00
Subtotal Additional Capital Improvement Costs					**$25.314,00**
Land Acquisition Costs					
ROW/Easements					$0,00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$20.307,00
Legal/Administrative		5%			$6.769,00
Contract Admin/Construction Management		10%			$13.538,00
Contingency		25%			$33.845,00
Subtotal Other Costs					**$74.459.00**
Total Capital Improvement Costs					**$209,837.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	6	EA	$64,00	$77,00
Total Annual Operation and Maintenance Cost				**$77.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$2,695.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	16th Ave. Ct. Outfall
REACH :	20thAveCt
JURISDICTION :	City of Greeley
REACH ID:	16thAveCt-Reach20thAveCt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
30-inch	1320	1	1320	L.F.	$116,00	$153.120,00	L024,04
18-inch	50	5	250	L.F.	$69,00	$17.250,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			5	EA	$3,726,00	$18.630,00	
Storm Inlet, Type R/Type 14, 5-foot			5	EA	$5,910,00	$29.550,00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		758	S.Y.	$50,00	$37.900,00	
Waterline Lowering	<----User Defined Items		5	EA	$5,000,00	$25.000,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$218.550,00
Concrete Box Culverts					$0,00
Hydraulic Structures					$0,00
Channel Improvements					$0,00
Detention/Water Quality Facilities					$0,00
Removals					$0,00
Landscaping and Maintenance Improvements					$0,00
Special Items (User Defined)					$62.900,00
Subtotal Capital Improvement Costs					**$281,450.00**
Additional Capital Improvement Costs					
Dewatering		$2,814,50	L.S.		$2,815,00
Mobilization		5%			$14.073,00
Traffic Control		$5.629,00	L.S.		$5.629,00
Utility Coordination/Relocation		$28.145,00	L.S.		$28.145,00
Stormwater Management/Erosion Control		5%			$14.073,00
Subtotal Additional Capital Improvement Costs					**$64,735.00**
Land Acquisition Costs					
ROW/Easements					$0,00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$51.928,00
Legal/Administrative		5%			$17.309,00
Contract Admin/Construction Management		10%			$34.619,00
Contingency		25%			$86.546,00
Subtotal Other Costs					**$190,402.00**
Total Capital Improvement Costs					**$536,587.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	10	EA	$64,00	$128,00
Total Annual Operation and Maintenance Cost				**$128.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$4,480.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	16th Ave. Ct. Outfall
REACH :	Nof2ndSt
JURISDICTION :	City of Greeley
REACH ID:	16thAveCt-ReachNof2ndSt

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	2	100	L.F.	$69,00	$6.900,00	Inlet Laterals
30-inch	1350	1	1350	L.F.	$116,00	$156,600,00	L024,04
18-inch	760	1	760	L.F.	$69,00	$52.440,00	L024,03
30-inch	890	1	890	L.F.	$116,00	$103,240,00	L024,02
30-inch	375	1	375	L.F.	$116,00	$43.500,00	L824,01
42-inch	275	1	275	L.F.	$162,00	$44.550,00	L724,01
42-inch	450	1	450	L.F.	$162,00	$72.900,00	L943,02
42-inch	380	1	380	L.F.	$162,00	$61.560,00	L843,02
42-inch	150	1	150	L.F.	$162,00	$24.300,00	L743,01
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
42-inch	Yes	1	1	EA	$2,184,00	$2,184,00	
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			1	EA	$3,726,00	$3,726,00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			6	EA	$5,010,00	$30,060,00	
Storm Inlet, Type R/Type 14, 5-foot			2	EA	$5,910,00	$11,820,00	
Special Items (User Defined)							
Asphalt Patch	**<----User Defined Items**		800	S.Y.	$50,00	$40,000,00	
Railroad Boring	**<----User Defined Items**		120	L.F.	$4,500,00	$540,000,00	
Waterline Lowering	**<----User Defined Items**		3	EA	$5,000,00	$15,000,00	
Land Acquisition							
Easement/ROW Acquisition			0,56	ACRE	$98.706,22	$55,739,00	Easement Required

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$613,780,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$595.000,00
Subtotal Capital Improvement Costs				**$1,208,780,00**
Additional Capital Improvement Costs				
Dewatering	$12,087,80	L.S.		$12,088,00
Mobilization	5%			$60,439,00
Traffic Control	$24,175,60	L.S.		$24,176,00
Utility Coordination/Relocation	$120,878,00	L.S.		$120,878,00
Stormwater Management/Erosion Control	5%			$60,439,00
Subtotal Additional Capital Improvement Costs				**$278,020,00**
Land Acquisition Costs				
ROW/Easements				$55,739,00
Subtotal Land Acquisition Costs				**$55,739,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$223,020,00
Legal/Administrative	5%			$74,340,00
Contract Admin/Construction Management	10%			$148,680,00
Contingency	25%			$371,700,00
Subtotal Other Costs				**$817,740,00**
Total Capital Improvement Costs				**$2,360,279,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	9	EA	$64,00	$115,00
Total Annual Operation and Maintenance Cost				**$115,00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$4,025,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	16th Ave. Outfall
REACH :	13thSt
JURISDICTION :	City of Greeley
REACH ID:	16thCt-Reach13thSt

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	540	1	540	L.F.	$69,00	$37.260,00	L018,2_pipe
24-inch	400	1	400	L.F.	$92,00	$36.800,00	L017,3_pipe
24-inch	400	1	400	L.F.	$92,00	$36.800,00	L017,4_pipe
60-inch	950	1	950	L.F.	$308,00	$292.600,00	L017,5_pipe
18-inch	50	16	800	L.F.	$69,00	$55.200,00	Inlet Laterals
Headwalls							
Diameter (in)	**Applicable**	**No. of Barrels**					
60-inch	Yes	1	1	EA	$2.047,85	$2,048,00	
Wingwalls (includes concrete apron)							
Diameter (in)		**No. of Barrels**					
60-inch		1	1	EA	$11.460,50	$11.461,00	
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			10	EA	$3,726,00	$37.260,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			2	EA	$15.416,00	$30.832,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			2	EA	$19.271,00	$38.542,00	
Storm Inlet, Type R/Type 14, 5-foot			16	EA	$5,910,00	$94.560,00	
Special Items (User Defined)							
Aspahalt Repave	**<----User Defined Items**		809	S.Y.	$40,00	$32.360,00	
Asphalt Patch	**<----User Defined Items**		821	S.Y.	$50,00	$41.050,00	
Waterline Lowering	**<----User Defined Items**		5	EA	$5.000,00	$25.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$673,363,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$98.410,00
Subtotal Capital Improvement Costs				**$771.773,00**
Additional Capital Improvement Costs				
Dewatering	$7.717,73	L.S.		$7.718,00
Mobilization	5%			$38.589,00
Traffic Control	$15.435,46	L.S.		$15.435,00
Utility Coordination/Relocation	$77.177,30	L.S.		$77.177,00
Stormwater Management/Erosion Control	5%			$38.589,00
Subtotal Additional Capital Improvement Costs				**$177.508,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$142.392,00
Legal/Administrative	5%			$47.464,00
Contract Admin/Construction Management	10%			$94.928,00
Contingency	25%			$237.320,00
Subtotal Other Costs				**$522.104,00**
Total Capital Improvement Costs				**$1,471,385,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	25	EA	$64,00	$320,00
Total Annual Operation and Maintenance Cost				**$320,00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$11,200,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	16th Ave. Outfall
REACH :	16thAveCt
JURISDICTION :	City of Greeley
REACH ID:	16thCt-Reach16thAveCt

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
36-inch	650	1	650	L.F.	$139,00	$90.350,00	L004,6_pipe
48-inch	1050	1	1050	L.F.	$185,00	$194.250,00	L917,1_pipe
18-inch	50	16	800	L.F.	$69,00	$55.200,00	Inlet Laterals
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			2	EA	$5.010,00	$10.020,00	
Manhole, 6' Dia, (Pipe Dia, = 48")			3	EA	$5.524,00	$16.572,00	
Storm Inlet, Type R/Type 14, 5-foot			16	EA	$5.910,00	$94.560,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		1231	S.Y.	$50,00	$61.550,00	
Waterline Lowering	<---User Defined Items		3	EA	$5.000,00	$15.000,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains				$460.952,00	
Concrete Box Culverts				$0,00	
Hydraulic Structures				$0,00	
Channel Improvements				$0,00	
Detention/Water Quality Facilities				$0,00	
Removals				$0,00	
Landscaping and Maintenance Improvements				$0,00	
Special Items (User Defined)				$76.550,00	
Subtotal Capital Improvement Costs				**$537.502,00**	
Additional Capital Improvement Costs					
Dewatering	$5.375,02	L.S.		$5.375,00	
Mobilization	5%			$26.875,00	
Traffic Control	$10.750,04	L.S.		$10.750,00	
Utility Coordination/Relocation	$53.750,20	L.S.		$53.750,00	
Stormwater Management/Erosion Control	5%			$26.875,00	
Subtotal Additional Capital Improvement Costs				**$123.625,00**	
Land Acquisition Costs					
ROW/Easements				$0,00	
Subtotal Land Acquisition Costs				**$0,00**	
Other Costs (percentage of Capital Improvement Costs)					
Engineering	15%			$99.169,00	
Legal/Administrative	5%			$33.056,00	
Contract Admin/Construction Management	10%			$66.113,00	
Contingency	25%			$165.282,00	
Subtotal Other Costs				**$363.620,00**	
Total Capital Improvement Costs				**$1,024,747.00**	

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	21	EA	$64,00	$269,00
Total Annual Operation and Maintenance Cost				**$269.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$9,415.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	16th Ave. Outfall
REACH :	16thSt
JURISDICTION :	City of Greeley
REACH ID:	16thCt-Reach16thSt

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
24-inch	1500	1	1500	L.F.	$92,00	$138.000,00	L004,2_pipe
42-inch	700	1	700	L.F.	$162,00	$113.400,00	L004,5_pipe
18-inch	50	26	1300	L.F.	$69,00	$89.700,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			4	EA	$3.726,00	$14.904,00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			4	EA	$5.010,00	$20.040,00	
Storm Inlet, Type R/Type 14, 5-foot			26	EA	$5.910,00	$153.660,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		1343	S.Y.	$50,00	$67.150,00	
Waterline Lowering	<---User Defined Items		5	EA	$5.000,00	$25.000,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains				$529.704,00	
Concrete Box Culverts				$0,00	
Hydraulic Structures				$0,00	
Channel Improvements				$0,00	
Detention/Water Quality Facilities				$0,00	
Removals				$0,00	
Landscaping and Maintenance Improvements				$0,00	
Special Items (User Defined)				$92.150,00	
Subtotal Capital Improvement Costs				**$621.854,00**	
Additional Capital Improvement Costs					
Dewatering	$6.218,54	L.S.		$6.219,00	
Mobilization	5%			$31.093,00	
Traffic Control	$12.437,08	L.S.		$12.437,00	
Utility Coordination/Relocation	$62.185,40	L.S.		$62.185,00	
Stormwater Management/Erosion Control	5%			$31.093,00	
Subtotal Additional Capital Improvement Costs				**$143.027,00**	
Land Acquisition Costs					
ROW/Easements				$0,00	
Subtotal Land Acquisition Costs				**$0,00**	
Other Costs (percentage of Capital Improvement Costs)					
Engineering	15%			$114.732,00	
Legal/Administrative	5%			$38.244,00	
Contract Admin/Construction Management	10%			$76.488,00	
Contingency	25%			$191.220,00	
Subtotal Other Costs				**$420.684,00**	
Total Capital Improvement Costs				**$1,185,565.00**	

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	34	EA	$64,00	$435,00
Total Annual Operation and Maintenance Cost				**$435.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$15,225.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	16th Ave. Outfall
REACH :	21stAve
JURISDICTION :	City of Greeley
REACH ID:	16thCt-Reach21stAve Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	1450	1	1450	L.F.	$69,00	$100.050,00	L904,1_pipe
24-inch	600	1	600	L.F.	$92,00	$55.200,00	L804,1_pipe
24-inch	1000	1	1000	L.F.	$92,00	$92.000,00	L004,4_pipe
18-inch	50	8	400	L.F.	$69,00	$27.600,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			9	EA	$3.726,00	$33.534,00	
Storm Inlet, Type R/Type 14, 5-foot			8	EA	$5.910,00	$47.280,00	
Special Items (User Defined)							
Asphalt Patch	**<----User Defined Items**		1244	S.Y.	$50,00	$62.200,00	
Waterline Lowering	**<----User Defined Items**		6	EA	$5.000,00	$30.000,00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$355.664,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$92.200,00
Subtotal Capital Improvement Costs				**$447.864,00**
Additional Capital Improvement Costs				
Dewatering	$4.478,64	L.S.		$4.479,00
Mobilization	5%			$22.393,00
Traffic Control	$8.957,28	L.S.		$8.957,00
Utility Coordination/Relocation	$44.786,40	L.S.		$44.786,00
Stormwater Management/Erosion Control	5%			$22.393,00
Subtotal Additional Capital Improvement Costs				**$103.008,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$82.631,00
Legal/Administrative	5%			$27.544,00
Contract Admin/Construction Management	10%			$55.087,00
Contingency	25%			$137.718,00
Subtotal Other Costs				**$302.980,00**
Total Capital Improvement Costs				**$853,852.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	17	EA	$64,00	$218,00
Total Annual Operation and Maintenance Cost				**$218.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$7,630.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	16th St. Outfall
REACH :	16thSt
JURISDICTION :	City of Greeley
REACH ID:	16thSt-Reach16thSt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	1120	1	1120	L.F.	$69,00	$77.280,00	L009,1_pipe
24-inch	600	1	600	L.F.	$92,00	$55.200,00	L013,1_pipe
30-inch	500	1	500	L.F.	$116,00	$58.000,00	L013,3_pipe
30-inch	600	1	600	L.F.	$116,00	$69.600,00	L013,4_pipe
18-inch	50	18	900	L.F.	$69,00	$62.100,00	Inlet Laterals
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
30-inch	Yes	1	1	EA	$2.017,00	$2.017,00	Outfall into Greeley No. 3 Canal
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			9	EA	$3.726,00	$33.534,00	
Storm Inlet, Type R/Type 14, 5-foot			18	EA	$5.910,00	$106.380,00	
Special Items (User Defined)							
Asphalt Patch	**<----User Defined Items**		1566	S.Y.	$50,00	$78.300,00	
Waterline Lowering	**<----User Defined Items**		6	EA	$5.000,00	$30.000,00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$464.111,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$108.300,00
Subtotal Capital Improvement Costs				**$572.411,00**
Additional Capital Improvement Costs				
Dewatering	$5.724,11	L.S.		$5.724,00
Mobilization	5%			$28.621,00
Traffic Control	$11.448,22	L.S.		$11.448,00
Utility Coordination/Relocation	$57.241,10	L.S.		$57.241,00
Stormwater Management/Erosion Control	5%			$28.621,00
Subtotal Additional Capital Improvement Costs				**$131.655,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$105.610,00
Legal/Administrative	5%			$35.203,00
Contract Admin/Construction Management	10%			$70.407,00
Contingency	25%			$176.017,00
Subtotal Other Costs				**$387.237,00**
Total Capital Improvement Costs				**$1,091,303.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	27	EA	$64,00	$346,00
Total Annual Operation and Maintenance Cost				**$346.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$12,110.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 17th St, Outfall
REACH : 17thSt
JURISDICTION : City of Greeley
REACH ID: 17thSt-Reach17thSt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
24-inch	700	1	700	L.F.	$92,00	$64.400,00	L912,1_pipe
30-inch	600	1	600	L.F.	$116,00	$69.600,00	L012,1
18-inch	50	15	750	L.F.	$69,00	$51.750,00	Inlet Laterals
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
30-inch	Yes	1	1	EA	$2.017,00	$2.017,00	Outfall into Greeley No. 3 Canal
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			5	EA	$3.726,00	$18.630,00	
Storm Inlet, Type R/Type 14, 5-foot			15	EA	$5.910,00	$88.650,00	
Special Items (User Defined)							
Asphalt Patch	**<---User Defined Items**		730	S.Y.	$50,00	$36.500,00	
Waterline Lowering	**<---User Defined Items**		4	EA	$5.000,00	$20.000,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$295.047,00
Concrete Box Culverts					$0,00
Hydraulic Structures					$0,00
Channel Improvements					$0,00
Detention/Water Quality Facilities					$0,00
Removals					$0,00
Landscaping and Maintenance Improvements					$0,00
Special Items (User Defined)					$56.500,00
Subtotal Capital Improvement Costs					**$351.547,00**
Additional Capital Improvement Costs					
Dewatering	$3.515,47	L.S.			$3.515,00
Mobilization	5%				$17.577,00
Traffic Control	$7.030,94	L.S.			$7.031,00
Utility Coordination/Relocation	$35.154,70	L.S.			$35.155,00
Stormwater Management/Erosion Control	5%				$17.577,00
Subtotal Additional Capital Improvement Costs					**$80.855,00**
Land Acquisition Costs					
ROW/Easements					$0,00
Subtotal Land Acquisition Costs					**$0,00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering	15%				$64.860,00
Legal/Administrative	5%				$21.620,00
Contract Admin/Construction Management	10%				$43.240,00
Contingency	25%				$108.101,00
Subtotal Other Costs					**$237.821,00**
Total Capital Improvement Costs					**$670,223,00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	20	EA	$64,00	$256,00
Total Annual Operation and Maintenance Cost				**$256.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$8,960.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 22nd Ave, Outfall
REACH : 22ndAve
JURISDICTION : City of Greeley
REACH ID: 22ndAve-Reach22ndAve Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
24-inch	1000	1	1000	L.F.	$92,00	$92.000,00	L018,1_pipe
30-inch	500	1	500	L.F.	$116,00	$58.000,00	L918,1_pipe
18-inch	50	19	950	L.F.	$69,00	$65.550,00	Inlet Laterals
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
30-inch	Yes	1	1	EA	$2.017,00	$2.017,00	Outlet into Luther Park
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			6	EA	$3.726,00	$22.356,00	
Storm Inlet, Type R/Type 14, 5-foot			19	EA	$5.910,00	$112.290,00	
Special Items (User Defined)							
Asphalt Patch	**<---User Defined Items**		898	S.Y.	$50,00	$44.900,00	
Waterline Lowering	**<---User Defined Items**		6	EA	$5.000,00	$30.000,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$352.213,00
Concrete Box Culverts					$0,00
Hydraulic Structures					$0,00
Channel Improvements					$0,00
Detention/Water Quality Facilities					$0,00
Removals					$0,00
Landscaping and Maintenance Improvements					$0,00
Special Items (User Defined)					$74.900,00
Subtotal Capital Improvement Costs					**$427,113,00**
Additional Capital Improvement Costs					
Dewatering	$4.271,13	L.S.			$4.271,00
Mobilization	5%				$21.356,00
Traffic Control	$8.542,26	L.S.			$8.542,00
Utility Coordination/Relocation	$42.711,30	L.S.			$42.711,00
Stormwater Management/Erosion Control	5%				$21.356,00
Subtotal Additional Capital Improvement Costs					**$98,236,00**
Land Acquisition Costs					
ROW/Easements					$0,00
Subtotal Land Acquisition Costs					**$0,00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering	15%				$78.802,00
Legal/Administrative	5%				$26.267,00
Contract Admin/Construction Management	10%				$52.535,00
Contingency	25%				$131.337,00
Subtotal Other Costs					**$288.941,00**
Total Capital Improvement Costs					**$814,290,00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	25	EA	$64,00	$320,00
Total Annual Operation and Maintenance Cost				**$320.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$11,200.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	23rd Ave. Outfall
REACH :	23rdAve
JURISDICTION :	City of Greeley
REACH ID:	23rdAve-Reach23rdAve

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	300	1	300	L.F.	$69,00	$20.700,00	L003,3_pipe
24-inch	1000	1	1000	L.F.	$92,00	$92.000,00	L003,4_pipe
36-inch	1850	1	1850	L.F.	$139,00	$257.150,00	L003,6_pipe
42-inch	800	1	800	L.F.	$162,00	$129.600,00	L019,1
36-inch	800	1	800	L.F.	$139,00	$111.200,00	L020,6
18-inch	50	30	1500	L.F.	$69,00	$103.500,00	Inlet Laterals
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
36-inch	Yes	1	1	EA	$2.068,00	$2.068,00	Outlet into Luther Park
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			4	EA	$3.726,00	$14.904,00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			10	EA	$5.010,00	$50.100,00	
Manhole, 6' Dia, (Pipe Dia, = 48")				EA	$5.524,00	$0,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)				EA	$15.416,00	$0,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)				EA	$19.271,00	$0,00	
Storm Inlet, Type R/Type 14, 5-foot			30	EA	$5.910,00	$177.300,00	
Special Items (User Defined)							
Asphalt Patch	**<----User Defined Items**		3139	S.Y.	$50,00	$156.950,00	
Waterline Lowering	**<----User Defined Items**		10	EA	$5.000,00	$50.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$958.522,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$206.950,00
Subtotal Capital Improvement Costs				**$1,165,472.00**
Additional Capital Improvement Costs				
Dewatering	$11.654,72	L.S.		$11.655,00
Mobilization	5%			$58.274,00
Traffic Control	$23.309,44	L.S.		$23.309,00
Utility Coordination/Relocation	$116.547,20	L.S.		$116.547,00
Stormwater Management/Erosion Control	5%			$58.274,00
Subtotal Additional Capital Improvement Costs				**$268,059.00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$215.030,00
Legal/Administrative	5%			$71.677,00
Contract Admin/Construction Management	10%			$143.353,00
Contingency	25%			$358.383,00
Subtotal Other Costs				**$788.443.00**
Total Capital Improvement Costs				**$2,221,974.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	44	EA	$64,00	$563,00
Total Annual Operation and Maintenance Cost				**$563.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$19,705.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	Hwy 85 Outfall
REACH :	18thSt
JURISDICTION :	City of Greeley
REACH ID:	Hwy85Chan-Reach18thSt

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
42-inch	3000	1	3000	L.F.	$162,00	$486.000,00	L035,04
54-inch	1780	1	1780	L.F.	$277,00	$493.060,00	L036,37
18-inch	50	34	1700	L.F.	$69,00	$117.300,00	inlet laterals
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
42-inch	Yes	1	2	EA	$2.184,00	$4.368,00	
Headwalls							
Diameter (in)	**Applicable**	**No. of Barrels**					
54-inch	Yes	1	2	EA	$1.843,52	$3.687,00	
Wingwalls (includes concrete apron)							
Diameter (in)		**No. of Barrels**					
54-inch		1	2	EA	$11.271,99	$22.544,00	
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			15	EA	$5.010,00	$75.150,00	
Storm Inlet, Type R/Type 14, 5-foot			34	EA	$5.910,00	$200.940,00	
Special Items (User Defined)							
Asphalt Repave	**<----User Defined Items**		2421	SY	$40,00	$96.840,00	
Waterline Lowering	**<----User Defined Items**		4	EA	$5.000,00	$20.000,00	
Highway Boring	**<----User Defined Items**		100	LF	$4.500,00	$450.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$1.403.049,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$566.840,00
Subtotal Capital Improvement Costs				**$1,969,889,00**
Additional Capital Improvement Costs				
Dewatering	$19.698,89	L.S.		$19.699,00
Mobilization	5%			$98.494,00
Traffic Control	$39.397,78	L.S.		$39.398,00
Utility Coordination/Relocation	$196.988,90	L.S.		$196.989,00
Stormwater Management/Erosion Control	5%			$98.494,00
Subtotal Additional Capital Improvement Costs				**$453,074,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$363.444,00
Legal/Administrative	5%			$121.148,00
Contract Admin/Construction Management	10%			$242.296,00
Contingency	25%			$605.741,00
Subtotal Other Costs				**$1,332,629.00**
Total Capital Improvement Costs				**$3,755,592.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	49	EA	$64,00	$627,00
Total Annual Operation and Maintenance Cost				**$627.00**
Effective Interest Rate				0,00%
Total Operation and Maintenance Costs Over 50 Years				**$31,350.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 1st St, Outfall
REACH : 9thAveNofASt
JURISDICTION : City of Greeley
REACH ID: 1stSt-Reach9thAveNofASt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	**Length (ft)**	**No. of Barrels**				
42-inch	160	1	160	L.F.	$162.00	$25,920.00	L041.01
48-inch	750	1	750	L.F.	$185.00	$138,750.00	L041.02
Manholes and Inlets						
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			1	EA	$5,010.00	$5,010.00	
Manhole, 6' Dia. (Pipe Dia. = 48")			3	EA	$5,524.00	$16,572.00	
Storm Inlet, Type R/Type 14, 5-foot			15	EA	$5,910.00	$88,650.00	
Special Items (User Defined)							
Asphalt Repave	<---User Defined Items		593	S.Y.	$40.00	$23,720.00	
Asphalt Patch	<---User Defined Items		103	S.Y.	$50.00	$5,150.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$274,902.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$28,870.00
Subtotal Capital Improvement Costs				**$303,772.00**
Additional Capital Improvement Costs				
Dewatering	$3,037.72	L.S.		$3,038.00
Mobilization	5%			$15,189.00
Traffic Control	$6,075.44	L.S.		$6,075.00
Utility Coordination/Relocation	$30,377.20	L.S.		$30,377.00
Stormwater Management/Erosion Control	5%			$15,189.00
Subtotal Additional Capital Improvement Costs				**$69,868.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$56,046.00
Legal/Administrative	5%			$18,682.00
Contract Admin/Construction Management	10%			$37,364.00
Contingency	25%			$93,410.00
Subtotal Other Costs				**$205,502.00**
Total Capital Improvement Costs				**$579,142.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	19	EA	$64.00	$243.00
Total Annual Operation and Maintenance Cost				**$243.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$8,505.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 1st St, Outfall
REACH : 9thAveSouthofASt
JURISDICTION : City of Greeley
REACH ID: 1stSt-Reach9thAveSouthofASt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	**Length (ft)**	**No. of Barrels**				
18-inch	780	1	780	L.F.	$69.00	$53,820.00	L039.03
24-inch	400	1	400	L.F.	$92.00	$36,800.00	L039.07
30-inch	500	1	500	L.F.	$116.00	$58,000.00	L939.05
42-inch	1260	1	1260	L.F.	$162.00	$204,120.00	L839.05
18-inch	50	34	1700	L.F.	$69.00	$117,300.00	Inlet Laterals
Manholes and Inlets						
Manhole, 4' Dia. (Pipe Dia. < 36")			5	EA	$3,726.00	$18,630.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			4	EA	$5,010.00	$20,040.00	
Storm Inlet, Type R/Type 14, 5-foot			34	EA	$5,910.00	$200,940.00	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			2	AC-FT	$58,582.00	$119,507.00	5-yr max storage ~2.04 Ac-ft.
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		1748	S.Y.	$50.00	$87,400.00	
Waterline Lowering	<---User Defined Items		8	EA	$5,000.00	$40,000.00	
RR Boring	<---User Defined Items		80	LF	$4,500.00	$360,000.00	1 - 42" Boring (80 LF per cell)

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$709,650.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$119,507.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$487,400.00
Subtotal Capital Improvement Costs				**$1,316,557.00**
Additional Capital Improvement Costs				
Dewatering	$13,165.57	L.S.		$13,166.00
Mobilization	5%			$65,828.00
Traffic Control	$26,331.14	L.S.		$26,331.00
Utility Coordination/Relocation	$131,655.70	L.S.		$131,656.00
Stormwater Management/Erosion Control	5%			$65,828.00
Subtotal Additional Capital Improvement Costs				**$302,809.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$242,905.00
Legal/Administrative	5%			$80,968.00
Contract Admin/Construction Management	10%			$161,937.00
Contingency	25%			$404,842.00
Subtotal Other Costs				**$890,652.00**
Total Capital Improvement Costs				**$2,510,018.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	43	EA	$64.00	$550.00
Total Annual Operation and Maintenance Cost				**$550.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$19,250.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	1st St, Outfall
REACH :	ASt
JURISDICTION :	City of Greeley
REACH ID:	1stSt-ReachASt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	1410	1	1410	L.F.	$139.00	$195,990.00	L042.06 .pipe
18-inch	50	29	1450	L.F.	$69.00	$100,050.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			15	EA	$15,416.00	$231,240.00	
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			1	EA	$19,271.00	$19,271.00	
Storm Inlet, Type R/Type 14, 5-foot			29	EA	$5,910.00	$171,390.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
8	4	1	400	L.F.	$819.72	$327,890.00	L941.06
8	4	1	350	L.F.	$819.72	$286,903.00	L9003
9	4	1	820	L.F.	$878.76	$720,579.00	L9001
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
9	1	11.00	1	EA	$968.39	$968.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
9	4	1	1	EA	$8,683.39	$8,683.40	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			5	AC-FT	$58,582.00	$291,445.00	WQCV
Special Items (User Defined)							
Asphalt Repave	<---User Defined Items		356	S.Y.	$40.00	$14,240.00	
Asphalt Patch	<---User Defined Items		888	S.Y.	$50.00	$44,400.00	
RR Boring (Hwy 85)	<---User Defined Items		480	L.F.	$4,500.00	$2,160,000.00	3 - 48" 160 L.F. per cell
RR Boring (UPRR)	<---User Defined Items		240	LF	$4,500.00	$1,080,000.00	3 - 48" 80 L.F. per cell
Land Acquisition							
Easement/ROW Acquisition			3.34	ACRE	$144,474.00	$482,543.00	

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains		$717,941.00	
Concrete Box Culverts		$1,345,023.00	
Hydraulic Structures		$0.00	
Channel Improvements		$0.00	
Detention/Water Quality Facilities		$291,445.00	
Removals		$0.00	
Landscaping and Maintenance Improvements		$0.00	
Special Items (User Defined)		$3,298,640.00	
Subtotal Capital Improvement Costs		**$5,653,049.00**	
Additional Capital Improvement Costs			
Dewatering	$56,530.49 L.S.	$56,530.00	
Mobilization	5%	$282,652.00	
Traffic Control	$113,060.98 L.S.	$113,061.00	
Utility Coordination/Relocation	$565,304.90 L.S.	$565,305.00	
Stormwater Management/Erosion Control	5%	$282,652.00	
Subtotal Additional Capital Improvement Costs		**$1,300,200.00**	
Land Acquisition Costs			
ROW/Easements		$482,543.00	
Subtotal Land Acquisition Costs		**$482,543.00**	
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%	$1,042,987.00	
Legal/Administrative	5%	$347,662.00	
Contract Admin/Construction Management	10%	$695,325.00	
Contingency	25%	$1,738,312.00	
Subtotal Other Costs		**$3,824,286.00**	
Total Capital Improvement Costs		**$11,260,078.00**	

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	45	EA	$64.00	$576.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, s	4.975	ACRE	$1,927.00	$4,793.00
Total Annual Operation and Maintenance Cost				**$5,369.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$187,913.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave, Outfall Trunk
REACH :	14thAveTrunk
JURISDICTION :	City of Greeley
REACH ID:	14thAveTrunk-Reach14thAveTrunk Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
42-inch	350	1	350	L.F.	$162,00	$56,700,00	L027,09
48-inch	360	1	360	L.F.	$185,00	$66,600,00	L027,07
48-inch	400	1	400	L.F.	$185,00	$74,000,00	L027,04
48-inch	550	1	550	L.F.	$185,00	$101,750,00	L027,01
18-inch	50	75	3750	L.F.	$69,00	$258,750,00	Inlet Laterals
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			1	EA	$5,010,00	$5,010,00	
Manhole, 6' Dia, (Pipe Dia, = 48")			4	EA	$5,524,00	$22,096,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			17	EA	$15,416,00	$262,072,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			2	EA	$19,271,00	$38,542,00	
Storm Inlet, Type R/Type 14, 5-foot			75	EA	$5,910,00	$443,250,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
7	4	1	530	L.F.	$758,92	$402.229,00	L026,03
7	4	1	530	L.F.	$758,92	$402.229,00	L926,02
7	4	1	280	L.F.	$758,92	$212.498,00	L926,01
8	4	1	340	L.F.	$819,72	$278.706,00	L925,01
10	4	1	850	L.F.	$938,56	$797.773,00	L825,01
12	4	1	1510	L.F.	$1.059,16	$1.599.333,00	L942,02
11	5	1	960	L.F.	$1.123,05	$1.078.123,00	L942,01
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
11	1	13,00	1	EA	$1.218,56	$1.219,00	Outfall into Poudre
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
11	5	1	1	EA	$11.837,53	$11.837,50	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			8	AC-FT	$58,582,00	$472,464,00	WQCV for 14th Avenue Outfall
Special Items (User Defined)							
Asphalt Repave	<---User Defined Items		6069	S.Y.	$40,00	$242.760,00	
Waterline Lowering	<---User Defined Items		12	EA	$5.000,00	$60.000,00	
Railroad Boring	<---User Defined Items		300	LF	$4,500,00	$1,350.000,00	3 - 60" parallel closed face borings
Land Acquisition							
Easement/ROW Acquisition			9,30	ACRE	$21,980,00	$204,414,00	WQCV

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$1,328,770,00
Concrete Box Culverts				$4,783,948,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$472,464,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$1,652,760,00
Subtotal Capital Improvement Costs				**$8,237,942.00**
Additional Capital Improvement Costs				
Dewatering	$82.379,42	L.S.		$82.379,00
Mobilization	5%			$411.897,00
Traffic Control	$164.758,84	L.S.		$164.759,00
Utility Coordination/Relocation	$823.794,20	L.S.		$823.794,00
Stormwater Management/Erosion Control	5%			$411.897,00
Subtotal Additional Capital Improvement Costs				**$1,894,726.00**
Land Acquisition Costs				
ROW/Easements				$204,414,00
Subtotal Land Acquisition Costs				**$204,414.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$1,519.900,00
Legal/Administrative	5%			$506.633,00
Contract Admin/Construction Management	10%			$1,013.267,00
Contingency	25%			$2,533.167,00
Subtotal Other Costs				**$5,572,967.00**
Total Capital Improvement Costs				**$15,910,049,00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	99	EA	$64,00	$1,267,00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, struc	8,085	ACRE	$1,927,00	$7.771,00
Total Annual Operation and Maintenance Cost				**$9,038.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$316,327,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. Outfall
REACH :	Lateral_4thSt
JURISDICTION :	City of Greeley
REACH ID:	14thAve-ReachLateral_4thSt

Jeremy Deischer | DATE : | 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	910	1	910	L.F.	$69,00	$62.790,00	4th Street Lateral, L025,02
18-inch	50	2	100	L.F.	$69,00	$6.900,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			5	EA	$3.726,00	$18.630,00	
Storm Inlet, Type R/Type 14, 5-foot			2	EA	$5.910,00	$11.820,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		421	S.Y.	$50,00	$21.050,00	
Land Acquisition							
Easement/ROW Acquisition			0,38	ACRE	$25.337,99	$9.665,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs						
Pipe Culverts and Storm Drains						$100.140,00
Concrete Box Culverts						$0,00
Hydraulic Structures						$0,00
Channel Improvements						$0,00
Detention/Water Quality Facilities						$0,00
Removals						$0,00
Landscaping and Maintenance Improvements						$0,00
Special Items (User Defined)						$21.050,00
Subtotal Capital Improvement Costs						**$121.190,00**
Additional Capital Improvement Costs						
Dewatering			$1.211,90	L.S.		$1.212,00
Mobilization			5%			$6.060,00
Traffic Control			$2.423,80	L.S.		$2.424,00
Utility Coordination/Relocation			$12.119,00	L.S.		$12.119,00
Stormwater Management/Erosion Control			5%			$6.060,00
Subtotal Additional Capital Improvement Costs						**$27.875,00**
Land Acquisition Costs						
ROW/Easements						$9.665,00
Subtotal Land Acquisition Costs						**$9.665,00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$22.360,00
Legal/Administrative			5%			$7.453,00
Contract Admin/Construction Management			10%			$14.907,00
Contingency			25%			$37.266,00
Subtotal Other Costs						**$81.986,00**
Total Capital Improvement Costs						**$240.716,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	7	EA	$64,00	$90,00
Total Annual Operation and Maintenance Cost				**$90,00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$3.150,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. Outfall
REACH :	Lateral_5thSt
JURISDICTION :	City of Greeley
REACH ID:	14thAve-ReachLateral_5thSt

Jeremy Deischer | DATE : | 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	670	1	670	L.F.	$69,00	$46.230,00	L027,15_pipe
24-inch	330	1	330	L.F.	$92,00	$30.360,00	L027,06_pipe
30-inch	480	1	480	L.F.	$116,00	$55.680,00	L027,05
30-inch	590	1	590	L.F.	$116,00	$68.440,00	L027,14_pipe
30-inch	1600	1	1600	L.F.	$116,00	$185.600,00	L026,04_pipe
36-inch	400	1	400	L.F.	$139,00	$55.600,00	L027,13_pipe
36-inch	470	1	470	L.F.	$139,00	$65.330,00	L027,02
42-inch	690	1	690	L.F.	$162,00	$111.780,00	L926,03
18-inch	50	15	750	L.F.	$69,00	$51.750,00	
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			12	EA	$3.726,00	$44.712,00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			2	EA	$5.010,00	$10.020,00	
Storm Inlet, Type R/Type 14, 5-foot			15	EA	$5.910,00	$88.650,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		3158	S.Y.	$50,00	$157.900,00	
Waterline Lowering	<---User Defined Items		9	EA	$5.000,00	$45.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs						
Pipe Culverts and Storm Drains						$814.152,00
Concrete Box Culverts						$0,00
Hydraulic Structures						$0,00
Channel Improvements						$0,00
Detention/Water Quality Facilities						$0,00
Removals						$0,00
Landscaping and Maintenance Improvements						$0,00
Special Items (User Defined)						$202.900,00
Subtotal Capital Improvement Costs						**$1.017.052,00**
Additional Capital Improvement Costs						
Dewatering			$10.170,52	L.S.		$10.171,00
Mobilization			5%			$50.853,00
Traffic Control			$20.341,04	L.S.		$20.341,00
Utility Coordination/Relocation			$101.705,20	L.S.		$101.705,00
Stormwater Management/Erosion Control			5%			$50.853,00
Subtotal Additional Capital Improvement Costs						**$233.923,00**
Land Acquisition Costs						
ROW/Easements						$0,00
Subtotal Land Acquisition Costs						**$0,00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$187.646,00
Legal/Administrative			5%			$62.549,00
Contract Admin/Construction Management			10%			$125.098,00
Contingency			25%			$312.744,00
Subtotal Other Costs						**$688.037,00**
Total Capital Improvement Costs						**$1.939.012,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	29	EA	$64,00	$371,00
Total Annual Operation and Maintenance Cost				**$371,00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$12.985,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. Outfall
REACH :	Lateral_8thSt
JURISDICTION :	City of Greeley
REACH ID:	14thAve-ReachLateral_8thSt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	1000	1	1000	L.F.	$92.00	$92,000.00	L027,08
18-inch	50	4	200	L.F.	$69.00	$13,800.00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			3	EA	$3,726.00	$11,178.00	
StormInlet, Type R/Type 14, 5-foot			4	EA	$5,910.00	$23,640.00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		520	S.Y.	$50.00	$26,000.00	
Waterline Lowering	<----User Defined Items		2	EA	$5,000.00	$10,000.00	

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains						$140,618.00
Concrete Box Culverts						$0.00
Hydraulic Structures						$0.00
Channel Improvements						$0.00
Detention/Water Quality Facilities						$0.00
Removals						$0.00
Landscaping and Maintenance Improvements						$0.00
Special Items (User Defined)						$36,000.00
Subtotal Capital Improvement Costs						**$176,618.00**
Additional Capital Improvement Costs						
Dewatering			$1,766.18	L.S.		$1,766.00
Mobilization			5%			$8,831.00
Traffic Control			$3,532.36	L.S.		$3,532.00
Utility Coordination/Relocation			$17,661.80	L.S.		$17,662.00
Stormwater Management/Erosion Control			5%			$8,831.00
Subtotal Additional Capital Improvement Costs						**$40,622.00**
Land Acquisition Costs						
ROW/Easements						$0.00
Subtotal Land Acquisition Costs						**$0.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$32,586.00
Legal/Administrative			5%			$10,862.00
Contract Admin/Construction Management			10%			$21,724.00
Contingency			25%			$54,310.00
Subtotal Other Costs						**$119,482.00**
Total Capital Improvement Costs						**$336,722.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	7	EA	$64.00	$90.00
Total Annual Operation and Maintenance Cost				**$90.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$3,150.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. Outfall
REACH :	Lateral_9thSt
JURISDICTION :	City of Greeley
REACH ID:	14thAve-ReachLateral_9thSt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
30-inch	670	1	670	L.F.	$116.00	$77,720.00	L027,11_pipe
36-inch	1000	1	1000	L.F.	$139.00	$139,000.00	L027,10_pipe
18-inch	50	12	600	L.F.	$69.00	$41,400.00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			3	EA	$3,726.00	$11,178.00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			2	EA	$5,010.00	$10,020.00	
StormInlet, Type R/Type 14, 5-foot			12	EA	$5,910.00	$70,920.00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		996	S.Y.	$50.00	$49,800.00	
Waterline Lowering	<----User Defined Items		1	EA	$5,000.00	$5,000.00	

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains						$350,238.00
Concrete Box Culverts						$0.00
Hydraulic Structures						$0.00
Channel Improvements						$0.00
Detention/Water Quality Facilities						$0.00
Removals						$0.00
Landscaping and Maintenance Improvements						$0.00
Special Items (User Defined)						$54,800.00
Subtotal Capital Improvement Costs						**$405,038.00**
Additional Capital Improvement Costs						
Dewatering			$4,050.38	L.S.		$4,050.00
Mobilization			5%			$20,252.00
Traffic Control			$8,100.76	L.S.		$8,101.00
Utility Coordination/Relocation			$40,503.80	L.S.		$40,504.00
Stormwater Management/Erosion Control			5%			$20,252.00
Subtotal Additional Capital Improvement Costs						**$93,159.00**
Land Acquisition Costs						
ROW/Easements						$0.00
Subtotal Land Acquisition Costs						**$0.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$74,730.00
Legal/Administrative			5%			$24,910.00
Contract Admin/Construction Management			10%			$49,820.00
Contingency			25%			$124,549.00
Subtotal Other Costs						**$274,009.00**
Total Capital Improvement Costs						**$772,206.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	17	EA	$64.00	$218.00
Total Annual Operation and Maintenance Cost				**$218.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$7,630.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	16th Ave. Outfall
REACH :	13thSt
JURISDICTION :	City of Greeley
REACH ID:	16thCt-Reach13thSt

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	540	1	540	L.F.	$92,00	$49.680,00	L018,2_pipe
24-inch	400	1	400	L.F.	$92,00	$36.800,00	L017,3_pipe
24-inch	400	1	400	L.F.	$92,00	$36.800,00	L017,4_pipe
54-inch	950	1	950	L.F.	$277,00	$263.150,00	L017,5_pipe
42-inch	448	1	448	L.F.	$162,00	$72.576,00	MoonPond_Alt_Outlet
18-inch	50	16	800	L.F.	$69,00	$55.200,00	Inlet Laterals
Headwalls							
Diameter (in)	Applicable	No. of Barrels					
54-inch	Yes	1	1	EA	$1.843,52	$1.844,00	
Wingwalls (includes concrete apron)							
Diameter (in)		No. of Barrels					
54-inch		1	1	EA	$11.271,99	$11.272,00	
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			10	EA	$3.726,00	$37.260,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			2	EA	$15.416,00	$30.832,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			2	EA	$19.271,00	$38.542,00	
Storm Inlet, Type R/Type 14, 5-foot			16	EA	$5.910,00	$94.560,00	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			6	AC-FT	$58.582,00	$363.794,00	Moon Pond
Special Items (User Defined)							
Asphalt Repave	<---User Defined Items		809	S.Y.	$40,00	$32.360,00	
Aspahalt Patch	<---User Defined Items		821	S.Y.	$50,00	$41.050,00	
Waterline Lowering	<---User Defined Items		5	EA	$5.000,00	$25.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$728.516,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$363.794,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$98.410,00
Subtotal Capital Improvement Costs				**$1,190,720.00**
Additional Capital Improvement Costs				
Dewatering	$11.907,20	L.S.		$11.907,00
Mobilization	5%			$59.536,00
Traffic Control	$23.814,40	L.S.		$23.814,00
Utility Coordination/Relocation	$119.072,00	L.S.		$119.072,00
Stormwater Management/Erosion Control	5%			$59.536,00
Subtotal Additional Capital Improvement Costs				**$273,865.00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$219.688,00
Legal/Administrative	5%			$73.229,00
Contract Admin/Construction Management	10%			$146.459,00
Contingency	25%			$366.146,00
Subtotal Other Costs				**$805,522.00**
Total Capital Improvement Costs				**$2,270,107.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	25	EA	$64,00	$320,00
Total Annual Operation and Maintenance Cost				**$320.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$11,200,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	16th Ave. Outfall
REACH :	16thAveCt
JURISDICTION :	City of Greeley
REACH ID:	16thCt-Reach16thAveCt

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	650	1	650	L.F.	$139,00	$90.350,00	L004,6_pipe
36-inch	1050	1	1050	L.F.	$139,00	$145.950,00	L917,1_pipe
24-inch	203	1	203	L.F.	$92,00	$18.676,00	16thSt Outlet
18-inch	50	16	800	L.F.	$69,00	$55.200,00	Inlet Laterals
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			2	EA	$5.010,00	$10.020,00	
Manhole, 6' Dia, (Pipe Dia, = 48")			3	EA	$5.524,00	$16.572,00	
Storm Inlet, Type R/Type 14, 5-foot			16	EA	$5.910,00	$94.560,00	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			10	AC-FT	$58.582,00	$574.689,00	16thSt
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		1231	S.Y.	$50,00	$61.550,00	
Waterline Lowering	<---User Defined Items		3	EA	$5.000,00	$15.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$431.328,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$574.689,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$76.550,00
Subtotal Capital Improvement Costs				**$1,082,567.00**
Additional Capital Improvement Costs				
Dewatering	$10.825,67	L.S.		$10.826,00
Mobilization	5%			$54.128,00
Traffic Control	$21.651,34	L.S.		$21.651,00
Utility Coordination/Relocation	$108.256,70	L.S.		$108.257,00
Stormwater Management/Erosion Control	5%			$54.128,00
Subtotal Additional Capital Improvement Costs				**$248,990.00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$199.734,00
Legal/Administrative	5%			$66.578,00
Contract Admin/Construction Management	10%			$133.156,00
Contingency	25%			$332.889,00
Subtotal Other Costs				**$732.357,00**
Total Capital Improvement Costs				**$2,063,914.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	21	EA	$64,00	$269,00
Total Annual Operation and Maintenance Cost				**$269.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$9,415,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	16th Ave, Outfall
REACH :	16thSt
JURISDICTION :	City of Greeley
REACH ID:	16thCt-Reach16thSt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	1500	1	1500	L.F.	$92,00	$138.000,00	L004,2_pipe
42-inch	700	1	700	L.F.	$162,00	$113.400,00	L004,5_pipe
18-inch	50	26	1300	L.F.	$69,00	$89.700,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			4	EA	$3.726,00	$14.904,00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			4	EA	$5.010,00	$20.040,00	
Storm Inlet, Type R/Type 14, 5-foot			26	EA	$5.910,00	$153.660,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		1343	S.Y.	$50,00	$67.150,00	
Waterline Lowering	<---User Defined Items		5	EA	$5.000,00	$25.000,00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains			$529.704,00	
Concrete Box Culverts			$0,00	
Hydraulic Structures			$0,00	
Channel Improvements			$0,00	
Detention/Water Quality Facilities			$0,00	
Removals			$0,00	
Landscaping and Maintenance Improvements			$0,00	
Special Items (User Defined)			$92.150,00	
Subtotal Capital Improvement Costs			**$621.854,00**	
Additional Capital Improvement Costs				
Dewatering	$6.218,54	L.S.	$6.219,00	
Mobilization	5%		$31.093,00	
Traffic Control	$12.437,08	L.S.	$12.437,00	
Utility Coordination/Relocation	$62.185,40	L.S.	$62.185,00	
Stormwater Management/Erosion Control	5%		$31.093,00	
Subtotal Additional Capital Improvement Costs			**$143,027,00**	
Land Acquisition Costs				
ROW/Easements			$0,00	
Subtotal Land Acquisition Costs			**$0,00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$114.732,00	
Legal/Administrative	5%		$38.244,00	
Contract Admin/Construction Management	10%		$76.488,00	
Contingency	25%		$191.220,00	
Subtotal Other Costs			**$420.684,00**	
Total Capital Improvement Costs			**$1,185,565.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	34	EA	$64,00	$435,00	
Total Annual Operation and Maintenance Cost				**$435.00**	
Effective Interest Rate				1,50%	
Total Operation and Maintenance Costs Over 50 Years				**$15,225.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	16th Ave, Outfall
REACH :	21stAve
JURISDICTION :	City of Greeley
REACH ID:	16thCt-Reach21stAve Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	1450	1	1450	L.F.	$69,00	$100.050,00	L904,1_pipe
24-inch	600	1	600	L.F.	$92,00	$55.200,00	L804,1_pipe
24-inch	1000	1	1000	L.F.	$92,00	$92.000,00	L004,4_pipe
18-inch	50	8	400	L.F.	$69,00	$27.600,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			9	EA	$3.726,00	$33.534,00	
Storm Inlet, Type R/Type 14, 5-foot			8	EA	$5.910,00	$47.280,00	
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		1244	S.Y.	$50,00	$62.200,00	
Waterline Lowering	<---User Defined Items		6	EA	$5.000,00	$30.000,00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains			$355.664,00	
Concrete Box Culverts			$0,00	
Hydraulic Structures			$0,00	
Channel Improvements			$0,00	
Detention/Water Quality Facilities			$0,00	
Removals			$0,00	
Landscaping and Maintenance Improvements			$0,00	
Special Items (User Defined)			$92.200,00	
Subtotal Capital Improvement Costs			**$447.864,00**	
Additional Capital Improvement Costs				
Dewatering	$4.478,64	L.S.	$4.479,00	
Mobilization	5%		$22.393,00	
Traffic Control	$8.957,28	L.S.	$8.957,00	
Utility Coordination/Relocation	$44.786,40	L.S.	$44.786,00	
Stormwater Management/Erosion Control	5%		$22.393,00	
Subtotal Additional Capital Improvement Costs			**$103,008,00**	
Land Acquisition Costs				
ROW/Easements			$0,00	
Subtotal Land Acquisition Costs			**$0,00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$82.631,00	
Legal/Administrative	5%		$27.544,00	
Contract Admin/Construction Management	10%		$55.087,00	
Contingency	25%		$137.718,00	
Subtotal Other Costs			**$302,980,00**	
Total Capital Improvement Costs			**$853,852.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	17	EA	$64,00	$218,00	
Total Annual Operation and Maintenance Cost				**$218.00**	
Effective Interest Rate				1,50%	
Total Operation and Maintenance Costs Over 50 Years				**$7,630.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	22nd Ave, Outfall
REACH :	22ndAve
JURISDICTION :	City of Greeley
REACH ID:	22ndAve-Reach22ndAve

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	1000	1	1000	L.F.	$92.00	$92,000.00	L018,1_pipe
24-inch	500	1	500	L.F.	$92.00	$46,000.00	L918,1_pipe
18-inch	50	19	950	L.F.	$69.00	$65,550.00	Inlet Laterals
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
24-inch	Yes	1	1	EA	$1,246.00	$1,246.00	Outlet into Luther Park
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			6	EA	$3,726.00	$22,356.00	
Storm Inlet, Type R/Type 14, 5-foot			19	EA	$5,910.00	$112,290.00	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			3	AC-FT	$58,582.00	$181,604.00	Maplewood Elementary
Detention Facility 2 (Complete-in-Place)			4	AC-FT	$58,582.00	$216,753.00	Luther Park North
Special Items (User Defined)							
Asphalt Patch	<---User Defined Items		898	S.Y.	$50.00	$44,900.00	
Waterline Lowering	<---User Defined Items		6	EA	$5,000.00	$30,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$339,442.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$398,357.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$74,900.00
Subtotal Capital Improvement Costs				**$812,699.00**
Additional Capital Improvement Costs				
Dewatering	$8,126.99	L.S.		$8,127.00
Mobilization	5%			$40,635.00
Traffic Control	$16,253.98	L.S.		$16,254.00
Utility Coordination/Relocation	$81,269.90	L.S.		$81,270.00
Stormwater Management/Erosion Control	5%			$40,635.00
Subtotal Additional Capital Improvement Costs				**$186,921.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$149,943.00
Legal/Administrative	5%			$49,981.00
Contract Admin/Construction Management	10%			$99,962.00
Contingency	25%			$249,905.00
Subtotal Other Costs				**$549,791.00**
Total Capital Improvement Costs				**$1,549,411.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	25	EA	$64.00	$320.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, struc	6.8	ACRE	$1,927.00	$6,552.00
Total Annual Operation and Maintenance Cost				**$6,872.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$240,518.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 7th St_Outfall - 8th Ave.
REACH : 7thSt_8thAve
JURISDICTION : City of Greeley
REACH ID: 7th St_8thAve-Reach7thSt_8thAve Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	262	13100	L.F.	$69,00	$903.900,00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			23	EA	$15.416,00	$354.568,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			1	EA	$19.271,00	$19.271,00	
Storm Inlet, Type R/Type 14, 5-foot			262	EA	$5.910,00	$1.548.420,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
11	5	2	500	L.F.	$2.246,09	$1.123.045,00	L930,12 pipe
11	5	2	540	L.F.	$2.246,09	$1.212.889,00	L930,08 pipe
11	5	2	470	L.F.	$2.246,09	$1.055.662,00	L938,14
10	5	2	250	L.F.	$2.092,11	$523.027,00	L838,14
10	5	2	240	L.F.	$2.092,11	$502.106,00	L938,13
9	5	2	350	L.F.	$1.914,53	$670.084,00	L938,12
9	5	2	360	L.F.	$1.914,53	$689.230,00	L938,11
11	5	1	500	L.F.	$1.123,05	$561.523,00	L029,01 pipe
10	5	2	500	L.F.	$2.092,11	$1.046.054,00	L030,17 pipe
10	5	2	500	L.F.	$2.092,11	$1.046.054,00	L030,14 pipe
Special Items (User Defined)							
Asphalt Repave	**<---User Defined Items**		5818	S.Y.	$40,00	$232.720,00	
Waterline Lowering	**<---User Defined Items**		10	EA	$5.000,00	$50.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$2.826.159,00
Concrete Box Culverts				$8.429.674,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$282.720,00
Subtotal Capital Improvement Costs				**$11.538.553,00**
Additional Capital Improvement Costs				
Dewatering	$115.385,53	L.S.		$115.386,00
Mobilization	5%			$576.928,00
Traffic Control	$230.771,06	L.S.		$230.771,00
Utility Coordination/Relocation	$1.153.855,30	L.S.		$1.153.855,00
Stormwater Management/Erosion Control	5%			$576.928,00
Subtotal Additional Capital Improvement Costs				**$2.653.868,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$2.128.863,00
Legal/Administrative	5%			$709.621,00
Contract Admin/Construction Management	10%			$1.419.242,00
Contingency	25%			$3.548.105,00
Subtotal Other Costs				**$7.805.831,00**
Total Capital Improvement Costs				**$21.998.252,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	286	EA	$64,00	$3.661,00
Total Annual Operation and Maintenance Cost				**$3,661.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$128,134,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 7th St_Outfall
REACH : 7thSt_Trunk
JURISDICTION : City of Greeley
REACH ID: 7th St-Reach7thSt_Trunk Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	66	3300	L.F.	$69,00	$227.700,00	
Manholes and Inlets							
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			17	EA	$15.416,00	$262.072,00	
Storm Inlet, Type R/Type 14, 5-foot			66	EA	$5.910,00	$390.060,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
12	5	1	500	L.F.	$1.199,54	$599.768,00	L930,01
12	5	1	500	L.F.	$1.199,54	$599.768,00	L938,17
11	5	2	500	L.F.	$2.246,09	$1.123.045,00	L738,11
10	5	3	400	L.F.	$3.138,16	$1.255.265,00	L838,07
12	5	3	400	L.F.	$3.598,61	$1.439.443,00	L937,04
12	5	3	615	L.F.	$3.598,61	$2.213.144,00	L837,04
11	6	3	500	L.F.	$3.740,19	$1.870.097,00	L937,03
12	4	2	250	L.F.	$2.118,32	$529.581,00	L937,02
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
11	3	36,00	1	EA	$3.374,46	$3.374,00	Outfall into Poudre
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
11	6	3	1	EA	$21.570,39	$21.570,40	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			6	AC-FT	$58.582,00	$336.847,00	WQCV
Special Items (User Defined)							
Asphalt Repave	**<---User Defined Items**		6686	S.Y.	$40,00	$267.440,00	
Waterline Lowering	**<---User Defined Items**		6	EA	$5.000,00	$30.000,00	
RR Boring	**<---User Defined Items**		800	L.F.	$4.500,00	$3.600.000,00	8 - 60" Parallel
Land Acquisition							
Easement/ROW Acquisition			6,10	ACRE	$238.551,61	$1.455.165,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$879.832,00
Concrete Box Culverts				$9.655.055,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$336.847,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$3.897.440,00
Subtotal Capital Improvement Costs				**$14.769.174,00**
Additional Capital Improvement Costs				
Dewatering	$147.691,74	L.S.		$147.692,00
Mobilization	5%			$738.459,00
Traffic Control	$295.383,48	L.S.		$295.383,00
Utility Coordination/Relocation	$1.476.917,40	L.S.		$1.476.917,00
Stormwater Management/Erosion Control	5%			$738.459,00
Subtotal Additional Capital Improvement Costs				**$3.396.910,00**
Land Acquisition Costs				
ROW/Easements				$1.455.165,00
Subtotal Land Acquisition Costs				**$1.455.165,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$2.724.913,00
Legal/Administrative	5%			$908.304,00
Contract Admin/Construction Management	10%			$1.816.608,00
Contingency	25%			$4.541.521,00
Subtotal Other Costs				**$9,991,346.00**
Total Capital Improvement Costs				**$29,612,595,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	83	EA	$64,00	$1.062,00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, struc	5,75	ACRE	$1.927,00	$5.540,00
Total Annual Operation and Maintenance Cost				**$6,602.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$231,068.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 7th St. Outfall
REACH : Lateral_6thAve
JURISDICTION : City of Greeley
REACH ID: 7th St-ReachLateral_6thAve Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	500	1	500	L.F.	$69,00	$34.500,00	L037,07
24-inch	825	1	825	L.F.	$92,00	$75.900,00	L937,05
36-inch	330	1	330	L.F.	$139,00	$45.870,00	L037,05
18-inch	50	11	550	L.F.	$69,00	$37.950,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			5	EA	$3.726,00	$18.630,00	
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			6	EA	$5.010,00	$30.060,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			1	EA	$15.416,00	$15.416,00	
Storm Inlet, Type R/Type 14, 5-foot			11	EA	$5.910,00	$65.010,00	
Special Items (User Defined)							
Asphalt Patch	**<---User Defined Items**		1014	S.Y.	$50,00	$50.700,00	
Waterline Lowering	**<---User Defined Items**		3	EA	$5.000,00	$15.000,00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$323.336,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$65.700,00
Subtotal Capital Improvement Costs				**$389.036,00**
Additional Capital Improvement Costs				
Dewatering	$3.890,36	L.S.		$3.890,00
Mobilization	5%			$19.452,00
Traffic Control	$7.780,72	L.S.		$7.781,00
Utility Coordination/Relocation	$38.903,60	L.S.		$38.904,00
Stormwater Management/Erosion Control	5%			$19.452,00
Subtotal Additional Capital Improvement Costs				**$89.479,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$71.777,00
Legal/Administrative	5%			$23.926,00
Contract Admin/Construction Management	10%			$47.852,00
Contingency	25%			$119.629,00
Subtotal Other Costs				**$263.184,00**
Total Capital Improvement Costs				**$741,699,00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	18	EA	$64,00	$230,00
Total Annual Operation and Maintenance Cost				**$230.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$8,050.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 7th St. Outfall
REACH : Lateral_7thAve_N
JURISDICTION : City of Greeley
REACH ID: 7th St-ReachLateral_7thAve_N Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
36-inch	500	1	500	L.F.	$139,00	$69.500,00	L038,21
18-inch	50	17	850	L.F.	$69,00	$58.650,00	Inlet Laterals
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			2	EA	$5.010,00	$10.020,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			1	EA	$15.416,00	$15.416,00	
Storm Inlet, Type R/Type 14, 5-foot			17	EA	$5.910,00	$100.470,00	
Special Items (User Defined)							
Asphalt Patch	**<---User Defined Items**		309	SY	$50,00	$15.450,00	
Waterline Lowering	**<---User Defined Items**		1	EA	$5.000,00	$5.000,00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$254.056,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$20.450,00
Subtotal Capital Improvement Costs				**$274.506,00**
Additional Capital Improvement Costs				
Dewatering	$2.745,06	L.S.		$2.745,00
Mobilization	5%			$13.725,00
Traffic Control	$5.490,12	L.S.		$5.490,00
Utility Coordination/Relocation	$27.450,60	L.S.		$27.451,00
Stormwater Management/Erosion Control	5%			$13.725,00
Subtotal Additional Capital Improvement Costs				**$63.136,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$50.646,00
Legal/Administrative	5%			$16.882,00
Contract Admin/Construction Management	10%			$33.764,00
Contingency	25%			$84.411,00
Subtotal Other Costs				**$185,703.00**
Total Capital Improvement Costs				**$523,345.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	12	EA	$64,00	$154,00
Total Annual Operation and Maintenance Cost				**$154.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$5,390.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7th St. Outfall
REACH :	Lateral_7thAve_S
JURISDICTION :	City of Greeley
REACH ID:	7th St-ReachLateral_7thAve_S Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
30-inch	860	1	860	L.F.	$116,00	$99.760,00	L038,09
42-inch	360	1	360	L.F.	$162,00	$58.320,00	L938,08
18-inch	50	30	1500	L.F.	$69,00	$103.500,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			5	EA	$3.726,00	$18.630,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			2	EA	$15.416,00	$30.832,00	
Storm Inlet, Type R/Type 14, 5-foot			30	EA	$5.910,00	$177.300,00	
Special Items (User Defined)							
Asphalt Repave	**<----User Defined Items**		226	S.Y.	$40,00	$9.040,00	
Asphalt Patch	**<----User Defined Items**		532	S.Y.	$50,00	$26.600,00	
Waterline Lowering	**<----User Defined Items**		3	EA	$5.000,00	$15.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$488.342,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$50.640,00
Subtotal Capital Improvement Costs				**$538.982,00**
Additional Capital Improvement Costs				
Dewatering	$5.389,82	L.S.		$5.390,00
Mobilization	5%			$26.949,00
Traffic Control	$10.779,64	L.S.		$10.780,00
Utility Coordination/Relocation	$53.898,20	L.S.		$53.898,00
Stormwater Management/Erosion Control	5%			$26.949,00
Subtotal Additional Capital Improvement Costs				**$123.966,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$99.442,00
Legal/Administrative	5%			$33.147,00
Contract Admin/Construction Management	10%			$66.295,00
Contingency	25%			$165.737,00
Subtotal Other Costs				**$364.621,00**
Total Capital Improvement Costs				**$1,027,569.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	22	EA	$64,00	$282,00
Total Annual Operation and Maintenance Cost				**$282.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$9,870.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7th St. Outfall
REACH :	Lateral_8thAve_N
JURISDICTION :	City of Greeley
REACH ID:	7th St-ReachLateral_8thAve_N Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
36-inch	520	1	520	L.F.	$139,00	$72.280,00	
18-inch	50	15	750	L.F.	$69,00	$51.750,00	Inlet Laterals
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			2	EA	$5.010,00	$10.020,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			1	EA	$15.416,00	$15.416,00	
Storm Inlet, Type R/Type 14, 5-foot			15	EA	$5.910,00	$88.650,00	
Special Items (User Defined)							
Asphalt Patch	**<----User Defined Items**		315	SY	$5.000,00	$1.575.000,00	
Waterline Lowering	**<----User Defined Items**		1	EA	$5.000,00	$5.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$238.116,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$1.580.000,00
Subtotal Capital Improvement Costs				**$1,818,116,00**
Additional Capital Improvement Costs				
Dewatering	$18.181,16	L.S.		$18.181,00
Mobilization	5%			$90.906,00
Traffic Control	$36.362,32	L.S.		$36.362,00
Utility Coordination/Relocation	$181.811,60	L.S.		$181.812,00
Stormwater Management/Erosion Control	5%			$90.906,00
Subtotal Additional Capital Improvement Costs				**$418,167,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$335.442,00
Legal/Administrative	5%			$111.814,00
Contract Admin/Construction Management	10%			$223.628,00
Contingency	25%			$559.071,00
Subtotal Other Costs				**$1,229,955.00**
Total Capital Improvement Costs				**$3,466,238.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	11	EA	$64,00	$141,00
Total Annual Operation and Maintenance Cost				**$141.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$4,935.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7th St. Outfall
REACH :	Lateral_9thAve
JURISDICTION :	City of Greeley
REACH ID:	7th St-ReachLateral_9thAve Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
24-inch	585	1	585	L.F.	$92.00	$53,820.00	L038,03
30-inch	400	1	400	L.F.	$116.00	$46,400.00	L038,04
18-inch	50	10	500	L.F.	$69.00	$34,500.00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			4	EA	$3,726.00	$14,904.00	
StormInlet, Type R/Type 14, 5-foot			10	EA	$5,910.00	$59,100.00	
Special Items (User Defined)							
Asphalt Patch	**<----User Defined Items**		620	SY	$50.00	$31,000.00	
Waterline Lowering	**<----User Defined Items**		3	EA	$5,000.00	$15,000.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains				$208,724.00	
Concrete Box Culverts				$0.00	
Hydraulic Structures				$0.00	
Channel Improvements				$0.00	
Detention/Water Quality Facilities				$0.00	
Removals				$0.00	
Landscaping and Maintenance Improvements				$0.00	
Special Items (User Defined)				$46,000.00	
Subtotal Capital Improvement Costs				**$254,724.00**	
Additional Capital Improvement Costs					
Dewatering	$2,547.24	L.S.		$2,547.00	
Mobilization	5%			$12,736.00	
Traffic Control	$5,094.48	L.S.		$5,094.00	
Utility Coordination/Relocation	$25,472.40	L.S.		$25,472.00	
Stormwater Management/Erosion Control	5%			$12,736.00	
Subtotal Additional Capital Improvement Costs				**$58,585.00**	
Land Acquisition Costs					
ROW/Easements				$0.00	
Subtotal Land Acquisition Costs				**$0.00**	
Other Costs (percentage of Capital Improvement Costs)					
Engineering	15%			$46,996.00	
Legal/Administrative	5%			$15,665.00	
Contract Admin/Construction Management	10%			$31,331.00	
Contingency	25%			$78,327.00	
Subtotal Other Costs				**$172,319.00**	
Total Capital Improvement Costs				**$485,628.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	9	EA	$64.00	$115.00	
Total Annual Operation and Maintenance Cost				**$115.00**	
Effective Interest Rate				1.50%	
Total Operation and Maintenance Costs Over 50 Years				**$4,025.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7th St. Outfall
REACH :	Lateral_11thAve_N
JURISDICTION :	City of Greeley
REACH ID:	7th St-ReachLateral_11thAve_N Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
60-inch	1015	1	1015	L.F.	$308.00	$312,620.00	L030,03_pipe
18-inch	50	50	2500	L.F.	$69.00	$172,500.00	Inlet Lateral
Manholes and Inlets							
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			2	EA	$15,416.00	$30,832.00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			4	EA	$19,271.00	$77,084.00	
StormInlet, Type R/Type 14, 5-foot			50	EA	$5,910.00	$295,500.00	
Special Items (User Defined)							
Asphalt Repave	**<----User Defined Items**		865	SY	$40.00	$34,600.00	
Waterline Lowering	**<----User Defined Items**		2	EA	$5,000.00	$10,000.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains				$888,536.00	
Concrete Box Culverts				$0.00	
Hydraulic Structures				$0.00	
Channel Improvements				$0.00	
Detention/Water Quality Facilities				$0.00	
Removals				$0.00	
Landscaping and Maintenance Improvements				$0.00	
Special Items (User Defined)				$44,600.00	
Subtotal Capital Improvement Costs				**$933,136.00**	
Additional Capital Improvement Costs					
Dewatering	$9,331.36	L.S.		$9,331.00	
Mobilization	5%			$46,657.00	
Traffic Control	$18,662.72	L.S.		$18,663.00	
Utility Coordination/Relocation	$93,313.60	L.S.		$93,314.00	
Stormwater Management/Erosion Control	5%			$46,657.00	
Subtotal Additional Capital Improvement Costs				**$214,622.00**	
Land Acquisition Costs					
ROW/Easements				$0.00	
Subtotal Land Acquisition Costs				**$0.00**	
Other Costs (percentage of Capital Improvement Costs)					
Engineering	15%			$172,164.00	
Legal/Administrative	5%			$57,388.00	
Contract Admin/Construction Management	10%			$114,776.00	
Contingency	25%			$286,940.00	
Subtotal Other Costs				**$631,268.00**	
Total Capital Improvement Costs				**$1,779,026.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	56	EA	$64.00	$717.00	
Total Annual Operation and Maintenance Cost				**$717.00**	
Effective Interest Rate				1.50%	
Total Operation and Maintenance Costs Over 50 Years				**$25,095.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7th St, Outfall
REACH :	Lateral_11thAve_S
JURISDICTION :	City of Greeley
REACH ID:	7th St-ReachLateral_11thAve_S Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	25	1250	L.F.	$69,00	$86.250,00	Inlet Laterals
Manholes and Inlets							
Manhole, 6' Dia, (Pipe Dia, = 48")			2	EA	$5.524,00	$11.048,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			8	EA	$15.416,00	$123.328,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			1	EA	$19.271,00	$19.271,00	
StormInlet, Type R/Type 14, 5-foot			175	EA	$5.910,00	$1.034.250,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
10	5	1	500	L.F.	$1.046,05	$523.027,00	L030,05 pipe
10	5	1	850	L.F.	$1.046,05	$889.146,00	L030,04 pipe
Special Items (User Defined)							
Asphalt Repave	**<---User Defined Items**		1400	SY	$40,00	$56.000,00	
Waterline Lowering	**<---User Defined Items**		3	EA	$5.000,00	$15.000,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$1.274.147,00
Concrete Box Culverts					$1.412.173,00
Hydraulic Structures					$0,00
Channel Improvements					$0,00
Detention/Water Quality Facilities					$0,00
Removals					$0,00
Landscaping and Maintenance Improvements					$0,00
Special Items (User Defined)					$71.000,00
Subtotal Capital Improvement Costs					**$2.757.320,00**
Additional Capital Improvement Costs					
Dewatering		$27.573,20	L.S.		$27.573,00
Mobilization		5%			$137.866,00
Traffic Control		$55.146,40	L.S.		$55.146,00
Utility Coordination/Relocation		$275.732,00	L.S.		$275.732,00
Stormwater Management/Erosion Control		5%			$137.866,00
Subtotal Additional Capital Improvement Costs					**$634.183,00**
Land Acquisition Costs					
ROW/Easements					$0,00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$508.725,00
Legal/Administrative		5%			$169.575,00
Contract Admin/Construction Management		10%			$339.150,00
Contingency		25%			$847.876,00
Subtotal Other Costs					**$1.865.326,00**
Total Capital Improvement Costs					**$5,256,829.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	186	EA	$64,00	$2.381,00
Total Annual Operation and Maintenance Cost				**$2,381.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$83,334,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St, Outfall Trunk
REACH :	12thSt_Trunk
JURISDICTION :	City of Greeley
REACH ID:	12thSt_Trunk-Reach12thSt_Trunk Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	252	12600	L.F.	$69,00	$869.400,00	Inlet Laterals
Manholes and Inlets							
Manhole, 6' Dia, (Pipe Dia, = 48")			4	EA	$5.524,00	$22.096,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			20	EA	$15.416,00	$308.320,00	
StormInlet, Type R/Type 14, 5-foot			252	EA	$5.910,00	$1.489.320,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
10	5	1	490	L.F.	$1.046,05	$512.566,00	L029,02
8	5	2	500	L.F.	$1.737,72	$868.858,00	L931,02
10	5	2	500	L.F.	$2.092,11	$1.046.054,00	L831,01
11	5	2	500	L.F.	$2.246,09	$1.123.045,00	L838,15
12	5	2	500	L.F.	$2.399,07	$1.199.536,00	L738,15
12	5	2	700	L.F.	$2.399,07	$1.679.350,00	L936,26
12	5	2	1190	L.F.	$2.399,07	$2.854.896,00	L036,07 & L036,15
12	5	2	510	L.F.	$2.399,07	$1.223.527,00	L036,19
12	6	3	1330	L.F.	$4.019,73	$5.346.245,00	L836,11
12	5	3	1010	L.F.	$3.598,61	$3.634.594,00	L830,18 & L930,15
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
12	3	39,00	1	EA	$3.632,27	$3.632,00	Outfall into Poudre
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
12	6	3	1	EA	$22.403,26	$22.403,30	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			7	AC-FT	$58.582,00	$385.938,00	WQCV
Special Items (User Defined)							
Asphalt Repave	**<---User Defined Items**		14132	S.Y.	$40,00	$565.280,00	
Waterline Lowering	**<---User Defined Items**		15	EA	$5.000,00	$75.000,00	
RR Boring	**<---User Defined Items**		700	LF	$4.500,00	$3.150.000,00	7 - 60" (100 LF each)
Hwy 85 Boring	**<---User Defined Items**		1600	LF	$4.500,00	$7.200.000,00	10 - 60" (160 LF each)
Land Acquisition							
Easement/ROW Acquisition			7,56	ACRE	$375.371,00	$2.837.805,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$2.689.136,00
Concrete Box Culverts					$19.514.706,00
Hydraulic Structures					$0,00
Channel Improvements					$0,00
Detention/Water Quality Facilities					$385.938,00
Removals					$0,00
Landscaping and Maintenance Improvements					$0,00
Special Items (User Defined)					$10.990.280,00
Subtotal Capital Improvement Costs					**$33.580.060,00**
Additional Capital Improvement Costs					
Dewatering		$335.800,60	L.S.		$335.801,00
Mobilization		5%			$1.679.003,00
Traffic Control		$671.601,20	L.S.		$671.601,00
Utility Coordination/Relocation		$3.358.006,00	L.S.		$3.358.006,00
Stormwater Management/Erosion Control		5%			$1.679.003,00
Subtotal Additional Capital Improvement Costs					**$7,723,414.00**
Land Acquisition Costs					
ROW/Easements					$2.837.805,00
Subtotal Land Acquisition Costs					**$2.837.805.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$6.195.521,00
Legal/Administrative		5%			$2.065.174,00
Contract Admin/Construction Management		10%			$4.130.347,00
Contingency		25%			$10.325.869,00
Subtotal Other Costs					**$22,716,911.00**
Total Capital Improvement Costs					**$66,858,190.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	276	EA	$64,00	$3.533,00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, struc	6,588	ACRE	$1.927,00	$6.348,00
Total Annual Operation and Maintenance Cost				**$9,881.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$345,832.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St, Outfall
REACH :	LateralsNof12th
JURISDICTION :	City of Greeley
REACH ID:	12thSt-ReachLateralsNof12th
Jeremy Deischer	DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	475	1	475	L.F.	$69,00	$32.775,00	L038,10
24-inch	500	1	500	L.F.	$92,00	$46.000,00	L938,20
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			4	EA	$3,726,00	$14.904,00	
Storm Inlet, Type R/Type 14, 5-foot			7	EA	$5.910,00	$41.370,00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		569	S.Y.	$50,00	$28.450,00	
Waterline Lowering	<----User Defined Items		2	EA	$5.000,00	$10.000,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$135.049,00
Concrete Box Culverts					$0,00
Hydraulic Structures					$0,00
Channel Improvements					$0,00
Detention/Water Quality Facilities					$0,00
Removals					$0,00
Landscaping and Maintenance Improvements					$0,00
Special Items (User Defined)					$38.450,00
Subtotal Capital Improvement Costs					**$173.499,00**
Additional Capital Improvement Costs					
Dewatering			$1,734,99	L.S.	$1.735,00
Mobilization			5%		$8.675,00
Traffic Control			$3,469,98	L.S.	$3.470,00
Utility Coordination/Relocation			$17.349,90	L.S.	$17.350,00
Stormwater Management/Erosion Control			5%		$8.675,00
Subtotal Additional Capital Improvement Costs					**$39.905,00**
Land Acquisition Costs					
ROW/Easements					$0,00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering			15%		$32.011,00
Legal/Administrative			5%		$10.670,00
Contract Admin/Construction Management			10%		$21.340,00
Contingency			25%		$53.351,00
Subtotal Other Costs					**$117.372,00**
Total Capital Improvement Costs					**$330,776.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	8	EA	$64,00	$102,00
Total Annual Operation and Maintenance Cost				**$102.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$3,570.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St, Outfall
REACH :	STribEofRR
JURISDICTION :	City of Greeley
REACH ID:	12thSt-ReachSTribEofRR
Jeremy Deischer	DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
48-inch	660	1	660	L.F.	$185,00	$122.100,00	L936,25
48-inch	500	1	500	L.F.	$185,00	$92.500,00	L036,25
48-inch	500	1	500	L.F.	$185,00	$92.500,00	L036,23
48-inch	500	1	500	L.F.	$185,00	$92.500,00	L036,22
24-inch	480	1	480	L.F.	$92,00	$44.160,00	L036,24
18-inch	50	73	3650	L.F.	$69,00	$251.850,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			2	EA	$3,726,00	$7.452,00	
Manhole, 6' Dia, (Pipe Dia, = 48")			7	EA	$5,524,00	$38.668,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			3	EA	$15.416,00	$46.248,00	
Storm Inlet, Type R/Type 14, 5-foot			73	EA	$5.910,00	$431.430,00	
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		1593	S.Y.	$40,00	$63.720,00	
Asphalt Patch	<----User Defined Items		237	S.Y.	$50,00	$11.850,00	
Waterline Lowering	<----User Defined Items		4	EA	$5.000,00	$20.000,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$1,219.408,00
Concrete Box Culverts					$0,00
Hydraulic Structures					$0,00
Channel Improvements					$0,00
Detention/Water Quality Facilities					$0,00
Removals					$0,00
Landscaping and Maintenance Improvements					$0,00
Special Items (User Defined)					$95.570,00
Subtotal Capital Improvement Costs					**$1,314.978,00**
Additional Capital Improvement Costs					
Dewatering			$13,149,78	L.S.	$13.150,00
Mobilization			5%		$65.749,00
Traffic Control			$26.299,56	L.S.	$26.300,00
Utility Coordination/Relocation			$131.497,80	L.S.	$131.498,00
Stormwater Management/Erosion Control			5%		$65.749,00
Subtotal Additional Capital Improvement Costs					**$302.446,00**
Land Acquisition Costs					
ROW/Easements					$0,00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering			15%		$242.614,00
Legal/Administrative			5%		$80.871,00
Contract Admin/Construction Management			10%		$161.742,00
Contingency			25%		$404.356,00
Subtotal Other Costs					**$889.583,00**
Total Capital Improvement Costs					**$2,507,007.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	49	EA	$64,00	$627,00
Total Annual Operation and Maintenance Cost				**$627.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$21,945.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St, Outfall
REACH :	STribWofRR
JURISDICTION :	City of Greeley
REACH ID:	12thSt-ReachSTribWofRR

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
54-inch	490	1	490	L.F.	$277,00	$135.730,00	L031,04
60-inch	510	1	510	L.F.	$308,00	$157.080,00	L032,04
48-inch	505	1	505	L.F.	$185,00	$93.425,00	L032,10
48-inch	500	1	500	L.F.	$185,00	$92.500,00	L932,06
66-inch	500	1	500	L.F.	$339,00	$169.500,00	L032,05
48-inch	510	1	510	L.F.	$185,00	$94.350,00	L032,09
48-inch	485	1	485	L.F.	$185,00	$89.725,00	L932,07
78-inch	500	1	500	L.F.	$501,00	$250.500,00	L832,07
42-inch	500	1	500	L.F.	$162,00	$81.000,00	L936,31
42-inch	500	1	500	L.F.	$162,00	$81.000,00	L036,30
36-inch	500	1	500	L.F.	$139,00	$69.500,00	L936,33
36-inch	500	1	500	L.F.	$139,00	$69.500,00	L936,28
48-inch	500	1	500	L.F.	$185,00	$92.500,00	L836,33
18-inch	50	250	12500	L.F.	$69,00	$862.500,00	Inlet Laterals
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			9	EA	$5.010,00	$45.090,00	
Manhole, 6' Dia, (Pipe Dia, = 48")			9	EA	$5.524,00	$49.716,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			19	EA	$15.416,00	$292.904,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			4	EA	$19.271,00	$77.084,00	
Storm Inlet, Type R/Type 14, 5-foot			250	EA	$5.910,00	$1.477.500,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	6	1	520	L.F.	$1.339,91	$696.754,00	L736,30
Special Items (User Defined)							
Asphalt Repave	<---User Defined Items		4752	S.Y.	$40,00	$190.080,00	
Asphalt Patch	<---User Defined Items		617	S.Y.	$50,00	$30.850,00	
Waterline Lowering	<---User Defined Items		15	EA	$5.000,00	$75.000,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$4.281.104,00
Concrete Box Culverts					$696.754,00
Hydraulic Structures					$0,00
Channel Improvements					$0,00
Detention/Water Quality Facilities					$0,00
Removals					$0,00
Landscaping and Maintenance Improvements					$0,00
Special Items (User Defined)					$295.930,00
Subtotal Capital Improvement Costs					**$5.273.788,00**
Additional Capital Improvement Costs					
Dewatering	$52.737,88	L.S.			$52.738,00
Mobilization	5%				$263.689,00
Traffic Control	$105.475,76	L.S.			$105.476,00
Utility Coordination/Relocation	$527.378,80	L.S.			$527.379,00
Stormwater Management/Erosion Control	5%				$263.689,00
Subtotal Additional Capital Improvement Costs					**$1.212.971,00**
Land Acquisition Costs					
ROW/Easements					$0,00
Subtotal Land Acquisition Costs					**$0,00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering	15%				$973.014,00
Legal/Administrative	5%				$324.338,00
Contract Admin/Construction Management	10%				$648.676,00
Contingency	25%				$1.621.690,00
Subtotal Other Costs					**$3.567.718,00**
Total Capital Improvement Costs					**$10.054.477,00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	166	EA	$64,00	$2.125,00
Total Annual Operation and Maintenance Cost				**$2.125,00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$74.374,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St, Outfall Trunk
REACH :	12thSt_Trunk
JURISDICTION :	City of Greeley
REACH ID:	12thSt_Trunk-Reach12thSt_Trunk

Jeremy Deischer — DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
60-inch	1010	1	1010	L.F.	$308,00	$311.080,00	L_12thSt
48-inch	570	1	570	L.F.	$185,00	$105.450,00	L_14thAve
18-inch	50	35	1750	L.F.	$69,00	$120.750,00	Inlet Laterals
Manholes and Inlets							
Manhole, 6' Dia, (Pipe Dia, = 48")			4	EA	$5.524,00	$22.096,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			20	EA	$15.416,00	$308.320,00	
Storm Inlet, Type R/Type 14, 5-foot			35	EA	$5.910,00	$206.850,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
8	4	1	490	L.F.	$819,72	$401.665,00	L029,02
8	4	1	995	L.F.	$819,72	$815.625,00	L830,18 & 930,15
10	4	1	1030	L.F.	$938,56	$966.714,00	L931,02 & L831,01
11	4	1	970	L.F.	$999,36	$969.378,00	L838,15 & L738,15
8	4	2	700	L.F.	$1.639,45	$1.147.614,00	L936,26
10	4	2	710	L.F.	$1.877,11	$1.332.751,00	L036,07
8	5	2	490	L.F.	$1.737,72	$851.481,00	L036,15
10	5	2	1820	L.F.	$2.092,11	$3.807.637,00	L036,19 & L836,11
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
10	2	23,00	1	EA	$2.155,91	$2.156,00	Outfall into Poudre
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
10	5	2	1	EA	$14.351,03	$14.351,00	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			7	AC-FT	$58.582,00	$385.938,00	WQCV
Special Items (User Defined)							
Asphalt Repave	**<---User Defined Items**		11735	S.Y.	$40,00	$469.400,00	
Waterline Lowering	**<---User Defined Items**		15	EA	$5.000,00	$75.000,00	
RR Boring	**<---User Defined Items**		500	LF	$4.500,00	$2.250.000,00	5 - 60" (100 LF each)
Hwy 85 Boring	**<---User Defined Items**		960	LF	$4.500,00	$4.320.000,00	6 - 60" (160 LF each)
Greeley No, 3 Boring	**<---User Defined Items**		120	LF	$4.500,00	$540.000,00	2 - 60"
Land Acquisition							
Easement/ROW Acquisition			7,56	ACRE	$375.371,00	$2.837.805,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$1.074.546,00
Concrete Box Culverts				$10.309.372,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$385.938,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$7.654.400,00
Subtotal Capital Improvement Costs				**$19.424.256.00**
Additional Capital Improvement Costs				
Dewatering	$194.242,56	L.S.		$194.243,00
Mobilization	5%			$971.213,00
Traffic Control	$388.485,12	L.S.		$388.485,00
Utility Coordination/Relocation	$1.942.425,60	L.S.		$1.942.426,00
Stormwater Management/Erosion Control	5%			$971.213,00
Subtotal Additional Capital Improvement Costs				**$4.467.580.00**
Land Acquisition Costs				
ROW/Easements				$2.837.805,00
Subtotal Land Acquisition Costs				**$2.837.805.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$3.583.775,00
Legal/Administrative	5%			$1.194.592,00
Contract Admin/Construction Management	10%			$2.389.184,00
Contingency	25%			$5.972.959,00
Subtotal Other Costs				**$13.140.510.00**
Total Capital Improvement Costs				**$39.870.151,00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	59	EA	$64,00	$755,00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, struc	6,588	ACRE	$1.927,00	$6.348,00
Total Annual Operation and Maintenance Cost				**$7,103,00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$248,603.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St, Outfall
REACH :	LateralsNof12th
JURISDICTION :	City of Greeley
REACH ID:	12thSt-ReachLateralsNof12th

Jeremy Deischer — DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	475	1	475	L.F.	$69,00	$32.775,00	L038,10
24-inch	500	1	500	L.F.	$92,00	$46.000,00	L938,20
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			4	EA	$3.726,00	$14.904,00	
Storm Inlet, Type R/Type 14, 5-foot			7	EA	$5.910,00	$41.370,00	
Special Items (User Defined)							
Asphalt Patch	**<---User Defined Items**		570	S.Y.	$50,00	$28.500,00	
Waterline Lowering	**<---User Defined Items**		2	EA	$5.000,00	$10.000,00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$135.049,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$38.500,00
Subtotal Capital Improvement Costs				**$173.549,00**
Additional Capital Improvement Costs				
Dewatering	$1.735,49	L.S.		$1.735,00
Mobilization	5%			$8.677,00
Traffic Control	$3.470,98	L.S.		$3.471,00
Utility Coordination/Relocation	$17.354,90	L.S.		$17.355,00
Stormwater Management/Erosion Control	5%			$8.677,00
Subtotal Additional Capital Improvement Costs				**$39.915,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$32.020,00
Legal/Administrative	5%			$10.673,00
Contract Admin/Construction Management	10%			$21.346,00
Contingency	25%			$53.366,00
Subtotal Other Costs				**$117.405.00**
Total Capital Improvement Costs				**$330,869.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	8	EA	$64,00	$102,00
Total Annual Operation and Maintenance Cost				**$102.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$3,570.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St, Outfall
REACH :	STribEofRR
JURISDICTION :	City of Greeley
REACH ID:	12thSt-ReachSTribEofRR

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
48-inch	660	1	660	L.F.	$185,00	$122.100,00	L936,25
48-inch	500	1	500	L.F.	$185,00	$92.500,00	L036,25
48-inch	500	1	500	L.F.	$185,00	$92.500,00	L036,23
48-inch	500	1	500	L.F.	$185,00	$92.500,00	L036,22
24-inch	480	1	480	L.F.	$92,00	$44.160,00	L036,24
18-inch	50	73	3650	L.F.	$69,00	$251.850,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			2	EA	$3.726,00	$7.452,00	
Manhole, 6' Dia, (Pipe Dia, = 48")			7	EA	$5.524,00	$38.668,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			3	EA	$15.416,00	$46.248,00	
Storm Inlet, Type R/Type 14, 5-foot			73	EA	$5.910,00	$431.430,00	
Special Items (User Defined)							
Asphalt Patch	**<----User Defined Items**		1796	S.Y.	$50,00	$89.800,00	
Waterline Lowering	**<----User Defined Items**		4	EA	$5.000,00	$20.000,00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$1.219.408,00
Concrete Box Culverts				$0,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$109.800,00
Subtotal Capital Improvement Costs				**$1,329,208,00**
Additional Capital Improvement Costs				
Dewatering	$13.292,08	L.S.		$13.292,00
Mobilization	5%			$66.460,00
Traffic Control	$26.584,16	L.S.		$26.584,00
Utility Coordination/Relocation	$132.920,80	L.S.		$132.921,00
Stormwater Management/Erosion Control	5%			$66.460,00
Subtotal Additional Capital Improvement Costs				**$305,717,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$245.239,00
Legal/Administrative	5%			$81.746,00
Contract Admin/Construction Management	10%			$163.493,00
Contingency	25%			$408.731,00
Subtotal Other Costs				**$899,209,00**
Total Capital Improvement Costs				**$2,534,134.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	49	EA	$64,00	$627,00
Total Annual Operation and Maintenance Cost				**$627.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$21,945.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St, Outfall
REACH :	STribWofRR
JURISDICTION :	City of Greeley
REACH ID:	12thSt-ReachSTribWofRR

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
48-inch	490	1	490	L.F.	$185,00	$90.650,00	L031,04
48-inch	510	1	510	L.F.	$185,00	$94.350,00	L032,04
48-inch	505	1	505	L.F.	$185,00	$93.425,00	L032,10
48-inch	500	1	500	L.F.	$185,00	$92.500,00	L932,06
54-inch	500	1	500	L.F.	$277,00	$138.500,00	L032,05
48-inch	510	1	510	L.F.	$185,00	$94.350,00	L032,09
48-inch	485	1	485	L.F.	$185,00	$89.725,00	L932,07
78-inch	500	1	500	L.F.	$501,00	$250.500,00	L832,07
42-inch	500	1	500	L.F.	$162,00	$81.000,00	L936,31
42-inch	500	1	500	L.F.	$162,00	$81.000,00	L036,30
36-inch	500	1	500	L.F.	$139,00	$69.500,00	L936,33
42-inch	500	1	500	L.F.	$162,00	$81.000,00	L936,28
42-inch	500	1	500	L.F.	$162,00	$81.000,00	L836,33
36-inch	1000	1	1000	L.F.	$139,00	$139.000,00	L_16thSt
36-inch	1400	1	1400	L.F.	$139,00	$194.600,00	L_17thSt
18-inch	50	98	4900	L.F.	$69,00	$338.100,00	Inlet Laterals
48-inch	900	1	900	L.F.	$185,00	$166.500,00	L14thSt
Manholes and Inlets							
Manhole, 5' Dia, (Pipe Dia, 36" - 42")			23	EA	$5.010,00	$115.230,00	
Manhole, 6' Dia, (Pipe Dia, = 48")			9	EA	$5.524,00	$49.716,00	
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			19	EA	$15.416,00	$292.904,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			4	EA	$19.271,00	$77.084,00	
Storm Inlet, Type R/Type 14, 5-foot			98	EA	$5.910,00	$579.180,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
7	4	1	500	L.F.	$758,92	$379.461,00	L832,07
10	5	1	520	L.F.	$1.046,05	$543.946,00	L736,30
Special Items (User Defined)							
Asphalt Repave	**<----User Defined Items**		3796	S.Y.	$40,00	$151.840,00	
Asphalt Patch	**<----User Defined Items**		3196	S.Y.	$50,00	$159.800,00	
Waterline Lowering	**<----User Defined Items**		15	EA	$5.000,00	$75.000,00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$3.289.814,00
Concrete Box Culverts				$923.409,00
Hydraulic Structures				$0,00
Channel Improvements				$0,00
Detention/Water Quality Facilities				$0,00
Removals				$0,00
Landscaping and Maintenance Improvements				$0,00
Special Items (User Defined)				$386.640,00
Subtotal Capital Improvement Costs				**$4,599,863,00**
Additional Capital Improvement Costs				
Dewatering	$45.998,63	L.S.		$45.999,00
Mobilization	5%			$229.993,00
Traffic Control	$91.997,26	L.S.		$91.997,00
Utility Coordination/Relocation	$459.986,30	L.S.		$459.986,00
Stormwater Management/Erosion Control	5%			$229.993,00
Subtotal Additional Capital Improvement Costs				**$1,057,968,00**
Land Acquisition Costs				
ROW/Easements				$0,00
Subtotal Land Acquisition Costs				**$0,00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$848.675,00
Legal/Administrative	5%			$282.892,00
Contract Admin/Construction Management	10%			$565.783,00
Contingency	25%			$1.414.458,00
Subtotal Other Costs				**$3,111,808,00**
Total Capital Improvement Costs				**$8,769,639.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	153	EA	$64,00	$1.958,00
Total Annual Operation and Maintenance Cost				**$1,958.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$68,529,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. Outfall
REACH :	Lateral_4thSt
JURISDICTION :	City of Greeley
REACH ID:	14thAve-ReachLateral_4thSt

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	910	1	910	L.F.	$69.00	$62,790.00	4th Street Lateral
18-inch	50	3	150	L.F.	$69.00	$10,350.00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			5	EA	$3,726.00	$18,630.00	
Storm Inlet, Type R/Type 14, 5-foot			3	EA	$5,910.00	$17,730.00	
Special Items (User Defined)							
Asphalt Patch	**<---User Defined Items**		421	S.Y.	$50.00	$21,050.00	
Land Acquisition							
Easement/ROW Acquisition			0.38	ACRE	$25,337.99	$9,665.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs						
Pipe Culverts and Storm Drains						$109,500.00
Concrete Box Culverts						$0.00
Hydraulic Structures						$0.00
Channel Improvements						$0.00
Detention/Water Quality Facilities						$0.00
Removals						$0.00
Landscaping and Maintenance Improvements						$0.00
Special Items (User Defined)						$21,050.00
Subtotal Capital Improvement Costs						**$130,550.00**
Additional Capital Improvement Costs						
Dewatering			$1,305.50	L.S.		$1,306.00
Mobilization			5%			$6,528.00
Traffic Control			$2,611.00	L.S.		$2,611.00
Utility Coordination/Relocation			$13,055.00	L.S.		$13,055.00
Stormwater Management/Erosion Control			5%			$6,528.00
Subtotal Additional Capital Improvement Costs						**$30,028.00**
Land Acquisition Costs						
ROW/Easements						$9,665.00
Subtotal Land Acquisition Costs						**$9,665.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$24,087.00
Legal/Administrative			5%			$8,029.00
Contract Admin/Construction Management			10%			$16,058.00
Contingency			25%			$40,145.00
Subtotal Other Costs						**$88,319.00**
Total Capital Improvement Costs						**$258,562.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	7	EA	$64.00	$90.00
Total Annual Operation and Maintenance Cost				**$90.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$3,150.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. Outfall
REACH :	Lateral_5thSt
JURISDICTION :	City of Greeley
REACH ID:	14thAve-ReachLateral_5thSt

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
24-inch	670	1	670	L.F.	$92.00	$61,640.00	
24-inch	315	1	315	L.F.	$92.00	$28,980.00	
30-inch	480	1	480	L.F.	$116.00	$55,680.00	
30-inch	470	1	470	L.F.	$116.00	$54,520.00	
30-inch	660	1	660	L.F.	$116.00	$76,560.00	
30-inch	1350	1	1350	L.F.	$116.00	$156,600.00	
36-inch	350	1	350	L.F.	$139.00	$48,650.00	
42-inch	520	1	520	L.F.	$162.00	$84,240.00	
18-inch	50	40	2000	L.F.	$69.00	$138,000.00	
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			18	EA	$3,726.00	$67,068.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			3	EA	$5,010.00	$15,030.00	
Storm Inlet, Type R/Type 14, 5-foot			40	EA	$5,910.00	$236,400.00	
Special Items (User Defined)							
Asphalt Repave	**<---User Defined Items**		473	S.Y.	$40.00	$18,920.00	
Asphalt Patch	**<---User Defined Items**		2147	S.Y.	$50.00	$107,350.00	
Waterline Lowering	**<---User Defined Items**		9	EA	$5,000.00	$45,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs						
Pipe Culverts and Storm Drains						$1,023,368.00
Concrete Box Culverts						$0.00
Hydraulic Structures						$0.00
Channel Improvements						$0.00
Detention/Water Quality Facilities						$0.00
Removals						$0.00
Landscaping and Maintenance Improvements						$0.00
Special Items (User Defined)						$171,270.00
Subtotal Capital Improvement Costs						**$1,194,638.00**
Additional Capital Improvement Costs						
Dewatering			$11,946.38	L.S.		$11,946.00
Mobilization			5%			$59,732.00
Traffic Control			$23,892.76	L.S.		$23,893.00
Utility Coordination/Relocation			$119,463.80	L.S.		$119,464.00
Stormwater Management/Erosion Control			5%			$59,732.00
Subtotal Additional Capital Improvement Costs						**$274,767.00**
Land Acquisition Costs						
ROW/Easements						$0.00
Subtotal Land Acquisition Costs						**$0.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$220,411.00
Legal/Administrative			5%			$73,470.00
Contract Admin/Construction Management			10%			$146,941.00
Contingency			25%			$367,351.00
Subtotal Other Costs						**$808,173.00**
Total Capital Improvement Costs						**$2,277,578.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	41	EA	$64.00	$525.00
Total Annual Operation and Maintenance Cost				**$525.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$18,375.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. Outfall
REACH :	Lateral_8thSt
JURISDICTION :	City of Greeley
REACH ID:	14thAve-ReachLateral_8thSt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
30-inch	1000	1	1000	L.F.	$116,00	$116.000,00	L027,08
18-inch	50	10	500	L.F.	$69,00	$34.500,00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia, (Pipe Dia, < 36")			3	EA	$3,726,00	$11,178,00	
Storm Inlet, Type R/Type 14, 5-foot			10	EA	$5.910,00	$59,100,00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		583	S.Y.	$50,00	$29,150,00	
Waterline Lowering	<----User Defined Items		2	EA	$5,000,00	$10,000,00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$220,778,00
Concrete Box Culverts					$0,00
Hydraulic Structures					$0,00
Channel Improvements					$0,00
Detention/Water Quality Facilities					$0,00
Removals					$0,00
Landscaping and Maintenance Improvements					$0,00
Special Items (User Defined)					$39,150,00
Subtotal Capital Improvement Costs					**$259,928,00**
Additional Capital Improvement Costs					
Dewatering		$2,599,28	L.S.		$2,599,00
Mobilization		5%			$12,996,00
Traffic Control		$5,198,56	L.S.		$5,199,00
Utility Coordination/Relocation		$25,992,80	L.S.		$25,993,00
Stormwater Management/Erosion Control		5%			$12,996,00
Subtotal Additional Capital Improvement Costs					**$59,783,00**
Land Acquisition Costs					
ROW/Easements					$0,00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$47,957,00
Legal/Administrative		5%			$15,986,00
Contract Admin/Construction Management		10%			$31,971,00
Contingency		25%			$79,928,00
Subtotal Other Costs					**$175,842.00**
Total Capital Improvement Costs					**$495,553.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	8	EA	$64,00	$102,00
Total Annual Operation and Maintenance Cost				**$102.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$3,570.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. Outfall
REACH :	Lateral_9thSt
JURISDICTION :	City of Greeley
REACH ID:	14thAve-ReachLateral_9thSt Jeremy Deischer DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
48-inch	1950	1	1950	L.F.	$185,00	$360.750,00	L_LP_Inflow
18-inch	50	14	700	L.F.	$69,00	$48.300,00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			6	EA	$15,416,00	$92,496,00	
Storm Inlet, Type R/Type 14, 5-foot			14	EA	$5,910,00	$82,740,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
6	4	1	800	L.F.	$699,12	$559.296,00	L027,11_pipe
6	4	1	800	L.F.	$699,12	$559.296,00	L027,10_pipe
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		2748	S.Y.	$40,00	$109.920,00	
Waterline Lowering	<----User Defined Items		1	EA	$5,000,00	$5,000,00	
No. 3 Boring	<----User Defined Items		100	LF	$4,500,00	$450,000,00	48" Boring (100 ft.)

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$584.286,00
Concrete Box Culverts					$1,118,592,00
Hydraulic Structures					$0,00
Channel Improvements					$0,00
Detention/Water Quality Facilities					$0,00
Removals					$0,00
Landscaping and Maintenance Improvements					$0,00
Special Items (User Defined)					$564,920,00
Subtotal Capital Improvement Costs					**$2,267,798,00**
Additional Capital Improvement Costs					
Dewatering		$22,677,98	L.S.		$22,678,00
Mobilization		5%			$113,390,00
Traffic Control		$45,355,96	L.S.		$45,356,00
Utility Coordination/Relocation		$226,779,80	L.S.		$226,780,00
Stormwater Management/Erosion Control		5%			$113,390,00
Subtotal Additional Capital Improvement Costs					**$521,594,00**
Land Acquisition Costs					
ROW/Easements					$0,00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$418,409,00
Legal/Administrative		5%			$139,470,00
Contract Admin/Construction Management		10%			$278,939,00
Contingency		25%			$697,348,00
Subtotal Other Costs					**$1,534,166,00**
Total Capital Improvement Costs					**$4,323,558.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	20	EA	$64,00	$256,00
Total Annual Operation and Maintenance Cost				**$256.00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$8,960,00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. Outfall Trunk
REACH :	14thAveTrunk
JURISDICTION :	City of Greeley
REACH ID:	14thAveTrunk-Reach14thAveTrunk Jeremy Deischer — DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	75	3750	L.F.	$69,00	$258.750,00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia, 48" and larger, deflection < 10 degrees)			19	EA	$15.416,00	$292.904,00	
Type P Manhole (Pipe Dia, 48" and larger, deflection > 10 degrees)			2	EA	$19.271,00	$38.542,00	
Storm Inlet, Type R/Type 14, 5-foot			75	EA	$5.910,00	$443.250,00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
10	4	1	530	L.F.	$938,56	$497.435,00	L026,03
11	4	1	810	L.F.	$999,36	$809.481,00	L926,02 & L926,01
11	4	1	340	L.F.	$999,36	$339.782,00	L925,01
11	5	1	850	L.F.	$1.123,05	$954.588,00	L825,01
12	5	1	1510	L.F.	$1.199,54	$1.811.299,00	L942,02
12	6	1	960	L.F.	$1.339,91	$1.286.315,00	L942,01
6	4	1	320	L.F.	$699,12	$223.718,00	L027,09
7	4	1	390	L.F.	$758,92	$295.980,00	L027,07
8	4	1	950	L.F.	$819,72	$778.738,00	L027,04 & L027,01
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
6	1	8,00	1	EA	$701,08	$701,00	Outfall into Poudre
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
6	4	1	1	EA	$8.008,15	$8.008,20	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			8	AC-FT	$58.582,00	$472.464,00	
Special Items (User Defined)							
Asphalt Repave	**<----User Defined Items**		6826	S.Y.	$50,00	$341.300,00	
Waterline Lowering	**<----User Defined Items**		12	EA	$5.000,00	$60.000,00	
Railroad Boring	**<----User Defined Items**		300	L.F.	$4.500,00	$1.350.000,00	3 - 60" parallel closed face borings
Land Acquisition							
Easement/ROW Acquisition			9,30	ACRE	$21.980,00	$204.414,00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains			$1.033.446,00	
Concrete Box Culverts			$7.006.045,00	
Hydraulic Structures			$0,00	
Channel Improvements			$0,00	
Detention/Water Quality Facilities			$472.464,00	
Removals			$0,00	
Landscaping and Maintenance Improvements			$0,00	
Special Items (User Defined)			$1.751.300,00	
Subtotal Capital Improvement Costs			**$10.263.255.00**	
Additional Capital Improvement Costs				
Dewatering	$102.632,55	L.S.	$102.633,00	
Mobilization	5%		$513.163,00	
Traffic Control	$205.265,10	L.S.	$205.265,00	
Utility Coordination/Relocation	$1.026.325,50	L.S.	$1.026.326,00	
Stormwater Management/Erosion Control	5%		$513.163,00	
Subtotal Additional Capital Improvement Costs			**$2.360.550.00**	
Land Acquisition Costs				
ROW/Easements			$204.414,00	
Subtotal Land Acquisition Costs			**$204.414.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$1.893.571,00	
Legal/Administrative	5%		$631.190,00	
Contract Admin/Construction Management	10%		$1.262.381,00	
Contingency	25%		$3.155.951,00	
Subtotal Other Costs			**$6.943.093.00**	
Total Capital Improvement Costs			**$19.771.312,00**	

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	96	EA	$64,00	$1.229,00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, struc	8,065	ACRE	$1.927,00	$7.771,00
Total Annual Operation and Maintenance Cost				**$9.000,00**
Effective Interest Rate				1,50%
Total Operation and Maintenance Costs Over 50 Years				**$314.997,00**

1: One Story, No Basement

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	0	0
-1	2.5	2.4
0	13.4	8.1
1	23.3	13.3
2	32.1	17.9
3	40.1	22
4	47.1	25.7
5	53.2	28.8
6	58.6	31.5
7	63.2	33.8
8	67.2	35.7
9	70.5	37.2
10	73.2	38.4

2: One Story, With Basement

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	13.8	10.5
-1	19.4	13.2
0	25.5	16
1	32	18.9
2	38.7	21.8
3	45.5	24.7
4	52.2	27.4
5	58.6	30
6	64.5	32.4
7	69.8	34.5
8	74.2	36.3
9	77.7	37.7
10	80.1	38.6

3: Split Level No Basement

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	0	0
-1	6.4	2.2
0	7.2	2.9
1	9.4	4.7
2	12.9	7.5
3	17.4	11.1
4	22.8	15.3
5	28.9	20.1
6	35.5	25.2
7	42.3	30.5
8	49.2	35.7
9	56.1	40.9
10	62.6	45.8

4: Split Level Wtih Basement

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	10.4	7.3
-1	14.2	9.4
0	18.5	11.6
1	23.2	13.8
2	28.2	16.1
3	33.4	18.2
4	38.6	20.2
5	43.8	22.1
6	48.8	23.6
7	53.5	24.9
8	57.8	25.8
9	61.6	26.3
10	64.8	26.3

5: Two Or More Levels No Basement

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	0	0
-1	3	1
0	9.3	5
1	15.2	8.7
2	20.9	12.2
3	26.3	15.5
4	31.4	18.5
5	36.2	21.3
6	40.7	23.9
7	44.9	26.3
8	48.8	28.4
9	52.4	30.3
10	55.7	32

6: Two Or More Levels With Basement

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	10.2	8.4
-1	13.9	10.1
0	17.9	11.9
1	22.3	13.8
2	27	15.7
3	31.9	17.7
4	36.9	19.8
5	41.9	22
6	46.9	24.3
7	51.8	26.7
8	56.4	29.1
9	60.8	31.7
10	64.8	34.4

7: Mobile Home

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	0	0
-1	0	0
0	8	12
1	44	66
2	63	90
3	73	90
4	78	90
5	80	90
6	81	90
7	82	90
8	82	90
9	82	90
10	82	90

8: Apartment

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	0	0
-1	0	0
0	0	0
1	11	22
2	17.4	30
3	21.3	39
4	26.2	45
5	29.6	48
6	32.1	52
7	34.1	56
8	37.2	59
9	38.9	61
10	41.1	63

9: Schools

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	0	10.5
-1	4	13.2
0	8	16
1	13	22
2	21.5	30
3	26.7	39
4	32.7	45
5	36.2	48
6	39.7	52
7	41.6	56
8	44.5	59
9	46.4	61
10	48.5	63

10: Medical Offices

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	0	0
-1	0	0
0	0.6	0
1	11.7	14
2	18.9	27
3	24.4	40
4	32.7	57
5	37.2	67
6	46.3	75
7	50.7	82
8	55.8	91
9	58.9	96
10	61.2	97

11: Warehouse Non-Refrig

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	0	0
-1	0	0
0	0	0
1	10.2	21
2	16.7	34
3	20.4	47
4	25.5	57
5	29.7	66
6	32.8	74
7	35.5	81
8	39.6	88
9	42.5	92
10	44.5	94

12: Industrial Light

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	0	0
-1	0	0
0	0	0
1	10.4	19
2	16.8	31
3	20.9	42
4	25.9	52
5	30.1	61
6	33.8	72
7	37	82
8	41.5	91
9	44.6	94
10	46.7	95

13: Office One-Story

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	0.4	10.5
-1	4	13.2
0	8	16
1	12.3	20
2	17.5	34
3	22.2	45
4	26.8	55
5	30.7	64
6	34.7	73
7	41.2	76
8	46.5	83
9	49.4	89
10	53.6	91

14: Recreation

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
	0	0
-1	0	0
0	0	0
1	11.9	26
2	20.2	44
3	26	63
4	32.2	73
5	36.8	80
6	40.7	84
7	43.4	91
8	47.4	95
9	49.4	95
10	51.6	95

15: Non-Fast Food

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	0	0
-1	0	0
0	1.2	0
1	17.7	28
2	29.1	49
3	36.4	57
4	44.1	72
5	51.2	80
6	57.5	85
7	60.7	93
8	64.9	93
9	65.7	94
10	67	94

16: Retail-Clothing

Depth	% Damage Structure	% Damage Contents
-8	0	0
-7	0	0
-6	0	0
-5	0	0
-4	0	0
-3	0	0
-2	0	0
-1	0	0
0	0	0
1	11.4	29
2	17.2	46
3	21.4	55
4	26.9	70
5	31.5	79
6	34.3	89
7	37.2	96
8	41.2	98
9	43.2	98
10	45.1	99

APPENDIX D
Project Useful Life Summary

Project Type	Useful Life (years)		Comment
	Standard Value	Acceptable Limits (documentation required)	
Acquisition/Relocation			
All Structures	100	100	
Elevation			
Residential Building	30	30–50	
Non-Residential Building	25	25–50	
Public Building	50	50–100	
Historic Buildings	50	50–100	
Structural/Non-Structural Building Project			
Residential Building Retrofit	30	30	
Non-Residential Building Retrofit	25	25–50	
Public Building Retrofit	50	50–100	
Historic Building Retrofit	50	50–100	
Roof Diaphragm Retrofit	30	30	Roof hardening and roof clips
Tornado Safe Room – Residential	30	30	
Tornado Safe Room – Community	30	30–50	Retrofit or small community safe room ≤ 16 people (30 yr), New (50 yr)
Non-Structural Building Elements	30	30	Ceilings, electrical cabinets, generators, parapet walls, or chimneys
Non-Structural Major Equipment	15	15–30	Elevators, HVAC, sprinklers
Non-Structural Minor Equipment	5	5–20	Generic contents, racks, shelves
Infrastructure Projects			
Major Infrastructure (minor localized flood reduction projects)	50	35–100	
Concrete Infrastructure, Flood Walls, Roads, Bridges, Major Drainage System	50	35–50	
Culverts (concrete, PVC, CMP, HDPE, etc.)	30	25–50	Culvert **with** end treatment (i.e., wing walls, end sections, head walls, etc.)
	10	5–20	Culvert **without** end treatment (i.e., wing walls, end sections, head walls, etc.)
Pump Stations, Substations, Wastewater Systems, or Equipment Such as Generators	50	50	Structures
	5	5–30	Equipment
Hurricane Storm Shutters	15	15–30	Depends on type of storm shutter
Utility Mitigation Projects	50	50–100	Major (power lines, cable, hardening gas, water, sewer lines, etc.)
	5	5–30	Minor (backflow values, downspout disconnect, etc.)

Table 10: Hazus MR2 Default Contents Value Based on Percentage of Structure Value

No.	Hazus Occupancy Class Code	Hazus Occupancy Class Description	Contents Value (% of BRV)
		Residential	
1	RES1	Single Family Dwelling	50
2	RES2	Mobile Home	50
3	RES3	Multi Family Dwelling	50
4	RES4	Temporary Lodging	50
5	RES5	Institutional Dormitory	50
6	RES6	Nursing Home	50
		Commercial	
7	COM1	Retail Trade	100
8	COM2	Wholesale Trade	100
9	COM3	Personal and Repair Services	100
10	COM4	Professional/Technical/Business Services	100
11	COM5	Banks	100
12	COM6	Hospital	150
13	COM7	Medical Office/Clinic	150
14	COM8	Entertainment & Recreation	100
15	COM9	Theaters	100
16	COM10	Parking	50
		Industrial	
17	IND1	Heavy	150
18	IND2	Light	150
19	IND3	Food/Drugs/Chemicals	150
20	IND4	Metals/Minerals Processing	150
21	IND5	High Technology	150
22	IND6	Construction	100
		Agriculture	
23	AGR1	Agriculture	100
		Religion/Non-Profit	
24	REL1	Church/Membership Organization	100
		Government	
25	GOV1	General Services	100
26	GOV2	Emergency Response	150
		Education	
27	EDU1	Schools/Libraries	100
28	EDU2	Colleges/Universities	150

The exception to these defaults is when users select residential USACE Generic DDFs. The BCA software uses 100% of the BRV for the contents replacement value as the default when USACE Generic DDFs are selected because the content-to-structure value ratio is already incorporated in the contents DDF.

When conducting a Flood module analysis, the user normally uses the default contents values provided by the BCA software. The default contents values are based on the DDF selection (residential or non-residential/primary use, number of stories, basement type, and default or generic). However, in some situations, the primary building use for non-residential buildings

UD-MP Cost Unit Costs

Item	Unit	Unit Cost 2012 Q1	Adjusted Unit Cost 2015 Q4
Circular Pipes			
12-inch	L.F.	$36.00	$46.00
18-inch	L.F.	$54.00	$69.00
24-inch	L.F.	$72.00	$92.00
30-inch	L.F.	$90.00	$116.00
36-inch	L.F.	$108.00	$139.00
42-inch	L.F.	$126.00	$162.00
48-inch	L.F.	$144.00	$185.00
54-inch	L.F.	$216.00	$277.00
60-inch	L.F.	$240.00	$308.00
66-inch	L.F.	$264.00	$339.00
72-inch	L.F.	$360.00	$462.00
78-inch	L.F.	$390.00	$501.00
84-inch	L.F.	$420.00	$540.00
90-inch	L.F.	$450.00	$578.00
96-inch	L.F.	$480.00	$617.00
102-inch	L.F.	$714.00	$917.00
108-inch	L.F.	$756.00	$971.00
120-inch	L.F.	$840.00	$1,079.00
Flared End Sections			
12-inch	EA	$710.00	$912.00
18-inch	EA	$920.00	$1,182.00
24-inch	EA	$970.00	$1,246.00
30-inch	EA	$1,570.00	$2,017.00
36-inch	EA	$1,610.00	$2,068.00
42-inch	EA	$1,700.00	$2,184.00
48-inch	EA	$2,060.00	$2,646.00
Manholes and Inlets			
Manhole, 4' Dia. (Pipe Dia. < 36"), Depth > 15-feet)	EA	$2,900.00	$3,726.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42"), Depth > 15-feet)	EA	$3,900.00	$5,010.00
Manhole, 6' Dia. (Pipe Dia. , Depth > 15-feet)	EA	$4,300.00	$5,524.00
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)	EA	$12,000.00	$15,416.00
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)	EA	$15,000.00	$19,271.00
Storm Inlet, Type R/Type 14, 5-foot, 10-foot deep avg.	EA	$4,600.00	$5,910.00

Item	Unit	Unit Cost 2012 Q1	Adjusted Unit Cost 2015 Q4
Hydraulic Structures			
Grouted Boulders, 36-inch	C.Y.	$190.00	$244.00
Soil Riprap, Type M	C.Y.	$70.00	$90.00
Excavation, Complete-in-Place	C.Y.	$11.00	$14.00
Bedding, Granular Type II	C.Y.	$58.00	$75.00
Grout	C.Y.	$240.00	$308.00
Check Structure, Concrete	L.F.	$270.00	$347.00
Channel Improvements			
Boulder Edging, 12" High	L.F.	$60.00	$77.00
Boulder Edging, 24" High	L.F.	$75.00	$96.00
Boulder Edging, 36" High	L.F.	$90.00	$116.00
Concrete Low Flow Channel	L.F.	$40.00	$51.00
Grouted Boulders, 12"	S.Y.	$130.00	$167.00
Grouted Boulders, 18"	S.Y.	$150.00	$193.00
Grouted Boulders, 24"	S.Y.	$170.00	$218.00
Grouted Boulders, 36"	S.Y.	$190.00	$244.00
Grouted Boulders, 48"	S.Y.	$200.00	$257.00
6-inch Riprap, Type VL	C.Y.	$45.00	$58.00
9-inch Riprap, Type L	C.Y.	$55.00	$71.00
12-inch Riprap, Type M	C.Y.	$60.00	$77.00
18-inch Riprap, Type H	C.Y.	$80.00	$103.00
24-inch Riprap, Type VH	C.Y.	$85.00	$109.00
Soil Riprap, Type VL	C.Y.	$50.00	$64.00
Soil Riprap, Type L	C.Y.	$60.00	$77.00
Soil Riprap, Type M	C.Y.	$70.00	$90.00
Soil Riprap, Type H	C.Y.	$80.00	$103.00
Soil Riprap, Type VH	C.Y.	$90.00	$116.00
Excavation, Low Range	C.Y.	$11.00	$14.00
Excavation, Mid Range	C.Y.	$24.00	$31.00
Excavation, High Range	C.Y.	$31.00	$40.00
Concrete and Steel			
Concrete	C.Y.	$600.00	$771.00
Steel	LB.	$0.90	$1.00

Item	Unit	Unit Cost 2012 Q1	Adjusted Unit Cost 2015 Q4
Landscaping and Recreation Improvements			
Wetlands Plantings	ACRE	$25,000.00	$32,118.00
Reclamation & seeding (native grasses)	ACRE	$1,000.00	$1,285.00
Trail/Path, Concrete (10' Width)	L.F.	$44.00	$57.00
Trail/Path, Crusher Fines (10' Width)	L.F.	$11.00	$14.00
Operation and Maintenance			
Culvert Maintenance	L.F.	$1.00	$1.00
Manhole and Inlet Maintenance	EA	$50.00	$64.00
Hydraulic Structure Maintenance	EA	$500.00	$642.00
Channel Maintenance	L.F.	$2.00	$3.00
Detention/WQ Maintenance	ACRE	$1,500.00	$1,927.00
Mowing	ACRE	$50.00	$64.00
Trail Maintenance	L.F.	$5.00	$6.00
Removals			
Removal of culvert pipe (D<48")	L.F.	$20.00	$26.00
Removal of culvert pipe (48"<D<84")	L.F.	$50.00	$64.00
Removal of culvert pipe (D>84")	L.F.	$75.00	$96.00
Concrete Box Culvert	L.F./CELL	$100.00	$128.00
Land Acquisition			
Temporary Easements	EA	User Defined	User Defined
Easement/ROW Acquisition	ACRE	User Defined	User Defined
Detention/Water Quality Facilities			
Excavation, Low Range	C.Y.	$11.00	$14.00
Excavation, Mid Range	C.Y.	$24.00	$31.00
Excavation, High Range	C.Y.	$31.00	$40.00
Outlet Works	EA	User Defined	User Defined
Water Quality Appurtenances	EA	User Defined	User Defined
Detention (Complete-in-Place)	AC-FT	$45,600.00	$58,582.00
Headwalls for Circular Pipes			
See Headwall Table			See Headwall Table
Wingwalls for Circular Pipes			
See Wingwall Table			See Wingwall Table
Box Culverts			
See Box Culvert Table			See Box Culvert Table

UD-MP Cost Unit Cost

Box Culvert (CDOT M-601-1)

Span (feet)	Cost $/LF								
	Rise (feet)								
	2	3	4	5	6	7	8	9	10
4	$459.68	$469.52	$529.45	$639.32	$699.12	$758.92	$819.72	$878.76	$938.56
5	$519.49	$579.29	$639.32	$699.12	$758.92	$819.72	$868.86	$957.26	$1,046.05
6	$579.29	$639.32	$699.12	$758.92	$777.47	$796.01	$917.99	$1,035.77	$1,153.55
7	$639.32	$699.12	$758.92	$819.72	$855.31	$890.90	$985.79	$1,099.13	$1,212.47
8	$699.12	$758.92	$819.72	$868.86	$917.99	$985.79	$1,053.60	$1,121.30	$1,188.99
9	ERROR	$819.72	$878.76	$957.26	$1,035.77	$1,099.13	$1,162.49	$1,224.52	$1,286.54
10	ERROR	$878.76	$938.56	$1,046.05	$1,153.55	$1,212.47	$1,271.38	$1,327.74	$1,384.10
11	ERROR	$938.56	$999.36	$1,123.05	$1,246.73	$1,311.15	$1,375.56	$1,437.99	$1,500.41
12	ERROR	ERROR	$1,059.16	$1,199.54	$1,339.91	$1,409.83	$1,479.74	$1,548.24	$1,616.73
13	ERROR	ERROR	ERROR	ERROR	$1,490.55	$1,555.22	$1,619.88	$1,689.91	$1,759.93
14	ERROR	ERROR	ERROR	ERROR	$1,641.19	$1,700.60	$1,760.02	$1,831.58	$1,903.13
15	ERROR	ERROR	ERROR	ERROR	$1,845.07	$1,914.97	$1,984.87	$2,059.76	$2,134.65
16	ERROR	ERROR	ERROR	ERROR	$2,048.95	$2,129.33	$2,209.72	$2,287.95	$2,366.17
17	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	$2,375.40	$2,456.24	$2,537.08
18	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	$2,541.07	$2,624.54	$2,708.00
19	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	$2,857.23	$2,931.79	$3,006.34
20	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	$3,173.38	$3,239.04	$3,304.69

Headwall/Toewall (CDOT M-601-2)

Span (feet)	Steel (lbs/lf)
4	18.9
6	22.1
8	22.5
10	28.2
12	27.6
14	34
16	32.3
18	39
20	38.6

Notes: Concrete quantity estimated as 0.085 CY/LF per standard detail.
Weight of steel for span of 4 feet was linearly extrapolated.

Concrete Cost ($/cy) =	$771.00
Steel Cost ($/lb) =	$1.00

Uses CDOT M-601-1 Single Concrete Box Culvert
Assumes 8 feet of cover
Assumes 10" wall thickness and 200 lb steel per cubic yard for small box culverts

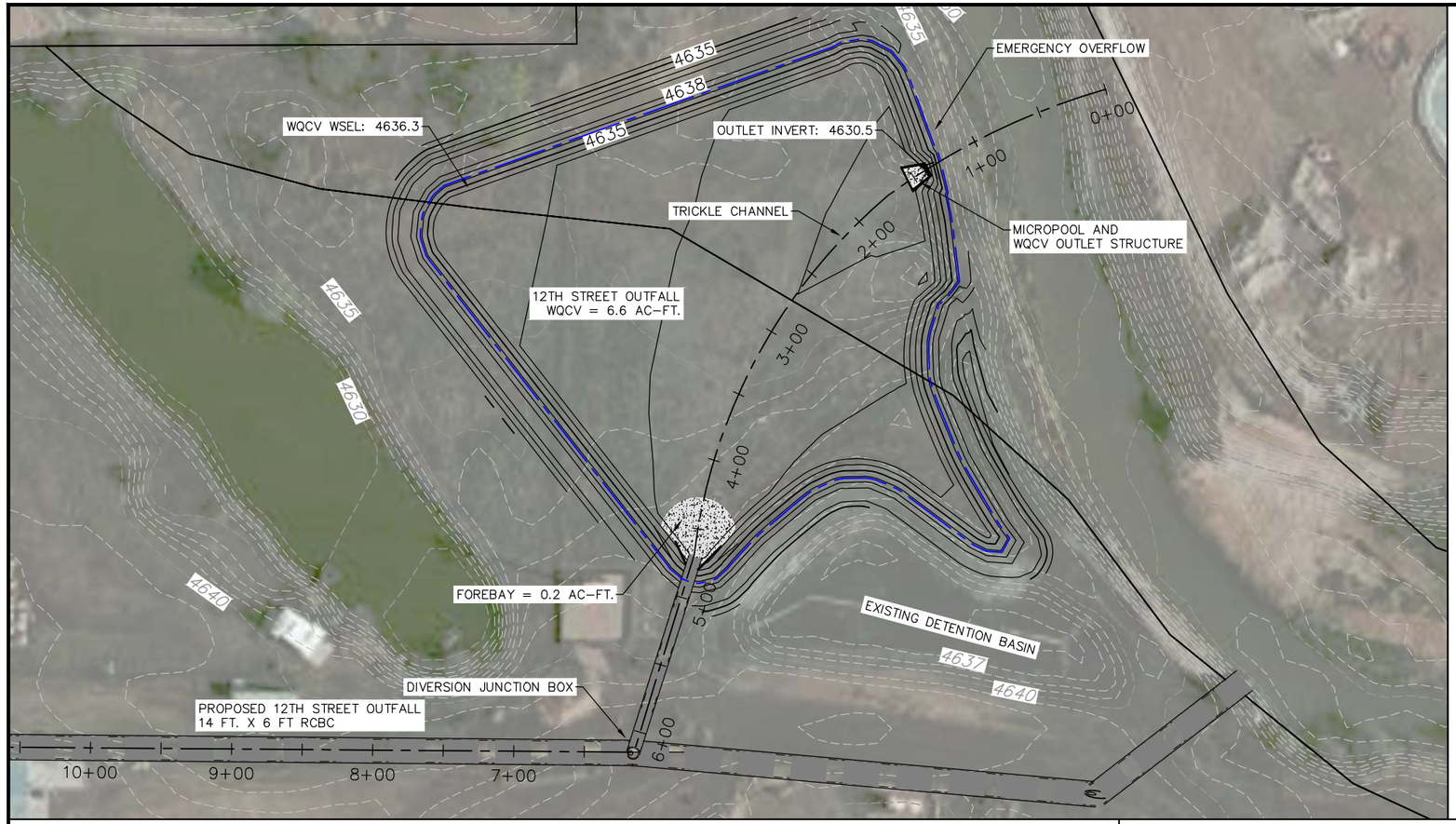
Available Box Sizes - For Data Validation

Span / Rise	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	2	2	2	2	2												
		3	3	3	3	3	3	3									
		4	4	4	4	4	4	4	4								
		5	5	5	5	5	5	5	5								
		6	6	6	6	6	6	6	6	6	6	6	6				
		7	7	7	7	7	7	7	7	7	7	7	7				
		8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
		9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Expanded Table

Span (feet)	RISE																									
	concrete	steel	2'	concrete	steel	3'	concrete	steel	4'	concrete	steel	5'	concrete	steel	6'	concrete	steel	7'	concrete	steel	8'	concrete	steel	9'	concrete	steel	10'
4	0.473	95	$460	0.484	97	$470	0.545	109	$529																	
5	0.535	107	$519	0.597	119	$579	0.658	132	$639	0.720	144	$699														
6	0.597	119	$579	0.658	132	$639	0.720	144	$699	0.782	156	$759	0.808	155	$777	0.834	153	$796								
7	0.658	132	$639	0.720	144	$699	0.782	156	$759	0.844	169	$820	0.884	174	$855	0.924	179	$891								
8	0.720	144	$699	0.782	156	$759	0.844	169	$820	0.898	177	$869	0.952	184	$918	1.014	204	$986	1.076	224	$1,054	1.145	239	$1,121	1.214	253	$1,189
9				0.844	169	$820	0.905	181	$879	0.986	197	$957	1.067	214	$1,036	1.128	229	$1,099	1.190	245	$1,162	1.260	253	$1,225	1.330	262	$1,287
10				0.905	181	$879	0.967	193	$939	1.074	218	$1,046	1.181	243	$1,154	1.243	255	$1,212	1.304	266	$1,271	1.375	268	$1,328	1.445	270	$1,384
11				0.967	193	$939	1.029	206	$999	1.145	240	$1,123	1.261	275	$1,247	1.323	292	$1,311	1.384	309	$1,376	1.461	312	$1,438	1.538	315	$1,500
12							1.091	218	$1,059	1.216	262	$1,200	1.341	306	$1,340	1.403	329	$1,410	1.464	351	$1,480	1.547	356	$1,548	1.630	360	$1,617
13													1.485	346	$1,491	1.546	363	$1,555	1.608	381	$1,620	1.686	390	$1,690	1.765	400	$1,760
14													1.628	386	$1,641	1.690	398	$1,701	1.751	410	$1,760	1.825	425	$1,832	1.899	439	$1,903
15													1.843	425	$1,845	1.906	445	$1,915	1.970	466	$1,985	2.060	472	$2,060	2.150	477	$2,135
16													2.057	463	$2,049	2.123	493	$2,129	2.189	522	$2,210	2.295	519	$2,288	2.401	515	$2,366
17																			2.376	544	$2,375	2.473	550	$2,456	2.570	556	$2,537
18																			2.563	565	$2,541	2.651	581	$2,625	2.738	597	$2,708
19																			2.868	646	$2,857	2.933	670	$2,932	2.999	695	$3,006
20																			3.173	727	$3,173	3.216	760	$3,239	3.259	792	$3,305

APPENDIX D - CONCEPTUAL DESIGN INFORMATION



811 Know what's below. Call before you dig.

NORTH

0 50' 100'

HORIZ. SCALE: 1" = 50'

WQCV PLATE

☐ ELEV: 4634.4

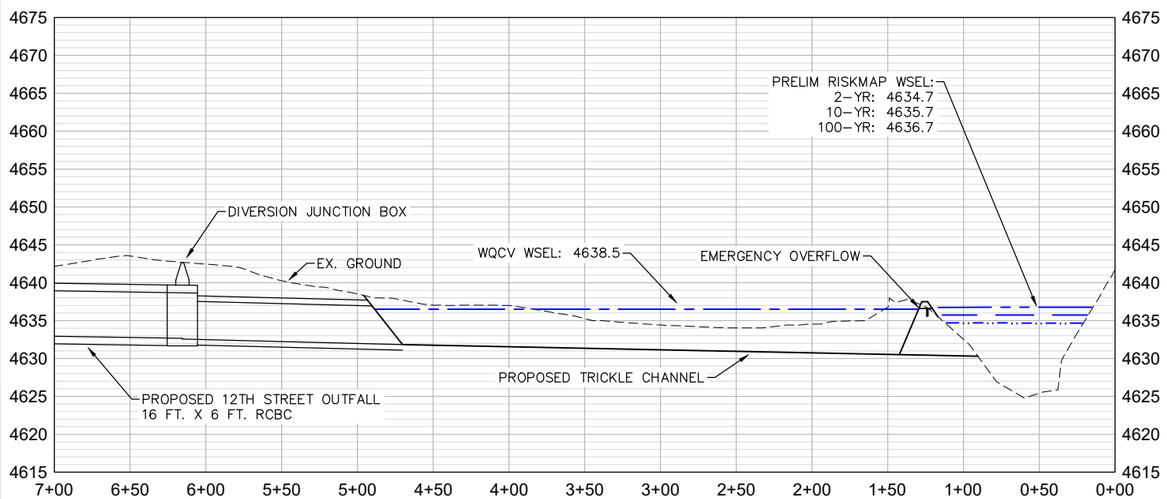
☐ ELEV: 4632.4

☐ ELEV: 4630.5

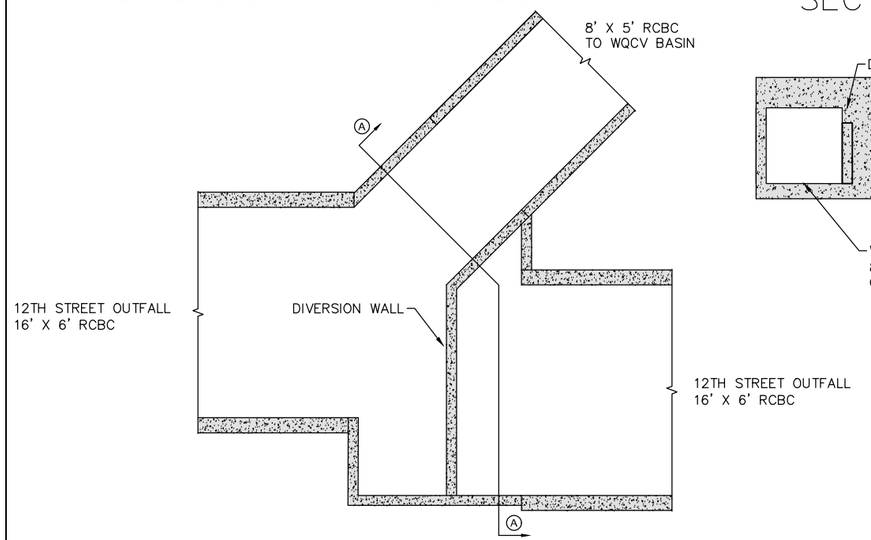
20 SQ. IN. OPENING AREA PER ROW

12TH STREET OUTFALL WQCV BASIN PROFILE

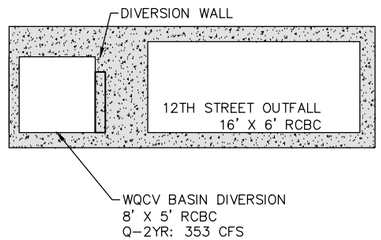
HORIZ. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'



DIVERSION JUNCTION BOX



SECTION A



No.	DATE	REVISIONS	APPR.

PLAN: DRAWN JKD; DESIGNED JKD; CHECKED CDJ
UTILITIES: RESEARCHED; DRAWN; CHECKED

City of Greeley Colorado

ICON ENGINEERING, INC
7000 S Yosemite Street I Suite 201 I Centennial CO 80112
Phone (303) 221-0802 / Fax (303) 221-1019
WWW.ICONENG.COM

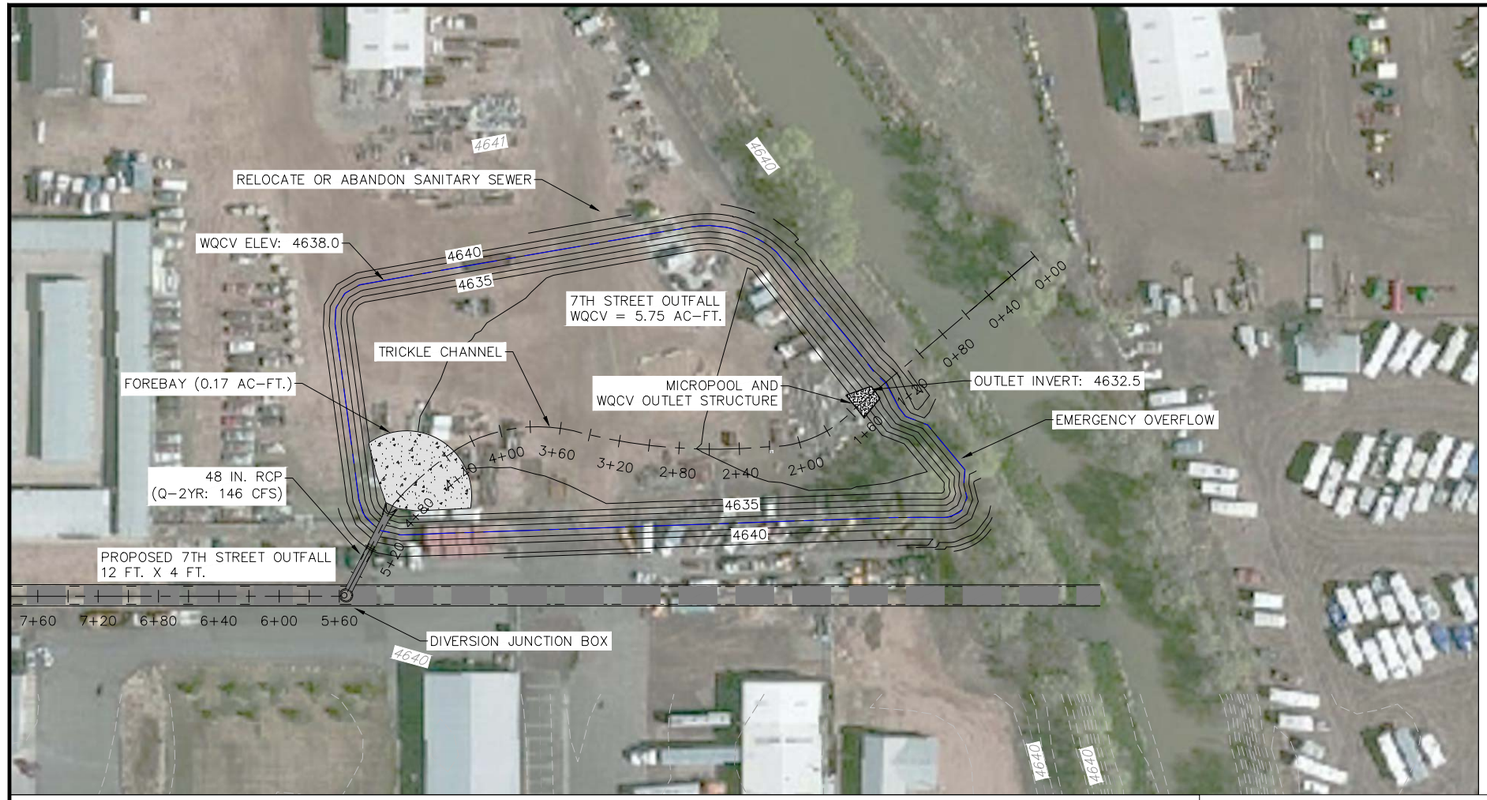
NORTH GREELEY AND DOWNTOWN BASIN
CONCEPTUAL DESIGN
12TH STREET OUTFALL WQCV BASIN

ICON PROJECT No. 15-018-N&D

DATE MAR 2017

SHEET D - 1

P:\2015\01\N&D\DWG\PLA MASTER PROPOSED\Consultant\Design\WQCV\12TH ST.dwg, 3/29/2017 1:24 PM, Jdeboer, Plan Sheet, — COMMITTED, P-SIZE, BW.ctb, 03/24/2017 1:24 PM



WQCV PLATE

ELEV: 4636.3

ELEV: 4634.4

ELEV: 4632.5

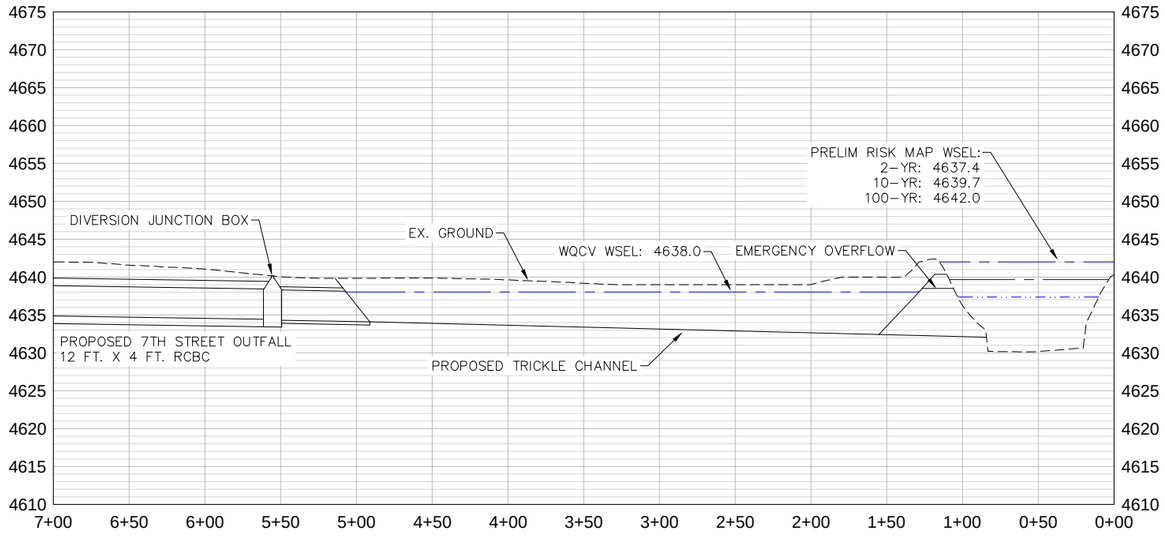
21.5 SQ. IN. OPENING
AREA PER ROW

811 Know what's below. Call before you dig.

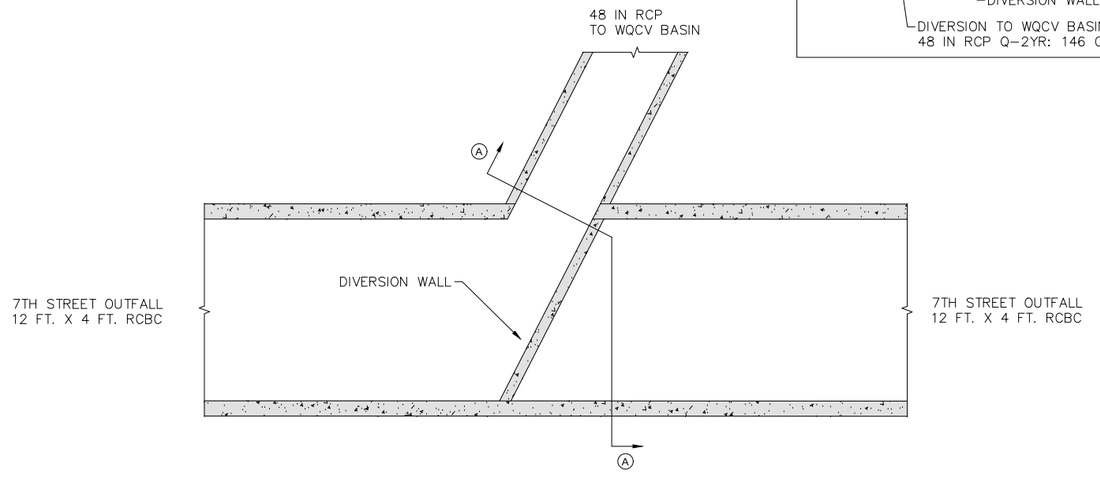
NORTH

0 10' 20'
HORIZ. SCALE: 1" = 10'

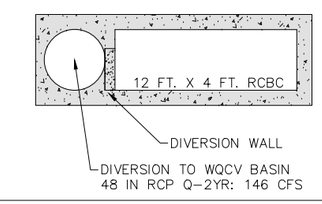
7TH STREET OUTFALL WQCV BASIN PROFILE
HORIZ. SCALE: 1" = 50'
VERT. SCALE: 1" = 10'



DIVERSION JUNCTION BOX



SECTION A



No.	DATE	REVISIONS	APPR.

PLAN	UTILITIES
DRAWN JKD	RESEARCHED
DESIGNED JKD	DRAWN
CHECKED CDJ	CHECKED

City of Greeley Colorado

ICON ENGINEERING, INC.
7000 S. Yosemite Street | Suite 120 | Centennial CO 80112
Phone (303) 221-0802 / Fax (303) 221-4019
WWW.ICONENG.COM

NORTH GREELEY AND DOWNTOWN BASIN
CONCEPTUAL DESIGN
7TH STREET WQCV BASIN

ICON PROJECT No. 15-018-NGD

DATE MAR 2017

SHEET D-2

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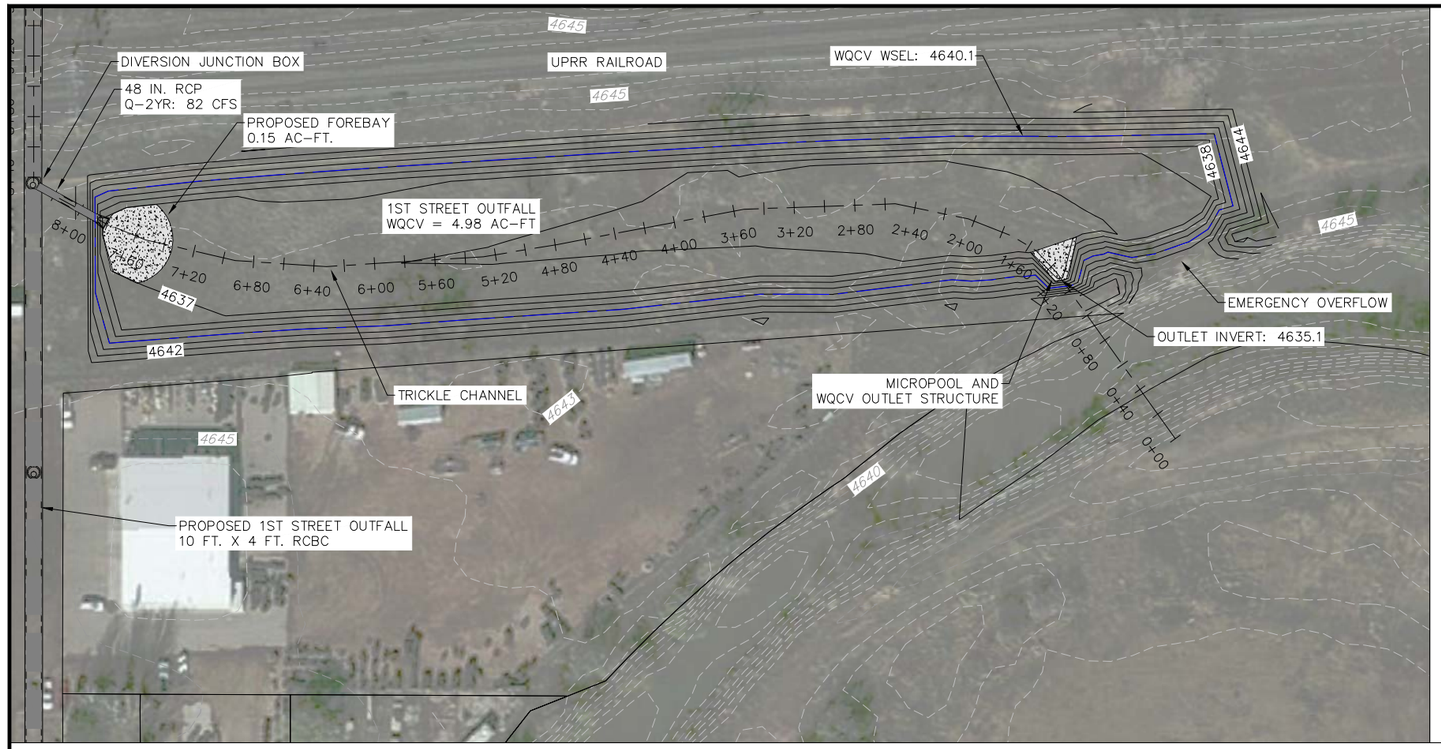


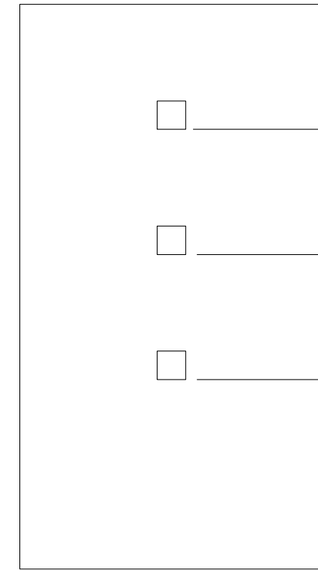
811 Know what's below. Call before you dig.

NORTH

0 50' 100'

HORIZ. SCALE: 1" = 50'

WQCV PLATE



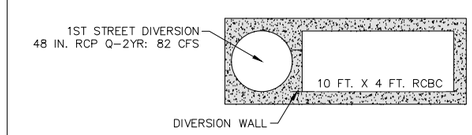
ELEV: 4638.4

ELEV: 4636.8

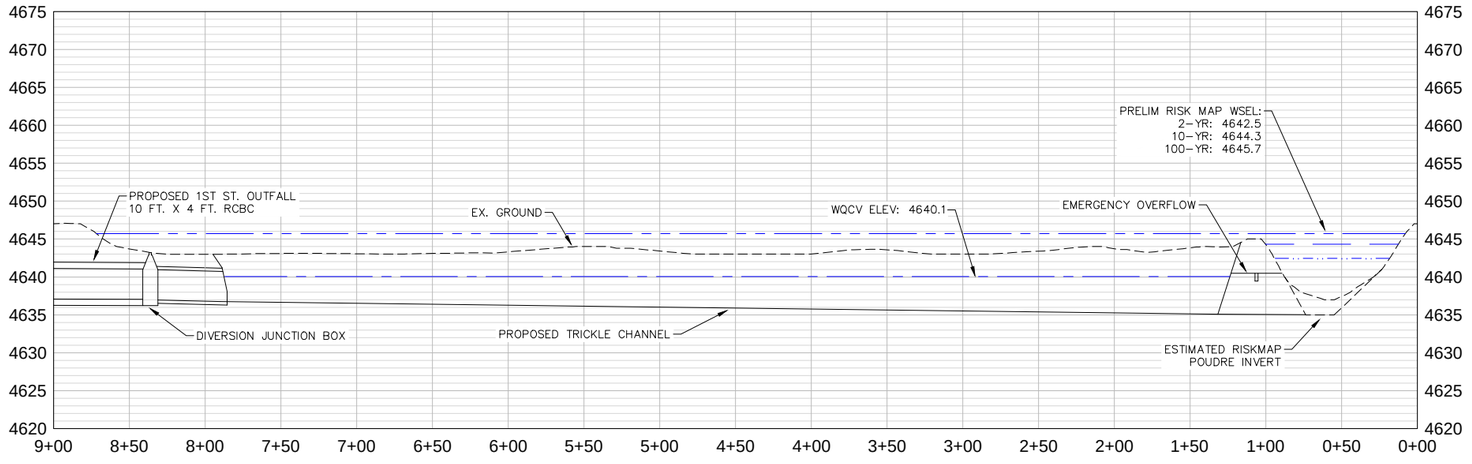
ELEV: 4635.1

17.9 SQ. IN. OPENING AREA PER ROW

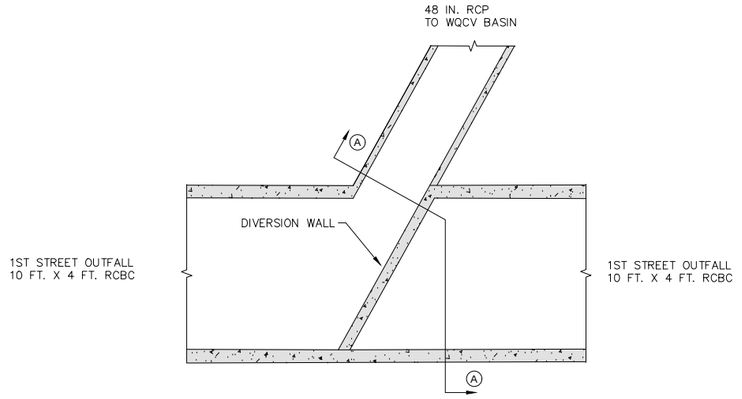
SECTION A



1ST STREET OUTFALL WQCV BASIN PROFILE
HORIZ. SCALE: 1" = 50'
VERT. SCALE: 1" = 10'



DIVERSION JUNCTION BOX



No.	DATE	REVISIONS	APPR.

PLAN	UTILITIES
DRAWN JKD	RESEARCHED
DESIGNED JKD	DRAWN
CHECKED CDJ	CHECKED

City of Greeley Colorado

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NORTH GREELEY AND DOWNTOWN BASIN
CONCEPTUAL DESIGN
1ST STREET WQCV BASIN

ICON PROJECT No. 15-018-NGD

DATE MAR 2017

SHEET D-3

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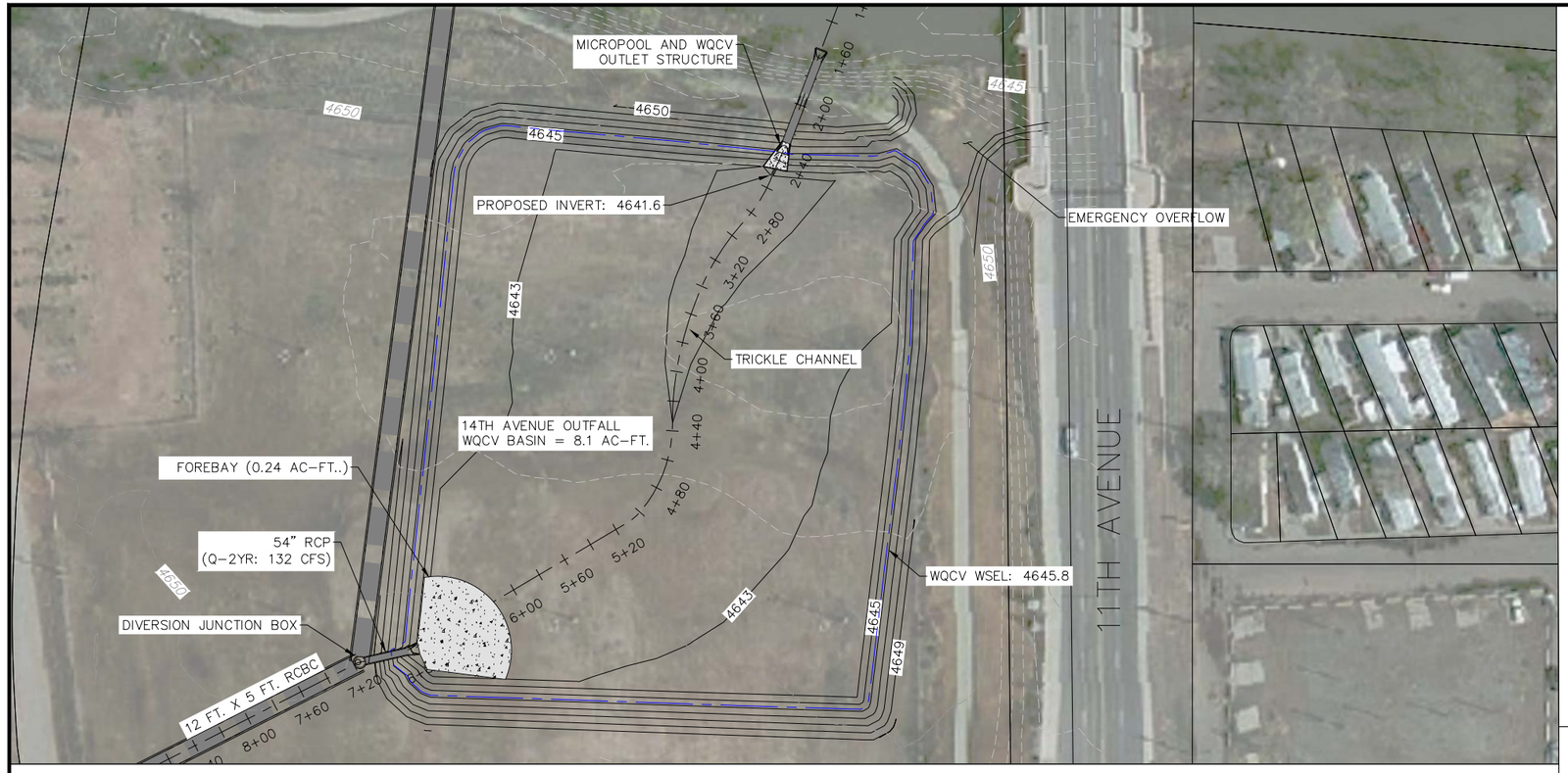
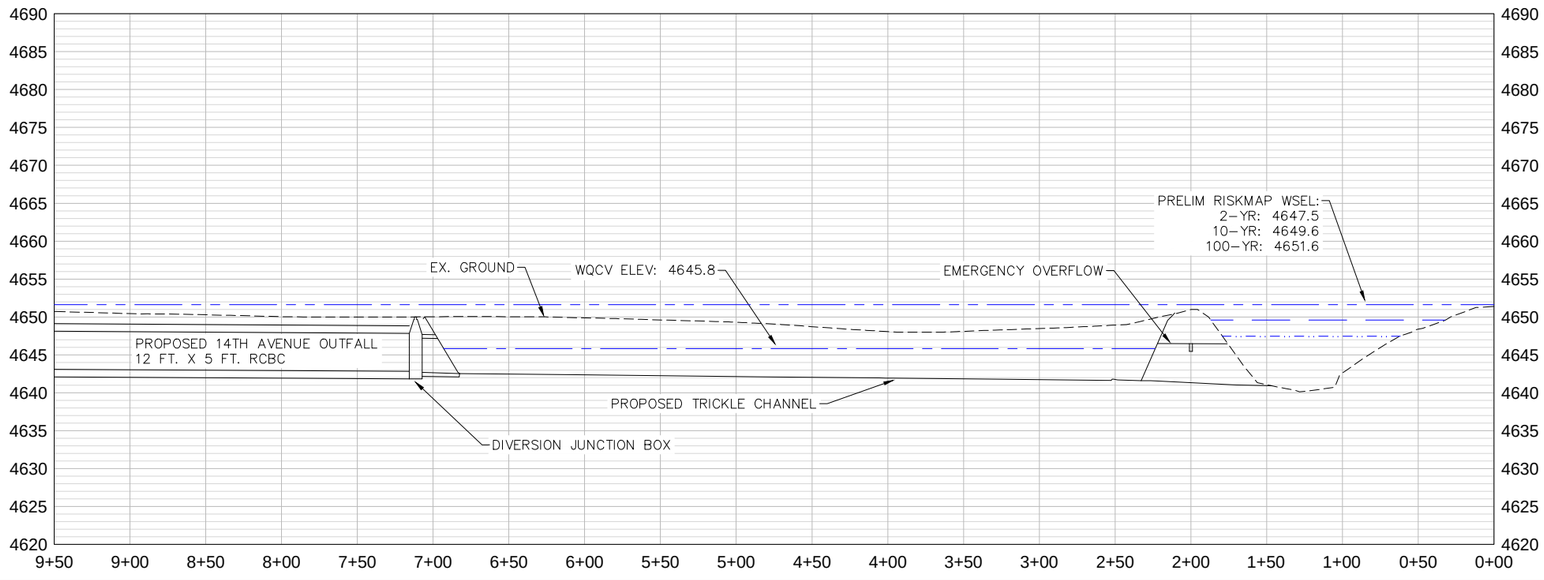


14TH AVENUE OUTFALL WQCV BASIN PROFILE
HORIZ. SCALE: 1" = 1'
VERT. SCALE: 1" = 0'0



WQCV PLATE

811 Know what's below. Call before you dig.

NORTH

HORIZ. SCALE: 1" = 10'

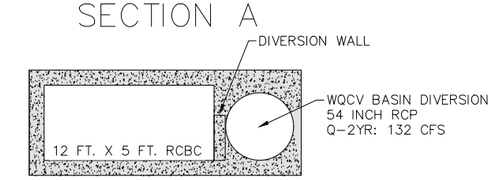
ELEV: 4644.4

ELEV: 4643.0

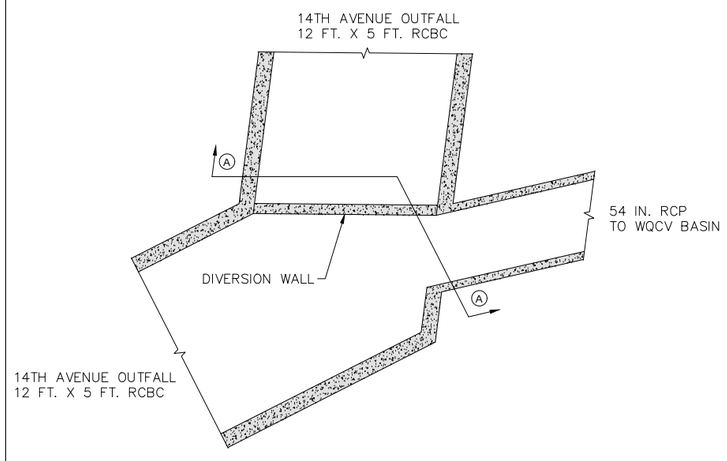
ELEV: 4641.6

31.3 SQ. IN. OPENING AREA PER ROW

SECTION A



DIVERSION JUNCTION BOX



No.	DATE	REVISIONS	APPR.

PLAN: DRAWN JKD; DESIGNED JKD; CHECKED CDJ

UTILITIES: RESEARCHED; DRAWN; CHECKED

City of Greeley Colorado

ICON ENGINEERING, INC.
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NORTH GREELEY AND DOWNTOWN BASIN
CONCEPTUAL DESIGN
14TH AVENUE OUTFALL WQCV BASIN

ICON PROJECT No. 15-018-NGD

DATE MAR 2017

SHEET D-4

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MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	23rd Ave. Outfall
REACH :	23rdAve
JURISDICTION :	City of Greeley
REACH ID:	23rdAve-Reach23rdAve

Jeremy Deischer | DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	300	1	300	L.F.	$69.00	$20,700.00	L003.3_pipe
24-inch	1000	1	1000	L.F.	$92.00	$92,000.00	L003.4_pipe
36-inch	1850	1	1850	L.F.	$139.00	$257,150.00	L003.6_pipe
42-inch	800	1	800	L.F.	$162.00	$129,600.00	L019.1
36-inch	800	1	800	L.F.	$139.00	$111,200.00	L020.6
18-inch	50	30	1500	L.F.	$69.00	$103,500.00	Inlet Laterals
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
36-inch	Yes	1	1	EA	$2,068.00	$2,068.00	Outlet into Luther Park
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			4	EA	$3,726.00	$14,904.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			10	EA	$5,010.00	$50,100.00	
Storm Inlet, Type R/Type 14, 5-foot			30	EA	$5,910.00	$177,300.00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		3139	S.Y.	$50.00	$156,950.00	
Waterline Lowering	<----User Defined Items		10	EA	$5,000.00	$50,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs					
Pipe Culverts and Storm Drains					$958,522.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$0.00
Detention/Water Quality Facilities					$0.00
Removals					$0.00
Landscaping and Maintenance Improvements					$0.00
Special Items (User Defined)					$206,950.00
Subtotal Capital Improvement Costs					**$1,165,472.00**
Additional Capital Improvement Costs					
Dewatering		$11,654.72	L.S.		$11,655.00
Mobilization		5%			$58,274.00
Traffic Control		$58,273.60	L.S.		$58,274.00
Utility Coordination/Relocation		$58,273.60	L.S.		$58,274.00
Stormwater Management/Erosion Control		5%			$58,274.00
Subtotal Additional Capital Improvement Costs					**$244,751.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$211,533.00
Legal/Administrative		5%			$70,511.00
Contract Admin/Construction Management		10%			$141,022.00
Contingency		25%			$352,556.00
Subtotal Other Costs					**$775,622.00**
Total Capital Improvement Costs					**$2,185,845.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs,	4750	L.F.	$1.00	$950.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	44	EA	$64.00	$563.00	
Total Annual Operation and Maintenance Cost				**$1,513.00**	
Effective Interest Rate				1.50%	
Total Operation and Maintenance Costs Over 50 Years				**$52,955.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	22nd Ave. Outfall
REACH :	22ndAve
JURISDICTION :	City of Greeley
REACH ID:	22ndAve-Reach22ndAve

Jeremy Deischer | DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
30-inch	320	1	320	L.F.	$116.00	$37,120.00	L018.1_pipe
30-inch	360	1	360	L.F.	$116.00	$41,760.00	L220.1_pipe
30-inch	50	1	50	L.F.	$116.00	$5,800.00	L320.1_pipe
24-inch	280	1	280	L.F.	$92.00	$25,760.00	L918.1_pipe
24-inch	185	1	185	L.F.	$92.00	$17,020.00	L221.1_pipe
18-inch	50	19	950	L.F.	$69.00	$65,550.00	Inlet Laterals
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
30-inch	Yes	1	1	EA	$2,017.00	$2,017.00	Outlet into Maplewood
24-inch	Yes	1	1	EA	$1,246.00	$1,246.00	Outlet into LPW
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			6	EA	$3,726.00	$22,356.00	
Storm Inlet, Type R/Type 14, 5-foot			19	EA	$5,910.00	$112,290.00	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			2	AC-FT	$58,582.00	$128,880.00	Maplewood Elementary
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		898	S.Y.	$50.00	$44,900.00	
Waterline Lowering	<----User Defined Items		6	EA	$5,000.00	$30,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs					
Pipe Culverts and Storm Drains					$330,919.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$0.00
Detention/Water Quality Facilities					$128,880.00
Removals					$0.00
Landscaping and Maintenance Improvements					$0.00
Special Items (User Defined)					$74,900.00
Subtotal Capital Improvement Costs					**$534,699.00**
Additional Capital Improvement Costs					
Dewatering		$5,346.99	L.S.		$5,347.00
Mobilization		5%			$26,735.00
Traffic Control		$26,734.95	L.S.		$26,735.00
Utility Coordination/Relocation		$26,734.95	L.S.		$26,735.00
Stormwater Management/Erosion Control		5%			$26,735.00
Subtotal Additional Capital Improvement Costs					**$112,287.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$97,048.00
Legal/Administrative		5%			$32,349.00
Contract Admin/Construction Management		10%			$64,699.00
Contingency		25%			$161,747.00
Subtotal Other Costs					**$355,843.00**
Total Capital Improvement Costs					**$1,002,829.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, e	1195	L.F.	$1.00	$239.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	25	EA	$64.00	$320.00	
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, s	2.2	ACRE	$1,927.00	$2,120.00	
Total Annual Operation and Maintenance Cost				**$2,679.00**	
Effective Interest Rate				1.50%	
Total Operation and Maintenance Costs Over 50 Years				**$93,764.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	16th Ave. Outfall
REACH :	16thAve
JURISDICTION :	City of Greeley
REACH ID:	16thCt-Reach16thAve Jeremy Deischer DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	1450	1	1450	L.F.	$69.00	$100,050.00	L004.1_pipe
24-inch	3704	1	3704	L.F.	$92.00	$340,768.00	L004.1_pipe, L004.4_pipe, L018.2_pipe, PIPE-12THST-36,35,34, MOONPONDD
30-inch	900	1	900	L.F.	$116.00	$104,400.00	L017.3_pipe, L017.4_pipe
42-inch	1865	1	1865	L.F.	$162.00	$302,130.00	PIPE-12THST-33, 32, 31, 30, 29, 28, 27
48-inch	475	1	475	L.F.	$185.00	$87,875.00	PIPE-12THST-26
54-inch	565	1	565	L.F.	$277.00	$156,505.00	PIPE-12THST-25, 22, 21
60-inch	805	1	805	L.F.	$308.00	$247,940.00	PIPE-12THST-24, 23
18-inch	50	66	3300	L.F.	$69.00	$227,700.00	Inlet Laterals
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
24-inch	Yes	1	1	EA	$1,246.00	$1,246.00	FES into Moon Pond
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			18	EA	$3,726.00	$67,068.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			8	EA	$5,010.00	$40,080.00	
Manhole, 6' Dia. (Pipe Dia. = 48")			1	EA	$5,524.00	$5,524.00	
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			6	EA	$15,416.00	$92,496.00	
Storm Inlet, Type R/Type 14, 5-foot			66	EA	$5,910.00	$390,060.00	
Special Items (User Defined)							
Asphalt Repave	**<----User Defined Items**		1073	S.Y.	$40.00	$42,920.00	
Asphalt Patch	**<----User Defined Items**		5590	S.Y.	$50.00	$279,500.00	
Waterline Lowering	**<----User Defined Items**		19	EA	$5,000.00	$95,000.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$2,163,842.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$417,420.00
Subtotal Capital Improvement Costs				**$2,581,262.00**
Additional Capital Improvement Costs				
Dewatering	$25,812.62	L.S.		$25,813.00
Mobilization	5%			$129,063.00
Traffic Control	$129,063.10	L.S.		$129,063.00
Utility Coordination/Relocation	$129,063.10	L.S.		$129,063.00
Stormwater Management/Erosion Control	5%			$129,063.00
Subtotal Additional Capital Improvement Costs				**$542,065.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$468,499.00
Legal/Administrative	5%			$156,166.00
Contract Admin/Construction Management	10%			$312,333.00
Contingency	25%			$780,832.00
Subtotal Other Costs				**$1,717,830.00**
Total Capital Improvement Costs				**$4,841,157.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs,	9764	L.F.	$1.00	$1,953.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	99	EA	$64.00	$1,267.00
Total Annual Operation and Maintenance Cost				**$3,220.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$112,699.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14th Ave. US Outfall
REACH :	14thAveUS
JURISDICTION :	City of Greeley
REACH ID:	14thAveUS-Reach14thAveUS Jeremy Deischer DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	350	1	350	L.F.	$69.00	$24,150.00	L004.7
18-inch	520	1	520	L.F.	$69.00	$35,880.00	L605.4
36-inch	230	1	230	L.F.	$139.00	$31,970.00	L905.3
42-inch	700	1	700	L.F.	$162.00	$113,400.00	L005.3_pipe
42-inch	550	1	550	L.F.	$162.00	$89,100.00	L016.1_pipe
42-inch	500	1	500	L.F.	$162.00	$81,000.00	L016.2_pipe
18-inch	50	25	1250	L.F.	$69.00	$86,250.00	Inlet Laterals
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
36-inch	Yes	1	1	EA	$2,068.00	$2,068.00	Glenmere Draw
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			3	EA	$3,726.00	$11,178.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			4	EA	$5,010.00	$20,040.00	
Manhole, 6' Dia. (Pipe Dia. = 48")			2	EA	$5,524.00	$11,048.00	
Storm Inlet, Type R/Type 14, 5-foot			25	EA	$5,910.00	$147,750.00	
Special Items (User Defined)							
Asphalt Repave	**<----User Defined Items**		370	S.Y.	$40.00	$14,800.00	
Asphalt Patch	**<----User Defined Items**		1426	S.Y.	$50.00	$71,300.00	
Waterline Lowering	**<----User Defined Items**		4	EA	$5,000.00	$20,000.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$653,834.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$106,100.00
Subtotal Capital Improvement Costs				**$759,934.00**
Additional Capital Improvement Costs				
Dewatering	$7,599.34	L.S.		$7,599.00
Mobilization	5%			$37,997.00
Traffic Control	$37,996.70	L.S.		$37,997.00
Utility Coordination/Relocation	$37,996.70	L.S.		$37,997.00
Stormwater Management/Erosion Control	5%			$37,997.00
Subtotal Additional Capital Improvement Costs				**$159,587.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$137,928.00
Legal/Administrative	5%			$45,976.00
Contract Admin/Construction Management	10%			$91,952.00
Contingency	25%			$229,880.00
Subtotal Other Costs				**$505,736.00**
Total Capital Improvement Costs				**$1,425,257.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs,	2850	L.F.	$1.00	$570.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	34	EA	$64.00	$435.00
Total Annual Operation and Maintenance Cost				**$1,005.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$35,175.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 12th Ave. Outfall
REACH : 12thAve
JURISDICTION : City of Greeley
REACH ID: 12thAve-Reach12thAve Jeremy Deischer DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	360	1	360	L.F.	$69.00	$24,840.00	L007.2_pipe
24-inch	1330	1	1330	L.F.	$92.00	$122,360.00	L006.1_pipe, L906.2_pipe
30-inch	1600	1	1600	L.F.	$116.00	$185,600.00	L906.3_pipe, L907.3_pipe, L907.4_pipe
36-inch	1200	1	1200	L.F.	$139.00	$166,800.00	L907.5_pipe
18-inch	50	28	1400	L.F.	$69.00	$96,600.00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			11	EA	$3,726.00	$40,986.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			4	EA	$5,010.00	$20,040.00	
Storm Inlet, Type R/Type 14, 5-foot			28	EA	$5,910.00	$165,480.00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		2373	S.Y.	$50.00	$118,650.00	
Waterline Lowering	<----User Defined Items		8	EA	$5,000.00	$40,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$822,706.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$158,650.00
Subtotal Capital Improvement Costs				**$981,356.00**
Additional Capital Improvement Costs				
Dewatering	$9,813.56	L.S.		$9,814.00
Mobilization	5%			$49,068.00
Traffic Control	$49,067.80	L.S.		$49,068.00
Utility Coordination/Relocation	$49,067.80	L.S.		$49,068.00
Stormwater Management/Erosion Control	5%			$49,068.00
Subtotal Additional Capital Improvement Costs				**$206,086.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$178,116.00
Legal/Administrative	5%			$59,372.00
Contract Admin/Construction Management	10%			$118,744.00
Contingency	25%			$296,861.00
Subtotal Other Costs				**$653,093.00**
Total Capital Improvement Costs				**$1,840,535.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, c	4490	L.F.	$1.00	$898.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	43	EA	$64.00	$550.00
Total Annual Operation and Maintenance Cost				**$1,448.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$50,680.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 16th St. Outfall
REACH : 16thSt
JURISDICTION : City of Greeley
REACH ID: 16thSt-Reach16thSt Jeremy Deischer DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	1120	1	1120	L.F.	$69.00	$77,280.00	L009.1_pipe
24-inch	600	1	600	L.F.	$92.00	$55,200.00	L013.1_pipe
30-inch	1100	1	1100	L.F.	$116.00	$127,600.00	L013.3_pipe, L013.4_pipe
18-inch	50	18	900	L.F.	$69.00	$62,100.00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			9	EA	$3,726.00	$33,534.00	
Storm Inlet, Type R/Type 14, 5-foot			18	EA	$5,910.00	$106,380.00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		1566	S.Y.	$50.00	$78,300.00	
Waterline Lowering	<----User Defined Items		6	EA	$5,000.00	$30,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$462,094.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$108,300.00
Subtotal Capital Improvement Costs				**$570,394.00**
Additional Capital Improvement Costs				
Dewatering	$5,703.94	L.S.		$5,704.00
Mobilization	5%			$28,520.00
Traffic Control	$28,519.70	L.S.		$28,520.00
Utility Coordination/Relocation	$28,519.70	L.S.		$28,520.00
Stormwater Management/Erosion Control	5%			$28,520.00
Subtotal Additional Capital Improvement Costs				**$119,784.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$103,527.00
Legal/Administrative	5%			$34,509.00
Contract Admin/Construction Management	10%			$69,018.00
Contingency	25%			$172,545.00
Subtotal Other Costs				**$379,599.00**
Total Capital Improvement Costs				**$1,069,777.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, c	2820	L.F.	$1.00	$564.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	27	EA	$64.00	$346.00
Total Annual Operation and Maintenance Cost				**$910.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$31,850.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 17th St. Outfall
REACH : 17thSt
JURISDICTION : City of Greeley
REACH ID: 17thSt-Reach17thSt Jeremy Deischer DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	700	1	700	L.F.	$92.00	$64,400.00	L912.1 pipe
36-inch	600	1	600	L.F.	$139.00	$83,400.00	L012.1
42-inch	130	1	130	L.F.	$162.00	$21,060.00	L911.2
18-inch	50	15	750	L.F.	$69.00	$51,750.00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			6	EA	$3,726.00	$22,356.00	
Storm Inlet, Type R/Type 14, 5-foot			15	EA	$5,910.00	$88,650.00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		767	S.Y.	$50.00	$38,350.00	
Waterline Lowering	<----User Defined Items		4	EA	$5,000.00	$20,000.00	
Sanitary Sewer Relocation (Pipe)	<----User Defined Items		275	LF	$75.00	$20,625.00	
Sanitary Sewer Relocation (Manhole)	<----User Defined Items		1	EA	$5,000.00	$5,000.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$331,616.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$83,975.00
Subtotal Capital Improvement Costs				**$415,591.00**
Additional Capital Improvement Costs				
Dewatering	$4,155.91	L.S.		$4,156.00
Mobilization	5%			$20,780.00
Traffic Control	$20,779.55	L.S.		$20,780.00
Utility Coordination/Relocation	$20,779.55	L.S.		$20,780.00
Stormwater Management/Erosion Control	5%			$20,780.00
Subtotal Additional Capital Improvement Costs				**$87,276.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$75,430.00
Legal/Administrative	5%			$25,143.00
Contract Admin/Construction Management	10%			$50,287.00
Contingency	25%			$125,717.00
Subtotal Other Costs				**$276,577.00**
Total Capital Improvement Costs				**$779,444.00**

Master Plan Operation and Maintenance Cost Summary					
Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs,	1430	L.F.	$1.00	$286.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	21	EA	$64.00	$269.00	
Total Annual Operation and Maintenance Cost				**$555.00**	
Effective Interest Rate				1.50%	
Total Operation and Maintenance Costs Over 50 Years				**$19,425.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 16th Ave. Ct. Outfall
REACH : 16thAveCt
JURISDICTION : City of Greeley
REACH ID: 16thAveCt-Reach16thAveCt Jeremy Deischer DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	760	1	760	L.F.	$69.00	$52,440.00	L024.03
30-inch	2585	1	2585	L.F.	$116.00	$299,860.00	L024.04, L024.02, L824.01
42-inch	1255	1	1255	L.F.	$162.00	$203,310.00	L724.01,L943.02,L843.02,L743.01
18-inch	50	9	450	L.F.	$69.00	$31,050.00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			10	EA	$3,726.00	$37,260.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			6	EA	$5,010.00	$30,060.00	
Storm Inlet, Type R/Type 14, 5-foot			9	EA	$5,910.00	$53,190.00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		1938	S.Y.	$50.00	$96,900.00	
Railroad Boring	<----User Defined Items		120	L.F.	$4,500.00	$540,000.00	
Waterline Lowering	<----User Defined Items		9	EA	$5,000.00	$45,000.00	
Sanitary Sewer Relocation (Pipe)	<----User Defined Items		170	LF	$75.00	$12,750.00	
Sanitary Sewer Relocation (MH)	<----User Defined Items		1	EA	$5,000.00	$5,000.00	
Land Acquisition							
Easement/ROW Acquisition			0.56	ACRE	$98,706.22	$55,275.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$707,170.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$699,650.00
Subtotal Capital Improvement Costs				**$1,406,820.00**
Additional Capital Improvement Costs				
Dewatering	$16,002.94	L.S.		$16,003.00
Mobilization	5%			$70,341.00
Traffic Control	$70,341.00	L.S.		$70,341.00
Utility Coordination/Relocation	$70,341.00	L.S.		$70,341.00
Stormwater Management/Erosion Control	5%			$70,341.00
Subtotal Additional Capital Improvement Costs				**$297,367.00**
Land Acquisition Costs				
ROW/Easements				$55,275.00
Subtotal Land Acquisition Costs				**$55,275.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$255,628.00
Legal/Administrative	5%			$85,209.00
Contract Admin/Construction Management	10%			$170,419.00
Contingency	25%			$426,047.00
Subtotal Other Costs				**$937,303.00**
Total Capital Improvement Costs				**$2,696,765.00**

Master Plan Operation and Maintenance Cost Summary					
Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs,	4600	L.F.	$1.00	$920.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	25	EA	$64.00	$320.00	
Total Annual Operation and Maintenance Cost				**$1,240.00**	
Effective Interest Rate				1.50%	
Total Operation and Maintenance Costs Over 50 Years				**$43,400.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 14th Ave. Outfall Trunk
REACH : 14thAveTrunk
JURISDICTION : City of Greeley
REACH ID: 14thAveTrunk-Reach14thAveTrunk | Jeremy Deischer | DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	140	1	140	L.F.	$69.00	$9,660.00	PIPE-14THAVE-101
30-inch	550	1	550	L.F.	$116.00	$63,800.00	PIPE-14THAVE-28, 27, 26, 31
30-inch	210	1	210	L.F.	$116.00	$24,360.00	PIPE-14thAVE-31
36-inch	500	1	500	L.F.	$139.00	$69,500.00	PIPE-14THAVE-25
48-inch	500	1	500	L.F.	$185.00	$92,500.00	PIPE-14THAVE-24
54-inch	33	1	33	L.F.	$277.00	$9,141.00	WQCV Diversion
18-inch	50	75	3750	L.F.	$69.00	$258,750.00	Inlet Laterals
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
18-inch	Yes	1	2	EA	$1,182.00	$2,364.00	Luther Park East Outlet & Luther Park North Inlet
30-inch	Yes	1	2	EA	$2,017.00	$4,034.00	Luther Park West Outlet & Luther Park North Inlet
30-inch	Yes	1	1	EA	$2,017.00	$2,017.00	Luther Park North Outlet
Headwalls							
Diameter (in)	**Applicable**	**No. of Barrels**					
54-inch	Yes	1	1	EA	$1,843.52	$1,844.00	WQCV Diversion
Wingwalls (includes concrete apron)							
Diameter (in)		**No. of Barrels**					
54-inch		1	1	EA	$11,271.99	$11,272.00	
Manholes and Inlets							
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			19	EA	$15,416.00	$292,904.00	
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			2	EA	$19,271.00	$38,542.00	
Storm Inlet, Type R/Type 14, 5-foot			75	EA	$5,910.00	$443,250.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
6	4	1	3191	L.F.	$699.12	$2,230,682.00	PIPE-14THAVE-23,22,21,20,19,18,17
9	4	1	500	L.F.	$878.76	$439,378.00	PIPE-14THAVE-16
10	4	1	1144	L.F.	$938.56	$1,073,756.00	PIPE-14THAVE-15,14,13
11	4	1	540	L.F.	$999.36	$539,654.00	PIPE-14THAVE-12,10
12	4	1	2115	L.F.	$1,059.16	$2,240,126.00	PIPE-14THAVE-9,8,7,6,5,4
12	5	1	935	L.F.	$1,199.54	$1,121,566.00	PIPE-14THAVE-3,2,1
Headwall and Cutwalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
12	1	14.00	1	EA	$1,303.89	$1,304.00	Outfall into Poudre
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
12	5	1	1	EA	$12,088.88	$12,088.90	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			8	AC-FT	$58,582.00	$472,464.00	WQCV
Detention Facility 2 (Complete-in-Place)			4	AC-FT	$58,582.00	$234,328.00	Luther Park North
Landscaping and Maintenance Improvements							
Trail/Path, Concrete (10' Width)			150	L.F.	$57.00	$8,550.00	Trail at Poudre River
Special Items (User Defined)							
Asphalt Repave	**<----User Defined Items**		6826	S.Y.	$50.00	$341,300.00	
Waterline Lowering	**<----User Defined Items**		12	EA	$5,000.00	$60,000.00	
Great Western RR Crossing	**<----User Defined Items**		130	L.F.	$20,222.33	$2,628,903.00	
Sanitary Sewer Relocation (Pipe)	**<----User Defined Items**		2731	LF	$75.00	$204,825.00	
Sanitary Sewer Relocation (MH)	**<----User Defined Items**		13	EA	$5,000.00	$65,000.00	
Sanitary Sewer Conflict Vault	**<----User Defined Items**		3	EA	$30,000.00	$90,000.00	
Diversion Junction Box	**<----User Defined Items**		1	EA	$37,000.00	$37,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$1,323,938.00
Concrete Box Culverts				$7,658,555.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$706,792.00
Removals				$0.00
Landscaping and Maintenance Improvements				$8,550.00
Special Items (User Defined)				$3,427,028.00
Subtotal Capital Improvement Costs				**$13,124,863.00**
Additional Capital Improvement Costs				
Dewatering	$131,248.63	L.S.		$131,249.00
Mobilization	5%			$656,243.00
Traffic Control	$656,243.15	L.S.		$656,243.00
Utility Coordination/Relocation	$656,243.15	L.S.		$656,243.00
Stormwater Management/Erosion Control	5%			$656,243.00
Subtotal Additional Capital Improvement Costs				**$2,756,221.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$2,382,163.00
Legal/Administrative	5%			$794,054.00
Contract Admin/Construction Management	10%			$1,588,108.00
Contingency	25%			$3,970,271.00
Subtotal Other Costs				**$8,734,596.00**
Total Capital Improvement Costs				**$24,615,680.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	10358	L.F.	$1.00	$2,072.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	96	EA	$64.00	$1,229.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, struct	8.065	ACRE	$1,927.00	$7,771.00
Total Annual Operation and Maintenance Cost				**$11,072.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$387,517.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 14th Ave. Outfall
REACH : 4,5,8thLaterals
JURISDICTION : City of Greeley
REACH ID: 14thAve-Reach4,5,8thLaterals | Jeremy Deischer | DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	1580	1	1580	L.F.	$69.00	$109,020.00	L027.15_pipe, L025.02
24-inch	2160	1	2160	L.F.	$92.00	$198,720.00	L027.06_pipe,L026.04_pipe,L027.14_pipe
30-inch	1464	1	1464	L.F.	$116.00	$169,824.00	L027.13_pipe, L027.08
36-inch	690	1	690	L.F.	$139.00	$95,910.00	L926.03, L826.03
18-inch	50	53	2650	L.F.	$69.00	$182,850.00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			26	EA	$3,726.00	$96,876.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			3	EA	$5,010.00	$15,030.00	
Storm Inlet, Type R/Type 14, 5-foot			53	EA	$5,910.00	$313,230.00	
Special Items (User Defined)							
Asphalt Patch	**<----User Defined Items**		3151	S.Y.	$50.00	$157,550.00	
Waterline Lowering	**<----User Defined Items**		11	EA	$5,000.00	$55,000.00	
Asphalt Repave	**<----User Defined Items**		473	S.Y.	$40.00	$18,920.00	
Land Acquisition							
Easement/ROW Acquisition			0.38	ACRE	$25,337.99	$9,628.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$1,181,460.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$231,470.00
Subtotal Capital Improvement Costs				**$1,412,930.00**
Additional Capital Improvement Costs				
Dewatering	$14,129.30	L.S.		$14,129.00
Mobilization	5%			$70,647.00
Traffic Control	$70,646.50	L.S.		$70,647.00
Utility Coordination/Relocation	$70,646.50	L.S.		$70,647.00
Stormwater Management/Erosion Control	5%			$70,647.00
Subtotal Additional Capital Improvement Costs				**$296,717.00**
Land Acquisition Costs				
ROW/Easements				$9,628.00
Subtotal Land Acquisition Costs				**$9,628.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$256,447.00
Legal/Administrative	5%			$85,482.00
Contract Admin/Construction Management	10%			$170,965.00
Contingency	25%			$427,412.00
Subtotal Other Costs				**$940,306.00**
Total Capital Improvement Costs				**$2,659,581.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, e	5894	L.F.	$1.00	$1,179.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	82	EA	$64.00	$1,050.00
Total Annual Operation and Maintenance Cost				**$2,229.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$78,014.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	1st St. Outfall
REACH :	1stSt
JURISDICTION :	City of Greeley
REACH ID:	1stSt-Reach1stSt — Jeremy Deischer — DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	1590	1	1590	L.F.	$92.00	$146,280.00	L039.03, L039.07, OUT_Nof2ndSt
30-inch	975	1	975	L.F.	$116.00	$113,100.00	L939.05, L839.05
36-inch	1410	1	1410	L.F.	$139.00	$195,990.00	L042.06_pipe
42-inch	880	1	880	L.F.	$162.00	$142,560.00	L041.01, L041.02
48-inch	50	1	50	L.F.	$185.00	$9,250.00	Diversion into WQCV Basin
18-inch	50	63	3150	L.F.	$69.00	$217,350.00	Inlet Laterals
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
24-inch	Yes	1	1	EA	$1,246.00	$1,246.00	NW Detention Outlet
48-inch	Yes	1	1	EA	$2,646.00	$2,646.00	WQCV Outlet
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			4	EA	$3,726.00	$14,904.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			6	EA	$5,010.00	$30,060.00	
Manhole, 6' Dia. (Pipe Dia. = 48")			3	EA	$5,524.00	$16,572.00	
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			15	EA	$15,416.00	$231,240.00	
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			1	EA	$19,271.00	$19,271.00	
Storm Inlet, Type R Type 14, 5-foot			78	EA	$5,910.00	$460,980.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
9	4	1	400	L.F.	$878.76	$351,502.00	L941.06
10	4	1	350	L.F.	$938.56	$328,495.00	L9003
10	4	1	820	L.F.	$938.56	$769,617.00	L9001
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
10	1	12.00	1	EA	$1,124.82	$1,125.00	Outfall into Poudre
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
10	4	1	1	EA	$8,908.47	$8,908.50	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			12	AC-FT	$58,582.00	$702,984.00	NW Detention
Detention Facility 2 (Complete-in-Place)			5	AC-FT	$58,582.00	$291,445.00	WQCV Basin
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		2711	S.Y.	$40.00	$108,440.00	
Asphalt Patch	<----User Defined Items		1198	S.Y.	$50.00	$59,900.00	
Waterline Lowering	<----User Defined Items		8	EA	$5,000.00	$40,000.00	
RR Boring	<----User Defined Items		160	LF	$4,500.00	$720,000.00	2 - 48" Boring (80 LF per cell)
RR Boring (Hwy 85)	<----User Defined Items		640	L.F.	$4,500.00	$2,880,000.00	4 - 48" 160 L.F. per cell
RR Boring (UPRR)	<----User Defined Items		320	LF	$4,500.00	$1,440,000.00	4 - 48" 80 L.F. per cell
Diversion Junction Box	<----User Defined Items		1	EA	$37,000.00	$37,000.00	
Sanitary Sewer Conflict Vault	<----User Defined Items		3	EA	$30,000.00	$90,000.00	
Land Acquisition							
Easement/ROW Acquisition			3.34	ACRE	$144,474.00	$482,543.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$1,601,449.00
Concrete Box Culverts				$1,459,648.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$994,429.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$5,375,340.00
Subtotal Capital Improvement Costs				**$9,430,866.00**
Additional Capital Improvement Costs				
Dewatering	$94,308.66	L.S.		$94,309.00
Mobilization	5%			$471,543.00
Traffic Control	$471,543.30	L.S.		$471,543.00
Utility Coordination/Relocation	$471,543.30	L.S.		$471,543.00
Stormwater Management/Erosion Control	5%			$471,543.00
Subtotal Additional Capital Improvement Costs				**$1,980,481.00**
Land Acquisition Costs				
ROW/Easements				$482,543.00
Subtotal Land Acquisition Costs				**$482,543.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$1,711,702.00
Legal/Administrative	5%			$570,567.00
Contract Admin/Construction Management	10%			$1,141,135.00
Contingency	25%			$2,852,837.00
Subtotal Other Costs				**$6,276,241.00**
Total Capital Improvement Costs				**$18,170,131.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, c	6475	L.F.	$1.00	$1,295.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	107	EA	$64.00	$1,370.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, s	15.975	ACRE	$1,927.00	$15,392.00
Total Annual Operation and Maintenance Cost				**$18,057.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$631,989.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	5th St. Outfall
REACH :	5thSt
JURISDICTION :	City of Greeley
REACH ID:	5thSt-Reach5thSt — Jeremy Deischer — DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	800	1	800	L.F.	$92.00	$73,600.00	L940.09_pipe
30-inch	400	1	400	L.F.	$116.00	$46,400.00	L040.09_pipe
18-inch	50	11	550	L.F.	$69.00	$37,950.00	Inlet Laterals
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
30-inch	Yes	1	1	EA	$2,017.00	$2,017.00	Outfall into Poudre
Manholes and Inlets							
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			3	EA	$5,010.00	$15,030.00	
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			1	EA	$15,416.00	$15,416.00	
Storm Inlet, Type R Type 14, 5-foot			11	EA	$5,910.00	$65,010.00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		644	S.Y.	$50.00	$32,200.00	
Waterline Lowering	<----User Defined Items		2	EA	$5,000.00	$10,000.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$255,423.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$42,200.00
Subtotal Capital Improvement Costs				**$297,623.00**
Additional Capital Improvement Costs				
Dewatering	$2,976.23	L.S.		$2,976.00
Mobilization	5%			$14,881.00
Traffic Control	$14,881.15	L.S.		$14,881.00
Utility Coordination/Relocation	$14,881.15	L.S.		$14,881.00
Stormwater Management/Erosion Control	5%			$14,881.00
Subtotal Additional Capital Improvement Costs				**$62,500.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$54,018.00
Legal/Administrative	5%			$18,006.00
Contract Admin/Construction Management	10%			$36,012.00
Contingency	25%			$90,031.00
Subtotal Other Costs				**$198,067.00**
Total Capital Improvement Costs				**$558,190.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, c	1200	L.F.	$1.00	$240.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	15	EA	$64.00	$192.00
Total Annual Operation and Maintenance Cost				**$432.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$15,120.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 7th St. Outfall
REACH : 7thSt
JURISDICTION : City of Greeley
REACH ID: 7th St-Reach7thSt | Jeremy Deischer | DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	1940	1	1940	L.F.	$69.00	$133,860.00	L037.07, L937.05, L038.03
24-inch	2620	1	2620	L.F.	$92.00	$241,040.00	L037.05, L038.09, L038.21, L938.05, L038.04
30-inch	860	1	860	L.F.	$116.00	$99,760.00	L938.08, L030.05_pipe
42-inch	1515	1	1515	L.F.	$162.00	$245,430.00	PIPE-7thSt-18, L030.03_pipe
54-inch	500	1	500	L.F.	$277.00	$138,500.00	PIPE-7thSt-17
60-inch	60	1	60	L.F.	$308.00	$18,480.00	WQCV Diversion
18-inch	50	162	8100	L.F.	$69.00	$558,900.00	Inlet Laterals
Headwalls							
Diameter (in)	Applicable	No. of Barrels					
60-inch	Yes	1	1	EA	$2,047.85	$2,048.00	WQCV Diversion
Wingwalls (includes concrete apron)							
Diameter (in)		No. of Barrels					
60-inch		1	1	EA	$11,460.50	$11,461.00	
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			20	EA	$3,726.00	$74,520.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			11	EA	$5,010.00	$55,110.00	
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			32	EA	$15,416.00	$493,312.00	
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			1	EA	$19,271.00	$19,271.00	
Storm Inlet, Type R/Type 14, 5-foot			162	EA	$5,910.00	$957,420.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
6	4	1	3204	L.F.	$699.12	$2,239,771.00	PIPE-7thSt-16,15,14,13,12,11,10,9
7	4	1	500	L.F.	$758.92	$379,461.00	PIPE-7thSt-8
8	4	1	765	L.F.	$819.72	$627,089.00	PIPE-7thSt-6,5
10	4	1	540	L.F.	$938.56	$506,821.00	PIPE-7thSt-4,3
12	4	1	785	L.F.	$1,059.16	$831,441.00	PIPE-7thSt-2,1
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			6	AC-FT	$58,582.00	$336,847.00	WQCV
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		8310	S.Y.	$40.00	$332,400.00	
Asphalt Patch	<----User Defined Items		3396	S.Y.	$50.00	$169,800.00	
Waterline Lowering	<----User Defined Items		32	EA	$5,000.00	$160,000.00	
Great Western and UPRR Crossing	<----User Defined Items		180	LF	$17,112.51	$3,080,252.00	
Sanitary Sewer Relocations (Pipe)	<----User Defined Items		1420	LF	$75.00	$106,500.00	
Sanitary Sewer Relocations (MH)	<----User Defined Items		9	EA	$5,000.00	$45,000.00	
Diversion Junction Box	<----User Defined Items		1	EA	$37,000.00	$37,000.00	
Land Acquisition							
Easement/ROW Acquisition			5.87	ACRE	$72,505.11	$425,605.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$3,049,112.00
Concrete Box Culverts				$4,584,583.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$336,847.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$3,930,952.00
Subtotal Capital Improvement Costs				**$11,901,494.00**
Additional Capital Improvement Costs				
Dewatering	$119,014.94	L.S.		$119,015.00
Mobilization	5%			$595,075.00
Traffic Control	$595,074.70	L.S.		$595,075.00
Utility Coordination/Relocation	$595,074.70	L.S.		$595,075.00
Stormwater Management/Erosion Control	5%			$595,075.00
Subtotal Additional Capital Improvement Costs				**$2,499,315.00**
Land Acquisition Costs				
ROW/Easements				$425,605.00
Subtotal Land Acquisition Costs				**$425,605.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$2,160,121.00
Legal/Administrative	5%			$720,040.00
Contract Admin/Construction Management	10%			$1,440,081.00
Contingency	25%			$3,600,202.00
Subtotal Other Costs				**$7,920,444.00**
Total Capital Improvement Costs				**$22,746,858.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, c	13289	L.F.	$1.00	$2,658.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	226	EA	$64.00	$2,893.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, s	5.75	ACRE	$1,927.00	$5,540.00
Total Annual Operation and Maintenance Cost				**$11,091.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$388,182.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 9th St. Outfall
REACH : 9thSt
JURISDICTION : City of Greeley
REACH ID: 9th St-Reach9thSt | Jeremy Deischer | DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	570	1	570	L.F.	$69.00	$39,330.00	L936.05
18-inch	1000	1	1000	L.F.	$69.00	$69,000.00	L737.10
36-inch	360	1	360	L.F.	$139.00	$50,040.00	L037.09
18-inch	50	12	600	L.F.	$69.00	$41,400.00	Inlet Laterals
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
36-inch	Yes	1	1	EA	$2,068.00	$2,068.00	
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			5	EA	$3,726.00	$18,630.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			2	EA	$5,010.00	$10,020.00	
Storm Inlet, Type R/Type 14, 5-foot			12	EA	$5,910.00	$70,920.00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		1012	S.Y.	$50.00	$50,600.00	
Waterline Lowering	<----User Defined Items		3	EA	$5,000.00	$15,000.00	
Land Acquisition							
Easement/ROW Acquisition			0.14	ACRE	$43,987.24	$6,325.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$301,408.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$65,600.00
Subtotal Capital Improvement Costs				**$367,008.00**
Additional Capital Improvement Costs				
Dewatering	$3,670.08	L.S.		$3,670.00
Mobilization	5%			$18,350.00
Traffic Control	$18,350.40	L.S.		$18,350.00
Utility Coordination/Relocation	$18,350.40	L.S.		$18,350.00
Stormwater Management/Erosion Control	5%			$18,350.00
Subtotal Additional Capital Improvement Costs				**$77,070.00**
Land Acquisition Costs				
ROW/Easements				$6,325.00
Subtotal Land Acquisition Costs				**$6,325.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$66,612.00
Legal/Administrative	5%			$22,204.00
Contract Admin/Construction Management	10%			$44,408.00
Contingency	25%			$111,020.00
Subtotal Other Costs				**$244,244.00**
Total Capital Improvement Costs				**$694,647.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, c	1930	L.F.	$1.00	$386.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	19	EA	$64.00	$243.00
Total Annual Operation and Maintenance Cost				**$629.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$22,015.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 11th St. Outfall
REACH : 11thSt
JURISDICTION : City of Greeley
REACH ID: 11th St-Reach11thSt | Jeremy Deischer | DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	850	1	850	L.F.	$69.00	$58,650.00	L036.06
18-inch	600	1	600	L.F.	$69.00	$41,400.00	L036.17_pipe
18-inch	490	1	490	L.F.	$69.00	$33,810.00	L036.10
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			6	EA	$3,726.00	$22,356.00	
Storm Inlet, Type R/Type 14, 5-foot			4	EA	$5,910.00	$23,640.00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		903	S.Y.	$50.00	$45,150.00	
Waterline Lowering	<----User Defined Items		3	EA	$5,000.00	$15,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$179,856.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$60,150.00
Subtotal Capital Improvement Costs				**$240,006.00**
Additional Capital Improvement Costs				
Dewatering	$2,400.06	L.S.		$2,400.00
Mobilization	5%			$12,000.00
Traffic Control	$12,000.30	L.S.		$12,000.00
Utility Coordination/Relocation	$12,000.30	L.S.		$12,000.00
Stormwater Management/Erosion Control	5%			$12,000.00
Subtotal Additional Capital Improvement Costs				**$50,400.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$43,561.00
Legal/Administrative	5%			$14,520.00
Contract Admin/Construction Management	10%			$29,041.00
Contingency	25%			$72,602.00
Subtotal Other Costs				**$159,724.00**
Total Capital Improvement Costs				**$450,130.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, c	1450	L.F.	$1.00	$290.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	10	EA	$64.00	$128.00
Total Annual Operation and Maintenance Cost				**$418.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$14,630.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 12th St. Outfall Trunk
REACH : 12thSt_Trunk
JURISDICTION : City of Greeley
REACH ID: 12thSt_Trunk-Reach12thSt_Trunk | Jeremy Deischer | DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
30-inch	225	1	225	L.F.	$116.00	$26,100.00	PIPE-12THST-39
36-inch	500	1	500	L.F.	$139.00	$69,500.00	PIPE-12THST-38
36-inch	30	1	30	L.F.	$139.00	$4,170.00	PIPE-12THST-37
18-inch	475	1	475	L.F.	$69.00	$32,775.00	L038.10
24-inch	500	1	500	L.F.	$92.00	$46,000.00	L938.20
18-inch	50	35	1750	L.F.	$69.00	$120,750.00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			6	EA	$3,726.00	$22,356.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			2	EA	$5,010.00	$10,020.00	
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			22	EA	$15,416.00	$339,152.00	
Storm Inlet, Type R/Type 14, 5-foot			42	EA	$5,910.00	$248,220.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
6	4	1	485	L.F.	$699.12	$339,073.00	PIPE-12THST-21
7	4	1	1514	L.F.	$758.92	$1,149,008.00	PIPE-12THST-89, 20, 19, 18
9	4	1	1000	L.F.	$878.76	$878,755.00	PIPE-12THST-17, 16
10	4	1	500	L.F.	$938.56	$469,279.00	PIPE-12THST-15
8	5	1	525	L.F.	$868.86	$456,150.00	STM-PIPE-88, PIPE-12THST-14
13	6	1	1930	L.F.	$1,490.55	$2,876,761.00	PIPE-12THST-11, 10, 9, 8, 7
14	6	1	415	L.F.	$1,641.19	$681,093.00	PIPE-12THST-13, 6,
8	5	1	150	L.F.	$868.86	$130,329.00	Diversion into WQCV
16	6	1	1287	L.F.	$2,048.95	$2,636,995.00	PIPE-12THST-4,3,2,1
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
8	1	10.00	1	EA	$880.35	$880.00	Diversion into WQCV
16	1	18.00	1	EA	$1,761.03	$1,761.00	Outfall into Poudre
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
8	5	1	1	EA	$11,083.48	$11,083.50	
16	6	1	1	EA	$16,295.59	$16,295.60	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			7	AC-FT	$58,582.00	$385,938.00	WQCV
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		8119	S.Y.	$40.00	$324,760.00	
Waterline Lowering	<----User Defined Items		17	EA	$5,000.00	$85,000.00	
Great Western and UPRR Tunneling Crossing	<----User Defined Items		200	LF	$17,822.32	$3,564,463.00	
Highway 85 Tunneling Crossing	<----User Defined Items		160	LF	$18,718.24	$2,994,919.00	
Asphalt Patch	<----User Defined Items		495	S.Y.	$50.00	$24,750.00	
Sanitary Sewer Relocation (Pipe)	<----User Defined Items		1085	LF	$75.00	$81,375.00	
Sanitary Sewer Relocation (MH)	<----User Defined Items		6	EA	$5,000.00	$30,000.00	
Diversion Junction Box	<----User Defined Items		1	EA	$37,000.00	$37,000.00	
Sanitary Sewer Conflict Vault	<----User Defined Items		1	EA	$30,000.00	$30,000.00	
Land Acquisition							
Easement/ROW Acquisition			10.01	ACRE	$25,738.66	$257,644.00	WQCV and just upstream of Hwy 85

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$919,043.00
Concrete Box Culverts				$9,647,463.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$385,938.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$7,172,267.00
Subtotal Capital Improvement Costs				**$18,124,711.00**
Additional Capital Improvement Costs				
Dewatering	$181,247.11	L.S.		$181,247.00
Mobilization	5%			$906,236.00
Traffic Control	$906,235.55	L.S.		$906,236.00
Utility Coordination/Relocation	$906,235.55	L.S.		$906,236.00
Stormwater Management/Erosion Control	5%			$906,236.00
Subtotal Additional Capital Improvement Costs				**$3,806,191.00**
Land Acquisition Costs				
ROW/Easements				$257,644.00
Subtotal Land Acquisition Costs				**$257,644.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$3,289,635.00
Legal/Administrative	5%			$1,096,545.00
Contract Admin/Construction Management	10%			$2,193,090.00
Contingency	25%			$5,482,726.00
Subtotal Other Costs				**$12,061,996.00**
Total Capital Improvement Costs				**$34,250,542.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, et	9536	L.F.	$1.00	$1,907.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	69	EA	$64.00	$883.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, st	6.588	ACRE	$1,927.00	$6,348.00
Total Annual Operation and Maintenance Cost				**$9,138.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$319,827.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan			
DRAINAGEWAY :	12th St. Outfall			
REACH :	STribWofRR			
JURISDICTION :	City of Greeley			
REACH ID:	12thSt-ReachSTribWofRR	Jeremy Deischer	DATE :	2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
30-inch	384	1	384	L.F.	$116.00	$44,544.00	L_17thSt
36-inch	2910	1	2910	L.F.	$139.00	$404,490.00	L032.10, L033.03_pipe, L936.33, L_16thSt
42-inch	1506	1	1506	L.F.	$162.00	$243,972.00	L932.06, L836.33, L936.28
48-inch	2395	1	2395	L.F.	$185.00	$443,075.00	L032.09, L932.07, L936.31, L14thSt
54-inch	1500	1	1500	L.F.	$277.00	$415,500.00	L031.04, L032.04, L036.30
60-inch	500	1	500	L.F.	$308.00	$154,000.00	L032.05
18-inch	50	98	4900	L.F.	$69.00	$338,100.00	Inlet Laterals
Manholes and Inlets							
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			23	EA	$5,010.00	$115,230.00	
Manhole, 6' Dia. (Pipe Dia. = 48")			9	EA	$5,524.00	$49,716.00	
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			19	EA	$15,416.00	$292,904.00	
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			4	EA	$19,271.00	$77,084.00	
Storm Inlet, Type R/Type 14, 5-foot			91	EA	$5,910.00	$537,810.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
8	4	1	500	L.F.	$819.72	$409,862.00	L832.07
10	5	1	520	L.F.	$1,046.05	$543,948.00	L736.30
6	3	1	578	L.F.	$639.32	$369,654.00	L936.31
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		3796	S.Y.	$40.00	$151,840.00	
Asphalt Patch	<----User Defined Items		3196	S.Y.	$50.00	$159,800.00	
Waterline Lowering	<----User Defined Items		15	EA	$5,000.00	$75,000.00	
Sanitary Sewer Relocation (Pipe)	<----User Defined Items		1245	LF	$75.00	$93,375.00	
Sanitary Sewer Relocation (MH)	<----User Defined Items		6	EA	$5,000.00	$30,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$3,116,425.00
Concrete Box Culverts				$1,323,464.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$510,015.00
Subtotal Capital Improvement Costs				**$4,949,904.00**
Additional Capital Improvement Costs				
Dewatering	$49,499.04	L.S.		$49,499.00
Mobilization	5%			$247,495.00
Traffic Control	$247,495.20	L.S.		$247,495.00
Utility Coordination/Relocation	$247,495.20	L.S.		$247,495.00
Stormwater Management/Erosion Control	5%			$247,495.00
Subtotal Additional Capital Improvement Costs				**$1,039,479.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$898,407.00
Legal/Administrative	5%			$299,469.00
Contract Admin/Construction Management	10%			$598,938.00
Contingency	25%			$1,497,346.00
Subtotal Other Costs				**$3,294,160.00**
Total Capital Improvement Costs				**$9,283,543.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, et	10793	L.F.	$1.00	$2,159.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	146	EA	$64.00	$1,869.00
Total Annual Operation and Maintenance Cost				**$4,028.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$140,979.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan			
DRAINAGEWAY :	12th St. Outfall			
REACH :	STribEofRR			
JURISDICTION :	City of Greeley			
REACH ID:	12thSt-ReachSTribEofRR	Jeremy Deischer	DATE :	2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	500	1	500	L.F.	$69.00	$34,500.00	L036.22
24-inch	1000	1	1000	L.F.	$92.00	$92,000.00	L036.34, L036.13
30-inch	500	1	500	L.F.	$116.00	$58,000.00	L036.12
36-inch	1480	1	1480	L.F.	$139.00	$205,720.00	L036.23, L036.24, L936.23
42-inch	1160	1	1160	L.F.	$162.00	$187,920.00	L936.25, L036.25
18-inch	50	73	3650	L.F.	$69.00	$251,850.00	Inlet Laterals
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			6	EA	$3,726.00	$22,356.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			10	EA	$5,010.00	$50,100.00	
Storm Inlet, Type R/Type 14, 5-foot			43	EA	$5,910.00	$254,130.00	
Special Items (User Defined)							
Asphalt Patch	<----User Defined Items		1628	S.Y.	$50.00	$81,400.00	
Waterline Lowering	<----User Defined Items		6	EA	$5,000.00	$30,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$1,156,576.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$111,400.00
Subtotal Capital Improvement Costs				**$1,267,976.00**
Additional Capital Improvement Costs				
Dewatering	$12,679.76	L.S.		$12,680.00
Mobilization	5%			$63,399.00
Traffic Control	$63,398.80	L.S.		$63,399.00
Utility Coordination/Relocation	$63,398.80	L.S.		$63,399.00
Stormwater Management/Erosion Control	5%			$63,399.00
Subtotal Additional Capital Improvement Costs				**$266,276.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$230,138.00
Legal/Administrative	5%			$76,713.00
Contract Admin/Construction Management	10%			$153,425.00
Contingency	25%			$383,563.00
Subtotal Other Costs				**$843,839.00**
Total Capital Improvement Costs				**$2,378,091.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, et	4640	L.F.	$1.00	$928.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	59	EA	$64.00	$755.00
Total Annual Operation and Maintenance Cost				**$1,683.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$58,904.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : Hwy 85 Outfall
REACH : 18thSt
JURISDICTION : City of Greeley
REACH ID: Hwy85Chan-Reach18thSt Jeremy Deischer DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
42-inch	3000	1	3000	L.F.	$150.00	$450,000.00	L035.04
54-inch	1620	1	1620	L.F.	$257.00	$416,340.00	L036.37
18-inch	50	34	1700	L.F.	$64.00	$108,800.00	Inlet Laterals
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
42-inch	Yes	1	2	EA	$2,025.00	$4,050.00	
Headwalls							
Diameter (in)	Applicable	No. of Barrels					
54-inch	Yes	1	2	EA	$1,724.80	$3,450.00	
Wingwalls (includes concrete apron)							
Diameter (in)		No. of Barrels					
54-inch		1	2	EA	$10,499.26	$20,999.00	
Manholes and Inlets							
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			15	EA	$4,646.00	$69,690.00	
Storm Inlet, Type R/Type 14, 5-foot			34	EA	$5,480.00	$186,320.00	
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		2421	SY	$40.00	$96,840.00	
Waterline Lowering	<----User Defined Items		4	EA	$5,000.00	$20,000.00	
Highway Boring	<----User Defined Items		100	LF	$4,500.00	$450,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$1,259,649.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$566,840.00
Subtotal Capital Improvement Costs				**$1,826,489.00**
Additional Capital Improvement Costs				
Dewatering	$18,264.89	L.S.		$18,265.00
Mobilization	5%			$91,324.00
Traffic Control	$91,324.45	L.S.		$91,324.00
Utility Coordination/Relocation	$91,324.45	L.S.		$91,324.00
Stormwater Management/Erosion Control	5%			$91,324.00
Subtotal Additional Capital Improvement Costs				**$383,561.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$331,508.00
Legal/Administrative	5%			$110,503.00
Contract Admin/Construction Management	10%			$221,005.00
Contingency	25%			$552,513.00
Subtotal Other Costs				**$1,215,529.00**
Total Capital Improvement Costs				**$3,425,579.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs,	4620	L.F.	$1.00	$924.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	49	EA	$60.00	$588.00	
Channel Maintenance (e.g. sediment & debris removal, erosion, tree & weed removal, etc.)	1150	L.F.	$2.00	$460.00	
Total Annual Operation and Maintenance Cost				**$1,972.00**	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				**$61,967.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT : North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY : 12th St. Outfall Trunk
REACH : A
JURISDICTION : City of Greeley
REACH ID: 12thSt_Trunk-ReachA Jeremy Deischer DATE : 2016-03-17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Manholes and Inlets							
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			3	EA	$15,416.00	$46,248.00	MH-12thSt-1, MH-12thSt-2, MH-12thSt-3
Concrete Box Culverts							
Box Culvert Type							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
16	6	1	132	L.F.	$2,048.95	$270,461.00	PIPE-12th-1
16	6	1	330	L.F.	$2,048.95	$676,153.00	PIPE-12th-2
16	6	1	475	L.F.	$2,048.95	$973,250.00	PIPE-12th-3
8	5	1	145	L.F.	$868.86	$125,984.00	PIPE-12th-106
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
16	1	18.00	1	EA	$1,761.03	$1,761.00	
8	1	10.00	1	EA	$880.35	$880.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
16	6	1	1	EA	$16,295.59	$16,295.60	
8	5	1	1	EA	$11,083.48	$11,083.50	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			7	AC-FT	$58,582.00	$386,641.00	WQCV Facility (6.6 Ac-ft)
Special Items (User Defined)							
Waterline Lowering	<----User Defined Items		1	EA	$5,000.00	$5,000.00	
Diversion Junction Box	<----User Defined Items		1	EA	$37,000.00	$37,000.00	
Asphalt Repave	<----User Defined Items		598	S.Y.	$40.00	$23,920.00	
Land Acquisition							
Easement/ROW Acquisition			9.90	ACRE	$20,812.53	$206,044.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$46,248.00
Concrete Box Culverts				$2,075,868.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$386,641.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$65,920.00
Subtotal Capital Improvement Costs				**$2,574,677.00**
Additional Capital Improvement Costs				
Dewatering	$25,746.77	L.S.		$25,747.00
Mobilization	5%			$128,734.00
Traffic Control	$128,733.85	L.S.		$128,734.00
Utility Coordination/Relocation	$128,733.85	L.S.		$128,734.00
Stormwater Management/Erosion Control	5%			$128,734.00
Subtotal Additional Capital Improvement Costs				**$540,683.00**
Land Acquisition Costs				
ROW/Easements				$206,044.00
Subtotal Land Acquisition Costs				**$206,044.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$467,304.00
Legal/Administrative	5%			$155,768.00
Contract Admin/Construction Management	10%			$311,536.00
Contingency	25%			$778,840.00
Subtotal Other Costs				**$1,713,448.00**
Total Capital Improvement Costs				**$5,034,852.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs,	1082	L.F.	$1.00	$216.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	5	EA	$64.00	$64.00	
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, s	6.6	ACRE	$1,927.00	$6,359.00	
Total Annual Operation and Maintenance Cost				**$6,639.00**	
Effective Interest Rate				1.50%	
Total Operation and Maintenance Costs Over 50 Years				**$232,363.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St. Outfall Trunk
REACH :	B
JURISDICTION :	City of Greeley
REACH ID:	12thSt_Trunk-ReachB

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains						
Manholes and Inlets						
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)		3	EA	$15,416.00	$46,248.00	MH-12thSt-4, MH-12thSt-5, MH-12thSt-6
Concrete Box Culverts						
Box Culvert Pipe						
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**			
13	6	1	350	L.F.	$1,490.55	$521,692.00	PIPE-12th-4
14	6	1	100	L.F.	$1,641.19	$164,119.00	PIPE-12th-6
Special Items (User Defined)						
Highway 85 Tunneling	**<----User Defined Items**	160	LF	$18,718.24	$2,994,919.00	
Waterline Lowering	**<----User Defined Items**	2	EA	$5,000.00	$10,000.00	
Sanitary Sewer Relocation (Pipe)	**<----User Defined Items**	50	LF	$5,000.00	$250,000.00	
Sanitary Sewer Relocation (MH)	**<----User Defined Items**	2	EA	$5,000.00	$10,000.00	
Asphalt Repave	**<----User Defined Items**	567	S.Y.	$40.00	$22,680.00	
Land Acquisition						
Easement/ROW Acquisition		0.11	ACRE	$469,090.91	$51,600.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$46,248.00
Concrete Box Culverts				$685,811.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$3,287,599.00
Subtotal Capital Improvement Costs				**$4,019,658.00**
Additional Capital Improvement Costs				
Dewatering	$40,196.58	L.S.		$40,197.00
Mobilization	5%			$200,983.00
Traffic Control	$200,982.90	L.S.		$200,983.00
Utility Coordination/Relocation	$200,982.90	L.S.		$200,983.00
Stormwater Management/Erosion Control	5%			$200,983.00
Subtotal Additional Capital Improvement Costs				**$844,129.00**
Land Acquisition Costs				
ROW/Easements				$51,600.00
Subtotal Land Acquisition Costs				**$51,600.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$729,568.00
Legal/Administrative	5%			$243,189.00
Contract Admin/Construction Management	10%			$486,379.00
Contingency	25%			$1,215,947.00
Subtotal Other Costs				**$2,675,083.00**
Total Capital Improvement Costs				**$7,590,470.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	450	L.F.	$1.00	$90.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	5	EA	$64.00	$64.00
Total Annual Operation and Maintenance Cost				**$154.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$5,390.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St. Outfall Trunk
REACH :	C
JURISDICTION :	City of Greeley
REACH ID:	12thSt_Trunk-ReachC

Jeremy Deischer | DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	7	350	L.F.	$69.00	$24,150.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			3	EA	$15,416.00	$46,248.00	MH-12thSt-7, MH-12thSt-8, MH-12thSt-9
Storm Inlet_Type R/Type 14_5-foot			7	EA	$5,910.00	$41,370.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
13	6	1	490	L.F.	$1,490.55	$730,369.00	PIPE-12th-7
13	6	1	260	L.F.	$1,490.55	$387,543.00	PIPE-12th-8
13	6	1	260	L.F.	$1,490.55	$387,543.00	PIPE-12th-9
Special Items (User Defined)							
Waterline Lowering	**<----User Defined Items**		2	EA	$5,000.00	$10,000.00	
Asphalt Repave	**<----User Defined Items**		1234	S.Y.	$40.00	$49,360.00	
Sanitary Sewer Conflict Vault	**<----User Defined Items**		1	EA	$30,000.00	$30,000.00	3rd Avenue

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$111,768.00
Concrete Box Culverts				$1,505,455.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$89,360.00
Subtotal Capital Improvement Costs				**$1,706,583.00**
Additional Capital Improvement Costs				
Dewatering	$17,065.83	L.S.		$17,066.00
Mobilization	5%			$85,329.00
Traffic Control	$85,329.15	L.S.		$85,329.00
Utility Coordination/Relocation	$85,329.15	L.S.		$85,329.00
Stormwater Management/Erosion Control	5%			$85,329.00
Subtotal Additional Capital Improvement Costs				**$358,382.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$309,745.00
Legal/Administrative	5%			$103,248.00
Contract Admin/Construction Management	10%			$206,497.00
Contingency	25%			$516,241.00
Subtotal Other Costs				**$1,135,731.00**
Total Capital Improvement Costs				**$3,200,696.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	1010	L.F.	$1.00	$202.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	10	EA	$64.00	$128.00
Total Annual Operation and Maintenance Cost				**$330.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$11,550.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St. Outfall Trunk
REACH :	D
JURISDICTION :	City of Greeley
REACH ID:	12thSt_Trunk-ReachD — Jeremy Deischer — DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	2	100	L.F.	$69.00	$6,900.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia .48" and larger, deflection < 10 degrees)			2	EA	$15,416.00	$30,832.00	MH-12thSt-10, MH-12thSt-11
Storm Inlet, Type R/Type 14, .5-foot			2	EA	$5,910.00	$11,820.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
13	6	1	490	L.F.	$1,490.55	$730,369.00	PIPE-12th-10
13	6	1	430	L.F.	$1,490.55	$640,936.00	PIPE-12th-11
Special Items (User Defined)							
Waterline Lowering	**<----User Defined Items**		1	EA	$5,000.00	$5,000.00	
Asphalt Repave	**<----User Defined Items**		1124	S.Y.	$40.00	$44,960.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$49,552.00
Concrete Box Culverts				$1,371,305.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$49,960.00
Subtotal Capital Improvement Costs				**$1,470,817.00**
Additional Capital Improvement Costs				
Dewatering	$14,708.17	L.S.		$14,708.00
Mobilization	5%			$73,541.00
Traffic Control	$73,540.85	L.S.		$73,541.00
Utility Coordination/Relocation	$73,540.85	L.S.		$73,541.00
Stormwater Management/Erosion Control	5%			$73,541.00
Subtotal Additional Capital Improvement Costs				**$308,872.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$266,953.00
Legal/Administrative	5%			$88,984.00
Contract Admin/Construction Management	10%			$177,969.00
Contingency	25%			$444,922.00
Subtotal Other Costs				**$978,828.00**
Total Capital Improvement Costs				**$2,758,517.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	920	L.F.	$1.00	$184.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	4	EA	$64.00	$51.00
Total Annual Operation and Maintenance Cost				**$235.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$8,225.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St. Outfall Trunk
REACH :	E
JURISDICTION :	City of Greeley
REACH ID:	12thSt_Trunk-ReachE — Jeremy Deischer — DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Manholes and Inlets							
Type B Manhole (Pipe Dia .48" and larger, deflection < 10 degrees)			2	EA	$15,416.00	$30,832.00	MH-12thSt-12, MH-12thSt-13
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
14	6	1	315	L.F.	$1,641.19	$516,974.00	PIPE-12th-13
Special Items (User Defined)							
Waterline Lowering	**<----User Defined Items**		1	EA	$5,000.00	$5,000.00	
Asphalt Repave	**<----User Defined Items**		397	S.Y.	$40.00	$15,880.00	
Great Western and Union Pacific RR Crossing	**<----User Defined Items**		200	LF	$17,822.32	$3,564,463.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$30,832.00
Concrete Box Culverts				$516,974.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$3,585,343.00
Subtotal Capital Improvement Costs				**$4,133,149.00**
Additional Capital Improvement Costs				
Dewatering	$41,331.49	L.S.		$41,331.00
Mobilization	5%			$206,657.00
Traffic Control	$206,657.45	L.S.		$206,657.00
Utility Coordination/Relocation	$206,657.45	L.S.		$206,657.00
Stormwater Management/Erosion Control	5%			$206,657.00
Subtotal Additional Capital Improvement Costs				**$867,959.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$750,166.00
Legal/Administrative	5%			$250,055.00
Contract Admin/Construction Management	10%			$500,111.00
Contingency	25%			$1,250,277.00
Subtotal Other Costs				**$2,750,609.00**
Total Capital Improvement Costs				**$7,751,717.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	315	L.F.	$1.00	$63.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	2	EA	$64.00	$26.00
Total Annual Operation and Maintenance Cost				**$89.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$3,115.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St. Outfall Trunk
REACH :	F
JURISDICTION :	City of Greeley
REACH ID:	12thSt_Trunk-ReachF

Jeremy Deischer — DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	5	250	L.F.	$69.00	$17,250.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia .48" and larger, deflection < 10 degrees)			1	EA	$15,416.00	$15,416.00	MH-12thSt-16
Type P Manhole (Pipe Dia .48" and larger, deflection > 10 degrees)			2	EA	$19,271.00	$38,542.00	MH-12thSt-14, MH-12thSt-15
Storm Inlet, Type R/Type 14, 5-foot			4	EA	$5,910.00	$23,640.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
8	5	1	475	L.F.	$868.86	$412,708.00	PIPE-12thSt-14
8	5	1	50	L.F.	$868.86	$43,443.00	PIPE-12thSt-15
10	4	1	500	L.F.	$938.56	$469,279.00	PIPE-12thSt-16
Special Items (User Defined)							
Waterline Lowering	**<----User Defined Items**		2	EA	$5,000.00	$10,000.00	
Asphalt Repave	**<----User Defined Items**		987	S.Y.	$40.00	$39,480.00	
Sanitary Sewer Relocation (Pipe)	**<----User Defined Items**		1035	LF	$75.00	$77,625.00	
Sanitary Sewer Relocation (MH)	**<----User Defined Items**		4	EA	$5,000.00	$20,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$94,848.00
Concrete Box Culverts				$925,430.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$147,105.00
Subtotal Capital Improvement Costs				**$1,167,383.00**
Additional Capital Improvement Costs				
Dewatering	$11,673.83	L.S.		$11,674.00
Mobilization	5%			$58,369.00
Traffic Control	$58,369.15	L.S.		$58,369.00
Utility Coordination/Relocation	$58,369.15	L.S.		$58,369.00
Stormwater Management/Erosion Control	5%			$58,369.00
Subtotal Additional Capital Improvement Costs				**$245,150.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$211,880.00
Legal/Administrative	5%			$70,627.00
Contract Admin/Construction Management	10%			$141,253.00
Contingency	25%			$353,133.00
Subtotal Other Costs				**$776,893.00**
Total Capital Improvement Costs				**$2,189,426.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	1025	L.F.	$1.00	$205.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	7	EA	$64.00	$90.00
Total Annual Operation and Maintenance Cost				**$295.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$10,325.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	12th St. Outfall Trunk
REACH :	G
JURISDICTION :	City of Greeley
REACH ID:	12thSt_Trunk-ReachG

Jeremy Deischer — DATE : 3/17/2016

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	10	500	L.F.	$69.00	$34,500.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia .48" and larger, deflection < 10 degrees)			2	EA	$15,416.00	$30,832.00	MH-12thSt-17, MH-12thSt-18
Storm Inlet, Type R/Type 14, 5-foot			10	EA	$5,910.00	$59,100.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
9	4	1	500	L.F.	$878.76	$439,378.00	PIPE-12thSt-17
9	4	1	500	L.F.	$878.76	$439,378.00	PIPE-12thSt-18
Special Items (User Defined)							
Waterline Lowering	**<----User Defined Items**		2	EA	$5,000.00	$10,000.00	
Asphalt Repave	**<----User Defined Items**		926	S.Y.	$40.00	$37,040.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$124,432.00
Concrete Box Culverts				$878,756.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$47,040.00
Subtotal Capital Improvement Costs				**$1,050,228.00**
Additional Capital Improvement Costs				
Dewatering	$10,502.28	L.S.		$10,502.00
Mobilization	5%			$52,511.00
Traffic Control	$52,511.40	L.S.		$52,511.00
Utility Coordination/Relocation	$52,511.40	L.S.		$52,511.00
Stormwater Management/Erosion Control	5%			$52,511.00
Subtotal Additional Capital Improvement Costs				**$220,546.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$190,616.00
Legal/Administrative	5%			$63,539.00
Contract Admin/Construction Management	10%			$127,077.00
Contingency	25%			$317,694.00
Subtotal Other Costs				**$698,926.00**
Total Capital Improvement Costs				**$1,969,700.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	1000	L.F.	$1.00	$200.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	10	EA	$64.00	$128.00
Total Annual Operation and Maintenance Cost				**$328.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$11,480.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7thSt Outfall Trunk
REACH :	A
JURISDICTION :	City of Greeley
REACH ID:	7thSt_Trunk-ReachA — Jeremy Deischer — DATE : 3/20/2017

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	9	450	L.F.	$69.00	$31,050.00	Inlet Laterals
48-inch	60	1	60	L.F.	$185.00	$11,100.00	WQCV Diversion
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
48-inch	Yes	1	1	EA	$2,646.00	$2,646.00	
Manholes and Inlets							
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			1	EA	$15,416.00	$15,416.00	MH-7thSt-2
Storm Inlet, Type R/Type 14, 5-foot			9	EA	$5,910.00	$53,190.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
12	4	1	500	L.F.	$1,059.16	$529,581.00	PIPE-7thSt-1
12	4	1	285	L.F.	$1,059.16	$301,861.00	PIPE-7thSt-2
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
12	1	14.00	1	EA	$1,303.89	$1,304.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
12	4	1	1	EA	$9,358.63	$9,358.60	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			6	AC-FT	$58,582.00	$336,847.00	WQCV Basin
Special Items (User Defined)							
Diversion Junction Box	**<----User Defined Items**		1	EA	$37,000.00	$37,000.00	
Asphalt Repave	**<----User Defined Items**		814	S.Y.	$40.00	$32,560.00	
Sanitary Sewer Relocation (Pipe)	**<----User Defined Items**		420	LF	$75.00	$31,500.00	
Sanitary Sewer Relocation (MH)	**<----User Defined Items**		2	EA	$5,000.00	$10,000.00	
Land Acquisition							
Easement/ROW Acquisition			5.87	ACRE	$72,505.11	$425,605.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$113,402.00
Concrete Box Culverts				$842,105.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$336,847.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$111,060.00
Subtotal Capital Improvement Costs				**$1,403,414.00**
Additional Capital Improvement Costs				
Dewatering	$14,034.14	L.S.		$14,034.00
Mobilization	5%			$70,171.00
Traffic Control	$70,170.70	L.S.		$70,171.00
Utility Coordination/Relocation	$70,170.70	L.S.		$70,171.00
Stormwater Management/Erosion Control	5%			$70,171.00
Subtotal Additional Capital Improvement Costs				**$294,718.00**
Land Acquisition Costs				
ROW/Easements				$425,605.00
Subtotal Land Acquisition Costs				**$425,605.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$254,720.00
Legal/Administrative	5%			$84,907.00
Contract Admin/Construction Management	10%			$169,813.00
Contingency	25%			$424,533.00
Subtotal Other Costs				**$933,973.00**
Total Capital Improvement Costs				**$3,057,710.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	845	L.F.	$1.00	$169.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	11	EA	$64.00	$141.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, struc	5.75	ACRE	$1,927.00	$5,540.00
Total Annual Operation and Maintenance Cost				**$5,850.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$204,748.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7thSt Outfall Trunk
REACH :	B
JURISDICTION :	City of Greeley
REACH ID:	7thSt_Trunk-ReachB — Jeremy Deischer — DATE : 3/20/2017

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	6	300	L.F.	$69.00	$20,700.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			3	EA	$15,416.00	$46,248.00	MH-7thSt-3, MH-7thSt-4, MH-7thSt-5
Storm Inlet, Type R/Type 14, 5-foot			6	EA	$5,910.00	$35,460.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
10	4	1	80	L.F.	$938.56	$75,085.00	PIPE-7thSt-3
10	4	1	460	L.F.	$938.56	$431,736.00	PIPE-7thSt-4
8	4	1	501	L.F.	$819.72	$410,682.00	PIPE-7thSt-5
Special Items (User Defined)							
Water Line Lowering	**<----User Defined Items**		2	EA	$5,000.00	$10,000.00	
Sanitary Sewer Relcoation (Pipe)	**<----User Defined Items**		150	LF	$75.00	$11,250.00	
Sanitary Sewer Relocation (MH)	**<----User Defined Items**		2	EA	$5,000.00	$10,000.00	
Asphalt Repave	**<----User Defined Items**		965	S.Y.	$40.00	$38,600.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$102,408.00
Concrete Box Culverts				$917,503.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$69,850.00
Subtotal Capital Improvement Costs				**$1,089,761.00**
Additional Capital Improvement Costs				
Dewatering	$10,897.61	L.S.		$10,898.00
Mobilization	5%			$54,488.00
Traffic Control	$54,488.05	L.S.		$54,488.00
Utility Coordination/Relocation	$54,488.05	L.S.		$54,488.00
Stormwater Management/Erosion Control	5%			$54,488.00
Subtotal Additional Capital Improvement Costs				**$228,850.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$197,792.00
Legal/Administrative	5%			$65,931.00
Contract Admin/Construction Management	10%			$131,861.00
Contingency	25%			$329,653.00
Subtotal Other Costs				**$725,237.00**
Total Capital Improvement Costs				**$2,043,848.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	1041	L.F.	$1.00	$208.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	9	EA	$64.00	$115.00
Total Annual Operation and Maintenance Cost				**$323.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$11,305.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7thSt Outfall Trunk
REACH :	C
JURISDICTION :	City of Greeley
REACH ID:	7thSt_Trunk-ReachC — Jeremy Deischer — DATE : 3/20/2017

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	4	200	L.F.	$69.00	$13,800.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia .48" and larger, deflection < 10 degrees)			2	EA	$15,416.00	$30,832.00	MH-7thSt-6, MH-7thSt-7
Storm Inlet, Type R/Type 14, 5-foot			4	EA	$5,910.00	$23,640.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
8	4	1	265	L.F.	$819.72	$217,227.00	PIPE-7thSt-6
Special Items (User Defined)							
Water Line Lowering	**<----User Defined Items**		1	EA	$5,000.00	$5,000.00	
Great Western and UPRR Crossings	**<----User Defined Items**		180	LF	$17,112.51	$3,080,252.00	
Asphalt Repave	**<----User Defined Items**		431	S.Y.	$40.00	$17,240.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains			$68,272.00	
Concrete Box Culverts			$217,227.00	
Hydraulic Structures			$0.00	
Channel Improvements			$0.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$0.00	
Special Items (User Defined)			$3,102,492.00	
Subtotal Capital Improvement Costs			**$3,387,991.00**	
Additional Capital Improvement Costs				
Dewatering	$33,879.91	L.S.	$33,880.00	
Mobilization	5%		$169,400.00	
Traffic Control	$169,399.55	L.S.	$169,400.00	
Utility Coordination/Relocation	$169,399.55	L.S.	$169,400.00	
Stormwater Management/Erosion Control	5%		$169,400.00	
Subtotal Additional Capital Improvement Costs			**$711,480.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$614,921.00	
Legal/Administrative	5%		$204,974.00	
Contract Admin/Construction Management	10%		$409,947.00	
Contingency	25%		$1,024,868.00	
Subtotal Other Costs			**$2,254,710.00**	
Total Capital Improvement Costs			**$6,354,181.00**	

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	265	L.F.	$1.00	$53.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	6	EA	$64.00	$77.00	
Total Annual Operation and Maintenance Cost				**$130.00**	
Effective Interest Rate				1.50%	
Total Operation and Maintenance Costs Over 50 Years				**$4,550.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7thSt Outfall Trunk
REACH :	D
JURISDICTION :	City of Greeley
REACH ID:	7thSt_Trunk-ReachD — Jeremy Deischer — DATE : 3/20/2017

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	7	350	L.F.	$69.00	$24,150.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia .48" and larger, deflection < 10 degrees)			2	EA	$15,416.00	$30,832.00	MH-7thSt-8, MH-7thSt-9
Storm Inlet, Type R/Type 14, 5-foot			7	EA	$5,910.00	$41,370.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
7	4	1	500	L.F.	$758.92	$379,461.00	PIPE-7thSt-8
6	4	1	500	L.F.	$699.12	$349,560.00	PIPE-7thSt-9
Special Items (User Defined)							
Water Line Lowering	**<----User Defined Items**		1	EA	$5,000.00	$5,000.00	
Asphalt Repave	**<----User Defined Items**		833	S.Y.	$40.00	$33,320.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains			$96,352.00	
Concrete Box Culverts			$729,021.00	
Hydraulic Structures			$0.00	
Channel Improvements			$0.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$0.00	
Special Items (User Defined)			$38,320.00	
Subtotal Capital Improvement Costs			**$863,693.00**	
Additional Capital Improvement Costs				
Dewatering	$8,636.93	L.S.	$8,637.00	
Mobilization	5%		$43,185.00	
Traffic Control	$43,184.65	L.S.	$43,185.00	
Utility Coordination/Relocation	$43,184.65	L.S.	$43,185.00	
Stormwater Management/Erosion Control	5%		$43,185.00	
Subtotal Additional Capital Improvement Costs			**$181,377.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$156,761.00	
Legal/Administrative	5%		$52,254.00	
Contract Admin/Construction Management	10%		$104,507.00	
Contingency	25%		$261,268.00	
Subtotal Other Costs			**$574,790.00**	
Total Capital Improvement Costs			**$1,619,860.00**	

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	1000	L.F.	$1.00	$200.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	7	EA	$64.00	$90.00	
Total Annual Operation and Maintenance Cost				**$290.00**	
Effective Interest Rate				1.50%	
Total Operation and Maintenance Costs Over 50 Years				**$10,150.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	7thSt Outfall Trunk
REACH :	E
JURISDICTION :	City of Greeley
REACH ID:	7thSt_Trunk-ReachE — Jeremy Deischer — DATE : 3/20/2017

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	5	250	L.F.	$69.00	$17,250.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia .48" and larger, deflection < 10 degrees)			1	EA	$15,416.00	$15,416.00	MH-7thSt-10,
Type P Manhole (Pipe Dia .48" and larger, deflection > 10 degrees)			2	EA	$19,271.00	$38,542.00	MH-7thSt-11, MH-7thSt-12
Storm Inlet, Type R/Type 14, 5-foot			5	EA	$5,910.00	$29,550.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
6	4	1	500	L.F.	$699.12	$349,560.00	PIPE-7thSt-10
6	4	1	30	L.F.	$699.12	$20,974.00	PIPE-7thSt-11
6	4	1	359	L.F.	$699.12	$250,774.00	PIPE-7thSt-12
Special Items (User Defined)							
Water Line Lowering	**<----User Defined Items**		3	EA	$5,000.00	$15,000.00	
Asphalt Repave	**<----User Defined Items**		757	S.Y.	$40.00	$30,280.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains				$100,758.00	
Concrete Box Culverts				$621,308.00	
Hydraulic Structures				$0.00	
Channel Improvements				$0.00	
Detention/Water Quality Facilities				$0.00	
Removals				$0.00	
Landscaping and Maintenance Improvements				$0.00	
Special Items (User Defined)				$45,280.00	
Subtotal Capital Improvement Costs				**$767,346.00**	
Additional Capital Improvement Costs					
Dewatering	$7,673.46	L.S.		$7,673.00	
Mobilization	5%			$38,367.00	
Traffic Control	$38,367.30	L.S.		$38,367.00	
Utility Coordination/Relocation	$38,367.30	L.S.		$38,367.00	
Stormwater Management/Erosion Control	5%			$38,367.00	
Subtotal Additional Capital Improvement Costs				**$161,141.00**	
Land Acquisition Costs					
ROW/Easements				$0.00	
Subtotal Land Acquisition Costs				**$0.00**	
Other Costs (percentage of Capital Improvement Costs)					
Engineering	15%			$139,273.00	
Legal/Administrative	5%			$46,424.00	
Contract Admin/Construction Management	10%			$92,849.00	
Contingency	25%			$232,122.00	
Subtotal Other Costs				**$510,668.00**	
Total Capital Improvement Costs				**$1,439,155.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	889	L.F.	$1.00	$178.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	8	EA	$64.00	$102.00	
Total Annual Operation and Maintenance Cost				**$280.00**	
Effective Interest Rate				1.50%	
Total Operation and Maintenance Costs Over 50 Years				**$9,800.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14thAveOutfall Trunk
REACH :	A
JURISDICTION :	City of Greeley
REACH ID:	14thAve_Trunk-ReachA — Jeremy Deischer — DATE : 3/20/2017

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	17	850	L.F.	$69.00	$58,650.00	Inlet Laterals
48-inch	30	1	30	L.F.	$185.00	$5,550.00	WQCV Diversion
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
48-inch	Yes	1	1	EA	$2,646.00	$2,646.00	
Manholes and Inlets							
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			2	EA	$15,416.00	$30,832.00	MH-14thAve-3, MH-14thAve-4
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			1	EA	$19,271.00	$19,271.00	MH-14thAve-2
Storm Inlet, Type R/Type 14, 5-foot			17	EA	$5,910.00	$100,470.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
12	5	1	480	L.F.	$1,199.54	$575,777.00	PIPE-14thAve-1
12	5	1	235	L.F.	$1,199.54	$281,891.00	PIPE-14thAve-2
12	5	1	220	L.F.	$1,199.54	$263,898.00	PIPE-14thAve-3
12	4	1	350	L.F.	$1,059.16	$370,706.00	PIPE-14thAve-4
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
12	1	14.00	1	EA	$1,303.89	$1,304.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
12	5	1	1	EA	$12,088.88	$12,088.90	
Detention/Water Quality Facilities							
Detention (Complete-in-Place)							
Detention Facility 1 (Complete-in-Place)			8	AC-FT	$58,582.00	$474,514.00	WQCV
Special Items (User Defined)							
Water Line Lowering	**<----User Defined Items**		2	EA	$5,000.00	$10,000.00	
Diversion Junction Box	**<----User Defined Items**		1	EA	$37,000.00	$37,000.00	
Asphalt Repave	**<----User Defined Items**		571	S.Y.	$40.00	$22,840.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains				$217,419.00	
Concrete Box Culverts				$1,505,665.00	
Hydraulic Structures				$0.00	
Channel Improvements				$0.00	
Detention/Water Quality Facilities				$474,514.00	
Removals				$0.00	
Landscaping and Maintenance Improvements				$0.00	
Special Items (User Defined)				$69,840.00	
Subtotal Capital Improvement Costs				**$2,267,438.00**	
Additional Capital Improvement Costs					
Dewatering	$22,674.38	L.S.		$22,674.00	
Mobilization	5%			$113,372.00	
Traffic Control	$113,371.90	L.S.		$113,372.00	
Utility Coordination/Relocation	$113,371.90	L.S.		$113,372.00	
Stormwater Management/Erosion Control	5%			$113,372.00	
Subtotal Additional Capital Improvement Costs				**$476,162.00**	
Land Acquisition Costs					
ROW/Easements				$0.00	
Subtotal Land Acquisition Costs				**$0.00**	
Other Costs (percentage of Capital Improvement Costs)					
Engineering	15%			$411,540.00	
Legal/Administrative	5%			$137,180.00	
Contract Admin/Construction Management	10%			$274,360.00	
Contingency	25%			$685,900.00	
Subtotal Other Costs				**$1,508,980.00**	
Total Capital Improvement Costs				**$4,252,580.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	1315	L.F.	$1.00	$263.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	20	EA	$64.00	$256.00	
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, struc	8.1	ACRE	$1,927.00	$7,804.00	
Total Annual Operation and Maintenance Cost				**$8,323.00**	
Effective Interest Rate				1.50%	
Total Operation and Maintenance Costs Over 50 Years				**$291,302.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14thAveOutfall Trunk
REACH :	B
JURISDICTION :	City of Greeley
REACH ID:	14thAve_Trunk-ReachB — Jeremy Deischer — DATE : 3/20/2017

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	50	17	850	L.F.	$69.00	$58,650.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia .48" and larger, deflection < 10 degrees)			4	EA	$15,416.00	$61,664.00	MH-14thAve-5, MH-14thAve-7, MH-14thAve-8, MH-14thAve-9
Type P Manhole (Pipe Dia .48" and larger, deflection > 10 degrees)			1	EA	$19,271.00	$19,271.00	MH-14thAve-6,
Storm Inlet, Type R/Type 14, 5-foot			17	EA	$5,910.00	$100,470.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	4	1	350	L.F.	$1,059.16	$370,706.00	PIPE-14thAve-5
12	4	1	300	L.F.	$1,059.16	$317,748.00	PIPE-14thAve-6
12	4	1	300	L.F.	$1,059.16	$317,748.00	PIPE-14thAve-7
12	4	1	500	L.F.	$1,059.16	$529,581.00	PIPE-14thAve-8
12	4	1	500	L.F.	$1,059.16	$529,581.00	PIPE-14thAve-9
Special Items (User Defined)							
Water Line Lowering	<----User Defined Items		2	EA	$5,000.00	$10,000.00	
Asphalt Repave	<----User Defined Items		1867	S.Y.	$40.00	$74,680.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$240,055.00
Concrete Box Culverts					$2,065,364.00
Hydraulic Structures					$0.00
Channel Improvements					$0.00
Detention/Water Quality Facilities					$0.00
Removals					$0.00
Landscaping and Maintenance Improvements					$0.00
Special Items (User Defined)					$84,680.00
Subtotal Capital Improvement Costs					**$2,390,099.00**
Additional Capital Improvement Costs					
Dewatering		$23,900.99	L.S.		$23,901.00
Mobilization		5%			$119,505.00
Traffic Control		$119,504.95	L.S.		$119,505.00
Utility Coordination/Relocation		$119,504.95	L.S.		$119,505.00
Stormwater Management/Erosion Control		5%			$119,505.00
Subtotal Additional Capital Improvement Costs					**$501,921.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$433,803.00
Legal/Administrative		5%			$144,601.00
Contract Admin/Construction Management		10%			$289,202.00
Contingency		25%			$723,005.00
Subtotal Other Costs					**$1,590,611.00**
Total Capital Improvement Costs					**$4,482,631.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	1950	L.F.	$1.00	$390.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	22	EA	$64.00	$282.00
Total Annual Operation and Maintenance Cost				**$672.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$23,520.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14thAveOutfall Trunk
REACH :	C
JURISDICTION :	City of Greeley
REACH ID:	14thAve_Trunk-ReachC — Jeremy Deischer — DATE : 3/20/2017

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	50	5	250	L.F.	$69.00	$17,250.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia .48" and larger, deflection < 10 degrees)			3	EA	$15,416.00	$46,248.00	MH-14thAve-10, MH-14thAve-11, MH-14thAve-12
Storm Inlet, Type R/Type 14, 5-foot			5	EA	$5,910.00	$29,550.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	4	1	230	L.F.	$1,059.16	$243,607.00	PIPE-14thAve-10
12	4	1	310	L.F.	$1,059.16	$328,340.00	PIPE-14thAve-12
Special Items (User Defined)							
Water Line Lowering	<----User Defined Items		2	EA	$5,000.00	$10,000.00	
Asphalt Repave	<----User Defined Items		705	S.Y.	$40.00	$28,200.00	
Great Western Railroad Crossing	<----User Defined Items		130	LF	$20,222.33	$2,628,903.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$93,048.00
Concrete Box Culverts				$571,947.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$2,667,103.00
Subtotal Capital Improvement Costs				**$3,332,099.00**
Additional Capital Improvement Costs				
Dewatering	$33,320.98	L.S.		$33,321.00
Mobilization	5%			$166,605.00
Traffic Control	$166,604.90	L.S.		$166,605.00
Utility Coordination/Relocation	$166,604.90	L.S.		$166,605.00
Stormwater Management/Erosion Control	5%			$166,605.00
Subtotal Additional Capital Improvement Costs				**$699,741.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$604,776.00
Legal/Administrative	5%			$201,592.00
Contract Admin/Construction Management	10%			$403,184.00
Contingency	25%			$1,007,960.00
Subtotal Other Costs				**$2,217,512.00**
Total Capital Improvement Costs				**$6,249,351.00**

Master Plan Operation and Maintenance Cost Summary				
Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs,	540	L.F.	$1.00	$108.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	8	EA	$64.00	$102.00
Total Annual Operation and Maintenance Cost				**$210.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$7,350.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14thAveOutfall Trunk
REACH :	D
JURISDICTION :	City of Greeley
REACH ID:	14thAve_Trunk-ReachD — Jeremy Deischer — DATE : 3/20/2017

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	8	400	L.F.	$69.00	$27,600.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia .48" and larger, deflection < 10 degrees)			2	EA	$15,416.00	$30,832.00	MH-14thAve-13, MH-14thAve-14
Storm Inlet, Type R/Type 14, 5-foot			8	EA	$5,910.00	$47,280.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
11	4	1	365	L.F.	$999.36	$364,766.00	PIPE-14thAve-13
11	4	1	279	L.F.	$999.36	$278,821.00	PIPE-14thAve-14
Special Items (User Defined)							
Water Line Lowering	**<----User Defined Items**		1	EA	$5,000.00	$5,000.00	
Asphalt Repave	**<----User Defined Items**		655	S.Y.	$40.00	$26,200.00	
Sanitary Conflict Vault	**<----User Defined Items**		1	EA	$30,000.00	$30,000.00	3rd Street
Sanitary Sewer Relocation (Pipe)	**<----User Defined Items**		216	LF	$75.00	$16,200.00	
Sanitary Sewer Relocation (MH)	**<----User Defined Items**		3	EA	$5,000.00	$15,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$105,712.00
Concrete Box Culverts				$643,587.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$92,400.00
Subtotal Capital Improvement Costs				**$841,699.00**
Additional Capital Improvement Costs				
Dewatering	$8,416.99	L.S.		$8,417.00
Mobilization	5%			$42,085.00
Traffic Control	$42,084.95	L.S.		$42,085.00
Utility Coordination/Relocation	$42,084.95	L.S.		$42,085.00
Stormwater Management/Erosion Control	5%			$42,085.00
Subtotal Additional Capital Improvement Costs				**$176,757.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$152,768.00
Legal/Administrative	5%			$50,923.00
Contract Admin/Construction Management	10%			$101,846.00
Contingency	25%			$254,614.00
Subtotal Other Costs				**$560,151.00**
Total Capital Improvement Costs				**$1,578,607.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	644	L.F.	$1.00	$129.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	10	EA	$64.00	$128.00
Total Annual Operation and Maintenance Cost				**$257.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$8,995.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14thAveOutfall Trunk
REACH :	E
JURISDICTION :	City of Greeley
REACH ID:	14thAve_Trunk-ReachE — Jeremy Deischer — DATE : 3/20/2017

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	16	800	L.F.	$69.00	$55,200.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia .48" and larger, deflection < 10 degrees)			3	EA	$15,416.00	$46,248.00	MH-14thAve-15, MH-14thAve-16, MH-14thAve-17
Storm Inlet, Type R/Type 14, 5-foot			16	EA	$5,910.00	$94,560.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
11	4	1	500	L.F.	$999.36	$499,680.00	PIPE-14thAve-15
10	4	1	500	L.F.	$938.56	$469,279.00	PIPE-14thAve-16
10	4	1	35	L.F.	$938.56	$32,849.00	PIPE-14thAve-17
Special Items (User Defined)							
Water Line Lowering	**<----User Defined Items**		3	EA	$5,000.00	$15,000.00	
Sanitary Sewer Relocation (Pipe)	**<----User Defined Items**		525	LF	$75.00	$39,375.00	
Sanitary Sewer Relocation (MH)	**<----User Defined Items**		2	EA	$5,000.00	$10,000.00	
Asphalt Repave	**<----User Defined Items**		1015	S.Y.	$40.00	$40,600.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$196,008.00
Concrete Box Culverts				$1,001,808.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$104,975.00
Subtotal Capital Improvement Costs				**$1,302,791.00**
Additional Capital Improvement Costs				
Dewatering	$13,027.91	L.S.		$13,028.00
Mobilization	5%			$65,140.00
Traffic Control	$65,139.55	L.S.		$65,140.00
Utility Coordination/Relocation	$65,139.55	L.S.		$65,140.00
Stormwater Management/Erosion Control	5%			$65,140.00
Subtotal Additional Capital Improvement Costs				**$273,588.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$236,457.00
Legal/Administrative	5%			$78,819.00
Contract Admin/Construction Management	10%			$157,638.00
Contingency	25%			$394,095.00
Subtotal Other Costs				**$867,009.00**
Total Capital Improvement Costs				**$2,443,388.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	1035	L.F.	$1.00	$207.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	16	EA	$64.00	$205.00
Total Annual Operation and Maintenance Cost				**$412.00**
Effective Interest Rate				1.50%
Total Operation and Maintenance Costs Over 50 Years				**$14,420.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	North Greeley and Downtown Basin Storm Drainage Master Plan
DRAINAGEWAY :	14thAveOutfall Trunk
REACH :	F
JURISDICTION :	City of Greeley
REACH ID:	14thAve_Trunk-ReachF

Jeremy Deischer | DATE : 3/20/2017

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
18-inch	50	11	550	L.F.	$69.00	$37,950.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia 48" and larger, deflection < 10 degrees)			4	EA	$15,416.00	$61,664.00	MH-14thAve-18, MH-14thAve-19, MH-14thAve-20, MH-14thAve-21
Storm Inlet, Type R/Type 14, 5-foot			11	EA	$5,910.00	$65,010.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
6	4	1	465	L.F.	$699.12	$325,091.00	PIPE-14thAve-18
6	4	1	500	L.F.	$699.12	$349,560.00	PIPE-14thAve-19
6	4	1	320	L.F.	$699.12	$223,718.00	PIPE-14thAve-20
6	4	1	341	L.F.	$699.12	$238,190.00	PIPE-14thAve-21
Special Items (User Defined)							
Water Line Lowering	**<----User Defined Items**		2	EA	$5,000.00	$10,000.00	
Asphalt Repave	**<----User Defined Items**		1349	SY	$40.00	$53,960.00	
Sanitary Sewer Relocation (Pipe)	**<----User Defined Items**		1660	LF	$75.00	$124,500.00	
Sanitary Sewer Relocation (MH)	**<----User Defined Items**		19	EA	$5,000.00	$95,000.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains			$164,624.00	
Concrete Box Culverts			$1,136,559.00	
Hydraulic Structures			$0.00	
Channel Improvements			$0.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$0.00	
Special Items (User Defined)			$283,460.00	
Subtotal Capital Improvement Costs			**$1,584,643.00**	
Additional Capital Improvement Costs				
Dewatering	$15,846.43	L.S.	$15,846.00	
Mobilization	5%		$79,232.00	
Traffic Control	$79,232.15	L.S.	$79,232.00	
Utility Coordination/Relocation	$79,232.15	L.S.	$79,232.00	
Stormwater Management/Erosion Control	5%		$79,232.00	
Subtotal Additional Capital Improvement Costs			**$332,774.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$287,613.00	
Legal/Administrative	5%		$95,871.00	
Contract Admin/Construction Management	10%		$191,742.00	
Contingency	25%		$479,354.00	
Subtotal Other Costs			**$1,054,580.00**	
Total Capital Improvement Costs			**$2,971,997.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	1626	L.F.	$1.00	$325.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	15	EA	$64.00	$192.00	
Total Annual Operation and Maintenance Cost				**$517.00**	
Effective Interest Rate				1.50%	
Total Operation and Maintenance Costs Over 50 Years				**$18,095.00**	

APPENDIX E - RAILROAD TUNNELING ASSESSMENT

LITHOS ENGINEERING
12567 W. Cedar Drive, Suite 104
Lakewood, Colorado 80228
303.625.9502
www.LithosEng.com

March 10, 2017
Project No. 17005-1

Icon Engineering, Inc.
7000 S. Yosemite Street, Suite 120
Centennial, CO 80112

Attention: Mr. Craig Jacobson, PE
Principal

Regarding: Opinion of Probable Construction Costs
Concrete Box Culvert Trenchless Crossings
Greeley Stormwater Master Plan
Greeley, Colorado

Mr. Jacobson,

Icon Engineering (Icon) is preparing a Stormwater Master Plan for the downtown area of Greeley, Colorado. In order to convey storm water to the Cache la Poudre River from the downtown area, it is necessary to cross several railroad tracks and Highway 85. It is likely that these crossings will need to be constructed using trenchless technology. Icon retained Lithos Engineering (Lithos) to prepare a master plan level opinion of probable construction cost (OPCC) for each of four proposed trenchless crossings.

Trenchless construction using reinforced concrete boxes (RCB) is a technology that has been employed throughout the United States for decades. Despite this long history, jacked boxes are rare in the Colorado Front Range, mostly due to lack of local contractor experience. Our experience has most often been that proposed jacked boxes get switched to pipes either in the design phase or during the bidding phase by the contractor. Therefore, a bid suitable history is unavailable for this type of construction in the local area. However, aside from the shape of the excavation, which creates some unique challenges, jacked box installation is not significantly different from jacked pipe operations.

In order to gain a sense of the construction costs and challenges, Lithos 1) spoke with contractors who had performed jacked box construction elsewhere in the country, 2) talked with contractors who had bid jacked box tunnels in the Denver area and subsequently "value engineered" them to be jacked pipes, and 3) spoke with a manufacturer who designs and builds shields and jacking frames for rectangular boxes. Lithos' OPCC are based on these references, our understanding of the geologic conditions obtained from borings on previous projects in the general area, and our experience with the underground construction industry in general. Additionally, the costs below are than typical trenchless projects to reflect the risk of using either an inexperienced local contractor or bringing in an out-of-state contractor to perform the work.

The table below provides the total OPCC for each of the four jack box installations. The detailed estimates are provided attached to this letter.

Master Plan OPCC for Jacked Box Trenchless Crossings

Crossing	Total Cost
14th Avenue Outfall - RR Crossing	$2,628,903
7th Street Outfall - RR Crossing	$3,080,252
12th Street Outfall - RR Crossing	$3,564,463
12th Street Outfall - Hwy 85 Crossing	$2,994,919

The following is a list and explanation of the inputs and assumptions we used to create the OPCC:

1. The dimensions of each crossing are as follows:
   a. 14th Avenue Outfall – RR Crossing RBC 11 x 4 feet 130 feet long
   b. 7th Street Outfall – RR Crossing RBC 8 x 4 feet 180 feet long
   c. 12th Street Outfall – RR Crossing RBC 13 x 5 feet 200 feet long
   d. 12th Street Outfall – Hwy 85 Crossing RBC 12 x 6 feet 160 feet long
   e. The length of each crossing is based on a desktop reconnaissance of the area around each crossing with an attempt to minimize the length.
2. Dewatering will be necessary at each shaft location and along the length of each crossing
3. Permeation grouting
   a. Ground improvement, in this case, permeation grouting will be necessary along the length of each crossing
   b. The cost of permeation grouting is a significant contributor to the overall costs. We feel the grouting is necessary due to the shallow amount of cover and the anticipated granular nature of the soils. The grouting will help to create a stable excavation face as well as reduce potential for surface settlement.
4. Launching and receiving shafts
   a. Each shaft will be extended two feet below the bottom of the RBC.
   b. Launch shaft dimensions are 20 x 22 feet.
   c. Receiving shaft dimensions are 18 x 12 feet.
   d. Ground support will utilize trench boxes
   e. A designed reinforced concrete thrust block will be necessary in each launch shaft
   f. An unreinforced concrete floor or mud mat will be required in each launch shaft
5. Guide rails
   a. Guide rails will be required and will consist of 12-inch diameter steel pipe filled with concrete will be installed prior to box jacking to act as guides for the box as it is advanced.
   b. The guide rails will be installed using a guided pilot tube and auger boring.
6. Shield and jacking frame adapter
   a. The cost of the leading-edge shield and jacking frame adapter plate is included in each estimate.
   b. The shield will be composed of steel sheeting and will have removable sand shelves. Dimensions will be at least one inch larger on all sides than the outside dimensions of the RBC.
   c. Since the boxes are all of different sizes and the work is anticipated to be bid as separate projects, it will be necessary to manufacture new equipment each crossing.

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7. RBC Materials
    a. We received a cost estimate for RBC construction specifically for jacking applications and to cover Railroad E-80 loading. The cost per linear foot of box for each tunnel is:
        i. 14th Avenue Outfall – RR Crossing $1,400
        ii. 7th Street Outfall – RR Crossing $850
        iii. 12th Street Outfall – RR Crossing $1,800
        iv. 12th Street Outfall – Hwy 85 Crossing $1,810
8. Tunnel Excavation
    a. Ground excavation will be by hand equipment as well as a modified mini excavator
    b. Due to the length of the crossings, 2 intermediate jacking stations are assumed to be needed for each crossing.
    c. Water-bentonite lubrication will be injected between the ground and the RBC to help reduce frictional forces.
9. Contact Grouting
    a. Post installation, cementitious grout will be injected through preinstalled ports in the RBC to fill the space between the ground and the RBC.
    b. Contact grouting will reduce long term settlement of the ground surface.
10. Railroad
    a. A railroad flagman is assumed to be onsite full time at $1,800/day during guide rail installation, tunnel excavation, and contact grouting.
    b. We have assumed that settlement will occur beyond the allowable limits of the railroad and that track releveling will be necessary
    c. A railroad flagman is not included in the Hwy 85 crossing.

If you have any questions regarding the contents of this letter, please contact the undersigned.

Sincerely,
Lithos Engineering

Nate Soule, PE, PG
Vice President

Robin Dornfest, CPG
President

Attachments: OPCC 14th Avenue Outfall - RR Crossing
OPCC 7th Street Outfall - RR Crossing
OPCC 12th Street Outfall - RR Crossing
OPCC 12th Street Outfall - Hwy 85 Crossing

North Greeley Downtown Basin
Storm Drainage Master Plan

Summary

Tunnel ID: 14th Avenue Outfall Railroad Crossing

Tunnel Length (ft)	130
Excavated Width (ft)	13
Excavated Height (ft)	6

COST SUMMARY

Task	Description	Duration (days)	Labor	Equipment	Material	Subs	Total
1	Mobilization	2	$ 6,630	$ 4,672	$ -	$ 10,000	$ 21,302
2	Permeation Grouting	10	$ 15,180	$ -	$ -	$ 350,000	$ 365,180
3	Launch Shaft	5	$ 20,645	$ 11,880	$ 7,500	$ 24,449	$ 64,474
4	Receiving Shaft	2	$ 5,830	$ 4,752	$ 2,500	$ 22,184	$ 35,266
5	Guide Rails	6	$ 19,614	$ 20,208	$ 11,612	$ 10,800	$ 62,234
6	Tunnel Excavation	26	$ 133,666	$ 434,608	$ 189,500	$ 107,800	$ 865,574
7	Contact Grout	5	$ 15,345	$ 11,880	$ 3,400	$ 9,000	$ 39,625
8	Demobilization	2	$ 6,230	$ 4,672	$ -	$ 7,000	$ 17,902
	Direct Costs		$ 223,140	$ 492,672	$ 214,512	$ 541,233	$ 1,471,557
	Duration (work days)	58					

Field Overhead	(% of direct costs)	25%	$ 367,889
Home Office Overhead	(% of labor)	3%	$ 6,694
Bonding & Insurance	(% of direct costs)	2%	$ 29,431
Construction Engineering	(% of direct costs)	2%	$ 29,431
Total Cost			$ 1,905,002
Profit		15%	$ 285,750
Contingency		20%	$ 438,151
Total Cost			**$ 2,628,903**
Total Cost/LF			*$ 20,222*

Notes and Assumptions
1) Does not include treatment or special handling of contaminated groundwater
2) Method is jacked box sections from shaft with excavation from mini-backhoe and hand assistance
3) Shield includes sand shelves that are capable of supporting the excavation face
4) Geology is medium dense to dense sand and silty sand
5) Dry cast method for RCB. For wet cast add 20% cost of RCB materials
6) Does not include tunnel design engineering

03/10/2017

North Greeley Downtown Basin
Storm Drainage Master Plan

Summary

Tunnel ID: 7th Street Outfall Railroad Crossing

Tunnel Length (ft)	180
Excavated Width (ft)	10
Excavated Height (ft)	6

COST SUMMARY

Task	Description	Duration (days)	Labor	Equipment	Material	Subs	Total
1	Mobilization	2	$ 6,630	$ 4,672	$ -	$ 10,000	$ 21,302
2	Permeation Grouting	14	$ 21,252	$ -	$ -	$ 450,000	$ 471,252
3	Launch Shaft	5	$ 20,645	$ 11,880	$ 7,500	$ 24,131	$ 64,156
4	Receiving Shaft	2	$ 5,830	$ 4,752	$ 2,500	$ 22,184	$ 35,266
5	Guide Rails	7	$ 22,883	$ 23,576	$ 14,139	$ 12,600	$ 73,198
6	Tunnel Excavation	36	$ 185,076	$ 518,688	$ 160,500	$ 128,800	$ 993,064
7	Contact Grout	6	$ 18,414	$ 14,256	$ 4,000	$ 10,800	$ 47,470
8	Demobilization	2	$ 6,230	$ 4,672	$ -	$ 7,000	$ 17,902
	Direct Costs		$ 286,960	$ 582,496	$ 188,639	$ 665,515	$ 1,723,610
	Duration (work days)	74					

Field Overhead	(% of direct costs)	25%	$ 430,903
Home Office Overhead	(% of labor)	3%	$ 8,609
Bonding & Insurance	(% of direct costs)	2%	$ 34,472
Construction Engineering	(% of direct costs)	2%	$ 34,472
Total Cost			$ 2,232,066
Profit		15%	$ 334,810
Contingency		20%	$ 513,375
Total Cost			**$ 3,080,252**
Total Cost/LF			*$ 17,113*

Notes and Assumptions

1) Does not include treatment or special handling of contaminated groundwater
2) Method is jacked box sections from shaft with excavation from mini-backhoe and hand assistance
3) Shield includes sand shelves that are capable of supporting the excavation face
4) Geology is medium dense to dense sand and silty sand
5) Dry cast method for RCB. For wet cast add 20% cost of RCB materials
6) Does not include tunnel design engineering

03/10/2017

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North Greeley Downtown Basin
Storm Drainage Master Plan

Summary

Tunnel ID: 12th Street Outfall Railroad Crossing

Tunnel Length (ft)	200
Excavated Width (ft)	15
Excavated Height (ft)	7

COST SUMMARY

Task	Description	Duration (days)	Labor	Equipment	Material	Subs	Total
1	Mobilization	2	$ 6,630	$ 4,672	$ -	$ 10,000	$ 21,302
2	Permeation Grouting	15	$ 22,770	$ -	$ -	$ 450,000	$ 472,770
3	Launch Shaft	5	$ 20,645	$ 11,880	$ 7,500	$ 24,131	$ 64,156
4	Receiving Shaft	2	$ 5,830	$ 4,752	$ 2,500	$ 22,184	$ 35,266
5	Guide Rails	7	$ 22,883	$ 23,576	$ 15,710	$ 12,600	$ 74,769
6	Tunnel Excavation	40	$ 205,640	$ 552,320	$ 367,500	$ 136,000	$ 1,261,460
7	Contact Grout	6	$ 18,414	$ 14,256	$ 4,000	$ 10,800	$ 47,470
8	Demobilization	2	$ 6,230	$ 4,672	$ -	$ 7,000	$ 17,902
	Direct Costs		$ 309,042	$ 616,128	$ 397,210	$ 672,715	$ 1,995,096
	Duration (work days)	79					

Field Overhead	(% of direct costs)	25%	$ 498,774
Home Office Overhead	(% of labor)	3%	$ 9,271
Bonding & Insurance	(% of direct costs)	2%	$ 39,902
Construction Engineering	(% of direct costs)	2%	$ 39,902
Total Cost			$ 2,582,944
Profit		15%	$ 387,442
Contingency		20%	$ 594,077
Total Cost			**$ 3,564,463**
Total Cost/LF			*$ 17,822*

Notes and Assumptions

1) Does not include treatment or special handling of contaminated groundwater
2) Method is jacked box sections from shaft with excavation from mini-backhoe and hand assistance
3) Shield includes sand shelves that are capable of supporting the excavation face
4) Geology is medium dense to dense sand and silty sand
5) Dry cast method for RCB. For wet cast add 20% cost of RCB materials
6) Does not include tunnel design engineering

03/10/2017

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Summary

Tunnel ID: 12th Street Outfall Highway 85 Crossing

Tunnel Length (ft)	160
Excavated Width (ft)	14
Excavated Height (ft)	8

COST SUMMARY

Task	Description	Duration (days)	Labor	Equipment	Material	Subs	Total
1	Mobilization	2	$ 6,630	$ 4,672	$ -	$ 10,000	$ 21,302
2	Permeation Grouting	12	$ 18,216	$ -	$ -	$ 400,000	$ 418,216
3	Launch Shaft	5	$ 20,645	$ 11,880	$ 7,500	$ 26,038	$ 66,063
4	Receiving Shaft	2	$ 5,830	$ 4,752	$ 2,500	$ 22,808	$ 35,890
5	Guide Rails	6	$ 19,614	$ 20,208	$ 12,568	$ 10,800	$ 63,190
6	Tunnel Excavation	32	$ 164,512	$ 485,056	$ 297,100	$ 60,000	$ 1,006,668
7	Contact Grout	6	$ 18,414	$ 14,256	$ 3,600	$ 10,800	$ 47,070
8	Demobilization	2	$ 6,230	$ 4,672	$ -	$ 7,000	$ 17,902
	Direct Costs		$ 260,091	$ 545,496	$ 323,268	$ 547,446	$ 1,676,301
	Duration (work days)	67					

Field Overhead	(% of direct costs)	25%	$ 419,075
Home Office Overhead	(% of labor)	3%	$ 7,803
Bonding & Insurance	(% of direct costs)	2%	$ 33,526
Construction Engineering	(% of direct costs)	2%	$ 33,526
Total Cost			$ 2,170,231
Profit		15%	$ 325,535
Contingency		20%	$ 499,153
Total Cost			**$ 2,994,919**
Total Cost/LF			*$ 18,718*

Notes and Assumptions

1) Does not include treatment or special handling of contaminated groundwater
2) Method is jacked box sections from shaft with excavation from mini-backhoe and hand assistance
3) Shield includes sand shelves that are capable of supporting the excavation face
4) Geology is medium dense to dense sand and silty sand
5) Dry cast method for RCB. For wet cast add 20% cost of RCB materials
6) Does not include tunnel design engineering

03/10/2017

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Mobilization

Tunnel ID: 14th Avenue Outfall Railroad Crossing

GENERAL

Duration	2 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR

*OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.5	5	$ 80	$ 120	$ 400
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,315**
Total Labor						**$ 6,630**

EQUIPMENT

*OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pipe Carrier	0	$ 20	$ 15	$ 190	$ 15	$ -
Pump Submersible - 2"	0	$ 1	$ 1	$ 10	$ 1	$ -
Total Daily Equipment						**$ 2,336**
Total Equipment						**$ 4,672**

SUBCONTRACTORS

Description	Total
Trucking and Equipment Transportation (lump sum)	$ 10,000
Total Subs	**$ 10,000**

Total Cost for Activity	**$ 21,302**

03/10/2017

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Permeation Grouting

GENERAL — Tunnel ID: 14th Avenue Outfall Railroad Crossing

Duration	10 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	0	0.5	5	$ 80	$ 120	$ -
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	0	1	10	$ 53	$ 80	$ -
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	0	1	10	$ 74	$ 111	$ -
Total Daily Labor						**$ 1,518**
Total Labor						**$ 15,180**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	0	$ 76	$ 57	$ 722	$ 88	$ -
Cat 950H Loader	0	$ 33	$ 25	$ 314	$ 42	$ -
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	0	$ 1	$ 1	$ 10	$ 1	$ -
Total Daily Equipment						**$ -**
Total Equipment						**$ -**

MATERIALS

Description	Total
Total Materials	**$ -**

SUBCONTRACTORS

Description	Total
Grouting Sub (lump sum)	$ 450,000
Total Subs	**$ 350,000**

Total Cost for Activity: $ 365,180

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Launch Shaft

GENERAL — Tunnel ID: 14th Avenue Outfall Railroad Crossing

Duration	5 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.5	5	$ 80	$ 120	$ 400
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	2	1	10	$ 74	$ 111	$ 1,628
Total Daily Labor						**$ 4,129**
Total Labor						**$ 20,645**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 2,376**
Total Equipment						**$ 11,880**

MATERIALS

Description	Total
Concrete for thrust blocks and mud mat	$ 5,000
Trench boxes for shoring	$ 2,500
Total Materials	**$ 7,500**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Total
Dewatering Sub (lump sum)				$ 20,000
Muck Hauling (20'W x 22'L x 14'D)	1.3	297	$ 15	$ 4,449
Total Subs				**$ 24,449**

Total Cost for Activity: $ 64,474

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Receiving Shaft

GENERAL Tunnel ID: 14th Avenue Outfall Railroad Crossing

Duration	2 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	0	1	10	$ 80	$ 120	$ -
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 2,915**
Total Labor						**$ 5,830**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 2,376**
Total Equipment						**$ 4,752**

MATERIALS

Description	Total
Trench boxes for shoring	$ 2,500
Total Materials	**$ 2,500**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Total
Dewatering Sub (lump sum)				$ 20,000
Muck Hauling (18'W x 12'L x 14'D)	1.3	146	$ 15	$ 2,184
Total Subs				**$ 22,184**

Total Cost for Activity **$ 35,266**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Guide Rails

GENERAL Tunnel ID: 14th Avenue Outfall Railroad Crossing

Duration	6 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.25	2.5	$ 80	$ 120	$ 200
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	2	1	10	$ 53	$ 80	$ 1,166
Laborer (unskilled)	1	1	10	$ 39	$ 59	$ 429
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,269**
Total Labor						**$ 19,614**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	1	$ 7	$ 5	$ 66	$ 10	$ 166
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	1	$ 8	$ 6	$ 76	$ 6	$ 136
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
GBM Jack and Guide	1	$ 60	$ 45	$ 570	$ 12	$ 690
Total Daily Equipment						**$ 3,368**
Total Equipment						**$ 20,208**

MATERIALS

Description	Qty	Unit Cost	Total
12" Steel Pipe (per ft)	300	$ 35	$ 10,500
Grout inside pipes (per cy)	7.6	$ 147	$ 1,112
Total Materials			**$ 11,612**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Rate/Day	Total
Railroad Flagman				$ 1,800	$ 10,800
Total Subs					**$ 10,800**

Total Cost for Activity **$ 62,234**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Tunnel Excavation

GENERAL — Tunnel ID: 14th Avenue Outfall Railroad Crossing

Duration	26 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.5	5	$ 80	$ 120	$ 400
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	2	1	10	$ 53	$ 80	$ 1,166
Laborer (unskilled)	3	1	10	$ 39	$ 59	$ 1,287
Equipment Operator	2	1	10	$ 74	$ 111	$ 1,628
Total Daily Labor						**$ 5,141**
Total Labor						**$ 133,666**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	1	$ 8	$ 6	$ 76	$ 23	$ 306
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	1	$ 9	$ 7	$ 86	$ 4	$ 126
Generator - 500 kw	2	$ 21	$ 16	$ 200	$ 188	$ 4,160
Grout Pump	1	$ 7	$ 5	$ 66	$ 10	$ 166
Grove 36 Ton Crane (RT640E)	1	$ 68	$ 36	$ 616	$ 57	$ 1,186
Kubota K008-3 Mini-BH	1	$ 4	$ 3	$ 38	$ 5	$ 88
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 8,408**
Shield and Adapter Plate (lump sum)						$ 200,000
IJS (2, rented 1 month)						$ 16,000
Total Equipment						**$ 434,608**

	Unit Rate
Shield and Adapter Plate (lump sum)	
IJS (2, rented 1 month)	$ 16,000

MATERIALS

Description	LF	Unit Cost	Total
RCB for Jacking	130	$ 1,400	$ 182,000
Geotechnical Instrumentation (lump sum)			$ 5,000
Lubrication (lump sum)			$ 2,500
Total Materials			**$ 189,500**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Rate/Day	Total
Muck Hauling (13'W x 7'H x 140'L)	1.3	613	$ 15		$ 9,201
Shield Manufacturer Rep (lump sum)					$ 5,000
Railroad Flagman				$ 1,800	$ 46,800
Track releveling (lump sum)					$ 6,000
Dewatering Sub (lump sum)					$ 50,000
Total Subs					**$ 107,800**

Total Cost for Activity **$ 865,574**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Contact Grout

GENERAL — Tunnel ID: 14th Avenue Outfall Railroad Crossing

Duration	5 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0	0	$ 80	$ 120	$ -
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	2	1	10	$ 53	$ 80	$ 1,166
Laborer (unskilled)	1	1	10	$ 39	$ 59	$ 429
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,069**
Total Labor						**$ 15,345**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	0	$ 33	$ 25	$ 314	$ 42	$ -
Compressor - 375 cfm	1	$ 8	$ 6	$ 76	$ 23	$ 306
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	1	$ 9	$ 7	$ 86	$ 4	$ 126
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	1	$ 7	$ 5	$ 66	$ 10	$ 166
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	1	$ 8	$ 6	$ 76	$ 6	$ 136
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 2,376**
Total Equipment						**$ 11,880**

MATERIALS

Description	Cubic Yds	Unit Cost	Total
Cement Grout	17	$ 200	$ 3,400
Total Materials			**$ 3,400**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Rate/Day	Total
Railroad Flagman				$ 1,800	$ 9,000
Total Subs					**$ 9,000**

Total Cost for Activity **$ 39,625**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Demobilization

GENERAL — Tunnel ID: 14th Avenue Outfall Railroad Crossing

Duration	2 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.25	2.5	$ 80	$ 120	$ 200
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,115**
Total Labor						**$ 6,230**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pipe Carrier	0	$ 20	$ 15	$ 190	$ 15	$ -
Pump Submersible - 2"	0	$ 1	$ 1	$ 10	$ 1	$ -
Total Daily Equipment						**$ 2,336**
Total Equipment						**$ 4,672**

SUBCONTRACTORS

Description	Total
Trucking and Equipment Transportation (lump sum)	$ 7,000
Total Subs	**$ 7,000**

Total Cost for Activity **$ 17,902**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Mobilization

GENERAL — Tunnel ID: 7th Street Outfall Railroad Crossing

Duration	2 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.5	5	$ 80	$ 120	$ 400
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,315**
Total Labor						**$ 6,630**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pipe Carrier	0	$ 20	$ 15	$ 190	$ 15	$ -
Pump Submersible - 2"	0	$ 1	$ 1	$ 10	$ 1	$ -
Total Daily Equipment						**$ 2,336**
Total Equipment						**$ 4,672**

SUBCONTRACTORS

Description	Total
Trucking and Equipment Transportation (lump sum)	$ 10,000
Total Subs	**$ 10,000**

Total Cost for Activity **$ 21,302**

03/10/2017

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Permeation Grouting

GENERAL — Tunnel ID: 7th Street Outfall Railroad Crossing

Duration	14 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	0	0.5	5	$ 80	$ 120	$ -
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	0	1	10	$ 53	$ 80	$ -
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	0	1	10	$ 74	$ 111	$ -
Total Daily Labor						**$ 1,518**
Total Labor						**$ 21,252**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	0	$ 76	$ 57	$ 722	$ 88	$ -
Cat 950H Loader	0	$ 33	$ 25	$ 314	$ 42	$ -
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	0	$ 1	$ 1	$ 10	$ 1	$ -
Total Daily Equipment						**$ -**
Total Equipment						**$ -**

MATERIALS

Description	Total
Total Materials	**$ -**

SUBCONTRACTORS

Description	Total
Grouting Sub (lump sum)	$ 450,000
Total Subs	**$ 450,000**

Total Cost for Activity: $ 471,252

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Launch Shaft

GENERAL — Tunnel ID: 7th Street Outfall Railroad Crossing

Duration	5 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.5	5	$ 80	$ 120	$ 400
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	2	1	10	$ 74	$ 111	$ 1,628
Total Daily Labor						**$ 4,129**
Total Labor						**$ 20,645**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 2,376**
Total Equipment						**$ 11,880**

MATERIALS

Description	Total
Concrete for thrust blocks and mud mat	$ 5,000
Trench boxes for shoring	$ 2,500
Total Materials	**$ 7,500**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Total
Dewatering Sub (lump sum)				$ 20,000
Muck Hauling (20'W x 22'L x 13'D)	1.3	275	$ 15	$ 4,131
Total Subs				**$ 24,131**

Total Cost for Activity: $ 64,156

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Receiving Shaft

GENERAL Tunnel ID: 7th Street Outfall Railroad Crossing

Duration	2 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	0	1	10	$ 80	$ 120	$ -
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 2,915**
Total Labor						**$ 5,830**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 2,376**
Total Equipment						**$ 4,752**

MATERIALS

Description	Total
Trench boxes for shoring	$ 2,500
Total Materials	**$ 2,500**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Total
Dewatering Sub (lump sum)				$ 20,000
Muck Hauling (18'W x 12'L x 14'D)	1.3	146	$ 15	$ 2,184
Total Subs				**$ 22,184**

Total Cost for Activity **$ 35,266**

North Greeley Downtown Basin
Storm Drainage Master Plan

Guide Rails

GENERAL Tunnel ID: 7th Street Outfall Railroad Crossing

Duration	7 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.25	2.5	$ 80	$ 120	$ 200
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	2	1	10	$ 53	$ 80	$ 1,166
Laborer (unskilled)	1	1	10	$ 39	$ 59	$ 429
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,269**
Total Labor						**$ 22,883**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	1	$ 7	$ 5	$ 66	$ 10	$ 166
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	1	$ 8	$ 6	$ 76	$ 6	$ 136
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
GBM Jack and Guide	1	$ 60	$ 45	$ 570	$ 12	$ 690
Total Daily Equipment						**$ 3,368**
Total Equipment						**$ 23,576**

MATERIALS

Description	Qty	Unit Cost	Total
12" Steel Pipe (per ft)	360	$ 35	$ 12,600
Grout inside pipes (per cy)	10.5	$ 147	$ 1,539
Total Materials			**$ 14,139**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Rate/Day	Total
Railroad Flagman				$ 1,800	$ 12,600
Total Subs					**$ 12,600**

Total Cost for Activity **$ 73,198**

North Greeley Downtown Basin
Storm Drainage Master Plan

Tunnel Excavation

GENERAL — Tunnel ID: 7th Street Outfall Railroad Crossing

Duration	36 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.5	5	$ 80	$ 120	$ 400
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	2	1	10	$ 53	$ 80	$ 1,166
Laborer (unskilled)	3	1	10	$ 39	$ 59	$ 1,287
Equipment Operator	2	1	10	$ 74	$ 111	$ 1,628
Total Daily Labor						**$ 5,141**
Total Labor						**$ 185,076**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	1	$ 8	$ 6	$ 76	$ 23	$ 306
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	1	$ 9	$ 7	$ 86	$ 4	$ 126
Generator - 500 kw	2	$ 21	$ 16	$ 200	$ 188	$ 4,160
Grout Pump	1	$ 7	$ 5	$ 66	$ 10	$ 166
Grove 36 Ton Crane (RT640E)	1	$ 68	$ 36	$ 616	$ 57	$ 1,186
Kubota K008-3 Mini-BH	1	$ 4	$ 3	$ 38	$ 5	$ 88
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 8,408**
Shield and Adapter Plate (lump sum)						$ 200,000
IJS (2, rented 1 month)						$ 16,000
Total Equipment						**$ 518,688**

	Unit Rate
Shield and Adapter Plate (lump sum)	$ 200,000
IJS (2, rented 1 month)	$ 16,000

MATERIALS

Description	LF	Unit Cost	Total
RCB for Jacking	180	$ 850	$ 153,000
Geotechnical Instrumentation (lump sum)			$ 5,000
Lubrication (lump sum)			$ 2,500
Total Materials			**$ 160,500**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Rate/Day	Total
Muck Hauling (10'W x 6'H x 180'L)	1.3	520	$ 15		$ 7,800
Shield Manufacturer Rep (lump sum)					$ 5,000
Railroad Flagman				$ 1,800	$ 64,800
Track releveling (lump sum)					$ 9,000
Dewatering Sub (lump sum)					$ 50,000
Total Subs					**$ 128,800**

Total Cost for Activity **$ 993,064**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Contact Grout

GENERAL — Tunnel ID: 7th Street Outfall Railroad Crossing

Duration	6 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0	0	$ 80	$ 120	$ -
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	2	1	10	$ 53	$ 80	$ 1,166
Laborer (unskilled)	1	1	10	$ 39	$ 59	$ 429
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,069**
Total Labor						**$ 18,414**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	0	$ 33	$ 25	$ 314	$ 42	$ -
Compressor - 375 cfm	1	$ 8	$ 6	$ 76	$ 23	$ 306
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	1	$ 9	$ 7	$ 86	$ 4	$ 126
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	1	$ 7	$ 5	$ 66	$ 10	$ 166
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	1	$ 8	$ 6	$ 76	$ 6	$ 136
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 2,376**
Total Equipment						**$ 14,256**

MATERIALS

Description	Cubic Yds	Unit Cost	Total
Cement Grout	20	$ 200	$ 4,000
Total Materials			**$ 4,000**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Rate/Day	Total
Railroad Flagman				$ 1,800	$ 10,800
Total Subs					**$ 10,800**

Total Cost for Activity **$ 47,470**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Demobilization

GENERAL Tunnel ID: 7th Street Outfall Railroad Crossing

Duration	2 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.25	2.5	$ 80	$ 120	$ 200
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,115**
Total Labor						**$ 6,230**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pipe Carrier	0	$ 20	$ 15	$ 190	$ 15	$ -
Pump Submersible - 2"	0	$ 1	$ 1	$ 10	$ 1	$ -
Total Daily Equipment						**$ 2,336**
Total Equipment						**$ 4,672**

SUBCONTRACTORS

Description	Total
Trucking and Equipment Transportation (lump sum)	$ 7,000
Total Subs	**$ 7,000**

Total Cost for Activity **$ 17,902**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Mobilization

GENERAL Tunnel ID: 12th Street Outfall Railroad Crossing

Duration	2 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.5	5	$ 80	$ 120	$ 400
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,315**
Total Labor						**$ 6,630**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pipe Carrier	0	$ 20	$ 15	$ 190	$ 15	$ -
Pump Submersible - 2"	0	$ 1	$ 1	$ 10	$ 1	$ -
Total Daily Equipment						**$ 2,336**
Total Equipment						**$ 4,672**

SUBCONTRACTORS

Description	Total
Trucking and Equipment Transportation (lump sum)	$ 10,000
Total Subs	**$ 10,000**

Total Cost for Activity **$ 21,302**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Permeation Grouting

GENERAL — Tunnel ID: 12th Street Outfall Railroad Crossing

Duration	15 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	0	0.5	5	$ 80	$ 120	$ -
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	0	1	10	$ 53	$ 80	$ -
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	0	1	10	$ 74	$ 111	$ -
Total Daily Labor						**$ 1,518**
Total Labor						**$ 22,770**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	0	$ 76	$ 57	$ 722	$ 88	$ -
Cat 950H Loader	0	$ 33	$ 25	$ 314	$ 42	$ -
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	0	$ 1	$ 1	$ 10	$ 1	$ -
Total Daily Equipment						**$ -**
Total Equipment						**$ -**

MATERIALS

Description	Total
Total Materials	**$ -**

SUBCONTRACTORS

Description	Total
Grouting Sub (lump sum)	$ 450,000
Total Subs	**$ 450,000**

Total Cost for Activity: $ 472,770

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Launch Shaft

GENERAL — Tunnel ID: 12th Street Outfall Railroad Crossing

Duration	5 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.5	5	$ 80	$ 120	$ 400
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	2	1	10	$ 74	$ 111	$ 1,628
Total Daily Labor						**$ 4,129**
Total Labor						**$ 20,645**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 2,376**
Total Equipment						**$ 11,880**

MATERIALS

Description	Total
Concrete for thrust blocks and mud mat	$ 5,000
Trench boxes for shoring	$ 2,500
Total Materials	**$ 7,500**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Total
Dewatering Sub (lump sum)				$ 20,000
Muck Hauling (20'W x 22'L x 13'D)	1.3	275	$ 15	$ 4,131
Total Subs				**$ 24,131**

Total Cost for Activity: $ 64,156

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Receiving Shaft

GENERAL Tunnel ID: 12th Street Outfall Railroad Crossing

Duration	2 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	0	1	10	$ 80	$ 120	$ -
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 2,915**
Total Labor						**$ 5,830**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 2,376**
Total Equipment						**$ 4,752**

MATERIALS

Description	Total
Trench boxes for shoring	$ 2,500
Total Materials	**$ 2,500**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Total
Dewatering Sub (lump sum)				$ 20,000
Muck Hauling (18'W x 12'L x 14'D)	1.3	146	$ 15	$ 2,184
Total Subs				**$ 22,184**

Total Cost for Activity **$ 35,266**

North Greeley Downtown Basin
Storm Drainage Master Plan

Guide Rails

GENERAL Tunnel ID: 12th Street Outfall Railroad Crossing

Duration	7 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.25	2.5	$ 80	$ 120	$ 200
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	2	1	10	$ 53	$ 80	$ 1,166
Laborer (unskilled)	1	1	10	$ 39	$ 59	$ 429
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,269**
Total Labor						**$ 22,883**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	1	$ 7	$ 5	$ 66	$ 10	$ 166
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	1	$ 8	$ 6	$ 76	$ 6	$ 136
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
GBM Jack and Guide	1	$ 60	$ 45	$ 570	$ 12	$ 690
Total Daily Equipment						**$ 3,368**
Total Equipment						**$ 23,576**

MATERIALS

Description	Qty	Unit Cost	Total
12" Steel Pipe (per ft)	400	$ 35	$ 14,000
Grout inside pipes (per cy)	11.6	$ 147	$ 1,710
Total Materials			**$ 15,710**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Rate/Day	Total
Railroad Flagman				$ 1,800	$ 12,600
Total Subs					**$ 12,600**

Total Cost for Activity **$ 74,769**

North Greeley Downtown Basin
Storm Drainage Master Plan

Tunnel Excavation

GENERAL — Tunnel ID: 12th Street Outfall Railroad Crossing

Duration	40 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.5	5	$ 80	$ 120	$ 400
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	2	1	10	$ 53	$ 80	$ 1,166
Laborer (unskilled)	3	1	10	$ 39	$ 59	$ 1,287
Equipment Operator	2	1	10	$ 74	$ 111	$ 1,628
Total Daily Labor						**$ 5,141**
Total Labor						**$ 205,640**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	1	$ 8	$ 6	$ 76	$ 23	$ 306
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	1	$ 9	$ 7	$ 86	$ 4	$ 126
Generator - 500 kw	2	$ 21	$ 16	$ 200	$ 188	$ 4,160
Grout Pump	1	$ 7	$ 5	$ 66	$ 10	$ 166
Grove 36 Ton Crane (RT640E)	1	$ 68	$ 36	$ 616	$ 57	$ 1,186
Kubota K008-3 Mini-BH	1	$ 4	$ 3	$ 38	$ 5	$ 88
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 8,408**
Shield and Adapter Plate (lump sum)						$ 200,000
IJS (2, rented 1 month)						$ 16,000
Total Equipment						**$ 552,320**

	Unit Rate
	$ 16,000

MATERIALS

Description	LF	Unit Cost	Total
RCB for Jacking	200	$ 1,800	$ 360,000
Geotechnical Instrumentation (lump sum)			$ 5,000
Lubrication (lump sum)			$ 2,500
Total Materials			**$ 367,500**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Rate/Day	Total
Muck Hauling (15'W x 7'H x 200'L)	1.3	1011	$ 15		$ 15,167
Shield Manufacturer Rep (lump sum)					$ 5,000
Railroad Flagman				$ 1,800	$ 72,000
Track releveling (lump sum)					$ 9,000
Dewatering Sub (lump sum)					$ 50,000
Total Subs					**$ 136,000**

Total Cost for Activity **$ 1,261,460**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Contact Grout

GENERAL — Tunnel ID: 12th Street Outfall Railroad Crossing

Duration	6 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0	0	$ 80	$ 120	$ -
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	2	1	10	$ 53	$ 80	$ 1,166
Laborer (unskilled)	1	1	10	$ 39	$ 59	$ 429
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,069**
Total Labor						**$ 18,414**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	0	$ 33	$ 25	$ 314	$ 42	$ -
Compressor - 375 cfm	1	$ 8	$ 6	$ 76	$ 23	$ 306
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	1	$ 9	$ 7	$ 86	$ 4	$ 126
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	1	$ 7	$ 5	$ 66	$ 10	$ 166
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	1	$ 8	$ 6	$ 76	$ 6	$ 136
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 2,376**
Total Equipment						**$ 14,256**

MATERIALS

Description	Cubic Yds	Unit Cost	Total
Cement Grout	20	$ 200	$ 4,000
Total Materials			**$ 4,000**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Rate/Day	Total
Railroad Flagman				$ 1,800	$ 10,800
Total Subs					**$ 10,800**

Total Cost for Activity **$ 47,470**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Demobilization

GENERAL — Tunnel ID: 12th Street Outfall Railroad Crossing

Duration	2 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.25	2.5	$ 80	$ 120	$ 200
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,115**
Total Labor						**$ 6,230**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pipe Carrier	0	$ 20	$ 15	$ 190	$ 15	$ -
Pump Submersible - 2"	0	$ 1	$ 1	$ 10	$ 1	$ -
Total Daily Equipment						**$ 2,336**
Total Equipment						**$ 4,672**

SUBCONTRACTORS

Description	Total
Trucking and Equipment Transportation (lump sum)	$ 7,000
Total Subs	**$ 7,000**

Total Cost for Activity **$ 17,902**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Mobilization

GENERAL — Tunnel ID: 12th Street Outfall Highway 85 Crossing

Duration	2 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.5	5	$ 80	$ 120	$ 400
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,315**
Total Labor						**$ 6,630**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pipe Carrier	0	$ 20	$ 15	$ 190	$ 15	$ -
Pump Submersible - 2"	0	$ 1	$ 1	$ 10	$ 1	$ -
Total Daily Equipment						**$ 2,336**
Total Equipment						**$ 4,672**

SUBCONTRACTORS

Description	Total
Trucking and Equipment Transportation (lump sum)	$ 10,000
Total Subs	**$ 10,000**

Total Cost for Activity **$ 21,302**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Permeation Grouting

GENERAL Tunnel ID: 12th Street Outfall Highway 85 Crossing

Duration	12 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	0	0.5	5	$ 80	$ 120	$ -
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	0	1	10	$ 53	$ 80	$ -
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	0	1	10	$ 74	$ 111	$ -
Total Daily Labor						**$ 1,518**
Total Labor						**$ 18,216**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	0	$ 76	$ 57	$ 722	$ 88	$ -
Cat 950H Loader	0	$ 33	$ 25	$ 314	$ 42	$ -
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	0	$ 1	$ 1	$ 10	$ 1	$ -
Total Daily Equipment						**$ -**
Total Equipment						**$ -**

MATERIALS

Description	Total
Total Materials	**$ -**

SUBCONTRACTORS

Description	Total
Grouting Sub (lump sum)	$ 400,000
Total Subs	**$ 400,000**

Total Cost for Activity $ 418,216

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Launch Shaft

GENERAL Tunnel ID: 12th Street Outfall Highway 85 Crossing

Duration	5 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.5	5	$ 80	$ 120	$ 400
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	2	1	10	$ 74	$ 111	$ 1,628
Total Daily Labor						**$ 4,129**
Total Labor						**$ 20,645**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 2,376**
Total Equipment						**$ 11,880**

MATERIALS

Description	Total
Concrete for thrust blocks and mud mat	$ 5,000
Trench boxes for shoring	$ 2,500
Total Materials	**$ 7,500**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Total
Dewatering Sub (lump sum)				$ 20,000
Muck Hauling (20'W x 22'L x 19'D)	1.3	403	$ 15	$ 6,038
Total Subs				**$ 26,038**

Total Cost for Activity $ 66,063

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Receiving Shaft

GENERAL Tunnel ID: 12th Street Outfall Highway 85 Crossing

Duration	2 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	0	1	10	$ 80	$ 120	$ -
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 2,915**
Total Labor						**$ 5,830**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
Total Daily Equipment						**$ 2,376**
Total Equipment						**$ 4,752**

MATERIALS

Description	Total
Trench boxes for shoring	$ 2,500
Total Materials	**$ 2,500**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Total
Dewatering Sub (lump sum)				$ 20,000
Muck Hauling (18'W x 12'L x 18'D)	1.3	187	$ 15	$ 2,808
Total Subs				**$ 22,808**

Total Cost for Activity **$ 35,890**

North Greeley Downtown Basin
Storm Drainage Master Plan

Guide Rails

GENERAL Tunnel ID: 12th Street Outfall Highway 85 Crossing

Duration	6 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.25	2.5	$ 80	$ 120	$ 200
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	2	1	10	$ 53	$ 80	$ 1,166
Laborer (unskilled)	1	1	10	$ 39	$ 59	$ 429
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,269**
Total Labor						**$ 19,614**

EQUIPMENT *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	1	$ 7	$ 5	$ 66	$ 10	$ 166
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	1	$ 8	$ 6	$ 76	$ 6	$ 136
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40
GBM Jack and Guide	1	$ 60	$ 45	$ 570	$ 12	$ 690
Total Daily Equipment						**$ 3,368**
Total Equipment						**$ 20,208**

MATERIALS

Description	Qty	Unit Cost	Total
12" Steel Pipe (per ft)	320	$ 35	$ 11,200
Grout inside pipes (per cy)	9.3	$ 147	$ 1,368
Total Materials			**$ 12,568**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Rate/Day	Total
Railroad Flagman				$ 1,800	$ 10,800
Total Subs					**$ 10,800**

Total Cost for Activity **$ 63,190**

North Greeley Downtown Basin
Storm Drainage Master Plan

Tunnel Excavation

GENERAL — Tunnel ID: 12th Street Outfall Highway 85 Crossing

Duration	32 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total	
Superintendent	1	0.5	5	$ 80	$ 120	$ 400	
Foreman	1	1	10	$ 60	$ 90	$ 660	
Laborer (skilled)	2	1	10	$ 53	$ 80	$ 1,166	
Laborer (unskilled)	3	1	10	$ 39	$ 59	$ 1,287	
Equipment Operator	2	1	10	$ 74	$ 111	$ 1,628	
Total Daily Labor						**$ 5,141**	
Total Labor							**$ 164,512**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total	
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602	
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734	
Compressor - 375 cfm	1	$ 8	$ 6	$ 76	$ 23	$ 306	
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -	
Fan - 60 hp	1	$ 9	$ 7	$ 86	$ 4	$ 126	
Generator - 500 kw	2	$ 21	$ 16	$ 200	$ 188	$ 4,160	
Grout Pump	1	$ 7	$ 5	$ 66	$ 10	$ 166	
Grove 36 Ton Crane (RT640E)	1	$ 68	$ 36	$ 616	$ 57	$ 1,186	
Kubota K008-3 Mini-BH	1	$ 4	$ 3	$ 38	$ 5	$ 88	
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -	
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40	
Total Daily Equipment		**Unit Rate**				**$ 8,408**	
Shield and Adapter Plate (lump sum)						$ 200,000	
IJS (2, rented 1 month)		$ 16,000				$ 16,000	
Total Equipment							**$ 485,056**

MATERIALS

Description	LF	Unit Cost	Total	
RCB for Jacking	160	$ 1,810	$ 289,600	
Geotechnical Instrumentation (lump sum)			$ 5,000	
Lubrication (lump sum)			$ 2,500	
Total Materials				**$ 297,100**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Rate/Day	Total	
Muck Hauling (14'W x 8'H x 160'L)	1.3	863	$ 15		$ 12,942	
Shield Manufacturer Rep (lump sum)					$ 5,000	
Dewatering Sub (lump sum)					$ 55,000	
Total Subs						**$ 60,000**

Total Cost for Activity **$ 1,006,668**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Contact Grout

GENERAL — Tunnel ID: 12th Street Outfall Highway 85 Crossing

Duration	6 days
Hrs/shift	10 hours
Days/Wk	5 days

LABOR — *OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total	
Superintendent	1	0	0	$ 80	$ 120	$ -	
Foreman	1	1	10	$ 60	$ 90	$ 660	
Laborer (skilled)	2	1	10	$ 53	$ 80	$ 1,166	
Laborer (unskilled)	1	1	10	$ 39	$ 59	$ 429	
Equipment Operator	1	1	10	$ 74	$ 111	$ 814	
Total Daily Labor						**$ 3,069**	
Total Labor							**$ 18,414**

EQUIPMENT — *OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total	
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602	
Cat 950H Loader	0	$ 33	$ 25	$ 314	$ 42	$ -	
Compressor - 375 cfm	1	$ 8	$ 6	$ 76	$ 23	$ 306	
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -	
Fan - 60 hp	1	$ 9	$ 7	$ 86	$ 4	$ 126	
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -	
Grout Pump	1	$ 7	$ 5	$ 66	$ 10	$ 166	
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -	
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -	
Grout Mixer	1	$ 8	$ 6	$ 76	$ 6	$ 136	
Pump Submersible - 2"	2	$ 1	$ 1	$ 10	$ 1	$ 40	
Total Daily Equipment						**$ 2,376**	
Total Equipment							**$ 14,256**

MATERIALS

Description	Cubic Yds	Unit Cost	Total	
Cement Grout	18	$ 200	$ 3,600	
Total Materials				**$ 3,600**

SUBCONTRACTORS

Description	Bulking	Muck Vol (cy)	Haul Cost (cy)	Rate/Day	Total	
Railroad Flagman				$ 1,800	$ 10,800	
Total Subs						**$ 10,800**

Total Cost for Activity **$ 47,070**

LITHOS ENGINEERING

North Greeley Downtown Basin
Storm Drainage Master Plan

Demobilization

GENERAL

Tunnel ID: 12th Street Outfall Highway 85 Crossing

Duration	2	days
Hrs/shift	10	hours
Days/Wk	5	days

LABOR

*OT rate takes effect after 8 hrs worked per day

Description	Number	Shifts	Hours	ST Rate/Hr	OT Rate/Hr*	Total
Superintendent	1	0.25	2.5	$ 80	$ 120	$ 200
Foreman	1	1	10	$ 60	$ 90	$ 660
Laborer (skilled)	1	1	10	$ 53	$ 80	$ 583
Laborer (unskilled)	2	1	10	$ 39	$ 59	$ 858
Equipment Operator	1	1	10	$ 74	$ 111	$ 814
Total Daily Labor						**$ 3,115**
Total Labor						**$ 6,230**

EQUIPMENT

*OT rate takes effect after 8 hrs worked per day

Description	Number	ST Rate/Hr	OT Rate/Hr*	Equip Cost	Operating Cost/Hr	Total
Cat 330 Excavator	1	$ 76	$ 57	$ 722	$ 88	$ 1,602
Cat 950H Loader	1	$ 33	$ 25	$ 314	$ 42	$ 734
Compressor - 375 cfm	0	$ 8	$ 6	$ 76	$ 23	$ -
Compressor - 900 cfm	0	$ 18	$ 14	$ 172	$ 55	$ -
Fan - 60 hp	0	$ 9	$ 7	$ 86	$ 4	$ -
Generator - 500 kw	0	$ 21	$ 16	$ 200	$ 188	$ -
Grout Pump	0	$ 7	$ 5	$ 66	$ 10	$ -
Grove 36 Ton Crane (RT640E)	0	$ 68	$ 36	$ 616	$ 57	$ -
Kubota K008-3 Mini-BH	0	$ 4	$ 3	$ 38	$ 5	$ -
Grout Mixer	0	$ 8	$ 6	$ 76	$ 6	$ -
Pipe Carrier	0	$ 20	$ 15	$ 190	$ 15	$ -
Pump Submersible - 2"	0	$ 1	$ 1	$ 10	$ 1	$ -
Total Daily Equipment						**$ 2,336**
Total Equipment						**$ 4,672**

SUBCONTRACTORS

Description	Total
Trucking and Equipment Transportation (lump sum)	$ 7,000
Total Subs	**$ 7,000**

Total Cost for Activity **$ 17,902**

APPENDIX F - MASTER PLAN MAP

CLICK HERE TO VIEW MASTER PLAN MAPS

CLICK HERE TO VIEW EASY TO PRINT 12TH STREET MASTER PLAN MAPS

CLICK HERE TO VIEW EASY TO PRINT 7TH STREET MASTER PLAN MAPS

CLICK HERE TO VIEW EASY TO PRINT 14TH AVENUE MASTER PLAN MAPS

APPENDIX G - MASTER PLAN PROFILES

CLICK HERE TO VIEW MASTER PLAN PROFILES

CLICK HERE TO VIEW EASY TO PRINT 12TH STREET MASTER PLAN PROFILES

CLICK HERE TO VIEW EASY TO PRINT 7TH STREET MASTER PLAN PROFILES

CLICK HERE TO VIEW EASY TO PRINT 14TH AVENUE MASTER PLAN PROFILES