



7000 South Yosemite Street, Suite 120 Centennial, CO 80112 303-221-0802



www.iconeng.com





## ICON ENGINEERING, INC.

7000 S. Yosemite Street, Suite 120, Centennial, CO 80112 303.221.0802 | www.iconeng.com

September 4, 2019

Mr. Andrew Fisher, P.E., CFM City of Greeley Stormwater Division Project Manager 1001 9<sup>th</sup> Avenue Greeley, CO 80631

#### Sharktooth Bluffs Basin Storm Drainage Master Plan RE:

Dear Mr. Fisher:

ICON Engineering, Inc. is pleased to submit the Final Conceptual Design Report for the Sharktooth Bluffs Storm Drainage Master Plan. This submittal includes revisions to the report based on comments received on the DRAFT Conceptual Design Report.

We believe this report will provide a solid framework to assist in prioritizing storm drainage improvements to ease flooding concerns and guide development in the watershed.

Once again, we would like to acknowledge the City'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

Jacque Michaelsen Jeromy Deischer

Jaclyn Y. Michaelsen, P.E., CFM **Project Engineer** 

Jeremy K. Deischer, P.E. **Project Engineer** 





## TABLE OF CONTENTS

ES E	Executive Summary	1
ES 1	1.0 Purpose and Objective	1
ES 2	2.0 Planning Process	1
ES S	3.0 Project Area Description	1
ES 4	4.0 Alternative Analysis	4
ES 5	5.0 Master Plan	∠
1.0	Introduction	14
1.1	Authorization	14
1.2	Purpose and Scope	14
1.3	Planning Process	14
1.4	Mapping and Survey	14
1.5	Data Collection	14
1.6	Acknowledgements	15
2.0	Study Area Description	16
2.1	Project Area	16
2.2	Land use	16
2.3	Outfall Descriptions	17
2.4	City of Greeley Long Term Growth Area	20
3.0	Hydrologic Analysis	24
3.1	Overview	24
3.2	Colorado Urban Hydrograph Procedure	24
3.3	Design Rainfall	24
3.4	Subwatershed Characteristics	24
3.5	Hydrograph Routing	25
3.6	Results of Analysis	26
4.0	Hydraulic Analysis	31
4.1	Previous Analysis	31
4.2		
4.3	-	
5.0	Alternative Analysis	41
5.1		
5.2		

5.3	Alternative Categories
5.4	Alternative Hydraulics
5.5	Alternative Costs
5.6	Alternative Plans
5.7	Benefit Cost Analysis
5.8	Other Considerations
6.0	Recommended Plan
6.1	Plan Description
6.2	Water Quality Impacts
6.3	Operation and Maintenance
6.4	Environmental and Safety Assessment
7.0	Concentual Design
7.0	Conceptual Design
7.1	Plan Development Overview
-	
7.1	Plan Development Overview
7.1 7.2	Plan Development Overview Master Plan Description
7.1 7.2 7.3	Plan Development Overview Master Plan Description Benefit Cost Analysis
7.1 7.2 7.3 7.4	Plan Development Overview Master Plan Description Benefit Cost Analysis Prioritization and Phasing
<ul><li>7.1</li><li>7.2</li><li>7.3</li><li>7.4</li><li>7.5</li></ul>	Plan Development Overview Master Plan Description Benefit Cost Analysis Prioritization and Phasing Stream Buffer Width
7.1 7.2 7.3 7.4 7.5 7.6	Plan Development Overview Master Plan Description Benefit Cost Analysis Prioritization and Phasing Stream Buffer Width Stream Management Corridor
7.1 7.2 7.3 7.4 7.5 7.6 7.7	Plan Development Overview Master Plan Description Benefit Cost Analysis Prioritization and Phasing Stream Buffer Width Stream Management Corridor Geomorphic Roadway Crossings
7.1 7.2 7.3 7.4 7.5 7.6 7.7 7.8	Plan Development Overview Master Plan Description Benefit Cost Analysis Prioritization and Phasing Stream Buffer Width Stream Management Corridor Geomorphic Roadway Crossings Water Quality Impacts



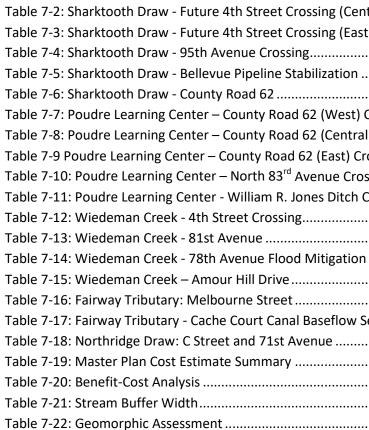
 41
 41
 41
 57
 63
 89
 89
 89
 90
 91
 91
 91
-



## SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN

Tables

Table ES 1: Project Participants	1
Table ES 2: Stream Buffer Width	9
Table ES 3: Geomorphic Analysis	9
Table ES 4: Master Plan Cost Estimate Summary	11
Table 1-1: Data Collected	14
Table 1-2: Project Participants	15
Table 2-1: Existing Land Use Classification	17
Table 2-2: Future Land Use Classification	17
Table 2-3: Long Term Growth Area	20
Table 3-1: 1- and 6-hr Rainfall Depth	24
Table 3-2: Watershed SWMM Modeling Abbreviations	25
Table 3-3: Future Land Use Proposed Detention Basin Sizing	
Table 3-4: Peak Flow Comparison	29
Table 4-1: Existing Facilities Inventory	
Table 4-2: Existing Detention Basin Capacity	34
Table 5-1: Sharktooth Draw - Minimum Criteria Alternatives	43
Table 5-2: Sharktooth Draw - Flood Control and Flood Hazard Mitigation Alternatives	43
Table 5-3: Sharktooth Draw Alternative Costs	44
Table 5-4: Poudre Learning Center Minimum Criteria Alternatives	45
Table 5-5: Poudre Learning Center Flood Mitigation Alternatives	
Table 5-6: Poudre Learning Center Canal Seperation Alternatives	45
Table 5-7: Poudre Learning Center Alternatives Cost	45
Table 5-8: Wiedeman Creek Minimum Criteria Alternatives	46
Table 5-9: Wiedeman Creek Flood Mitigation Alternatives	47
Table 5-10: Wiedeman Creek Alternative Costs	47
Table 5-11: Poudre River Ranch Alternative Cost	48
Table 5-12: Fairway Tributary Flood Hazard Mitigation Alternatives	48
Table 5-13: Fairway Tributary Canal Seperation Alternatives	48
Table 5-14: Fairway Tributary Alternatives Cost	49
Table 5-15: Northridge Draw Minimum Criteria Alternatives	49
Table 5-16: Northridge Draw Flood Mitigation Alternative	49
Table 5-17: Northridge Draw Canal Baseflow Seperation Alternative	49
Table 5-18: Northridge Draw Alternative Cost Estimates	50
Table 5-19: Benefit-Cost Analysis	50
Table 5-20: Stream Buffer Width	51
Table 6-1: Recommended Plan	58
Table 6-2: Recommended Plan Cost Estimates - Sharktooth Draw and Poudre Learning Center Wate	ersheds59
Table 6-3: Recommended Plan Cost Estimates - Wiedeman Creek, Fairway Tributary, Northridge Dr	aw Watersheds60
Table 7-1: Sharktooth Draw - Future 4th Street Crossing (West)	65



tral)	66
t)	67
	68
	69
Crossing	72
I) Crossing	
ossing	
ssing	
Canal Baseflow Separation	
eapartion	
	91



Figure ES.1: Vicinity Map	2
Figure ES.2: Study Area Map	3
Figure ES 3: Stream Belt Width (Wildland Hydrology, 2013)	8
Figure ES.4: Master Plan Schematic - Sharktooth Draw and Poudre Learning Center	12
Figure ES.5: Master Plan Schematic - Wiedeman Creek, Fairway Tributary, and Northridge Draw	13
Figure 2.1: Vicinity Map	
Figure 2.2: Study Area Map	22
Figure 2.3: Watershed Map	
Figure 3.1: SWMM Peak Flow Discharges	
Figure 3.2: Required Detention for Future Conditions	30
Figure 4.1: FLO-2D Residual Flooding – Baseline Hydrology - 10-yr Design Storm	35
Figure 4.2: FLO-2D Residual Flooding - Baseline Hydrology - 100-yr Design Storm	
Figure 4.3: FLO-2D Residual Flooding - Rain-on-grid - 10-yr Design Storm	37
Figure 4.4: FLO-2D Residual Flooding – Rain-on-grid 100-yr Design Storm	38
Figure 4.5: High Hazard Area Identification – Baseline Hydrology - 10-yr Design Storm	39
Figure 4.6: High Hazard Area Identification – Baseline Hydrology - 100-yr Design Storm	
Figure 5.1: Stream Belt Width (Wildland Hydrology, 2013)	
Figure 5.2: Alternative Map – Sharktooth Draw Watershed	
Figure 5.3: Alternative Map – Poudre Learning Center Watershed	54
Figure 5.4: Alternative Map – Wiedeman Creek Watershed	
Figure 5.5: Alternative Map – Fairway Tributary and Northridge Draw Watershed	
Figure 6.1: Recommended Plan - Sharktooth Draw and Poudre Learning Center Watersheds	
Figure 6.2: Recommended Plan Wiedeman Creek, Fairway Tributary, Northridge Draw Watersheds	
Figure 7.1: Master Plan Schematic - Sharktooth Draw and Poudre Learning Center	86
Figure 7.2: Master Plan Schematic - Wiedeman Creek, Fairway Tributary, and Northridge Draw	87
Figure 7.3: Stream Belt Width (Wildland Hydrology, 2013)	
Figure 7.4: Stream Buffer Widths	92

Appendices

**APPENDIX A - PROJECT CORRESPONDENCE** 

APPENDIX B - HYDROLOGIC ANALYSIS

**APPENDIX C - ALTERNATIVE ANALYSIS** 

**APPENDIX D - CONCEPTUAL DESIGN INFORMATION** 







#### **EXECUTIVE SUMMARY** ES

#### ES 1.0 **PURPOSE AND OBJECTIVE**

The purpose of this study is to develop a storm drainage master plan to be used by the City of Greeley as a guideline for future storm drainage infrastructure within the Sharktooth Bluffs Basin. This study developed design flows, analyzed the existing storm drainage systems, identified problem areas, developed alternatives to mitigate flooding hazards, and provides a preliminary design for future improvements.

#### ES 2.0 **PLANNING PROCESS**

The planning process began by reviewing previous studies within the basin and holding a kickoff meeting with City staff to discuss project goals and objectives. Aside from site specific development reports, most of the basin had not been studied previously. Eastern portions of the basin had previously been included in the 2006 Sheep Draw Comprehensive Drainage Plan. The original Sheep Draw Basin boundary can be seen on Figure ES.1.

Several progress meetings were held throughout the duration of the project. Meeting minutes for each progress meeting can be found in Appendix A. On February 13<sup>th</sup>, 2019 a public meeting was held at the Greeley Family FunPlex to gather community input regarding the baseline hydrology, problem areas, and initial alternatives developed to mitigate flooding hazards throughout the basin.

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

Table	ES	1:	Project	Participants
-------	----	----	---------	--------------

Participant	Representing	Title
Andrew Fisher, P.E., CFM	City of Greeley	Stormwater Capital Projects Engineer
Joel Hemesath	City of Greeley	Public Works Director
Craig Jacobson, P.E., CFM	ICON Engineering, Inc.	Project Manager
Jaclyn Michaelsen, P.E., CFM	ICON Engineering, Inc.	Project Engineer
Jeremy Deischer, P.E.	ICON Engineering, Inc.	Project Engineer
Monica Ramirez, El	ICON Engineering, Inc.	Project Engineer

#### ES 3.0 **PROJECT AREA DESCRIPTION**

The Sharktooth Bluffs Basin, named after fossilized shark teeth found in the area, has a rich history dating back to World War II. The basin was home to a 320 acre World War II Prisoner of War Camp that housed Germans and Austrians from 1944 – 1946. Several years later, in 1961, one of four Atlas E nuclear missile silos constructed in Weld County was built in the basin. The missile site was deactivated in 1965, but still serves as an amenity to the basin, providing tours of the site and is home to a campground. Sharktooth Ski Area, referred to as the world's smallest ski resort, was in operation from 1971-1986. During the construction of the ski area, the fossilized shark teeth, in which the area was named after, were found.

Located within the City of Greeley, Town of Windsor, and unincorporated Weld County, the Sharktooth Bluffs Basin covers an area of approximately 7.8 square miles. Previously known as West Poudre Basin, Sharktooth Bluffs Basin generally slopes from the southwest near 10<sup>th</sup> Street to the northeast where stormwater runoff discharges into the

Cache La Poudre River. The basin is generally bounded by US Highway 257 to the west, the Cache La Poudre to the north, N 71<sup>st</sup> Avenue to the east and 10<sup>th</sup> Street to the south. Of the total basin area, 3.7 square miles are currently within the City of Greeley, with 6.8 square miles located in the City's Long Range Growth boundary.

The current study area encompasses the West Poudre Basin and areas previously studied as part of the Comprehensive Drainage Plan for Sheep Draw Basin in 2006. Four watersheds, Wiedeman Creek, Poudre River Ranch, Fairway Tributary, and Northridge Draw, located in the eastern portion of Sharktooth Bluffs are not directly tributary to Sheep Draw and were incorporated into the Sharktooth Bluffs Basin.

Currently the basin is approximately ten percent built-out with various residential developments in addition to notable landmarks; Missile Site Park, Sharktooth Bluff, Boomerang Links Golf Course, Northridge High School, and Winograd K-8 School. Some commercial properties exist along the eastern edge of the watershed south of Canberra Commons.

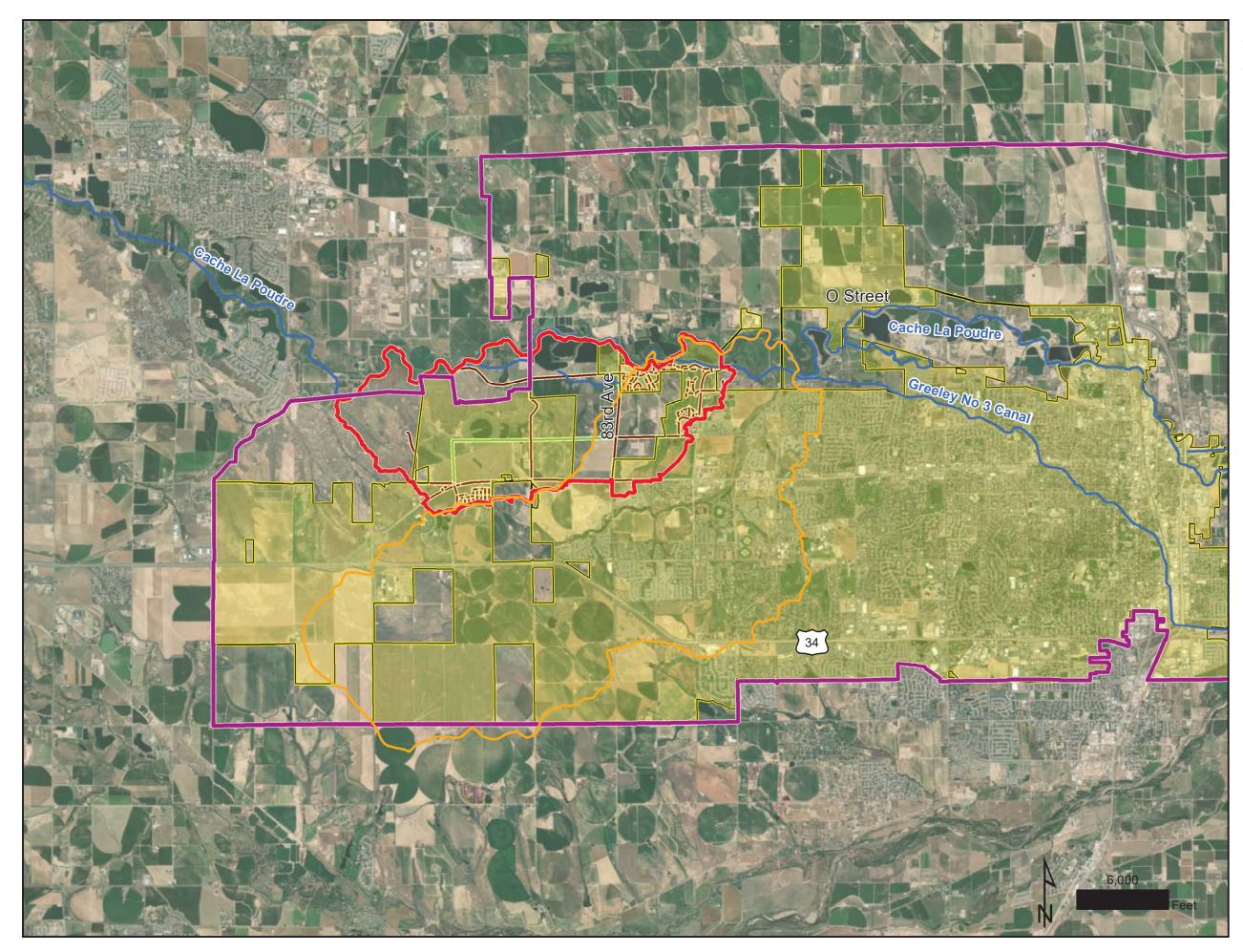
Sharktooth Bluffs Basin is made up of numerous drainageways which outfall into the Cache La Poudre River. These drainageways include; Spur Draw, Hertzke Draw, Orr Gulch, Sharktooth Draw, Poudre Learning Center Tributary, Wiedeman Creek, Fairway Tributary, and Northridge Draw.

Two irrigation canals are found within the watershed. The Greeley No. 3 Canal, a 13-mile long canal conveying flow east through downtown Greeley, originates in the eastern portion of the basin. The William R. Jones Ditch conveys flow from the Cache La Poudre River just east of the bluffs to Siebring Reservoir. Siebring Reservoir, a series of ponds located between N 95<sup>th</sup> Avenue and N 83<sup>rd</sup> Avenue, is a raw water storage facility owned by Central Colorado Water Conservancy District. On the eastern edge of Siebring Reservoir is the Poudre Learning Center, a 65 acre area donated to the local community after the gravel mining operations ceased.

Bisecting the watershed are water transmission lines from the Bellevue Water Treatment Plant.

In the next twenty years, Greeley's population is expected to grow by up to fifty percent, per Greeley's 2035 *Comprehensive Transportation Plan.* Much of this growth will push development west of the downtown area, into the Sharktooth Bluffs Basin. Roadway improvements to 83rd Avenue and 4<sup>th</sup> Street are planned in the 2035 Comprehensive Transportation Plan to accommodate the increase in population, connecting Windsor, Greeley, Milliken and Platteville. Much of the area is currently located within unincorporated Weld County but lies within the City of Greeley Long Term Growth Area.



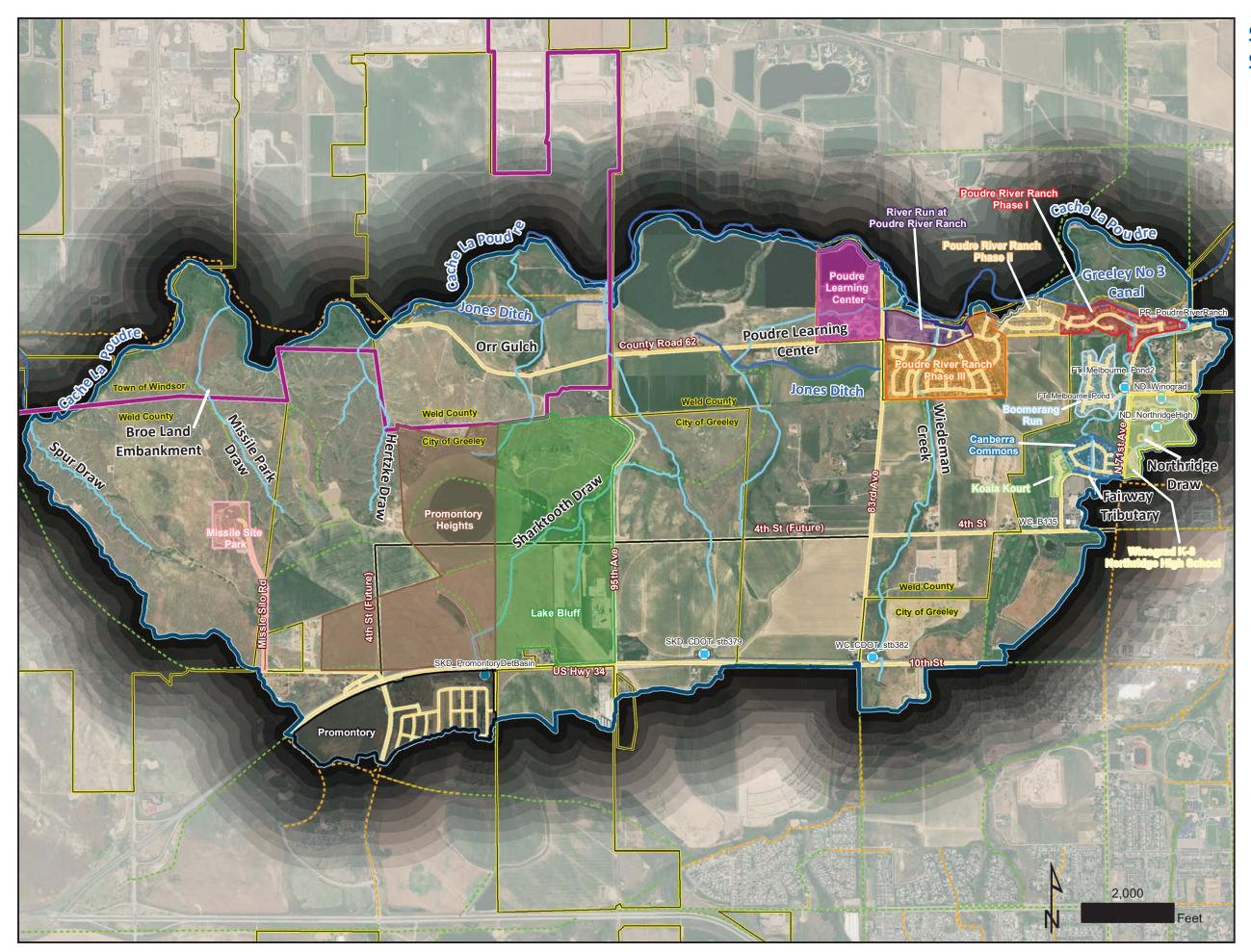


## Figure ES.1 - Vicinity Map

- Sheep Draw Basin
  Long Range Expected Growth Boundary
  Sharktooth Bluffs Boundary
  City of Greeley Boundary
  - Existing Roads
  - Future Roads







## Figure ES.2 - Study Area Map

# Neighborhoods Boomerang Run

- Canberra Commons
- Koala Kourt
- Lake Bluff
- Missile Site Park
- Poudre Learning Center
- Poudre River Ranch Phase I
- Poudre River Ranch Phase II
- Poudre River Ranch Phase III
- Promontory
- Promontory Heights
- River Run at Poudre River Ranch
- Winograd K-8 Northridge High School
- Existing Detention Basin
- Drainageway
- Long Range Expected Growth Boundary
- Basin Boundary
- Jurisdictional Boundary
- ----- Existing Trails
- ----- Future Trails







## ES 3.1 PROJECT AREA HYDROLOGY

A new hydrologic model was prepared for the Sharktooth Bluffs Basin. The model establishes hydrology for the 2-, 5-, 10-, 50-, and 100-year storm frequencies for both existing and future land use conditions. 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 5.1.012 (SWMM) to determine discharges at each design point.

FLO-2D, a two-dimensional hydrodynamic model, was used to develop diversion curves for two separate areas where flow splits were observed to occur.

During the existing conditions evaluations, agricultural irrigation was accounted for by adjusting soil infiltration parameters within the hydrologic model.

City of Greeley stormwater criteria requires any future development to detain to historic 5-year discharges. To evaluate the impact development will have on design flows, a future conditions hydrologic model was developed to simulate the change in land use and estimate the required detention.

### ES 3.2 PROJECT AREA HYDRAULICS

No previous hydraulic analysis had been completed for the watershed. Site specific drainage reports existed independently for each development. For this study, flooding hazards were identified using hydraulic models for the 10-, and 100-year events. Areas of high hazard, representing flood hazards more likely to affect the safety of people and property was also identified for the basin by routing the baseline hydrology through the drainages using FLO-2D. Hydraulic analysis in this study was also completed to evaluate roadway crossings and existing storm drainage systems to determine whether they met current City drainage criteria.

### ES 4.0 ALTERNATIVE ANALYSIS

Alternatives were developed to improve the conveyance of roadway crossings, mitigate existing flooding hazards observed in the hydraulic analysis, and separate stormwater runoff from entering the irrigation canals.

For each roadway crossing, alternatives were developed to increase the conveyance of the crossing to meet current City criteria, allowing overtopping during the 100-year event. An additional alternative to convey the entire 100year discharge without any overtopping was also developed. Flood control and flood hazard mitigation alternatives were also developed to best manage the major split flows occurring, or to alleviate flooding on homes and buildings through drainageway improvements, storm drain systems, or detention.

Finally, guidance regarding the future management of the stream and riparian corridors has also been provided such that natural function of the stream corridors can continue to thrive as development becomes more prevalent in the basin.

## ES 5.0 MASTER PLAN

The Selected Plan identifies the alternatives selected by the project team to include in the Conceptual Design phase of the project. The Selected Plan generally follows the recommended plan alternatives, with the modification to the proposed improvements in Sharktooth Draw. A memo, dated June 11, 2019, summarizes new alternatives for the

basin and explains why the previously proposed alternatives were revised. This memo can be found in <u>Appendix A</u>. In summary, a detention pond and storm drain outfall are now being proposed near 95<sup>th</sup> Avenue and County Road 62, in lieu of extensive channel improvements to the outfall to the Cache La Poudre River. An additional alternative was developed at the Bellevue Pipeline crossing of Sharktooth Draw to provide further protection against future stream erosion.

The master plan improvements are intended to mitigate existing flooding hazards, ensure current and future roadway crossings are compliant with City criteria, to address any channel stability issues and concerns, separate base flows from irrigation ditches, enhance water quality, and provide general guidance for preservation and improvement to the drainageways throughout the Sharktooth Bluffs Basin. Finally, the master plan improvements identify and incorporate trail connections to the regional networks, where applicable.

Culverts were sized for existing conditions land use scenario. Prior to construction and final design, any development that has occurred upstream of the roadway crossing should be added into the existing conditions model to update the design discharge.

Cost estimates can be found in <u>Table ES 4</u>. A schematic of the master plan improvements can be found in <u>Figure ES.4</u> and <u>Figure ES.5</u>.

### ES 5.1 Spur Draw

Spur Draw, the western most watershed in the Sharktooth Basin, is located just east of US Highway 257. Stormwater runoff from the basin sheet flows to the Sharktooth Bluffs where the narrow gullies convey water northwest to the Cache La Poudre River. All flow is confined to the bluff areas. The watershed is currently undeveloped and future land use projects the watershed to remain open space. No roadway crossings, or other infrastructure is currently proposed in the watershed. Beyond monitoring runoff and potential sediment transport from the bluffs areas, no improvements are currently proposed for this watershed.

### ES 5.2 MISSILE PARK DRAW

This 275 acre watershed is bounded by Spur Draw to the west, Hertzke Draw to the east, Sharktooth Draw to the south and Cache La Poudre River to the north. The watershed spans three jurisdictions: Town of Windsor at the downstream end of the watershed, unincorporated Weld County, and the City of Greeley. Similar to Spur Draw, stormwater runoff is conveyed in narrow gullies which converge into a drainageway that bisects the watershed. Near the downstream end of the watershed, in the Town of Windsor and Weld County, there is an approximately 10-foot high embankment which detains flows from continuing north to the Cache La Poudre River. No records were found regarding this being a regulated detention basin or registered state dam.

With exception to ponding that could occur behind this embankment, no other significant drainage problems were identified for this watershed, particularly within the limits of the City of Greeley. Beyond monitoring runoff and potential sediment transport from the bluffs areas, and monitoring the effects of the embankment for water collection, repair, or need to breach, no improvements are currently proposed for this watershed.





### ES 5.3 HERTZKE DRAW

Hertzke Draw, located to the east of Missile Park Draw and west of Sharktooth Draw watersheds, primarily consists of steep gullies conveying stormwater runoff to the north. Upstream of the outfall into the Cache La Poudre River, the watershed transitions from the confined gully drainageway to an alluvial fan. The watershed lies within Town of Windsor, unincorporated Weld County, and City of Greeley. The bluffs in the southeastern portion of the watershed, within the City of Greeley, lie on property proposed to be developed as part of the Promontory Heights Development.

Flooding potential within the watershed is minimal with more flooding potential located in the alluvial zones near the Poudre River. No buildings or structures are shown to be inundated and flooding potential will be lessened with future development in the watershed. Beyond monitoring runoff and potential sediment transport from the bluffs areas, no improvements are currently proposed for this watershed.

### ES 5.4 ORR GULCH

Orr Gulch is bounded by Hertzke Draw to the west and Sharktooth Draw to the south and east. The northern portion of the watershed falls within unincorporated Weld County, while the southern portion is located within the City of Greeley. The portion within the City of Greeley is proposed to remain open space as part of the proposed Lake Bluff Development. The narrow bluff gullies collect stormwater runoff in the headwater of the basin before the flow is spread into an alluvial fan south of County Road 62. North of County Road 62, the William R. Jones Ditch bisects the lower watershed, conveying irrigation flows from the Cache La Poudre River to Siebring Reservoir.

Flooding problems within the watershed are primarily related to ponding south of the William R. Jones Ditch, where flow depths approach 3-feet in what appears to be a historic oxbow from the Cache La Poudre River and potential overtopping of County Road 62. Since this area is located outside of the City of Greeley with no current plans for expansion of this roadway system, no alternatives were evaluated in this watershed.

### ES 5.5 SHARKTOOTH DRAW

Sharktooth Draw extends from south of 10th Street to the Cache La Poudre River. The watershed lies within the City of Greeley and unincorporated Weld County. The headwaters of Sharktooth Draw begin south of 10th Street, east of Promontory Circle near the State Farm property. Stormwater runoff then continues in a northeast direction to the river.

Flooding within the watershed is generally confined near 10<sup>th</sup> Street, then transitions between overland and confined flow through 95<sup>th</sup> Avenue when entering the bluffs region. Downstream, flood flows again become unconfined when Sharktooth Draw splits to the north and the east, in an alluvial pattern, near County Road 62, where nearly half of the 100-year discharge diverts to the Poudre Learning Center watershed.

Problems areas within the watershed focus around overtopping of existing roadway crossings, including: 95<sup>th</sup> Avenue, both north of 10<sup>th</sup> Street and closer to the Poudre River near County Road 62; and County Road 62, which currently has no defined drainage system and is located within Greeley's anticipated expansion area. These areas experience overtopping in both the 10- and 100-year events. In addition to the roadway crossings, the split flow near 95<sup>th</sup> Avenue and County Road 62 has the potential to impact roadway improvements and future development

during the larger storm events (above the 10-year level). Finally, the future expansion of 4<sup>th</sup> Street will require planning as it crosses drainages within the Sharktooh Draw watershed. Currently, the proposed 4<sup>th</sup> Street alignment is proposed to cross three local drainages.

## ES 5.5.1 SHARKTOOTH DRAW – FUTURE 4<sup>TH</sup> STREET CROSSING WEST

The western most future 4<sup>th</sup> Street crossing is located approximately 1600 ft. west of 95<sup>th</sup> Avenue. A 10 ft. wide by 4.5 ft. high RCBC is proposed to convey the 10-year design discharge, while limiting overtopping during the 100-year design storm to a depth less than 6 inches.

## ES 5.5.2 SHARKTOOTH DRAW – FUTURE 4<sup>TH</sup> STREET CROSSING CENTRAL

The central future 4<sup>th</sup> Street crossing is located approximately 700 ft. west of 95<sup>th</sup> Avenue. A 48-inch RCP is proposed to convey flow underneath the road and limit overtopping in accordance with City criteria.

## ES 5.5.3 SHARKTOOTH DRAW – FUTURE 4<sup>TH</sup> STREET CROSSING EAST

The third of the 4<sup>th</sup> Street future crossings of Sharktooth Draw is located approximately 2,000 ft. east of 95<sup>th</sup> Avenue. A 48-inch RCP is proposed such that the future crossing meets City overtopping criteria.

## ES 5.5.4 SHARKTOOTH DRAW – 95<sup>TH</sup> AVENUE CULVERT CROSSING

Approximately 4,200 ft. north of 10<sup>th</sup> Street, Sharktooth Draw crosses 95<sup>th</sup> Street. The existing crossing is undersized to convey flow within City criteria. Flow overtops the roadway to the north of the current culvert crossing, with one to two feet of flooding inundating the roadway during the 100-year event.

Proposed improvements at 95<sup>th</sup> Street to meet City criteria include a dual cell 8 ft. wide by 4.5 ft. high RCBC. Although the roadway will still overtop during the existing conditions 100-year event, overtopping depths are limited to within City criteria.

## ES 5.5.5 SHARKTOOTH DRAW – BELLEVUE PIPELINE STABILITY

Three water mains from the Bellevue Water Treatment Plant cross Sharktooth Bluffs downstream of 95<sup>th</sup> Avenue. Runoff within the drainageway has the potential to erode the channel, exposing the water mains. Cutoff walls are proposed upstream and downstream of the crossing location to stabilize the drainageway at this location.

Prior to installation, further investigation into the actual depths of the pipelines should be done to further confirm the risk and stabilization needs at this location. Depths are unknown at this time.

#### ES 5.5.6 SHARKTOOTH DRAW – COUNTY ROAD 62

As part of the alternatives review process, the Central Colorado Water Conservancy District (CCWCD), the owners of Siebring Reservoir, were engaged to discuss the possibility of discharging stormwater into the reservoir. After discussions with CCWCD, concerns regarding costs to manage the system and water rights of any stormwater discharged in the reservoir determined that the outfall as proposed in one of the alternatives was not feasible. The alternate alignment proposed, channel downstream of County Road 62 parallel to 95th Avenue, was also determined to be infeasible due to the recent development of a gas extraction site spanning west from 95th Avenue.



A supplemental alternative analysis developed four additional alternatives for this area. After discussion with City staff, the chosen improvements in this location include: a regional detention basin to manage existing runoff to the area; a drainage channel paralleling 95<sup>th</sup> Avenue; and a 38 inch by 60 inch horizontal elliptical reinforced concrete pipe (HERCP) storm drain system in 95<sup>th</sup> Avenue, downstream of County Road 62 to the Cache La Poudre River.

The detention basin as proposed will provide a multi-objective function for the local natural area in Sharktooth Draw, providing flood management, but also improving the ecological function, wildlife habitat, and public access within the site. Future trails currently proposed along Sharktooth could be incorporated into the facility located through the bottom and along the top of the facility. The detention facility area would also help promote wildlife through preservation of native vegetation and habitat areas, as well as be designed to provide regional water quality benefits. Natural hydrologic function could continue to exit by conveying bankfull, base, flows undetained through the pond area, up to the capacity of the proposed downstream infrastructure and acceptable roadway overtopping. Pond landscaping could include seeding with drought-tolerant native seed mixes, infrequent or no-mow areas. Any needed mowing practices could occur outside of ground-nesting bird seasons in the spring.

The proposed detention basin layout for the conceptual design is such that it does not exceed the requirements of a jurisdictional dam in the State of Colorado. However, given the changing dam safety requirements, it is still recommended that the City consult the State for current guidance prior to purchasing land or designing the detention facility.

Similar to other improvements mentioned above, the pond has been sized for existing conditions discharges to reduce overtopping at 95<sup>th</sup> Avenue and County Road 62 to meet City Criteria, as if no changes in hydrology occur upstream. Prior to implementation, the pond site should be reevaluated to determine if upstream development has reduced flows and volume into the pond. The downstream channel and pipe system at 95<sup>th</sup> Avenue and County Road 62 has been sized for future discharges as if all proposed development is in place. Once development is in place, the pond may be significantly reduced, or not needed altogether. This scenario would be indicative of Alternative D, as presented in the supplemental alternatives analysis found in <u>Appendix A</u>. Regardless of the proposed detention facility, all developments in the Sharktooth Draw Basin are to adhere to current City of Greeley detention standards, detaining to the 5-yr historic discharge.

Similarly, it should be noted that under existing conditions, these alternatives, as proposed, will still result in overtopping of County Road 62, following the existing flow path, north to the Cache La Poudre River. As the basin develops further, this overtopping will eventually be eliminated.

### ES 5.6 POUDRE LEARNING CENTER

The Poudre Learning Center watershed extends from the Cache La Poudre River south to 10th Street, between N 83rd Avenue to the east and N 95th Avenue to the west. Flow in the upper portion of the watershed primarily consists of sheet flow down into the bluffs. The stormwater runoff spreads from the confined flow in the bluffs into an alluvial fan south of County Road 62. Flow crosses the William R. Jones Ditch and County Road 62 into Siebring Reservoir. An outlet channel from the most eastern portion of Siebring Reservoir conveys flow east to 83rd Avenue before the outfall location into the Cache La Poudre River.

Future development near the Poudre Learning Center Basin is zoned to occur in the areas where potential flooding is shown in the models. For these future developments to be protected, careful consideration should be taken in site layout and future storm drainage infrastructure.

An out-building is potentially inundated from flooding, north of the Jones Ditch near the westernmost sump location. Even after improvements are made to the western spill flows in the Sharktooth Draw basin, this building may remain in a potential inundation area due to its proximity with the canal. No other buildings are identified to be inundated during the existing conditions 100-year event; however, it should be noted that an oil and gas well site does exist within the headwaters channel of the draw, near the future 4<sup>th</sup> Street alignment.

Discharges at the future 4<sup>th</sup> Street alignment remain less than 100-cfs at this location; therefore, improvement alternatives were not developed within the Poudre Learning Center watershed for the roadway system.

## ES 5.6.1 POUDRE LEARNING CENTER - COUNTY ROAD 62 (WEST) CROSSING

The westernmost crossing of the Poudre Learning Center is located approximately 3,000 ft. east of 95<sup>th</sup> Avenue. Dual 10 ft. wide by 4 ft. high RCBCs are proposed to limit overtopping to City criteria. The culvert is proposed to be installed in a sump condition discharging towards the quarry area located in the center of the western flow path.

## ES 5.6.2 POUDRE LEARNING CENTER – COUNTY ROAD 62 (CENTRAL) CROSSING

The central crossing of Poudre Learning Center at County Road 62 is located approximately 2,300 ft. west of North 83<sup>rd</sup> Avenue. A 36 inch RCP culvert is proposed to provide adequate conveyance underneath the roadway and Poudre River trail for the localized sump. The proposed culvert will discharge into the swale in the Poudre Learning Center property.

## ES 5.6.3 POUDRE LEARNING CENTER – COUNTY ROAD 62 (EAST) CROSSING

The easternmost crossing of County Road 62 is located approximately 150 ft. west of North 83<sup>rd</sup> Avenue. A 6 ft. wide by 4 ft. tall RCBC is proposed to convey flow through the roadway crossing, limiting overtopping to City criteria. Downstream of the culvert, channel grading is proposed to convey the flow to the main stem of the Poudre Learning Center channel just west of 83<sup>rd</sup> Avenue.

## ES 5.6.4 POUDRE LEARNING CENTER – NORTH 83<sup>RD</sup> AVENUE CROSSING

Approximately 650 ft. north of County Road 62, a dual cell 13 foot wide by 6 foot tall RCBC is proposed to convey flow underneath 83<sup>rd</sup> Avenue to the Cache La Poudre River. 83<sup>rd</sup> Avenue is a major arterial, requiring 100-year conveyance capacity of the culvert with no overtopping.

## ES 5.6.5 POUDRE LEARNING CENTER – WILLIAM R. JONES CANAL BASEFLOW SEPARATION

In the Poudre Learning Center Basin, flow crosses an old remnant of the William R. Jones Ditch and County Road 62 into Siebring Reservoir. The Jones Ditch downstream of Siebring Reservoir is no longer used for irrigation purposes. During storm events, the Jones Ditch has the potential to intercept runoff from flow exiting the Poudre Learning Center main draw, and from backwater behind County Road 62. Formalizing a spill location just upstream of 83<sup>rd</sup> Avenue is proposed to help mitigate flooding hazards on downstream property created from uncontrolled spill flows.







#### ES 5.7 WIEDEMAN CREEK

The Wiedeman Creek watershed extends from the Cache La Poudre River south beyond 10th Street. The watershed lies within the City of Greeley and unincorporated Weld County. Runoff generally drains from south of 10th Street, north to the Cache La Poudre River. Poudre River Ranch Phase III and the River Run at Poudre River Ranch Phases I and II developments are present within this watershed. Two main drainage patterns convey flow through Poudre River Ranch. Street flooding along Poudre River Road and North 81st Avenue pose flooding hazards with flooding depths exceeding City maximum flow depth criteria. Additional flood hazards were identified south of the 4th Street roadway crossing, east of Wiedeman Creek in a localized sump area.

## ES 5.7.1 WIEDEMAN CREEK – 4<sup>TH</sup> STREET CROSSING

Wiedeman Creek crosses 4<sup>th</sup> Street approximately 900 ft. east of 83<sup>rd</sup> Avenue. A proposed 6 ft. wide by 4 ft. high RCBC will convey flows such that overtopping during the 100-year event is within City overtopping criteria.

## ES 5.7.2 WIEDEMAN CREEK – 81<sup>ST</sup> AVENUE

Primary problems within the Wiedeman Creek watershed focus on drainage within the Poudre River Ranch Phase III development. Infrastructure within the development is undersized for existing conditions design flows. As flow enters the development, the undersized 7 ft. wide by 4 ft. tall RCBC leads to flow overtopping Skyview Street in excess of City criteria. Downstream of Skyview Street, the drainage system continues in an open channel parallel 81<sup>st</sup> Avenue before the system is intercepted in a 5 foot wide by 4 foot tall RCBC. Flows in excess of the storm drain system spill onto 81<sup>st</sup> Avenue, resulting in flood depths exceeding City criteria. Two homes are inundated west of the 5 foot by 4 foot box culvert entrance where flow spills onto 81<sup>st</sup> Avenue.

Upstream of the development, a 22.7 Ac-ft. regional detention basin is proposed to mitigate the flooding hazards. A 72 inch RCP is proposed as the outlet structure to the facility, limiting the peak release such that the downstream infrastructure meets City criteria at Skyview Street and 81<sup>st</sup> Avenue.

Construction of a detention basin could provide the City can opportunity to work with the surrounding land owners to minimize costs of the pond while maximizing the potential benefit of the pond. Future development in the area could use the detention pond footprint to help minimize the remaining on-site detention requirements, thus promoting a working relationship between the City and development groups.

The proposed detention pond has been designed such that it does not exceed the requirements of a jurisdictional dam in the State of Colorado. However, given the changing dam safety requirements, it is still recommended that the City consult the State for current guidance prior to purchasing land or designing the detention facility.

Prior to implementation of the detention pond, the pond would need to be re-evaluated based upon upstream development and possible reduction in volume. Regardless of the proposed detention facility, all developments in the Wiedeman Creek Basin are to adhere to current City of Greeley detention standards, detaining to the 5-yr historic discharge.

Similarly to in Sharktooth Draw, the proposed detention pond in could provide a multi-objective function for a natural area. A future trail is currently proposed to extend along Wiedeman Creek through the proposed detention basin. The detention facility would also promote wildlife activities by maintaining adequate flows to preserve native vegetation and habitat, as well to improve water quality. It should be noted that the conceptual design cost estimate for the pond assumes minimal facility enhancements since the pond itself may no longer be needed as the upstream property develops.

## ES 5.7.3 WIEDEMAN CREEK – 78<sup>TH</sup> AVENUE

At the upstream end of Poudre River Ranch Phase III at 78<sup>th</sup> Avenue, offsite flow inundates one structure along the west side of 78<sup>th</sup> Avenue. A swale is proposed south of the Poudre River Ranch Phase III development to capture flows from the south east to 78<sup>th</sup> Avenue. A combination of storm drain and surface flow conveyance will carry the flow north, meeting City of Greeley depth criteria without inundating structures.

### ES 5.7.4 WIEDEMAN CREEK – AMOUR HILL DRIVE

An existing 30 inch storm drain intercepts stormwater runoff from the agricultural land east of Amour Hill Drive. The shallow unconfined flow from the Wiedeman Family Farm runoff potentially inundates two structures as the stormwater continues west to Amour Hill Drive. The storm drain flow is conveyed west between two residential properties where the flow is discharged into an open channel between N 78th Avenue and Amour Hill Drive. The open channel is conveyed underneath Poudre River Road in a 36-inch storm drain which outfalls in the same open channel as the storm drain in N 78th Avenue. The capacity in the existing storm drain is greatly reduced by the slope of the system.

Improving the slope of the system at Armor Hill Drive will greatly increase the capacity of the system. Relaying the 30 inch storm drain as it crosses Amour Hill Drive will collect the majority of the flow. The flow that is not collected in the proposed system will travel overland through a defined channel to Amour Hill Drive.

The improvements also consist of replacing two inlets on Amour Hill Drive, one manhole and relaying 55ft of 30-inch pipe. Since this project improves the drainage on the existing system, any changes to future hydrology are not anticipated to impact this proposed improvement.

#### ES 5.8 **FAIRWAY TRIBUTARY**

The Fairway Tributary Watershed extends from the Greeley No. 3 Canal south past Dundee Court. The watershed lies within the City of Greeley and unincorporated Weld County. Stormwater runoff is conveyed from the south through Boomerang Links Golf Course north to Poudre River Road in the Poudre River Ranch Phase I development. Runoff is ultimately discharged into the Greeley No. 3 Canal.

Flows near the upstream end of the watershed meander through the golf course converging at the corner of C Street and Melbourne Street. Baseline hydrologic modeling does not account for the unformalized and inadvertent detention on the golf course and indicates overtopping of Melbourne Street at a depth less than 6 inches. Overtopping flows not intercepted by the storm drain inlet at the C Street and Melbourne Street intersection continue north along 71<sup>st</sup> Avenue into the Northridge Draw Watershed.

Runoff from the Wiedeman Family Farm property on the northwest edge of the watershed is conveyed in a northeast direction, crossing Vallevue Drive to the east where flows enter a storm drain crossing Poudre River Road. The storm drain continues north and is flumed in the 36 inch storm drain over the Greeley No. 3 Canal.





### ES 5.8.1 FAIRWAY TRIBUTARY – MELBOURNE STREET

The proposed storm drain system improvements at Melbourne Street include intercepting flow from Boomerang Links Golf Course south of Melbourne Street. A proposed 42 inch RCP storm drain will convey the discharge into the existing Northridge Draw channel north of C Street.

The improvement requires removal of a portion of the existing storm drain system, resetting the existing inlet laterals at West C Street and 71<sup>st</sup> Avenue, and CDOT Type D inlets to collect water from the fairway.

Minor channel improvements to the drainageway will be required upstream and downstream of the storm drain system in order to promote drainage.

The culvert was sized for existing conditions land use scenario. Prior to construction and final design, any development that has occurred upstream of the roadway crossing should be added into the existing conditions model to update the design discharge.

## ES 5.8.2 FAIRWAY TRIBUTARY - CACHE COURT CANAL BASEFLOW SEPARATION

To separate stormwater flow from the Greeley No. 3 Canal, a flume is proposed just west of Cache Court. Conveying the flows over the canal and discharging the stormwater into the open space north of the canal will reduce flows in excess of the decreed flow entering the canal that pose flooding hazarding downstream. Improvements to the open space north of the canal include a low flow crossing such that the open space trail is not inundated by nuisance runoff.

### ES 5.9 NORTHRIDGE DRAW

On the eastern edge of the basin, Northridge Draw is home to Northridge High School, Winograd K-8, and Northridge Estates. Runoff drains from south to north, passing through the school property to C Street where the existing drainageway continues north onto private property. No formal conveyance is provided north of C Street with flows overtopping 71<sup>st</sup> Avenue to the north, at a depth less than six inches, into the Foothills Tributary Watershed. At the downstream end of the watershed stormwater runoff is discharged into the Greeley No. 3 Canal.

## ES 5.10 NORTHRIDGE DRAW – C STREET AND 71<sup>ST</sup> AVENUE

The proposed storm drain system proposed in the Fairway Tributary discharges into an existing swale north of C Street. The Winograd detention basin also contributes to the existing swale, conveying flow from south of C Street to the north through the 18 inch RCP outlet. The existing drainage swale is proposed to convey flow north to an existing retention pond. A 42 inch RCP outlet is proposed to intercept any runoff in excess of the normal water pool elevation and discharge to the northwest. A CDOT Type D inlet will intercept flow near 71<sup>st</sup> Avenue in a 42 inch RCP storm drain system. The culvert will discharge into an existing drainage swale that will convey flow north to 71<sup>st</sup> Street.

Approximately 5 acres of easement acquisition is proposed. Property acquisition costs were estimated based from a unit cost per acre. Property acquisition may or may not be needed should the City take on management of the drainage swale and retention pond.

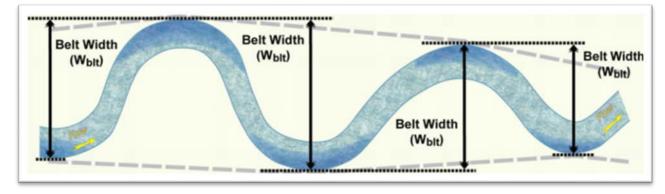
At 71<sup>st</sup> Avenue, a proposed inlet will collect the 100-year flow of 71 cfs and convey it into a proposed 42 inch storm drain system that will discharge into a drainage swale along the south side of 71<sup>st</sup> Avenue. The swale will be conveyed under 71<sup>st</sup> Avenue into an existing detention pond in the Poudre River Ranch Phase I development. Slight regrading of the existing detention basin from Poudre River Drive downstream is proposed to encourage better drainage in the area.

A 7 foot wide by 3 foot deep flume is proposed to be installed at the existing spillway elevation of the pond. The flume will convey flows to the north side of the Greeley No. 3 ditch, separating stormwater runoff from the Greeley No. 3 Canal. On the north side of the canal, flow will travel to 71<sup>st</sup> Avenue where a proposed 24 inch culvert will increase the drainage capacity of the two existing RCP crossing. East of 71<sup>st</sup> Avenue, the flow is conveyed along the historic drainage path in a wetland channel continuing into the Sheep Draw Basin. The wetland channel, within the 100-year Cache La Poudre River floodplain, outfalls into the Poudre River approximately 200 feet upstream of the main stem of Sheep Draw.

CDOT Type D inlets were estimated as the pond outlet to maintain the existing pool elevation in the pond such that the facility is used for stormwater detention beyond the current storage elevations. The official water right requirements associated with the existing retention pond should be investigated prior to implementation.

### ES 5.11 STREAM BUFFER WIDTH

In order to ensure the long-term stability of a stream system, a buffer is recommended to be preserved between the stream and anthropogenic influences. In natural streams, the stream belt width or floodplain width often serves as the buffer. The stream belt width is diagrammatically shown in Figure ES 3. Belt width is the lateral distance from the outside edge of one meander to the outside edge of the next meander. Channel meanders shift through time, generally moving in a downstream direction. By preserving the land within the belt width of a stream, one can allow the channel to continue to evolve and change its planform without coming into conflict with human infrastructure.



## Figure ES 3: Stream Belt Width (Wildland Hydrology, 2013)

Two methods were used to estimate stream belt widths for major drainageways within the Sharktooth Basin. The Stream Belt Width method is an empirical procedure based on a relationship of the meander belt width to channel bankfull width through a power equation. The second method utilizes the ideal stream belt width based on shear stress. If the shear stress applied on a floodplain by flowing water exceeds the carrying capacity of the floodplain vegetation, the vegetation will be destroyed, and subsequent erosion, scour, and channel avulsions could occur. In





order to prevent this, the critical shear stress at which the vegetation will begin to fail was reviewed. The two methods were compared for each scenario for existing and future hydrology with the most conservative values shown in the table below.

	Channel Buffer Width								
Drainageway	Ex. Conditions	Fut. Conditions							
Sharktooth Draw	186	73							
Poudre Learning Center	130 <sup>1</sup>	56							
Wiedeman Creek	119	64							

#### **Table ES 2: Stream Buffer Width**

1-Value adjusted based on Rosgen classification

As shown by the table, the required belt or floodplain width has the potential to change over time with projected hydrology changes from new development. It is recommended that at a minimum, the existing stream belt widths be preserved within the basin to maintain stream health and maximize drainageway resiliency. Further evaluations may be required as the basin develops over time. The approximate buffer width for both existing and future hydrologic scenarios can be found in Figure 7.4.

As development occurs in each watershed, City detention criteria will reduce peak flows along the drainageways. As such, channel buffer widths may reduce accordingly to the future condition widths shown above. It is recommended that this transition be considered after the upstream watershed has reached approximately 80 percent development density. At this time it is also recommended that a more detailed geomorphic study be completed to best determine the appropriate thresholds for the bankfull channel and floodplain areas within the buffer width. Additional design considerations are discussed below.

#### ES 5.12 STREAM MANAGEMENT CORRIDOR

Given an adequate floodplain corridor, natural streams adjust to changing hydrologic and sediment supply regimes have well-established, healthy riparian corridors that provide bank stabilization, and have increased resiliency to higher flow rates. A healthy stream corridor is generally comprised of a multi-stage channel, promoting riparian vegetation during smaller flows while providing flood terraces, activating the overbanks to relieve pressure on the system during periodic higher flow events. The multi-stage channel allows for energy to dissipate as flow spreads on the floodplain terraces, naturally transports and deposits sediment, and promotes a healthy biodiversity of vegetation.

As urbanization occurs within a basin, buildings, roadways, and infrastructure often encroach on a stream corridor. Allowable widths and depths of floodplains are often restricted, increasing the velocities and erosive power of flood flows. With development anticipated throughout the Sharktooth Basin in coming years, existing stream corridors should be protected in order to maintain or establish High-Functioning, Low Maintenance (HFLM) stream systems and promote the overall health of the drainageway.

Channel parameters for the stream management corridor were developed using Rosgen stream classifications. Bankfull areas were estimated using regional regression equations developed for the Front Range based on tributary area to each design reach. General geomorphic bankfull channel parameters can be found in Table ES 3.

Guidance for other stream parameters such as pool to pool spacing, entrenchment ratio, meander width, and sinuosity for each reach are summarized in Table 7-22. These values were developed as guidance for planning purposes but further analysis would be required during design. The complete geomorphic analysis for each reach can be found in Appendix D.

Several recent stream restoration projects completed by ICON were used to approximate a stream restoration cost per linear foot of drainageway along the major drainageway corridors in the Sharktooth Basin: Sharktooth Draw, Poudre Learning Center Tributary, and Wiedeman Creek. The unit cost per linear foot reflects: earthwork; installation stream restoration items such as riffle structures, bank protection, riprap, and other stabilization measures; reseeding and native vegetation that might be beneficial. An average cost per linear foot of \$750 was used. It is recommended that through a City budget, or property reimbursement fees, the costs presented in Table ES 3 be used to plan for future stream restoration needs which may develop as the hydrology changes overtime.

### **Table ES 3: Geomorphic Analysis**

		Bankfull Channel							
		Reach	Approx.	Approx.					
Watershed	Design Pt	Length (ft.)	Width (ft.)	Depth (ft.)	<b>Cost Estimate</b>				
Sharktooth Draw	95th Ave	4050	9.6	0.9	\$3,037,500				
Sharktooth Draw	Sharktooth Bluffs to CR 62	2660	10.4	1.0	\$1,995,000				
Poudre Learning Center	CR 62 to Poudre	3900	9.3	0.5	\$2,925,000				
Poudre Learning Center	DS of Bluffs to CR 62	2140	5.9	0.5	\$1,605,000				
Wiedeman Creek	4th St. to 81st Ave	2860	9.3	0.8	\$2,145,000				
Wiedeman Creek	10th St to 4th St	3240	7.3	0.7	\$2,430,000				

#### ES 5.13 **PRIORITIZATION AND PHASING**

In general, drainage improvements should be constructed from downstream to upstream within each watershed, with exception to improvements which may reduce downstream discharges, such as detention basin projects. Proposed improvements were ranked based on: effectiveness in mitigating flood hazards, feasibility of construction, and performance of existing storm drainage infrastructure in the vicinity of each project.

High priority should be given to any project that mitigates flooding hazards and increases public health and safety. This includes the proposed improvements in Wiedeman Creek at 81<sup>st</sup> Avenue and Amour Hill Drive that removes structures from being inundated during the 100-year design storm and improvements in Northridge Draw which protect structures near the drainageway in Northridge Estates.

Medium priority was assigned to projects where existing flooding hazards were not imminent but proposed improvements provided protection against future flooding hazards. These projects include separating stormwater runoff from the irrigation canals within the basin that were not designed to convey runoff and the improvements along Sharktooth Draw at County Road 62 that provides a drainageway downstream of the bluffs.





Low priority was given to roadway crossing improvements to bring them up to current City criteria. The roadway crossing improvements should be completed in conjunction as planned roadway improvement and expansion occur.

The following projects have phasing impacts that need to be considered prior to final design and construction:

- The County Road 62 (east) roadway crossing in the Poudre Learning Center watershed needs to be constructed prior to, or in conjunction with, the Jones ditch canal baseflow separation.
- The flood mitigation project at Melbourne Street, in the Fairway Tributary watershed, cannot be installed until the flood mitigation projects in the Northridge Draw watershed have been completed.

A benefit cost analysis was completed for the proposed improvements along 81<sup>st</sup> Avenue. The proposed improvements mitigate \$175,656 total expected damages over the project life of 50 years. The project cost estimate including maintenance of \$4,996,304 resulted in a benefit to cost ratio of 0.04.

Although the benefit from mitigating flood damages does not solely justify the project, the proposed improvements accomplish several other project goals such as removing overtopping of roadways and flooding depths in streets in excess of City criteria. More information on the benefit cost analysis can be found in Section 7.3. No other proposed improvements mitigated significant damage on insurable structures warranting a benefit cost analysis.

Prioritization and costs of each improvement can be found in Table ES 4.



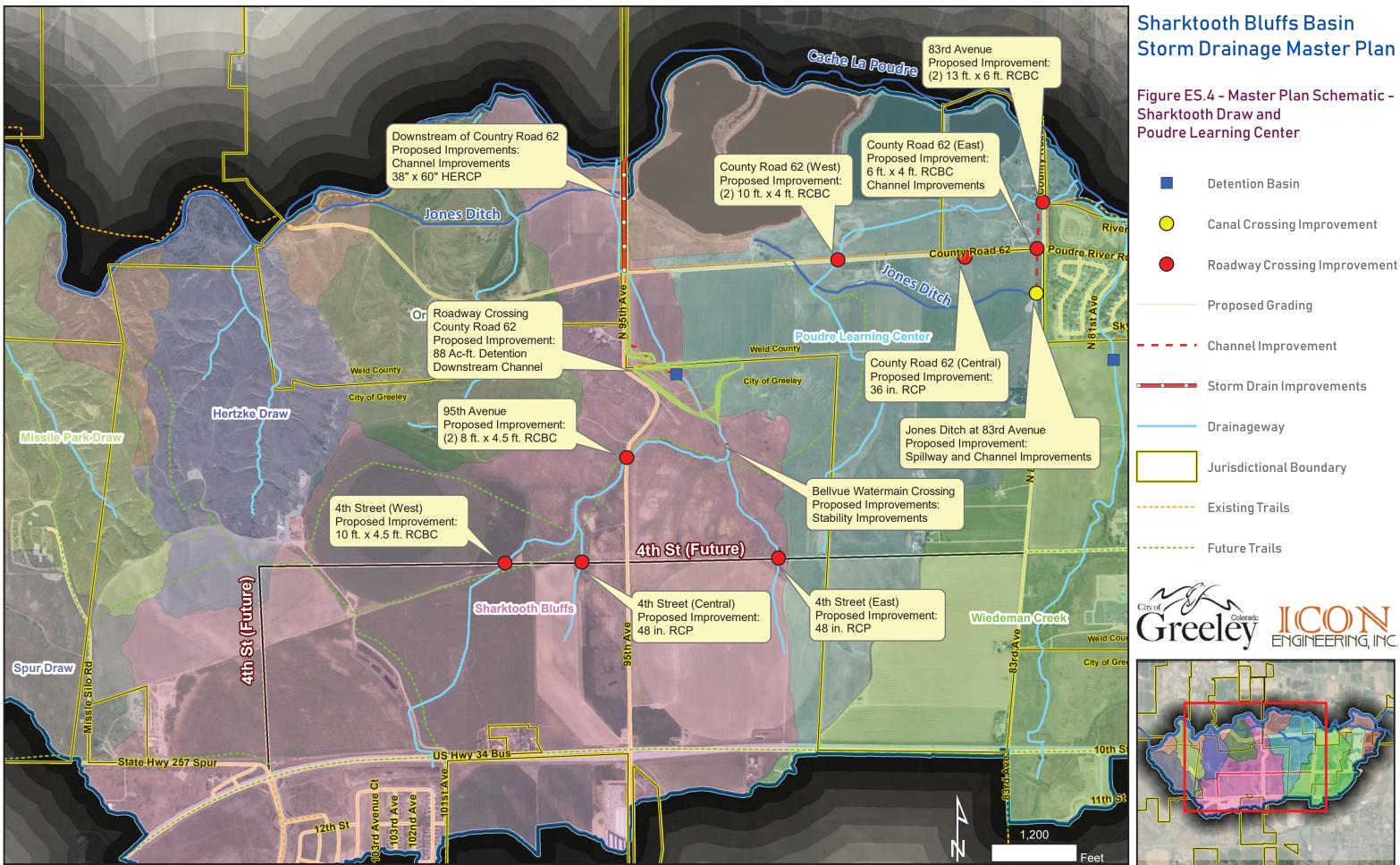


Watershed	Location	Priority			Capital		Easement / ROW		Engineering		Legal / Admin	Contract Admin / CM				Total Capital ency Cost		l Annual O&M		50-year O&M	
watersneu	Future 4th Street (West) Roadway Crossing	Low	ć	125,408	\$ -	Ċ	18,811	ć	6,270	Ś	12,541	ć	31,352	ć	194,382	ć	50	ć	1,571		
	Future 4th Street (Central) Roadway Crossing	Low	ې د	45,134	<u> </u>	ې د	6,770	ې \$	2,257	ې د	4,513	ې د	11,284	ې د	69,958	ې د	50	ې د	1,571		
	Future 4th Street (East) Roadway Crossing	Low	ې د	45,134	\$ -	ې د	6,770	ې د	2,257	ې د	4,513	ې د	11,284	ې د	69,958	ې د	50	ې د	1,571		
	95th Avenue Roadway Crossing	Low	ې د	214,015	\$ -	<del>ب</del> د	32,102	<del>ب</del> خ	10,701	ې د	21,402	ې د	53,504	ې د	331,724	ې د	120	ې د	3,771		
Sharktooth Draw	County Road 62 Improvements & Upstream	2011		214,015	<del>, ,</del>	Ļ	52,102		10,701	7	21,402		55,504	- <del>-</del> -	551,724	<u> </u>	120	<u> </u>	3,771		
	Detention Pond	Medium	\$	7,626,086	\$ 2,114,000	\$	1,143,913	\$	381,304	\$	762,609	\$ :	1,906,522	\$1	3,934,434	\$	90,019	\$ 2	2,828,722		
	Bellevue Pipeline Stabilitization	Medium	\$	79,900		\$	11,985				7,990	\$	19,975	\$	123,845	\$	670	\$	21,054		
	Total			8,135,677	\$ 2,114,000	\$	1,220,351	\$	406,784	\$	813,568	\$ 2	2,033,921	\$1	4,724,301	\$	90,959	\$ 2	2,858,260		
	County Road 62 (West) Roadway Crossing	Low	\$	311,206	\$-	\$	46,681	\$	15,560	\$	31,121	\$	77,802	\$	482,370	\$	100	\$	3,142		
	County Road 62 (Central) Roadway Crossing	Low	\$	38,892	\$-	\$	5,834	\$	1,945	\$	3,889	\$	9,723	\$	60,283	\$	50	\$	1,571		
Poudre Learning Center	County Road 62 (East) Roadway Crossing	Low	\$	401,548	\$ 96,800	\$	60,232	\$	20,077	\$	40,155	\$	100,387	\$	719,199	\$	2,125	\$	66,775		
	83rd Avenue Roadway Crossing	Low	\$	420,038	\$-	\$	63,006	\$	21,002	\$	42,004	\$	105,010	\$	651,060	\$	160	\$	5,028		
	Jones Ditch at 83rd Avenue Canal Baseflow																				
	Seperation	Medium	\$	100,193	\$ 96,800	\$	15,029	\$	5,010	\$	10,019	\$	25,048	\$	252,099	\$	1,034	\$	32,492		
	Total		\$	1,271,877	\$ 193,600	\$	190,782	\$	63,594	\$	127,188	\$	317,970	\$	2,165,011	\$	3,469	\$	109,008		

### Table ES 4: Master Plan Cost Estimate Summary

				Eas	sement /			Legal /	(	Contract			Тс	tal Capital	A	nnual	5	50-year
Watershed	Location	Priority	Capital		ROW	En	gineering	Admin	Ad	min / CM	Со	ntingency		Cost		0&M		0&M
	4th Street Roadway Crossing	Low	\$ 90,415	\$	-	\$	13,562	\$ 4,521	\$	9,042	\$	22,604	\$	140,144	\$	100	\$	3,142
	Skyview Street		\$ -	\$	-	\$	-	\$ -	\$	-	\$	-	\$	-	\$	1,502	\$	47,198
Wiedeman Creek	81st Avenue Detention Basin	High	\$ 1,799,261	\$	998,000	\$	269,889	\$ 89,963	\$	179,926	\$	449,815	\$	3,786,854	\$	23,589	\$1	1,179,450
Wiedeman Creek	78th Avenue	High	\$ 100,152	\$	59,000	\$	15,023	\$ 5,008	\$	10,015	\$	25,038	\$	214,236	\$	1,224	\$	61,200
	Amour Hill Drive	High	\$ 110,013	\$	22,000	\$	16,502	\$ 5,501	\$	11,001	\$	27,503	\$	192,520	\$	1,073	\$	53,650
	Total		\$ 2,099,841	\$ 1	1,079,000	\$	314,976	\$ 104,993	\$	209,984	\$	524,960	\$	4,333,754	\$	27,488	\$1	1,344,640
Poudre River Ranch	Poudre River Road		\$ -	\$	-	\$	-	\$ -	\$	-	\$	-	\$	-	\$	818	\$	25,705
Phase I and II	Total		\$ -	\$	-	\$	-	\$ -	\$	-	\$	-	\$	-	\$	818	\$	25,705
	Cache Court Canal Baseflow Seperation	Medium	\$ 86,021	\$	-	\$	12,903	\$ 4,301	\$	8,602	\$	21,505	\$	133,332	\$	434	\$	13,638
Fairman Tributan	Melbourne Street	High	\$ 93,050	\$	8,800	\$	13,958	\$ 4,653	\$	9,305	\$	23,263	\$	153,029	\$	301	\$	9,459
Fairway Tributary	Detention North of Melbourne Street		\$ -	\$	-	\$	-	\$ -	\$	-	\$	-	\$	-	\$	702	\$	22,059
	Total		\$ 179,071	\$	8,800	\$	26,861	\$ 8,954	\$	17,907	\$	44,768	\$	286,361	\$	1,437	\$	45,156
No athridae Dana	C Street and 71st Avenue	High	\$ 942,378	\$	470,000	\$	141,357	\$ 47,119	\$	94,238	\$	235,595	\$	1,930,687	\$	4,739	\$	148,916
Northridge Draw	Total		\$ 942,378	\$	470,000	\$	141,357	\$ 47,119	\$	94,238	\$	235,595	\$	1,930,687	\$	4,739	\$	148,916











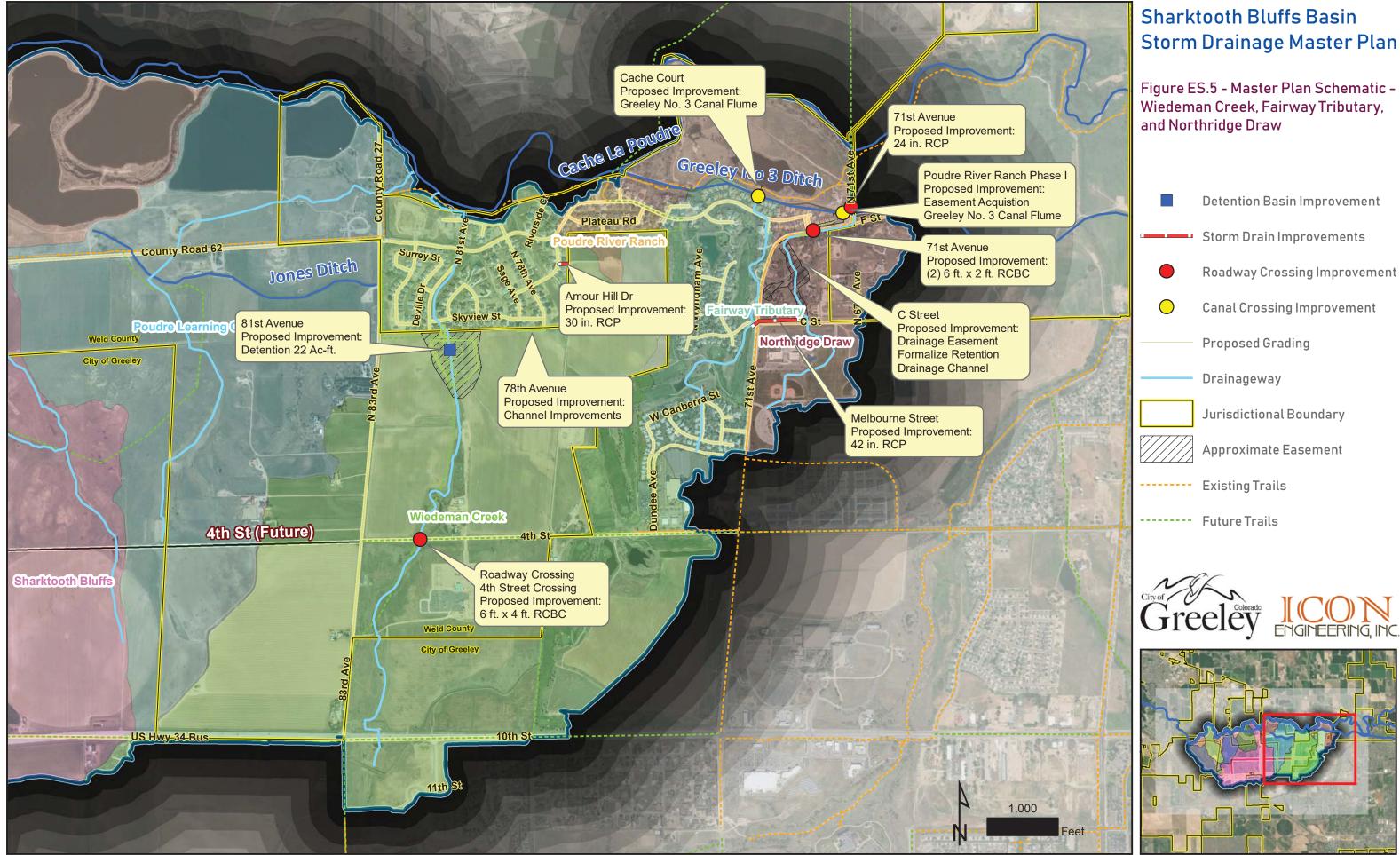


























#### INTRODUCTION 1.0

## **1.1 AUTHORIZATION**

This study was authorized by the City of Greeley on May 1<sup>st</sup> 2018 under project #FA18-03-022.

## **1.2 PURPOSE AND SCOPE**

The focus of the study is to produce a comprehensive storm drainage master plan to assist the City, guide development, prioritize capital improvement projects, and improve water quality throughout the Sharktooth Bluffs Basin.

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

- Review of Existing Information and Field Reconnaissance
- Evaluate and update baseline hydrology and hydraulics
  - 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.
    - Identify existing and potential future areas prone to flooding.
- Alternatives Analysis
  - Identify and analyze feasible alternative storm drain and water quality solutions.
    - Develop set of rating criteria to evaluate alternative solutions to drainage problems.
- Conceptual Design
  - o Refine the selected plan to a conceptual design level.
  - Prepare updated cost estimates and phasing of improvements for selected plan.

## **1.3** PLANNING PROCESS

Progress Meetings were held on a bi-weekly basis throughout the project. Minutes from progress meetings can be found in Appendix A.

## 1.4 MAPPING AND SURVEY

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

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

## SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN

- 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

Following the collection of the 2013 LiDAR data, the River Run at Poudre River Ranch development was constructed. The proposed grading plan from this development has been incorporated into the existing conditions surface.

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

### 1.5 DATA COLLECTION

Various drainage reports and planning documents were reviewed as part of this study. A summary of the reports can be found below:

### Table 1-1: Data Collected

Document Title	Date	Author
Final Drainage Report for Boomerang Ranch Subdivision First Filing	Jul-2001	Pickett Engineering Company
Drainage Report for Poudre River Ranch Phase I	Dec-1998	Pickett Engineering Company
Final Drainage Report for Poudre River Ranch Second Filing	Aug-1999	Pickett Engineering Company
Addendum to Drainage Report for Boomerang Ranch First Filing	Jul-2001	Futura Engineering, Inc.
Drainage and Erosion Control Study for Poudre River Ranch Third		
Filing	Jul-2002	North Star Design, Inc.
Lake Bluff Preliminary Planned Unit Development Plan	Nov-2008	Westside Investment Partners, Inc.
2035 Comprehensive Transportation Plan	May-2011	City of Greeley
River Run at Poudre River Ranch, First Filing	Mar-2014	King Surveyors
Final Drainage and Erosion Control Study for River Run at Poudre		
River Ranch, Second Filing	Apr-2016	North Star Design, Inc.
City of Greeley Parks, Trails and Open Lands	May-2016	Design Workshop, Inc.
Final Utility Plans River Run at Poudre River Ranch, Second Filing	Jan-2017	North Star Design, Inc.
Imagine Greeley Comprehensive Plan	Jan-2018	City of Greeley
Lake Bluff Preliminary Planned Unit Development Plan	Aug-2018	Westside Investment Partners, Inc.
Promontory Heights Preliminary Planned Unit Development Plan	Jun-2019	Planscapes



## **1.6** ACKNOWLEDGEMENTS

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

Table 1-2: Project Participants

Participant	Representing	Title
Andrew Fisher, P.E., CFM	City of Greeley	Stormwater Capital Projects Engineer
Joel Hemesath	City of Greeley	Public Works Director
Craig Jacobson, P.E., CFM	ICON Engineering, Inc.	Project Manager
Jaclyn Michaelsen, P.E., CFM	ICON Engineering, Inc.	Project Engineer
Jeremy Deischer, P.E.	ICON Engineering, Inc.	Project Engineer
Monica Ramirez, El	ICON Engineering, Inc.	Project Engineer





## 2.0 STUDY AREA DESCRIPTION

## 2.1 PROJECT AREA

The Sharktooth Bluffs Basin, named after fossilized shark teeth found in the area has a rich history dating back to World War II. The basin was home to a 320 acre World War II Prisoner of War Camp that housed Germans and Austrians from 1944 – 1946. Several years later in 1961, one of four Atlas E nuclear missile silos constructed in Weld County was built in the basin. The missile site was deactivated in 1965, but still serves as an amenity to the basin, providing tours of the site and is home to a campground. Sharktooth Ski Area, referred to as the world's smallest ski resort, was in operation from 1971-1986. During the construction of the ski area, the fossilized shark teeth in which the area was named after were found.

Located within the City of Greeley, Town of Windsor, and unincorporated Weld County, the Sharktooth Bluffs Basin covers an area of approximately 7.8 square miles. Previously known as West Poudre Basin, Sharktooth Bluff Basin generally slopes from the southwest near 10<sup>th</sup> Street to the northeast where stormwater runoff discharges into the Cache La Poudre River. The basin is generally bounded by US Highway 257 to the west, the Cache La Poudre to the north, N 71<sup>st</sup> Avenue to the east and 10<sup>th</sup> Street to the south. Of the total basin area, 3.7 square miles are currently within the City of Greeley with 6.8 square miles are in the Long Range Growth boundary.

The current study area encompasses the West Poudre Basin and areas previously studied as part of the *Comprehensive Drainage Plan for Sheep Draw Basin* in 2006. Four watersheds, Wiedeman Creek, Poudre River Ranch, Fairway Tributary, and Northridge Draw, located in the eastern portion of Sharktooth Bluffs are not directly tributary to Sheep Draw and were incorporated into the Sharktooth Bluffs Basin.

Currently the basin is approximately ten percent built-out with various residential developments in addition to notable landmarks; Missile Site Park, Sharktooth Bluff, Boomerang Links Golf Course, Northridge High School, and Winograd K-8 School. Some commercial properties exist along the eastern edge of the watershed south of Canberra Commons.

Sharktooth Bluffs Basin is made up of numerous drainageways which outfall into the Cache La Poudre River. These drainageways include; Spur Draw, Hertzke Draw, Orr Gulch, Sharktooth Draw, Poudre Learning Center Tributary, Wiedeman Creek, Fairway Tributary, and Northridge Draw.

Two irrigation canals are found within the watershed. The Greeley No. 3 Canal, a 13-mile long canal conveying flow east through downtown Greeley, originates in the eastern portion of the basin. The William R. Jones Ditch conveys flow from the Cache La Poudre River just east of the bluffs to Siebring Reservoir. Siebring Reservoir, a series of ponds located between N 95<sup>th</sup> Avenue and N 83<sup>rd</sup> Avenue, is a raw water storage facility owned by Central Colorado Water Conservancy District. On the eastern edge of Siebring Reservoir is the Poudre Learning Center, a 65 acre area donated to the local community after the gravel mining operations ceased.

Bisecting the watershed are water transmission lines from the Bellevue Water Treatment Plant.

In the next twenty years, Greeley's population is expected to grow by up to fifty percent, per Greeley's 2035 *Comprehensive Transportation Plan.* Much of this growth will push development west of the downtown area, into Sharktooth Bluffs Basin. Roadway improvements to 83rd Avenue and 4<sup>th</sup> Street are planned in the 2035 *Comprehensive Transportation Plan* to accommodate the increase in population, connecting Windsor, Greeley, Milliken and Platteville. Much of the area is currently located within unincorporated Weld County but lies within the City of Greeley Long Term Growth Area.

A watershed map highlighting features throughout the watershed can be found in Figure 2.1.

## 2.2 LAND USE

Sharktooth Bluffs Basin is comprised of Type A, B, C, and D soils as defined by the Natural Resources Conservation Service (NRCS). The western half of the basin is predominately Type A and D soil with the eastern primarily consisting of Type A and Type B soils. To account for increased runoff caused by irrigation flows and irrigation-induced saturated soils on agricultural lands, Type A and B soils were assigned soil infiltration properties of Type C and D soils in the existing conditions analysis. More information on the soil parameters can be found in <u>Section</u> 3.4.5. A soil map of the watershed can be found in <u>Appendix B.</u>

Existing 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 <u>Table 2-1</u>. In several areas in Poudre River Ranch and River Run at Poudre River Ranch the existing land use GIS shapefiles did not reflect the extent of current development. Representative sections were developed to determine typical percent impervious for these areas and applied to the neighborhoods lacking data.

Future land use parameters were developed using GIS zoning shapefiles provided by the City. Projected land use in the *Imagine Greeley* planning document was used to supplement areas outside of the City. The impervious values chosen for each zoning classification can be found in <u>Table 2-2</u>. Open space areas were assigned a 7% imperviousness in the future conditions model to account for paved surfaces within open space areas.

Imperviousness for each subwatershed was computed using the area weighted average of each land use type through GIS. The entire study area is approximately 13 percent impervious for existing conditions land use. Future land use projects the entire study area to be approximately 42 percent impervious. Impervious values are shown for the watershed on the impervious map in <u>Appendix B</u>.



### Table 2-1: Existing Land Use Classification

Land Use	Percent Impervious (%)
Pervious	5
Road- Unpaved	40
Trail	40
Building	90
Driveway	90
Sidewalk	90
Road- Paved	100
Parking	100
Water	100

### **Table 2-2: Future Land Use Classification**

Zoning Classification	DU / Ac. P	ercent Impervious (%)
Open Space		7
Residential Estate	1-3	30
Residential - Low Density	3 - 5	50
Residential - Medium Density	5 - 10	60
Residential - High Density	10 - 20	70
Planned Urban Development (PUD)		70
Industrial - Low Density		80
Industrial - Medium Density		85
Commercial High Intensity		95

## 2.3 OUTFALL DESCRIPTIONS

Outfalls were categorized based on their location spatially within the basin and which major drainage watersheds to which they are tributary. An inventory of all major storm drainage structures can be found in Table 4-1. An outfall map can be found in Figure 2.3. The amount of area for each watershed within the current City limits and within the Long Term Growth Area can be found in Table 2-3.

#### 2.3.1 SPUR DRAW

Spur Draw, the western most watershed, is located just east of US Highway 257. The watershed, approximately 330 acres of the basin, lies entirely within unincorporated Weld County. Stormwater runoff from the basin sheet flows to the Sharktooth Bluffs where the narrow gullies convey water northwest to the Cache La Poudre River. The drainageway in the central portion of the watershed is approximately 4,600 feet in length, with an average slope of 2.9 percent. The watershed is currently undeveloped and future land use projects the watershed to remain open space.



Looking west from Missile Site Park into Spur Draw Watershed

## SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN

#### 2.3.2 **MISSILE PARK DRAW**

This 275 acre watershed is bounded by Spur Draw to the west, Hertzke Draw to the east, Sharktooth Draw to the south and Cache La Poudre River to the north. The watershed spans three jurisdictions: Town of Windsor at the downstream end of the watershed, unincorporated Weld County, and the City of Greeley. Similar to Spur Draw, stormwater runoff is conveyed in narrow gullies which converge into a drainageway that bisects the watershed. Near the downstream end of the watershed, in the Town of Windsor and Weld County, the Broe Land Embankment is an approximately Narrow gullies in the bluffs convey 10-foot high embankment detaining flows from continuing north to the stormwater runoff in Missile Park Draw Cache La Poudre River. Research into this property found no record it was a regulated detention basin or registered state dam. Therefore, no detention was accounted for behind the embankment. The Missile Park Draw basin is not expected to develop in the future due to the open space zoning it is assigned.

The watersheds namesake, Missile Site Park, is located near the headwaters of the watershed on the southwest side. In 1961, Missile Site Park was constructed and the location of one of the four Atlas E nuclear missile silo constructed in Weld County. Deactivated in 1961, the site still serves as an amenity, providing tours of the site and home to a campground.

#### 2.3.3 HERTZKE DRAW

Hertzke Draw, located to the east of Missile Park Draw and west of Sharktooth Draw watersheds, primarily consists of steep gullies conveying stormwater runoff to the north. Upstream of the outfall into the Cache La Poudre River, the 270 acre watershed transitions from the confined gully drainageway to an alluvial fan. The main drainageway in the watershed is approximately 4,200 feet long, at an approximate 2 percent slope. The watershed lies within Town of Windsor, unincorporated Weld County, and City of Greeley. The bluffs in the southeastern portion of the watershed, within the City of Greeley, lie on property proposed to be developed as part of the Lake Bluff Development.

#### 2.3.4 **ORR GULCH**

Orr Gulch, bounded by Hertzke Draw to the west and Sharktooth Draw to the south and east, is a 270 acre watershed. Sharktooth Bluff, home of the ski resort from 1971 – 1986, separates Orr Gulch from the Sharktooth Draw watershed along the southeastern boundary. The northern portion of the watershed falls within unincorporated Weld County. The southern portion is within the City of Greeley. The portion within the City of Greeley is proposed to remain open space as part of the proposed Lake Bluff Development. The narrow bluff gullies collect stormwater runoff in the headwater of the basin before the flow is spread into an alluvial fan south of County Road 62. North of County Road 62, the William R. Jones







William R Jones Ditch conveys irrigation flow in the lower portion of Orr Gulch



Ditch bisects the lower watershed, conveying irrigation flows from the Cache La Poudre River to Siebring Reservoir.

#### 2.3.5 **SHARKTOOTH DRAW**

Sharktooth Draw extends from south of 10<sup>th</sup> Street to the Cache La Poudre River, covering 1,235 acres. The watershed lies within the City of Greeley and unincorporated Weld County. The headwaters of Sharktooth Draw begin south of 10<sup>th</sup> Street, east of Promontory Circle near the State Farm property. Stormwater runoff continues in a northeast direction to the Promontory subdivision detention basin. Flow is conveyed under 10<sup>th</sup> Street to the north at numerous locations, including west of 101<sup>st</sup> Avenue Sharktooth Bluff was the home for the ski at the Promontory development, and east and west of 95<sup>th</sup> Avenue.



resort from 1971 - 1986

North of 10<sup>th</sup> Street, west of 95<sup>th</sup> Avenue, sheet flow conveys the runoff through existing farm fields before reaching the bluffs and a better defined drainageway. The future proposed roadway expansion of 4<sup>th</sup> Street to the west will cross Sharktooth Draw before the runoff reaches the bluffs. North of the future 4<sup>th</sup> Street expansion, the flow is conveyed in a northeast direction to the roadway crossing at 95<sup>th</sup> Avenue where dual 36-inch pipes convey flow underneath the roadway. East of 95<sup>th</sup> Avenue, the drainageway sharply turns to the north, exiting the bluffs into an alluvial fan, south of County Road 62. Sharktooth Bluff, the home of the ski resort in operation from 1971 – 1986, is located west of N 95<sup>th</sup> Avenue as the flow exits the bluffs. Flow overtops County Road 62 to the northwest and crosses the William R. Jones Ditch before the outfall location into the Cache La Poudre River, west of Siebring Reservoir.

#### 2.3.6 **POUDRE LEARNING CENTER TRIBUTARY**

The 610 acre Poudre Learning Center watershed extends from the Cache La Poudre River south to 10<sup>th</sup> Street, between N 83<sup>rd</sup> Avenue to the east and N 95<sup>th</sup> Avenue to the west. The Poudre Learning Center is located northwest of the County Road 62 and N 83<sup>rd</sup> Avenue intersection. Flow in the upper portion of the watershed primarily consists of sheet flow down into the bluffs. The stormwater runoff spreads from the confined flow in the bluffs into an alluvial fan south of County Road 62. Flow crosses the William R. Jones Ditch and County Road 62 into Siebring Reservoir. An outlet channel from the most eastern portion of Siebring Reservoir conveys flow east to 83<sup>rd</sup> Avenue before the outfall location into the Cache La Poudre River.

#### 2.3.7 WIEDEMAN CREEK

The Wiedeman Creek watershed extends from the Cache La Poudre River south beyond 10<sup>th</sup> Street. The 875 acre watershed is generally bounded by N 83<sup>rd</sup> Avenue to the west and the Fairway Tributary watershed to the east. The watershed lies within the City of Greeley and unincorporated Weld County. Runoff south of 10<sup>th</sup> Street is conveyed underneath 10<sup>th</sup> Street into a water quality basin constructed as part of the 10<sup>th</sup> Street improvements in 2005, which also forced CDOT to relocate the P.O.W. Camp 202 pillars. Flow from the detention basin is released into Wiedeman Creek, continuing north past 4<sup>th</sup> Street to Poudre River Ranch. Roadway crossings at N 83<sup>rd</sup> Avenue and 4<sup>th</sup> Street convey flow from the existing farmland west of N 83<sup>rd</sup> Avenue to Wiedeman Creek south of 4<sup>th</sup> Street. North of 4<sup>th</sup>

Street Wiedeman Creek intercepts the 12-inch corrugated metal pipe that drains the area on Boomerang Links Golf Course south of 4<sup>th</sup> Street and Dundee Avenue.

Wiedeman Creek enters Poudre River Ranch Phase III, crossing Skyview Street through a 7 foot wide by 4 foot tall box culvert. An open channel along N 81<sup>st</sup> Avenue conveys discharge through Poudre River Ranch Phase III. Flows are then intercepted by a 5 foot wide by 4 foot tall box culvert south of Poudre River Road. This box culvert discharges flow north of River Run at Poudre River Ranch into a water quality basin before discharging into the Cache La Poudre River.

Local runoff west of N 81<sup>st</sup> Avenue in Poudre River Ranch Phase II is Wiedeman Creek conveyed through two primary flow paths. A grass swale conveys flow to three elliptical concrete pipes crossing Poudre River Road just east of N 83<sup>rd</sup> Avenue. Street flow is conveyed north on Double Tree Drive turning east at Poudre River Road. Stormwater at this location is intercepted in a storm drain that conveys and intercepts additional stormwater runoff through River Run at Poudre River Ranch.

Runoff from the existing farm land and Boomerang Links concentrates in two additional locations before being conveyed through Poudre River Ranch Phase III. First, stormwater is intercepted along N 78<sup>th</sup> Avenue in a storm drain system that increases in size from 18-inches at Skyview Street to 36-inches at Poudre River Road. The storm drain discharges west of Riverside Court into an open channel that conveys flow into a water quality basin and subsequently the Cache La Poudre River.

Second, a 30-inch storm drain intercepts stormwater runoff from the existing farm land east of Amour Hill Drive. The flow is conveyed west where the flow is discharged into an open channel between N 78<sup>th</sup> Avenue and Amour Hill Drive. The open channel is conveyed underneath Poudre River Road in a 36-inch storm drain which outfalls in the same open channel as the storm drain in N 78<sup>th</sup> Avenue.

The Wiedeman Creek watershed was previously considered to be in the Sheep Draw Basin, and was studied in a report from 2006 by Anderson.

#### 2.3.8 **POUDRE RIVER RANCH TRIBUTARY**

The Poudre River Ranch watershed consists of the 25 acre Poudre River Ranch Phase II development. The watershed is bounded by Wiedeman Creek to the west, and Fairway Tributary to the south and east. Flow is conveyed off the existing farmland onto the street at N 77<sup>th</sup> Avenue then west on Plateau Road before being directed northeast on Poudre River Road to an existing water quality basin. Flow from the water quality basin discharges into Cache La Poudre River just upstream of the Greeley No. 3 Canal diversion.

The Poudre River Ranch watershed was previously considered to be in the Sheep Draw Basin, and was studied in a report from 2006 by Anderson.







**River Run at Poudre River Ranch is** located at the downstream end of



**Poudre River Ranch Subdivision** 





#### 2.3.9 **FAIRWAY TRIBUTARY**

The 144 acre Fairway Tributary originates north of 4<sup>th</sup> Street and west of N 71<sup>st</sup> Avenue. Stormwater runoff from Canberra Commons, located north of Dundee Avenue and west of N 71<sup>st</sup> Avenue, is conveyed to the Boomerang Links Golf Course. The runoff is then conveyed northeast through the golf course to the intersection of W Melbourne Street and N 71<sup>st</sup> Avenue. Flow continues north into the two existing detention basins along the west side of N 71<sup>st</sup> Avenue. Stormwater from the detention basins are conveyed into the Northridge Draw watershed through an 18inch storm drain. Flows exceeding the capacity of the detention basin continue north in an open channel to the roadway crossing at Poudre



Runoff is conveyed north through **Boomerang Links Golf Course** 

River Road. A 30-inch storm drain conveys flow under the roadway, discharging into the Greeley No. 3 Canal.

The western portion of Boomerang Links Golf Course is conveyed along the golf course to the retention pond on the northern side of the golf course. The retention pond does not outlet and retains stormwater runoff for irrigation use. Flows north of the golf course enter a 42-inch storm drain, near the intersection of Vallevue Drive and Poudre River Road, which convey flow across the Greeley No. 3 Canal into the Poudre River Ranch Natural Area.

The Fairway Tributary watershed was previously considered to be in the Sheep Draw Basin, and was studied in a report from 2006 by Anderson.

#### 2.3.10 **NORTHRIDGE DRAW**

Northridge Draw, located east of N 71<sup>st</sup> Avenue, is the easternmost watershed in the basin, covering an area of 98 acres. The watershed originates near the intersection of N 71<sup>st</sup> Avenue and Dundee Avenue. Stormwater runoff from the parking lot of Northridge High School is conveyed in a storm drain underneath the baseball fields to the detention basin in the northeast corner of the high school property. Runoff from the school property east of the parking lot is collected in a storm drain system and conveyed out of the basin to the east. Flow from the detention basin north of Northridge High School is conveyed north past Winograd K-8 school to the detention basin south of C Street. The detention basin discharges flow north under C Street to a drainageway on private property. The drainageway conveys flow north through a retention pond to a small roadside swale along N 71<sup>st</sup> Avenue. Flows in



Detention is provided at both Winograd K-8 and Northridge HS

excess of the 18 inch storm drain underneath N 71<sup>st</sup> Avenue continue north east discharging into the Greeley No. 3 Canal.

The Northridge Draw watershed was previously considered to be in the Sheep Draw Basin, and was studied in a report from 2006 by Anderson.



#### 2.3.11 **POUDRE RIVER WATERSHEDS**

Several subwatersheds are direct flow areas to the Cache La Poudre River or Greeley No. 3 Canal. These watersheds span from adjacent to Spur Draw to the west and Northridge Draw to the east. Combined these watersheds account for 410 acres of the basin.

The Poudre River direct flow area to the north of Greeley No 3 Canal was previously considered part of the Sheep Draw Basin, and was studied in a 2006 Anderson report.



Several subwatersheds drain directly to the Cache La Poudre River



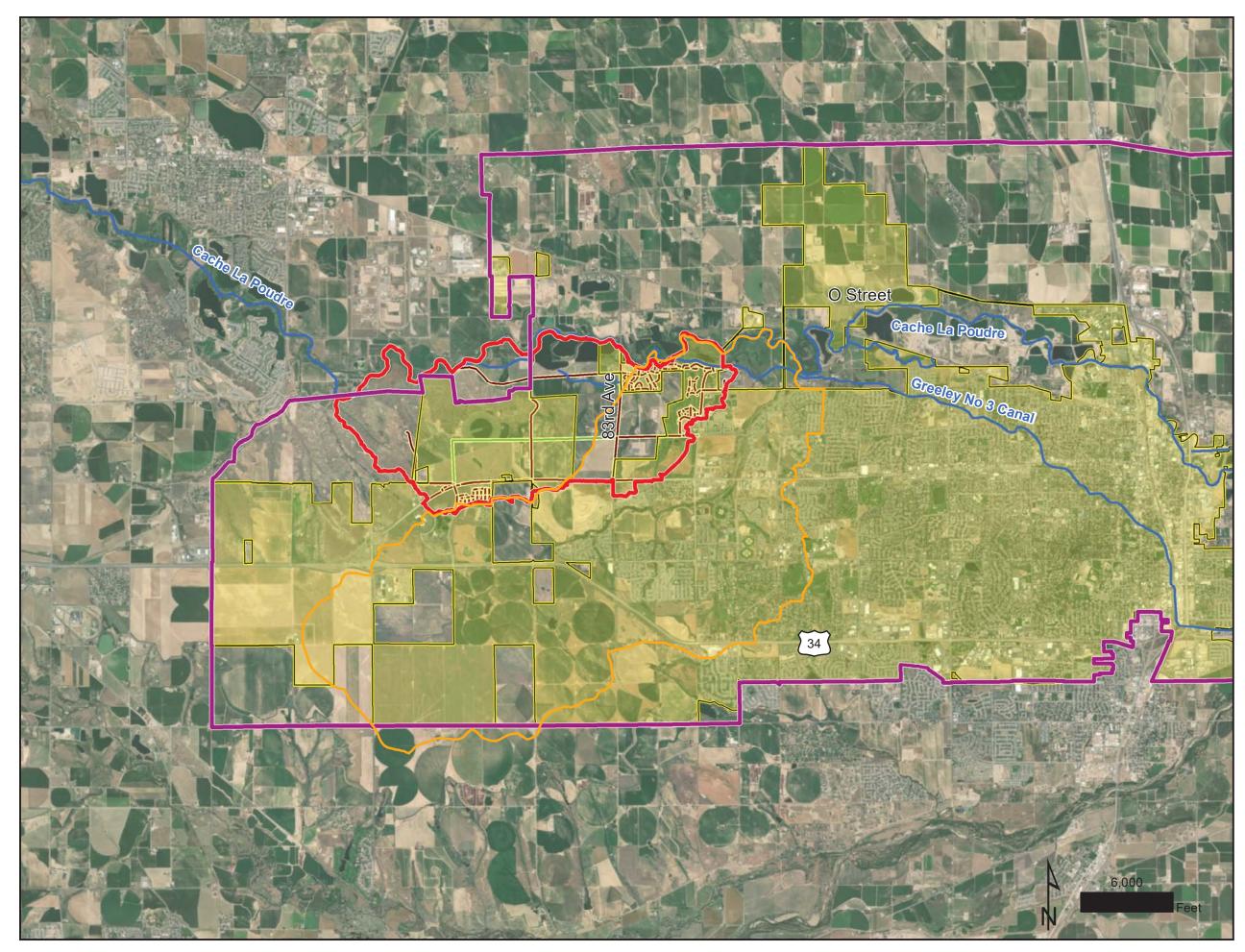
## 2.4 CITY OF GREELEY LONG TERM GROWTH AREA

In the next twenty years, Greeley's population is expected to grow by up to fifty percent, per Greeley's 2035 *Comprehensive Transportation Plan.* Much of this growth will push development west of the downtown area, into Sharktooth Bluffs Basin. Roadway improvements to 83rd Avenue and 4<sup>th</sup> Street are planned in the 2035 Comprehensive Transportation Plan to accommodate the increase in population, connecting Windsor, Greeley, Milliken and Platteville. Much of the area is currently located within unincorporated Weld County but lies within the City of Greeley Long Term Growth Area. A comparison of the percentage of each watershed currently within City boundaries and the amount in the projected City of Greeley Long Term Growth Area can be found in the table below.

Table	2-3:	Long	Term	<b>Growth Area</b>	
-------	------	------	------	--------------------	--

Watershed	Existing	Greeley	Future (	Greeley	
watersned	Area (Ac)	% of Basin	Area (Ac)	% of Basin	
Fairway Tributary	125	87	144	100	
Hertzke Draw	215	80	215	80	
Missile Park Draw	44	16	186	68	
Northridge Draw	70	72	98	100	
Orr Gulch	84	31	84	31	
Poudre Learning Center	168	28	607	100	
Poudre River	130	32	321	79	
Poudre River Ranch	17	70	25	100	
Sharktooth Bluffs	1123	91	1152	93	
Spur Draw	23	7	332	100	
Wiedeman Creek	383	44	876	100	





## Figure 2.1 – Vicinity Map

- Sheep Draw Basin Long Range Expected Growth Boundary Sharktooth Bluffs Boundary City of Greeley Boundary
  - Existing Roads
  - Future Roads





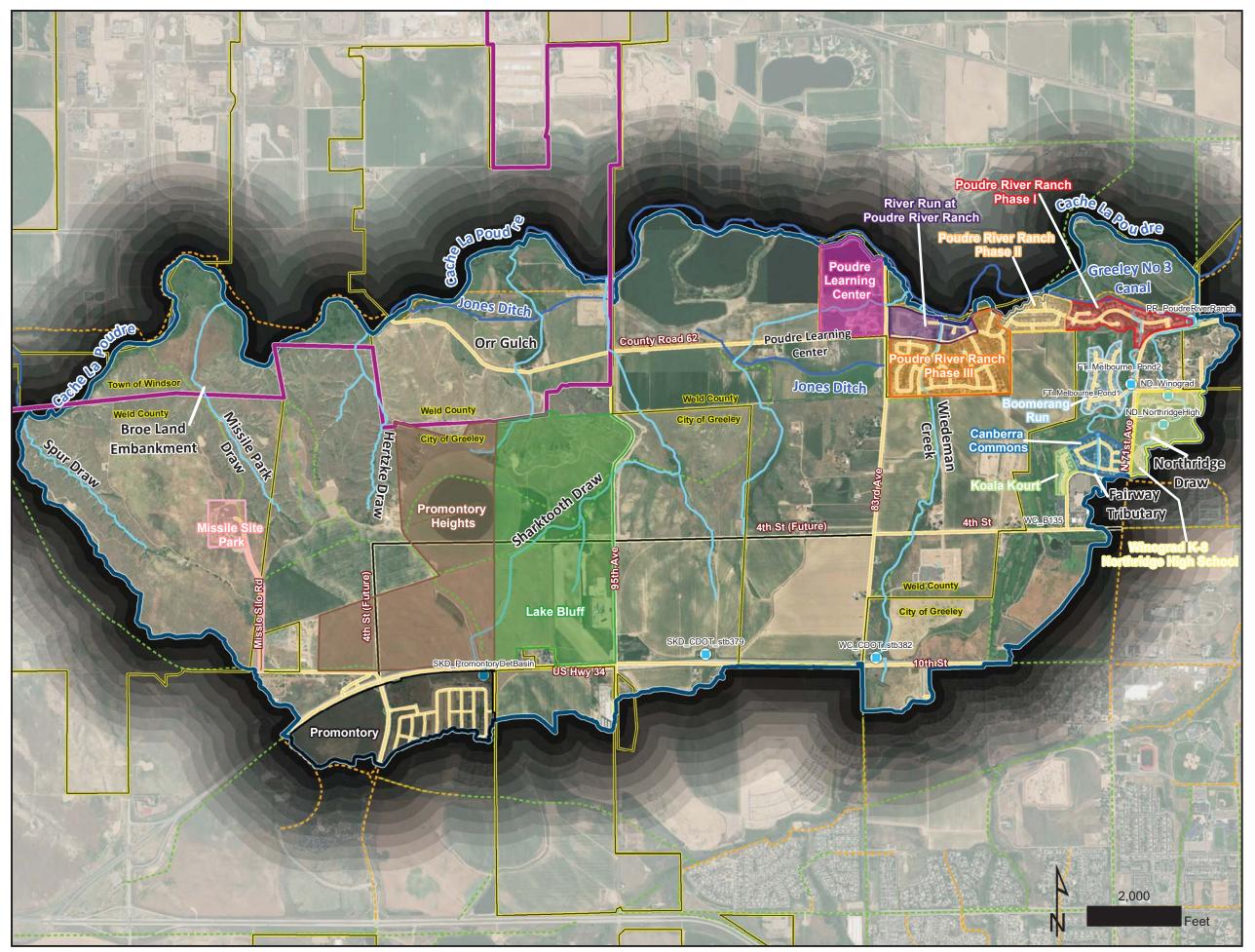


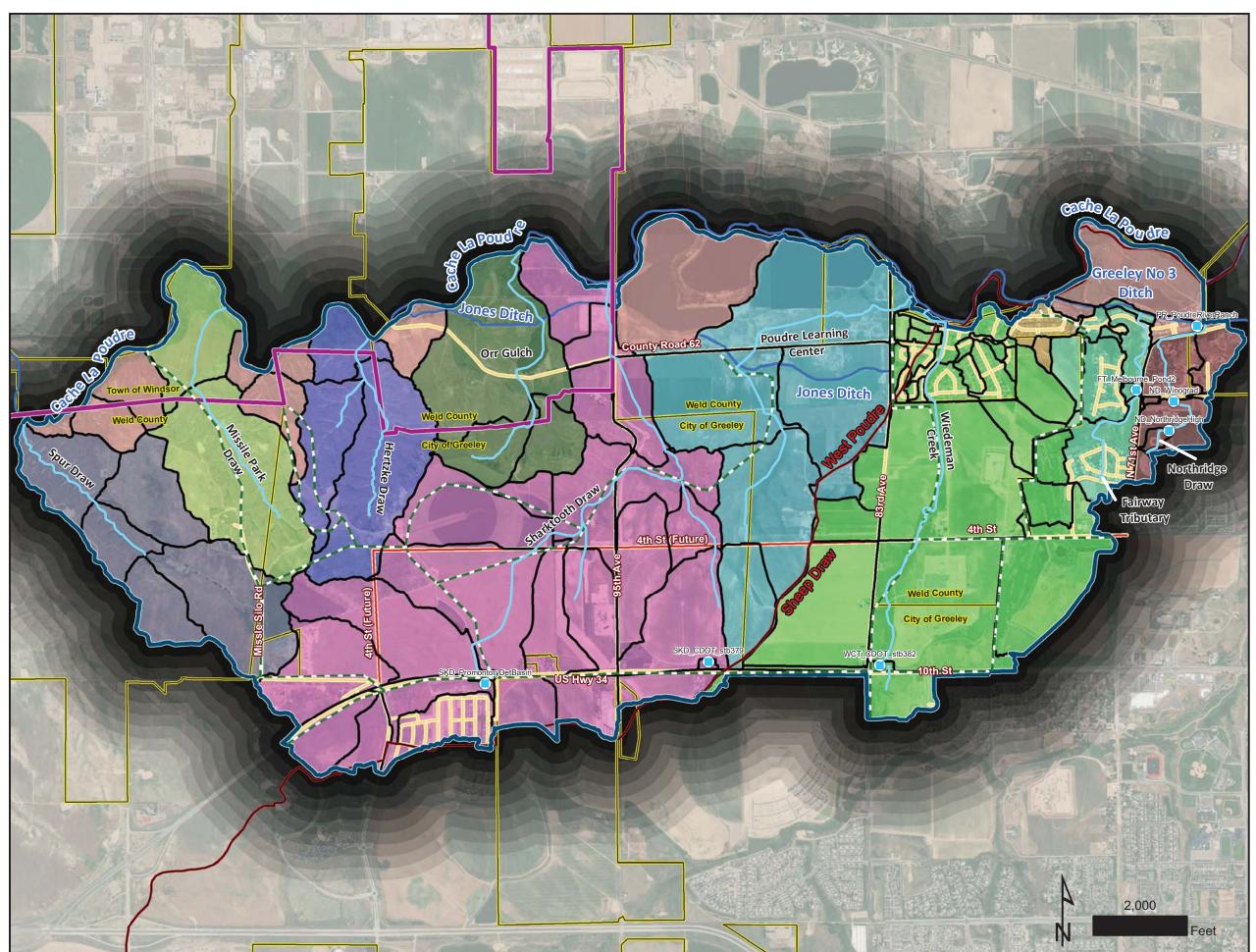
Figure 2.2 - Study Area Map

## Neighborhoods

- Boomerang Run Canberra Commons Koala Kourt Lake Bluff Missile Site Park Poudre Learning Center Poudre River Ranch Phase I Poudre River Ranch Phase II Poudre River Ranch Phase III Promontory Promontory Heights River Run at Poudre River Ranch Winograd K-8 Northridge High School Existing Detention Basin Drainageway Long Range Expected Growth Boundary Basin Boundary Jurisdictional Boundary
- ----- Existing Trails
- ----- Future Trails







## Figure 2.3 – Watershed Map

	Existing Detention Basin
	Ū.
	Drainageway
	Proposed Trails (City Trails MP)
	Long Range Expected Growth Boundary
	Basin Boundary
	Sheep Draw Boundary
	Subwatershed Boundary
	Jurisdictional Boundary
Wate	ershed
	Fairway Tributary
	Hertzke Draw
	Missile Park Draw
	Northridge Draw
	Orr Gulch
	Poudre Learning Center
	Poudre River
	Poudre River Ranch
	Sharktooth Bluffs
	Spur Draw
	Wiedeman Creek







#### HYDROLOGIC ANALYSIS 3.0

## 3.1 OVERVIEW

A new hydrologic model was prepared for the Sharktooth Bluffs Basin. The model establishes hydrology for the 2-, 5-, 10-, 50-, and 100-year storm frequencies for both existing and future land use conditions. 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 5.1.012 (SWMM) to determine discharges at each design point.

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 sixteen exceptions for pipes smaller than 30 inches were made when the storm drain systems diverted flow in a different direction than the topographic conveyance.

During the existing conditions evaluations, soil infiltration parameters were adjusted to account for saturated soil from agricultural irrigation. The adjustment to the soil infiltration parameters are further described in Section 3.4.5.

Two areas in the basin were identified where flow splits changed routing direction. These areas were refined to include tabular flow diversions within the SWMM model. The tabular 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. These diversions are further explained in Section 3.5.3.

City of Greeley stormwater criteria requires any future development to detain to historic 5-year discharges. To simulate these effects from the future land use, conceptual ponds were modeled in each subwatershed where zoning or future land use projections indicated future development would occur. The conceptual detention basins estimated the storage required for each subwatershed to detain to 5-year historic release rates. The future conditions SWMM model is further described in Section 3.5.4.

### **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 2). 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 2). Urban Drainage and Flood Control District (UDFCD), now operating as the Mile High Flood District, 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 2).

## SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN

#### **3.3** DESIGN RAINFALL

One- and six-hour rainfall depths were obtained from NOAA Atlas 14 Point Precipitation Frequency Data Server for various points throughout the basin. Spatially varying the rainfall throughout the watershed was not deemed necessary after examining the distribution of point precipitation values. The one- and six-hour rainfall point precipitation value can be found in Table 3-1.

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

<b>Return Period</b>	1-Hr Rainfall Depth (in)	6-Hr Rainfall Depth (in)
2-yr	0.85	1.28
5-yr	1.12	1.68
10-yr	1.41	2.08
50-yr	2.29	3.38
100-yr	2.77	4.07

Areal adjustments were not applied due to the lack of a contiguous basin exceeding the thresholds of two square miles for the 2-, 5-, 10-year design storms and fifteen square miles for the 50-, and 100-year storms. 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 7.8 square mile Sharktooth Bluffs Basin was delineated into 105 subwatersheds. Subwatersheds were named based on their tributary outfall. The outfalls from west to east are: Spur Draw, Missile Park Draw, Hertzke Draw, Orr Gulch, Sharktooth Draw, Poudre Learning Center Tributary, Wiedeman Creek, Poudre River Ranch Tributary, Fairway Tributary, and Northridge Draw. All irrigation facilities were assumed to be flowing full at the start of the design storm and were not taken into consideration for subwatershed delineation.

Subwatersheds ranged from 0.4 acres to 200 acres in size, with the average subwatershed size of 43 acres.

#### 3.4.2 WATERSHED IMPERVIOUSNESS

Characterizations of existing and future watershed imperviousness were determined using various sources of information provided by the City. Existing imperviousness was predominately developed using the City of Greeley land use GIS shapefiles. Future imperviousness was developed from City of Greeley Zoning GIS Shapefiles. Modifications to the base data for both existing and future land use are further described below.

Imperviousness for each subwatershed was computed with GIS software using the area weighted average of each land use type. Subwatershed imperviousness during existing conditions range from 5 percent to 69 percent. Future land use projects subwatershed imperviousness to range from 5 percent to 85 percent.

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





The impervious values chosen for each land use type and zoning classification can be found in <u>Table 2-1</u> and <u>Table 2-2</u>.

### 3.4.2.1 EXISTING CONDITIONS WATERSHED IMPERVIOUSNESS

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 <u>Table 2-1</u>. In Poudre River Ranch Phase III and River Run at Poudre River Ranch, the existing land use GIS shapefiles did not reflect the extent of current development. Representative sections for each land use density were developed to determine typical percent impervious for these areas and applied to the neighborhoods.

## 3.4.2.2 FUTURE CONDITIONS WATERSHED IMPERVIOUSNESS

Impervious values for future land use were derived from Greeley's land use zoning map along with the City's *Imagine Greeley Land Use Guidance Map*, Adopted in January 2018 to determine the densities of each designated land use area. The imperviousness of each of these areas can be seen in <u>Table 2-2</u>. Specific development plans were also used to determine future imperviousness in the Lake Bluff subdivision. Instead of using specific land use assignment the Lake Bluff subdivision was assigned an overall imperviousness due to the uncertainty in placement of specific development components (i.e. schools, shopping, and housing). A composite imperviousness value was derived from an area weighted average of the plan and found to be 51.2 percent; this imperviousness was applied to the extents of the Lake Bluff Development.

## **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 generated from FEMA 2013 Post-flood LiDAR mapping. Slopes were computed using the length-weighted, corrected average slope from Equation 6-7 and Figure 6-4 of the 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 to determine depression loss characteristics. Developed areas were assigned pervious depression loss values of 0.35 inches with undeveloped areas assigned a depression loss value more typical of wooded areas and open fields, 0.40 inches. During future conditions modeling, areas with projected future development were adjusted to a pervious depression loss value of 0.35 inches was selected for the impervious depression storage loss for all subwatersheds.

## **3.4.5** SOIL INFILTRATION PARAMETERS

Soil data for the watershed was obtained from Natural Resources Conservation Service (NRCS) web soil survey. Each soil classification assigned a map unit symbol based on the soil characteristics. Map unit symbols categorization was 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 were 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 (Reference 1).

Soil types throughout the watershed are spatially varied, consisting predominantly of Type A soils on the eastern side, Type A and B soils in the southern portion of the basin, and a mix of Type A, B, and D soils in the northern and western portions of the basin. Soil parameters were averaged on an area weighted basis for subwatersheds that contained multiple soil types.

During existing conditions analysis, soil infiltration parameters were adjusted to account for the possibility of saturated soils during the design storm. Type A and Type B soils in areas determined to be actively irrigated agricultural land, as identified by historic photographs, were adjusted to reflect the soil infiltration parameters more typical with a Type C or D soils to account for the soil to be saturated during the design storm. This adjustment addressed the decreased imperviousness from saturated soils in actively irrigated areas, as well as additional irrigation runoff.

No changes were made to the NRCS web soil survey soil infiltration parameters for future land use conditions.

Soil types for existing and future land use conditions can be found in <u>Appendix B</u>.

## 3.5 HYDROGRAPH ROUTING

Subwatershed runoff hydrographs were routed using EPA SWMM 5.1.012 to determine design discharges at each design point. Naming conventions for each junction and routing element were spatially assigned based on the watershed they were within. Watersheds were abbreviated within the SWMM modeling and can be found in <u>Table</u> <u>3-2</u>, below.

### Table 3-2: Watershed SWMM Modeling Abbreviations

Watershed	SWMM Model Abbreviation
Spur Draw	SD
Missile Park Draw	MPD
Hertzke Draw	HD
Orr Gulch	OG
Sharktooth Draw	SKD
Poudre Learning Center	PLC
Wiedeman Creek	WC
Poudre River Ranch	PRR
Fairway	FT
Northridge Draw	ND
Poudre River Direct Flow Areas	PR

## 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 n-values for pipes 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 channel sections were used for open channel conveyance in Spur Draw, Missile Park Draw, Sharktooth Draw, and Wiedeman Creek based on existing contour data. Closed circular conduits were assigned to storm drain infrastructure, based on City of Greeley's GIS information, and supplemented by field data. Irregular cross sections were developed to represent typical street cross sections of varying widths, to convey surface flow. Generalized street cross sections were defined as transects in the SWMM model representing street widths of thirty and forty feet. Irrigation canals were assumed to be flowing full at the beginning of the design storm and were not accounted for in routing of any stormwater runoff.

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

#### 3.5.3 **EXISTING CONDITIONS DETENTION FACILITIES**

Several existing detention facilities were accounted for in the baseline hydrology SWMM model. These included the Promontory detention basin, two CDOT detention basins north of 10<sup>th</sup> Street, two detention basins northwest of West Melbourne Street and N 71<sup>st</sup> Avenue, Northridge High School detention basin, Winograd K-8 School detention basin, and the Poudre River Ranch Phase I detention basin. 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 gathered by ICON Engineering 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 other embankments were not included in the hydrologic models, as detention since the City cannot adequately ensure that the current detention volumes or characteristics will remain. Any future development on these privately owned parcels would likely disrupt the detention volume relationship, altering the hydrologic modeling. These areas include the embankment in Missile Park Draw and south of 10<sup>th</sup> Street and 83<sup>rd</sup> Avenue.

#### 3.5.4 **FUTURE CONDITIONS DETENTION FACILITIES**

As mentioned previously, City of Greeley criteria requires any future development to detain the developed 100-year design discharge to the 5-year historic design discharge. Conceptual detention basins were placed in the future conditions SWMM model to approximate the detention required in each subwatershed with future development. The volume required to detain each subwatershed to 5-year historic discharges can be found in Table 3-3 with locations shown in Figure 3.2. Although each subwatershed is detained to the 5-year historic release rate, due to hydrograph and routing timing, slight increases in total flow are observed at some design points.

It should be noted the existing 5-year flow rates were developed with reduced soil infiltration parameters on irrigated agricultural land, further described in Section 3.4.5. Reducing the existing soil infiltration parameters to account for saturated soils increases the peak flow for these subwatersheds during existing conditions analysis. This approach would lead to detaining flows to an increased flow rate compared to future soil infiltration parameters.

#### 3.5.5 **FLOW DIVERSIONS**

Tabular diversion curves were developed using FLO-2D to more accurately represent diversions in the Sharktooth Draw and Poudre Learning Center Watersheds. A range of steady state discharges were applied to the FLO-2D 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.

#### **3.6** 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 <u>3-4</u> with the design points labeled in Figure 3.1. Detention volumes required to meet City criteria to detain future 100-year discharges to historic 5-year discharges can be found in Table 3-3 with the locations labeled in Figure 3.2.





Table 3-3: Future Land Use Proposed Detention Basin Sizing

	Historic	Future	Approximate		Historic	Future	Approximate
Basin	5 yr (cfs)	100 yr (cfs)	Detention (Ac-ft.)	Basin	5 yr (cfs)	100 yr (cfs)	Detention (Ac-ft.)
FT_100	0.2	6.5	0.8	SKD_126	2.9	243.6	16.5
FT_101	0.2	47.8	3.3	SKD_130	1.6	143.3	11.8
FT_105	0.1	25.2	1.5	SKD_135	2.8	213.6	11.7
FT_110	0.1	5.0	0.3	SKD_136	1.8	158.9	10.5
FT_115	0.4	8.3	0.4	SKD_137	1.1	116.9	9.7
FT_120	0.2	66.4	5.0	SKD_140	2.2	243.0	15.4
FT_125	0.1	54.1	3.3	SKD_141	0.5	51.0	2.8
FT_130	0.6	106.0	8.9	SKD_145	2.6	361.0	23.4
HD_100	1.5	56.7	5.4	SKD_150	0.8	173.3	16.0
HD_105	1.6	91.4	9.4	SKD_155	1.3	222.8	16.4
HD_110	4.8	209.7	23.1	SKD_165	2.3	31.3	3.4
MPD_100	2.9	117.6	9.4	SKD_170	3.9	46.6	3.9
MPD_105	1.6	264.0	26.5	SKD_175	2.1	32.8	3.9
ND_100	0.3	67.4	3.6	SKD_190	0.1	77.0	5.3
ND_105	0.2	72.5	4.8	SKD_195	0.6	121.3	8.0
ND_110	0.1	2.9	0.2	WC_100	0.1	7.5	0.6
ND_115	0.1	3.9	0.2	WC_101	0.1	26.5	1.4
ND_120	0.1	1.2	0.1	WC_102	0.2	18.4	1.3
ND_130	0.2	96.2	6.0	WC_103	0.1	12.4	0.8
ND_135	0.1	14.8	1.0	WC_105	0.2	32.2	2.2
ND_140	0.1	21.0	1.1	WC_105.1	0.1	8.2	0.4
OG_100	4.1	191.3	21.1	WC_106	0.3	40.3	3.0
OG_105	1.3	101.6	7.8	WC_107	0.4	32.9	1.6
OG_110	1.6	115.3	7.3	WC_109	0.1	8.2	0.5
PLC_100	0.4	12.8	1.4	WC_110	0.3	55.0	3.4
PLC_105	3.9	245.1	29.3	WC_111	0.5	23.4	1.4
PLC_110	4.4	254.9	20.2	WC_112	0.1	7.5	0.5
PLC_115	2.8	219.3	18.4	WC_112.5	0.1	11.5	0.6
PLC_120	4.0	240.0	21.2	WC_113	0.4	96.1	5.7
PLC_121	1.6	181.3	11.0	WC_114	0.2	87.2	5.1
PRR_100	0.9	53.7	3.4	WC_115	0.3	42.6	2.7
PRR_105	1.0	16.9	0.9	WC_120	3.2	706.0	39.1
SD_100	2.2	87.6	8.5	WC_130	0.3	38.2	3.5
SD_105	1.9	88.6	7.1	WC_135	1.6	300.4	19.0
SD_110	1.3	52.1	4.4	WC_140	4.5	567.1	34.8
SD_115	1.3	50.4	5.2	WC_146	0.9	80.6	4.7
SD_120	3.2	150.7	15.1	WC_150	3.4	371.4	24.1
SKD_100	1.5	58.9	6.9	WC_160	1.4	149.1	7.7
SKD_105	0.5	24.7	3.1	WC_170	0.3	7.7	0.7
SKD_110	0.1	66.2	5.4	WC_171	0.1	10.9	0.5
SKD_115	1.0	56.2	4.7	WC_172	0.2	16.6	0.8
SKD_120	2.0	131.8	9.5	WC_173	0.1	11.2	0.8
SKD_125	1.5	80.9	5.2				



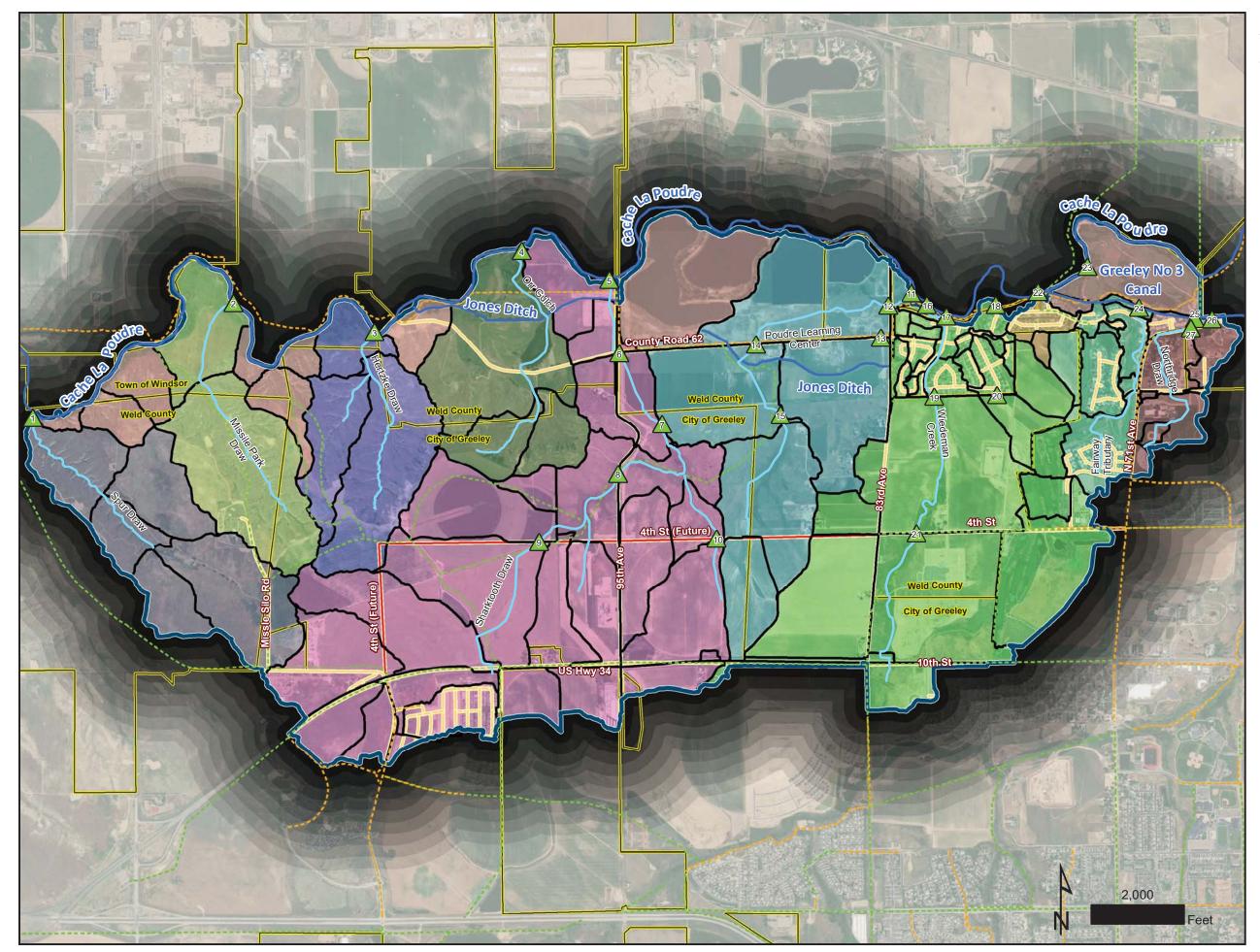


Figure 3.1 – SWMM Peak Flow Discharge



- Design Point
- Drainageway
- ---- Existing Trails
- ----- Future Trails
  - **Basin Boundary**
  - Subwatershed Boundary
  - Jurisdictional Boundary



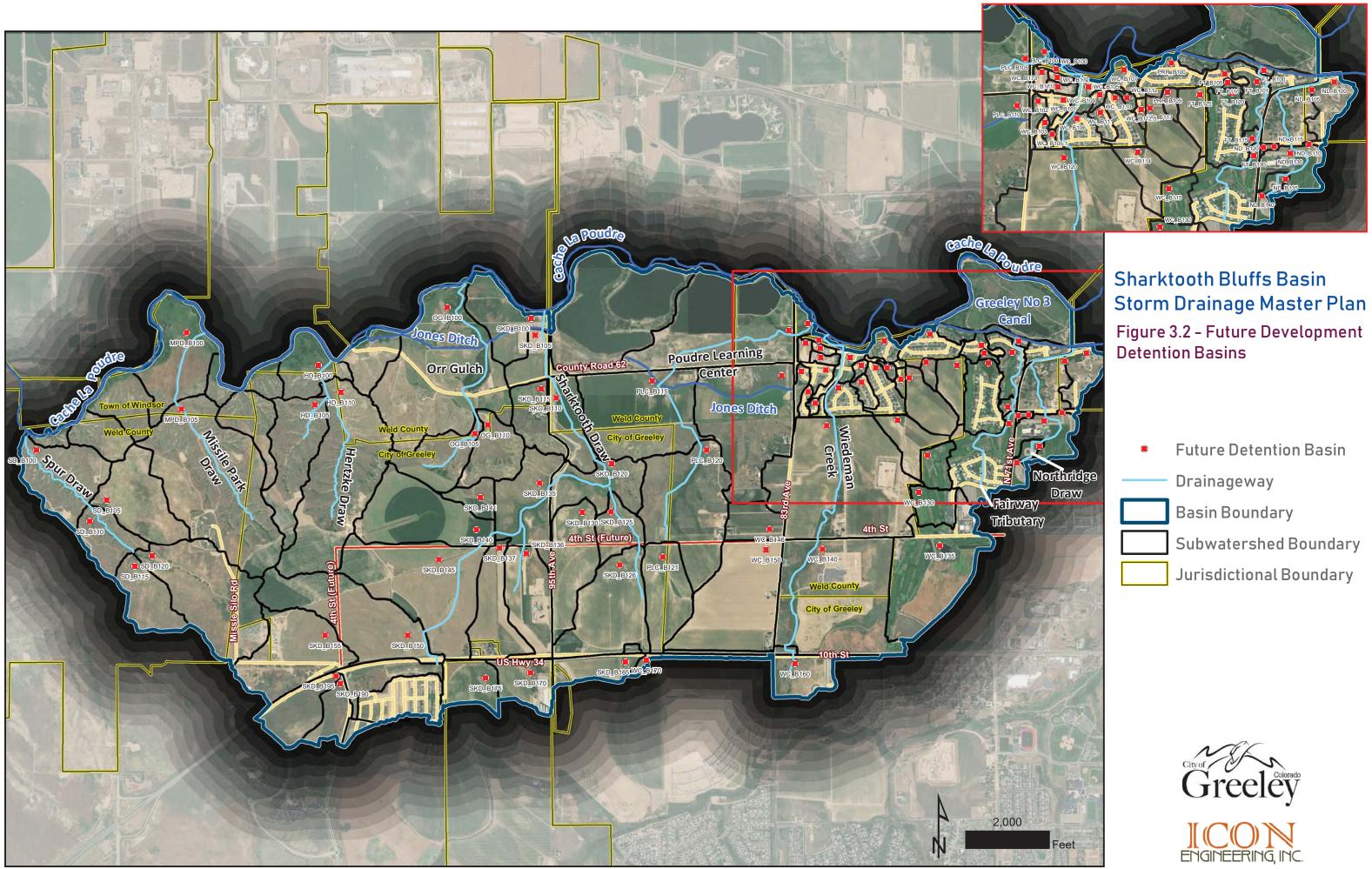




Figure 3-1/			Existin	g Peak Flow F	Rate (cfs)			Future	Peak Flow R	ate (cfs)	
Figure 3-2 ID	Location	2-yr	5-yr	10-yr	50-yr	100-yr	2-yr	5-yr	10-yr	50-yr	100-yr
1	Spur Draw Outfall	4	10	31	275	412	4	7	10	10	10
2	Missile Park Draw Outfall	5	10	38	246	365	1	2	4	4	4
3	Hertzke Draw Outfall	5	11	48	232	335	5	6	8	8	8
4	Orr Gulch Outfall	2	5	18	154	254	3	4	7	7	7
5	Sharktooth Draw Outfall	13	35	122	450	636	24	26	31	40	47
6	Sharktooth Draw at CR 62	12	33	115	391	542	22	24	28	37	44
7	Sharktooth Draw at Diversion	14	37	142	710	1063	25	26	31	40	48
8	Sharktooth Draw at 95th Ave	11	29	104	528	793	16	18	23	32	40
9	Sharktooth Draw at Future 4th St (West)	5	14	48	250	374	6	6	8	13	13
10	Sharktooth Draw at Future 4th St (East)	3	6	22	88	124	3	3	3	4	4
11	Poudre Learning Center Outfall	31	49	98	136	139	19	19	19	20	21
12	Poudre Learning Center at 83rd Ave	31	48	96	686	1110	19	19	19	20	20
13	Poudre Learning Center at CR 62 and 83rd Ave	3	7	21	163	251	4	4	4	4	4
14	Poudre Learning Center at CR 62	2	5	37	440	732	10	10	11	11	12
15	Poudre Learning Center at Diversion	2	5	24	135	198	8	5	5	5	5
16	Wiedeman Creek Outlet 1	19	39	104	199	219	16	16	16	17	17
17	Wiedeman Creek Outlet 2	5	7	10	370	608	1	2	3	5	6
18	Wiedeman Creek Outlet 3	10	16	32	121	174	3	4	4	6	8
19	Wiedeman Creek at Poudre River Ranch	12	27	84	475	698	15	15	15	15	15
20	Wiedeman Creek at N 78th Ave	1	2	7	37	55	1	1	1	1	1
21	Wiedeman Creek at Future 4th St	8	18	48	195	264	9	9	9	10	10
22	Poudre River Ranch Outfall	6	8	12	32	44	1	1	1	2	2
23	Fairway Tributary Outfall	8	11	18	25	25	1	1	1	1	1
24	Fairway Tributary Outfall 2	2	4	5	18	50	0	0	0	0	0
25	Poudre River Outfall	6	10	14	26	31	5	7	10	21	27
26	Northridge Draw Outfall	0	1	5	66	114	0	0	0	0	0
27	Northridge Draw at 71st Ave	6	9	15	67	104	1	1	2	2	2

Table 3-4: Peak Flow Comparison







## 4.0 HYDRAULIC ANALYSIS

Existing capacity for each storm drain system, comprised of inlets and subsurface pipes, was estimated from normal depth pipe calculations. The approximate design storm capacity of existing storm drain infrastructure can be found in <u>Table 4-1</u> and is further discussed in <u>Section 4.2</u>. Design storm capacity was determined from the normal depth pipe capacity in the baseline SWMM model.

FLO-2D was used to evaluate the residual flooding and hazard potential throughout the watershed for the 10- and 100-year design storms. 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 topology. 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 in <u>Section 4.2.1</u>. Identifying areas of high hazard potential is further discussed in <u>Section 4.3</u>.

### 4.1 PREVIOUS ANALYSIS

No previous analysis has studied the western portion of the Sharktooth Bluffs Basin. On the eastern side of the basin, Weidman Creek, Poudre River Ranch, Fairway Tributary, and Northridge Draw have been previously studied in the Sheep Draw Basin study. These areas were included in subwatershed delineation when developing peak flows along the main stem of Sheep Draw but were not studied in detail. Drainage reports developed as part of each proposed developed site only studied site specific locations.

### 4.2 EVALUATION OF EXISTING FACILITIES

The existing storm drain infrastructure and roadway crossings were evaluated to determine the approximate design storm conveyance capacity. A summary of existing infrastructure and the approximate design storm capacity can be found in <u>Table 4-1</u>. In general, roadway crossing capacities exceeded the 10-year levels, but were found to be less than 50-year capacity. When considering the additional detention required through development of the basin, the roadway crossing capacity increased to convey the 100-year design storm in most locations. The approximate capacity of existing detention basins can be found in <u>Table 4-2</u>.

### 4.2.1 FLO-2D MODEL DEVELOPMENT

Three FLO-2D models were created to encompass the Sharktooth Bluffs Basin. Separate models were created for the west portion (Spur Draw, Missile Park Draw, and Hertzke Draw), central portion (Orr Gulch, Sharktooth Draw), and eastern portion (Poudre Learning Center, Wiedeman Creek, Fairway Tributary, and Northridge Draw) of the basin. The three discrete models allowed the grid cell size to be refined to 10-foot by 10-foot in order 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 Section 1.4. Building obstructions were incorporated into the FLO-2D model as blockages based on the building footprints GIS information provided by the City of Greeley.

The existing storm drain system for pipes 30 inches and greater in diameter were accounted for in the hydraulic analysis by integrating a dynamic SWMM model within the FLO-2D models.

Two different approaches were taken for the residual FLO-2D modeling of the basin. The first FLO-2D approach utilized individual subwatershed hydrographs from the baseline hydrology model (CUHP) and applied these hydrographs directly 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. This approach more accurately correlates the hydrology CUHP runoff with the FLO-2D modeling; however, this approach also leaves gaps in the inundated area upstream of the location where the individual hydrograph is applied.

The second approach used was a rain-on-grid, this approach models the general inundation limits basin-wide. FLO-2D uniformly applies the rainfall hyetograph across the entire basin. The rainfall hyetograph was determined from CUHP using the point precipitation rainfall values. Infiltration was spatially varied throughout the basin using the Horton's infiltration method. Although this method would produce different results from CUHP, it provides an estimate of residual inundated areas within each individual sub-watershed, information which is also valuable to the City.

FLO-2D rain-on-grid is typically modeled to provide general flow paths throughout the basin, identify key design points, and provide preliminary problems area. The baseline hydrology model, utilizing the subwatershed runoff hydrographs from CUHP, is used to help refine problem area identification and provide flooding depths throughout the basin using project hydrology.

## 4.3 FLOOD HAZARDS

The result of the baseline hydrology FLO-2D residual flooding for the 10-, and 100-year design storms can be found in <u>Figure 4.1</u> and <u>Figure 4.2</u>, respectively.

The result of the rain-on-grid analysis for the 10- and 100-year design storm can be found in <u>Figure 4.3</u> and <u>Figure 4.4</u>, respectively.

High hazard zone mapping was completed for the basin using the baseline hydrology FLO-2D. Areas of high hazard indicate locations where an unacceptably high hazard to human safety exists. High hazard was defined as areas where the product of velocity (feet per second) and depth (feet) equals or exceeds four, or where flow depths equal or exceed four feet.

Areas of high hazard for the 10-, and 100-year design storm can be found in <u>Figure 4.5</u> and <u>Figure 4.6</u>, respectively. The flood hazards of each watershed are discussed below:

## 4.3.1 Spur Draw

The FLO-2D analysis indicated the major runoffs are confined within Spur Draw during both the 10- and 100-year design storms. There were also inundation areas during the 100-year design storm to the east of the bluffs but west of the Missile Site Park. These inundated areas do not pose any flooding hazards to insurable structures and no future development is expected in Spur Draw according to future City of Greeley Zoning.

### 4.3.2 MISSILE PARK DRAW

Flows in the upper portions of Missile Park Draw are mainly concentrated in defined drainageways. Discharge is conveyed downstream, ponding behind the Broe Land embankment, with maximum depths nearing nine feet during





the 100-year design storm. Shallow flow overtops the embankment, spreading out, as it flows to the north, northeast to the Cache La Poudre River. Additional ponding areas northwest of Missile Site Park were also observed. Maximum depths of up to ten inches pond in these areas before flow is conveyed northeast into the defined drainageway through the bluffs.

## 4.3.3 HERTZKE DRAW

Runoff in the Hertzke Draw is characterized by centralized flow paths through the drainages in the bluffs with a major alluvial fan as the flows exit the bluffs and continue to the Cache La Poudre River. In the bluffs, subdrainageways converge into a main south to north drainage channel, which has depths ranging from six to twelve inches during the 100-year event. With no current development in the watershed and future zoning indicating the area remain open space, no flooding hazards to structures are expected in Hertzke Draw.

#### 4.3.4 ORR GULCH

Sheet flooding is typical in the lower Orr Gulch basins as the flows leave the defined drainages and, then spread to the alluvial fan as the flows continue north to the Cache La Poudre River. Some of these flows in the lower basins of the watershed split and continue into the Sharktooth Draw outfall. Additional areas of inundation in the western portion of Orr Gulch were also identified. Flow of less than six inches in depth is conveyed north where the runoff ponds against the embankment of the William R. Jones Ditch. North of the Jones Ditch, the flow outfalls into the Cache La Poudre River in multiple locations.

The *Imagine Greeley Land Use Guidance Map* indicates the watershed to remain as open space. If the area were to develop, consideration should be taken to formalize the drainage paths within the watershed.

#### 4.3.5 SHARKTOOTH DRAW

Major inundation is confined to the major drainage ways with depths up to 2.5 feet in areas. There are flooding concerns around the intersection of North 95<sup>th</sup> Avenue and County Road 62. The majority of areas showing inundation are where future land development is designated as open space or nature areas. A significant area of ponding was identified in the area of the proposed Lake Bluff Development, currently irrigated farmland located in the western portion of the watershed. Grading and onsite drainage associated with the Lake Bluff Development would be expected to remove the sump area and convey the discharge downstream. Near the downstream end of the watershed, overtopping of County Road 62 and N 95<sup>th</sup> Avenue pose significant flooding hazards as the basin develops.

#### 4.3.6 POUDRE LEARNING CENTER

The baseline hydrologic scenario show the flows confined to the major drainageways in the southern portions of the watershed before opening up and spreading out as the flows approach the outfalls into the Cache La Poudre River. Flows are ponded to the west of North 83<sup>rd</sup> Avenue as they move from west to east to the river. Several areas of inundation were observed in the Poudre Learning Center subwatershed. West of North 83<sup>rd</sup> Avenue, flow sumps in three locations before continuing north to County Road 62. These three locations have maximum ponding depths of

approximately four feet south of County Road 62. As development occurs, flows overtopping County Road 62 pose increased flooding hazards in the primary east-west corridor in the basin.

Future development in the Poudre Learning Center Basin is zoned to occur in the areas where potential flooding is shown in the models. For these future developments to be protected, careful consideration should be taken in site layout and future storm drainage infrastructure.

## 4.3.7 WIEDEMAN CREEK

The lower portions of Wiedeman Creek, near Poudre River Ranch and River Run at Poudre River Ranch, are fully developed. Two main drainage patterns convey flow through Poudre River Ranch. During the 100-year design storm, depths exceed five feet near the entrance to both culverts along the North 81<sup>st</sup> Avenue drainageway. Street flooding along Poudre River Road and North 81<sup>st</sup> Avenue pose flooding hazards to the watershed with flooding depths exceeding City maximum flow depth criteria of 18-inches. Additional flood hazards were identified south of the future 4<sup>th</sup> Street expansion east of Wiedeman Creek. During the 100-year design storm, flows overtop 4<sup>th</sup> Street in a secondary location east of the roadway culvert crossing. As this area develops, onsite drainage should provide a secondary crossing of 4<sup>th</sup> Street or convey this flow safely to the existing roadway crossing.

As the upper portions of the basin develop and possible 4<sup>th</sup> Street expansion occur, consideration should be taken to ensure no additional flow is conveyed that pose hazards to downstream properties.

## 4.3.8 POUDRE RIVER RANCH

Poudre River Ranch has one major drainage way through the development from the existing farmland to the south. These flows enter the site on North 77<sup>th</sup> Avenue and follow Plateau Road to the west and Poudre River Road to the northeast and east before flows outfall north to the Cache La Poudre River. The FLO-2D modeling shows flows are generally contained within the roadway and don't pose significant flooding hazards to structures.

Future development in the farmlands in the central portion of the Weidman Creek basin south of the Poudre River Ranch Development could potentially direct flows from this area into Poudre River Ranch, creating the potential for hazards.

#### 4.3.9 FAIRWAY TRIBUTARY

On the northern edge of the watershed, flows are generally conveyed in Poudre River Road to the east. Depths approach thirty inches on the south side of the road near the storm drain culvert crossing with depths in the roadway near one foot in this location. Flooding hazards associated with the overtopping of W Melbourne Street and N 71<sup>st</sup> Avenue exists along the eastern edge of the watershed. Flows overtopping N 71<sup>st</sup> Avenue to the east are conveyed into Northridge Draw watershed, adding additional flooding hazards to what local runoff in Northridge Draw would indicate.

Further analysis in the Fairway Tributary watershed identified several areas of inundation, in the upper portions of the watershed, not shown in the baseline conditions model. Discharge is conveyed in the street in Canberra Commons and along Dundee Avenue south of Boomerang Links Golf Course. In general, the models indicate flow is contained within the right-of-way with some flow ponding on private property during the 100-year design storm.





Throughout the golf course, local depressions and the retention ponds north of Canberra Commons were shown to pond in excess of two and half feet during the 100-year design storm. In Boomerang Run, local runoff is conveyed north on Brisbane Avenue discharging into the retention pond located on the north end of the subdivision.

#### 4.3.10 **NORTHRIDGE DRAW**

Throughout Northridge Draw, similar flow patterns were observed between the baseline conditions and rain-on-grid analysis. The 100-year design storm indicates flooding hazards to properties north of C Street and east of N 71<sup>st</sup> Avenue, discharge overtops the private pond to the south of this area, inundating structures to the north. The model also indicates flooding to the south of North 71<sup>st</sup> Ave with depths nearing twelve inches.

#### 4.3.11 **POUDRE RIVER WATERSHEDS**

The Poudre River Watersheds tend to be in the more remote western portion of the study area, or downstream of any development where they do not pose a hazard. The models identified a flow path from North 71<sup>st</sup> Ave northeast to Greeley No. 3 Canal, this flow path does not currently inundate any structures but structures to the south of North 71<sup>st</sup> Street in the Northridge Draw drainage are inundated. Although additional flow paths were observed, no additional flooding hazards were identified in the rain-on-grid analysis for those areas directly tributary to the Cache La Poudre River or the Greeley No. 3 Canal.

#### **Table 4-1: Existing Facilities Inventory**

		Pipe Characte	Pipe Characteristics Design Storm		m Capacity	y Ex. Peak Discharge (cfs)			s)	Fut. Peak Discharge (cfs)			fs)		
Watershed	Location	Size	Capacity (cfs)	Existing	Future	2	5	10	50	100	2	5	10	50	100
Fairway Tributary	Poudre River Road crossing west of Cache Ct.	30" RCP	11	< 50-yr	> 100-yr	1.6	2.8	7.2	53.2	85.3	0.2	0.2	0.2	0.2	0.2
Fallway Inducary	Poudre River Rd. crossing east of Vallevue Dr.	42" RCP	69	> 100-yr	> 100-yr	2.7	4.0	8.2	30.2	43.4	0.5	0.5	0.5	0.5	0.5
	Poudre River Rd. crossing west of Riverside Ct.	36" RCP	111	> 100-yr	> 100-yr	1.4	3.3	9.2	35.3	50.4	0.6	0.6	0.6	0.6	0.6
	78th Ave	30" RCP	38	< 100-yr	>100-yr	0.7	1.7	7.1	36.5	55.0	0.5	0.5	0.5	0.5	0.5
	78th Ave & Poudre River Rd	48" RCP	115	> 100-yr	>100-yr	7.3	11.5	20.5	74.6	107.6	2.3	2.8	3.3	5.7	7.1
	Skyview St	7' x 4' RCBC	309	< 50-yr	> 100-yr	11.9	27.7	84.6	476.8	699.7	14.9	15.0	15.1	15.3	15.5
Wiedeman Creek	81st Ave	5' x 4' RCBC	150	< 50-yr	> 100-yr	14.0	31.0	90.2	494.8	725.5	15.2	15.4	15.5	15.7	15.9
	River Run at Poudre River Ranch	42" RCP	58	> 100-yr	> 100-yr	5.2	6.8	9.0	21.9	29.9	0.1	0.1	0.1	0.1	0.1
	Poudre River Road east of N 83rd Ave	(3) 19" x 30" HERCP	36	> 100-yr	> 100-yr	3.4	4.9	6.7	12.6	15.7	0.3	0.3	0.3	0.3	0.3
	N 83rd Ave south of 4th St	36" RCP	47	< 50-yr	> 100-yr	3.0	7.7	26.9	108.2	153.1	3.4	3.4	3.4	3.4	3.4
	10th St	36" RCP	32	< 50-yr	> 100-yr	3.8	6.0	12.5	46.4	64.7	3.5	4.3	5.1	8.7	10.6
Poudre Learning Center	PLC Crossing of 83rd Ave	48" RCP	128	< 50-yr	> 100-yr	30.7	47.2	97.7	690.0	1094.3	18.5	18.6	18.9	19.7	20.2
	95th Ave	(2) 36" RCP	132	< 50-yr	> 100-yr	10.9	28.8	104.3	528.3	793.3	16.2	18.3	22.6	32.1	40.0
Sharktooth Bluffs	10th Street at Promontory	24" RCP	8	< 50-yr	< 50-yr	0.5	0.6	0.9	9.7	22.6	1.3	1.7	3.6	13.4	21.2
	10th Street west of 95th	54" CMP	188	> 100-yr	> 100-yr	3.2	5.5	13.6	55.9	79.4	2.4	4.5	6.0	11.4	19.2



# SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN





Detention Basin	Watershed	100-yr Peak Inflow (cfs)	100-yr Peak Release (cfs)	Maximum Available Storage (Ac-ft.)	Approximate Capacity (yr)
Melbourne Pond 1	Foothills Tributary	70.6	70.4	0.4	< 2-yr
Melbourne Pond 2	Foothills Tributary	70.4	70.4	0.5	< 10-yr
Northridge High School	Northridge Draw	19.0	8.5	1.2	> 100-yr
Winograd K-8 School	Northridge Draw	36.6	8.7	5.2	> 100-yr
Poudre River Ranch	Poudre River	31.2	31.2	0.02	> 100-yr
CDOT stb 379	Sharktooth Draw	32.4	18.9	3.6	> 100-yr
Promontory	Sharktooth Draw	147.1	22.6	23.4	> 100-yr
CDOT stb 382	Wiedeman Creek	77.5	39.6	4.8	< 50-yr

## Table 4-2: Existing Detention Basin Capacity



# SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN



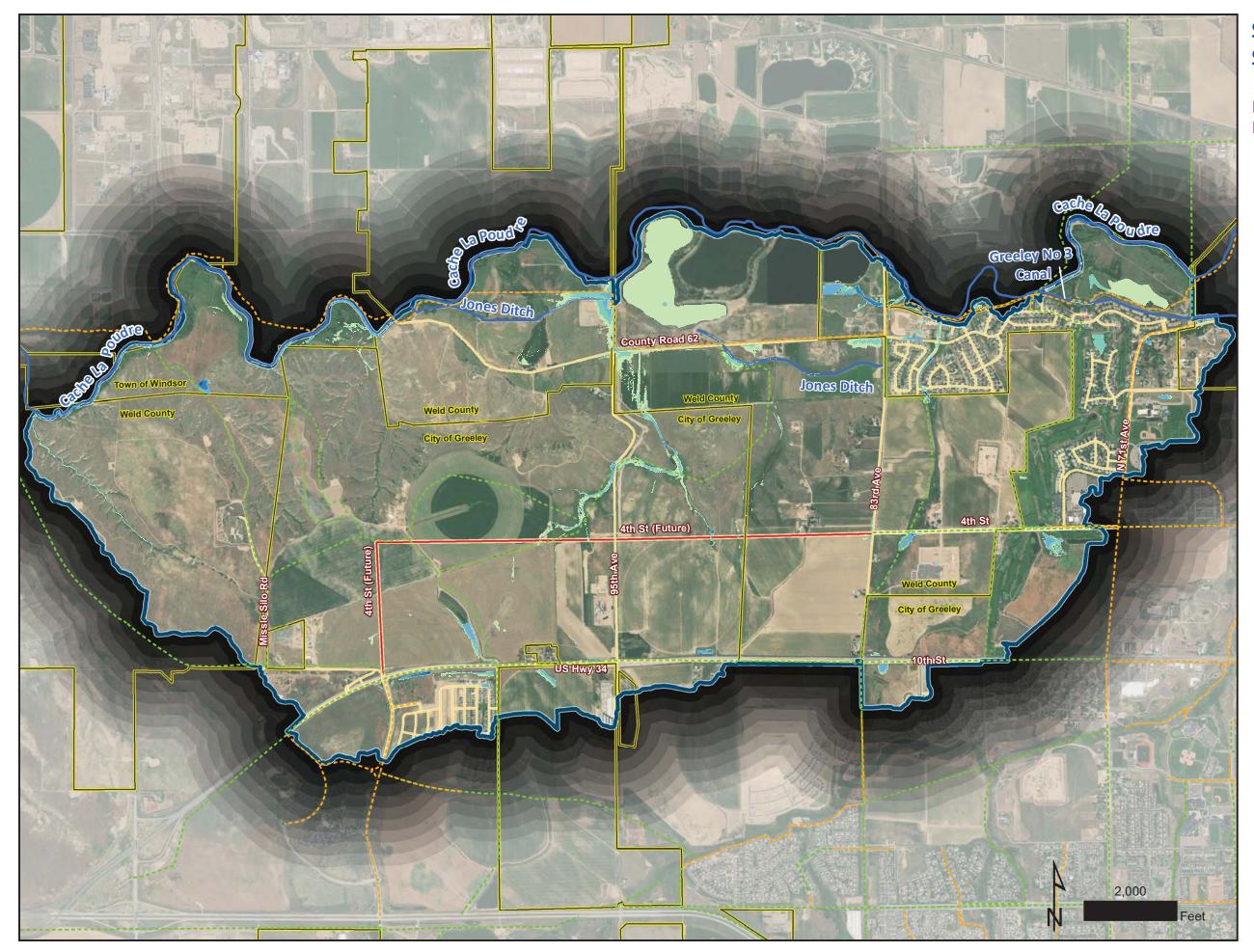


Figure 4.1 - FLO-2D Residual Flooding -Baseline Hydrology - 10-Year

- Existing Trails
- ----- Future Trails
  - Basin Boundary
  - Jurisdictional Boundary

# **Residual Flooding Depth**

3 - 6"
6 - 12"
1 - 2.5'
2.5 - 5'
> 5'





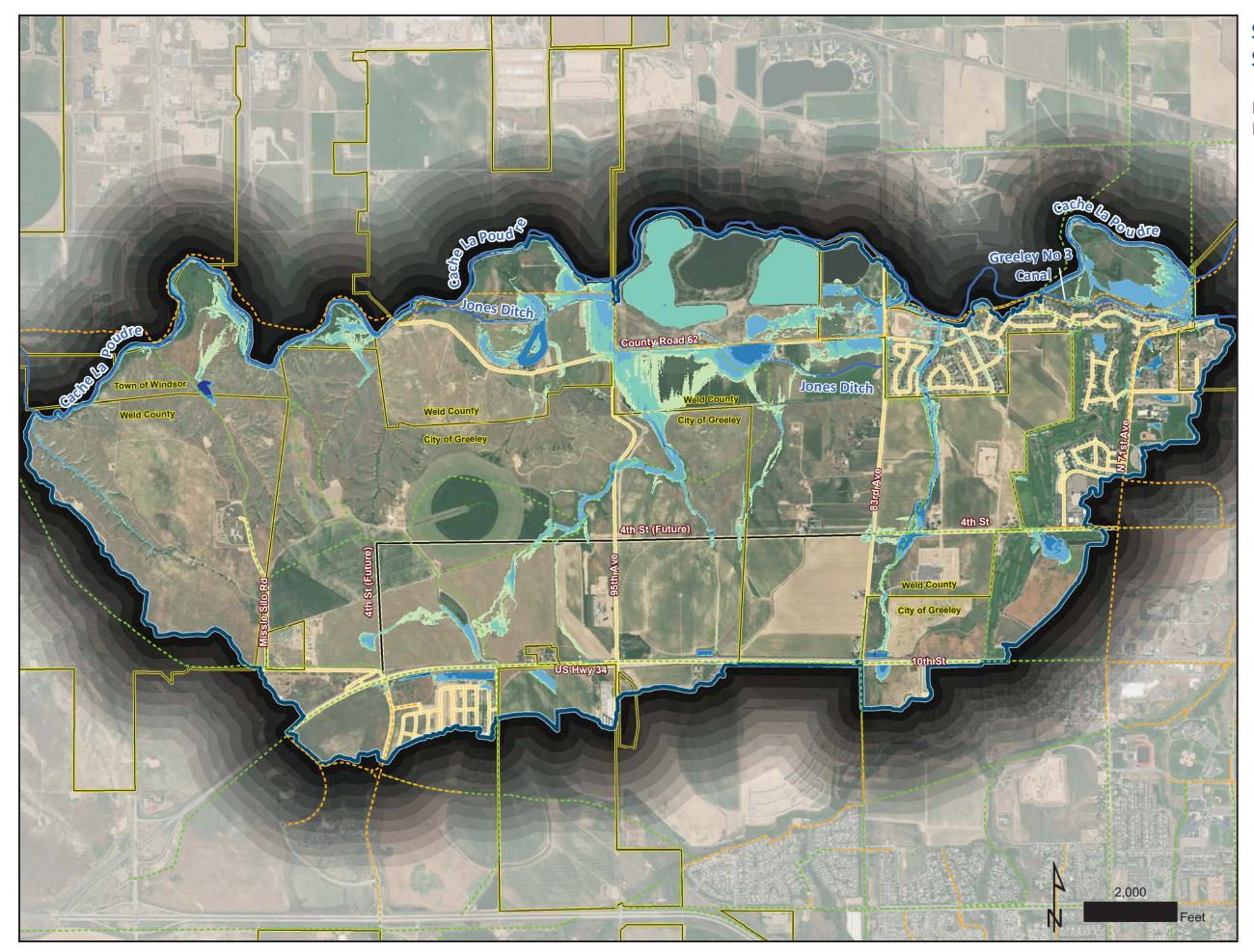


Figure 4.2 - FLO-2D Residual Flooding -Baseline Hydrology - 100-Year

## ----- Existing Trails

----- Future Trails

## **Residual Flooding Depth**

3 - 6"
6 - 12"
1 - 2.5'
2.5 - 5'
> 5'
Basin Boundary
Jurisdictional Boundary





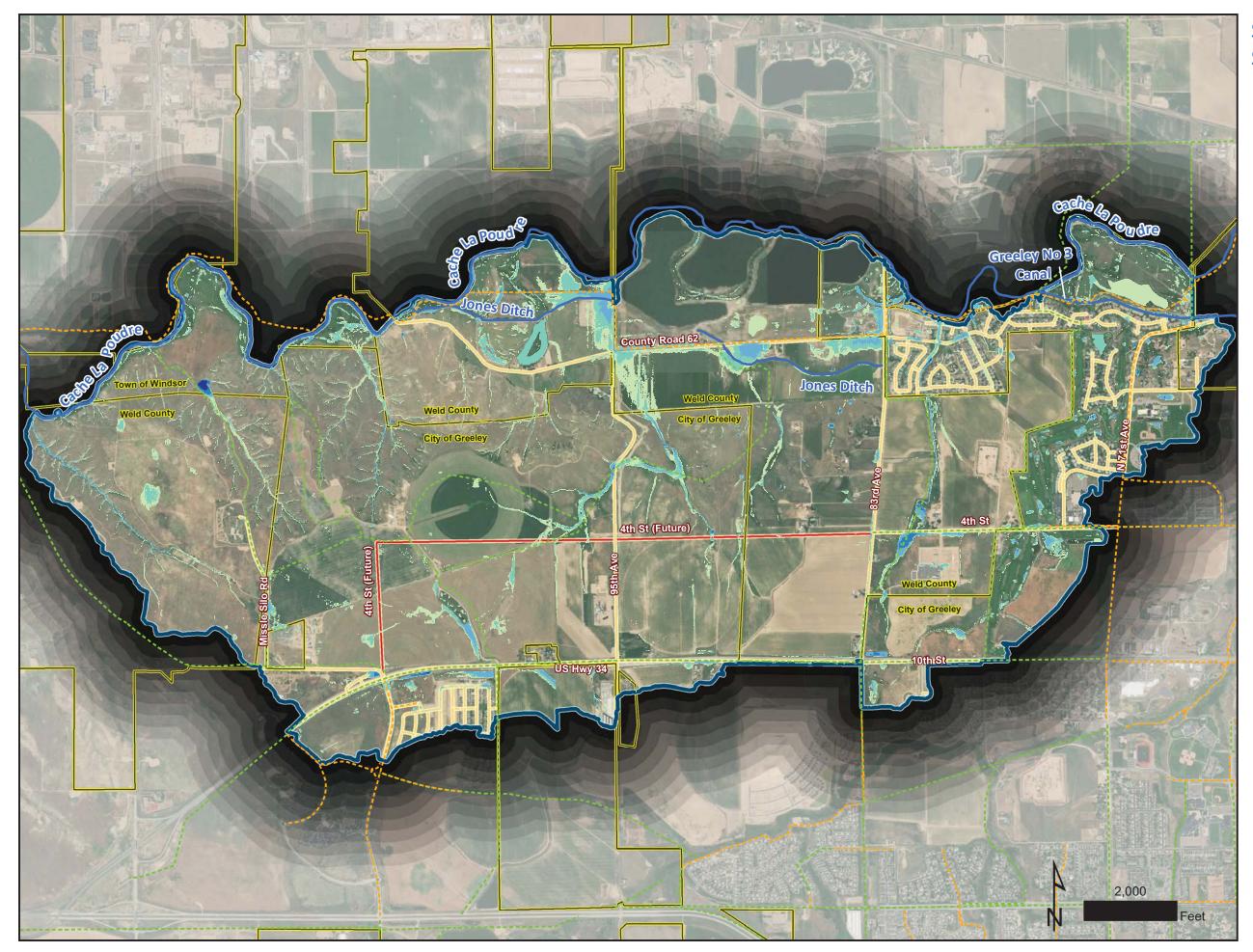


Figure 4.3 - FLO-2D Residual Flooding -Rain-on-grid - 10-Year

- ----- Existing Trails
- ----- Future Trails
  - Basin Boundary
  - Jurisdictional Boundary

# **Residual Flooding Depth**

3 - 6" 6 - 12" 1 - 2.5' 2.5 - 5' > 5'

Greeley



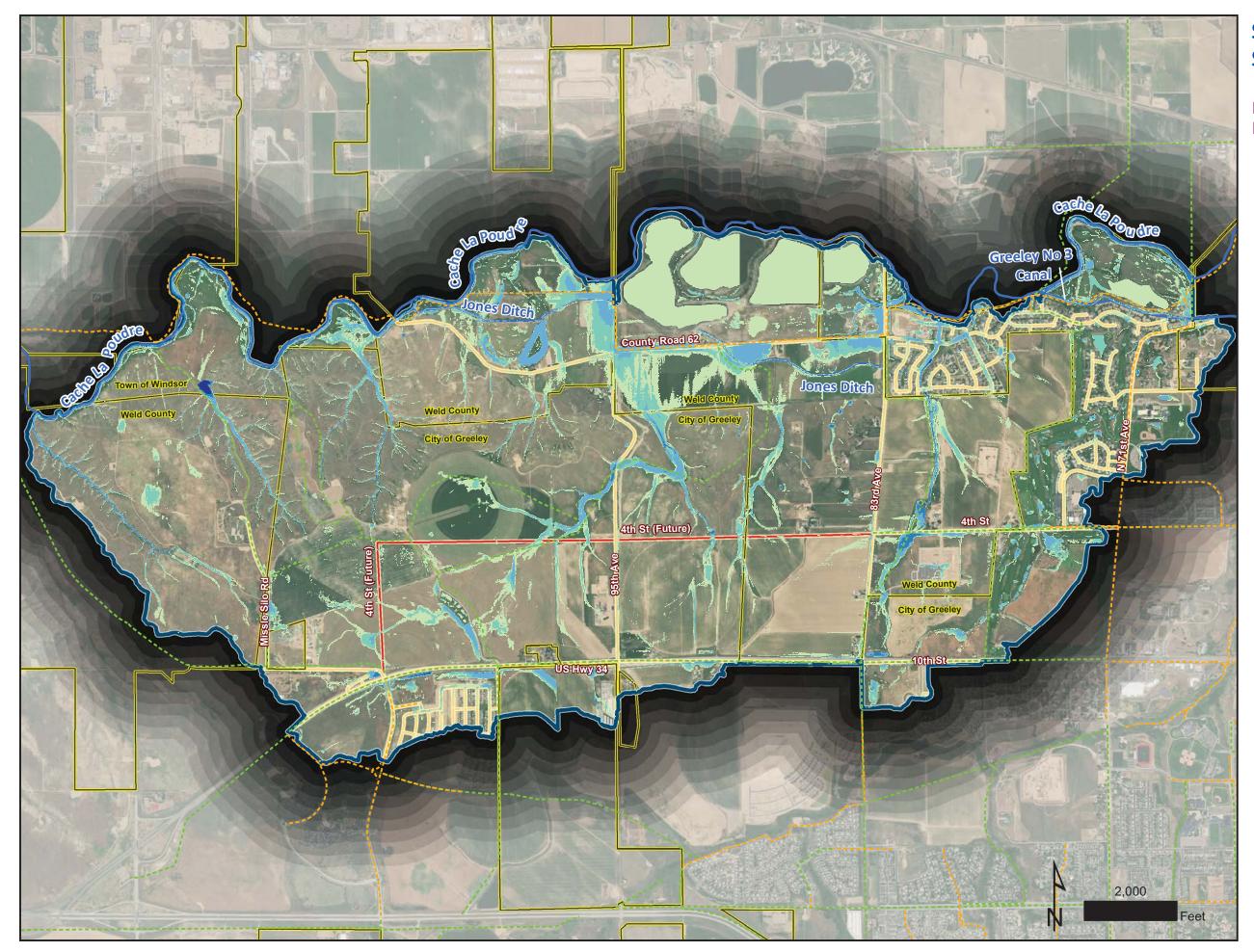


Figure 4.4 - FLO-2D Residual Flooding -Rain-on-grid - 100-Year

# ----- Existing Trails

----- Future Trails

Basin Boundary

Jurisdictional Boundary

# **Residual Flooding Depth**

3 - 6" 6 - 12" 1 - 2.5' 2.5 - 5' > 5'





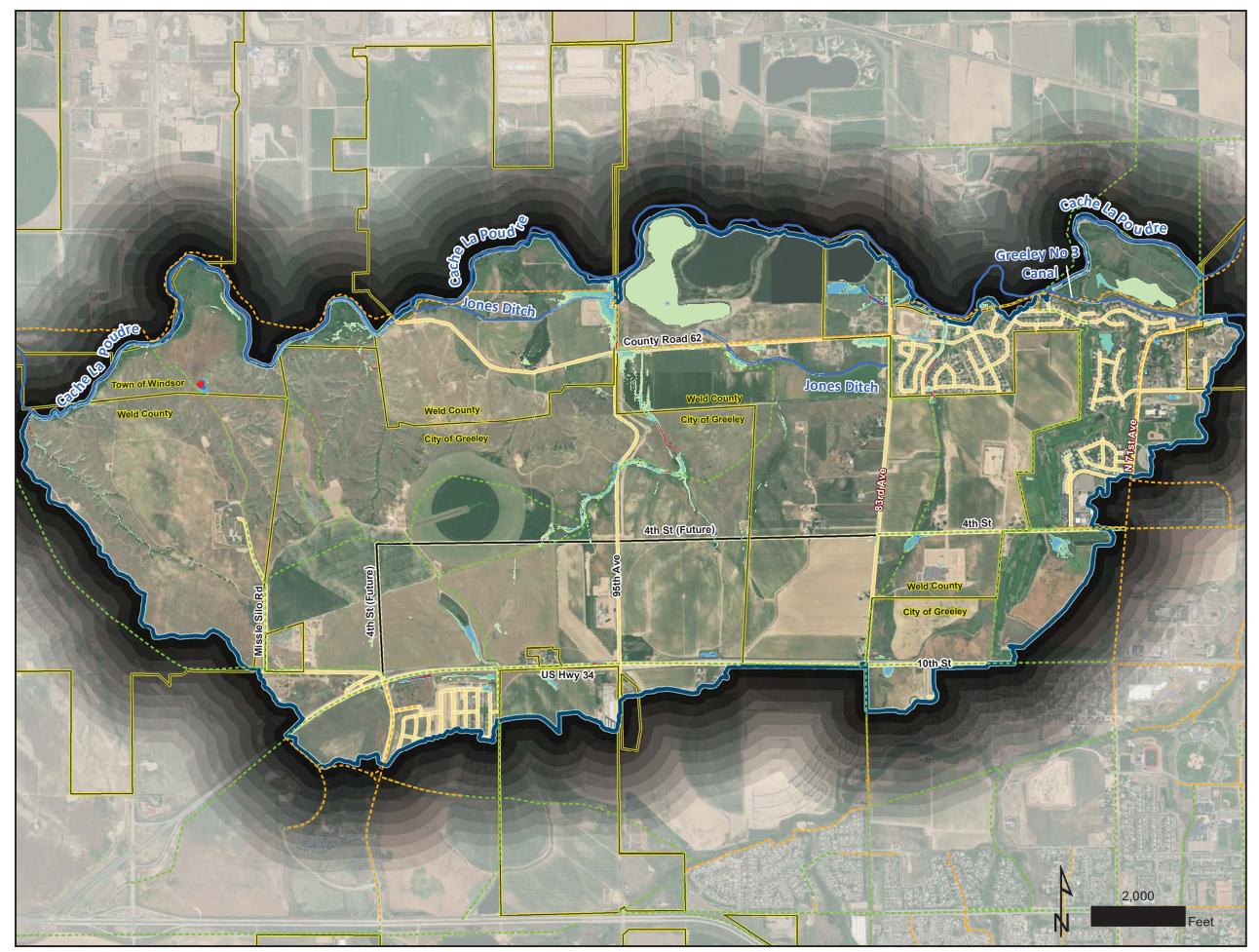


Figure 4.5 - FLO-2D Hazard ID -Baseline - 10-Year

- ----- Existing Trails
- ----- Future Trails

# **Residual Flooding Depth**

3 - 6"
6 - 12"
1 - 2.5'
2.5 - 5'
> 5'
Basin Boundary
Jurisdictional Boundary

\*High hazard area was defined as areas where the product of velocity (feet per second) and depth (feet) equals or exceeds four, or where flow depth equals or exceeds four feet





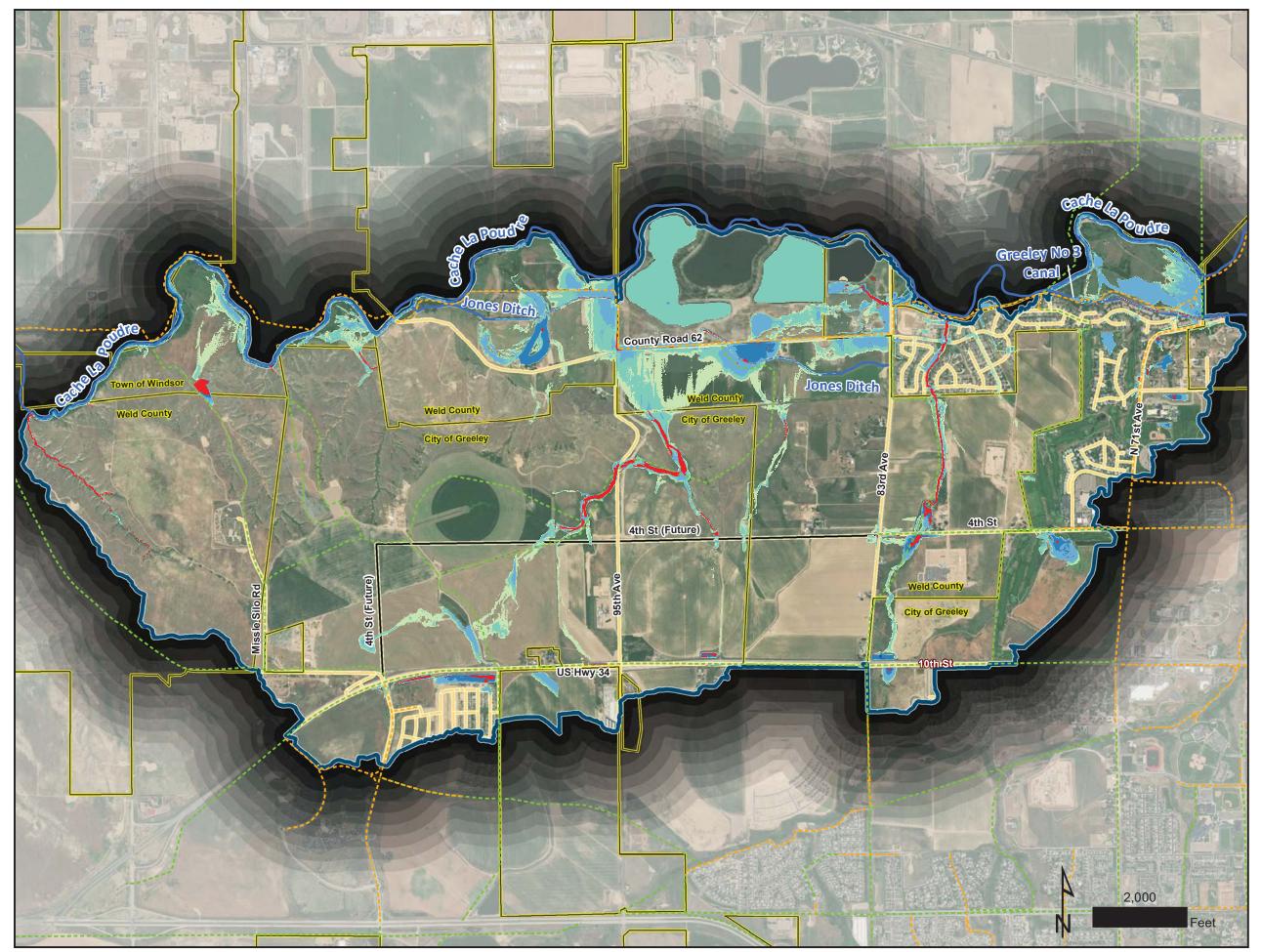


Figure 4.6 - FLO-2D Hazard ID -Baseline - 100-Year

High Hazard Area

	Existing	Trails
--	----------	--------

----- Future Trails

# **Residual Flooding Depth**

3 - 6"
6 - 12"
1 - 2.5'
2.5 - 5'
> 5'
Basin Boundary
Jurisdictional Boundary

\*High hazard area was defined as areas where the product of velocity (feet per second) and depth (feet) equals or exceeds four, or where flow depth equals or exceeds four feet









#### ALTERNATIVE ANALYSIS 5.0

## 5.1 ALTERNATIVE DEVELOPMENT PROCESS

The primary goals of this phase of the project is to develop alternatives which: mitigate existing flooding hazards, ensure current and future roadway crossings are compliant with City criteria, assess channel stability and possible sediment transport from the bluff areas, separate base flows from irrigation ditches, enhance water quality, and provide general guidance for preservation and improvement to the Sharktooth Bluffs drainageways throughout the basin as development begins to occur.

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 the review of project benefits and costs for applicable options. The alternatives can be found in Figure 5.2 through Figure 5.5.

## 5.2 CRITERIA AND CONSTRAINTS

All alternatives were designed to meet criteria set forth in the City of Greeley Design Criteria and Construction Specifications Storm Drainage Volume II (Reference 3).

#### 5.2.1 **FLOOD HAZARD MITIGATION CRITERIA**

Detention basins were designed in accordance to Section 11a of City criteria. Maximum slopes on earthen embankments were designed to be no steeper than 4 horizontal to 1 vertical. Trickle channels were designed with a minimum longitudinal slope of 0.4 percent. A minimum of one foot freeboard was provided above the 100-year water surface elevation. In addition to City criteria, detention basins were limited to a maximum depth of five feet during the 100-year for safety concerns.

Storm drainage alternatives were designed to maintain a minimum of 18-inches of cover.

#### 5.2.2 **ROADWAY CROSSING CRITERIA**

Culvert sizing for proposed roadway crossings were designed to meet criteria set forth in Section 8a and 9a of City criteria. This criteria states that: no overtopping shall occur for any street classification during the 10-year design storm; for local roads with a roadside ditch, collector, and minor arterial roadways, overtopping during the 100-year design storm shall not exceed 6-inches at the street crown; and no overtopping is allowed for roadways classified at major arterials. Roadway crossings were designed such that outlet velocities would not exceed twelve feet per second with a maximum headwater depth of one and one-half times the culvert diameter, or culvert height for nonround shapes.

#### 5.3 ALTERNATIVE CATEGORIES

Across the basin several types of alternative categories were considered to meet project goals within each watershed.

#### 5.3.1 **NO ACTION ALTERNATIVE**

The baseline alternative, or no action alternative, represents no improvements in the basin. The existing flood hazards and roadway overtopping would remain, or potentially worsen over time. Maintenance costs are included in this alternative for existing infrastructure.

#### **MINIMUM DRAINAGE CRITERIA:** 5.3.1

Improvements to meet the minimum criteria for existing and future roadway crossings, along with drainage through development areas, are recommended under this category. Roadway crossings were designed for locations in which the 100-year existing conditions design flow exceeded 100 cfs.

#### 5.3.2 FLOOD CONTROL AND FLOOD HAZARD MITIGATION:

Flood control and flood hazard mitigation alternatives are proposed in areas of the basin when damage to buildings occur and where site specific mitigation measures could be considered to best manage spilt or unconfined flow. In addition, flood control alternatives are proposed in locations with the potential to improve drainage or flooding beyond the City's minimum standards, such as providing conveyance for the 100-year storm event. Alternatives ranged from: confinement of split flows to a central flow path, increasing storm drain capacity to 100-year levels, and detention alternatives to attenuate flows such that existing storm infrastructure could provide a higher level of service.

#### 5.3.3 **CANAL BASE FLOW SEPARATION IMPROVEMENTS:**

In order to help mitigate flooding hazards on downstream property from flows exceeding the capacity of the William R. Jones Ditch and Greeley No. 3 Canal, alternatives were developed in Poudre River Ranch Phase I and II to separate stormwater from entering the canal, continuing the flow paths to the Cache La Poudre River.

#### **5.4 ALTERNATIVE HYDRAULICS**

Alternatives were developed using a variety of hydraulic software. Roadway crossings were designed using the U.S. Department of Transportation's, Federal Highway Administration's, HY-8 Culvert Analysis Program (HY-8). Storm drainage and detention alternatives were modeled using SWMM to determine appropriate pond and pipe size. The reduction in flooding was also reviewed 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, 2018 Third Quarter Report. The average value of the last four quarters (1.34) of the Fisher Ideal Index 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 per year. The minimum level-of-service for maintenance on detention basins and water quality facilities was assumed to occur once a year. Structural maintenance on canal spillways were assumed to be performed once every five years.



# SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN



Costs for detention basins were estimated using the Complete-in-Place detention facility unit costs based on the necessary acre-feet of detention.

More naturalized stream systems are recommended for the Sharktooth Basin. Given many unknown factors, costs developed during alternative analysis also included riprap for undefined bank stabilization (i.e. Type L riprap over an estimated one half of the channel length); planting costs for disturbed areas assumed to be 85 percent reclamation and seeding (native grasses) and the remaining 15 percent wetland plantings; and as applicable riffle grade control at 200 ft. intervals along the channel length.

Right-of way, easement costs, and property values were calculated from current Weld County Assessor's information. Easement / ROW acquisition amounts were calculated as a percentage of the total actual land value. For undeveloped parcels, an average value of \$88,000 / Acre was estimated from properties throughout the basin.

Asphalt was included as a special item within the UD-Cost spreadsheet at \$250 lb. / ton for each roadway crossing.

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. 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%).

#### 5.6 ALTERNATIVE PLANS

## 5.6.1 Spur Draw

Spur Draw, the western most watershed in the Sharktooth Basin, is located just east of US Highway 257. Stormwater runoff from the basin sheet flows to the Sharktooth Bluffs where the narrow gullies convey water northwest to the Cache La Poudre River. All flow is confined to the bluff areas. The watershed is currently undeveloped and future land use projects the watershed to remain open space. No roadway crossings, or other infrastructure is currently proposed in the watershed. Beyond monitoring runoff and potential sediment transport from the bluffs areas, no improvements are currently proposed for this watershed.

#### 5.6.2 MISSILE PARK DRAW

This 275 acre watershed is bounded by Spur Draw to the west, Hertzke Draw to the east, Sharktooth Draw to the south and Cache La Poudre River to the north. The watershed spans three jurisdictions: Town of Windsor at the downstream end of the watershed, unincorporated Weld County, and the City of Greeley. Similar to Spur Draw, stormwater runoff is conveyed in narrow gullies which converge into a drainageway that bisects the watershed. Near the downstream end of the watershed, in the Town of Windsor and Weld County, there is an approximately 10-foot high embankment which detains flows from continuing north to the Cache La Poudre River. As discussed prior, no records were found regarding this being a regulated detention basin or registered state dam.

With exception to ponding that could occur behind this embankment, no other significant drainage problems were identified for this watershed, particularly within the limits of the City of Greeley. Beyond monitoring runoff and potential sediment transport from the bluffs areas, and monitoring the effects of the embankment for water collection, repair, or need to breach, no improvements are currently proposed for this watershed.

#### 5.6.3 HERTZKE DRAW

Hertzke Draw, located to the east of Missile Park Draw and west of Sharktooth Draw watersheds, primarily consists of steep gullies conveying stormwater runoff to the north. Upstream of the outfall into the Cache La Poudre River, the watershed transitions from the confined gully drainageway to an alluvial fan. The watershed lies within Town of Windsor, unincorporated Weld County, and City of Greeley. The bluffs in the southeastern portion of the watershed, within the City of Greeley, lie on property proposed to be developed as part of the Lake Bluff Development.

Flooding potential within the watershed is minimal with more flooding potential located in the alluvial zones near the Poudre River. No buildings or structures are shown to be inundated and flooding potential will be lessened with future development in the watershed. Beyond monitoring runoff and potential sediment transport from the bluffs areas, no improvements are currently proposed for this watershed.

## 5.6.4 ORR GULCH

Orr Gulch is bounded by Hertzke Draw to the west and Sharktooth Draw to the south and east. The northern portion of the watershed falls within unincorporated Weld County, while the southern portion is located within the City of Greeley. The portion within the City of Greeley is proposed to remain open space as part of the proposed Lake Bluff Development. The narrow bluff gullies collect stormwater runoff in the headwater of the basin before the flow is spread into an alluvial fan south of County Road 62. North of County Road 62, the William R. Jones Ditch bisects the lower watershed, conveying irrigation flows from the Cache La Poudre River to Siebring Reservoir.

Flooding problems within the watershed are primarily related to ponding south of the William R. Jones Ditch, where flow depths approach 3-feet in what appears to be a historic oxbow from the Cache La Poudre River and potential overtopping of County Road 62. Since this area is located outside of the City of Greeley with no current plans for expansion of this roadway system, no alternatives were evaluated in this watershed.

#### 5.6.5 SHARKTOOTH DRAW

Sharktooth Draw extends from south of 10th Street to the Cache La Poudre River, covering 1,235 acres. The watershed lies within the City of Greeley and unincorporated Weld County. The headwaters of Sharktooth Draw begin south of 10th Street, east of Promontory Circle near the State Farm property. Stormwater runoff then continues in a northeast direction to the river.

Flooding within the watershed is generally confined near 10<sup>th</sup> Street, then transitions between overland and confined flow through 95<sup>th</sup> Avenue when entering the bluffs region. Downstream, flood flows again become unconfined when Sharktooth Draw splits to the north and the east, in an alluvial pattern, near County Road 62, diverting up to 541 cfs of the total 100-year discharge of 1063 cfs to the Poudre Learning Center watershed.

Problems areas within the watershed focus around overtopping of existing roadway crossings, including: 95<sup>th</sup> Avenue, both north of 10<sup>th</sup> Street and closer to the Poudre River near County Road 62; and County Road 62, which currently has no defined drainage system and is located within Greeley's anticipated expansion area. These areas experience overtopping in both the 10- and 100-year events. In addition to the roadway crossings, the split flow near 95<sup>th</sup> Avenue and County Road 62 has the potential to impact roadway improvements and future development





during the larger storm events (above the 10-year level). Finally, the future expansion of 4<sup>th</sup> Street will require planning as it crosses drainages within the Sharktooh Draw watershed. Currently, the proposed 4<sup>th</sup> Street alignment is proposed to cross three local drainages.

#### 5.6.5.1 **NO ACTION ALTERNATIVE**

The No Action Alternative for the Sharktooth Draw watershed consists of maintaining the existing roadway culvert crossings at 95<sup>th</sup> Avenue, north of 10<sup>th</sup> Street. This work is required to ensure that the existing culvert is functional during a storm event. No other action is required within the watershed.

#### 5.6.5.2 MINIMUM CRITERIA ALTERNATIVE

The Minimum Criteria Alternative addresses overtopping for 95<sup>th</sup> Avenue near 10<sup>th</sup> Street and overtopping of 95<sup>th</sup> Avenue near County Road 62. In addition, this alternative proposes culverts sized for the three drainageway crossings along the 4<sup>th</sup> Street Alignment.

95<sup>th</sup> Avenue, north of 10th Street. As shown by the hydraulic study, drainage in this area overtops the roadway to the north of the current crossing. 0.5 foot to 1 foot of overtopping occurs during the 10-year event and 1 foot to 2 foot of overtopping occurs during the 100-year event. The Minimum Criteria Alternative proposes to improve the 95<sup>th</sup> Avenue crossing from two 36-inch RCP's to a two cell 8 foot by 4.5 foot RCBC. The improved crossing structure will convey 764 cfs, with approximately 29 cfs overtopping the roadway during existing conditions 100-year event.

95<sup>th</sup> Avenue and County Road 62. No significant culvert crossings currently exist for either 95<sup>th</sup> Avenue or County Road 62 at this location. Only an 18" CMP currently crosses 95<sup>th</sup> Avenue, east to west. As shown by the hydraulic study, drainage in this area overtops each roadway splitting flow between the Sharktooth Draw and Poudre Learning Center Watersheds. 10-year overtopping depths are approximately 3 to 6 inches, whereas 100-year depths exceed a foot. The Minimum Criteria Alternative proposes to add a double 10 foot by 6 foot RCBC culvert at the 95<sup>th</sup> Avenue/ County Road 62 intersection to reduce overtopping depths to meet criteria. Approximately 1,063 cfs will be conveyed in the box culvert with 45 cfs overtopping the roadways during the 100-year event. The improved crossing structure will convey 935 cfs, with approximately 45 cfs overtopping the roadway during existing conditions 100-year event. To effectively collect the Sharktooth Draw flows for the culvert conveyance, channel grading would be anticipated up to 3,000 feet upstream and 1,500 feet downstream of the proposed culvert crossing, along private property to the east of 95<sup>th</sup> Avenue. Alternative outfall channels were developed to convey the flow downstream of County Road 62 on both the east and west side. The east side alternative proposes to discharge the outfall to Siebring Reservoir; however it may be preferred to outfall to the Cache La Poudre River, in which case a separation crossing with the Jones Ditch may be required. Both construction costs and easement costs for the 90 foot wide channel have been included in the alternative cost estimates, although this work could also be completed through redevelopment. With this improvement, the split flow to the Poudre Learning Center Basin will be eliminated for flows up to the 100-year event.

*Future* 4<sup>th</sup> Street Culvert Crossings: The future expansion of 4<sup>th</sup> Street will require planning as it crosses drainages within the Sharktooth Draw watershed. Currently, the proposed 4<sup>th</sup> Street alignment is proposed to cross three local drainages, referred to as 4<sup>th</sup> Street West, Central, and East, for comparison. The Minimum Criteria Alternative proposes to add new culvert crossings meeting city criteria. These culverts are identified below:

	Ex. 100-year Discharge		<b>Culvert Flow</b>	<b>Overtopping Flow</b>
Location	(cfs)	Improvement	(cfs)	(cfs)
Future 4th Street				
Crossing (West)	391	10 ft. x 4.5 ft RCBC	338	53
Future 4th Street				
Crossing (Central)	151	48 in. RCP	122	29
Future 4th Street				
Crossing (East)	124	48 in. RCP	111	13
95th Avenue	793	(2) 8 ft. x 4.5 ft. RCBC	764	29
95th Avenue /				
County Road 62	1,063	(2) 10 ft. x 6 ft. RCBC	1020	43

FLO-2D modeling in the area of 4<sup>th</sup> Street identified depths surrounding the future roadway ranging from one to six inches in the 10-year design storm to over 1 foot during the 100-year event. More importantly, the flow width during the 100-year even can exceed two hundred feet, where special consideration should be taken in the culvert design and construction. It may be more practical to construct more than one culvert in each area.

## 5.6.5.3 FLOOD CONTROL AND FLOOD HAZARD MITIGATION ALTERNATIVES

No buildings or structures are inundated by flood flows within the Sharktooth Draw Basin. Flood control improvements consist of upsizing the proposed roadway crossings to 100-year facilities. A listing of the proposed facilities meeting 100-year capacity is shown below.

## Table 5-2: Sharktooth Draw - Flood Control and Flood Hazard Mitigation Alternatives

Location	Ex. 100-year Discharge (cfs)	Improvement Size
Future 4th Street Crossing (West)	391	12' x 4' RCBC
Future 4th Street Crossing (Central)	151	6 ft. x 3 ft. RCBC
Future 4th Street Crossing (East)	124	6 ft. x 3 ft. RCBC
95th Avenue	793	(2) 10 ft. x 5 ft. RCBC
95th Avenue / County Road 62	1,063	(2) 10 ft. x 7 ft. RCBC

#### CANAL BASE FLOW SEPARATION IMPROVEMENTS 5.6.5.4

No specific canal base flow separation alternatives have been proposed for the Sharktooth Draw watershed. As discussed previously, depending on the selected outfall for the watershed (i.e. the Cache La Poudre River or the Siebring Reservoir, an improvement to bypass the Jones Ditch may be required. If selected, this will be addressed during the conceptual design phase.



#### Table 5-1: Sharktooth Draw - Minimum Criteria Alternatives



## 5.6.5.1 SUMMARY

A summary of alternatives and costs based on each alternative plan are presented below. The total costs include property acquisition, City project management, and engineering costs broken out in further sections of this report.

Location	Alternative Plan	Improvement	Total Capital Cost	50-YR O&M
Future 4th Street	Minimum Criteria	10 ft. x 4.5 ft. RCBC	\$ 188,188	\$ 3,142
Crossing (West)	Flood Control	12 ft. x 4 ft. RCBC	\$ 210,434	\$ 3,142
Future 4th Street	Minimum Criteria	48 in. RCP	\$ 51,379	\$ 3,142
Crossing (Central)	Flood Control	6 ft. x 3 ft. RCBC	\$ 116,330	\$ 3,142
Future 4th Street	Minimum Criteria	48 in. RCP	\$ 51,379	\$ 1,571
Crossing (East)	Flood Control	6 ft. x 3 ft. RCBC	\$ 127,482	\$ 1,571
95th Avenue	Minimum Criteria	(2) 8 ft. x 4.5 ft. RCBC	\$ 326,674	\$ 3,771
95th Avenue	Flood Control	(2) 10 ft. x 5 ft. RCBC	\$ 384,338	\$ 3,771
County Road 62 &	Minimum Criteria	(2) 10 ft. x 6 ft. RCBC Channel Improv.	\$ 4,482,851	\$ 331,519
Upstream Channel	Flood Control	(2) 10 ft. x 7 ft. RCBC Channel Improv.	\$ 4,584,145	\$ 331,519
Downstream of	Option 1	Channel Improv West of CR 62	\$ 2,387,740	\$ 169,687
County Road 62	Option 2	Channel Improv East of CR 62	\$ 1,374,785	\$ 94,271

#### Table 5-3: Sharktooth Draw Alternative Costs

#### 5.6.6 POUDRE LEARNING CENTER

The Poudre Learning Center watershed extends from the Cache La Poudre River south to 10th Street, between N 83rd Avenue to the east and N 95th Avenue to the west. Flow in the upper portion of the watershed primarily consists of sheet flow down into the bluffs. The stormwater runoff spreads from the confined flow in the bluffs into an alluvial fan south of County Road 62. Flow crosses the William R. Jones Ditch and County Road 62 into Siebring Reservoir. An outlet channel from the most eastern portion of Siebring Reservoir conveys flow east to 83rd Avenue before the outfall location into the Cache La Poudre River.

Hydraulic analysis demonstrates that flows within the watershed are generally confined to the major drainageways in the southern portions of the watershed before fanning overland as the flows approach the outfalls into the Cache La Poudre River. Flow ponds south of County Road 62 and west of North 83rd Avenue, including open areas of the Poudre Learning Center property. South of County Road 62, three locations have maximum ponding depths of approximately four feet. Future development near the Poudre Learning Center Basin is zoned to occur in the areas where potential flooding is shown in the models. For these future developments to be protected, careful consideration should be taken in site layout and future storm drainage infrastructure.

County Road 62 bisects the watershed at the north end of the basin. Similar to the Sharktooth Draw watershed, County Road 62 is mostly outside of the City of Greeley; however it is located within Greeley's anticipated expansion area. Just west of 83<sup>rd</sup> Avenue, adjacent to the Poudre Learning Center, County Road 62 is located within the City boundaries.

An out-building is potentially inundated from flooding, north of the Jones Ditch near the westernmost sump location. Even after improvements are made to the western spill flows in the Sharktooth Draw basin, this building may remain in a potential inundation area due to its proximity with the canal. No other buildings are identified to be inundated during the existing conditions 100-year event; however, it should be noted that an oil and gas well site does exist within the headwaters channel of the draw, near the future 4<sup>th</sup> Street alignment.

Discharges at the future 4<sup>th</sup> Street alignment remain less than 100-cfs at this location; therefore, improvement alternatives were not developed within the Poudre Learning Center watershed for the roadway system.

#### 5.6.6.1 NO ACTION ALTERNATIVE

The No Action Alternative for the Poudre Learning Center watershed consists of maintaining the existing roadway culvert crossings at County Road 62, an existing 24" CMP, and the existing crossing at 83rd Avenue, a 48" RCP. This work is required to ensure that the existing culvert is functional during a storm event. No other action is required within the watershed.

#### 5.6.6.2 MINIMUM CRITERIA ALTERNATIVE

The Minimum Criteria Alternative proposes to install, or improve, culvert crossings along County Road 62 and 83<sup>rd</sup> Avenue. At 83<sup>rd</sup> Avenue, the existing 48" RCP is proposed to be replaced with a two cell 13 foot by 6 foot RCBC. 83<sup>rd</sup> Avenue is a major arterial, requiring 100-year conveyance capacity with no overtopping. The RCBC will convey the 100-year design flow of 1,094 cfs through the crossing.

Along County Road 62, new culverts are proposed at the three sump locations located between the Jones Ditch and the roadway. These three culverts are fed by the 790 cfs runoff exiting the draw. The alluvial topography generally splits flow evenly between east and west flow paths, roughly 400-cfs each way. 12 foot by 4 foot RCBC's are proposed at the western most and easternmost sump locations to convey 400-cfs each, with less than six inches of water overtopping the roadway. The western culvert is proposed to be installed in a sump condition discharging towards the quarry area located in the center of the western flow path. The eastern culvert will replace the existing 24" CMP and discharge west of 83<sup>rd</sup> Avenue on the Poudre Learning Center property. Due to the culvert depth at this location channel and bank grading between the learning center and roadway will be needed to the 83<sup>rd</sup> Avenue Culvert. The primary purpose of the central culvert is to drain the localized sump from crossing the roadway. A 36" RCP culvert is proposed to cross County Road 62 and bike path, discharging into a localized swale in the Poudre Learning Center property.





Location

County Road 62 (West)

County Road 62 (Central)

County Road 62 (East)

83rd Avenue

# SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN

All of these improvements assume that the split flow from Sharktooth Draw is able to be discharged north with flow removed from the Poudre Learning Center basin. If improvements within the Poudre Learning Center Watershed occur first, the culvert sizes may need to be enlarged for additional discharges.

#### 5.6.6.5 SUMMARY

A summary of alternatives and costs based on each alternative plan are presented below. The total costs include property acquisition, City project management, and engineering costs broken out in further sections of this report.

#### Table 5-7: Poudre Learning Center Alternatives Cost

Location	Alternative Plan	Improvement	Total	Capital Cost	50-	YR O&M
County Road 62 (West)	Minimum Criteria	12 ft. x 4 ft. RCBC	\$	303,689	\$	3,142
County Road of (West)	Flood Mitigation	12 ft. x 5 ft. RCBC	\$	346,173	\$	3,142
County Road 62 (Central)	Minimum Criteria	36 in. RCP	\$	40,735	\$	1,571
		12 ft. x 4 ft. RCBC &				
County Road 62 (East)	Minimum Criteria	DS Channel	\$	586,032	\$	66,775
County Road of (East)		12 ft. x 5 ft. RCBC &				
	Flood Mitigation	DS Channel	\$	619,772	\$	66,775
Jones Ditch at 83rd Ave	Canal Baseflow	Spillway &				
Jones Ditch at 83rd Ave	Separation	DS Channel	\$	130,249	\$	32,492
83rd Avenue	Minimum Criteria	(2) 13 ft. x 6 ft. RCBC	\$	562,723	\$	5,028

#### 5.6.6.3 FLOOD MITIGATION ALTERNATIVE

Ex. 100-year Discharge

(cfs)

400

--

400

1,094

Flood control improvements consist of upsizing the proposed roadway crossings to 100-year facilities. Street classification dictated 83<sup>rd</sup> Avenue as a 100-year crossing in the Minimum Criteria Alternative and no additional Flood Mitigation Alternative was developed. A listing of the proposed facilities meeting 100-year capacity is shown below.

#### Table 5-5: Poudre Learning Center Flood Mitigation Alternatives

Location	Ex. 100-year Discharge (cfs)	Improvement Size
County Road 62		
(West)	400	12 ft. x 5 ft. RCBC
County Road 62		
(East)	400	12 ft. x 5 ft. RCBC
83rd Avenue		

#### 5.6.6.4 **CANAL BASE FLOW SEPARATION IMPROVEMENTS:**

The Jones Ditch has the potential to intercept runoff from flow exiting the Poudre Learning Center main draw, and from backwater behind County Road 62. Due to the alignment differences between the ditch, roadway, and draw exit location, separation of the inflows did not appear practical. As an option, a designated spill location has been proposed upstream of 83<sup>rd</sup> Avenue to spill flows above the canal decree to the County Road 62 east culvert and subsequently through 83<sup>rd</sup> Avenue and to the Cache La Poudre River.

#### **Table 5-6: Poudre Learning Center Canal Seperation Alternatives**

Location	Improvement Size
Jones Ditch at	50 ft. spillway and DS
83rd Avenue	Channel

#### 5.6.7 WIEDEMAN CREEK

The Wiedeman Creek watershed extends from the Cache La Poudre River south beyond 10th Street. The watershed lies within the City of Greeley and unincorporated Weld County. Runoff generally drains south of 10th Street, north to the Cache La Poudre River. Poudre River Ranch Phase III and the River Run at Poudre River Ranch Phases I and II developments are present within this watershed. Two main drainage patterns convey flow through Poudre River Ranch. During the 100-year design storm, depths exceed five feet near the entrance to both culverts along the North 81st Avenue drainageway. Street flooding along Poudre River Road and North 81st Avenue pose flooding hazards with flooding depths exceeding City maximum flow depth criteria of 18-inches. Additional flood hazards were identified south of the future 4th Street roadway expansion, east of Wiedeman Creek in a localized sump area.

Primary problems within the Wiedeman Creek watershed focus on drainage within the Poudre River Ranch Phase III development area. The more prominent area of concern is at the southern boundary of the property, where the drainage infrastructure is undersized. First, the 700 cfs discharge from the south exceeds the capacity of the existing 7 foot wide by 4 foot tall RCBC. This results in overtopping of Skyview Street in excess of City criteria. Downstream, the system downsizes to a 5 foot wide by 4 foot tall RCBC, resulting in spill flows to 81<sup>st</sup> Avenue with flow depths in excess of the City's 18 inch criteria. Two homes are inundated west of the 5 foot by 4 foot box culvert entrance where flow spills onto 81<sup>st</sup> Avenue. A reduced slope on the culvert section limits the storm drain capacity to less than an estimated 185 cfs. The combined lack of drainage in this area exceeds City criteria regarding flow depth, with also the potential to inundate recently constructed homes. Baseline hydraulic modeling indicates one home in the River Run at Poudre River Ranch Phase I is inundated at the northeast corner of Poudre River Road and 81<sup>st</sup> Avenue. Surface flow continues north in 81<sup>st</sup> Avenue spilling over River Run Drive to the north into the Cache La Poudre River.



## Table 5-4: Poudre Learning Center Minimum Criteria Alternatives

Improvement

12 ft. x 4 ft. RCBC

36 in RCP

12 ft. x 4 ft. RCBC

(2) 13 ft. x 6 ft. RCBC

**Culvert Flow** 

(cfs)

351

--

351

1,094

**Overtopping Flow** 

(cfs)

49

--

49

--



Local runoff west of 81st Avenue in Poudre River Ranch Phase III is conveyed through two primary flow paths. A grass swale conveys flow to three elliptical concrete pipes crossing Poudre River Road just east of N 83rd Avenue. Street flow is conveyed north on Double Tree Drive turning east at Poudre River Road. Stormwater at this location is intercepted in a storm drain that conveys and intercepts additional stormwater runoff through River Run at Poudre River Ranch Phase II. Flow sumps in two locations along Redwing Avenue within River Run at Poudre River Ranch Phase II but flooding is confined within the right-of-way and does not exceed City depth criteria of 18 inches.

Runoff from the existing farm land and Boomerang Links concentrates in two additional locations before being conveyed through Poudre River Ranch Phase III. First, stormwater is intercepted along N 78th Avenue in a storm drain system that increases in size from 18-inches at Skyview Street to 36-inches at Poudre River Road. The flow is unconfined upstream of the neighborhood inundating one structure south of Skyview Street and west of 78<sup>th</sup> Avenue. Flows exceeding the capacity of the 18 inch lateral along Sage Avenue spill to the east inundating three homes during the 100-year storm. Surface runoff sumps just west of 78<sup>th</sup> Avenue, exceeding City criteria of 18 inches in depth. The storm drain discharges west of Riverside Court into an open channel that conveys flow into a water quality basin and subsequently the Cache La Poudre River. Second, a 30-inch storm drain intercepts stormwater runoff from the existing farm land east of Amour Hill Drive. The shallow unconfined flow from the Wiedeman Family Farm is intercepted within the 30-inch storm drain, inundating two structures as the stormwater continues west to Amour Hill Drive. The storm drain flow is conveyed west where the flow is discharged into an open channel between N 78th Avenue and Amour Hill Drive. The open channel is conveyed underneath Poudre River Road in a 36-inch storm drain which outfalls in the same open channel as the storm drain in N 78th Avenue.

#### 5.6.7.1 NO ACTION ALTERNATIVE

The No Action Alternative Plan proposes no improvements to the drainage systems within the Wiedeman Creek watershed. This alternative consists of maintaining the existing roadway culvert crossings at 10<sup>th</sup> Street, N 83<sup>rd</sup> Avenue, Poudre River Road (east of 83<sup>rd</sup> Avenue), River Run at Poudre River Ranch, 81<sup>st</sup> Avenue, 78<sup>th</sup> Avenue, and the Poudre River Road crossing west of Riverside Court.

With the No Action Alternative, drainage concerns will not be improved through the Poudre River Ranch Phase II and the River Run at Poudre River Phase I and II neighborhoods, but will rely on future development upstream to alleviate the problems over time through established development criteria.

#### 5.6.7.1 MINIMUM CRITERIA ALTERNATIVE

For Poudre River Ranch Phase III, meeting the minimum City criteria requires that the roadways not overtop beyond a 6 inch depth during the 100-year event and that an 18 inch depth is not exceeded along the roadways. This predominately requires improvement to the Skyview Street culvert and 81<sup>st</sup> Avenue storm drain system. At Skyway Street, a 12 foot by 5 foot RCBC is proposed to convey the 700 cfs, with 607 cfs passing the culvert and 93 cfs overtopping the roadway at a depth less than 6 inches. Along North 81st Avenue, utility conflicts north of Poudre River Road restrict storm drain infrastructure height to four feet. The Minimum Criteria Alternative proposes a 9 foot by 4 foot box culvert to convey approximately 380 cfs in the storm drain allowing the excess 320 cfs to overtop onto North 81st Avenue. Existing street capacity in 81st Avenue is approximately 380 cfs before the flooding depth criteria of 18-inches is exceeded. As an alternative, detention upstream of Skyview Drive on the vacant Wiedeman Family Farm parcel was considered to reduce flood depths downstream. Approximately 7.5 Ac-ft. of detention is required to detain the existing conditions 100-yr flow to 500 cfs. The detained 100-year peak flow rate of 500 cfs can be safely conveyed in the existing storm drain at North 81st Avenue and overflow in the street at a depth of less than 18-inches. The proposed detention improvements would alleviate the existing flooding issues in Poudre River Ranch Phase II and could be incorporated into the future detention required at upstream properties develop. Alternative costs include purchase of property for this detention pond. However, the City may be able to request payback for this property should it be incorporated into the future development needs.

Proposed improvements to the 78<sup>th</sup> Avenue storm drain system from Poudre River Road east alleviate depth in excess of 18-inches during the 100-year design storm just west of 78<sup>th</sup> Avenue. Increasing the existing 48 inch storm drain to a 60 inch provides the additional conveyance capacity to reduce street flooding to meet City depth criteria.

For the current conditions and future 4<sup>th</sup> Street alignment, to meet current City criteria, the 4<sup>th</sup> Street roadway crossing near 83<sup>rd</sup> Avenue is proposed to be improved to a 6 foot by 4 foot RCBC, reflecting 238 cfs culvert capacity and 36 cfs overtopping. Similar to the Sharktooth Draw watershed, the top width of flow in this area is significant, close to 1,500 feet. The expanse of flow will need to be considered in the design of a culvert for 4<sup>th</sup> Street. Improvements at this location will also reduce inundation on 83<sup>rd</sup> Avenue which has the potential to occur.

#### Table 5-8: Wiedeman Creek Minimum Criteria Alternatives

	Ex. 100-year		<b>Culvert Flow</b>	<b>Overtoping Flow</b>
Location	Discharge (cfs)	Improvement	(cfs)	(cfs)
4th Street	264	6 ft. x 4 ft. RCBC	238	36
Skyview Street	700	12 ft. x 5 ft. RCBC	607	93
81st Avenue (Storm				
Drain)	700	9 ft. x 4 ft. RCBC	380	320
81st Avenue	Inflow 700	<b>Detention Basin</b>		
(Detention)	Outflow 500	(7.5 Ac-ft.)	180	320
78th Avenue	108	60" RCP	108	

#### 5.6.7.2 FLOOD MITIGATION ALTERNATIVES

Similar to the minimum criteria alternatives, flood mitigation alternatives are proposed in Poudre River Ranch Phase III to eliminate flooding from the streets and development areas. Along the southern flowpath, from Skyview Street through Poudre River Road, double cell 8 foot by 4 foot RCBCs, transitioning to a double cell 11 foot by 4 foot RCBC are proposed to eliminate overtopping.

Similarly, as an alternative, multiple detention alternatives upstream of Skyview Drive on the vacant Wiedeman Family Farm parcel were also considered. To detain existing conditions peak flows to the existing storm drain capacity of 140 cfs, a detention facility with a maximum storage of approximately 44 Ac-ft. is required. The proposed detention would mitigate any flooding and overtopping of both Skyview Street and North 81<sup>st</sup> Avenue during the existing conditions, 100-year design storm, and could be incorporated to include on-site detention when upstream properties develop. An additional detention alternative was evaluated to detain existing conditions peak





flows to a level of service that the existing Skyview Street crossing would meet minimum criteria and flooding in 81<sup>st</sup> Avenue would be reduced below 18-inches in depth. Providing an approximate maximum storage of 22 Ac-ft., detains the peak discharge to 325 cfs, reducing the overtopping of Skyview Street to less than six inches and flooding in 81<sup>st</sup> Avenue to less than 18 inches. Alternative costs include purchase of property for these detention pond options. However, the City may be able to request payback for this property should it be incorporated into the future development needs.

At Amour Hill Drive formalized conveyance of offsite flows and proposed improvements to the storm drain system will mitigate two structures inundated in the baseline hydrologic modeling east of Amour Hill Drive. Maintaining a 0.5 percent slope through the entire system provides the adequate capacity to collect flows off the fields east of the neighborhood and flows within the street without inundating structures. Detention upstream of the storm drain system would detain flows in excess of the existing storm drain capacity. Approximately 4.4 Ac-ft. of detention is required to detain flows to existing storm drain capacity.

At the upstream end of Poudre River Ranch Phase III at 78<sup>th</sup> Avenue, offsite flow inundates one structure along the west side of 78<sup>th</sup> Avenue. The Flood Hazard Mitigation Alternative proposes to convey this flow to the east upstream of the neighborhood where the flow can convey on the street with City depth criteria and does not inundate structures.

Other flood control improvements consisted of upsizing the proposed roadway crossings to 100-year facilities, specifically at 4<sup>th</sup> Street and Skyview Street. The 4<sup>th</sup> Street culvert is proposed to be upsized to a 7 foot by 3 foot RCBC to convey the existing conditions 100-year discharge of 264 cfs. At Skyview Street, a 14 foot by 5 foot RCBC will convey the 700 cfs 100-year discharge without overtopping.

#### **Table 5-9: Wiedeman Creek Flood Mitigation Alternatives**

Location	Ex. 100-year Discharge (cfs)	Improvement
4th Street	264	7 ft. x 4 ft. RCBC
Skyview Street	700	14 ft. x 6 ft. RCBC
81st Avenue		(2) 8 ft. x 4 ft. RCBC
(Storm Drain)	700	(2) 11 ft. x 4 ft. RCBC
81st Avenue	Inflow 700	Detention Basin
(Detention)	Outflow 325	(22 Ac-ft.)
81st Avenue	Inflow 700	Detention Basin
(Detention)	Outflow 150	(44 Ac-ft.)
Amour Hill Drive	15	30" RCP
	Inflow 43	Detention Basin
Amour Hill Drive	Outflow 15	(4.4 Ac-ft)
78th Avenue	55	Channel Improv.

## 5.6.7.3 CANAL BASE FLOW SEPARATION IMPROVEMENTS

No canal separation alternatives are proposed for this watershed.



## 5.6.7.4 SUMMARY

A summary of alternatives and costs based on each alternative plan are presented below. The total costs include property acquisition, City project management, and engineering costs broken out in further sections of this report.

## Table 5-10: Wiedeman Creek Alternative Costs

Location	Alternative Plan	Improvement	Tota	l Capital Cost	5	50-YR O&M
	No Action					
4th Street	Minimum Criteria	6 ft. x 4 ft. RCBC	\$	128,584	\$	3,142
	Flood Mitigation	7 ft. x 4 ft. RCBC	\$	138,001	\$	3,142
	No Action				\$	17,849
Skyview Street	Minimum Criteria	12 ft. x 5 ft. RCBC	\$	551,087	\$	9,427
	Flood Mitigation	14 ft. x 6 ft. RCBC	\$	710,363	\$	17,849
	No Action		\$	-	\$	47,198
	Minimum Criteria					
	(Storm Drain)	9 ft. x 4 ft. RCBC	\$	1,591,481	\$	47,198
	Minimum Criteria	Detention Basin (7.5				
	(Detention)	Ac-ft.)	\$	1,483,853	\$	426,167
81st Avenue	Flood Mitigation	(2) 8 ft. x 4 ft. RCBC				
	(Storm Drain)	(2) 11 ft. x 4 ft. RCBC	\$	4,872,927	\$	81,764
	Flood Mitigation	Detention Basin				
	(Detention)	(22 Ac-ft.)	\$	3,369,232	\$	678,813
	Flood Mitigation	Detention Basin				
	(Detention)	(44 Ac-ft.)	\$	6,676,439	\$	1,089,362
	No Action	Easement	\$	39,785	\$	47,450
Amour Hill Drive	Flood Mitigation	30" RCP	\$	260,792	\$	47,450
Amour fim Drive		Detention Basin				
	Flood Mitigation	(4.4 Ac-ft.)	\$	504,245	\$	277,910
	No Action		\$	-	\$	9,019
78th Avenue	Minimum Criteria	60" RCP	\$	689,284	\$	15,335
	Flood Mitigation	Channel Improv.	\$	64,028	\$	23,568

#### 5.6.8 POUDRE RIVER RANCH

The Poudre River Ranch Watershed, located in the northeast corner of the basin, lies completely within the City boundary. Runoff in the watershed is conveyed through two major flow paths both originating south of the neighborhood on the undeveloped Wiedeman Family Farm parcel. Runoff from the field collects at 77<sup>th</sup> Avenue and the north east corner of the parcel. At 77<sup>th</sup> Avenue, runoff is conveyed in the street as the flow travels west on Plateau Road before turning east on Poudre River Road. Flow is intercepted by a storm drain system and outfalls into the water quality pond just south of the Cache La Poudre River. Runoff from the Wiedeman Family Farm parcel is also conveyed between private property and the Boomerang Links Golf Course where several storm drains conveyed source.



flow to Vallevue Drive. Flows exceeding the capacity of the storm drain near Vallevue Drive continue east in the roadway into the Foothills Tributary watershed.

Conveyance within the western portion of the watershed is entirely dependent on stormwater in the street. The baseline FLO-2D indicates the street has capacity to convey the 100-year design storm without inundating structures or exceeding City depth criteria. In the eastern portion of the watershed, flow bypassing the existing 36 inch storm drain south of the neighborhood nearly inundates one structure, with flows splitting to the north and east around the property as flow is conveyed towards Vallevue Drive.

#### 5.6.8.1 NO ACTION ALTERNATIVE

The No Action Alternative for Poudre River Ranch provides maintenance costs for the existing storm drains in Poudre River Road and behind the property near Vallevue Drive. Providing maintenance on these systems will ensure they function as intended and keep runoff from inundating structures in the watershed.

#### Table 5-11: Poudre River Ranch Alternative Cost

Location	<b>Alternative Plan</b>	Improvement	Total Capital	Cost	50-Y	/RO&M
Poudre River Road	No Action		\$	-	\$	25,705

#### 5.6.9 **FAIRWAY TRIBUTARY**

The Fairway Tributary Watershed extends from the Greeley No. 3 Canal south past Dundee Court. The watershed lies within the City of Greeley and unincorporated Weld County. Stormwater runoff is conveyed from the south through Boomerang Links Golf Course north to Poudre River Road in the Poudre River Ranch Phase I development. Runoff is ultimately discharged into the Greeley No. 3 Canal.

Flows near the upstream end of the watershed meander through the golf course converging at the corner of C Street and Melbourne Street. Baseline hydrologic modeling does not account for the unformalized and inadvertent detention on the golf course and indicates overtopping of Melbourne Street at a depth less than 6 inches. Overtopping flows not intercepted by the storm drain inlet at the C Street and Melbourne Street intersection continue north along 71<sup>st</sup> Avenue into the Northridge Draw Watershed.

Runoff from the Wiedeman Family Farm property on the northwest edge of the watershed is conveyed in a northeast direction, crossing Vallevue Drive to the east where flows enter a storm drain crossing Poudre River Road. The storm drain continues north and is flumed in the 36 inch storm drain over the Greeley No. 3 Canal.

Areas identified as possible flooding concerns include two roadway crossings and stormwater discharging into the Greeley No. 3 Canal. On the eastern edge of the watershed, two small existing detention basins just north of C Street west of 71<sup>st</sup> Avenue are undersized. Flows exceeding the 18 inch RCP outlet pipe spill north along the golf course and east over 71<sup>st</sup> Avenue. During the 100-year design storm flows overtopping 71<sup>st</sup> Avenue do not exceed 6 inches in depth.

Flows contained in Poudre River Road are conveyed in an easterly direction towards a sump location just west of Cache Court. As stormwater is conveyed within the street and in the sump location, flows do not exceed the City's 18 inch criteria.

Unformalized detention and areas of retention on the golf course were not accounted for in the hydrologic analysis since adequate assurances of maintenance could not be obtained. Future zoning information identifies the golf course as an area of possible future development which could have impact on the runoff patterns in the watershed.

## 5.6.9.1 NO ACTION ALTERNATIVE

The No Action Alternative proposes no improvements to existing stormwater infrastructure. Maintenance costs are provided for the existing 18 inch storm drain underneath 71<sup>st</sup> Avenue to ensure depths are limited to less than six inches in the 100-year design storm.

#### 5.6.9.2 MINIMUM CRITERIA ALTERNATIVE

Stormwater infrastructure within Fairway Tributary meets current City criteria and therefore no Minimum Criteria Alternatives are proposed.

#### 5.6.9.3 FLOOD MITIGATION ALTERNATIVES

The Flood Mitigation Alternative proposes to mitigate all flow overtopping 71<sup>st</sup> Avenue. The proposed improvements include intercepting 59 cfs from Boomerang Links Golf Course south of Melbourne Street. Option 1 proposes a 42 inch RCP to convey the discharge into the storm drain Flood Hazard Mitigation Alternative proposed in Northridge Draw Watershed at 71<sup>st</sup> Avenue and Melbourne Street. In addition to inflows from the golf course, the proposed storm drain in the Northridge Draw Watershed will intercept discharge from the two existing detention basins north of Melbourne Street. Option 2 conveys the flow east to the open channel north of Winograd K-8 detention basin. This alternative requires the Minimum Criteria Alternative for Northridge to be in place prior to implementation

## Table 5-12: Fairway Tributary Flood Hazard Mitigation Alternatives

Location	Ex. 100-year Discharge (cfs)	Improvement Size
Melbourne Street	59	42" RCP
Detention North of Melbourne Street	5	18" RCP

#### 5.6.9.4 CANAL BASE FLOW SEPARATION IMPROVEMENTS

The Canal Base Flow Separation Alternative proposes to flume the stormwater just west of Cache Court over the Greeley No. 3 Canal. Discharging the stormwater into the open space north of the canal will reduce flows in excess of the decreed flow entering the canal that pose flooding hazards downstream of uncontrolled spill flows from the canal. Improvements to the open space north of the canal include a low flow crossing such that the open space trail is not inundated by nuisance runoff.

#### Table 5-13: Fairway Tributary Canal Seperation Alternatives

Location	Design Flow (cfs)	Improvement Size
Cache Ct	15	Flume and Low flow
Cache Ct. 45	trail crossing	



#### 5.6.9.5 SUMMARY

A summary of alternatives and costs based on each alternative plan are presented below. The total costs include property acquisition, City project management, and engineering costs broken out in further sections of this report.

Location	Alternative Plan	Improvement	Total Capital Cost	50-YR O&M
	No Action			
Cache Court	Canal Baseflow	36" Flume		
	Separation	& DS Channel	\$ 65,299	\$ 13,638
	Flood Mitigation			
	(Option 1)	42" RCP	\$ 79,719	\$ 7,887
Melbourne Street	Flood Mitigation <sup>1</sup>			
	(Option 2)	42" RCP	\$ 552,061	\$ 37,300
Detention North of	No Action		\$-	\$ 22,059
Melbourne Street	Flood Mitigation <sup>1</sup>	18" RCP	\$ 24,862	\$ 15,775

**Table 5-14: Fairway Tributary Alternatives Cost** 

1 - Alternative relies on Northridge Draw Flood Mitigation Alternative being in place

#### 5.6.10 **NORTHRIDGE DRAW**

On the eastern edge of the basin, Northridge Draw is home to Northridge High School, Winograd K-8, and Northridge Estates. Runoff drains from south to north, passing through the school property to C Street where the existing drainageway continues north onto private property. No formal conveyance is provided north of C Street with flows overtopping 71<sup>st</sup> Avenue to the north at a depth less than six inches into the Foothills Tributary Watershed. At the downstream end of the watershed stormwater runoff is discharged into the Greeley No. 3 Canal.

#### 5.6.10.1 MINIMUM CRITERIA ALTERNATIVE

For Northridge Draw, easement acquisition, formalizing the existing retention pond, and channel conveyance improvements are proposed north of C Street. Channel improvements will provide conveyance for runoff from Winograd K-8 detention basin and flows from Melbourne Street proposed to be conveyed in the Fairway Tributary Flood Mitigation Alternative Option 1. The existing retention pond is proposed to be formalized to ensure flows continue north in the channel and do not divert east out of the retention pond inundating homes.

# SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN

Location	Improvement	
	Easement Acquisition / Channel	
C Street	Improvements / Outlet works	

#### 5.6.10.2 FLOOD MITIGATION ALTERNATIVE

Flood Mitigation Alternatives are proposed in the watershed to intercept runoff currently discharged onto private property and safely convey the flow within the right-of-way. Flows from the Winograd K-8 detention basin are intercepted at C Street and conveyed west in a 24 inch RCP. The pipe increases in size at 71<sup>st</sup> Avenue to 42 inches where the Melbourne Street Option 2 and Detention North of Melbourne improvements in the Fairway Tributary Watershed outfall into the proposed system. Fifteen hundred feet north of C Street the proposed storm drain discharges into a 250 foot roadside swale on the south east side of the road. A 7 by 3 RCBC conveys the stormwater underneath the road into the existing Poudre River Ranch Phase I development detention basin. A flume, proposed in the Canal Base Flow Separation Alternative, will convey flow exceeding the capacity of the detention basin over the canal into the open space.

#### Table 5-16: Northridge Draw Flood Mitigation Alternative

Location	Ex. 100-year Discharge (cfs)	Improvement Size
C Christian	9	24" RCP
C Street	66	42" RCP
71st Avenue	102	7 ft. x 3 ft. RCBC

#### 5.6.10.3 CANAL BASE FLOW SEPARATION ALTERNATIVE

The existing Poudre River Ranch Phase I detention basin intercepts flow on the west side of 71<sup>st</sup> Avenue south of the Greeley No. 3 Canal. The detention basin discharges all runoff into the canal through the combination of an outlet pipe and spillway. Several alternatives were evaluated to disconnect the outfall completely from the canal but were determined to be infeasible without creating a siphon system underneath the canal. A flume is proposed to cross the canal at the existing spillway elevation to convey flows into the open space north of the Greeley No. 3 Canal. The 7 foot by 3 foot RCBC flume will convey 116 cfs from the storm drain and roadside swale proposed in the Flood Mitigation Alternative. Construction of the flume over the canal will also require reconfiguration of the existing maintenance road in the open space north of the canal.

#### Table 5-17: Northridge Draw Canal Baseflow Seperation Alternative

Location	In
Poudre River	
Ranch Phase I	



#### Table 5-15: Northridge Draw Minimum Criteria Alternatives

nprovement Size Spillway and DS Improvements



#### 5.6.10.4 SUMMARY

A summary of alternatives and costs based on each alternative plan are presented below. The total costs include property acquisition, City project management, and engineering costs broken out in further sections of this report.

## Table 5-18: Northridge Draw Alternative Cost Estimates

Location	Alternative Plan	Improvement	Total	<b>Capital Cost</b>	50-	YR O&M
		Easement / Channel /				
C Street	Minimum Criteria	<b>Retention Pond</b>	\$	791,893	\$	213,995
	Flood Mitigation	Storm Drain	\$	1,360,601	\$	102,724
71st Avenue	Flood Mitigation	Roadway Crossing	\$	142,575	\$	2,043
	Canal Baseflow	Greeley No. 3 Canal				
PRR Phase I	Seperation	Flume	\$	253,128	\$	33,937

#### 5.7 BENEFIT COST ANALYSIS

A benefit cost analysis was performed to determine the potential benefits of implementing flood mitigation alternatives along North 81<sup>st</sup> Avenue. For the purposes of this analysis, all residential structures were assumed to have finished basements with window openings at ground level.

Structure values were obtained from the Weld County Assessor's website. Contents value was assumed to be 50 percent of the structure value. A standard FEMA discount rate of seven percent was used along with the project useful lifetime of 50 years when computing present value of damages.

An Excel spreadsheet was developed to simulate FEMA's calculations of benefit-cost ratio. All flood return intervals (2-, 5-, 10-, 50-, and 100-yr) were accounted for when computing expected annual damages before mitigation for each structure. All proposed alternatives along 81<sup>st</sup> Avenue mitigated flooding from all structures and therefore an expected annual damage after mitigation of zero was used. Expected annual benefits were converted to total project benefits to include damages incurred over the entire lifetime of the project.

As seen below, the benefit-cost ratio for the 81<sup>st</sup> Avenue improvement is 0.04. Although the benefit from mitigating flood damages does not solely justify the project, the proposed improvements at 81<sup>st</sup> accomplish several other project goals such as removing overtopping of roadways in excess of six inches and flooding depths in streets of greater than 18 inches.

#### Table 5-19: Benefit-Cost Analysis

81st Avenue Benefit Cost Analys	is	
Expected Annual Damages Before Mitigation	\$	12,728
Expected Annual Damages After Mitigation	\$	-
Expected Annual Benefit	\$	12,728
Total Project Benefits Over Project Useful Life	\$	175,656
Total Project Cost Including Maintenance	\$	4,048,045
Benefit - Cost Ratio		0.04

## SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN

#### 5.8 OTHER CONSIDERATIONS

#### 5.8.1 WATER QUALITY:

No specific water quality improvements have been evaluated for the Sharktooth Bluffs Basin. Site-specific water quality control measures will be incorporated as the basin develops and the City's development criteria is met. Land buffers for major drainageways will also help preserve the natural water quality features that exist today.

#### 5.8.2 **BANK EROSION AND SEDIMENT TRANSPORT FROM SHARKTOOTH BLUFFS**

The Sharktooth Bluffs represent a unique erosional land feature located in the western portion of the basin. The bluffs consist of a number of dendritic gullies eroded into sandy loam soils. The narrow gullies are often 10-40 feet deep. Soils in the area primarily consist as Type 61, tassel fine sandy loam, as defined by the NRCS. The tassel fine sandy loam soils have a very slow infiltration rate, which results in a high runoff potential when thoroughly saturated.

A desktop review of this area was performed to evaluate continued erosion potential as an active source of sediment to the Poudre River. Historic aerial imagery dating back to 1999 was compared to current imagery. This review revealed that the extent of the gullies has not changed significantly over the last 20 years. Headcuts appear to be either



Historic imagery showed the extent of the bluffs have not changed significantly in recent years (Google Earth) migrating very slowly or not at all. The change in depth of the gullies is unknown. However, the bottom of the gullies appear well vegetated and not believed to be actively deepening. For these reasons it is believed the bluffs are largely stabilized and may not be an active source of sediment to the Cache La Poudre River. Further on-site investigation may be necessary to confirm this conclusion should aggradation be identified in areas of the Poudre River near these locations. After discussion with City staff, and due to limited site access, an onsite analysis was not

#### 5.8.3 **STREAM BUFFER WIDTH**

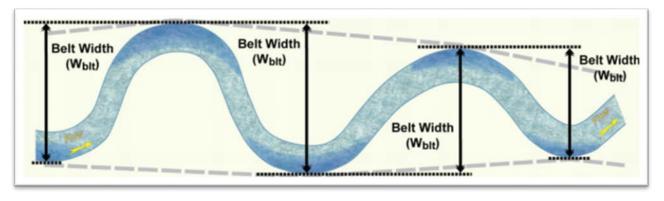
deemed necessary for this study.

In order to ensure the long-term stability of a stream system, a buffer is recommended to be preserved between the stream and anthropogenic influences. In natural streams, the stream belt width or floodplain width often serves as the buffer. The stream belt width is diagrammatically shown in Figure 5-1. Belt width is the lateral distance from the outside edge of one meander to the outside edge of the next meander (Figure 1). Channel meanders shift through time, generally moving in a downstream direction. By preserving the land within the belt width of a stream, one can allow the channel to continue to evolve and change its planform without coming into conflict with human infrastructure.



# 1999 2016





#### Figure 5.1: Stream Belt Width (Wildland Hydrology, 2013)

Two methods were used to estimate stream belt widths for major drainages within the Sharktooth Basin. The Stream Belt Width method is an empirical procedure based on a relationship of data from stream systems across many physiographical regions, developed by Williams in 1986, this procedure related the meander belt width to channel bankfull width through a power equation. The expression Williams developed is shown below (Equation 1).

## Equation 1 : $W_{hlt} = 3.7^* W_{hankfull}^{1.12}$

Many of the streams within the Sharktooth Basin, including for Sharktooth Draw, Poudre Learning Center, and Wiedeman Creek, have had their planform changed or influenced by humans in the past. Because a field geomorphic survey of the subject streams was not possible, estimates of bankfull width had to be utilized for the Williams equation to work. Therefore, a regional relationship developed for urban Front Range streams was utilized. The equation which was developed by ICON and subconsultants from field data, relates bankfull area (square feet) to drainage area (square miles) (Equation 2). Utilizing Equation 2 along with an average bankfull width-to-depth ratio of 18, allowed the bankfull widths to be estimated, along with the estimates for the ideal channel belt width for the Sharktooth Basin drainageways.

## Equation 2: $A_{bankfull}$ =7.4051\* $A_{Drainage}$ <sup>0.6582</sup>

The second method utilized to calculate the ideal stream belt width was based on shear stress. If the shear stress applied on a floodplain by flowing water exceeds the carrying capacity of the floodplain vegetation, the vegetation will be destroyed, and subsequent erosion, scour, and channel avulsions could occur. In order to prevent this, the critical shear stress at which the vegetation will begin to fail was reviewed.

For vegetation types such those found on the floodplains of Sharktooth Draw, Poudre Learning Center Creek, and Wiedeman Creek (short grass prairie without bushes and trees), a critical shear stress of 1.5 lbs. per square foot was used. Using this critical shear stress threshold, the average stream slope, the 100-year discharge, and the average stream velocity, the minimum floodplain width can be calculated (Equation 3).

Equation 3: 
$$W_{Floodplain} = \frac{Q_{100}}{V*\left(\frac{\tau_c}{\gamma*S}\right)}$$

Where  $\tau_c$ =Critical Shear Stress (lb/ft<sup>2</sup>),  $\gamma$  = Unit Weight of Water (lb/ft<sup>3</sup>),  $Q_{100}$  = 100-year Discharge (cfs), V = Average Velocity of Flow (ft/s),  $W_{floodplain}$  = Width of Floodplain (ft), S = Stream Slope (ft/ft)

Results from both the belt width method and floodplain width method are shown in table 5-6 below.

Table 5-20: Stream Buffer Width

	Channel Buffer Width					
Drainageway	Ex. Conditions	Fut. Conditions				
Sharktooth Draw	186	73				
Poudre Learning Center	130 <sup>1</sup>	56				
Wiedeman Creek	119	64				

1-Value adjusted based on Rosgen classification

As shown by the table, the required belt or floodplain width has the potential to change over time with projected hydrology changes from new development. It is recommended that at a minimum, the existing stream belt widths be preserved within the basin to maintain stream health and maximize drainageway resiliency. Further evaluations may be required as the basin develops over time.

As development occurs in each watershed, City detention criteria will reduce peak flows along the drainageways. As such, channel buffer widths may reduce accordingly to the future condition widths shown above. It is recommended that this transition be considered after the upstream watershed has reached approximately 80 percent development density. At this time it is also recommended that a more detailed geomorphic study be completed to best determine the appropriate thresholds for the bankfull channel and floodplain areas within the buffer width. Additional design considerations are discussed below.

#### **GEOMORPHIC ROADWAY CROSSINGS** 5.8.4

Roadway crossings sized to compliment high functioning streams are safer, more resilient to large flood events, better convey sediment and debris, require less maintenance over time, and also provide better conditions for aquatic passage than traditionally designed crossings. The Urban Drainage and Flood Control District, now operating as the Mile High Flood District, supports this concept but understands that in some cases, site conditions will limit the design.

For new stream crossings within developing areas, and also for the replacement of old structures at already established crossings, geomorphic crossing design should be considered. It is recognized that geomorphic design is not possible for all stream crossing situations. Economically, Geomorphically Sized Crossing (GSCs) are more expensive initially than traditional designs. Additionally, GSCs generally require more space than traditional crossings. Sometimes these or other constraints may limit geomorphic design. In these instances, the reasons why a geomorphic design is not feasible at a particular site, should be clearly demonstrated prior to undertaking a different design approach.

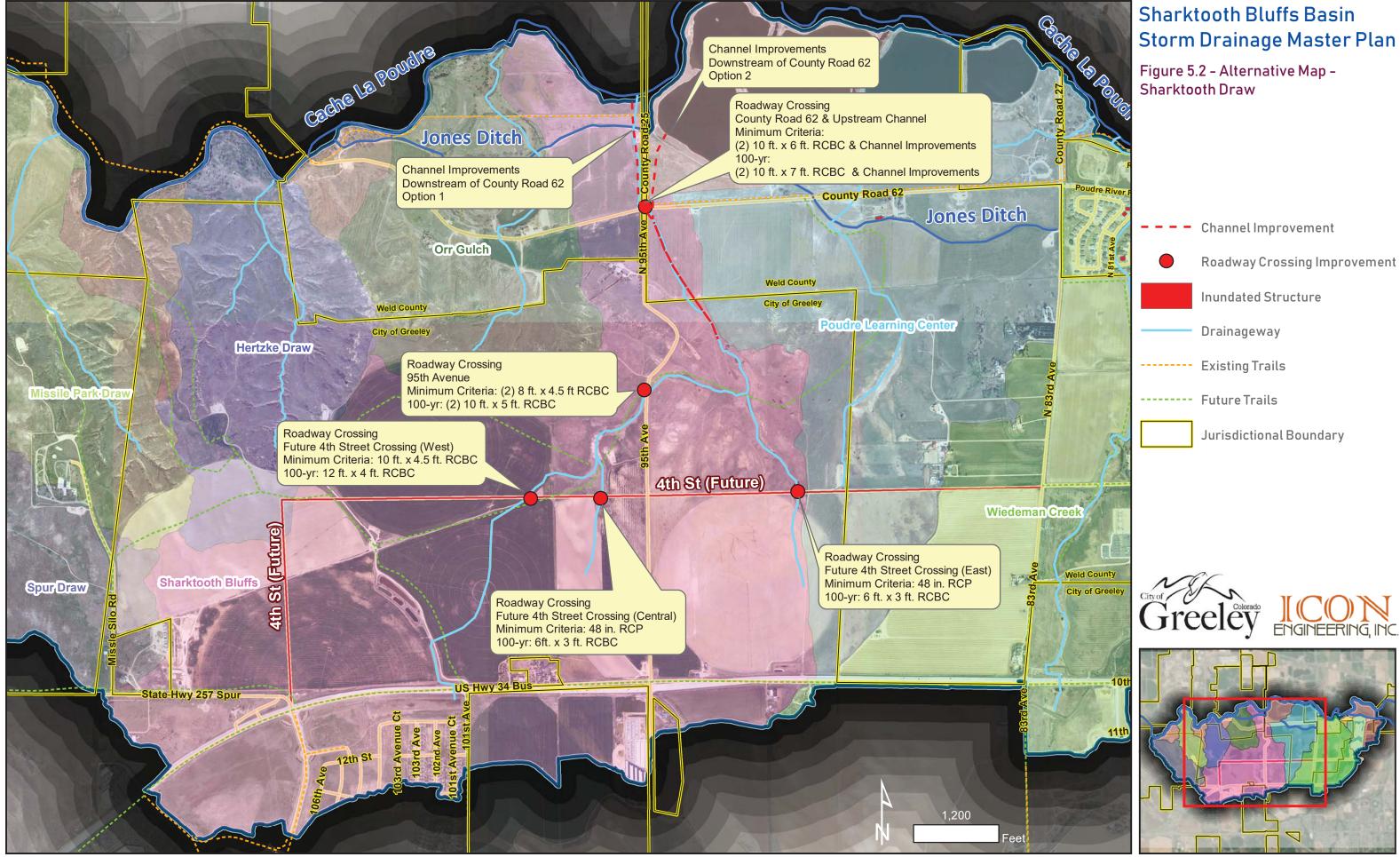
The key principle of GSCs is that rather than being sized primarily on a hydraulic basis where the primary goal is to pass a design discharge, the crossing is sized based on the dimensions and characteristics of the upstream and downstream channel and floodplain. Further information regarding the design of GSCs is available from the UDFCD.



Alongside the GSCs, auxiliary floodplain culverts should be considered as a means of minimizing contraction and expansion of high flows at the crossing, where practical. Many small floodplain culverts function more efficiently than just one large floodplain culvert. Floodplain relief culverts should be sized large enough to allow for maintenance as needed.



# SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN



Roadway Crossing Improvement









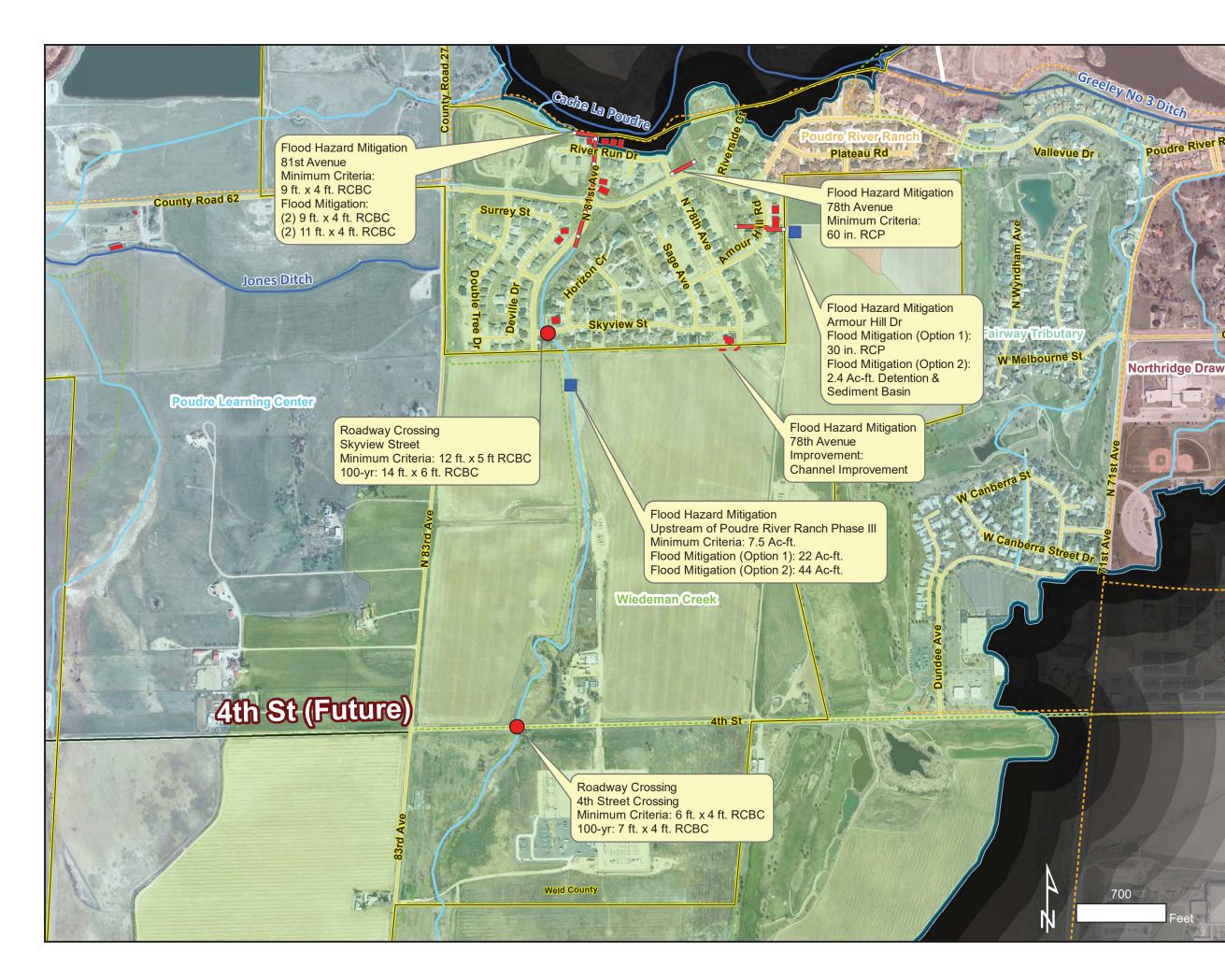
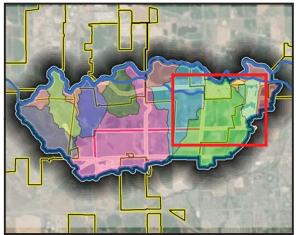


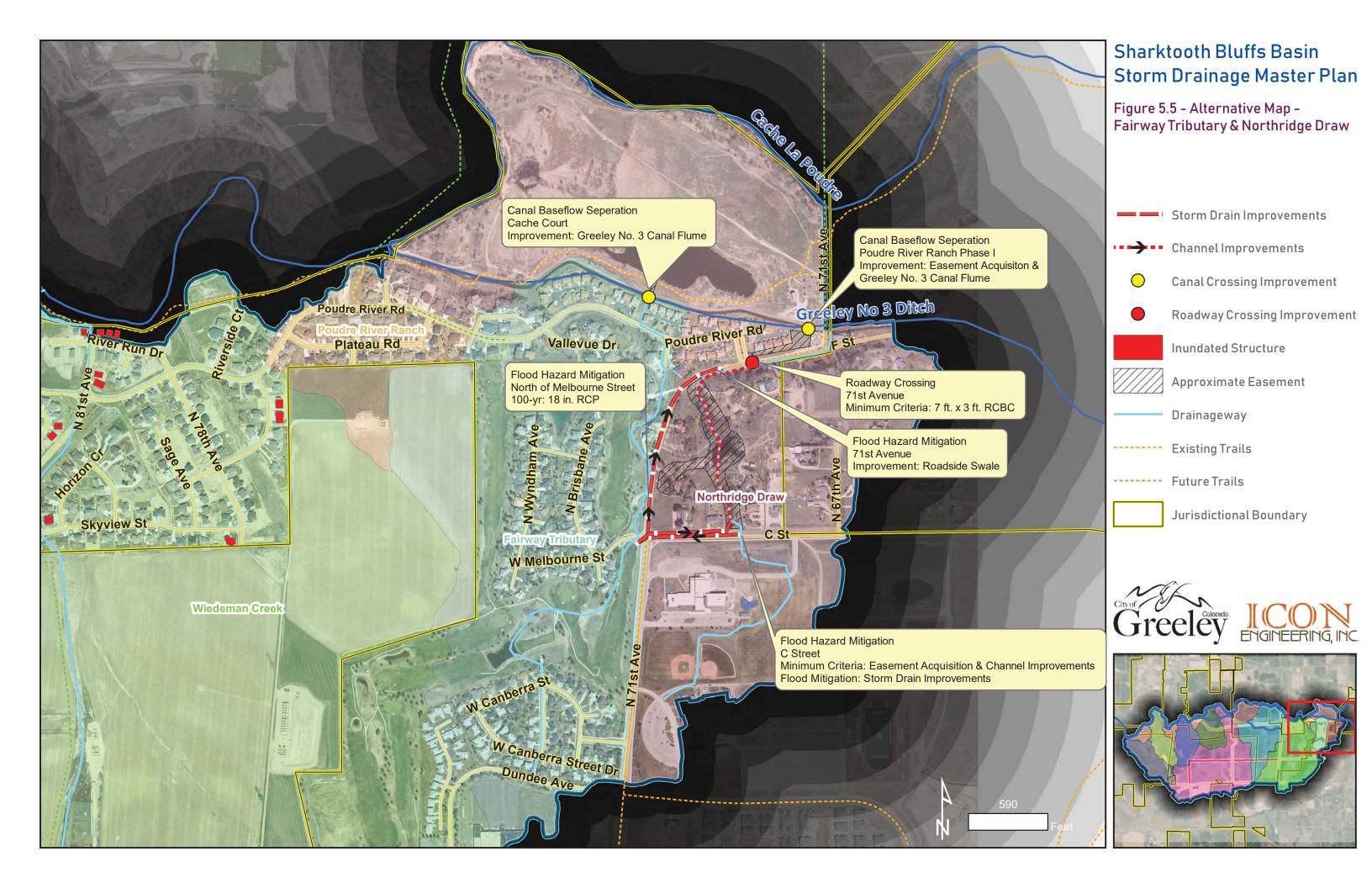
Figure 5.4 – Alternative Map – Wiedeman Creek

- Storm Drain Improvement
- - · Channel Improvement
  - Inundated Structure
- Detention Basin Improvement
- Roadway Crossing Improvement
  - Drainageway
- Jurisdictional Boundary
- ----- Existing Trails
- ----- Future Trails











## 6.0 RECOMMENDED PLAN

The recommended plan is a combination of alternative plans for each watershed. Improvements proposed in the recommended plan for each watershed are shown in <u>Figure 6.1</u>, <u>Table 6-1</u> and discussed in further detail below. Cost estimates for all proposed improvements can be found in Table 6-2 and Table 6-3.

## 6.1 PLAN DESCRIPTION

All roadway crossings that do not currently meet City criteria are proposed to be improved to the Minimum Criteria Crossing Alternative sizing with the exception of Skyview Street in the Wiedeman Creek Watershed. While overtopping will still occur during the existing condition 100-year storm, future detention as the basin develops will reduce the peak discharge and eliminate overtopping. When the basin is fully developed, all roadway crossing infrastructure proposed in the recommended plan will exceed the 100-year discharges.

For the purpose of alternative analysis, all roadway crossings were sized as a single crossing structure. Each roadway crossing should be further evaluated to implement a high functioning, low maintenance stream crossing, where practical. Further guidance on geomorphic roadway crossings can be found in <u>Section 5.8.4</u>.

All components of the Canal Base Flow Separation plan are included in the recommended plan. Separating stormwater from the canal will protect downstream users by responsibly managing the spill of the canal and help reduce uncontrolled spills from canal further downstream.

The recommended plan includes several components of the Flood Hazard Mitigation Alternative Plan. At 81<sup>st</sup> Avenue in Wiedeman Creek, the proposed detention of 22 Ac-ft. upstream of Poudre River Ranch Phase III will reduce flows overtopping Skyview Street to less than six inches and reduce the depth in the street from flow overtopping the storm drain system into 81<sup>st</sup> Avenue to less than 18 inches. Although this alternative is more expensive than the combination of Minimum Criteria Alternatives for Skyview Street and 81<sup>st</sup> Avenue, the cost of the proposed detention could be offset by incorporating the facility into future development and would not drastically oversize Skyview Street when considering future detained flows. The recommended plan will remove all structures along 81<sup>st</sup> Avenue currently inundated in the baseline modeling. On the eastern edge of Wiedeman Creek, formalizing runoff from the farm field and replacing the Amour Hill Drive storm drain system will remove structures on the east side of the road from flooding.

At 78<sup>th</sup> Avenue and Poudre River Road, the No Action Plan is recommended. No structures are currently inundated at the intersection and future detention upstream of the development will reduce flows such that street flooding depths do not exceed 18 inches. At the southern end of 78<sup>th</sup> Avenue channel improvements proposed in the Flood

Hazard Mitigation Alternative will alleviate the flooding on the house on the west side of 78<sup>th</sup> Avenue by conveying flows to 78<sup>th</sup> Avenue where the flow can be conveyed on the street.

In Northridge Draw, the Minimum Criteria Alternative is recommended. Easement acquisition, channel improvements and formalizing the outlet structure ensure the City access to perform maintenance and maintain the integrity of the drainageway from north of C Street to the 71<sup>st</sup> Avenue roadway crossing. Once this alternative is in place, the Option 2 Alternative for Foothills Tributary can be implemented conveying additional runoff to the open channel.

The recommended plan for the stream buffer width on each drainageway is Method 2, Floodplain Width, as described in <u>Section 5.8.3</u>. Method 2, the larger of the stream buffer widths, was chosen as the recommended plan in order to encourage a health stream system by providing room for the channel to meander and an adequate corridor for a stable floodplain.

## 6.2 WATER QUALITY IMPACTS

No regional water quality improvements are proposed for the Sharktooth Bluffs Basin. Water quality will be provided on a site specific basis throughout the basin as development occurs.

Eroding channel banks also can lead to degradation in water quality throughout a basin. By monitoring the bluffs for erosion and sediment transport and providing adequate channel buffer widths less erosion and sediment transport will occur, increasing the water quality for the basin and the Cache La Poudre River.

## 6.3 OPERATION AND MAINTENANCE

The recommended plan includes the installation of storm drain infrastructure, requiring maintenance for culverts, inlets and manholes. Proposed detention basins 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 Sharktooth Bluffs Basin by increasing the public safety from flood hazards throughout the watershed and enhancing the environmental impacts of the watershed through the responsible management of the drainageways in the watershed.





			Minimum	Flood Hazard	Canal Basef
Watershed	Location	No Action	Criteria	Mitigation	Separatio
	Future 4th Street (West)		Х		
	Future 4th Street (Central)		Х		
Sharktooth Draw	Future 4th Street (East)		Х		
Sharktooth Draw	95th Avenue		Х		
	County Road 62 & Upstream Channel		Х		
	Downstream of County Road 62			Х	
	County Road 62 (West)		Х		
	County Road 62 (Central)		Х		
Poudre Learning Center	County Road 62 (East)		Х		
	83rd Avenue		Х		
	Jones Ditch at 83rd Avenue				Х
	4th Street		Х		
	Skyview Street	Х			
Wiedeman Creek	81st Avenue			Х	
Wiedeman Creek	78th Avenue - Poudre River Road	Х			
	78th Avenue - Upstream of Development		Х		
	Armour Hill Drive			Х	
Poudre River Ranch	Poudre River Road	х			
	Cache Court				Х
Fairway Tributary	Melbourne Street			Х	
	Detention North of Melbourne Street	Х			
	C Street				
Northridge Draw	71st Avenue			Х	
	PRR Phase 1				

#### Table 6-1: Recommended Plan







				Ea	sement /			Legal /		Contract			Total				
Watershed	Location	Alternative Type	Capital		ROW	En	gineering	Administrative	Ad	lmin / CM	Со	ntingency	<b>Capital Cost</b>	Anr	ual O&M	50-	year O&M
	Future 4th Street (West)	Minimum Criteria	\$ 121,411	\$	-	\$	18,212	\$ 6,071	\$	12,141	\$	30,353	\$ 188,188	\$	100	\$	3,142
	Future 4th Street																
	(Central)	Minimum Criteria	\$ 33,148	\$	-	\$	4,972	\$ 1,657	\$	3,315	\$	8,287	\$ 51,379	\$	100	\$	3,142
	Future 4th Street (East)	Minimum Criteria	\$ 33,148	\$	-	\$	4,972	\$ 1,657	\$	3,315	\$	8,287	\$ 51,379	\$	50	\$	1,571
Sharktooth Draw	95th Avenue	Minimum Criteria	\$ 210,757	\$	-	\$	31,614	\$ 10,538	\$	21,076	\$	52,689	\$ 326,674	\$	120	\$	3,771
Sharktooth Draw	County Road 62 &																
	Upstream Channel	Minimum Criteria	\$ 2,277,297	\$	953,040	\$	341,595	\$ 113,865	\$	227,730	\$	569,324	\$4,482,851	\$	10,550	\$	331,519
	Downstream of County	Channel Improv															
	Road 62	East of CR 62	\$ 745,023	\$	220,000	\$	111,753	\$ 37,251	\$	74,502	\$	186,256	\$1,374,785	\$	3,000	\$	94,271
	Total		\$ 2,675,761	\$	953,040	\$	401,365	\$ 133,788	\$	267,577	\$	668,940	\$5,100,471	\$	10,920	\$	343,145
	County Road 62 (West)	Minimum Criteria	\$ 195,929	\$	-	\$	29,389	\$ 9,796	\$	19,593	\$	48,982	\$ 303,689	\$	100	\$	3,142
	County Road 62 (Central)	Minimum Criteria	\$ 26,281	\$	-	\$	3,942	\$ 1,314	\$	2,628	\$	6,570	\$ 40,735	\$	50	\$	1,571
Poudre Learning																	
Center	County Road 62 (East)	Minimum Criteria	\$ 378,085	\$	-	\$	56,713	\$ 18,904	\$	37,809	\$	94,521	\$ 586,032	\$	2,125	\$	66,775
	83rd Avenue	Minimum Criteria	\$ 363,047	\$	-	\$	54,457	\$ 18,152	\$	36,305	\$	90,762	\$ 562,723	\$	160	\$	5,028
	Jones Ditch at 83rd	Canal Base flow															
	Avenue	Separation	\$ 84,031	\$	-	\$	12,605	\$ 4,202	\$	8,403	\$	21,008	\$ 130,249	\$	1,034	\$	32,492
	Total		\$ 1,047,373	\$	-	\$	157,106	\$ 52,368	\$	104,738	\$	261,843	\$1,623,428	\$	3,469	\$	109,008

## Table 6-2: Recommended Plan Cost Estimates - Sharktooth Draw and Poudre Learning Center Watersheds





				Ea	sement /			Legal /		Contract				Total				
Watershed	Location	Alternative Type	Capital		ROW	En	gineering	Administrative	Ad	dmin / CM	Сог	ntingency	Сар	pital Cost	Ann	ual O&M	50-	year O&M
	4th Street	Minimum Criteria	\$ 82,957	\$	-	\$	12,444	\$ 4,148	\$	8,296	\$	20,739	\$	128,584	\$	100	\$	3,142
	Skyview Street	No Action	\$ -	\$	-	\$	-	\$ -	\$	-	\$	-	\$	-	\$	1,502	\$	47,198
		Flood Mitigation																
		(22 Ac-ft.																
Wiedeman Creek	81st Avenue	Detention)	\$ 616,679	\$	528,000	\$	92,502	\$ 30,834	\$	61,668	\$	154,170	\$1	,483,853	\$	13,562	\$	426,167
		No Action	\$ -	\$	-	\$	-	\$ -	\$	-	\$	-	\$	-	\$	287	\$	9,019
	78th Avenue	Flood Mitigation	\$ 41,309	\$	-	\$	6,196	\$ 2,065	\$	4,131	\$	10,327	\$	64,028	\$	750	\$	23,568
	Amour Hill Drive	Flood Mitigation	\$ 142,585	\$	39,785	\$	21,388	\$ 7,129	\$	14,259	\$	35,646	\$	260,792	\$	1,510	\$	47,450
	Total		\$ 883,530	\$	567,785	\$	132,530	\$ 44,176	\$	88,354	\$	220,882	\$1	,937,257	\$	17,711	\$	556,544
Poudre River Ranch	Poudre River Road	No Action	\$ -	\$	-	\$	-	\$ -	\$	-	\$	-	\$	-	\$	818	\$	25,705
Phase I and II	Total		\$ -	\$	-	\$	-	\$ -	\$	-	\$	-	\$	-	\$	818	\$	25,705
		Canal Base flow																
	Cache Court	Separation	\$ 42,129	\$	-	\$	6,319	\$ 2,106	\$	4,213	\$	10,532	\$	65,299	\$	434	\$	13,638
		Flood Mitigation1																
Fairway Tributary	Melbourne Street	(Option 1)	\$ 51,431	\$	-	\$	7,715	\$ 2,572	\$	5,143	\$	12,858	\$	79,719	\$	251	\$	7,887
	Detention North of																	
	Melbourne Street	No Action	\$ -	\$	-	\$	-	\$ -	\$	-	\$	-	\$	-	\$	702	\$	22,059
	Total		\$ 93,560	\$	-	\$	14,034	\$ 4,678	\$	9,356	\$	23,390	\$	145,018	\$	1,387	\$	43,584
	C Street	Minimum Criteria	\$ 371,099	\$	216,689	\$	55,665	\$ 18,555	\$	37,110	\$	92,775	\$	791,893	\$	6,810	\$	213,995
	71st Avenue	Flood Mitigation	\$ 91,984	\$	-	\$	13,798	\$ 4,599	\$	9,198	\$	22,996	\$	142,575	\$	65	\$	2,043
Northridge Draw		Canal Baseflow																
_	PRR Phase 1	Seperation	\$ 159,483	\$	159,483	\$	159,483	\$ 159,483	\$	159,483	\$	159,483	\$	159,483	\$	159,483	\$	159,483
	Total		\$ 463,083	\$	216,689	\$	69,463	\$ 23,154	\$	46,308	\$	115,771	\$	934,468	\$	6,875	\$	216,038

## Table 6-3: Recommended Plan Cost Estimates - Wiedeman Creek, Fairway Tributary, Northridge Draw Watersheds



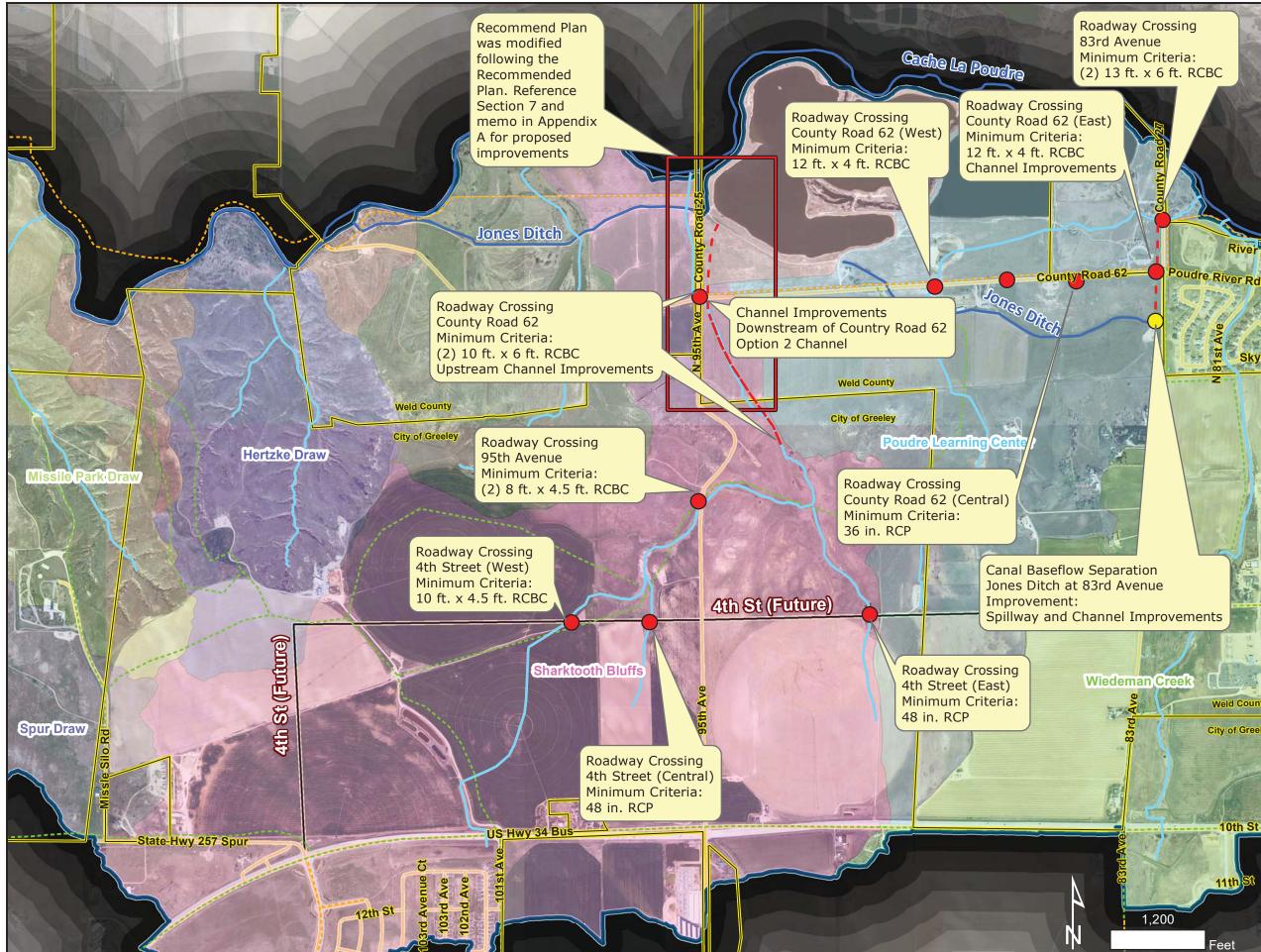


Figure 6.1 - Recommended Plan -Sharktooth Draw and **Poudre Learning Center** 

**Channel Improvement** 

**Canal Crossing Improvement** 



 $\bigcirc$ 

Roadway Crossing Improvement

Drainageway

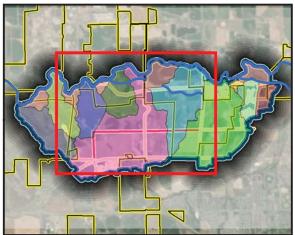
**Existing Trails** 

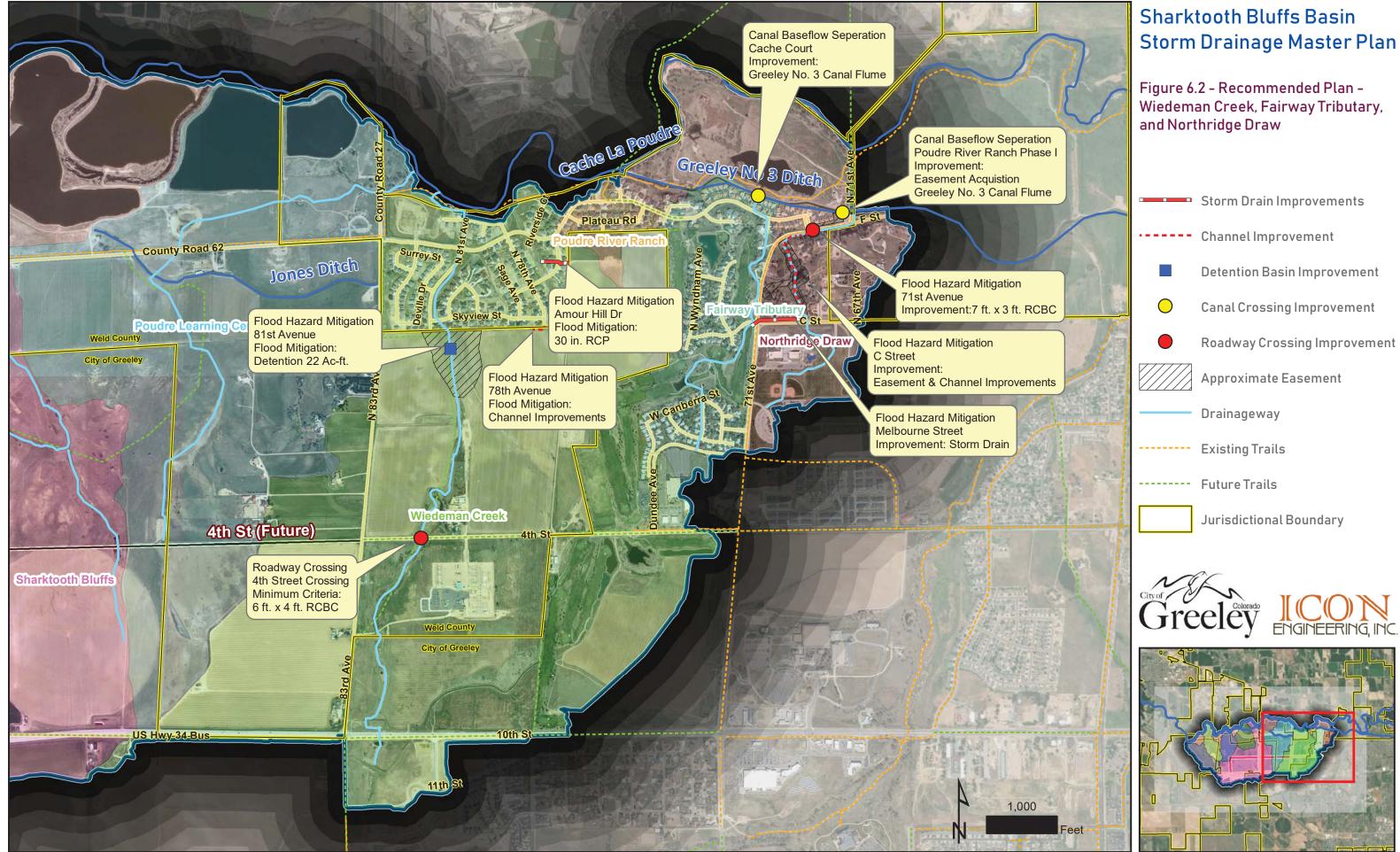


Jurisdictional Boundary

























#### CONCEPTUAL DESIGN 7.0

## 7.1 PLAN DEVELOPMENT OVERVIEW

The Selected Plan identifies the alternatives selected by the project team to proceed to the Conceptual Design phase of the project. The Selected Plan generally follows the recommended plan alternatives, with the modification to the proposed improvements in Sharktooth Draw. A memo, dated June 11, 2019 found in Appendix A, summarizes new alternatives for the basin and explains why the previously proposed alternative was revised. In summary, a detention pond and storm drain outfall are now being proposed instead of the channel improvements at the north end of the watershed. An additional alternative was also proposed at the Sharktooth Draw crossing of the Bellevue Pipeline to provide additional protection again stream erosion beyond that discussed with the future stream restoration needs.

The master plan improvements are intended to mitigate existing flooding hazards, ensure current and future roadway crossings are compliant with City criteria, to address any channel stability issues and concerns, separate base flows from irrigation ditches, enhance water quality, and provide general guidance for preservation and improvement to the drainageways throughout the Sharktooth Bluffs Basin. Finally, the master plan improvements identify and incorporate trail connections to the regional networks, where applicable.

#### 7.1.1 **GENERAL RECOMMENDATIONS**

Land-use changes to contributing watersheds affect the flood hazard nature (i.e., runoff rates, volumes and depths), the transport of sediment, and the water quality of the receiving natural waterways. To encourage implementation of this master plan, it is recommended that:

- As the basin urbanizes, the City shall take steps to ensure that the major waterways are stabilized, that any existing degraded reaches of the waterways, and their tributaries, are rehabilitated, and erosion and sediment transport during construction activities is controlled.
- 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) and Excess Urban Runoff Volume (EURV) as recommended in the Urban Storm Drainage Criteria Manual - Volume 3, after accounting for volume reductions achieved using volume control practices.
- The City of Greeley should adopt a policy of preserving a stream corridor as open spaces to the maximum extent possible as development occurs. Approximate Stream Buffer Widths were developed for Sharktooth Draw, Poudre Learning Center, and can be found in Section 5.8.3.
- Geomorphic Roadway Crossings, as described in Section 5.8.4, should be considered during final design to • compliment high functioning streams, be more resilient to large flood events, better convey sediment and debris, require less maintenance over time, and also provide better conditions for aquatic passage than traditionally designed crossings.

- for wildlife between larger habitat areas.

#### 7.1.2 **COST ESTIMATES**

Cost estimates for the Conceptual Design 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, 2018 Third Quarter Report. The average value of the last four quarters (1.34) of the Fisher Ideal Index was used to adjust unit costs. A summary of unit costs can be found in Appendix C.

Operation and Maintenance costs were also included within the UD-MP Cost worksheet. A minimum level-ofservice for manhole and inlet maintenance was assumed to occur once per year. The minimum level-of-service for maintenance on detention basins and water quality facilities was assumed to occur once a year. Structural maintenance on canal spillways were assumed to be performed once every five years.

Costs for detention basins were estimated using the unit costs for earthwork based on the necessary acre-feet of detention.

Headwalls were assumed on storm drain infrastructure 54 inches in diameter and greater. Flared end sections were assumed on storm drain improvements less than 54 inches in diameter.

Several recent stream restoration projects were analyzed to approximate a stream restoration cost per linear foot of drainageway. An average cost per linear foot of \$750 was used to estimate future stream restoration costs along Sharktooth Draw, Poudre Learning Center Tributary, and Wiedeman Creek.

Right-of way, easement costs, and property values were calculated from current Weld County Assessor's information. Easement / ROW acquisition amounts were calculated as a percentage of the total actual land value. For undeveloped parcels, an average value of \$88,000 / Acre was estimated from properties throughout the basin.

Asphalt was included as a special item within the UD-Cost spreadsheet at \$250 lb. / ton for each roadway crossing.

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. Dewatering, Traffic Control and Utility Coordination / Relocation were assigned the minimum of \$5000 or the following percentages of capital costs for most locations: Dewatering (1%), Traffic Control (5%), Utility Coordination / Relocation (5%).



 The City of Greeley Natural Resources Department strongly supports a naturalized stormwater management strategy that not only provides stormwater management for the benefit of the life, safety and property of the citizens of Greeley, but also considers and supports sustainable natural systems in the installation and maintenance of stormwater management facilities. Small creeks and drainages only encompass approximately one percent of the land mass in Colorado but supports nearly 85 percent of the state's wildlife species, making these areas critical for wildlife. These areas are also important movement corridors

• Wherever possible, provide public use and access and/or trails within the corridors of identified waterways in order to provide maintenance access that will also provide for active and passive recreation of the public.



## 7.2 MASTER PLAN DESCRIPTION

The Conceptual Design is described on a watershed by watershed basis in <u>Section 7.2.1</u> through <u>Section 7.2.9</u>. Cost estimates can be found in <u>Table 7-19</u>. A schematic of the master plan improvements can be found in <u>Figure 7.1</u> and <u>Figure 7.2</u>.

#### 7.2.1 Spur Draw

Spur Draw, the western most watershed in the Sharktooth Basin, is located just east of US Highway 257. Stormwater runoff from the basin sheet flows to the Sharktooth Bluffs where the narrow gullies convey water northwest to the Cache La Poudre River. All flow is confined to the bluff areas. The watershed is currently undeveloped and future land use projects the watershed to remain open space. No roadway crossings, or other infrastructure is currently proposed in the watershed. Beyond monitoring runoff and potential sediment transport from the bluffs areas, no improvements are currently proposed for this watershed.

#### 7.2.2 MISSILE PARK DRAW

This 275 acre watershed is bounded by Spur Draw to the west, Hertzke Draw to the east, Sharktooth Draw to the south and Cache La Poudre River to the north. The watershed spans three jurisdictions: Town of Windsor at the downstream end of the watershed, unincorporated Weld County, and the City of Greeley. Similar to Spur Draw, stormwater runoff is conveyed in narrow gullies which converge into a drainageway that bisects the watershed. Near the downstream end of the watershed, in the Town of Windsor and Weld County, there is an approximately 10-foot high embankment which detains flows from continuing north to the Cache La Poudre River. As discussed prior, no records were found regarding this being a regulated detention basin or registered state dam.

With exception to ponding that could occur behind this embankment, no other significant drainage problems were identified for this watershed, particularly within the limits of the City of Greeley. Beyond monitoring runoff and potential sediment transport from the bluffs areas, and monitoring the effects of the embankment for water collection, repair, or need to breach, no improvements are currently proposed for this watershed.

#### 7.2.3 HERTZKE DRAW

Hertzke Draw, located to the east of Missile Park Draw and west of Sharktooth Draw watersheds, primarily consists of steep gullies conveying stormwater runoff to the north. Upstream of the outfall into the Cache La Poudre River, the watershed transitions from the confined gully drainageway to an alluvial fan. The watershed lies within Town of Windsor, unincorporated Weld County, and City of Greeley. The bluffs in the southeastern portion of the watershed, within the City of Greeley, lie on property proposed to be developed as part of the Lake Bluff Development.

Flooding potential within the watershed is minimal with more flooding potential located in the alluvial zones near the Poudre River. No buildings or structures are shown to be inundated and flooding potential will be lessened with future development in the watershed. Beyond monitoring runoff and potential sediment transport from the bluffs areas, no improvements are currently proposed for this watershed.

## SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN

#### 7.2.4 ORR GULCH

Orr Gulch is bounded by Hertzke Draw to the west and Sharktooth Draw to the south and east. The northern portion of the watershed falls within unincorporated Weld County, while the southern portion is located within the City of Greeley. The portion within the City of Greeley is proposed to remain open space as part of the proposed Lake Bluff Development. The narrow bluff gullies collect stormwater runoff in the headwater of the basin before the flow is spread into an alluvial fan south of County Road 62. North of County Road 62, the William R. Jones Ditch bisects the lower watershed, conveying irrigation flows from the Cache La Poudre River to Siebring Reservoir.

Flooding problems within the watershed are primarily related to ponding south of the William R. Jones Ditch, where flow depths approach 3-feet in what appears to be a historic oxbow from the Cache La Poudre River and potential overtopping of County Road 62. Since this area is located outside of the City of Greeley with no current plans for expansion of this roadway system, no alternatives were evaluated in this watershed.

#### 7.2.5 SHARKTOOTH DRAW

Sharktooth Draw extends from south of 10th Street to the Cache La Poudre River, covering 1,235 acres. The watershed lies within the City of Greeley and unincorporated Weld County. The headwaters of Sharktooth Draw begin south of 10th Street, east of Promontory Circle near the State Farm property. Stormwater runoff then continues in a northeast direction to the river.

Flooding within the watershed is generally confined near 10<sup>th</sup> Street, then transitions between overland and confined flow through 95<sup>th</sup> Avenue when entering the bluffs region. Downstream, flood flows again become unconfined when Sharktooth Draw splits to the north and the east, in an alluvial pattern, near County Road 62, diverting up to 541 cfs of the total 100-year discharge of 1063 cfs to the Poudre Learning Center watershed.

Problems areas within the watershed focus around overtopping of existing roadway crossings, including: 95<sup>th</sup> Avenue, both north of 10<sup>th</sup> Street and closer to the Poudre River near County Road 62; and County Road 62, which currently has no defined drainage system and is located within Greeley's anticipated expansion area. These areas experience overtopping in both the 10- and 100-year events. In addition to the roadway crossings, the split flow near 95<sup>th</sup> Avenue and County Road 62 has the potential to impact roadway improvements and future development during the larger storm events (above the 10-year level). Finally, the future expansion of 4<sup>th</sup> Street will require planning as it crosses drainages within the Sharktooth Draw watershed. Currently, the proposed 4<sup>th</sup> Street alignment is proposed to cross three local drainages.





## 7.2.5.1 SHARKTOOTH DRAW – FUTURE 4<sup>TH</sup> STREET CROSSING WEST

The western most future 4<sup>th</sup> Street crossing is located approximately 1,600 ft. west of 95<sup>th</sup> Avenue. A 10 ft. wide by 4.5 ft. high RCBC is proposed to convey 378 cfs of the 431 cfs, 100-yr event design discharge. Flows in excess of the culvert capacity, 53 cfs during the 100-yr event, will overtop at a depth less than 6 inches.

The future roadway crossing was conceptually designed with minimal ground cover over the top of the crossing. The improvement requires installation of headwall and wingwalls on the upstream and downstream side of the box culvert. Riprap will be required for outlet protection on the downstream end. During final design, the culvert height and width may need to be adjusted to accommodate the proposed roadway design section and guidance for a low maintenance stream crossing. Slight changes in geometry would be expected with more design information.

No known water or sanitary conflicts are anticipated at this location. Location of dry utilities are unknown and should be investigated prior to final design. Minor channel improvements to the drainageway will be required upstream and downstream of the crossing in order to promote drainage.

The culvert was sized for existing conditions land use scenario. Prior to final design and construction, any development that has occurred upstream of the roadway crossing should be added into the existing conditions model to update the design discharge.

MAS	STER PLAN C	OST ESTIMAT	E FOR INDIVI	DUAL RE	ACH	
200 1507						
PROJECT : DRAINAGEWAY :	Shaktooth Bluffs Sharktooth Draw	Storm Drainage Master	Plan			
REACH :	Future 4th St Cros	sing (West)				
JURISDICTION :	City of Greeley					
REACH ID:	SKD Conceptual I	Design	Enter Estimator Name	e on Project In	fo DATE :	12/26/2018
						TOTAL
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST
oncrete Box Culverts						
Box Culvert Pipe	-		I			
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft) 50	L.F.	\$1,081.50	\$54,075.00
Headwall and Toewalls	5	1	50	L.F.	\$1,081.50	\$54,075.00
Individual Box Span (ft)	No. of Barrels	Total Span (ft)				
10	1	12.00	2	EA	\$1,158.48	\$2,317.00
Wingwalls (includes wingwalls on ei	ither side of channel	and concrete apron)				
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels				
10	5	1	2	EA	\$12,054.14	\$24,108.30
hannel Improvements						
cavation, Mid Range			296	C.Y.	\$32.00	\$9,472.00
inch Riprap, Type M			22	C.Y.	\$80.00	\$1,778.00
andscaping and Maintenance Ir	mprovements					
clamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00
pecial Items (User Defined)						
	User Defined Item	s	29	TON	\$250.00	\$7,250.00
	Master Pla	n Capital Improv	ement Cost Sur	nmary		
Capital Improvement Costs						
be Culverts and Storm Drains						\$0.00
in crete Box Culverts						\$80,500.00
draulic Structures annel Improvements						\$0.00 \$11,250.00
tention/Water Quality Facilities						\$0.00
movals						\$0.00
ndscaping and Mainten ance Improvements						\$1,340.00
ecial Items (User Defined)						\$7,250.00
btotal Capital Improvement Costs						\$100,340.00
Additional Capital Improvement Cos	its					
watering			\$5,000.00	L.S.		\$5,000.00
bilization			5%			\$5,017.00
affic Control			\$5,017.00	L.S.		\$5,017.00
ility Coordination/Relocation ormwater Management/Erosion Control			\$5,017.00	L.S.		\$5,017.00 \$5,017.00
ibtotal Additional Capital Improvement Cos	te		578			\$25,068.00
Land Acquisition Costs						423,000.00
DW/Easements						\$0.00
Ibtotal Land Acquisition Costs						\$0.00
Other Costs (percentage of Capital I	mprovement Costs)					
gineering			15%			\$18,811.00
gal/Administrative			5%			\$6,270.00
ntract Admin/Construction Management			10%			\$12,541.00
ntingency			25%			\$31,352.00
btotal Other Costs	271					\$68,974.00
otal Capital Improvement Cost	s					\$194,382.0
	Dian Or ant	and Mainten	- Cast C			
	Plan Operation	and Maintenanc			1	
			Quantity	Unit	Unit Cost \$1.00	Total Annual Co \$50.00
scription	and another at the	and a data in the second se				
scription Ivert Maintenance (e.g. sediment & debris rem		nce/exit, structural repairs	50	L.F.	\$1.00	
scription Ivert Maintenance (e.g. sediment & debris rem otal Annual Operation and Mair		ice/exit, structural repairs	50	UF.	\$1.00	\$50.00
Master scription livert Maintenance (e.g. sediment & debris rem otal Annual Operation and Maintenance fective Interest Rate otal Operation and Maintenance	ntenance Cost		50	UF.	\$1.00	



#### Table 7-1: Sharktooth Draw - Future 4th Street Crossing (West)



## 7.2.5.1 SHARKTOOTH DRAW – FUTURE 4<sup>TH</sup> STREET CROSSING CENTRAL

The central, future 4<sup>th</sup> Street crossing is located approximately 700 ft. west of 95<sup>th</sup> Avenue, and will experience approximately 151 cfs during a 100-year event. A 48-inch RCP is proposed to convey 122 cfs during a 100-year event, with the remaining 29 cfs overtopping at a depth less than 6 inches.

The future roadway crossing was conceptually designed with minimal ground cover over the top of the crossing. The improvement requires installation of flared end sections, at a minimum, on the upstream and downstream side of the RCP culvert. Riprap will be required for outlet protection on the downstream end. During final design, the culvert height and width may need to be adjusted to accommodate the proposed roadway design section. Slight changes in geometry would be expected with more design information.

No known water or sanitary conflicts are anticipated at this location. Location of dry utilities are unknown and should be investigated prior to final design. Minor channel improvements to the drainageway will be required upstream and downstream of the crossing in order to promote drainage.

The culvert was sized for existing conditions land use scenario. Prior to final design and construction, any development that has occurred upstream of the roadway crossing should be added into the existing conditions model to update the design discharge.

Table 7-2: Sharktooth Draw - Fu	tı
---------------------------------	----

PROJECT :	Sharktooth Bluffs	Storm Drainage Master	Plan			
DRAINAGEWAY :	Sharktooth Draw					
REACH :	Future 4th Street	(Central)				
JURISDICTION :	City of Greeley					
REACH ID:	SKD Conceptual I	Design	Enter Estimator Nam	e on Project in	DATE :	12/21/2018
						TOTAL
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in) 48-inch	Length (ft) 50	No. of Barrels	50	LE	\$193.00	\$9,650.00
Flare End Sections	50		50	L.F.	\$195.00	\$9,650.00
Diameter (in)	Applicable	No, of Barrels				
48-inch	Yes	1	2	EA	\$2,760.00	\$5,520.00
Channel Improvements						
xcavation, Mid Range			167	C.Y.	\$32.00	\$5,344.00
2-inch Riprap, Type M			13	C.Y.	\$80.00	\$1,040.00
andscaping and Maintenance	mprovements					
Reclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00
Special Items (User Defined)				1 101 100	4.10.000	41,010.00
	<user defined="" item<="" td=""><td>21</td><td>18</td><td>TON</td><td>\$250.00</td><td>\$4,500.00</td></user>	21	18	TON	\$250.00	\$4,500.00
sprran				1.011		
	Master Pla	an Capital Improv	ement Cost Sur	nmarv		
Capital Improvement Costs						
pe Culverts and Storm Drains						\$15,170.00
Concrete Box Culverts						\$0.00
lydraulic Structures						\$0.00
Channel Improvements						\$6,384.00
Detention/Water Quality Facilities						\$0.00
Removals						\$0.00 \$1.340.00
andscaping and Mainten ance Improvements Special Items (User Defined)						\$4,500.00
						\$27,394,00
Subtotal Capital Improvement Costs	sts		_	_		\$27,394.00
Additional Capital Improvement Cos	sts		\$5,000.00	L.S.		\$27,394.00 \$5.000.00
Additional Capital Improvement Cos Dewatering	sts		\$5,000.00 5%	L.S.		
Additional Capital Improvement Cos Deviatering Mobilization	sts			L.S.		\$5,000.00
Additional Capital Improvement Cos Dewatering Mobilization Traffic Control	sts		5%			\$5,000.00 \$1,370.00
Additional Capital Improvement Cos Deveztering Mobilization Traffic Control Jälity Coordination/Relocation	sts		5% \$5,000.00	L.S.		\$5,000.00 \$1,370.00 \$5,000.00
Additional Capital Improvement Co: Deviction g Mobilization Fraffic Control Julity Coordination/Relocation Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Cos			5% \$5,000.00 \$5,000.00	L.S.		\$5,000.00 \$1,370.00 \$5,000.00 \$5,000.00
Additional Capital Improvement Cos Devatering Molilization Traffic Control Julity Coordination/Relocation Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Cos Land Acquisition Costs			5% \$5,000.00 \$5,000.00	L.S.		\$5,000.00 \$1,370.00 \$5,000.00 \$1,370.00 \$1,370.00 \$17,740.00
Additional Gapital Improvement Cos Devatering Mobilization Traffic Control Jällty Coordination/Refocation Stortwater Management/Erosion Control Subtotal Additional Capital Improvement Cos Land Acquisition Costs ROW/Easements			5% \$5,000.00 \$5,000.00	L.S.		\$5,000.00 \$1,370.00 \$5,000.00 \$1,370.00 \$1,370.00 \$17,740.00 \$0.00
Additional Capital Improvement Co Devatering Mobilization Traffic Control Julity Coordination/Relocation Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Cos Land Acquisition Costs Subtotal Land Acquisition Costs	sts		5% \$5,000.00 \$5,000.00	L.S.		\$5,000.00 \$1,370.00 \$5,000.00 \$1,370.00 \$1,370.00 \$17,740.00
Additional Capital Improvement Cos Devertering Mobilization Taffic Control Jility Coordination/Relocation Rormwater Management/Erosion Control Jubtotal Additional Capital Improvement Cos Land Acquisition Costs Utotal Land Acquisition Costs Other Costs (percentage of Capital I	sts		5% \$5,000.00 \$5,000.00 5%	L.S.		\$5,000.00 \$1,370.00 \$5,000.00 \$1,370.00 \$1,370.00 \$1,370.00 \$17,740.00 \$0.00 \$0.00
Additional Gapital Improvement Cos Dewatering Mobilization raffic Control Wiley Coordination/Relocation Sormwater Management/Erosion Control Subtotal Additional Capital Improvement Cos Subtotal Additional Capital Improvement Cos COV/Essements Subtotal Land Acquisition Costs Other Costs (percentage of Capital I Engineering)	sts		5% \$5,000.00 \$5,000.00 5%	L.S.		\$5,000.00 \$1,370.00 \$5,000.00 \$1,370.00 \$1,370.00 \$1,370.00 \$1,7,740.00 \$0,00 \$0,00 \$0,00 \$0,00 \$6,770.00
Additional Capital Improvement Co Devatering Mobilization Fraffic Control Julity Coordination/Relocation Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Cos Land Acquisition Costs COW/Easements Subtotal Land Acquisition Costs Other Costs (percentage of Capital I Engineering e.gal/Administrative	sts		5% \$5,000.00 \$5,000.00 5%	L.S.		\$5,000.00 \$1,370.00 \$5,000.00 \$1,370.00 \$1,370.00 \$17,740.00 \$0.00 \$0.00 \$5,070.00 \$2,257.00
Additional Gapital Improvement Co Devatering Mobilization Traffic Control Julity Coordination/Refocation Stormwater Management/Erosion Control Bubtotal Additional Capital Improvement Cos Land Acquisition Costs COWEasoments Bubtotal Land Acquisition Costs Other Costs (percentage of Capital I Ingineering .egal/Administrative Contract Admini/Construction Management Contingency	sts		5% \$5,000.00 \$5,000.00 5% 15% 5%	L.S.		\$5,000.00 \$1,370.00 \$5,000.00 \$1,370.00 \$1,370.00 \$1,370.00 \$1,7,740.00 \$0,00 \$0,00 \$0,00 \$0,00 \$6,770.00
Additional Gapital Improvement Cos Devatering Molilization raffic Control Villy Coordination/Relocation Subtotal Additional Capital Improvement Cos Land Acquisition Costs CV/KEasements Subtotal Land Acquisition Costs Other Costs (percentage of Capital I Ingineering egal/Administrative Contract Admin/Construction Management Contract Admin/Construction Management Contract Admin/Construction Management	sts		5% \$5,000.00 5% 15% 5% 10%	L.S.		\$5,000.00 \$1,370.00 \$5,000.00 \$1,370.00 \$1,370.00 \$17,740.00 \$0.00 \$0.00 \$8,770.00 \$2,257.00 \$4,513.00
Additional Capital Improvement Cos Devatering Mobilization raffic Control Jility Coordination/Relocation Stubtotal Additional Capital Improvement Cos Land Acquisition Costs OWEasements Ubtotal Land Acquisition Costs Other Costs (percentage of Capital I ingineering gal/Administrative contract Admin/Construction Management contingency Ubtotal Ubtor Costs	sts Improvement Costs)		5% \$5,000.00 5% 15% 5% 10%	L.S.		\$5,000.00 \$1,370.00 \$5,000.00 \$1,370.00 \$1,370.00 \$1,370.00 \$0.00 \$0.00 \$0.00 \$0.00 \$2,257.00 \$4,513.00 \$11,284.00 \$24,824.00
Additional Capital Improvement Cos leverating dollization raffic Control titity Coordination/Relocation tormwater Management/Erosion Control utubatal Additional Capital Improvement Cos Land Acquisition Costs cov/Resements utubatal Land Acquisition Costs other Costs (percentage of Capital I ingineering contract Admin(Construction Management contract Admin(Construction Management contract Admin(Construction Management Costs) fortal Capital Improvement Cost	sts Improvement Costs)	and Mainter	5% \$5,000.00 \$5,000.00 5% 15% 5% 10% 25%	LS LS		\$5,000.00 \$1,370.00 \$5,000.00 \$1,370.00 \$1,370.00 \$1,370.00 \$0.00 \$0.00 \$0.00 \$0.00 \$2,257.00 \$4,513.00 \$11,284.00 \$24,824.00
Additional Gapital Improvement Cos Devatering dobilization raffic Control JUly Coordination/Relocation Subtotal Additional Capital Improvement Cos Lund Acquisition Costs Cov/Easements Subtotal Land Acquisition Costs Other Costs (percentage of Capital I egal/Administrative contract Admin/Construction Management Contragency Subtotal Other Costs Fotal Capital Improvement Cost Master	sts Improvement Costs)	and Maintenance	5% \$5,000.00 \$5,000.00 5% 15% 5% 5% 25%	LS LS	Unit Cost	\$5,000.00 \$1,370.00 \$5,000.00 \$1,370.00 \$1,370.00 \$0.00 \$0.00 \$6,770.00 \$2,257.00 \$4,513.00 \$11,284.00 \$24,824.00 \$69,958.00
Additional Capital Improvement Cos Devertering Mobilization raffic Control Jility Coordination/Relocation Stototal Additional Capital Improvement Cos Land Acquisition Costs Other Costs Other Costs Other Costs Other Costs Other Costs Contract Admin/Construction Management Contract Admin/Construction Management Contract Admin/Construction Management Contract Admin/Construction Management Contract Other Costs Fotal Capital Improvement Cost Master Description	sts Improvement Costs) IS Plan Operation		5% \$5,000.00 \$5,000.00 5% 15% 5% 10% 25% e Cost Summar Quantity	LS LS	Unit Cost \$1.00	\$5,000.00 \$1,370.00 \$5,000.00 \$1,370.00 \$1,370.00 \$0.00 \$0.00 \$6,770.00 \$2,257.00 \$4,513.00 \$11,284.00 \$24,824.00 \$69,958.00
Additional Gapital Improvement Cos leverating doblization raffic Control tility Coordination/Relocation tormwater Management/Erosion Control usbotal Additional Gapital Improvement Cos Land Acquisition Costs contract Administrative contract AdminicCosts (percentage of Capital I ngineering egal/Administrative contract AdminiConstruction Management contract AdminiConstruction Management contract AdminicConstruction Management contract AdminicConstruction Management contract Administrative Contract Administra	Improvement Costs) IS Plan Operation moval, erosion at entrar		5% \$5,000.00 \$5,000.00 5% 15% 5% 10% 25% e Cost Summar Quantity	L S L S Vuit		\$5,000,00 \$1,370,00 \$5,000,00 \$1,370,00 \$1,370,00 \$1,7740,00 \$0,00 \$0,00 \$2,257,00 \$4,513,00 \$11,284,00 \$24,824,00 \$49,958,000 Total Annual Co \$50,00
Additional Gapital Improvement Cos Devicting Additization Traffic Control Julity Coordination/Relocation Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Cost Land Acquisition Costs Contract Additional Capital Improvement Cother Costs (percentage of Capital I Engineering eggal/Administrative contract Administrative Contract Administrative Contract Administrative Contract Administrative Subtotal Other Costs Total Capital Improvement Cost	Improvement Costs) IS Plan Operation moval, erosion at entrar		5% \$5,000.00 \$5,000.00 5% 15% 5% 10% 25% e Cost Summar Quantity	L S L S Vuit		\$5,000.00 \$1,370.00 \$5,000.00 \$1,370.00 \$1,370.00 \$1,370.00 \$0,00 \$0,00 \$0,00 \$0,00 \$2,257.00 \$4,513.00 \$11,284.00 \$24,824.00 \$49,958.00 Total Annual Co



#### ture 4th Street Crossing (Central)





## 7.2.5.1 SHARKTOOTH DRAW – FUTURE 4<sup>TH</sup> STREET CROSSING EAST

The third of the three 4<sup>th</sup> Street expansion culverts is the Future 4<sup>th</sup> Street Crossing (East). This culvert is located approximately 2,000 ft. east of 95<sup>th</sup> Avenue, and will experience approximately 124 cfs during a 100-year event. A 48-inch RCP is proposed. The culvert will convey 111 cfs during the 100-year event with 13 cfs overtopping at a depth less than 6 inches.

The future roadway crossing was conceptually designed with minimal ground cover over the top of the crossing. The improvement requires installation of flared end sections, at a minimum, on the upstream and downstream side of the RCP culvert. Riprap will be required for outlet protection on the downstream end. During final design, the culvert height and width may need to be adjusted to accommodate the proposed roadway design section. Slight changes in geometry would be expected with more design information.

No known water or sanitary conflicts are anticipated at this location. Location of dry utilities are unknown and should be investigated prior to final design. Minor channel improvements to the drainageway will be required upstream and downstream of the crossing in order to promote drainage.

The culvert was sized for existing conditions land use scenario. Prior to final design and construction, any development that has occurred upstream of the roadway crossing should be added into the existing conditions model to update the design discharge.

#### Table 7-3: Sharktooth Draw - Future 4th Street Crossing (East)

DESCRIPTION         QUANTITY         UNIT         UNIT         UNIT         COM           Pipe Culverts and Storm Drains	PROJECT :	Sharktooth Bluff	s Storm Drainage Maste	r Plan				
URBOLCTION:         Ulty of Greetey BRACH D:         Enter Estimator Name on Project Ind DaTE:         DaTE:         122/1001           DESCRIPTION         QUANTITY         UNIT         UNIT         CONT         CONT           Circular Post Circular Post Bands         Content for Discrete (n)         Length (ft)         No. of Berris         Content for Discrete (n)         Content for Discrete (n)         Applicable         No. of Berris         Content for Discrete (n)         Sole         Sole<	DRAINAGEWAY :	Sharktooth Draw						
BEACHID:         Skin Conceptual Design         Enter Estimator Name on Project Infd         DATE:         1221/0019           DESCRIPTION         QUANTITY         UNIT         UNIT         CONC           Pipe Culverts and Storm Drains         Circular Pipes         Circular Pipes         Circular Pipes           Circular Pipes         Circular Pipes         Circular Pipes         Circular Pipes         Circular Pipes           Circular Pipes         Circular Pipes         Circular Pipes         Circular Pipes         Circular Pipes           Barnet of Internet Stand Scorm Applicable         No. of Barrels         Circular Pipes         Stand Score Stand			Crossing (East)					
DESCRIPTION         QUANTITY         UNIT         UNIT COST         TOI           Circular Plans								
DESCRIPTION         QUANTITY         UNIT         UNIT COST         CO           Pipe Culverts and Storm Drains         Circuit Pipes         Encode Pipes	REACH ID:	SKD Conceptual	Design	Enter Estimator Nam	e on Project Inf	9 DATE: 1	2/21/2018	
Pipe Culverts and Storm Drains Circule graps Diameter (in) Length (t) No. of Barrels Advanced in Sections Diameter (in) Applicable No. of Barrels Diameter (in) Applicable No. of Barrels No. of Barrels Diameter (in) Applicable No. of Barrels No. of Barrels No. of Barrels Diameter (in) Applicable No. of Barrels No.	DESCRIPTION						TOTAL	
Other (In)         Length (II)         No. of Barrels         Image: Constraint of Constrain	The second se			QUANTITY	UNIT	UNITCOST	CUST	
Diameter (in) Bahach         Length (ft) 50         No. of Barrels         Image: Constraint of the Station of Sta								
dism         50         1         50         L.F.         9193.00         99.65           Firer End Sections         Diameter (in)         Applicable         No. of Barrels         Image Control           Bitter (in)         Applicable         No. of Barrels         Image Control         Status           Channel Improvements         1         2         EA         Status         Status           Channel Improvements         107         C.Y.         Status         Status           Channel Improvements         1         ACRE         Status         Status           Control Status         1         ACRE         Status         Status           Status         Status         Status         Status         Status           Status         Status         Status         Status         Status				1				
Fure End Sections         Applicable         No. of Barrels         Image: Constraint of Con			No. of Barrels	50	1.5	£403.00	\$9.650.00	
Diameter (in)         Applicable         No. of Barrels         Image: Control of Control One of Control of Contro		30	1		L.F.	\$193.00	\$9,650.00	
48indh         Yes         1         2         EA         \$2,70,000         \$5,55           Channel Improvements         167         C.Y.         \$32,000         \$5,34           Secondon, Mail Ranga         167         C.Y.         \$32,000         \$5,34           Landscaping and Maintenance Improvements         1         ACRE         \$1,34         \$1,34           Special Items (User Defined)         1         ACRE         \$1,340,000         \$1,34           Special Items (User Defined)         1         ACRE         \$1,340,000         \$4,55           Special Item (User Defined)         1         ACRE         \$1,340,000         \$4,55           Special Item (User Defined)         1         ACRE         \$1,340,000         \$4,55           Carrier Box Calverts         18         TON         \$250,000         \$4,55           Carrier Box Calverts         51,01         \$50,000         \$1,34           Additional Improvements         51,01         \$1,34           Special Item (User Defined)         \$1,34         \$1,34           Special Item (User Defined)         \$1,34         \$1,34           Special Item (User Defined)         \$1,34         \$1,34           Special Item (User Defined)         \$1,03 <td></td> <td>Applicable</td> <td>No. of Barrels</td> <td>1</td> <td>-</td> <td></td> <td></td>		Applicable	No. of Barrels	1	-			
Channel Improvements       167       C.Y.       \$32.00       \$5.34         Scark Renge, Type M       13       C.Y.       \$32.00       \$5.34         Landscaping and Maintenance Improvements       1       ACRE       \$1,34.000       \$1.34         Special Items (User Defined)       1       ACRE       \$1,34.000       \$1.34         Special Items (User Defined)       1       ACRE       \$1,34.000       \$4.50         Special Items (User Defined Items       18       TON       \$250.00       \$4.50         Master Plan Capital Improvement Cost Summary         Ceptial Improvement Costs       \$15,1       \$15,1         Special Items (User Defined)       \$10       \$15,1       \$15,1         Special Items (User Defined)       \$15,20       \$15,20       \$15,20       \$15,20         Special Items (User Defined)       \$10,30       \$10,30       \$15,30       \$15,20				2	EA	\$2,760.00	\$5,520.00	
Science Born, Molt Range         167         C.Y.         \$32.00         \$5.34           Lands caping and Maintenance Improvements         13         C.Y.         \$80.00         \$1.04           Landscaping and Maintenance Improvements         1         ACRE         \$1.340.00         \$1.34           Special Items (User Defined)         Special Items (User Defined)         \$260.00         \$1.34           Special Items (User Defined)         Master Plan Capital Improvement Cost Summary         \$260.00         \$4.50           Special Items (User Defined)         Special Improvement Costs         \$45.1         \$45.1           Special Improvement Costs         \$45.1         \$45.1         \$45.1           Special Improvement Costs         \$45.1         \$45.0         \$45.0           Special Improvements         \$45.1         \$45.0         \$45.0           Special Improvements         \$5.00.00         L.S         \$5.00           Storted Soc Cubers         \$5.00.00         L.S         \$5.00           Special Improvement Costs         \$5.00.00         L.S         \$5.00           Storted Soc Cubers         \$5.00.00         L.S         \$5.00           Special Improvement Costs         \$5.00.00         L.S         \$5.00           Storted Adminingrowe	Channel Improvements							
2and: Rigrap, Type M         13         C.Y.         \$80.00         \$1.04           andscaping and Maintenance Improvements         1         ACRE         \$1.340.00         \$1.04           Special Items (User Defined)         1         ACRE         \$1.340.00         \$1.34           Special Inprovement Costs         18         TON         \$2.50.00         \$1.54           Special Inprovements         91.51         90.00         \$1.34         \$1.34           Special Inprovements         90.00         \$1.34         \$1.34         \$1.34           Special Inprovements         90.00         \$1.34         \$1.34         \$1.34           Special Inprovement Costs         90.00         \$1.34         \$1.34         \$1.34           Special Inprovement Costs         \$1.34         \$1.34         \$1.34         \$1.34           Actitions! Cepital Inprovement Costs         \$1.34         \$1.34         \$1.34         \$1.34           Special Inprov				167	C.Y.	\$32.00	\$5,344.00	
Landscaping and Maintenance Improvements       1       ACRE       \$1,340.00       \$1,34         Special Items (User Defined)       Special Items (User Defined)       \$1,340.00       \$1,34         Special Items (User Defined)       1       ACRE       \$1,340.00       \$1,34         Special Items (User Defined)       Master Plan Capital Improvement Costs Summary       \$1,51       \$1,50       \$1,5							\$1,040.00	
Accuration & seeding (nutive grasses)         1         ACRE         \$1,340.00         \$1,34           Special Items (User Defined)         Special Items (User Defined)         Special Items (User Defined)         Special Items (User Defined)           Special Items (User Defined)         Master Plan Capital Improvement Costs Summary         Special Improvement Costs         \$15.1           Concrete Eox Culverts         Special Improvement Costs         \$15.1         Special Items (User Defined)         \$15.1           Concrete Eox Culverts         Special Improvements         \$15.1         \$15.1         \$15.1           Concrete Eox Culverts         Special Items (User Defined)         \$15.1         \$15.1           Concrete Eox Culverts         \$15.1         \$15.1         \$15.1           Concrete Eox Culverts         \$15.3         \$15.3         \$15.3           Concrete Eox Culverts         \$15.3         \$1	Landscaping and Maintenance In	nprovements						
Special Items (User Defined)       Item State Plan Capital Improvement Costs Summary         Capital Improvement Costs       \$15.1         Ope Culverts and Storm Drains       \$15.3         Ope Culverts and Storm Drains       \$16.3         Ope Culverts and Storm Drains       \$17.40         Ope Defined It Improvements       \$17.40         Subtor Capital Improvement Costs       \$17.40         Device Defined Item Costs       \$17.40         Subtor Capital Improvement Costs       \$17.40         Device Defined Item Costs       \$17.40         Subtor Capital Improvement Costs       \$17.40         Device Defined Item Costs       \$17.40         Subtor Capital Improvement Costs       \$17.40         Costs				1	ACRE	\$1,340.00	\$1,340.00	
Sephalt       <       User Defined Items       18       TON       \$280.00       \$44.50         Master Plan Capital Improvement Costs Summary         Capital Improvement Costs         Ope Outwets and Storm Drains       \$15,11         Concrete Box Culverts       \$15,01         Ope Outwets and Storm Drains       \$15,01         Concrete Box Culverts       \$15,01         Ope Outwets and Storm Drains       \$15,01         Concrete Box Culverts       \$10,01         Operation Improvements       \$10,01         Detention/Water Quality Facilities       \$10,01         Cannol Improvements       \$10,01         Special Improvement Costs       \$27,38         Additional Grapital Improvement Costs       \$27,38         Additional Grapital Improvement Costs       \$27,38         Additional Grapital Improvement Costs       \$25,000,00       L.S.       \$55,000         Ownster Management/Erosion       \$55,000,000       L.S.       \$50,000         Statust Additional Grapital Improvement Costs       \$00       \$13,37         Subtotal Capital Improvement Costs       \$00       \$13,37       \$13,17         Land Additional Grapital Improvement Costs       \$00       \$13,37       \$13,37 <th colsto<="" td=""><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td></th>	<td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td>				-			
Master Plan Capital Improvement Cost Summary         Capital Improvement Costs       \$15,1'         Concrete Box Culvets       \$00         Vydualle Structures       \$00         Channel Improvements       \$5,38         Detention/Water Quality Facilities       \$00         Channel Improvements       \$13,33         Detention/Water Quality Facilities       \$13,33         Concrete State       \$27,38         Additional Capital Improvement Costs       \$27,38         State Total       \$5,000,00       L.S.         State Total       \$5,000,00       L.S.         State Total State       \$2,000,00       L.S.         State Total State       \$2,000,00       L.S.         State Total State       \$2,000,00       L.S.         State Total Capital Improvement Costs       \$30         State Total Capital Improvement Costs       \$30         State Total Capital Improvement Costs       \$30 <tr< td=""><td></td><td> I ker Defined Iter</td><td>me</td><td>18</td><td>TON</td><td>\$250.00</td><td>\$4,500.00</td></tr<>		I ker Defined Iter	me	18	TON	\$250.00	\$4,500.00	
Capital Inprovement Costs       \$15,1'         Pipe Culverts and Storn Drains       \$15,1'         Concrete Box Culverts       \$10         Sydrawic Structures       \$10         Channel Improvements       \$6,38         Steenton/Water Qualty Facilities       \$10         Steenton/Water Qualty Facilities       \$10         Steenton/Water Qualty Facilities       \$10         Steenton/Water Qualty Facilities       \$13,34         Special Items (User Defined)       \$13,44         Subtotal Capital Improvement Costs       \$27,38         Additional Capital Improvement Costs       \$27,38         Dewatering       \$5,000.00       L.S.       \$5,000         Additional Capital Improvement Costs       \$27,38       \$5,000       L.S.       \$5,000         Subtotal Additional Capital Improvement Costs       \$13,33       \$5,000.00       L.S.       \$5,000         Subtotal Additional Capital Improvement Costs       \$13,33       \$5,000.00       L.S.       \$5,000         Subtotal Additional Capital Improvement Costs       \$13,33       \$13,33       \$13,33       \$13,33         Subtotal Additional Capital Improvement Costs       \$13,33       \$13,33       \$13,33       \$13,33         Subtotal Additional Capital Improvement Costs       \$1	sophan	oser Denned Rei		10	1011	4700.00	44,000.00	
Capital Improvement Costs       \$15,1'         Pipe Outvetts and Store Datas       \$15,1'         Concrete Box Culvetts       \$10         Sydraulic Structures       \$10         Channel Improvements       \$6,38         Steendon/Water Qualty Facilities       \$10         Steendon/Water Qualty Facilities       \$10         Steendon/Water Qualty Facilities       \$10         Steendon/Water Qualty Facilities       \$13,4         Special Items (User Defined)       \$13,4         Subtotal Capital Improvements       \$13,4         Special Items (User Defined)       \$4,60         Subtotal Capital Improvement Costs       \$27,30         Additional Capital Improvement Costs       \$27,30         Devideing       \$5,000.00       L.S.       \$5,000         Subtotal Capital Improvement Costs       \$27,30       \$25,000.00       L.S.       \$5,000         Subtotal Additional Capital Improvement Costs       \$13,31       \$1		Maeter DI	an Canital Impro	vom ont Cost Su	nman/			
ippe Curverts and Storm Drains         \$15.1           Concrete Box Curverts         \$30.           Vydaulic Strutures         \$5.8           Drainen Improvements         \$5.8           Setention/Water Quality Facilities         \$1.3           andscaping and Mantenance Improvements         \$1.3           pacial Items (User Defined)         \$1.3           Usbottal Capital Improvement Costs         \$27.38           Additional Capital Improvement Costs         \$27.38           Additional Capital Improvement Costs         \$25.000.00         L.S.           Devide Internet Costs         \$5.000.00         L.S.           Devide Control         \$5.000.00         L.S.         \$5.000           Dity Control         \$5.000.00         L.S.         \$5.00           Dity Control	Canital Improvement Costs	Master PT	an capitar impro	verneni Cost Su	minary			
Concrete Box Culverts         90           Vptraulic Structures         90           Vptraulic Structures         90           Structures         90           Detention/Water Quality Facilities         90           Removals         90           andscaping and Manten ance Improvements         91           Structures         91           andscaping and Manten ance Improvements         91           Subtet Capital Improvement Costs         92           Additional Capital Improvement Costs         92           Additional Capital Improvement Costs         95           Subtet Additional Capital Improvement Costs         91           Cordination Relocation         95         91           Subtet Additional Capital Improvement Costs         90           Cordination Costs         90         91           Other Costs (percentage of Capital Improvement Costs)         90           Other Costs (percentage of Capital Improvement Costs)         90           Contrad Adminiconagem							\$15,170.00	
hydraulic Structures         90           Channel Improvements         \$63.33           beendon/Water Quality Facilities         \$13.44           andiscaping and Mantenance Improvements         \$13.44           andiscaping and Mantenance Improvements         \$13.44           andiscaping and Mantenance Improvements         \$13.44           Additional Capital Improvement Costs         \$27.33           Additional Capital Improvement Costs         \$25.000.00           L.S.         \$55.000           Dewatering         \$5.000.00         L.S.           Additional Capital Improvement Costs         \$55.000           Dewatering         \$5.000.00         L.S.           Itality Coordination/Relocation         \$5.000.00         L.S.           Distoral Additional Capital Improvement Costs         \$13.34           Distoral Additional Capital Improvement Costs         \$13.37           Distoral Additional Capital Improvement Costs         \$13.37           Distoral Additional Capital Improvement Costs         \$13.37           Distoral Additional Capital Improvement Costs         \$10.77           Land Additional Capital Improvement Costs         \$10.77           Distoral Additional Capital Improvement Costs         \$10.77           Subtotal Cheprotentage of Capital Improvement Costs							\$0.00	
Detention/Water Quality Facilities         90.           Permovals         90.           andscaping and Manten ance Improvements         91.3           special terms (User Defined)         \$1.34.           Additional Capital Improvement Costs         \$27.38           Additional Capital Improvement Costs         \$5.000.00         L.S.           Deversering         \$5.000.00         L.S.         \$5.000.00           Additional Capital Improvement Costs         \$5.000.00         L.S.         \$5.000.00           Mobilization         \$5.000.00         L.S.         \$5.000.00           Mobilization         \$5.000.00         L.S.         \$5.000.00           Subtetal Additional Capital Improvement Costs         \$5.000.00         L.S.         \$5.000.00           Subtetal Additional Capital Improvement Costs         \$5.000.00         L.S.         \$5.000.00           Subtetal Additional Capital Improvement Costs         \$5.000.00         L.S.         \$5.000.00           Subtetal Land Acquisition Costs         \$5.000.00         L.S.         \$5.000.00         L.S.         \$5.000.00           Subtetal Land Acquisition Costs         \$5.000.00         L.S.         \$5.000.00         \$5.000.00         \$5.000.00         \$5.000.00         \$5.000.00         \$5.000.00         \$5.000.0							\$0.00	
Removals     90,       andisciping and Maintenance Improvements     \$1,34       Special Items (User Defined)     \$27,38       Additional Capital Improvement Costs     \$27,38       Additional Capital Improvement Costs     \$27,38       Additional Capital Improvement Costs     \$27,38       Mobilization     5%     \$1,37       Treffic Control     \$5,000.00     L.S.       Uity Coordination/Relocation     \$5,000.00     L.S.       Stormwater Management/Erosion Control     \$5,000.00     L.S.       Subtetal Additional Capital Improvement Costs     \$1,37       Subtetal Land Acquisition Costs     \$1,37       Control     \$5%     \$1,37       Subtetal Land Acquisition Costs     \$0.       Subtetal Costs (percentage of Capital Improvement Costs)     \$0.       Engineening     15%     \$8,77       Control     \$5%     \$1,24       Subtetal Other Costs     \$2,25     \$1,12       Subtetal Other Costs<							\$6,384.00	
andscaping and Manteniance Improvements         \$1,34           Special Items (User Defined)         \$27,33           Additional Capital Improvement Costs         \$27,33           Additional Capital Improvement Costs         \$5,000,000         L.S.           Devalering         \$5,000,000         L.S.         \$5,000           Jaily Coordination/Relocation         \$5,000,000         L.S.         \$5,000           Jaily Coordination/Relocation         \$5,000,000         L.S.         \$5,000           Jaily Coordination/Relocation         \$5,000,000         L.S.         \$5,000           Subtotal Capital Improvement Costs         \$5,000,000         L.S.         \$5,000           Subtotal Capital Improvement Costs         \$5,000,000         L.S.         \$5,000           Subtotal Land Acquisition Costs         \$1,37         \$1,37         \$1,37           Contract Administrative         \$5,000,000         L.S.         \$5,000         \$1,37           Subtotal Land Acquisition Costs         \$5,000,000         L.S.         \$1,37           Contract Administrative         \$5,000,000         \$2,27         \$2,000         \$2,000         \$2,000         \$2,000         \$2,000         \$2,000         \$2,000         \$2,000         \$2,000         \$2,000         \$2,000	Detention/Water Quality Facilities						\$0.00	
Special lemms (User Defined)         \$45.00           Subtatal Capital Improvement Costs         \$57.00           Devideing Capital Improvement Costs         \$55.000.00         L.S.         \$55.00           Madditional Capital Improvement Costs         \$55.000.00         L.S.         \$55.00           Mobilization         \$56.000.00         L.S.         \$55.000           Madditional Capital Improvement Costs         \$56.000.00         L.S.         \$55.000           Julity Coordination/Relocation         \$56.000.00         L.S.         \$55.000           Subtatal Additional Capital Improvement Coats         \$56.000.00         L.S.         \$57.000           Subtatal Additional Capital Improvement Coats         \$50.000.00         L.S.         \$50.000           Subtatal Additional Capital Improvement Coats         \$50.000.00         L.S.         \$50.000.00           Subtatal Land Acquisition Coats         \$50.000.00         L.S.         \$50.000.00           Other Coats (percentage of Capital Improvement Coats)         \$50.000.00         \$50.000.00         \$50.000.00           Other Coats (percentage of Capital Improvement Coats)         \$50.000.00         \$50.000.000.000.000.000.000.000.000.000.	Removals						\$0.00	
Subtotal Capital Improvement Costs         \$27,31           Additional Capital Improvement Costs         \$5,000.00         L.S.         \$5,000.00           Wobilization         5%         \$1,37         \$1,37           Treffic Control         \$5,000.00         L.S.         \$5,000.00           Uilty Coordination/Relocation         \$5,000.00         L.S.         \$5,000.00           Stormwater Management/Erosion Control         \$5,000.00         L.S.         \$5,000.00           Subtotal Additional Capital Improvement Costs         \$1,37         \$1,37           Subtotal Land Acquisition Costs         \$1,37         \$1,37           Subtotal Land Acquisition Costs         \$1,37         \$1,37           Other Costs (percentage of Capital Improvement Costs)         \$1,37         \$1,37           Engineening         15%         \$1,37         \$2,25           Subtotal Onstruction Management         10%         \$4,51         \$2,25           Subtotal Other Costs         \$5%         \$11,21         \$2,42,85							\$1,340.00	
Additional Capital Improvement Costs         \$5,000.00         L.S.         \$5,000.00           Devratering         \$5,000.00         L.S.         \$5,000.00         L.S.         \$5,000.00           Jailty Coordination/Relocation         \$5,000.00         L.S.         \$5,000.00         LS.         \$5,000.00           Jailty Coordination/Relocation         \$5,000.00         L.S.         \$5,000.00         LS.         \$5,000.00           Jailty Coordination/Relocation         \$5,000.00         L.S.         \$5,000.00         LS.         \$5,000.00           Subtotal Additional Capital Improvement Costs         \$5,000.00         L.S.         \$1,37         \$1,37           Subtotal Land Acquisition Costs         \$1,37         \$1,37         \$1,37         \$1,37           Conternation         \$5,000.00         L.S.         \$1,37         \$1,37         \$1,37           Subtotal Land Acquisition Costs         \$1,37         \$2,07         \$1,37							\$4,500.00	
Dewetering         \$5,000.00         L.S.         \$5,000.00           Woblization         5%         -         \$1,03           Woblization         \$5,000.00         L.S.         \$5,000           Utily Coordination/Relocation         \$5,000.00         L.S.         \$5,000           Utily Coordination/Relocation         \$5,000.00         L.S.         \$5,000           Subtatal Additional Capital Improvement Coats         \$1,031         \$1,031           Subtatal Land Acquisition Coats         \$0,000         \$1,031         \$1,031           Other Coats         \$0,000         \$1,031         \$1,031         \$1,031           Contract Admini/Construction Management!         \$1056         \$2,021         \$2,051         \$2							\$27,394.00	
Mobilization         5%         \$1,37           Traffic Control         \$5,000.00         L.S.         \$5,000           Stormwater ManagementErosion Control         \$5,000.00         L.S.         \$5,000           Stormwater ManagementErosion Control         \$5,000.00         L.S.         \$1,37           Subtotal Additional Capital Improvement Costs         \$1,37         \$1,37           Subtotal Additional Capital Improvement Costs         \$1,37         \$1,37           Subtotal Additional Capital Improvement Costs         \$1,37         \$1,37           Subtotal Land Acquisition Costs         \$1,37         \$1,37           Other Costs (percentage of Capital Improvement Costs)         \$1,37         \$1,37           Other Costs (percentage of Capital Improvement Costs)         \$0         \$1,57         \$1,37           Contract Administrative         \$1,5%         \$6,77         \$2,25		ts						
Traffic Control         \$5,000.00         L.S.         \$5,000           Utility Condination/Relocation         \$5,000.000         L.S.         \$5,000           Utility Condination/Relocation         \$5,000.000         L.S.         \$5,000           Subtrat Additional Capital Improvement Costs         \$1,37         \$1,37           Subtrat Additional Capital Improvement Costs         \$1,37         \$1,37           Contrast Additional Capital Improvement Costs         \$1,37         \$1,37           Subtrat Additional Capital Improvement Costs         \$1,37         \$1,37           Contrast Additional Capital Improvement Costs         \$1,37         \$1,37           Subtrat Land Acquisition Costs         \$1,37         \$1,37         \$1,37           Contrast Administrative         \$1,37         \$1,37         \$1,37         \$1,37           Contrast Administrative         \$5,69         \$2,22         \$2,59         \$2,22         \$2,59         \$2,22         \$2,59         \$2,22         \$2,59         \$11,12         \$2,50         \$2,22         \$2,50         \$11,22         \$2,50         \$11,22         \$2,50         \$11,22         \$2,50         \$11,22         \$2,50         \$11,22         \$2,50         \$11,22         \$2,50         \$11,22         \$2,50         \$11,22         <					L.S.		\$5,000.00	
Jality Coordination/Relocation Jality Coordination/Relocation L.S. 150000 L.S. 150000 L.S. 150000 1507 150 150 150 150 150 150 150 150 150 150							\$1,370.00	
Stormwater Management/Erosion Control 5% \$133 Subtet Additional Capital Improvement Costs \$17,7 Land Acquisition Costs 20W/Easements \$0, Other Costs (percentage of Capital Improvement Costs) Engineering 5% \$0, egal/Administrative 5% \$12,25 Contract Administrative 5% \$12,25 Subtet Other Costs (Percentage of Capital Improvement Costs) Engineering 5% \$12,25 Subtet Other Costs (Percentage of Capital Improvement Costs) Engineering 5% \$12,25 Subtet Other Costs (Percentage of Capital Improvement Costs) Engineering 5% \$12,25 Subtet Other Costs (Percentage of Capital Improvement Costs) Engineering 5% \$13,27 Subtet Other Costs \$25% \$13,12 Subtet Other Costs \$25% \$11,2 Subtet Other Costs \$25% \$11,2 Subtet Other Costs \$26% \$2,2 Subtet Other Costs \$26% \$11,2 Subtet Other Costs \$26% \$11,2 Subtet Other Costs \$26% \$2,2 Subtet Other Costs \$26							\$5,000.00	
Subtetal Additional Capital Improvement Costs Land Acquisition Costs S0 Subtetal Land Acquisition Costs Collegements Subtetal Land Acquisition Costs Contract Admin/Construction Management Costs) Contract Admin/Construction Management Subtetal Land Acquisition Costs Contract Admin/Construction Management Subtetal Land Acquisition Costs S0 Other Costs S0 Subtetal Land Acquisition Costs S0 Subtetal Costs S0 Subte					L.S.		\$5,000.00	
Land Acquisition Costs 20W/Elserments 30 Other Costs (percentage of Capital Improvement Costs) Contract Admin/Construction Management 20W/Elserments 20W/Els		e		0.40			\$17,740.00	
ROW/Easements         \$0           Subteta Land Acquisition Costs         \$0           Other Costs (percentage of Capital Improvement Costs)         \$15%         \$8.77           Engineering         15%         \$8.77           egalAdministrative         5%         \$2.25           Contract Administrative         \$25%         \$11.2           Contract Administrative         25%         \$11.2           Subtetal Other Costs         \$25%         \$11.2           Subtetal Other Costs         \$\$69,9         \$\$69,9           Master Plan Operation and Maintenance Cost Summary           Contrigue Costs         \$\$69,9           Master Plan Operation and Maintenance Cost Summary           Count of the Costs         \$\$69,9           Master Plan Operation and Maintenance Cost Summary           Count Operation and Maintenance Cost Summary           Outer Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs         \$0         L.F.         \$1.00         \$50           Total Annual Operation and Maintenance Cost         \$50         L.F.         \$1.00         \$50							017,740.00	
Subtetal Land Acquisition Costs     \$0.       Other Costs (percentage of Gapital Improvement Costs)     15%     \$6.77       Engineering     15%     \$6.77       .egal/Administrative     5%     \$2.25       Contract Admin/Construction Management     10%     \$4.51       Contract Admin/Construction Management     10%     \$4.51       Contract Admin/Construction Management     10%     \$4.51       Subtotal Other Costs     \$25%     \$41.2       Subtotal Other Costs     \$69,91     \$69,91       Master Plan Operation and Maintenance Cost Summary     \$69,91       Description     Quantity     Unit     Unit Cost       Outwert Meintenance (e.g. sediment & debris removal, erosion at entrance/eval, structural reparts     \$50     L.F.     \$1.00       Total Annual Operation and Maintenance Cost     \$50     S50     \$50						1	\$0.00	
Other Costs (percentage of Gapital Improvement Costs)         Engineering       15%       \$6,77         Engineering       5%       \$2,25         contract Admin/Construction Management       10%       \$4,51         Contract Admin/Construction Management       10%       \$4,51         Contingency       25%       \$11,2         Subtotal Other Costs       \$24,85       \$44,85         Total Capital Improvement Costs       \$89,93       \$12,25         Master Plan Operation and Maintenance Cost Summary         Description       Quantity       Unit       Unit Cost       Total Annual Operation and Maintenance Cost         Total Annual Operation and Maintenance Cost       \$10%       \$50       L.F.       \$100       \$50							\$0.00	
Engineering         15%         \$8,77           egal/Administrative         5%         \$2,25           contract AdminisConstruction Management         10%         \$4,51           Contingency         25%         \$11,2           Subtatal Other Coats         25%         \$11,2           Contingency         25%         \$11,2           Subtatal Other Coats         \$25%         \$11,2           Contained Construction Management         \$\$69,9         \$\$69,9           Master Plan Operation and Maintenance Cost Summary           Contrigency         \$\$69,9           Unit         Unit         Unit Cost           Contrigency         \$\$69,9           Contrigency         \$\$60           Contrigency         \$\$60           Contrigencontrigencontregates         \$50		mprovement Costs)						
Contract Admin/Construction Management     10%     \$4.51       Contingency     25%     \$11.2       Subted Other Costs     \$24.81       Total Capital Improvement Costs     \$69,91       Master Plan Operation and Maintenance Cost Summary       Description       Quantity     Unit     Unit Cost       Total Annual Operation and Maintenance Cost     \$50     LF.       \$50     Stop     \$50				15%			\$6,770.00	
Contingency 25% \$11.2 Subtotal Other Costs \$24,8 Total Capital Improvement Costs \$\$69,9 Master Plan Operation and Maintenance Cost Summary Description Unit Unit Cost Total Ann Unit Unit Cost Total Ann Unit Unit Cost \$50 U.F. \$1.00 \$50 Total Annual Operation and Maintenance Cost \$\$				5%			\$2,257.00	
Subtral Other Costs     \$24,8:       Total Capital Improvement Costs     \$69,9:       Master Plan Operation and Maintenance Cost Summary     Secretarian       Description     Quantity     Unit     Unit Cost       Durvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs     50     L.F.     \$1.00     \$50       Total Annual Operation and Maintenance Cost     \$50     L.F.     \$1.00     \$50							\$4,513.00	
Total Capital Improvement Costs     \$69,91       Master Plan Operation and Maintenance Cost Summary       Description       Quantity     Unit     Unit Cost     Total Ann       Uvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs     50     L.F.     \$1.00     \$50       Total Annual Operation and Maintenance Cost				25%			\$11,284.00	
Master Plan Operation and Maintenance Cost Summary           Quantity         Unit         Unit Cost         Total Ann           Description         Quantity         Unit         Unit Cost         Total Ann           Duvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs         50         L.F.         \$1.00         \$50           Total Annual Operation and Maintenance Cost         \$50							\$24,824.00	
Description         Quantity         Unit         Unit Cost         Total Ann           Dulvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repars         50         L.F.         \$1.00         \$50           Total Annual Operation and Maintenance Cost         \$50         L.F.         \$1.00         \$50	Total Capital Improvement Costs	3					\$69,958.00	
Description         Quantity         Unit         Unit Cost         Total Ann           Dulvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs         50         L.F.         \$1.00         \$50           Total Annual Operation and Maintenance Cost         \$50         L.F.         \$1.00         \$50	Meeter	Plan Operation	n and Maintanan	Cost Summer				
Dulvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs 50 L.F. \$1.00 \$50 Fotal Annual Operation and Maintenance Cost \$50		Plan Operation	n and maintenand			Unit Cost	Total Annual Co	
Fotal Annual Operation and Maintenance Cost \$50		ioval erosion at entra	ance/exit_structural_renair				\$50.00	
	variant mainterience (e.g. sediment & debits fell		ancerexit, au ucturiar repair		la C.		\$50.00	
creación de companya de	Total Annual Operation and Main							
Total Operation and Maintenance Costs Over 50 Years \$1,57		tenance Cost						



# SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN



## 7.2.5.2 SHARKTOOTH DRAW – 95<sup>TH</sup> AVENUE CULVERT CROSSING

Approximately 4,200 ft. north of 10<sup>th</sup> Street, Sharktooth Draw crosses 95<sup>th</sup> Street. The existing dual 36 inch RCPs are undersized to safely convey the 100-yr design discharge of 793 cfs underneath the roadway. As shown by the hydraulic study, drainage in this area overtops the roadway to the north of the current culvert crossing. Half a foot to 1 foot of overtopping occurs during the 10-year event and 1 foot to 2 foot of overtopping occurs during the 100-year event.

Proposed improvements at 95<sup>th</sup> Street to meet City of Greeley criteria require a dual cell 8 ft. wide by 4.5 ft. high RCBC. The improved crossing structure will convey 764 cfs, with approximately 29 cfs overtopping the roadway during existing conditions 100-year event. The overtopping depth will be less than 6 inches.

The improvement requires removal of the existing storm culvert crossings, installation of headwall and wingwalls on the upstream and downstream side of the box culvert. Riprap will be required for outlet protection on the downstream end, and should be analyzed in further detail during final design.

No known water or sanitary conflicts are anticipated at this location. Location of dry utilities are unknown and should be investigated prior to final design. Minor channel improvements to the drainageway will be required upstream and downstream of the crossing in order to promote drainage.

The culvert was sized for existing conditions land use scenario. Prior to final design and construction, any development that has occurred upstream of the roadway crossing should be added into the existing conditions model to update the design discharge.

MA	STER PLAN C	OST ESTIMAT	E FOR INDIVI	DUAL REA	ACH	
PROJECT :	Sharktooth Draw S	Storm Drainage				
DRAINAGEWAY :	Sharktooth Draw	Scottin Drainage				
REACH :	95th Avenue					
JURISDICTION :	City of Greeley		Fata Fatimata Mari	Design the		12/21/2018
REACH ID:	SKD Conceptual D	Design	Enter Estimator Name	e on Project Info	DATE :	12/21/2018
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Concrete Box Culverts						
Box Culvert Pipe	D	No. of Barrels	Locath (0)		1	
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft) 60	L.E.	\$1,796.98	\$107,819.00
Headwall and Toewalls	, in the second		00	C.1 .	\$1,750.50	\$107,013.00
Individual Box Span (ft)	No. of Barrels	Total Span (ft)				
8	2	19.00	2	EA	\$1,725.96	\$3,452.00
Wingwalls (includes wingwalls on Individual Box Span (ft)	either side of channel Box Rise (ft)	and concrete apron) No. of Barrels	1 1		1	1
8	Box Rise (ft)	2	2	EA	\$13,884.19	\$27,768.40
Channel Improvements	, , , , , , , , , , , , , , , , , , ,			1071	10,001.10	
Excavation, Mid Range			490	C.Y.	\$32.00	\$15,680.00
12-in ch Riprap, Type M			36	C.Y.	\$80.00	\$2,880.00
Removals						
Removal of culvert pipe (D<48")			120	L.F.	\$27.00	\$3,240.00
Landscaping and Maintenance	Improvements					
Reclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00
Special Items (User Defined)						
Asphalt	<user defined="" item<="" td=""><td>S</td><td>48</td><td>TON</td><td>\$250.00</td><td>\$12,000.00</td></user>	S	48	TON	\$250.00	\$12,000.00
Capital Improvement Costs	Master Pla	n Capital Improv	vement Cost Sur	nmary		
Pipe Culverts and Storm Drains						\$0.00 \$139,039.00
Concrete Box Culverts Hydraulic Structures						\$139,039.00
Channel Improvements						\$18,560.00
Detention/Water Quality Facilities						\$0.00
Removals						\$3,240.00
Landscaping and Maintenance Improvements Special Items (User Defined)						\$1,340.00
Subtotal Capital Improvement Costs						\$174,179.00
Additional Capital Improvement Co	sts					
Dewatering			\$5,000.00	L.S.		\$5,000.00
Mobilization			5%			\$8,709.00
Traffic Control Utility Coordination/Relocation			\$8,708.95 \$8,708.95	L.S.		\$8,709.00 \$8,709.00
Stormwater Management/Erosion Control			5%	L.0.		\$8,709.00
Subtotal Additional Capital Improvement Co	sts		· · · · · · · · · · · · · · · · · · ·			\$39,836.00
Land Acquisition Costs						
ROW/Easements						\$0.00 \$0.00
Subtotal Land Acquisition Costs Other Costs (percentage of Capital	Improvement Costs)		_			\$0.00
Engineering			15%			\$32,102.00
Legal/Administrative			5%			\$10,701.00
Contract Admin/Construction Management			10%			\$21,402.00
Contingency Subtotal Other Costs			25%			\$53,504.00 \$117,709.00
Total Capital Improvement Cost	te					\$331,724.00
rotal Capital improvement Cos	10					\$331,724.00
	DI O	and Maintenanc	e Cost Summar	v		
Master	r Plan Operation	and mannenanc				
Description			Quantity	Unit	Unit Cost	Total Annual Cost
Description Culvert Maintenance (e.g. sediment & debris re	moval, erosion at entran		Quantity		Unit Cost \$1.00	\$120.00
Description Culvert Maintenance (e.g. sediment & debris re Total Annual Operation and Mai	moval, erosion at entran		Quantity	Unit		\$120.00 <b>\$120.00</b>
Description Culvert Maintenance (e.g. sediment & debris re	moval, erosion at entran	ace/exit, structural repairs	Quantity	Unit		\$120.00



### Table 7-4: Sharktooth Draw - 95th Avenue Crossing





## 7.2.5.3 SHARKTOOTH DRAW – BELLEVUE PIPELINE STABILIZATION

After completion of the alternative analysis, stability concerns of Sharktooth Draw were evaluated at the Bellevue Pipeline crossing east of 95<sup>th</sup> Avenue. Three water mains, ranging in diameter from 20 to 27 inches, cross the drainageway approximately 1,725 ft. downstream of 95<sup>th</sup> Avenue as Sharktooth Draw turns to the north. The constant flow in Sharktooth Draw has the potential to erode the channel, exposing the Bellevue Treatment Water Plant water mains.

Sharktooth Draw conveys flow at an approximate longitudinal slope of 1.5 percent downstream of 95<sup>th</sup> Avenue. During the existing conditions 100-year event, approximately 890 cfs is conveyed at a velocity of 9.8 ft./sec. The resulting shear stress in the channel is approximately 4.5 lbs/ft2. For comparison, the 5-year event results in approximately 30 cfs in the channel at a velocity of 4.0 ft./sec. To protect the water mains against erosion, sheet piling at a depth of 20 feet is proposed. To further protect the crossing, riprap should be installed.

The depth and exact location of the water mains were not determined for the conceptual design. GIS shapefiles were used to approximate the location of the water lines and depths are expected to be 3 feet in depth to top of pipes at a minimum. During final design the water mains should be potholed to verify location and depth. Once the exact location of the water lines is known, potential scour should be calculated and depth of the cut off walls and rip rap sizing adjusted accordingly.

### Table 7-5: Sharktooth Draw - Bellevue Pipeline Stabilization

PROJECT :	Sharktooth Bluffs Storm Drainage M	seter Plan					
DRAINAGEWAY :	Sharktooth Draw	aster Fian					
REACH :	Bellevue Pipeline Stabilization						
JURISDICTION :	City of Greeley						
REACH ID:	City of Greeley SKD Conceptual Design Enter Estimator Name on Project Infd DATE : 6/6/2019						
REACTION .	Sito Conceptual Design		e en riejea na	g DATE.			
DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST		
Channel Improvements							
2-inch Riprap, Type M		50	C.Y.	\$80.00	\$4,000.00		
Special Items (User Defined)							
	<user defined="" items<="" td=""><td>1000</td><td>S.F.</td><td>\$55.00</td><td>\$55,000.00</td></user>	1000	S.F.	\$55.00	\$55,000.00		
shoernang	Contractions	1000	0.1.	400.00	400,000.00		
	Master Plan Capital Imp	rovement Cost Su	man				
Capital Improvement Costs	master Flan Capitar Imp	novement cost su	initary				
Pipe Culverts and Storm Drains					\$0.00		
Concrete Box Culverts					\$0.00		
lydraulic Structures					\$0.00		
Channel Improvements					\$4,000.00		
Detention/Water Quality Facilities					\$0.00		
Removals					\$0.00		
andscaping and Mainten ance Improvements					\$0.00		
Special Items (User Defined)					\$55,000.00		
Subtotal Capital Improvement Costs					\$59,000.00		
Additional Capital Improvement Co	sts						
Dewatering		\$5,000.00	L.S.		\$5,000.00		
Nobilization		5%			\$2,950.00		
raffic Control		\$5,000.00	L.S.		\$5,000.00		
Jtility Coordination/Relocation		\$5,000.00	L.S.		\$5,000.00		
Stormwater Management/Erosion Control		5%			\$2,950.00		
Subtotal Additional Capital Improvement Co	sts				\$20,900.00		
Land Acquisition Costs							
ROW/Easements					\$0.00		
Subtotal Land Acquisition Costs					\$0.00		
Other Costs (percentage of Capital	Improvement Costs)		-				
Engineering		15%			\$11,985.00		
.egal/Administrative		5%			\$3,995.00		
Contract Admin/Construction Management		10%			\$7,990.00		
Contingency		25%			\$19,975.00		
Subtotal Other Costs					\$43,945.00		
Total Capital Improvement Cost	s				\$123,845.00		
Master	Plan Operation and Mainten	ance Cost Summar	v				
Description		Quantity	Unit	Unit Cost	Total Annual Co		
fydraulic Structure Mainten an ce (e.g. debris re	moval, erosion, structural repairs, etc.)	1	EA	\$670.00	\$670.00		
Fotal Annual Operation and Mai					\$670.00		
			100 C				
ffective Interest Rate					2.00%		





## 7.2.5.4 SHARKTOOTH DRAW – COUNTY ROAD 62

As part of the alternatives review process, the Central Colorado Water Conservancy District (CCWCD), the owners of Siebring Reservoir, were engaged to discuss the possibility of discharging stormwater into the reservoir. After discussions with CCWCD, concerns regarding costs to manage the system and water rights of any stormwater discharged in the reservoir determined that the outfall as proposed in one of the alternatives was not feasible. The alternate alignment proposed, channel downstream of County Road 62 parallel to 95th Avenue, was also determined to be infeasible due to the recent development of a gas extraction site spanning west from 95th Avenue.

A supplemental alternative analysis developed four additional alternatives. After discussion with City staff, the chosen improvements were Alternative C from the analysis memorandum. Alternative C is comprised of an 88 Ac-ft. regional detention basin to manage existing runoff to the area; a drainage channel paralleling 95<sup>th</sup> Avenue; and a 38 inch by 60 inch horizontal elliptical reinforced concrete pipe (HERCP) storm drain system in 95<sup>th</sup> Avenue, downstream of County Road 62 to the Cache La Poudre River.

The proposed detention facility, located east of 95th Avenue, intercepts Sharktooth Draw as the drainageway exits the bluffs. Approximately 88 Ac-ft. of storage is provided to detain the 100-year existing conditions discharge of 1,063 cfs and release a maximum flow rate of 230 cfs. Downstream of the detention facility, flow will be conveyed in a drainage channel with a top width of 30 ft. parallel to 95<sup>th</sup> Avenue north to the intersection with County Road 62. A storm drain system is proposed to intercept flow at the County Road 62 intersect and convey runoff north approximately 1,660 ft. to the Cache La Poudre River. The storm drain system is designed to convey 75 cfs, the 100-year future conditions discharge. Limited ground cover north of County Road 62 requires a 38 inch tall by 60 inch wide horizontal elliptical reinforced concrete pipe (HERCP) to convey the flow. In the interim condition, before development occurs upstream which will detain flows leaving each development to historic 5-year flow rates, overtopping of County Road 62 will occur but be limited to six inches or less in depth. Flows overtopping the roadway will continue along the existing flow path north to the Cache La Poudre River.

The proposed detention basin layout for the conceptual design is such that it does not exceed the requirements of a jurisdictional dam in the State of Colorado. However, given the changing dam safety requirements, it is still recommended that the City consult the State for current guidance prior to purchasing land or designing the detention facility.

Similar to other improvements mentioned, the pond has been sized for existing conditions discharges to reduce overtopping at 95<sup>th</sup> Avenue and County Road 62 to meet City Criteria, as if no changes in hydrology occur upstream. Prior to implementation, the pond site should be reevaluated to determine if upstream development has reduced flows and volume into the pond. The downstream channel and pipe system at 95<sup>th</sup> Avenue and County Road 62 has been sized for future discharges as if all proposed development is in place. At this point in time, the pond may be significantly reduced, or not needed altogether. This scenario would be indicative of Alternative D, as presented in the supplemental alternatives analysis found in <u>Appendix A</u>. Regardless of the proposed detention facility, all developments in the Sharktooth Daw Basin are proposed to adhere to current City of Greeley detention standards, detaining to the 5-yr historic discharge.

The detention basin as proposed will provide a multi-objective function for the local natural area in Sharktooth Draw, providing flood management, but also improving the ecological function, wildlife habitat, and public access within the site. Future trails currently proposed along Sharktooth could be incorporated into the facility located through the bottom and along the top of the facility. The detention facility area would also help promote wildlife through preservation of native vegetation and habitat areas, as well as be designed to provide regional water quality benefits. Natural hydrologic function could continue to exit by conveying bankfull, base, flows undetained through the pond area, up to the capacity of the proposed downstream infrastructure and acceptable roadway overtopping. Pond landscaping could include seeding with drought-tolerant native seed mixes, infrequent or no-mow areas. Any needed mowing practices could occur outside of ground-nesting bird seasons in the spring.

The improvements also consist of the removal of the existing storm culvert crossing at County Road 62, installation of headwall and wingwalls on the upstream and downstream side of pond culvert outlet, and the installation of riprap stilling basin for outlet protection. Several drop structures are proposed along the proposed alignment in the detention basin to ensure the long-term stability of the stream system.

The proposed improvement requires purchase of approximately 23 acres of land for the detention pond and drainage channel. It is assumed that the 38" x 60" HERCP will be installed within City right-of-way. Utilities along the proposed improvements are unknown, but conflicts with the gas extraction site should be anticipated. Adjustment of the William R. Jones Ditch will be required in addition to the headgate structure located just east of 95<sup>th</sup> Avenue. Upstream of the detention pond, three Bellevue pipelines should be located prior to final design in order to ensure that the water mains will not be impacted.

CLICK HERE TO VIEW SHARKTOOTH DRAW OVERVIEW

CLICK HERE TO VIEW SHARKTOOTH DRAW DETENTION BASIN DETAIL





## Table 7-6: Sharktooth Draw - County Road 62

M	ASTER PLAN C	OST ESTIMA	TE FOR INDIVI	DUAL RE	ACH		
PROJECT :	Sharktooth Bluffs	Storm Drainage Mast	er Plan				
DRAINAGEWAY :	Sharktooth Draw County Road 62						
REACH :							
JURISDICTION :	City of Greeley						
REACH ID:	SKD Conceptual D	Design	Enter Estimator Nam	e on Project Inf	DATE :	6/6/2019	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL	
Pipe Culverts and Storm Drain	าร						
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
48-inch	190	1	190	L.F.	\$193.00	\$36,670.00	
48-inch	1660	1	1660	L.F.	\$193.00	\$320,380.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
48-inch	Yes	1	2	EA	\$2,760.00	\$5,520.00	
Manholes and Inlets							
vlanhole, 6' Dia. (Pipe Dia. = 48")			4	EA	\$5,762.00	\$23,048.00	
Hydraulic Structures							
Sloping Drop Structures							
Height (ft)	Bottom Width (ft)	Yn (ft)					
4	10	0.5	2	EA	\$25,595.02	\$51,190.00	
1.5	10	0.5	2	EA	\$21,393.82	\$42,788.00	
4	10	0.5	2	EA	\$25,595.02	\$51,190.00	
Channel Improvements							
12-inch Riprap, Type M			300	C.Y.	\$80.00	\$24,000.00	
Excavation, Low Range			8000	C.Y.	\$15.00	\$120,000.00	
Detention/Water Quality Facilit	ties						
Detention (User Entered Quantitie							
Excavation, Low Range			175200	C.Y.	\$15.00	\$2,628,000.00	
Removals			110200			41,010,000.00	
Removal of culvert pipe (D<48")	1		100	L.F.	\$27.00	\$2,700.00	
			100	L.F.	\$27.00	\$2,700.00	
Landscaping and Maintenance	mprovements						
Vetlands Plantings	4		1	ACRE	\$33,500.00	\$33,500.00	
Reclamation & seeding (native grasses)			23	ACRE	\$1,340.00	\$30,820.00	
Trail/Path, Crusher Fines (10' Width)			5500	L.F.	\$15.00	\$82,500.00	
Special Items (User Defined)							
Excavation Haul Pond	<user defined="" item<="" td=""><td></td><td>156000</td><td>CY</td><td>\$12.00</td><td>\$1,872,000.00</td></user>		156000	CY	\$12.00	\$1,872,000.00	
Asphalt	<user defined="" item<="" td=""><td></td><td>1334</td><td>TON</td><td>\$250.00</td><td>\$333,500.00</td></user>		1334	TON	\$250.00	\$333,500.00	
Pond Park Improvements	<user defined="" item<="" td=""><td>-</td><td>1</td><td>LS</td><td>\$500,000.00</td><td>\$500,000.00</td></user>	-	1	LS	\$500,000.00	\$500,000.00	
Spillway/Berm	<user defined="" item<="" td=""><td></td><td>1</td><td>LS</td><td>\$500,000.00</td><td>\$500,000.00</td></user>		1	LS	\$500,000.00	\$500,000.00	
andscape	<user defined="" item<="" td=""><td></td><td>1</td><td>LS</td><td>\$150,000.00</td><td>\$150,000.00</td></user>		1	LS	\$150,000.00	\$150,000.00	
Outfall Backflow Prevention	<user defined="" item<="" td=""><td>5</td><td>1</td><td>EA</td><td>\$25,000.00</td><td>\$25,000.00</td></user>	5	1	EA	\$25,000.00	\$25,000.00	
and Acquisition							
emporary Easements			3	EA	\$30,000.00	\$90,000.00	
Easement/ROW Acquisition			23.00	ACRE	\$88,000.00	\$2,024,000.00	

Master Plan Capital Improve	ment Cost Su	mmary		
Capital Improvement Costs				
Pipe Culverts and Storm Drains				\$385,618.00
Concrete Box Culverts				\$0.00
Hydraulic Structures				\$145,168.00
Channel Improvements				\$144,000.00
Detention/Water Quality Facilities				\$2,628,000.00
Removals				\$2,700.00
Landscaping and Mainten ance Improvements				\$146,820.00
Special Items (User Defined)				\$3,380,500.00
Subtotal Capital Improvement Costs				\$6,832,806.00
Additional Capital Improvement Costs				
Dewatering	\$35,000.00	L.S.		\$35,000.00
Mobilization	5%			\$341,640.00
Traffic Control	\$25,000.00	L.S.		\$25,000.00
Utility Coordination/Relocation	\$50,000.00	L.S.		\$50,000.00
Stormwater Management/Erosion Control	5%			\$341,640.00
Subtotal Additional Capital Improvement Costs				\$793,280.00
Land Acquisition Costs				
ROW/Easements				\$2,114,000.00
Subtotal Land Acquisition Costs				\$2,114,000.00
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			\$1,143,913.00
Legal/Administrative	5%			\$381,304.00
Contract Admin/Construction Management	10%			\$762,609.00
Contingency	25%			\$1,906,522.00
Subtotal Other Costs				\$4,194,348.00
Total Capital Improvement Costs				\$13,934,434.0
Master Plan Operation and Maintenance	Cost Summa			
	Quantity	y Unit	Unit Cost	Total Annual Cost
Description Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	1850	L.F.	\$1.00	\$1,850.00
	4	EA	\$67.00	\$1,850.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.) Hydraulic Structure Maintenance (e.g. debris removal, erosion, structural repairs, etc.)	4	EA	\$670.00	\$2680.00
Pydraulic Structure Maintenance (e.g. debris removal, erosion, structural repairs, etc.) Channel Maintenance (e.g. sediment & debris removal, erosion, tree & weed removal, etc.)	3000	L.F.	\$3.00	\$2,080.00
	18	ACRE	\$3.00	\$9,000.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal,				\$35,180.00 \$1,541.00
Mowing (e.g. channels, ponds, etc.) Trail Maintenance (e.g. structural repairs, crusher fines, etc.)	23 5500	ACRE L.F.	\$67.00 \$7.00	\$1,541.00 \$38,500.00
	0000	L.F.	÷/.00	
Total Annual Operation and Maintenance Cost				\$90,019.00
Effective Interest Rate				2.00%
Total Operation and Maintenance Costs Over 50 Years				\$2,828,722.00







The Poudre Learning Center watershed extends from the Cache La Poudre River south to 10th Street, between N 83rd Avenue to the east and N 95th Avenue to the west. Flow in the upper portion of the watershed primarily consists of sheet flow down into the bluffs. The stormwater runoff spreads from the confined flow in the bluffs into an alluvial fan south of County Road 62. Flow crosses the William R. Jones Ditch and County Road 62 into Siebring Reservoir. An outlet channel from the most eastern portion of Siebring Reservoir conveys flow east to 83rd Avenue before the outfall location into the Cache La Poudre River.

Future development near the Poudre Learning Center Basin is zoned to occur in the areas where potential flooding is shown in the models. For these future developments to be protected, careful consideration should be taken in site layout and future storm drainage infrastructure.

An out-building is potentially inundated from flooding, north of the Jones Ditch near the westernmost sump location. Even after improvements are made to the western spill flows in the Sharktooth Draw basin, this building may remain in a potential inundation area due to its proximity with the canal. No other buildings are identified to be inundated during the existing conditions 100-year event; however, it should be noted that an oil and gas well site does exist within the headwaters channel of the draw, near the future 4<sup>th</sup> Street alignment.

Discharges at the future 4<sup>th</sup> Street alignment remain less than 100-cfs at this location; therefore, improvement alternatives were not developed within the Poudre Learning Center watershed for the roadway system.

### 7.2.6.1 POUDRE LEARNING CENTER - COUNTY ROAD 62 (WEST) CROSSING

The westernmost crossing of the Poudre Learning Center is located approximately 3,000 ft. east of 95<sup>th</sup> Avenue. The crossing proposes to convey 692 cfs during the 100-year design storm through dual 10 ft. wide by 4 ft. high RCBCs. Approximately 40cfs will overtop the roadway during the existing conditions, at a depth less than 6 inches. The culvert is proposed to be installed in a sump condition discharging towards the quarry area located in the center of the western flow path.

The roadway crossing was conceptually designed with minimal ground cover over the top of the crossing. The improvement requires installation of headwalls and wingwalls, at a minimum, on the upstream and downstream side of the RCBC culvert. Riprap will be required for outlet protection on the downstream end. During final design, the culvert height and width may need to be adjusted to accommodate the proposed roadway design section. Slight changes in geometry would be expected with more design information.

No known water or sanitary conflicts are anticipated at this location. Location of dry utilities are unknown and should be investigated prior to final design. Minor channel improvements to the drainageway will be required upstream and downstream of the crossing in order to promote drainage.

The culvert was sized for the existing conditions land use scenario. Prior to final design and construction, any development that has occurred upstream of the roadway crossing should be considered to update the design discharge.

### Table 7-7: Poudre Learning Center – County Road 62 (West) Crossing

MA	STER PLAN C	OST ESTIMAT	E FOR INDIVI	DUAL REA	СН	
PROJECT :	Sharktooth Bluffs	Storm Drainage Maste	r Plan			
DRAINAGEWAY :	Poudre Learning					
REACH :	County Road 62 (	West) Crossing				
JURISDICTION :	City of Greeley		Enter Estimates blow	Deale at left		100010010
REACH ID:	SKD Conceputal D	Jesign	Enter Estimator Name	e on Project Inito	DATE :	12/21/2018
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Concrete Box Culverts						
Box Culvert Pipe						
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)			
10 Headwall and Toewalls	4	2	100	L.F.	\$1,940.94	\$194,094.00
Individual Box Span (ft)	No. of Barrels	Total Span (ft)	1 1			
10	2	23.00	2	EA	\$2,220.42	\$4,441.00
Wingwalls (includes wingwalls on e		and concrete apron)				
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels				
10	4	2	2	EA.	\$11,842.43	\$23,684.90
Channel Improvements						
Excavation, Mid Range			630	C.Y.	\$32.00	\$20,160.00
12-inch Riprap, Type M			50	C.Y.	\$80.00	\$4,000.00
Landscaping and Maintenance I	mprovements					
Reclamation & seeding (native grasses)			1 50	ACRE L.F.	\$1,340.00 \$59.00	\$1,340.00
Trail/Path, Concrete (10' Width)			50	L.F.	\$59.00	\$2,950.00
Special Items (User Defined)	<user defined="" item<="" td=""><td></td><td>18</td><td>TON</td><td>\$250.00</td><td>\$4,500.00</td></user>		18	TON	\$250.00	\$4,500.00
Asphalt	<user denned="" item<="" td=""><td>15</td><td>10</td><td>TON</td><td>\$250.00</td><td>\$4,000.00</td></user>	15	10	TON	\$250.00	\$4,000.00
	Master Pla	an Capital Improv	vement Cost Sur	nmany		
Capital Improvement Costs	Waster Fla	an Capitar improv	venieni Cosi Sui	innary		
Pipe Culverts and Storm Drains						\$0.00
Concrete Box Culverts						\$222,220.00
Hydraulic Structures						\$0.00
Channel Improvements						\$24,160.00
Detention/Water Quality Facilities						\$0.00
Removals Landscaping and Mainten ance Improvements						\$0.00
Special Items (User Defined)						\$4,500.00
Subtotal Capital Improvement Costs						\$255,170.00
Additional Capital Improvement Cos	sts					
Dewatering			\$5,000.00	L.S.		\$5,000.00
Mobilization			5%			\$12,759.00
Traffic Control Jtility Coordination/Relocation			\$12,758.50 \$12,758.50	L.S.		\$12,759.00 \$12,759.00
Stormwater Management/Erosion Control			\$12,750.50	L.3.		\$12,759.00
Subtotal Additional Capital Improvement Cos	sts					\$56,036.00
Land Acquisition Costs						
ROW/Easements						\$0.00
Subtotal Land Acquisition Costs	10.11					\$0.00
Other Costs (percentage of Capital I Engineering	mprovement Costs)		15%			\$46,681.00
_ngineening _egal/Administrative			5%			\$15,560.00
Contract Admin/Construction Management			10%			\$31,121.00
Contingency			25%			\$77,802.00
Subtotal Other Costs						\$171,164.00
Total Capital Improvement Cost	S					\$482,370.00
Master	Plan Operation	and Maintenand	ce Cost Summar	v		
Description			Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris rer		nce/exit, structural repain	s 100	L.F.	\$1.00	\$100.00
Total Annual Operation and Main	ntenance Cost					\$100.00
Effective Interest Rate						2.00%
Total Operation and Maintenanc	e Costs Over 5	0 Years				\$3,142.00





## 7.2.6.2 POUDRE LEARNING CENTER - COUNTY ROAD 62 (CENTRAL) CROSSING

The County Road 62 (East) crossing is located approximately 2,300 ft. west of North 83<sup>rd</sup> Avenue. A 36 inch RCP culvert is proposed to provide adequate conveyance underneath the roadway and Poudre River trail for the localized sump. The proposed culvert will discharge into the swale in the Poudre Learning Center property.

The improvement requires installation of a flared end section on the upstream and downstream side of the culvert. Riprap will be required for outlet protection on the downstream end. Sizing should be reevaluated during final design considering the upstream inflows tributary to the crossing and downstream channel capacity.

No known water or sanitary conflicts are anticipated at this location. Location of dry utilities are unknown and should be investigated prior to final design. Minor channel improvements to the drainageway will be required upstream and downstream of the crossing in order to promote drainage.

The culvert was sized for the existing conditions land use scenario. Prior to final design and construction, any development that has occurred upstream of the roadway crossing should be considered to update the design discharge.

PROJECT :	Sharktooth Bluffs Storm Drainage Master Plan						
DRAINAGEWAY :	Poudre Learning						
REACH :	County Road 62 (						
JURISDICTION :	City of Greeley						
REACH ID:	SKD Conceptual I	SKD Conceptual Design Enter Estimator Name on Project Info DATE : 12/21/2018					
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels	50		A445.00	A7 050 00	
36-inch Flare End Sections	50	1	50	L.F.	\$145.00	\$7,250.00	
Diameter (in)	Applicable	No. of Barrels	1	-	1		
36-inch	Yes	1 1 1	2	EA	\$2,157.00	\$4,314.00	
Channel Improvements	100		-	Cr.	44,101.000	41,011.00	
Excavation, Mid Range			133	CY	\$32.00	\$4,256.00	
2-inch Riprap, Type M			7	CY	\$80.00	\$560.00	
Landscaping and Maintenance	mprovemente			0.1.	00000	4000.00	
Reclamation & seeding (native grasses)	inprovements		1	ACRE	\$1,340.00	\$1,340.00	
				ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined)				2011	4484.44	A 1 000 00	
Asphalt	<user defined="" item<="" th=""><th>15</th><th>16</th><th>TON</th><th>\$250.00</th><th>\$4,000.00</th></user>	15	16	TON	\$250.00	\$4,000.00	
	Master Pla	n Capital Impro	vement Cost Su	mmarv			
Capital Improvement Costs	muotorrit	in ouplianinpro		, and the second s			
pe Culverts and Storm Drains							
						\$11,564.00	
						\$11,564.00 \$0.00	
Concrete Box Culverts							
Concrete Box Culverts Hydraulic Structures Channel Improvements						\$0.00 \$0.00 \$4,816.00	
Concrete Box Culverts Hydraulic Structures Channel Improvements Detention/Water Quality Facilities						\$0.00 \$0.00 \$4,816.00 \$0.00	
Concrete Box Culverts Hydraulic Structures Channel Improvements Detention/Water Quality Facilities Removals						\$0.00 \$0.00 \$4,816.00 \$0.00 \$0.00	
Concrete Box Culverts Hydraulic Structures Dannel Improvements Detention/Water Quality Facilities Removals andscaping and Maintenance Improvements						\$0.00 \$0.00 \$4,816.00 \$0.00 \$0.00 \$1,340.00	
Concrete Box Culverts dydraulic Structures Thomel Improvements Detention/Water Quality Facilities Removals Landscaping and Maintenance Improvements Special Items (User Defined)						\$0.00 \$0.00 \$4,816.00 \$0.00 \$0.00 \$1,340.00 \$4,000.00	
Concrete Box Culverts fydraulic Structures Channel Improvements Detention/Water Quality Facilities Removals Removals andscaping and Maintenance Improvements Spocial Items (User Defined) Stubtotal Capital Improvement Costs						\$0.00 \$0.00 \$4,816.00 \$0.00 \$0.00 \$1,340.00	
Concrete Box Culverts Hydraulic Structures Channel Improvements Removals andscaping and Mantenance Improvements Special Items (User Defined) Subtetal Capital Improvement Costs Additional Capital Improvement Co	sts		45.000.00	1.5		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$4,000.00 \$4,000.00 \$21,720.00	
Concrete Box Culverts  dydraulic Structures  channel Improvements Detention/Water Quality Facilities  Removals andScaping and Maintenance Improvements  special Items (User Defined)  Subtota Capital Improvement Costs  Additional Cepital Improvement Co Dewatering	sts		\$5,000.00	L.S.		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$4.000.00 \$21,720.00 \$5.000.00	
Concrete Box Culverts Hydraulic Structures Channel Improvements Detention/Water Quality Facilities wernovals andscaping and Mantenance Improvements Special Terms (User Dvfmed) Subtota Capital Improvement Cots Additional Gapital Improvement Co Dewatering Additional	sts		5%			\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$4.000 \$4.000 \$4.0000 \$21,720.00 \$5.000.00 \$1.086.00	
Concrete Box Quiverts 4ydraulic Structures 4ydraulic Structures Detention/Water Quality Facilities Removals Removals and Scaping and Mainten ance Improvements Special Itoms (User Defined) Subtetal Capital Improvement Costs Additional Capital Improvement Co Dewatering Mobilization Traffic Control	sts			LS. LS.		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$4.000.00 \$21,720.00 \$5.000.00	
Concrete Box Culverts  dydraulic Structures  channel Improvements Detention/Water Quality Facilities  Permovals  andscaping and Maintenance Improvements  special Items (User Defined)  Subtota Capital Improvement Costs  Additional Cepital Improvement Co Dewatering  dobilization  Fraffic Control  Ibity Coordination/Relocation	sts		5% \$5,000.00	L.S.		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$4,000.00 \$4,000.00 \$21,720.00 \$5,000.00 \$1,086.00 \$5,000.00	
Concrete Box Culverts Hydraulic Structures Channel Improvements Detention/Water Quality Facilities Removals andscaping and Maintenance Improvements Subtot Capitel Improvement Costs Additional Genital Improvement Costs Additional Genital Improvement Costs Additional Genital Improvement Costs Costration Traffic Control Jality Coordination/Relocation Storwater Management/Erosion Control			5% \$5,000.00 \$5,000.00	L.S.		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$4.000.00 \$4.000.00 \$21,720.00 \$5,000.00 \$5,000.00 \$5,000.00	
Concrete Box Culverts hydraulic Structures hydraulic Structures Channel Improvements Detention/Water Quality Facilities Removals andscaping and Maintenance Improvements Special Items (User Defined) Subtotal Capital Improvement Costs Additional Gapital Improvement Co Dewatering Mobilization Iraffic Control Diffy Coordination/Relocation Stormwater Management/Erosion Control Bubtotal Additional Capital Improvement Co Land Acquisition Costs			5% \$5,000.00 \$5,000.00	L.S.		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$4,000.00 \$21,720.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$1.086.00 \$1,086.00 \$1,086.00 \$1,086.00	
Concrete Box Culverts +ydraulic Structures Channel Improvements Detention/Water Quality Facilities Removals andscaping and Maintenance Improvements Special Items (User Defined) Subtotal Capital Improvement Costs Additional Gepital Improvement Co Devetering Mobilization Fraffic Control Jitity Coordination/Relocation Stortwater Management/Erosion Control Subtotal Additional Capital Improvement Co Land Acquisition Costs ROW/E asements			5% \$5,000.00 \$5,000.00	L.S.		\$0.00 \$0.00 \$4,816.00 \$0.00 \$1.340.00 \$4,000.00 \$21,720.00 \$5,000.00 \$5,000.00 \$5,000.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00	
Concrete Box Quiverts +ydraulic Structures -tydraulic Structures -thonnel Improvements Removals Removals andscaping and Maintenance Improvements Special Items (User Defined) Subtetal Capital Improvement Costs Additional Capital Improvement Co Jeweteng Mobilization Traffic Control Julity Coordinaton/Relocation Stortwater Management/Erosion Control Subtetal Additional Capital Improvement Co Land Acquisition Costs Subtetal Additional Capital Improvement Co Subtetal Additional Capital Improvement Co Land Acquisition Costs Subtetal Additional Capital Improvement Co Land Acquisition Costs	sts		5% \$5,000.00 \$5,000.00	L.S.		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$4,000.00 \$21,720.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$1.086.00 \$1,086.00 \$1,086.00 \$1,086.00	
Concrete Box Culverts 4ydraulic Structures 4ydraulic Structures 5utention/Water Quality Facilities exemovals and/scaping and Mantenance Improvements peocal fems (User Dvfmed) Subtota Capital Improvement Cos Additional Capital Improvement Co Dewatering Additional Capital Improvement Subtota Additional Capital Improvement Co Land Acquisition Costs Other Costs (percentage of Capital	sts		5% \$5,000.00 \$5,000.00 5%	L.S.		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$4.000.00 \$21,720.00 \$5.000.00 \$5.000.00 \$5.000.00 \$5.000.00 \$1.086.00 \$1.080.00	
Concrete Box Culverts  dydraulic Structures  Channel Improvements  eternton/Water Quality Facilities  ternovals  andscaping and Maintenance Improvements  pecial Items (User Defined)  Subtots Capital Improvement Costs  Additional Capital Improvement Co  Dewatering  doblization  raffic Control  Subtotal Additional Capital Improvement Co  Land Acquisition Costs  Subtotal Land Acquisition Costs  Other Costs (percentage of Capital  ragineering	sts		5% \$5,000.00 \$5,000.00 5%	L.S.		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$4.000.00 \$21,720.00 \$5.000.00 \$1.086.00	
Concrete Box Quiverts  dydraulic Structures  Teannel Improvements  termovals andscaping and Maintenance Improvements  pocial Items (User Defined)  Subtotal Capital Improvement Costs  Additional Capital Improvement Co  Jeweteng  Adoblization Traffic Control  Jibly Coordination/Relocation  Jistotal Additional Capital Improvement Co Land Acquisition Costs  QOWLeasements  Other Costs (percentage of Capital I  progening  gaal/Admistrative	sts		5% \$5,000.00 \$5,000.00 5% 15% 5%	L.S.		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$1.340.00 \$1.086.00 \$5.000.00 \$5.000.00 \$5.000.00 \$1.086.00 \$5.000.00 \$5.000.00 \$1.086.00 \$5.000.00 \$5.000.00 \$1.086.00 \$1.080.00 \$	
Concrete Box Culverts  dydraulic Structures  channel Improvements  betention/Water Quality Facilities  exemovals  andscaping and Mantenance Improvements  genovals  andscaping and Mantenance Improvements  genovals  andscaping and Mantenance Improvements  dubtata Capital Improvement Costs  Additional Capital Improvement Cost  Land Acquisition Costs  Cotticas Additional Capital Improvement  costs  Cotticas Costs  percentage  other Costs  percentage  office Costs  percentage  office Costs  percentage  office Costs  percentage  costract Admin/Construction Management	sts		5% \$\$,000.00 \$\$,000.00 5% 15% 5% 10%	L.S.		\$0.00 \$0.00 \$4,816.00 \$0.00 \$0.00 \$1,340.00 \$4,000.00 \$21,720.00 \$5,000.00 \$5,000.00 \$5,000.00 \$1,086.00 \$1,0	
Concrete Box Culverts  dydraulic Structures  hannel Improvements  termovals andscaping and Mantenance Improvements  termovals andscaping and Mantenance Improvements  Subtotal Capital Improvement Costs  Additional Cepital Improvement Co  Devetering  doblization  fraffic Control  Subtotal Additional Capital Improvements  Subtotal Additional Capital Improvement Co  Land Acquisition Costs  Subtotal Land Acquisition Costs  Subtotal Land Acquisition Costs  Other Costs (percentage of Capital  ingineering  egal/Administrative Contract Admin/Construction Management	sts		5% \$5,000.00 \$5,000.00 5% 15% 5%	L.S.		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$4.000.00 \$21,720.00 \$5.000.00 \$5.000.00 \$5.000.00 \$1.086.00 \$1.086.00 \$1.086.00 \$1.086.00 \$1.086.00 \$1.086.00 \$1.086.00 \$1.945.00 \$0.00 \$0.00 \$0.00 \$0.00 \$1.945.00 \$1.94	
Concrete Box Culverts (ydraulic Structures (honnel improvements termovals andscaping and Maintenance Improvements termovals andscaping and Maintenance Improvements bootstal Capital Improvement Costs Additional Capital Improvement Co leveratering Additional Capital Improvement Co Land Acquisition Costs Cubtotal Additional Capital Improvement Co Land Acquisition Costs Other Costs (percentage of Capital ingineering eqai/Administrative contract Admin/Construction Management contingency	sts Improvement Costs)		5% \$\$,000.00 \$\$,000.00 5% 15% 5% 10%	L.S.		\$0.00 \$0.00 \$1.340.00 \$1.340.00 \$1.340.00 \$1.340.00 \$1.340.00 \$1.080.00 \$1.080.00 \$1.080.00 \$1.080.00 \$1.080.00 \$1.080.00 \$1.080.00 \$1.080.00 \$1.080.00 \$1.389.00 \$1.345.00 \$1.3	
concrete Box Culverts ydraulic Structures hannel improvements vetention/Water Quality Facilities termovals andscaping and Mantenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Cepital Improvement Co wextering fobilization faffic Control fility Coordination/Relocation tormwater Management/Erosion Control Utototal Additional Capital Improvement Co Land Acquisition Costs Other Costs (percentage of Capital ingineering gai/Administrative contract Admin/Construction Management contogenet	sts Improvement Costs)		5% \$\$,000.00 \$\$,000.00 5% 15% 5% 10%	L.S.		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$1.340.00 \$1.086.00 \$5.000.00 \$1.086.00 \$5.000.00 \$1.086.00 \$5.000.00 \$1.086.00 \$5.000.00 \$1.086.00 \$5.000.00 \$1.086.00 \$1.080.00 \$1.086.00 \$1.080.00 \$1.086.00 \$1.080.00 \$	
concrete Box Culverts ydraulic Structures hannel improvements steention/Water Quality Facilities semovals andscaping and Mantenance Improvements pecial Items (User Detrind) uitetal Capital Improvement Costs Additional Capital Improvement Cost Used Capital Improvement Costs Additional Capital Improvement Cost Land Acquisition Costs Other Costs (percentage of Capital I ingineering egal/Administrative contract AdminiConstruction Management Costs Cother Costs	sts Improvement Costs)	and Maintenan	5% \$\$,000.00 \$\$,000.00 5% 15% 5% 10%	L.S.		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$1.340.00 \$1.086.00 \$5.000.00 \$1.086.00 \$5.000.00 \$1.086.00 \$5.000.00 \$1.086.00 \$5.000.00 \$1.086.00 \$5.000.00 \$1.086.00 \$1.080.00 \$1.086.00 \$1.080.00 \$1.086.00 \$1.080.00 \$	
concrete Box Culverts ydraulic Structures hannel improvements vetention/Water Quality Facilities smovals andscaping and Mantenance Improvements pocial items (User Defined) ubitotal Capital Improvement Costs Additional Capital Improvement Cost Additional Capital Improvement Cost intro Costs Control Inity Coordination/Relocation InterCosts Cother Costs Cother Costs Cother Costs Cotal Capital Improvement Costs Cot	sts Improvement Costs) is • Plan Operation		5% \$5,000.00 \$5,000.00 5% 15% 10% 25% 25%	L.S. L.S. Y Unit	Unit Cost	\$0.00 \$0.00 \$4.816.00 \$0.00 \$0.00 \$1.340.00 \$4.000.00 \$1.086.00 \$5.000.00 \$1.086.00 \$5.000.00 \$1.086.00 \$5.000.00 \$1.086.00 \$1.086.00 \$1.086.00 \$5.000.00 \$1.086.00 \$1.08	
Concrete Box Quiverts kydraulic Structures kydraulic Structures hannel improvements betention/Water Quality Facilities termovals andscaping and Mantenance Improvements pocial Items (User Defined) builtottal Capital Improvement Cots Additional Capital Improvement Cot Dewatering dobited additional Capital Improvement Co Land Acquisition Costs Cotted Education State Costs (percentage of Capital Ingineering egal/Administrative Contract Admin/Construction Management Contact Capital Improvement Cost Fotal Capital Improvement Cost Master Description	sts Improvement Costs) is • Plan Operation		5% \$5,000.00 \$5,000.00 5% 15% 10% 25% 25%	LS LS	Unit Cost \$1.00	\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$4.000.00 \$21,720.00 \$5.000.00 \$5.000.00 \$5.000.00 \$5.000.00 \$1.086.00 \$1.086.00 \$5.000.00 \$1.086.00	
Concrete Box Culverts kydraulic Structures kydraulic Structures hannel improvements betention/Water Quality Facilities termovals andscaping and Mantenance Improvements andscaping and Mantenance Improvements butotal Capital Improvement Costs Additional Capital Improvement Cost Land Acquisition Costs Cottre Costs (percentage of Capital inganeering egal/Administrative Contract Admin/Construction Management Costs Cottal Capital Improvement Costs Cottal Capital Cottal	sts Improvement Costs) Its Plan Operation moval, erosion at entrar		5% \$5,000.00 \$5,000.00 5% 15% 10% 25% 25%	L.S. L.S. Y Unit		\$0.00 \$0.00 \$4.816.00 \$0.00 \$1.340.00 \$1.340.00 \$1.340.00 \$1.086.00 \$5.000.00 \$5.000.00 \$1.086.00 \$5.000.00 \$1.086.00 \$	
Concrete Box Culverts  dydraulic Structures  channel Improvements  betention/Water Quality Facilities  termovals  andscaping and Maintenance Improvements  geolal Items (User Detrined)  subtotal Capital Improvement Costs  Additional Capital Improvement Cost  Control  Jatily Coordination/Relocation  tormwater ManagementErosion Control  Subtotal Additional Capital Improvement Cost  Control  Land Acquisition Costs  Other Costs (percentage of Capital I  rignieering  opartar. Administrative  Contract AdminiConstruction Management  Contract AdminiConstruction Management  Contract AdminiConstruction Management  Subtotal Other Costs  Contract AdminiConstruction Management  Contract Adminiconstruction Management  Contract Administrative  Contract	sts Improvement Costs) Its Plan Operation moval, erosion at entrar		5% \$5,000.00 \$5,000.00 5% 15% 10% 25% 25%	L.S. L.S. Y Unit		\$0.00 \$0.00 \$0.00 \$1,48,16.00 \$0.00 \$1,340.00 \$4,000.00 \$1,340.00 \$21,720.00 \$5,000.00 \$5,000.00 \$5,000.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,945.00 \$1,945.00 \$3,839.00 \$3,839.00 \$21,391.00 \$21,3	



### Table 7-8: Poudre Learning Center – County Road 62 (Central) Crossing



### 7.2.6.3 POUDRE LEARNING CENTER - COUNTY ROAD 62 (EAST) CROSSING

The easternmost crossing of County Road 62 is located approximately 150 ft. west of North 83<sup>rd</sup> Avenue. The 100year design discharge at the crossing is 251 cfs during the existing conditions 100-year event. A 6 ft. wide by 4 ft. tall RCBC is proposed to convey 194 cfs, with 57 cfs overtopping at a depth less than 6 inches. The culvert will replace the existing 24" CMP and discharge west of 83<sup>rd</sup> Avenue on the Poudre Learning Center property. Downstream of the culvert, channel grading is proposed to convey the flow to the main stem of Poudre Learning Center just west of 83<sup>rd</sup> Avenue.

The roadway crossing was conceptually designed with minimal ground cover over the top of the crossing. The improvement requires installation of headwalls and wingwalls, at a minimum, on the upstream and downstream side of the RCBC culvert. Riprap will be required for outlet protection on the downstream end. During final design, the culvert height and width may need to be adjusted to accommodate the proposed roadway design section. Slight changes in geometry would be expected with more design information.

No known water or sanitary conflicts are anticipated at this location. Location of dry utilities are unknown and should be investigated prior to final design. Minor channel improvements to the drainageway will be required upstream and downstream of the crossing in order to promote drainage.

The culvert was sized for the existing conditions land use scenario. Prior to final design and construction, any development that has occurred upstream of the roadway crossing should be considered to update the design discharge.

### Table 7-9 Poudre Learning Center – County Road 62 (East) Crossing

		OST ESTIMAT						
PROJECT : DRAINAGEWAY :		Sharktooth Bluffs Storm Drainage Master Plan Poudre Learning Center						
REACH :	County Road 62 (E							
JURISDICTION :	City of Greeley	Losy or owning						
REACH ID:	SKD Conceptual E	Design	Enter Estimator Nam	e on Project Inf	DATE:	12/21/2018		
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST		
Concrete Box Culverts								
Box Culvert Pipe Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)					
12	5	1	100	L.F.	\$1,239.66	\$123,966.00		
Headwall and Toewalls								
Individual Box Span (ft)	No. of Barrels	Total Span (ft)						
12	1	14.00	2	EA	\$1,343.16	\$2,686.00		
Wingwalls (includes wingwalls on Individual Box Span (ft)	either side of channel Box Rise (ft)	and concrete apron) No. of Barrels						
12-	Box Rise (π)	No. of Barrels	2	EA	\$12,577.01	\$25,154.00		
Channel Improvements	2		4	EA.	#12,017.01	420,104.00		
Excavation, Mid Range			670	C.Y.	\$32.00	\$21,440.00		
2-inch Riprap, Type M	1		18	C.Y.	\$32.00	\$1,440.00		
xcavation, Mid Range	1		2300	C.Y.	\$32.00	\$73,600.00		
2-inch Riprap, Type M			16	C.Y.	\$80.00	\$1,280.00		
Removals								
temoval of culvert pipe (D<48")			50	L.F.	\$27.00	\$1,350.00		
andscaping and Maintenance	Improvements							
Vetlands Plantings			2	ACRE	\$33,500.00	\$67,000.00		
eclamation & seeding (native grasses)	]		1	ACRE	\$1,340.00	\$1,340.00		
rail/Path, Concrete (10' Width)			50	L.F.	\$59.00	\$2,950.00		
Special Items (User Defined)								
sphalt	<user defined="" item<="" td=""><td>8</td><td>33</td><td>TON</td><td>\$250.00</td><td>\$8,250.00</td></user>	8	33	TON	\$250.00	\$8,250.00		
					\$200.00	40,200.00		
asement/ROW Acquisition	Master Pla	n Capital Improv	1.10 vement Cost Su	ACRE	\$88,000.00	\$96,800.00		
asement/ROW Acquisition Capital Improvement Costs (pe Culverts and Storm Drains	Master Pla	n Capital Improv		ACRE		\$96,800.00 \$0.00		
asement/ROW Acquisition Capital Improvement Costs "pe Culverts and Storm Drains concrete Box Culverts	Master Pla	n Capital Improv		ACRE		\$96,800.00 \$0.00 \$151,806.00		
Pipe Culverts and Storm Drains Concrete Box Culverts Hydraulic Structures	Master Pla	<mark>n Capital Improv</mark>		ACRE		\$96,800.00 \$0.00 \$151,806.00 \$0.00		
asement/ROW Acquisition Capital Improvement Costs (pe Culvets and Storm Drains cnorete Box Culvets channel Improvements channel Improvements	Master Pla	an Capital Improv		ACRE		\$96,800.00 \$0.00 \$151,806.00		
Capital Improvement Costs Capital Improvement Costs Spe Culverts and Storm Drains Concrete Box Culverts Vydraulic Structures Teannel Improvements Detention/Water Quality Facilities	Master Pla	ın Capital Improv		ACRE		\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$97,760.00 \$0.00 \$1,350.00		
asement/ROW Acquisition Capital Improvement Costs tipe Culverts and Storm Drains Concrete Box Culverts Mydraulic Structures hannel Improvements Hetention/Water Quality Facilities termovals andscaping and Maintenance Improvements	Master Pla	ın Capital Improv		ACRE		\$96,800.00 \$0.00 \$151,806.00 \$9.00 \$97,760.00 \$1,350.00 \$1,350.00		
Capital Improvement Costs Capital Improvement Costs inco curke and Storm Drains Overale Docularies Indered Extructures Anamel Improvements Vetention/Water Quality Facilities termovals andiscaping and Mainten ance Improvements pecial Items (User Defined)	Master Pla	un Capital Improv		ACRE		\$96,800,00 \$0,00 \$151,806,00 \$0,00 \$97,760,00 \$0,00 \$1,350,00 \$1,350,00 \$1,350,00 \$8,250,00		
Capital Improvement Costs Capital Improvement Costs Concrete Box Culverts Channel Improvements Channel Improvements Setention/Water Quality Facilities removads andscaping and Maintenance Improvements special Items (User Defined) Subtatal Capital Improvement Costs		an Capital Improv		ACRE		\$96,800.00 \$0.00 \$151,806.00 \$9.00 \$97,760.00 \$1,350.00 \$1,350.00		
asement/ROW Acquisition Capital Improvement Costs ipe Culverts and Storm Drains Concrete Box Culverts ydraulic Structures channel Improvements Stennich/Water Quality Facilities termovals andscaping and Maintenance Improvements pecial Items (User Defined) subtotal Capital Improvement Costs Additional Capital Improvement Costs		ın Capital Improv	vement Cost Su	ACRE		\$96,800.00 \$10,00 \$151,806.00 \$97,760.00 \$97,760.00 \$1,380.00 \$1,380.00 \$1,280.00 \$330,466.00		
Capital Improvement Costs ipe Curverts and Storm Drains concrete Box Curverts lydraulic Structures hannel improvements etention/Water Quality Facilities removals andscepting and Mainten ance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Co watoring		ın Capital Improv	rement Cost Sur \$5,000.00 5%	ACRE mmary		\$96,800,00 \$0,00 \$151,806,00 \$0,00 \$7,760,00 \$1,350,00 \$7,290,00 \$330,465,00 \$330,465,00 \$15,523,00		
asement/ROW Acquisition Capital Improvement Costs (pe Culverts and Storm Drains oncrete Box Culverts ydraulic Structures hannel improvements vetention/Water Quality Facilities emovals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Co sewatering Itobilization Taffic Control		n Capital Improv	*ement Cost Sui \$5,000.00 5% \$16,522.80	ACRE mmary		\$96,800.00 \$151,806.00 \$0.00 \$0.00 \$0.00 \$1,350.00 \$71,290.00 \$82,250.00 \$330,466.00 \$5,000.00 \$16,523.00		
Capital Improvement Costs ipe Quiverts and Storm Drains oncrete Box Quiverts ydraulic Structures hannel Improvements etention/Water Quality Facilities emovals andscaping and Maintenance Improvements pecial Items (Quer Defined) ubtotal Capital Improvement Costs Additional Cepital Improvement Co watoring totalization raffic Control bity Coordination/Relocation		an Capital Improv	rement Cost Sur \$5,000.00 5%	ACRE mmary		\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$7,760.00 \$7,780.00 \$7,290.00 \$330,456.00 \$5,000.00 \$16,523.00 \$16,523.00		
Capital Improvement Costs (pe Quiverts and Storm Drains ion crete Box Quiverts bannel Improvements etention/Water Quality Facilities errowds andscaping and Maintenance Improvements pecial Items (User Defined) <b>ubtotal Capital Improvement Costs</b> Additional Capital Improvement Cost isovatoring boblization raffii: Control Itility Coordination/Relocation Comwater Management/Erosion Control	sts	ın Capital Improv	*ement Cost Sui \$5,000.00 5% \$16,522.80	ACRE mmary		\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$0.00 \$1,350.00 \$1,350.00 \$30,466.00 \$30,466.00 \$16,523.00 \$16,523.00		
asement/ROW Acquisition Capital Improvement Costs ipe Curverts and Storm Drains concrete Box Curverts ydraulic Structures hannel Improvements vention/Ware Quality Facilities emovals andscaping and Mainten an ce Improvements pecial Items (User Defined) ubtotal Additional Capital Improvement Co textoring Additional Capital Improvement Co textoring tormwater Management/Erosion Control ubtotal Additional Capital Improvement Co textorial	sts	n Capital Improv	*ement Cost Sui \$5,000.00 5% \$16,522.80	ACRE mmary		\$96,800.00 \$151,806.00 \$0.00 \$97,760.00 \$7,780.00 \$7,720.00 \$7,290.00 \$330,466.00 \$15,523.00 \$16,523.00 \$16,523.00		
Capital Improvement Costs Capital Improvement Costs Capital Improvement Costs Concrete Box Culverts Oversis Concrete Box Culverts Oversis Concrete Box Culverts Oversis Concrete Box Culverts Oversis Concrete Con	sts	ın Capital Improv	*ement Cost Sui \$5,000.00 5% \$16,522.80	ACRE mmary		\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$7,760.00 \$1,360.00 \$7,7290.00 \$8,250.00 \$330,466.00 \$10,523.00 \$16,523.00		
Capital Improvement Costs ipe Culverts and Storm Drains concrete Box Culverts ydraulic Structures hannel improvements etention/Water Quality Facilities eremovals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Co towatoring tobolization raffic Control tablet Additional Capital Improvement Co tubtotal Additional Capital Improvement Co ubtotal Additional Capital Improvement Co tubtotal Additional Capital Improvement Co Land Acquisition Costs Udvitotal Additional Capital Improvement Co Land Acquisition Costs	osta osta	an Capital Improv	*ement Cost Sui \$5,000.00 5% \$16,522.80	ACRE mmary		\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$7,760.00 \$0.00 \$1,350.00 \$1,350.00 \$1,350.00 \$1,250.00 \$16,523.00 \$16,523.00 \$16,523.00 \$16,523.00 \$16,523.00		
Capital Improvement Costs Capital Improvement Costs Capital Acquisition Capital Expression Concrete Box Culverts Overssion Concrete Conc	osta osta	an Capital Improv	\$5,000.00 5% \$16,522.80 5%	ACRE mmary		\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$7,760.00 \$7,760.00 \$7,290.00 \$7,290.00 \$330,456.00 \$16,523.00 \$16,52		
asement/ROW Acquisition Capital Improvement Costs ipe Culverts and Storm Drains oncrete Box Culverts ydraulic Structures hannel improvements wetention/Water Quality Facilities emovals andscaping and Maintenance Improvements pecial items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Co sewatering Itelity Coordination/Relocation atric: Control Itelity Coordination/Relocation atomwater Management/Erosion Control ubtotal Additional Capital Improvement Co Leasements ubtotal Land Acquisition Costs UCWLeasements ubtotal Land Acquisition Costs Other Costs (percentage of Capital ingineering	osta osta	n Capital Improv	*ement Cost Sur \$5,000 00 5% \$16,522 80 \$10,522 80 5% 15%	ACRE mmary		\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$97,760.00 \$71,290.00 \$71,290.00 \$72,290.00 \$75,290.00 \$75,290.00 \$75,290.00 \$16,523.00 \$16		
Capital Improvement Costs ipe QLIVerts and Storm Drains on crete Box QLIVerts ydraulic Structures hannel Improvements extension/Water Quality Facilities emovds andsceping and Mainten an ce Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Co ewatoring lobalization raffic Control bibly Coordination/Relocation Bity Coordination/Relocation Bity Coordination/Relocation Dibutal Additional Capital Improvement Co User Management/Erosion Control ubtotal Additional Capital Improvement Co Land Acquisition Costs Others Costs (percentage of Capital gail/Administrative	osta osta	un Capital Improv	*ement Cost Sui \$5,000.00 5% \$16,522.80 \$16,522.80 5%	ACRE mmary		\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$0.00 \$1,350.00 \$1,350.00 \$1,290.00 \$1,290.00 \$1,290.00 \$1,523.00 \$16,523.00 \$1		
Capital Improvement Costs Declaration Decl	osta osta	an Capital Improv	*ement Cost Sur \$5,000 00 5% \$16,522 80 \$10,522 80 5% 15%	ACRE mmary		\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$77,780.00 \$77,780.00 \$330,456.00 \$16,523.00 \$16,530.00 \$16,550.00 \$1		
asement/ROW Acquisition Capital Improvement Costs ipe Culverts and Storm Drains concrete Box Culverts ydraulic Structures hannel Improvements vention/Water Quality Facilities emovals andscaping and Mainten an ce Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Co lobolization Taffic Control Ubitotal Additional Capital Improvement Co Usotal Land Acquisition Costs Other Costs (percentage of Gapital ngineeting egal/Administrative ontract Admin/Construction Management	osta osta	an Capital Improv	*ement Cost Sur \$5,000.00 5% \$10,522.80 5% 15% 15% 15%	ACRE mmary		\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$0.00 \$17,760.00 \$0.00 \$1,350.00 \$330,466.00 \$16,523.00 \$16,523.00 \$16,523.00 \$16,523.00 \$16,523.00 \$16,523.00 \$16,523.00 \$16,523.00 \$16,523.00 \$10,327.00 \$0,000 \$0,000 \$10		
Capital Improvement Costs Capital Improvement Costs Capital Improvement Costs Concrete Dox Culvents Vydraulic Structures Channel Improvements Capital Improvements Costs Capital Improvement Costs Additional Capital Improvement Costs Colorador ManagementErosion Control Usitotal Additional Capital Improvement Costs Cototal Additional Capital Improvement Costs Cototal Additional Capital Improvement Costs Communication Additional Capital Improvement Costs Communication Costs Cost Cost	osts Dists Improvement Costs)	an Capital Improv	*ement Cost Sur \$5,000.00 5% \$10,522.80 5% 15% 15% 15%	ACRE mmary		\$96,800.00 \$0.00 \$151,806,00 \$0.00 \$0.00 \$7,7290.00 \$330,466,00 \$16,523.00 \$16,530.00 \$16,530.00 \$16,530.00 \$16,550		
Capital Improvement Costs ipe Quiverts and Storm Drains ion crete Box Quiverts between the service of the service of the service termion/Water Quality Facilities etermion/Water Quality Facilities etermovals andscaping and Mainten an ce Improvements pecial terms (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Co wavarbring towarbring	osts osts Improvement Costs) ts		*ement Cost Sur \$5,000.00 5% \$16,522.80 \$16,522.80 5% 15% 5% 25%	ACRE mmary L.S. L.S. L.S.		\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$1,350.00 \$1,350.00 \$1,350.00 \$1,350.00 \$16,523.00 \$16,525		
asement/ROW Acquisition Capital Improvement Costs pe Culverts and Storm Drains on crete Box Culverts ydraulic Structures hannel Improvements variation/Refer Cullety Facilities emovds andscaping and Maintenance Improvements pedial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Co ewatering Variation/Referation User Management/Erosion Control Ubtotal Additional Capital Improvement Co CVLEasements Ubtotal Capital Improvement Co CVLEasements Co CVLEasements CO CVLEASE	osts osts Improvement Costs) ts	n Capital Improv	*ement Cost Sur \$5,000 00 5% \$16,522.80 \$16,522.80 \$16,522.80 5% 10% 25% e Cost Summar	ACRE mmary		\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$77,760.00 \$77,760.00 \$77,280.00 \$74,290.00 \$74,290.00 \$74,290.00 \$74,290.00 \$16,523.00 \$100,387.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,977.00 \$2		
asement/ROW Acquisition Capital Improvement Costs pie Quiverts and Storm Drains on crete Box Quiverts ydraulic Structures hannel Improvements vertnion/Water Quality Facilities emovals andscapting and Maintenance Improvements existing and Maintenance Improvement Costs Additional Capital Improvement Costs Cother Costs Other Costs Cother Costs Cother Costs Cotal Capital Improvement Costs Cotal Capital Improvement Costs Cother Costs Cother Costs Cotal Capital Improvement Costs Cotal Capital Improvement Costs Cotal Capital Improvement Costs Cother Costs Cother Costs Cotal Capital Improvement Costs Cotal Capital Capital Improvement Costs Cotal Capital	osts Improvement Costs) ts r Plan Operation	and Maintenanc	*ement Cost Sur \$5,000.00 5% \$16,522.80 \$16,522.80 5% 15% 5% 25%	ACRE mmary L.S. L.S. L.S.		\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$77,780.00 \$77,780.00 \$77,290.00 \$7,290.00 \$7,290.00 \$7,290.00 \$7,290.00 \$16,523.00 \$100,387.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,877.00 \$20,97		
asement/ROW Acquisition  Capital Improvement Costs  pe Culverts and Storm Drains on crete Box Culverts ydraulic Structures hannel Improvements setnion/Water Cuality Facilities emovals andscaping and Mantenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost Additional Capital Improvement Cost artic: Control Dility Coordination/Relocation tormwater Management/Erosion Control ubtotal Additional Capital Improvement Co CoV/Easements ubtotal Land Acquisition Costs Other Costs (Derentsue of Gapital) ngineening gag//Administrative ontract Admin/Construction Management costs onthogenent company ubtotal Other Costs Cottal Capital Improvement Cost Company ubtotal Land Acquisition Costs Other Costs (Derentsue of Gapital) ngineening ubtotal Other Costs Cottal Capital Improvement Costs Cottal Capital Improvement Costs Other Costs Other Costs Co	osts osts Improvement Costs) ts r Plan Operation moval, erosion at entrar	and Maintenance	*ement Cost Sur \$5,000.00 5% \$10,522.80 \$10,522.80 5% 10% 25% e Cost Summar Quantity	ACRE mmary	\$88.000.00	\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$1,350.00 \$1,350.00 \$1,290.00 \$1,290.00 \$1,290.00 \$1,523.00 \$16,523.00 \$10,387.0		
Capital Improvement Costs ipe Culverts and Storm Drains increte Box Culverts ydraulic Structures hannel Maintenance Improvements becall items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Co twotoring Ibility Coordination/Relocation tormwater Management/Erosion Control ubtotal Additional Capital Improvement Co Land Acquisition Costs Other Costs (percentage of Gapital nginering egal/Administrative contract Admin/Construction Management contaget Inter Costs Other Costs Other Costs Other Costs Inter Costs In	osts osts Improvement Costs) ts r Plan Operation moval, erosion, stre 8.	and Maintenance	*ement Cost Sur \$5,000.00 5% \$16,522.80 \$16,522.80 5% 15% 15% 25% e Cost Summar Quantity 100	ACRE mmary L.S. L.S. L.S. L.S.	\$88,000.00	\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$0.00 \$17,290.00 \$330,456.00 \$16,523.00 \$10,550.00 \$10,550.00 \$10,357.00 \$100,35		
Capital Improvement Costs Capital Improvement Costs Concrete Box Culverts Concrete Improvements Concrete Improvements Concrete Improvements Concrete Improvement Costs Concrete Costs Concrete Control C	osts osts Improvement Costs) ts r Plan Operation moval, erosion, stre 8.	and Maintenance	*ement Cost Sur \$5,000.00 5% \$16,522.80 \$16,522.80 5% 15% 15% 25% e Cost Summar Quantity 100	ACRE mmary L.S. L.S. L.S. L.S.	\$88,000.00	\$96,800.00 \$0.00 \$151,806.00 \$0.00 \$97,760.00 \$0.00 \$1,350.00 \$1,350.00 \$1,350.00 \$16,523.00 \$10,387.00 \$20,877.00 \$10,387.00 \$20,025.00 \$20,0000 \$20,000 \$20,000 \$20,0000 \$20,0000 \$20,0000		







## 7.2.6.1 POUDRE LEARNING CENTER – 83<sup>RD</sup> AVENUE CROSSING

Approximately 650 ft. north of County Road 62, a dual cell 13 foot wide by 6 foot tall RCBC is proposed to convey flow underneath 83<sup>rd</sup> Avenue to the Cache La Poudre River. The existing 48 inch RCP is proposed to be replaced with a dual 13 foot by 6 foot RCBC in order to meet City criteria. 83<sup>rd</sup> Avenue is a major arterial, requiring 100-year conveyance capacity of the culvert with no overtopping. The RCBC will convey the 100-year existing conditions design flow of 1,110 cfs with no roadway overtopping.

This improvement will require installation of headwalls and wingwalls, at a minimum, on the upstream and downstream side of the RCBC culvert. Riprap will be required for outlet protection on the downstream end. During final design, the culvert height and width may need to be adjusted to accommodate the proposed roadway design section. Slight changes in geometry would be expected with more design information.

No known water or sanitary conflicts are anticipated at this location. Location of dry utilities are unknown and should be investigated prior to final design. Minor channel improvements to the drainageway will be required upstream and downstream of the crossing in order to promote drainage.

The proposed improvement requires approximately 1 acre of property acquisition.

The culvert was sized for the existing conditions land use scenario. Prior to final design and construction, any development that has occurred upstream of the roadway crossing should be considered to update the design discharge.

## Table 7-10: Poudre Learning Center – North 83<sup>rd</sup> Avenue Crossing

PROJECT : DRAINAGEWAY : REACH : JURISDICTION : REACH ID:	Sharktooth Bluffs Storm Drainage Maste Poudre Learning Center North 83rd Avenue Crossing City of Greeley SKD Conceptual Design		r Plan Enter Estimator Nam	e on Project Info	DATE :	12/21/2018
						TOTAL
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST
Concrete Box Culverts						
Box Culvert Pipe Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)			1
13	6	2	80	L.F.	\$3,079.08	\$246,326.00
Headwall and Toewalls						
Individual Box Span (ft)	No. of Barrels	Total Span (ft)	2	<b>5</b> .	40 700 00	AF FOF 00
13 Wingwalls (includes wingwalls on e	2 ither side of chappel	29.00 and concrete apron)	2	EA	\$2,782.26	\$5,565.00
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels				
13	6	2	2	EA	\$20,131.04	\$40,262.10
hannel Improvements						
cavation, Mid Range			1043	C.Y.	\$32.00	\$33,376.00
2-in ch Riprap, Type M			33	C.Y.	\$80.00	\$2,607.00
Removals						
emoval of culvert pipe (D<48")			70	L.F.	\$27.00	\$1,890.00
andscaping and Maintenance	mprovements			1005		
eclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00
pecial Items (User Defined) sphalt	<user defined="" item<="" td=""><td></td><td>58</td><td>TON</td><td>\$250.00</td><td>\$14,500.00</td></user>		58	TON	\$250.00	\$14,500.00
spiran	Comparing the second se	9	90	TON	\$250.00	\$14,000.00
Capital Improvement Costs	Master Pla	n Capital Impro	vement Cost Su	mmary		
ipe Culverts and Storm Drains						
						\$0.00
						\$292,153.00
ydraulic Structures						
ydraulic Structures hannel Improvements						\$292,153.00 \$0.00
ydraulic Structures hannel Improvements etention/Water Quality Facilities emovals						\$292,153.00 \$0.00 \$35,983.00 \$0.00 \$1,890.00
ydraulic Structures hannel Improvements extention/Water Quality Facilities emovals andscaping and Maintenance Improvements						\$292,153.00 \$0.00 \$35,983.00 \$0.00 \$1,890.00 \$1,340.00
concrete Box Quivorts lydraulic Structures hannel Improvements teomovals andscaping and Manteniance Improvements special Items (User Defined) livehold Fabrik Improvement Cents						\$292,153.00 \$0.00 \$35.983.00 \$0.00 \$1,890.00 \$1,340.00 \$14,500.00
ydraulic Structures hannel Improvements vietonition/Water Quality Facilities emovals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotat Capital Improvement Costs	sts					\$292,153.00 \$0.00 \$35,983.00 \$0.00 \$1,890.00 \$1,340.00
ydraulic Structures hannel Improvements etention/Water Quality Facilities emovads andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs	sts		\$5,000.00	L.S.		\$292,153.00 \$0.00 \$35,983.00 \$1,890.00 \$1,890.00 \$14,500.00 \$345,866.00 \$5,000.00
ydraulic Structures hannel Improvernents stennion/Water Quality Facilities emovals andscaping and Mantenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cos ewatering oblization	sta		5%	-		\$292,153,00 \$0,00 \$35,983,00 \$1,990,00 \$1,340,00 \$14,500,00 \$345,866,00 \$5,000,00 \$17,293,00
ydraulic Structures hannel Improvements vention/Water Gualty Facilities emovals andscaping and Maintenarce Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost exectening Itoblization artic: Control	sta		5% \$17,293.30	L.S.		\$292,153,00 \$0,00 \$35,983,00 \$1,890,00 \$1,40,00 \$14,500,00 \$345,806,00 \$345,806,00 \$17,293,00 \$17,293,00
ydraulic Structures hannel Improvements extention/Water Qualty Facilities emovds emovds (User Defined) ubtota Capital Improvement Costs Additional Cepital Improvement Cost watering boblization raffic Control hity Coordination/Relocation	sta		5%	-		\$292,153,00 \$0,00 \$35,983,00 \$1,990,00 \$1,340,00 \$1,4,500,00 \$14,500,00 \$14,500,00 \$17,293,00 \$17,293,00
ydraulic Structures hannel Improvernents etnologi Martenance Improvements emovals andscaping and Maritenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost ewatering oblization raffic Control uitay Coordination/Relocation			5% \$17,293.30 \$17,293.30	L.S.		\$292,153,00 \$0,00 \$35,983,00 \$1,890,00 \$1,40,00 \$14,500,00 \$345,806,00 \$345,806,00 \$17,293,00 \$17,293,00
ydraulic Structures hannel Improvements kenniom/Vare Qualty Facilities emovals emovals ubtotal Capital Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost evaceting toblization raffic Control libly Coordination/Relocation tormwater Management/Erosion Control ubtotal Additional Capital Improvement Cost Land Acquisition Costs			5% \$17,293.30 \$17,293.30	L.S.		\$292,153,00 \$0,00 \$35,983,00 \$1,990,00 \$1,340,00 \$14,500,00 \$14,500,00 \$17,293,00
ydraulic Structures hannel Improvements extention/Water Qualty Facilities emovals emovals emovals emovals emovals emovals andscaping and Mantenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cos evatening oblization raffic Control ubtotal Additional Capital Improvement Cost Land Acquisition Costs OW/Easements			5% \$17,293.30 \$17,293.30	L.S.		\$292,153,00 \$0,00 \$35,983,00 \$1,890,00 \$1,340,00 \$14,500,00 \$345,866,00 \$17,293,00 \$17,203,00 \$17,200
ydraulic Structures hannel Improvements wennion/Water Quality Facilities emovals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost ewatering toblization raffic Control titity Coordination/Relocation tormwater ManagementErosion Control ubtotal Additional Capital Improvement Cost Land Acquisition Costs OW/Leasements Udotal Addition Costs	sts		5% \$17,293.30 \$17,293.30	L.S.		\$292,153,00 \$0,00 \$35,983,00 \$1,990,00 \$1,340,00 \$14,500,00 \$14,500,00 \$17,293,00
ydraulic Structures hannel Improvements extention/Water Qualty Facilities emovids emovids (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Cost everation oblization reffic Control hity Coordination/Relocation hity Coordination/Relocation lubtotal Additional Capital Improvement Cost Land Acquisition Costs Other Costs (percentage of Capital I	sts		5% \$17,293.30 \$17,293.30 5%	L.S.		\$292,153,00 \$0,00 \$35,983,00 \$1,990,00 \$1,340,00 \$14,500,00 \$14,500,00 \$17,293,00 \$10,00 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0
vdraulic Structures hannel Improvements exention/Water Qualty Facilities amovals amova	sts		5% \$17,293.30 \$17,293.30	L.S.		\$292,153.00 \$0.00 \$35,983.00 \$1,890.00 \$1,340.00 \$14,500.00 \$345,866.00 \$17,293.00
vdraulic Structures hannel Improvements exention/Water Quality Facilities emovals emovals (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Cost oblization affic Control affic Control ubtotal Additional Capital Improvement Cos ubtotal Additional Capital Improvement Cost User ManagementErosion Control ubtotal Additional Capital Improvement Cost User Costs Uter Costs (percentage of Capital II gineering ugal/Administrative ontract Admin/Construction Management	sts		5% \$17,293.30 \$17,293.30 5% 15% 15% 10%	L.S.		\$292,153,00 \$0,00 \$35,583,00 \$1,90,00 \$1,340,00 \$14,500,00 \$345,966,00 \$17,293,00 \$17,20,00 \$1,20,000 \$1,20,000 \$1,20,000 \$1,20,000 \$1,20,000 \$1,20,000
ydraulic Structures ananel Improvements textnom/Water Quality Facilities movals andscaping and Maintenance Improvements oedal Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost additional Capital Improvement Cost additional Capital Improvement Cost blottal Additional Capital Improvement Cost blottal Additional Capital Improvement Cost blottal Additional Capital Improvement Cost OWEasements blottal Additional Capital Improvement Cost Other Costs (percentage of Capital I pige/Administrative outract Admini/Construction Management contage	sts		5% \$17,293.30 \$17,293.30 5% 5%	L.S.		\$292,153,00 \$0,00 \$35,983,00 \$1,990,00 \$1,340,00 \$14,500,00 \$14,500,00 \$17,293,00 \$10,00 \$10,00 \$10,00 \$10,000 \$10,0000 \$10,0000 \$10,0000 \$10,00000 \$10,00000 \$10,00000000000000000000000000000000000
ydraulic Structures hannel Improvements extention/Wator Quality Facilities emovais andscaping and Maintenance Improvements excial items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost externing oblization emits Control table Costs Control Ustotal Additional Capital Improvement Cost Other Costs Other Costs (percentage of Capital I ngineering egg/Administrative ontract Admini/Construction Management ontigency Ustotal Other Costs Ustotal Other Costs	sts mprovement Costs)		5% \$17,293.30 \$17,293.30 5% 15% 15% 10%	L.S.		\$292,153,00 \$0,00 \$35,983,00 \$1,990,00 \$1,840,00 \$14,500,00 \$14,500,00 \$17,293,00 \$17,203,00 \$17,203,00 \$17,203,00 \$17,203,00 \$17,20,00 \$2,00 \$0,00 \$2,00 \$10,00 \$10,00 \$10,00 \$2,00,00 \$10,00 \$10,00 \$10,00 \$10,00
draulic Structures annel Improvements senton/Wator Quality Facilities smovals Generation Quality Facilities smovals Generation Quality Facilities Generation Quality Control Jabotal Capital Improvement Costs Additional Capital Improvement Cost Additional Capital Improvement Cost Info Control Jabotal Additional Capital Improvement Cost Land Acquisition Costs Other Costs (percentage of Capital II Jigineering gal/Administrative Distract Admin/Construction Management Costs Dother Costs Costs Distract Costs Other Costs Costs Distract Admin/Construction Management Costs Distract Admin/Construction Management Costs Distract Admin/Construction Management Costs Distract	rts mprovement Costs) S	and Maintenen	5% \$17,293.30 \$17,293.30 5% 15% 5% 10% 25%	L.S. L.S		\$292,153,00 \$0,00 \$35,983,00 \$1,990,00 \$1,840,00 \$14,500,00 \$14,500,00 \$17,293,00 \$17,203,00 \$17,203,00 \$17,203,00 \$17,203,00 \$17,20,00 \$2,00 \$0,00 \$2,00 \$10,00 \$10,00 \$10,00 \$2,00,00 \$10,00 \$10,00 \$10,00 \$10,00
ydraulic Structures annel Improvements worke and Capital Improvement Costs Additional Capital Improvement Costs additional Capital Improvement Costs additional Capital Improvement Costs additional Capital Improvement Cost additional Capital Improvement Cost bactal Additional Capital Improvement Cost bactal Additional Capital Improvement Cost bactal Additional Capital Improvement Cost Cother Costs Other Costs Other Costs Cother Costs bactal Admini/Construction Management costs bactal Capital Improvement Costs Cother Costs Cother Costs bactal Capital Improvement Costs bactal Capital Improvement bactal Admini/Construction Management cost bactal Capital Improvement	rts mprovement Costs) S	and Maintenand	5% \$17,293.30 \$17,293.30 5% 15% 5% 10% 25%	L.S. L.S	Unit Cost	\$292,153,00 \$0,00 \$35,983,00 \$1,990,00 \$1,340,00 \$14,500,00 \$14,500,00 \$14,500,00 \$17,293,00 \$10,00 \$10,000 \$10,000 \$10,000 \$10,000 \$10,000 \$10,000 \$21,002,000 \$10,000 \$231,022,00 \$651,060,00
ydraulic Structures hannel Improvements sectoniomVater Quality Facilities emovals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost additional Capital Improvement Cost Additional Capital Improvement Cost Cost (Decomposition Costs Other Costs (Decomposition Costs Other Costs Other Costs Costal Capital Improvement Costs Cost (Decomposition Management contingent) ubtotal Addition Costs Other Costs Cost (Decomposition Management contingency ubtotal Defined Costs Costs Cost (Decomposition Costs	nprovement Costs) S Plan Operation		5% \$17,293.30 \$17,293.30 5% 15% 5% 10% 25% 25%	L.S. L.S	Unit Cost \$1.00	\$292,153,00 \$0,00 \$35,983,00 \$1,990,00 \$1,340,00 \$1,340,00 \$14,500,00 \$17,293,00 \$17,00,00 \$10,00 \$10,000 \$10,0000 \$10,0000 \$10,0000 \$10,0000 \$10,0000 \$10,
ydraulic Structures hannel Improvements extention/Water Quality Facilities emovals emovals emovals (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Cost Additional Capital Improvement Cost inty Coordination/Relocation inty Coordination/Relocation bitotal Additional Capital Improvement Cost Ubtotal Additional Capital Improvement Cost Ubtotal Additional Capital Improvement Cost Ubtotal Additional Capital Improvement Cost OW/Easements Ubtotal Capital Improvement Costs Other Costs Other Costs Cotal Capital Improvement Costs Cotal Capital Improvement Cost Ubtotal Cher Costs Cotal Capital Improvement Cost Ubtotal Ubter Costs Cotal Capital Improvement Cost	nprovement Costs)		5% \$17,293.30 \$17,293.30 5% 15% 5% 10% 25% 25%	L.S. L.S.		\$292,153,00 \$0,00 \$35,983,00 \$0,00 \$1,990,00 \$1,990,00 \$14,500,00 \$14,500,00 \$17,293,00 \$10,000 \$10,000 \$10,000 \$10,000 \$10,000 \$10,000 \$10,000 \$10,000 \$10,000 \$10,
ydraulic Structures hannel Improvements wetniom/Water Qualty Facilities emovdis andscepting and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost evartering tobilization raffic Control titity Coordination/Relocation tormwater ManagementErosion Control ubtotal Additional Capital Improvement Cos Land Acquisition Costs Other Costs (percentage of Capital I nganeering egal/Administrative onfrast Admin/Construction Management ionbragency ubtotal Other Costs	tts mprovement Costs) S Plan Operation noval, erosion at entrar ntenance Cost	ice/exit, structural repain	5% \$17,293.30 \$17,293.30 5% 15% 5% 10% 25% 25%	L.S. L.S.		\$292,153,00 \$0,00 \$35,983,00 \$1,990,00 \$1,340,00 \$14,500,00 \$14,500,00 \$14,500,00 \$17,293,00 \$10,00 \$10,010,00 \$23,002,00 \$23,000,00 \$23,000,00 \$23,000,00 \$23,000,00 \$23,000,00 \$23,000,00 \$23,000,00 \$23,000,00 \$23,000,00 \$23,000,00 \$23,000,00 \$20,000





### 7.2.6.2 POUDRE LEARNING CENTER – WILLIAM R. JONES CANAL BASEFLOW SEPARATION

In the Poudre Learning Center Basin, flow crosses an old remnant of the William R. Jones Ditch and County Road 62, flowing into Siebring Reservoir. The Jones Ditch downstream of Siebring Reservoir is no longer used for irrigation purposes. During storm events, the Jones Ditch has the potential to intercept runoff from flow exiting the Poudre Learning Center main draw, and from backwater behind County Road 62. Due to the alignment differences between the ditch, roadway, and draw exit location, separation of the inflows did not appear practical. Formalizing a spill location just upstream of 83<sup>rd</sup> Avenue is proposed to help mitigate flooding hazards on downstream property created from uncontrolled spill flows.

The proposed 50 ft. wide concrete spillway will passively discharge flow from the William R. Jones Ditch along an existing flowpath to the County Road 62 East Crossing. The spillway will prevent uncontrolled spill flow at 83<sup>rd</sup> Avenue where a pipe intercepts any flow in the ditch, conveying flow north to the Cache La Poudre River.

The proposed improvements require approximately 1 acre of property acquisition.

No known water or sanitary conflicts are anticipated at this location. Location of dry utilities are unknown and should be investigated prior to final design.

### Table 7-11: Poudre Learning Center - William R. Jones Ditch Canal Baseflow Separation

PROJECT :	Sharktooth Bluffs Storm Drainage	Master Plan					
DRAINAGEWAY :	Poudre Learning Center						
REACH :	William R. Jones Ditch Canal Base	flow Separation					
JURISDICTION :	City of Greeley						
REACH ID:	SKD Conceptual Design	Enter Estimator Nam	e on Project Inf	DATE :	12/21/2018		
					TOTAL		
DESCRIPTION		QUANTITY	UNIT	UNIT COST	COST		
Channel Improvements							
xcavation, Mid Range		890	C.Y.	\$32.00	\$28,480.00		
2-inch Riprap, Type M		100	C.Y.	\$80.00	\$8,000.00		
andscaping and Maintenance	mprovements						
Reclamation & seeding (native grasses)	in provements	1	ACRE	\$1,340.00	\$769.00		
			AGRE	\$1,540.00	\$105.00		
Special Items (User Defined)				4004.00	A 40 200		
	<user defined="" items<="" td=""><td>50</td><td>C.Y.</td><td>\$804.00</td><td>\$40,200.00</td></user>	50	C.Y.	\$804.00	\$40,200.00		
Land Acquisition							
Easement/ROW Acquisition		1,10	ACRE	\$88,000.00	\$96,800.00		
	Maatax Dian Canital Im	numericant Coast Cu					
Conital Improvement Conte	Master Plan Capital Im	provement Cost Su	mmary				
Capital Improvement Costs Pipe Culverts and Storm Drains					\$0.00		
Concrete Box Culverts					\$0.00		
Avdraulic Structures					\$0.00		
Channel Improvements					\$36,480.00		
Detention/Water Quality Facilities					\$0.00		
Removals					\$0.00		
andscaping and Mainten ance Improvements					\$769.00		
Special Items (User Defined)					\$40,200.00		
Subtotal Capital Improvement Costs					\$77,449.00		
Additional Capital Improvement Co:	sts						
Dewaterin g		\$5,000.00	L.S.		\$5,000.00		
Mobilization		5%			\$3,872.00		
raffic Control		\$5,000.00	L.S.		\$5,000.00		
Jtility Coordination/Relocation		\$5,000.00	L.S.		\$5,000.00		
Stormwater Management/Erosion Control		5%			\$3,872.00		
Subtotal Additional Capital Improvement Cos	sts				\$22,744.00		
Land Acquisition Costs							
ROW/Easements					\$96,800.00		
Subtotal Land Acquisition Costs					\$96,800.00		
Other Costs (percentage of Capital I	mprovement Costs)						
Engineering		15%			\$15,029.00		
egal/Administrative		5%			\$5,010.00		
Contract Admin/Construction Management		10%			\$10,019.00		
Contingency		25%			\$25,048.00		
hitted all others Constants					\$55,106.00		
Subtotal Other Costs					\$252,099.0		
	s						
Fotal Capital Improvement Cost		names Cost Summer			,,		
Fotal Capital Improvement Cost Master	r Plan Operation and Mainte			Unit Cost			
Total Capital Improvement Cost Master	Plan Operation and Mainte	nance Cost Summar	Unit	Unit Cost	Total Annual Co		
Total Capital Improvement Cost Master Description Voraulic Structure Maintenance (e.g. debris ret	Plan Operation and Mainte	Quantity 1	Unit	\$670.00	Total Annual Co \$134.00		
Fotal Capital Improvement Cost Master Rescription Nydraulic Structure Maintenance (e.g. debris re channel Maintenance (e.g. sedment & debris re	Plan Operation and Mainter moval, erosion, structural repairs, etc.) emoval, erosion, tree & weed removal, etc	Quantity 1	Unit		Total Annual Co \$134.00 \$900.00		
Fotal Capital Improvement Cost Master	Plan Operation and Mainter moval, erosion, structural repairs, etc.) emoval, erosion, tree & weed removal, etc	Quantity 1	Unit	\$670.00	Total Annual Co \$134.00		







### 7.2.7 WIEDEMAN CREEK

The Wiedeman Creek watershed extends from the Cache La Poudre River south beyond 10th Street. The watershed lies within the City of Greeley and unincorporated Weld County. Runoff generally drains south of 10th Street, north to the Cache La Poudre River. Poudre River Ranch Phase III and the River Run at Poudre River Ranch Phases I and II developments are present within this watershed. Two main drainage patterns convey flow through Poudre River Ranch. During the 100-year design storm, depths exceed five feet near the entrance to both culverts along the North 81st Avenue drainageway. Street flooding along Poudre River Road and North 81st Avenue pose flooding hazards with flooding depths exceeding the City maximum flow depth criteria of 18-inches. Additional flood hazards were identified south of the future 4th Street roadway expansion, east of Wiedeman Creek in a localized sump area.

## 7.2.7.1 WIEDEMAN CREEK –4<sup>TH</sup> STREET CROSSING

Wiedeman Creek crosses 4<sup>th</sup> Street approximately 900 ft. east of 83<sup>rd</sup> Avenue. A proposed 6 ft. wide by 4 ft. high RCBC will convey approximately 238 of the 264 cfs during the 100-year design storm. Flows in excess of the culvert capacity, 26 cfs during the existing conditions 100-year event, will overtop the roadway at a depth less than 6inches.

The roadway crossing was conceptually designed with minimal ground cover over the top of the crossing. The improvement requires installation of headwalls and wingwalls, at a minimum, on the upstream and downstream side of the RCBC culvert. Riprap will be required for outlet protection on the downstream end. During final design, the culvert height and width may need to be adjusted to accommodate the proposed roadway design section. Slight changes in geometry would be expected with more design information.

No known sanitary conflicts are present at the crossing. A 27 inch Bellevue water main is present along the north side of the roadway but is not anticipated to be in conflict with the proposed improvements. Other dry utilities are unknown for this crossing and should be investigated prior to final design. Minor channel improvements to the drainageway will be required upstream and downstream of the crossing in order to promote drainage.

The culvert was sized for the existing conditions land use scenario. Prior to final design and construction, any development that has occurred upstream of the roadway crossing should be considered to update the design discharge.

### Table 7-12: Wiedeman Creek - 4th Street Crossing

PROJECT :		Storm Drainage Maste	er Plan			
DRAINAGEWAY : REACH :	Wiedeman Creek 4th Street Crossin					
JURISDICTION :	City of Greeley	Ig				
REACH ID:	SKD Conceptual I	Design	Enter Estimator Nam	e on Proiect Info	DATE :	12/21/2018
harden b.	one conceptual	overgit		,	DATE:	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Concrete Box Culverts						
Box Culvert Pipe						
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)			
6	4	1	50	L.F.	\$722.88	\$36,144.00
Headwall and Toewalls						
Individual Box Span (ft)	No. of Barrels	Total Span (ft)	-		A1100 E.0	
6 Milescolle final advantages of the second	1	8.00	2	EA	\$723.52	\$1,447.00
Wingwalls (includes wingwalls on Individual Box Span (ft)	Box Rise (ft)	No. of Barrels	T 1			1
6	4	INO. OF Barreis	2	EA	\$8,330.86	\$16,661,70
	4		2	CA.	\$0,550.00	\$10,001.70
Channel Improvements					***	
Excavation, Mid Range			200	C.Y.	\$32.00	\$6,400.00
2-inch Riprap, Type M			13	C.Y.	\$80.00	\$1,066.00
andscaping and Maintenance	mprovements					
eclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00
Special Items (User Defined)						
	<user defined="" item<="" th=""><th></th><th>22 vement Cost Sur</th><th>TON</th><th>\$250.00</th><th>\$5,500.00</th></user>		22 vement Cost Sur	TON	\$250.00	\$5,500.00
Capital Improvement Costs			22 vement Cost Sur		\$250.00	
Capital Improvement Costs Pipe Culverts and Storm Drains					\$250.00	\$0,00
Capital Improvement Costs Pipe Culverts and Storm Drains Concrete Box Culverts					\$250.00	\$0.00 \$54,253.00
Capital Improvement Costs Capital Improvement Costs Concrete Box Culverts Vydraulic Structores					\$250.00	\$0.00 \$54,253.00 \$0.00
Capital Improvement Costs Pipe Culverts and Storm Drains Concrete Box Culverts lydraulic Structures Tannel Improvements					\$250.00	\$0.00 \$54,253.00
Capital Improvement Costs Pipe Culverts and Storm Drains Concrete Box Culverts Hydraulic Structures Thannel Improvements Detention/Water Quality Facilities					\$250.00	\$0.00 \$54,253.00 \$0.00 \$7,466.00
Capital Improvement Costs Pipe Culverts and Storm Drains Concrete Box Culverts hydraulic Structures hannel Improvements betention/Water Quality Facilities Removals andscaping and Maintenance Improvements					\$250.00	\$0.00 \$54,253.00 \$0.00 \$7,466.00 \$0.00 \$0.00 \$1,340.00
Capital Improvement Costs Pro-Octoberts and Storm Drains Pro-Octoberts and Storm Drains hydraulic Structures hannel Improvements vention/Water Quality Facilities termore/as andscaping and Maintenance Improvements pecial terms (User Defined)					\$250.00	\$0.00 \$54,253.00 \$0.00 \$7,466.00 \$0.00 \$0.00 \$1,340.00 \$5,500.00
Capital Improvement Costs Capital Improvement Costs Concrete Box Culverts Channel Improvements Channel Improvements Detention/Water Quality Facilities Ermovals andscaping and Maintonance Improvements Special Items (User Defined) Subtots Capital Improvement Costs	Master Pla				\$250.00	\$0.00 \$54,253.00 \$0.00 \$7,466.00 \$0.00 \$0.00 \$1,340.00
Capital Improvement Costs "pe Culverts and Storm Drains Concrete Box Culverts Mydraulic Structures Channel Improvements Stension/Water Quality Facilities termovals andscaping and Maintenance Improvements pecial Items (User Defined) Subtetal Capital Improvement Costs Additional Capital Improvement Costs	Master Pla		vement Cost Sur	nmary	\$250.00	\$0.00 \$54,253.00 \$0.00 \$7,466.00 \$0.00 \$1,340.00 \$5,500.00 \$888,559.00
Capital Improvement Costs "po Curverts and Storm Drains concrete Box Culverts lydraulic Structures hannel Improvements vetention/Water Quality Facilities temovals andscaping and Maintonance Improvements pecial Items (User Defined) subtotal Capital Improvement Costs Additional Capital Improvement Go lewatering	Master Pla		vement Cost Sur		\$250.00	\$0.00 \$54,253.00 \$7,466.00 \$0.00 \$1,00 \$1,340.00 \$5,500.00 \$68,559.00 \$68,559.00
Capital Improvement Costs "ipe Culverts and Storm Drains concrete Box Culverts Vyraulic Structures channel Improvements betention/Water Quality Facilities eternovals andscaping and Maintonance Improvements special Items (User Defined) <b>Wottett Capital Improvement Costs</b> Additional Capital Improvement Cost bewatering foblization	Master Pla		**************************************	nmary L.S.	\$250.00	\$0.00 \$54,253.00 \$0.00 \$1,466.00 \$0.00 \$1,340.00 \$5,500.00 \$88,559.00 \$88,559.00 \$5,000.00 \$4,428.00
Capital Improvement Costs Capital Improvement Costs Concrete Dox Culvents Vydraulic Structures Channel Improvements Channel Improvements Vention/Water Quality Facilities Fermovals andscaping and Maintenan-ce Improvements Special Items (User Defined) Subtotal Capital Improvement Costs Additional Capital Improvement Co Dewsteing Additional Capital Improvement Co Dewsteing Concrete Co Dewsteing Co Dewstei	Master Pla		**************************************	nmary L.S. L.S.	\$250.00	\$0.00 \$54,253.00 \$7,465.00 \$0.00 \$1,240.00 \$1,340.00 \$5,500.00 \$88,559.00 \$3,428.00 \$3,428.00 \$5,000.00
Capital Improvement Costs Pipe Cutverts and Storm Drains Concrete Box Cutvents Indraulic Structures Thannel Improvements Stennion/Water Quality Facilities temorals andscaping and Maintenance Improvements pecial Items (User Defined) bubtetal Capital Improvement Costs Additional Cepital Improvement Co vextering tobilization raffic Control Ibity Coordination/Relocation	Master Pla		**************************************	nmary L.S.	\$250.00	\$0.00 \$54,253.00 \$7.466.00 \$0.00 \$1.240.00 \$5,500.00 \$68,559.00 \$5,500.00 \$5,000.00 \$5,000.00 \$5,000.00
Capital Improvement Costs Capital Improvement Costs Concrete Box Culverts Concrete Box Culverts Channel Improvements Concrete Improvements Concrete Improvements Concrete Improvement Costs Concrete Concrete Control	Master Pla		**************************************	nmary L.S. L.S.	\$250.00	\$0.00 \$54,253.00 \$0.00 \$7,466.00 \$0.00 \$0.00 \$1,340.00 \$6,550.00 \$6,550.00 \$6,550.00 \$5,500.00 \$5,428.00 \$5,000.00 \$3,428.00 \$5,000.00 \$3,428.00 \$5,000.00 \$3,428.00 \$5,000.00 \$3,428.00 \$5,000.00 \$3,428.00 \$5,000.00 \$3,428.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$3,428.00 \$5,000.00 \$5,0
Capital Improvement Costs ipe Culverts and Storm Drains correte Box Culverts bydraulic Structures hannol Improvements vention/Water Quality Facilities removals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Cepital Improvement Co lobilization raftic Control bibly Coordination/Relocation tormwater Management/Erosion Control ubtotal Additional Capital Improvement Co	Master Pla		**************************************	nmary L.S. L.S.	\$250.00	\$0.00 \$54,253.00 \$7.466.00 \$0.00 \$1.240.00 \$5,500.00 \$68,559.00 \$5,500.00 \$5,000.00 \$5,000.00 \$5,000.00
Capital Improvement Costs ipe Outverts and Storm Drains concrete Box Outverts lydraulic Structures hannel Improvements stennion/Water Quality Facilities ternovals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Cepital Improvement Co evadering tobilization raffic Control Ibility Coordination/Relocation termwater Management/Erosion Control ubtotal Additional Capital Improvement Co	Master Pla		**************************************	nmary L.S. L.S.	\$250.00	\$0.00 \$54,253.00 \$0.00 \$7,466.00 \$0.00 \$1,240.00 \$5,500.00 \$5,500.00 \$5,500.00 \$3,428.00 \$5,000.00 \$3,428.00 \$5,000.00 \$3,428.00 \$5,000.00 \$2,1866.00
Capital Improvement Costs pe Quiverts and Storm Drains oncrete Box Quiverts sydralic Structures hannel Improvements etention/Water Quality Facilities emova's andscaping and Maintonance Improvements pecial items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Co ewatering oblig/acion raffic Control bility/Coordination/Relocation formwater Management/Erosion Control ubtotal Additional Capital Improvement Co Land Acquisition Costs OW/Easements	Master Pla		**************************************	nmary L.S. L.S.	\$250.00	\$0.00 \$54,253.00 \$0.00 \$7,466.00 \$0.00 \$0.00 \$1,340.00 \$68,559.00 \$68,559.00 \$68,559.00 \$68,559.00 \$5,000.00 \$3,428.00 \$5,000.00 \$3,428.00 \$5,000.00 \$3,428.00 \$5,000.00 \$3,428.00
Capital Improvement Costs ipe Cluvers and Storm Drains oncrete Box Culvers ydraulic Structures hannel Improvements vetnion/Water Quality Facilities emovals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Geoltal Improvement Go ewatoring Additional Geoltal Improvement Co tarlis: Control bibly Coordination/Relocation tormwater ManagementErosion Control ubtotal Additional Capital Improvement Co Land Acquisition Costs OW/Easements	Master Pla sto		**************************************	nmary L.S. L.S.	\$250.00	\$0.00 \$54,253.00 \$0.00 \$7,466.00 \$0.00 \$1,340.00 \$5,500.00 \$68,559.00 \$5,500.00 \$3,428.00 \$5,000.00 \$3,428.00 \$2,000.00 \$2,428.00 \$2,000 \$2,1,256.00 \$0,000 \$0,0000 \$0,0000 \$0,0000 \$0,0000
Capital Improvement Costs ipe Culverts and Storm Drains Concrete Box Culverts lydraulic Structures hannel Improvements stennion/Water Quality Facilities ternovals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Cepital Improvement Co evadering tobilization raffic Control bibly Coordination/Relocation termwater ManagementErosion Control ubtotal Additional Capital Improvement Co Land Acquisition Costs Otivicasements ubtotal Land Acquisition Costs Other Costs (percentage of Capital Other Costs (percentage of Capital	Master Pla sto		**************************************	nmary L.S. L.S.	\$250.00	\$0.00 \$54,253.00 \$0.00 \$7,466.00 \$0.00 \$1,340.00 \$5,500.00 \$68,559.00 \$5,500.00 \$3,428.00 \$5,000.00 \$3,428.00 \$2,000.00 \$2,428.00 \$2,000 \$2,1,256.00 \$0,000 \$0,0000 \$0,0000 \$0,0000 \$0,0000
Capital Improvement Costs ipe Culverts and Storm Drains oncrete Box Culverts ydraulic Structures hannol Improvements vention/Water Cualty Facilities emovals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Co avaitering lobilizzation fartic Control Dibly Coordination/Relocation tormwater Management/Erosion Control ubtotal Additional Capital Improvement Co Cov/Easements ubtotal Land Acquisition Costs Other: Costs (percentage of Capital ngineening	Master Pla sto		\$5,000.00 5% \$5,000.00 5%	nmary L.S. L.S.	\$250.00	\$0.00 \$54,253.00 \$0.00 \$1,260.00 \$1,260.00 \$5,500.00 \$5,500.00 \$5,500.00 \$5,500.00 \$3,428.00 \$5,000.00 \$3,428.00 \$5,000.00 \$0.00 \$0.00
Capital Improvement Costs     Sphalt     Capital Improvement Costs     Sige Culverts and Storm Drains     Concrete Box Culverts     Workaulic Structures     hannel Improvements     wetention/Water Quality Facilities     ermovals     andscaping and Maintenance Improvements     pecial Items (User Defined)     ubtotal Capital Improvement Costs         Additional Capital Improvement Co     watering         Additional Capital Improvement Co         Water ManagementErosion Control         User Defined)     tabtotal Additional Capital Improvement Co     severe ManagementErosion Control     tubtotal Additional Capital Improvement Co     ubtotal Additional Capital Improvement Co     User Severe ManagementErosion Control     ubtotal Additional Capital Improvement Co     Land Acquisition Costs         Other Costs (percentage of Capital         agia/Administrative	Master Pla sto		\$500.00 \$5% \$500.00 \$5% \$500.00 \$5%	nmary L.S. L.S.	\$250.00	\$0.00 \$54,253.00 \$7,466.00 \$0.00 \$1,340.00 \$5,500.00 \$68,559.00 \$5,000.00 \$3,428.00 \$5,000.00 \$3,428.00 \$2,1,856.00 \$3,428.00 \$3,000 \$3,000 \$3,000 \$3,000 \$3,435.00 \$3,428.00 \$3,428.00 \$3,428.00 \$3,428.00 \$3,4000 \$3,4000 \$3,4000 \$3,4000 \$3,4000 \$3,4000 \$3,4000 \$3,4000 \$3,4000 \$3,4000 \$3,4000 \$3,4000 \$3,4000 \$3,4000 \$3,4000 \$3,4
Capital Improvement Costs     ipe Culverts and Storm Drains     oncrete Box Culverts     ydraulic Structures     hannol Improvement Section     words     and Capital Improvement     section     Additional Capital Improvement     Costs     Additional Capital Improvement Costs     Additional Capital Improvement Co     wordering     control     bibly Coordination/Relocation     tormwater Management/Erosion Control     wototal Additional Capital Improvement Co     Land Acquisition Costs     Other Costs (percentage of Capital     ngineering     egal/Administrative     ontract Admin/Construction Management	Master Pla sto		\$5,000.00 5% \$5,000.00 \$5% \$5,000.00 \$5% 5%	nmary L.S. L.S.	\$250.00	\$0.00 \$54,253.00 \$0.00 \$1,466.00 \$0.00 \$1,240.00 \$5,500.00 \$5,500.00 \$3,428.
Capital Improvement Costs Pipe Cutverts and Storm Drains Concrete Box Cutvents Mydraulic Structures Extension/Ware Quality Facilities Extension/Ware Quality Facilities Extension/Ware Quality Facilities Extension/Ware Quality Facilities Extension Vare Quality Facilities Extension Vare Quality Facilities Extension Costs Additional Capital Improvement Costs Additional Capital Improvement Costs Ustots Additional Capital Improvement Cost Extension Vare ManagementErosion Control Ustots Additional Capital Improvement Cost Extension Costs Extension	Master Pla sto		**************************************	nmary L.S. L.S.	\$250.00	\$0.00 \$54,253.00 \$0.00 \$1,466.00 \$0.00 \$1,340.00 \$5,500.00 \$5,500.00 \$5,500.00 \$5,500.00 \$5,500.00 \$3,428.00 \$5,000.00 \$3,428.00 \$5,000.00 \$3,428.00 \$1,352.00 \$0,00 \$0,00 \$1,352.00 \$0,00 \$0,00 \$0,00 \$0,00 \$1,340.00 \$1





## 7.2.7.2 WIEDEMAN CREEK – 81<sup>ST</sup> AVENUE

Primary problems within the Wiedeman Creek watershed focus on drainage within the Poudre River Ranch Phase III development. Infrastructure within the development is undersized for existing conditions design flows. As flow enters the development, the undersized 7 ft. wide by 4 ft. tall RCBC leads to flow overtopping Skyview Street in excess of City criteria. Downstream of Skyview Street, the drainage system continues in an open channel parallel 81<sup>st</sup> Avenue before the system is intercepted in a 5 foot wide by 4 foot tall RCBC. Flows in excess of the 140 cfs storm drain capacity spill onto 81<sup>st</sup> Avenue, exceeding City criteria of 18 inch ponding depth. Two homes are inundated west of the 5 foot by 4 foot box culvert entrance where flow spills onto 81<sup>st</sup> Avenue.

Upstream of the development, a 22.7 Ac-ft. regional detention basin is proposed to mitigate the flooding hazards. The detention facility would capture the 100-year event (703 cfs) prior to entering Poudre River Ranch Phase III development area at 81<sup>st</sup> Avenue. A 72 inch RCP is proposed as the outlet structure to the facility, limiting the peak release to 325 cfs. From the pond, flow will be conveyed downstream through the existing storm drain system at Skyview Street. The reduced flow out of the pond will reduce the overtopping at Skyview Street to less than 6 inches in depth. The overtopping flow at 81<sup>st</sup> Avenue will also be reduced to 185 cfs, meeting the City's criteria of less than 18 inches in depth.

Construction of a detention basin could provide the City can opportunity to work with the surrounding land owners to minimize costs of the pond while maximizing the potential benefit of the pond. Future development in the area could use the detention pond footprint to help minimize the remaining on-site detention requirements, thus promoting a working relationship between the City and development groups.

The proposed detention pond has been designed such that it does not exceed the requirements of a jurisdictional dam in the State of Colorado, with a maximum depth of less than 10 ft. deep, surface area less than 20 acres, and less than 100 acre-feet in size. However, given the changing dam safety requirements, it is still recommended that the City consult the State for current guidance prior to purchasing land or designing the detention facility.

Prior to implementation, the basin volume would need to be re-evaluated based upon upstream development and possible reduction in volume. Regardless of the proposed detention facility, all developments in the Wiedeman Creek Basin are to adhere to current City of Greeley detention standards, detaining to the 5-yr historic discharge.

Similarly to Sharktooth Draw, the proposed detention basin could provide a multi-objective function for the local natural area in Wiedeman Creek, providing flood management, but also improving the ecological function, wildlife habitat, and public access within the site. A future trail is currently proposed to extend along Wiedeman Creek through the proposed detention basin. The detention facility would also help promote wildlife through the preservation of native vegetation and habitat areas, as well as be designed to provide regional water quality benefits. Natural hydrologic function could continue to exist by conveying bankfull, base flows undetained through the pond area, up to the capacity of the proposed downstream infrastructure and acceptable roadway overtopping. Pond landscaping could include seeding with drought-tolerant native seed mixes, infrequent or no-mow areas. Any needed mowing practices could occur outside of ground-nesting bird seasons in the spring. Conceptual cost estimate of the pond assumes minimal facility enhancements as the storage capacity of this detention basin will not be required when the upstream property develops.

The proposed improvement requires purchase of approximately 11 acres of land for the detention basin.

No known water or sanitary conflicts have been identified in the area. Dry utilities in the location of the pond are unknown, but assumed to be minimal. The improvements also consist of the installation of headwalls and wingwalls on the upstream and downstream side of pond outlet, and the installation of a riprap stilling basin for outlet protection. Channel improvements to the drainageway will be required downstream of the crossing in order to promote drainage. The low flow channel through the pond will require drop structures in order to ensure the longterm stability of the stream system.

The detention basin was sized for the existing conditions land use scenario. Prior to final design and construction, any development that has occurred upstream of the roadway crossing should be considered to update the design discharge.

CLICK HERE TO VIEW WIEDEMAN CREEK EXHIBITS





### Table 7-13: Wiedeman Creek - 81st Avenue

PROJECT : DRAINAGEWAY :	Sharktooth Bluffs S Wiedeman Creek	Storm Drainage Master	Plan			
REACH :	81st A venue Deten	tion				
JURISDICTION : REACH ID:	City of Greeley SKD Conceptual De	a al am	Enter Estimator Nam	e en Preject Infe	DATE:	6/10/2019
REACH ID:	SKD Conceptual De	esign	Enter Estimator Nam	e on Projectinio	DATE:	6/10/2019
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
ipe Culverts and Storm Drains						
Circular Pipes				1	-	
Diameter (in) 88-inch Headwalls	Length (ft) 72	No. of Barrels	72	LF.	\$354.00	\$25,488.00
Diameter (in)	Applicable	No. of Barrels				
66-inch	Yes	1	2	EA	\$2,339.40	\$4,679.00
Wingwalls (includes concrete apron) Diameter (in)	Í	No. of Barrels	1	1	-	
66-inch		1	2	EA	\$13,825.58	\$27,651.00
lydraulic Structures						
Sloping Drop Structures			-		1	
Height (ft)	Bottom Width (ft) 10	Yn (ft) 0.5	2	EA	\$22,233.52	\$44,467.00
Detention/Water Quality Facilitie		2.0				- 1. pro 1. ad
Detention (User Entered Quantities)						
xcavation, Low Range			51720	C.Y.	\$15.00	\$775,800.00
andscaping and Maintenance Ir	nprovements			1000		
Reclamation & seeding (native grasses) rail/Path, Crusher Fines (10' Width)			11	ACRE LF.	\$1,340.00 \$15.00	\$14,740.00 \$49,500.00
Special Items (User Defined)						
	<user defined="" items<="" td=""><td>1</td><td>51720</td><td>CY</td><td>\$12.00</td><td>\$620,640.00</td></user>	1	51720	CY	\$12.00	\$620,640.00
and Acquisition						
emporary Easements			1	EA	\$30,000.00	\$30,000.00
asement/ROW Acquisition			11.00	ACRE	\$88,000.00	\$968,000.00
	Master Pla	an Capital Impro	vement Cost Su	mmary		
Capital Improvement Costs						
ipe Culverts and Storm Drains oncrete Box Culverts						\$57,818.00 \$0.00
lydraulic Structures						\$44,467.00
channel Improvements						\$0.00
Detention/Water Quality Facilities Removals						\$775,800.00 \$0.00
andscaping and Maintenance Improvements						\$64,240.00
Special Items (User Defined)						\$620,640.00
Subtotal Capital Improvement Costs A dditional Capital Improvement Costs	_			_		\$1,562,965.00
Devatering	1		\$50,000.00	L.S.		\$50,000.00
obilization			5%			\$78,148.00
raffic Control Itility Coordination/Relocation			\$5,000.00 \$25,000.00	LS.		\$5,000.00 \$25,000.00
tomwater Management/Erosion Control			5%	6.0.		\$79,148.00
ubtotal Additional Capital Improvement Cost	ts					\$236,296.00
Land Acquisition Costs						\$998,000.00
OW/Easements Subtotal Land Acquisition Costs						\$998,000.00
Other Costs (percentage of Capital Im	provement Costs)			4		
ingineering			15%			\$269,889.00
egal/Administrative Contract Admin/Construction Management			5% 10%			\$89,963.00 \$179,926.00
ontingency			25%			\$449,815.00
ubtotal Other Costs						\$989,593.00
otal Capital Improvement Costs	5					\$3,786,854.00
Maste	er Plan Operation	and Maintenand	e Cost Summan	v		
escription			Quantity	Unit	Unit Cost	Total Annual Cos
	val, erosion at entrance/e:		) 72	LF.	\$1.00	\$72.00
			1	EA	\$670.00	\$670.00
ydraulic Structure Maintenance (e.g. debris remo					\$2,010,00	
Culvert Maintenance (e.g. sediment & debris remo lydraulic Structure Maintenance (e.g. debris remo Detention/WO Maintenance (e.g. sediment & debri fowing (e.g. channels, ponds, etc.)				ACRE	\$2,010.00 \$67.00	\$22,110.00 \$737.00
ydraulic Structure Maintenance (e.g. debris remo etention/WQ Maintenance (e.g. sediment & debri lowing (e.g. channels, ponds, etc.)	is removal, mucking out, tr		t. 11	ACRE		\$22,110.00
ydraulic Structure Maintenance (e.g. debris remo etention/WO Maintenance (e.g. sediment & debri	is removal, mucking out, tr		t. 11	ACRE		\$22,110.00 \$737.00







## **7.2.7.3** WIEDEMAN CREEK – 78<sup>TH</sup> AVENUE

At the upstream end of Poudre River Ranch Phase III at 78<sup>th</sup> Avenue, offsite flow inundates one structure along the west side of 78<sup>th</sup> Avenue. A swale is proposed south of the Poudre River Ranch Phase III development to capture flows east to 78<sup>th</sup> Avenue. The swale, with a five foot bottom, conveys the 100-year existing discharge of 54 cfs at a depth of 2.1 feet. A combination of storm drain and surface flow conveyance will carry the flow north on 78<sup>th</sup> Avenue within the City of Greeley depth criteria.

The north side of the swale will be covered in an reinforcement turf mat to help prevent bank erosion along the channel, further protecting the homes in Poudre River Ranch Phase III.

No known water or sanitary conflicts are anticipated at this location. Location of dry utilities are unknown and should be investigated prior to final design.

The swale was sized for the existing conditions land use scenario. Prior to final design and construction, any development that has occurred upstream of the roadway crossing should be considered to update the design discharge.

**CLICK HERE TO VIEW EXHIBITS** 

### Table 7-14: Wiedeman Creek - 78th Avenue Flood Mitigation

PROJECT :	Sharktooth Bluffs Storm Drainag	e Master Plan				
DRAINAGEWAY :	Wiedeman Creek					
REACH :	78th Avenue					
JURISDICTION :	City of Greeley					
REACH ID:	SKD Conceptual Design	Enter Estimator Nam	e on Project Info	DATE :	6/10/2019	
DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	
Channel Improvements			0111	01111 0001		
Excavation, Low Range		100	C.Y.	\$15.00	\$1,500.00	
Landscaping and Maintenance	morouomonto	100	9.1.	\$10.00	\$1,000.00	
Reclamation & seeding (native grasses)	inprovements	1	ACRE	\$1,340.00	1070.00	
		1	ACRE	\$1,340.00	\$670.00	
Special Items (User Defined)						
	<user defined="" items<="" td=""><td>100</td><td>CY</td><td>\$12.00</td><td>\$1,200.00</td></user>	100	CY	\$12.00	\$1,200.00	
	<user defined="" items<="" td=""><td>6170</td><td>SF</td><td>\$12.00</td><td>\$74,040.00</td></user>	6170	SF	\$12.00	\$74,040.00	
Land Acquisition						
Temporary Easements		1	EA	\$30,000.00	\$15,000.00	
Easement/ROW Acquisition		0.50	ACRE	\$88,000.00	\$44,000.00	
	Master Dias Co. 11	10.10				
	master Plan Capital li	mprovement Cost Su	nmary			
Capital Improvement Costs						
Pipe Culverts and Storm Drains					\$0.00	
Concrete Box Culverts fydraulic Structures					\$0.00 \$0.00	
Channel Improvements					\$1.500.00	
Detention/Water Quality Facilities					\$1,500.00	
Removals					\$0.00	
andscaping and Mainten ance Improvements					\$670.00	
Special Items (User Defined)					\$75,240.00	
Subtotal Capital Improvement Costs					\$77,410.00	
Additional Capital Improvement Co	sts					
Dewatering		\$5,000.00	L.S.		\$5,000.00	
Mobilization		5%			\$3,871.00	
Traffic Control		\$5,000.00	L.S.		\$5,000.00	
Utility Coordination/Relocation		\$5,000.00	L.S.		\$5,000.00	
Stormwater Management/Erosion Control		5%			\$3,871.00	
Subtotal Additional Capital Improvement Co	sts		_		\$22,742.00	
Land Acquisition Costs ROW/Eesements					\$50,000,00	
ROW/Easements Subtotal Land Acquisition Costs					\$59,000.00 \$59,000.00	
Other Costs (percentage of Capital)	mprovement Costs)				\$55,000.00	
Engineering	improvement coata)	15%			\$15,023.00	
.egal/Administrative		5%			\$5,008.00	
Contract Admin/Construction Management		10%			\$10,015.00	
Contingency		25%			\$25,038.00	
Subtotal Other Costs					\$55,084.00	
Total Capital Improvement Cost	S				\$214,236.00	
	Plan Operation and Maint					
Description	manual aragian trac 0 used and	Quantity	Unit	Unit Cost	Total Annual Cos	
Channel Maintenance (e.g. sediment & debris r		etc.) 408	L.F.	\$3.00	\$1,224.00	
Total Annual Operation and Mai	ntenance Cost				\$1,224.00	
Effective Interest Rate					0.00%	
Total Operation and Maintenanc	a Coste Over 50 Veare				\$61,200.00	





## 7.2.7.4 WIEDEMAN CREEK – AMOUR HILL DRIVE

An existing 30 inch storm drain intercepts stormwater runoff from the farm land east of Amour Hill Drive. The shallow unconfined flow from the Wiedeman Family Farm inundates two structures as the stormwater continues west to Amour Hill Drive. The storm drain flow is conveyed west between two residential properties where the flow is discharged into an open channel between N 78th Avenue and Amour Hill Drive. The open channel is conveyed underneath Poudre River Road in a 36 inch storm drain which outfalls in the same open channel as the storm drain in N 78th Avenue. The capacity in the existing storm drain is greatly reduced by the slope of the system, currently less than 0.1 percent.

Improving the slope of the system at Amour Hill Drive will greatly increase the capacity of the system. Relaying the 30 inch storm drain at 0.5 percent as it crosses Amour Hill Drive will collect the majority of the flow. The flow that is not collected in the proposed system will travel overland through a defined channel to Amour Drive.

The improvements also consist of replacing two inlets on Amour Hill Drive, one manhole and relaying 55 ft. of 30inch pipe. It is assumed that utility conflicts will be minimal as the proposed system will be located in the alignment of the existing storm drain. Since this project improves the drainage on the existing system, any changes to future hydrology are not anticipated to impact this proposed improvement.

**CLICK HERE TO VIEW EXHIBITS** 

MA	STER PLAN COST ESTIMAT	E FOR INDIVI	DUAL RE	ACH	
PROJECT :	Sharktooth Bluffs Storm Drainage Master				
DRAINAGEWAY :	Wiedeman Creek	riali			
REACH :	Armour Hill Drive				
JURISDICTION :	City of Greeley				
REACH ID:	SKD Conceptual Design	Enter Estimator Nam	e on Project Inf	DATE :	6/10/2019
					TOTAL
DESCRIPTION		QUANTITY	UNIT	UNIT COST	COST
Pipe Culverts and Storm Drains	1				
Circular Pipes					_
Diameter (in)	Length (ft) No. of Barrels				
30-inch	55 1	55	L.F.	\$121.00	\$6,655.00
Manholes and Inlets Manhole, 6' Dia. (Pipe Dia. = 48'')		4	EA	\$5,762.00	\$5,762.00
Storm Inlet, Type R/Type 14, 5-foot		2	EA	\$6,164.00	\$12,328.00
Special Items (User Defined)		4	EA	40,104.00	\$12,520.00
	<user defined="" items<="" td=""><td>40</td><td>ÚF.</td><td>\$26.00</td><td>\$1,040.00</td></user>	40	ÚF.	\$26.00	\$1,040.00
Asphalt	<user defined="" items<="" td=""><td>33</td><td>TON</td><td>\$250.00</td><td>\$8,250.00</td></user>	33	TON	\$250.00	\$8,250.00
	<user defined="" items<="" td=""><td>30</td><td>LF</td><td>\$78.00</td><td>\$2,340.00</td></user>	30	LF	\$78.00	\$2,340.00
Land Acquisition					
Easement/ROW Acquisition		0.25	ACRE	\$88,000.00	\$22,000.00
	Master Plan Capital Improv	ement Cost Su	nmary		
Capital Improvement Costs					
Pipe Culverts and Storm Drains					\$24,745.00
Concrete Box Culverts					\$0.00
Hydraulic Structures					\$0.00
Channel Improvements					\$0.00
Detention/Water Quality Facilities					\$0.00
Removals					\$0.00 \$0.00
Landscaping and Mainten ance Improvements Special Items (User Defined)					\$0.00
Subtotal Capital Improvement Costs					\$36,375.00
Additional Capital Improvement Co	sts				400,070,00
Dewatering		\$5,000.00	L.S.		\$5,000.00
Mobilization		5%			\$1,819.00
Traffic Control		\$15,000.00	L.S.		\$15,000.00
Utility Coordination/Relocation		\$50,000.00	L.S.		\$50,000.00
Stormwater Management/Erosion Control		5%			\$1,819.00
Subtotal Additional Capital Improvement Co	sts				\$73,638.00
Land Acquisition Costs ROW/Essements					\$22.000.00
Subtotal Land Acquisition Costs					\$22,000.00
Other Costs (percentage of Capital	Improvement Costs)				422,000.00
Engineering		15%			\$16,502.00
Legal/Administrative		5%			\$5,501.00
Contract Admin/Construction Management		10%			\$11,001.00
Contingency		25%			\$27,503.00
Subtotal Other Costs					\$60,507.00
Total Capital Improvement Cost	ts				\$192,520.00
Mostor	Plan Operation and Maintenanc	a Coat Summar			
Description	Fian operation and maintenanc	Quantity	y Unit	Unit Cost	Total Annual Cost
	moval, erosion at entrance/exit, structural repairs	415	L.F.	\$1.00	\$415.00
Manhole and Inlet Maintenance (e.g. sediment & debris re		415	EA.	\$67.00	\$268.00
Channel Maintenance (e.g. sediment & debris r		130	L.F.	\$3.00	\$390.00
Total Annual Operation and Mai					\$1.073.00
Effective Interest Rate					0.00%
Total Operation and Maintenand	e Costs Over 50 Years				\$53,650.00
rotar operation and maintenant	COSIS OVEL OV LEALS				\$55,650.00



### Table 7-15: Wiedeman Creek – Amour Hill Drive



### 7.2.8 FAIRWAY TRIBUTARY

The Fairway Tributary Watershed extends from the Greeley No. 3 Canal south past Dundee Court. The watershed lies within the City of Greeley and unincorporated Weld County. Stormwater runoff is conveyed from the south through Boomerang Links Golf Course north to Poudre River Road in the Poudre River Ranch Phase I development. Runoff is ultimately discharged into the Greeley No. 3 Canal.

Flows near the upstream end of the watershed meander through the golf course converging at the corner of C Street and Melbourne Street. Baseline hydrologic modeling does not account for the unformalized and inadvertent detention on the golf course and indicates overtopping of Melbourne Street at a depth less than 6 inches. Overtopping flows not intercepted by the storm drain inlet at the C Street and Melbourne Street intersection continue north along 71<sup>st</sup> Avenue into the Northridge Draw Watershed.

Runoff from the Wiedeman Family Farm property on the northwest edge of the watershed is conveyed in a northeast direction, crossing Vallevue Drive to the east where flows enter a storm drain crossing Poudre River Road. The storm drain continues north and is flumed in the 36 inch storm drain over the Greeley No. 3 Canal.

### 7.2.8.1 FAIRWAY TRIBUTARY - MELBOURNE STREET

The proposed storm drain system improvements at Melbourne Street include intercepting 67 cfs from Boomerang Links Golf Course south of Melbourne Street. A proposed 42 inch RCP storm drain will convey the discharge into the existing Northridge Draw channel north of C Street.

The improvement requires removal of a portion of the existing storm drain system, resetting the existing inlet laterals at West C Street and 71<sup>st</sup> Avenue, and CDOT Type D inlets to collect water from the fairway.

No sanitary conflicts are known along the proposed alignment. A water line crossing is anticipated in 71<sup>st</sup> Avenue. Dry utilities are unknown for this crossing and should be investigated prior to final design.

Minor channel improvements to the drainageway will be required upstream and downstream of the storm drain system in order to promote drainage.

The culvert was sized for the existing conditions land use scenario. Prior to final design and construction, any development that has occurred upstream of the roadway crossing should be considered to update the design discharge.

	STER FLAN C	OST ESTIMA	TE FOR INDIVI	DUAL RE	ACH	
PROJECT : DRAINAGEWAY :	Fairway Tributary	Storm Drainage Maste	er Plan			
REACH :	Melbourne Street					
JURISDICTION :	City of Greeley	No. alian	Enter Estimator Nam	on Project Info	DATE :	12/19/2018
REACH ID:	SKD Conceptual D	Design	Enter Estimator Nam	e on Project mit	DATE:	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
ipe Culverts and Storm Drains	۶					
Circular Pipes Diameter (in)	Length //tt)	No. of Barrels			1	
42-inch	Length (ft) 50	1 1	50	L.F.	\$169.00	\$8,450.00
18-inch	50	2	100	L.F.	\$72.00	\$7,200.00
Manholes and Inlets						
anhole, 5' Dia. (Pipe Dia. 36" - 42")			1	EA	\$5,226.00	\$5,226.00
orm Inlet, Type R/Type 14, 5-foot			2	EA	\$6,164.00	\$12,328.00
Channel Improvements						
xcavation, Mid Range			150	C.Y.	\$32.00	\$4,800.00
Removals						
emoval of culvert pipe (D<48")			100	L.F.	\$27.00	\$2,700.00
Special Items (User Defined)						
sphalt	<user defined="" item<="" td=""><td>15</td><td>9</td><td>TON</td><td>\$250.00</td><td>\$2,250.00</td></user>	15	9	TON	\$250.00	\$2,250.00
urb and Gutter	<user defined="" item<="" td=""><td></td><td>50</td><td>LF</td><td>\$50.00</td><td>\$2,500.00</td></user>		50	LF	\$50.00	\$2,500.00
ype D Inlet	<user defined="" item<="" td=""><td></td><td>3</td><td>EA</td><td>\$8,500.00</td><td>\$25,500.00</td></user>		3	EA	\$8,500.00	\$25,500.00
and Acquisition						
asement/ROW Acquisition			0.10	ACRE	\$88,000.00	\$8,800.00
oncrete Box Culverts ydraulic Structures hannel Improvements etention/Water Quality Facilities emovals						\$0.00 \$0.00 \$4,800.00 \$0.00 \$2,700.00
errovars andscaping and Maintenance Improvements						
pecial Items (User Defined)						\$0.00
						\$0.00
	sts					\$0.00 \$30,250.00 <b>\$70,954.00</b>
ubtotal Capital Improvement Costs Additional Capital Improvement Co swatering	sts		\$5,000.00	L.S.	_	\$0.00 \$30,250.00 <b>\$70,954.00</b> \$5,000.00
ubtotal Capital Improvement Costs Additional Capital Improvement Co ewatering Iobilization	sta		5%			\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$3,548.00
ubtotal Capital Improvement Costs Additional Capital Improvement Co owatering Iobilization raffic Control	sta		5% \$5,000.00	L.S.		\$0.00 \$30,250.00 <b>\$70,954.00</b> \$5,000.00 \$3,548.00 \$5,000.00
ubtotal Capital Improvement Costs Additional Capital Improvement Co ewatering lobilization affic Control billy Coordination/Relocation	ste		5% \$5,000.00 \$5,000.00			\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$3,548.00 \$5,000.00 \$5,000.00
ubtotal Capital Improvement Costs Additional Capital Improvement Co evadering oblization raffic Control Billy Coordination/Relocation formwater Menagement/Erosion Control			5% \$5,000.00	L.S.		\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$3,548.00
Additional Capital Improvement Costs Additional Capital Improvement Co ewatering loolization raffic Control bility Coordination/Relocation formwater Menagement/Erosion Control			5% \$5,000.00 \$5,000.00	L.S.		\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$3,548.00 \$5,000.00 \$5,000.00
Additional Capital Improvement Costs Additional Capital Improvement Co eventeing biblization afflic Control bibly Coordination/Relocation Cortwaldr Management/Erosion Control ubtota Additional Capital Improvement Co Land Acquisition Costs OW/Easements			5% \$5,000.00 \$5,000.00	L.S.		\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$2,096.00 \$22,096.00 \$2,88.00.00
Additional Capital Improvement Costs Additional Capital Improvement Co ewidering oblication raffic Control bitly Coordination/Relocation commuter Management/Erosion Control ubtotal Additional Capital Improvement Co Land Acquisition Costs OW/Easements ubtotal Land Acquisition Costs	sts		5% \$5,000.00 \$5,000.00	L.S.		\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$5,000.00 \$5,000.00 \$3,548.00 \$22,096.00
Additional Capital Improvement Costs Additional Capital Improvement Co wettering obilization amic Control bibly Coordination/Relocation bibly Coordination/Relocation tormwater Management/Erosion Control ubtotal Additional Capital Improvement Co Land Acquisition Costs OVV/Easements ubtotal Land Acquisition Costs Other Costs (percentage of Capital	sts		5% \$5,000.00 \$5,000.00 5%	L.S.		\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$8,800.00 \$8,800.00
Additional Capital Improvement Costs Additional Capital Improvement Co werkeng oblization affic Control bility Coordination/Relocation cormwater Management/Erosion Control ubtotal Additional Capital Improvement Co Land Acquisition Costs OW/Easements ubtotal Land Acquisition Costs Other Costs (percentage of Capital ngineering	sts		5% \$5,000.00 \$5,000.00 5%	L.S.		\$0.00 \$30,250.00 \$70,954.00 \$5.000.00 \$3,548.00 \$5.000.00 \$3,548.00 \$3,548.00 \$22,096.00 \$8,800.00 \$8,800.00 \$8,800.00 \$13,958.00
Additional Capital Improvement Costs Additional Capital Improvement Co evidence Ibilization raffic Control Ibility Coordination/Relocation Ibity Coordination/Relocation Ibity Coordination/Relocation Ibity Coordinal Capital Improvement Co Land Acquisition Costs OW/Easements Ubitotal Land Acquisition Costs Other Costs (percentage of Capital nginorring egu/Administrative	sts		5% \$5,000.00 \$5,000.00 5% 15% 5%	L.S.		\$0.00 \$30,250.00 \$70,954.00 \$3,544.00 \$3,544.00 \$5,000.00 \$3,548.00 \$2,096.00 \$2,2096.00 \$3,548.00 \$2,800.00 \$3,548.00 \$2,800.00 \$3,548.00 \$4,653.00 \$
ubtotal Capital Improvement Costs Additional Capital Improvement Co wetering obilization affic Control bility Coordination/Relocation formwater Management/Erosion Control ubtotal Additional Capital Improvement Co Land Acquisition Costs Other Costs (percentage of Capital ngineering eggl/Administrative onfract Admin/Construction Management	sts		5% \$5,000.00 \$5,000.00 5% 15% 5% 10%	L.S.		\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$3,548.00 \$22,096.00 \$8,800.00 \$8,800.00 \$4,653.00 \$4,653.00 \$9,305.00
bibtotal Capital Improvement Costs Additional Capital Improvement Co watching obilization affic Control lity Coordination/Relocation comwater Management/Erosion Control bibtotal Additional Capital Improvement Co Land Acquisition Costs DW/Easements bibtotal Land Acquisition Costs Other Costs (percentage of Capital iginoering gal/Administrative antract Admini/Construction Management ontingency)	sts		5% \$5,000.00 \$5,000.00 5% 15% 5%	L.S.		\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$3,548.00 \$5,000.00 \$3,548.00 \$3,548.00 \$22,096.00 \$8,800.00 \$8,800.00 \$8,800.00 \$4,653.00 \$9,305.00 \$3,263.00
Additional Capital Improvement Costs Additional Capital Improvement Cost watering oblization affic Control Ibity Coordination/Relocation crimwater Management/Erosion Control Jubotal Additional Capital Improvement Co Land Acquisition Costs Other Costs (percentage of Cepital Igineoring gal/Administrative ontract. Admin/Construction Management ontingency Jubotal Other Costs	ists Improvement Costs)		5% \$5,000.00 \$5,000.00 5% 15% 5% 10%	L.S.		\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$3,548.00 \$22,096.00 \$8,800.00 \$8,800.00 \$4,653.00 \$4,653.00 \$9,305.00
Additional Capital Improvement Costs Additional Capital Improvement Co wetkening obilization affic Control bibly Coordination/Relocation formwater Management/Erosion Control ubtota Additional Capital Improvement Co Land Acquisition Costs OW/Easements Ubtotal Land Acquisition Costs Other Costs (percentage of Capital ngineering gal/Administrative onfingency ubtotal Other Costs ortal Capital Improvement Cost	improvement Costs)		5% \$5,000.00 \$5,000.00 5% 15% 5% 10% 25%	LS LS		\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$3,544.00 \$5,000.00 \$3,544.00 \$3,544.00 \$3,544.00 \$3,544.00 \$3,544.00 \$3,548.00 \$3,548.00 \$3,548.00 \$3,800.00 \$3,200 \$3,200 \$3,200.00 \$3,2
ubtotal Capital Improvement Costs Additional Capital Improvement Co wetkenng obilization affic Control bibly Coordination/Relocation territy additional Capital Improvement Co Land Acquisition Costs OW/Easements Ubtotal Land Acquisition Costs Other Costs (percentage of Capital ngineering ggl/Administrative ontract. Admini/Construction Management ontract. Admini/Construction Management ontract. Admini/Construction Management ontract. Admini/Construction Management Costal Capital Improvement Costs Otal Capital Improvement Cost Master	improvement Costs)	and Maintenan	5% \$5,000.00 \$5,000.00 5% 10% 10% 25% <b>ce Cost Summar</b>	LS		\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$3,548.00 \$5,000.00 \$3,548.00 \$3,548.00 \$3,548.00 \$3,548.00 \$3,548.00 \$3,548.00 \$3,548.00 \$4,653.00 \$9,305.00 \$4,653.00 \$9,305.00 \$13,958.00 \$1,179.00 \$153,029.00
Additional Capital Improvement Costs Additional Capital Improvement Cost watering Inditization ratin Control bibly Coordination/Relocation tormwater Management/Erosion Control ubtotal Additional Capital Improvement Co Land Acquisition Costs Other Costs (percentage of Capital ontract Admin/Construction Management ontrageJ/Administrative ontract Admin/Construction Management ontingency ubtotal Cher Costs Cotal Capital Improvement Cost Master escription	ists Improvement Costs) ts r Plan Operation		5% \$5,000.00 \$5,000.00 5% 15% 10% 25% <b>ce Cost Summar</b> Quentity	L.S. L.S. Vnit	Unit Cost	\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$3,548.00 \$5,000.00 \$3,548.00 \$3,550.00 \$3
ewstering lobilization raftic Control bility Coordination/Relocation bility Coordination/Relocation bility Coordination/Relocation bility Coordination/Celocation bility Coordination Capital Improvement Coo Land Acquisition Costs Other Costs Other Costs Other Costs Other Costs Total Capital Improvement Cost Total Capital Improvement Cost Costs District Admin/Construction Management Ontingency Ubotal Ubotal State Improvement Costs Total Capital Improvement Costs District Admined Improvement Costs District Costs District Admined Improvement Costs District Admined Improvement Costs District Admined Improvement Costs District Capital Improvement Costs District Co	sts Improvement Costs) ts r Plan Operation moval, erosion at entrar	nce/exit, structural repai	5% \$5,000.00 \$5,000.00 5% 10% 10% 25% <b>ce Cost Summar</b> Quantity r5 100	L.S. L.S. Y Unit L.F.	\$1.00	\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$3,548.00 \$3,550.0
bitotal Capital Improvement Costs Additional Capital Improvement Cost warkening Iobilization famic Control Ibility Coordination/Relocation tormwater Management/Erosion Control ubotal Additional Capital Improvement Cost Land Acquisition Costs Oti/Easements ubotal Land Acquisition Costs Oti/Easements ubotal Land Acquisition Costs Other Costs (percentage of Capital ngineoring egal/Administrative ontract Admin(Construction Management ontract Admin(Construction Management ontract Admin(Construction Management ontract Admin(Construction Management ontract Admin(Construction Management ontract Admin(Construction Management contract Capital Improvement Cost Master escription ubert Maintenance (e.g. sediment & debris rei anhole and Inliet Maintenance (e.g. sediment )	ists Improvement Coste) ts r Plan Operation & debris removal, struct	nce/exit, structural repai	5% \$5,000.00 \$5,000.00 5% 15% 10% 25% <b>ce Cost Summar</b> Quentity	L.S. L.S. Vnit		\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$3,548.00 \$5,000.00 \$3,548.00 \$3,550.0
Additional Capital Improvement Costs Additional Capital Improvement Cost watkeing biblization rathic Control biblity Coordination/Relocation tormwater Management/Erosion Control ubtotal Additional Capital Improvement Cost Control Additional Capital Improvement Cost Other Costs (percentage of Capital outbotal Land Acquisition Costs Other Costs (percentage of Capital outpagnet) ubtotal Other Costs Costal Capital Improvement Cost Master escription Uvert Maintenance (e.g. sediment & debns re anble and Inliet Maintenance (e.g. sediment Total Annual Operation and Mai	ists Improvement Coste) ts r Plan Operation & debris removal, struct	nce/exit, structural repai	5% \$5,000.00 \$5,000.00 5% 10% 10% 25% <b>ce Cost Summar</b> Quantity r5 100	L.S. L.S. Y Unit L.F.	\$1.00	\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$3,548.00 \$5,000.00 \$3,548.00 \$3,500 \$3,268.00 \$3,179.00 \$1,179.00 \$1,179.00 \$1,179.00 \$1,179.00 \$1,179.00 \$1,179.00 \$1,000 \$1,000 \$1,000 \$1,000 \$1,000 \$1,000 \$1,000 \$1,000 \$1,000 \$1,000 \$1,000 \$2,000 \$1,000 \$1,000 \$2,000 \$1,000 \$1,000 \$2,000 \$1,000 \$2,000 \$1,000 \$2,000 \$1,000 \$2,000 \$1,000 \$2,000 \$1,000 \$2,000 \$1,000 \$2,000 \$2,000 \$1,000 \$2,000 \$1,000 \$2,000 \$2,000 \$2,000 \$1,000 \$2,000
bitotal Capital Improvement Costs Additional Capital Improvement Cost warkening Iobilization famic Control Ibility Coordination/Relocation tormwater Management/Erosion Control ubotal Additional Capital Improvement Cost Land Acquisition Costs Oti/Easements ubotal Land Acquisition Costs Oti/Easements ubotal Land Acquisition Costs Other Costs (percentage of Capital ngineoring egal/Administrative ontract Admin(Construction Management ontract Admin(Construction Management ontract Admin(Construction Management ontract Admin(Construction Management ontract Admin(Construction Management ontract Admin(Construction Management contract Capital Improvement Cost Master escription ubert Maintenance (e.g. sediment & debris rei anhole and Inliet Maintenance (e.g. sediment )	Improvement Costs) Improvement Costs) ts r Plan Operation moval, erosion at entrara & debris removal, struct intenance Cost	nce/exit, structural repai tural repairs, etc.)	5% \$5,000.00 \$5,000.00 5% 10% 10% 25% <b>ce Cost Summar</b> Quantity r5 100	L.S. L.S. Y Unit L.F.	\$1.00	\$0.00 \$30,250.00 \$70,954.00 \$5,000.00 \$3,548.00 \$5,000.00 \$3,548.00 \$3,548.00 \$3,548.00 \$22,096.00 \$8,800.00 \$8,800.00 \$4,653.00 \$9,305.00 \$4,653.00 \$9,305.00 \$13,958.00 \$13,959.00 \$13,950.00 \$13,950.00 \$13,950.00 \$13,950.00 \$13,95



### Table 7-16: Fairway Tributary: Melbourne Street



### 7.2.8.2 FAIRWAY TRIBUTARY – CACHE COURT CANAL BASEFLOW SEPARATION

To separate stormwater flow from the Greeley No. 3 Canal, a flume is proposed just west of Cache Court. Conveying the flows over the canal and discharging the stormwater into the open space north of the canal will reduce flows in excess of the decreed flow entering the canal that pose flooding hazards downstream. Improvements to the open space north of the canal include a low flow crossing such that the open space trail is not inundated by nuisance runoff.

A 30 inch sanitary sewer line is present along the north side of the canal. No conflicts are anticipated with this utility as all proposed improvements will be at grade. No known water line conflicts are present. Dry utilities are unknown for this crossing and should be investigated prior to final design.

PROJECT :	Sharktooth Bluffs	Storm Drainage Mast	er Plan					
DRAINAGEWAY :	Fairway Tributary							
REACH :		al Baseflow Separation	1					
JURISDICTION :	City of Greeley							
REACH ID:	SKD Conceptual I	Design	Enter Estimator Name	on Project Inf	DATE:	12/19/2018		
						TOTAL		
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST		
Pipe Culverts and Storm Drains								
Circular Pipes								
Diameter (in)	Length (ft)	No. of Barrels						
36-inch	75	1	75	L.F.	\$145.00	\$10,875.00		
18-inch	30	1	30	L.F.	\$72.00	\$2,160.00		
Flare End Sections					1			
Diameter (in)	Applicable	No. of Barrels						
36-inch	Yes	1	2	EA	\$2,157.00	\$4,314.00		
18-inch	Yes	1	2	EA	\$1,233.00	\$2,466.00		
Manholes and Inlets	10 41	1		<b>E</b> 1	200 400 OC	A40.000.00		
ype P Manhole (Pipe Dia. 48" and larger, deflec	tion > 10 degrees)		2	EA	\$20,100.00	\$40,200.00		
Channel Improvements								
xcavation, Mid Range			50	C.Y.	\$32.00	\$1,600.00		
andscaping and Maintenance In	nprovements							
rail/Path. Concrete (10' Width)			50	L.F.	\$59.00	\$2,950.00		
Capital Improvement Costs pe Oulverts and Storm Drains						\$60,015.00		
on crete Box Culverts						\$0.00		
lydraulic Structures						\$0.00		
Channel Improvements						\$1,600.00		
						\$1,600.00		
Detention/Water Quality Facilities						\$1,600.00		
						\$0.00 \$0.00		
Removals andscaping and Mainten ance Improvements						\$0.00 \$0.00 \$2,950.00		
Detention/Water Quality Facilities Removals andscaping and Maintenance Improvements Special Items (User Defined)						\$0.00 \$0.00 \$2,950.00 \$0.00		
Removals andscaping and Maintenance Improvements Special Items (User Defined) Subtotal Capital Improvement Costs						\$0.00 \$0.00 \$2,950.00		
temovals andscaping and Mainten <i>a</i> nce Improvements ipecial Items (User Defined) iubtotal Capital Improvement Costs Additional Capital Improvement Cost	ts		#F 000.00	1.0		\$0.00 \$0.00 \$2.950.00 \$0.00 \$64,565.00		
removals andscaping and Mainten an ce Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost evadering	ts		\$5,000.00	L.S.		\$0.00 \$0.00 \$2,950.00 \$0.00 \$64,565.00 \$5,000.00		
temovals andscaping and Maintenance Improvements pecial Items (User Defined) tubtotal Capital Improvement Costs Additional Capital Improvement Cost lewatering toblization	ts		5%			\$0.00 \$0.00 \$2,950.00 \$0.00 \$64,565.00 \$5,000.00 \$3,228.00		
temovals andscaping and Maintenance Improvements ipecial Items (User Defined) Jubitotal Capital Improvement Cost Additional Capital Improvement Cost Devadering foblization raffic Control	ts		5% \$5,000.00	L.S.		\$0.00 \$0.00 \$2.950.00 \$0.00 \$64,565.00 \$5,000.00 \$3,228.00 \$5,000.00		
temovals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cos evadering foblication raffic Control Itily Coordination/Relocation	ts		5% \$5,000.00 \$5,000.00			\$0.00 \$0.00 \$2.950.00 \$64,565.00 \$5.000.00 \$3,228.00 \$5,000.00 \$5,000.00		
temovals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost foblization raffic Control Ibity Coordination/Relocation Cormvater Management/Erosion Control			5% \$5,000.00	L.S.		\$0.00 \$0.00 \$2,950.00 \$0.00 \$64,665.00 \$3,228.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$3,228.00		
emovis andscaping and Mainten an ce improvements andscapital second second second second additional Capital Improvement Costs Additional Capital Improvement Cost evalering lobilization raffic Control Bity Coordination/Relocation Bity Coordination/Relocation Cortineter Management/Erosion Control ubtotal Additional Capital Improvement Cost			5% \$5,000.00 \$5,000.00	L.S.		\$0.00 \$0.00 \$2.950.00 \$64,565.00 \$5.000.00 \$3,228.00 \$5,000.00 \$5,000.00		
emovals andscaping and Mainten ance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost evastering Ibblization raffic Control Ibily Coordination/Relocation Ibity Coordination/Relocation tormwater Management/Erosion Control ubtotal Additional Capital Improvement Cost Land Acquisition Costs			5% \$5,000.00 \$5,000.00	L.S.		\$0.00 \$0.00 \$2,950.00 \$0.00 \$64,665.00 \$3,228.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$3,228.00		
emovals andscaping and Maintenance Improvements andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost evarlering lobilization raffic Control libity Coordination/Relocation formwater Management/Erosion Control ubtotal Additional Capital Improvement Cost Land Acquisition Costs OW/Easements			5% \$5,000.00 \$5,000.00	L.S.		\$0.00 \$2.050.00 \$2.950.00 \$0.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$3,228.00 \$5,000.00 \$21,466.00		
emovals andscaping and Mainten an ce Improvements andscaping and Mainten an ce Improvements andscaping and Mainten an ce Improvements and control costs Additional Capital Improvement Costs avadering boblization artific Control bitty Coordination/Relocation formwater Management/Erosion Control ubtotal Additional Capital Improvement Cost Land Acquisition Costs OW/Easements Ubtotal Land Acquisition Costs	ts		5% \$5,000.00 \$5,000.00	L.S.		\$0.00 \$0.00 \$0.00 \$0.00 \$64,565.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$21,466.00 \$0 \$0.00 \$0.00 \$0.00 \$0 \$0.00 \$0 \$0.00 \$0 \$0 \$0.00 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$		
emovals andscaping and Mainten ance Improvements andscaping and Mainten ance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs avareing obdization raffic Control Bitly Coordination/Relocation Bitly Coordination/Relocation tormwater Management/Erosion Control ubtotal Additional Capital Improvement Cost Land Acquisition Costs Otiv/Easements ubtotal Land Acquisition Costs Other Costs (percentage of Capital In	ts		5% \$5,000.00 \$5,000.00	L.S.		\$0.00 \$0.00 \$0.00 \$0.00 \$64,565.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$5,000.00 \$21,466.00 \$0 \$0.00 \$0.00 \$0.00 \$0 \$0.00 \$0 \$0.00 \$0 \$0 \$0.00 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$		
emovals andscaping and Maintenance Improvements andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cos evarlering libity Coordination/Relocation tormwater Management/Erosion Control ubtotal Additional Capital Improvement Cost Land Acquisition Costs Other Costs (percentage of Capital Ir ngineering	ts		5% \$5,000.00 \$5,000.00 5%	L.S.		\$0.00 \$0.00 \$2.950.00 \$64,666.00 \$5.000.00 \$5.000.00 \$5.000.00 \$3.228.00 \$5.000.00 \$3.228.00 \$2.1,466.00 \$0.00 \$0.00		
emovals andscaping and Maintenance Improvements andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Cost additional Capital Improvement Cost Ibity Coordination/Relocation Untotal Additional Capital Improvement Cost Land Acquisition Costs OtW/Easements Ubtotal Land Acquisition Costs Other Costs (percentage of Capital Irr ngineering) egal/Administrative ontract Admin/Construction Management	ts		5% \$5,000.00 \$5,000.00 5% 15% 5% 10%	L.S.		\$0.00 \$0.00 \$2.950.00 \$64,565.00 \$5,000.00 \$3,228.00 \$5,000.00 \$3,228.00 \$3,		
temovals andscaping and Mainten an ce Improvements andscaping and Mainten an ce Improvements andscaping and Kanada and Andrea and An	ts		5% \$5,000.00 \$5,000.00 5% 15% 5%	L.S.		\$0.00 \$0.00 \$2.950.00 \$5.000.00 \$5.000.00 \$5.000.00 \$5.000.00 \$5.000.00 \$2.1466.00 \$0.00 \$12,903.00 \$12,903.00 \$14,301.00		



### Table 7-17: Fairway Tributary - Cache Court Canal Baseflow Seapartion



### 7.2.9 NORTHRIDGE DRAW

On the eastern edge of the basin, Northridge Draw is home to Northridge High School, Winograd K-8, and Northridge Estates. Runoff drains from south to north, passing through the school property to C Street where the existing drainageway continues north onto private property. No formal conveyance is provided north of C Street with flows overtopping 71<sup>st</sup> Avenue to the north at a depth less than six inches into the Foothills Tributary Watershed. At the downstream end of the watershed stormwater runoff is discharged into the Greeley No. 3 Canal.

## 7.2.9.1 NORTHRIDGE DRAW – C STREET AND 71<sup>ST</sup> AVENUE

The proposed storm drain system proposed in the Fairway Tributary discharges into an existing swale north of C Street. The Winograd detention basin also contributes to the existing swale, conveying flow from south of C Street to the north through the 18 inch RCP outlet. The existing drainage swale is proposed to convey flow north to an existing retention pond. The existing swale has drainage capacity to convey the 100-year discharge of 71 cfs. The existing retention pond is proposed to be formalized with the installation of an outlet to the existing pond to convey stormwater through the retention pond. The outlet, a 42 inch RCP, is designed to intercept any runoff in excess of the normal water pool elevation and discharge to the northwest. A CDOT Type D inlet will intercept flow near 71<sup>st</sup> Avenue in a 42 inch RCP storm drain system. The culvert will discharge into an existing drainage swale that will convey flow north to 71<sup>st</sup> Street.

At 71<sup>st</sup> Street, a proposed inlet will collect the 100-year flow of 71 cfs and convey it into a proposed 42 inch storm drain system that will discharge into a drainage swale along the south side of 71<sup>st</sup> Street. The swale will be conveyed under 71<sup>st</sup> Street in dual 2 foot high x 6 foot wide RCBC culverts and into an existing detention pond located at the bend in 71<sup>st</sup> Avenue. Slight regrading of the existing detention basin from Poudre River Drive downstream is proposed to encourage better drainage in the area.

Local drainage combines with the pond outfall flows, increasing the 100-year peak flow to 102 cfs. A 7 foot by 3 foot RCBC flume will be installed at the 100-year water surface elevation in the pond. The flume will convey flows in excess of the outlet structure to the north side of the Greeley No. 3 ditch, separating stormwater runoff from the Greeley No. 3 Canal. On the north side of the canal, flow will travel to 71<sup>st</sup> Street where a proposed 24 inch culvert will increase the drainage capacity of the two existing RCP crossing. East of 71<sup>st</sup> Avenue, the flow is conveyed along the historic flow path in a wetland channel continuing into the Sheep Draw Basin and ultimately the Poudre River.

A CDOT Type D inlet was estimated as the pond outlet to maintain the existing pool elevation in the pond such that the facility is used for stormwater detention beyond the current storage elevations. The sizing of the Type D should be confirmed during final design once survey is available to determine the available head on the inlet to intercept the 100-year discharge. The official water right requirements associated with the existing retention pond should also be investigated prior to implementation.

A water main conflict is anticipated at the 71<sup>st</sup> Avenue crossing as a 16 inch water main is present. Multiple sanitary sewer lines are also present, including a 30 inch sanitary north of the Greeley No. 3 Canal. None of the sanitary utilities are anticipated to be in conflict as the improvements near the Greeley No. 3 Canal are proposed at grade. Dry utilities are unknown and should be investigated prior to final design. Minor channel improvements to the drainageway will be required upstream and downstream of the crossing in order to promote drainage.



CLICK HERE TO VIEW EXHIBITS

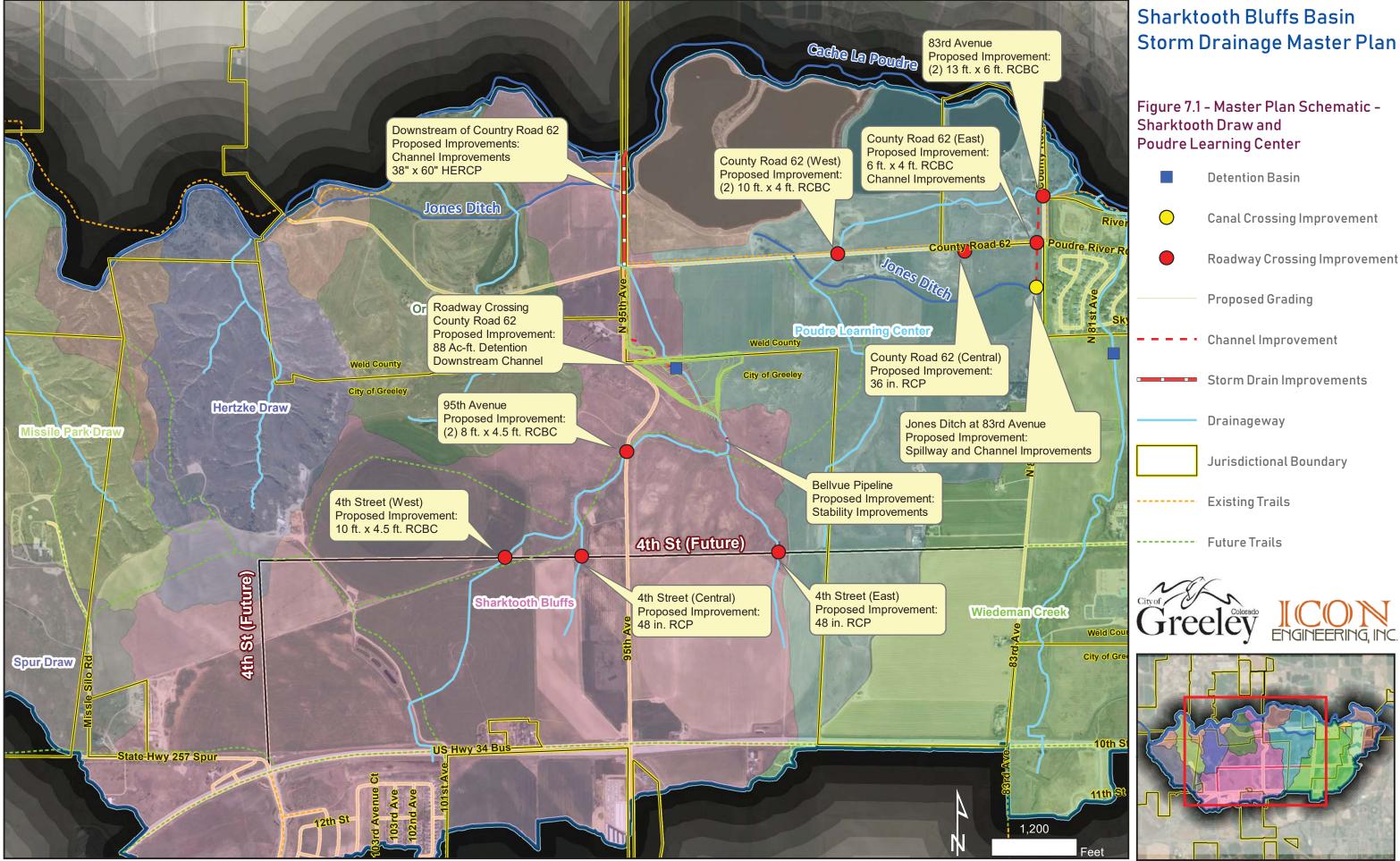


Table 7-18: Northridge Draw: C Street and 71st Avenue

PROJECT :	Sharktooth Bluffs	Storm Drainage Maste	er Plan			
DRAINAGEWAY :	Northridge Draw					
REACH :	71st Avenue and 0	C Street				
JURISDICTION :	City of Greeley					
REACH ID:	SKD Conceptual E	Design	Enter Estimator Nam	e on Project Info	DATE :	12/19/2018
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains			QUANTIT	UNIT	UNIT COST	0001
Circular Pipes	,					
Diameter (in)	Length (ft)	No. of Barrels				1
24-inch	52	1	52	L.F.	\$96.00	\$4,992.00
42-inch	207	1	207	L.F.	\$169.00	\$34,983.00
42-inch	78	1	78	L.F.	\$169.00	\$13,182.00
42-inch	665	1	665	L.F.	\$169.00	\$112,385.00
Flare End Sections			-			
Diameter (in)	Applicable	No. of Barrels				
24-inch	Yes	1	2	EA.	\$1,300.00	\$2,600.00
42-inch	Yes	1	1	EA	\$2,278.00	\$2,278.00
42-inch	Yes	1	1	EA	\$2,278.00	\$2,278.00
42-inch	Yes	1	1	EA	\$2,278.00	\$2,278.00
Manholes and Inlets			-		45 700 00	
Manhole, 6' Dia. (Pipe Dia. = 48")			3	EA	\$5,762.00	\$17,286.00
storm Inlet, Type R/Type 14, 5-foot				EA	\$6,164.00	\$6,164.00
Concrete Box Culverts						
Box Culvert Pipe			-			-
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)			
7	3	2	61	L.F.	\$722.88 \$1.197.98	\$44,096.00 \$110,214.00
Headwall and Toewalls	2	2	92	L.F.	\$1,197.98	\$110,214.00
Individual Box Span (ft)	No. of Barrels	Total Span (ft)	1			1
7	1	9.00	2	EA	\$813.96	\$1.628.00
6	2	15.00	2	EA	\$1,356.60	\$2,713.00
Wingwalls (includes wingwalls on	either side of channel	and concrete apron)				
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels				
7	3	1	2	EA	\$6,827.66	\$13,655.30
6	2	2	2	EA	\$7,484.16	\$14,968.30
Hydraulic Structures						
Sloping Drop Structures						
Height (ft)	Bottom Width (ft)	Yn (ft)				
4	10	0.5	1	EA	\$25,595.02	\$25,595.00
Channel Improvements						
excavation, Mid Range			1000	C.Y.	\$32.00	\$32,000.00
2-inch Riprap, Type M			200	C.Y.	\$80.00	\$16,000.00
Concrete Low Flow Channel			375	L.F.	\$54.00	\$20,250.00
Removals						
Removal of culvert pipe (D<48")			20	L.F.	\$27.00	\$540.00
andscaping and Maintenance	mprovemente					
Reclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00
Special Items (User Defined)				1 ror the	11,010.00	1,010.00
sphalt	d Lines Defined How	-	4	LS	£100.000.00	£100.000.00
Regrade Access Road	<user defined="" item<br=""><user defined="" item<="" td=""><td></td><td>1</td><td>LS</td><td>\$100,000.00 \$75,000.00</td><td>\$100,000.00 \$75,000.00</td></user></user>		1	LS	\$100,000.00 \$75,000.00	\$100,000.00 \$75,000.00
urf Reinforcing Mat	<user defined="" item<="" td=""><td></td><td>3450</td><td>SE</td><td>\$15,000.00</td><td>\$15,000.00</td></user>		3450	SE	\$15,000.00	\$15,000.00
CDOT Type D Area Inlet	<user defined="" item<="" td=""><td></td><td>3450</td><td>EA</td><td>\$8,500.00</td><td>\$59,500.00</td></user>		3450	EA	\$8,500.00	\$59,500.00
Curb and Gutter	<user defined="" item<="" td=""><td></td><td>30</td><td>LF</td><td>\$50.00</td><td>\$1,500.00</td></user>		30	LF	\$50.00	\$1,500.00
Vater line relocation	<user defined="" item<="" td=""><td></td><td>2</td><td>EA</td><td>\$10,000.00</td><td>\$20,000.00</td></user>		2	EA	\$10,000.00	\$20,000.00
and Acquisition		-		-	*10,000.00	410,000.00
emporary Easements			1	EA	\$30,000.00	\$30,000.00
asement/ROW Acquisition			5.00	ACRE	\$88,000.00	\$440.000.00

Master Plan Capital Improve	ment Cost Su	mmary		
Capital Improvement Costs				
Pipe Culverts and Storm Drains				\$198,426.00
Concrete Box Culverts				\$187,275.00
lydraulic Structures				\$25,595.00
Channel Improvements				\$68,250.00
Detention/Water Quality Facilities				\$0.00
Removals				\$540.00
andscaping and Maintenance Improvements				\$1,340.00
Special Items (User Defined)				\$297,400.00
Subtotal Capital Improvement Costs				\$778,826.00
Additional Capital Improvement Costs				
Dewatering	\$7,788.26	L.S.		\$7,788.00
Mobilization	5%			\$38,941.00
Fraffic Control	\$38,941.30	L.S.		\$38,941.00
Jtility Coordination/Relocation	\$38,941.30	L.S.		\$38,941.00
Stormwater Management/Erosion Control	5%			\$38,941.00
Subtotal Additional Capital Improvement Costs				\$163,552.00
Land Acquisition Costs				
ROW/Easements				\$470,000.00
Subtotal Land Acquisition Costs				\$470,000.00
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			\$141,357.00
.egal/Administrative	5%			\$47,119.00
Contract Admin/Construction Management	10%			\$94,238.00
Contingency	25%			\$235,595.00
Subtotal Other Costs				\$518,309.00
Total Capital Improvement Costs				\$1,930,687.00
Master Plan Operation and Maintenance	Cost Summar	Y		
Description	Quantity	y Unit	Unit Cost	Total Annual Cos
Description Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	1002	LF	\$1.00	\$1.002.00
Juivert Maintenance (e.g. searnent & debris removal, erosion at entrance/exit, structural repairs, Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	1002	EA	\$1.00	\$737.00
Viannole and Intel Maintenance (e.g. sediment & debris removal, structural reparts, etc.) Channel Maintenance (e.g. sediment & debris removal, erosion, tree & weed removal, etc.)	1000	L.F.	\$3.00	\$3.000.00
	1000	L.F.:	40.00	
Total Annual Operation and Maintenance Cost				\$4,739.00
Effective Interest Rate				2.00%
Total Operation and Maintenance Costs Over 50 Years				\$148,916.00





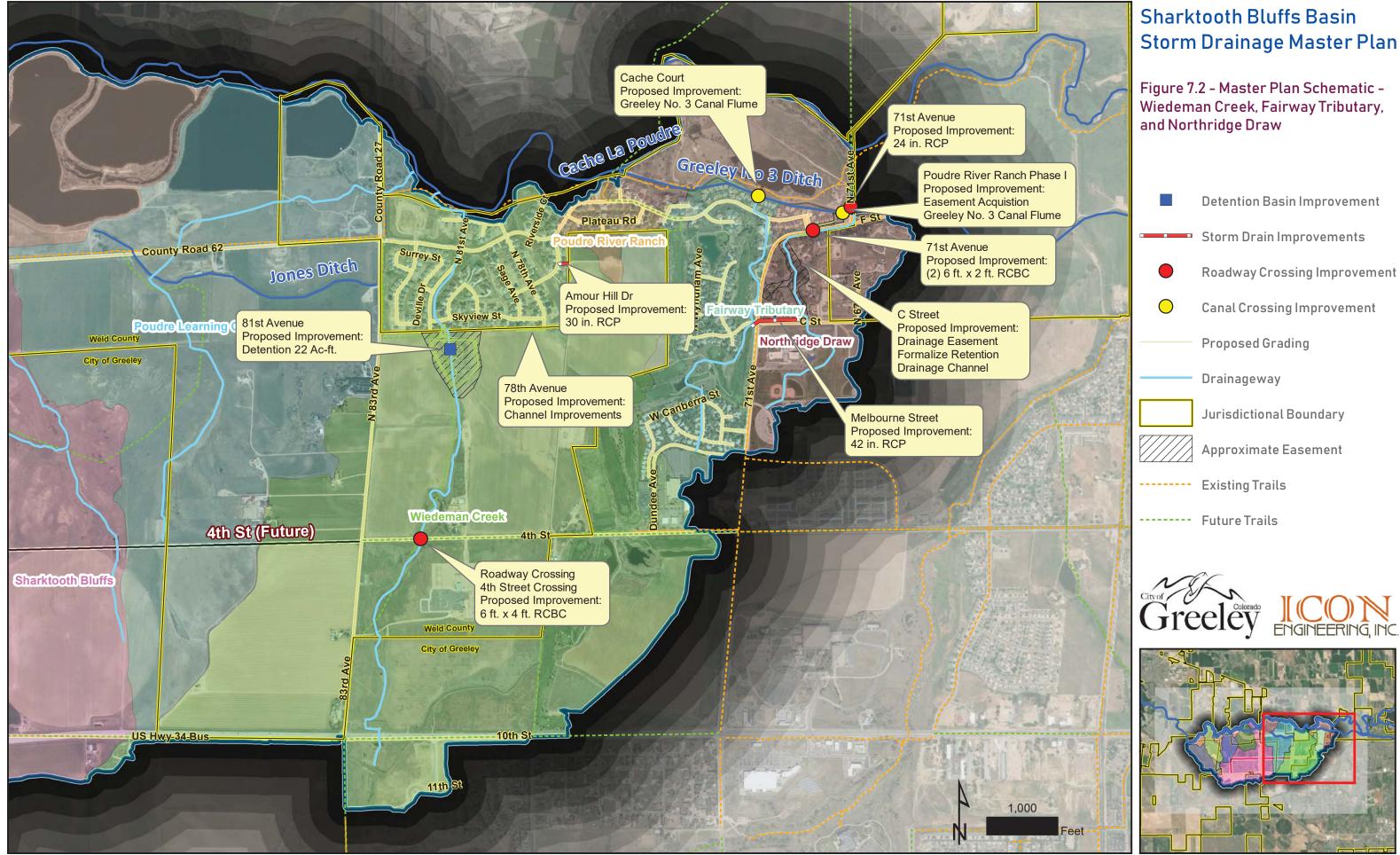


























				Easement	:/		Legal /		Contract		Тс	otal Capital	A	nnual	5	50-year
Watershed	Location	Priority	Capital	ROW		Engineering	Admin	Ad	lmin / CM	Contingency		Cost		0&M		0&M
	Future 4th Street (West) Roadway Crossing	Low	\$ 125,408	\$-		\$ 18,811	\$ 6,270	\$	12,541	\$ 31,352	\$	194,382	\$	50	\$	1,571
	Future 4th Street (Central) Roadway Crossing	Low	\$ 45,134	\$-		\$ 6,770	\$ 2,257	\$	4,513	\$ 11,284	\$	69,958	\$	50	\$	1,571
	Future 4th Street (East) Roadway Crossing	Low	\$ 45,134	\$-		\$ 6,770	\$ 2,257	\$	4,513	\$ 11,284	\$	69,958	\$	50	\$	1,571
Charlite ath Draw	95th Avenue Roadway Crossing	Low	\$ 214,015	\$-		\$ 32,102	\$ 10,701	\$	21,402	\$ 53,504	\$	331,724	\$	120	\$	3,771
Sharktooth Draw	County Road 62 Improvements & Upstream															
	Detention Pond	Medium	\$ 7,626,086	\$ 2,114,00	00	\$ 1,143,913	\$ 381,304	\$	762,609	\$ 1,906,522	\$	13,934,434	\$	90,019	\$ 2	2,828,722
	Bellevue Pipeline Stabilitization	Medium	\$ 79,900	\$-		\$ 11,985	\$ 3,995	\$	7,990	\$ 19,975	\$	123,845	\$	670	\$	21,054
	Total		\$ 8,135,677	\$ 2,114,00	00	\$ 1,220,351	\$ 406,784	\$	813,568	\$ 2,033,921	\$	14,724,301	\$	90,959	\$ 2	2,858,260
	County Road 62 (West) Roadway Crossing	Low	\$ 311,206	\$-		\$ 46,681	\$ 15,560	\$	31,121	\$ 77,802	\$	482,370	\$	100	\$	3,142
	County Road 62 (Central) Roadway Crossing	Low	\$ 38,892			\$ 5,834	\$ 1,945		3,889	\$ 9,723		60,283	\$	50	\$	1,571
Poudre Learning Center	County Road 62 (East) Roadway Crossing	Low	\$ 401,548	\$ 96,80	00	\$ 60,232	\$ 20,077	\$	40,155	\$ 100,387	\$	719,199	\$	2,125	\$	66,775
	83rd Avenue Roadway Crossing	Low	\$ 420,038	\$-		\$ 63,006	\$ 21,002	\$	42,004	\$ 105,010	\$	651,060	\$	160	\$	5,028
	Jones Ditch at 83rd Avenue Canal Baseflow															
	Seperation	Medium	\$ 100,193	\$ 96,80	00	\$ 15,029	\$ 5,010	\$	10,019	\$ 25,048	\$	252,099	\$	1,034	\$	32,492
	Total		\$ 1,271,877	\$ 193,60	00	\$ 190,782	\$ 63,594	\$	127,188	\$ 317,970	\$	2,165,011	\$	3,469	\$	109,008

Table 7-19: Master Plan Cost Estimate Summary

				Ea	sement /			Legal /		Contract			То	tal Capital	A	Annual	ļ	50-year
Watershed	Location	Alternative Type	Capital		ROW	En	gineering	Admin	Ad	dmin / CM	Con	tingency		Cost	l	0&M		O&M
	4th Street Roadway Crossing	Low	\$ 90,415	\$	-	\$	13,562	\$ 4,521	\$	9,042	\$	22,604	\$	140,144	\$	100	\$	3,142
	Skyview Street		\$ -	\$	-	\$	-	\$ -	\$	-	\$	-	\$	-	\$	1,502	\$	47,198
Wiedeman Creek	81st Avenue Detention Basin	High	\$ 1,799,261	\$	998,000	\$	269,889	\$ 89,963	\$	179,926	\$	449,815	\$	3,786,854	\$	23,589	\$ 1	1,179,450
Wiedeman Creek	78th Avenue	High	\$ 100,152	\$	59,000	\$	15,023	\$ 5,008	\$	10,015	\$	25,038	\$	214,236	\$	1,224	\$	61,200
	Amour Hill Drive	High	\$ 110,013	\$	22,000	\$	16,502	\$ 5,501	\$	11,001	\$	27,503	\$	192,520	\$	1,073	\$	53,650
	Total		\$ 2,099,841	\$	1,079,000	\$	314,976	\$ 104,993	\$	209,984	\$	524,960	\$	4,333,754	\$	27,488	\$ 1	1,344,640
Poudre River Ranch	Poudre River Road		\$ -	\$	-	\$	-	\$ -	\$	-	\$	-	\$	-	\$	818	\$	25,705
Phase I and II	Total		\$ -	\$	-	\$	-	\$ -	\$	-	\$	-	\$	-	\$	818	\$	25,705
	Cache Court Canal Baseflow Seperation	Medium	\$ 86,021	\$	-	\$	12,903	\$ 4,301	\$	8,602	\$	21,505	\$	133,332	\$	434	\$	13,638
Foinway Tributany	Melbourne Street	High	\$ 93,050	\$	8,800	\$	13,958	\$ 4,653	\$	9,305	\$	23,263	\$	153,029	\$	301	\$	9,459
Fairway Tributary	Detention North of Melbourne Street		\$ -	\$	-	\$	-	\$ -	\$	-	\$	-	\$	-	\$	702	\$	22,059
	Total		\$ 179,071	\$	8,800	\$	26,861	\$ 8,954	\$	17,907	\$	44,768	\$	286,361	\$	1,437	\$	45,156
Newtheidee Drevu	C Street and 71st Avenue	High	\$ 942,378	\$	470,000	\$	141,357	\$ 47,119	\$	94,238	\$	235,595	\$	1,930,687	\$	4,739	\$	148,916
Northridge Draw	Total		\$ 942,378	\$	470,000	\$	141,357	\$ 47,119	\$	94,238	\$	235,595	\$	1,930,687	\$	4,739	\$	148,916





## 7.3 BENEFIT COST ANALYSIS

A benefit cost analysis was performed to determine the potential benefits of implementing flood mitigation alternatives along North 81<sup>st</sup> Avenue. No other proposed improvements mitigated significant damage on insurable structures warranting a benefit cost analysis.

For the purposes of this analysis, all residential structures were assumed to have finished basements with window openings at ground level. Structure values were obtained from the Weld County Assessor's website. Contents value was assumed to be 50 percent of the structure value. A standard FEMA discount rate of seven percent was used along with the project useful lifetime of 50 years when computing present value of damages.

An Excel spreadsheet was developed to simulate FEMA's calculations of benefit-cost ratio. All flood return intervals (2-, 5-, 10-, 50-, and 100-yr) were accounted for when computing expected annual damages before mitigation for each structure. All proposed alternatives along 81<sup>st</sup> Avenue mitigated flooding from all structures and therefore an expected annual damage after mitigation of zero was used. Expected annual benefits were converted to total project benefits to include damages incurred over the entire lifetime of the project.

As seen below, the benefit-cost ratio for the 81<sup>st</sup> Avenue improvement is 0.04. Although the benefit from mitigating flood damages does not solely justify the project, the proposed improvements at 81<sup>st</sup> accomplish several other project goals such as removing overtopping of roadways in excess of six inches and flooding depths in streets of greater than 18 inches.

### Table 7-20: Benefit-Cost Analysis

81st Avenue Benefit Cost Analys	is	
Expected Annual Damages Before Mitigation	\$	12,728
Expected Annual Damages After Mitigation	\$	-
Expected Annual Benefit	\$	12,728
Total Project Benefits Over Project Useful Life	\$	175,656
Total Project Cost Including Maintenance	\$	4,966,304
Benefit - Cost Ratio		0.04

## 7.4 PRIORITIZATION AND PHASING

In general, drainage improvements should be constructed from downstream to upstream within each watershed, with exception to improvements which may reduce downstream discharges, such as detention basin projects. Proposed improvements were ranked based on: effectiveness in mitigating flood hazards, feasibility of construction, and performance of existing storm drainage infrastructure in the vicinity of each project.

Prioritization and costs of each improvement can be found in Table 7-19.

### 7.4.1 **HIGH PRIORITIZATION**

High priority should be given to any project that mitigates flooding hazards and increases public health and safety. High prioritization was given to projects within Wiedeman Creek to reduce flow into Poudre River Ranch Phase III that inundated structures and exceeded street overtopping and depth criteria. Both the detention facility along 81<sup>st</sup> Avenue and the improvements proposed at Armor Hill Drive would remove structures from being inundated and mitigate flooding hazards on existing systems that do not currently meet City criteria.

Proposed improvements in both Fairway Tributary and Northridge Draw also provide flood protection to homes and businesses were assigned a high priority ranking. Design flows are much less than what are experienced along Wiedeman Creek but do aim at increasing the public health and safety.

### 7.4.2 MEDIUM PRIORITIZATION

Canal baseflow separation projects were assigned a medium priority. Excess storm flow in the irrigation canals can overwhelm the ditches and spill flow out at unknown locations, leading to flooding of downstream structures, land, and streets. Overtopping of the irrigation canals are not known to currently pose flooding hazards to homes and businesses but detailed hydraulic modeling of the irrigation canals was not completed as part of this study.

The improvements along Sharktooth Draw at County Road 62, which include the detention pond, drainage channel and storm drain in 95<sup>th</sup> Avenue have been assigned a medium priority. The downstream channel and storm drain system provide a path for the future 100-year flow to discharge safely to the river; however the existing overland flow paths do not pose hazards to structures.

### 7.4.3 LOW PRIORITIZATION

Roadway crossings designed to enhance the drainage system to meet current City criteria were assigned a low priority. The improved roadway crossings should be made in conjunction with the planned widening of roads and the addition of the future roadways. Development immediately upstream of the proposed crossings should evaluate the need for the crossing at the time of development, as current crossings have a tendency to constrict flow prior to eventually overtopping the roadway. This could lead to an easily avoidable situation in new development. Downstream impacts should also be evaluated with any improved crossing plan.

### 7.4.4 PHASING

The following projects have phasing impacts that need to be considered prior to final design and construction:

- constructed prior to, or in conjunction with, the Jones ditch canal baseflow separation.
- The flood mitigation project at Melbourne Street, in the Fairway Tributary watershed, cannot be installed until the flood mitigation projects in the Northridge Draw watershed have been completed.

## 7.5 STREAM BUFFER WIDTH

In order to ensure the long-term stability of a stream system, a buffer is recommended to be preserved between the stream and anthropogenic influences. In natural streams, the stream belt width or floodplain width often serves as the buffer. The stream belt width is diagrammatically shown in Figure ES 3. Belt width is the lateral distance from the outside edge of one meander to the outside edge of the next meander (Figure 1). Channel meanders shift through time, generally moving in a downstream direction. By preserving the land within the belt width of a stream, one can allow the channel to continue to evolve and change its planform without coming into conflict with human infrastructure.



• The County Road 62 (east) roadway crossing in the Poudre Learning Center watershed needs to be





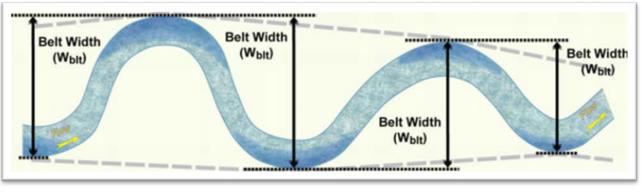


Figure 7.3: Stream Belt Width (Wildland Hydrology, 2013)

Two methods were used to estimate stream belt widths for major drainages within the Sharktooth Basin. The Stream Belt Width method is an empirical procedure based on a relationship of data from stream systems across many physiographical regions, developed by Williams in 1986, this procedure related the meander belt width to channel bankfull width through a power equation. The second method utilized to calculate the ideal stream belt width was based on shear stress. If the shear stress applied on a floodplain by flowing water exceeds the carrying capacity of the floodplain vegetation, the vegetation will be destroyed, and subsequent erosion, scour, and channel avulsions could occur. In order to prevent this, the critical shear stress at which the vegetation will begin to fail was reviewed.

Table	7-21:	Stream	Buffer	Width
-------	-------	--------	--------	-------

	Channel Buffer Width						
Drainageway	Ex. Conditions	Fut. Conditions					
Sharktooth Draw	186	73					
Poudre Learning Center	130 <sup>1</sup>	56					
Wiedeman Creek	119	64					

1-Value adjusted based on Rosgen classification

As shown by the table, the required belt or floodplain width has the potential to change over time with projected hydrology changes from new development. It is recommended that at a minimum, the existing stream belt widths be preserved within the basin to maintain stream health and maximize drainageway resiliency. Belt widths for each drainageway for both existing and future hydrologic scenarios can be found in Figure 7.4.

As development occurs in each watershed, City detention criteria will reduce peak flows along the drainageways. As such, channel buffer widths may reduce accordingly to the future condition widths shown above. It is recommended that this transition be considered after the upstream watershed has reached approximately 80 percent development density. At this time it is also recommended that a more detailed geomorphic study be completed to best determine the appropriate thresholds for the bankfull channel and floodplain areas within the buffer width. Additional design considerations are discussed below.

## 7.6 STREAM MANAGEMENT CORRIDOR

Given an adequate floodplain corridor, natural streams adjust to changing hydrologic and sediment supply regimes, have well-established, healthy riparian corridors that provides bank stabilization, and have increased resiliency to higher flow rates. A healthy stream corridor is comprised of a multi-stage channel that promotes riparian vegetation during smaller flows while providing flood terraces to relieve pressure on the system by allowing higher flows to periodically activate the overbanks. The multi-stage channel allows for energy to dissipate as flow spreads on the floodplain terraces, sediment to flow freely, and promote a healthy biodiversity of vegetation.

As urbanization occurs within a basin, buildings, roadways, and infrastructure often encroach on a stream corridor. Allowable widths and depths of floodplains are often restricted, increasing the velocities and erosive power of flood flows. With development anticipated throughout the Sharktooth Basin in coming years, existing stream corridors should be protected in order to maintain or establish High-Functioning, Low Maintenance (HFLM) stream systems and promote the overall health of the drainageway.

Channel parameters for the stream management corridor were developed using Rosgen stream classifications. Bankfull areas were estimated using regional regression equations developed for the Front Range based on tributary area to each design reach. A Rosgen stream type was assigned to each reach based on the longitudinal slope of the existing drainageway. Reaches ranging between 0.2 percent and 0.4 percent were assigned a Type E, between 0.4 percent and 2 percent assigned a Type C, and greater than 2 percent assigned a Type B stream classification.

A range of bankfull channel dimensions were developed from width to depth ratios based on each stream type. Rosgen Type B and E streams are proposed to have a width to depth ratio of 10-12, while Type C streams were designed to have a width to depth ratio of 18 to 20.

Guidance for other stream parameters such as pool to pool spacing, entrenchment ratio, meander width, and sinuosity for each reach are summarized in Table 7-22, below. These geomorphic parameters were developed from a desktop assessment for planning purposes. An on-site geomorphic analysis will be required prior to development of channel design. The complete geomorphic analysis for each reach can be found in Appendix D.

Several recent stream restoration projects were analyzed to approximate a stream restoration cost per linear foot of drainageway. The unit cost per linear foot was developed to include: earthwork, riffle structures, bank protection, riprap, and other stabilization techniques that might be required. An average cost per linear foot of \$750 was used to estimate future stream restoration costs along Sharktooth Draw, Poudre Learning Center Tributary, and Wiedeman Creek stream reaches. It is recommended that through a City budget, or property reimbursement fees, the costs presented in Table 7-21 be used to plan for future stream restoration needs which may develop as the hydrology changes overtime within each basin. As an alternate, the stream restoration improvements recommended are constructed alongside the new development should the stream corridor be in need of rehabilitation at the time of development.





			Reach Length	Slope	Stream						
Watershed	Design Pt	Area (mi <sup>2</sup> )	(ft)	(ft/ft)	Туре	Width Range	Depth Range	Pool Spacing	Entrenchment Ratio	Meander Width	Cost Estimate
Sharktooth Draw	95th Ave	1.22	4050	0.020	В	9.2 ft - 10.1 ft	0.8 ft - 0.9 ft	38.5 ft - 48.1 ft	Greater than 2.2	20.9 ft - 83.5 ft	\$3,037,500
Sharktooth Draw	Sharktooth Bluffs to CR 62	1.56	2660	0.020	В	10 ft - 10.9 ft	0.9 ft - 1 ft	41.7 ft - 52.2 ft	Greater than 2.2	20.9 ft - 83.5 ft	\$1,995,000
Poudre Learning Center	CR 62 to Poudre	0.47	3900	0.014	С	9 ft - 9.5 ft	0.5 ft - 0.5 ft	46.3 ft - 55.6 ft	Greater than 2.2	74.1 ft - 129.7 ft	\$2,925,000
Poudre Learning Center	DS of Bluffs to CR 62	0.28	2140	0.040	В	5.6 ft - 6.2 ft	0.5 ft - 0.6 ft	23.6 ft - 29.5 ft	Greater than 2.2	11.8 ft - 47.2 ft	\$1,605,000
Wiedeman Creek	4th St. to 81st Ave	1.08	2860	0.022	В	8.8 ft - 9.7 ft	0.8 ft - 0.9 ft	37 ft - 46.3 ft	Greater than 2.2	18.5 ft - 74 ft	\$2,145,000
Wiedeman Creek	10th St to 4th St	0.52	3240	0.020	В	7 ft - 7.6 ft	0.6 ft - 0.7 ft	29.1 ft - 36.4 ft	Greater than 2.2	14.6 ft - 58.3 ft	\$2,430,000

### Table 7-22: Geomorphic Assessment

## 7.7 GEOMORPHIC ROADWAY CROSSINGS

Roadway crossings sized to compliment high functioning streams are safer, more resilient to large flood events, better convey sediment and debris, require less maintenance over time, and also provide better conditions for aquatic passage than traditionally designed crossings. The Urban Drainage and Flood Control District (UDFCD), now operating as the Mile High Flood District, supports this concept but understands that in some cases, site conditions will limit the design.

For new stream crossings within developing areas, and also for the replacement of old structures at already established crossings, geomorphic crossing design should be considered. It is recognized that geomorphic design is not possible for all stream crossing situations. Economically, Geomorphically Sized Crossing (GSCs) are more expensive initially than traditional designs. Additionally, GSCs generally require more space than traditional crossings. Sometimes these or other constraints may limit geomorphic design. In these instances, the reasons why a geomorphic design is not feasible at a particular site, should be clearly demonstrated prior to undertaking a different design approach.

The key principle of GSCs is that rather than being sized primarily on a hydraulic basis where the primary goal is to pass a design discharge, the crossing is sized based on the dimensions and characteristics of the upstream and downstream channel and floodplain. Further information regarding the design of GSCs is available from the UDFCD.

Alongside the GSCs, auxiliary floodplain culverts should be considered as a means of minimizing contraction and expansion of high flows at the crossing, where practical. Many small floodplain culverts function more efficiently than just one large floodplain culvert. Floodplain relief culverts should be sized large enough to allow for maintenance as needed.

## 7.8 WATER QUALITY IMPACTS

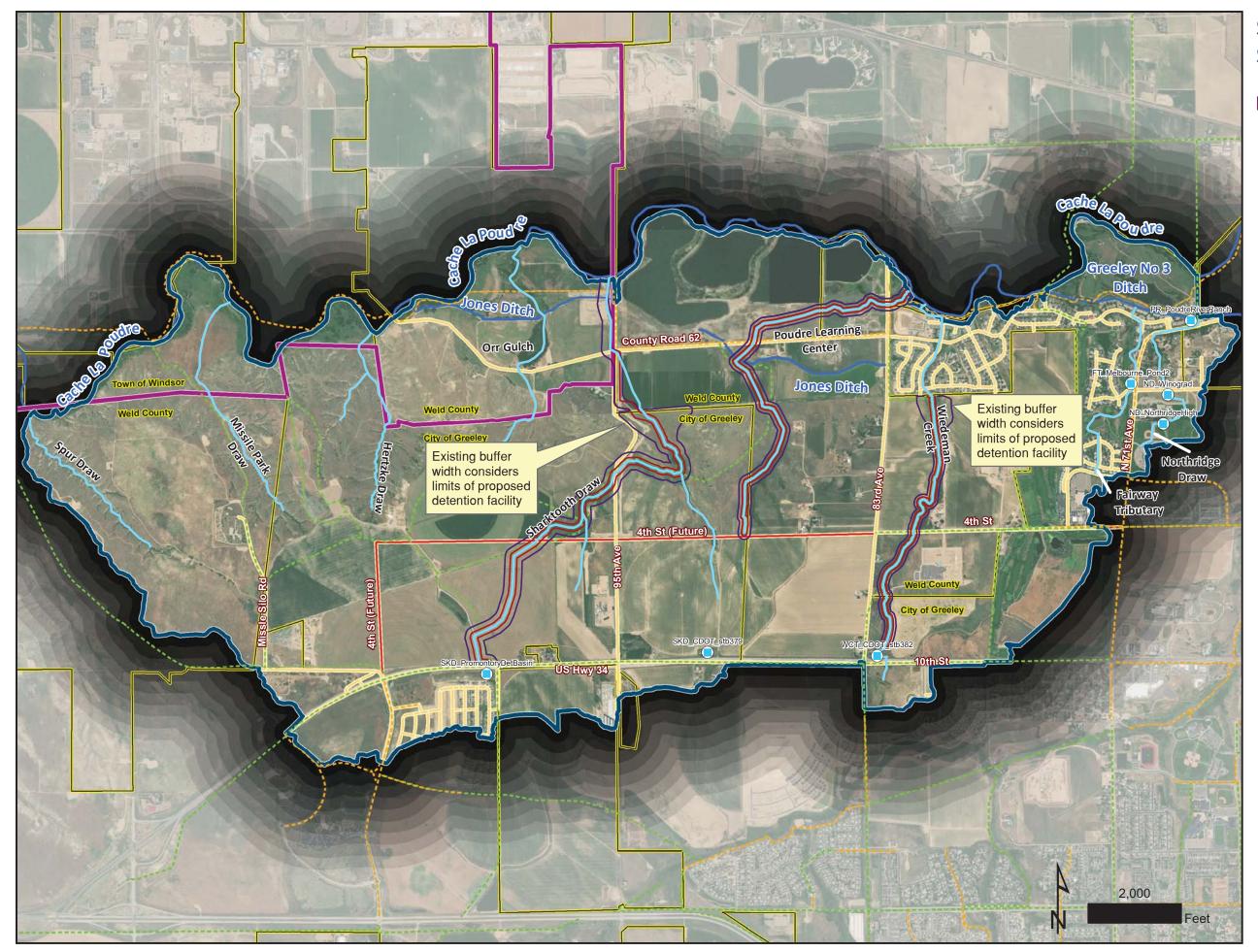
No specific regional water quality improvements are proposed for the Sharktooth Bluffs Basin. Water quality will be provided on a site specific basis throughout the basin as development occurs.

Eroding channel banks also can lead to degradation in water quality throughout a basin. By monitoring the bluffs for erosion and sediment transport, providing adequate channel preservation or restoration, and through the promotion of riparian vegetation, less erosion and sediment transport would be expected to occur, and the overall water quality for the basin would increase.

## 7.9 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. Costs were included on detention facilities for maintenance roads to provide access around the facility.





# Sharktooth Bluffs Basin Storm Drainage Master Plan

Figure 7.4 - Stream Buffer Width

	Existing Detention Basin
--	--------------------------

- Drainageway
- ----- Existing Buffer
- ----- Future Buffer
- ----- Existing Trails
- ----- Future Trails
  - Basin Boundary

Long Range Expected Growth Boundary

Jurisdictional Boundary







### 8.0 REFERENCES

- 1) Urban Drainage and Flood Control District (2016) Urban Storm Drainage Criteria Manual Volume 1 and 2
- 2) Urban Drainage and Flood Control District (2016) CUHP\_Users\_Manual\_2016-09-09
- 3) City of Greeley Public Works (2007 Addendum June 2008), Design Criteria and Construction Specifications Storm Drainage Volume II
- 4) Williams, G. P. (1986). River meanders and channel size. Journal of hydrology, 88(1-2), 147-164.
- 5) Pickett Engineering Company (2001), Final Drainage Report for Boomerang Ranch Subdivision First Filing
- 6) Pickett Engineering Company (1998), Drainage Report for Poudre River Ranch Phase I
- 7) Pickett Engineering Company (1999), Final Drainage Report for Poudre River Ranch Second Filing
- 8) Futura Engineering Company (2001), Addendum to Drainage Report for Boomerang Ranch First Filing
- 9) North Star Design (2002), Drainage and Erosion Control Study for Poudre River Ranch Third Filing
- 10) Westside Investment Partners, Inc. (2008), Lake Bluff Preliminary Planned Unit Development Plan
- 11) City of Greeley (2011), 2035 Comprehensive Transportation Plan
- 12) North Star Design (2016), Final Drainage and Erosion Control Study for River Run at Poudre River Ranch, Second Filing
- 13) Design Workshop, Inc (2016), City of Greeley Parks, Trails and Open Lands
- 14) City of Greeley (2018), Imagine Greeley Comprehensive Plan
- 15) Westside Investment Partners, Inc. (2018) Imagine Greeley Comprehensive Plan





# **APPENDIX A - PROJECT CORRESPONDENCE**





KICK-OFF MEETING SHARKTOOTH BLUFFS MASTER PLAN **CITY OF GREELEY** APRIL 24, 2018 AT 2:00 PM

MINUTES

ATTENDANCE:	Andrew Fisher	City of Greeley
	Craig Jacobson	ICON Engineering
	Jaclyn Michaelsen	ICON Engineering
	Jeremy Deischer	ICON Engineering

### 1) COMMUNICATION

• Progress meetings will be held on a bi-weekly basis in conjunction with the 7<sup>th</sup> Avenue Storm Drainage Final Design. Meetings will between rotate between teleconference meetings and City of Greeley offices.

### 2) PROJECT SCOPE REVIEW:

### a) Data Collection

- The team discussed the GIS data available from the City. ICON had already obtained the GIS data available through the City of Greeley website. The City will provide ICON additional GIS shapefiles for: Land Use, Storm Drain, and Storm Sewer. The land use information includes asphalt, concrete, gravel, hard packed earth, and building footprints that will be used to determine existing imperviousness. The City will also provide ICON recent aerial imagery for the basin.
- The team discussed the future development in the basin. The City zoning shapefile • identifies the area within the City planned for development. No further information is available on these developments at this time and subwatershed boundaries will not be adjusted to account for any future development.
- Several areas of detention were discussed. ICON will provide the City with a list of possible areas to consider for detention in the hydrologic analysis. The City will review the operation and maintenance plan for each facility to ensure that adequate assurances are in place for the detention characteristics to remain and therefore should be included in the master plan hydrology. Once these areas are identified the City will provide the development plans for the detention basins, if available.

### b) Hydrology & Hydraulics

- Craig described different approaches to the SWMM modeling to account for future development in the watershed. The current City of Greeley criteria requires any future development to detain the 100-year post development flows to a 5-year historic level. Craig described conceptual ponds that would be placed in the future development EPA SWMM models that will detain the site runoff to 5-yr historic levels. This will allow the team to have accurate peak flows along the tributaries, while accounting for the increased volume of runoff associated with any future development.
- The SWMM model will include storm drains that are 30-inches or greater in diameter or are hydrologically significant.
- FLO-2D, utilizing a 10-ft grid cell, will be used to evaluate residual flooding in the watershed.
- The irrigation canals will be assumed full in the analysis and will not incorporated in the EPA SWMM model.
- Basins will be named using hydraulic features (ie: Shark Tooth Gulch) and street names. This can be determined by ICON with input from the City.
- After the master plan is completed it will be presented to the community. Input will not be sought from the public since it is a master plan.



- for treatment in the basin.
- is greatly reduced.
- c) Alternatives Analysis
  - provide water quality for the watershed.
  - undeveloped.

### 3) SCHEDULE

The schedule, as originally proposed, was agreed to with no modifications.

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:

Jeremy Deischer ICON Engineering, Inc.

P:\P\18019SBB\03 Meetings\2018 04 24 Sharktooth Kickoff Meeting\Minutes\Sharktooth Bluffs Master Plan Kickoff Meeting Minutes.docx

### MINUTES

 Environmental assessment (water guality) will be focused at the outfall locations in the basin. Urban drainage recommendations for water guality treatment will be consulted

• The City will host a web-site for the project. The City may ask ICON for exhibits. The approach to analyze irrigated farm land should be evaluated further. Since farmland is typically being irrigated during flood season, infiltration during a storm event

• The main goal of the alternatives analysis is to reduce flooding levels on structures and

 The significance of the benefit-cost analysis when evaluating proposed alternatives will be discussed further later on in the project since the basin is predominately

## - END OF MEETING--

April 25, 2018



PROGRESS MEETING SHARKTOOTH BLUFFS MASTER PLAN CONFERENCE CALL MAY 9, 2018 AT 3:30 PM

MINUTES

### **ATTENDANCE:**

City of Greeley Andrew Fisher. Heather Seitz, City of Greeley Craig Jacobson, **ICON Engineering** Jaclyn Michaelsen, ICON Engineering Jeremy Deischer, ICON Engineering

### 1) Hydrology Development

a) ICON provided an overview of the hydrology. Subwatershed delineations were close to being final and basin parameters were beginning to be developed. Names for each tributary in the basin were provided by the City.

### 2) Data Collection Review:

- a) The team reviewed the existing land use shapefiles provided by the City of Greeley. The GIS information included polygon shapefiles for roads, building footprints, sidewalks, and a shapefile called LandUse. It was believe the LandUse shapefile represented hard packed earth. ICON noted information on driveways was not provided in the initial shapefiles. The City will investigate whether the current GIS information exists, and is updated for the basin. If the data does not exist, ICON will investigate whether to create a shapefile and digitize all the information or to digitize a representative section of the basin and apply to developed areas.
- The team discussed how to handle the future land use projections. The City had not been h) able to obtain a shapefile of the Imagine Greeley Land Use Guidance Map. ICON will proceed with digitizing relevant information off of the guidance map. Following the kick off meeting the City provided ICON the Lake Bluff Preliminary Planned Unit Development Plan. The team will develop an area weighted average of the projected land use and apply that to the whole development area. As discussed in the kick off meeting, conceptual detention basins will be placed in the future conditions SWMM model to simulate Greeley criteria of detaining 100-year future development runoff to a 5-year historic levels while considering the additional stormwater runoff volume.
- c) Andrew informed the team he had collected several drainage plans for the developments within the basin and they were in progress of being scanned. These plans will be used to verify drainage patterns not reflected in the 2014 LiDAR and verify outlet structure parameters for any detention basins.
- d) ICON asked the City if they could obtain drainage plans for the State Farm Development and Boomerang Ranch. Both of these developments are south of 10<sup>th</sup> Street and on the southern boundary of the basin.
- e) The team discussed the detention area in the Town of Windsor / Weld County. This area was not identified as a storage basin in the shapefiles provided by the City. ICON will look into whether this area is a dam registered with the State of Colorado. The area also did not appear to affect City of Greeley infrastructure should the inflows not be increased. It will be determined how to handle this area in the future should the site not be accessible.

**PROGRESS MEETING** SHARKTOOTH BLUFFS MASTER PLAN CONFERENCE CALL MAY 9. 2018 AT 3:30 PM

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:

Jeremy Deischer ICON Engineering, Inc.

### MINUTES

### - END OF MEETING--

May 10, 2018



**PROGRESS MEETING** SHARKTOOTH BLUFFS MASTER PLAN **CITY OF GREELEY** MAY 24, 2018 AT 9:00 AM

MINUTES

**ATTENDANCE:** Andrew Fisher. City of Greeley Craig Jacobson, **ICON** Engineering Jaclyn Michaelsen, ICON Engineering Jeremy Deischer, **ICON Engineering** 

### 1) Hydrology Development

- a) ICON provided an overview of the hydrology development for the basin. Subwatershed boundaries have been refined and SWMM model elements are being developed. The rain-ongrid FLO-2D is being used to help guide the subwatershed delineations and SWMM routing.
- Watersheds names will be based off of the tributary shapefile provided by the City.
- c) The team discussed the approach for future land use in areas not within the City. The team decided to use the designations in the Imagine Greeley land use document to determine future land use.

### 2) Data Collection Review:

- a) ICON reviewed the approach taken to the Lake Bluff development. Projected land use has been digitized and an area weighted percent impervious value will be computed for the entire development. When determining future land use the area weighted value will be applied to the entire parcel.
- b) ICON was unable to find any record of the dam on the Broe Land Property in the state records for both jurisdictional and non-jurisdictional land. The City will reach out to a contact at the Town of Windsor to see if they have any information about the property.
- c) ICON scanned and ran the OCR process to make the documents searchable. ICON was beginning to review the documents for any applicable information to be included in the development of the hydrology model.

### 3) Data Request:

- a) The City provided a flash drive containing the basefiles for existing land use. For future land use projections not defined in the City of Greeley Zoning shapefile, ICON will use the projections from the Imagine Greeley document.
- b) The City is in the process of obtaining the drainage reports for Boomerang Ranch, State Farm, and Winograd K-8 and Northridge High School.
- c) ICON asked if the City had any information on the Hertzel Property, located west of Lake Bluff. The area was zoned PUD but was not covered in the development plans for Lake Bluff. The City will inquire about any more information available on the future land use for the area. If no information is available, the Imagine Greeley future land use document will be used.

**PROGRESS MEETING** SHARKTOOTH BLUFFS MASTER PLAN CITY OF GREELEY MAY 24, 2018 AT 9:00 AM

### 4) Schedule:

meetings. The baseline hydrology report will be submitted by June 29<sup>th</sup>.

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:

Jeremy Deischer ICON Engineering, Inc.

### MINUTES

a) Draft SWMM results and existing conditions inundation mapping will be presented at the two

### - END OF MEETING--

May 25, 2018



**PROGRESS MEETING** SHARKTOOTH BLUFFS MASTER PLAN CONFERENCE CALL JUNE 7, 2018 AT 9:00 AM

MINUTES

### **ATTENDANCE:**

Andrew Fisher. City of Greeley Heather Seitz, City of Greeley Craig Jacobson, **ICON Engineering** Jaclyn Michaelsen, ICON Engineering Jeremy Deischer, **ICON Engineering** Wyatt Reis, ICON Engineering

### 1) Basin Boundaries Review

- a) ICON provided an overview of the hydrology basin extents, providing reasoning for development for the basin boundaries due to existing topography and storm systems along the southern boundary.
- b) The team discussed the use of Greeley No. 3 Canal as the basin outflow for select subwatersheds that currently drain into the canal. While delineating subwatersheds, all irrigation canals were assumed full and provided no conveyance during the design storm. The team decided although the canal was assumed full in the hydrology development, the outfall locations for the eastern Poudre River Ranch subwatershed would be the Greeley No. 3 Canal.

### 2) Detention Facilities Review

- a) The team reviewed areas where ICON identified possible detention to consider in the hydrologic model. Any basin that only provides water quality would not be considered in the model. The City was going to look into whether adequate assurances could be made for the maintenance of the detention areas and whether to include them in the hydrologic model. The team agreed to use a survey grade GPS unit to gather elevation information on the detention facilities.
  - Promontory Will be considered for this study
- CDOT Ponds The City will see what information is available on these detention basins ii. and whether there are enough assurances they will remain and be maintained into the future to consider in the hydrologic models.
- Boomerang Golf Course ICON asked Greeley if they knew about the 8" pipe running iii. from the sump area at 4<sup>th</sup> Street and Dundee Street into the field northwest of Dundee Ave and 4th St. Greeley recalled recent work in that area but needed to look into the scope of that work.
- Boomerang Run South Will be considered for this study iv.
- Boomerang Run North The Poudre River Ranch drainage report states this basin ν. provides detention.
- North Ridge High School The City hasn't been able to obtain the drainage report for the vi. area but the basin will be considered in the hydrologic model.
- Poudre River Ranch PUD 1A The drainage report notes both water quality and vii. stormwater detention is provided.
- Poudre River Ranch Phase 2 & 3 All 3 basins in the Poudre River Ranch Phase 2 & 3 viii. developments are water quality and will not be considered for the hydrologic model.
- Broe Land Prior to the meeting, Andrew provided the team with information he had ix. obtained from Kellie Bauer (Colorado DNR Dam Safety Engineer), Craig Stith (Great Western Industrial Park PM/Omnitrax), Doug Roth (City of Windsor Floodplain Administrator). Diana Aungst (Weld County Floodplain Administrator), and Mark Simpson (Colorado DNR Water Commissioner) about the property. No one had any knowledge the

P:\P\18019SBB\03 Meetings\2018 06 07 Progress Meeting\Minutes\Sharktooth Bluffs Master Plan Progress Meeting Minutes - June 7.docx

riahts.

## 3) Basin Parameters Review

- a) Existing Land Use
- i. development to determine the impervious area.
- ii. impervious.
- b) Future Land Use
- i. project land use, and the Imagine Greeley document.
- c) Soils

### 4) SWMM Routing Elements

each flow split that will be used in the FLO-2D model.

### 5) Schedule:

- storm drains or storm drains 30-inches in diameter or greater.
- b) At the next meeting, hydrologic results will be reviewed.

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.

wyatt Resy

Minutes prepared by:

Wyatt Reis ICON Engineering, Inc.

P:\P\18019SBB\03\_Meetings\2018\_06\_07 Progress Meeting\Minutes\Sharktooth Bluffs Master Plan Progress Meeting Minutes - June 7.docx

### MINUTES

area was designed to detain stormwater runoff or was registered as a dam or had water

The team discussed inaccuracies and missing information found in the existing land use shapefiles due to recent development in the watershed. It was decided to forgo completing the existing land use layer shapefiles and instead use representative sections of each

The "hard pack" areas, such as the golf course, were decided to be modeled at 20%

Future conditions land use will use a combination of City Zoning shapefiles, Lake Bluff

The team discussed how to handle the saturated soils associated with the irrigated farm land. For the existing condition, ICON will identify areas that appear as irrigated farm land and conservatively reduce the soil infiltration to a level associated with soil type C/D.

a) For two areas south of County Road 62, ICON will be run a FLO-2D model to define a trans basin flow split. A range of steady state discharges will be used to generate a rating curve for

a) ICON will schedule King Surveyors to collect invert information on hydrologically significant

### - END OF MEETING--

June 7, 2018



**PROGRESS MEETING** SHARKTOOTH BLUFFS MASTER PLAN CONFERENCE CALL JUNE 21, 2018 AT 11:00 AM

MINUTES

### **ATTENDANCE:**

Andrew Fisher. City of Greeley Heather Seitz, City of Greeley Craig Jacobson, ICON Engineering Jaclyn Michaelsen, ICON Engineering Jeremy Deischer, ICON Engineering

### 1) Basin Boundaries Review

a) ICON reviewed the revisions to the basin boundaries following the previous progress meeting. Subwatersheds for the CDOT detention basins were delineated and routing elements were added to the SWMM model. Subwatershed boundaries were adjusted near C Street to account for two inlets on the south side of the street that intercepts flow back to the detention basin near Winograd K-8 School. Any flow not intercepted by these inlets will continue north into the drainageway on private property.

### 2) Detention Facilities Survey Review

- a) On Monday June 18<sup>th</sup>, Wyatt completed their survey of the detention facilities in the watershed. Jeremy reviewed each facility and the outlet structure characteristics of each detention facility.
- i. While gathering the survey information, Wyatt visited the area south of 4<sup>th</sup> Street and Dundee Ave to determine if there was any other stormwater infrastructure other than the 8inch diameter pipe in the GIS shapefile. No other infrastructure was seen on the site visit and the area will be modeled as a sump with the 8-inch pipe conveying flows to the west.
- ICON reviewed the outlet structure of an area on the Boomerang Links Golf Course. ii. Andrew informed the team the area used to be drained by perforated pipe conveying flows to the north to C Street. The perforated pipe was believed to be causing groundwater issues for local residents and has been capped.

### 3) Survey of Existing Storm Drain

a) ICON has contacted King Surveyors to collect information on storm drains with diameters 30 inches and larger. King is currently scheduled to collect information on July 9<sup>th</sup> and July 11<sup>th</sup>.

### 4) Hydraulic Modeling Approach

Minutes prepared by:

a) The team discussed the approach to the FLO-2D hydraulic modeling. The FLO-2D model will be broken into 3 separate areas to increase the stability and run time of the model.

### - 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.

Jeremy Deischer ICON Engineering, Inc.

June 25, 2018

P:\P\18019SBB\03\_Meetings\2018\_06\_21 Progress Meeting\Minutes\Sharktooth Bluffs Master Plan Progress Meeting Minutes - June 21.docx



**PROGRESS MEETING** SHARKTOOTH BLUFFS MASTER PLAN CONFERENCE CALL AUGUST 2, 2018 9:00 AM

### **ATTENDANCE:**

Andrew Fisher. Heather Seitz, Craig Jacobson, Jaclyn Michaelsen, Jeremy Deischer, Wyatt Reis,

### 1) Data Collection and Review

- discuss internally and update ICON of any additional information available.

### 2) Future Land Use

the future imperviousness shapefile.

### 3) Existing SWMM Model

- information from King Surveyors.
- equal split at all design flows.

### 4) Existing Residual Flood Mapping

subwatershed.

### 5) Future Conditions SWMM Model

### 6) SWMM Peak Discharge Comparison

P:\P\18019SBB\03 Meetings\2018\_08\_02 Progress Meeting\Minutes\Sharktooth Bluffs Master Plan Progress Meeting Minutes - August 2.docx

### MINUTES

City of Greeley City of Greeley **ICON Engineering ICON** Engineering **ICON** Engineering **ICON** Engineering

a) ICON provided an overview of invert information for the storm drain pipe from King Surveyors. There were a few locations in Poudre River Ranch that the initial survey information reported adverse pipe slopes. ICON will verify with King that the report depths are accurate. b) ICON asked the City if any additional information for the pond on Boomerang Links Golf Course was available. It was unclear based on the field inspection by ICON whether this facility served as detention and should be considered in the hydrologic model. The City will

a) ICON reviewed the future land use shapefile to be used when developing future percent imperviousness for each subwatershed. The shapefile was a combination of City of Greeley Zoning shapefile and the Imagine Greeley plan. The shapefile did not include any right-of-way for 10<sup>th</sup> Street. ICON will edit the shapefile to account for the existing extents of 10<sup>th</sup> Street in

a) The existing SWMM model was reviewed after incorporating all of the storm drain invert

a) The diversion curves for Sharktooth Draw and Poudre Learning Center were reviewed. A FLO-2D model with steady state discharges was created to generate a tabular rating curve that could be placed into SWMM. The diversion in Sharktooth predominately conveyed flow west at lower discharges, while at high flows the diversion was more evenly split between the western and east flow path. The Poudre Learning Center diversion was approximately an

a) The existing conditions FLO-2D results were reviewed. Both the rain-on-grid and CUHP hydrology models will be presented in the report. The rain-on-grid model provided more information about general flow paths within each subwatershed while the CUHP hydrology FLO-2D model used same basin runoff as in the SWMM at the design point of each

a) The team reviewed the approach to generate the future conditions SWMM model. City criteria requires any future development to detain the developed 100-year peak flow rate to the historic 5-year. Conceptual detention basins were inserted into each subwatershed with the possibility of future development to restrict the outflow to the existing 5-year discharge.



**PROGRESS MEETING** SHARKTOOTH BLUFFS MASTER PLAN CONFERENCE CALL AUGUST 2, 2018 9:00 AM

MINUTES

a) Comparisons at several design points were reviewed for the 10-, and 100-year for the existing and future conditions model. In general, the future detention in the watershed reduces the peak flow rates when comparing future conditions land use to existing.

### 7) Schedule

a) ICON will submit the Baseline Hydrology Report by the next progress meeting on August 16<sup>th</sup>.

### - 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:

Jeremy Deischer ICON Engineering, Inc. August 3, 2018



**PROGRESS MEETING** SHARKTOOTH BLUFFS MASTER PLAN CONFERENCE CALL AUGUST 16, 2018 9:00 AM

### **ATTENDANCE:**

Andrew Fisher. Craig Jacobson, Jaclyn Michaelsen, Jeremy Deischer,

### 1) Integrated SWMM / FLO-2D Model Review

the team in evaluating alternatives more efficiently in the next phase of the project.

### 2) Review Draft Baseline Hydrology and Hydraulics Report

- detention to meet City criteria as the basin develops.
- 3) Schedule
  - for comments.

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:

Jeremy Deischer ICON Engineering, Inc.

P:\P\18019SBB\03\_Meetings\2018\_08\_02 Progress Meeting\Minutes\Sharktooth Bluffs Master Plan Progress Meeting Minutes - August 2.docx

16.docx

### MINUTES

City of Greeley **ICON Engineering ICON Engineering ICON Engineering** 

 A coupled FLO-2D / SWMM was used to analyze the residual flooding throughout the basin. FLO-2D computes the routing calculations for the overland flow while SWMM is used for closed conduit calculations. Discharge is transferred between the models at each time step based on the water surface elevation at each inlet and outlet node. This approach will assist

• The team reviewed the format of the draft baseline report. Each section of the report and report figure was reviewed. The report will include FLO-2D figures for both the rain-on-grid analysis and the baselines conditions analysis for the 10-year and 100-year design storm. An additional figure will be added to the report to show where and the required volume for future

ICON will finalize the draft baseline hydraulics and hydrology report and will submit to the City

### - END OF MEETING--

August 20, 2018



**PROGRESS MEETING** SHARKTOOTH BLUFFS MASTER PLAN CONFERENCE CALL AUGUST 30, 2018 9:00 AM

MINUTES

### **ATTENDANCE:**

Andrew Fisher. City of Greeley Heather Seitz, City of Greeley Craig Jacobson, ICON Engineering Jaclyn Michaelsen, ICON Engineering Jeremy Deischer, **ICON Engineering** Wyatt Reis, ICON Engineering

### 1) Survey

- King Surveyors resurveyed the two areas which were originally identified to have inverse slopes. The area to the north of Poudre River Rd and Vallevue Dr was determined to have a minimal, but positive slope to the north. The other area in question, west of Cache Ct on Poudre River Rd, was determined to have no change in elevation between the invert and outlet, instead of the inverse slope which was originally surveyed.
- King Surveyors notified us of an error in the eastern portion of their data which they have now corrected. In this area, a majority of the points were affected by a conversion error which produced uniformly incorrect elevations. These elevation corrections will be incorporated into the final baseline hydrology model.

### 2) Boomerang Links Pond

 The pond on the north end of Boomerang Links Golf Course was determined to be a retention pond for the golf course and thus will not be included in the baseline hydrology.

### 3) Overview of Baseline Hydrology and Hydraulics Report

• ICON provided a chapter by chapter overview of the draft Hydrology and Hydraulics report. Design flows for existing and future conditions land use at key locations throughout the basin were reviewed. In general, due to City criteria requiring detention in areas of future development, a reduction in peak discharge was observed from existing to future conditions. The team reviewed the approximate detention volumes for each subwatershed that would be required to meet City criteria of detaining the developed 100-year peak discharge to the historic 5-year peak discharge.

### 4) Submit Baseline Hydrology and Hydraulics Report

• ICON will provide the baseline report to the City of Greely on Friday, August 30<sup>th</sup>.

### - 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:

wyatt Resig

Wyatt Reis ICON Engineering, Inc.

September 7, 2018

\\ICON-2K12B\Projects\P\18019SBB\03\_Meeting\2018\_08\_30 Progress Meeting\Minutes\Sharktooth Bluffs Master Plan Progress Meeting Minutes - August 30.docx



**PROGRESS MEETING** SHARKTOOTH BLUFFS MASTER PLAN **CITY OF GREELEY** SEPTEMBER 13, 2018 9:00 AM

### **ATTENDANCE:**

Andrew Fisher. Heather Seitz, Craig Jacobson, Jaclyn Michaelsen, Jeremy Deischer,

### 1) Discussion of Baseline Hydrology Comments:

- Comment 5:
  - was included in the analysis for Sharktooth Bluffs.
- Comment 8:
- Comment 18:
  - estimate of when the 10<sup>th</sup> Street improvements occurred.
- Comment 25:
  - expected long term growth area.
- Comment 27, 29, 30, 39
  - expected growth area shapefiles.
- Comment 42:
  - water conditions.
- Comment 45:
  - floodplain / floodway is warranted.
- Comment 57:
  - problem area identification of alternative analysis.

\\ICON-2K12B\Projects\P\18019SBB\03\_Meeting\2018\_09\_13 Progress Meeting\Minutes\Sharktooth Bluffs Master Plan Progress Meeting Minutes - September 13.docx

### MINUTES

City of Greeley City of Greeley **ICON Engineering** ICON Engineering **ICON** Engineering

 The figures will be revised or an additional figure included displaying the original Bity basin boundaries and the additional area originally within the Sheep Draw Basin that

• The report will be revised to include a reference to the City of Greeley Comprehensive Transportation Plan as the source of the projected population growth within the City.

 ICON estimated the 10<sup>th</sup> Street improvements were constructed ~2006 based on historical aerials from Google Earth. Andrew mentioned the 10<sup>th</sup> Street improvements were in conjunction with the relocation of the POW camp columns. ICON will investigate what information about the column relocation is available for a better

o A table will be added to the report showing the existing percentage of each watershed within the City of Greeley and what percentage of each watershed is within the

• The figures will be revised to include the future trails alignment, and long term

• The team discussed the approach to determining the maximum pipe capacity for existing infrastructure. The baseline SWMM model, using normal depth pipe capacity, was used to determine the maximum flow for existing infrastructure. During the alternative analysis, pipe capacity analysis will be refined based on headwater and tail

• The team discussed several options the City has to regulate Sharktooth Draw and Wiedeman Creek and whether to pursue developing a floodplain / floodway on these drainageways. ICON will develop a high hazard shapefile for the City to review showing all areas were the product of flow depth and velocity exceed seven. After review of this analysis the team will discuss further whether the pursuit of a regulatory

 ICON will identify areas within the watershed that exceed the City's criteria of 18 inches of depth during the 100-year storm. These areas will be discussed further during the



### PROGRESS MEETING SHARKTOOTH BLUFFS MASTER PLAN CITY OF GREELEY SEPTEMBER 13, 2018 9:00 AM

MINUTES

### 2) Schedule

• The comments from the Draft Baseline Hydrology Report will be incorporated into the Alternative Analysis Report and will not require a resubmittal of the Baseline Hydrology Report.

## - 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:

lenomy lischer

Jeremy Deischer ICON Engineering, Inc.

September 16, 2018

No.	YOUR NAME (last name, first name)	SECTION #	PAGE	LINE	СОММЕНТ	S, R, E (Substantive, Requested, Editorial)	A, R, C (Accepted, Rejected with explanation, Needs Clarification)	RESPONSE (by consultant)
2	Fisher, Andrew Fisher, Andrew	Cover Letter Cover Letter	1	Title 3	Correct name of project Revise 71st Street to 71st Avenue	E	A A	Name has been corrected Comment addressed
3	Fisher, Andrew	Cover Letter	i	4	Please specifiy Highway 257 is to the west.	E	A	Comment addressed
4	Fisher, Andrew	Introduction	1		Some reports seem to be missing that were evaluated and incorporated at some level, including the State Farm Development, Promontory, Boomerang Ranch, River Run, 1st Filing, the 2035 Comprehensive Transportation Plan, and City of greeley Parks and Trails Master Plan. Some of these are mentioned in the report and definitely should be listed here.	R	A	reports have been aded to table
5	Fisher, Andrew	Study Area Description	3	2.1	This study revises the boundary between West Poudre (now Sharktooth) and Sheep Draw basins. Please reference the Comprehensive Drainage Plan for Sheep Draw Basin (ACE, 2006), and identify which tributaries and subbasins have been incorporated in this report that were addressed in that report. Add pertinent discussion and any comparison in data between the 2006 report and your findings, if any exist.	S	A	As discussed in the progress meeting the Sheep Draw Plan boundary will b added to the exhibit. No detailed analysis was included in the Sheep Draw Plan to be compared to this stud
6	Fisher, Andrew	Study Area Description	3	2.1	Please add to this report the assumption that irrigation ditches were considered to be full and unavailable for storm drainage conveyance, as the City does not desire to count on conveyance capacity of irrigation structures for storm runoff protection. Maybe this should occur in 3.5.2	R	A	Added to section 3.5.2
7	Fisher, Andrew	Study Area Description	3	2.1	Please identify total area in City of Greeley now and how tota area within Long-Range Growth Boundary of Greeley	R	Α	Comment addressed
8	Fisher, Andrew	Study Area Description	3	2.1	Do you have a source for Greeley's expected population growth? I could provide one if needed.	R	А	2035 Transportation Plan
9	Fisher, Andrew	Study Area Description	3	2.1	Please reference 2035 Transportation Plan regarding 83rd Ave and 4th Street	R	A	Comment addressed
10	Fisher, Andrew	Missile Park Draw	4	2.3.2	Revise to gullies and converge as noted	E	Α	Comment addressed
11	Fisher, Andrew	Missile Park Draw	4	2.3.2	Revise spelling of Missile in photo caption	E	Α	Comment addressed
12	Fisher, Andrew	Missile Park Draw	4	2.3.2	Please specify rationale for assumption Missile Park Draw is not expected to develop. Clarify if comment is in regards to the draw itself or entire sub-basin contributing to Missile Park Draw	R	A	Missle Park Draw basin is not expecte to develop due to the open space zoning assignment
13	Fisher, Andrew	Missile Park Draw	4	2.3.2	Add comma as noted	E	А	Comment addressed
14	Fisher, Andrew	Hertzke Draw	4	2.3.3	Hertzke Draw is referred to as a basin, all others as watershed. Please use consistent terminology	E	А	Comment addressed
15	Fisher, Andrew	Orr Gulch	4	2.3.4	Please reword last sentence for clarity	E	A	Comment addressed
16	Fisher, Andrew	Sharktooth	4		Acreage of Sharktooth Draw not listed. Please add.	R	А	Comment addressed
10	Fisher, Andrew	Draw Sharktooth	5	2.3.5	Revise commas as noted	E	A	Comment addressed
18	Fisher, Andrew	Draw Wiedeman	5	2.3.7	If you have a ballpark time for when 10st Street	R	A	POW Camp Pillars moved in 2005 fo
10	Fisher, Andrew	Creek Wiedeman	5	2.3.7	Improvements were completed, add this. Please add additional detail to the water quality basin or use	R	A	these improvements Comment addressed
20	Fisher, Andrew	Creek Poudre River Ranch	5	2.3.8	the indefinite article to refer to it. Erroneous Foothills reference	E	A	Comment addressed
21	Fisher, Andrew	Tributary Poudre River Ranch Tributary	5	2.3.8	Please add acreage of this watershed	R	A	Comment addressed
22	Fisher, Andrew	Fairway Tributary	5	2.3.9	Please add comma as noted	E	А	Comment addressed
23	Fisher, Andrew	Northridge	5	2.3.10	Please write as easternmost	E	A	Comment addressed
24	Fisher, Andrew	Draw Northridge	5	2.3.10	Please add acreage of watershed	E	А	Comment addressed
25	Fisher, Andrew	Draw Outfall Descriptions	6	2.3	Please add a table showing the tabular properties of each watershed, including size, area withing City of Greeley currently and area in future long-range growth boundary	R	A	Table has been added
26	Fisher, Andrew	Outfall Descriptions	6	2.3	Please note that watersheds Wiedeman Creek, Fairway Tributary, Northridge Draw, Poudre River Ranch and the direct flow area north of Greeley No 3 Canal were previously considered part of the Sheep Draw Basin in the 2006 Anderson report.	R	A	Note added to each of the watersheds

\/ICON-2K12B\Projects\P\18019SBB\03\_Meetings\2018\_09\_13 Progress Meeting\Minutes\Sharktooth Bluffs Master Plan Progress Meeting Minutes - September 13.docx

)raft Ba	seline H+H Report							
No.	YOUR NAME (last name, first name)	SECTION #	PAGE	LINE	COMMENT	S, R, E (Substantive, Requested, Editorial)	A, R, C (Accepted, Rejected with explanation, Needs Clarification)	RESPONSE (by consultant)
NO.	Fisher, Andrew	Study Area	7		Please add Long Range Growth boundary to map as well, if it	R	Giarmication)	
27		Мар		2.1	can be depicted clearly. This may require a Study Area Map for present day boundaries and a separate map for future forecasted boundaries.			A vincity map was added to show the LRG boundary in relationship to the Sharktooth Bluffs Boundary
28	Fisher, Andrew	Subwatershed Map	8	Figure 2.2	Please increase the size of Tributary labels to the size of the Jones Ditch and No.3 canal at minimum	R		Size has been increased
29	Fisher, Andrew	Subwatershed Map	8	Figure 2.2	Please add Long Range Growth boundary to map as well, if i can be depicted clearly. This may require a Study Area Map for present day boundaries and a separate map for future forecasted boundaries.	R		Long Range Growth Boundary has been added
30	Fisher, Andrew	Subwatershed Map	8	2.2	Please either show the original boundary between West Poudre and Sheep Draw basins, or if the boundary is sufficiently close, add a note that Wiedeman Creek, Fairway Tributary, Northridge Draw, Poudre River Ranch and the direct flow area north of Greeley No 3 Canal were previously considered part of the Sheep Draw Basin in the 2006 Anderson report	R		Boundary is now shown
31	Fisher, Andrew	3.2	9	6	Please spell out UDFCD acronym at first mention	E	A	Comment addressed
32	Fisher, Andrew Fisher, Andrew	3.4.1 3.4.2.2	9 10	2	Revise spelling of Missile, Hertzke and Orr Please revise to state Imagine Greeley Land Use Guidance	E R	Α	Comment addressed
33	r lonor, / tharew	0.4.2.2	10	-	Map, adopted in January 2018.		Α	Comment addressed
34	Fisher, Andrew	3.4.3	10	2	Please clarify source of topographic data	R	А	Comment addressed
35	Fisher, Andrew	3.4.5	10	Paragr aph 3	In this paragraph, please clarify that this procedure was completed on Type A and B soils in areas found to be actively irrigated agricultural land, as identified by inspection or historic aerial photographs.		А	Paragraph was revised to clarify
36	Fisher, Andrew	3.5.3	10	9	Add comma as noted	E	А	Comment addressed
37	Fisher, Andrew	3.5.3	10	11	Add "likely" as noted. Disruption not guaranteed by development	R	Α	Comment addressed
38	Fisher, Andrew		12		Please display the Figures in the same order they are initially mentioned in the report. This appears to be preferred to have Detention Facility Locations first and Peak Flow Design Points second based on the wording	R	A	Figures have been revised to reflec the order they are mentioned in the report
39	Fisher, Andrew		12/14	Figure 3.1	Please add Long Range Growth boundary and future trails alignments	R	Α	Long Range Growth Boundary has been added
40	Fisher, Andrew		13	Table 3.3	There are frequent instances of increased peak flows from existing to future year conditions. Please speak to these, particularly for the Northridge and Poudre River Ranch watersheds that are predominantly developed already. Is detenrion required to increase beyond what is presented?	S	A	Table has been revised to accurate reflect detaining all future condition discharges to historic 5 yr release rates as required by Greeley criteria
41	Fisher, Andrew	4.0	15	1	Clarify meaning of "storm drain system"	S	А	Comment addressed
42	Fisher, Andrew	4.0	15	1	Do we have enough information to deduce headwater and tailwater depths and refine culvert capacities with various culvert type equations?	R	A	This comment was discussed in the progress meeting. HY-8 models wi be created for roadway crossings to verify capacity initially determined b normal depth pipe capacities
43	Fisher, Andrew	4.1	15	2	Reference Sheep Draw Basin Conceptual Plan and which subbasins the report provides any additional information on.	S	A	Comment addressed
44	Fisher, Andrew	4.2.1	15	8	Please clarify how the building footprints are incorporated in the model to affect flow patterns. Elevations? Mannings n?	R	A	Buildings were incorporated as block obstructions. Texted has been revise
45	Fisher, Andrew	4.3	15	1	Would you recommend pursuing development of a regulatory floodplain and/or floodway in this basin, particularly for Wiedeman Creek or Sharktooth Draw?	S	A	This comment was discussed in the progress meeting. Hazard identification was completed for the watershed using a threshold of 4. Future detention will reduce flows below the threshold of a major drainageway and a floodplain / floodway will not be developed with t study
46	Fisher, Andrew	4.3.1	15	4	State why development is not expected in Spur Draw	S	A	According to City of Greeley 's futur Zoning plan development is not expected
47	Fisher, Andrew	4.3.2	15	1	I am aware of where the Broe Land embankment is based on our conversations but please specify with a figure or Design Point	S		Broe Land added to study area ma
48	Fisher, Andrew	4.3.3	15	3	Add comma and word as noted.	E	А	Comment addressed
49	Fisher, Andrew	4.3.3	15	3	What is "considerable" depth?	E		Comment addressed
50 51	Fisher, Andrew Fisher, Andrew	4.3.4 4.3.4	15 15	1 5	Please revise for clarity as noted Please add comma as noted	E	A	Comment addressed Comment addressed
51	Fisher, Andrew	4.3.4	15	5	Revise "planning document" to "Land Use Guidance Map	E	A A	Comment addressed

# Co Dr

Commer	tooth Bluffs E and Response Tra seline H+H Report		terpla	n			1	
No.	YOUR NAME (last name, first name)	SECTION #	PAGE	LINE	COMMENT	S, R, E (Substantive, Requested, Editorial)	A, R, C (Accepted, Rejected with explanation, Needs Clarification)	RESPONSE (by consultant)
53	Fisher, Andrew	4.3.6	16	4	Please revise word choice	E	A	Comment addressed
54	Fisher, Andrew	4.3.6	16	7	"To one the primary"?	E	A	Sentence has been revised
55	Fisher, Andrew	4.3.6	16	8	I think I understand the point. Can this be worded cleaner?	E	А	Comment addressed
56	Fisher, Andrew	4.3.7	16	3	culverts?	E	Α	Comment addressed
57	Fisher, Andrew	4.3.7	16	5	The City's standard currently and at the time of development allows for 18". It is noteworthy whether flow exceeds 18" specifically. Please identify this as a critical measurement for this watershed and all street flooding for 100-year events.	S	А	Comment addressed
58	Fisher, Andrew	4.3.8	16	5	Specify this is identifying the PRR watershed, not planned neighborhood Filing	R	А	Comment addressed
59	Fisher, Andrew	Table 4.1	17	Waters hed	Wiedeman spelling	E	Α	Comment addressed
60	Fisher, Andrew	Table 4.1	17	Pipe Char	Please add pipe material to characteristics.	R	A	Comment addressed
61	Fisher, Andrew	Figure 4.1	18-21		Please add future trails and long range growth boundary	R	A	Future trails and long range growth boundary has been added
60	Fisher, Andrew	Appendix B	B-21	Rating Curves	Overtopping elevation on Orr Pond is certainly incorrect	E	A	Table has been revised
61	Fisher, Andrew	Appendix B	B-21		Please add a row to each table corresponding to overtopping elevation with interpolated surface area, storage and discharge	R	A	Table revised
62	Fisher, Andrew	Diversion Curves	56-57		Can you add a zoomed out vicinity map to help identify where these locations are within the basin?	R	A	Figures revised



MINUTES

#### **ATTENDANCE:**

Andrew Fisher, City of Greeley Heather Seitz. City of Greeley Craig Jacobson, ICON Engineering Jaclyn Michaelsen, ICON Engineering Jeremy Deischer, **ICON Engineering** Wyatt Reis, **ICON Engineering** 

# 1) Remaining Baseline Hydrology Comments

- a) Exhibit for Long Range Growth
- i. ICON will create a vicinity map to better depict the extent of the Sharktooth Bluffs Basin within the future growth boundary.
- b) Original Greeley Basin Boundaries
  - i. The original basin boundary between the West Poudre and Sheep Draw Basins was added to the report figures. The report text will be revised to mention the areas previously studied as part of the Sheep Draw Basin.

# 2) Problem Area and Alternative Plan Identification

- a) West SBB
- i. Potential erosion from the bluffs is the main concern; a quick review of the area in Google Earth did not raise any concern. It was agreed ICON will not perform a site visit when evaluating the area.
- b) Sharktooth Draw
  - Downstream in the basin the concerns are with confining the flows as they exit the bluffs and convey the flows safely the Poudre River. Alternatives will also be developed for roadway crossing improvements at 95<sup>th</sup>, CR 62, and 4<sup>th</sup> Street. The spill flows from Sharktooth Draw to Poudre Learning Center would also be removed with these improvements.
- c) Poudre Learning Center
  - Similar to Sharktooth Draw, the formalization of flows exiting the bluffs is a major concern i. in the subwatershed. Canal separation will be encouraged to prevent stormwater runoff entering Jones Ditch. Alternatives will be developed for roadway crossings at 83<sup>rd</sup> Ave, CR 62 and 4<sup>th</sup> Street.
- d) Wiedeman Creek
  - Alternatives will be developed to mitigate flooding exceeding City criteria within the Poudre i. River Ranch subdivision on 81<sup>st</sup> Street. Known flooding also exists on the east side of the Poudre River Run neighborhood. Upstream of the neighborhood on Wiedeman Creek, roadway crossing improvements will be developed for 4<sup>th</sup> Street and 83<sup>rd</sup> Avenue.
- e) Poudre River Ranch
- Although stormwater is conveyed on the street, depths do not exceed the City criteria of 18" criteria so no problem areas were identified.
- f) Foothills Tributary
  - Flows overtopping 71<sup>st</sup> Ave do not exceed the 6" limit but do contribute to overland flooding i. – in Northridge Draw. Alternatives will be developed to convey flow to the Poudre maintaining separation from the Greeley No. 3 Canal.
- g) Northridge Draw
  - In an effort to encourage separation with the Greeley No. 3 Canal, alternatives will be developed to formalize convevance just south of 71<sup>st</sup> Ave.

P:\P\18019SBB\03\_Meetings\2018\_10\_02 Progress Meeting\Minutes\Sharktooth Bluffs Masterplan October 2 Alternatives Kickoff Meeting Minutes.docx

**PROGRESS MEETING** SHARKTOOTH BLUFFS BASIN MASTERPLAN **CITY OF GREELEY** OCTOBER 2, 2018 AT 2:30 PM

# 3) Alternative Analysis Criteria

a) Design Flows (Existing or Future?)

- A high hazard identification using the CWCB threshold of 7 will be used to help identify ii. additional problem areas throughout the basin.

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:

wyett Resig Wyatt Reis

ICON Engineering, Inc.

Minutes.docx

MINUTES

i. Two separate alternative sets will be developed, one the city may want to consider in the coming years to address current issues and a separate set for future development and the issues that will need to be addressed at the time of development.

#### - END OF MEETING--

October 3, 2018



PROGRESS MEETING SHARKTOOTH BLUFFS BASIN MASTERPLAN **CITY OF GREELEY** OCTOBER 11, 2018 AT 9:00 AM

MINUTES

**ATTENDANCE:** Andrew Fisher, City of Greeley Heather Seitz. City of Greeley Craig Jacobson, **ICON Engineering** Jaclyn Michaelsen, ICON Engineering Jeremy Deischer, ICON Engineering Wyatt Reis, **ICON Engineering** 

# 1) Sheep Draw Comprehensive Drainage Plan Review

A. Previously studied areas now within Sharktooth Bluffs Basin

a. The over lapping basins from the Sheep Draw Master Plan (Wiedeman Creek, Poudre River Run, Fairway Tributary, Northridge Draw) line up well with the basins in the Sharktooth study. These basins do not have any proposed improvements or additional information to incorporate in the current study with the main focus of this report was the main tributary of Sheep Draw.

## 2) Lake Bluff PUD First Submittal

- A. Decreased size of development
  - a. The first submittal of the Lake Bluff PUD decreases the overall size of the development from nearly 800 acres to just less than 300 acres
  - b. The area that is included to be developed is in the central portion of the original development area with 95<sup>th</sup> paralleling the development to the east.
- B. Changes in land use
  - a. There are some minor changes in the land uses in the area but it was determined that redoing the future conditions was not necessary due to the limited changes and the need to still assume the conditions on the remainder of the development based of an area weighted average which was used originally. These minor changes were also not included because the development will still have to develop according to the city of Greeley's development criteria which are based on the existing conditions.
- C. No significant changes to drainage patterns
  - a. The basins for this area also have no change from this new PUD submittal due to the drainage basins and flow paths not changing in this area from the original submittal.

### 3) High Hazard Identification

- A. Max Depth \* Max Velocity >= 7
  - a. A high hazard layer was created using a product of 7. This layer will be included on figures in the report and was used to help identify problem areas.
  - b. The high hazard areas from Wiedeman Creek within the Poudre River Ranch development and upstream were larger than expected. There were also areas of high hazard in Spur Draw but does not currently impact any structures in the basin.

# 4) Benefit / Cost Evaluation of Alternatives

- A. Similar approach to NGD Master Plan
  - a. The approach to the benefit cost analysis was reviewed. A benefit cost analysis will only be performed on alternatives that impact structures. Those alternatives will be evaluated using a similar method to the North Greeley and Downtown Basin Storm Drainage Master Plan. Equations from the FEMA BCA Toolkit will be used to determine the pre and post project damages on impacted structures.

P:\P\18019SBB\03\_Meetings\2018\_10\_11 Progress Meeting\Minutes\Sharktooth Bluffs Masterplan October 11 Alternatives Kickoff Meeting Minutes.docx



PROGRESS MEETING SHARKTOOTH BLUFFS BASIN MASTERPLAN **CITY OF GREELEY** OCTOBER 11, 2018 AT 9:00 AM

## 5) Schedule

A. Draft Alternatives Report - End of November

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:

wyett Resig

Wyatt Reis

Minutes.docx

MINUTES

#### -- END OF MEETING--

October 11, 2018

ICON Engineering, Inc.



PROGRESS MEETING SHARKTOOTH BLUFFS BASIN MASTERPLAN **CITY OF GREELEY** OCTOBER 26, 2018 AT 9:00 AM

MINUTES

**ATTENDANCE:** Andrew Fisher, City of Greeley Heather Seitz. City of Greeley Craig Jacobson, ICON Engineering Jaclyn Michaelsen, ICON Engineering Jeremy Deischer, ICON Engineering

#### 1) Alternative Plans

A. The team reviewed the alternative plans that were being developed. ICON has developed HY-8 models to confirm the capacity of the existing storm drain infrastructure at each roadway crossing. Crossing improvements were being designed for both minimum City criteria and 100-year design flow crossings.

## 2) Poudre River Ranch Phase III Drainage Report

A. The Poudre River Ranch subdivision had been identified during the problem area identification as an area that exceeded current City criteria for flow depth on the street. The team reviewed the hydrologic analysis in the drainage report for the development compared to the hydrology being developed as part of this study. Several differences between the studies were noted including tributary area for offsite basin, existing conditions soil hydrologic properties, and asbuilt condition for the storm drain infrastructure. This area will be further evaluated with alternatives developed to mitigate the flooding hazards in excess of City criteria.

#### 3) Schedule

A. ICON will revised the Baseline Hydrology Chapter of the master plan report to address all City comments and provide the updated report to the City.

#### -- 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:

Jeremy Deischer ICON Engineering, Inc.

October 29, 2018



PROGRESS MEETING SHARKTOOTH BLUFFS BASIN MASTERPLAN CONFERENCE CALL NOVEMBER 8, 2018 AT 9:00 AM

# **ATTENDANCE:**

Andrew Fisher, Heather Seitz. Craig Jacobson, Jaclyn Michaelsen, Jeremy Deischer,

#### 1) Alternative Plans

- flooding concerns.
- problem areas identified in the FLO-2D modeling in Northridge Draw.

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:



Jeremy Deischer ICON Engineering, Inc.

#### MINUTES

City of Greeley City of Greeley **ICON Engineering ICON Engineering ICON Engineering** 

A. The team reviewed the alternatives that were being developed. An alternative was developed to alleviate the flooding associated with Poudre River Ranch Phase III. The drainage report prepared for that development had significant less tributary area draining to the neighborhood than the master plan. The additional flow associated with the increased tributary area and differences in hydrology lead to the drainage facilities built for this development no longer meeting City criteria. ICON requested any as-built storm drainage information available from River Run at Poudre River Ranch Phase I to verify storm drainage capacity. Detention alternatives will be developed to detain flow upstream of the development to alleviate the

B. Alternatives will be developed for the Poudre River Ranch subdivision to separate stormwater from discharging into the Greeley No. 3 Canal. Additional alternatives will be developed for

### -- END OF MEETING--

December 5, 2018



# PROGRESS MEETING SHARKTOOTH BLUFFS BASIN MASTERPLAN **CITY OF GREELEY** FEBRUARY 6 AT 2:00 PM

#### MINUTES

ATTENDANCE:	Andrew Fisher,	City of Greeley
	Florian Fiebig,	City of Greeley
	Craig Jacobson,	ICON Engineering
	Jeremy Deischer,	ICON Engineering

#### 1) Review Draft Alternative Report Comments

The team reviewed all substantive comments noted received on the DRAFT Alternative Analysis Report:

- Comment 5: The table will be revised to clarify the areas listed are a comparison of the watershed size currently within City of Greeley boundaries and the long term expected growth boundarv area.
- Comment 16: The text will be revised to indicated UD-MP Cost 2012 was used for all cost estimates.
- Comment 21: The term inundated area will replace any reference to floodplain since a regulated floodplain will not be established for Sharktooth Draw.
- Comment 31: A detention alternative will be added upstream of Amour Hill Drive to mitigate the flooding hazard.
- Comment 32: An additional exhibit will be created to show the Canal Base Flow Separation • Alternative.
- Comment 36: The team discussed the best way to present the recommended plan. A matrix will be created indicating the selected alternative for each area.
- Comment 38: An index will be created to help easily identify the cost estimates in Appendix C.

### 2) Conceptual Design

Given the nature of the isolated improvements, the format of the Conceptual Design will not follow the standard UDFCD E-Plan format. The format will be further discussed at subsequent meetings but a text description and cost estimate of the selected plan will be followed by an exhibit of the improvement.

The City will research possible additional stakeholders for the master plan to help evaluate the feasibility of certain improvements for the Conceptual Design. Possible stakeholders include the Jones Ditch, Greeley No. 3 Canal, Seibring Reservoir, and Poudre Learning Center.

### 3) Preparation for Public Meeting

The City will prepare a presentation for the public meeting. The team decided four of the exhibits presented in the DRAFT Alternative Analysis Report would be printed at 22" x 34" to be distributed around the room. The High Hazard Area would be incorporated into the Baseline 100-year FLO-2D exhibit. The Study Area and Recommended Plan Exhibits would also be presented.

### 4) Schedule

- a) Public Meeting February 13<sup>th</sup>
- b) Final Alternative Analysis Report March 6<sup>th</sup>

# **Action Items:**

ICON:

- 1. Revise exhibits based on comments received prior to the public meeting
- 2. Submit final Alternative Analysis Report by March 6<sup>th</sup>.



# City of Greelev:

- 1. Prepare presentation for public meeting.
- 2. Research decreed flow for both Greeley No. 3 Canal and Jones Ditch.

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:



Jeremy Deischer

**PROGRESS MEETING** SHARKTOOTH BLUFFS BASIN MASTERPLAN **CITY OF GREELEY** FEBRUARY 6 AT 2:00 PM

#### MINUTES

## -- END OF MEETING--

ICON Engineering, Inc.

February 11, 2019

# ICONENGINEERING, INC.

# Memorandum

TO:	Andrew Fisher, P.E., CFM
FROM:	ICON Engineering, Inc.
DATE:	June 11, 2019
RE:	Sharktooth Draw Alternative Analysis

# Purpose

The purpose of this memorandum is to summarize several alternatives developed for Sharktooth Draw following the submittal of the DRAFT Alternative Analysis Report. Following the submittal of the report, the recommended plan for Sharktooth Draw downstream of County Road 62 and the alternative channel alignment were both deemed infeasible.

# Drainage Pattern

The Sharktooth Draw Watershed extends from south of 10<sup>th</sup> Street to the Cache La Poudre River, covering 1,235 acres. The headwaters of Sharktooth Draw begin south of 10<sup>th</sup> Street, east of Promontory Circle near the State Farm property. North of 10<sup>th</sup> Street, west of 95<sup>th</sup> Avenue, sheet flow conveys the runoff through existing farm fields before reaching the bluffs and to a defined drainageway. Once the runoff reaches the drainageway, the 100-yr flow (1063 cfs) travels north through the bluffs to an open field. The flow splits in two directions through the field in an alluvial fan pattern; approximately 514 cfs heads northwest to the intersection of 95<sup>th</sup> Avenue and County Road 62, and 542 cfs heads northeast to Jones Ditch.

Problem areas within the watershed focus around overtopping of existing roadway crossings, including 95<sup>th</sup> Avenue and County Road 62. No significant culvert crossings currently exist for either 95<sup>th</sup> Avenue or County Road 62 at this location. Only an 18" CMP currently crosses 95<sup>th</sup> Avenue, conveying flow east to west. As shown by the FLO-2D analysis performed as part of this study, drainage in this area overtops each roadway splitting flow between Sharktooth Draw and the Poudre Learning Center Watersheds. 10-year overtopping depths are approximately 3 to 6 inches, whereas 100-year depths exceed one foot. The road overtopping poses significant flooding hazards.

The Sharktooth Draw Watershed is located within the City of Greeley's Long Range Expected Growth Boundary. However, there is no defined drainageway downstream of the bluffs for future development to discharge into.

# Master Plan Alternative

The DRAFT Alternative Analysis Report recommended a drainage channel that extended from immediately downstream of the bluffs to Siebring Reservoir. The channel would convey runoff under County Road 62 in dual 10ft wide x 6ft high reinforced concrete box culverts (RCBCs). The proposed solution would eliminate overtopping of 95<sup>th</sup> Avenue and County Road 62, as well as providing a drainageway for future development. Soon after completion of the DRAFT Alternatives Analysis Report, the City discussed the plan with the Central Colorado Water Conservancy District (CCWCD), the owners of Siebring Reservoir. After discussions with CCWCD, concerns regarding costs to manage the system and water rights of any stormwater discharged in the reservoir eliminated this alternative for further

# ICONENGINEERING, INC.

consideration, as any stormwater that entered the reservoir would be required to be pumped to the river and a natural outlet could not be provided as intended. An alternate alignment was developed during the initial alternative analysis proposing to cross 95<sup>th</sup> Avenue to the west at the intersection with County Road 62. The channel downstream of County Road 62 would parallel 95<sup>th</sup> Avenue to the west conveying runoff to the Cache La Poudre River. Recent development of a gas extraction site spanning west from 95<sup>th</sup> Avenue also prohibited this channel alignment. With both alternatives deemed infeasible, additional alternatives were developed for the area.

# **Proposed Alternatives**

Four main alternatives were analyzed to address the overtopping of 95<sup>th</sup> Avenue and County Road 62. These alternatives also were proposed to formalize Sharktooth Draw channel downstream of the bluffs where the existing flow patterns become alluvial. The formalized channel will provide a drainageway for future development in the area. A description of each alternative can be found below and can be seen in the attached exhibits.

# Alternative A – Drainageway to the west

Alternative A is a proposed 170-ft wide drainage channel that begins immediately downstream of the bluffs. The channel contains a 10-ft wide low flow channel that would meander through the bottom of the channel. The 100-year flow from the bluffs will sheet flow across undeveloped land where it is collected in the proposed drainage channel. The proposed channel will convey the flow to the west to the intersection of 95<sup>th</sup> Avenue and County Road 62. A 16ft wide x 6ft high reinforced concrete box culvert (RCBC) is proposed under 95<sup>th</sup> Avenue, eliminating any overtopping of the 95<sup>th</sup> Avenue and County Road 62 intersection. Improvements are also proposed to 95<sup>th</sup> Avenue in order to provide cover over the proposed culvert.

Downstream of 95<sup>th</sup> Avenue the 100-year drainage channel continues to the extension of County Road 62, where the roadway is proposed to be realigned to convey the 100-year flows through another 16ft wide x 6ft high RCBC. Downstream of County Road 62, the flow will continue in a 100yr drainage channel to the existing oxbow channel, located approximately 2,000 ft south of the Cache La Poudre River. From here, a low flow channel is proposed to convey runoff north to the Cache La Poudre River.

The alternative also consists of a proposed pedestrian bridge to raise the Poudre River bike trail over the proposed low flow channel. This alternative also proposes to siphon the Jones Ditch under the proposed channel.

# Alternative B - Drainageway to the east

Alternative B is also a proposed 170ft wide drainage channel that begins immediately downstream of the bluffs. However, this channel conveys the flow to the east, through the Poudre Learning Center, and 83<sup>rd</sup> Avenue to the Cache La Poudre River. The proposed channel will convey the 100-year flows to County Road 62, in the vicinity of Jones Ditch. At County Road 62 a 16ft wide x 6ft high RCBC is proposed to convey the 100-year flows under the road. Downstream of County Road 62 the 100-year channel will continue to the east, south of the Siebring Reservoir, through the Poudre Learning Center property to 83<sup>rd</sup> Avenue. At 83<sup>rd</sup> Avenue, an improved crossing of a 12ft wide x 4ft high RCBC conveys flow underneath 83<sup>rd</sup> Avenue to the east. The conveyance capacity at 83<sup>rd</sup> Avenue is restricted by the existing channel capacity on the eastern side of the road due to a conservation easement which

# ICONENGINEERING, INC.

prohibits any channel improvements. Therefore, to convey flows in excess of the 83<sup>rd</sup> Avenue crossing, passive overflow paths are proposed along the slough adjacent to Siebring Reservoir and along the west side of 83<sup>rd</sup> Avenue north to the Cache La Poudre River.

The alternative also proposes to flume the Jones Ditch over the proposed drainage channel and proposes a pedestrian bridge to raise the Poudre River bike trail over the proposed low flow channel.

### Alternative C – Existing Detention with Future Conditions Outfall

Alternative C proposes a large 88 acre-ft detention facility at the downstream end of the bluffs. The detention facility would capture the 100-year event (1063 cfs) and release it at approximately 230 cfs. The outflows will be conveyed in a 30ft drainage channel that will travel to the intersection of County Road 62 and 95<sup>th</sup> Avenue. A proposed storm drain system is proposed, starting at the intersection, and discharging 1660 ft north into the Cache La Poudre River. Due to cover constraints, the storm drain would need to be a 38" x 60" horizontal elliptical reinforced concrete pipe (HERCP). The system will convey the future 100-year event of 75cfs. The rest of the flow will overtop the intersection of 95<sup>th</sup> Avenue and County Road 62, with less than 6 inches in depth. The overtopping flow will continue in the same path as the existing flows, heading north to the Cache La Poudre River.

The detention pond is proposed in the same location as a pond proposed in the original Lake Bluff Preliminary Planned Unit Development Plan (April 2009). In October 2018, the City received a revised development plan for Lake Bluff with all development now proposed west of 95<sup>th</sup> Avenue. At the time of this study, the City is awaiting an updated submittal showing the updated drainage plan for Lake Bluff. Construction of a detention pond at the downstream end of the bluffs would provide the City can opportunity to work with the developer to minimize costs of the pond while maximizing the potential benefit of the pond. Any proposed development in the area could use the detention pond footprint to help minimize the remaining on-site detention requirements, thus promoting a working relationship between the City and development groups. Detaining the flows at the downstream end of the bluffs greatly reduces the size of the downstream infrastructure.

The proposed detention pond has been designed such that it does not exceed the requirements of a jurisdictional dam in the State of Colorado, with a maximum depth of less than 10 ft deep, surface area less than 20 acres, and less than 100 acre-feet in size. However, given the changing dam safety requirements, it is still recommended that the City consult the State for current guidance prior to purchasing land or designing the detention facility.

#### Alternative D – Future Conditions Outfall

This alternative proposes an outfall channel that would convey the future conditions 100-year flow (75cfs). This channel is proposed to begin immediately downstream of the bluffs and would run along the east side of 95<sup>th</sup> Avenue to the intersection of 95<sup>th</sup> Avenue and County Road 62. At the roadway intersection a 38" X 60" HERCP storm drain would convey the 75cfs north in 95<sup>th</sup> Avenue and into the Cache La Poudre River. Alternative D provides a solution for future drainage but does not reduce or eliminate road overtopping depths significantly during the existing conditions.

#### Future Trails and Open Space

The City of Greeley Natural Resources Department strongly supports a naturalized stormwater management strategy that not only provides stormwater management for the benefit of the life, safety

# ICONENGINEERING, INC.

and property of the citizens of Greeley, but also considers and supports sustainable natural systems in the installation and maintenance of stormwater management facilities. Small creeks and drainages only encompass approximately one percent of the land mass in Colorado but supports nearly 85 percent of the state's wildlife species, making these areas critical for wildlife. These areas are also important movement corridors for wildlife between larger habitat areas.

The 100-year flood control channels in Alternatives A and B can be incorporated into the City's future trail system as well as provide opportunities for habitat creation. The proposed channels are proposed to be multi-staged, incorporating a natural, meandering bankfull channel concept and floodplain bench. The bench can support a meandering pathway through the natural areas.

The proposed detention pond in Alternative C could also provide a multi-objective function for the natural area. The City's trail system could cross through the bottom and along the top of the facility. The detention facility would also help promote wildlife habitat by maintaining adequate flows downstream (both in volume and timing) to preserve native vegetation and wildlife habitat, as well as be designed to provide water quality benefits. Finally, the detention facility itself could function as a natural area for both wildlife habitat and public access.

Both the proposed channel and ponds would be designed as native as possible. This includes seeding with drought-tolerant native seed mixes, infrequent or no-mow practices and mowing outside of ground-nesting bird seasons in the spring, and leaving native vegetation where possible to provide habitat while maintaining storage capacity needs.

# Preliminary Cost Estimate

A preliminary cost estimate was created for each of the alternatives using the UD-MP Cost tool. The total costs include property acquisition, City project management, and engineering costs. Costs are presented consistent with the current Alternatives Analysis Section of the master planning document.

# **Table 1: Preliminary Cost Estimate**

Alternative	Construction Costs	Land Cost	Engineering, Legal/Administration, Construction Management	Contingency (25%)	Total Costs
A – West					
Drainageway	\$ 4,000,309	\$ 2,554,000	\$ 1,200,092	\$ 1,000,077	\$ 8,754,478
B – East					
Drainageway	\$ 8,241,353	\$ 3,082,000	\$ 2,472,406	\$ 2,060,338	\$ 15,856,097
C – Detention					
with Future					
Outfall	\$ 7,247,827	\$ 2,114,000	\$ 2,174,348	\$ 1,811,957	\$ 13,348,132
D – Future					
Outfall Only	\$ 643,777	\$ 206,000	\$ 193,134	\$ 160,944	\$ 1,203,855

# ICONENGINEERING, INC.

# Pros and Cons

Each alternative has pros and cons that should be reviewed prior to selecting a recommended alternative.

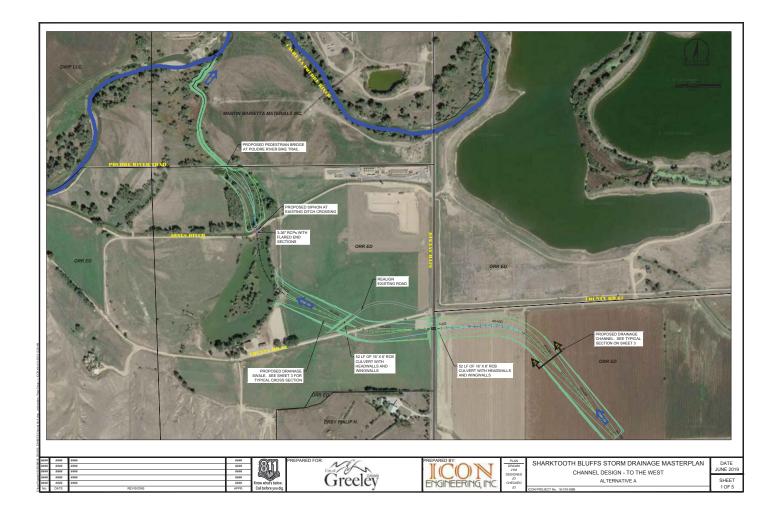
#### **Table 2: Alternative Pros and Cons**

Alternative	Pros	Cons
	Least expensive alternative that solves the existing conditions flooding concerns	Channel divides developable land
	Conveys 100-year event	Requires extensive roadwork
A	Eliminates overtopping of 95 <sup>th</sup> Ave and County Road 62 in existing conditions	Constructability concerns with minimal longitudinal slopes of 0.1% to 0.2%, interaction with oxbox
	Can incorporate the channel into the City's trail system	Requires large amount of acquisition given channel footprint
	Provides an outfall for development	
	Conveys 100-year event Uses land would be less likely to develop	Most expensive alternative Least desirable alignment from feedback from property owner
5	Eliminates overtopping of 95 <sup>th</sup> Ave and County Road 62 in existing conditions	Requires the most land acquisition out of all the alternatives
В	Can incorporate the channel into the City's trail system	
	Provides an outfall for development Higher construction feasibility, proposed channel has steeper longitudinal slopes	
	Provides regional detention	Requires a large amount of property acquisition
	Uses land that is currently being proposed for developer's detention, potential buy-back for future development	Construction costs of detention facility
С	Can incorporate the channel and the pond into the City's trail system	Possibility of being regulated as a jurisdictional dam
	Provides an outfall for development	May be difficult to work together with a developer
	Can be utilized as a natural area for the City	
	Reduces the overtopping of 95 <sup>th</sup> Ave and County Road 62 to City criteria	
	Cheapest alternative	Does not reduce flood risk or bring
D	Provides an outfall for development	overtopping of 95 <sup>th</sup> Ave and CR 62 into
	Requires the least amount of land acquisition	criteria during the existing conditions, a general goal of this Master Plan

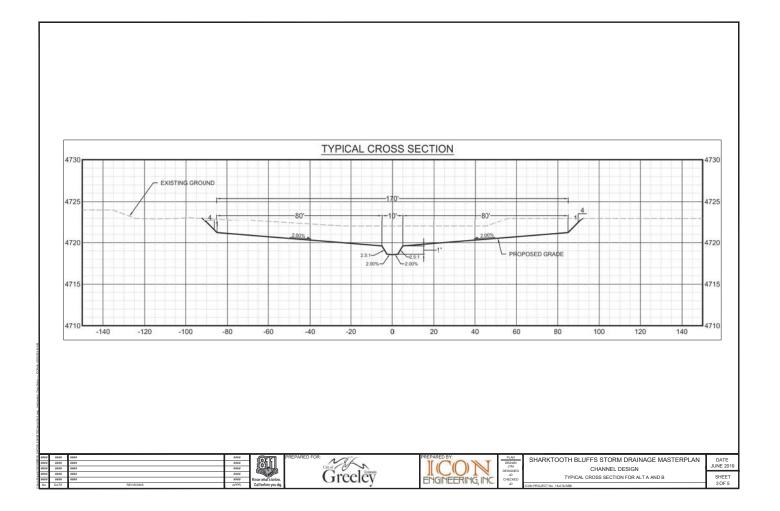
# ICONENGINEERING, INC.

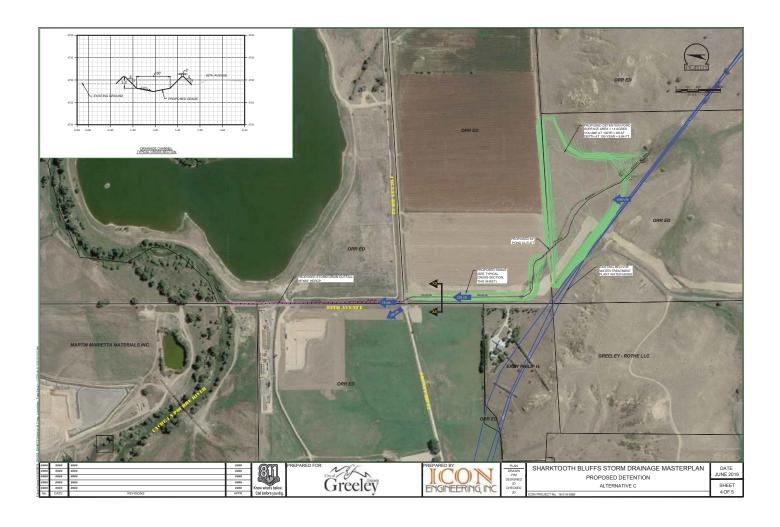
# **Recommended Alternative**

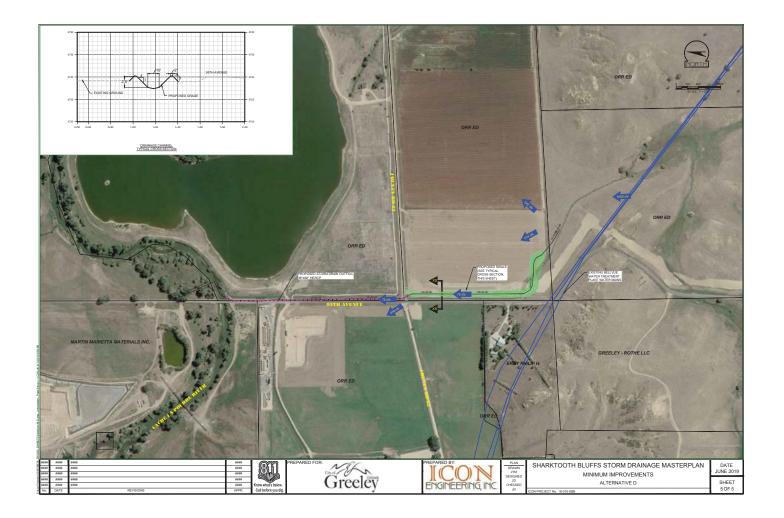
Alternative C is the recommended alternative. In general, it achieves the main objectives presented in the Sharktooth Basin Master Plan, as well as provides a benefit through the potential natural area that the citizens of Greeley can use for years to come. It would be encouraged that the City develop a plan to fund the alternative through reimbursement from development which may also make use of the pond to minimizing detention requirements or share in the land open space amenity.











PROJECT : DRAINAGEWAY :	Sharktooth Sharktooth						-
REACH :	Alt A						
JURISDICTION :	City of Greeley						
REACH ID:	Alt A-ReachAlt A		Enter Estimator Name	e on Project Inf	DATE :	6/6/2019	1
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes	l I		r	-	1	T	
Diameter (in) 36-inch	Length (ft) 71	No. of Barrels	213	LE	\$145.00	\$30,885.00	
Flare End Sections		3	213	L.F.	\$143.00	\$30,885.00	
Diameter (in)	Applicable	No. of Barrels					
36-inch	Yes	3	6	EA	\$2,157.00	\$12,942.00	
Manholes and Inlets Ianhole, 4' Dia. (Pipe Dia. < 36")			2	EA	\$3,886.00	\$7,772.00	MH Risers for the Siphon
Concrete Box Culverts			2	LA	\$3,000.00	\$1,112.00	
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
16	6	1	52	L.F.	\$2,116.83	\$110,075.00	
10 16	5	1	75 65	L.F.	\$1,081.50 \$2,116.83	\$81,112.00 \$137,594.00	Estimated Siphon
16 Headwall and Toewalls	U		CU	L.F.	92,110.83	\$137,594.00	
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
16	1	18.00	2	EA	\$1,811.52	\$3,623.00	
10	1	12.00	2	EA	\$1,158.48 \$1,811.52	\$2,317.00 \$3,623.00	-
Wingwalls (includes wingwalls on e	ither side of channel ar	id concrete apron)	2	EA	\$1,011.02	\$3,023.00	
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
16	6	1	2	EA	\$16,954.63	\$33,909.30	
10	5	1	2	EA	\$12,054.14 \$16,954.63	\$24,108.30 \$33.909.30	
	0	1	2	EA	\$10,904.03	\$33,909.30	
Channel Improvements Excavation, Low Range	[		88525	C.Y.	\$15.00	\$1,327,875.00	-
2-inch Riprap, Type M			500	C.Y.	\$80.00	\$40,000.00	
Removals					·		
Removal of culvert pipe (D<48")			100	L.F.	\$27.00	\$2,700.00	
andscaping and Maintenance	Improvements						
Reclamation & seeding (native grasses)			31	ACRE	\$1,340.00	\$41,540.00	
frail/Path, Crusher Fines (10' Width)			4500	L.F.	\$15.00	\$67,500.00	
Special Items (User Defined)						T	
Pedestrian Bridge	<user defined="" items<="" td=""><td></td><td>1</td><td>EA</td><td>\$75,000.00</td><td>\$75,000.00</td><td></td></user>		1	EA	\$75,000.00	\$75,000.00	
Road Improvements Road Realignment	<user defined="" items<br=""><user defined="" items<="" td=""><td></td><td>2222 2000</td><td>CY CY</td><td>\$85.00 \$55.00</td><td>\$188,889.00 \$110,000.00</td><td></td></user></user>		2222 2000	CY CY	\$85.00 \$55.00	\$188,889.00 \$110,000.00	
Road Realignment Grading	<user defined="" items<="" td=""><td></td><td>1</td><td>LS</td><td>\$300,000.00</td><td>\$300,000.00</td><td></td></user>		1	LS	\$300,000.00	\$300,000.00	
excavation Haul	<user defined="" items<="" td=""><td>5</td><td>66394</td><td>CY</td><td>\$12.00</td><td>\$796,725.00</td><td></td></user>	5	66394	CY	\$12.00	\$796,725.00	
andscape	<user defined="" items<="" td=""><td>5</td><td>1</td><td>LS</td><td>\$100,000.00</td><td>\$100,000.00</td><td>-</td></user>	5	1	LS	\$100,000.00	\$100,000.00	-
and Acquisition			0	54	¢20,000,00	600.000.00	
emporary Easements Easement/ROW Acquisition			3 28.00	EA ACRE	\$30,000.00 \$88,000.00	\$90,000.00 \$2,464,000.00	
	Master Pla	n Capital Improv	/ement Cost Sur	nmarv			
Capital Improvement Costs							
Pipe Culverts and Storm Drains						\$51,599.00	
oncrete Box Culverts lydraulic Structures						\$430,271.00 \$0.00	
channel Improvements						\$1,367,875.00	
etention/Water Quality Facilities						\$0.00	
lemovals						\$2,700.00	-
andscaping and Maintenance Improvements pecial Items (User Defined)						\$109,040.00 \$1,570,614.00	
ubtotal Capital Improvement Costs						\$3,532,099.00	
Additional Capital Improvement Co	sts						
lewatering			\$50,000.00	L.S.		\$50,000.00	
lobilization raffic Control			5% \$15,000.00	L.S.		\$176,605.00 \$15.000.00	-
tility Coordination/Relocation			\$15,000.00	L.S. L.S.		\$15,000.00	
tormwater Management/Erosion Control			5%			\$176,605.00	
ubtotal Additional Capital Improvement Cos	ts					\$468,210.00	
Land Acquisition Costs						\$2 EE4 000 C0	
OW/Easements ubtotal Land Acquisition Costs						\$2,554,000.00 \$2,554,000.00	
Other Costs (percentage of Capital	Improvement Costs)					42,000,000.00	
ngineering			15%			\$600,046.00	
egal/Administrative			5% 10%			\$200,015.00	
Contract Admin/Construction Management			10%			\$400,031.00 \$1.000.077.00	
			2570				
ubtotal Other Costs						\$2,200,169.00	

UD-MP Cost Version 2.2 Sharktooth Alternatives.xls, Alt A-ReachAlt A

PROJECT :	Sharktooth						
DRAINAGEWAY :	Sharktooth Sharktooth						
REACH :	Alt B						
JURISDICTION :	City of Greeley					-	
REACH ID:	Alt B-ReachAlt B		Enter Estimator Nam	e on Project Inf	DATE :	6/6/2019	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
			QUANTIT	UNIT	01111 0031	0001	USER COMMENTS
Box Culverts Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
16	6	1	65	L.F.	\$2,116.83	\$137,594.00	
12	4	1	58	L.F.	\$1,095.16	\$63,520.00	
Headwall and Toewalls	T T		T	ľ	1		
Individual Box Span (ft)	No. of Barrels	Total Span (ft) 18.00	2	EA	£1 011 50	\$2.622.00	
16	1	18.00	2	EA	\$1,811.52 \$1,343.16	\$3,623.00 \$2,686.00	
12 Wingwalls (includes wingwalls on e	aither side of channel ar	id concrete apron)	2	EA	\$1,343.10	\$2,000.00	
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
16	6	1	2	EA	\$16,954.63	\$33,909.30	
12	4	1	2	EA	\$9,735.48	\$19,471.00	
Channel Improvements							
Excavation, Low Range			271692	C.Y.	\$15.00	\$4,075,380.00	
2-inch Riprap, Type M			300	C.Y.	\$80.00	\$24,000.00	
Removals							
Removal of culvert pipe (D<48")			200	L.F.	\$27.00	\$5,400.00	
andscaping and Maintenance	Improvements						
Reclamation & seeding (native grasses)			40	ACRE	\$1,340.00	\$53,600.00	
rail/Path, Crusher Fines (10' Width)			8000	L.F.	\$15.00	\$120,000.00	
Special Items (User Defined)							
Pedestrian Bridge	<user defined="" items<="" td=""><td></td><td>1</td><td>EA</td><td>\$75,000.00</td><td>\$75,000.00</td><td></td></user>		1	EA	\$75,000.00	\$75,000.00	
lume	<user defined="" items<="" td=""><td></td><td>100</td><td>CY</td><td>\$1,100.00</td><td>\$110,000.00</td><td></td></user>		100	CY	\$1,100.00	\$110,000.00	
Excavation Haul	<user defined="" items<="" td=""><td></td><td>203769</td><td>CY</td><td>\$12.00</td><td>\$2,445,228.00</td><td></td></user>		203769	CY	\$12.00	\$2,445,228.00	
andscape	<user defined="" items<="" td=""><td>•</td><td>1</td><td>LS</td><td>\$150,000.00</td><td>\$150,000.00</td><td></td></user>	•	1	LS	\$150,000.00	\$150,000.00	
Land Acquisition			0	54	600.000.00	¢00.000.00	
Temporary Easements Easement/ROW Acquisition	1		3 34.00	EA	\$30,000.00	\$90,000.00 \$2,992,000.00	
Augustum	1		34.00	HONE	400,000.00	42,002,000.00	
	Master Dia	n Canital Impro	vement Cost Su	mmarv			
Capital Improvement Costs	master Pla	apital impro	Concine Cost Sul	initial y			
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts						\$260,803.00	
lydraulic Structures	-	-	-			\$0.00	
Channel Improvements						\$4,099,380.00	
Detention/Water Quality Facilities						\$0.00	
Removals andscaping and Maintenance Improvements						\$5,400.00	
pecial Items (User Defined)						\$2,780,228.00	
ubtotal Capital Improvement Costs						\$7,319,411.00	
Additional Capital Improvement Co	sts						
Dewatering			\$75,000.00	L.S.		\$75,000.00	
Abbilization			5%			\$365,971.00	
raffic Control			\$15,000.00	L.S.		\$15,000.00	
Itility Coordination/Relocation itormwater Management/Erosion Control			\$100,000.00 5%	L.S.		\$100,000.00 \$365,971.00	
ubtotal Additional Capital Improvement Cost	sts		570			\$921,942.00	
Land Acquisition Costs							
OW/Easements						\$3,082,000.00	
ubtotal Land Acquisition Costs						\$3,082,000.00	
Other Costs (percentage of Capita	Improvement Costs)						
ingineering			15%			\$1,236,203.00	
egal/Administrative			5% 10%			\$412,068.00 \$824,135.00	
			25%			\$2,060,338.00	
Contract Admin/Construction Management Contingency							
Contingency Subtotal Other Costs			20%			\$4,532,744.00	

PROJECT :	Sharktooth						
DRAINAGEWAY : REACH :	Sharktooth Alt C						
JURISDICTION :	City of Greeley						
REACH ID:	Alt C-ReachAlt C		Enter Estimator Name	e on Project Infe	O DATE :	6/6/2019	
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Pipe Culverts and Storm Drains	6						
Circular Pipes	Longeth (ft)	No. of Downla	1 1		1		
Diameter (in) 54-inch	Length (ft) 190	No. of Barrels	190	L.F.	\$289.00	\$54,910.00	
48-inch	1660	1	1660	L.F.	\$193.00	\$320,380.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels	2	EA	eo 700 00	AF 500.00	
48-inch Headwalls	Yes	1	2	EA	\$2,760.00	\$5,520.00	
Diameter (in)	Applicable	No. of Barrels					
54-inch	Yes	1	2	EA	\$1,913.48	\$3,827.00	
Wingwalls (includes concrete apro	on)	No. of Demain	1 1		1		
Diameter (in) 54-inch		No. of Barrels	2	EA	\$11,727.35	\$23,455.00	
Manholes and Inlets						020,100.00	
lanhole, 6' Dia. (Pipe Dia. = 48")			4	EA	\$5,762.00	\$23,048.00	
lydraulic Structures							
Sloping Drop Structures		N			1		
Height (ft)	Bottom Width (ft) 10	Yn (ft) 0.5	2	FA	\$25,595.02	\$51,190.00	
4 1.5	10	0.5	2	EA	\$25,595.02 \$21,393.82	\$42,788.00	
Channel Improvements		5.0			42.,500.0L	¢.2,.00.00	
2-inch Riprap, Type M			300	C.Y.	\$80.00	\$24,000.00	
xcavation, Low Range			8000	C.Y.	\$15.00	\$120,000.00	
Detention/Water Quality Faciliti	ies						
Detention (User Entered Quantities	s)						
xcavation, Low Range	1		175200	C.Y.	\$15.00	\$2,628,000.00	
Removals	1						
Removal of culvert pipe (D<48")	1		100	L.F.	\$27.00	\$2,700.00	
andscaping and Maintenance	Improvements						
Vetlands Plantings Reclamation & seeding (native grasses)	-		1 23	ACRE	\$33,500.00 \$1,340.00	\$33,500.00 \$30,820.00	
rail/Path, Crusher Fines (10' Width)	Ī		5500	L.F.	\$15.00	\$82,500.00	
Special Items (User Defined)							
Excavation Haul Pond	<user defined="" item<="" td=""><td>IS</td><td>156000</td><td>CY</td><td>\$12.00</td><td>\$1,872,000.00</td><td></td></user>	IS	156000	CY	\$12.00	\$1,872,000.00	
Road Improvements	<user defined="" item<="" td=""><td></td><td>369</td><td>CY</td><td>\$55.00</td><td>\$20,295.00</td><td></td></user>		369	CY	\$55.00	\$20,295.00	
Pond Park Improvements	<user defined="" item<="" td=""><td></td><td>1</td><td>LS</td><td>\$500,000.00 \$500,000.00</td><td>\$500,000.00 \$500,000.00</td><td></td></user>		1	LS	\$500,000.00 \$500,000.00	\$500,000.00 \$500,000.00	
Spillway/Berm andscape	<user defined="" item<="" td=""><td></td><td>1</td><td>LS</td><td>\$150,000.00</td><td>\$150,000.00</td><td></td></user>		1	LS	\$150,000.00	\$150,000.00	
and Acquisition							
emporary Easements	1		3	EA	\$30,000.00	\$90,000.00	
asement/ROW Acquisition			23.00	ACRE	\$88,000.00	\$2,024,000.00	
		<b>0</b> 14 11					
	Master Pla	an Capital Improv	vement Cost Sur	nmary			
Capital Improvement Costs	Master Pla	an Capital Improv	vement Cost Sur	nmary		\$431,140.00	
Capital Improvement Costs ipe Culverts and Storm Drains concrete Box Culverts	Master Pla	an Capital Improv	vement Cost Sur	nmary		\$431,140.00 \$0.00	
Capital Improvement Costs ipe Culverts and Storm Drains oncrete Box Culverts ydraulic Structures	Master Pla	an Capital Improv	vement Cost Sur	nmary		\$0.00 \$93,978.00	
Capital Improvement Costs ripe Culverts and Storm Drains Concrete Box Culverts ydraulic Structures hannel Improvements	Master Pla	an Capital Improv	vement Cost Sur	nmary		\$0.00 \$93,978.00 \$144,000.00	
Capital Improvement Costs pic Culvers and Storn Drains concrete Box Culvers ydraulic Structures hannel Improvements elemton/Water Qualty Facilities	Master Pla	an Capital Improv	vement Cost Sur	nmary		\$0.00 \$93,978.00 \$144,000.00 \$2,628,000.00	
Capital Ingrovement Costs lipe Calverts and Storm Drains concrete Box Culverts hannel Ingrovements elevition/Water Qualty Facilities envolus andscaping and Maintenance Improvements	Master Pla	an Capital Improv	vement Cost Sur	nmary		\$0.00 \$93,978.00 \$144,000.00 \$2,628,000.00 \$2,700.00 \$146,820.00	
Capital Ingrovement Costs ipe Culverts and Storm Drains concrete Box Culverts ydrauld: Structures hannol Improvements etemfon/Water Quality Facilities etemolos andiscaping and Maintenance Improvements pecial Items (User Defined)	Master Pla	an Capital Improv	vement Cost Sur	nmary		\$0.00 \$93,978.00 \$144,000.00 \$2,628,000.00 \$2,700.00 \$146,820.00 \$3,042,295.00	
Capital Improvement Costs ppc Culverts and Storm Drains concrete Box Culverts ydraulo Structures hannel Improvements etention/Water Cusity Facilities errowals emrowals amfocaping and Maintenance Improvements pecial Items (User Defined) ubotal Capital Improvement Costs	Master Pla	an Capital Improv	vement Cost Sur	nmary		\$0.00 \$93,978.00 \$144,000.00 \$2,628,000.00 \$2,700.00 \$146,820.00	
Capital Ingrovement Costs pp Cutwerts and Storm Drains oncrete Box Cutwerts draulc Structures hannel Ingrovements eterionfWater Cuality Facilities emovals andscaping and Maintenance Ingrovements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs	Master Pla	an Capital Improv	s35,000.00	LS.		\$0.00 \$33,978.00 \$144,000.00 \$2,628,000.00 \$2,700.00 \$146,820.00 \$3,042,295.00 \$6,488,933.00	
Capital Improvement Costs pp Culverts and Storm Drains correle Box Culverts ydrautic Structures hannel Improvements eenton/Water Cualty Facilities emovals andscaping and Maintenance Improvements pacial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs Capital Capital Improvement Costs Capital Capital Capital Improvemen	Master Pla	an Capital Improv	\$35,000.00 5%	LS.		\$0.00 \$33,978.00 \$144,000.00 \$2,628,000.00 \$146,820.00 \$3,042,295.00 \$6,488,933.00 \$35,000.00 \$324,447.00	
Capital Improvement Costs pe Culverts and Storm Drains concrete Box Culverts ydrautic Structures hannel Improvements etention/Water Cuality Facilities amovalis andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Geptial Improvement Cost watering biblization affic Control	Master Pla	an Capital Improv	\$35,000.00 5% \$25,000.00	L.S.		\$0.00 \$93,978.00 \$144,000.00 \$2,628,000.00 \$146,820.00 \$146,820.00 \$3,042,295.00 \$6,488,933.00 \$35,000.00 \$324,447.00 \$25,000.00	
Capital Improvement Costs pipe Culverts and Storm Drains oncrete Box Culverts hannel Improvements electricon/Water Qualty Facilities emovals entocaping and Maintenance Improvements pecial Items (User Defined) ubiotal Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Cost Additional Capital Improvement Cost additional Capital Improvement Cost Additional Capital Improvement Cost Mathematication (Cost) Mathematication (Cost)	Master Pla	an Capital Improv	\$35,000.00 5% \$25,000.00 \$50,000.00	L.S.		\$0.00 \$93,978.00 \$144,000.00 \$2,628.000.00 \$2,700.00 \$146,820.00 \$3,042,295.00 \$6,488,933.00 \$35,000.00 \$324,447.00 \$250,000.00	
Capital Improvement Costs ppe Culverts and Storm Drains concrete Box Culverts ydrautic Structures hannel Improvements etention/Water Cuality Facilities amovals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Gupital Improvement Costs Additional Gupital Improvement Costs Additional Gupital Improvement Costs Main Control biblization affic Control	sts	an Capital Improv	\$35,000.00 5% \$25,000.00	L.S.		\$0.00 \$93,375.00 \$144,000.00 \$2,628,000.00 \$2,700.00 \$1,446,820.00 \$3,042,225.00 \$5,448,933.00 \$35,422,447.00 \$25,000.00 \$23,447.00	
Capital Improvement Costs ppe Culverts and Storm Drains concrete Box Culverts ydrautic Structures hannel Improvements etention/Water Cuality Facilities amovals andscaping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Gupital Improvement Costs Additional Gupital Improvement Costs Additional Gupital Improvement Costs Main Control biblization affic Control	sts	an Capital Improv	\$35,000.00 5% \$25,000.00 \$50,000.00	L.S.		\$0.00 \$93,978.00 \$144,000.00 \$2,628.000.00 \$2,700.00 \$146,820.00 \$3,042,295.00 \$6,488,933.00 \$35,000.00 \$324,447.00 \$250,000.00	
Capital Improvement Costs [pc Culverts and Storn Drains concrete Box Culverts ydraulo Structures hannel Improvements etention/Water Cusity Facilities etention/Water Cusity Facilities etention/Water Cusity Facilities etention motics aping and Maintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Cost Indication formwater Management/Ecosion Control Ubtotal Additional Capital Improvement Cost Land Acquisition Costs OV/Easements	sts	an Capital Improv	\$35,000.00 5% \$25,000.00 \$50,000.00	L.S.		\$0.00 \$93,976.00 \$144,000.00 \$2,628.000.00 \$2,628.000.00 \$3,042.295.00 \$3,042.295.00 \$35,000.00 \$32,447.00 \$250,000.00 \$252,447.00 \$252,447.00 \$258,000.00 \$252,447.00 \$258,400 \$21,114,000.00	
Capital Ingrovement Costs lipe Clivers and Storn Drains correle Box Clivers ydrauls Structures hannel Ingrovements etenfion Water Cuality Facilities amovals andscaping and Maintenance Ingrovements pecial times (User Defined) utotal Capital Ingrovement Costs Additional Capital Ingrovement Costs Additional Capital Ingrovement Costs Indicontrol affic Control affic Control affic Control bitization control and Capital Ingrovement Costs Workingenent/Ecosion Control Land Acquisition Costs WV/Easements utotal Land Acquisition Costs	sets	an Capital Improv	\$35,000.00 5% \$25,000.00 \$50,000.00	L.S.		\$0.00 \$93,378.00 \$144,000.00 \$2,628,000.00 \$2,700.00 \$1,042,226.00 \$3,042,226.00 \$3,042,226.00 \$3,042,226.00 \$3,244,47.00 \$25,000.00 \$324,447.00 \$324,447.00	
Capital Ingrovement Costs pipe Cilverts and Storn Drains concrete Box Culverts ydrauld: Structures hannel Imgrovements teennion/Water Quality Facilities termovals teennion/Water Quality Facilities termovals teennion/Water Quality Facilities termovals termovals termovals dubtatal capital Imgrovement Costs Additional Capital Imgrovement Costs Additional Capital Imgrovement Costs Matrix Additional Capital Imgrovement Co Unitorial Additional Capital Imgrovement Cost Land Acquisition Costs Subtotal Land Acquisition Costs Other costs (percentage of Capital Other Costs (percentage of Capital	sets	an Capital Improv	\$35,000.00 5% \$25,000.00 5% \$50,000.00 5%	L.S.		\$0.00 \$39.378.00 \$144.000.00 \$2.628.000.00 \$2.628.000.00 \$3.642.205.00 \$3.642.205.00 \$3.042.295.00 \$3.000.00 \$324.447.00 \$250.000.00 \$2324.447.00 \$250.000.00 \$224.447.00 \$254.447.00 \$250.000.00 \$278.894.00 \$2,114.000.00	
Capital Improvement Costs (Capital Improvement Costs) Coverts and Storm Drains correle Box Culverts ydrauls Structures hannel Improvements elemiton/Water Cuality Facilities terminals andiscaping and Maintenance Improvements pacial items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Co watering tobilization artific Control tilly CoordinationRelocation othmater Management/Erosion Control ubtotal Additional Capital Improvement Co Coversement Fromon Costs Ubtoral Additional Capital Improvement Co Ubtracted Internet Costs Other Costs (percentage of Capital gen/Administrative	sets	an Capital Improv	\$35,000.00 5% \$25,000.00 5% 5% 15%	L.S.		\$0.00 \$30.378.00 \$144.000.00 \$2.628.000.00 \$2.628.000.00 \$3.4648.033.00 \$3.4648.933.00 \$3.5000.00 \$2.24.447.00 \$2.24.447.00 \$2.24.447.00 \$2.24.447.00 \$2.24.447.00 \$2.2114.000.00 \$2.114.000.00 \$2.114.000.00 \$2.31.00 \$3.31.00	
Capital Ingrovement Costs lipe Culverts and Storm Drains correle Box Culverts Structures hannel Improvements elemion/Water Quality Facilities errovats andscaping and Maintenance Improvements entrolia Capital Improvement Costs Additional Capital Improvement Cost Additional Capital Improvement Cost Additional Capital Improvement Cost Additional Capital Improvement Cost Marking Coordination/Relocation bitorial Additional Capital Improvement Cor Land Acquisition Costs Other Costs (percentage of Capita Other Costs (	sets	an Capital Improv	\$35,000.00 5% \$25,000.00 \$5% 5% 15% 15%	L.S.		\$0.00 \$39.378.00 \$144.000.00 \$2.628.000.00 \$2.628.000.00 \$3.042.295.00 \$3.042.295.00 \$3.542.295.00 \$3.542.295.00 \$3.544.47.00 \$22.447.00 \$232.447.00 \$323.447.00 \$333.447.00 \$	
Capital Improvement Costs (Capital Improvement Costs) Coverts and Storm Drains correle Box Culverts ydrauls Structures hannel Improvements elemiton/Water Cuality Facilities terminals andiscaping and Maintenance Improvements pacial items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Co watering tobilization artific Control tilly CoordinationRelocation othmater Management/Erosion Control ubtotal Additional Capital Improvement Co Coversement Fromon Costs Ubtoral Additional Capital Improvement Co Ubtracted Internet Costs Other Costs (percentage of Capital gen/Administrative	sets	an Capital Improv	\$35,000.00 5% \$25,000.00 5% 5% 15%	L.S.		\$0.00 \$30.378.00 \$144.000.00 \$2.628.000.00 \$2.628.000.00 \$3.4648.033.00 \$3.4648.933.00 \$3.5000.00 \$2.24.447.00 \$2.24.447.00 \$2.24.447.00 \$2.24.447.00 \$2.24.447.00 \$2.2114.000.00 \$2.114.000.00 \$2.114.000.00 \$2.31.00 \$3.31.00	

6/11/2019, 11:31 AM

UD-MP Cost Version 2.2 Sharktooth Alternatives.xls, Alt C-ReachAlt C

MAS	STER PLAN C	OST ESTIMAT	E FOR INDIV	IDUAL RE	ACH		
	-						
PROJECT : DRAINAGEWAY :	Sharktooth						
DRAINAGEWAY : REACH :	Sharktooth Alt D						
JURISDICTION :							
REACH ID:	City of Greeley Alt D-ReachAlt D		Enter Estimator Nam	o on Project Inf	DATE :	6/6/2019	
REACH ID:	Alt D-ReachAlt D		Enter Estimator Nan	e on Project ini	DATE:	6/6/2019	
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Pipe Culverts and Storm Drains	6						
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
48-inch	1660	1	1660	L.F.	\$193.00	\$320,380.00	
Flare End Sections	1	1	1	1	1	1	
Diameter (in)	Applicable	No. of Barrels					
48-inch	Yes	1	2	EA	\$2,760.00	\$5,520.00	
Manholes and Inlets		1					
Manhole, 6' Dia. (Pipe Dia. = 48")		I	4	EA	\$5,762.00	\$23,048.00	
Channel Improvements							
9-inch Riprap, Type L			30	C.Y.	\$74.00	\$2,220.00	
Excavation, Low Range			4500	C.Y.	\$15.00	\$67,500.00	
Removals							
Removal of culvert pipe (D<48")			100	L.F.	\$27.00	\$2,700.00	
	Improvomente					42,000.00	
andscaping and Maintenance	improvements		2	ACRE	\$1,340.00	\$2,680.00	
Reclamation & seeding (native grasses)	1		2	AURE	\$1,340.00	\$2,080.00	
Special Items (User Defined)							
Road Improvements	<user defined="" iten<="" td=""><td></td><td>369</td><td>CY</td><td>\$55.00</td><td>\$20,295.00</td><td></td></user>		369	CY	\$55.00	\$20,295.00	
andscape	<user defined="" iten<="" td=""><td>15</td><td>1</td><td>LS</td><td>\$50,000.00</td><td>\$50,000.00</td><td></td></user>	15	1	LS	\$50,000.00	\$50,000.00	
Land Acquisition							
Temporary Easements			1	EA	\$30,000.00	\$30,000.00	
Easement/ROW Acquisition			2.00	ACRE	\$88,000.00	\$176,000.00	
	Master Pl	an Capital Impro	vement Cost Su	mmary			
Capital Improvement Costs							
Pipe Culverts and Storm Drains						\$348,948.00	
Concrete Box Culverts						\$0.00	
Hydraulic Structures						\$0.00	
Channel Improvements						\$69,720.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$2,700.00	
andscaping and Maintenance Improvements						\$2,680.00	
Special Items (User Defined)						\$70,295.00	
Subtotal Capital Improvement Costs						\$494,343.00	
Additional Capital Improvement Co	ists			1			
Dewatering			\$25,000.00	L.S.		\$25,000.00	
Mobilization			5%			\$24,717.00	
raffic Control			\$25,000.00	L.S.		\$25,000.00	
Itility Coordination/Relocation			\$50,000.00	L.S.		\$50,000.00	
Stormwater Management/Erosion Control			5%	L		\$24,717.00	
Subtotal Additional Capital Improvement Con	sts					\$149,434.00	
Land Acquisition Costs							
ROW/Easements						\$206,000.00	
Subtotal Land Acquisition Costs				_	_	\$206,000.00	
Other Costs (percentage of Capita	I Improvement Costs)		450/			000 507 00	
Ingineering			15%			\$96,567.00	
egal/Administrative			5%			\$32,189.00	
Contract Admin/Construction Management			10% 25%			\$64,378.00 \$160,944.00	
Contingency Subtotal Other Costs			20%	L		\$160,944.00 \$354,078.00	
Fotal Capital Improvement Cost	ts					\$1,203,855.00	

Comment and Response Tracking Alternatives Analysis Report

No.	YOUR NAME (last name, first name)	SECTION #	PAGE	PARA	COMMENT	S, R, E (Substantive, Requested, Editorial)	A, R, C (Accepted, Rejected with explanation, Needs Clarification)	RESPONSE (by consultant)
1	Fisher, Andrew	2.2	6	1	Sutured should be saturated	E	Α	Report Updated
2	Fisher, Andrew	2.3.2	9	10	Embankment is referred to as "The Broe Land Embankment" further into report. If calling it so, make first reference here	R	A	Report Updated
3	Fisher, Andrew	2.3.10	9	1	Line 5 - should be conveyed	E	Α	Report Updated
4	Fisher, Andrew	2.3.11	9	2	Capitalize Sheep	E	Α	Report Updated
5	Fisher, Andrew	Table 2-3	9		I believe this table indicates the amount of each watershed that is expected to one day be within Greeley given the long- range growth boundary. I'm not fully clear though. Please clarify	S	A	Report was clarifed to explain the long range growth boundary.
6	Fisher, Andrew	Figure 2-1	10		I like it. Maybe add Highway 34, 83rd Avenue and O Street labels for context. It may be helpful to screen the existing Greeley limits - it's a bit hard to decipher Weld County/Greeley boundaries with the bizarre boundary conditions	R	A	Report Updated
7	Fisher, Andrew	Figure 2-2	11		Looks like developments are highlighted from parcel layer, but this makes dense parcel areas look different than more open parcels. For example, parts of River Run look to be different colors. Can you make each dev't off one outside perimeter? Also, Promontory may be too light to see?	E	A	Report Updated
8	Fisher, Andrew	3.5.3	14		Can you add a table for each detention pond utilized in the model (as shown in the rating curves later in the report) that displays what design storm each pond provides sufficient storage, a la the NGDTMP?	R	A	An existing detention basin table was added to the report in Chapter 4
9	Fisher, Andrew	Table 3-2	15		Can we have a legend or supplemental table to ID which watershed the basin ID shorthand correlates to	R	A	A table was added to the report to clarify the watershed abbreviations
10	Fisher, Andrew	Figure 3-1	16		First read seems to imply all displayed detention basins are recommended from future development, but some currently exist. Clarify if figure is "Future Conditions" detention basins, or code in the existing detention basins with a different color.	S	A	Figure was revised to only show future detention basin. Existing detention basins can be found on the watershed exhibit
11	Fisher, Andrew	Table 3-3	17		Can you add a description for why peak flow exceeds 5-yr existing peak flow in future conditions	R	A	Clarification was added to the report tha although each subwatershed was detained to 5-yr historic levels in the future conditions modeling, slight increases in peak flow were observed due hydrograph timing and routing.

Page 1 of 4

tornat	ives Analysis Report			1			1	
No.	YOUR NAME (last name, first name)	SECTION #	PAGE	PARA	COMMENT	S, R, E (Substantive, Requested, Editorial)	A, R, C (Accepted, Rejected with explanation, Needs Clarification)	RESPONSE (by consultant)
12	Fisher, Andrew	4.2.1	19		Can you add further commentary on which hydrologic method is recommended for which applications? Rain on grid more useful when evaluating X whereas the CUHP method better for X	R	A	A paragraph was added to clarify rain- grid is typically used for preliminary identification of flow paths while proble areas and flooding depths better correlate to the baseline hydrology usi the runoff hydrographs from CUHP
13	Fisher, Andrew	Figure 4.5, Figure 4.6	26-27		Change Color of Future 4th St so it doesn't look like a High Hazard area	R	А	Report Updated
14	Fisher, Andrew	Figures 4.5, 4.6	26-27		Can you please add the definition of "high hazard area" to these figures for more convenient referece?	R	A	Report Updated
15	Fisher, Andrew	5.3.1	28		Make overtime into over time	E	Α	Report Updated
16	Fisher, Andrew	5.5	28		Appendix says UD-MP 2012 costs were used, here it says 2014?	S	Α	Report was updated. All unit costs we updated from 2012
17	Fisher, Andrew	Figure 5.4			Revise Figure title to "Wiedeman Creek"	E	Α	Report Updated
18	Fisher, Andrew	Figure 5.4			This Figure does not include indundated strcutres but others do.	R		
19	Fisher, Andrew	5.6.5.2	30		Ensure all references to 95th Street are changed to 95th Avenue	E	Α	Report Updated
20	Fisher, Andrew	5.6.5.2	30	Future 4th St	Sharktooth is misspelled	E	A	Report Updated
21	Fisher, Andrew	5.6.5.2	30	5	Can we use an alternative term for floodplain if we aren't recommending establishment of regulatory floodplain for Sharktooth Draw?	R	A	References to floodplain were substituted within the report
22	Fisher, Andrew	Table 5.7	31		Separation misspelled	E	Α	Report Updated
23	Fisher, Andrew	5.6.7.1	33	5	Can we use an alternative term for floodplain if we aren't recommending establishment of regulatory floodplain for Wiedeman Creek?	R	A	References to floodplain were substituted within the report
24	Fisher, Andrew	Table 5.10	34		It's a bit unclear which alternatives are pitted against each other as choices. For example, The 7.5ac-ft detention pond is listed in the text as an alternative for Skyview Street but in the Table under 81st Ave. If selected, which alternatives no longer apply?	S	A	This comment was discussed during progress meeting. The selected upstream of 81st Avenue mitigates b the Skyview St and 81st storm drain exceeding City criteria
25	Fisher, Andrew	Table 5-14	36		The table note and text on previous page disagree on which alternative requires Northridge Minimum Criteria Alternative to be implemented	S	A	Table has been revised
26	Fisher, Andrew	Table 5-14	36	1	Separation misspelled	E	Α	Report Updated
27	Fisher, Andrew	5.8.3	38	5	Wiedeman misspelled	E	Α	Report Updated

Comment and Response Tracking Alternatives Analysis Report

No.	YOUR NAME (last name, first name) Fisher. Andrew	SECTION # Table 5-20	<b>PAGE</b> 38	PARA	COMMENT Ensure all references to 95th Street are changed to 95th	S, R, E (Substantive, Requested, Editorial) F	A, R, C (Accepted, Rejected with explanation, Needs Clarification) A	RESPONSE (by consultant) Report Updated
28					Avenue	_		
29	Fisher, Andrew	Figure 5-4			Amour Hill Rd misspelled	E	Α	Report Updated
30	Fisher, Andrew	Figure 5-4, Section 5.6.7.2			In pursuing a storm drain solution, is laying the pipe at a different slope all that's truly required to mitigate the issues experienced here?	R	A	This comment was clarified in the progess meeting. Relaying pipe to increase conveyance in the area reduces the flooding depth to within City criteria
31	Fisher, Andrew	Figure 5-4			Expected detention as a possibility at Amour hill Dr a la on Wiedeman Creek, due to likely detention pond with future development and anecdotal issues with those two inundated structures. Wouldn't this be cheaper than relaying the 30" such that it could be evaluated as an alternative? Alternately, detention pond with development may eliminate this alternative from being required at all	S	A	This alternative was incorporated into the alternative analysis. It was not include in the recommended plan or conceptual design.
32	Fisher, Andrew				Canal Base-flow. I think it may be helpful to have a standalone Figure and paragraph showing all locations evaluated for Canal Base-flow, and why the ones not recommended were impractical	R	с	All proposed canal baseflow projects were included in the conceptual design. If a stand alone figure is still desired it can be added in the subsequent submittal
33	Fisher, Andrew	6.1	43	2	Change size to sized	R	А	Report Updated
34	Fisher, Andrew	Figure 6-1			Separation is misspelled	E	A	Report Updated
35	Fisher, Andrew	Figure 6-2			Suggest making Detention Basin icon a different color than Canal Crossing Improvement.	R	Α	Report Updated
36	Fisher, Andrew				As this Alternatives Analysis will result in an a la carte option rather than a basin-wide alternative, I think it would be instructive to have a master matrix of each Alternative Plan (No Action, Minimum Criteria, Flood Mitigation, Canal Baseflow Separation) for each watershed and within that each location, which each one clearly stated as "Recommended," "Not Recommended" or "Not Applicable." There may be fourth category between Recommended or Not Recommended.	R	A	Table 6-1 was added identifying each component of the recommended plan
37	Fisher, Andrew				We will definitely need recommended phasing or priorities.	R	A	This will be provided in the conceptual design section

Page 2 of 4

Page 3 of 4

No.	YOUR NAME (last name, first name)	SECTION #	PAGE	LINE	COMMENT	S, R, E (Substantive, Requested, Editorial)	A, R, C (Accepted, Rejected with explanation, Needs Clarification)	RESPONSE (by consultant)
1	Fisher, Andrew	TOC	iii	<b>T</b> 1	Wiedeman misspelled on Table 7-15	E	A	Report revised
2	Fisher, Andrew	ES	1	Tab ES1	Should we included Joel in here? HE had more impact on the study than Heather certainly, and had some definite impact on the final alternatives	S	A	Report revised
3	Fisher, Andrew	ES	1		See pdf. Misspellings of Wiedeman, Greeley and Bluffs.	E	Α	Report revised
4	Fisher, Andrew	ES	2		Can we please change the color of the existing roads so they stand out more	R	Α	Figure has been revised
5	Fisher, Andrew	ES	3		There are many areas that are shades of red or purple, so it's really difficult to differentiate between River Run and Promontory Heights. Please update colors and/or label the major developments	R	A	Figure has been revised
6	Fisher, Andrew	ES	4	ES 5.2	In the first paragraph, it states that it was discussed prevficusly that no records were found regarding the dam/basin. This is actually the first mention of this location in the report	E	A	Report was revised to remove the reference
7	Fisher, Andrew	ES	5	ES 5.3	Is it the Promontory Heights development or Lake Bluff that Hertzke Draw watershed impacts?	S	A	The reference to the Lake Bluf development was made before the development was separated. The reference has been revised to Promontory Heights
8	Fisher, Andrew	ES	6	ES 5.5	See pdf. There is a statement that dictates a point in time but it is unclear what this refers to. Please clarify	R	A	Report revised
9	Fisher, Andrew	ES	7	5.7	Add "from" for clarity	R	Α	Report revised
10	Fisher, Andrew	ES	7	5.7.4	Change "Amour Drive" to "Amour Hill Drive"	E	Α	Report revised
11	Fisher, Andrew	ES	7	5.7.4	"relying" should bwe "relaying"	E	Α	Report revised
12	Fisher, Andrew	ES ES	8	5.10	Revise 71st Street to 71st Avenue throughout report. Can you speak to the proposed conveyance of flows across	E S	A	Report revised
13					the basin boundary from Sharktooth to Sheep Draw?			explain the existing RCP culverts discharge into a wetland channel on the east side of 71st Ave. The wetland channel is within the Poudre 100-yr floodplain and outfall just upstream of the main stem of Sheep Draw
14	Fisher, Andrew	ES	8	5.10	Can you speak to the proposed conveyance of flows across the basin boundary from Sharktooth to Sheep Draw?	S	A	See comment 13
15	Fisher, Andrew	ES	9	5.12	Change Armor to Amour	E	Α	Report revised
16	Fisher, Andrew	ES	9	5.12	Are we planning on a fully fleshed out BCA in the final report per the RFP, including a more fleshed out prioritization?	S	R	The BCA developed in the alternative analysis was carried forward into the Conceptual Design and Exective Summary sections. The majority of alternatives do not have benefits to develop a BCA but rather increase the conveyance capacity to meet current City criteria
17	Fisher, Andrew	ES	10	Table ES 3	Typo in title	E	A	Report revised
18	Fisher, Andrew	1	13	Table 1- 1	Text is cut off in first column	E	A	Report revised
19	Fisher, Andrew	1	13	Table 1- 1	Promontory Heights?	E	A	Report revised
20	Fisher, Andrew	1	14		Same comment as No 2	E	A	Report revised
21	Fisher, Andrew	2	20	Fig 2.1	Same as Comment No 4	R	А	Report revised
22	Fisher, Andrew	2	21		Same as Comment No 5	R	A	Report revised
23	Fisher, Andrew	2	22		What are the blue squares inscribed in circles with a 0? Existing ponds? Are these intended to be shown?	E	A	Yes, existing detention basins were shown on the figure. The figure has been revised to include the detention basin names
24	Fisher, Andrew	3	23	3.1	How many instances was a pipeline in SWMM conveyed across subbasin boundaries?	R	A	The report was revised to include a reference to sixteen locations where this occurred

Alternati	ves Analysis Report							
No.	YOUR NAME (last name, first name)	SECTION #	PAGE	PARA	COMMENT	S, R, E (Substantive, Requested, Editorial)	A, R, C (Accepted, Rejected with explanation, Needs Clarification)	
38	Fisher, Andrew	Cost Estimates			It is difficult to identify the locations some of these cost estimate sheet correspond to, given shorthand, Reach numbers, and missing Drainageway names. I did not closely scrutinize these costs in part due to this.	R	A	The cost estimates were revised include an index on the cover she providing page numbers for each o estimate
39	Fisher, Andrew	Cost Estimates			I cannot find the Cost Estimate sheet that corresponds to the Amour Hill Drive pipe replacement cost estimate, but that estimate strikes me as quite low	R	A	see above

Page 4 of 4

raft Cr	onceptual Design Re	port						
No.	YOUR NAME (last name, first name)	SECTION #	PAGE	LINE	COMMENT	S, R, E (Substantive, Requested, Editorial)	A, R, C (Accepted, Rejected with explanation, Needs Clarification)	RESPONSE (by consultant)
	Fisher, Andrew	3	23	3.2	You may know phasing more than I, but with the rebrand of	S	A	Reference to the MHFD has
25					UDFCD to MHFD, is reissuance of the UDFCD manuals forthcoming such that it would behoove us to change references of UDFCD to MHFD? Assuming that is not clearcut, it may be worth a short passage mentioning the connection.			been included in the report
26	Fisher, Andrew	3	24	3.4.5	Beginning of paragraph got lost in the header	E	Α	Report revised
27	Fisher, Andrew	4	30	4.1	Is there anything to note from the previous Sheep Draw study that informed this study?	S	A	The previous study did not include information for these areas. The previous study focused on the main stem of Sheep Draw
28	Fisher, Andrew	4	30	4.2.1	Please specify pipes 30" and up	R	A	Report revised
29	Fisher, Andrew	4	37-38	Fig 4.5/4.6	High hazard designations at end of Spur Draw, Missile, Hertzke and near 71st Ave. I presume this is a result of boundary condition and that there isn't specifically a high	R	A	High hazard designations hav been revised
30	Fisher, Andrew	5	48	5.7	hazard adjacent to the river? Can this be edited out? Why is a BCA completed for 81st Avenue alone?	S	A	See comment 16. No other projects provided mitigation benefits to justify a BCA bein completed
31	Fisher, Andrew	5	49	5.8.3	It may be helpful to have an exhibit showing the extent of the drainageway reaches	R	A	Figure 7.3 has been added to the report
32	Fisher, Andrew	6	54	6.1	As development continues, stream buffer width needs decrease. Do you have recommendations for how to manage the decreased needs with increased development?	S	A	A recommendation threshold of 80 percent has been included in the report. Once
	Fisher Androw	6	55	Table 6	78th Avneue has No Action and minimum Criteria	E	A	the threshold is exceeded th buffer widths could be reduced
33	Fisher, Andrew			1	Alternatives selected. Please clarify.			Table has been revised
34	Fisher, Andrew	6	58	Figure 6-1	Figure reflects recommendations from initial Alt Analysis. Please update with final recommended plans	S	Α	Figure has been revised
35 36	Fisher, Andrew Fisher, Andrew	7 7	60 78	7.1.1 7.2.7.4	Typo Please ensure all mentions of street are "Amour Hill Drive"	E	A A	Report revised Report revised
	Eistern Andress	7	70	7074	Nach de all a la carlad lessa Nacharde all			Demonstrand
37 38	Fisher, Andrew Fisher, Andrew	7	78 78	7.2.7.4	"relying" should bwe "relaying" What is the existing slope of the 30" RCP?	E R	A	Report revised The existing pipe at 0% slope was determined from survey which was verified.
39	Fisher, Andrew	7	78	Table 7 15	Wiedeman misspelled on Table 7-15	E	Α	Report revised
40	Fisher, Andrew	7	87	10	As development continues, stream buffer width needs decrease. Do you have recommendations for how to manage the decreased needs with increased development?	S	A	See comment 32
41	Fisher, Andrew	Арр А	A-13		Do we have meeting minutes after February 6?	R	A	Informal communication followed the Feb. 6 meeting. The memo supplements the meeting minutes to summariz this communication
42	Fisher, Andrew	App D	C St / 71st		Change all mentions of 71st St to 71st Ave	E	А	References have been changed
43	Fisher, Andrew	App D	C St / 71st		"Type D" Inlet is intended to capture all 71 cfs? Can you clarify? This would require many inlets, and this location is not currently a detention pond. It seems more infrastructure would be required to route 71 cfs to an inlet point here.	S	A	The label has been revised to include further description o the extent of the proposed improvements
44	Fisher, Andrew	App D	C St / 71st		Design proposed to remove use of an existing detention facility while creating a 100-year storm drain? I may have missed this discussion, but why is this storm drain so large?	S	A	Design has been revised to continue low flows through the detention facility
45	Fisher, Andrew	App D	C St/71st		Typical channel section?	R	A	Typical Channel section has been added
46	Fisher, Andrew	App D	C St / 71st		Please label existing storm drains and indicate they are proposed to remain	R	Α	Revised
47	Fisher, Andrew	App D	C St/71st		How are we addressing proption of flows conveyed to a different drainage basin?	S	A	Existing drainage patterns in Sheep Draw to Poudre has been clarified in text
48	Fisher, Andrew	App D	C St/71st		Profile indicates receiving channel has adverse slope. Is this real, or is the alignment working its way up the channel embankment?	S	A	Profile has been revised

Co Dr

	nt and Response Tra nceptual Design Re		•					
No.	YOUR NAME (last name, first name)	SECTION #	PAGE	LINE	COMMENT	S, R, E (Substantive, Requested, Editorial)	A, R, C (Accepted, Rejected with explanation, Needs Clarification)	RESPONSE (by consultant)
110.	Fisher, Andrew	App D	SD		Why is HERCP pipe proposed instead of 48"?	R	A	The proposed design
49	Fisher, Andrew	Abb D	Outfall			K	~	transitions to 48" once adequate cover is available
50	Fisher, Andrew	App D	SD Outfall		Profile slope switches from 0.30% to -0.30%	E	А	Pipe slope label has been revised
51	Fisher, Andrew	App D	SD Outfall		What is the required boundary for easement and/or ROW acquisition for the channel and pond?	R	A	Proposed easement and acquisiton limits have been added
52	Fisher, Andrew	App D	Wied	1	Amour Hill Dr misspelled	E	Α	Revised
53	Fisher, Andrew	App D	Wied	1	83rd Ave is incorrectly labeled as 95th Ave	R	Α	Revised
54	Fisher, Andrew	App D	Wied	2	What is the required boundary for easement and/or ROW acquisition for the channel and pond?	R	A	Proposed easement and acquisiton limits have been added
55	Fisher, Andrew	App D	Wied	3	What is the required boundary for easement and/or ROW acquisition for the channel and pond?	R	A	Proposed easement and acquisiton limits have been added
56	Fisher, Andrew	App D	Wied	4	How is depth estimated on water and sewer? Existing pipe being dead flat is suspicious. Dropping 0.4ft shouldn't conflict with sanitary but it might, which would invalidate this alt.	S	A	The existing pipe at 0% slope was determined from survey which was verified.
57	Fisher, Andrew	Appd D	CR 62 E		Roads are mislabeled and the north arrow is the wrong direction.	S	Α	Report revised
58	Fisher, Andrew	App D	Jones	6	Does this detail provide enough freeboard?	S	A	The detail was revised to show 1 ft of depth of flow over the spillway and the 1 ft of freeboard



# **APPENDIX B - HYDROLOGIC ANALYSIS**

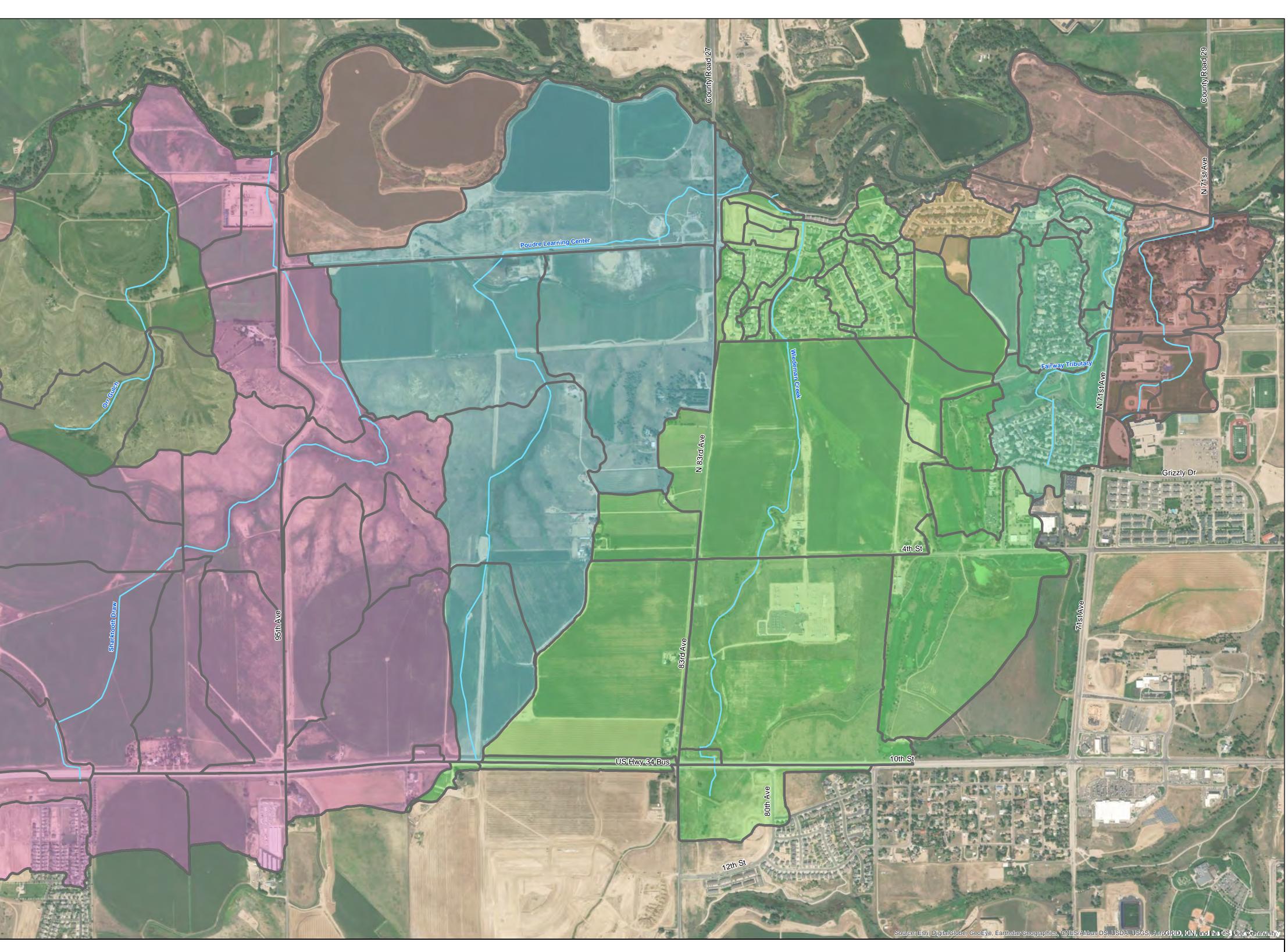


# SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN

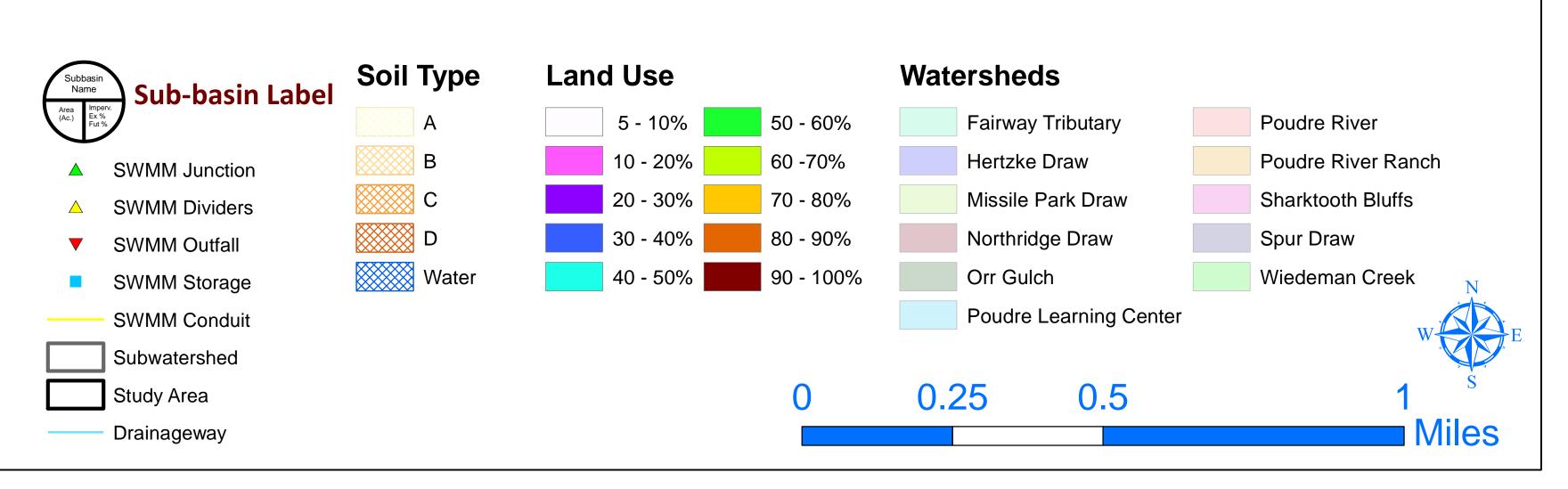
# **Interactive Figures (Select Below)**

Study Area Map

Existing Soils Map			
Future Soils Map			
Existing Land Use			
Future Land Use	<u>1-ft Contours</u>	<u>ON</u>	<u>OFF</u>
Existing SWMM Routing	10-ft Contours & Labels	<u>ON</u>	<u>OFF</u>
Future SWMM Routing	Subwatershed Labels	<u>ON</u>	<u>OFF</u>



# **Sharktooth Bluff Basin - Interactive Map**





# **CUHP Rainfall Distribution**

	2-Year		5-Year		10-Year		50-Year
1-hr Point	Rainfall = 0.85 in	1-hr Point	Rainfall = 1.12 in	1-hr Point	t Rainfall = 1.41 in	1-hr Point	t Rainfall = 2.
Time (min)	Depth (in)	Time (min)	Depth (in)	Time (min)	Depth (in)	Time (min)	Depth (in)
00:05	0.02	00:05	0.02	00:05	0.03	00:05	0.0
00:10	0.03	00:10	0.04	00:10	0.05	00:10	0.0
00:15	0.07	00:15	0.10	00:15	0.12	00:15	0.1
00:20	0.14	00:20	0.17	00:20	0.21	00:20	0.1
00:25	0.21	00:25	0.28	00:25	0.35	00:25	0.3
00:30	0.12	00:30	0.15	00:30	0.17	00:30	0.5
00:35	0.05	00:35	0.06	00:35	0.08	00:35	0.2
00:40	0.04	00:40	0.05	00:40	0.06	00:40	0.1
00:45	0.03	00:45	0.04	00:45	0.05	00:45	0.1
00:50	0.03	00:50	0.04	00:50	0.05	00:50	0.1
00:55	0.03	00:55	0.03	00:55	0.05	00:55	0.0
01:00	0.03	01:00	0.03	01:00	0.05	01:00	0.0
01:05	0.03	01:05	0.03	01:05	0.05	01:05	0.0
01:10	0.02	01:10	0.03	01:10	0.05	01:10	0.0
01:15	0.02	01:15	0.03	01:15	0.05	01:15	0.0
01:20	0.02	01:20	0.02	01:20	0.04	01:20	0.04
01:25	0.02	01:25	0.02	01:25	0.03	01:25	0.04
01:30	0.02	01:30	0.02	01:30	0.03	01:30	0.03
01:35	0.02	01:35	0.02	01:35	0.03	01:35	0.0
01:40	0.02	01:40	0.02	01:40	0.03	01:40	0.0
01:45	0.02	01:45	0.02	01:45	0.03	01:45	0.0
01:50	0.02	01:50	0.02	01:50	0.03	01:50	0.0
01:55	0.01	01:55	0.02	01:55	0.02	01:55	0.0
02:00	0.01	02:00	0.01	02:00	0.02	02:00	0.0

1	00-Year
L-hr Point	Rainfall = 2.77 in
e (min)	Depth (in)
00:05	0.03
00:10	0.08
00:15	0.13
00:20	0.22
00:25	0.39
00:30	0.69
00:35	0.39
00:40	0.22
00:45	0.17
00:50	0.14
00:55	0.11
01:00	0.11
01:05	0.11
01:10	0.06
01:15	0.06
01:20	0.03
01:25	0.03
01:30	0.03
01:35	0.03
01:40	0.03
01:45	0.03
01:50	0.03
01:55	0.03
02:00	0.03

# **CUHP Input Parameters**

								Depressio	n Storage (in) Horton's Infiltration Paramaters			
Subcatchment	EPA SWMM		Area	Length to	Length	Slope	Percent				Decay Coefficient	Final Rate
Name	Target Node	Raingage	(mi <sup>2</sup> )	Centroid (mi)	(mi)	(ft/ft)	Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	(1/seconds)	(in/hr)
FT_100	FT_B100	Sharktooth Bluffs	0.007087	0.101268939	0.23786	0.0029	31.8	0.35	0.1	3.05	0.0018	0.51
FT_101	FT_B101	Sharktooth Bluffs	0.030624	0.098087121	0.295795	0.0057	27.5	0.35	0.1	4.82	0.0008	0.96
FT_105	FT_B105	Sharktooth Bluffs	0.012618	0.106477273	0.19928	0.0425	43.2	0.35	0.1	4.84	0.0008	0.96
FT_110	FT_B110	Sharktooth Bluffs	0.002841	0.032784091	0.096591	0.0283	8.6	0.35	0.1	5	0.0007	1.00
FT_115	FT_B115	Sharktooth Bluffs	0.005095	0.051647727	0.104754	0.0275	21.7	0.35	0.1	5	0.0007	1.00
FT_120	FT_B120	Sharktooth Bluffs	0.053347	0.222518939	0.377405	0.0138	36.6	0.35	0.1	4.65	0.0007	0.93
FT_125	FT_B125	Sharktooth Bluffs	0.029471	0.133106061	0.32214	0.0229	5.7	0.4	0.1	3.19	0.0017	0.55
FT_130	FT_B130	Sharktooth Bluffs	0.083929	0.382537879	0.604716	0.0175	34.3	0.35	0.1	4.86	0.0009	0.92
HD_100	HD_B100	Sharktooth Bluffs	0.062669	0.197594697	0.400038	0.0188	5	0.4	0.1	3.57	0.0017	0.52
HD_105	HD_B105	Sharktooth Bluffs	0.113026	0.326136364	0.804451	0.0448	5.5	0.4	0.1	3.52	0.0015	0.63
HD_110	HD_B110	Sharktooth Bluffs	0.2449	0.502253788	1.085038	0.0315	5.8	0.4	0.1	3.1	0.0017	0.52
MPD_100	MPD_B100	Sharktooth Bluffs	0.12456	0.183371212	0.559489	0.0192	5.4	0.4	0.1	3.68	0.0013	0.68
MPD_105	MPD_B105	Sharktooth Bluffs	0.304375	0.418731061	0.974072	0.0315	6.7	0.4	0.1	3.47	0.0016	0.58
ND_100	ND_B100	Sharktooth Bluffs	0.035205	0.11967803	0.303125	0.035	12.1	0.35	0.1	4.83	0.0008	0.96
ND_105	ND_B105	Sharktooth Bluffs	0.051102	0.179943182	0.406061	0.0237	20.5	0.35	0.1	4.96	0.0007	0.99
ND_110	ND_B110	Sharktooth Bluffs	0.00163	0.057651515	0.086648	0.022	45.8	0.35	0.1	5	0.0007	1.00
ND_115	ND_B115	Sharktooth Bluffs	0.001861	0.046306818	0.085758	0.0295	16.2	0.35	0.1	5	0.0007	1.00
ND_120	ND_B120	Sharktooth Bluffs	0.000614	0.028011364	0.061837	0.0348	69.2	0.35	0.1	5	0.0007	1.00
ND_130	ND_B130	Sharktooth Bluffs	0.046312	0.135094697	0.41697	0.0125	25	0.35	0.1	5	0.0007	1.00
ND_135	ND_B135	Sharktooth Bluffs	0.007525	0.082234848	0.175341	0.0187	5.3	0.35	0.1	5	0.0007	1.00
ND_140	ND_B140	Sharktooth Bluffs	0.008558	0.060587121	0.128352	0.0207	59.1	0.35	0.1	5	0.0007	1.00
OG_100	OG_B100	Sharktooth Bluffs	0.293962	0.502367424	0.94125	0.0167	6.1	0.4	0.1	3.87	0.0012	0.72
OG_105	OG_B105	Sharktooth Bluffs	0.069535	0.329772727	0.570758	0.042	5.3	0.4	0.1	3.26	0.0017	0.57
OG_110	OG_B110	Sharktooth Bluffs	0.063768	0.20155303	0.419261	0.042	6.4	0.4	0.1	3.08	0.0018	0.52
PLC_100	PLC_B100	Sharktooth Bluffs	0.014299	0.064090909	0.315227	0.0081	18.9	0.4	0.1	3.31	0.0018	0.52
PLC_105	PLC_B105	Sharktooth Bluffs	0.251714	0.507594697	1.249337	0.0043	41.2	0.4	0.1	2.56	0.0011	0.38
PLC_110	PLC_B110	Sharktooth Bluffs	0.208985	0.324393939	0.716383	0.0253	7.1	0.4	0.1	3.99	0.0015	0.67
PLC_115	PLC_B115	Sharktooth Bluffs	0.196614	0.362026515	0.653636	0.0129	5.9	0.4	0.1	4.31	0.0012	0.79
PLC_120	PLC_B120	Sharktooth Bluffs	0.190338	0.263920455	0.520057	0.0013	6.4	0.4	0.1	4.02	0.0018	0.58
PLC_121	PLC_B121	Sharktooth Bluffs	0.086158	0.231666667	0.517008	0.0237	5.6	0.4	0.1	3.47	0.0018	0.54
PR_100	PR_B100	Sharktooth Bluffs	0.011813	0.090208333	0.163428	0.0599	5	0.4	0.1	2.73	0.0016	0.45
PR_105	PR_B105	Sharktooth Bluffs	0.042886	0.162992424	0.28572	0.0281	5.4	0.4	0.1	3.88	0.0015	0.63
PR_110	PR_B110	Sharktooth Bluffs	0.058249	0.148617424	0.350511	0.0531	5.4	0.4	0.1	2.91	0.0016	0.49
PR_115	PR_B115	Sharktooth Bluffs	0.016751	0.103806818	0.210095	0.0034	5.3	0.4	0.1	3.18	0.0015	0.53
 PR_120		Sharktooth Bluffs		0.19219697	0.528996	0.0362	5.7	0.4	0.1	3.36	0.0017	0.54
 PR_125		Sharktooth Bluffs	0.021478	0.126723485	0.217197	0.0315	5.3	0.4	0.1	3.02	0.0016	0.46
 PR_130	_ PR_B130	Sharktooth Bluffs		0.068219697	0.250947	0.0576	7	0.4	0.1	3.32	0.0015	0.56
 PR_135		Sharktooth Bluffs			0.662898	0.0042	65.8	0.4	0.1	1.2	0.0006	0.20
 PR_150	_ PR_B150	Sharktooth Bluffs	0.135777	0.314507576	0.606345	0.0021	17	0.4	0.1	2.5	0.0014	0.42
 PR_155		Sharktooth Bluffs			0.246023	0.0215	41.1	0.35	0.1	3.16	0.0017	0.54
PR_160	PR B160	Sharktooth Bluffs					21.7	0.35	0.1	4.19	0.0011	0.80
PRR_100	PRR B100	Sharktooth Bluffs			0.30428	0.0226	46.7	0.35	0.1	4.76	0.0008	0.94

# **CUHP Input Parameters**

								Depression Storage (in)		Horton's Infiltration Paramaters		
Subcatchment	EPA SWMM		Area	Length to	Length	Slope	Percent				Decay Coefficient	Final Rate
Name	Target Node	Raingage	(mi <sup>2</sup> )	Centroid (mi)	(mi)	(ft/ft)	Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	(1/seconds)	(in/hr)
PRR_105	PRR_B105	Sharktooth Bluffs	0.008214	0.068674242	0.161383	0.0179	5.1	0.4	0.1	3.01	0.0018	0.50
SD_100	SD_B100	Sharktooth Bluffs	0.10412	0.296174242	0.604205	0.0295	5.5	0.4	0.1	3.47	0.0016	0.59
SD_105	SD_B105	Sharktooth Bluffs	0.104729	0.234280303	0.520928	0.0356	5.3	0.4	0.1	4.59	0.0013	0.77
SD_110	SD_B110	Sharktooth Bluffs	0.056662	0.19217803	0.438466	0.0449	5.6	0.4	0.1	3.79	0.0015	0.66
SD_115	SD_B115	Sharktooth Bluffs	0.064756	0.238125	0.575341	0.0286	5.1	0.4	0.1	4.36	0.0018	0.60
SD_120	SD_B120	Sharktooth Bluffs	0.18846	0.432518939	0.815341	0.0305	7.3	0.4	0.1	4.39	0.0015	0.68
SKD_100	SKD_B100	Sharktooth Bluffs	0.07954	0.179772727	0.339053	0.002	6.7	0.4	0.1	3.17	0.0017	0.54
SKD_105	SKD_B105	Sharktooth Bluffs	0.034963	0.164318182	0.320682	0.0042	7.2	0.4	0.1	3.74	0.0014	0.68
SKD_106	SKD_B106	Sharktooth Bluffs	0.0045	0.140965909	0.258049	0.0213	16.1	0.4	0.1	4.66	0.0009	0.92
SKD_110	SKD_B110	Sharktooth Bluffs	0.059574	0.260852273	0.530303	0.043	6.2	0.4	0.1	4.5	0.0012	0.81
SKD_115	SKD_B115	Sharktooth Bluffs	0.051916	0.171060606	0.422443	0.026	6.9	0.4	0.1	4.08	0.0014	0.71
SKD_120	SKD_B120	Sharktooth Bluffs	0.080488	0.204109848	0.734508	0.0237	5.5	0.4	0.1	3.19	0.0017	0.53
SKD_125	SKD_B125	Sharktooth Bluffs	0.044067	0.169299242	0.294962	0.016	5	0.4	0.1	3.07	0.0018	0.50
SKD_126	SKD_B126	Sharktooth Bluffs	0.139805	0.348598485	0.691307	0.0278	7.8	0.4	0.1	3.27	0.0018	0.52
SKD_130	SKD_B130	Sharktooth Bluffs	0.09865	0.361022727	0.743674	0.0236	5.4	0.4	0.1	3.38	0.0018	0.54
SKD_135	SKD_B135	Sharktooth Bluffs	0.101898	0.185511364	0.376723	0.018	5.7	0.4	0.1	3.51	0.0016	0.61
SKD_136	SKD_B136	Sharktooth Bluffs	0.090337	0.263712121	0.512481	0.0237	7.8	0.4	0.1	3.17	0.0018	0.52
SKD_137	SKD_B137	Sharktooth Bluffs	0.082834	0.356950758	0.69197	0.0215	8.2	0.4	0.1	3.43	0.0017	0.55
SKD_140	SKD_B140	Sharktooth Bluffs	0.141376	0.256969697	0.660568	0.0224	5.4	0.4	0.1	3.07	0.0018	0.52
SKD_141	SKD_B141	Sharktooth Bluffs	0.02627	0.085075758	0.265511	0.0259	5.1	0.4	0.1	3.4	0.0016	0.60
SKD_145	SKD_B145	Sharktooth Bluffs	0.217092	0.335094697	0.769659	0.0196	6.3	0.4	0.1	3.04	0.0018	0.51
SKD_150	SKD_B150	Sharktooth Bluffs	0.175452	0.473598485	0.880739	0.0105	6.3	0.4	0.1	3.07	0.0018	0.52
SKD_155	SKD_B155	Sharktooth Bluffs	0.137107	0.429431818	0.674697	0.0169	8.1	0.4	0.1	4.05	0.0014	0.69
SKD_160	SKD_B160	Sharktooth Bluffs	0.002978	0.028219697	0.075871	0.0164	24.4	0.4	0.1	4.5	0.0018	0.60
SKD_165	SKD_B165	Sharktooth Bluffs	0.041927	0.237897727	0.469659	0.0148	16.5	0.4	0.1	3.83	0.0016	0.61
SKD_170	SKD_B170	Sharktooth Bluffs	0.052826	0.188295455	0.358864	0.0118	17	0.4	0.1	3.86	0.0017	0.59
SKD_175	SKD_B175	Sharktooth Bluffs	0.050648	0.253541667	0.418958	0.0088	11.9	0.4	0.1	3.35	0.0017	0.54
SKD_180	SKD_B180	Sharktooth Bluffs	0.047986	0.286969697	0.687898	0.0159	22.1	0.35	0.1	4.78	0.0012	0.82
SKD_185	SKD_B185	Sharktooth Bluffs	0.068374	0.278352273	0.543636	0.0146	23.2	0.35	0.1	4.71	0.0013	0.77
SKD_190	SKD_B190	Sharktooth Bluffs	0.038657	0.232045455	0.329186	0.0205	13.7	0.35	0.1	4.63	0.0015	0.70
SKD_195	SKD_B195	Sharktooth Bluffs	0.060824	0.231458333	0.440511	0.0163	16.3	0.35	0.1	4.8	0.0011	0.84
WC_100	WC_B100	Sharktooth Bluffs	0.005163	0.024981061	0.119375	0.0044	24.6	0.35	0.1	4.49	0.0018	0.60
WC_101	WC_B101	Sharktooth Bluffs	0.011879	0.064356061	0.151023	0.0177	64.2	0.35	0.1	4.94	0.0008	0.96
WC_102		Sharktooth Bluffs			0.30661	0.0313	39.7	0.35	0.1	4.12	0.0015	0.69
WC_103	WC_B103	Sharktooth Bluffs			0.170436	0.0426	59.8	0.35	0.1	3.44	0.0016	0.61
		Sharktooth Bluffs			0.30608	0.0124	54.5	0.35	0.1	4.5	0.0013	0.77
WC_105.1		Sharktooth Bluffs		0.036912879	0.106174	0.0441	60.7	0.35	0.1	3.23	0.0017	0.56
		Sharktooth Bluffs		0.066363636	0.154148		62.1	0.35	0.1	3.75	0.0014	0.69
WC_106		Sharktooth Bluffs			0.332348		36.8	0.35	0.1	3.83	0.0013	0.71
WC_107		Sharktooth Bluffs			0.183144		26.7	0.35	0.1	4.12	0.0014	0.71
WC_108	WC B108	Sharktooth Bluffs			0.182311		56.9	0.35	0.1	4.92	0.0008	0.96
WC_109	WC B109	Sharktooth Bluffs			0.128277	0.019	43.3	0.35	0.1	4.28	0.0011	0.81

								Depressio	n Storage (in)	Horton's I	nfiltration Paramaters	;
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (mi <sup>2</sup> )	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)
WC_110	WC_B110	Sharktooth Bluffs	0.027039	0.153276515	0.305	0.0309	36.4	0.35	0.1	4.69	0.0011	0.84
WC_111	WC_B111	Sharktooth Bluffs	0.010801	0.07	0.224697	0.0191	37.9	0.35	0.1	3.11	0.0018	0.51
WC_112	WC_B112	Sharktooth Bluffs	0.003977	0.067140152	0.128674	0.0344	22.4	0.35	0.1	5	0.0007	1.00
WC_112.5	WC_B112.5	Sharktooth Bluffs	0.005305	0.047234848	0.120492	0.0244	32.5	0.35	0.1	4.87	0.0008	0.97
WC_113	WC_B113	Sharktooth Bluffs	0.04514	0.158958333	0.351477	0.0196	5.4	0.4	0.1	3	0.0018	0.50
WC_114	WC_B114	Sharktooth Bluffs	0.042074	0.141287879	0.337955	0.0176	5.6	0.4	0.1	3.12	0.0017	0.53
WC_115	WC_B115	Sharktooth Bluffs	0.025658	0.115795455	0.240739	0.0158	9.7	0.4	0.1	4.84	0.001	0.89
WC_120	WC_B120	Sharktooth Bluffs	0.311137	0.297253788	0.739167	0.0162	6.9	0.4	0.1	3.36	0.0017	0.58
WC_130	WC_B130	Sharktooth Bluffs	0.031627	0.166515152	0.309318	0.0042	19.1	0.4	0.1	4.85	0.001	0.88
WC_135	WC_B135	Sharktooth Bluffs	0.175939	0.276647727	0.640284	0.017	19.3	0.4	0.1	4.37	0.0011	0.76
WC_140	WC_B140	Sharktooth Bluffs	0.266844	0.336931818	0.802633	0.0139	10.8	0.4	0.1	4.29	0.0015	0.69
WC_145	WC_B145	Sharktooth Bluffs	0.004284	0.013712121	0.076629	0.0143	30.3	0.4	0.1	4.28	0.0018	0.59
WC_146	WC_B146	Sharktooth Bluffs	0.041462	0.126174242	0.308883	0.0185	7.4	0.4	0.1	4.64	0.0015	0.71
WC_150	WC_B150	Sharktooth Bluffs	0.181991	0.29467803	0.876875	0.0138	6.5	0.4	0.1	3.15	0.0018	0.51
WC_155	WC_B155	Sharktooth Bluffs	0.008148	0.241969697	0.497064	0.0151	52.9	0.4	0.1	4.73	0.0013	0.78
WC_160	WC_B160	Sharktooth Bluffs	0.052767	0.094412879	0.295814	0.0088	17	0.4	0.1	4.29	0.0018	0.59
WC_165	WC_B165	Sharktooth Bluffs	0.008387	0.242594697	0.496572	0.0153	52.4	0.4	0.1	4.74	0.0013	0.79
WC_170	WC_B170	Sharktooth Bluffs	0.005682	0.112859848	0.233561	0.0093	18.3	0.4	0.1	4.5	0.0018	0.60
WC_171	WC_B171	Sharktooth Bluffs	0.004063	0.021003788	0.081989	0.009	63.4	0.35	0.1	4.5	0.0018	0.60
WC_172	WC_B172	Sharktooth Bluffs	0.006514	0.030587121	0.106761	0.0089	55.4	0.35	0.1	4.55	0.0017	0.64
WC_173	WC_B173	Sharktooth Bluffs	0.006277	0.060454545	0.162481	0.0069	47.3	0.35	0.1	4.47	0.0018	0.60

# **CUHP Input Parameters**

# Future CUHP Input Parameters

								Depressior	Storage (in)	Horton's	Infiltration Paramaters	;
Subcatchment	EPA SWMM		Area	Length to	Length	Slope	Percent				Decay Coefficient	Final Rate
Name	Target Node	Raingage	(mi²)	Centroid (mi)	(mi)	(ft/ft)	Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	(1/seconds)	(in/hr)
FT_100	-	Sharktooth Bluffs	0.007087	0.101268939	0.23786	0.0029	45	0.35	0.1	2.76		
FT_101	-	Sharktooth Bluffs	0.030624	0.098087121	0.295795		60	0.35	0.1	5.51		1.09
FT_105	FT_B105	Sharktooth Bluffs	0.012618	0.106477273	0.19928		66	0.35	0.1	4.61		0.91
FT_110	FT_B110	Sharktooth Bluffs	0.002841	0.032784091	0.096591	0.0283	54	0.35	0.1	5.5	0.0008	1.1
FT_115	FT_B115	Sharktooth Bluffs	0.005095	0.051647727	0.104754	0.0275	50	0.35	0.1	4.6	0.0006	0.92
FT_120	FT_B120	Sharktooth Bluffs	0.053347	0.222518939	0.377405	0.0138	50	0.35	0.1	4.98	0.0007	1
FT_125	FT_B125	Sharktooth Bluffs	0.029471	0.133106061		0.0229	67	0.35	0.1	6.18		1.24
FT_130	FT_B130	Sharktooth Bluffs	0.083929	0.382537879	0.604716	0.0175	55	0.35	0.1	4.39	0.0008	0.83
HD_100	HD_B100	Sharktooth Bluffs	0.062669	0.197594697	0.400038	0.0188	6.999993	0.4	0.1	3.74	0.0018	0.55
HD_105	HD_B105	Sharktooth Bluffs	0.113026	0.326136364	0.804451	0.0448	7.000004	0.4	0.1	3.3	0.0014	0.58
HD_110	HD_B110	Sharktooth Bluffs	0.2449	0.502253788	1.085038	0.0315	19	0.4	0.1	3.29	0.0016	0.53
MPD_100	MPD_B100	Sharktooth Bluffs	0.12456	0.183371212	0.559489	0.0192	6.999999	0.4	0.1	3.59	0.0013	0.66
MPD_105	MPD_B105	Sharktooth Bluffs	0.304375	0.418731061	0.974072	0.0315	7.000001	0.4	0.1	3.16	0.0013	0.53
ND_100	ND_B100	Sharktooth Bluffs	0.035205	0.11967803	0.303125	0.035	57	0.35	0.1	5.37	0.0009	1.07
ND_105	ND_B105	Sharktooth Bluffs	0.051102	0.179943182	0.406061	0.0237	51	0.35	0.1	5.56	0.0008	1.11
ND_110	ND_B110	Sharktooth Bluffs	0.00163	0.057651515	0.086648	0.022	79	0.35	0.1	5.3	0.0007	1.06
ND_115	ND_B115	Sharktooth Bluffs	0.001861	0.046306818	0.085758	0.0295	80	0.35	0.1	4.2	0.0006	0.84
ND_120	ND_B120	Sharktooth Bluffs	0.000614	0.028011364	0.061837	0.0348	80	0.35	0.1	5.09	0.0007	1.02
ND_130	ND_B130	Sharktooth Bluffs	0.046312	0.135094697	0.41697	0.0125	80	0.35	0.1	5.23	0.0007	1.05
ND_135	ND_B135	Sharktooth Bluffs	0.007525	0.082234848	0.175341	0.0187	80	0.35	0.1	5.27	0.0007	1.05
ND_140	ND_B140	Sharktooth Bluffs	0.008558	0.060587121	0.128352	0.0207	80	0.35	0.1	4.56	0.0006	0.91
OG_100	OG_B100	Sharktooth Bluffs	0.293962	0.502367424	0.94125	0.0167	7.118841	0.4	0.1	3.8	0.0012	0.7
OG_105	OG_B105	Sharktooth Bluffs	0.069535	0.329772727	0.570758	0.042	47	0.4	0.1	3.46	0.0015	0.61
OG_110	OG_B110	Sharktooth Bluffs	0.063768	0.20155303	0.419261	0.042	44	0.4	0.1	3.15	0.0018	0.53
PLC_100	PLC_B100	Sharktooth Bluffs	0.014299	0.064090909	0.315227	0.0081	22	0.4	0.1	3.41	0.0019	0.54
PLC_105	PLC_B105	Sharktooth Bluffs	0.251714	0.507594697	1.249337	0.0043	44	0.4	0.1	2.46	0.0011	0.36
PLC_110	PLC_B110	Sharktooth Bluffs	0.208985	0.324393939	0.716383	0.0253	30	0.35	0.1	3.72	0.0013	0.63
PLC_115	PLC_B115	Sharktooth Bluffs	0.196614	0.362026515	0.653636	0.0129	34	0.35	0.1	4.47	0.0013	0.81
PLC_120	PLC_B120	Sharktooth Bluffs	0.190338	0.263920455	0.520057	0.0013	46	0.35	0.1	4.3	0.0017	0.61
PLC_121	PLC_B121	Sharktooth Bluffs	0.086158	0.231666667	0.517008	0.0237	67	0.35	0.1	4.64	0.0017	0.64
PR_100	PR_B100	Sharktooth Bluffs	0.011813	0.090208333	0.163428	0.0599	7.000013	0.4	0.1	2.78	0.0017	0.46
PR_105	PR_B105	Sharktooth Bluffs	0.042886	0.162992424	0.28572	0.0281	6.999996	0.4	0.1	3.83	0.0015	0.62
PR_110	PR_B110	Sharktooth Bluffs	0.058249	0.148617424	0.350511	0.0531	6.999995	0.4	0.1	2.73	0.0015	0.46
PR_115	PR_B115	Sharktooth Bluffs	0.016751	0.103806818	0.210095	0.0034	6.999981	0.4	0.1	3.12	0.0015	0.52
PR_120	PR_B120	Sharktooth Bluffs	0.054683	0.19219697	0.528996	0.0362	7.000006	0.4	0.1	3.56	0.0019	0.57
PR_125	PR_B125	Sharktooth Bluffs	0.021478	0.126723485	0.217197	0.0315	6.999986	0.4	0.1	3.27	0.0017	0.5
PR_130	PR_B130	Sharktooth Bluffs	0.04892	0.068219697	0.250947	0.0576	7	0.4	0.1	3.29	0.0015	0.56
PR_135	PR_B135	Sharktooth Bluffs	0.222832	0.256325758	0.662898	0.0042	67	0.4	0.1	1.14	0.0005	0.19
PR_150	PR_B150	Sharktooth Bluffs	0.135777	0.314507576	0.606345	0.0021	17	0.4	0.1	2.65	0.0015	0.45
 PR_155	 PR_B155	Sharktooth Bluffs	0.014449	0.112935606	0.246023	0.0215	61	0.35	0.1	2.97	0.0016	0.51
_ PR_160		Sharktooth Bluffs	0.010397	0.096174242	0.143485	0.0249	54	0.35	0.1	4.36	0.0012	0.83
 PRR_100	_ PRR_B100	Sharktooth Bluffs	0.030097	0.176212121	0.30428		70	0.35	0.1	5.9		1.18

# Future CUHP Input Parameters

							Depressior	Storage (in)	Horton's Infiltration Paramaters			
Subcatchment	EPA SWMM		Area	Length to	Length	Slope	Percent				Decay Coefficient	Final Rate
Name	Target Node	Raingage	(mi²)	Centroid (mi)	(mi)	(ft/ft)	Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	(1/seconds)	(in/hr)
PRR_105	PRR_B105	Sharktooth Bluffs	0.008214	0.068674242	0.161383	0.0179	75	0.35	0.1	5.52	0.0008	1.1
SD_100	SD_B100	Sharktooth Bluffs	0.10412	0.296174242	0.604205	0.0295	7.000005	0.4	0.1	3.56	0.0016	0.61
SD_105	SD_B105	Sharktooth Bluffs	0.104729	0.234280303	0.520928	0.0356	6.999999	0.4	0.1	4.74	0.0013	0.79
SD_110	SD_B110	Sharktooth Bluffs	0.056662	0.19217803	0.438466	0.0449	6.999997	0.4	0.1	3.67	0.0014	0.63
SD_115	SD_B115	Sharktooth Bluffs	0.064756	0.238125	0.575341	0.0286	6.999995	0.4	0.1	4.74	0.0019	0.63
SD_120	SD_B120	Sharktooth Bluffs	0.18846	0.432518939	0.815341	0.0305	14	0.4	0.1	4.33	0.0014	0.67
SKD_100	SKD_B100	Sharktooth Bluffs	0.07954	0.179772727	0.339053	0.002	9.524667	0.4	0.1	3.35	0.0018	0.57
SKD_105	SKD_B105	Sharktooth Bluffs	0.034963	0.164318182	0.320682	0.0042	23	0.4	0.1	3.18	0.0011	0.58
SKD_106	SKD_B106	Sharktooth Bluffs	0.0045	0.140965909	0.258049	0.0213	49	0.4	0.1	3.99	0.0008	0.78
SKD_110	SKD_B110	Sharktooth Bluffs	0.059574	0.260852273	0.530303	0.043	37	0.4	0.1	5.04	0.0012	0.92
SKD_115	SKD_B115	Sharktooth Bluffs	0.051916	0.171060606	0.422443	0.026	29	0.4	0.1	3.82	0.0012	0.67
SKD_120	SKD_B120	Sharktooth Bluffs	0.080488	0.204109848	0.734508	0.0237	51	0.4	0.1	3.15	0.0017	0.53
SKD_125	SKD_B125	Sharktooth Bluffs	0.044067	0.169299242	0.294962	0.016	51	0.35	0.1	3.44	0.0019	0.54
SKD_126	SKD_B126	Sharktooth Bluffs	0.139805	0.348598485	0.691307	0.0278	53	0.35	0.1	4.58	0.0018	0.6
SKD_130	SKD_B130	Sharktooth Bluffs	0.09865	0.361022727	0.743674	0.0236	51	0.35	0.1	3.52	0.0016	0.53
SKD_135	SKD_B135	Sharktooth Bluffs	0.101898	0.185511364	0.376723	0.018	51	0.35	0.1	3.66	0.0016	0.62
SKD_136	SKD_B136	Sharktooth Bluffs	0.090337	0.263712121	0.512481	0.0237	53	0.35	0.1	4.24	0.0016	0.63
SKD_137	SKD_B137	Sharktooth Bluffs	0.082834	0.356950758	0.69197	0.0215	55	0.35	0.1	4.67	0.0016	0.72
SKD_140	SKD_B140	Sharktooth Bluffs	0.141376	0.256969697	0.660568	0.0224	51	0.35	0.1	4.77	0.0013	0.78
SKD_141	SKD_B141	Sharktooth Bluffs	0.02627	0.085075758	0.265511	0.0259	51	0.35	0.1	3.7	0.0009	0.72
SKD_145	SKD_B145	Sharktooth Bluffs	0.217092	0.335094697	0.769659	0.0196	54	0.35	0.1	4.88	0.0011	0.87
SKD_150	SKD_B150	Sharktooth Bluffs	0.175452	0.473598485	0.880739	0.0105	47	0.35	0.1	4.69	0.0007	0.92
SKD_155	SKD_B155	Sharktooth Bluffs	0.137107	0.429431818	0.674697	0.0169	65	0.35	0.1	5.23	0.0012	0.91
SKD_160	SKD_B160	Sharktooth Bluffs	0.002978	0.028219697	0.075871	0.0164	63	0.4	0.1	4.72	0.0019	0.63
SKD_165	SKD_B165	Sharktooth Bluffs	0.041927	0.237897727	0.469659	0.0148	25	0.4	0.1	4.1	0.0014	0.6
SKD_170	SKD_B170	Sharktooth Bluffs	0.052826	0.188295455	0.358864	0.0118	26	0.4	0.1	5.02	0.0015	0.79
SKD_175	SKD_B175	Sharktooth Bluffs	0.050648	0.253541667	0.418958	0.0088	14	0.4	0.1	3.61	0.0012	0.54
		Sharktooth Bluffs	0.047986	0.286969697	0.687898	0.0159	79	0.35	0.1	4.14	0.0011	0.69
		Sharktooth Bluffs	0.068374	0.278352273	0.543636	0.0146	75	0.35	0.1	5.27	0.0015	0.86
SKD_190	SKD_B190	Sharktooth Bluffs	0.038657	0.232045455	0.329186	0.0205	75	0.35	0.1	3.76	0.0012	0.58
		Sharktooth Bluffs	0.060824	0.231458333	0.440511	0.0163	78	0.35	0.1	5.11	0.0011	0.92
WC_100		Sharktooth Bluffs	0.005163	0.024981061	0.119375	0.0044	36	0.35	0.1	4.25	0.0016	0.55
WC_101	WC_B101	Sharktooth Bluffs	0.011879	0.064356061	0.151023	0.0177	70	0.35	0.1	5.04	0.0008	0.98
WC_102	WC_B102	Sharktooth Bluffs	0.010288	0.105208333	0.30661	0.0313	70	0.35	0.1	3.8	0.0013	0.64
	WC_B103	Sharktooth Bluffs	0.006006	0.086212121	0.170436	0.0426	70	0.35	0.1	3.55	0.0016	
		Sharktooth Bluffs	0.017401	0.093143939	0.30608	0.0124	70	0.35	0.1	4.22	0.0012	
	WCB105.1	Sharktooth Bluffs	0.003206	0.036912879	0.106174	0.0441	70	0.35	0.1	3.41	0.0018	
		Sharktooth Bluffs	0.00344	0.066363636			70	0.35	0.1	3.27	0.0011	0.61
WC_106	WC_B106	Sharktooth Bluffs	0.023522	0.213238636			70	0.35	0.1	3.82	0.0013	0.71
		Sharktooth Bluffs	0.014284	0.065738636			56	0.35	0.1	4.16	0.0013	0.73
WC_108	WC_B108	Sharktooth Bluffs	0.003947	0.093011364			70	0.35	0.1	3.92	0.0006	
WC_109	WC_B109	Sharktooth Bluffs	0.004449	0.071325758		0.019	70	0.35	0.1	4.79	0.0012	0.91

# Future CUHP Input Parameters

								Depressior	Storage (in)	Horton's I	nfiltration Paramaters	5
Subcatchment	EPA SWMM	Deingen		Length to	Length	Slope	Percent	Demieure	luce and acco		Decay Coefficient	Final Rate
Name	Target Node	Raingage	(mi <sup>2</sup> )	Centroid (mi)	(mi)	(ft/ft)	Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	(1/seconds)	(in/hr)
WC_110	WC_B110	Sharktooth Bluffs	0.027039	0.153276515	0.305	0.0309	70	0.35	0.1	4.42	0.001	0.79
WC_111	WC_B111	Sharktooth Bluffs	0.010801	0.07	0.224697	0.0191	70	0.35	0.1	2.91	0.0017	0.48
WC_112	WC_B112	Sharktooth Bluffs	0.003977	0.067140152	0.128674	0.0344	70	0.35	0.1	4.52	0.0006	0.9
WC_112.5	WC_B112.5	Sharktooth Bluffs	0.005305	0.047234848	0.120492	0.0244	70	0.35	0.1	4.42	0.0006	0.88
WC_113	WC_B113	Sharktooth Bluffs	0.04514	0.158958333	0.351477	0.0196	75	0.35	0.1	3.98	0.0006	0.8
WC_114	WC_B114	Sharktooth Bluffs	0.042074	0.141287879	0.337955	0.0176	74	0.35	0.1	5.24	0.0007	1.05
WC_115	WC_B115	Sharktooth Bluffs	0.025658	0.115795455	0.240739	0.0158	52	0.35	0.1	4.23	0.0009	0.77
WC_120	WC_B120	Sharktooth Bluffs	0.311137	0.297253788	0.739167	0.0162	74	0.35	0.1	4.78	0.0009	0.93
WC_130	WC_B130	Sharktooth Bluffs	0.031627	0.166515152	0.309318	0.0042	52	0.35	0.1	3.8	0.0009	0.67
WC_135	WC_B135	Sharktooth Bluffs	0.175939	0.276647727	0.640284	0.017	52	0.4	0.1	4.46	0.0011	0.78
WC_140	WC_B140	Sharktooth Bluffs	0.266844	0.336931818	0.802633	0.0139	73	0.35	0.1	4.74	0.0015	0.74
WC_145	WC_B145	Sharktooth Bluffs	0.004284	0.013712121	0.076629	0.0143	80	0.4	0.1	3.72	0.0016	0.51
WC_146	WC_B146	Sharktooth Bluffs	0.041462	0.126174242	0.308883	0.0185	54	0.35	0.1	5.22	0.0017	0.78
WC_150	WC_B150	Sharktooth Bluffs	0.181991	0.29467803	0.876875	0.0138	73	0.35	0.1	4.69	0.0018	0.64
WC_155	WC_B155	Sharktooth Bluffs	0.008148	0.241969697	0.497064	0.0151	88	0.4	0.1	3.64	0.001	0.61
WC_160	WC_B160	Sharktooth Bluffs	0.052767	0.094412879	0.295814	0.0088	92	0.35	0.1	4.75	0.002	0.64
WC_165	WC_B165	Sharktooth Bluffs	0.008387	0.242594697	0.496572	0.0153	85	0.4	0.1	5.31	0.0014	0.89
WC_170	WC_B170	Sharktooth Bluffs	0.005682	0.112859848	0.233561	0.0093	73	0.4	0.1	4.95	0.002	0.66
WC_171	WC_B171	Sharktooth Bluffs	0.004063	0.021003788	0.081989	0.009	70	0.35	0.1	5.38	0.0021	0.69
WC_172	WC_B172	Sharktooth Bluffs	0.006514	0.030587121	0.106761	0.0089	70	0.35	0.1	4.8	0.0018	0.67
WC_173	WC_B173	Sharktooth Bluffs	0.006277	0.060454545	0.162481	0.0069	70	0.35	0.1	4.54	0.0018	0.61

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
FT_B100	JUNCTION	0.5	0.8	1.3	3.6	4.9
FT B101	JUNCTION	1.6	2.8	4.0	14.6	22.0
	JUNCTION	2.5	3.4	4.6	12.1	16.9
_ FT_B110	JUNCTION	0.0	0.1	0.1	1.0	1.7
	JUNCTION	0.2	0.4	0.6	2.5	4.0
	JUNCTION	5.8	8.2	11.4		49.2
	JUNCTION	0.5	0.8	4.1	18.4	26.4
_ FT_B130	JUNCTION	6.5	9.9	13.8	45.0	66.0
	JUNCTION	0.5	0.8	4.2	19.3	28.0
_ FT J130	JUNCTION	3.0	3.1	3.1	3.5	3.8
	JUNCTION	2.7	4.0	8.2	24.8	24.8
_ FT_J201	JUNCTION	1.6	2.8	7.2	53.2	85.3
	JUNCTION	0.5	0.8	4.2	19.3	28.0
	JUNCTION	6.7	10.2	14.1	45.7	66.9
FT_J305	JUNCTION	2.7	4.0	8.2	24.8	24.8
_ FT_J310	JUNCTION	0.5	0.8	4.1	18.4	26.4
	JUNCTION	2.7	4.0	8.2	24.8	24.8
	JUNCTION	2.7	4.0	8.2	24.8	24.8
	JUNCTION	2.7	4.0	8.2	24.8	24.8
	JUNCTION	0.5	0.8	4.1	18.4	26.4
HD B100	JUNCTION	0.8	1.5	8.4	39.3	56.3
 HDB105	JUNCTION	1.3	2.5	9.3	60.9	89.4
HD B110	JUNCTION	3.2	7.2	31.0	134.6	192.3
_ HD_J110	JUNCTION	4.3	9.6	40.2	195.1	280.9
HD Outlet	JUNCTION	4.9	10.8	47.7	232.4	334.9
_ MPD B100	JUNCTION	1.4	3.0	7.5	77.2	115.0
MPD B105	JUNCTION	4.9	9.2	36.0	185.5	267.4
	JUNCTION	0.4	1.3	2.2	15.8	25.9
ND B105	JUNCTION	1.6	3.1	4.7	20.3	32.8
 ND	JUNCTION	0.3	0.4	0.5	1.2	1.7
ND B115	JUNCTION	0.0	0.1	0.1	0.6	1.0
 ND	JUNCTION	0.2	0.3	0.4	0.8	1.1
 NDB130	JUNCTION	2.1	3.6	5.3	19.4	30.6
_ ND_B135	JUNCTION	0.0	0.1	0.1	1.6	3.1
ND B140	JUNCTION	3.3	4.3	5.6	12.0	16.2
ND J100	JUNCTION	0.4	1.3	2.2	28.3	53.5
ND J105	JUNCTION	5.6	8.4	8.8	13.1	14.2
ND_J130	JUNCTION	0.0	0.1	0.1	0.6	1.0
ND_J135	JUNCTION	3.3	4.3	5.6	12.0	16.2
ND_J205	JUNCTION	2.5	3.4	4.1	8.4	9.5
ND J230	JUNCTION	0.3	0.4	0.5	1.2	1.7
ND_J235	JUNCTION	3.3	4.3	5.6	12.0	16.2
ND J305	JUNCTION	3.4	5.1	5.1	5.1	5.1
ND J330	JUNCTION	0.9	1.4	2.0	5.1	8.4

	Existing I	Node I	Peak F	lows (	cfs)	
Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
ND_J430	JUNCTION	0.9	1.5	2.0	5.1	8.5
OG_B100	JUNCTION	2.1	4.9	8.2	120.8	187.5
OG_B105	JUNCTION	0.8	1.5	7.9	37.9	54.6
OG_B110	JUNCTION	1.3	3.4	12.1	47.5	66.7
OG_J100	JUNCTION	1.6	3.8	16.5	78.7	113.8
OG_Outlet	JUNCTION	2.1	4.9	17.8	154.2	253.6
PLC B100	JUNCTION	0.7	1.2	2.7	8.9	12.4
PLC B105	JUNCTION	28.0	40.7	64.6	172.1	231.2
PLC_B110	JUNCTION	3.2	6.4	17.6	126.1	185.5
 PLC_B115	JUNCTION	1.2	3.2	5.5	83.5	132.6
PLC B120	JUNCTION	2.1	4.0	16.6	86.0	125.4
PLC B121	JUNCTION	1.3	2.5	12.5	55.0	78.5
PLC_J100	JUNCTION	30.7	47.2	97.7	127.0	127.4
 PLC_J110	JUNCTION	3.2	6.4	17.6	126.1	185.5
PLC_J115	JUNCTION	3.1	7.3	45.6	496.6	790.0
PLC_J120	JUNCTION	2.3	4.8	24.0	134.7	198.3
PLC_J215	JUNCTION	2.5	6.4	42.8	445.2	688.9
PR_B100	JUNCTION	0.2	0.8	2.6	9.9	13.8
PR_B105	JUNCTION	0.6	1.1	4.0	27.8	40.5
PR_B110	JUNCTION	1.2	3.0	12.7	51.3	71.5
PR_B115	JUNCTION	0.2	0.3	1.5	7.6	11.0
PR B120	JUNCTION	0.8	1.5	7.4	33.7	48.3
PR_B125	JUNCTION	0.4	1.0	3.8	15.5	21.8
PR_B130	JUNCTION	1.7	3.1	11.9	55.6	79.2
PR_B135	JUNCTION	85.8	124.0	169.4	340.5	432.9
PR_B150	JUNCTION	4.6	9.0	19.6	64.6	90.7
PR_B155	JUNCTION	2.6	4.1	6.4	15.6	20.5
PR_B160	JUNCTION	0.6	1.0	1.4	6.7	9.7
PR_J355	JUNCTION	6.2	9.5	11.1	11.6	11.6
PRR_B100	JUNCTION	5.9	8.1	10.9	27.7	38.3
PRR_B105	JUNCTION	0.1	0.4	1.4	5.4	7.6
PRR_J100	JUNCTION	5.9	8.1	11.5	31.7	44.1
SD_B100	JUNCTION	1.3	2.5	11.1	60.5	87.7
SD_B100	JUNCTION	0.8	2.1	3.5	57.1	88.6
SD_B105	JUNCTION	0.7	1.5	4.9	35.2	51.6
SD_B110 SD_B115	JUNCTION	0.7	1.3	6.0	34.6	50.2
SD_B115	JUNCTION	2.3	4.9	11.4	96.4	143.6
SD_J100	JUNCTION	3.9	4. <i>9</i> 9.6	31.1	274.6	411.6
SD_J100 SD_J110	JUNCTION			21.1		
-		3.2	7.1		163.7	242.6
SD_J200	JUNCTION	3.8	8.6	24.1	217.5	327.3
SD_J210	JUNCTION	3.0	6.2	17.4	130.9	193.8
SKD_B100	JUNCTION	1.1	2.1	9.2	40.6	58.1
SKD_B105	JUNCTION	0.3	0.7	1.7	13.8	20.6
SKD_B106	JUNCTION	0.1	0.1	0.2	0.9	1.6

Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
JUNCTION	0.4	1.0	1.7	24.7	39.7
JUNCTION	0.6	1.4	2.9	28.4	42.6
JUNCTION	1.1	2.1	10.4	46.4	66.4
JUNCTION	0.7	2.1	7.4	29.3	41.4
JUNCTION	2.9	6.4	22.0	88.0	124.4
JUNCTION	1.1	2.3	10.9	49.3	70.8
JUNCTION	1.7	3.2	13.8	74.7	107.1
JUNCTION	2.0	4.5	14.9	58.4	82.6
JUNCTION	1.3	2.3	8.7	39.5	56.7
JUNCTION	2.3	6.2	23.8	96.3	136.2
JUNCTION	0.4	0.8	3.7	19.4	27.6
JUNCTION	3.9	10.7	36.4	143.0	201.8
JUNCTION	2.1	5.5	19.5	81.1	116.6
JUNCTION	1.6	3.3	7.0	60.3	90.4
JUNCTION	0.3	0.5	0.8	2.8	3.8
JUNCTION	1.4	2.3	4.7	20.4	29.0
JUNCTION	2.4	3.9	8.4	32.9	46.5
JUNCTION	1.2	2.1	6.1	24.6	34.9
JUNCTION	1.6	2.6	3.8	17.8	26.6
JUNCTION	3.2	5.2	7.6	34.2	49.6
JUNCTION	1.1	1.9	4.1	20.4	29.6
JUNCTION	1.6	3.0	4.6	27.0	41.8
JUNCTION	12.4	33.9	117.6	420.6	626.4
JUNCTION	12.4	33.6	116.6	410.9	610.8
JUNCTION	12.1	33.1	114.8	391.2	578.3
JUNCTION	12.3	33.4	115.5	391.5	579.5
JUNCTION	13.6	37.0	142.5	709.8	1063.6
JUNCTION	3.1	7.8	28.4	116.2	164.6
JUNCTION	2.9	6.5	22.0	88.0	124.5
JUNCTION	3.7	7.7	22.3	102.6	150.6
JUNCTION	5.9	17.4	65.2	326.7	489.2
JUNCTION	4.5	13.6	48.3	250.3	374.1
JUNCTION	2.8	7.6	24.2	137.7	203.9
JUNCTION	1.4	2.3	4.7	20.4	29.0
JUNCTION	1.2	2.1	6.1	24.6	34.9
JUNCTION	2.7	4.8	8.6	47.4	71.2
JUNCTION	13.2	35.8	135.4	671.4	1006.0
JUNCTION	0.3	0.5	1.0	9.2	18.9
JUNCTION	10.4	27.4	96.8	477.7	713.3
JUNCTION	0.5	0.6	0.9	8.5	8.5
JUNCTION	0.0	0.0	0.0	0.0	0.0
JUNCTION	0.0	0.0	0.0	1.8	14.8
JUNCTION	2.7	4.9	8.7	47.4	71.3
JUNCTION	2.7	4.9	8.7	47.4	64.8

Node

SKD\_B110 SKD\_B115 SKD\_B120 SKD\_B125 SKD\_B126 SKD\_B130 SKD\_B135 \_ SKD\_B136 SKD\_B137 SKD\_B140 SKD\_B141 SKD\_B145 SKD\_B150 SKD\_B155 SKD\_B160 SKD\_B170 SKD\_B175 SKD\_B180 SKD\_B185 SKD\_B190 SKD\_B195 SKD\_J100 SKD\_J106 SKD\_J120 SKD\_J126 SKD\_J136 SKD\_J145 SKD\_J150 SKD\_J160 SKD\_J175 SKD\_J220 SKD\_J235 SKD\_J250 SKD\_J265 SKD\_J275 

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
SKD_J320	JUNCTION	11.3	30.3	112.9	572.4	859.5
	JUNCTION	10.2	27.0	94.6	464.0	691.9
	JUNCTION	3.1	5.4	13.6	55.9	79.4
	JUNCTION	2.7	4.9	8.7	47.4	65.0
	JUNCTION	10.9	28.8	104.3	528.3	793.2
SKD J436	JUNCTION	3.1	5.5	13.6	55.9	79.4
	JUNCTION	3.1	5.5	13.6	55.9	79.4
	JUNCTION	3.2	5.5	13.6	55.9	79.4
WC_B100	JUNCTION	0.5	0.7	1.4	4.3	5.8
WC_B101	JUNCTION	5.2	6.8	9.0	18.7	24.8
WC_B102	JUNCTION	1.5	2.1	3.3	9.1	12.2
WC_B103	JUNCTION	2.1	2.9	4.1	8.7	11.3
WC_B105	JUNCTION	4.4	6.3	8.4	20.2	26.6
WC_B105.1	JUNCTION	1.5	2.1	2.9	5.9	7.6
WC_B105.2	JUNCTION	1.1	1.6	2.1	4.5	5.9
WC_B106	JUNCTION	2.7	4.0	6.0	18.0	24.6
WC_B107	JUNCTION	1.6	2.5	4.2	14.1	19.3
WC_B108	JUNCTION	0.9	1.2	1.6	3.7	4.9
WC_B109	JUNCTION	0.7	1.1	1.5	4.1	5.6
WC_B110	JUNCTION	3.4	5.2	7.2	23.0	32.1
WC_B111	JUNCTION	1.9	3.1	4.9	12.0	15.7
WC_B112	JUNCTION	0.1	0.3	0.4	1.6	2.5
WC_B112.5	JUNCTION	0.5	0.9	1.2	3.9	5.7
WC_B113	JUNCTION	0.7	2.3	7.8	30.3	42.8
WC_B114	JUNCTION	0.7	1.4	6.5	27.7	39.5
WC_B115	JUNCTION	0.2	0.6	1.1	10.3	17.2
WC_B120	JUNCTION	6.2	11.2	46.7	215.7	308.1
WC_B130	JUNCTION	0.7	1.3	2.0	10.2	16.4
WC_B140	JUNCTION	5.6	10.9	22.2	147.4	216.9
WC_B145	JUNCTION	0.8	1.2	2.2	6.3	8.6
WC_B146	JUNCTION	0.6	1.3	2.6	24.8	36.9
WC_B150	JUNCTION	3.0	7.7	26.9	108.2	153.1
WC_B155	JUNCTION	0.9	1.3	1.7	4.4	5.9
WC_B160	JUNCTION	3.2	5.1	11.2	42.9	59.5
WC_B165	JUNCTION	0.9	1.3	1.7	4.5	6.1
WC_B170	JUNCTION	0.2	0.3	0.5	2.2	3.2
WC_B171	JUNCTION	2.1	2.9	4.0	8.0	10.4
WC_B172	JUNCTION	2.5	3.6	5.1	11.1	14.6
WC_B173	JUNCTION	1.2	1.8	2.7	6.6	8.6
WC_J100	JUNCTION	19.4	39.3	104.3	198.7	218.6
WC_J101	JUNCTION	5.2	6.8	9.0	21.9	29.9
WC_J102	JUNCTION	3.4	4.9	6.7	12.6	15.7
WC_J105	JUNCTION	1.1	1.5	2.1	358.2	590.0
WC_J106	JUNCTION	12.2	28.2	85.6	479.5	703.5

# Existing Node Peak Flows (cfs)

	<u> </u>					
Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
WC_J107	JUNCTION	7.3	11.5	20.5	74.6	107.6
WC_J108	JUNCTION	7.3	11.5	20.5	74.6	107.6
WC_J109	JUNCTION	1.6	2.3	3.0	7.8	14.6
WC_J112	JUNCTION	1.2	3.0	8.8	33.8	48.0
WC_J112.5	JUNCTION	1.2	3.0	8.8	13.4	13.4
WC_J113.5	JUNCTION	0.7	2.3	7.8	10.4	10.4
WC_J114	JUNCTION	0.7	1.7	7.1	36.6	55.1
WC_J120	JUNCTION	11.9	27.7	84.6	476.8	699.7
WC_J135	JUNCTION	0.2	0.3	0.5	2.2	3.2
WC_J140	JUNCTION	8.0	17.6	47.7	194.6	264.1
WC_J145	JUNCTION	0.9	1.3	1.7	4.4	5.9
WC_J146	JUNCTION	0.6	1.3	2.6	84.2	141.0
WC_J165	JUNCTION	0.9	1.4	2.0	5.9	8.4
WC_J170	JUNCTION	9.7	13.1	17.9	40.3	53.9
WC_J171	JUNCTION	9.7	13.1	17.9	40.3	54.0
WC_J172	JUNCTION	7.7	10.3	14.0	32.7	44.0
WC_J173	JUNCTION	4.3	6.2	9.0	18.6	23.8
WC_J200	JUNCTION	14.0	31.0	90.2	140.0	140.0
WC_J201	JUNCTION	15.8	34.4	96.1	178.5	192.9
WC_J202	JUNCTION	2.1	2.9	3.8	3.8	3.8
WC_J205	JUNCTION	14.0	31.0	90.2	140.0	140.0
WC_J206	JUNCTION	12.2	28.2	85.6	479.5	703.5
WC_J207	JUNCTION	8.6	14.5	29.7	109.7	157.8
WC_J212.5	JUNCTION	0.7	2.3	7.8	10.4	10.4
WC_J220	JUNCTION	8.6	19.6	51.3	277.9	404.1
WC_J240	JUNCTION	0.6	0.8	1.2	13.3	35.1
WC_J245	JUNCTION	3.8	6.0	12.5	46.4	64.7
WC_J272	JUNCTION	5.2	6.8	9.0	21.9	29.9
WC_J273	JUNCTION	3.4	4.9	6.7	12.6	15.7
WC_J305	JUNCTION	5.1	7.2	9.7	372.0	609.8
WC_J306	JUNCTION	0.0	0.0	0.0	0.0	0.0
WC_J307	JUNCTION	1.4	3.3	9.2	35.3	50.4
WC_J312.5	JUNCTION	0.7	2.3	7.8	10.4	10.4
WC_J320	JUNCTION	8.4	18.5	49.6	275.6	401.8
WC_J340	JUNCTION	3.0	7.7	26.9	50.8	50.8
WC_J405	JUNCTION	1.1	1.5	2.1	358.1	590.0
WC_J420	JUNCTION	1.8	3.3	3.3	3.0	3.0
WC_J505	JUNCTION	1.1	1.6	2.1	4.5	6.9
WC_J506	JUNCTION	1.4	2.1	2.9	5.9	7.1
	JUNCTION	11.9	27.7	84.6	476.8	699.6
FT_OUTLET	OUTFALL	2.2	3.3	7.3	25.0	25.2
FT_OUTLET2	OUTFALL	2.1	3.6	8.2	56.8	90.2
MPD_OUTLET	OUTFALL	4.8	9.9	38.0	246.3	364.6
PLC_OUTLET	OUTFALL	31.2	48.3	99.1	135.9	139.4

Node PR\_OUTLET \_ PRR\_OUTLET SKD\_OUTLET WC\_OUTLET WC\_OUTLET2 WC\_OUTLET3 FT\_OUTLET3 PLC\_OUTLET2 SD\_Outlet \_ FT\_D101 \_ FT\_D125 \_ FT\_D205 FT\_D305 FT\_J115 ND\_D105 \_ ND\_D110 \_ ND\_D120 ND\_D140 \_ PLC\_D115 PLC\_J105 SKD\_D110 SKD\_D135 SKD\_D580 SKD\_\$180 WC\_D101 WC\_D103 WC\_D105.1 WC\_D106 WC\_D110 WC\_D111 WC\_D112 \_ WC\_D112.5 WC\_D113 WC\_D150

Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
OUTFALL	7.0	10.9	14.5	26.3	31.2
OUTFALL	5.9	8.1	11.5	31.7	44.1
OUTFALL	12.7	34.7	122.4	449.6	670.0
OUTFALL	19.4	39.3	104.3	198.7	218.6
OUTFALL	5.1	7.2	9.7	372.0	609.8
OUTFALL	9.5	16.1	32.5	121.3	173.9
OUTFALL	0.0	0.0	0.0	5.4	18.6
OUTFALL	0.0	0.0	0.0	554.6	951.6
OUTFALL	3.9	9.6	31.1	274.6	411.6
DIVIDER	1.6	2.8	7.2	53.2	85.3
DIVIDER	2.7	4.0	8.2	30.2	43.4
DIVIDER	0.5	0.8	4.1	18.4	26.4
DIVIDER	6.5	9.9	13.8	45.0	66.0
DIVIDER	2.7	4.0	8.2	30.2	43.4
DIVIDER	0.5	0.8	4.1	18.4	26.4
DIVIDER	3.4	6.0	10.2	49.5	70.4
DIVIDER	6.2	9.5	11.4	27.4	41.6
DIVIDER	0.3	0.4	0.5	1.2	1.7
DIVIDER	0.0	0.1	0.1	0.6	1.0
DIVIDER	0.2	0.3	0.4	0.8	1.1
DIVIDER	3.3	4.3	5.6	12.0	16.2
DIVIDER	2.3	4.8	24.0	134.6	198.3
DIVIDER	30.7	47.2	97.7	690.0	1094.3
DIVIDER	13.6	36.9	142.3	709.5	1063.2
DIVIDER	10.9	28.8	104.3	528.3	793.3
DIVIDER	1.4	2.3	4.7	20.4	29.0
DIVIDER	3.2	5.5	13.6	55.9	79.4
DIVIDER	2.7	4.9	8.7	47.4	71.4
DIVIDER	0.0	0.0	0.0	0.0	0.0
DIVIDER	2.7	4.9	8.7	47.4	71.4
DIVIDER	0.5	0.6	0.9	9.7	22.6
DIVIDER	0.0	0.0	0.5	4.9	7.3
DIVIDER	2.1	2.9	4.1	8.7	11.3
DIVIDER	5.1	7.2	9.7	372.0	609.8
DIVIDER	1.5	2.1	2.9	5.9	7.6
DIVIDER	1.1	1.6	2.1	4.5	5.9
DIVIDER	14.0	31.0	90.2	494.8	725.5
DIVIDER	1.6	2.3	3.0	7.8	14.6
DIVIDER	5.7	9.2	17.7	67.5	98.0
DIVIDER	1.9	3.1	4.9	12.0	15.7
DIVIDER	1.4	3.3	9.2	35.3	50.4
DIVIDER	0.5	0.9	1.2	23.4	37.6
DIVIDER	0.7	2.3	7.8	30.3	42.8
DIVIDER	3.0	7.7	26.9	108.2	153.1

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
WC_D155	DIVIDER	0.9	1.3	1.7	4.4	5.9
WC_D172	DIVIDER	2.5	3.6	5.1	11.1	14.6
WC_D205	DIVIDER	14.0	31.0	90.2	140.0	140.0
WC_D210	DIVIDER	2.5	4.4	11.3	47.0	69.1
WC_D272	DIVIDER	2.1	2.9	4.0	8.0	10.4
WC_D310	DIVIDER	0.7	1.7	7.1	36.5	55.0
WC_D806	DIVIDER	11.9	27.7	84.6	476.8	699.7
WC_D160	DIVIDER	3.8	6.0	12.5	46.4	64.7
FT_Melbourne	STORAGE	6.9	10.5	14.7	48.0	70.6
FT_Melbourne	STORAGE	4.9	8.2	12.9	47.8	70.4
FT_\$120	STORAGE	5.8	8.2	11.4	34.0	49.2
ND_Northridg	STORAGE	3.1	4.1	5.4	13.2	18.8
ND_Winograd	STORAGE	2.8	4.3	6.2	22.5	35.8
PR_PoudreRiv	STORAGE	7.0	10.9	14.4	26.3	31.2
SKD_CDOT_st	STORAGE	1.6	2.7	5.4	22.8	32.4
SKD_Promont	STORAGE	7.4	12.5	19.9	99.2	147.1
WC_B135	STORAGE	7.7	13.5	20.0	102.3	153.4
WC_CDOT_stl	STORAGE	5.3	8.2	15.9	56.0	77.5

Existing Node Peak Flows (cfs)

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
FT_B100	JUNCTION	0.9	1.4	2.1	4.9	6.5
FT_B101	JUNCTION	9.5	12.6	16.4	35.7	47.8
FT_B105	JUNCTION	5.3	7.1	9.2	19.1	25.2
FT_B110	JUNCTION	0.9	1.2	1.6	3.6	5.0
FT_B115	JUNCTION	1.4	1.9	2.6	5.9	8.3
FT_B120	JUNCTION	11.4	15.0	20.1	47.9	66.4
FT_B125	JUNCTION	11.9	15.7	20.1	40.8	54.1
FT_B130	JUNCTION	18.4	25.0	33.2	78.9	106.0
FT D101	DIVIDER	0.2	0.2	0.2	0.2	0.2
	DIVIDER	0.5	0.5	0.5	0.5	0.5
FTD125	DIVIDER	0.1	0.1	0.1	0.1	0.1
_ FT_D130	DIVIDER	0.6	0.6	0.6	0.6	0.6
FTD205	DIVIDER	0.5	0.5	0.5	0.5	0.5
_ FT_D305	DIVIDER	0.1	0.1	0.1	0.1	0.1
FT_J110	JUNCTION	0.4	0.4	0.4	0.4	0.4
	DIVIDER	0.8	0.9	1.0	1.1	1.1
	JUNCTION	0.6	0.6	0.7	0.7	0.7
	JUNCTION	0.5	0.5	0.5	0.5	0.5
_ FT_J201	JUNCTION	0.2	0.2	0.2	0.2	0.2
_ FT_J210	JUNCTION	0.4	0.4	0.4	0.4	0.4
	JUNCTION	0.6	0.6	0.7	0.7	0.7
	JUNCTION	0.5	0.5	0.5	0.5	0.5
	JUNCTION	0.1	0.1	0.1	0.1	0.1
FT_J405	JUNCTION	0.5	0.5	0.5	0.5	0.5
FT_J505	JUNCTION	0.5	0.5	0.5	0.5	0.5
	JUNCTION	0.5	0.5	0.5	0.5	0.5
FTJ705	JUNCTION	0.1	0.1	0.1	0.1	0.1
FT Melbourne		0.8	0.9	1.1	1.1	1.1
FT Melbourne		0.8	0.9	1.0	1.1	1.1
FT OUTLET	OUTFALL	0.5	0.5	0.5	0.5	0.5
FT_OUTLET2	OUTFALL	0.4	0.4	0.4	0.4	0.4
FTB1		0.9	1.4	2.1	4.9	6.5
Future_FT_B1		9.5	12.6	16.4	35.7	47.8
Future FT B1		5.3	7.1	9.2	19.1	25.2
Future FT B1		0.9	1.2	1.6	3.6	5.0
Future_FT_B1		1.4	1.9	2.6	5.9	8.3
Future_FT_B1		11.4	15.0	20.1	47.9	66.4
Future FT B1		11.9	15.7	20.1	40.8	54.1
Future_FT_B1		18.4	25.0	33.2	78.9	106.0
Future HD B:		1.2	2.1	8.9	39.7	56.7
Future HD B:		1.7	3.2	10.8	62.8	91.4
Future HD B:		12.2	19.1	42.3	150.2	209.7
Future MPD		1.9	4.0	9.8	79.8	117.6
Future MPD	STORAGE	4.9	9.3	32.3	182.2	264.0

	Future Node Peak Flows (cfs)								
Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr			
Future_ND_B100	STORAGE	12.8	16.9	22.4	49.8	67.4			
Future_ND_B105	STORAGE	12.8	17.0	22.5	52.3	72.5			
Future_ND_B110	STORAGE	0.7	0.9	1.2	2.2	2.9			
Future_ND_B115	STORAGE	1.0	1.3	1.6	3.1	3.9			
Future_ND_B120	STORAGE	0.3	0.4	0.5	1.0	1.2			
Future_ND_B130	STORAGE	23.7	31.2	40.0	75.0	96.2			
Future_ND_B135	STORAGE	3.6	4.8	6.2	11.6	14.8			
Future_ND_B140	STORAGE	5.2	6.9	8.8	16.2	21.0			
Future OG B100	STORAGE	2.6	5.9	9.7	124.6	191.3			
Future OG B105	STORAGE	14.4	20.9	30.5	77.1	101.6			
Future_OG_B110	STORAGE	15.8	23.2	36.8	87.5	115.3			
Future_PLC_B100	STORAGE	0.9	1.4	2.9	9.3	12.8			
Future_PLC_B105	STORAGE	31.8	45.9	72.1	183.9	245.1			
Future PLC B110	STORAGE	22.3	34.7	58.0	186.2	254.9			
Future PLC B115	STORAGE	21.5	32.7	46.7	157.6	219.3			
Future_PLC_B120	STORAGE	33.3	47.7	72.9	181.6	240.0			
Future_PLC_B121	STORAGE	36.8	50.9	69.2	141.4	181.3			
Future PRR B100	STORAGE	12.2	16.1	20.6	40.9	53.7			
Future PRR B105	STORAGE	4.0	5.2	6.7	13.0	16.9			
Future_SD_B100	STORAGE	1.7	3.1	11.2	60.4	87.6			
Future_SD_B105	STORAGE	1.0	2.7	4.5	57.1	88.6			
Future_SD_B110	STORAGE	0.9	1.8	5.3	35.6	52.1			
Future SD B115	STORAGE	0.9	1.8	6.3	34.8	50.4			
Future SD B120	STORAGE	5.4	9.8	16.6	102.7	150.7			
Future_SKD_B100	STORAGE	1.6	2.8	9.8	41.3	58.9			
Future_SKD_B105	STORAGE	1.6	2.6	4.1	17.3	24.7			
Future_SKD_B110	STORAGE	7.1	10.7	14.9	46.7	66.2			
Future_SKD_B115	STORAGE	4.6	7.3	10.3	40.1	56.2			
Future SKD B120	STORAGE	20.5	29.3	43.9	101.2	131.8			
Future_SKD_B125	STORAGE	12.9	19.5	28.5	62.3	80.9			
Future SKD B126	STORAGE	39.6	56.3	82.8	187.4	243.6			
Future_SKD_B130	STORAGE	22.3	32.6	47.9	110.4	143.3			
Future SKD B135	STORAGE	34.0	48.6	72.3	163.3	213.6			
Future SKD B136	STORAGE	25.8	36.8	53.3	121.8	158.9			
Future_SKD_B137	STORAGE	19.2	27.2	38.0	89.6	116.9			
Future_SKD_B140	STORAGE	37.5	54.3	72.3	182.4	243.0			
Future_SKD_B141	STORAGE	7.9	11.5	15.3	37.9	51.0			
Future SKD B145	STORAGE	60.5	84.6	112.2	269.7	361.0			
Future SKD B150	STORAGE	27.4	36.3	48.9	124.0	173.3			
Future_SKD_B155	STORAGE	44.1	60.2	78.4	170.7	222.8			
Future_SKD_B165	STORAGE	2.3	3.5	5.7	22.2	31.3			
Future_SKD_B170	STORAGE	3.5	5.5	7.7	32.4	46.6			
Future_SKD_B175	STORAGE	1.2	2.1	4.0	22.5	32.8			
Future SKD B190	STORAGE	17.2	23.5	30.7	60.5	77.0			

Nod	е
Future_SKD_B	
Future_WC_B	
Future_WC_B	101
Future_WC_B	102
Future_WC_B	
Future_WC_B	
Future_WC_B	
Future_WC_B	106
Future_WC_B	
Future_WC_B	
Future_WC_B	
Future_WC_B	
Future_WC_B	112
Future_WC_B	112.5
Future_WC_B	
Future_WC_B	
Future_WC_B	115
Future_WC_B	120
Future_WC_B	130
Future_WC_B	
Future_WC_B	
Future_WC_B	146
Future_WC_B	150
Future_WC_B	160
Future_WC_B	
Future_WC_B	171
Future_WC_B	
Future_WC_B	173
HD_B100	
HD_B105	
HD_B110	
HD_J105	
HD_J110	
HD_Outlet	
MPD_B100	
MPD_B105	
MPD_J105	
MPD_OUTLET	
ND_B100	
ND_B105	
ND_B110	
ND_B115	
ND_B120	
ND_B130	

Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
STORAGE	28.2	16.9	22.4	49.8	67.4
STORAGE	0.8	17.0	22.5	52.3	72.5
STORAGE	5.9	0.9	1.2	2.2	2.9
STORAGE	3.8	1.3	1.6	3.1	3.9
STORAGE	2.6	0.4	0.5	1.0	1.2
STORAGE	6.7	31.2	40.0	75.0	96.2
STORAGE	1.8	4.8	6.2	11.6	14.8
STORAGE	8.4	6.9	8.8	16.2	21.0
STORAGE	5.7	5.9	9.7	124.6	191.3
STORAGE	1.7	20.9	30.5	77.1	101.6
STORAGE	11.7	23.2	36.8	87.5	115.3
STORAGE	5.0	1.4	2.9	9.3	12.8
STORAGE	1.7	45.9	72.1	183.9	245.1
STORAGE	2.6	34.7	58.0	186.2	254.9
STORAGE	22.3	32.7	46.7	157.6	219.3
STORAGE	20.5	47.7	72.9	181.6	240.0
STORAGE	6.9	50.9	69.2	141.4	181.3
STORAGE	160.8	16.1	20.6	40.9	53.7
STORAGE	5.9	5.2	6.7	13.0	16.9
STORAGE	48.2	3.1	11.2	60.4	87.6
STORAGE	123.3	2.7	4.5	57.1	88.6
STORAGE	13.4	1.8	5.3	35.6	52.1
STORAGE	80.9	1.8	6.3	34.8	50.4
STORAGE	41.0	9.8	16.6	102.7	150.7
STORAGE	1.6	2.8	9.8	41.3	58.9
STORAGE	2.4	2.6	4.1	17.3	24.7
STORAGE	3.6	10.7	14.9	46.7	66.2
STORAGE	2.4	7.3	10.3	40.1	56.2
JUNCTION	1.2	29.3	43.9	101.2	131.8
JUNCTION	1.7	19.5	28.5	62.3	80.9
JUNCTION	12.2	56.3	82.8	187.4	243.6
JUNCTION	0.1	32.6	47.9	110.4	143.3
JUNCTION	4.9	48.6	72.3	163.3	213.6
JUNCTION	5.2	36.8	53.3	121.8	158.9
JUNCTION	1.9	27.2	38.0	89.6	116.9
JUNCTION	4.9	54.3	72.3	182.4	243.0
JUNCTION	0.5	11.5	15.3	37.9	51.0
OUTFALL	0.8	84.6	112.2	269.7	361.0
JUNCTION	12.8	36.3	48.9	124.0	173.3
JUNCTION	12.8	60.2	78.4	170.7	222.8
JUNCTION	0.7	3.5	5.7	22.2	31.3
JUNCTION	1.0	5.5	7.7	32.4	46.6
JUNCTION	0.3	2.1	4.0	22.5	32.8
JUNCTION	23.7	23.5	30.7	60.5	77.0

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
ND_B135	JUNCTION	3.6	4.8	6.2	11.6	14.8
ND_B140	JUNCTION	5.2	6.9	8.8	16.2	21.0
ND_D105	DIVIDER	1.4	1.5	1.6	1.7	1.7
ND_D110	DIVIDER	0.1	0.1	0.1	0.1	0.1
ND D115	DIVIDER	0.1	0.1	0.1	0.1	0.1
 ND	DIVIDER	0.0	0.0	0.1	0.1	0.1
ND D140	DIVIDER	0.1	0.1	0.1	0.1	0.1
ND_J100	JUNCTION	0.3	0.3	0.3	0.3	0.3
 ND_J105	JUNCTION	1.2	1.3	1.4	1.5	1.5
	JUNCTION	0.1	0.1	0.1	0.1	0.1
 ND_J135	JUNCTION	0.1	0.1	0.1	0.1	0.1
ND_J205	JUNCTION	0.4	0.4	0.4	0.4	0.4
 ND_J230	JUNCTION	0.1	0.1	0.1	0.1	0.1
 ND_J235	JUNCTION	0.1	0.1	0.1	0.1	0.1
ND_J305	JUNCTION	0.8	0.9	1.0	1.1	1.1
	JUNCTION	0.0	0.0	0.0	0.0	0.0
 ND_J430	JUNCTION	0.0	0.0	0.0	0.0	0.0
 ND_NorthridgeHigh	STORAGE	0.2	0.2	0.2	0.2	0.2
ND Pond inflow	JUNCTION	0.1	0.1	0.1	0.1	0.1
ND_Winograd	STORAGE	0.4	0.4	0.4	0.4	0.4
OG_B100	JUNCTION	2.6	5.9	9.7	124.6	191.3
OG_B105	JUNCTION	14.4	20.9	30.5	77.1	101.6
OG_B110	JUNCTION	15.8	23.2	36.8	87.5	115.3
OG_J100	JUNCTION	2.8	2.8	2.8	2.8	2.8
OG_J105	JUNCTION	1.3	1.3	1.3	1.3	1.3
OG_J110	JUNCTION	1.6	1.6	1.6	1.6	1.6
OG_Outlet	JUNCTION	3.1	3.9	6.7	6.9	6.9
PLC_B100	JUNCTION	0.9	1.4	2.9	9.3	12.8
PLC_B105	JUNCTION	31.8	45.9	72.1	183.9	245.1
PLC_B110	JUNCTION	22.3	34.7	58.0	186.2	254.9
PLC_B115	JUNCTION	21.5	32.7	46.7	157.6	219.3
PLC_B120	JUNCTION	33.3	47.7	72.9	181.6	240.0
PLC_B121	JUNCTION	36.8	50.9	69.2	141.4	181.3
PLC_D115	DIVIDER	7.6	5.5	5.5	5.5	5.5
PLC_J100	JUNCTION	18.5	18.6	18.9	19.7	20.2
PLC_J105	DIVIDER	18.5	18.6	18.9	19.7	20.2
PLC_J110	JUNCTION	4.4	4.4	4.4	4.4	4.4
PLC_J115	JUNCTION	10.1	10.3	10.6	11.4	12.0
PLC_J120	JUNCTION	5.5	5.5	5.5	5.5	5.5
PLC_J121	JUNCTION	1.6	1.6	1.6	1.6	1.6
_ PLC_J215	JUNCTION	8.0	7.5	7.8	8.6	9.2
PLC_OUTLET	OUTFALL	18.6	18.9	19.3	20.1	20.6
_ PR_B100	JUNCTION	0.3	1.0	2.8	10.2	14.0
_ PR_B105	JUNCTION	0.8	1.5	4.6	28.4	41.1

# Future Node Peak Flows (cfs)

NodeNodeYpp2-yr5-yr10-yr50-yr100-yrPRJUNCTION1.63.913.652.372.6PRJUNCTION0.20.41.67.811.2PRB120JUNCTION0.51.03.815.521.8PRB125JUNCTION1.73.112.055.779.3PRB135JUNCTION87.8125.8171.734.3436.2PRB150JUNCTION5.720.120.826.7PRB155JUNCTION3.14.45.914.118.8PRJUNCTION1.41.51.61.71.7PRDUNCTION1.41.51.61.71.7PRDUNCTION1.41.51.61.71.7PROUTEUNCTION1.216.120.026.9PRPRJUNCTION1.21.61.01.0PRJUNCTION1.11.21.41.91.9PRR_1100JUNCTION1.11.21.41.91.9PRJUNCTION1.11.21.41.91.9PRJUNCTION1.02.74.55.18.6SD_B100JUNCTION1.02.74.55.18.6SD_B100JUNCTION1.02.74.55.18.6SD_B110JUNCTION5.49.81.66102.7
PR_B115       JUNCTION       0.2       0.4       1.6       7.8       11.2         PR_B120       JUNCTION       1.0       1.8       8.0       34.2       48.9         PR_B125       JUNCTION       0.5       1.0       3.8       15.5       21.8         PR_B130       JUNCTION       1.7       3.1       12.0       55.7       79.3         PR_B155       JUNCTION       87.8       125.8       171.7       343.3       436.2         PR_B155       JUNCTION       5.0       7.2       10.1       20.8       26.7         PR_B160       JUNCTION       1.4       1.5       1.6       1.7       1.7         PR_OUTLET       OUTFALL       5.2       7.4       10.3       21.0       26.9         PR_B100       JUNCTION       1.2       16.1       20.6       40.9       53.7         PR_B105       JUNCTION       1.1       1.2       1.4       1.9       1.9         PR_POUTLET       OUTFALL       1.1       1.1.2       1.4       1.9       1.9         SD_B100       JUNCTION       1.0       2.7       4.5       57.1       88.6         SD_B110       JUNCTION       1.
PR_B120       JUNCTION       1.0       1.8       8.0       34.2       48.9         PR_B125       JUNCTION       0.5       1.0       3.8       15.5       21.8         PR_B130       JUNCTION       1.7       3.1       12.0       55.7       79.3         PR_B150       JUNCTION       87.8       125.8       171.7       343.3       436.2         PR_B155       JUNCTION       5.0       7.2       10.1       20.8       26.7         PR_B160       JUNCTION       3.1       4.4       5.9       14.1       18.8         PR_J355       JUNCTION       1.4       1.5       1.6       1.7       1.7         PR_OUTLET       OUTFALL       5.2       7.4       10.3       21.0       26.9         PR_B100       JUNCTION       1.2       16.1       20.6       40.9       53.7         PRR_B100       JUNCTION       1.1       1.2       1.4       1.9       1.9         PRR_B105       JUNCTION       0.2       0.3       0.5       1.0       1.0         PR_B105       JUNCTION       1.1       1.2       1.4       1.9       1.9         PS_B105       JUNCTION       1.7 </td
PR_B125         JUNCTION         0.5         1.0         3.8         15.5         21.8           PR_B130         JUNCTION         1.7         3.1         12.0         55.7         79.3           PR_B135         JUNCTION         87.8         125.8         171.7         343.3         436.2           PR_B150         JUNCTION         4.6         8.7         19.1         64.0         90.1           PR_B155         JUNCTION         5.0         7.2         10.1         20.8         26.7           PR_B160         JUNCTION         3.1         4.4         5.9         14.1         1.88           PR_J355         JUNCTION         1.4         1.5         1.6         1.7         1.7           PR_OUTLET         OUTFALL         5.2         7.4         10.3         21.0         26.9           PR_B100         JUNCTION         1.2         16.1         20.6         40.9         53.7           PR_B105         JUNCTION         1.1         1.2         1.4         1.9         1.9           SD_B100         JUNCTION         1.7         3.1         11.2         60.4         87.6           SD_B110         JUNCTION         1.7
PR_B130         JUNCTION         1.7         3.1         12.0         55.7         79.3           PR_B13S         JUNCTION         87.8         125.8         171.7         343.3         436.2           PR_B150         JUNCTION         4.6         8.7         19.1         64.0         90.1           PR_B155         JUNCTION         5.0         7.2         10.1         20.8         26.7           PR_B155         JUNCTION         3.1         4.4         5.9         14.1         18.8           PR_J355         JUNCTION         1.4         1.5         1.6         1.7         1.7           PR_OUTLET         OUTFALL         5.2         7.4         10.3         21.0         26.9           PR_B100         JUNCTION         12.2         16.1         20.6         40.9         53.7           PRR_B105         JUNCTION         1.1         1.2         1.4         1.9         1.9           PSD_SD_JUNCTION         1.1         1.2         1.4         1.9         1.9           SD_B100         JUNCTION         1.0         2.7         4.5         57.1         88.6           SD_B100         JUNCTION         1.0         2.7
PP_B135         JUNCTION         87.8         125.8         171.7         343.3         436.2           PR_B150         JUNCTION         4.6         8.7         19.1         64.0         90.1           PR_B155         JUNCTION         3.1         4.4         5.9         14.1         18.8           PR_B160         JUNCTION         1.4         1.5         1.6         1.7         1.7           PR_OUTLET         OUTFALL         5.2         7.4         10.3         21.0         26.9           PRR_B100         JUNCTION         1.2         16.1         20.6         40.9         53.7           PRR_B105         JUNCTION         4.0         5.2         6.7         13.0         16.9           PRR_B105         JUNCTION         1.1         1.2         1.4         1.9         1.9           PRR_D105         JUNCTION         1.1         1.2         1.4         1.9         1.9           SD_B105         JUNCTION         1.7         3.1         11.2         60.4         87.6           SD_B100         JUNCTION         1.7         3.1         11.2         60.4         87.6           SD_B110         JUNCTION         1.0
PP_B150         JUNCTION         4.6         8.7         19.1         64.0         90.1           PR_B155         JUNCTION         5.0         7.2         10.1         20.8         26.7           PR_B160         JUNCTION         3.1         4.4         5.9         14.1         18.8           PR_J355         JUNCTION         1.4         1.5         1.6         1.7         1.7           PR_OUTLET         OUTFALL         5.2         7.4         10.3         21.0         26.9           PRR_B100         JUNCTION         12.2         16.1         20.6         40.9         53.7           PRR_B105         JUNCTION         1.1         1.2         1.4         1.9         1.9           PRR_B105         JUNCTION         1.1         1.2         1.4         1.9         1.9           PRR_D105         JUNCTION         0.2         0.3         0.5         1.0         1.0           PR_D105         JUNCTION         1.1         1.2         1.4         1.9         1.9           SD_B105         JUNCTION         1.7         3.1         11.2         60.4         87.6           SD_B105         JUNCTION         1.0         2.
PP_B155         JUNCTION         5.0         7.2         10.1         20.8         26.7           PR_B160         JUNCTION         3.1         4.4         5.9         14.1         18.8           PR_J355         JUNCTION         1.4         1.5         1.6         1.7         1.7           PR_OUTLET         OUTFALL         5.2         7.4         10.3         21.0         26.9           PR_B100         JUNCTION         12.2         16.1         20.6         40.9         53.7           PRR_B105         JUNCTION         4.0         5.2         6.7         13.0         16.9           PRR_J105         JUNCTION         1.1         1.2         1.4         1.9         1.9           PRR_J105         JUNCTION         1.1         1.2         1.4         1.9         1.9           SD_B100         JUNCTION         1.7         3.1         11.2         60.4         87.6           SD_B105         JUNCTION         1.0         2.7         4.5         57.1         88.6           SD_B100         JUNCTION         1.0         2.7         4.5         57.1         85.6           SD_B110         JUNCTION         1.0
PR_B160         JUNCTION         3.1         4.4         5.9         14.1         18.8           PR_J355         JUNCTION         1.4         1.5         1.6         1.7         1.7           PR_OUTLET         OUTFALL         5.2         7.4         10.3         21.0         26.9           PR_PoudreRiv         STORAGE         5.2         7.4         10.3         21.0         26.9           PR_B100         JUNCTION         12.2         16.1         20.6         40.9         53.7           PRR_B105         JUNCTION         4.0         5.2         6.7         13.0         16.9           PRR_J105         JUNCTION         1.1         1.2         1.4         1.9         1.9           PRR_SD_B100         JUNCTION         1.7         3.1         11.2         60.4         87.6           SD_B105         JUNCTION         1.0         2.7         4.5         57.1         88.6           SD_B105         JUNCTION         1.0         2.7         4.5         57.1         88.6           SD_B105         JUNCTION         1.8         6.3         34.8         50.4           SD_B115         JUNCTION         4.5         7.4
PF_J355         JUNCTION         1.4         1.5         1.6         1.7         1.7           PR_OUTLET         OUTFALL         5.2         7.4         10.3         21.0         26.9           PR_PoudreRiv         STORAGE         5.2         7.4         10.3         21.0         26.9           PRR_B100         JUNCTION         12.2         16.1         20.6         40.9         53.7           PRR_B105         JUNCTION         1.1         1.2         1.4         1.9         1.9           PRR_J105         JUNCTION         0.2         0.3         0.5         1.0         1.0           PRR_OUTLET         OUTFALL         1.1         1.2         1.4         1.9         1.9           SD_B105         JUNCTION         1.7         3.1         11.2         60.4         87.6           SD_B105         JUNCTION         1.0         2.7         4.5         57.1         88.6           SD_B110         JUNCTION         0.9         1.8         6.3         34.8         50.4           SD_B120         JUNCTION         4.7         7.7         7.7         7.7           SD_J100         JUNCTION         3.7         4.7 <t< td=""></t<>
PR_OUTLET         OUTFALL         5.2         7.4         10.3         21.0         26.9           PR_PoudreRiv         STORAGE         5.2         7.4         10.3         21.0         26.9           PRR_B100         JUNCTION         12.2         16.1         20.6         40.9         53.7           PRR_B105         JUNCTION         1.1         1.2         1.4         1.9         1.9           PRR_J105         JUNCTION         0.2         0.3         0.5         1.0         1.0           PRR_OUTLET         OUTFALL         1.1         1.2         1.4         1.9         1.9           SD_B100         JUNCTION         1.7         3.1         11.2         60.4         87.6           SD_B105         JUNCTION         1.0         2.7         4.5         57.1         88.6           SD_B110         JUNCTION         0.9         1.8         6.3         34.8         50.4           SD_B120         JUNCTION         4.7         5.8         5.8         5.8           SD_J100         JUNCTION         3.7         4.7         5.8         5.8           SD_J100         JUNCTION         3.7         4.7         5.8 <t< td=""></t<>
PP_PoudreRiv         STORAGE         5.2         7.4         10.3         21.0         26.9           PRR_B100         JUNCTION         12.2         16.1         20.6         40.9         53.7           PRR_B105         JUNCTION         4.0         5.2         6.7         13.0         16.9           PRR_J100         JUNCTION         1.1         1.2         1.4         1.9         1.9           PRR_J105         JUNCTION         0.2         0.3         0.5         1.0         1.0           PRR_OUTLET         OUTFALL         1.1         1.2         1.4         1.9         1.9           SD_B100         JUNCTION         1.0         2.7         4.5         57.1         88.6           SD_B105         JUNCTION         0.9         1.8         6.3         34.8         50.4           SD_B110         JUNCTION         4.5         7.4         10.0         9.9         9.9           SD_J100         JUNCTION         4.5         7.4         10.0         9.9         9.9           SD_J100         JUNCTION         3.7         4.7         5.8         5.8         5.8           SD_J100         JUNCTION         3.4
PR_B100         JUNCTION         12.2         16.1         20.6         40.9         53.7           PRR_B105         JUNCTION         4.0         5.2         6.7         13.0         16.9           PRR_J100         JUNCTION         1.1         1.2         1.4         1.9         1.9           PRR_J105         JUNCTION         0.2         0.3         0.5         1.0         1.0           PRR_OUTLET         OUTFALL         1.1         1.2         1.4         1.9         1.9           SD_B100         JUNCTION         1.7         3.1         11.2         60.4         87.6           SD_B105         JUNCTION         1.0         2.7         4.5         57.1         88.6           SD_B110         JUNCTION         0.9         1.8         6.3         34.8         50.4           SD_B110         JUNCTION         5.4         9.8         16.6         102.7         150.7           SD_B110         JUNCTION         3.7         4.7         5.8         5.8         5.8           SD_J100         JUNCTION         3.4         4.0         4.5         4.5         4.5           SD_D1210         JUNCTION         3.4         4
PRR_B105         JUNCTION         4.0         5.2         6.7         13.0         16.9           PRR_J100         JUNCTION         1.1         1.2         1.4         1.9         1.9           PRR_J105         JUNCTION         0.2         0.3         0.5         1.0         1.0           PRR_OUTLET         OUTFALL         1.1         1.2         1.4         1.9         1.9           SD_B100         JUNCTION         1.7         3.1         11.2         60.4         87.6           SD_B105         JUNCTION         1.0         2.7         4.5         57.1         88.6           SD_B110         JUNCTION         0.9         1.8         6.3         34.8         50.4           SD_B120         JUNCTION         5.4         9.8         16.6         102.7         150.7           SD_J100         JUNCTION         4.5         7.4         10.0         9.9         9.9           SD_J110         JUNCTION         3.7         4.7         5.8         5.8         5.8           SD_J200         JUNCTION         3.4         4.0         4.5         4.5         4.5           SD_DUtet         OUTFALL         4.5         7.4
PRR_B105         JUNCTION         4.0         5.2         6.7         13.0         16.9           PRR_J100         JUNCTION         1.1         1.2         1.4         1.9         1.9           PRR_J105         JUNCTION         0.2         0.3         0.5         1.0         1.0           PRR_OUTLET         OUTFALL         1.1         1.2         1.4         1.9         1.9           SD_B100         JUNCTION         1.7         3.1         11.2         60.4         87.6           SD_B105         JUNCTION         1.0         2.7         4.5         57.1         88.6           SD_B110         JUNCTION         0.9         1.8         6.3         34.8         50.4           SD_B110         JUNCTION         5.4         9.8         16.6         102.7         150.7           SD_B110         JUNCTION         4.5         7.4         10.0         9.9         9.9           SD_J100         JUNCTION         3.7         4.7         5.8         5.8         5.8           SD_J200         JUNCTION         3.4         4.0         4.5         4.5         4.5           SD_DUtet         OUTFALL         4.5         7.4
PRR_J105         JUNCTION         0.2         0.3         0.5         1.0         1.0           PRR_OUTLET         OUTFALL         1.1         1.2         1.4         1.9         1.9           SD_B100         JUNCTION         1.7         3.1         11.2         60.4         87.6           SD_B105         JUNCTION         0.9         1.8         5.3         35.6         52.1           SD_B115         JUNCTION         0.9         1.8         6.3         34.8         50.4           SD_B120         JUNCTION         5.4         9.8         16.6         102.7         150.7           SD_J100         JUNCTION         4.5         7.4         10.0         9.9         9.9           SD_J100         JUNCTION         3.7         4.7         5.8         5.8         5.8           SD_J200         JUNCTION         3.4         4.0         4.5         4.5         4.5           SD_J210         JUNCTION         1.6         2.8         9.8         41.3         58.9           SKD_B100         JUNCTION         1.6         2.6         4.1         17.3         24.7           SKD_B115         JUNCTION         1.6         2.6<
PRR_J105         JUNCTION         0.2         0.3         0.5         1.0         1.0           PRR_OUTLET         OUTFALL         1.1         1.2         1.4         1.9         1.9           SD_B100         JUNCTION         1.7         3.1         11.2         60.4         87.6           SD_B105         JUNCTION         1.0         2.7         4.5         57.1         88.6           SD_B105         JUNCTION         0.9         1.8         6.3         34.8         50.4           SD_B120         JUNCTION         5.4         9.8         16.6         102.7         150.7           SD_J100         JUNCTION         4.5         7.4         10.0         9.9         9.9           SD_J100         JUNCTION         4.5         7.4         10.0         9.9         9.9           SD_J200         JUNCTION         3.4         4.0         4.5         4.5         4.5           SD_J210         JUNCTION         1.6         2.8         9.8         41.3         58.9           SKD_B100         JUNCTION         1.6         2.6         4.1         17.3         24.7           SKD_B115         JUNCTION         1.6         2.6
SD_B100       JUNCTION       1.7       3.1       11.2       60.4       87.6         SD_B105       JUNCTION       1.0       2.7       4.5       57.1       88.6         SD_B110       JUNCTION       0.9       1.8       5.3       35.6       52.1         SD_B115       JUNCTION       0.9       1.8       6.3       34.8       50.4         SD_B120       JUNCTION       5.4       9.8       16.6       102.7       150.7         SD_J100       JUNCTION       4.5       7.4       10.0       9.9       9.9         SD_J110       JUNCTION       3.7       4.7       5.8       5.8       5.8         SD_J200       JUNCTION       3.4       4.0       4.5       4.5       4.5         SD_J210       JUNCTION       3.4       4.0       4.5       4.5       4.5         SD_DUtlet       OUTFALL       4.5       7.4       10.0       9.9       9.9         SKD_B100       JUNCTION       1.6       2.8       9.8       41.3       58.9         SKD_B105       JUNCTION       1.6       2.6       4.1       17.3       24.7         SKD_B105       JUNCTION       7.1
SD_B105       JUNCTION       1.0       2.7       4.5       57.1       88.6         SD_B110       JUNCTION       0.9       1.8       5.3       35.6       52.1         SD_B115       JUNCTION       0.9       1.8       6.3       34.8       50.4         SD_B120       JUNCTION       5.4       9.8       16.6       102.7       150.7         SD_J100       JUNCTION       4.5       7.4       10.0       9.9       9.9         SD_J110       JUNCTION       3.7       4.7       5.8       5.8       5.8         SD_J200       JUNCTION       3.4       4.0       4.5       4.5       4.5         SD_Outlet       OUTFALL       4.5       7.4       10.0       9.9       9.9         SKD_B100       JUNCTION       1.6       2.8       9.8       41.3       58.9         SKD_B105       JUNCTION       1.6       2.6       4.1       17.3       24.7         SKD_B105       JUNCTION       1.6       2.6       4.1       17.3       24.7         SKD_B105       JUNCTION       1.6       2.6       4.1       17.3       24.7         SKD_B115       JUNCTION       7.1
ND_B110JUNCTION0.91.85.335.652.1SD_B115JUNCTION0.91.86.334.850.4SD_B120JUNCTION5.49.816.6102.7150.7SD_J100JUNCTION4.57.410.09.99.9SD_J110JUNCTION3.74.75.85.85.8SD_J200JUNCTION4.05.97.77.77.7SD_J210JUNCTION3.44.04.54.54.5SD_OutletOUTFALL4.57.410.09.99.9SKD_B100JUNCTION1.62.89.841.358.9SKD_B105JUNCTION1.62.64.117.324.7SKD_B105JUNCTION7.110.714.946.766.2SKD_B110JUNCTION7.110.714.946.766.2SKD_B120JUNCTION20.529.343.9101.2131.8SKD_B125JUNCTION20.529.343.9101.2131.8SKD_B126JUNCTION22.332.647.9110.4143.3SKD_B130JUNCTION25.836.853.3121.8158.9SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION37.554.372.3182.4243.0SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141
SD_B115         JUNCTION         0.9         1.8         6.3         34.8         50.4           SD_B120         JUNCTION         5.4         9.8         16.6         102.7         150.7           SD_J100         JUNCTION         4.5         7.4         10.0         9.9         9.9           SD_J110         JUNCTION         3.7         4.7         5.8         5.8         5.8           SD_J200         JUNCTION         4.0         5.9         7.7         7.7         7.7           SD_J210         JUNCTION         3.4         4.0         4.5         4.5         4.5           SD_Outlet         OUTFALL         4.5         7.4         10.0         9.9         9.9           SKD_B100         JUNCTION         1.6         2.8         9.8         41.3         58.9           SKD_B105         JUNCTION         1.6         2.6         4.1         17.3         24.7           SKD_B105         JUNCTION         7.1         10.7         14.9         46.7         66.2           SKD_B110         JUNCTION         7.1         10.7         14.9         46.7         66.2           SKD_B120         JUNCTION         20.5 <t< td=""></t<>
SD_B120       JUNCTION       5.4       9.8       16.6       102.7       150.7         SD_J100       JUNCTION       4.5       7.4       10.0       9.9       9.9         SD_J110       JUNCTION       3.7       4.7       5.8       5.8       5.8         SD_J200       JUNCTION       4.0       5.9       7.7       7.7       7.7         SD_J210       JUNCTION       3.4       4.0       4.5       4.5       4.5         SD_Outlet       OUTFALL       4.5       7.4       10.0       9.9       9.9         SKD_B100       JUNCTION       1.6       2.8       9.8       41.3       58.9         SKD_B105       JUNCTION       1.6       2.6       4.1       17.3       24.7         SKD_B106       JUNCTION       1.6       2.6       4.1       17.3       24.7         SKD_B105       JUNCTION       7.1       10.7       14.9       46.7       66.2         SKD_B110       JUNCTION       7.1       10.7       14.9       46.7       66.2         SKD_B120       JUNCTION       20.5       29.3       43.9       101.2       131.8         SKD_B126       JUNCTION
SD_J100JUNCTION4.57.410.09.99.9SD_J110JUNCTION3.74.75.85.85.8SD_J200JUNCTION4.05.97.77.77.7SD_J210JUNCTION3.44.04.54.54.5SD_OutletOUTFALL4.57.410.09.99.9SKD_B100JUNCTION1.62.89.841.358.9SKD_B105JUNCTION1.62.64.117.324.7SKD_B106JUNCTION7.110.714.946.766.2SKD_B110JUNCTION7.110.714.946.766.2SKD_B120JUNCTION20.529.343.9101.2131.8SKD_B125JUNCTION20.529.343.9101.2131.8SKD_B126JUNCTION39.656.382.8187.4243.6SKD_B130JUNCTION22.332.647.9110.4143.3SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION7.911.515.337.951.0SKD_B145JUNCTION27.436.348.9124.0173.3
SD_J110JUNCTION3.74.75.85.85.8SD_J200JUNCTION4.05.97.77.7SD_J210JUNCTION3.44.04.54.54.5SD_OutletOUTFALL4.57.410.09.99.9SKD_B100JUNCTION1.62.89.841.358.9SKD_B105JUNCTION1.62.64.117.324.7SKD_B106JUNCTION0.60.81.12.73.8SKD_B110JUNCTION7.110.714.946.766.2SKD_B115JUNCTION4.67.310.340.156.2SKD_B120JUNCTION20.529.343.9101.2131.8SKD_B125JUNCTION12.919.528.562.380.9SKD_B126JUNCTION22.332.647.9110.4143.3SKD_B130JUNCTION25.836.853.3121.8158.9SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION27.436.348.9124.0173.3
SD_J110JUNCTION3.74.75.85.85.8SD_J200JUNCTION4.05.97.77.77.7SD_J210JUNCTION3.44.04.54.54.5SD_OutletOUTFALL4.57.410.09.99.9SKD_B100JUNCTION1.62.89.841.358.9SKD_B105JUNCTION1.62.64.117.324.7SKD_B106JUNCTION0.60.81.12.73.8SKD_B110JUNCTION7.110.714.946.766.2SKD_B115JUNCTION4.67.310.340.156.2SKD_B120JUNCTION20.529.343.9101.2131.8SKD_B125JUNCTION12.919.528.562.380.9SKD_B126JUNCTION22.332.647.9110.4143.3SKD_B130JUNCTION25.836.853.3121.8158.9SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION7.911.515.337.951.0SKD_B150JUNCTION27.436.348.9124.0173.3 </td
SD_J210JUNCTION3.44.04.54.54.5SD_OutletOUTFALL4.57.410.09.99.9SKD_B100JUNCTION1.62.89.841.358.9SKD_B105JUNCTION1.62.64.117.324.7SKD_B106JUNCTION0.60.81.12.73.8SKD_B110JUNCTION7.110.714.946.766.2SKD_B115JUNCTION4.67.310.340.156.2SKD_B120JUNCTION20.529.343.9101.2131.8SKD_B126JUNCTION12.919.528.562.380.9SKD_B126JUNCTION22.332.647.9110.4143.3SKD_B130JUNCTION25.836.853.3121.8158.9SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION37.554.372.3182.4243.0SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION60.584.6112.2269.7361.0SKD_B150JUNCTION27.436.348.9124.0173.3
SD_J210JUNCTION3.44.04.54.54.5SD_OutletOUTFALL4.57.410.09.99.9SKD_B100JUNCTION1.62.89.841.358.9SKD_B105JUNCTION1.62.64.117.324.7SKD_B106JUNCTION0.60.81.12.73.8SKD_B110JUNCTION7.110.714.946.766.2SKD_B115JUNCTION4.67.310.340.156.2SKD_B120JUNCTION20.529.343.9101.2131.8SKD_B126JUNCTION12.919.528.562.380.9SKD_B126JUNCTION39.656.382.8187.4243.6SKD_B130JUNCTION22.332.647.9110.4143.3SKD_B135JUNCTION25.836.853.3121.8158.9SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION37.554.372.3182.4243.0SKD_B140JUNCTION7.911.515.337.951.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION27.436.348.9124.0173.3
SKD_B100JUNCTION1.62.89.841.358.9SKD_B105JUNCTION1.62.64.117.324.7SKD_B106JUNCTION0.60.81.12.73.8SKD_B110JUNCTION7.110.714.946.766.2SKD_B115JUNCTION4.67.310.340.156.2SKD_B120JUNCTION20.529.343.9101.2131.8SKD_B125JUNCTION12.919.528.562.380.9SKD_B126JUNCTION22.332.647.9110.4143.3SKD_B130JUNCTION25.836.853.3121.8158.9SKD_B135JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION19.227.238.089.6116.9SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION7.911.515.337.951.0SKD_B145JUNCTION27.436.348.9124.0173.3
SKD_B105JUNCTION1.62.64.117.324.7SKD_B106JUNCTION0.60.81.12.73.8SKD_B110JUNCTION7.110.714.946.766.2SKD_B115JUNCTION4.67.310.340.156.2SKD_B120JUNCTION20.529.343.9101.2131.8SKD_B125JUNCTION12.919.528.562.380.9SKD_B126JUNCTION39.656.382.8187.4243.6SKD_B130JUNCTION22.332.647.9110.4143.3SKD_B135JUNCTION25.836.853.3121.8158.9SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION19.227.238.089.6116.9SKD_B140JUNCTION7.911.515.337.951.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION27.436.348.9124.0173.3
SKD_B106JUNCTION0.60.81.12.73.8SKD_B110JUNCTION7.110.714.946.766.2SKD_B115JUNCTION4.67.310.340.156.2SKD_B120JUNCTION20.529.343.9101.2131.8SKD_B125JUNCTION12.919.528.562.380.9SKD_B126JUNCTION39.656.382.8187.4243.6SKD_B130JUNCTION22.332.647.9110.4143.3SKD_B135JUNCTION34.048.672.3163.3213.6SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION19.227.238.089.6116.9SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION27.436.348.9124.0173.3
SKD_B106JUNCTION0.60.81.12.73.8SKD_B110JUNCTION7.110.714.946.766.2SKD_B115JUNCTION4.67.310.340.156.2SKD_B120JUNCTION20.529.343.9101.2131.8SKD_B125JUNCTION12.919.528.562.380.9SKD_B126JUNCTION39.656.382.8187.4243.6SKD_B130JUNCTION22.332.647.9110.4143.3SKD_B135JUNCTION34.048.672.3163.3213.6SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION19.227.238.089.6116.9SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION27.436.348.9124.0173.3
SKD_B115JUNCTION4.67.310.340.156.2SKD_B120JUNCTION20.529.343.9101.2131.8SKD_B125JUNCTION12.919.528.562.380.9SKD_B126JUNCTION39.656.382.8187.4243.6SKD_B130JUNCTION22.332.647.9110.4143.3SKD_B135JUNCTION34.048.672.3163.3213.6SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION19.227.238.089.6116.9SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION60.584.6112.2269.7361.0SKD_B150JUNCTION27.436.348.9124.0173.3
SKD_B120JUNCTION20.529.343.9101.2131.8SKD_B125JUNCTION12.919.528.562.380.9SKD_B126JUNCTION39.656.382.8187.4243.6SKD_B130JUNCTION22.332.647.9110.4143.3SKD_B135JUNCTION34.048.672.3163.3213.6SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION19.227.238.089.6116.9SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION60.584.6112.2269.7361.0SKD_B150JUNCTION27.436.348.9124.0173.3
SKD_B125JUNCTION12.919.528.562.380.9SKD_B126JUNCTION39.656.382.8187.4243.6SKD_B130JUNCTION22.332.647.9110.4143.3SKD_B135JUNCTION34.048.672.3163.3213.6SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION19.227.238.089.6116.9SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION60.584.6112.2269.7361.0SKD_B150JUNCTION27.436.348.9124.0173.3
SKD_B126JUNCTION39.656.382.8187.4243.6SKD_B130JUNCTION22.332.647.9110.4143.3SKD_B135JUNCTION34.048.672.3163.3213.6SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION19.227.238.089.6116.9SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION60.584.6112.2269.7361.0SKD_B150JUNCTION27.436.348.9124.0173.3
SKD_B130JUNCTION22.332.647.9110.4143.3SKD_B135JUNCTION34.048.672.3163.3213.6SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION19.227.238.089.6116.9SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION60.584.6112.2269.7361.0SKD_B150JUNCTION27.436.348.9124.0173.3
SKD_B135JUNCTION34.048.672.3163.3213.6SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION19.227.238.089.6116.9SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION60.584.6112.2269.7361.0SKD_B150JUNCTION27.436.348.9124.0173.3
SKD_B136JUNCTION25.836.853.3121.8158.9SKD_B137JUNCTION19.227.238.089.6116.9SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION60.584.6112.2269.7361.0SKD_B150JUNCTION27.436.348.9124.0173.3
SKD_B137JUNCTION19.227.238.089.6116.9SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION60.584.6112.2269.7361.0SKD_B150JUNCTION27.436.348.9124.0173.3
SKD_B137JUNCTION19.227.238.089.6116.9SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION60.584.6112.2269.7361.0SKD_B150JUNCTION27.436.348.9124.0173.3
SKD_B140JUNCTION37.554.372.3182.4243.0SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION60.584.6112.2269.7361.0SKD_B150JUNCTION27.436.348.9124.0173.3
SKD_B141JUNCTION7.911.515.337.951.0SKD_B145JUNCTION60.584.6112.2269.7361.0SKD_B150JUNCTION27.436.348.9124.0173.3
SKD_B145JUNCTION60.584.6112.2269.7361.0SKD_B150JUNCTION27.436.348.9124.0173.3
SKD_B150 JUNCTION 27.4 36.3 48.9 124.0 173.3
_

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
SKD_B160	JUNCTION	1.4	1.9	2.6	5.5	7.2
SKD_B165	JUNCTION	2.3	3.5	5.7	22.2	31.3
SKD_B170	JUNCTION	3.5	5.5	7.7	32.4	46.6
SKD_B175	JUNCTION	1.2	2.1	4.0	22.5	32.8
SKD_B180	JUNCTION	17.0	23.1	29.6	59.1	74.7
SKD_B185	JUNCTION	27.0	37.1	47.6	96.0	122.4
SKD_B190	JUNCTION	17.2	23.5	30.7	60.5	77.0
SKD_B195	JUNCTION	28.2	38.2	48.9	94.9	121.3
SKD_CDOT_stb3	STORAGE	1.7	2.8	3.7	7.7	9.5
SKD_D110	DIVIDER	24.9	26.2	30.6	40.3	48.1
SKD_D135	DIVIDER	16.2	18.3	22.6	32.1	40.0
SKD_D165	DIVIDER	1.5	2.3	2.3	2.3	2.3
SKD_D170	DIVIDER	2.4	4.5	6.0	11.4	19.2
SKD_D190	DIVIDER	0.7	0.7	0.7	0.7	0.7
SKD_D270	DIVIDER	0.0	0.0	0.0	0.0	0.0
SKD_D580	DIVIDER	0.7	0.7	0.7	0.7	0.7
SKD_J100	JUNCTION	23.3	25.7	29.7	38.7	45.8
SKD_J105	JUNCTION	22.8	25.2	29.2	38.2	45.3
SKD_J106	JUNCTION	22.3	24.2	28.2	37.2	44.3
SKD_J110	JUNCTION	22.3	24.2	28.2	37.2	44.4
SKD_J115	JUNCTION	0.5	1.0	1.0	1.0	1.0
SKD_J120	JUNCTION	25.6	26.2	30.6	40.3	48.1
SKD_J125	JUNCTION	4.5	4.7	4.9	5.7	5.7
SKD_J126	JUNCTION	3.0	3.2	3.4	4.2	4.2
SKD_J130	JUNCTION	1.6	1.6	1.6	1.5	1.6
SKD_J136	JUNCTION	4.1	6.1	8.0	13.0	20.9
SKD_J137	JUNCTION	1.1	1.1	1.1	1.1	1.1
SKD_J140	JUNCTION	8.2	8.5	10.5	14.8	14.8
SKD_J141	JUNCTION	0.5	0.5	0.5	0.5	0.5
SKD_J145	JUNCTION	6.0	6.3	8.3		12.7
SKD_J150	JUNCTION	3.4	3.8	5.7	10.1	10.1
SKD_J155	JUNCTION	1.3	1.3	1.3	1.3	1.3
SKD_J160	JUNCTION	1.5	2.3	2.3	2.3	2.3
SKD_J175	JUNCTION	0.5	1.3	2.1	7.5	15.3
SKD_J180	JUNCTION	0.7	0.7	0.7	0.7	0.7
SKD_J220	JUNCTION	22.1	24.2	28.6	38.3	46.1
SKD_J226	JUNCTION	0.1	0.3	0.5	1.3	1.3
SKD_J235	JUNCTION	13.4	15.5	19.8	29.3	37.2
SKD_J250	JUNCTION	1.3	1.7	3.6	8.5	8.5
SKD_J265	JUNCTION	0.0	0.0	0.0	0.0	0.0
SKD_J275	JUNCTION	0.0	0.0	0.0	5.6	13.4
SKD_J280	JUNCTION	0.7	0.7	0.7	0.7	0.7
SKD_J290	JUNCTION	0.7	0.7	0.7	0.7	0.7
SKD_J320	JUNCTION	17.7	19.7	24.0	33.6	41.4

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
SKD_J335	JUNCTION	12.9	15.0	19.3	28.8	36.7
SKD_J336	JUNCTION	2.4	4.5	6.1	11.3	19.2
SKD_J380	JUNCTION	0.7	0.7	0.7	0.7	0.7
SKD J420	JUNCTION	16.2	18.3	22.6	32.1	40.0
	JUNCTION	2.4	4.5	6.1	11.3	19.2
	JUNCTION	2.4	4.5	6.1	11.3	19.2
SKD_J636	JUNCTION	2.4	4.5	6.0	11.4	19.2
SKD_OUTLET	OUTFALL	23.6	26.3	31.2	40.2	47.3
SKD_Promont	STORAGE	44.3	60.5	77.5	155.2	197.2
SKD_\$180	DIVIDER	1.3	1.7	3.6	13.4	21.2
WC_B100	JUNCTION	0.8	1.2	2.1	5.6	7.5
WC_B101	JUNCTION	5.9	7.8	10.1	20.2	26.5
WC_B102	JUNCTION	3.8	5.3	7.1	14.4	18.4
WC_B103	JUNCTION	2.6	3.6	4.9	9.7	12.4
WC_B105	JUNCTION	6.7	9.3	12.1	25.0	32.2
WC_B105.1	JUNCTION	1.8	2.5	3.3	6.4	8.2
WC_B105.2	JUNCTION	1.3	1.9	2.5	5.0	6.4
WC_B106	JUNCTION	8.4	11.6	15.3	31.5	40.3
WC_B107	JUNCTION	5.7	8.1	11.0	24.9	32.9
WC_B108	JUNCTION	1.3	1.7	2.3	4.6	6.0
WC_B109	JUNCTION	1.7	2.4	3.1	6.3	8.2
WC_B110	JUNCTION	11.7	16.0	20.7	42.4	55.0
WC_B111	JUNCTION	5.0	7.1	9.5	18.4	23.4
WC_B112	JUNCTION	1.7	2.2	2.9	5.7	7.5
WC_B112.5	JUNCTION	2.6	3.4	4.4	8.8	11.5
WC_B113	JUNCTION	22.3	29.7	38.2	74.3	96.1
WC_B114	JUNCTION	20.5	27.0	34.6	66.8	87.2
WC_B115	JUNCTION	6.9	9.8	13.0	31.6	42.6
WC_B120	JUNCTION	160.8	215.7	279.4	548.4	706.0
WC_B130	JUNCTION	5.9	8.4	11.2	28.6	38.2
WC_B135	JUNCTION	48.2	67.9	90.6	223.0	300.4
WC_B140	JUNCTION	123.3		221.8	445.1	567.1
WC_B145	JUNCTION	3.5	4.8	6.3	11.9	14.5
WC_B146	JUNCTION	13.4	19.1	26.5	61.3	80.6
WC_B150	JUNCTION	80.9	111.0	148.3	292.7	371.4
WC_B155	JUNCTION	2.2	2.9	3.7	7.2	9.1
WC_B160	JUNCTION	41.0	54.3	68.7	120.6	149.1
WC_B165	JUNCTION	2.2	2.9	3.7	7.2	9.2
WC_B170	JUNCTION	1.6	2.2	2.9	6.1	7.7
WC_B171	JUNCTION	2.4	3.2	4.4	8.5	10.9
WC_B172	JUNCTION	3.6	4.9	6.6	12.9	16.6
WC_B173	JUNCTION	2.4	3.3	4.4	8.8	11.2
WC_CDOT_stł	STORAGE	7.3	9.5	12.0	22.2	27.6
WC_D101	DIVIDER	0.0	0.0	0.0	0.0	0.0

FULLIE NOUE FEAK FIOWS (CIS	<b>Future Node Peak Flo</b>	ows (	(cfs)	
-----------------------------	-----------------------------	-------	-------	--

				10113 [		
Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
WC_D103	DIVIDER	0.1	0.1	0.1	0.1	0.1
WC_D105	DIVIDER	1.5	2.0	2.5	5.1	6.4
WC_D105.1	DIVIDER	0.1	0.1	0.1	0.1	0.1
WC_D105.2	DIVIDER	1.3	1.9	2.5	5.0	6.4
WC_D106	DIVIDER	15.2	15.4	15.5	15.7	15.9
WC_D109	DIVIDER	1.4	1.8	2.4	4.7	6.1
WC_D110	DIVIDER	1.3	1.3	1.3	1.3	1.3
WC_D111	DIVIDER	0.5	0.5	0.5	0.5	0.5
WC_D112	DIVIDER	0.6	0.6	0.6	0.6	0.6
WC_D112.5	DIVIDER	0.1	0.1	0.1	0.1	0.1
WC_D113	DIVIDER	0.4	0.4	0.4	0.4	0.4
WC_D150	DIVIDER	3.4	3.4	3.4	3.4	3.4
WC_D155	DIVIDER	2.2	2.9	3.7	7.2	9.1
	DIVIDER	3.5	4.3	5.1	8.7	10.6
	DIVIDER	0.2	0.2	0.2	0.2	0.2
	DIVIDER	15.2	15.4			15.9
WC D210	DIVIDER	1.0	1.0	1.0	1.0	1.0
WC D272	DIVIDER	0.0	0.1	0.1	0.1	0.1
WC D310	DIVIDER	0.5	0.5	0.5	0.5	0.5
	DIVIDER		15.0	15.1		15.5
	JUNCTION	15.8	16.0	16.3	16.6	16.8
	JUNCTION	0.1	0.1	0.1	0.1	0.1
WC J102	JUNCTION	0.3	0.3	0.3	0.3	0.3
	JUNCTION	1.3	1.8	2.4	4.9	6.3
WC_J106	JUNCTION	14.9	15.1	15.2		15.6
	JUNCTION	2.3	2.8	3.3	5.7	7.1
	JUNCTION	2.3	2.8	3.3	5.7	7.1
	JUNCTION	1.4	1.8	2.4	4.7	6.1
	JUNCTION	0.5	0.5	0.5	0.5	0.5
	JUNCTION		0.5	0.5	0.5	0.5
		0.4	0.4	0.4	0.4	0.4
	JUNCTION	0.5	0.5	0.5	0.5	0.5
	JUNCTION	0.3	0.3	0.3	0.3	0.3
	JUNCTION	14.9	15.0	15.1	15.3	15.5
WC_J130	JUNCTION	0.3	0.3	0.3	0.3	0.3
	JUNCTION	0.3	0.3	0.3	0.3	0.3
WC J140	JUNCTION	9.0	9.2	9.2	9.5	9.6
WC J145	JUNCTION	2.2	2.9	3.7	7.2	9.1
WC_J146	JUNCTION	0.9	0.9	0.9	0.9	0.9
WC_J165	JUNCTION	2.2	2.9	3.7	7.3	9.3
WC_J170	JUNCTION	0.3	0.4	0.4	0.4	0.4
WC J171	JUNCTION	0.3	0.4	0.4	0.4	0.4
WC_J172	JUNCTION	0.3	0.3	0.3	0.3	0.3
_			0.4		0.4	

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
WC_J200	JUNCTION	15.2	15.4	15.5	15.7	15.9
WC_J201	JUNCTION	15.4	15.6	15.8	16.1	16.3
WC_J202	JUNCTION	0.1	0.1	0.1	0.1	0.1
WC_J205	JUNCTION	15.2	15.4	15.5	15.7	15.9
WC_J206	JUNCTION	14.9	15.1	15.2	15.4	15.6
WC_J207	JUNCTION	2.9	3.3	3.8	6.3	7.7
WC_J212.5	JUNCTION	0.4	0.4	0.4	0.4	0.4
WC_J220	JUNCTION	11.4	11.5	11.6	11.8	12.0
WC_J235	STORAGE	1.6	1.6	1.6	1.6	1.6
WC_J240	JUNCTION	1.2	1.3	1.4	1.6	1.7
WC_J245	JUNCTION	3.5	4.3	5.1	8.7	10.6
WC_J272	JUNCTION	0.1	0.1	0.1	0.1	0.1
WC_J273	JUNCTION	0.3	0.3	0.3	0.3	0.3
WC_J305	JUNCTION	1.5	2.0	2.5	5.1	6.4
WC_J306	JUNCTION	0.0	0.0	0.0	0.0	0.0
WC_J307	JUNCTION	0.6	0.6	0.6	0.6	0.6
WC_J312.5	JUNCTION	0.4	0.4	0.4	0.4	0.4
WC_J320	JUNCTION	10.0	10.1	10.1	10.4	10.5
WC_J340	JUNCTION	3.4	3.4	3.4	3.4	3.4
WC_J405	JUNCTION	1.3	1.8	2.4	4.9	6.3
WC_J420	JUNCTION	1.4	1.4	1.4	1.4	1.4
WC_J505	JUNCTION	1.3	1.9	2.5	5.0	6.4
WC_J506	JUNCTION	0.1	0.1	0.1	0.1	0.1
WC_J706	JUNCTION	14.9	15.0	15.1	15.3	15.5
WC_OUTLET	OUTFALL	15.8	16.0	16.3	16.6	16.8
WC_OUTLET2	OUTFALL	1.5	2.0	2.5	5.1	6.4
WC_OUTLET3	OUTFALL	3.1	3.5	4.0	6.4	7.9
1	OUTFALL	0.0	0.0	0.0	0.0	0.0
2	OUTFALL	0.0	0.0	0.0	0.0	0.0

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
FT_B100	JUNCTION	0.9	1.5	2.4	6.0	8.0
FT_B101	JUNCTION	2.1	3.3	4.7	14.3	21.9
FT_B105	JUNCTION	2.0	2.7	3.7	8.1	11.4
FT_B110	JUNCTION	0.0	0.0	0.1	0.7	1.2
FT_B115	JUNCTION	0.2	0.4	0.5	1.8	3.0
FT	JUNCTION	6.4	9.0	12.3	29.6	42.7
FT_B125	JUNCTION	0.4	0.8	3.7	18.1	26.9
FT_B130	JUNCTION	8.8	13.2	18.0	47.9	70.3
FT_J110	JUNCTION	0.4	0.8	3.8	18.7	28.1
FT_J130	JUNCTION	5.9	6.5	6.9	7.5	7.8
FT_J150	JUNCTION	2.4	3.6	7.4	25.6	31.6
FT_J201	JUNCTION	2.1	3.9	8.9	49.1	80.4
FT_J210	JUNCTION	0.4	0.8	3.8	18.7	28.1
_ FT_J215	JUNCTION	9.0	13.4	18.3	48.5	71.2
FT_J305	JUNCTION	2.4	3.6	7.4	25.6	31.6
	JUNCTION	0.4	0.8	3.7	18.1	26.9
FT_J405	JUNCTION	2.4	3.6	7.4	25.6	31.6
	JUNCTION	2.4	3.6	7.4	25.6	31.6
FT J605	JUNCTION	2.4	3.6	7.4	25.6	31.6
	JUNCTION	0.4	0.8	3.7	18.1	26.9
HD B100	JUNCTION	0.7	1.5	7.7	38.7	57.1
HD B105	JUNCTION	1.2	2.5	8.9	61.4	94.5
HD B110	JUNCTION	3.6	8.4	34.4	155.0	228.0
HD J110	JUNCTION	4.8	11.0	43.3	216.4	322.2
HD Outlet	JUNCTION	5.6	12.6	51.3	255.0	380.6
_ MPD B100	JUNCTION	1.1	2.3	5.9	60.8	97.3
 MPD	JUNCTION	4.4	9.1	32.8	179.2	268.8
	JUNCTION	0.5	1.0	1.7	10.9	19.2
	JUNCTION	1.9	3.3	4.9	18.0	29.3
ND B110	JUNCTION	0.3	0.4	0.5	1.0	1.4
ND B115	JUNCTION	0.0	0.1	0.1	0.6	1.0
_ ND_B120	JUNCTION	0.2	0.2	0.3	0.6	0.7
ND B130	JUNCTION	2.6	4.1	5.9	18.4	28.8
 ND	JUNCTION	0.0	0.1	0.1	1.5	3.0
ND B140	JUNCTION	2.0	2.7	3.6	6.8	9.0
ND_J100	JUNCTION	0.5	1.0	1.8	30.7	54.6
ND_J105	JUNCTION	14.1	20.7	24.9	45.1	60.5
ND J130	JUNCTION	0.0	0.1	0.1	0.6	1.0
ND_J135	JUNCTION	2.0	2.7	3.6	6.8	9.0
ND_J205	JUNCTION	4.9	7.3	10.2	28.3	43.3
ND_J230	JUNCTION	0.3	0.4	0.5	1.0	1.4
ND_J235	JUNCTION	2.0	2.7	3.6	6.8	9.0
ND J305	JUNCTION	9.2	13.3	14.7	16.7	17.2
ND_J330	JUNCTION	2.1	2.8	3.7	8.3	12.1

	<b>Existing No</b>	ode To	tal Inf	flow (A	Ac-ft)	
Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
ND_J430	JUNCTION	2.1	2.8	3.7	8.3	12.0
OG_B100	JUNCTION	2.4	5.5	10.2	132.9	218.8
OG_B105	JUNCTION	0.8	1.7	8.0	41.7	62.3
 OG_B110	JUNCTION	1.1	2.8	9.7	41.1	60.2
 OG_J100	JUNCTION	2.2	4.9	18.9	85.6	125.8
OG_Outlet	JUNCTION	5.1	11.4	31.6	224.3	352.9
PLC_B100	JUNCTION	0.9	1.6	3.3	10.3	14.6
PLC_B105	JUNCTION	40.8	61.1	97.3	225.3	298.0
PLC_B110	JUNCTION	2.7	5.6	15.0	109.6	170.3
PLC_B115	JUNCTION	1.3	3.1	5.9	79.8	137.2
PLC_B120	JUNCTION	2.7	5.5	21.2	112.9	169.1
PLC_B121	JUNCTION	1.2	2.5	11.1	53.4	79.2
PLC_J100	JUNCTION	51.9	84.1	179.2	349.9	383.6
PLC_J110	JUNCTION	2.7	5.6	15.0	109.6	170.3
PLC_J115	JUNCTION	8.0	17.1	66.3	589.2	972.9
PLC_J120	JUNCTION	4.3	8.7	33.8	169.1	251.4
PLC_J215	JUNCTION	6.7	14.0	60.2	509.5	834.8
PR_B100	JUNCTION	0.2 0.4	0.6	2.1	7.9	11.4
PR_B105 PR B110	JUNCTION JUNCTION	0.4	0.9 2.1	3.0 8.7	22.9 37.4	35.3 54.9
PR B115	JUNCTION	0.8	0.4	1.9	10.1	15.0
PR_B120	JUNCTION	0.2	1.5	6.8	33.8	49.7
PR_B125	JUNCTION	0.3	0.9	3.5	14.1	20.5
PR B130	JUNCTION	0.7	1.5	5.3	29.1	43.6
PR_B135	JUNCTION	63.8	95.1	132.9	248.3	313.0
PR_B150	JUNCTION	7.7	15.3	34.1	102.2	141.8
	JUNCTION	2.4	3.7	5.5	12.7	16.9
PR_B160	JUNCTION	0.6	0.9	1.4	5.6	8.7
PR_J355	JUNCTION	16.1	24.0	29.8	43.3	54.6
PRR_B100	JUNCTION	5.2	7.2	9.6	20.7	28.6
PRR_B105	JUNCTION	0.1	0.4	1.3	5.3	7.8
PRR_J100	JUNCTION	5.3	7.5	10.9	26.1	36.5
SD_B100	JUNCTION	1.2	2.5	10.2	59.8	90.5
SD_B105	JUNCTION	0.6	1.5	2.9	44.2	74.6
SD_B110	JUNCTION	0.6	1.2	3.9	29.6	46.0
SD_B115	JUNCTION	0.7	1.4	6.0	36.8	55.9
SD_B120	JUNCTION	2.4	5.0	11.8	96.4	151.3
SD_J100	JUNCTION	5.8	12.2	35.3	268.5	420.5
SD_J110	JUNCTION	3.7	7.8	21.9	163.3	253.8
SD_J200	JUNCTION	4.4	9.3	24.8	207.2	328.4
SD_J210	JUNCTION	3.0	6.4	17.8	133.2	207.2
SKD_B100 SKD B105	JUNCTION	1.3	2.7	10.7	49.7	73.3
SKD_B105 SKD_B106	JUNCTION	0.4	0.9	2.3	18.0 1.7	28.2 2 9
0010_0100	JUNCTION	0.1	0.2	0.3	1.7	2.9

Node

SKD\_B110 SKD\_B115 SKD\_B120 SKD\_B125 SKD\_B126

Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
JUNCTION	0.4	1.0	1.8	23.4	40.8
JUNCTION	0.6	1.2	2.7	25.4	40.5
JUNCTION	1.1	2.3	10.6	50.0	74.0
JUNCTION	0.6	1.9	6.8	28.5	41.7
JUNCTION	2.8	6.7	21.8	90.8	132.3
JUNCTION	1.3	2.9	12.8	61.4	90.5
JUNCTION	1.2	2.5	9.5	57.7	87.8
JUNCTION	1.8	4.5	14.3	58.9	85.9
JUNCTION	1.6	3.3	11.2	51.9	76.1
JUNCTION	2.0	5.6	20.7	90.2	132.6
JUNCTION	0.3	0.6	2.5	14.9	22.7
JUNCTION	3.6	10.1	34.4	141.5	205.9
JUNCTION	2.9	7.7	26.7	113.2	165.4
JUNCTION	1.9	4.0	8.7	69.7	109.6
JUNCTION	0.2	0.4	0.7	2.1	3.0
JUNCTION	1.9	3.3	6.6	26.7	39.0
JUNCTION	2.6	4.5	9.1	34.7	50.3
JUNCTION	1.6	3.0	8.3	33.1	48.2
JUNCTION	2.7	4.3	6.6	25.9	39.6
JUNCTION	4.4	7.0	10.6	40.2	60.2
JUNCTION	1.3	2.2	4.6	22.0	33.1
JUNCTION	2.0	3.4	5.5	27.9	45.1
JUNCTION	29.2	65.1	193.0	705.9	997.4
JUNCTION	28.9	64.4	190.9	687.5	969.8
JUNCTION	28.3	63.2	188.1	659.8	926.8
JUNCTION	28.4	63.2	188.1	659.8	926.8
JUNCTION	30.7	67.5	211.8	972.9	1463.9
JUNCTION	5.5	11.6	34.4	140.6	208.4
JUNCTION	4.9	9.8	27.6	112.0	166.6
JUNCTION	6.4	12.4	32.5	130.7	228.6
JUNCTION	13.9	32.5	98.5	466.5	678.2
JUNCTION	12.0	27.1	78.0	377.5	546.3
JUNCTION	8.4	17.1	43.3	235.1	340.7
JUNCTION	1.9	3.3	6.6	26.7	39.0
JUNCTION	1.6	3.0	8.3	35.6	90.5
JUNCTION	3.3	5.7	10.2	50.0	78.6
JUNCTION	29.7	65.4	201.3	920.7	1390.3
JUNCTION	2.1	3.3	6.0	21.8	34.7
JUNCTION	22.0	48.8	144.5	662.9	1003.6
JUNCTION	3.7	5.3	7.7	51.6	63.8
JUNCTION	0.0	0.0	0.0	0.0	0.0
JUNCTION	0.0	0.0	0.0	2.1	42.0
JUNCTION	3.3	5.6	10.1	50.0	78.6
JUNCTION	3.3	5.6	10.1	50.0	77.0

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
SKD_J320	JUNCTION	24.3	53.7	167.0	782.6	1181.6
SKD_J335	JUNCTION	21.8	48.2	142.4	647.6	982.1
SKD_J336	JUNCTION	4.3	7.6	17.6	70.3	140.9
SKD_J380	JUNCTION	3.3	5.6	10.1	50.0	77.3
SKD_J420	JUNCTION	23.1	51.3	154.1	721.2	1092.6
SKD_J436	JUNCTION	4.2	7.5	17.5	70.3	140.9
SKD_J536	JUNCTION	4.2	7.5	17.5	70.3	140.9
SKD_J636	JUNCTION	4.2	7.5	17.5	70.3	140.9
WC_B100	JUNCTION	0.4	0.7	1.2	3.7	5.2
WC_B101	JUNCTION	3.1	4.2	5.5	10.4	13.6
WC_B102	JUNCTION	1.5	2.2	3.3	8.2	11.1
WC_B103	JUNCTION	1.5	2.1	2.9	5.9	7.6
WC_B105	JUNCTION	3.7	5.3	7.1	15.2	20.2
WC_B105.1	JUNCTION	0.8	1.2	1.6	3.2	4.1
WC_B105.2	JUNCTION	0.9	1.2	1.7	3.3	4.3
WC_B106	JUNCTION	3.1	4.5	6.7	17.6	24.4
WC_B107	JUNCTION	1.2	1.9	3.0	9.5	13.7
WC_B108	JUNCTION	0.9	1.2	1.6	3.1	4.2
WC_B109	JUNCTION	0.7	1.0	1.4	3.3	4.6
WC_B110	JUNCTION	3.3	4.8	6.6	17.7	25.4
WC_B111	JUNCTION	1.6	2.6	4.1	9.5	12.6
WC_B112	JUNCTION	0.2	0.3	0.4	1.5	2.4
WC_B112.5	JUNCTION	0.5	0.7	1.0	2.7	4.1
WC_B113	JUNCTION	0.6	2.1	7.2	29.4	43.0
WC_B114	JUNCTION	0.6	1.3	5.6	26.3	39.0
WC_B115	JUNCTION	0.2	0.6	1.0	8.6	15.6
WC_B120	JUNCTION	4.9	9.9	37.1	187.2	279.3
WC_B130	JUNCTION	1.2	2.1	3.2	13.5	22.2
WC_B140	JUNCTION	5.6	11.0	22.8	143.0	220.7
WC_B145	JUNCTION	0.4	0.7	1.1	3.2	4.5
WC_B146	JUNCTION	0.5	1.1	2.2	20.5	32.5
WC_B150	JUNCTION	3.1	8.3	28.5	118.2	172.5
WC_B155	JUNCTION	1.7	2.4	3.1	6.8	9.2
WC_B160	JUNCTION	2.6	4.5	9.2	34.7	50.3
WC_B165	JUNCTION	1.7	2.4	3.2	7.0	9.4
WC_B170	JUNCTION	0.3	0.5	1.0	3.7	5.4
WC_B171	JUNCTION	1.1	1.5	2.1	4.1	5.3
WC_B172	JUNCTION	1.5	2.1	2.9	6.1	8.0
 WC_B173	JUNCTION	1.2	1.7	2.5	5.6	7.4
	JUNCTION	39.6	69.4	149.5	365.2	414.3
	JUNCTION	3.1	4.2	5.6	12.4	17.1
	JUNCTION	3.1	4.4	6.2	12.2	15.4
 WC_J105	JUNCTION	0.9	1.2	1.7	241.8	484.9
WC J106	JUNCTION	26.4	50.6	122.8	543.2	813.3

# Existing Node Total Inflow (Ac-ft)

	-					
Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
WC_J107	JUNCTION	7.3	11.5	20.2	68.7	101.6
WC_J108	JUNCTION	7.3	11.5	20.3	68.7	101.6
WC_J109	JUNCTION	1.6	2.2	2.9	6.4	9.4
WC J112	JUNCTION	1.1	2.8	8.2	32.2	47.0
	JUNCTION	1.1	2.8	8.2	20.5	23.2
	JUNCTION	0.6	2.1	7.2	16.9	19.0
WC J114	JUNCTION	0.8	1.9	6.7	35.3	54.6
WC_J120	JUNCTION	25.7	49.4	121.2	540.1	810.2
WC_J135	JUNCTION	0.3	0.5	1.0	3.7	5.4
WC_J140	JUNCTION	13.0	25.3	60.2	253.2	365.2
WC_J145	JUNCTION	1.7	2.4	3.1	6.8	9.2
WC_J146	JUNCTION	0.5	1.1	2.2	57.4	112.0
WC_J165	JUNCTION	2.1	3.0	4.3	11.0	15.1
WC_J170	JUNCTION	5.6	7.8	10.6	22.5	30.2
WC_J171	JUNCTION	5.6	7.8	10.6	22.6	30.2
WC_J172	JUNCTION	4.6	6.3	8.5	18.5	25.0
WC_J173	JUNCTION	4.3	6.1	8.7	17.8	22.8
WC_J200	JUNCTION	29.4	54.9	129.2	322.2	359.1
WC_J201	JUNCTION	35.0	62.6	139.6	343.7	386.7
WC_J202	JUNCTION	1.5	2.1	2.9	4.0	4.2
WC_J205	JUNCTION	29.4	54.9	129.2	322.2	359.1
WC_J206	JUNCTION	26.5	50.6	122.8	543.2	813.3
WC_J207	JUNCTION	8.6	14.6	28.9	102.2	151.0
WC_J212.5	JUNCTION	0.6	2.1	7.2	16.9	19.0
WC_J220	JUNCTION	19.6	37.4	80.4	337.6	506.4
WC_J240	JUNCTION	4.7	6.4	9.6	30.1	52.8
WC_J245	JUNCTION	4.6	7.4	13.5	45.7	65.4
WC_J272	JUNCTION	3.1	4.2	5.6	12.4	17.1
WC_J273	JUNCTION	3.1	4.4	6.2	12.2	15.4
WC_J305	JUNCTION	4.6	6.5	8.7	256.9	503.3
WC_J306	JUNCTION	0.0	0.0	0.0	0.0	0.0
WC_J307	JUNCTION	1.3	3.1	8.7	33.8	49.4
WC_J312.5	JUNCTION	0.6	2.1	7.2	16.9	19.0
WC_J320	JUNCTION	13.5	26.3	62.3	310.0	478.8
WC_J340	JUNCTION	3.1	8.3	28.5	81.3	93.0
WC_J405	JUNCTION	0.9	1.2	1.7	241.8	484.9
WC_J420	JUNCTION	6.2	11.3	18.2	28.3	28.4
WC_J505	JUNCTION	0.9	1.2	1.7	3.3	4.5
WC_J506	JUNCTION	0.8	1.2	1.6	3.2	4.1
WC_J706	JUNCTION	25.7	49.4	121.2	540.1	810.2
FT_OUTLET	OUTFALL	2.6	3.8	7.7	26.0	31.9
FT_OUTLET2	OUTFALL	3.0	5.4	11.3	55.2	88.4
MPD_OUTLET	OUTFALL	5.8	11.9	39.6	242.1	368.3
PLC_OUTLET	OUTFALL	52.8	85.9	182.3	362.1	399.0

Node
PR_OUTLET
PRR_OUTLET
SKD_OUTLET
WC_OUTLET
WC_OUTLET2
NC_OUTLET3
T_OUTLET3
PLC_OUTLET2
SD_Outlet
T_D101
T_D105
T_D125
T_D130
T_D205
-1_1112
ND_D105
ND_D110
ND_D115
ND_D120
ND_D140
PLC_D115
PLC_J105
SKD_D110
SKD_D135
SKD_D165
SKD_D170
SKD_D190
SKD_D270
SKD_D580
SKD_S180
WC_D101 WC_D103
WC_D103 WC_D105
WC_D105 WC_D105.1
WC_D105.1 WC_D105.2
WC_D103.2 WC_D106
WC_D100 WC_D109
WC_D109
WC_D110 WC_D111
WC_D112
WC_D112.5
WC_D112.5
WC_D150

Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
OUTFALL	18.5	27.7	35.3	55.9	71.5
OUTFALL	5.3	7.5	10.9	26.1	36.5
OUTFALL	30.5	67.8	203.8	755.0	1071.1
OUTFALL	39.6	69.4	149.5	365.2	414.3
OUTFALL	4.6	6.5	8.7	256.9	503.3
OUTFALL	10.0	16.7	31.9	112.0	164.8
OUTFALL	0.0	0.0	0.0	1.2	7.9
OUTFALL	0.0	0.0	0.0	580.0	1068.0
OUTFALL	5.8	12.2	35.3	268.5	420.5
DIVIDER	2.1	3.9	8.9	49.1	80.1
DIVIDER	2.4	3.6	7.4	26.9	39.6
DIVIDER	0.4	0.8	3.7	18.1	26.9
DIVIDER	8.8	13.2	18.0	47.9	70.3
DIVIDER	2.4	3.6	7.4	26.9	39.6
DIVIDER	0.4	0.8	3.7	18.1	26.9
DIVIDER	9.2	13.8	18.8	50.3	74.0
DIVIDER	16.1	24.0	29.8	62.9	89.6
DIVIDER	0.3	0.4	0.5	1.0	1.4
DIVIDER	0.0	0.1	0.1	0.6	1.0
DIVIDER	0.2	0.2	0.3	0.6	0.7
DIVIDER	2.0	2.7	3.6	6.8	9.0
DIVIDER	4.3	8.7	33.8	169.1	251.4
DIVIDER	51.9	84.1	179.2	926.8	1445.5
DIVIDER	30.6	67.5	211.8	972.9	1463.9
DIVIDER	23.1	51.3	154.1	721.2	1092.6
DIVIDER	1.9	3.3	6.6	26.7	39.0
DIVIDER	4.2	7.5	17.5	70.3	140.9
DIVIDER	3.3	5.7	10.1	50.0	78.6
DIVIDER	0.0	0.0	0.0	0.0	0.0
DIVIDER	3.3	5.6	10.1	50.0	78.6
DIVIDER	3.7	5.3	7.7	53.7	105.9
DIVIDER	0.0	0.0	0.1	2.0	3.5
DIVIDER	1.5	2.1	2.9	5.9	7.6
DIVIDER	4.6	6.5	8.7	256.9	503.3
DIVIDER	0.8	1.2	1.6	3.2	4.1
DIVIDER	0.9	1.2	1.7	3.3	4.3
DIVIDER	29.5	55.2	129.2	561.6	837.8
DIVIDER	1.6	2.2	2.9	6.4	9.4
DIVIDER	5.7	9.3	17.3	62.3	93.0
DIVIDER	1.6	2.6	4.1	9.5	12.6
DIVIDER	1.3	3.1	8.7	33.8	49.4
DIVIDER	0.5	0.7	1.0	15.2	28.0
DIVIDER	0.6	2.1	7.2	29.4	43.0
DIVIDER	3.1	8.3	28.5	118.2	172.5

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
WC_D155	DIVIDER	1.7	2.4	3.1	6.8	9.2
WC_D172	DIVIDER	1.5	2.1	2.9	6.1	8.0
WC_D205	DIVIDER	29.4	54.9	129.2	322.2	359.1
WC_D210	DIVIDER	2.4	4.5	10.7	44.5	67.5
WC_D272	DIVIDER	1.1	1.5	2.1	4.1	5.3
WC_D310	DIVIDER	0.8	1.9	6.7	35.3	54.6
WC_D806	DIVIDER	25.7	49.4	121.2	540.1	810.2
WC_D160	DIVIDER	4.6	7.4	13.5	45.7	65.4
FT_Melbourn@	STORAGE	9.2	13.8	18.8	50.3	74.0
FT_Melbourn@	STORAGE	9.2	13.8	18.8	50.3	74.0
FT_\$120	STORAGE	6.4	9.0	12.3	29.6	42.7
ND_Northridg	STORAGE	2.1	2.8	3.7	8.3	12.1
ND_Winograd	STORAGE	5.0	7.4	10.3	28.4	43.3
PR_PoudreRiv	STORAGE	18.5	27.7	35.3	55.9	71.5
SKD_CDOT_st	STORAGE	2.1	3.7	7.3	28.8	42.0
SKD_Promont	STORAGE	10.4	17.0	27.3	116.0	178.3
WC_B135	STORAGE	7.7	13.0	20.4	89.0	140.3
WC_CDOT_stł	STORAGE	6.8	10.5	17.7	55.9	78.9

Existing Node Total Inflow (Ac-ft)

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
FT_B100	JUNCTION	1.3	2.1	3.1	6.7	8.6
FT_B101	JUNCTION	7.4	10.0	13.1	25.2	33.1
FT_B105	JUNCTION	3.4	4.6	6.0	11.4	14.9
FT_B110	JUNCTION	0.6	0.8	1.1	2.1	2.8
FT_B115	JUNCTION	1.0	1.3	1.7	3.5	4.8
FT_B120	JUNCTION	10.2	13.7	18.2	36.8	50.0
FT_B125	JUNCTION	8.1	10.9	14.2	26.0	33.8
FT_B130	JUNCTION	18.1	24.9	32.8	67.5	90.5
FT_D101	DIVIDER	1.9	1.9	1.9	1.9	1.9
FT_D105	DIVIDER	4.3	4.5	4.7	4.8	4.8
FT_D125	DIVIDER	1.0	1.0	1.0	1.0	1.0
FT_D130	DIVIDER	5.7	5.8	5.8	5.8	5.8
FT_D205	DIVIDER	4.3	4.5	4.7	4.8	4.8
FT_D305	DIVIDER	1.0	1.0	1.0	1.0	1.0
FT_J110	JUNCTION	3.4	3.6	3.8	3.8	3.8
FT_J115	DIVIDER	6.4	6.8	7.3	9.1	9.9
FT_J130	JUNCTION	5.8	5.9	6.0	6.2	6.4
FT_J150	JUNCTION	4.3	4.5	4.7	4.8	4.8
FT_J201	JUNCTION	1.9	1.9	1.9	1.9	1.9
FT_J210	JUNCTION	3.4	3.6	3.8	3.8	3.8
FT_J215	JUNCTION	5.8	5.9	6.0	6.2	6.4
FT_J305	JUNCTION	4.3	4.5	4.7	4.8	4.8
FT_J310	JUNCTION	0.9	1.0	1.0	1.0	1.0
FT_J405	JUNCTION	4.3	4.5	4.7	4.8	4.8
FT_J505	JUNCTION	4.3	4.5	4.7	4.8	4.8
FT_J605	JUNCTION	4.3	4.5	4.7	4.8	4.8
FT_J705	JUNCTION	1.0	1.0	1.0	1.0	1.0
FT_Melbourne	STORAGE	6.5	6.9	7.4	9.2	10.1
FT_Melbourne	STORAGE	6.5	6.9	7.4	9.2	10.1
FT_OUTLET	OUTFALL	4.1	4.3	4.5	4.5	4.5
FT_OUTLET2	OUTFALL	3.0	3.7	3.8	3.8	3.8
Future_FT_B1	STORAGE	1.3	2.1	3.1	6.7	8.6
Future_FT_B1	STORAGE	7.4	10.0	13.1	25.2	33.1
Future_FT_B1	STORAGE	3.4	4.6	6.0	11.4	14.9
Future_FT_B1	STORAGE	0.6	0.8	1.1	2.1	2.8
Future_FT_B1	STORAGE	1.0	1.3	1.7	3.5	4.8
Future_FT_B1	STORAGE	10.2	13.7	18.2	36.8	50.0
Future_FT_B1	STORAGE	8.1	10.9	14.2	26.0	33.8
Future_FT_B1	STORAGE	18.1	24.9	32.8	67.5	90.5
Future_HD_B:	STORAGE	1.0	2.1	8.1	38.7	57.4
Future_HD_B:	STORAGE	1.6	3.4	10.7	64.8	97.9
 Future_HD_B:	STORAGE	14.6	24.6	50.9	172.5	243.4
Future_MPD_	STORAGE	1.5	3.2	7.8	63.8	100.0
Future_MPD_	STORAGE	4.5	9.6	30.4	179.2	268.5

	Future Node Total Inflow (Ac-ft)								
Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr			
Future_ND_B100	STORAGE	7.9	10.7	14.2	27.9	37.1			
Future_ND_B105	STORAGE	10.0	13.5	17.8	35.6	48.5			
Future_ND_B110	STORAGE	0.5	0.7	0.9	1.7	2.1			
Future_ND_B115	STORAGE	0.6	0.9	1.1	2.0	2.5			
Future_ND_B120	STORAGE	0.2	0.3	0.4	0.6	0.8			
Future_ND_B130	STORAGE	15.6	21.1	27.4	48.2	60.5			
Future_ND_B135	STORAGE	2.5	3.4	4.5	7.8	9.8			
Future_ND_B140	STORAGE	2.9	3.9	5.1	8.9	11.2			
Future_OG_B100	STORAGE	3.0	6.7	12.2	138.4	221.6			
Future_OG_B105	STORAGE	12.8	18.4	26.4	60.5	80.4			
Future_OG_B110	STORAGE	11.2	16.6	25.0	57.1	75.8			
Future_PLC_B100	STORAGE	1.1	1.8	3.5	10.6	14.8			
Future_PLC_B105	STORAGE	44.5	66.3	104.7	233.2	303.2			
Future_PLC_B110	STORAGE	21.0	32.2	51.6	151.0	211.5			
Future_PLC_B115	STORAGE	22.3	32.8	46.6	133.2	190.0			
Future_PLC_B120	STORAGE	35.0	50.0	73.7	167.0	221.9			
Future_PLC_B121	STORAGE	24.2	33.8	45.7	88.7	113.2			
Future_PRR_B100	STORAGE	8.7	11.8	15.2	27.5	35.3			
Future_PRR_B105	STORAGE	2.6	3.5	4.5	8.1	10.3			
Future_SD_B100	STORAGE	1.5	3.2	10.4	59.5	90.2			
Future_SD_B105	STORAGE	0.9	2.0	3.8	44.2	74.6			
Future_SD_B110	STORAGE	0.7	1.6	4.3	30.4	47.0			
Future_SD_B115	STORAGE	1.0	1.9	6.4	36.8	55.5			
Future_SD_B120	STORAGE	5.9	10.8	18.8	104.7	159.3			
Future_SKD_B100	STORAGE	1.9	3.7	11.6	50.3	72.7			
Future_SKD_B105	STORAGE	2.3	3.9	6.3	22.9	32.2			
Future_SKD_B110	STORAGE	7.3	10.7	14.5	38.1	54.6			
Future_SKD_B115	STORAGE	4.7	7.2	10.5	34.4	49.4			
Future_SKD_B120	STORAGE	16.7	24.1	35.0	75.8	99.1			
Future_SKD_B125	STORAGE	9.3	13.8	19.9	42.0	54.9			
Future_SKD_B126	STORAGE	30.3	43.0	61.4	130.7	170.9			
Future_SKD_B130	STORAGE	20.6	30.0	43.3	93.0	121.5			
Future_SKD_B135	STORAGE	21.1	29.9	43.0	93.3	122.5			
Future_SKD_B136	STORAGE	19.4	27.4	38.7	83.2	108.9			
Future SKD B137	STORAGE	18.3	25.8	35.6	75.5	99.1			
Future_SKD_B140	STORAGE	27.8	39.6	52.8	118.2	158.7			
Future_SKD_B141	STORAGE	5.1	7.3	9.7	21.5	29.0			
Future_SKD_B145	STORAGE	45.7	63.8	84.1	178.6	239.7			
Future_SKD_B150	STORAGE	30.7	42.0	56.2	118.2	162.7			
Future_SKD_B155	STORAGE	36.2	50.0	65.4	128.0	166.6			
Future SKD B165	STORAGE	3.2	5.2	8.3	28.5	39.9			
Future_SKD_B170	STORAGE	4.0	6.2	9.1	31.9	47.3			
Future_SKD_B175	STORAGE	1.7	3.2	6.0	30.6	43.9			
Future_SKD_B190	STORAGE	12.3	17.0	22.5	42.0	53.1			

Node

Future\_SKD\_B195 Future\_WC\_B100 Future\_WC\_B101 Future\_WC\_B102 Future\_WC\_B103 Future\_WC\_B105 Future\_WC\_B105.1 Future\_WC\_B106 Future\_WC\_B107 Future\_WC\_B109 Future\_WC\_B110 Future\_WC\_B111

Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
STORAGE	19.9	27.3	35.3	64.1	81.3
STORAGE	0.7	1.0	1.7	4.2	5.7
STORAGE	3.4	4.6	6.0	11.1	14.3
STORAGE	3.0	4.2	5.6	10.7	13.6
STORAGE	1.8	2.5	3.3	6.4	8.1
STORAGE	5.0	7.0	9.2	17.7	22.6
STORAGE	1.0	1.3	1.8	3.4	4.4
STORAGE	6.9	9.5	12.7	24.2	31.0
STORAGE	3.2	4.5	6.1	12.9	17.0
STORAGE	1.3	1.8	2.3	4.4	5.6
STORAGE	7.8	10.7	14.0	26.7	34.4
STORAGE	3.3	4.7	6.3	11.8	14.9
STORAGE	1.1	1.5	2.0	3.7	4.7
STORAGE	1.5	2.1	2.7	4.9	6.3
STORAGE	14.1	19.2	25.0	45.1	57.4
STORAGE	12.9	17.5	22.7	40.5	51.9
STORAGE	5.1	7.2	9.5	20.6	27.9
STORAGE	95.8	130.7	170.0	313.0	399.0
STORAGE	6.3	9.0	11.9	26.4	35.3
STORAGE	35.3	49.4	65.4	143.0	193.7
STORAGE	81.6	112.9	149.5	281.1	356.0
STORAGE	8.9	12.6	17.2	36.8	48.8
STORAGE	56.5	78.3	105.0	196.1	247.7
STORAGE	21.4	29.2	37.7	64.8	79.8
STORAGE	1.8	2.4	3.3	6.1	7.7
STORAGE	1.2	1.7	2.2	4.3	5.4
STORAGE	1.9	2.7	3.6	6.8	8.7
STORAGE	1.9	2.6	3.5	6.7	8.4
JUNCTION	1.0	2.1	8.1	38.7	57.4
JUNCTION	1.6	3.4	10.7	64.8	97.9
JUNCTION	14.6	24.6	50.9	172.5	243.4
JUNCTION	0.5	1.6	7.7	13.7	13.8
JUNCTION	14.9	26.0	53.1	59.2	59.2
JUNCTION	15.8	28.0	60.5	72.7	72.7
JUNCTION	1.5	3.2	7.8	63.8	100.0
JUNCTION	4.5	9.6	30.4	179.2	268.5
JUNCTION	2.4	6.7	13.7	13.8	13.8
OUTFALL	3.7	9.6	20.7	40.8	40.8
JUNCTION	7.9	10.7	14.2	27.9	37.1
JUNCTION	10.0	13.5	17.8	35.6	48.5
JUNCTION	0.5	0.7	0.9	1.7	2.1
JUNCTION	0.6	0.9	1.1	2.0	2.5
JUNCTION	0.2	0.3	0.4	0.6	0.8
JUNCTION	15.6	21.1	27.4	48.2	60.5

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
ND_B135	JUNCTION	2.5	3.4	4.5	7.8	9.8
ND_B140	JUNCTION	2.9	3.9	5.1	8.9	11.2
ND_D105	DIVIDER	10.6	11.4	12.2	14.2	14.9
ND_D110	DIVIDER	0.4	0.6	0.8	0.9	0.9
ND_D115	DIVIDER	0.5	0.7	0.9	1.0	1.0
ND_D120	DIVIDER	0.1	0.2	0.2	0.5	0.6
ND_D140	DIVIDER	1.0	1.0	1.0	1.0	1.0
ND_J100	JUNCTION	2.9	2.9	2.9	2.9	2.9
ND_J105	JUNCTION	8.8	9.5	10.4	12.4	13.1
ND_J130	JUNCTION	0.5	0.7	0.9	0.9	0.9
ND_J135	JUNCTION	1.0	1.0	1.0	1.0	1.0
ND_J205	JUNCTION	2.5	2.9	3.2	3.4	3.4
ND_J230	JUNCTION	0.4	0.6	0.8	0.9	0.9
ND_J235	JUNCTION	1.0	1.0	1.0	1.0	1.0
ND_J305	JUNCTION	6.4	6.8	7.3	9.1	9.9
ND_J330	JUNCTION	0.0	0.0	0.0	0.0	0.0
ND_J430	JUNCTION	0.0	0.0	0.0	0.0	0.0
ND_NorthridgeHigh	STORAGE	1.9	1.9	1.9	1.9	1.9
ND_Pond_inflow	JUNCTION	1.0	1.0	1.0	1.0	1.0
ND_Winograd	#N/A	2.8	3.2	3.6	3.8	3.8
OG_B100	JUNCTION	3.0	6.7	12.2	138.4	221.6
OG_B105	JUNCTION	12.8	18.4	26.4	60.5	80.4
OG_B110	JUNCTION	11.2	16.6	25.0	57.1	75.8
OG_J100	JUNCTION	17.1	23.4	25.0	25.2	25.3
OG_J105	JUNCTION	9.3	12.1	12.3	12.3	12.3
OG_J110	JUNCTION	8.2	12.1	13.8	13.9	13.9
OG_Outlet	JUNCTION	18.9	27.7	34.4	61.1	61.4
PLC_B100	JUNCTION	1.1	1.8	3.5	10.6	14.8
PLC_B105	JUNCTION	44.5	66.3	104.7	233.2	303.2
PLC_B110	JUNCTION	21.0	32.2	51.6	151.0	211.5
PLC_B115	JUNCTION	22.3	32.8	46.6	133.2	190.0
PLC_B120	JUNCTION	35.0	50.0	73.7	167.0	221.9
PLC_B121	JUNCTION	24.2	33.8	45.7	88.7	113.2
PLC_D115	DIVIDER	47.6	51.3	51.6	51.6	51.6
PLC_J100	JUNCTION	138.7	156.8	168.2	174.0	176.2
PLC_J105	DIVIDER	138.7	156.8	168.2	174.0	176.5
PLC_J110	JUNCTION	20.4	31.3	41.7	42.0	42.0
PLC_J115	JUNCTION	82.6	92.1	93.6	99.4	101.9
PLC_J120	JUNCTION	47.6	51.6	51.6	51.9	51.9
PLC_J121	JUNCTION	13.9	13.9	14.0	14.0	14.0
PLC_J215	JUNCTION	61.4	66.3	67.8	73.7	75.8
PLC_OUTLET	OUTFALL	138.7	156.8	169.7	176.2	178.3
PR_B100	JUNCTION	0.2	0.7	2.2	8.1	11.6
PR_B105	JUNCTION	0.6	1.2	3.6	23.6	36.2

# Future Node Total Inflow (Ac-ft)

				<u> </u>	<u> </u>	
Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
PR_B110	JUNCTION	1.1	2.8	10.0	39.0	56.2
PR_B115	JUNCTION	0.3	0.6	2.1	10.4	14.9
PR_B120	JUNCTION	0.9	1.9	7.3	33.8	50.0
PR_B125	JUNCTION	0.4	0.9	3.3	13.9	20.3
PR_B130	JUNCTION	0.7	1.6	5.4	29.1	43.6
PR_B135	JUNCTION	64.8	95.1	132.6	248.3	313.0
PR_B150	JUNCTION	7.6	14.7	32.8	100.7	130.1
PR_B155	JUNCTION	3.7	5.4	7.5	14.8	19.0
PR_B160	JUNCTION	2.2	3.1	4.1	8.8	11.8
PR_J355	JUNCTION	10.6	11.4	12.2	14.2	14.9
PR_OUTLET	OUTFALL	14.3	16.7	19.6	28.9	33.8
PR_PoudreRiv	STORAGE	14.3	16.8	19.7	29.0	33.8
PRR_B100	JUNCTION	8.7	11.8	15.2	27.5	35.3
PRR_B105	JUNCTION	2.6	3.5	4.5	8.1	10.3
PRR_J100	JUNCTION	9.3	10.3	11.2	14.1	15.8
PRR_J105	JUNCTION	1.1	1.7	2.5	5.5	7.2
PRR_OUTLET	OUTFALL	9.3	10.3	11.2	14.1	15.8
SD_B100	JUNCTION	1.5	3.2	10.4	59.5	90.2
SD_B105	JUNCTION	0.9	2.0	3.8	44.2	74.6
SD_B110	JUNCTION	0.7	1.6	4.3	30.4	47.0
SD_B115	JUNCTION	1.0	1.9	6.4	36.8	55.5
SD_B120	JUNCTION	5.9	10.8	18.8	104.7	159.3
SD_J100	JUNCTION	9.5	19.0	43.0	91.1	91.1
SD_J110	JUNCTION	7.2	13.9	28.9	54.3	54.3
SD_J200	JUNCTION	7.9	15.8	32.5	72.1	72.4
	JUNCTION	6.5	12.4	24.7	42.7	42.7
SD_Outlet	OUTFALL	9.5	19.0	43.0	91.1	91.1
	JUNCTION	1.9	3.7	11.6	50.3	72.7
SKD_B105	JUNCTION	2.3	3.9	6.3	22.9	32.2
	JUNCTION	0.8	1.2	1.5	3.3	4.6
	JUNCTION	7.3	10.7	14.5	38.1	54.6
	JUNCTION	4.7	7.2	10.5	34.4	49.4
	JUNCTION	16.7	24.1	35.0	75.8	99.1
_ SKD_B125	JUNCTION	9.3	13.8	19.9	42.0	54.9
SKD B126	JUNCTION	30.3	43.0	61.4	130.7	170.9
	JUNCTION	20.6	30.0	43.3	93.0	121.5
SKD_B135	JUNCTION	21.1	29.9	43.0	93.3	122.5
SKD B136	JUNCTION	19.4	27.4	38.7	83.2	108.9
	JUNCTION	18.3	25.8	35.6	75.5	99.1
SKD B140	JUNCTION	27.8	39.6	52.8	118.2	158.7
SKD B141	JUNCTION	5.1	7.3	9.7	21.5	29.0
SKD_B145	JUNCTION	45.7	63.8	84.1	178.6	239.7
SKD_B150	JUNCTION	30.7	42.0	56.2	118.2	162.7
SKD_B155	JUNCTION	36.2	50.0	65.4	128.0	166.6
210 0100	JUNCTION	JU.Z	50.0	05.4	120.0	100.0

	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
	JUNCTION	0.8	1.1	1.5	3.0	3.8
	JUNCTION	3.2	5.2	8.3	28.5	39.9
	JUNCTION	4.0	6.2	9.1	31.9	47.3
	JUNCTION	1.7	3.2	6.0	30.6	43.9
	JUNCTION	16.0	22.1	28.8	52.5	66.3
	JUNCTION	21.5	29.6	38.7	72.1	91.5
	JUNCTION	12.3	17.0	22.5	42.0	53.1
	JUNCTION	19.9	27.3	35.3	64.1	81.3
3	STORAGE	3.9	6.2	9.7	24.7	25.6
	DIVIDER	188.4	209.9	226.8	303.8	334.5
	DIVIDER	127.1	141.5	156.8	232.0	263.0
	DIVIDER	3.1	5.1	8.2	21.8	21.8
	DIVIDER	5.4	9.2	14.9	60.2	87.5
	DIVIDER	6.8	6.8	6.8	6.8	6.8
	DIVIDER	0.0	0.0	0.0	0.0	0.0
	DIVIDER	6.7	6.8	6.8	6.8	6.8
	JUNCTION	171.3	192.4	211.5	284.2	313.0
	JUNCTION	170.6	190.6	208.7	281.4	310.0
	JUNCTION	168.5	186.9	202.2	273.4	301.7
	JUNCTION	170.6	189.4	204.7	274.7	302.3
	JUNCTION	2.6	4.8	7.2	9.4	9.5
	JUNCTION	189.7	211.5	228.6	306.0	337.6
	JUNCTION	37.1	42.4	44.5	48.2	48.8
	JUNCTION	28.6	29.5	30.6	34.7	35.0
	JUNCTION	13.6	13.8	13.9	13.9	13.9
	JUNCTION	22.7	26.6	32.5	76.1	101.9
	JUNCTION	10.3	10.4	10.4	10.4	10.5
	JUNCTION	74.0	77.0	86.2	118.5	124.3
	JUNCTION	3.0	4.3	4.7	4.8	4.8
	JUNCTION	53.7	56.5	66.0	98.2	104.0
	JUNCTION	30.1	32.8	42.4	75.2	81.3
	JUNCTION	12.3	12.4	12.4	12.4	12.4
	JUNCTION	3.1	5.1	8.2	21.7	21.8
	JUNCTION	1.5	3.1	5.9	28.7	50.9
	JUNCTION	6.6	6.6	6.6	6.6	6.7
	JUNCTION	174.3	193.3	210.8	288.8	319.2
	JUNCTION	1.0	1.9	3.1	7.4	7.9
	JUNCTION	107.7	116.0	131.4	206.9	238.2
	JUNCTION	11.2	14.1	23.4	56.8	62.9
	JUNCTION	0.0	0.0	0.0	0.0	0.0
	JUNCTION	0.0	0.0	0.0	8.7	30.6
	JUNCTION	6.7	6.7	6.8	6.8	6.8
	JUNCTION	6.8	6.8	6.8	6.8	6.8
	JUNCTION	138.1	152.2	167.6	241.8	272.5

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
SKD_J335	JUNCTION	105.6	112.6	127.7	203.2	234.8
SKD_J336	JUNCTION	5.4	9.1	14.9	59.5	86.5
SKD_J380	JUNCTION	6.7	6.8	6.8	6.8	6.8
SKD_J420	JUNCTION	127.1	141.5	156.8	232.0	263.0
SKD_J436	JUNCTION	5.4	9.2	14.9	59.8	86.9
SKD_J536	JUNCTION	5.4	9.2	14.9	59.8	86.9
SKD_J636	JUNCTION	5.4	9.2	14.9	60.2	87.5
SKD_OUTLET	OUTFALL	172.2	194.9	221.9	297.4	325.3
SKD_Promont	STORAGE	44.2	58.3	74.0	131.0	164.2
SKD_\$180	DIVIDER	11.2	14.1	23.4	65.7	93.6
WC_B100	JUNCTION	0.7	1.0	1.7	4.2	5.7
WC_B101	JUNCTION	3.4	4.6	6.0	11.1	14.3
WC_B102	JUNCTION	3.0	4.2	5.6	10.7	13.6
WC_B103	JUNCTION	1.8	2.5	3.3	6.4	8.1
WC_B105	JUNCTION	5.0	7.0	9.2	17.7	22.6
WC_B105.1	JUNCTION	1.0	1.3	1.8	3.4	4.4
WC_B105.2	JUNCTION	1.0	1.4	1.9	3.6	4.5
WC_B106	JUNCTION	6.9	9.5	12.7	24.2	31.0
WC_B107	JUNCTION	3.2	4.5	6.1	12.9	17.0
WC_B108	JUNCTION	1.1	1.5	2.0	3.7	4.8
WC_B109	JUNCTION	1.3	1.8	2.3	4.4	5.6
WC_B110	JUNCTION	7.8	10.7	14.0	26.7	34.4
WC_B111	JUNCTION	3.3	4.7	6.3	11.8	14.9
WC_B112	JUNCTION	1.1	1.5	2.0	3.7	4.7
WC_B112.5	JUNCTION	1.5	2.1	2.7	4.9	6.3
WC_B113	JUNCTION	14.1	19.2	25.0	45.1	57.4
WC_B114	JUNCTION	12.9	17.5	22.7	40.5	51.9
WC_B115	JUNCTION	5.1	7.2	9.5	20.6	27.9
WC_B120	JUNCTION	95.8	130.7	170.0	313.0	399.0
WC_B130	JUNCTION	6.3	9.0	11.9	26.4	35.3
WC_B135	JUNCTION	35.3	49.4	65.4	143.0	193.7
WC_B140	JUNCTION	81.6	112.9	149.5	281.1	356.0
WC_B145	JUNCTION	1.5	2.0	2.7	4.8	6.0
WC_B146	JUNCTION	8.9	12.6	17.2	36.8	48.8
WC_B150	JUNCTION	56.5	78.3	105.0	196.1	247.7
WC_B155	JUNCTION	3.1	4.2	5.5	9.6	11.8
WC_B160	JUNCTION	21.4	29.2	37.7	64.8	79.8
WC_B165	JUNCTION	3.0	4.2	5.4	9.5	11.8
WC_B170	JUNCTION	1.8	2.4	3.3	6.1	7.7
WC_B171	JUNCTION	1.2	1.7	2.2	4.3	5.4
WC_B172	JUNCTION	1.9	2.7	3.6	6.8	8.7
WC_B173	JUNCTION	1.9	2.6	3.5	6.7	8.4
WC_CDOT_stł	STORAGE	22.7	26.2	29.6	40.2	45.7
WC_D101	DIVIDER	0.0	0.0	0.0	0.0	0.0

# Future Node Total Inflow (Ac-ft)

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
WC_D103	DIVIDER	1.0	1.0	1.0	1.0	1.0
WC_D105	DIVIDER	2.9	3.3	3.8	5.5	6.5
WC_D105.1	DIVIDER	0.8	1.0	1.0	1.0	1.0
WC_D105.2	DIVIDER	1.0	1.4	1.9	3.6	4.5
WC_D106	DIVIDER	132.9	134.7	136.3	139.0	140.3
WC_D109	DIVIDER	2.1	2.5	3.0	4.7	5.8
WC_D110	DIVIDER	10.3	11.7	12.3	12.3	12.3
WC_D111	DIVIDER	3.0	4.2	4.8	4.8	4.8
WC_D112	DIVIDER	5.6	5.7	5.7	5.7	5.7
WC_D112.5	DIVIDER	0.9	0.9	1.0	1.0	1.0
WC_D113	DIVIDER	3.8	3.9	3.9	3.9	3.9
WC_D150	DIVIDER	32.5	32.8	32.8	32.8	32.8
WC_D155	DIVIDER	3.1	4.2	5.5	9.6	11.8
WC_D160	DIVIDER	18.2	19.9	21.5	25.7	28.0
WC_D172	DIVIDER	1.1	1.6	1.9	1.9	1.9
WC_D205	DIVIDER	132.6	134.4	135.6	138.4	139.9
WC_D210	DIVIDER	7.4	8.8	9.4	9.4	9.5
WC_D272	DIVIDER	0.3	0.5	0.8	0.9	0.9
WC_D310	DIVIDER	4.5	4.6	4.6	4.7	4.7
WC_D806	DIVIDER	130.4	132.0	133.2	136.3	137.5
WC_J100	JUNCTION	137.8	140.6	142.7	145.5	147.0
WC_J101	JUNCTION	1.0	1.0	1.0	1.0	1.0
WC_J102	JUNCTION	2.8	2.8	2.8	2.8	2.8
WC_J105	JUNCTION	1.0	1.4	1.9	3.6	4.5
WC_J106	JUNCTION	130.7	132.6	133.8	136.6	138.1
WC_J107	JUNCTION	12.4	14.1	15.2	17.0	18.1
WC_J108	JUNCTION	12.4	14.2	15.3	17.0	18.1
WC_J109	JUNCTION	2.1	2.5	3.0	4.7	5.8
WC_J112	JUNCTION	4.8	4.8	4.8	4.8	4.8
WC_J112.5	JUNCTION	4.8	4.8	4.8	4.8	4.8
WC_J113.5	JUNCTION	3.8	3.9	3.9	3.9	3.9
WC_J114	JUNCTION	4.5	4.6	4.7	4.7	4.7
WC_J115	JUNCTION	2.6	2.8	2.8	2.8	2.9
WC_J120	JUNCTION	130.4	132.0	133.2	136.3	137.5
WC_J130	JUNCTION	2.8	2.8	2.8	2.8	2.8
WC_J135	JUNCTION	1.7	2.3	2.9	2.9	2.9
WC_J140	JUNCTION	83.5	85.0	86.2	89.0	90.5
WC_J145	JUNCTION	3.1	4.2	5.5	9.6	11.8
WC_J146	JUNCTION	8.3	8.6	8.7	8.7	8.7
WC_J165	JUNCTION	4.8	6.5	8.0	12.2	14.5
WC_J170	JUNCTION	2.4	3.1	3.7	3.8	3.8
WC_J171	JUNCTION	2.4	3.1	3.7	3.8	3.8
WC_J172	JUNCTION	2.1	2.6	2.9	2.9	2.9
WC_J173	JUNCTION	3.7	3.7	3.7	3.7	3.7

Node	Node Type	2-yr	5-yr	10-yr	50-yr	100-yr
WC_J200	JUNCTION	132.3	134.1	135.3	138.4	139.6
WC_J201	JUNCTION	134.1	136.6	138.4	141.5	142.7
WC_J202	JUNCTION	0.9	1.0	1.0	1.0	1.0
WC_J205	JUNCTION	132.6	134.4	136.0	138.7	139.9
WC_J206	JUNCTION	130.7	132.6	133.8	136.9	138.1
WC_J207	JUNCTION	18.0	19.9	20.9	22.7	23.8
WC_J212.5	JUNCTION	3.8	3.8	3.9	3.9	3.9
WC_J220	JUNCTION	98.5	100.4	101.6	104.3	105.6
WC_J235	STORAGE	13.9	14.0	14.0	14.0	14.0
WC_J240	JUNCTION	9.1	10.4	11.4	14.4	15.7
WC_J245	JUNCTION	18.2	19.9	21.5	25.6	27.9
WC_J272	JUNCTION	1.0	1.0	1.0	1.0	1.0
WC_J273	JUNCTION	2.8	2.8	2.8	2.8	2.8
WC_J305	JUNCTION	2.9	3.3	3.8	5.5	6.5
WC_J306	JUNCTION	0.0	0.0	0.0	0.0	0.0
WC_J307	JUNCTION	5.6	5.7	5.7	5.7	5.7
WC_J312.5	JUNCTION	3.8	3.8	3.9	3.9	3.9
WC_J320	JUNCTION	91.1	92.7	93.9	96.7	97.9
WC_J340	JUNCTION	32.5	32.8	32.8	32.8	32.8
WC_J405	JUNCTION	1.0	1.4	1.9	3.6	4.5
WC_J420	JUNCTION	9.0	9.0	9.1	9.1	9.1
WC_J505	JUNCTION	1.0	1.4	1.9	3.6	4.5
WC_J506	JUNCTION	0.8	1.0	1.0	1.0	1.0
WC_J706	JUNCTION	130.1	132.0	133.2	136.3	137.5
WC_OUTLET	OUTFALL	137.8	140.6	142.7	145.5	147.0
WC_OUTLET2	OUTFALL	2.9	3.3	3.8	5.5	6.5
WC_OUTLET3	OUTFALL	20.5	23.3	24.4	26.1	27.2
1.0	OUTFALL	0.0	0.0	0.0	0.0	0.0
2.0	OUTFALL	0.0	0.0	0.0	0.0	0.0

Promontory Pond						
Stage (ft)	Surface Area (ft <sup>2</sup> )	Storage (Ac-ft)	Discharge (cfs)			
4905.6						
4906	41,312	0.1	0.1			
4907	103,496	1.7	0.7			
4908	169,486	4.8	1.6			
4909	200,585	9.1	9.9			
4910	218,867	13.9	26.9			
4911	218,867	18.9	31.6			
4911.9*	218,867	23.4	34.7			
4912	218,867	23.9	37.0			
4913	218,867	29.0	341.4			
*Overtop	ping Elevation					

### **Detention Rating Curves**

Orr Pond - CDOT						
Stage (ft)	Surface Area (ft <sup>2</sup> )	Storage (Ac-ft)	Discharge (cfs)			
4864.5						
4865	363	0.0	0.1			
4866	14,217	0.1	0.3			
4867	24,137	0.6	1.1			
4868	33,250	1.2	1.6			
4869	37,086	2.0	14.1			
4870	37,086	2.9	37.0			
4870.8*	37,086	3.6	45.5			
4871	37,086	3.7	67.5			
4872	37,086	4.6	351.7			
*Overtop	ping Elevation					

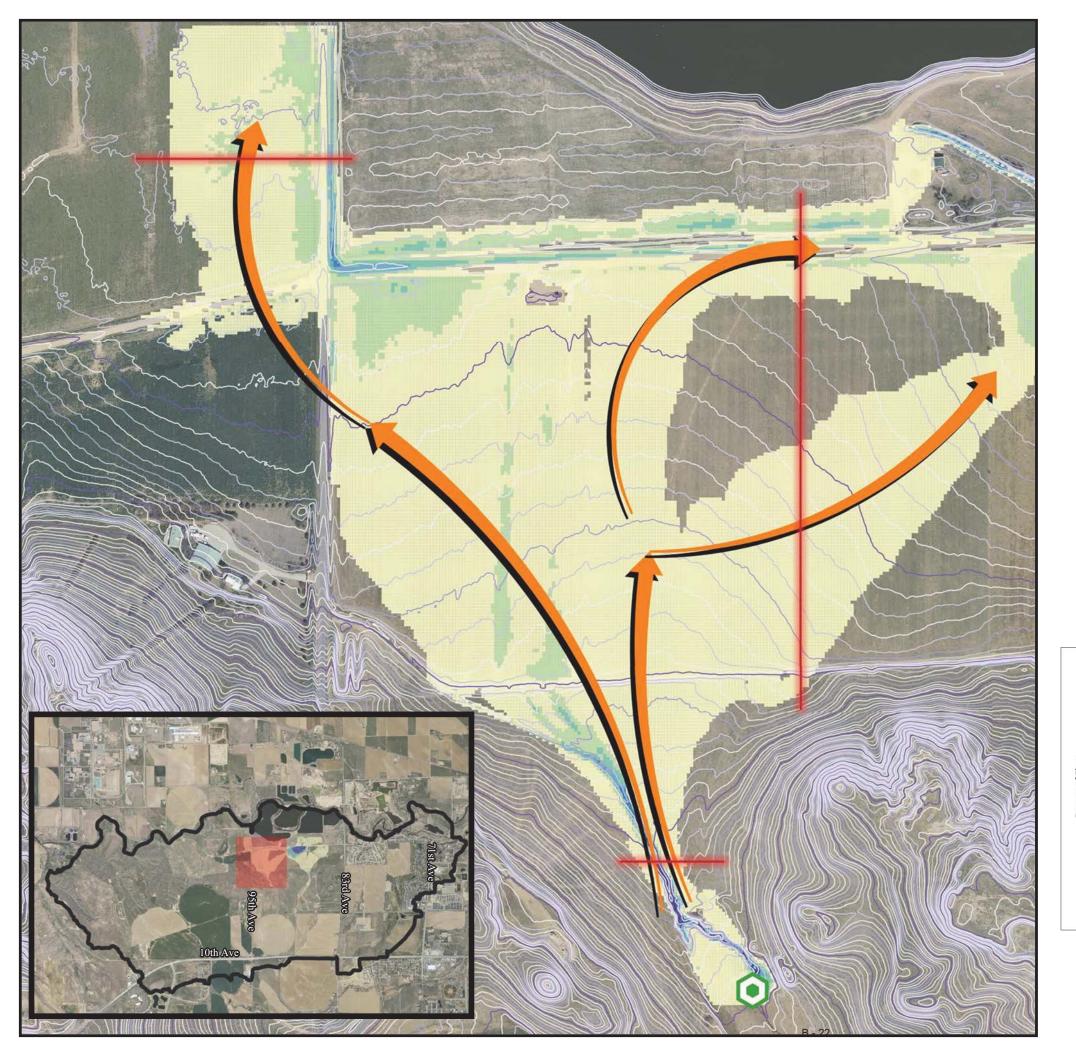
	83rd Ave P	ond - CDO	ſ
Stage (ft)	Surface Area (ft <sup>2</sup> )	Storage (Ac-ft)	Discharge (cfs)
4817.6			
4818	6,636	0.5	0.1
4819	36,183	1.4	0.6
4820	43,152	2.4	1.2
4821	48,271	3.5	1.6
4822	48,271	4.6	1.9
4822.1*	48,271	4.8	1.9
4823	48,271	5.7	66.2
4824	48,271	5.8	226.7
*Overtop	ping Elevation		

	C Street Pond						
Stage (ft)	Surface Area (ft <sup>2</sup> )	Storage (Ac-ft)	Discharge (cfs)				
4752.4	0						
4754	3,374	0.0	2.4				
4755	17,578	0.3	4.3				
4756	31,809	0.8	7.8				
4757	46,022	1.7	8.9				
4758	56,484	2.9	9.8				
4759	56,484	4.2	10.7				
4759.8*	56,484	5.2	11.3				
4760	56,484	5.5	17.9				
4761	56,484	6.8	119.0				
4762	56,484	8.1	336.8				
*Overtop	ping Elevation						

Stage (ft)	Surface Area (ft <sup>2</sup> )	Storage (Ac-ft)	Discharge (cfs)
4756.9	0		
4758	419	0.0	0.3
4759	2,189	0.1	1.0
4760	4,059	0.2	1.4
4761	6,047	0.4	1.7
4761.4*	6,047	0.4	2.0
4762	6,047	0.5	10.0
4763	6,047	0.6	70.7
4764	6,047	0.6	390.0
*Overtop	ping Elevation		

Melbourne St Pond - 2					
Stage (ft)	Surface Area (ft <sup>2</sup> )	Storage (Ac-ft)	Discharge (cfs)		
4750.2	0				
4751	700	0.0	0.7		
4752	1,488	0.1	1.2		
4753	2,158	0.1	1.5		
4754	2,816	0.2	1.8		
4755	3,573	0.3	3.2		
4756	3,573	0.4	4.3		
4757	3,573	0.4	5.1		
4757.6*	3,573	0.5	5.5		
4758	3,573	0.5	16.9		
4759	3,573	0.5	588.9		
*Overtop	ping Elevation				

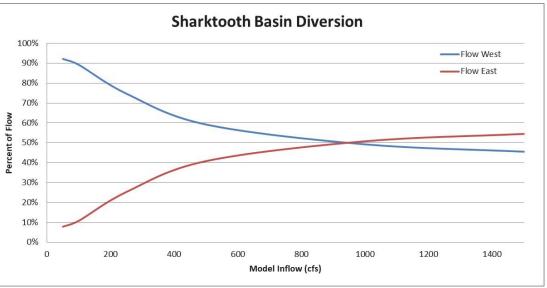
Poudre River Ranch						
Stage (ft)	Surface Area (ft <sup>2</sup> )	Storage (Ac-ft)	Discharge (cfs)			
4700	0					
4701	625	0.00	1.5			
4702	625	0.02	27.4			
4702.2*	625	0.02	51.1			
4703	625	0.03	205.4			
*Overtop	ping Elevation					

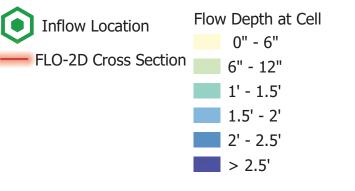


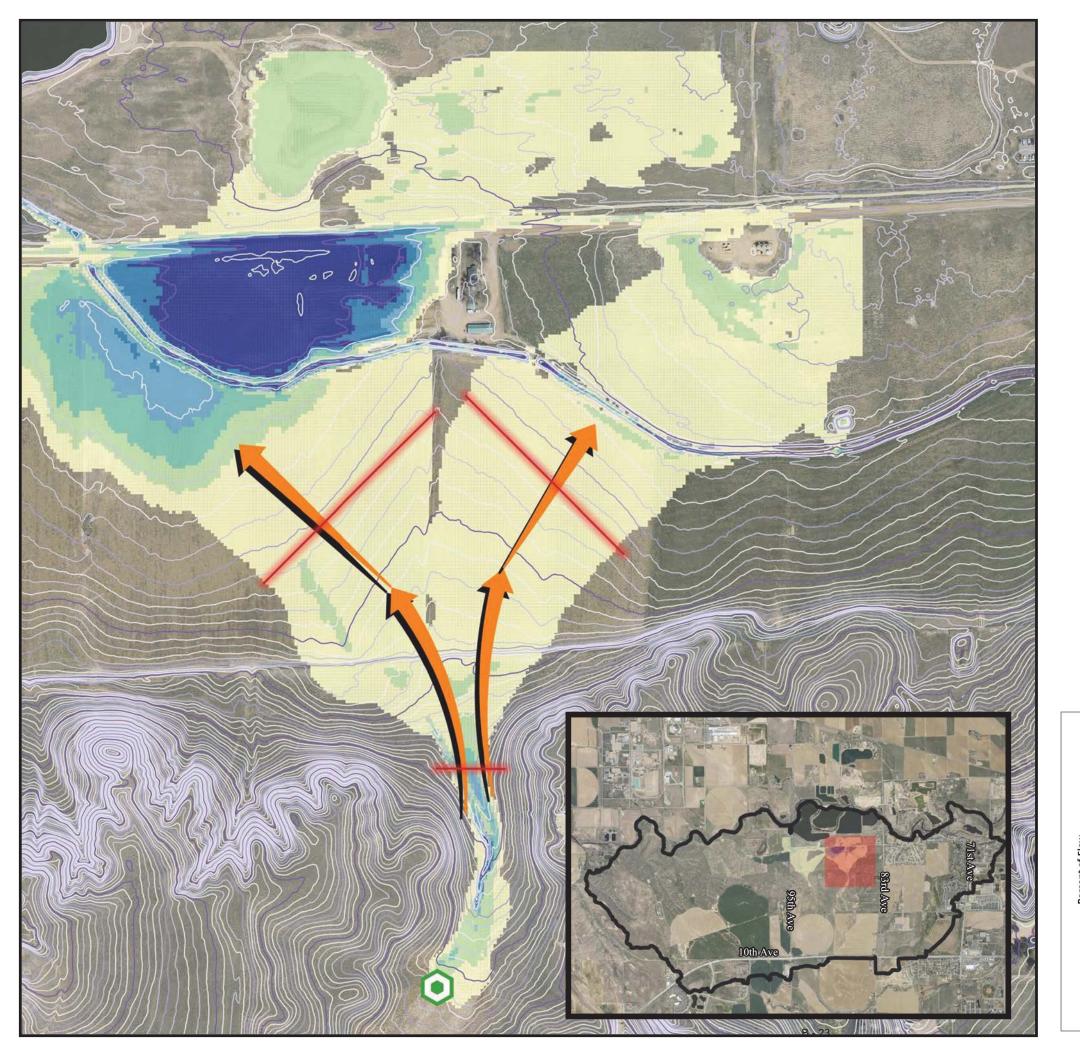
# Sharktooth Bluffs Storm Drainage Master Plan **FLO-2D Diversion Curve** SWMM Element: SKD\_D110



Sharktooth Diversion						
	Diversion to the West		Diversion to the East			
Model Inflow	Percent (%)	Discharge (cfs)	Percent (%)	Discharge (cfs)		
50	92%	46.1	8%	3.9		
100	89%	89.2	11%	10.8		
250	75%	186.7	25%	63.3		
500	59%	296.0	41%	204.0		
1000	49%	492.3	51%	507.7		
1500	46%	682.9	54%	817.1		



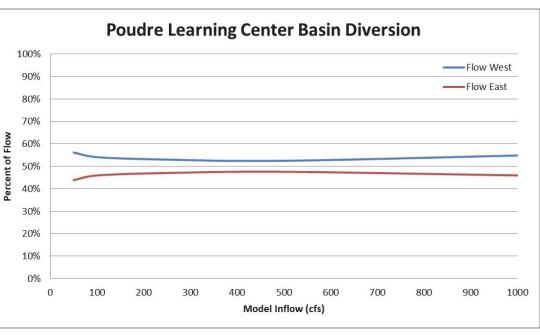




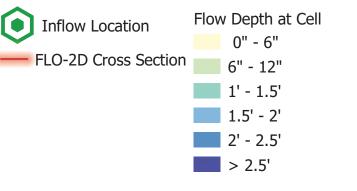




Poudre Learning Center						
	Diversion to the West		Diversion to the East			
Model Inflow	Percent (%) Discharge (cfs)		Percent (%)	Discharge (cfs)		
50	56%	28.1	44%	21.9		
100	54%	54.1	46%	45.9		
250	53%	132.5	47%	117.5		
500	52%	262.3	48%	237.7		
1000	55%	548.0	46%	452.0		



## Sharktooth Bluffs Storm Drainage Master Plan **FLO-2D Diversion Curve** SWMM Element: PLC\_D115





## **APPENDIX C - ALTERNATIVE ANALYSIS**



### SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN

		Unit Cost	Adjusted Unit Cost
Item	Unit	2012 Q1	2018 Q3
Circular Pipes			
12-inch	L.F.	\$36.00	\$48.00
18-inch	L.F.	\$54.00	\$72.00
24-inch	L.F.	\$72.00	\$96.00
30-inch	L.F.	\$90.00	\$121.00
36-inch	L.F.	\$108.00	\$145.00
42-inch	L.F.	\$126.00	\$169.00
48-inch	L.F.	\$144.00	\$193.00
54-inch	L.F.	\$216.00	\$289.00
60-inch	L.F.	\$240.00	\$322.00
66-inch	L.F.	\$264.00	\$354.00
72-inch	L.F.	\$360.00	\$482.00
78-inch	L.F.	\$390.00	\$523.00
84-inch	L.F.	\$420.00	\$563.00
90-inch	L.F.	\$450.00	\$603.00
96-inch	L.F.	\$480.00	\$643.00
102-inch	L.F.	\$714.00	\$957.00
108-inch	L.F.	\$756.00	\$1,013.00
120-inch	L.F.	\$840.00	\$1,126.00
Flared End Sections			
12-inch	EA	\$710.00	\$951.00
18-inch	EA	\$920.00	\$1,233.00
24-inch	EA	\$970.00	\$1,300.00
30-inch	EA	\$1,570.00	\$2,104.00
36-inch	EA	\$1,610.00	\$2,157.00
42-inch	EA	\$1,700.00	\$2,278.00
48-inch	EA	\$2,060.00	\$2,760.00
Manholes and Inlets			
Manhole, 4' Dia. (Pipe Dia. < 36"), Depth > 15-feet)	EA	\$2,900.00	\$3,886.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42"), Depth > 15-feet)	EA	\$3,900.00	\$5,226.00
Manhole, 6' Dia. (Pipe Dia. , Depth > 15-feet)	EA	\$4,300.00	\$5,762.00
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)	EA	\$12,000.00	\$16,080.00
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)	EA	\$15,000.00	\$20,100.00
Storm Inlet, Type R/Type 14, 5-foot, 10-foot deep avg.	EA	\$4,600.00	\$6,164.00

### UD MP-Cost Unit Costs

ltem	Unit	Unit Cost 2012 Q1	Adjusted Unit Cost 2018 Q3
Hydraulic Structures			
Grouted Boulders, 36-inch	C.Y.	\$190.00	\$255.00
Soil Riprap, Type M	C.Y.	\$70.00	\$94.00
Excavation, Complete-in-Place	C.Y.	\$11.00	\$15.00
Bedding, Granular Type II	C.Y.	\$58.00	\$78.00
Grout	C.Y.	\$240.00	\$322.00
Check Structure, Concrete	L.F.	\$270.00	\$362.00
Channel Improvements			•
Boulder Edging, 12" High	L.F.	\$60.00	\$80.00
Boulder Edging, 24" High	L.F.	\$75.00	\$101.00
Boulder Edging, 36" High	L.F.	\$90.00	\$121.00
Concrete Low Flow Channel	L.F.	\$40.00	\$54.00
Grouted Boulders, 12"	S.Y.	\$130.00	\$174.00
Grouted Boulders, 18"	S.Y.	\$150.00	\$201.00
Grouted Boulders, 24"	S.Y.	\$170.00	\$228.00
Grouted Boulders, 36"	S.Y.	\$190.00	\$255.00
Grouted Boulders, 48"	S.Y.	\$200.00	\$268.00
6-inch Riprap, Type VL	C.Y.	\$45.00	\$60.00
9-inch Riprap, Type L	C.Y.	\$55.00	\$74.00
12-inch Riprap, Type M	C.Y.	\$60.00	\$80.00
18-inch Riprap, Type H	C.Y.	\$80.00	\$107.00
24-inch Riprap, Type VH	C.Y.	\$85.00	\$114.00
Soil Riprap, Type VL	C.Y.	\$50.00	\$67.00
Soil Riprap, Type L	C.Y.	\$60.00	\$80.00
Soil Riprap, Type M	C.Y.	\$70.00	\$94.00
Soil Riprap, Type H	C.Y.	\$80.00	\$107.00
Soil Riprap, Type VH	C.Y.	\$90.00	\$121.00
Excavation, Low Range	C.Y.	\$11.00	\$15.00
Excavation, Mid Range	C.Y.	\$24.00	\$32.00
Excavation, High Range	C.Y.	\$31.00	\$42.00
Concrete and Steel			
Concrete	C.Y.	\$600.00	\$771.00
Steel	LB.	\$0.90	\$1.00

		Unit Cost	Adjusted Unit Cost
Item	Unit	2012 Q1	2018 Q3
Landscap	ing and Recreatio	on Improvements	
Wetlands Plantings	ACRE	\$25,000.00	\$33,500.00
Reclamation & seeding (native grasses)	ACRE	\$1,000.00	\$1,340.00
Trail/Path, Concrete (10' Width)	L.F.	\$44.00	\$59.00
Trail/Path, Crusher Fines (10' Width)	L.F.	\$11.00	\$15.00
Operation and Maintenance			
Culvert Maintenance	L.F.	\$1.00	\$1.00
Manhole and Inlet Maintenance	EA	\$50.00	\$67.00
Hydraulic Structure Maintenance	EA	\$500.00	\$670.00
Channel Maintenance	L.F.	\$2.00	\$3.00
Detention/WQ Maintenance	ACRE	\$1,500.00	\$2,010.00
Mowing	ACRE	\$50.00	\$67.00
Trail Maintenance	L.F.	\$5.00	\$7.00
Removals			
Removal of culvert pipe (D<48")	L.F.	\$20.00	\$27.00
Removal of culvert pipe (48" <d<84")< td=""><td>L.F.</td><td>\$50.00</td><td>\$67.00</td></d<84")<>	L.F.	\$50.00	\$67.00
Removal of culvert pipe (D>84")	L.F.	\$75.00	\$101.00
Concrete Box Culvert	L.F./CELL	\$100.00	\$134.00
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	\$15.00
Excavation, Mid Range	C.Y.	\$24.00	\$32.00
Excavation, High Range	C.Y.	\$31.00	\$42.00
Outlet Works	EA	User Defined	User Defined
Water Quality Appurtenances	EA	User Defined	User Defined
Detention (Complete-in-Place)	AC-FT	\$45,600.00	\$61,104.00
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 Tab

## **UD-MP Cost Unit Costs**

### Box Culvert (CDOT M-601-1)

### Headwall/Toewall (CDOT M-601-2)

Span	Cost \$/LF											
(feet)					Rise (fee	et)						
	2	3	4	5	6	7	8	9	10			
4	\$475.29	\$485.47	\$547.45	\$661.03	\$722.88	\$784.73	\$847.58	\$908.62	\$970.47			
5	\$537.14	\$598.99	\$661.03	\$722.88	\$784.73	\$847.58	\$898.49	\$989.79	\$1,081.50			
6	\$598.99	\$661.03	\$722.88	\$784.73	\$804.13	\$823.54	\$949.41	\$1,070.97	\$1,192.52			
7	\$661.03	\$722.88	\$784.73	\$847.58	\$884.49	\$921.40	\$1,019.26	\$1,136.36	\$1,253.47			
8	\$722.88	\$784.73	\$847.58	\$898.49	\$949.41	\$1,019.26	\$1,089.10	\$1,159.08	\$1,229.06			
9	ERROR	\$847.58	\$908.62	\$989.79	\$1,070.97	\$1,136.36	\$1,201.76	\$1,266.09	\$1,330.42			
10	ERROR	\$908.62	\$970.47	\$1,081.50	\$1,192.52	\$1,253.47	\$1,314.42	\$1,373.10	\$1,431.78			
11	ERROR	\$970.47	\$1,033.32	\$1,160.83	\$1,288.34	\$1,354.79	\$1,421.24	\$1,486.19	\$1,551.15			
12	ERROR	ERROR	\$1,095.16	\$1,239.66	\$1,384.16	\$1,456.11	\$1,528.06	\$1,599.29	\$1,670.52			
13	ERROR	ERROR	ERROR	ERROR	\$1,539.54	\$1,606.23	\$1,672.93	\$1,745.54	\$1,818.16			
14	ERROR	ERROR	ERROR	ERROR	\$1,694.91	\$1,756.36	\$1,817.80	\$1,891.80	\$1,965.80			
15	ERROR	ERROR	ERROR	ERROR	\$1,905.87	\$1,977.88	\$2,049.88	\$2,127.74	\$2,205.60			
16	ERROR	ERROR	ERROR	ERROR	\$2,116.83	\$2,199.39	\$2,281.96	\$2,363.68	\$2,445.40			
17	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	\$2,453.80	\$2,537.84	\$2,621.88			
18	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	\$2,625.65	\$2,712.00	\$2,798.35			
19	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	\$2,951.87	\$3,028.58	\$3,105.29			
20	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	\$3,278.09	\$3,345.16	\$3,412.24			

		note
Span	Steel	
(feet)	(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.

# Minimum Criteria Alternatives

- C-4: Northridge Draw 71<sup>st</sup> Avenue Crossing
- C-4: Northridge Draw C Street
- C-5: Poudre Learning Center 83<sup>rd</sup> Avenue
- C-5: Poudre Learning Center County Road 62 Central
- C-6: Poudre Learning Center County Road 62 Eastern
- C-6: Poudre Learning Center County Road 62 Western
- C-7: Sharktooth Draw 4<sup>th</sup> Street Central
- C-7: Sharktooth Draw 4<sup>th</sup> Street Eastern
- C-8: Sharktooth Draw 4<sup>th</sup> Street Western
- C-8: Sharktooth Draw 95<sup>th</sup> Avenue
- C-9: Sharktooth Draw County Road 62
- C-9: Wiedeman Creek 4<sup>th</sup> Street
- C-10: Wiedeman Creek 78<sup>th</sup> Avenue
- C-10: Wiedeman Creek 81<sup>st</sup> Avenue
- C-11: Wiedeman Creek Skyview Street

MAS	TER PLAN C	OST ESTIMAT	E FOR INDIV	IDUAL RE	ACH			
PROJECT :	Sharktooth Bluff						1	
DRAINAGEWAY :	ND							
REACH :	1							
JURISDICTION : REACH ID:	City of Greeley 71stAveCrossing-	Poach1	Enter Estimator Nam	e on Project Int	DATE :	12/19/2018		
REACH ID.	7 ISLAVECTOSSING-	Reactin	Enter Estimator Nam	e on Froject in	DATE.	12/13/2010	1	
						TOTAL		
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS	
Concrete Box Culverts								
Box Culvert Pipe								
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)					
7	3	1	65	L.F.	\$722.88	\$46,987.00		
Headwall and Toewalls Individual Box Span (ft)	No. of Barrels	Total Span (ft)	1	1	1	1		
7	1	9.00	2	EA	\$813.96	\$1,628.00		
Wingwalls (includes wingwalls on ei	ther side of channel a	nd concrete apron)	-	En	010.00	\$1,020.00		
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels						
7	3	1	2	EA	\$6,827.66	\$13,655.30		
Channel Improvements								
Excavation, Mid Range			250	C.Y.	\$32.00	\$8,000.00	Trench Excavation	
12-inch Riprap, Type M			10	C.Y.	\$80.00	\$800.00		
Removals								
Removal of culvert pipe (D<48")			50	L.F.	\$27.00	\$1,350.00		
Special Items (User Defined)								
Asphalt	<user defined="" item<="" td=""><td>15</td><td>24</td><td>TON</td><td>\$150.00</td><td>\$3,600.00</td><td>l</td><td></td></user>	15	24	TON	\$150.00	\$3,600.00	l	
	Master Pla	an Capital Improv	ement Cost Su	mmary				
Capital Improvement Costs								
Pipe Culverts and Storm Drains Concrete Box Culverts						\$0.00 \$62,270.00		
Hydraulic Structures						\$0.00		
Channel Improvements						\$8,800.00		
Detention/Water Quality Facilities						\$0.00		
Removals						\$1,350.00		
Landscaping and Maintenance Improvements Special Items (User Defined)						\$0.00 \$3,600.00		
Subtotal Capital Improvement Costs						\$76,020.00		
Additional Capital Improvement Cos	ts					\$10,020.00		
Dewatering			\$760.20	L.S.		\$760.00		
Mobilization			5%			\$3,801.00		
Traffic Control			\$3,801.00	L.S.		\$3,801.00		
Utility Coordination/Relocation Stormwater Management/Erosion Control			\$3,801.00	L.S.		\$3,801.00 \$3,801.00		
Subtotal Additional Capital Improvement Cost	e		570			\$15,964.00		
Land Acquisition Costs						\$10,004.00		
ROW/Easements						\$0.00		
Subtotal Land Acquisition Costs						\$0.00		
Other Costs (percentage of Capital	Improvement Costs)		15%			\$13,798.00		
Engineering _egal/Administrative			15%			\$13,798.00 \$4,599.00		
Contract Admin/Construction Management			10%			\$9,198.00		
			25%			\$22,996.00		
Contingency						\$50,591.00		
Subtotal Other Costs	ş					\$142,575.00		
Subtotal Other Costs Total Capital Improvement Costs		and Mainta	o Coot Summer			\$142,575.00		
Subtotal Other Costs Total Capital Improvement Costs Master		n and Maintenand			Unit Cost			
Subtotal Other Costs Total Capital Improvement Costs Master Description	Plan Operation		Quantity	Unit	Unit Cost \$1.00	Total Annual Cost		
Subtotal Other Costs Total Capital Improvement Costs Master Description Culvert Maintenance (e.g. sediment & debris rem	Plan Operation				Unit Cost \$1.00	Total Annual Cost \$65.00		
Description	Plan Operation		Quantity	Unit		Total Annual Cost		

PROJECT : Sh	arktooth Bluff					
DRAINAGEWAY : NE						
REACH : 1						
JURISDICTION : Cit	y of Greeley					
REACH ID: Cs	treet	JKD		DATE :	12/19/2018	
				1	TOTAL	
DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Channel Improvements						
xcavation, Mid Range		1720	C.Y.	\$32.00	\$55,040.00	Channel Excavation
Detention/Water Quality Facilities						
Detention (Complete-in-Place)						
etention Facility 1 (Complete-in-Place)		3	AC-FT	\$61,104.00	\$183,312.00	Reconfigure existing retention
andscaping and Maintenance Impro	ovements					
Vetlands Plantings		2	ACRE	\$33,500.00	\$67,000.00	
Reclamation & seeding (native grasses)		1	ACRE	\$1,340.00	\$1,340.00	
and Acquisition						
asement/ROW Acquisition		5.00	ACRE	\$43,337.77	\$216,689.00	
	Master Plan Capital Improv	ement Cost Sur	nmary			
Capital Improvement Costs						
tipe Culverts and Storm Drains					\$0.00	
Concrete Box Culverts					\$0.00	
lydraulic Structures					\$0.00	
Channel Improvements					\$55,040.00	
etention/Water Quality Facilities					\$183,312.00	
lemovals					\$0.00	
andscaping and Maintenance Improvements special Items (User Defined)					\$68,340.00 \$0.00	
ubtotal Capital Improvement Costs					\$306,692.00	
Additional Capital Improvement Costs					\$306,692.00	
Dewatering		\$3,066.92	L.S.		\$3,067.00	
Nobilization		5%			\$15,335.00	
raffic Control		\$15,334.60	L.S.		\$15,335.00	
tility Coordination/Relocation		\$15,334.60	L.S.		\$15,335.00	
tormwater Management/Erosion Control		5%			\$15,335.00	
ubtotal Additional Capital Improvement Costs					\$64,407.00	
Land Acquisition Costs						
OW/Easements					\$216,689.00	
ubtotal Land Acquisition Costs Other Costs (percentage of Capital Improv	(oment Costo)				\$216,689.00	
ingineering	ement Costs)	15%	-		\$55,665.00	
egal/Administrative		5%			\$18,555.00	
Contract Admin/Construction Management		10%			\$37,110.00	
Contingency		25%			\$92,775.00	
ubtotal Other Costs					\$204,105.00	
Total Capital Improvement Costs					\$791,893.00	
Master Play	Operation and Maintenanc	o Cost Summar				
Master Plan	operation and maintenance	Quantity	y Unit	Unit Cost	Total Annual Cost	
hescription Channel Maintenance (e.g. sediment & debris removal,	erosion tree & weed removal etc.)	1600	L.F.	\$3.00	\$4,800.00	
etention/WQ Maintenance (e.g. sediment & debris removal,		1 1	ACRE	\$2,010.00	\$2,010.00	
otal Annual Operation and Mainten					\$6,810.00	
	ance oust				90,010.00	
ffective Interest Rate					2.00%	

1/30/2019, 6:31 PM

SBB\_UD-MP Cost Version 2.2\_ND\_71st.xlsm, Min-Reach1

MAS	STER PLAN C	OST ESTIMAT	E FOR INDIVI	IDUAL RE	ACH		]
PROJECT :	Sharktooth Bluff						-
DRAINAGEWAY :	PLC						
REACH :	2						
JURISDICTION :	City of Greeley						1
REACH ID:	83rd Ave		JKD		DATE :	12/21/2018	
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
13	6	2	80	L.F.	\$3,079.08	\$246,326.00	
Channel Improvements							
Excavation, Mid Range			1043	C.Y.	\$32.00	\$33,376.00	
12-inch Riprap, Type M			33	C.Y.	\$80.00	\$2,607.00	
Removals							
Removal of culvert pipe (D<48")	]		70	L.F.	\$27.00	\$1,890.00	
Landscaping and Maintenance	Improvements						
Reclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined)							
Asphalt	<user defined="" item<="" td=""><td>s</td><td>58</td><td>TON</td><td>\$250.00</td><td>\$14,500.00</td><td></td></user>	s	58	TON	\$250.00	\$14,500.00	
	Master Pla	an Capital Impro	vement Cost Su	mmary			
Capital Improvement Costs						1	
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts Hydraulic Structures						\$246,326.00 \$0.00	
Channel Improvements						\$35,983.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$1,890.00	
Landscaping and Maintenance Improvements						\$1,340.00	
Special Items (User Defined)						\$14,500.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Co	-1-					\$300,039.00	
Dewatering	SIS		\$3,000.39	L.S.		\$3,000.00	
Mobilization			5%	2.0.		\$15,002.00	
Traffic Control			\$15,001.95	L.S.		\$15,002.00	
Utility Coordination/Relocation			\$15,001.95	L.S.		\$15,002.00	
Stormwater Management/Erosion Control			5%	1		\$15,002.00	
Subtotal Additional Capital Improvement Cos Land Acquisition Costs	its			_		\$63,008.00	
ROW/Easements						\$0.00	
Subtotal Land Acquisition Costs						\$0.00	
Other Costs (percentage of Capital	Improvement Costs)						
Engineering			15%			\$54,457.00	
Legal/Administrative			5%			\$18,152.00	
Contract Admin/Construction Management Contingency			10% 25%			\$36,305.00 \$90,762.00	
Subtotal Other Costs			2070			\$199,676.00	
Total Capital Improvement Cost	s					\$562,723.00	
rotar cupitar improvement cost						<i>vool,</i> 120.00	
Maeta	r Plan Operation	and Maintonan	ce Cost Summar	'V			
Description	i i ian operation	und mannellan	Quantity	y Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris rer	noval, erosion at entranc	e/exit, structural repairs,		L.F.	\$1.00	\$160.00	
Total Annual Operation and Ma				·		\$160.00	
Effective Interest Rate						2.00%	
Total Operation and Maintenan	ce Costs Over 5	) Years				\$5,028.00	
. otal operation and maintenan	00 00010 0101 01					w0,020.00	

							1
PROJECT : DRAINAGEWAY :	Sharktooth Bluff PLC						
DRAINAGEWAY : REACH :	3 2						
JURISDICTION :	City of Greeley						
REACH ID:	CR 62 Central Cro	ossing	JKD		DATE :	12/21/2018	
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Pipe Culverts and Storm Drains	s						
Circular Pipes	-						
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	50	1	50	L.F.	\$145.00	\$7,250.00	
Flare End Sections	1	1	T	r	1	1	
Diameter (in)	Applicable	No. of Barrels					
36-inch	Yes	1	2	EA	\$2,157.00	\$4,314.00	
Channel Improvements					1		
Excavation, Mid Range	-		133	C.Y.	\$32.00	\$4,256.00	
2-inch Riprap, Type M	-		7	C.Y.	\$80.00	\$560.00	
Landscaping and Maintenance	Improvements		-				
Reclamation & seeding (native grasses)	1		1	ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined)							
Asphalt	<user defined="" iten<="" td=""><td>ns</td><td>16</td><td>TON</td><td>\$250.00</td><td>\$4,000.00</td><td></td></user>	ns	16	TON	\$250.00	\$4,000.00	
Capital Improvement Costs Pipe Culverts and Storm Drains		an Capital Impro				\$11,564.00	
Concrete Box Culverts						\$0.00	
Hydraulic Structures						\$0.00	
Channel Improvements Detention/Water Quality Facilities						\$4,816.00 \$0.00	
Removals						\$0.00	
andscaping and Maintenance Improvements							
Special Items (User Defined)						\$1,340.00 \$4,000.00	
Subtotal Capital Improvement Costs						\$1,340.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Co	osts			1		\$1,340.00 \$4,000.00 <b>\$21,720.00</b>	
Subtotal Capital Improvement Costs Additional Capital Improvement Co Dewatering	osts		\$217.20	L.S.		\$1,340.00 \$4,000.00 <b>\$21,720.00</b> \$217.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Co Dewatering Mobilization	osts		5%			\$1,340.00 \$4,000.00 <b>\$21,720.00</b> \$217.00 \$1,086.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Co Dewatering vobilization Traffic Control	osts		5% \$1,086.00	L.S.		\$1,340.00 \$4,000.00 <b>\$21,720.00</b> \$217.00 \$1,086.00 \$1,086.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Co Dewatering Mobilization Fraffic Control Jility Coordination/Relocation	osts		5% \$1,086.00 \$1,086.00			\$1,340.00 \$4,000.00 \$21,720.00 \$1,086.00 \$1,086.00 \$1,086.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Co Dewatering Mobilization			5% \$1,086.00	L.S.		\$1,340.00 \$4,000.00 <b>\$21,720.00</b> \$217.00 \$1,086.00 \$1,086.00	
Subtol Capital Improvement Costs Additional Capital Improvement Cr Develoring Additional Capital Improvement Cr Development Cost Ally Coordination/Relocation Summater Management/Erosion Control Subtola Additional Capital Improvement Co Land Acquisition Costs			5% \$1,086.00 \$1,086.00	L.S.		\$1,340.00 \$4,000.00 \$21,720.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$4,561.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Co Develoring Mobilization Traffic Control Jilly Coordination/Relocation Subtotal Additional Capital Improvement Co Subtotal Additional Capital Improvement Co Land Acquisition Costs XOL/Easements			5% \$1,086.00 \$1,086.00	L.S.		\$1,340.00 \$4,000.00 \$21,720.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00	
Additional Capital Improvement Costs Additional Capital Improvement Cr Architecture Additional Capital Improvement Cr Altip Council and Capital Costs Subtotal Additional Capital Improvement Co Land Acquisition Costs XXV/Easements XXV/Easements	osts		5% \$1,086.00 \$1,086.00	L.S.		\$1,340.00 \$4,000.00 \$21,720.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$4,561.00	
Additional Capital Improvement Costs Additional Capital Improvement Co Develoring Additional Capital Improvement Co Development Costs Allity Coordination/Relocation Subtotal Additional Capital Improvement Co Land Acquisition Costs CW/Easements Other Costs (percentage of Capita Other Costs (percentage of Capita	osts		5% \$1,086.00 \$1,086.00 5%	L.S.		\$1,340.00 \$4,000.00 \$21,720.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,080.00 \$0,00	
Additional Capital Improvement Costs Additional Capital Improvement Ci Advitation Indific Control Ally Coordination/Relocation Subtotal Additional Capital Improvement Co Subtotal Additional Capital Improvement Co Land Acquisition Costs COV/Easements Subtotal Land Acquisition Costs Other Costs (percentage of Capita Opineering	osts		5% \$1,086.00 \$1,086.00 5%	L.S.		\$1,340.00 \$4,000.00 \$21,720.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,080.00 \$3,080.00 \$3,042.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Co Jewalaring Mobilization Taffic Control Jilly Coordination/Relocation Sumwater Management/Erosion Control Subtotal Additional Capital Improvement Co Lind Acquisition Costs OV/Eleaments Subtotal Land Acquisition Costs Other Costs (percentage of Cepita regimenting oggi/Administrative	osts		5% \$1,086.00 \$1,086.00 5% 15% 5%	L.S.		\$1,340.00 \$4,000.00 \$21,720.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,080.00 \$1,080.00 \$3,040.00 \$3,042.00 \$1,314.00	
Additional Capital Improvement Costs Additional Capital Improvement Ci Advitation Indific Control Ally Coordination/Relocation Subtotal Additional Capital Improvement Co Subtotal Additional Capital Improvement Co Land Acquisition Costs COV/Easements Subtotal Land Acquisition Costs Other Costs (percentage of Capita Opineering	osts		5% \$1,086.00 \$1,086.00 5%	L.S.		\$1,340.00 \$4,000.00 \$21,720.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,080.00 \$3,080.00 \$3,042.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Co Additional Capital Improvement Co Additional Capital Improvement Co Software Management/Erosion Control Subtotal Additional Capital Improvement Co Lund Acquisition Costs Zubtotal Land Acquisition Costs Other Costs (percentage of Cepita Genering Other Costs (percentage of Cepita Genering) Contract Admini/Construction Management	osts		5% \$1,086.00 \$1,086.00 5% 15% 5% 10%	L.S.		\$1,340.00 \$4,000.00 \$21,720.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$3,086.00 \$3,086.00 \$3,086.00 \$3,086.00 \$3,082.00 \$3,042.00 \$3,042.00 \$2,628.00	
substal Capital Improvement Costs Additional Capital Improvement Co bevalering biblication Taffic Control Its Coordination/Relocation Its Coordination/Relocation Its Coordination/Relocation Its Coordination Regulation Costs UNE assements UNE assements UNE assements UNE assements UNE assements United Land Acquisition Costs Onther Costs (percentiage of Cepita Repering Onther Costs (percentiage of Cepita Repering Contract Administrative United United Costs United Costs (percentiage of Cepita Repering)	al Improvement Costs)		5% \$1,086.00 \$1,086.00 5% 15% 5% 10%	L.S.		\$1,340.00 \$4,000.00 \$21,720.00 \$1,066.00 \$1,066.00 \$1,066.00 \$1,066.00 \$1,066.00 \$1,066.00 \$1,066.00 \$1,066.00 \$1,066.00 \$1,060.00 \$1,042.00 \$0,00 \$3,042.00 \$1,314.00 \$2,028.00 \$5,770.00	
ubtotal Capital Improvement Costs Additional Capital Improvement Co ewatering Dollzation Tifle Control Billy Coordination/Relocation Ontwater Management/Erosion Control Ubtotal Additional Capital Improvement Co Land Acquisition Costs Other Gosts (percentage of Cepita Other Gosts (percentage of Cepita Other Gosts (percentage of Cepita Other Costs (percentage of Cepital Other Costs (percentage of Cepital Other Costs)	al Improvement Costs) ts	and Mainter-re-	5% \$1,086.00 \$1,086.00 5% 15% 5% 10% 25%	LS. LS.		\$1,340.00 \$4,000.00 \$21,720.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$3,040 \$3,042.00 \$3,342.00 \$3,342.00 \$1,344.00 \$1,4454.00	
satotal Capital Improvement Costs Additional Capital Improvement Co Advances Capital Improvement Co Advisation Taffic Control May Coordinator/Relocation Sommeter Management/Erosion Control Matotal Additional Capital Improvement Co Land Acquisition Costs (Wirklasaments Watotal Land Acquisition Costs (Wirklasaments) Watotal Capital Improvement Costs (Contract AdminisConstruction Management Contingency) Matotal Capital Improvement Costs Fotal Capital Improvement Costs	al Improvement Costs)	n and Maintenan	5% \$1,086.00 \$1,086.00 5% 15% 5% 10% 25%	LS. LS.	Unit Cost	\$1,340.00 \$4,000.00 \$21,720.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$3,040 \$3,042.00 \$3,342.00 \$3,342.00 \$1,344.00 \$1,4454.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Co Devalening Additional Capital Improvement Co Devalening Additional Capital Improvement Co Subtotal Additional Capital Improvement Co Land Acquisition Costs OV/Easements Subtotal Land Acquisition Costs Other Costs (percentage of Cepita Engineering oga/Administratve Confract Admin/Construction Management Confingency Subtotal Other Costs Total Capital Improvement Costs	al Improvement Costs) ts er Plan Operation		5% \$1,089.00 \$1,089.00 5% 15% 5% 10% 25% Ce Cost Summan Quantity	LS. LS.	Unit Cost \$1.00	\$1.340.00 \$4,000.00 \$217,20.00 \$1.086.00 \$1.086.00 \$1.086.00 \$1.086.00 \$1.086.00 \$3.086.00 \$3.086.00 \$3.086.00 \$3.086.00 \$3.080 \$3.942.00	
Sabtolal Capital Improvement Costs Additional Capital Improvement Co Advances of Capital Improvement Co Advitation Capital Improvement Co Advitation Control Improvement Control Improvement Costs Control Costs (percentiage of Capita Control Costs (percentiage of Capita Costs) Cost Capital Improvement Costs Cost Capital Improvement Costs Cost Capital Costs (Capital Costs) Cost Costs (Capital Co	nets al Improvement Cost()) ts er Plan Operation arroval, erosion at entrans	ce/exit, structural repairs,	5% \$1,089.00 \$1,089.00 5% 15% 5% 10% 25% Ce Cost Summan Quantity	LS. LS.		\$1,340.00 \$4,000.00 \$21,720.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,086.00 \$1,088.00 \$4,086.00 \$4,561.00 \$0.00 \$3,042.00 \$3,942.00 \$1,314.00 \$2,628.00 \$4,454.00 \$14,456.00 \$14,456.	
Additional Capital Improvement Costs Additional Capital Improvement Co Jowatering Molization Taffic Centrol Mity Coordination/Relocation Simular Management/Erosition Control Subtotal Additional Capital Improvement Co Land Acquisition Costs Other Costs (percentage of Capital Subtotal Land Acquisition Costs Other Costs (percentage of Capital Genering) Subtotal Other Costs Confragency Subtotal Other Costs Confingency Subtotal Other Costs	nets al Improvement Cost()) ts er Plan Operation arroval, erosion at entrans	ce/exit, structural repairs,	5% \$1,089.00 \$1,089.00 5% 15% 5% 10% 25% Ce Cost Summan Quantity	LS. LS.		\$1,340.00 \$4,000.00 \$21,720.00 \$1,086.00 \$1,08	

MAST	ER PLAN C	OST ESTIMAT	E FOR INDIVI	DUAL RE	ACH		
PROJECT :	Sharktooth Bluff						_
DRAINAGEWAY :	PLC						
REACH :	3						_
JURISDICTION : REACH ID:	City of Greeley CR 62 East Crossi	~~	JKD		DATE :	12/21/2018	
REACH ID.	GR 62 East Grossi	ng	510		DATE .	12/2 // 2010	
DEGODIDION						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	4	1	100	L.F.	\$1,095.16	\$109,516.00	
Headwall and Toewalls					1	1	
Individual Box Span (ft) 12	No. of Barrels	Total Span (ft) 14.00	2	FA	\$1,343.16	\$2,686.00	
Wingwalls (includes wingwalls on eith	er side of channel ar	nd concrete apron)	2		01,040.10	92,000.00	
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
12	4	1	2	EA	\$9,735.48	\$19,471.00	
Channel Improvements					-		
xcavation, Mid Range			600	C.Y. C.Y.	\$32.00	\$19,200.00	Culvert
2-inch Riprap, Type M ixcavation, Mid Range			16 2300	C.Y. C.Y.	\$80.00 \$32.00	\$1,303.00 \$73,600.00	Culvert 675 ft channel downstream of CR 62 to PLC
2-inch Riprap, Type M			16	C.Y.	\$80.00	\$1,280.00	Downstream confluence
Removals							
Removal of culvert pipe (D<48")			50	L.F.	\$27.00	\$1,350.00	
andscaping and Maintenance Im	provements						
Vetlands Plantings			2	ACRE	\$33,500.00	\$71,522.00	
Reclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00	
rail/Path, Concrete (10' Width)			50	L.F.	\$59.00	\$2,950.00	
Special Items (User Defined)							
Asphalt <	User Defined Item	5	33	TON	\$250.00	\$8,250.00	
	Marsten Die						
Capital Improvement Costs	Master Pla	in Capital Improv	ement Cost Sur	nmary			
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts						\$131,673.00	
lydraulic Structures						\$0.00	
Channel Improvements Detention/Water Quality Facilities						\$95,383.00 \$0.00	
Removals						\$1,350.00	
andscaping and Maintenance Improvements						\$75,812.00	
Special Items (User Defined)						\$8,250.00	
Subtotal Capital Improvement Costs						\$312,468.00	
Additional Capital Improvement Costs Dewatering			\$3,124.68	L.S.		\$3,125.00	
Nobilization			5%	L.O.		\$15,623.00	
raffic Control			\$15,623.40	L.S.		\$15,623.00	
Milty Coordination/Relocation			\$15,623.40	L.S.		\$15,623.00	
Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Costs			5%			\$15,623.00 \$65,617.00	
Land Acquisition Costs						\$65,617.00	
OW/Easements						\$0.00	
ubtotal Land Acquisition Costs						\$0.00	
dubtotal Land Acquisition Costs						\$56,713.00	
Other Costs (percentage of Capital Im	provement Costs)		450/				
Other Costs (percentage of Capital Im ingineering	provement Costs)		15%				
Other Costs (percentage of Capital Im ngineering egal/Administrative	provement Costs)		15% 5% 10%			\$18,904.00 \$37,809.00	
Other Costs (percentage of Capital Im ngineering egal/Administrative contract Admin/Construction Management iontingency	provement Costs)		5%			\$18,904.00 \$37,809.00 \$94,521.00	
Other Costs (percentage of Capital Im ngineering egal/Administrative ontract Admin/Construction Management ontingency ubtotal Other Costs	provement Costs)		5% 10%			\$18,904.00 \$37,809.00 \$94,521.00 <b>\$207,947.00</b>	
Other Costs (percentage of Capital Im ngineering ggal/Administrative ontract Admin/Construction Management ontingency ubtotal Other Costs	provement Costs)		5% 10%			\$18,904.00 \$37,809.00 \$94,521.00	
Other Costs (percentage of Capital Im opering split/Administrative ontract AdminiConstruction Management ontragency ubtotal Other Costs 'otal Capital Improvement Costs	provement Costs)	and Maintenanc	5% 10% 25%	v		\$18,904.00 \$37,809.00 \$94,521.00 <b>\$207,947.00</b>	
Other Costs (percentage of Capital Im regimeering gagAdministrative ontract Admin/Construction Management ontragency ubtotal Other Costs Total Capital Improvement Costs Master P	provement Costs) Plan Operation	and Maintenanc	5% 10% 25%	Unit	Unit Cost	\$18,904.00 \$37,809.00 \$94,521.00 <b>\$207,947.00</b>	
Other Costs (percentage of Capital Im ngineering egglAdministrative ontract AdminConstruction Management ontragency ubtotal Other Costs Total Capital Improvement Costs Master P escription ubert Maintenance (e.g. sediment & debris remov	al, erosion at entrance	e/exit, structural repairs, e	5% 10% 25% e Cost Summar Quantity 100	Unit L.F.	\$1.00	\$18,904.00 \$37,809.00 \$94,521.00 <b>\$207,947.00</b> <b>\$586,032.00</b> Total Annual Cost \$100.00	
Other Costs (percentage of Capital Im onger/Administrative orderated Admin/Construction Management contingency: uabitatal Other Costs <b>Costal Capital Improvement Costs</b> Master P escription Juant Maintenance (e.g. sediment & debris remov harned Maintenance (e.g. sediment & debris remov	al, erosion at entranci oval, erosion, tree & w	e/exit, structural repairs, e	5% 10% 25% e Cost Summar Quantity	Unit		\$18,904.00 \$37,809.00 \$94,521.00 <b>\$207,947.00</b> <b>\$586,032.00</b> <b>Total Annual Cost</b> \$100.00 \$2,025.00	
Other Costs (percentage of Capital Im engli/Administrative eggil/Administrative ontract AdminiConstruction Management ontract AdminiConstruction Management outboth Other Costs Total Capital Improvement Costs Master P escription utvert Mainenance (e.g. sediment & debris remo- fotal Annual Operation and Maini	al, erosion at entranci oval, erosion, tree & w	e/exit, structural repairs, e	5% 10% 25% e Cost Summar Quantity 100	Unit L.F.	\$1.00	\$18,904.00 \$37,809.00 \$94,521.00 \$207,947.00 \$586,032.00 Total Annual Cost \$100.00 \$2,025.00 \$2,125.00	
Other Costs (percentage of Capital Im regineering egal/Administrative contract Admin Construction Management contragency ubtotal Other Costs Total Capital Improvement Costs	ral, erosion at entrance oval, erosion, tree & w tenance Cost	e/exit, structural repairs, e eed removal, etc.)	5% 10% 25% e Cost Summar Quantity 100	Unit L.F.	\$1.00	\$18,904.00 \$37,809.00 \$94,521.00 <b>\$207,947.00</b> <b>\$586,032.00</b> <b>Total Annual Cost</b> \$100.00 \$2,025.00	

PROJECT :	Sharktooth Bluff						
DRAINAGEWAY :	PLC			-			
REACH :	3						
JURISDICTION :	City of Greeley						
REACH ID:	CR 62 West Cross	ing	Enter Estimator Nam	e on Project Info	DATE :	12/21/2018	
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe Individual Box Span (ft)	Pey Height (8)	No. of Barrels	Longth (ft)		1	1	
12	Box Height (ft) 4	NO. OT Barreis	Length (ft) 100	L.F.	\$1,095.16	\$109,516.00	
Headwall and Toewalls			100		\$1,000.10	\$100,010.00	
Individual Box Span (ft)	No. of Barrels	Total Span (ft)	1		1		
12	1	14.00	2	EA	\$1,343.16	\$2,686.00	
Wingwalls (includes wingwalls on ei		nd concrete apron)					
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels		L			
12	4	1	2	EA	\$9,735.48	\$19,471.00	
Channel Improvements							
Excavation, Mid Range	ł		630	C.Y.	\$32.00	\$20,160.00	
2-inch Riprap, Type M	1		16	C.Y.	\$80.00	\$1,303.00	
andscaping and Maintenance	Improvements						
Reclamation & seeding (native grasses)	1		1	ACRE	\$1,340.00	\$1,340.00	
Trail/Path, Concrete (10' Width)	1		50	L.F.	\$59.00	\$2,950.00	
Special Items (User Defined)							
	<user defined="" item<="" td=""><td>s</td><td>18</td><td>TON</td><td>\$250.00</td><td>\$4,500.00</td><td></td></user>	s	18	TON	\$250.00	\$4,500.00	
ipe Culverts and Storm Drains oncrete Box Culverts						\$0.00 \$131,673.00	
łydraulic Structures						\$0.00	
Channel Improvements Detention/Water Quality Facilities						\$21,463.00 \$0.00	
Removals						\$0.00	
andscaping and Maintenance Improvements						\$4,290.00	
Special Items (User Defined)						\$4,500.00	
Subtotal Capital Improvement Costs						\$161,926.00	
Additional Capital Improvement Cos	sts					\$161,926.00	
Additional Capital Improvement Cos Dewatering	sts		\$1,619.26	L.S.		\$161,926.00 \$1,619.00	
Additional Capital Improvement Cos Dewatering Vobilization	sts		5%			\$161,926.00 \$1,619.00 \$8,096.00	
Additional Capital Improvement Cos Dewatering Mobilization Fraffic Control	sts		5% \$8,096.30	L.S.		\$161,926.00 \$1,619.00 \$8,096.00 \$8,096.00	
Additional Capital Improvement Cos Dewatering Mobilization fraffic Control Traffic Control Dilty Coordination/Relocation	sts		5%			\$161,926.00 \$1,619.00 \$8,096.00	
Additional Capital Improvement Cos Dewatering Mobilization Traffic Control			5% \$8,096.30 \$8,096.30	L.S.		\$161,926.00 \$1,619.00 \$8,096.00 \$8,096.00 \$8,096.00	
Additional Gapital Improvement Cos Jewatering Molizaton Taffic Control Mity CoordinationRetocation Stormwater Management/Erosion Control Subtoal Additional Capital Improvement Cos Land Acquisition Costs			5% \$8,096.30 \$8,096.30	L.S.		\$1,619,00 \$8,096.00 \$8,096.00 \$8,096.00 \$8,096.00 \$8,096.00 \$3,096.00	
Additional Capital Improvement Cos Additional Capital Improvement Cos Molization Inglic Control National Cost Inglic Control Witholal Additional Capital Improvement Cos Lund Acquisition Costs (LV/Essements)			5% \$8,096.30 \$8,096.30	L.S.		\$161,926.00 \$1,619.00 \$8,096.00 \$8,096.00 \$8,096.00 \$8,096.00 \$34,003.00 \$0.00	
Additional Gapital Improvement. Cos Jewataring Kolizateon Tafflic Control Nilly Coordination/Relocation Jisty Coordination/Relocation Jubiotal Additional Capital Improvement Cost Land Acquisition Costs XUV/Easements Jubiotal Land Acquisition Costs	sts		5% \$8,096.30 \$8,096.30	L.S.		\$1,619,00 \$8,096.00 \$8,096.00 \$8,096.00 \$8,096.00 \$8,096.00 \$3,096.00	
Additional Capital Improvement Cos wantering Utilization Taffic Control Network Management/Erosion Control Ubitral Additional Capital Improvement Cos Land Acquisition Costs CuF-Essements Utilizational Capital Costs Other Costs (percentage of Capital Other Costs (percentage of Capital	sts		5% \$8,096.30 \$8,096.30 5%	L.S.		\$161,926.00 \$1,619.00 \$8,096.00 \$8,096.00 \$8,096.00 \$8,096.00 \$34,003.00 \$34,003.00 \$0.00 \$0.00	
Additional Gapital Improvement Cos wentering biblization farfic Control and Costan Stromwater Management/Erosion Control whotolal Additional Capital Improvement Cost Land Acquisition Costs VU/Essements whotal Land Acquisition Costs Other Costs (purcentage of Capital ngineering	sts		5% \$8,096.30 \$8,096.30 5% 15%	L.S.		\$161,926.00 \$1,619.00 \$8,096.00 \$8,096.00 \$8,096.00 \$3,096.00 \$3,096.00 \$3,000 \$3,000 \$0,00 \$0,00 \$0,00	
Additional Capital Improvement Cos Jevatering Additation Taffic Control Jarrender Management/Erositon Jarrender Management/Erositon Control Jubitoral Additional Capital Improvement Cos Land Acquisition Costs CW/Easements Differ Costs Other Costs (percentage of Capital Ingineering oggi/Administrative	sts		5% \$3,096.30 \$% 5% 15% 5%	L.S.		\$161,926.00 \$1,619.00 \$4,096.00 \$4,096.00 \$4,096.00 \$4,096.00 \$4,096.00 \$4,096.00 \$4,090.00 \$0.00 \$0.00 \$29,389.00 \$7,950.00	
Additional Gapital Improvement Cos wentering tobilization faffic Control of Microsoft formwater Management/Erosion Control whotolal Additional Capital Improvement Cost Land Acquisition Costs CV/Essements whotal Land Acquisition Costs Chiner Costs, percentage of Capital ngineering	sts		5% \$8,096.30 \$8,096.30 5% 15%	L.S.		\$161,926.00 \$1,619.00 \$8,096.00 \$8,096.00 \$8,096.00 \$3,096.00 \$3,096.00 \$3,000 \$3,000 \$0,00 \$0,00 \$0,00	
Additional Capital Improvement Cos wantering tbit/Zation affic Control Bity CoordinationRelocation Bity CoordinationRelocation Usional Adjustion Costs Uk/Casements Ubitof Additional Capital Improvement Cost Uk/Casements Ubitof Costs (percentage of Capital Other Costs (percentage of Capital	sts		5% \$8,096.30 \$8,096.30 5% 15% 5% 10%	L.S.		\$161,926.00 \$1,619.00 \$3,096.00 \$3,096.00 \$3,096.00 \$3,096.00 \$3,096.00 \$3,096.00 \$3,090.00 \$3,000 \$0,000 \$0,0000 \$0,000 \$0,000 \$0,0000 \$0	
Additional Capital Improvement Cos eventering Ubilization affic Control of Wills Coordination (Section formwater Management Erssion Control Ubital Additional Capital Improvement Cost Land Acquisition Costs UK/Essements Ubital Land Acquisition Costs Other Costs (percentage of Capital Inglenering egal/Administrative contract Admin Construction Management contract Admin Construction Management contract Admin Construction Management contract Admin Construction Management	its Improvement Coste)		5% \$8,096.30 \$8,096.30 5% 15% 5% 10%	L.S.		\$161,926.00 \$1,619.00 \$3,096.00 \$3,096.00 \$3,096.00 \$3,096.00 \$3,096.00 \$3,096.00 \$3,090 \$0,000 \$0,0	
Additional Capital Improvement Cos wavening thilization raftic Control Mity CoordinationRelocation Mity CoordinationRelocation Motional Adquisition Costs Course Costs Course Costs (percentage of Capital Ingineering ogel/Administrative contract Admini Construction Management contingency ubbotal Other Costs Costs (Costs (Costs) Costs) (Construction Management Contage) (Construction Management Contage) (Costs) (Costs) Costs) (Cos	its Improvement Costs) \$	and Maintener	5% \$8,096.30 \$8,096.30 5% 5% 10% 25%	LS. LS.		\$161,926.00 \$1,619.00 \$2,096.00 \$2,096.00 \$2,096.00 \$2,096.00 \$3,096.00 \$3,090.00 \$0,00 \$0,00 \$29,389.00 \$29,389.00 \$3,780.00 \$3,167,780.00 \$10,7760.00	
Additional Capital Improvement Cos weatering Wolfization Taffic Control Nilly Coordination/Relocation Nilly Coordination/Relocation Nilly Coordination/Relocation Nilly Coordination Land Acquisition Costs Uther Acquisition Costs Other Costs (percentage of Capital Ingineering) egal/Administrative contract Admin Construction Management contagency Wolfcat Costs Total Capital Improvement Costs	its Improvement Costs) \$	and Maintenar	5% \$3,006.30 \$8,065.30 5% 15% 5% 10% 25%	LS. LS.	Unit Cost	\$161,926.00 \$1,619.00 \$8,096.00 \$8,096.00 \$8,096.00 \$8,096.00 \$4,095.00 \$0,000 \$0,0000 \$0,0000 \$0,0000 \$0,0000 \$0,0000 \$0	
Additional Capital Improvement Cos wavening thilization raftic Control Mity CoordinationRelocation Mity CoordinationRelocation Motional Adquisition Costs Course Costs Course Costs (percentage of Capital Ingineering ogel/Administrative contract Admini Construction Management contingency ubbotal Other Costs Costs (Costs (Costs) Costs) (Construction Management Contage) (Construction Management Contage) (Costs) (Costs) Costs) (Cos	its Improvement Costs) S r Plan Operation		5% 58,069.30 58,069.30 5% 15% 5% 10% 25% 25%	LS. LS.	Unit Cost \$1.00	\$161,926.00 \$1,619.00 \$2,096.00 \$2,096.00 \$2,096.00 \$2,096.00 \$3,096.00 \$3,090.00 \$0,00 \$0,00 \$29,389.00 \$29,389.00 \$3,780.00 \$3,167,780.00 \$10,7760.00	
Additional Capital Improvement Cost watering thilization raftic Control Mitry Coordination/Relocation termwater ManagementErosion Control ubitofal Additional Capital Improvement Cost Land Acquisition Costs Other Costs Other Costs Other Costs (percentage of Capital Ingineering age/Administrative Contract Admini/Construction Management Contract Capital Improvement Costs Costal Capital Improvement Costs Master tescription	inprovement Costs) S r Plan Operation movel, erosion at entranc		5% 58,069.30 58,069.30 5% 15% 5% 10% 25% 25%	LS. LS. Y Unit		\$161,926.00 \$1,619.00 \$3,066.00 \$3,066.00 \$3,066.00 \$3,066.00 \$3,066.00 \$3,066.00 \$3,066.00 \$3,060.00 \$3,000 \$0,00 \$0,00 \$0,00 \$0,00 \$0,00 \$0,706.00 \$10,706.00 \$10,77600	
Additional Capital Improvement Cos wavefariog bbilization iraffic Control bilitation farmater Management/Socialism Costs Unitotal Additional Capital Improvement Cost Land Acquisition Costs UNEssements ubtotal Land Acquisition Costs Other Costs (percentage of Capital Ingineering gegi/Administrative Contract Admini/Construction Management Contract Admini Construction Management Contract Admini Construction Management Contract Capital Improvement Costs Master Isoscription Juhert Maintence (e.g. sedment & debris rem	inprovement Costs) S r Plan Operation movel, erosion at entranc		5% 58,069.30 58,069.30 5% 15% 5% 10% 25% 25%	LS. LS. Y Unit		\$161,926.00 \$1,619.00 \$3,096.00 \$3,096.00 \$3,096.00 \$3,096.00 \$3,096.00 \$3,096.00 \$3,096.00 \$3,096.00 \$0,00 \$0,00 \$0,00 \$0,00 \$19,593.00 \$19,593.00 \$19,593.00 \$19,593.00 \$19,593.00 \$10,796.00 \$10,796.00 \$10,796.00 \$10,796.00 \$10,796.00 \$10,796.00 \$10,796.00 \$10,500 \$10,796.00 \$10,500 \$10,	

MAS	TER PLAN C	OST ESTIMAT	E FOR INDIVI	DUAL RE	ACH		
PROJECT :	Sharktooth Bluff						
DRAINAGEWAY :	SKD						
REACH :	3						
JURISDICTION : REACH ID:	City of Greeley 4th St Central - Mi	nimum Critoria	JKD		DATE :	12/21/2018	
REACH ID.	401 St Gentral - M		JRD		DATE .	12/21/2010	
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
48-inch	50	1	50	L.F.	\$193.00	\$9,650.00	
Flare End Sections			1 1	1	1	1	
Diameter (in) 48-inch	Applicable Yes	No. of Barrels	2	EA	\$2,760.00	\$5,520.00	
	162		4	EA	\$2,700.00	\$3,520.00	
Channel Improvements			100				
Excavation, Mid Range 12-inch Riprap, Type M			167 13	C.Y. C.Y.	\$32.00 \$80.00	\$5,344.00 \$1.040.00	
	here we we we we the		13	U. Y.	\$00.00	\$1,040.00	
Landscaping and Maintenance	improvements						
Reclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined)							
Asphalt	<user defined="" item<="" td=""><td>S</td><td>18</td><td>TON</td><td>\$250.00</td><td>\$4,500.00</td><td></td></user>	S	18	TON	\$250.00	\$4,500.00	
	Master Pla	an Capital Improv	vement Cost Sur	mmary			
Capital Improvement Costs							
Pipe Culverts and Storm Drains						\$15,170.00	
Concrete Box Culverts Hydraulic Structures						\$0.00 \$0.00	
Channel Improvements						\$6,384.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$0.00	
Landscaping and Maintenance Improvements						\$1,340.00	
Special Items (User Defined)						\$4,500.00	
Subtotal Capital Improvement Costs						\$27,394.00	
Additional Capital Improvement Co	sts						
Dewatering			\$273.94	L.S.		\$274.00	
Mobilization			5%	1.0		\$1,370.00	
Traffic Control Utility Coordination/Relocation			\$1,369.70 \$1,369.70	L.S.		\$1,370.00 \$1,370.00	
Stormwater Management/Erosion Control			5%	L.U.		\$1,370.00	
Subtotal Additional Capital Improvement Cos	ts					\$5,754.00	
Land Acquisition Costs							
ROW/Easements						\$0.00	
Subtotal Land Acquisition Costs						\$0.00	
Other Costs (percentage of Capital	Improvement Costs)						
Engineering			15%			\$4,972.00	
Legal/Administrative Contract Admin/Construction Management			5% 10%			\$1,657.00 \$3,315.00	
Contract Admin/Construction Management Contingency			25%			\$3,315.00	
Subtotal Other Costs			2010			\$18,231.00	
Total Capital Improvement Cost	s					\$51,379.00	
						,,	
	r Plan Operation	and Maintenan	Ce Cost Summar Quantity	Y Unit	Unit Cost	Total Annual Cost	
Description Culvert Maintenance (e.g. sediment & debris ren	noval erosion at entranc	e/exit_structural repairs	Quantity e 50	L.F.	\$1.00	S100.00	
Total Annual Operation and Ma		orow, autourarrepalls,	y 30	Let .	\$1.00	\$100.00	
Effective Interest Rate	internative COSt					2.00%	
Total Operation and Maintenan	co Coste Over E	Voare				\$3.142.00	
Total Operation and Maintenan	Le Cosis Over 5	u rears				<b>\$</b> 3,142.00	

	STER PLAN C	OST ESTIMAT	E FOR INDIVI	DUAL RE	ACH		
PROJECT :	Sharktooth Bluff						
DRAINAGEWAY :							
REACH :							
JURISDICTION :							
REACH ID:	4th Street Eastern	n - Min Criteria	JKD		DATE :	12/21/2018	
				. <u> </u>	1		
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Pipe Culverts and Storm Drain	S						
Circular Pipes	-		1		1	1	
Diameter (in)	Length (ft)	No. of Barrels					
48-inch Flare End Sections	50	1	50	L.F.	\$193.00	\$9,650.00	
Diameter (in)	Applicable	No. of Barrels	1		1		
48-inch	Yes	1	2	EA	\$2,760.00	\$5,520.00	
Channel Improvements	100		~		QL,100.00	\$0,020.00	
Excavation. Mid Range			167	C.Y.	\$32.00	\$5,344.00	
2-inch Riprap, Type M	-		167	C.Y. C.Y.	\$32.00	\$5,344.00 \$1,040.00	
			15	0.1.	900.00	\$1,040.00	
andscaping and Maintenance	s improvements			4005	C1 040 00	C1 040 00	
Reclamation & seeding (native grasses)	_		1	ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined)	_						
Asphalt	<user defined="" item<="" td=""><td>IS</td><td>18</td><td>TON</td><td>\$250.00</td><td>\$4,500.00</td><td></td></user>	IS	18	TON	\$250.00	\$4,500.00	
	Master Pla	an Capital Improv	vement Cost Sur	mmary			
Capital Improvement Costs						1	
Pipe Culverts and Storm Drains						\$15,170.00	
Concrete Box Culverts						\$0.00	
tydraulic Structures						\$0.00	
Channel Improvements						\$6,384.00	
Detention/Water Quality Facilities Removals						\$0.00 \$0.00	
andscaping and Maintenance Improvements						\$1,340.00	
Special Items (User Defined)						\$4,500.00	
Subtotal Capital Improvement Costs							
Additional Capital Improvement Co	osts						
						\$27,394.00	
Dewatering			\$273.94	L.S.		\$27,394.00	
			\$273.94 5%	L.S.			
Dewatering				L.S.		\$274.00	
Dewatering Abbilization Traffic Control Jility Coordination/Relocation			5% \$1,369.70 \$1,369.70			\$274.00 \$1,370.00 \$1,370.00 \$1,370.00	
Jewatering Mobilization Traffic Control Mility Coordination/Relocation Stormwater Management/Erosion Control			5% \$1,369.70	L.S.		\$274.00 \$1,370.00 \$1,370.00 \$1,370.00 \$1,370.00	
Jewatering Abilization Taffic Control Jilliy Coordination/Relocation Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Co			5% \$1,369.70 \$1,369.70	L.S.		\$274.00 \$1,370.00 \$1,370.00 \$1,370.00	
Jewatering Mobilization Taffic Control Xility Coordination/Relocation Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Co Land Acquisition Costs			5% \$1,369.70 \$1,369.70	L.S.		\$274.00 \$1,370.00 \$1,370.00 \$1,370.00 \$1,370.00 \$5,754.00	
Jewatering Jobilization Trific Control Xilly Coordination/Relocation Stormwater Management/Erosion Control subtotal Additional Capital Improvement Co Land Acquisition Costs COV/Easements			5% \$1,369.70 \$1,369.70	L.S.		\$274.00 \$1,370.00 \$1,370.00 \$1,370.00 \$1,370.00 \$5,754.00 \$0.00	
Jewatering dokization Taffic Control Bity Coordination/Relocation Bity Coordination/Relocation Somwater Management/Erosion Control Subtoal Additional Capital Improvement Co Land Acquisition Costs Autotal Land Acquisition Costs	osts		5% \$1,369.70 \$1,369.70	L.S.		\$274.00 \$1,370.00 \$1,370.00 \$1,370.00 \$1,370.00 \$5,754.00	
Jewatering doklization 'raffic Control Jilly Coordination/Relocation Stormater Management/Erosion Control Jubiotal Additional Capital Improvement Co Land Aquilistion Costs COW/Easements Jubiotal Land Aquilistion Costs Other Costs (percentage of Capit	osts		5% \$1,369.70 \$1,369.70 5%	L.S.		\$274.00 \$1,370.00 \$1,370.00 \$1,370.00 \$1,370.00 \$5,754.00 \$0.00 \$0.00 \$0.00	
Jewatering dobitzation Taffic Control Jilly Coordinator/Nelocation Jilly Coordinator/Nelocation Starmweler Management For Land Acquisition Costs CW/Easements Woltrotal Land Acquisition Costs Other Costs (percentage of Cepit regineering	osts		5% \$1,369.70 \$1,369.70 5%	L.S.		\$274.00 \$1,370.00 \$1,370.00 \$1,370.00 \$1,370.00 \$5,754.00 \$0.00 \$0.00 \$4,972.00	
Jewatering dokiization raffic Control Nily Coordination/Relocation Subtotal Additional Capital Improvement CC Land Acquisition Costs COV/Easements Subtotal Land Acquisition Costs Other Costs (percentage of Capit AgriArdministative	osts		5% \$1,369.70 \$1,369.70 5%	L.S.		\$274.00 \$1,370.00 \$1,370.00 \$1,370.00 \$1,370.00 \$5,754.00 \$5,754.00 \$0.00 \$4,972.00 \$1,657.00	
Jewatering Jobitzation Taffic Control Bity Coordination/Relocation Stormweter Management/Foresion Control Subtotal Additional Capital Improvement Cod Multical Land Acquisition Costs Witefoal Land Acquisition Costs Uniter Costs (percentage of Cepits Onter Costs (percentage of Cepits)	osts		5% \$1,369.70 5% 15% 5% 10%	L.S.		\$274.00 \$1.370.00 \$1.370.00 \$1.370.00 \$1.370.00 \$1.370.00 \$1.370.00 \$5.754.00 \$0.00 \$0.00 \$4.972.00 \$1.657.00 \$3.315.00	
Jewatering dokization raffic Control Mity Coordination/Relocation Subtotal Additional Capital Improvement Co- Land Acquisition Costs Other Costs Other Costs (percentage of Cepit gainering gai/Administrative Contract Admin/Construction Management Confingency	osts		5% \$1,369.70 \$1,369.70 5%	L.S.		\$274.00 \$1.370.00 \$1.370.00 \$1.370.00 \$1.370.00 \$5.764.00 \$0.00 \$0.00 \$4.972.00 \$1.657.00 \$3.315.00 \$8.287.00	
exetatring biblization raffic Control Bity Coordination/Relocation tormwater Management/Erosion Control ubotal Additional Capital Improvement Co- Lund Acquisition Costs United Land Acquisition Costs Other Costs (percentage of expit genering aga/Administrative ubotal Land Acquisition Costs United Costs (percentage of expit order Administrative United Costs (percentage of expit order Administrative United Costs (percentage of expit order Administrative United Costs (percentage of expit order Costs)	osts al Improvement Costs)		5% \$1,369.70 5% 15% 5% 10%	L.S.		\$274.00 \$1.370.00 \$1.370.00 \$1.370.00 \$1.370.00 \$5,754.00 \$0.00 \$0.00 \$4.972.00 \$1.687.00 \$3.315.00 \$3.315.00 \$3.315.00 \$1.8231.00	
exetatring biblization raffic Control Bity Coordination/Relocation tormwater Management/Erosion Control ubotal Additional Capital Improvement Co- Lund Acquisition Costs United Land Acquisition Costs Other Costs (percentage of expit genering aga/Administrative ubotal Land Acquisition Costs United Costs (percentage of expit order Administrative United Costs (percentage of expit order Administrative United Costs (percentage of expit order Administrative United Costs (percentage of expit order Costs)	osts al Improvement Costs)		5% \$1,369.70 5% 15% 5% 10%	L.S.		\$274.00 \$1.370.00 \$1.370.00 \$1.370.00 \$1.370.00 \$5.764.00 \$0.00 \$0.00 \$4.972.00 \$1.657.00 \$3.315.00 \$8.287.00	
levatering behization traffic Control Billy Coordination/Relocation Billy Coordination/Relocation Billy Coordination/Relocation Summater Management/Erosion Control ubtotal Additional Capital Improvement Co- Contract Admini Construction Management contract Admini Construction Management contract Admini Construction Management Contact Capital Improvement Cos Costa Capital Improvement Cos	osts tal Improvement Costs) StS	and Maintenan	5% \$1,369,70 \$1,369,70 5% 15% 15% 25% 25%	LS. LS.		\$274.00 \$1.370.00 \$1.370.00 \$1.370.00 \$1.370.00 \$5,754.00 \$0.00 \$0.00 \$4.972.00 \$1.687.00 \$3.315.00 \$3.315.00 \$3.315.00 \$1.8231.00	
Jewatering Molization Taffic Control Bity Coordination/Relocation Bity Coordination/Relocation Bity Coordination/Relocation Bity Coordination Control Bity Coordination Control Bity Coordination Control C	osts al Improvement Costs)	and Maintenand	5% \$1,369,70 \$1,369,70 5% 15% 15% 25% 25%	LS. LS.	Unit Cost	\$274.00 \$1.370.00 \$1.370.00 \$1.370.00 \$1.370.00 \$5,754.00 \$0.00 \$0.00 \$4.972.00 \$1.687.00 \$3.315.00 \$3.315.00 \$3.315.00 \$1.8231.00	
Jewatering dokization raffic Control Jilly Coordination/Relocation Strimeter Management/Erosion Control Subtotal Additional Capital Improvement Co- Land Acquisition Costs (Other Costs (percentage of Capit Bubtotal Land Acquisition Costs Other Costs (percentage of Capit Bratering gal/Administrative confract Admin/Construction Management Confingency Subtotal Other Costs	osts tal Improvement Costs) sts er Plan Operation		5% 51.399.70 51.399.70 5% 5% 10% 25% 25% 25%	LS. LS.	Unit Cost \$1.00	\$274.00 \$1.370.00 \$1.370.00 \$1.370.00 \$1.370.00 \$1.370.00 \$5,754.00 \$0.00 \$0.00 \$4.972.00 \$1.657.00 \$3.315.00 \$3.315.00 \$18,231.00 \$118,231.00	
Jewatering Molization Tartfic Control Bity Coordinator/Relocation Bity Coordinator/Relocation Bity Coordinator/Relocation Bity Coordinator Control Bity Coordination Control Bity Coordination Control Coording Control Coordination Optimation Control Control Coordination Optimation Control Control Coordination Optimation Control Control Coordination Control Control Control Coordination Control C	al Improvement Costs) sts er Plan Operation emovel, erosion at enfranc		5% 51.399.70 51.399.70 5% 5% 10% 25% 25% 25%	LS. LS.		\$274.00 \$1.370.00 \$1.370.00 \$1.370.00 \$1.370.00 \$5.754.00 \$0.00 \$4.972.00 \$1.657.00 \$3.315.00 \$3.315.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.827.00 \$1.927.00 \$1	
Develating dokization Taffic Control. Mity Coordination/Relocation Subtotal Additional Capital Improvement Co- Land Acquisition Costs CAV/Easements Jubiced Land Acquisition Costs Other Costs (percentage of Capita egal/Administrative Santract Admin/Construction Management confingency Jubiced Other Costs Fotal Capital Improvement Coss Description	al Improvement Costs) sts er Plan Operation emovel, erosion at enfranc		5% 51.399.70 51.399.70 5% 5% 10% 25% 25% 25%	LS. LS.		\$274.00 \$1.370.00 \$1.370.00 \$1.370.00 \$1.370.00 \$1.370.00 \$0.00 \$0.00 \$4.972.00 \$1.687.00 \$1.687.00 \$1.877.00 \$1.827.00 \$1.927.00	

7/1/2019, 1:49 PM

SBB\_UD-MP Cost Version 2.2\_SKD\_Future4thSt(East).xlsm, 100-YR, 6in-Reach3

MAS	TER PLAN C	OST ESTIMAT	E FOR INDIV	IDUAL RE	ACH		
PROJECT :	Sharktooth Bluff						
DRAINAGEWAY : REACH :	SKD 3						
JURISDICTION :	City of Greeley						
REACH ID:	4th Street Wester	n - Min Criteria	Enter Estimator Nam	e on Project Inf	DATE :	12/26/2018	
					1		
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
10 Headwall and Toewalls	5	1	50	L.F.	\$1,081.50	\$54,075.00	
Individual Box Span (ft)	No. of Barrels	Total Span (ft)	T		1	1	
10	1	12.00	2	EA	\$1,158.48	\$2,317.00	
Wingwalls (includes wingwalls on ei							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels	2	54	640.054.44	604 400 00	
10	5	1	2	EA	\$12,054.14	\$24,108.30	
Channel Improvements Excavation, Mid Range			000	C.Y.	¢00.00	60.470.00	
Excavation, Mid Range 12-inch Riprap, Type M			296 22	C.Y. C.Y.	\$32.00	\$9,472.00 \$1,778.00	
Landscaping and Maintenance I	mprovemente			0.1.	000.00	\$1,110.00	
Reclamation & seeding (native grasses)	inprovements		1	ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined)							
	<user defined="" item<="" td=""><td>s</td><td>29</td><td>TON</td><td>\$250.00</td><td>\$7,250.00</td><td></td></user>	s	29	TON	\$250.00	\$7,250.00	
	Master Pla	an Capital Improv	vement Cost Sui	mmary			
Capital Improvement Costs							
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts Hydraulic Structures						\$80,500.00 \$0.00	
Channel Improvements						\$11,250.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$0.00	
Landscaping and Maintenance Improvements Special Items (User Defined)						\$1,340.00 \$7,250.00	
Subtotal Capital Improvement Costs						\$100,340.00	
Additional Capital Improvement Cos	ts						
Dewatering			\$1,003.40	L.S.		\$1,003.00	
Mobilization Traffic Control			5% \$5,017.00	L.S.		\$5,017.00 \$5,017.00	
Utility Coordination/Relocation			\$5,017.00	L.3. L.S.		\$5,017.00	
Stormwater Management/Erosion Control			5%			\$5,017.00	
Subtotal Additional Capital Improvement Cost Land Acquisition Costs	\$					\$21,071.00	
ROW/Easements						\$0.00	
Subtotal Land Acquisition Costs						\$0.00	
Other Costs (percentage of Capital I Engineering	mprovement Costs)		15%			\$18,212.00	
Legal/Administrative			5%			\$6,071.00	
Contract Admin/Construction Management			10%			\$12,141.00	
Contingency			25%			\$30,353.00	
Subtotal Other Costs Total Capital Improvement Costs	;					\$66,777.00 \$188,188.00	
• •		and Mainterrate	an Cont Summer				
	Plan Operation	and Maintenand	Quantity	y Unit	Unit Cost	Total Annual Cost	
Description Culvert Maintenance (e.g. sediment & debris rem	oval, erosion at entranc	e/exit, structural repairs,	e 50	L.F.	\$1.00	\$100.00	
Description		e/exit, structural repairs,		L.F.	\$1.00	\$100.00 \$100.00	
Description Culvert Maintenance (e.g. sediment & debris rem		e/exit, structural repairs,		L.F.	\$1.00	1	

MAS	STER PLAN C	OST ESTIMAT	E FOR INDIV	IDUAL RE	ACH		
PROJECT : DRAINAGEWAY :	Sharktooth Bluff SKD						
REACH :	3						
JURISDICTION : REACH ID:	City of Greeley 95th Ave - Min Cri	terie	JKD		DATE :	12/21/2018	
REACH ID:	95th Ave - Min Ch	teria	JKD		DATE :	12/21/2010	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)	1	1		
8	5	2	60	L.F.	\$1,796.98	\$107,819.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
8	2	19.00	2	EA	\$1,725.96	\$3,452.00	
Wingwalls (includes wingwalls on e		ind concrete apron)	1	r	T		
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels			*** *** **		
8	5	2	2	EA	\$13,884.19	\$27,768.40	
Channel Improvements							
Excavation, Mid Range			490	C.Y.	\$32.00	\$15,680.00	
12-inch Riprap, Type M			36	C.Y.	\$80.00	\$2,880.00	
Removals							
Removal of culvert pipe (D<48")			120	L.F.	\$27.00	\$3,240.00	
Landscaping and Maintenance	Improvements						
Reclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined)							
	<user defined="" iten<="" td=""><td>ns</td><td>48</td><td>TON</td><td>\$250.00</td><td>\$12,000.00</td><td></td></user>	ns	48	TON	\$250.00	\$12,000.00	
	Master Pl	an Capital Impro	vement Cost Su	mmarv			
Capital Improvement Costs	Masterri		Venient 005t 0u	i i i i i i i i i i i i i i i i i i i			
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts						\$139,039.00	
lydraulic Structures						\$0.00	
Channel Improvements						\$18,560.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$3,240.00	
andscaping and Maintenance Improvements						\$1,340.00	
Special Items (User Defined)						\$12,000.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Cost	4.					\$174,179.00	
Additional Capital Improvement Cos Dewatering	515		\$1,741.79	L.S.		\$1,742.00	
Nobilization			5%	L.U.		\$8,709.00	
Traffic Control			\$8,708.95	L.S.		\$8,709.00	
Julity Coordination/Relocation			\$8,708.95	L.S.		\$8,709.00	
Stormwater Management/Erosion Control			5%			\$8,709.00	
Subtotal Additional Capital Improvement Cos	ts					\$36,578.00	
Land Acquisition Costs							
ROW/Easements						\$0.00	
Subtotal Land Acquisition Costs						\$0.00	
Other Costs (percentage of Capital	Improvement Costs)		450/	1		604.044.00	
ingineering .egal/Administrative			15% 5%			\$31,614.00 \$10,538.00	
Contract Admin/Construction Management			10%			\$21,076.00	
Contingency			25%			\$52,689.00	
ubtotal Other Costs						\$115,917.00	
otal Capital Improvement Cost	s					\$326,674.00	
Master	Plan Operation	n and Maintenan	ce Cost Summa	v			
			Quantity	Unit	Unit Cost	Total Annual Cost	
				L.F.	\$1.00	\$120.00	
Description	noval, erosion at entrand	ce/exit, structural repairs,	e 120	L.F.	\$1.00	\$120.00	
Description Culvert Maintenance (e.g. sediment & debris rem		ce/exit, structural repairs,	e 120	ш.г.	\$1.00		
Description Juvert Maintenance (e.g. sediment & debris rem Fotal Annual Operation and Mai Effective Interest Rate		ce/exit, structural repairs,	e 120	L.F.	\$1.00	\$120.00 \$120.00 2.00%	

7/1/2019, 1:53 PM

MAS	TER PLAN C	OST ESTIMAT	E FOR INDIVI	DUAL RE	ACH		]
PROJECT :							
DRAINAGEWAY :	Sharktooth Bluff SKD						-
REACH :	3						-
JURISDICTION :	City of Greeley				1		
REACH ID:	County Road 62 -	Min Criteria	JKD		DATE :	12/21/2018	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe					1	1	
Individual Box Span (ft) 10	Box Height (ft)	No. of Barrels 2	Length (ft)	L.F.	\$2,385.05	6440.050.00	
	6	2	50	L.F.	\$2,385.05	\$119,252.00	
Channel Improvements Excavation, Mid Range			530	C.Y.	\$32.00	\$16,960.00	Culvert
12-inch Riprap, Type M			44	C.Y.	\$80.00	\$3,555.00	Culvert
Excavation, Mid Range			35625	C.Y.	\$32.00	\$1,140,000.00	Channel Excavation (1800 ft downstream, 3000 ft upstream
9-inch Riprap, Type L			1944	C.Y.	\$74.00	\$143,889.00	Channel Stabilization
Removals							
Removal of culvert pipe (D<48")			50	L.F.	\$27.00	\$1,350.00	
Landscaping and Maintenance Ir	nprovements						
Wetlands Plantings			1	ACRE	\$33,500.00	\$33,500.00	
Reclamation & seeding (native grasses)			6	ACRE	\$1,340.00	\$8,308.00	
Trail/Path, Crusher Fines (10' Width)			3500	L.F.	\$15.00	\$52,500.00	
Special Items (User Defined)			10				
	User Defined Item		47 18	TON	\$250.00 \$19,500.00	\$11,750.00 \$351,000.00	Riffle Drop ~200 ft.
Land Acquisition	Constant Delined Item	•	10	LA	\$13,300.00	\$331,000.00	
Easement/ROW Acquisition			10.83	ACRE	\$88,000.00	\$953,040.00	
Edomentron requisitor			10.00	TIONE	\$00,000.00	\$000,040.00	
	Master Pla	n Capital Improv	ement Cost Sur	mmarv			
Capital Improvement Costs	maotorrit		0000000				
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts						\$119,252.00	
Hydraulic Structures						\$0.00	
Channel Improvements Detention/Water Quality Facilities						\$1,304,404.00 \$0.00	
Removals						\$1,350.00	
Landscaping and Maintenance Improvements						\$94,308.00	
Special Items (User Defined)						\$362,750.00	
Subtotal Capital Improvement Costs						\$1,882,064.00	
Additional Capital Improvement Cost	\$		640.000.04	L.S.		640.004.00	
Dewatering Mobilization			\$18,820.64 5%	L.O.		\$18,821.00 \$94,103.00	
Traffic Control			\$94,103.20	L.S.		\$94,103.00	
Utility Coordination/Relocation			\$94,103.20	L.S.		\$94,103.00	
Stormwater Management/Erosion Control			5%			\$94,103.00	
Subtotal Additional Capital Improvement Costs	5			_		\$395,233.00	
ROW/Easements						\$953,040.00	
Subtotal Land Acquisition Costs						\$953,040.00	
Other Costs (percentage of Capital In	mprovement Costs)						
Engineering			15%			\$341,595.00	
Legal/Administrative			5% 10%			\$113,865.00 \$227,730.00	
Contract Admin/Construction Management Contingency			25%			\$227,730.00 \$569,324.00	
Subtotal Other Costs			2070			\$1,252,514.00	
Total Capital Improvement Costs						\$4,482,851.00	
	Plan Operation	and Maintenand					
Description	uni erecion et ent	alouit atsuctural sor -!	Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris remo Channel Maintenance (e.g. sediment & debris rem			6 50 3500	L.F.	\$1.00 \$3.00	\$50.00 \$10,500.00	
Total Annual Operation and Mair			0000	had a	0.00	\$10,550.00	
Effective Interest Rate	nenance cost					2.00%	
Total Operation and Maintenanc	a Costs Over 50	Voars				\$331,519.00	
rotal operation and maintenanc	e obsis over si	redis				\$331,313.00	

PROJECT :	Charletooth Dluff						
DRAINAGEWAY :	Sharktooth Bluff WC						
REACH :	3						
JURISDICTION :	City of Greeley						
REACH ID:	4th Street - Min C	riteria	JKD		DATE :	12/21/2018	
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe				1	1		
Individual Box Span (ft)	Box Height (ft) 4	No. of Barrels	Length (ft) 50	L.F.	\$722.88	\$36,144.00	
Headwall and Toewalls	4	1		<b>E</b> .1.	\$722.00	\$30,144.00	
Individual Box Span (ft)	No. of Barrels	Total Span (ft)	1				
6	1	8.00	2	EA	\$723.52	\$1,447.00	
		ind concrete apron)	-		-		
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels	0	54	60.000.00	640.004.70	
6	4	1	2	EA	\$8,330.86	\$16,661.70	
Channel Improvements							
xcavation, Mid Range			200	C.Y.	\$32.00	\$6,400.00	
2-inch Riprap, Type M			13	C.Y.	\$80.00	\$1,066.00	
andscaping and Maintenance	improvements			1			
Reclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined)							
Asphalt	<user defined="" iten<="" td=""><td>ns</td><td>22</td><td>TON</td><td>\$250.00</td><td>\$5,500.00</td><td></td></user>	ns	22	TON	\$250.00	\$5,500.00	
	Meeter DI	an Canital Immun	warmant Coat Cu				
Capital Improvement Costs	waster Pi	an Capital Improv	vement Cost Sui	mmary			
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts						\$54,253.00	
tydraulic Structures						\$0.00	
Channel Improvements						\$7,466.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$0.00	
andscaping and Maintenance Improvements Special Items (User Defined)						\$1,340.00 \$5,500.00	
Subtotal Capital Improvement Costs						\$5,500.00	
Additional Capital Improvement Costs	te					\$66,555.00	
Dewatering			\$685.59	L.S.		\$686.00	
Abilization			5%			\$3,428.00	
raffic Control	-	-	\$3,427.95	L.S.	-	\$3,428.00	
Julity Coordination/Relocation			\$3,427.95	L.S.		\$3,428.00	
Stormwater Management/Erosion Control			5%	I		\$3,428.00	
Subtotal Additional Capital Improvement Cos Land Acquisition Costs	ts	_	_	_	_	\$14,398.00	
ROW/Easements						\$0.00	
Subtotal Land Acquisition Costs						\$0.00	
Other Costs (percentage of Capital	Improvement Costs)						
ngineering			15%			\$12,444.00	
egal/Administrative			5%			\$4,148.00	
Contract Admin/Construction Management Contingency			10% 25%			\$8,296.00 \$20,739.00	
Subtotal Other Costs			2076			\$20,739.00 \$45,627.00	
Fotal Capital Improvement Cost	•					\$128.584.00	
otar capital improvement Cost	3					ψ120, <del>3</del> 04.00	
Master	Plan Operation	and Maintenan	ce Cost Summar	ry .			
escription	- an operation		Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris ren	noval, erosion at entrand	ce/exit, structural repairs,		L.F.	\$1.00	\$100.00	
otal Annual Operation and Ma	intenance Cost					\$100.00	
ffective Interest Rate						2.00%	

SBB\_UD-MP Cost Version 2.2\_SKD\_CR62.xlsm, 100-YR, 6in-Reach3

SBB\_UD-MP Cost Version 2.2\_WC\_4thSt.xlsm, 100-YR, 6in-Reach3

MAS	TER PLAN C	OST ESTIMAT	E FOR INDIVI	DUAL RE	ACH		
PROJECT :	Enter Project Nam	e on Project Info Tab					_
DRAINAGEWAY :	WC-78thAve						
REACH :	2						
JURISDICTION :	City of Greeley						
REACH ID:	Min-Reach2		Enter Estimator Nam	e on Project Info	DATE :	Enter Date on Project I	nfo Tab.
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains						1	
Circular Pipes			1		T	Т	
Diameter (in)	Length (ft)	No. of Barrels					
60-inch Manholes and Inlets	220	1	220	L.F.	\$322.00	\$70,840.00	
Type B Manhole (Pipe Dia. 48" and larger, defle	ction < 10 degrees)		1	EA	\$16,080.00	\$16,080.00	
	caon s to adgrees)			CA .	\$10,080.00	\$10,000.00	
Channel Improvements Excavation, Mid Range	1		900	C.Y.	\$32.00	\$28,800.00	Trench Excavation
Special Items (User Defined)			900	U.Y.	\$32.00	\$28,800.00	Interrich Excelvation
	<user defined="" item<="" td=""><td></td><td>25</td><td>LF</td><td>\$10.000.00</td><td>\$250.000.00</td><td></td></user>		25	LF	\$10.000.00	\$250.000.00	
	<user defined="" item<="" td=""><td></td><td>12</td><td>TON</td><td>\$10,000.00</td><td>\$250,000.00</td><td></td></user>		12	TON	\$10,000.00	\$250,000.00	
toprituin	- Ober Benned Rein		12	1011	\$100.00	\$1,000.00	
	Master Pla	n Canital Impro	vement Cost Sur	mmary			
Capital Improvement Costs	Masterrit	in oupital impro	rement 005t 0ui	Timery			
Pipe Culverts and Storm Drains						\$86,920.00	
Concrete Box Culverts						\$0.00	
Hydraulic Structures						\$0.00	
Channel Improvements						\$28,800.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$0.00	
Landscaping and Maintenance Improvements						\$0.00	
Special Items (User Defined)						\$251,800.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Cost	1.					\$367,520.00	
Dewatering	515		\$3,675.20	L.S.		\$3,675.00	
Mobilization			5%	L.J.		\$18,376.00	
Traffic Control			\$18.376.00	L.S.		\$18,376.00	
Utility Coordination/Relocation			\$18,376.00	L.S.		\$18,376.00	
Stormwater Management/Erosion Control			5%			\$18,376.00	
Subtotal Additional Capital Improvement Cos	ts					\$77,179.00	
Land Acquisition Costs							
ROW/Easements						\$0.00	
Subtotal Land Acquisition Costs						\$0.00	
Other Costs (percentage of Capital	Improvement Costs)		450/			000 705 00	
Engineering Legal/Administrative			15% 5%			\$66,705.00 \$22,235.00	
Contract Admin/Construction Management			10%			\$44,470.00	
Contingency			25%			\$111,175.00	
Subtotal Other Costs						\$244,585.00	
Total Capital Improvement Cost	s					\$689,284.00	
	r Plan Operation	and Maintenan	ce Cost Summar				
Description			Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris rem				L.F.	\$1.00	\$220.00	
Manhole and Inlet Maintenance (e.g. sediment &		ai repairs, etc.)	4	EA	\$67.00	\$268.00	
Total Annual Operation and Mai	intenance Cost					\$488.00	
Effective Interest Rate Total Operation and Maintenand						2.00%	
Lotal Uneration and Maintenand	ce Costs Over 5	Years				\$15.335.00	

DRAINAGEWAY :	Sharktooth Bluffs WC						_
REACH :	1						_
JURISDICTION : REACH ID:	City of Greeley 81st Ave - Min Cri	teria	]				
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes Diameter (in)	Length (ft)	No. of Barrels	1		1	T	
18-inch	50	3	150	L.F.	\$72.00	\$10,800.00	Inlet replacement
Manholes and Inlets ype B Manhole (Pipe Dia. 48" and larger, deflet	ction < 10 degrees)		2	EA	\$16,080.00	\$32,160.00	
ype P Manhole (Pipe Dia. 48" and larger, defle			1	EA	\$20,100.00	\$20,100.00	
itorm Inlet, Type R/Type 14, 5-foot			3	EA	\$6,164.00	\$18,492.00	
Box Culverts							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
9 Headwall and Toewalls	4	1	565	L.F.	\$908.62	\$513,370.00	
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
9 Wingwalls (includes wingwalls on e	1 ither side of channel a	11.00 nd concrete apron)	1	EA	\$999.24	\$999.00	
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
9	4	1	1	EA	\$9,033.17	\$9,033.20	
Channel Improvements ixcavation, Mid Range			2825	C.Y.	\$32.00	\$90,400.00	
Removals			LOLO	0.1.	401.00	400,100.00	
oncrete Box Culvert			565	L.F./CELL	\$134.00	\$75,710.00	
Special Items (User Defined)							
Curb and Gutter sphalt	<user defined="" iten<br=""><user defined="" iten<="" td=""><td>15</td><td>50 300</td><td>LF TON</td><td>\$50.00 \$250.00</td><td>\$2,500.00 \$75,000.00</td><td></td></user></user>	15	50 300	LF TON	\$50.00 \$250.00	\$2,500.00 \$75,000.00	
	Master Pla	an Capital Improv	vement Cost Su	mmary		\$81,552.00 \$523.402.00	
ioncrete Box Culverts lydraulic Structures hannel Improvements	Master Pla	an Capital Improv	vement Cost Su	mmary		\$523,402.00 \$0.00 \$90,400.00	
ioncrete Box Culverts lydraulic Structures hannel Improvements letention/Water Quality Facilities	Master Pi	an Capital Improv	vement Cost Su	mmary		\$523,402.00 \$0.00 \$90,400.00 \$0.00	
oncrete Box Culverts ydraulic Structures hannel Improvements etendion/Water Quality Facilities bernovals andscaping and Maintenance Improvements	Master Pla	an Capital Improv	vement Cost Su	mmary		\$523,402.00 \$0.00 \$90,400.00 \$0.00 \$75,710.00 \$0.00	
oncrete Box Culverts dydraufic Structures hannel Improvements etention/Water Quality Facilities emovals andscaping and Maintenance Improvements pecial Items (User Defined)	Master Ph	an Capital Improv	vement Cost Su	mmary		\$523,402.00 \$0.00 \$90,400.00 \$75,710.00 \$0.00 \$77,500.00	
oncrete Box Culverts ydraulo: Structures hannel Improsements etention/Water Quality Facilities emrovals andiscaping and Maintenance Improvements opecial tiems (Ueer Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs	Master Ph	an Capitai Improv				\$523,402.00 \$0.00 \$90,400.00 \$0.00 \$75,710.00 \$75,710.00 \$77,500.00 \$848,564.00	
oncrete Box Culverts ydraufic Structures hannel Improvements annel Improvements merovals amovals amovals amovals andscaping and Maintenance Improvements pecial Imero (Lever Defined) ubtotal Capital Improvement Costs Additional G-pital Improvement Costs (Cost Cost) (Cost	Master Ph	an Capitai Improv	\$8,485.64	mmary LS.		\$523,402.00 \$0.00 \$90.400.00 \$0.00 \$75,710.00 \$75,710.00 \$77,500.00 \$848,564.00 \$8,486.00	
oncrete Box Culverts yrdaulo Structures hannel Improvements elention/Water Quality Facilities enrovals andscaping and Maintenance Improvements pecial tems (User Defined) ubtotal Capital Improvement Costs Additional Gepital Improvement Cost evalating biolization artific Control	MidSter Ph	an Capital Improv	\$8,485.64 5% \$42,428.20	LS. LS.		\$523,402.00 \$0.00 \$0,400.00 \$7,5710.00 \$77,500.00 \$77,500.00 \$848,564.00 \$8,486.00 \$42,428.00 \$42,428.00	
oncrete Box Culverts yeardlo Structures hannel Improvements werklon/Water Quality Facilities amovals andscaping and Maintenance Improvements pecial times (Ucer Defined) ubtotal Capital Improvement Costs Adstational Cepital Improvement Costs advantational Cepital Improvement Cost advantational Cepital Improvement Cost advantational Cepital Improvement Cost advantational Cepital Improvement Cost advantational Cepital Improvement Cost Biblization afflic Coordination/Relocation	Midster Pi	an Capital Improv	\$8,485.64 5%	LS.		\$523,402.00 \$0.00 \$90,400.00 \$0.00 \$75,710.00 \$77,500.00 \$77,500.00 \$848,564.00 \$848,564.00 \$842,428.00	
Newatering Idoblization faffic Control Nility Coordination/Relocation Sormwater Management/Erosion Control ubtotal Additional Capital Improvement Cos	ite	an Capital Improv	\$8,485.64 5% \$42,428.20 \$42,428.20	LS. LS.		\$523,402,00 \$0,00 \$00,400,00 \$75,710,00 \$77,500,00 \$77,500,00 \$846,564,00 \$42,428,00 \$42,428,00 \$42,428,00	
oncrete Box Culverts yidraulo Structures hannel Improvements extertion Water Quality Facilities entrovals andscaping and Maintennance Improvements andscapital tems (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs watering biblization control biblization formader Management/Erosion Control ubtotal Additional Capital Improvement Costs Land Acquisition Costs	ite	an Capital Improv	\$8,485.64 5% \$42,428.20 \$42,428.20	LS. LS.		\$523.402.00 \$0.00 \$0.00 \$75.710.00 \$77.500.00 \$77.500.00 \$848,564.00 \$848,664.00 \$42.428.00 \$42.428.00 \$42.428.00	
Ioncrete Box Culverts Varialle Structures Thannel Improvements letention/Water Cuality Facilities enrovals enrovals andiscapital Improvement Costs Additional Capital Improvement Cost Mutotal Capital Improvement Cost Internative Management/Erosion Control Mutotal Capital Improvement Cost Land Acquisition Costs Land Acquisition Costs Udotal Land Acquisition Costs	its ts	an Capital Improv	\$8,485.64 5% \$42,428.20 \$42,428.20	LS. LS.		\$523.402.00 \$0.00 \$90.400.00 \$75,710.00 \$77,500.00 \$77,500.00 \$848,564.00 \$848,660 \$42,428.00 \$42,428.00 \$42,428.00 \$42,428.00 \$42,428.00 \$42,428.00	
oncrete Box Culvers yirallo Structures hannel Improvements evention/Water Cually Facilities emovals andscaping and Maintenance Improvements pecial Items (User Defined) uibtotal Capital Improvement Costs Additional Gepital Improvement Cost biblization affile Control affile Control Big Coordinator/Relocation Big Coordinator/Relocation Big Coordinator/Relocation Big Coordinator Capital Improvement Cos Land Acquisition Costs Other Costs (porcentage of Capital	its ts	an Capital Improv	\$8,485.64 5% \$42,428.20 \$42,428.20	LS. LS.		\$523.402.00 \$0.00 \$0.00 \$75.710.00 \$75.710.00 \$77.500.00 \$77.500.00 \$8448,564.00 \$42.428.00 \$40.428.000\$\$40.428.000\$\$40.4	
oncrete Box Culvers virtualo Structures hannel Improvements evention/Water Catualy Facilities emovals emovals andscaping and Maintenance Improvements pecial Items (User Defined) uubtotal Capital Improvement Cost uubtotal Capital Improvement Cost biblization Additional Capital Improvement Cost lig: Coordination/Relocation attific Control Usitotal Additional Capital Improvement Cost Land Acquisition Costs OUArdseemots butotal Land Acquisition Costs OUArdseemots butotal Land Acquisition Costs OUArdseemots Ditter Costs OUArdseemots	its ts	an Capital Improv	\$8,485.64 5% \$42.428.20 5% 5% 15% 5%	LS. LS.		\$523.402.00           \$0.00           \$0.402.00           \$0.402.00           \$0.402.00           \$75.710.00           \$75.710.00           \$75.9710.00           \$75.9710.00           \$848.564.00           \$848.564.00           \$42.428.00           \$42.428.00           \$42.428.00           \$42.428.00           \$42.428.00           \$42.428.00           \$42.428.00           \$42.428.00           \$42.428.00           \$42.428.00           \$42.428.00           \$42.428.00           \$42.428.00           \$42.428.00           \$42.428.00           \$42.428.00           \$51.3198.00           \$51.31.38.00	
oncrete Box Culverts yetande Structures hannel Improvements elemitoritivater Quality Facilities morouits andiscaping and Maintenance Improvements Additional Cepital Improvement Costs Additional Cepital Improvement Cost biblization rafflic Control Bibli CoordinationRelocation Bibli CoordinationRelocation termwater ManagementErosoin Control ubtotal Additional Capital Improvement Cost OW/Easements Ubtotal Additional Capital Improvement Cost Other Costs (percentage of Capital Onlinering ogal/Administrative	its ts	an Capital Improv	\$8,485,64 5% \$42,478,20 \$42,478,20 5%	LS. LS.		\$223.402.00 \$0.00 \$90.400.00 \$75,710.00 \$77,500.00 \$848,564.00 \$848,564.00 \$42,428.00\$42,428.00 \$42,428.00 \$42,428.00\$42,428.00 \$42,428.00\$42,428.00 \$42,428.00\$42,428.00 \$42,428.00\$42,428.00 \$42,428.00\$42,428.00 \$42,428.00\$42,428.00 \$42,428.00\$42,428.000\$\$42,428.000\$\$42,428.000\$\$42,428.000\$\$42,428.0	
oncrete Box Culvers yorkaulo Structures hannel Improvements evention/Water Qually Facilities tenronis andscaping and Maintenance Improvements pecial terms (Loar Defined) ubtotal Capital Improvement Costs Adstional Capital Improvement Costs watering biblization raffic Control With CoordinationRelocation termwater ManagementForsion Control ubtotal Additional Capital Improvement Costs United Land Acquisition Costs Other Sources (percentage of Capital Ingineering) outrait Admin Construction Management ontrait Admin Construction Management ontrait Admin Costs	ts Improvement Costs)	an Capital Improv	\$8,485,64 5% \$42,478,20 5% 5% 15% 15%	LS. LS.		\$523,402,00 \$0,00 \$90,400,00 \$75,710,00 \$77,5710,00 \$77,500,00 \$848,564,00 \$848,564,00 \$42,428,000\$42,428,000 \$42,428,000\$42,428,000 \$42,428,000\$42,428,000 \$42,428,000\$42,428,000 \$42,428,000\$42,428,000 \$42,428,000\$42,428,0000\$42,428,000\$42,428,000\$42,428,000\$42,428,000\$42,428,0	
oncrete Box Culvers yirallo Structures bannel Improvements eventom/Water Catually Facilities emovals and scaging and Meintenance Improvements pecial Items (User Defined) ubtotal Capital Improvement Costs Actional Genital Improvement Cost Actional Capital Improvement Cost and Control Withold Actional Capital Improvement Cost Land Acquisition Costs Other Costs Other Costs (percentage of Capital ingineering age//Administrative ontract Admin/Construction Management contage//Administrative ontract Admini/Construction Management contage Capital Improvement Costs ontract Admini/Construction Management ontract Admini/Constru	ts Improvement Costs) S		\$8,485.64 5% \$42.428.20 5% 10% 5% 10% 20%	LS. LS. LS.		\$523.402.00           \$0.00           \$0.402.00           \$0.402.00           \$0.402.00           \$0.402.00           \$75.710.00           \$75.710.00           \$75.9710.00           \$848.564.00           \$848.564.00           \$842.428.00           \$842.428.00           \$842.428.00           \$842.428.00           \$842.428.00           \$842.428.00           \$842.428.00           \$842.428.00           \$842.428.00           \$817.8198.00           \$151.514.014.00           \$51.338.00           \$152.676.00           \$256.661.00	
oncrete Box Calverts yorkande Structures hannel Improvements evention/Water Qualty Facilities amounts andscaping and Maintenance Improvements pecial times (Ueer Defined) ubtotal Capital Improvement Costs Adational Capital Improvement Cost eventering biblization raffic Control Bibli Coordination/Relocation termwater Management/Erosion Control ubtotal Capital Improvement Cost Land Acquisition Costs Officer Costs (secondage of Cepital gigin/Aministrative Contract Admin Construction Management contract contract contract contract contract contract contract contract contract contract contract contract	ts Improvement Costs) S	an Capital Improv	\$8,485.64 5% \$42,428.20 5% 15% 5% 10% 25% Ce Cost Summar	LS. LS. LS.	ligit Part	\$223.402.00 \$0.00 \$90.400.00 \$75,710.00 \$77,5710.00 \$77,500.00 \$845,564.00 \$845,564.00 \$42,428.00 \$44,4000\$44,4000\$44,4000\$44,400\$44,4000\$44,4000\$44,400\$	
oncrete Box Culverts viewalor Structures thannel Improvements evention/Water Qualy Facilities amounts andscaping and Maintenance Improvements pecial times (Ucer Defined) ubtotal Capital Improvement Costs Adstational Capital Improvement Cost Motization raffic Control Bity CoordinatorRelation Ubtotal Additional Capital Improvement Cost Ubtotal Capital India Costs Ubtotal Capital Improvement Costs Contract Admin Construction Management contingency ubtotal Capital Improvement Costs Capital Improvement Costs Ubtotal Costs Cos	its ts Improvement Costs) S r Plan Operation roval, erosion at entranc	and Maintenan	\$8,485.64 5% \$42,428.20 \$42,428.20 5% 15% 10% 25% <b>ce Cost Summar</b> Quantity (100	LS. LS. LS. V Unit LF.	Unit Cost \$1.00	\$223.402.00 \$0.00 \$90.400.00 \$75,710.00 \$77,5710.00 \$77,500.00 \$845,664.00 \$845,664.00 \$842,428.00 \$44,428.00 \$44,428.00\$44,428.00 \$44,428.00\$44,428.00	
oncrete Box Culverts yetande Structures tananel Improvements elemitoritivater Quality Facilities mervails andiscaping and Maintenance Improvements Additional Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Cost Ibit Quality Internation Ibit Quality Internation Ibit Quality Ibit Ibit Ibit Ibit Ibit Ibit Ibit Ibit	ts ts s r Plan Operation roval, erosion at entranc	and Maintenan	\$8,485.64 5% \$42.428.20 5% 5% 10% 25% 25% 25%	LS. LS. LS. Unit		\$223.402.00 \$0.00 \$90.400.00 \$75.710.00 \$75.710.00 \$77.500.00 \$848.564.00 \$848.60 \$42.428.00 \$40.00 \$40.00 \$102.678.00 \$31.531.481.00 \$40.200	
oncrete Box Culverts viewalor Structures thannel Improvements evention/Water Qualy Facilities amounts andscaping and Maintenance Improvements pecial times (Ucer Defined) ubtotal Capital Improvement Costs Adstational Capital Improvement Costs indicapital Improvement Costs indicapital Improvement Costs indicapital Improvement Costs United Additional Capital Improvement Cost United Additional Capital Improvement Costs United Additional Capital Improvement Costs United Additional Capital Improvement Costs United Costs United Costs (Driver Costs) Contract Admin Costs Contract C	ts ts s r Plan Operation roval, erosion at entranc	and Maintenan	\$8,485.64 5% \$42,428.20 \$42,428.20 5% 15% 10% 25% <b>ce Cost Summar</b> Quantity (100	LS. LS. LS. V Unit LF.	\$1.00	\$223.402.00 \$0.00 \$90.400.00 \$75,710.00 \$77,5710.00 \$77,500.00 \$845,664.00 \$845,664.00 \$842,428.00 \$44,428.00 \$44,428.00\$44,428.00 \$44,428.00\$44,428.00	

1/30/2019, 3:47 PM

SBB\_UD-MP Cost Version 2.2\_WC\_81stAve.xlsm, SD\_Min-Reach1

MAS	TER PLAN C	OST ESTIMAT	E FOR INDIVI	DUAL RE	ACH		
PROJECT :	Sharktooth Bluff						
DRAINAGEWAY :	WC						
REACH : JURISDICTION :	3 City of Greeley						
REACH ID:	Skyview Street - M	fin Criteria	JKD		DATE :	12/21/2018	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes Diameter (in)	Length (ft)	No. of Barrels			T		
18-inch	50	2	100	L.F.	\$72.00	\$7,200.00	Reset inlets on Skyview Street
Manholes and Inlets		1					
itorm Inlet, Type R/Type 14, 5-foot Concrete Box Culverts			2	EA	\$6,164.00	\$12,328.00	
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12 Headwall and Toewalls	5	1	150	L.F.	\$1,239.66	\$185,950.00	
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
12 Wingwalls (includes wingwalls on ei	1 ither eide of ehenerte	14.00	2	EA	\$1,343.16	\$2,686.00	
Wingwalls (includes wingwalls on ei Individual Box Span (ft)	ther side of channel a Box Rise (ft)	No. of Barrels	1				
12	5	1	2	EA	\$12,577.01	\$25,154.00	
Channel Improvements							
Excavation, Mid Range 12-inch Riprap, Type M			1000 22	C.Y. C.Y.	\$32.00 \$80.00	\$32,000.00 \$1,776.00	
Removals							
Removal of culvert pipe (D>84")			150	L.F.	\$101.00	\$15,150.00	
Landscaping and Maintenance	Improvements						
Reclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined) Asphalt	<user defined="" item<="" td=""><td></td><td>26</td><td>TON</td><td>\$250.00</td><td>\$6,500.00</td><td></td></user>		26	TON	\$250.00	\$6,500.00	
	<user defined="" item<="" td=""><td></td><td>75</td><td>LF</td><td>\$50.00</td><td>\$3,750.00</td><td></td></user>		75	LF	\$50.00	\$3,750.00	
		<b>A</b> 14 11					
Capital Improvement Costs	Master Pla	an Capital Improv	vement Cost Sur	nmary			
Pipe Culverts and Storm Drains						\$19,528.00	
Concrete Box Culverts Hydraulic Structures						\$213,790.00 \$0.00	
Channel Improvements						\$33,776.00	
Detention/Water Quality Facilities						\$0.00	
Removals .andscaping and Maintenance Improvements						\$15,150.00 \$1,340.00	
Special Items (User Defined)						\$10,250.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Cos	te			_	_	\$293,834.00	
Dewatering	<u></u>		\$2,938.34	L.S.		\$2,938.00	
Abbilization			5%				
Traffic Control				1.0		\$14,692.00	
Julity Coordination/Relocation			\$14,691.70	L.S. L.S.		\$14,692.00	
Jtility Coordination/Relocation Stormwater Management/Erosion Control				L.S. L.S.		\$14,692.00 \$14,692.00 \$14,692.00	
Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Cost	ts		\$14,691.70 \$14,691.70			\$14,692.00 \$14,692.00	
Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Cost Land Acquisition Costs ROW/Easements	ts		\$14,691.70 \$14,691.70			\$14,692.00 \$14,692.00 \$14,692.00 <b>\$61,706.00</b> \$0.00	
Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Cost Land Acquisition Costs SUV/Easements Subtotal Land Acquisition Costs	_		\$14,691.70 \$14,691.70			\$14,692.00 \$14,692.00 \$14,692.00 <b>\$61,706.00</b>	
Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Cost Land Acquisition Costs OW/Easements Subtotal Land Acquisition Costs Other Costs (percentage of Capital	_		\$14,691.70 \$14,691.70			\$14,692.00 \$14,692.00 \$14,692.00 <b>\$61,706.00</b> \$0.00	
Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Cost Land Acquisition Costs OW/Easements Subtotal Land Acquisition Costs Other Costs (percentage of Gapital Ingineering ogal/Administrative	_		\$14,691.70 \$14,691.70 5% 15%			\$14,692.00 \$14,692.00 \$14,692.00 \$61,706.00 \$0.00 \$0.00 \$53,331.00 \$17,777.00	
Stormater Management/Encosion Control substolal Additional Capital Improvement Cost Land Acquisition Costs (20W/Essements Wottrolal Land Acquisition Costs Other Costs (percentage of Capital Other Costs (percentage of Capital Capital Control Costs Costs) Contract Admin Construction Management			\$14,691.70 \$14,691.70 5% 15% 5% 10%			\$14,692.00 \$14,692.00 \$14,692.00 \$61,706.00 \$0.00 \$50,00 \$53,331.00 \$17,777.00 \$35,554.00	
tormater Management/Encosion Control uitotal Additional Capital Improvement Cost Land Acquisition Costs (ViEsements) uitotal Land Acquisition Costs Other Costs (secontage of Capital regineering egal/Administrative omaret Admini/Construction Management contingercy uitotal Other Costs	Improvement Costs)		\$14,691.70 \$14,691.70 5% 15%			\$14,692.00 \$14,692.00 \$14,692.00 \$61,706.00 \$0.00 \$0.00 \$53,331.00 \$17,777.00	
Normaler Management/Ensolin Control Justical Additional Capital Improvement Cost Land Acquisition Costs (VEasements) Unter Costs (percentage of Capital orgineering egal/Administrative Contract Admini Construction Management contingency Ukotal Unter Costs	Improvement Costs)		\$14,691.70 \$14,691.70 5% 15% 5% 10%			\$14,692.00 \$14,692.00 \$14,692.00 \$61,706.00 \$0.00 \$53,331.00 \$53,331.00 \$17,777.00 \$35,554.00 \$88,885.00	
Stormater Management/Erosion Control subtotal Additional Capital Improvement Cost Land Acquisition Costs COW/Easements Subtotal Land Acquisition Costs Other Costs (percentage of Capital Igninering agal/Administrative contract Admin/Construction Management contingency subtotal Other Costs Fotal Capital Improvement Costs	Improvement Costs)	and Maintenan	\$14,691.70 \$14,691.70 \$% \$% \$% 10% 25%	L.S.		\$14,692.00 \$14,692.00 \$14,692.00 \$61,706.00 \$0.00 \$0.00 \$53,331.00 \$17,777.00 \$35,554.00 \$88,885.00 \$195,547.00	
Stormater Management/Erosion Control subtotal Additional Capital Improvement Cost Land Acquisition Costs (Wile Seaments Woltrotal Land Acquisition Costs Other Costs (percentage of Capital Ingineering egal/Administrative Contract Administrative Contract Administrative Co	Improvement Costs) S r Plan Operation		\$14,09170 \$14,09170 \$5% 15% 5% 10% 25% 25%	L.S.	Unit Cost	\$14.692.00 \$14.692.00 \$61,706.00 \$0.00 \$0.00 \$53,331.00 \$17.777.00 \$35,554.00 \$88,885.00 \$195,547.00 \$195,547.00 \$551,087.00 Total Annual Cost	
tormater Management/Erosion Control whotal Additional Capital Improvement Cost Land Acquisition Costs (Vilesements) whotal Land Acquisition Costs Other Costs (percentage of Capital regineering egal/Administrative comarel Admin/Construction Management comarel Admin/Construction Management Material Material Costs Material Material Costs Material M	Improvement Costs) S r Plan Operation noval, erosion at entranc		\$14,09170 \$14,09170 \$5% 15% 5% 10% 25% 25%	L.S.	Unit Cost \$1.00	\$14.692.00 \$14.692.00 \$14.692.00 \$0.00 \$0.00 \$0.00 \$0.00 \$35.554.00 \$35.554.00 \$35.554.00 \$35.554.00 \$35.554.00 \$35.554.00 \$35.554.00 \$35.51,087.00 Total Annual Cost \$300.00	
tormater Management/Encosion Control ubtoral Additional Capital Improvement Cost UCW/Easements UCW/Easements UDWF Costs (percentage of Capital inglineering geal/Administrative contract AdminiSconstruction Management icontract Administruction Master isocription	Improvement Costs) S r Plan Operation noval, erosion at entranc		\$14,09170 \$14,09170 \$5% 15% 5% 10% 25% 25%	L.S.		\$14.692.00 \$14.692.00 \$61,706.00 \$0.00 \$0.00 \$53,331.00 \$17.777.00 \$35,554.00 \$88,885.00 \$195,547.00 \$195,547.00 \$551,087.00 Total Annual Cost	

7/1/2019, 2:11 PM

# Flood Hazard Mitigation Alternatives

- C-13: Foothills Tributary Melbourne Street Option 1 C-13: Foothills Tributary – Melbourne Street Option 2 C-14: Foothills Tributary – North of Melbourne Street C-14: Northridge Draw – C Street C-14: Poudre Learning Center – County Road 62 Eastern C-15: Poudre Learning Center – County Road 62 Western C-15: Sharktooth Draw – 4<sup>th</sup> Street Central C-16: Sharktooth Draw – 4<sup>th</sup> Street Eastern C-16: Sharktooth Draw – 4<sup>th</sup> Street Western C-17: Sharktooth Draw – 95<sup>th</sup> Avenue C-17: Sharktooth Draw – County Road 62 C-18: Sharktooth Draw – Downstream Option 1 C-18: Sharktooth Draw – Downstream Option 2 C-19: Wiedeman Creek – 4<sup>th</sup> Street C-19: Wiedeman Creek – 78<sup>th</sup> Avenue C-20: Wiedeman Creek – 81<sup>st</sup> Avenue: 100-yr Storm Drain C-20: Wiedeman Creek – 81<sup>st</sup> Avenue: Detention (8 Ac-ft.) C-21: Wiedeman Creek – 81<sup>st</sup> Avenue: Detention (22 Ac-ft.) C-21: Wiedeman Creek – 81<sup>st</sup> Avenue: Detention (44 Ac-ft.) C-22: Wiedeman Creek – Armor Hill Road
- C-22: Wiedeman Creek Skyview Street

MAS	STER PLAN C	OST ESTIMAT	E FOR INDIV	IDUAL RE	АСН		
		20112011201					1
PROJECT : DRAINAGEWAY :	Sharktooth Bluff NofMelbourneSt						
REACH :	1						
JURISDICTION :	City of Greeley						
REACH ID:	FM (Option 1)-Rea	ach1	Enter Estimator Nan	ne on Project Infe	DATE :	12/19/2018	
	1				1	TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Pipe Culverts and Storm Drains	;						
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
42-inch	50	1	50	L.F.	\$169.00	\$8,450.00	
18-inch	50	2	100	L.F.	\$72.00	\$7,200.00	Reset inlet laterals
Flare End Sections Diameter (in)	Anallashia	No. of Barrels	1	1	1	1	
42-inch	Applicable Yes	NO. OF BAFFEIS	1	EA	\$2,278.00	\$2,279,00	
Manholes and Inlets	Tes			EA	\$2,276.00	\$2,278.00	
torm Inlet, Type R/Type 14, 5-foot		1	2	EA	\$6,164.00	\$12,328.00	
Channel Improvements							
Excavation, Mid Range			150	C.Y.	\$32.00	\$4,800.00	
			100	0.1.	ψυ2.00	94,000.00	
Removals			100				
Removal of culvert pipe (D<48")	1		100	L.F.	\$27.00	\$2,700.00	
Special Items (User Defined)							
Curb and Gutter	<user defined="" iten<="" td=""><td></td><td>50</td><td>LF</td><td>\$50.00</td><td>\$2,500.00</td><td></td></user>		50	LF	\$50.00	\$2,500.00	
Asphalt	<user defined="" iten<="" td=""><td>15</td><td>9</td><td>TON</td><td>\$250.00</td><td>\$2,250.00</td><td></td></user>	15	9	TON	\$250.00	\$2,250.00	
	Master Pl	an Capital Impro	vement Cost Su	mmarv			
Capital Improvement Costs				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
Pipe Culverts and Storm Drains						\$30,256.00	
Concrete Box Culverts						\$0.00	
lydraulic Structures						\$0.00	
Channel Improvements						\$4,800.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$2,700.00	
andscaping and Maintenance Improvements						\$0.00 \$4,750.00	
Special Items (User Defined) Subtotal Capital Improvement Costs						\$4,750.00	
Additional Capital Improvement Costs	ete					\$42,506.00	
Dewatering	313		\$425.06	L.S.		\$425.00	
Aobilization			5%			\$2,125.00	
raffic Control			\$2,125.30	L.S.		\$2,125.00	
Itility Coordination/Relocation			\$2,125.30	L.S.		\$2,125.00	
Stormwater Management/Erosion Control			5%			\$2,125.00	
Subtotal Additional Capital Improvement Cos	sts					\$8,925.00	
Land Acquisition Costs							
ROW/Easements						\$0.00	
Subtotal Land Acquisition Costs Other Costs (percentage of Capital						\$0.00	
Other Costs (percentage of Capital	i improvement Costs)		15%	1		\$7,715.00	
.egal/Administrative			5%			\$7,715.00	
Contract Admin/Construction Management			10%			\$5,143.00	
Contingency			25%			\$12,858.00	
Subtotal Other Costs						\$28,288.00	
Total Capital Improvement Cost	s					\$79,719.00	
Masta	r Plan Operation	and Maintonen	an Cont Summer	20 A			
	r Plan Operation	and Maintenan			Unit Ocert	Total Annual O	
Pescription	mount proving at a t-t	alauit atructural re	Quantity	Unit	Unit Cost	Total Annual Cost	
ulvert Maintenance (e.g. sediment & debris rer fanhole and Inlet Maintenance (e.g. sediment &			e 50 3	EA	\$1.00 \$67.00	\$50.00 \$201.00	
		rar ropellis, etc.j	3	EA	\$07.00	\$251.00	
Fotal Annual Operation and Ma	intenance Cost						
ffective Interest Rate						2.00%	
Total Operation and Maintenan	ce Costs Over 5	0 Years				\$7,887.00	

MAS	STER PLAN C	OST ESTIMAT	E FOR INDIVI	DUAL RE	ACH		
PROJECT :	Sharktooth Bluff						L
DRAINAGEWAY :	NofMelbourneSt						
REACH :	2						
JURISDICTION :	City of Greeley		Enter Estimator Nam	Declaret Inf		12/19/2018	
REACH ID:	FM (Option 2)-Rea	ach2	Enter Estimator Nam	e on Project in	fo DATE :	12/19/2018	
	1					TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Pipe Culverts and Storm Drains	3						
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
42-inch	785	1	785	L.F.	\$169.00	\$132,665.00	
18-inch	50	2	100	L.F.	\$72.00	\$7,200.00	Reset inlet laterals
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
42-inch	Yes	1	2	EA	\$2,278.00	\$4,556.00	
Manholes and Inlets		1					
Manhole, 5' Dia. (Pipe Dia. 36" - 42")		4	4	EA	\$5,226.00	\$20,904.00	
Storm Inlet, Type R/Type 14, 5-foot		l	2	EA	\$6,164.00	\$12,328.00	
Channel Improvements							
Excavation, Mid Range			2350	C.Y.	\$32.00	\$75,200.00	Trench Excavation
Special Items (User Defined)							
Asphalt	<user defined="" iten<="" td=""><td>15</td><td>260</td><td>TON</td><td>\$150.00</td><td>\$39,000.00</td><td></td></user>	15	260	TON	\$150.00	\$39,000.00	
Curb and Gutter	<user defined="" iten<="" td=""><td></td><td>50</td><td>LF</td><td>\$50.00</td><td>\$2,500.00</td><td></td></user>		50	LF	\$50.00	\$2,500.00	
	Mactor Pl	an Capital Improv	omont Cost Sur	many			
Capital Improvement Costs	Waster Fr	an capital impro-	rement 00st Sui	minary			
						\$177,653.00	
Pipe Culverts and Storm Drains Concrete Box Culverts						\$177,653.00	
Hydraulic Structures						\$0.00	
Channel Improvements						\$75,200.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$0.00	
andscaping and Maintenance Improvements						\$0.00	
Special Items (User Defined)						\$41,500.00	
Subtotal Capital Improvement Costs						\$294,353.00	Î.
Additional Capital Improvement Co	sts						
Dewatering			\$2,943.53	L.S.		\$2,944.00	
Mobilization			5%			\$14,718.00	
Traffic Control			\$14,717.65	L.S.		\$14,718.00	
Utility Coordination/Relocation			\$14,717.65	L.S.		\$14,718.00	
Stormwater Management/Erosion Control			5%			\$14,718.00	
Subtotal Additional Capital Improvement Cos	sts					\$61,816.00	
Land Acquisition Costs							
ROW/Easements						\$0.00	
Subtotal Land Acquisition Costs						\$0.00	
Other Costs (percentage of Capita	I Improvement Costs)						
			15%			\$53,425.00	
Engineering			5%			\$17,808.00	
.egal/Administrative			10% 25%			\$35,617.00	
egal/Administrative Contract Admin/Construction Management						\$89,042.00 \$195,892.00	
.egal/Administrative Contract Admin/Construction Management Contingency			2370				
egal/Administrative Contract Admin/Construction Management Contingency Subtotal Other Costs			2370				
egal/Administrative Contract Admin/Construction Management Contingency Subtotal Other Costs	ts		2376			\$552,061.00	
egal/Administrative Contract Admin/Construction Management Contingency Subtotal Other Costs	ts		2370				
egal/Administrative Contract Admin/Construction Management Contingency Watbotal Other Costs Total Capital Improvement Cost		n and Maintenan		v			
.egal/AdminiStrative 2ontract Admini/Construction Management 2ontractor Subtotal Other Costs Total Capital Improvement Cost Maste		n and Maintenand		<b>y</b> Unit	Unit Cost		
egal/Administrative contract.AdminiSconstruction Management Contingency Subtotal Other Costs Total Capital Improvement Cost Maste Description	r Plan Operation		ce Cost Summar Quantity		Unit Cost \$1.00	\$552,061.00	
egal/Administrative Contract Admin/Construction Management Contingency Watbotal Other Costs Total Capital Improvement Cost	r Plan Operation	ce/exit, structural repairs,	ce Cost Summar	Unit		\$552,061.00 Total Annual Cost	
egal/Administrative Contract Administrative Contract Administrative Statistical Other Costs Fotal Capital Improvement Cost Maste Description Culterr Maintenance (e.g. sediment & debris res Marthela and Intel Maintenance (e.g. sediment &	r Plan Operation moval, erosion at entrano & debris removal, structu	ce/exit, structural repairs,	ce Cost Summar Quantity	Unit L.F.	\$1.00	\$552,061.00 Total Annual Cost \$785.00 \$402.00	Image: Control of the second
agal/Administrative Sontract Admini/Construction Management Sontract Admini/Construction Management Subtotal Other Costs Fotal Capital Improvement Cost Maste Description Subert Maintenance (e.g. sediment & debris rei	r Plan Operation moval, erosion at entrano & debris removal, structu	ce/exit, structural repairs,	ce Cost Summar Quantity	Unit L.F.	\$1.00	\$552,061.00 Total Annual Cost \$785.00	

1/30/2019, 3:34 PM

SBB\_UD-MP Cost Version 2.2\_FT\_Melbourne.xlsm, FM (Option 2)-Reach2

MAS	TER PLAN C	OST ESTIMAT	E FOR INDIV	IDUAL REA	ACH		
							-
PROJECT : DRAINAGEWAY :	Sharktooth Bluff NofMelbourneSt						-
REACH :	1						
JURISDICTION :	City of Greeley						-
REACH ID:	FM-Reach1		Enter Estimator Nam	e on Project Info	DATE :	12/19/2018	
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	1	50	L.F.	\$72.00	\$3,600.00	
Channel Improvements							
Excavation, Mid Range			90	C.Y.	\$32.00	\$2,880.00	Excavation
Detention/Water Quality Facilitie	es						
Detention (User Entered Quantities	)						
Outlet Works	[		1	EA	\$5,000.00	\$5,000.00	Modify existin outlet strucutre with new outlet pipe
Special Items (User Defined)							
Asphalt	<user defined="" iten<="" td=""><td>ns</td><td>7</td><td>TON</td><td>\$250.00</td><td>\$1,775.00</td><td></td></user>	ns	7	TON	\$250.00	\$1,775.00	
	Master PI	an Capital Impro	vement Cost Sui	mmary			
Capital Improvement Costs Pipe Culverts and Storm Drains						\$3,600.00	
Concrete Box Culverts						\$3,000.00	
Hydraulic Structures						\$0.00	
Channel Improvements						\$2,880.00	
Detention/Water Quality Facilities						\$5,000.00	
Removals						\$0.00	
Landscaping and Maintenance Improvements						\$0.00	
Special Items (User Defined)						\$1,775.00 \$13,255.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Cost	te					\$13,255.00	
Dewatering			\$132.55	L.S.		\$133.00	
Mobilization			5%			\$663.00	
Traffic Control			\$662.75	L.S.		\$663.00	
Jtility Coordination/Relocation			\$662.75	L.S.		\$663.00	
Stormwater Management/Erosion Control			5%			\$663.00	
Subtotal Additional Capital Improvement Cos Land Acquisition Costs	ts					\$2,785.00	
ROW/Easements						\$0.00	
Subtotal Land Acquisition Costs						\$0.00	
Other Costs (percentage of Capital	Improvement Costs)						
Engineering			15%			\$2,406.00	
_egal/Administrative			5%			\$802.00	
Contract Admin/Construction Management Contingency			10% 25%			\$1,604.00 \$4,010.00	
Subtotal Other Costs			2070			\$4,010.00	
Total Capital Improvement Cost	s					\$24.862.00	
	-					÷1.,001.00	
	r Plan Operation	n and Maintenan				1	
Description			Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris ren Detention/WQ Maintenance (e.g. sediment & del				L.F. ACRE	\$1.00 \$2.010.00	\$100.00 \$402.00	
		ui, u ee & weed removal,	5 U.Z	AURE	\$2,010.00		
Total Annual Operation and Ma	intenance Cost					\$502.00	
Effective Interest Rate		0. \/				2.00%	
Total Operation and Maintenand	ce Costs Over 5	u rears				\$15,775.00	

		COT LOTIMA	E FOR INDIV		АСП		
PROJECT :	Sharktooth Bluff						
DRAINAGEWAY :	ND						
REACH :	2						
JURISDICTION :	City of Greeley						
REACH ID:	C Street		JKD		DATE :	12/19/2018	
			· · · · · · · · · · · · · · · · · · ·				
DESCRIPTION			QUANTITY	UNIT		TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	700	1	700	L.F.	\$72.00	\$50,400.00	
42-inch	1550	1	1550	L.F.	\$169.00	\$261,950.00	
Flare End Sections		1	1	1	1		
Diameter (in)	Applicable	No. of Barrels					
42-inch	Yes	1	1	EA	\$2,278.00	\$2,278.00	
Manholes and Inlets		1					
fanhole, 5' Dia. (Pipe Dia. 36" - 42")			7	EA	\$5,226.00	\$36,582.00	
Channel Improvements							
excavation, Mid Range			3880	C.Y.	\$32.00	\$124,160.00	Trench Excavation (Shallow to Mid) & Roadside Swale
excavation, High Range			5000	C.Y.	\$42.00	\$210,000.00	Trench Excavation (Deep)
andscaping and Maintenance	Improvements						
Reclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00	
				AUNE	91,040.00	φ1,040.00	
Special Items (User Defined)							
Asphalt	<user defined="" iten<="" td=""><td>าร</td><td>775</td><td>TON</td><td>\$50.00</td><td>\$38,750.00</td><td></td></user>	าร	775	TON	\$50.00	\$38,750.00	
Capital Improvement Costs ipe Culverts and Storm Drains	Master Pl	an Capital Impro	vement Cost Su	mmary		\$351,210.00	
Concrete Box Culverts						\$0.00	
wdraulic Structures							
,						\$0.00	
Channel Improvements						\$334,160.00	
Channel Improvements Detention/Water Quality Facilities						\$334,160.00 \$0.00	
Zhannel Improvements Detention/Water Quality Facilities Removals						\$334,160.00 \$0.00 \$0.00	
Channel Improvements Detention/Water Quality Facilities Removals Landscaping and Maintenance Improvements						\$334,160.00 \$0.00 \$0.00 \$1,340.00	
Ananel Improvements Detention/Water Quality Facilities Removals andscaping and Maintenance Improvements Special Items (User Defined)						\$334,160.00 \$0.00 \$0.00 \$1,340.00 \$38,750.00	- 
Channel Improvements Detention/Water Quality Facilities Aemovals andscaping and Maintenance Improvements Special Items (User Defined) Subtotal Capital Improvement Costs						\$334,160.00 \$0.00 \$0.00 \$1,340.00	
Annel Improvements betention/Water Quality Facilities amovals amoscaping and Maintenance Improvements special Items (User Defined) Subtotal Capital Improvement Costs Additional Capital Improvement Costs	sts					\$334,160.00 \$0.00 \$1,340.00 \$38,750.00 \$725,460.00	
Shannel Improvements betenford Water Quality Facilities termouls andscaping and Maintenance Improvements special Items (User Defined) subtotal Capital Improvement Costs Additional G-pital Improvement Cos bevatering	sts		\$7,254.60	L.S.		\$334,160.00 \$0.00 \$1,340.00 \$38,750.00 <b>\$725,460.00</b> \$7,255.00	
Zhannel Improvements bernfort/Water Quality Facilities terrovels andscaping and Maintenance Improvements pocial times (User Defined) subtotal Capital Improvement Costs Additional Capital Improvement Cos exettering	sts		5%			\$334,160.00 \$0.00 \$1,340.00 \$38,750.00 <b>\$725,460.00</b> \$7,255.00 \$36,273.00	
Sannel Improvements behenfon Water Quality Facilities behenfon Water Quality Facilities behovals andscaping and Maintenance Improvements peoral times (User Defined) babtotal Capital Improvement Costs Additional Capital Improvement Cost bevalaring biblization Taffic Control	sts		5% \$36,273.00	L.S.		\$334,160.00 \$0.00 \$1,340.00 \$725,460.00 \$7,255.00 \$36,273.00 \$36,273.00	
Shannal Improvements bernfort/Water Quality Facilities termoials andiscaping and Maintenance Improvements pocial times (Leer Defined) ubtotal Capital Improvement Costs Additional Cepital Improvement Costs eventering hobitzation Taffic Control Mity Coordination/Relocation	ts		5% \$36,273.00 \$36,273.00			\$334,160.00 \$0.00 \$1,340.00 \$38,750.00 \$7,255.00 \$7,255.00 \$36,273.00 \$36,273.00 \$36,273.00	
Damal Improvements     Detention Water Caualty Facilities     Wernoals     entroals     entroals     andscaping and Maintenance Improvements     andscaping and Maintenance Improvement     Additional Gripital     Traite Control     Nity Coordination/Relocation     Nity Coordination/Relocation			5% \$36,273.00	L.S.		\$334,160.00 \$0.00 \$1,340.00 \$725,460.00 \$77,255.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00	
Samal Improvements Sternfort/Water Quality Facilities termonik andiscaping and Maintenance Improvements pacial terms (User Defined) Jubiotal Capital Improvement Costs Additional Genital Improvement Cost Additional Genital Improvement Cost Notization Taffic Control Mity Coordination/Relocation Nativotal Additional Capital Improvement Cost			5% \$36,273.00 \$36,273.00	L.S.		\$334,160.00 \$0.00 \$1,340.00 \$38,750.00 \$7,255.00 \$7,255.00 \$36,273.00 \$36,273.00 \$36,273.00	-           -
Dennel Improvements     Detention/Water Cuality Facilities     Werroals     entroals     andscaping and Maintenance Improvements     andscaping and Maintenance Improvement     Additional Capital Improvement Costs     Additional Capital Improvement Cost     Additional Capital Improvement     Subvisit Coordination/Relocation     Nilly Coordination/Relocation     Subvisit Additional Capital Improvement     Subvisit Additional Capital Improvement     Subvisit Additional Capital Improvement     Subvisit     Land Acquisition Costs			5% \$36,273.00 \$36,273.00	L.S.		\$334,160.00 \$0.00 \$1,340.00 \$38,750.00 \$725,460.00 \$7,255.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00	
Samal Improvements Submit Of Wardshift ( Submit Of Ward Vally Facilities Internation (User Defined) Jubicial Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Costs Networking Oblization Faffic Control Nity Coordination/Relocation Nity Coordination/Relocation Nity Coordination/Relocation Nity Cost Addition Capital Improvement Costs Land Acquisition Costs OV/Essements			5% \$36,273.00 \$36,273.00	L.S.		\$334,160.00 \$0.00 \$1,340.00 \$38,750.00 \$725,460.00 \$725,460.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00	-           -
hannel Improvements     letention/Water Quality Facilities     entrovals     entrovals     and/scaping and Maintenance Improvements     and/scaping and Maintenance Improvements     Additional Capital Improvement Costs     Additional Capital Improvement Cost     advance     Additional Capital Improvement     Software Management/Erosion Control     Whotal Additional Capital Improvement Cost     Land Acquisition Costs     Wototal Land Acquisition Costs	ts		5% \$36,273.00 \$36,273.00	L.S.		\$334,160.00 \$0.00 \$1,340.00 \$38,750.00 \$725,460.00 \$7,255.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00 \$36,273.00	
hannel Improvements     wentom/Water Qualy Facilities     territorial     andesaging and Maintenance Improvements     pecial terrs (User Defined)     wettortal Capital Improvement Costs         Additional Geolal Improvement Cost         Additional Geolal Improvement Cost         Additional Geolal Improvement         Cost and Costs         MonagementErosion Control         Wortal Additional Capital         Improvement         Cost and Capital         mprovement         Cost         Land Acquisition Costs         Wortal         Addition         Costs	ts		5% \$36,273.00 \$36,273.00 5%	L.S.		\$334,160,00 \$0,00 \$1,00 \$38,750,00 \$725,460,00 \$725,460,00 \$725,460,00 \$725,460,00 \$72,73,00 \$36,273,000\$36,273,000\$36,270,000\$36,270,000\$36,270,000\$36,270,000\$36,270,000\$36,20	
hannel Improvements     letention/Water Cuality Facilities     eleminals     enrovals     andscaping and Maintenance Improvements     andscaping and Maintenance Improvements     Additional Capital Improvement Costs     Additional Capital Improvement Cost     bitization     andscaping	ts		5% \$36,273.00 \$36,273.00 5% 15%	L.S.		\$34140.00 \$0.00 \$1.040.00 \$38,750.00 \$725,460.00 \$725,460.00 \$38,773.00 \$38,773.00 \$38,773.00 \$38,773.00 \$38,773.00 \$38,773.00 \$38,773.00 \$38,773.00 \$38,773.00 \$38,773.00	-           -
hannel Improvements wennowikar Qualy Facilities wennowikar Qualy Facilities wennowikar Qualy Facilities gealat Improvement Costs	ts		5% \$36,273.00 \$36,273.00 5% 15% 5%	L.S.		\$334 160.00 \$0.00 \$1.340.00 \$7.255.00 \$7.255.00 \$7.255.00 \$3.8,273.00 \$3.8,0700 \$3.8,0700 \$3.8,0700 \$3.8,0700 \$	
Dannel Improvements     Detention/Water Cuality Facilities     Detention/Water Cuality Facilities     Detention     Detentin     Detention     Detention     Detentio	ts		5% \$36,273.00 \$36,273.00 5% 5% 15% 5%	L.S.		\$334.160.00 \$0.00 \$0.00 \$38,750.00 \$725,460.00 \$725,460.00 \$725,460.00 \$725,460.00 \$38,773.00 \$38,773.00 \$38,273.00 \$38,273.00 \$38,273.00 \$38,273.00 \$38,273.00 \$39,273.00 \$131,671.00 \$43,890.00 \$87,781.00	-           -
hannel Improvements     wehnor/Wark OLABY Facilities     territorials     andesaging and Meintenance Improvements     peotal terres (User Defined)     uubtotal Capital Improvement Costs         Locational Capital Improvement Cost         Lond Acquisition Costs         Other Costs         Othe	ts		5% \$36,273.00 \$36,273.00 5% 15% 5%	L.S.		3334 160.00         30.00           \$0.00         \$1.340.00           \$1.340.00         \$3.8750.00           \$7.255.00         \$3.8750.00           \$7.255.00         \$3.8773.00           \$3.8773.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.827781.00           \$3.827781.00         \$3.827781.00	Image: Control of the sector of the
hannal improvements elention/Water Qualty Facilities emovals indiscaping and Maintenance Improvements pedial items (User Defined) ubtotal Capital improvement Costs Adational Capital improvement Cost biblization afflic Octortiol Bibly Coordination/Relocation afflic Octortion Capital Improvement Cost Ustotal Additional Capital Improvement Cost United Costs United Costs (Inter Costs (percentage of Cepital Ingineering gair/Aministrative omfact Admin Construction Management onfact Admin Construction Management onfact Admin Construction Management onfact Admin Construction Management onfact Admin Costs	ts Improvement Costs)		5% \$36,273.00 \$36,273.00 5% 5% 15% 5%	L.S.		334/160.00         \$0.00           \$0.00         \$5.00           \$1.040.00         \$38.750.00           \$725,460.00         \$725,460.00           \$725,460.00         \$36.773.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$42,274.00         \$42,274.00	Image: Control of the sector of the
hannel Improvements evention/Water Qualty Facilities evention/Water Qualty Facilities evention/Water Qualty Facilities models and facilitation and emprovements pecial terms (User Defined) ubtoal Logital Improvement Costs Adardional Cegital Improvement Cost biblization raffic Control Otto Working Adardiano/Relocation termwater ManagementErosion Control ubtoal Additional Capital Improvement Cost Land Acquisition Costs Otties Costs (Direc Costs (percentage of Cepital) ingineering gail/Aministrative contract Admin Construction Management contract contract Admin Construction contract contract contract	ts Improvement Costs)		5% \$36,273.00 \$36,273.00 5% 5% 15% 5%	L.S.		3334 160.00         30.00           \$0.00         \$1.340.00           \$1.340.00         \$3.8750.00           \$7.255.00         \$3.8750.00           \$7.255.00         \$3.8773.00           \$3.8773.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.8273.00           \$3.8273.00         \$3.827781.00           \$3.827781.00         \$3.827781.00	-           -
hannel Improvements eventrom Vited Vally Facilities microsits andscaping and Maintenance Improvements pacial Items (User Defined) ubitotal Capital Improvement Costs Additional Expital Improvement Costs Additional Expital Improvement Cost Solization raffic Control Solization Staff Control Capital Improvement Cost Land Acquisition Costs Other Costs (percontage of Capital Ingineering ogal/Administrative contract Admin/Construction Management contage/Idministrative contract Costs	ts Improvement Costs) S		5% \$36,273.00 \$36,273.00 5% 15% 15% 10% 25%	L.S.		334/160.00         \$0.00           \$0.00         \$5.00           \$1.040.00         \$38.750.00           \$725,460.00         \$725,460.00           \$725,460.00         \$36.773.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$42,274.00         \$42,274.00	Image: Constraint of the sector of
hannel Improvements wetenfort/Water Quality Facilities andscaping and Maintenance Improvements andscaping and Maintenance Improvements andscaping and Maintenance Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Cost Multiple Control Registration Costs Multiple Cost Costs Conter Costs Conter Costs Conter Costs Costa Capital Improvement Costs Costa Capital Improvement Costs Multiple Costs Cost Cost Cost Costs Cost	ts Improvement Costs) S	n and Maintenan	5% 586,273.00 5% 5% 10% 10% 22%	LS. LS.		3334 160.00         \$0.00           \$0.00         \$0.00           \$0.00         \$0.00           \$0.00         \$0.00           \$1,340.00         \$38,750.00           \$725,460.00         \$725,460.00           \$72,56.00         \$38,773.00           \$38,273.00         \$38,273.00           \$38,273.00         \$38,273.00           \$38,273.00         \$38,273.00           \$38,273.00         \$38,273.00           \$30,000         \$33,671.00           \$43,360.00         \$413,1671.00           \$44,2784.00         \$41,360,601.00           \$1,360,601.00         \$1,360,601.00	Image: Control of the sector of the
hannel Improvements extendion/Water Quality Facilities errowals mindiscaping and Maintenance Improvements Additional Capital Improvement Costs Additional Capital Improvement Costs Motization Taffic Control Utily CoordinationRelocation Dubtotal Additional Capital Improvement Costs Collegation Dubtotal Land Acquisition Costs Other Costs (percentage of Capital Implement Onter Costs Other Co	ts Improvement Costs) S r Plan Operation		5% 5%27.00 5%57.00 5% 15% 5% 10% 25% 20%	L.S. L.S.	Unit Cost	\$334.160.00 \$0.00 \$1.340.00 \$3.8750.00 \$725.460.00 \$725.460.00 \$3.8773.00 \$3.8773.00 \$3.8773.00 \$3.8773.00 \$3.8773.00 \$3.8773.00 \$3.8773.00 \$3.8773.00 \$3.8773.00 \$3.8773.00 \$3.8774.00 \$3.734.00 \$3	Image: Control of the sector of the
hannel Improvements wetenfort/Water Quality Facilities andscaping and Maintenance Improvements pecial times (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs Mobilization faffic Control Mity Coordination/Relocation Mity Coordination Mity Mity Mity Mity Mity Mity Mity Mity Mity	ts Improvement Costs) S r Plan Operation	ce/exit, structural repairs,	5%         5%           586,273.00         586,273.00           5%         5%           10%         5%           10%         25%           cce Cost Summar         Quantity           Quantity         2200	LS. LS. Y Unit LF.	\$1.00	3334 160.00         \$0.00           \$0.00         \$0.00           \$1.00.00         \$38.750.00           \$28.750.00         \$372,860.00           \$72,860.00         \$36.773.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$36,273.00         \$36,273.00           \$43,860.00         \$43,274.00           \$43,860.00         \$47,741.00           \$42,794.00         \$42,794.00           \$13,660,601.00         \$42,794.00           \$14,360,601.00         \$13,260,601.00	Image: Control of the sector of the
hannel Improvements extendion/Water Quality Facilities enrovals merovals mindicaping and Maintenance Improvements Additional Gapital Improvement Costs Additional Gapital Improvement Costs Maintenance (a gamma and a gamma and and and and and and and and and an	ts Improvement Costs) S r Plan Operation roval, erosion al entrano	ce/exit, structural repairs, ral repairs, etc.)	5% 5% 273.00 5% 5% 15% 5% 10% 25% 20% 20% 7	LS. LS. V Unit LF. EA	\$1.00 \$67.00	\$334.160.00 \$0.00 \$0.00 \$1.340.00 \$3.8,750.00 \$725,460.00 \$725,460.00 \$3.8,773.00 \$3.8,773.00 \$3.8,773.00 \$3.8,273.00 \$3.9,270.00 \$3.9,2	Image: Control of the sector of the
hannel Improvements eventor/Water Qualty Facilities Additional Gegital Improvement Gosts Additional Gegital Improvement Costs for Cortrol Water Management/Erosion Control Water Management/Erosion Control Water Management/Erosion Master escription Water Management ( g., sediment & debris re Mannel Maintenance ( g., sediment & debris re Ma	ts Instrovement Costs) S r Plan Operation roxal, erosion at entranc debria removal, structur	ce/exit, structural repairs, ral repairs, etc.) weed removal, etc.)	5%         5%           586,273.00         586,273.00           5%         5%           10%         5%           10%         25%           cce Cost Summar         Quantity           Quantity         2200	LS. LS. Y Unit LF.	\$1.00	3334 160.00         \$0.00           \$0.00         \$1.340.00           \$1.340.00         \$3.8,750.00           \$725,860.00         \$725,860.00           \$725,860.00         \$38,773.00           \$36,773.00         \$36,773.00           \$36,773.00         \$36,773.00           \$36,773.00         \$36,773.00           \$36,773.00         \$36,773.00           \$36,773.00         \$36,773.00           \$37,781.00         \$36,870.00           \$43,890.00         \$443,280.00           \$443,2784.00         \$442,2784.00           \$443,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,000         \$442,000	Image: Control of the sector of the
hannel Improvements etention Water Quality Facilities emovals andscaping and Maintenance Improvements Additional Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Costs Indication Capital Improvement Costs Indication Capital Improvement Costs Indication Capital Improvement Costs Collection Costs Collection Costs Collection Costs Collection Costs Cost	ts Instrovement Costs) S r Plan Operation roxal, erosion at entranc debria removal, structur	ce/exit, structural repairs, ral repairs, etc.) weed removal, etc.)	5% 5% 273.00 5% 5% 15% 5% 10% 25% 20% 20% 7	LS. LS. V Unit LF. EA	\$1.00 \$67.00	3334 160.00         \$             80.00               80.00             50.00             \$             80.00               80.00             858.750.00             \$             8725.460.00               97.25.00             838.773.00             838.773.00               838.773.00             838.773.00             838.773.00               838.773.00             838.773.00               838.773.00             838.773.00               838.773.00               848.774.00               848.774.00               848.774.00               848.774.00               848.774.00               848.774.00               848.774.00               848.774.00               848.774.00               848.700.00               848.700.00               848.700.00               848.700.00               830.00               830.00               830.00               830.00               830.00               830.00               830.00               830.00               830.00               830.00               830.00	Image: Control of the sector of the
hannel Improvements extendion/Water Quality Facilities errowals mindiscaping and Maintenance Improvements Additional Capital Improvement Costs Additional Capital Improvement Costs Motization Taffic Control Utily CoordinationRelocation Dubtotal Additional Capital Improvement Costs Collegation Dubtotal Land Acquisition Costs Other Costs (percentage of Capital Implement Onter Costs Other Co	ts Instrovement Costs) S r Plan Operation roxal, erosion at entranc debria removal, structur	ce/exit, structural repairs, ral repairs, etc.) weed removal, etc.)	5% 5% 273.00 5% 5% 15% 5% 10% 25% 20% 20% 7	LS. LS. V Unit LF. EA	\$1.00 \$67.00	3334 160.00         \$0.00           \$0.00         \$1.340.00           \$1.340.00         \$3.8,750.00           \$725,860.00         \$725,860.00           \$725,860.00         \$38,773.00           \$36,773.00         \$36,773.00           \$36,773.00         \$36,773.00           \$36,773.00         \$36,773.00           \$36,773.00         \$36,773.00           \$36,773.00         \$36,773.00           \$37,781.00         \$36,870.00           \$43,890.00         \$443,280.00           \$443,2784.00         \$442,2784.00           \$443,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,2784.00         \$442,2784.00           \$442,000         \$442,000	Image: Control of the section of t

MAST	ER PLAN C	OST ESTIMAT	E FOR INDIVI	DUAL RE	ACH		]
PROJECT :	Sharktooth Bluff						
	PLC						-
	2						
	City of Greeley		Fatas Fatimatas Nam	Desile et le fe		12/21/2018	
REACH ID:	CR 62 East - FHMA	4	Enter Estimator Nam	e on Project init	DATE :	12/21/2018	
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)			1	
12	5	1	100	L.F.	\$1,239.66	\$123,966.00	
Headwall and Toewalls					I	1	
Individual Box Span (ft) 12	No. of Barrels	Total Span (ft) 14.00	2	EA	\$1,343.16	\$2,686.00	
Wingwalls (includes wingwalls on eithe	er side of channel ar	nd concrete apron)	2	EA	\$1,343.10	\$2,080.00	
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
12	5	1	2	EA	\$12,577.01	\$25,154.00	
Channel Improvements							
xcavation, Mid Range			670	C.Y.	\$32.00	\$21,440.00	Culvert
2-inch Riprap, Type M			18 2300	C.Y. C.Y.	\$80.00 \$32.00	\$1,440.00 \$73,600.00	Culvert 675 ft channel DS of CR 62 to PLC
Excavation, Mid Range 2-inch Riprap, Type M			16	C.Y.	\$32.00	\$1,280.00	Downstream
Removals							
Removal of culvert pipe (D<48")			50	L.F.	\$27.00	\$1,350.00	
andscaping and Maintenance Im	provements						
Vetlands Plantings			2	ACRE	\$33,500.00	\$67,000.00	
Reclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00	
rail/Path, Concrete (10' Width)			50	L.F.	\$59.00	\$2,950.00	
Special Items (User Defined)							
Asphalt <	User Defined Item	\$	33	TON	\$250.00	\$8,250.00	
	Marchan Dia						
Capital Improvement Costs	Master Pla	an Capital Improv	ement Cost Sur	nmary			
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts						\$151,806.00	
Hydraulic Structures						\$0.00	
Channel Improvements						\$97,760.00	
Detention/Water Quality Facilities Removals						\$0.00 \$1,350.00	
andscaping and Maintenance Improvements						\$71,290.00	
Special Items (User Defined)						\$8,250.00	
Subtotal Capital Improvement Costs						\$330,456.00	
Additional Capital Improvement Costs				1.0			
Dewatering Abbilization			\$3,304.56	L.S.		\$3,305.00 \$16,523.00	
raffic Control			\$16,522.80	L.S.		\$16,523.00	
Itility Coordination/Relocation			\$16,522.80	L.S.		\$16,523.00	
Stormwater Management/Erosion Control			5%			\$16,523.00	
Subtotal Additional Capital Improvement Costs				-		\$69,397.00	
Contract Acquisition Costs						\$0.00	
						\$0.00	
Subtotal Land Acquisition Costs							
Subtotal Land Acquisition Costs Other Costs (percentage of Capital Imp	provement Costs)					\$59,978.00	
ubtotal Land Acquisition Costs Other Costs (percentage of Capital Imp ingineering	provement Costs)		15%				
ubtotal Land Acquisition Costs Other Costs (percentage of Capital Imp ingineering egal/Administrative	provement Costs)		5%			\$19,993.00	
kubtotal Land Acquisition Costs Other Costs (percentage of Capital Imp ingineering egal/Administrative contract Admin/Construction Management	provement Costs)		5% 10%			\$19,993.00 \$39,985.00	
ubtotal Land Acquisition Costs Other Costs (percentage of Capital Imp ngineering egal/Administrative contract Admin/Construction Management contingency	provement Costs)		5%			\$19,993.00	
ubtotal Land Acquisition Costs Other Costs (percentage of Capital Imp agai/Administrative contract Admini/Construction Management confingency ubtotal Other Costs	provement Costs)		5% 10%			\$19,993.00 \$39,985.00 \$99,963.00	
ubtotal Land Acquisition Costs Online Costs (percentage of Capital Imp oggi/Administrative ondingency) ubtotal Other Costs Total Capital Improvement Costs	provement Costs)	and Maintenanc	5% 10% 25%			\$19,993.00 \$39,985.00 \$99,963.00 \$219,919.00	
Subtotal Land Acquisition Costs Other Costs (percentage of Gapital Imp ingineering gal/Administrative contract AdminiConstruction Management contract AdminiConstruction Management Contract Costs Fotal Capital Improvement Costs Master Pl	provement Costs)	and Maintenanc	5% 10% 25% e Cost Summar		Unit Cost	\$19,993.00 \$39,985.00 \$99,963.00 \$219,919.00 \$619,772.00	
altotal Land Acquisition Costs     Other Costs (percentage of Gapital Imp nagineering gal/Administrative orinite AdminiConstruction Management orinite AdminiConstruction Management andrex y altotal Cher Costs fotal Capital Improvement Costs Master Pl lescription Juert Maintenace (e.g. sediment & debris remova	al, erosion at entrance	e/exit, structural repairs,	5% 10% 25% e Cost Summar Quantity 100	Unit L.F.	Unit Cost \$1.00	\$19,993.00 \$39,985.00 \$59,963.00 \$219,919.00 \$619,772.00 Total Annual Cost \$100.00	
Subtotal Land Acquisition Costs Other Costs (percentage of Capital Imp egal/Administrative confingency utotal Other Costs Fotal Capital Improvement Costs Example Costs Example Costs Example Costs Description Cubert Maintenance (e.g. sediment & debris remove Lament Maintenance (e.g. sediment & debris remove	al, erosion at entrance val, erosion, tree & w	e/exit, structural repairs,	5% 10% 25% e Cost Summar Quantity	Unit		\$19,993.00 \$39,985.00 \$99,963.00 \$219,919.00 \$619,772.00 Total Annual Cost \$100.00 \$2,025.00	
ubtotal Land Acquisition Costs Other Costs (percentage of Capital Imp organizering contract Admin/Construction Management ioningency) ubtotal Other Costs Cotal Capital Improvement Costs Master Pl tecription advert Maintenance (e.g. sediment & debris remoto ahannel Maintenance (e.g. sediment & debris remoto Cotal Annual Operation and Maint	al, erosion at entrance val, erosion, tree & w	e/exit, structural repairs,	5% 10% 25% e Cost Summar Quantity 100	Unit L.F.	\$1.00	\$19,993.00 \$39,985.00 \$39,985.00 \$59,963.00 \$619,772.00 Total Annual Cost \$100.00 \$2,025.00 \$2,125.00	
Utilitat Land Acquisition Costs Other Costs (percentage of Capital Imp aga/Administrative opar/Administrative contingency utilotal Other Costs Fotal Capital Improvement Costs Master Pl tescription Autori Maintenance (e.g. sediment & debris remova hannel Maintenance (e.g. sediment & debris remova	al, erosion at entrance val, erosion, tree & w tenance Cost	e/exit, structural repairs, eed removal, etc.)	5% 10% 25% e Cost Summar Quantity 100	Unit L.F.	\$1.00	\$19,993.00 \$39,985.00 \$99,963.00 \$219,919.00 \$619,772.00 Total Annual Cost \$100.00 \$2,025.00	

PROJECT :	Sharktooth Bluff						
DRAINAGEWAY :	PLC						
REACH :	2						
JURISDICTION :	City of Greeley						
REACH ID:	CR 62 West - FHM	AM	Enter Estimator Nam	ne on Project Inf	DATE :	12/21/2018	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts			Quintin		0.000		COLIC COMMENTO
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	5	1	100	L.F.	\$1,239.66	\$123,966.00	
Headwall and Toewalls				r	1		
Individual Box Span (ft)	No. of Barrels	Total Span (ft)				** *** **	
12 Minawelle (includes viagualle en e	ither olds of shorest r	14.00	2	EA	\$1,343.16	\$2,686.00	
Wingwalls (includes wingwalls on e Individual Box Span (ft)	ither side of channel a Box Rise (ft)	No. of Barrels	1	1	1	1	
12	Box Rise (π) 5	No. or Barreis	2	EA	\$12,577.01	\$25,154.00	
Channel Improvements	Ŭ		-		- the official states of the s	020,101.00	
xcavation, Mid Range			693	C.Y.	\$32.00	\$22,176.00	
2-inch Riprap, Type M			16	C.Y.	\$80.00	\$1,303.00	
andscaping and Maintenance	Improvements						
Reclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00	
rail/Path, Concrete (10' Width)	,		50	L.F.	\$59.00	\$2,950.00	
Special Items (User Defined)							
	<user defined="" iten<="" td=""><td>ns</td><td>20</td><td>TON</td><td>\$250.00</td><td>\$5,000.00</td><td></td></user>	ns	20	TON	\$250.00	\$5,000.00	
	Master Pl	<mark>an Capital Impro</mark>	vement Cost Su	mmary		\$0.00	
Pipe Culverts and Storm Drains Concrete Box Culverts	Master Pl	an Capital Impro	vement Cost Su	mmary			
Pipe Culverts and Storm Drains Concrete Box Culverts Hydraulic Structures Channel Improvements	Master Pl	an Capital Impro	vement Cost Su	mmary	J	\$0.00 \$151,806.00 \$0.00 \$23,479.00	
Pipe Culverts and Storm Drains Concrete Box Culverts Hydraulic Structures Channel Improvements Detention/Water Quality Facilities	Master Pl	an Capital Impro	vement Cost Su	mmary	,	\$0.00 \$151,806.00 \$0.00 \$23,479.00 \$0.00	
Pipe Culverts and Storm Drains Concrete Box Culverts dydraulic Structures Dhannel Improvements Detention/Water Quality Facilities Memovals	Master Pl	an Capital Impro	vement Cost Su	mmary	,	\$0.00 \$151,806.00 \$0.00 \$23,479.00 \$0.00 \$0.00	
Vipe Culverts and Storm Drains Concrete Box Culverts Vydraulic Structures 2tannel Improvements Detention/Water Quality Facilities Vernovals andscaping and Maintenance Improvements	Master Pl	an Capital Impro	vement Cost Su	mmary		\$0.00 \$151,806.00 \$0.00 \$23,479.00 \$0.00 \$0.00 \$4,230.00	
Vipe Culverts and Storm Drains Concrete Box Culverts Channel Improvements Detention/Water Cuality Facilities Networks AndScaping and Maintenance Improvements special Items (User Defined)	Master PI	an Capital Impro	vement Cost Sur	mmary		\$0.00 \$151,806.00 \$0.00 \$0.00 \$0.00 \$0.00 \$4,290.00 \$5,000.00	
tipe Culverts and Storm Drains concrete Box Culverts by draule. Structures brannel Improvements teention/Water Quality Facilities territorials and/scaping and Maintenance Improvements pecial Items (User Defined)		an Capital Impro	vement Cost Sur	mmary		\$0.00 \$151,806.00 \$0.00 \$23,479.00 \$0.00 \$0.00 \$4,230.00	
Vipe Culverts and Storm Dnains Soncrete Box Culverts Shannel Improvements Shannel Improvements Bernioxitäs Bernioxitäs Bernioxitäs and Maintenance Improvements special Items (User Defined) Subtotal Capital Improvement Costs Additional Cepital Improvement Costs		an Capital Impro	vement Cost Sur	LS.		\$0.00 \$151,806.00 \$0.00 \$0.00 \$0.00 \$0.00 \$4,290.00 \$5,000.00	
Vipe Culverts and Storm Drains Soncrete Box Culverts Variand: Bructures Anannel Improvements Ananos Improvements benovals amdicaping and Maintenance Improvements opcial Items (User Defined) subtotal Capital Improvement Costs Additional Gepital Improvement Cost Additional Cost Additional Gepital Improvement Cost Additional Gepital Improvement Cost Additional Gepital Improvement Cost Additional Gepital Improvement Cost Additional Cost Additio		an Capital Impro	\$1.845.75 5%	LS.		\$0.00 \$151,808.00 \$0.00 \$0.00 \$0.00 \$4,290.00 \$5,000.00 \$184,575.00 \$1,846.00 \$3,229.00	
Vipe Culvers and Stern Drains     Concrete Box Culvers     Vdraile Structures     Standt proceenents     Detertion/Water Cuality Facilities     Winovas     Variande Improvements     pecial times (User Defined)     Varians		an Capital Impro	\$1,845.75 5% \$9,228.75	LS.		\$0.00 \$151,808.00 \$2.00 \$0.00 \$0.00 \$4,280.00 \$5,000.00 \$184,575.00 \$1,846.00 \$9,229.00 \$9,229.00	
Pipe Culverts and Stern Drains Zoncrete Box Culverts Vortaulic Structures Dannel Improvements Dannel Improvements Demotion Vater Culty Facilities Pernovals andicaping and Maintenance Improvements pacial Items (User Defined) Subtotal Capital Improvement Costs Additional Gripital Improvement Costs Develoring Molization Taffic Control Milly CoordinationRelocation		an Capital Impro	\$1,845.75 5% \$9,228.75 \$9,228.75	LS.		\$0.00 \$151,808.00 \$0.00 \$0.00 \$0.00 \$4,290.00 \$184,575.00 \$1,846.00 \$5,229.00 \$9,229.00 \$9,229.00	
Dipe Culverts and Storn Drains Concrete Box Culverts ydrauls Structures Schend Improvements Detertion/Water Custity Facilities Itemovals Detertion/Water Custity Facilities Itemovals Detertion (Concerns) Detertion (Conce	sis	an Capital Impro	\$1,845.75 5% \$9,228.75	LS.		\$0.00 \$151,808.00 \$2,3479.00 \$0.00 \$5.00 \$5.000 \$5.000 \$5.000 \$5.000 \$1.846.00 \$5.229.00 \$9.229.00 \$9.229.00	
Dipe Culverts and Storm Drains Soncrete Box Culverts Varianic Structures Anannel Improvements Ananoel Improvements entrocality and Maintenance Improvements special Items (User Defined) subtolar Capital Improvement Costs Additional Gepital Improvement Cost Additional Gepital Improvement Cost Additional Gepital Improvement Cost Additional Gepital Improvement Cost Additional Gepital Improvement Cost Stalizaton Taffic Control	sis	an Capital Impro	\$1,845.75 5% \$9,228.75 \$9,228.75	LS.		\$0.00 \$151,808.00 \$0.00 \$0.00 \$0.00 \$4,290.00 \$184,575.00 \$1,846.00 \$5,229.00 \$9,229.00 \$9,229.00	
Dipe Culverts and Stern Drains Concrete Box Culverts Surand Improvements Methods and Structures Eventorial Water Quality Facilities Methods and Maintenance Improvements objectal thems (User Defined) ubtotal Capital Improvement Costs Additional Gapital Improvement Costs Additional Gapital Improvement Cost Mathication Taffic Control Maily Coordination/Relocation Distributed Management/Erosion Control Ubtotal Additional Capital Improvement Cos Land Acquisition Costs	sis	an Capital Impro	\$1,845.75 5% \$9,228.75 \$9,228.75	LS.		\$0.00 \$1151.806.00 \$0.00 \$0.00 \$0.00 \$4.23470.00 \$5.000.00 \$184.575.00 \$184.575.00 \$229.00 \$9.229.00 \$9.229.00 \$9.229.00 \$9.229.00 \$9.229.00 \$9.229.00 \$9.229.00 \$9.229.00 \$9.229.00 \$9.229.00 \$9.229.00 \$9.229.00 \$9.229.00	
Type Culvers and Storn Drains Concrete Box Culvers's Schnell mycowens's Schnell mycowens's Netmion/Water Cuality Facilities Introdals andiscipating and Maintenance Improvements ipecial Items (User Defined) Walchal Capital Improvement Cost Additional Capital Improvement Cost Additional Capital Improvement Cost Schnell Management Ecosion Network Management Ecosion Stromater Management Ecosion Schnell Additional Capital Improvement Cost Subtotal Additional Capital Improvement Cost	ats 15	an Capital Impro	\$1,845.75 5% \$9,228.75 \$9,228.75	LS.		\$0.00 \$151,806.00 \$2,479.00 \$0.00 \$5.00 \$5.000 \$5.000 00 \$5.000 00 \$184,575.00 \$1,846.00 \$9,229.00 \$9,229.00 \$9,229.00 \$3,229.00 \$3,229.00	
Dipe Culverts and Stern Drains Concrete Box Culverts Scharnel Box Culverts Scharnel Improvements elerifor Water Cuality Facilities termosis termosis termosis termosis termosis termosis termosis termosis termosis termosis termosis Additional Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Cost Schortal Additional Capital Improvement Cost Lund Acquisition Costs Culve Land Acquisition Costs Other Costs (percentage of Capital Other Costs (percentage of Capital	ats 15	an Capital Impro	\$1,845,75 5% \$9,228,75 \$9,228,75 \$9,228,75 \$9,228,75	LS.		\$0.00 \$151,806.00 \$0.00 \$0.00 \$0.00 \$4,280.00 \$4,280.00 \$164,575.00 \$184,575.00 \$184,575.00 \$1,846.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00	
Dipe Culverts and Stern Drains Jorarde Box Culver's Surande Box Culver's Surande Trigrovements Juannel Improvements Jeendon Water Cually Facilities termovals amdicaping and Maintenance Improvements pecial Items (User Defined) stabitical Capital Improvement Costs Additional Gapital Improvement Cost Devoluting Oblization Stormwater ManagementErosion Control Stortwater ManagementErosion Control Subtotal Additional Capital Improvement Cost Lund Acquisition Costs COMPE Costs (percentage of Capital Other Costs (percentage of Capital	ats 15	an Capital Impro	\$1.645.75 5% \$9.228.75 5% 15%	LS.		\$0.00 \$151,806.00 \$20,479.00 \$0.00 \$5,000 \$5,000.00 \$5,000.00 \$184,575.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00 \$38,762.00 \$38,762.00 \$30,000 \$30,000	
Ige Calverts and Storn Drains Concrete Box Culverts Manuel Expouents Anamel Improvements electrical Water Cuality Facilities entrovals entrovals andscaping and Maintenance Improvements opecial Items (User Defined) ubiotal capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Cost Motification Taffic Control Nilly CoordinationRelocation Stromater Management/Erosion Control ubiotal Additional Capital Improvement Costs Land Acquisition Costs Culve Easements Other Costs (percentage of Capital Ingineering oggi/Administrative	ats 15	an Capital Impro	\$1,845,75 5% \$9,228,75 5% 5% 15% 5%	LS.		\$0.00 \$151,808.00 \$0.00 \$0.00 \$0.00 \$4,290.00 \$4,290.00 \$4,290.00 \$184,675.00 \$184,675.00 \$1,846.00 \$0,220.00 \$0,230.00 \$0,230.00 \$0,230.00 \$0,230.00 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000 \$0,000	
Ipe Calverts and Storn Drains Concrete Box Culverts Maranel Improvements hannel Improvements elevention/Water Qualty Facilities terrowsis andscaping and Maintenance Improvements pecial Items (User Defined) utilotal Capital Improvement Costs Additional Gapital Improvement Cost watering biblization failt: Coordination/Relocation Nilfy Coordination/Relocation Nilfy Coordination/Relocation Nilfy Coordination/Relocation Nilfy Coordination/Relocation Nilfy Coordination Capital Improvement Cost Land Acquisition Costs Unter Costs (percentage of Capital Ingineering gap/Administrative	ats 15	an Capital Impro	\$1.645.75 5% \$9.228.75 5% 15%	LS.		\$0.00 \$151,806.00 \$20,479.00 \$0.00 \$5,000 \$5,000.00 \$5,000.00 \$184,575.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00 \$38,762.00 \$38,762.00 \$30,000 \$30,000	
Ige Calverts and Storn Drains correte Box Culverts hannel improvements electroni Water Cualty Facilities electroni Water Cualty Facilities electroni Water Cualty Facilities electroni Water Cualty Facilities electronic Water Cualty Facilities without Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Costs United Capital Improvement Costs Control Networks and Costs Control Capital Improvement Costs Land Acquisition Costs Control Costs (percentage of Capital Control Costs (percentage of Capital Ingineering oggi/Administrative Control Capital Costs	ats 15	an Capital Impro	\$1,845.75 5% \$9,228.75 5% 5% 15% 5%	LS.		\$0.00 \$151,806.00 \$20,479.00 \$0.00 \$5,000 \$5,000.00 \$184,576.00 \$1,846.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00 \$38,762.00 \$38,762.00 \$30,00 \$30,00 \$33,501.00 \$11,167.00 \$22,33.00	
Ige Calverts and Storn Drains correle Box Culorhs hannel Improvements electrical Valence and Calverts movals enticipation of the Culory Facilities enticipation of the Culory pecial Items (User Defined) ubtotal Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Cost watering Ubtotal Capital Improvement Cost Ubtotal Capital Improvement Cost Ubtotal Capital Improvement Cost Ubtotal Additional Capital Improvement Cost Suffasements Ubtotal Capital Improvement Cost Suffasements	its ts Improvement Costs)	an Capital Impro	\$1,845.75 5% \$9,228.75 5% 5% 15% 5%	LS.		\$0.00 \$151,808.00 \$2.3,479.00 \$0.00 \$0.00 \$4,280.00 \$4,280.00 \$184,575.00 \$1,846.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00 \$38,762.00 \$38,762.00 \$33,501.00 \$11,167.00 \$22,334.00	
Ige Calverts and Storn Drains correte Box Culverts by draute Structures hannel Improvements electricni Water Cuality Facilities electricni Water Cuality Facilities electricni Water Cuality Facilities electricni Water Cuality Facilities withorial capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Cost evatering Ubbization attile Control Billy Coordination/Relocation tormwater Management/Erosion Control ubtotal Additional Capital Improvement Costs Other Costs (percentage of Capital Control Costs (percentage of Capital Inglenering oppl/Administrative ontract Admini/Construction Management contingency ubtotal Capital Improvement Costs 'coal Capital Improvement Costs	ts Improvement Costs)		\$1,845,75 5% \$8,228,75 \$9,228,75 \$9,228,75 \$9,57% \$7% \$5% \$10% \$25%	LS. LS. LS.		\$0.00 \$151,800,00 \$20,479,00 \$0.00 \$0.00 \$4,290,00 \$1,846,00 \$1,846,00 \$1,846,00 \$222,00 \$2220,00 \$2220,00 \$2220,00 \$2220,00 \$2220,00 \$2220,00 \$2220,00 \$2220,00 \$223,00 \$33,801,00 \$132,834,00 \$55,554,00 \$122,834,00	
Ipe Calverts and Storn Drains Concrete Box Cultorhs Mannel Improvements electronic Visit Cultors Entrovals Entrovals entrovals andscaping and Maintenance Improvements pecial Items (User Defined) ubiotal Capital Improvement Costs Additional Gripital Improvement Costs Additional Gripital Improvement Cost avalenting Ubiotal Capital Improvement Costs United Capital Improvement Costs United Capital Improvement Cost United Capital Improvement Cost United Capital Improvement Cost United Capital Improvement Cost Costs (Dorson Capital Improvement Cost Land Acquisition Costs Other Costs (Dorsontage of Capital Ingineering) egal/Administrative Contract Admin/Construction Management Costs Costs (Data Improvement Costs Costs (Capital Improvement Costs)	ts Improvement Costs)	an Capital Impro	\$1,845,75 5% \$9,228,75 \$9,228,75 \$9,287 5% 5% 16% 25% 25% 25%	LS. LS. LS.		\$0.00 \$151,800,00 \$20,479,00 \$20,479,00 \$0.00 \$4,290,00 \$4,290,00 \$184,575,00 \$1,846,00 \$9,229,00 \$9,234,00 \$9,244,173,00	
Ige Calverts and Storn Drains correle Box Culverts hannel Improvements electroni Water Cualty Facilities electricni Water Cualty Facilities electroni Water Cualty Facilities electroni Water Cualty Facilities pecial Items (User Defined) ubiotal Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Cost Ubiotal Capital Improvement Costs Cost Capital Improvement Costs Ubiotal Capital Improvement Costs Costs United Costs (Deriver Costs) Cost Capital Improvement Costs Cost Capital Improvement Costs Costs Capital Improvement Costs Costs Capital Improvement Costs Costs Capital Improvement Costs Costs Capital Improvement Costs	ts Improvement Costs) S r Plan Operation	n and Maintenan	\$1,845,75 \$9,228,75 \$9,258,75 \$9,258,75 \$0,258,758,75 \$0,258,758,758,758,758,758,758,758,758,758,7	LS. LS. LS.	Unit Cost \$1.00	\$0.00 \$151,800,00 \$20,479,00 \$0.00 \$0.00 \$4,290,00 \$1,846,00 \$1,846,00 \$1,846,00 \$222,00 \$2220,00 \$2220,00 \$2220,00 \$2220,00 \$2220,00 \$2220,00 \$2220,00 \$2220,00 \$223,00 \$33,801,00 \$132,834,00 \$55,554,00 \$122,834,00	
Ipe Calverts and Storn Drains Concrete Box Culterts ydrauld: Structures hannel Improvements elevention Water Cuality Facilities terrovals	ts Improvement Costs) S r Plan Operation rovel, erosion al entran	n and Maintenan	\$1,845,75 \$9,228,75 \$9,258,75 \$9,258,75 \$0,258,758,75 \$0,258,758,758,758,758,758,758,758,758,758,7	LS. LS. LS.	Unit Cost	\$0.00 \$151,800,00 \$0.00 \$0.00 \$0.00 \$1,23,479,00 \$0.00 \$1,23,479,00 \$0.00 \$1,24,79,00 \$1,846,00 \$1,846,00 \$1,846,00 \$1,846,00 \$1,846,00 \$1,846,00 \$1,846,00 \$1,846,00 \$1,846,00 \$1,846,00 \$1,846,00 \$1,846,00 \$1,167,000\$1,167,000\$1,167,000\$1,167,000\$1,167,000	
Ipe Calverts and Storn Drains Concrete Box Culverts ydrauts Structures Drannel Improvements electricni Water Cuality Facilities emrovals emrovals emrovals emrovals endocapting and Maintenance Improvements pecial Items (User Defined) utotal Capital Improvement Costs Additional Capital Improvement Costs Additional Capital Improvement Costs Mainto Costs Control Billy Coordination/Relocation stormater ManagementFrosion Control utotal Land Acquisition Costs Control Costs Control Costs Control Costs Control Implementative Control Costs Costs Control Costs	ts Improvement Costs) S r Plan Operation rovel, erosion al entran	n and Maintenan	\$1,845,75 \$9,228,75 \$9,258,75 \$9,258,75 \$0,258,758,75 \$0,258,758,758,758,758,758,758,758,758,758,7	LS. LS. LS.	Unit Cost	\$0.00 \$151,808.00 \$0.00 \$23,479.00 \$0.00 \$4,290.00 \$4,290.00 \$5,000 \$184,575.00 \$1,846.00 \$9,229.00 \$9,229.00 \$9,229.00 \$9,229.00 \$38,762.00 \$38,762.00 \$38,762.00 \$38,762.00 \$33,610.00 \$11,167.00 \$22,334.00 \$11,167.00 \$22,334.00 \$31,167.00 \$35,534.00 \$122,836.00 \$134,677.00 \$122,836.00 \$134,677.00 \$122,836.00 \$124,677.00 \$122,836.00 \$124,677.00 \$125,677.00 \$125,677.00 \$125,677.00 \$125,677.00 \$125,677.00 \$1	

MAS	TER PLAN C	OST ESTIMAT	E FOR INDIV	DUAL RE	ACH		
PROJECT :	Sharktooth Bluff						
DRAINAGEWAY : REACH :	SKD 2						
JURISDICTION :	City of Greeley						
REACH ID:	4th Street Central	- FHMA	Enter Estimator Nam	e on Project Inf	DATE :	12/21/2018	
			1		1		
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
6	3	1	50	L.F.	\$661.03	\$33,052.00	
Headwall and Toewalls Individual Box Span (ft)	No. of Barrels	Total Span (ft)	T	[	1		
6	1	8.00	2	EA	\$723.52	\$1,447.00	
Wingwalls (includes wingwalls on ei		nd concrete apron)					
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels		= 1			
6	3	1	2	EA	\$6,607.22	\$13,214.40	
Channel Improvements							
Excavation, Mid Range 12-inch Riprap, Type M			178	C.Y. C.Y.	\$32.00 \$80.00	\$5,696.00 \$1,778.00	
	mprovomonto			0.1.	\$00.00	\$1,770.00	
Landscaping and Maintenance I Reclamation & seeding (native grasses)	improvements		1	ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined)				ACIAL	\$1,040.00	\$1,040.00	
	<user defined="" item<="" td=""><td></td><td>22</td><td>TON</td><td>\$250.00</td><td>\$5,500.00</td><td></td></user>		22	TON	\$250.00	\$5,500.00	
		-			+=====	**!*****	
	Master Pla	an Capital Improv	ement Cost Su	nmarv			
Capital Improvement Costs				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts						\$47,713.00	
Hydraulic Structures Channel Improvements						\$0.00 \$7,474.00	
Detention/Water Quality Facilities						\$7,474.00	
Removals						\$0.00	
Landscaping and Maintenance Improvements						\$1,340.00	
Special Items (User Defined)						\$5,500.00	
Subtotal Capital Improvement Costs Additional Capital Improvement Cos	4-					\$62,027.00	
Additional Capital Improvement Cos	15		\$620.27	L.S.		\$620.00	
Mobilization			5%	2.0.		\$3,101.00	
Traffic Control			\$3,101.35	L.S.		\$3,101.00	
Utility Coordination/Relocation			\$3,101.35	L.S.		\$3,101.00	
Stormwater Management/Erosion Control	h-		5%			\$3,101.00	
Subtotal Additional Capital Improvement Cost Land Acquisition Costs	15					\$13,024.00	
ROW/Easements Subtotal Land Acquisition Costs						\$0.00 \$0.00	
Other Costs (percentage of Capital	Improvement Costs)					\$0.00	
Engineering			15%			\$11,258.00	
Legal/Administrative			5%			\$3,753.00	
Contract Admin/Construction Management			10%			\$7,505.00	
Contingency Subtotal Other Costs			25%			\$18,763.00 \$41,279.00	
Total Capital Improvement Costs	3					\$116,330.00	
Mastor	Plan Operation	and Maintenand	ce Cost Summar	v			
Description	. an operation	and mannelland	Quantity	y Unit	Unit Cost	Total Annual Cost	
	oval, erosion at entranc	e/exit, structural repairs,	d 50	L.F.	\$1.00	\$100.00	
Culvert Maintenance (e.g. sediment & debris rem							
Total Annual Operation and Mai	ntenance Cost					\$100.00	
	ntenance Cost					\$100.00 2.00%	

PROJECT : DRAINAGEWAY :	Sharktooth Bluff SKD						
REACH :	2						
JURISDICTION :	City of Greeley						
REACH ID:	4th Street Eastern	n - FHMA	Enter Estimator Nam	ne on Project Inf	DATE :	12/21/2018	
			1		1		
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe		-	-	1	1	-	
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
6 Headwall and Toewalls	3	1	50	L.F.	\$661.03	\$33,052.00	
Individual Box Span (ft)	No. of Barrels	Total Span (ft)	1	1	1		
6	1	8.00	2	EA	\$723.52	\$1,447.00	
Wingwalls (includes wingwalls on e	ither side of channel a	and concrete apron)	-		\$120.0L	¢1,111.00	
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
6	3	1	2	EA	\$6,607.22	\$13,214.40	
Channel Improvements							
excavation, Mid Range			278	C.Y.	\$32.00	\$8,889.00	
2-inch Riprap, Type M			22	C.Y.	\$80.00	\$1,778.00	
andscaping and Maintenance	Improvements						
Reclamation & seeding (native grasses)			1	ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined)							
	<user defined="" iten<="" td=""><td>ne</td><td>33</td><td>TON</td><td>\$250.00</td><td>\$8,250.00</td><td></td></user>	ne	33	TON	\$250.00	\$8,250.00	
apriai.	Comoser Denned Ren	10		1014	\$230.00	\$0,230.00	
	Mactor DI	an Capital Impro	romont Cost Su	mmany			
Capital Improvement Costs	Widster Fi	an capital impro-	vement cost out	minary			
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts					\$47,713.00		
tydraulic Structures						\$0.00	
Channel Improvements						\$10,667.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$0.00	
andscaping and Maintenance Improvements						\$1,340.00	
Special Items (User Defined)						\$8,250.00	
Subtotal Capital Improvement Costs						\$67,970.00	
Additional Capital Improvement Cos	sts		\$679.70	L.S.		\$680.00	
Dewatering Abilization			5%	L.O.		\$3,399.00	
raffic Control			\$3,398.50	L.S.		\$3,399.00	
Julity Coordination/Relocation			\$3,398.50	L.S.		\$3,399.00	
Stormwater Management/Erosion Control			5%			\$3,399.00	
Subtotal Additional Capital Improvement Cos	ts					\$14,276.00	
Land Acquisition Costs							
ROW/Easements						\$0.00	
Subtotal Land Acquisition Costs						\$0.00	
Other Costs (percentage of Capital Ingineering	improvement costs)		15%	1		\$12,337.00	
.egal/Administrative			5%			\$4,112.00	
Contract Admin/Construction Management			10%			\$8,225.00	
Contingency			25%			\$20,562.00	
Subtotal Other Costs						\$45,236.00	
otal Capital Improvement Cost	S					\$127,482.00	
· · ·							
	r Plan Operation	n and Maintenan			1		
Description			Quantity	Unit	Unit Cost	Total Annual Cost	
ulvert Maintenance (e.g. sediment & debris rem			e 50	L.F.	\$1.00	\$50.00	
Fotal Annual Operation and Mai	intenance Cost					\$50.00	
ffective Interest Rate						2.00%	
	ce Costs Over 5					\$1,571.00	

MAS	STER PLAN C	OST ESTIMAT	E FOR INDIV	IDUAL RE	ACH		l
PROJECT :	Sharktooth Bluff						
DRAINAGEWAY :	SKD						
REACH : JURISDICTION :	2 City of Greeley						
REACH ID:	4th Street West -	FHMA	Enter Estimator Nam	e on Project Inf	DATE :	12/26/2018	
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe			1	1	1		
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft) 50	L.F.	\$1,239.66	\$61,983.00	
Headwall and Toewalls		1		<b>6</b> .1 .	\$1,235.00	401,303.00	
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
12	1	14.00	2	EA	\$1,343.16	\$2,686.00	
Wingwalls (includes wingwalls on e					1		
Individual Box Span (ft) 12	Box Rise (ft) 5	No. of Barrels	2	EA	\$12,577.01	\$25,154.00	
	5		2	EA	\$12,577.01	\$23,134.00	
Channel Improvements Excavation, Mid Range	1		202	C.Y.	632.00	\$10,656,00	
Excavation, Mid Kange 12-inch Riprap, Type M	-		333 27	C.Y. C.Y.	\$32.00 \$80.00	\$10,656.00 \$2,133.00	
	Improvomorte		21	0.1.	00.00	92,100.00	
Landscaping and Maintenance Reclamation & seeding (native grasses)	improvements		1	ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined)	-			AURE	\$1,340.00	\$1,340.00	
Asphalt	<user defined="" iten<="" td=""><td></td><td>33</td><td>TON</td><td>\$250.00</td><td>\$8,250.00</td><td></td></user>		33	TON	\$250.00	\$8,250.00	
Aspitai	<oser denned="" iten<="" td=""><td>15</td><td>33</td><td>TON</td><td>\$230.00</td><td>\$6,230.00</td><td></td></oser>	15	33	TON	\$230.00	\$6,230.00	
	Mastor Di	an Capital Improv	oment Cost Su	mmary			
Capital Improvement Costs	Master Fi	an capital improv	rement cost ou	ininary			
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts						\$89,823.00	
Hydraulic Structures						\$0.00	
Channel Improvements						\$12,789.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$0.00	
Landscaping and Maintenance Improvements Special Items (User Defined)						\$1,340.00 \$8,250.00	
Subtotal Capital Improvement Costs						\$112,202.00	
Additional Capital Improvement Costs	sts					\$112,202.00	
Dewatering			\$1,122.02	L.S.		\$1,122.00	
Mobilization			5%			\$5,610.00	
Traffic Control			\$5,610.10	L.S.		\$5,610.00	
Utility Coordination/Relocation			\$5,610.10	L.S.		\$5,610.00	
Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Cos	ata		5%	L		\$5,610.00 \$23,562.00	
Land Acquisition Costs	515						
ROW/Easements						\$0.00	
Subtotal Land Acquisition Costs						\$0.00	
Other Costs (percentage of Capita Engineering	I Improvement Costs)		15%			\$20,365.00	
Engineering Legal/Administrative			5%			\$20,365.00 \$6,788.00	
Contract Admin/Construction Management			10%			\$13,576.00	
Contingency			25%			\$33,941.00	
Subtotal Other Costs						\$74,670.00	
Total Capital Improvement Cost	ts					\$210,434.00	
Maste	r Plan Operation	and Maintenand	ce Cost Summar	v			
Description			Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris re	moval, erosion at entrand	e/exit, structural repairs,	e 50	L.F.	\$1.00	\$100.00	
Total Annual Operation and Ma	intenance Cost					\$100.00	
Effective Interest Rate						2.00%	
Total Operation and Maintenan	ce Costs Over 5	0 Years				\$3,142.00	
oral operation and maintenan	00 00010 0401 0	• · • • • •				ψ0,142.00	

PROJECT :	Sharktooth Bluff						
DRAINAGEWAY :	SKD						
REACH :	2						
JURISDICTION :	City of Greeley						
REACH ID:	95th Ave - FHMA		Enter Estimator Nam	ne on Project Inf	DATE :	12/21/2018	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts			40/11/11	0	0.000		COLIN COMMENTO
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)	1			
10	5	2	60	L.F.	\$2,162.99	\$129,780.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
10	2	23.00	2	EA	\$2,220.42	\$4,441.00	
Wingwalls (includes wingwalls on ei Individual Box Span (ft)	Box Rise (ft)	No. of Barrels	1	1	1	1	
10	5	2	2	EA	\$14,929.93	\$29,859.90	
Channel Improvements		-					
Excavation, Mid Range			578	C.Y.	\$32.00	\$18,496.00	
12-inch Riprap, Type M	t		44	C.Y.	\$80.00	\$3,520.00	
Removals							
Removal of culvert pipe (D<48")			120	L.F.	\$27.00	\$3,240.00	
	Improvomente		120	1 Bel -	927.00	\$3,240.00	
Landscaping and Maintenance I Reclamation & seeding (native grasses)	improvements		1	ACRE	\$1,340.00	\$1,340.00	
	1			ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined)							
Asphalt	<user defined="" iten<="" td=""><td>ns</td><td>57</td><td>TON</td><td>\$250.00</td><td>\$14,250.00</td><td></td></user>	ns	57	TON	\$250.00	\$14,250.00	
	Marchan DI						
Capital Improvement Costs	waster Pi	an Capital Impro	vement Cost Su	mmary			
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts						\$164,081.00	
Hydraulic Structures						\$0.00	
Channel Improvements							
Detention/Water Quality Facilities						\$22,016.00 \$0.00	
Detention/Water Quality Facilities Removals						\$0.00 \$3,240.00	
Detention/Water Quality Facilities Removals Landscaping and Maintenance Improvements						\$0.00 \$3,240.00 \$1,340.00	
Detention/Water Quality Facilities Removals Landscaping and Maintenance Improvements Special Items (User Defined)						\$0.00 \$3,240.00 \$1,340.00 \$14,250.00	
Detention/Water Quality Facilities Pernovals andscaping and Maintenance Improvements pocial Items (User Defined) Subtotal Capital Improvement Costs	ste					\$0.00 \$3,240.00 \$1,340.00	
Detention/Water Quality Facilities Removals andscaping and Maintenance Improvements Special Items (User Defined) Subtotal Capital Improvement Costs Additional Capital Improvement Cos	sts		\$2,049.27	LS.		\$0.00 \$3,240.00 \$1,340.00 \$14,250.00	
Detention/Water Quality Facilities Perrovals Aandscaping and Maintenance Improvements Special Items (User Defined) Subtotal Capital Improvement Costs Additional Capital Improvement Cos Dewatering	sts		\$2,049.27 5%	L.S.		\$0.00 \$3,240.00 \$1,340.00 \$14,250.00 <b>\$204,927.00</b>	
DetentionWater Cuality Facilities andiscaping and Maintenance Improvements Special Items (User Defined) Subtotal Capital Improvement Costs Additional Griptial Improvement Cost Development Mobilization Traffic Control	sts		5% \$10,246.35	L.S.		\$0.00 \$3,240.00 \$1,340.00 \$14,250.00 \$204,927.00 \$2,049.00 \$10,246.00 \$10,246.00	
DetentionWater Qualty Facilities Periorals andscaping and Maintenance Improvements adscaping and Maintenance Improvement Subtotal Capital Improvement Cost Additional Grapital Improvement Cost Additional Grapital Improvement Cost Partening Additional Grapital Improvement Cost Additional Improvement Cost Additiona	sts		5% \$10,246.35 \$10,246.35			\$0.00 \$1,340.00 \$1,340.00 \$14,250.00 \$204,927.00 \$2,049.00 \$10,246.00 \$10,246.00 \$10,246.00	
Detention/Water Quality Facilities emocals andiscaping and Maintenance Improvements Special Iters (User Defined) Subtotal Capital Improvement Costs Additional Capital Improvement Loco Devotering Mobilization Traffic Control Nilly Coordination/Relocation Distrovement Amagement/Erosion Control			5% \$10,246.35	L.S.		\$0.00 \$1,340.00 \$14,250.00 \$204,927.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00	
DeendonWater Qualty Facilities andscaping and Maintenance Improvements Special Items (User Defined) Subtotal Capital Improvement Costs Additional Gapital Improvement Cost Materia Molization Traffic Control Jility Coordinalion/Relocation Stormater Management/Erosion Control Subtotal Additional Capital Improvement Cost			5% \$10,246.35 \$10,246.35	L.S.		\$0.00 \$1,340.00 \$1,340.00 \$14,250.00 \$204,927.00 \$2,049.00 \$10,246.00 \$10,246.00 \$10,246.00	
Detention/Water Quality Facilities emocals andscaping and Maintenance Improvements pocial times (User Defined) Additional Gepital Improvement Cos Additional Gepital Improvement Cos Develoring Mobilization Traftic Control Softwater Management/Erosion Control Subtotal Additional Capital Improvement Cos Land Acquisition Costs			5% \$10,246.35 \$10,246.35	L.S.		\$0.00 \$3,240.00 \$1,340.00 \$14,250.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00	
Deendon/Water Cuality Facilities andscaping and Maintenance Improvements Special Items (User Defined) Subtotal Capital Improvement Costs Additional Capital Improvement Cost Mobilization Taffic Control Milly CoordinationRelecation Stormweter Management/Erositon Control Subtotal Additional Capital Improvement Cost Land Acquisition Costs CW/Essemets			5% \$10,246.35 \$10,246.35	L.S.		\$0.00 \$3,240.00 \$1,340.00 \$14,250.00 \$204,927.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$43,033.00	
Detention/Water Quality Facilities emocals andscaping and Maintenance Improvements Social times (User Defined) Subtotal Capital Improvement Costs Additional Capital Improvement Cost Devalation Ality Coordination/Relocation Subtotal Additional Capital Improvement Cost Subtotal Camital Capital Camital Capital Improvement Cost Subtotal Camital Capital Camital Camital Camital Capital Camital Camital Ca	ts		5% \$10,246.35 \$10,246.35	L.S.		\$0.00 \$3,240.00 \$1,340.00 \$14,250.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00	
Deendon/Water Cuality Facilities andscaping and Maintenance Improvements Special Items (User Defined) Subtotal Capital Improvement Costs Additional Capital Improvement Cost Mobilization Taffic Control Milly CoordinationRelecation Stormweter Management/Erositon Control Subtotal Additional Capital Improvement Cost Land Acquisition Costs CW/Essemets	ts		5% \$10,246.35 \$10,246.35	L.S.		\$0.00 \$3,240.00 \$1,340.00 \$14,250.00 \$204,927.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$43,033.00	
beendon/Water Qualty Facilities beroads andscaping and Maintenance Improvements andscaping and Maintenance Improvements Additional Capital Improvement Costs Additional Capital Improvement Cost Additional Capital Improvement Cost Summater Management/Erosion Control Subtotal Additional Capital Improvement Cost Land Acquisition Costs Colver Acquisition Costs Other Costs (percentage of Capital Ingineering	ts		5% \$10,246.35 \$10,246.35 5%	L.S.		\$0.00 \$3,240.00 \$1,340.00 \$14,250.00 \$204,927.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00	
beendon/Water Qualty Facilities emonals andscaping and Maintenance Improvements andscaping and Maintenance Improvements Additional Gapital Improvement Costs Additional Gapital Improvement Cost Additional Gapital Improvement Cost Softwater Magament/Erosion Control Water and Additional Capital Improvement Cost Land Acquisition Costs Other Costs (percentage of Capital Gapiering aga/Administrative	ts		5% \$10,246.35 \$10,246.35 5% 5% 15% 5% 10%	L.S.		\$0.00 \$3,240.00 \$1,340.00 \$14,250.00 \$204,927.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$310,246.00 \$310,246.00 \$310,246.00 \$310,246.00 \$310,246.00 \$3,00 \$3,00 \$3,00 \$3,7,194.00 \$2,378.00	
Jelention/Water Qualty Facilities emovals andscaping and Maintenance Improvements ipacial terms (User Defined) Waltotal Capital Improvement Costs Additional Capital Improvement Cost Motilization Triflic Control Nilly CoordinationRecation Stormwater ManagementErosion Control Subtotal Additional Capital Improvement Cost Land Acquisition Costs OWE assements intotal Land Acquisition Costs OWE costs (percentage of Capital) Conter Costs (percentage of Capital) Engli-Administrative Contract Admini Construction Management Contingency	ts		5% \$10,246.35 \$10,246.35 5% 5%	L.S.		\$0.00 \$3,240.00 \$1,340.00 \$14,250.00 \$204,927.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$310,246.00 \$310,246.00 \$310,246.00 \$313,940.00 \$32,194.00 \$37,194.00 \$37,194.00 \$37,194.00 \$37,194.00 \$37,194.00 \$31,298.00 \$37,194.00 \$31,298.00 \$31,298.00 \$31,194.00	
letention/Water Quality Facilities     amdesaping and Maintenance Improvements     pecial times (User Defined)     ubtotal Capital Improvement Costs     Additional Capital Improvement Cost     Motoral Capital Improvement Cost     Motoral Additional Capital Improvement     Costs     Motoral Costs     Motoral Costs     Motoral Costs     Motoral Costs     Motoral Costs     Motoral Additional Capital     Motoral Costs     Motoral Additional Capital     Motoral Costs     Motoral Additional Capital     Motoral Costs	its Improvement Costs)		5% \$10,246.35 \$10,246.35 5% 5% 15% 5% 10%	L.S.		50.00           \$3,240.00           \$1,340.00           \$1,340.00           \$1,4250.00           \$204,927.00           \$20,49.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$23,7194.00           \$24,796.00           \$24,796.00           \$14,6378.00	
etention/Water Quality Facilities emovals andscaping and Maintenance Improvements pacial items (User Defined) ubictal Capital Improvement Costs Additional Capital Improvement Cost biblization affilic Control Utility Coordination/Relocation termwater Management/Erositon Control ubictal Additional Capital Improvement Cost Land Acquisition Costs Ubical And Acquisition Costs Other Costs (porcontage of Capital Ingineering) egal/Administrative contract Admin/Construction Management contaget Costs	its Improvement Costs)		5% \$10,246.35 \$10,246.35 5% 5% 15% 5% 10%	L.S.		\$0.00 \$3,240.00 \$1,340.00 \$14,250.00 \$204,927.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$310,246.00 \$310,246.00 \$310,246.00 \$313,940.00 \$32,194.00 \$37,194.00 \$37,194.00 \$37,194.00 \$37,194.00 \$37,194.00 \$31,298.00 \$37,194.00 \$31,298.00 \$31,298.00 \$31,194.00	
behnion/Water Qualty Facilities emovals andscaping and Maintenance Improvements ipecial Items (User Defined) Wutotal Capital Improvement Costs Additional Capital Improvement Cost Motoral Capital Improvement Cost Strongent ManagementErosion Control Sabtotal Additional Capital Improvement Cost Land Acquisition Costs Other Costs (percentage of Capital Ingineering age/Administrative Contract Admini Construction Management Contingency Jubitatal Other Costs Fordal Capital Improvement Costs	its Improvement Costs) : S	n and Maintenan	5% \$10,248,35 \$10,248,35 5% 15% 5% 10% 25%	LS. LS.		50.00           \$3,240.00           \$1,340.00           \$1,340.00           \$1,4250.00           \$204,927.00           \$20,49.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$23,7194.00           \$24,796.00           \$24,796.00           \$14,6378.00	
keterion/Water Quality Facilities     kerroratis     andscaping and Maintenance Improvements     andscaping and Maintenance Improvements     Additional Genetal Improvement Costs     Additional Genetal Improvement Costs     Additional Genetal Improvement Cost     Additional Capital Improvement Cost     Additional Capital Improvement Cost     Land Acquisition Costs     Coller Costs     (percentage of Capital     Gondrad, Costs     Coller Costs     Costa Capital Improvement     Costs     Control Costs	its Improvement Costs) : S	n and Maintenan	5% \$10,248,35 \$10,248,35 5% 15% 5% 10% 25%	LS. LS.	Unit Cost	\$0.00 \$3,240.00 \$1,340.00 \$14,250.00 \$204,927.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$10,246.00 \$310,246.00 \$310,246.00 \$310,246.00 \$310,246.00 \$310,246.00 \$310,246.00 \$313,310,00 \$32,7194.00 \$24,796.00 \$31,398.00 \$31,398.00	
Veneration/Water Qualty Facilities emorals andscaping and Maintenance Improvements pecial times (User Defined) kutotal Capital Improvement Costs Additional Capital Improvement Cost Additional Capital Improvement Cost Status (Cost) kutotal Capital Improvement Cost Status (Cost) Kornwater ManagementErosion Costs Status (Cost) Kornwater ManagementErosion Costs Status (Cost) Kornwater ManagementErosion Costs Status (Cost) Status (Cost) Cost (C	its Improvement Costs) S r Plan Operation		5% \$10,246.35 \$10,246.35 5% 10% 5% 10% 25% Ce Cost Summa Quantity	LS. LS.	Unit Cost \$1.00	50.00           \$3,240.00           \$1,340.00           \$1,340.00           \$1,4250.00           \$204,927.00           \$20,49.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$23,7194.00           \$24,796.00           \$24,796.00           \$14,6378.00	
Deendon/Water Qualty Facilities andeseging and Maintenance Improvements Special Items (User Defined) Subtotal Capital Improvement Costs Additional Graptial Improvement Costs Additional Graptial Improvement Costs Mobilization Traffic Control Subtotal Additional Capital Improvement Costs Land Acquisition Costs Subtotal Land Acquisition Costs Other Costs (percentage of Capital Ingineering Qui/Administrative Contract Admin/Construction Management Costs Subtotal Other Costs Subtotal Other	improvement Costs) S r Plan Operation		5% \$10,246.35 \$10,246.35 5% 10% 5% 10% 25% Ce Cost Summa Quantity	LS. LS.		8.0.00           \$3,240.00           \$1,340.00           \$1,420.00           \$1,420.00           \$1,2450.00           \$204,927.00           \$20,049.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$24,960.00           \$12,966.00           \$24,796.00           \$24,796.00           \$312,398.00           \$344,338.00           \$344,338.00	
Veneration/Water Qualty Facilities emorals andscaping and Maintenance Improvements pecial times (User Defined) kutotal Capital Improvement Costs Additional Capital Improvement Cost Additional Capital Improvement Cost Status (Cost) kutotal Capital Improvement Cost Status (Cost) Kornwater ManagementErosion Costs Status (Cost) Kornwater ManagementErosion Costs Status (Cost) Kornwater ManagementErosion Costs Status (Cost) Status (Cost) Cost (C	improvement Costs) S r Plan Operation		5% \$10,246.35 \$10,246.35 5% 10% 5% 10% 25% Ce Cost Summa Quantity	LS. LS.		50.00           \$3,240.00           \$1,340.00           \$1,4250.00           \$204,927.00           \$20,49.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$10,246.00           \$23,7,194.00           \$24,796.00           \$24,796.00           \$313,8378.00           \$3384,338.00           \$314,338.00	

MAS	STER PLAN C		]				
PROJECT :	Sharktooth Bluff						- !
DRAINAGEWAY	SKD						
REACH :	2						
JURISDICTION : REACH ID:	City of Greeley CR 62 - FHMA		Enter Estimator Nam	e on Project Infi	DATE :	12/21/2018	i
REAGIND.	CIX 02 - I TIMA		Enter Estimator Ham		DAIL.	1212112010	1
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)	L.F.			
10 Headwall and Toewalls	/	2	50	L.F.	\$2,506.94	\$125,347.00	
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
10	2	23.00	2	EA	\$2,220.42	\$4,441.00	
Wingwalls (includes wingwalls on e	either side of channel a	nd concrete apron)			1	1	
Individual Box Span (ft) 10	Box Rise (ft) 7	No. of Barrels 2	2	EA	\$20,616.17	\$41,232.30	
	1	2	2	EA	\$20,010.17	\$41,232.30	
Channel Improvements Excavation, Mid Range			600	C.Y.	\$32.00	\$19,200.00	Culvert
12-inch Riprap, Type M	1		44	C.Y.	\$80.00	\$3,555.00	Culvert
Excavation, Mid Range	1		35625	C.Y.	\$32.00	\$1,140,000.00	Channel Excavation
9-inch Riprap, Type L	]		1944	C.Y.	\$74.00	\$143,889.00	Channel Stabilization
Removals							
Removal of culvert pipe (D<48")			50	L.F.	\$27.00	\$1,350.00	
Landscaping and Maintenance	Improvements						
Wetlands Plantings	-		1	ACRE	\$33,500.00	\$33,500.00	
Reclamation & seeding (native grasses) Trail/Path, Crusher Fines (10' Width)	-		6 3500	ACRE L.F.	\$1,340.00 \$15.00	\$8,308.00 \$52,500.00	
			3300	L.F.	\$15.00	\$32,300.00	
Special Items (User Defined)	<user defined="" item<="" td=""><td>•</td><td>47</td><td>TON</td><td>\$250.00</td><td>\$11,750.00</td><td></td></user>	•	47	TON	\$250.00	\$11,750.00	
Aspahlt Riffle Drop	<user defined="" item<="" td=""><td></td><td>47 18</td><td>EA</td><td>\$250.00</td><td>\$351,000.00</td><td>~Riffle every 200 ft</td></user>		47 18	EA	\$250.00	\$351,000.00	~Riffle every 200 ft
Land Acquisition		-			,		
Easement/ROW Acquisition	1		10.83	ACRE	\$88,000.00	\$953,040.00	
							·
	Master Pla	an Capital Impro	vement Cost Sur	nmary			
Capital Improvement Costs							
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts Hydraulic Structures						\$171,020.00 \$0.00	
Channel Improvements						\$1,306,644.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$1,350.00	
Landscaping and Maintenance Improvements							
Special Items (User Defined) Subtotal Capital Improvement Costs				\$94,308.00			
						\$94,308.00 \$362,750.00	
Additional Capital Improvement Co	sts					\$94,308.00	
Additional Capital Improvement Co Dewatering	sts		\$19,360.72	L.S.		\$94,308.00 \$362,750.00 <b>\$1,936,072.00</b> \$19,361.00	
Additional Capital Improvement Cos Dewatering Mobilization	sts		5%			\$94,308.00 \$362,750.00 <b>\$1,936,072.00</b> \$19,361.00 \$96,804.00	
Additional Capital Improvement Co: Dewatering Mobilization Traffic Control	sts		5% \$96,803.60	L.S.		\$94,308.00 \$362,750.00 <b>\$1,936,072.00</b> \$19,361.00 \$96,804.00 \$96,804.00	
Additional Capital Improvement Co: Dewatering Mobilization Traffic Control Utility Coordination/Relocation	sts		5% \$96,803.60 \$96,803.60			\$94,308.00 \$362,750.00 \$19,361.00 \$96,804.00 \$96,804.00 \$96,804.00	
Additional Capital Improvement Co: Dewatering Mobilization Traffic Control			5% \$96,803.60	L.S.		\$94,308.00 \$362,750.00 <b>\$1,936,072.00</b> \$19,361.00 \$96,804.00 \$96,804.00	
Additional Capital Improvement Co Devatering Mobilization Traffic Control Uitly Coordination/Relocation Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Cos Land Acquisition Costs			5% \$96,803.60 \$96,803.60	L.S.		\$94,308.00 \$362,750.00 \$1,936,072.00 \$19,361.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00	
Additional Capital Improvement Co Dewatering Mebization Traffe Control Utity Coordination/Relocation Stormwater Management/Erosion Control Storteal Additional Capital Improvement Cos Land Acquisition Costs ROW/Easements			5% \$96,803.60 \$96,803.60	L.S.		\$44,308.00 \$362,750.00 \$1,936,072.00 \$19,361.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$965,940.00	
Additional Capital Improvement Co Develoring Mobilization Traffic Control Billy Coordination/Relocation Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Cos Land Acquisition Costs ROW/Easements Subtotal Land Acquisition Costs	sts		5% \$96,803.60 \$96,803.60	L.S.		\$94,308.00 \$362,750.00 \$1,936,072.00 \$19,361.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00	
Additional Capital Improvement Cor Dewatering Mediization Traffic Control Utity Coordination/Relocation Stormwetr Management/Erosion Control Storteal Additional Capital Improvement Cos Subtotal Addition Costs ROWEasements	sts		5% \$96,803.60 \$96,803.60	L.S.		\$44,308.00 \$362,750.00 \$1,936,072.00 \$19,361.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$953,040.00	
Additional Capital Improvement Cor Dewatering Mobilization Traffic Control Utility Coordination/Refocation Subtotal Additional Capital Improvement Cos Subtotal Additional Capital Improvement Cos EcoviEasemets Subtotal Land Acquisition Costs Other Costs (percentage of Capital Other Costs (percentage of Capital	sts		5% \$96,803.60 \$96,803.60 5%	L.S.		\$44,308.00 \$362,750.00 \$1,936,072.00 \$19,361.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$96,804.00 \$965,940.00	
Additional Capital Improvement Cor Devatering Mobilization Traffic Control Billy Coordination/Relocation Stormweter Management/Erosion Control Subtrolat Additional Capital Improvement Cos Subtrolat Additional Capital Improvement Cos Subtrolat Addition Costs Subtrolat Land Acquisition Costs Other Costs (percentage of Capital Engineering Legal Administrative Contract Administrative	sts		5% \$96,803.60 \$96,803.60 5% 15% 5% 10%	L.S.		\$44,308.00 \$382,760.00 \$1,936,072.00 \$19,361.00 \$56,804.00 \$56,804.00 \$56,804.00 \$366,804.00 \$496,577.00 \$4953,040.00 \$3853,040.00 \$3853,040.00 \$3851,397.00 \$117,132.00 \$234,265.00	
Additional Capital Improvement Cor Develoring Mobilization Traffic Control Uilly Coordination/Refocation Stateotal Additional Capital Improvement Cos Subtotal Additional Capital Improvement Cos Subtotal Land Acquisition Costs Other Costs (percentage of Capital Control Admini/Construction Management Contract Admini/Construction Management Contingency	sts		5% \$96,803.60 \$96,803.60 5%	L.S.		\$44.308.00 \$382.750.00 \$1,936,072.00 \$19,361.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,804.00 \$96,804.00 \$406,577.00 \$4953,040.00 \$351,397.00 \$317,132.00 \$234,295.00	
Additional Capital Improvement Co Devalering Weblization Traffic Control Jillity Coordination/Relocation Sitomalen Management/Erosion Control Sitottal Additional Capital Improvement Cos Subtotal Additional Capital Improvement Cos Subtotal Land Acquisition Costs Other Costs (percentage of Capital Engineering Legal/Admistrative Contract Admity/Construction Management Contract Admity/Construction Management Contract Admity/Construction Management Contract Admity/Construction Management	ts Improvement Costs)		5% \$96,803,80 \$96,803,60 5% 15% 5% 10%	L.S.		\$44,308.00 \$382,750.00 \$1,936,072.00 \$19,361.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,604.00 \$365,3040.00 \$365,3040.00 \$365,3040.00 \$355,1397.00 \$351,137.00 \$351,397.00 \$351,397.00 \$351,397.00	
Additional Capital Improvement Co Devalering Weblization Traffic Control Jillity Coordination/Relocation Sitomalen Management/Erosion Control Sitottal Additional Capital Improvement Cos Subtotal Additional Capital Improvement Cos Subtotal Land Acquisition Costs Other Costs (percentage of Capital Engineering Legal/Admistrative Contract Admity/Construction Management Contract Admity/Construction Management Contract Admity/Construction Management Contract Admity/Construction Management	ts Improvement Costs)		5% \$96,803,80 \$96,803,60 5% 15% 5% 10%	L.S.		\$44.308.00 \$382.750.00 \$1,936,072.00 \$19,361.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,804.00 \$96,804.00 \$406,577.00 \$4953,040.00 \$351,397.00 \$317,132.00 \$234,295.00	
Additional Capital Improvement Cor Develoring Medication Traffic Control Utility Coordination/Relocation Stormweiter Management/Ecosion Control Stormweiter Management/Coost Subtotal Additional Capital Improvement Cost Subtotal Land Acquisition Costs Other Costs (percentage of Capital Engineering Lagal/Administrahe Contract Admini/Construction Management Contract A	ts Improvement Costs)	and Maintenan	5% 5%,603.60 5%,603.60 5% 15% 5% 10% 25%	LS. LS.		\$44,308.00 \$382,760.00 \$1,936,072.00 \$19,361.00 \$56,804.00 \$56,804.00 \$56,804.00 \$56,804.00 \$56,804.00 \$56,804.00 \$565,040.00 \$585,040.00 \$355,340.00 \$355,340.00 \$355,340.00 \$355,340.00 \$355,340.00 \$355,340.00 \$354,356,00 \$4,584,145.00	
Additional Capital Improvement Col Devalering Mobilization Traffic Control Uilly Coordination/Relocation Subtotal Additional Capital Improvement Cos Eard Acquisition Costs Compared Land Acquisition Costs Contract Admin/Construction Management Contract Admin/Construction Management Confingency Subtotal Other Costs Total Capital Improvement Cost Maste Description	its Improvement Costs) S r Plan Operation		5% 5% 808.00.60 5% 803.60 5% 15% 15% 10% 25% 20%	L.S. L.S. Y Unit	Unit Cost	\$44.308.00 \$382.700.00 \$1,936.072.00 \$19.361.00 \$96.604.00 \$96.604.00 \$96.604.00 \$96.604.00 \$96.604.00 \$96.804.00 \$96.804.00 \$96.304.00 \$965.3040.00 \$953.040.00 \$955.00 \$	
Additional Capital Improvement Cor Develoring Mediization Tatility Coordination/Relocation Utility Coordination/Relocation Stormwater Management/Ecosion Control Stormwater Management/Ecosion Control Subtotal Additional Capital Improvement Cost Subtotal Land Acquisition Costs Other Costs (percentage of Capital Engineering Lagal/Administrahe Contract Admini/Construction Management Contract Admini/Construc	its Improvement Costs) S r Pian Operation movel, erosion at entranc	e/exit, structural repairs,	5% 5%,603.60 5%,603.60 5% 10% 5% 10% 25% 25% 25%	L.S. L.S. Y Unit L.F.	\$1.00	\$44,308.00 \$382,750.00 \$1,936,072.00 \$19,361.00 \$56,804.00 \$56,804.00 \$56,804.00 \$56,804.00 \$366,804.00 \$365,3040.00 \$3953,040.00 \$3953,040.00 \$3953,040.00 \$3953,040.00 \$3953,040.00 \$3953,040.00 \$3953,040.00 \$3953,040.00 \$3953,040.00 \$3954,525.00 \$4,584,145.00	
Additional Capital Improvement Col Devaletring Mediization Traffic Control Listly Coordination/Relocation Studtotal Additional Capital Improvement Cost Subtotal Additional Capital Improvement Cost Cost Cost Subtotal Land Acquisition Costs Other Costs (percentage of Capital Cost Costs (percentage of Capital Costs (percentage of Capital Capital Capital Costs (percentage of Ca	its Improvement Costs) S r Plan Operation moral, erosion at entranc	e/exit, structural repairs,	5% 5% 808.00.60 5% 803.60 5% 15% 15% 10% 25% 20%	L.S. L.S. Y Unit		\$94,308.00           \$362,750.00           \$19,36,072.00           \$19,36,072.00           \$19,361.00           \$19,361.00           \$96,804.00           \$96,804.00           \$98,804.00           \$98,804.00           \$98,804.00           \$98,804.00           \$98,804.00           \$98,804.00           \$98,804.00           \$985,804.00           \$985,804.00           \$985,804.00           \$985,804.00           \$985,804.00           \$985,804.00           \$985,804.00           \$9845,806.00           \$12,828,456.00           \$12,828,456.00           \$12,824,456.00           \$12,824,456.00           \$10,500.10	
Additional Capital Improvement Cor Devaleting Mobilization Traffic Control Utility Coordination/Relocation Subtoal Additional Capital Improvement Cor Subtoal Additional Capital Improvement Cos Land Acquisition Costs Other Costs (percentage of Capital Engineering Legal/Administrative Contract Admin/Construction Management Contingency Subtoal Other Costs Total Capital Improvement Cost Maste Description Cuhert Maintenance (e.g. aediment & debris re Chamel Maintenance (e.g. aediment & debris re	its Improvement Costs) S r Plan Operation moral, erosion at entranc	e/exit, structural repairs,	5% 5%,603.60 5%,603.60 5% 10% 5% 10% 25% 25% 25%	L.S. L.S. Y Unit L.F.	\$1.00	\$44.308.00 \$382.700.00 \$1,936,072.00 \$19,361.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,604.00 \$96,504.00 \$406,577.00 \$953,040.00 \$406,577.00 \$351,397.00 \$117,132.00 \$1324,265.00 \$14,288,465.00 \$14,288,445.00 \$10,550.00	
Additional Capital Improvement Col Devaletring Mediization Traffic Control Listly Coordination/Relocation Studtotal Additional Capital Improvement Cost Subtotal Additional Capital Improvement Cost Cost Cost Subtotal Land Acquisition Costs Other Costs (percentage of Capital Cost Costs (percentage of Capital Costs (percentage of Capital Capital Capital Costs (percentage of Ca	Improvement Costs) S r Plan Operation moral, erosion, tree & w intenance Cost	e/exit, structural repairs, eed removal, etc.)	5% 5%,603.60 5%,603.60 5% 10% 5% 10% 25% 25% 25%	L.S. L.S. Y Unit L.F.	\$1.00	\$94,308.00           \$362,750.00           \$19,36,072.00           \$19,36,072.00           \$19,361.00           \$19,361.00           \$96,804.00           \$96,804.00           \$98,804.00           \$98,804.00           \$98,804.00           \$98,804.00           \$98,804.00           \$98,804.00           \$98,804.00           \$985,806.00           \$985,806.00           \$985,806.00           \$985,806.00 <td></td>	

PROJECT :	Sharktooth Bluff					
DRAINAGEWAY :	SKD at CR 62					
REACH :	1					
JURISDICTION :	City of Greeley		,		1	
REACH ID:	DSCh_Option1-Reach1	Enter Estimator Nam	ne on Project Info	DATE :	12/21/2018	
					TOTAL	
DESCRIPTION		QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Channel Improvements						
Excavation, Mid Range		21375	C.Y.	\$32.00	\$684,000.00	Excavation downstream (1800 ft)
-inch Riprap, Type L		2000	C.Y.	\$74.00	\$148,000.00	Channel stabilization (1800 ft)
Landscaping and Maintenance I	mprovements					
rail/Path, Crusher Fines (10' Width)		1800	L.F.	\$15.00	\$27,000.00	
Special Items (User Defined)						
	<user defined="" items<="" td=""><td>9</td><td>EA</td><td>\$19,500.00</td><td>\$175,500.00</td><td>~Every 200 ft</td></user>	9	EA	\$19,500.00	\$175,500.00	~Every 200 ft
Villiam R Jones Ditch Separation Structure	<user defined="" items<="" td=""><td>1</td><td>EA</td><td>\$50,000.00</td><td>\$50,000.00</td><td></td></user>	1	EA	\$50,000.00	\$50,000.00	
Land Acquisition						
Easement/ROW Acquisition		4.02	ACRE	\$88,000.00	\$353,760.00	
						li
	Master Plan Capital Imp	rovement Cost Su	mmary			
Capital Improvement Costs						
Pipe Culverts and Storm Drains Concrete Box Culverts					\$0.00 \$0.00	
lydraulic Structures					\$0.00	
Channel Improvements					\$832,000.00	
Detention/Water Quality Facilities					\$0.00	
Removals					\$0.00	
andscaping and Maintenance Improvements					\$27,000.00	
Special Items (User Defined)					\$225,500.00	
Subtotal Capital Improvement Costs					\$1,084,500.00	
Additional Capital Improvement Cost Dewatering	ts	\$10,845.00	L.S.		\$10,845.00	
Vobilization		5%	L.3.		\$54,225.00	
Traffic Control		\$54,225.00	L.S.		\$54,225.00	
Jtility Coordination/Relocation		\$54,225.00	L.S.		\$54,225.00	
Stormwater Management/Erosion Control		5%			\$54,225.00	
Subtotal Additional Capital Improvement Cost	S				\$227,745.00	
Land Acquisition Costs						
ROW/Easements					\$353,760.00	
Subtotal Land Acquisition Costs Other Costs (percentage of Capital I	Improvoment Costs)				\$353,760.00	
Engineering	improvement costs)	15%			\$196,837.00	
.egal/Administrative		5%			\$65,612.00	
Contract Admin/Construction Management		10%			\$131,225.00	
Contingency		25%			\$328,061.00	
Subtotal Other Costs					\$721,735.00	
Fotal Capital Improvement Costs	3				\$2,387,740.00	
						1
	Plan Operation and Mainten			Halt Oraci	Total Annual C	
Description Channel Maintenance (e.g. sediment & debris rer	moval erosion free & weed removal etc.)	Quantity 1800	Unit L.F.	Unit Cost \$3.00	Total Annual Cost \$5,400.00	
Total Annual Operation and Mai		1000	61.	φ0.00	\$5,400.00	
Effective Interest Rate	intenance Cost				2.00%	
	Conto Over 50 Veer-					
Total Operation and Maintenanc	ce Costs Over 50 Years				\$169,687.00	

						3
MAS	STER PLAN COST ESTIMATI	E FOR INDIVI	IDUAL REA	ACH		1
PROJECT :	Sharktooth Bluff					
DRAINAGEWAY :	SKD at CR 62					-
REACH :	2					
JURISDICTION :	City of Greeley					
REACH ID:		Enter Estimator Nam	e on Project Info	DATE :	12/21/2018	1
						-
					TOTAL	
DESCRIPTION		QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Channel Improvements						
9-inch Riprap, Type L		1111	C.Y.	\$74.00	\$82,222.00	Bank stablization (1000 ft)
Excavation, Mid Range		13250	C.Y.	\$32.00	\$424,000.00	Channel excavation (1000 ft)
Landscaping and Maintenance	Improvements					
Trail/Path, Crusher Fines (10' Width)		800	L.F.	\$15.00	\$12.000.00	
Special Items (User Defined)	+	000	Best -			
	<user defined="" items<="" td=""><td>5</td><td>EA</td><td>\$19,500.00</td><td>\$97,500.00</td><td>Every ~200 ft</td></user>	5	EA	\$19,500.00	\$97,500.00	Every ~200 ft
	See Defined items	5	EA	\$19,000.00	\$97,500.00	Every "200 It
Land Acquisition		2.50	4005	000 000 00	6000.000.00	
Easement/ROW Acquisition		2.50	ACRE	\$88,000.00	\$220,000.00	
	Master Dian Ossital Immuni					
	Master Plan Capital Improv	ement Cost Sur	mmary			
Capital Improvement Costs Pipe Culverts and Storm Drains					\$0.00	
Concrete Box Culverts					\$0.00	
Hydraulic Structures					\$0.00	
Channel Improvements					\$506,222.00	
Detention/Water Quality Facilities					\$0.00	
Removals					\$0.00	
Landscaping and Maintenance Improvements					\$12,000.00	
Special Items (User Defined)					\$97,500.00	
Subtotal Capital Improvement Costs					\$615,722.00	
Additional Capital Improvement Co	sts		1.0			
Dewatering Mobilization		\$6,157.22 5%	L.S.		\$6,157.00	
Mobilization Traffic Control		\$30,786.10	L.S.		\$30,786.00 \$30,786.00	
Utility Coordination/Relocation		\$30,786.10	L.S.		\$30,786.00	
Stormwater Management/Erosion Control		5%	L.O.		\$30,786.00	
Subtotal Additional Capital Improvement Cos	sts				\$129.301.00	
Land Acquisition Costs						
ROW/Easements					\$220,000.00	
Subtotal Land Acquisition Costs					\$220,000.00	
Other Costs (percentage of Capital	Improvement Costs)					
Engineering		15%			\$111,753.00	
Legal/Administrative Contract Admin/Construction Management		5% 10%			\$37,251.00 \$74,502.00	
Contract Admin/Construction Management Contingency		25%			\$74,502.00 \$186,256.00	
Subtotal Other Costs		2370			\$409,762.00	
Total Capital Improvement Cost	e				\$1,374,785.00	
rotar capital improvement Cost	3				φ1,3/4,/03.00	
Marta	Disc. On section and Maintenance					
	r Plan Operation and Maintenanc			Unit Oracl	Total Annual C	
Description Channel Maintenance (e.g. sediment & debris re	amount analone trace 9 years removed ato )	Quantity 1000	Unit L.F.	Unit Cost \$3.00	Total Annual Cost \$3.000.00	
		1000	L.F.	\$3.00		
Total Annual Operation and Ma	Intenance Cost				\$3,000.00	
Effective Interest Rate					2.00%	
Total Operation and Maintenan	ce Costs Over 50 Years				\$94,271.00	

MAS	STER PLAN C	OST ESTIMAT	E FOR INDIV	IDUAL RE	ACH		
		2011201121					
PROJECT : DRAINAGEWAY :	Sharktooth Bluff WC						
REACH :	2						
JURISDICTION :	City of Greeley						
REACH ID:	4th St - FHMA		Enter Estimator Nam	ne on Project Inf	DATE :	12/21/2018	]
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe	1					1	
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)		000100		
7 Headwall and Toewalls	4	1	50	L.F.	\$784.73	\$39,236.00	
Individual Box Span (ft)	No. of Barrels	Total Span (ft)	1	1	1	1	
7	1	9.00	2	EA	\$813.96	\$1,628.00	
Wingwalls (includes wingwalls on e	either side of channel a						
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
7	4	1	2	EA	\$8,564.96	\$17,129.90	
Channel Improvements							
Excavation, Mid Range			217	C.Y.	\$32.00	\$6,944.00	
12-inch Riprap, Type M			16	C.Y.	\$80.00	\$1,303.00	
Landscaping and Maintenance	Improvements						
Reclamation & seeding (native grasses)	1		1	ACRE	\$1,340.00	\$1,340.00	
Special Items (User Defined)							
Asphalt	<user defined="" iten<="" td=""><td>ns</td><td>24</td><td>TON</td><td>\$250.00</td><td>\$6,000.00</td><td></td></user>	ns	24	TON	\$250.00	\$6,000.00	
•							
	Master Pl	an Capital Improv	vement Cost Su	mmarv			
Capital Improvement Costs				,			
Pipe Culverts and Storm Drains						\$0.00	
Concrete Box Culverts						\$57,994.00	
Hydraulic Structures						\$0.00	
Channel Improvements						\$8,247.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$0.00	
Landscaping and Maintenance Improvements Special Items (User Defined)						\$1,340.00 \$6,000.00	
Subtotal Capital Improvement Costs						\$73,581.00	
Additional Capital Improvement Costs	vete					\$73,561.00	
Dewatering			\$735.81	L.S.		\$736.00	
Mobilization			5%			\$3,679.00	
Traffic Control			\$3,679.05	L.S.		\$3,679.00	
Utility Coordination/Relocation			\$3,679.05	L.S.		\$3,679.00	
Stormwater Management/Erosion Control	-		5%		-	\$3,679.00	
Subtotal Additional Capital Improvement Cos Land Acquisition Costs	sts					\$15,452.00	
ROW/Easements						\$0.00	
Subtotal Land Acquisition Costs						\$0.00	
Other Costs (percentage of Capita	I Improvement Costs)					<b>\$0.00</b>	
Engineering			15%			\$13,355.00	
Legal/Administrative			5%			\$4,452.00	
Contract Admin/Construction Management			10%			\$8,903.00	
Contingency			25%	l		\$22,258.00	
Subtotal Other Costs Total Capital Improvement Cost	te					\$48,968.00 \$138,001.00	
Total Capital improvement Cost	15					\$130,001.00	
Maste	r Plan Operation	and Maintenan	ce Cost Summar	ry .			
Description			Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris ren	moval, erosion at entrand	ce/exit, structural repairs,		L.F.	\$1.00	\$100.00	
Total Annual Operation and Ma	intenance Cost					\$100.00	
Effective Interest Rate						2.00%	
Total Operation and Maintenan	ce Costs Over 5	0 Years				\$3,142.00	
or operation and malifielian	oc obata over a	0 10013				φ <b>3</b> ,1 <del>4</del> 2.00	

					_					
MASTER PLAN COST ESTIMA	TE FOR INDIV	IDUAL RE	ACH							
PROJECT : Enter Project Name on Project Info Tab										
DRAINAGEWAY : WC-78thAve					-					
BEACH : 3					-					
JURISDICTION : City of Greeley					-					
REACH ID: FM-Reach3										
REACH ID. PWI-Reactio										
				TOTAL						
DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS					
Channel Improvements										
Excavation, Mid Range	1000	C.Y.	\$32.00	\$32,000.00						
12-inch Riprap, Type M	10	C.Y.	\$80.00	\$800.00						
Landscaping and Maintenance Improvements										
Reclamation & seeding (native grasses)	1	ACRE	\$1,340.00	\$1,340.00						
Master Plan Capital Impro	vement Cost Su	mmary								
Capital Improvement Costs										
Pipe Culverts and Storm Drains				\$0.00 \$0.00						
Concrete Box Culverts										
Hydraulic Structures				\$0.00						
Channel Improvements				\$32,800.00						
Detention/Water Quality Facilities				\$0.00 \$0.00						
Removals				\$0.00						
Landscaping and Maintenance Improvements				\$1,340.00						
Special Items (User Defined)				\$34,140,00						
Subtotal Capital Improvement Costs Additional Capital Improvement Costs				\$34,140.00						
Dewatering	\$341.40	L.S.		\$341.00						
Mobilization	5%	L.O.		\$1.707.00						
Traffic Control	\$1,707.00	L.S.		\$1,707.00						
Utility Coordination/Relocation	\$1,707.00	L.S.		\$1,707.00						
Stormwater Management/Erosion Control	5%	L.U.		\$1,707.00						
Subtotal Additional Capital Improvement Costs				\$7,169.00						
Land Acquisition Costs				\$1,100.00						
ROW/Easements				\$0.00						
Subtotal Land Acquisition Costs				\$0.00						
Other Costs (percentage of Capital Improvement Costs)										
Engineering	15%			\$6,196.00						
Legal/Administrative	5%			\$2,065.00						
Contract Admin/Construction Management	10%			\$4,131.00						
Contingency	25%			\$10,327.00						
Subtotal Other Costs				\$22,719.00						
Total Capital Improvement Costs				\$64,028.00						
	0									
Master Plan Operation and Maintenan										
Description Channel Maintenance (e.g. sediment & debris removal, erosion, tree & weed removal, etc.)	Quantity 250	Unit L.F.	Unit Cost \$3.00	Total Annual Cost \$750.00						
Total Annual Operation and Maintenance Cost	230	L.F.	\$3.00	\$750.00						
Effective Interest Rate				2.00%						
Total Operation and Maintenance Costs Over 50 Years				\$23,568.00						
rotal operation and maintenance costs over 50 reals				φ <b>2</b> 3,300.00						

PROJECT : DRAINAGEWAY :	Sharktooth Bluffs SKD						_
REACH :	81stAve						-
JURISDICTION : REACH ID:	City of Greeley 81st Ave - FHMA 1	100-yr storm	Monica Ramirez		DATE :	12/19/2018	]
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains			QUAITIT	UNIT		0001	BOER COMMENTS
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch Manholes and Inlets	50	3	150	L.F.	\$72.00	\$10,800.00	Replace Inlet Laterals
ype P Manhole (Pipe Dia. 48" and larger, deflection	on > 10 degrees)	1	3	EA	\$20,100.00	\$60,300.00	
itorm Inlet, Type R/Type 14, 5-foot			3	EA	\$6,164.00	\$18,492.00	
Concrete Box Culverts							
Box Culvert Pipe Individual Box Span (ft)	Rox Height (ft)	No. of Barrels	Length (ft)	1	1	1	
8	Box Height (ft) 4	2	Length (π) 500	L.F.	\$1,695.15	\$847,576.00	
11	4	2	565	L.F.	\$2,066.63	\$1,167,647.00	
Headwall and Toewalls	No. of Barrels	Total Span (#)		1		1	
Individual Box Span (ft) 8	2	Total Span (ft) 19.00	1	EA	\$1,725.96	\$1,726.00	
11	2	25.00	1	EA	\$2,413.50	\$2,414.00	
Wingwalls (includes wingwalls on eithe	er side of channel a Box Rise (ft)	nd concrete apron) No. of Barrels		1	1		
Individual Box Span (ft) 8	4 4	2	1	EA	\$10,906.01	\$10,906.00	
11	4	2	1	EA	\$12,310.64	\$12,310.60	
Channel Improvements							
xcavation, Mid Range			5535	C.Y.	\$32.00	\$177,120.00	Excavation
Removals			1065		\$134.00	\$142,710.00	
Concrete Box Culvert	provomonto		1000	L.F./CELL	\$134.00	\$142,710.00	
rail/Path, Concrete (10' Width)	iprovements		50	L.F.	\$59.00	\$2,950.00	
Special Items (User Defined)			00	Let .	400.00	¢2,000.00	
	User Defined Item	ns	100	L.F.	\$50.00	\$5,000.00	
	User Defined Item		553	TON	\$250.00	\$138,250.00	
	Master Di	an Capital Improv	amont Coat Su				
Capital Improvement Costs	waster Pla	an Capital Improv	ement Cost Su	mmary			
Pipe Culverts and Storm Drains						\$89,592.00	
Concrete Box Culverts						\$2,042,580.00	
lydraulic Structures Channel Improvements						\$0.00 \$177,120.00	
Detention/Water Quality Facilities						\$0.00	
temovals						\$142,710.00	
andscaping and Maintenance Improvements opecial Items (User Defined)						\$2,950.00 \$143.250.00	
ubtotal Capital Improvement Costs						\$2,598,202.00	
Additional Capital Improvement Costs							
Newatering Mobilization			\$25,982.02 5%	L.S.		\$25,982.00 \$129,910.00	
raffic Control			\$129,910.10	L.S.		\$129,910.00	
tility Coordination/Relocation			\$129,910.10 5%	L.S.		\$129,910.00 \$129,910.00	
			5%			\$129,910.00 \$545,622.00	
itormwater Management/Erosion Control autotal Additional Capital Improvement Costs							
Land Acquisition Costs						\$0.00	
Ubtotal Additional Capital Improvement Costs Land Acquisition Costs							
iubtotal Additional Capital Improvement Costs Land Acquisition Costs IOW/Easements iubtotal Land Acquisition Costs	nprovement Costs)			_	_	\$0.00	
Ubtotal Additional Capital Improvement Costs Land Acquisition Costs	provement Costs)		15%				
ubtotal Additional Capital Improvement Costs Land Acquisition Costs OV/Essements ubtotal Land Acquisition Costs Other Costs (percentage of Capital Im igneering egal/Administrative	provement Costs)		5%			\$0.00 \$471,574.00 \$157,191.00	
ubtotal Additional Capital Improvement Costs Land Acquisition Costs CW/Easements ubtotal Land Acquisition Costs Other Costs (percentage of Capital Im ingineering gap/Administrative contract Admini/Construction Management	provement Costs)		5% 10%			\$0.00 \$471,574.00 \$157,191.00 \$314,382.00	
ubtotal Additional Capital Improvement Costs Land Acquisition Costs OV/Essements ubtotal Land Acquisition Costs Other Costs (percentage of Capital Im igneering egal/Administrative	provement Costs)		5%			\$0.00 \$471,574.00 \$157,191.00	
uibtota Additional Capital Improvement Costs Land Acquisition Costs CM/Easements uibtotal Land Acquisition Costs Courte Costs (percentage of Capital Im galpeering gal/Administrative contract Admin/Construction Management contract Admin/Construction Management	provement Costs)		5% 10%			\$0.00 \$471,574.00 \$157,191.00 \$314,382.00 \$785,956.00	
ubtotal Additional Capital Improvement Costs Land Acquisition Costs OV/Essements Ubtotal Land Acquisition Costs Other Costs (percentage of Capital Im gigneering aga/Adminictarile ontract AdminiConstruction Management ontract AdminiConstruction Management ontigency Ubtotal Other Costs Total Capital Improvement Costs			5% 10% 25%			\$0.00 \$471,574.00 \$157,191.00 \$314,382.00 \$785,956.00 \$1,729,103.00	
valutotal Additional Capital Improvement Costs Land Acquisition Costs Oth/Easements Uthof Land Acquisition Costs Other Costs (percentage of Capital Im gigleering aggi/Administrative Contract AdminiConstruction Management Contagency Uthof Costs Costal Capital Improvement Costs Master P		n and Maintenanc	5% 10% 25% e Cost Summa		Linit Cost	\$0.00 \$471,574.00 \$157,191.00 \$314,382.00 \$785,956.00 \$1,729,103.00 \$4,872,927.00	
ubdotal Additional Capital Improvement Costs Land Acquisition Costs UCVIEssements ubdotal Land Acquisition Costs Other Costs (percentage of Capital Im prenering ografAministrative ornarci Admin Construction Management Admingency ubtotal Other Costs Total Capital Improvement Costs Master P vescription	Plan Operation		5% 10% 25% e Cost Summa Quantity	TY LF.	Unit Cost \$1.00	\$0.00 \$471,574.00 \$157,191.00 \$314,382.00 \$785,956.00 \$1,729,103.00	
ubdotal Additional Capital Improvement Costs Land Acquisition Costs (CW/Essements ubdotal Land Acquisition Costs Other Costs (percentage of Capital Im gap/Administrative gap/Administrative contract Admin Construction Management Costal Costs Costal Costs Costal Costs Costal Costs Costs Master P Rescription	Plan Operation	ce/exit, structural repairs, o	5% 10% 25% e Cost Summa	Unit		\$0.00 \$471,574.00 \$157,191.00 \$143,432.00 \$785,956.00 \$1,729,103.00 \$4,872,927.00 Total Annual Cost \$2,200.00 \$402.00	
ubiotal Additional Capital Improvement Costs Land Acquisition Costs CVI/Easements ubiotal Land Acquisition Costs CVI/Easements ubiotal Costs (parcentiage of Capital Im grigmeering aggi/Administrative contract AdminiConstruction Management contingency ubiotal Other Costs Fotal Capital Improvement Costs Master P lescription Livert Maintennance (e.g. sediment & debris remove	Plan Operation	ce/exit, structural repairs, o	5% 10% 25% e Cost Summa Quantity 2200	Unit L.F.	\$1.00	\$0.00 \$471,574.00 \$157,191.00 \$314,382.00 \$785,956.00 \$1,729,103.00 \$4,872,927.00 Total Annual Cost \$2,200.00	

1/30/2019, 7:38 PM

SBB\_UD-MP Cost Version 2.2\_WC\_81stAve.xlsm, 100yr-Reach81stAve

MASTER PLAN COST ESTIMA	TE FOR INDIV	IDUAL RE	ACH		1
					1
PROJECT : Sharktooth Bluffs					
DRAINAGEWAY : WC					-
REACH : 1					
JURISDICTION : City of Greeley					1
REACH ID: 81st Ave - FHMA - 22 Ac.ft	Monica Ramirez		DATE :	12/19/2018	
DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Detention/Water Quality Facilities					
Detention (Complete-in-Place)					
Detention (complete-in-Place)	22	AC-FT	\$61,104.00	\$1,313,736.00	
		AC-FT	\$01,104.00	\$1,313,730.00	
Landscaping and Maintenance Improvements			1	1	
Trail/Path, Crusher Fines (10' Width)	900	L.F.	\$15.00	\$13,500.00	
Land Acquisition					
Easement/ROW Acquisition	10.00	ACRE	\$88,000.00	\$880,000.00	
	-				
Master Plan Capital Impr	ovement Cost Su	mmary			
Capital Improvement Costs					
Pipe Culverts and Storm Drains				\$0.00	
Concrete Box Culverts				\$0.00	
Hydraulic Structures				\$0.00	
Channel Improvements				\$0.00	
Detention/Water Quality Facilities				\$1,313,736.00	
Removals				\$0.00	
Landscaping and Maintenance Improvements				\$13,500.00	
Special Items (User Defined)				\$0.00	
Subtotal Capital Improvement Costs				\$1,327,236.00	
Additional Capital Improvement Costs					
Dewatering	\$13,272.36	L.S.		\$13,272.00	
Mobilization	5%			\$66,362.00	
Traffic Control	\$66,361.80	L.S.		\$66,362.00	
Utility Coordination/Relocation	\$66,361.80	L.S.		\$66,362.00	
Stormwater Management/Erosion Control	5%			\$66,362.00	
Subtotal Additional Capital Improvement Costs				\$278,720.00	
Land Acquisition Costs ROW/Easements				\$880.000.00	
				\$880,000.00	
Subtotal Land Acquisition Costs Other Costs (percentage of Capital Improvement Costs)				\$880,000.00	
Engineering	15%			\$240.893.00	
Legal/Administrative	5%			\$80,298.00	
Contract Admin/Construction Management	10%			\$160.596.00	
Contingency	25%			\$401,489.00	
Subtotal Other Costs				\$883,276.00	
Total Capital Improvement Costs				\$3.369.232.00	
Total oupital improvement oosta				w0,000,202.00	
Master Plan Operation and Maintena	nce Cost Summar	ry			
Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repair		L.F.	\$1.00	\$1,100.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	6	EA	\$67.00	\$402.00	
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed remova	l, s 10	ACRE	\$2,010.00	\$20,100.00	
Total Annual Operation and Maintenance Cost				\$21,602.00	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				\$678.813.00	
Total Operation and Maintenance Costs Over 50 Years				\$070,013.00	

MASTE	R PLAN COST ESTIMAT	E FOR INDIV	DUAL RE	ACH		
PROJECT :	Sharktooth Bluffs					
	wc					
	l					
	City of Greeley			1		
REACH ID:	31st Ave - FHMA - 44 Ac.ft	Monica Ramirez		DATE :	12/19/2018	
					TOTAL	
DESCRIPTION		QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Detention/Water Quality Facilities						
Detention (Complete-in-Place)			10.55			
Detention Facility 1 (Complete-in-Place)		44	AC-FT	\$61,104.00	\$2,688,576.00	
Landscaping and Maintenance Imp	rovements		1	1		
Vetlands Plantings		3	ACRE	\$33,500.00	\$83,750.00	
Reclamation & seeding (native grasses)		14	ACRE	\$1,340.00	\$18,760.00	
Trail/Path, Crusher Fines (10' Width)		1200	L.F.	\$15.00	\$18,000.00	Maintenance Road
Easement/ROW Acquisition		16.00	ACRE	\$88,000.00	\$1,408,000.00	
	Master Plan Capital Improv	ement Cost Su	mmary			
Capital Improvement Costs						
Pipe Culverts and Storm Drains					\$0.00	
Concrete Box Culverts					\$0.00 \$0.00	
hydraulic Structures Channel Improvements					\$0.00	
Detention/Water Quality Facilities					\$2,688,576.00	
Removals					\$2,088,576.00	
andscaping and Maintenance Improvements					\$120,510.00	-
Special Items (User Defined)					\$0.00	
Subtotal Capital Improvement Costs					\$2,809,086.00	
Additional Capital Improvement Costs						
Dewatering		\$28,090.86	L.S.		\$28,091.00	
Mobilization		5%			\$140,454.00	
Traffic Control		\$140,454.30	L.S.		\$140,454.00	
Jtility Coordination/Relocation		\$140,454.30	L.S.		\$140,454.00	
Stormwater Management/Erosion Control		5%			\$140,454.00	
Subtotal Additional Capital Improvement Costs					\$589,907.00	
ROW/Easements					\$1,408,000.00	
Subtotal Land Acquisition Costs					\$1,408,000.00	
Other Costs (percentage of Capital Impr	ovement Costs)					
Engineering		15%			\$509,849.00	
.egal/Administrative		5%			\$169,950.00	
Contract Admin/Construction Management		10%			\$339,899.00	
Contingency		25%			\$849,748.00	
Subtotal Other Costs					\$1,869,446.00	
Total Capital Improvement Costs					\$6,676,439.00	
Master Bl	an Operation and Maintenanc	a Cost Summar	v			
Description	an operation and maintenance	Quantity	y Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal,	erosion at entrance/exit, structural repairs, e	1100	L.F.	\$1.00	\$1,100.00	
Manhole and Inlet Maintenance (e.g. sediment & debr		6	EA	\$67.00	\$402.00	
Detention/WQ Maintenance (e.g. sediment & debris re	emoval, mucking out, tree & weed removal, s	16.5	ACRE	\$2,010.00	\$33,165.00	
Total Annual Operation and Mainte	nance Cost				\$34,667.00	
Effective Interest Rate					2.00%	1
					\$1,089,362.00	9

7/1/2019, 3:00 PM

MASTER	PLAN COST ESTIMAT	E FOR INDIVI	DUAL RE	ACH		
PROJECT : Shar	ktooth Bluffs					
DRAINAGEWAY : WC	ktootn Bluns					-
REACH : 2						-
	of Greeley					
REACH ID: 81st	Ave - FHMA 8 Ac.ft	Monica Ramirez		DATE :	12/19/2018	
				1	TOTAL	
DESCRIPTION		QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Detention/Water Quality Facilities						
Detention (Complete-in-Place)						
Detention Facility 1 (Complete-in-Place)		8	AC-FT	\$61,104.00	\$458,280.00	
Landscaping and Maintenance Improv	vements			1	1	
Wetlands Plantings		1	ACRE	\$33,500.00	\$33,500.00	
Reclamation & seeding (native grasses) Trail/Path, Crusher Fines (10' Width)		6 700	ACRE L.F.	\$1,340.00 \$15.00	\$7,370.00 \$10,500.00	Maintenance Road
		700	L.F.	\$15.00	\$10,000.00	
Land Acquisition Easement/ROW Acquisition		6.00	ACRE	\$88,000.00	\$528,000.00	
Coordinate Cort Augulation		0.00	AUNE	900,000.00	9020,000.00	
	Master Plan Capital Improv	ement Cost Su	mmarv			
Capital Improvement Costs	autor i fan Sapital Improv	chieffe 303t Sul	in a second s			
Pipe Culverts and Storm Drains					\$0.00	
Concrete Box Culverts					\$0.00	
Hydraulic Structures					\$0.00	
Channel Improvements	\$0.00					
Detention/Water Quality Facilities					\$458,280.00	
Removals					\$0.00	
Landscaping and Maintenance Improvements Special Items (User Defined)					\$51,370.00 \$0.00	
Subtotal Capital Improvement Costs					\$509,650.00	
Additional Capital Improvement Costs					\$303,030.00	
Dewatering		\$5,096.50	L.S.		\$5,097.00	
Mobilization		5%			\$25,483.00	
Traffic Control		\$25,482.50	L.S.		\$25,483.00	
Utility Coordination/Relocation		\$25,482.50	L.S.		\$25,483.00	
Stormwater Management/Erosion Control		5%			\$25,483.00	
Subtotal Additional Capital Improvement Costs Land Acquisition Costs		_	_		\$107,029.00	
ROW/Easements					\$528,000.00	
Subtotal Land Acquisition Costs					\$528,000.00	
Other Costs (percentage of Capital Improve	ment Costs)					
Engineering		15%			\$92,502.00	
Legal/Administrative		5%			\$30,834.00	
Contract Admin/Construction Management		10%			\$61,668.00	
Contingency Subtotal Other Costs		25%	l		\$154,170.00 \$339,174.00	
					\$1.483.853.00	
Total Capital Improvement Costs					\$1,403,003.UU	
	Operation and Maintenand			1		
Description	along at automorphists atomstications in the	Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal, eros Manhole and Inlet Maintenance (e.g. sediment & debris re		1100 6	L.F.	\$1.00 \$67.00	\$1,100.00 \$402.00	
Manhole and Inlet Maintenance (e.g. sediment & debris re Detention/WQ Maintenance (e.g. sediment & debris remov			ACRE	\$67.00 \$2,010.00	\$402.00	
Total Annual Operation and Maintena			AUNE	92,010.00	\$13.562.00	
Effective Interest Rate	100 0051				2.00%	
	the Ower EQ Veere					
Total Operation and Maintenance Cos	ats Over 50 Years				\$426,167.00	

7/1/2019, 2:59 PM

# Canal Base Flow Separation Alternatives

C-24: Northridge Draw – Poudre River Ranch

C-24: Poudre Learning Center – Jones Ditch

MAS	TER PLAN C	OST ESTIMAT	E FOR INDIV	IDUAL RE	ACH		]
PROJECT :	Sharktooth Bluff						-
DRAINAGEWAY :	ND						-
REACH :	1						
JURISDICTION : REACH ID:	City of Greeley PRR - Baseflow Se	naration	Enter Estimator Nam	e on Project Infr	DATE :	12/19/2018	1
REACH ID.	FRR - Basellow Se	paration	Enter Estimator Nam	e on Project init	DATE.	12/13/2010	1
						TOTAL	
DESCRIPTION			QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Manholes and Inlets			2	EA	\$16,080.00	\$32,160.00	
Type B Manhole (Pipe Dia. 48" and larger, deflec Concrete Box Culverts	tion < 10 degrees)		2	EA	\$16,080.00	\$32,100.00	
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
7	3	1	70	L.F.	\$722.88	\$50,602.00	Flume over Greeley No. 3 Canal
Headwall and Toewalls Individual Box Span (ft)	No. of Barrels	Total Span (ft)	1		T	1	
7	1	9.00	2	EA	\$813.96	\$1,628.00	
Wingwalls (includes wingwalls on ei	ther side of channel ar	nd concrete apron)				· ·	
Individual Box Span (ft)	Box Rise (ft) 3	No. of Barrels	2	EA	\$6,827.66	\$13,655.30	
Channel Improvements	3	1	4	EA	30,027.00	\$13,000.00	
Excavation, Mid Range			900	C.Y.	\$32.00	\$28,800.00	Channel Excavation
18-inch Riprap, Type H			5	C.Y.	\$107.00	\$535.00	Outlet Protection
Landscaping and Maintenance I	mprovements						
Trail/Path, Concrete (10' Width)			75	L.F.	\$59.00	\$4,425.00	Maintenance Road north of Greeley No. 3
Land Acquisition							
Easement/ROW Acquisition			0.70	ACRE	\$8,471.71	\$5,930.00	
	Mactor Bla	n Capital Improv	amont Cost Su	mmory			
Capital Improvement Costs	waster Pla	in Capital Improv	rement Cost Sui	mmary			
Pipe Culverts and Storm Drains						\$32,160.00	
Concrete Box Culverts						\$65,885.00	
Hydraulic Structures Channel Improvements						\$0.00 \$29,335.00	
Detention/Water Quality Facilities						\$0.00	
Removals						\$0.00	
Landscaping and Maintenance Improvements Special Items (User Defined)						\$4,425.00 \$0.00	
Subtotal Capital Improvement Costs						\$131,805.00	
Additional Capital Improvement Cost	ts						
Dewatering			\$1,318.05	L.S.		\$1,318.00	
Mobilization Traffic Control			5% \$6,590.25	L.S.		\$6,590.00 \$6,590.00	
Utility Coordination/Relocation			\$6,590.25	L.S.		\$6,590.00	
Stormwater Management/Erosion Control			5%			\$6,590.00	
Subtotal Additional Capital Improvement Cost Land Acquisition Costs	\$			_		\$27,678.00	
ROW/Easements						\$5,930.00	
Subtotal Land Acquisition Costs						\$5,930.00	
Other Costs (percentage of Capital	mprovement Costs)					1	
Engineering Legal/Administrative			15% 5%			\$23,922.00 \$7,974.00	
Contract Admin/Construction Management			10%			\$15,948.00	
Contingency		-	25%			\$39,871.00	
Subtotal Other Costs				_		\$87,715.00	
Total Capital Improvement Costs						\$253,128.00	
Maator	Plan Operation	and Maintenand	o Cost Summer	74			
Description	rian Operation	and Mannenant	Quantity	y Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris rem			e 75	L.F.	\$1.00	\$75.00	
Detention/WQ Maintenance (e.g. sediment & deb		t, tree & weed removal, s	0.5	ACRE	\$2,010.00	\$1,005.00	
Total Annual Operation and Mai	ntenance Cost					\$1,080.00	
Effective Interest Rate						2.00%	
Total Operation and Maintenanc	e Costs Over 50	) Years				\$33,937.00	

	PLAN COST ESTIMA					
PROJECT : Sha	ktooth Bluff					
DRAINAGEWAY : PLC						
REACH : 1						
	of Greeley					
REACH ID: Jone	s Ditch - Baseflow Separation	Enter Estimator Nam	ne on Project Info	DATE :	12/21/2018	
			1		TOTAL	
DESCRIPTION		QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Channel Improvements						
xcavation, Mid Range		890	C.Y.	\$32.00	\$28,480.00	600 LF overflow channel
andscaping and Maintenance Improv	vements					
Reclamation & seeding (native grasses)		1	ACRE	\$1,340.00	\$769.00	
Special Items (User Defined)						
	r Defined Items	50	C.Y.	\$804.00	\$40,200.00	Concrete for canal separation spillway
	Master Plan Capital Impro	ovement Cost Su	mmary			
Capital Improvement Costs	actor i full oupitul impre	Standing Good Out				
Pipe Culverts and Storm Drains					\$0.00	
Concrete Box Culverts					\$0.00	
lydraulic Structures					\$0.00	
Channel Improvements					\$28,480.00	
etention/Water Quality Facilities					\$0.00	
Removals					\$0.00	
andscaping and Maintenance Improvements					\$769.00	
Special Items (User Defined)					\$40,200.00	
Subtotal Capital Improvement Costs					\$69,449.00	
Additional Capital Improvement Costs						
Dewatering		\$694.49	L.S.		\$694.00	
Abbilization		5%			\$3,472.00	
raffic Control		\$3,472.45	L.S.		\$3,472.00	
Jtility Coordination/Relocation		\$3,472.45	L.S.		\$3,472.00	
Stormwater Management/Erosion Control		5%			\$3,472.00	
Subtotal Additional Capital Improvement Costs					\$14,582.00	
ROW/Easements					\$0.00	
Subtotal Land Acquisition Costs					\$0.00	
Other Costs (percentage of Capital Improve	ment Costs)				\$0.00	
ingineering		15%			\$12,605.00	
egal/Administrative		5%			\$4,202.00	
Contract Admin/Construction Management		10%			\$8,403.00	
Contingency		25%			\$21,008.00	
Subtotal Other Costs					\$46,218.00	
otal Capital Improvement Costs					\$130,249.00	
Master Plan	Operation and Maintena	nce Cost Summar	ry			
Description		Quantity	Unit	Unit Cost	Total Annual Cost	
lydraulic Structure Maintenance (e.g. debris removal, er	sion, structural repairs, etc.)	1	EA	\$670.00	\$134.00	
Channel Maintenance (e.g. sediment & debris removal, er		600	L.F.	\$3.00	\$900.00	
otal Annual Operation and Maintena	nce Cost				\$1.034.00	
ffective Interest Rate					2.00%	
			\$32.492.00			

7/1/2019, 3:44 PM

SBB\_UD-MP Cost Version 2.2\_PLC\_JonesDitch.xlsm, 10-YR Cul-Reach1

## No Action Alternatives

- C-26: Foothills Tributary North of Melbourne
- C-26: Poudre Learning Center 83<sup>rd</sup> Avenue
- C-27: Poudre River Ranch East
- C-27: Wiedeman Creek 4<sup>th</sup> Street
- C-28: Wiedeman Creek 78<sup>th</sup> Avenue
- C-28: Wiedeman Creek 81<sup>st</sup> Avenue
- C-29: Wiedeman Creek Armour Hill Road
- C-29: Wiedeman Creek Skyview Street

MASTER PLAN COST ESTIMAT	E FOR INDIV	DUAL RE	ACH									
PROJECT : Sharktooth Bluff												
DRAINAGEWAY: NofMelbourneSt												
REACH : 1												
JURISDICTION : City of Greeley												
REACH ID: NoAction-Reach1	Enter Estimator Nam	o on Project Infr	DATE :	12/19/2018								
REACH ID: NOACLIOIT-ReaCTT	Enter Estimator Nam	e on Project int	DATE.	12/13/2010								
				TOTAL								
DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS							
BESCRIFTION	QUANTIT	UNIT	0111 0001	0001	USER COMMENTS							
Master Plan Capital Improv	omont Cost Su	mary										
Capital Improvement Costs	ement cost out	ninar y										
Pipe Culverts and Storm Drains				\$0.00								
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)				\$0.00								
Subtotal Capital Improvement Costs				\$0.00								
Additional Capital Improvement Costs				1 100								
Dewatering		L.S.		\$0.00								
Mobilization	5%			\$0.00								
Traffic Control		L.S.		\$0.00								
Utility Coordination/Relocation		L.S.		\$0.00								
Stormwater Management/Erosion Control	5%			\$0.00								
Subtotal Additional Capital Improvement Costs				\$0.00								
Land Acquisition Costs												
ROW/Easements				\$0.00								
Subtotal Land Acquisition Costs				\$0.00								
Other Costs (percentage of Capital Improvement Costs)												
Engineering	15%			\$0.00								
Legal/Administrative	5%			\$0.00								
Contract Admin/Construction Management	10%			\$0.00								
Contingency	25%			\$0.00								
Subtotal Other Costs				\$0.00								
Total Capital Improvement Costs				\$0.00								
Martin Plan Orantian 1991	0											
	Master Plan Operation and Maintenance Cost Summary											
Description	Quantity	Unit L.F.	Unit Cost \$1.00	Total Annual Cost \$300.00								
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal, s	150	L.F. ACRE	\$1.00 \$2,010.00	\$300.00 \$402.00								
	0.2	AURE	\$2,010.00									
Total Annual Operation and Maintenance Cost				\$702.00								
Effective Interest Rate				2.00%								
Total Operation and Maintenance Costs Over 50 Years				\$22,059.00								

MASTER PLAN COST ESTIMAT	E FOR INDIV	IDUAL RE	ACH		
PROJECT: Sharktooth Bluff DRAINAGEWAY: 83rd Ave REACH: 5 JURISIDCTION: City of Greekey					
REACH ID: No Action-Reach5	Enter Estimator Nam	ne on Project Info	DATE :	12/21/2018	
DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Master Plan Capital Improv	ement Cost Su	mmarv			
Capital Improvement Costs	ciliciti ocor ou	initial y			
Pipe Culverts and Storm Drains				\$0.00	
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)				\$0.00	
Subtotal Capital Improvement Costs				\$0.00	
Additional Capital Improvement Costs	-	1		\$0.00	
Dewatering		L.S.			
Mobilization	5%			\$0.00	
Traffic Control		L.S.		\$0.00	
Utility Coordination/Relocation Stormwater Management/Erosion Control	5%	L.S.		\$0.00 \$0.00	
Stormwater Management/Erosion Control Subtotal Additional Capital Improvement Costs	2%			\$0.00	
Land Acquisition Costs				\$0.00	
ROW/Easements				\$0.00	
Subtotal Land Acquisition Costs				\$0.00	
Other Costs (percentage of Capital Improvement Costs)				\$0.00	
Engineering	15%	1		\$0.00	
Legal/Administrative	5%			\$0.00	
Contract Admin/Construction Management	10%			\$0.00	
Contingency	25%			\$0.00	
Subtotal Other Costs				\$0.00	
Total Capital Improvement Costs				\$0.00	
Master Plan Operation and Maintenance	ce Cost Summar Quantity	ry .			
Description	Total Annual Cost				
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs,	e 77	L.F.	\$1.00	\$77.00	
Total Annual Operation and Maintenance Cost				\$77.00	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				\$2,420.00	

1/30/2019, 2:25 PM

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH         PROJECT       Employed Status of Burl         DENALOWS       Employed Status of Burl         DENALOWS       Employed Status of Burl         DENALOWS       Epployed Status of Burl         DESCRIPTION       QUANTITY       UNIT       UNIT COST       TOTAL         DESCRIPTION       QUANTITY       UNIT       UNIT COST       USER COMMENTS         Processor       Status of Burl       Status of Burl       Status of Burl         Processor       Status of Burl       Status of Burl       Status of Burl         Processor       Status of Burl       Status of Burl       Status of Burl         Operation       Status of Burl       Status of Burl       Status of Burl         Processor       Status of Burl       Status of Burl       Status of Burl         Operative Status of Burl       Status of Burl       Status of Burl       Status of Burl         Operative Status of Burl       Status of Burl       Status of Burl       Status of Burl         Operative Status of Burl       Status of Burl       Status of Burl       Status of Burl         Operative Status of Burl         Operative Status of							
BRANAGEWAY:         East Poude River Rid           REACH:         1           JURSDICTION:         City of Greeky           REACH:         DATE:           IDESCRIPTION         DATE:           DESCRIPTION         QUANTITY         UNIT         UNIT COST         COST           DESCRIPTION         QUANTITY         UNIT         UNIT COST         COST         USER COMMENTS           Pipe Cuberts and Stom Drain         Stotal Inprovement Cost         90.00         Stotal Inprovement Cost         90.00           Concrete Box Cuberts         90.00         Stotal Inprovement Stotal Inprovement Cost         90.00           Charter Inprovement Cost         Stotal Inprovement Stotal	MAST	ER PLAN COST ESTIMATE	E FOR INDIVI	DUAL RE	ACH		
BRANAGEWAY:         East Poudre River Rid           REACH ID:         I	PDO ISOT	Observation Distil					
REACH II       I         BURDENDI       EVENT ASSAULT       DATE:       12/19/2018         DESCRIPTION       QUANTIY       UNIT       UNIT COST       TOTAL COST       USER COMMENTS         DESCRIPTION       Master Plan Capital Improvement Cost Summary       0 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>							
JURESDETION:         Ety of Greeley_ EPRR-Result         Monica Ramirez         DATE:         12/19/2018           DESCRIPTION         QUANTITY         UNIT         UNIT COST         TOTAL COST         USER COMMENTS           Master Plan Capital Improvement Cost Summary         Cost         Solo         Solo           Concrete Box Coderts         Solo         Solo         Solo           Advantation Structures         Solo         Solo         Solo           Concrete Box Coderts         Solo         Solo         Solo           Advantation Structures         Solo         Solo         Solo           Concrete Box Coderts         Solo         Solo         Solo           Advantation Structures         Solo         Solo         Solo           Concrete Box Coderts         Solo         Solo         Solo           Advantation Structures         Solo         Solo         Solo           Solo         Solo         Solo         Solo         Solo           Solo <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>							
REACH ID:         EPRR-Reach1         Monice Raminez         DATE:         1219/2018           DESCRIPTION         QUANTITY         UNIT         UNIT COST         TOTAL COST         USER COMMENTS           Master Plan Capital Improvement Cost Summary         Master Plan Capital Improvement Cost Summary         S000         USER COMMENTS           Option Summary Field Improvement Cost Summary         S000         S000         S000         S000           Option Summary Field Improvement Cost Summary         S000         S000         S000         S000           Option Summary Field Improvement Cost         S000         S000         S000         S000           Option Summary Field Improvement Cost         S000         S000         S000         S000         S000           Option Summary Field Improvement Costs         S000         S000         LS         S000							
Description         QUANTITY         UNIT         UNIT COST         TOTAL Cost         USER COMMENTS           Master Plan Capital Improvement Cost Summary           Capital Improvement Costs         \$0.00         Cost         \$0.00           Concrete Box Colerts         \$0.00         \$0.00         \$0.00           Concrete Box Colerts         \$0.00         \$0.00         \$0.00           Concrete Box Colerts         \$0.00         \$0.00         \$0.00           Channel Improvements         \$0.00         \$0.00         \$0.00           Capital Maintence Improvements         \$0.00         \$0.00         \$0.00           Subcotal Capital Improvement Costs         \$0.00         \$0.00         \$0.00           Amovalis         \$0.00         \$0.00         \$0.00         \$0.00           Concrete Box Coler Definid)         \$0.00			Monica Pamiroz		DATE	12/10/2018	
DESCRIPTION         QUANTITY         UNIT         UNIT         COST         USER COMMENTS           Contrait Improvement Cost Summary           Section Costs	REACH ID.	EFRR-RedCIII	mornea rearinez		DATE .	12/13/2010	1
DESCRIPTION         QUANTITY         UNIT         UNIT         COST         USER COMMENTS           Carpital Improvement Costs         So						τοται	
Master Plan Capital Improvement Cost Summary           Cepital Improvement Costs           Pipe Cidents and Storn Drains           Concrete Box Cidents           Storage Box Cidents           Hydraulic Structures           Channel Improvements           Descripte Box Cidents           Storage Box Ciden	DESCRIPTION		OUANTITY	LINUT	UNIT COST		LISED COMMENTS
Capital Improvement Costs         S0.00           Operative Box Caherts         \$0.00           Mydradic Structures         \$0.00           Channel Improvements         \$0.00           Mydradic Structures         \$0.00           Channel Improvements         \$0.00           Detention/Water Castly Features         \$0.00           Emrovalis         \$0.00           Detention/Water Castly Features         \$0.00           Landscaping and Maintenance Improvements         \$0.00           Subtotal Capital Improvement Costs         \$0.00           Additional Capital Improvement Costs         \$0.00           Additional Capital Improvement Costs         \$0.00           Additional Capital Improvement Costs         \$0.00           Develoating         \$0.00         LS.           Mobilization         \$0.00         LS.           Traffic Control         \$0.00         LS.           Stubtotal Addition Costs         \$0.00         LS.           Forwater Management/Ecosins Control         \$0.00         LS.           Stubtotal Addition Costs         \$0.00         LS.           Forwater Management/Ecosins         \$0.00         Ecosis           Control         \$0.00         S0.00         Ecosis     <	DESCRIPTION		QUANTIT	UNII	UNII COST	0031	USER COMMENTS
Capital Improvement Cests         \$0.00           Oper Caberts and Sorm Paries         \$0.00           Concrete Box Caberts         \$0.00           Hydraufe: Structures         \$0.00           Channel Improvements         \$0.00           Cancer May Concerns         \$0.00           Detention/Valer Cably Facilities         \$0.00           Removalis         \$0.00           Detention/Valer Cably Facilities         \$0.00           Removalis         \$0.00           Subtotal Capital Improvements         \$0.00           Subtotal Capital Improvement Cests         \$0.00           Subtotal Capital Improvement Cests         \$0.00           Mobilization         \$5%         \$0.00           Mobilization         \$5%         \$0.00           Traffic Control         \$0.00         LS.         \$0.00           Subtotal Addition Costs         \$0.00         Subtotal Addition Costs         \$0.00           Subtotal Addition Costs         \$0.00         Subtotal Addition Costs							
Pip Clavet's and Som Drains         \$0.00           Concrete Box Cabet's         \$0.00           Hydraule Structures         \$0.00           Channel Improvements         \$0.00           Channel Improvements         \$0.00           Detention'Water Cablety Facilies         \$0.00           Removals         \$0.00           Landscaping and Maintenance Improvements         \$0.00           Special Improvement Costs         \$0.00           Additional Capital Improvement Costs         \$0.00           Additional Capital Improvement Costs         \$0.00           Iter Control         \$0.00         LS.           Mobilization         \$0.00         LS.           Mobilization         \$0.00         LS.           Stortical Margement/Ecosin         \$0.00         LS.           Stortical Control         \$0.00         LS.           Usity Coordination Relaction         \$0.00         LS.           Stortical Addition Costs         \$0.00         Stortical Addition Costs           Control         \$0.00         LS.         \$0.00           Stortical Addition Costs         \$0.00         Stortical Addition Costs         \$0.00           Stortical Cost Control         \$0.00         Stortical Cost         \$0.00<		Master Plan Capital Improve	ement Cost Sur	nmary			
Concrete box Cakerts         \$0.00           Channel Improvements         \$0.00           Detention/Water Qualty Facilities         \$0.00           Bernovalls         \$0.00           Detention/Water Qualty Facilities         \$0.00           Bernovalls         \$0.00           Detention/Water Qualty Facilities         \$0.00           Bernovalls         \$0.00           Landscaping and Maintenance Improvements         \$0.00           Subtotal Capital Improvement Costs         \$0.00           Subtotal Capital Improvement Costs         \$0.00           Additional Capital Improvement Costs         \$0.00           Additional Capital Improvement Costs         \$0.00           Mobilization         \$0.00         LS.           Mobilization         \$0.00         LS.           Statotal Additional Capital Improvement Costs         \$0.00           Statotal Additional Capital Improvement Costs         \$0.00           Statotal Additional Capital Improvement Costs         \$0.00           Statotal Addition Costs         \$0.00 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>							
https://def Structures         90.00           Channel Improvements         90.00           Detertion / Valar Quality Facilities         90.00           Removals         90.00           Landscaping and Maintenance Improvements         90.00           Special Items (User Defined)         90.00           Special Items (User Defined)         90.00           Subtotal Capital Improvement Costs         90.00           Additional Capital Improvement Costs         90.00           Montational Capital Improvement Costs         90.00           Infite Control         90.00         L.S.         90.00           Montational Relation Review         90.00         L.S.         90.00           Infite Control         90.00         L.S.         90.00           Stormater Management Relocation         90.00         E.S.         90.00           Stormater Management Relocation         90.00         E.S.							
Channel Improvements         90.00           Detendinal Vietor Casily Eacilities         \$0.00           Encrosols         \$0.00           Landecaping and Maintenance Improvements         \$0.00           Subtotal Capital Improvements         \$0.00           Subtotal Capital Improvement Costs         \$0.00           Additional Capital Improvement Costs         \$0.00           Devalering         \$0.00           Mobilization         \$0.00           Lis         \$0.00           State Testing         \$0.00           Mobilization         \$0.00           Traffic Control         \$0.00           UBity Coordination/Robication         \$0.00           State Testing         \$0.00           State Testing of Capital Improvement Costs         \$0.00							
Determinivitate         \$0.00           Removals         \$0.00           Landscaping and Maintenance Improvements         \$0.00           Special Items (Mer Defined)         \$0.00           Subtrait Capital Improvement Costs         \$0.00           Modificanal Capital Improvement Costs         \$0.00           Notatical Capital Improvement Costs         \$0.00           Listonal Capital Improvement Costs         \$0.00           Notatical Capital Improvement Costs         \$0.00           Stortial Capital Improvement Costs         \$0.00							
Berrowiks         \$0.00           Landscaping and Maintensen Engrowements         \$0.00           Special Iterra (Letr Defined)         \$0.00           Subtoal Capital Improvement Costs         \$0.00           Advision of Capital Improvement Costs         \$0.00           Develoring         \$0.00         L.S.           Mobilization         \$0.00         L.S.         \$0.00           Usity Coordinator/Relocation         \$0.00         L.S.         \$0.00           Starwater Management/Erosian Control         \$0.00         L.S.         \$0.00           Statotial Addition Costs         \$0.00         L.S.         \$0.00           Developments         \$0.00         L.S.         \$0.00           Statotial Addition Costs         \$0.00         L.S.         \$0.00           Statotial Land Acquisition Costs         \$0.00         L.S.         \$0.00           Obtication Costs (processings of Capital Improvement Costs)         \$0.00         Legal-Administration         \$0.00           Le							
Indexaging and Maintense Improvements         \$0.00           Special Improvement Costs         \$0.00           Additional Capital Improvement Costs         \$0.00           Additional Capital Improvement Costs         \$0.00           Devatering         \$0.00         LS.         \$0.00           Mobilization         \$100         \$100         \$100           Mobilization         \$100         \$100         \$100           Mobilization         \$100         \$100         \$100           Mobilization         \$1000         LS.         \$0.00           Subtrait Capital Improvement Costs         \$0.00         LS.         \$0.00           Subtrait Capital Improvement Costs         \$0.00         LS.         \$0.00           Subtrait Additional Capital Improvement Costs         \$0.00         LS.         \$0.00           Subtrait Additional Capital Improvement Costs         \$0.00         \$0.00         \$0.00           Subtrait Additional Capital Improvement Costs         \$0.00         \$0.00         \$0.00           Subtrait Additional Capital Improvement Costs         \$0.00         \$0.00         \$0.00           Subtrait Costs (percentage of Capital Improvement Costs)         \$0.00         \$0.00         \$0.00           Contract Admin/Construction Manage							
Special lumery (Jear Defined)         \$0.00           Additional (Capital Improvement Costs         \$0.00           Additional (Capital Improvement Costs         \$0.00           Dewatering         \$0.00         L.S.         \$0.00           Moltization         \$1.00         \$1.00         \$1.00           Traffic Control         \$0.00         L.S.         \$0.00           Usity Coordination/Relocation         \$0.00         L.S.         \$0.00           Stormater Management/Forsion Control         \$0.00         L.S.         \$0.00           Stormater Management/Forsion Control         \$1.00         \$1.00         \$1.00           Statistical Land Acquisition Costs         \$1.00         \$1.00         \$1.00           Statistical Land Acquisition Costs         \$1.00         \$1.00         \$1.00           Other Costs (percentage of Capital Improvement Costs)         \$1.00         \$1.00         \$1.00<							
Subtotal Capital Improvement Costs         \$9.00           Additional Capital Improvement Costs         50.00         L.S.         \$0.00           Develoring         50.00         L.S.         \$0.00           Mobilization         5%         \$0.00         Control           Taffic Control         \$0.00         L.S.         \$0.00           Ubility Coordination/Relocation         \$0.00         L.S.         \$0.00           Subtotal Capital Improvement Costs         \$0.00         L.S.         \$0.00           Subtotal Capital Improvement Costs         \$0.00         L.S.         \$0.00           Subtotal Capital Improvement Costs         \$0.00         Subtotal Additional Capital Improvement Costs         \$0.00           Subtotal Additional Costs         \$0.00         Subtotal Costs         \$0.00         Subtotal Costs           Contract Administrative         \$0.00         \$0.00         \$0.00         \$0.00           Contract Administrative         \$15%         \$0.00         \$0.00         \$0.00           Contract Administrative         \$15%         \$0.00         \$0.00         \$0.00         \$0.00         \$0.00         \$0.00         \$0.00         \$0.00         \$0.00         \$0.00         \$0.00         \$0.00         \$0.00         \$0.00<							
Additional Capital Improvement Costs         S0.00         L.S.         \$0.00           Mobization         5%         \$0.00         LS.         \$0.00           Mobization         5%         \$0.00         LS.         \$0.00           Lift, Coordinaton/Relocation         \$0.00         LS.         \$0.00         LS.           Stormater Management/Focian Control         \$0.00         Stormater Management/Focian Control         \$0.00           Stormatic Land Acquisition Costs         \$0.00         Stormater Management Focial Costs         \$0.00           Static Land Acquisition Costs         \$0.00         Stormater Management Focial Costs         \$0.00           Other Costs (precentage of Capital Improvement Costs)         \$0.00         Stormater Maniferative         \$0.00           Contral Administrative         \$0%         \$0.00         Stormater Maniferative Stormater Management							
Developing         \$0.00         L.S.         \$0.00           Mobilization         5%          \$0.00           Traffic Control         \$0.00         L.S.         \$0.00           Traffic Control         \$0.00         L.S.         \$0.00           Stormate/Mendation/Relocation         \$0.00         L.S.         \$0.00           Stormater/Management/Ecosim Control         \$0.00         L.S.         \$0.00           Subtatal Additional Capital Improvement Costs         \$0.00          \$0.00           Subtatal Additional Capital Improvement Costs         \$0.00          \$0.00           Subtatal Addition Costs         \$0.00         \$0.00          \$0.00           Costs (percentage of Capital Improvement Costs)         \$0.00         \$0.00          \$0.00           Englendering         15%         \$0.00         \$0.00         \$0.00          \$0.00          \$0.00						\$0.00	
Mohizarán         5%         90.00           Traffic Control         \$0.00         L.S.         \$0.00           Billy Condition/Relocation         \$0.00         L.S.         \$0.00           Stormater Management/Foolen Control         \$0.00         L.S.         \$0.00           Stormater Management/Foolen Control         \$%         \$0.00			60.00	1.0		¢0.00	
Traffic Control         \$0.00         L.S.         \$0.00           Billy Conditation/Relacedian         \$0.00         L.S.         \$0.00           Stormater Management/Encisin Control         \$0.00         L.S.         \$0.00           Subtatal AdditionRelacedian         \$0.00         L.S.         \$0.00           Subtatal AdditionRelacedian         \$0.00         L.S.         \$0.00           Subtatal AdditionRelacedian         \$0.00         L.S.         \$0.00           Subtatal Additional Capital Improvement Costs         \$0.00         Subtatal Addition Costs         \$0.00           Outrier Costs (percentage of Capital Improvement Costs)         \$0.00         \$0.00         Subtatal Addition Costs         \$0.00           Contract Administrative         \$0%         \$0.00         Subtatal Addition Costs         \$0.00           Contract Administrative         \$0%         \$0.00         Subtatal Addition Costs         \$0.00           Contract Administrative         \$0%         \$0.00         \$0.00         Subtatal Addition Costs				L.S.			
Number         Story         LS.         Story           Stormater Management/ErositoControl         5%         50.00         50.00           Subtrait Additional Capital Improvement Costs         50.00         50.00         50.00           Land Acquisition Costs         50.00         50.00         50.00         50.00           Subtrait Additional Costs         50.00         50.0				1.6			
Stormater Management/Encisin Control         5%         \$0.00           Subtrait Additional Capital Improvement Costs         \$0.00           Land Acquisition Costs         \$0.00           Subtrait Additional Capital Improvement Costs         \$0.00           Subtrait Additional Costs         \$0.00           Contract Administrative         \$0.00							
Subtoal Additional Capital Improvement Costs         \$0.00           Land Acquisition Costs         \$0.00           ROW/Easements         \$0.00           Other Costs (percentage of Capital Improvement Costs)         \$0.00           Engineering         15%         \$0.00           Logal/Administrative         \$%         \$0.00           Contract Admin/Construction Management         5%         \$0.00           Contract Admin/Construction Management         10%         \$0.00           Contract Admin/Construction Management         25%         \$0.00           Contract Admin/Construction Management         25%         \$0.00				L.O.			
Land Acquisition Costs         \$0.00           SW/bitsenmits         \$0.00           Subtat Land Acquisition Costs         \$0.00           Subtat Land Acquisition Costs         \$0.00           Contract Administrative         \$0.00           LogarAdministrative         \$0.00           Contract Administrative         \$0.00			570				
EOW/resements         \$0.00           Subtotal Land Acquisition Costs Other Costs (percentage of Capital Improvement Costs)         \$0.00           Engineering Legal/Administrative         \$5%         \$0.00           Contract. Admini/Construction Management         5%         \$0.00           Contract. Admini/Construction Management         00%         \$0.00           Contract. Admini/Construction Management         25%         \$0.00           Subtotal Other Costs         \$0.00         \$0.00						\$0.00	
Subtoal Land Acquisition Costs         \$9,00           Other Costs (percentage of Capital Improvement Costs)         15%         \$0,00           Engineering         15%         \$0,00           Logal/Administrative         5%         \$0,00           Contract Admin Construction Management         10%         \$0,00           Contract Admin Construction Management         10%         \$0,00           Contract Admin Construction Management         25%         \$0,00           Contract Admin Construction Management         \$0,00         \$0,00						\$0.00	
Other Costs (percentage of Capital Improvement Costs)           Engineering         \$0.00           EnginVariistative         \$0.00           Contract Admin/Constructor Management         \$0%         \$0.00           Contract Admin/Constructor Management         \$0%         \$0.00           Stabiotal Other Costs         \$0.00         \$0.00							
Engineering         15%         \$0.00           Legal/Administrative         5%         \$0.00           Contract Admini/Construction Management         10%         \$0.00           Contract Admini/Construction Management         25%         \$0.00           Subtoat Other Costs         \$0.00         \$0.00		provement Costs)				\$0.00	
Legal/Administrative         5%         \$0.00           Contract.Admin/Construction Management         10%         \$0.00           Contingercy         25%         \$0.00           Subtotal Other Costs         \$0.00         \$0.00			15%			\$0.00	
Contract.dxmin/Construction Management         10%         \$0.00           Contingency         25%         \$0.00           Subtotal Other Costs         \$0.00							
Confingency         25%         \$0.00           Subtotal Other Costs         \$0.00         \$0.00			10%			\$0.00	
			25%			\$0.00	
	tal Other Costs					\$0.00	
						\$0.00	
							•
Master Plan Operation and Maintenance Cost Summary	Master P	lan Operation and Maintenanco	e Cost Summar	v			
Description Quantity Unit Unit Cost Total Annual Cost					Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, e 275 L.F. \$1.00 \$550.00		al, erosion at entrance/exit, structural repairs, e					
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.) 2 EA \$67.00 \$268.00			2	EA	\$67.00	\$268.00	
Total Annual Operation and Maintenance Cost \$818.00	al Annual Operation and Main	enance Cost				\$818.00	
Effective Interest Rate 2.00%							
Total Operation and Maintenance Costs Over 50 Years \$25,705.00	al Operation and Maintenance	Costs Over 50 Years				\$25,705.00	

MASTER PLAN COST ESTIMAT	E FOR INDIVI	IDUAL RE	ACH								
PROJECT : Sharktooth Bluff DRAINAGEWAY : Wiedeman Creek - 4th Street											
REACH : 1											
JURISDICTION : City of Greeley											
REACH ID: No Action-Reach1	Enter Estimator Nam	e on Project Inf	DATE :	12/21/2018							
			BAIL .								
				TOTAL							
DESCRIPTION	OUANTITY										
DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS						
Master Plan Capital Impro	vement Cost Sur	mmary									
Capital Improvement Costs											
Pipe Culverts and Storm Drains				\$0.00							
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)				\$0.00							
Subtotal Capital Improvement Costs				\$0.00							
Additional Capital Improvement Costs											
Dewatering		L.S.		\$0.00							
Mobilization	5%			\$0.00							
Traffic Control		L.S.		\$0.00							
Utility Coordination/Relocation		L.S.		\$0.00							
Stormwater Management/Erosion Control	5%			\$0.00							
Subtotal Additional Capital Improvement Costs				\$0.00							
Land Acquisition Costs											
ROW/Easements				\$0.00							
Subtotal Land Acquisition Costs				\$0.00							
Other Costs (percentage of Capital Improvement Costs)											
Engineering	15%			\$0.00							
Legal/Administrative	5%			\$0.00							
Contract Admin/Construction Management	10%			\$0.00							
Contingency	25%			\$0.00							
Subtotal Other Costs				\$0.00							
Total Capital Improvement Costs				\$0.00							
Meeter Dien Operation and Maintenan	an Cont Summer										
	Master Plan Operation and Maintenance Cost Summary										
Description Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs,	Quantity 6 50	Unit L.F.	Unit Cost \$1.00	Total Annual Cost \$100.00							
	UC P	L.F.	\$1.00								
Total Annual Operation and Maintenance Cost				\$100.00							
Effective Interest Rate				2.00%							
Total Operation and Maintenance Costs Over 50 Years				\$3,142.00							

1/30/2019, 2:35 PM

MASTER PLAN COST ESTIMAT	E FOR INDIVI	DUAL RE	ACH		
PROJECT : Enter Project Name on Project Info Tab					
DRAINAGEWAY: WC-78thAve					
REACH : 1					
	Enter Estimator Nam	o on Drojaat Infr	DATE :	Enter Date on Project In	de Teh
REACH ID: NO ACTION-REACH1	Enter Estimator Nam	e on Project into	DATE:	Enter Date on Project in	ilo tab.
				TOTAL	
DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
BEGGRI HON	QUANTIT	UNIT		0001	COER COMMENTS
Master Plan Capital Improv	amont Cost Sur	mary			
Capital Improvement Costs	ement cost our	Timary			
Pipe Culverts and Storm Drains				\$0.00	
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)				\$0.00	
Subtotal Capital Improvement Costs				\$0.00	
Additional Capital Improvement Costs				\$0.00	
Dewatering		L.S.		\$0.00	
Mobilization	5%			\$0.00	
Traffic Control		L.S.		\$0.00	
Utility Coordination/Relocation		L.S.		\$0.00	
Stormwater Management/Erosion Control	5%			\$0.00	
Subtotal Additional Capital Improvement Costs				\$0.00	
Land Acquisition Costs					
ROW/Easements				\$0.00	
Subtotal Land Acquisition Costs				\$0.00	
Other Costs (percentage of Capital improvement Costs)					
Engineering	15%			\$0.00	
Legal/Administrative	5%			\$0.00	
Contract Admin/Construction Management	10%			\$0.00	
Contingency	25%			\$0.00	
Subtotal Other Costs				\$0.00	
Total Capital Improvement Costs				\$0.00	
Master Diag Oneration and Maintenance					
Master Plan Operation and Maintenanc	Quantity	<b>y</b> Unit	Unit Cost	Total Annual Cost	
Description Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, e	Quantity 220	L.F.	\$1.00	S220.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, erosion at entrancerexit, structural repairs, e Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	220	EA	\$67.00	\$220.00	
		EA	\$07.00	1	
Total Annual Operation and Maintenance Cost				\$287.00	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				\$9,019.00	

MASTER PLAN COST ES	TIMATE FOR INDIV	IDUAL RE	ACH		
PROJECT : Sharktooth Bluffs					
DRAINAGEWAY : WC					
REACH : 5					
JURISDICTION : City of Greeley			T		
REACH ID: NoAction-Reach5	Monica Ramirez		DATE :	12/19/2018	
				TOTAL	
DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS
Master Plan Capita	I Improvement Cost Su	Immary			
Capital Improvement Costs	•				
Pipe Culverts and Storm Drains				\$0.00	
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)				\$0.00	
Subtotal Capital Improvement Costs				\$0.00	
Additional Capital Improvement Costs					
Dewatering		L.S.		\$0.00	
Mobilization	5%			\$0.00	
Traffic Control		L.S.		\$0.00	
Utility Coordination/Relocation		L.S.		\$0.00	
Stormwater Management/Erosion Control	5%			\$0.00	
Subtotal Additional Capital Improvement Costs				\$0.00	
Land Acquisition Costs					
ROW/Easements				\$0.00	
Subtotal Land Acquisition Costs				\$0.00	
Other Costs (percentage of Capital Improvement Costs)		1			
Engineering	15%			\$0.00	
Legal/Administrative	5%			\$0.00	
Contract Admin/Construction Management	10%			\$0.00	
Contingency	25%			\$0.00	
Subtotal Other Costs				\$0.00	
Total Capital Improvement Costs				\$0.00	
Master Plan Operation and Main	ntenance Cost Summa	rv.			
Description	Quantity	Total Annual Cost			
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structur		Unit L.F.	Unit Cost \$1.00	\$1,100.00	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc		EA	\$67.00	\$402.00	
Total Annual Operation and Maintenance Cost				\$1,502.00	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				\$47,198.00	

1/30/2019, 3:44 PM

MAS	STER PLAN COST ESTIMAT	E FOR INDIVI	DUAL RE	ACH									
PROJECT :	Enter Project Name on Project Info Tab												
DRAINAGEWAY :	Wiedeman Creek - Armour Hill Dr												
REACH :	1												
JURISDICTION : REACH ID:	City of Greeley No Action-Reach1	Enter Estimator Nam	o on Droigot Info	DATE :	Enter Date on Project In	do Toh							
REACH ID:	No Action-Reach1	Enter Estimator Nam	e on Project into	DATE:	Enter Date on Project in	io tab.							
					TOTAL								
DESCRIPTION		QUANTITY	UNIT	UNIT COST	COST	USER COMMENTS							
Land Acquisition	7												
Easement/ROW Acquisition		0.30	ACRE	\$132,618.00	\$39,785.00								
	Master Plan Capital Improv	ement Cost Sur	mmary										
	Capital Improvement Costs												
Pipe Culverts and Storm Drains		\$0.00											
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)					\$0.00								
Subtotal Capital Improvement Costs					\$0.00								
Additional Capital Improvement Co	sts		1.0		¢0.00								
Dewatering Mobilization		5%	L.S.		\$0.00 \$0.00								
Traffic Control		5%	L.S.		\$0.00								
Utility Coordination/Relocation			L.S.		\$0.00								
Stormwater Management/Erosion Control		5%	L.3.		\$0.00								
Subtotal Additional Capital Improvement Cos	ate.	0,0			\$0.00								
Land Acquisition Costs					\$0.00								
ROW/Easements					\$39,785.00								
Subtotal Land Acquisition Costs					\$39,785.00								
Other Costs (percentage of Capital	Improvement Costs)												
Engineering		15%			\$0.00								
Legal/Administrative		5%			\$0.00								
Contract Admin/Construction Management		10%			\$0.00								
Contingency		25%			\$0.00								
Subtotal Other Costs					\$0.00								
Total Capital Improvement Cost	s				\$39,785.00								
	r Plan Operation and Maintenanc				I								
Description		Quantity	Unit	Unit Cost	Total Annual Cost								
	moval, erosion at entrance/exit, structural repairs, e				\$840.00								
Manhole and Inlet Maintenance (e.g. sediment &		5	EA	\$67.00	\$670.00								
Total Annual Operation and Ma	intenance Cost		\$1,510.00										
Effective Interest Rate					2.00%								
Total Operation and Maintenan	ce Costs Over 50 Years				\$47,450.00								

1/30/2019, 1:57 PM

## Benefit - Cost Ratio Calculations

BCA Assumptions	
Discount Rate	7.0%
Project Life	50 years
EAD Before Migitation	\$ 12,728
EAD After Mitigation	\$ -
EAB	\$ 12,728
Project Benefits	\$ 175,656

	Building Information Existing Conditions FFE Flooding Depth									Exis	sting Conditions S	tructure Percer		Existing Conditions Content Percent Damages					
Parcel No.	Address	Struct	ure Value	Contents Value	2-yr	5-yr	10-yr	50-yr	100-yr	2-yr	5-yr	10-yr	50-yr	100-yr	2-yr	5-yr	10-yr	50-yr	100-yr
80532331003	7907 RIVER RUN DR	\$	346,465	\$ 173,233	0.00	0.00	0.00	0.00	0.48	0.0%	0.0%	0.0%	0.0%	7.2%	0.0%	0.0%	0.0%	0.0%	4.1%
80532331002	7911 RIVER RUN DR	\$	298,312	\$ 149,156	0.00	0.00	0.00	0.00	1.37	0.0%	0.0%	0.0%	0.0%	17.3%	0.0%	0.0%	0.0%	0.0%	10.0%
80532331001	7915 RIVER RUN DR	\$	302,555	\$ 151,278	0.00	0.33	0.30	0.31	0.39	0.0%	5.0%	4.6%	4.7%	5.9%	0.0%	2.9%	2.6%	2.7%	3.4%
80532332013	604 N 81ST AVE	\$	279,742	\$ 139,871	0.00	0.00	0.00	0.00	0.19	0.0%	0.0%	0.0%	0.0%	2.9%	0.0%	0.0%	0.0%	0.0%	1.7%
80532332014	600 N 81ST AVE	\$	365,666	\$ 182,833	0.00	0.00	0.00	0.00	1.12	0.0%	0.0%	0.0%	0.0%	15.9%	0.0%	0.0%	0.0%	0.0%	9.1%
80532330005	8101 RIVER RUN DR	\$	296,998	\$ 148,499	0.00	0.00	0.00	0.00	1.11	0.0%	0.0%	0.0%	0.0%	15.8%	0.0%	0.0%	0.0%	0.0%	9.1%
80532306001	441 HORIZON CIR	\$	501,078	\$ 250,539	0.00	0.00	0.00	0.00	0.85	0.0%	0.0%	0.0%	0.0%	13.0%	0.0%	0.0%	0.0%	0.0%	7.4%
80532329038	520 DEVILLE DR	\$	318,259	\$ 159,130	0.00	0.00	0.00	0.00	0.65	0.0%	0.0%	0.0%	0.0%	9.9%	0.0%	0.0%	0.0%	0.0%	5.7%
80532329037	516 DEVILLE DR	\$	301,865	\$ 150,933	0.00	0.00	0.00	0.00	0.62	0.0%	0.0%	0.0%	0.0%	9.4%	0.0%	0.0%	0.0%	0.0%	5.4%

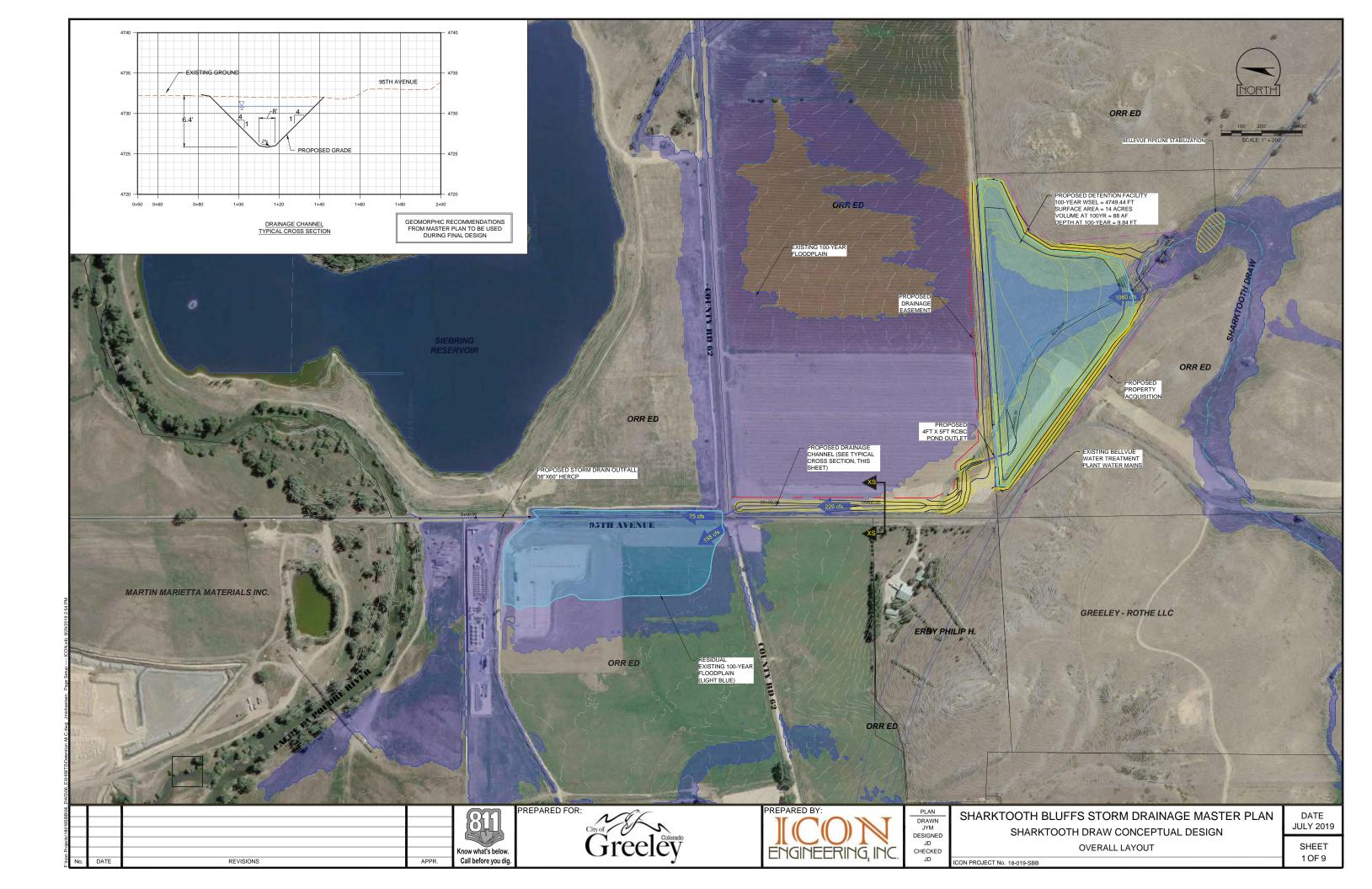
	Building Information									Existing Conditions Damages							Expected Annualized						
Parcel No.	Address	Stru	ucture Value	Cont	ents Value	2-yr		5-yr		10-yr	ļ	50-yr	1	L00-yr	Befo	re Mitigation	Afte	er Mitigation	Ве	nefit	Proj	ect Benefits	
80532331003	7907 RIVER RUN DR	\$	346,465	\$	173,233	\$-	\$	-	\$	-	\$	-	\$	32,241	\$	484	\$	-	\$	484	\$	6,674	
80532331002	7911 RIVER RUN DR	\$	298,312	\$	149,156	\$ -	\$	-	\$	-	\$	-	\$	66,454	\$	997	\$	-	\$	997	\$	13,757	
80532331001	7915 RIVER RUN DR	\$	302,555	\$	151,278	\$ -	\$	19,401	\$	17,745	\$	18,455	\$	22,891	\$	6,651	\$	-	\$	6,651	\$	91,790	
80532332013	604 N 81ST AVE	\$	279,742	\$	139,871	\$ -	\$	-	\$	-	\$	-	\$	10,446	\$	157	\$	-	\$	157	\$	2,162	
80532332014	600 N 81ST AVE	\$	365,666	\$	182,833	\$ -	\$	-	\$	-	\$	-	\$	74,811	\$	1,122	\$	-	\$	1,122	\$	15,487	
80532330005	8101 RIVER RUN DR	\$	296,998	\$	148,499	\$ -	\$	-	\$	-	\$	-	\$	60,475	\$	907	\$	-	\$	907	\$	12,519	
80532306001	441 HORIZON CIR	\$	501,078	\$	250,539	\$ -	\$	-	\$	-	\$	-	\$	83,658	\$	1,255	\$	-	\$	1,255	\$	17,318	
80532329038	520 DEVILLE DR	\$	318,259	\$	159,130	\$ -	\$	-	\$	-	\$	-	\$	40,629	\$	609	\$	-	\$	609	\$	8,411	
80532329037	516 DEVILLE DR	\$	301,865	\$	150,933	\$-	\$	-	\$	-	\$	-	\$	36,412	\$	546	\$	-	\$	546	\$	7,538	

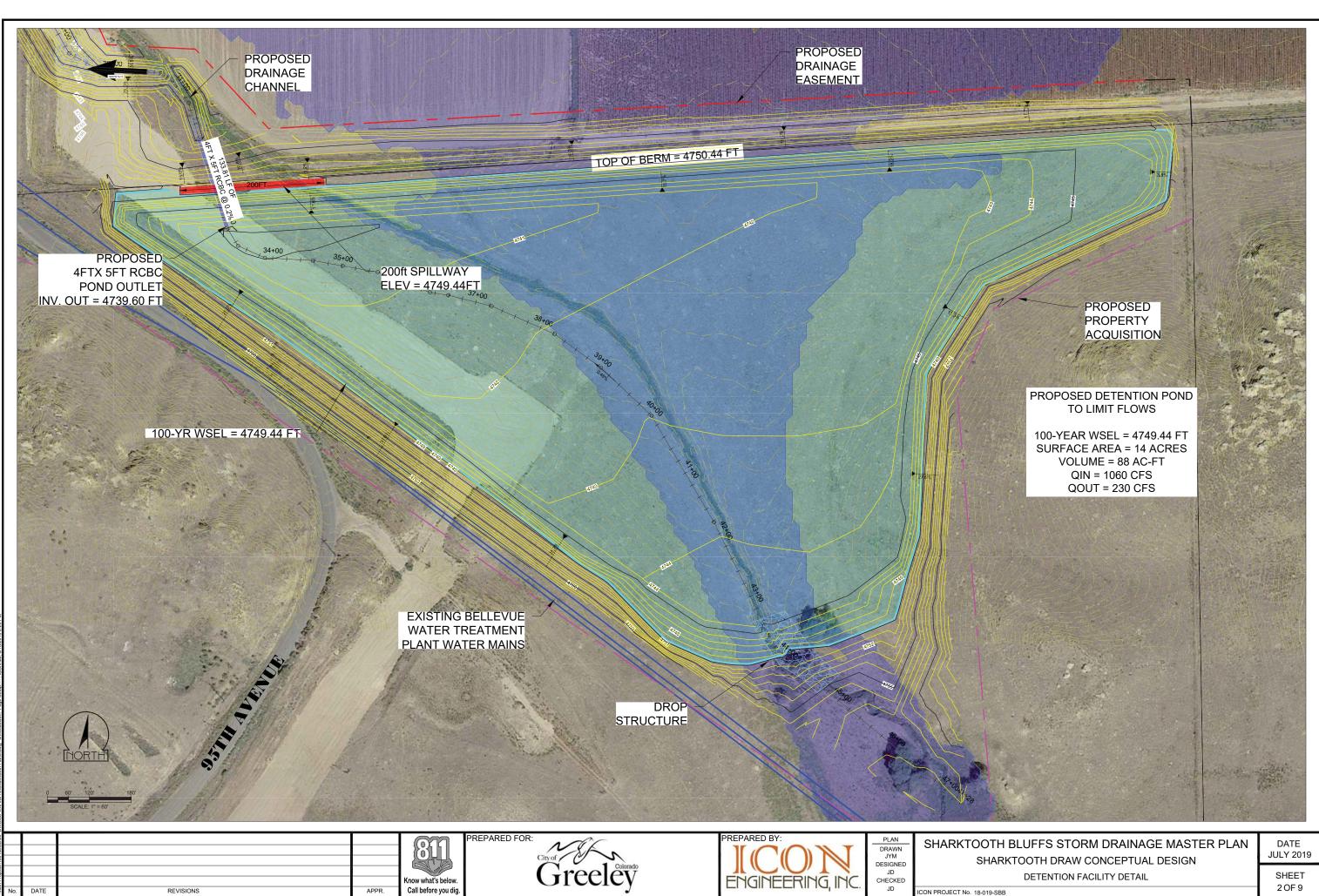


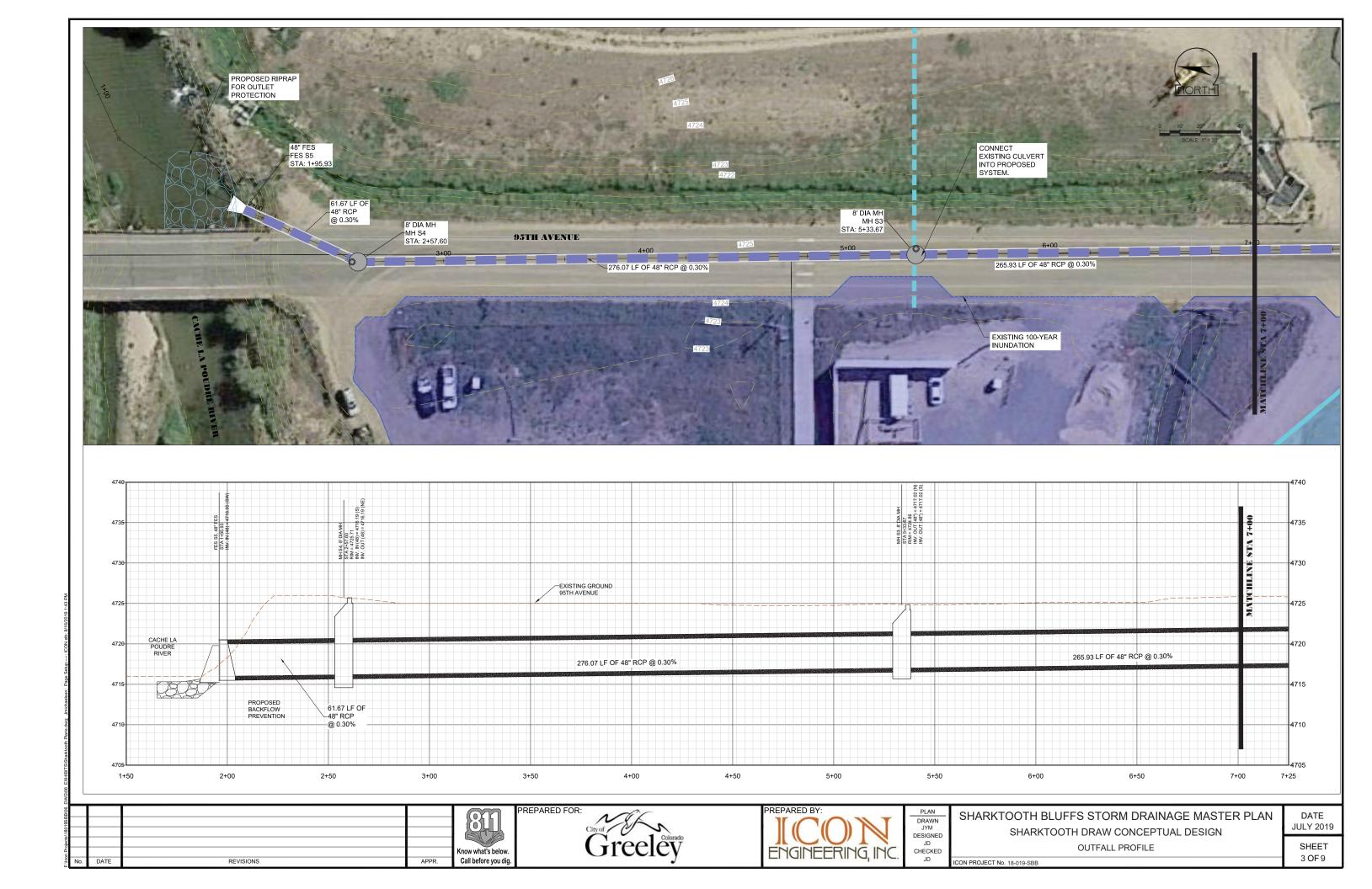
## **APPENDIX D - CONCEPTUAL DESIGN INFORMATION**

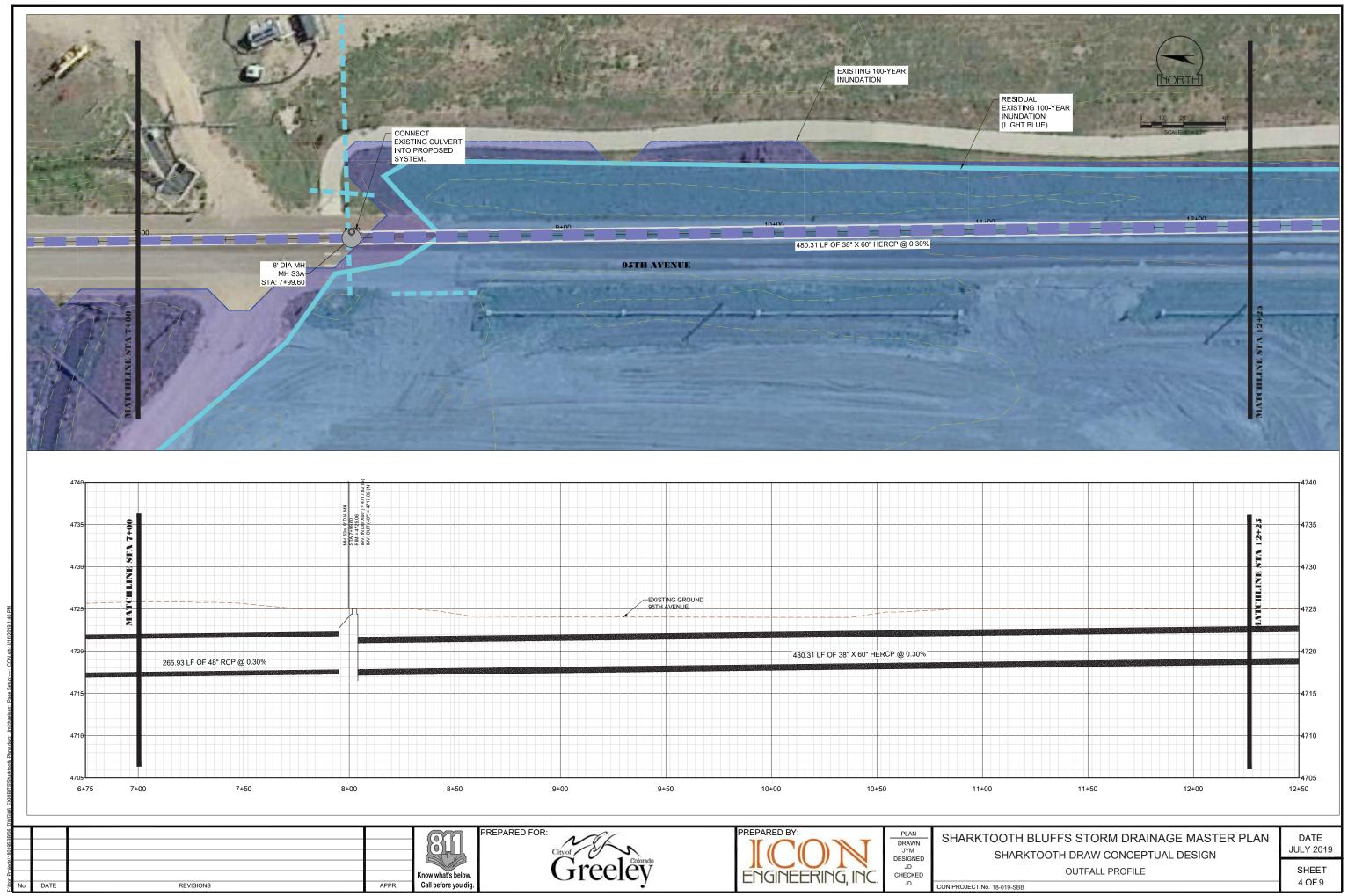


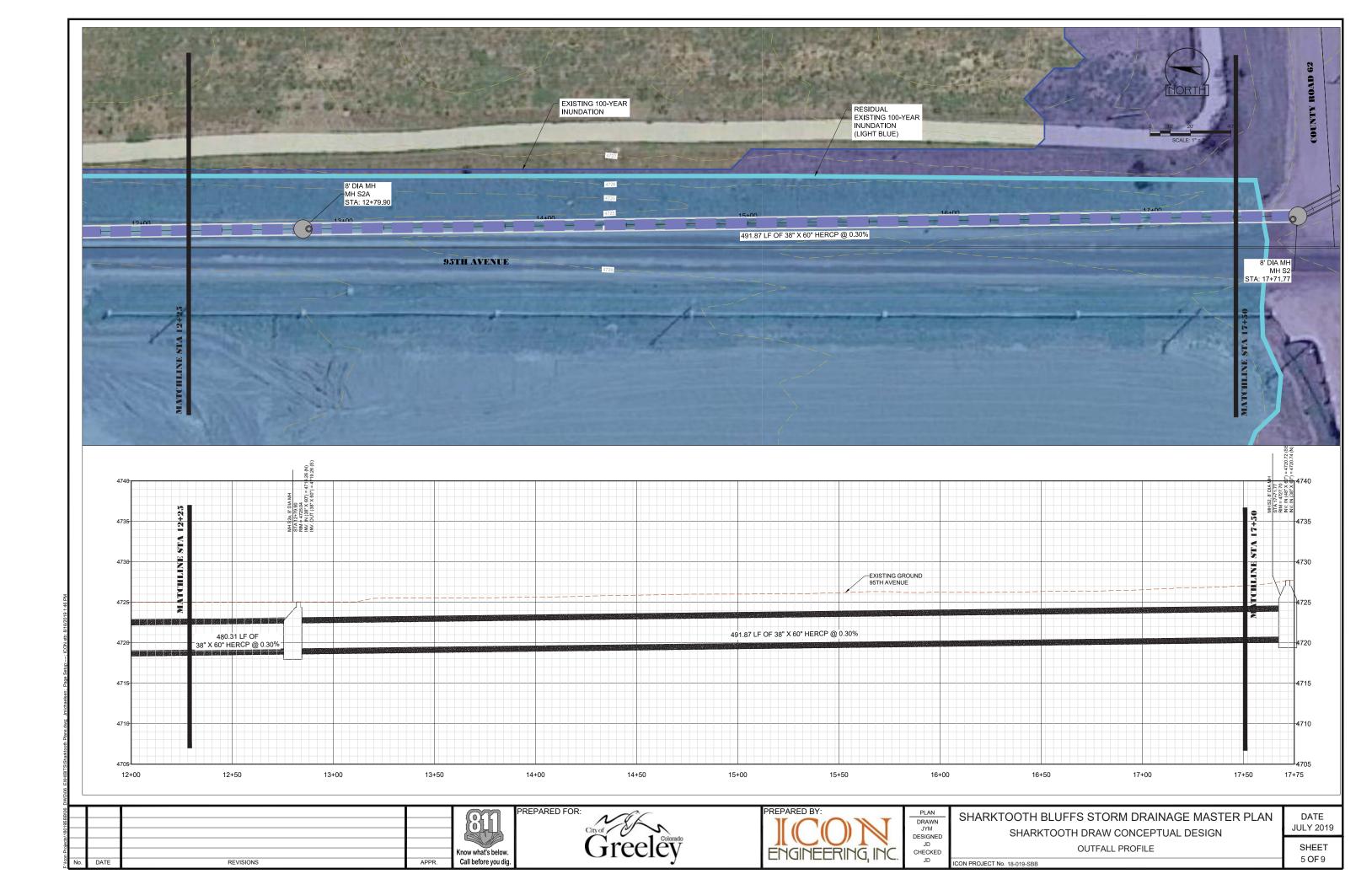
### SHARKTOOTH BLUFFS STORM DRAINAGE MASTER PLAN

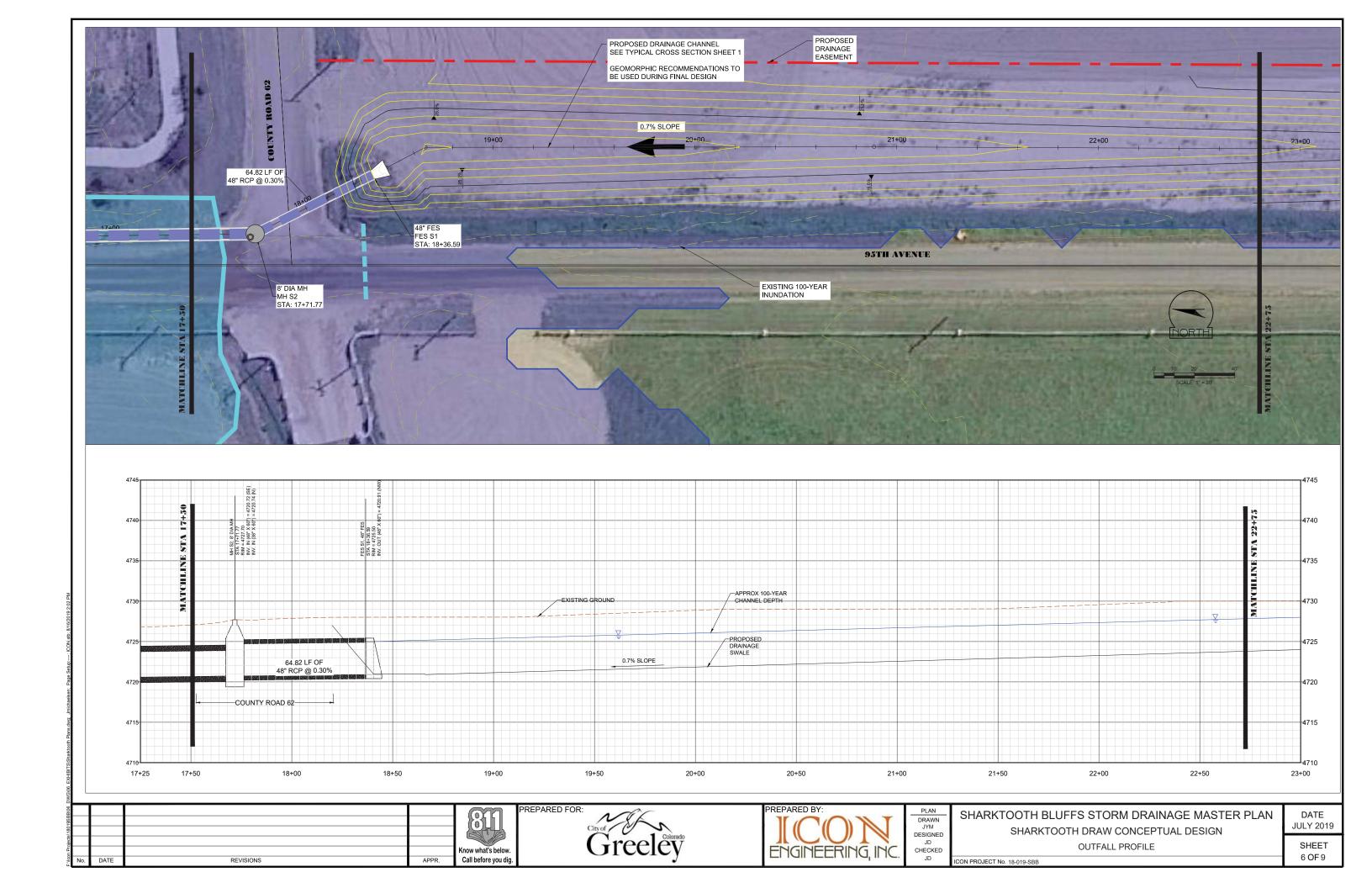


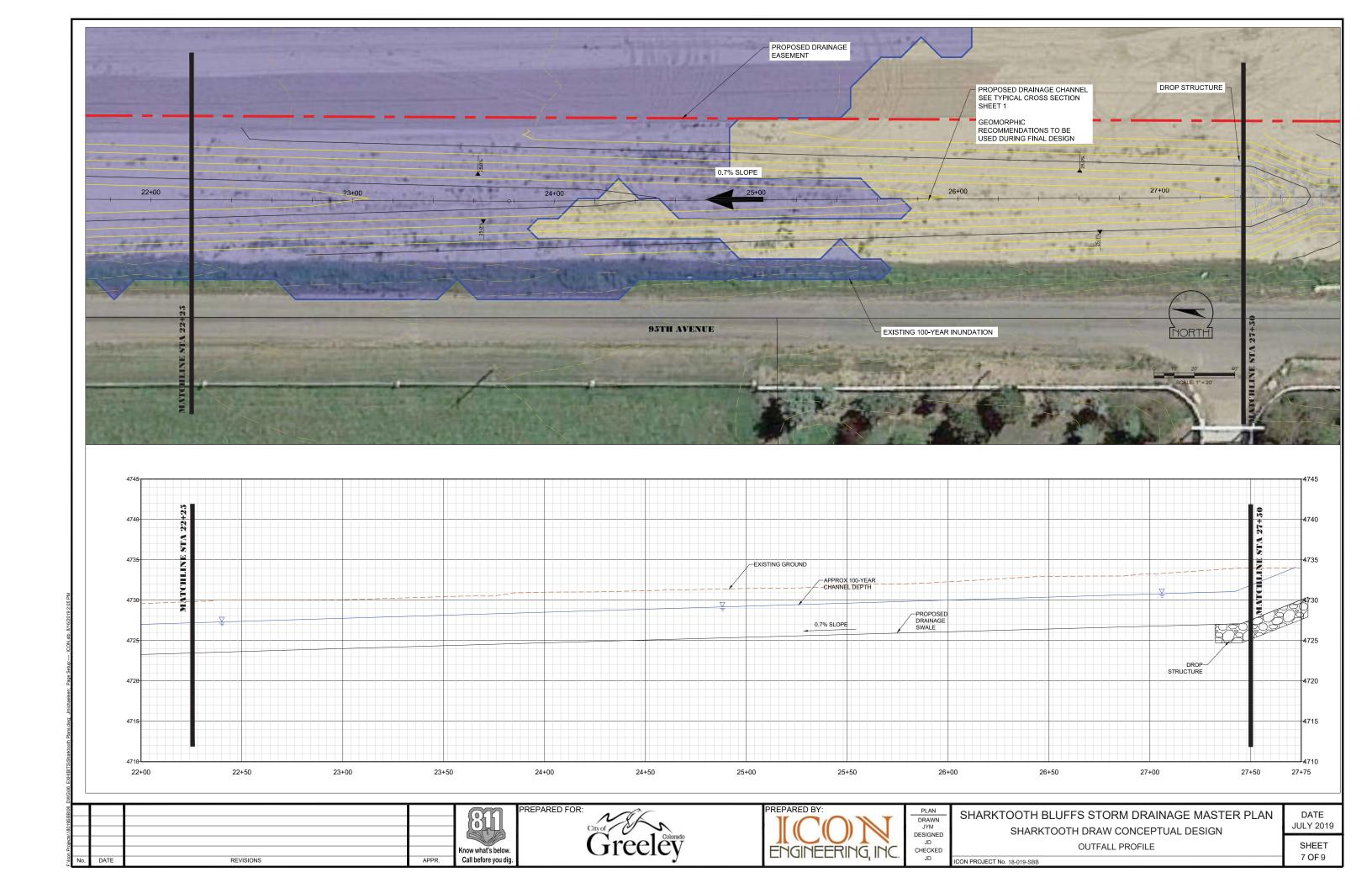


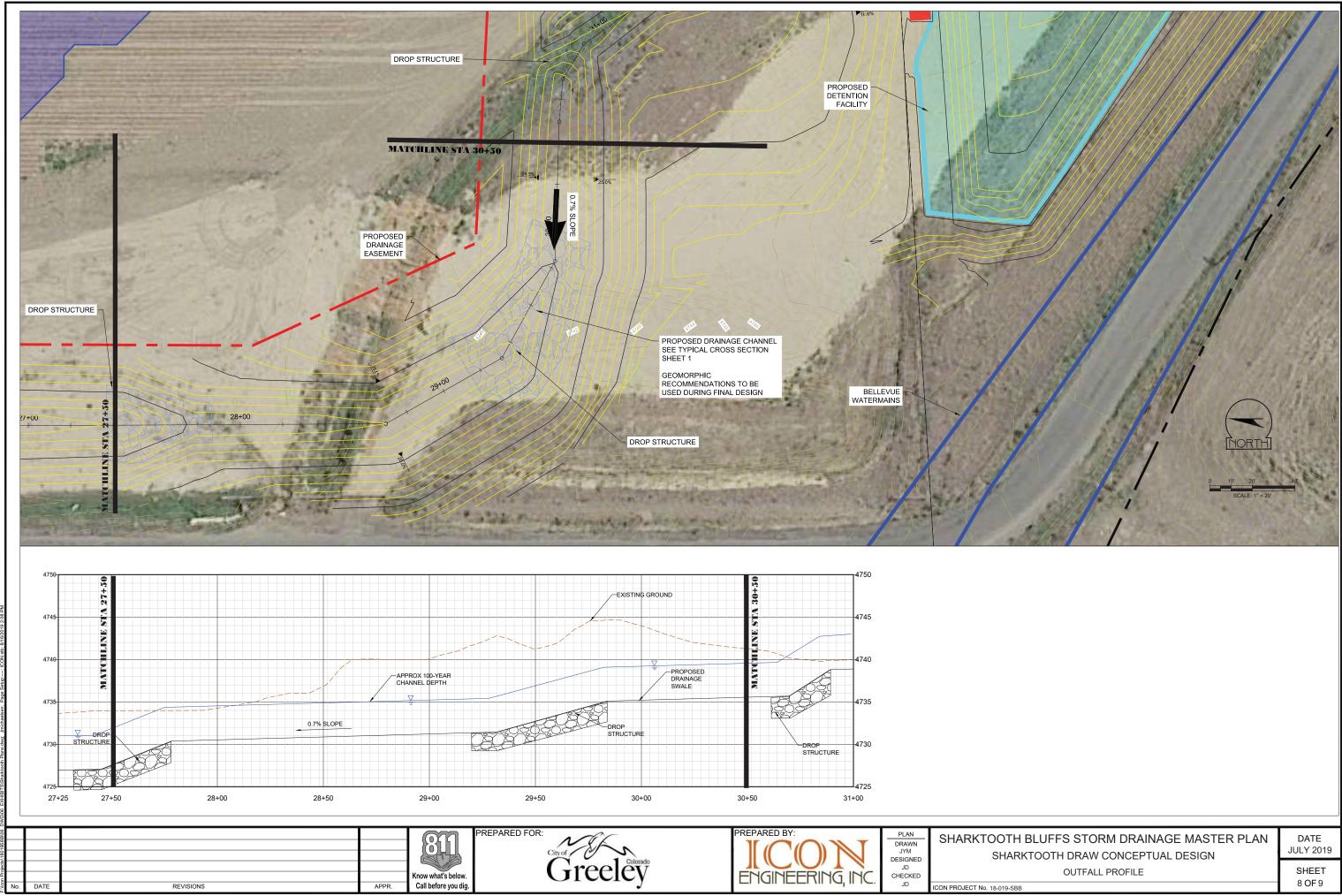


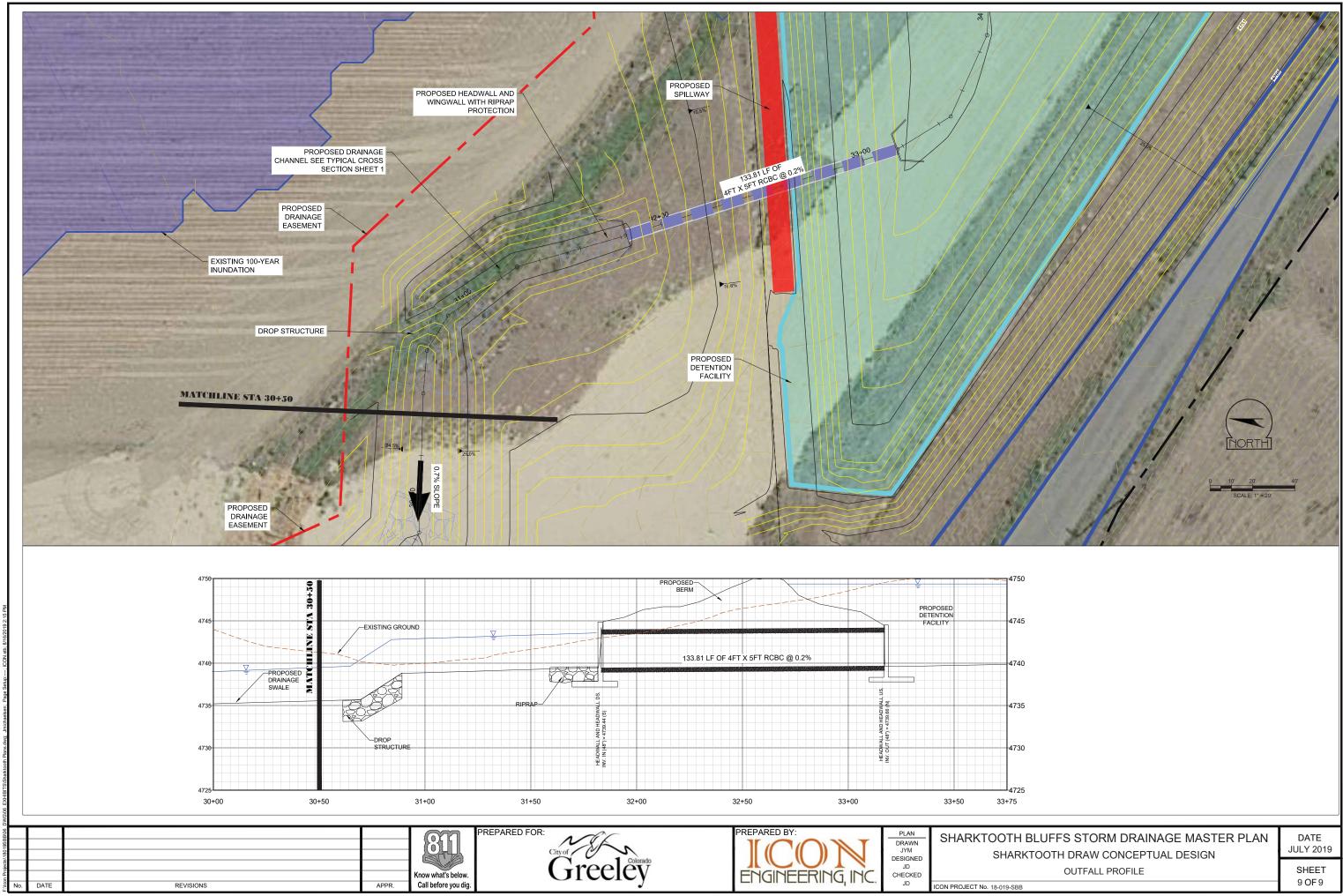


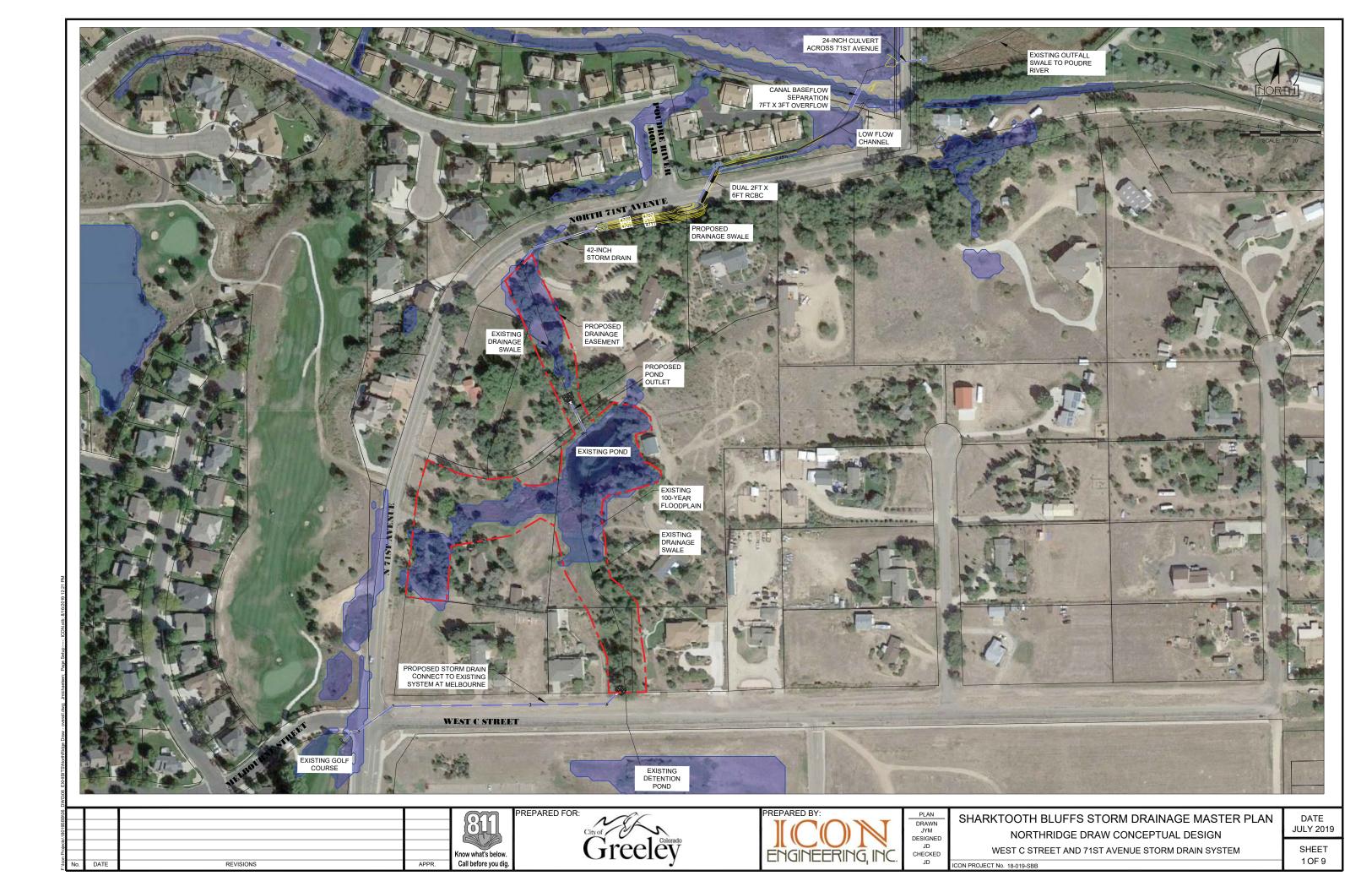


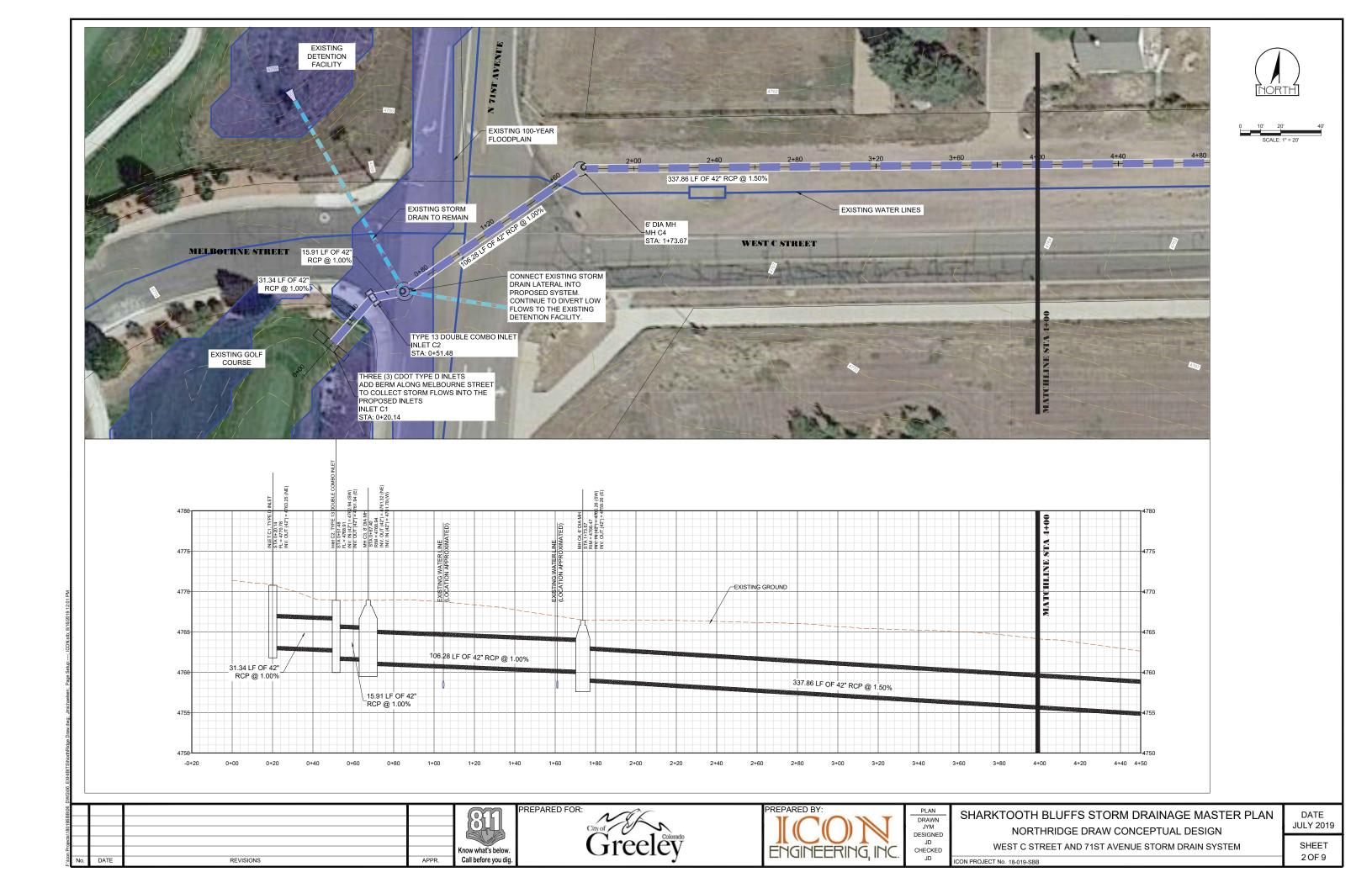


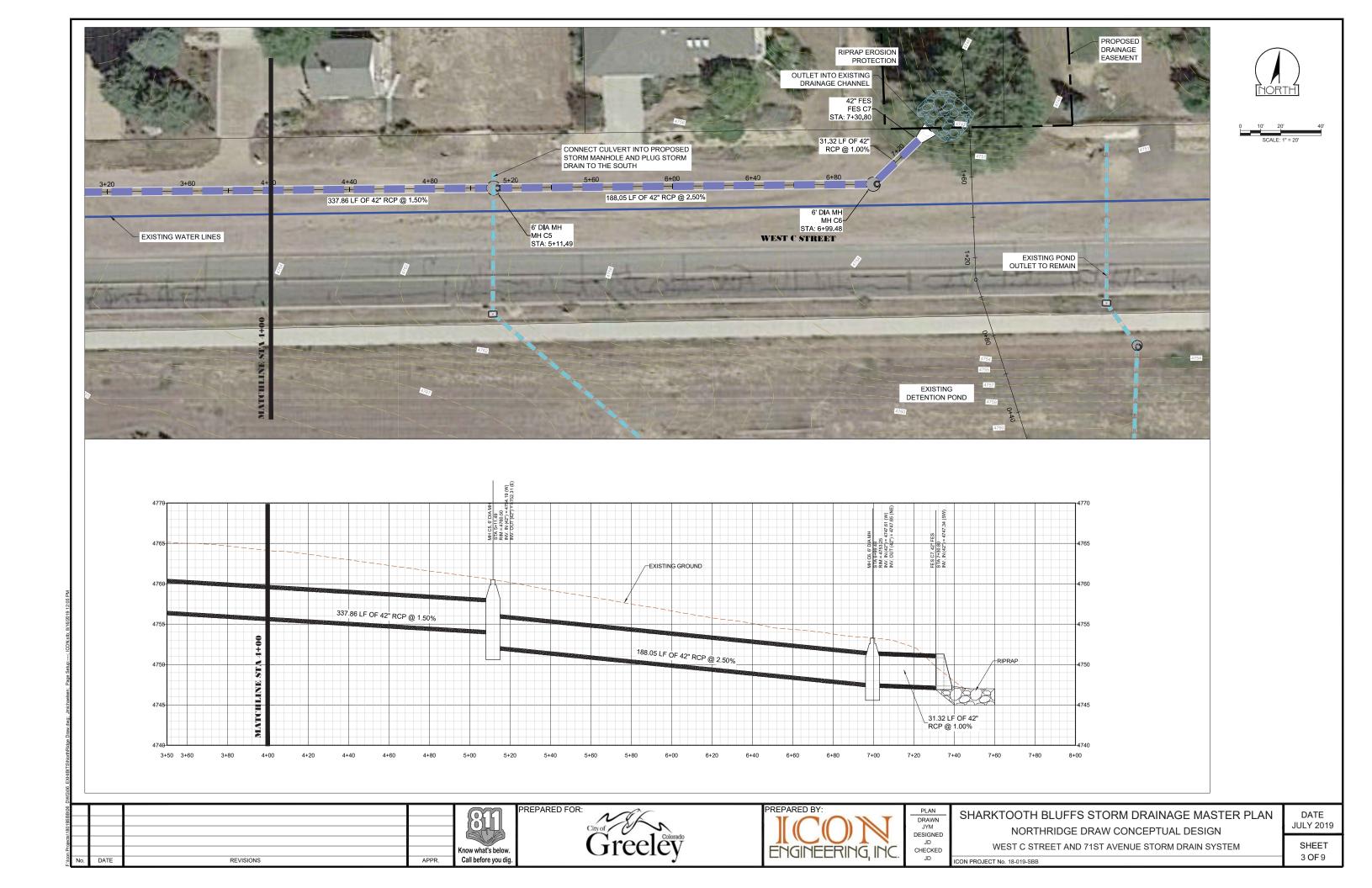


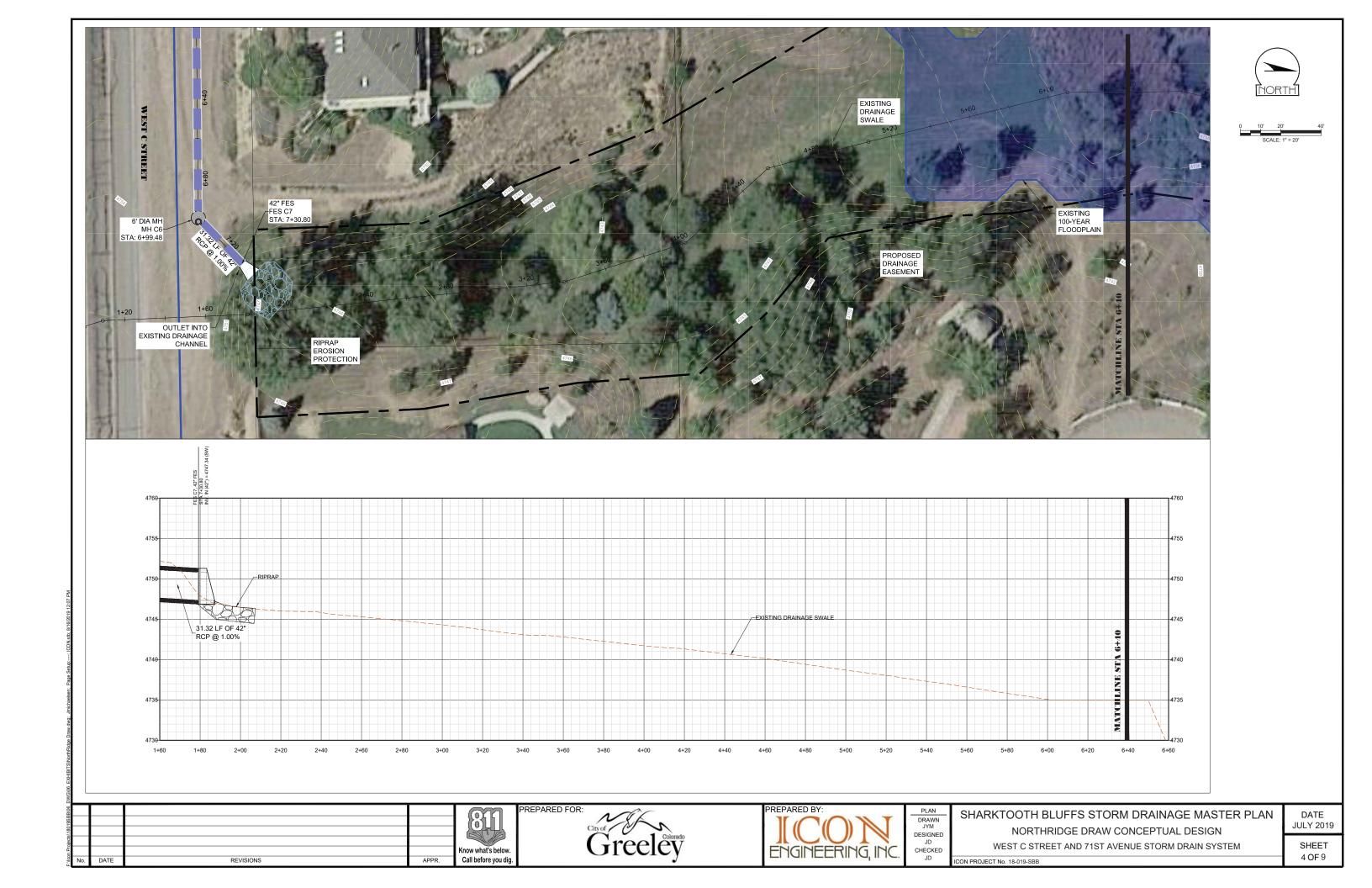


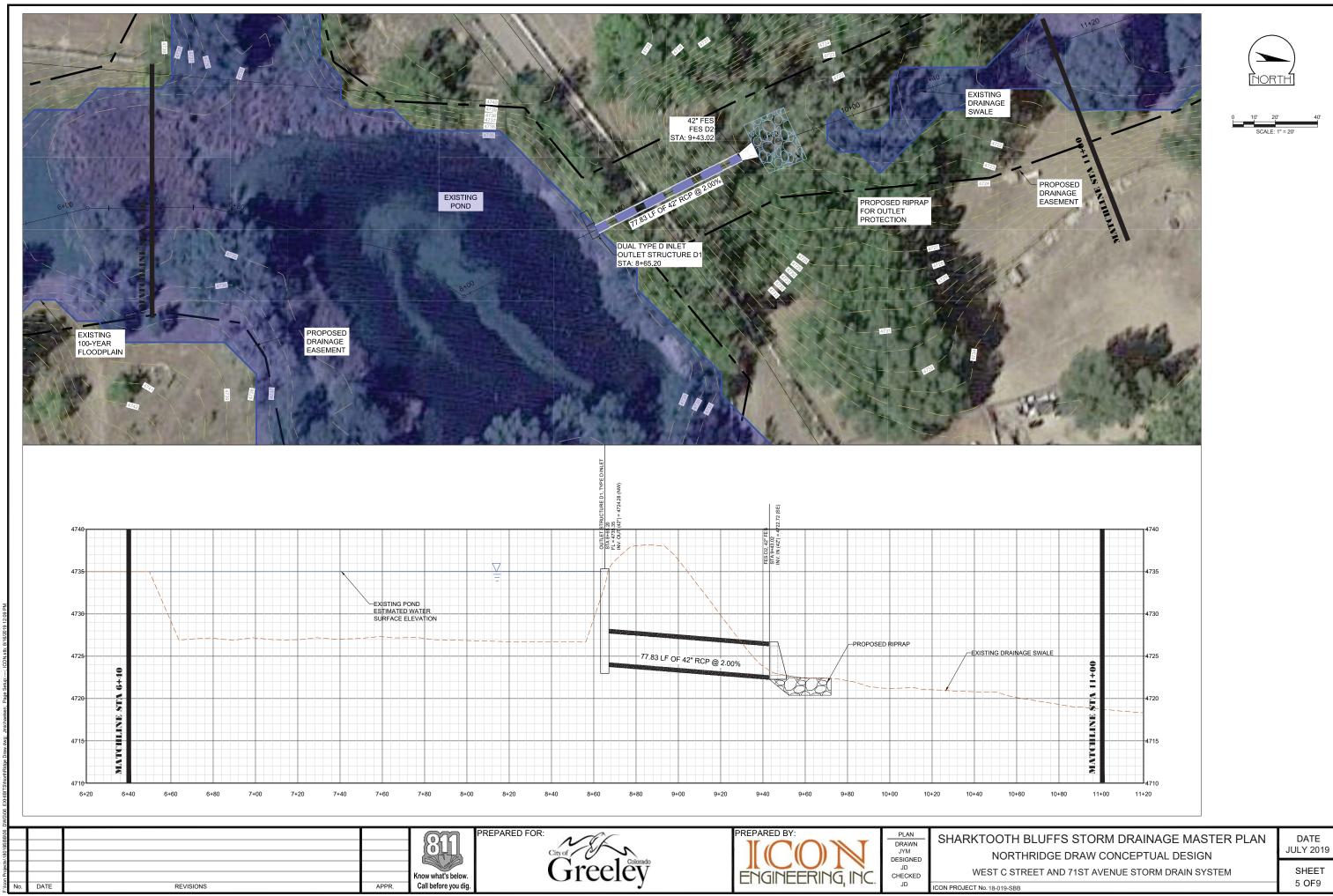




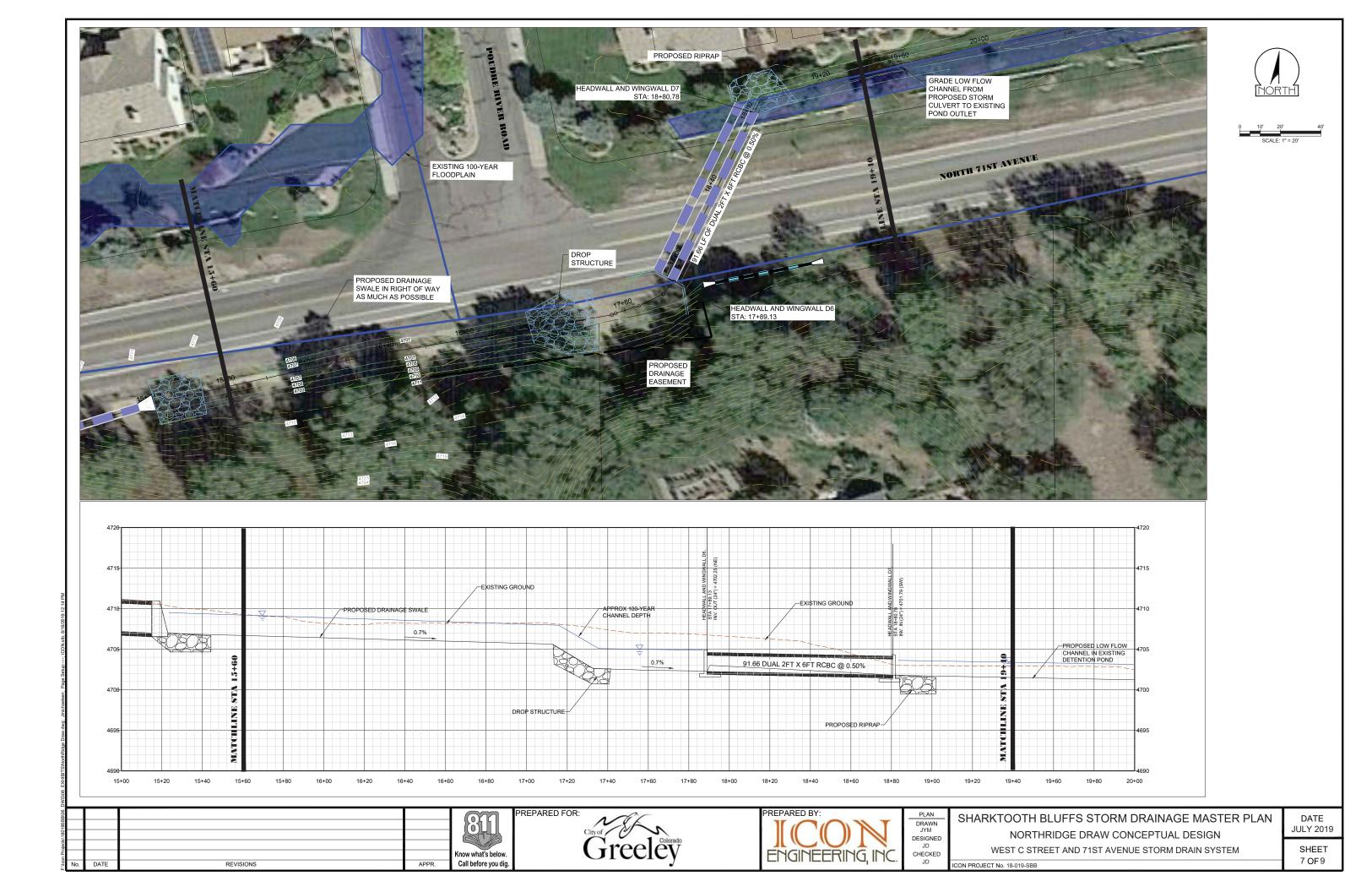


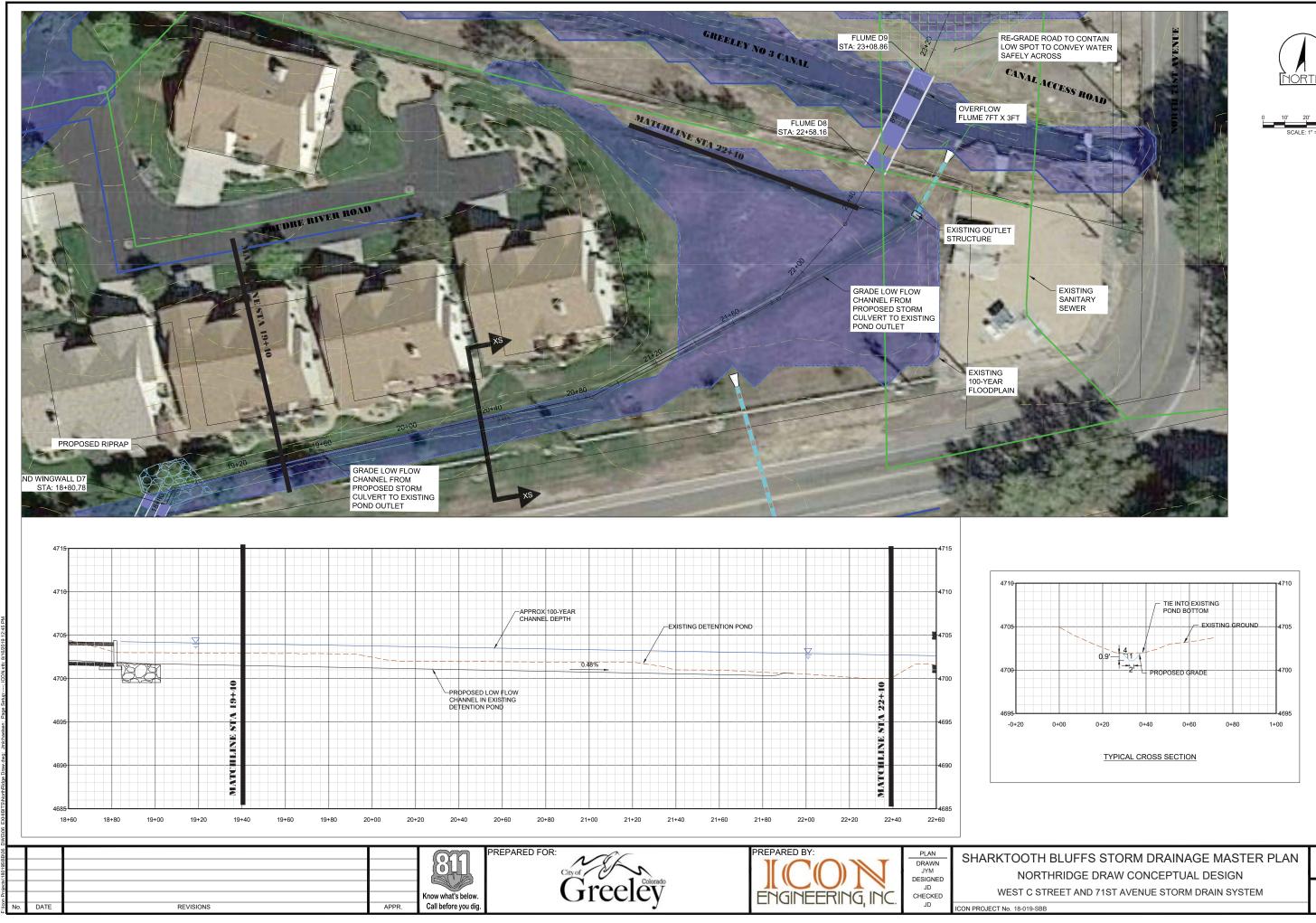


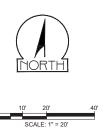






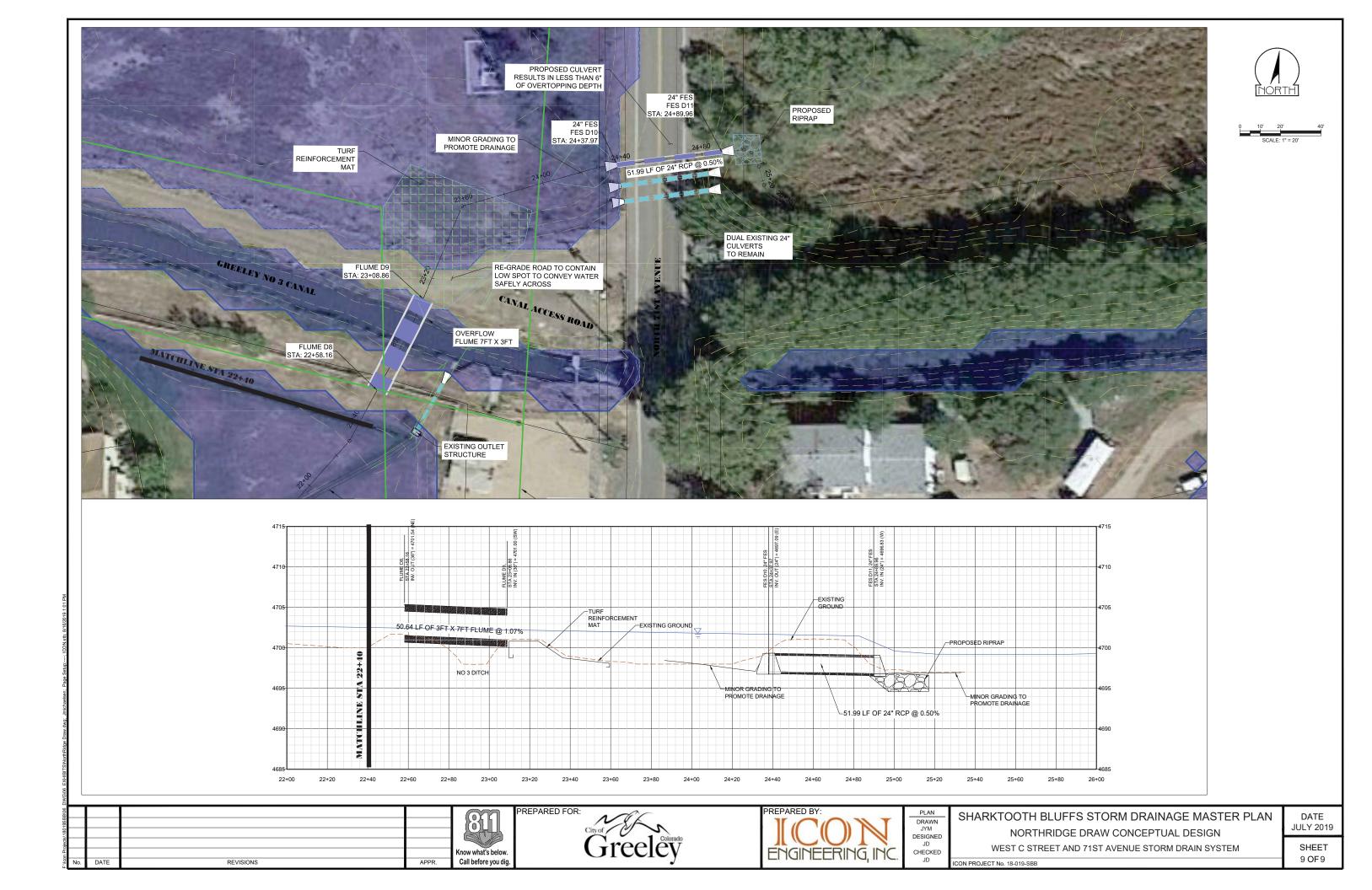






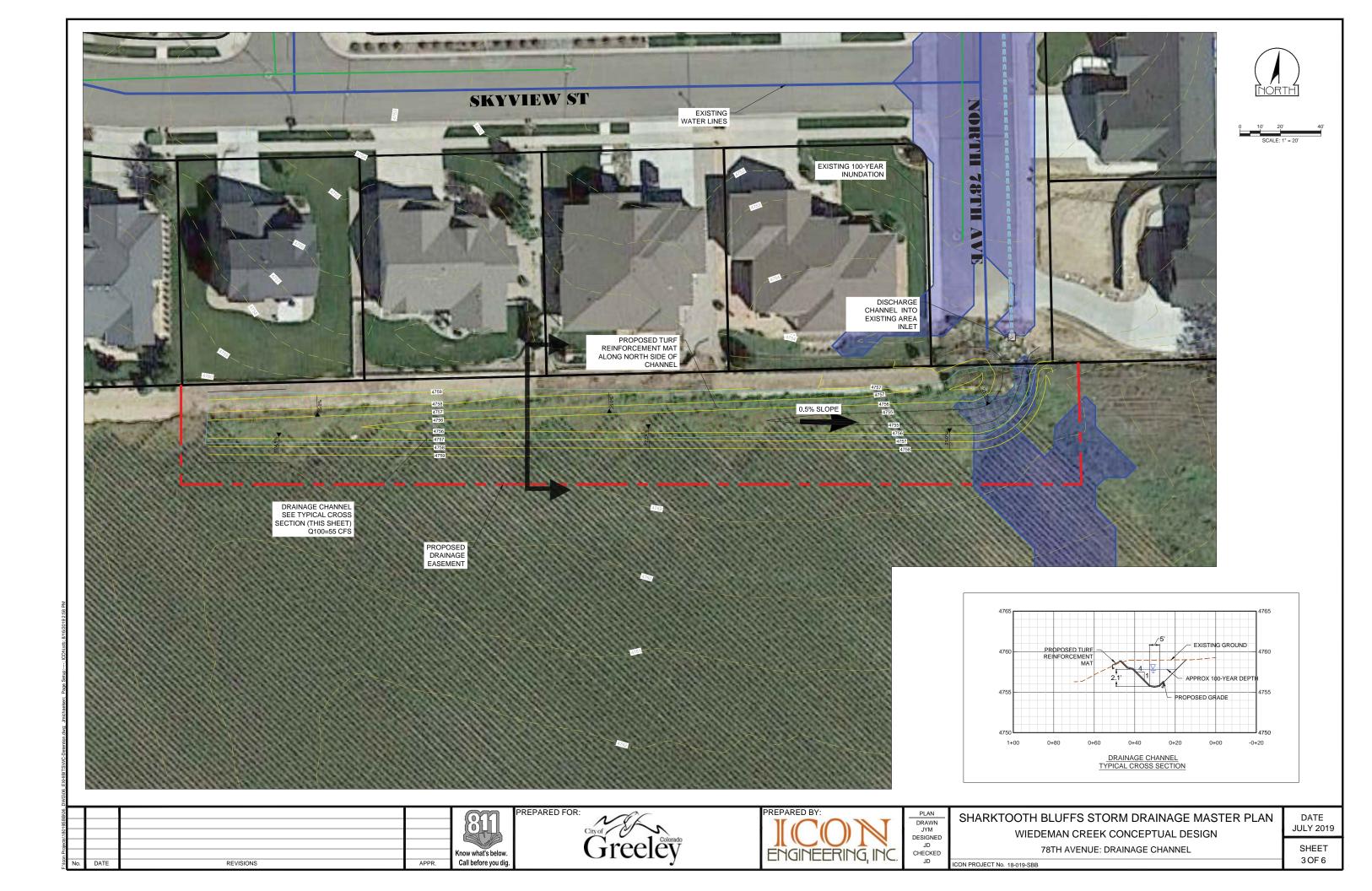
DATE JULY 2019

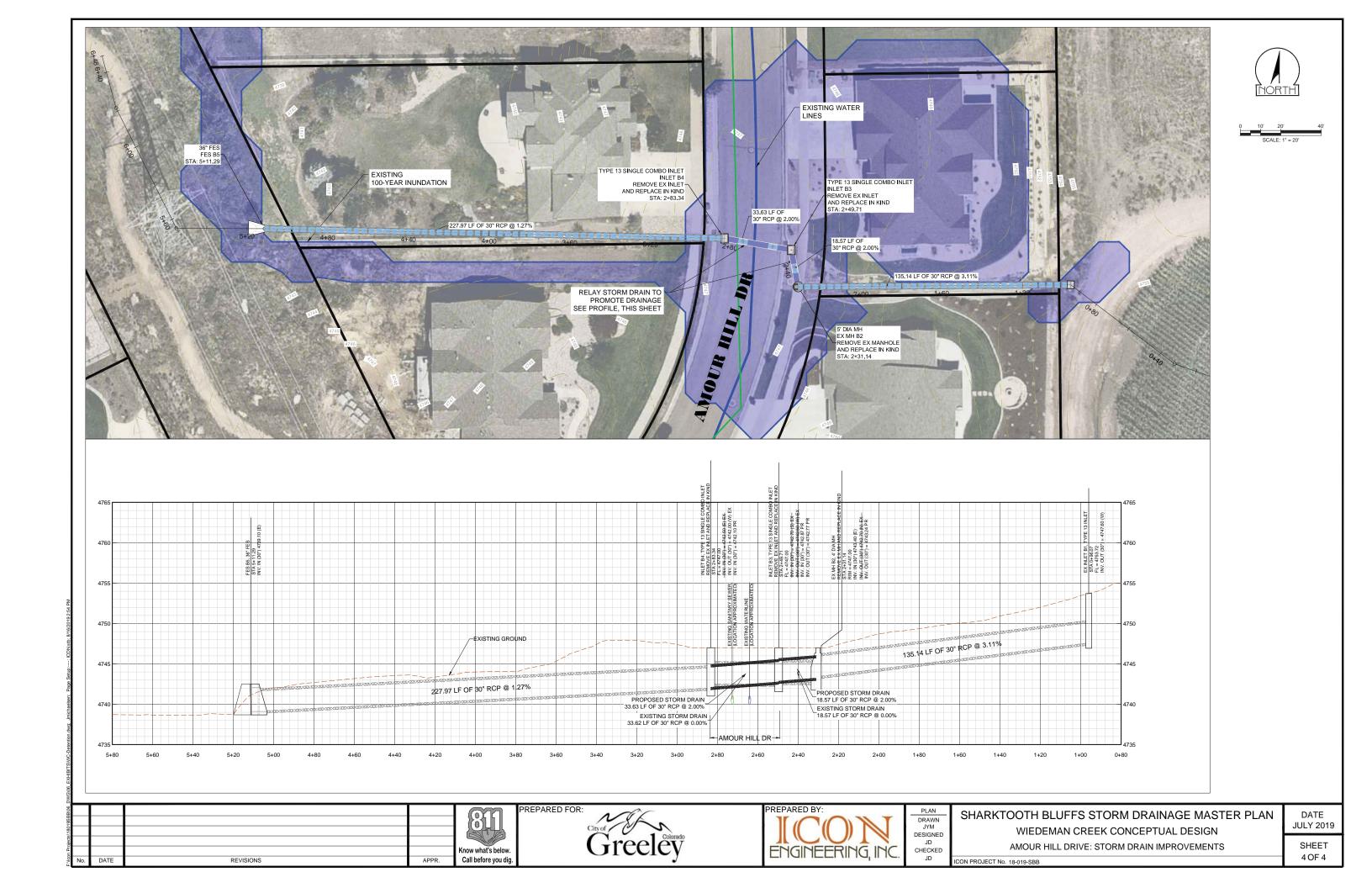
SHEET 8 OF 9

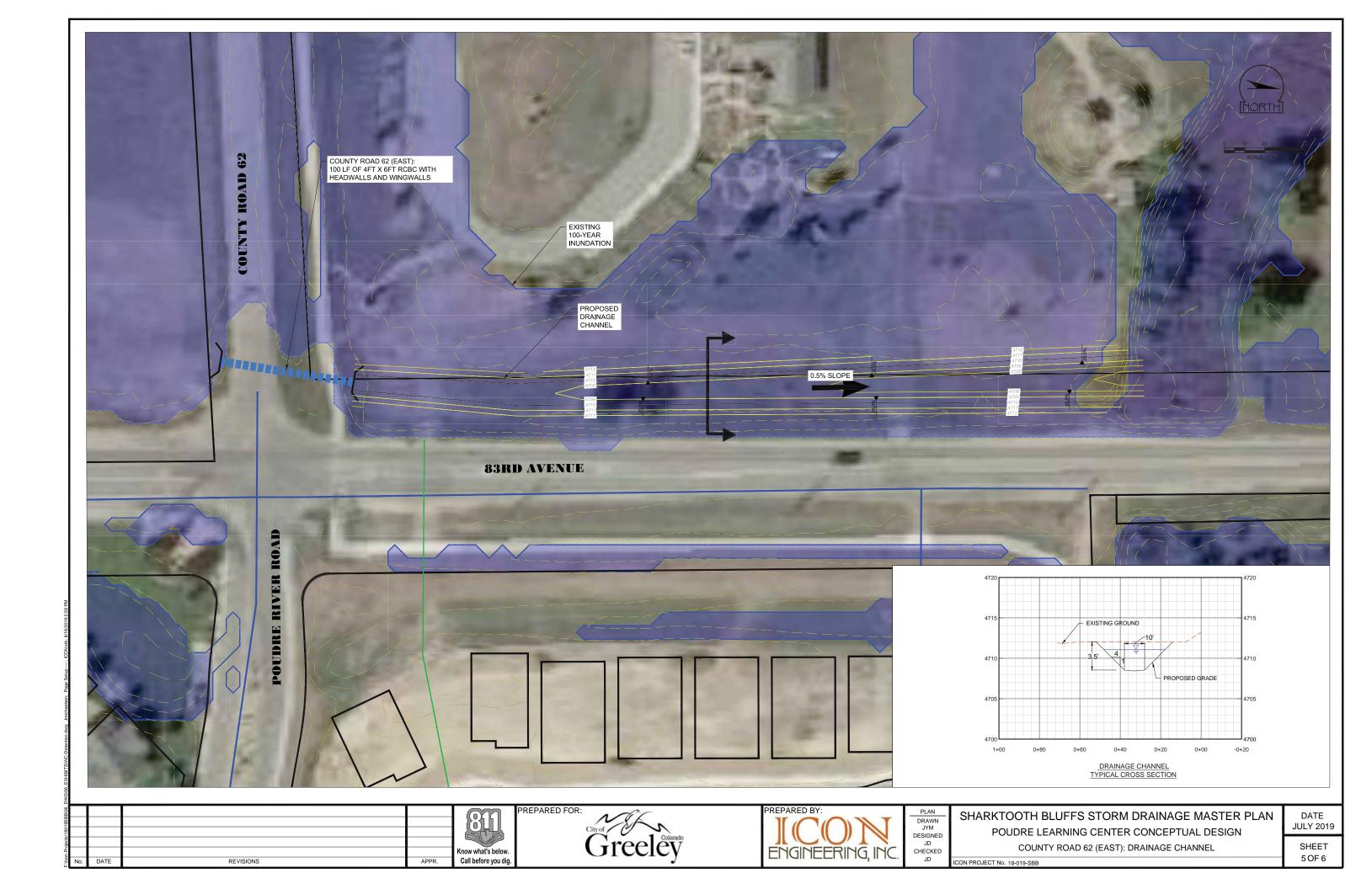


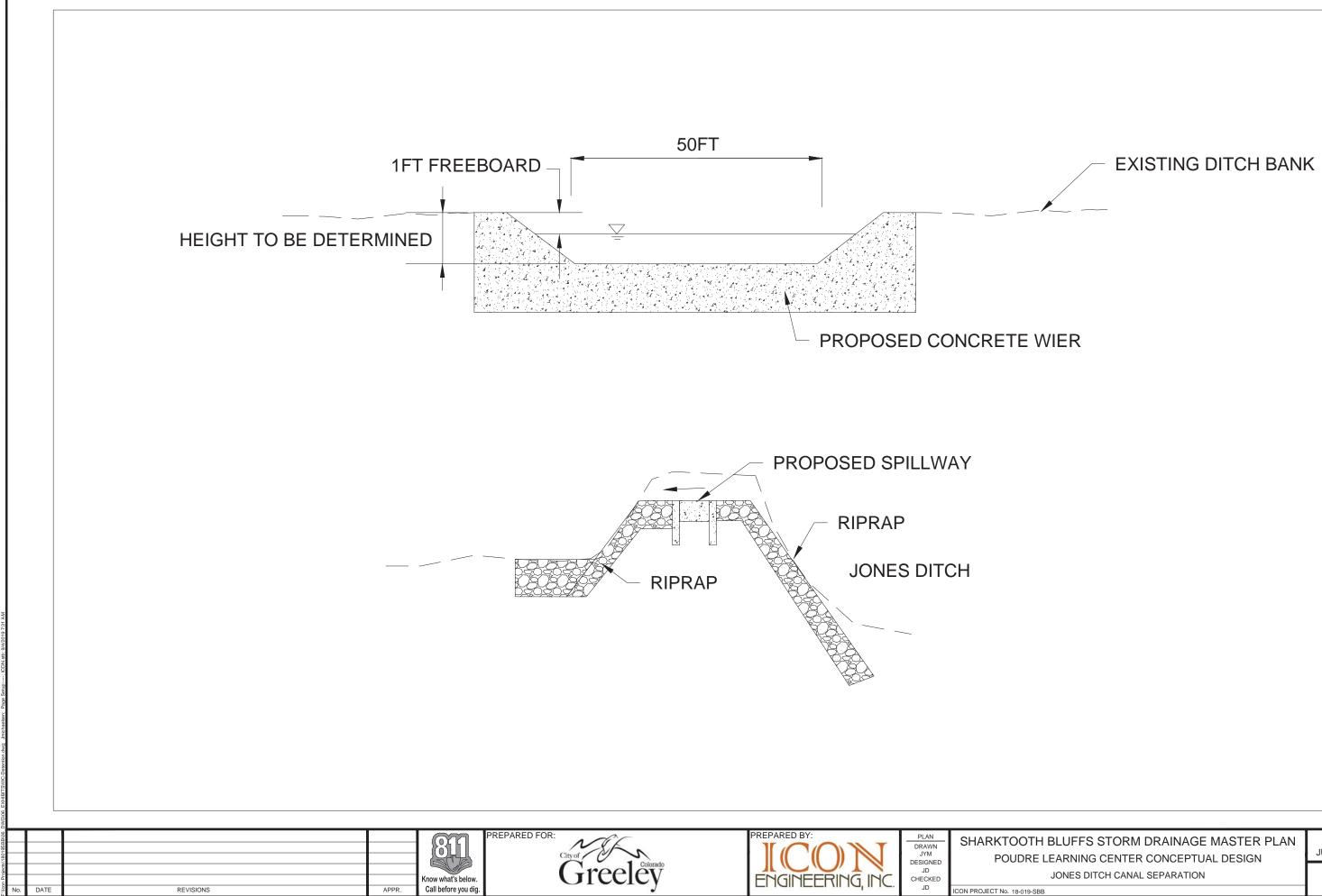












DATE JULY 2019

> SHEET 6 OF 6

Stream Restoration Planning Guidance		
Watershed: Sharktooth Draw		
Design Point:	95th Ave	
Slope of Reach: ft/ft	0.020	
Drainage Area (x): sq miles	1.220	
Bankfull Area (y): ft <sup>2</sup> y = 7.4051x <sup>0.6582</sup>	8.44	
Stream Type based on slope of Reach	В	
Stream Channel Design		
Width Range	Depth Range	
10.1 ft	0.8 ft	
9.2 ft	0.9 ft	
Pool to Pool Spacing: 4 to 5 x Bankfull Width	38.5 ft - 48.1 ft	
Entrenchment Ratio	Greater than 2.2	
Meander Width: 2 to 8 x Bankfull Width	19.3 ft - 77 ft	

	Calculations		
Stream Type based on slope	e of Reach	В	
SI	Slope (ft/ft): 0.02-0.039		
SI	ope (ft/ft): 0.004-0.02	С	
Slo	pe (ft/ft): 0.002-0.004	Е	
Width/Depth Ratio based o	on Stream Type	10-12	
	W/D = 10-12	В	
	W/D = 18-20	С	
	W/D = 10-12	Е	
Bank Full Width/Depth Ratio			
	W/D: ft/ft	12	
	W/D: ft/ft	10	
Bank full Depth range			
	Based on Ratio of 12	0.84	
	Based on Ratio of 10	0.92	
Bank full Width range			
	Based on Ratio of 12	10.06	
	Based on Ratio of 10	9.19	
Pool to Pool Spacing: 4 to 5 x Bankfull Width			
	Min: ft	38.5	
	Max: ft	48.1	
Entrenchment Ratio	Ratio Greater than 2.2		
Meander Width: 2 to 8 x Bankfull Width			
	Min: ft	19.3	
	Max: ft	77	

Stream Restoration Planning Guidance		
Watershed: Sharktooth Dr		
Design Point:	Sharktooth Bluffs to CR 62	
Slope of Reach: ft/ft	0.020	
Drainage Area (x): sq miles	1.560	
Bankfull Area (y): ft <sup>2</sup> y = 7.4051x <sup>0.6582</sup>	9.92	
Stream Type based on slope of Reach	В	
Stream Channel Design		
Width Range	Depth Range	
10.9 ft	0.9 ft	
10 ft	1 ft	
Pool to Pool Spacing: 4 to 5 x Bankfull Width	41.7 ft - 52.2 ft	
Entrenchment Ratio	Greater than 2.2	
Meander Width: 2 to 8 x Bankfull Width	20.9 ft - 83.5 ft	

	Calculations		
Stream Type based on slope of Reach		В	
	ft/ft): 0.02-0.039	В	
Slope (	ft/ft): 0.004-0.02	С	
Slope (ft	/ft): 0.002-0.004	Е	
Width/Depth Ratio based on Str	eam Type	10-12	
	W/D = 10-12	В	
	W/D = 18-20	С	
	W/D = 10-12	Е	
Bank Full Width/Depth Ratio			
	W/D: ft/ft	12	
	W/D: ft/ft	10	
Bank full Depth range			
Base	ed on Ratio of 12	0.91	
Bas	ed on Ratio of 10	1.00	
Bank full Width range			
Bas	ed on Ratio of 12	10.91	
Base	ed on Ratio of 10	9.96	
Pool to Pool Spacing: 4 to 5 x Bar	Pool to Pool Spacing: 4 to 5 x Bankfull Width		
	Min: ft	41.7	
	Max: ft	52.2	
Entrenchment Ratio	Catio Greater than 2.2		
Meander Width: 2 to 8 x Bankfull Width			
	Min: ft	20.9	
	Max: ft	83.5	

Calculations			
am Type based on slope of Reach	В		
Slope (ft/ft): 0.02-0.039	В		
Slope (ft/ft): 0.004-0.02	С		
Slope (ft/ft): 0.002-0.004	E		
th/Depth Ratio based on Stream Type	10-12		
W/D = 10-12	В		
W/D = 18-20	С		
W/D = 10-12	E		
k Full Width/Depth Ratio			
W/D: ft/ft	12		
W/D: ft/ft	10		
k full Depth range			
Based on Ratio of 12	0.91		
Based on Ratio of 10	1.00		
k full Width range			
Based on Ratio of 12	10.91		
Based on Ratio of 10	9.96		
l to Pool Spacing: 4 to 5 x Bankfull Width			
Min: ft	41.7		
Max: ft	52.2		
enchment Ratio	Greater than 2.2		
ander Width: 2 to 8 x Bankfull Width			
Min: ft	20.9		
Max: ft	83.5		

Stream Restoration Planning Guidance		
Watershed: Poudre Learning Cer		
Design Point:	CR 62 to Poudre	
Slope of Reach: ft/ft	0.014	
Drainage Area (x): sq miles	0.473	
Bankfull Area (y): ft <sup>2</sup> y = 7.4051x <sup>0.6582</sup>	4.52	
Stream Type based on slope of Reach	С	
Stream Channel Design		
Width Range	Depth Range	
9.5 ft	0.5 ft	
9 ft	0.5 ft	
Pool to Pool Spacing: 5 to 6 x Bankfull Width	46.3 ft - 55.6 ft	
Entrenchment Ratio	Greater than 2.2	
Meander Width: 8 to 14 x Bankfull Width	74.1 ft - 129.7 ft	

	Calculations		
Stream Type based on slope of Reach		С	
Slop	Slope (ft/ft): 0.02-0.039		
Slop	be (ft/ft): 0.004-0.02	С	
Slope	e (ft/ft): 0.002-0.004	E	
Width/Depth Ratio based on	Stream Type	18-20	
	W/D = 10-12	В	
	W/D = 18-20	С	
	W/D = 10-12	E	
Bank Full Width/Depth Ratio	Bank Full Width/Depth Ratio		
	W/D: ft/ft	20	
	W/D: ft/ft	18	
Bank full Depth range			
E	Based on Ratio of 20	0.48	
E	Based on Ratio of 18	0.50	
Bank full Width range			
E	Based on Ratio of 20	9.51	
E	Based on Ratio of 18	9.02	
Pool to Pool Spacing: 5 to 6 x Bankfull Width			
	Min: ft	46.3	
	Max: ft	55.6	
Entrenchment Ratio	Greater than 2.2		
Meander Width: 8 to 14 x Bankfull Width			
	Min: ft	74.1	
	Max: ft	129.7	

Stream Restoration Planning Guidance		
Watershed: Poudre Learning Ce		
Design Point:	DS of Bluffs to CR 62	
Slope of Reach: ft/ft	0.040	
Drainage Area (x): sq miles	0.276	
Bankfull Area (y): ft <sup>2</sup> y = 7.4051x <sup>0.6582</sup>	3.18	
Stream Type based on slope of Reach	В	
Stream Channel Design		
Width Range	Depth Range	
6.2 ft	0.5 ft	
5.6 ft	0.6 ft	
Pool to Pool Spacing: 4 to 5 x Bankfull Width	23.6 ft - 29.5 ft	
Entrenchment Ratio	Greater than 2.2	
Meander Width: 2 to 8 x Bankfull Width	11.8 ft - 47.2 ft	

Calculations			
Stream Type based on slope of Reach	В		
Slope (ft/ft): 0.02-0.039	B		
Slope (ft/ft): 0.004-0.02	С		
Slope (ft/ft): 0.002-0.004	E		
Width/Depth Ratio based on Stream Type	10-12		
W/D = 10-12	В		
W/D = 18-20	С		
W/D = 10-12	Е		
Bank Full Width/Depth Ratio			
W/D: ft/ft	12		
W/D: ft/ft	10		
Bank full Depth range			
Based on Ratio of 12	0.51		
Based on Ratio of 10	0.56		
Bank full Width range			
Based on Ratio of 12	6.17		
Based on Ratio of 10	5.64		
Pool to Pool Spacing: 4 to 5 x Bankfull Width			
Min: ft	23.6		
Max: ft	29.5		
ntrenchment Ratio Greater than 2.2			
Meander Width: 2 to 8 x Bankfull Width			
Min: ft	11.8		
Max: ft	47.2		

	-		
Calculations			
ream Type based on slope of Reach	В		
Slope (ft/ft): 0.02-0.039	В		
Slope (ft/ft): 0.004-0.02	С		
Slope (ft/ft): 0.002-0.004	E		
idth/Depth Ratio based on Stream Type	10-12		
W/D = 10-12	В		
W/D = 18-20	С		
W/D = 10-12	E		
nk Full Width/Depth Ratio			
W/D: ft/ft	12		
W/D: ft/ft	10		
nk full Depth range			
Based on Ratio of 12	0.51		
Based on Ratio of 10	0.56		
nk full Width range			
Based on Ratio of 12	6.17		
Based on Ratio of 10	5.64		
ool to Pool Spacing: 4 to 5 x Bankfull Width			
Min: ft	23.6		
Max: ft	29.5		
trenchment Ratio	Greater than 2.2		
eander Width: 2 to 8 x Bankfull Width			
Min: ft	11.8		
Max: ft	47.2		

Stream Restoration Planning Guidance		
Watershed: Wiedeman Creek		
Design Point:	4th St. to 81st Ave	
Slope of Reach: ft/ft	0.022	
Drainage Area (x): sq miles	1.083	
Bankfull Area (y): ft <sup>2</sup> y = 7.4051x <sup>0.6582</sup>	7.80	
Stream Type based on slope of Reach	В	
Stream Channel Design		
Width Range	Depth Range	
9.7 ft	0.8 ft	
8.8 ft	0.9 ft	
Pool to Pool Spacing: 4 to 5 x Bankfull Width	37 ft - 46.3 ft	
Entrenchment Ratio	Greater than 2.2	
Meander Width: 2 to 8 x Bankfull Width	18.5 ft - 74 ft	

	Calculations	
Stream Type based on slope	e of Reach	В
Slope (ft/ft): 0.02-0.039		В
S	lope (ft/ft): 0.004-0.02	С
Slo	pe (ft/ft): 0.002-0.004	E
Width/Depth Ratio based of	on Stream Type	10-12
	W/D = 10-12	В
	W/D = 18-20	С
	W/D = 10-12	E
Bank Full Width/Depth Ratio		
	W/D: ft/ft	12
	W/D: ft/ft	10
Bank full Depth range		
	Based on Ratio of 12	0.81
	Based on Ratio of 10	0.88
Bank full Width range		
	Based on Ratio of 12	9.68
	Based on Ratio of 10	8.83
Pool to Pool Spacing: 4 to 5 x Bankfull Width		
	Min: ft	37
	Max: ft	46.3
Entrenchment Ratio	Greater than 2.2	
Meander Width: 2 to 8 x Bankfull Width		
	Min: ft	18.5
	Max: ft	74

Stream Restoration Planning Guidance		
Watershed:	Wiedeman Creek	
Design Point:	10th St to 4th St	
Slope of Reach: ft/ft	0.020	
Drainage Area (x): sq miles	0.523	
Bankfull Area (y): ft <sup>2</sup> y = 7.4051x <sup>0.6582</sup>	4.83	
Stream Type based on slope of Reach	В	
Stream Channel Design		
Width Range	Depth Range	
7.6 ft	0.6 ft	
7 ft	0.7 ft	
Pool to Pool Spacing: 4 to 5 x Bankfull Width	29.1 ft - 36.4 ft	
Entrenchment Ratio	Greater than 2.2	
Meander Width: 2 to 8 x Bankfull Width	14.6 ft - 58.3 ft	

Calculations		
Stream Type based on slope of Reach	В	
Slope (ft/ft): 0.02-0.039	В	
Slope (ft/ft): 0.004-0.02	С	
Slope (ft/ft): 0.002-0.004	E	
Width/Depth Ratio based on Stream Type	10-12	
W/D = 10-12	В	
W/D = 18-20	С	
W/D = 10-12	Е	
Bank Full Width/Depth Ratio		
W/D: ft/ft	12	
W/D: ft/ft	10	
Bank full Depth range		
Based on Ratio of 12	0.63	
Based on Ratio of 10	0.70	
Bank full Width range		
Based on Ratio of 12	7.61	
Based on Ratio of 10	6.95	
Pool to Pool Spacing: 4 to 5 x Bankfull Width		
Min: ft	29.1	
Max: ft	36.4	
Entrenchment Ratio	Greater than 2.2	
Meander Width: 2 to 8 x Bankfull Width		
Min: ft	14.6	
Max: ft	58.3	

Calculations		
ream Type based on slope of Reach	В	
Slope (ft/ft): 0.02-0.03	39 B	
Slope (ft/ft): 0.004-0.0	D2 C	
Slope (ft/ft): 0.002-0.00	04 E	
idth/Depth Ratio based on Stream Type	10-12	
W/D = 10-1	2 В	
W/D = 18-2	0 C	
W/D = 10-1	2 E	
nk Full Width/Depth Ratio		
W/D: ft/	′ft 12	
W/D: ft/	′ft 10	
nk full Depth range		
Based on Ratio of 1	0.63	
Based on Ratio of 1	LO 0.70	
nk full Width range		
Based on Ratio of 1	12 7.61	
Based on Ratio of 1	LO 6.95	
ool to Pool Spacing: 4 to 5 x Bankfull Width		
Min:	ft 29.1	
Max:	ft 36.4	
trenchment Ratio	Greater than 2.2	
eander Width: 2 to 8 x Bankfull Width		
Min:	ft 14.6	
Max:	ft 58.3	