PRELIMINARY DRAINAGE REPORT

QuikTrip #4201

8040 Rosemary Street,
Commerce City, CO 80022

PREPARED FOR:
QuikTrip Corporation

PREPARED BY:
Galloway & Company, Inc.
5500 Greenwood Plaza Blvd, Suite 200
Greenwood Village, CO 80111

DATE:
December 29, 2023

PRELIMINARY DRAINAGE REPORT

QuikTrip #4201

Legal Description
A parcel of land located in the southwest 1/4 of Section 28, Township 2 South, Range 67 West of the Principal Meridian, City of Commerce City, County of Adams, State of Colorado, containing 104,489 square feet or 2.40 acres of land more or less.

Preparation Date
August 28, 2023
Revised: December 29, 2023

Prepared for
QuikTrip Corporation
12000 N. Washington Street, Suite 175
Thornton, CO 80241
Phone (913) 593-1690
Attn: Mike Talcott

Prepared by:

Stephen Orehosky

Reviewed by:

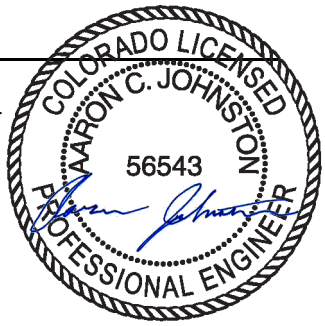
Aaron Johnston

ENGINEER'S STATEMENT

I hereby certify that this final drainage study for the QuikTrip #4201 was prepared by me (or under my direct supervision) in accordance with the provisions of the City of Commerce City Storm Drainage Design and Technical Criteria Manual for the owners thereof. I understand that the City of Commerce City does not, and will not, assume liability for drainage facilities designed by others.

12/29/23

Aaron Johnston, P.E.
Registered Professional Engineer
State of Colorado No. 56543



Date

DEVELOPER'S CERTIFICATION

"QuikTrip Corporation hereby certifies that the drainage facilities for QuikTrip #4201 shall be constructed according to the design presented in this report. I understand that the City of Commerce City does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that the City of Commerce City reviews drainage plans pursuant to the Municipal Code; but cannot, on behalf of QuikTrip #4201, guarantee that final drainage design review will absolve QuikTrip Corporation and/or their successors and/or assigns of future liability for improper design."

Talcott, Michael

Digitally signed by Talcott, Michael
DN: E=mtalcott@quiktrip.com, CN="Talcott, Michael", OU=Corp, OU=User Accounts, DC=QT, DC=quiktrip, DC=com
Location: Denver
Reason: I have reviewed this document
Contact Info: mtalcott@quiktrip.com
Date: 2024.01.04 07:16:55-07'00'

1/4/2024

Authorized Signature
Mike Talcott

Date

TABLE OF CONTENTS

I. General Location and Description

A. Location

The proposed QuikTrip is located in Adams County, at the northeast corner of Rosemary Street and State Highway 2, in Commerce City, Colorado, and consists of approximately 2.40 acres of developed land and is currently zoned Agricultural District. The site is contained in the southwest quarter of Section 28, Township 2 South, Range 67 West of the Principal Meridian. The site is bordered by Rosemary Street to the west, State Highway 2 to the south and east, and various residential lots along the north property line. In between the project site and State Highway 2 is a railroad track. This project site in existing conditions discharges towards the railroad tracks and continues northeast to Irondale Gulch and ultimately reaching South Platte River. It is the intent of this development to continue this drainage pattern and release at existing rates. No water quality or detention is currently associated with the existing lot.

B. Description of Property

The project site consists of developed land, comprised of a single story building, native grasses, and gravel parking behind the existing building. The proposed development will include the development of the QuikTrip site, the detention and water quality pond for the site, and associated utility and road infrastructure. The approximately 2.40 acres of undeveloped land generally slopes from southwest to northeast. The existing zoning for this site is Agricultural, but will be amended to become commercial zoning.

The NRCS Web Soil Survey of Adams County, Colorado, indicates site soils to be Truckton sandy loam, and Vona sandy loam soils, described as Hydrologic Soil Group A, and with varying slopes of 0-20 percent. Group A soils have very low runoff potential and are classified as being well-drained.

The FEMA Flood Insurance Map (08001C0607H) dated March 5, 2007 shows that this site is located in Zone X, which is outside the 0.2% annual chance flood plain. No office calculation or field surveying was

performed to determine this information. A copy of the FIRM map is included for reference in the appendices.

There are no irrigation facilities on-site, or nearby, which flow through the project site. The site is developed with a single story structure and gravel parking lot and slopes towards the existing railroad to the east. Currently, there are no slope/drainage easements, utility easements, or temporary utility easements. A geotechnical report has not been completed at this time, however, will be provided as an appendix to this report when completed, this also includes bore samples of the site. Based on the Mile High Flood District's Confluence Map there is no flooding immediately adjacent or downstream of the site. However, there is flood concerns due to lack of capacity within Irondale Gulch on the southside of the State Highway 2. This project site does not discharge directly into Irondale Gulch, but instead a drainage ditch on the north side of the BNSF railroad. The drainage ditch does eventually discharge into Irondale Gulch further downstream. A copy of the MHFD Confluence Map for this area is included in the appendix.

II. Drainage Basins and Sub-basins

A. Major Existing Basin Description

Irondale Gulch is discussed within the *Irondale Gulch Outfall Systems Plan* (herein referred to as the *Existing OSP*) dated 2011. Specifically, this project tributary to Reach 2 and is contained within Basin ID 951 per Figure E-1 of the *Existing OSP*. Figure E-1 shows a conceptual design of how the various basins will be routed to Reach 2 and ultimately towards the South Platte River. The project site is located at the most upstream location oof Basin 951, and no conceptual improvements were recommended immediately adjacent or downstream of the site. Existing flows are routed through a grass lined channel along the northern edge of the BNSF railroad, and continue northeast until sheet flowing through residential roads towards 88th Avenue. According to the *Existing OSP* the project site will be collected in a grass lined channel and routed towards a future regional detention facility with Basin ID 8951. In the *Existing OSP* the project site was analyzed to have a future site impervious value of 90%, coinciding with the assumption the site would be developed for commercial uses. According to the *Existing* OSP, "Detention Basin 8951's conceptual design includes storage volume of 27.5 acre-feet and a release rate of 8.3 cfs. It detains runoff between 86th Avenue, Rosemary Street, and State Highway 2. Runoff naturally sheet flows to the detention basin and there is an open channel around the perimeter of the basin to collect runoff and discharge into the pond at the drop structure and forebay location. The detention basin discharges are conveyed in a 30-inch RCP along Ulster Street to the 60-inch RCP within 88th Avenue." The 60-inch RCP in 88th Avenue will route the runoff to the South Platte River. This site is located in Zone X according to the FEMA FIRM panel previously mentioned. The proposed on-site water quality and detention facility will release at existing rates and will be directed along the same existing flow path along the BNSF railroad where runoff will then be directed north towards 88th Avenue within various open channels.

B. Sub-basin Descriptions

Specifically, the project site consists of approximately 2.40 acres of developed land, containing a single story structure and gravel parking lot, which sheet flows into an existing drainage ditch along the north side of the BNSF railroad. According to the Mile High Flood Districts Map Gallery webpage the drainage ditch enters Irondale Gulch where runoff is directed north towards 88th Avenue. The existing site produces approximately 3.81 cfs of runoff, and since the site is located at the most upstream portion of the *Existing OSP* report, there is minimal to no off-site flow entering the project site.

Approximately 1.71 acres of the existing 2.40 acres is proposed to be developed with this plan, while the remaining 0.69 acres will remain undeveloped and pervious landscaping. The proposed development will include a single story convenience store, a fuel canopy for dispenser islands, pavement for parking

surfaces, various utilities, and a proposed on-site water quality and detention facility. Soils on-site are classified as Hydrologic Group A and have well-draining characteristics. The 1.71 acres that is planned to be disturbed and developed will be routed to the on-site drainage facility and will be discharged into the drainage ditch along the BNSF railroad similar to the existing condition flow path.

According to Section 2.3.2, within the City of Commerce City Storm Drainage Criteria Manual and Figure 2-1 Requirements for Detention and Stormwater Quality in Commerce City, this site is proposing to disturb more than 5,000 square feet of land, no regional water quality or detention is currently provided, therefore minimizing directly connected impervious areas and an on-site full spectrum detention facility will be required on site. Per Figure 2-1 the 20/10 rule does not apply to this site.

III. Design Criteria

A. Development Criteria References and Constraints

This site discharges into a drainage ditch along the BNSF railroad and ultimately into the Irondale Gulch which was analyzed as part of an overall basin in the *Irondale Gulch Outfall Systems Plan* dated 2011. This report discusses specific improvements and future regional detention facilities, but did not have any specific improvements associated with the project site. No improvements were discussed for the drainage ditch along the railroad, and future improvements were discussed for Irondale Gulch as a concern for flooding does existing within Irondale Gulch.

B. Hydrologic Criteria

The Rational Method was used to calculate the flows generated within each basin for both the 5-year and 100-year storm events. Soils on-site consist of Truckton sandy loam, and Vona sandy loam soils, described as Hydrologic Soil Group A, and with varying slopes of 0-20 percent. Group A soils have very low runoff potential and are classified as being well-drained. Intensities, times of concentrations, and routed flow accumulations were all calculated using the formulas and/or charts provided in the City of Commerce City Storm Drainage Design and Technical Criteria Manual. Composite “C” values and site imperviousness were derived from runoff coefficients provided for pavement, landscaping, and roofs in the Mile High Flood District Urban Storm Drainage Criteria Manual. Calculations herein demonstrate runoff and flow accumulations for the 5- and 100-year events. The site imperviousness that is being routed to the proposed on-site detention facility is approximately 76.5%.

Detention and storm water quality will be provided on-site by the proposed detention and water quality pond located on the northeast side of the site. The pond will release stormwater at the existing rate into the existing drainage ditch, where it will be conveyed to Irondale Gulch, and ultimately the South Platte River. The Mile High Flood District Detention spreadsheet was used to verify pond storage and the outlet structure design will be provided with the final drainage report and construction documents.

C. Hydraulic Criteria

All proposed storm sewer will be sized using StormCAD and all inlet capacities will be verified with the most recent MHFD UD-Inlet spreadsheet. All storm sewer inlets will be designed to capture and convey the major storm event. StormCAD modeling will be utilized to verify pipe capacity and Hydraulic Grade Lines for the 5-year and 100-year storm events through all proposed piping.

D. Stormwater Quality

This project proposes to satisfy the MS4 Permit requirements by providing water quality within the detention facility and releasing runoff from the pond at or below the historic rates into the drainage ditch similar to the existing conditions.

IV. Drainage Plan

A. General Concept

The following information outlines the concepts for collecting and conveying excess site rainfall. Refer to the appendices for the Drainage Plan.

All proposed on-site storm sewer is routed to the on-site detention and water quality pond. The on-site runoff is collected by CDOT Type R inlets and conveyed through the proposed storm sewer system to the pond. Treatment to permanent water quality standards is provided here and the runoff eventually outfalls on the southeast side of the pond to the drainage ditch, where it is conveyed to the Irondale Gulch. Maintenance of the facilities is the responsibility of the Property Owner.

All on-site runoff will be routed to the proposed on-site water quality and detention facility, a summary table of elevations, volume storage, and release rates is provided below.

PROPOSED DETENTION POND SUMMARY TABLE

Attribute	Value
Tributary Sub-basin	DA 1 - DA 5
Area (acres)	1.71
Imperviousness	81%
WQCV Volume Req. (ac-ft)	0.055
WQCV WSEL (ft)	5154.34
EURV Volume Req. (ac-ft)	0.156
EURV WSEL (ft)	5155
100-Year Volume Req. (ac-ft)	0.290
Volume Provided (ac-ft)	0.654
100-Year WSEL	5155.98
Top of Pond	5158.50
Freeboard (ft)	2.52
Q_{ALL} (cfs)	3.11
Q_{ACT} (cfs)	3.10
Total Runoff Into Pond (cfs)	DA 1 - DA 5
Pond Spillway Flowline (ft)	5157.50
Clogged 100-Yr WSEL (ft)	5158.02
Freeboard (ft)	0.48

B. Specific Details

Collection and conveyance within and from each of the sub-basins is detailed below. Basin delineations can be found on the Drainage Map in the appendices of this report.

Basin EX-1 (2.40 AC, Q_5=0.56 cfs, Q_{100}=3.18 cfs): a basin consisting of the existing property. Runoff generally flows from the northwest to the southeast and discharges into an existing drainage ditch along the north side of the BNSF railroad.

Basin DA-1 (0.13 AC, Q_5=0.48 cfs, Q_{100}=0.99 cfs): a basin defining the roof of the proposed QuikTrip. Runoff will flow into a downspout, which will tie into the proposed storm sewer system underground with an inserta-tee. Runoff will then be routed to the on-site water quality and detention facility.

Basin DA-2 (0.17 AC, Q_5=0.62 cfs, Q_{100}=1.26 cfs): a basin defining the roof of the proposed fuel canopy. Runoff will flow into downspouts which will tie into the proposed storm sewer system. Runoff will then be routed to the on-site water quality and detention facility.

Basin DA-3 (0.39 AC, Q_5=1.22 cfs, Q_{100}=2.46 cfs): a basin towards the northwest side of the site consisting of a portion of the parking, drives, and landscaping. Runoff will be routed by curb and gutter to a proposed curb inlet, Inlet A3, located in sump. Runoff will then be routed to the on-site water quality and detention facility.

Basin DA-4 (0.84 AC, Q_5=2.97 cfs, Q_{100}=5.86 cfs): a basin located at the south side of the site and consisting of parking, drives, and landscaping. Runoff will be routed by curb and gutter to a proposed Type R inlet, Inlet A4, located in sump. Runoff will then be routed to the on-site water quality and detention facility.

Basin DA-5 (0.19 AC, Q_5=0.05 cfs, Q_{100}=0.18 cfs): a basin consisting of the proposed water quality and detention facility, and some upstream landscaping.

Basin DA-6 (0.69 AC, Q_5=0.16 cfs, Q_{100}=0.69 cfs): a basin consisting of existing pervious landscaping which will largely remain undisturbed. Runoff will sheet flow from the site into the existing drainage ditch following existing flow patterns.

Detention and storm water quality will be provided on-site by the proposed detention and water quality pond located on the west side of the site. The pond will release stormwater at the existing rate into the existing drainage ditch, where it will be conveyed to the Irondale Gulch, and ultimate receiving waters, the South Platte River. The Mile High Flood District Detention spreadsheet was used to verify pond storage and outlet structure design. The emergency spillway has been designed to accommodate the full 100-year storm runoff of the site. The emergency spillway will have a 10-foot bottom width and a total depth of 1-foot with 4:1 side slopes to convey 13.45 cfs. Maintenance and access is provided to the detention pond by a 10-foot wide access ramp with a maximum longitudinal slope of 10%.

V. Conclusions

A. Compliance with Standards

This report has been prepared using the criteria and methods as described in the City of Commerce City Storm Drainage and Technical Criteria Manual, provisions of the Mile-High Flood District Urban Storm Drainage Criteria Manual, and the *Irondale Gulch Outfall Systems Plan*. With development, site imperviousness and runoff will increase compared to existing rates but will not adversely impact downstream properties or existing drainage infrastructure due to the proposed water quality and detention facility. The proposed detention and water quality will ensure runoff into the existing drainage ditch does not exceed existing rates and that proper water quality is provided.

B. Drainage Design

The proposed detention and water quality pond will discharge at, or below, existing rates into the existing drainage ditch immediately southeast of the site. Additionally, rip rap will be provided at the flared end section leaving the proposed pond to provide stability and energy control prior to runoff entering the existing ditch. MS4 and MDCIA compliance will be achieved with water quality detention design. The proposed water quality and detention facility will be privately owned and maintained.

C. Water Quality

MS4 and MDCIA compliance will be achieved with water quality detention design.

D. Operation and Maintenance provisions

An operation and Maintenance Plan for the proposed stormwater facilities will be provided in the final drainage study in accordance with the provisions section 3.1.3 in the City Criteria Manual. The on-site pond will be privately maintained and follow O&M provisions provided in the final drainage study. The O&M plan will adhere to the requirements listed subsection 3.1.3.D.e.

VI. References

1. Urban Storm Drainage Criteria Manual, Mile High Flood District, January 2016 (with current revisions).

2. Storm Drainage Design and Technical Criteria Manual, City of Commerce City, Colorado, May 2023.

3. Irondale Gulch Outfall Systems Plan, Moser and Associates Engineering, September 2011.

4. Flood Insurance Rate Map – Adams County, Colorado and Incorporated Areas Community Panel No. 08001C0607H, Effective March 5, 2007

5. Soil Map – Adams County Area, Parts of Adams and Denver Counties, Colorado as available through the Natural Resources Conservation Service National Cooperative Soil Survey web site via Web Soil Survey 2.0.

VII. Appendices

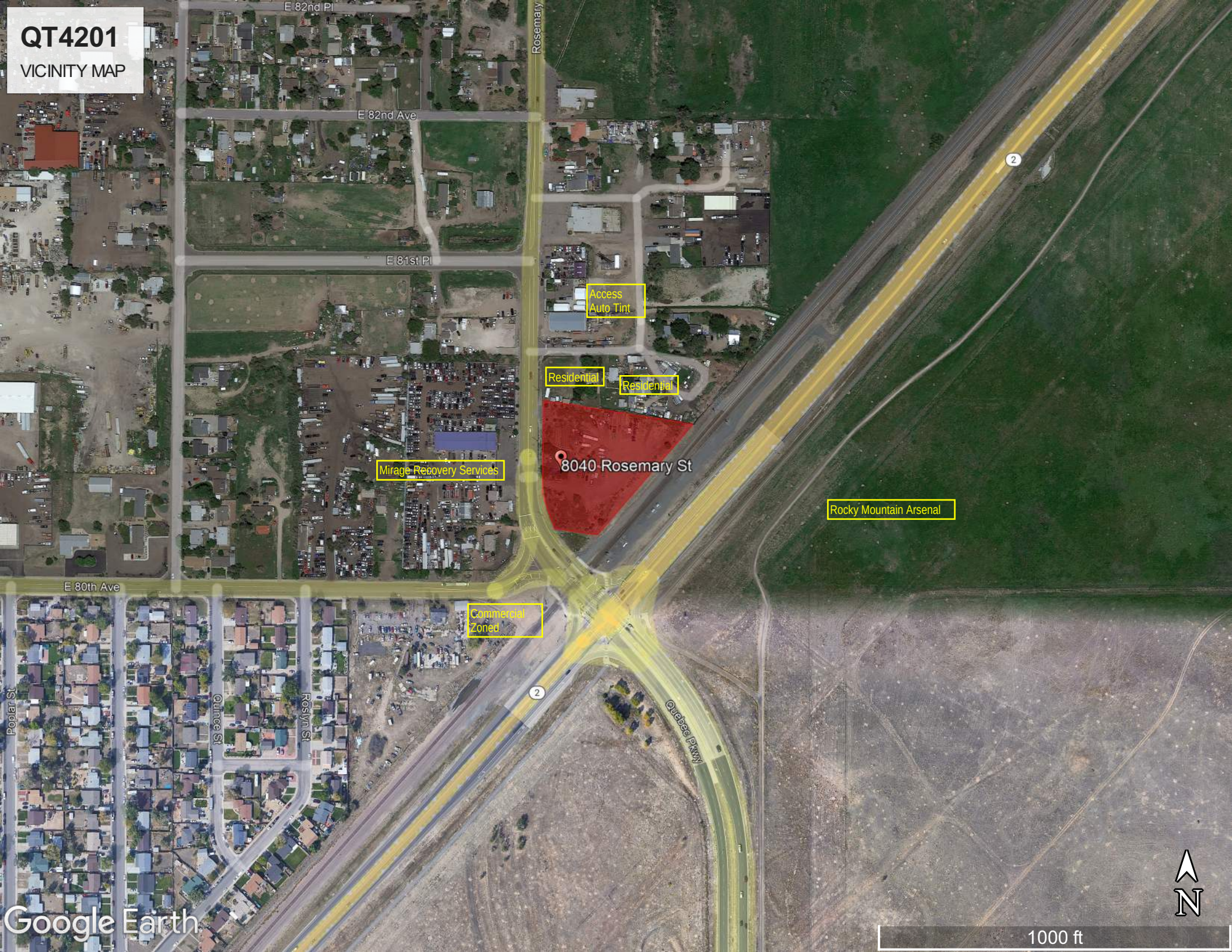
A. Exhibits and Figures
B. Hydrologic Computations
C. Hydraulic Computations
D. Drainage Map
E. City Checklist

APPENDIX A

Exhibits and Figures

QT4201

VICINITY MAP



National Flood Hazard Layer FIRMette

FEMA

104°54'17"W 39°50'47"N

104°53'39"W 39°50'20"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

- **SPECIAL FLOOD HAZARD AREAS**
  - Without Base Flood Elevation (BFE) *Zone A, V, A99*
  - With BFE or Depth *Zone AE, AO, AH, VE, AR*
  - Regulatory Floodway
- **OTHER AREAS OF FLOOD HAZARD**
  - 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
  - Future Conditions 1% Annual Chance Flood Hazard *Zone X*
  - Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
  - Area with Flood Risk due to Levee *Zone D*
- **OTHER AREAS**
  - NO SCREEN — Area of Minimal Flood Hazard *Zone X*
  - Effective LOMRs
  - Area of Undetermined Flood Hazard *Zone D*
- **GENERAL STRUCTURES**
  - Channel, Culvert, or Storm Sewer
  - Levee, Dike, or Floodwall
- **OTHER FEATURES**
  - 20.2 — Cross Sections with 1% Annual Chance
  - 17.5 — Water Surface Elevation
  - Coastal Transect
  - Base Flood Elevation Line (BFE)
  - Limit of Study
  - Jurisdiction Boundary
  - Coastal Transect Baseline
  - Profile Baseline
  - Hydrographic Feature
- **MAP PANELS**
  - Digital Data Available
  - No Digital Data Available
  - Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/16/2023 at 12:38 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Adams County Area, Parts of Adams and Denver Counties, Colorado

QuikTrip #4201

January 19, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:967 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 45 90 180 270

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.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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: Adams County Area, Parts of Adams and Denver Counties, Colorado
Survey Area Data: Version 19, Sep 1, 2022

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
TuB	Truckton sandy loam, 0 to 3 percent slopes	1.3	53.9%
VoC	Vona sandy loam, 3 to 5 percent slopes	1.1	46.1%
Totals for Area of Interest		**2.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Adams County Area, Parts of Adams and Denver Counties, Colorado

TuB—Truckton sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2yvrf
Elevation: 4,600 to 6,100 feet
Mean annual precipitation: 12 to 17 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 125 to 155 days
Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition

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

Description of Truckton

Setting

Landform: Terraces, interfluves
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind re-worked alluvium derived from arkose

Typical profile

A - 0 to 6 inches: sandy loam
Bt1 - 6 to 10 inches: sandy loam
Bt2 - 10 to 16 inches: sandy loam
C - 16 to 80 inches: loamy coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
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 content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Minor Components

Bresser

Percent of map unit: 4 percent
Landform: Terraces, interfluves
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Vona

Percent of map unit: 4 percent
Landform: Hills, dunes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R067BY015CO - Deep Sand
Hydric soil rating: No

Blakeland

Percent of map unit: 3 percent
Landform: Interfluves, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R067BY015CO - Deep Sand
Hydric soil rating: No

Pleasant, frequently ponded

Percent of map unit: 2 percent
Landform: Closed depressions
Down-slope shape: Concave, linear
Across-slope shape: Concave
Ecological site: R067BY010CO - Closed Upland Depression
Hydric soil rating: Yes

Urban land

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

VoC—Vona sandy loam, 3 to 5 percent slopes

Map Unit Setting

National map unit symbol: 34xc
Elevation: 4,000 to 5,600 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 48 to 52 degrees F

Frost-free period: 125 to 155 days
Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition

Vona and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Vona

Setting

Landform: Plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sands

Typical profile

H1 - 0 to 7 inches: sandy loam
H2 - 7 to 22 inches: sandy loam
H3 - 22 to 60 inches: loamy sand

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Minor Components

Truckton

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

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report
Map—Hydrologic Soil Group

Map Scale: 1:967 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 45 90 180 270

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 Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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.

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Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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Survey Area Data: Version 19, Sep 1, 2022

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Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
TuB	Truckton sandy loam, 0 to 3 percent slopes	A	1.3	53.9%
VoC	Vona sandy loam, 3 to 5 percent slopes	A	1.1	46.1%
Totals for Area of Interest			**2.4**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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IRONDALE GULCH

OUTFALL SYSTEMS PLAN
CONCEPTUAL DESIGN REPORT

Project Sponsors

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

COMMERCE CITY

Prepared by:

MOSER & associates ENGINEERING
720 South Colorado Boulevard
Suite 410 S
Denver, Colorado 80246
phone (303) 757-3655
fax (303) 300-1635

September 2011

DOWNSTREAM IRONDALE GULCH STUDY LIMIT

REACH 1

REACH 2

88TH AVENUE

IRONDALE GULCH WATERSHED BOUNDARY

PROJECT SITE

REACH 3

TRIBUTARY A

ROCKY MOUNTAIN ARSENAL

SOUTH PLATTE RIVER

BRIGHTON ROAD

UNION PACIFIC RAILROAD

I-76

CITY OF THORNTON

80TH AVENUE

BNSF

STATE HIGHWAY 2

TRIBUTARY B

REACH 4

72ND AVENUE

IRONDALE GULCH

QUEBEC PARKWAY

COMMERCE CITY

FORMER LOCATION OF UPPER DERBY POND

UNINCORPORATED ADAMS COUNTY

PENA BOULEVARD

56TH AVENUE

UPSTREAM STUDY LIMIT

CITY AND COUNTY OF DENVER

I-70

SMITH ROAD

HAVANA STREET

PEORIA STREET

CHAMBERS ROAD

TOWER ROAD

CITY OF AURORA

LEGEND

- EXISTING DETENTION POND
- WATERSHED BOUNDARY
- FLOW PATH
- COUNTY BOUNDARIES
- COMMERCE CITY
- CITY OF AURORA
- CITY AND COUNTY OF DENVER
- UNINCORPORATED ADAMS COUNTY
- CITY OF THORTON

Urban Drainage and Flood Control District

BOULDER · ADAMS · JEFFERSON · DENVER · ARAPAHOE · DOUGLAS · BROOMFIELD

PROJECT AREA

N

2000 0 1000 2000 4000

SCALE: 1" = 4000'

Exisitng Detention Basin IDs		
Figure 2-1 ID	Basin Name	SWMM ID
1	Lake Mary	200
2	Lake Ladora	201
3	Havana/Ladora Con. 3	833
4	Havana/Ladora Con. 2	832
5	Havana/Ladora Con.1	831
6	Havana Pond	202
7	Lower Derby	203
8	Parkfield II Pond	207
9	Parkfield Lake	210
10	Chambers II Pond	216
11	Gateway Park B	416
12	Gateway Park C	414
13	Highline Pond	218
14	Silverado I	211
15	Upland C	213
16	Upland B	641
17	Upland A	640
18		920
19	GVR-A-3	205
20	GVR-A-2	206
N/A		240*
N/A		265*
N/A		268*
N/A		271*
N/A		310*
N/A		425*
N/A	Majestic	910*
N/A		540*
N/A		570*

*These basins are located in the Gateway Park and Majestic Commercenter. Please refer to the Development Reports from the City of Aurora for exact locations.

NAME: Z:\UDFCD PLANNING\Irondale Gulch\CAD_Irondale Gulch\dwg\Fig ES-1 - Study Area Map.DWG
PLOT DATE: Aug 26, 2011 9:13am

TOPOGRAPHIC METHOD:	LIDAR
TOPOGRAPHIC MAPPING BY:	
TOPOGRAPHIC MAPPING QA/QC BY:	
CONTOUR INTERVAL:	2 FOOT
DATE FLOWN:	2008

MOSER & associates ENGINEERING
720 S. COLORADO BLVD. SUITE 410 S DENVER, CO 80246
PHONE: 303-757-3655 FAX: 303-300-1635

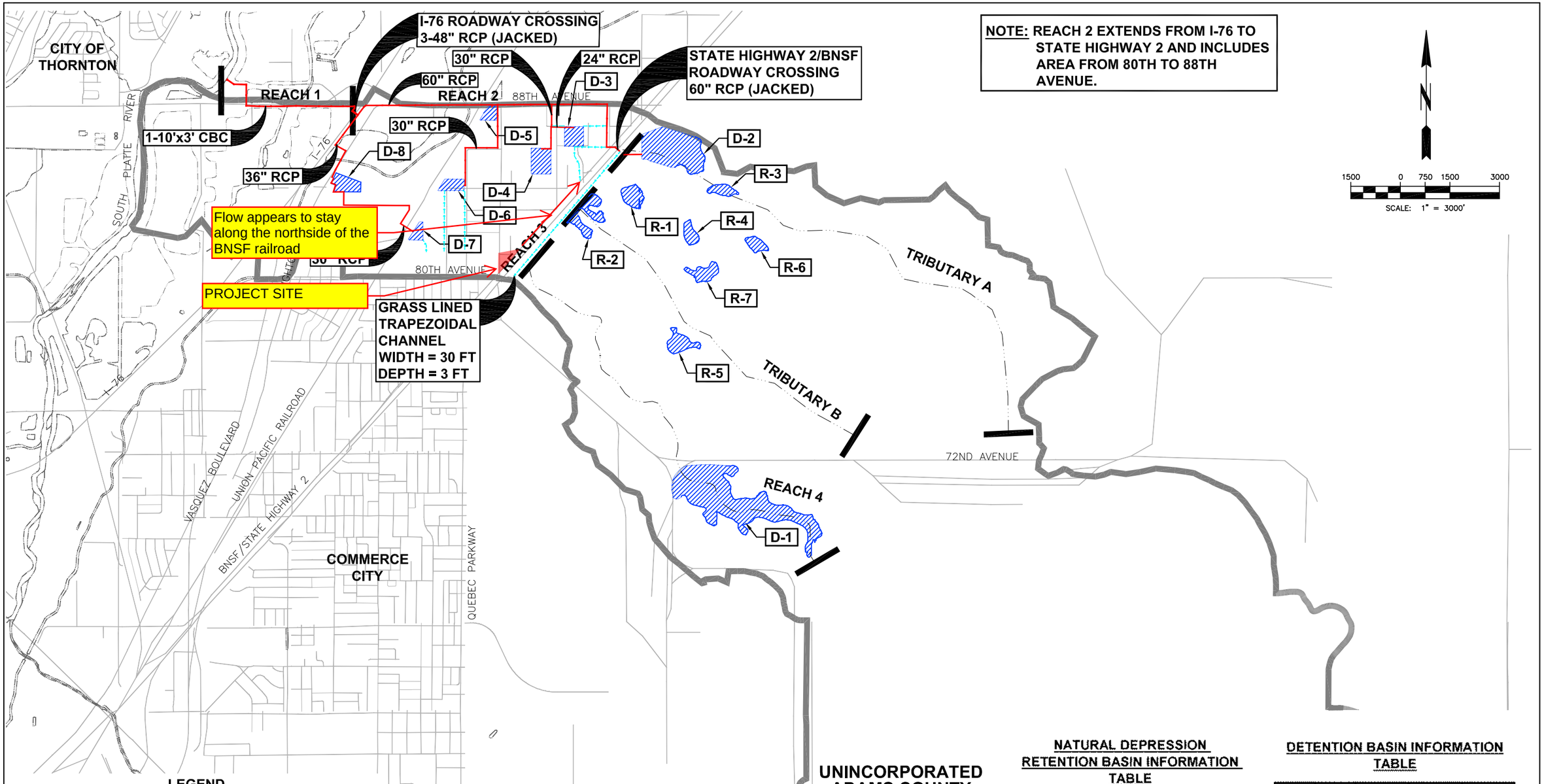
DESIGNED	AGC	DATE 10/10/10
DRAWN	RWM	DATE 11/15/10
CHECKED	RCO	DATE 1/20/11
REVISED		DATE

COMMERCE CITY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

IRONDALE GULCH OUTFALL SYSTEMS PLAN

STUDY AREA

FIGURE ES-1



LEGEND

- JURISDICTIONAL BOUNDARIES
- WATERSHED BOUNDARY
- FLOW PATH
- REACH LIMIT
- DETENTION/RETENTION BASIN
- TRAPEZOIDAL CHANNEL
- UNDERGROUND CONDUIT

NATURAL DEPRESSION RETENTION BASIN INFORMATION TABLE

ID	NAME	VOL (AC-FT)	$Q_{100\ IN}$ (CFS)	$Q_{100\ OUT}$ (CFS)
R-1	9912	2.9	28.4	0.0
R-2	9913	10.7	111.9	0.0
R-3	9916	12.8	561.0	547.6
R-4	9917	3.9	47.4	0.0
R-5	9918	10.1	121.8	0.0
R-6	9921	14.1	376.1	235.7
R-7	9922	4.2	47.8	0.0

DETENTION BASIN INFORMATION TABLE

ID	NAME	VOL (AC-FT)	$Q_{100\ IN}$ (CFS)	$Q_{100\ OUT}$ (CFS)
D-1	209	646.3	723.5	89.0
D-2	8911	48.8	561.2	4.3
D-3	8950	11.4	291.7	6.6
D-4	8951	27.5	560.0	8.3
D-5	8953	18.9	406.5	20.7
D-6	8955	19.7	417.0	8.5
D-7	8957	14.5	269.8	8.8
D-8	8961	42.2	696.4	22.7

NAME: Z:\UDFCD PLANNING\Irondale Gulch\CAD_Irondale Gulch\dwg\Fig ES-2 - Conceptual Design Plan.DWG
PLOT DATE: Sep 07, 2011 3:19pm

TOPOGRAPHIC METHOD:	LIDAR
TOPOGRAPHIC MAPPING BY:	
TOPOGRAPHIC MAPPING QA/QC BY:	
CONTOUR INTERVAL:	2 FOOT
DATE FLOWN:	2008

MOSER & associates ENGINEERING
720 S. COLORADO BLVD.
SUITE 410 S
DENVER, CO 80246
PHONE: 303-757-3655
FAX: 303-300-1635

DESIGNED	AGC	DATE 10/10/10
DRAWN	RWM	DATE 11/15/10
CHECKED	RCO	DATE 1/20/11
REVISED		DATE

COMMERCE CITY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

IRONDALE GULCH OUTFALL SYSTEMS PLAN

CONCEPTUAL DESIGN PLAN

FIGURE ES-2

DOWNSTREAM IRONDALE GULCH STUDY LIMIT

REACH 1

REACH 2

88TH AVENUE

IRONDALE GULCH WATERSHED BOUNDARY

PROJECT SITE

REACH 3

TRIBUTARY A

ROCKY MOUNTAIN ARSENAL

CITY OF THORNTON

80TH AVENUE

TRIBUTARY B

REACH 4

72ND AVENUE

IRONDALE GULCH

FORMER LOCATION OF UPPER DERBY POND

UNINCORPORATED ADAMS COUNTY

COMMERCE CITY

UPSTREAM STUDY LIMIT

CITY AND COUNTY OF DENVER

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I-76

SOUTH PLATTE RIVER

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PENA BOULEVARD

HAVANA STREET

PEORIA STREET

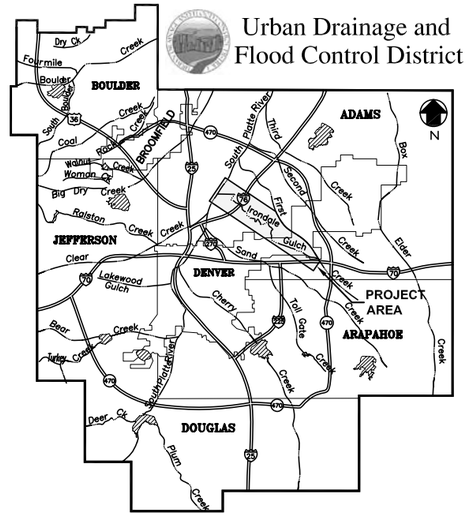
CHAMBERS ROAD

TOWER ROAD

LEGEND

- EXISTING DETENTION POND
- WATERSHED BOUNDARY
- FLOW PATH
- COUNTY BOUNDARIES
- COMMERCE CITY
- CITY OF AURORA
- CITY AND COUNTY OF DENVER
- UNINCORPORATED ADAMS COUNTY
- CITY OF THORTON

Urban Drainage and Flood Control District



2000 0 1000 2000 4000

SCALE: 1" = 4000'

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9	Parkfield Lake	210
10	Chambers II Pond	216
11	Gateway Park B	416
12	Gateway Park C	414
13	Highline Pond	218
14	Silverado I	211
15	Upland C	213
16	Upland B	641
17	Upland A	640
18		920
19	GVR-A-3	205
20	GVR-A-2	206
N/A		240*
N/A		265*
N/A		268*
N/A		271*
N/A		310*
N/A		425*
N/A	Majestic	910*
N/A		540*
N/A		570*

*These basins are located in the Gateway Park and Majestic Commercenter. Please refer to the Development Reports from the City of Aurora for exact locations.

NAME: Z:\UDFCD PLANNING\Irondale Gulch\CAD_Irondale Gulch\dwg\Fig 2-1 - Study Area Map.DWG
PLOT DATE: Aug 26, 2011 9:28am

TOPOGRAPHIC METHOD: LIDAR
TOPOGRAPHIC MAPPING BY:
TOPOGRAPHIC MAPPING QA/QC BY:
CONTOUR INTERVAL: 2 FOOT
DATE FLOWN: 2008

MOSER & associates ENGINEERING
720 S. COLORADO BLVD. SUITE 410 S
DENVER, CO 80246
PHONE: 303-757-3655
FAX: 303-300-1635

DESIGNED AGC DATE 10/10/10
DRAWN RWM DATE 11/15/10
CHECKED RCO DATE 1/20/11
REVISED DATE

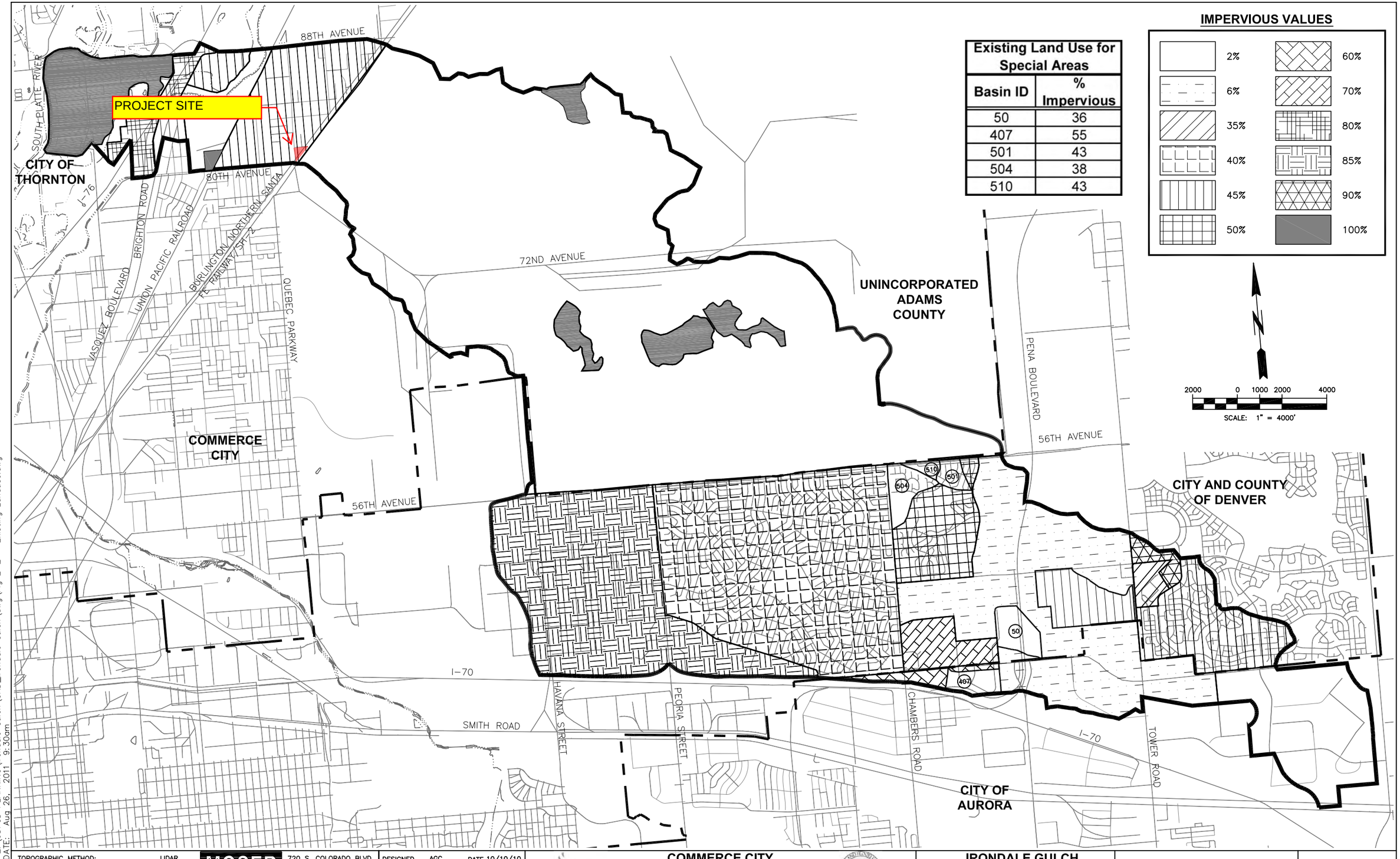
Commerce CITY

COMMERCE CITY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

IRONDALE GULCH OUTFALL SYSTEMS PLAN

STUDY AREA

FIGURE 2-1



Existing Land Use for Special Areas	
Basin ID	% Impervious
50	36
407	55
501	43
504	38
510	43

IMPERVIOUS VALUES

2%	60%
6%	70%
35%	80%
40%	85%
45%	90%
50%	100%

2000 0 1000 2000 4000

SCALE: 1" = 4000'

NAME: Z:\UDFCD PLANNING\Irondale Gulch\CAD_Irondale Gulch\dwg\Fig 2-2 - Existing Landuse.dwg
PLOT DATE: Aug 26, 2011 9:30am

TOPOGRAPHIC METHOD: LIDAR
TOPOGRAPHIC MAPPING BY:
TOPOGRAPHIC MAPPING QA/QC BY:
CONTOUR INTERVAL: 2 FOOT
DATE FLOWN: 2008

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720 S. COLORADO BLVD.
SUITE 410 S
DENVER, CO 80246
PHONE: 303-757-3655
FAX: 303-300-1635

DESIGNED AGC DATE 10/10/10
DRAWN RWM DATE 11/15/10
CHECKED RCO DATE 1/20/11
REVISED DATE

COMMERCE CITY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

IRONDALE GULCH OUTFALL SYSTEMS PLAN

EXISTING LAND USE

FIGURE 2-2

PROJECT SITE

CITY OF THORNTON

UNINCORPORATED ADAMS COUNTY

COMMERCE CITY

CITY AND COUNTY OF DENVER

CITY OF AURORA

88TH AVENUE
80TH AVENUE
72ND AVENUE
64TH AVENUE
56TH AVENUE
SMITH ROAD
I-70
I-76
SOUTH PLATTE RIVER
BRIGHTON ROAD
UNION PACIFIC RAILROAD
BURLINGTON NORTHERN SANTA FE RAILWAY
SH-2
VASQUEZ BOULEVARD
QUEBEC PARKWAY
HAVANA STREET
PEDRIA STREET
CHAMBERS ROAD
PENA BOULEVARD
TOWER ROAD

Future Land Use for Special Areas (per Bolye 2003 Study)	
Basin ID	% Impervious
50	36
60	75
62	48
64	44
163	49
263	92
363	87
401	10
406	80
500	63
501	43
502	48
503	58
504	38
505	66
507	66
510	43
603	85
606	84
660	73
661	70
662	67
703	43
706	70
806	23
906	10

Future Land Use for Gateway Park and the Majestic Commercenter Development	
Basin ID	% Impervious
101	85
102	85
103	85
104	85
105	85
106	85
107	85
108	85
109	85
110	85
111	85
112	85
113	85
114	85
115	85
116	85
117	85
118	85
119	85
120	85
121	85
122	85
123	85
124	99
125	85
126	99

IMPERVIOUS VALUES

2%	75%
40%	85%
45%	90%
50%	95%
55%	100%

2000 0 1000 2000 4000

SCALE: 1" = 4000'

* GATEWAY PARK AND MAJESTIC COMMERCENTER: PLEASE SEE TABLE ABOVE AND CITY OF AURORA PLANS FOR BASIN DELINEATIONS AND CHARACTERISTICS

NAME: Z:\UDFCD PLANNING\Irondale Gulch\CAD_Irondale Gulch\dwg\Fig 2-3 - Future Landuse.dwg
PLOT DATE: Aug 26, 2011 9:32am

TOPOGRAPHIC METHOD:	LIDAR
TOPOGRAPHIC MAPPING BY:	
TOPOGRAPHIC MAPPING QA/QC BY:	
CONTOUR INTERVAL:	2 FOOT
DATE FLOWN:	2008

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720 S. COLORADO BLVD.
SUITE 410 S
DENVER, CO 80246
PHONE: 303-757-3655
FAX: 303-300-1635

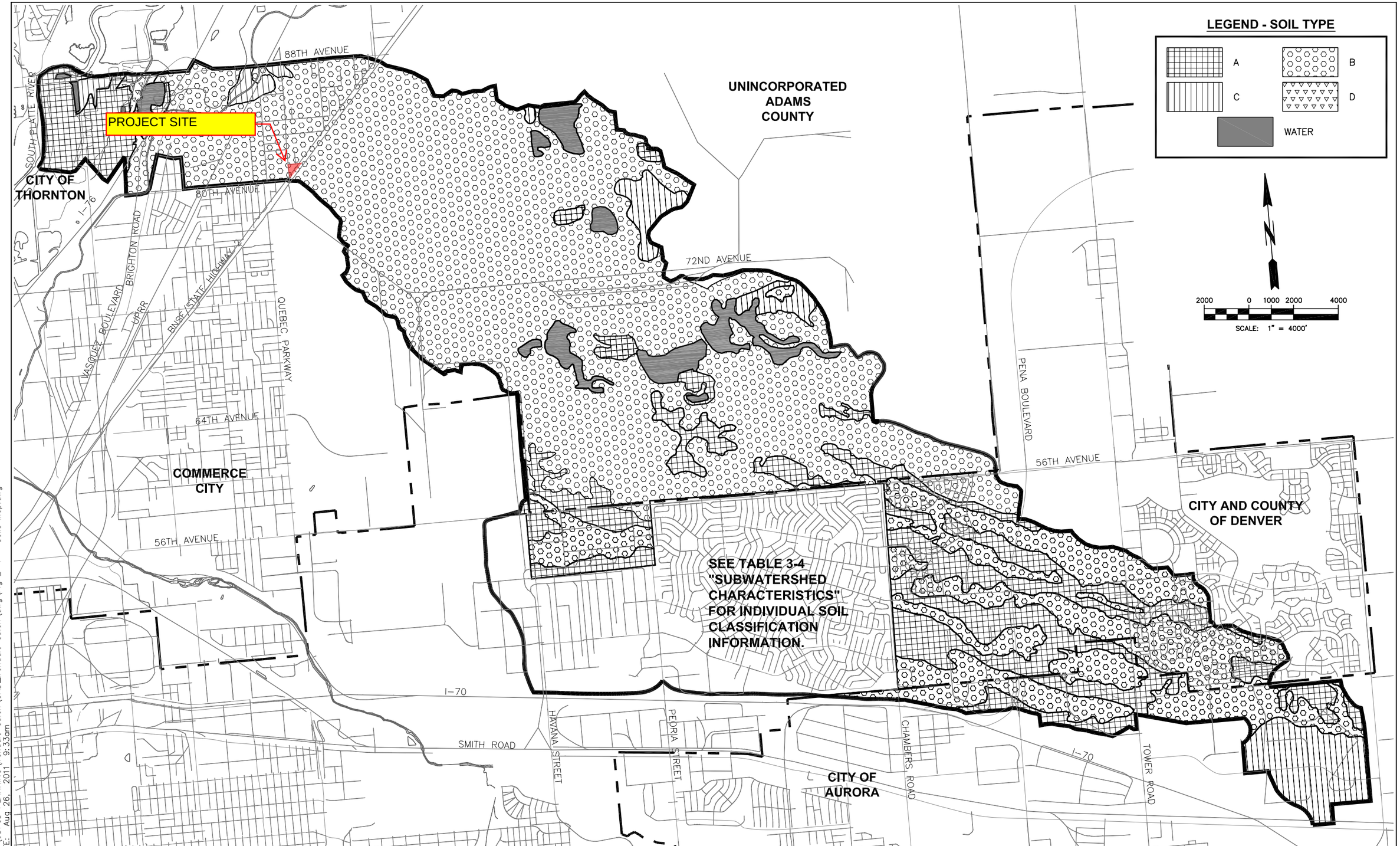
DESIGNED	AGC	DATE 10/10/10
DRAWN	RWM	DATE 11/15/10
CHECKED	RCO	DATE 1/20/11
REVISED		DATE

COMMERCE CITY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

IRONDALE GULCH OUTFALL SYSTEMS PLAN

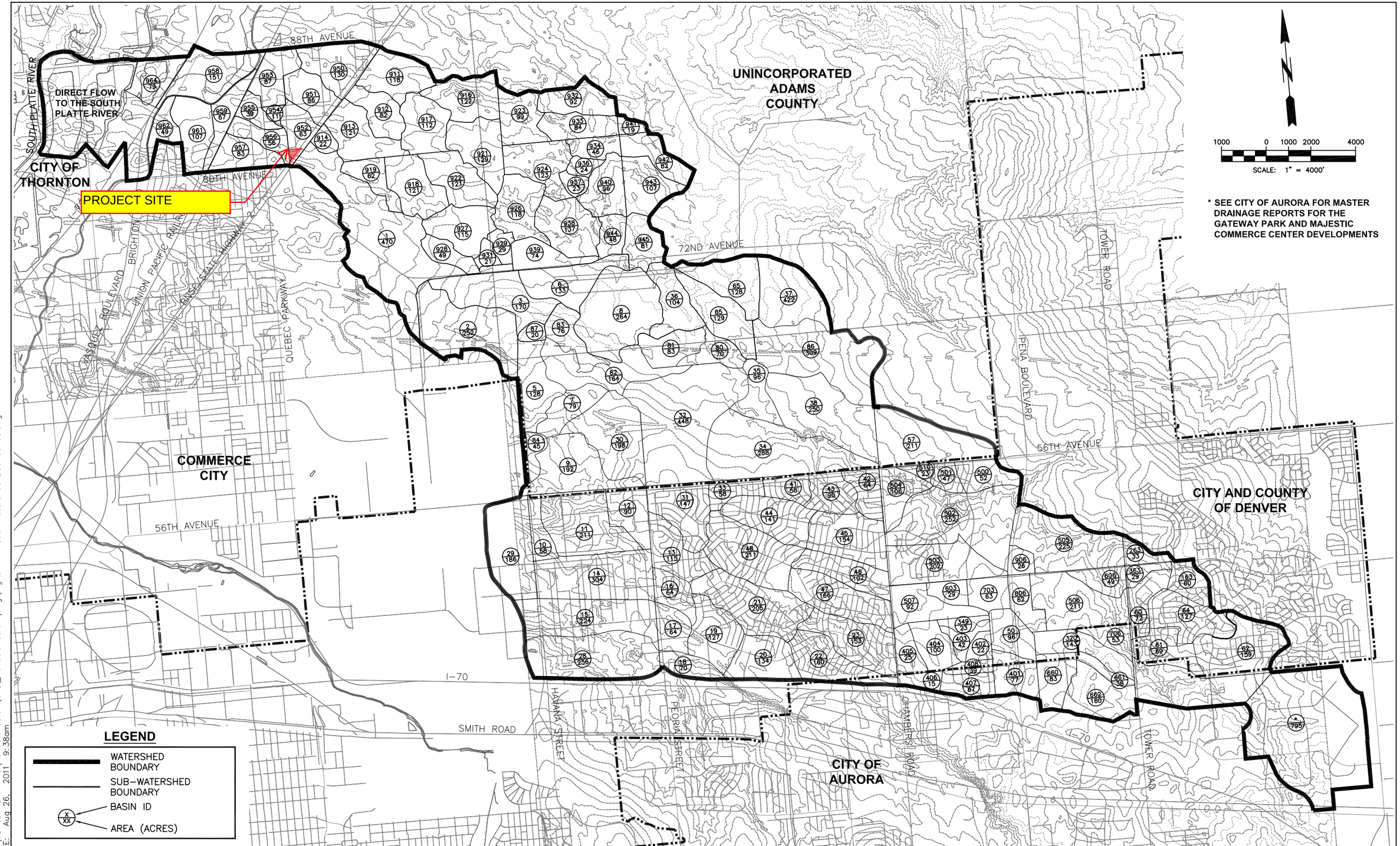
FUTURE LAND USE

FIGURE 2-3



NAME: Z:\UDFCD PLANNING\Irondale Gulch\CAD_Irondale Gulch\dwg\Fig 2-4 - Soils Map.dwg
PLOT DATE: Aug 26, 2011 9:33am

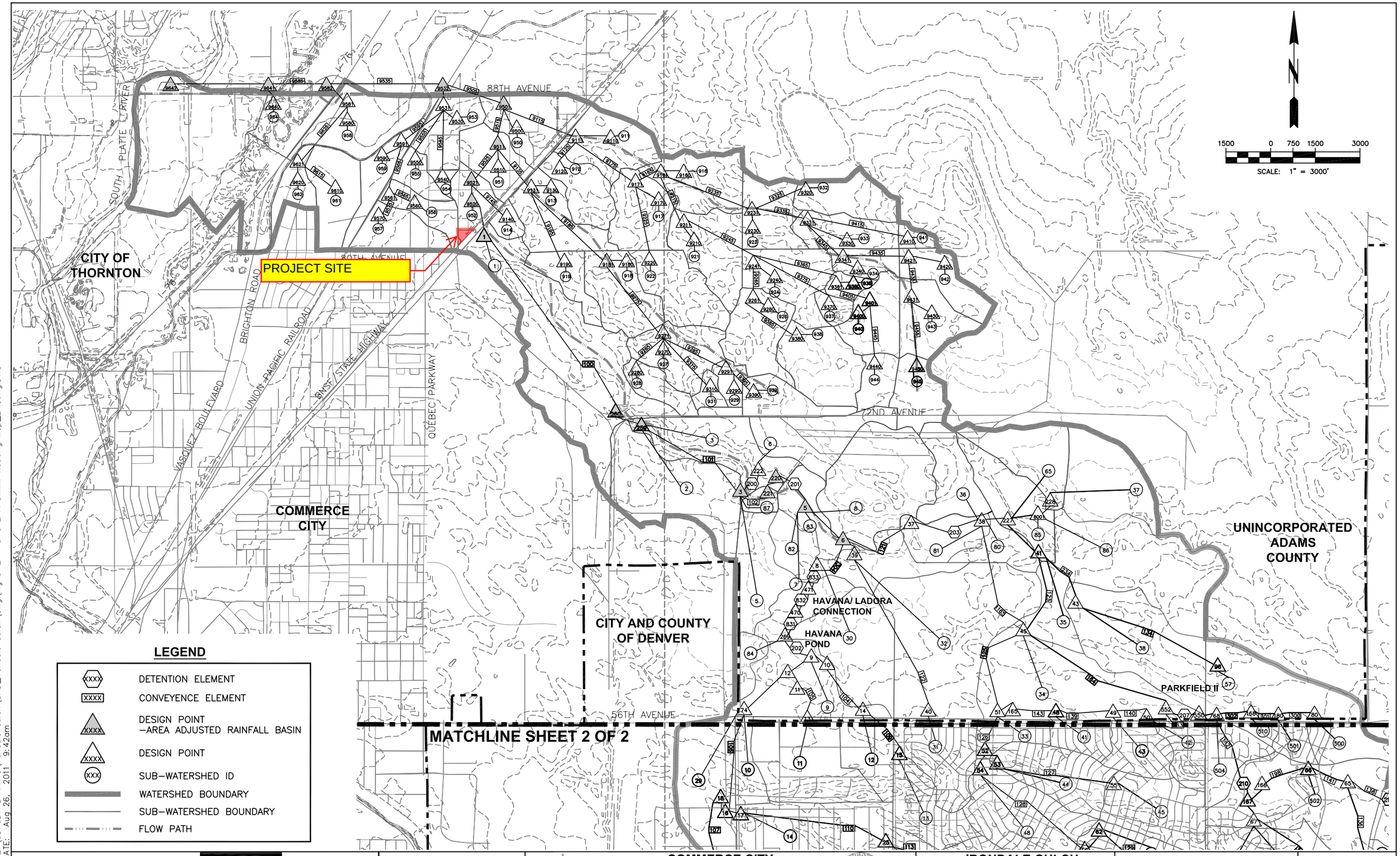
TOPOGRAPHIC METHOD: LIDAR TOPOGRAPHIC MAPPING BY: TOPOGRAPHIC MAPPING QA/QC BY: CONTOUR INTERVAL: 2 FOOT DATE FLOWN: 2008	MOSER & associates ENGINEERING	720 S. COLORADO BLVD. SUITE 410 S DENVER, CO 80246 PHONE: 303-757-3655 FAX: 303-300-1635	DESIGNED AGC DRAWN RWM CHECKED RCO REVISED	DATE 10/10/10 DATE 11/15/10 DATE 1/20/11 DATE	Commerce CITY	COMMERCE CITY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT	IRONDALE GULCH OUTFALL SYSTEMS PLAN	SOILS MAP	FIGURE 2-4



NAME: Z:\UDFCD PLANNING\Irondale Gulch\CAD_Irondale Gulch\dwg\Fig 3-1 - Sub-Watershed Boundaries.dwg
PLOT DATE: Aug 26, 2011 9:38am

TOPOGRAPHIC METHOD:		DESIGNED AGC	DATE 10/10/10	COMMERCE CITY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT	IRONDALE GULCH OUTFALL SYSTEMS PLAN
TOPOGRAPHIC MAPPING BY:	USGS	DRAWN RWM	DATE 11/15/10		SUBWATERSHED BOUNDARIES
TOPOGRAPHIC MAPPING QA/QC BY:		CHECKED RCO	DATE 1/20/11		FIGURE 3-1
CONTOUR INTERVAL:		REVISED	DATE		
DATE FLOWN:					

MOSER & associates ENGINEERING
720 S. COLORADO BLVD.
SUITE 410 S
DENVER, CO 80246
PHONE: 303-757-3655
FAX: 303-300-1635



LEGEND

- XXXX — DETENTION ELEMENT
- XXXX — CONVEYENCE ELEMENT
- XXXX — DESIGN POINT –AREA ADJUSTED RAINFALL BASIN
- XXXX — DESIGN POINT
- XXX — SUB–WATERSHED ID
- WATERSHED BOUNDARY
- SUB–WATERSHED BOUNDARY
- FLOW PATH

TOPOGRAPHIC METHOD:	
TOPOGRAPHIC MAPPING BY:	USGS
TOPOGRAPHIC MAPPING QA/QC BY:	
CONTOUR INTERVAL:	
DATE FLOWN:	

MOSER & associates ENGINEERING
720 S. COLORADO BLVD.
SUITE 410 S
DENVER, CO 80246
PHONE: 303–757–3655
FAX: 303–300–1635

DESIGNED	AGC	DATE	10/10/10
DRAWN	RWM	DATE	11/15/10
CHECKED	RCO	DATE	1/20/11
REVISED		DATE	

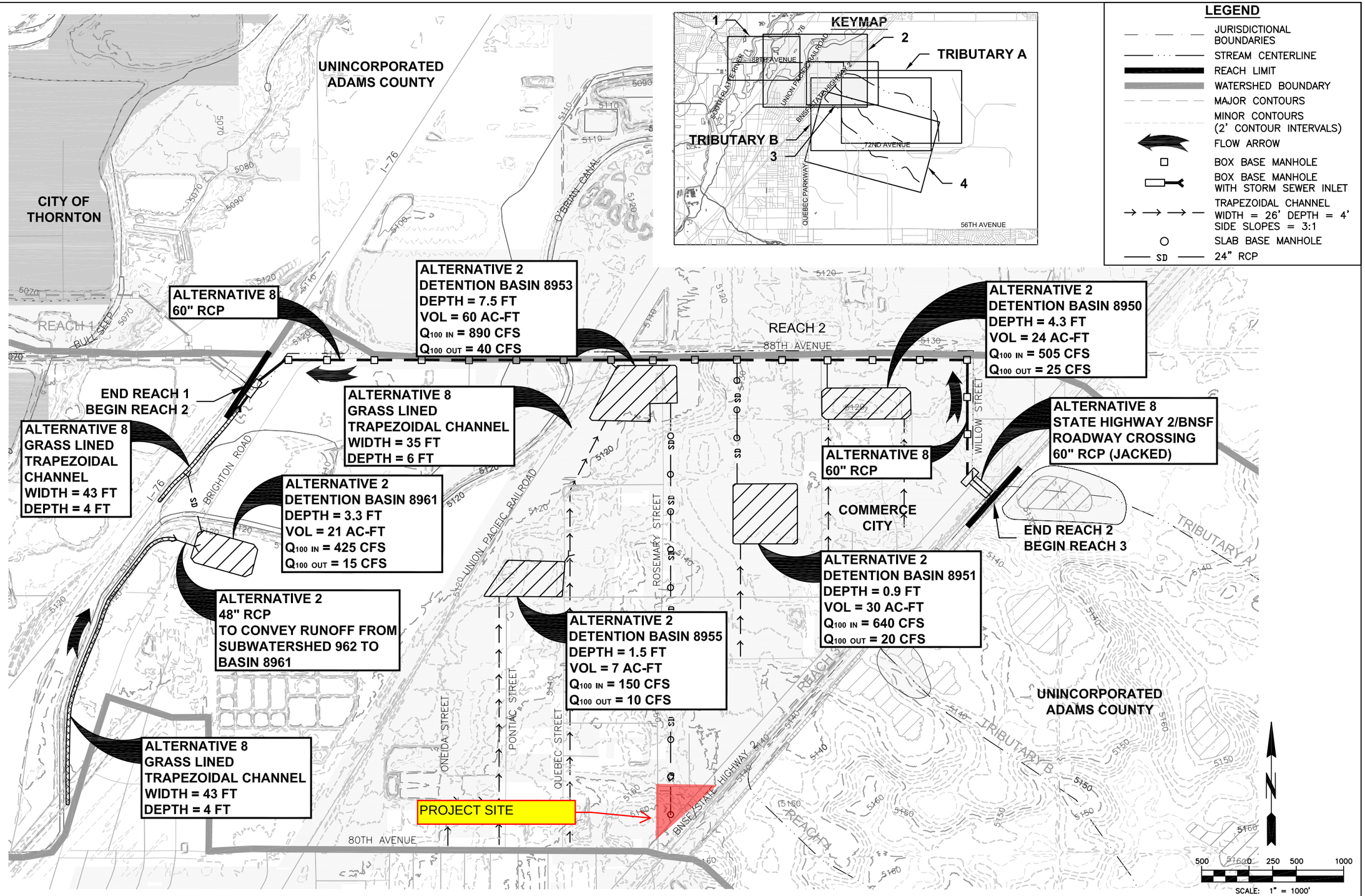
COMMERCE CITY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

IRONDALE GULCH OUTFALL SYSTEMS PLAN

BASELINE HYDROLOGY EPA SWMM ROUTING MAP

FIGURE 3-2

NAME: Z:\UDFCD PLANNING\Irondale Gulch\CAD_Irondale Gulch\dwg\Fig 3-2 – 3-3 EPA SWMM Routing Map_Existing.DWG
PLOT DATE: Aug 26, 2011 9:42am



NAME: Z:\UDFCD PLANNING\Irondale Gulch\CAD_Irondale Gulch\dwg\2- Alt Report\Fig 5.5-2 - Reach 2.dwg
PLOT DATE: Aug 26, 2011 10:00am

TOPOGRAPHIC METHOD:	LIDAR
TOPOGRAPHIC MAPPING BY:	
TOPOGRAPHIC MAPPING QA/QC BY:	
CONTOUR INTERVAL:	2 FOOT
DATE FLOWN:	2008

MOSER & associates ENGINEERING
720 S. COLORADO BLVD.
SUITE 410 S
DENVER, CO 80246
PHONE: 303-757-3655
FAX: 303-300-1635

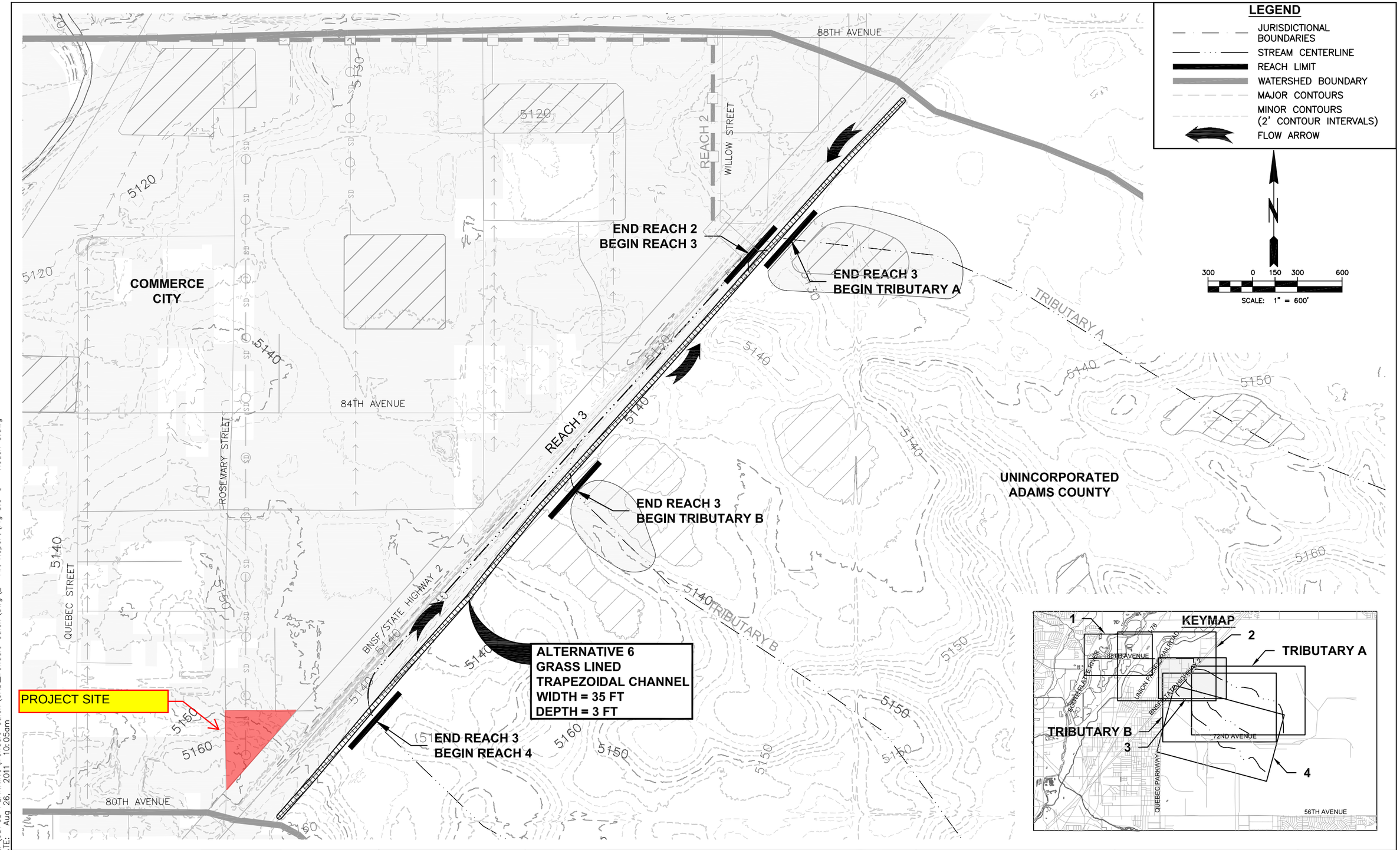
DESIGNED	AGC	DATE 10/10/10
DRAWN	RWM	DATE 11/15/10
CHECKED	RCO	DATE 1/20/11
REVISED		DATE

COMMERCE CITY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

IRONDALE GULCH OUTFALL SYSTEMS PLAN

REACH 2 ALTERNATIVES EVALUATED

FIGURE 5.5-2



NAME: Z:\UDFCD PLANNING\Irondale Gulch\CAD_Irondale Gulch\dwg\2- Alt Report\Fig 5.5-3 - Reach 3.dwg
PLOT DATE: Aug 26, 2011 10:05am

TOPOGRAPHIC METHOD:	LIDAR
TOPOGRAPHIC MAPPING BY:	
TOPOGRAPHIC MAPPING QA/QC BY:	
CONTOUR INTERVAL:	2 FOOT
DATE FLOWN:	2008

MOSER & associates ENGINEERING
720 S. COLORADO BLVD.
SUITE 410 S
DENVER, CO 80246
PHONE: 303-757-3655
FAX: 303-300-1635

DESIGNED	AGC	DATE	10/10/10
DRAWN	RWM	DATE	11/15/10
CHECKED	RCO	DATE	1/20/11
REVISED		DATE	

Commerce CITY

COMMERCE CITY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

IRONDALE GULCH OUTFALL SYSTEMS PLAN

REACH 3 ALTERNATIVES EVALUATED

FIGURE 5.5-3

8.3.2 Irondale Gulch Reach 2: I-76 at 88th Avenue to State Highway 2 at 88th Avenue

Regional Detention and Channels/Conduits Combined

Reach 2 of Irondale Gulch is between stations 50+59 to 144+95 and is within Commerce City and Unincorporated Adams County. The downstream reach limit is located at I-76 and the upstream limit is located at SH 2 and the BNSF Railroad.

Existing Conditions

Reach 2 of Irondale Gulch consists of a mix of residential, commercial, industrial, and areas of open space. The existing land use primarily consists of 2% and 45% impervious areas. There is an existing storm sewer system along 88th Avenue that collects and conveys runoff to an existing retention basin at the northeast corner of 88th Avenue and the UPRR. The retention basin has the capacity to retain 15.3 acre-feet of runoff. There are no defined channels along the minor roadways south of 88th Avenue and flooding has been experienced in the past.

Proposed Conditions

The future development of Reach 2 calls for a large increase in imperviousness and assumes the basin will primarily be 90% impervious. Regional detention and channels/conduits are the proposed improvements to be implemented within this reach. A summary of the proposed improvements are listed below and expanded on further throughout the section:

- 60-inch RCP jacked under SH 2/BNSF
- 60-inch RCP along Willow Street, 88th Avenue, Brighton Road and I-76 ROW to tie to Reach 1
- Six (6) Detention Basins
- Engineered channels and conduits along minor roadways to convey runoff to the detention basins

A 60-inch RCP will be jacked under SH 2/BNSF and convey all the runoff from the RMA from Reach 3, Reach 4, Tributary A and Tributary B. The 60-inch RCP is designed to convey the 100-year Conceptual Design peak flow of 91 cfs.

The 60-inch RCP then continues north on Willow Street, west along 88th Avenue and Brighton Road, then south to tie into the box base manhole at the confluence with Reach 1. There were numerous existing utilities within 88th Avenue, including sanitary sewer, water, and gas lines which are shown on the plan and profiles. The sanitary sewers and large utilities were missed however there are a number of small gas lines and water service lines that will need to be relocated. Avoiding the important existing utilities raised the profile of the storm sewer which will require the roadway to be raised in several locations including along Willow Street, 88th Avenue between Willow Street and Verbena Street, 88th Avenue between Rosemary Street and UPRR, and 88th Avenue between the O'Brain Canal and Wikiup Drive. These utility locations and depths are approximate and need to be verified during final design. Box based manholes are spaced at a maximum of every 500 feet.

The storm sewer will go under the O'Brian Canal, in a 48"x76" HERCP which is the equivalent to the 60-inch RCP. The 60-inch RCP is designed to convey the 100-year Conceptual Design peak flow which ranges between 91 to 115 cfs.

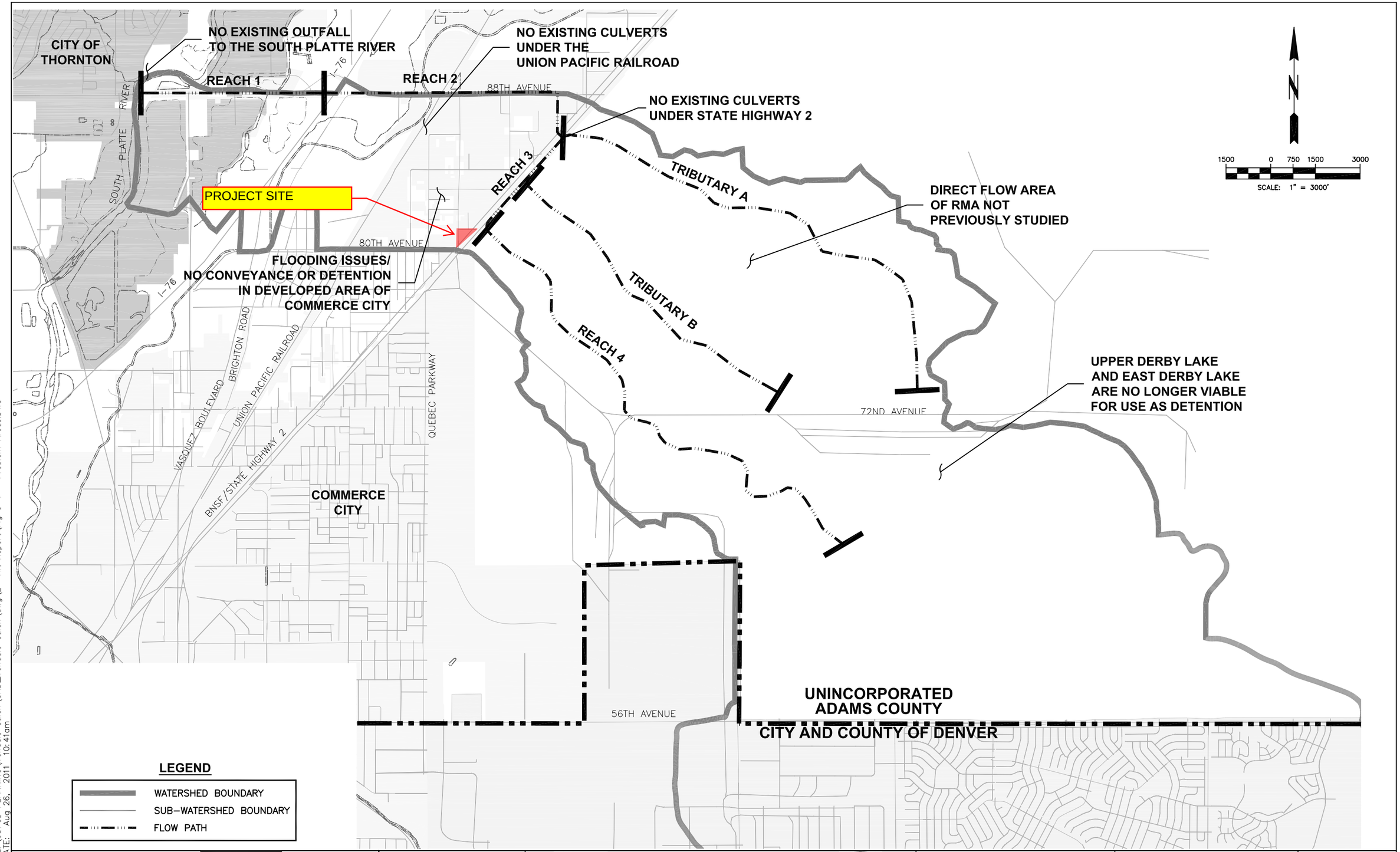
There are four (4) locations where outflow from upstream detention basins will enter the 60-inch RCP under 88th Avenue: Verbena Street (Detention Basin 8950), Ulster Street (Detention Basin 8951), Rosemary Street (Detention Basin 8953), and by the UPRR (Detention Basin 8955). The four (4) proposed detention basins detain a majority of the tributary area between 88th Avenue and 80th Avenue and the UPRR and SH2/BNSF with the exception of the area west of Pontiac Street (flows to Brighton Road) and northeast of 87th and Tamarac Street (which will continue to flow to the existing retention basin at 88th Avenue and UPRR). These four (4) detention basins and their tributary areas are described in further detail below.

Detention Basin 8950

Detention Basin 8950 has a 100-year storage volume of 11.4 acre-feet and a release rate of 6.6 cfs. It detains runoff between 87th Avenue, Ulster Street and SH2. There are open channels along Valentia Street and 86th to convey runoff into the detention basin. The detention basin discharges are conveyed in a 24-inch RCP along 87th Avenue to Ulster Street where it confluences with the 30-inch RCP outfall from Detention Basin 8951 and flows to the 60-inch RCP within 88th Avenue.

Detention Basin 8951

Detention Basin 8951 has a 100-year storage volume of 27.5 acre-feet and a release rate of 8.3 cfs. It detains runoff between 86th Avenue, Rosemary Street and SH2. Runoff naturally sheet flows to the detention basin and there is an open channel around the perimeter of the basin to collect runoff and discharge into the pond at the drop structure and forebay location. The detention basin discharges are conveyed in a 30-inch RCP along Ulster Street to the 60-inch RCP within 88th Avenue.



NAME: Z:\UDFCD PLANNING\Irondale Gulch\CAD_Irondale Gulch\dwg\2- Alt Report\Fig C-1 - Problem Areas.DWG
PLOT DATE: Aug 26, 2011 10:41am

TOPOGRAPHIC METHOD: LIDAR TOPOGRAPHIC MAPPING BY: TOPOGRAPHIC MAPPING QA/QC BY: CONTOUR INTERVAL: 2 FOOT DATE FLOWN: 2008	MOSER & associates ENGINEERING	720 S. COLORADO BLVD. SUITE 410 S DENVER, CO 80246 PHONE: 303-757-3655 FAX: 303-300-1635	DESIGNED AGC DATE 10/10/10 DRAWN RWM DATE 11/15/10 CHECKED RCO DATE 1/20/11 REVISED DATE	COMMERCE CITY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT	IRONDALE GULCH OUTFALL SYSTEMS PLAN	IDENTIFIED PROBLEM AREAS	FIGURE C-1

CITY OF THORNTON

SUB-WATERSHED NOT INCLUDED IN MODEL. DRAINS TO EXISTING 88TH AVENUE STORM SEWER.

9642 9645 9641 9585 9582 9535 9532 9505 9501 9115 9111

REACH 2

88TH AVENUE

BULL SEEP

O'BRIAN CANAL

9625 9581 958

END REACH 1
BEGIN REACH 2

I-76 BRIGHTON ROAD

9621 8961 9575

UNION PACIFIC RAILROAD

8953 9531 953

ROSEMARY STREET

9515 8951 9510 951

8950 9500 950

WILLOW STREET

END REACH 2
BEGIN REACH 3

TRIBUTARY A

9620 962 9610 961 9590 959 8957 9570 957

8955 9550 955

PONTIAC STREET

QUEBEC STREET

ONEIDA STREET

80TH AVENUE

COMMERCE CITY

UNINCORPORATED ADAMS COUNTY

TRIBUTARY B

REACH 4

BNSF / STATE HIGHWAY 2

PROJECT SITE

N

1000 0 500 1000 2000

SCALE: 1" = 1000'

LEGEND

- DETENTION ELEMENT (XXXX)
- CONVEYENCE ELEMENT (XXXX)
- DESIGN POINT –AREA ADJUSTED RAINFALL BASIN
- DESIGN POINT (XXXX)
- SUB–WATERSHED ID (XXX)
- SUB–WATERSHED BOUNDARY
- DETENTION BASIN
- CONDUIT
- TRAPEZOIDAL CHANNEL
- SUB–WATERSHED NOT INCLUDED IN MODEL

NAME: Z:\UDFCD PLANNING\Irondale Gulch\CAD_Irondale Gulch\dwg\Fig E-1 - Conceptual Design Reach 2 Revised Basin Delineations and Routing.dwg
PLOT DATE: Sep 07, 2011 5:45pm

TOPOGRAPHIC METHOD:	LIDAR
TOPOGRAPHIC MAPPING BY:	
TOPOGRAPHIC MAPPING QA/QC BY:	
CONTOUR INTERVAL:	2 FOOT
DATE FLOWN:	2008

MOSER & associates ENGINEERING
720 S. COLORADO BLVD.
SUITE 410 S
DENVER, CO 80246
PHONE: 303-757-3655
FAX: 303-300-1635

DESIGNED	AGC	DATE 10/10/10
DRAWN	RWM	DATE 11/15/10
CHECKED	RCO	DATE 1/20/11
REVISED		DATE

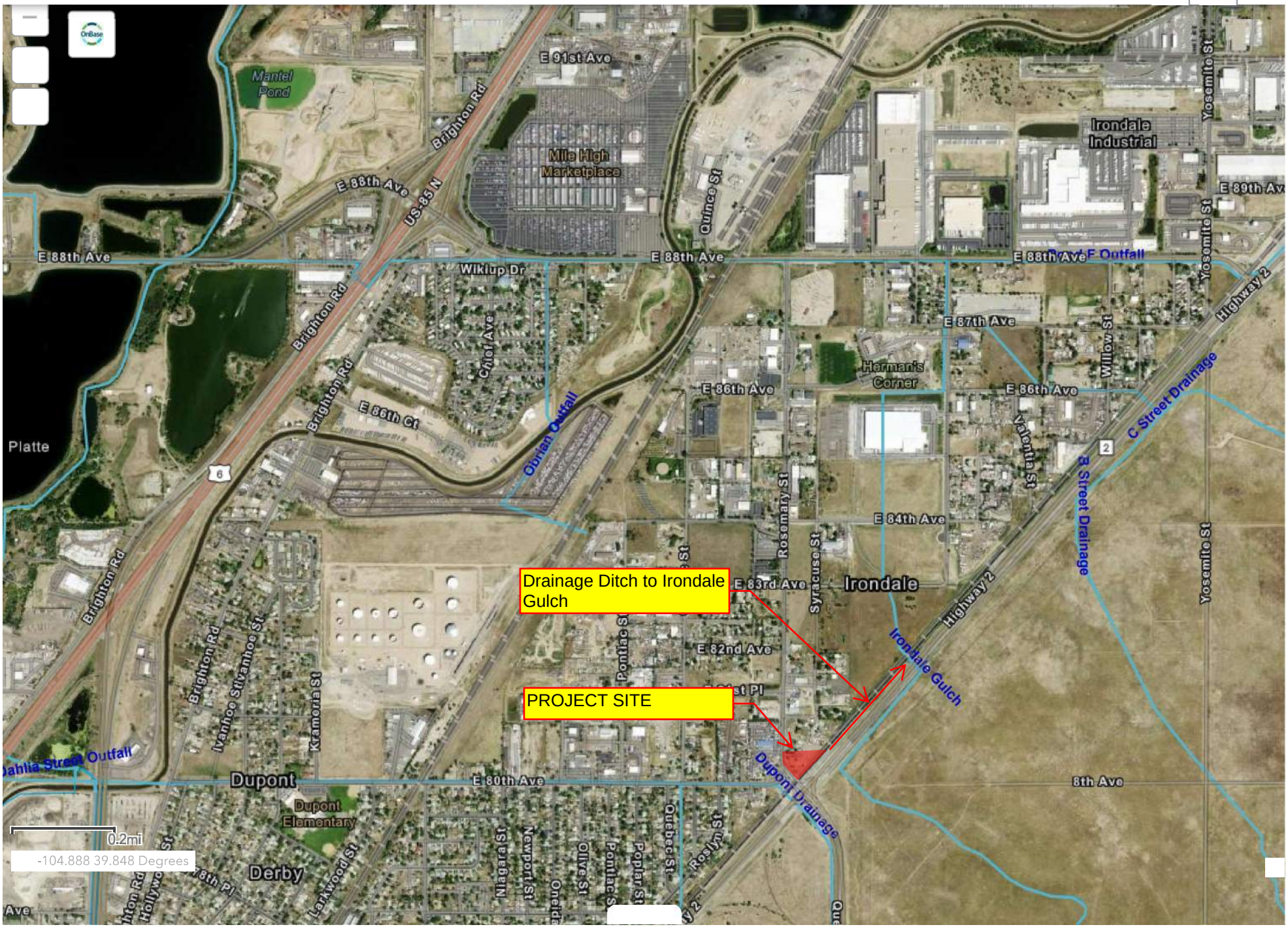
COMMERCE CITY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

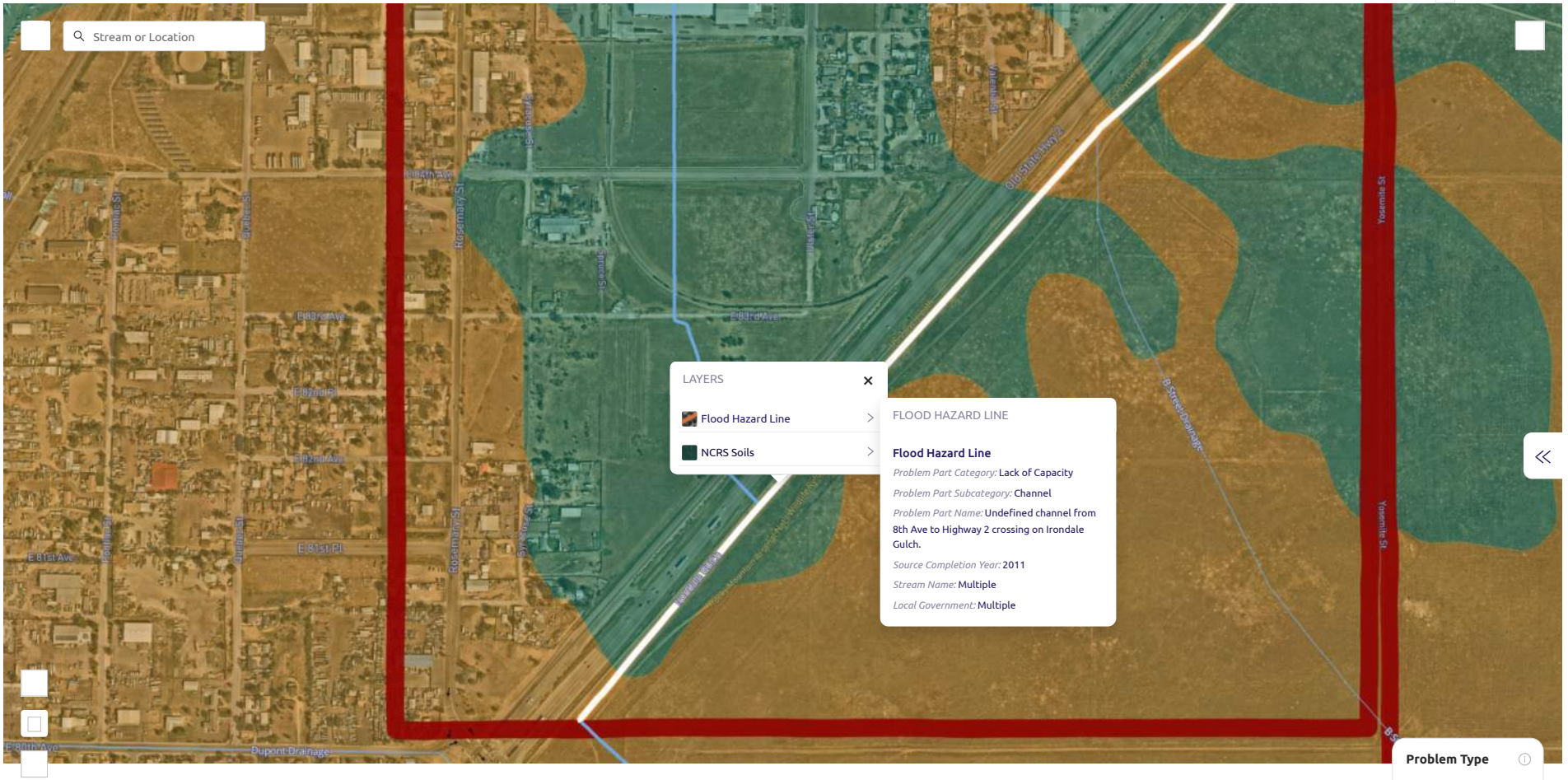
IRONDALE GULCH OUTFALL SYSTEMS PLAN

CONCEPTUAL DESIGN REACH 2 REVISED BASIN DELINEATIONS AND ROUTING

FIGURE E-1

MHFD **Map Search** Documents by Stream Map Gallery




Stream or Location
LAYERS
Flood Hazard Line
NCRS Soils
FLOOD HAZARD LINE
Flood Hazard Line
Problem Part Category: Lack of Capacity
Problem Part Subcategory: Channel
Problem Part Name: Undefined channel from 8th Ave to Highway 2 crossing on Irondale Gulch.
Source Completion Year: 2011
Stream Name: Multiple
Local Government: Multiple
Problem Type
Flood Hazard
Watershed Change
Stream Function
Rosemary St
Yosemite St
Old State Hwy 2
E 81st Ave
E 81st Pl
E 82nd Ave
E 83rd Ave
Dupont Drainage
300'
Nearmap: September 4, 2022 Zoom Level: 15.62
© Mapbox © OpenStreetMap © Maxar

APPENDIX B

Hydrologic Computations

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: QuikTrip 4201
Location: CO, Commerce City

Project Name: QuikTrip 4201
Project No.: QKT004201
Calculated By: DLR
Checked By: DLR
Date: 6/14/23

Basin ID	Total Area (ac)	Paved Roads			Lawns			Roofs			Gravel			2-YEAR COEFF.	5-YEAR COEFF.	10-YEAR COEFF.	100-YEAR COEFF.	Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.					
EX 1	2.40	100	0.04	1.5	0	1.75	0.0	90	0.06	2.20	40.00	0.55	9.20	0.04	0.07	0.04	0.25	12.9
Total Existing	2.40	100	0.04	1.5	0	1.75	0.0	90	0.06	2.20	40.00	0.55	9.20	0.04	0.07	0.04	0.25	12.9
DA-A1	0.13	100	0.00	0.0	0	0.00	0.0	90	0.13	90.00	40.00	0.00	0.00	0.73	0.75	0.77	0.84	90.0
DA-A2	0.17	100	0.00	0.0	0	0.00	0.0	90	0.17	90.00	40.00	0.00	0.00	0.73	0.75	0.77	0.84	90.0
DA-A3	0.39	100	0.34	86.6	0	0.05	0.0	90	0.00	0.00	40.00	0.00	0.00	0.73	0.75	0.75	0.80	86.6
DA-A4	0.84	100	0.71	84.7	0	0.13	0.0	90	0.00	0.00	40.00	0.00	0.00	0.71	0.74	0.74	0.78	84.7
DA-A5	0.19	100	0.00	0.0	0	0.19	0.0	90	0.00	0.00	40.00	0.00	0.00	0.01	0.05	0.01	0.13	0.0
Total to Pond	1.71	100	1.04	61.0	0	0.37	0.0	90	0.30	15.50	40.00	0.00	0.00	0.64	0.67	0.67	0.72	76.5
DA-A6	0.69	100	0.01	0.8	0	0.69	0.0	90	0.00	0.00	40.00	0.00	0.00	0.02	0.06	0.02	0.14	0.8
Total Not to Pond	0.69	100	0.01	0.8	0	0.69	0.0	90	0.00	0.00	40.00	0.00	0.00	0.02	0.06	0.02	0.14	0.8
Overall Total	2.40	100	1.05	43.7	0	1.06	0.0	90	0.30	11.10	40.00	0.00	0.00	0.46	0.49	0.48	0.55	54.8

*PERCENT IMPERVIOUS VALUES	
LANDSCAPE	2
PAVING	100
ROOFING	90
GRAVEL	40

* RUNOFF COEFFICIENTS USED (Group A Soils)				
	2-Year	5-Year	10-year	100-Year
LANDSCAPE	0.01	0.05	0.01	0.13
PAVING	0.84	0.86	0.87	0.90
ROOFING	0.73	0.75	0.77	0.84
GRAVEL	0.25	0.27	0.28	0.51

* Table 6-5, Chapter 6, USDCM Vol. I

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: QuikTrip 4201
Location: CO, Commerce City

Project Name: QuikTrip 4201
Project No.: QKT004201
Calculated By: DLR
Checked By: DLR
Date: 6/14/23

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					Tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	Hydrologic Soils Group	Impervious (%)	C_{100}	C_5	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	Cv	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH (FT)	Urbanized T_c (MIN)	T_c (MIN)
EX 1	2.40	A	12.9	0.25	0.07	56	1.0	14.1	395	3.0	10.0	1.7	3.8	17.9	451.0	12.5	12.5
DA-A1	0.13	A	90.0	0.84	0.75	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	5.0
DA-A2	0.17	A	90.0	0.84	0.75	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	5.0
DA-A3	0.39	A	86.6	0.80	0.75	81	1.4	5.1	305	1.1	20.0	2.1	2.4	7.6	386.0	12.1	7.6
DA-A4	0.84	A	84.7	0.78	0.74	22	1.2	3.0	282	1.4	20.0	2.4	2.0	4.9	304.0	11.7	5.0
DA-A5	0.19	A	0.0	0.13	0.05	0	0.0	0.0	0	0.0	20.0	0.0	0.0	0.0	0.0	10.0	5.0
DA-A6	0.69	A	0.8	0.14	0.06	30	2.8	7.4	91	8.1	7.0	2.0	0.8	8.2	121.0	10.7	8.2

NOTES:

T_i = (0.395*(1.1 - C_5)*(L)^0.5)/((S)^0.33), S in ft/ft

T_t=L/60V (Velocity From Fig. 501)

Velocity V=Cv*S^0.5, S in ft/ft

Tc Check = 10+L/180

For Urbanized basins a minimum T_c of 5.0 minutes is required.

For non-urbanized basins a minimum T_c of 10.0 minutes is required

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: QuikTrip 4201
Location: CO, Commerce City
Design Storm: 5-Year

Project Name: QuikTrip 4201
Project No.: QKT004201
Calculated By: DLR
Checked By: DLR
Date: 6/14/23

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
	1	EX 1	2.40	0.07	12.5	0.16	3.43	0.5													Drains Off-Site towards RailRoad
		Total Existing							12.5	0.16	3.43	0.5									
	1	DA-A1	0.13	0.75	5.0	0.10	4.79	0.5													Drains towards curb inlet
	1	DA-A2	0.17	0.75	5.0	0.13	4.79	0.6													Drains towards curb inlet
	1	DA-A3	0.39	0.75	7.6	0.29	4.21	1.2													Drains towards curb inlet
	1	DA-A4	0.84	0.74	5.0	0.62	4.79	3.0													Drains towards curb inlet
	1	DA-A5	0.19	0.05	5.0	0.01	4.79	0.0													Pond
	1	DA-A6	0.69	0.06	8.2	0.04	4.09	0.2													Drains Off-Site towards RailRoad

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: QuikTrip 4201
Location: CO, Commerce City
Design Storm: 100-Year

Project Name: QuikTrip 4201
Project No.: QKT004201
Calculated By: DLR
Checked By: DLR
Date: 6/14/23

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
	1	EX 1	2.40	0.25	12.5	0.59	6.45	3.8													Drains Off-Site towards RailRoad
	Total Existing								12.5	0.59	6.45	3.8									
	1	DA-A1	0.13	0.84	5.0	0.11	9.02	1.0													Drains towards curb inlet
	1	DA-A2	0.17	0.84	5.0	0.14	9.02	1.3													Drains towards curb inlet
	1	DA-A3	0.39	0.80	7.6	0.31	7.92	2.5													Drains towards curb inlet
	1	DA-A4	0.84	0.78	5.0	0.65	9.02	5.9													Drains into roof drains
	1	DA-A5	0.19	0.13	5.0	0.02	9.02	0.2													Drains into roof drains
	1	DA-A6	0.69	0.14	8.2	0.09	7.70	0.7													Drains Off-Site towards RailRoad

APPENDIX C

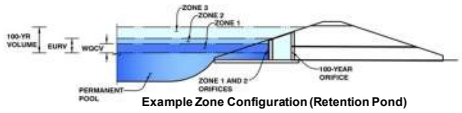
Hydraulic Computations

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: QuikTrip Store #4201

Basin ID: Detention Pond



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	1.71	acres
Watershed Length =	387	ft
Watershed Length to Centroid =	202	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	76.50%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Commerce City - Civic Center	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.044	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.170	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 0.84 in.) =	0.079	acre-feet	inches
5-yr Runoff Volume (P1 = 1.12 in.) =	0.108	acre-feet	inches
10-yr Runoff Volume (P1 = 1.37 in.) =	0.135	acre-feet	inches
25-yr Runoff Volume (P1 = 1.75 in.) =	0.180	acre-feet	inches
50-yr Runoff Volume (P1 = 2.08 in.) =	0.222	acre-feet	inches
100-yr Runoff Volume (P1 = 2.43 in.) =	0.270	acre-feet	inches
500-yr Runoff Volume (P1 = 3.35 in.) =	0.396	acre-feet	inches
Approximate 2-yr Detention Volume =	0.079	acre-feet	
Approximate 5-yr Detention Volume =	0.108	acre-feet	
Approximate 10-yr Detention Volume =	0.136	acre-feet	
Approximate 25-yr Detention Volume =	0.181	acre-feet	
Approximate 50-yr Detention Volume =	0.209	acre-feet	
Approximate 100-yr Detention Volume =	0.236	acre-feet	

Define Zones and Basin Geometry

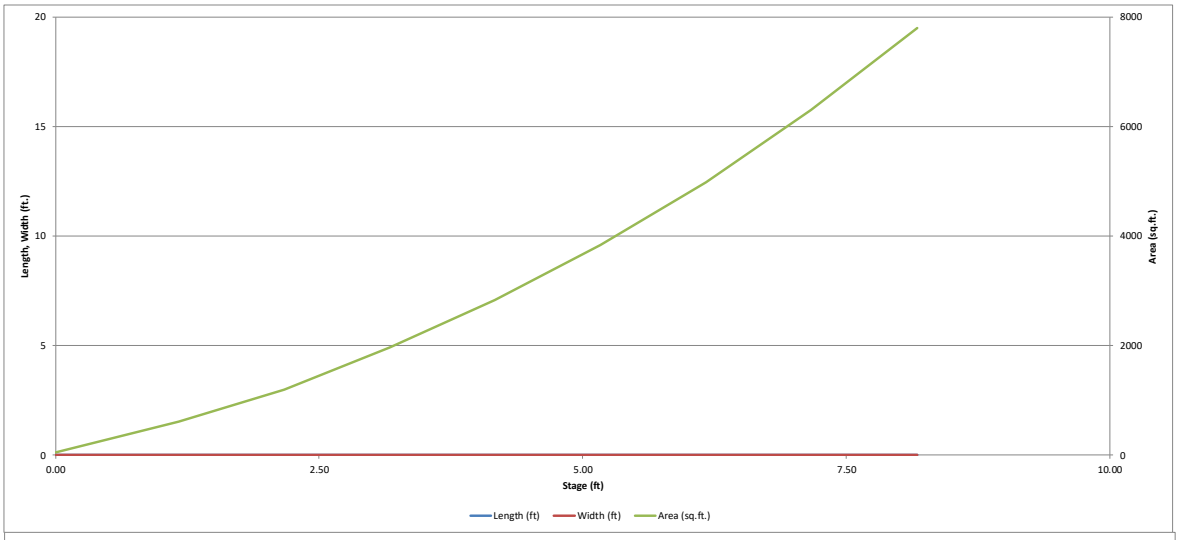
Select Zone 1 Storage Volume (Required) =		acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =		acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

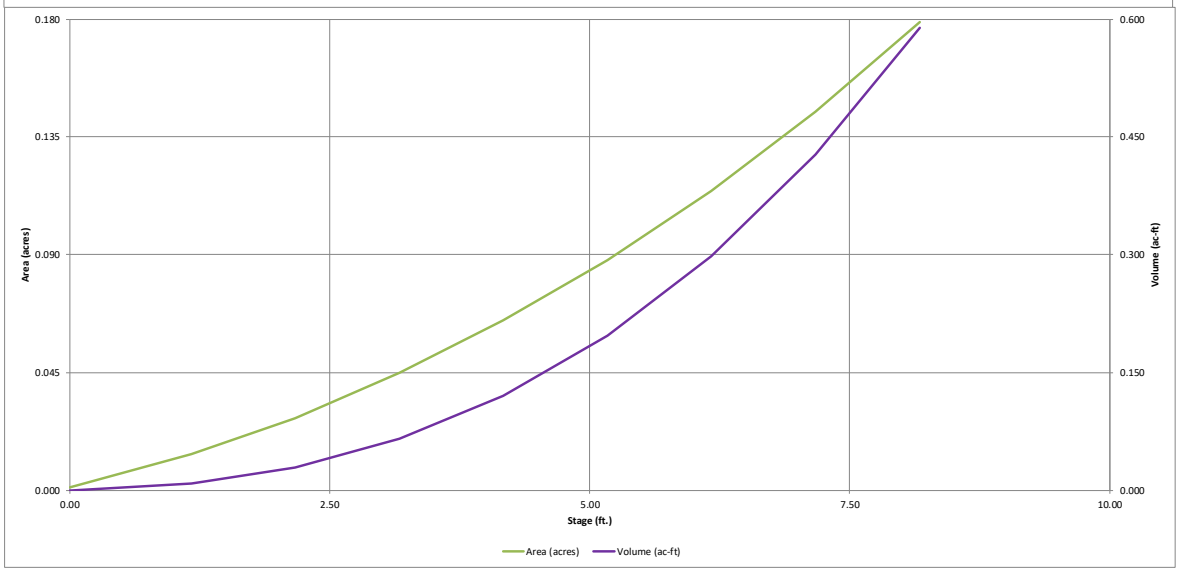
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
5151.5	--	1.17	--	--	--	603	0.014	382	0.009
5152.5	--	2.17	--	--	--	1,194	0.027	1,280	0.029
5153.5	--	3.17	--	--	--	1,958	0.045	2,856	0.066
5154.5	--	4.17	--	--	--	2,825	0.065	5,248	0.120
5155.5	--	5.17	--	--	--	3,829	0.088	8,575	0.197
5156.5	--	6.17	--	--	--	4,983	0.114	12,981	0.298
5157.5	--	7.17	--	--	--	6,304	0.145	18,624	0.428
5158.5	--	8.17	--	--	--	7,799	0.179	25,676	0.589

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)





Weir Report

QT4201 - Emergency Spillway 100 Year Clogged

Trapezoidal Weir

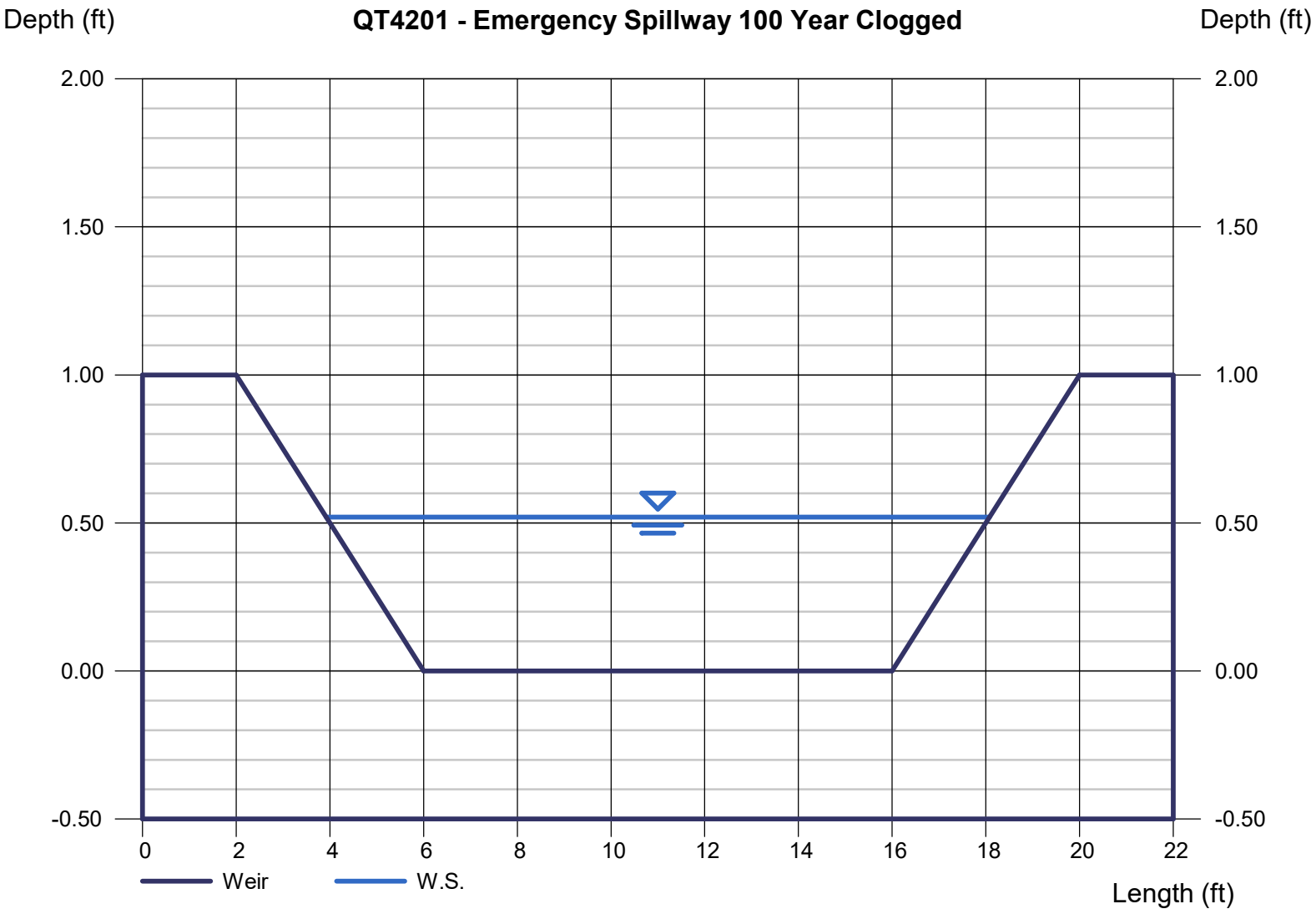
Crest	= Sharp
Bottom Length (ft)	= 10.00
Total Depth (ft)	= 1.00
Side Slope (z:1)	= 4.00

Calculations

Weir Coeff. Cw	= 3.10
Compute by:	Known Q
Known Q (cfs)	= 13.45

Highlighted

Depth (ft)	= 0.52
Q (cfs)	= 13.45
Area (sqft)	= 6.28
Velocity (ft/s)	= 2.14
Top Width (ft)	= 14.16



APPENDIX D

Drainage Maps

PROJECT NO.:QKT004201

Galloway
5500 Greenwood Plaza Boulevard, Suite 200
Greenwood Village, CO 80111
303.770.8884
GallowayUS.com

QuikTrip No. 4201

8040 ROSEMARY STREET
COMMERCE CITY, CO

PROTOTYPE: P-112 (11/01/22)
DIVISION: 83
VERSION: 001
DESIGNED BY: HCP
DRAWN BY: MSJ
REVIEWED BY: ACJ

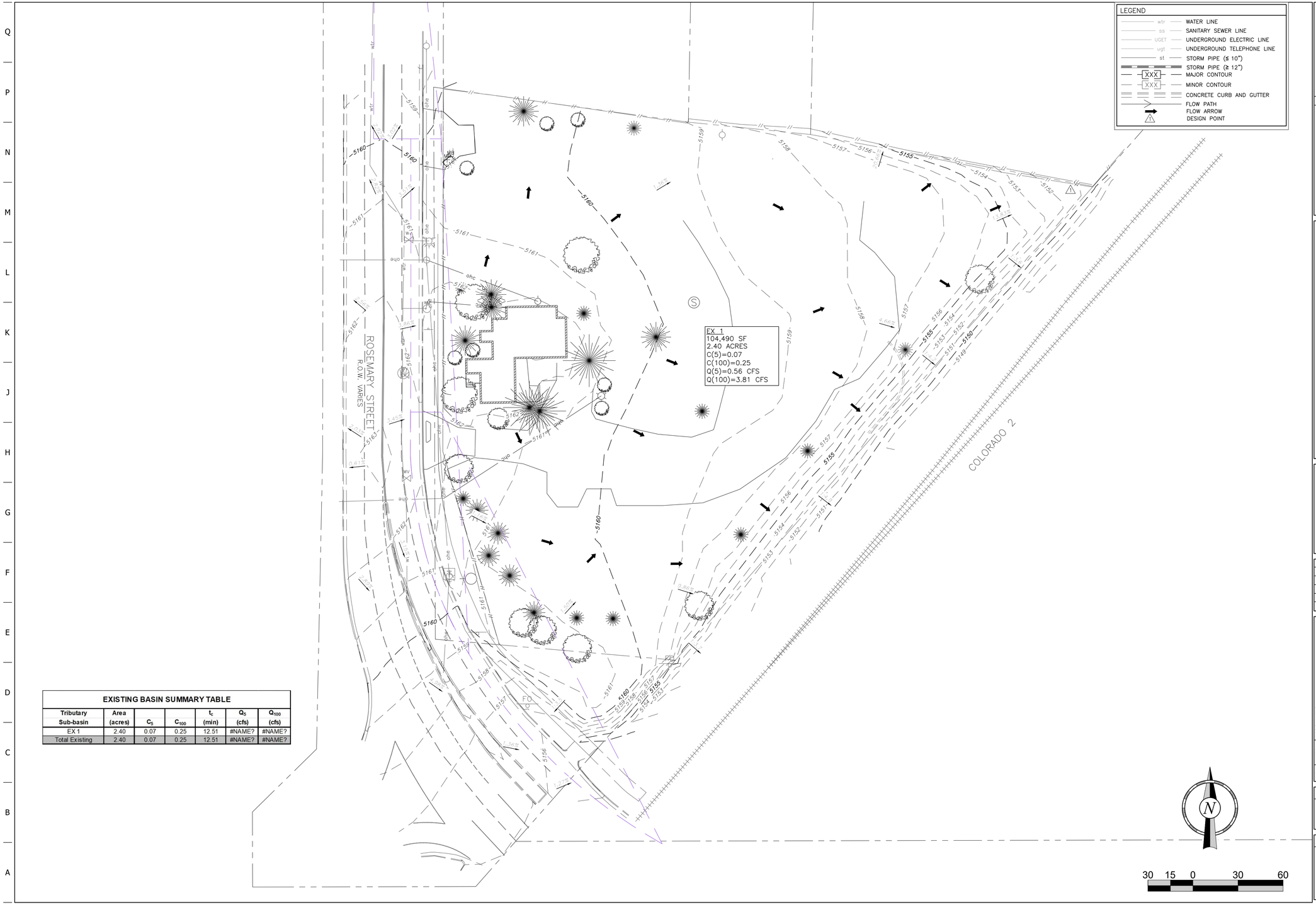
REV	DATE	DESCRIPTION

ORIGINAL ISSUE DATE: 01/20/2023

SHEET TITLE:
GENERAL LOCATION MAP

SHEET NUMBER:
1

FILE LOCATION:C:\Users\duncan_rady\Desktop\QKT4201_Civil.dwg TAB NAME:General Location USER:Duncan_Rady SAVED:1/20/2023 1:01 PM PLOTTED:1/20/2023 1:02 PM



EXISTING BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EX 1	2.40	0.07	0.25	12.51	#NAME?	#NAME?
Total Existing	2.40	0.07	0.25	12.51	#NAME?	#NAME?

PROJECT NO.:QKT004201

Galloway
5500 Greenwood Plaza Boulevard, Suite 200
Greenwood Village, CO 80111
303.770.8884
GallowayUS.com

QuikTrip No. 4201

8040 ROSEMARY STREET
COMMERCE CITY, CO
ASSESSOR'S PIN: 172128300113

PROTOTYPE:	P-112 (11/01/22)
DIVISION:	83
VERSION:	001
DESIGNED BY:	MSJ
DRAWN BY:	MSJ
REVIEWED BY:	ACJ

REV	DATE	DESCRIPTION
1	6/14/23	2ND DP SUBMITTAL
2	9/8/23	3RD DP SUBMITTAL

ORIGINAL ISSUE DATE: 05/23/2023

SHEET TITLE:
PRE-DEVELOPED DRAINAGE MAP

SHEET NUMBER:
C123

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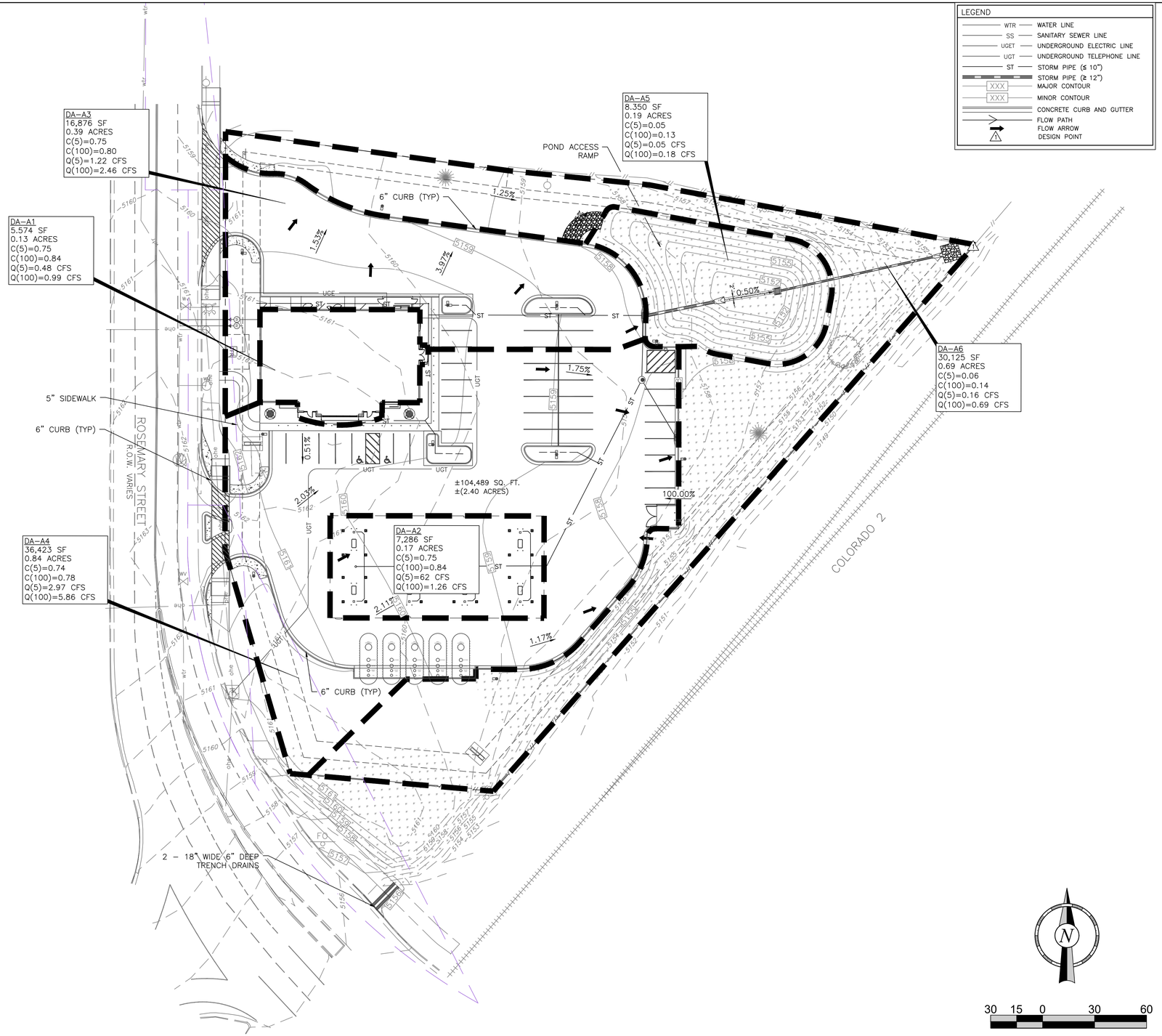

LEGEND

- WTR — WATER LINE
- SS — SANITARY SEWER LINE
- UGET — UNDERGROUND ELECTRIC LINE
- UGT — UNDERGROUND TELEPHONE LINE
- ST — STORM PIPE (≤ 10")
- STORM PIPE (≥ 12")
- XXX — MAJOR CONTOUR
- XXX — MINOR CONTOUR
- CONCRETE CURB AND GUTTER
- FLOW PATH
- FLOW ARROW
- DESIGN POINT

PROPOSED DETENTION POND SUMMARY TABLE

Attribute	Value
Tributary Sub-basin	DA 1 - DA 5
Area (acres)	1.71
Imperviousness %	81%
WQCV Volume Req. (ac-ft)	0.055
WQCV WSEL (ft)	5154.34
EURV Volume Req. (ac-ft)	0.156
EURV WSEL (ft)	5155
100-Year Volume Req. (ac-ft)	0.290
Volume Provided (ac-ft)	0.654
100-Year WSEL	5155.98
Top of Pond	5158.50
Freeboard (ft)	2.52
Q_{ALL} (cfs)	#NAME?
Q_{ACT} (cfs)	3.10
Total Runoff Into Pond (cfs)	DA 1 - DA 5
Pond Spillway Flowline (ft)	5157.50
Clogged 100-Yr WSEL (ft)	5158.02
Freeboard (ft)	0.48

PROPOSED BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
DA-A1	0.13	0.75	0.84	5.00	#NAME?	#NAME?
DA-A2	0.17	0.75	0.84	5.00	#NAME?	#NAME?
DA-A3	0.39	0.75	0.80	7.56	#NAME?	#NAME?
DA-A4	0.84	0.74	0.78	5.00	#NAME?	#NAME?
DA-A5	0.19	0.05	0.13	5.00	#NAME?	#NAME?
Total to Pond	1.71	0.67	0.72	-	#NAME?	#NAME?
DA-A6	0.69	0.06	0.14	8.16	#NAME?	#NAME?
Total Not to Pond	0.69	0.06	0.14	8.16	#NAME?	#NAME?

30 15 0 30 60

PROJECT NO.: QKT004201

Galloway
5500 Greenwood Plaza Boulevard, Suite 200
Greenwood Village, CO 80111
303.770.8884
GallowayUS.com

QuikTrip No. 4201

8040 ROSEMARY STREET
COMMERCE CITY, CO
ASSESSOR'S PIN: 172128300113

PROTOTYPE: P-112 (11/01/22)
DIVISION: 83
VERSION: 001
DESIGNED BY: MSJ
DRAWN BY: MSJ
REVIEWED BY: ACJ

REV	DATE	DESCRIPTION
1	6/14/23	2ND DP SUBMITTAL
2	9/8/23	3RD DP SUBMITTAL

ORIGINAL ISSUE DATE: 05/23/2023

SHEET TITLE:
POST-DEVELOPED DRAINAGE MAP

SHEET NUMBER:
C124

FILE LOCATION:H:\Q\Quiktrip\QKT004201--Commerce City, CO\QCIV\2-Plan\QKT4201_Civil.dwg TAB NAME:Post Dev Map USER:Matt_Jarrett SAVED:9/8/2023 10:45 AM PLOTTED:9/8/2023 10:55 AM

APPENDIX E

City Checklist

Storm Drainage & Technical Criteria Form SF-1				
Drainage Study Submittal Checklist and Review Sheet				
Prepared by:	Galloway & Company		Date:	06/09/2023
The drainage study with plan drawings, as noted below, has been received and found to lack the information noted. This information must be submitted before the study will be accepted for review. Please provide the required information and return this checklist with your submittal.				
Subdivision:	QuikTrip 4201 Subdivision			
Location:	8040 Rosemary Street, Commerce City, CO			
Date Submitted:				
Type of Study (check one):	Preliminary _X_		Final _____	
Submitted by (firm):	Galloway & Company			
Contact:	Duncan Rady		Phone:	303-770-8884
Submitted Date:	(1)	(2)	(3)	(4)
Date Approved:				
Item	**Description**		**Received (Y, N, or Not Applicable)**	**To be Submitted (Y or N)**
Overall Submittal	Typed, bound study or PDF equivalent		Y	
P.E. Certification	Signed and sealed certification statement and stamps and signatures on reports and plans			Y
I. General Location and Description				
A. Location	City, county, and local streets within and adjacent to the site		Y	
	Township, range, section, ¼ section, lot(s) and block(s)		Y	
	Major drainageways and drainage and water quality facilities		Y	
	Names of surrounding developments		Y	
	Location map		Y	
B. Description of Property	Site area		Y	
	Ground cover		Y	
	Drainageway characteristics		Y	
	General project description		Y	
	Proposed land use(s)		Y	

Storm Drainage & Technical Criteria Form SF-1			
	Soil types, depth to water table, soil boring logs, and location map	Y	
	Infiltration test results or geotechnical study		Y
	Irrigation facilities on site or nearby related to site drainage	N/A	
	History of flooding	Y	
	Easements within and adjacent to the site	Y	
	Documentation of areas of known or suspected contamination and regulatory coordination	N/A	
II. Drainage Basins and Sub-basins			
A. Major Basin Descriptions	Reference relevant MHFD FHADs, MDP reports, OSP reports, and FEMA FIRM panels	Y	
	Areas, existing and proposed land uses, imperviousness, soils information, overland and channelized slopes, and other parameters used in calculations	Y	
	All nearby irrigation facilities that may be affected by local drainage	N/A	
	All outfalls to major drainageways	N/A	
B. Sub-basin Descriptions	Historical on-site and off-site sub-basin drainage patterns of the property and surrounding areas	Y	
	Proposed on-site and off-site sub-basin characteristics and impacts of development	Y	
	Sub-basin characteristics for existing and proposed conditions including area, existing and proposed land uses, imperviousness, hydrologic soil groups, overland and channelized slopes, and other physical parameters used for drainage calculations or analyses	Y	
	Determine whether exemptions in Section 2.3.2 applicable.	Y	
	Determine if the conditions for 20/10 Rule apply.	N	

Storm Drainage & Technical Criteria Form SF-1			
III. Drainage Design Criteria			
A. Development Criteria References and Constraints	Previous drainage studies	Y	
	Adjacent drainage studies	Y	
	Drainage impacts of site constraints	Y	
B. Hydrologic Criteria	Design rainfall and design storm recurrence intervals	Y	
	Hydrologic soil groups	Y	
	Calculate imperviousness	Y	
	Runoff calculation method	Y	
	Detention discharge and storage calculation method	Y	
	Other criteria or calculation methods	Y	
C. Hydraulic Criteria	Capacity analysis of existing and proposed drainage infrastructure		Y
	Storm drains must be designed to convey the minor storm flood peaks while flowing at most 80% of the full pipe capacity		Y
	Floodplain analyses (if required)	N/A	
	Other drainage facility design criteria used	Y	
D. Stormwater Quality	Describe how the project will satisfy MS4 Permit	Y	
	Describe how the project will satisfy MS4 post-construction requirements	Y	
	Describe how the project will satisfy MDCIA requirements	Y	
IV. Drainage Facility Design			
A. General Concept	General drainage concepts and drainage patterns	Y	
	Off-site runoff considerations	Y	
	Discuss tables, charts, figures, and drawings	Y	
	Anticipated and proposed drainage patterns	Y	
B. Specific Details	Drainage problems and solutions	Y	
	Design flows and detention storage volumes	Y	
	Existing stormwater conveyance and storage facilities	Y	

Storm Drainage & Technical Criteria Form SF-1			
	Proposed stormwater conveyance, storage facilities, and outlet structures	Y	
	Maintenance access and aspects	Y	
	Easements and tracts	Y	
	Compliance with local, state, and federal requirements	Y	
	Structural and non-structural Control Measures (SCMs)	Y	
	Spillway design included	Y	
	Spillway design includes 100% blocked flow condition of outfall structure.	Y	
	For pumped drainage systems:	N/A	
	Hydraulic criteria for sizing pumps	N/A	
	Types of pumps and power sources	N/A	
	Description of pump maintenance requirements	N/A	
	Plans for access for maintenance	N/A	
	Soils and station foundation	N/A	
	Pump station surroundings	N/A	
	Telemetry systems (if used) and pump controls	N/A	
	Cost estimate for pump station	N/A	
C. Variances	Any requested variances from Commerce City drainage criteria or approved master plans	N/A	
V. Conclusions			
A. Compliance with Standards	Compliance with criteria in Commerce City Manual	Y	
	Compliance with CDPS MS4 Permit	Y	
	Compliance with Commerce City and FEMA floodplain rules and regulations	Y	
B. Drainage Concept	Drainage design will control damage from storm runoff	Y	
	Compatibility of proposed development with approved master plans	Y	

Storm Drainage & Technical Criteria Form SF-1			
	Drainage impacts of proposed development on upstream and downstream properties	Y	
C. Water Quality	Compliance with Commerce City MS4 Permit	Y	
	Post-construction design standards in the MS4 Permit will be met	Y	
VI. References	**Criteria and technical information used**	Y	
VII. Appendices			
A. Hydrologic Computations	Land use assumptions for adjacent properties	Y	
	Connectivity diagram	N	
	Historic runoff computations	Y	
	Calculations for WQCV, EURV, detention storage volumes, release rates, and drain time	Y	
B. Hydraulic Computations	Culvert capacity calculations	N/A	
	Street capacity and inlet calculations		Y
	Storm drain capacity calculations		Y
	Detention area/volume capacity and outlet capacity calculations	Y	
	Documentation, water surface profiles for open channel. Designs for low-flow and trickle channel, stabilization (erosive velocities), and grade control		Y
	Energy dissipation and calculations		Y
	Downstream/outfall system capacity		Y
Drawing Contents			
A. General Location Map	Title block	Y	
	Legend	Y	
	Engineering firm name	Y	
	Signature		Y
	Date	Y	
	North arrow	Y	
	Flow arrows	Y	
	Drainage flows and patterns	Y	
	Existing and proposed stormwater management facilities	Y	

Storm Drainage & Technical Criteria Form SF-1			
	Scale 1" = 1000' or 1" = 2000'	Y	
B. Floodplain Information	FIRM	Y	
	Flow path for major drainageways	Y	
C. Drainage Plan Map(s)	Scale 1' = 20' to 1" = 200'	Y	
	Size 18" x 24" or 24" x 36"	Y	
	Existing and proposed contours at 2-foot maximum intervals	Y	
	Property lines and easements	Y	
	Streets, right-of-way, flowline, curb type, sidewalk, and slopes	Y	
	Major basin and sub-basin boundaries	Y	
	Existing drainage facilities and structures	Y	
	Proposed types of street flow	Y	
	Proposed storm drains and open drainageways	Y	
	Proposed outfall – consistent with drainage calculations	Y	
	Spillway design – 100% blocked outfall condition	Y	
	Routing and accumulation of flows at critical points for initial and major storm runoff	Y	
	Volumes and release rates for detention storage facilities		Y
	Location and elevations of floodplain boundaries	N/A	
	Location and elevations of existing and proposed utilities	Y	
	Off-site feature influencing development	Y	
	Definition of flow path	Y	
	Legend	Y	
	Title block	Y	
	Locations and footprints of water quality and/or detention facilities	Y	