TOWN OF LYONS STORMWATER MASTERPLAN

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Town of Lyons Stormwater Masterplan

ICON Engineering, Inc.

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1.0 Introduction

1.1 Authorization

This report was authorized by the Town of Lyons in the Disaster Recovery Services Agreement of February 16, 2016. A fully executed agreement was received by ICON Engineering Inc. on March 28, 2016. This study was supported by the grant funding from the Community Development Block Grant Disaster Recovery program.

1.2 Purpose and Scope

Stormwater Master Plans are commonly used by local and regional governments in a manner similar to land use, parks, or other master plans. These plans become part of the local community's comprehensive and capital improvement plans. Stormwater master plans help community leaders, planners, and engineers work with developers and private land owners. Stormwater drainage is unaffected by administrative or paper boundaries and a stormwater master plan helps all parties understand the natural conditions, constraints, and opportunities to manage stormwater in a safe, compliant, and sustainable manner. Like most master plans, this report provides the Town a starting point for ensuring the public safety and welfare of its citizens, businesses, and visitors.

The purpose of this study is to develop a comprehensive stormwater master plan for the Town of Lyons. The focus of the study is to:

- Quantify stormwater runoff and quantity
- Identify potential flood hazards and problem areas for subbasins tributary to North St. Vrain Creek, South St. Vrain Creek, and St. Vrain Creek, as they flow through the Town
- Identify and prioritize capital improvement projects to reduce flood frequency and flood risk
- Recommended improvement to enhance water quality and meet other sustainable objectives
- Provide a guide for increasing stormwater resilience within the Town of Lyons.

The original drainage master plan for the Town of Lyons was completed by BRW, Inc. in 1998. This study will provide and update to the 1998 plan. Today, the Town has grown beyond the limits of the 1998 study. Furthermore, updates to the means and methods of engineering analysis provide additional information to determine risk and benefits. This Stormwater Master Plan utilizes current topographic, property, and engineering data collected between 2013 and 2016. Like its predecessor, this report is likely to serve the community for many years to come.

This study initially identified and inventoried stormwater infrastructure throughout town. A geospatial database of over 250 features was collected and is being incorporated into the Town's larger GIS inventory. From that point, hydrologic analysis was completed to determine the range of stormwater runoff from each of the Town's drainage basins. A hydraulic analysis used the stormwater runoff values to model how the surface waters drained through town. The existing storm sewer system was evaluated to determine how capture and conveyance systems operated during the various design storms. The resulting flood depth maps were used to identify or confirm problem areas and structures at risk of flood damages. Alternative solutions to mitigate the potential damages were developed. Each alternative was considered for resulting benefits (i.e. averted damages) and costs. A recommended plan was developed to guide the town through future infrastructure, land use, and stormwater management decisions. Additional information was developed for System Maintenance, Storm Water Utility, Adjacent Watersheds, and Water Quality.

The following is a summary of the scope of work completed for the Town of Lyons Storm Drainage Master Planning study:

- Data Collection and Review
- Field inventory of existing stormwater features
- Baseline Hydrology and Hydraulics
  - Document rainfall using NOAA Atlas 14
  - Develop a basin-wide two-dimensional hydrodynamic model to estimate general flow paths within the watershed.
  - Define individual subwatershed boundaries
  - Develop hydrologic models for the 2-, 5-, 10-, 50-, and 100-year return period storms subject to the following guidelines:
    - Use the Colorado Urban Hydrograph Procedure (CUHP) to generate basin runoff hydrographs
    - Use the Environment Protection Agency Storm Water Management Model (EPA SWMM) to route the individual hydrographs
    - Evaluate the performance of existing storm drain infrastructure 24 inches or greater in size

  - Evaluate hydrologic condition for 120% of the 100-year return period
  - Identify residual flood potential within the basin using a two-dimensional hydrodynamic model, such as FLO-2D

- Alternatives Analysis

  - Identify existing and future potential drainage and water quality problems along tributary paths to North St. Vrain Creek, South St. Vrain Creek, and St. Vrain Creek, as they flow through the Town
  - Develop and evaluate alternative plans on an outfall-by-outfall basis to reduce flooding potential on insurable structures and to provide water quality treatment
  - Estimate benefits of flood reduction

- Capital Improvements Plan

  - Development of a recommended approach to stormwater management within the Town Limits
  - Identify a Phasing and Prioritization Plan for improvements

1.3 Mapping and Survey

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

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

Survey data at existing storm drains and sewers were collected by ICON Engineering and associated sub-consultants as part of this contract. All survey was also gathered on NAD83 horizontal datum and the NAVD88 vertical datum.

An inventory of existing storm sewer infrastructure was completed between May and July 2016. A photo, description, condition, and location of each structure was recorded in the field and stored in a geospatial database. The geospatial data has been utilized within the Town's larger GIS database. A link to the online repository for the data is available for review[1]. This online repository link will expire in

[1] `https://iconengineering.github.io/lyons/collection`

the near future, but the data is preserved in perpetuity through the Town's GIS database.

1.4 Data Collection

A summary of reports reviewed alongside the preparation of this report are presented below:

Table 1-1: Data Collected

Document Title	**Date**	**Author**
Town of Lyons, Boulder County, Colorado, Drainage Master Plan Final Report	April 1998	BRW, Inc.
Zoning District Map of the Town of Lyons, Colorado	January 2009	King Surveyors, Inc.
2010 Lyons Planning Area Map	2010	Civil Resources
Urban Drainage and Flood Control District (UDFCD) Urban Storm Drainage Criteria Manual		UDFCD

1.5 Data Delivery

This report is produced for the Town in a variety of formats. Hard-copy reports are provided to the Town as interim and final deliverables. A web based version of the entire report and appendices are provided to the Town for integration into the Town web portal. A downloadable PDF is also available from the web link version. And, the supporting map information is provided on a web-based mapping program that can be hosted on the Town's website now and in the future.

GIS data collected during the stormwater inventory was transferred to the town in September 2016 to complement the separate GIS database project undertaken by the town.

2.0 Study Area Description

2.1 Project Area

The project area includes the subbasins tributary to the North Saint Vrain Creek, South Saint Vrain Creek, Red Hill Gulch, and Stone Canyon within the Town of Lyons. The total drainage area studied is approximately 8.6 square miles.

Existing drainage in the Town reflects open channel drainageways in combination with storm sewer conveyance for more urbanized areas. Most of the Town's existing drainage infrastructure is undersized due to the increase in development within the Town during the 1990s. The existing conveyance system has the capacity to convey nuisance flows, but it does not have the capacity to convey even the minor (5-year) storm events.

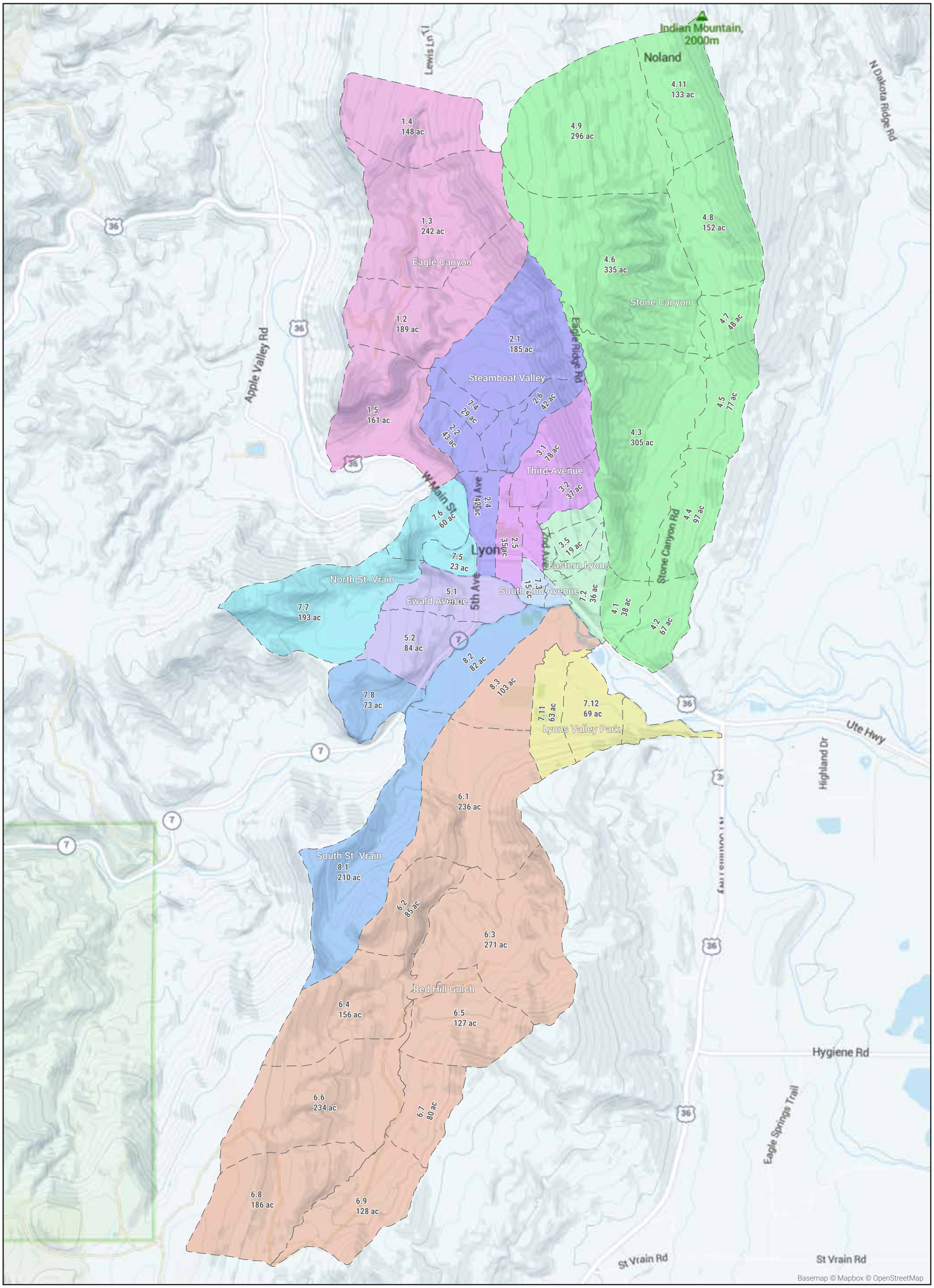
At the time of this report, there are current requests for study and analysis of potential annexation areas adjacent to the current town limits. These areas were identified for study after the completion of the stormwater inventory and hydrologic analysis. However, this study has provided some limited information relative to adjacent areas.

2.2 Land Use

The study area watershed is comprised of a combination of Hydrologic Soil Group (HSG) A, B, C, and D soils as classified by the Natural Resources Conservation Service (NRCS). These soil types are very intermixed with HSG A soils (i.e. soils with increased hydrologic conductivity) covering areas such as downtown locations, and north-south along the eastern basin limits. HSG B soils cover the least area in the watershed, with locations predominately along Saint Vrain Creek, and north and south branches. HSG C soils are represented along a north-south plane, along the easternmost portions of the watershed. Finally, HSG D soils (i.e. soils with the least potential for hydrologic conductivity) represent the greatest are of the watershed and are predominately located towards the northern and western watershed limits, covering rock outcrops and other less permeable sources.

It should be noted that for the study area, the HSG A soils are colluvial land type soil. According to the colluvial land soil description, the depth to restrictive feature is 2 to 60 inches to lithic bedrock. Because of the underlying bedrock, it was assumed that the HSG A soils would have the drainage characteristics of HSG B soils.

Land use was determined by compiling information from the 2009 Zoning District Map, 2010 Lyons Planning Area Map, and by ground-truthing the land cover based on an October 2015 aerial image of the watershed. Each land use category was assigned a percent imperviousness with guidance from Chapter 6 – Runoff of the UDFCD Urban Storm Drainage Criteria Manual. Table 2-1 outlines the land use categories and the corresponding percent imperviousness. In addition to the land use categories found in Table 2-1, Boulder County Open Space land use represented a significant portion of the watershed. Table 2-2 displays the soil types used to calculate imperviousness for the Boulder County Open Space land use category.



Lyons Stormwater Masterplan

Figure 2-1: Watersheds

LYONS COLORADO

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Table 2-1: Land Use Description

Land Use Category	UDFCD Equivalent	Imperviousness
Agriculture	Undeveloped: Greenbelts, agricultural	2%
Business	Business: Downtown areas	95%
Park	Parks, cemeteries	10%
Municipal Facilities	Business: Suburban areas	75%
Estate Residential1	Residential: Single Family: 2.5 acres or larger	35%
Low Density Residential1	Residential: Single Family: 0.25-0.75 acres	75%
Medium Density Residential1	Residential: Single Family: 0.75-2.5 acres	85%
Commercial	Business: Downtown areas	95%
Employment Area	Business: Downtown areas	95%
Commercial Entertainment	Business: Downtown areas	95%
Light Industrial	Industrial: Light areas	80%
General Industrial	Industrial: Heavy areas	90%

Table 2-2: Soil Types Found in Boulder County Open Space Land Use Category

Soil Unit	HSG	Soil Type	Drainage Class	Runoff Class	Rock Outcrop	Imperviousness
MdB	A	sandy loam	well	very low		2%
Nh	B	loam	poorly	very low		2%
Cu	A	gravelly sandy loam	excessively	low		5%
NnB	C	sandy clay loam	well	medium		8%
SmF	C	stony loam	well	high	10%	10%
BaF	D	very stony sandy loam	well	very high	10%	10%
PrF	D	very stony loamy fine sand	well	very high	35%	35%
Ro	D	unweathered bedrock	N/A	very high	100%	100%

It should be noted that land use category corresponds to the 2010 Lyons Planning Area Map. However, in some cases, the planning description and corresponding lot size were not representative of what is observed through aerial imagery and field reconnaissance. In these cases, the imperviousness percentages were revised to be more representative of what was observed.

Future imperviousness was determined by comparing the land use in the 2010 Lyons Planning Area Map to current aerial imagery, and noting which areas of the Town could be further developed based on the planning guidance.

2.3 Outfall Descriptions

The study area has been divided into eleven separate outfalls based on their general drainage patterns. A description of each outfall can be found below.

2.3.1 Eagle Canyon The Eagle Canyon watershed, with a tributary area of 740 acres, is located west of downtown Lyons. The drainage path for the watershed is a steep mountain channel with an approximate slope between 5% and 35%. The channel flows south turning east near Eagle Canyon Subdivision before draining along the left bank of North St. Vrain Creek. The watershed ranges in elevation from 6670 feet to 5390 feet. The majority of the watershed is undeveloped or large lot residential with the exception of the Eagle Canyon Subdivision. The Eagle Canyon Subdivision drains to the southeast into an existing detention basin before discharging into Eagle Canyon drainage.

2.3.2 Eastern Lyons The Eastern Lyons Watershed is generally bounded by 2nd Avenue to the west and Stone Canyon Watershed to the east. The watershed ranges in elevation from 5850 feet to 5300 feet. The 87 acre watershed conveys flow southwest to the 2nd Avenue and Main Street intersection. An existing storm drain intercepts flow from the new development along 1st Avenue discharging onto the street on 2nd Avenue. Flow within the Eastern Lyons Watershed is conveyed along the east side of 2nd Avenue in a small roadside swale. Any flows exceeding the capacity of this swale that overtop 2nd Avenue have the possibility of spilling into the Third Avenue Watershed. A small, 18-inch, storm drain intercepts minor flows north of Main Street and conveys flow through the shopping center. The storm drain crosses Main Street discharging into an open channel in the South 2nd Avenue Watershed before discharging into St. Vrain Creek.

During the course of this study, the Colorado Department of Transportation initiated a roadway and storm drainage improvements along Main Street in the vicinity of 2nd Avenue. The as-built documents were not available at the time of the hydraulic analysis, but an estimated version of the storm drain system in that area was used in the study.

Eastern Lyons Watershed on First Avenue looking towards downtown

2.3.3 Ewald Ave The Ewald Avenue Watershed originates southwest of the North and South St. Vrain Creek confluence. The 160 acre watershed ranges in elevation from 5875 feet to 5320 feet. Unlike the other major watersheds, the Ewald Avenue Watershed does not have a defined channel flow path. The runoff from this watershed is primarily sheet flow along the steep hillsides northeast towards the residential developments. The hillside in the upper reaches of the watershed has an approximately slope of 15 percent. In the developed portion of the watershed the slope is approximately six percent. The majority of conveyance is through the residential street with the exception of a 48 inch reinforced concrete storm drain pipe installed along Park Street from 4^{th} Avenue to North St. Vrain Creek.

Ewald Watershed looking east down Prospect Street

2.3.4 Lyons Valley Park Located south of St. Vrain Creek, the Lyons Valley Park Watershed is primarily medium residential lots. The watershed ranges in elevation from 5860 feet to 5260 feet. The runoff from the 210 acre watershed is conveyed northeast through the subdivision to St. Vrain Creek. There is no defined flow path through the watershed as flow is primarily conveyed down McConnell Drive. There is an 18-inch reinforced concrete storm drain system on Bohn Court, Noland Court, and Estes Court. Curb side combination inlets capture stormwater in these areas. The system is upsized to a 30-inch reinforced concrete pipe at McConnell Drive before the flow is discharged into the St. Vrain Creek.

Lyons Valley Park looking south towards hogback

2.3.5 North St. Vrain The North St. Vrain Creek Watershed is a combination of several subwatersheds that are directly tributary to North St. Vrain Creek. There are both left and right bank tributaries with subwatersheds ranging in size from 20 acres to 190 acres. The watersheds vary in land use including dense residential, commercial, open space, and undeveloped areas.

Headwaters of the Red Hill Gulch Watershed

2.3.6 Red Hill Gulch The Red Hill Gulch Watershed is located on the south side of the St. Vrain Creek ranging in elevation from 6800 feet to 5300 feet. The runoff from this 1560 acre watershed is conveyed in the upper reaches by an open channel with an average slope of 5 to 20 percent. The channel generally follows Red Gulch Road north before flows exit the mountainous terrain and enters a broad alluvial valley. The runoff continues north where flows are intercepted by South Ledge Ditch. Any flows exceeding the capacity of the South Ledge Ditch will overtop the ditch and continue north. Due to the limited capacity of the irrigation ditch, major storm events have the possibility of conveying a large volume of water north into Bohn Park and Lyons Valley Park Subdivision. The average slope of the overflow path downstream of the South Ledge Ditch is approximately two percent.

Red Hill Gulch Watershed exiting the canyons

2.3.7 South St. Vrain The South St. Vrain Creek is a combination of several subwatersheds that are directly tributary to South St. Vrain Creek. These subwatersheds are both left and right bank tributaries to the South St. Vrain Creek ranging in size from 70 acres to 210 acres. The development throughout the watershed varies from undeveloped to large lot residential.

2.3.8 South 2nd Avenue The South 2nd Avenue Watershed is bounded by 3rd Avenue to the west, Main Street to the north and east and the St. Vrain Creek to the south. The approximately 20 acre watershed drains southeast ranging in elevation from 5360 feet to 5310 feet. A combination 24-inch storm drain and open channel system conveys flow along the south side of Main Street discharging into St. Vrain Creek. An 18-inch storm drain conveys flow south from the Park Street and 2nd Avenue intersection into St. Vrain Creek.

Steamboat Valley upstream of Vasquez Road

Steamboat Valley downstream of Vasquez Road

Steamboat Valley downstream of Seward Avenue

2.3.9 Steamboat Valley The Steamboat Valley watershed is located directly north of downtown, bounded by the Eagle Canyon Watershed to the west and to the east by the Third Avenue and Stone Canyon Watersheds. The majority of the 370 acre watershed converges just upstream of downtown and is conveyed between 4th and 5th Avenue. In the upper reaches, the watershed consists of large lot residential and undeveloped properties. The lower third of the watershed is fully developed consisting of residential and commercial lots. In the lower downtown area the watershed is bounded by 4th Avenue to the east and North St. Vrain Creek to the west. The watershed ranges in elevation from 6520 feet to 5335 feet.

The flow concentrates in the upper reaches in an open channel with an approximate slope of 16 percent. The flow continues south into a private inadvertent storage area on the Russell property upstream of the old railroad embankment. Downstream of the railroad embankment the drainageway is confined in a small open channel that conveys flow through backyards of private property. There are several roadway crossings within this reach including Vasquez Road, McCall Alley, Reese Avenue, Steward Avenue, and Stickney Avenue. A reportedly historic stone box culvert intercepts flow and conveys flow underneath downtown until the outfall location into North St. Vrain Creek. The slope is approximately four percent downstream of the railroad embankment.

An 18-inch reinforced concrete storm drain pipe collects flow along 5th Street south of Main Street to Park Drive. This pipe increases in size just downstream of Park Drive to a 28-inch by 16-inch reinforced concrete elliptical pipe before discharging to North St. Vrain Creek.

Along 4th Avenue an 18-inch reinforced concrete storm drain pipe intercepts flow at Stickney Avenue and conveys the flow south to Railroad Avenue. At Railroad Avenue the storm drain increases in size to a 24-inch reinforced concrete storm drain pipe continuing south to the outfall location into North St. Vrain Creek.

2.3.10 Stone Canyon The Stone Canyon Watershed is located east of the Third Avenue and Eastern Lyons Watersheds. In the upper reaches, the 1550 acre watershed is dominated by large residential and undeveloped properties. The open channel which conveys the majority of the runoff for the Stone Canyon watershed has an average slope of approximately four percent. The watershed ranges in elevation from 6580 feet to 5294 feet.

Stone Canyon upstream of Stone Canyon Road

The open channel drainageway passes through multiple roadway crossings within Boulder County. Within the Town of Lyons, Stone Canyon is conveyed underneath Stone Canyon Road through a 13 foot by 8 foot reinforced concrete box culvert. The drainage path continues south where flow is conveyed underneath Ute Highway through an 8 foot by 4 foot reinforced concrete box culvert into St. Vrain Creek.

2.3.11 Third Avenue The Third Avenue watershed, approximately 170 acres, conveys flow southwest into the downtown area along Third Avenue. The watershed is undeveloped upstream of the downtown area bounded by Steamboat Valley to the west and Eastern Lyons and Stone Canyon. The watershed ranges in elevation from 6260 feet to 5320 feet. Development within the lower portions of the watershed is dominated by residential and commercial development. The watershed discharges flow into North St. Vrain Creek just upstream of the confluence with South St. Vrain Creek.

Third Avenue downstream towards Main Street

An existing 5 foot x 4 foot elliptical pipe conveys flow underneath Main Street at Third Avenue into the South 2nd Avenue Watershed.

3.0 Hydrologic Analysis

3.1 Overview

For this study, a new hydrologic model was prepared for the Town of Lyons. This purpose of this model was to develop updated hydrology for the 2-, 5-, 10-, 50-, and 100-year storm frequencies for both existing and future imperviousness. Similar to the 1998 BRW study, the UDFCD's Colorado Urban Hydrograph Procedure (CUHP) was used to develop runoff hydrographs for each sub-basin in the study. However, with the recent release of CUHP v2.0 by the UDFCD, and that Lyons is located outside of the UDFCD boundary, further investigations were made to confirm the applicability of the new CUHP software in comparison to other hydrologic methods. The selection of the hydrologic model is discussed below.

A full copy of the Hydrologic study is provided in *Appendix A.*

3.2 Hydrologic Model

To evaluate the latest version of CUHP (and other hydrologic methods) and to determine the appropriate model inputs, a peak flow sensitivity analysis was conducted for a typical undeveloped sub-basin near the Town, using various hydrologic techniques. The following lists the hydrologic methods that were reviewed in the sensitivity analysis:

- United States Geologic Survey (USGS) Regional Regression Equations.
- Rational Method.
- CUHP 2005 Version 1.4.4 – This is the more recent model used by UDFCD (prior to the recent update) and has been used for over 40 years to estimate peak flows in the Denver metropolitan area and front range.
- CUHP Version 2.0 – Recently the UDFCD has determined that peak flows developed in recent hydrologic studies using CUHP 2005 version 1.4.4 deviated from statistical stream gage analysis across the District and created uncertainty with CUHP model results for some studies. Additionally, CUHP 2005 version 1.4.4 has not been calibrated with gage data since its inception in the 1970s with adjustments made in the 1980s. Therefore, UDFCD has recalibrated CUHP with updated rainfall and runoff with results tested against stream gage frequency analysis. However, it should be noted that during the recalibration of CUHP, there were no watersheds with an imperviousness less than 20 percent.

Therefore, for sub-basins with imperviousness below 20 percent, the peak flows are estimated using similar methodology used in CUHP 2005 version 1.4.4.

- HEC-HMS Model - using Curve Number method.
- UDFCD Allowable Release Rates – The UDFCD Urban Storm Drainage Criteria Manual, Volume 2, Storage chapter provides pre-development peak unit discharge rates for watersheds of various slopes and Hydrologic Soil Groups (HSGs) that are utilized to determine the maximum allowable 100-year release rates for a full spectrum detention facility.

Based on the results of the undeveloped sub-basin peak flow sensitivity analysis, CUHP version 2.0 was recommended for the hydrologic modeling for the Lyons storm drainage master plan. The unit rates of runoff from CUHP version 2.0 were generally in the same range as those generated using the Rational Method, in addition to the UDFCD allowable release rates. The unit rates of runoff generated using CUHP 2005 version 1.4.4 were higher than any of the other hydrologic methods which potentially would overestimate the peak flows for the Town. The regional regression equations significantly underestimated the unit rates of runoff when compared to the other hydrologic model methods. Further documentation on the hydrologic model recommendations can be found in *Appendix A*.

3.3 Design Rainfall

The design rainfall for the project was derived using the one-hour precipitation depths from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14. One-hour point precipitation depths were based on the centroid of the entire project area and were recorded for the 2-, 5-, 10-, 50-, and 100-year recurrence intervals. Point precipitation depths for varying elevation within the project area were identified, but point precipitation depth adjustments due to elevation were not necessary since the difference in the one-hour precipitation depths by elevation was less than 0.1 inches. Using the one-hour precipitation depth, CUHP calculates the incremental depth for each time increment from 5 to 120 minutes. Due to the smaller sizes of sub-basins, precipitation depth-area reduction factors were not utilized. Table 3-1 summarizes the design rainfall depths for various recurrence intervals.

Table 3-1: 1-hr Rainfall Depth

Return Period	1-Hr Rainfall Depth (in)
2-yr	0.77
5-yr	1.05
10-yr	1.33
50-yr	2.23
100-yr	2.71

3.4 Sub-basin Characteristics

Sub-basin characteristics for each basin are further described below and can be found in *Appendix A*.

3.4.1 Sub-basin Delineation Sub-basins were delineated using the 2011 LIDAR and associated 1-ft contours. There is a total of 44 sub-basins within the project area. The undeveloped sub-basins located higher up in the watersheds are larger in size than the sub-basins within the urbanized Town. Sub-basin sizes range from 17 acres to 335 acres. *Appendix A* provides an overview of the sub-basins.

3.4.2 Length, Centroid Distance, Slope CUHP parameters such as sub-basin length, distance to centroid, and slopes were derived for each sub-basin using topographic data. Slopes were computed using the length-weighted, corrected average slope from UDFCD's Urban Storm Drainage Criteria Manual (USDCM), including corrections for stream and vegetated channels.

3.4.3 Depression Losses The maximum pervious depression storage was set to the recommended value of 0.4 inches for wooded areas and open fields. The maximum impervious depression storage was set to the recommended value of 0.1 inches. No adjustments were made to these recommended values.

3.4.4 Infiltration Soils data was obtained from USDA NRCS Soil Survey Geographic Database for the project area which classified the soils into Hydrologic Soils Groups (HSGs). Additional soils mapping was obtained from the USDA NRCS Web Soil Survey. This information is provided in *Appendix A*.

The initial rate, final rate, and decay coefficient for the Horton's infiltration parameters were based on the recommended values in the USDCM. The Horton's infiltration parameters were weighted based on the percentage of each soil type within each sub-basin. Table 3-2 summarizes the Horton's infiltration parameters utilized in the analysis.

Table 3-2: 1-hr Rainfall Depth

Hydrologic Soil Group	Infiltration (inches per hour) Initial - fi	Final - fo	Decay Coefficient
A/B	4.5	0.6	0.0018
C	3.0	0.5	0.0018
D	3.0	0.5	0.0018

3.4.5 CUHP Output The hydrologic analysis was conducted for both existing conditions and future conditions land use. The 100-year peak discharges from CUHP v2.0 for both conditions are presented in Table 3-3. CUHP output for other recurrence intervals is provided in *Appendix A*.

Although this hydrologic analysis did not calibrate peak flows to the previous Town of Lyons Drainage Master Plan Final Report prepared by BRW, the CUHP unit rates of runoff were compared with the previous study unit rates of runoff for sub-basins that were similarly delineated. In some cases, the unit rates of runoff are similar, but there are cases where the unit rates of runoff differ. These differences are primarily due to physical differences in input assumptions (imperviousness, HSGs, etc.).

3.5 Hydrograph Routing

A hydrograph routing network was developed based on field reconnaissance, survey of the existing storm sewer network within Town, and the BRW, Inc. drainage master plan using EPA SWMM. The routing network in EPA SWMM includes: nodes (junctions and dividers), conduits (including overflow or diverted links), storage units, storage outlets, and outfalls. The model input parameters for nodes include: node identifier, invert elevation, maximum node depth, and overflow or diverted link identifier. Input parameters for conduits include: conduit identifier, upstream and downstream node identifiers, shape (e.g. trapezoidal, circular, rectangular, etc.), length, bottom width, side slopes, roughness coefficient, number of barrels, and inlet/outlet offset depths. Input parameters for storage units include: storage unit identifier, invert elevation, maximum depth, and a stage-area relationship. Input parameters for storage outlets include: outlet identifier, upstream and downstream node identifiers, and a stage-discharge relationship. Input parameters for outfalls include

Table 3-3: CUHP Output, 100-Year

Subbasin	Existing Conditions 100-Year Peak Discharge (cfs)	Existing Conditions Unit Rate of Runoff (cfs/ac)	Future Conditions 100-Year Peak Discharge (cfs)	Future Conditions Unit Rate of Runoff (cfs/ac)
1.2	408	2.16	408	2.16
1.3	534	2.21	534	2.21
1.4	403	2.72	403	2.72
1.5	449	2.79	449	2.79
2.1	306	1.65	306	1.65
2.2	97	2.27	97	2.27
2.3	59	2.55	59	2.55
2.4	116	2.61	116	2.61
2.5	102	2.89	102	2.89
2.6	54	1.29	54	1.29
3.1	142	1.83	167	2.15
3.2	92	2.49	92	2.49
3.3	21	3.68	21	3.68
3.4	52	3.05	52	3.05
3.5	32	1.64	32	1.64
3.6	20	1.34	20	1.34
3.7	12	4.55	12	4.55
3.8	31	2.18	31	2.18
4.1	102	2.66	128	3.32
4.1	183	1.38	183	1.38
4.2	113	1.69	114	1.70
4.3	386	1.27	386	1.27
4.4	128	1.32	128	1.32
4.5	117	1.52	117	1.52
4.6	526	1.57	526	1.57
4.7	70	1.47	70	1.47
4.8	227	1.49	227	1.49
4.9	575	1.94	575	1.94
5.1	171	2.19	208	2.67
5.2	194	2.33	194	2.33
6.1	387	1.64	393	1.67
6.2	187	2.18	187	2.19
6.3	370	1.37	370	1.37
6.4	186	1.19	186	1.19
6.5	213	1.68	213	1.68
6.6	233	1.00	233	1.00
6.7	176	2.21	176	2.21
6.8	252	1.35	252	1.35
6.9	216	1.69	216	1.69
7.1	25	0.97	28	1.09
7.1	161	2.55	161	2.55
7.1	199	2.86	234	3.37
7.2	70	1.94	70	1.94
7.3	50	3.29	50	3.29
7.4	69	2.37	69	2.37
7.5	26	1.16	26	1.16
7.6	134	2.25	134	2.25
7.7	359	1.86	359	1.86
7.8	144	1.97	145	1.99
7.9	24	3.66	24	3.66
8.1	315	1.50	315	1.50
8.2	93	1.13	93	1.13
8.3	136	1.32	136	1.32

the outfall identifier and invert elevation. Input parameters for the SWMM model are provided in *Appendix A*.

3.5.1 SWMM Node Input Parameters Node identifiers in SWMM are synonymous with the sub-basin IDs. Invert elevations were determined using the 2011 LIDAR data. In some instances, a divider was used to allow the flow to be routed through the existing storm sewer system but when the capacity of the storm sewer is exceeded, the water overflows into the street (along 2nd Avenue south of E. Main Street and near the intersection of Main Street and E. Main Street).

3.5.2 SWMM Conduit Input Parameters For the drainage basins located outside of Town, transects of the drainage channels were generated using the 2011 LIDAR and a representative channel cross-section was input into the SWMM model. The manning's roughness coefficient for these undeveloped drainage basins was estimated to be 0.035 to represent channels with some weeds and stones.

Within the developed areas, characteristics of the drainage facilities were based on survey of the existing storm sewer system, field reconnaissance, and sizing the channels so that the flow could adequately be conveyed to the outfall. Between 5th Avenue and 4th Avenue, there is an existing drainage ditch that varies in width and depth but is enclosed downstream to accommodate development over the ditch. For the purposes of the SWMM model, it was assumed to have a uniform width and depth. There is a small roadside swale with intermittent driveway and roadway culverts along the west side of 3rd Avenue. However, the swale and culverts have such limited capacity and during large storm events, the water would flow down 3rd Avenue. At 3rd Avenue and Main Street there is a 30" reinforced concrete pipe that diverts flow from 3rd Avenue to the southeast along E. Main Street. During large storm events, the flow continues down within E. Main Street, which was modeled as an open channel, until it discharges into the St. Vrain Creek. South of E. Main Street along 2nd Avenue there is a storm sewer system consisting of 18-inch, 12-inch, and 15-inch corrugated metal pipe which discharges into the St. Vrain Creek. This storm sewer system was modeled as a 12-inch pipe in the SWMM model.

There are many sub-basins which are direct flow areas into the North St. Vrain Creek, South St. Vrain Creek, or St. Vrain Creek. Therefore, the conduits for these sub-basins were modeled as "dummy" conduits.

3.5.3 SWMM Storage Input Parameters An existing detention pond is located within Sub-basin 1.5. The stage-area relationship was taken directly from the BRW, Inc. drainage master plan, as well as the stage-discharge relationship for the outlet. No additional detention ponds were modeled for the existing conditions, although inadvertent storage and/or privately owned detention may elsewhere within the project area.

3.5.4 SWMM Output The SWMM routing was conducted for both existing conditions and future conditions. The 100-year peak discharges at all of the outfalls from the SWMM model for both conditions are presented in Table 3-4. SWMM output for other recurrence intervals is provided in *Appendix A.*

Table 3-4: SWMM Output, 100-Year

SWMM Outfall Name	Routed Subbasins	Receiving Water	Existing Conditions 100-Year Peak Discharge (cfs)	Future Conditions 100-Year Peak Discharge (cfs)
StoneCanyonSt.VrainOUT	4.9, 4.11, 4.6, 4.8, 4.7, 4.3, 4.5, 4.4, 4.1, 4.2	St. Vrain Creek	2356	2361
EagleCanyonN.St.VrainOUT	1.4, 1.3, 1.2, 1.5	North St. Vrain Creek	1716	1716
RedHillGulchS.St.VrainOUT	6.8, 6.9, 6.6, 6.7, 6.4, 6.5, 6.2, 6.3, 6.1	South St. Vrain Creek	2198	2203
Sub2.4N.St.VrainOUT	2.1, 2.2, 7.4, 2.3, 2.4	North St. Vrain Creek	682	682
Sub7.2St.VrainOUT	3.1, 3.2, 2.5, 3.4, 3.3, 7.2	St. Vrain Creek	581	611
Sub7.3St.VrainOUT	7.3	St. Vrain Creek	50	50
Sub7.7N.St.VrainOUT	7.7	North St. Vrain Creek	359	359
Sub7.8S.St.VrainOUT	7.8	South St.Vrain Creek	144	145
Sub5.1N.St.VrainOUT	5.1	North St. Vrain Creek	171	208
Sub7.5N.St.VrainOUT	7.5	North St. Vrain Creek	26	26
Sub8.2St.VrainOUT	8.2	St. Vrain Creek	407	407
Sub7.1St.VrainOUT	7.1	St. Vrain Creek	378	414
Sub7.6N.St.VrainOUT	7.6	North St. Vrain Creek	134	134

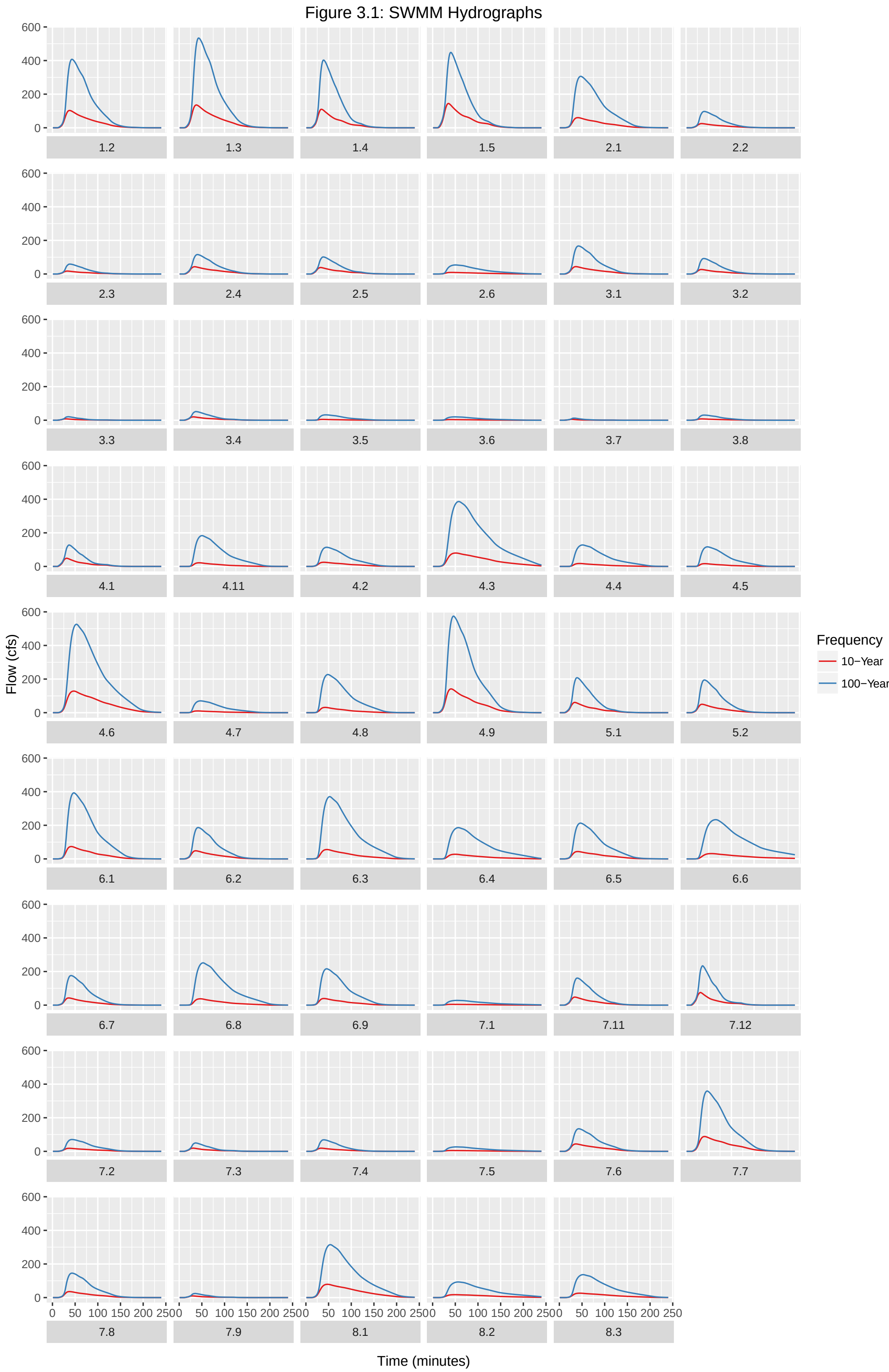


Figure 3.1: SWMM Hydrographs
Flow (cfs)
Time (minutes)
Frequency
10−Year
100−Year
1.2
1.3
1.4
1.5
2.1
2.2
2.3
2.4
2.5
2.6
3.1
3.2
3.3
3.4
3.5
3.6
3.7
3.8
4.1
4.11
4.2
4.3
4.4
4.5
4.6
4.7
4.8
4.9
5.1
5.2
6.1
6.2
6.3
6.4
6.5
6.6
6.7
6.8
6.9
7.1
7.11
7.12
7.2
7.3
7.4
7.5
7.6
7.7
7.8
7.9
8.1
8.2
8.3

Table 3-5: SWMM Output, Outfalls

Outfall	Design Flow Location	2-yr	5-yr	10-yr	50-yr	100-yr
Eagle Canyon						
	Outfall into North St. Vrain Creek	160	261	433	1268	1716
North St. Vrain						
	Subwatershed 7.7	34	54	88	265	359
	Subwatershed 7.6	21	32	44	104	134
	Subwatershed 7.5	2	3	5	19	26
Ewald Avenue						
	Subwatershed 5.1	27	41	61	157	208
	Subwatershed 5.2	19	30	50	145	194
South St. Vrain						
	Subwatershed 7.8	13	20	36	108	145
	Subwatershed 8.1	29	46	79	232	315
	Subwatershed 8.2	6	11	17	66	93
Steamboat Valley						
	Vasquez Road	20	33	60	221	306
	Old Railroad Embankment	48	78	126	418	573
	Main Street	69	108	165	503	682
	Outfall into North St. Vrain Creek	69	108	165	503	682
Third Avenue						
	East of Cemetary	18	29	44	125	167
	Stickney Avenue	12	18	27	70	92
	Stickney Ave. and 3rd Ave.	30	47	70	194	258
	Main Street	50	75	108	272	358
	Outfall into North St. Vrain Creek	83	125	179	461	611
Eastern Lyons						
	Second Avenue at Stickney Alley	3	5	8	23	31
	First Avenue	1	2	5	23	32
	Kelling Drive	1	2	4	14	20
	Main Street	9	14	23	73	100
South 2nd Avenue						
	West of Second Avenue	10	15	19	39	50
	East of Second Avenue	5	8	10	19	24
Red Hill Gulch						
	Upstream end of Red Gulch Road	66	122	286	1213	1726
	South Ledge Ditch	80	148	341	1447	2078
	Bohn Park	86	160	361	1533	2204
Lyons Valley						
	West of McConnell Dr	21	32	48	122	161
	East of McConnell Dr	35	52	75	178	234
	East of Lyons Valley Park	1	2	4	20	28
Stone Canyon						
	Stone Canyon Subdivision	129	219	432	1566	2183
.	Ute Highway	146	246	474	1694	2361

Table 3-6: SWMM Output, Existing Structures

Outfall	Structure	Size	Approximate Capacity (cfs)	Approximate Return Period
Steamboat Valley				
	5th Ave.: Main St. to Park Dr.	18-inch	15	< 2-yr
	5th Ave.: Park Dr. to N St. Vrain Creek	28-inch x 16-inch	37	< 10-yr
	4th Ave.: Stickney Ave. to Railroad Ave.	18-inch	17	< 2-yr
	4th Ave.: Railroad Ave. to N St. Vrain Creek	24-inch	38	< 10-yr
	Vasquez Rd.	(2) 48-inch	330	> 100-yr
	McCall Alley	42-inch	183	< 50-yr
	Reese Ave.	36-inch	105	< 10-yr
	Seward St. Alley	60-inch x 36-inch	154	< 50-yr
	5th Ave.: Main St.	24-inch	32	< 10-yr
Third Avenue				
	Main Street	60-inch x 48-inch	303	> 100-yr
	Evans St. to Park St.	18-inch	15	< 2-yr
	Park St. to N St. Vrain Creek	36-inch x 24-inch	97	< 100-yr
South 2nd Avenue				
	South of Main St.	24-inch	45	< 2-yr
	3rd Ave.: Railroad Ave.	24-inch	30	< 2-yr
	2nd Ave.: Park St.to St. Vrain Creek	18-inch	15	< 2-yr
Ewald Avenue				
	Park St.	48-inch	261	< 50-yr
Lyons Valley				
	Raymond Ct.	24-inch	41	< 2-yr
	McConnel Drive	30-inch	75	< 5-yr
	McConnel Drive: Outfall	30-inch	75	< 5-yr
	McConnel Dr.: McConnel Dr.	24-inch	41	< 2-yr
Eastern Lyons				
	1st Ave.: 2nd Ave.	30-inch	104	< 100-yr
Stone Canyon				
	Stone Canyon Rd.: Stone Canyon Rd.	13 ft. x 8 ft. box	4361	> 100-yr
.	Ute Highway: Stone Canyon Road	8 ft. x 4 ft. box	920	< 50-yr

4.0 Hydraulic Analysis

4.1 Previous Analysis and Events

The information provided in the previous 1998 Drainage Master Plan study was used to help identify flood hazards throughout the Town of Lyons. The previous report identifies several key areas as having potential for flooding hazards. A few key events are highlighted for reference.

In the August 1994 flood the Ewald Avenue subwatershed was observed to produce enough runoff to carry debris off the hillside onto the residential streets.

Steamboat Valley was identified as having the greatest impact to flooding throughout the Town of Lyons. The report indicated the Steamboat Valley Watershed was the hardest hit area during the 1994 storm. The existing storm drain system between 4th and 5th Avenue was estimated to be an approximate 5-year storm capacity. The storage behind the old railroad embankment was identified as an issue of major concern. The properties downstream of the railroad embankment have grown reliant on this detention and removal of this detention would have negative impacts to downstream property owners. Several properties behind the railroad embankment were noted to be at risk of flooding when the detention area was full.

The conveyance of Red Hill Gulch stormwater runoff in South Ledge Ditch was identified as a possible flooding hazard. The report noted the possibility of the ditch embankment to become compromised and the bank to be breached with the conveyance of storm water runoff. It should be noted that Lyons Valley Subdivision was not constructed at the time of the previous report.

The 2013 flood event had a well-documented impact on the Town of Lyons. The confluence of the north and south St. Vrain Rivers was the center of flood damages during the 2013 floods. Several reports provide further documentation of the flood event. Numerous post-flood studies on the floodplain and restoration projects are also available.

A 2015 flood event was notable because of the hail associated with the storm. The resulting hail-laden runoff clogged surface conveyance (streets, gutters) as well as capture systems (inlets, outlet structures).

4.2 Evaluation of Existing Facilities

Existing storm drain infrastructure was evaluated to determine the approximate design storm frequency. A summary of existing infrastructure is provided in the GIS data provided in *Appendix F*.

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 below.

4.2.1 Flo-2D Model Development 10-foot by 10-foot grid cells were used to maximize the precision in identifying flooding potential throughout the watershed. Elevations for each grid cell were computed through FLO-2D by interpolating the project LiDAR data. Building obstructions were incorporated into the FLO-2D model based on building footprint data that was generated as part of this study.

Individual subwatershed hydrographs were taken from the hydrology model (CUHP) and applied to the FLO-2D surface. Each hydrograph was applied at a single FLO-2D grid cell where the majority of discharges were expected to converge for each subwatershed. Existing storm drain systems 24-inch and larger were included in the FLO-2D model.

Separate FLO-2D models were used to distinguish the flooding potential for the study area for each of the design storms.

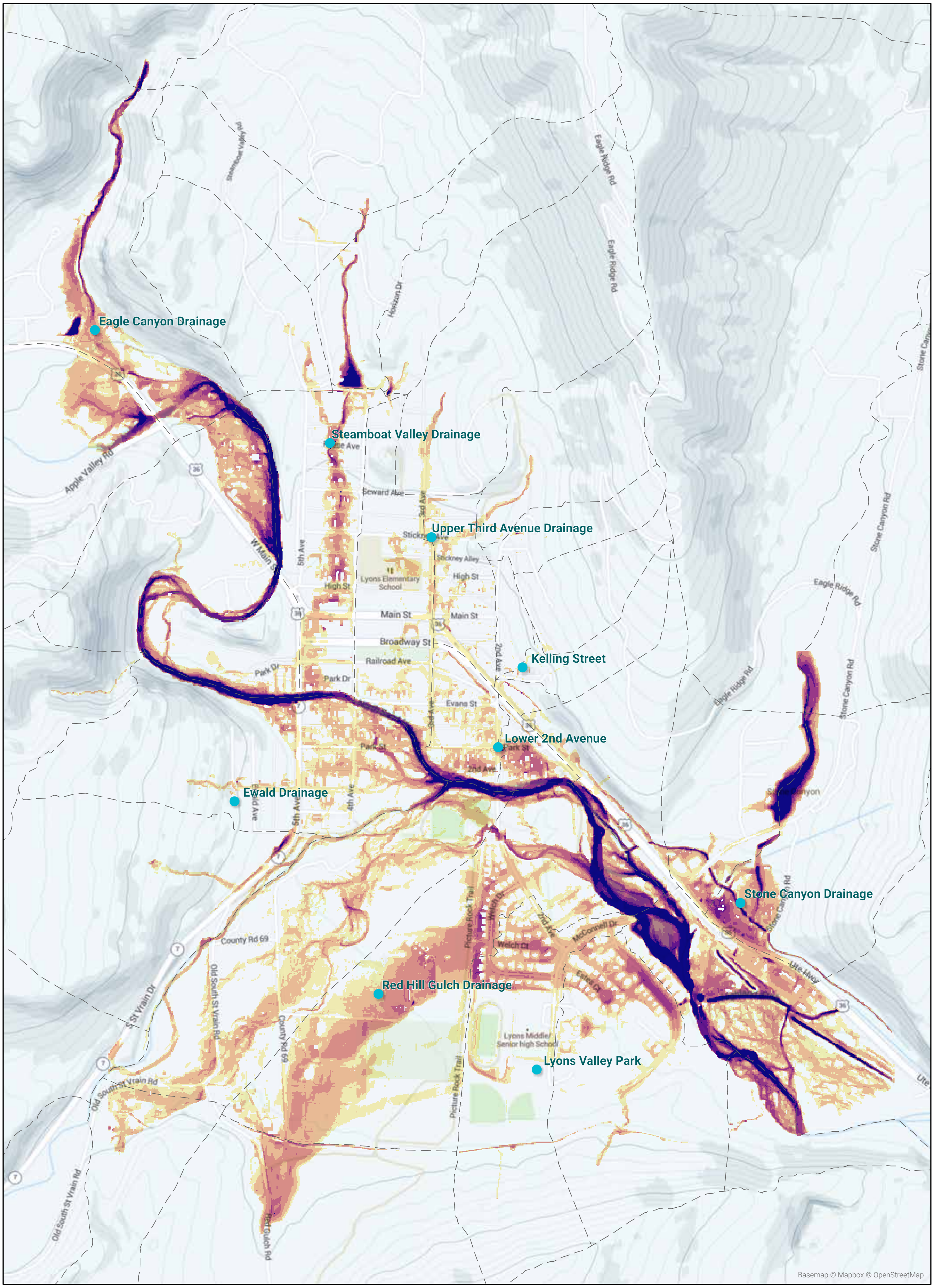
The results of these models are provided in *Appendix B*.[2]

[2] Results are also available on the project's interactive webmap at `https://iconengineering.github.io/lyons-stormwater-masterplan/map`

4.3 Flood Hazards

FLO-2D uses the full dynamic wave momentum equation when computing flow depth at each cell in the study area. This computational methodology accounts for floodplain storage at each sump location in the watershed attenuating flows as they traverse the watershed downstream. This floodplain storage is not accounted for in the SWMM model which is computed using a kinematic wave approach. This difference in modeling approach leads to discrepancies when comparing design peak flows from the SWMM model and the inundation limits shown in the hydraulic analysis. Existing capacity for each outfall system was estimated from normal depth calculations given each pipe slope. The existing storm drain infrastructure generally lacks the capacity to adequately convey the 5-year storm event.

This is not unusual for a town the age and size of the Town of Lyons. Land use regulations and stormwater management policies were not common to smaller towns along the Front Range of Colorado until sometime after the 1965 flood on the South Platte River ravaged metro Denver. By the time development regulation and stormwater infrastructure recommendations expanded to include smaller towns along the Front Range, a lot of Lyons' roadways and private development had encroached on the natural drainageways.



Lyons Stormwater Masterplan

Figure 4-1: Problem Identification

100-year Max Flow Depth (ft)

.5 1 2 3 4 5 6+

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4.3.1 Eagle Canyon The most significant flooding hazard in the Eagle Canyon Watershed is just upstream of the confluence with North St. Vrain Creek. Development immediately upstream of the confluence has limited the capacity of the channel. By limiting the ability of the channel to convey water to North St. Vrain, the discharge overtops Main Street and spills to the south.

4.3.2 Eastern Lyons The small swale and private roadway culverts along the east side of 2nd Avenue limit the capacity to convey the basin runoff downstream. With no storm drain or curb and gutter system installed along 2nd Avenue, all basin runoff will flow along 2nd Avenue on the street. As mentioned previously, during major events runoff from the Eastern Lyons watershed any flow overtopping 2nd Avenue will flow west and contribute flow to the Third Avenue Watershed.

In the lower reaches of Eastern Lyons Watershed the businesses along Main Street and residences along Kelling Drive have experienced flooding in the past. The only storm drain intercepting flow near the businesses is an 18-inch storm drain. This system can capture less than the 5-year design flow in ideal, free flow, no debris conditions.

4.3.3 Ewald Ave As noted in the previous study, the steep slopes of the Ewald Ave Watershed pose a flooding hazard to the residential development in the lower portions of the watershed. The steep slopes in the upper portion of the watershed result in high velocities of runoff eroding the hillside and carrying debris into the residential development.

The Boulder County open space borders these properties and constrains the range of solutions for intercepting or diverting these flows. However, the lower end of this basin drains well into the confluence area of North and South St. Vrain rivers.

4.3.4 Lyons Valley Park Flooding hazards in the Lyons Valley Park Watershed are a result of development within the basin without adequate storm drain conveyance. The 18-inch storm drain throughout the upper reaches of the development was not designed to convey major storm events.

A significant flooding hazard for the Lyons Valley Park Watershed is overflow from the Red Hill Gulch Watershed. The overflow drainage path from Red Hill Gulch is discussed in further detail below.

An overflow path from the hillside south of the High School, Ledge Ditch sub-basin, is an interesting problem. The modeling scenarios do not account for the irrigation ditch that traverses the hillside near the toe of slope. This is a common hydraulic modeling assumption to account for a runoff event during a ditch full scenario. However, in a practical sense the irrigation ditch catches most minor storm events and effectively protects the adjacent residential structures. At a minimum, the ditch should be monitored for stability to ensure overflows and spills from stormwater are handled safely. Additional planning for a time when the ditch is no longer operational or maintained should be considered. Finally, protection or enhancement of the minor swale along the rear lot lines of the neighborhood should be considered to ensure sheet flows are passed around the structures.

4.3.5 North St. Vrain Flooding hazards in the North St. Vrain Watershed are limited to the lower end of the basin. Generally flows in this basin concentrate in natural valleys and are conveyed overland towards the St. Vrain River. Land use changes in this area have limited the flood risk significantly.

4.3.6 Red Hill Gulch The most significant flooding hazard in the Red Hill Gulch Watershed is flow overtopping the South Ledge Ditch and flow continuing north into Bohn Park and Lyons Valley Subdivision. As noted above, utilizing the ditch for intercepting and conveying stormwater runoff creates a significant hazard for downstream properties. These comingled flows exceed the design capacity of the canal jeopardizing the structural integrity of the ditch. Flows overtopping the ditch create an uncontrolled overflow impacting Bohn Park and homes in the Lyons Valley Subdivision.

Flows exceeding the capacity of the South Ledge Ditch continue north in an unconfined flow path

The surface flows from Red Hill Gulch follow an ancient alluvial fan pattern starting at the intersection of Red Hill Gulch Road and Jasper Drive and extending north towards the South St. Vrain. The surface flows generally follow Red Hill Gulch Road north until it turns west, the surface flows continue north east of a high point on County Road 69. This is an interesting key point in the surface drainage conditions of Red Hill Gulch because the surface flows are so close to the South St. Vrain, but instead follow a natural topographic low point east-northeast. This ultimately leads to a flow path intersecting with Lyons Valley subdivision and the newly planned Bohn Park.

4.3.7 South St. Vrain Flooding hazards in the South St. Vrain Watershed are generally created by the lack of a formal drainage conveyance system. The topography within these watersheds conveys the runoff in separate flow paths to South St. Vrain Creek. The flow paths are generally shallow native grass and rock swales with minimal impact to private property or public infrastructure.

4.3.8 South 2nd Avenue Flood hazards within the South 2nd Avenue Watershed are caused by contributing flow from other watersheds, lack of local runoff storm drain conveyance, and proximity to St. Vrain Creek. The elliptical pipe underneath Main Street conveys runoff from the Third Avenue Watershed to the South 2nd Avenue Watershed. The pipe discharges flow into an undersized open channel that conveys flow southeast towards 2nd Avenue. Any flow that is not intercepted by the 24-inch storm drain at 2nd Avenue spills to the south impacting properties. The 18-inch storm drain at 2nd Avenue and Park Street intercepts approximately the XX design flow for the subwatershed, impacting more properties.

Existing Steamboat Valley channel lacks conveyance capacity

4.3.9 Steamboat Valley The most significant flood hazard impacting downtown Lyons is runoff from Steamboat Valley. The runoff from the upper watershed concentrates behind the old railroad embankment. The area behind the old railroad embankment poses a significant flood hazard to downstream properties. Close observation on the stability and maintenance of this embankment is important to managing the risk of a breach or other failure during a storm event. This will require coordination with several private property owners. Downstream of the railroad embankment development within the natural drainage path has confined the runoff to an undersized open channel through private property. The lack of conveyance capacity of this channel and culvert roadway crossings between 4th Avenue and 5th Avenue creates a flooding hazard damaging private property. Any flow that is not intercepted by the historic stone culvert continues on the surface flowing through backyards with additional impact to private property and structures.

Steamboat Valley at Reese Street between 4th and 5th Avenue

The existing conveyance within Steamboat Valley does not have the hydraulic capacity to convey storms greater than the 5-year return period. More importantly, the materials (stone and open channel) and alignment (erratic with several sharp bends and constrictions) subjects the adjacent properties to additional risk from debris clogging.

4.3.10 Stone Canyon The steep natural drainageway in the Stone Canyon Watershed conveys the runoff into the open space of the Stone Canyon Subdivision without significant flood hazards. The roadway crossing at Stone Canyon Road conveys the flow downstream without impacting a significant number of residences within the subdivision. Development downstream of Stone Canyon Road has eliminated the conveyance capacity of the channel to convey runoff without impacting properties. The water backs up against Ute Highway as water is conveyed underneath the roadway through the box culvert.

There have been reports of soil subsidence in the open space areas adjacent to the channel. This study did not include detailed geotechnical analysis to determine a cause or effect of the reported soil movement. More formal identification of the problem areas, formal and regular monitoring of those sites, and geotechnical analysis would be required to properly evaluate the risk of those soils relative to flood hazards (i.e. bank failure reducing channel capacity), private, or public property.

4.3.11 Third Avenue Runoff from the undeveloped upper watershed enters the downtown in two distinct locations. East of the cemetery flow drains south into the developed area of the watershed along Third Avenue. Flow from the eastern portion of the watershed flows into the downtown area west along Stickney Avenue before turning south on Third Avenue. The runoff from the watershed continues south along Third Avenue where the majority of the flow is conveyed in the street. The elliptical pipe at Main Street conveys flow underneath Main Street into the South 2nd Avenue Watershed. Flows exceeding the capacity of the elliptical pipe split with some flow continuing southeast north of Main Street while some flow overtops Main Street and continues flowing down Third Street.

5.0 Flood Hazard Area Mapping

5.1 Approach

Two dimensional floodplain analysis.

5.2 Assumptions

The flood hazard area maps are non-regulatory, but identify structures at risk of flood damage based on surface flow depths. The flooding depicted on this map is a uniform storm event across all watersheds at the same period of time and same duration.

Free flow. These depths do not account for debris or hail or other impediments in storm water conveyance systems. Debris flow modeling is possible, but is beyond the scope of this master plan study.

Storm sewer systems. Small diameter storm sewer systems were not accounted for in the hydraulic modeling and resulting floodplain mapping for this master plan study. The impact of a 4 or 8-inch or even 18-inch culvert on flood depths is limited when considering storm events beyond the 2 year recurrence interval. As a sensitivity analysis, the 18-inch storm sewer pipes and inlets were accounted for in the Lyons Village area. The resulting flood depths were unchanged for all but the 2 year recurrence interval. In the 2 year recurrence interval storm, the flood depths were reduced by approximately 3 inches. The floodplain mapping is drawn as a quilt of interlocking 10 foot squares with depth averaged across that area. There were less than 40 squares (4,000 square feet) removed from flooding when accounting for the 18-inch storm sewer.

It is important to note, this is not a referendum on the existing 18-inch storm sewer system. Clearly, an 18-inch storm sewer conveys water and a has a beneficial impact on the flood risk in the neighborhood. This is a clear indication of the limitations of master plan level, town wide, flood risk mapping. The uncertainty variables at the master plan level results in floodplain maps depicting general, conservative areas of risk. When areas such as developed neighborhoods with existing storm sewer systems show up on the master plan flood maps attention should be given to determine if a higher level of study is necessary. In the case of Lyons Valley, the storm is functional and clearly benefits the properties more than the master plan flood hazard maps indicate. However, when combined with anecdotal stories about spring and summer street flooding from overwhelmed inlets, this may be an area to consider for additional detailed field survey and hydraulic analysis.

5.3 Regulatory Floodplains

Conversion of these flood hazard areas to regulatory floodplains is a complicated, long, but well documented process. At this time, the master plan makes no specific recommendation for submitting these floodplain delineations to FEMA for formal adoption. As flood recovery projects are completed and budgets are set for priority capital improvements, a more formal Flood Insurance Study can be considered to accurately map the flood hazards to FEMA specifications.

6.0 Alternative Analysis

6.1 Alternative Development Process

An Alternative Analysis was completed to develop flood mitigation solutions for the problem areas identified in the previous section. Goals for mitigation focused on solutions to reducing flooding on insurable structures. Consideration was also given to reducing infrastructure sizing and costs by incorporating detention.

Alternatives were considered first for open channel and then for piped systems. Open channels are more cost effective, provide additional ecological benefits, mimic or sometimes restore the natural environment, but require additional stabilization and maintenance to provide long term benefits. Piped systems are far more hydraulically efficient and allow for more flexible land uses in and around the system, but do not benefit the natural environment and can be significantly more costly to install, particularly in underlying rock soils.

For example, the development of downtown Lyons over the historic drainageway has limited the ability to convey the major storm events through an open channel system. Since an open channel system is not feasible, large storm drain infrastructure is needed to reduce the flood hazards throughout the study area. The storm drain infrastructure must limit the amount of flow in the street to provide emergency vehicles access during storm events.

The analysis aimed to develop stormwater solutions first within the Town of Lyons. When those alternatives were exhausted as cost prohibitive or unfeasible, then the project team considered alternatives outside of the Town limits. The cost of land acquisition, land use regulations, and extra-territorial jurisdiction can add significant costs to stormwater projects outside of the Town limits. Conversely, knowing about potential out of town solutions to in-town risks can be prudent to future planning exercises in annexation, development referrals, and multi-agency coordination.

6.2 Criteria and Constraints

As noted above, goals for the baseline alternative plan was to provide storm drainage capacity to meeting currently defined drainage criteria set forth in the Town of Lyons Storm Drainage System Criteria. The minor storm frequency for the Town of Lyons is the 2-yr design storm. The major storm frequency for the Town of Lyons is classified as the 100-yr design storm frequency. The only inlet type allowed on streets is CDOT Type R inlets.

6.3 Evaluation of Detention

6.3.1 Detention Detention is a common approach to reduce peak flows, optimize pipe size, and save on downstream infrastructure costs. Review of the previous master plan confirmed that previously master planned detention facilities were drafted to meet this goal. If detention is installed in the upper watersheds of the Town, there is a significant cost savings to downstream stormwater infrastructure. However, upon closer examination of the previous master plan assumptions, field inspection of the proposed detention sites, and conceptual pond grading and layout there were additional constraints on the detention pond locations.

6.3.2 Steep Topography The steep slopes on the north end of Steamboat drainage require significant grading operations to achieve a functional detention volume even approaching 0.5 acre feet. This fact alone may still be a viable alternative since excavation is generally less expensive than long lengths of large storm sewer pipe material, utility crossings, and installation. However, given the geology of the upper Steamboat drainage the depth to bedrock is known to be very shallow in many locations. Rock excavation for a detention facility is prohibitively expensive. Excavation of the rock in a quarry scenario would be one economically viable means of providing sufficient detention volume at a reasonable cost for Steamboat drainage.

6.3.3 Multiple Hillside Ponds Staged detention facilities staggered in stair-step fashion up the steep slopes is another alternative to achieve the benefits of detention without significant excavation. However, the extensive footprint of disturbance for multiple embankments, overflow spillway design, and permanent impact on property makes this a challenging alternative. If future development, annexation, and stormwater infrastructure funding allows this alternative can be studied in greater detail. For the immediate future, this is a difficult alternative to consider for near term funding.

6.3.4 Property Acquisition The natural valleys between 4^{th} and 5^{th} Streets and 3^{rd} and 4^{th} Streets could provide suitable detention facilities if several existing constraints are mitigated. First, the private homes in the adjacent parcels would be impacted by detention depths of more than approximately 5 feet. Purchase and demolition of homes affected by a proposed detention facility would be required to achieve a useful detention volume. Second, the existing embankments between 4^{th} and 5^{th} Street should be reconstructed to replace the rock and native soils that were used to build what is reported to be an old railroad embankment. Until the compaction and stability of that embankment can be verified, it should not be relied upon to safely detain stormwater. It is unclear what the overflow path may be should the outlet under the embankment fail, collapse or clog. However it is likely the overflow could lead to additional erosion and scour of the embankment flanks and expedite complete failure of the embankment. Third, the valleys near the cemetery are also candidates for detention, but the steep slopes make each valley individually difficult to achieve a reasonable volume. However, purchase of a uniquely shaped parcel of land slicing between the valleys could allow an embankment to be constructed that joins the two valleys and creates a reasonable detention volume.

6.4 Alternative Categories

For the purpose of this study, alternatives were generally developed to mitigate the flooding hazards identified in Section 5.0. Specific details related to individual alternatives follow in subsequent report sections.

6.5 Alternative Hydraulics

Alternatives were modeled using EPA SWMM to determine the size of the structures necessary to convey the design flow. The reduction in flooding potential throughout the basin was evaluated for the minor and major design storm frequencies using FLO-2D.

6.6 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 2016 Second Quarter Report. A rolling four-quarter inflation rate of 1.2673 was used to adjust unit costs.

Operation and Maintenance was also included within the UD MP Cost worksheet. Maintenance to remove sediment and debris and conduct structural repairs on storm drain manholes and inlets was assumed to occur one every year. Maintenance to remove tree and weeds and sediment and debris in open channel alternatives was also assumed to occur once every year. Costs for maintenance of the hydraulic drops for the Red Hill Gulch West Channel was assumed to occur once a year.

Inlet quantities were calculated assuming an inlet interception capacity of 1 cfs / foot of inlet.

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

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

- Asphalt Repaving: $40 / S.Y.
- Curb and Gutter: $30 / L.F.

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.

6.7 Alternative Plans

A - Red Hill Gulch Overflow Channel East A diversion channel west of Lyons Valley Park Subdivision is proposed to intercept overflow from Red Hill Gulch before the discharge damages property. Any flow exceeding the capacity of the South Ledge Ditch continues north spilling into Bohn Park and Lyons Valley Park Subdivision. This uncontrolled spill flow risks the structural integrity of the ditch and poses a hazard to homes along the west side of Lyons Valley Park. The Red Hill Gulch Overflow Channel East would intercept flows along the east side of Bohn Park preventing these flows from diverting into the Lyons Valley Park Subdivision. The grading associated with the overflow channel would change the surface conditions of the east side of the park but still allow for parking and multi-purpose uses. The multiple uses of this eastern side of the park require the channel to be wider and flatter that typical conveyance channels in order to maintain the function of the space for parking and exhibitions.

Red Hill Gulch Overflow Channel East would intercept flows before diverting runoff into Lyons Valley Park Subdivision

In general, this option intercepts and conveys large storm events from Red Hill Gulch before those flows encroach on private property. The alignment utilizes existing town property and requires no additional easements or property acquisition.

However, this alternative compromises existing functions of the park land and assumes upstream development will not have an impact on the drainage conditions. In other words, solving the Red Hill Gulch drainage this far down in the watershed costs a lot when compared to what upstream alternatives may do to reduce stormwater impacts.

B - Red Hill Gulch Overflow Channel West An alternative to the east channel at the downstream end of the watershed is a western channel. When the Western Corridor is annexed into the Town of Lyons the overflow channel alignment should be evaluated to intercept the flows upstream of Bohn Park eliminating any disturbance to the park. The flows would be conveyed west of Bohn Park and discharged into South St. Vrain Creek. This is a smaller channel used for a singular stormwater purpose – it does not have to share uses with a park or parking lot. The western alignment also conveys water around Bohn Park and Lyons Valley subdivision.

However, the channel would require an easement or land acquisition from the adjoining land owners. And, because of the smaller footprint, the hydraulics of the channel require drop structures to control erosive velocities.

C - Red Hill Gulch Cut-Off Channel Outside of the Town, there is another problem area and option for managing Red Hill Gulch stormwater runoff.

A third alternative for Red Hill Gulch drainage intercepts the gulch flows at the Picture Rock Trailhead and diverts those flows west into the South St. Vrain. This alternative has the advantage of working a stormwater solution upstream of existing development and mitigating flood risk as high up in the watershed as feasible. This is the most hydraulically efficient alternative in that the diversion distance to the South St. Vrain is short and the diversion volume is reduced when compared to downstream alternatives.

However, the constraints on this alternative are compounded by the need for easement or land acquisition on both public and county open space property. The details of a diversion in this location will require careful design and analysis. The surface flows are spread over a large area, but the right grading could allow just enough water to drain north through the park area and intercept the remainder to safely divert it west to the South St. Vrain. Easements and reconstruction of Red Gulch Road would be required. Existing irrigation ditches in the area compound problems rerouting surface flows. Any diversion would still have to cross Ledge Ditch and Meadow Ditch.

There are several roadside ditches and ditch crossings that should be investigated further. The stormwater flows into Ledge and Meadow ditches complicate the flow paths for this drainage. Upstream and downstream of the irrigation ditches, the roadside swales are an important part of conveying stormwater but need to be maintained to ensure positive drainage away from the roadway.

D - Steamboat Drainage Culvert Replacement The historic flowpath of Steamboat Valley Watershed conveys flow south between Fourth and Fifth Avenue through private property. The existing confined channel and culvert roadway crossings could be replaced with a reinforced concrete box culvert conveying the entire 100-year design flow. The proposed culvert replacement along the existing alignment uses the natural topography to convey the runoff to the new culvert. However, implementing this alternative would require extensive easements as the historic culvert runs through the downtown area underneath development on private properties.

E - Steamboat Drainage Interceptors The Steamboat Drainage Interceptor Alternative proposes to intercept flow just downstream of the private railroad embankment at McCalley Alley. Flows in excess of the existing channel and roadway crossing capacity would be intercepted and conveyed west to Fifth Avenue. The storm drain system would continue south where the system would outfall into North St. Vrain Creek. This alternative proposes a lateral in Fourth Avenue from Stickney Avenue to North St. Vrain Creek to intercept local runoff in the lower portions of the Steamboat Valley Watershed.

F - Third Avenue Inlets and Storm Drain To mitigate flood hazards associated with the Third Avenue Watershed, a storm drain is proposed along Third Avenue from Cemetry Circle to North St. Vrain Creek. A lateral along Stickney Avenue is proposed to intercept flow from the east as it enters the residential area. Continuing the storm drain system south of Main Street would mitigate some of the flooding hazards within the South Second Avenue Watershed. Any flows in excess of the existing storm drain in the Third Avenue Watershed currently spill in the South 2nd Avenue Watershed impacting properties.

However, it is important to note that excavation in the northern end of the Third Avenue basin is likely to encounter rock and other earthwork complications. Depth of inlets and storm sewers will be limited by excavation cost, which limits the hydraulic head and increases pipe size. As pipe size increases, depth to cover the pipe must increase and become a costly design loop to determine a feasible storm sewer alignment.

G - Lower 3rd Avenue Inlet Excess surface flows on 3rd Avenue could be conveyed to a large storm sewer inlet at the existing storm sewers on the southeast corner of 3rd and Broadway. The existing grated inlets on the west flowline of 3rd Avenue at Main Street could be improved, but flows exceeding the capacity of those inlets will continue south on 3rd Avenue. The proposed lower 3rd Avenue inlets would capture flows from both gutter flowlines to maintain safe street capacity on the south end of 3rd Avenue during storm events.

The west flowline is also one of the locations where surface flows could be routed through a minor storm weir into a small volume water quality pond in the east end of Sandstone Park. The pond would treat 'first flush' or the initial runoff volume with larger flows continuing south.

H - Third Avenue Drainage Interceptors Similar to the Steamboat drainage alternative, the surface conveyance on Third Avenue could be improved instead of excavation and installation of inlets and pipes. The surface conveyance improvement contains flows within the Town ROW, gutters, and directs flow south to the river. This reduces many of the overflows into private property that exceed the existing roadway swales or smaller curbs. This alternative also reduces surface flows intercepted at cross street intersections that drain water into private property and complicate street flows entering Steamboat drainage.

This alternative does not resolve major storm overflows. The minor storms are handled with the interceptor gutters and cross pans. However, when those conveyance paths are at capacity, the overflow will continue down the natural topography. An inlet and pipe system could be sized to convey a much larger portion of the major storm event. But, as a relatively low cost alternative, the benefits are tangible.

I - Eastern Lyons - Second Avenue Gutter Interceptor Recent development within the Eastern Lyons watershed has increased the runoff from the hillside causing local flooding problems. For larger events the existing roadway conveyance and roadside swale along 2nd Avenue does not adequately convey the runoff south along 2nd Avenue instead diverting flow to the west into the Third Avenue Watershed. Formalizing the street conveyance by installing curb and gutters and cross pans in 2nd Avenue would encourage runoff from this watershed to continue south along 2nd Avenue and not impact properties the Third Avenue Watershed.

J - Eastern Lyons - Second Avenue Inlets and Storm Sewer To ensure no runoff diverts from the Eastern Lyons Watershed, inlets and a storm drain pipe can be installed along 2nd Avenue. The storm drain inlets and pipe in combination with curb and gutter would intercept the flow and convey the flow south to Main Street. South of Main Street the storm drain would convey runoff to the Second Avenue and Park Street intersection before turning east to the outfall location into the St. Vrain Creek.

K - Lyons Valley Inlet Improvements Runoff from the upper portions of the subwatershed sheet flows in a general northeast direction through the subdivision to St. Vrain Creek. The storm drain infrastructure installed with the development of Lyons Valley Park Subdivision is a minor drainage system and lacks capacity to convey major storm events. This alternative proposes to increases the storm drain along the existing alignment to convey the design flow for the 100-year storm.

L - Lyons Valley South Ditch Improvements The South Ledge Ditch located south of Lyons Valley Park Subdivision intercepts runoff from the subwatershed. Formalizing the ditch to convey stormwater east towards St. Vrain Creek would reduce the tributary area contributing to the flooding hazards of Lyons Valley Park Subdivision.

This alternative should be developed in coordination with the future development of Lyons Valley. A drainage feature around the south end of the currently platted lots would benefit the new construction as well as the existing homes in the neighborhood.

The greatest limitation of this alternative is the operation and maintenance of the irrigation ditch and the coordination with any future development. Breaches and overtopping of the existing ditch are likely to continue to occur given the earthern embankment construction of the ditch. As the platted future development moves into the final plan approval process, careful coordination should identify the benefits to both existing and future homes in the area. And, when the cost of perimeter surface water conveyance (i.e. swale) is compared to sizing interior storm inlets and pipes sized to safely capture and convey the offsite flows, the cost-benefit should resolve any further limitations of the concept.

M - Lyons Valley McConnel Drive Culvert The impervious area of the school campus leads to nuisance drainage issues along McConnel Drive. It is unclear how the stormwater runoff is treated within the school campus, but the roof drains and parking along the east side of the campus are direct discharge to the west gutter of McConnel Drive. On-site water quality and detention facilities, perhaps conversion of part of the irrigated turf areas, would collect, treat, and attenuate on-site discharges. A pond near the northeast corner of the site could connect to a new underground storm sewer tied into the Type R inlets at 2nd Avenue. This would move surface flow, particularly nuisance flows dribbling winter melt water that freezes overnight, into the on-site pond and underground, safely conveyed in a pipe system.

N - Ewald Ave - Corona Hill Diversion Ditch As witnessed in the 1994 event, the Ewald Avenue Watershed poses a significant flooding hazard to downstream properties within the watershed. High velocity runoff flow off Corona Hill can carry debris into the residential neighborhood. Intercepting the flow upstream of the development and conveying the flow to the south would prevent debris flow from impacting private properties. The diversion channel south of the development would require significant energy dissipation to prevent the discharge from reaching high velocities and eroding the hillside south of the development. The steep slopes along the hillside would make construction of any diversion channel difficult.

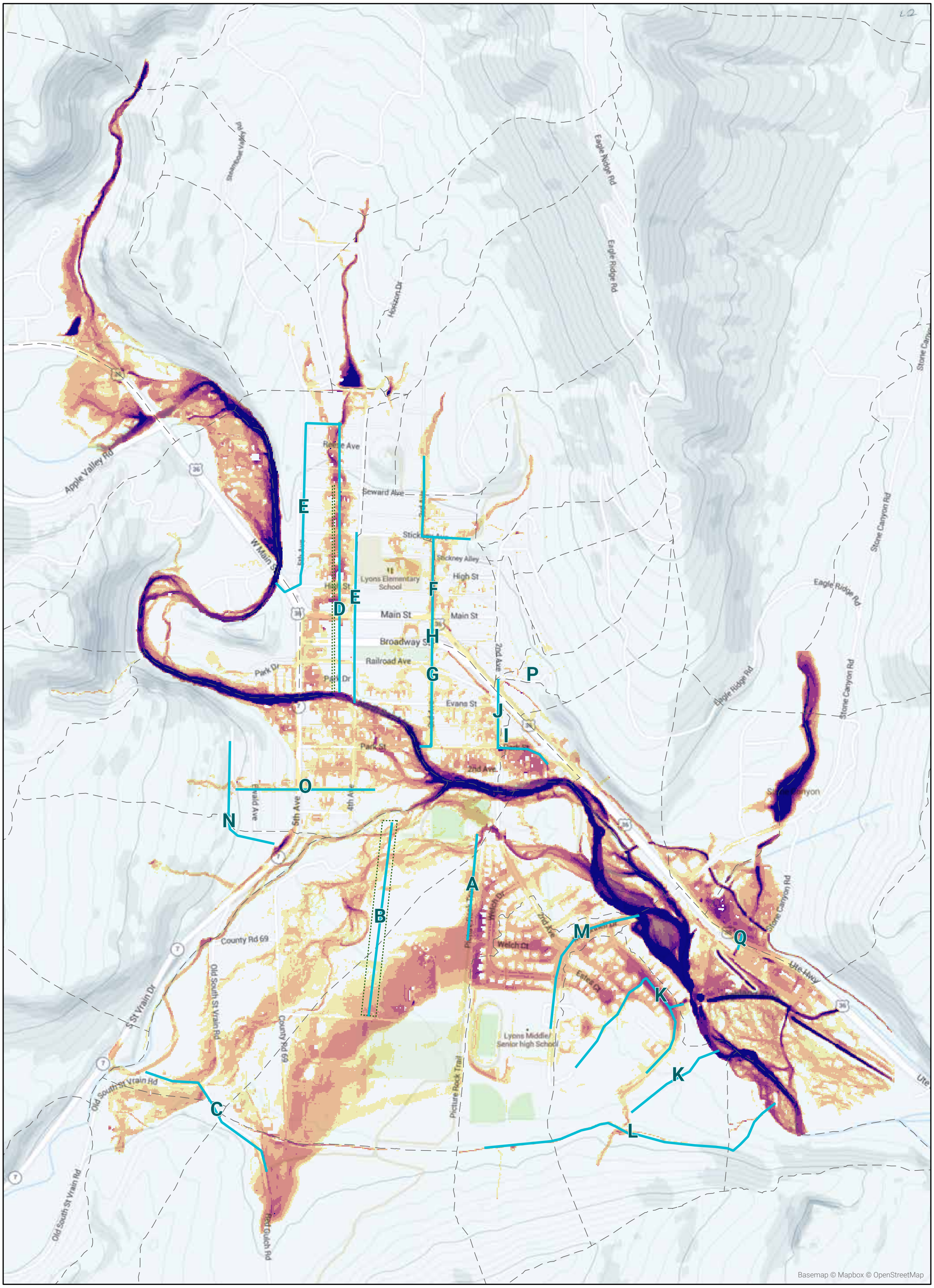
O - Ewald Ave - Corona Hill Street Inlets An alternative to intercepting flows upstream of the residential development is formalizing street conveyance and installing storm drain infrastructure along Prospect Road. The storm drain infrastructure in combination with curb and gutter improvements would confine the runoff from Corona Hill to the street limiting the impact to private properties. The storm drain system would continue east along Prospect Road to the confluence area between North and South St. Vrain Creek

P - 2nd Avenue – Kelling Drive Private Improvements There are past stormwater runoff events that have led to private property damages (fencing, landscaping, and structural flooding). Magnitude of the damages has not be investigated as part of this study. The subject properties, residential structures on the north side of Kelling Drive and commercial structures on the south side of Kelling Drive, are near the bottom of a steep southwestern facing slope. Runoff from the upstream property impervious area is controlled through downspouts, gutters, landscape swales, street gutters, and storm sewer systems.

The northern properties appear to have all or most of their foundations above adjacent grade, positive drainage away from the structure. However, additional property line swales could convey surface flows around the structures. The southern properties appear to have adverse drainage slopes near the building and could benefit from more formalized drain pans along top or toe of the retaining walls on the north side of the property. An existing grated inlet in the north flowline of Kelling Drive could be improved to increase surface water capture, but only reduces surface flows already in the street.

Support from the Town in terms of permitting, review, and easement terminology could resolve drainage issues in the vicinity of Kelling Drive. The installation of swales, inlets, pipes, moving existing outbuildings, and re-landscaping perimeter swales on each of the affected lots can be highly effective private improvements that mitigate the flood risks in this area. However, the work would be on private property and therefore require special agreements (easements, cost-sharing, access requirements, or code updates, etc.) for the Town to participate in design, construction, operation, maintenance, or financing. Therefore, the town's assistance could come in the form of coordinating the private efforts to ensure a comprehensive solution is achieved.

Q - Stone Canyon Outfall Improvements Downstream of Stone Canyon Road, private development has infringed on Stone Canyon Drainageway. The existing roadway crossing at Ute Highway lacks the capacity to convey the 100-year discharge without overtopping the roadway. A significant box culvert roadway crossing structure would be required to convey the 100-year discharge without overtopping. The conveyance of Stone Canyon Drainageway downstream of Stone Canyon Road to the St. Vrain Creek should be analyzed in further detail when the Eastern Corridor expansion is finalized.



Lyons Stormwater Masterplan

Figure 6-1: Project Alternatives

100-year Max Flow Depth (ft)

.5 1 2 3 4 5 6+

Alternative Easement

Alternative Structure

LYONS COLORADO

ICON ENGINEERING, INC.

Table 6-1: Cost Summary

Alt ID	Description	Capital	Easement / ROW	Engineering	Legal / Admin	Contract Admin / CM	Contingency	Total Capital Cost	Annual O-M Cost	50-Year O-M Cost
A	Red Hill Gulch Overflow Channel East	$435,644	$-	$65,347	$21,782	$43,564	$108,911	$675,248	$2,580	$81,073
B	Red Hill Gulch Overflow Channel West	$1,434,809	$200,328	$215,221	$71,740	$143,481	$358,702	$2,424,281	$16,752	$526,408
C	Red Hill Gulch Cut-Off Channel	$1,263,005	$500,000	$189,451	$63,150	$126,301	$315,751	$2,457,658	$2,302	$72,337
D	Steamboat Drainage Culvert Replacement	$2,994,801	$2,825,346	$449,220	$149,740	$299,480	$748,700	$7,467,287	$1,638	$51,472
E	Steamboat Drainage Interceptors	$382,800	$-	$57,420	$19,140	$38,280	$95,700	$593,340	$-	$-
F	Third Avenue Inlets and Storm Drain	$1,977,609	$-	$296,641	$98,880	$197,761	$494,402	$3,065,293	$1,638	$51,472
G	Lower Third Avenue Inlet	$963,061	$-	$144,459	$48,153	$96,306	$240,765	$1,492,744	$1,512	$47,512
H	Third Avenue Drainage Interceptors	$228,000	$-	$34,200	$11,400	$22,800	$57,000	$353,400	$-	$-
I	Eastern Lyons Second Avenue Gutter Interceptor	$120,564	$-	$18,085	$6,028	$12,056	$30,141	$186,874	$-	$-
J	Eastern Lyons Second Avenue Inlets and Storm Drain	$1,187,423	$-	$178,113	$59,371	$118,742	$296,856	$1,840,505	$2,583	$81,167
K	Lyons Valley Inlet Improvements	$1,568,145	$-	$235,222	$78,407	$156,815	$392,036	$2,430,625	$3,213	$100,964
L	Lyons Valley South Ditch Improvements	$742,627	$-	$111,394	$37,131	$74,263	$185,657	$1,151,072	$1,400	$43,993
M	Lyons Valley McConnell Drive	$933,962	$-	$140,094	$46,698	$93,396	$233,491	$1,447,641	$2,268	$71,269
N	Ewald Ave Corona Hill Diversion Ditch	$537,491	$-	$80,624	$26,875	$53,749	$134,373	$833,112	$290	$9,113
O	Ewald Ave Corona Hill Street Inlets	$811,845	$-	$121,777	$40,592	$81,185	$202,961	$1,258,360	$1,386	$43,553
P	2nd Avenue Kelling Drive Private Improvements	$-	$-	$4,250	$250	$500	$-	$5,000	$-	$-
Q	Stone Canyon Outfall Improvements	$887,133	$-	$133,070	$44,357	$88,713	$221,783	$1,375,056	$150	$4,714

7.0 Water Quality Improvements

Comprehensive stormwater management includes a wide variety of rainfall scenarios from exceedingly rare peak flow events to statistically average events to brief afternoon rain showers. The best plans acknowledge all phases of stormwater management and provide benefits throughout the watershed and throughout the range of recurrence intervals.

Constraints to this approach are clearly financial, the major capital improvement projects are expensive and the minor water quality BMPs can become costly pieces of infrastructure to maintain in working order. However, there are localized water quality improvements that can be implemented in certain watersheds in specific communities. These smaller scale projects fit within smaller towns well because a reasonable implementation density (i.e. participation percentage) is within reach of public-private partnerships.

Other larger scale water quality projects are just as important to the overall stream health. Larger ponds integrated into public spaces are a typical method of capturing a large water quality volume. Ordinances that require water quality implementation for new and redevelopment can be equally important.

7.1 Small Scale Water Quality Improvements

7.1.1 Tree Wells The downtown area could benefit from design of landscape and streetscape improvements that incorporate water quality treatment. One example of this multi-purpose streetscape is a tree-well water quality installation. Additional information is provided by the EPA's "Stormwater to Street Trees" informational guide.[3]

[3] http://www.davey.com/media/183712/stormwater_to_street_trees.pdf

The tree wells have an advantage of water quality treatment in the highly impervious main street area, but also have application in side street and park areas. In any case, the tree wells treat for water quality, but from a volumetric standpoint are a small scale solution.

7.1.2 Rain Gardens Another small scale option for targeted water quality is installation of rain gardens. Generally accepted as a means of treating roof top runoff from private property downspouts, there are applications for rain gardens in commercial and municipal applications. A commercial property or municipal building could route downspouts to a street side rain garden, with proper consideration for saturation of soils resulting impact on roadways, sidewalks, icing, and maintenance. A cul-de-sac or small parking area could be routed to an infiltration basin or rain garden for additional water quality treatment. Additional design and maintenance information is provided by UDFCD.[4]

[4] http://udfcd.org/wp-content/uploads/2014/07/T-03-Bioretention.pdf

7.1.3 Rainwater Harvesting Recent changes in state law (HB 1005) allow for private properties to harvest a small amount of rainwater from their rooftop for allowable uses (irrigation) on their property. Typically, a 55 gallon barrel or cistern is connected to roof downspouts to collect rainfall and snowmelt. Although rooftop runoff is not the largest source of stormwater pollution, it can still have a beneficial impact on urban water quality. The dust and wind blown litter that reaches rooftops can be captured in rain water harvesting systems. More importantly, the peak runoff events from the impervious surfaces are attenuated, or delayed, from entering the municipal stormwater system. This reduces the volume of stormwater treated by downstream systems.[5]

[5] http://extension.colostate.edu/topic-areas/natural-resources/rainwater-collection-colorado-6-707/

7.2 Large Scale Water Quality Improvements

7.2.1 Confluence Area Water Quality Pond At the time of this report, the ongoing confluence area and St. Vrain restoration projects are making improvements in and around the rivers. One area that could have an advantageous siting for a water quality pond is the east end of Prospect in the confluence area. If other project designs allow for a pond to be constructed in this area, the outlet could be configured to treat a water quality capture volume for the confluence area basin.

There are other water quality pond locations, but the confluence area was identified as the largest potential pond with urbanized runoff. The existing pond at Eagle Canyon could be studied for reconfiguration, but the impervious area is relatively low in that overall basin. Large water quality ponds along the northern side of Town near the river would treat the most urbanized stormwater runoff. However, a property and topographic review of the area could not identify areas large enough to capture a full water quality capture volume. Sandstone Park was the largest open space parcel, but would require significant grading and storm sewer installation that would significantly limit the park uses. Other upstream areas are available, but generally treat only the undeveloped portions of town.

7.2.2 Streambank Wetlands There are several good locations for water quality treatment along the St. Vrain, particularly downstream of Lyons Valley stormwater outlet structures. The side channels north and south of McConnell Drive as well as the Bohn Park outfall east of 2nd Avenue can treat stormwater runoff upstream of the St. Vrain main channel. Wetland plantings in a specifically designed low velocity channel can absorb pollutants conveyed through nuisance and first flush stormwater events, while allowing larger runoff events to pass through the channel. The streambank wetlands are similar to the St. Vrain restoration work upstream, but designed and managed on a smaller scale to adapt to the side tributary flows.

7.2.3 Pervious Pavers The reduction of impervious area is a direct means of increasing infiltration and interrupting the transmission of water borne pollutants in the urbanized watershed. For the Main Street and downtown areas, the addition of pervious pavers can be a good way to reduce impervious area. There are several candidate locations in parking areas, sidewalks, plaza areas that could infiltrate runoff before it reaches the curb and gutter system. However, there are also many lessons learned on maintenance of pervious pavement surfaces, specifically related to the winter environment and non-infiltrating soils of Colorado. The impact of a snow plow on pavers, expansion of clay soils creating ponding in pervious asphalt, or the freeze thaw action on pervious concrete surfaces are all documented issues. Ultimately, pervious pavement surfaces work well when combined with traditional pavement surfaces for high traffic, heavy load, and high maintenance pathways. The UDFCD has a good worksheet[6] describing the opportunities and limitations of pervious surfaces.

[6] http://udfcd.org/wp-content/uploads/2014/07/T-10-Permeable-Pavements.pdf

7.3 Outfall Water Quality

There is a separate category of water quality treatment that is particularly suited to the Town of Lyons – outfall water quality. Given the limitations on property, soils, and age of the infrastructure in Lyons the outfall pipes discharge directly into the rivers. In many ways, the outfall is the last option for water quality treatment in a particular watershed. Other communities along Front Range have investigated these same challenges and found a few specific treatment options that have unique water quality advantages. It takes a very unique topographic condition with a small tributary basin for these elements to meet a full water quality capture volume. But, in all cases, the advantage of intercepting even the 'urban drool' nuisance flows in a small, maintainable, vegetated basin improves even the perception of a standard metal culvert dribbling directly into the river.

A list of outfall water quality options are detailed in the appendix. Each option is suited for different outfall locations and uses. The infiltration basin concepts are essentially miniaturized infiltration basins with a design suitable for curbside maintenance. Whereas the level spreaders are more complicated structures diverting low flows into hillside infiltration laterals that can irrigate and help sustain native vegetation on the stream banks. These concepts require additional design based on site specific conditions, but can be a starting point for high visual impact outfall improvement projects.

8.0 Capital Improvements Plan

A Capital Improvements Plan (CIP) in its most basic sense includes a budget and a list of capital improvement projects. From those elements, the CIP is aligned with priorities of the governing agency, permitting, and construction logistics. This undoubtedly includes discussion relative to other master plans, comprehensive plans, current events, future plans, and historical performance. With priority projects identified, the budget and requisite financing discussions move forward. Internal and external funding sources are aligned with candidate projects, perhaps influencing the relative priorities. Finally, the plan is ratified and set forth in terms of planning, timing, and contracting.

This stormwater master plan prepares one element of a full Capital Improvements Plan – the list of projects and anticipated costs. All alternatives were evaluated during the master plan process, and cost estimates for each alternative were part of that evaluation. An engineer's recommendation highlights the alternatives that have the highest likelihood of implementation and therefore highest priority within the comprehensive list of alternatives. The Town can take the recommended alternatives and associated costs into further deliberations with the Town staff, consultants, and advisors to determine the best course of action. Essentially, this storm water master plan completes the first phase of a stormwater CIP. But from this solid starting point, the Town will be able to further evaluate the priority of stormwater improvements relative to other municipal projects. And, then determine how the essential stormwater needs can be funded and completed to increase the resilience of the entire community to flood hazard damages.

Cost estimates for the alternatives described in Section 6 were completed using the Urban Drainage and Flood Control District cost estimating spreadsheets. These spreadsheets are routinely used to evaluate the life cycle costs of stormwater infrastructure projects. The cost estimates are comprehensive estimates including design, construction and maintenance.

The appendix provides all supporting information for cost estimates and rankings of selected alternatives. In summary, the recommended stormwater improvements have a total life-cycle cost of $750M for the Town of Lyons.

9.0 System Maintenance

There are three primary components to system maintenance that can maximize the capacity and function of the existing, and proposed, storm sewer systems. Schedule, equipment, and monitoring are three of the key elements to operation and maintenance of a stormwater system.

The schedule of maintenance operations is a function of unpredictable storm events and routine dry-weather maintenance activities. A standard operating procedure for municipal work crews will include a schedule identifying which storm sewer systems get maintained at which time. At a minimum, every storm sewer inlet and outfall within Town right-of-way or open space property should be cleaned, patched, sealed, or otherwise maintained once a year. Although sediment and debris removal is the most common maintenance activity, patching of exposed reinforcing steel, clearing inlet grate frames to ease removal, mastic sealing joints at asphalt/concrete, sealing pipe joints, or tightening clamps holding flared end sections can all be effective, routine maintenance activities.

The equipment used in maintenance operations can be a significant initial cost, but ultimately reduce manpower requirements. Given the Town's variety of storm sewer inlet grates, pipe sizes, and culvert dimensions the equipment must be flexible and manage a variety of debris conditions. Fortunately, most of the Town's stormwater infrastructure is accessible from Town right-of-way. Therefore, a vacuum truck is a likely candidate for use in maintenance operations. Whether the truck is owned, leased, or rented for the year, month, or days of stormwater infrastructure maintenance is a decision for budgeting and policy. However, the ability to lift a grate, insert a flexible nozzle of varying size, and hydro-excavate the debris and sediment from the system is an effective means of clearing the system, increasing capacity, and extending the life of the components. The material is captured in an on-board tank and disposed at an in-town stockpile for processing or an offsite dump. Other equipment can be either too large to effectively clear the inlets and pipes (i.e. backhoe, skidsteer); or too small to complete the job in an efficient manner (i.e. handheld shovels and picks).

Monitoring the system becomes a preventative maintenance activity. Observation of the storm sewer system during small rain events, fire hydrant testing, or snow melt events can identify blockages or pipe failures before large spring storms cause bigger problems. Observation of the inlet systems can become part of a staff or consultant responsibility or become a down-time task for maintenance staff. The existing system inventory completed for this master plan includes photos of every element of the system as of the Summer of 2016. The database of photos can be helpful in determining the rate of deterioration, sedimentation, or failure since that benchmark time.

Other activities can be important to a System Maintenance program, but schedule, equipment, and monitoring cover the key aspects of sustaining the existing storm sewer system. A good maintenance program increases the overall resilience of the system through knowledge of the system limitations and tendencies. When large spring storm events clog the system with hail and leaf debris, maintenance staff with experience maintaining the system over time can quickly clear choke points with effective equipment and understand the impact on the system.

10.0 Storm Water Utility

This study evaluated the existing stormwater infrastructure and proposed new stormwater infrastructure to mitigate flood risk. To improve resiliency of the Town to flood disasters, there is an infrastructure solution but that requires a significant capital investment. Grants, joint projects, cost shares, and other large scale funding mechanisms will be useful for making those improvements. But a regular funding source for stormwater improvements is equally valuable. A stormwater fee can offset the routine costs of operation and maintenance of stormwater facilities that may otherwise be overlooked in the regular municipal budgeting process. The fee is as much a reminder for proper care of the existing infrastructure as it is a financial support to critical public facilities.

Stormwater fees can be controversial. A stormwater fee supported by defensible cost projections and allocated on a reasonable and controlled metric can be less controversial than broad based uniform fees. Details of a storm water utility implementation are beyond the scope of this master plan. However, additional information is provided here to start the conversation about implementing a mechanism to fund routine stormwater maintenance and projects.

Stormwater fees exist in many communities along Colorado's front range, some have been around for decades and others are more recently adopted.

10.1 What is a Stormwater Utility

The basic concept of a stormwater utility is to charge property owners for the amount of impervious area on their property in return for providing construction and maintenance of a stormwater system. Impervious area consists of manmade surfaces, which prevent the infiltration of rainfall and snowmelt into the ground, and include; buildings, driveways, parking lots, patios, commercial and industrial roads, private roads, and other "hard" surfaces. It can be estimated that runoff from these impervious surfaces increases 2 to 3 times from what the runoff was when the parcel was undeveloped. In addition, the water quality of the stormwater is worse than it was when the parcel was undeveloped.

Most stormwater utilities therefore have a fee based on the amount of impervious area on each parcel. This type of fee, if developed correctly, has been upheld in the courts of Colorado as a legal fee. Under the Tax Payers Bill of Rights (TABOR), a utility is termed an enterprise and is allowed if its meets the TABOR definition of an enterprise. Under this definition, an enterprise is a government owned business (similar to a water or sewer utility), which derives 90% or more of its revenue from non-governmental sources.

10.2 Stormwater Utility Fee Study Outline

Phase A - Feasibility Study. A data collection and litmus test for feasibility of the stormwater fee. This introduces the concept and builds the project team of consultants, staff, legal representatives, and engineers. This study results in a budget level estimate of fees that could be generated from several alternative mechanisms. (i.e. impervious area, rooftop area, lot size, etc.) The billing options are usually a key driving factor in the decision for how the fee is implemented. A town with existing billing systems for water and sewer may be able to easily add on a stormwater fee to the existing invoicing and collections systems. However, depending on billing systems or operational constraints, a separate invoice may need to be developed with its own schedule. These initial research results will then be compared to adjacent communities and discussed amongst the project team to determine a preferred approach. It is at this point the scope of the fee will be identified and limitations on how the funds can be spent will be drafted. This work should take between 3 and 4 months and not require any legislative action.

Phase B – Preliminary Plan. The initial preferences are formalized into a preliminary plan that can be presented to staff, councils, and the general public for review and comment. A municipal and public process can revise and adjust the fees, structure, and invoicing to fit the needs of the administration and general public. This preliminary plan will provide a more accurate estimate of impervious area or other metrics selected to quantify the fee across various properties. A selection of a rate structure and any classifications of properties (i.e. private, public, non-profit, etc.) can be made at this stage. Billing options will be finalized. And inherent to the more defined rate structure will be a discussion on potential credits to the fee (i.e. installation of rain barrels saves 10% of the fee per year, etc.). An implementation cost for new software, systems, adjustment of existing systems, or migration of existing processes can be estimated. This work could take as long as 6 months and may require public hearings or other administrative processes to document the public process.

Phase C – Implementation. This process finalizes the preliminary plan and results in the delivery of the first stormwater fee invoices to the community. Consequently, additional public outreach is necessary. Rate classes are finalized for single family, multi family, commercial, public, non-profit and other criteria. A financial outlook projecting revenues and expenditures should be developed to support the final adoption of the fee. Public works staff and consultants can be utilized to prioritize stormwater utility routine tasks, annual procedures, emergency operation allowances, and qualified special projects. A budget for routine tasks may involve a monthly allocation for 12 hours of vac truck time for stormwater inlet cleaning. An annual procedure may be an inventory of outfall conditions townwide. Emergency operation allowances can be an agreement that specifies how much of the annual stormwater fee budget is reserved for emergency repairs and operations. A list of qualifications for special projects that can use the stormwater fee can be developed to provide guidance for staff and consultants to use when calls on the stormwater fee are made for repair, rehabilitation or improvement of stormwater infrastructure. Before presentation of the fee to the legislative process, a trial run of the billing, time keeping, and tracking systems should be run. In some cases, this can be a staged implementation where the fee is instituted for public facilities at a trial rate of $1 per parcel. When those systems are functional, the whole project can be presented to council for adoption.

10.3 Use of Funds

There can be specific study of how the funds are used. How the funds are transferred within the Town's accounting system is important and includes how the Town staff records their expenses related to stormwater. The funds from a stormwater utility should be used primarily for projects benefitting existing development because the existing property owners pay the fees. New developers are expected to pay their share of major drainage projects serving new development, because they are responsible for the excess stormwater their development creates. New developments are responsible for the minor drainage infrastructure within their development such as street drainage systems, and minor system pipes and channels conveying water to the major drainage facilities.

10.4 Range of Nearby Stormwater Utility Fees

The existing stormwater utilities in nearby communities can provide a rough estimate for what a fee may be in Lyons. The range is from less than $1 to more than $11. Berthoud has a fee of approximately $2.50 per single family residential unit. Greeley, a much larger community, has a fee of just over $5 per single family unit. Loveland has a fee over $11 and has been in existence since the early 1980s. In general, the average around the front range of Colorado is about $5 per single family residential unit. However, the average can be misleading as the variables for how the fee is paid, used, and allocated changes for every community, land use, and sometimes by year.

11.0 Conclusion

There are several key concepts developed through the master plan study of local stormwater in the Town of Lyons.

11.1 Hydrology

Since the 2013 Floods, there has been a number of studies on the hydrology of major watersheds within the State and in particular along the Front Range of Colorado. This study utilized the latest software and methods to evaluate the basins immediately affecting the Town of Lyons. Evaluations of the minor (2 year), intermediate, and major (100 year) storms were completed. Analysis of the basins included a scenario for wild fire, with consideration for the vegetation density and impact of charred earth on stormwater runoff. This hydrologic analysis can be a useful starting point for public and private studies of future stormwater detention, capture, conveyance, as well as redevelopment of Town of Lyons watersheds.

11.2 Land Use

The land use assumptions for this study determined the land use within the 2016 Town boundary is effectively built out. In other words, when comparing the existing impervious area with the impervious areas assumed by the future land use maps, the increase is less than 10% of the impervious area. Therefore, this study utilized the future land use impervious area for hydrologic and hydraulic computations. This is a unique, but not atypical, condition for a smaller front range community with the topographic constraints of Lyons.

Consequently, development or redevelopment within the Town limits will not immediately invalidate the conclusions of this master plan.

11.3 Detention

Detention is a valuable means of slowing down stormwater, storing it for a short period of time, and releasing it in a controlled manner. However, the steep slopes and land use constraints in the Town have limited the feasibility of detention. Further evaluation of the detention facilities contemplated in the previous (1998) master plan identified several costly and complicated factors in the grading, stability, and available storage volume. Consequently, this master plan does not recommend significant benefit from detention facilities. However, if the Town expands into the upper elevations on the north side of Town development of new detention facilities should be recommended and carefully designed.

11.4 Water Quality

Stormwater master plans are quick to identify the major storm water risks and highlight the capital projects that can alleviate those risks. The nature of benefit-cost financing decisions forces communities to consider damages averted as a major element of the process. However, there are incremental damages that are more difficult to quantify with current technologies – water quality impairments for example. Therefore, it is prudent to consider the means and methods by which a community can improve water quality in the larger watersheds in which the community resides. This master plan has identified a number of smaller, achievable water quality improvements for the Town. The macro scale water quality ponds that can record an official water quality capture volume are as difficult to construct as the detention facilities on steep slopes in essentially built-out communities. Therefore, this master plan considers the greatest benefit to water quality will come through private, small-scale water quality installations throughout an engaged and caring community.

11.5 Public Outreach

This master plan was scoped to focus on engineering analysis to investigate the localized flood risk areas and evaluate mitigation alternatives. The public process was coordinated with Town staff and consultants and included presentations at the Utility and Engineering Board, Board of Trustees, and meetings with concerned citizens and neighbors. The public input to the process is essential in validating the assumptions used to model the flood risks throughout areas of complicated terrain, infrastructure, and changing ground conditions due to flood recovery and construction projects. Given the dynamic nature of flood recovery projects and the current economic environment, the public outreach for this particular master plan must continue through at least the planned completion of flood recovery projects in March 2018. At that time, the regional projects and plans on the North and South St. Vrain Rivers will be substantially completed. Evaluation and future implementation of the stormwater master plan will be influenced by completion of the major river projects. The online version of the master includes a 'click-to-comment' function that allows users to add stormwater master plan comments that get stored in a single database. This commenting function, as well as the Town's ongoing attention to stormwater related matters, ensures this stormwater master plan has a long shelf life.

11.6 Operation and Maintenance

Operation and maintenance is always a key element to any stormwater plan. When the CIP projects reach nearly impossible budget figures, or when the priorities for other municipal infrastructure out rank surface drainage improvements, or when the best projects don't get built for another 10 years, the operation and maintenance of the existing system continues. The Town's existing stormwater system is functional despite limited capacity and generally disconnected conveyance systems. Therefore, resilience to flood risks can still improve even if it is only maintenance activities on the existing system. Trash removal, debris clean up, sediment removal, pipe maintenance, inlet cleaning, gutter pan replacements, and other routine tasks are the preeminent recommendation of the stormwater master plan.

11.7 Next Steps

The next steps for the Town of Lyons stormwater master plan include a frequent and routine review of the projects, priorities, and plans set forth in this document. This document in and of itself cannot solve a stormwater problem, avert flood risk, or increase resilience in the community. But, when this plan is paired with other planning efforts, included in development discussions, use of the technical appendices in evaluation of future projects, or other citations this plan can add value and clarity to stormwater management discussions in the Town of Lyons for many years to come.

Appendix A - HYDROLOGY

Town of Lyons, CO
Hydrologic Analysis

Prepared on behalf of:
ICON Engineering, Inc.

Prepared by:
Wright Water Engineers, Inc.
Denver, Colorado

WWE

Wright Water Engineers, Inc.

October 2016

161-057.000

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1.0 INTRODUCTION

This introduction provides basic information including purpose and scope, mapping sources, and data collection. The remainder of this report represents the hydrologic analysis conducted on subbasins which are tributary to North St. Vrain Creek, South St. Vrain Creek, and St. Vrain Creek near the Town of Lyons, Colorado (Town).

1.1 Purpose and Scope

The intent of this report is to document the hydrologic analysis conducted by Wright Water Engineers, Inc. (WWE) to provide updated peak discharges for the 2-, 5-, 10-, 50-, and 100-year storm events for subbasins which are tributary to North St. Vrain Creek, South St. Vrain Creek, and St. Vrain Creek as they flow through the Town. This hydrologic analysis focused on the existing and future drainage conditions of the watershed that can be used to develop alternative drainageway planning concepts and prepare a preliminary design of improvements.

1.2 Mapping

Mapping used in the hydrologic analysis was based on 2011 LIDAR topography with 1-ft contour intervals provided by ICON Engineering, Inc. As a result of the September 2013 flood, there were significant changes in channels due to avulsion, scour, and deposition. However, these changes primarily affected channel and floodplain areas rather than upland areas that comprise the vast majority of subbasin drainage areas. The 2011 LIDAR data was found to be suitable for subbasin delineation and parameterization. Aerial mapping from Google Earth dated October 2015 was used to determine existing land use conditions and calculate subbasin imperviousness.

1.3 Data Collection

The following summarizes the information that was used as a reference for this hydrologic analysis:

- Town of Lyons, Boulder County, Colorado, Drainage Master Plan Final report, BRW, Inc., April 1998.

- Zoning District Map of the Town of Lyons, Colorado, King Surveyors, Inc., Readopted January 2009.
- 2010 Lyons Planning Area Map, Civil Resources, 2010.
- Urban Drainage and Flood Control District (UDFCD) Urban Storm Drainage Criteria Manual.

2.0 HYDROLOGIC ANALYSIS

This section of the report provides an overview of the hydrologic characteristics, calculations, and modeling used to develop the hydrology for the project area, as well as detailed descriptions of the design rainfall, subbasin characteristics, model input, model results, results, and comparisons with previous studies.

2.1 Project Area Description

The project area includes the subbasins tributary to the North Saint Vrain Creek, South Saint Vrain Creek, Red Hill Gulch, and Stone Canyon within the Town. The total drainage area studied is approximately 8.6 square miles.

Existing drainage in the area consists of mostly open channels with some storm sewers in urbanized areas in Town. Most of the Town's existing drainage infrastructure is undersized due to the increase in development within the Town during the 1990s. The existing conveyance system has the capacity to convey the nuisance flows, but it does not have the capacity to convey even the minor (5-year) storm events.

2.2 Previous Studies

Hydrology of watersheds running through the Town was previously studied by BRW, Inc. for the *Town of Lyons Drainage Master Plan Final Report* dated April 1998. This drainage master plan utilized the Colorado Urban Hydrograph Procedure (CUHP) and the Urban Drainage Storm Water Management Model (SWMM) to simulate developed stormwater runoff rates and volumes to identify problem areas. Additionally, the drainage master plan formulated a strategy to cost effectively upgrade the Town's flood control facilities and provided feasibility-level cost analyses to enable subsequent capital budgeting.

The hydrologic analysis conducted for the Town as a part of this effort was not "calibrated" to the hydrology defined in the BRW, Inc. drainage master plan. Comparisons were made to the unit rates of runoff from the BRW, Inc. drainage master plan, but the hydrologic analysis described in this report was conducted independently using the CUHP version 2.0. Both hydrologic studies utilized CUHP so differences between the BRW and WWE model results can be explained by physical factors (i.e. differences in subbasin imperviousness and the use of updated NOAA Atlas 14 precipitation data).

2.3 Hydrologic Model

To evaluate the latest version of CUHP (and other methods) and to determine the appropriate model inputs, WWE conducted a peak flow sensitivity analysis for a typical undeveloped subbasin near the Town using various hydrologic methods. This sensitivity analysis was conducted to determine which hydrologic method should be utilized for the Lyons stormwater master plan since Lyons is located outside of the UDFCD boundary and the hydrologic method to be used to estimate peak discharges is not limited to CUHP. The following lists the hydrologic methods that were utilized in this sensitivity analysis:

- United States Geologic Survey (USGS) Regional Regression Equations.
- Rational Method.
- CUHP 2005 Version 1.4.4 -- This is the current model used by UDFCD and has been used for over 40 years to estimate peak flows in the Denver metropolitan area.
- CUHP Version 2.0 -- Recently the UDFCD has determined that peak flows developed in recent hydrologic studies using CUHP 2005 version 1.4.4 deviated from statistical stream gage analysis across the District and created uncertainty with CUHP model results for some studies. Additionally, CUHP 2005 version 1.4.4 has not been calibrated with gage data since its inception in the 1970s with adjustments made in the 1980s. Therefore, UDFCD has recalibrated CUHP with updated rainfall and runoff with results tested against stream gage frequency analysis. However, it should be noted that during the recalibration of CUHP, there were no watersheds with an imperviousness less than 20

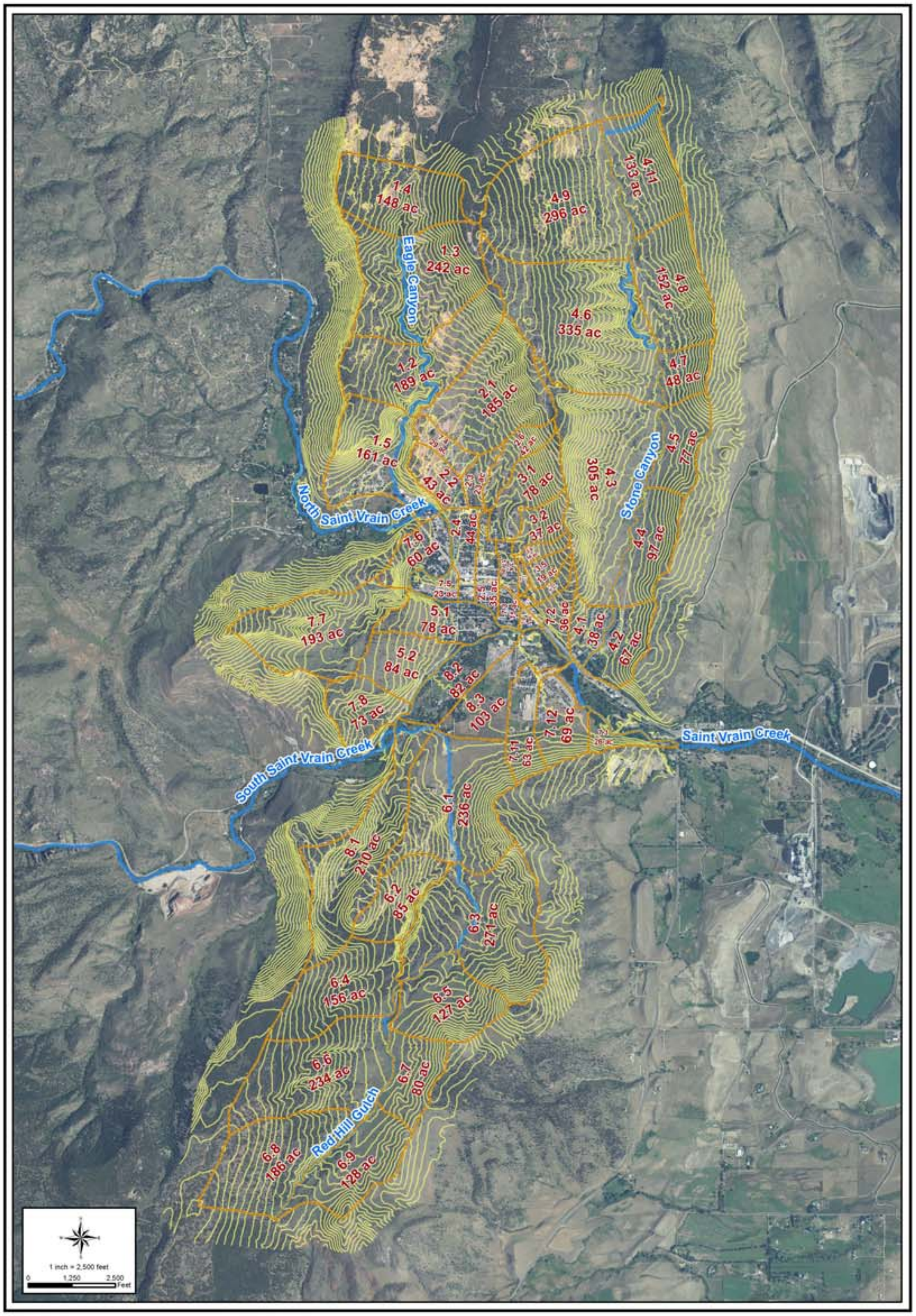
percent. Therefore, for subbasins with imperviousness below 20 percent, the peak flows are estimated using similar methodology used in CUHP 2005 version 1.4.4.

- HEC-HMS Model -- using Curve Number method.
- UDFCD Allowable Release Rates -- The UDFCD *Urban Storm Drainage Criteria Manual, Volume 2, Storage* chapter provides pre-development peak unit discharge rates for watersheds of various slopes and Hydrologic Soil Groups (HSGs) that are utilized to determine the maximum allowable 100-year release rates for a full spectrum detention facility.

Based on the results of the undeveloped subbasin peak flow sensitivity analysis, WWE recommended using CUHP version 2.0 for the hydrologic modeling for the Lyons stomwater master plan. The unit rates of runoff from CUHP version 2.0 were in the same range as those generated using the Rational Method and the UDFCD allowable release rates. The unit rates of runoff generated using CUHP 2005 version 1.4.4 were higher than any of the other hydrologic methods which may overestimate the peak flows for the Town. The regional regression equations significantly underestimate the unit rates of runoff when compared to the other hydrologic model methods.

2.4 Subbasin Delineation

Subbasins were delineated using the 2011 LIDAR and associated 1-ft contours. There is a total of 53 subbasins within the project area. The undeveloped subbasins located higher up in the watersheds are larger in size than the subbains within the urbanized Town. Subbasin sizes range from 3 acres to 335 acres. Figure 1 provides an overview of the subbasins.



WRIGHT WATER ENGINEERS, INC.

TOWN OF LYONS DRAINAGE BASIN MAP
REVISED - NOVEMBER 30, 2016
40-FT CONTOURS DERIVED VIA
LIDAR (2011)

PROJECT NO. 161-057.000

FIGURE 1

Figure 1. Subbasin Overview Map

2.5 Design Rainfall

The design rainfall for the project was derived using the one-hour precipitation depths from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14. One-hour point precipitation depths were based on the centroid of the entire project area and were recorded for the 2-, 5-, 10-, 50-, and 100-year recurrence intervals. Point precipitation depths for varying elevation within the project area were identified, but point precipitation depth adjustments due to elevation were not necessary since the difference in the one-hour precipitation depths by elevation was less than 0.1 inches. Using the one-hour precipitation depth, CUHP calculates the incremental depth for each time increment from 5 to 120 minutes. Due to the smaller sizes of subbasins, precipitation depth-area reduction factors were not utilized. Table 1 summarizes the design rainfall depths for various recurrence intervals.

Table 1. Design Rainfall Depths (inches) for Recurrence Intervals

Storm Duration	2-Year	5-Year	10-Year	50-Year	100-Year
One-Hour	0.77	1.05	1.33	2.23	2.71

2.6 CUHP Input Parameters

The following summarizes the input parameters utilized in CUHP version 2.0. Using GIS, subbasin characteristics were calculated and input into CUHP. The summary of CUHP input parameters for existing conditions and future conditions for the 2-, 5-, 10-, 50-, and 100-year recurrence intervals is provided in Appendix A.

2.6.1 Length to Centroid

The length to centroid is calculated as the distance from the design point of the subbasin along the main drainageway path to the subbasin's centroid. Figure 2 provides an overview of the longest flow paths. The subbasin centroids are identified on the figure with the red and white dots. The length to the centroid was measured from the downstream design point of the subbasin to the centroid along the flow path.

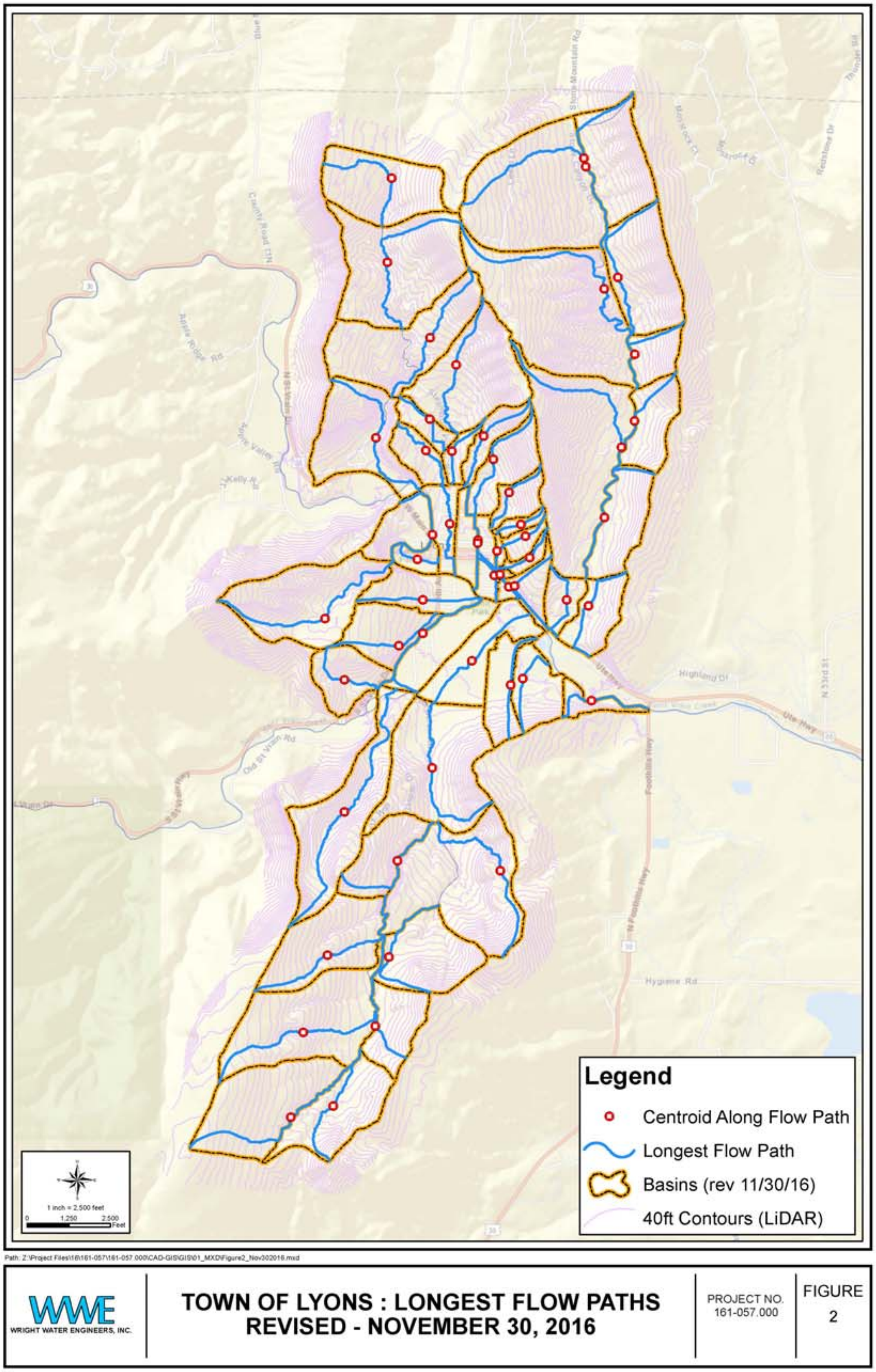


Figure 2. Subbasin Longest Flow Paths

2.6.2 Length

The length is the distance from the downstream design point of the subbasin along the main drainageway path to the furthest point on the subbasin boundary. The length was calculated based on the longest flow path (blue line) shown in Figure 2.

2.6.3 Slope

The slope is the length-weighted, corrected average slope of the subbasin in feet per foot. Per the UDFCD *Urban Storm Drainage Criteria Manual, Volume 1, Chapter 6 Runoff*, there are natural processes at work that limit the time to peak of a unit hydrograph as a natural stream or vegetated channel becomes steeper. To account for this phenomenon, it is recommended that the slope used in CUHP for stream and vegetated channels be adjusted. Table 2 provides a summary of the measured subbasin slopes compared to the adjusted slope for use in CUHP per Figure 6-4 of the UDFCD *Urban Storm Drainage Criteria Manual*.

Table 2. CUHP Subbasin Slope Adjustment

Subbasin	Measured Slope (ft/ft)	Adjusted Slope for use in CUHP (ft/ft)
1.2	0.19	0.06
1.3	0.15	0.06
1.4	0.12	0.06
1.5	0.11	0.06
2.1	0.20	0.06
2.2	0.10	0.058
2.3	0.11	0.06
2.4	0.03	0.03
2.5	0.04	0.04
2.6	0.22	0.06
3.1	0.19	0.06
3.2	0.22	0.06
3.3	0.12	0.06
3.4	0.04	0.04
3.5	0.24	0.06
3.6	0.20	0.06
3.7	0.03	0.03
3.8	0.26	0.06
4.1	0.10	0.058
4.11	0.14	0.06
4.2	0.09	0.057
4.3	0.10	0.058
4.4	0.09	0.057
4.5	0.15	0.06
4.6	0.11	0.06
4.7	0.16	0.06
4.8	0.16	0.06
4.9	0.12	0.06
5.1	0.11	0.06
5.2	0.13	0.06
6.1	0.11	0.06
6.2	0.17	0.06
6.3	0.15	0.06
6.4	0.14	0.06
6.5	0.16	0.06
6.6	0.10	0.058
6.7	0.10	0.058
6.8	0.12	0.06
6.9	0.13	0.06
7.1	0.10	0.058
7.11	0.14	0.06
7.12	0.15	0.06
7.2	0.10	0.058
7.3	0.03	0.03
7.4	0.09	0.057
7.5	0.003	0.003
7.6	0.02	0.02
7.7	0.17	0.06
7.8	0.14	0.06
7.9	0.03	0.03
8.1	0.11	0.06
8.2	0.01	0.01
8.3	0.02	0.02

2.6.4 Percent Imperviousness

The percent imperviousness model input was determined based on land use and soil types found in each subbasin. Land use was determined by compiling information from the 2009 Zoning District Map, 2010 Lyons Planning Area Map, and by ground-truthing the land cover based on an October 2015 aerial image from Google Earth. Each land use category was assigned a percent imperviousness with guidance from Chapter 6 – Runoff of the UDFCD *Urban Storm Drainage Criteria Manual*. Table 3 outlines the land use categories and the corresponding percent imperviousness. In addition to the land use categories found in Table 3, Boulder County Open Space land use category represented a large amount of many subbasins. Soil types mapped using the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey were assigned a percent imperviousness based on drainage and runoff class and area weighted within each subbasin. (See Appendix B for detailed soil descriptions). Table 4 displays the soil types used to calculate imperviousness for the Boulder County Open Space land use category.

Table 3. Land Use Categories and Corresponding Percent Imperviousness

Land Use Category	UDFCD Vol. 1 Table 6-3 Equivalent	Lyons Percentage Imperviousness
Agriculture	Undeveloped - Greenbelts, agricultural	0.20
Business	Business - Downtown areas	0.95
Park	Parks, cemeteries	0.10
Municipal Facilities	Business - Suburban areas	0.75
Estate Residential[1]	Residential - Single Family: 2.5 acres or larger	0.35
Low Density Residential[1]	Residential - Single Family: 0.25-0.75 acres	0.75
Medium Density Residential[1]	Residential - Single Family: 0.75-2.5 acres	0.85
Commercial	Business - Downtown areas	0.95
Employment Area	Business - Downtown areas	0.95
Commercial Entertainment	Business - Downtown areas	0.95
Light Industrial	Industrial - Light areas	0.80
General Industrial	Industrial - Heavy areas	0.90

[1] Land use category corresponds to the 2010 Lyons Planning Area Map, although the description and corresponding lot size is not representative of what is observed in aerial imagery. WWE revised the percent imperviousness to be more representative of what is observed through imagery and on the ground.

Table 4. Soil Types Found in Boulder County Open Space Land Use Category

Soil Unit	HSG	Soil Type	Drainage Class	Runoff Class	Percent Rock Outcrop	Percent Imperviousness
MdB	A	sandy loam	well	very low		2
Nh	B	loam	poorly	very low		2
Cu	A	gravelly sandy loam	excessively	low		5
NnB	C	sandy clay loam	well	medium		8
SmF	C	stony loam	well	high	10	10
BaF	D	very stony sandy loam	well	very high	10	10
PrF	D	very stony loamy fine sand	well	very high	35	35
Ro	D	unweathered bedrock	N/A	very high	100	100

Future imperviousness was determined by comparing the land use in the 2010 Lyons Planning Area Map to a 2015 Google Earth image and noting which areas of the Town reflected current zoning and which areas may be further developed based on the planning map. The directly connected impervious area was set at level zero to represent "standard practice," meaning impervious surfaces are not designed to drain over grass buffer strips or other pervious surfaces before reaching a stormwater conveyance system.

2.6.5 Maximum Depression Storage

The maximum pervious depression storage was set to the recommended value of 0.4 inches for wooded areas and open fields. The maximum impervious depression storage was set to the recommended value of 0.1 inches. No adjustments were made to these recommended values.

2.6.6 Horton's Infiltration Parameters

Soils data was obtained from USDA NRCS Soil Survey Geographic Database for the project area which classified the soils into HSGs. Figure 3 shows an overview of the HSGs for each of the subbasins. Additional soils mapping was obtained from the USDA NRCS Web Soil Survey which is provided in Appendix B.

The HSG A soils are colluvial land type soil. According to the colluvial land soil description, the depth to restrictive feature is 2 to 60 inches to lithic bedrock. Because of the underlying bedrock, it was assumed that the HSG A soils would have the drainage characteristics of HSG B soils.

The initial rate, final rate, and decay coefficient for the Horton's infiltration parameters were based on the recommended values in CUHP. The Horton's infiltration parameters were weighted based on the percentage of each soil type within each subbasin. Table 5 summarizes the Horton's infiltration parameters utilized in the analysis.

Table 5. Horton's Infiltration Parameters

Hydrologic Soil Group	Infiltration (inches per hour)		Decay Coefficient
	Initial - f_i	Final – f_o	
A/B	4.5	0.6	0.0018
C	3.0	0.5	0.0018
D	3.0	0.5	0.0018

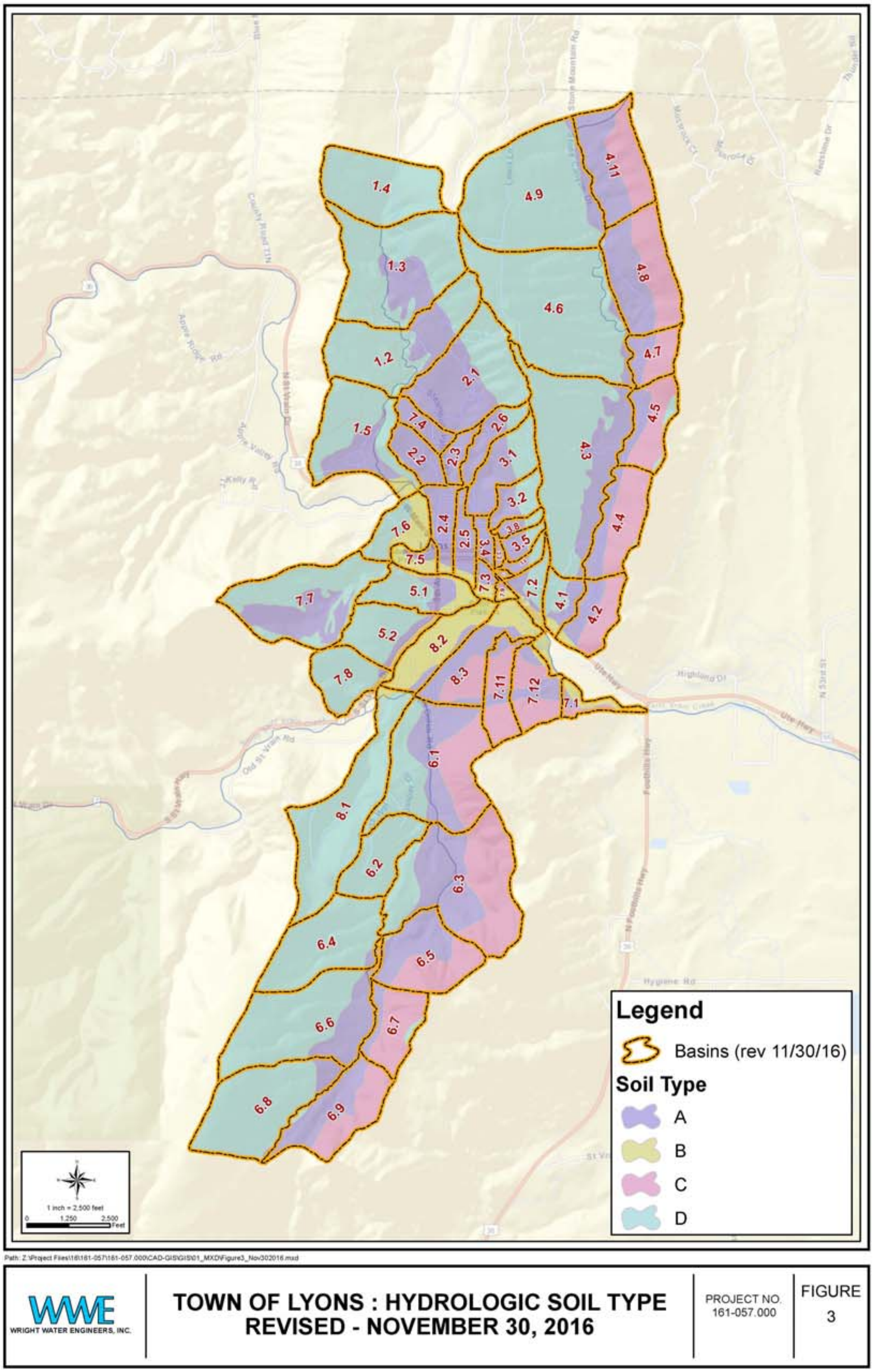


Figure 3. Soils Data

2.7 CUHP Output

The hydrologic analysis was conducted for both existing conditions and future conditions. The 100-year peak discharges from CUHP version 2.0 for both conditions are presented in Table 6. CUHP output for other recurrence intervals is provided in Appendix A.

Although this hydrologic analysis did not calibrate peak flows to the previous Town of Lyons Drainage Master Plan Final Report prepared by BRW, the CUHP unit rates of runoff were compared with the previous study unit rates of runoff for subbasins that were similarly delineated. In some cases, the unit rates of runoff are similar, but there are cases where the unit rates of runoff differ. These differences are primarily due to physical differences in input assumptions (imperviousness, HSGs, etc.).

Table 6. CUHP Output, 100-Year

Subbasin	Existing Conditions 100-Year Peak Discharge (cfs)	Existing Conditions Unit Rate of Runoff (cfs/ac)	Future Conditions 100-Year Peak Discharge (cfs)	Future Conditions Unit Rate of Runoff (cfs/ac)
1.2	408	2.16	408	2.16
1.3	534	2.21	534	2.21
1.4	403	2.72	403	2.72
1.5	449	2.79	449	2.79
2.1	306	1.65	306	1.65
2.2	97	2.27	97	2.27
2.3	59	2.55	59	2.55
2.4	116	2.61	116	2.61
2.5	102	2.89	102	2.89
2.6	54	1.29	54	1.29
3.1	142	1.83	167	2.15
3.2	92	2.49	92	2.49
3.3	21	3.68	21	3.68
3.4	52	3.05	52	3.05
3.5	32	1.64	32	1.64
3.6	20	1.34	20	1.34
3.7	12	4.55	12	4.55
3.8	31	2.18	31	2.18
4.1	102	2.66	128	3.32
4.11	183	1.38	183	1.38
4.2	113	1.69	114	1.70
4.3	386	1.27	386	1.27
4.4	128	1.32	128	1.32
4.5	117	1.52	117	1.52
4.6	526	1.57	526	1.57
4.7	70	1.47	70	1.47
4.8	227	1.49	227	1.49
4.9	575	1.94	575	1.94
5.1	171	2.19	208	2.67
5.2	194	2.33	194	2.33
6.1	387	1.64	393	1.67
6.2	187	2.18	187	2.19
6.3	370	1.37	370	1.37
6.4	186	1.19	186	1.19
6.5	213	1.68	213	1.68
6.6	233	1.00	233	1.00
6.7	176	2.21	176	2.21
6.8	252	1.35	252	1.35
6.9	216	1.69	216	1.69
7.1	25	0.97	28	1.09
7.11	161	2.55	161	2.55
7.12	199	2.86	234	3.37
7.2	70	1.94	70	1.94
7.3	50	3.29	50	3.29
7.4	69	2.37	69	2.37
7.5	26	1.16	26	1.16
7.6	134	2.25	134	2.25
7.7	359	1.86	359	1.86
7.8	144	1.97	145	1.99
7.9	24	3.66	24	3.66
8.1	315	1.50	315	1.50
8.2	93	1.13	93	1.13
8.3	136	1.32	136	1.32

2.8 Hydrograph Routing

WWE developed the hydrograph routing network based on field reconnaissance, survey of the existing storm sewer network within Town, and the BRW, Inc. drainage master plan using EPA SWMM. The routing network in EPA SWMM includes: nodes (junctions and dividers), conduits (including overflow or diverted links), storage units, storage outlets, and outfalls. The model input parameters for nodes include: node identifier, invert elevation, maximum node depth, and overflow or diverted link identifier. Input parameters for conduits include: conduit identifier, upstream and downstream node identifiers, shape (e.g. trapezoidal, circular, rectangular, etc.), length, bottom width, side slopes, roughness coefficient, number of barrels, and inlet/outlet offset depths. Input parameters for storage units include: storage unit identifier, invert elevation, maximum depth, and a stage-area relationship. Input parameters for storage outlets include: outlet identifier, upstream and downstream node identifiers, and a stage-discharge relationship. Input parameters for outfalls include the outfall identifier and invert elevation. Input parameters for the SWMM model are provided in Appendix C.

2.8.1 SWMM Node Input Parameters

Node identifiers in SWMM are synonymous with the subbasin IDs. Invert elevations were determined using the 2011 LIDAR data. In some instances, a divider was used to allow the flow to be routed through the existing storm sewer system but when the capacity of the storm sewer is exceeded, the water overflows into the street (along 2nd Avenue south of E. Main Street and near the intersection of Main Street and E. Main Street).

2.8.2 SWMM Conduit Input Parameters

For the drainage basins located outside of Town, transects of the drainage channels were generated using the 2011 LIDAR and a representative channel cross-section was input into the SWMM model. The manning's roughness coefficient for these undeveloped drainage basins was estimated to be 0.035 to represent channels with some weeds and stones.

Within the developed areas, characteristics of the drainage facilities were based on survey of the existing storm sewer system, field reconnaissance, and sizing the channels so that the flow could adequately be conveyed to the outfall. Between 5th Avenue and 4th Avenue, there is an existing drainage ditch that varies in width and depth but is enclosed downstream to accommodate development over the ditch. For the purposes of the SWMM model, it was assumed to have a uniform width and depth. There is a small roadside swale with intermittent driveway and roadway culverts along the west side of 3rd Avenue. However, the swale and culverts have such limited capacity and during large storm events, the water would flow down 3rd Avenue. At 3rd Avenue and Main Street there is a 30" reinforced concrete pipe that diverts flow from 3rd Avenue to the southeast along E. Main Street. During large storm events, the flow continues down within E. Main Street, which was modeled as an open channel, until it discharges into the St. Vrain Creek. South of E. Main Street along 2nd Avenue there is a storm sewer system consisting of 18-inch, 12-inch, and 15-inch corrugated metal pipe which discharges into the St. Vrain Creek. This storm sewer system was modeled as a 12-inch pipe in the SWMM model.

There are many subbasins which are direct flow areas into the North St. Vrain Creek, South St. Vrain Creek, or St. Vrain Creek. Therefore, the conduits for these subbasins were modeled as "dummy" conduits.

2.8.3 SWMM Storage Input Parameters

There is an existing detention pond located within Subbasin 1.5. The stage-area relationship was taken from the BRW, Inc. drainage master plan, as well as the stage-discharge relationship for the outlet. Although there may be inadvertent storage and/or privately owned detention elsewhere within the project area, no additional detention ponds were modeled for the existing conditions.

2.8.4 SWMM Output

The SWMM routing was conducted for both existing conditions and future conditions. The 100-year peak discharges at all of the outfalls from SWMM for both conditions are presented in Table 7. SWMM output for other recurrence intervals is provided in Appendix C.

Table 7. SWMM Output, 100-Year

SWMM Outfall Name	Routed Subbasins	Receiving Water	Existing Conditions 100-Year Peak Discharge (cfs)	Future Conditions 100-Year Peak Discharge (cfs)
StoneCanyonSt.VrainOUT	4.9, 4.11, 4.6, 4.8, 4.7, 4.3, 4.5, 4.4, 4.1, 4.2	St. Vrain Creek	2356	2361
EagleCanyonN.St.VrainOUT	1.4, 1.3, 1.2, 1.5	North St. Vrain Creek	1716	1716
RedHillGulchS.St.VrainOUT	6.8, 6.9, 6.6, 6.7, 6.4, 6.5, 6.2, 6.3, 6.1	South St. Vrain Creek	2198	2203
Sub2.4N.St.VrainOUT	2.1, 2.2, 7.4, 2.3, 2.4	North St. Vrain Creek	682	682
Sub7.2St.VrainOUT	3.1, 3.2, 2.5, 3.4, 3.3, 7.2	St. Vrain Creek	581	611
Sub7.3St.VrainOUT	7.3	St. Vrain Creek	50	50
Sub7.7N.St.VrainOUT	7.7	North St. Vrain Creek	359	359
Sub7.8S.St.VrainOUT	7.8	South St.Vrain Creek	144	145
Sub5.1N.St.VrainOUT	5.1	North St. Vrain Creek	171	208
Sub7.5N.St.VrainOUT	7.5	North St. Vrain Creek	26	26
Sub8.2St.VrainOUT	8.2	St. Vrain Creek	407	407
Sub7.1St.VrainOUT	7.1	St. Vrain Creek	378	414
Sub7.6N.St.VrainOUT	7.6	North St. Vrain Creek	134	134

3.0 WILDFIRE ANALYSIS

Post-wildfire flooding was evaluated for the subbasins tributary to the North St. Vrain Creek, South St. Vrain Creek, and St. Vrain Creek near the Town based on forest coverage determined from aerial imagery inspection. Beetle kill mapping from an aerial detection survey performed by the U.S. Forest Service was reviewed; however, the trees in this area do not exhibit signs of beetle kill. The purpose of this modeling exercise was to illustrate how peak discharges could potentially temporarily increase following a wildfire. This analysis is intended to provide the Town of Lyons with an order of magnitude approximation of potential wildfire effects on hydrology. Post-wildfire hydrology is typically analyzed using the Curve Number (CN) method (USDA, 2016). For this post-wildfire flood scenario, the watershed was assumed to experience moderate burn severity since the forest coverage in these watersheds is not extremely dense. The CN WWE assigned to a moderate burn severity was an 89, which is consistent with the CN developed by WWE in other post-wildfire hydrology assessments, including the Boulder County Fourmile wildfire in 2010, and the newly released Hydrology Technical Note No. 4, Hydrologic Analyses of Post-Wildfire Conditions, issued by the NRCS in August 2016.

Three representative subbasins, each with different watershed slopes, were modeled in HEC-HMS using existing condition (pre-wildfire) curve numbers as well as post-wildfire curve numbers. These modeling scenarios provide a relative increase in the unit rate of runoff for post-wildfire conditions. Table 8 provides the average factors of increase of the unit rates of runoff for existing, pre-wildfire conditions to post-wildfire conditions.

Table 8. Average Factor of Increase in Unit Rate of Runoff from Existing, Pre-Wildfire Conditions to Post-Wildfire Conditions

Recurrence Interval	Average Factor of Increase
2-yr	11
5-yr	5
10-yr	3
50-yr	2
100-yr	2

Each subbasin was evaluated for forest cover and assigned an approximate percent coverage found in Table 2. Subbasins that are not displayed in Table 9 were either in town, and therefore have minimal potential to experience wildfire, or do not have notable forest coverage. The peak discharge resulting from a wildfire burned subbasin is dependent on the forest coverage in each basin. In other words, the 2-year event may only increase the peak discharge in a subbasin with 20 percent forest coverage by approximately a 2.2 factor of increase (or about two times the existing condition peak discharge).

Table 9. Approximate Percent Coverage of Forest for Forested Subbasins

Subbasin with Forest Coverage	Percent Cover
1.2	20
1.3	30
1.4	80
4.3	10
4.6	20
4.9	50
6.1	20
6.2	70
6.3	20
6.4	90
6.6	80
6.8	70
6.9	10
8.1	50

The results in this evaluation provide useful information on the potential magnitude of hydrologic effects of burn areas in this watershed. The unit rate of runoff average factors of increase can be applied to the existing, pre-wildfire unit rates of runoff generated from the CUHP modeling to determine the potential increase in runoff after a wildfire. Changes in hydrology due to wildfires are temporary in nature and decrease back to pre-burn levels over periods of time ranging from 5 to 10 years or more; however, changes in runoff and volumes in the years immediately following a wildfire can be extreme.

Mud and debris flows can be triggered by as little as 0.25 inches of rain in 30 minutes on steep, burned slopes (WWE, 2011). Mud and debris flows are most common in smaller tributaries, but some "bulking" would be expected even on the main stems due to ash, sediment, and debris. In addition, debris damming and subsequent breaching (which are not accounted for in the modeling) can significantly increase peak discharges in post-wildfire floods. WWE did not account for sediment bulking in this hydrologic analysis, and additional analysis would be needed to determine approximate bulking factors for different reaches. Debris damming and breaching also was not evaluated as a part of this study. If there are high risk locations that could be affected by this phenomenon in Town, additional analysis using dam break routines could be used to estimate potential peak discharges.

This post-wildfire flooding analysis is just a representative scenario. Additional studies could be performed to evaluate different burn area scenarios based on factors including locations of key infrastructure in the watershed, applying USGS debris flow regression equations to specific subbasins, varying burn area size and severity, and other considerations discussed above.

4.0 CONCLUSIONS

This effort to develop updated hydrology for subbasins tributary to the North Saint Vrain Creek, South Saint Vrain Creek, Red Hill Gulch, and Stone Canyon within the Town utilizes an updated hydrologic model than the model that was utilized in the previous hydrologic study. Results of this hydrologic analysis provide reasonable estimates of peak discharges that can be used to develop alternative drainageway planning concepts and prepare a preliminary design of improvements.

5.0 REFERENCES & SOURCES OF DATA

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APPENDIX A

CUHP INPUT AND OUTPUT

EXISTING CONDITIONS

2-YEAR

Existing Conditions: 2-Year Input

Summary of CUHP Input Parameters (Version 2.0.0)

								Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	**SWMM Node/ID**	**Raingage Name/ID**	**Area (sq.mi.)**	**Dist. to Centroid (miles)**	**Length (miles)**	**Slope (ft./ft.)**	**Percent Imperv.**	**Pervious (inches)**	**Imperv. (inches)**	**Initial Rate (in./hr.)**	**Final Rate (in.hr.)**	**Decay Coeff. (1/sec.)**	**DCIA Level**	**Dir. Con'ct Imperv. Fraction**	**Receiv. Perv. Fraction**	**Percent Eff. Imperv.**
1.2	Sub1.2	2-YEAR	0.295	0.498	1.021	0.060	35.7	0.40	0.10	3.34	0.52	0.0018	0.00	0.71	0.19	32.13
1.3	Sub1.3	2-YEAR	0.378	0.498	1.137	0.060	35.6	0.40	0.10	3.30	0.52	0.0018	0.00	0.71	0.19	32.13
1.4	Sub1.4	2-YEAR	0.231	0.308	0.798	0.060	37.7	0.40	0.10	3.00	0.50	0.0018	0.00	0.75	0.19	34.65
1.5	Sub1.5	2-YEAR	0.251	0.510	1.073	0.060	55.6	0.40	0.10	3.51	0.53	0.0018	0.00	0.88	0.25	52.98
2.1	Sub2.1	2-YEAR	0.290	0.511	0.954	0.060	24.3	0.40	0.10	3.83	0.56	0.0018	0.00	0.49	0.15	20.05
2.2	Sub2.2	2-YEAR	0.067	0.273	0.545	0.058	41.5	0.40	0.10	4.45	0.60	0.0018	0.00	0.81	0.20	37.85
2.3	Sub2.3	2-YEAR	0.036	0.194	0.471	0.060	50.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.85	0.23	47.34
2.4	Sub2.4	2-YEAR	0.069	0.403	0.684	0.030	75.1	0.40	0.10	4.49	0.60	0.0018	0.00	0.93	0.32	72.72
2.5	Sub2.5	2-YEAR	0.055	0.279	0.667	0.040	75.9	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	73.57
2.6	Sub2.6	2-YEAR	0.065	0.342	0.705	0.060	21.2	0.40	0.10	4.12	0.57	0.0018	0.00	0.42	0.13	16.82
3.1	Sub3.1	2-YEAR	0.121	0.403	0.838	0.060	33.4	0.40	0.10	3.91	0.56	0.0018	0.00	0.67	0.18	29.31
3.2	Sub3.2	2-YEAR	0.058	0.267	0.529	0.060	47.3	0.40	0.10	3.74	0.55	0.0018	0.00	0.84	0.22	44.26
3.3	Sub3.3	2-YEAR	0.009	0.106	0.159	0.060	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	73.44
3.4	Sub3.4	2-YEAR	0.026	0.215	0.369	0.040	77.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.32	75.48
3.5	Sub3.5	2-YEAR	0.030	0.146	0.320	0.060	14.3	0.40	0.10	3.99	0.57	0.0018	0.00	0.29	0.11	10.60
3.6	Sub3.6	2-YEAR	0.023	0.208	0.410	0.060	22.1	0.40	0.10	3.76	0.55	0.0018	0.00	0.44	0.14	17.97
3.7	Sub3.7	2-YEAR	0.004	0.034	0.076	0.030	81.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.33	78.99
3.8	Sub3.8	2-YEAR	0.022	0.155	0.330	0.060	38.3	0.40	0.10	3.94	0.56	0.0018	0.00	0.77	0.19	34.69
4.1	Sub4.1	2-YEAR	0.060	0.280	0.531	0.058	52.5	0.40	0.10	3.75	0.55	0.0018	0.00	0.86	0.24	49.62
4.11	Sub4.11	2-YEAR	0.207	0.406	1.021	0.060	7.2	0.40	0.10	3.84	0.56	0.0018	0.00	0.14	0.07	4.94
4.2	Sub4.2	2-YEAR	0.105	0.379	0.732	0.057	29.5	0.40	0.10	3.67	0.54	0.0018	0.00	0.59	0.17	25.32
4.3	Sub4.3	2-YEAR	0.477	0.901	1.974	0.058	27.2	0.40	0.10	3.43	0.53	0.0018	0.00	0.54	0.16	23.16
4.4	Sub4.4	2-YEAR	0.151	0.388	0.981	0.057	8.4	0.40	0.10	3.49	0.53	0.0018	0.00	0.17	0.08	5.96
4.5	Sub4.5	2-YEAR	0.120	0.303	0.693	0.060	8.5	0.40	0.10	3.45	0.53	0.0018	0.00	0.17	0.09	6.08
4.6	Sub4.6	2-YEAR	0.523	0.888	2.033	0.060	33.9	0.40	0.10	3.06	0.50	0.0018	0.00	0.68	0.18	30.37
4.7	Sub4.7	2-YEAR	0.075	0.230	0.655	0.060	10.7	0.40	0.10	3.60	0.54	0.0018	0.00	0.21	0.10	7.73
4.8	Sub4.8	2-YEAR	0.237	0.388	0.998	0.060	10.4	0.40	0.10	3.76	0.55	0.0018	0.00	0.21	0.10	7.39
4.9	Sub4.9	2-YEAR	0.463	0.577	1.449	0.060	33.2	0.40	0.10	3.11	0.51	0.0018	0.00	0.66	0.18	29.61
5.1	Sub5.1	2-YEAR	0.122	0.337	0.718	0.060	36.2	0.40	0.10	3.68	0.55	0.0018	0.00	0.72	0.19	32.56
5.2	Sub5.2	2-YEAR	0.130	0.302	0.722	0.060	36.0	0.40	0.10	3.33	0.52	0.0018	0.00	0.72	0.19	32.52
6.1	Sub6.1	2-YEAR	0.368	0.445	1.114	0.060	18.1	0.40	0.10	3.54	0.54	0.0018	0.00	0.36	0.12	14.39
6.2	Sub6.2	2-YEAR	0.133	0.321	0.818	0.060	34.8	0.40	0.10	3.01	0.50	0.0018	0.00	0.70	0.18	31.45
6.3	Sub6.3	2-YEAR	0.423	0.652	1.213	0.060	12.2	0.40	0.10	3.58	0.54	0.0018	0.00	0.24	0.11	9.07
6.4	Sub6.4	2-YEAR	0.244	0.682	1.185	0.060	7.6	0.40	0.10	3.04	0.50	0.0018	0.00	0.15	0.08	5.56
6.5	Sub6.5	2-YEAR	0.198	0.468	0.896	0.060	27.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.54	0.16	22.77
6.6	Sub6.6	2-YEAR	0.366	0.997	1.654	0.058	9.0	0.40	0.10	3.40	0.53	0.0018	0.00	0.18	0.09	6.48
6.7	Sub6.7	2-YEAR	0.124	0.313	0.593	0.058	32.2	0.40	0.10	3.30	0.52	0.0018	0.00	0.64	0.18	28.40
6.8	Sub6.8	2-YEAR	0.290	0.501	1.241	0.060	8.1	0.40	0.10	3.14	0.51	0.0018	0.00	0.16	0.08	5.91
6.9	Sub6.9	2-YEAR	0.200	0.386	0.805	0.060	20.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.40	0.13	15.98
7.1	Sub7.1	2-YEAR	0.040	0.352	0.632	0.058	6.0	0.40	0.10	4.07	0.57	0.0018	0.00	0.12	0.06	4.00
7.11	Sub7.11	2-YEAR	0.099	0.349	0.658	0.060	47.5	0.40	0.10	3.40	0.53	0.0018	0.00	0.84	0.22	44.56
7.12	Sub7.12	2-YEAR	0.109	0.236	0.554	0.060	42.1	0.40	0.10	3.57	0.54	0.0018	0.00	0.81	0.21	39.04
7.2	Sub7.2	2-YEAR	0.057	0.323	0.601	0.058	39.1	0.40	0.10	3.68	0.55	0.0018	0.00	0.78	0.20	35.85
7.3	Sub7.3	2-YEAR	0.024	0.152	0.302	0.030	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	73.46
7.4	Sub7.4	2-YEAR	0.045	0.243	0.463	0.057	46.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.83	0.22	42.57
7.5	Sub7.5	2-YEAR	0.036	0.151	0.309	0.003	26.5	0.40	0.10	4.50	0.60	0.0018	0.00	0.53	0.16	21.79
7.6	Sub7.6	2-YEAR	0.093	0.388	0.787	0.020	59.6	0.40	0.10	3.73	0.55	0.0018	0.00	0.90	0.27	57.12
7.7	Sub7.7	2-YEAR	0.301	0.624	1.311	0.060	36.0	0.40	0.10	3.55	0.54	0.0018	0.00	0.72	0.19	32.37
7.8	Sub7.8	2-YEAR	0.114	0.383	0.660	0.060	32.2	0.40	0.10	3.16	0.51	0.0018	0.00	0.64	0.18	28.55
7.9	Sub7.9	2-YEAR	0.010	0.089	0.191	0.030	82.2	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.34	80.25
8.1	Sub8.1	2-YEAR	0.329	0.967	1.813	0.060	35.9	0.40	0.10	3.03	0.50	0.0018	0.00	0.72	0.19	32.58
8.2	Sub8.2	2-YEAR	0.128	0.408	0.894	0.010	28.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.56	0.16	23.35
8.3	Sub8.3	2-YEAR	0.162	0.451	0.822	0.020	25.6	0.40	0.10	3.99	0.56	0.0018	0.00	0.51	0.15	21.22

Existing Conditions: 2-Year Output

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
1.2		0.098	0.226	28.8	5.30	15.0	3.74	8.8	307	684,491	0.22	150,115	38.0	39	150,099	0.21
1.3		0.098	0.244	28.1	5.56	14.6	3.93	9.3	404	878,950	0.22	192,832	38.0	51	192,823	0.21
1.4		0.096	0.220	20.5	3.76	10.6	2.66	6.3	339	537,728	0.24	129,030	34.0	42	129,021	0.28
1.5		0.087	0.284	21.1	4.90	11.0	3.46	8.2	358	583,860	0.38	221,413	35.0	67	221,411	0.42
2.1		0.110	0.193	37.2	5.83	19.4	4.12	9.7	233	673,131	0.13	85,421	42.0	20	85,417	0.11
2.2		0.094	0.138	25.3	2.99	13.2	2.11	5.0	79	154,853	0.26	40,489	35.0	11	40,483	0.25
2.3		0.089	0.119	22.0	2.31	11.4	1.63	3.8	49	83,672	0.33	27,926	33.0	8	27,926	0.35
2.4		0.079	0.188	24.6	3.87	12.8	2.73	6.4	84	161,033	0.53	85,702	35.0	23	85,701	0.52
2.5		0.079	0.170	21.0	3.04	10.9	2.15	5.1	79	127,641	0.54	68,795	33.0	20	68,782	0.58
2.6		0.115	0.108	49.5	4.40	25.7	3.11	7.3	40	151,909	0.10	15,628	43.0	3	15,628	0.07
3.1		0.100	0.155	35.2	4.50	18.3	3.18	7.5	103	281,400	0.20	55,237	40.0	12	55,236	0.16
3.2		0.091	0.142	23.1	2.82	12.0	1.99	4.7	75	134,232	0.31	41,854	34.0	12	41,849	0.32
3.3		0.079	0.075	13.7	1.09	7.1	0.77	1.8	19	20,546	0.54	11,053	30.0	4	11,044	0.75
3.4		0.078	0.123	19.2	2.11	10.0	1.49	3.5	41	61,240	0.55	33,942	32.0	11	33,932	0.63
3.5		0.125	0.080	33.1	2.33	17.2	1.65	3.9	28	70,588	0.06	4,167	39.0	1	4,167	0.06
3.6		0.113	0.067	47.4	2.75	24.6	1.95	4.6	15	53,882	0.11	6,049	41.0	1	6,049	0.08
3.7		0.077	0.054	8.8	0.67	4.6	0.47	1.1	14	9,755	0.58	5,681	30.0	3	5,659	1.02
3.8		0.096	0.080	26.6	1.93	13.9	1.36	3.2	25	50,834	0.24	12,100	35.0	3	12,099	0.22
4.1		0.088	0.153	21.5	2.82	11.2	1.99	4.7	84	139,608	0.35	49,259	33.0	15	49,253	0.38
4.11		0.145	0.209	41.8	7.00	21.7	4.95	11.7	149	481,581	0.02	11,371	44.0	3	11,371	0.02
4.2		0.104	0.133	39.3	4.32	20.5	3.06	7.2	80	243,448	0.17	40,432	41.0	9	40,431	0.13
4.3		0.106	0.223	58.3	10.31	30.3	7.28	17.2	245	1,107,581	0.15	167,480	50.0	27	167,477	0.09
4.4		0.141	0.182	45.5	6.65	23.7	4.70	11.1	99	350,494	0.03	10,457	44.0	2	10,457	0.03
4.5		0.140	0.163	37.5	5.00	19.5	3.53	8.3	96	278,587	0.03	8,516	42.0	2	8,515	0.03
4.6		0.099	0.260	46.7	9.61	24.3	6.79	16.0	336	1,214,444	0.21	250,632	47.0	46	250,631	0.14
4.7		0.134	0.127	39.2	4.13	20.4	2.92	6.9	57	174,022	0.04	6,970	42.0	2	6,970	0.04
4.8		0.136	0.205	38.6	6.39	20.1	4.51	10.6	185	551,326	0.04	20,644	43.0	5	20,643	0.04
4.9		0.100	0.247	34.2	6.78	17.8	4.79	11.3	406	1,074,701	0.20	215,396	42.0	51	215,394	0.17
5.1		0.097	0.166	27.4	3.79	14.2	2.68	6.3	134	283,224	0.22	62,859	37.0	16	62,856	0.21
5.2		0.097	0.171	25.3	3.62	13.1	2.56	6.0	155	303,147	0.22	67,427	36.0	19	67,429	0.23
6.1		0.119	0.213	36.6	6.29	19.0	4.44	10.5	302	855,446	0.09	74,795	42.0	19	74,791	0.08
6.2		0.098	0.169	28.1	3.96	14.6	2.80	6.6	142	310,064	0.21	66,622	37.0	18	66,619	0.21
6.3		0.129	0.235	45.3	8.48	23.6	5.99	14.1	280	983,329	0.05	48,378	46.0	11	48,377	0.04
6.4		0.142	0.216	54.7	9.39	28.5	6.64	15.6	134	567,681	0.03	16,367	48.0	3	16,366	0.02
6.5		0.107	0.172	37.8	5.28	19.6	3.73	8.8	157	460,570	0.15	67,673	41.0	15	67,671	0.12
6.6		0.139	0.239	68.6	12.89	35.7	9.11	21.5	160	849,255	0.03	27,924	54.0	5	27,924	0.02
6.7		0.101	0.154	27.1	3.51	14.1	2.48	5.8	138	288,618	0.19	54,978	37.0	15	54,978	0.19
6.8		0.141	0.226	45.8	8.24	23.8	5.82	13.7	190	673,793	0.03	20,476	46.0	5	20,475	0.03
6.9		0.116	0.176	34.7	4.98	18.0	3.52	8.3	173	464,273	0.10	45,538	41.0	12	45,536	0.09
7.1		0.148	0.105	63.7	5.44	33.1	3.84	9.1	19	93,834	0.02	1,727	45.0	0	1,727	0.01
7.11		0.091	0.181	22.8	3.47	11.8	2.45	5.8	130	228,947	0.31	72,111	34.0	21	72,107	0.33
7.12		0.094	0.176	18.5	2.79	9.6	1.97	4.7	176	252,216	0.27	68,698	33.0	23	68,688	0.33
7.2		0.095	0.124	32.3	3.39	16.8	2.40	5.7	52	131,449	0.25	32,552	38.0	7	32,551	0.20
7.3		0.079	0.117	16.8	1.80	8.7	1.27	3.0	43	55,243	0.54	29,725	31.0	10	29,717	0.67
7.4		0.092	0.125	24.1	2.61	12.5	1.84	4.3	56	105,069	0.30	31,218	34.0	8	31,216	0.29
7.5		0.108	0.081	57.9	3.90	30.1	2.76	6.5	18	82,806	0.14	11,449	43.0	2	11,448	0.08
7.6		0.085	0.199	29.0	4.73	15.1	3.34	7.9	96	216,873	0.41	89,087	37.0	21	89,084	0.36
7.7		0.098	0.229	35.7	6.57	18.5	4.64	10.9	253	699,676	0.22	154,485	42.0	34	154,479	0.18
7.8		0.101	0.149	32.2	3.99	16.8	2.82	6.6	106	265,168	0.19	50,992	39.0	12	50,989	0.17
7.9		0.077	0.082	14.4	1.21	7.5	0.86	2.0	22	24,315	0.59	14,404	30.0	5	14,405	0.81
8.1		0.097	0.236	49.8	9.32	25.9	6.59	15.5	198	763,699	0.22	170,768	47.0	29	170,763	0.14
8.2		0.106	0.144	64.4	7.42	33.5	5.24	12.4	60	297,906	0.15	44,641	49.0	6	44,640	0.08
8.3		0.109	0.160	50.6	6.52	26.3	4.61	10.9	96	375,517	0.13	50,577	45.0	9	50,577	0.09

EXISTING CONDITIONS

5-YEAR

Existing Conditions: 5-Year Input

Summary of CUHP Input Parameters (Version 2.0.0)

								Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
1.2	Sub1.2	5-YEAR	0.295	0.498	1.021	0.060	35.7	0.40	0.10	3.34	0.52	0.0018	0.00	0.71	0.19	32.97
1.3	Sub1.3	5-YEAR	0.378	0.498	1.137	0.060	35.6	0.40	0.10	3.30	0.52	0.0018	0.00	0.71	0.19	32.96
1.4	Sub1.4	5-YEAR	0.231	0.308	0.798	0.060	37.7	0.40	0.10	3.00	0.50	0.0018	0.00	0.75	0.19	35.38
1.5	Sub1.5	5-YEAR	0.251	0.510	1.073	0.060	55.6	0.40	0.10	3.51	0.53	0.0018	0.00	0.88	0.25	53.63
2.1	Sub2.1	5-YEAR	0.290	0.511	0.954	0.060	24.3	0.40	0.10	3.83	0.56	0.0018	0.00	0.49	0.15	21.07
2.2	Sub2.2	5-YEAR	0.067	0.273	0.545	0.058	41.5	0.40	0.10	4.45	0.60	0.0018	0.00	0.81	0.20	38.81
2.3	Sub2.3	5-YEAR	0.036	0.194	0.471	0.060	50.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.85	0.23	48.23
2.4	Sub2.4	5-YEAR	0.069	0.403	0.684	0.030	75.1	0.40	0.10	4.49	0.60	0.0018	0.00	0.93	0.32	73.33
2.5	Sub2.5	5-YEAR	0.055	0.279	0.667	0.040	75.9	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.18
2.6	Sub2.6	5-YEAR	0.065	0.342	0.705	0.060	21.2	0.40	0.10	4.12	0.57	0.0018	0.00	0.42	0.13	17.88
3.1	Sub3.1	5-YEAR	0.121	0.403	0.838	0.060	33.4	0.40	0.10	3.91	0.56	0.0018	0.00	0.67	0.18	30.32
3.2	Sub3.2	5-YEAR	0.058	0.267	0.529	0.060	47.3	0.40	0.10	3.74	0.55	0.0018	0.00	0.84	0.22	45.04
3.3	Sub3.3	5-YEAR	0.009	0.106	0.159	0.060	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.05
3.4	Sub3.4	5-YEAR	0.026	0.215	0.369	0.040	77.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.32	76.06
3.5	Sub3.5	5-YEAR	0.030	0.146	0.320	0.060	14.3	0.40	0.10	3.99	0.57	0.0018	0.00	0.29	0.11	11.50
3.6	Sub3.6	5-YEAR	0.023	0.208	0.410	0.060	22.1	0.40	0.10	3.76	0.55	0.0018	0.00	0.44	0.14	18.96
3.7	Sub3.7	5-YEAR	0.004	0.034	0.076	0.030	81.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.33	79.52
3.8	Sub3.8	5-YEAR	0.022	0.155	0.330	0.060	38.3	0.40	0.10	3.94	0.56	0.0018	0.00	0.77	0.19	35.59
4.1	Sub4.1	5-YEAR	0.060	0.280	0.531	0.058	52.5	0.40	0.10	3.75	0.55	0.0018	0.00	0.86	0.24	50.35
4.11	Sub4.11	5-YEAR	0.207	0.406	1.021	0.060	7.2	0.40	0.10	3.84	0.56	0.0018	0.00	0.14	0.07	5.49
4.2	Sub4.2	5-YEAR	0.105	0.379	0.732	0.057	29.5	0.40	0.10	3.67	0.54	0.0018	0.00	0.59	0.17	26.32
4.3	Sub4.3	5-YEAR	0.477	0.901	1.974	0.058	27.2	0.40	0.10	3.43	0.53	0.0018	0.00	0.54	0.16	24.12
4.4	Sub4.4	5-YEAR	0.151	0.388	0.981	0.057	8.4	0.40	0.10	3.49	0.53	0.0018	0.00	0.17	0.08	6.54
4.5	Sub4.5	5-YEAR	0.120	0.303	0.693	0.060	8.5	0.40	0.10	3.45	0.53	0.0018	0.00	0.17	0.09	6.66
4.6	Sub4.6	5-YEAR	0.523	0.888	2.033	0.060	33.9	0.40	0.10	3.06	0.50	0.0018	0.00	0.68	0.18	31.19
4.7	Sub4.7	5-YEAR	0.075	0.230	0.655	0.060	10.7	0.40	0.10	3.60	0.54	0.0018	0.00	0.21	0.10	8.45
4.8	Sub4.8	5-YEAR	0.237	0.388	0.998	0.060	10.4	0.40	0.10	3.76	0.55	0.0018	0.00	0.21	0.10	8.12
4.9	Sub4.9	5-YEAR	0.463	0.577	1.449	0.060	33.2	0.40	0.10	3.11	0.51	0.0018	0.00	0.66	0.18	30.45
5.1	Sub5.1	5-YEAR	0.122	0.337	0.718	0.060	36.2	0.40	0.10	3.68	0.55	0.0018	0.00	0.72	0.19	33.46
5.2	Sub5.2	5-YEAR	0.130	0.302	0.722	0.060	36.0	0.40	0.10	3.33	0.52	0.0018	0.00	0.72	0.19	33.35
6.1	Sub6.1	5-YEAR	0.368	0.445	1.114	0.060	18.1	0.40	0.10	3.54	0.54	0.0018	0.00	0.36	0.12	15.27
6.2	Sub6.2	5-YEAR	0.133	0.321	0.818	0.060	34.8	0.40	0.10	3.01	0.50	0.0018	0.00	0.70	0.18	32.25
6.3	Sub6.3	5-YEAR	0.423	0.652	1.213	0.060	12.2	0.40	0.10	3.58	0.54	0.0018	0.00	0.24	0.11	9.83
6.4	Sub6.4	5-YEAR	0.244	0.682	1.185	0.060	7.6	0.40	0.10	3.04	0.50	0.0018	0.00	0.15	0.08	6.05
6.5	Sub6.5	5-YEAR	0.198	0.468	0.896	0.060	27.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.54	0.16	23.80
6.6	Sub6.6	5-YEAR	0.366	0.997	1.654	0.058	9.0	0.40	0.10	3.40	0.53	0.0018	0.00	0.18	0.09	7.08
6.7	Sub6.7	5-YEAR	0.124	0.313	0.593	0.058	32.2	0.40	0.10	3.30	0.52	0.0018	0.00	0.64	0.18	29.30
6.8	Sub6.8	5-YEAR	0.290	0.501	1.241	0.060	8.1	0.40	0.10	3.14	0.51	0.0018	0.00	0.16	0.08	6.44
6.9	Sub6.9	5-YEAR	0.200	0.386	0.805	0.060	20.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.40	0.13	16.94
7.1	Sub7.1	5-YEAR	0.040	0.352	0.632	0.058	6.0	0.40	0.10	4.07	0.57	0.0018	0.00	0.12	0.06	4.50
7.11	Sub7.11	5-YEAR	0.099	0.349	0.658	0.060	47.5	0.40	0.10	3.40	0.53	0.0018	0.00	0.84	0.22	45.27
7.12	Sub7.12	5-YEAR	0.109	0.236	0.554	0.060	42.1	0.40	0.10	3.57	0.54	0.0018	0.00	0.81	0.21	39.80
7.2	Sub7.2	5-YEAR	0.057	0.323	0.601	0.058	39.1	0.40	0.10	3.68	0.55	0.0018	0.00	0.78	0.20	36.67
7.3	Sub7.3	5-YEAR	0.024	0.152	0.302	0.030	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.06
7.4	Sub7.4	5-YEAR	0.045	0.243	0.463	0.057	46.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.83	0.22	43.49
7.5	Sub7.5	5-YEAR	0.036	0.151	0.309	0.003	26.5	0.40	0.10	4.50	0.60	0.0018	0.00	0.53	0.16	22.96
7.6	Sub7.6	5-YEAR	0.093	0.388	0.787	0.020	59.6	0.40	0.10	3.73	0.55	0.0018	0.00	0.90	0.27	57.76
7.7	Sub7.7	5-YEAR	0.301	0.624	1.311	0.060	36.0	0.40	0.10	3.55	0.54	0.0018	0.00	0.72	0.19	33.25
7.8	Sub7.8	5-YEAR	0.114	0.383	0.660	0.060	32.2	0.40	0.10	3.16	0.51	0.0018	0.00	0.64	0.18	29.42
7.9	Sub7.9	5-YEAR	0.010	0.089	0.191	0.030	82.2	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.34	80.76
8.1	Sub8.1	5-YEAR	0.329	0.967	1.813	0.060	35.9	0.40	0.10	3.03	0.50	0.0018	0.00	0.72	0.19	33.37
8.2	Sub8.2	5-YEAR	0.128	0.408	0.894	0.010	28.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.56	0.16	24.52
8.3	Sub8.3	5-YEAR	0.162	0.451	0.822	0.020	25.6	0.40	0.10	3.99	0.56	0.0018	0.00	0.51	0.15	22.29

Existing Conditions: 5-Year Output

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
1.2		0.097	0.230	28.1	5.27	14.6	3.72	8.8	314	684,491	0.35	237,456	37.0	62	237,448	0.33
1.3		0.097	0.248	27.5	5.53	14.3	3.91	9.2	413	878,950	0.35	305,149	37.0	81	305,151	0.33
1.4		0.096	0.223	20.1	3.74	10.5	2.65	6.2	345	537,728	0.38	201,690	33.0	66	201,672	0.44
1.5		0.087	0.286	20.9	4.88	10.9	3.45	8.1	361	583,860	0.56	328,938	34.0	101	328,933	0.63
2.1		0.109	0.193	36.9	5.76	19.2	4.07	9.6	236	673,131	0.22	147,364	40.0	33	147,364	0.18
2.2		0.094	0.141	24.8	2.98	12.9	2.11	5.0	81	154,853	0.40	61,676	34.0	17	61,669	0.39
2.3		0.089	0.120	21.7	2.30	11.3	1.62	3.8	50	83,672	0.50	41,674	32.0	12	41,672	0.53
2.4		0.079	0.189	24.5	3.86	12.8	2.73	6.4	85	161,033	0.77	123,697	34.0	33	123,689	0.74
2.5		0.079	0.171	20.9	3.04	10.9	2.15	5.1	79	127,641	0.78	99,210	33.0	29	99,196	0.84
2.6		0.113	0.108	49.0	4.35	25.5	3.07	7.2	40	151,909	0.18	27,797	43.0	5	27,797	0.12
3.1		0.099	0.159	34.2	4.47	17.8	3.16	7.4	106	281,400	0.31	88,468	38.0	20	88,464	0.26
3.2		0.091	0.143	22.8	2.81	11.8	1.98	4.7	76	134,232	0.47	63,153	33.0	18	63,149	0.49
3.3		0.079	0.075	13.6	1.09	7.1	0.77	1.8	19	20,546	0.78	15,942	30.0	6	15,930	1.08
3.4		0.078	0.123	19.1	2.11	9.9	1.49	3.5	41	61,240	0.80	48,860	31.0	15	48,847	0.91
3.5		0.123	0.079	33.0	2.30	17.1	1.63	3.8	28	70,588	0.12	8,210	36.0	2	8,210	0.11
3.6		0.112	0.067	47.0	2.72	24.4	1.93	4.5	15	53,882	0.20	10,647	41.0	2	10,647	0.13
3.7		0.077	0.055	8.8	0.67	4.6	0.47	1.1	14	9,755	0.84	8,151	27.0	4	8,118	1.44
3.8		0.095	0.081	26.1	1.92	13.6	1.36	3.2	25	50,834	0.37	18,758	33.0	5	18,756	0.35
4.1		0.088	0.154	21.2	2.81	11.0	1.99	4.7	85	139,608	0.53	73,530	33.0	22	73,521	0.57
4.11		0.143	0.206	41.7	6.91	21.7	4.88	11.5	149	481,581	0.05	26,348	43.0	6	26,347	0.05
4.2		0.103	0.136	38.0	4.28	19.8	3.03	7.1	83	243,448	0.27	66,845	39.0	14	66,843	0.21
4.3		0.105	0.223	57.7	10.20	30.0	7.21	17.0	248	1,107,581	0.25	281,819	52.0	44	281,816	0.14
4.4		0.139	0.179	45.4	6.55	23.6	4.63	10.9	100	350,494	0.07	23,554	44.0	5	23,554	0.05
4.5		0.138	0.161	37.4	4.93	19.5	3.48	8.2	96	278,587	0.07	19,125	41.0	5	19,125	0.06
4.6		0.099	0.264	45.6	9.55	23.7	6.75	15.9	344	1,214,444	0.33	402,146	46.0	73	402,133	0.22
4.7		0.132	0.125	39.1	4.05	20.3	2.87	6.8	57	174,022	0.09	15,011	40.0	4	15,011	0.07
4.8		0.133	0.202	38.5	6.26	20.0	4.43	10.4	185	551,326	0.08	45,082	42.0	11	45,079	0.07
4.9		0.099	0.251	33.4	6.73	17.4	4.76	11.2	416	1,074,701	0.32	347,170	40.0	81	347,165	0.27
5.1		0.097	0.169	26.7	3.76	13.9	2.66	6.3	137	283,224	0.35	98,845	35.0	26	98,847	0.34
5.2		0.097	0.174	24.7	3.60	12.9	2.54	6.0	158	303,147	0.35	106,420	35.0	30	106,418	0.36
6.1		0.117	0.212	36.4	6.22	18.9	4.39	10.4	304	855,446	0.16	137,368	41.0	32	137,360	0.14
6.2		0.098	0.172	27.5	3.93	14.3	2.78	6.6	145	310,064	0.34	106,210	36.0	28	106,199	0.33
6.3		0.127	0.231	45.2	8.30	23.5	5.86	13.8	281	983,329	0.10	99,530	46.0	21	99,528	0.08
6.4		0.141	0.214	54.6	9.27	28.4	6.55	15.5	134	567,681	0.06	36,752	50.0	7	36,751	0.04
6.5		0.106	0.172	37.4	5.23	19.4	3.69	8.7	159	460,570	0.25	114,073	40.0	25	114,069	0.20
6.6		0.137	0.236	68.5	12.69	35.6	8.97	21.2	160	849,255	0.07	62,208	57.0	10	62,207	0.04
6.7		0.100	0.157	26.3	3.48	13.7	2.46	5.8	141	288,618	0.31	89,211	35.0	24	89,205	0.31
6.8		0.139	0.223	45.7	8.13	23.8	5.75	13.6	190	673,793	0.07	45,904	46.0	10	45,904	0.05
6.9		0.115	0.175	34.4	4.92	17.9	3.48	8.2	174	464,273	0.18	81,895	39.0	20	81,895	0.15
7.1		0.146	0.104	63.6	5.37	33.1	3.80	9.0	19	93,834	0.04	4,116	49.0	1	4,116	0.03
7.11		0.091	0.183	22.5	3.46	11.7	2.44	5.8	131	228,947	0.48	108,930	34.0	32	108,914	0.50
7.12		0.093	0.178	18.2	2.78	9.5	1.97	4.6	179	252,216	0.42	105,015	32.0	36	104,990	0.51
7.2		0.095	0.126	31.7	3.38	16.5	2.39	5.6	53	131,449	0.38	50,259	36.0	11	50,258	0.32
7.3		0.079	0.117	16.7	1.80	8.7	1.27	3.0	43	55,243	0.78	42,871	31.0	15	42,859	0.96
7.4		0.091	0.126	23.7	2.59	12.3	1.83	4.3	57	105,069	0.45	47,034	33.0	13	47,033	0.45
7.5		0.107	0.081	57.2	3.86	29.8	2.73	6.4	19	82,806	0.23	19,297	45.0	3	19,297	0.13
7.6		0.085	0.199	28.8	4.71	15.0	3.33	7.9	97	216,873	0.61	131,247	36.0	32	131,245	0.53
7.7		0.097	0.232	34.9	6.53	18.1	4.61	10.9	259	699,676	0.35	243,507	40.0	54	243,506	0.28
7.8		0.100	0.152	31.4	3.96	16.3	2.80	6.6	109	265,168	0.31	82,731	37.0	20	82,725	0.27
7.9		0.077	0.083	14.4	1.21	7.5	0.85	2.0	22	24,315	0.85	20,644	30.0	8	20,646	1.15
8.1		0.097	0.239	48.8	9.27	25.4	6.55	15.5	202	763,699	0.35	270,163	47.0	46	270,157	0.22
8.2		0.105	0.144	63.6	7.33	33.1	5.18	12.2	61	297,906	0.25	74,265	51.0	11	74,264	0.13
8.3		0.107	0.160	50.0	6.44	26.0	4.55	10.7	97	375,517	0.23	86,396	45.0	15	86,395	0.15

EXISTING CONDITIONS

10-YEAR

Existing Conditions: 10-Year Input
Summary of CUHP Input Parameters (Version 2.0.0)

								Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
1.2	Sub1.2	10-YEAR	0.295	0.498	1.021	0.060	35.7	0.40	0.10	3.34	0.52	0.0018	0.00	0.71	0.19	33.46
1.3	Sub1.3	10-YEAR	0.378	0.498	1.137	0.060	35.6	0.40	0.10	3.30	0.52	0.0018	0.00	0.71	0.19	33.45
1.4	Sub1.4	10-YEAR	0.231	0.308	0.798	0.060	37.7	0.40	0.10	3.00	0.50	0.0018	0.00	0.75	0.19	35.81
1.5	Sub1.5	10-YEAR	0.251	0.510	1.073	0.060	55.6	0.40	0.10	3.51	0.53	0.0018	0.00	0.88	0.25	54.00
2.1	Sub2.1	10-YEAR	0.290	0.511	0.954	0.060	24.3	0.40	0.10	3.83	0.56	0.0018	0.00	0.49	0.15	21.67
2.2	Sub2.2	10-YEAR	0.067	0.273	0.545	0.058	41.5	0.40	0.10	4.45	0.60	0.0018	0.00	0.81	0.20	39.30
2.3	Sub2.3	10-YEAR	0.036	0.194	0.471	0.060	50.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.85	0.23	48.70
2.4	Sub2.4	10-YEAR	0.069	0.403	0.684	0.030	75.1	0.40	0.10	4.49	0.60	0.0018	0.00	0.93	0.32	73.66
2.5	Sub2.5	10-YEAR	0.055	0.279	0.667	0.040	75.9	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.50
2.6	Sub2.6	10-YEAR	0.065	0.342	0.705	0.060	21.2	0.40	0.10	4.12	0.57	0.0018	0.00	0.42	0.13	18.48
3.1	Sub3.1	10-YEAR	0.121	0.403	0.838	0.060	33.4	0.40	0.10	3.91	0.56	0.0018	0.00	0.67	0.18	30.89
3.2	Sub3.2	10-YEAR	0.058	0.267	0.529	0.060	47.3	0.40	0.10	3.74	0.55	0.0018	0.00	0.84	0.22	45.46
3.3	Sub3.3	10-YEAR	0.009	0.106	0.159	0.060	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.38
3.4	Sub3.4	10-YEAR	0.026	0.215	0.369	0.040	77.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.32	76.37
3.5	Sub3.5	10-YEAR	0.030	0.146	0.320	0.060	14.3	0.40	0.10	3.99	0.57	0.0018	0.00	0.29	0.11	12.00
3.6	Sub3.6	10-YEAR	0.023	0.208	0.410	0.060	22.1	0.40	0.10	3.76	0.55	0.0018	0.00	0.44	0.14	19.53
3.7	Sub3.7	10-YEAR	0.004	0.034	0.076	0.030	81.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.33	79.80
3.8	Sub3.8	10-YEAR	0.022	0.155	0.330	0.060	38.3	0.40	0.10	3.94	0.56	0.0018	0.00	0.77	0.19	36.08
4.1	Sub4.1	10-YEAR	0.060	0.280	0.531	0.058	52.5	0.40	0.10	3.75	0.55	0.0018	0.00	0.86	0.24	50.75
4.11	Sub4.11	10-YEAR	0.207	0.406	1.021	0.060	7.2	0.40	0.10	3.84	0.56	0.0018	0.00	0.14	0.07	5.80
4.2	Sub4.2	10-YEAR	0.105	0.379	0.732	0.057	29.5	0.40	0.10	3.67	0.54	0.0018	0.00	0.59	0.17	26.90
4.3	Sub4.3	10-YEAR	0.477	0.901	1.974	0.058	27.2	0.40	0.10	3.43	0.53	0.0018	0.00	0.54	0.16	24.68
4.4	Sub4.4	10-YEAR	0.151	0.388	0.981	0.057	8.4	0.40	0.10	3.49	0.53	0.0018	0.00	0.17	0.08	6.88
4.5	Sub4.5	10-YEAR	0.120	0.303	0.693	0.060	8.5	0.40	0.10	3.45	0.53	0.0018	0.00	0.17	0.09	7.00
4.6	Sub4.6	10-YEAR	0.523	0.888	2.033	0.060	33.9	0.40	0.10	3.06	0.50	0.0018	0.00	0.68	0.18	31.68
4.7	Sub4.7	10-YEAR	0.075	0.230	0.655	0.060	10.7	0.40	0.10	3.60	0.54	0.0018	0.00	0.21	0.10	8.85
4.8	Sub4.8	10-YEAR	0.237	0.388	0.998	0.060	10.4	0.40	0.10	3.76	0.55	0.0018	0.00	0.21	0.10	8.53
4.9	Sub4.9	10-YEAR	0.463	0.577	1.449	0.060	33.2	0.40	0.10	3.11	0.51	0.0018	0.00	0.66	0.18	30.96
5.1	Sub5.1	10-YEAR	0.122	0.337	0.718	0.060	36.2	0.40	0.10	3.68	0.55	0.0018	0.00	0.72	0.19	33.97
5.2	Sub5.2	10-YEAR	0.130	0.302	0.722	0.060	36.0	0.40	0.10	3.33	0.52	0.0018	0.00	0.72	0.19	33.84
6.1	Sub6.1	10-YEAR	0.368	0.445	1.114	0.060	18.1	0.40	0.10	3.54	0.54	0.0018	0.00	0.36	0.12	15.80
6.2	Sub6.2	10-YEAR	0.133	0.321	0.818	0.060	34.8	0.40	0.10	3.01	0.50	0.0018	0.00	0.70	0.18	32.72
6.3	Sub6.3	10-YEAR	0.423	0.652	1.213	0.060	12.2	0.40	0.10	3.58	0.54	0.0018	0.00	0.24	0.11	10.27
6.4	Sub6.4	10-YEAR	0.244	0.682	1.185	0.060	7.6	0.40	0.10	3.04	0.50	0.0018	0.00	0.15	0.08	6.34
6.5	Sub6.5	10-YEAR	0.198	0.468	0.896	0.060	27.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.54	0.16	24.39
6.6	Sub6.6	10-YEAR	0.366	0.997	1.654	0.058	9.0	0.40	0.10	3.40	0.53	0.0018	0.00	0.18	0.09	7.43
6.7	Sub6.7	10-YEAR	0.124	0.313	0.593	0.058	32.2	0.40	0.10	3.30	0.52	0.0018	0.00	0.64	0.18	29.82
6.8	Sub6.8	10-YEAR	0.290	0.501	1.241	0.060	8.1	0.40	0.10	3.14	0.51	0.0018	0.00	0.16	0.08	6.74
6.9	Sub6.9	10-YEAR	0.200	0.386	0.805	0.060	20.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.40	0.13	17.50
7.1	Sub7.1	10-YEAR	0.040	0.352	0.632	0.058	6.0	0.40	0.10	4.07	0.57	0.0018	0.00	0.12	0.06	4.77
7.11	Sub7.11	10-YEAR	0.099	0.349	0.658	0.060	47.5	0.40	0.10	3.40	0.53	0.0018	0.00	0.84	0.22	45.66
7.12	Sub7.12	10-YEAR	0.109	0.236	0.554	0.060	42.1	0.40	0.10	3.57	0.54	0.0018	0.00	0.81	0.21	40.22
7.2	Sub7.2	10-YEAR	0.057	0.323	0.601	0.058	39.1	0.40	0.10	3.68	0.55	0.0018	0.00	0.78	0.20	37.12
7.3	Sub7.3	10-YEAR	0.024	0.152	0.302	0.030	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.39
7.4	Sub7.4	10-YEAR	0.045	0.243	0.463	0.057	46.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.83	0.22	43.98
7.5	Sub7.5	10-YEAR	0.036	0.151	0.309	0.003	26.5	0.40	0.10	4.50	0.60	0.0018	0.00	0.53	0.16	23.62
7.6	Sub7.6	10-YEAR	0.093	0.388	0.787	0.020	59.6	0.40	0.10	3.73	0.55	0.0018	0.00	0.90	0.27	58.10
7.7	Sub7.7	10-YEAR	0.301	0.624	1.311	0.060	36.0	0.40	0.10	3.55	0.54	0.0018	0.00	0.72	0.19	33.75
7.8	Sub7.8	10-YEAR	0.114	0.383	0.660	0.060	32.2	0.40	0.10	3.16	0.51	0.0018	0.00	0.64	0.18	29.94
7.9	Sub7.9	10-YEAR	0.010	0.089	0.191	0.030	82.2	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.34	81.03
8.1	Sub8.1	10-YEAR	0.329	0.967	1.813	0.060	35.9	0.40	0.10	3.03	0.50	0.0018	0.00	0.72	0.19	33.83
8.2	Sub8.2	10-YEAR	0.128	0.408	0.894	0.010	28.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.56	0.16	25.18
8.3	Sub8.3	10-YEAR	0.162	0.451	0.822	0.020	25.6	0.40	0.10	3.99	0.56	0.0018	0.00	0.51	0.15	22.90

Existing Conditions: 10-Year Output

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
1.2		0.097	0.232	27.8	5.25	14.5	3.71	8.7	318	684,491	0.56	380,045	38.0	103	380,025	0.55
1.3		0.097	0.250	27.1	5.51	14.1	3.89	9.2	418	878,950	0.56	489,830	38.0	136	489,829	0.56
1.4		0.095	0.225	19.9	3.74	10.4	2.64	6.2	349	537,728	0.60	324,101	34.0	110	324,062	0.74
1.5		0.086	0.287	20.8	4.87	10.8	3.44	8.1	363	583,860	0.80	467,005	35.0	145	466,993	0.90
2.1		0.108	0.193	36.6	5.72	19.1	4.05	9.5	237	673,131	0.39	259,190	41.0	60	259,191	0.32
2.2		0.093	0.142	24.6	2.97	12.8	2.10	5.0	81	154,853	0.58	89,809	34.0	25	89,801	0.58
2.3		0.089	0.121	21.5	2.29	11.2	1.62	3.8	50	83,672	0.70	58,615	32.0	17	58,612	0.75
2.4		0.079	0.189	24.5	3.85	12.7	2.72	6.4	85	161,033	1.03	165,160	34.0	43	165,150	0.97
2.5		0.079	0.171	20.8	3.03	10.8	2.14	5.1	79	127,641	1.04	132,281	32.0	39	132,264	1.10
2.6		0.112	0.107	48.8	4.32	25.4	3.05	7.2	40	151,909	0.33	49,946	43.0	9	49,946	0.22
3.1		0.099	0.160	33.7	4.45	17.5	3.14	7.4	108	281,400	0.49	139,266	39.0	32	139,264	0.42
3.2		0.090	0.144	22.6	2.80	11.8	1.98	4.7	77	134,232	0.69	91,957	33.0	27	91,949	0.73
3.3		0.079	0.075	13.6	1.08	7.1	0.77	1.8	20	20,546	1.03	21,260	30.0	8	21,244	1.42
3.4		0.078	0.123	19.0	2.11	9.9	1.49	3.5	42	61,240	1.06	64,962	31.0	20	64,946	1.18
3.5		0.122	0.079	32.9	2.29	17.1	1.62	3.8	28	70,588	0.25	17,706	37.0	5	17,706	0.25
3.6		0.111	0.067	46.7	2.71	24.3	1.91	4.5	15	53,882	0.36	19,517	41.0	4	19,517	0.25
3.7		0.077	0.055	8.8	0.67	4.6	0.47	1.1	14	9,755	1.11	10,784	26.0	5	10,740	1.87
3.8		0.095	0.081	25.8	1.91	13.4	1.35	3.2	25	50,834	0.56	28,397	35.0	8	28,393	0.55
4.1		0.088	0.155	21.1	2.81	11.0	1.98	4.7	85	139,608	0.75	104,843	33.0	32	104,824	0.82
4.11		0.141	0.205	41.7	6.85	21.7	4.84	11.4	149	481,581	0.18	85,527	44.0	22	85,526	0.16
4.2		0.102	0.138	37.3	4.26	19.4	3.01	7.1	84	243,448	0.46	111,749	40.0	25	111,746	0.37
4.3		0.105	0.224	57.4	10.15	29.8	7.17	16.9	249	1,107,581	0.45	493,607	51.0	80	493,604	0.26
4.4		0.137	0.178	45.4	6.49	23.6	4.59	10.8	100	350,494	0.22	75,559	45.0	17	75,558	0.18
4.5		0.137	0.160	37.4	4.89	19.4	3.45	8.1	96	278,587	0.22	61,282	42.0	17	61,281	0.22
4.6		0.098	0.267	45.0	9.51	23.4	6.72	15.9	348	1,214,444	0.55	669,064	47.0	128	669,060	0.38
4.7		0.130	0.124	39.1	4.01	20.3	2.83	6.7	58	174,022	0.23	40,603	41.0	10	40,601	0.21
4.8		0.131	0.200	38.4	6.19	20.0	4.38	10.3	185	551,326	0.22	120,405	43.0	31	120,399	0.21
4.9		0.099	0.253	32.9	6.70	17.1	4.74	11.2	422	1,074,701	0.54	579,320	41.0	141	579,332	0.48
5.1		0.096	0.170	26.4	3.75	13.7	2.65	6.3	139	283,224	0.54	153,967	36.0	43	153,966	0.54
5.2		0.097	0.175	24.4	3.58	12.7	2.53	6.0	160	303,147	0.56	169,937	35.0	50	169,929	0.60
6.1		0.116	0.211	36.2	6.18	18.8	4.36	10.3	305	855,446	0.33	280,639	42.0	70	280,631	0.30
6.2		0.097	0.173	27.2	3.92	14.1	2.77	6.5	147	310,064	0.57	175,752	36.0	48	175,736	0.56
6.3		0.125	0.229	45.1	8.23	23.4	5.81	13.7	282	983,329	0.25	249,579	46.0	56	249,576	0.21
6.4		0.139	0.212	54.6	9.21	28.4	6.51	15.3	134	567,681	0.24	138,271	50.0	28	138,269	0.18
6.5		0.105	0.172	37.1	5.20	19.3	3.67	8.7	160	460,570	0.42	194,575	41.0	44	194,564	0.35
6.6		0.135	0.234	68.4	12.57	35.6	8.89	21.0	160	849,255	0.23	194,540	56.0	32	194,539	0.13
6.7		0.100	0.159	25.9	3.46	13.5	2.45	5.8	144	288,618	0.51	148,530	36.0	43	148,526	0.54
6.8		0.138	0.222	45.7	8.07	23.7	5.70	13.4	191	673,793	0.24	161,217	47.0	38	161,215	0.20
6.9		0.114	0.174	34.3	4.89	17.8	3.46	8.2	175	464,273	0.34	156,016	40.0	39	156,016	0.31
7.1		0.145	0.103	63.6	5.34	33.1	3.77	8.9	19	93,834	0.15	14,034	46.0	2	14,033	0.09
7.11		0.090	0.184	22.4	3.45	11.6	2.44	5.8	132	228,947	0.70	160,526	34.0	48	160,511	0.76
7.12		0.093	0.179	18.0	2.78	9.4	1.96	4.6	181	252,216	0.63	157,986	33.0	55	157,940	0.79
7.2		0.095	0.127	31.4	3.37	16.3	2.38	5.6	54	131,449	0.58	76,602	37.0	18	76,602	0.50
7.3		0.079	0.117	16.7	1.80	8.7	1.27	3.0	43	55,243	1.03	57,172	31.0	19	57,155	1.26
7.4		0.091	0.127	23.5	2.59	12.2	1.83	4.3	58	105,069	0.64	67,158	33.0	19	67,160	0.65
7.5		0.106	0.081	56.8	3.83	29.6	2.71	6.4	19	82,806	0.38	31,205	45.0	5	31,205	0.21
7.6		0.085	0.200	28.7	4.70	14.9	3.32	7.8	98	216,873	0.84	182,973	37.0	44	182,973	0.74
7.7		0.097	0.235	34.4	6.50	17.9	4.60	10.8	262	699,676	0.55	383,134	41.0	88	383,124	0.46
7.8		0.100	0.153	30.9	3.94	16.1	2.79	6.6	111	265,168	0.52	139,065	38.0	35	139,058	0.48
7.9		0.077	0.083	14.3	1.21	7.5	0.85	2.0	22	24,315	1.12	27,268	30.0	10	27,270	1.48
8.1		0.097	0.241	48.3	9.24	25.1	6.53	15.4	204	763,699	0.58	441,433	48.0	79	441,419	0.38
8.2		0.104	0.145	62.5	7.28	32.5	5.15	12.1	62	297,906	0.40	118,232	49.0	17	118,230	0.21
8.3		0.107	0.160	49.7	6.40	25.9	4.52	10.7	98	375,517	0.39	146,618	45.0	26	146,612	0.25

EXISTING CONDITIONS

50-YEAR

Existing Conditions: 50-Year Input
Summary of CUHP Input Parameters (Version 2.0.0)

								Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
1.2	Sub1.2	50-YEAR	0.295	0.498	1.021	0.060	35.7	0.40	0.10	3.34	0.52	0.0018	0.00	0.71	0.19	34.26
1.3	Sub1.3	50-YEAR	0.378	0.498	1.137	0.060	35.6	0.40	0.10	3.30	0.52	0.0018	0.00	0.71	0.19	34.25
1.4	Sub1.4	50-YEAR	0.231	0.308	0.798	0.060	37.7	0.40	0.10	3.00	0.50	0.0018	0.00	0.75	0.19	36.52
1.5	Sub1.5	50-YEAR	0.251	0.510	1.073	0.060	55.6	0.40	0.10	3.51	0.53	0.0018	0.00	0.88	0.25	54.58
2.1	Sub2.1	50-YEAR	0.290	0.511	0.954	0.060	24.3	0.40	0.10	3.83	0.56	0.0018	0.00	0.49	0.15	22.65
2.2	Sub2.2	50-YEAR	0.067	0.273	0.545	0.058	41.5	0.40	0.10	4.45	0.60	0.0018	0.00	0.81	0.20	40.07
2.3	Sub2.3	50-YEAR	0.036	0.194	0.471	0.060	50.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.85	0.23	49.42
2.4	Sub2.4	50-YEAR	0.069	0.403	0.684	0.030	75.1	0.40	0.10	4.49	0.60	0.0018	0.00	0.93	0.32	74.17
2.5	Sub2.5	50-YEAR	0.055	0.279	0.667	0.040	75.9	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	75.00
2.6	Sub2.6	50-YEAR	0.065	0.342	0.705	0.060	21.2	0.40	0.10	4.12	0.57	0.0018	0.00	0.42	0.13	19.46
3.1	Sub3.1	50-YEAR	0.121	0.403	0.838	0.060	33.4	0.40	0.10	3.91	0.56	0.0018	0.00	0.67	0.18	31.81
3.2	Sub3.2	50-YEAR	0.058	0.267	0.529	0.060	47.3	0.40	0.10	3.74	0.55	0.0018	0.00	0.84	0.22	46.13
3.3	Sub3.3	50-YEAR	0.009	0.106	0.159	0.060	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.87
3.4	Sub3.4	50-YEAR	0.026	0.215	0.369	0.040	77.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.32	76.85
3.5	Sub3.5	50-YEAR	0.030	0.146	0.320	0.060	14.3	0.40	0.10	3.99	0.57	0.0018	0.00	0.29	0.11	12.83
3.6	Sub3.6	50-YEAR	0.023	0.208	0.410	0.060	22.1	0.40	0.10	3.76	0.55	0.0018	0.00	0.44	0.14	20.49
3.7	Sub3.7	50-YEAR	0.004	0.034	0.076	0.030	81.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.33	80.24
3.8	Sub3.8	50-YEAR	0.022	0.155	0.330	0.060	38.3	0.40	0.10	3.94	0.56	0.0018	0.00	0.77	0.19	36.87
4.1	Sub4.1	50-YEAR	0.060	0.280	0.531	0.058	52.5	0.40	0.10	3.75	0.55	0.0018	0.00	0.86	0.24	51.39
4.11	Sub4.11	50-YEAR	0.207	0.406	1.021	0.060	7.2	0.40	0.10	3.84	0.56	0.0018	0.00	0.14	0.07	6.31
4.2	Sub4.2	50-YEAR	0.105	0.379	0.732	0.057	29.5	0.40	0.10	3.67	0.54	0.0018	0.00	0.59	0.17	27.85
4.3	Sub4.3	50-YEAR	0.477	0.901	1.974	0.058	27.2	0.40	0.10	3.43	0.53	0.0018	0.00	0.54	0.16	25.61
4.4	Sub4.4	50-YEAR	0.151	0.388	0.981	0.057	8.4	0.40	0.10	3.49	0.53	0.0018	0.00	0.17	0.08	7.43
4.5	Sub4.5	50-YEAR	0.120	0.303	0.693	0.060	8.5	0.40	0.10	3.45	0.53	0.0018	0.00	0.17	0.09	7.55
4.6	Sub4.6	50-YEAR	0.523	0.888	2.033	0.060	33.9	0.40	0.10	3.06	0.50	0.0018	0.00	0.68	0.18	32.49
4.7	Sub4.7	50-YEAR	0.075	0.230	0.655	0.060	10.7	0.40	0.10	3.60	0.54	0.0018	0.00	0.21	0.10	9.53
4.8	Sub4.8	50-YEAR	0.237	0.388	0.998	0.060	10.4	0.40	0.10	3.76	0.55	0.0018	0.00	0.21	0.10	9.21
4.9	Sub4.9	50-YEAR	0.463	0.577	1.449	0.060	33.2	0.40	0.10	3.11	0.51	0.0018	0.00	0.66	0.18	31.79
5.1	Sub5.1	50-YEAR	0.122	0.337	0.718	0.060	36.2	0.40	0.10	3.68	0.55	0.0018	0.00	0.72	0.19	34.79
5.2	Sub5.2	50-YEAR	0.130	0.302	0.722	0.060	36.0	0.40	0.10	3.33	0.52	0.0018	0.00	0.72	0.19	34.63
6.1	Sub6.1	50-YEAR	0.368	0.445	1.114	0.060	18.1	0.40	0.10	3.54	0.54	0.0018	0.00	0.36	0.12	16.67
6.2	Sub6.2	50-YEAR	0.133	0.321	0.818	0.060	34.8	0.40	0.10	3.01	0.50	0.0018	0.00	0.70	0.18	33.51
6.3	Sub6.3	50-YEAR	0.423	0.652	1.213	0.060	12.2	0.40	0.10	3.58	0.54	0.0018	0.00	0.24	0.11	10.99
6.4	Sub6.4	50-YEAR	0.244	0.682	1.185	0.060	7.6	0.40	0.10	3.04	0.50	0.0018	0.00	0.15	0.08	6.81
6.5	Sub6.5	50-YEAR	0.198	0.468	0.896	0.060	27.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.54	0.16	25.37
6.6	Sub6.6	50-YEAR	0.366	0.997	1.654	0.058	9.0	0.40	0.10	3.40	0.53	0.0018	0.00	0.18	0.09	8.01
6.7	Sub6.7	50-YEAR	0.124	0.313	0.593	0.058	32.2	0.40	0.10	3.30	0.52	0.0018	0.00	0.64	0.18	30.69
6.8	Sub6.8	50-YEAR	0.290	0.501	1.241	0.060	8.1	0.40	0.10	3.14	0.51	0.0018	0.00	0.16	0.08	7.26
6.9	Sub6.9	50-YEAR	0.200	0.386	0.805	0.060	20.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.40	0.13	18.43
7.1	Sub7.1	50-YEAR	0.040	0.352	0.632	0.058	6.0	0.40	0.10	4.07	0.57	0.0018	0.00	0.12	0.06	5.22
7.11	Sub7.11	50-YEAR	0.099	0.349	0.658	0.060	47.5	0.40	0.10	3.40	0.53	0.0018	0.00	0.84	0.22	46.31
7.12	Sub7.12	50-YEAR	0.109	0.236	0.554	0.060	42.1	0.40	0.10	3.57	0.54	0.0018	0.00	0.81	0.21	40.90
7.2	Sub7.2	50-YEAR	0.057	0.323	0.601	0.058	39.1	0.40	0.10	3.68	0.55	0.0018	0.00	0.78	0.20	37.84
7.3	Sub7.3	50-YEAR	0.024	0.152	0.302	0.030	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.89
7.4	Sub7.4	50-YEAR	0.045	0.243	0.463	0.057	46.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.83	0.22	44.73
7.5	Sub7.5	50-YEAR	0.036	0.151	0.309	0.003	26.5	0.40	0.10	4.50	0.60	0.0018	0.00	0.53	0.16	24.68
7.6	Sub7.6	50-YEAR	0.093	0.388	0.787	0.020	59.6	0.40	0.10	3.73	0.55	0.0018	0.00	0.90	0.27	58.65
7.7	Sub7.7	50-YEAR	0.301	0.624	1.311	0.060	36.0	0.40	0.10	3.55	0.54	0.0018	0.00	0.72	0.19	34.57
7.8	Sub7.8	50-YEAR	0.114	0.383	0.660	0.060	32.2	0.40	0.10	3.16	0.51	0.0018	0.00	0.64	0.18	30.79
7.9	Sub7.9	50-YEAR	0.010	0.089	0.191	0.030	82.2	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.34	81.46
8.1	Sub8.1	50-YEAR	0.329	0.967	1.813	0.060	35.9	0.40	0.10	3.03	0.50	0.0018	0.00	0.72	0.19	34.59
8.2	Sub8.2	50-YEAR	0.128	0.408	0.894	0.010	28.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.56	0.16	26.24
8.3	Sub8.3	50-YEAR	0.162	0.451	0.822	0.020	25.6	0.40	0.10	3.99	0.56	0.0018	0.00	0.51	0.15	23.91

Existing Conditions: 50-Year Output

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
1.2		0.096	0.235	27.2	5.22	14.2	3.69	8.7	324	684,491	1.51	1,032,767	43.0	303	1,032,671	1.61
1.3		0.096	0.253	26.6	5.48	13.8	3.87	9.1	426	878,950	1.51	1,328,801	43.0	397	1,328,728	1.64
1.4		0.095	0.227	19.6	3.72	10.2	2.63	6.2	354	537,728	1.56	840,485	39.0	301	840,448	2.03
1.5		0.086	0.288	20.6	4.86	10.7	3.43	8.1	366	583,860	1.76	1,027,286	40.0	344	1,027,231	2.14
2.1		0.107	0.193	36.3	5.66	18.9	4.00	9.4	240	673,131	1.32	888,205	46.0	220	888,203	1.19
2.2		0.093	0.143	24.2	2.96	12.6	2.10	4.9	83	154,853	1.51	233,598	41.0	72	233,569	1.70
2.3		0.088	0.121	21.3	2.28	11.1	1.61	3.8	51	83,672	1.64	137,000	38.0	44	136,988	1.93
2.4		0.079	0.189	24.4	3.84	12.7	2.72	6.4	85	161,033	1.99	320,167	40.0	91	320,155	2.05
2.5		0.078	0.171	20.8	3.03	10.8	2.14	5.0	79	127,641	2.00	255,250	38.0	80	255,224	2.26
2.6		0.111	0.107	48.3	4.27	25.1	3.02	7.1	41	151,909	1.25	190,262	51.0	38	190,259	0.91
3.1		0.098	0.163	32.8	4.42	17.1	3.12	7.4	111	281,400	1.43	403,778	44.0	104	403,780	1.34
3.2		0.090	0.145	22.4	2.79	11.6	1.97	4.7	78	134,232	1.64	219,522	40.0	70	219,503	1.88
3.3		0.079	0.075	13.6	1.08	7.0	0.77	1.8	20	20,546	2.00	41,052	35.0	16	41,019	2.87
3.4		0.078	0.124	19.0	2.10	9.9	1.49	3.5	42	61,240	2.03	124,088	37.0	40	124,057	2.40
3.5		0.121	0.078	32.7	2.27	17.0	1.60	3.8	28	70,588	1.17	82,667	42.0	23	82,663	1.16
3.6		0.110	0.067	46.3	2.68	24.1	1.89	4.5	15	53,882	1.30	69,857	49.0	14	69,856	0.96
3.7		0.077	0.055	8.7	0.67	4.5	0.47	1.1	14	9,755	2.07	20,239	30.0	10	20,154	3.69
3.8		0.095	0.083	25.3	1.91	13.2	1.35	3.2	26	50,834	1.50	76,191	40.0	23	76,179	1.63
4.1		0.088	0.156	20.9	2.80	10.9	1.98	4.7	86	139,608	1.70	237,952	38.0	78	237,935	2.02
4.11		0.140	0.202	41.6	6.77	21.6	4.78	11.3	149	481,581	1.09	526,820	50.0	127	526,812	0.96
4.2		0.101	0.141	36.2	4.22	18.8	2.99	7.0	87	243,448	1.40	341,245	45.0	82	341,223	1.23
4.3		0.104	0.228	55.7	10.05	29.0	7.10	16.7	257	1,107,581	1.39	1,542,048	56.0	277	1,542,039	0.91
4.4		0.135	0.175	45.3	6.40	23.5	4.52	10.7	100	350,494	1.14	401,289	51.0	89	401,285	0.92
4.5		0.135	0.158	37.3	4.82	19.4	3.40	8.0	96	278,587	1.15	320,560	46.0	82	320,548	1.06
4.6		0.097	0.271	44.1	9.46	22.9	6.68	15.8	356	1,214,444	1.51	1,832,646	52.0	386	1,832,563	1.15
4.7		0.128	0.122	38.9	3.94	20.2	2.78	6.6	58	174,022	1.16	202,116	46.0	49	202,103	1.03
4.8		0.129	0.197	38.3	6.08	19.9	4.30	10.1	186	551,326	1.14	629,343	48.0	159	629,331	1.04
4.9		0.098	0.257	32.2	6.66	16.7	4.71	11.1	431	1,074,701	1.50	1,608,004	46.0	424	1,607,940	1.43
5.1		0.096	0.173	25.9	3.73	13.5	2.64	6.2	141	283,224	1.49	422,076	41.0	127	422,053	1.63
5.2		0.096	0.178	24.0	3.57	12.5	2.52	5.9	163	303,147	1.51	459,191	41.0	145	459,158	1.74
6.1		0.115	0.210	36.0	6.11	18.7	4.32	10.2	307	855,446	1.26	1,081,897	47.0	276	1,081,869	1.17
6.2		0.097	0.176	26.7	3.90	13.9	2.76	6.5	150	310,064	1.53	473,139	42.0	139	473,122	1.63
6.3		0.124	0.228	44.9	8.15	23.3	5.76	13.6	283	983,329	1.18	1,164,545	52.0	260	1,164,521	0.96
6.4		0.138	0.210	54.5	9.09	28.3	6.43	15.2	134	567,681	1.18	672,594	56.0	130	672,584	0.83
6.5		0.104	0.174	36.2	5.15	18.8	3.64	8.6	164	460,570	1.36	626,781	46.0	154	626,753	1.21
6.6		0.133	0.230	68.2	12.38	35.5	8.75	20.6	161	849,255	1.16	986,683	62.0	160	986,679	0.68
6.7		0.099	0.162	25.3	3.44	13.2	2.43	5.7	147	288,618	1.47	423,521	41.0	130	423,521	1.64
6.8		0.136	0.219	45.6	7.96	23.7	5.62	13.3	191	673,793	1.18	794,534	52.0	176	794,532	0.95
6.9		0.113	0.174	34.0	4.84	17.7	3.42	8.1	176	464,273	1.27	588,803	45.0	155	588,793	1.21
7.1		0.144	0.102	63.5	5.28	33.0	3.73	8.8	19	93,834	1.06	99,137	54.0	17	99,134	0.66
7.11		0.090	0.185	22.1	3.44	11.5	2.43	5.7	134	228,947	1.66	379,712	40.0	122	379,692	1.93
7.12		0.093	0.181	17.8	2.77	9.3	1.96	4.6	183	252,216	1.58	397,644	37.0	149	397,575	2.14
7.2		0.094	0.129	30.9	3.36	16.1	2.37	5.6	55	131,449	1.53	200,986	42.0	53	200,983	1.45
7.3		0.079	0.117	16.6	1.80	8.6	1.27	3.0	43	55,243	2.00	110,386	36.0	39	110,353	2.57
7.4		0.091	0.128	23.2	2.58	12.1	1.82	4.3	59	105,069	1.57	165,109	40.0	52	165,107	1.78
7.5		0.105	0.081	56.2	3.79	29.2	2.68	6.3	19	82,806	1.30	107,278	52.0	19	107,278	0.83
7.6		0.084	0.201	28.5	4.69	14.8	3.32	7.8	98	216,873	1.80	390,699	42.0	104	390,691	1.73
7.7		0.096	0.238	33.8	6.47	17.6	4.57	10.8	268	699,676	1.50	1,047,475	46.0	265	1,047,424	1.37
7.8		0.099	0.156	30.2	3.92	15.7	2.77	6.5	113	265,168	1.48	392,555	43.0	107	392,540	1.46
7.9		0.077	0.083	14.3	1.21	7.4	0.85	2.0	22	24,315	2.09	50,868	35.0	19	50,870	2.88
8.1		0.096	0.244	47.4	9.19	24.6	6.50	15.3	208	763,699	1.54	1,174,089	53.0	232	1,174,091	1.10
8.2		0.103	0.149	60.3	7.21	31.4	5.09	12.0	64	297,906	1.32	392,459	55.0	66	392,452	0.80
8.3		0.106	0.160	49.2	6.34	25.6	4.48	10.6	99	375,517	1.32	497,154	52.0	98	497,146	0.94

EXISTING CONDITIONS

100-YEAR

Existing Conditions: 100-Year Input

Summary of CUHP Input Parameters (Version 2.0.0)

								Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	**SWMM Node/ID**	**Raingage Name/ID**	**Area (sq.mi.)**	**Dist. to Centroid (miles)**	**Length (miles)**	**Slope (ft./ft.)**	**Percent Imperv.**	**Pervious (inches)**	**Imperv. (inches)**	**Initial Rate (in./hr.)**	**Final Rate (in.hr.)**	**Decay Coeff. (1/sec.)**	**DCIA Level**	**Dir. Con'ct Imperv. Fraction**	**Receiv. Perv. Fraction**	**Percent Eff. Imperv.**
1.2	Sub1.2	100-YEAR	0.295	0.498	1.021	0.060	35.7	0.40	0.10	3.34	0.52	0.0018	0.00	0.71	0.19	34.50
1.3	Sub1.3	100-YEAR	0.378	0.498	1.137	0.060	35.6	0.40	0.10	3.30	0.52	0.0018	0.00	0.71	0.19	34.48
1.4	Sub1.4	100-YEAR	0.231	0.308	0.798	0.060	37.7	0.40	0.10	3.00	0.50	0.0018	0.00	0.75	0.19	36.72
1.5	Sub1.5	100-YEAR	0.251	0.510	1.073	0.060	55.6	0.40	0.10	3.51	0.53	0.0018	0.00	0.88	0.25	54.75
2.1	Sub2.1	100-YEAR	0.290	0.511	0.954	0.060	24.3	0.40	0.10	3.83	0.56	0.0018	0.00	0.49	0.15	22.94
2.2	Sub2.2	100-YEAR	0.067	0.273	0.545	0.058	41.5	0.40	0.10	4.45	0.60	0.0018	0.00	0.81	0.20	40.28
2.3	Sub2.3	100-YEAR	0.036	0.194	0.471	0.060	50.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.85	0.23	49.62
2.4	Sub2.4	100-YEAR	0.069	0.403	0.684	0.030	75.1	0.40	0.10	4.49	0.60	0.0018	0.00	0.93	0.32	74.31
2.5	Sub2.5	100-YEAR	0.055	0.279	0.667	0.040	75.9	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	75.14
2.6	Sub2.6	100-YEAR	0.065	0.342	0.705	0.060	21.2	0.40	0.10	4.12	0.57	0.0018	0.00	0.42	0.13	19.75
3.1	Sub3.1	100-YEAR	0.121	0.403	0.838	0.060	33.4	0.40	0.10	3.91	0.56	0.0018	0.00	0.67	0.18	32.08
3.2	Sub3.2	100-YEAR	0.058	0.267	0.529	0.060	47.3	0.40	0.10	3.74	0.55	0.0018	0.00	0.84	0.22	46.33
3.3	Sub3.3	100-YEAR	0.009	0.106	0.159	0.060	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	75.02
3.4	Sub3.4	100-YEAR	0.026	0.215	0.369	0.040	77.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.32	76.99
3.5	Sub3.5	100-YEAR	0.030	0.146	0.320	0.060	14.3	0.40	0.10	3.99	0.57	0.0018	0.00	0.29	0.11	13.07
3.6	Sub3.6	100-YEAR	0.023	0.208	0.410	0.060	22.1	0.40	0.10	3.76	0.55	0.0018	0.00	0.44	0.14	20.77
3.7	Sub3.7	100-YEAR	0.004	0.034	0.076	0.030	81.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.33	80.37
3.8	Sub3.8	100-YEAR	0.022	0.155	0.330	0.060	38.3	0.40	0.10	3.94	0.56	0.0018	0.00	0.77	0.19	37.09
4.1	Sub4.1	100-YEAR	0.060	0.280	0.531	0.058	52.5	0.40	0.10	3.75	0.55	0.0018	0.00	0.86	0.24	51.57
4.11	Sub4.11	100-YEAR	0.207	0.406	1.021	0.060	7.2	0.40	0.10	3.84	0.56	0.0018	0.00	0.14	0.07	6.46
4.2	Sub4.2	100-YEAR	0.105	0.379	0.732	0.057	29.5	0.40	0.10	3.67	0.54	0.0018	0.00	0.59	0.17	28.13
4.3	Sub4.3	100-YEAR	0.477	0.901	1.974	0.058	27.2	0.40	0.10	3.43	0.53	0.0018	0.00	0.54	0.16	25.89
4.4	Sub4.4	100-YEAR	0.151	0.388	0.981	0.057	8.4	0.40	0.10	3.49	0.53	0.0018	0.00	0.17	0.08	7.59
4.5	Sub4.5	100-YEAR	0.120	0.303	0.693	0.060	8.5	0.40	0.10	3.45	0.53	0.0018	0.00	0.17	0.09	7.71
4.6	Sub4.6	100-YEAR	0.523	0.888	2.033	0.060	33.9	0.40	0.10	3.06	0.50	0.0018	0.00	0.68	0.18	32.73
4.7	Sub4.7	100-YEAR	0.075	0.230	0.655	0.060	10.7	0.40	0.10	3.60	0.54	0.0018	0.00	0.21	0.10	9.72
4.8	Sub4.8	100-YEAR	0.237	0.388	0.998	0.060	10.4	0.40	0.10	3.76	0.55	0.0018	0.00	0.21	0.10	9.40
4.9	Sub4.9	100-YEAR	0.463	0.577	1.449	0.060	33.2	0.40	0.10	3.11	0.51	0.0018	0.00	0.66	0.18	32.03
5.1	Sub5.1	100-YEAR	0.122	0.337	0.718	0.060	36.2	0.40	0.10	3.68	0.55	0.0018	0.00	0.72	0.19	35.03
5.2	Sub5.2	100-YEAR	0.130	0.302	0.722	0.060	36.0	0.40	0.10	3.33	0.52	0.0018	0.00	0.72	0.19	34.86
6.1	Sub6.1	100-YEAR	0.368	0.445	1.114	0.060	18.1	0.40	0.10	3.54	0.54	0.0018	0.00	0.36	0.12	16.93
6.2	Sub6.2	100-YEAR	0.133	0.321	0.818	0.060	34.8	0.40	0.10	3.01	0.50	0.0018	0.00	0.70	0.18	33.74
6.3	Sub6.3	100-YEAR	0.423	0.652	1.213	0.060	12.2	0.40	0.10	3.58	0.54	0.0018	0.00	0.24	0.11	11.20
6.4	Sub6.4	100-YEAR	0.244	0.682	1.185	0.060	7.6	0.40	0.10	3.04	0.50	0.0018	0.00	0.15	0.08	6.95
6.5	Sub6.5	100-YEAR	0.198	0.468	0.896	0.060	27.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.54	0.16	25.66
6.6	Sub6.6	100-YEAR	0.366	0.997	1.654	0.058	9.0	0.40	0.10	3.40	0.53	0.0018	0.00	0.18	0.09	8.17
6.7	Sub6.7	100-YEAR	0.124	0.313	0.593	0.058	32.2	0.40	0.10	3.30	0.52	0.0018	0.00	0.64	0.18	30.95
6.8	Sub6.8	100-YEAR	0.290	0.501	1.241	0.060	8.1	0.40	0.10	3.14	0.51	0.0018	0.00	0.16	0.08	7.41
6.9	Sub6.9	100-YEAR	0.200	0.386	0.805	0.060	20.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.40	0.13	18.70
7.1	Sub7.1	100-YEAR	0.040	0.352	0.632	0.058	6.0	0.40	0.10	4.07	0.57	0.0018	0.00	0.12	0.06	5.35
7.11	Sub7.11	100-YEAR	0.099	0.349	0.658	0.060	47.5	0.40	0.10	3.40	0.53	0.0018	0.00	0.84	0.22	46.49
7.12	Sub7.12	100-YEAR	0.109	0.236	0.554	0.060	42.1	0.40	0.10	3.57	0.54	0.0018	0.00	0.81	0.21	41.10
7.2	Sub7.2	100-YEAR	0.057	0.323	0.601	0.058	39.1	0.40	0.10	3.68	0.55	0.0018	0.00	0.78	0.20	38.05
7.3	Sub7.3	100-YEAR	0.024	0.152	0.302	0.030	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	75.03
7.4	Sub7.4	100-YEAR	0.045	0.243	0.463	0.057	46.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.83	0.22	44.94
7.5	Sub7.5	100-YEAR	0.036	0.151	0.309	0.003	26.5	0.40	0.10	4.50	0.60	0.0018	0.00	0.53	0.16	25.00
7.6	Sub7.6	100-YEAR	0.093	0.388	0.787	0.020	59.6	0.40	0.10	3.73	0.55	0.0018	0.00	0.90	0.27	58.81
7.7	Sub7.7	100-YEAR	0.301	0.624	1.311	0.060	36.0	0.40	0.10	3.55	0.54	0.0018	0.00	0.72	0.19	34.81
7.8	Sub7.8	100-YEAR	0.114	0.383	0.660	0.060	32.2	0.40	0.10	3.16	0.51	0.0018	0.00	0.64	0.18	31.04
7.9	Sub7.9	100-YEAR	0.010	0.089	0.191	0.030	82.2	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.34	81.58
8.1	Sub8.1	100-YEAR	0.329	0.967	1.813	0.060	35.9	0.40	0.10	3.03	0.50	0.0018	0.00	0.72	0.19	34.81
8.2	Sub8.2	100-YEAR	0.128	0.408	0.894	0.010	28.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.56	0.16	26.55
8.3	Sub8.3	100-YEAR	0.162	0.451	0.822	0.020	25.6	0.40	0.10	3.99	0.56	0.0018	0.00	0.51	0.15	24.20

Existing Conditions: 100-Year Output

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
1.2		0.096	0.236	27.1	5.21	14.1	3.68	8.7	326	684,491	2.06	1,406,754	43.0	408	1,406,622	2.16
1.3		0.096	0.254	26.5	5.47	13.8	3.87	9.1	429	878,950	2.06	1,809,161	43.0	534	1,809,001	2.21
1.4		0.095	0.228	19.5	3.72	10.1	2.63	6.2	356	537,728	2.11	1,134,368	39.0	403	1,134,290	2.72
1.5		0.086	0.288	20.6	4.86	10.7	3.43	8.1	366	583,860	2.30	1,342,360	40.0	449	1,342,319	2.79
2.1		0.107	0.193	36.2	5.65	18.8	3.99	9.4	240	673,131	1.87	1,256,252	47.0	306	1,256,236	1.65
2.2		0.093	0.144	24.1	2.96	12.5	2.09	4.9	83	154,853	2.05	317,208	40.0	97	317,169	2.27
2.3		0.088	0.122	21.2	2.28	11.0	1.61	3.8	51	83,672	2.18	182,007	38.0	59	181,988	2.55
2.4		0.079	0.189	24.3	3.84	12.7	2.72	6.4	85	161,033	2.52	405,946	40.0	116	405,933	2.61
2.5		0.078	0.171	20.7	3.03	10.8	2.14	5.0	79	127,641	2.53	323,218	38.0	102	323,188	2.89
2.6		0.111	0.107	48.2	4.26	25.1	3.01	7.1	41	151,909	1.80	273,182	51.0	54	273,173	1.29
3.1		0.098	0.164	32.6	4.41	17.0	3.11	7.3	111	281,400	1.98	556,901	45.0	142	556,891	1.83
3.2		0.090	0.145	22.3	2.79	11.6	1.97	4.6	78	134,232	2.18	292,167	39.0	92	292,139	2.49
3.3		0.078	0.075	13.5	1.08	7.0	0.76	1.8	20	20,546	2.53	51,993	35.0	21	51,951	3.68
3.4		0.078	0.124	19.0	2.10	9.9	1.48	3.5	42	61,240	2.56	156,673	37.0	52	156,635	3.05
3.5		0.121	0.078	32.6	2.26	17.0	1.60	3.8	28	70,588	1.72	121,382	43.0	32	121,374	1.64
3.6		0.109	0.067	46.2	2.67	24.0	1.89	4.5	15	53,882	1.84	99,372	48.0	20	99,372	1.34
3.7		0.077	0.055	8.7	0.67	4.5	0.47	1.1	14	9,755	2.61	25,423	32.0	12	25,315	4.55
3.8		0.095	0.083	25.2	1.90	13.1	1.35	3.2	26	50,834	2.04	103,784	40.0	31	103,770	2.18
4.1		0.087	0.156	20.9	2.80	10.8	1.98	4.7	86	139,608	2.24	313,304	38.0	102	313,282	2.66
4.11		0.139	0.202	41.6	6.74	21.6	4.76	11.2	150	481,581	1.65	792,303	50.0	183	792,287	1.38
4.2		0.101	0.142	35.9	4.21	18.7	2.98	7.0	88	243,448	1.95	474,267	46.0	113	474,247	1.69
4.3		0.103	0.230	55.2	10.02	28.7	7.08	16.7	259	1,107,581	1.94	2,149,431	57.0	386	2,149,410	1.27
4.4		0.135	0.175	45.3	6.37	23.5	4.50	10.6	100	350,494	1.70	595,337	51.0	128	595,331	1.32
4.5		0.134	0.157	37.3	4.80	19.4	3.39	8.0	97	278,587	1.70	474,893	47.0	117	474,874	1.52
4.6		0.097	0.272	43.8	9.44	22.8	6.67	15.7	358	1,214,444	2.06	2,497,874	53.0	526	2,497,794	1.57
4.7		0.127	0.121	38.9	3.92	20.2	2.77	6.5	58	174,022	1.71	298,215	47.0	70	298,197	1.47
4.8		0.128	0.196	38.2	6.05	19.9	4.28	10.1	186	551,326	1.69	933,100	48.0	227	933,083	1.49
4.9		0.098	0.259	32.0	6.65	16.6	4.70	11.1	434	1,074,701	2.04	2,196,833	46.0	575	2,196,714	1.94
5.1		0.096	0.173	25.7	3.73	13.4	2.63	6.2	142	283,224	2.03	576,279	41.0	171	576,246	2.19
5.2		0.096	0.178	23.8	3.56	12.4	2.52	5.9	164	303,147	2.06	624,810	41.0	194	624,790	2.33
6.1		0.115	0.210	35.9	6.09	18.7	4.30	10.2	308	855,446	1.82	1,552,647	47.0	387	1,552,588	1.64
6.2		0.097	0.177	26.5	3.89	13.8	2.75	6.5	151	310,064	2.07	642,884	42.0	187	642,853	2.18
6.3		0.124	0.227	44.8	8.12	23.3	5.74	13.5	283	983,329	1.74	1,707,227	52.0	370	1,707,174	1.37
6.4		0.137	0.209	54.5	9.06	28.3	6.40	15.1	135	567,681	1.74	988,603	57.0	186	988,586	1.19
6.5		0.104	0.175	35.9	5.13	18.6	3.63	8.6	166	460,570	1.91	878,433	47.0	213	878,404	1.68
6.6		0.133	0.230	68.2	12.32	35.5	8.71	20.5	161	849,255	1.72	1,457,427	65.0	233	1,457,419	1.00
6.7		0.099	0.162	25.1	3.43	13.1	2.43	5.7	148	288,618	2.01	581,564	41.0	176	581,555	2.21
6.8		0.136	0.218	45.5	7.93	23.7	5.60	13.2	191	673,793	1.74	1,169,296	53.0	252	1,169,295	1.35
6.9		0.112	0.174	33.9	4.82	17.6	3.41	8.0	177	464,273	1.82	843,366	46.0	216	843,355	1.69
7.1		0.143	0.102	63.5	5.26	33.0	3.72	8.8	19	93,834	1.61	150,728	56.0	25	150,723	0.97
7.11		0.090	0.185	22.1	3.44	11.5	2.43	5.7	134	228,947	2.20	503,916	40.0	161	503,892	2.55
7.12		0.093	0.181	17.7	2.77	9.2	1.96	4.6	184	252,216	2.12	534,679	37.0	199	534,596	2.86
7.2		0.094	0.129	30.8	3.35	16.0	2.37	5.6	55	131,449	2.07	272,451	43.0	70	272,436	1.94
7.3		0.078	0.117	16.6	1.79	8.6	1.27	3.0	43	55,243	2.53	139,804	36.0	50	139,764	3.29
7.4		0.091	0.128	23.1	2.58	12.0	1.82	4.3	59	105,069	2.11	221,727	40.0	69	221,734	2.37
7.5		0.104	0.081	56.0	3.78	29.1	2.67	6.3	19	82,806	1.84	152,228	52.0	26	152,228	1.16
7.6		0.084	0.201	28.5	4.69	14.8	3.31	7.8	98	216,873	2.34	507,360	43.0	134	507,345	2.25
7.7		0.096	0.239	33.6	6.46	17.5	4.57	10.8	269	699,676	2.04	1,428,870	47.0	359	1,428,847	1.86
7.8		0.099	0.157	30.0	3.91	15.6	2.76	6.5	114	265,168	2.03	537,884	43.0	144	537,870	1.97
7.9		0.077	0.083	14.3	1.21	7.4	0.85	2.0	22	24,315	2.62	63,781	35.0	24	63,783	3.66
8.1		0.096	0.245	47.1	9.18	24.5	6.49	15.3	209	763,699	2.08	1,591,921	54.0	315	1,591,902	1.50
8.2		0.103	0.150	59.7	7.18	31.0	5.08	12.0	64	297,906	1.86	554,082	56.0	93	554,071	1.13
8.3		0.105	0.160	49.0	6.32	25.5	4.46	10.5	99	375,517	1.87	701,878	52.0	136	701,867	1.32

FUTURE CONDITIONS

2-YEAR

Future Conditions: 2-Year Input
Summary of CUHP Input Parameters (Version 2.0.0)

								Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
1.2	Sub1.2	2-YEAR	0.295	0.498	1.021	0.060	35.7	0.40	0.10	3.34	0.52	0.0018	0.00	0.71	0.19	32.13
1.3	Sub1.3	2-YEAR	0.378	0.498	1.137	0.060	35.6	0.40	0.10	3.30	0.52	0.0018	0.00	0.71	0.19	32.13
1.4	Sub1.4	2-YEAR	0.231	0.308	0.798	0.060	37.7	0.40	0.10	3.00	0.50	0.0018	0.00	0.75	0.19	34.65
1.5	Sub1.5	2-YEAR	0.251	0.510	1.073	0.060	55.6	0.40	0.10	3.51	0.53	0.0018	0.00	0.88	0.25	52.98
2.1	Sub2.1	2-YEAR	0.290	0.511	0.954	0.060	24.3	0.40	0.10	3.83	0.56	0.0018	0.00	0.49	0.15	20.05
2.2	Sub2.2	2-YEAR	0.067	0.273	0.545	0.058	41.5	0.40	0.10	4.45	0.60	0.0018	0.00	0.81	0.20	37.85
2.3	Sub2.3	2-YEAR	0.036	0.194	0.471	0.060	50.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.85	0.23	47.34
2.4	Sub2.4	2-YEAR	0.069	0.403	0.684	0.030	75.1	0.40	0.10	4.49	0.60	0.0018	0.00	0.93	0.32	72.72
2.5	Sub2.5	2-YEAR	0.055	0.279	0.667	0.040	75.9	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	73.57
2.6	Sub2.6	2-YEAR	0.065	0.342	0.705	0.060	21.2	0.40	0.10	4.12	0.57	0.0018	0.00	0.42	0.13	16.82
3.1	Sub3.1	2-YEAR	0.121	0.403	0.838	0.060	41.3	0.40	0.10	3.91	0.56	0.0018	0.00	0.81	0.20	37.98
3.2	Sub3.2	2-YEAR	0.058	0.267	0.529	0.060	47.3	0.40	0.10	3.74	0.55	0.0018	0.00	0.84	0.22	44.26
3.3	Sub3.3	2-YEAR	0.009	0.106	0.159	0.060	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	73.44
3.4	Sub3.4	2-YEAR	0.026	0.215	0.369	0.040	77.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.32	75.48
3.5	Sub3.5	2-YEAR	0.030	0.146	0.320	0.060	14.3	0.40	0.10	3.99	0.57	0.0018	0.00	0.29	0.11	10.60
3.6	Sub3.6	2-YEAR	0.023	0.208	0.410	0.060	22.1	0.40	0.10	3.76	0.55	0.0018	0.00	0.44	0.14	17.97
3.7	Sub3.7	2-YEAR	0.004	0.034	0.076	0.030	81.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.33	78.99
3.8	Sub3.8	2-YEAR	0.022	0.155	0.330	0.060	38.3	0.40	0.10	3.94	0.56	0.0018	0.00	0.77	0.19	34.69
4.1	Sub4.1	2-YEAR	0.060	0.280	0.531	0.058	74.1	0.40	0.10	3.75	0.55	0.0018	0.00	0.93	0.31	71.98
4.11	Sub4.11	2-YEAR	0.207	0.406	1.021	0.060	7.2	0.40	0.10	3.84	0.56	0.0018	0.00	0.14	0.07	4.94
4.2	Sub4.2	2-YEAR	0.105	0.379	0.732	0.057	29.7	0.40	0.10	3.67	0.54	0.0018	0.00	0.59	0.17	25.59
4.3	Sub4.3	2-YEAR	0.477	0.901	1.974	0.058	27.2	0.40	0.10	3.43	0.53	0.0018	0.00	0.54	0.16	23.16
4.4	Sub4.4	2-YEAR	0.151	0.388	0.981	0.057	8.4	0.40	0.10	3.49	0.53	0.0018	0.00	0.17	0.08	5.96
4.5	Sub4.5	2-YEAR	0.120	0.303	0.693	0.060	8.5	0.40	0.10	3.45	0.53	0.0018	0.00	0.17	0.09	6.08
4.6	Sub4.6	2-YEAR	0.523	0.888	2.033	0.060	33.9	0.40	0.10	3.06	0.50	0.0018	0.00	0.68	0.18	30.37
4.7	Sub4.7	2-YEAR	0.075	0.230	0.655	0.060	10.7	0.40	0.10	3.60	0.54	0.0018	0.00	0.21	0.10	7.73
4.8	Sub4.8	2-YEAR	0.237	0.388	0.998	0.060	10.4	0.40	0.10	3.76	0.55	0.0018	0.00	0.21	0.10	7.39
4.9	Sub4.9	2-YEAR	0.463	0.577	1.449	0.060	33.2	0.40	0.10	3.11	0.51	0.0018	0.00	0.66	0.18	29.61
5.1	Sub5.1	2-YEAR	0.122	0.337	0.718	0.060	47.6	0.40	0.10	3.68	0.55	0.0018	0.00	0.84	0.22	44.58
5.2	Sub5.2	2-YEAR	0.130	0.302	0.722	0.060	36.0	0.40	0.10	3.33	0.52	0.0018	0.00	0.72	0.19	32.52
6.1	Sub6.1	2-YEAR	0.368	0.445	1.114	0.060	19.8	0.40	0.10	3.54	0.54	0.0018	0.00	0.40	0.13	15.91
6.2	Sub6.2	2-YEAR	0.133	0.321	0.818	0.060	34.9	0.40	0.10	3.01	0.50	0.0018	0.00	0.70	0.18	31.47
6.3	Sub6.3	2-YEAR	0.423	0.652	1.213	0.060	12.2	0.40	0.10	3.58	0.54	0.0018	0.00	0.24	0.11	9.07
6.4	Sub6.4	2-YEAR	0.244	0.682	1.185	0.060	7.6	0.40	0.10	3.04	0.50	0.0018	0.00	0.15	0.08	5.56
6.5	Sub6.5	2-YEAR	0.198	0.468	0.896	0.060	27.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.54	0.16	22.77
6.6	Sub6.6	2-YEAR	0.366	0.997	1.654	0.058	9.0	0.40	0.10	3.40	0.53	0.0018	0.00	0.18	0.09	6.48
6.7	Sub6.7	2-YEAR	0.124	0.313	0.593	0.058	32.2	0.40	0.10	3.30	0.52	0.0018	0.00	0.64	0.18	28.40
6.8	Sub6.8	2-YEAR	0.290	0.501	1.241	0.060	8.1	0.40	0.10	3.14	0.51	0.0018	0.00	0.16	0.08	5.91
6.9	Sub6.9	2-YEAR	0.200	0.386	0.805	0.060	20.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.40	0.13	15.98
7.1	Sub7.1	2-YEAR	0.040	0.352	0.632	0.058	18.7	0.40	0.10	4.07	0.57	0.0018	0.00	0.37	0.13	14.55
7.11	Sub7.11	2-YEAR	0.099	0.349	0.658	0.060	47.5	0.40	0.10	3.40	0.53	0.0018	0.00	0.84	0.22	44.56
7.12	Sub7.12	2-YEAR	0.109	0.236	0.554	0.060	54.1	0.40	0.10	3.57	0.54	0.0018	0.00	0.87	0.25	51.30
7.2	Sub7.2	2-YEAR	0.057	0.323	0.601	0.058	39.1	0.40	0.10	3.68	0.55	0.0018	0.00	0.78	0.20	35.85
7.3	Sub7.3	2-YEAR	0.024	0.152	0.302	0.030	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	73.46
7.4	Sub7.4	2-YEAR	0.045	0.243	0.463	0.057	46.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.83	0.22	42.57
7.5	Sub7.5	2-YEAR	0.036	0.151	0.309	0.003	26.5	0.40	0.10	4.50	0.60	0.0018	0.00	0.53	0.16	21.79
7.6	Sub7.6	2-YEAR	0.093	0.388	0.787	0.020	59.6	0.40	0.10	3.73	0.55	0.0018	0.00	0.90	0.27	57.12
7.7	Sub7.7	2-YEAR	0.301	0.624	1.311	0.060	36.0	0.40	0.10	3.55	0.54	0.0018	0.00	0.72	0.19	32.37
7.8	Sub7.8	2-YEAR	0.114	0.383	0.660	0.060	32.6	0.40	0.10	3.16	0.51	0.0018	0.00	0.65	0.18	28.99
7.9	Sub7.9	2-YEAR	0.010	0.089	0.191	0.030	82.2	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.34	80.25
8.1	Sub8.1	2-YEAR	0.329	0.967	1.813	0.060	35.9	0.40	0.10	3.03	0.50	0.0018	0.00	0.72	0.19	32.58
8.2	Sub8.2	2-YEAR	0.128	0.408	0.894	0.010	28.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.56	0.16	23.35
8.3	Sub8.3	2-YEAR	0.162	0.451	0.822	0.020	25.6	0.40	0.10	3.99	0.56	0.0018	0.00	0.51	0.15	21.22

Future Conditions: 2-Year Output

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
1.2		0.098	0.226	28.8	5.30	15.0	3.74	8.8	307	684,491	0.22	150,115	38.0	39	150,099	0.21
1.3		0.098	0.244	28.1	5.56	14.6	3.93	9.3	404	878,950	0.22	192,832	38.0	51	192,823	0.21
1.4		0.096	0.220	20.5	3.76	10.6	2.66	6.3	339	537,728	0.24	129,030	34.0	42	129,021	0.28
1.5		0.087	0.284	21.1	4.90	11.0	3.46	8.2	358	583,860	0.38	221,413	35.0	67	221,411	0.42
2.1		0.110	0.193	37.2	5.83	19.4	4.12	9.7	233	673,131	0.13	85,421	42.0	20	85,417	0.11
2.2		0.094	0.138	25.3	2.99	13.2	2.11	5.0	79	154,853	0.26	40,489	35.0	11	40,483	0.25
2.3		0.089	0.119	22.0	2.31	11.4	1.63	3.8	49	83,672	0.33	27,926	33.0	8	27,926	0.35
2.4		0.079	0.188	24.6	3.87	12.8	2.73	6.4	84	161,033	0.53	85,702	35.0	23	85,701	0.52
2.5		0.079	0.170	21.0	3.04	10.9	2.15	5.1	79	127,641	0.54	68,795	33.0	20	68,782	0.58
2.6		0.115	0.108	49.5	4.40	25.7	3.11	7.3	40	151,909	0.10	15,628	43.0	3	15,628	0.07
3.1		0.094	0.182	28.3	4.25	14.7	3.00	7.1	128	281,400	0.26	74,163	37.0	18	74,159	0.24
3.2		0.091	0.142	23.1	2.82	12.0	1.99	4.7	75	134,232	0.31	41,854	34.0	12	41,849	0.32
3.3		0.079	0.075	13.7	1.09	7.1	0.77	1.8	19	20,546	0.54	11,053	30.0	4	11,044	0.75
3.4		0.078	0.123	19.2	2.11	10.0	1.49	3.5	41	61,240	0.55	33,942	32.0	11	33,932	0.63
3.5		0.125	0.080	33.1	2.33	17.2	1.65	3.9	28	70,588	0.06	4,167	39.0	1	4,167	0.06
3.6		0.113	0.067	47.4	2.75	24.6	1.95	4.6	15	53,882	0.11	6,049	41.0	1	6,049	0.08
3.7		0.077	0.054	8.8	0.67	4.6	0.47	1.1	14	9,755	0.58	5,681	30.0	3	5,659	1.02
3.8		0.096	0.080	26.6	1.93	13.9	1.36	3.2	25	50,834	0.24	12,100	35.0	3	12,099	0.22
4.1		0.079	0.176	16.8	2.57	8.7	1.81	4.3	108	139,608	0.53	73,628	32.0	26	73,629	0.66
4.11		0.145	0.209	41.8	7.00	21.7	4.95	11.7	149	481,581	0.02	11,371	44.0	3	11,371	0.02
4.2		0.104	0.134	39.0	4.31	20.3	3.05	7.2	81	243,448	0.17	40,924	41.0	9	40,923	0.13
4.3		0.106	0.223	58.3	10.31	30.3	7.28	17.2	245	1,107,581	0.15	167,480	50.0	27	167,477	0.09
4.4		0.141	0.182	45.5	6.65	23.7	4.70	11.1	99	350,494	0.03	10,457	44.0	2	10,457	0.03
4.5		0.140	0.163	37.5	5.00	19.5	3.53	8.3	96	278,587	0.03	8,516	42.0	2	8,515	0.03
4.6		0.099	0.260	46.7	9.61	24.3	6.79	16.0	336	1,214,444	0.21	250,632	47.0	46	250,631	0.14
4.7		0.134	0.127	39.2	4.13	20.4	2.92	6.9	57	174,022	0.04	6,970	42.0	2	6,970	0.04
4.8		0.136	0.205	38.6	6.39	20.1	4.51	10.6	185	551,326	0.04	20,644	43.0	5	20,643	0.04
4.9		0.100	0.247	34.2	6.78	17.8	4.79	11.3	406	1,074,701	0.20	215,396	42.0	51	215,394	0.17
5.1		0.091	0.200	21.2	3.55	11.0	2.51	5.9	172	283,224	0.31	89,033	34.0	27	89,035	0.34
5.2		0.097	0.171	25.3	3.62	13.1	2.56	6.0	155	303,147	0.22	67,427	36.0	19	67,429	0.23
6.1		0.116	0.211	36.2	6.17	18.8	4.36	10.3	305	855,446	0.10	84,323	42.0	21	84,321	0.09
6.2		0.098	0.169	28.1	3.96	14.6	2.80	6.6	142	310,064	0.22	66,673	37.0	18	66,669	0.21
6.3		0.129	0.235	45.3	8.48	23.6	5.99	14.1	280	983,329	0.05	48,378	46.0	11	48,377	0.04
6.4		0.142	0.216	54.7	9.39	28.5	6.64	15.6	134	567,681	0.03	16,367	48.0	3	16,366	0.02
6.5		0.107	0.172	37.8	5.28	19.6	3.73	8.8	157	460,570	0.15	67,673	41.0	15	67,671	0.12
6.6		0.139	0.239	68.6	12.89	35.7	9.11	21.5	160	849,255	0.03	27,924	54.0	5	27,924	0.02
6.7		0.101	0.154	27.1	3.51	14.1	2.48	5.8	138	288,618	0.19	54,978	37.0	15	54,978	0.19
6.8		0.141	0.226	45.8	8.24	23.8	5.82	13.7	190	673,793	0.03	20,476	46.0	5	20,475	0.03
6.9		0.116	0.176	34.7	4.98	18.0	3.52	8.3	173	464,273	0.10	45,538	41.0	12	45,536	0.09
7.1		0.118	0.088	60.6	4.40	31.5	3.11	7.3	20	93,834	0.09	8,140	44.0	1	8,140	0.05
7.11		0.091	0.181	22.8	3.47	11.8	2.45	5.8	130	228,947	0.31	72,111	34.0	21	72,107	0.33
7.12		0.088	0.203	15.0	2.63	7.8	1.86	4.4	218	252,216	0.37	92,349	32.0	35	92,343	0.50
7.2		0.095	0.124	32.3	3.39	16.8	2.40	5.7	52	131,449	0.25	32,552	38.0	7	32,551	0.20
7.3		0.079	0.117	16.8	1.80	8.7	1.27	3.0	43	55,243	0.54	29,725	31.0	10	29,717	0.67
7.4		0.092	0.125	24.1	2.61	12.5	1.84	4.3	56	105,069	0.30	31,218	34.0	8	31,216	0.29
7.5		0.108	0.081	57.9	3.90	30.1	2.76	6.5	18	82,806	0.14	11,449	43.0	2	11,448	0.08
7.6		0.085	0.199	29.0	4.73	15.1	3.34	7.9	96	216,873	0.41	89,087	37.0	21	89,084	0.36
7.7		0.098	0.229	35.7	6.57	18.5	4.64	10.9	253	699,676	0.22	154,485	42.0	34	154,479	0.18
7.8		0.100	0.150	31.8	3.97	16.5	2.81	6.6	108	265,168	0.20	51,862	39.0	13	51,860	0.17
7.9		0.077	0.082	14.4	1.21	7.5	0.86	2.0	22	24,315	0.59	14,404	30.0	5	14,405	0.81
8.1		0.097	0.236	49.8	9.32	25.9	6.59	15.5	198	763,699	0.22	170,768	47.0	29	170,763	0.14
8.2		0.106	0.144	64.4	7.42	33.5	5.24	12.4	60	297,906	0.15	44,641	49.0	6	44,640	0.08
8.3		0.109	0.160	50.6	6.52	26.3	4.61	10.9	96	375,517	0.13	50,577	45.0	9	50,577	0.09

FUTURE CONDITIONS

5-YEAR

Future Conditions: 5-Year Input

Summary of CUHP Input Parameters (Version 2.0.0)

								Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
1.2	Sub1.2	5-YEAR	0.295	0.498	1.021	0.060	35.7	0.40	0.10	3.34	0.52	0.0018	0.00	0.71	0.19	32.97
1.3	Sub1.3	5-YEAR	0.378	0.498	1.137	0.060	35.6	0.40	0.10	3.30	0.52	0.0018	0.00	0.71	0.19	32.96
1.4	Sub1.4	5-YEAR	0.231	0.308	0.798	0.060	37.7	0.40	0.10	3.00	0.50	0.0018	0.00	0.75	0.19	35.38
1.5	Sub1.5	5-YEAR	0.251	0.510	1.073	0.060	55.6	0.40	0.10	3.51	0.53	0.0018	0.00	0.88	0.25	53.63
2.1	Sub2.1	5-YEAR	0.290	0.511	0.954	0.060	24.3	0.40	0.10	3.83	0.56	0.0018	0.00	0.49	0.15	21.07
2.2	Sub2.2	5-YEAR	0.067	0.273	0.545	0.058	41.5	0.40	0.10	4.45	0.60	0.0018	0.00	0.81	0.20	38.81
2.3	Sub2.3	5-YEAR	0.036	0.194	0.471	0.060	50.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.85	0.23	48.23
2.4	Sub2.4	5-YEAR	0.069	0.403	0.684	0.030	75.1	0.40	0.10	4.49	0.60	0.0018	0.00	0.93	0.32	73.33
2.5	Sub2.5	5-YEAR	0.055	0.279	0.667	0.040	75.9	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.18
2.6	Sub2.6	5-YEAR	0.065	0.342	0.705	0.060	21.2	0.40	0.10	4.12	0.57	0.0018	0.00	0.42	0.13	17.88
3.1	Sub3.1	5-YEAR	0.121	0.403	0.838	0.060	41.3	0.40	0.10	3.91	0.56	0.0018	0.00	0.81	0.20	38.82
3.2	Sub3.2	5-YEAR	0.058	0.267	0.529	0.060	47.3	0.40	0.10	3.74	0.55	0.0018	0.00	0.84	0.22	45.04
3.3	Sub3.3	5-YEAR	0.009	0.106	0.159	0.060	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.05
3.4	Sub3.4	5-YEAR	0.026	0.215	0.369	0.040	77.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.32	76.06
3.5	Sub3.5	5-YEAR	0.030	0.146	0.320	0.060	14.3	0.40	0.10	3.99	0.57	0.0018	0.00	0.29	0.11	11.50
3.6	Sub3.6	5-YEAR	0.023	0.208	0.410	0.060	22.1	0.40	0.10	3.76	0.55	0.0018	0.00	0.44	0.14	18.96
3.7	Sub3.7	5-YEAR	0.004	0.034	0.076	0.030	81.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.33	79.52
3.8	Sub3.8	5-YEAR	0.022	0.155	0.330	0.060	38.3	0.40	0.10	3.94	0.56	0.0018	0.00	0.77	0.19	35.59
4.1	Sub4.1	5-YEAR	0.060	0.280	0.531	0.058	74.1	0.40	0.10	3.75	0.55	0.0018	0.00	0.93	0.31	72.52
4.11	Sub4.11	5-YEAR	0.207	0.406	1.021	0.060	7.2	0.40	0.10	3.84	0.56	0.0018	0.00	0.14	0.07	5.49
4.2	Sub4.2	5-YEAR	0.105	0.379	0.732	0.057	29.7	0.40	0.10	3.67	0.54	0.0018	0.00	0.59	0.17	26.59
4.3	Sub4.3	5-YEAR	0.477	0.901	1.974	0.058	27.2	0.40	0.10	3.43	0.53	0.0018	0.00	0.54	0.16	24.12
4.4	Sub4.4	5-YEAR	0.151	0.388	0.981	0.057	8.4	0.40	0.10	3.49	0.53	0.0018	0.00	0.17	0.08	6.54
4.5	Sub4.5	5-YEAR	0.120	0.303	0.693	0.060	8.5	0.40	0.10	3.45	0.53	0.0018	0.00	0.17	0.09	6.66
4.6	Sub4.6	5-YEAR	0.523	0.888	2.033	0.060	33.9	0.40	0.10	3.06	0.50	0.0018	0.00	0.68	0.18	31.19
4.7	Sub4.7	5-YEAR	0.075	0.230	0.655	0.060	10.7	0.40	0.10	3.60	0.54	0.0018	0.00	0.21	0.10	8.45
4.8	Sub4.8	5-YEAR	0.237	0.388	0.998	0.060	10.4	0.40	0.10	3.76	0.55	0.0018	0.00	0.21	0.10	8.12
4.9	Sub4.9	5-YEAR	0.463	0.577	1.449	0.060	33.2	0.40	0.10	3.11	0.51	0.0018	0.00	0.66	0.18	30.45
5.1	Sub5.1	5-YEAR	0.122	0.337	0.718	0.060	47.6	0.40	0.10	3.68	0.55	0.0018	0.00	0.84	0.22	45.34
5.2	Sub5.2	5-YEAR	0.130	0.302	0.722	0.060	36.0	0.40	0.10	3.33	0.52	0.0018	0.00	0.72	0.19	33.35
6.1	Sub6.1	5-YEAR	0.368	0.445	1.114	0.060	19.8	0.40	0.10	3.54	0.54	0.0018	0.00	0.40	0.13	16.83
6.2	Sub6.2	5-YEAR	0.133	0.321	0.818	0.060	34.9	0.40	0.10	3.01	0.50	0.0018	0.00	0.70	0.18	32.27
6.3	Sub6.3	5-YEAR	0.423	0.652	1.213	0.060	12.2	0.40	0.10	3.58	0.54	0.0018	0.00	0.24	0.11	9.83
6.4	Sub6.4	5-YEAR	0.244	0.682	1.185	0.060	7.6	0.40	0.10	3.04	0.50	0.0018	0.00	0.15	0.08	6.05
6.5	Sub6.5	5-YEAR	0.198	0.468	0.896	0.060	27.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.54	0.16	23.80
6.6	Sub6.6	5-YEAR	0.366	0.997	1.654	0.058	9.0	0.40	0.10	3.40	0.53	0.0018	0.00	0.18	0.09	7.08
6.7	Sub6.7	5-YEAR	0.124	0.313	0.593	0.058	32.2	0.40	0.10	3.30	0.52	0.0018	0.00	0.64	0.18	29.30
6.8	Sub6.8	5-YEAR	0.290	0.501	1.241	0.060	8.1	0.40	0.10	3.14	0.51	0.0018	0.00	0.16	0.08	6.44
6.9	Sub6.9	5-YEAR	0.200	0.386	0.805	0.060	20.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.40	0.13	16.94
7.1	Sub7.1	5-YEAR	0.040	0.352	0.632	0.058	18.7	0.40	0.10	4.07	0.57	0.0018	0.00	0.37	0.13	15.56
7.11	Sub7.11	5-YEAR	0.099	0.349	0.658	0.060	47.5	0.40	0.10	3.40	0.53	0.0018	0.00	0.84	0.22	45.27
7.12	Sub7.12	5-YEAR	0.109	0.236	0.554	0.060	54.1	0.40	0.10	3.57	0.54	0.0018	0.00	0.87	0.25	51.99
7.2	Sub7.2	5-YEAR	0.057	0.323	0.601	0.058	39.1	0.40	0.10	3.68	0.55	0.0018	0.00	0.78	0.20	36.67
7.3	Sub7.3	5-YEAR	0.024	0.152	0.302	0.030	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.06
7.4	Sub7.4	5-YEAR	0.045	0.243	0.463	0.057	46.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.83	0.22	43.49
7.5	Sub7.5	5-YEAR	0.036	0.151	0.309	0.003	26.5	0.40	0.10	4.50	0.60	0.0018	0.00	0.53	0.16	22.96
7.6	Sub7.6	5-YEAR	0.093	0.388	0.787	0.020	59.6	0.40	0.10	3.73	0.55	0.0018	0.00	0.90	0.27	57.76
7.7	Sub7.7	5-YEAR	0.301	0.624	1.311	0.060	36.0	0.40	0.10	3.55	0.54	0.0018	0.00	0.72	0.19	33.25
7.8	Sub7.8	5-YEAR	0.114	0.383	0.660	0.060	32.6	0.40	0.10	3.16	0.51	0.0018	0.00	0.65	0.18	29.85
7.9	Sub7.9	5-YEAR	0.010	0.089	0.191	0.030	82.2	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.34	80.76
8.1	Sub8.1	5-YEAR	0.329	0.967	1.813	0.060	35.9	0.40	0.10	3.03	0.50	0.0018	0.00	0.72	0.19	33.37
8.2	Sub8.2	5-YEAR	0.128	0.408	0.894	0.010	28.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.56	0.16	24.52
8.3	Sub8.3	5-YEAR	0.162	0.451	0.822	0.020	25.6	0.40	0.10	3.99	0.56	0.0018	0.00	0.51	0.15	22.29

Future Conditions: 5-Year Output

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
1.2		0.097	0.230	28.1	5.27	14.6	3.72	8.8	314	684,491	0.35	237,456	37.0	62	237,448	0.33
1.3		0.097	0.248	27.5	5.53	14.3	3.91	9.2	413	878,950	0.35	305,149	37.0	81	305,151	0.33
1.4		0.096	0.223	20.1	3.74	10.5	2.65	6.2	345	537,728	0.38	201,690	33.0	66	201,672	0.44
1.5		0.087	0.286	20.9	4.88	10.9	3.45	8.1	361	583,860	0.56	328,938	34.0	101	328,933	0.63
2.1		0.109	0.193	36.9	5.76	19.2	4.07	9.6	236	673,131	0.22	147,364	40.0	33	147,364	0.18
2.2		0.094	0.141	24.8	2.98	12.9	2.11	5.0	81	154,853	0.40	61,676	34.0	17	61,669	0.39
2.3		0.089	0.120	21.7	2.30	11.3	1.62	3.8	50	83,672	0.50	41,674	32.0	12	41,672	0.53
2.4		0.079	0.189	24.5	3.86	12.8	2.73	6.4	85	161,033	0.77	123,697	34.0	33	123,689	0.74
2.5		0.079	0.171	20.9	3.04	10.9	2.15	5.1	79	127,641	0.78	99,210	33.0	29	99,196	0.84
2.6		0.113	0.108	49.0	4.35	25.5	3.07	7.2	40	151,909	0.18	27,797	43.0	5	27,797	0.12
3.1		0.094	0.184	27.8	4.23	14.5	2.99	7.1	130	281,400	0.40	113,402	36.0	29	113,400	0.37
3.2		0.091	0.143	22.8	2.81	11.8	1.98	4.7	76	134,232	0.47	63,153	33.0	18	63,149	0.49
3.3		0.079	0.075	13.6	1.09	7.1	0.77	1.8	19	20,546	0.78	15,942	30.0	6	15,930	1.08
3.4		0.078	0.123	19.1	2.11	9.9	1.49	3.5	41	61,240	0.80	48,860	31.0	15	48,847	0.91
3.5		0.123	0.079	33.0	2.30	17.1	1.63	3.8	28	70,588	0.12	8,210	36.0	2	8,210	0.11
3.6		0.112	0.067	47.0	2.72	24.4	1.93	4.5	15	53,882	0.20	10,647	41.0	2	10,647	0.13
3.7		0.077	0.055	8.8	0.67	4.6	0.47	1.1	14	9,755	0.84	8,151	27.0	4	8,118	1.44
3.8		0.095	0.081	26.1	1.92	13.6	1.36	3.2	25	50,834	0.37	18,758	33.0	5	18,756	0.35
4.1		0.079	0.177	16.7	2.56	8.7	1.81	4.3	108	139,608	0.76	106,586	31.0	37	106,583	0.96
4.11		0.143	0.206	41.7	6.91	21.7	4.88	11.5	149	481,581	0.05	26,348	43.0	6	26,347	0.05
4.2		0.103	0.137	37.7	4.27	19.6	3.02	7.1	83	243,448	0.28	67,510	39.0	14	67,509	0.21
4.3		0.105	0.223	57.7	10.20	30.0	7.21	17.0	248	1,107,581	0.25	281,819	52.0	44	281,816	0.14
4.4		0.139	0.179	45.4	6.55	23.6	4.63	10.9	100	350,494	0.07	23,554	44.0	5	23,554	0.05
4.5		0.138	0.161	37.4	4.93	19.5	3.48	8.2	96	278,587	0.07	19,125	41.0	5	19,125	0.06
4.6		0.099	0.264	45.6	9.55	23.7	6.75	15.9	344	1,214,444	0.33	402,146	46.0	73	402,133	0.22
4.7		0.132	0.125	39.1	4.05	20.3	2.87	6.8	57	174,022	0.09	15,011	40.0	4	15,011	0.07
4.8		0.133	0.202	38.5	6.26	20.0	4.43	10.4	185	551,326	0.08	45,082	42.0	11	45,079	0.07
4.9		0.099	0.251	33.4	6.73	17.4	4.76	11.2	416	1,074,701	0.32	347,170	40.0	81	347,165	0.27
5.1		0.090	0.201	20.9	3.54	10.9	2.50	5.9	175	283,224	0.47	134,295	33.0	41	134,288	0.53
5.2		0.097	0.174	24.7	3.60	12.9	2.54	6.0	158	303,147	0.35	106,420	35.0	30	106,418	0.36
6.1		0.115	0.210	35.9	6.10	18.7	4.31	10.2	307	855,446	0.18	151,566	41.0	35	151,561	0.15
6.2		0.098	0.172	27.5	3.93	14.3	2.78	6.6	146	310,064	0.34	106,276	36.0	28	106,265	0.33
6.3		0.127	0.231	45.2	8.30	23.5	5.86	13.8	281	983,329	0.10	99,530	46.0	21	99,528	0.08
6.4		0.141	0.214	54.6	9.27	28.4	6.55	15.5	134	567,681	0.06	36,752	50.0	7	36,751	0.04
6.5		0.106	0.172	37.4	5.23	19.4	3.69	8.7	159	460,570	0.25	114,073	40.0	25	114,069	0.20
6.6		0.137	0.236	68.5	12.69	35.6	8.97	21.2	160	849,255	0.07	62,208	57.0	10	62,207	0.04
6.7		0.100	0.157	26.3	3.48	13.7	2.46	5.8	141	288,618	0.31	89,211	35.0	24	89,205	0.31
6.8		0.139	0.223	45.7	8.13	23.8	5.75	13.6	190	673,793	0.07	45,904	46.0	10	45,904	0.05
6.9		0.115	0.175	34.4	4.92	17.9	3.48	8.2	174	464,273	0.18	81,895	39.0	20	81,895	0.15
7.1		0.117	0.088	60.2	4.35	31.3	3.07	7.2	20	93,834	0.16	14,918	47.0	2	14,918	0.09
7.11		0.091	0.183	22.5	3.46	11.7	2.44	5.8	131	228,947	0.48	108,930	34.0	32	108,914	0.50
7.12		0.087	0.204	14.8	2.62	7.7	1.85	4.4	220	252,216	0.55	137,568	31.0	52	137,562	0.75
7.2		0.095	0.126	31.7	3.38	16.5	2.39	5.6	53	131,449	0.38	50,259	36.0	11	50,258	0.32
7.3		0.079	0.117	16.7	1.80	8.7	1.27	3.0	43	55,243	0.78	42,871	31.0	15	42,859	0.96
7.4		0.091	0.126	23.7	2.59	12.3	1.83	4.3	57	105,069	0.45	47,034	33.0	13	47,033	0.45
7.5		0.107	0.081	57.2	3.86	29.8	2.73	6.4	19	82,806	0.23	19,297	45.0	3	19,297	0.13
7.6		0.085	0.199	28.8	4.71	15.0	3.33	7.9	97	216,873	0.61	131,247	36.0	32	131,245	0.53
7.7		0.097	0.232	34.9	6.53	18.1	4.61	10.9	259	699,676	0.35	243,507	40.0	54	243,506	0.28
7.8		0.100	0.153	31.0	3.94	16.1	2.79	6.6	110	265,168	0.32	83,903	37.0	20	83,898	0.28
7.9		0.077	0.083	14.4	1.21	7.5	0.85	2.0	22	24,315	0.85	20,644	30.0	8	20,646	1.15
8.1		0.097	0.239	48.8	9.27	25.4	6.55	15.5	202	763,699	0.35	270,163	47.0	46	270,157	0.22
8.2		0.105	0.144	63.6	7.33	33.1	5.18	12.2	61	297,906	0.25	74,265	51.0	11	74,264	0.13
8.3		0.107	0.160	50.0	6.44	26.0	4.55	10.7	97	375,517	0.23	86,396	45.0	15	86,395	0.15

FUTURE CONDITIONS

10-YEAR

Future Conditions: 10-Year Input

Summary of CUHP Input Parameters (Version 2.0.0)

								Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
1.2	Sub1.2	10-YEAR	0.295	0.498	1.021	0.060	35.7	0.40	0.10	3.34	0.52	0.0018	0.00	0.71	0.19	33.46
1.3	Sub1.3	10-YEAR	0.378	0.498	1.137	0.060	35.6	0.40	0.10	3.30	0.52	0.0018	0.00	0.71	0.19	33.45
1.4	Sub1.4	10-YEAR	0.231	0.308	0.798	0.060	37.7	0.40	0.10	3.00	0.50	0.0018	0.00	0.75	0.19	35.81
1.5	Sub1.5	10-YEAR	0.251	0.510	1.073	0.060	55.6	0.40	0.10	3.51	0.53	0.0018	0.00	0.88	0.25	54.00
2.1	Sub2.1	10-YEAR	0.290	0.511	0.954	0.060	24.3	0.40	0.10	3.83	0.56	0.0018	0.00	0.49	0.15	21.67
2.2	Sub2.2	10-YEAR	0.067	0.273	0.545	0.058	41.5	0.40	0.10	4.45	0.60	0.0018	0.00	0.81	0.20	39.30
2.3	Sub2.3	10-YEAR	0.036	0.194	0.471	0.060	50.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.85	0.23	48.70
2.4	Sub2.4	10-YEAR	0.069	0.403	0.684	0.030	75.1	0.40	0.10	4.49	0.60	0.0018	0.00	0.93	0.32	73.66
2.5	Sub2.5	10-YEAR	0.055	0.279	0.667	0.040	75.9	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.50
2.6	Sub2.6	10-YEAR	0.065	0.342	0.705	0.060	21.2	0.40	0.10	4.12	0.57	0.0018	0.00	0.42	0.13	18.48
3.1	Sub3.1	10-YEAR	0.121	0.403	0.838	0.060	41.3	0.40	0.10	3.91	0.56	0.0018	0.00	0.81	0.20	39.27
3.2	Sub3.2	10-YEAR	0.058	0.267	0.529	0.060	47.3	0.40	0.10	3.74	0.55	0.0018	0.00	0.84	0.22	45.46
3.3	Sub3.3	10-YEAR	0.009	0.106	0.159	0.060	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.38
3.4	Sub3.4	10-YEAR	0.026	0.215	0.369	0.040	77.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.32	76.37
3.5	Sub3.5	10-YEAR	0.030	0.146	0.320	0.060	14.3	0.40	0.10	3.99	0.57	0.0018	0.00	0.29	0.11	12.00
3.6	Sub3.6	10-YEAR	0.023	0.208	0.410	0.060	22.1	0.40	0.10	3.76	0.55	0.0018	0.00	0.44	0.14	19.53
3.7	Sub3.7	10-YEAR	0.004	0.034	0.076	0.030	81.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.33	79.80
3.8	Sub3.8	10-YEAR	0.022	0.155	0.330	0.060	38.3	0.40	0.10	3.94	0.56	0.0018	0.00	0.77	0.19	36.08
4.1	Sub4.1	10-YEAR	0.060	0.280	0.531	0.058	74.1	0.40	0.10	3.75	0.55	0.0018	0.00	0.93	0.31	72.81
4.11	Sub4.11	10-YEAR	0.207	0.406	1.021	0.060	7.2	0.40	0.10	3.84	0.56	0.0018	0.00	0.14	0.07	5.80
4.2	Sub4.2	10-YEAR	0.105	0.379	0.732	0.057	29.7	0.40	0.10	3.67	0.54	0.0018	0.00	0.59	0.17	27.16
4.3	Sub4.3	10-YEAR	0.477	0.901	1.974	0.058	27.2	0.40	0.10	3.43	0.53	0.0018	0.00	0.54	0.16	24.68
4.4	Sub4.4	10-YEAR	0.151	0.388	0.981	0.057	8.4	0.40	0.10	3.49	0.53	0.0018	0.00	0.17	0.08	6.88
4.5	Sub4.5	10-YEAR	0.120	0.303	0.693	0.060	8.5	0.40	0.10	3.45	0.53	0.0018	0.00	0.17	0.09	7.00
4.6	Sub4.6	10-YEAR	0.523	0.888	2.033	0.060	33.9	0.40	0.10	3.06	0.50	0.0018	0.00	0.68	0.18	31.68
4.7	Sub4.7	10-YEAR	0.075	0.230	0.655	0.060	10.7	0.40	0.10	3.60	0.54	0.0018	0.00	0.21	0.10	8.85
4.8	Sub4.8	10-YEAR	0.237	0.388	0.998	0.060	10.4	0.40	0.10	3.76	0.55	0.0018	0.00	0.21	0.10	8.53
4.9	Sub4.9	10-YEAR	0.463	0.577	1.449	0.060	33.2	0.40	0.10	3.11	0.51	0.0018	0.00	0.66	0.18	30.96
5.1	Sub5.1	10-YEAR	0.122	0.337	0.718	0.060	47.6	0.40	0.10	3.68	0.55	0.0018	0.00	0.84	0.22	45.76
5.2	Sub5.2	10-YEAR	0.130	0.302	0.722	0.060	36.0	0.40	0.10	3.33	0.52	0.0018	0.00	0.72	0.19	33.84
6.1	Sub6.1	10-YEAR	0.368	0.445	1.114	0.060	19.8	0.40	0.10	3.54	0.54	0.0018	0.00	0.40	0.13	17.36
6.2	Sub6.2	10-YEAR	0.133	0.321	0.818	0.060	34.9	0.40	0.10	3.01	0.50	0.0018	0.00	0.70	0.18	32.75
6.3	Sub6.3	10-YEAR	0.423	0.652	1.213	0.060	12.2	0.40	0.10	3.58	0.54	0.0018	0.00	0.24	0.11	10.27
6.4	Sub6.4	10-YEAR	0.244	0.682	1.185	0.060	7.6	0.40	0.10	3.04	0.50	0.0018	0.00	0.15	0.08	6.34
6.5	Sub6.5	10-YEAR	0.198	0.468	0.896	0.060	27.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.54	0.16	24.39
6.6	Sub6.6	10-YEAR	0.366	0.997	1.654	0.058	9.0	0.40	0.10	3.40	0.53	0.0018	0.00	0.18	0.09	7.43
6.7	Sub6.7	10-YEAR	0.124	0.313	0.593	0.058	32.2	0.40	0.10	3.30	0.52	0.0018	0.00	0.64	0.18	29.82
6.8	Sub6.8	10-YEAR	0.290	0.501	1.241	0.060	8.1	0.40	0.10	3.14	0.51	0.0018	0.00	0.16	0.08	6.74
6.9	Sub6.9	10-YEAR	0.200	0.386	0.805	0.060	20.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.40	0.13	17.50
7.1	Sub7.1	10-YEAR	0.040	0.352	0.632	0.058	18.7	0.40	0.10	4.07	0.57	0.0018	0.00	0.37	0.13	16.13
7.11	Sub7.11	10-YEAR	0.099	0.349	0.658	0.060	47.5	0.40	0.10	3.40	0.53	0.0018	0.00	0.84	0.22	45.66
7.12	Sub7.12	10-YEAR	0.109	0.236	0.554	0.060	54.1	0.40	0.10	3.57	0.54	0.0018	0.00	0.87	0.25	52.36
7.2	Sub7.2	10-YEAR	0.057	0.323	0.601	0.058	39.1	0.40	0.10	3.68	0.55	0.0018	0.00	0.78	0.20	37.12
7.3	Sub7.3	10-YEAR	0.024	0.152	0.302	0.030	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.39
7.4	Sub7.4	10-YEAR	0.045	0.243	0.463	0.057	46.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.83	0.22	43.98
7.5	Sub7.5	10-YEAR	0.036	0.151	0.309	0.003	26.5	0.40	0.10	4.50	0.60	0.0018	0.00	0.53	0.16	23.62
7.6	Sub7.6	10-YEAR	0.093	0.388	0.787	0.020	59.6	0.40	0.10	3.73	0.55	0.0018	0.00	0.90	0.27	58.10
7.7	Sub7.7	10-YEAR	0.301	0.624	1.311	0.060	36.0	0.40	0.10	3.55	0.54	0.0018	0.00	0.72	0.19	33.75
7.8	Sub7.8	10-YEAR	0.114	0.383	0.660	0.060	32.6	0.40	0.10	3.16	0.51	0.0018	0.00	0.65	0.18	30.36
7.9	Sub7.9	10-YEAR	0.010	0.089	0.191	0.030	82.2	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.34	81.03
8.1	Sub8.1	10-YEAR	0.329	0.967	1.813	0.060	35.9	0.40	0.10	3.03	0.50	0.0018	0.00	0.72	0.19	33.83
8.2	Sub8.2	10-YEAR	0.128	0.408	0.894	0.010	28.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.56	0.16	25.18
8.3	Sub8.3	10-YEAR	0.162	0.451	0.822	0.020	25.6	0.40	0.10	3.99	0.56	0.0018	0.00	0.51	0.15	22.90

Future Conditions: 10-Year Output

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
1.2		0.097	0.232	27.8	5.25	14.5	3.71	8.7	318	684,491	0.56	380,045	38.0	103	380,025	0.55
1.3		0.097	0.250	27.1	5.51	14.1	3.89	9.2	418	878,950	0.56	489,830	38.0	136	489,829	0.56
1.4		0.095	0.225	19.9	3.74	10.4	2.64	6.2	349	537,728	0.60	324,101	34.0	110	324,062	0.74
1.5		0.086	0.287	20.8	4.87	10.8	3.44	8.1	363	583,860	0.80	467,005	35.0	145	466,993	0.90
2.1		0.108	0.193	36.6	5.72	19.1	4.05	9.5	237	673,131	0.39	259,190	41.0	60	259,191	0.32
2.2		0.093	0.142	24.6	2.97	12.8	2.10	5.0	81	154,853	0.58	89,809	34.0	25	89,801	0.58
2.3		0.089	0.121	21.5	2.29	11.2	1.62	3.8	50	83,672	0.70	58,615	32.0	17	58,612	0.75
2.4		0.079	0.189	24.5	3.85	12.7	2.72	6.4	85	161,033	1.03	165,160	34.0	43	165,150	0.97
2.5		0.079	0.171	20.8	3.03	10.8	2.14	5.1	79	127,641	1.04	132,281	32.0	39	132,264	1.10
2.6		0.112	0.107	48.8	4.32	25.4	3.05	7.2	40	151,909	0.33	49,946	43.0	9	49,946	0.22
3.1		0.094	0.185	27.6	4.23	14.3	2.99	7.0	132	281,400	0.60	168,787	36.0	44	168,782	0.57
3.2		0.090	0.144	22.6	2.80	11.8	1.98	4.7	77	134,232	0.69	91,957	33.0	27	91,949	0.73
3.3		0.079	0.075	13.6	1.08	7.1	0.77	1.8	20	20,546	1.03	21,260	30.0	8	21,244	1.42
3.4		0.078	0.123	19.0	2.11	9.9	1.49	3.5	42	61,240	1.06	64,962	31.0	20	64,946	1.18
3.5		0.122	0.079	32.9	2.29	17.1	1.62	3.8	28	70,588	0.25	17,706	37.0	5	17,706	0.25
3.6		0.111	0.067	46.7	2.71	24.3	1.91	4.5	15	53,882	0.36	19,517	41.0	4	19,517	0.25
3.7		0.077	0.055	8.8	0.67	4.6	0.47	1.1	14	9,755	1.11	10,784	26.0	5	10,740	1.87
3.8		0.095	0.081	25.8	1.91	13.4	1.35	3.2	25	50,834	0.56	28,397	35.0	8	28,393	0.55
4.1		0.079	0.177	16.6	2.56	8.7	1.81	4.3	108	139,608	1.03	143,473	31.0	49	143,464	1.27
4.11		0.141	0.205	41.7	6.85	21.7	4.84	11.4	149	481,581	0.18	85,527	44.0	22	85,526	0.16
4.2		0.102	0.139	37.0	4.25	19.2	3.00	7.1	85	243,448	0.46	112,537	40.0	25	112,535	0.37
4.3		0.105	0.224	57.4	10.15	29.8	7.17	16.9	249	1,107,581	0.45	493,607	51.0	80	493,604	0.26
4.4		0.137	0.178	45.4	6.49	23.6	4.59	10.8	100	350,494	0.22	75,559	45.0	17	75,558	0.18
4.5		0.137	0.160	37.4	4.89	19.4	3.45	8.1	96	278,587	0.22	61,282	42.0	17	61,281	0.22
4.6		0.098	0.267	45.0	9.51	23.4	6.72	15.9	348	1,214,444	0.55	669,064	47.0	128	669,060	0.38
4.7		0.130	0.124	39.1	4.01	20.3	2.83	6.7	58	174,022	0.23	40,603	41.0	10	40,601	0.21
4.8		0.131	0.200	38.4	6.19	20.0	4.38	10.3	185	551,326	0.22	120,405	43.0	31	120,399	0.21
4.9		0.099	0.253	32.9	6.70	17.1	4.74	11.2	422	1,074,701	0.54	579,320	41.0	141	579,332	0.48
5.1		0.090	0.202	20.8	3.53	10.8	2.49	5.9	176	283,224	0.69	195,681	34.0	61	195,668	0.78
5.2		0.097	0.175	24.4	3.58	12.7	2.53	6.0	160	303,147	0.56	169,937	35.0	50	169,929	0.60
6.1		0.114	0.210	35.8	6.06	18.6	4.28	10.1	309	855,446	0.35	297,733	42.0	73	297,730	0.31
6.2		0.097	0.173	27.2	3.92	14.1	2.77	6.5	147	310,064	0.57	175,826	36.0	48	175,809	0.56
6.3		0.125	0.229	45.1	8.23	23.4	5.81	13.7	282	983,329	0.25	249,579	46.0	56	249,576	0.21
6.4		0.139	0.212	54.6	9.21	28.4	6.51	15.3	134	567,681	0.24	138,271	50.0	28	138,269	0.18
6.5		0.105	0.172	37.1	5.20	19.3	3.67	8.7	160	460,570	0.42	194,575	41.0	44	194,564	0.35
6.6		0.135	0.234	68.4	12.57	35.6	8.89	21.0	160	849,255	0.23	194,540	56.0	32	194,539	0.13
6.7		0.100	0.159	25.9	3.46	13.5	2.45	5.8	144	288,618	0.51	148,530	36.0	43	148,526	0.54
6.8		0.138	0.222	45.7	8.07	23.7	5.70	13.4	191	673,793	0.24	161,217	47.0	38	161,215	0.20
6.9		0.114	0.174	34.3	4.89	17.8	3.46	8.2	175	464,273	0.34	156,016	40.0	39	156,016	0.31
7.1		0.116	0.087	59.9	4.32	31.1	3.05	7.2	20	93,834	0.30	28,230	45.0	4	28,230	0.17
7.11		0.090	0.184	22.4	3.45	11.6	2.44	5.8	132	228,947	0.70	160,526	34.0	48	160,511	0.76
7.12		0.087	0.205	14.7	2.62	7.7	1.85	4.4	221	252,216	0.78	196,067	32.0	75	196,055	1.08
7.2		0.095	0.127	31.4	3.37	16.3	2.38	5.6	54	131,449	0.58	76,602	37.0	18	76,602	0.50
7.3		0.079	0.117	16.7	1.80	8.7	1.27	3.0	43	55,243	1.03	57,172	31.0	19	57,155	1.26
7.4		0.091	0.127	23.5	2.59	12.2	1.83	4.3	58	105,069	0.64	67,158	33.0	19	67,160	0.65
7.5		0.106	0.081	56.8	3.83	29.6	2.71	6.4	19	82,806	0.38	31,205	45.0	5	31,205	0.21
7.6		0.085	0.200	28.7	4.70	14.9	3.32	7.8	98	216,873	0.84	182,973	37.0	44	182,973	0.74
7.7		0.097	0.235	34.4	6.50	17.9	4.60	10.8	262	699,676	0.55	383,134	41.0	88	383,124	0.46
7.8		0.099	0.155	30.6	3.93	15.9	2.78	6.5	112	265,168	0.53	140,392	38.0	36	140,384	0.49
7.9		0.077	0.083	14.3	1.21	7.5	0.85	2.0	22	24,315	1.12	27,268	30.0	10	27,270	1.48
8.1		0.097	0.241	48.3	9.24	25.1	6.53	15.4	204	763,699	0.58	441,433	48.0	79	441,419	0.38
8.2		0.104	0.145	62.5	7.28	32.5	5.15	12.1	62	297,906	0.40	118,232	49.0	17	118,230	0.21
8.3		0.107	0.160	49.7	6.40	25.9	4.52	10.7	98	375,517	0.39	146,618	45.0	26	146,612	0.25

FUTURE CONDITIONS

50-YEAR

Future Conditions: 50-Year Input

Summary of CUHP Input Parameters (Version 2.0.0)

								Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
1.2	Sub1.2	50-YEAR	0.295	0.498	1.021	0.060	35.7	0.40	0.10	3.34	0.52	0.0018	0.00	0.71	0.19	34.26
1.3	Sub1.3	50-YEAR	0.378	0.498	1.137	0.060	35.6	0.40	0.10	3.30	0.52	0.0018	0.00	0.71	0.19	34.25
1.4	Sub1.4	50-YEAR	0.231	0.308	0.798	0.060	37.7	0.40	0.10	3.00	0.50	0.0018	0.00	0.75	0.19	36.52
1.5	Sub1.5	50-YEAR	0.251	0.510	1.073	0.060	55.6	0.40	0.10	3.51	0.53	0.0018	0.00	0.88	0.25	54.58
2.1	Sub2.1	50-YEAR	0.290	0.511	0.954	0.060	24.3	0.40	0.10	3.83	0.56	0.0018	0.00	0.49	0.15	22.65
2.2	Sub2.2	50-YEAR	0.067	0.273	0.545	0.058	41.5	0.40	0.10	4.45	0.60	0.0018	0.00	0.81	0.20	40.07
2.3	Sub2.3	50-YEAR	0.036	0.194	0.471	0.060	50.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.85	0.23	49.42
2.4	Sub2.4	50-YEAR	0.069	0.403	0.684	0.030	75.1	0.40	0.10	4.49	0.60	0.0018	0.00	0.93	0.32	74.17
2.5	Sub2.5	50-YEAR	0.055	0.279	0.667	0.040	75.9	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	75.00
2.6	Sub2.6	50-YEAR	0.065	0.342	0.705	0.060	21.2	0.40	0.10	4.12	0.57	0.0018	0.00	0.42	0.13	19.46
3.1	Sub3.1	50-YEAR	0.121	0.403	0.838	0.060	41.3	0.40	0.10	3.91	0.56	0.0018	0.00	0.81	0.20	39.98
3.2	Sub3.2	50-YEAR	0.058	0.267	0.529	0.060	47.3	0.40	0.10	3.74	0.55	0.0018	0.00	0.84	0.22	46.13
3.3	Sub3.3	50-YEAR	0.009	0.106	0.159	0.060	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.87
3.4	Sub3.4	50-YEAR	0.026	0.215	0.369	0.040	77.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.32	76.85
3.5	Sub3.5	50-YEAR	0.030	0.146	0.320	0.060	14.3	0.40	0.10	3.99	0.57	0.0018	0.00	0.29	0.11	12.83
3.6	Sub3.6	50-YEAR	0.023	0.208	0.410	0.060	22.1	0.40	0.10	3.76	0.55	0.0018	0.00	0.44	0.14	20.49
3.7	Sub3.7	50-YEAR	0.004	0.034	0.076	0.030	81.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.33	80.24
3.8	Sub3.8	50-YEAR	0.022	0.155	0.330	0.060	38.3	0.40	0.10	3.94	0.56	0.0018	0.00	0.77	0.19	36.87
4.1	Sub4.1	50-YEAR	0.060	0.280	0.531	0.058	74.1	0.40	0.10	3.75	0.55	0.0018	0.00	0.93	0.31	73.28
4.11	Sub4.11	50-YEAR	0.207	0.406	1.021	0.060	7.2	0.40	0.10	3.84	0.56	0.0018	0.00	0.14	0.07	6.31
4.2	Sub4.2	50-YEAR	0.105	0.379	0.732	0.057	29.7	0.40	0.10	3.67	0.54	0.0018	0.00	0.59	0.17	28.11
4.3	Sub4.3	50-YEAR	0.477	0.901	1.974	0.058	27.2	0.40	0.10	3.43	0.53	0.0018	0.00	0.54	0.16	25.61
4.4	Sub4.4	50-YEAR	0.151	0.388	0.981	0.057	8.4	0.40	0.10	3.49	0.53	0.0018	0.00	0.17	0.08	7.43
4.5	Sub4.5	50-YEAR	0.120	0.303	0.693	0.060	8.5	0.40	0.10	3.45	0.53	0.0018	0.00	0.17	0.09	7.55
4.6	Sub4.6	50-YEAR	0.523	0.888	2.033	0.060	33.9	0.40	0.10	3.06	0.50	0.0018	0.00	0.68	0.18	32.49
4.7	Sub4.7	50-YEAR	0.075	0.230	0.655	0.060	10.7	0.40	0.10	3.60	0.54	0.0018	0.00	0.21	0.10	9.53
4.8	Sub4.8	50-YEAR	0.237	0.388	0.998	0.060	10.4	0.40	0.10	3.76	0.55	0.0018	0.00	0.21	0.10	9.21
4.9	Sub4.9	50-YEAR	0.463	0.577	1.449	0.060	33.2	0.40	0.10	3.11	0.51	0.0018	0.00	0.66	0.18	31.79
5.1	Sub5.1	50-YEAR	0.122	0.337	0.718	0.060	47.6	0.40	0.10	3.68	0.55	0.0018	0.00	0.84	0.22	46.43
5.2	Sub5.2	50-YEAR	0.130	0.302	0.722	0.060	36.0	0.40	0.10	3.33	0.52	0.0018	0.00	0.72	0.19	34.63
6.1	Sub6.1	50-YEAR	0.368	0.445	1.114	0.060	19.8	0.40	0.10	3.54	0.54	0.0018	0.00	0.40	0.13	18.26
6.2	Sub6.2	50-YEAR	0.133	0.321	0.818	0.060	34.9	0.40	0.10	3.01	0.50	0.0018	0.00	0.70	0.18	33.53
6.3	Sub6.3	50-YEAR	0.423	0.652	1.213	0.060	12.2	0.40	0.10	3.58	0.54	0.0018	0.00	0.24	0.11	10.99
6.4	Sub6.4	50-YEAR	0.244	0.682	1.185	0.060	7.6	0.40	0.10	3.04	0.50	0.0018	0.00	0.15	0.08	6.81
6.5	Sub6.5	50-YEAR	0.198	0.468	0.896	0.060	27.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.54	0.16	25.37
6.6	Sub6.6	50-YEAR	0.366	0.997	1.654	0.058	9.0	0.40	0.10	3.40	0.53	0.0018	0.00	0.18	0.09	8.01
6.7	Sub6.7	50-YEAR	0.124	0.313	0.593	0.058	32.2	0.40	0.10	3.30	0.52	0.0018	0.00	0.64	0.18	30.69
6.8	Sub6.8	50-YEAR	0.290	0.501	1.241	0.060	8.1	0.40	0.10	3.14	0.51	0.0018	0.00	0.16	0.08	7.26
6.9	Sub6.9	50-YEAR	0.200	0.386	0.805	0.060	20.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.40	0.13	18.43
7.1	Sub7.1	50-YEAR	0.040	0.352	0.632	0.058	18.7	0.40	0.10	4.07	0.57	0.0018	0.00	0.37	0.13	17.07
7.11	Sub7.11	50-YEAR	0.099	0.349	0.658	0.060	47.5	0.40	0.10	3.40	0.53	0.0018	0.00	0.84	0.22	46.31
7.12	Sub7.12	50-YEAR	0.109	0.236	0.554	0.060	54.1	0.40	0.10	3.57	0.54	0.0018	0.00	0.87	0.25	52.97
7.2	Sub7.2	50-YEAR	0.057	0.323	0.601	0.058	39.1	0.40	0.10	3.68	0.55	0.0018	0.00	0.78	0.20	37.84
7.3	Sub7.3	50-YEAR	0.024	0.152	0.302	0.030	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	74.89
7.4	Sub7.4	50-YEAR	0.045	0.243	0.463	0.057	46.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.83	0.22	44.73
7.5	Sub7.5	50-YEAR	0.036	0.151	0.309	0.003	26.5	0.40	0.10	4.50	0.60	0.0018	0.00	0.53	0.16	24.68
7.6	Sub7.6	50-YEAR	0.093	0.388	0.787	0.020	59.6	0.40	0.10	3.73	0.55	0.0018	0.00	0.90	0.27	58.65
7.7	Sub7.7	50-YEAR	0.301	0.624	1.311	0.060	36.0	0.40	0.10	3.55	0.54	0.0018	0.00	0.72	0.19	34.57
7.8	Sub7.8	50-YEAR	0.114	0.383	0.660	0.060	32.6	0.40	0.10	3.16	0.51	0.0018	0.00	0.65	0.18	31.21
7.9	Sub7.9	50-YEAR	0.010	0.089	0.191	0.030	82.2	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.34	81.46
8.1	Sub8.1	50-YEAR	0.329	0.967	1.813	0.060	35.9	0.40	0.10	3.03	0.50	0.0018	0.00	0.72	0.19	34.59
8.2	Sub8.2	50-YEAR	0.128	0.408	0.894	0.010	28.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.56	0.16	26.24
8.3	Sub8.3	50-YEAR	0.162	0.451	0.822	0.020	25.6	0.40	0.10	3.99	0.56	0.0018	0.00	0.51	0.15	23.91

Future Conditions: 50-Year Output

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
1.2		0.096	0.235	27.2	5.22	14.2	3.69	8.7	324	684,491	1.51	1,032,767	43.0	303	1,032,671	1.61
1.3		0.096	0.253	26.6	5.48	13.8	3.87	9.1	426	878,950	1.51	1,328,801	43.0	397	1,328,728	1.64
1.4		0.095	0.227	19.6	3.72	10.2	2.63	6.2	354	537,728	1.56	840,485	39.0	301	840,448	2.03
1.5		0.086	0.288	20.6	4.86	10.7	3.43	8.1	366	583,860	1.76	1,027,286	40.0	344	1,027,231	2.14
2.1		0.107	0.193	36.3	5.66	18.9	4.00	9.4	240	673,131	1.32	888,205	46.0	220	888,203	1.19
2.2		0.093	0.143	24.2	2.96	12.6	2.10	4.9	83	154,853	1.51	233,598	41.0	72	233,569	1.70
2.3		0.088	0.121	21.3	2.28	11.1	1.61	3.8	51	83,672	1.64	137,000	38.0	44	136,988	1.93
2.4		0.079	0.189	24.4	3.84	12.7	2.72	6.4	85	161,033	1.99	320,167	40.0	91	320,155	2.05
2.5		0.078	0.171	20.8	3.03	10.8	2.14	5.0	79	127,641	2.00	255,250	38.0	80	255,224	2.26
2.6		0.111	0.107	48.3	4.27	25.1	3.02	7.1	41	151,909	1.25	190,262	51.0	38	190,259	0.91
3.1		0.093	0.187	27.2	4.21	14.1	2.98	7.0	134	281,400	1.54	433,780	42.0	125	433,739	1.61
3.2		0.090	0.145	22.4	2.79	11.6	1.97	4.7	78	134,232	1.64	219,522	40.0	70	219,503	1.88
3.3		0.079	0.075	13.6	1.08	7.0	0.77	1.8	20	20,546	2.00	41,052	35.0	16	41,019	2.87
3.4		0.078	0.124	19.0	2.10	9.9	1.49	3.5	42	61,240	2.03	124,088	37.0	40	124,057	2.40
3.5		0.121	0.078	32.7	2.27	17.0	1.60	3.8	28	70,588	1.17	82,667	42.0	23	82,663	1.16
3.6		0.110	0.067	46.3	2.68	24.1	1.89	4.5	15	53,882	1.30	69,857	49.0	14	69,856	0.96
3.7		0.077	0.055	8.7	0.67	4.5	0.47	1.1	14	9,755	2.07	20,239	30.0	10	20,154	3.69
3.8		0.095	0.083	25.3	1.91	13.2	1.35	3.2	26	50,834	1.50	76,191	40.0	23	76,179	1.63
4.1		0.079	0.177	16.6	2.56	8.6	1.81	4.3	109	139,608	2.00	278,846	36.0	100	278,812	2.60
4.11		0.140	0.202	41.6	6.77	21.6	4.78	11.3	149	481,581	1.09	526,820	50.0	127	526,812	0.96
4.2		0.101	0.142	35.9	4.21	18.7	2.98	7.0	88	243,448	1.41	342,080	45.0	83	342,067	1.24
4.3		0.104	0.228	55.7	10.05	29.0	7.10	16.7	257	1,107,581	1.39	1,542,048	56.0	277	1,542,039	0.91
4.4		0.135	0.175	45.3	6.40	23.5	4.52	10.7	100	350,494	1.14	401,289	51.0	89	401,285	0.92
4.5		0.135	0.158	37.3	4.82	19.4	3.40	8.0	96	278,587	1.15	320,560	46.0	82	320,548	1.06
4.6		0.097	0.271	44.1	9.46	22.9	6.68	15.8	356	1,214,444	1.51	1,832,646	52.0	386	1,832,563	1.15
4.7		0.128	0.122	38.9	3.94	20.2	2.78	6.6	58	174,022	1.16	202,116	46.0	49	202,103	1.03
4.8		0.129	0.197	38.3	6.08	19.9	4.30	10.1	186	551,326	1.14	629,343	48.0	159	629,331	1.04
4.9		0.098	0.257	32.2	6.66	16.7	4.71	11.1	431	1,074,701	1.50	1,608,004	46.0	424	1,607,940	1.43
5.1		0.090	0.204	20.6	3.52	10.7	2.49	5.9	178	283,224	1.64	465,192	39.0	157	465,122	2.01
5.2		0.096	0.178	24.0	3.57	12.5	2.52	5.9	163	303,147	1.51	459,191	41.0	145	459,158	1.74
6.1		0.113	0.209	35.5	6.00	18.5	4.24	10.0	311	855,446	1.29	1,100,110	46.0	282	1,100,087	1.20
6.2		0.097	0.176	26.6	3.90	13.9	2.76	6.5	150	310,064	1.53	473,216	42.0	139	473,196	1.63
6.3		0.124	0.228	44.9	8.15	23.3	5.76	13.6	283	983,329	1.18	1,164,545	52.0	260	1,164,521	0.96
6.4		0.138	0.210	54.5	9.09	28.3	6.43	15.2	134	567,681	1.18	672,594	56.0	130	672,584	0.83
6.5		0.104	0.174	36.2	5.15	18.8	3.64	8.6	164	460,570	1.36	626,781	46.0	154	626,753	1.21
6.6		0.133	0.230	68.2	12.38	35.5	8.75	20.6	161	849,255	1.16	986,683	62.0	160	986,679	0.68
6.7		0.099	0.162	25.3	3.44	13.2	2.43	5.7	147	288,618	1.47	423,521	41.0	130	423,521	1.64
6.8		0.136	0.219	45.6	7.96	23.7	5.62	13.3	191	673,793	1.18	794,534	52.0	176	794,532	0.95
6.9		0.113	0.174	34.0	4.84	17.7	3.42	8.1	176	464,273	1.27	588,803	45.0	155	588,793	1.21
7.1		0.114	0.087	59.4	4.27	30.9	3.02	7.1	20	93,834	1.22	114,804	53.0	20	114,801	0.76
7.11		0.090	0.185	22.1	3.44	11.5	2.43	5.7	134	228,947	1.66	379,712	40.0	122	379,692	1.93
7.12		0.087	0.206	14.6	2.61	7.6	1.85	4.4	223	252,216	1.73	437,584	36.0	178	437,544	2.57
7.2		0.094	0.129	30.9	3.36	16.1	2.37	5.6	55	131,449	1.53	200,986	42.0	53	200,983	1.45
7.3		0.079	0.117	16.6	1.80	8.6	1.27	3.0	43	55,243	2.00	110,386	36.0	39	110,353	2.57
7.4		0.091	0.128	23.2	2.58	12.1	1.82	4.3	59	105,069	1.57	165,109	40.0	52	165,107	1.78
7.5		0.105	0.081	56.2	3.79	29.2	2.68	6.3	19	82,806	1.30	107,278	52.0	19	107,278	0.83
7.6		0.084	0.201	28.5	4.69	14.8	3.32	7.8	98	216,873	1.80	390,699	42.0	104	390,691	1.73
7.7		0.096	0.238	33.8	6.47	17.6	4.57	10.8	268	699,676	1.50	1,047,475	46.0	265	1,047,424	1.37
7.8		0.098	0.157	29.9	3.90	15.5	2.76	6.5	115	265,168	1.49	393,942	43.0	108	393,932	1.47
7.9		0.077	0.083	14.3	1.21	7.4	0.85	2.0	22	24,315	2.09	50,868	35.0	19	50,870	2.88
8.1		0.096	0.244	47.4	9.19	24.6	6.50	15.3	208	763,699	1.54	1,174,089	53.0	232	1,174,091	1.10
8.2		0.103	0.149	60.3	7.21	31.4	5.09	12.0	64	297,906	1.32	392,459	55.0	66	392,452	0.80
8.3		0.106	0.160	49.2	6.34	25.6	4.48	10.6	99	375,517	1.32	497,154	52.0	98	497,146	0.94

FUTURE CONDITIONS

100-YEAR

Future Conditions: 100-Year Input

Summary of CUHP Input Parameters (Version 2.0.0)

								Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
1	Sub1.2	100-YEAR	0.295	0.498	1.021	0.060	35.7	0.40	0.10	3.34	0.52	0.0018	0.00	0.71	0.19	34.50
1	Sub1.3	100-YEAR	0.378	0.498	1.137	0.060	35.6	0.40	0.10	3.30	0.52	0.0018	0.00	0.71	0.19	34.48
1	Sub1.4	100-YEAR	0.231	0.308	0.798	0.060	37.7	0.40	0.10	3.00	0.50	0.0018	0.00	0.75	0.19	36.72
2	Sub1.5	100-YEAR	0.251	0.510	1.073	0.060	55.6	0.40	0.10	3.51	0.53	0.0018	0.00	0.88	0.25	54.75
2	Sub2.1	100-YEAR	0.290	0.511	0.954	0.060	24.3	0.40	0.10	3.83	0.56	0.0018	0.00	0.49	0.15	22.94
2	Sub2.2	100-YEAR	0.067	0.273	0.545	0.058	41.5	0.40	0.10	4.45	0.60	0.0018	0.00	0.81	0.20	40.28
2	Sub2.3	100-YEAR	0.036	0.194	0.471	0.060	50.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.85	0.23	49.62
2	Sub2.4	100-YEAR	0.069	0.403	0.684	0.030	75.1	0.40	0.10	4.49	0.60	0.0018	0.00	0.93	0.32	74.31
3	Sub2.5	100-YEAR	0.055	0.279	0.667	0.040	75.9	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	75.14
3	Sub2.6	100-YEAR	0.065	0.342	0.705	0.060	21.2	0.40	0.10	4.12	0.57	0.0018	0.00	0.42	0.13	19.75
3	Sub3.1	100-YEAR	0.121	0.403	0.838	0.060	41.3	0.40	0.10	3.91	0.56	0.0018	0.00	0.81	0.20	40.18
3	Sub3.2	100-YEAR	0.058	0.267	0.529	0.060	47.3	0.40	0.10	3.74	0.55	0.0018	0.00	0.84	0.22	46.33
3	Sub3.3	100-YEAR	0.009	0.106	0.159	0.060	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	75.02
3	Sub3.4	100-YEAR	0.026	0.215	0.369	0.040	77.7	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.32	76.99
4	Sub3.5	100-YEAR	0.030	0.146	0.320	0.060	14.3	0.40	0.10	3.99	0.57	0.0018	0.00	0.29	0.11	13.07
4	Sub3.6	100-YEAR	0.023	0.208	0.410	0.060	22.1	0.40	0.10	3.76	0.55	0.0018	0.00	0.44	0.14	20.77
4	Sub3.7	100-YEAR	0.004	0.034	0.076	0.030	81.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.33	80.37
4	Sub3.8	100-YEAR	0.022	0.155	0.330	0.060	38.3	0.40	0.10	3.94	0.56	0.0018	0.00	0.77	0.19	37.09
4	Sub4.1	100-YEAR	0.060	0.280	0.531	0.058	74.1	0.40	0.10	3.75	0.55	0.0018	0.00	0.93	0.31	73.41
4	Sub4.11	100-YEAR	0.207	0.406	1.021	0.060	7.2	0.40	0.10	3.84	0.56	0.0018	0.00	0.14	0.07	6.46
4	Sub4.2	100-YEAR	0.105	0.379	0.732	0.057	29.7	0.40	0.10	3.67	0.54	0.0018	0.00	0.59	0.17	28.39
4	Sub4.3	100-YEAR	0.477	0.901	1.974	0.058	27.2	0.40	0.10	3.43	0.53	0.0018	0.00	0.54	0.16	25.89
4	Sub4.4	100-YEAR	0.151	0.388	0.981	0.057	8.4	0.40	0.10	3.49	0.53	0.0018	0.00	0.17	0.08	7.59
5	Sub4.5	100-YEAR	0.120	0.303	0.693	0.060	8.5	0.40	0.10	3.45	0.53	0.0018	0.00	0.17	0.09	7.71
5	Sub4.6	100-YEAR	0.523	0.888	2.033	0.060	33.9	0.40	0.10	3.06	0.50	0.0018	0.00	0.68	0.18	32.73
5	Sub4.7	100-YEAR	0.075	0.230	0.655	0.060	10.7	0.40	0.10	3.60	0.54	0.0018	0.00	0.21	0.10	9.72
5	Sub4.8	100-YEAR	0.237	0.388	0.998	0.060	10.4	0.40	0.10	3.76	0.55	0.0018	0.00	0.21	0.10	9.40
5	Sub4.9	100-YEAR	0.463	0.577	1.449	0.060	33.2	0.40	0.10	3.11	0.51	0.0018	0.00	0.66	0.18	32.03
5	Sub5.1	100-YEAR	0.122	0.337	0.718	0.060	47.6	0.40	0.10	3.68	0.55	0.0018	0.00	0.84	0.22	46.62
5	Sub5.2	100-YEAR	0.130	0.302	0.722	0.060	36.0	0.40	0.10	3.33	0.52	0.0018	0.00	0.72	0.19	34.86
6	Sub6.1	100-YEAR	0.368	0.445	1.114	0.060	19.8	0.40	0.10	3.54	0.54	0.0018	0.00	0.40	0.13	18.53
6	Sub6.2	100-YEAR	0.133	0.321	0.818	0.060	34.9	0.40	0.10	3.01	0.50	0.0018	0.00	0.70	0.18	33.76
6	Sub6.3	100-YEAR	0.423	0.652	1.213	0.060	12.2	0.40	0.10	3.58	0.54	0.0018	0.00	0.24	0.11	11.20
6	Sub6.4	100-YEAR	0.244	0.682	1.185	0.060	7.6	0.40	0.10	3.04	0.50	0.0018	0.00	0.15	0.08	6.95
7	Sub6.5	100-YEAR	0.198	0.468	0.896	0.060	27.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.54	0.16	25.66
7	Sub6.6	100-YEAR	0.366	0.997	1.654	0.058	9.0	0.40	0.10	3.40	0.53	0.0018	0.00	0.18	0.09	8.17
7	Sub6.7	100-YEAR	0.124	0.313	0.593	0.058	32.2	0.40	0.10	3.30	0.52	0.0018	0.00	0.64	0.18	30.95
7	Sub6.8	100-YEAR	0.290	0.501	1.241	0.060	8.1	0.40	0.10	3.14	0.51	0.0018	0.00	0.16	0.08	7.41
7	Sub6.9	100-YEAR	0.200	0.386	0.805	0.060	20.0	0.40	0.10	3.77	0.55	0.0018	0.00	0.40	0.13	18.70
7	Sub7.1	100-YEAR	0.040	0.352	0.632	0.058	18.7	0.40	0.10	4.07	0.57	0.0018	0.00	0.37	0.13	17.35
7	Sub7.11	100-YEAR	0.099	0.349	0.658	0.060	47.5	0.40	0.10	3.40	0.53	0.0018	0.00	0.84	0.22	46.49
7	Sub7.12	100-YEAR	0.109	0.236	0.554	0.060	54.1	0.40	0.10	3.57	0.54	0.0018	0.00	0.87	0.25	53.14
7	Sub7.2	100-YEAR	0.057	0.323	0.601	0.058	39.1	0.40	0.10	3.68	0.55	0.0018	0.00	0.78	0.20	38.05
7	Sub7.3	100-YEAR	0.024	0.152	0.302	0.030	75.8	0.40	0.10	4.50	0.60	0.0018	0.00	0.93	0.32	75.03
7	Sub7.4	100-YEAR	0.045	0.243	0.463	0.057	46.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.83	0.22	44.94
8	Sub7.5	100-YEAR	0.036	0.151	0.309	0.003	26.5	0.40	0.10	4.50	0.60	0.0018	0.00	0.53	0.16	25.00
8	Sub7.6	100-YEAR	0.093	0.388	0.787	0.020	59.6	0.40	0.10	3.73	0.55	0.0018	0.00	0.90	0.27	58.81
8	Sub7.7	100-YEAR	0.301	0.624	1.311	0.060	36.0	0.40	0.10	3.55	0.54	0.0018	0.00	0.72	0.19	34.81
8	Sub7.8	100-YEAR	0.114	0.383	0.660	0.060	32.6	0.40	0.10	3.16	0.51	0.0018	0.00	0.65	0.18	31.46
8	Sub7.9	100-YEAR	0.010	0.089	0.191	0.030	82.2	0.40	0.10	4.50	0.60	0.0018	0.00	0.94	0.34	81.58
8	Sub8.1	100-YEAR	0.329	0.967	1.813	0.060	35.9	0.40	0.10	3.03	0.50	0.0018	0.00	0.72	0.19	34.81
8	Sub8.2	100-YEAR	0.128	0.408	0.894	0.010	28.1	0.40	0.10	4.50	0.60	0.0018	0.00	0.56	0.16	26.55
8	Sub8.3	100-YEAR	0.162	0.451	0.822	0.020	25.6	0.40	0.10	3.99	0.56	0.0018	0.00	0.51	0.15	24.20

Future Conditions: 100-Year Output

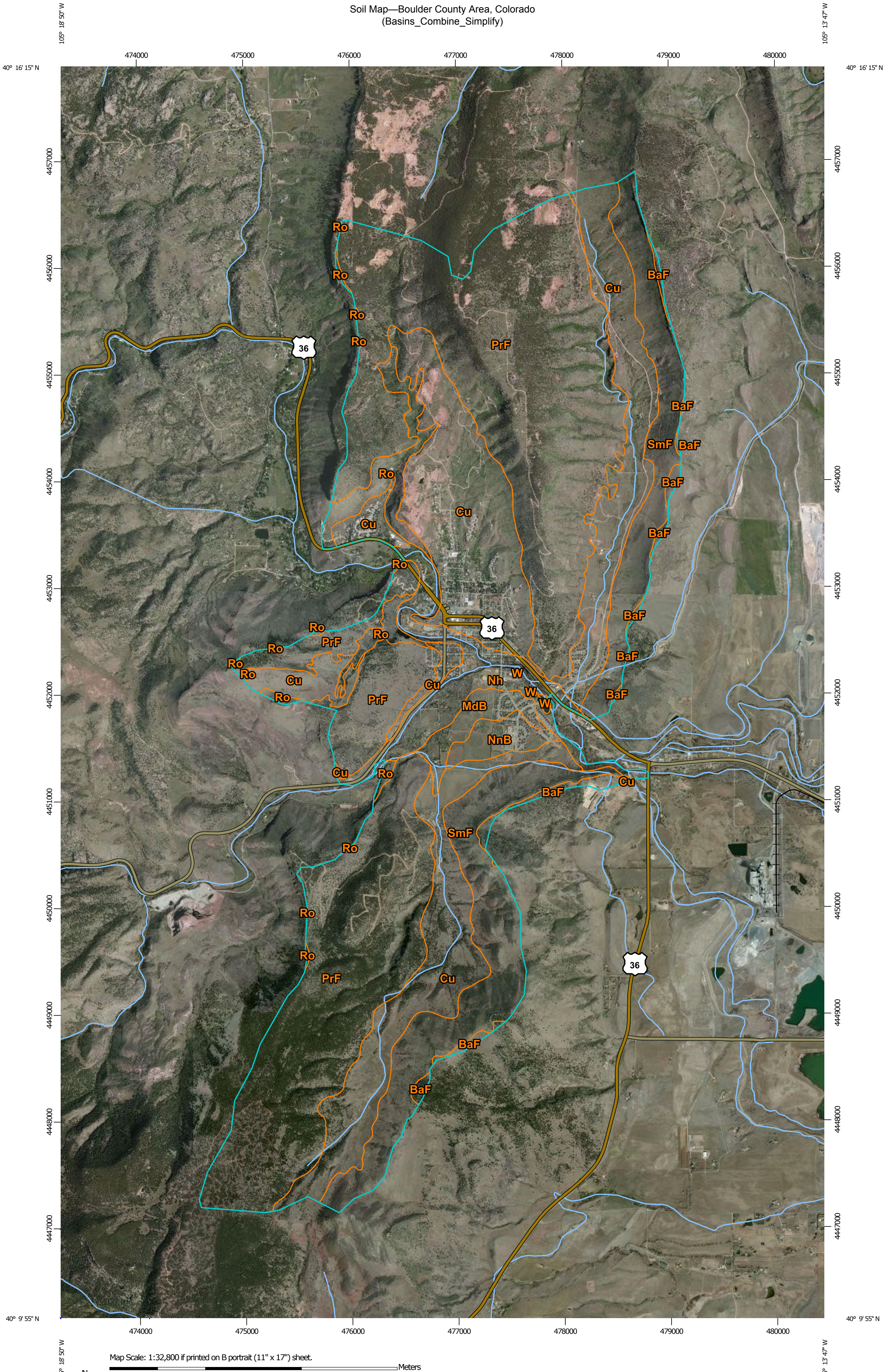
Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
1.2		0.096	0.236	27.1	5.21	14.1	3.68	8.7	326	684,491	2.06	1,406,754	43.0	408	1,406,622	2.16
1.3		0.096	0.254	26.5	5.47	13.8	3.87	9.1	429	878,950	2.06	1,809,161	43.0	534	1,809,001	2.21
1.4		0.095	0.228	19.5	3.72	10.1	2.63	6.2	356	537,728	2.11	1,134,368	39.0	403	1,134,290	2.72
1.5		0.086	0.288	20.6	4.86	10.7	3.43	8.1	366	583,860	2.30	1,342,360	40.0	449	1,342,319	2.79
2.1		0.107	0.193	36.2	5.65	18.8	3.99	9.4	240	673,131	1.87	1,256,252	47.0	306	1,256,236	1.65
2.2		0.093	0.144	24.1	2.96	12.5	2.09	4.9	83	154,853	2.05	317,208	40.0	97	317,169	2.27
2.3		0.088	0.122	21.2	2.28	11.0	1.61	3.8	51	83,672	2.18	182,007	38.0	59	181,988	2.55
2.4		0.079	0.189	24.3	3.84	12.7	2.72	6.4	85	161,033	2.52	405,946	40.0	116	405,933	2.61
2.5		0.078	0.171	20.7	3.03	10.8	2.14	5.0	79	127,641	2.53	323,218	38.0	102	323,188	2.89
2.6		0.111	0.107	48.2	4.26	25.1	3.01	7.1	41	151,909	1.80	273,182	51.0	54	273,173	1.29
3.1		0.093	0.188	27.1	4.21	14.1	2.98	7.0	134	281,400	2.08	586,349	42.0	167	586,287	2.15
3.2		0.090	0.145	22.3	2.79	11.6	1.97	4.6	78	134,232	2.18	292,167	39.0	92	292,139	2.49
3.3		0.078	0.075	13.5	1.08	7.0	0.76	1.8	20	20,546	2.53	51,993	35.0	21	51,951	3.68
3.4		0.078	0.124	19.0	2.10	9.9	1.48	3.5	42	61,240	2.56	156,673	37.0	52	156,635	3.05
3.5		0.121	0.078	32.6	2.26	17.0	1.60	3.8	28	70,588	1.72	121,382	43.0	32	121,374	1.64
3.6		0.109	0.067	46.2	2.67	24.0	1.89	4.5	15	53,882	1.84	99,372	48.0	20	99,372	1.34
3.7		0.077	0.055	8.7	0.67	4.5	0.47	1.1	14	9,755	2.61	25,423	32.0	12	25,315	4.55
3.8		0.095	0.083	25.2	1.90	13.1	1.35	3.2	26	50,834	2.04	103,784	40.0	31	103,770	2.18
4.1		0.079	0.177	16.6	2.55	8.6	1.81	4.3	109	139,608	2.53	353,395	37.0	128	353,348	3.32
4.11		0.139	0.202	41.6	6.74	21.6	4.76	11.2	150	481,581	1.65	792,303	50.0	183	792,287	1.38
4.2		0.101	0.143	35.6	4.20	18.5	2.97	7.0	88	243,448	1.95	475,084	46.0	114	475,068	1.70
4.3		0.103	0.230	55.2	10.02	28.7	7.08	16.7	259	1,107,581	1.94	2,149,431	57.0	386	2,149,410	1.27
4.4		0.135	0.175	45.3	6.37	23.5	4.50	10.6	100	350,494	1.70	595,337	51.0	128	595,331	1.32
4.5		0.134	0.157	37.3	4.80	19.4	3.39	8.0	97	278,587	1.70	474,893	47.0	117	474,874	1.52
4.6		0.097	0.272	43.8	9.44	22.8	6.67	15.7	358	1,214,444	2.06	2,497,874	53.0	526	2,497,794	1.57
4.7		0.127	0.121	38.9	3.92	20.2	2.77	6.5	58	174,022	1.71	298,215	47.0	70	298,197	1.47
4.8		0.128	0.196	38.2	6.05	19.9	4.28	10.1	186	551,326	1.69	933,100	48.0	227	933,083	1.49
4.9		0.098	0.259	32.0	6.65	16.6	4.70	11.1	434	1,074,701	2.04	2,196,833	46.0	575	2,196,714	1.94
5.1		0.090	0.204	20.5	3.51	10.7	2.48	5.9	178	283,224	2.18	618,515	39.0	208	618,416	2.67
5.2		0.096	0.178	23.8	3.56	12.4	2.52	5.9	164	303,147	2.06	624,810	41.0	194	624,790	2.33
6.1		0.112	0.209	35.4	5.98	18.4	4.22	10.0	312	855,446	1.84	1,570,449	47.0	393	1,570,386	1.67
6.2		0.097	0.177	26.5	3.89	13.8	2.75	6.5	151	310,064	2.07	642,959	42.0	187	642,929	2.19
6.3		0.124	0.227	44.8	8.12	23.3	5.74	13.5	283	983,329	1.74	1,707,227	52.0	370	1,707,174	1.37
6.4		0.137	0.209	54.5	9.06	28.3	6.40	15.1	135	567,681	1.74	988,603	57.0	186	988,586	1.19
6.5		0.104	0.175	35.9	5.13	18.6	3.63	8.6	166	460,570	1.91	878,433	47.0	213	878,404	1.68
6.6		0.133	0.230	68.2	12.32	35.5	8.71	20.5	161	849,255	1.72	1,457,427	65.0	233	1,457,419	1.00
6.7		0.099	0.162	25.1	3.43	13.1	2.43	5.7	148	288,618	2.01	581,564	41.0	176	581,555	2.21
6.8		0.136	0.218	45.5	7.93	23.7	5.60	13.2	191	673,793	1.74	1,169,296	53.0	252	1,169,295	1.35
6.9		0.112	0.174	33.9	4.82	17.6	3.41	8.0	177	464,273	1.82	843,366	46.0	216	843,355	1.69
7.1		0.114	0.087	59.3	4.25	30.8	3.01	7.1	20	93,834	1.77	166,111	54.0	28	166,107	1.09
7.11		0.090	0.185	22.1	3.44	11.5	2.43	5.7	134	228,947	2.20	503,916	40.0	161	503,892	2.55
7.12		0.087	0.206	14.6	2.61	7.6	1.84	4.4	223	252,216	2.27	573,764	36.0	234	573,690	3.37
7.2		0.094	0.129	30.8	3.35	16.0	2.37	5.6	55	131,449	2.07	272,451	43.0	70	272,436	1.94
7.3		0.078	0.117	16.6	1.79	8.6	1.27	3.0	43	55,243	2.53	139,804	36.0	50	139,764	3.29
7.4		0.091	0.128	23.1	2.58	12.0	1.82	4.3	59	105,069	2.11	221,727	40.0	69	221,734	2.37
7.5		0.104	0.081	56.0	3.78	29.1	2.67	6.3	19	82,806	1.84	152,228	52.0	26	152,228	1.16
7.6		0.084	0.201	28.5	4.69	14.8	3.31	7.8	98	216,873	2.34	507,360	43.0	134	507,345	2.25
7.7		0.096	0.239	33.6	6.46	17.5	4.57	10.8	269	699,676	2.04	1,428,870	47.0	359	1,428,847	1.86
7.8		0.098	0.158	29.7	3.90	15.4	2.75	6.5	115	265,168	2.03	539,236	43.0	145	539,200	1.99
7.9		0.077	0.083	14.3	1.21	7.4	0.85	2.0	22	24,315	2.62	63,781	35.0	24	63,783	3.66
8.1		0.096	0.245	47.1	9.18	24.5	6.49	15.3	209	763,699	2.08	1,591,921	54.0	315	1,591,902	1.50
8.2		0.103	0.150	59.7	7.18	31.0	5.08	12.0	64	297,906	1.86	554,082	56.0	93	554,071	1.13
8.3		0.105	0.160	49.0	6.32	25.5	4.46	10.5	99	375,517	1.87	701,878	52.0	136	701,867	1.32

APPENDIX B

SOILS DATA

Soil Map—Boulder County Area, Colorado
(Basins_Combine_Simplify)



Map Scale: 1:32,800 if printed on B portrait (11" x 17") sheet.

Meters: 0, 450, 900, 1800, 2700

Feet: 0, 1500, 3000, 6000, 9000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Boulder County Area, Colorado
Survey Area Data: Version 12, Sep 22, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 28, 2011—Apr 13, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Boulder County Area, Colorado (CO643)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BaF	Baller stony sandy loam, 9 to 35 percent slopes	64.0	1.1%
Cu	Colluvial land	1,521.8	27.2%
MdB	Manter sandy loam, 1 to 3 percent slopes	79.3	1.4%
Nh	Niwot soils	254.6	4.6%
NnB	Nunn sandy clay loam, 1 to 3 percent slopes	68.6	1.2%
PrF	Pinata-Rock outcrop complex, 5 to 55 percent slopes	2,652.0	47.4%
Ro	Rock outcrop	170.5	3.1%
SmF	Sixmile stony loam, 10 to 50 percent slopes	774.9	13.9%
W	Water	5.0	0.1%
Totals for Area of Interest		**5,590.7**	**100.0%**

Boulder County Area, Colorado

BaF—Baller stony sandy loam, 9 to 35 percent slopes

Map Unit Setting

National map unit symbol: jpr9
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 47 to 51 degrees F
Frost-free period: 140 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Baller and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Baller

Setting

Landform: Ridges
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy residuum weathered from sandstone

Typical profile

H1 - 0 to 10 inches: very stony sandy loam
H2 - 10 to 15 inches: very stony fine sandy loam, very stony sandy loam
H2 - 10 to 15 inches: unweathered bedrock
H3 - 15 to 19 inches:

Properties and qualities

Slope: 9 to 35 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Shallow Foothill (R049BY204CO)
Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 10 percent
Hydric soil rating: No

Paoli

Percent of map unit: 2 percent
Hydric soil rating: No

Hargreave

Percent of map unit: 2 percent
Hydric soil rating: No

Aquic haplustolls

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Boulder County Area, Colorado
Survey Area Data: Version 12, Sep 22, 2015

Boulder County Area, Colorado

Cu—Colluvial land

Map Unit Setting

National map unit symbol: jprk
Elevation: 7,500 to 9,000 feet
Mean annual precipitation: 6 to 10 inches
Mean annual air temperature: 39 to 43 degrees F
Frost-free period: 80 to 100 days
Farmland classification: Not prime farmland

Map Unit Composition

Colluvial land: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Colluvial Land

Setting

Landform: Valleys
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Colluvium

Typical profile

H1 - 0 to 3 inches: gravelly sandy loam
H2 - 3 to 60 inches: gravelly sand, very gravelly sand, gravelly loamy sand
H2 - 3 to 60 inches:
H2 - 3 to 60 inches:

Properties and qualities

Slope: 9 to 25 percent
Depth to restrictive feature: 2 to 60 inches to lithic bedrock
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 0.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Haverson

Percent of map unit: 10 percent
Hydric soil rating: No

Kim

Percent of map unit: 7 percent
Hydric soil rating: No

Otero

Percent of map unit: 3 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Boulder County Area, Colorado
Survey Area Data: Version 12, Sep 22, 2015

Boulder County Area, Colorado

MdB—Manter sandy loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: jps3
Elevation: 4,900 to 5,500 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 140 to 155 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Manter and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manter

Setting

Landform: Terraces
Landform position (three-dimensional): Side slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy eolian deposits and/or outwash

Typical profile

H1 - 0 to 6 inches: sandy loam
H2 - 6 to 16 inches: fine sandy loam, sandy loam
H2 - 6 to 16 inches: sandy loam, loamy sand, loamy fine sand
H3 - 16 to 60 inches:
H3 - 16 to 60 inches:
H3 - 16 to 60 inches:

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very high (about 17.9 inches)

Interpretive groups

Land capability classification (irrigated): 3e

Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: Sandy (R067XB026CO)
Hydric soil rating: No

Minor Components

Calkins
Percent of map unit: 8 percent
Hydric soil rating: No

Ascalon
Percent of map unit: 7 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Boulder County Area, Colorado
Survey Area Data: Version 12, Sep 22, 2015

Boulder County Area, Colorado

Nh—Niwot soils

Map Unit Setting

National map unit symbol: jps8
Elevation: 4,900 to 5,500 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 140 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Niwot and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Niwot

Setting

Landform: Flood plains, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy over sandy and gravelly alluvium

Typical profile

H1 - 0 to 14 inches: loam
H2 - 14 to 60 inches: gravelly sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B
Ecological site: Wet Meadow (R067XB038CO)
Hydric soil rating: No

Minor Components

Loveland

Percent of map unit: 10 percent
Hydric soil rating: No

Nunn

Percent of map unit: 4 percent
Hydric soil rating: No

Aquolls

Percent of map unit: 1 percent
Landform: Flood plains
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Boulder County Area, Colorado
Survey Area Data: Version 12, Sep 22, 2015

Boulder County Area, Colorado

NnB—Nunn sandy clay loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: jpsb
Elevation: 4,900 to 5,500 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 140 to 155 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Nunn and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nunn

Setting

Landform: Terraces, valley sides
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

H1 - 0 to 10 inches: sandy clay loam
H2 - 10 to 14 inches: clay
H3 - 14 to 60 inches: clay loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Clayey (R067XB042CO)
Hydric soil rating: No

Minor Components

Weld

Percent of map unit: 10 percent
Hydric soil rating: No

Ascalon

Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Boulder County Area, Colorado
Survey Area Data: Version 12, Sep 22, 2015

Boulder County Area, Colorado

PrF—Pinata-Rock outcrop complex, 5 to 55 percent slopes

Map Unit Setting

National map unit symbol: jpsk
Elevation: 6,000 to 7,000 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 47 to 51 degrees F
Frost-free period: 100 to 130 days
Farmland classification: Not prime farmland

Map Unit Composition

Pinata and similar soils: 45 percent
Rock outcrop: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pinata

Setting

Landform: Ridges, mountain slopes
Landform position (three-dimensional): Mountaintop, mountainflank
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stony sandy clayey colluvium over residuum weathered from sandstone and shale

Typical profile

H1 - 0 to 12 inches: very stony loamy fine sand
H2 - 12 to 32 inches: very stony clay
H3 - 32 to 36 inches: unweathered bedrock

Properties and qualities

Slope: 5 to 55 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Other vegetative classification: Ponderosa pine/true mountain mahogany (PIPO/CEMO2) (C1107)

Description of Rock Outcrop

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Free face
Parent material: Sandstone and shale

Typical profile

H1 - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 55 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D

Minor Components

Hargreave

Percent of map unit: 8 percent

Terry

Percent of map unit: 7 percent

Baller

Percent of map unit: 3 percent

Peyton

Percent of map unit: 2 percent

Data Source Information

Soil Survey Area: Boulder County Area, Colorado
Survey Area Data: Version 12, Sep 22, 2015

Boulder County Area, Colorado

Ro—Rock outcrop

Map Unit Composition

Rock outcrop: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rock Outcrop

Setting

Landform: Cliffs, mountain slopes
Landform position (three-dimensional): Free face, mountaintop
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Mixed

Typical profile

H1 - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 20 to 95 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D

Data Source Information

Soil Survey Area: Boulder County Area, Colorado
Survey Area Data: Version 12, Sep 22, 2015

Boulder County Area, Colorado

SmF—Sixmile stony loam, 10 to 50 percent slopes

Map Unit Setting

National map unit symbol: jpst
Elevation: 5,800 to 6,600 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Sixmile and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sixmile

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from calcareous shale

Typical profile

H1 - 0 to 4 inches: stony loam
H2 - 4 to 30 inches: clay loam
H3 - 30 to 34 inches: weathered bedrock

Properties and qualities

Slope: 10 to 50 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Rocky Foothill (R049XY206CO)
Hydric soil rating: No

Minor Components

Rock outcrop
Percent of map unit: 10 percent
Hydric soil rating: No

Hargreave
Percent of map unit: 10 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Boulder County Area, Colorado
Survey Area Data: Version 12, Sep 22, 2015

APPENDIX C

SWMM INPUT AND OUTPUT

EXISTING CONDITIONS

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.010)
--------------------------------------------------------------

WARNING 08: elevation drop exceeds length for Conduit C2.3
WARNING 08: elevation drop exceeds length for Conduit C6.4
WARNING 08: elevation drop exceeds length for Conduit Dum1.2
WARNING 08: elevation drop exceeds length for Conduit Dum1.3
WARNING 08: elevation drop exceeds length for Conduit Dum1.4
WARNING 08: elevation drop exceeds length for Conduit Dum1.5
WARNING 08: elevation drop exceeds length for Conduit Dum2.1
WARNING 08: elevation drop exceeds length for Conduit Dum2.3
WARNING 08: elevation drop exceeds length for Conduit Dum3.1
WARNING 08: elevation drop exceeds length for Conduit Dum3.2
WARNING 08: elevation drop exceeds length for Conduit Dum3.3
WARNING 08: elevation drop exceeds length for Conduit Dum3.5
WARNING 08: elevation drop exceeds length for Conduit Dum3.6
WARNING 08: elevation drop exceeds length for Conduit Dum3.7
WARNING 08: elevation drop exceeds length for Conduit Dum4.11
WARNING 08: elevation drop exceeds length for Conduit Dum4.3
WARNING 08: elevation drop exceeds length for Conduit Dum4.4
WARNING 08: elevation drop exceeds length for Conduit Dum4.5
WARNING 08: elevation drop exceeds length for Conduit Dum4.6
WARNING 08: elevation drop exceeds length for Conduit Dum4.7
WARNING 08: elevation drop exceeds length for Conduit Dum4.8
WARNING 08: elevation drop exceeds length for Conduit Dum4.9
WARNING 08: elevation drop exceeds length for Conduit Dum5.1
WARNING 08: elevation drop exceeds length for Conduit Dum6.1
WARNING 08: elevation drop exceeds length for Conduit Dum6.2
WARNING 08: elevation drop exceeds length for Conduit Dum6.3
WARNING 08: elevation drop exceeds length for Conduit Dum6.6
WARNING 08: elevation drop exceeds length for Conduit Dum6.8
WARNING 08: elevation drop exceeds length for Conduit Dum6.9
WARNING 08: elevation drop exceeds length for Conduit Dum7.4
WARNING 08: elevation drop exceeds length for Conduit Dum7.6
WARNING 08: elevation drop exceeds length for Conduit Dum7.7
WARNING 08: elevation drop exceeds length for Conduit Dum7.8
WARNING 08: elevation drop exceeds length for Conduit Dum8.1
WARNING 08: elevation drop exceeds length for Conduit DumPrivateDetention

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ JAN-01-2000 00:00:00
Ending Date .............. JAN-02-2000 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Routing Time Step ........ 30.00 sec


**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........       894.501        291.487
External Outflow .........       895.256        291.733
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......         0.019          0.006
Continuity Error (%) .....        -0.087


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :    30.00 sec
Average Time Step           :    30.00 sec
Maximum Time Step           :    30.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00
```

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days	hr:min	Reported Max Depth Feet
J1.2	JUNCTION	0.17	3.26	5577.74	0	00:48	3.26
J1.2.5	JUNCTION	0.15	2.73	5384.12	0	00:50	2.73
J1.3	JUNCTION	0.17	3.27	5783.03	0	00:45	3.27
J1.4	JUNCTION	0.13	2.86	6045.13	0	00:39	2.86
J2.1	JUNCTION	0.03	0.53	5515.53	0	00:47	0.53
J2.3	JUNCTION	0.13	2.37	5423.37	0	00:46	2.37
J2.4	JUNCTION	0.13	2.36	5329.36	0	00:48	2.37
J3.2	JUNCTION	0.02	0.42	5416.42	0	00:39	0.42
J3.4	JUNCTION	0.02	0.53	5394.53	0	00:43	0.53
J3.4b	JUNCTION	0.02	0.53	5365.03	0	00:44	0.53
J3.4bStormSewer	JUNCTION	0.16	2.50	5362.66	0	00:28	2.50
J3.4cStormSewer	JUNCTION	0.13	2.29	5355.59	0	00:42	2.28
J3.4eStormSewer	JUNCTION	0.12	2.56	5348.62	0	00:42	2.56
J3.4f	JUNCTION	0.03	0.63	5322.63	0	00:43	0.63
J4.1.2	JUNCTION	0.47	5.94	5299.67	0	01:00	5.94
J4.4.3	JUNCTION	0.47	5.94	5350.88	0	00:58	5.94
J4.5	JUNCTION	0.34	5.07	5447.02	0	00:55	5.07
J4.6.7	JUNCTION	0.29	4.41	5516.53	0	00:52	4.41
J4.8	JUNCTION	0.21	3.47	5577.70	0	00:50	3.47
J4.9.11	JUNCTION	0.14	2.44	5784.17	0	00:47	2.44
J6.2.3	JUNCTION	0.59	7.21	5501.24	0	00:58	7.21
J6.4	JUNCTION	0.33	4.39	5739.72	0	00:57	4.39
J6.5	JUNCTION	0.39	4.62	5718.58	0	01:00	4.62
J6.7	JUNCTION	0.27	3.78	5977.68	0	00:57	3.78
J6.8	JUNCTION	0.15	2.32	6032.84	0	00:53	2.32
J6.9	JUNCTION	0.25	3.79	6010.37	0	00:51	3.79
J7.3bStormSewer	JUNCTION	0.08	1.00	5317.10	0	00:17	1.00
J6.1	JUNCTION	0.60	7.20	5394.20	0	01:01	7.20
Sub1.2	JUNCTION	0.00	0.00	6528.00	0	00:00	0.00
Sub1.3	JUNCTION	0.00	0.00	6693.09	0	00:00	0.00
Sub1.4	JUNCTION	0.00	0.00	6566.27	0	00:00	0.00
Sub1.5	JUNCTION	0.00	0.00	6032.28	0	00:00	0.00
Sub2.1	JUNCTION	0.00	0.00	6528.50	0	00:00	0.00
Sub2.2	JUNCTION	0.00	0.00	5721.00	0	00:00	0.00
Sub2.3	JUNCTION	0.00	0.00	6262.00	0	00:00	0.00
Sub2.4	JUNCTION	0.00	0.00	5447.00	0	00:00	0.00
Sub2.5	JUNCTION	0.00	0.00	5471.00	0	00:00	0.00
Sub3.1	JUNCTION	0.00	0.00	6256.00	0	00:00	0.00
Sub3.2	JUNCTION	0.00	0.00	6034.00	0	00:00	0.00
Sub3.3	JUNCTION	0.00	0.00	5847.00	0	00:00	0.00
Sub3.4	JUNCTION	0.00	0.00	5417.00	0	00:00	0.00
Sub4.1	JUNCTION	0.00	0.00	5585.27	0	00:00	0.00
Sub4.11	JUNCTION	0.00	0.00	6585.86	0	00:00	0.00
Sub4.2	JUNCTION	0.00	0.00	5638.97	0	00:00	0.00
Sub4.3	JUNCTION	0.00	0.00	6433.29	0	00:00	0.00
Sub4.4	JUNCTION	0.00	0.00	5833.27	0	00:00	0.00
Sub4.5	JUNCTION	0.00	0.00	6007.89	0	00:00	0.00
Sub4.6	JUNCTION	0.00	0.00	6693.09	0	00:00	0.00
Sub4.7	JUNCTION	0.00	0.00	6052.15	0	00:00	0.00
Sub4.8	JUNCTION	0.00	0.00	6404.40	0	00:00	0.00
Sub4.9	JUNCTION	0.00	0.00	6682.05	0	00:00	0.00
Sub5.1	JUNCTION	0.00	0.00	5861.07	0	00:00	0.00
Sub6.1	JUNCTION	0.00	0.00	6062.30	0	00:00	0.00
Sub6.2	JUNCTION	0.00	0.00	6221.59	0	00:00	0.00
Sub6.3	JUNCTION	0.00	0.00	6436.63	0	00:00	0.00
Sub6.4	JUNCTION	0.00	0.00	6612.61	0	00:00	0.00
Sub6.5	JUNCTION	0.06	0.99	6462.92	0	00:47	0.99
Sub6.6	JUNCTION	0.00	0.00	6748.23	0	00:00	0.00
Sub6.7	JUNCTION	0.00	0.00	6271.60	0	00:00	0.00
Sub6.8	JUNCTION	0.00	0.00	6801.67	0	00:00	0.00
Sub6.9	JUNCTION	0.00	0.00	6566.11	0	00:00	0.00
Sub7.1	JUNCTION	0.00	0.00	5276.00	0	00:00	0.00
Sub7.2	JUNCTION	0.00	0.00	5632.00	0	00:00	0.00
Sub7.3	JUNCTION	0.00	0.00	5357.00	0	00:00	0.00
Sub7.4	JUNCTION	0.00	0.00	5721.00	0	00:00	0.00
Sub7.5	JUNCTION	0.00	0.00	5361.56	0	00:00	0.00
Sub7.6	JUNCTION	0.00	0.00	5439.88	0	00:00	0.00
Sub7.7	JUNCTION	0.00	0.00	6539.22	0	00:00	0.00
Sub7.8	JUNCTION	0.00	0.00	5862.24	0	00:00	0.00
Sub8.1	JUNCTION	0.00	0.00	6452.46	0	00:00	0.00
Sub8.2	JUNCTION	0.00	0.00	5381.27	0	00:00	0.00
Sub8.3	JUNCTION	0.00	0.00	5389.38	0	00:00	0.00
RedHillGulchOUT	JUNCTION	0.38	4.68	5336.68	0	01:03	4.68
Sub2.6	JUNCTION	0.00	0.00	5456.00	0	00:00	0.00
2ndAve_MainSt	JUNCTION	0.02	0.41	5334.32	0	00:42	0.41
Sub3.6	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
Sub3.8	JUNCTION	0.01	0.13	5424.13	0	00:40	0.13
Sub3.5	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
PrivateDetention	JUNCTION	0.03	0.53	0.53	0	00:48	0.53
Sub5.2	JUNCTION	0.00	0.00	5353.00	0	00:00	0.00
Sub7.11	JUNCTION	0.00	0.00	5306.00	0	00:00	0.00
Sub7.12	JUNCTION	0.00	0.00	5303.00	0	00:00	0.00
Sub3.7	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
Sub7.9	JUNCTION	0.00	0.00	5318.00	0	00:00	0.00
StoneCanyonStVrainOUT	OUTFALL	0.00	0.00	5290.00	0	00:00	0.00
EagleCanyonN.St.VrainOUT	OUTFALL	0.00	0.00	5381.00	0	00:00	0.00
Sub7.7N.St.VrainOUT	OUTFALL	0.00	0.00	5348.86	0	00:00	0.00
Sub7.8S.St.VrainOUT	OUTFALL	0.00	0.00	5370.49	0	00:00	0.00
Sub5.1N.St.VrainOUT	OUTFALL	0.00	0.00	5332.66	0	00:00	0.00
Sub7.5N.St.VrainOUT	OUTFALL	0.00	0.00	5356.67	0	00:00	0.00
Sub8.2St.VrainOUT	OUTFALL	0.00	0.00	5316.23	0	00:00	0.00

Sub8.3St.VrainOUT	OUTFALL	0.00	0.00	5306.96	0	00:00	0.00
Sub7.1St.VrainOUT	OUTFALL	0.00	0.00	5282.58	0	00:00	0.00
Sub7.6N.St.VrainOUT	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
Sub2.4N.St.VrainOUT	OUTFALL	0.00	0.00	5326.00	0	00:00	0.00
Sub7.2St.VrainOUT	OUTFALL	0.00	0.00	5319.00	0	00:00	0.00
Sub7.3St.VrainOUT	OUTFALL	0.00	0.00	5315.00	0	00:00	0.00
O_BohnPark	OUTFALL	0.38	4.68	5318.68	0	01:04	4.68
Sub5.2St.VrainOUT	OUTFALL	0.00	0.00	5347.00	0	00:00	0.00
2	DIVIDER	1.07	2.50	5366.93	0	00:27	2.50
2ndAve_ParkSt	DIVIDER	0.08	1.00	5326.90	0	00:14	1.00
J3.4dStormSewer	DIVIDER	0.12	2.56	5355.50	0	00:42	2.56
EagleCanyonExistDetPond	STORAGE	1.59	8.65	5508.65	0	00:43	8.65

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Node Inflow Summary
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Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
J1.2	JUNCTION	0.00	1311.05	0	00:47	0	32.6	0.000
J1.2.5	JUNCTION	0.00	1716.39	0	00:49	0	42.6	0.000
J1.3	JUNCTION	0.00	918.48	0	00:45	0	22	0.000
J1.4	JUNCTION	0.00	402.92	0	00:39	0	8.48	0.000
J2.1	JUNCTION	0.00	306.23	0	00:47	0	9.4	0.000
J2.3	JUNCTION	0.00	572.67	0	00:46	0	16.8	0.000
J2.4	JUNCTION	0.00	682.01	0	00:47	0	19.9	0.000
J3.2	JUNCTION	0.00	92.13	0	00:39	0	2.19	0.000
J3.4	JUNCTION	0.00	231.93	0	00:43	0	6.35	0.000
J3.4b	JUNCTION	0.00	330.69	0	00:42	0	8.77	0.000
J3.4bStormSewer	JUNCTION	0.00	330.69	0	00:42	0	8.77	0.000
J3.4cStormSewer	JUNCTION	0.00	330.69	0	00:42	0	8.77	0.000
J3.4eStormSewer	JUNCTION	0.00	380.33	0	00:42	0	9.94	0.000
J3.4f	JUNCTION	0.00	559.09	0	00:43	0	15	0.000
J4.1.2	JUNCTION	0.00	2356.76	0	01:00	0	80.3	0.000
J4.4.3	JUNCTION	0.00	2182.51	0	00:58	0	74.4	0.000
J4.5	JUNCTION	0.00	1679.34	0	00:55	0	53.8	0.000
J4.6.7	JUNCTION	0.00	1571.28	0	00:52	0	50.3	0.000
J4.8	JUNCTION	0.00	978.15	0	00:50	0	29.4	0.000
J4.9.11	JUNCTION	0.00	754.72	0	00:47	0	22.4	0.000
J6.2.3	JUNCTION	0.00	1725.87	0	00:58	0	61.9	0.000
J6.4	JUNCTION	0.00	1016.29	0	00:57	0	37.7	0.000
J6.5	JUNCTION	0.00	1015.24	0	01:00	0	37.7	0.000
J6.7	JUNCTION	0.00	830.59	0	00:56	0	30.3	0.000
J6.8	JUNCTION	0.00	251.51	0	00:53	0	8.75	0.000
J6.9	JUNCTION	0.00	461.18	0	00:51	0	15.1	0.000
J7.3bStormSewer	JUNCTION	0.00	49.86	0	00:38	0	1.05	0.000
J6.1	JUNCTION	0.00	2073.88	0	01:00	0	73.6	0.000
Sub1.2	JUNCTION	407.58	407.58	0	00:43	10.5	10.5	0.000
Sub1.3	JUNCTION	534.22	534.22	0	00:43	13.5	13.5	0.000
Sub1.4	JUNCTION	402.92	402.92	0	00:39	8.48	8.48	0.000
Sub1.5	JUNCTION	448.65	448.65	0	00:40	10	10	0.000
Sub2.1	JUNCTION	306.23	306.23	0	00:47	9.4	9.4	0.000
Sub2.2	JUNCTION	96.93	96.93	0	00:40	2.37	2.37	0.000
Sub2.3	JUNCTION	58.81	58.81	0	00:38	1.36	1.36	0.000
Sub2.4	JUNCTION	115.65	115.65	0	00:40	3.04	3.04	0.000
Sub2.5	JUNCTION	101.50	101.50	0	00:38	2.42	2.42	0.000
Sub3.1	JUNCTION	141.72	141.72	0	00:45	4.17	4.17	0.000
Sub3.2	JUNCTION	92.13	92.13	0	00:39	2.19	2.19	0.000
Sub3.3	JUNCTION	20.82	20.82	0	00:35	0.389	0.389	0.000
Sub3.4	JUNCTION	51.51	51.51	0	00:37	1.17	1.17	0.000
Sub4.1	JUNCTION	102.21	102.21	0	00:38	2.34	2.34	0.000
Sub4.11	JUNCTION	183.39	183.39	0	00:50	5.93	5.93	0.000
Sub4.2	JUNCTION	113.32	113.32	0	00:46	3.55	3.55	0.000
Sub4.3	JUNCTION	386.21	386.21	0	00:57	16.1	16.1	0.000
Sub4.4	JUNCTION	127.90	127.90	0	00:51	4.45	4.45	0.000
Sub4.5	JUNCTION	116.65	116.65	0	00:47	3.55	3.55	0.000
Sub4.6	JUNCTION	526.00	526.00	0	00:53	18.7	18.7	0.000
Sub4.7	JUNCTION	70.26	70.26	0	00:47	2.23	2.23	0.000
Sub4.8	JUNCTION	227.00	227.00	0	00:48	6.98	6.98	0.000
Sub4.9	JUNCTION	574.60	574.60	0	00:46	16.4	16.4	0.000
Sub5.1	JUNCTION	170.76	170.76	0	00:41	4.31	4.31	0.000
Sub6.1	JUNCTION	386.63	386.63	0	00:47	11.6	11.6	0.000
Sub6.2	JUNCTION	186.56	186.56	0	00:42	4.81	4.81	0.000
Sub6.3	JUNCTION	370.40	370.40	0	00:52	12.8	12.8	0.000
Sub6.4	JUNCTION	185.94	185.94	0	00:57	7.39	7.39	0.000
Sub6.5	JUNCTION	212.95	212.95	0	00:47	6.57	6.57	0.000
Sub6.6	JUNCTION	233.38	233.38	0	01:05	10.9	10.9	0.000
Sub6.7	JUNCTION	175.93	175.93	0	00:41	4.35	4.35	0.000
Sub6.8	JUNCTION	251.51	251.51	0	00:53	8.75	8.75	0.000
Sub6.9	JUNCTION	216.21	216.21	0	00:46	6.31	6.31	0.000
Sub7.1	JUNCTION	25.00	25.00	0	00:56	1.13	1.13	0.000
Sub7.2	JUNCTION	70.43	70.43	0	00:43	2.04	2.04	0.000
Sub7.3	JUNCTION	50.10	50.10	0	00:36	1.05	1.05	0.000
Sub7.4	JUNCTION	68.64	68.64	0	00:40	1.66	1.66	0.000
Sub7.5	JUNCTION	26.47	26.47	0	00:52	1.14	1.14	0.000
Sub7.6	JUNCTION	134.43	134.43	0	00:43	3.79	3.79	0.000
Sub7.7	JUNCTION	358.89	358.89	0	00:47	10.7	10.7	0.000
Sub7.8	JUNCTION	144.08	144.08	0	00:43	4.02	4.02	0.000
Sub8.1	JUNCTION	314.83	314.83	0	00:54	11.9	11.9	0.000
Sub8.2	JUNCTION	92.88	92.88	0	00:56	4.14	4.14	0.000
Sub8.3	JUNCTION	136.38	136.38	0	00:52	5.25	5.25	0.000
RedHillGulchOUT	JUNCTION	0.00	2200.09	0	01:03	0	78.8	0.000
Sub2.6	JUNCTION	53.83	53.83	0	00:51	2.04	2.04	0.000
2ndAve_MainSt	JUNCTION	0.00	99.66	0	00:42	0	2.82	0.000
Sub3.6	JUNCTION	19.89	19.89	0	00:48	0.743	0.743	0.000

Sub3.8	JUNCTION	30.52	30.52	0	00:40	0.776	0.776	0.000
Sub3.5	JUNCTION	31.84	31.84	0	00:43	0.908	0.908	0.000
PrivateDetention	JUNCTION	0.00	426.03	0	00:46	0	12.4	0.000
Sub5.2	JUNCTION	194.46	194.46	0	00:41	4.67	4.67	0.000
Sub7.11	JUNCTION	160.86	160.86	0	00:40	3.77	3.77	0.000
Sub7.12	JUNCTION	198.79	198.79	0	00:37	4	4	0.000
Sub3.7	JUNCTION	12.23	12.23	0	00:32	0.189	0.189	0.000
Sub7.9	JUNCTION	24.49	24.49	0	00:35	0.477	0.477	0.000
StoneCanyonStVrainOUT	OUTFALL	0.00	2356.76	0	01:00	0	80.3	0.000
EagleCanyonN.St.VrainOUT	OUTFALL	0.00	1716.39	0	00:49	0	42.6	0.000
Sub7.7N.St.VrainOUT	OUTFALL	0.00	358.89	0	00:47	0	10.7	0.000
Sub7.8S.St.VrainOUT	OUTFALL	0.00	144.08	0	00:43	0	4.02	0.000
Sub5.1N.St.VrainOUT	OUTFALL	0.00	170.76	0	00:41	0	4.31	0.000
Sub7.5N.St.VrainOUT	OUTFALL	0.00	26.47	0	00:52	0	1.14	0.000
Sub8.2St.VrainOUT	OUTFALL	0.00	407.41	0	00:54	0	16.1	0.000
Sub8.3St.VrainOUT	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 gal
Sub7.1St.VrainOUT	OUTFALL	0.00	377.96	0	00:39	0	8.9	0.000
Sub7.6N.St.VrainOUT	OUTFALL	0.00	134.43	0	00:43	0	3.79	0.000
Sub2.4N.St.VrainOUT	OUTFALL	0.00	682.01	0	00:47	0	19.9	0.000
Sub7.2St.VrainOUT	OUTFALL	0.00	580.89	0	00:42	0	15.5	0.000
Sub7.3St.VrainOUT	OUTFALL	0.00	49.86	0	00:38	0	1.05	0.000
O_BohnPark	OUTFALL	0.00	2198.46	0	01:04	0	78.8	0.000
Sub5.2St.VrainOUT	OUTFALL	0.00	194.46	0	00:41	0	4.67	0.000
2	DIVIDER	0.00	330.69	0	00:42	0	8.77	0.000
2ndAve_ParkSt	DIVIDER	0.00	50.10	0	00:36	0	1.05	0.000
J3.4dStormSewer	DIVIDER	0.00	380.33	0	00:42	0	9.94	0.000
EagleCanyonExistDetPond	STORAGE	0.00	448.65	0	00:40	0	10	0.117

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Node Surcharge Summary
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Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
J1.2	JUNCTION	30.00	3.261	2.602
J1.2.5	JUNCTION	30.00	2.726	0.673
J1.3	JUNCTION	30.00	3.270	4.109
J1.4	JUNCTION	30.00	2.864	4.515
J2.1	JUNCTION	30.00	0.528	9.472
J2.3	JUNCTION	30.00	2.366	0.634
J2.4	JUNCTION	30.00	2.365	0.635
J3.2	JUNCTION	30.00	0.420	0.580
J3.4	JUNCTION	30.00	0.530	0.470
J3.4b	JUNCTION	30.00	0.530	0.470
J3.4bStormSewer	JUNCTION	30.00	2.500	0.500
J3.4cStormSewer	JUNCTION	30.00	2.285	0.715
J3.4eStormSewer	JUNCTION	30.00	2.556	0.944
J3.4f	JUNCTION	30.00	0.625	0.375
J4.1.2	JUNCTION	30.00	5.941	2.059
J4.4.3	JUNCTION	30.00	5.944	2.056
J4.5	JUNCTION	30.00	5.069	1.455
J4.6.7	JUNCTION	30.00	4.414	1.320
J4.8	JUNCTION	30.00	3.466	1.045
J4.9.11	JUNCTION	30.00	2.439	0.981
J6.2.3	JUNCTION	30.00	7.206	2.014
J6.4	JUNCTION	30.00	4.388	0.612
J6.5	JUNCTION	30.00	4.615	4.605
J6.7	JUNCTION	30.00	3.775	1.881
J6.8	JUNCTION	30.00	2.320	4.374
J6.9	JUNCTION	30.00	3.786	2.908
J7.3bStormSewer	JUNCTION	30.00	1.000	0.000
J6.1	JUNCTION	30.00	7.201	2.799
Sub1.2	JUNCTION	30.00	0.000	0.000
Sub1.3	JUNCTION	30.00	0.000	0.000
Sub1.4	JUNCTION	30.00	0.000	0.000
Sub1.5	JUNCTION	30.00	0.000	0.000
Sub2.1	JUNCTION	30.00	0.000	0.000
Sub2.2	JUNCTION	30.00	0.000	0.000
Sub2.3	JUNCTION	30.00	0.000	0.000
Sub2.4	JUNCTION	30.00	0.000	0.000
Sub2.5	JUNCTION	30.00	0.000	0.000
Sub3.1	JUNCTION	30.00	0.000	0.000
Sub3.2	JUNCTION	30.00	0.000	0.000
Sub3.3	JUNCTION	30.00	0.000	0.000
Sub3.4	JUNCTION	30.00	0.000	0.000
Sub4.1	JUNCTION	30.00	0.000	0.000
Sub4.11	JUNCTION	30.00	0.000	0.000
Sub4.2	JUNCTION	30.00	0.000	0.000
Sub4.3	JUNCTION	30.00	0.000	0.000
Sub4.4	JUNCTION	30.00	0.000	0.000
Sub4.5	JUNCTION	30.00	0.000	0.000
Sub4.6	JUNCTION	30.00	0.000	0.000
Sub4.7	JUNCTION	30.00	0.000	0.000
Sub4.8	JUNCTION	30.00	0.000	0.000
Sub4.9	JUNCTION	30.00	0.000	0.000
Sub5.1	JUNCTION	30.00	0.000	0.000
Sub6.1	JUNCTION	30.00	0.000	0.000
Sub6.2	JUNCTION	30.00	0.000	0.000
Sub6.3	JUNCTION	30.00	0.000	0.000
Sub6.4	JUNCTION	30.00	0.000	0.000
Sub6.5	JUNCTION	30.00	0.995	4.005
Sub6.6	JUNCTION	30.00	0.000	0.000
Sub6.7	JUNCTION	30.00	0.000	0.000
Sub6.8	JUNCTION	30.00	0.000	0.000
Sub6.9	JUNCTION	30.00	0.000	0.000

Sub7.1	JUNCTION	30.00	0.000	0.000
Sub7.2	JUNCTION	30.00	0.000	0.000
Sub7.3	JUNCTION	30.00	0.000	0.000
Sub7.4	JUNCTION	30.00	0.000	0.000
Sub7.5	JUNCTION	30.00	0.000	0.000
Sub7.6	JUNCTION	30.00	0.000	0.000
Sub7.7	JUNCTION	30.00	0.000	0.000
Sub7.8	JUNCTION	30.00	0.000	0.000
Sub8.1	JUNCTION	30.00	0.000	0.000
Sub8.2	JUNCTION	30.00	0.000	0.000
Sub8.3	JUNCTION	30.00	0.000	0.000
RedHillGulchOUT	JUNCTION	30.00	4.681	5.319
Sub2.6	JUNCTION	30.00	0.000	0.000
2ndAve_MainSt	JUNCTION	30.00	0.408	0.592
Sub3.6	JUNCTION	30.00	0.000	0.000
Sub3.8	JUNCTION	30.00	0.134	0.866
Sub3.5	JUNCTION	30.00	0.000	0.000
PrivateDetention	JUNCTION	30.00	0.528	9.472
Sub5.2	JUNCTION	30.00	0.000	0.000
Sub7.11	JUNCTION	30.00	0.000	0.000
Sub7.12	JUNCTION	30.00	0.000	0.000
Sub3.7	JUNCTION	30.00	0.000	0.000
Sub7.9	JUNCTION	30.00	0.000	0.000
2	DIVIDER	30.00	2.500	0.000
2ndAve_ParkSt	DIVIDER	30.00	1.000	0.000
J3.4dStormSewer	DIVIDER	30.00	2.556	0.944
EagleCanyonExistDetPond	STORAGE	30.00	8.649	0.351

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Node Flooding Summary
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No nodes were flooded.

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Storage Volume Summary
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Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
EagleCanyonExistDetPond	6.750	6	0	0	105.629	88	0 00:43	443.47

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
StoneCanyonStVrainOUT	40.25	246.96	2356.76	80.300
EagleCanyonN.St.VrainOUT	40.72	129.55	1716.39	42.617
Sub7.7N.St.VrainOUT	13.14	100.69	358.89	10.688
Sub7.8S.St.VrainOUT	12.36	40.29	144.08	4.023
Sub5.1N.St.VrainOUT	11.47	46.51	170.76	4.310
Sub7.5N.St.VrainOUT	17.58	8.02	26.47	1.139
Sub8.2St.VrainOUT	18.53	107.25	407.41	16.052
Sub8.3St.VrainOUT	0.00	0.00	0.00	0.000
Sub7.1St.VrainOUT	18.56	59.34	377.96	8.895
Sub7.6N.St.VrainOUT	12.06	38.97	134.43	3.795
Sub2.4N.St.VrainOUT	27.75	88.66	682.01	19.875
Sub7.2St.VrainOUT	25.86	74.05	580.89	15.470
Sub7.3St.VrainOUT	14.89	8.72	49.86	1.048
O_BohnPark	42.03	232.17	2198.46	78.826
Sub5.2St.VrainOUT	11.08	52.20	194.46	4.673
System	20.42	1233.35	8758.96	291.711

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Link Flow Summary
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Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
2ndAve	CONDUIT	30.47	0 00:42	5.72	0.04	0.13
C1.2	CHANNEL	912.77	0 00:48	15.53	0.26	0.56
C1.3	CHANNEL	388.36	0 00:46	12.67	0.10	0.38
C1.5	CHANNEL	1304.14	0 00:50	14.00	0.59	0.80
C2.3	CONDUIT	306.18	0 00:48	45.89	0.00	0.05
C2.4	CONDUIT	571.88	0 00:48	14.42	0.58	0.79
C3.3.7.2	CONDUIT	380.16	0 00:43	12.17	0.46	0.63
C3.4	CONDUIT	231.88	0 00:44	14.59	0.35	0.53
C3.4bStormSewer	CONDUIT	330.69	0 00:42	25.33	0.48	0.76
C3.4cStormSewer	CONDUIT	380.33	0 00:42	30.37	0.94	0.73
C3.4cStormSewer_OF	DUMMY	0.00	0 00:00			
C3.4Overflow	CONDUIT	245.04	0 00:42	13.72	0.43	0.60
C3.4StormSewer	CONDUIT	92.31	0 01:41	19.98	1.08	1.00
C4.1.2	CONDUIT	2179.73	0 01:00	13.21	0.45	0.74
C4.4	CHANNEL	1672.53	0 00:58	16.54	0.58	0.78

C4.5	CHANNEL	1567.11	0	00:55	14.61	0.46	0.77
C4.7	CHANNEL	977.28	0	00:51	16.64	0.53	0.77
C4.8	CHANNEL	751.77	0	00:50	14.27	0.48	0.71
C6.1	CHANNEL	1721.82	0	01:01	14.62	0.48	0.78
C6.3	CHANNEL	1014.59	0	01:01	20.66	0.17	0.50
C6.4	DUMMY	185.94	0	00:57			
C6.5	CONDUIT	830.36	0	00:57	19.66	0.26	0.54
C6.5b	CONDUIT	1015.24	0	01:00	9.29	0.76	0.88
C6.6.7	CHANNEL	457.36	0	00:57	6.65	0.30	0.67
C6.9	CHANNEL	251.47	0	00:54	10.77	0.08	0.35
C7.3	CONDUIT	2.47	0	02:14	3.63	1.08	1.00
C7.3Overflow	CONDUIT	47.58	0	00:38	5.04	0.15	0.32
CStickneyAve	CONDUIT	92.12	0	00:40	10.97	0.24	0.42
Dum1.2	DUMMY	407.58	0	00:43			
Dum1.3	DUMMY	534.22	0	00:43			
Dum1.4	DUMMY	402.92	0	00:39			
Dum1.5	DUMMY	448.65	0	00:40			
Dum2.1	DUMMY	306.23	0	00:47			
Dum2.2	DUMMY	96.93	0	00:40			
Dum2.3	DUMMY	58.81	0	00:38			
Dum2.4	DUMMY	115.65	0	00:40			
Dum2.4OUT	DUMMY	682.01	0	00:47			
Dum2.5	DUMMY	101.50	0	00:38			
Dum2.6	DUMMY	53.83	0	00:51			
Dum3.1	DUMMY	141.72	0	00:45			
Dum3.2	DUMMY	92.13	0	00:39			
Dum3.3	DUMMY	20.82	0	00:35			
Dum3.4	DUMMY	51.51	0	00:37			
Dum3.4b	DUMMY	330.69	0	00:42			
Dum3.4c	DUMMY	330.69	0	00:42			
Dum3.5	DUMMY	31.84	0	00:43			
Dum3.6	DUMMY	19.89	0	00:48			
Dum3.7	DUMMY	12.23	0	00:32			
Dum4.1	DUMMY	102.21	0	00:38			
Dum4.11	DUMMY	183.39	0	00:50			
Dum4.2	DUMMY	113.32	0	00:46			
Dum4.3	DUMMY	386.21	0	00:57			
Dum4.4	DUMMY	127.90	0	00:51			
Dum4.5	DUMMY	116.65	0	00:47			
Dum4.6	DUMMY	526.00	0	00:53			
Dum4.7	DUMMY	70.26	0	00:47			
Dum4.8	DUMMY	227.00	0	00:48			
Dum4.9	DUMMY	574.60	0	00:46			
Dum5.1	DUMMY	170.76	0	00:41			
Dum5.2	DUMMY	194.46	0	00:41			
Dum6.1	DUMMY	386.63	0	00:47			
Dum6.2	DUMMY	186.56	0	00:42			
Dum6.3	DUMMY	370.40	0	00:52			
Dum6.5	CONDUIT	212.59	0	00:49	18.03	0.03	0.20
Dum6.6	DUMMY	233.38	0	01:05			
Dum6.7	DUMMY	175.93	0	00:41			
Dum6.8	DUMMY	251.51	0	00:53			
Dum6.9	DUMMY	216.21	0	00:46			
Dum7.1	DUMMY	25.00	0	00:56			
Dum7.12	DUMMY	198.79	0	00:37			
Dum7.11	DUMMY	160.86	0	00:40			
Dum7.2	DUMMY	70.43	0	00:43			
Dum7.2b	DUMMY	559.09	0	00:43			
Dum7.3	DUMMY	50.10	0	00:36			
Dum7.3b	DUMMY	49.86	0	00:38			
Dum7.4	DUMMY	68.64	0	00:40			
Dum7.5	DUMMY	26.47	0	00:52			
Dum7.6	DUMMY	134.43	0	00:43			
Dum7.7	DUMMY	358.89	0	00:47			
Dum7.8	DUMMY	144.08	0	00:43			
Dum7.9	DUMMY	24.49	0	00:35			
Dum8.1	DUMMY	314.83	0	00:54			
Dum8.2	DUMMY	92.88	0	00:56			
Dum8.3	DUMMY	136.38	0	00:52			
DumEagleCanyonOUT	DUMMY	1716.39	0	00:49			
DumPrivateDetention	DUMMY	426.03	0	00:46			
DumStoneCanyonOut	DUMMY	2356.76	0	01:00			
MainSt	CONDUIT	99.63	0	00:43	6.11	0.23	0.41
RedHillGulchBohnPark	CONDUIT	2198.46	0	01:04	9.08	0.84	0.94
RedHillGulchOut	CONDUIT	2069.75	0	01:03	10.83	0.10	0.41
EagleCanyonExistDetPondOut	DUMMY	443.47	0	00:43			

****
Conduit Surcharge Summary
****

Conduit	Hours Full Both Ends	Hours Full Upstream	Hours Full Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C3.4StormSewer	1.27	1.27	1.27	1.28	1.27
C7.3	1.96	1.96	1.96	1.98	1.96

Analysis begun on: Thu Dec 08 08:15:27 2016
Analysis ended on: Thu Dec 08 08:15:27 2016
Total elapsed time: < 1 sec

FUTURE CONDITIONS

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.010)
--------------------------------------------------------------

WARNING 08: elevation drop exceeds length for Conduit C2.3
WARNING 08: elevation drop exceeds length for Conduit C6.4
WARNING 08: elevation drop exceeds length for Conduit Dum1.2
WARNING 08: elevation drop exceeds length for Conduit Dum1.3
WARNING 08: elevation drop exceeds length for Conduit Dum1.4
WARNING 08: elevation drop exceeds length for Conduit Dum1.5
WARNING 08: elevation drop exceeds length for Conduit Dum2.1
WARNING 08: elevation drop exceeds length for Conduit Dum2.3
WARNING 08: elevation drop exceeds length for Conduit Dum3.1
WARNING 08: elevation drop exceeds length for Conduit Dum3.2
WARNING 08: elevation drop exceeds length for Conduit Dum3.3
WARNING 08: elevation drop exceeds length for Conduit Dum3.5
WARNING 08: elevation drop exceeds length for Conduit Dum3.6
WARNING 08: elevation drop exceeds length for Conduit Dum3.7
WARNING 08: elevation drop exceeds length for Conduit Dum4.11
WARNING 08: elevation drop exceeds length for Conduit Dum4.3
WARNING 08: elevation drop exceeds length for Conduit Dum4.4
WARNING 08: elevation drop exceeds length for Conduit Dum4.5
WARNING 08: elevation drop exceeds length for Conduit Dum4.6
WARNING 08: elevation drop exceeds length for Conduit Dum4.7
WARNING 08: elevation drop exceeds length for Conduit Dum4.8
WARNING 08: elevation drop exceeds length for Conduit Dum4.9
WARNING 08: elevation drop exceeds length for Conduit Dum5.1
WARNING 08: elevation drop exceeds length for Conduit Dum6.1
WARNING 08: elevation drop exceeds length for Conduit Dum6.2
WARNING 08: elevation drop exceeds length for Conduit Dum6.3
WARNING 08: elevation drop exceeds length for Conduit Dum6.6
WARNING 08: elevation drop exceeds length for Conduit Dum6.8
WARNING 08: elevation drop exceeds length for Conduit Dum6.9
WARNING 08: elevation drop exceeds length for Conduit Dum7.4
WARNING 08: elevation drop exceeds length for Conduit Dum7.6
WARNING 08: elevation drop exceeds length for Conduit Dum7.7
WARNING 08: elevation drop exceeds length for Conduit Dum7.8
WARNING 08: elevation drop exceeds length for Conduit Dum8.1
WARNING 08: elevation drop exceeds length for Conduit DumPrivateDetention

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ JAN-01-2000 00:00:00
Ending Date .............. JAN-02-2000 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Routing Time Step ........ 30.00 sec


**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........       894.501        291.487
External Outflow .........       895.256        291.733
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......         0.019          0.006
Continuity Error (%) .....        -0.087


*******************************
Highest Flow Instability Indexes
*******************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :    30.00 sec
Average Time Step           :    30.00 sec
Maximum Time Step           :    30.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00
```

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
J1.2	JUNCTION	0.17	3.26	5577.74	0 00:48	3.26
J1.2.5	JUNCTION	0.15	2.73	5384.12	0 00:50	2.73
J1.3	JUNCTION	0.17	3.27	5783.03	0 00:45	3.27
J1.4	JUNCTION	0.13	2.86	6045.13	0 00:39	2.86
J2.1	JUNCTION	0.03	0.53	5515.53	0 00:47	0.53
J2.3	JUNCTION	0.13	2.37	5423.37	0 00:46	2.37
J2.4	JUNCTION	0.13	2.36	5329.36	0 00:48	2.37
J3.2	JUNCTION	0.02	0.42	5416.42	0 00:39	0.42
J3.4	JUNCTION	0.02	0.53	5394.53	0 00:43	0.53
J3.4b	JUNCTION	0.02	0.53	5365.03	0 00:44	0.53
J3.4bStormSewer	JUNCTION	0.16	2.50	5362.66	0 00:28	2.50
J3.4cStormSewer	JUNCTION	0.13	2.29	5355.59	0 00:42	2.28
J3.4eStormSewer	JUNCTION	0.12	2.56	5348.62	0 00:42	2.56
J3.4f	JUNCTION	0.03	0.63	5322.63	0 00:43	0.63
J4.1.2	JUNCTION	0.47	5.94	5299.67	0 01:00	5.94
J4.4.3	JUNCTION	0.47	5.94	5350.88	0 00:58	5.94
J4.5	JUNCTION	0.34	5.07	5447.02	0 00:55	5.07
J4.6.7	JUNCTION	0.29	4.41	5516.53	0 00:52	4.41
J4.8	JUNCTION	0.21	3.47	5577.70	0 00:50	3.47
J4.9.11	JUNCTION	0.14	2.44	5784.17	0 00:47	2.44
J6.2.3	JUNCTION	0.59	7.21	5501.24	0 00:58	7.21
J6.4	JUNCTION	0.33	4.39	5739.72	0 00:57	4.39
J6.5	JUNCTION	0.39	4.62	5718.58	0 01:00	4.62
J6.7	JUNCTION	0.27	3.78	5977.68	0 00:57	3.78
J6.8	JUNCTION	0.15	2.32	6032.84	0 00:53	2.32
J6.9	JUNCTION	0.25	3.79	6010.37	0 00:51	3.79
J7.3bStormSewer	JUNCTION	0.08	1.00	5317.10	0 00:17	1.00
J6.1	JUNCTION	0.60	7.20	5394.20	0 01:01	7.20
Sub1.2	JUNCTION	0.00	0.00	6528.00	0 00:00	0.00
Sub1.3	JUNCTION	0.00	0.00	6693.09	0 00:00	0.00
Sub1.4	JUNCTION	0.00	0.00	6566.27	0 00:00	0.00
Sub1.5	JUNCTION	0.00	0.00	6032.28	0 00:00	0.00
Sub2.1	JUNCTION	0.00	0.00	6528.50	0 00:00	0.00
Sub2.2	JUNCTION	0.00	0.00	5721.00	0 00:00	0.00
Sub2.3	JUNCTION	0.00	0.00	6262.00	0 00:00	0.00
Sub2.4	JUNCTION	0.00	0.00	5447.00	0 00:00	0.00
Sub2.5	JUNCTION	0.00	0.00	5471.00	0 00:00	0.00
Sub3.1	JUNCTION	0.00	0.00	6256.00	0 00:00	0.00
Sub3.2	JUNCTION	0.00	0.00	6034.00	0 00:00	0.00
Sub3.3	JUNCTION	0.00	0.00	5847.00	0 00:00	0.00
Sub3.4	JUNCTION	0.00	0.00	5417.00	0 00:00	0.00
Sub4.1	JUNCTION	0.00	0.00	5585.27	0 00:00	0.00
Sub4.11	JUNCTION	0.00	0.00	6585.86	0 00:00	0.00
Sub4.2	JUNCTION	0.00	0.00	5638.97	0 00:00	0.00
Sub4.3	JUNCTION	0.00	0.00	6433.29	0 00:00	0.00
Sub4.4	JUNCTION	0.00	0.00	5833.27	0 00:00	0.00
Sub4.5	JUNCTION	0.00	0.00	6007.89	0 00:00	0.00
Sub4.6	JUNCTION	0.00	0.00	6693.09	0 00:00	0.00
Sub4.7	JUNCTION	0.00	0.00	6052.15	0 00:00	0.00
Sub4.8	JUNCTION	0.00	0.00	6404.40	0 00:00	0.00
Sub4.9	JUNCTION	0.00	0.00	6682.05	0 00:00	0.00
Sub5.1	JUNCTION	0.00	0.00	5861.07	0 00:00	0.00
Sub6.1	JUNCTION	0.00	0.00	6062.30	0 00:00	0.00
Sub6.2	JUNCTION	0.00	0.00	6221.59	0 00:00	0.00
Sub6.3	JUNCTION	0.00	0.00	6436.63	0 00:00	0.00
Sub6.4	JUNCTION	0.00	0.00	6612.61	0 00:00	0.00
Sub6.5	JUNCTION	0.06	0.99	6462.92	0 00:47	0.99
Sub6.6	JUNCTION	0.00	0.00	6748.23	0 00:00	0.00
Sub6.7	JUNCTION	0.00	0.00	6271.60	0 00:00	0.00
Sub6.8	JUNCTION	0.00	0.00	6801.67	0 00:00	0.00
Sub6.9	JUNCTION	0.00	0.00	6566.11	0 00:00	0.00
Sub7.1	JUNCTION	0.00	0.00	5276.00	0 00:00	0.00
Sub7.2	JUNCTION	0.00	0.00	5632.00	0 00:00	0.00
Sub7.3	JUNCTION	0.00	0.00	5357.00	0 00:00	0.00
Sub7.4	JUNCTION	0.00	0.00	5721.00	0 00:00	0.00
Sub7.5	JUNCTION	0.00	0.00	5361.56	0 00:00	0.00
Sub7.6	JUNCTION	0.00	0.00	5439.88	0 00:00	0.00
Sub7.7	JUNCTION	0.00	0.00	6539.22	0 00:00	0.00
Sub7.8	JUNCTION	0.00	0.00	5862.24	0 00:00	0.00
Sub8.1	JUNCTION	0.00	0.00	6452.46	0 00:00	0.00
Sub8.2	JUNCTION	0.00	0.00	5381.27	0 00:00	0.00
Sub8.3	JUNCTION	0.00	0.00	5389.38	0 00:00	0.00
RedHillGulchOUT	JUNCTION	0.38	4.68	5336.68	0 01:03	4.68
Sub2.6	JUNCTION	0.00	0.00	5456.00	0 00:00	0.00
2ndAve_MainSt	JUNCTION	0.02	0.41	5334.32	0 00:42	0.41
Sub3.6	JUNCTION	0.00	0.00	0.00	0 00:00	0.00
Sub3.8	JUNCTION	0.01	0.13	5424.13	0 00:40	0.13
Sub3.5	JUNCTION	0.00	0.00	0.00	0 00:00	0.00
PrivateDetention	JUNCTION	0.03	0.53	0.53	0 00:48	0.53
Sub5.2	JUNCTION	0.00	0.00	5353.00	0 00:00	0.00
Sub7.11	JUNCTION	0.00	0.00	5306.00	0 00:00	0.00
Sub7.12	JUNCTION	0.00	0.00	5303.00	0 00:00	0.00
Sub3.7	JUNCTION	0.00	0.00	0.00	0 00:00	0.00
Sub7.9	JUNCTION	0.00	0.00	5318.00	0 00:00	0.00
StoneCanyonStVrainOUT	OUTFALL	0.00	0.00	5290.00	0 00:00	0.00
EagleCanyonN.St.VrainOUT	OUTFALL	0.00	0.00	5381.00	0 00:00	0.00
Sub7.7N.St.VrainOUT	OUTFALL	0.00	0.00	5348.86	0 00:00	0.00
Sub7.8S.St.VrainOUT	OUTFALL	0.00	0.00	5370.49	0 00:00	0.00
Sub5.1N.St.VrainOUT	OUTFALL	0.00	0.00	5332.66	0 00:00	0.00
Sub7.5N.St.VrainOUT	OUTFALL	0.00	0.00	5356.67	0 00:00	0.00
Sub8.2St.VrainOUT	OUTFALL	0.00	0.00	5316.23	0 00:00	0.00

Sub8.3St.VrainOUT	OUTFALL	0.00	0.00	5306.96	0	00:00	0.00
Sub7.1St.VrainOUT	OUTFALL	0.00	0.00	5282.58	0	00:00	0.00
Sub7.6N.St.VrainOUT	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
Sub2.4N.St.VrainOUT	OUTFALL	0.00	0.00	5326.00	0	00:00	0.00
Sub7.2St.VrainOUT	OUTFALL	0.00	0.00	5319.00	0	00:00	0.00
Sub7.3St.VrainOUT	OUTFALL	0.00	0.00	5315.00	0	00:00	0.00
O_BohnPark	OUTFALL	0.38	4.68	5318.68	0	01:04	4.68
Sub5.2St.VrainOUT	OUTFALL	0.00	0.00	5347.00	0	00:00	0.00
2	DIVIDER	1.07	2.50	5366.93	0	00:27	2.50
2ndAve_ParkSt	DIVIDER	0.08	1.00	5326.90	0	00:14	1.00
J3.4dStormSewer	DIVIDER	0.12	2.56	5355.50	0	00:42	2.56
EagleCanyonExistDetPond	STORAGE	1.59	8.65	5508.65	0	00:43	8.65

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
J1.2	JUNCTION	0.00	1311.05	0	00:47	0	32.6	0.000
J1.2.5	JUNCTION	0.00	1716.39	0	00:49	0	42.6	0.000
J1.3	JUNCTION	0.00	918.48	0	00:45	0	22	0.000
J1.4	JUNCTION	0.00	402.92	0	00:39	0	8.48	0.000
J2.1	JUNCTION	0.00	306.23	0	00:47	0	9.4	0.000
J2.3	JUNCTION	0.00	572.67	0	00:46	0	16.8	0.000
J2.4	JUNCTION	0.00	682.01	0	00:47	0	19.9	0.000
J3.2	JUNCTION	0.00	92.13	0	00:39	0	2.19	0.000
J3.4	JUNCTION	0.00	231.93	0	00:43	0	6.35	0.000
J3.4b	JUNCTION	0.00	330.69	0	00:42	0	8.77	0.000
J3.4bStormSewer	JUNCTION	0.00	330.69	0	00:42	0	8.77	0.000
J3.4cStormSewer	JUNCTION	0.00	330.69	0	00:42	0	8.77	0.000
J3.4eStormSewer	JUNCTION	0.00	380.33	0	00:42	0	9.94	0.000
J3.4f	JUNCTION	0.00	559.09	0	00:43	0	15	0.000
J4.1.2	JUNCTION	0.00	2356.76	0	01:00	0	80.3	0.000
J4.4.3	JUNCTION	0.00	2182.51	0	00:58	0	74.4	0.000
J4.5	JUNCTION	0.00	1679.34	0	00:55	0	53.8	0.000
J4.6.7	JUNCTION	0.00	1571.28	0	00:52	0	50.3	0.000
J4.8	JUNCTION	0.00	978.15	0	00:50	0	29.4	0.000
J4.9.11	JUNCTION	0.00	754.72	0	00:47	0	22.4	0.000
J6.2.3	JUNCTION	0.00	1725.87	0	00:58	0	61.9	0.000
J6.4	JUNCTION	0.00	1016.29	0	00:57	0	37.7	0.000
J6.5	JUNCTION	0.00	1015.24	0	01:00	0	37.7	0.000
J6.7	JUNCTION	0.00	830.59	0	00:56	0	30.3	0.000
J6.8	JUNCTION	0.00	251.51	0	00:53	0	8.75	0.000
J6.9	JUNCTION	0.00	461.18	0	00:51	0	15.1	0.000
J7.3bStormSewer	JUNCTION	0.00	49.86	0	00:38	0	1.05	0.000
J6.1	JUNCTION	0.00	2073.88	0	01:00	0	73.6	0.000
Sub1.2	JUNCTION	407.58	407.58	0	00:43	10.5	10.5	0.000
Sub1.3	JUNCTION	534.22	534.22	0	00:43	13.5	13.5	0.000
Sub1.4	JUNCTION	402.92	402.92	0	00:39	8.48	8.48	0.000
Sub1.5	JUNCTION	448.65	448.65	0	00:40	10	10	0.000
Sub2.1	JUNCTION	306.23	306.23	0	00:47	9.4	9.4	0.000
Sub2.2	JUNCTION	96.93	96.93	0	00:40	2.37	2.37	0.000
Sub2.3	JUNCTION	58.81	58.81	0	00:38	1.36	1.36	0.000
Sub2.4	JUNCTION	115.65	115.65	0	00:40	3.04	3.04	0.000
Sub2.5	JUNCTION	101.50	101.50	0	00:38	2.42	2.42	0.000
Sub3.1	JUNCTION	141.72	141.72	0	00:45	4.17	4.17	0.000
Sub3.2	JUNCTION	92.13	92.13	0	00:39	2.19	2.19	0.000
Sub3.3	JUNCTION	20.82	20.82	0	00:35	0.389	0.389	0.000
Sub3.4	JUNCTION	51.51	51.51	0	00:37	1.17	1.17	0.000
Sub4.1	JUNCTION	102.21	102.21	0	00:38	2.34	2.34	0.000
Sub4.11	JUNCTION	183.39	183.39	0	00:50	5.93	5.93	0.000
Sub4.2	JUNCTION	113.32	113.32	0	00:46	3.55	3.55	0.000
Sub4.3	JUNCTION	386.21	386.21	0	00:57	16.1	16.1	0.000
Sub4.4	JUNCTION	127.90	127.90	0	00:51	4.45	4.45	0.000
Sub4.5	JUNCTION	116.65	116.65	0	00:47	3.55	3.55	0.000
Sub4.6	JUNCTION	526.00	526.00	0	00:53	18.7	18.7	0.000
Sub4.7	JUNCTION	70.26	70.26	0	00:47	2.23	2.23	0.000
Sub4.8	JUNCTION	227.00	227.00	0	00:48	6.98	6.98	0.000
Sub4.9	JUNCTION	574.60	574.60	0	00:46	16.4	16.4	0.000
Sub5.1	JUNCTION	170.76	170.76	0	00:41	4.31	4.31	0.000
Sub6.1	JUNCTION	386.63	386.63	0	00:47	11.6	11.6	0.000
Sub6.2	JUNCTION	186.56	186.56	0	00:42	4.81	4.81	0.000
Sub6.3	JUNCTION	370.40	370.40	0	00:52	12.8	12.8	0.000
Sub6.4	JUNCTION	185.94	185.94	0	00:57	7.39	7.39	0.000
Sub6.5	JUNCTION	212.95	212.95	0	00:47	6.57	6.57	0.000
Sub6.6	JUNCTION	233.38	233.38	0	01:05	10.9	10.9	0.000
Sub6.7	JUNCTION	175.93	175.93	0	00:41	4.35	4.35	0.000
Sub6.8	JUNCTION	251.51	251.51	0	00:53	8.75	8.75	0.000
Sub6.9	JUNCTION	216.21	216.21	0	00:46	6.31	6.31	0.000
Sub7.1	JUNCTION	25.00	25.00	0	00:56	1.13	1.13	0.000
Sub7.2	JUNCTION	70.43	70.43	0	00:43	2.04	2.04	0.000
Sub7.3	JUNCTION	50.10	50.10	0	00:36	1.05	1.05	0.000
Sub7.4	JUNCTION	68.64	68.64	0	00:40	1.66	1.66	0.000
Sub7.5	JUNCTION	26.47	26.47	0	00:52	1.14	1.14	0.000
Sub7.6	JUNCTION	134.43	134.43	0	00:43	3.79	3.79	0.000
Sub7.7	JUNCTION	358.89	358.89	0	00:47	10.7	10.7	0.000
Sub7.8	JUNCTION	144.08	144.08	0	00:43	4.02	4.02	0.000
Sub8.1	JUNCTION	314.83	314.83	0	00:54	11.9	11.9	0.000
Sub8.2	JUNCTION	92.88	92.88	0	00:56	4.14	4.14	0.000
Sub8.3	JUNCTION	136.38	136.38	0	00:52	5.25	5.25	0.000
RedHillGulchOUT	JUNCTION	0.00	2200.09	0	01:03	0	78.8	0.000
Sub2.6	JUNCTION	53.83	53.83	0	00:51	2.04	2.04	0.000
2ndAve_MainSt	JUNCTION	0.00	99.66	0	00:42	0	2.82	0.000
Sub3.6	JUNCTION	19.89	19.89	0	00:48	0.743	0.743	0.000

Sub3.8	JUNCTION	30.52	30.52	0	00:40	0.776	0.776	0.000
Sub3.5	JUNCTION	31.84	31.84	0	00:43	0.908	0.908	0.000
PrivateDetention	JUNCTION	0.00	426.03	0	00:46	0	12.4	0.000
Sub5.2	JUNCTION	194.46	194.46	0	00:41	4.67	4.67	0.000
Sub7.11	JUNCTION	160.86	160.86	0	00:40	3.77	3.77	0.000
Sub7.12	JUNCTION	198.79	198.79	0	00:37	4	4	0.000
Sub3.7	JUNCTION	12.23	12.23	0	00:32	0.189	0.189	0.000
Sub7.9	JUNCTION	24.49	24.49	0	00:35	0.477	0.477	0.000
StoneCanyonStVrainOUT	OUTFALL	0.00	2356.76	0	01:00	0	80.3	0.000
EagleCanyonN.St.VrainOUT	OUTFALL	0.00	1716.39	0	00:49	0	42.6	0.000
Sub7.7N.St.VrainOUT	OUTFALL	0.00	358.89	0	00:47	0	10.7	0.000
Sub7.8S.St.VrainOUT	OUTFALL	0.00	144.08	0	00:43	0	4.02	0.000
Sub5.1N.St.VrainOUT	OUTFALL	0.00	170.76	0	00:41	0	4.31	0.000
Sub7.5N.St.VrainOUT	OUTFALL	0.00	26.47	0	00:52	0	1.14	0.000
Sub8.2St.VrainOUT	OUTFALL	0.00	407.41	0	00:54	0	16.1	0.000
Sub8.3St.VrainOUT	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 gal
Sub7.1St.VrainOUT	OUTFALL	0.00	377.96	0	00:39	0	8.9	0.000
Sub7.6N.St.VrainOUT	OUTFALL	0.00	134.43	0	00:43	0	3.79	0.000
Sub2.4N.St.VrainOUT	OUTFALL	0.00	682.01	0	00:47	0	19.9	0.000
Sub7.2St.VrainOUT	OUTFALL	0.00	580.89	0	00:42	0	15.5	0.000
Sub7.3St.VrainOUT	OUTFALL	0.00	49.86	0	00:38	0	1.05	0.000
O_BohnPark	OUTFALL	0.00	2198.46	0	01:04	0	78.8	0.000
Sub5.2St.VrainOUT	OUTFALL	0.00	194.46	0	00:41	0	4.67	0.000
2	DIVIDER	0.00	330.69	0	00:42	0	8.77	0.000
2ndAve_ParkSt	DIVIDER	0.00	50.10	0	00:36	0	1.05	0.000
J3.4dStormSewer	DIVIDER	0.00	380.33	0	00:42	0	9.94	0.000
EagleCanyonExistDetPond	STORAGE	0.00	448.65	0	00:40	0	10	0.117

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Node Surcharge Summary
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Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
J1.2	JUNCTION	30.00	3.261	2.602
J1.2.5	JUNCTION	30.00	2.726	0.673
J1.3	JUNCTION	30.00	3.270	4.109
J1.4	JUNCTION	30.00	2.864	4.515
J2.1	JUNCTION	30.00	0.528	9.472
J2.3	JUNCTION	30.00	2.366	0.634
J2.4	JUNCTION	30.00	2.365	0.635
J3.2	JUNCTION	30.00	0.420	0.580
J3.4	JUNCTION	30.00	0.530	0.470
J3.4b	JUNCTION	30.00	0.530	0.470
J3.4bStormSewer	JUNCTION	30.00	2.500	0.500
J3.4cStormSewer	JUNCTION	30.00	2.285	0.715
J3.4eStormSewer	JUNCTION	30.00	2.556	0.944
J3.4f	JUNCTION	30.00	0.625	0.375
J4.1.2	JUNCTION	30.00	5.941	2.059
J4.4.3	JUNCTION	30.00	5.944	2.056
J4.5	JUNCTION	30.00	5.069	1.455
J4.6.7	JUNCTION	30.00	4.414	1.320
J4.8	JUNCTION	30.00	3.466	1.045
J4.9.11	JUNCTION	30.00	2.439	0.981
J6.2.3	JUNCTION	30.00	7.206	2.014
J6.4	JUNCTION	30.00	4.388	0.612
J6.5	JUNCTION	30.00	4.615	4.605
J6.7	JUNCTION	30.00	3.775	1.881
J6.8	JUNCTION	30.00	2.320	4.374
J6.9	JUNCTION	30.00	3.786	2.908
J7.3bStormSewer	JUNCTION	30.00	1.000	0.000
J6.1	JUNCTION	30.00	7.201	2.799
Sub1.2	JUNCTION	30.00	0.000	0.000
Sub1.3	JUNCTION	30.00	0.000	0.000
Sub1.4	JUNCTION	30.00	0.000	0.000
Sub1.5	JUNCTION	30.00	0.000	0.000
Sub2.1	JUNCTION	30.00	0.000	0.000
Sub2.2	JUNCTION	30.00	0.000	0.000
Sub2.3	JUNCTION	30.00	0.000	0.000
Sub2.4	JUNCTION	30.00	0.000	0.000
Sub2.5	JUNCTION	30.00	0.000	0.000
Sub3.1	JUNCTION	30.00	0.000	0.000
Sub3.2	JUNCTION	30.00	0.000	0.000
Sub3.3	JUNCTION	30.00	0.000	0.000
Sub3.4	JUNCTION	30.00	0.000	0.000
Sub4.1	JUNCTION	30.00	0.000	0.000
Sub4.11	JUNCTION	30.00	0.000	0.000
Sub4.2	JUNCTION	30.00	0.000	0.000
Sub4.3	JUNCTION	30.00	0.000	0.000
Sub4.4	JUNCTION	30.00	0.000	0.000
Sub4.5	JUNCTION	30.00	0.000	0.000
Sub4.6	JUNCTION	30.00	0.000	0.000
Sub4.7	JUNCTION	30.00	0.000	0.000
Sub4.8	JUNCTION	30.00	0.000	0.000
Sub4.9	JUNCTION	30.00	0.000	0.000
Sub5.1	JUNCTION	30.00	0.000	0.000
Sub6.1	JUNCTION	30.00	0.000	0.000
Sub6.2	JUNCTION	30.00	0.000	0.000
Sub6.3	JUNCTION	30.00	0.000	0.000
Sub6.4	JUNCTION	30.00	0.000	0.000
Sub6.5	JUNCTION	30.00	0.995	4.005
Sub6.6	JUNCTION	30.00	0.000	0.000
Sub6.7	JUNCTION	30.00	0.000	0.000
Sub6.8	JUNCTION	30.00	0.000	0.000
Sub6.9	JUNCTION	30.00	0.000	0.000

Sub7.1	JUNCTION	30.00	0.000	0.000
Sub7.2	JUNCTION	30.00	0.000	0.000
Sub7.3	JUNCTION	30.00	0.000	0.000
Sub7.4	JUNCTION	30.00	0.000	0.000
Sub7.5	JUNCTION	30.00	0.000	0.000
Sub7.6	JUNCTION	30.00	0.000	0.000
Sub7.7	JUNCTION	30.00	0.000	0.000
Sub7.8	JUNCTION	30.00	0.000	0.000
Sub8.1	JUNCTION	30.00	0.000	0.000
Sub8.2	JUNCTION	30.00	0.000	0.000
Sub8.3	JUNCTION	30.00	0.000	0.000
RedHillGulchOUT	JUNCTION	30.00	4.681	5.319
Sub2.6	JUNCTION	30.00	0.000	0.000
2ndAve_MainSt	JUNCTION	30.00	0.408	0.592
Sub3.6	JUNCTION	30.00	0.000	0.000
Sub3.8	JUNCTION	30.00	0.134	0.866
Sub3.5	JUNCTION	30.00	0.000	0.000
PrivateDetention	JUNCTION	30.00	0.528	9.472
Sub5.2	JUNCTION	30.00	0.000	0.000
Sub7.11	JUNCTION	30.00	0.000	0.000
Sub7.12	JUNCTION	30.00	0.000	0.000
Sub3.7	JUNCTION	30.00	0.000	0.000
Sub7.9	JUNCTION	30.00	0.000	0.000
2	DIVIDER	30.00	2.500	0.000
2ndAve_ParkSt	DIVIDER	30.00	1.000	0.000
J3.4dStormSewer	DIVIDER	30.00	2.556	0.944
EagleCanyonExistDetPond	STORAGE	30.00	8.649	0.351

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Node Flooding Summary
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No nodes were flooded.

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Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
EagleCanyonExistDetPond	6.750	6	0	0	105.629	88	0 00:43	443.47

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Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
StoneCanyonStVrainOUT	40.25	246.96	2356.76	80.300
EagleCanyonN.St.VrainOUT	40.72	129.55	1716.39	42.617
Sub7.7N.St.VrainOUT	13.14	100.69	358.89	10.688
Sub7.8S.St.VrainOUT	12.36	40.29	144.08	4.023
Sub5.1N.St.VrainOUT	11.47	46.51	170.76	4.310
Sub7.5N.St.VrainOUT	17.58	8.02	26.47	1.139
Sub8.2St.VrainOUT	18.53	107.25	407.41	16.052
Sub8.3St.VrainOUT	0.00	0.00	0.00	0.000
Sub7.1St.VrainOUT	18.56	59.34	377.96	8.895
Sub7.6N.St.VrainOUT	12.06	38.97	134.43	3.795
Sub2.4N.St.VrainOUT	27.75	88.66	682.01	19.875
Sub7.2St.VrainOUT	25.86	74.05	580.89	15.470
Sub7.3St.VrainOUT	14.89	8.72	49.86	1.048
O_BohnPark	42.03	232.17	2198.46	78.826
Sub5.2St.VrainOUT	11.08	52.20	194.46	4.673
System	20.42	1233.35	8758.96	291.711

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Link Flow Summary
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Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
2ndAve	CONDUIT	30.47	0 00:42	5.72	0.04	0.13
C1.2	CHANNEL	912.77	0 00:48	15.53	0.26	0.56
C1.3	CHANNEL	388.36	0 00:46	12.67	0.10	0.38
C1.5	CHANNEL	1304.14	0 00:50	14.00	0.59	0.80
C2.3	CONDUIT	306.18	0 00:48	45.89	0.00	0.05
C2.4	CONDUIT	571.88	0 00:48	14.42	0.58	0.79
C3.3.7.2	CONDUIT	380.16	0 00:43	12.17	0.46	0.63
C3.4	CONDUIT	231.88	0 00:44	14.59	0.35	0.53
C3.4bStormSewer	CONDUIT	330.69	0 00:42	25.33	0.48	0.76
C3.4cStormSewer	CONDUIT	380.33	0 00:42	30.37	0.94	0.73
C3.4cStormSewer_OF	DUMMY	0.00	0 00:00			
C3.4Overflow	CONDUIT	245.04	0 00:42	13.72	0.43	0.60
C3.4StormSewer	CONDUIT	92.31	0 01:41	19.98	1.08	1.00
C4.1.2	CONDUIT	2179.73	0 01:00	13.21	0.45	0.74
C4.4	CHANNEL	1672.53	0 00:58	16.54	0.58	0.78

C4.5	CHANNEL	1567.11	0	00:55	14.61	0.46	0.77
C4.7	CHANNEL	977.28	0	00:51	16.64	0.53	0.77
C4.8	CHANNEL	751.77	0	00:50	14.27	0.48	0.71
C6.1	CHANNEL	1721.82	0	01:01	14.62	0.48	0.78
C6.3	CHANNEL	1014.59	0	01:01	20.66	0.17	0.50
C6.4	DUMMY	185.94	0	00:57			
C6.5	CONDUIT	830.36	0	00:57	19.66	0.26	0.54
C6.5b	CONDUIT	1015.24	0	01:00	9.29	0.76	0.88
C6.6.7	CHANNEL	457.36	0	00:57	6.65	0.30	0.67
C6.9	CHANNEL	251.47	0	00:54	10.77	0.08	0.35
C7.3	CONDUIT	2.47	0	02:14	3.63	1.08	1.00
C7.3Overflow	CONDUIT	47.58	0	00:38	5.04	0.15	0.32
CStickneyAve	CONDUIT	92.12	0	00:40	10.97	0.24	0.42
Dum1.2	DUMMY	407.58	0	00:43			
Dum1.3	DUMMY	534.22	0	00:43			
Dum1.4	DUMMY	402.92	0	00:39			
Dum1.5	DUMMY	448.65	0	00:40			
Dum2.1	DUMMY	306.23	0	00:47			
Dum2.2	DUMMY	96.93	0	00:40			
Dum2.3	DUMMY	58.81	0	00:38			
Dum2.4	DUMMY	115.65	0	00:40			
Dum2.4OUT	DUMMY	682.01	0	00:47			
Dum2.5	DUMMY	101.50	0	00:38			
Dum2.6	DUMMY	53.83	0	00:51			
Dum3.1	DUMMY	141.72	0	00:45			
Dum3.2	DUMMY	92.13	0	00:39			
Dum3.3	DUMMY	20.82	0	00:35			
Dum3.4	DUMMY	51.51	0	00:37			
Dum3.4b	DUMMY	330.69	0	00:42			
Dum3.4c	DUMMY	330.69	0	00:42			
Dum3.5	DUMMY	31.84	0	00:43			
Dum3.6	DUMMY	19.89	0	00:48			
Dum3.7	DUMMY	12.23	0	00:32			
Dum4.1	DUMMY	102.21	0	00:38			
Dum4.11	DUMMY	183.39	0	00:50			
Dum4.2	DUMMY	113.32	0	00:46			
Dum4.3	DUMMY	386.21	0	00:57			
Dum4.4	DUMMY	127.90	0	00:51			
Dum4.5	DUMMY	116.65	0	00:47			
Dum4.6	DUMMY	526.00	0	00:53			
Dum4.7	DUMMY	70.26	0	00:47			
Dum4.8	DUMMY	227.00	0	00:48			
Dum4.9	DUMMY	574.60	0	00:46			
Dum5.1	DUMMY	170.76	0	00:41			
Dum5.2	DUMMY	194.46	0	00:41			
Dum6.1	DUMMY	386.63	0	00:47			
Dum6.2	DUMMY	186.56	0	00:42			
Dum6.3	DUMMY	370.40	0	00:52			
Dum6.5	CONDUIT	212.59	0	00:49	18.03	0.03	0.20
Dum6.6	DUMMY	233.38	0	01:05			
Dum6.7	DUMMY	175.93	0	00:41			
Dum6.8	DUMMY	251.51	0	00:53			
Dum6.9	DUMMY	216.21	0	00:46			
Dum7.1	DUMMY	25.00	0	00:56			
Dum7.12	DUMMY	198.79	0	00:37			
Dum7.11	DUMMY	160.86	0	00:40			
Dum7.2	DUMMY	70.43	0	00:43			
Dum7.2b	DUMMY	559.09	0	00:43			
Dum7.3	DUMMY	50.10	0	00:36			
Dum7.3b	DUMMY	49.86	0	00:38			
Dum7.4	DUMMY	68.64	0	00:40			
Dum7.5	DUMMY	26.47	0	00:52			
Dum7.6	DUMMY	134.43	0	00:43			
Dum7.7	DUMMY	358.89	0	00:47			
Dum7.8	DUMMY	144.08	0	00:43			
Dum7.9	DUMMY	24.49	0	00:35			
Dum8.1	DUMMY	314.83	0	00:54			
Dum8.2	DUMMY	92.88	0	00:56			
Dum8.3	DUMMY	136.38	0	00:52			
DumEagleCanyonOUT	DUMMY	1716.39	0	00:49			
DumPrivateDetention	DUMMY	426.03	0	00:46			
DumStoneCanyonOut	DUMMY	2356.76	0	01:00			
MainSt	CONDUIT	99.63	0	00:43	6.11	0.23	0.41
RedHillGulchBohnPark	CONDUIT	2198.46	0	01:04	9.08	0.84	0.94
RedHillGulchOut	CONDUIT	2069.75	0	01:03	10.83	0.10	0.41
EagleCanyonExistDetPondOut	DUMMY	443.47	0	00:43			

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Conduit Surcharge Summary
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Conduit	--------- Hours Full -------- Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C3.4StormSewer	1.27	1.27	1.27	1.28	1.27
C7.3	1.96	1.96	1.96	1.98	1.96

Analysis begun on: Thu Dec 08 08:15:27 2016
Analysis ended on: Thu Dec 08 08:15:27 2016
Total elapsed time: < 1 sec

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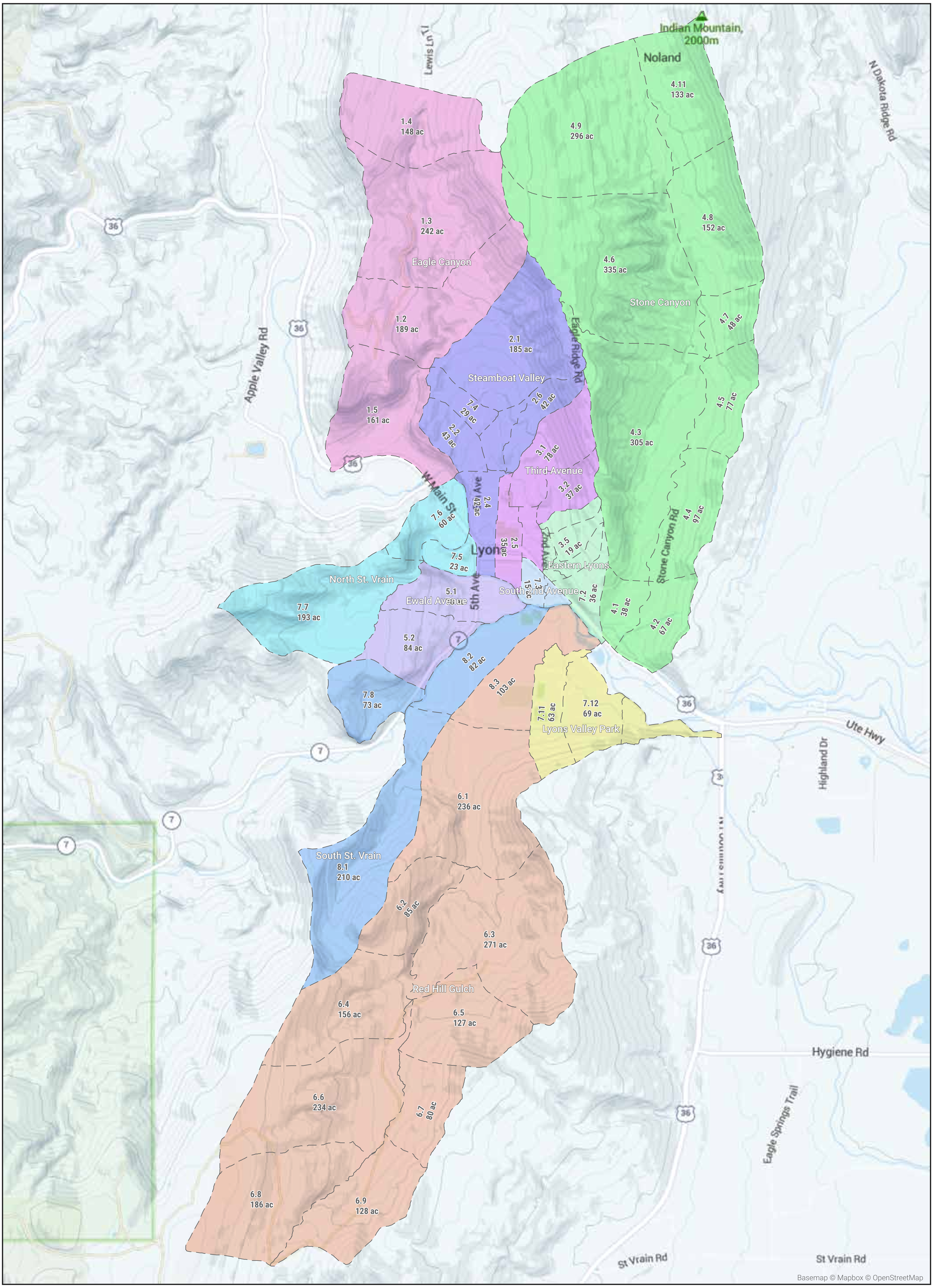
Wright Water Engineers, Inc.

	Existing Conditions					Future Conditions				
Junction	Ex002yr	Ex005yr	Ex010yr	Ex050yr	Ex100yr	Pk002yr	Pk005yr	Pk010yr	Pk050yr	Pk100yr
J1.2	117	187	321	967	1311	117	187	321	967	1311
J1.2.5	160	261	433	1268	1716	160	261	433	1268	1716
J1.3	85	135	231	681	918	85	135	231	681	918
J1.4	42	66	110	301	403	42	66	110	301	403
J2.1	20	33	60	221	306	20	33	60	221	306
J2.3	48	78	126	418	573	48	78	126	418	573
J2.4	69	108	165	503	682	69	108	165	503	682
J3.2	12	18	27	70	92	12	18	27	70	92
J3.4	24	38	59	172	232	30	47	70	194	258
J3.4b	44	66	96	250	331	50	75	108	272	358
J3.4bStormSewer	44	66	102	250	331	50	75	108	272	358
J3.4cStormSewer	44	66	102	250	331	50	75	108	272	358
J3.4eStormSewer	54	81	121	289	380	60	90	127	312	412
J3.4f	72	109	165	422	559	78	118	171	444	589
J4.1.2	143	242	469	1689	2357	146	246	474	1694	2361
J4.4.3	129	219	432	1566	2183	129	219	432	1566	2183
J4.5	105	175	342	1211	1679	105	175	342	1211	1679
J4.6.7	104	171	328	1137	1571	104	171	328	1137	1571
J4.8	57	95	191	704	978	57	95	191	704	978
J4.9.11	53	87	163	548	755	53	87	163	548	755
J6.2.3	66	122	286	1213	1726	66	122	286	1213	1726
J6.4	34	63	165	714	1016	34	63	165	714	1016
J6.5	34	62	164	713	1015	34	62	164	713	1015
J6.7	31	56	138	585	831	31	56	138	585	831
J6.8	5	10	38	176	252	5	10	38	176	252
J6.9	16	29	75	325	461	16	29	75	325	461
J7.3bStormSewer	10	14	19	39	50	10	14	19	39	50
J6.1	78	145	338	1443	2074	80	148	341	1447	2078
Sub1.2	39	62	103	303	408	39	62	103	303	408
Sub1.3	51	81	136	397	534	51	81	136	397	534
Sub1.4	42	66	110	301	403	42	66	110	301	403
Sub1.5	67	101	145	344	449	67	101	145	344	449
Sub2.1	20	33	60	221	306	20	33	60	221	306
Sub2.2	11	17	25	72	97	11	17	25	72	97
Sub2.3	8	12	17	44	59	8	12	17	44	59
Sub2.4	23	33	43	91	116	23	33	43	91	116

	Existing Conditions					Future Conditions				
Junction	Ex002yr	Ex005yr	Ex010yr	Ex050yr	Ex100yr	Pk002yr	Pk005yr	Pk010yr	Pk050yr	Pk100yr
Sub2.5	20	29	39	80	102	20	29	39	80	102
Sub3.1	12	20	32	104	142	18	29	44	125	167
Sub3.2	12	18	27	70	92	12	18	27	70	92
Sub3.3	4	6	8	16	21	4	6	8	16	21
Sub3.4	11	15	20	40	52	11	15	20	40	52
Sub4.1	15	22	32	78	102	26	37	49	100	128
Sub4.11	3	6	22	127	183	3	6	22	127	183
Sub4.2	9	14	25	82	113	9	14	25	83	114
Sub4.3	27	44	80	277	386	27	44	80	277	386
Sub4.4	2	5	17	89	128	2	5	17	89	128
Sub4.5	2	5	17	82	117	2	5	17	82	117
Sub4.6	46	73	128	386	526	46	73	128	386	526
Sub4.7	2	4	10	49	70	2	4	10	49	70
Sub4.8	5	11	31	159	227	5	11	31	159	227
Sub4.9	51	81	141	424	575	51	81	141	424	575
Sub5.1	16	26	43	127	171	27	41	61	157	208
Sub6.1	19	32	70	276	387	21	35	73	282	393
Sub6.2	18	28	48	139	187	18	28	48	139	187
Sub6.3	11	21	56	260	370	11	21	56	260	370
Sub6.4	3	7	28	130	186	3	7	28	130	186
Sub6.5	15	25	44	154	213	15	25	44	154	213
Sub6.6	5	10	32	160	233	5	10	32	160	233
Sub6.7	15	24	43	130	176	15	24	43	130	176
Sub6.8	5	10	38	176	252	5	10	38	176	252
Sub6.9	12	20	39	155	216	12	20	39	155	216
Sub7.1	0	1	2	17	25	1	2	4	20	28
Sub7.2	7	11	18	53	70	7	11	18	53	70
Sub7.3	10	15	19	39	50	10	15	19	39	50
Sub7.4	8	13	19	52	69	8	13	19	52	69
Sub7.5	2	3	5	19	26	2	3	5	19	26
Sub7.6	21	32	44	104	134	21	32	44	104	134
Sub7.7	34	54	88	265	359	34	54	88	265	359
Sub7.8	12	20	35	107	144	13	20	36	108	145
Sub8.1	29	46	79	232	315	29	46	79	232	315
Sub8.2	6	11	17	66	93	6	11	17	66	93
Sub8.3	9	15	26	98	136	9	15	26	98	136

Junction	Existing Conditions					Future Conditions				
	Ex002yr	Ex005yr	Ex010yr	Ex050yr	Ex100yr	Pk002yr	Pk005yr	Pk010yr	Pk050yr	Pk100yr
RedHillGulchOUT	84	157	358	1529	2200	86	160	361	1533	2204
Sub2.6	3	5	9	38	54	3	5	9	38	54
2ndAve_MainSt	9	14	23	73	100	9	14	23	73	100
Sub3.6	1	2	4	14	20	1	2	4	14	20
Sub3.8	3	5	8	23	31	3	5	8	23	31
Sub3.5	1	2	5	23	32	1	2	5	23	32
PrivateDetention	35	56	93	310	426	35	56	93	310	426
Sub5.2	19	30	50	145	194	19	30	50	145	194
Sub7.11	21	32	48	122	161	21	32	48	122	161
Sub7.12	23	36	55	149	199	35	52	75	178	234
Sub3.7	3	4	5	10	12	3	4	5	10	12
Sub7.9	5	8	10	19	24	5	8	10	19	24
StoneCanyonStVrainOUT	143	242	469	1689	2357	146	246	474	1694	2361
EagleCanyonN.St.VrainOUT	160	261	433	1268	1716	160	261	433	1268	1716
Sub7.7N.St.VrainOUT	34	54	88	265	359	34	54	88	265	359
Sub7.8S.St.VrainOUT	12	20	35	107	144	13	20	36	108	145
Sub5.1N.St.VrainOUT	16	26	43	127	171	27	41	61	157	208
Sub7.5N.St.VrainOUT	2	3	5	19	26	2	3	5	19	26
Sub8.2St.VrainOUT	36	57	96	298	407	36	57	96	298	407
Sub7.1St.VrainOUT	44	68	104	283	378	56	85	125	313	414
Sub7.6N.St.VrainOUT	21	32	44	104	134	21	32	44	104	134
Sub2.4N.St.VrainOUT	69	108	165	503	682	69	108	165	503	682
Sub7.2St.VrainOUT	76	116	173	439	581	83	125	179	461	611
Sub7.3St.VrainOUT	10	14	19	39	50	10	14	19	39	50
O_BohnPark	84	157	358	1528	2198	86	159	360	1532	2203
Sub5.2St.VrainOUT	19	30	50	145	194	19	30	50	145	194
2ndAve_ParkSt	10	15	19	39	50	10	15	19	39	50
J3.4dStormSewer	54	81	121	289	380	60	90	127	312	408
EagleCanyonExistDetPond	67	101	145	344	449	67	101	145	344	449

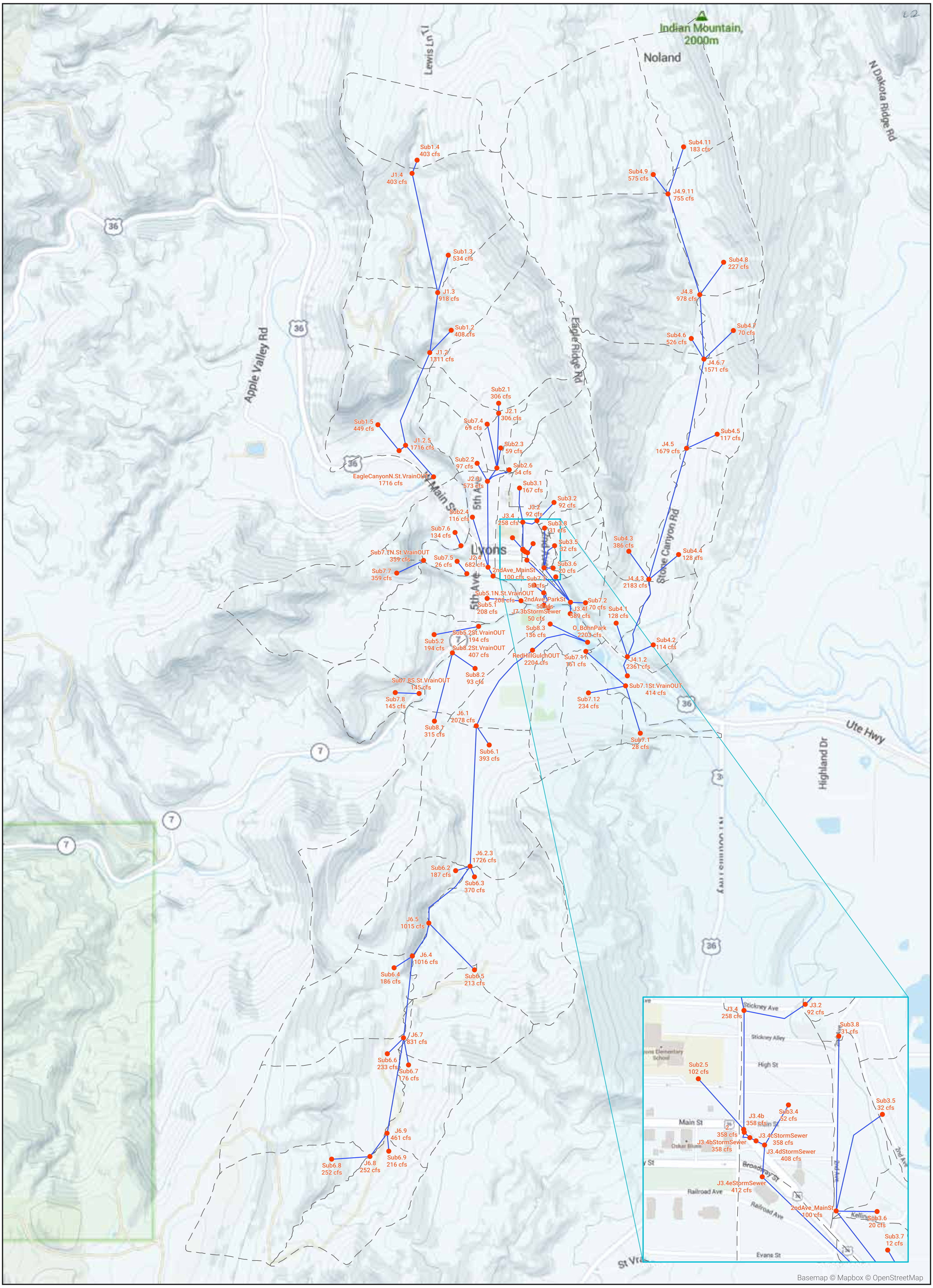


Lyons Stormwater Masterplan

Figure A-1: Watersheds

LYONS COLORADO

ICON ENGINEERING, INC.



Design Point

Conveyance Element

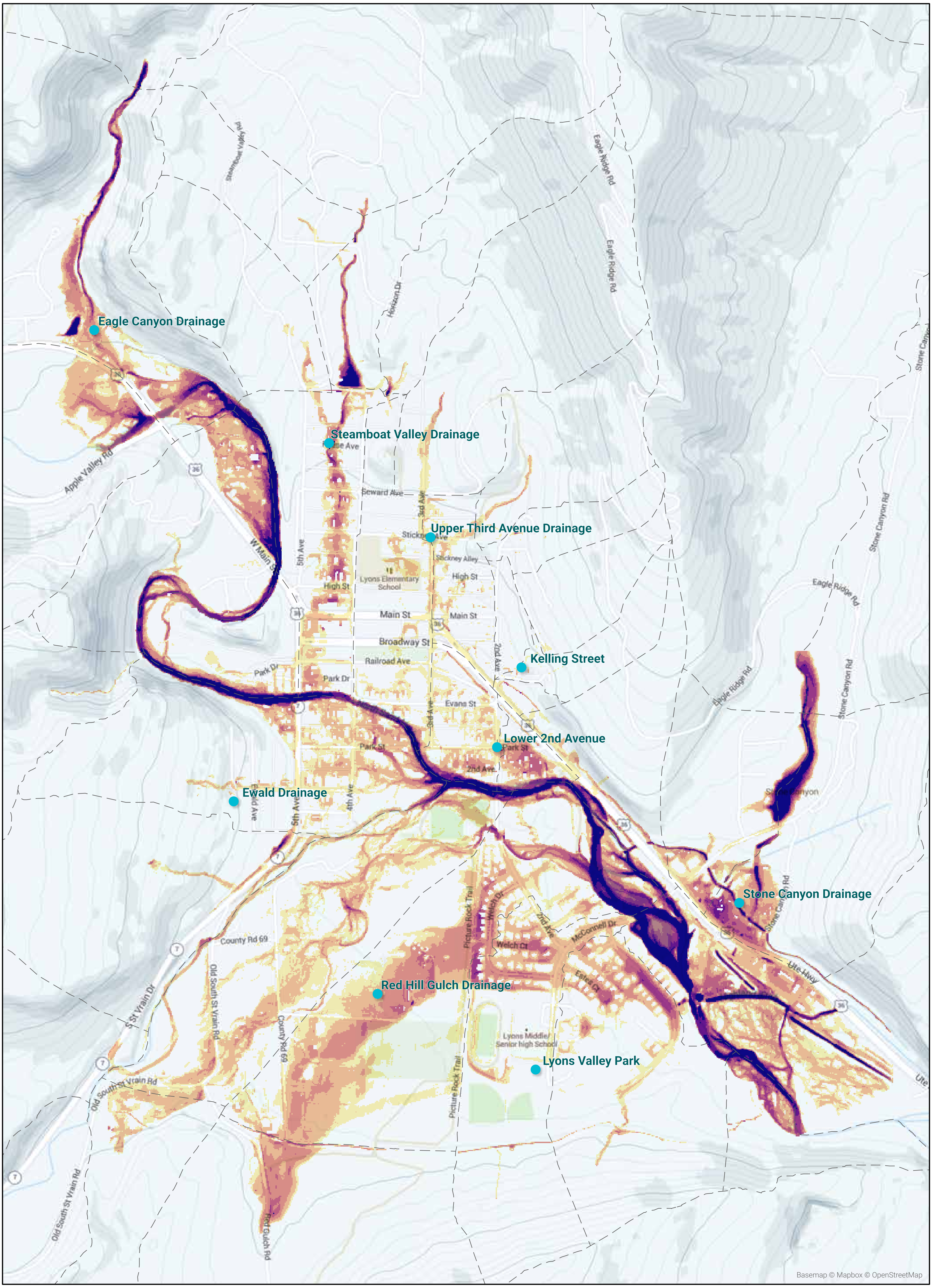
Lyons Stormwater Masterplan

Figure A-2: Routing Schematic

LYONS COLORADO

ICON ENGINEERING, INC.

Appendix B - HYDRAULICS



Lyons Stormwater Masterplan

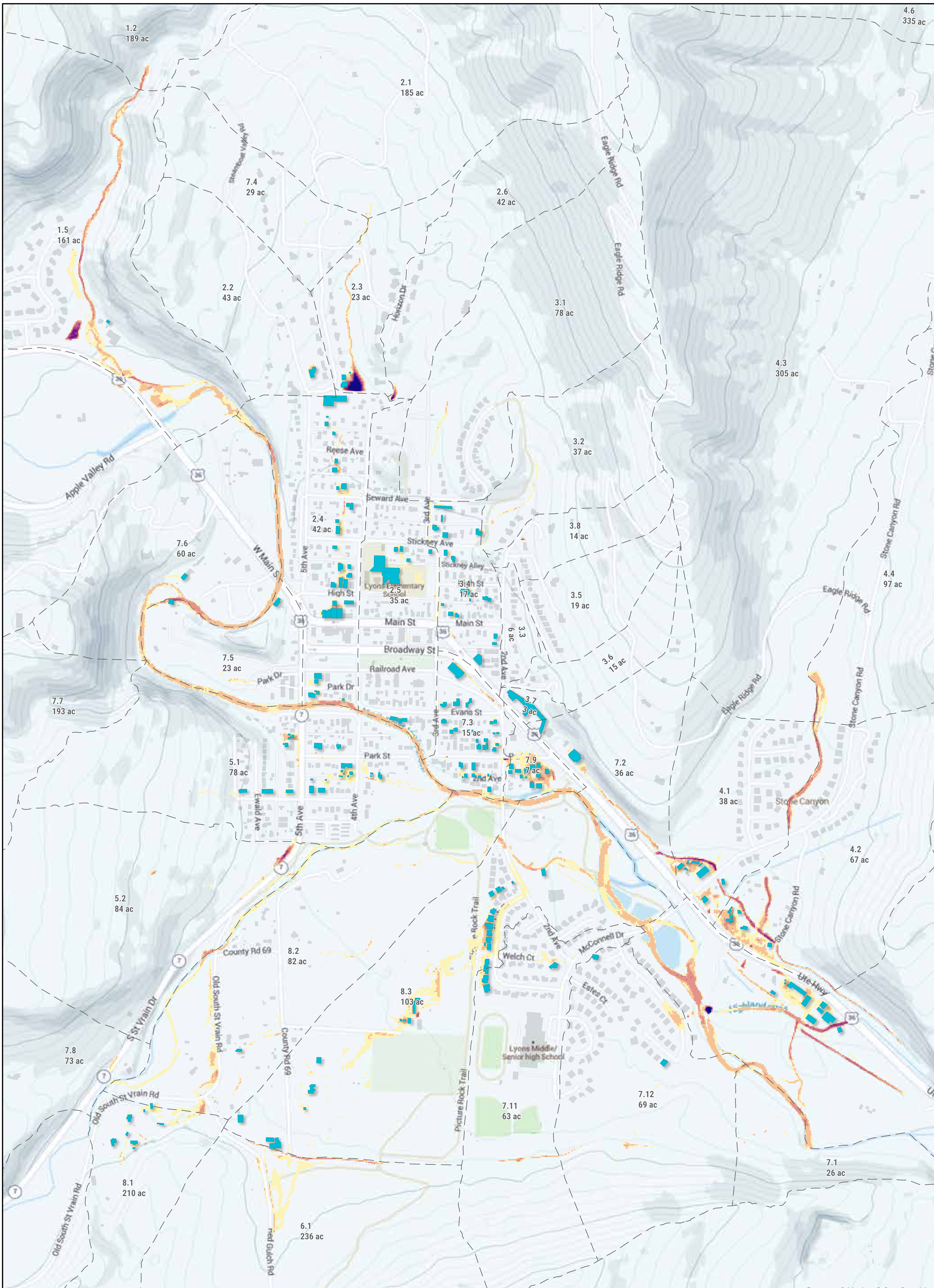
Figure B-1: Problem Identification

100-year Max Flow Depth (ft)

.5 | 1 | 2 | 3 | 4 | 5 | 6+

LYONS COLORADO

ICON ENGINEERING, INC.



Lyons Stormwater Masterplan

Figure B-2: FLO2D Results: 2-Year Future Conditions

Max Flow Depth (ft)

.5 | 1 | 2 | 3 | 4 | 5 | 6+

Building Footprint

At-Risk Building

Sub-Basins

LYONS COLORADO

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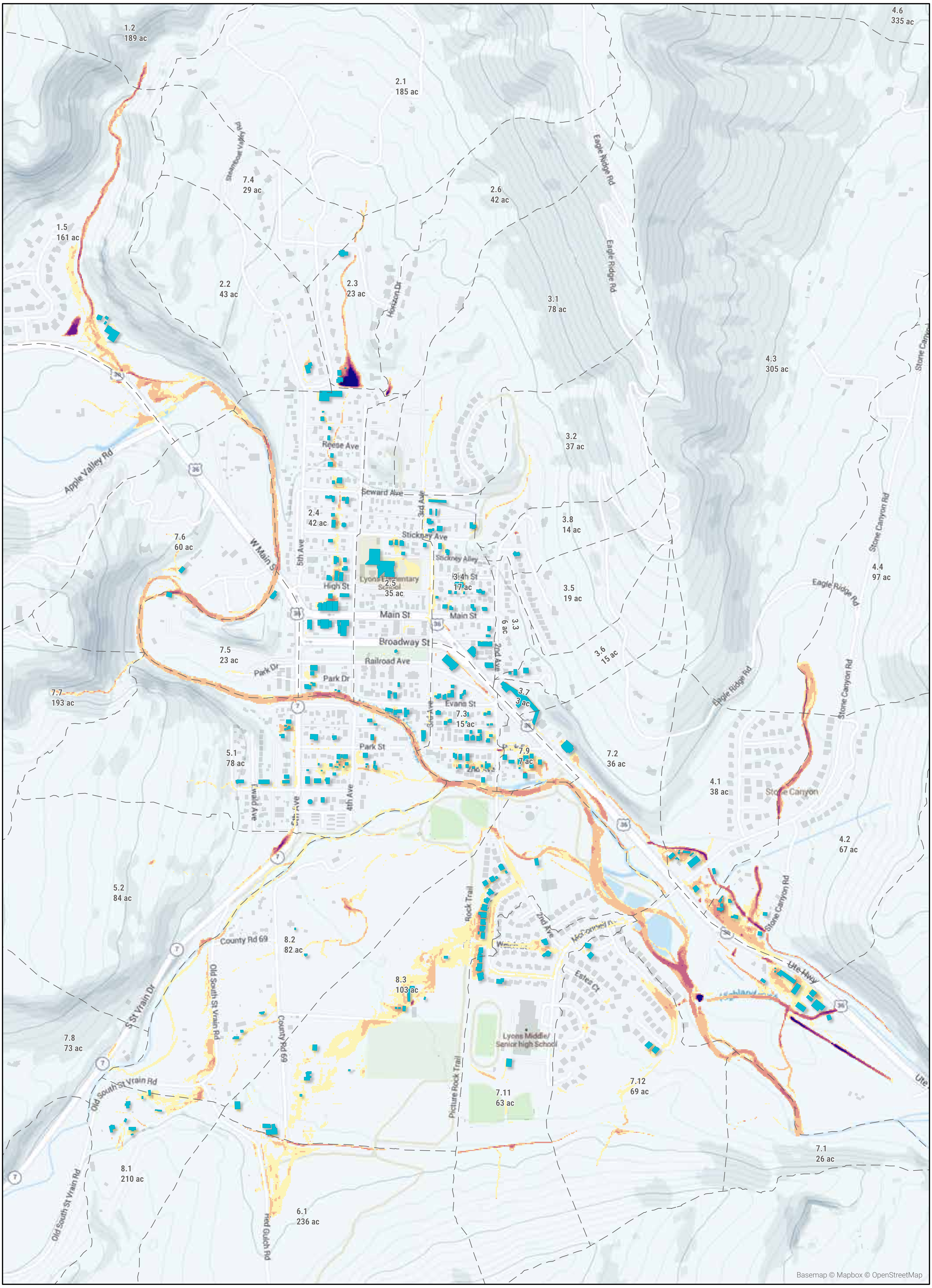
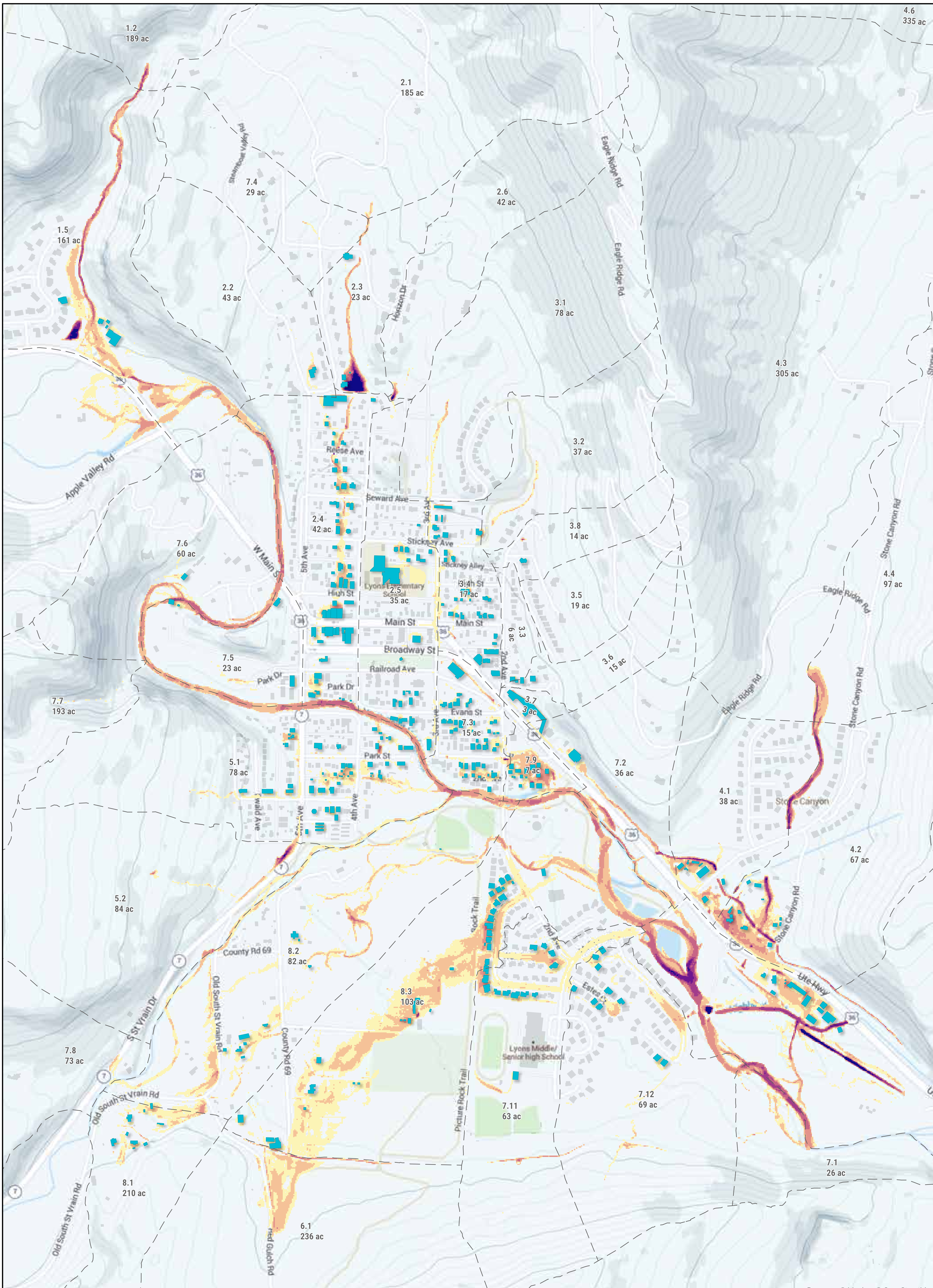


Lyons Stormwater Masterplan

Figure B-3: FLO2D Results: 5-Year Future Conditions

LYONS COLORADO

ICON ENGINEERING, INC.



Lyons Stormwater Masterplan

Figure B-4: FLO2D Results: 10-Year Future Conditions

Max Flow Depth (ft)

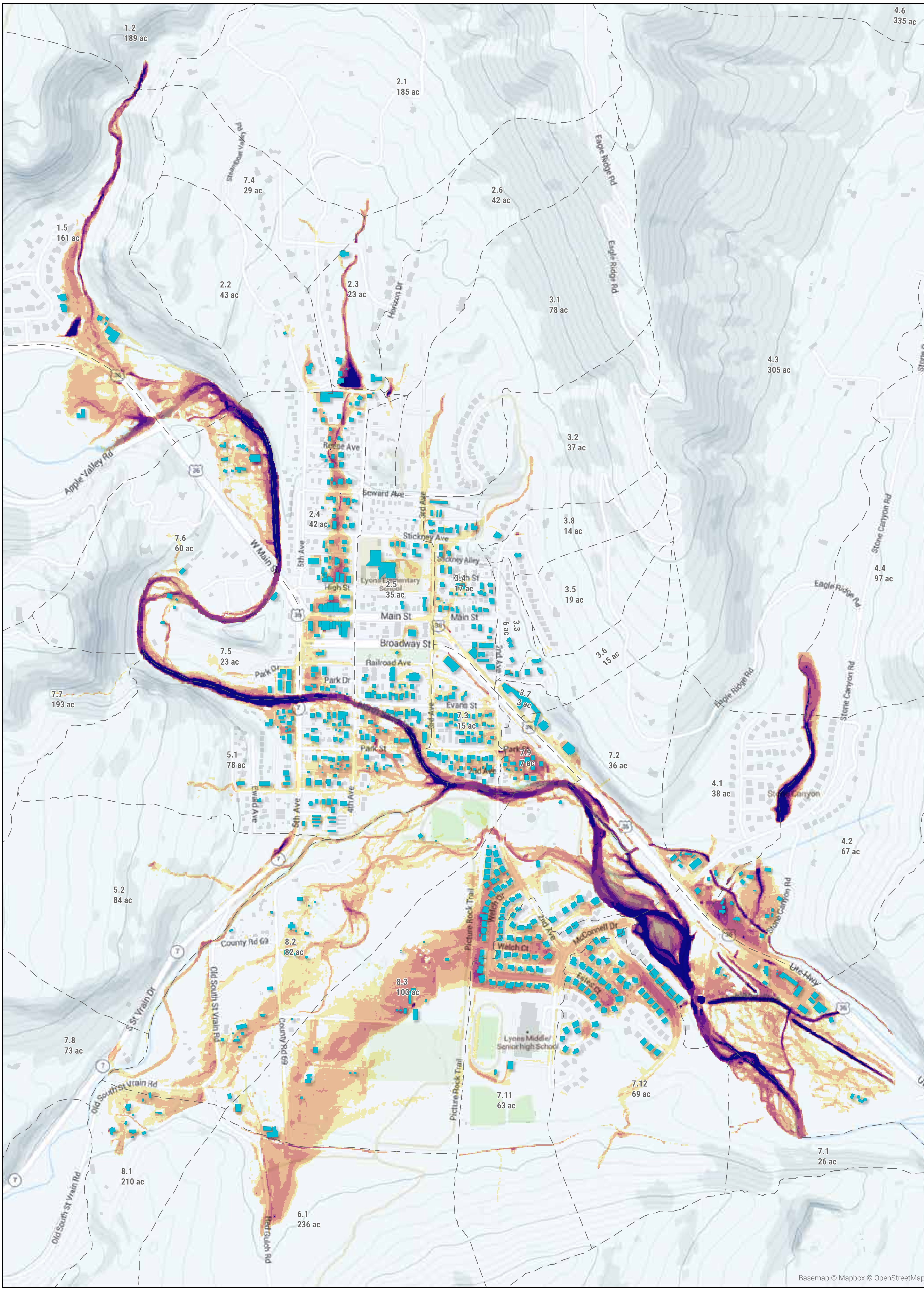
.5 1 2 3 4 5 6+

Building Footprint

At-Risk Building

Sub-Basins

ICON ENGINEERING, INC.



Lyons Stormwater Masterplan

Figure B-5: FLO2D Results: 50-Year Future Conditions

Max Flow Depth (ft)
.5 1 2 3 4 5 6+

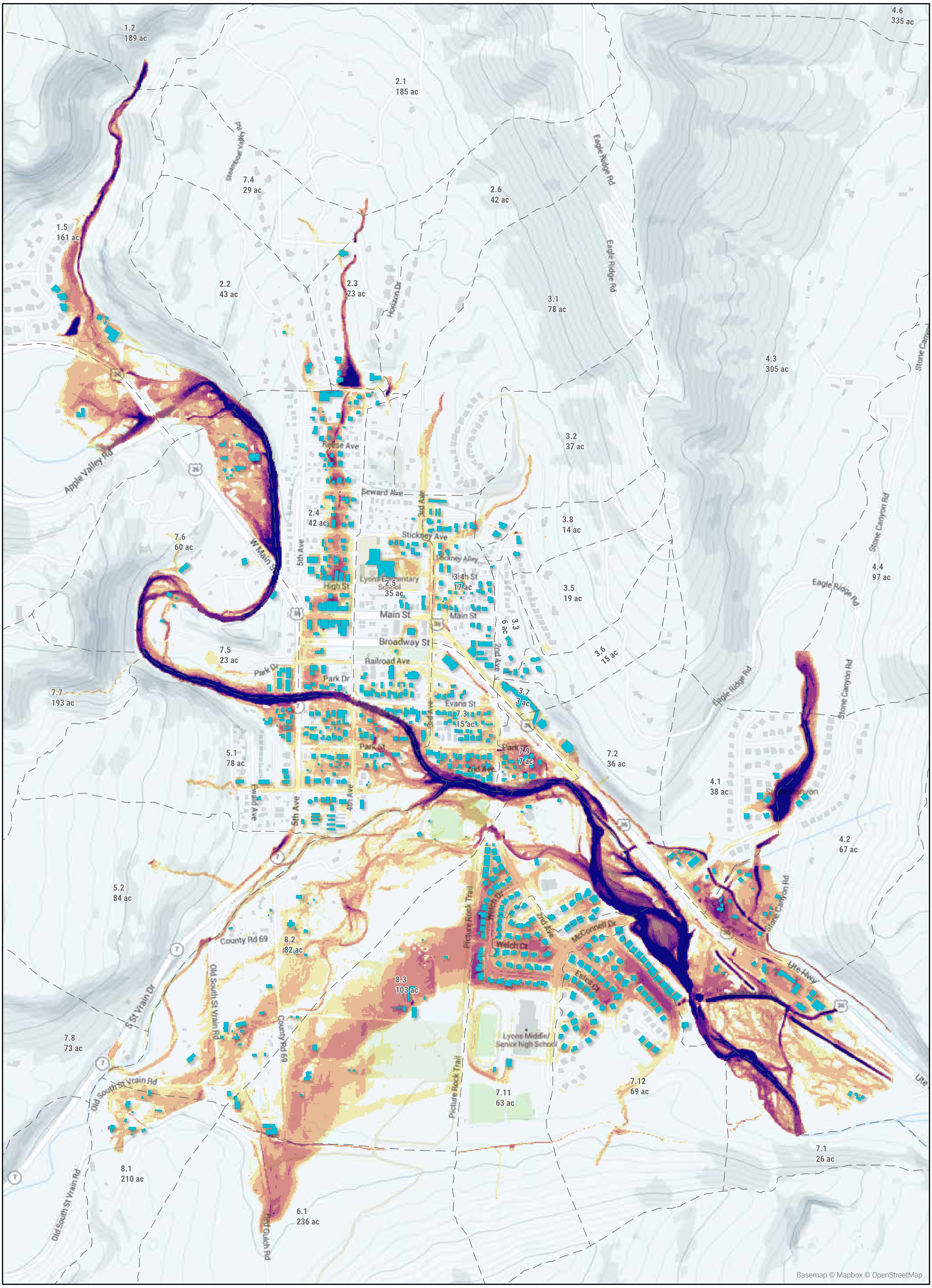
Building Footprint

At-Risk Building

Sub-Basins

LYONS COLORADO

ICON ENGINEERING, INC.



Lyons Stormwater Masterplan

Figure B-6: FLO2D Results: 100-Year Future Conditions

Max Flow Depth (ft)

.5 1 2 3 4 5 6+

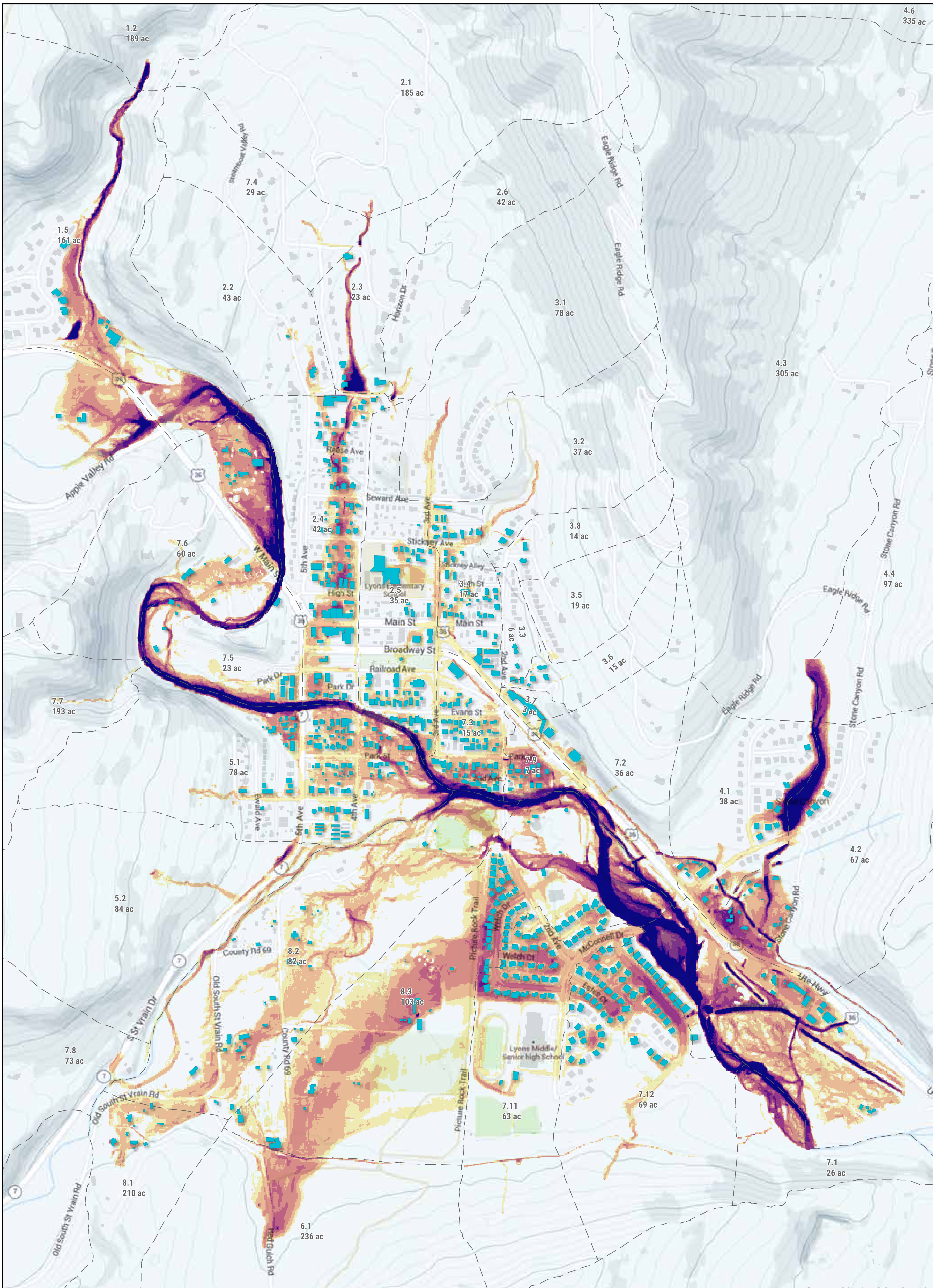
Building Footprint

At-Risk Building

Sub-Basins

LYONS COLORADO

ICON ENGINEERING, INC.



Lyons Stormwater Masterplan

Figure B-7: FLO2D Results: 120% Future Conditions

Max Flow Depth (ft)

.5 | 1 | 2 | 3 | 4 | 5 | 6+

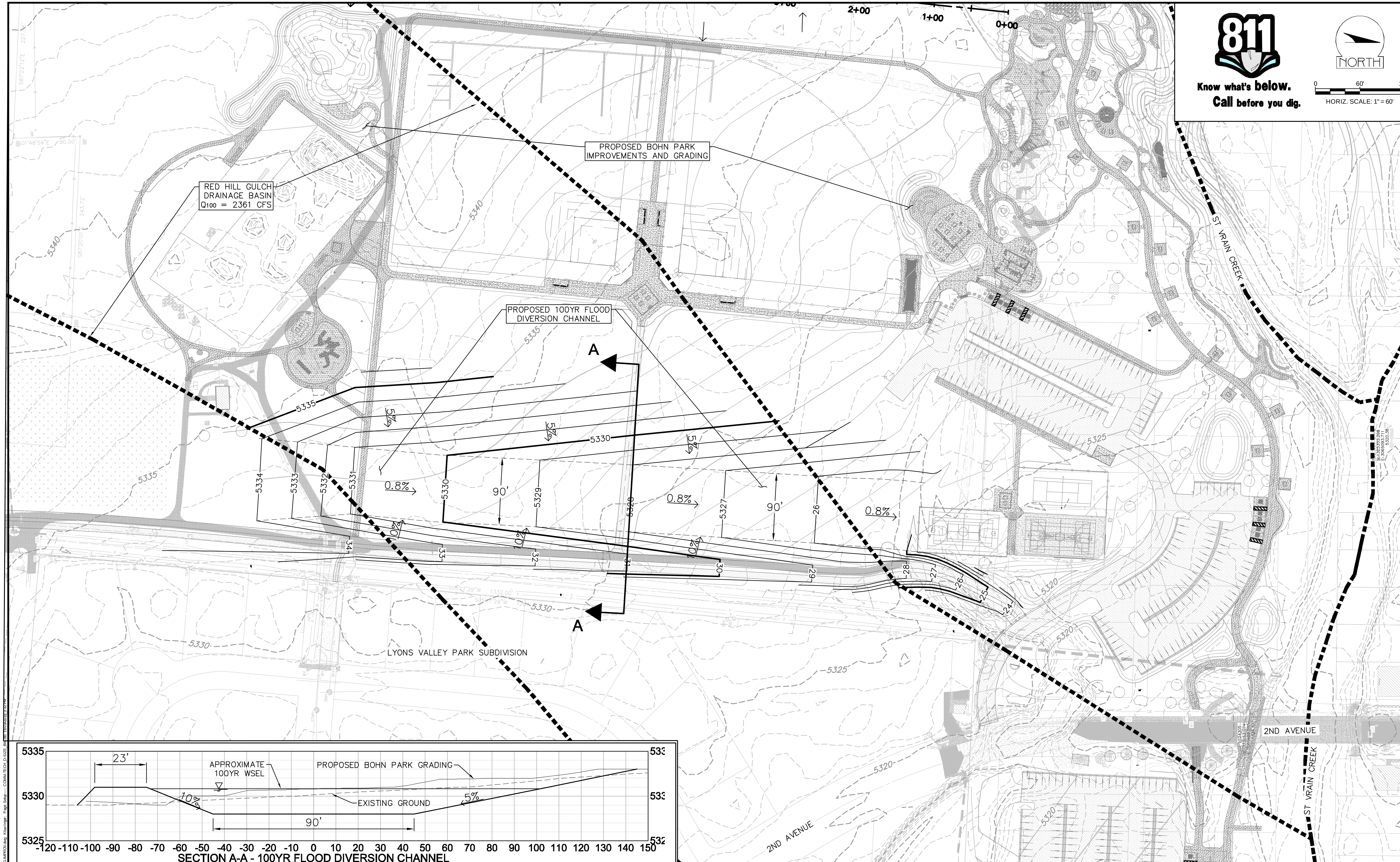
Building Footprint

At-Risk Building

Sub-Basins

ICON ENGINEERING, INC.

Appendix C - ALTERNATIVES ANALYSIS



No.	DATE	REVISIONS	APPR.

PLAN	UTILITIES
DRAWN KDB	RESEARCHED
DESIGNED KDB	DRAWN
CHECKED TC	CHECKED

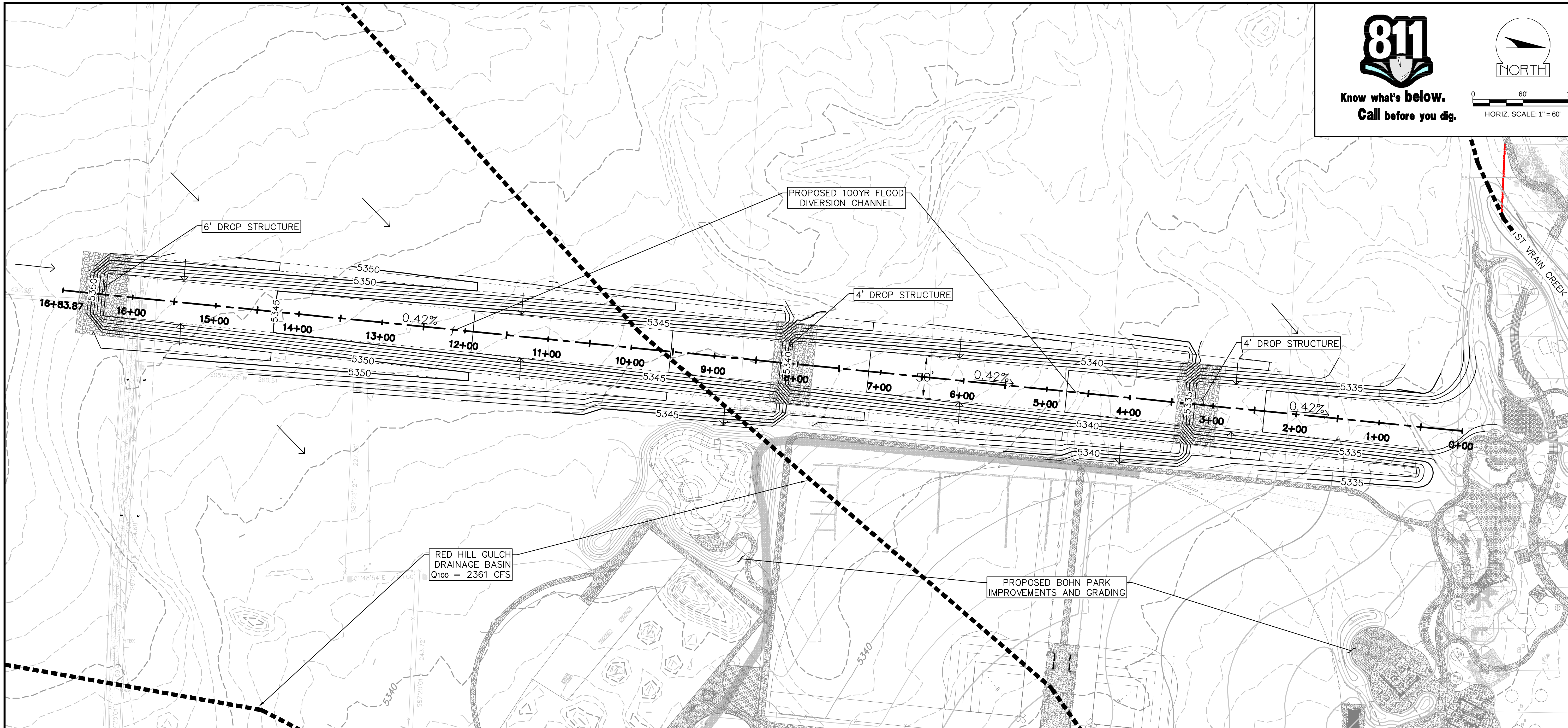
ICON ENGINEERING, INC.
7000 S Yosemite Street | Suite 120 | Centennial CO 80112
Phone (303) 221-0802 / Fax (303) 221-4019

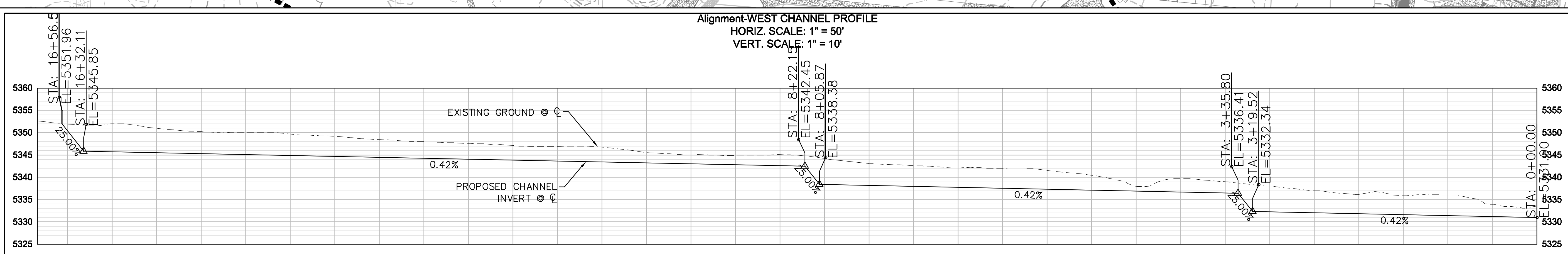
TOWN OF LYONS DRAINAGE MASTER PLAN
CONCEPTUAL DRAINAGEWAY IMPROVEMENTS - RED HILL GULCH CHANNEL DIVERSION ON BOHN PARK PROPERTY

ICON PROJECT No. 16-014-LYN-416

DATE NOV 2016

SHEET 1





No.	DATE	REVISIONS	APPR.	PLAN	UTILITIES
				DRAWN KDB	RESEARCHED
				DESIGNED KDB	DRAWN
				CHECKED TC	CHECKED

ICON ENGINEERING, INC.
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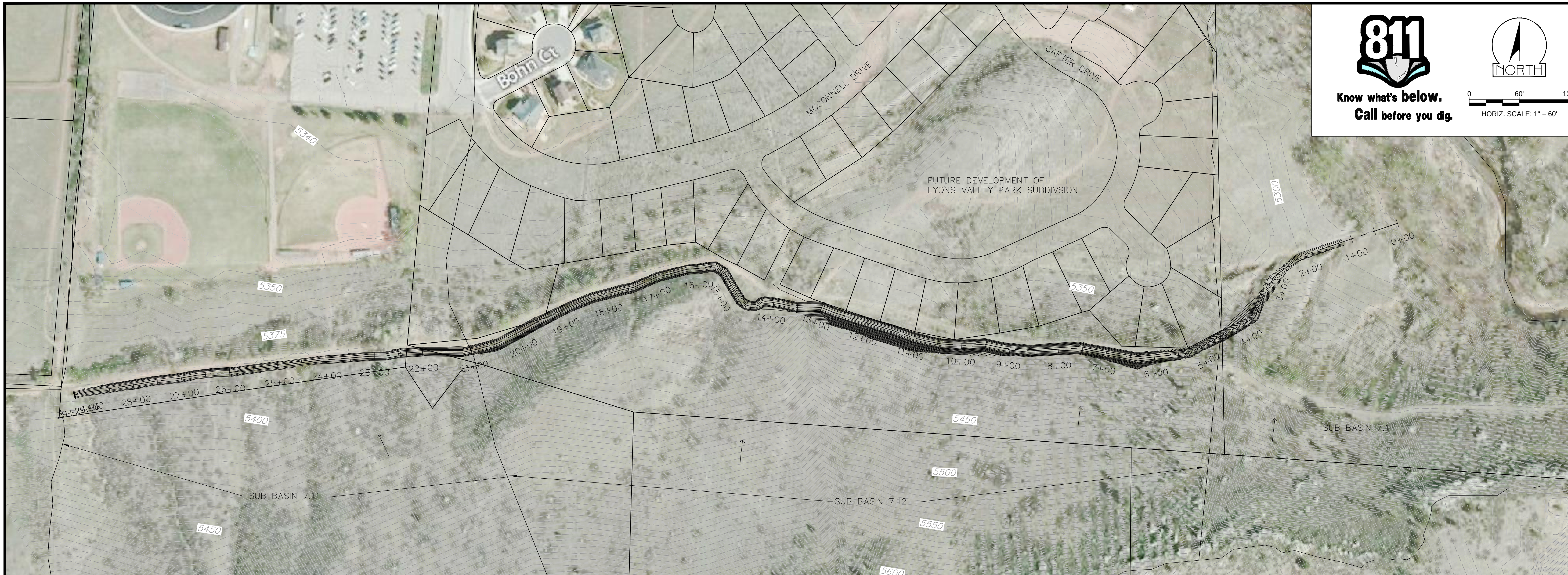
Phone (303) 221-0802 / Fax (303) 221-4019

TOWN OF LYONS DRAINAGE MASTER PLAN
CONCEPTUAL DRAINAGEWAY IMPROVEMENTS - RED HILL GULCH
DIVERSION CHANNEL WEST OF BOHN PARK

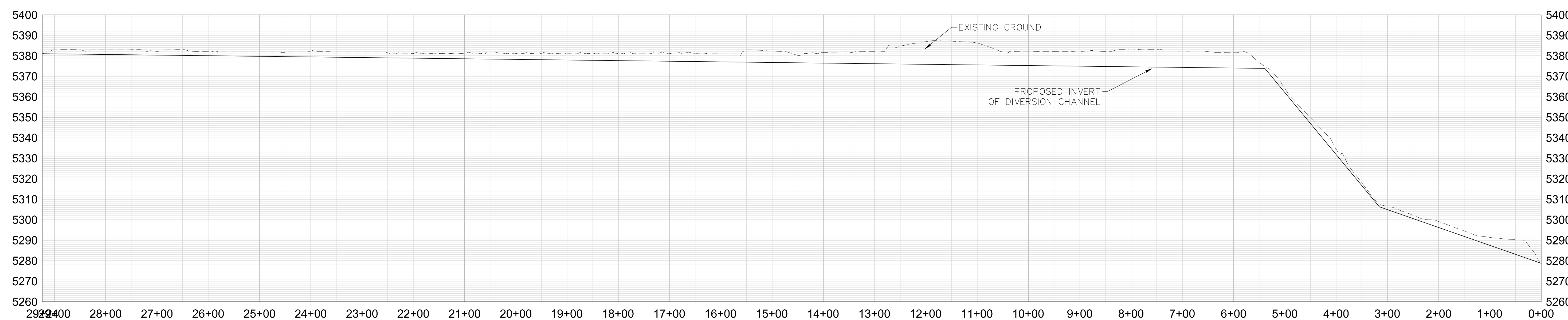
ICON PROJECT No. 16-014-LYN-416

DATE NOV 2016

SHEET 1



P-ALIGN-S-LEDGE-DITCH PROFILE
HORIZ. SCALE: 1" = 100'
VERT. SCALE: 1" = 25'



No.	DATE	REVISIONS	APPR.

PLAN	UTILITIES
DRAWN KDB	RESEARCHED
DESIGNED JD	DRAWN
CHECKED TC	CHECKED

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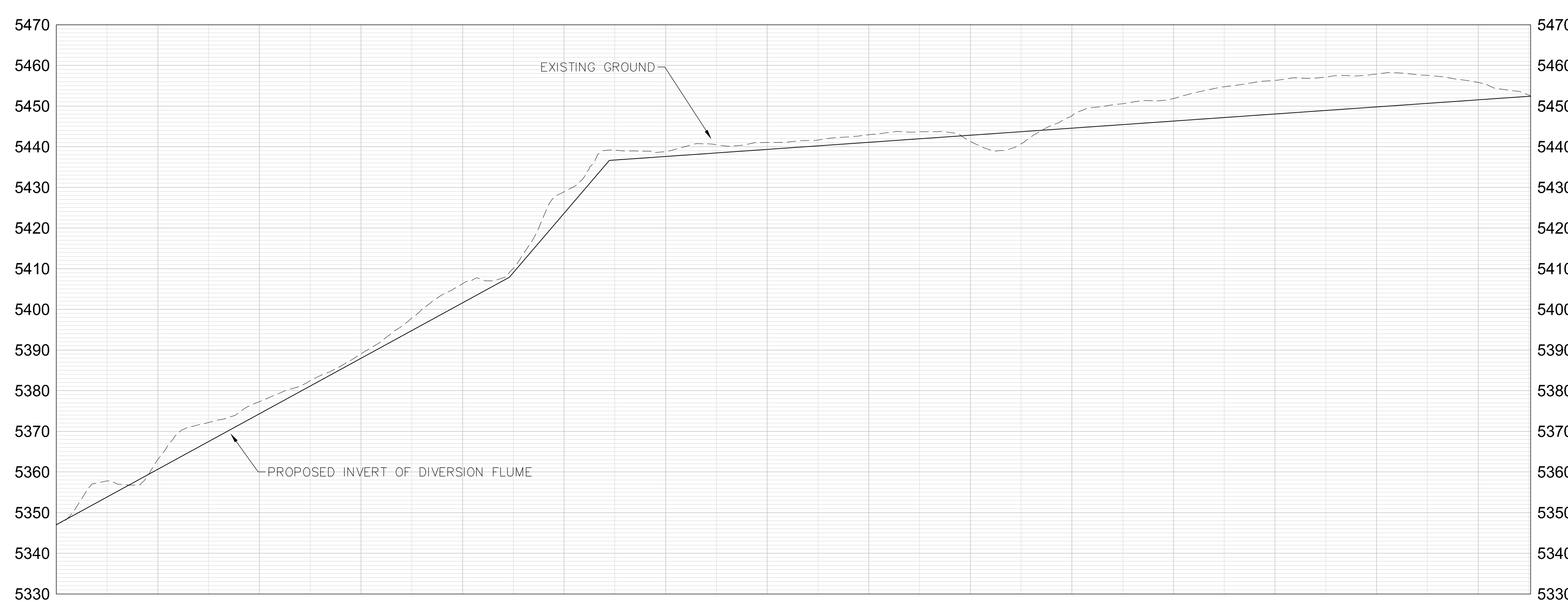
TOWN OF LYONS DRAINAGE MASTER PLAN
CONCEPTUAL DRAINAGEWAY IMPROVEMENTS
SOUTH LEDGE DITCH DIVERSION CHANNEL

ICON PROJECT No. 16-014-LYN-415

DATE NOV 2016

SHEET 1

Alignment - EWALD PROFILE
HORIZ. SCALE: 1" = 70'
VERT. SCALE: 1" = 18'



No.	DATE	REVISIONS	APPR.	PLAN	UTILITIES
				DRAWN JD	RESEARCHED
				DESIGNED JD	DRAWN
				CHECKED TC	CHECKED

ICON ENGINEERING, INC.
8100 South Akron Street, Suite 300, Centennial, CO 80112
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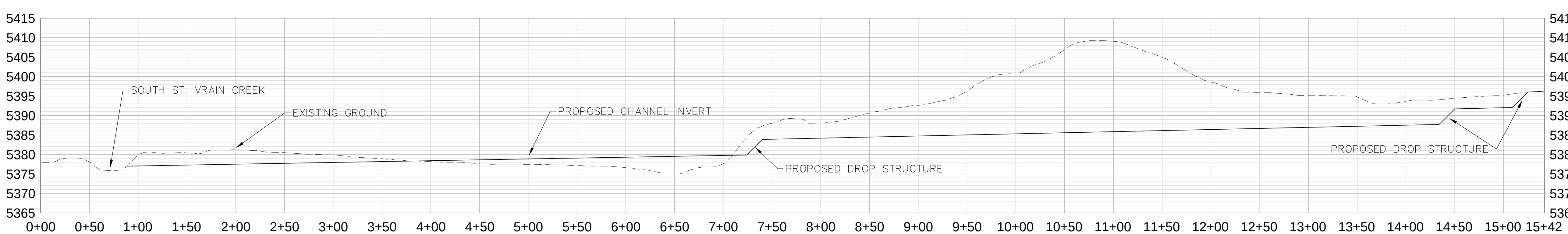
TOWN OF LYONS DRAINAGE MASTER PLAN
CONCEPTUAL DRAINAGEWAY IMPROVEMENTS
EWALD DIVERSION CHANNEL

ICON PROJECT No. 16-014-LYN-415

DATE NOV 2016

SHEET 1

Alignment - Red Hill Gulch Cut-Off Channel PROFILE
HORIZ. SCALE: 1" = 50'
VERT. SCALE: 1" = 12'



No.	DATE	REVISIONS	APPR.	PLAN	UTILITIES
				DRAWN JD	RESEARCHED
				DESIGNED JD	DRAWN
				CHECKED TC	CHECKED

ICON ENGINEERING, INC.
8100 South Akron Street, Suite 300, Centennial, CO 80112
Phone (303) 221-0802 / Fax (303) 221-4019
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TOWN OF LYONS DRAINAGE MASTER PLAN
CONCEPTUAL DRAINAGEWAY IMPROVEMENTS
RED HILL GULCH CUT-OFF CHANNEL

ICON PROJECT No. 16-014-LYN-415

DATE
NOV 2016

SHEET
1

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan
DRAINAGEWAY :	Town of Lyons
REACH :	ALTA
JURISDICTION :	Town of Lyons
REACH ID:	TL-ReachALTA — Enter Estimator Name on Project Info — DATE : 2016-11-22

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Channel Improvements						
Excavation, Low Range		2824	C.Y.	$14.00	$39,536.00	Cut and fill on site
Excavation, Mid Range		6975	C.Y.	$30.00	$209,250.00	Cut and haul off site
Soil Riprap, Type M		1250	C.Y.	$89.00	$111,250.00	Riprap Rundown into diversion channel

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains			$0.00	
Concrete Box Culverts			$0.00	
Hydraulic Structures			$0.00	
Channel Improvements			$360,036.00	
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			**$360,036.00**	
Additional Capital Improvement Costs				
Dewatering	$3,600.36	L.S.	$3,600.00	
Mobilization	5%		$18,002.00	
Traffic Control	$0.00	L.S.	$0.00	
Utility Coordination/Relocation	$36,003.60	L.S.	$36,004.00	
Stormwater Management/Erosion Control	5%		$18,002.00	
Subtotal Additional Capital Improvement Costs			**$75,608.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$65,347.00	
Legal/Administrative	5%		$21,782.00	
Contract Admin/Construction Management	10%		$43,564.00	
Contingency	25%		$108,911.00	
Subtotal Other Costs			**$239,604.00**	
Total Capital Improvement Costs			**$675,248.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Channel Maintenance (e.g. sediment & debris removal, erosion, tree & weed removal, etc.)	860	L.F.	$3.00	$2,580.00	
Total Annual Operation and Maintenance Cost				**$2,580.00**	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				**$81,073.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan
DRAINAGEWAY :	Town of Lyons
REACH :	ALTB
JURISDICTION :	Town of Lyons
REACH ID:	TL-ReachALTB — Enter Estimator Name on Project Info — DATE : 2016-11-22

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Hydraulic Structures							
Sloping Drop Structures							
Height (ft)	Bottom Width (ft)	Yn (ft)					
6	90	5	1	EA	$258,492.14	$258,492.00	
4	90	5	2	EA	$224,412.13	$448,824.00	
Channel Improvements							
Excavation, Low Range			5799	C.Y.	$14.00	$81,186.00	Cut and fill onsite
Excavation, Mid Range			10163	C.Y.	$30.00	$304,890.00	Cut and haul offsite
Landscaping and Maintenance Improvements							
Trail/Path, Concrete (10' Width)			1650	L.F.	$56.00	$92,400.00	
Land Acquisition							
Easement/ROW Acquisition			5.10	ACRE	$39,280.00	$200,328.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains			$0.00	
Concrete Box Culverts			$0.00	
Hydraulic Structures			$707,316.00	
Channel Improvements			$386,076.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$92,400.00	
Special Items (User Defined)			$0.00	
Subtotal Capital Improvement Costs			**$1,185,792.00**	
Additional Capital Improvement Costs				
Dewatering	$11,857.92	L.S.	$11,858.00	
Mobilization	5%		$59,290.00	
Traffic Control	$0.00	L.S.	$0.00	
Utility Coordination/Relocation	$118,579.20	L.S.	$118,579.00	
Stormwater Management/Erosion Control	5%		$59,290.00	
Subtotal Additional Capital Improvement Costs			**$249,017.00**	
Land Acquisition Costs				
ROW/Easements			$200,328.00	
Subtotal Land Acquisition Costs			**$200,328.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$215,221.00	
Legal/Administrative	5%		$71,740.00	
Contract Admin/Construction Management	10%		$143,481.00	
Contingency	25%		$358,702.00	
Subtotal Other Costs			**$789,144.00**	
Total Capital Improvement Costs			**$2,424,281.00**	

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Hydraulic Structure Maintenance (e.g. debris removal, erosion, structural repairs, etc.)	3	EA	$634.00	$1,902.00	
Channel Maintenance (e.g. sediment & debris removal, erosion, tree & weed removal, etc.)	1650	L.F.	$3.00	$4,950.00	
Trail Maintenance (e.g. structural repairs, crusher fines, etc.)	1650	L.F.	$6.00	$9,900.00	
Total Annual Operation and Maintenance Cost				**$16,752.00**	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				**$526,408.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan
DRAINAGEWAY :	Town of Lyons
REACH :	ALTC
JURISDICTION :	Town of Lyons
REACH ID:	TL-ReachALTC — Enter Estimator Name on Project Info — DATE : 2016-11-22

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
48-inch	50	2	100	L.F.	$182.00	$18,200.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
48-inch	Yes	2	4	EA	$2,611.00	$10,444.00	
Hydraulic Structures							
Sloping Drop Structures							
Height (ft)	Bottom Width (ft)	Yn (ft)					
4	40	4	3	EA	$124,056.43	$372,169.00	
Channel Improvements							
Excavation, Low Range			1912	C.Y.	$14.00	$26,768.00	
Excavation, Mid Range			18485	C.Y.	$30.00	$554,550.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,267.00	$1,774.00	
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		462	S.Y.	$40.00	$18,480.00	
Land Acquisition							
Easement/ROW Acquisition			3.20	ACRE	$156,250.00	$500,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains			$28,644.00	
Concrete Box Culverts			$0.00	
Hydraulic Structures			$372,169.00	
Channel Improvements			$581,318.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$1,774.00	
Special Items (User Defined)			$18,480.00	
Subtotal Capital Improvement Costs			**$1,002,385.00**	
Additional Capital Improvement Costs				
Dewatering	$10,023.85	L.S.	$10,024.00	
Mobilization	5%		$50,119.00	
Traffic Control	$50,119.25	L.S.	$50,119.00	
Utility Coordination/Relocation	$100,238.50	L.S.	$100,239.00	
Stormwater Management/Erosion Control	5%		$50,119.00	
Subtotal Additional Capital Improvement Costs			**$260,620.00**	
Land Acquisition Costs				
ROW/Easements			$500,000.00	
Subtotal Land Acquisition Costs			**$500,000.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$189,451.00	
Legal/Administrative	5%		$63,150.00	
Contract Admin/Construction Management	10%		$126,301.00	
Contingency	25%		$315,751.00	
Subtotal Other Costs			**$694,653.00**	
Total Capital Improvement Costs			**$2,457,658.00**	

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, e	100	L.F.	$1.00	$100.00	
Hydraulic Structure Maintenance (e.g. debris removal, erosion, structural repairs, etc.)	3	EA	$634.00	$1,902.00	
Channel Maintenance (e.g. sediment & debris removal, erosion, tree & weed removal, etc.)	100	L.F.	$3.00	$300.00	
Total Annual Operation and Maintenance Cost				**$2,302.00**	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				**$72,337.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan
DRAINAGEWAY :	Town of Lyons
REACH :	ALTD
JURISDICTION :	Town of Lyons
REACH ID:	TL-ReachALTD — Enter Estimator Name on Project Info — DATE : 2016-11-22

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	20	1000	L.F.	$68.00	$68,000.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			6	EA	$15,208.00	$91,248.00	
Storm Inlet, Type R/Type 14, 5-foot			20	EA	$5,830.00	$116,600.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
8	4	1	950	L.F.	$810.44	$769,918.00	
9	4	1	1400	L.F.	$868.80	$1,216,320.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
8	1	10.00	1	EA	$871.00	$871.00	
9	1	11.00	1	EA	$958.10	$958.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
8	4	1	1	EA	$8,344.73	$8,344.70	
9	4	1	1	EA	$8,566.80	$8,566.80	
Special Items (User Defined)							
Curb and Gutter	<----User Defined Items		3000	L.F.	$30.00	$90,000.00	
Asphalt Repaving	<----User Defined Items		150	S.Y.	$40.00	$6,000.00	
Land Acquisition							
Easement/ROW Acquisition			1.82	ACRE	$1,552,387.85	$2,825,346.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains			$275,848.00	
Concrete Box Culverts			$2,004,979.00	
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)			$96,000.00	
Subtotal Capital Improvement Costs			**$2,376,827.00**	
Additional Capital Improvement Costs				
Dewatering	$23,768.27	L.S.	$23,768.00	
Mobilization	5%		$118,841.00	
Traffic Control	$118,841.35	L.S.	$118,841.00	
Utility Coordination/Relocation	$237,682.70	L.S.	$237,683.00	
Stormwater Management/Erosion Control	5%		$118,841.00	
Subtotal Additional Capital Improvement Costs			**$617,974.00**	
Land Acquisition Costs				
ROW/Easements			$2,825,346.00	
Subtotal Land Acquisition Costs			**$2,825,346.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$449,220.00	
Legal/Administrative	5%		$149,740.00	
Contract Admin/Construction Management	10%		$299,480.00	
Contingency	25%		$748,700.00	
Subtotal Other Costs			**$1,647,140.00**	
Total Capital Improvement Costs			**$7,467,287.00**	

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	26	EA	$63.00	$1,638.00	
Total Annual Operation and Maintenance Cost				**$1,638.00**	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				**$51,472.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan
DRAINAGEWAY :	Town of Lyons
REACH :	ALTE
JURISDICTION :	Town of Lyons
REACH ID:	TL-ReachALTE — Enter Estimator Name on Project Info — DATE : 2016-11-22

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Special Items (User Defined)						
Curb and Gutter	<----User Defined Items	3600	L.F.	$30.00	$108,000.00	
Asphalt Repave	<----User Defined Items	1000	S.Y.	$40.00	$40,000.00	

Master Plan Capital Improvement Cost Summary

				USER COMMENTS
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)			$148,000.00	
Subtotal Capital Improvement Costs			**$148,000.00**	
Additional Capital Improvement Costs				
Dewatering	$20,000.00	L.S.	$20,000.00	
Mobilization	5%		$7,400.00	
Traffic Control	$100,000.00	L.S.	$100,000.00	
Utility Coordination/Relocation	$100,000.00	L.S.	$100,000.00	
Stormwater Management/Erosion Control	5%		$7,400.00	
Subtotal Additional Capital Improvement Costs			**$234,800.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$57,420.00	
Legal/Administrative	5%		$19,140.00	
Contract Admin/Construction Management	10%		$38,280.00	
Contingency	25%		$95,700.00	
Subtotal Other Costs			**$210,540.00**	
Total Capital Improvement Costs			**$593,340.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan
DRAINAGEWAY :	Town of Lyons
REACH :	ALTF
JURISDICTION :	Town of Lyons
REACH ID:	TL-ReachALTF — Enter Estimator Name on Project Info — DATE : 2016-11-22

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
42-inch	825	1	825	L.F.	$160.00	$132,000.00	From 3rd Ave to Stickney Ave
36-inch	325	1	325	L.F.	$137.00	$44,525.00	East Stickney to 3rd Ave
60-inch	625	1	625	L.F.	$304.00	$190,000.00	From Stickney to Main St
66-inch	1300	1	1300	L.F.	$335.00	$435,500.00	From Main St to N St Vrain
18-inch	50	20	1000	L.F.	$68.00	$68,000.00	Inlet Laterals
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
42-inch	Yes	1	1	EA	$2,154.00	$2,154.00	
36-inch	Yes	1	1	EA	$2,040.00	$2,040.00	
Headwalls							
Diameter (in)	Applicable	No. of Barrels					
66-inch	Yes	1	1	EA	$2,225.00	$2,225.00	
Wingwalls (includes concrete apron)							
Diameter (in)		No. of Barrels					
66-inch		1	1	EA	$13,109.91	$13,110.00	
Manholes and Inlets							
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			3	EA	$4,942.00	$14,826.00	
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			5	EA	$15,208.00	$76,040.00	
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			1	EA	$19,010.00	$19,010.00	
Storm Inlet, Type R/Type 14, 5-foot			20	EA	$5,830.00	$116,600.00	
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		8375	S.Y.	$40.00	$335,000.00	
Curb and Gutter	<----User Defined Items		3950	L.F.	$30.00	$118,500.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs			
Pipe Culverts and Storm Drains			$1,116,030.00
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)			$453,500.00
Subtotal Capital Improvement Costs			**$1,569,530.00**
Additional Capital Improvement Costs			
Dewatering	$15,695.30	L.S.	$15,695.00
Mobilization	5%		$78,477.00
Traffic Control	$78,476.50	L.S.	$78,477.00
Utility Coordination/Relocation	$156,953.00	L.S.	$156,953.00
Stormwater Management/Erosion Control	5%		$78,477.00
Subtotal Additional Capital Improvement Costs			**$408,079.00**
Land Acquisition Costs			
ROW/Easements			$0.00
Subtotal Land Acquisition Costs			**$0.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$296,641.00
Legal/Administrative	5%		$98,880.00
Contract Admin/Construction Management	10%		$197,761.00
Contingency	25%		$494,402.00
Subtotal Other Costs			**$1,087,684.00**
Total Capital Improvement Costs			**$3,065,293.00**

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	26	EA	$63.00	$1,638.00
Total Annual Operation and Maintenance Cost				**$1,638.00**
Effective Interest Rate				2.00%
Total Operation and Maintenance Costs Over 50 Years				**$51,472.00**

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan
DRAINAGEWAY :	Town of Lyons
REACH :	ALTG
JURISDICTION :	Town of Lyons
REACH ID:	TL-ReachALTG

Enter Estimator Name on Project Info | DATE : 2016-11-22

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
66-inch	1300	1	1300	L.F.	$335.00	$435,500.00	From Main St to N St Vrain
18-inch	50	20	1000	L.F.	$68.00	$68,000.00	Inlet Laterals
Manholes and Inlets							
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			3	EA	$15,208.00	$45,624.00	
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			1	EA	$19,010.00	$19,010.00	
Storm Inlet, Type R/Type 14, 5-foot			20	EA	$5,830.00	$116,600.00	
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		940	S.Y.	$40.00	$37,600.00	
Curb and Gutter	<----User Defined Items		1400	L.F.	$30.00	$42,000.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains			$684,734.00	
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)			$79,600.00	
Subtotal Capital Improvement Costs			**$764,334.00**	
Additional Capital Improvement Costs				
Dewatering	$7,643.34	L.S.	$7,643.00	
Mobilization	5%		$38,217.00	
Traffic Control	$38,216.70	L.S.	$38,217.00	
Utility Coordination/Relocation	$76,433.40	L.S.	$76,433.00	
Stormwater Management/Erosion Control	5%		$38,217.00	
Subtotal Additional Capital Improvement Costs			**$198,727.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$144,459.00	
Legal/Administrative	5%		$48,153.00	
Contract Admin/Construction Management	10%		$96,306.00	
Contingency	25%		$240,765.00	
Subtotal Other Costs			**$529,683.00**	
Total Capital Improvement Costs			**$1,492,744.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	24	EA	$63.00	$1,512.00	
Total Annual Operation and Maintenance Cost				**$1,512.00**	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				**$47,512.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan
DRAINAGEWAY :	Town of Lyons
REACH :	ALTQ
JURISDICTION :	Town of Lyons
REACH ID:	TL-ReachALTQ — Enter Estimator Name on Project Info — DATE : 2016-11-22

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Special Items (User Defined)						
Curb and Gutter	<----User Defined Items	6080	L.F.	$30.00	$182,400.00	

Master Plan Capital Improvement Cost Summary					
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)				$182,400.00	
Subtotal Capital Improvement Costs				**$182,400.00**	
Additional Capital Improvement Costs					
Dewatering		L.S.		$0.00	
Mobilization	5%			$9,120.00	
Traffic Control	$9,120.00	L.S.		$9,120.00	
Utility Coordination/Relocation	$18,240.00	L.S.		$18,240.00	
Stormwater Management/Erosion Control	5%			$9,120.00	
Subtotal Additional Capital Improvement Costs				**$45,600.00**	
Land Acquisition Costs					
ROW/Easements				$0.00	
Subtotal Land Acquisition Costs				**$0.00**	
Other Costs (percentage of Capital Improvement Costs)					
Engineering	15%			$34,200.00	
Legal/Administrative	5%			$11,400.00	
Contract Admin/Construction Management	10%			$22,800.00	
Contingency	25%			$57,000.00	
Subtotal Other Costs				**$125,400.00**	
Total Capital Improvement Costs				**$353,400.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan		
DRAINAGEWAY :	Town of Lyons		
REACH :	ALTI		
JURISDICTION :	Town of Lyons		
REACH ID:	TL-ReachALTI	Enter Estimator Name on Project Info	DATE : 2016-11-22

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Special Items (User Defined)						
Curb and Gutter	<----User Defined Items	3215	L.F.	$30.00	$96,450.00	

Master Plan Capital Improvement Cost Summary						
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)					$96,450.00	
Subtotal Capital Improvement Costs					**$96,450.00**	
Additional Capital Improvement Costs						
Dewatering			L.S.		$0.00	
Mobilization		5%			$4,823.00	
Traffic Control		$4,822.50	L.S.		$4,823.00	
Utility Coordination/Relocation		$9,645.00	L.S.		$9,645.00	
Stormwater Management/Erosion Control		5%			$4,823.00	
Subtotal Additional Capital Improvement Costs					**$24,114.00**	
Land Acquisition Costs						
ROW/Easements					$0.00	
Subtotal Land Acquisition Costs					**$0.00**	
Other Costs (percentage of Capital Improvement Costs)						
Engineering		15%			$18,085.00	
Legal/Administrative		5%			$6,028.00	
Contract Admin/Construction Management		10%			$12,056.00	
Contingency		25%			$30,141.00	
Subtotal Other Costs					**$66,310.00**	
Total Capital Improvement Costs					**$186,874.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan			
DRAINAGEWAY :	Town of Lyons			
REACH :	ALTJ			
JURISDICTION :	Town of Lyons			
REACH ID:	TL-ReachALTJ	Enter Estimator Name on Project Info	DATE :	2016-11-22

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	600	1	600	L.F.	$137.00	$82,200.00	From Main St to Park St
18-inch	50	36	1800	L.F.	$68.00	$122,400.00	Inlet Laterals
Manholes and Inlets							
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			3	EA	$4,942.00	$14,826.00	
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			2	EA	$19,010.00	$38,020.00	
Storm Inlet, Type R/Type 14, 5-foot			36	EA	$5,830.00	$209,880.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
9	3	1	500	L.F.	$810.44	$405,220.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
9	1	11.00	1	EA	$958.10	$958.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
9	3	1	1	EA	$6,894.73	$6,894.70	
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		800	S.Y.	$40.00	$32,000.00	
Curb and Gutter	<----User Defined Items		1000	L.F.	$30.00	$30,000.00	
Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$467,326.00	
Concrete Box Culverts						$413,073.00	
Hydraulic Structures						$0.00	
Channel Improvements						$0.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$62,000.00	
Subtotal Capital Improvement Costs						**$942,399.00**	
Additional Capital Improvement Costs							
Dewatering			$9,423.99	L.S.		$9,424.00	
Mobilization			5%			$47,120.00	
Traffic Control			$47,119.95	L.S.		$47,120.00	
Utility Coordination/Relocation			$94,239.90	L.S.		$94,240.00	
Stormwater Management/Erosion Control			5%			$47,120.00	
Subtotal Additional Capital Improvement Costs						**$245,024.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$178,113.00	
Legal/Administrative			5%			$59,371.00	
Contract Admin/Construction Management			10%			$118,742.00	
Contingency			25%			$296,856.00	
Subtotal Other Costs						**$653,082.00**	
Total Capital Improvement Costs						**$1,840,505.00**	
Master Plan Operation and Maintenance Cost Summary							
Description			**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)			41	EA	$63.00	$2,583.00	
Total Annual Operation and Maintenance Cost						**$2,583.00**	
Effective Interest Rate						2.00%	
Total Operation and Maintenance Costs Over 50 Years						**$81,167.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan
DRAINAGEWAY :	Town of Lyons
REACH :	ALTK
JURISDICTION :	Town of Lyons
REACH ID:	TL-ReachALTK — Enter Estimator Name on Project Info — DATE : 2016-11-22

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
30-inch	600	1	600	L.F.	$114.00	$68,400.00	Bohn Ct. to Estes Ct.
36-inch	750	1	750	L.F.	$137.00	$102,750.00	Estes Ct. to McConnell Dr
18-inch	50	35	1750	L.F.	$68.00	$119,000.00	Inlet Lateral
36-inch	660	1	660	L.F.	$137.00	$90,420.00	S McConnell
60-inch	100	1	100	L.F.	$304.00	$30,400.00	
72-inch	950	1	950	L.F.	$456.00	$433,200.00	
Headwalls							
Diameter (in)	**Applicable**	**No. of Barrels**					
60-inch	Yes	1	1	EA	$2,022.00	$2,022.00	
72-inch	Yes	1	1	EA	$2,436.00	$2,436.00	
Wingwalls (includes concrete apron)							
Diameter (in)		**No. of Barrels**					
60-inch		1	1	EA	$11,306.20	$11,306.00	
72-inch		1	1	EA	$14,706.38	$14,706.00	
Manholes and Inlets							
Manhole, 4' Dia. (Pipe Dia. < 36")			3	EA	$3,675.00	$11,025.00	
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			7	EA	$4,942.00	$34,594.00	
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)			5	EA	$15,208.00	$76,040.00	
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			1	EA	$19,010.00	$19,010.00	
Storm Inlet, Type R/Type 14, 5-foot			35	EA	$5,830.00	$204,050.00	
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		630	S.Y.	$40.00	$25,200.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains			$1,219,359.00	
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)			$25,200.00	
Subtotal Capital Improvement Costs			**$1,244,559.00**	
Additional Capital Improvement Costs				
Dewatering	$12,445.59	L.S.	$12,446.00	
Mobilization	5%		$62,228.00	
Traffic Control	$62,227.95	L.S.	$62,228.00	
Utility Coordination/Relocation	$124,455.90	L.S.	$124,456.00	
Stormwater Management/Erosion Control	5%		$62,228.00	
Subtotal Additional Capital Improvement Costs			**$323,586.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$235,222.00	
Legal/Administrative	5%		$78,407.00	
Contract Admin/Construction Management	10%		$156,815.00	
Contingency	25%		$392,036.00	
Subtotal Other Costs			**$862,480.00**	
Total Capital Improvement Costs			**$2,430,625.00**	

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	51	EA	$63.00	$3,213.00	
Total Annual Operation and Maintenance Cost				**$3,213.00**	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				**$100,964.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan		
DRAINAGEWAY :	Town of Lyons		
REACH :	ALTL		
JURISDICTION :	Town of Lyons		
REACH ID:	TL-ReachALTL	Enter Estimator Name on Project Info	DATE : 2016-11-22

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Channel Improvements						
Excavation, Low Range		888	C.Y.	$14.00	$12,437.00	Cut and fill onsite
Excavation, Mid Range		235	C.Y.	$30.00	$7,050.00	
Special Items (User Defined)						
Concrete for Diversion Flume	<----User Defined Items	740	C.Y.	$760.00	$562,400.00	
Energy Dissapator	<----User Defined Items	1	L.S.	$7,500.00	$7,500.00	

Master Plan Capital Improvement Cost Summary

				Total	User Comments
Capital Improvement Costs					
Pipe Culverts and Storm Drains				$0.00	
Concrete Box Culverts				$0.00	
Hydraulic Structures				$0.00	
Channel Improvements				$19,487.00	
Detention/Water Quality Facilities				$0.00	
Removals				$0.00	
Landscaping and Maintenance Improvements				$0.00	
Special Items (User Defined)				$569,900.00	
Subtotal Capital Improvement Costs				**$589,387.00**	
Additional Capital Improvement Costs					
Dewatering	$5,893.87	L.S.		$5,894.00	
Mobilization	5%			$29,469.00	
Traffic Control	$29,469.35	L.S.		$29,469.00	
Utility Coordination/Relocation	$58,938.70	L.S.		$58,939.00	
Stormwater Management/Erosion Control	5%			$29,469.00	
Subtotal Additional Capital Improvement Costs				**$153,240.00**	
Land Acquisition Costs					
ROW/Easements				$0.00	
Subtotal Land Acquisition Costs				**$0.00**	
Other Costs (percentage of Capital Improvement Costs)					
Engineering	15%			$111,394.00	
Legal/Administrative	5%			$37,131.00	
Contract Admin/Construction Management	10%			$74,263.00	
Contingency	25%			$185,657.00	
Subtotal Other Costs				**$408,445.00**	
Total Capital Improvement Costs				**$1,151,072.00**	

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, e	1400	L.F.	$1.00	$1,400.00	
Total Annual Operation and Maintenance Cost				**$1,400.00**	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				**$43,993.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan
DRAINAGEWAY :	Town of Lyons
REACH :	ALTM
JURISDICTION :	Town of Lyons
REACH ID:	TL-ReachALTM — Enter Estimator Name on Project Info — DATE : 2016-11-22

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
54-inch	1000	1	1000	L.F.	$274.00	$274,000.00	
18-inch	50	32	1600	L.F.	$68.00	$108,800.00	
30-inch	450	1	450	L.F.	$114.00	$51,300.00	
Headwalls							
Diameter (in)	Applicable	No. of Barrels					
54-inch	Yes	1	1	EA	$1,820.20	$1,820.00	
Wingwalls (includes concrete apron)							
Diameter (in)		No. of Barrels					
54-inch		1	1	EA	$11,120.20	$11,120.00	
Manholes and Inlets							
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)			4	EA	$19,010.00	$76,040.00	
Storm Inlet, Type R/Type 14, 5-foot			32	EA	$5,830.00	$186,560.00	
Special Items (User Defined)							
Asphalt Repave	<----User Defined Items		790	S.Y.	$40.00	$31,600.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains				$709,640.00	
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)				$31,600.00	
Subtotal Capital Improvement Costs				**$741,240.00**	
Additional Capital Improvement Costs					
Dewatering	$7,412.40	L.S.		$7,412.00	
Mobilization	5%			$37,062.00	
Traffic Control	$37,062.00	L.S.		$37,062.00	
Utility Coordination/Relocation	$74,124.00	L.S.		$74,124.00	
Stormwater Management/Erosion Control	5%			$37,062.00	
Subtotal Additional Capital Improvement Costs				**$192,722.00**	
Land Acquisition Costs					
ROW/Easements				$0.00	
Subtotal Land Acquisition Costs				**$0.00**	
Other Costs (percentage of Capital Improvement Costs)					
Engineering	15%			$140,094.00	
Legal/Administrative	5%			$46,698.00	
Contract Admin/Construction Management	10%			$93,396.00	
Contingency	25%			$233,491.00	
Subtotal Other Costs				**$513,679.00**	
Total Capital Improvement Costs				**$1,447,641.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	36	EA	$63.00	$2,268.00	
Total Annual Operation and Maintenance Cost				**$2,268.00**	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				**$71,269.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan
DRAINAGEWAY :	Town of Lyons
REACH :	ALTN
JURISDICTION :	Town of Lyons
REACH ID:	TL-ReachALTN — Enter Estimator Name on Project Info — DATE : 2016-11-22

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Channel Improvements						
Excavation, Low Range		970	C.Y.	$14.00	$13,580.00	Cut and fill onsite
Excavation, Mid Range		3890	C.Y.	$30.00	$116,700.00	Cut and haul offsite
Special Items (User Defined)						
Concrete Flume Diversion Channel	<----User Defined Items	380	C.Y.	$760.00	$288,800.00	
Energy Dissipation	<----User Defined Items	1	L.S.	$7,500.00	$7,500.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains			$0.00	
Concrete Box Culverts			$0.00	
Hydraulic Structures			$0.00	
Channel Improvements			$130,280.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$0.00	
Special Items (User Defined)			$296,300.00	
Subtotal Capital Improvement Costs			**$426,580.00**	
Additional Capital Improvement Costs				
Dewatering	$4,265.80	L.S.	$4,266.00	
Mobilization	5%		$21,329.00	
Traffic Control	$21,329.00	L.S.	$21,329.00	
Utility Coordination/Relocation	$42,658.00	L.S.	$42,658.00	
Stormwater Management/Erosion Control	5%		$21,329.00	
Subtotal Additional Capital Improvement Costs			**$110,911.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$80,624.00	
Legal/Administrative	5%		$26,875.00	
Contract Admin/Construction Management	10%		$53,749.00	
Contingency	25%		$134,373.00	
Subtotal Other Costs			**$295,621.00**	
Total Capital Improvement Costs			**$833,112.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, e	1450	L.F.	$1.00	$290.00	
Total Annual Operation and Maintenance Cost				**$290.00**	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				**$9,113.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

PROJECT :	Town of Lyons Masterplan
DRAINAGEWAY :	Town of Lyons
REACH :	ALTO
JURISDICTION :	Town of Lyons
REACH ID:	TL-ReachALTO — Enter Estimator Name on Project Info — DATE : 2016-11-22

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
42-inch	1200	1	1200	L.F.	$160.00	$192,000.00	From Ewald Ave to confluence area
18-inch	50	40	2000	L.F.	$68.00	$136,000.00	Inlet Laterals
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
42-inch	Yes	1	1	EA	$2,154.00	$2,154.00	
Manholes and Inlets							
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			4	EA	$4,942.00	$19,768.00	
Storm Inlet, Type R/Type 14, 5-foot			40	EA	$5,830.00	$233,200.00	
Special Items (User Defined)							
Asphalt Repave	**<----User Defined Items**		780	S.Y.	$40.00	$31,200.00	
Curb and Gutter	**<----User Defined Items**		1000	L.F.	$30.00	$30,000.00	Curb and Gutter on Prospect east of 5th Ave.

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains			$583,122.00	
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)			$61,200.00	
Subtotal Capital Improvement Costs			**$644,322.00**	
Additional Capital Improvement Costs				
Dewatering	$6,443.22	L.S.	$6,443.00	
Mobilization	5%		$32,216.00	
Traffic Control	$32,216.10	L.S.	$32,216.00	
Utility Coordination/Relocation	$64,432.20	L.S.	$64,432.00	
Stormwater Management/Erosion Control	5%		$32,216.00	
Subtotal Additional Capital Improvement Costs			**$167,523.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$121,777.00	
Legal/Administrative	5%		$40,592.00	
Contract Admin/Construction Management	10%		$81,185.00	
Contingency	25%		$202,961.00	
Subtotal Other Costs			**$446,515.00**	
Total Capital Improvement Costs			**$1,258,360.00**	

Master Plan Operation and Maintenance Cost Summary

Description	Quantity	Unit	Unit Cost	Total Annual Cost	
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)	44	EA	$63.00	$1,386.00	
Total Annual Operation and Maintenance Cost				**$1,386.00**	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				**$43,553.00**	

MASTER PLAN COST ESTIMATE FOR INDIVIDUAL REACH

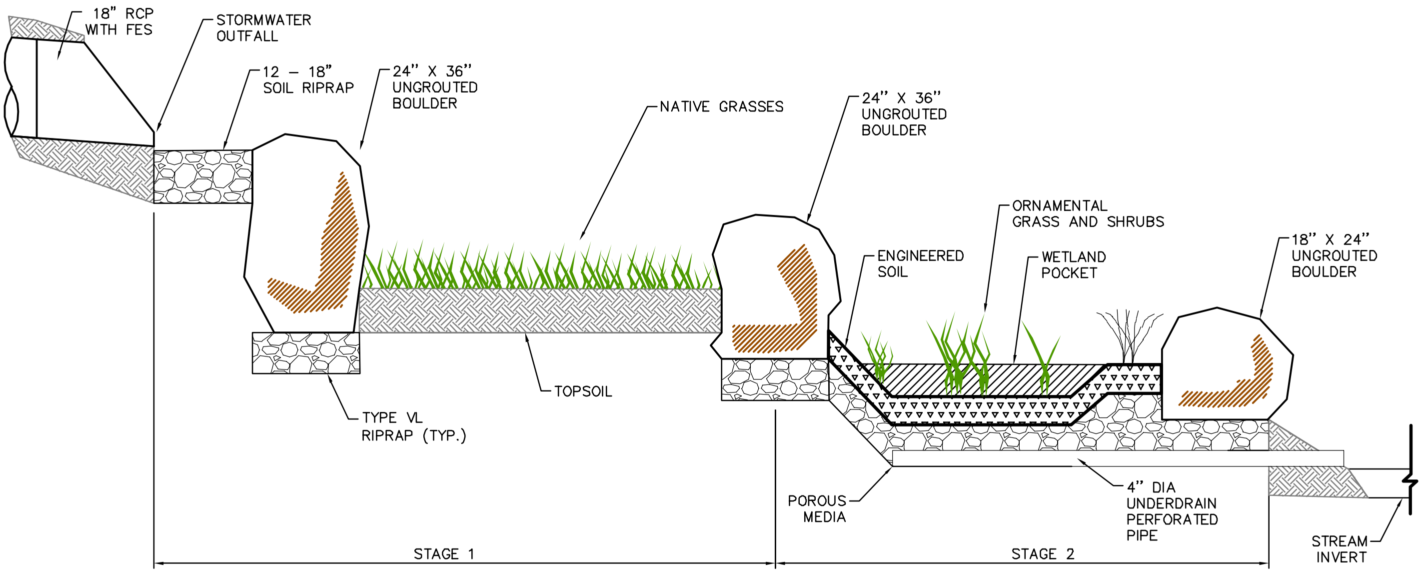
PROJECT :	Town of Lyons Masterplan
DRAINAGEWAY :	Town of Lyons
REACH :	ALTQ
JURISDICTION :	Town of Lyons
REACH ID:	TL-ReachALTQ — Enter Estimator Name on Project Info T — DATE : 2016-11-22

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)				
12	4	4	150	L.F.	$4,188.64	$628,296.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
12	4	52.00	2	EA	$4,794.40	$9,589.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
12	4	4	2	EA	$17,893.73	$35,787.50	
Special Items (User Defined)							
Asphalt Repave	<---User Defined Items		380	S.Y.	$40.00	$15,200.00	

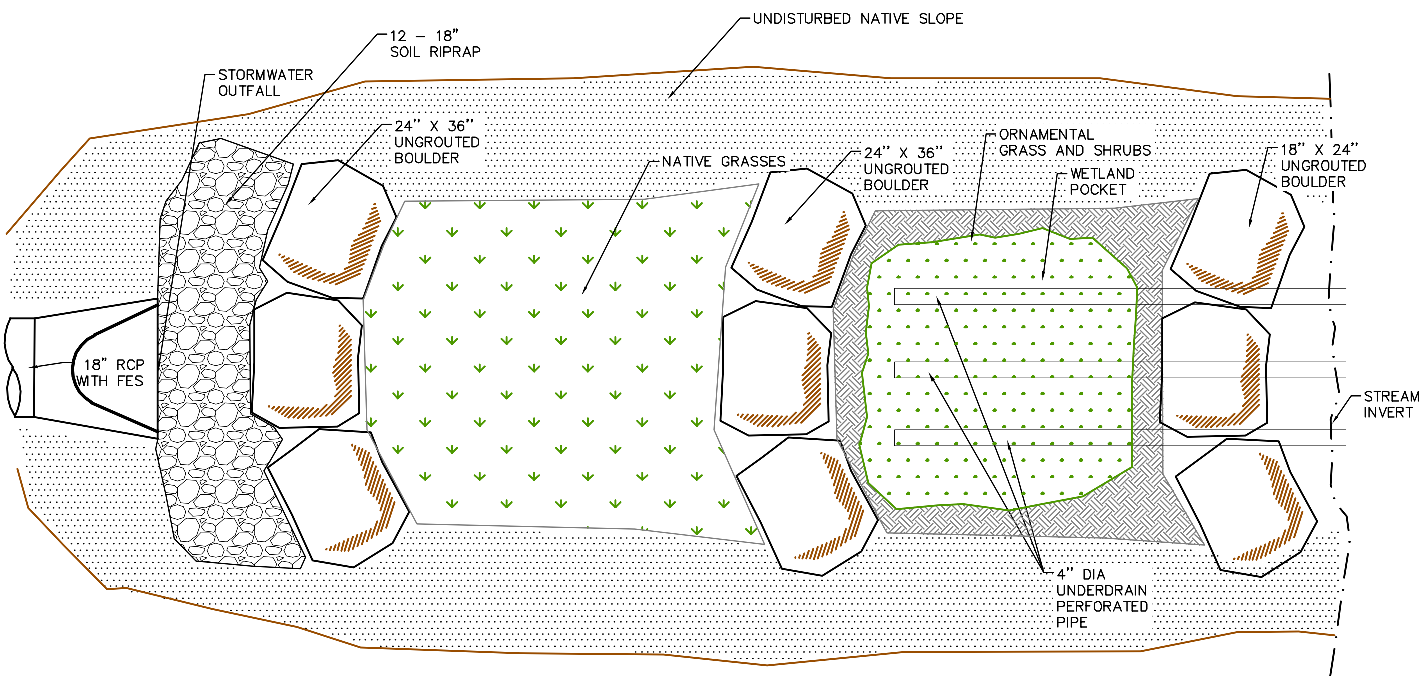
Master Plan Capital Improvement Cost Summary				USER COMMENTS
Capital Improvement Costs				
Pipe Culverts and Storm Drains			$0.00	
Concrete Box Culverts			$673,673.00	
Hydraulic Structures			$0.00	
Channel Improvements			$0.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$0.00	
Special Items (User Defined)			$15,200.00	
Subtotal Capital Improvement Costs			**$688,873.00**	
Additional Capital Improvement Costs				
Dewatering	$6,888.73	L.S.	$6,889.00	
Mobilization	5%		$34,444.00	
Traffic Control	$34,443.65	L.S.	$34,444.00	
Utility Coordination/Relocation	$68,887.30	L.S.	$68,887.00	
Stormwater Management/Erosion Control	5%		$34,444.00	
Subtotal Additional Capital Improvement Costs			**$179,108.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$130,197.00	
Legal/Administrative	5%		$43,399.00	
Contract Admin/Construction Management	10%		$86,798.00	
Contingency	25%		$216,995.00	
Subtotal Other Costs			**$477,389.00**	
Total Capital Improvement Costs			**$1,345,370.00**	

Master Plan Operation and Maintenance Cost Summary					
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**	
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs, etc.)	150	L.F.	$1.00	$150.00	
Total Annual Operation and Maintenance Cost				**$150.00**	
Effective Interest Rate				2.00%	
Total Operation and Maintenance Costs Over 50 Years				**$4,714.00**	

Appendix D - WATER QUALITY



PROFILE



PLAN

NOTES:

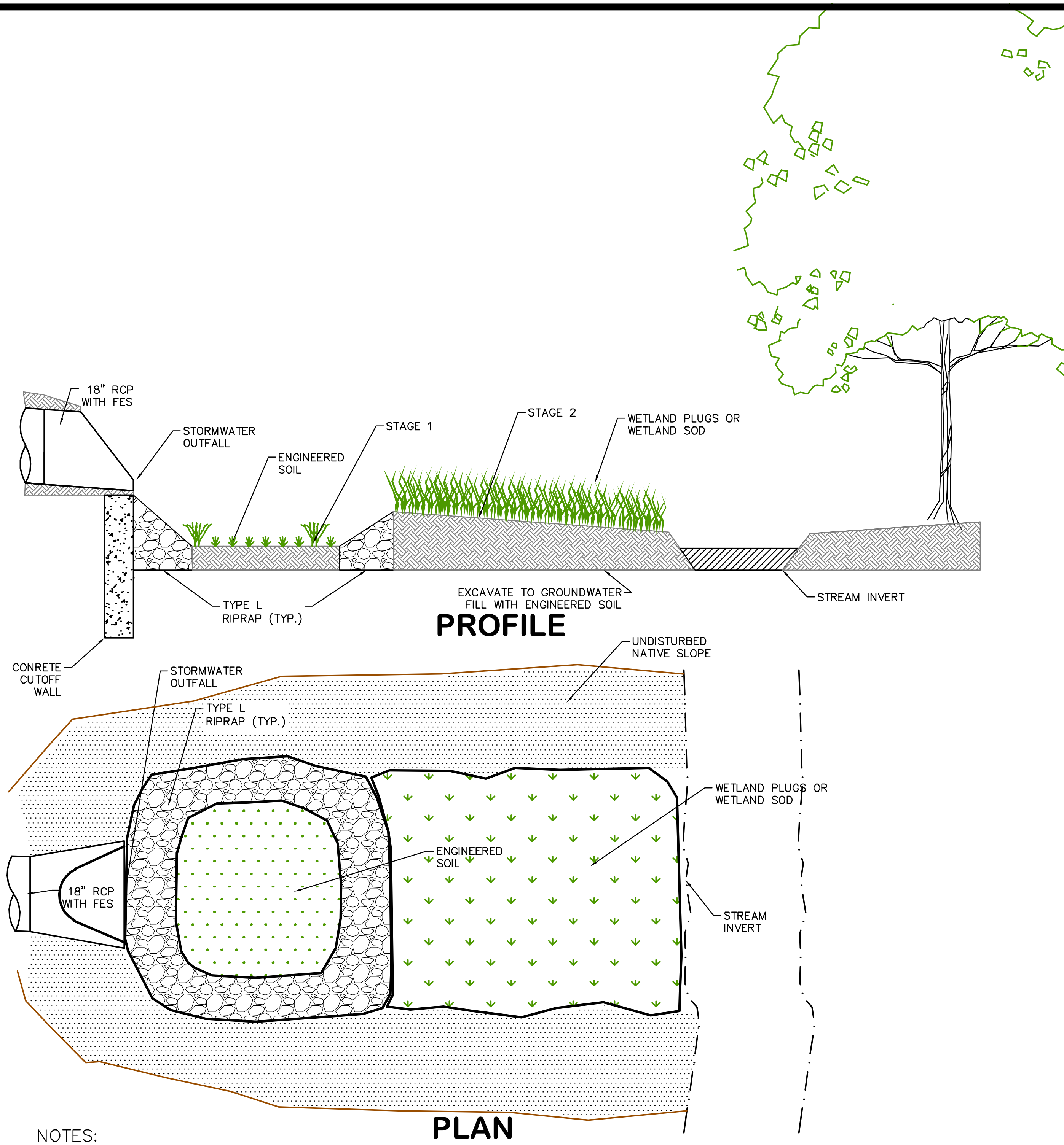
A. STAGE 1 : REMOVAL OF SANDS, GRAVEL AND TRASH

B. STAGE 2 : FILTRATION AND NUTRIENT REMOVAL

C. ENGINEERED SOIL: WELL GRADED GRANULAR SOIL WITH ORGANIC SUPPLEMENT

WATER QUALITY – CASCADE

ICON	–OUTFALL WATER QUALITY TREATMENT CONCEPT– WELL SUITED FOR NEAR–INVERT OUTFALLS IN TIERED STREAM BANKS	DRAWN DDB	JOB NUMBER: 16–014–LYO–415
		DESIGNED TWC	DATE: SEP. 2016
		CHECKED TWC	SHEET: 1



NOTES:

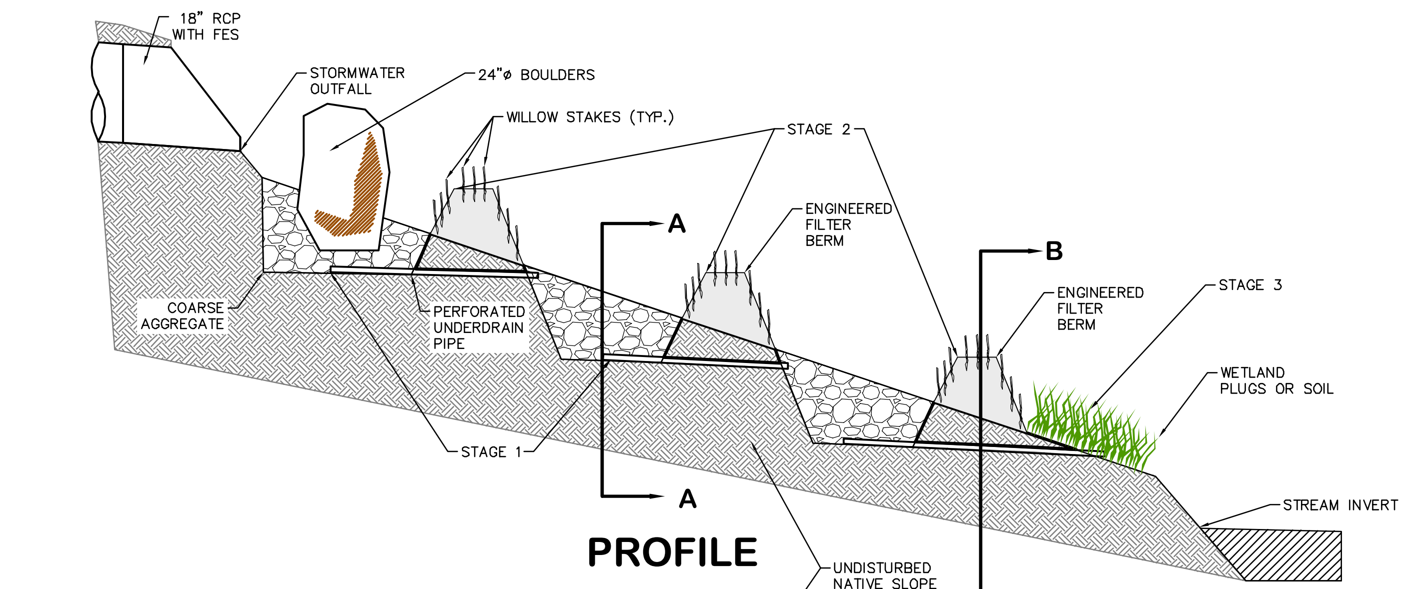
A. STAGE 1 : REMOVAL OF SANDS, GRAVEL AND TRASH

B. STAGE 2 : FILTRATION AND NUTRIENT REMOVAL

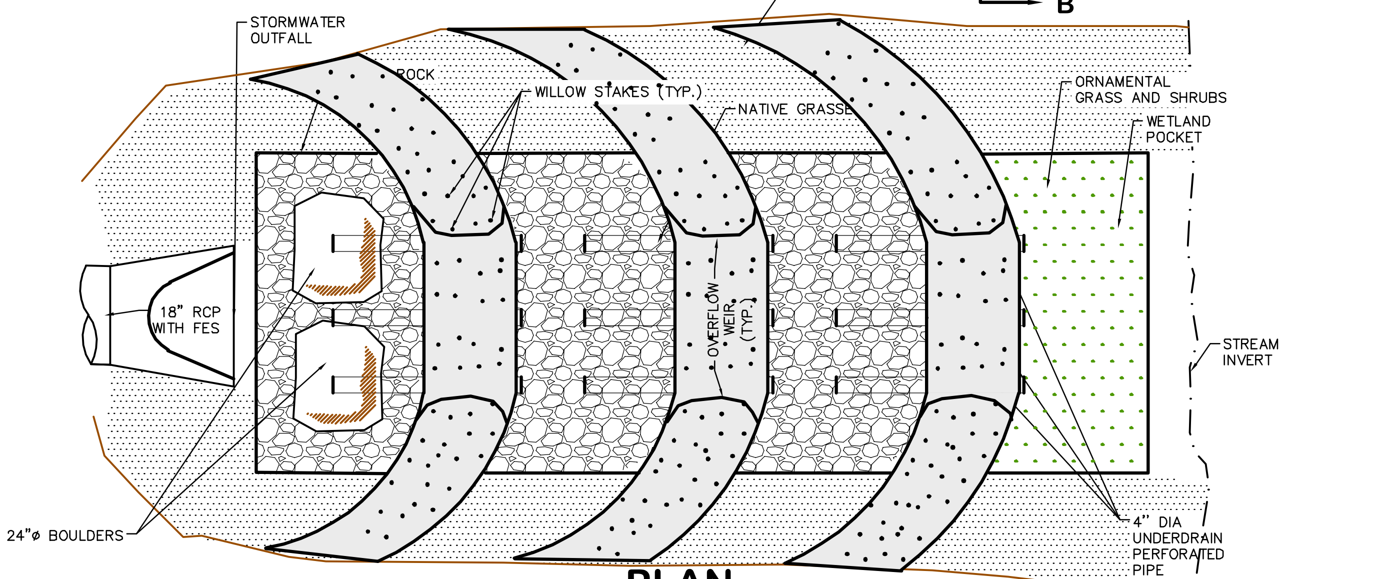
C. ENGINEERED SOIL: WELL GRADED GRANULAR SOIL WITH ORGANIC SUPPLEMENT.

WATER QUALITY – SOFT FOREBAY

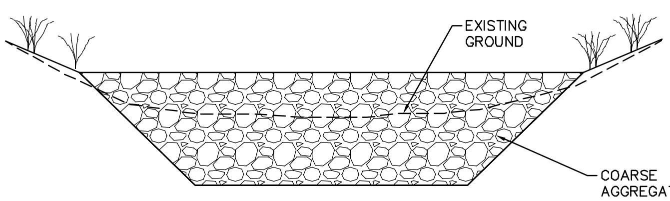
ICON	–OUTFALL WATER QUALITY TREATMENT CONCEPT– WELL SUITED FOR LOW GRADE OUTFALL WITH WIDE RIPARIAN BENCH	DRAWN DDB	JOB NUMBER: 16–014–LYO–415
		DESIGNED TWC	DATE: SEP. 2016
		CHECKED TWC	SHEET: 2



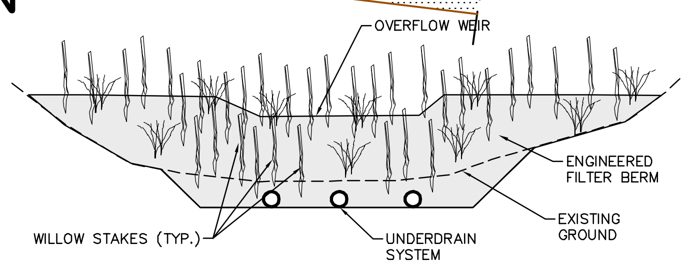
PROFILE



PLAN



SECTION A-A



SECTION B-B

NOTES:

A. STAGE 1 : REMOVAL OF SANDS, GRAVEL AND TRASH

B. STAGE 2 : FILTRATION AND NUTRIENT REMOVAL

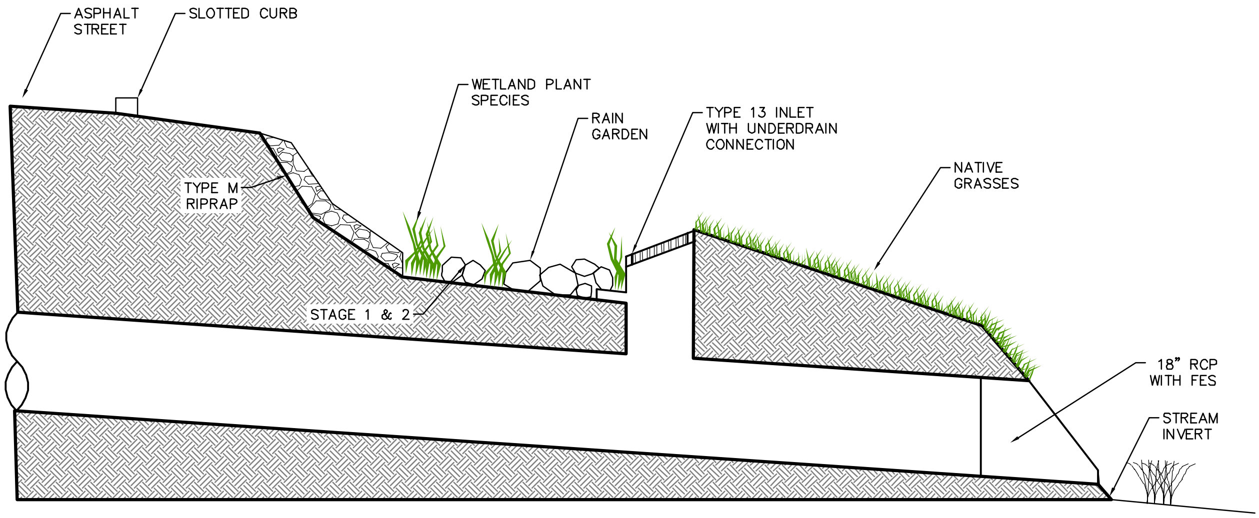
C. ENGINEERED FILTER BERM: TOPSOIL WRAPPED IN NATURAL FIBER EROSION BLANKET AND PLANTED WITH WILLOW STAKES AND GRASSES

WATER QUALITY – LIVING WALLS

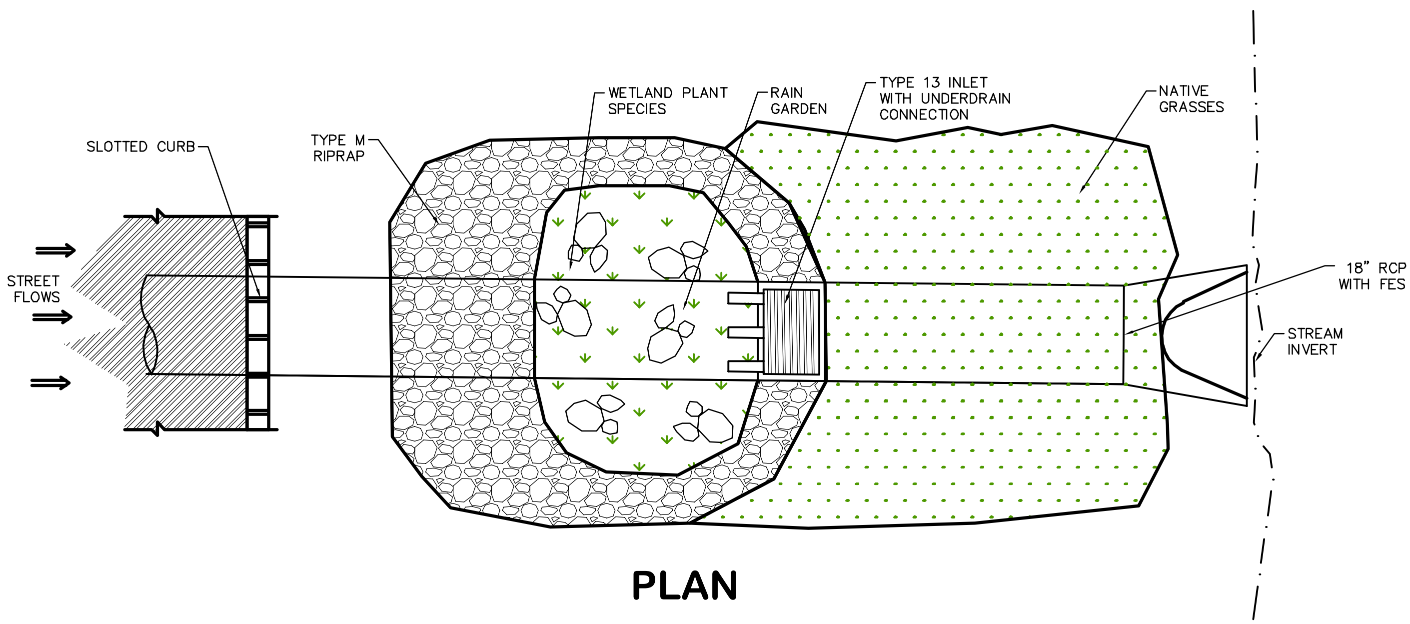
ICON

–OUTFALL WATER QUALITY TREATMENT CONCEPT–
WELL SUITED FOR STEEP SLOPES

DRAWN DDB	JOB NUMBER: 16-014-LYO-415
DESIGNED TWC	DATE: SEP. 2016
CHECKED TWC	SHEET: 3



PROFILE



PLAN

NOTES:

A. STAGE 1 ; REMOVAL OF SANDS, GRAVEL AND TRASH

B. STAGE 2 : FILTRATION AND NUTRIENT REMOVAL

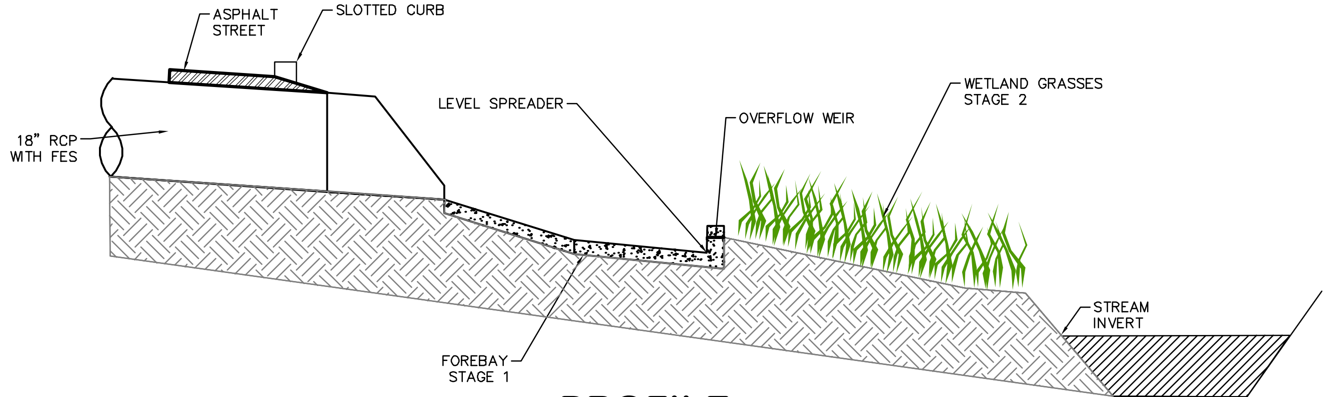
C. ENGINEERED SOIL: WELL GRADED GRANULAR SOIL WITH ORGANIC SUPPLEMENT.

WATER QUALITY – RAIN GARDEN

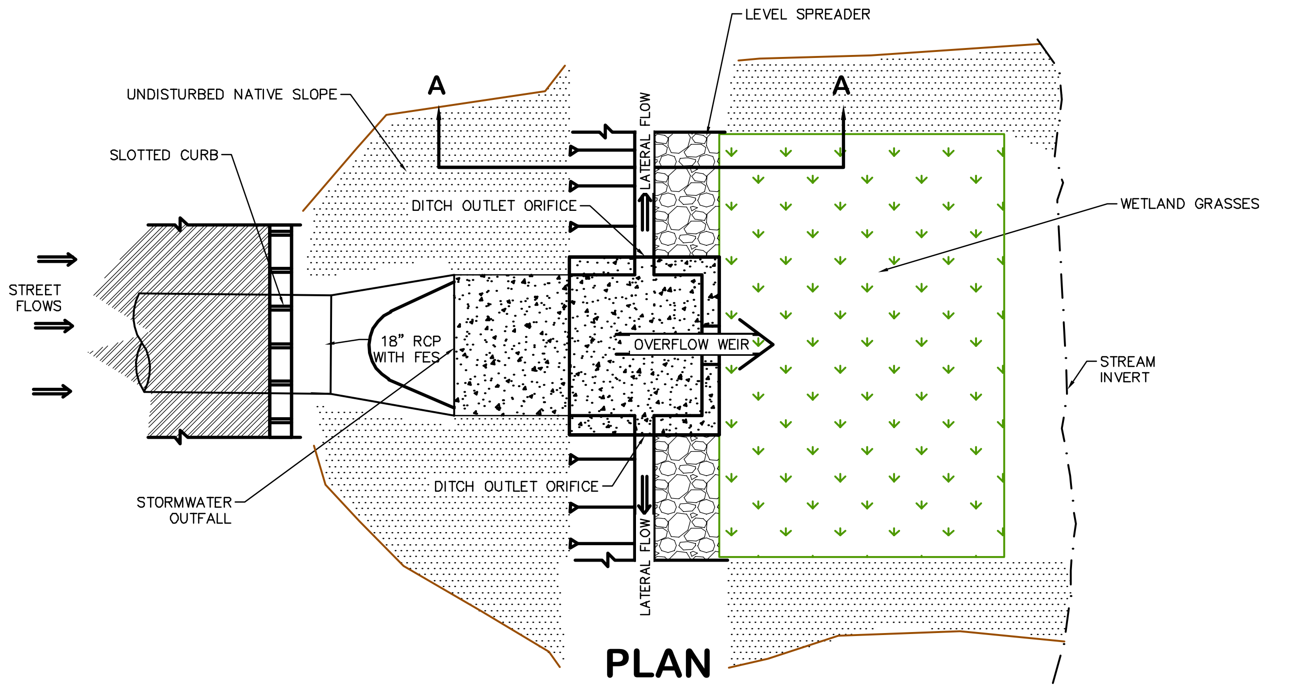
ICON

–OUTFALL WATER QUALITY TREATMENT CONCEPT–
WELL SUITED FOR IMPERVIOUS SURFACE RUNOFF,
REQUIRES PROXIMITY TO STORM SEWER

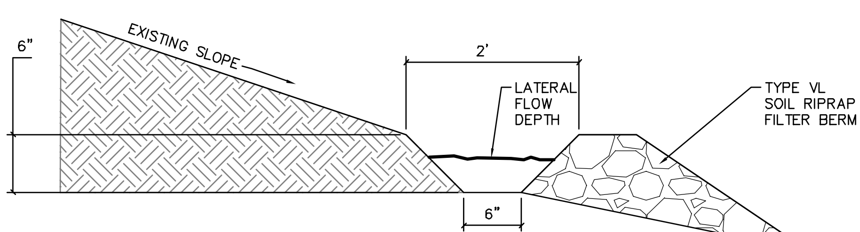
DRAWN DDB	JOB NUMBER: 16-014-LYO-415
DESIGNED TWC	DATE: SEP. 2016
CHECKED TWC	SHEET: 4



PROFILE



PLAN



CROSS SECTION A - A

NOTES:

A. STAGE 1 ; REMOVAL OF SANDS, GRAVEL AND TRASH

B. STAGE 2 : FILTRATION AND NUTRIENT REMOVAL

C. LATERAL DITCH SPREADS FLOWS ALONG SLOPE FOR INFILTRATION

WATER QUALITY – LEVEL SPREADER

ICON

–OUTFALL WATER QUALITY TREATMENT CONCEPT–
WELL SUITED FOR WIDE SOUTH FACING STREAM
BANK IN NEED OF SUPPLEMENTAL IRRIGATION

DRAWN DDB	JOB NUMBER:	16–014–LYO–415
DESIGNED TWC	DATE:	SEP. 2016
CHECKED TWC	SHEET:	5

Appendix

Water Quality

Draft Ordinance Outline

Sample Ordinance Language – Cherry Hills Village

Sample Ordinance Language – Boulder County

Sample Commercial and Mixed Use Design Standards and Guidelines – Town of Lyons

Draft Stormwater Ordinance Outline

The following is a brief outline of stormwater standards that can be considered for the Town of Lyons. In general, the Town's water quality requirements are less restrictive than those required by larger municipalities governed by the Clean Water Act (MS4) but more restrictive than other smaller, unincorporated towns along the Front Range. State law, and current Town ordinances, requires land owners to control stormwater to prevent adverse impacts to downstream property owners (including water right holders). Additional ordinances can require specific BMPS for stormwater quality – this ordinance outline provides some of the key elements for future work in that regard. Sections 7, 10, and 12 are stormwater specific, the remaining sections are typically composed with a team of legal, administrative, engineering, and Town staff.

1. Purpose and Need. The Town of Lyons is situated around the confluence of two rivers, in the foothills of the Front Range, with older developments in historic drainages, and new developments in large, steep watersheds. The proximity of development to the recreation and ecological areas along and in the streams requires attention to water quality. The character of the watersheds in the development areas requires attention to run-on and run-off to ensure new properties are reasonably safe from flooding.
2. Definitions. Generally standard definitions from Boulder County or other similar ordinance.
3. Prohibitions. Generally standard information from Boulder County or other similar ordinance.
4. Exemptions. Emergency and critical facilities could be listed here. For instance, wastewater treatment plants can be exempted from certain stormwater regulations due to their proximity to streams and requirements imposed by gravity fed systems that prevent relocation or modification for stormwater quality.
5. Requirements applicable to certain discharges. Generally standard information from Boulder County or other similar ordinance. Hazardous materials, oils, grease and other key pollutants have specific requirements related to department of health or other regulations.
6. Release reporting and clean up. This section can detail how a spill or contaminant is documented and cleaned up. Generally standard information from Boulder County or other similar ordinance.
7. **Best Management Practices.**
    a. **UDFCD Volume 3 best management practices can be referenced here.**
    b. **This can also include Town specific BMPs such as Rainwater Harvesting (110 gallons / residential lot).**
    c. **In general, these are water quality improvements treating stormwater runoff from impervious surfaces. Grass swales, rain gardens, rain barrels, and UDFCD volume 3 BMPs.**
8. General Permit Requirements. Not directly applicable because the Town is not managed by a Clean Water Act permit. Reserve this section for future use.
9. Technical Standards and Specifications. UDFCD Volumes 1, 2, and 3 can be referenced here.
10. **Storm Water Management Plan.**

a. **This is the section that details when a development or redevelopment site is required to design to the Town of Lyons storm drainage design and technical criteria.**

b. **Threshold. Not all sites will be required to meet storm drainage design and technical criteria, there is a threshold for which small projects are too small to implement design and technical criteria.**

    i. **Square footage. If a project adds more than 2000 square feet of additional impervious area, the applicant needs to design stormwater systems to prevent the additional runoff generated from that new area from causing adverse impacts (flooding, water quality impairment, etc.) downstream. The 2000 SF threshold was roughly based on paving a gravel driveway, but a 1000 SF or 500-SF threshold could be equally defensible.**

    ii. **Percent increase. To account for variable lot sizes, the percent increase could be the threshold. A project that increases imperviousness by more than 10% would be required to implement stormwater management designs (detention, water quality, etc.)**

    iii. **Tiered system. A tiered system could be implemented to further specify impervious area thresholds based on lot size. Lot sizes from 0 to 20,000 SF have to implement stormwater designs for increases over 50% of existing impervious. 20,000 SF to 50,000 SF need to implement stormwater designs if they increase more than 20% over existing impervious. Lots larger than than 50,000 SF need to implement stormwater control if impervious area increases more than 10%.**

c. **Stormwater Management Plan. This part of the ordinance directs the applicant to the submittal requirements of a plan and the storm drainage and technical criteria for which that submittal will be judged.**

11. Implementation of Approved Stormwater Management Plans. This section outlines how the stormwater requirements are constructed and inspected. This is also where erosion control BMPs and inspection is noted. This can be standard language from other sample ordinances.

12. **Post-Construction requirements for permanent best management practices. This section can explain the permanent blanket easement for water quality improvements. A blanket easement has been used to allow for changes within the property such as relocating a grass swale, changing location of a detention pond, etc. The blanket easement allows flexibility for future owners to treat stormwater in new and improved ways, as long as it is treated to the same level somewhere on the property. Sample language may be:**

    a. **Comprehensive Sample language: Maintenance of all permanent best management practices shall be ensured through the creation of a formal maintenance covenant that must be approved by the TOWN and recorded against the title of the subject property. The covenant shall be binding on all subsequent owners of land served by the permanent best management practices. As part of the covenant, a schedule shall be developed, detailing when and how often maintenance will occur to ensure proper function of the permanent best management practices. The covenant shall also include plans for periodic inspections by the TOWN to ensure proper performance of**

the facility between scheduled cleanouts. The covenant shall provide for access to the facility at reasonable times for periodic inspection or any required maintenance by the TOWN, or its contractor or agent, and for regular or special assessments of property owners to ensure that the facility is maintained in proper working condition to meet design standards and any other provisions established by this Chapter. The covenant shall be memorialized on the subdivision plat, annexation plat, development agreement or other instrument, or in a separate form acceptable to the TOWN and shall be recorded in the office of the County Clerk and Recorder.

b. **Simplified sample language: A blanket easement will be recorded on the applicant's property requiring the owner to maintain the stormwater improvements in perpetuity as judged by the Town's stormwater criteria (UDFCD vol. 3). This allows the owner and future owners to change the specific BMPs within the property as long as discharge from the site is still treated in accordance with town criteria.**

13. Enforcement. This can be standard language the Town uses for enforcement provisions.
14. Penalties. This can be standard language the Town uses for penalty provisions.
15. Upset Condition. This can be standard language the Town uses for upset provisions.

Sample Ordinance Language – Cherry Hills Village

This ordinance is provided for reference. As an NPDES MS4 (Clean Water Act) regulated municipality located within the Denver Metro urbanized area, Cherry Hills Village is required to meet the NPDES permit requirements. However, the City is uniquely composed of estate properties, many lots greater than 1 acre, and a rural character. As a result, the City has developed an ordinance that requires individual lot owners that develop or redevelop the property to install a permanent water quality BMP on the property. Furthermore, they require a blanket easement that is titled to the property requiring current and future property owners to maintain the function of that water quality BMP.

As noted, this is a unique situation for a unique community. However, the blanket easement and water quality BMP is something that could be considered to meet the Town of Lyons desire for increased water quality. By spreading water quality treatment across the Town, there is increased resilience from flood hazards because the smaller water quality features through the watershed can be brought back online quicker than larger regional facilities restricted to the lower end of the watershed.

This ordinance as written has little to no direct relevance to the Town of Lyons. However, with some modification, this kind of water quality language could be used to improve a specific, targeted portion of the Town of Lyons water quality regulation.

Sec. 19-1-120. - Post-construction requirements for permanent best management practices.

(a) Owners that are subject to the requirements of this Chapter, specifically including but not limited to Section 19-1-80 of this Article, are required to address stormwater runoff quality through the use of permanent best management practices and shall maintain those best management practices in perpetuity and in accordance with the requirements of this Section. If the permittee can document that permanent BMPs exist as part of an original or previous subdivision or building process, no new BMPs will be required if the existing BMPs meet the requirements of this Chapter, specifically including but not limited to Section 19-1-90, Technical standards and specifications.

(1) All permanent best management practices of any site including, without limitation, detention basins, retention basins, ponds, inlets, outlets, outfall ditches and structures for which the owner thereof or his or her predecessor-in-interest obtained approval from the City for the construction or establishment, shall be maintained in good repair and in substantially the form, condition and nature which was represented at the time they were constructed. It is the intention of this Section that such permanent best management practices, having once been approved for construction or development, shall not be allowed to deteriorate to a condition which is in any respect inferior to the condition or state upon which the original approval for construction or development was based. For purposes of this Section, either or both the owner or tenant of the structure or real property shall be considered the responsible party.

(2) Maintenance of all permanent best management practices shall be ensured through the creation of a formal maintenance covenant that must be approved by the City and recorded against the title of the subject property. The covenant shall be binding on all subsequent owners of land served by the permanent best management practices. As part of the covenant, a schedule shall be developed, detailing when and how often maintenance will occur to ensure proper function of the permanent best management practices. The covenant shall also include plans for periodic inspections by the City to ensure proper performance of the facility between scheduled cleanouts. The covenant shall provide for access to the facility at reasonable times for periodic inspection or any required maintenance by the City, or its contractor or agent, and for regular or special assessments of property owners to ensure that the facility is maintained in proper working condition to meet design standards and any other provisions established by this Chapter. The covenant shall be memorialized on the subdivision plat, annexation plat, development agreement or other instrument, or in a separate form acceptable to the City and shall be recorded in the office of the County Clerk and Recorder.

(b) Inspections of permanent best management practices.

(1) All permanent best management practices must undergo, at the minimum, periodic inspections by the City, as deemed appropriate by the City Manager, to document maintenance and repair needs and ensure compliance with the requirements of this Chapter and accomplishment of its purposes. These needs may include, but are not limited to: the removal of silt, litter and other debris from all catch basins, inlets, ponds and detention/retention basins, outlet structures and drainage pipes;

grass cutting and vegetation removal; and necessary replacement of landscape vegetation. Any maintenance needs found by City inspection or otherwise must be addressed in a timely manner, as determined by the City Manager. The inspection and maintenance requirement may be increased as deemed necessary to ensure proper functioning of the permanent best management practices.

(2) Inspection programs may be established by the City on any reasonable basis, including but not limited to: routine inspections; random inspections; inspections based upon complaints or other notice of possible violations; inspection of drainage basins or areas identified as higher than typical sources of sediment or other contaminants or pollutants; inspections of businesses or industries of a type associated with higher than usual discharges of contaminants or pollutants or with discharges of a type which are more likely than the typical discharge to cause violations of state or federal water or sediment quality standards or the CDPS stormwater permit; and joint inspections with other agencies inspecting under environmental or safety laws. Inspections may include but are not limited to reviewing maintenance and repair records; sampling discharges, surface water, groundwater and material or water in drainage control facilities; and evaluating the condition of drainage control facilities and other stormwater treatment practices.

(3) Parties responsible for the operation and maintenance of a permanent best management practice shall make records of its installation and of all maintenance and repairs, and shall retain the records for at least two (2) years. These records shall be made available to the City during inspection of the facility and at other reasonable times upon request.

(Ord. 06 §1, 2007; Ord. 10, 2009; Ord. 10 §1, 2012)

Sample Ordinance Language – Boulder County

This ordinance is provided for reference. The Boulder County ordinance generally applies to the Town of Lyons geographically, but is limited by the fact that Lyons itself is not an NPDES MS4 (Clean Water Act) regulated community. This ordinance provides a bookend for what would be the more complicated ordinance language and stormwater regulations for the Town.

ORDINANCE NO. 2012-4

AN ORDINANCE CONCERNING ILLICIT STORMWATER DISCHARGE

WHEREAS, the County is required by state and federal law, and as a condition of its State of Colorado stormwater discharge permit, to establish by ordinance methods for controlling the introduction of pollutants into the storm drainage system, in order to protect and enhance the water quality of the state's watercourses, water bodies, and wetlands in a manner pursuant to and consistent with the State and Federal Clean Water Act; and

WHEREAS, it is necessary to repeal Ordinance No. 2005-1 regulating illicit discharges, and to enact a new ordinance in order to incorporate changes recommended by the Colorado Department of Health, to delete unnecessary language and to improve on and simplify other language based on experience gained over the last seven years; and

WHEREAS, §30-15-401(11) provides that a county which holds a municipal separate storm sewer system permit pursuant to part 5 of article 8 of title 25, C.R.S., may adopt a storm water ordinance to develop, implement and enforce the stormwater management program required by the permit; and

WHEREAS, the Board of County Commissioners of Boulder County and Boulder County Public Health ("BCPH") are given additional authority to address the discharge and threatened discharge of pollutants to the waters of the State, including

> C.R.S. §18-4-511, which makes it a crime to place any foreign substance whether solid or liquid into any body of water or watercourse; and
>
> C.R.S.§30-15-401(1)(a)(V), which provides that, in addition to the authority given counties under §18-4-511, C.R.S., above, is authorized to do all acts and make all regulations which may be necessary or expedient for the promotion of health or the suppression of disease, including the authority to restrain, fine, and punish persons for dumping rubbish, including trash, junk and garbage on public or private property, and "public or private property" is defined at C.R.S.,§18-4-511 to include "waters and watercourses"; and
>
> C.R.S. §16-13-305(1)(e), which makes any unlawful pollution or contamination of any surface or subsurface waters in this state a Class 3 Public Nuisance; and

WHEREAS, BCPH is authorized to administer and enforce the laws pertaining to public health and water quality and to investigate and abate nuisances when necessary in order to eliminate conditions affecting public health; and

WHEREAS, this ordinance is necessary to protect the health, safety, and general welfare of the citizens of Boulder County through the regulation of non-stormwater discharges to the storm drainage system.

NOW, THEREFORE, BE IT ORDAINED by the Board of County Commissioners of Boulder County:

SECTION 1. PURPOSE/INTENT.

The objectives of this ordinance are:

1. To regulate the introduction of pollutants to the storm drainage system
2. To prohibit illicit connections and discharges to the storm drainage system
3. To establish procedures to carry out the inspection, surveillance and monitoring necessary to ensure compliance with this ordinance
4. To promote public awareness of the hazards involved in the improper discharge of trash, yard waste, lawn chemicals, pet waste, wastewater, grease, oil, petroleum products, cleaning products, paint products, hazardous waste, sediment and other pollutants into the storm drainage system.

SECTION 2. DEFINITIONS.

For the purposes of this ordinance, the following shall mean:

<u>Best Management Practices (BMPs)</u> means the schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

<u>Construction Activity</u> means activities including but not limited to clearing and grubbing, grading, excavating, and demolition.

<u>Illicit Discharge</u> means any direct or indirect non-stormwater discharge of pollutants to the storm drainage system, except as exempted in *Section 6.C.* of this ordinance.

<u>Illicit Connection</u> is defined as either of the following: Any drain or conveyance, whether on the surface or subsurface, which allows an illicit discharge to enter the storm drainage system, including but not limited to any conveyance which allows any non-stormwater discharge including sewage, process wastewater, and wash water to enter the storm drainage system, and any connection to the storm drainage system from indoor drains, sump pumps and sinks, regardless of whether said drain or connection had been previously allowed, permitted, or approved by BCPH.

<u>Hazardous Material</u> means any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Mobile Washing Operation is a commercial activity involving power washing, steam cleaning, and any other method of mobile cosmetic cleaning of, by way of example, the following: vehicles, fabric, pets and/or exterior surfaces.

National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit means a permit issued by EPA (or by a State under authority delegated pursuant to 33 USC § 1342(b) i.e. Colorado Discharge Permit System) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

Non-Stormwater Discharge means any discharge to the storm drainage system that is not composed entirely of stormwater.

Person means any individual, association, organization, partnership, firm, corporation or other entity recognized by law and acting as either the owner or as the owner's agent.

Pollutant means anything, which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; oil and other automotive fluids; non-hazardous liquid and solid wastes; yard wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects; accumulations that may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; hazardous substances and wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; wastes and residues that result from mobile washing operations; noxious or offensive matter of any kind, and any soil, rock, and any type of landscaping material**.**

Premises means any building, lot, parcel of land, or portion of land whether improved or unimproved, including adjacent sidewalks and parking strips.

Storm Drainage System means the publicly owned facilities by which stormwater is collected and conveyed, including, but no limited to, any roads and drainage systems, streets, gutters, curbs, catch basins, inlets, piped storm drains, pumping facilities, retention and detention basins, and natural and manmade or altered drainage, ditches/channels/lakes/reservoirs, and other drainage structures.

Stormwater means any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation.

Stormwater Pollution Prevention Plan or Stormwater Management Plan means a document which describes the Best Management Practices and activities to be implemented by a person or business to identify sources of pollution or contamination at a site and the actions to eliminate or reduce pollutant discharges to Stormwater, Stormwater Conveyance Systems, and/or Receiving Waters to the Maximum Extent Practicable.

Threatened Discharge means a condition creating a substantial probability of harm, when the probability and potential extent of harm make it reasonably necessary to take immediate action to prevent, reduce or mitigate damages to persons, property or natural resources.

Watercourse means a natural or artificial channel through which stormwater or floodwater can flow, either regularly or infrequently.

Waters of the State of Colorado (State waters) means any and all surface waters that are contained in or flow in or through the state of Colorado. The definition includes all watercourses, even if they are usually dry.

SECTION 3. APPLICABILITY.

This ordinance shall apply to all water entering the storm drainage system generated on any developed or undeveloped lands in unincorporated Boulder County, unless explicitly exempted by an authorized enforcement agency.

SECTION 4. RESPONSIBILITY FOR ADMINISTRATION.

Boulder County Public Health shall administer, implement, and enforce the provisions of this ordinance.

SECTION 5. ULTIMATE RESPONSIBILITY.

The standards set forth herein and promulgated pursuant to this ordinance are minimum standards; therefore this ordinance does not intend nor imply that compliance by any person will ensure that there will be no contamination, pollution, nor unauthorized discharge of pollutants.

SECTION 6. DISCHARGE PROHIBITIONS, EXEMPTIONS AND REQUIREMENTS.

A. Prohibition of Illicit Discharges

1) No person shall discharge or cause to be discharged into the storm drainage system or watercourses any pollutants or waters containing any pollutants that cause or contribute to a violation of applicable water quality standards, other than stormwater.

2) It shall be unlawful to cause pollutants to be deposited in such a manner or location as to constitute a threatened discharge into the storm drainage system or waters of the State. Pollutants that are no longer contained in a pipe, tank or other container are considered to be threatened discharges unless they are actively being cleaned up.

B. Prohibition of Illicit Connections

The construction, use, maintenance or continued existence of illicit connections to the storm drainage system is prohibited. This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.

C. Exemptions

The commencement, conduct or continuance of any illicit discharge to the storm drainage system is prohibited except as described as follows:

1) The following discharges are exempt from the discharge prohibitions established by this ordinance when properly managed: water line flushing or other potable water sources, landscape irrigation or lawn watering, diverted stream flows, rising ground water, uncontaminated ground water infiltration to storm drains, uncontaminated pumped ground water, foundation or footing drains, crawl space pumps, air conditioning condensation, springs, non-commercial washing of vehicles, natural riparian habitat or wetland flows, swimming pools (if dechlorinated - typically less than one PPM chlorine).

2) Discharges from emergency firefighting activities and water incidental to street sweeping (including associated sidewalks and medians) not associated with construction.

3) Dye testing is an allowable discharge, but requires a verbal notification to BCPH 24 hours prior to the time of the test.

4) The discharge prohibition shall also not apply to any non-stormwater discharge permitted under an NPDES or CDPHE permit.

5) The prohibitions set forth in this section shall not apply to any non-stormwater discharge for which an authorization, or formal commitment to not pursue enforcement actions under a policy or waste discharge order is issued and administered under the authority of the CDPHE, provided that the discharger is in full compliance with all requirements of the policy or order.

D. Requirements Applicable to Potential Dischargers

1) Cleaning of Paved Surfaces Required. The owner of any paved parking lot, street or drive shall clean the pavement as required to prevent the buildup and discharge of pollutants. The visible buildup of mechanical fluid, waste materials, sediment or debris is a violation of this ordinance. Paved surfaces shall be cleaned by dry sweeping, wet vacuum sweeping, collection and treatment of wash water or other methods in compliance with this Ordinance.

2) Mobile Washing Operations. Mobile washing operations shall not discharge to the storm drainage system in violation of this Ordinance.

3) Maintenance of Equipment. Any leak or spill related to equipment maintenance in an outdoor, uncovered area should be contained to prevent the potential release of pollutants.

4) Materials Storage: Materials including, but not limited to, stockpiles used in construction and landscaping activities shall be stored to minimize the release of pollutants.

5) Pesticides, Herbicides and Fertilizers. Pesticides, herbicides and fertilizers shall be applied in accordance with manufacturer recommendations and applicable laws. Excessive application shall be avoided.

SECTION 7. INDUSTRIAL OR CONSTRUCTION ACTIVITY DISCHARGES.

Any person subject to an industrial or construction activity NPDES stormwater discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to BCPH prior to the allowing of discharges to the storm drainage system.

SECTION 8. ACCESS AND INSPECTION OF PROPERTIES AND FACILITIES.

1) Whenever BCPH has reasonable cause to believe that there exists, or potentially exists, in or upon any premises any condition which constitutes a violation of this ordinance, BCPH shall have the right to enter the premises at any reasonable time to determine if the owner or operator is complying with all requirements of this ordinance. In the event that the owner or occupant refuses entry after a request to enter has been made, BCPH is hereby empowered to seek assistance from a court of competent jurisdiction in obtaining such entry.

2) Any violation that is part of the County's stormwater quality management program required by the County's MS4 permit from the Colorado Water Quality Division, and that remains unabated following notice of violation, may be administratively abated by the County in accordance with C.R.S. section 30-15-401(11). BCPH shall seek an administrative entry and abatement (seizure) warrant, and shall execute the warrant in accordance with the directions of the court. BCPH may assess the reasonable cost of the abatement, including five percent for inspection and other incidental costs, upon the property by recording a notice of such assessment with the County Clerk and Recorder specifying a reasonable time within which the assessment must be paid to the County, which generally shall be within thirty (30) days. Once recorded, the assessment shall be a lien against the property until paid and shall have priority based upon its date of recording. If the assessment is not paid within the time specified in the notice, BCPH may request the County Clerk and Recorder certify that fact to the County Treasurer, who shall collect the assessment, together with a ten percent penalty for the cost of collection, in the same manner as taxes are collected.

3) BCPH shall have the right to set up on the property of any discharger to the storm drainage system such devices that are necessary to conduct an investigation of such discharges. The investigation may include, but is not limited to, the following: sampling of any discharge or process waters, the taking of photographs, interviewing staff on alleged violations, and access to any and all facilities or areas within the premises that may have any effect on the discharge.

4) BCPH may, without prior notice, act to prevent an actual or threatened discharge which presents or may present an imminent danger to the environment, public health or safety, or to the storm drainage system or waters of the State. If a Person fails to comply with a verbal or written order issued in such an emergency, BCPH may take such steps as are necessary to prevent or minimize the danger.

SECTION 9. REQUIREMENT TO PREVENT, CONTROL, AND REDUCE STORMWATER POLLUTANTS BY THE USE OF BEST MANAGEMENT PRACTICES.

The owner or operator of a commercial or industrial establishment shall provide, at their own expense, reasonable protection from accidental discharge of prohibited materials or other wastes into the storm drainage system or watercourses through the use of these structural and non-structural BMPs. Further, any person responsible for a property or premises, which is, or may be, the source of an illicit discharge may be required to implement, at said person's expense, additional structural and non-structural BMPs to prevent the further discharge of pollutants to the storm drainage system.

SECTION 10. NOTIFICATION OF SPILLS.

Notwithstanding other requirements of law, as soon as any person responsible for a premises, or responsible for emergency response for such premises has information of any known or suspected release of materials which are resulting or may result in illicit discharges into stormwater, the storm drainage system, or waters of the State, said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release of hazardous materials said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services.

SECTION 11. VIOLATIONS, ENFORCEMENT AND PENALTIES.

Notice of Violation.

Whenever BCPH finds that a person has violated a prohibition or failed to meet a requirement of this Ordinance, BCPH may order compliance by verbal or written notice of violation to the responsible person. Such notice may require without limitation:

(1) The immediate elimination of illicit connections or discharges;
(2) That violating discharges, practices, or operations shall cease and desist;
(3) The abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property;
(4) Payment to cover administrative and remediation costs; and
(5) The implementation of source control or treatment BMPs.

Once the illicit discharge or connection is eliminated, and if abatement of a violation and/or restoration of affected property is required, the notice shall set forth a deadline within which such remediation or restoration must be completed. Said notice shall further advise that, should the violator fail to remediate or restore within the established deadline, BCPH may seek the enforcement of the work through injunction or other legal means, or the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the violator.

Criminal Prosecution.

Any person that has violated or continues to violate this ordinance shall be liable to criminal prosecution to the fullest extent of the law, and shall be subject to a criminal penalty authorized pursuant to Colorado Revised Statutes, Title 30, Article 15. BCPH may recover all attorneys' fees, court costs and other expenses associated with enforcement of this ordinance, including sampling and monitoring expenses.

Violations Deemed a Public Nuisance.

In addition to the enforcement processes and penalties provided, any condition caused or permitted to exist in violation of any of the provisions of this Ordinance is a threat to public health, safety, and welfare, and is declared and deemed a nuisance, and may be summarily abated or restored at the violator's expense, and/or a civil action to abate, enjoin, or otherwise compel the cessation of such nuisance may be taken.

Remedies Not Exclusive.

The remedies listed in this ordinance are not exclusive of any other remedies available under any applicable federal, state or local law, and it is within the discretion of BCPH to seek cumulative remedies.

SECTION 12. SEVERABILITY.

If any provision, clause, sentence or paragraph of this Ordinance or the application thereof to any person or circumstances shall be held invalid, such invalidity shall not affect the other provisions of this Ordinance which can be given effect without the invalid provision or application, and to this end the provisions of this Ordinance are declared to be severable.

SECTION 13. EFFECTIVE DATE, REPEAL OF PRIOR ORDINANCE.

This article shall be effective sixty (60) days from and after the date of its adoption and final publication. Ordinance No. 2005-1 shall be repealed as of such effective date.

INTRODUCED, READ AND ADOPTED ON FIRST READING on October 30, 2012, and ordered published in the BOULDER DAILY CAMERA.

THE BOARD OF COMMISSIONERS
OF THE COUNTY OF BOULDER, COLORADO

____

Cindy Domenico, Chair

ATTEST:

____
Clerk to the Board

ADOPTED ON SECOND AND FINAL READING on November 29, 2012.

THE BOARD OF COMMISSIONERS
OF THE COUNTY OF BOULDER, COLORADO

____
Cindy Domenico, Chair

ATTEST:

____
Clerk to the Board

TOWN OF LYONS

COMMERCIAL DEVELOPMENT AND MIXED USE DEVELOPMENT

DESIGN STANDARDS AND GUIDELINES

Adopted ______________

Sample Commercial and Mixed Use Design Standards and Guidelines – Town of Lyons

This is provided for reference only. This is sample language used in previously published standards and guidelines. This general language and intent could be merged with a truncated and reduce version of the Boulder Ordinance. This general language and intent could be merged with an expanded and customized Cherry Hills Village water quality ordinance.

In any case, these references are meant to provide general parameters, parts, and recommendations for customizing an ordinance or other legislation to support the sustainable management of stormwater quality in the Town of Lyons.

6. Dumpsters and their enclosures shall be located and designed to facilitate collection and to minimize negative impact on-site or to neighboring properties, or public rights-of-way**. (S)**
7. All dumpsters and all other waste disposal activities shall be adequately screened or otherwise concealed from the view of persons traveling on any public street, sidewalk or other public ways. **(S)**

H. Water Quality Control and Drainage

Intent: Preserve natural drainage and design stormwater improvements as landscape amenities to enhance the project, slow stormwater runoff, capture water pollutants, prevent erosion and minimize impervious surfaces. Storm water and snow-melt from rooftops, paved areas, and lawns carry plant debris, soil particles, and dissolved chemicals into rivers and streams. Site development plans should employ management and best engineering practices to protect storm water discharge from these undesirable elements, before releasing water off site or into the Town's storm drainage system or natural waterways.

Site drainage should be designed to minimize water collection near building foundations, entrances, service ramps and primary pedestrian routes.

In addition to the Town of Lyons's Storm Drainage and Technical Criteria, the following standards and guidelines apply.

Standards and Guidelines:

1. Storm water should not drain directly into the public storm drainage system or released overland into rivers or streams without first going through peak runoff mitigation and water quality treatment systems. **(G)**
2. Design all storm sewers, grassed swales and other drainage channels in accordance with the Town of Lyons storm drainage design and technical criteria. **(S)**
3. Avoid hard concrete-lined channel designs, where practical. If a hard channel design is necessary, use a more natural approach that incorporates river rock or natural rock channel lining when possible. **(G)**
4. Utilize accepted design criteria and recommendations of the Urban Drainage and Flood Control District (or other commonly recognized and appropriate engineering standards) and the Town of Lyons for detention pond design and to enhance water quality. **(S)**
5. Design on-site drainage and detention facilities with attractive, landscape features and amenities. **(S)**
6. Integrate local durable materials in pond design, such as flagstone terracing. **(G)**
7. Every development plan shall be accompanied by a drainage plan and report prepared by a licensed professional engineer in the State of Colorado in accordance with the Manual of Design Criteria and Standard Specifications for the Construction of Public Improvements. **(S)**
8. The plan and report is subject to review and acceptance by the Town. **(S)**

9. The drainage design shall:
    a. Restrict runoff from a parcel to historic conditions, unless otherwise indicated in the Town's Master Drainage Plan, or demonstrate that doing so would be detrimental to the overall system; **(S)**
    b. Accept and convey runoff in its historic manner, unless otherwise indicated in the Town's Master Drainage Plan, or unless other offsite permanent arrangements are made. **(S)**
    c. Include easements in favor of the Town to facilitate emergency maintenance of controls, structures, features or other improvements that, when not operating correctly, could result in damage to adjacent property or to the Town. **(S)**
    d. Respect existing conditions and adjacent properties and follow general topographic constraints of the site and adjacent lands. **(S)**
10. Drainage improvements serving a regional area may be turned over to the Town for ownership and maintenance if accepted by the Board of Trustees and approved easements and agreements are in place. Drainage improvements serving a common ownership, cluster development, shopping plaza, industrial park, or other similar development will remain under the ownership and maintenance of the owner or managing association. Easements will be required in favor of the Town as noted above. **(S)**
11. Drainage plans and reports shall be accompanied by an Erosion and Sediment Control Plan. **(S)** Erosion and Sediment Control Plans are required for construction and for permanent improvements. Erosion and Sediment Control Plans shall:
    a. Encompass the phasing of a development or site design. **(S)**
    b. Be in consideration of other upstream and downstream property owners, drainage conveyances, and the north and south St. Vrain Creeks. **(S)**
    c. Protect existing vegetation. **(S)**
    d. Minimize disturbance to natural lands and geologic features. **(S)**
    e. Address construction related dust mitigation. **(S)**
    f. Include details and specifications for the proper installation and maintenance of temporary and permanent improvements. **(S)**
    g. Comply with all applicable state and federal standards including but not limited to the Colorado State Department of Health and Environment. **(S)**
12. Parking Lot Stormwater Management:
    a. Stormwater runoff should be routed or directed over perimeter and interior plantings to the greatest extent possible. **(G)**
    b. Stormwater runoff management should facilitate infiltration as close to where it falls as possible provided it does not harm structures or hard surface pavements. **(G)**
    c. The consolidation of planting islands to be used for storm water quality enhancement is encouraged and allowed for the promotion of plant growth and cleansing of runoff. **(G)**
    d. The use of biofiltration techniques such as constructed rain gardens to filter pollutants carried by runoff and infiltrate stormwater for irrigation is recommended. **(G)**
    e. Use of permeable concrete or asphalt pavement systems for parking lots is strongly encouraged. **(G)**

13. The Town of Lyons considers sustainability to be an important consideration for today's actions. As such, drainage design should consider sustainability through local treatment of surface runoff, infiltration and capture and use of runoff on site (provided such use is not in violation of applicable State regulations).

Appendix E - DRAINAGE CRITERIA

TOWN OF LYONS

STORM DRAINAGE CRITERIA ADDENDUM

TO URBAN DRAINAGE STORM DRAINAGE CRITERIA MANUALS (VOLUMES 1, 2, AND 3)

Date: October 2016

Prepared By: ICON Engineering

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Purpose of this Manual

The purpose of this manual is to set forth the criteria to be used in the design of drainage systems within the Town of Lyons, Colorado. All subdivision plats, planned unit development, or any other proposed construction must include adequate storm drainage analysis using this manual supplemented by the UDSCM and Boulder County criteria as a guide.

Whenever possible master drainage plan studies should be referenced for proposed developments located within the study area. Although the Town of Lyons lies outside of the Urban Drainage and Flood Control District, the regional drainage concepts written in the Urban Storm Drainage Criteria Manual (USDCM) can be applied to Lyons. Many of the communities outside of Denver have also adopted the UDSCM for their communities with an addendum to fit their specific community needs.

All section numbers referenced are based off of USDCM Volumes 1, and 2 dated June 2001 Revised April 2008, and USDCM Volume 3 dated November 2010 available for download from their website at www.udfcd.org.

Prior to any construction of development activity, there must be an adequate plan for storm drainage in compliance with all regulations and specifications set forth in this Manual and approved by the Town.

Master Drainage Study

Any annexation or planned unit development (PUD) in excess of 40 acres or phased commercial/industrial development in excess of 10 acres is required to prepare a master drainage study. The purpose of the study is to identify major drainageways, ponding areas, siting and sizing of culverts, bridges, open channels and drainage basins which are tributary to the proposed development. The master drainage study should discuss alternatives to the drainage problems identified by the study. Downstream drainage facilities should be thoroughly analyzed to confirm they can convey the developed runoff. The report shall include but not be limited to:

- Calculations for peak flow from all off-site tributary drainage basins.
- Calculations for peak flow within the proposed development.
- Discussion and analysis of downstream facilities.
- Discussion of drainage problems and solutions which may be anticipated to occur within the development.
- Reports shall be bound and typed on 8-1/2” x 11” paper.

The drawings shall include, but not limited to the following information:

- Any and all flood plains
- Existing topography (Two-foot intervals)
- Location and size of open channels, bridges, culverts, storm sewers, and ponding areas.
- Identification of drainage basins within and tributary to the development.
- Location of all streets.

- Scales as small as 1”=500’ may be used to show the entire development and all off-site drainage areas. (Drawings shall be 22” x 34”).

Preliminary Drainage Report

A preliminary drainage report must be approved prior to approval of any final plat, planned building group or planned unit development. The report must be approved by engineering and planning staff prior to Planning Commission action. A Planning Commission action without engineering approval risks violation of State statues for water rights, floodplain regulations, and other water resource criterion.

The purpose of the preliminary drainage study is to identify and propose specific solutions to any on-site drainage problems that will occur as a result of the proposed development. Off-site information required on the preliminary drainage study is similar to that of the master drainage study and may be omitted from the preliminary drainage study when adequately analyzed by a master drainage study. The preliminary drainage report must include adequate topography to verify all conclusions regarding off-site drainage. Unless known, the capacity of downstream drainage structures must be thoroughly analyzed to determine their ability to convey the developed discharge.

Whenever the possibility of downstream flooding or property damage exists, it will be necessary to utilize either detention or retention ponds to reduce the developed discharge to an acceptable rate.

The preliminary drainage report shall include, but not limited to:

- A description of the property (Township, Range, Section, surrounding developments, major drainage channels, general topography, ground cover).
- Detailed analysis of receiving structures
- Adequate on-site analysis to determine the location and required capacity of culverts, bridges, open channels, detention ponds and storm sewers
- Report shall be bound and typed on 8-1/2” x 11” paper. Drawings, figures, plates, and tables shall be bound with the report or included in a folder/pocket attached to the report.

Drawings accompanying the report shall include, but not limited to, the following:

- Scales as small as 1”=500’ may be used to show the entire development and all off-site drainage areas. (Drawings shall be 22” x 34”).
- All floodplains affecting the property must be shown.
- Topography map of the development showing street layout and/or building location on a contour interval not to exceed two feet
- Location and size of all drainage structures
- Drainage patterns within the proposed developments

Whenever open channels are planned, the following additional information shall be required:

- Preliminary profile showing existing and proposed grades

- Cross sections on 100-foot stations showing existing and proposed cross sections and required right-of-way
- Location and size of all structures
- As-built profiles of any existing utilities which may be affected by the channel construction.

Inlet and storm sewer size calculations are not required with the preliminary drainage study because the number of subbasins analyzed in the report should be held to the smallest practical amount.

Final Drainage Report

The final drainage report shall be a detailed study and analysis of the proposed development. It shall include detailed calculations for all runoff within the proposed development, and detailed calculations for the design of all drainage structures within the development. The final drainage report shall be typed on 8-1/2" x 11" paper. Drawings, figures, plates, and/or tables shall be bound with the report or included in a folder/pocket attached to the report.

Construction plans for all drainage structures, grading plans and street grades, where applicable, shall also be included with and considered as a part of the final drainage study.

Drawings and calculations comprising the final drainage report shall include but not limited to:

- Existing and proposed contours (Two-foot intervals)
- Location and elevations of city benchmarks. All elevations shall be on a NAVD 88 datum.
- Property lines
- Street, names and grades
- Existing drainage facilities and structures, including existing irrigation ditches, roadside ditches, drainageways, swales, gutter flow directions, culverts, etc. All pertinent information such as size, shape, slope, location, etc., shall also be included to facilitate review and approval of drainage plans.
- Overall drainage area boundary and drainage subarea boundaries
- Proposed type of curb and gutter, gutter flow direction, including cross pans.
- Proposed storm sewers and open drainageways and right-of-way requirements, including proposed inlets, manholes, culverts, erosion control and energy dissipation devices, and other appurtenances.
- Proposed outfall point for runoff from the developed area and facilities to convey flows to the final outfall point without damage to downstream properties.
- Routing and accumulative flows at various critical points for the minor storm runoff
- Routing and accumulative flows at various critical points for the major storm runoff
- Details of detention storage facilities and outlet works.
- Critical minimum finished floor elevations for protection from major storm runoff.
- An overall drawing of the proposed development which shall show the following information:
    - Location and size of all drainage structures
    - General flow patterns within the development

- Finished floor elevations of all buildings
- Flood level in all streets in which the curb is overtopped during the 100-year storm.
- All drainage basins within the development.
- All floodplains within the proposed development
- Location and elevation of all existing and proposed utilities affected by or affecting the drainage design
- All drawings shall be on 22” x 34” sheets.

USDCM VOLUME 1

DRAINAGE POLICY

1.1 Policy – Accepted

1.2 Principles – Accepted

1.3 Basic Knowledge – Accepted

1.4 Planning – Accepted

Change:

"A master plan for storm drainage should be developed and maintained in an up-to-date fashion at all times for each urbanizing drainage watershed in the Denver region."

To:

"The town Masterplan should be updated based on annexations, hydrologic study changes by FEMA, CWCB, or other agencies, and following capital improvement projects, or not less than every five (5) years."

1.5 Technical Issues– Accepted

Change:

"Proper design and construction of stormwater detention and retention basins are necessary to minimize future maintenance and operating costs to avoid public nuisances and health hazards. This is particularly important, given the many detention and retention facilities in the Denver region."

To:

Proper design and construction of stormwater detention basins are necessary to minimize future maintenance and operating costs to avoid public nuisances and health hazards.

Change:

"The various governmental agencies within the Denver region have adopted and need to maintain their floodplain management programs."

To:

The Town of Lyons has adopted the FEMA NFIP floodplain ordinance as required by the CWCB and needs to maintain their floodplain management programs.

1.6 Flood Insurance – Accepted

1.7 Implementation – Accepted

2.0 PRINCIPLES

2.1 Drainage Is a Regional Phenomenon That Does Not Respect the Boundaries Between Government Jurisdictions or Between Properties – Accepted

2.2 A Storm Drainage System Is a Subsystem of the Total Urban Water Resource System – Accepted

2.3 Every Urban Area Has an Initial (i.e., Minor) and a Major Drainage System, Whether or Not They Are Actually Planned and Designed – Accepted

2.4 Runoff Routing Is Primarily a Space Allocation Problem – Accepted

2.5 Planning and Design of Stormwater Drainage Systems Generally Should Not Be Based on the Premise That Problems Can Be Transferred From One Location to Another – Accepted

2.6 An Urban Storm Drainage Strategy Should Be a Multi-Objective and Multi-Means Effort – Accepted

2.7 Design of the Stormwater Drainage System Should Consider the Features and Functions of the Existing Drainage System – Accepted

2.8 In New Developments, Attempts Should Be Made to Reduce Stormwater Runoff Rates and Pollutant Load Increases After Development to the Maximum Extent Practicable – Accepted

2.9 The Stormwater Management System Should Be Designed Beginning With the Outlet or Point of Outflow From the Project, Giving Full Consideration to Downstream Effects and the Effects of Off-Site Flows Entering the System – Accepted

2.10 The Stormwater Management System Should Receive Regular Maintenance – Accepted

2.11 Floodplains Need to Be Preserved Whenever Feasible and Practicable – Accepted

2.12 Reserve Sufficient Right-of-Way for Lateral Movement of Incised Floodplains – Accepted

3.0 BASIC KNOWLEDGE – Deleted *(Although the concepts by title are valuable to the Town of Lyons, the content is UDFCD specific and is therefore deleted to avoid confusion. i.e. 3.1.4 Library references plans and reports within the UDFCD.)*

3.1 Data Collection - Deleted

3.1.1 Storm Runoff and Flood Damage - Deleted

3.1.2 Rainfall-Runoff Relationships - Deleted

3.1.3 Inventory of Successful Projects - Deleted

3.1.4 Library - Deleted

3.1.5 Runoff Magnitudes - Deleted

3.2 Floodplain Data - Deleted

3.2.1 Small Waterways - Deleted

3.2.2 Data Inventory - Deleted

3.2.3 Floodplains - Deleted

3.2.4 Priority for Data Acquisition - Deleted

3.3 Data Use - Deleted

3.3.1 Master Plan - Deleted

3.3.2 Public Cost - Deleted

3.3.3 Easements - Deleted

4.0 PLANNING

4.1 Total Urban System - Amended

Change:

“Master plans for storm drainage have been developed and maintained in an up-to-date fashion for most of the watersheds in the Denver region. An effort to complete the coverage of master plans for yet unplanned areas of the District should be continued until full coverage is achieved.”

To:

“The Town Master Plan should be updated based on annexations, hydrologic study changes by FEMA, CWCB, or other agencies, and following capital improvement projects, or not less than every five (5) years.”

4.1.1 Development Plan - Accepted

4.1.2 Master Plan- Amended- Amended

Delete entire first paragraph

Change:

"The District has established a suitable format for master plan reports and drawings so that a uniform planning approach and coordination of efforts can more easily be made. Master planning should be done in enough detail and with adequate thoroughness to provide a ready drainage development guide for the future in a particular watershed. "

To:

"Any master plan for the town should be done in enough detail and with adequate thoroughness to provide a ready drainage development guide for the future. Guidelines for drainage reports are provided in sections for the Master Drainage Study, Preliminary Drainage Report, and Final Drainage Report."

4.1.3 Planning Process Ingredients- Amended

Change:

"2. Initial Drainage System Planning. All local and regional planning must take into consideration the initial drainage system to transport the runoff from storms expected to occur once every 2 to 10 years."

To:

2. Initial Drainage System Planning. All local and regional planning must take into consideration the initial drainage system to transport the runoff from storms expected to occur once every 2 years.

4.1.4 Local and Regional Planning- Accepted

4.1.5 Site Planning- Accepted

4.1.6 Water Quality- Amended

Change:

"Sanitary sewage systems that overflow or bypass untreated sewage into surface streams should not be permitted in the Denver region."

To:

Sanitary sewage systems that overflow or bypass untreated sewage into surface streams should not be permitted in the town.

4.2 Multiple-Objective Considerations- Accepted

4.2.1 Lower Drainage Costs- Accepted

4.2.2 Open Space - Accepted

4.2.3 Transportation - Accepted

4.3 Natural Channels- Accepted

4.3.1 Channelization- Amended

Add:

It shall be the policy of the town to review proposed channel designs on a case-by-case basis. Proposed modifications to natural channels shall be approved only if the work causes no injury to water rights and is not in violation of State of Federal Law.

4.3.2 Channel Storage- Accepted

4.3.3 Major Runoff Capacity- Accepted

4.3.4 Maintenance and Maintenance Access- Accepted

4.4 Transfer of Problems- Accepted

4.4.1 Intra-Watershed Transfer- Accepted

4.4.2 Inter-Watershed Transfer- Accepted

4.4.3 Watershed Planning- Accepted

4.5 Detention and Retention Storage- Amended

Add:

“The policy of the Town of Lyons shall be to require regional and/or on-site detention for all future developments. Temporary or interim detention/retention may be required if the downstream regional facilities have not yet been constructed per the applicable Master Plan. It is the town’s policy to require detention of runoff from the 100-year storm falling on the developed site and release of the detained water at the rate of the runoff of the 5-year storm falling on the undeveloped site. Detention releases based on soil types are not approved for the town.

Proposed development must provide for the safe conveyance of offsite flows through the proposed development site. Offsite flow may be routed through or around the proposed detention facilities. Positive drainage must be provided. The town will not approve any detention pond that does not drain in less than 72 hours, or causes injury to water rights, or is in violation of State or Federal law.

All detention facilities must be recorded with the State database: Stormwater Detention and Infiltration Facility Notification in compliance with Colorado Revised Statute §37-92-602(8)(b)(I)(A). Additional information is presented on the state website: https://maperture.digitaldataservices.com/gvh/?viewer=cswdif

Owing to the updated guidance from the State Engineer on 72 hour drain time, retention facilities must meet that same threshold. Retention facilities holding water longer than 72 hours are subject to review by the State Engineer for water rights, augmentation, or other basin requirements. At a minimum, any drainage plan proposing retention facilities must prove infiltration rates of soils in the retention facility can empty the pond within 72 hours. Drainage plans proposing retention must also consider clogging pore spaces in the pond bottom, seasonal variation in groundwater and its impact on infiltration rates, and other criteria required by the Town Engineer.

4.5.1 Upstream Storage - Accepted

4.5.2 Minimized Directly Connected Impervious Area Development - Accepted

4.5.3 Downstream Storage - Accepted

4.5.4 Reliance on Non-Flood-Control Reservoirs - Amended

Delete entire paragraph

Add:

"Jurisdictional dams are classified by the State Engineer as low, moderate, or high hazard structures depending on conditions downstream. Dams are classified as high hazard structures when, in the event of failure, there is a potential loss of life. Dams presently rated as low or moderate hazard structures may be changed to high hazard rating if development occurs within the potential path of flooding due to a dam breach. In this case, the reservoir owners would be liable for the cost of upgrading the structure to meet the higher hazard classification.

The Policy of the Town of Lyons shall be to:

1. Restrict upstream development to areas outside of the jurisdictional dam water surface elevation created by a 100-year storm plus freeboard.

2. Restrict downstream development to areas outside of the jurisdictional dam 100-year floodplain. The jurisdictional dam 100-year floodplain is defined as either:

   a. The 100-year floodplain downstream of the emergency spillway assuming the dam is full to the elevation of the emergency spillway at the beginning of the 100-year storm and the 100-year storm is routed through the dam and out the emergency spillway,

   b. Or the path that the basin's 100-year floodplain would form through the downstream development if the dam were removed by the owner.

4.5.5 Reliance on Embankments - Amended

Change:

“The detention of floodwaters behind embankments created by railroads, highways or roadways resulting from hydraulically undersized culverts or bridges should not be utilized by the drainage engineer for flood peak mitigation when determining the downstream flood peaks for channel capacity purposes unless such detention has been covered by a binding agreement approved by the District.”

To:

“The detention of floodwaters behind embankments created by railroads, highways or roadways resulting from hydraulically undersized culverts or bridges should not be utilized by the drainage engineer for flood peak mitigation when determining the downstream flood peaks for channel capacity purposes unless such detention has been covered by a binding agreement approved by the Town.

Historical development within the Town limits includes mining, rail, and associated infrastructure subsequently repurposed in part or in full for private and public uses. Applicants should carefully review existing topographic features to ensure stability of embankments, fill, slopes, and other surface and sub-surface features.”

5.0 TECHNICAL CRITERIA

5.1 Design Criteria - Amended

Change:

“Storm drainage planning and design should adhere to the criteria developed and presented in this Manual maintained by the District.”

To:

“Storm drainage planning and design should adhere to the criteria developed and presented in this Manual maintained by the Town.”

5.1.1 Design Criteria- Amended

Change:

“The design criteria presented herein represent current good engineering practice, and their use in the Denver region is recommended. The criteria are not intended to be an ironclad set of rules that the planner and designer must follow; they are intended to establish guidelines, standards and methods for sound planning and design.”

To:

“The design criteria presented herein represent current good engineering practice, and their use in the Town of Lyons is recommended. The criteria are not intended to be an ironclad set of rules that the planner, engineer, and designer must follow; they are intended to establish guidelines, standards and methods for sound planning and design. The planner, engineer, designer, and owner should carefully coordinate with Town staff to collect the best available data for the watersheds affecting the subject property."

5.1.2 Criteria Updating - Accepted

5.1.3 Use of Criteria - Accepted

5.2 Initial and Major Drainage - Accepted

5.2.1 Design Storm Return Periods - Amended

Delete second paragraph

5.2.2 Initial Storm Provisions - Amended

Change:

"The initial storm drainage system, capable of safely handling 2- to 10-year floods depending on local criteria, is necessary to reduce the frequency of street flooding and maintenance costs, to provide protection against regularly recurring damage from storm runoff, to help create an orderly urban system, and to provide convenience to urban residents."

To:

"The initial storm drainage system, capable of safely handling 2-year floods, is necessary to reduce the frequency of street flooding and maintenance costs, to provide protection against regularly recurring damage from storm runoff, to help create an orderly urban system, and to provide convenience to urban residents. Considerations shall be made to ensure downstream facilities are sized to accept flows associated with any new development."

5.2.3 Major Storm Provisions - Accepted

5.2.4 Critical Facilities - Accepted

5.2.5 Major Drainage Channels - Accepted

5.2.6 Tailwater -Accepted

5.3 Runoff Computation - Accepted

5.3.1 Accuracy - Accepted

5.4 Streets - Accepted

5.4.1 Use of Streets - Amended

Change:

"Bubblers (inverted siphons which convey flows beneath roadways) are not encouraged in the Denver region because of possible plugging with sediment and difficulty in maintaining them."

To:

Bubblers (inverted siphons which convey flows beneath roadways) are not encouraged in Lyons because of possible plugging with sediment and difficulty in maintaining them."

Add:

"Street conveyance in portions of the Town is an important means of stormwater conveyance due to limitations of excavation for pipe systems in the rock subgrade present in the majority of the northern side of the St. Vrain."

5.5 Irrigation Ditches- Amended

Add:

Lyons does not allow the discharge of stormwater runoff from developed areas into irrigation ditches and facilities except as required by water rights or where such discharges are in conformance with approved Master Drainage plans. Further, wherever new development will alter patterns of drainage into irrigation ditches by increasing flow rates or volumes, or will change the historic concentration points of runoff, the Town shall require each new development to obtain written consent of the appropriate ditch company before approving the drainage design and development.

Where irrigation and stormwater conveyance intersect, the Town will recommend gravity flow for the stormwater system to prevail and siphon, pump, or other forced flow regimes be reserved for irrigation flows. Irrigation systems typically have a routine maintenance cycle built around seasonal flow patterns unlike perpetual flows within Town storm sewer systems."

5.5.1 Use of Ditches- Amended

Change:

"Land planners downhill from a ditch should plan for pre-ditch drainage conditions as well as continued ditch seepage."

To:

"Land planners and engineers with a proposed development downhill from a ditch shall plan for pre-ditch drainage conditions as well as continued ditch seepage.

Add:

For new development, it shall be the policy of Lyons to prohibit undetained discharges to roadside ditches located in the Town right-of-way. In the event a proposed development wishes to design stormwater discharge to a Town right-of-way, the developer, at the request of the Town, shall have the requirement to design and construct drainage improvements to the right-of-way at the developers' own expense. Such improvements shall include, but not be limited to: detention ponds, armored channels, culverts, level spreaders, and other drainage facilities. Cost-sharing of such needed improvements may be borne by adjacent, upstream, or downstream developments, such cost sharing to be negotiated by the developer. The Town of Lyons will require written agreements and construction bonding of such offsite drainage improvements.

5.5.2 Ditch Perpetuation - Accepted

5.5.3 Conformance With Master Plan - Accepted

Change:

"Use of irrigation ditches for collection and transport of either initial or major storm runoff should be prohibited unless specifically provided in a District's master plan or approved by the District and the ditch owner."

To:

"Use of irrigation ditches for collection and transport of either initial or major storm runoff should be prohibited unless specifically provided in the Town's master plan or approved in writing by the Town and the ditch owner."

5.6 Detention and Retention Facilities Maintenance - Amended

Change:

"The significant cost of handling stormwater runoff, coupled with the social benefits to be derived from proper storm drainage facilities, points towards the use of detention and retention basins for storage of stormwater runoff in the Denver region. Maintenance provisions must be arranged. Maintenance of detention or retention facilities includes the removal of debris, excessive vegetation from the embankment, and sediment. Without maintenance, a detention/retention facility will become an unsightly social liability and eventually become ineffective."

To:

"The significant cost of handling stormwater runoff, coupled with the social benefits to be derived from proper storm drainage facilities, points towards the use of detention basins for storage of stormwater runoff in the Town. Maintenance provisions must be arranged, documented, and reviewed annually. Maintenance of detention facilities includes the removal of debris, trimming excessive vegetation from the embankment, sediment removal, and other procedures set forth by Town Maintenance personnel and engineering staff. Without maintenance, a detention facility will become an unsightly social liability, eventually become ineffective, and ultimately could become a threat to public health and safety."

5.6.1 Water Quality – Accepted

Add:

"Colorado House Bill 1005, provides that rain barrels can only be installed at single-family households and multi-family households with four or fewer units. A maximum of two rain barrels can be used at each household and the combined storage of the two rain barrels cannot exceed 110 gallons. Rain barrels can only be used to capture rainwater from rooftop downspouts and the captured rainwater must be used to water outdoor lawns, plants and/or gardens on the same property from which the rainwater was captured. Rain barrel water cannot be used for drinking or other indoor water uses. The capture and use of rainwater using rain barrels does not constitute a water right.

The Town will consider drainage plans that utilize rain barrels to offset water quality and detention requirements. In no circumstance will rain barrels completely eliminate other water quality or detention requirements."

6.0 FLOODPLAIN MANAGEMENT

6.1 Purpose - Amended

Delete:

“Various governmental agencies within the Denver region should initiate floodplain management programs.”

6.2 Goals - Amended

Change:

“To reduce the vulnerability of Denver region residents to the danger and damage of floods.”

To:

To reduce the vulnerability of the Town’s residents to the danger and damage of floods.

6.3 National Flood Insurance Program- Accepted

6.3.1 Participation - Accepted

6.3.2 New Development - Amended

If a CLOMR/LOMR submittal is needed with a development application, Lyons shall follow the requirements of the floodplain ordinance.

The Town of Lyons reserves the right to outsource engineering review of all CLOMR and LOMR submittals received with a development application. The Developers shall reimburse the Lyons for all outsourced engineering review costs. Upon FEMA approval of a CLOMR or LOMR, payment of all outsourced engineering review costs is due and payable to Lyons. It is possible for developers to contract directly with one of the Town’s outsourced Consultant(s) for the preparation of CLOMR’s and LOMR’s, if they so desire. However, the Town maintains the right to in in-house or outsourced independent review of the application before providing Town concurrence.”

6.4 Floodplain Management - Accepted

6.5 Floodplain Filling- Accepted

6.6 New Development - Accepted

6.7 Strategies and Tools - Accepted

6.7.1 Exposure to Floods - Accepted

6.7.2 Development Policies - Accepted

6.7.3 Preparedness - Accepted

6.7.4 Flood Proofing - Accepted

6.7.5 Flood Forecasting - Accepted

6.7.6 Flood Modification - Accepted

6.7.7 Impact of Modification - Accepted

7.0 IMPLEMENTATION

7.1 Adoption of Drainage Master Plans – Amended

Change:

"This *Manual* and master plans should be adopted and used by all governmental agencies operating within the District."

To:

This Manual and masterplans should be adopted and used by all parties operating within the Town.

7.1.1 Manual Potential - Accepted

7.2 Governmental Operations - Accepted

7.3 Amendments - Amended

Change:

"Problems in urban drainage administration encountered by any governmental agency should be reviewed by the District to determine if equity or public interests indicate a need for drainage policy, practice, or procedural amendments. The District should continually review the needs of the Denver region in regard to urban runoff criteria and should recommend changes as necessary to this *Manual*."

To:

Problems in urban drainage administration encountered by anyone should be reviewed by the Town to determine if equity or public interests indicate a need for drainage policy, practice, or procedural amendments. The Town should continually review the needs of the town in regard to urban runoff criteria and should recommend changes as necessary to this *Manual*.

7.4 Financing - Accepted

7.4.1 Drainage Costs - Accepted

7.5 Drainage Improvements - Amended

Add:

The policy of Lyons regarding the design and construction of improvements within the Master Drainage Plan shall be set forth below:

a. Lyons shall identify needed design and construction of improvements as set forth in adopted Master Drainage Plans for existing and future growth areas.
b. The drainage systems for future development and redevelopment shall be designed and constructed by the Developer(s).
c. The Developers shall be responsible for design and construction of temporary or interim storm drainage systems required due to the lack of adequate storm drainage facilities downstream of new development.
d. The Developers may be responsible for design and construction of permanent storm drainage systems required due to the lack of adequate storm drainage facilities downstream of new development.

8.0 REFERENCES - *Accepted*

DRAINAGE LAW - Deleted

1.0 SUMMARY OF CURRENT GENERAL PRINCIPLES OF DRAINAGE AND FLOOD CONTROL LAW - Deleted

1.1 Introduction - Deleted

1.2 Legal Principles - Deleted

2.0 GENERAL PRINCIPLES OF DRAINAGE LAW - Deleted

2.1 Private Liability - Deleted

2.1.1 Common Enemy Rule - Deleted

2.1.2 Civil Law Rule - Deleted

2.1.3 Reasonable Use Rule - Deleted

2.2 Municipal Liability - Deleted

2.2.1 Planning Drainage Improvements - Deleted

2.2.2 Construction, Maintenance, and Repair of Drainage Improvements - Deleted

2.2.3 Summary - Deleted

2.3 Municipal Liability for Acts of Others - Deleted

2.3.1 Acts or Omissions of Municipal Officers, Agents, or Employees - Deleted

2.3.2 Municipal Liability for Acts of Developers - Deleted

2.4 Personal Liability of Municipal Officers, Agents, and Employees - Deleted

3.0 DRAINAGE IMPROVEMENTS BY A LOCAL GOVERNMENT - Deleted

3.1 Constitutional Power - Deleted

3.2 Statutory Power - Deleted

3.2.1 Statutes—Municipalities - Deleted

3.2.1.1 Municipal Powers—Public Property and Improvements - Deleted

3.2.1.2 Public Improvements—Special Improvement Districts in Municipalities - Deleted

3.2.1.3 Public Improvements—Improvement Districts in Municipalities - Deleted

3.2.1.4 Sewer and Water Systems—Municipalities - Deleted

3.2.2 Statutes—County - Deleted

3.2.2.1 Public Improvements—Sewer and Water Systems - Deleted

3.2.2.2 County Public Improvement Districts - Deleted

3.2.2.3 Public Improvements—Local Improvement Districts—Counties- Deleted

3.2.2.4 Flood Control—Control of Stream Flow - Deleted

3.2.2.5 Conservancy Law—Flood Control - Deleted

3.2.2.6 Drainage Districts - Deleted

3.2.3 Statutes—State - Deleted

3.2.3.1 Colorado Land Use Act - Deleted

3.2.3.2 Drainage of State Lands - Deleted

3.2.3.3 Water Conservation Board of Colorado - Deleted

3.2.3.4 State Canals and Reservoirs - Deleted

3.2.3.5 Regulatory Impairment of Property Rights - Deleted

3.2.3.6 Intergovernmental Relationships - Deleted

3.2.4 Urban Drainage and Flood Control Act - Deleted

4.0 FINANCING DRAINAGE IMPROVEMENTS - Deleted

4.1 Capital Improvement - Deleted

4.2 Local Improvement - Deleted

4.3 Special Improvement - Deleted

4.4 Service Charge - Deleted

4.5 Developer's Cost - Deleted

4.6 The Taxpayers Bill of Rights, Article X, Section 20, Colorado Constitution - Deleted

4.7 Water Activities—Enterprise Statute 37-45.1-101 C.R.S - Deleted

5.0 FLOODPLAIN MANAGEMENT - Deleted

5.1 Floodplain Regulations - Deleted

5.1.1 Constitutional Considerations- Deleted

5.1.2 Statutory Grants of Power - Deleted

5.1.3 Court Review of Floodplain Regulations - Deleted

5.1.3.1 Restriction of Uses - Deleted

5.1.3.2 Health Regulations - Deleted

5.1.3.3 Determination of Boundaries - Deleted

5.2 Flood Insurance - Deleted

5.3 Flood Warning Systems and Notification - Deleted

6.0 SPECIAL MATTERS - Deleted

6.1 Irrigation Ditches - Deleted

6.2 Dams and Detention Facilities - Deleted

6.3 Water Quality - Deleted

6.4 Professional Responsibility - Deleted

7.0 CONCLUSION - Deleted

PLANNING

1.0 THE DRAINAGE SUBSYSTEM - Accepted

1.1 Planning - Accepted

1.2 Planning Philosophy - Accepted

1.3 Drainage Management Measures - Accepted

1.4 Water Quality - Accepted

2.0 EARLY PLANNING ADVANTAGES - Accepted

2.1 Advantages - Accepted

2.2 New Development - Accepted

2.3 Get the Facts - Accepted

2.4 Regulatory Considerations - Accepted

3.0 CONSIDER DRAINAGE BENEFITS - Accepted

3.1 Benefits- Accepted

4.0 MASTER PLANNING

4.1 Master Plan - Accepted

4.2 Uniformity - Accepted

5.0 PLANNING FOR THE FLOODPLAIN

5.1 Floodplains - Accepted

5.2 Concept of Floodplain Regulation - Accepted

5.3 Tools - Accepted

6.0 PLANNING FOR MAJOR DRAINAGE

6.1 Major Drainage - Accepted

6.2 Initial Route Considerations - Accepted

6.3 The Master Plan - Accepted

6.4 Open Channels- Accepted

7.0 PLANNING FOR INITIAL DRAINAGE

7.1 Initial Drainage - Amended

Change:

“The initial storm has been defined for the area served by the District to have a return frequency ranging from once in 2 years to once in 10 years.”

To:

The initial storm has been defined for Lyons to have a return frequency once in 2 years.

7.2 Streets - Accepted

8.0 PLANNING FOR STORAGE

8.1 Upstream Storage - Accepted

8.2 Downstream Storage - Accepted

8.3 Channel Storage -Accepted

8.4 Other Benefits-Accepted

9.0 PLANNING FOR STORM SEWERS

9.1 Storm Sewers -Amended

Change:

“It is what directly contributes to the orderly growth of a community by handling the storm runoff expected to occur once every two to ten years.”

To:

It is what directly contributes to the orderly growth of a community by handling the storm runoff expected to occur once every two years.

9.2 Function of Storm Sewers -Accepted

9.3 Layout Planning -Accepted

9.4 System Sizing –Amended

Change:

“The suggested design return periods to be used by local jurisdictions in the Denver region for storm sewer design for all land uses is 2- to 10-years.”

To:

The design return period to be used for storm sewer design in Lyons is the 2-year storm for all land uses. Storm sewers passing flow under Town roads shall have a minimum design capacity for the 10-year storm and a minimum diameter of 18 inches or equivalent open area. System sizing design shall adhere to Boulder County street inundation criteria.

9.5 Inlets -Accepted

9.6 Alternate Selection-Accepted

10.0 PLANNING FOR OPEN SPACE

10.1 Greenbelts -Accepted

11.0 PLANNING FOR TRANSPORTATION

11.1 Coordination Needed-Accepted

12.0 CLEAN WATER ACT SECTION 404 PERMITTING PROCESS

12.1 Purpose of the 404 Permit-Accepted

12.2 Activities Requiring Permit-Accepted

12.3 Who Should Obtain a Permit-Accepted

12.4 Definition of Waters of the United States-Accepted

12.5 Pre-Application Meetings-Accepted

13.0 REFERENCES

RAINFALL

1.0 OVERVIEW - Amended

Rainfall values were determined using NOAA ATLAS 2 Volume III. These values were used into UDFCD's UD-Rain v.1.01 spreadsheet to convert these values from the 6-hr and 24-hr storms present in the NOAA ATLAS to more frequently used storm durations. Intensity-Duration-Frequency and Depth-Duration-Frequency graphs and tables were created using point values from the UD-Rain worksheet. Intensity-Duration-Frequency values can be seen in Table 1 and Figure 1. Depth-Duration-Frequency values can be found in Table 2 and Figure 2.

2.0 RAINFALL DEPTH-DURATION-FREQUENCY

2.1 Rainfall Depth-Duration-Frequency Maps - Deleted

2.2 Rainfall Depths For Durations Between 1- and 6-Hours - Amended

Table 1: Rainfall Depth (in) at Time Duration

Return Period	Rainfall Depth in Inches at Time Duration								
	5-min	*10-min*	*15-min*	*30-min*	*1-hr*	*2-hr*	*3-hr*	*6-hr*	*24-hr*
2-yr	0.27	0.43	0.54	0.62	0.95	1.10	1.22	1.40	1.90
5-yr	0.38	0.61	0.77	0.89	1.35	1.56	1.71	1.95	2.65
10-yr	0.46	0.73	0.92	1.06	1.61	1.85	2.02	2.30	3.05
25-yr	0.55	0.88	1.10	1.28	1.95	2.22	2.43	2.75	3.80
50-yr	0.64	1.02	1.28	1.48	2.26	2.55	2.76	3.10	4.25
100-yr	0.72	1.15	1.45	1.68	2.55	2.84	3.06	3.40	4.85
500-yr	0.90	1.44	1.81	2.09	3.19	3.56	3.83	4.26	6.01

3.0 DESIGN STORM DISTRIBUTION FOR CUHP

3.1 Temporal Distribution

3.2 Adjustment to Rainfall Distribution for Watershed Size - Amended

Due to the size of the Lyons watershed, there is no need for any area adjustment.

4.0 INTENSITY-DURATION CURVES FOR RATIONAL METHOD - Amended

Table 2: Rainfall Intensity (in/hr) at Time Duration

Return Period	Rainfall Intensity in Inches Per Hour at Time Duration								
	5-min	*10-min*	*15-min*	*30-min*	*1-hr*	*2-hr*	*3-hr*	*6-hr*	*24-hr*
2-yr	3.22	2.57	2.16	1.49	0.95	0.59	0.44	0.26	0.09
5-yr	4.58	3.65	3.07	2.12	1.35	0.84	0.62	0.37	0.13
10-yr	5.47	4.37	3.66	2.53	1.61	1.00	0.74	0.44	0.15
25-yr	6.60	5.27	4.42	3.05	1.95	1.21	0.90	0.53	0.18
50-yr	7.66	6.11	5.13	3.55	2.26	1.40	1.04	0.62	0.21
100-yr	8.66	6.91	5.80	4.01	2.55	1.59	1.18	0.70	0.24
500-yr	10.83	8.63	7.25	5.01	3.19	1.98	1.47	0.87	0.30

5.0 BASIS FOR DESIGN STORM DISTRIBUTION - Accepted

6.0 SPREADSHEET DESIGN AIDS - Accepted

7.0 EXAMPLES - Deleted

7.1 Example Computation of Point Rainfall - Deleted

7.2 Example Distribution of Point Rainfall - Deleted

7.3 Example Preparation of Intensity-Duration-Frequency Curve - Deleted

8.0 REFERENCES - Accepted

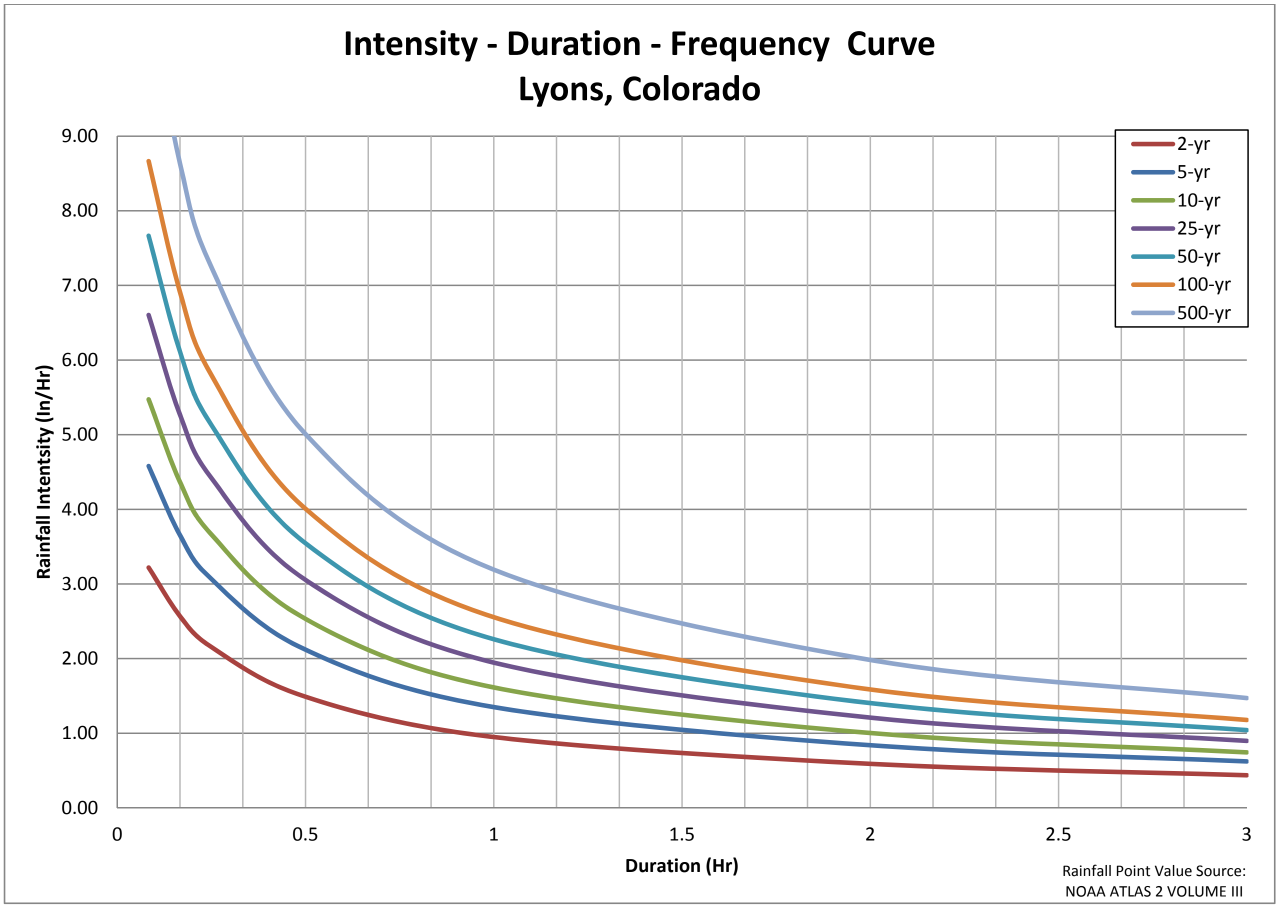


Figure 1: Intensity-Duration-Frequency Curve

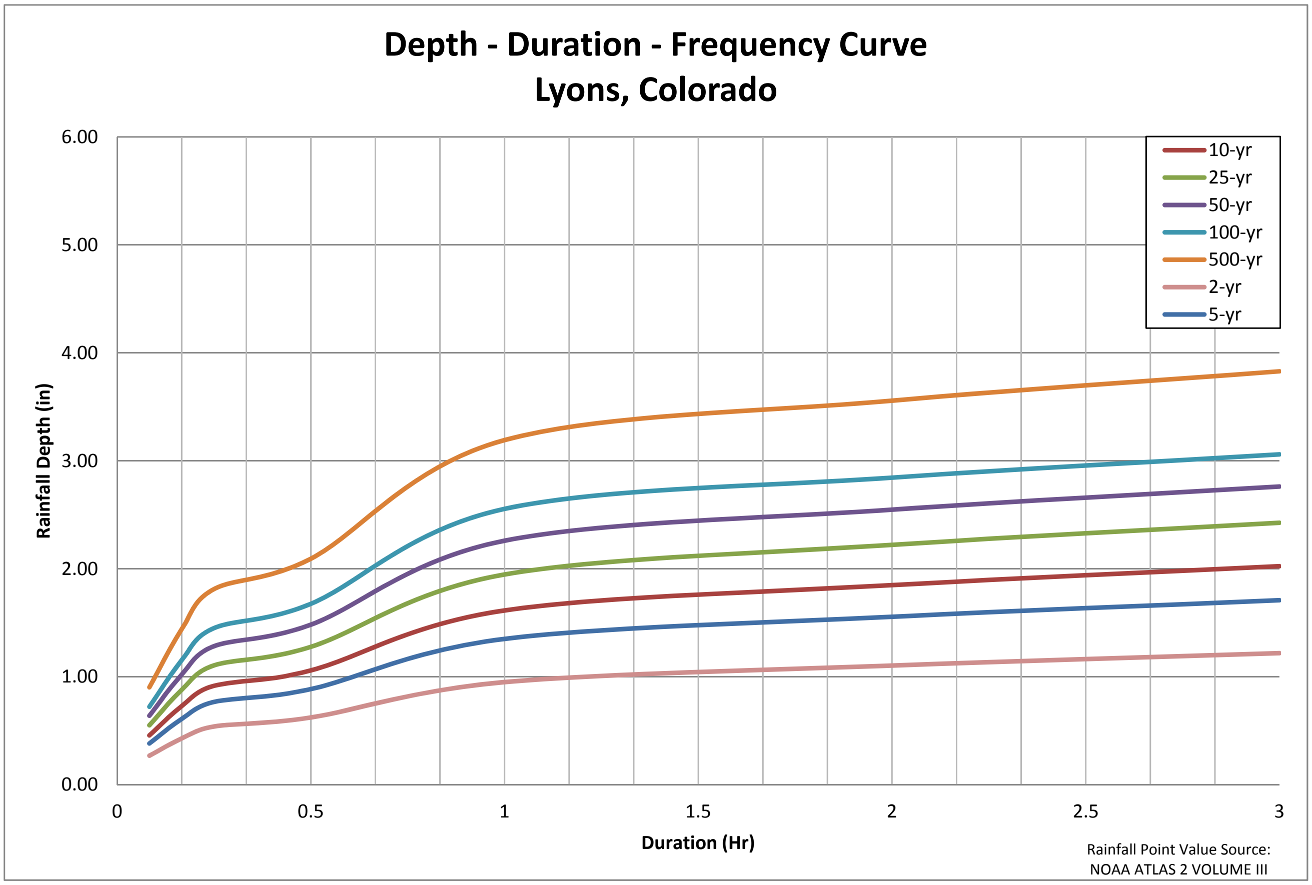


Figure 2: Depth-Duration-Frequency Curve

RUNOFF

1.0 OVERVIEW - Accepted

2.0 RATIONAL METHOD - Accepted

2.1 Rational Formula- Accepted

2.2 Assumptions- Accepted

2.3 Limitations- Accepted

2.4 Time of Concentration - Accepted

2.4.1 Initial Flow Time- Accepted

2.4.2 Overland Travel Time - Accepted

2.4.3 First Design Point Time of Concentration in Urban Catchments- Accepted

2.4.4 Minimum Time of Concentration- Accepted

2.4.5 Common Errors in Calculating Time of Concentration - Accepted

2.5 Intensity- Accepted

2.6 Watershed Imperviousness- Amended

The intensity for a design point should be selected from **Error! Reference source not found.**

2.7 Runoff Coefficient – Accepted

3.0 COLORADO URBAN HYDROGRAPH PROCEDURE- Accepted

3.1 Background- Accepted

3.2 Effective Rainfall for CUHP- Accepted

3.2.1 Pervious-Impervious Area- Accepted

3.2.2 Depression Losses- Accepted

3.2.3 Infiltration- Accepted

3.3 CUHP Parameter Selection- Accepted

3.3.1 Rainfall- Accepted

3.3.2 Catchment Description- Accepted

3.3.3 Catchment Delineation Criteria- Accepted

3.3.3 Combining and Routing Sub-Catchment CUHP Hydrographs- Accepted

4.0 EPA SWMM AND HYDROGRAPH ROUTING- Accepted

4.1 Software Description- Accepted

4.1.1 Surface Flows and Flow Routing Features- Accepted

4.1.2 Flow Routing Method of Choice - Accepted

4.2 Data Preparation for the SWMM Software- Accepted

4.2.1 Step 1—Method of Discretization - Accepted

4.2.2 Step 2—Estimate Coefficients and Functional/Tabular Characteristic of Storage and Outlets- Accepted

4.2.3 Step 3—Preparation of Data for Computer Input - Accepted

5.0 OTHER HYDROLOGIC METHODS - Accepted

5.1 Published Hydrologic Information -Amended

Change:

"The District has prepared hydrologic studies for the majority of the major drainageways within District boundaries. These studies contain information regarding peak flow and runoff volume from the 2-year through 100-year storm events for numerous design points within the watershed. They also contain information regarding watershed and sub-watershed boundaries, soil types, percentage imperviousness, and rainfall. The studies are available at the District library. When published flow values are available from the District for any waterway of interest, these values should be used for design unless there are compelling reasons to modify the published values."

To:

The Town of Lyons has a master plan containing information regarding peak flow and runoff volume from the 2-year through 100-year storm events for numerous design points within the watershed. The report also contains information regarding watershed and sub-watershed boundaries, soil types, percentage imperviousness, and rainfall. The study is available through the Town. These flow values should be used for design unless there are compelling reasons to modify the published values.

5.2 Statistical Methods – Amended

Statistical methods should not be applied to watersheds within Lyons.

6.0 SPREADSHEETS AND OTHER SOFTWARE - Accepted

7.0 EXAMPLES - Accepted

7.1 Rational Method Example 1 - Accepted

7.2 Rational Method Example 2 - Accepted

7.3 Effective Rainfall Example - Accepted

8.0 REFERENCES

APPENDIX A - DETAILS OF THE COLORADO URBAN HYDROGRAPH PROCEDURE (CUHP) - Accepted

STREETS/INLETS/STORM SEWERS

1.0 INTRODUCTION

1.1 Purpose - Accepted

1.2 Urban Stormwater Collection and Conveyance Systems - Accepted

1.3 Components of Urban Stormwater Collection and Conveyance Systems - Accepted

Change:

"Urban stormwater collection and conveyance systems within the District are comprised of three primary components: (1) street gutters and roadside swales, (2) stormwater inlets, and (3) storm sewers (and appurtenances like manholes, junctions, etc.)."

To:

Urban stormwater collection and conveyance systems within the town are comprised of three primary components: (1) street gutters and roadside swales, (2) stormwater inlets, and (3) storm sewers (and appurtenances like manholes, junctions, etc.).

1.4 Minor and Major Storms - Accepted

2.0 STREET DRAINAGE

2.1 Street Function and Classification - Accepted

2.2 Design Considerations - Amended

Change:

"Based on these considerations, the District has established encroachment (spread) standards for the minor storm event. These standards were given in the POLICY chapter and are repeated in Table ST-2 for convenience."

To:

Based on these considerations, the town has established encroachment (spread) standards for the minor storm event. These standards were given in the POLICY chapter of the USDCM and are repeated in Table ST-2 for convenience.

2.3 Hydraulic Evaluation – Accepted

2.3.1 Curb and Gutter - Accepted

2.3.1.1 Gutters With Uniform Cross Slopes (i.e., Where Gutter Cross Slope = Street Cross Slope) – Accepted

2.3.1.2 Gutters With Composite Cross Slopes (i.e., Where Gutter Cross Slope ≠ Street Cross Slope) – Accepted

2.3.1.3 Allowable Gutter Hydraulic Capacity - Amended

Change:

“There are two sets of reduction factors developed for Denver metropolitan areas (Guo 2000b).”

To:

There are two sets of reduction factors developed for Denver metropolitan areas (Guo 2000b) and shall be utilized for the town.

2.4 Major Storm Hydraulics

2.4.1 Purpose and Objectives - Accepted

2.4.2 Street Hydraulic Capacity - Accepted

3.0 INLETS

3.1 Inlet Functions, Types and Appropriate Applications - Accepted

Add:

The standard inlets permitted for use in the town streets are:

Table 3: Permitted Inlet Type Use

INLET TYPE PERMITTED USE	
Curb Opening Inlet Type R	All street types with 6” vertical curb
Grated Inlet Type C	All streets with a roadside ditch or swale
Grated Inlet Type 13	Alleys or private drives with a valley gutter
Combination Inlet Type 13	All street types with 6” vertical curb

3.2 Design Considerations – Accepted

3.3 Hydraulic Evaluation – Accepted

3.3.1 Grate Inlets (On a Continuous Grade) – Accepted

3.3.2 Curb-Opening Inlets (On a Continuous Grade) – Accepted

3.3.3 Combination Inlets (On a Continuous Grade) – Accepted

3.3.4 Slotted Inlets (On a Continuous Grade) – Accepted

3.3.5 Inlets Located in Sumps - Accepted

3.3.6 Inlet Clogging - Accepted

3.3.6 Inlet Clogging - Amended

Add:

To account for effects which decrease the capacity of the various types of inlets, such as debris plugging, pavement overlaying and variations in design assumptions, the theoretical capacity calculated for the inlets is to be reduced by the factors presented below for the standard inlets permitted for use in the town.

Table 4: Allowable Inlet Capacity

ALLOWABLE INLET CAPACITY		
CONDITION	INLET TYPE	PERCENT OF THEORETICAL CAPACITY ALLOWED
Sump or Continuous Grade	CDOT Type R	
	5’ length	88
	10’ length	92
	15’ length	95
Continuous Grade	Combination Type 13	66
Sump	Grate Type C	50
Sump	Grate Type 13	50
Sump	Combination Type 13	65

3.4 Inlet Location and Spacing on Continuous Grades

3.4.1 Introduction - Accepted

3.4.2 Design Considerations - Amended

Delete:

“Table ST-2 lists pavement encroachment standards for minor storms in the Denver metropolitan area.”

3.4.3 Design Procedure - Accepted

4.0 STORM SEWERS

4.1 Introduction - Accepted

4.2 Design Process, Considerations, and Constraints - Amended

Change:

"Pipes sizes smaller than 15 inches are not recommended for storm sewers."

To:

The minimum size storm sewer pipe within a Public Right-of-Way or Public Drainage Easement shall be 15 inches in diameter or equivalent open area.

4.3 Storm Sewer Hydrology

4.3.1 Peak Runoff Prediction - Accepted

4.4 Storm Sewer Hydraulics (Gravity Flow in Circular Conduits)

4.4.1 Flow Equations and Storm Sewer Sizing - Amended

Add:

"The Manning's roughness coefficient "n" for all storm sewer pipe capacity Boulder County calculations shall be 0.013 regardless of pipe material (i.e. Concrete, PVC, or HDPE) with the exception of corrugated metal pipes which shall have a coefficient of 0.025."

4.4.2 Energy Grade Line and Head Losses - Accepted

4.4.2.1 Losses at the Downstream Manhole—Section 1 to Section 2 - Accepted

4.4.2.2 Losses in the Pipe, Section 2 to Section 3. - Accepted

4.4.2.3 Losses at the Upstream Manhole, Section 3 to Section 4 - Accepted

4.4.2.4 Juncture and Bend Losses at the Upstream Manhole, Section 4 to Section 1 - Accepted

4.4.2.5 Transitions - Accepted

4.4.2.6 Curved Sewers - Accepted

4.4.2.7 Losses at Storm Sewer Exit - Accepted

4.5 Hydraulic and Energy Grade Line Calculations - Amended

Add:

"The hydraulic grade line and energy grade line shall be calculated for each storm sewer system and included in the Final Drainage Report. Each storm sewer system shall be profiled on the Final Construction Drawings and shall include the design flow hydraulic grade line (HGL). The energy grade line (EGL) for the design flow shall be at least 6 inches below the final finished elevation of the manhole rims and inlet flow lines."

5.0 SPREADSHEETS - Accepted

6.0 EXAMPLES - Accepted

6.1 Example—Triangular Gutter Capacity- Accepted

6.2 Example—Composite Gutter Capacity - Accepted

6.3 Example—Composite Gutter Spread - Accepted

6.4 Example—V-Shaped Swale Capacity - Accepted

6.5 Example—V-Shaped Swale Design - Accepted

6.6 Example—Major Storm Street Capacity- Accepted

6.7 Example—Grate Inlet Capacity - Accepted

6.8 Example—Curb-Opening Inlet Capacity - Accepted

6.9 Example—Curb-Opening Inlet Capacity - Accepted

6.10 Example—Combination Inlet Capacity - Accepted

6.11 Example—Curb-Opening Inlet in a Sump Condition - Accepted

6.12 Example—Storm Sewer Hydraulics (Akan and Houghtalen 2002) - Accepted

6.13 Example—Storm Sewer Hydrology - Accepted

7.0 REFERENCES

MAJOR DRAINAGE

1.0 INTRODUCTION

1.1 General – Accepted

1.2 Types of Major Drainage Channels – Accepted

1.3 Overview of Chapter – Accepted

1.4 Issues in Major Drainage Planning and Engineering – Accepted

1.5 Fluvial Geomorphology – Accepted

1.5.1 Stream Channel Characterization – Accepted

1.5.2 Effects of Urbanization on Stream Channels – Accepted

1.5.3 Stable Channel Balance – Accepted

1.5.4 References for Additional Information – Accepted

2.0 PLANNING

2.1 General – Accepted

2.2 Impacts of Urbanization and Associated Effects – Accepted

2.3 Special Considerations for Semi-Arid Climates – Accepted

2.4 Route Considerations – Accepted

2.4.1 Present Flow Path – Accepted

2.4.2 Historic Flow Path – Accepted

2.4.3 Permitting and Regulations – Accepted

2.4.4 Public Safety – Accepted

2.4.5 Public Acceptance – Accepted

2.4.6 Alternate Routes – Accepted

2.4.7 Maintenance – Accepted

2.4.8 Route Cost – Accepted s

2.4.9 Recreational Use Potential – Accepted

2.4.10 Environmental Considerations – Accepted

2.4.11 Presentation of Choice – Accepted

2.4.12 Underground Conduits – Accepted

2.4.13 Two-Stage Channels – Accepted

2.5 Layout – Accepted

2.5.1 Working Map – Accepted

2.5.2 Preliminary Plan and Profile – Accepted

2.6 Master Planning or Preliminary Design – Accepted

2.6.1 Criteria for Final Hydrology – Accepted

2.7 The Master Plan – Accepted

2.7.1 Report – Amended

The previous section, 4.1 Master Plan - Accepted

, along with Preliminary Drainage Report and Final Drainage Report outlined the requirements for drainage studies within the town.

2.7.2 Drawings – Amended

See Section 2.7.1 for links to drawing requirements for drainage studies within the town.

3.0 OPEN CHANNEL DESIGN PRINCIPLES

3.1 General Open Channel Flow Hydraulics – Accepted

3.1.1 Types of Flow in Open Channels – Accepted

3.1.2 Roughness Coefficients – Accepted

3.1.3 Flow Regime – Accepted

3.1.3.1 Critical Flow – Accepted

3.1.3.2 Subcritical Flow – Accepted

3.1.3.3 Supercritical Flow – Amended

Change:

“In the Denver region, all channels carrying supercritical flow shall be lined with continuously reinforced concrete linings, both longitudinally and laterally.”

To:

"In Lyons, all channels carrying supercritical flow shall be lined with continuously reinforced concrete linings, both longitudinally and laterally."

3.2 Preliminary Design Criteria

3.2.1 Design Velocity–Accepted

3.2.2 Design Depths–Accepted

3.2.3 Design Slopes

3.2.3.1 Channel Slope–Accepted

3.2.3.2 Side Slopes -Amended

Add following Paragraph 1:

"For constructed or natural channels with side slopes steeper than 2:1, appropriate construction setbacks not less than 5 feet laterally from the channel edge may be required to allow potential future channel meandering. Rock excavated channels may be submitted for approval of smaller setbacks based on consistency, erosion potential, and stability of the rock subgrade. Access for maintenance may require easement."

3.2.4 Curvature and Transitions–Accepted

3.2.5 Design Discharge Freeboard –Accepted

3.2.6 Erosion Control –Accepted

3.2.7 Summary of Preliminary Design Guidance–Amended

Add to Table MD-2:

"Grass lined open channels conveying < 50 cfs may reduce the minimum 1.0 foot freeboard requirement to the freeboard required to conveying 1.33 times the 100-year design flow. The reduced freeboard may only occur if a 1.0-foot minimum freeboard is not physically or reasonably possible and a variance request is submitted."

3.2.8 Maintenance Eligibility–Amended

Delete first paragraph

Add:

Lyons will only maintain eligible major drainage ways by special agreement. The requirements below must be satisfied as of (adoption date) for a major drainage channel to be eligible for maintenance. Note that the town's "Maintenance Eligibility Guidelines" may change with time.

3.2.8.1 Natural Channels (Open Floodplain Design) – Accepted

3.2.8.2 Open Floodway Design (Natural Channel With Floodplain Encroachment) – Accepted

3.2.8.3 Grass-Lined Channel Design – Amended

Change:

"The design for a grass-lined channel must meet the following criteria to be eligible for District maintenance:"

To:

The design for a grass-lined channel must meet the following criteria to be eligible for maintenance:

3.3 Choice of Channel Type and Alignment

3.3.1 Types of Channels for Major Drainageways – Accepted

3.3.2 Factors to Consider in Selection of Channel Type and Alignment – Accepted

3.3.3 Environmental Permitting Issue – Accepted

3.3.4 Maintenance – Amended

Change:

"A maintenance access road with a minimum passage width of 12 feet shall be provided along the entire length of all major drainageways. The local government may require the road to be surfaced with 6 inches of Class 2 roadbase or a 5-inch-thick concrete slab."

To:

The town and the design engineer shall work together to provide access to all major drainageways as determined appropriate at the time of preliminary and final design.

3.4 Design Flows– Accepted

3.5 Choice of Channel Lining– Accepted

4.0 OPEN-CHANNEL DESIGN CRITERIA

4.1 Grass-Lined Channels– Accepted

4.1.1 Design Criteria – Accepted

4.1.1.1 Design Velocity and Froude number– Accepted

4.1.1.2 Design Depths– Accepted

4.1.1.3 Design Slopes – Accepted

4.1.1.4 Curvature– Accepted

4.1.1.5 Design Discharge Freeboard – Accepted

4.1.2 Grass and Vegetation Selection and Use – Accepted

4.1.3 Channel Cross Sections– Accepted

4.1.3.1 Side Slopes – Accepted

4.1.3.2 Depth– Accepted

4.1.3.3 Bottom Width– Accepted

4.1.3.4 Trickle and Low-Flow Channels – Accepted

4.1.3.5 Outfalls Into Channel– Accepted

4.1.4 Roughness Coefficients – Accepted

4.1.5 Trickle and Low-Flow Channels – Amended

Add:

“Under drain pipes shall not be used in lieu of trickle channel within the town but will be considered by the town on a case-by-case basis. Any under drain pipe that is installed will require clean outs not less than every 50 feet, pipe bedding, and headwalls or manholes at the outlet.

4.1.6 Erosion Control – Accepted

4.1.6.1 Erosion at Bends – Accepted

4.1.6.2 Riprap Lining of Grass-lined Channels – Accepted

4.1.7 Water Surface Profile – Accepted

4.1.8 Maintenance – Amended

Change:

"A stable maintenance access road with a minimum passage width of 12 feet shall be provided along the entire length of all major drainageways. The local government may require the road to have an all-weather surface such as a 5-inch-thick concrete pavement."

To:

The town and the design engineer shall work together to provide access to all major drainageways as determined appropriate at the time of preliminary and final design.

4.1.9 Calculation Tool – Accepted

4.1.10 D e s i g n Submittal Checklist – Accepted

4.2 Composite Channels – Accepted

4.2.1 Design Criteria – Accepted

4.2.2 Design Procedure – Accepted

4.2.3 Life Expectancy and Maintenance – Amended

Change:

"A maintenance access road with a minimum passage width of 12 feet shall be provided along the entire length of all major drainageways. The local government may require the road to be surfaced with 6 inches of Class 2 roadbase or a 5-inch-thick concrete slab."

To:

The town and design engineer shall work together to provide access to all major drainageways as determined appropriate at the time of preliminary and final design.

4.2.4 Calculation Example for Wetland Bottom Channel – Accepted

4.2.5 Design Submittal Checklist – Accepted

4.3 Concrete-Lined Channels – *Accepted*

4.3.1 Design Criteria

4.3.1.1 Design Velocity and Froude Number – Accepted

4.3.1.2 Design Depths – Accepted

4.3.1.3 Curvature – Accepted

4.3.1.4 Design Discharge Freeboard – Accepted

4.3.2 Concrete Lining Specifications

4.3.2.1 Concrete Lining Section – Accepted

4.3.2.2 Concrete Joints – Accepted

4.3.2.3 Concrete Finish – Accepted

4.3.2.4 Underdrain – Accepted

4.3.3 Channel Cross Section – Accepted

4.3.3.1 Side Slopes – Accepted

4.3.3.2 Depth – Accepted

4.3.3.3 Bottom Width – Accepted

4.3.3.4 Trickle and Low-Flow Channels – Accepted

4.3.3.5 Outfalls Into Channel – Accepted

4.3.4 Safety Requirements – Accepted

4.3.5 Calculation Tools – Accepted

4.3.6 Maintenance – Accepted

4.3.7 Design Submittal Checklist – Accepted

4.4 Riprap-Lined Channels – *Accepted*

4.4.1 Types of Riprap – Accepted

4.4.1.1 Ordinary and Soil Riprap – Accepted

4.4.1.2 Grouted Boulders – Accepted

4.4.1.3 Wire-Enclosed Rock (Gabions) – Amended

Change:

“For these reasons, the District discourages the use of wire-enclosed rock.”

To:

For these reasons, the town discourages the use of wire-enclosed rock.

4.4.2 Design Criteria - Accepted

4.4.2.1 Design Velocity – Accepted

4.4.2.2 Design Depths – Accepted

4.4.2.3 Riprap Sizing – Accepted

4.4.2.4 Riprap Toes – Accepted

4.4.2.5 Curves and Bends – Accepted

4.4.2.6 Transitions – Accepted

4.4.2.7 Design Discharge Freeboard – Accepted

4.4.3 Roughness Coefficient –Accepted

4.4.4 Bedding Requirements – Accepted

4.4.4.1 Granular Bedding –Accepted

4.4.4.2 Filter Fabric– Accepted

4.4.5 Channel Cross Section

4.4.5.1 Side Slopes –Accepted

4.4.5.2 Depth – Accepted

4.4.5.3 Bottom Width – Accepted

4.4.5.4 Outfalls Into Channel –Accepted

4.4.6 Erosion Control – Accepted

4.4.7 Maintenance – Amended

Change:

“A maintenance access road with a minimum passage width of 12 feet shall be provided along the entire length of all major drainageways. The local government may require the road to have an all-weather surface such as 5-inch-thick concrete pavement.”

To:

The town and design engineer shall work together to provide access to all major drainageways as determined appropriate at the time of preliminary and final design.

4.4.8 Calculation Example – Accepted

4.4.9 Design Submittal Checklist– Accepted

4.5 Bioengineered Channels – Amended

Change:

“The District advocates the integration of bioengineering techniques into drainage planning, design, and construction when the use of such channels is consistent with the District’s policies concerning flow carrying capacity, stability, maintenance, and enhancement of the urban environment and wildlife habitat.”

To:

The town advocates the integration of bioengineering techniques into drainage planning, design, and construction when the use of such channels is consistent with the town’s policies concerning flow carrying capacity, stability, maintenance, and enhancement of the urban environment and wildlife habitat.

4.5.1 Components – Accepted

4.5.2 Applications – Accepted

4.5.3 Bioengineering Resources – Amended

Change:

"The purpose of this section is to provide the designer with an overview of bioengineering and basic guidelines for the use of bioengineered channels on major drainage projects within the District."

To:

The purpose of this section is to provide the designer with an overview of bioengineering and basic guidelines for the use of bioengineered channels on major drainage projects within the town.

4.5.4 Characteristics of Bioengineered Channels – Amended

Change (1):

"In the absence of grade control structures, especially in the semi-arid climate of the Denver area, purely bioengineered channels will normally be subject to bed and bank erosion, channel instability, and degradation."

To:

In the absence of grade control structures, especially in the semi-arid, high altitude climate of the Lyons area, purely bioengineered channels will normally be subject to bed and bank erosion, channel instability, seasonal variations, and degradation.

Change (2):

"In addition to grade controls, most bioengineered channels require some structural methods to assist the vegetation with maintaining channel stability."

To:

In addition to grade controls, bioengineered channels will require some structural methods to assist the vegetation with maintaining channel stability.

4.5.5 Advantages of Bioengineered Channels – Amended

Change:

"Public reaction to bioengineered channels is generally favorable, not only in metropolitan Denver, but also regionally and nationally."

To:

Public reaction to bioengineered channels is generally favorable, not only in northern Colorado, but also regionally and nationally.

Change (6):

“Create a living system that may strengthen over time.”

To:

Create a living system that will strengthen over time.

Add (8):

“8. Are less costly to maintain”

4.5.6 Technical Constraints – Amended

Change:

“The following constraints are associated with bioengineered channels:”

To:

The following constraints may be associated with bioengineered channels:

Change (2):

“The semi-arid conditions that characterize Denver can be at odds with the need for an adequate water supply for maintaining the vegetation”

To:

The semi-arid conditions that characterize Lyons can be at odds with the need for an adequate water supply for maintaining the vegetation

Change (3):

“A basic design criterion within the District is to demonstrate channel stability during the major (100-year) storm, due to public safety and property protection concerns within urban areas.”

To:

A basic design criterion within Lyons is to demonstrate channel stability during the major (100-year) storm, due to public safety and property protection concerns within urban areas.

Delete:

“Large trees can threaten the integrity of structural protection by root invasion, by toppling and damaging the protection works, by toppling and directing flow into an adjacent unprotected bank, or by leaving voids in embankments due to decomposition.”

Change:

“Many of these problems may be avoided through selection of the appropriate type and species of vegetation. Such selections and expert advice must be obtained from qualified individuals in revegetation and bioengineering. Invasion by other species is quite likely over the years the bioengineered channel is in operation.”

To:

Many of these problems may be avoided through selection of the appropriate type and species of vegetation. Such selections and expert advice must be obtained from qualified individuals in revegetation and bioengineering. Consideration of native plant species can provide additional confidence in the long term sustainability of the natural vegetation. Resources available through the Colorado State University Extension and Colorado Native Plant Society can be useful references during planning, design, and management of a project.

4.5.7 Design Guidelines – Accepted

4.6 Natural Channels

Change:

"Natural waterways in the Denver region are sometimes in the form of steep-banked gulches, which have eroding banks and bottoms."

To:

Natural waterways are sometimes in the form of steep-banked gulches, which have eroding banks and bottoms.

Change:

"In the Denver area, most natural waterways will need drops and/or erosion cutoff check structures to maintain a mild channel slope and to control channel erosion."

To

In Lyons, most natural waterways will need drops and/or erosion cutoff check structures to maintain a mild channel slope and to control channel erosion.

Change (2):

"A water surface profile should be defined in order to identify the 100-year floodplain, to control earthwork, and to build structures in a manner consistent with the District's and local floodplain regulations and ordinances."

To:

A water surface profile should be defined in order to identify the 100-year floodplain, to control earthwork, and to build structures in a manner consistent with the Lyons floodplain regulations and ordinances.

4.7 Retrofitting Open-Channel Drainageways – Accepted

4.7.1 Opportunities for Retrofitting – Accepted

4.7.2 Objectives of Retrofitting – Accepted

4.7.3 Natural and Natural-Like Channel Creation and Restoration – Accepted

5.0 RECTANGULAR CONDUITS

5.1 Hydraulic Design – Accepted

5.1.1 Entrance – Accepted

5.1.2 Internal Pressure – Accepted

5.1.3 Curves and Bends – Accepted

5.1.4 Transitions – Accepted

5.1.5 Air Entrainment – Accepted

5.1.6 Major Inlets – Accepted

5.1.7 Sedimentation – Accepted

5.2 Appurtenances – Accepted

5.2.1 Energy Dissipators – Accepted

5.2.2 Access Manholes – Accepted

5.2.3 Vehicle Access Points – Accepted

5.2.4 Safety – Accepted

5.2.5 Air Venting – Accepted

6.0 LARGE PIPES – Accepted

6.1 Hydraulic Design – Accepted

6.1.1 Entrance – Accepted

6.1.2 Internal Pressure – Accepted

6.1.3 Curves and Bends – Accepted

6.1.4 Transitions – Accepted

6.1.5 Air Entrainment and Venting – Accepted

6.1.6 Major Inlets – Accepted

6.2 Appurtenances – Accepted

6.3 Safety – Accepted

7.0 PROTECTION DOWNSTREAM OF PIPE OUTLETS

7.1 Configuration of Riprap Protection – Accepted

7.2 Required Rock Size – Accepted

7.3 Extent of Protection – Accepted

7.4 Multiple Conduit Installations – Accepted

8.0 Sediment – Accepted

9.0 Examples – Accepted

9.1 Example MD-1: Normal Depth Calculation with Normal Worksheet

9.2 Example MD-2: Composite Section Calculations Using Composite Design Worksheet

9.3 Example MD-3: Riprap Lined Channel Calculations Using Riprap Channel Worksheet

10.0 REFERENCES

USDCM VOLUME 2

HYDRAULIC STRUCTURES

1.0 USE OF STRUCTURES IN DRAINAGE

1.1 Introduction – Accepted

1.2 Channels Used for Boating – Accepted

1.3 Channel Grade Control Structures – Accepted

1.4 Wetland Channel Grade Control – Accepted

1.5 Conduit Outlet Structures – Accepted

1.6 Bridges – Accepted

1.7 Transitions and Constrictions – Accepted

1.8 Bends and Confluences – Accepted

1.9 Rundowns – Accepted

1.10 Energy Dissipation – Accepted

1.11 Maintenance – Accepted

1.12 Structure Safety and Aesthetics – Accepted

2.0 CHANNEL GRADE CONTROL STRUCTURES (CHECK AND DROP STRUCTURES)

2.1 Planning for the Future – Accepted

2.1.1 Outline of Section – Accepted

2.1.2 Boatable Channels – Deleted

2.1.3 Grass and Wetland Bottom Channels – Accepted

2.1.4 Basic Approach to Drop Structure Design – Accepted

2.2 Drop Selection – Accepted

2.3 Detailed Hydraulic Analysis – Accepted

2.3.1 Introduction – Accepted

2.3.2 Crest and Upstream Hydraulics – Accepted

2.3.3 Water Surface Profile Downstream of the Crest – Accepted

2.3.7.1 Critical Depth Along a Drop Structure. – Accepted

2.3.7.2 Hydraulic Analysis. – Accepted

2.3.7.3 Manning's n for Concrete, Boulders and Grouted Boulders – Accepted

2.3.7.4 Avoid Low Froude Number Jumps in Grass-Lined Channels. – Accepted

2.3.4 Hydraulic Jump Location – Accepted

2.3.5 Jump and Basin Length – Accepted

2.3.6 Seepage Analysis – Accepted

2.3.7 Force Analysis – Accepted

2.3.7.1 Shear Stress – Accepted

2.3.7.2 Buoyant Weight of Structure – Accepted

2.3.7.3 Impact, Drag and Hydrodynamic Lift Forces – Accepted

2.3.7.4 Turning Force – Accepted

2.3.7.5 Friction – Accepted

2.3.7.6 Frost Heave – Accepted

2.3.7.7 Seepage Uplift Pressure – Accepted

2.3.7.8 Dynamic Pressure Fluctuations– Accepted

2.3.7.9 Overall Analysis– Accepted

2.4 Simplified Drop Structure Designs for District's Grass-Lined Channels

2.4.1 Introduction and Cautions –Accepted

2.4.2 Applicability of Simplified Channel Drop Designs –Accepted

2.4.3 Simplified Grouted Sloping Boulder Drop Design – Accepted

2.4.4 Vertical Hard Basin Drops –Accepted

2.5 Baffle Chute Drops– Accepted

2.6 Seepage Control – Accepted

2.6.1 Seepage Analysis Methods –Accepted

2.6.2 Foundation/Seepage Control Systems – Accepted

2.7 Simplified Minimum Design Approach for Boatable Channels –Deleted

2.8 Construction Concerns: Grass-Lined Channels –Accepted

2.8.1 Foundation/Seepage Control – Accepted

2.8.2 Baffle Chute Construction – Accepted

2.8.3 Vertical Hard Basin Construction – Accepted

2.8.4 Sloping Grouted Boulder Construction –Accepted

2.9 Low-Flow Check and Wetland Structures– Accepted

3.1 General –Accepted

3.2 Impact Stilling Basin– Accepted

3.2.1 Modified Impact Basins for Smaller Outlets– Accepted

3.2.2 Low-flow Modifications– Accepted

3.2.3 Multiple Conduit Installations – Accepted

3.2.4 General Design Procedure for Type IV Impact Basin– Accepted

3.3 Pipe Outlet Rundowns –Accepted

3.3.1 Baffle Chute Rundown – Accepted

3.3.2 Grouted Boulder Chute Rundown – Accepted

3.4 Low Tailwater Riprap Basins at Pipe Outlets

3.4.1 General – Accepted

3.4.2 Objective – Accepted

3.4.3 Low Tailwater Basin Design – Accepted

3.4.3.1 Finding Flow Depth and Velocity of Storm Sewer Outlet Pipe – Accepted

3.4.3.2 Riprap Size – Accepted

3.4.3.3 Basin Length – Accepted

3.4.3.4 Basin Width – Accepted

3.4.3.5 Other Design Requirements – Accepted

3.5 Culvert Outlets – Accepted

4.0 BRIDGES

4.1 Basic Criteria – Accepted

4.1.1 Design Approach – Accepted

4.1.2 Bridge Opening Freeboard – Amended

Add:

“The bridge low chord elevation shall be a minimum 1-foot above the 100-year water energy grade line.”

4.2 Hydraulic Analysis – Accepted

4.2.1 Expression for Backwater – Accepted

4.2.2 Backwater Coefficient – Accepted

4.2.3 Effect of M and Abutment Shape (Base Curves) – Accepted

4.2.4 Effect of Piers (Normal Crossings) – Accepted

4.3 Design Procedure – Accepted

5.0 TRANSITIONS AND CONSTRICTIONS

5.1 Introduction – Accepted

5.2 Transition Analysis – Accepted

5.2.1 Subcritical Transitions – Accepted

5.2.2 Supercritical Transition Analysis – Accepted

5.3 Constriction Analysis – Accepted

5.3.1 Constrictions With Upstream Subcritical Flow – Accepted

6.0 BENDS AND CONFLUENCES

6.1 Introduction – Accepted

6.2 Bends – Accepted

6.2.1 Subcritical Bends – Accepted

6.2.2 Supercritical Bends – Accepted

6.3 Confluences – Accepted

6.3.1 Subcritical Flow Confluence Design – Accepted

7.0 RUNDOWNS

7.1 Cross Sections – Accepted

7.2 Design Flow – Accepted

7.3 Flow Depth – Accepted

7.4 Outlet Configuration for Trickle Channel – Accepted

7.5 Outlet Configuration for Wetland Channel – Accepted

7.6 Grouted Boulder Rundowns – Accepted

8.0 MAINTENANCE

8.1 General – Accepted

8.2 Access – Accepted

8.3 Maintenance Optimization – Accepted

9.0 BOATABLE DROPS – Accepted

9.1 Introduction – Accepted

9.2 Retrofitting Existing Structures – Accepted

9.2.1 Downstream Face – Accepted

9.2.2 Boat Chute– Accepted

9.2.3 Sharp Edges– Accepted

9.2.4 Barriers and Signing– Accepted

9.2.5 Portages – Accepted

9.3 Safety – Accepted

10.0 STRUCTURE AESTHETICS, SAFETY AND ENVIRONMENTAL IMPACT

10.1 Introduction – Accepted

10.2 Aesthetics and Environmental Impact – Accepted

10.3 Safety– Accepted

11.0 CHECKLIST – Accepted

12.0 REFERENCES

CULVERTS

1.0 INTRODUCTION AND OVERVIEW – Accepted

1.1 Required Design Information – Accepted

1.1.1 Discharge – Accepted

1.1.2 Headwater – Amended

Add:

The maximum culvert headwater to diameter ratios is:

STORM FREQUENCY	HEADWATER TO DIAMETER
10-Year	HW/D < 1.0
100-Year	HW/D < 1.5

The minimum culvert capacities are:

STREET CLASSIFICATION	MINIMUM CAPACITY (RECURRENCE INTERVAL)
Local	10-Year
Collector	10-Year
Arterial	10-Year

When the flow exceeds the capacity of the culvert and overtops the cross street, the flow over the street crown shall not exceed the minor storm and major storm depth limits presented in Chapter 3, Planning, Section 9.4 of the manual. Lyons may require additional culvert capacity in order to prevent flooding of adjacent properties.

1.1.3 Tailwater – Accepted

1.1.4 Outlet Velocity – Accepted

2.0 CULVERT HYDRAULICS

2.1 Key Hydraulic Principles– Accepted

2.1.1 Energy and Hydraulic Grade Lines – Amended

Add:

“The hydraulic grade line and energy grade line shall be determined for each culvert system and included in the Final Drainage Report. Each culvert system shall be profiled on the Final Construction Drawings and shall include the design flow hydraulic grade line.”

2.1.2 Inlet Control – Accepted

2.1.3 Outlet Control – Accepted

2.2 Energy Losses – Accepted

2.2.1 Inlet Losses – Accepted

2.2.2 Outlet Losses – Accepted

2.2.3 Friction Losses – Accepted

3.0 CULVERT SIZING AND DESIGN

3.2 Use of Capacity Charts – Accepted

3.3 Use of Nomographs– Accepted

3.4 Computer Applications, Including Design Spreadsheet – Accepted

3.5 Design Considerations – Accepted

3.5.1 Design Computation Forms– Accepted

3.5.2 Invert Elevations – Accepted

3.5.3 Culvert Diameter– Amended

Add:

"Lyons requires a minimum culvert diameter of 15 inches. Lyons may require additional culvert capacity in order to prevent flooding of adjacent properties."

Add:

"The Manning's roughness coefficient "n" for all culvert pipe sizing calculations shall be 0.013 regardless of pipe material (Concrete, PVC, or HDPE) with the exception of corrugated metal pipes which shall have a coefficient of 0.025."

3.5.4 Limited Headwater – Accepted

3.6 Culvert Outlet– Accepted

3.7 Minimum Slope – Accepted

4.0 CULVERT INLETS

4.1 Projecting Inlets – Amended

Add:

At a minimum, a culvert entrance and outlet shall include a flared end section. Erosion protection (riprap, etc.) may be required.

4.1.1 Corrugated Metal Pipe – Accepted

4.1.2 Concrete Pipe – Accepted

4.2 Inlets with Headwalls – Accepted

4.2.1 Corrugated Metal Pipe – Accepted

4.2.2 Concrete Pipe – Accepted

4.2.3 Wingwalls – Accepted

4.2.4 Aprons 24 – Accepted

4.3 Special Inlets – Accepted

4.3.1 Corrugated Metal Pipe – Accepted

4.3.2 Concrete Pipe – Accepted

4.3.3 Mitered Inlets – Accepted

4.3.4 Long Conduit Inlets – Accepted

4.4 Improved Inlets – Accepted

5.0 Inlet Protection

5.1 Debris Control – Accepted

5.2 Buoyancy – Accepted

6.0 OUTLET PROTECTION

6.1 Local Scour – Accepted

6.2 General Stream Degradation – Accepted

7.0 GENERAL CONSIDERATIONS

7.1 Culvert Location – Accepted

7.2 Sedimentation – Accepted

7.3 Fish Passage – Accepted

7.4 Open Channel Inlets – Accepted

7.5 Transitions – Accepted

7.6 Large Stormwater Inlets – Accepted

7.6.1 Gratings – Accepted

7.6.2 Openings – Accepted

7.6.3 Headwater – Accepted

7.7 Culvert Replacements – Accepted

7.8 Fencing for Public Safety – Accepted

8.0 TRASH/SAFETY RACKS – Amended

Change:

"The District strongly recommends against the installation of trash racks at culvert outlets, because debris or a person carried into the culvert will impinge against the rack, thus leading to pressurized conditions within the culvert, virtually destroying its flow capacity and creating a greater hazard to the public or a person trapped in the culvert than not having one."

To:

The town strongly recommends against the installation of trash racks at culvert outlets, because debris or a person carried into the culvert will impinge against the rack, thus leading to pressurized conditions within the culvert, virtually destroying its flow capacity and creating a greater hazard to the public or a person trapped in the culvert than not having one.

8.1 Collapsible Gratings – Amended

Change:

"The District does not recommend the use of collapsible gratings."

To:

Lyons does not recommend the use of collapsible gratings.

8.2 Upstream Trash Collectors– Accepted

9.0 DESIGN EXAMPLE

9.1 Culvert Under an Embankment – Accepted

10.0 CHECKLIST – Accepted

11.0 CAPACITY CHARTS AND NOMOGRAPHS– Accepted

12.0 REFERENCES

STORAGE

1.0 OVERVIEW – Accepted

2.0 APPLICATION OF DIFFERENT TYPES OF STORAGE – Amended

Add (6):

"Above ground parking lot detention ponds may be utilized when land area for a grassed lined detention pond is not available. To prevent damage to and floatation of automobiles, parking lot detention ponds shall not exceed 12 inches in depth at any point. Parking lot detention ponds shall have signage to inform the general public about the potential for flooding. The 100-year water surface elevation of a parking lot detention pond shall not encroach into a public street."

3.0 HYDROLOGIC AND HYDRAULIC DESIGN BASIS

3.1 Procedures for the Sizing of Storage Volumes – Accepted

3.1.1 Use of Simplified On-Site Detention Sizing Procedures – Accepted

3.1.2 Use of Hydrograph Routing Detention Sizing Procedure –Amended

Change:

"Whenever the area limits described above in Section 3.1.1. are exceeded (for tributary catchments larger than 90 acres for empirical equations and FAA Method and 160 acres for the *Full Spectrum Detention* method), the District recommends the use of hydrograph flood routing procedures (e.g., using CUHP- generated hydrographs and reservoir routing calculations)."

To:

Whenever the area limits described above in Section 3.1.1. are exceeded (for tributary catchments larger than 90 acres for empirical equations and FAA Method and 160 acres for the *Full Spectrum Detention* method), the town recommends the use of hydrograph flood routing procedures (e.g., using CUHP- generated hydrographs and reservoir routing calculations).

Add:

"Sizing of detention storage volumes shall utilize outflow hydrographs that have been properly calculated to account for variable head discharge rates.

3.1.3 Water Quality Capture Volume in Sizing Detention Storage –Amended

Add:

"The water quality capture volume shall be considered a portion of the total 100-yr detention pond volume."

3.2 Sizing of On-Site Detention Facilities

3.2.1 Maximum Allowable Unit Release Rates for On-Site Facilities –Amended

Change:

"These maximum releases rates will apply for all on-site detention facilities unless other rates are recommended in a District- approved master plan."

To:

These maximum releases rates will apply for all on-site detention facilities unless other rates are recommended in the town master plan.

3.2.2 Empirical Equations for the Sizing of On-Site Detention Storage Volumes– Amended

Change:

"The following set of empirical equations provided preliminary estimates of on-site detention facility sizing for areas within the District."

To:

The following set of empirical equations provided preliminary estimates of on-site detention facility sizing for areas within Lyons.

Change:

"If the District has a master plan that contains specific guidance for detention storage or sizing of on-site detention facilities, those guidelines should be followed instead."

To:

Where the town's master plan contains specific guidance for detention storage or sizing of on-site detention facilities, those guidelines should be followed instead.

3.2.3 Rational Formula-Based Modified FAA Procedure –Accepted

3.2.4 Simplified Full-Spectrum Detention Sizing (Excess Urban Runoff Flow Control) –Accepted

3.2.5 Excess Urban Runoff Flow Control at Regional Facilities –Accepted

3.2.6 Multi-Level Control –Amended

Change:

"The District recommends that no more than two levels of controls, in addition to the WQCV controls, be used for on-site detention facilities."

To:

The town recommends that no more than two levels of controls, in addition to the WQCV controls, be used for on-site detention facilities.

3.2.7 On-Site Detention and UDFCD 100-year Floodplain Management Policy – Accepted

3.3 Design Storms for Sizing Storage Volumes– Amended

Add:

The 10-year and 100-year storms shall be the design storms for all water quality and detention pond designs, respectively, within Lyons. Each storm should be detained to be released at the historic rate for each respective storm.

3.3.1 Water Quality Capture Volume – Accepted

3.3.2 Drainage and Flood Control – Amended

Change:

"Whenever a District-approved master plan recommends detention sites and release rates, or on-site detention/retention storage and release rates, this sizing and rates should be used in final design of detention/retention facilities."

To:

Whenever a town-approved master plan recommends detention sites and release rates, or on-site detention/retention storage and release rates, this sizing and rates should be used in final design of detention/retention facilities.

3.3.3 Spillway Sizing – Amended

Add:

"Each detention pond shall contain an emergency spillway capable of conveying the peak 100-year storm discharge draining into the detention pond. The invert of the emergency spillway shall be set equal to or above the 100-year water surface elevation. The depth of flow out the emergency spillway shall be < 6 inches and the spillway shall have effective erosion protection."

3.3.4 Retention Facilities – Amended

Change:

"When a retention basin is proposed as a temporary solution, the District recommends that it be sized to capture, as a minimum, the runoff equal to 1.5 times the 24-hour, 100-year storm plus 1-foot of freeboard."

To:

When a retention basin is proposed as a temporary solution, the town recommends that it be sized to capture, as a minimum, the runoff equal to 1.5 times the 24-hour, 100-year storm plus 1-foot of freeboard.

Add:

"The town will not approve any detention or retention pond that does not drain in less than 72 hours, or causes injury to water rights, or is in violation of State or Federal law.

3.4 Reservoir Routing of Storm Hydrographs for Sizing of Storage Volumes – Amended

Change (2):

“Determine the inflow hydrograph to the storage basin and the allowable peak discharge from the basin for the design storm events. The hydrograph may be available in published district outfall system planning or a major drainageway master plan report. The allowable peak discharge is limited by the local criteria or by the requirements spelled out in a District-approved master plan.

To:

The allowable peak discharge is limited by the local criteria or by the requirements spelled out in a town-approved master plan.

3.4.1 Initial Sizing – Accepted

3.4.2 Initial Shaping – Amended

Change:

“This does not mean that the District encourages the use of storage facilities with uniform geometric properties. To the contrary, the District encourages designers to collaborate with landscape architects to develop storage facilities that are visually attractive, fit into the fabric of the landscape, and enhance the overall character of an area.”

To:

This does not mean that the town encourages the use of storage facilities with uniform geometric properties. To the contrary, the town encourages designers to collaborate with landscape architects to develop storage facilities that are visually attractive, fit into the fabric of the landscape, and enhance the overall character of an area.

3.4.3 Outlet Works Design – Accepted

3.4.4 Preliminary Design – Accepted

3.4.5 Final Design – Accepted

4.0 FINAL DESIGN CONSIDERATIONS – Amended

Change:

“The District urges all designers to review and adhere to the guidance in such references because the failure of even small embankments can have serious consequences for the public and the municipalities downstream of the embankment.”

To:

The town urges all designers to review and adhere to the guidance in such references because the failure of even small embankments can have serious consequences for the public and the municipalities downstream of the embankment.

4.1 Storage Volume – Accepted

4.2 Potential for Multiple Uses – Accepted

4.3 Geometry of Storage Facilities– Accepted

4.3 Geometry of Storage Facilities – Amended

Change:

"Several key features should be incorporated in all storage facilities located within the District."

To:

Several key features should be incorporated in all storage facilities located within Lyons.

4.4 Embankments and Cut Slopes – Amended

Change (2):

"Freeboard – The elevation of the top of the embankment shall be a minimum of 1 foot above the water surface elevation when the emergency spillway is conveying the maximum design or emergency flow."

To:

Freeboard – The elevation of the top of the embankment shall be a minimum of 1 foot above the 100-year water surface elevation in the detention pond.

Add (5):

Emergency Spillway Downstream Protection – In order to protect the emergency spillway from catastrophic erosion failure, buried riprap shall be placed from the emergency spillway downhill to the embankment toe of slope and covered with 6 inches of topsoil. The riprap shall be sized at the time of final engineering design. Grouting of the riprap may be required

Add (6):

Concrete Cutoff Wall – A concrete cutoff wall, 8 inches thick, 3 foot deep, extending 5 feet into the embankment beyond the emergency spillway opening, is encouraged on all private detention ponds and required on all publicly-owned regional detention ponds. A concrete cutoff wall will permanently define the emergency spillway opening. The emergency spillway elevation shall be tied back into the top of embankment using a maximum slope of 4:1.

4.5 Linings – Accepted

4.6 Inlets– Accepted

4.7 Outlet Works – Amended

Add:

The outlet pipe of regional detention ponds shall contain a minimum of two (2) concrete cutoff walls embedded a minimum of 18" into undisturbed earthen soil. The cutoff walls shall be a minimum of 8 inches thick. The outlet pipe bedding material shall consist of native earthen soil and not granular bedding material to at least the first downstream manhole or daylight point.

4.8 Trash Racks – Amended

Add:

For safety reasons, trash rack angles are to be 3 horizontal to 1 vertical (3:1) or flatter per Urban Drainage research (Nelson & Kroeger, 2005).

4.9 Vegetation – Accepted

4.10 Operation and Maintenance– Amended

Add (15):

An operations maintenance manual for each water quality pond, detention pond, and outlet structure facility shall be developed and provided to the town at the time of final submittal.

4.11 Access – Amended

Add:

Drivable access applies only to Regional Detention facilities within Lyons. Each regional detention pond will be considered on a case-by-case basis at the time of final design.

4.12 Geotechnical Considerations – Accepted

4.13 Environmental Permitting and Other Considerations – Accepted

5.0 DISTRICT MAINTENANCE ELIGIBILITY FOR DETENTION FACILITIES– Amended

Add:

Regional Master Planned detention ponds, designed and constructed by or on behalf of Lyons, shall be owned and maintained by the town as specified in the applicable Development Agreement(s). All other detention ponds shall be considered privately owned and privately maintained.

6.0 DESIGN EXAMPLES– Accepted

6.1 Example—Empirical Equations Sizing of a Detention Basin
6.2 Example—Rational Method Analysis
6.3 Example—Hydrograph Procedure Preliminary Sizing

7.0 CHECKLIST – Accepted

8.0 REFERENCES

FLOOD PROOFING

1.0 FLOOD PROOFING

1.1 Definition of Flood Proofing – Accepted

1.2 Overview of Flood-Proofing Methods – Accepted

1.2.1 Classification of Flood Proofing – Amended

Change:

"In the Denver metropolitan area, flood-proofing efforts should focus on permanent measures due to the rapid response of most of the Front Range stream systems."

To:

"In Lyons, flood-proofing efforts should focus on permanent measures due to the rapid response of most of the Front Range stream systems."

1.2.2 FEMA Recommended Methods – Accepted

1.3 Approach of Manual Relative to Flood-Proofing Guidance – Accepted

1.4 Regulatory Considerations – Accepted

1.5 Flood Proofing In the Context of Overall Floodplain Management – Accepted

2.0 WHEN TO FLOOD PROOF

2.1 How Flooding Can Damage Structures – Accepted

2.1.1 Depth/Elevation of Flooding – Accepted

2.1.2 Flow Velocity – Accepted

2.1.3 Flood Frequency – Accepted

2.1.4 Rate of Rise and Rate of Fall – Accepted

2.1.5 Duration – Accepted

2.1.6 Debris Impact – Accepted

2.2 When Flood Proofing is Not Appropriate – Accepted

2.3 Typical Causes of Flooding Problems – Accepted

2.3.1 Inadequate Street Conveyance – Accepted

2.3.2 Inadequate Storm Sewer Conveyance – Accepted

2.3.3 Inadequate Drainage Channel Conveyance – Accepted

2.3.4 Sewage Backup– Accepted

3.0 FLOOD PROOFING METHODS

3.1 Overview of Six Methods Identified by FEMA – *Accepted*

3.1.1 Elevation – Accepted

3.1.2 Wet Flood Proofing – Accepted

3.1.3 Dry Flood Proofing– Accepted

3.1.4 Relocation– Accepted

3.1.5 Levees and Floodwalls – Accepted

3.1.6 Demolition– Accepted

3.2 Engineering Aspects– *Accepted*

3.2.1 Analysis of Flood Hazards– Accepted

3.2.2 Site Characteristics– Accepted

3.2.3 Building Characteristics – Accepted

3.3 Selection of Flood-Proofing Techniques –*Accepted*

3.3.1 Regulatory Considerations – Accepted

3.3.2 Appearance – Accepted

3.3.3 Accessibility –Accepted

3.3.4 Human Intervention Required –Accepted

3.3.5 Benefit/Cost Analysis –Accepted

3.3.6 Other –Accepted

4.0 PROVIDING ASSISTANCE TO PROPERTY OWNERS

4.1 Decision Making Process for Property Owners– *Accepted*

4.1.1 Determine Flood Hazards –Amended

Change:

“Information about flooding in the area is available from the District and local officials.”

To:

"Information about flooding in the area is available from the Town of Lyons."

4.1.2 Inspect Structure – Accepted

4.1.3 Contact Local Officials – Accepted

4.1.3 Contact Local Officials – Amended

Change:

"The District and local officials have copies of the FIS and FIRM published for the community by FEMA."

To:

"The town and local officials have copies of the FIS and FIRM published for the community by FEMA."

4.1.4 Consult With Professionals – Accepted

4.2 Potential Sources of Financial Assistance at Federal, State, and Local Levels – Accepted

5.0 REFERENCES

REVEGETATION

1.0 INTRODUCTION – Amended

Change:

"This chapter provides information on methods and plant materials needed for revegetation of drainage facilities within the Urban Drainage and Flood Control District (District)."

To:

This chapter provides information on methods and plant materials needed for revegetation of drainage facilities within the town of Lyons.

Change:

"The semi-arid nature of the climate, prevalence of introduced weeds, and variety of soil types encountered in the District virtually mandate prompt implementation of a revegetation plan to achieve revegetation success."

To:

The semi-arid nature of the climate, prevalence of introduced weeds, and variety of soil types encountered in Lyons virtually mandate prompt implementation of a revegetation plan to achieve revegetation success. Specific consideration of native plant species and their inherent limitations and advantages should be part of every revegetation plan."

2.0 SCOPE OF THIS CHAPTER AND RELATION TO OTHER RELEVANT DOCUMENTS – Amended

Add:

See revisions to RV tables included in this chapter for seed mix recommendations.

3.0 GENERAL GUIDELINES FOR REVEGETATION

3.1 Plant Materials – Accepted

3.2 Site Preparation – Amended

Add:

Before revegetation work is started, an inventory of vegetation should be taken. If noxious weeds, as listed on the State of Colorado index, exist on-site, appropriate steps need to be taken before, during, and after work is completed, to control their spread. Contact the Town of Lyons for additional information if needed.

3.3 Seeding and Planting – Amended

Add:

Seed mixtures should be coated with Mycorrhiza at the rate of 2 pounds per acre at the time of seeding. If mulching with straw, be sure the straw is seed free and weed free.

3.4 Maintenance – Amended

Change:

“Access to and grazing on recently revegetated areas should be limited with temporary fencing and signage while plants are becoming established (normally the first year).”

To:

Access to and grazing on recently revegetated areas should be limited with temporary fencing and signage while plants are becoming established (for 1 to 2 years at least).

Change:

“Weed infestations should be managed using appropriate physical, chemical, or biological methods as soon as possible. (See the other documents referenced for details on weed management options.)”

To:

Weed infestations should be managed using appropriate physical or chemical methods as soon as possible.

Add:

The project owners/developer, not Lyons, will be responsible for site maintenance until vegetative establishment.

4.0 PREPARATION OF A PLANTING PLAN

4.1 General – Accepted

4.2 Soil Amendments – Amended

Change:

“Since soil pH is typically suitable within the District, amendments are usually needed for increasing organic matter content or providing nutrients in the form of fertilizers.”

To:

“Since soil pH is typically suitable within Lyons, amendments are usually needed for increasing organic matter content or providing nutrients in the form of fertilizers.”

Change:

“Consideration should be given to importing topsoil, instead of amending poor quality subsoil, as this may be less expensive.”

To:

“Consideration should be given to importing topsoil, from the vicinity, instead of amending poor quality subsoil, as this may be less expensive.”

Change:

"Both of these materials are relatively new and show promise as soil conditioners and sources of slow-release fertilizers for revegetation work in the District."

To:

Both of these materials are relatively new and show promise as soil conditioners and sources of slow-release fertilizers for revegetation work in the town.

4.2.1 Humate Conditioner – Accepted

4.2.2 Biosol – Accepted

4.3 Recommended Seed Mixes – Amended

Change:

"Recommended seed mixes for the bottom (wet soils) and side slopes of drainage facilities within the District are included in Tables RV-1 and RV-2."

To:

Recommended seed mixes for the bottom (wet soils) and side slopes of drainage facilities within Lyons are included in Tables RV-1 and RV-2.

Add:

The inclusion of wild flowers in the seed mix is optional in Lyons. Areas seeded along Boulder County roads may be spot sprayed in the county to control the spread of noxious weeds. This spraying may affect some wild flower species. Do not plant trees or shrubs in the town right-of-way.

Delete:

Redtop (Agrostis alba) from Table RV-1

Nuttall's sunflower (Holianthus nuttallii) from Table RV-1

Canadian bluegrass (Ruebens) (Poa compressa) from Table RV-2

Flax* (Linum lewisii) from Table RV-2

Blue Flax (Linum lewisii) from Table RV-3

Canby bluegrass (Poa canbyi) from Table RV-4

Flax (Linum lewisii) from Table RV-4

Change:

Common Name (Variety)	Scientific Name	Growth Season	Growth Form	Seeds/Lb	Lbs PLS/Acre
Blue grama (Hachita)	*Chondrosum gracile*	Warm	Sod/bunch	825,000	2.1

To:

Blue grama (Hachita)	*Chondrosum gracile*	Warm	Sod/bunch	825,000	0.3

Change:

Common Name (Variety)	Scientific Name	Growth Season	Growth Form	Seeds/Lb	Lbs PLS/Acre
Sand dropseed	*Sporobolus cryptandrus*	Warm	Bunch	5,298,000	0.3

To:

Sand dropseed	*Sporobolus cryptandrus*	Warm	Bunch	5,298,000	2.1

Delete:

Flax (Linum lewisii) from Table RV-5

Blue Flax (Linum lewisii) from Table RV-7

California poppy (Eschscholtzia californica) from Table RV-7

Blackeyed Susan (Rudbeckia hirta) from Table RV-7

Rubber rabbitbrush (Chrysothamnus nauseosus) from Table RV-8

Spanish bayonet (Yucca glauca) from Table RV-8

Smart weed (Polygonum persicaria) from Table RV-9

Foxtail barley (Hordeum jubatum) from Table RV-9

Refer to Grass Seeding Recommendations for Boulder County:

4.4 Trees, Shrubs and Wetland Plantings – Accepted

4.5 Mulching – Amended

Add:

- At least 70 percent of the mulch by weight shall be 10 inches or more in length.
- The appropriate use of fabric blankets under trees and shrubs is suggested

4.6 Bioengineering – Accepted

4.7 Collection of Live Stakes, Willow Cuttings, and Poles – Accepted

4.7.1 Harvest Procedure – Accepted

4.7.2 Installation – Accepted

5.0 POST-CONSTRUCTION MONITORING – Amended

Change:

"This is especially important for establishing native species since it may take several years for vegetation to become adequately established. Sites should be observed several times during their first two growing seasons and at least once a year thereafter."

To:

"This is especially important for establishing native species since it may take three to five years for vegetation to become adequately established. Sites should be observed several times during their first two or three growing seasons and at least twice a year thereafter."

6.0 REFERENCES

DESIGN EXAMPLES – Accepted

Add:

Use the UDFCD C1, C2, C3 coefficients within the "Detention Volume by Modified FAA Method" spreadsheet.

USCDM VOLUME 3

PREFACE

1.0 Acknowledgements – Accepted

2.0 Purpose – Accepted

3.0 Overview – Accepted

4.0 Revisions to USDCM Volume 3 – Accepted

5.0 Acronyms and Abbreviations – Accepted

CHAPTER 1 - STORMWATER MANAGEMENT AND PLANNING

1.0 Introduction – Accepted

2.0 Urban Stormwater Characteristics – Accepted

3.0 Stormwater Management Requirements under the Clean Water Act – Accepted

3.1 Clean Water Act Basics – Accepted

3.2 Colorado's Stormwater Permitting Program – Accepted

3.2.1 Construction Site Stormwater Runoff Control – Accepted

3.2.2 Post-construction Stormwater Management – Accepted

3.2.3 Pollution Prevention/Good Housekeeping – Accepted

3.3 Total Maximum Daily Loads and Stormwater Management – Accepted

4.0 Four Step Process to Minimize Adverse Impacts of Urbanization – Amended

Change:

"UDFCD has long recommended a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls."

To:

Lyons recommends a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls.

4.1 Step 1. Employ Runoff Reduction Practices – Accepted

4.2 Step 2. Implement BMPs That Provide a Water Quality Capture Volume with Slow Release – Accepted

4.3 Step 3. Stabilize Drainageways – Accepted

Change:

"Many drainageways within UDFCD boundaries are included in major drainageway or outfall systems plans, identifying needed channel stabilization measures."

To:

The Lyons master plan identifies needed channel stabilization measures along drainageway in the town.

4.4 Step 4. Implement Site Specific and Other Source Control BMPs – Accepted

5.0 Onsite, Subregional and Regional Stormwater Management – Accepted

6.0 Conclusion – Amended

Change:

"UDFCD criteria are based on a Four Step Process focused on reducing runoff volumes, treating the remaining WQCV, stabilizing receiving drainageways and providing targeted source controls for post-construction operations at a site."

To:

Lyons criteria is based on Four Step Process focused on reducing runoff volumes, treating the remaining WQCV, stabilizing receiving drainageways and providing targeted source controls for post-construction operations at a site.

7.0 References

Chapter 2 - BMP Selection

1.0 BMP Selection – Accepted

1.1 Physical Site Characteristics – Accepted

1.2 Space Constraints – Accepted

1.3 Targeted Pollutants and BMP Processes – Accepted

1.4 Storage-Based Versus Conveyance-Based – Accepted

1.5 Volume Reduction – Accepted

1.6 Pretreatment – Accepted

1.7 Treatment Train – Accepted

1.8 Online Versus Offline Facility Locations – Accepted

1.9 Integration with Flood Control – Accepted

1.9.1 Sedimentation BMPs – Accepted

1.9.2 Infiltration/Filtration BMPs – Accepted

1.10 Land Use, Compatibility with Surroundings, and Safety – Accepted

1.11 Maintenance and Sustainability – Accepted

1.12 Costs – Accepted

2.0 BMP Selection Tool – Accepted

3.0 Life Cycle Cost and BMP Performance Tool – Accepted

3.1 BMP Whole Life Costs – Amended

Change:

“In addition, UDFCD recommends the cost of administering a stormwater management program also be included as a long-term cost for BMPs. Reporting whole life costs in terms of net present value (NPV) is an effective method for comparing mutually exclusive alternatives (Newnan 1996).”

To:

In addition, the cost of administering a stormwater management program also be included as a long-term cost for BMPs. Reporting whole life costs in terms of net present value (NPV) is an effective method for comparing mutually exclusive alternatives (Newnan 1996).

Change:

“All cost estimates are considered "order-of-magnitude" approximations, hence UDFCD's recommendation of using this concept primarily at the planning level.”

To:

All cost estimates are considered "order-of-magnitude" approximations, hence the Town’s recommendation of using this concept primarily at the planning level.

Change:

- **“Contingency/Engineering/Administration Costs:** The additional costs of designing and permitting a new BMP are estimated as a percentage of the total construction costs. For Denver-area projects, a value of 40% is recommended if no other information is available.”

To:

- **Contingency/Engineering/Administration Costs:** The additional costs of designing and permitting a new BMP are estimated as a percentage of the total construction costs. For Lyons projects, a value of 40% is recommended if no other information is available.

Change:

- **“Administration Costs:** The costs of administering a stormwater management program are estimated as percentage of the average annual maintenance costs of a BMP. For Denver-area projects, a value of 12% is recommended if no other information is available.”

To:

- **“Administration Costs:** The costs of administering a stormwater management program are estimated as percentage of the average annual maintenance costs of a BMP. For Lyons projects, a value of 12% is recommended if no other information is available.”

3.2 BMP Performance

Change:

“Instead, UDFCD recommends an approach that is expected to predict long-term (i.e. average annual) BMP pollutant removal and runoff volume reduction with reasonable accuracy, using BMP performance data reported in the International Stormwater BMP Database (as discussed in Section 1.3).”

To:

“Instead, Lyons recommends an approach that is expected to predict long-term (i.e. average annual) BMP pollutant removal and runoff volume reduction with reasonable accuracy, using BMP performance data reported in the International Stormwater BMP Database (as discussed in Section 1.3).”

3.3 Cost Effectiveness – Accepted

4.0 Conclusion – Accepted

5.0 References

Chapter 3 – Calculating the WQCV and Volume Reduction

1.0 Introduction – Accepted

2.0 Hydrologic Basis of the WQCV

2.1 Development of the WQCV – Accepted

2.2 Optimizing the Capture Volume – Accepted

2.3 Attenuation of the WQCV (BMP Drain Time) – Accepted

2.4 Excess Urban Runoff Volume (EURV) and Full Spectrum Detention – Accepted

3.0 Calculation of the WQCV – Accepted

4.0 Quantifying Volume Reduction – Accepted

4.1 Conceptual Model for Volume Reduction BMPs—Cascading Planes – Accepted

4.2 Watershed/Master Planning-level Volume Reduction Method – Accepted

4.3 Site-level Volume Reduction Methods – Accepted

4.3.1 SWMM Modeling Using Cascading Planes – Accepted

4.3.2 IRF Charts and Spreadsheet – Accepted

4.4 Other Types of Credits for Volume Reduction BMPs/LID – Accepted

5.0 Examples

5.1 Calculation of WQCV – Accepted

5.2 Volume Reduction Calculations for Storage-based Approach – Accepted

5.3 Effective Imperviousness Spreadsheet – Accepted

6.0 Conclusion – Accepted

7.0 References

Chapter 4 – Treatment BMPs

1.0 Overview – Accepted

2.0 Treatment BMP Fact Sheets – Amended

Change:

"UDFCD does not provide endorsement or approval of specific practices; instead, guidance is provided identifying when use of underground BMPs may be considered and the minimum criteria that should be met when site constraints do not enable aboveground treatment of runoff or when underground devices are used to provide pretreatment for site-specific or watershed-specific purposes."

To:

Lyons does not provide endorsement or approval of specific practices; instead, guidance is provided identifying when use of underground BMPs may be considered and the minimum criteria that should be met when site constraints do not enable aboveground treatment of runoff or when underground devices are used to provide pretreatment for site-specific or watershed-specific purposes.

3.0 References

Treatment BMP Fact Sheets

T-1 Grass Buffer – Accepted

T-2 Grass Swale – Accepted

T-3 Bioretention (Rain Garden or Porous Landscape Detention) – Accepted

T-4 Green Roof – Accepted

T-5 Extended Detention Basin (EDB) – Accepted

T-6 Sand Filter – Accepted

T-7 Retention Pond – Amended

Add:

Retention facilities are normally not allowed in Lyons, but will be considered for special circumstances.

Retention facilities shall be sized to contain a volume equal to twice the 100-year storm runoff volume plus one foot of freeboard. Water within a retention facility shall be mechanically removed and disposed of off-site by the property owner within 48 hours after a storm event. Lyons will not approve any detention or retention pond that does not drain in less than 72 hours, or causes injury to water rights, or is in violation of State or Federal law.

T-8 Constructed Wetland Pond – Accepted

T-9 Constructed Wetland Channel – Accepted

T-10 Permeable Pavements: – Accepted

T-10.1 Permeable Interlocking Concrete Pavements (PICP) – Accepted

T-10.2 Concrete Grid Pavement – Accepted

T-10.3 Pervious Concrete – Accepted

T-10.4 Porous Gravel Pavement – Accepted

T-10.5 Reinforced Grass Pavement – Accepted

T-11 Underground BMPs – Accepted

T-12 Outlet Structures – Accepted

Chapter 5 – Source Control BMPs

1.0 Introduction – Accepted

2.0 Structural Source Controls – Accepted

3.0 Procedural Source Control BMPs – Accepted

3.1 Municipal Operations – Accepted

3.2 Commercial and Industrial Operations – Accepted

3.3 Residential Activities – Accepted

4.0 Combining Source Control BMPs to Target Pollutants of Concern – Accepted

5.0 References

Source Control BMP Fact Sheets

S-1 Covering Outdoor Storage and Handling Areas – Accepted

S-2 Spill Prevention, Containment and Control – Accepted

S-3 Disposal of Household Waste – Accepted

S-4 Illicit Discharge Controls – Accepted

S-5 Good Housekeeping – Accepted

S-6 Preventative Maintenance – Accepted

S-7 Vehicle Maintenance, Fueling and Storage – Accepted

S-8 Use of Pesticides, Herbicides and Fertilizers – Accepted

S-9 Landscape Maintenance – Accepted

S-10 Snow and Ice Management – Accepted

S-11 Street Sweeping and Cleaning – Accepted

S-12 Storm Sewer System Cleaning – Accepted

Chapter 6 – BMP Maintenance

1.0 Introduction – Accepted

2.0 Defining Maintenance Responsibility for Public and Private Facilities – Accepted

3.0 Developing a Maintenance Plan – Accepted

4.0 Grass Buffers and Swales – Accepted

4.1 Inspection – Accepted

4.2 Debris and Litter Removal – Accepted

4.3 Aeration – Accepted

4.4 Mowing – Accepted

4.5 Irrigation Scheduling and Maintenance – Accepted

4.6 Fertilizer, Herbicide, and Pesticide Application – Accepted

4.7 Sediment Removal – Accepted

5.0 Bioretention (Rain Garden or Porous Landscape Detention) – Accepted

5.1 Inspection – Accepted

5.2 Debris and Litter Removal – Accepted

5.3 Mowing and Plant Care – Accepted

5.4 Irrigation Scheduling and Maintenance – Accepted

5.5 Replacement of Wood Mulch – Accepted

5.6 Sediment Removal and Growing Media Replacement – Accepted

6.0 Green Roofs – Accepted

6.1 Inspection – Accepted

6.2 Plant Care and Media Replacement – Accepted

6.3 Irrigation Scheduling and Maintenance – Accepted

7.0 Extended Detention Basins (EDBs) – Accepted

7.1 Inspection – Accepted

7.2 Debris and Litter Removal – Accepted

7.3 Mowing and Plant Care – Accepted

7.4 Aeration – Accepted

7.5 Mosquito Control – Accepted

7.6 Irrigation Scheduling and Maintenance – Accepted

7.7 Sediment Removal from the Forebay, Trickle Channel, and Micropool – Accepted

7.8 Sediment Removal from Basin Bottom – Accepted

7.9 Erosion and Structural Repairs – Accepted

8.0 Sand Filters – Accepted

8.1 Inspection – Accepted

8.2 Debris and Litter Removal – Accepted

8.3 Filter Surface Maintenance – Accepted

8.4 Erosion and Structural Repairs – Accepted

9.0 Retention Ponds and Constructed Wetland Ponds – Accepted

9.1 Inspection – Accepted

9.2 Debris and Litter Removal – Accepted

9.3 Aquatic Plant Harvesting – Accepted

9.4 Mosquito Control – Accepted

9.5 Sediment Removal from the Forebay – Accepted

9.6 Sediment Removal from the Pond Bottom – Accepted

10.0 Constructed Wetland Channels – Accepted

10.1 Inspection – Accepted

10.2 Debris and Litter Removal – Accepted

10.3 Aquatic Plant Harvesting – Accepted

10.4 Sediment Removal – Accepted

11.0 Permeable Pavement Systems – Accepted

11.1 Inspection – Accepted

11.2 Debris Removal, Sweeping, and Vacuuming – Accepted

11.3 Snow Removal – Accepted

11.4 Full and Partial Replacement of the Pavement or Infill Material – Accepted

12.0 Underground BMPs – Accepted

12.1 Inspection– Accepted

12.2 Debris Removal, Cartridge Replacement, and Vacuuming – Accepted

13.0 References

Chapter 7 – Construction BMPs

1.0 Introduction – Accepted

2.0 Fundamental Erosion and Sediment Control Principles

2.1 Erosion – Accepted

2.2 Sedimentation – Accepted

2.3 Effective Erosion and Sediment Control– Accepted

3.0 Colorado Construction Stormwater Discharge Permits – Accepted

3.1 Preparing and Implementing a Stormwater Management Plan (SWMP) – Accepted

3.1.1 General SWMP Recommendations – Accepted

3.1.2 SWMP Elements – Accepted

3.2 Inspections – Accepted

3.2.1 Inspection Frequency – Accepted

3.2.2 Inspection Records – Accepted

3.3 Maintenance – Accepted

3.4 Disposition of Temporary Measures – Accepted

3.5 2009 Federal Effluent Limitation Guidelines – Accepted

4.0 Overview of Construction BMPs – Accepted

4.1 Erosion Control Measures – Accepted

4.2 Sediment Control Measures – Accepted

4.3 Site Management – Accepted

4.4 Materials Management – Accepted

4.5 Proprietary BMPs – Accepted

5.0 BMP Selection and Planning– Accepted

5.1 Site Assessment – Accepted

5.2 Slope-Length and Runoff Considerations – Accepted

5.3 Using the Revised Universal Soil Loss Equation – Accepted

5.4 BMP Functions – Accepted

5.5 Consistency with Other Plans – Accepted

5.5.1 Drainage Plans – Accepted

5.5.2 Post Construction Stormwater Management – Accepted

5.5.3 Air Quality Plans – Accepted

5.6 Guidelines for Integrating Site Conditions and BMPs into a SWMP – Accepted

6.0 Construction Dewatering – Accepted

7.0 Construction in Waterways – Accepted

8.0 Considerations for Linear Construction Projects – Accepted

8.1 General Considerations – Accepted

8.2 Underground Utility Trenching Criteria – Accepted

9.0 References

Construction BMP Fact Sheets – Accepted

Erosion Controls

EC-1 Surface Roughening (SR) – Accepted

EC-2 Temporary and Permanent Seeding (TS/PS) EC-3 Soil Binders (SB) – Accepted

EC-4 Mulching (MU) – Accepted

EC-5 Compost Blanket and Filter Berm (CB) – Accepted

EC-6 Rolled Erosion Control Products (RECP) (multiple types) – Accepted

EC-7 Temporary Slope Drains (TSD) – Accepted

EC-8 Temporary Outlet Protection (TOP) – Accepted

EC-9 Rough Cut Street Control (RCS) – Accepted

EC-10 Earth Dikes and Drainage Swales (ED/DS) – Accepted

EC-11 Terracing (TER) – Accepted

EC-12 Check Dams (CD) (multiple types) – Accepted

EC-13 Streambank Stabilization (SS) – Accepted

EC-14 Wind Erosion / Dust Control (DC) – Accepted

Materials Management

MM-1 Concrete Washout Area (CWA) – Accepted

MM-2 Stockpile Management (SP) (multiple types) – Accepted

MM-3 Good Housekeeping Practices (GH) – Accepted

Sediment Controls

SC-1 Silt Fence (SF) – Accepted

SC-2 Sediment Control Log (SCL) – Accepted

SC-3 Straw Bale Barrier (SBB) – Accepted

SC-4 Brush Barrier (BB) – Accepted

SC-5 Rock Sock (RS) – Accepted

SC-6 Inlet Protection (IP) (multiple types) – Accepted

SC-7 Sediment Basin (SB) – Accepted

SC-8 Sediment Trap (ST) – Accepted

SC-9 Vegetative Buffers (VB) – Accepted

SC-10 Chemical Treatment (CT) – Accepted

Site Management and Other Specific Practices

SM-1 Construction Phasing/Sequencing (CP) – Accepted

SM-2 Protection of Existing Vegetation (PV) – Accepted

SM-3 Construction Fence (CF) – Accepted

SM-4 Vehicle Tracking Control (VTC) (multiple types) – Accepted

SM-5 Stabilized Construction Roadway (SCR) – Accepted

SM-6 Stabilized Staging Area (SSA) – Accepted

SM-7 Street Sweeping and Vacuuming (SS) – Accepted

SM-8 Temporary Diversion Methods (TDM) – Accepted

SM-9 Dewatering Operations (DW) – Accepted

SM-10 Temporary Stream Crossing (TSC) (multiple types) – Accepted

SM-11 Temporary Batch Plant (TBP) – Accepted

SM-12 Paving and Grinding Operations (PGO) – Accepted

Appendix F - COLLECTED DATA

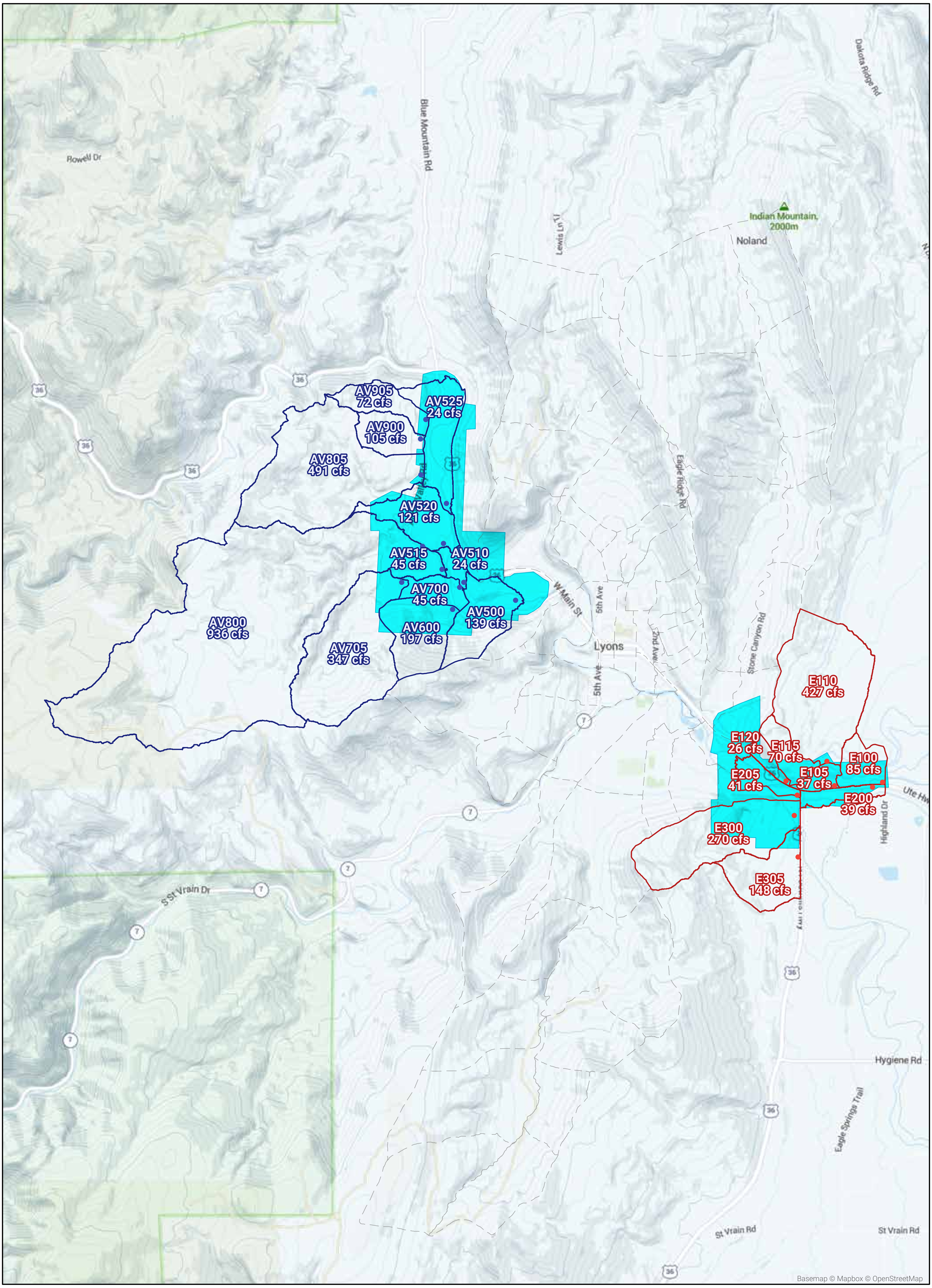
FID	OBJECTID	created_at	updated_at	version	status	latitude	longitude	type	type_other	material	material_o	condition	sediment	water_qual	maintenanc	photos
0	1	2016-05-18	2016-05-18	1	inspected	40.2331652	-105.291165	Conveyance,Box		Other	60x28 concrete	Acceptable	Moderate	None	Hand Tools	cf44bea3-9c81-428a-a773-48d6d4579fa2
1	2	2016-05-18	2016-05-18	1	inspected	40.2331909	-105.2911585	Conveyance,Box		Other	60x28 concrete	Acceptable	High	None	Hand Tools	92590ad3-6d32-4a94-817e-be2c9767dfbe
2	3	2016-05-18	2016-05-18	1	inspected	40.2482842	-105.2898495	Conveyance,Box		Other	75x75 con	New	Low	None	Hand Tools	ba47c948-7c75-4cf4-9e3f-3fd1cf794cf0
3	4	2016-05-18	2016-05-18	1	inspected	40.2480579	-105.2898487	Conveyance,Box		Other	75x75 con	New	Low	None	Hand Tools	868dcf9b-44fb-492a-ad9b-2cebd8b7da43
4	5	2016-05-18	2016-05-18	1	inspected	40.2423174	-105.2911063	Conveyance,Pipe		Metal		Deficient	Moderate	None	Hand Tools	f902b669-c895-4aa0-809e-31d8d46d387f,5fa37a1b-a3e0-49cd-b0bf-6012a5d5684d
5	6	2016-05-18	2016-05-18	1	inspected	40.2413708	-105.2912574	Conveyance,Pipe		Other	18 in. CMP	Acceptable	Moderate	None	Hand Tools	3d17cd01-8a34-4ec8-a606-9f9aa9fd4725,5c794881-d671-400f-a61d-6b1111f0565c
6	7	2016-05-18	2016-05-18	1	inspected	40.2393558	-105.2909709	Conveyance,Pipe		Other	36in cmp	Acceptable	Low	None	Power Tools	3049475f-7ef4-4c27-b80a-0456b79edd4d,e125b429-498e-4e42-8682-d5058f653344
7	8	2016-05-18	2016-05-18	1	inspected	40.2311476	-105.2889191	Conveyance,Pipe		Other	18in cmp	Deficient	High	None	Hand Tools	7df68910-66df-424c-bf39-d91e6d2c0cf0
8	9	2016-05-18	2016-05-18	1	inspected	40.2312295	-105.2886781	Conveyance,Pipe		Other	24in cmp	Good	Low	None	Hand Tools	1e4a34e3-96d9-4cfe-8959-9daaec1c38c8
9	10	2016-05-18	2016-05-18	1	inspected	40.2301823	-105.2885815	Conveyance,Pipe		Other	36in cmp	Acceptable	Low	None	Hand Tools	7ea18e3f-ce41-48e0-a5d2-7cafe5f7aa51
10	11	2016-05-18	2016-05-18	1	inspected	40.2301503	-105.2883225	Conveyance,Pipe		Other	36in cmp	Good	Low	None	Hand Tools	23cdcf77-cdd6-47ad-bcdf-321b55287915
11	12	2016-05-18	2016-05-18	1	inspected	40.2290742	-105.2883208	Conveyance,Pipe		Other	12in cmp	Deficient	High	None	Power Tools	f72c4592-1690-42af-a005-d91b15f4a699
12	13	2016-05-18	2016-05-18	1	inspected	40.229115	-105.2881939	Conveyance,Pipe		Other	12in cmp	Deficient	High	None	Power Tools	b8882161-1aed-4cd1-875b-20ccb08639d9
13	14	2016-05-18	2016-05-18	1	inspected	40.2278534	-105.2956397	Conveyance,Pipe		Other	18in plastic	Good	Low	None	Hand Tools	25fbcd46-5d8c-4b42-9e9f-b09114dfd832
14	15	2016-05-18	2016-05-18	1	inspected	40.2280352	-105.2956501	Conveyance,Pipe		Other	18in plastic	Good	Moderate	None	Hand Tools	47426490-74ea-44af-82f9-d22e72bbcc0b
15	16	2016-05-18	2016-05-18	1	inspected	40.2389236	-105.2878973	Conveyance,Pipe		Other	24in con	New	Low	None	Hand Tools	f31d7c3f-2fb1-4b00-97af-8caacf34b3ac
16	17	2016-05-18	2016-05-18	1	inspected	40.2388568	-105.2878418	Conveyance,Pipe		Other	24 con	New	Low	None	Hand Tools	329fe083-4c36-4631-b926-0ab23f954eab
17	18	2016-05-18	2016-05-18	1	inspected	40.2433555	-105.2873077	Conveyance,Pipe		Other	24in con	New	Low	None	Hand Tools	63c47341-3093-45bb-bb64-200873bbc96e
18	19	2016-05-18	2016-05-18	1	inspected	40.2433988	-105.2875433	Conveyance,Pipe		Other	24in con	New	Low	None	Hand Tools	6441290d-e321-4154-9ab1-4f0c6eb2f11e
19	20	2016-05-18	2016-05-18	1	inspected	40.2447981	-105.2866839	Conveyance,Pipe		Other	36in con	New	Low	None	Hand Tools	3bfb3464-2352-41a5-b2d3-f393e80752e8
20	21	2016-05-18	2016-05-18	1	inspected	40.2448842	-105.2870547	Conveyance,Pipe		Other	36in con	New	Low	None	Hand Tools	d851443f-4672-4146-b514-62b98d3f4658
21	22	2016-05-18	2016-05-18	1	inspected	40.2474342	-105.2870062	Conveyance,Pipe		Other	36in con	New	Low	None	Hand Tools	53b76ab5-e895-4a7a-9909-afb116a1e5e6
22	23	2016-05-18	2016-05-18	1	inspected	40.2473807	-105.2871685	Conveyance,Pipe		Other	36in con	New	Low	None	Hand Tools	1030c520-23a1-4bae-9cca-45238c720126
23	24	2016-05-18	2016-05-18	1	inspected	40.2480354	-105.2893543	Conveyance,Pipe		Other	36in con	New	Low	None	Hand Tools	64594d81-cfdf-4a30-a09a-7bc41cdcc97d
24	25	2016-05-18	2016-05-18	1	inspected	40.2482343	-105.2893009	Conveyance,Pipe		Other	36in con	New	Low	None	Hand Tools	7b3ebae8-9317-40dc-bd38-9d9ec842b7f8
25	26	2016-05-18	2016-05-18	1	inspected	40.2175219	-105.2591607	Conveyance,Pipe		Other	24in cmp	Good	Low	None	Hand Tools	6faeea95-3162-4e8f-b6e3-a317e52a3260
26	27	2016-05-18	2016-05-18	1	inspected	40.2314862	-105.2794515	Conveyance,Pipe		Other	48in con	Good	Moderate	None	Hand Tools	2465deeb-ac85-4ebe-9f5b-4b2be93268f4
27	28	2016-05-18	2016-05-18	1	inspected	40.2295659	-105.2762046	Inlet,Grate		Concrete		Good	Moderate	None	Hand Tools	445afdd6-a1d8-4c3a-bc0a-2bd5b7570746
28	29	2016-05-18	2016-05-18	1	inspected	40.2482546	-105.290942	Inlet,Grate		Concrete		New	Low	None	Hand Tools	6048e0d7-9971-49b1-acf4-2e35b20b9b13
29	30	2016-05-18	2016-05-18	1	inspected	40.231203	-105.2786585	Inlet,Grate		Concrete		Good	Low	None	Hand Tools	68bee461-bf84-4a73-ad91-beddb41c35f4
30	31	2016-05-18	2016-05-18	1	inspected	40.2299535	-105.2765276	Inlet,Vault		Other	16ft	Good	Low	None	Hand Tools	832ca3b5-c880-47d3-bed0-0dab3f3cdd5f
31	32	2016-05-18	2016-05-18	1	inspected	40.2308538	-105.2805609	Inlet,Vault		Other	5ft concrete	Good	Low	None	Hand Tools	87abb321-7282-4e9d-9f44-721c7264de34
32	33	2016-05-18	2016-05-18	1	inspected	40.231314	-105.2802544	Inlet,Vault		Other	5ft concrets	Good	Low	None	Hand Tools	cb969067-8a24-4d17-aed5-c4f6ff857370
33	34	2016-05-18	2016-05-18	1	inspected	40.2318222	-105.2795581	Inlet,Vault		Other	5ft concrete	Good	Low	None	Hand Tools	f2644f0f-06cf-4fc6-876d-f9195a7d92d2
34	35	2016-05-18	2016-05-18	1	inspected	40.2319115	-105.2795971	Inlet,Vault		Other	10ft concrete	Good	Low	None	Hand Tools	0b4353fa-01a4-4454-b20b-317fd006437a
35	36	2016-05-18	2016-05-18	1	inspected	40.2327013	-105.2797183	Inlet,Vault		Other	10ft con	Good	Low	None	Hand Tools	c42fd690-81d2-4371-a8c5-6915f19d3b6e
36	37	2016-05-18	2016-05-18	1	inspected	40.232806	-105.2799045	Inlet,Vault		Other	5ft con	Good	Low	None	Hand Tools	5c4c8893-a213-4c1f-ba9b-6af4f99a0bdd
37	38	2016-05-18	2016-05-18	1	inspected	40.2480894	-105.290929	Outlet,Pipe		Other	24in con	New	Low	None	Hand Tools	798acb15-f9f5-4668-a0c3-fcdadd8a650e
38	39	2016-05-18	2016-05-18	1	inspected	40.214927	-105.2722927	Conveyance,Box		Other	72x24 con	New	Low	None	Hand Tools	87b56e54-b8c8-45fd-92b2-8a7b844792a5
39	40	2016-05-18	2016-05-18	1	inspected	40.2149311	-105.2722092	Conveyance,Box		Other	72x24in	New	Low	None	Hand Tools	877c78eb-1a1f-48e7-81bc-726f2182a45f
40	41	2016-05-18	2016-05-18	1	inspected	40.2194159	-105.2566276	Conveyance,Box		Other	8ftx13ft	Good				6b1a075c-7bf0-4aa6-a6b5-fcb65304276e
41	42	2016-05-18	2016-05-18	1	inspected	40.2197487	-105.2566101	Conveyance,Box		Other	8ftx13ft	Good	Low			c80ad50b-d603-4d49-881b-d65d35a6dc21,3f31cd2c-217c-4fa9-bfa8-e7cb16c3882f
42	43	2016-05-18	2016-05-18	1	inspected	40.2187282	-105.2588601	Conveyance,Box		Other	4x12ft	Good	Low			7717b8cf-dd9b-48b6-8653-74252bb06f8e
43	44	2016-05-18	2016-05-18	1	inspected	40.218614	-105.2588147	Conveyance,Box		Other	4x12ft	Good	Low			d246c735-f4c2-45ff-8d29-015e7caa2a74
44	45	2016-05-18	2016-05-18	1	inspected	40.2168896	-105.2743606	Conveyance,Other	Bridge							434ea06d-e688-4079-9017-01ac8d629bea
45	46	2016-05-18	2016-05-18	1	inspected	40.2226678	-105.2715795	Conveyance,Other	Bridge							971e05c5-8457-4147-a697-f15b4d2eb8b2,35ad1aaa-c6cc-48a6-8772-b7e64b882485
46	47	2016-05-18	2016-05-18	1	inspected	40.2167204	-105.2630615	Conveyance,Other	MH	Concrete		Good				
47	48	2016-05-18	2016-05-18	1	inspected	40.2152228	-105.2600741	Conveyance,Other	MH							
48	49	2016-05-18	2016-05-18	1	inspected	40.2153835	-105.259708	Conveyance,Other	MH							
49	50	2016-05-18	2016-05-18	1	inspected	40.2153626	-105.2595767	Conveyance,Other	Detention	Rock		Good	Low	None	Hand Tools	583d0e4c-6e5e-45af-b155-068501b8ef84
50	51	2016-05-18	2016-05-18	1	inspected	40.2141902	-105.2600874	Conveyance,Other	MH							
51	52	2016-05-18	2016-05-18	1	inspected	40.2142278	-105.2600818	Conveyance,Other	MH							
52	53	2016-05-18	2016-05-18	1	inspected	40.2140845	-105.2601591	Conveyance,Other	MH							
53	54	2016-05-18	2016-05-18	1	inspected	40.2141146	-105.2599145	Conveyance,Other	MH							
54	55	2016-05-18	2016-05-18	1	inspected	40.2143574	-105.2599775	Conveyance,Other	MH							
55	56	2016-05-18	2016-05-18	1	inspected	40.2136764	-105.2608023	Conveyance,Other	MH							
56	57	2016-05-18	2016-05-18	1	inspected	40.2147836	-105.2597888	Conveyance,Other	MH							
57	58	2016-05-18	2016-05-18	1	inspected	40.2150597	-105.2599233	Conveyance,Other	MH							
58	59	2016-05-18	2016-05-18	1	inspected	40.2159243	-105.2607987	Conveyance,Other	MH							
59	60	2016-05-18	2016-05-18	1	inspected	40.2177675	-105.2601132	Conveyance,Other	Bridge							cd4b36c6-81c7-4b79-aea6-78686bdaa319,2510f4ee-da50-4f49-a4da-1b9fd2af0b01
60	61	2016-05-18	2016-05-18	1	inspected	40.2133509	-105.2746192	Conveyance,Pipe		Other	18in cmp	Acceptable	Moderate	None	Hand Tools	843ab126-680f-4273-aa3a-7bbcc39462e4
61	62	2016-05-18	2016-05-18	1	inspected	40.213272	-105.2747123	Conveyance,Pipe		Other	18in. Cmp	Good	Low	None	Hand Tools	403cf650-eaa6-4768-8c5e-96dfc3963092
62	63	2016-05-18	2016-05-18	1	inspected	40.2134342	-105.2747894	Conveyance,Pipe		Other	30in cmp	Acceptable	Moderate	None	Hand Tools	9a65e0c2-8866-4a6b-aa72-9ab18ccc5c05
63	64	2016-05-18	2016-05-18	1	inspected	40.2133641	-105.2745695	Conveyance,Pipe		Other	30in cmp	Deficient	Moderate	None	Hand Tools	29c8452a-0de9-4276-b100-b303401979be
64	65	2016-05-18	2016-05-18	1	inspected	40.2169747	-105.274369	Conveyance,Pipe		Other	18in cmp	Good	Low	None	Hand Tools	e427fa86-f0a2-4b34-b9cf-14e3d58c2142
65	66	2016-05-18	2016-05-18	1	inspected	40.217046	-105.2742719	Conveyance,Pipe		Other	18in cmp	Good	Low	None	Hand Tools	fb5dab50-a436-4aea-958f-d2d49720506f
66	67	2016-05-18	2016-05-18	1	inspected	40.2150104	-105.2718973	Conveyance,Pipe		Other	30in con	Acceptable	Low	None	Hand Tools	a5b03895-822c-4fda-b479-9ed4946c837c
67	68	2016-05-18	2016-05-18	1	inspected	40.2150492	-105.2719002	Conveyance,Pipe		Other	30in con	Acceptable	Low	None	Hand Tools	84a6f4fd-af37-4057-802c-aebf1969a300
68	69	2016-05-18	2016-05-18	1	inspected	40.2169776	-105.2724245	Conveyance,Pipe		Other	24in cmp	Acceptable	Low	None	Hand Tools	4a33acaa-4336-4ade-a0a0-0df35dd157b2
69	70	2016-05-18	2016-05-18	1	inspected	40.2167937	-105.2724432	Conveyance,Pipe		Other	24in cmp	Acceptable	Low	None	Hand Tools	1afe2fca-e3cf-496e-b3f1-0c30545fe64b
70	71	2016-05-18	2016-05-18	1	inspected	40.2172763	-105.260948	Conveyance,Pipe		Other	5 60in cmp	Good	Low			238ee6b5-4c6b-4e8e-92a0-bd7e096054d9
71	72	2016-05-18	2016-05-18	1	inspected	40.2212145	-105.2546648	Inlet,Grate		Concrete		Good	Low			6980cdf7-437f-48ef-881c-37728bf4ffbd
72	73	2016-05-18	2016-05-18	1	inspected	40.2226579	-105.2716116	Inlet,Other	6in drain	Metal		Good	Moderate	None	Hand Tools	99d66e14-e7c9-46de-80cf-a35503ae1e91
73	74	2016-05-18	2016-05-18	1	inspected	40.2227606	-105.2716053	Inlet,Other	6in drain	Metal		Good	Low	None	Hand Tools	292d29bf-71ad-4589-ada3-db750b93693b
74	75	2016-05-18	2016-05-18	1	inspected	40.2227539	-105.2717141	Inlet,Other	6in drain	Metal		Good	Low	None	Hand Tools	39f8b6c6-b06e-44b2-bd08-4c7b20210dc8
75	76	2016-05-18	2016-05-18	1	inspected	40.2226426	-105.2717072	Inlet,Other	6in drain	Metal		Good	Low	None	Hand Tools	9fb56d56-5522-4519-b4d6-5ddc97a71113
76	77	2016-05-18	2016-05-18	1	inspected	40.2153738	-105.2595201	Inlet,Pipe		Other	28x38 rcp	Good				e196d85e-893d-4681-8d46-805bbe1cec64
77	78	2016-05-18	2016-05-18	1	inspected	40.2214267	-105.2692506	Inlet,Vault		Other	10ft con	New	Low	None	Hand Tools	66fab495-d95b-45bc-bf59-de473819a26f
78	79	2016-05-18	2016-05-18	1	inspected	40.2216996	-105.2701795	Inlet,Vault		Other	10ft con	New	Low	None	Hand Tools	2b1cb67b-e216-4f18-87fc-f1b1bfa0471b
79	80	2016-05-18	2016-05-18	1	inspected	40.2225582	-105.2721068	Inlet,Vault		Other	5ft con	New	Low	None	Hand Tools	9161adb3-d518-43ae-9c1f-b91045130995
80	81	2016-05-18	2016-05-18	1	inspected	40.222551	-105.2720667	Inlet,Vault		Other	5ft con	New	Low	None	Hand Tools	6a43a0f7-a721-495c-8218-48712af354a9
81	82	2016-05-18	2016-05-18	1	inspected	40.222517	-105.2701384	Inlet,Vault		Other	5ft	New	Low	None	Hand Tools	28608546-05a3-4206-a9cf-2ccd3d82cf59
82	83	2016-05-18	2016-05-18	1	inspected	40.222474	-105.2701288	Inlet,Vault		Other	5ft con	New	Low	None	Hand Tools	f48377e0-9d8a-4934-85dd-4c4c8e8efb4b
83	84	2016-05-18	2016-05-18	1	inspected	40.218993	-105.2652931	Inlet,Vault		Other	10ft	Good	Low	None	Hand Tools	892370bc-a84f-4760-9b64-fea17ee2bc28
84	85	2016-05-18	2016-05-18	1	inspected	40.2191679	-105.2652484	Inlet,Vault		Other	5ft	Good	Low	None	Hand Tools	49858323-fa4f-433f-9f6f-2970990bf9f0
85	86	2016-05-18	2016-05-18	1	inspected	40.2167943	-105.2641497	Inlet,Vault		Concrete		Good	Low	None	Hand Tools	0bc3ed05-a304-4244-9686-a39510f4050f
86	87	2016-05-18	2016-05-18	1	inspected	40.2137881	-105.2629573	Inlet,Vault		Other	5ft	Good	Low	None	Hand Tools	67b128d1-9694-4e6b-8c0b-8ab8a747c4a3
87	88	2016-05-18	2016-05-18	1	inspected	40.2147218	-105.2626159	Inlet,Vault		Other	5ft	Good		None	Hand Tools	e503ab3c-708d-4970-9ab5-cea08553dabb
88	89	2016-05-18	2016-05-18	1	inspected	40.2147502	-105.2626927	Inlet,Vault		Other	5ft	Good	Low	None	Hand Tools	cf40b262-3d6f-4105-91fd-27bade0a48f2
89	90	2016-05-18	2016-05-18	1	inspected	40.2153609	-105.2620319	Inlet,Vault		Other	5ft	Good	Low	None	Hand Tools	edf0e262-ebfc-4789-8fce-474488ff5384
90	91	2016-05-18	2016-05-18	1	inspected	40.2164718	-105.2632989	Inlet,Vault		Other	5ft	Good	Low	None	Hand Tools	fef9dfec-deab-4d12-a593-36593ab72ee6
91	92	2016-05-18	2016-05-18	1	inspected	40.2165297	-105.2633998	Inlet,Vault		Other	3ft	Good	Low	None	Hand Tools	48dc67e0-ac1f-4f24-a882-9b79da8e6b30
92	93	2016-05-18	2016-05-18	1	inspected	40.2166488	-105.26343	Inlet,Vault		Other	3ft	Good	Low	None	Hand Tools	b9bd1df6-f0d1-448b-819c-2c3d068a8270
93	94	2016-05-18	2016-05-18	1	inspected	40.2176468	-105.2625239	Inlet,Vault		Other	5ft	Good	Moderate	None	Hand Tools	5476e366-016b-46ef-8b42-c89b4fa38b4f
94	95	2016-05-18	2016-05-18	1	inspected	40.2158743	-105.2608785	Inlet,Vault		Other	10ft	Good	Low	None	Hand Tools	88fff3c3-70c9-4b0f-a2f6-f830da66f958
95	96	2016-05-18	2016-05-18	1	inspected	40.2152593	-105.2601433	Inlet,Vault		Other	5ft	Good				d1e7365a-a937-4690-bf01-b8f6bf557657
96	97	2016-05-18	2016-05-18	1	inspected	40.2152407	-105.2599769	Inlet,Vault		Other	5ft	Good	Low			ee3f8b5d-c8f1-4be7-a0d5-c7e32fe80b4e
97	98	2016-05-18	2016-05-18	1	inspected	40.2142496	-105.2602424	Inlet,Vault		Other	5ft	Good				99bed7fd-d60a-4faa-b258-4759c455986e
98	99	2016-05-18	2016-05-18	1	inspected	40.2141293	-105.2599872	Inlet,Vault		Other	10ft	Good				91e14947-bfa7-487b-92e7-b2534b42c5e0
99	100	2016-05-18	2016-05-18	1	inspected	40.2138671	-105.2609284	Inlet,Vault		Other	5ft	Good				2ffd61e1-ea60-47e7-ab52-0754a6e5b6d4
100	101	2016-05-18	2016-05-18	1	inspected	40.2184317	-105.2591426	Inlet,Vault		Other	10ft	Good	Low			89271162-5150-4f90-b38f-a1c4fe49535a
101	102	2016-05-18	2016-05-18	1	inspected	40.218507	-105.2592187	Inlet,Vault		Other	10ft	Good	Low	None		781aefe6-57eb-4e34-8b8f-aa999e7009dd
102	103	2016-05-18	2016-05-18	1	inspected	40.2195357	-105.2566674	Inlet,Vault		Other	5ft	Good	Low			a5e59c0b-45b9-45b2-a061-cb42340c6220
103	104	2016-05-18	2016-05-18	1	inspected	40.2197017	-105.2566269	Inlet,Vault		Other	5ft	Good				b375a47f-7f98-4c71-9953-ccd80a5c1e7d
104	105	2016-05-18	2016-05-18	1	inspected	40.2197786	-105.2559328	Inlet,Vault		Other	5ft	Good				5882b199-60c8-4605-9c00-8de6718c889b
105	106	2016-05-18	2016-05-18	1	inspected	40.2198617	-105.2559633	Inlet,Vault		Other	5ft	Good				76df88d8-ae77-4a0f-867e-a010393e06c9
106	107	2016-05-18	2016-05-18	1	inspected	40.2212139	-105.2547105	Inlet,Vault		Other	5ft	Good				242ca11c-9d4d-489d-b1e3-d2bdfa6229fd
107	108	2016-05-18	2016-05-18	1	inspected	40.2211984	-105.2548421	Inlet,Vault		Other	5ft	Good				e45838e5-5a53-45ef-bb7f-98f27b0cb789
108	109	2016-05-18	2016-05-18	1	inspected	40.2217056	-105.2562264	Inlet,Vault		Other	10ft	Good				3f42f379-0e84-4c91-90cb-4985b92f8d71
109	110	2016-05-18	2016-05-18	1	inspected	40.2204403	-105.2577333	Inlet,Vault		Other	15ft	Good	High			bd1efe0d-1c0b-4486-8e53-6a99eb9e7e43
110	111	2016-05-18	2016-05-18	1	inspected	40.2207976	-105.2569189	Inlet,Vault		Other	10ft	Good	Moderate			a8dbaa14-1f37-402e-ae40-13f7d4098ac1
111	112	2016-05-18	2016-05-18	1	inspected	40.2200294	-105.257886	Inlet,Vault		Other	15ft	Good	Low			779b7c74-ab8a-41e4-847b-c903dfb21bd4
112	113	2016-05-18	2016-05-18	1	inspected	40.220066	-105.2570719	Inlet,Vault		Other	10ft	Good	Low			8f823c9c-bf4f-4eda-b34c-a6f54af29ffb
113	114	2016-05-18	2016-05-18	1	inspected	40.2182517	-105.2595899	Inlet,Vault		Other	5ft	New	Low			2f075400-39d7-4f0e-ab77-37435734269c
114	115	2016-05-18	2016-05-18	1	inspected	40.2181508	-105.2594355	Inlet,Vault		Other	5ft	New	Low			c31d3d2d-0356-4d7d-a5e4-1279e4a6b5fe
115	116	2016-05-18	2016-05-18	1	inspected	40.2221736	-105.2678024	Outlet,Pipe		Other	48in con	New	Moderate	None	Hand Tools	95072729-78d3-4150-af14-89fe90a20a6e
116	117	2016-05-18	2016-05-18	1	inspected	40.22286645	-105.2715198	Outlet,Pipe		Other	16x28 cmp	Good	Low	None	Hand Tools	2cb77d90-9d3c-4fcb-ac8a-688912cc7e27
117	118	2016-05-18	2016-05-18	1	inspected	40.2228403	-105.2711771	Outlet,Pipe		Other	3x5ft	Good	Low	None	Hand Tools	75743c3b-010b-47bd-b0f9-5ee2a5d1fdc6
118	119	2016-05-18	2016-05-18	1	inspected	40.2191053	-105.2648587	Outlet,Pipe		Other	30in rcp	Good	Moderate	None	Hand Tools	3059a479-b4b5-4c9f-b897-0b880756a9e9
119	120	2016-05-18	2016-05-18	1	inspected	40.2177418	-105.262139	Outlet,Pipe		Other	18in rcp	Good	Low	None	Hand Tools	8ee1b85f-145d-4bf8-aa28-826bc280dc17
120	121	2016-05-18	2016-05-18	1	inspected	40.2170725	-105.2638845	Outlet,Pipe		Other	12in pvc	Good	Low	None	Hand Tools	c475573d-2c96-424e-979a-e3a24671f48f
121	122	2016-05-18	2016-05-18	1	inspected	40.2153709	-105.2596787	Outlet,Pipe		Other	30in rcp	Good				c769a47e-972f-4321-8639-06f6a476342f
122	123	2016-05-18	2016-05-18	1	inspected	40.2154073	-105.2594481	Outlet,Pipe		Other	28x38 rcp	Good				7c500a67-c013-46d4-b337-e6f09cf3dde7
123	124	2016-05-18	2016-05-18	1	inspected	40.2172045	-105.2613499	Outlet,Pipe		Other	24in rcp	Good	High			ba1c9966-547b-4029-8b9c-85e5d86af714
124	125	2016-05-18	2016-05-18	1	inspected	40.2198944	-105.2565731	Outlet,Pipe		Other	24in rcp	Good				d1a02de9-cdda-468b-be18-6ae1a7a5b12f
125	126	2016-05-18	2016-05-18	1	inspected	40.2213253	-105.2554654	Outlet,Pipe		Other	24in rcp	Good	High			4407c82e-1f73-45a8-9979-3fdca1c0da2f
126	127	2016-05-18	2016-05-18	1	inspected	40.2219046	-105.2558192	Outlet,Pipe		Other	18in rcp	Good	High			3b1be03c-91cc-4527-a84d-123fcf49f42f
127	128	2016-05-18	2016-05-18	1	inspected	40.2205423	-105.2564101	Outlet,Pipe		Other	18in rcp	Good	Moderate			237096ef-cb7b-4471-8fd5-b44d09bf198a
128	129	2016-05-18	2016-05-18	1	inspected	40.2200845	-105.2566357	Outlet,Pipe		Other	18in rcp	Good	Low			c40979ef-db09-4956-87df-083c68fa5b7e
129	130	2016-05-19	2016-05-19	1	inspected	40.2275603	-105.2703456	Conveyance,Box		Rock		Good				5781dc22-6766-4f03-8243-7dcbbdf4a528
130	131	2016-05-19	2016-05-19	1	inspected	40.2204691	-105.265487	Conveyance,Other	Bridge							95b72cad-a804-4552-9307-ac4c24cf36c8,e643ba17-46e7-4506-8d90-9f25375f10fd
131	132	2016-05-19	2016-05-19	1	inspected	40.2215535	-105.2644192	Conveyance,Other	MH							
132	133	2016-05-19	2016-05-19	1	inspected	40.2230554	-105.2664768	Conveyance,Other	MH							
133	134	2016-05-19	2016-05-19	1	inspected	40.2229179	-105.2658163	Conveyance,Other	MH							
134	135	2016-05-19	2016-05-19	1	inspected	40.2253771	-105.2712769	Conveyance,Other	Bridge							
135	136	2016-05-19	2016-05-19	1	inspected	40.22570283	-105.2723969	Conveyance,Other	Bridge							ee1cdf4b-c13a-48ea-825f-8d4ecfbe33d6
136	137	2016-05-19	2016-05-19	1	inspected	40.2254387	-105.2722679	Conveyance,Other	MH	Metal						
137	138	2016-05-19	2016-05-19	1	inspected	40.2247064	-105.2684367	Conveyance,Other	MH							
138	139	2016-05-19	2016-05-19	1	inspected	40.2246304	-105.2684356	Conveyance,Other	MH							
139	140	2016-05-19	2016-05-19	1	inspected	40.2248392	-105.2699721	Conveyance,Other	MH							
140	141	2016-05-19	2016-05-19	1	inspected	40.2241425	-105.2699815	Conveyance,Other	MH							
141	142	2016-05-19	2016-05-19	1	inspected	40.224167	-105.2699385	Conveyance,Other	MH							
142	143	2016-05-19	2016-05-19	1	inspected	40.2230369	-105.2655884	Conveyance,Other	MH							
143	144	2016-05-19	2016-05-19	1	inspected	40.2212565	-105.2639939	Conveyance,Other	MH							
144	145	2016-05-19	2016-05-19	1	inspected	40.2213955	-105.2653689	Conveyance,Pipe		Other	12in cast iron	Good	Moderate			f9e5cb62-2c58-46b3-aee2-40be713beacf
145	146	2016-05-19	2016-05-19	1	inspected	40.222335	-105.2653206	Conveyance,Pipe		Other	18in cmp	Acceptable	High		Hand Tools	c0b6661b-335c-4654-b1d4-c9a8d7cb4113
146	147	2016-05-19	2016-05-19	1	inspected	40.2224834	-105.2655159	Conveyance,Pipe		Other	18in cmp	Acceptable	Moderate			69b9f2ed-1816-4117-8a5a-0e63679685eb
147	148	2016-05-19	2016-05-19	1	inspected	40.2217249	-105.2652762	Conveyance,Pipe		Other	12in cmp	Good	Moderate			ac388127-3386-4a2e-830d-279398ed45fb
148	149	2016-05-19	2016-05-19	1	inspected	40.2303712	-105.2715381	Conveyance,Pipe		Other	3ft cmp	Good	Low			94ea66a5-3306-497a-9f5f-f1483ba066f7
149	150	2016-05-19	2016-05-19	1	inspected	40.2303757	-105.2716369	Conveyance,Pipe		Other	36in cmp	Good	High			20c91363-ebbc-462b-bada-ab87124a8411
150	151	2016-05-19	2016-05-19	1	inspected	40.2335862	-105.2698777	Conveyance,Pipe		Other	2 4ft rcp	Good	Low			132a63a2-0022-4765-8ba6-820f8012eae6
151	152	2016-05-19	2016-05-19	1	inspected	40.2333576	-105.2697992	Conveyance,Pipe		Other	2 4ft rcp	Good	Low			0c9b18ff-0a52-4efd-85d9-46e513836013
152	153	2016-05-19	2016-05-19	1	inspected	40.2292118	-105.2703637	Conveyance,Pipe		Other	42in cmp	Good				0ba5dc13-1fb5-44a5-b273-4f56fb5f072a
153	154	2016-05-19	2016-05-19	1	inspected	40.2292748	-105.2702896	Conveyance,Pipe		Other	42in cmp	Good	Low			60b85cf9-5538-4471-8523-05dcd4748228
154	155	2016-05-19	2016-05-19	1	inspected	40.228833	-105.2705196	Conveyance,Pipe		Other	36in cmp	Good				69f01ffe-0c0c-4a5f-9ef8-5bb22ae7090d
155	156	2016-05-19	2016-05-19	1	inspected	40.2286686	-105.2706709	Conveyance,Pipe		Other	36in cmp	Good				6612b3c2-0cbd-493c-b320-3baa91bc66d8
156	157	2016-05-19	2016-05-19	1	inspected	40.2266527	-105.2678717	Conveyance,Pipe		Other	18in cmp	Good	Low			59888450-6744-4148-b3aa-62aecb81321d
157	158	2016-05-19	2016-05-23	2	inspected	40.2265545	-105.2678378	Conveyance,Pipe		Other	18in cmp	Good				b22ca499-b630-4e68-b17f-673c4a782611
158	159	2016-05-19	2016-05-19	1	inspected	40.2250745	-105.2674961	Conveyance,Pipe		Other	18in	Acceptable	High		Hand Tools	99017203-6460-4fad-9991-e671a6bc6a45
159	160	2016-05-19	2016-05-19	1	inspected	40.2252315	-105.267541	Conveyance,Pipe		Other	18in	Acceptable	Low			de828a5f-a7e2-4821-b5c9-34ac4d329982
160	161	2016-05-19	2016-05-19	1	inspected	40.221368	-105.2654272	Inlet,Grate		Metal		Good	Moderate			e2b98845-24e4-4398-b61e-18c0f0404057
161	162	2016-05-19	2016-05-19	1	inspected	40.2214993	-105.2653437	Inlet,Grate		Metal		Good	Moderate			ed3653e6-85f6-4ed8-a7f6-dc75f58dcc9d
162	163	2016-05-19	2016-05-19	1	inspected	40.2213835	-105.2654895	Inlet,Grate		Metal		Good	Moderate			d455e902-7e14-4385-afce-dc72cdc7206a
163	164	2016-05-19	2016-05-19	1	inspected	40.2224821	-105.2673955	Inlet,Grate		Metal		Good	Low			2e974006-3d85-48e3-b790-8d5388fc4a7d
164	165	2016-05-19	2016-05-19	1	inspected	40.2233206	-105.2673326	Inlet,Grate		Metal		Good				07c95515-c66a-49f6-a1f7-65d3ff65408c
165	166	2016-05-19	2016-05-19	1	inspected	40.2231378	-105.2663223	Inlet,Grate				Good	Low			7e386d7b-ffdd-4b0a-8051-678ae0c8006c

166	167	2016-05-19	2016-05-19	1	inspected	40.2235603	-105.266796	Inlet,Grate		Metal		Good	Low			44f26140-d374-4e25-bae3-f57a43de74d3
167	168	2016-05-19	2016-05-19	1	inspected	40.2234941	-105.2673747	Inlet,Grate		Metal		Good	Low			c413ec67-fe65-490e-b58c-c435b2e09be7
168	169	2016-05-19	2016-05-19	1	inspected	40.2236389	-105.267229	Inlet,Grate		Metal		Good				68a298e9-1cdc-4546-8814-dac712dd81f3
169	170	2016-05-19	2016-05-19	1	inspected	40.223668	-105.2698235	Inlet,Grate		Metal		Good				afb06a04-11f0-4a9a-82fe-a40763f530fc
170	171	2016-05-19	2016-05-19	1	inspected	40.2236544	-105.270023	Inlet,Grate		Metal		Good	Low			427cbcae-01dc-4e92-b713-f28b3ef12f12
171	172	2016-05-19	2016-05-19	1	inspected	40.2236633	-105.2702192	Inlet,Grate		Metal		Good	Low			350ab18b-f9c8-4bbe-9e35-7c2256250af6
172	173	2016-05-19	2016-05-19	1	inspected	40.223486	-105.2715266	Inlet,Grate		Metal		Good				53605db3-d89c-42d1-b601-cf45bf11f6e6
173	174	2016-05-19	2016-05-19	1	inspected	40.2237538	-105.2715395	Inlet,Grate		Metal		Good	Moderate			092e386d-6818-4dde-860e-fbca702e4634
174	175	2016-05-19	2016-05-19	1	inspected	40.2234773	-105.2711476	Inlet,Grate		Metal		Good	Low			ce8f3b58-cdfa-4ec5-a178-7ca0523533d1
175	176	2016-05-19	2016-05-19	1	inspected	40.2230521	-105.2715545	Inlet,Grate		Metal		Deficient				8dcdc07c-da7a-460c-b27f-0a02c8e71157
176	177	2016-05-19	2016-05-19	1	inspected	40.2232022	-105.2715433	Inlet,Grate		Metal		Acceptable	High			49599547-2859-4fdd-b179-546e22e20de2
177	178	2016-05-19	2016-05-19	1	inspected	40.2231853	-105.2709451	Inlet,Grate		Metal		Acceptable				d69ea321-3176-48f1-9c55-71a25cbd0150
178	179	2016-05-19	2016-05-19	1	inspected	40.2232232	-105.2710827	Inlet,Grate		Metal		Good				f39cb137-eabd-40a5-9f2e-c8f155d13801
179	180	2016-05-19	2016-05-19	1	inspected	40.2231071	-105.2707346	Inlet,Grate		Metal		Good				62af01f8-3b05-40b5-a460-88302fd13008
180	181	2016-05-19	2016-05-19	1	inspected	40.2291889	-105.2663996	Inlet,Grate		Metal		Good				85b2c700-8062-433b-9a27-b50e3c4bfabc
181	182	2016-05-19	2016-05-19	1	inspected	40.2292462	-105.2662106	Inlet,Grate		Metal		Acceptable	Moderate			73f8736c-41a1-469f-aacd-97c9578b9129
182	183	2016-05-19	2016-05-19	1	inspected	40.2277616	-105.265969	Inlet,Grate		Metal						c3bbe5e8-5694-43dc-bb83-ef8a05d3fa5e
183	184	2016-05-19	2016-05-19	1	inspected	40.2276147	-105.2677105	Inlet,Grate		Metal		Good				9f0a0b9e-2c5d-4639-afdd-f1f82876d6e3
184	185	2016-05-19	2016-05-19	1	inspected	40.2265129	-105.2680967	Inlet,Grate		Metal		Good	High			96699797-92fd-4144-b8fe-c922746197f0
185	186	2016-05-19	2016-05-19	1	inspected	40.2267243	-105.2697667	Inlet,Grate		Metal		Good	Low			0abdf1d6-2293-475b-84b8-ff24a9f0d49d
186	187	2016-05-19	2016-05-19	1	inspected	40.2267102	-105.2704128	Inlet,Grate		Metal		Good				a79fbb80-c339-48fb-8ebb-42b32f43914e
187	188	2016-05-19	2016-05-19	1	inspected	40.2266446	-105.2704336	Inlet,Grate		Metal		Good				55e5853d-5f52-4d01-9cfc-eaee90182d9f
188	189	2016-05-19	2016-05-19	1	inspected	40.2257047	-105.2715044	Inlet,Grate		Metal		Good	Low			63a9b71f-87ea-4057-9496-23903705c695
189	190	2016-05-19	2016-05-19	1	inspected	40.2255084	-105.2697223	Inlet,Grate		Metal		Good				921bf385-1848-4f9b-b990-6f478d0c22dd
190	191	2016-05-19	2016-05-19	1	inspected	40.2255033	-105.2699113	Inlet,Grate		Metal		Good				ec197755-9022-423c-87b0-aed4d64e65c9
191	192	2016-05-19	2016-05-19	1	inspected	40.2253489	-105.2699542	Inlet,Grate		Metal		Good				39f8340d-9036-474a-8835-b057b5c53098
192	193	2016-05-19	2016-05-19	1	inspected	40.2257915	-105.2722905	Inlet,Grate		Metal		Good				6feea83f-222d-402c-b28f-53c54ce0cbea
193	194	2016-05-19	2016-05-23	2	inspected	40.2251553	-105.2711853	Inlet,Grate		Metal		Good				a5f733ba-3dc4-4bea-a13f-f7e68bc36c5f
194	195	2016-05-19	2016-05-19	1	inspected	40.2239101	-105.2700164	Inlet,Grate		Metal		Good				f40ea86f-911f-4dd2-bde0-a061123b8774
195	196	2016-05-19	2016-05-19	1	inspected	40.224113	-105.2690117	Inlet,Grate		Metal						4f8603e1-1766-47b2-964e-338277acbde0
196	197	2016-05-19	2016-05-19	1	inspected	40.2251341	-105.2675733	Inlet,Grate		Metal		Good	High			8f982ec5-f77e-41b1-8028-15dde6fef1b7
197	198	2016-05-19	2016-05-19	1	inspected	40.2248056	-105.2675356	Inlet,Grate		Metal		Good	High			81b82af1-17d7-48b7-b809-757bbfaf790f
198	199	2016-05-19	2016-05-19	1	inspected	40.2266333	-105.2654244	Inlet,Grate		Metal		Good	High			fa4b8923-28e6-48e1-9615-04429a1c9c5b
199	200	2016-05-19	2016-05-19	1	inspected	40.2265972	-105.2650378	Inlet,Grate		Metal		Good	Moderate			cf631813-d364-43dd-956c-4e8428e12597
200	201	2016-05-19	2016-05-19	1	inspected	40.2231894	-105.2653051	Inlet,Grate		Metal		Good	Moderate			ac37b32a-b3bc-4e38-bfe7-047f8754a4f9
201	202	2016-05-19	2016-05-19	1	inspected	40.2230623	-105.2655738	Inlet,Grate		Metal		Good	Moderate			4ad0cf92-9f5d-44d4-9969-8f8843cc2f50
202	203	2016-05-19	2016-05-19	1	inspected	40.2220591	-105.2644204	Inlet,Grate		Metal		Good	Low			15d0bc67-74f0-4eb6-aa4a-4ee8f5c7130c
203	204	2016-05-19	2016-05-19	1	inspected	40.2192627	-105.2658289	Inlet,Pipe		Other	36x48in rcp	Deficient	High		Hand Tools	e327639a-3d88-4bfc-ab2d-864bc470c3f8
204	205	2016-05-19	2016-05-19	1	inspected	40.2212209	-105.2653441	Inlet,Pipe		Other	18in cmp	Acceptable	Moderate			6c732389-e6d4-4379-90b6-1aba5935ab5f
205	206	2016-05-19	2016-05-19	1	inspected	40.2225865	-105.267394	Inlet,Pipe		Other	18 pvc	Good				5d9920e4-b8b1-480a-884e-aac208d1a654
206	207	2016-05-19	2016-05-19	1	inspected	40.2228773	-105.2658799	Inlet,Pipe		Other	36in rcp	New				f57a41c0-2d8e-4bb1-8d07-38924fc71183
207	208	2016-05-19	2016-05-19	1	inspected	40.2237033	-105.2673317	Inlet,Pipe		Other	24in cmp	Good	Low			145c29e0-4630-4e5b-8f39-1018df820c8b
208	209	2016-05-19	2016-05-19	1	inspected	40.2266995	-105.2648906	Inlet,Pipe		Other	30in cmp	Good	High			7e5f5420-7348-4ca4-94ec-530de38a76fb
209	210	2016-05-19	2016-05-19	1	inspected	40.2235518	-105.265363	Inlet,Pipe		Other	12in cmp	Acceptable	Moderate			7e57540d-ff05-4ab3-bea7-5f33a27de7b1
210	211	2016-05-19	2016-05-19	1	inspected	40.2214936	-105.2644357	Inlet,Vault		Other	3ft	Good				554242ad-0370-4d78-92c1-44469d52202f
211	212	2016-05-19	2016-05-19	1	inspected	40.2213908	-105.2645293	Inlet,Vault		Other	5ff	Good				e47e096a-df15-42f0-b119-cef3c86b56a8
212	213	2016-05-19	2016-05-19	1	inspected	40.2216403	-105.2644691	Inlet,Vault		Other	5ft	New				f1ec472a-6f57-4421-b256-dfc14546d9ae
213	214	2016-05-19	2016-05-19	1	inspected	40.2219432	-105.264636	Inlet,Vault		Other	5ft	New				00f79751-e81c-4e99-acfc-dacd5ebe032a
214	215	2016-05-19	2016-05-19	1	inspected	40.222721	-105.2656092	Inlet,Vault		Other	10ft	New				546e7a0e-da61-4b1e-9c8a-06f6d2b6313e
215	216	2016-05-19	2016-05-19	1	inspected	40.2215018	-105.267299	Inlet,Vault		Other	10ft	New				9b0c7daa-8f25-4b2b-a054-6587aaff5ecb
216	217	2016-05-19	2016-05-19	1	inspected	40.221501	-105.2674874	Inlet,Vault		Other	10ft	New				7edde469-b39e-4542-a5d9-e5d04ff951e9
217	218	2016-05-19	2016-05-19	1	inspected	40.2231169	-105.2676306	Inlet,Vault		Metal		Good	Low			cfb0a365-316a-4c26-bfd9-b8ddcb179c91
218	219	2016-05-19	2016-05-19	1	inspected	40.2239874	-105.2690311	Inlet,Vault		Other	5ft	Good				62158c67-5d15-4ecd-be0c-63c8a170ac65
219	220	2016-05-19	2016-05-19	1	inspected	40.2302468	-105.2713803	Inlet,Vault		Other	5ft	Good				487a24ce-9f68-41b7-b05e-3e1a53156a14
220	221	2016-05-19	2016-05-19	1	inspected	40.2309321	-105.2706749	Inlet,Vault		Other	5ft					7bdc51fc-28e4-4dcc-929f-53d1d6404dc1
221	222	2016-05-19	2016-05-19	1	inspected	40.2309193	-105.2707259	Inlet,Vault		Other	10ft	Good				981194dd-0e19-4e20-8d67-0ccb32862a01
222	223	2016-05-19	2016-05-19	1	inspected	40.2310306	-105.2707445	Inlet,Vault		Other	10ft	Good				64cd6420-5547-4b49-a958-183841e50395
223	224	2016-05-19	2016-05-19	1	inspected	40.2332492	-105.2695643	Inlet,Vault		Other	15ft	Good	Low			e3fbbde1-3940-4d7f-9c90-e392a17635a5
224	225	2016-05-19	2016-05-19	1	inspected	40.2332223	-105.2696765	Inlet,Vault		Other	10ft	Good				b4b92867-2d44-49c0-9e8f-c0c565c4b0fc
225	226	2016-05-19	2016-05-19	1	inspected	40.2315109	-105.2687897	Inlet,Vault		Other	4ft	Good				62b044a1-81cb-4c18-a87c-faa76ec560fa
226	227	2016-05-19	2016-05-19	1	inspected	40.231636	-105.2687384	Inlet,Vault		Other	5ft	Good				5a0f7659-894a-40dd-b79c-34800b301c1f
227	228	2016-05-19	2016-05-19	1	inspected	40.2277685	-105.2703885	Inlet,Vault		Rock		Acceptable	Low			0464235d-57f3-414d-a1ca-5adf52121d47
228	229	2016-05-19	2016-05-19	1	inspected	40.2255263	-105.2716835	Inlet,Vault		Other	5ft	Good	Low			2cfbf2f2-d20c-452b-aed8-a40469a756ca
229	230	2016-05-19	2016-05-19	1	inspected	40.2255467	-105.2719377	Inlet,Vault		Other	15ft	Good	Low			0a49db95-0869-4948-bdeb-5bf230b735a0
230	231	2016-05-19	2016-05-19	1	inspected	40.2264102	-105.2728955	Inlet,Vault		Other	15ft	Good				a729763e-d6db-4ae9-9947-570f92375a66
231	232	2016-05-19	2016-05-19	1	inspected	40.2277096	-105.2742588	Inlet,Vault		Other	15ft	Good				87ab8f40-f477-46ae-8bad-dc4d36eaf8dc
232	233	2016-05-19	2016-05-19	1	inspected	40.2254876	-105.2722475	Inlet,Vault		Metal		Good				9f8fa320-3130-4260-a3b9-110a7fd3d8e1
233	234	2016-05-19	2016-05-19	1	inspected	40.2242172	-105.2715182	Inlet,Vault		Other	5ft	Good				92bac5e5-aa31-45f2-9b90-703fa9c87b89
234	235	2016-05-19	2016-05-19	1	inspected	40.2244481	-105.2715132	Inlet,Vault		Other	5ft	Good				e46d4bb6-0856-4e97-aef8-196c3550e4f9
235	236	2016-05-19	2016-05-19	1	inspected	40.2240348	-105.2701709	Inlet,Vault		Other	5ft	Good				743a7cf6-b1e7-46e8-b5d0-34436a176133
236	237	2016-05-19	2016-05-19	1	inspected	40.2246009	-105.2685068	Inlet,Vault		Other	5ft					f9a0e937-a371-477b-81b7-923a49fc88f9
237	238	2016-05-19	2016-05-19	1	inspected	40.2246997	-105.2684221	Inlet,Vault		Other	5ft	Good				00836d68-9e69-4ae0-9eaf-3bc8fcb92c37
238	239	2016-05-19	2016-05-19	1	inspected	40.2247566	-105.2685698	Inlet,Vault		Other	5ft	Good	Moderate			7c6329f2-29fd-430e-b6bb-48d964c04eb8
239	240	2016-05-19	2016-05-19	1	inspected	40.2246376	-105.2681707	Inlet,Vault		Other	5ft	Good				8e6da5dc-1630-4b5f-b306-98abbd352a01
240	241	2016-05-19	2016-05-19	1	inspected	40.2248379	-105.2699926	Inlet,Vault		Other	5ft	Good				784c5aaa-d972-4414-8d61-477c80e01e5a
241	242	2016-05-19	2016-05-19	1	inspected	40.2246212	-105.271094	Inlet,Vault		Other	5ft	Good				32b20f34-4278-474f-8353-1fa7529be348
242	243	2016-05-19	2016-05-19	1	inspected	40.2247895	-105.2713254	Inlet,Vault		Other	5ft	Good				afe09555-a319-4988-aea3-95bb3e87a4d5
243	244	2016-05-19	2016-05-19	1	inspected	40.2244197	-105.2702709	Inlet,Vault		Other	5ft	Good	High			8d83bb67-aca4-4fe1-ae56-242c1225ae47
244	245	2016-05-19	2016-05-19	1	inspected	40.2241202	-105.2699809	Inlet,Vault		Other	5ft	Good				7d62e716-5d7d-429a-9d6a-bc404eb30246
245	246	2016-05-19	2016-05-19	1	inspected	40.2242228	-105.2640774	Inlet,Vault		Other	20ft	Good	Low			b25d2f6c-d704-497f-955a-d392313e1056
246	247	2016-05-19	2016-05-19	1	inspected	40.2242032	-105.2642301	Inlet,Vault		Other	15ft	Good	Low			19454ced-5b99-4a87-a317-4144545de7b1
247	248	2016-05-19	2016-05-19	1	inspected	40.2261098	-105.265016	Inlet,Vault		Other	10ft	Good				6a591da5-b2d8-4e3e-9107-07d21b8552fa
248	249	2016-05-19	2016-05-19	1	inspected	40.2261683	-105.2651404	Inlet,Vault		Other	10ft	Good	Low			12a14369-48c0-4fbc-89bb-b855588b74c6
249	250	2016-05-19	2016-05-19	1	inspected	40.2232375	-105.2657449	Inlet,Vault		Other	10ft	New				050a3326-b90d-40fc-a880-e48b8ded4493
250	251	2016-05-19	2016-05-19	1	inspected	40.2236466	-105.2662419	Inlet,Vault		Other	10ft probably demo	Good	Moderate			7ecdb407-a1f2-47ec-9bee-66f9f5855a8c
251	252	2016-05-19	2016-05-19	1	inspected	40.224585	-105.2669831	Inlet,Vault		Other	5ft	Good	High			415f305c-0a1e-4ef5-99f3-62d342da594e,3d24f946-bc32-47bb-942b-b761546d3c4b
252	253	2016-05-19	2016-05-19	1	inspected	40.2215291	-105.263731	Inlet,Vault		Other	10ft	New	Low			04e517d2-ce0c-4198-9103-e87da7882771
253	254	2016-05-19	2016-05-19	1	inspected	40.2221165	-105.2643747	Inlet,Vault		Other	5ft	New	Low			f5379bec-c83f-45df-ba33-b2251a63a99c
254	255	2016-05-19	2016-05-19	1	inspected	40.2229476	-105.2649672	Inlet,Vault		Other	10ft	New	Low			000e5c42-d390-41c2-95cc-998ef80e2ed8
255	256	2016-05-19	2016-05-19	1	inspected	40.2226976	-105.2651318	Inlet,Vault		Other	10ft	New				a937d2ff-4db5-40c2-b820-4fd2f494a8c8
256	257	2016-05-19	2016-05-19	1	inspected	40.2241645	-105.2675572	Inlet,Vault		Other	5ft	Good				faba7bd8-350f-4f4b-9767-454f74c61de5
257	258	2016-05-19	2016-05-19	1	inspected	40.2203051	-105.265699	Outlet,Pipe		Other	36x48in rcp	Acceptable	Moderate	None		a6b48832-e553-4fd8-8526-3f62c8d9329b
258	259	2016-05-19	2016-05-19	1	inspected	40.2192813	-105.2658518	Outlet,Pipe		Other	24in cmp	Good	Low			24960789-a67c-4cac-aa9b-e2003be39166
259	260	2016-05-19	2016-05-19	1	inspected	40.2213944	-105.2653732	Outlet,Pipe		Other	8in pvc	Acceptable	Moderate			cf2bcc37-e984-4bb9-9c79-ca93f7f1425b
260	261	2016-05-19	2016-05-19	1	inspected	40.2205181	-105.2653152	Outlet,Pipe		Other	18in cmp	Good	Low			451afb65-737c-44a8-8562-7fec92b01f1c
261	262	2016-05-19	2016-05-19	1	inspected	40.2215026	-105.2678051	Outlet,Pipe		Other	24x36in rcp	New				b42d046f-1c21-49e4-9d97-9ea856248731
262	263	2016-05-19	2016-05-19	1	inspected	40.2231691	-105.2662062	Outlet,Pipe		Other	24in iron	Good	Low			054af3d2-c143-408d-b56a-203dae999443
263	264	2016-05-19	2016-05-19	1	inspected	40.22304	-105.2661188	Outlet,Pipe		Other	24in cmp	Good	Low			1b060936-cc7b-472b-9e69-2db68ca8ac1c
264	265	2016-05-19	2016-05-19	1	inspected	40.2237676	-105.2673226	Outlet,Pipe		Other	24in rcp	Good	Low			0a1fd9f3-4dcb-41b5-a384-2c0d73904808
265	266	2016-05-19	2016-05-19	1	inspected	40.2227549	-105.2700082	Outlet,Pipe		Other	24in	Acceptable	Low			efe8b1fc-326d-4f3b-8cb3-0cda82ab9d97
266	267	2016-05-19	2016-05-19	1	inspected	40.2231592	-105.2705389	Outlet,Pipe		Other	18in rcp	New				5f7bc998-9061-4b3c-99c3-1c91cc88b563
267	268	2016-05-19	2016-05-19	1	inspected	40.2309262	-105.2704472	Outlet,Pipe		Other	18in rcp	Good	Low			da3a3b79-5206-4e61-a8a9-ab5511bc1ccc
268	269	2016-05-19	2016-05-19	1	inspected	40.2332522	-105.2697168	Outlet,Pipe		Other	24in rcp	Good				800a9abd-1727-49b0-868b-bb0e6f3a0734
269	270	2016-05-19	2016-05-19	1	inspected	40.2311372	-105.2708196	Outlet,Pipe		Other	18in rcp	Good	Low			0b9628f1-4460-407f-98aa-52d2401c646b
270	271	2016-05-19	2016-05-19	1	inspected	40.23158461	-105.2682089	Outlet,Pipe		Other	18in	Good				f309d86c-7945-4758-a986-c896e8f2df72
271	272	2016-05-19	2016-05-19	1	inspected	40.2270313	-105.2658693	Outlet,Pipe		Other	6in					
272	273	2016-05-19	2016-05-19	1	inspected	40.2275465	-105.2676961	Outlet,Pipe		Other	12in pvc	Acceptable	High			e60ced52-2f1a-4e0f-8af0-ac8fd6f9bd5c
273	274	2016-05-19	2016-05-19	1	inspected	40.2254571	-105.2722786	Outlet,Pipe		Other	24in rcp	Deficient				acc60e54-0afd-4041-b751-58799a9cac11
274	275	2016-05-19	2016-05-19	1	inspected	40.2266458	-105.2651142	Outlet,Pipe		Other	12in ccp	Good	Low			2ecfddb6-6f80-4157-b072-6c954543d85c
275	276	2016-05-19	2016-05-19	1	inspected	40.2266701	-105.2651643	Outlet,Pipe		Other	30in cmp	Good	Low			9f754662-d8dd-4895-9ad3-08fc41b96699
276	277	2016-05-19	2016-05-23	2	inspected	40.2236591	-105.2652881	Outlet,Pipe		Other	12in cmp	Acceptable				1feb89a6-d590-41a3-8b26-03289cae15aa
277	278	2016-05-19	2016-05-19	1	inspected	40.2211899	-105.2639145	Outlet,Pipe		Other	24in rcp	New	Moderate		Hand Tools	ffacb1ad-7f5c-4a45-86f8-e2a34e5e6947
278	279	2016-05-23	2016-05-23	1	inspected	40.216571	-105.2723206	Conveyance,Box		Other	12x12in	Good	Low			90a32aa2-fb1f-44bb-b8a8-b78fe4b3a533
279	280	2016-05-23	2016-05-23	1	inspected	40.2165272	-105.272307	Conveyance,Box		Other	12x12in	Good	Moderate			e88acc61-e97d-4764-a839-754d678f8b82
280	281	2016-05-23	2016-05-23	1	inspected	40.2377251	-105.2914144	Conveyance,Channel		Other		Good	High			c4a0413d-d5df-4e0e-9b39-78562985fa4a
281	282	2016-05-23	2016-05-23	1	inspected	40.2479032	-105.2896484	Conveyance,Other	Bridge							578d5cf7-f793-4b2b-8742-168c55dfaefa,2b4fe862-7461-4cf2-afdb-25b22a80f3b3
282	283	2016-05-23	2016-05-23	1	inspected	40.2327983	-105.2898881	Conveyance,Other	Bridge	Other	Wood 5x10	Acceptable				4410d653-1383-450d-b4d6-284b46ccc7bd
283	284	2016-05-23	2016-05-23	1	inspected	40.2327928	-105.2895117	Conveyance,Other	Bridge	Other	5x10ft	Good				035881af-e968-44ed-86e2-40e6ab564935
284	285	2016-05-23	2016-05-23	1	inspected	40.2328078	-105.288911	Conveyance,Other	Bridge	Other	5x15ft	Good				3d44efc2-9151-45a5-8d98-eafe7df6856e
285	286	2016-05-23	2016-05-23	1	inspected	40.2417262	-105.2883521	Conveyance,Other	Bridge							f0a24841-0df5-4dca-9b69-d3877cb5cf66
286	287	2016-05-23	2016-05-23	1	inspected	40.2475076	-105.2897452	Conveyance,Pipe		Other	18in cmp	Acceptable	Moderate			9bcd0d3b-55ba-49ec-856d-b83305936c8e
287	288	2016-05-23	2016-05-23	1	inspected	40.2475678	-105.2895155	Conveyance,Pipe		Other	18in cmp	Acceptable				52eee5ee-717f-414e-be15-45b5f80a297d
288	289	2016-05-23	2016-05-23	1	inspected	40.2442036	-105.2905544	Conveyance,Pipe		Other	30in cmp	Good	Low			b1970d26-62ab-4a1d-ba25-561d0335d103
289	290	2016-05-23	2016-05-23	1	inspected	40.2442231	-105.290417	Conveyance,Pipe		Other	30in cmp	Good			Not Accessible	85aa550d-7c46-426d-9a3b-2992d50d51ca
290	291	2016-05-23	2016-05-23	1	inspected	40.2389371	-105.2910597	Conveyance,Pipe		Other	20in steel	Acceptable				f7608790-0cd1-4dda-97c5-a540c74d28cd
291	292	2016-05-23	2016-05-23	1	inspected	40.2389849	-105.2910286	Conveyance,Pipe		Other	20in steel					349f1601-37f4-4bfc-b43f-12a8005b4cc0
292	293	2016-05-23	2016-05-23	1	inspected	40.2383152	-105.2912079	Conveyance,Pipe		Other	18in cmp					367547e7-39b5-48aa-ba7d-b08575ffd725
293	294	2016-05-23	2016-05-23	1	inspected	40.2381176	-105.2912643	Conveyance,Pipe		Other	18in cmp	Acceptable	High			c78ea4d9-4c69-4c9d-b4c1-962d5d7f1d47
294	295	2016-05-23	2016-05-23	1	inspected	40.2380005	-105.2913169	Conveyance,Pipe		Other	18in cmp	Acceptable	High			3ea75c1b-d708-4df3-a2d9-c632bfb88413
295	296	2016-05-23	2016-05-23	1	inspected	40.2379853	-105.2913041	Conveyance,Pipe		Other	18in cmp	Deficient	High			
296	297	2016-05-23	2016-05-23	1	inspected	40.2378602	-105.2913894	Conveyance,Pipe		Other	20 in rcp	Good	Moderate			7fc66125-1147-4ff1-839c-a20aef8f1ce5
297	298	2016-05-23	2016-05-23	1	inspected	40.2376782	-105.2914356	Conveyance,Pipe		Other	16in steel	Good	High			49d0985d-0a65-4dd3-9859-4ac2f5c7f6dc
298	299	2016-05-23	2016-05-23	1	inspected	40.2376347	-105.2914923	Conveyance,Pipe		Other	16in steel	Acceptable	High			c4f3d600-f33d-4894-b0db-f73984e6b160
299	300	2016-05-23	2016-05-23	1	inspected	40.2375556	-105.2915047	Conveyance,Pipe		Other	20in cmp	Acceptable	High			6fd27a30-608e-4dd1-832b-e78ad73be518
300	301	2016-05-23	2016-05-23	1	inspected	40.2374686	-105.2915328	Conveyance,Pipe		Other	20in	Deficient	High			a8eca8df-3445-4958-8ca5-e34eb34114a1
301	302	2016-05-23	2016-05-23	1	inspected	40.2373111	-105.2915833	Conveyance,Pipe		Other	12in rcp	Deficient	High			b20f6bba-7cdf-4c43-8adf-c3d9f82a70e3
302	303	2016-05-23	2016-05-23	1	inspected	40.2372803	-105.2915795	Conveyance,Pipe		Other	12in rcp	Deficient	High			bb07805a-6262-4403-81b3-06dbb8160165
303	304	2016-05-23	2016-05-23	1	inspected	40.2366513	-105.2918888	Conveyance,Pipe		Other	18in cmp	Good	High			48d172f0-574a-4eec-9dcd-931a62d0a436
304	305	2016-05-23	2016-05-23	1	inspected	40.2366221	-105.2919621	Conveyance,Pipe		Other	18in	Deficient	High			10db6751-46b7-4d61-a42c-9935a2a862a7
305	306	2016-05-23	2016-05-23	1	inspected	40.2359609	-105.2922461	Conveyance,Pipe		Other	8in steel	Acceptable	High			151be9c8-5b8d-4b22-a445-41a657b63531
306	307	2016-05-23	2016-05-23	1	inspected	40.2359543	-105.2921908	Conveyance,Pipe		Other	8in steel	Acceptable	Low			92803bb5-c39f-4b07-9aae-fe453bb1b9a6
307	308	2016-05-23	2016-05-23	1	inspected	40.2336007	-105.2924276	Conveyance,Pipe		Other	24in cmp	Acceptable	High			91c15cdc-28f5-484d-9078-9c7d9b46543d
308	309	2016-05-23	2016-05-23	1	inspected	40.2335684	-105.2923144	Conveyance,Pipe		Other	24in cmp	Acceptable	High			b90134a7-20e9-487e-9697-e9036ec5053c
309	310	2016-05-23	2016-05-23	1	inspected	40.2314845	-105.2891258	Conveyance,Pipe		Other	18in cmp	Acceptable	Moderate			e0339636-b586-4572-8b25-0c1b2b2e0d42
310	311	2016-05-23	2016-05-23	1	inspected	40.2315499	-105.2890646	Conveyance,Pipe		Other	18in cmp	Acceptable	Moderate			912c1fab-c0b6-4cda-90a3-082428ba4ee7
311	312	2016-05-23	2016-05-23	1	inspected	40.2316825	-105.2890064	Conveyance,Pipe		Other	18in cmp	Deficient	High			75083282-9e25-4ec4-836c-bf1da6a920e5
312	313	2016-05-23	2016-05-23	1	inspected	40.2316352	-105.2889838	Conveyance,Pipe		Other	18in cmp	Deficient	High			738996f5-2f83-4ee0-abdc-2943b2c7b477
313	314	2016-05-23	2016-05-23	1	inspected	40.229525	-105.2884274	Conveyance,Pipe		Other	18cmp	Good	Low			79f76886-19c3-4945-a22d-0fd6002ab302
314	315	2016-05-23	2016-05-23	1	inspected	40.2294036	-105.28845	Conveyance,Pipe		Other	18in cmp	Good	Moderate			dcf4795d-a69e-4009-b73c-0b357c1b3643
315	316	2016-05-23	2016-05-23	1	inspected	40.228681	-105.2882469	Conveyance,Pipe		Other	20in cmp	Acceptable	High			e4bbf844-e0d6-4e8b-8811-680cbe9d681b
316	317	2016-05-23	2016-05-23	1	inspected	40.2286553	-105.2882536	Conveyance,Pipe		Other	20in cmp	Deficient	High			d96f66ef-2f18-4cbe-8168-4dbaeabf155c
317	318	2016-05-23	2016-05-23	1	inspected	40.2285389	-105.2940837	Conveyance,Pipe		Other	18in cmp	Acceptable	Moderate			76c69688-8e04-4d8a-80ec-72333d0e5567
318	319	2016-05-23	2016-05-23	1	inspected	40.2285281	-105.2939519	Conveyance,Pipe		Other	18in cmp	Deficient	High			04fdf918-14ad-42b4-98f6-74f0fa32b433
319	320	2016-05-23	2016-05-23	1	inspected	40.2285886	-105.2933854	Conveyance,Pipe		Other	18in cmp	Deficient	High			d6e08165-6f45-49f4-a2af-4351cac78097
320	321	2016-05-23	2016-05-23	1	inspected	40.2285863	-105.2931973	Conveyance,Pipe		Other	18in cmp	Deficient	High			c615a777-155f-4d87-853a-50bd60fdf4f7
321	322	2016-05-23	2016-05-23	1	inspected	40.2285634	-105.2918669	Conveyance,Pipe		Other	18in cmp	Acceptable	Low			9d2c573e-5318-4419-824f-24b59ea2a3e5
322	323	2016-05-23	2016-05-23	1	inspected	40.2285558	-105.2917523	Conveyance,Pipe		Other	18in cmp	Acceptable	Moderate			759057fb-0eea-401b-8794-9cc99ffd7423
323	324	2016-05-23	2016-05-23	1	inspected	40.2281921	-105.2902395	Conveyance,Pipe		Other	18in cmp	Acceptable	Moderate			5e2c398a-dfcc-441e-a2e6-94e9a10332c6
324	325	2016-05-23	2016-05-23	1	inspected	40.2281904	-105.2901159	Conveyance,Pipe		Other	18in cmp	Deficient	High			6bd3c5d0-580f-4743-8312-7ebb9b7a0b61
325	326	2016-05-23	2016-05-23	1	inspected	40.2281087	-105.2897168	Conveyance,Pipe		Other	18in cmp	Acceptable	Low			1b306b02-6346-40eb-a97f-9d13ab1a3125
326	327	2016-05-23	2016-05-23	1	inspected	40.2281187	-105.2896128	Conveyance,Pipe		Other	18in cmp	Acceptable	Moderate			9aaff543-3303-49a2-abc2-024e9fe2478e
327	328	2016-05-23	2016-05-23	1	inspected	40.2279889	-105.2881143	Conveyance,Pipe		Other	18x32in	Acceptable	Low			c55a361c-0876-46f6-a505-6eb669270287
328	329	2016-05-23	2016-05-23	1	inspected	40.22796	-105.2879718	Conveyance,Pipe		Other	18x32in	Good	Moderate			d69a1c76-3c63-4f21-9df1-09a2d354bb65
329	330	2016-05-23	2016-05-23	1	inspected	40.2272871	-105.2868708	Conveyance,Pipe		Other	18in cmp	Acceptable	Moderate			ff33a9cc-2586-4ef0-b87b-50615ef3dffa
330	331	2016-05-23	2016-05-23	1	inspected	40.2272056	-105.2867632	Conveyance,Pipe		Other	18in	Deficient	High			4d3c7df8-2eb6-470a-a101-76815c62bbdd
331	332	2016-05-23	2016-05-23	1	inspected	40.2272561	-105.2866447	Conveyance,Pipe				Deficient	High			36ce2484-a00c-4793-9562-b98078179847
332	333	2016-05-23	2016-05-23	1	inspected	40.227263	-105.2866287	Conveyance,Pipe		Other	18in	Acceptable	Moderate			26940f26-6db3-4884-b3f5-dc312f66e25d

333	334	2016-05-23	2016-05-23	1	inspected	40.227213	-105.2865411	Conveyance,Pipe		Other	18in	Acceptable	Moderate	a2b91c55-24ab-4032-be6c-5693092f4bb1
334	335	2016-05-23	2016-05-23	1	inspected	40.2273141	-105.2867482	Conveyance,Pipe		Other	18in cmp	Deficient	High	d70f570d-9389-4cc2-ac23-b04c6dcabb67
335	336	2016-05-23	2016-05-23	1	inspected	40.2270893	-105.2864085	Conveyance,Pipe		Other	18in	Deficient	High	763cd465-380a-4fa5-a915-7d033f5788de
336	337	2016-05-23	2016-05-23	1	inspected	40.2271093	-105.2864084	Conveyance,Pipe		Other	18in	Acceptable	Moderate	258d2f3e-b201-4f34-a133-351c60265d60
337	338	2016-05-23	2016-05-23	1	inspected	40.2267674	-105.2858156	Conveyance,Pipe		Other	18in	Good	Moderate	db4aad26-c30a-4a74-8bcb-1bc6f031f240
338	339	2016-05-23	2016-05-23	1	inspected	40.2268139	-105.2859508	Conveyance,Pipe		Other	18in	Acceptable	High	2fcffb9f-8fe0-47f3-bc0d-6c41cce9f617
339	340	2016-05-23	2016-05-23	1	inspected	40.2267232	-105.2855515	Conveyance,Pipe		Other	18in	Deficient	High	0ab9a406-679f-4cb7-bb5a-3ba3ec8385eb
340	341	2016-05-23	2016-05-23	1	inspected	40.2268325	-105.2856151	Conveyance,Pipe		Other	18in	Deficient	High	f3e21461-2d4a-425f-86ce-54d6925ad1b8
341	342	2016-05-23	2016-05-23	1	inspected	40.2314607	-105.2820093	Conveyance,Pipe		Other	24in cmp	Good	Moderate	bec2e3f0-94bb-470c-a0fa-9302dd58b95f
342	343	2016-05-23	2016-05-23	1	inspected	40.230872	-105.2823282	Conveyance,Pipe		Other	24in cmp	Acceptable	Moderate	71337e83-99f1-44d3-a9de-3ad612b211d2
343	344	2016-05-23	2016-05-23	1	inspected	40.2423415	-105.2879863	Conveyance,Pipe		Other	24in	New	Low	7b78bb38-1bf3-4ed4-ac45-de440aabdcd2
344	345	2016-05-23	2016-05-23	1	inspected	40.2422703	-105.2877377	Conveyance,Pipe		Other	24in rcp	New	Low	8ccdebd1-278b-4307-bc50-8350b7985a1a
345	346	2016-05-23	2016-05-23	1	inspected	40.2415369	-105.2880813	Conveyance,Pipe		Other	24in rcp	New	Low	5415e4d7-ab1f-4e4a-9118-fe63516ccddc
346	347	2016-05-23	2016-05-23	1	inspected	40.2415837	-105.2878304	Conveyance,Pipe		Other	24in	New	Low	e04d8848-d087-47ef-8bb6-9e513ee56a80
347	348	2016-05-23	2016-05-23	1	inspected	40.2399579	-105.2880598	Conveyance,Pipe		Other	24in rcp	New		7f1fac15-54d0-4a5b-b559-1b839126a2a2
348	349	2016-05-23	2016-05-23	1	inspected	40.2400477	-105.2878606	Conveyance,Pipe		Other	24in rcp	New		ae2b626c-7fce-4bb8-9810-442389cfadcb
349	350	2016-05-23	2016-05-23	1	inspected	40.2393199	-105.2880301	Conveyance,Pipe		Other	3x5 rcp	Acceptable	High	a1cdc7ef-d0e9-4604-b6e0-b0da92f56ea5
350	351	2016-05-23	2016-05-23	1	inspected	40.2393416	-105.2880234	Conveyance,Pipe		Other	3x5 rcp	Acceptable	Moderate	9391b595-0c7c-499f-bdc7-1d5362811170
351	352	2016-05-23	2016-05-23	1	inspected	40.2392715	-105.2878186	Conveyance,Pipe		Other	24in rcp	New		0f173586-6ea4-4c8a-ac1d-a97d697656c5
352	353	2016-05-23	2016-05-23	1	inspected	40.2391028	-105.2878567	Conveyance,Pipe		Other	24in rcp	New	Low	982e6111-3604-4bdb-8a71-f4e3cfc4b141
353	354	2016-05-23	2016-05-23	1	inspected	40.2382066	-105.2879533	Conveyance,Pipe		Other	4ft cmp	Good	Low	1960ebc9-ff88-4471-9271-5e96b082cdb9
354	355	2016-05-23	2016-05-23	1	inspected	40.2382544	-105.288123	Conveyance,Pipe		Other	4ft cmp	Good	Low	42581c07-9593-46f9-bb12-ba1781f5f625
355	356	2016-05-23	2016-05-23	1	inspected	40.2366965	-105.2880233	Conveyance,Pipe		Other	30in cmp	Good	Low	7c871102-7415-4709-a894-e5fd95e96540
356	357	2016-05-23	2016-05-23	1	inspected	40.2366631	-105.2879768	Conveyance,Pipe		Other	30in cmp	Good	Low	77d1ab28-2b1f-4017-a106-2561482c0587
357	358	2016-05-23	2016-05-23	1	inspected	40.2310422	-105.2839891	Conveyance,Pipe		Other	30in cmp	Good	Low	15265f18-9aa3-45c5-8771-925525d12200
358	359	2016-05-23	2016-05-23	1	inspected	40.2303779	-105.2836876	Conveyance,Pipe		Other	30in cmp	Good		64b60210-63da-4578-b4fe-f6a67f1b37ef
359	360	2016-05-23	2016-05-23	1	inspected	40.2305541	-105.2771603	Conveyance,Pipe		Other	3x5ft	Good	Low	4d95c596-42c8-4dbd-89e4-d42226911610
360	361	2016-05-23	2016-05-23	1	inspected	40.2305035	-105.2770637	Conveyance,Pipe		Other	3x5 cmp	Good	Moderate	19679c81-f505-4f6c-900c-f9bc4a922366
361	362	2016-05-23	2016-05-23	1	inspected	40.226608	-105.2735483	Conveyance,Pipe		Other	18in cmp	Good		5a13b4e1-00eb-43a3-bc39-e9c33c4d70eb
362	363	2016-05-23	2016-05-23	1	inspected	40.2268434	-105.2737779	Conveyance,Pipe		Other	24in cmp	Good		576f5dca-f759-4daf-a902-d548661bdf82
363	364	2016-05-23	2016-05-23	1	inspected	40.2140224	-105.2742984	Conveyance,Pipe		Other	4ft cmp	Good		ec1d620f-a2ae-44c6-959e-d23cab5c5161
364	365	2016-05-23	2016-05-23	1	inspected	40.2140354	-105.2741814	Conveyance,Pipe		Other	4ft cmp	Good		200eb6c6-0969-4662-a2e2-7a4143d25a3e
365	366	2016-05-23	2016-05-23	1	inspected	40.2141585	-105.2722468	Conveyance,Pipe		Other	18in cmp	Good	Moderate	4a44ef1a-c8f9-4ecf-bc45-e86d56a62529
366	367	2016-05-23	2016-05-23	1	inspected	40.2142329	-105.2722558	Conveyance,Pipe		Other	18in steel	Good	Moderate	b63be8fd-8d5f-473d-89f5-f68edd40357c
367	368	2016-05-23	2016-05-23	1	inspected	40.2144938	-105.2722378	Conveyance,Pipe		Other	18in steel	Good	Moderate	fa6fba9c-9d2e-4f70-b6f6-5461733f0fb7
368	369	2016-05-23	2016-05-23	1	inspected	40.2146031	-105.2722344	Conveyance,Pipe		Other	18in steel	Deficient	High	abf4d208-5da9-4150-acde-47100cdb5d8b
369	370	2016-05-23	2016-05-23	1	inspected	40.2141411	-105.2722472	Conveyance,Pipe		Other	18in steel	Good	Low	ca119fb4-60a6-4775-817d-4cabb25862df
370	371	2016-05-23	2016-05-23	1	inspected	40.214096	-105.2722467	Conveyance,Pipe		Other	18in steel	Good	Moderate	07ecddba-a69d-424b-8ac1-a10ecc22e100
371	372	2016-05-23	2016-05-23	1	inspected	40.2138975	-105.2722209	Conveyance,Pipe		Other	12in cmp	Good	Low	c21b42a2-0e82-4b8d-a4c9-155c96eb1df7
372	373	2016-05-23	2016-05-23	1	inspected	40.2138155	-105.2722151	Conveyance,Pipe		Other	12in cmp	Good	Moderate	d79c462f-d7e9-423b-a178-39a4dada776b
373	374	2016-05-23	2016-05-23	1	inspected	40.2146142	-105.2721804	Conveyance,Pipe		Other	32in cmp	Good	Low	
374	375	2016-05-23	2016-05-23	1	inspected	40.2146701	-105.272228	Conveyance,Pipe		Other	32in cmp	Acceptable	High	1bf8d29e-5f8f-4219-8407-b4db460e7f53
375	376	2016-05-23	2016-05-23	1	inspected	40.2154468	-105.272265	Conveyance,Pipe		Other	18in cmp	Good	Moderate	d2300ebc-8d87-4450-bb74-b09995c6f576
376	377	2016-05-23	2016-05-23	1	inspected	40.2153976	-105.2723723	Conveyance,Pipe		Other	18in cmp	Good	Moderate	f8683ee1-2723-4e07-a080-74ae143dd72c
377	378	2016-05-23	2016-05-23	1	inspected	40.2168128	-105.2723761	Conveyance,Pipe		Other	18in	Good	Low	8631cc57-8818-4ff9-92ec-2d5f4e2efa37
378	379	2016-05-23	2016-05-23	1	inspected	40.2168672	-105.2723492	Conveyance,Pipe		Other	18in cmp	Good	Low	99de6674-99b6-4cd1-918f-bbb0c0ea4397
379	380	2016-05-23	2016-05-23	1	inspected	40.2170983	-105.2723466	Conveyance,Pipe		Other	18in cmp	Acceptable	Moderate	f81f0ae7-4f74-40fe-a7ed-ca4bc610e278
380	381	2016-05-23	2016-05-23	1	inspected	40.2171543	-105.2723649	Conveyance,Pipe		Other	18in cmp	Good	Moderate	39bf01bc-04d3-48f1-91d4-ae4941fa4345
381	382	2016-05-23	2016-05-23	1	inspected	40.217553	-105.2723969	Conveyance,Pipe		Other	18in cmp	Acceptable	Moderate	e7523a4e-3d3f-48a8-a5d0-b7d6d2633902
382	383	2016-05-23	2016-05-23	1	inspected	40.217582	-105.2723757	Conveyance,Pipe		Other	18in cmp	Good	Moderate	5692f04e-9894-4ccd-9122-481370346f03
383	384	2016-05-23	2016-05-23	1	inspected	40.2180502	-105.2725042	Conveyance,Pipe		Other	12in cmp	Acceptable	Moderate	5e91e424-dbdf-47dc-a4f1-fd0afe526d29
384	385	2016-05-23	2016-05-23	1	inspected	40.2180906	-105.2724405	Conveyance,Pipe		Other	12in cmp	Acceptable	Moderate	a6108382-741b-48cd-9509-597e5cfeb4cb
385	386	2016-05-23	2016-05-23	1	inspected	40.2177824	-105.2724537	Conveyance,Pipe		Other	18in cmp	Good	Moderate	2c67d9b1-4dbc-420a-91c4-b0499d346df3
386	387	2016-05-23	2016-05-23	1	inspected	40.2177186	-105.2724397	Conveyance,Pipe		Other	18in. Mp	Good	Low	4bc3adc9-4914-4175-ae30-95cc861074ad
387	388	2016-05-23	2016-05-23	1	inspected	40.2173164	-105.2724312	Conveyance,Pipe		Other	18im cmp	Good	Low	7441253d-2736-44c2-9192-bfc77bdf564b
388	389	2016-05-23	2016-05-23	1	inspected	40.2172639	-105.272437	Conveyance,Pipe		Other	18in cmp	Good	Low	4d51f66d-2dfd-4c7e-8d97-972d7dc1eee4
389	390	2016-05-23	2016-05-23	1	inspected	40.2186577	-105.2728708	Conveyance,Pipe		Other	24in cmp	Acceptable	High	1c7b257b-37c2-4dd6-b32e-378d244e513d
390	391	2016-05-23	2016-05-23	1	inspected	40.2186112	-105.2728991	Conveyance,Pipe		Other	24in cmp	Acceptable	High	4d736dd9-aab6-460b-b700-19b8ec1f1549
391	392	2016-05-23	2016-05-23	1	inspected	40.2203804	-105.271759	Inlet,Grate		Metal		Good	Low	133e5c4f-226c-4e90-8b6c-8743eb4949ac
392	393	2016-05-23	2016-05-23	1	inspected	40.2203615	-105.2714187	Inlet,Pipe		Other	20in cmp	Good	High	7a826b40-ea50-4d80-a97b-238e086aff0a
393	394	2016-05-23	2016-05-23	1	inspected	40.2203638	-105.2715217	Outlet,Pipe		Other	36in cmp	Deficient	High	af62d642-5350-4e6d-bd4a-fd3ebd8a718b
394	395	2016-05-23	2016-05-23	1	inspected	40.2191018	-105.2610298	Conveyance,Box		Other	10x4ft	Good		a339059f-ca7f-49f5-a7ad-f3658f69573a
395	396	2016-05-23	2016-05-23	1	inspected	40.2191692	-105.2607349	Conveyance,Box		Other	10x4ft	Good	Moderate	42100d68-9e67-4c8d-9500-eb5a12d3c69d
396	397	2016-05-23	2016-05-23	1	inspected	40.220581	-105.2634633	Conveyance,Other	Bridge					102658c2-772a-4d96-a36d-3f2d85f26ac5
397	398	2016-05-23	2016-05-23	1	inspected	40.2190532	-105.2612196	Conveyance,Other	Bridge					
398	399	2016-05-23	2016-05-23	1	inspected	40.2190325	-105.2612955	Conveyance,Other	Irrigation gate					9f7dcca3-3b69-4d0a-b03a-cb789bdf0df5
399	400	2016-05-23	2016-05-23	1	inspected	40.2134527	-105.2611379	Conveyance,Other	MH					
400	401	2016-05-23	2016-05-23	1	inspected	40.2132806	-105.2615074	Conveyance,Other	MH					
401	402	2016-05-23	2016-05-23	1	inspected	40.2132359	-105.261455	Inlet,Vault		Other	10ft	New		48339749-553c-4697-9d16-e57f6d8a9c4d
402	403	2016-05-23	2016-05-23	2	inspected	40.2261004	-105.2709949	Conveyance,Channel		Concrete		Good		d6ab7c63-6643-4874-875f-1eb9b332a771
403	404	2016-05-23	2016-05-23	1	inspected	40.2231931	-105.2651355	Conveyance,Pipe		Other	15in cmp	Good	Low	38003b51-5116-4d36-9f8b-1fbf61b091aa
404	405	2016-05-23	2016-05-23	1	inspected	40.2240491	-105.2653316	Conveyance,Pipe		Other	12in cmp	Good	Low	8af0e439-3ebc-4d36-a38b-45926f8b578a
405	406	2016-05-23	2016-05-23	1	inspected	40.2239219	-105.2653189	Conveyance,Pipe		Other	12in cmp	Acceptable	High	c30ad926-7575-4ce8-ac01-4aaeb50ba30a
406	407	2016-05-23	2016-05-23	1	inspected	40.2242272	-105.2652983	Conveyance,Pipe		Other	3oin pvc	Good	Low	d6038f56-ff1b-4d31-a2cd-8d93b86a51ac
407	408	2016-05-23	2016-05-23	1	inspected	40.2243892	-105.2653104	Conveyance,Pipe		Other	18in cmp	Good	Moderate	e274432f-ffd8-4654-8ec7-65ad85536afe
408	409	2016-05-23	2016-05-23	1	inspected	40.2244847	-105.2653258	Conveyance,Pipe		Other	18in cmp	Good	Moderate	d2247f58-8aa1-4a3e-baec-4ed46fcbd43d
409	410	2016-05-23	2016-05-23	1	inspected	40.2245035	-105.2653264	Conveyance,Pipe		Other	18in cmp	Good	Low	39038784-55d9-4540-9b9c-fd756ec2757f
410	411	2016-05-23	2016-05-23	1	inspected	40.2246081	-105.2653536	Conveyance,Pipe		Other	18in cmp	Good	Low	427a0e00-b846-4e1a-8f11-de9cb90138d6
411	412	2016-05-23	2016-05-23	1	inspected	40.2246194	-105.2653566	Conveyance,Pipe		Other	18in cmp	Good		fce37650-1878-4bf1-8a71-5f429706aff1
412	413	2016-05-23	2016-05-23	1	inspected	40.2247364	-105.26547	Conveyance,Pipe		Other	1iin cmp	Good	Low	6b9ead2e-c1ce-438e-aea5-3fe8d5edacaf
413	414	2016-05-23	2016-05-23	1	inspected	40.2247169	-105.2653288	Conveyance,Pipe		Other	18in cmp	Good	High	4122574e-296d-414f-94d9-d71630e22c06
414	415	2016-05-23	2016-05-23	1	inspected	40.2247479	-105.2653574	Conveyance,Pipe		Other	18in cmp	Good	Moderate	f0b1b0ab-44ab-4548-b837-77ee24289ddc
415	416	2016-05-23	2016-05-23	1	inspected	40.2248356	-105.2653234	Conveyance,Pipe		Other	18in cmp	Good	Moderate	678ff102-14c6-463b-8ee4-ad8af430e4fc
416	417	2016-05-23	2016-05-23	1	inspected	40.2249881	-105.2653433	Conveyance,Pipe		Other	15in	Good	Moderate	d8d660b8-65f3-40ca-be2c-80047b1d10c0
417	418	2016-05-23	2016-05-23	1	inspected	40.2250301	-105.2653373	Conveyance,Pipe		Other	18in cmp	Good	Low	63f84cbd-d2e0-41b0-af74-3374a810574d
418	419	2016-05-23	2016-05-23	1	inspected	40.2251075	-105.2653586	Conveyance,Pipe		Other	18in cmp	Acceptable	Moderate	f84dc0f1-6ab3-4483-9e10-4e84348de21c
419	420	2016-05-23	2016-05-23	1	inspected	40.2251441	-105.2654345	Conveyance,Pipe		Other	18in cmp	Good	Low	9c6f990c-72c1-46ae-8e38-eaef33b27b5d
420	421	2016-05-23	2016-05-23	1	inspected	40.2250753	-105.2654666	Conveyance,Pipe		Other	18in cmp	Good	Low	bac40ebc-0b98-4832-9f1b-4ae671de5148
421	422	2016-05-23	2016-05-23	1	inspected	40.227343	-105.2676685	Conveyance,Pipe		Other	18in	Good	Low	45ab078f-bc80-4523-97de-c4aad93ad9c9
422	423	2016-05-23	2016-05-23	1	inspected	40.2272793	-105.2676878	Conveyance,Pipe		Other	18in cmp	Good	Low	2d54cb1e-a4d2-4791-8859-4f94c55d958b
423	424	2016-05-23	2016-05-23	1	inspected	40.2231002	-105.2643454	Inlet,Grate				Good	Moderate	8d09543e-2619-4260-baa5-51ca06500a16
424	425	2016-05-23	2016-05-23	1	inspected	40.2231265	-105.264509	Inlet,Grate				Good	High	c7b2730b-ee71-4dce-830d-4984c1e94f43
425	426	2016-05-23	2016-05-23	1	inspected	40.2242318	-105.2653092	Inlet,Grate		Metal		Deficient	High	858e552e-87e7-44b7-8025-c5279b568e2a
426	427	2016-05-23	2016-05-23	1	inspected	40.2276948	-105.2696088	Inlet,Grate				Good	Low	7225b9c4-f1fd-484c-b575-473efb4f1324
427	428	2016-05-23	2016-05-23	1	inspected	40.2275522	-105.2694929	Inlet,Grate				Good	Low	d72ecd79-6b2a-4434-84ca-7a0b4fc26e56
428	429	2016-05-23	2016-05-23	1	inspected	40.2275268	-105.2697284	Inlet,Grate				Good	Low	04f4ce1e-5804-4ed6-9d76-b8e014a99394
429	430	2016-05-23	2016-05-23	1	inspected	40.2277198	-105.269685	Inlet,Grate		Metal		Good	Moderate	2a6a7d8b-4b2e-4df0-b937-2e4ff09e9b38
430	431	2016-05-23	2016-05-23	1	inspected	40.2231589	-105.2649887	Inlet,Pipe		Other	15in cmp	Good	Low	e9f2eea8-8320-4109-8849-f098a05708f1
431	432	2016-05-23	2016-05-23	1	inspected	40.2271578	-105.2703719	Inlet,Pipe		Other	3x5ft	Good	Low	18966aed-fcea-4bc6-8355-8783d67e5e25
432	433	2016-05-23	2016-05-23	1	inspected	40.2265998	-105.2699579	Inlet,Pipe						5bd2c615-d1a5-40ae-9762-c99349ca618c
433	434	2016-05-23	2016-05-23	1	inspected	40.2260172	-105.265264	Outlet,Box		Metal		Good	High	0b1d3a80-71d6-4077-925c-04f09747816d
434	435	2016-05-23	2016-05-23	1	inspected	40.2274829	-105.2697381	Outlet,Pipe		Other	12in	Good	Low	6af4cbc4-c709-450e-8656-16dde44e504c
435	436	2016-05-23	2016-05-23	1	inspected	40.2265808	-105.2699442	Outlet,Pipe		Other	18in	Good	Low	2eafd0d5-8d49-47f0-b096-59092af5b7ec
436	437	2016-05-24	2016-05-24	1	inspected	40.2209663	-105.2659657	Inlet,Other	Unknown vault	Metal				78553ad4-45e4-4fdc-8799-830d3f44c5e5
437	438	2016-05-24	2016-05-24	1	inspected	40.2230902	-105.2698002	Inlet,Grate		Metal		Acceptable	Low	f5820ce8-46dc-43e2-b17e-042cf77feee0
438	439	2016-05-24	2016-05-24	1	inspected	40.223096	-105.2688887	Inlet,Grate		Metal		Good	Low	7f86a74e-4c9e-44bb-9c00-3abeafd242cf
439	440	2016-05-24	2016-05-24	1	inspected	40.2231113	-105.2686316	Conveyance,Channel		Concrete		Good	Moderate	9b0ea08a-b977-47eb-aea3-e28228479f00
440	441	2016-05-24	2016-05-24	1	inspected	40.2231132	-105.2684239	Conveyance,Channel		Concrete		Good		ad34f27a-37f0-4399-878c-2419893562b3
441	442	2016-05-24	2016-05-24	1	inspected	40.223124	-105.2686197	Inlet,Pipe		Other	8in pvc	Acceptable		cd97514c-44bc-413d-9f09-ea5950c52313
442	443	2016-05-24	2016-05-24	1	inspected	40.2231091	-105.2684111	Outlet,Pipe		Other	8in pvc	Acceptable	Moderate	817728a9-25d0-434d-8d2d-c9f40bf287c7
443	444	2016-05-24	2016-05-24	1	inspected	40.2242052	-105.2684142	Outlet,Pipe		Other	12in	Good	Low	b79fb1d8-b501-41b0-b94f-5d8ef4ea2ca0
444	445	2016-05-24	2016-05-24	1	inspected	40.2171305	-105.2592083	Conveyance,Other	Unknown	Concrete				3b9382ba-5f06-4503-845a-f4e2ef48a51a
445	446	2016-05-24	2016-05-24	1	inspected	40.2179726	-105.2598483	Conveyance,Pipe		Other	30x48in	Good	Moderate	cbe97576-3d10-4400-bc59-d9b6090d1eda
446	447	2016-05-24	2016-05-24	1	inspected	40.2177096	-105.2610431	Conveyance,Pipe		Other	30x48in rcp	Good	Moderate	a4641f3c-16b5-4ca2-b8d0-7f32225f412d
447	448	2016-05-24	2016-05-24	1	inspected	40.2172387	-105.2590724	Conveyance,Pipe		Other	30x48in cmp	Acceptable	Low	3c7ddd5b-f2dc-467d-a3be-51a1f99113eb
448	449	2016-05-24	2016-05-24	1	inspected	40.2172462	-105.2591181	Conveyance,Pipe		Other	30x48in cmp	Acceptable	Low	77e00f38-83ad-48f4-8248-738c9b90d310
449	450	2016-05-24	2016-05-24	1	inspected	40.2177483	-105.2590713	Inlet,Pipe		Other	3x5ft	Acceptable	High	eebee39c-be58-4363-a1a1-e295fd1df6bd
450	451	2016-05-24	2016-05-24	1	inspected	40.2181179	-105.2596636	Outlet,Pipe		Other	3x5ft	Good	Low	e7522bbe-43f4-4264-8dfc-44a20302ecca
451	452	2016-05-24	2016-05-24	1	inspected	40.2178214	-105.2590413	Outlet,Pipe		Other	3ft wide	Acceptable	High	16f026dc-085c-48da-b9d9-ea326c4397d1
452	453	2016-05-24	2016-05-24	1	inspected	40.2166442	-105.2578983	Conveyance,Box		Other	8x4ft	Good	High	f4a6ac9c-d7d0-4e75-9136-dd98aa649f3a
453	454	2016-05-24	2016-05-24	1	inspected	40.2169415	-105.2577977	Conveyance,Box		Other	4x8ft	Acceptable	Low	2421fbbd-cde8-4b20-9589-c3e92f73fe72
454	455	2016-05-24	2016-05-24	1	inspected	40.2151634	-105.2547845	Conveyance,Box		Other	3 9x6ft	Good	Moderate	07fd92bd-3ed0-4ffc-8379-f4eb3d46ed9e
455	456	2016-05-24	2016-05-24	1	inspected	40.2151905	-105.2544322	Conveyance,Box		Other	3 9x6ft	Good	Low	d6cfcbbe-e722-484b-a413-37006e5d8381
456	457	2016-05-24	2016-05-24	1	inspected	40.2168897	-105.2586357	Conveyance,Pipe		Other	3x5ft rcp	Acceptable	Moderate	019f5b9b-4c9a-426f-9ef4-c8fe4c76e126
457	458	2016-05-24	2016-05-24	1	inspected	40.2168099	-105.2585041	Conveyance,Pipe		Other	3x5ft	Acceptable	High	525d58d0-038a-4b8b-aaf2-d716e7ea5e3e
458	459	2016-05-24	2016-05-24	1	inspected	40.2165764	-105.2581568	Conveyance,Pipe		Other	3ft	Acceptable	High	4331290a-3e79-4e07-85b7-0caa6249dfc1
459	460	2016-05-24	2016-05-24	1	inspected	40.2164965	-105.2582618	Conveyance,Pipe		Other	3ft rcp	Acceptable	Low	6cfc1f5a-78c3-4b45-8290-1a24158a7d70
460	461	2016-05-24	2016-05-24	1	inspected	40.2164771	-105.2580653	Conveyance,Pipe		Other	5 4ft	Deficient	High	ffa8a245-c08b-4756-9d45-2e007f86a70f
461	462	2016-05-24	2016-05-24	1	inspected	40.2163272	-105.2581191	Conveyance,Pipe		Other	4 4ft rcp	Deficient	High	9d34c7d8-5ece-4a97-aaba-08c3787809cb
462	463	2016-05-24	2016-05-24	1	inspected	40.2153065	-105.2543985	Outlet,Pipe		Other	30in	Good	Low	9c0c3aa2-03ab-41f7-bca0-f82efc041fa0
463	464	2016-05-24	2016-05-24	1	inspected	40.2128575	-105.2488407	Conveyance,Box		Other	8x4ft	Good	Low	4f0bf0a9-ccf3-45c5-b0d9-5e8c4a81d0e5
464	465	2016-05-24	2016-05-24	1	inspected	40.2129368	-105.2488253	Conveyance,Box		Other	8x4ft	Good	Low	8be4c898-fb4f-40c3-b786-a3369469e917
465	466	2016-05-24	2016-05-24	1	inspected	40.2126933	-105.2489455	Conveyance,Box		Other	5x10ft	Good	Moderate	efd441cb-971e-496a-8e84-88eb3d731097
466	467	2016-05-24	2016-05-24	1	inspected	40.2125426	-105.2490686	Conveyance,Box		Other	5x10ft	Good	Moderate	4bd0ebdb-3b88-4f09-9fe5-d418d798314d
467	468	2016-05-24	2016-05-24	1	inspected	40.2125216	-105.2490941	Conveyance,Box		Other	5x10ft	Good	Moderate	4a9bfa0c-cc9d-4274-b3ee-9ffe1f486a9f
468	469	2016-05-24	2016-05-24	1	inspected	40.2111647	-105.2492399	Conveyance,Box		Other	10x5ft	Good	Moderate	ed54cd25-2741-4b28-806e-040a167c1179
469	470	2016-05-24	2016-05-24	1	inspected	40.2142607	-105.2536818	Inlet,Grate		Metal		Good	Low	e8358db6-3c7e-4c22-8beb-d06b82bde222
470	471	2016-05-24	2016-05-24	1	inspected	40.2278402	-105.2742071	Inlet,Pipe		Other	30in cmp	Good	Low	a0830714-d825-41ad-95ba-b281da77e97c
471	0	###############	###############	1	inspected	40.2147662	-105.2621098	Conveyance,Other	MH					
472	0	###############	###############	1	inspected	40.2149152	-105.2621701	Conveyance,Other	MH					
473	0	###############	###############	1	inspected	40.2149988	-105.2619453	Conveyance,Other	MH					
474	0	###############	###############	1	inspected	40.2144074	-105.2623268	Conveyance,Other	Mh					
475	0	###############	###############	1	inspected	40.2171166	-105.2623293	Conveyance,Other	MH					
476	0	###############	###############	1	inspected	40.215039	-105.2617043	Inlet,Grate		Other				07c91214-425a-4f12-825f-fa338dd320c6
477	0	###############	###############	1	inspected	40.2157529	-105.2609717	Inlet,Grate						37e46c97-f0d8-48cd-97e3-4baeff41ba09
478	0	###############	###############	1	inspected	40.2155693	-105.2613168	Inlet,Grate						0a89d7cf-e025-4e27-bf05-485f037b5ae5
479	0	###############	###############	1	inspected	40.2205245	-105.2550197	Conveyance,Other	MH					
480	0	###############	###############	1	inspected	40.2214724	-105.2644235	Conveyance,Other	Mh					
481	0	###############	###############	1	inspected	40.2231099	-105.2673625	Conveyance,Other	Mh					
482	0	###############	###############	1	inspected	40.2246589	-105.2700191	Conveyance,Other	Mh					
483	0	###############	###############	1	inspected	40.2222384	-105.2548371	Conveyance,Pipe		Other	18in rcp			f497c076-cb7c-4e55-8c46-87a33f1a0096
484	0	###############	###############	1	inspected	40.222029	-105.2540627	Conveyance,Pipe		Other	12in cmp			a1e629fc-c2ef-4771-9df0-fc734132a2db
485	0	###############	###############	1	inspected	40.2219809	-105.2540501	Conveyance,Pipe		Other	12in cmp			51356368-3df9-436f-b3ec-31fc3eedfda7
486	0	###############	###############	1	inspected	40.2217997	-105.2541804	Conveyance,Pipe		Other	12in cmp			ceda5579-abbc-4bd2-8465-213d67b28a05
487	0	###############	###############	1	inspected	40.2217527	-105.2542174	Conveyance,Pipe		Other	12in cmp			edd94ca3-fa75-4d85-bd80-ce278ca89f8f
488	0	###############	###############	1	inspected	40.2216748	-105.2542253	Conveyance,Pipe		Other	12in cmp			db38021e-a16e-452b-8324-f6023b839b44
489	0	###############	###############	1	inspected	40.2215848	-105.254282	Conveyance,Pipe		Other	12in cmp			a874444b-c3a3-4838-9551-6d60a6a88507
490	0	###############	###############	1	inspected	40.2214526	-105.2542539	Conveyance,Pipe		Other	12in cmp			07b7ff33-6d4a-4014-ba6d-f8bd667f0cc6
491	0	###############	###############	1	inspected	40.2213683	-105.2542595	Conveyance,Pipe		Other	12in cmp			0d1788be-78d9-4ee2-854d-2739c5b5f986
492	0	###############	###############	1	inspected	40.2208352	-105.2544446	Conveyance,Pipe		Other	12in cmp			2871f5d0-acf7-4629-84fc-e03395ae3103
493	0	###############	###############	1	inspected	40.220775	-105.2545169	Conveyance,Pipe		Other	12in cmp			ce7d44d2-101a-4c79-b099-74c924dcf079
494	0	###############	###############	1	inspected	40.2203967	-105.2547736	Conveyance,Pipe		Other	12in cmp			f136038d-66a7-437c-8175-2bb2daccbae2
495	0	###############	###############	1	inspected	40.2203483	-105.2549367	Conveyance,Pipe		Other	12in cmp			da2a5821-be19-41d7-9135-a6640e273b74
496	0	###############	###############	1	inspected	40.2202364	-105.2549977	Conveyance,Pipe		Other	12in cmp			021e1ddc-6e15-410a-83b7-aa35b1df14cd
497	0	###############	###############	1	inspected	40.2201403	-105.2550572	Conveyance,Pipe		Other	12in cmp			876f2f7d-a4f5-4a8f-9465-ae6e0df8f276
498	0	###############	###############	1	inspected	40.220106	-105.2550966	Conveyance,Pipe		Other	12in cmp			9c4a03c4-8555-40ce-af5e-bad9350c31fb
499	0	###############	###############	1	inspected	40.2199942	-105.2552154	Conveyance,Pipe		Other	12in cmp			67e91e07-c198-4f49-a21b-d295b03e412a

500	0	###############	###############	1	inspected	40.2199739	-105.2552928	Conveyance,Pipe		Other	12in cmp	963e55d7-433e-47f6-89a9-93b436ffba77
501	0	###############	###############	1	inspected	40.2199465	-105.2553807	Conveyance,Pipe		Other	12in cmp	aab7a637-579a-4630-a41b-82f13918f112
502	0	###############	###############	1	inspected	40.2199034	-105.2554534	Conveyance,Pipe		Other	12in cmp	f48d60d0-6f37-40ea-a7cd-7cf87a149143
503	0	###############	###############	1	inspected	40.2198845	-105.2555681	Conveyance,Pipe		Other	12in cmp	f7faa7bf-9a0b-4062-94a3-57cfc00f402c
504	0	###############	###############	1	inspected	40.2198821	-105.2555855	Conveyance,Pipe		Other	12in cmp	698a72cc-3669-4b72-8b5c-1de299f1111a
505	0	###############	###############	1	inspected	40.2198559	-105.2556997	Conveyance,Pipe		Other	12in cmp	b7c006ac-125c-4754-88ab-7ea28dcd53ef
506	0	###############	###############	1	inspected	40.2198393	-105.2557593	Inlet,Grate				14f3b1a7-88e9-4cfd-ab87-d143853d7846
507	0	###############	###############	1	inspected	40.2235814	-105.2695394	Inlet,Grate				1e9e5513-c8a0-49b5-b40e-d0ed6a16e4cb
508	0	###############	###############	1	inspected	40.2231087	-105.2704925	Inlet,Grate				d0f81c09-f018-4282-b965-295c29c2b876
509	0	###############	###############	1	inspected	40.2235627	-105.2723591	Inlet,Grate				9d0d229b-fc45-4799-9c27-731e41d5b3cf
510	0	###############	###############	1	inspected	40.2235808	-105.2718376	Inlet,Grate				31c069a7-6932-4e6e-a7d2-81f258b1db94
511	0	###############	###############	1	inspected	40.2235211	-105.2717879	Inlet,Grate				1914fe37-ac67-4584-ae3c-05352b44df2c
512	0	###############	###############	1	inspected	40.2207155	-105.2555133	Inlet,Pipe		Other	18in rcp	31e40c2b-8bed-46b7-b626-6fc4959481b3
513	0	###############	###############	1	inspected	40.2222825	-105.2546284	Inlet,Pipe		Other	18in rcp	0001a48d-0dd0-463d-a083-fb8529ec974a
514	0	###############	###############	1	inspected	40.2204758	-105.2546525	Inlet,Pipe		Other	18in cmp	cea5e011-7c17-4a93-ba14-a63f09a21110
515	0	###############	###############	1	inspected	40.2208783	-105.2558207	Outlet,Pipe		Other	18in rcp	54bc6d10-879b-4c0d-8f02-2cd845ba8d82
516	0	###############	###############	1	inspected	40.223794	-105.2689607	Outlet,Pipe		Other	18in plastic	90d46665-0491-456a-a88c-e2a8345ce2c0
517	0	###############	###############	1	inspected	40.2246044	-105.2713787	Conveyance,Other	Mh			
518	0	###############	###############	1	inspected	40.2251634	-105.2705453	Inlet,Grate				24ae27c1-62f5-4755-bb38-f642c1685983
519	0	###############	###############	1	inspected	40.2243216	-105.2669231	Inlet,Pipe		Other	48x60 r p	23d58aec-88f1-46e3-9f26-b6b5d4668c36
520	0	###############	###############	1	inspected	40.2245235	-105.2672286	Outlet,Pipe		Other	24in rcp	3a50a612-da18-4eab-8dbe-3fb2e7e8ffb1

Appendix G - FUTURE PLANNING AREAS



Lyons Stormwater Masterplan

Figure G-1: Future Planning Areas

Eastern Corridor Watershed
Apple Valley Watershed
Future Planning Area
Current Sub-Basins

LYONS COLORADO

ICON ENGINEERING, INC.

CUHP INPUT

Summary of CUHP Input Parameters (Version 2.0.0)

								Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
AV500		2YR	0.143	0.324	0.769	0.035	20.0	0.40	0.10	3.55	0.54	0.0018	0.00	0.40	0.13	17.00
AV510		2YR	0.026	0.151	0.255	0.022	20.0	0.40	0.10	4.30	0.59	0.0018	0.00	0.40	0.13	16.66
AV515		2YR	0.040	0.150	0.346	0.049	20.0	0.40	0.10	4.33	0.59	0.0018	0.00	0.40	0.13	16.65
AV520		2YR	0.122	0.310	0.730	0.049	20.0	0.40	0.10	4.04	0.57	0.0018	0.00	0.40	0.13	16.79
AV525		2YR	0.047	0.530	0.874	0.029	20.0	0.40	0.10	4.37	0.59	0.0018	0.00	0.40	0.13	16.64
AV600		2YR	0.151	0.284	0.551	0.060	20.0	0.40	0.10	3.02	0.50	0.0018	0.00	0.40	0.13	17.26
AV700		2YR	0.054	0.255	0.473	0.030	20.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.40	0.13	16.58
AV705		2YR	0.376	0.692	1.189	0.060	20.0	0.40	0.10	3.13	0.51	0.0018	0.00	0.40	0.13	17.20
AV800		2YR	1.364	1.381	3.162	0.060	20.0	0.40	0.10	3.47	0.53	0.0018	0.00	0.40	0.13	17.06
AV805		2YR	0.500	0.658	1.288	0.060	20.0	0.40	0.10	3.01	0.50	0.0018	0.00	0.40	0.13	17.27
AV900		2YR	0.082	0.208	0.445	0.060	20.0	0.40	0.10	3.03	0.50	0.0018	0.00	0.40	0.13	17.26
AV905		2YR	0.080	0.369	0.697	0.060	20.0	0.40	0.10	3.04	0.50	0.0018	0.00	0.40	0.13	17.26
E100		2YR	0.068	0.194	0.385	0.060	20.0	0.40	0.10	3.61	0.54	0.0018	0.00	0.40	0.13	16.99
E105		2YR	0.029	0.106	0.287	0.057	20.0	0.40	0.10	3.52	0.53	0.0018	0.00	0.40	0.13	17.04
E110		2YR	0.383	0.412	1.152	0.060	20.0	0.40	0.10	3.19	0.51	0.0018	0.00	0.40	0.13	17.19
E115		2YR	0.060	0.197	0.422	0.060	20.0	0.40	0.10	3.16	0.51	0.0018	0.00	0.40	0.13	17.20
E120		2YR	0.027	0.182	0.387	0.060	20.0	0.40	0.10	3.15	0.51	0.0018	0.00	0.40	0.13	17.20
E200		2YR	0.044	0.257	0.498	0.060	20.0	0.40	0.10	4.07	0.57	0.0018	0.00	0.40	0.13	16.78
E205		2YR	0.043	0.238	0.410	0.059	20.0	0.40	0.10	4.50	0.60	0.0018	0.00	0.40	0.13	16.58
E300		2YR	0.297	0.634	1.149	0.060	20.0	0.40	0.10	3.18	0.51	0.0018	0.00	0.40	0.13	17.19
E305		2YR	0.141	0.386	0.697	0.060	20.0	0.40	0.10	3.30	0.52	0.0018	0.00	0.40	0.13	17.13

CUHP OUTPUT

2-YEAR

<u>Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)</u>

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
AV500		0.115	0.153	40.2	5.03	20.9	3.56	8.4	107	331,782	0.17	58,029	41.0	13	58,028	0.14
AV510		0.115	0.071	39.6	2.47	20.6	1.74	4.1	20	60,149	0.17	10,059	40.0	2	10,060	0.14
AV515		0.115	0.087	31.0	2.37	16.1	1.67	3.9	39	93,255	0.17	15,584	36.0	4	15,584	0.17
AV520		0.115	0.143	38.1	4.48	19.8	3.17	7.5	96	283,140	0.17	48,170	41.0	11	48,169	0.15
AV525		0.115	0.093	93.5	7.00	48.6	4.95	11.7	15	109,481	0.17	18,276	59.0	2	18,276	0.07
AV600		0.114	0.157	27.4	3.62	14.3	2.55	6.0	166	351,747	0.19	66,563	39.0	19	66,562	0.20
AV700		0.115	0.099	45.8	3.78	23.8	2.67	6.3	35	124,436	0.17	20,593	42.0	4	20,593	0.12
AV705		0.114	0.211	45.4	7.66	23.6	5.41	12.8	249	874,576	0.18	159,143	45.0	33	159,138	0.14
AV800		0.114	0.311	68.8	16.73	35.8	11.82	27.9	595	3,168,083	0.18	557,981	61.0	84	557,973	0.10
AV805		0.114	0.230	42.2	7.76	22.0	5.48	12.9	356	1,162,689	0.19	220,330	45.0	48	220,329	0.15
AV900		0.114	0.120	28.0	2.88	14.6	2.03	4.8	88	191,555	0.19	36,198	38.0	10	36,194	0.20
AV905		0.114	0.118	46.3	4.51	24.1	3.19	7.5	52	186,473	0.19	35,188	43.0	7	35,188	0.14
E100		0.115	0.110	27.7	2.64	14.4	1.86	4.4	74	157,724	0.17	27,544	36.0	8	27,544	0.19
E105		0.115	0.075	26.7	1.84	13.9	1.30	3.1	33	67,591	0.18	11,890	35.0	4	11,888	0.19
E110		0.114	0.212	34.6	5.95	18.0	4.20	9.9	332	890,439	0.18	160,734	41.0	41	160,732	0.17
E115		0.114	0.103	30.8	2.75	16.0	1.94	4.6	58	138,521	0.18	25,105	37.0	7	25,104	0.18
E120		0.114	0.072	40.9	2.56	21.3	1.81	4.3	20	61,928	0.18	11,239	41.0	2	11,239	0.14
E200		0.115	0.090	43.6	3.33	22.6	2.35	5.5	30	102,257	0.17	17,383	41.0	4	17,383	0.13
E205		0.115	0.090	38.8	2.98	20.2	2.10	5.0	33	100,478	0.17	16,628	40.0	4	16,627	0.14
E300		0.114	0.197	45.9	7.24	23.9	5.12	12.1	194	689,301	0.18	124,593	45.0	25	124,589	0.13
E305		0.114	0.153	36.8	4.61	19.1	3.26	7.7	115	328,152	0.18	58,396	40.0	14	58,396	0.16

CUHP OUTPUT

5-YEAR

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
AV500		0.113	0.153	39.9	4.99	20.8	3.53	8.3	107	331,782	0.47	155,650	41.0	37	155,649	0.40
AV510		0.114	0.071	39.3	2.45	20.5	1.73	4.1	20	60,149	0.41	24,951	38.0	6	24,952	0.35
AV515		0.114	0.086	30.8	2.34	16.0	1.66	3.9	39	93,255	0.41	38,598	36.0	11	38,597	0.43
AV520		0.114	0.143	37.8	4.44	19.7	3.14	7.4	97	283,140	0.43	122,935	40.0	30	122,931	0.39
AV525		0.114	0.093	92.8	6.93	48.3	4.90	11.5	15	109,481	0.41	45,178	56.0	5	45,178	0.17
AV600		0.113	0.157	27.3	3.59	14.2	2.53	6.0	167	351,747	0.52	182,669	37.0	57	182,671	0.59
AV700		0.114	0.099	45.5	3.74	23.7	2.65	6.2	35	124,436	0.40	50,237	41.0	11	50,237	0.31
AV705		0.113	0.211	45.1	7.60	23.5	5.37	12.7	250	874,576	0.51	442,840	45.0	95	442,836	0.39
AV800		0.113	0.310	68.4	16.58	35.6	11.71	27.6	598	3,168,083	0.48	1,515,916	60.0	235	1,515,914	0.27
AV805		0.113	0.229	42.0	7.69	21.8	5.44	12.8	358	1,162,689	0.52	604,295	44.0	137	604,287	0.43
AV900		0.113	0.119	27.9	2.86	14.5	2.02	4.8	89	191,555	0.52	99,398	36.0	30	99,388	0.58
AV905		0.113	0.118	46.1	4.47	24.0	3.16	7.5	52	186,473	0.52	96,683	42.0	20	96,682	0.39
E100		0.114	0.109	27.5	2.61	14.3	1.85	4.4	74	157,724	0.47	73,629	36.0	23	73,629	0.53
E105		0.113	0.075	26.5	1.82	13.8	1.29	3.0	33	67,591	0.48	32,202	35.0	10	32,198	0.55
E110		0.113	0.212	34.4	5.90	17.9	4.17	9.8	334	890,439	0.50	448,633	41.0	120	448,629	0.49
E115		0.113	0.103	30.6	2.73	15.9	1.93	4.5	58	138,521	0.51	69,966	37.0	20	69,965	0.52
E120		0.113	0.072	40.6	2.54	21.1	1.80	4.2	20	61,928	0.51	31,305	40.0	7	31,306	0.42
E200		0.114	0.090	43.3	3.29	22.5	2.33	5.5	31	102,257	0.43	44,293	41.0	10	44,293	0.34
E205		0.114	0.089	38.5	2.95	20.0	2.08	4.9	34	100,478	0.40	40,565	38.0	10	40,562	0.35
E300		0.113	0.196	45.7	7.18	23.8	5.07	12.0	195	689,301	0.50	347,582	45.0	74	347,578	0.39
E305		0.113	0.152	36.5	4.57	19.0	3.23	7.6	116	328,152	0.49	161,321	40.0	41	161,322	0.45

CUHP OUTPUT

10-YEAR

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
AV500		0.113	0.153	39.8	4.97	20.7	3.51	8.3	108	331,782	0.71	236,910	41.0	52	236,906	0.57
AV510		0.113	0.071	39.2	2.44	20.4	1.72	4.1	20	60,149	0.64	38,422	38.0	9	38,423	0.52
AV515		0.113	0.086	30.7	2.33	16.0	1.65	3.9	39	93,255	0.64	59,463	36.0	16	59,462	0.63
AV520		0.113	0.142	37.7	4.42	19.6	3.12	7.4	97	283,140	0.67	188,710	40.0	44	188,708	0.56
AV525		0.113	0.093	92.6	6.90	48.1	4.88	11.5	15	109,481	0.64	69,642	59.0	8	69,642	0.25
AV600		0.113	0.157	27.2	3.57	14.1	2.53	6.0	167	351,747	0.77	272,000	36.0	79	272,000	0.82
AV700		0.113	0.098	45.4	3.73	23.6	2.63	6.2	35	124,436	0.62	77,486	41.0	16	77,486	0.45
AV705		0.113	0.210	45.0	7.57	23.4	5.35	12.6	251	874,576	0.76	663,856	45.0	133	663,850	0.55
AV800		0.113	0.310	68.2	16.51	35.5	11.67	27.5	600	3,168,083	0.73	2,301,411	61.0	338	2,301,397	0.39
AV805		0.113	0.229	41.9	7.67	21.8	5.42	12.8	359	1,162,689	0.77	899,575	44.0	191	899,550	0.59
AV900		0.113	0.119	27.8	2.85	14.5	2.01	4.7	89	191,555	0.77	148,046	36.0	42	148,029	0.80
AV905		0.113	0.118	46.0	4.46	23.9	3.15	7.4	52	186,473	0.77	144,040	43.0	28	144,039	0.54
E100		0.113	0.109	27.5	2.61	14.3	1.84	4.3	74	157,724	0.71	112,226	35.0	33	112,226	0.75
E105		0.113	0.075	26.4	1.82	13.7	1.28	3.0	33	67,591	0.72	48,959	35.0	15	48,953	0.78
E110		0.113	0.211	34.3	5.88	17.9	4.15	9.8	335	890,439	0.76	673,656	40.0	167	673,647	0.68
E115		0.113	0.103	30.6	2.72	15.9	1.92	4.5	59	138,521	0.76	104,971	36.0	28	104,969	0.73
E120		0.113	0.072	40.5	2.53	21.1	1.79	4.2	20	61,928	0.76	46,955	39.0	10	46,957	0.58
E200		0.113	0.090	43.1	3.28	22.4	2.32	5.5	31	102,257	0.67	68,031	41.0	14	68,030	0.50
E205		0.113	0.089	38.4	2.93	20.0	2.07	4.9	34	100,478	0.62	62,567	38.0	14	62,563	0.52
E300		0.113	0.196	45.6	7.15	23.7	5.05	11.9	195	689,301	0.76	521,776	45.0	103	521,767	0.54
E305		0.113	0.152	36.4	4.55	19.0	3.22	7.6	116	328,152	0.74	243,683	40.0	57	243,685	0.63

CUHP OUTPUT

50-YEAR

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
AV500		0.112	0.152	39.6	4.94	20.6	3.49	8.2	108	331,782	1.46	482,767	47.0	112	482,760	1.22
AV510		0.113	0.071	39.0	2.42	20.3	1.71	4.0	20	60,149	1.39	83,320	44.0	19	83,323	1.17
AV515		0.113	0.086	30.5	2.32	15.9	1.64	3.9	39	93,255	1.38	129,096	41.0	36	129,086	1.41
AV520		0.112	0.142	37.5	4.39	19.5	3.10	7.3	97	283,140	1.41	399,533	45.0	97	399,536	1.24
AV525		0.113	0.093	92.1	6.85	47.9	4.84	11.4	15	109,481	1.38	151,428	65.0	18	151,428	0.60
AV600		0.112	0.156	27.1	3.56	14.1	2.51	5.9	168	351,747	1.52	532,914	42.0	161	532,913	1.66
AV700		0.113	0.098	45.2	3.70	23.5	2.62	6.2	36	124,436	1.37	170,550	49.0	36	170,548	1.05
AV705		0.112	0.210	44.8	7.52	23.3	5.32	12.5	252	874,576	1.50	1,312,011	51.0	280	1,312,003	1.16
AV800		0.112	0.309	67.9	16.41	35.3	11.60	27.4	603	3,168,083	1.47	4,648,010	66.0	738	4,647,936	0.85
AV805		0.112	0.229	41.7	7.62	21.7	5.39	12.7	360	1,162,689	1.52	1,762,026	50.0	396	1,761,947	1.24
AV900		0.112	0.119	27.7	2.83	14.4	2.00	4.7	89	191,555	1.51	290,134	41.0	86	290,103	1.62
AV905		0.112	0.118	45.8	4.43	23.8	3.13	7.4	53	186,473	1.51	282,357	50.0	58	282,354	1.13
E100		0.112	0.109	27.3	2.59	14.2	1.83	4.3	75	157,724	1.45	229,132	41.0	69	229,128	1.59
E105		0.112	0.075	26.3	1.81	13.7	1.28	3.0	33	67,591	1.47	99,033	40.0	30	99,021	1.63
E110		0.112	0.211	34.2	5.84	17.8	4.13	9.7	336	890,439	1.50	1,333,533	46.0	346	1,333,521	1.41
E115		0.112	0.103	30.4	2.70	15.8	1.91	4.5	59	138,521	1.50	207,628	42.0	57	207,621	1.51
E120		0.112	0.072	40.3	2.52	21.0	1.78	4.2	20	61,928	1.50	92,849	45.0	21	92,852	1.21
E200		0.112	0.090	42.9	3.26	22.3	2.31	5.4	31	102,257	1.41	144,193	47.0	31	144,192	1.11
E205		0.113	0.089	38.2	2.92	19.9	2.06	4.9	34	100,478	1.37	137,713	44.0	33	137,703	1.18
E300		0.112	0.196	45.4	7.11	23.6	5.02	11.9	196	689,301	1.50	1,032,599	51.0	217	1,032,578	1.14
E305		0.112	0.152	36.3	4.53	18.9	3.20	7.5	117	328,152	1.48	486,642	45.0	120	486,636	1.32

CUHP OUTPUT

100-YEAR

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
AV500		0.112	0.152	39.6	4.93	20.6	3.49	8.2	108	331,782	1.83	608,777	48.0	139	608,770	1.52
AV510		0.112	0.071	39.0	2.42	20.3	1.71	4.0	20	60,149	1.76	106,108	46.0	24	106,112	1.47
AV515		0.112	0.086	30.5	2.32	15.8	1.64	3.9	40	93,255	1.76	164,420	42.0	45	164,407	1.75
AV520		0.112	0.142	37.5	4.38	19.5	3.10	7.3	98	283,140	1.79	506,880	47.0	121	506,883	1.55
AV525		0.112	0.093	92.0	6.84	47.8	4.83	11.4	15	109,481	1.76	192,889	68.0	24	192,890	0.78
AV600		0.112	0.156	27.1	3.55	14.1	2.51	5.9	168	351,747	1.89	665,948	42.0	197	665,952	2.03
AV700		0.112	0.098	45.1	3.70	23.4	2.61	6.2	36	124,436	1.75	217,650	49.0	45	217,648	1.32
AV705		0.112	0.210	44.7	7.51	23.3	5.31	12.5	252	874,576	1.88	1,643,799	52.0	347	1,643,800	1.44
AV800		0.112	0.309	67.8	16.38	35.2	11.57	27.3	604	3,168,083	1.85	5,851,739	68.0	936	5,851,640	1.07
AV805		0.112	0.229	41.6	7.61	21.7	5.38	12.7	361	1,162,689	1.89	2,201,765	51.0	491	2,201,693	1.53
AV900		0.112	0.119	27.7	2.83	14.4	2.00	4.7	89	191,555	1.89	362,582	42.0	105	362,540	1.98
AV905		0.112	0.118	45.7	4.43	23.8	3.13	7.4	53	186,473	1.89	352,883	50.0	72	352,878	1.40
E100		0.112	0.109	27.3	2.59	14.2	1.83	4.3	75	157,724	1.83	289,041	41.0	85	289,040	1.95
E105		0.112	0.074	26.3	1.80	13.7	1.27	3.0	33	67,591	1.84	124,704	41.0	37	124,689	2.00
E110		0.112	0.211	34.1	5.83	17.8	4.12	9.7	337	890,439	1.88	1,671,341	47.0	427	1,671,320	1.74
E115		0.112	0.103	30.4	2.70	15.8	1.91	4.5	59	138,521	1.88	260,178	42.0	70	260,171	1.84
E120		0.112	0.072	40.3	2.52	21.0	1.78	4.2	20	61,928	1.88	116,343	46.0	26	116,345	1.51
E200		0.112	0.090	42.9	3.26	22.3	2.30	5.4	31	102,257	1.79	182,955	48.0	39	182,952	1.39
E205		0.112	0.089	38.1	2.91	19.8	2.06	4.8	34	100,478	1.75	175,746	46.0	41	175,731	1.49
E300		0.112	0.195	45.3	7.10	23.6	5.02	11.8	197	689,301	1.88	1,294,100	52.0	270	1,294,076	1.42
E305		0.112	0.152	36.2	4.52	18.8	3.19	7.5	117	328,152	1.86	611,434	46.0	148	611,422	1.64

References