Print Form

TOWN OF ERIE
Community Development Department – Planning Division
645 Holbrook Street – PO Box 750 – Erie, CO 80516
Tel: 303.926.2770 – Fax: 303.926.2706 – Web: www.erieco.gov

LAND USE APPLICATION

Please fill in this form completely. Incomplete applications will not be processed.

STAFF USE ONLY
FILE NAME:
FILE NO: DATE SUBMITTED: FEES PAID:

PROJECT/BUSINESS NAME: Compass - Filing No. 4
PROJECT ADDRESS: TBD - part of the CompassCommunity
PROJECT DESCRIPTION: Proposal of Site Plan that proposes rear-loaded duplex homes, most facing green courts or park space. Includes town-required regional spine trail extension that runs along northern edge of site.

LEGAL DESCRIPTION *(attach legal description if Metes & Bounds)*
Subdivision Name: Compass
Filing #:4 Lot #: 1 - 146 Block #:1-3 Section:25 Township: 1 North Range:69 West

---

OWNER (*attach separate sheets if multiple*)	**AUTHORIZED REPRESENTATIVE**
Name/Company: CalAtlantic Homes	Company/Firm: PCS Group Inc.
Contact Person: Kent Pedersen	Contact Person:Garrett Graham
Address: 6161 South Syracuse Way / Ste. 200	Address: 200 Kalamath Street
City/State/Zip: Greenwood Village / CO / 80111	City/State/Zip: Denver / CO / 80223
Phone: 303-486-5002 Fax:	Phone:720-465-2261 Fax:
E-mail: Kent.Pedersen@calatl.com	E-mail: garrett@pcsgroupco.com

MINERAL RIGHTS OWNER (*attach separate sheets if multiple*)	**MINERAL LEASE HOLDER** (*attach separate sheets if multiple*)
Name/Company:	Name/Company:
Address:	Address:
City/State/Zip:	City/State/Zip:

LAND-USE & SUMMARY INFORMATION

Present Zoning: LR	Gross Site Density (du/ac): 3.32 (Overall Compass Dev't)
Proposed Zoning: PUD	# Lots/Units Proposed: 146
Gross Acreage: 20.67	Gross Floor Area: N/A

SERVICE PROVIDERS

Electric: Public Service	Gas: Public Service
Metro District: N/A at this time	Fire District: Mountain View Fire District
Water *(if other than Town)*:	Sewer *(if other than Town)*:

PAGE TWO MUST BE SIGNED AND NOTARIZED

DEVELOPMENT REVIEW FEES

ANNEXATION		**SUBDIVISION**	
☐ Major (10+ acres)	$ 4000.00	☐ Sketch Plan	$ 1000.00 + 10.00 per lot
☐ Minor (less than 10 acres)	$ 2000.00	☐ Preliminary Plat	$ 2000.00 + 40.00 per lot
☐ Deannexation	$ 1000.00	☐ Final Plat	$ 2000.00 + 20.00 per lot
COMPREHENSIVE PLAN AMENDMENT		☐ Minor Subdivision Plat	$ 2000.00
☐ Major	$ 3000.00	☐ Minor Amendment Plat	$ 1000.00 + 10.00 per lot
☐ Minor	$ 1200.00	☐ Road Vacation (constructed)	$ 1000.00
ZONING/REZONING		☐ Road Vacation (paper)	$ 100.00
☐ Rezoning	$ 1700.00 + 10.00 per acre	**SITE PLAN**	
☐ PUD Rezoning	$ 1700.00 + 10.00 per acre	☑ Residential	$ 1400.00 + 10.00 per unit
☐ PUD Amendment	$ 1700.00 + 10.00 per acre	☐ Non-Resi. (>10,000 sq. ft.)	$ 2200.00
☐ Major PD Amendment	$ 3700.00 + 10.00 per acre	☐ Non-Resi. (>2,000 sq. ft.)	$ 1000.00
☐ Minor PD Amendment	$ 500.00	☐ Non-Resi. (<2,000 sq. ft.)	$ 200.00
SPECIAL REVIEW USE		☐ Amendment (major)	$ 1100.00
☐ Major	$ 1000.00	☐ Amendment (minor)	$ 350.00
☐ Minor	$ 400.00	**VARIANCE**	$ 600.00
☐ Oil & Gas	$ 1200.00	**SERVICE PLAN**	$ 10,000.00

All fees ***include*** *both Town of Erie Planning & Engineering review. These fees* ***do not include*** *referral agency review fees, outside consultant review fees, or review fees incurred by consultants acting on behalf of staff. See Town of Erie Municipal Code, Title 2-10-5 for all COMMUNITY DEVELOPMENT FEES.*

The undersigned is fully aware of the request/proposal being made and the actions being initiated on the referenced property. The undersigned understand that the application must be found to be complete by the Town of Erie before the request can officially be accepted and the development review process initiated. The undersigned is aware that the applicant is fully responsible for all reasonable costs associated with the review of the application/request being made to the Town of Erie. Pursuant to Chapter 7 (Section 7.2.B.5) of the Unified Development Code (UDC) of the Town of Erie, applicants shall pay all costs billed by the Town for legal, engineering and planning costs incurred by staff, including consultants acting on behalf of staff, necessary for project review. By this acknowledgement, the undersigned hereby certify that the above information is true and correct.

Owner: Kent Pedersen Date: 5/3/19

Owner: Date:

Applicant: Date:

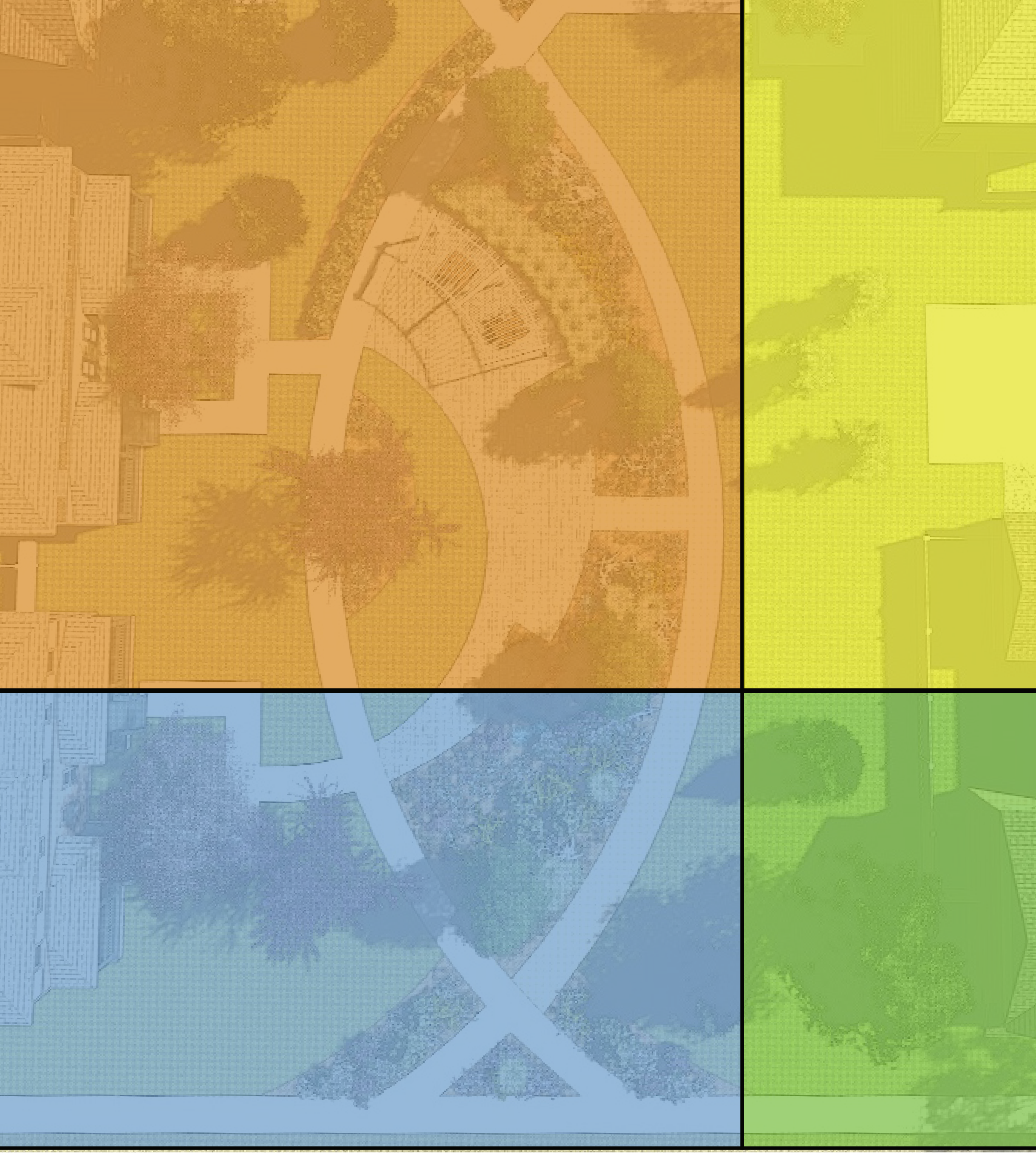
STATE OF COLORADO)
) ss.
County of Douglas)

The foregoing instrument was acknowledged before me this 3rd day of May, 2019,
by Kent Pedersen.

My commission expires: 7-10-22.
Witness my hand and official seal.

JENNIFER S. WAITON
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID #20144027146
COMMISSION EXPIRES JUL. 10, 2022

Jennifer S Waiton
Notary Public



TOWN OF ERIE
1874

COMPASS FILING NO. 4

SITE PLAN NARRATIVE - AUGUST - 2018

PROJECT TEAM

applicant:

CalAtlantic Homes
6161 South Syracuse Way / Suite 200, Greenwood Village, Colorado 80111
tel. 303.486.5002 - contact: Kent Pedersen

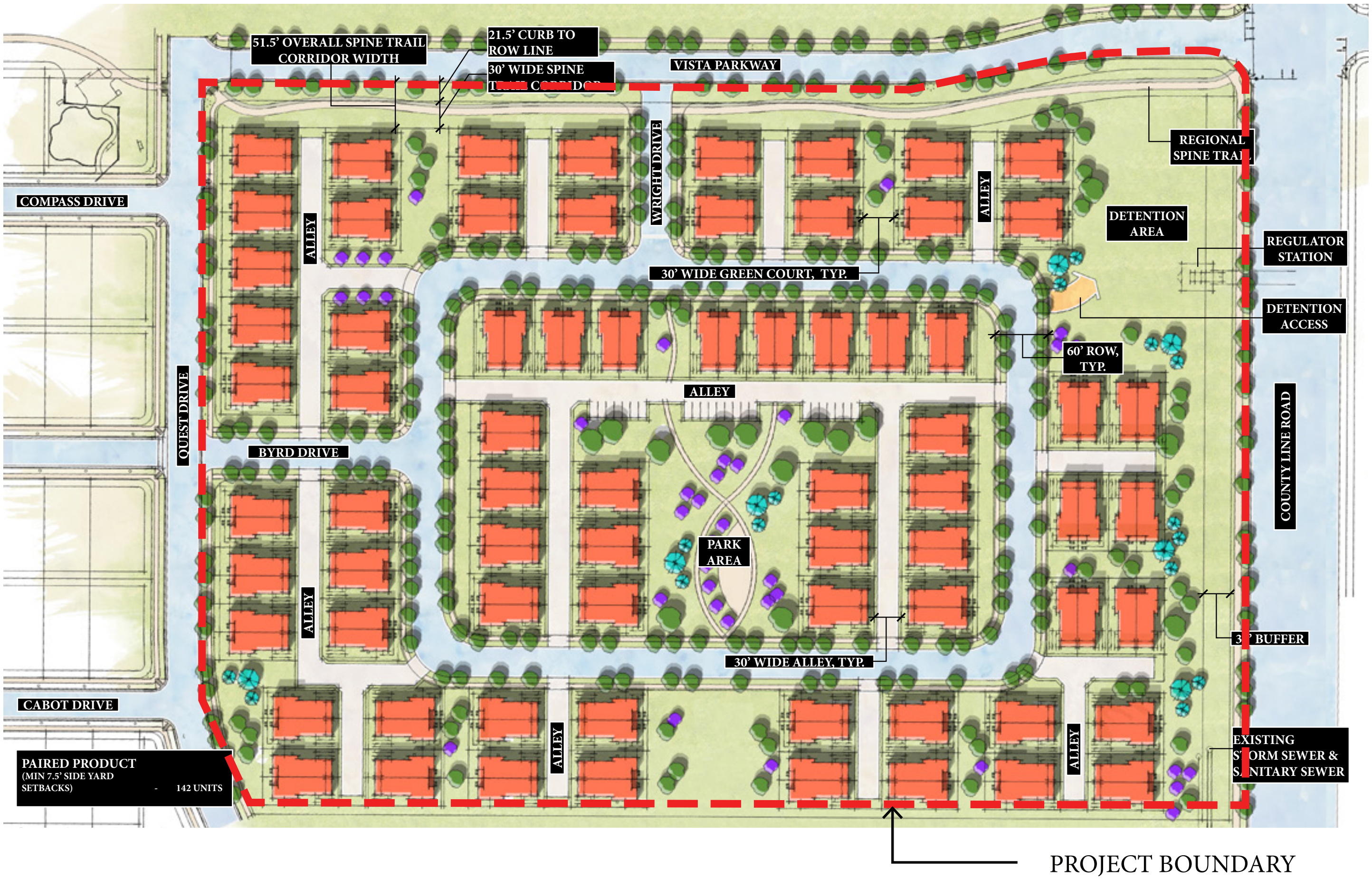
planning consultant:

PCS Group, Inc.
PO Box 18287, Denver, CO 80218
tel. 720.249.8246 - contact: John Prestwich

engineering & surveyor consultant:

Ware Malcomb
990 South Broadway, Suite 230, Denver, Colorado 80209
tel. 303.689.1506 - contact: Greg Blount

CONTENTS



SECTION A:

GENERAL PROJECT CONCEPT AND PURPOSE OF THE REQUEST

CalAtlantic Homes, (the 'Applicant') is pleased to present this document as part of the Site Plan submittal for a tract of land location in section 25, township 1 North, range 69 west of the 6th principal meridian, county of Boulder, state of Colorado, being presented as Compass Filing 4, an addition to the Compass Development. In this document, we will discuss the project concept and purpose of the request.

The project area is an approximately 22-acre parcel of land on the northeast end of the Compass Development along East County Line Road & Vista Parkway. The new site plan proposes attractive 146 rear-loaded paired homes with associated spacious green courts. As well as providing outdoor common areas and a passive park, the site hosts a continuance of a regional spine trail connection as part of Town's PROST Master Plan.

The purpose of this request is to gain the Town's approval for a Site Plan, a PUD plan, and development of a Final Plat for the Compass development as part of the subdivision process.

SECTION B:

TOWN'S COMPREHENSIVE PLAN AND ZONING APPROVAL CRITERIA

COMPREHENSIVE PLAN

"Erie is a community which recognizes the importance of conserving and enhancing its historic small town character, the roots from which it grew, preserving the natural environment in which it resides; a caring community which offers its residents an environment in which to seek a high quality of life; a balanced community with a diverse range of housing, employment, educational, shopping and recreational opportunities; and a vital community which provides financial and social support for quality of life programs."

Vision statement from the 2005 Comprehensive Plan

Excerpts from the Town of Erie Comprehensive Plan

Erie is a community which recognizes the importance of conserving and enhancing its historic small town character, the roots from which it grew, preserving the natural environment in which it resides; a caring community which offers its residents an environment in which to seek a high quality of life; a balanced community with a diverse range of housing, employment, educational, shopping and recreational opportunities; and a vital community which provides financial and social support for quality of life programs.

GUIDING PRINCIPLES

The following statements describe the community's aspirations and set the direction for the Comprehensive Plan. They demonstrate the general ideals to be sought for the Town within its planning area over the next 20 years, building on the Vision established for the community.

The Town of Erie Comprehensive Plan Vision includes the following key principles:

A Coordinated and Efficient Pattern of Growth

The Town will have a compact pattern that encourages urban growth to locate within the Planning Area Boundary, fosters the efficient provision of infrastructure and services, and balances development and conservation of the natural environment.

> The anticipated development pattern proposes compact alley-loaded paired homes and is a cohesive extension of the Compass development.

Quality Design and Development

Erie will promote a high standard of design for all new development, renovation, and rehabilitation to reinforce and enhance its unique nature for residential neighborhoods, public places, and commercial businesses.

> The design effort for this quality residential development to the Town of Erie will incorporate a high standard of design that includes fully landscape greenways, enhanced architectural elevations and passive park areas.

A Comprehensive, Integrated Transportation System

Erie has a safe, efficient, and innovative transportation system that reduces neighborhood isolation and promotes a sense of community by connecting all areas of town, accommodates various modes of public and private transit, and facilitates travel to regional centers.

> The proposed site plan provides additional access to the Compass development via East County Line Road through Vista Parkway's adjacent regional spine trail, internal connections through Byrd Drive, Green Court & Wright Drive, as well as detached walks that promote pedestrian movement through the property linking internal parks and green courts.

Stewardship of the Natural Environment

The Town will identify and conserve its natural, scenic, and environmentally sensitive areas including important wildlife habitat, waterways, and visually sensitive areas. Erie will strive to be a clean, sustainable, environmentally-friendly town.

This addition to the Compass Development has no adverse effects to environmentally sensitive areas, wildlife or waterways.

Trails, Parks and Recreation Opportunities

The Town will provide a diverse range of recreational opportunities to include facilities and programming for all ages and varying interests, both passive and active. Trails, parks, and recreation opportunities will be connected with and integrate open space into and between neighborhoods and other areas of the community.

This addition to the Compass Development will facilitate the construction and continuation of an important trail connection to the existing Coal Creek trail system east of the property. In addition, the design of this community has been planned to connect to adjacent pocket parks and trail connections within the overall Compass development.

Stable, Cohesive Neighborhoods Offering a Variety of Housing Types

The Town will promote new neighborhoods that contain a mix of land uses and diversified housing options that meet the varying needs of its residents, including single family, attached homes (duplexes, townhomes), multifamily dwellings, and housing included as part of mixed-use developments. The Town will work to maintain the quality and character of established neighborhoods and ensure that infill and redevelopment is designed in a manner that minimizes impacts on existing neighborhoods, including rural neighborhoods in the Planning Area. New housing and neighborhoods should be appropriate in size, scale, design and use. New housing areas should be located where residents will have access to the full range of infrastructure, facilities and services that are needed for healthy, livable neighborhoods.

The Filing 4 property is located adjacent to Vista Parkway & East County Line Road. Infrastructure and facilities are in close proximity to road access and services. This new addition of paired homes will add to the diversity of the overall Compass development while complimenting the single family homes that are presently being built around it.

Provide Infrastructure and Public Services Efficiently and Equitably

Erie will coordinate future development and/or provision of capital facility projects and infrastructure, including water, wastewater, fire protection, emergency management services, police protection, schools, parks, and other utilities that affect the quality of life and economic stability of the community.

Public infrastructure is proposed in the same efficient manner as it has been constructed in previous filings of the Compass Development. This application will add residents that will have a positive impact on the economic stability of the community and associated district by increasing the tax base and providing additional consumers for Town commercial businesses.

The following principles embody the community's vision for its future neighborhoods:

MIX OF HOUSING TYPES

Neighborhoods should contain a variety of housing types (single-family detached, single-family attached, townhomes, apartments, etc…) to provide a more diverse selection of lifestyles and housing pricing for Erie residents.

Neighborhoods should incorporate a variety of housing models and façade treatments to create visual interest and a more inviting pedestrian environment.

This new addition of paired homes is complimentary to the single-family lots in the Compass development and helps create more variation of housing types. Furthermore, it retains cohesion to the rest of the development by using similar landscape material & styling, road & pedestrian trail connections, and adjacency to neighborhood/pocket parks. The builder has extensive & proven experience with developing Master Plan communities throughout the Denver Metropolitan area and will ensure that the neighborhood incorporates a variety of housing models and facade treatments per the Town's Unified Development Code requirements.

CONNECTIVITY

Neighborhoods should be connected to adjacent neighborhoods and the surrounding community with direct roadway and pedestrian connections and open space. Isolating neighborhoods with walls and gates should be avoided.

The proposed site plan provides additional access to the Compass development via East County Line Road through Vista Parkway's adjacent regional spine trail, internal connections through Byrd Drive, Green Court & Wright Drive, as well as detached walks that promote pedestrian movement through the property linking internal parks and green courts. This addition to the Compass Development will not be isolated by walls or gates.

PARKS AND OPEN SPACE

Neighborhoods should include or be easily accessible to a range of parks and open space amenities to appeal to residents of all ages and abilities.

This addition will include a passive outdoor common area, open space areas, paseo/green courts, and trail corridors that will lead to additional parks within the Compass Development. The park area will be easily accessible to pedestrian traffic and will cater to residents of all ages and abilities.

ACTIVITY CENTERS

Each neighborhood should include an activity center for its residents. Activity centers may include a mix of commercial development, parks, open space, and other community facilities, where appropriate, to serve the needs of neighborhood residents. Larger, commercially-oriented activity centers may serve more than one neighborhood. Activity centers should be designed to be connected to adjacent neighborhoods with streets and sidewalks.

The Compass Development is in close proximity to commercial areas and community facilities, as the Erie Community Center is 1.2 miles away and 2.1 miles away from downtown Erie.

PRESERVATION OF NATURAL FEATURES

Neighborhoods should be planned to maximize the preservation of natural features, such as drainages, significant trees, topographic features, and other features.

The existing topography is very gentle and conducive for residential development. There are very few existing trees on the property or significant natural features.

DISTINCT IDENTITY

Neighborhoods should be planned to incorporate unique characteristics that serve as identifiers for residents, such as distinct streetscape elements, architectural styles, and neighborhood center features. However, neighborhoods should also incorporate features that visually and physically link them to the larger community and the Town of Erie. This may occur through naming, street graphics (i.e. incorporating the Town of Erie logo), trail connections, or other features that serve to create a common link between the

Town's many neighborhoods.

This duplex home proposal is a logical addition to the Compass development. Utilizing design characteristics from the previous filings of Compass, this project will draw inspiration from the style of the neighborhood streetscape elements, park, landscape materials, and most importantly the spine trail connections.

LOW DENSITY RESIDENTIAL POLICIES:

LDR 1.1—CHARACTERISTICS

Low Density Residential areas will primarily be suburban-style developments; however, the designation allows for a range of single-family detached and attached homes, townhomes, patio homes, and in appropriate cases include complementary neighborhood-scale supporting land uses, such as retail, commercial, and office uses in a neighborhood setting. Small-scale apartment and condominium buildings may also be permissible as part of a planned unit development provided open space requirements are adequate to stay within desired densities. Schools, places of worship, and other civic uses are also appropriate.

This proposal anticipates duplex homes within a suburban-style development. No retail, commercial or office use in this neighborhood setting has been proposed. The application does not intend to propose any small scale apartments or condominium buildings.

LDR 1.2—DENSITY RANGE

Low Density Residential areas have a gross density of 2-6 dwelling units per acre to accommodate a variety of housing types; however, gross densities will not typically exceed 4 dwelling units/acre.

This addition will be designed to be within the recommended density range based off the gross calculation of the overall Compass Development.

LDR 1.3—LOCATION

Low Density Residential neighborhoods should be located where they have convenient access and are within walking distance of community facilities and services that will be needed by residents of the neighborhood, including schools, shopping areas, and other community facilities. Where site characteristics allow, neighborhoods should be bounded by major streets (arterials and/or collectors) with a direct connection to work, shopping and leisure activities.

This addition is ideally located with respect to the Low Density Comprehensive Plan designation. Access to East County Line Road through Vista Parkway will provide convenient access to community facilities and services. In addition, the Town of Erie Community recreation facility and Public Library can be accessed through the use of an off-street spine trail system.

Initial Zoning Approval Criteria

The Board of Trustees may approve Initial Zonings if the Initial Zoning meets all of the following criteria:

1. The Initial Zoning will promote the public health, safety, and general welfare;

The initial zoning for the Compass property will conform to

the requirements of the Municipal Code. The stated general purpose of the Municipal Code is the promotion of the health, safety, and general welfare of the Town of Erie. Specifically this addition to the Compass Development will include open space, park uses, trail corridors, as well as an efficient and integrated transportation network. The plan will provide for a new connection to the Town of Erie, this connection will be extending Vista Parkway west of East County Line Road. This addition will provide internal street connections, as well as provide a trail connection between significant trails to the Coal Creek trail system east of the property.

2. The Initial Zoning is consistent with the Town's Comprehensive Plan and the purposes of the Municipal Code;

The gross density calculation of the total allowable number of units for the entire Compass Development is in compliance with the Town of Erie's Comprehensive Plan Low Density Residential designation.

3. Adequate facilities and services (including roads and transportation, water, gas, electric, police and fire protection, and sewage and waste disposal, as applicable) will be available to serve the subject property while maintaining adequate levels of service to existing development;

The Town of Erie Public Works department has verified that adequate facilities are available to serve the property. In addition the developer will be responsible for extending services and improving roads as a part of this proposal.

4. The Initial Zoning is not likely to result in significant adverse impacts upon the natural environment, including air, water, noise, storm water management, wildlife, and vegetation, or such impacts will be substantially mitigated;

The design for this addition includes the spine trail corridor along the north boundary of the properties. The majority of the property has been farmed and as such any impacts from the development of a residential community that will include open space, trails and park amenities will not result in a significant adverse impact.

5. The Initial Zoning is not likely to result in significant adverse impacts upon other property in the vicinity of the subject property; and

The initial zoning for the property will allow for road, open space, trail and park improvements that are not likely to result in significant adverse impacts for other properties in the vicinity of this property. The extension of municipal services to this area will result in a positive impact for the future of other properties in the vicinity of this property.

6. Future uses on the subject property will be compatible in scale with uses on other properties in the vicinity of the subject property.

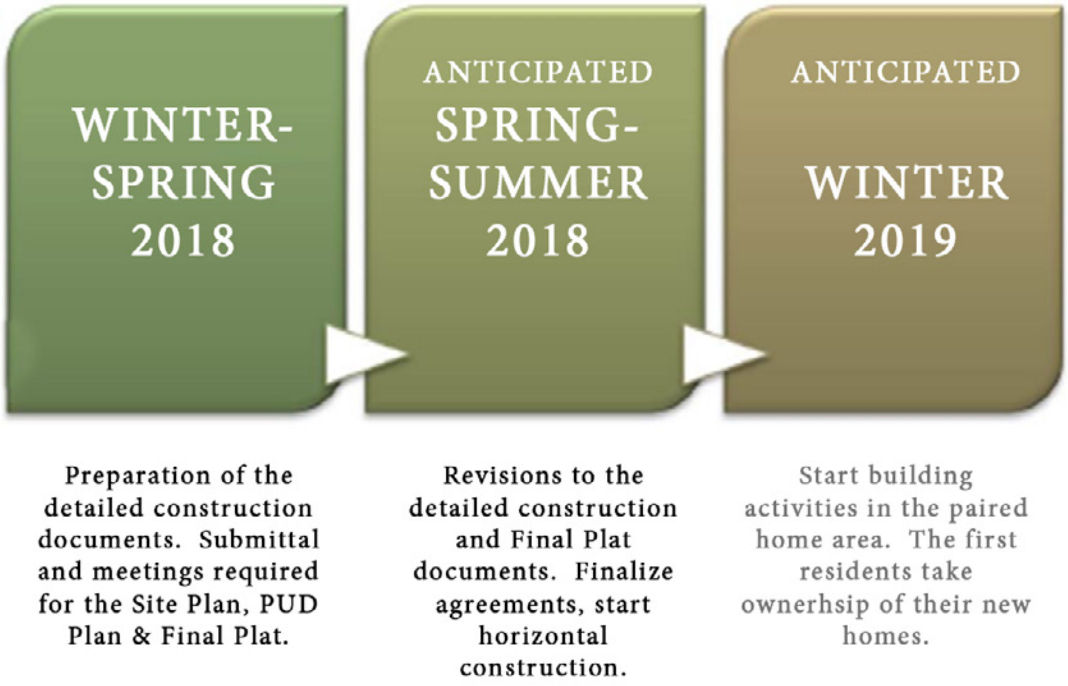
Future uses on this property will be residential which is consistent with the uses on the adjacent properties. The anticipated scale of development on the property will be smaller than the existing larger lots directly surrounding the property; however, the anticipated scale will be compatible with new neighborhoods being developed in the immediate area.

SECTION C:

PROPOSED ARCHITECTURAL ELEMENTS

The proposed building architecture for this new addition provides visual interest in regards to the rest of the Compass development's identity, character and scale. Although the units on this new addition are duplex homes, in contrast to the rest of the Compass development containing single family lots, the architecture mimics similar brick-exposed foundations, neutral-colored siding treatments, light colored trim / columns, & the abundance of windows. These attributes help unify the paired homes to the rest of the site while still allowing them to retain their own identity as a contrasting & complimentary housing type within the development.

Building facades and rooflines of the paired homes are articulated to reduce the mass, scale and uniform appearances through variation in roofing types ranging from gabled, dormer & hipped roofs. As well, slightly staggered unit footprints and non-uniformly located roof dormers create asymmetrical design and aid in visual interest from an overall community scale as well as the views from a pedestrian. Slight nuanced differences assist the paired homes visually by ranging from having bay windows, roof dormers, window trim, and shingle siding.



WINTER-SPRING 2018

Preparation of the detailed construction documents. Submittal and meetings required for the Site Plan, PUD Plan & Final Plat.

ANTICIPATED SPRING-SUMMER 2018

Revisions to the detailed construction and Final Plat documents. Finalize agreements, start horizontal construction.

ANTICIPATED WINTER 2019

Start building activities in the paired home area. The first residents take ownerhsip of their new homes.

SECTION D:

PROPOSED DEVELOPMENT SCHEDULE

TIME-LINE

Since we have worked with the Town from the initial planning phase/sketch plan phase submitted in December 2017, we will move into the phase of submitting detail construction plans as part Site Plan, PUD Plan & Final Plat during the Winter 2018.

Subsequently, these detailed construction & planning documents along with platting will be revised and finalized in early 2018, allowing for construction in Summer 2018 to begin.

We believe that our estimate of the proposed time-line is accurate based on the best market data; however; ultimately the developer will determine when the project will be constructed.

SECTION E:

PUBLIC / PRIVATE OPEN SPACE DESCRIPTIONS

Public open space dedication requirements have been satisfied in previous filings of the Compass development that are adjacent to this new addition to the community. Directly to the northwest of the proposed paired homes, at the intersection of Quest Drive & Vista Parkway, a pocket park will be installed as part of a previous filing that will serve as park space for this proposed site plan. Subsequently, no required pocket parks or other park space are required within this site plan's project boundaries.

However, this development will provide residents with spacious green court common areas adjacent to the fronts of homes throughout the site. As well, larger green courts located at the south-central edge of the site will provide residents a passive common area with enhanced landscaping, decorative shade arbor, benches, picnic tables, enhanced hardscape materials and open turf lawn. As part of a future phase of the Compass Development, a neighborhood park will be located directly south of the site, further connecting Compass, especially the duplex homes in this site plan, to a more enhanced outdoor experience within the entire development.

As part of the Town's Parks, Recreation, Open Space, & Trails Master Plan, this property requires a regional spine trail that will run along the northern project boundaries parallel to Vista Parkway. This trail will be the Town's 10 foot wide concrete trail that will connect resident's on a regional scale to the Coal Creek Trail.

The entirety of this site plan's outdoor amenities and common areas will be HOA maintained with the exception of the regional spine trail which will be the responsibility of the Town.

SECTION F:

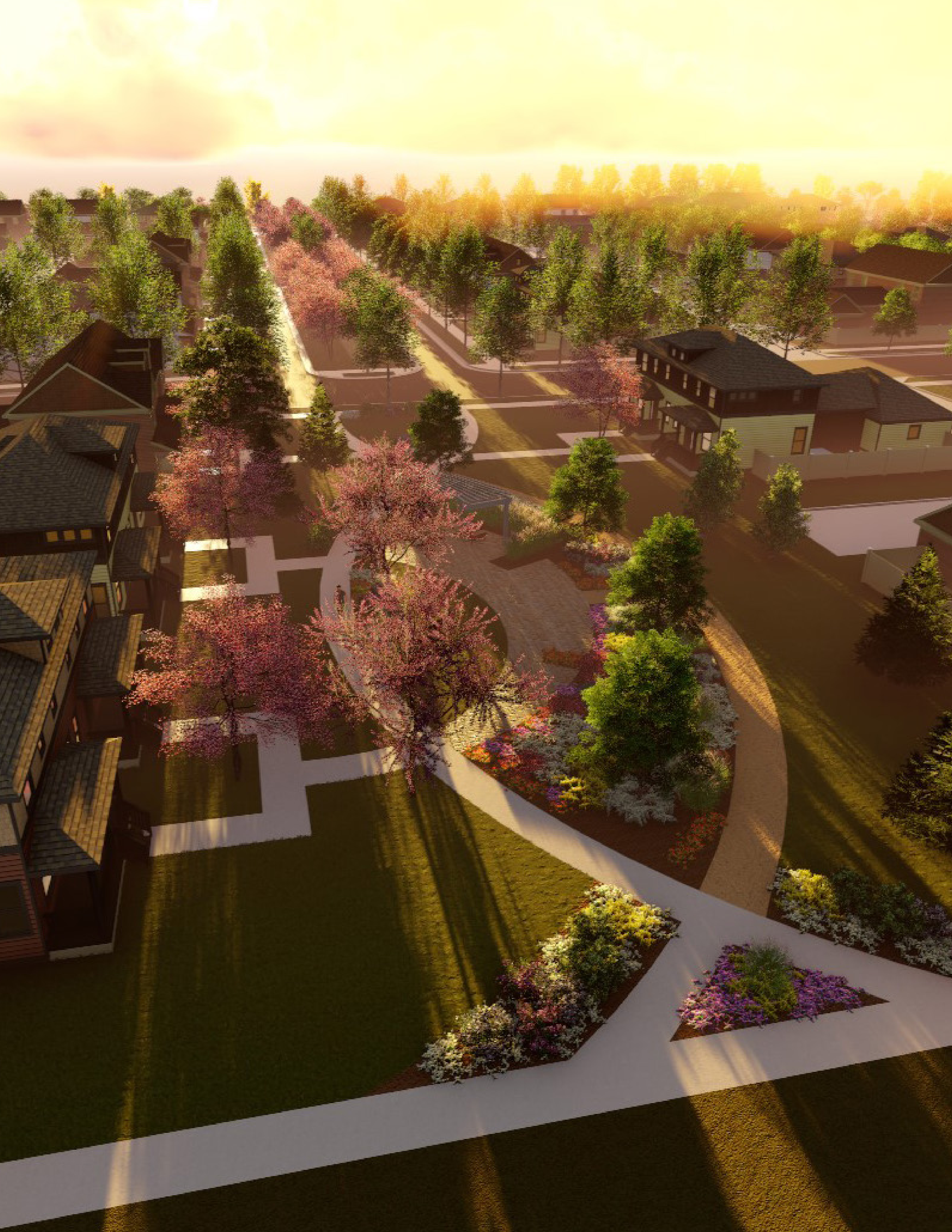
MINERAL RIGHTS DESCRIPTION

Mineral Rights

There is a surface use agreement in place for the entire Compass property however there is no impact to this portion the property.

Easements

All existing or proposed easements have been accommodated in the design of the community. In general there are no more development restrictions than is typical in any residential community.



PLAN 2421-1305 & 1306 FRONT ELEVATION “CL”

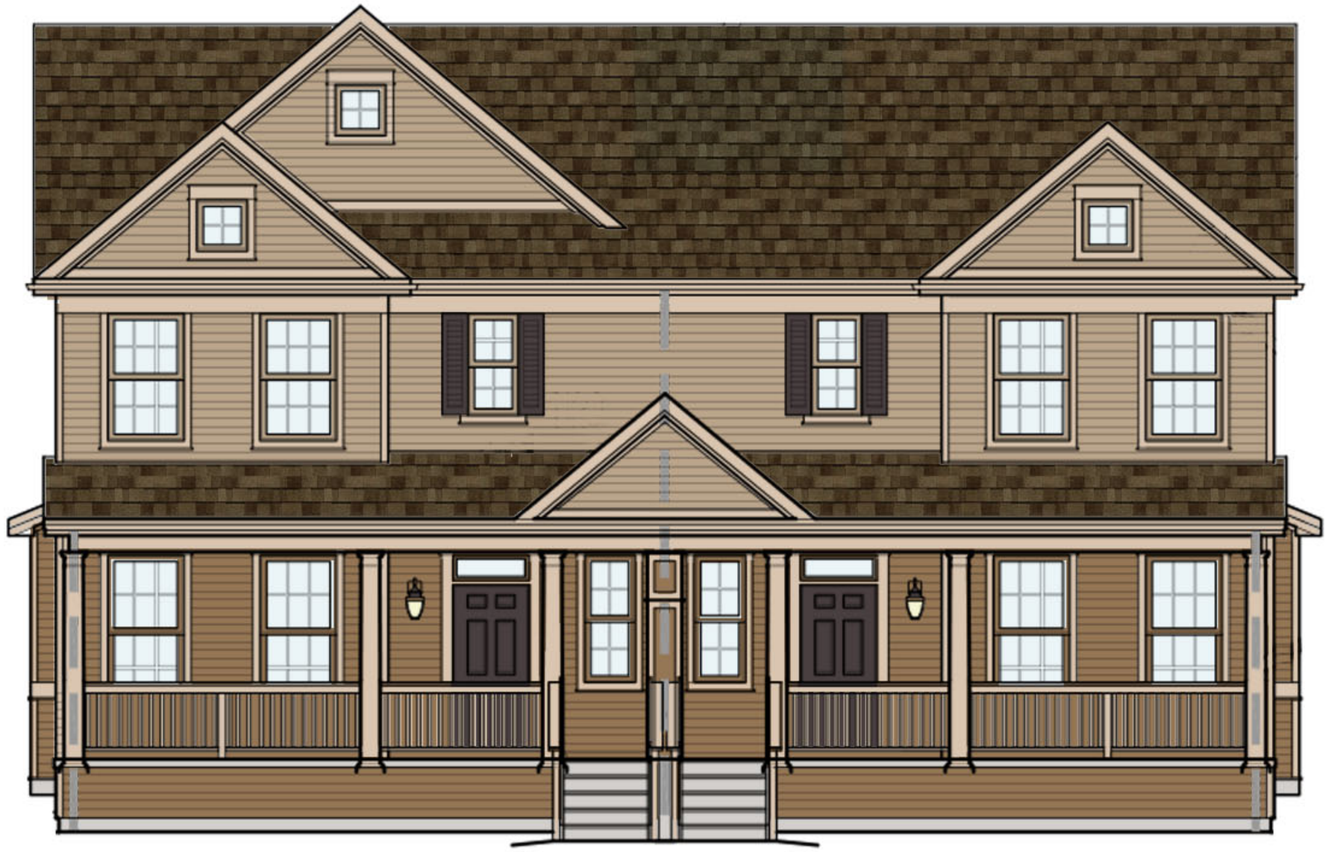
COMPASS FILING NO. 4

ARCHITECTURAL COLORED ELEVATIONS

PLAN 2421-1305 & 1306 FRONT ELEVATION “CR”

COMPASS FILING NO. 4

ARCHITECTURAL COLORED ELEVATIONS



PLAN 2422-1466 & 1467 FRONT ELEVATION “CR”

TOWN OF ERIE
1874

COMPASS FILING NO. 4

ARCHITECTURAL COLORED ELEVATIONS

PLAN 2422-1466 & 1467 FRONT ELEVATION “VC”

TOWN OF ERIE
1874

COMPASS FILING NO. 4

ARCHITECTURAL COLORED ELEVATIONS

PLAN 2423-1806 & 1807 FRONT ELEVATION “CL”

TOWN OF ERIE
1874

COMPASS FILING NO. 4

ARCHITECTURAL COLORED ELEVATIONS

PLAN 2423-1806 & 1807 FRONT ELEVATION “CR”

COMPASS FILING NO. 4

ARCHITECTURAL COLORED ELEVATIONS

TOWN OF ERIE
1874

PAIRED HOMES at
COMPASS
CALATLANTIC HOMES

STELLA
19JULY17

PAIRED HOMES at COMPASS: CALATLANTIC HOMES

STELLA
19JULY17

	SCHEME 1	**SCHEME 2**	**SCHEME 3**	**SCHEME 4**	**SCHEME 5**
ROOF	GAF BARKWOOD W/BRONZE	GAF WEATHERED WOOD W/BRONZE	GAF BARKWOOD W/BRONZE	GAF WEATHERED WOOD W/BRONZE	GAF BARKWOOD W/BRONZE
BODY1	SHERWIN WILLIAMS SW6054 CANYON CLAY	SHERWIN WILLIAMS SW7690 TOWNHALL TAN	SHERWIN WILLIAMS SW6095 TOASTY	SHERWIN WILLIAMS SW7544 FENLAND	SHERWIN WILLIAMS SW6172 HARDWARE
TRIM	SHERWIN WILLIAMS SW7512 PAVILION BEIGE	SHERWIN WILLIAMS SW6106 KILIM BEIGE	SHERWIN WILLIAMS SW7719 FRESCO CREAM	SHERWIN WILLIAMS SW7542 NATUREL	SHERWIN WILLIAMS SW7542 NATUREL
BODY2+ GARAGE	SHERWIN WILLIAMS SW7508 TAVERN TAUPE	SHERWIN WILLIAMS SW7032 WARM STONE	SHERWIN WILLIAMS SW6101 SANDS OF TIME	SHERWIN WILLIAMS SW7543 AVENUE TAN	SHERWIN WILLIAMS SW7549 STUDIO TAUPE
ACCENT	SHERWIN WILLIAMS SW6075 GARRET GRAY	SHERWIN WILLIAMS SW7625 MOUNT ETNA	SHERWIN WILLIAMS SW7630 RAISIN	SHERWIN WILLIAMS SW6012 BROWSE BROWN	SHERWIN WILLIAMS SW6006 BLACK BEAN
BRICK	GENERAL SHALE OLD CHICAGO	GENERAL SHALE COFFEEBEAN	GENERAL SHALE OLD CHICAGO	GENERAL SHALE OLD CHICAGO	GENERAL SHALE COFFEEBEAN

	SCHEME 6	**SCHEME 7**	**SCHEME 8**	**SCHEME 9**	**SCHEME 10**
ROOF	GAF WEATHERED WOOD W/BRONZE	GAF WEATHERED WOOD W/BRONZE	GAF BARKWOOD W/BRONZE	GAF WEATHERED WOOD W/BRONZE	GAF BARKWOOD W/BRONZE
BODY1	SHERWIN WILLIAMS SW7622 HOMBURG GRAY	SHERWIN WILLIAMS SW7655 STAMPED CONCRETE	SHERWIN WILLIAMS SW6005 FOLKSTONE	SHERWIN WILLIAMS SW6074 SPALDING GRAY	SHERWIN WILLIAMS SW7040 SMOKEHOUSE
TRIM	SHERWIN WILLIAMS SW7641 COLLONADE GRAY	SHERWIN WILLIAMS SW6197 ALOOF GRAY	SHERWIN WILLIAMS SW7030 ANEW GRAY	SHERWIN WILLIAMS SW6071 POPULAR GRAY	SHERWIN WILLIAMS SW7638 JOGGING PATH
BODY2+ GARAGE	SHERWIN WILLIAMS SW7642 PAVESTONE	SHERWIN WILLIAMS SW7019 GAUNTLET GRAY	SHERWIN WILLIAMS SW6004 MINK	SHERWIN WILLIAMS SW6072 VERSATILE GRAY	SHERWIN WILLIAMS SW7640 FAWN BRINDLE
ACCENT	SHERWIN WILLIAMS SW7041 VAN DYKE BROWN	SHERWIN WILLIAMS SW7594 CARRIAGE DOOR	SHERWIN WILLIAMS SW7630 RAISIN	SHERWIN WILLIAMS SW7027 WELL-BRED BROWN	SHERWIN WILLIAMS SW7595 SOMMELIER
BRICK	GENERAL SHALE WATERLODGE	GENERAL SHALE WATERLODGE	GENERAL SHALE COFFEEBEAN	GENERAL SHALE WATERLODGE	GENERAL SHALE OLD CHICAGO

PAIRED HOMES at COMPASS: CALATLANTIC HOMES

SIELLA
19JULY17

SCHEME 1

ROOF
GAF
BARKWOOD
W/BRONZE

BODY1
SHERWIN WILLIAMS
SW6054: CANYON CLAY

TRIM
SHERWIN WILLIAMS
SW7512: PAVILLION BEIGE

BODY2 + GARAGE
SHERWIN WILLIAMS
SW7508: TAVERN TAUPE

ACCENT
SHERWIN WILLIAMS
SW6075: GARRET GRAY

BRICK
GENERAL SHALE
OLD CHICAGO

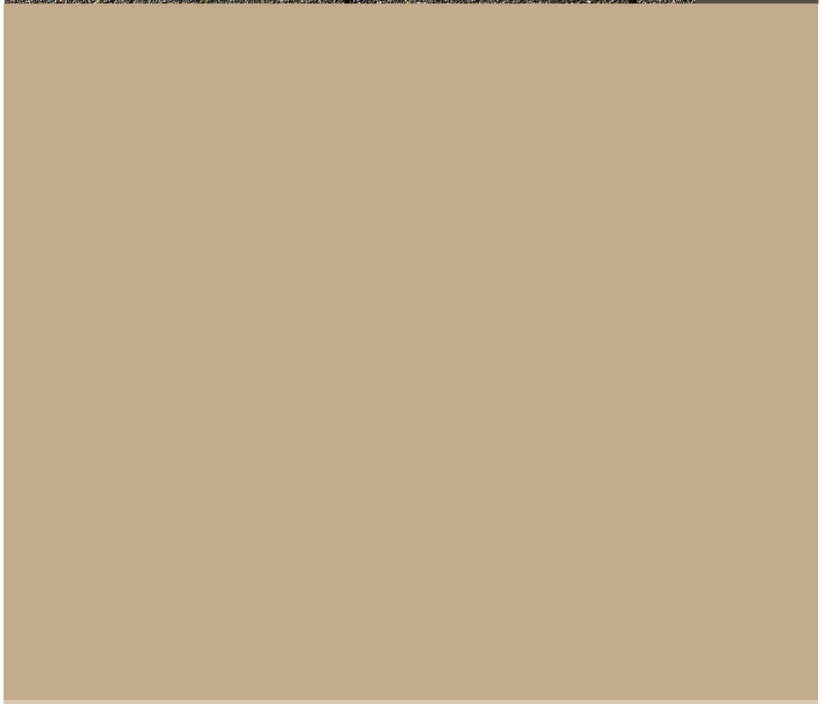
PAIRED HOMES at COMPASS: CALATLANTIC HOMES

STELLA
19JULY17

SCHEME 2

ROOF
GAF
WEATHERED WOOD
W/BRONZE

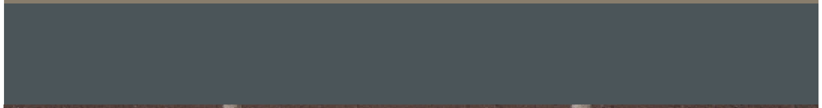
BODY1
SHERWIN WILLIAMS
SW7690: TOWNHALL TAN



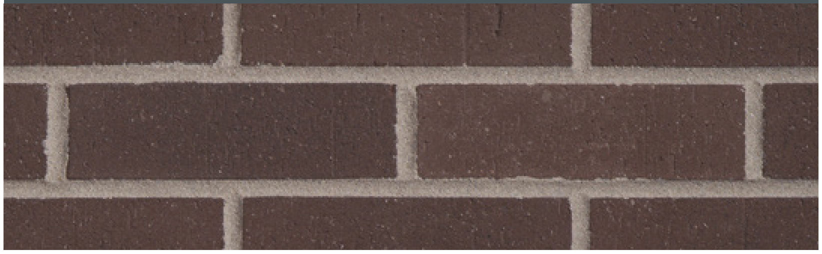
TRIM
SHERWIN WILLIAMS
SW6106: KILIM BEIGE

BODY2+ GARAGE
SHERWIN WILLIAMS
SW7032: WARM STONE

ACCENT
SHERWIN WILLIAMS
SW7625: MOUNT ETNA



BRICK
GENERAL SHALE
COFFEEBEAN



PAIRED HOMES at COMPASS: CALATLANTIC HOMES

STELLA
19JULY17

SCHEME 3

ROOF
GAF
BARKWOOD
W/BRONZE

BODY1
SHERWIN WILLIAMS
SW6095: TOASTY

TRIM
SHERWIN WILLIAMS
SW7719: FRESCO CREAM

BODY2+ GARAGE
SHERWIN WILLIAMS
SW6101: SANDS OF TIME

ACCENT
SHERWIN WILLIAMS
SW7630: RAISIN

BRICK
GENERAL SHALE
OLD CHICAGO

PAIRED HOMES at COMPASS: CalAtlantic HOMES

STELLA
19JULY17

SCHEME 4

ROOF
GAF
WEATHERED WOOD
W/BRONZE

BODY1
SHERWIN WILLIAMS
SW7544: FENLAND

TRIM
SHERWIN WILLIAMS
SW7542: NATUREL

BODY2+ GARAGE
SHERWIN WILLIAMS
SW7543: AVENUE TAN

ACCENT
SHERWIN WILLIAMS
SW6012: BROWSE BROWN

BRICK
GENERAL SHALE
OLD CHICAGO

PAIRED HOMES at COMPASS: CALATLANTIC HOMES

STELLA
19JULY17

SCHEME 5

ROOF
GAF
BARKWOOD
W/BRONZE

BODY1
SHERWIN WILLIAMS
SW6172: HARDWARE

TRIM
SHERWIN WILLIAMS
SW7542: NATUREL

BODY2+ GARAGE
SHERWIN WILLIAMS
SW7549: STUDIO TAUPE

ACCENT
SHERWIN WILLIAMS
SW6006: BLACK BEAN

BRICK
GENERAL SHALE
COFFEEBEAN

PAIRED HOMES at COMPASS: CALATLANTIC HOMES

STELLA
19JULY17

SCHEME 6

ROOF
GAF
WEATHERED WOOD
W/BRONZE

BODY1
SHERWIN WILLIAMS
SW7622: HOMBURG GRAY

TRIM
SHERWIN WILLIAMS
SW7641: COLLONADE GRAY

BODY2+ GARAGE
SHERWIN WILLIAMS
SW7642: PAVESTONE

ACCENT
SHERWIN WILLIAMS
SW7041: VAN DYKE BROWN

BRICK
GENERAL SHALE
WATERLODGE

PAIRED HOMES at COMPASS: CALATLANTIC HOMES

STELLA
19JULY17

SCHEME 7

ROOF
GAF
WEATHERED WOOD
W/BRONZE

BODY1
SHERWIN WILLIAMS
SW7655: STAMPED CONCRETE

TRIM
SHERWIN WILLIAMS
SW6197: ALOOF GRAY

BODY2+ GARAGE
SHERWIN WILLIAMS
SW7019: GAUNTLET GRAY

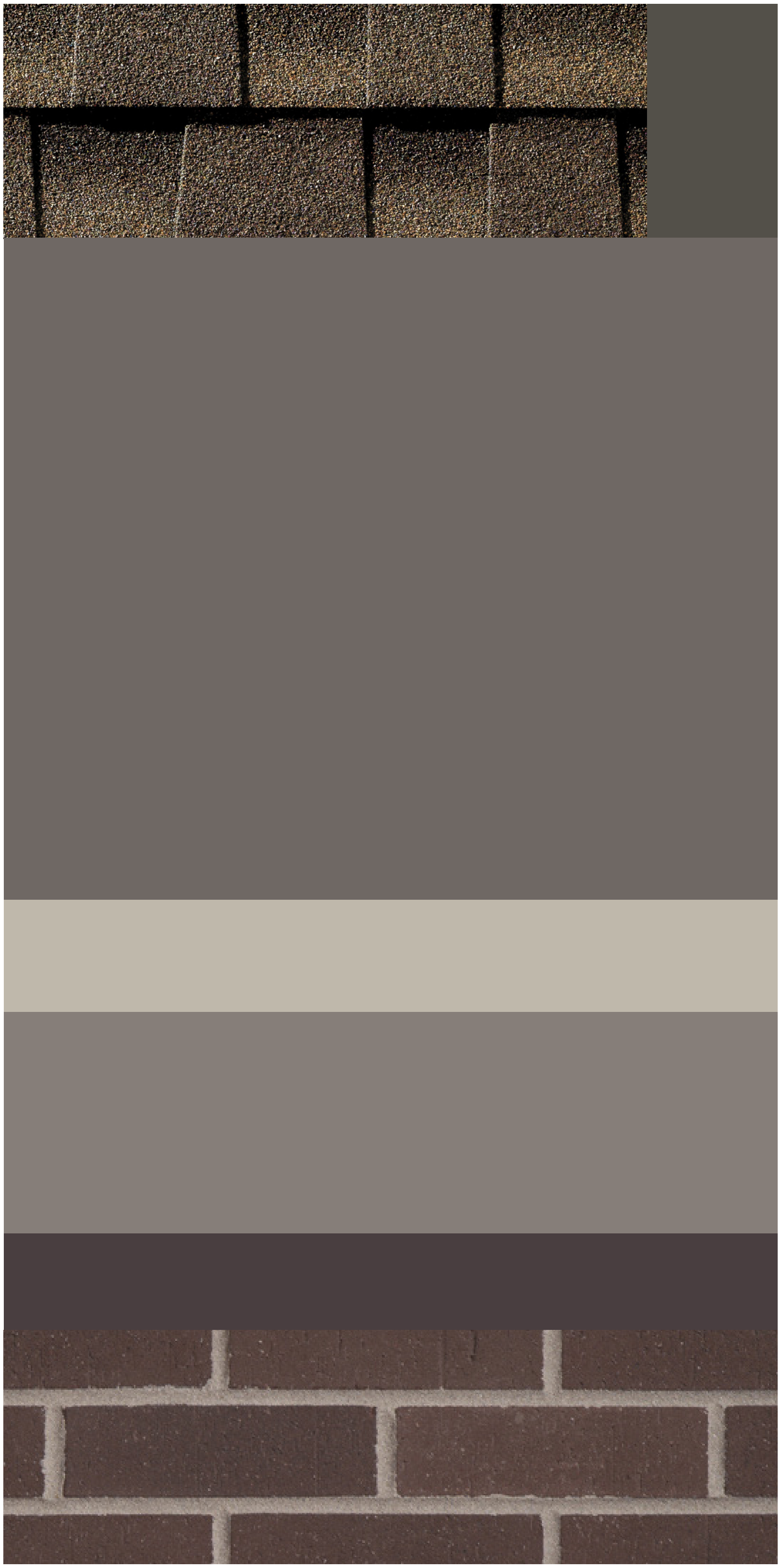
ACCENT
SHERWIN WILLIAMS
SW7594: CARRIAGE DOOR

BRICK
GENERAL SHALE
WATERLODGE

PAIRED HOMES at COMPASS: CALATLANTIC HOMES

STELLA
19JULY17

SCHEME 8



ROOF
GAF
BARKWOOD
W/BRONZE

BODY1
SHERWIN WILLIAMS
SW6005: FOLKSTONE

TRIM
SHERWIN WILLIAMS
SW7030: ANEW GRAY

BODY2+ GARAGE
SHERWIN WILLIAMS
SW6004: MINK

ACCENT
SHERWIN WILLIAMS
SW7630: RAISIN

BRICK
GENERAL SHALE
COFFEEBEAN

PAIRED HOMES at COMPASS: CALATLANTIC HOMES

STELLA
19JULY17

SCHEME 9

ROOF
GAF
WEATHERED WOOD
W/BRONZE

BODY1
SHERWIN WILLIAMS
SW6074: SPALDING GRAY

TRIM
SHERWIN WILLIAMS
SW6071: POPULAR GRAY

BODY2 + GARAGE
SHERWIN WILLIAMS
SW6072: VERSATILE GRAY

ACCENT
SHERWIN WILLIAMS
SW7027: WELL- BRED BROWN

BRICK
GENERAL SHALE
WATERLODGE

PAIRED HOMES at COMPASS: CalAtlantic Homes

STELLA
19JULY17

SCHEME 10

ROOF
GAF
BARKWOOD
W/BRONZE

BODY1
SHERWIN WILLIAMS
SW7040: SMOKEHOUSE

TRIM
SHERWIN WILLIAMS
SW7638: JOGGING PATH

BODY2+ GARAGE
SHERWIN WILLIAMS
SW7640: FAWN BRINDLE

ACCENT
SHERWIN WILLIAMS
SW7595: SOMMELIER

BRICK
GENERAL SHALE
OLD CHICAGO

First American Title Insurance Company - NCS
1125 17th Street, Suite 500
Denver, Colorado 80202
Phone: **(303)876-1112** Fax:**(877)235-9185**

DATE: November 21, 2018
FILE NUMBER: NCS-840345-A-CO
PROPERTY ADDRESS: A portion of the NE1/4, Section 25, Township 1 North, Range 69 West, Erie, CO
OWNER/BUYER: Erie Farm Metropolitan District/
YOUR REFERENCE NUMBER:
ASSESSOR PARCEL NUMBER: 146525000008

PLEASE REVIEW THE ENCLOSED MATERIAL COMPLETELY AND TAKE NOTE OF THE FOLLOWING TERMS CONTAINED THEREIN:
Transmittal:
Revision No.: 1
Schedule A: Effective Date
Schedule B - Section 1 Requirements: None
Schedule B - Section 2 Exceptions: added 9a, 22 and 23

Should you have any questions regarding these materials, please contact First American Title Insurance Company National Commercial Services at the above phone number. We sincerely thank you for your business.

TO:
First American Title Insurance Company National Commercial Services
1125 17th Street, Suite 500
Denver, Colorado 80202

TITLE OFFICER: Seth Holley
PHONE: **(303)876-1125**
FAX: **(877)235-9185**
E-MAIL: **seholley@firstam.com**
DELIVERY: **E-MAIL**

TO:
First American Title Insurance Company National Commercial Services
1125 17th Street, Suite 500
Denver, CO 80202

ESCROW OFFICER: **Tammi Thomas**
PHONE: **(303)876-1112**
FAX: **(877)235-9185**
E-MAIL: **TThomas@firstam.com**
DELIVERY: **E-MAIL**

To:
Lennar Colorado, LLC, a Colorado limited liability company
9193 South Jamaica Street, 4th Floor
Englewood, CO 80112-5935

ATTN: **Jennifer Waiton**
PHONE: **(303)486-5027**
MOBILE:
FAX:
E-MAIL: **jennifer.waiton@lennar.com**
DELIVERY: **E-MAIL**

To: **Ware Malcomb**

ATTN: **Tom Staab**
PHONE:
MOBILE:
FAX:
E-MAIL: **tom.staab@comcast.net**
DELIVERY: **E-MAIL**

To: **First American Title Insurance Company National Commercial Services**
1125 17th Street, Suite 750
Denver, CO 80202

ATTN: **Beverly M. Carlson**
PHONE: **(303)876-1138**
MOBILE: **(720)775-8892**
FAX: **(877)235-9185**
E-MAIL: **bevcarlson@firstam.com**
DELIVERY: **E-MAIL**

ALTA Commitment Form

COMMITMENT FOR TITLE INSURANCE

Issued by

First American Title Insurance Company

First American Title Insurance Company, a Nebraska corporation ("Company"), for a valuable consideration, commits to issue its policy or policies of title insurance, as identified in Schedule A, in favor of the Proposed Insured named in Schedule A, as owner or mortgagee of the estate or interest in the land described or referred to in Schedule A, upon payment of the premiums and charges and compliance with the Requirements; all subject to the provisions of Schedules A and B and to the Conditions of this Commitment.

This Commitment shall be effective only when the identity of the Proposed Insured and the amount of the policy or policies committed for have been inserted in Schedule A by the Company.

All liability and obligation under this Commitment shall cease and terminate six (6) months after the Effective Date or when the policy or policies committed for shall issue, whichever first occurs, provided that the failure to issue the policy or policies is not the fault of the Company.

The Company will provide a sample of the policy form upon request.

IN WITNESS WHEREOF, First American Title Insurance Company has caused its corporate name and seal to be affixed by its duly authorized officers on the date shown in Schedule A.

First American Title Insurance Company

Dennis J. Gilmore
President

Jeffrey S. Robinson

Jeffrey S. Robinson
Secretary

COMMITMENT FOR TITLE INSURANCE FORM
SCHEDULE A

1. Effective Date: November 15, 2018 at 5:00 p.m.

   a. ALTA Owner's Policy (06-17-06) $0.00

      Proposed Insured:
      None

   b. ALTA Loan Policy (06-17-06) $0.00

      Proposed Insured:
      None

2. The estate or interest in the Land described or referred to in this Commitment is:

   Fee Simple

3. Title to the estate or interest in the Land is at the Effective Date vested in:

   Erie Farm Metropolitan District, a special district of the State of Colorado

4. The Land referred to in this Commitment is described as follows:

   See Exhibit "A" attached hereto and made a part hereof.

   For informational purposes only: A portion of the NE1/4, Section 25, Township 1 North, Range 69 West,
   Erie, Colorado

EXHIBIT A

Commitment No.: NCS-840345-A-CO

The land referred to in Schedule A is situated in the County of Boulder, State of Colorado and is described as follows:

A parcel of land located in the Northeast Quarter of Section 25, Township 1 North, Range 69 West of the 6th P.M., Town of Erie, County of Boulder, State of Colorado, being more particularly described as follows:

Commencing at the Southeast corner of said Northeast Quarter of Section 25, and considering the East line of said Southeast Quarter of Section 25 to bear South 00°21'41" West, with all bearings hereon relative thereto;

Thence North 89°42'40" West along the South line of said Northeast Quarter a distance of 30.00 feet to a point on the westerly right-of-way line of East County Line Road (County Road No. 901), said point also being the Point of Beginning;

Thence continuing North 89°42'40" West along said South line of the Northeast Quarter of Section 25 a distance of 360.86 feet to a point of curvature;
Thence along a non-tangent curve to the left having a central angle of 19°18'50", a radius of 160 feet, an arc length of 53.93 feet, and a chord that bears North 80°37'55" East a distance of 53.68 feet;
Thence North 70°58'30" East a distance of 52.88 feet to a point of curvature;
Thence along a curve to the right having a central angle of 19°18'50", a radius of 240.00 feet, an arc length of 80.90 feet, and a chord that bears North 80°37'55"E East a distance of 80.52 feet;
Thence South 89°42'40" East a distance of 142.66 feet to a point of curvature;
Thence along a curve to the left having a central angle of 90°57'20", a radius of 2.00 feet, an arc length of 31.75 feet, and a chord that bears South 44°48'40" West;
Thence North 00°40'00" West a distance of 278.78 feet;
Thence North 03°55'56"East a distance of 187.08 feet to a point on said westerly right-of-way line of East County Line Road (County Road No. 901);
Thence South 00°40'00" East along said westerly right-of-way line a distance of 525.85 feet to the Point of Beginning,

County of Boulder, State of Colorado.

For informational purposes only: APN: 146525000008

COMMITMENT FOR TITLE INSURANCE FORM

SCHEDULE B

SECTION ONE

REQUIREMENTS

The following requirements must be met:

1. Pay the agreed amounts for the interest in the land and/or the mortgage to be insured.

2. Pay us the premiums, fees and charges for the policy.

3. Payment of all taxes and assessments now due and payable.

LIMITATION OF LIABILITY FOR INFORMATIONAL REPORT

IMPORTANT – READ CAREFULLY: THIS REPORT IS NOT AN INSURED PRODUCT OR SERVICE OR A REPRESENTATION OF THE CONDITION OF TITLE TO REAL PROPERTY. IT IS NOT AN ABSTRACT, LEGAL OPINION, OPINION OF TITLE, TITLE INSURANCE COMMITMENT OR PRELIMINARY REPORT, OR ANY FORM OF TITLE INSURANCE OR GUARANTY. THIS REPORT IS ISSUED EXCLUSIVELY FOR THE BENEFIT OF THE APPLICANT THEREFOR, AND MAY NOT BE USED OR RELIED UPON BY ANY OTHER PERSON. THIS REPORT MAY NOT BE REPRODUCED IN ANY MANNER WITHOUT FIRST AMERICAN'S PRIOR WRITTEN CONSENT. FIRST AMERICAN DOES NOT REPRESENT OR WARRANT THAT THE INFORMATION HEREIN IS COMPLETE OR FREE FROM ERROR, AND THE INFORMATION HEREIN IS PROVIDED WITHOUT ANY WARRANTIES OF ANY KIND, AS-IS, AND WITH ALL FAULTS. AS A MATERIAL PART OF THE CONSIDERATION GIVEN IN EXCHANGE FOR THE ISSUANCE OF THIS REPORT, RECIPIENT AGREES THAT FIRST AMERICAN'S SOLE LIABILITY FOR ANY LOSS OR DAMAGE CAUSED BY AN ERROR OR OMISSION DUE TO INACCURATE INFORMATION OR NEGLIGENCE IN PREPARING THIS REPORT SHALL BE LIMITED TO THE FEE CHARGED FOR THE REPORT. RECIPIENT ACCEPTS THIS REPORT WITH THIS LIMITATION AND AGREES THAT FIRST AMERICAN WOULD NOT HAVE ISSUED THIS REPORT BUT FOR THE LIMITATION OF LIABILITY DESCRIBED ABOVE. FIRST AMERICAN MAKES NO REPRESENTATION OR WARRANTY AS TO THE LEGALITY OR PROPRIETY OF RECIPIENT'S USE OF THE INFORMATION HEREIN.

COMMITMENT FOR TITLE INSURANCE FORM

SCHEDULE B

SECTION TWO

EXCEPTIONS

Schedule B of the policy or policies to be issued will contain exceptions to the following matters unless the same are disposed of to the satisfaction of the Company:

1. Any facts, rights, interests or claims which are not shown by the Public Records, but which could be ascertained by an inspection of the Land or by making inquiry of persons in possession thereof.

2. Easements, or claims of easements, not shown by the Public Records.

3. Discrepancies, conflicts in boundary lines, shortage in area, encroachments, and any facts which a correct survey and inspection of the Land would disclose, and which are not shown by the public records.

4. Any lien, or right to a lien, for services, labor or material heretofore or hereafter furnished, imposed by law and not shown in the Public Records.

5. Any and all unpaid taxes, assessments and unredeemed tax sales.

6. Unpatented mining claims; reservations or exceptions in patents or in Acts authorizing the issuance thereof.

7. Reservations made by the Union Pacific Railway Company, as evidenced by the Deed recorded June 3, 1883 in Book 157 at Page 423, providing substantially as follows: Reserving to said Company, and its assigns all Coal that may be underneath the surface of land herein described, also such right of way and other grounds as may appear necessary for proper working of any coal mines that may be developed upon said premises, and for transportation of coal from same, and any and all assignments thereof or interest therein.

8. This item has been intentionally deleted.

9. Oil and Gas Lease recorded August 22, 1980 at Reception No. 409220, and any and all assignments thereof or interests therein.

   NOTE: Assignment, Conveyance and Bill of Sale in connection therewith recorded August 23, 2018 at Reception No. 03672748.

10. An easement for a pipe line and incidental purposes granted to Panhandle Eastern Pipe Line Company, as set forth in an instrument recorded October 30, 1981 at Reception No. 470728 and recorded May 14, 1982 at Reception No. 494456.

11. An easement for pipelines and incidental purposes granted to Western Gas Supply Company, as set forth in an instrument recorded September 28, 1984 at Reception No. 00649223.

12. Oil and Gas Lease recorded November 2, 1988 at Reception No. 00950820, and any and all assignments thereof or interests therein.

13. Terms, conditions, provisions, obligations, easements and agreements as set forth in the Order Granting Request for Immediate Possession recorded April 17, 1995 at Reception No. 1510245 and recorded April 18, 1995, at Reception No. 1510592 and as set forth in Amended Rule and Order recorded September 24, 1997 at Reception No. 1733537.

14. Terms, conditions, provisions, obligations and agreements as set forth in the Surface Damages Agreement recorded July 26, 1996 at Reception No. 01628474.

15. Request for Notification of Surface Development recorded June 17, 2002 at Reception No. 2288463, April 11, 2006 at Reception No. 2769125 and Correction thereto recorded May 10, 2006 at Reception No. 2775747.

16. Request for Notification (Mineral Estate Owner) recorded December 21, 2007 at Reception No. 2900941.

17. Terms, conditions, provisions, obligations and agreements as set forth in the Ordinance No. 30-2013 recorded November 6, 2013 at Reception No. 03351719 and re-recorded December 4, 2013 at Reception No. 03355845.

18. Terms, conditions, provisions, obligations and agreements as set forth in the Ordinance No. 07-2014 recorded June 16, 2014 at Reception No. 03385640.

19. Terms, conditions, provisions, obligations and agreements as set forth in the Order Concerning Northern Colorado Water Conservancy District's Interests recorded May 27, 2015 at Reception No. 03448168 and Stipulation Concerning Order Concerning Northern Colorado Water Conservancy District's Interests recorded May 27, 2015 at Reception No. 03448169.

20. Terms, conditions, provisions, obligations and agreements as set forth in the Amended Findings of Fact, Conclusions of Law and Order recorded August 14, 2015 at Reception No. 03467015.

21. Terms, conditions, provisions, obligations and agreements as set forth in the Settlement Agreement recorded August 18, 2015 at Reception No. 03467741.

22. Easements, notes, covenants, restrictions and rights-of-way as shown on the Erie Farms No. 2 Zoning Map, recorded October 10, 2018 at Reception No. 03680358.

23. Easements, notes, covenants, restrictions and rights-of-way as shown on the Erie Farms Annexation , recorded October 10, 2018 at Reception No. 03680359.

24. Existing leases and tenancies.

EXHIBIT B
Statement of Charges

Informational Commitment	$500.00

CONDITIONS

1. The term mortgage, when used herein, shall include deed of trust, trust deed, or other security instrument.

2. If the proposed Insured has or acquired actual knowledge of any defect, lien, encumbrance, adverse claim or other matter affecting the estate or interest or mortgage thereon covered by this Commitment other than those shown in Schedule B hereof, and shall fail to disclose such knowledge to the Company in writing, the Company shall be relieved from liability for any loss or damage resulting from any act of reliance hereon to the extent the Company is prejudiced by failure to so disclose such knowledge. If the proposed Insured shall disclose such knowledge to the Company, or if the Company otherwise acquires actual knowledge of any such defect, lien, encumbrance, adverse claim or other matter, the Company at its option may amend Schedule B of this Commitment accordingly, but such amendment shall not relieve the Company from liability previously incurred pursuant to paragraph 3 of these Conditions and Stipulations.

3. Liability of the Company under this Commitment shall be only to the named proposed Insured and such parties included under the definition of Insured in the form of policy or policies committed for and only for actual loss incurred in reliance hereon in undertaking in good faith (a) to comply with the requirements hereof, or (b) to eliminate exceptions shown in Schedule B, or (c) to acquire or create the estate or interest or mortgage thereon covered by this Commitment. In no event shall such liability exceed the amount stated in Schedule A for the policy or policies committed for and such liability is subject to the insuring provisions and Conditions and Stipulations and the Exclusions from Coverage of the form of policy or policies committed for in favor of the proposed Insured which are hereby incorporated by reference and are made a part of this Commitment except as expressly modified herein.

4. This Commitment is a contract to issue one or more title insurance policies and is not an abstract of title or a report of the condition of title. Any action or actions or rights of action that the proposed Insured may have or may bring against the Company arising out of the status of the title to the estate or interest or the status of the mortgage thereon covered by this Commitment must be based on and are subject to the provisions of this Commitment.

5. The policy to be issued contains an arbitration clause. All arbitrable matters when the Amount of Insurance is $2,000,000 or less shall be arbitrated at the option of either the Company or the Insured as the exclusive remedy of the parties. You may review a copy of the arbitration rules at http://www.alta.org/.

First American Title

Privacy Information

We Are Committed to Safeguarding Customer Information

In order to better serve your needs now and in the future, we may ask you to provide us with certain information. We understand that you may be concerned about what we will do with such information - particularly any personal or financial information. We agree that you have a right to know how we will utilize the personal information you provide to us. Therefore, together with our subsidiaries we have adopted this Privacy Policy to govern the use and handling of your personal information.

Applicability

This Privacy Policy governs our use of the information that you provide to us. It does not govern the manner in which we may use information we have obtained from any other source, such as information obtained from a public record or from another person or entity. First American has also adopted broader guidelines that govern our use of personal information regardless of its source. First American calls these guidelines its Fair Information Values.

Types of Information

Depending upon which of our services you are utilizing, the types of nonpublic personal information that we may collect include:

- Information we receive from you on applications, forms and in other communications to us, whether in writing, in person, by telephone or any other means;
- Information about your transactions with us, our affiliated companies, or others; and
- Information we receive from a consumer reporting agency.

Use of Information

We request information from you for our own legitimate business purposes and not for the benefit of any nonaffiliated party. Therefore, we will not release your information to nonaffiliated parties except: (1) as necessary for us to provide the product or service you have requested of us; or (2) as permitted by law. We may, however, store such information indefinitely, including the period after which any customer relationship has ceased. Such information may be used for any internal purpose, such as quality control efforts or customer analysis. We may also provide all of the types of nonpublic personal information listed above to one or more of our affiliated companies. Such affiliated companies include financial service providers, such as title insurers, property and casualty insurers, and trust and investment advisory companies, or companies involved in real estate services, such as appraisal companies, home warranty companies and escrow companies. Furthermore, we may also provide all the information we collect, as described above, to companies that perform marketing services on our behalf, on behalf of our affiliated companies or to other financial institutions with whom we or our affiliated companies have joint marketing agreements.

Former Customers

Even if you are no longer our customer, our Privacy Policy will continue to apply to you.

Confidentiality and Security

We will use our best efforts to ensure that no unauthorized parties have access to any of your information. We restrict access to nonpublic personal information about you to those individuals and entities who need to know that information to provide products or services to you. We will use our best efforts to train and oversee our employees and agents to ensure that your information will be handled responsibly and in accordance with this Privacy Policy and First American's Fair Information Values. We currently maintain physical, electronic, and procedural safeguards that comply with federal regulations to guard your nonpublic personal information.

Information Obtained Through Our Web Site

First American Financial Corporation is sensitive to privacy issues on the Internet. We believe it is important you know how we treat the information about you we receive on the Internet.

In general, you can visit First American or its affiliates' Web sites on the World Wide Web without telling us who you are or revealing any information about yourself. Our Web servers collect the domain names, not the e-mail addresses, of visitors. This information is aggregated to measure the number of visits, average time spent on the site, pages viewed and similar information. First American uses this information to measure the use of our site and to develop ideas to improve the content of our site.

There are times, however, when we may need information from you, such as your name and email address. When information is needed, we will use our best efforts to let you know at the time of collection how we will use the personal information. Usually, the personal information we collect is used only by us to respond to your inquiry, process an order or allow you to access specific account/profile information. If you choose to share any personal information with us, we will only use it in accordance with the policies outlined above.

Business Relationships

First American Financial Corporation's site and its affiliates' sites may contain links to other Web sites. While we try to link only to sites that share our high standards and respect for privacy, we are not responsible for the content or the privacy practices employed by other sites.

Cookies

Some of First American's Web sites may make use of "cookie" technology to measure site activity and to customize information to your personal tastes. A cookie is an element of data that a Web site can send to your browser, which may then store the cookie on your hard drive.

FirstAm.com uses stored cookies. The goal of this technology is to better serve you when visiting our site, save you time when you are here and to provide you with a more meaningful and productive Web site experience.

Fair Information Values

Fairness We consider consumer expectations about their privacy in all our businesses. We only offer products and services that assure a favorable balance between consumer benefits and consumer privacy.

Public Record We believe that an open public record creates significant value for society, enhances consumer choice and creates consumer opportunity. We actively support an open public record and emphasize its importance and contribution to our economy.

Use We believe we should behave responsibly when we use information about a consumer in our business. We will obey the laws governing the collection, use and dissemination of data.

Accuracy We will take reasonable steps to help assure the accuracy of the data we collect, use and disseminate. Where possible, we will take reasonable steps to correct inaccurate information. When, as with the public record, we cannot correct inaccurate information, we will take all reasonable steps to assist consumers in identifying the source of the erroneous data so that the consumer can secure the required corrections.

Education We endeavor to educate the users of our products and services, our employees and others in our industry about the importance of consumer privacy. We will instruct our employees on our fair information values and on the responsible collection and use of data. We will encourage others in our industry to collect and use information in a responsible manner.

Security We will maintain appropriate facilities and systems to protect against unauthorized access to and corruption of the data we maintain.

DISCLOSURE STATEMENT

Pursuant to C.R.S. 30-10-406(3)(a) all documents received for recording or filing in the Clerk and Recorder's office shall contain a top margin of at least one inch and a left, right and bottom margin of at least one-half of an inch. The Clerk and Recorder will refuse to record or file any document that does not conform to the requirements of this section.

NOTE: If this transaction includes a sale of the property and the price exceeds $100,000.00, the seller must comply with the disclosure/withholding provisions of C.R.S. 39-22-604.5 (Nonresident withholding).

NOTE: Colorado Division of Insurance Regulations 8-1-2 requires that "Every title insurance company shall be responsible to the proposed insured(s) subject to the terms and conditions of the title commitment, other than the effective date of the title commitment, for all matters which appear of record prior to the time of recording whenever the title insurance company, or its agent, conducts the closing and settlement service that is in conjunction with its issuance of an owner's policy of title insurance and is responsible for the recording and filing of legal documents resulting from the transaction which was closed.

Pursuant to C.R.S. 10-11-122, the company will not issue its owner's policy or owner's policies of title insurance contemplated by this commitment until it has been provided a Certificate of Taxes due or other equivalent documentation from the County Treasurer or the County Treasurer's authorized agent; or until the Proposed Insured has notified or instructed the company in writing to the contrary.

The subject property may be located in a special taxing district. A Certificate of Taxes due listing each taxing jurisdiction shall be obtained from the County Treasurer or the County Treasurer's authorized agent. Information regarding special districts and the boundaries of such districts may be obtained from the Board of County Commissioners, the County Clerk and Recorder, or the County Assessor.

NOTE: Pursuant to CRS 10-11-123, notice is hereby given:

This notice applies to owner's policy commitments containing a mineral severance instrument exception, or exceptions, in Schedule B, Section 2.

A. **That there is recorded evidence that a mineral estate has been severed, leased, or otherwise conveyed from the surface estate and that there is a substantial likelihood that a third party holds some or all interest in oil, gas, other minerals, or geothermal energy in the property; and**
B. **That such mineral estate may include the right to enter and use the property without the surface owner's permission.**

NOTE: Pursuant to Colorado Division of Insurance Regulations 8-1-2, Affirmative mechanic's lien protection for the Owner may be available (typically by deletion of Exception no. 4 of Schedule B, Section 2 of the Commitment from the Owner's Policy to be issued) upon compliance with the following conditions:

A. **The land described in Schedule A of this commitment must be a single family residence which includes a condominium or townhouse unit.**
B. **No labor or materials have been furnished by mechanics or material-men for purposes of construction on the land described in Schedule A of this Commitment within the past 6 months.**
C. **The Company must receive an appropriate affidavit indemnifying the Company against un-filed mechanic's and material-men's liens.**
D. **The Company must receive payment of the appropriate premium.**

E. **If there has been construction, improvements or major repairs undertaken on the property to be purchased within six months prior to the Date of the Commitment, the requirements to obtain coverage for unrecorded liens will include: disclosure of certain construction information; financial information as to the seller, the builder and or the contractor; payment of the appropriate premium, fully executed Indemnity Agreements satisfactory to the company, and, any additional requirements as may be necessary after an examination of the aforesaid information by the Company.**

No coverage will be given under any circumstances for labor or material for which the insured has contracted for or agreed to pay.

NOTE: Pursuant to C.R.S. 38-35-125(2) no person or entity that provides closing and settlement services for a real estate transaction shall disburse funds as a part of such services until those funds have been received and are available for immediate withdrawal as a matter of right.

NOTE: C.R.S. 39-14-102 requires that a real property transfer declaration accompany any conveyance document presented for recordation in the State of Colorado. Said declaration shall be completed and signed by either the grantor or grantee.

NOTE: Pursuant to CRS 10-1-128(6)(a), It is unlawful to knowingly provide false, incomplete, or misleading facts or information to an insurance company for the purpose of defrauding or attempting to defraud the company. Penalties may include imprisonment, fines, denial of insurance and civil damages. Any insurance company or agent of an insurance company who knowingly provides false, incomplete, or misleading facts or information to a policyholder or claimant for the purpose of defrauding or attempting to defraud the policyholder or claimant with regard to a settlement or award payable from insurance proceeds shall be reported to the Colorado division of insurance within the department of regulatory agencies.

NOTE: Pursuant to Colorado Division of Insurance Regulations 8-1-3, notice is hereby given of the availability of an ALTA Closing Protection Letter which may, upon request, be provided to certain parties to the transaction identified in the commitment.

Nothing herein contained will be deemed to obligate the company to provide any of the coverages referred to herein unless the above conditions are fully satisfied.

CALATLANTIC
HOMES℠

July 13, 2017

Town of Erie
Community Development Department – Planning Division
645 Holbrook Street
PO Box 750
Erie, CO 80516

CalAtlantic Homes, as the Land Owner of Compass Development, hereby authorizes John Prestwich of PCS Group to make applications to the Town of Erie for Site Plan & PUD Plan Applications within the Compass Development.

Owner:
CalAtlantic Homes

By: Kent Pedersen

Name: KENT PEDERSEN

Title: VP LAND

STATE OF COLORADO
)SS.
COUNTY OF BOULDER

Subscribed and sworn to before me this 13th day of JULY, 201~~6~~7 KP by
KENT PEDERSEN as VP LAND (title) of CalAtlantic Homes.

Witness my hand and official seal.

My commission expires: Jen S. Waiton
Notary Public

JENNIFER S. WAITON
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20144027146
COMMISSION EXPIRES JUL. 10, 2018

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT

CONSTRUCTION PLANS FOR
COMPASS FILING NO. 4
A PORTION OF THE SOUTHEAST QUARTER OF SECTION 25, TOWNSHIP 1 NORTH, RANGE 69 WEST OF THE 6TH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF BOULDER, STATE OF COLORADO
21.05 ACRES± - 146 LOTS - 23 TRACTS

AGENCY CONTACT LIST

OWNER/DEVELOPER

LENNAR HOMES (303) 486-5002
9193 SOUTH JAMAICA STREET
ENGLEWOOD, COLORADO 80112
CONTACT: KENT PEDERSEN

CIVIL ENGINEER/SURVEYOR

WARE MALCOMB (303) 561-3333
990 SOUTH BROADWAY SUITE 230
DENVER, COLORADO 80209
CONTACT: GREG BLOUNT

LANDSCAPE ARCHITECT/PLANNER

PCS GROUP INC. (720) 465-2261
200 KALAMATH STREET
DENVER, COLORADO 80223
CONTACT: JOHN PRESTWICH

TOWN OF ERIE

TOWN OF ERIE (303) 926-2870
645 HOLBROOK STREET
P.O. BOX 750
ERIE, COLORADO 80516
CONTACT: MATT WIEDERSPAHN

PUBLIC UTILITIES

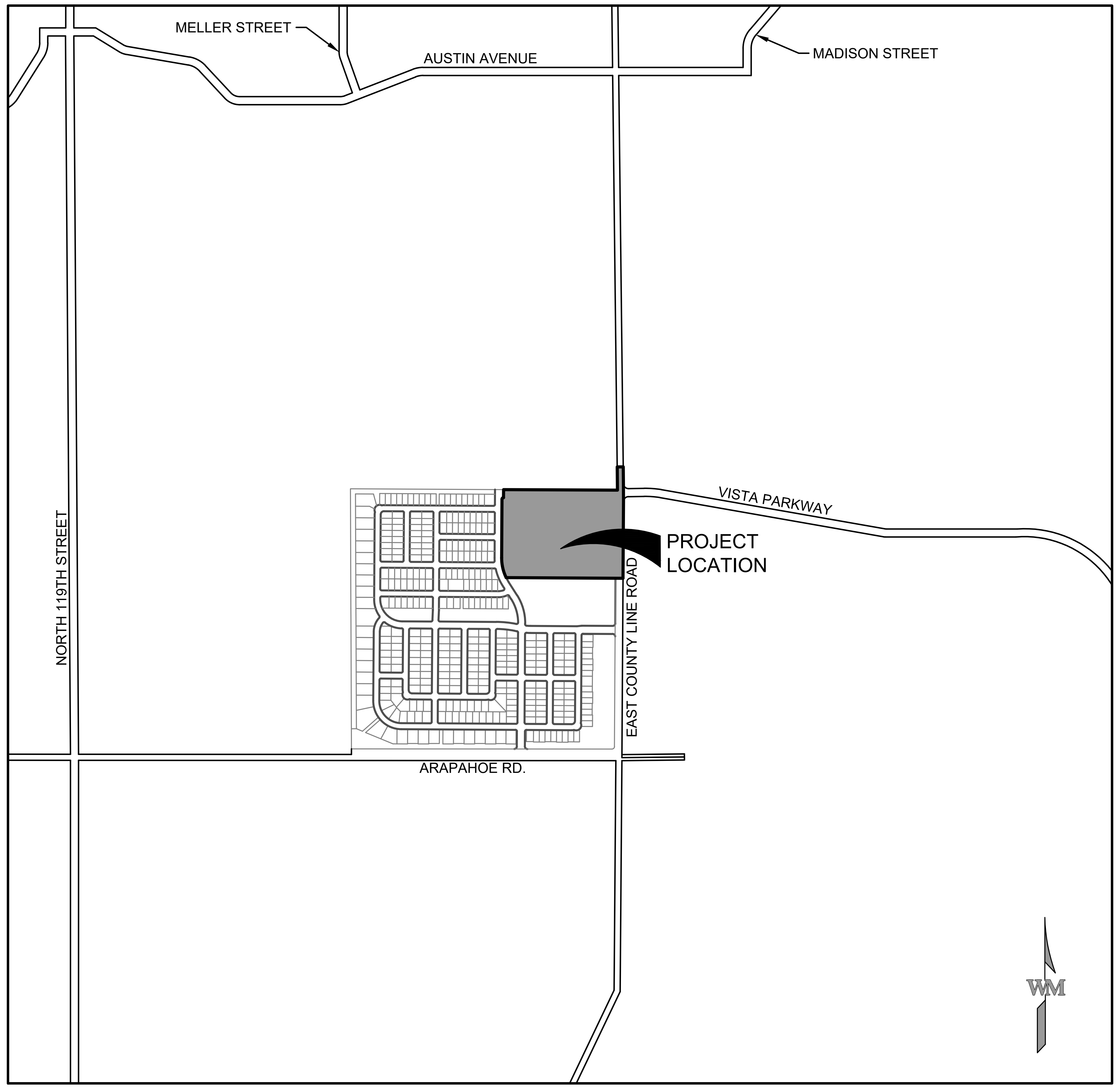
XCEL ENERGY (303) 571-3358
1123 WEST 3RD AVENUE
DENVER, COLORADO 80223

NORTHERN COLORADO WATER CONSERVANCY DISTRICT (970) 532-7700
220 WATER AVENUE
BERTHOUD, COLORADO 80513

NOBLE ENERGY PRODUCTION, INC. (303) 389-3600
1625 BROADWAY SUITE 2000
DENVER, CO 80202

CENTURY LINK (303) 840-1103
11290 SOUTH TWENTY MILE ROAD #130
PARKER, COLORADO 80134

COMCAST (303) 578-5142
6850 SOUTH TUCSON WAY
ENGLEWOOD, COLORADO 80112



VICINITY MAP
1"=1000'

SHEET INDEX CD'S

SHEET INDEX DRAINAGE MAPS

REVISION TABLE

REV NO.	DESCRIPTION	SHEETS	DATE

BENCHMARK
NGS 48V A.
ELEVATION=5074.67'

ACCEPTANCE STATEMENT

ALL WORK SHALL BE CONSTRUCTED TO TOWN OF ERIE STANDARDS AND SPECIFICATIONS. THIS DRAWING HAS BEEN REVIEWED AND FOUND TO BE IN GENERAL COMPLIANCE WITH THESE STANDARDS AND SPECIFICATIONS AND OTHER TOWN REQUIREMENTS.

THE ENGINEERING DESIGN AND CONCEPT REMAINS THE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEAR HEREON.

ACCEPTED BY: ______________________________ ________________
TOWN ENGINEER DATE

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4
COVER SHEET

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
CV01
Sheet 1 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT

GENERAL NOTES - CONSTRUCTION

1. ALL CONSTRUCTION SHALL CONFORM TO THE LATEST "STANDARDS AND SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF PUBLIC IMPROVEMENTS" BY THE TOWN OF ERIE. COPIES OF THE TOWN OF ERIE STANDARDS AND SPECIFICATIONS MAY BE OBTAINED FROM THE TOWN OF ERIE WEB SITE. CONTRACTOR SHALL HAVE A SET ON SITE AT ALL TIMES.
2. THE OWNER SHALL SCHEDULE A PRE-CONSTRUCTION MEETING WITH THE TOWN OF ERIE ENGINEERING STAFF PRIOR TO THE START OF CONSTRUCTION. THOSE IN ATTENDANCE SHALL INCLUDE THE OWNER, HIS ENGINEER, THE TOWN OF ERIE ENGINEERING STAFF, REPRESENTATIVES OF THE CONTRACTORS AND OTHER AFFECTED AGENCIES. PLANS SIGNED AND ACCEPTED BY THE TOWN OF ERIE WILL BE DISTRIBUTED AT THE PRE- CONSTRUCTION MEETING. CONTRACTOR SHALL HAVE (1) COPY OF THE SIGNED PLANS ON SITE AT ALL TIMES.
3. THE TOWN OF ERIE, THROUGH ACCEPTANCE OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT. THE OWNER AND DESIGN ENGINEER UNDERSTAND THAT THE RESPONSIBILITY FOR THE ENGINEERING ADEQUACY OF THE FACILITIES DEPICTED IN THIS DOCUMENT LIES SOLELY WITH THE REGISTERED PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE ARE AFFIXED TO THIS DOCUMENT. REPORT ALL DISCREPANCIES TO THE DESIGN ENGINEER IMMEDIATELY.
4. PRIOR TO BEGINNING THE WORK, THE CONTRACTOR SHALL OBTAIN ANY/ALL WRITTEN AGREEMENTS FOR INGRESS AND EGRESS TO THE WORK SITE FROM ADJACENT PRIVATE PROPERTY OWNERS. A COPY OF ALL AGREEMENTS SHALL BE PROVIDED TO THE TOWN. ACCESS TO ANY ADJACENT PRIVATE PROPERTY SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD.
5. ALL MATERIALS AND WORKMANSHIP SHALL BE SUBJECT TO INSPECTION BY THE TOWN OF ERIE ENGINEERING STAFF. THE TOWN RESERVES THE RIGHT TO ACCEPT OR REJECT ANY SUCH MATERIALS AND WORKMANSHIP THAT DOES NOT CONFORM TO TOWN STANDARDS AND SPECIFICATIONS. INSPECTIONS AND ONSITE VISITS ARE NOT TO BE CONSTRUED AS A GUARANTEE BY THE TOWN ENGINEERING STAFF OF THE CONTRACTORS'' CONTRACTUAL COMMITMENT. REQUESTS FOR INSPECTION BY THE TOWN OF ERIE SHALL BE MADE BY THE CONTRACTOR A MINIMUM OF TWENTY- FOUR (24) HOURS IN ADVANCE.
6. CONSTRUCTION WATER IS AVAILABLE TO THE CONTRACTOR AS ESTABLISHED IN THE TOWN OF ERIE STANDARDS AND SPECIFICATIONS. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO CONTACT THE TOWN OF ERIE REGARDING CURRENT REGULATIONS, FEES AND REQUIRED AGREEMENTS RELATED TO THE PROVISION OF CONSTRUCTION WATER.
7. THE CONTRACTOR SHALL COORDINATE HIS ACTIVITIES WITH THE AFFECTED UTILITY COMPANIES AND SHALL NOTIFY THE UTILITY NOTIFICATION CENTER, PHONE NUMBER 811, THREE (3) BUSINESS DAYS PRIOR TO THE START OF CONSTRUCTION.
8. UTILITIES IN THE AREA OF CONSTRUCTION ARE APPROXIMATE ONLY. THEY HAVE BEEN LOCATED FROM FIELD INVESTIGATION AND THE BEST AVAILABLE UTILITY RECORDS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION, PROTECTION AND REPAIR OF ALL UTILITIES ENCOUNTERED DURING CONSTRUCTION WHETHER SHOWN ON THESE PLANS OR NOT. THE CONTRACTOR SHALL CONTACT ALL RESPECTIVE UTILITIES AND HAVE ALL UTILITIES FIELD-LOCATED PRIOR TO CONSTRUCTION. IF ANY UNKNOWN SUBSURFACE STRUCTURES ARE ENCOUNTERED DURING CONSTRUCTION, IT SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE TOWN OF ERIE ENGINEERING STAFF AND DESIGN ENGINEER PRIOR TO PROCEEDING.
9. THE CONTRACTOR SHALL NOTIFY TOWN OF ERIE ENGINEERING STAFF OF ANY PROBLEM IMPACTING WATER AND WASTE WATER FACILITIES THAT WOULD POTENTIALLY REQUIRE A VARIANCE FROM THE APPROVED PLANS AND SPECIFICATIONS. ANY VARIANCE FROM THE APPROVED DOCUMENTS SHALL BE AT THE SOLE DISCRETION OF THE TOWN OF ERIE ENGINEERING STAFF.
10. CONTRACTOR SHALL OBTAIN, AT HIS OWN EXPENSE, ALL APPLICABLE SPECIFICATIONS AND PERMITS NECESSARY TO PERFORM THE PROPOSED WORK.
11. AS-BUILT DRAWINGS AS REQUIRED IN THE SPECIFICATIONS, ARE TO BE SUBMITTED BY THE OWNER/DEVELOPER PRIOR TO SUBSTANTIAL COMPLETION/CONSTRUCTION ACCEPTANCE OF THE CONSTRUCTION.
12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING AND REPLACING ANY EXISTING SIGNS, STRUCTURES, FENCES, ETC., ENCOUNTERED ON THE JOB AND RESTORING THEM TO THEIR ORIGINAL CONDITION.
13. THE CONTRACTOR IS RESPONSIBLE FOR:

    A. NOTIFYING THE TOWN OF ERIE UTILITY CUSTOMERS OF POTENTIAL SERVICE OUTAGES, AND COORDINATE WITH THE TOWN OF ERIE FOR DETERMINATION OF MINIMUM TIME REQUIREMENT.

    B. NOTIFYING THE TOWN OF ERIE ENGINEERING STAFF IF WORK IS SUSPENDED FOR ANY PERIOD OF TIME AFTER INITIAL START-UP. THE CONTRACTOR SHALL NOTIFY THE TOWN OF ERIE FORTY-EIGHT (48) HOURS PRIOR TO RESTART.

    C. IN THE EVENT OF AN AFTER HOURS EMERGENCY, CALL 303-441-4444.

    D.NOTIFYING THE MOUNTAIN VIEW FIRE PROTECTION DISTRICT OF ALL STREET CLOSURES AND EXISTING FIRE HYDRANTS TAKEN OUT OF SERVICE A MINIMUM OF FORTY-EIGHT (48) HOURS PRIOR TO THE START OF CONSTRUCTION.

14. PRIOR TO INSTALLATION OF UTILITY MAINS, ROAD CONSTRUCTION MUST HAVE COMPLETED THE OVER LOT GRADING STAGE.
15. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ANY GROUNDWATER ENCOUNTERED DURING THE CONSTRUCTION OF ANY PORTION OF THIS PROJECT. A CONSTRUCTION DEWATERING PERMIT MUST BE OBTAINED FROM THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT (CDPHE). GROUNDWATER SHALL BE PUMPED, PIPED, REMOVED AND DISPOSED OF IN A MANNER WHICH DOES NOT CAUSE FLOODING OF EXISTING STREETS OR EROSION OF ABUTTING PROPERTIES IN ORDER TO CONSTRUCT THE IMPROVEMENTS SHOWN ON THESE PLANS. THE USE OF ANY SANITARY SEWER TO DISPOSE OF TRENCH WATER WILL NOT BE PERMITTED. NO CONCRETE SHALL BE PLACED WHERE GROUNDWATER IS VISIBLE OR UNTIL THE GROUNDWATER TABLE HAS BEEN LOWERED BELOW THE PROPOSED IMPROVEMENTS. ANY UNSTABLE AREAS, AS A RESULT OF GROUNDWATER, ENCOUNTERED DURING THE CONSTRUCTION OF THE PROPOSED IMPROVEMENTS SHALL BE STABILIZED AS AGREED UPON BY THE CONTRACTOR, THE TOWN OF ERIE, AND THE DESIGN ENGINEER AT THE TIME OF THE OCCURRENCE.
16. IT SHALL BE THE RESPONSIBILITY OF THE DESIGN ENGINEER TO RESOLVE CONSTRUCTION PROBLEMS WITH THE TOWN OF ERIE DUE TO CHANGED CONDITIONS ENCOUNTERED BY THE CONTRACTOR DURING THE PROGRESS OF ANY PORTION OF THE PROPOSED WORK. IF, IN THE OPINION OF THE TOWN OF ERIE, PROPOSED ALTERATIONS TO THE SIGNED CONSTRUCTION PLANS INVOLVES SIGNIFICANT CHANGES TO THE CHARACTER OF THE WORK, OR TO THE FUTURE CONTIGUOUS PUBLIC OR PRIVATE IMPROVEMENTS, THE DESIGN ENGINEER SHALL BE RESPONSIBLE FOR SUBMITTING REVISED PLANS TO THE TOWN OF ERIE FOR REVIEW, PRIOR TO ANY FURTHER CONSTRUCTION RELATED TO THAT PORTION OF THE WORK.
17. DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS AT AND ADJACENT TO THE JOB INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THE CONTRACTOR SHALL PROVIDE ALL LIGHTS, SIGNS, BARRICADES, FLAGMEN, OR OTHER DEVICES NECESSARY TO PROVIDE FOR PUBLIC SAFETY. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND IS NOT LIMITED TO NORMAL WORKING HOURS. THE TOWN OF ERIE OR THE DESIGN ENGINEER EXERCISE NO CONTROLS OVER THE SAFETY OR ADEQUACY OF ANY EQUIPMENT, BUILDING COMPONENTS, SCAFFOLDING, FORMS OR OTHER WORK AIDS USED IN OR ABOUT THE PROJECT, OR IN THE SUPERINTENDING OF THE SAME. THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD HARMLESS FROM ANY AND ALL LIABILITY, REAL AND ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER, THE DESIGN ENGINEER OR THE TOWN. THE TOWN OF ERIE ENGINEERING STAFF, OR ANY CONTRACTED ENGINEER, ARE NOT RESPONSIBLE FOR SAFETY IN, ON OR ABOUT THE PROJECT SITE, NOR FOR COMPLIANCE BY THE APPROPRIATE PARTY OF ANY REGULATIONS RELATING THERETO.
18. WORK IN PUBLIC STREETS, ONCE BEGUN, SHALL BE PROSECUTED TO COMPLETION WITHOUT DELAY SO AS TO PROVIDE MINIMUM INCONVENIENCE TO ADJACENT PROPERTY OWNERS AND TO THE TRAVELING PUBLIC.
19. REGULAR WORK HOURS ARE SEVEN (7) A.M. UNTIL SEVEN (7) P.M. OR DUSK (WHICHEVER OCCURS FIRST) OF THE SAME DAY, MONDAY THROUGH FRIDAY. THE CONTRACTOR WILL NOT PERMIT OVERTIME WORK OUTSIDE OF REGULAR WORKING HOURS OR THE PERFORMANCE OF WORK ON SATURDAY, SUNDAY OR ANY LEGAL HOLIDAY WITHOUT RECEIVING WRITTEN CONSENT FROM THE PUBLIC WORKS DIRECTOR. REQUESTS FOR WEEKEND WORK APPROVAL MUST BE SUBMITTED, IN WRITING TO THE TOWN OF ERIE NO LATER THAN WEDNESDAYS AT 3:30PM FOR SUBSEQUENT WEEKEND AND REQUESTS FOR HOLIDAY WORK APPROVAL MUST BE SUBMITTED, IN WRITING TO THE TOWN OF ERIE NO LATER THAN 7:00AM-2 BUSINESS DAYS PRIOR TO THE HOLIDAY. ALL EXPENSES INCURRED BY THE TOWN SHALL BE REIMBURSED AT A RATE TO BE DETERMINED BY DIRECTOR OF FINANCE.
20. THE CONTRACTOR SHALL TAKE ALL NECESSARY AND PROPER PRECAUTIONS TO PROTECT ADJACENT PROPERTIES FROM ANY AND ALL DAMAGE THAT MAY OCCUR FROM STORM WATER RUNOFF AND/OR DEPOSITION OF DEBRIS RESULTING FROM ANY AND ALL WORK. THE OWNER/CONTRACTOR IS RESPONSIBLE FOR OBTAINING A STORMWATER DISCHARGE PERMIT FOR CONSTRUCTION ACTIVITIES FOR ANY PROJECT DISTURBING OVER ONE ACRE FROM BOTH THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND THE TOWN OF ERIE.
21. EACH TYPE OF CONSTRUCTION SHALL BE COMPLETED BY A CONTRACTOR THAT HAS DEMONSTRATED ACCEPTABLE QUALIFICATIONS TO THE TOWN AND IS A LICENSED CONTRACTOR IN THE TOWN OF ERIE.
22. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TRAFFIC CONTROL DURING CONSTRUCTION. ALL TRAFFIC CONTROLS SHALL CONFORM TO THE TOWN OF ERIE STANDARDS AND SPECIFICATIONS AND THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, (MUTCD) LATEST EDITIONS. A PLAN SHALL BE SUBMITTED TO THE TOWN FOR REVIEW AND ACCEPTANCE PRIOR TO CONSTRUCTION.
23. ALL BACKFILL SHALL CONFORM TO THE TRENCH DETAIL LOCATED IN THE TOWN OF ERIE STANDARDS & SPECIFICATIONS.
24. THE CONTRACTOR SHALL IMMEDIATELY REMOVE ANY CONSTRUCTION DEBRIS OR MUD TRACKED ONTO EXISTING ROADWAYS.
25. THE CONTRACTOR SHALL REPAIR ANY EXCAVATION OR PAVEMENT FAILURES CAUSED BY HIS CONSTRUCTION.
26. THE CONTRACTOR SHALL RENEW OR REPLACE ANY EXISTING TRAFFIC STRIPING AND/OR PAVEMENT MARKINGS, WHICH HAVE BEEN EITHER REMOVED OR THE EFFECTIVENESS OF WHICH HAS BEEN REDUCED DURING HIS OPERATION. RENEWAL OF PAVEMENT STRIPING AND MARKING SHALL BE DONE IN CONFORMANCE WITH THE TOWN OF ERIE STANDARD SPECIFICATIONS.
27. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO TAKE EVERY MEASURE NECESSARY TO COMPLY WITH ANY STATE, COUNTY OR TOWN DUST CONTROL ORDINANCE.
28. CONSTRUCTION VEHICLES SHALL USE TRUCK ROUTES DESIGNATED BY THE TOWN.
29. THE OWNER/DEVELOPER WILL BE HELD RESPONSIBLE FOR THE PROPER FUNCTIONING OF THE IMPROVEMENTS FOR A MINIMUM OF TWO (2) YEARS FROM THE DATE OF SUBSTANTIAL COMPLETION/CONSTRUCTION ACCEPTANCE OF THE IMPROVEMENTS BY THE TOWN OF ERIE. ANY FAILURE DURING THIS PERIOD OF GUARANTEE SHALL BE REMEDIED BY THE OWNER/CONTRACTOR TO THE SATISFACTION OF THE TOWN OF ERIE AT NO EXPENSE TO THE TOWN.
30. THE SOILS ENGINEER SHALL PERFORM SUFFICIENT INSPECTIONS DURING GRADING AND CONSTRUCTION SO THAT AN OPINION CAN BE RENDERED AND VERIFIED IN WRITING AS TO COMPLIANCE WITH THE PLANS AND CODES WITHIN THE SOILS ENGINEER'S PURVIEW.

GENERAL NOTES - WATER

1. AT ALL POINTS OF CONNECTION OF NEW WATER MAINS TO EXISTING MAINS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR EXCAVATING AND VERIFYING LOCATION OF THE EXISTING LINES PRIOR TO ANY CONSTRUCTION.
2. EXCEPT IN CASE OF AN EMERGENCY, VALVES ON THE TOWN OF ERIE WATER SYSTEM SHALL BE OPERATED BY OR UNDER THE DIRECTION OF THE APPROPRIATE TOWN OF ERIE PERSONNEL. THE CONTRACTOR SHALL GIVE THE TOWN OF ERIE ENGINEERING STAFF 48 HOURS NOTICE TO ARRANGE FOR OPERATING VALVES. BOTH THE CONTRACTOR AND THE APPROPRIATE TOWN OF ERIE PERSONNEL SHALL BE PRESENT WHEN THE VALVES ARE OPERATED.
3. WATER AND SANITARY SEWER LINES SHALL HAVE A MINIMUM HORIZONTAL SEPARATION OF TEN (10) FEET. WHEN A TEN (10) FOOT SEPARATION IS NOT PROVIDED OR WHEN SEWER LINES CROSS WATER LINES WITH LESS THAN ONE AND ONE-HALF (1½) FEET OF VERTICAL SEPARATION, SEWER LINE JOINTS SHALL BE CONCRETE ENCASED. FOR PERPENDICULAR CROSSINGS, ENCASED JOINTS SHALL EXTEND TEN (10) FEET, PERPENDICULAR TO THE WATER LINE IN BOTH DIRECTIONS.
4. ALL WATER LINES SHALL HAVE A MINIMUM OF FOUR AND ONE-HALF (4½) FEET OF COVER AND BE LOCATED A MINIMUM OF TEN (10) FEET FROM THE SANITARY SEWER AND THREE (3) FEET FROM THE EDGE OF CONCRETE CURB AND GUTTER PAN.
5. CHANGES IN DIRECTION OF WATERLINE PIPE SHALL REQUIRE BENDS IN ALL INSTANCES. AXIAL DEFLECTION AT THE JOINTS SHALL NOT BE ALLOWED.
6. WHEN IT IS NECESSARY TO DEPRESS WATER LINES AT UTILITY CROSSINGS, A MINIMUM CLEARANCE OF ONE AND ONE-HALF (1-1/2) FEET SHALL BE MAINTAINED BETWEEN OUTSIDES OF PIPE.
7. DISTANCES FOR WATER LINES ARE THE HORIZONTAL DISTANCE BETWEEN THE CENTERS OF THE FITTINGS. THEREFORE, DISTANCES SHOWN ON THE PLANS ARE APPROXIMATE AND COULD VARY DUE TO VERTICAL ALIGNMENT AND FITTING DIMENSIONS.
8. ALL WATER LINE VALVES SHALL BE SET ADJACENT TO THE TEE, EXCEPT FOR POINTS THAT FALL IN THE FLOW LINE OF A CONCRETE CROSS PAN. IN WHICH CASE, THE VALVE SHALL BE LOCATED SO THAT SURFACE DRAINAGE DOES NOT INFILTRATE THE VALVE BOX. VALVE BOXES SHALL BE SET AT AN ELEVATION IN ACCORDANCE WITH TOWN PAVING REQUIREMENTS.
9. ALL WATER MAINS SHALL BE POLYVINYL CHLORIDE (PVC) PRESSURE PIPE UNLESS SPECIFIED OTHERWISE. NOMINAL PVC PIPE SIZES 6-INCH THROUGH 12-INCH SHALL CONFORM TO ALL REQUIREMENTS OF AWWA STANDARD C-900, PRESSURE CLASS 150 (DR18). NOMINAL PVC PIPE SIZES 16-INCH THROUGH 24-INCH SHALL CONFORM TO ALL REQUIREMENTS OF AWWA STANDARD C-905, PRESSURE CLASS 165 (DR25). ALL PVC PIPES SHALL HAVE OUTSIDE DIAMETERS EQUIVALENT TO CAST IRON PIPE.
10. FIRE HYDRANT ASSEMBLY INCLUDES THE FIRE HYDRANT, SIX (6) INCH VALVE, AND SIX (6) INCH PIPE. INSTALLATION SHALL BE IN ACCORDANCE WITH THE TOWN OF ERIE STANDARDS AND SPECIFICATIONS.
11. ALL FITTINGS SHALL BE MADE FROM DUCTILE IRON, FURNISHED WITH MECHANICAL JOINT ENDS OR INTEGRAL RESTRAINED JOINTS, AND SHALL HAVE A PRESSURE RATING OF 350 PSI.
12. POLYETHYLENE WRAPPING SHALL BE INSTALLED AROUND ALL DUCTILE IRON PIPES, FITTINGS, VALVES, FIRE HYDRANT BARRELS AND ROD AND CLAMPS. THE POLYETHYLENE SHALL HAVE A MINIMUM THICKNESS OF EIGHT (8) MILS, IN ACCORDANCE WITH AWWA STANDARD C-105.
13. ALL WATER LINE PIPE SHALL BE PROVIDED WITH A MINIMUM GAGE SIZE OF 12 SINGLE STRAND INSULATED COPPER WIRE. SPLICES IN TRACER WIRE SHALL BE CAPPED IN WATER PROOF GEL CAP TYPE CONNECTORS SUITED FOR DIRECT BURY APPLICATION (3M TYPE DBY-6 LOW VOLTAGE OR EQUAL). WIRE SHALL BE ATTACHED TO TOP OF WATER LINE WITH 2-INCH WIDE PVC TAPE @ 5-FT INTERVALS ALONG PIPE. TRACER WIRE SHALL EXTEND TO THE SURFACE AND BE COILED IN A LOCATE BOX AT THE BACKSIDE OF EITHER EACH FIRE HYDRANT OR VALVE. UNDER THE SUPERVISION OF TOWN OF ERIE ENGINEERING STAFF, TEST SHALL BE MADE BY THE CONTRACTOR @ THE COMPLETION OF CONSTRUCTION TO INSURE THAT THE TRACER WIRES CARRY A CONTINUOUS CURRENT BETWEEN ALL ACCESS POINTS.
14. WARNING TAPE SHALL BE INSTALLED 12" MINIMUM AND 18" MAXIMUM ABOVE WATER PIPE.
15. BEDDING MATERIAL SHALL CONFORM TO TOWN OF ERIE STANDARDS AND SPECIFICATIONS.
16. VALVES SHALL OPEN COUNTER CLOCKWISE. VALVES 12-INCH AND SMALLER SHALL BE RESILIENT SEAT GATE VALVES. LARGER VALVES SHALL BE BUTTERFLY VALVES.
17. VALVE BOXES SHALL BE RAISED TO ONE-FOURTH (1/4) INCH BELOW GRADE AFTER COMPLETION OF SURFACE PAVING OR FINAL GRADING. VALVE BOXES IN NON-PAVED AREAS SHALL HAVE A CONCRETE COLLAR AROUND THE VALVE LID IN ACCORDANCE WITH THE DETAIL.
18. ALL SERVICE LINE TAPS SHALL HAVE DOUBLE STRAP BRASS TAPPING SADDLES. (ROMAC 202B OR APPROVED EQUAL).
19. ALL RESIDENTIAL WATER TAPS SHALL BE THREE-QUARTER (3/4) INCH OR AS REQUIRED BY THE CURRENT BUILDING CODE.
20. ALL WATER SERVICE LATERALS SHALL EXTEND FIVE (5) FEET BEYOND RIGHT OF WAY OR UTILITY EASEMENTS, WHICHEVER IS GREATER. THE ENDS SHALL BE MARKED BY A BLUE PAINTED WOOD POST UNTIL CURB AND GUTTER IS IN PLACE. WHEN CURB AND GUTTER IS IN PLACE THE LATERALS SHALL BE MARKED ON THE CONCRETE CURB FACE WITH A "V" OR "W".
21. CONCRETE THRUST BLOCKS AND/OR "MEGA-LUG" MECHANICAL RESTRAINTS ARE REQUIRED AT ALL MECHANICAL FITTINGS. THRUST BLOCKS MAY NOT BE REQUIRED IF PIPE RESTRAINT IS PROVIDED IN ACCORDANCE WITH RESTRAINED PIPE DETAIL.
22. NO WORK SHALL BE BACKFILLED (INCLUDING BEDDING MATERIAL ABOVE THE SPRING LINE OF THE PIPE) UNTIL THE CONSTRUCTION HAS BEEN INSPECTED AND APPROVED FOR BACKFILLING BY THE TOWN OF ERIE ENGINEERING STAFF.
23. ONLY ONE CONNECTION TO THE EXISTING WATER DISTRIBUTION SYSTEM SHALL BE MADE UNTIL ALL HYDROSTATIC TESTING, CHLORINATION AND FLUSHING HAS BEEN COMPLETED.
24. DISINFECTION AND HYDROSTATIC TESTING SHALL BE DONE IN THE PRESENCE OF A TOWN OF ERIE ENGINEERING STAFF. CONTACT THE TOWN OF ERIE DEPARTMENT OF PUBLIC WORKS, FORTY-EIGHT (48) HOURS PRIOR TO DISINFECTING AND/OR TESTING.
25. DISINFECTION AND FLUSHING SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF THE COLORADO DEPARTMENT OF HEALTH AND THE PROCEDURE SET FORTH IN AWWA C651, "STANDARD FOR DISINFECTING WATER MAINS". THE CHLORINATION OF THE WATER LINE SHALL BE PERFORMED PRIOR TO THE HYDROSTATIC TESTING. ALL VALVES, FIRE HYDRANTS AND OTHER APPURTANCES SHALL BE OPERATED WHILE PIPELINE IS FILLED WITH THE CHLORINATING AGENT TO INSURE THAT HIGH CHLORINE CONTACT IS MADE WITH ALL INTERNAL SURFACES.
26. ALL WATER LINES SHALL BE HYDROSTATIC TESTED. PRESSURE AND LEAKAGE TESTS SHALL BE CONDUCTED ACCORDING TO THE APPLICABLE SECTIONS OF AWWA C600/605 TO A MINIMUM PRESSURE OF ONE HUNDRED AND FIFTY (150) POUNDS PER SQUARE (PSI) INCH AT THE LOW POINT OF THE SECTION BEING TESTED FOR THE DURATION OF TWO (2) HOURS. THE MAXIMUM LENGTH OF LINE TO BE TESTED SHALL BE ONE THOUSAND (1,000) FEET. ALL JOINTS IN CONNECTIONS ARE TO BE WATERTIGHT WITHIN TOLERANCES ALLOWED BY THE SPECIFICATIONS IN AWWA C600/605. ANY LEAKAGE THAT IS DISCOVERED BY OBSERVATION OR TESTS SHALL BE LOCATED AND MADE WATERTIGHT BY THE CONTRACTOR. PRESSURE AND LEAKAGE TESTS SHALL NOT BE CONDUCTED UNTIL THE LINE HAS PASSED ALL REQUIRED DISINFECTION TESTS.
27. SUBSTANTIAL COMPLETION/CONSTRUCTION ACCEPTANCE OF THE NEW WATER LINES ARE CONTINGENT UPON RECEIVING COPIES OF:

    A. WATER TRENCH COMPACTION TEST RESULTS

    B. HYDRO STATIC TESTING OF 100% OF THE SYSTEM

    C. HEALTH DEPARTMENT TESTS. (CHLORINE AND/OR CLEAR WATER AS REQUIRED)

28. ALL METER PITS AND CURB STOPS SHALL BE PROTECTED AT THE TIME OF INSTALLATION WITH A MINIMUM OF THREE (3) T-POSTS AND ORANGE SAFETY FENCE. THE T-POST AND SAFETY FENCE SHALL REMAIN IN PLACE AND IN GOOD CONDITION UNTIL THE LANDSCAPING IS INSTALLED.
29. ALL WATER VAULTS SHALL BE WATER TIGHT. CONTRACTOR SHALL SEAL VAULTS TO ENSURE SURFACE WATER DOES NOT INFILTRATE INTO THE VAULTS. VAULT LIDS SHALL BE PLACED TO ENSURE THAT SURFACE WATER DOES NOT FLOW INTO THE VAULTS.

GENERAL NOTES - GRADING

1. ALL CONSTRUCTION ACTIVITIES THAT DISTURBS ONE OR MORE ACRES OF LAND, AS WELL AS ACTIVITIES THAT DISTURB LESS THAN ONE ACRE OF LAND, BUT IS PART OF A LARGER COMMON PLAN OF DEVELOPMENT, MUST COMPLY WITH BOTH LOCAL AND STATE REGULATIONS REGARDING STORMWATER DRAINAGE ON CONSTRUCTION SITES. OWNERS OR CONTRACTORS MUST OBTAIN A COLORADO STORMWATER DISCHARGE PERMIT FOR CONSTRUCTION ACTIVITIES FROM THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT (CDPHE) AND EITHER A PUBLIC IMPROVEMENT PERMIT OR A GRADING AND STORMWATER QUALITY PERMIT FROM THE TOWN OF ERIE. CONTRACTOR SHALL:
    A. MAINTAIN A COPY OF THE STORM WATER MANAGEMENT PLAN (SWMP) ONSITE AT ALL TIMES. THE SWMP MUST BE MAINTAINED AND MADE AVAILABLE TO TOWN OF ERIE INSPECTORS UPON REQUEST.
    B. INSTALL AND MAINTAIN EROSION, SEDIMENT, AND MATERIALS MANAGEMENT CONTROL BMPS AS SPECIFIED IN THE SWMP.
    C. INSPECT ALL BEST MANAGEMENT PRACTICES (BMPS) AT LEAST EVERY FOURTEEN (14) DAYS AND WITHIN TWENTY FOUR (24) HOURS AFTER ANY PRECIPITATION OR SNOWMELT EVENT THAT CAUSES SURFACE RUNOFF.
    D. MAINTAIN INSPECTION AND MAINTENANCE RECORDS OF BMPS ONSITE WITH THE SWMP. COPIES OF THESE REPORTS SHALL BE PROVIDED TO THE TOWN OF ERIE ENGINEERING STAFF.
    E. BASED ON INSPECTIONS PERFORMED BY THE PERMIT HOLDER OR BY TOWN PERSONNEL, MODIFICATIONS TO THE SWMP WILL BE NECESSARY IF AT ANY TIME THE SPECIFIED BMPS DO NOT MEET THE OBJECTIVES OF THE PERMIT. ALL MODIFICATIONS SHALL BE COMPLETED AS SOON AS PRACTICABLE AFTER THE REFERENCED INSPECTION, AND SHALL BE RECORDED ON THE OWNER'S COPY OF THE SWMP.
    F. THE OPERATOR SHALL AMEND THE SWMP WHENEVER THERE IS A SIGNIFICANT CHANGE IN DESIGN, CONSTRUCTION, OPERATION, OR MAINTENANCE, WHICH HAS A SIGNIFICANT EFFECT ON THE POTENTIAL FOR DISCHARGE OF POLLUTANTS TO THE RECEIVING WATERS, OR IF THE SWMP PROVES TO BE INEFFECTIVE IN ACHIEVING THE GENERAL OBJECTIVES OF CONTROLLING POLLUTANTS IN STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITIES.
    G. STANDARDS AND SPECIFICATIONS 1/2010 PAGE 1 OF 3 GENERAL NOTES GRADING INSTALLATION AND MAINTENANCE OF BMPS SHALL BE SUPERVISED BY PERSONNEL CERTIFIED IN EROSION AND SEDIMENT CONTROL.
2. ALL SITE GRADING (EXCAVATION, EMBANKMENT, AND COMPACTION) SHALL CONFORM TO THE RECOMMENDATIONS OF THE LATEST SOILS INVESTIGATION FOR THIS PROPERTY AND SHALL FURTHER BE IN CONFORMANCE WITH THE TOWN OF ERIE "STANDARDS AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF PUBLIC IMPROVEMENTS", LATEST EDITION.
3. ALL GRADING AND FILLING OPERATIONS SHALL BE OBSERVED, INSPECTED AND TESTED BY A LICENSED SOILS ENGINEER. ALL TEST RESULTS SHALL BE SUBMITTED TO THE TOWN OF ERIE ENGINEERING STAFF.
4. NATURAL VEGETATION SHALL BE RETAINED AND PROTECTED WHEREVER POSSIBLE. EXPOSURE OF SOIL TO EROSION BY REMOVAL OR DISTURBANCE OF VEGETATION SHALL BE LIMITED TO THE AREA REQUIRED FOR IMMEDIATE CONSTRUCTION OPERATION AND FOR THE SHORTEST PRACTICAL PERIOD OF TIME. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO AVOID ANY DAMAGE TO EXISTING FOLIAGE THAT LIES IN THE PROJECT AREA UNLESS DESIGNATED FOR REMOVAL AND SHALL BE LIABLE FOR SUCH DAMAGE AT HIS/HER EXPENSE.
5. TOPSOIL SHALL BE STOCKPILED TO THE EXTENT PRACTICABLE ON THE SITE FOR USE ON AREAS TO BE RE-VEGETATED. ANY AND ALL STOCKPILES SHALL BE LOCATED AND PROTECTED FROM EROSIVE ELEMENTS.
6. TEMPORARY VEGETATION SHALL BE INSTALLED ON ALL DISTURBED AREAS WHERE PERMANENT SURFACE IMPROVEMENTS ARE NOT SCHEDULED FOR IMMEDIATE INSTALLATION. SEEDING WILL BE DONE ACROSS THE SLOPE FOLLOWING THE CONTOURS. VEGETATION SHALL CONFORM TO THE TOWN OF ERIE STANDARDS AND SPECIFICATIONS. PROJECT SCHEDULING SHOULD TAKE ADVANTAGE OF SPRING OR FALL PLANTING SEASONS FOR NATURAL GERMINATION. SEEDED AREAS SHALL BE IRRIGATED IN ACCORDANCE WITH THE TOWN OF ERIE'S STANDARDS AND SPECIFICATIONS.

GENERAL NOTES - GRADING CONTINUED

7. AT ALL TIMES, THE PROPERTY SHALL BE MAINTAINED AND/OR WATERED TO PREVENT WIND-CAUSED EROSION. EARTHWORK OPERATIONS SHALL BE DISCONTINUED WHEN FUGITIVE DUST SIGNIFICANTLY IMPACTS ADJACENT PROPERTY. IF EARTHWORK IS COMPLETE OR DISCONTINUED AND DUST FROM THE SITE CONTINUES TO CREATE PROBLEMS, THE OWNER/DEVELOPER SHALL IMMEDIATELY INSTITUTE MITIGATIVE MEASURES AND SHALL CORRECT DAMAGE TO ADJACENT PROPERTY.
8. FILL SLOPES SHALL BE COMPACTED BY MEANS OF SHEEPSFOOT COMPACTOR OR OTHER SUITABLE EQUIPMENT. COMPACTING SHALL CONTINUE UNTIL SLOPES ARE STABLE AND THERE IS NOT AN APPRECIABLE AMOUNT OF LOOSE SOIL ON THE SLOPES.
9. TEMPORARY CUT/FILL SLOPES SHALL ABIDE BY THE SOILS REPORT. PERMANENT SLOPES SHALL BE AS SHOWN ON PLANS.
10. DEPTH OF MOISTURE-DENSITY CONTROL SHALL BE FULL DEPTH ON ALL EMBANKMENT AND SIX (6) INCHES ON THE BASE OF CUTS AND FILLS.
11. OUTLET SIDES OF ALL STORM PIPES SHALL BE GRADED TO DRAIN AND SHALL HAVE SUFFICIENT EROSION PROTECTION.
12. THE PERMITTEE OR HIS AGENT SHALL NOTIFY THE SITE GEOTECHNICAL ENGINEER WHEN THE GRADING OPERATION IS READY FOR EACH OF THE FOLLOWING INSPECTIONS:
    A. INITIAL INSPECTION WHEN THE PERMITTEE IS READY TO BEGIN WORK, BUT NOT LESS THAN TWO (2) DAYS BEFORE ANY GRADING OR GRUBBING IS STARTED.
    B. AFTER THE NATURAL GROUND OR BEDROCK IS EXPOSED AND PREPARED TO RECEIVE FILL, BUT BEFORE FILL IS PLACED.
    C. EXCAVATION INSPECTION AFTER THE EXCAVATION IS STARTED BUT BEFORE THE VERTICAL DEPTH OF THE EXCAVATION EXCEEDS TEN (10) FEET.
    D. FILL INSPECTION AFTER THE FILL PLACEMENT IS STARTED, BUT BEFORE THE FILL EXCEEDS TEN (10) FEET.

GENERAL NOTES - STORM DRAIN

1. EXCEPT WHERE NOTED, ALL STORM SEWER PIPE SHALL BE REINFORCED CONCRETE, CLASS III AND SHALL CONFORM TO REQUIREMENTS OF ASTM C76. ALL RCP SHALL HAVE RUBBER GASKETED JOINTS AND SHALL CONFORM TO REQUIREMENTS OF ASTM C443, AND SHALL PROVIDE WATERTIGHT PERFORMANCE CHARACTERISTICS.
2. TONGUE AND GROOVE JOINTS SHALL NOT BE ALLOWED.
3. THE MINIMUM COVERAGE FOR ALL STORM DRAINAGE PIPES SHALL BE 1.5 FEET FOR CLASS III PIPE AND 1 FOOT FOR CLASS IV PIPE.
4. BEDDING MATERIAL SHALL CONFORM TO TOWN OF ERIE STANDARDS AND SPECIFICATIONS.
5. ALL MANHOLES SHALL BE CONCRETE AND CONFORM TO CDOT STANDARD M-604-20.
6. THE MINIMUM MANHOLE DIAMETER SHALL BE AS SPECIFIED BELOW:

PIPE DIAMETER	MANHOLE SIZE
15" TO 18"	4' DIAMETER
21" TO 42"	5' DIAMETER
48" TO 54"	6' DIAMETER
60" AND LARGER	BOX BASE MANHOLE

7. ALL STREET INLETS SHALL BE CURB OPENING TYPE R, CONFORMING TO CDOT STANDARD M-604-12, EXCEPT WHERE OTHERWISE NOTED.
8. ALL INLET ACCESS COVERS SHALL HAVE THE WORDS "NO DUMPING - DRAINS TO RIVERS" AND "STORM SEWER" CAST INTO THE COVER PER TOWN OF ERIE STANDARD DETAIL.
9. ALL END SECTIONS SHALL CONFORM TO CDOT STANDARD M-603-10.
10. WHERE RIPRAP IS CALLED FOR ON THE PLANS FOR EROSION CONTROL, IT SHALL CONFORM TO THE URBAN STORM DRAINAGE CRITERIA MANUAL SPECIFICATIONS (LATEST REVISION).

GENERAL NOTES - SEWER

1. THE CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATIONS OF ALL EXISTING SEWERS TO BE CONNECTED TO PRIOR TO CONSTRUCTION STAKING.
2. CONNECTION TO EXISTING TOWN OF ERIE LINES WILL BE PERMITTED UPON SUBSTANTIAL COMPLETION/CONSTRUCTION ACCEPTANCE OF THE NEW SANITARY SEWER SYSTEM. EXISTING PIPE AT THE POINT OF CONNECTION SHALL NOT BE "BROKEN OUT" UNTIL THE NEW SYSTEM IS ACCEPTED. IF CONNECTING TO AN EXISTING MANHOLE, THE NEW LINE SHALL BE PLUGGED UNTIL THE NEW SYSTEM IS ACCEPTED.
3. MINIMUM VERTICAL SEPARATIONS BETWEEN ALL UTILITY PIPES SHALL BE EIGHTEEN (18) INCHES. IF VERTICAL SEPARATIONS ARE LESS THAN EIGHTEEN (18) INCHES, THE UTILITY PIPES SHALL BE REINFORCED AND PROTECTED AS REQUIRED BY CURRENT TOWN STANDARD SPECIFICATIONS.
4. WATER AND SANITARY SEWER LINES SHALL HAVE A MINIMUM HORIZONTAL SEPARATION OF TEN (10) FEET. WHEN A TEN (10) FOOT SEPARATION IS NOT PROVIDED OR WHEN SEWER LINES CROSS WATER LINES WITH LESS THAN ONE AND ONE-HALF (1½) FEET OF VERTICAL SEPARATION, SEWER LINE JOINTS SHALL BE CONCRETE ENCASED. FOR PERPENDICULAR CROSSINGS, ENCASED JOINTS SHALL EXTEND TEN (10) FEET, PERPENDICULAR TO THE WATER LINE IN BOTH DIRECTIONS.
5. ALL SANITARY SEWER SERVICES AND WATER SERVICES ARE TO BE TEN (10) FEET APART.
6. SERVICE LATERALS SHALL EXTEND FIVE (5) FEET BEYOND RIGHTS OF WAY OR UTILITY EASEMENTS, WHICHEVER IS GREATER. THE ENDS SHALL BE MARKED BY A GREEN PAINTED WOOD POST UNTIL CURB AND GUTTER IS IN PLACE. WHEN CURB AND GUTTER IS IN PLACE THE LATERALS SHALL BE MARKED ON THE CONCRETE CURB FACE WITH AN " S" OR "X".
7. THE LENGTH OF SANITARY SEWER LINE IS THE HORIZONTAL DISTANCE BETWEEN CENTER OF MANHOLE TO CENTER OF MANHOLE. THEREFORE, THE DISTANCES INDICATED ON THE PLANS ARE APPROXIMATE AND COULD VARY DUE TO VERTICAL ALIGNMENT AND MANHOLE DIMENSIONS.
8. SERVICE LINE CONNECTIONS TO DEAD END MANHOLES THAT HAVE NO FURTHER POSSIBILITY OF EXTENSION SHALL BE ALLOWED AND SHALL HAVE A MINIMUM DROP OF 0.75 X MAIN DIAMETER. SERVICE LINE CONNECTIONS TO IN-LINE MANHOLES ARE NOT PERMITTED. MINIMUM SERVICE LINE SLOPE; 4 INCHES=2%; 6 INCHES= 1%; 8 INCHES=0.4%.
9. ALL FOUR (4) THROUGH FIFTEEN (15) INCH SANITARY SEWER PIPE SHALL BE POLYVINYL CHLORIDE (PVC) AND SHALL BE IN ACCORDANCE WITH ASTM D-3034-SDR35, "STANDARD SPECIFICATION FOR PVC SEWER PIPE AND FITTINGS". ANY SANITARY SEWER HAVING A DEPTH IN EXCESS OF FIFTEEN (15) FEET SHALL BE COORDINATED WITH THE PUBLIC WORKS DEPARTMENT.
10. BEDDING MATERIAL SHALL CONFORM TO TOWN OF ERIE STANDARDS AND SPECIFICATIONS.
11. WARNING TAPE SHALL BE INSTALLED 12" MINIMUM AND 18" MAXIMUM ABOVE SEWER PIPE.
12. PRECAST CONCRETE MANHOLE SECTIONS SHALL BE IN ACCORDANCE WITH ASTM C0478. MANHOLE STEPS SHALL BE POLYPROPYLENE COVERED STEEL CONFORMING TO ASTM. D-4101 AND ASTMA-615. CAST IRON RING AND COVER SHALL CONFORM TO ASTM A-48.
13. MANHOLES SHALL BE A MINIMUM FOUR (4) FOOT DIAMETER AND CONSTRUCTED PER THE STANDARDS AND SPECIFICATIONS.
14. THE CONTRACTOR SHALL TAKE CARE TO PROPERLY SHAPE ALL MANHOLE INVERTS AND BENCHES IN ACCORDANCE WITH THE TOWN OF ERIE STANDARDS AND SPECIFICATIONS, TO PROMOTE SMOOTH FLOW THROUGH THE MANHOLE. INVERTS OF LINES INTERSECTING AT 90 DEGREES AND AT HIGHLY DIVERGENT OR FLAT SLOPES ARE ESPECIALLY CRITICAL. MANHOLE INVERTS SHALL BE CONSTRUCTED WITH A SMOOTH TROWEL FINISH, AND BENCH FINISHED WITH A LIGHT BROOMED, NON-SKID, FINISH.
15. SEWER TEES AND/OR WYES SHALL BE STAKED BY A SURVEY CREW. THE CONTRACTOR SHALL FURNISH TO THE ENGINEER "AS-CONSTRUCTED" LOCATION OF TEES AND WYES. ALL SERVICE LINES ARE FOUR (4) INCH UNLESS OTHERWISE NOTED.
16. THE CONTRACTOR, AT THE OWNER'S EXPENSE, WILL MAKE ALL SEWER SERVICE TAPS.
17. PRIOR TO BACKFILL THE TOWN OF ERIE ENGINEERING STAFF SHALL INSPECT ALL SANITARY SEWER MAINS AND SERVICE EXTENSIONS.
18. MANHOLE RIMS SHALL BE SET AT AN ELEVATION RELATIVE TO THE PAVEMENT, IN ACCORDANCE WITH THE TOWN OF ERIE STANDARDS. WHETHER THE MANHOLE IS AT PAVED OR UNPAVED GRADE, A MINIMUM OF ONE (1) AND A MAXIMUM OF FOUR (4) CONCRETE RINGS SHALL BE USED TO ADJUST THE RIM ELEVATION TO FINAL GRADE. THE MAXIMUM ACCEPTABLE VERTICAL ADJUSTMENT UTILIZING CONCRETE RINGS IS EIGHTEEN (18) INCHES.
19. SUBSTANTIAL COMPLETION/CONSTRUCTION ACCEPTANCE OF THE NEW SANITARY SEWER MAINS IS CONTINGENT UPON COMPLETION OF ITEMS LISTED IN THE TOWNS STANDARDS AND SPECIFICATIONS.

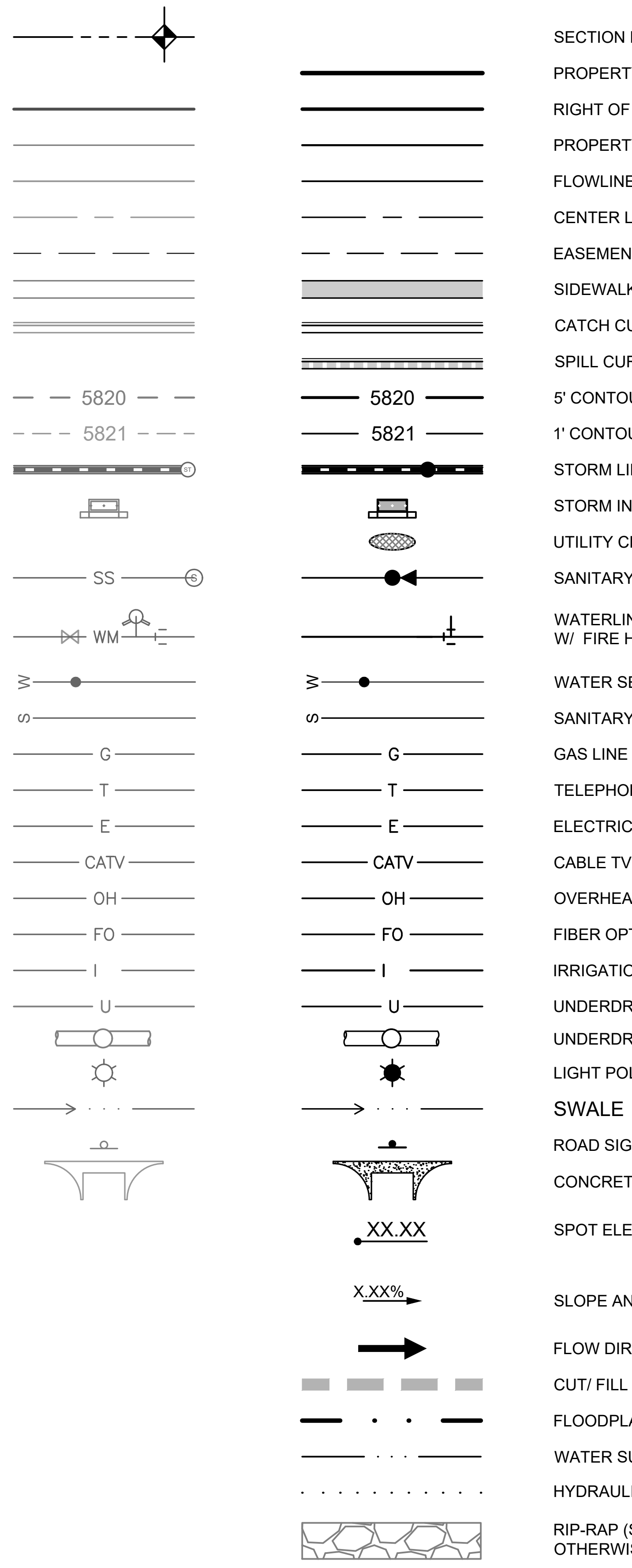
GENERAL NOTES - ROADWAY

1. ALL STATIONING IS BASED ON CENTERLINE OF ROADWAYS UNLESS OTHERWISE NOTED.
2. THE CONTRACTOR SHALL PREPARE THE SUBGRADE BY SCARIFYING THE UPPER ONE (1) FOOT OF THE SUBGRADE IN CUT AREAS OR AREAS WITH LITTLE OR NO FILL, UNLESS SPECIFIED IN THE SOILS REPORT. THE WORK SHALL CONFORM TO THE COLORADO DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS.
3. PAVEMENT SHALL NOT BE CONSTRUCTED UNTIL ALL UNDERGROUND UTILITIES HAVE BEEN INSTALLED, TESTED AND ACCEPTED BY THE TOWN OF ERIE ENGINEERING STAFF.
4. IT SHALL BE THE RESPONSIBILITY OF THE OWNER/CONTRACTOR TO SUPERVISE AND CERTIFY THAT PROPER COMPACTION HAS BEEN OBTAINED BY SUBCONTRACTORS AND AGENCIES CONCERNING UTILITY LINE BACKFILL INCLUDING, BUT NOT LIMITED TO, SEWER, WATER, ELECTRICAL, GAS AND LANDSCAPE IRRIGATION LINES AND ACCEPTED BY THE TOWN OF ERIE ENGINEERING STAFF AND THE SOILS ENGINEER.
5. STREET PAVING SHALL NOT START UNTIL:
    A. A SOILS REPORT AND PAVEMENT DESIGN IS ACCEPTED BY THE TOWN OF ERIE ENGINEERING STAFF.
    B. ALL STREETS ARE COMPACTED IN ACCORDANCE WITH THE SOILS REPORT AND THE TOWN OF ERIE SPECIFICATIONS.
    C. ALL COMPACTION TEST REPORTS HAVE BEEN SUBMITTED TO THE TOWN ENGINEERING STAFF PRIOR TO PROOF ROLLS.
    D. PROOF ROLLS ARE PERFORMED USING A LOADED SINGLE AXLE 2000 GALLON WATER TRUCK AND MONITORED BY THE TOWN OF ERIE ENGINEERING STAFF.
6. THE OWNER/CONTRACTOR SHALL BE RESPONSIBLE FOR ADJUSTING ALL UTILITY MANHOLE COVERS AND ACCESS LIDS TO GRADE.
7. ALL CONCRETE SHALL BE A MINIMUM OF CLASS B, IN CONFORMANCE WITH CDOT STANDARDS.
8. ALL CONCRETE EDGES MUST BE ROUNDED TO A FOURTH (1/4) INCH RADIUS, EXCEPT WHERE SHOWN OTHERWISE ON DRAWINGS.
9. ONE HALF (1/2) INCH EXPANSION JOINTS SHALL BE INSTALLED AT ALL CURB RETURNS, CURB CUTS AND EXISTING STRUCTURES. CONTROL JOINTS SHALL BE INSTALLED PER THE TOWNS STANDARDS AND SPECIFICATIONS.
10. BEFORE PLACING OF ASPHALT THE SUBGRADE SHALL RECEIVE A GROUND STERILANT APPLIED AT A RATE IN ACCORDANCE TO MANUFACTURERS RECOMMENDATIONS.
11. TACK COAT SHALL BE USED PRIOR TO OVERLAY, (CSS-1H), 50:50 DILUTION, 0.10 GAL/SY. ALL EDGES ABUTTING NEW PAVEMENT SHALL BE TACKED.
12. WHEN IT IS REQUIRED TO MATCH EXISTING PAVEMENT, EXISTING PAVEMENT SHALL BE SAW CUT IN A MANNER TO AFFECT A SMOOTH, VERTICAL STRAIGHT CUT EDGE. T PATCH MILLING MUST BE DONE PER STANDARD DETAILS.
13. ALL SAWCUT EDGES OF EXISTING PAVEMENT SHALL BE CLEAN AND COATED WITH TACK COAT PRIOR TO PLACING NEW PAVEMENT ADJACENT TO THE EXISTING PAVEMENT.
14. ALL ASPHALT SHALL BE ONE FOURTH (1/4) INCH ABOVE CONCRETE EDGES, MANHOLE COVERS AND ACCESS LIDS.
15. SIGNAGE AND STRIPING SHALL CONFORM TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, THE COLORADO DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, THE COLORADO DEPARTMENT OF TRANSPORTATION M&S STANDARDS, AND THE TOWN OF ERIE STANDARD DESIGN CRITERIA AND STANDARD CONSTRUCTION REQUIREMENTS.
16. THE PURCHASE AND INSTALLATION OF STREET NAME SIGNS SHALL BE THE RESPONSIBILITY OF THE OWNER/CONTRACTOR. THE OWNER/CONTRACTOR SHALL SECURE THE APPROVAL OF THE TOWN OF ERIE ENGINEERING STAFF FOR TYPE AND LOCATION OF THE STREET NAME SIGNS PRIOR TO INSTALLATION.
17. ALL NEW ROADWAY SECTIONS SHALL HAVE SUBGRADE PREPARATION AND INITIAL ASPHALT PAVEMENT PLACED WITH A 1% CROWN. FINAL OVERLAY IS TO BE PLACED WITH A 2% CROWN. SEE DETAIL ST7 IN THE "STANDARD DETAILS-STREET" FOR MORE INFORMATION.
18. DETERMINATION OF CROWN FOR CUL DE SAC PAVING SHALL BE EVALUATED ON A CASE BY CASE BASIS.

ABBREVIATIONS

ASSY.	ASSEMBLY	PL	PROPERTY LINE
BM	BENCHMARK	PCC	POINT OF COMPOUND CURVATURE
BO	BLOWOFF	PCR	POINT OF CURVE RETURN
CL	CENTERLINE	PRC	POINT OF REVERSE CURVATURE
DIA / Ø	DIAMETER	PT	POINT OF TANGENCY
DIP	DUCTILE IRON PIPE	PVC	POLYVINYL CHLORIDE PIPE
EL	ELEVATION	PVC / PVT	
EG	EXISTING GRADE	PVI	POINT OF VERTICAL INTERSECTION
EOA	EDGE OF ASPHALT	R	RADIUS
EOC	EDGE OF CONCRETE	RCP	REINFORCED CONCRETE PIPE
ESMT.	EASEMENT	ROW	RIGHT OF WAY
EX.	EXISTING	RT	RIGHT
F	FIRE SERVICE	S	SANITARY SEWER SERVICE
FF	FINISHED FLOOR	SAN	SANITARY SEWER
FG	FINISHED GRADE	SF	SILT FENCE
FH	FIRE HYDRANT	SSMH	SANITARY SEWER MANHOLE
FL	FLOW LINE	STA:	STATION
GBW	GRADE AT BOTTOM OF WALL	STMH	STORM SEWER MANHOLE
HDCP	HANDICAP	TBC	TOP BACK OF CURB
HGL	HYDRAULIC GRADE LINE	TBR	TO BE REMOVED
HOR	HORIZONTAL	TC	TOP OF CURB
H.P.	HIGH POINT	TFI	TOP FRONT OF INLET
INV.	INVERT	TOF	TOP OF FOUNDATION
LF	LINEAR FEET	TOW	TOP OF WALL
LP	LOW POINT	TOP	TOP OF PIPE
LT	LEFT	TYP.	TYPICAL
MH	MANHOLE	U.E.	UTILITY EASEMENT
OC	ON CENTER	VERT	VERTICAL
OHE	OVERHEAD ELECTRIC	W	WATER SERVICE
OS	OFFSET	WSEL	WATER SURFACE ELEVATION
PC	POINT OF CURVATURE	SW	SIDEWALK
		TGB	TOP OF GRADE BEAM

MASTER LEGEND



EXISTING	PROPOSED	DESCRIPTION
		SECTION LINE W/ SECTION CORNER
		PROPERTY BOUNDARY
		RIGHT OF WAY LINE
		PROPERTY LOT LINE
		FLOWLINE
		CENTER LINE
		EASEMENT LINE
		SIDEWALK
		CATCH CURB AND GUTTER
		SPILL CURB & GUTTER
5820	5820	5' CONTOUR
5821	5821	1' CONTOUR
ST		STORM LINE W/ MANHOLE
		STORM INLET
		UTILITY CROSSING
SS		SANITARY SEWER W/ MANHOLE
WM		WATERLINE & VALVE W/ FIRE HYDRANT ASSEMBLY
W	W	WATER SERVICE W/ METER
S	S	SANITARY SERVICE
G	G	GAS LINE
T	T	TELEPHONE LINE
E	E	ELECTRIC LINE
CATV	CATV	CABLE TV LINE
OH	OH	OVERHEAD LINE
FO	FO	FIBER OPTIC LINE
I	I	IRRIGATION LINE
U	U	UNDERDRAIN LINE
		UNDERDRAIN (FOR PROFILE VIEW)
		LIGHT POLE
		SWALE
		ROAD SIGN
		CONCRETE CROSSPAN
	XX.XX	SPOT ELEVATION
	X.XX%	SLOPE AND DIRECTION
		FLOW DIRECTION
		CUT/ FILL LINE
		FLOODPLAIN
		WATER SURFACE ELEVATION
		HYDRAULIC GRADE LINE (HGL)
		RIP-RAP (SOIL RIP-RAP UNLESS OTHERWISE INDICATED)

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

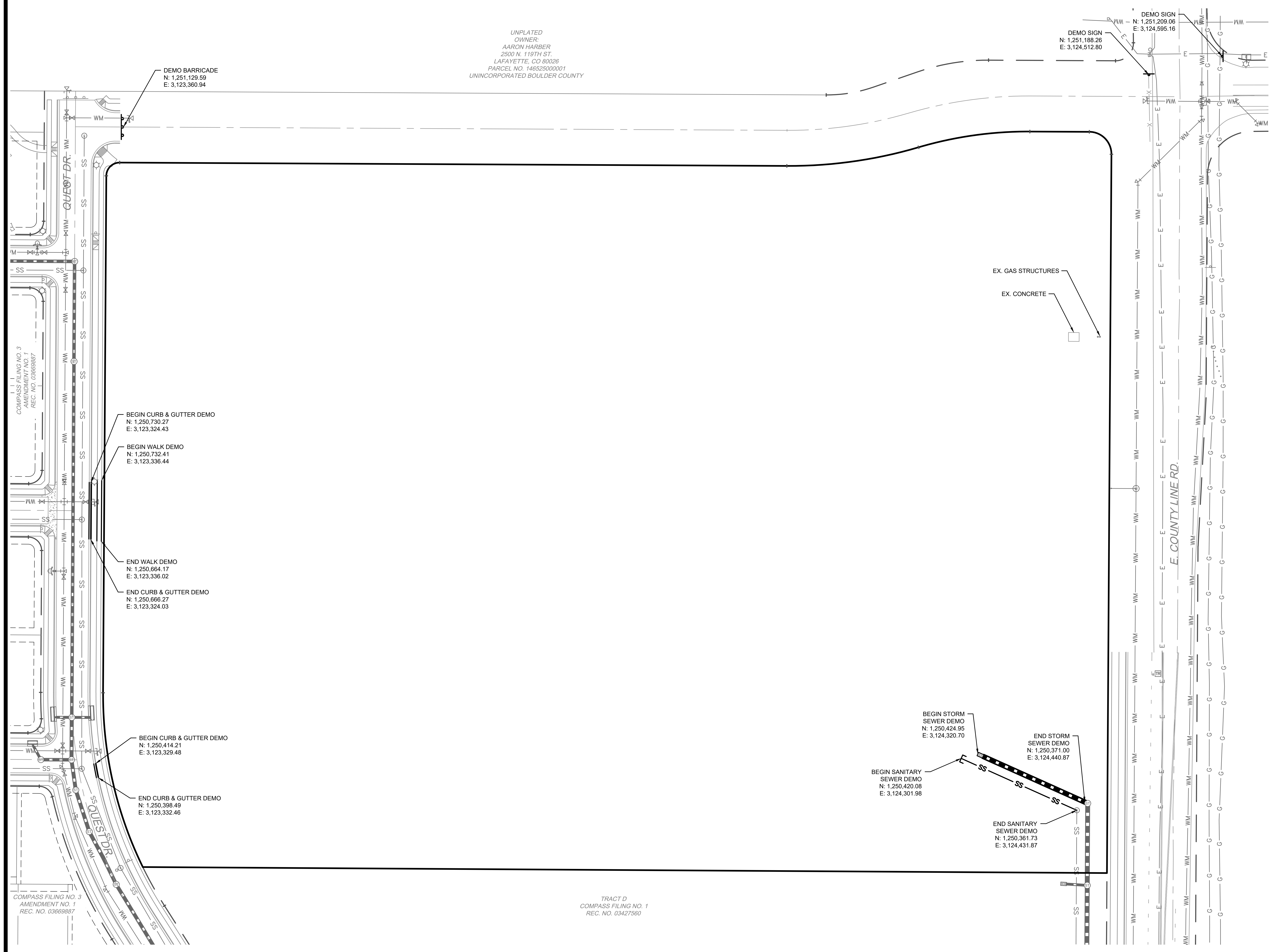
COMPASS FILING NO. 4
GENERAL NOTES & LEGEND

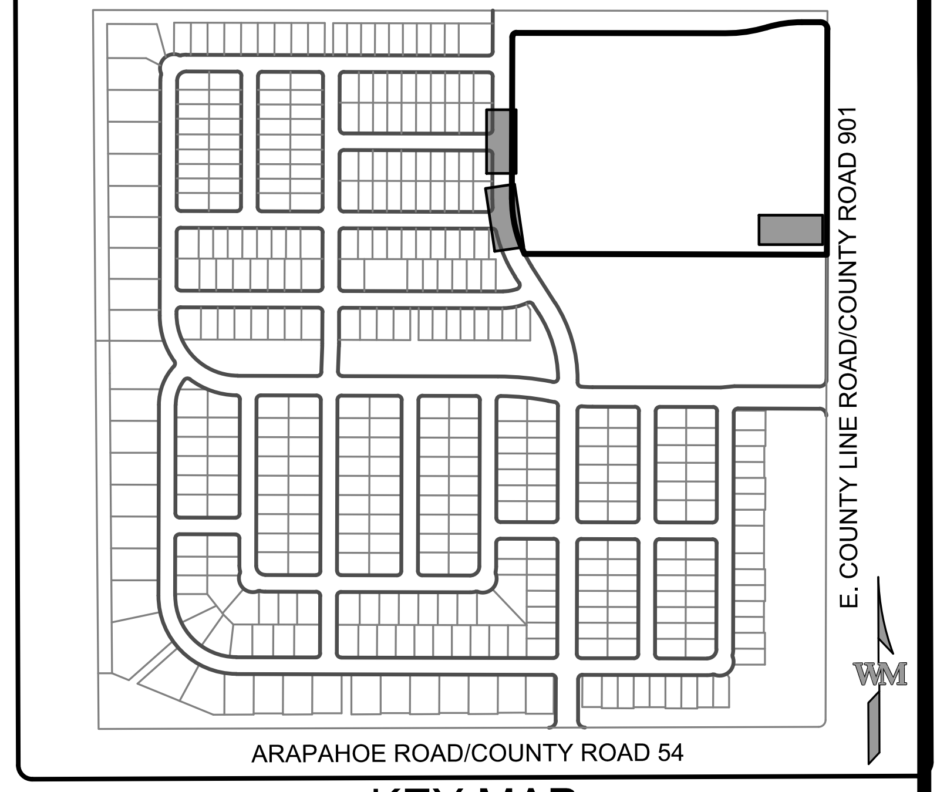
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
NT01
Sheet 2 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



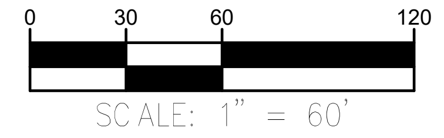


KEY MAP

N.T.S.

LEGEND

═	EXISTING CURB & GUTTER TO BE REMOVED
▭	EXISTING WALK & CRUSHER FINES TO BE REMOVED
⊸	EXISTING SIGN TO BE REMOVED
▬	EXISTING STORM SEWER TO BE REMOVED
— SS —	EXISTING SANITARY SEWER TO BE REMOVED



SCALE: 1" = 60'
ORIGINAL GRAPHIC SCALE

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

EXISTING CONDITIONS & DEMOLITION PLAN

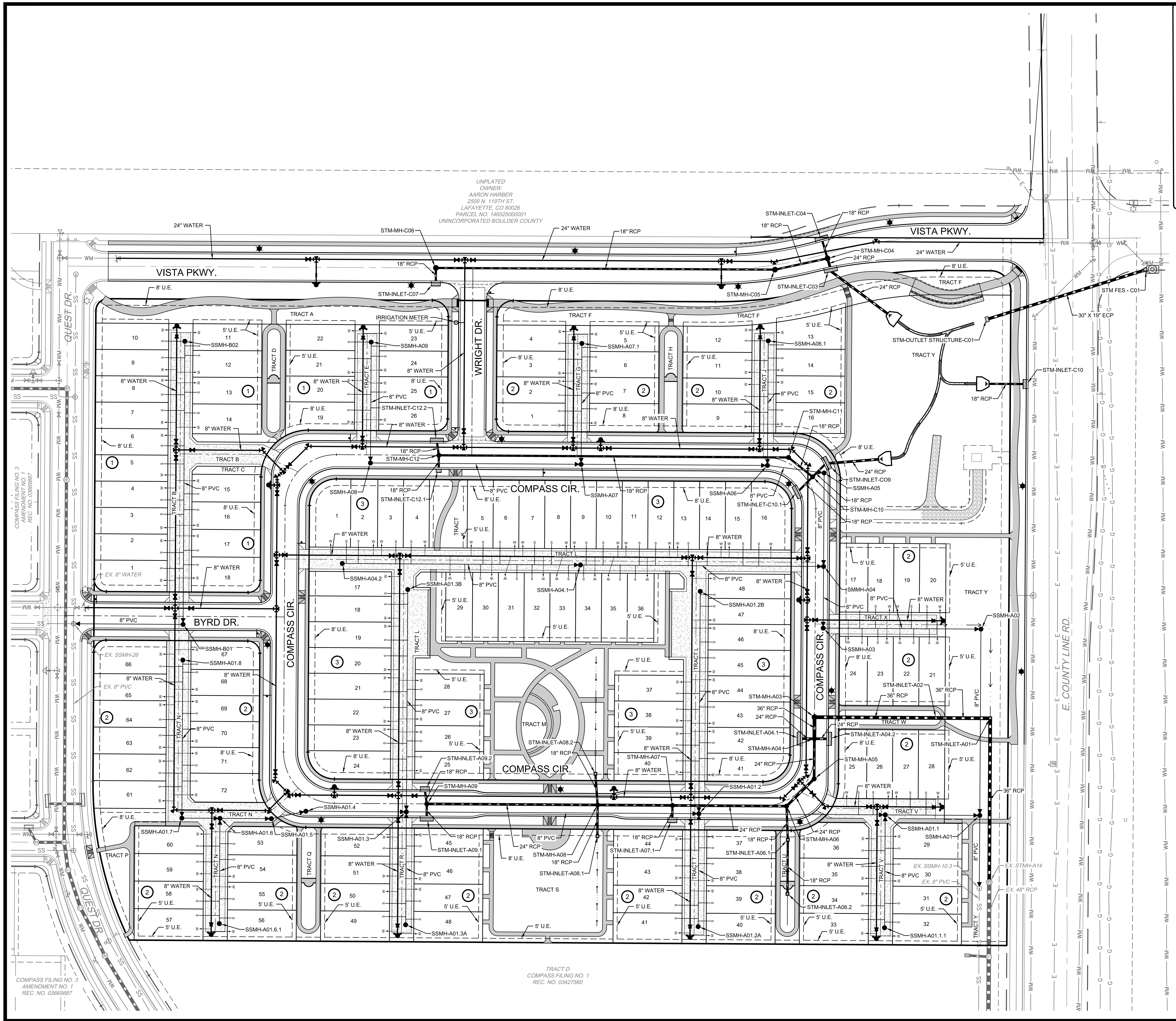
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

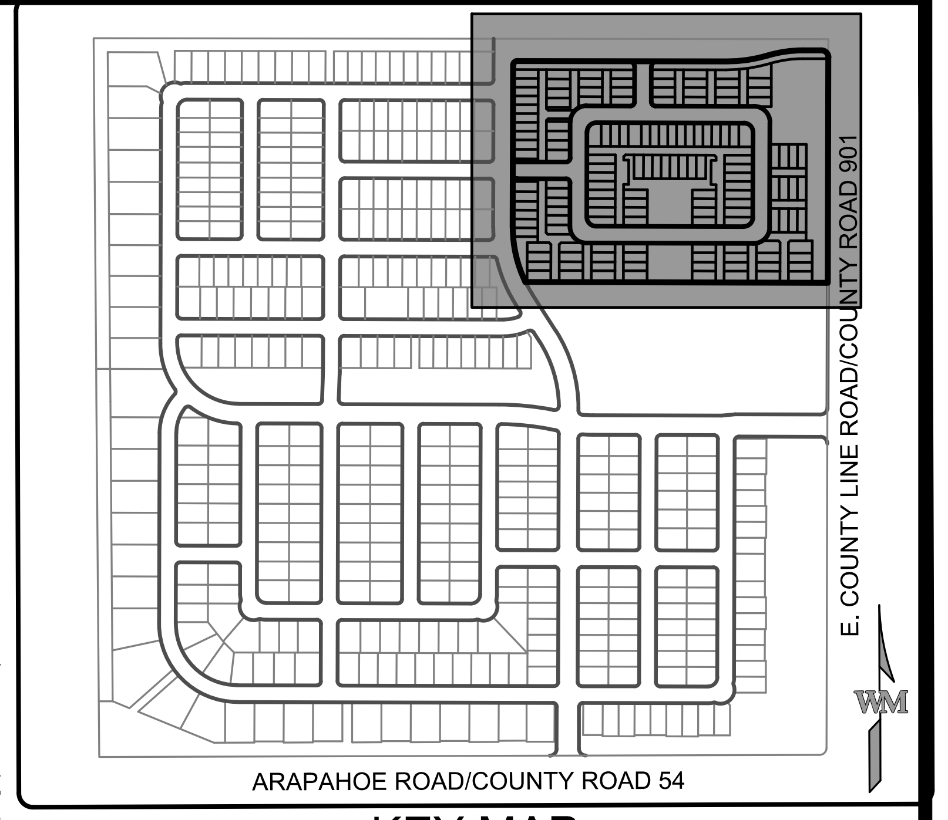
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
DP01
Sheet 3 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP
N.T.S.

NOTES:
1. FOR INFORMATION ONLY. SEE PLAN SHEETS FOR DESIGN AND CONSTRUCTION.

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

OVERALL SITE PLAN

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

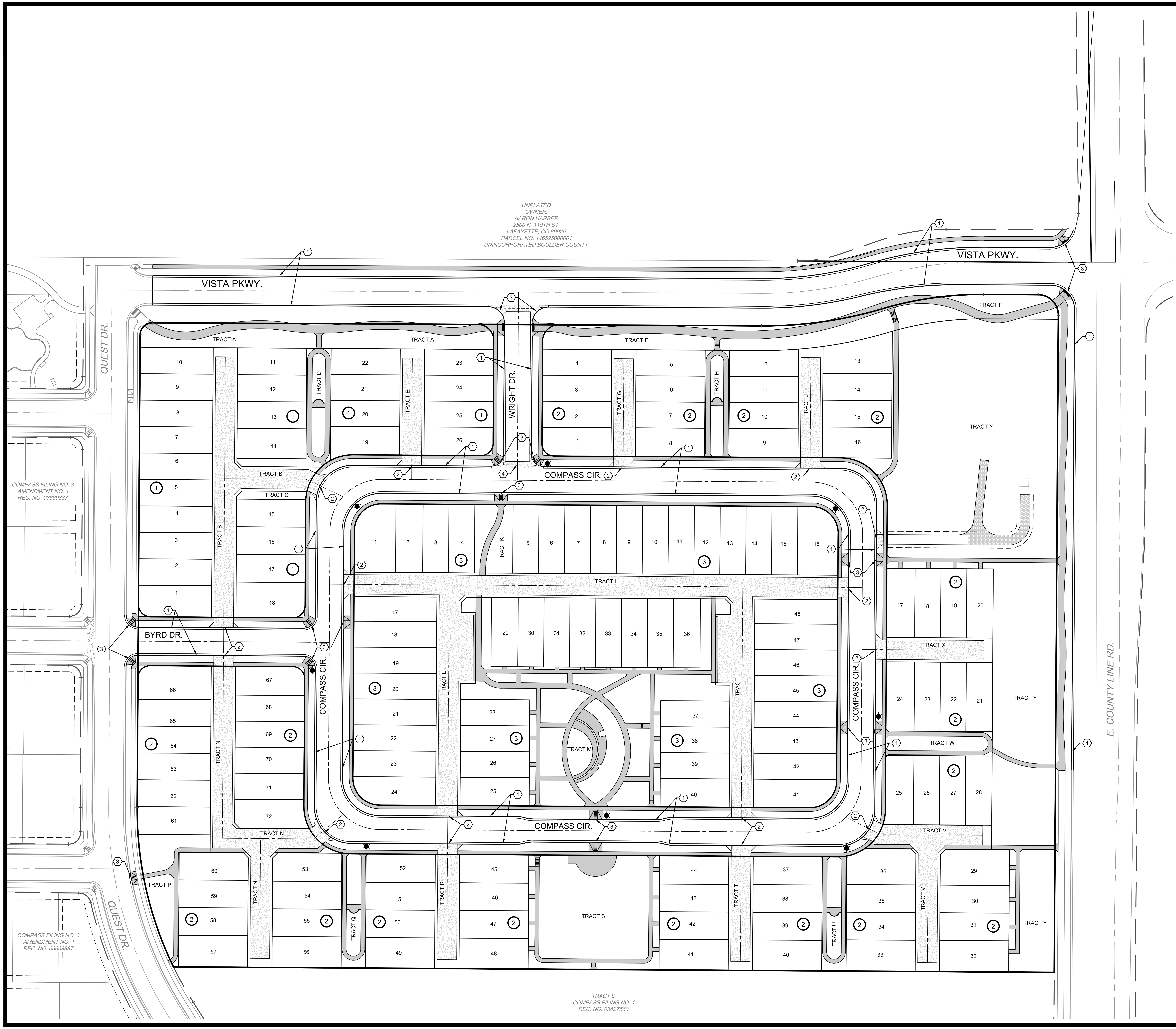
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

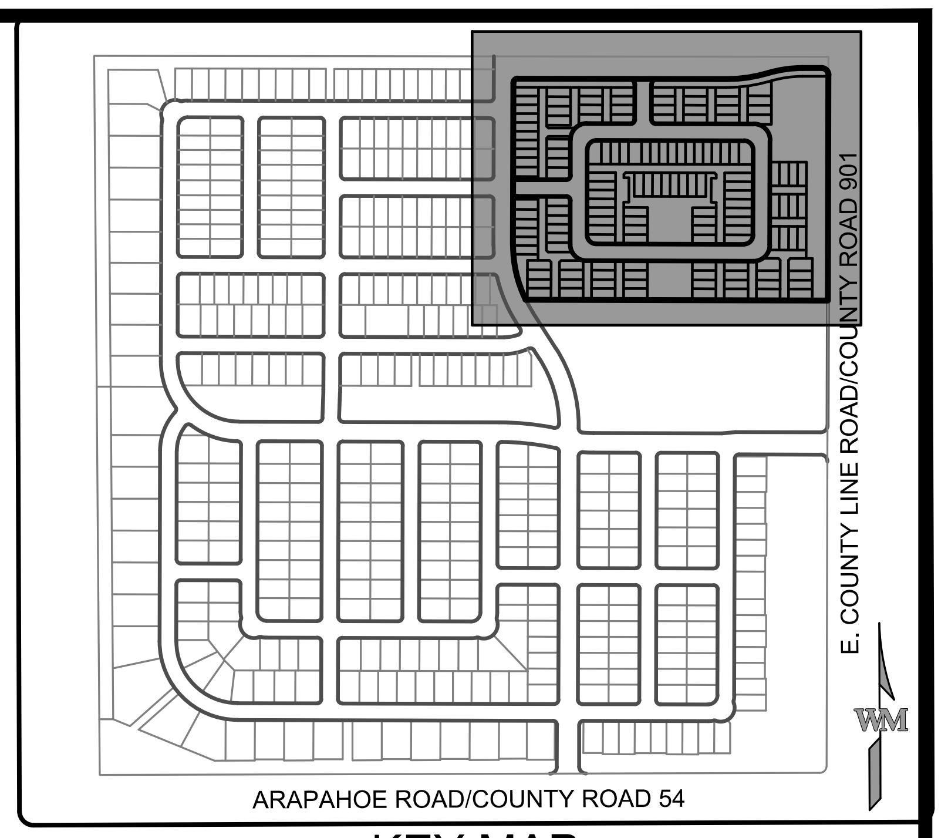
SHEET
OSP01

Sheet 4 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP

N.T.S.

LEGEND

① 6" VERTICAL CURB W/ DETACHED SIDEWALK, 2' GUTTER PER SW13 SEE PLANS FOR TREE LAWN WIDTH

② DRIVE CUT - DETACHED WALK PER DETAIL SW4A.

③ CURB RAMP PER DETAIL SW8 or SW10A (UNLESS OTHERWISE NOTED.)

④ 8' CONCRETE CROSSPAN PER SW3

0 30 60 120
SCALE: 1" = 60'
ORIGINAL GRAPHIC SCALE

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

CURB & GUTTER PLAN

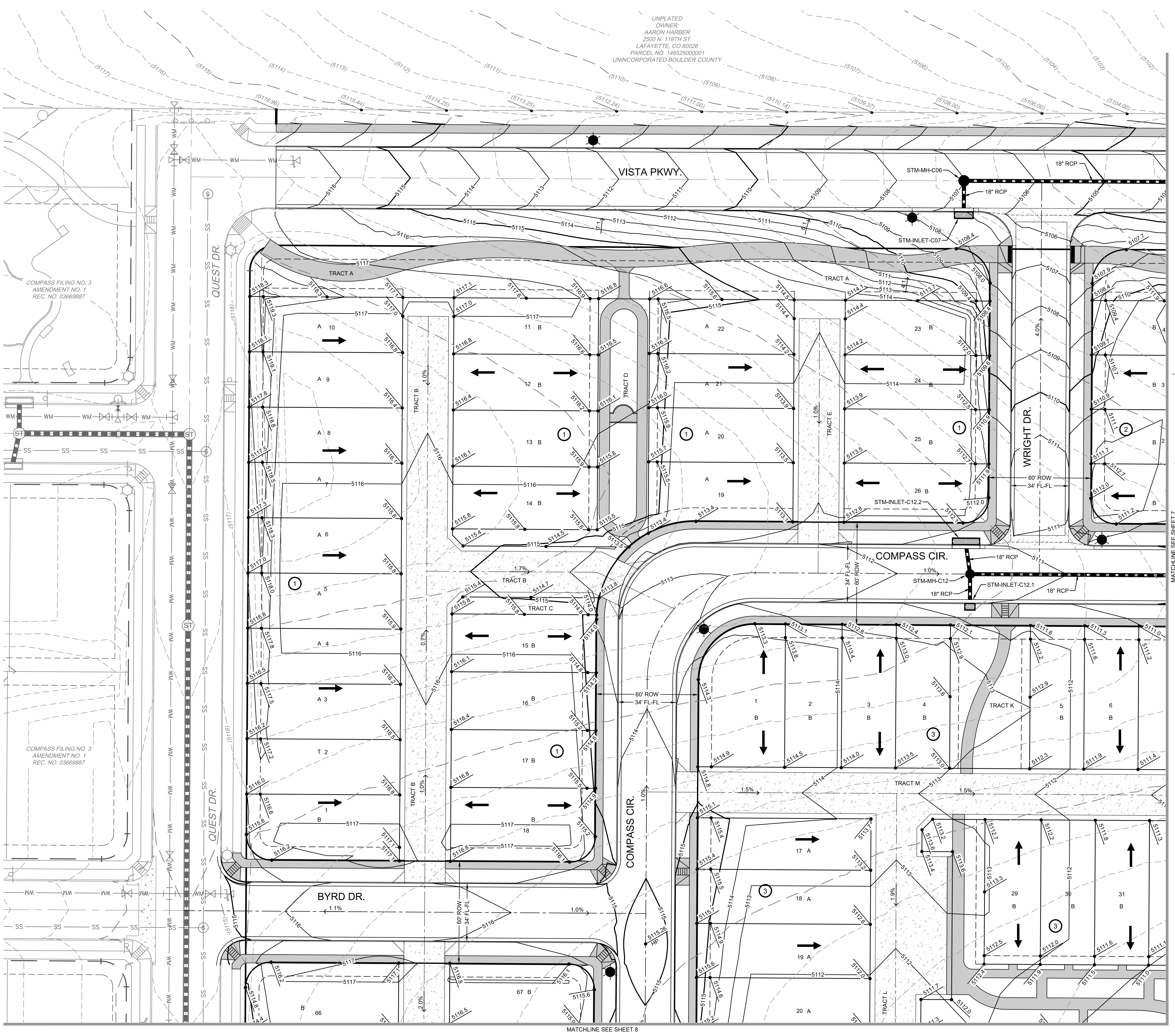
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

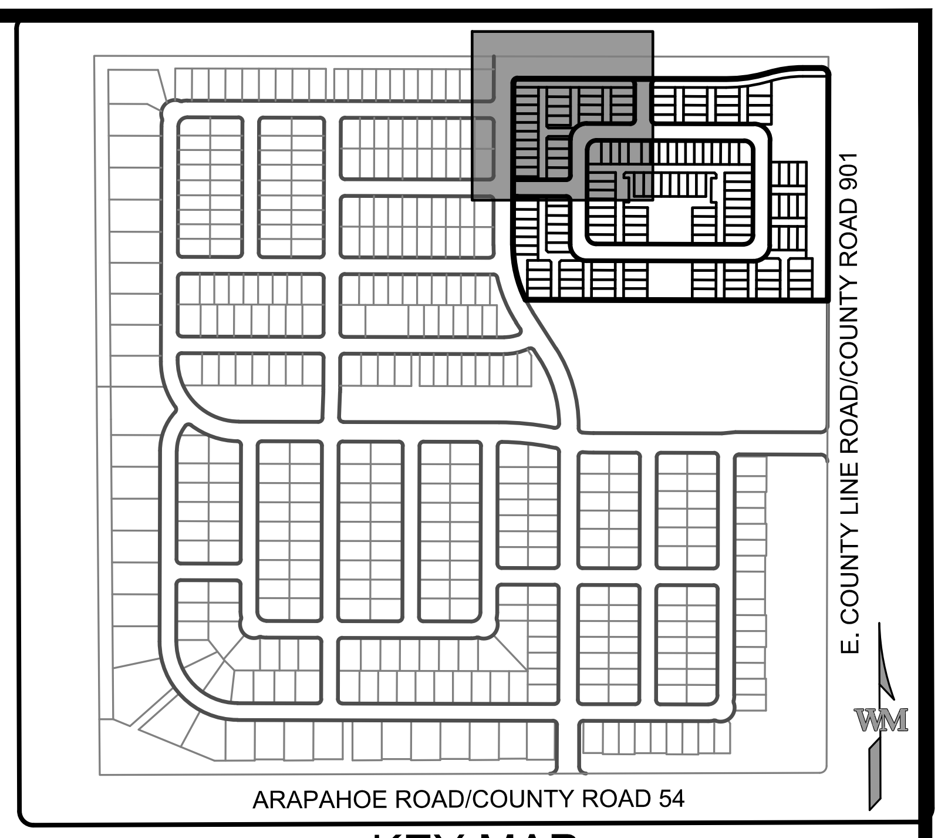
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
CGP01
Sheet 5 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



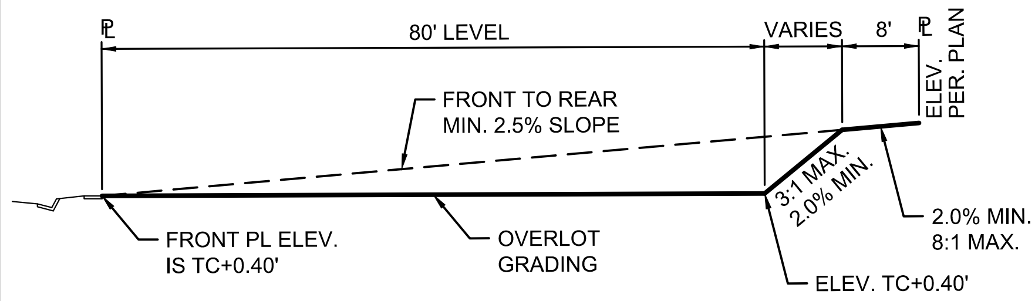


KEY MAP

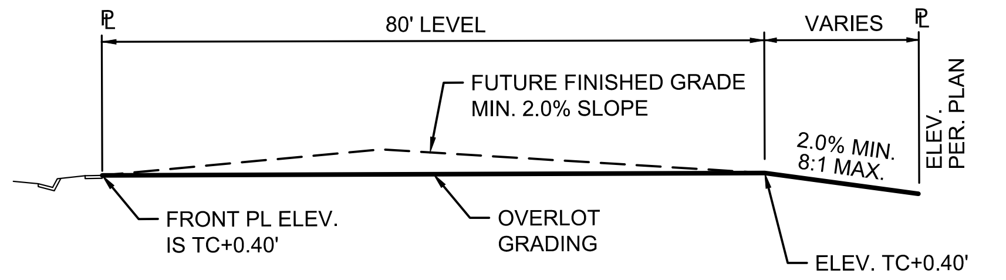
N.T.S.

NOTES:

1. MAX PERMANENT SLOPE = 4:1. MAX TEMPORARY SLOPE & OVERLOT SLOPE = 3:1.
2. THESE PLANS DO NOT REFLECT STREET CORES. CONSULT WITH THE PROPERTY OWNER FOR REQUIRED STREET CORE DEPTH.
3. "T" INDICATES A TRANSITION IN THE LOTS STYLE OF GRADING.
4. REFER TO THE AREA GRADING PLAN FOR SPECIFIC INFORMATION REGARDING INDIVIDUAL LOT GRADING DESIGN AND FLOWS.
5. * INDICATES MODIFIED GRADING TEMPLATE.



TYPICAL 'A' STYLE GRADING



TYPICAL 'B' STYLE GRADING

0 15 30 60

SCALE: 1" = 30'

ORIGINAL GRAPHIC SCALE

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942

Dec 04, 2018

FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

OVERALL GRADING PLAN

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

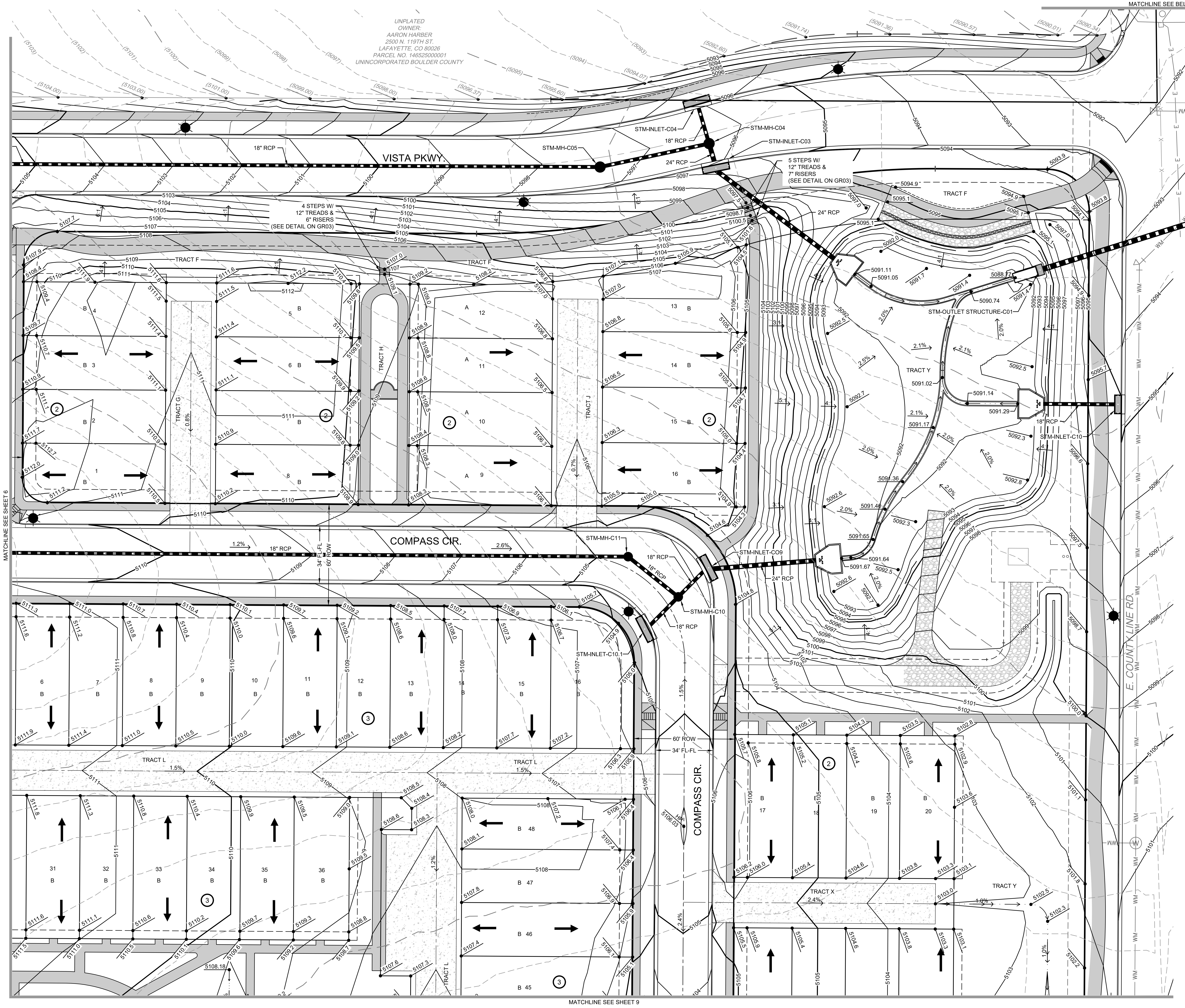
SHEET

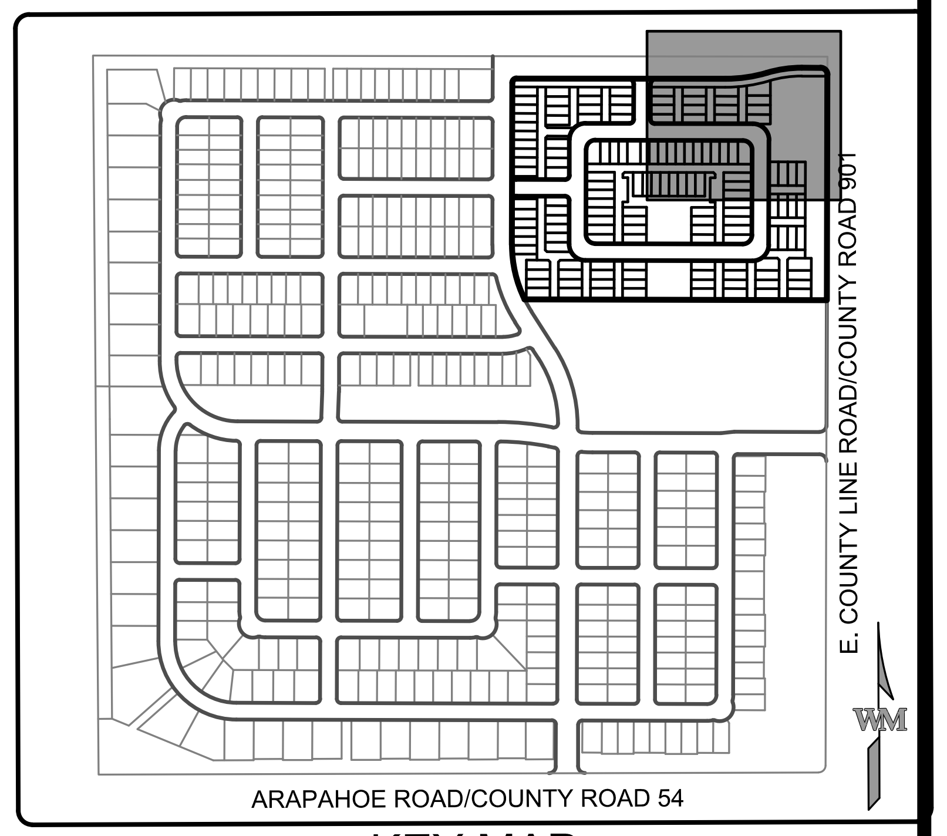
GR01

Sheet 6 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



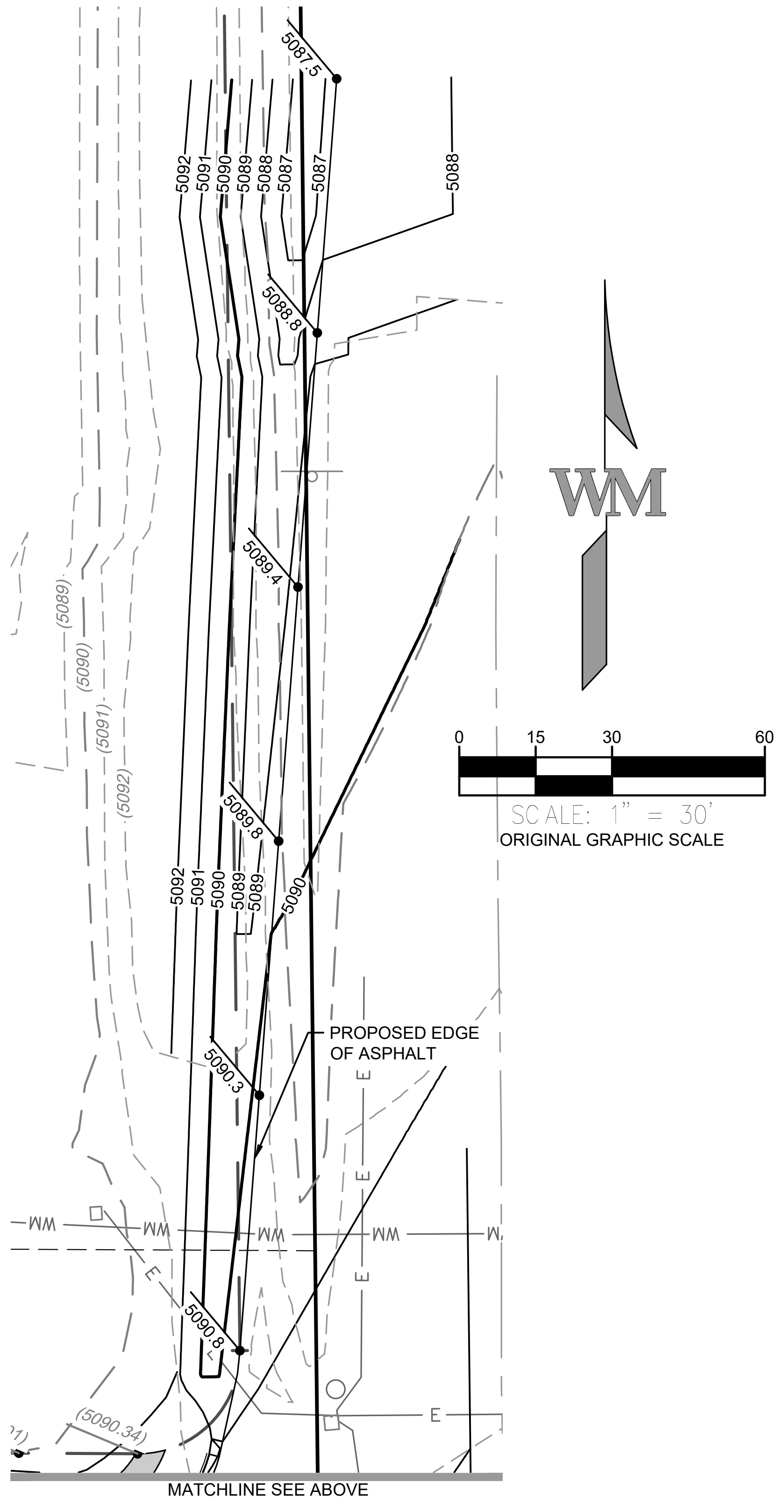


KEY MAP

N.T.S.

NOTES:

1. MAX PERMANENT SLOPE = 4:1. MAX TEMPORARY SLOPE & OVERLOT SLOPE = 3:1.
2. THESE PLANS DO NOT REFLECT STREET CORES. CONSULT WITH THE PROPERTY OWNER FOR REQUIRED STREET CORE DEPTH.
3. "T" INDICATES A TRANSITION IN THE LOTS STYLE OF GRADING.
4. REFER TO THE AREA GRADING PLAN FOR SPECIFIC INFORMATION REGARDING INDIVIDUAL LOT GRADING DESIGN AND FLOWS.
5. * INDICATES MODIFIED GRADING TEMPLATE.



WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED
THOMAS C. JANSEN
35942
PROFESSIONAL ENGINEER
Dec 04, 2018

FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

OVERALL GRADING PLAN

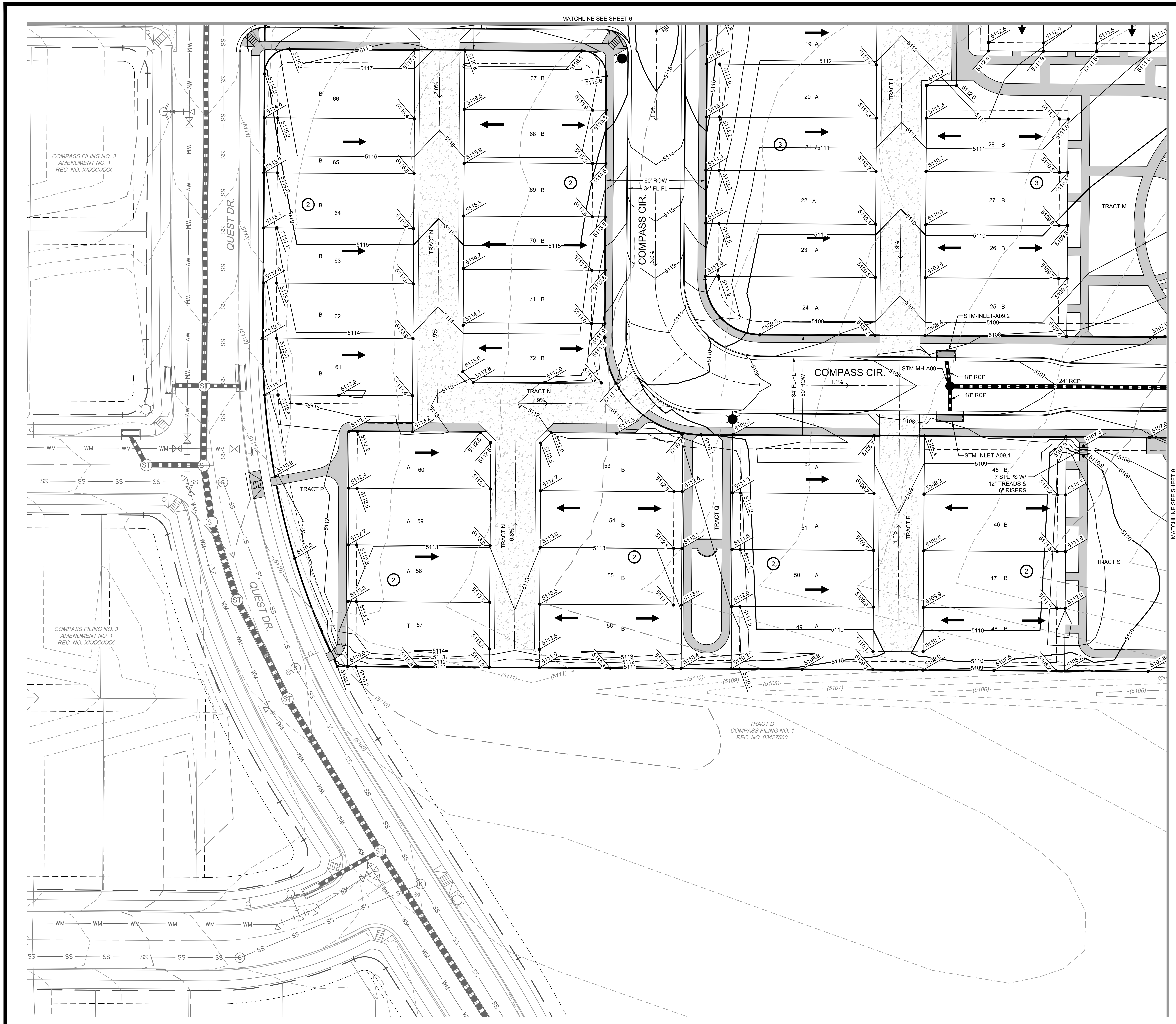
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
GR02
Sheet 7 of 74

NOT FOR CONSTRUCTION

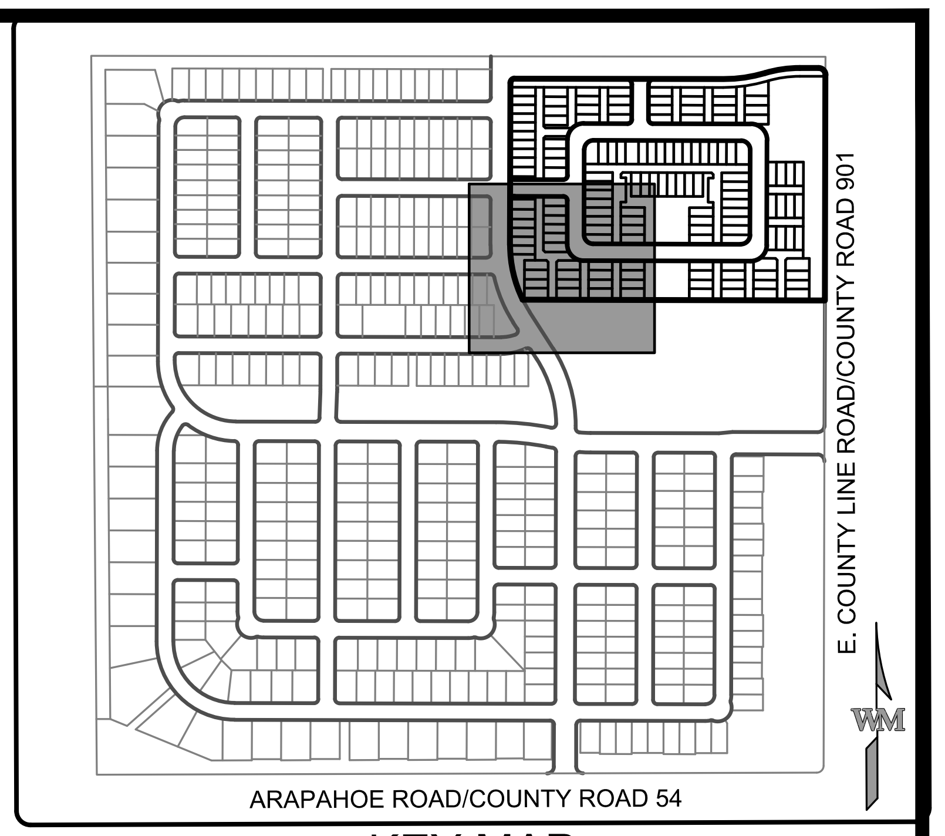
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



0 15 30 60

SCALE: 1" = 30'

ORIGINAL GRAPHIC SCALE

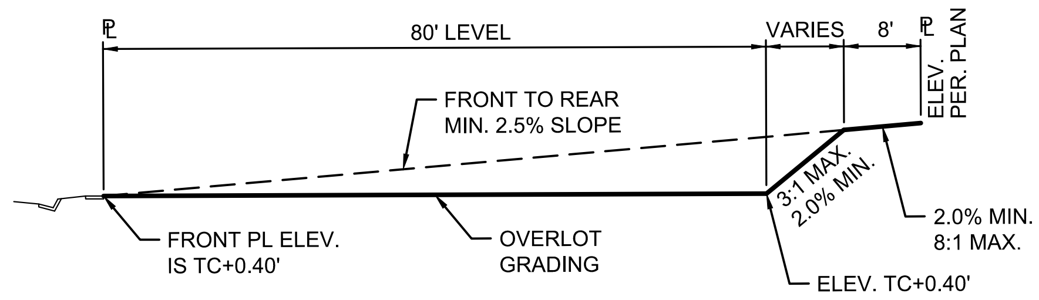


KEY MAP

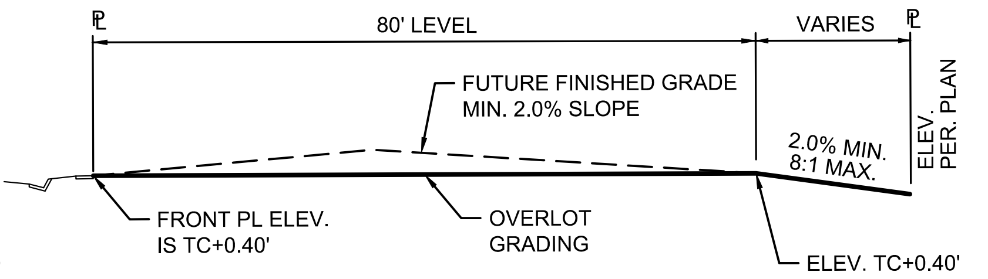
N.T.S.

NOTES:

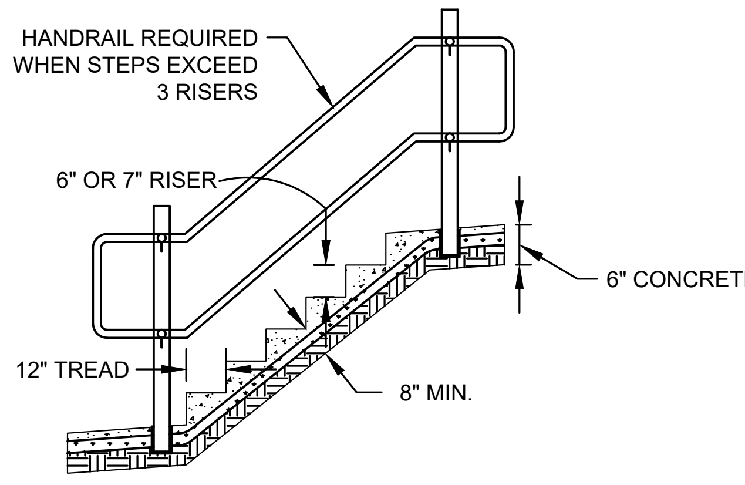
1. MAX PERMANENT SLOPE = 4:1. MAX TEMPORARY SLOPE & OVERLOT SLOPE = 3:1.
2. THESE PLANS DO NOT REFLECT STREET CORES. CONSULT WITH THE PROPERTY OWNER FOR REQUIRED STREET CORE DEPTH.
3. "T" INDICATES A TRANSITION IN THE LOTS STYLE OF GRADING.
4. REFER TO THE AREA GRADING PLAN FOR SPECIFIC INFORMATION REGARDING INDIVIDUAL LOT GRADING DESIGN AND FLOWS.
5. * INDICATES MODIFIED GRADING TEMPLATE.



TYPICAL 'A' STYLE GRADING

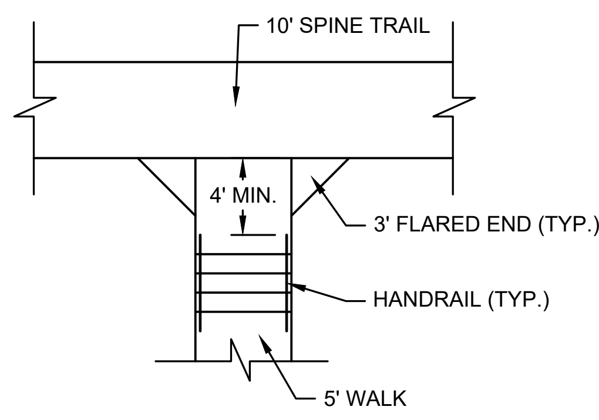


TYPICAL 'B' STYLE GRADING



STAIR SECTION DETAIL

N.T.S.



WALK / TRAIL CONNECTION DETAIL

N.T.S.

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

OVERALL GRADING PLAN

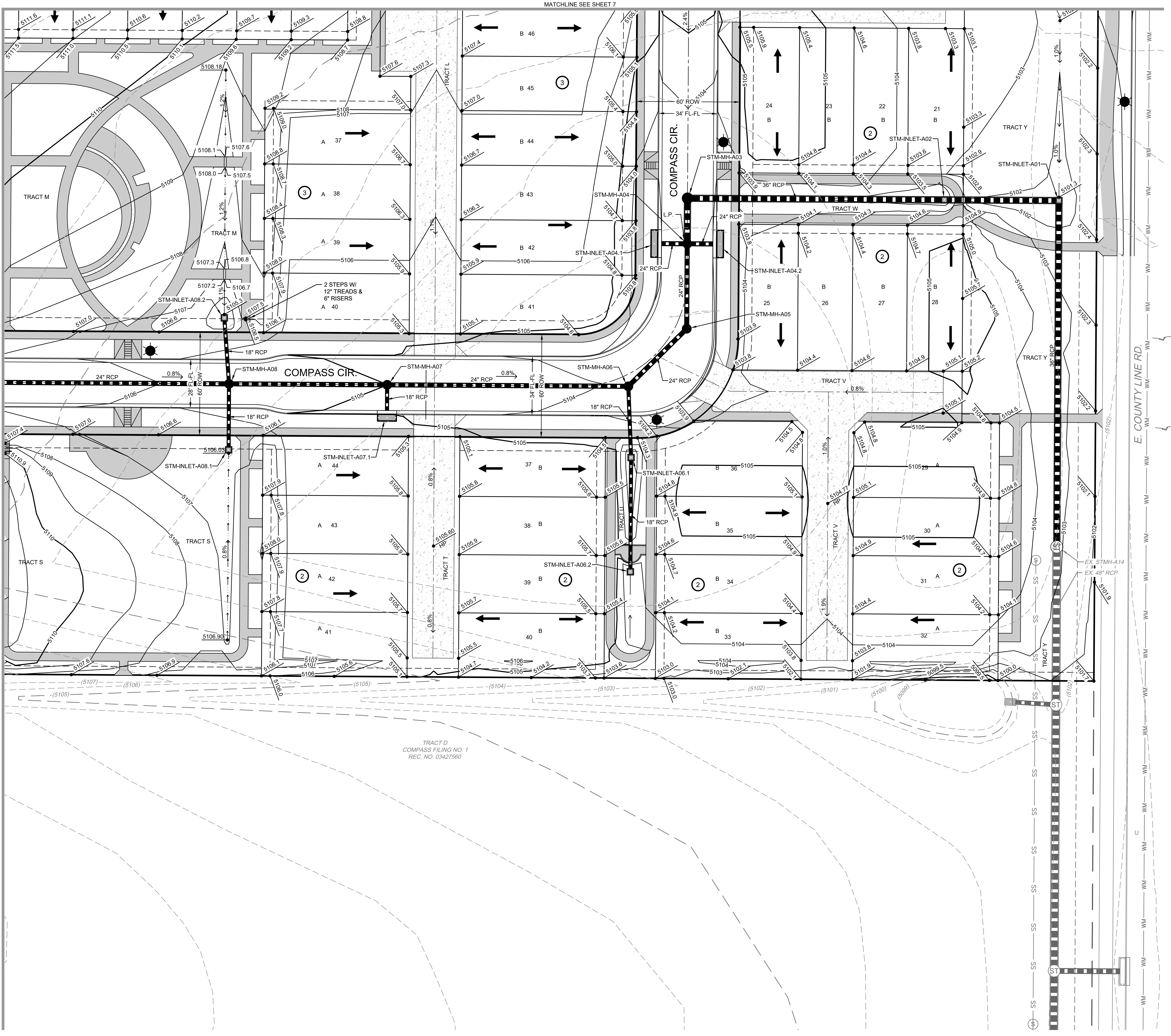
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

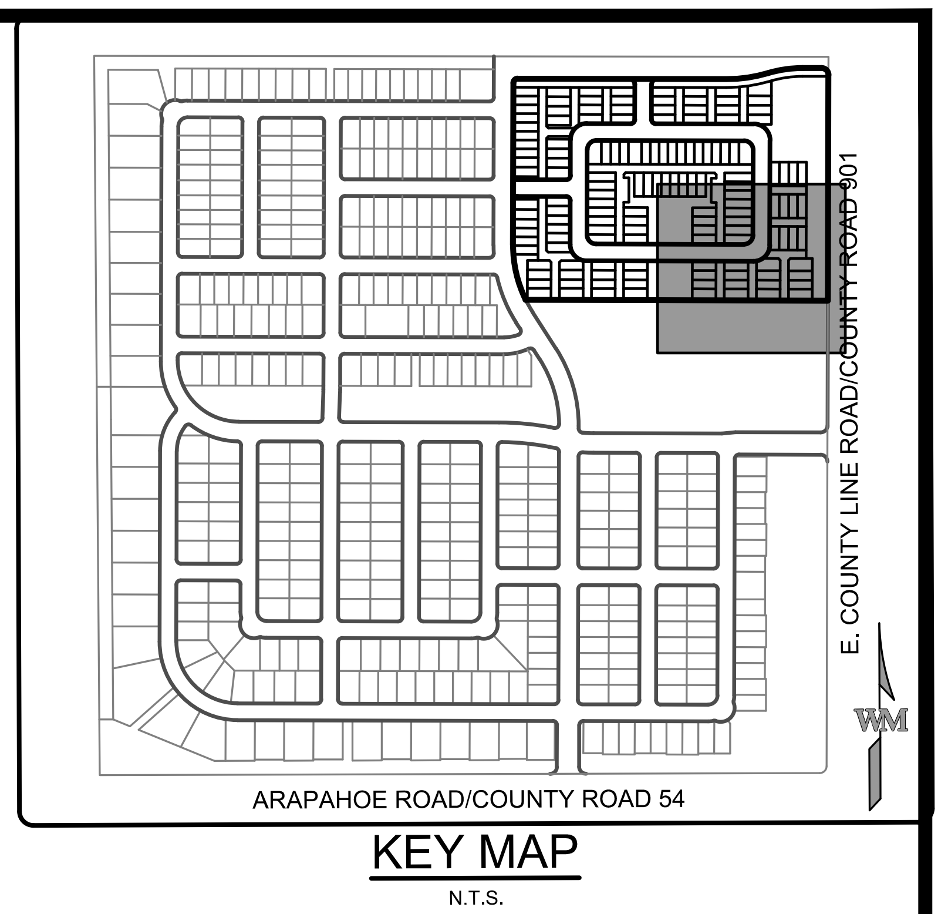
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
GR03
Sheet 8 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



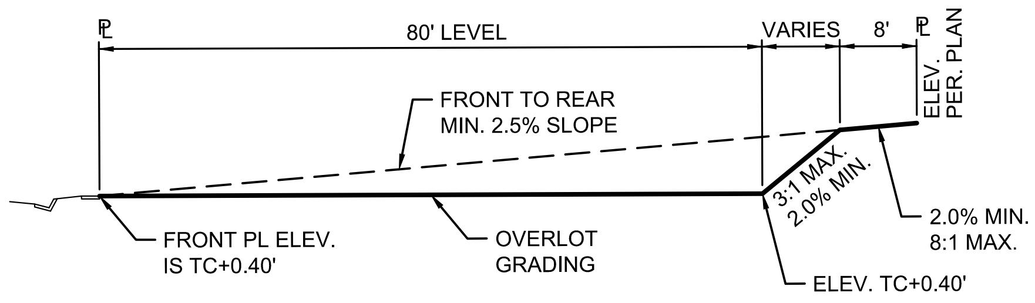


KEY MAP

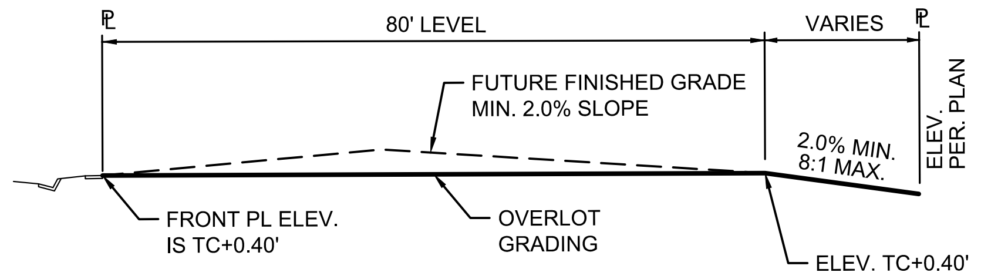
N.T.S.

NOTES:

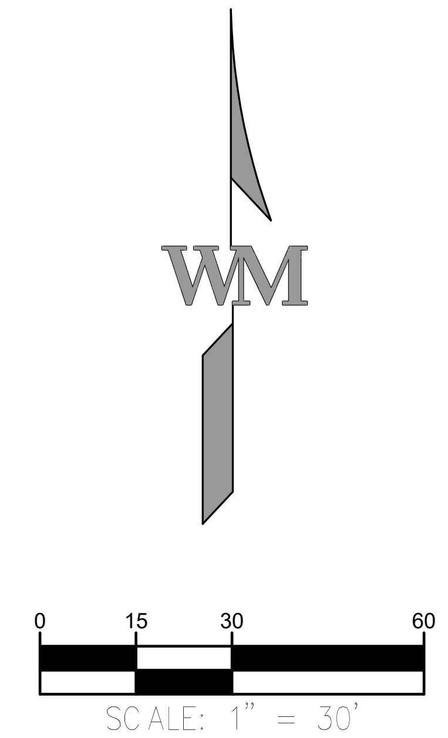
1. MAX PERMANENT SLOPE = 4:1. MAX TEMPORARY SLOPE & OVERLOT SLOPE = 3:1.
2. THESE PLANS DO NOT REFLECT STREET CORES. CONSULT WITH THE PROPERTY OWNER FOR REQUIRED STREET CORE DEPTH.
3. "T" INDICATES A TRANSITION IN THE LOTS STYLE OF GRADING.
4. REFER TO THE AREA GRADING PLAN FOR SPECIFIC INFORMATION REGARDING INDIVIDUAL LOT GRADING DESIGN AND FLOWS.
5. * INDICATES MODIFIED GRADING TEMPLATE.



TYPICAL 'A' STYLE GRADING



TYPICAL 'B' STYLE GRADING



ORIGINAL GRAPHIC SCALE

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

OVERALL GRADING PLAN

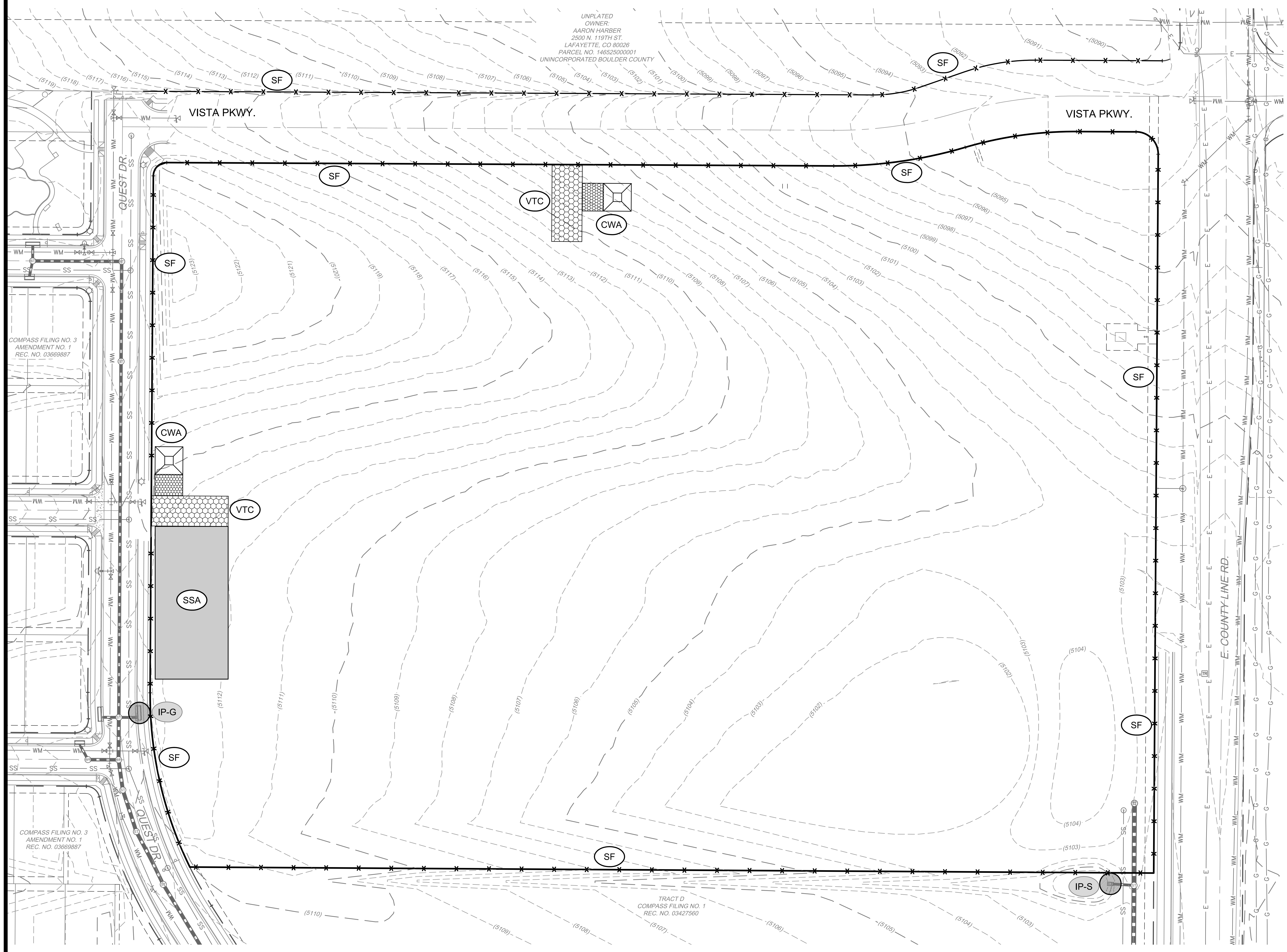
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

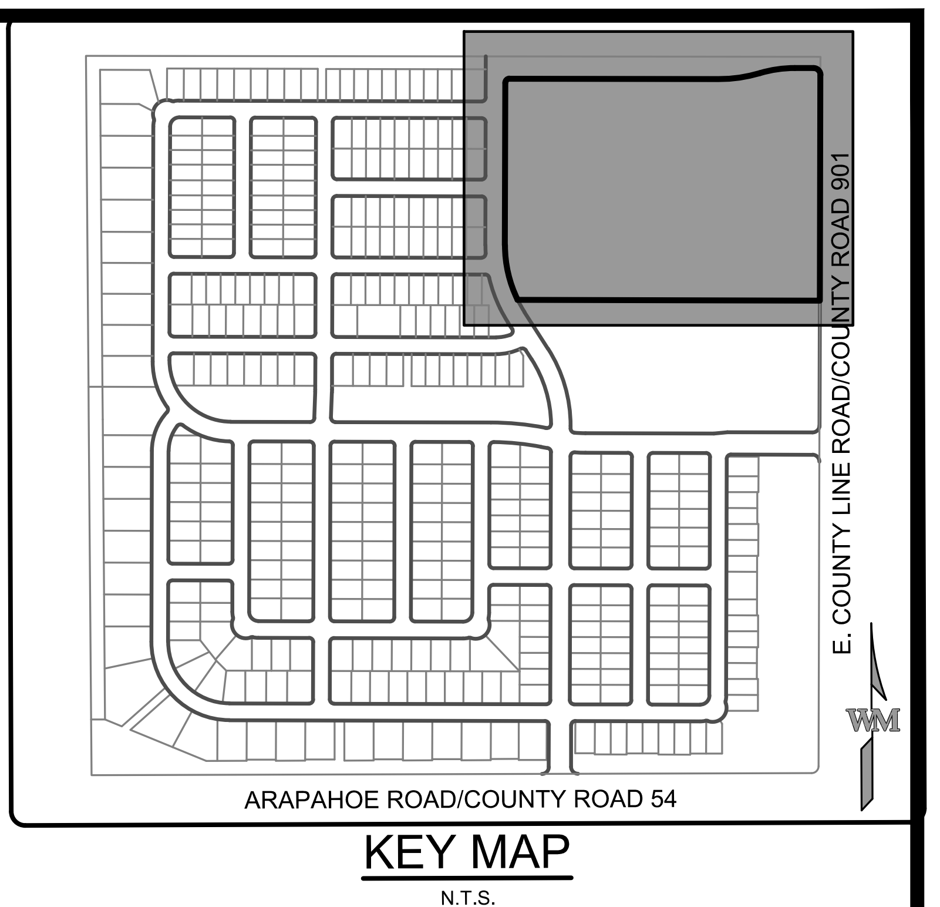
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
GR04
Sheet 9 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





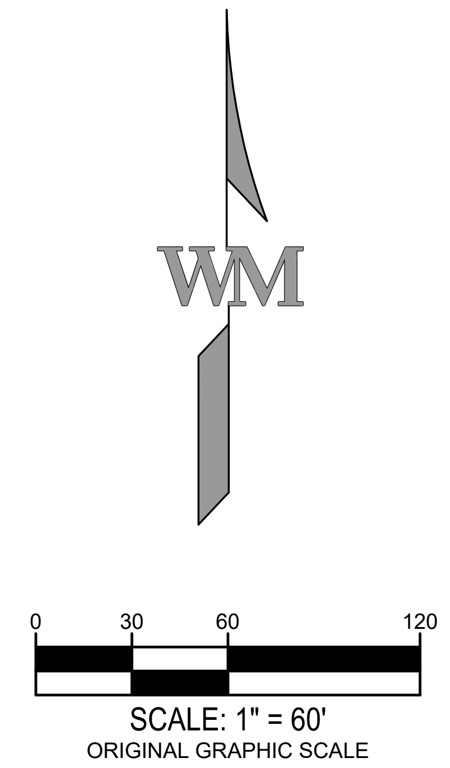
KEY MAP

N.T.S.

NOTES:
1. ADDITIONAL PRACTICES TO BE EMPLOYED AS NECESSARY MEET WATER QUALITY OBJECTIVES AND SUIT THE CURRENT WEATHER, SITE CONDITIONS, AND UNFORESEEN NEEDS.
2. CONTRACTOR RESPONSIBLE FOR ENSURING ALL PRACTICABLE SEDIMENT AND EROSION CONTROL SOLUTIONS ARE EMPLOYED TO MEET WATER QUALITY OBJECTIVES.
3. SEE LANDSCAPE PLANS FOR AREAS TO RECEIVE PERMANENT SEEDING.
4. ALL SEDIMENT CONTROL LOGS SHALL BE PLACED AT THE BACK OF WALKS FRONTING RESIDENTIAL LOTS.

BMP LEGEND

CS	—/—/—	CURB SOCK
IP-G	●	INLET PROTECTION - ON GRADE
IP-S	●	INLET PROTECTION - IN SUMP
OP	●	OUTLET PROTECTION
	←PS→	PERMANENT SEEDING
SF	—X—	SILT FENCE
DD	—>>—	DIVERSION DIKE
CF	—<>—	CONSTRUCTION FENCE
	←SR→	SURFACE ROUGHENING
	←T→	TACKIFIER
	←TS→	TEMPORARY SEEDING
	←SM→	TEMPORARY SEEDING & MULCHING
VTC	▨	VEHICLE TRACKING CONTROL
CD	CHECK DAM	▨
SCL	SEDIMENT CONTROL LOG	▨
SSA	▨	STABILIZED STAGING AREA
TSB	TEMPORARY SEDIMENT BASIN	
CWA	▨	CONCRETE WASHOUT AREA
LOC	LIMITS OF CONSTRUCTION	— —
BMP	EXISTING BMP	



SCALE: 1" = 60'
ORIGINAL GRAPHIC SCALE

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED
THOMAS C. JANSEN
35942
PROFESSIONAL ENGINEER
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

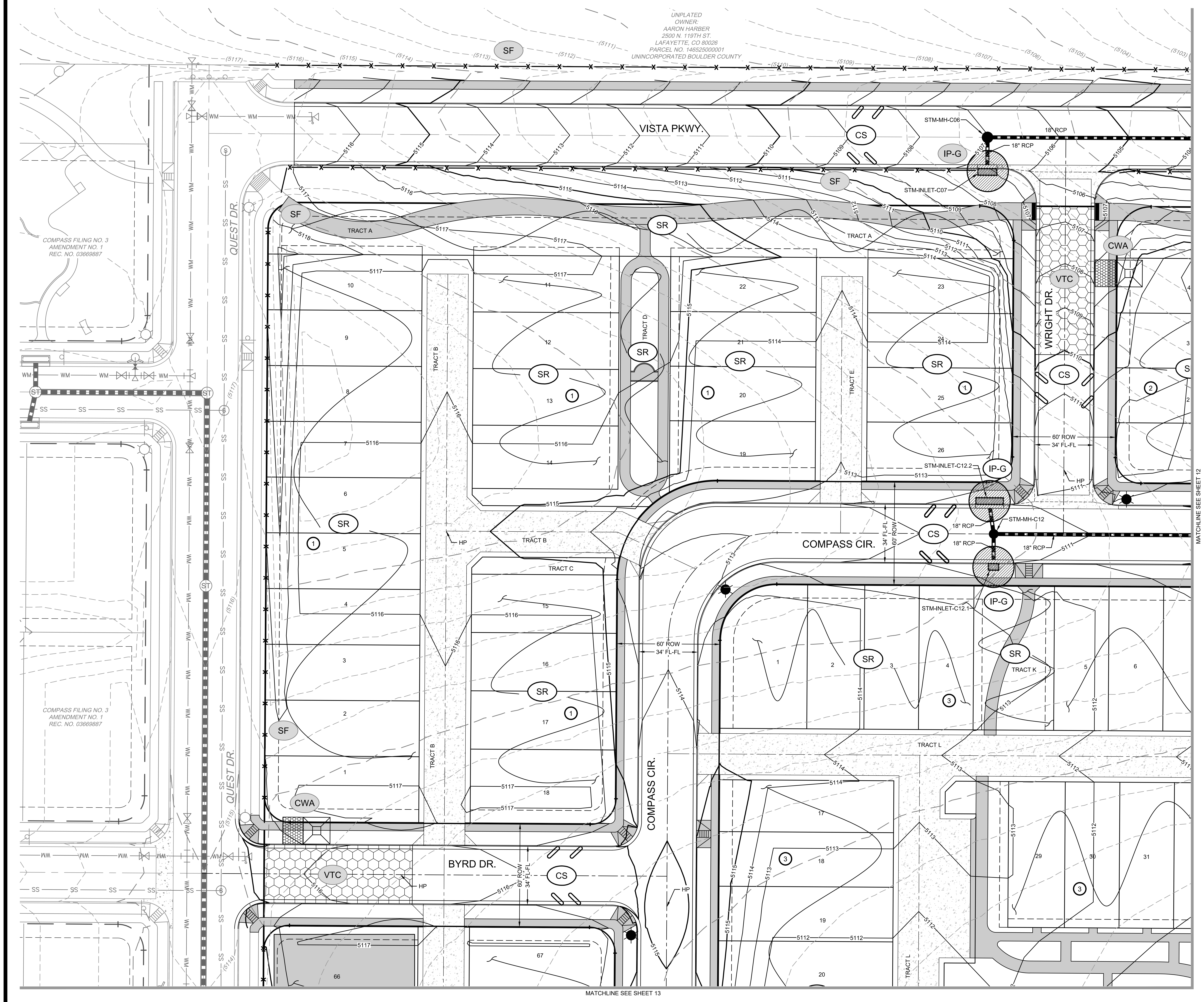
EROSION CONTROL PLAN
INITIAL

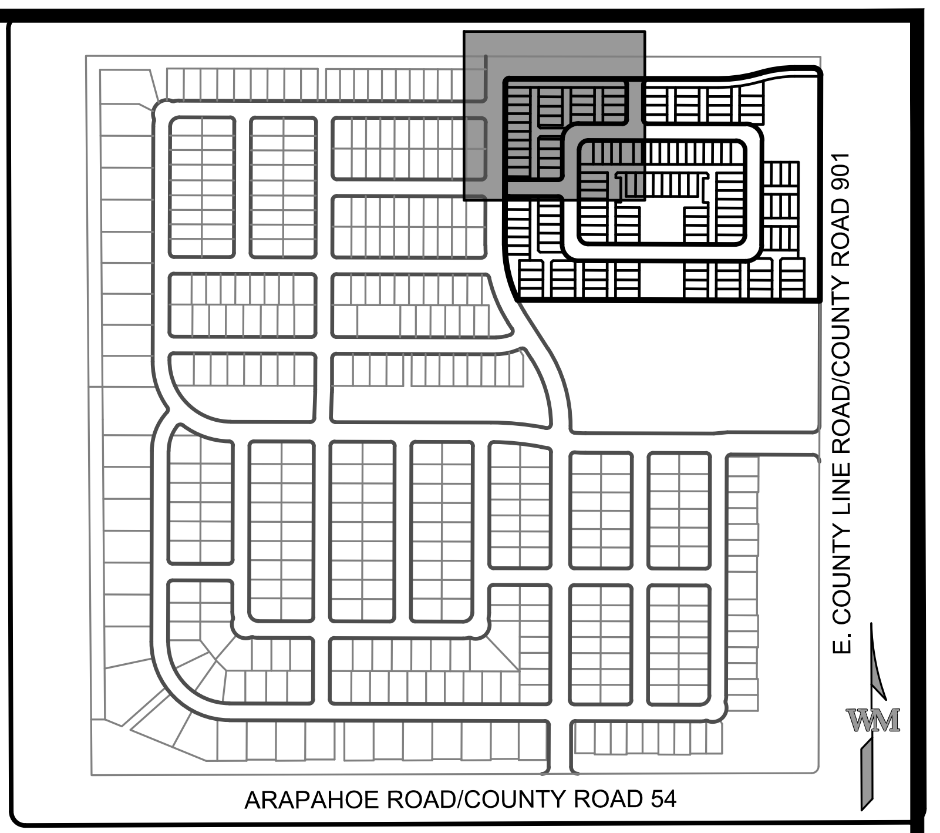
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
EC01
Sheet 10 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP

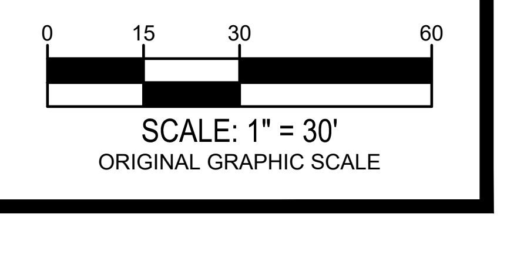
N.T.S.

NOTES:

1. ADDITIONAL PRACTICES TO BE EMPLOYED AS NECESSARY MEET WATER QUALITY OBJECTIVES AND SUIT THE CURRENT WEATHER, SITE CONDITIONS, AND UNFORESEEN NEEDS.
2. CONTRACTOR RESPONSIBLE FOR ENSURING ALL PRACTICABLE SEDIMENT AND EROSION CONTROL SOLUTIONS ARE EMPLOYED TO MEET WATER QUALITY OBJECTIVES.
3. SEE LANDSCAPE PLANS FOR AREAS TO RECEIVE PERMANENT SEEDING.
4. ALL SEDIMENT CONTROL LOGS SHALL BE PLACED AT THE BACK OF WALKS FRONTING RESIDENTIAL LOTS.

BMP LEGEND

CS	CURB SOCK
IP-G	INLET PROTECTION - ON GRADE
IP-S	INLET PROTECTION - IN SUMP
OP	OUTLET PROTECTION
PS	PERMANENT SEEDING
SF	SILT FENCE
DD	DIVERSION DIKE
CF	CONSTRUCTION FENCE
SR	SURFACE ROUGHENING
T	TACKIFIER
TS	TEMPORARY SEEDING
SM	TEMPORARY SEEDING & MULCHING
VTC	VEHICLE TRACKING CONTROL
CD	CHECK DAM
SCL	SEDIMENT CONTROL LOG
SSA	STABILIZED STAGING AREA
TSB	TEMPORARY SEDIMENT BASIN
CWA	CONCRETE WASHOUT AREA
LOC	LIMITS OF CONSTRUCTION
BMP	EXISTING BMP



SCALE: 1" = 30'
ORIGINAL GRAPHIC SCALE

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN 35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

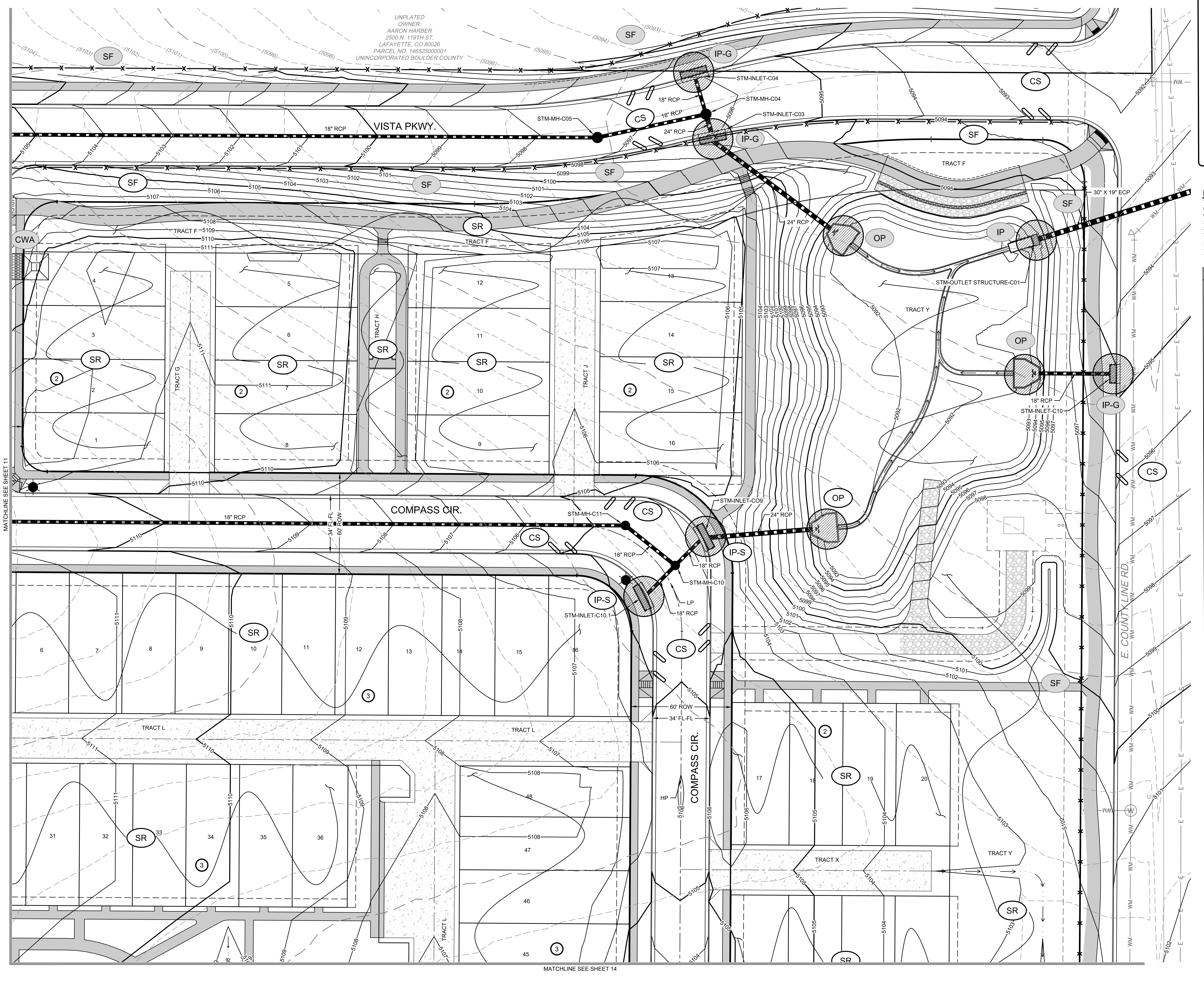
EROSION CONTROL PLAN
INTERIM

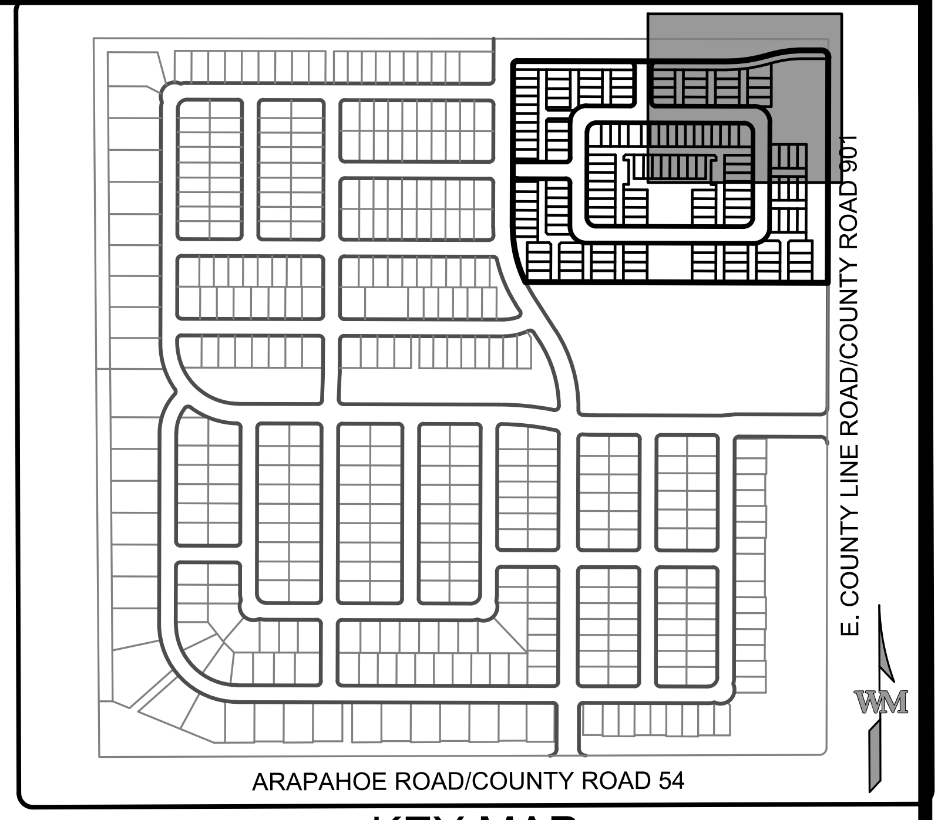
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
EC02
Sheet 11 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP

N.T.S.

NOTES:

1. ADDITIONAL PRACTICES TO BE EMPLOYED AS NECESSARY MEET WATER QUALITY OBJECTIVES AND SUIT THE CURRENT WEATHER, SITE CONDITIONS, AND UNFORESEEN NEEDS.
2. CONTRACTOR RESPONSIBLE FOR ENSURING ALL PRACTICABLE SEDIMENT AND EROSION CONTROL SOLUTIONS ARE EMPLOYED TO MEET WATER QUALITY OBJECTIVES.
3. SEE LANDSCAPE PLANS FOR AREAS TO RECEIVE PERMANENT SEEDING.
4. ALL SEDIMENT CONTROL LOGS SHALL BE PLACED AT THE BACK OF WALKS FRONTING RESIDENTIAL LOTS.

BMP LEGEND

CS	CURB SOCK
IP-G	INLET PROTECTION - ON GRADE
IP-S	INLET PROTECTION - IN SUMP
OP	OUTLET PROTECTION
PS	PERMANENT SEEDING
SF	SILT FENCE
DD	DIVERSION DIKE
CF	CONSTRUCTION FENCE
SR	SURFACE ROUGHENING
T	TACKIFIER
TS	TEMPORARY SEEDING
SM	TEMPORARY SEEDING & MULCHING
VTC	VEHICLE TRACKING CONTROL
CD	CHECK DAM
SCL	SEDIMENT CONTROL LOG
SSA	STABILIZED STAGING AREA
TSB	TEMPORARY SEDIMENT BASIN
CWA	CONCRETE WASHOUT AREA
LOC	LIMITS OF CONSTRUCTION
BMP	EXISTING BMP

0 15 30 60
SCALE: 1" = 30'
ORIGINAL GRAPHIC SCALE

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

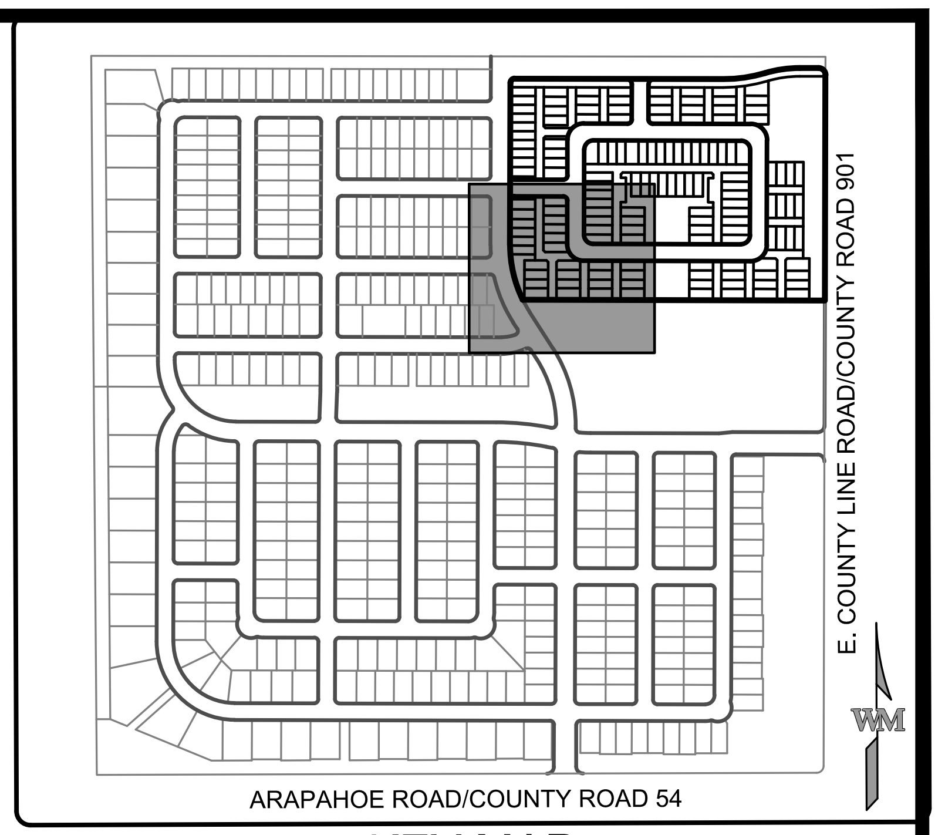
EROSION CONTROL PLAN
INTERIM

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
EC03
Sheet 12 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



KEY MAP

N.T.S.

NOTES:

1. ADDITIONAL PRACTICES TO BE EMPLOYED AS NECESSARY MEET WATER QUALITY OBJECTIVES AND SUIT THE CURRENT WEATHER, SITE CONDITIONS, AND UNFORESEEN NEEDS.
2. CONTRACTOR RESPONSIBLE FOR ENSURING ALL PRACTICABLE SEDIMENT AND EROSION CONTROL SOLUTIONS ARE EMPLOYED TO MEET WATER QUALITY OBJECTIVES.
3. SEE LANDSCAPE PLANS FOR AREAS TO RECEIVE PERMANENT SEEDING.
4. ALL SEDIMENT CONTROL LOGS SHALL BE PLACED AT THE BACK OF WALKS FRONTING RESIDENTIAL LOTS.

BMP LEGEND

CS	CURB SOCK
IP-G	INLET PROTECTION - ON GRADE
IP-S	INLET PROTECTION - IN SUMP
OP	OUTLET PROTECTION
PS	PERMANENT SEEDING
SF	SILT FENCE
DD	DIVERSION DIKE
CF	CONSTRUCTION FENCE
SR	SURFACE ROUGHENING
T	TACKIFIER
TS	TEMPORARY SEEDING
SM	TEMPORARY SEEDING & MULCHING
VTC	VEHICLE TRACKING CONTROL
CD	CHECK DAM
SCL	SEDIMENT CONTROL LOG
SSA	STABILIZED STAGING AREA
TSB	TEMPORARY SEDIMENT BASIN
CWA	CONCRETE WASHOUT AREA
LOC	LIMITS OF CONSTRUCTION
BMP	EXISTING BMP

0 15 30 60

SCALE: 1" = 30'

ORIGINAL GRAPHIC SCALE

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

35942
THOMAS C. JANSEN
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

EROSION CONTROL PLAN
INTERIM

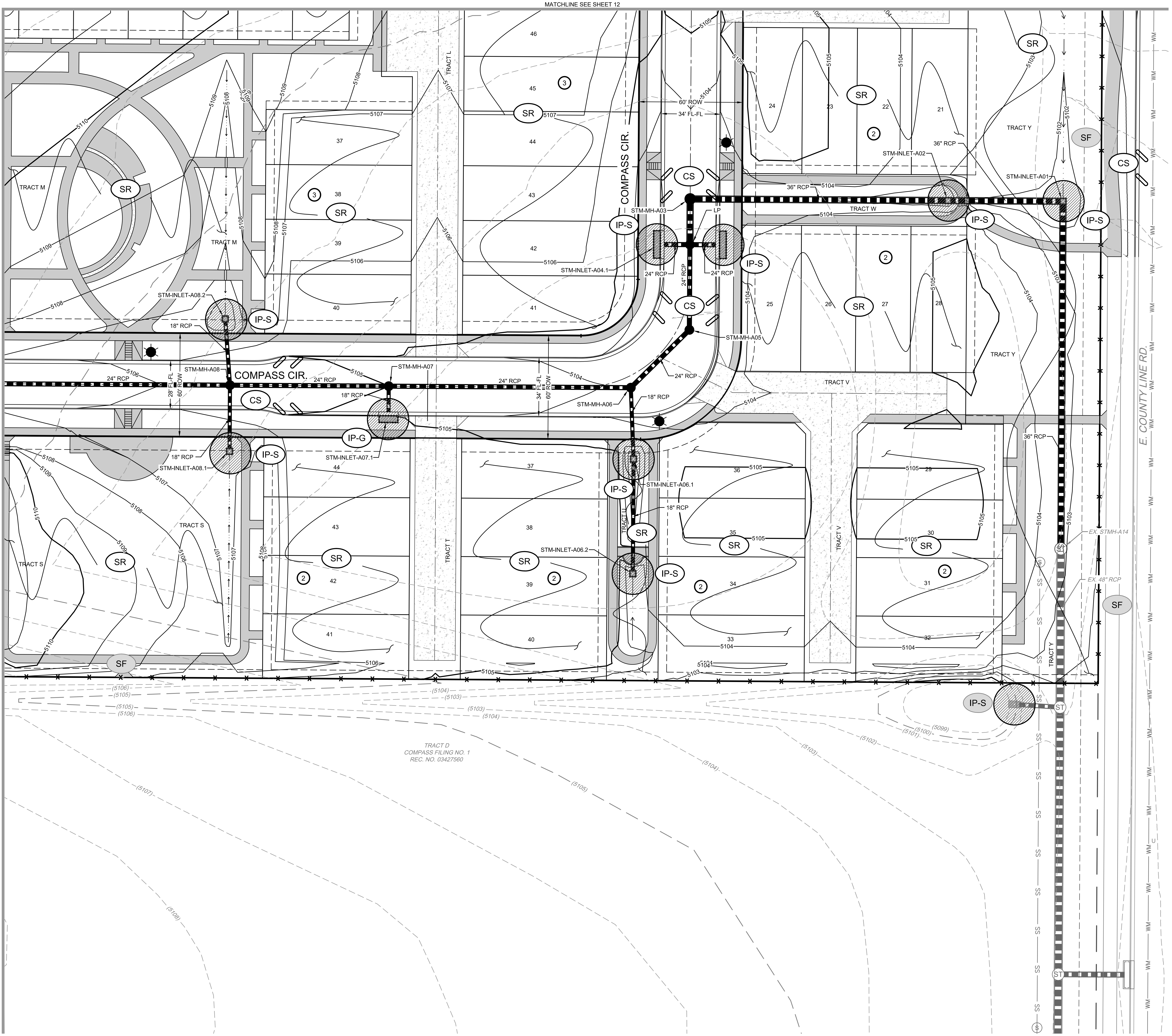
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

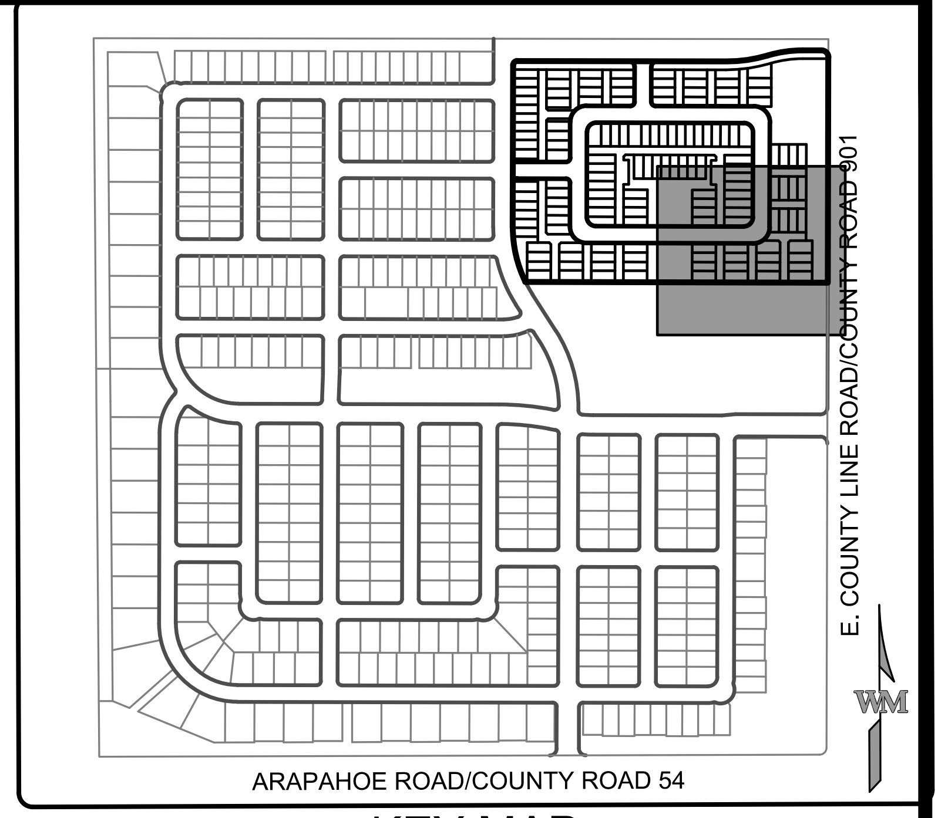
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
EC04
Sheet 13 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP

N.T.S.

NOTES:

1. ADDITIONAL PRACTICES TO BE EMPLOYED AS NECESSARY MEET WATER QUALITY OBJECTIVES AND SUIT THE CURRENT WEATHER, SITE CONDITIONS, AND UNFORESEEN NEEDS.
2. CONTRACTOR RESPONSIBLE FOR ENSURING ALL PRACTICABLE SEDIMENT AND EROSION CONTROL SOLUTIONS ARE EMPLOYED TO MEET WATER QUALITY OBJECTIVES.
3. SEE LANDSCAPE PLANS FOR AREAS TO RECEIVE PERMANENT SEEDING.
4. ALL SEDIMENT CONTROL LOGS SHALL BE PLACED AT THE BACK OF WALKS FRONTING RESIDENTIAL LOTS.

BMP LEGEND

CS	CURB SOCK
IP-G	INLET PROTECTION - ON GRADE
IP-S	INLET PROTECTION - IN SUMP
OP	OUTLET PROTECTION
PS	PERMANENT SEEDING
SF	SILT FENCE
DD	DIVERSION DIKE
CF	CONSTRUCTION FENCE
SR	SURFACE ROUGHENING
T	TACKIFIER
TS	TEMPORARY SEEDING
SM	TEMPORARY SEEDING & MULCHING
VTC	VEHICLE TRACKING CONTROL
CD	CHECK DAM
SCL	SEDIMENT CONTROL LOG
SSA	STABILIZED STAGING AREA
TSB	TEMPORARY SEDIMENT BASIN
CWA	CONCRETE WASHOUT AREA
LOC	LIMITS OF CONSTRUCTION
BMP	EXISTING BMP

0 15 30 60

SCALE: 1" = 30'
ORIGINAL GRAPHIC SCALE

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

EROSION CONTROL PLAN
INTERIM

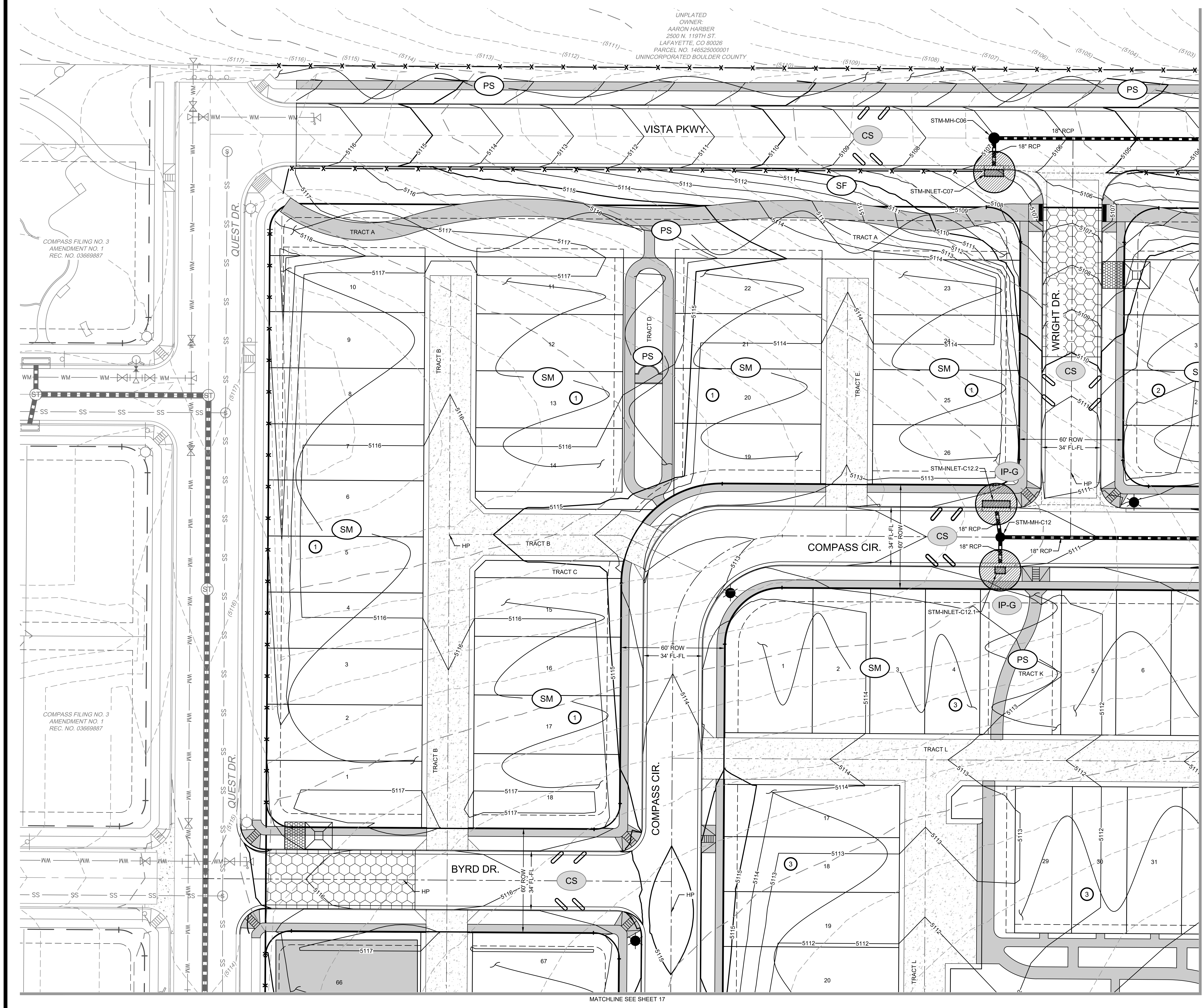
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

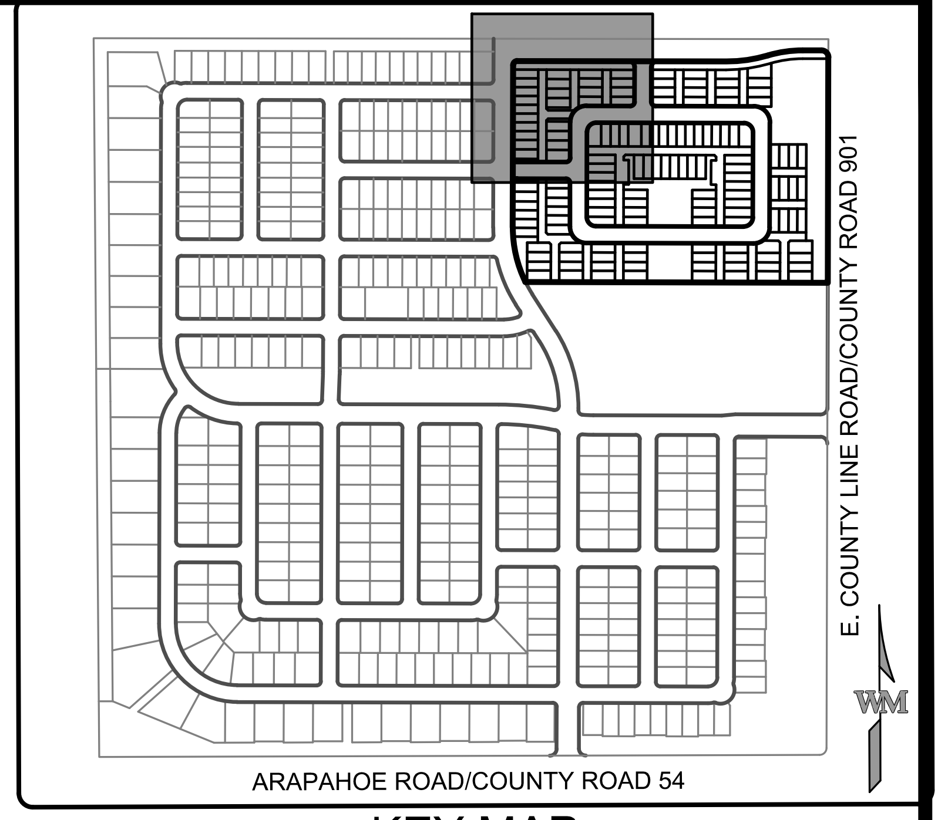
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
EC05
Sheet 14 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP

N.T.S.

NOTES:

1. ADDITIONAL PRACTICES TO BE EMPLOYED AS NECESSARY MEET WATER QUALITY OBJECTIVES AND SUIT THE CURRENT WEATHER, SITE CONDITIONS, AND UNFORESEEN NEEDS.
2. CONTRACTOR RESPONSIBLE FOR ENSURING ALL PRACTICABLE SEDIMENT AND EROSION CONTROL SOLUTIONS ARE EMPLOYED TO MEET WATER QUALITY OBJECTIVES.
3. SEE LANDSCAPE PLANS FOR AREAS TO RECEIVE PERMANENT SEEDING.
4. ALL SEDIMENT CONTROL LOGS SHALL BE PLACED AT THE BACK OF WALKS FRONTING RESIDENTIAL LOTS.

BMP LEGEND

CS	CURB SOCK
IP-G	INLET PROTECTION - ON GRADE
IP-S	INLET PROTECTION - IN SUMP
OP	OUTLET PROTECTION
PS	PERMANENT SEEDING
SF	SILT FENCE
DD	DIVERSION DIKE
CF	CONSTRUCTION FENCE
SR	SURFACE ROUGHENING
T	TACKIFIER
TS	TEMPORARY SEEDING
SM	TEMPORARY SEEDING & MULCHING
VTC	VEHICLE TRACKING CONTROL
CD	CHECK DAM
SCL	SEDIMENT CONTROL LOG
SSA	STABILIZED STAGING AREA
TSB	TEMPORARY SEDIMENT BASIN
CWA	CONCRETE WASHOUT AREA
LOC	LIMITS OF CONSTRUCTION
BMP	EXISTING BMP

SCALE: 1" = 30'
ORIGINAL GRAPHIC SCALE
0 15 30 60

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

EROSION CONTROL PLAN
FINAL

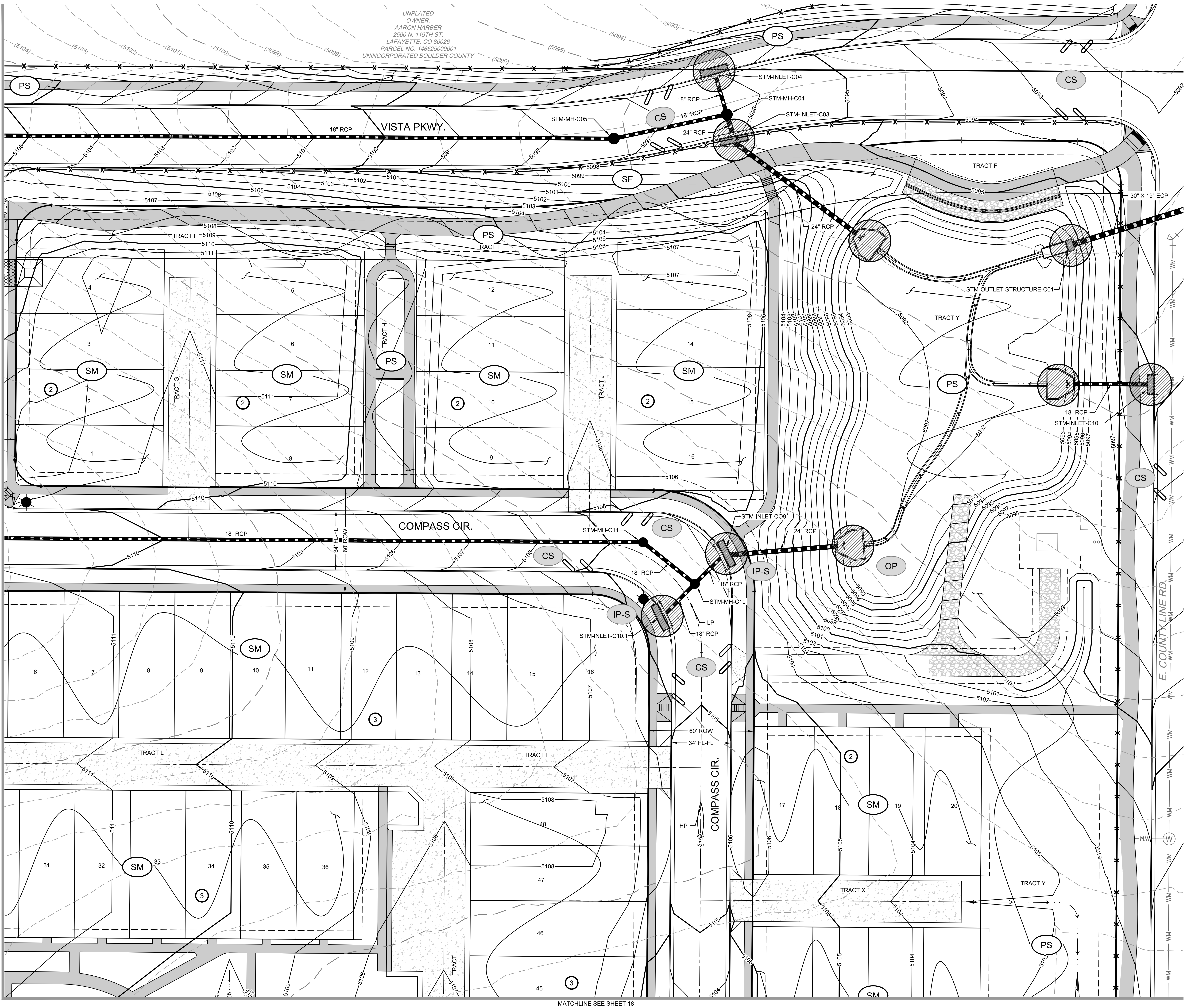
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

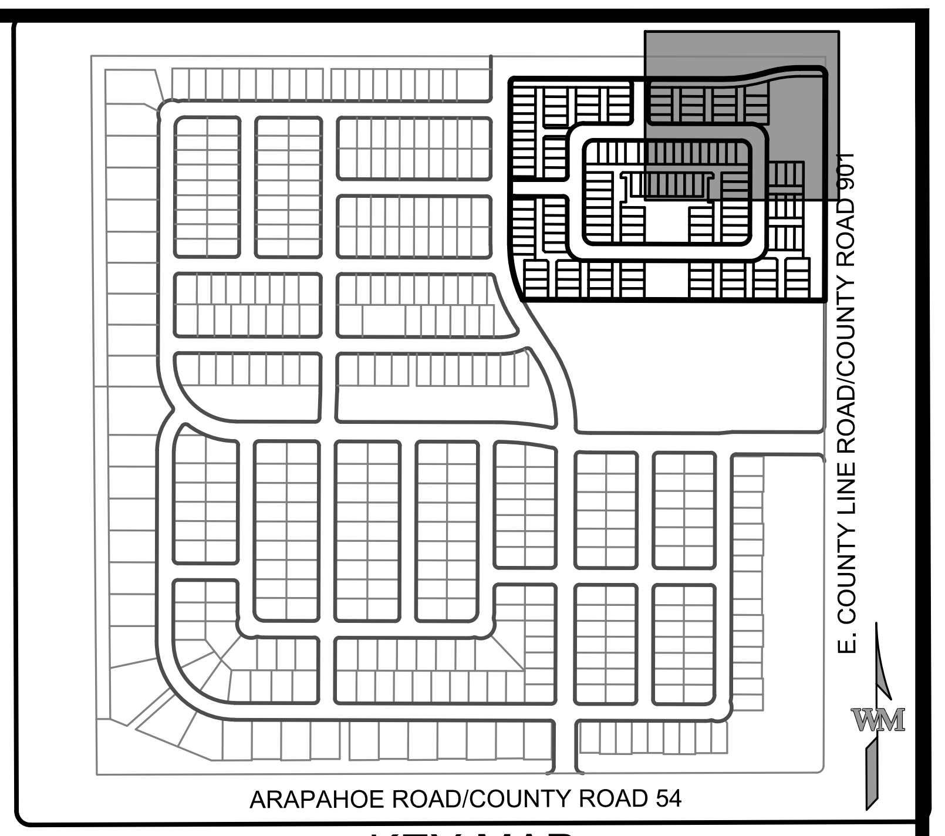
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
EC06
Sheet 15 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP

N.T.S.

NOTES:

1. ADDITIONAL PRACTICES TO BE EMPLOYED AS NECESSARY MEET WATER QUALITY OBJECTIVES AND SUIT THE CURRENT WEATHER, SITE CONDITIONS, AND UNFORESEEN NEEDS.
2. CONTRACTOR RESPONSIBLE FOR ENSURING ALL PRACTICABLE SEDIMENT AND EROSION CONTROL SOLUTIONS ARE EMPLOYED TO MEET WATER QUALITY OBJECTIVES.
3. SEE LANDSCAPE PLANS FOR AREAS TO RECEIVE PERMANENT SEEDING.
4. ALL SEDIMENT CONTROL LOGS SHALL BE PLACED AT THE BACK OF WALKS FRONTING RESIDENTIAL LOTS.

BMP LEGEND

CS	CURB SOCK
IP-G	INLET PROTECTION - ON GRADE
IP-S	INLET PROTECTION - IN SUMP
OP	OUTLET PROTECTION
PS	PERMANENT SEEDING
SF	SILT FENCE
DD	DIVERSION DIKE
CF	CONSTRUCTION FENCE
SR	SURFACE ROUGHENING
T	TACKIFIER
TS	TEMPORARY SEEDING
SM	TEMPORARY SEEDING & MULCHING
VTC	VEHICLE TRACKING CONTROL
CD	CHECK DAM
SCL	SEDIMENT CONTROL LOG
SSA	STABILIZED STAGING AREA
TSB	TEMPORARY SEDIMENT BASIN
CWA	CONCRETE WASHOUT AREA
LOC	LIMITS OF CONSTRUCTION
BMP	EXISTING BMP

SCALE: 1" = 30'
ORIGINAL GRAPHIC SCALE

0 15 30 60

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

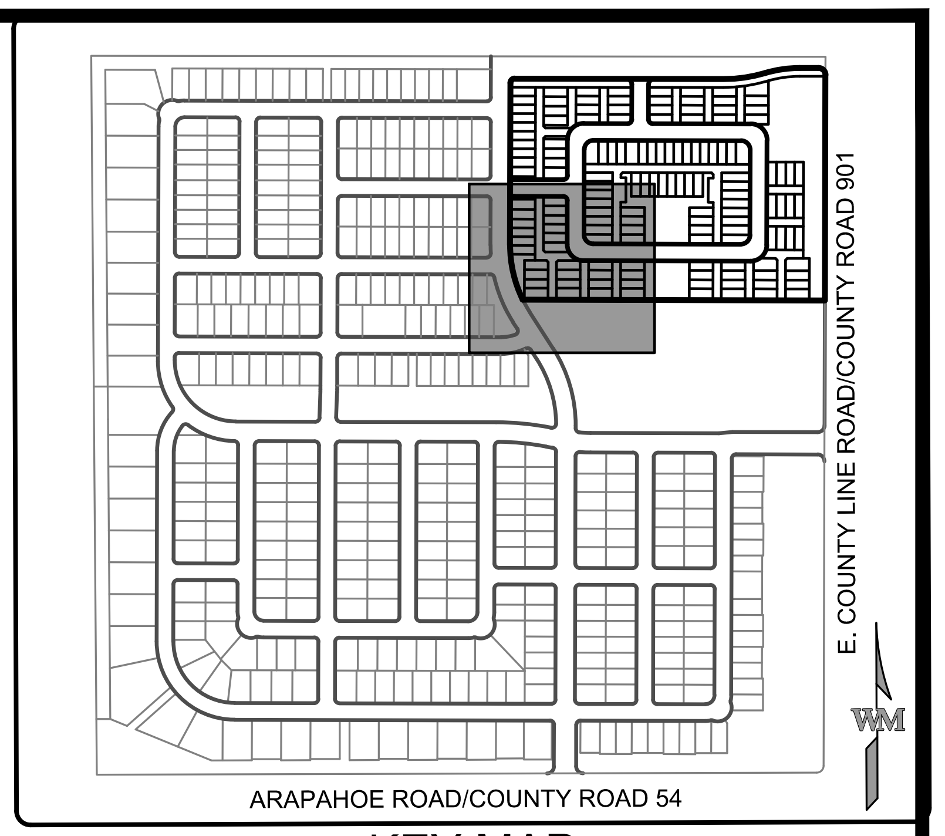
EROSION CONTROL PLAN
FINAL

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
EC07
Sheet 16 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



KEY MAP

N.T.S.

NOTES:

1. ADDITIONAL PRACTICES TO BE EMPLOYED AS NECESSARY MEET WATER QUALITY OBJECTIVES AND SUIT THE CURRENT WEATHER, SITE CONDITIONS, AND UNFORESEEN NEEDS.
2. CONTRACTOR RESPONSIBLE FOR ENSURING ALL PRACTICABLE SEDIMENT AND EROSION CONTROL SOLUTIONS ARE EMPLOYED TO MEET WATER QUALITY OBJECTIVES.
3. SEE LANDSCAPE PLANS FOR AREAS TO RECEIVE PERMANENT SEEDING.
4. ALL SEDIMENT CONTROL LOGS SHALL BE PLACED AT THE BACK OF WALKS FRONTING RESIDENTIAL LOTS.

BMP LEGEND

CS	CURB SOCK
IP-G	INLET PROTECTION - ON GRADE
IP-S	INLET PROTECTION - IN SUMP
OP	OUTLET PROTECTION
PS	PERMANENT SEEDING
SF	SILT FENCE
DD	DIVERSION DIKE
CF	CONSTRUCTION FENCE
SR	SURFACE ROUGHENING
T	TACKIFIER
TS	TEMPORARY SEEDING
SM	TEMPORARY SEEDING & MULCHING
VTC	VEHICLE TRACKING CONTROL
CD	CHECK DAM
SCL	SEDIMENT CONTROL LOG
SSA	STABILIZED STAGING AREA
TSB	TEMPORARY SEDIMENT BASIN
CWA	CONCRETE WASHOUT AREA
LOC	LIMITS OF CONSTRUCTION
BMP	EXISTING BMP

0 15 30 60

SCALE: 1" = 30'
ORIGINAL GRAPHIC SCALE

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

EROSION CONTROL PLAN
FINAL

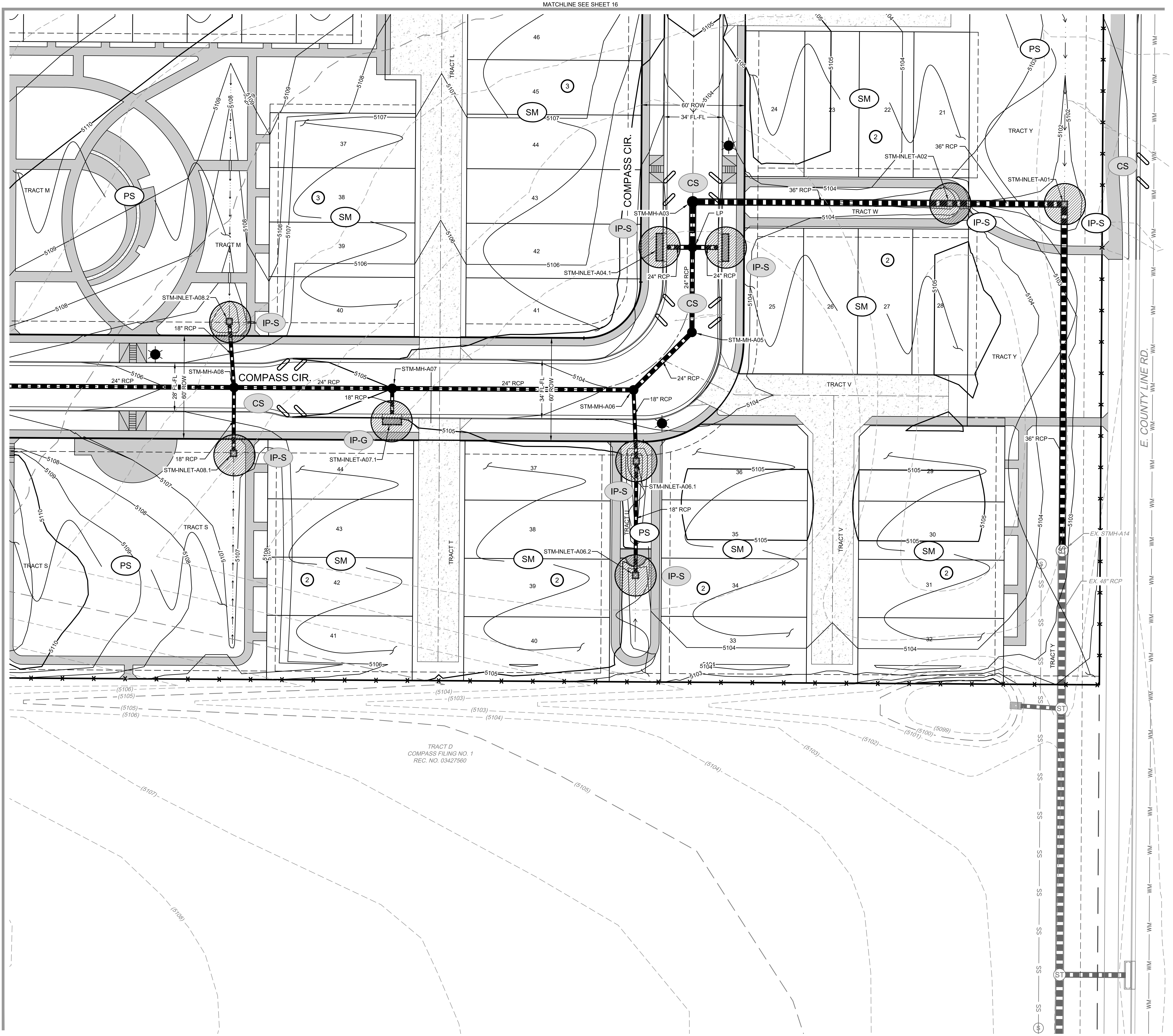
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

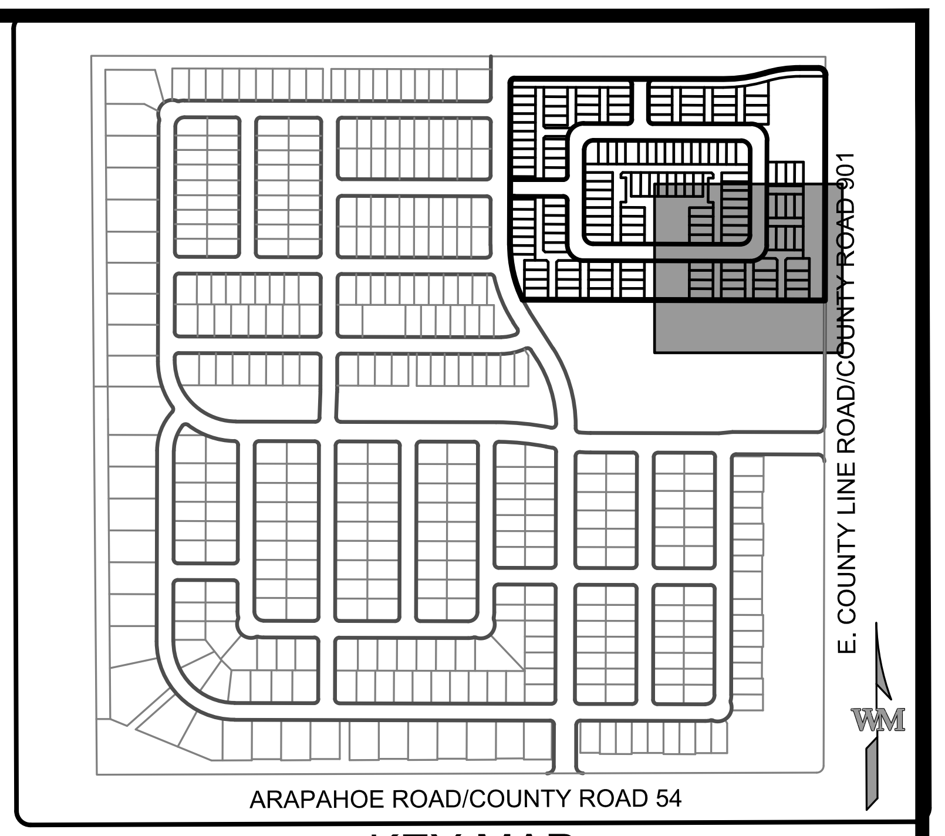
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
EC08
Sheet 17 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP

N.T.S.

NOTES:

1. ADDITIONAL PRACTICES TO BE EMPLOYED AS NECESSARY MEET WATER QUALITY OBJECTIVES AND SUIT THE CURRENT WEATHER, SITE CONDITIONS, AND UNFORESEEN NEEDS.
2. CONTRACTOR RESPONSIBLE FOR ENSURING ALL PRACTICABLE SEDIMENT AND EROSION CONTROL SOLUTIONS ARE EMPLOYED TO MEET WATER QUALITY OBJECTIVES.
3. SEE LANDSCAPE PLANS FOR AREAS TO RECEIVE PERMANENT SEEDING.
4. ALL SEDIMENT CONTROL LOGS SHALL BE PLACED AT THE BACK OF WALKS FRONTING RESIDENTIAL LOTS.

BMP LEGEND

CS	CURB SOCK
IP-G	INLET PROTECTION - ON GRADE
IP-S	INLET PROTECTION - IN SUMP
OP	OUTLET PROTECTION
PS	PERMANENT SEEDING
SF	SILT FENCE
DD	DIVERSION DIKE
CF	CONSTRUCTION FENCE
SR	SURFACE ROUGHENING
T	TACKIFIER
TS	TEMPORARY SEEDING
SM	TEMPORARY SEEDING & MULCHING
VTC	VEHICLE TRACKING CONTROL
CD	CHECK DAM
SCL	SEDIMENT CONTROL LOG
SSA	STABILIZED STAGING AREA
TSB	TEMPORARY SEDIMENT BASIN
CWA	CONCRETE WASHOUT AREA
LOC	LIMITS OF CONSTRUCTION
BMP	EXISTING BMP

0 15 30 60
SCALE: 1" = 30'
ORIGINAL GRAPHIC SCALE

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

EROSION CONTROL PLAN
FINAL

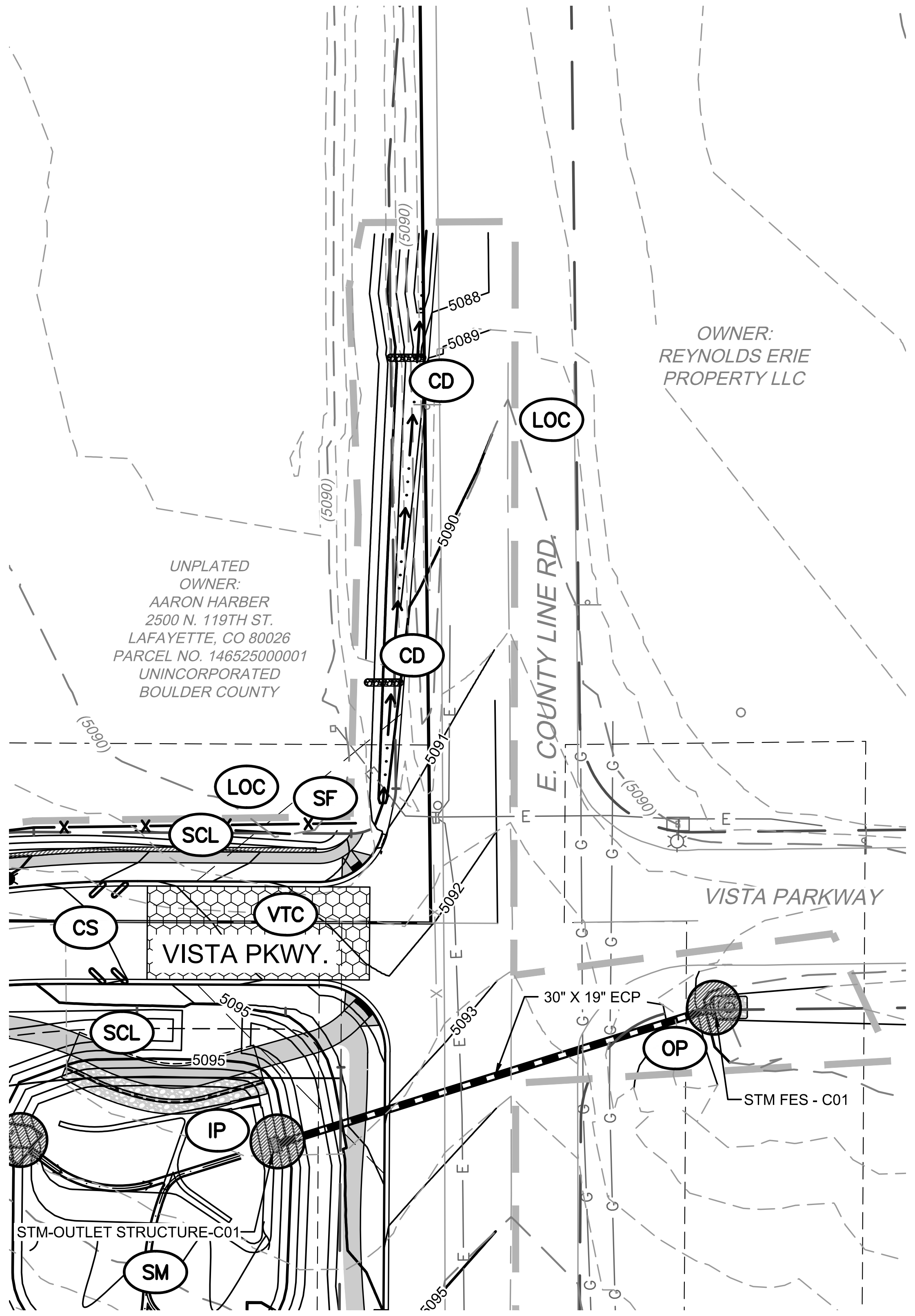
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

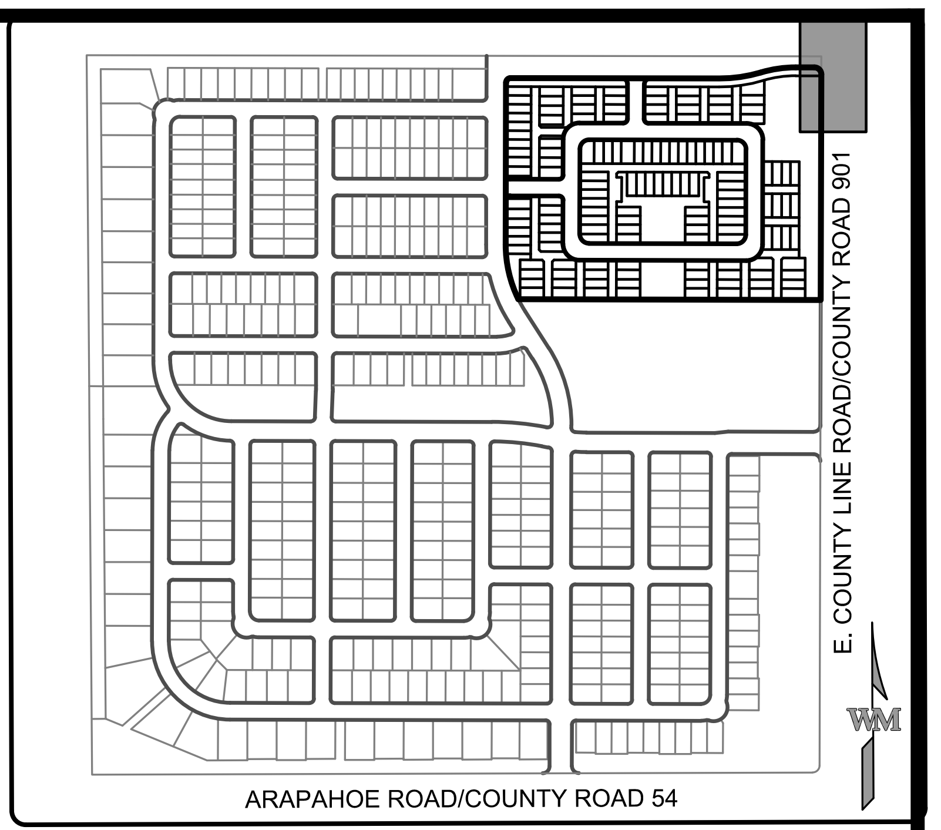
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
EC09
Sheet 18 of 74

NOT FOR CONSTRUCTION

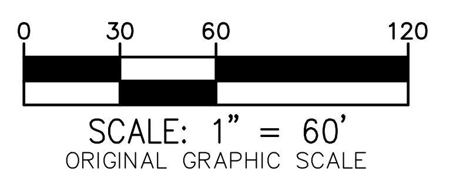
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP

N.T.S.



SCALE: 1" = 60'
ORIGINAL GRAPHIC SCALE

CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

35942
THOMAS C. JANSEN
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

EROSION CONTROL PLAN

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

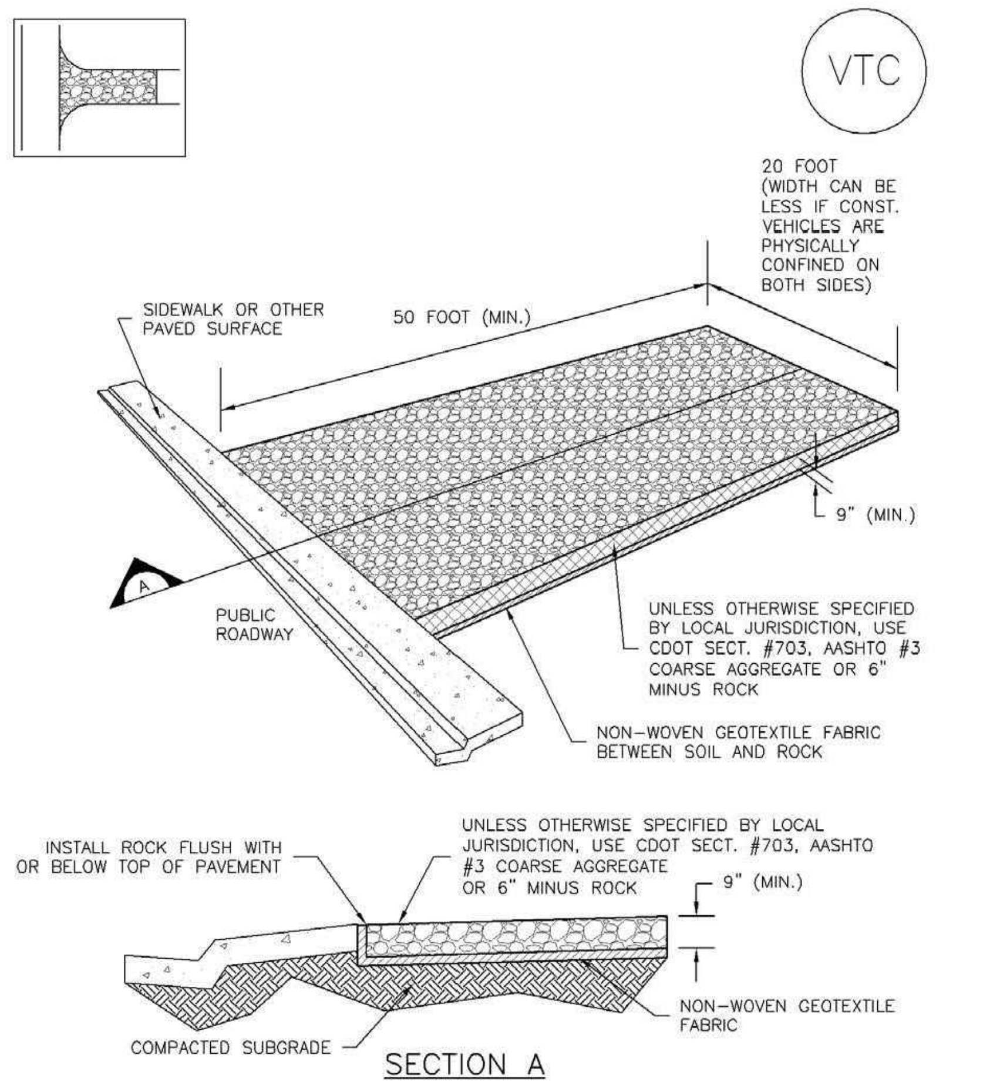
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
EC10
Sheet 19 of 74

NOT FOR CONSTRUCTION

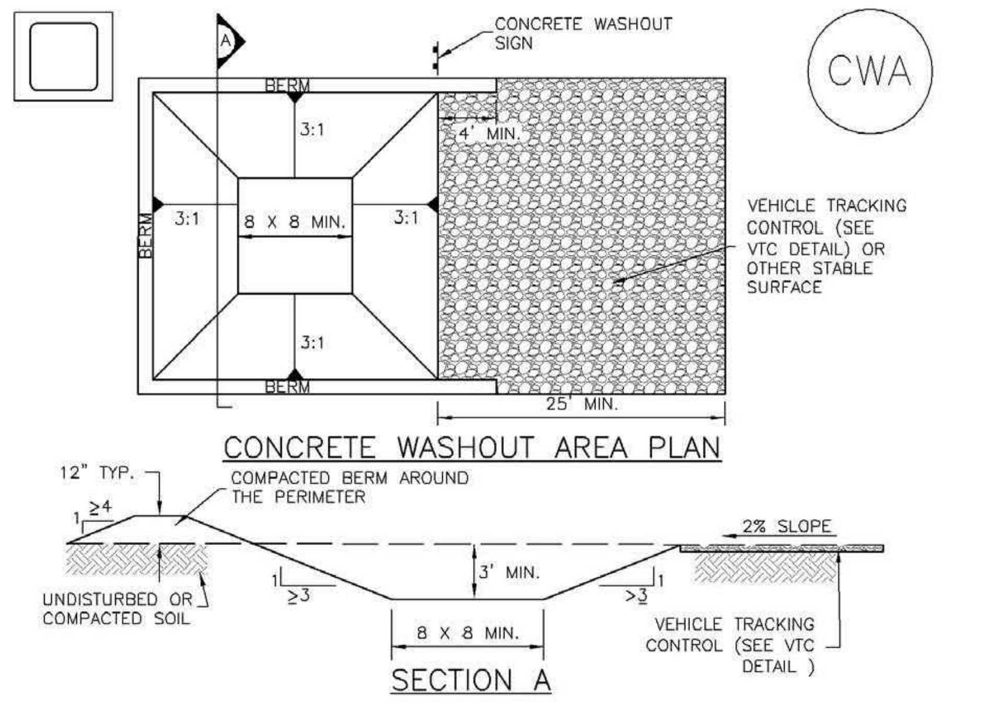
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT

Vehicle Tracking Control (VTC) SM-4



VTC-1. AGGREGATE VEHICLE TRACKING CONTROL

Concrete Washout Area (CWA) MM-1



CWA-1. CONCRETE WASHOUT AREA

CWA INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   -CWA INSTALLATION LOCATION.

2. DO NOT LOCATE AN UNLINED CWA WITHIN 400' OF ANY NATURAL DRAINAGE PATHWAY OR WATERBODY. DO NOT LOCATE WITHIN 1,000' OF ANY WELLS OR DRINKING WATER SOURCES. IF SITE CONSTRAINTS MAKE THIS INFEASIBLE, OR IF HIGHLY PERMEABLE SOILS EXIST ON SITE, THE CWA MUST BE INSTALLED WITH AN IMPERMEABLE LINER (16 MIL MIN. THICKNESS) OR SURFACE STORAGE ALTERNATIVES USING PREFABRICATED CONCRETE WASHOUT DEVICES OR A LINED ABOVE GROUND STORAGE ARE SHOULD BE USED.

3. THE CWA SHALL BE INSTALLED PRIOR TO CONCRETE PLACEMENT ON SITE.

4. CWA SHALL INCLUDE A FLAT SUBSURFACE PIT THAT IS AT LEAST 8' BY 8' SLOPES LEADING OUT OF THE SUBSURFACE PIT SHALL BE 3:1 OR FLATTER. THE PIT SHALL BE AT LEAST 3' DEEP.

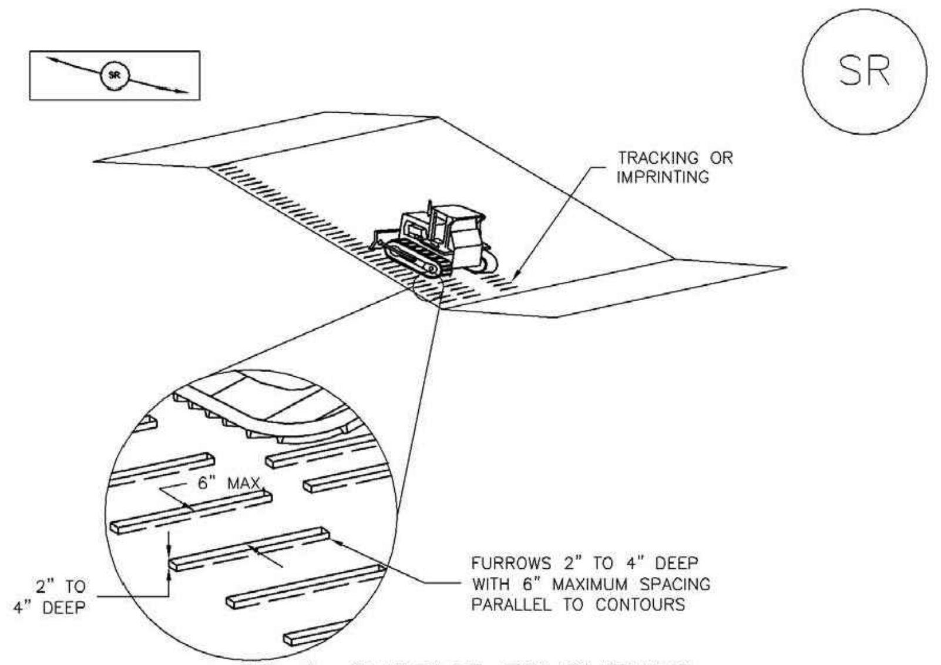
5. BERM SURROUNDING SIDES AND BACK OF THE CWA SHALL HAVE MINIMUM HEIGHT OF 1'.

6. VEHICLE TRACKING PAD SHALL BE SLOPED 2% TOWARDS THE CWA.

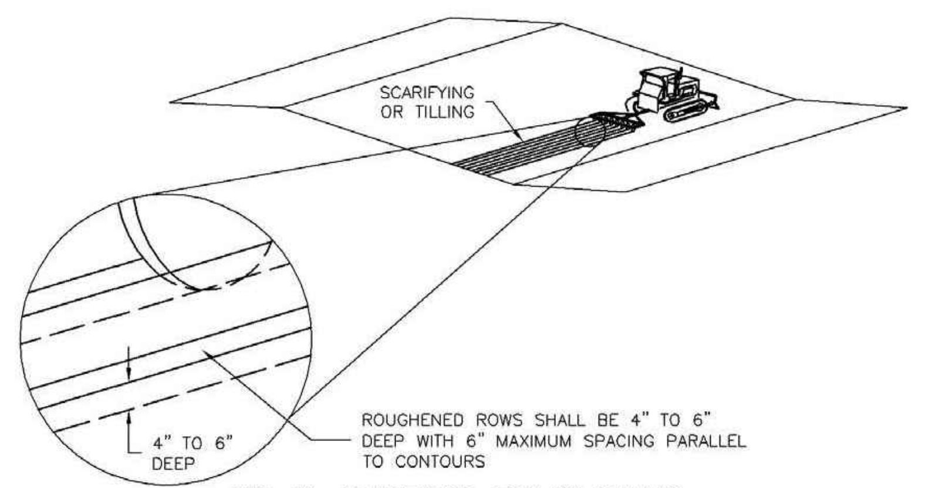
7. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE CWA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CWA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.

8. USE EXCAVATED MATERIAL FOR PERIMETER BERM CONSTRUCTION.

Surface Roughening (SR) EC-1

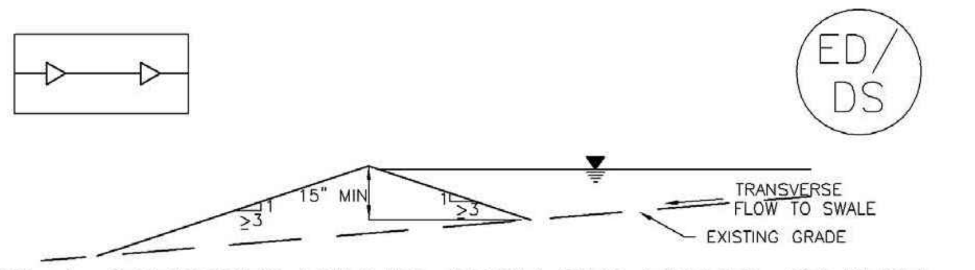


SR-1. SURFACE ROUGHENING
FOR STEEP SLOPES (3:1 OR STEEPER)

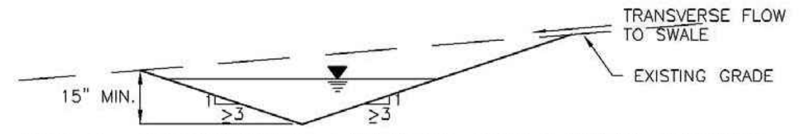


SR-2. SURFACE ROUGHENING
FOR LOW SLOPES (LESS THAN 3:1)

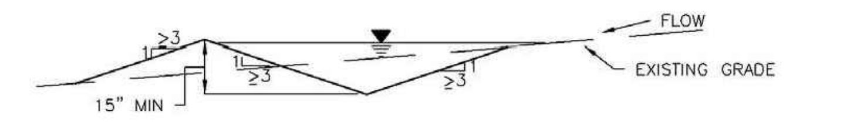
Earth Dikes and Drainage Swales (ED/DS) EC-10



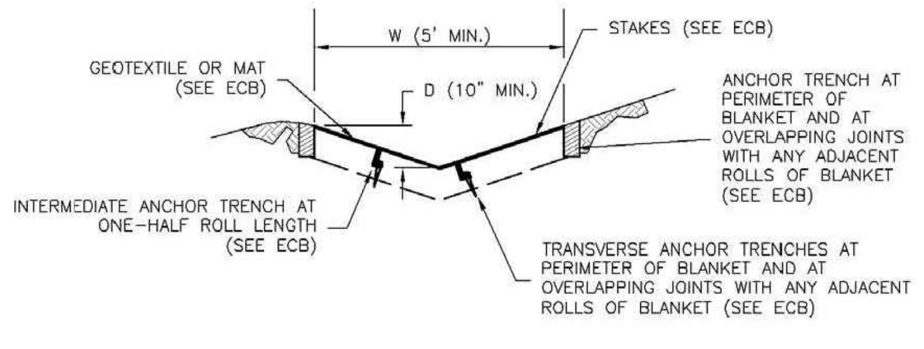
ED-1. COMPACTED UNLINED EARTH DIKE FORMED BY BERM



DS-1. COMPACTED UNLINED EXCAVATED SWALE

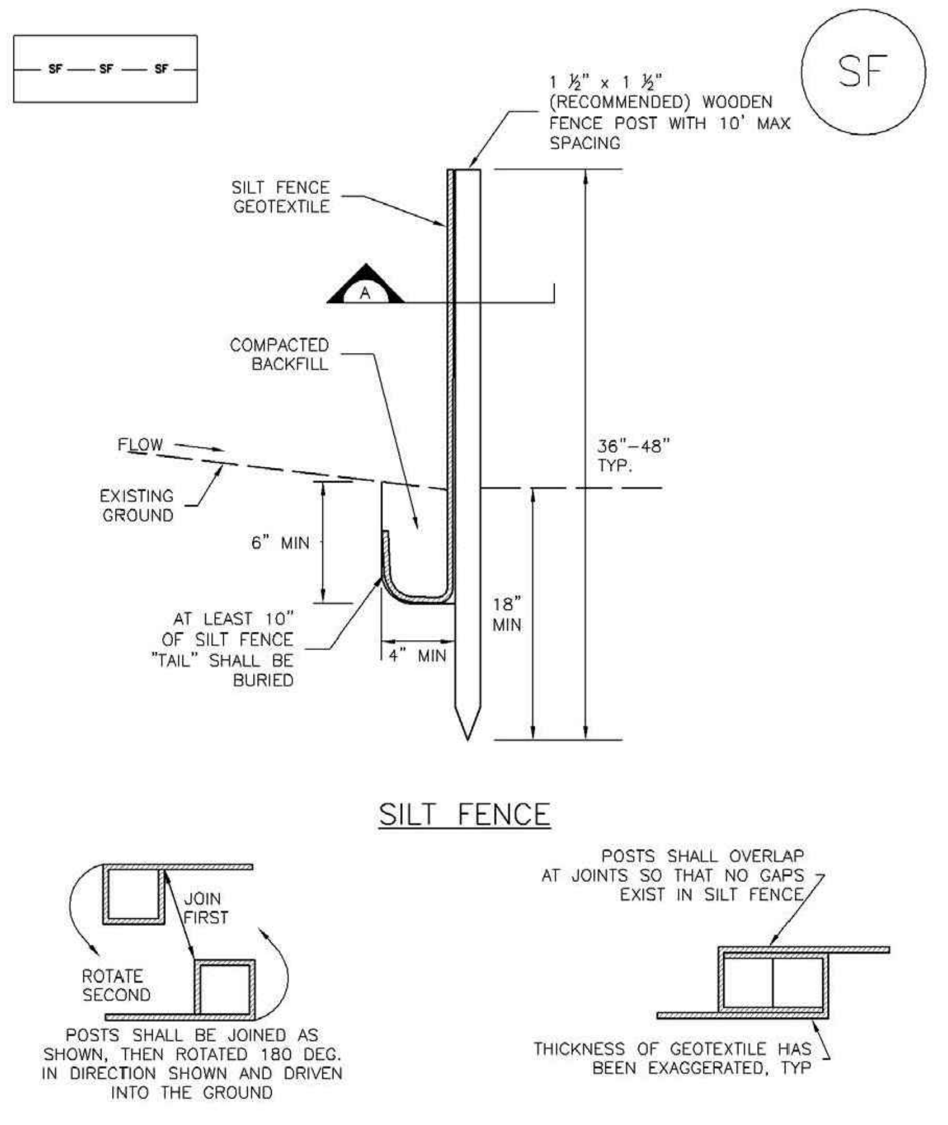


DS-2. COMPACTED UNLINED SWALE FORMED BY CUT AND FILL



DS-3. ECB LINED SWALE (CUT AND FILL OR BERM)

Silt Fence (SF) SC-1

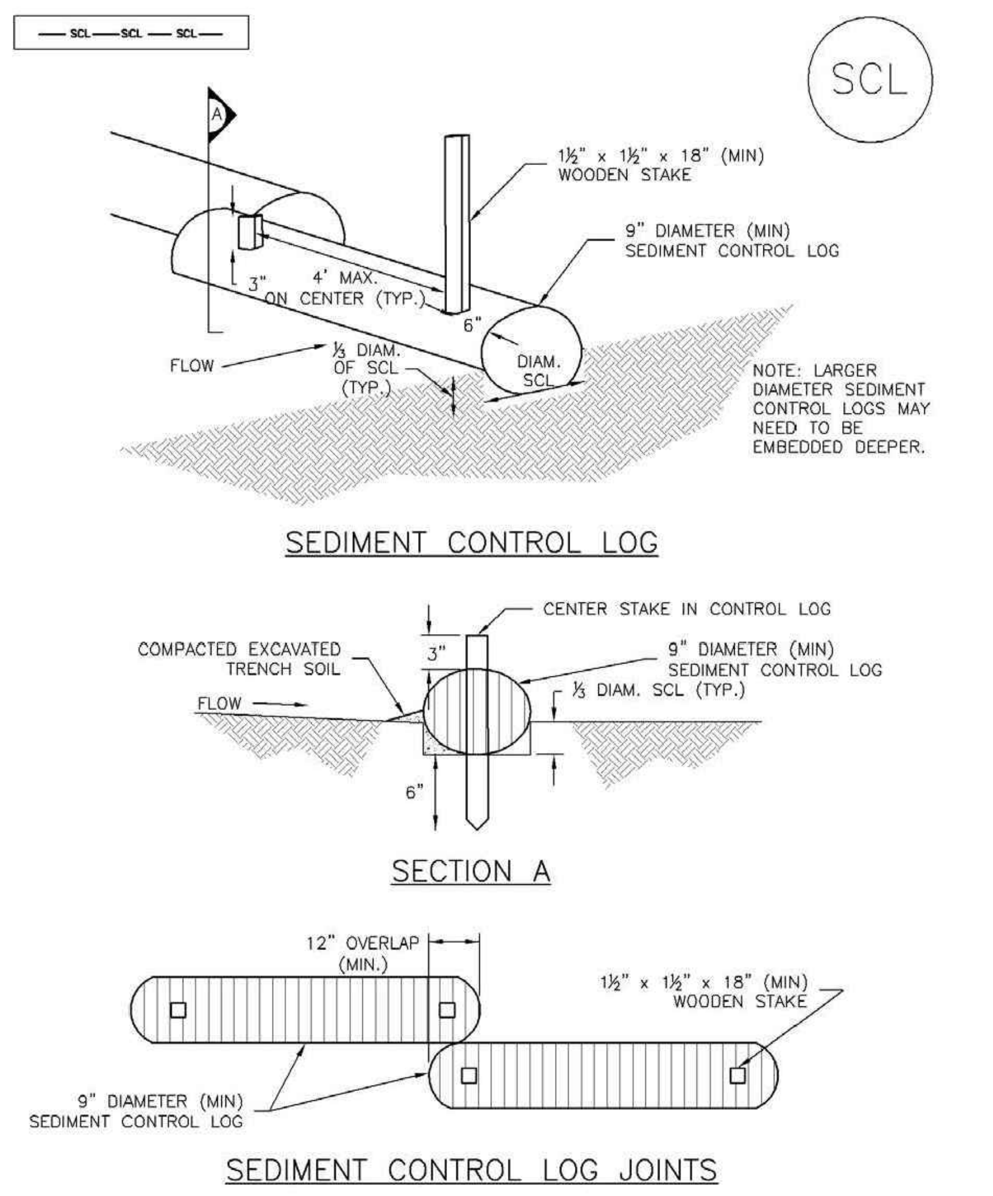


SILT FENCE

SECTION A

SF-1. SILT FENCE

Sediment Control Log (SCL) SC-2



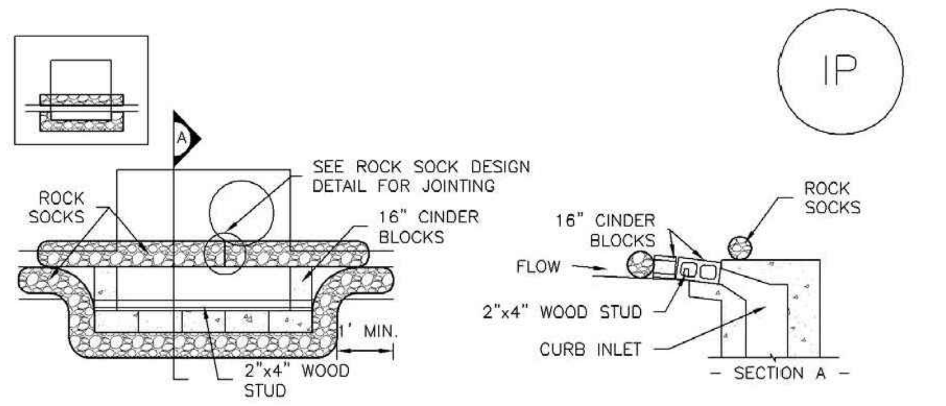
SEDIMENT CONTROL LOG

SECTION A

SEDIMENT CONTROL LOG JOINTS

SCL-1. SEDIMENT CONTROL LOG

SC-6 Inlet Protection (IP)



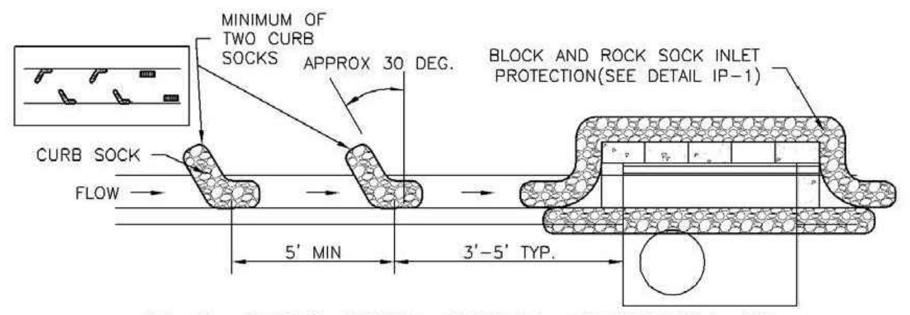
IP-1. BLOCK AND ROCK SOCK SUMP OR ON GRADE INLET PROTECTION

BLOCK AND CURB SOCK INLET PROTECTION INSTALLATION NOTES

1. SEE ROCK SOCK DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.

2. CONCRETE "CINDER" BLOCKS SHALL BE LAID ON THEIR SIDES AROUND THE INLET IN A SINGLE ROW, ABUTTING ONE ANOTHER WITH THE OPEN END FACING AWAY FROM THE CURB.

3. GRAVEL BAGS SHALL BE PLACED AROUND CONCRETE BLOCKS, CLOSELY ABUTTING ONE ANOTHER AND JOINTED TOGETHER IN ACCORDANCE WITH ROCK SOCK DESIGN DETAIL.



IP-2. CURB ROCK SOCKS UPSTREAM OF INLET PROTECTION

CURB ROCK SOCK INLET PROTECTION INSTALLATION NOTES

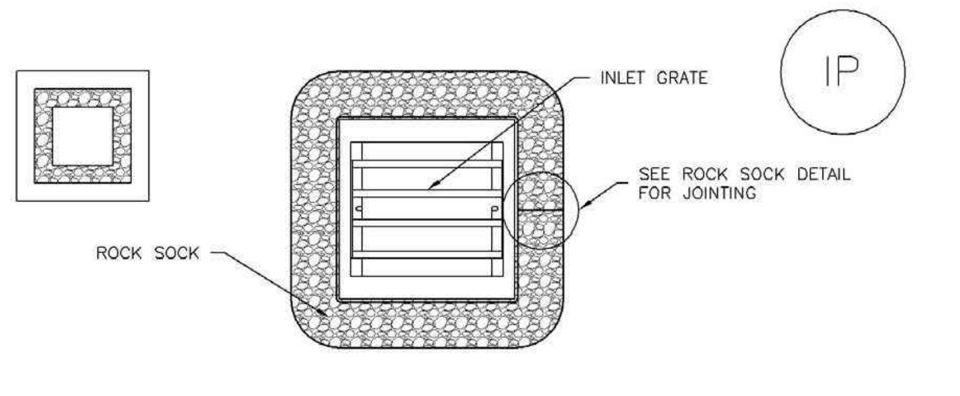
1. SEE ROCK SOCK DESIGN DETAIL INSTALLATION REQUIREMENTS.

2. PLACEMENT OF THE SOCK SHALL BE APPROXIMATELY 30 DEGREES FROM PERPENDICULAR IN THE OPPOSITE DIRECTION OF FLOW.

3. SOCKS ARE TO BE FLUSH WITH THE CURB AND SPACED A MINIMUM OF 5 FEET APART.

4. AT LEAST TWO CURB SOCKS IN SERIES ARE REQUIRED UPSTREAM OF ON-GRADE INLETS.

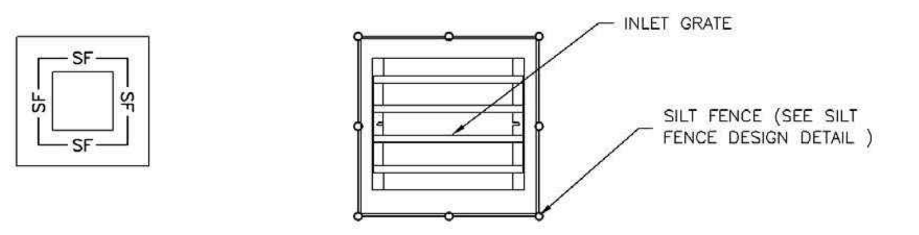
Inlet Protection (IP) SC-6



IP-3. ROCK SOCK SUMP/AREA INLET PROTECTION

ROCK SOCK SUMP/AREA INLET PROTECTION INSTALLATION NOTES
1. SEE ROCK SOCK DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.

2. STRAW WATTLES/SEDIMENT CONTROL LOGS MAY BE USED IN PLACE OF ROCK SOCKS FOR INLETS IN PERVIOUS AREAS. INSTALL PER SEDIMENT CONTROL LOG DETAIL.



IP-4. SILT FENCE FOR SUMP INLET PROTECTION

SILT FENCE INLET PROTECTION INSTALLATION NOTES

1. SEE SILT FENCE DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.

2. POSTS SHALL BE PLACED AT EACH CORNER OF THE INLET AND AROUND THE EDGES AT A MAXIMUM SPACING OF 3 FEET.

3. STRAW WATTLES/SEDIMENT CONTROL LOGS MAY BE USED IN PLACE OF SILT FENCE FOR INLETS IN PERVIOUS AREAS. INSTALL PER SEDIMENT CONTROL LOG DETAIL.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

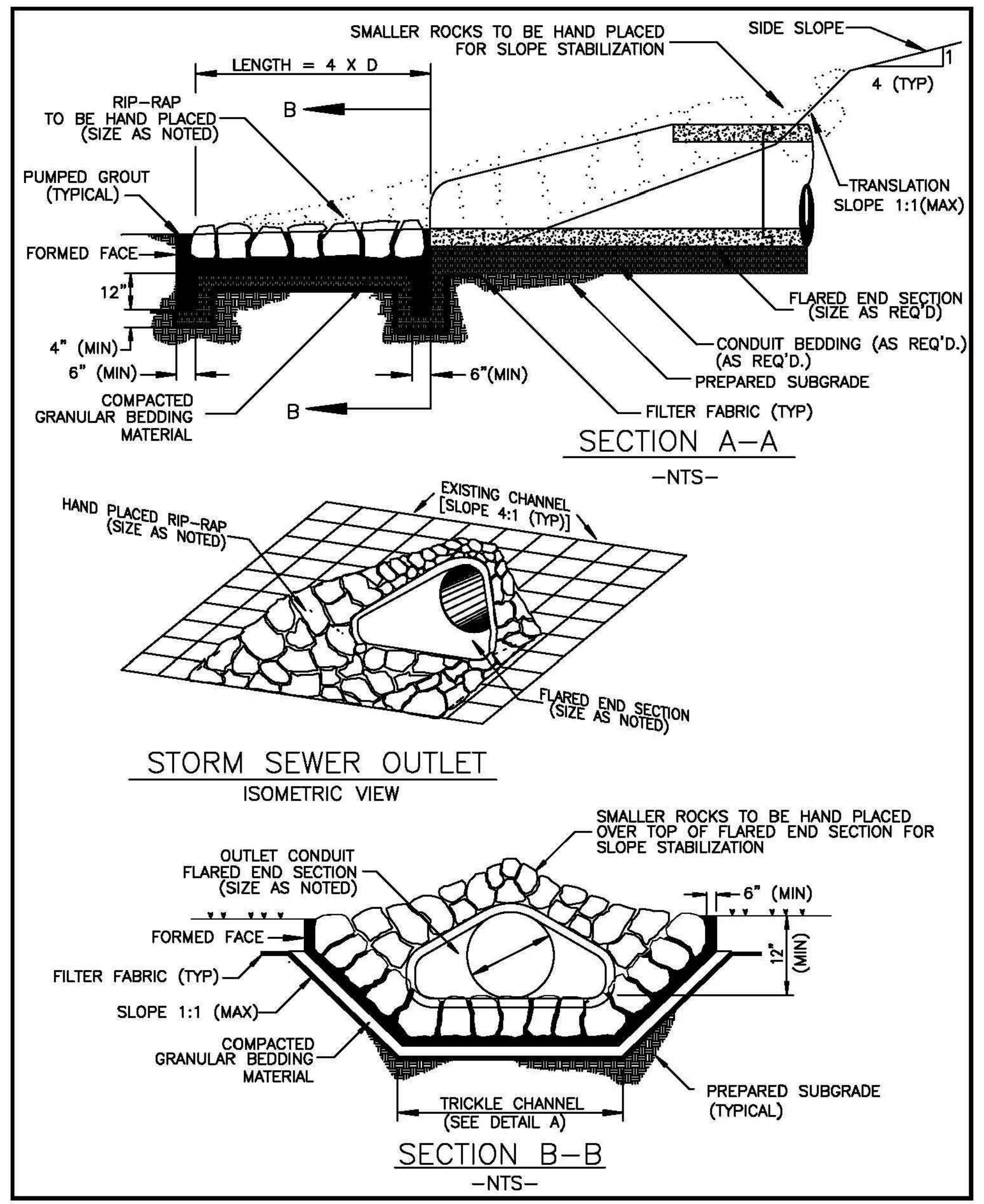
EROSION CONTROL DETAILS

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
EC11
Sheet 20 of 74

NOT FOR CONSTRUCTION



The Town of ERIE COLORADO

DRAWING TITLE: STORM SEWER OUTLET
DRAWING NUMBER: STM2
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004

EC-8 Temporary Outlet Protection (TOP)

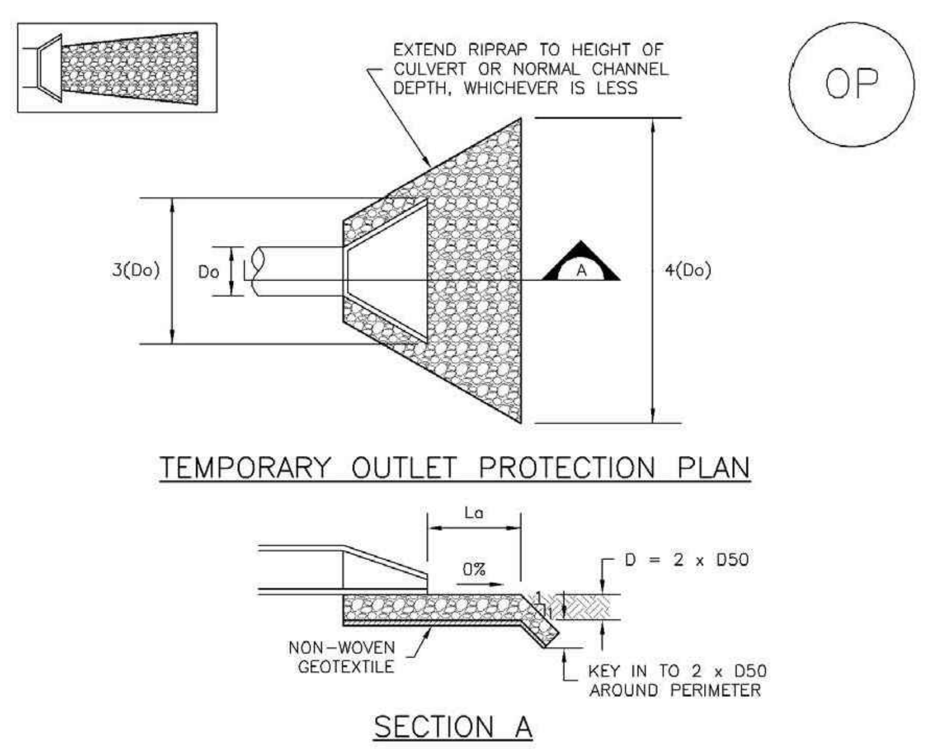
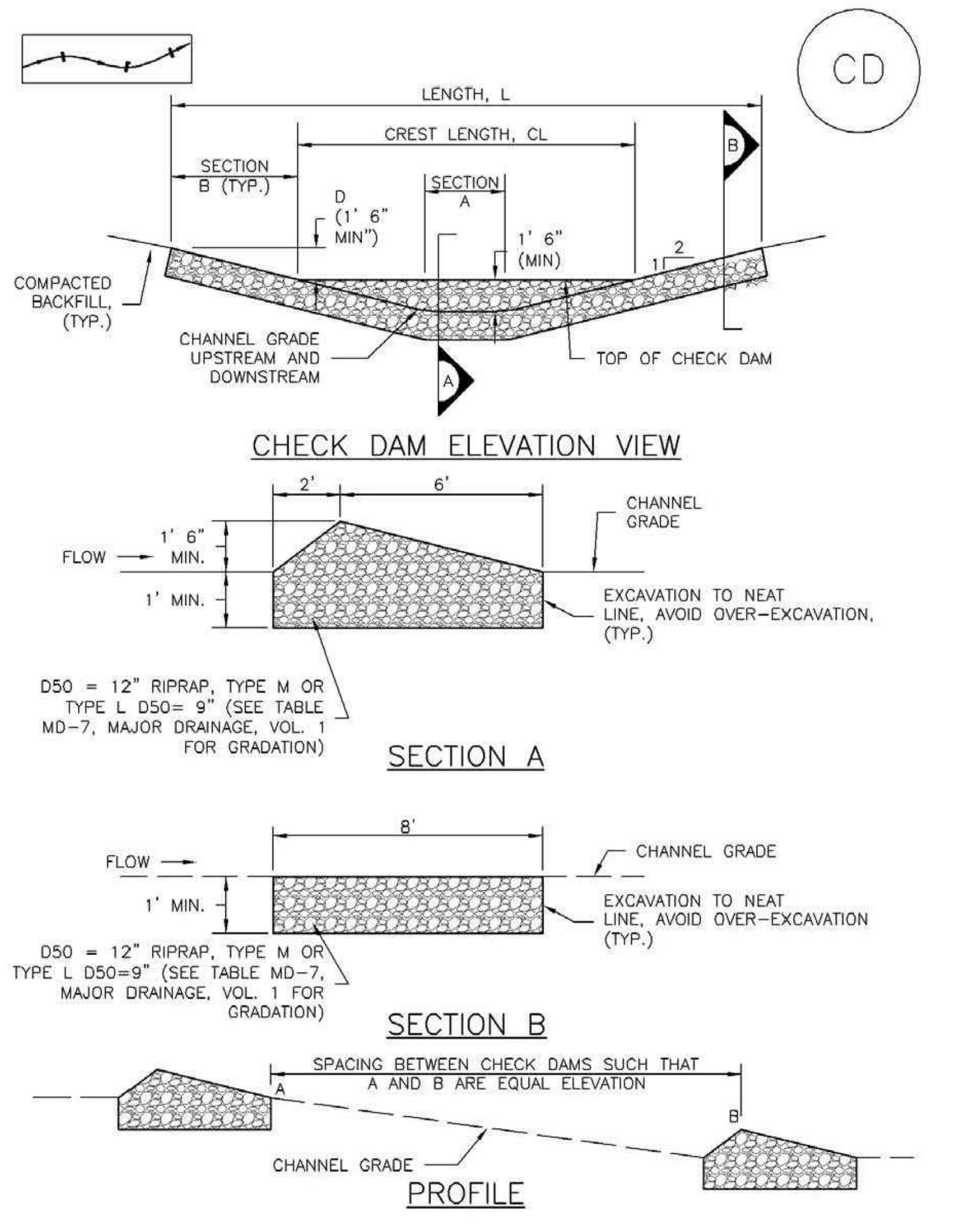


TABLE OP-1. TEMPORARY OUTLET PROTECTION SIZING TABLE

PIPE DIAMETER, Do (INCHES)	DISCHARGE, Q (CFS)	APRON LENGTH, La (FT)	RIPRAP D50 DIAMETER MIN (INCHES)
8	2.5 5	5 10	4 6
12	5 10	10 13	4 6
18	10 20 30 40	10 16 23 26	6 9 12 16
24	30 40 50 60	16 26 26 30	9 9 12 16

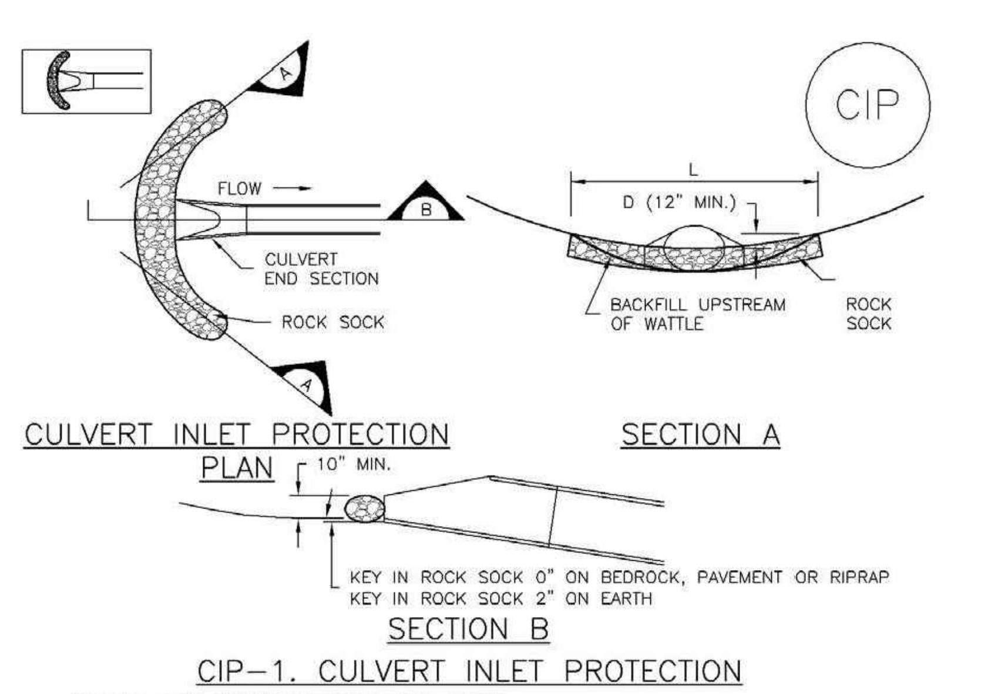
OP-1. TEMPORARY OUTLET PROTECTION

Check Dams (CD) EC-12



CD-1. CHECK DAM

Inlet Protection (IP) SC-6



CIP-1. CULVERT INLET PROTECTION

CULVERT INLET PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   -LOCATION OF CULVERT INLET PROTECTION.

2. SEE ROCK SOCK DESIGN DETAIL FOR ROCK GRADATION REQUIREMENTS AND JOINTING DETAIL.

CULVERT INLET PROTECTION MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF THE CULVERT SHALL BE REMOVED WHEN THE SEDIMENT DEPTH IS ½ THE HEIGHT OF THE ROCK SOCK.

5. CULVERT INLET PROTECTION SHALL REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS PERMANENTLY STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

(DETAILS ADAPTED FROM AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Table 2. Shortgrass Prairie Native Seed Mixture. For use in open space native seeding less than 25 feet from road and trail edges, or within the top of slope above roadway/trail and inside the toe of slope below roadway/trail if sloped areas are present adjacent to roadway or trail. This mixture is for specific usage near trails or where shorter grasses are desired (such as smaller park sites). It is dominated by short to mid sized native prairie grasses (6-18 inches in height), but includes a few native wildflowers (identified with the *, below). Best for use along roads and trails and in smaller native seeded park areas. Be sure to over seed any swales or moist areas within this seeding type with the moist swale seed mixture (Table 3). While seeding is preferred beginning in late winter (after February 1st) this mixture may be used between October 30th and April 30th only without supplemental irrigation. If adequate supplemental irrigation is in place, this mixture may be seeded through June 15th.

COMMON NAME	SCIENTIFIC NAME	VARIETY	OZ/ACRE	PLS LBS/ACRE
Buffalograss	*Buchloe dactyliodes*	Native, Bison or Texoka		10
Blue grama	*Chondrosum gracile*	Lovington Alma,Native,or Hachita		8
Sand dropseed	*Sporobolus cryptandrus*	Common		4
Prairie Junegrass	*Loeleria macrantha*	Common		4
Hard Fescue	*Festuca brevipila*	'Durar'		4
Fringed sage*	*Artemisia frigida*	Common	1	
Purple prairie clover*	*Dalea purpurea*	Common	4	
Gayfeather*	*Liatris punctata*	Common	4	
Tansy aster*	*Machaeranthera tanacetafolia*	Common	3	
Yarrow*	*Achillea millefolium*	Western	2	
OUNCES			14	.875
SEEDING RATE POUNDS PLS/ACRE				**30.875**

Table 3. Moist Swale Seed mixture. This mixture is intended to be seeded over the top of either Table 1 or Table 2 seed mixtures in locations which may be moist at least some of the year (such as pond edges, small or larger swales or ditches within the open space areas or along roads, in detention or retention basins, or along the inner banks of irrigation ditches. Be sure to seed one of the other seed mixtures first and then add this mixture to provide adequate species adapted to moist conditions. This mixture may be used between October 30th and June 15th without supplemental irrigation, and from June 16th through July 31st if adequate supplemental irrigation is present and acceptable to the Parks & Recreation Director or designee.

COMMON NAME	SCIENTIFIC NAME	VARIETY	PLS LBS/ACRE
Woolly sedge	*Carex lanuginosa*	Native	0.5
Nebraska sedge	*Carex nebrascensis*	Native	0.1
Blue grama	*Chondrosum gracile*	Lovington, Alma,Native or Hachita	1.5
Buffalograss	*Buchloe dactyloides*	Native, Bison or Texoka	0.5
Inland saltgrass	*Distichlis stricta*	Native	0.5
Baltic rush	*Juncus balticus*	Native	0.1
Prairie cordgrass	*Spartina pectinata*	Native	1
Alkali sacaton	*Sporobolus airoides*	Native	3
Switchgrass	*Panicum virgatum*	Blackwell	3
Western wheatgrass	*Pascopyrum smithii*	Arriba or Rosana	5
Aster	*Aster laevis*		0.05
Yarrow	*Achillea millefolium*	Western	0.05
Prairie coneflower	*Ratibida columnifera*		0.05
SEEDING RATE POUNDS PLS/ACRE			**15.35**

Table 4. Roadside Native Seed mixture. This mixture is intended for use for seeding of Public Works roadside re-vegetation projects. It is an adaptable mix of short to mid-size native and introduced warm and cool season grasses. Use for Public Works roadside and right-of-way seeding projects only. This mixture may be used between October 30th and April 30th only.

COMMON NAME	SCIENTIFIC NAME	VARIETY	PLS LBS/ACRE
Western wheatgrass	*Pascopyrum smithii*	Arriba, Oahe or Rosana	7.0
Crested wheatgrass	*Agropyron cristatum*	Ephriam	4.0
Streambank wheatgrass	*Elymus lanceolatus*	Sodar	4.0
Sideoats grama	*Bouteloua gracilis*	Butte, Niner or El Reno	2.0
Blue grama	*Bouteloua gracilis*	Lovington, Alma,Native or Hachita	5.0
Buffalograss	*Buchloe dactyloides*	Native, Bison or Texoka	3.0
Sand dropseed	*Sporobolus cryptandrus*	Common	1.0
Prairie Junegrass	*Loeleria macrantha*	Common	3.0
Hard Fescue	*Festuca brevipila*	'Durar'	3.0
SEEDING RATE POUNDS PLS/ACRE			**32.0**

Table 6: Warm Season Shortgrass Prairie and Roadside Native Seed Mixture: This mixture is an adaptable mix of short to mid-size native warm season grasses with specific usage near trails or where shorter grasses are desired (such as smaller park sites). It is dominated by short to mid sized native prairie grasses (6-18 inches in height). Use for areas within 25 feet from road and trail edges, or within the top of slope above roadway/trail and inside the toe of slope below roadway/trail if sloped areas are present adjacent to roadway or trail, as well as for Public Works roadside and right-of-way seeding projects between the months of April 1st and June 15th ONLY, unless sufficient supplemental irrigation is present. If sufficient irrigation is present as determined by the Parks & Recreation Director or designee, this mixture can be seeded between June 16th and July 31st.

COMMON NAME	SCIENTIFIC NAME	VARIETY	PLS POUNDS/ACRE
Side Oats Grama	Bouteloua curtipendula	Butte, Niner or El Reno	8
Blue Grama	Bouteloua gracilis	Lovington, Alma,Native or Hachita	10
Buffalograss	Buchloe dactyloides	Native, Bison or Texoka	12
SEEDING RATE POUNDS PLS/ACRE			**30.00**

Table 7: Cool Season Grass Native Seed Mixture: This mixture shall be used for Mixed Grass Prairie, Moist Swale and Roadside locations ONLY between the dates of August 1st and October 30th . Areas adjacent to trails shall be seeded with the standard Shortgrass Prairie Native Seed Mixture between the months of October 30th and April 30th ONLY.

COMMON NAME	SCIENTIFIC NAME	VARIETY	PLS POUNDS/ACRE
Western Wheatgrass	Pascopyrum smithii	Arriba, Oahe or Rosana	12
Crested Wheatgrass	Agropyron cristatum	Ephriam	9
Streambank Wheatgrass	Elymus lanceolatus	Sodar	9
SEEDING RATE POUNDS PLS/ACRE			**30.00**

1034.05 Additional Seed Varieties

Additional native and/or non-native seed varieties may be considered on a case-by-case basis. All varieties, mixtures, seed rates and dates of application not within Tables 1-7 above MUST be approved by the Parks & Recreation Director or designee prior to seeding.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

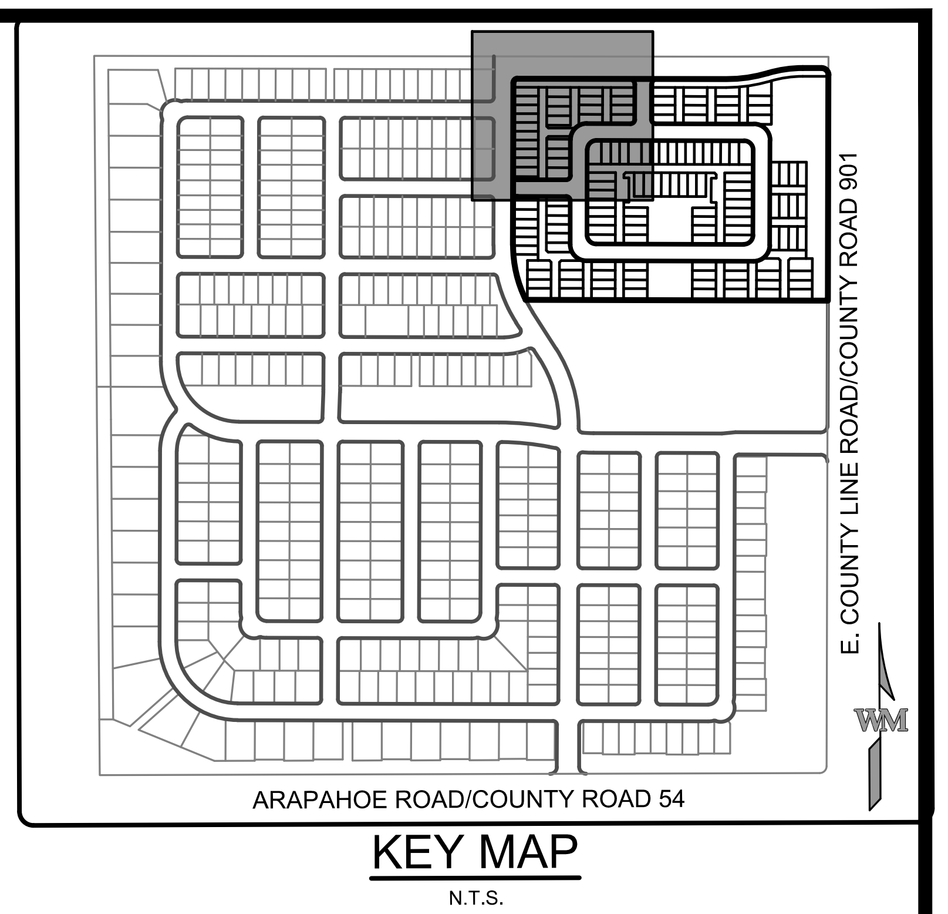
EROSION CONTROL DETAILS

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
EC12
Sheet 21 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



KEY MAP

N.T.S.

SCALE: 1" = 30'

ORIGINAL GRAPHIC SCALE

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

AREA GRADING PLAN

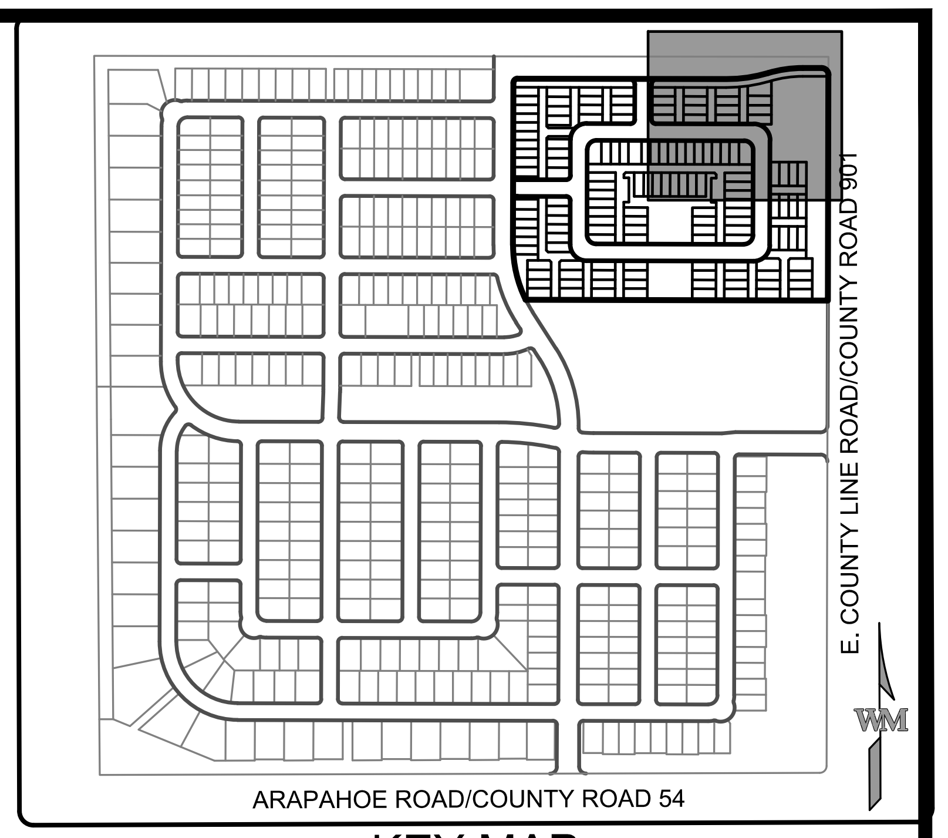
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
AGP01
Sheet 22 of 74

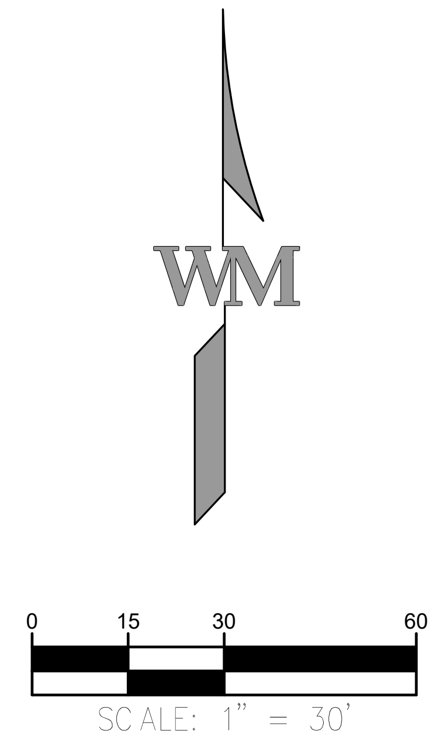
NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



KEY MAP

N.T.S.



SCALE: 1" = 30'

ORIGINAL GRAPHIC SCALE

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

AREA GRADING PLAN

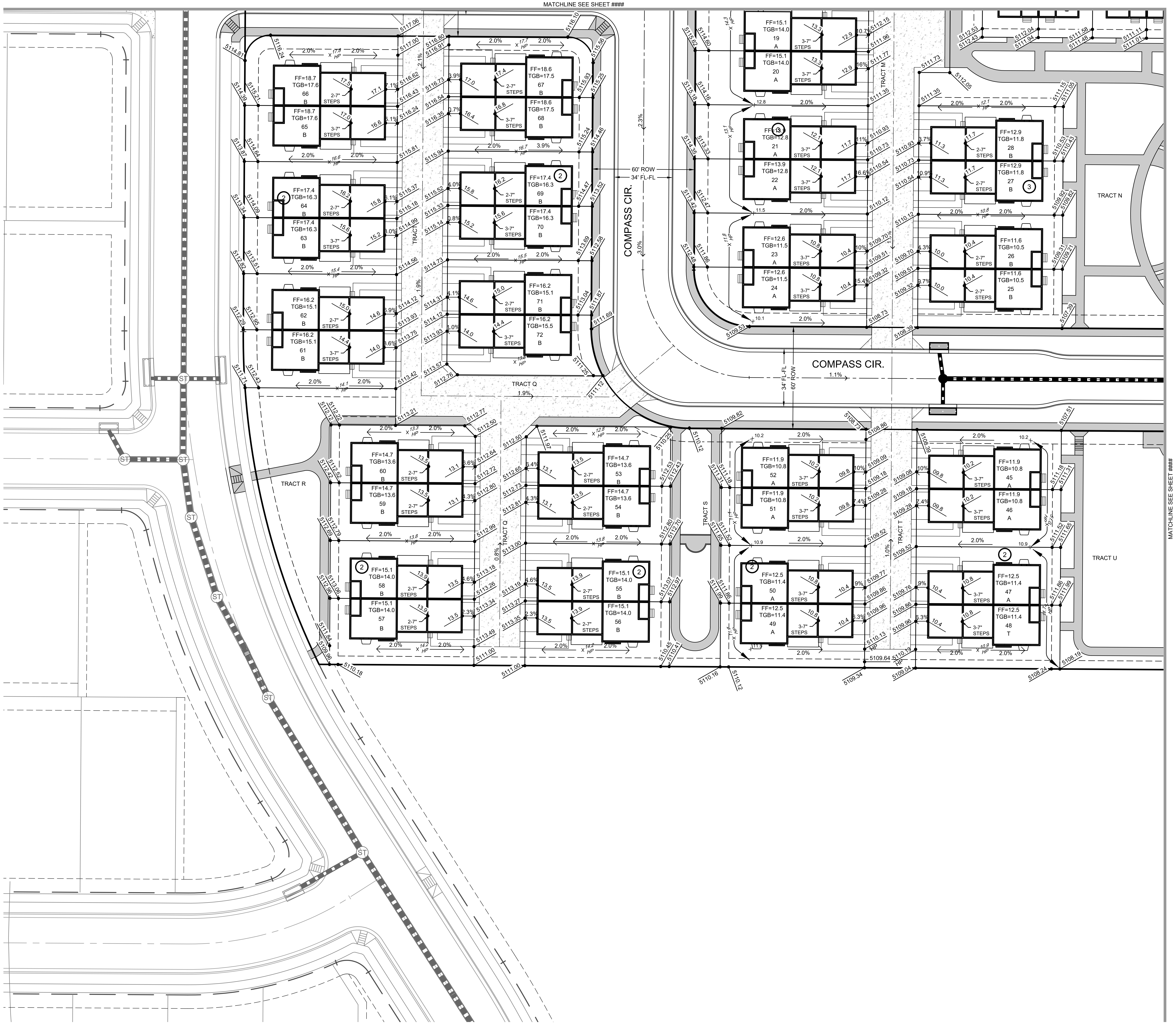
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

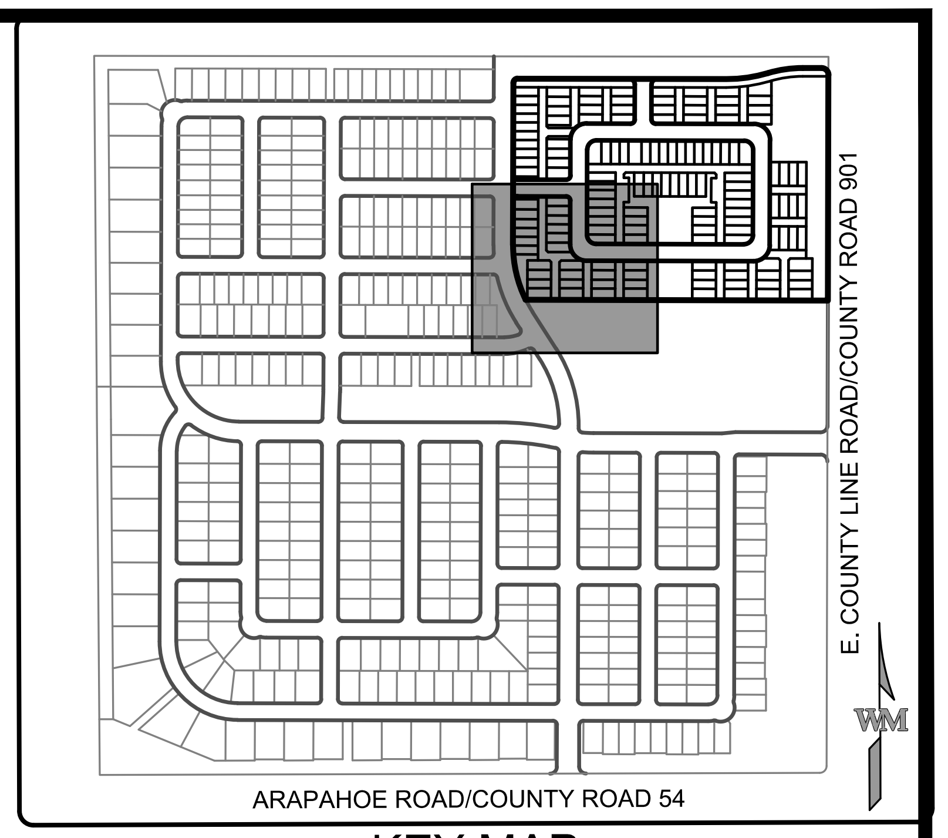
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
AGP02
Sheet 23 of 74

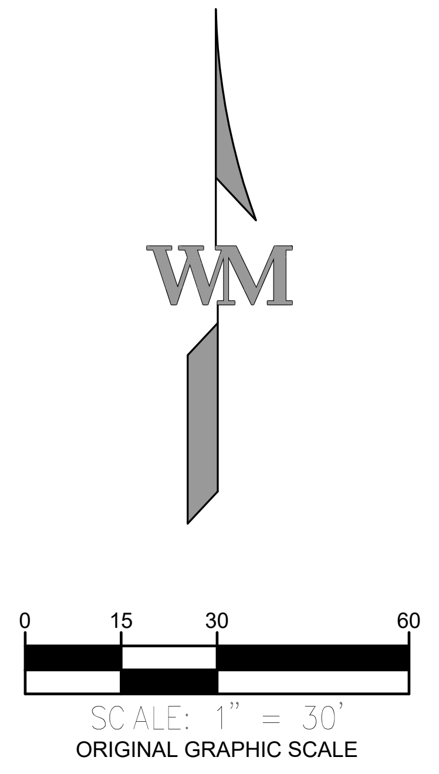
NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP
N.T.S.



THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN 35942

Dec 04, 2018

FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

AREA GRADING PLAN

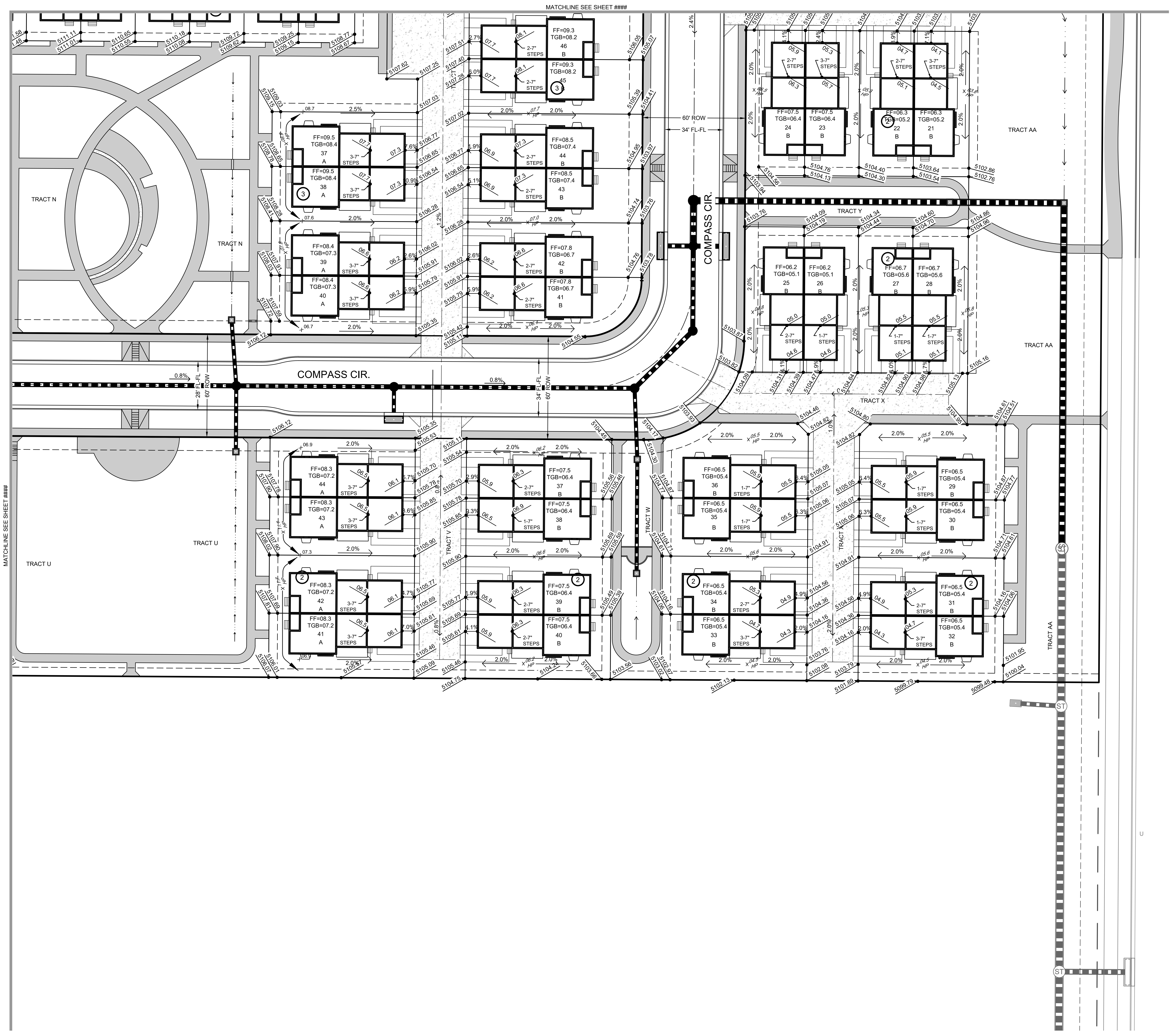
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
AGP03
Sheet 24 of 74

NOT FOR CONSTRUCTION

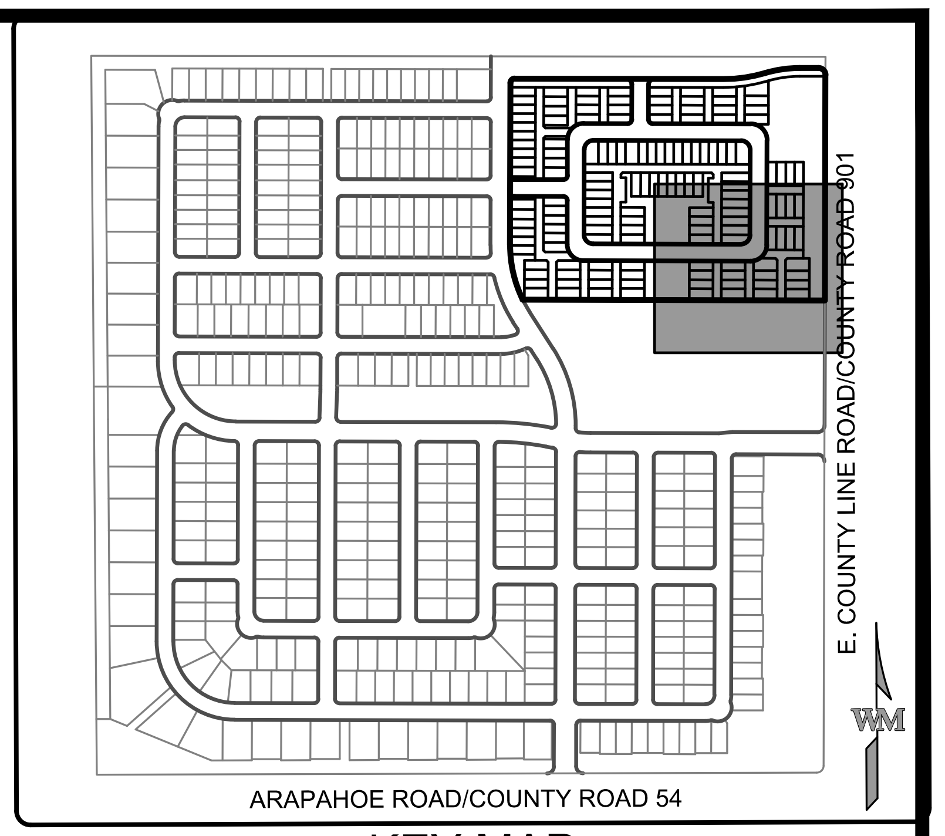
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



0 15 30 60

SCALE: 1" = 30'

ORIGINAL GRAPHIC SCALE



KEY MAP

N.T.S.

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

AREA GRADING PLAN

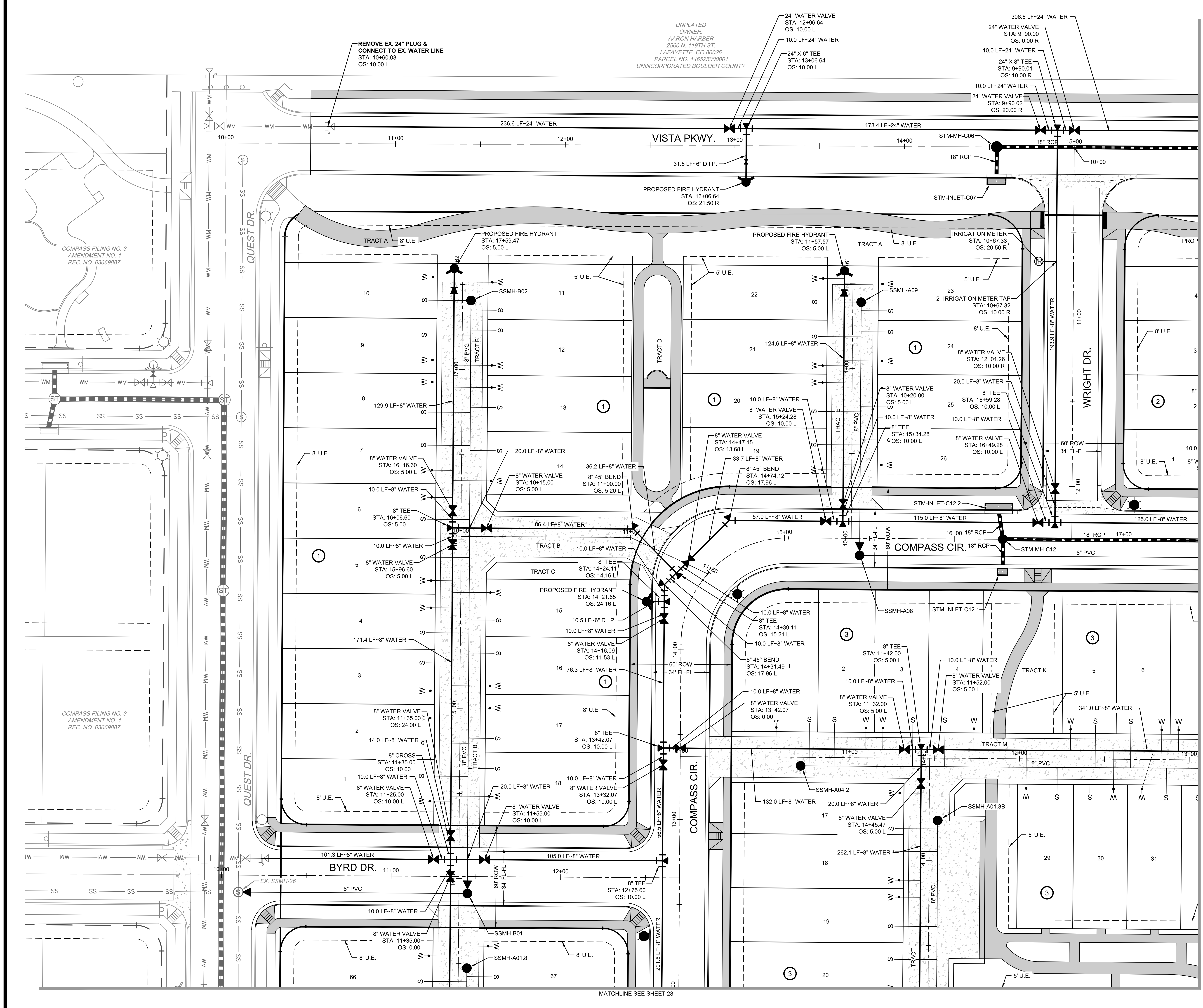
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

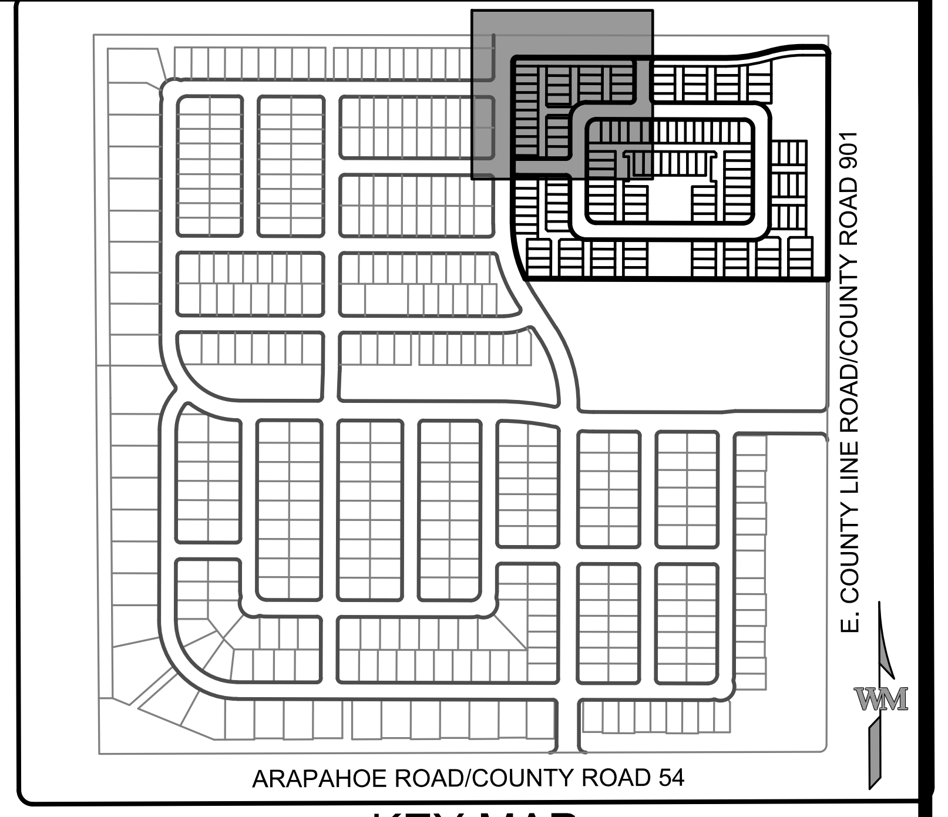
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
AGP04
Sheet 25 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP
N.T.S.

0 15 30 60
SCALE: 1" = 30'
ORIGINAL GRAPHIC SCALE

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

OVERALL UTILITY PLAN

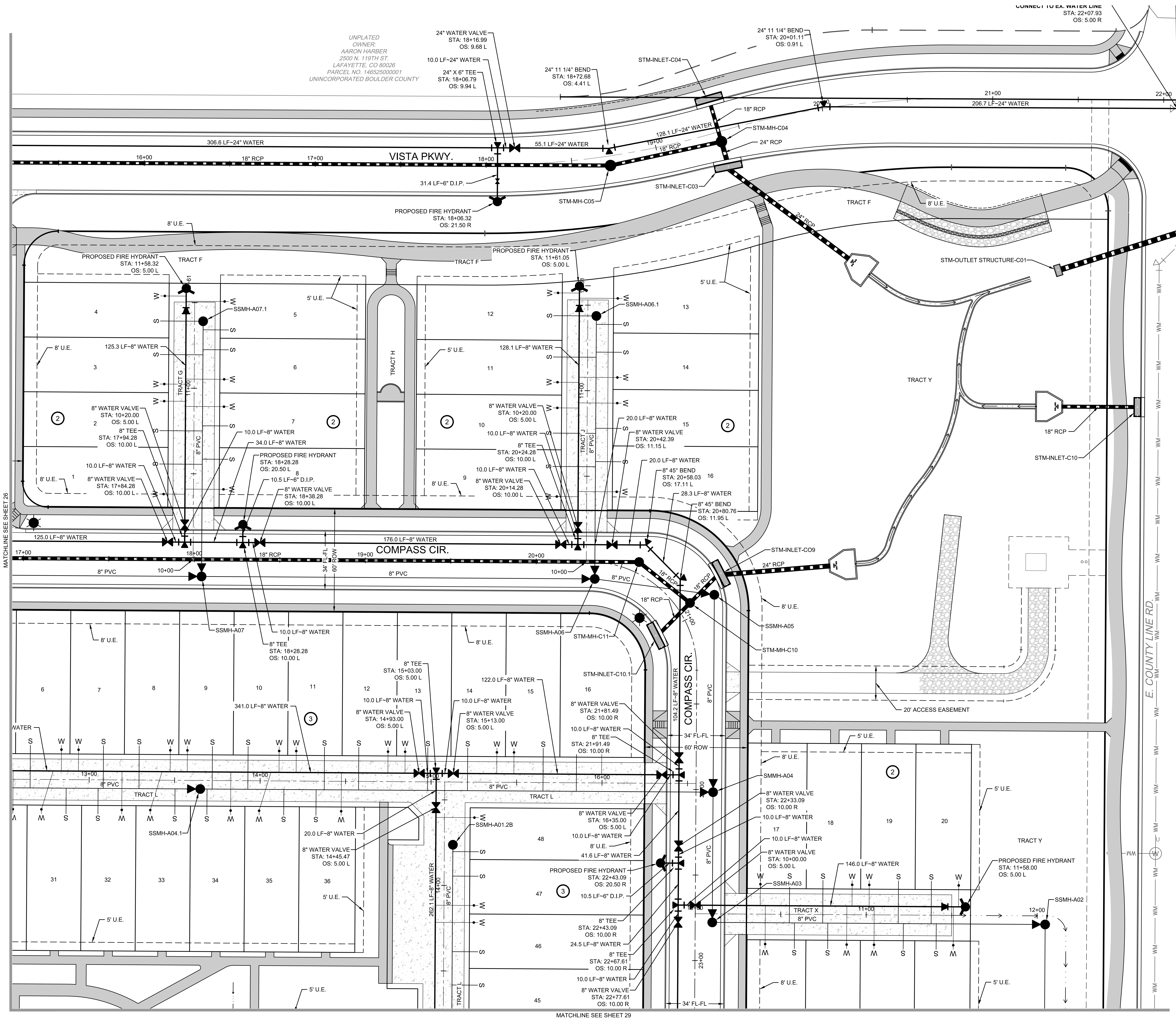
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

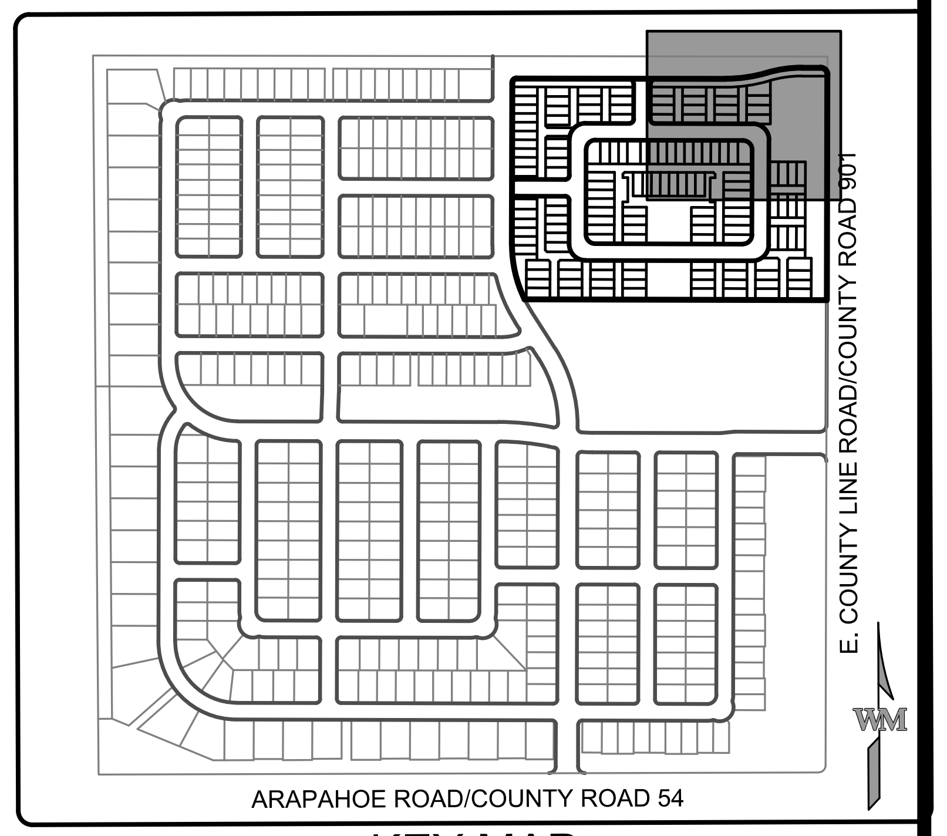
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
UT01
Sheet 26 of 74

NOT FOR CONSTRUCTION

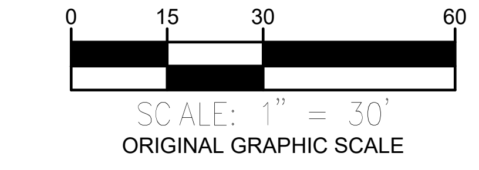
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP

N.T.S.



ORIGINAL GRAPHIC SCALE

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

OVERALL UTILITY PLAN

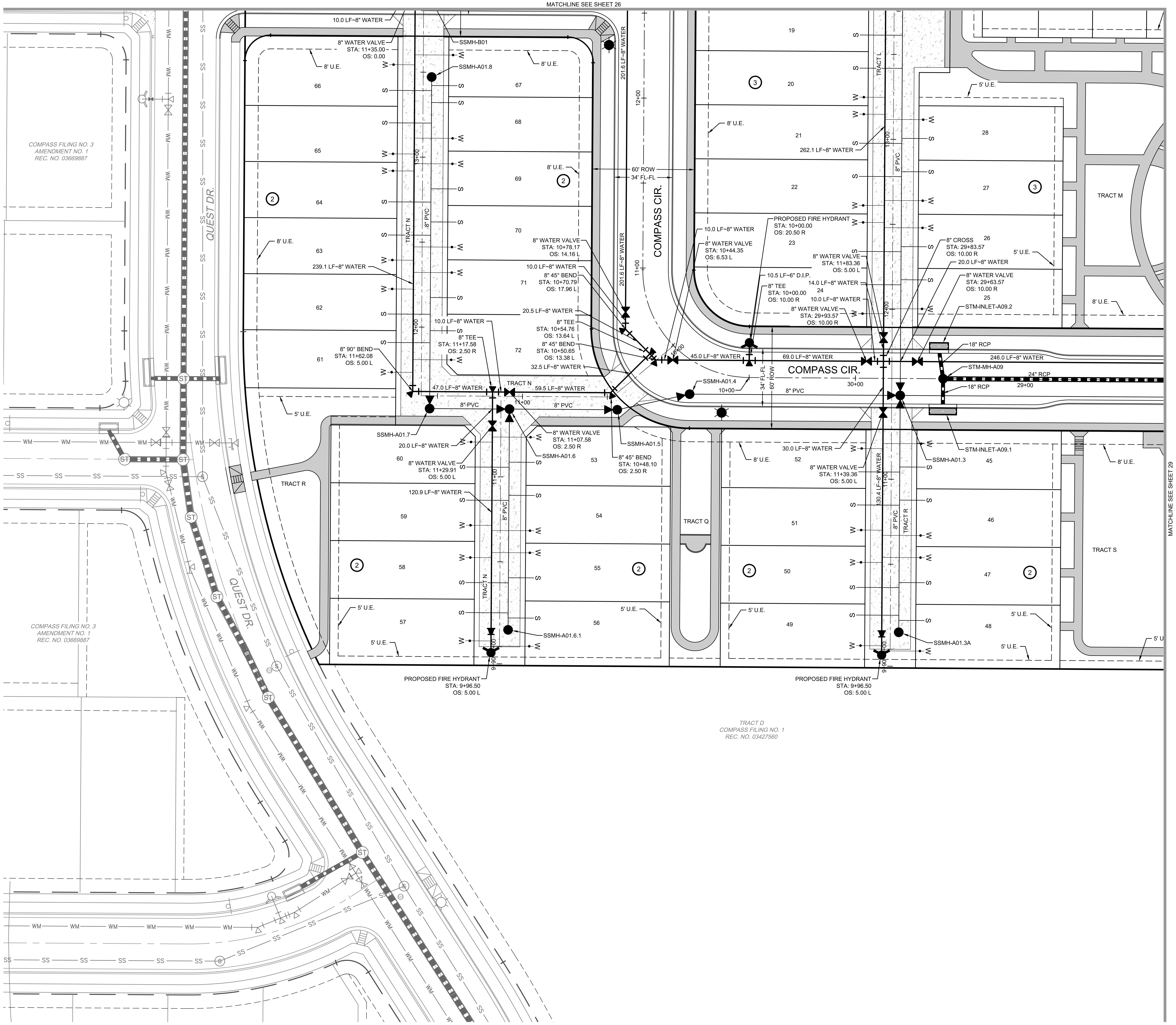
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

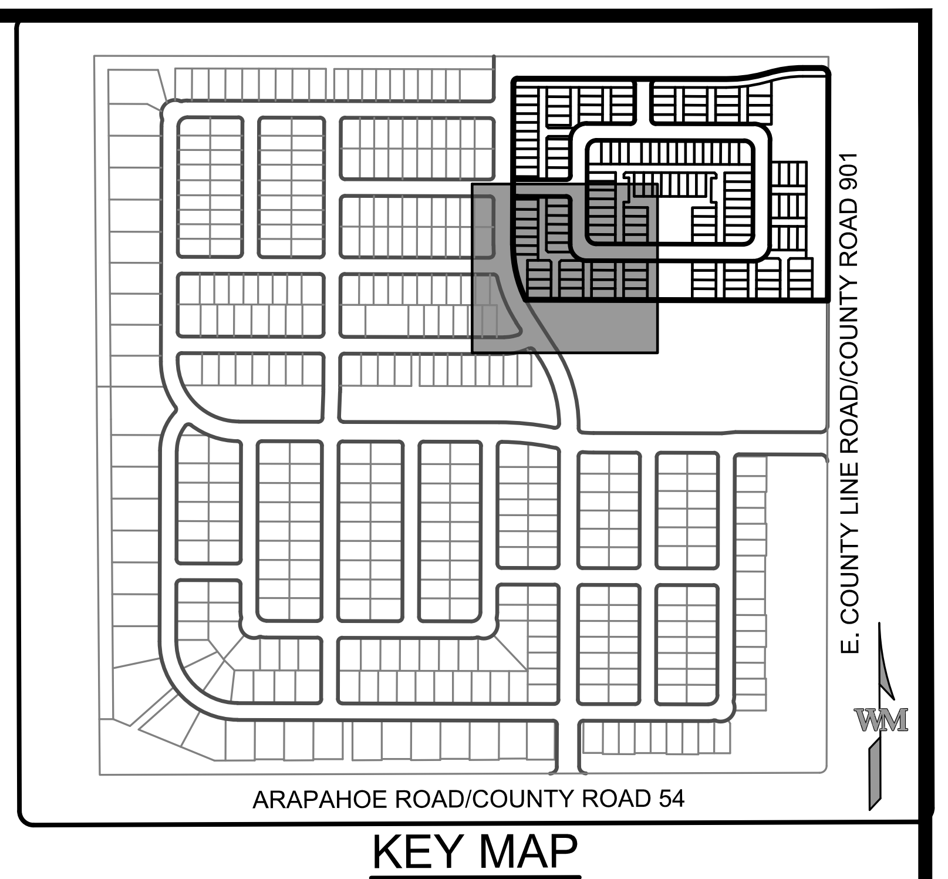
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
UT02
Sheet 27 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP

N.T.S.

0 15 30 60

SCALE: 1" = 30'

ORIGINAL GRAPHIC SCALE

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942

Dec 04, 2018

FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

OVERALL UTILITY PLAN

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

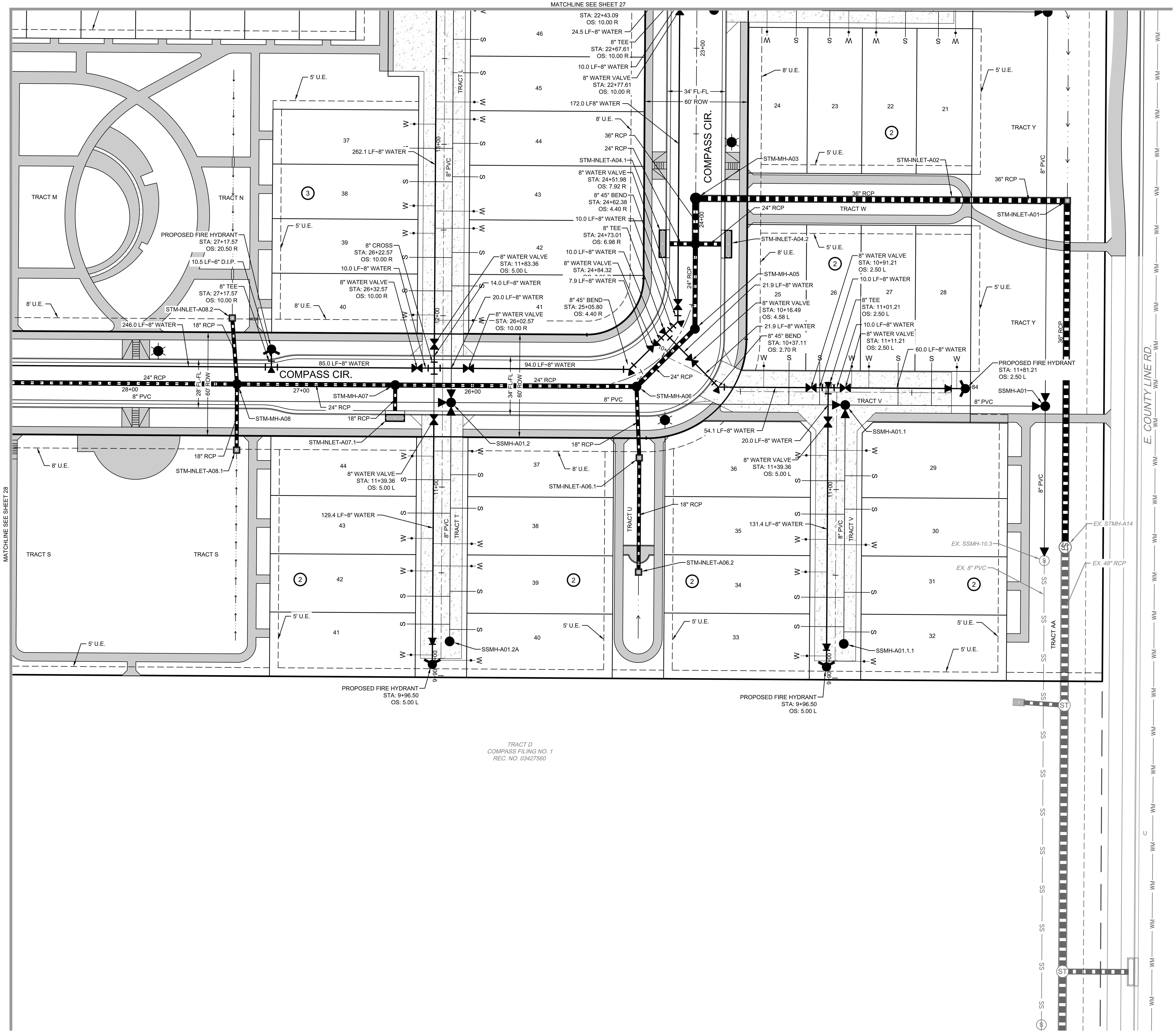
SHEET

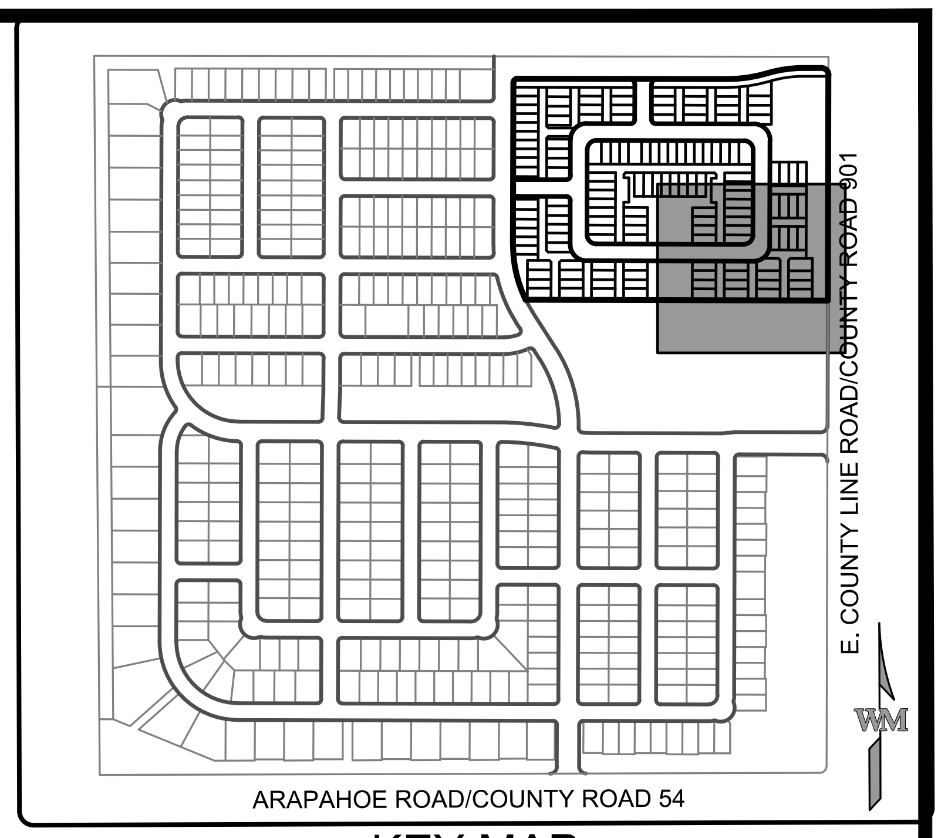
UT03

Sheet 28 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP
N.T.S.

0 15 30 60
SCALE: 1" = 30'
ORIGINAL GRAPHIC SCALE

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

OVERALL UTILITY PLAN

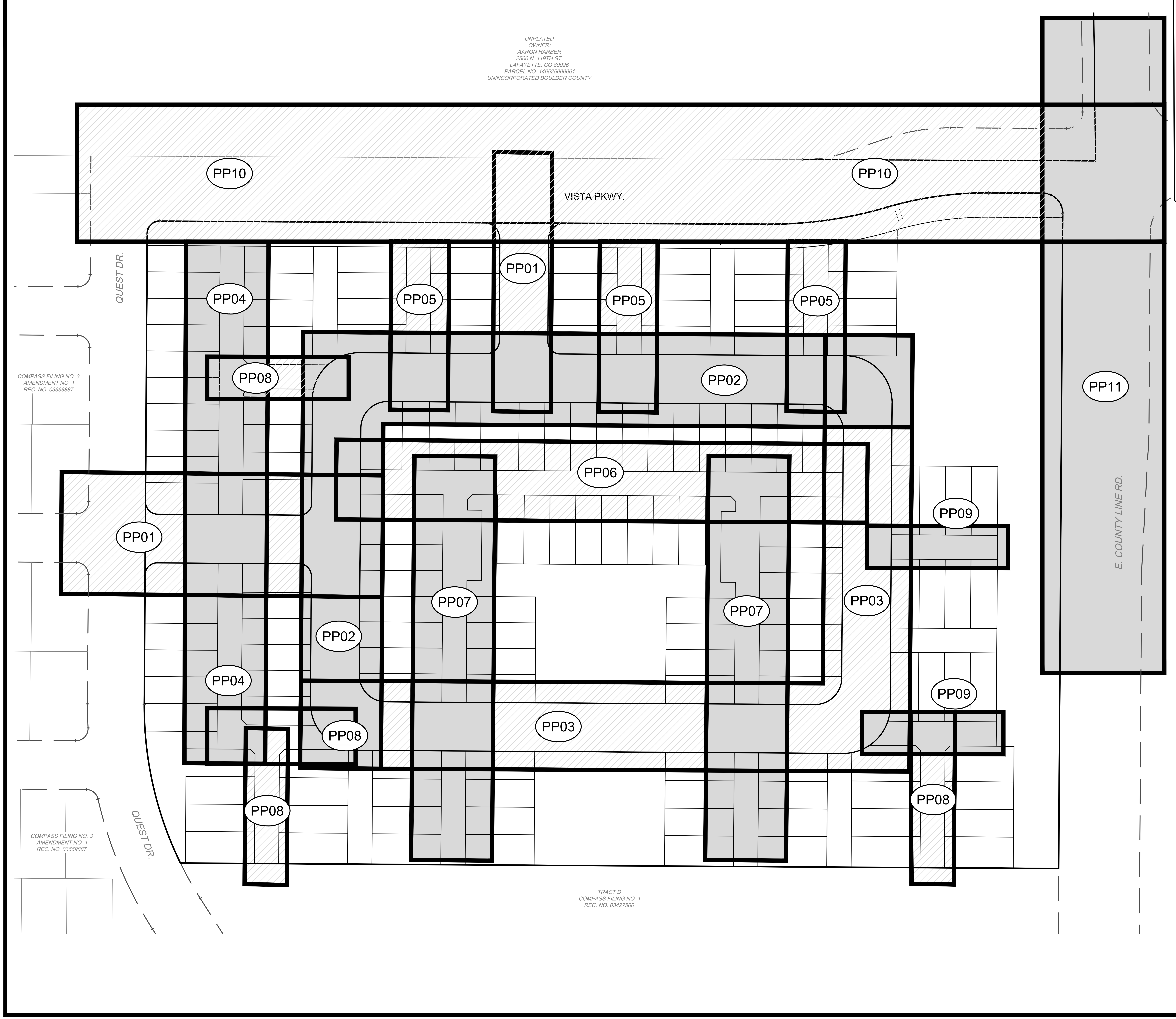
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

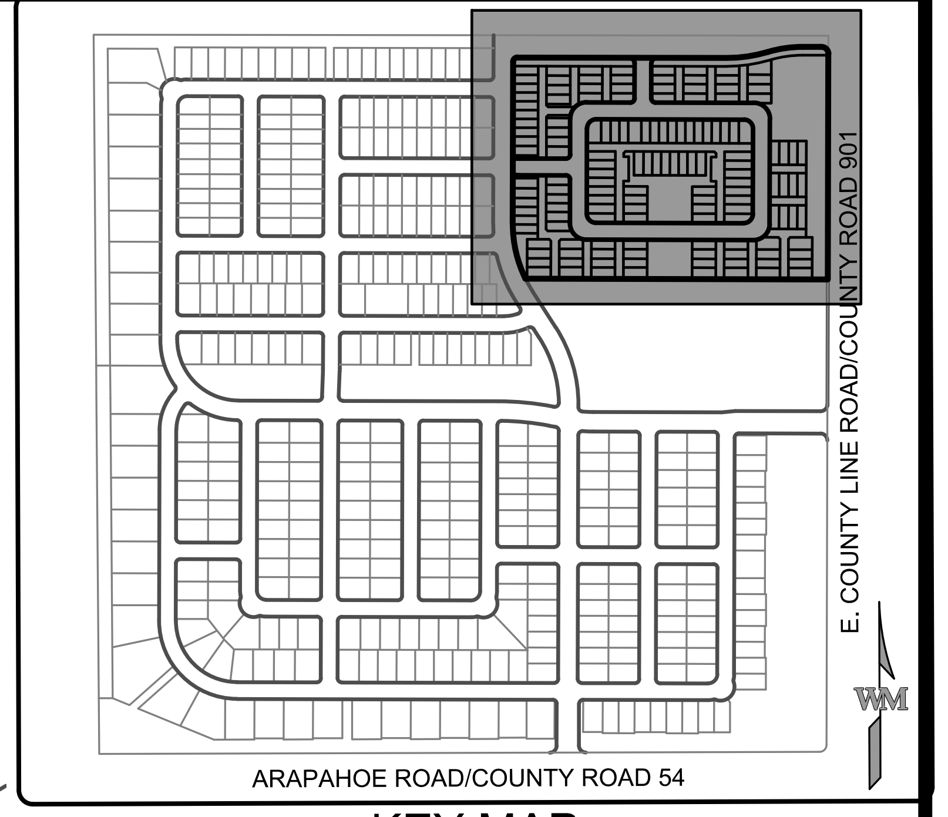
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
UT04
Sheet 29 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP
N.T.S.

0 30 60 120
SCALE: 1" = 60'
ORIGINAL GRAPHIC SCALE

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

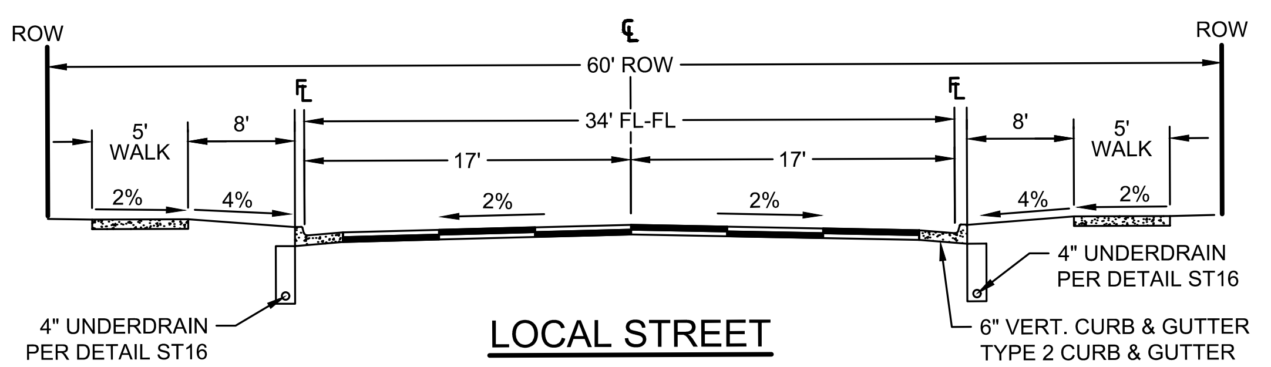
PLAN & PROFILE INDEX SHEET

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

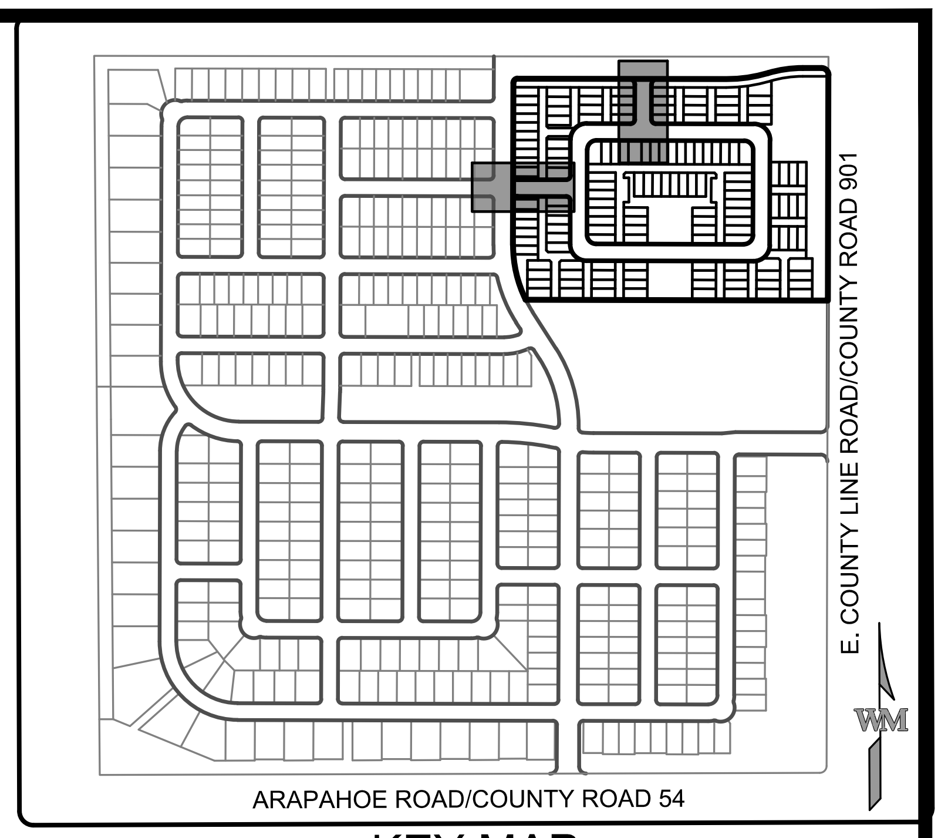
SHEET
PPI01
Sheet 30 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT

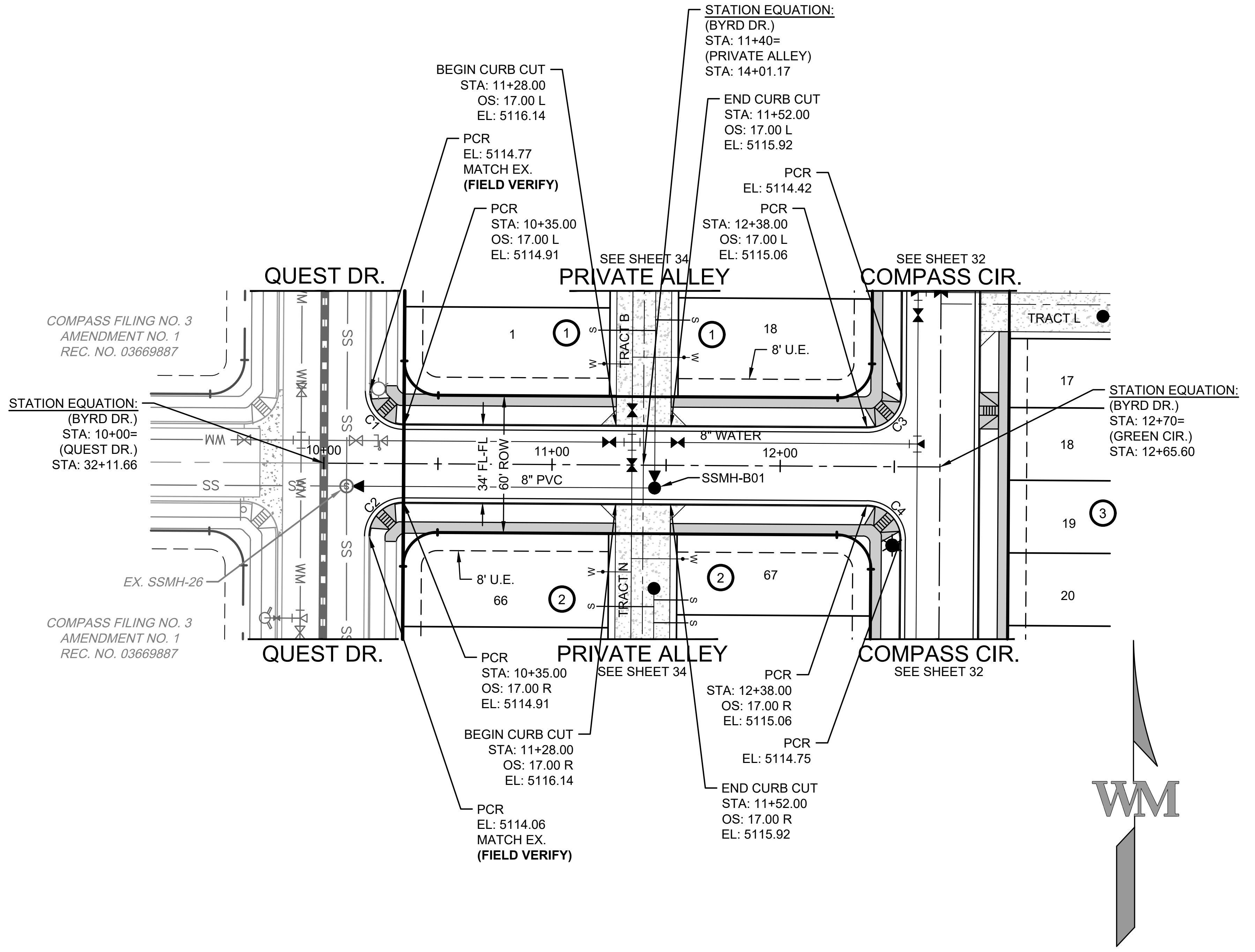


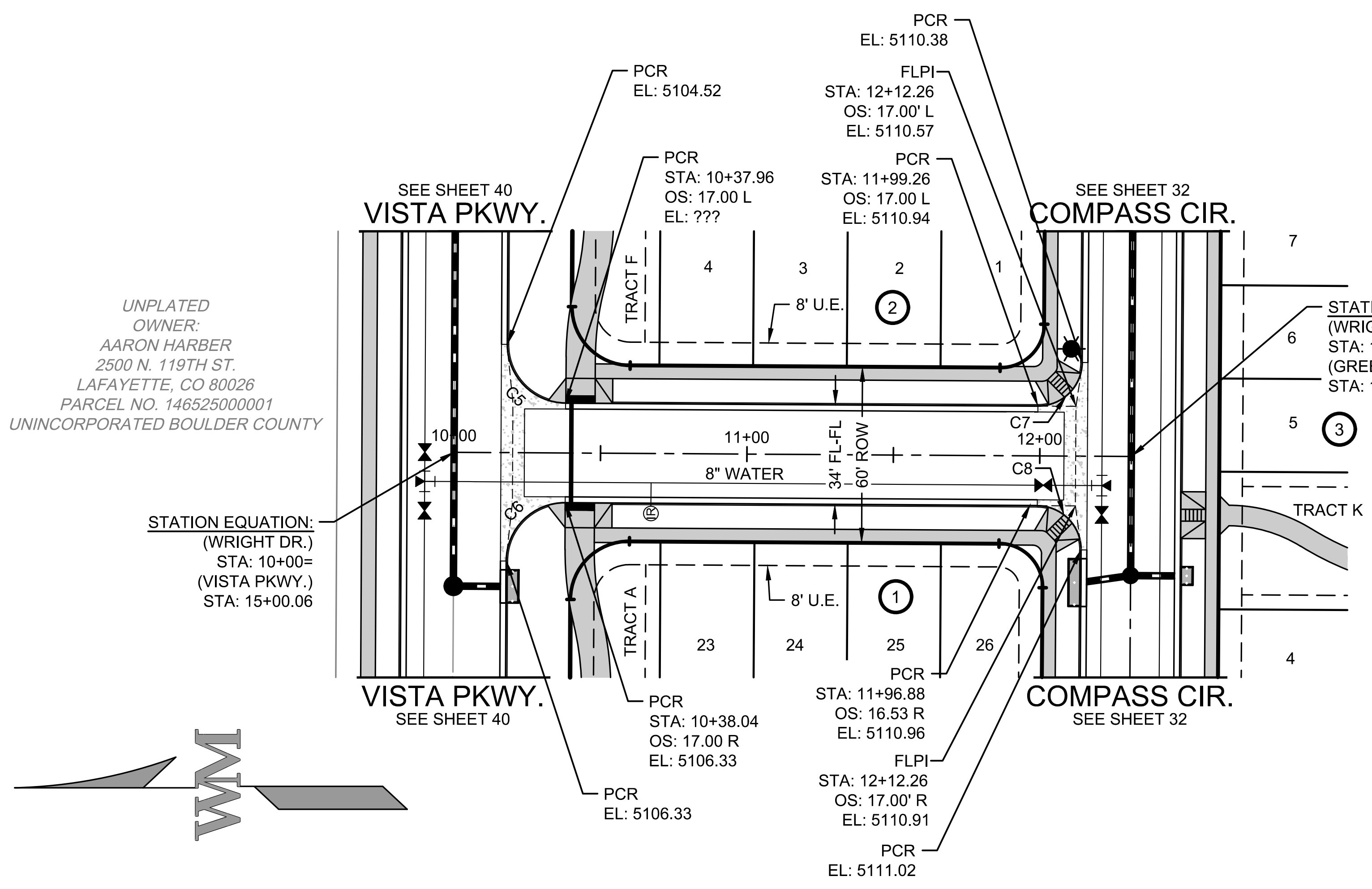
LOCAL STREET
N.T.S.

CURVE TABLE					
CURVE #	DELTA	RADIUS	ARC LENGTH	CHORD DIRECTION	CHORD LENGTH
C1	89°38'34"	15.00'	23.47'	S44°49'17"E	21.15'
C2	90°21'26"	15.00'	23.66'	S45°10'43"W	21.28'
C3	90°00'00"	15.00'	23.56'	N45°21'26"E	21.21'
C4	90°00'00"	15.00'	23.56'	N44°38'34"W	21.21'
C5	89°55'54"	20.00'	31.39'	S45°19'23"W	28.27'
C6	90°04'06"	20.00'	31.44'	N44°40'37"W	28.30'
C7	90°00'00"	15.00'	23.56'	S44°38'34"E	21.21'
C8	90°00'00"	15.00'	23.56'	N45°21'26"E	21.21'



KEY MAP
N.T.S.

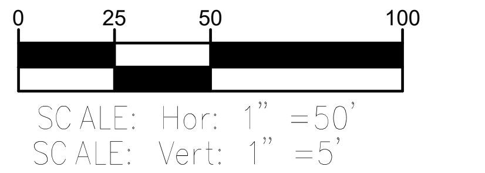




NOTES:

1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED.
2. 8' CROSS PANS TYPICAL UNLESS OTHERWISE NOTED.
3. STANDARD TOWN OF ERIE HANDICAP RAMPS ARE TO BE CONSTRUCTED AT ALL CURB RETURNS AND AT ALL "T" INTERSECTIONS, AND/OR AS OTHERWISE SHOWN ON THESE PLANS.
4. TFI GRADE AT INLETS IN PROFILE ARE AT MID POINT OF INLET, REFER TO STICK DETAIL FOR END OF INLET TFI GRADES.
5. CONTRACTOR IS RESPONSIBLE FOR ADJUSTING ALL EXISTING UTILITIES TO PROPOSED FINISHED GRADE.
6. ELEVATIONS ARE TO FLOWLINE UNLESS OTHERWISE NOTED.
7. MILL AND OVERLAY PER TOWN OF ERIE STANDARDS AND SPECS TO NEXT ADJACENT LANE LINE.
8. STORM SEWER AND SANITARY SEWER MANHOLE RIMS SHALL BE ROTATED TO PROVIDE A MINIMUM OF 2' (TYP.) OF CLEARANCE TO ADJACENT CONCRETE GUTTER.
9. ALL STORM SEWER IS CLASS III UNLESS OTHERWISE NOTED.
10. REFER TO DEMOLITION PLANS FOR MILL AND OVERLAY EXTENTS AND SAWCUT EXTENTS.
11. HANDICAP RAMPS SHALL BE INSTALLED PER ADA CRITERIA. SLOPES SHALL NOT EXCEED 8.3%.
12. OFFSETS ON INLETS ARE TO TFI (TOP FRONT OF INLET).

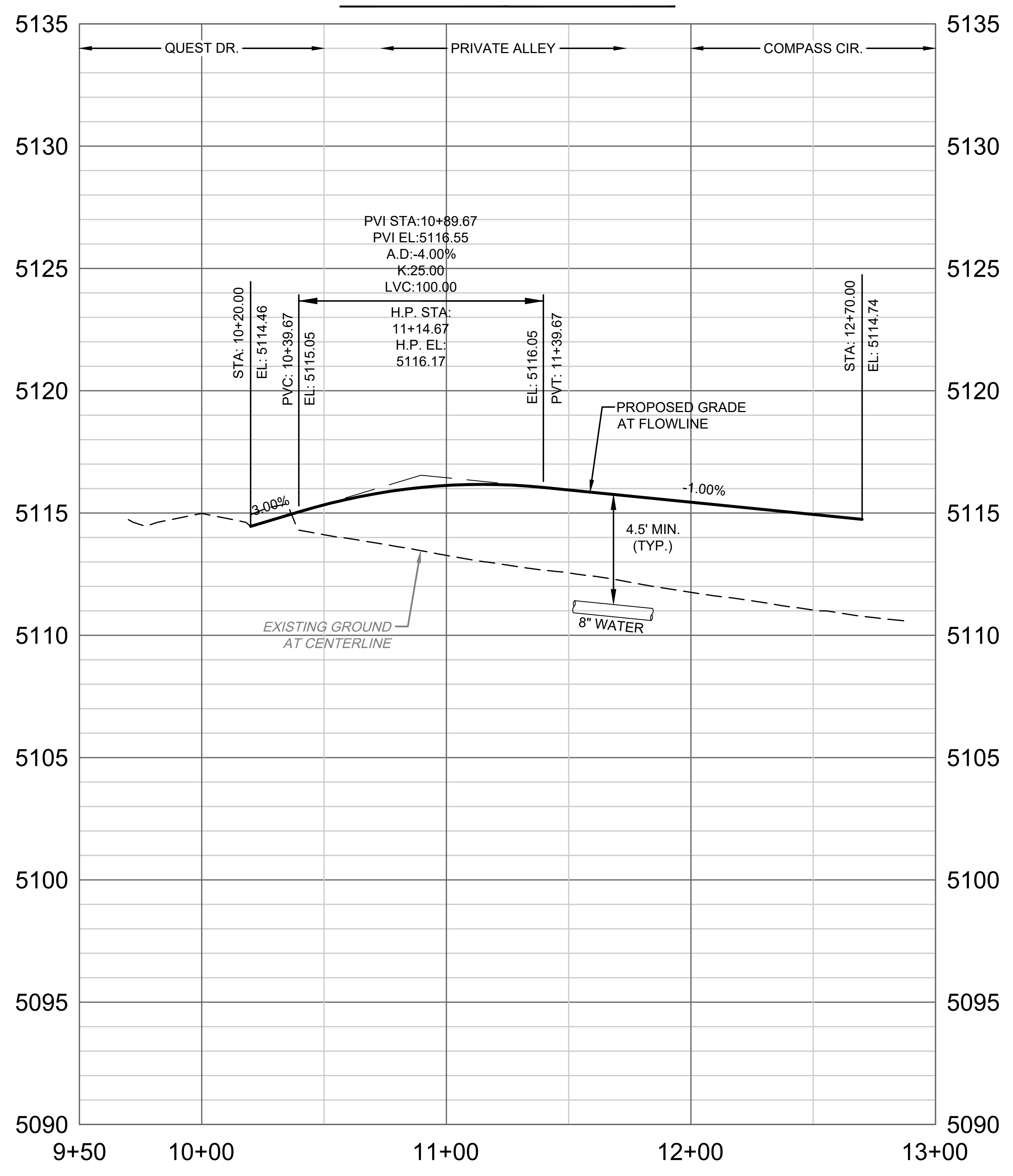
CONTRACTOR TO FIELD VERIFY LOCATION OF ALL EXISTING UTILITES PRIOR TO CONSTRUCTION



SCALE: Hor: 1" =50'
SCALE: Vert: 1" =5'
ORIGINAL GRAPHIC SCALE

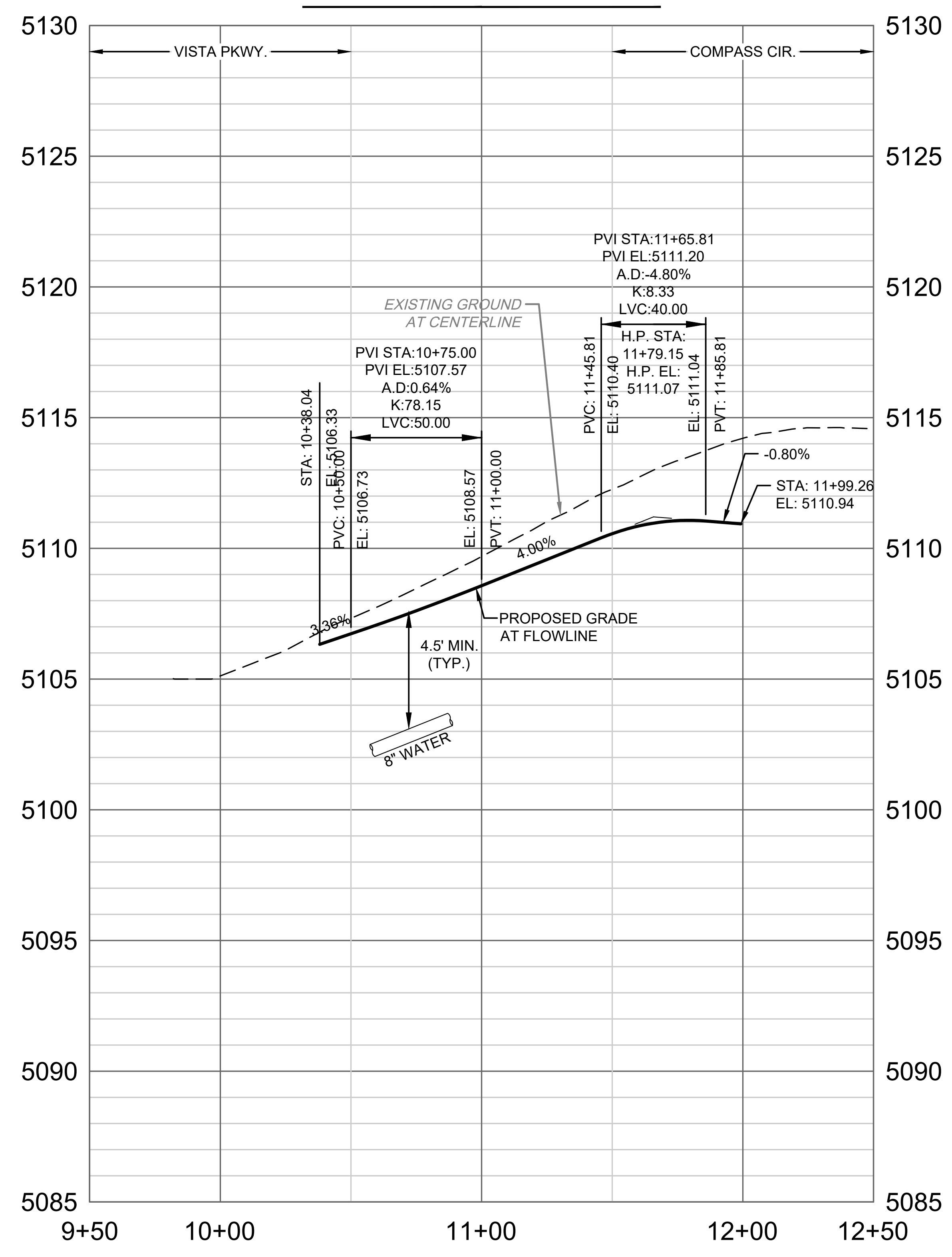
STA. 9+50.00 TO STA. 13+00.00

BYRD DR.



STA. 9+50.00 TO STA. 12+50.00

WRIGHT DR.



THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

BYRD DR. & WRIGHT DR. STREET & STORM SEWER PLAN & PROFILE

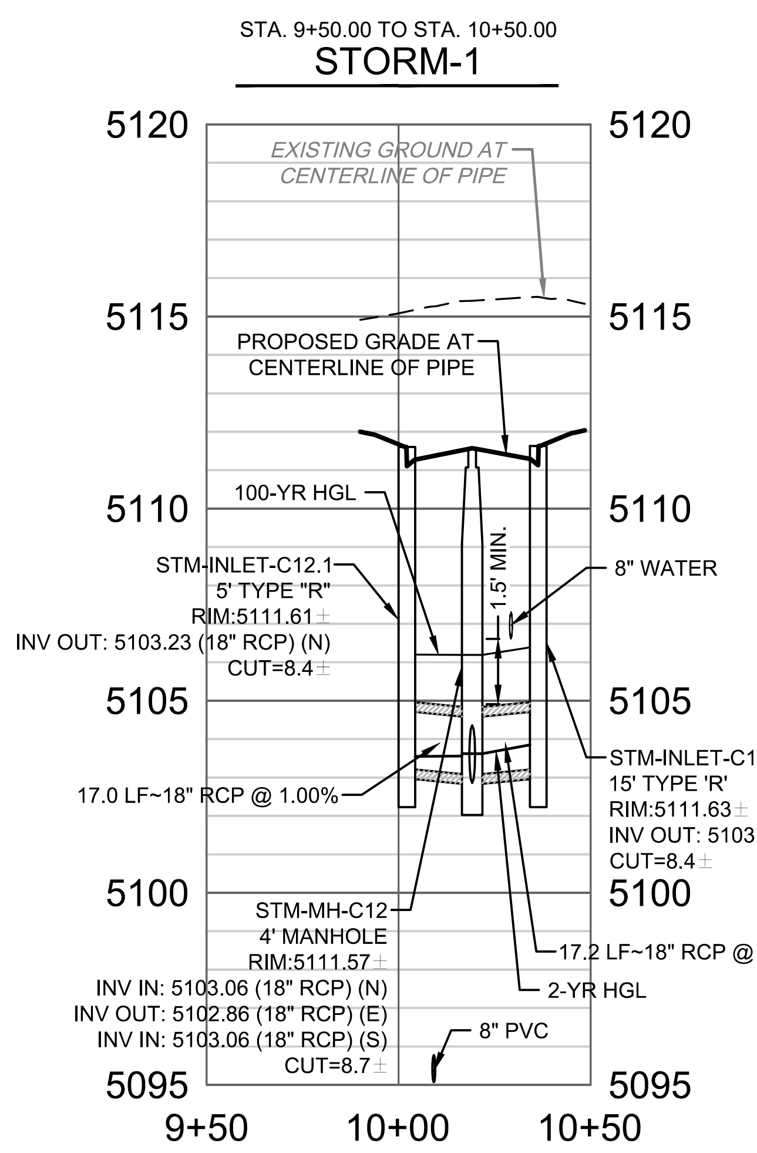
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

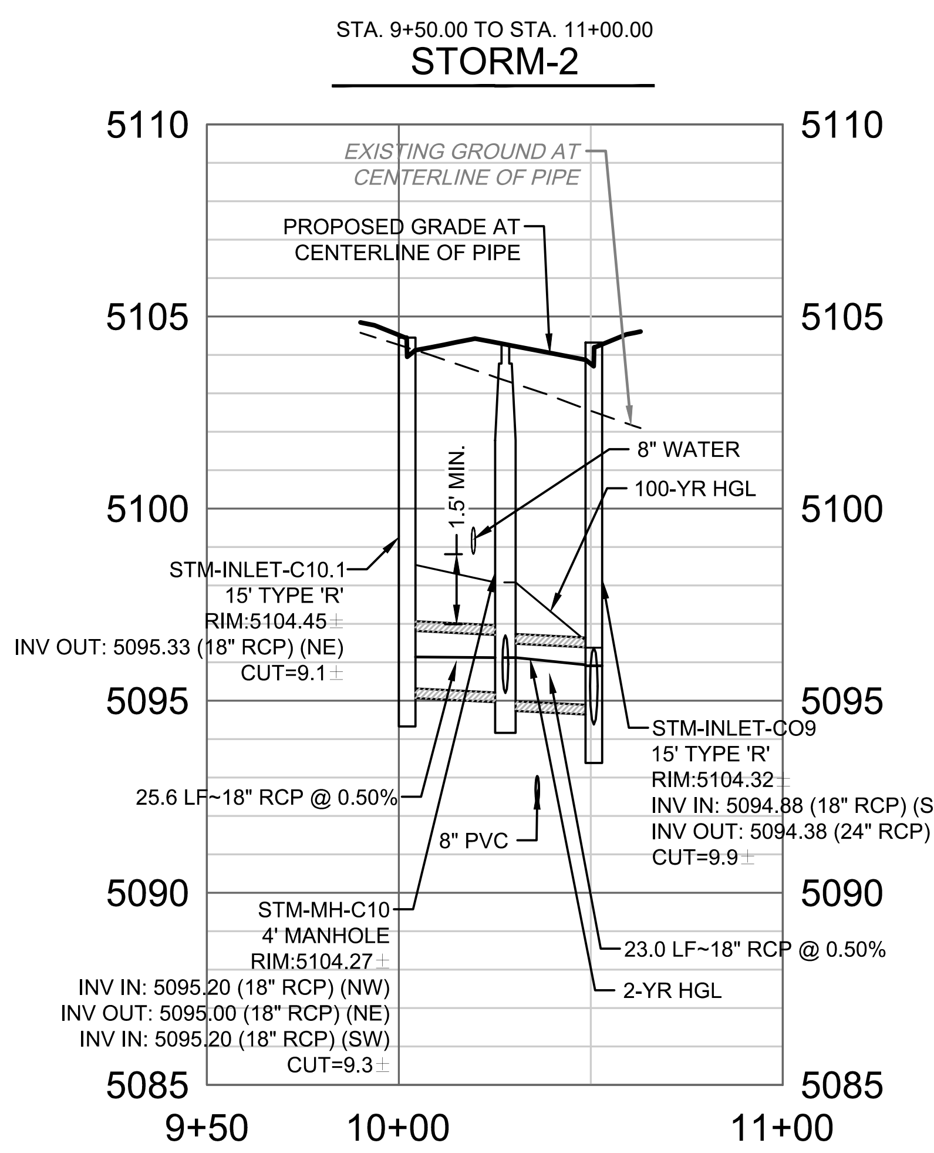
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
PP01
Sheet 31 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT

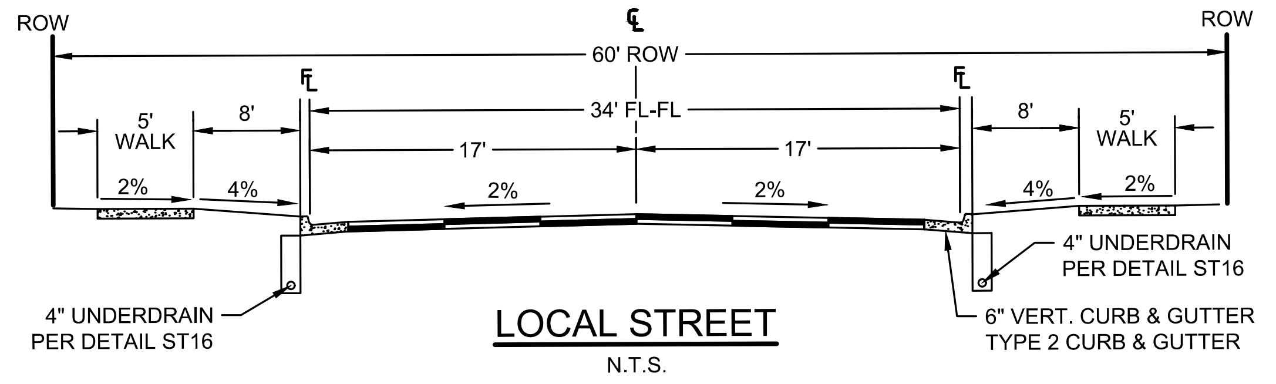




NOTES:
1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED.
2. 8' CROSS PANS TYPICAL UNLESS OTHERWISE NOTED.
3. STANDARD TOWN OF ERIE HANDICAP RAMPS ARE TO BE CONSTRUCTED AT ALL CURB RETURNS AND AT ALL "T" INTERSECTIONS, AND/OR AS OTHERWISE SHOWN ON THESE PLANS.
4. TFI GRADE AT INLETS IN PROFILE ARE AT MID POINT OF INLET, REFER TO STICK DETAIL FOR END OF INLET TFI GRADES.
5. CONTRACTOR IS RESPONSIBLE FOR ADJUSTING ALL EXISTING UTILITIES TO PROPOSED FINISHED GRADE.
6. ELEVATIONS ARE TO FLOWLINE UNLESS OTHERWISE NOTED.
7. MILL AND OVERLAY PER TOWN OF ERIE STANDARDS AND SPECS TO NEXT ADJACENT LANE LINE.
8. STORM SEWER AND SANITARY SEWER MANHOLE RIMS SHALL BE ROTATED TO PROVIDE A MINIMUM OF 2' (TYP.) OF CLEARANCE TO ADJACENT CONCRETE GUTTER.
9. ALL STORM SEWER IS CLASS III UNLESS OTHERWISE NOTED.
10. REFER TO DEMOLITION PLANS FOR MILL AND OVERLAY EXTENTS AND SAWCUT EXTENTS.
11. HANDICAP RAMPS SHALL BE INSTALLED PER ADA CRITERIA. SLOPES SHALL NOT EXCEED 8.3%.
12. OFFSETS ON INLETS ARE TO TFI (TOP FRONT OF INLET).

CURVE TABLE

CURVE #	DELTA	RADIUS	ARC LENGTH	CHORD DIRECTION	CHORD LENGTH
C1	90°00'00"	46.00'	72.26'	S44°38'34"E	65.05'
C2	90°00'00"	45.00'	70.69'	S44°38'34"E	63.64'
C3	90°00'00"	15.00'	23.56'	N44°38'34"W	21.21'
C4	90°00'00"	15.00'	23.56'	N45°21'26"E	21.21'
C5	90°00'00"	45.00'	70.69'	S45°21'26"W	63.64'
C6	90°00'00"	46.00'	72.26'	S45°21'26"W	65.05'
C7	90°00'00"	15.00'	23.56'	N45°21'26"E	21.21'
C8	90°00'00"	15.00'	23.56'	S44°38'34"E	21.21'
C9	90°00'00"	45.00'	70.69'	N44°38'34"W	63.64'
C10	90°00'00"	46.00'	72.26'	N44°38'34"W	65.05'



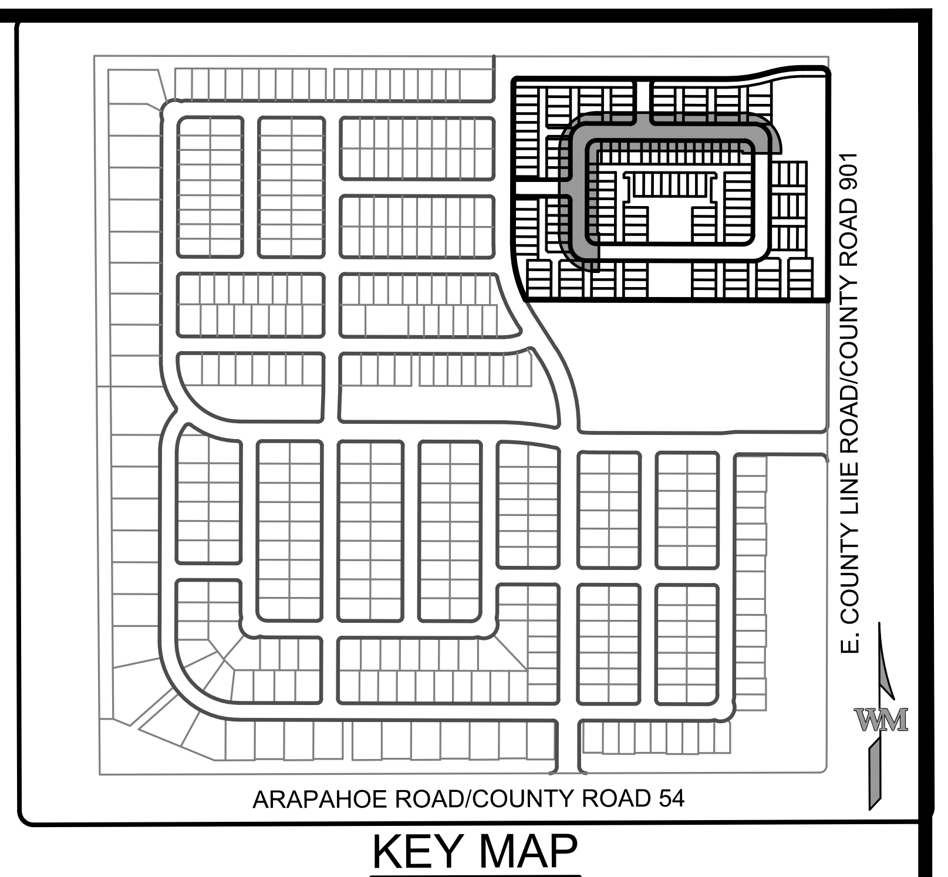
LOCAL STREET

N.T.S.

CONTRACTOR TO FIELD VERIFY LOCATION OF ALL EXISTING UTILITES PRIOR TO CONSTRUCTION

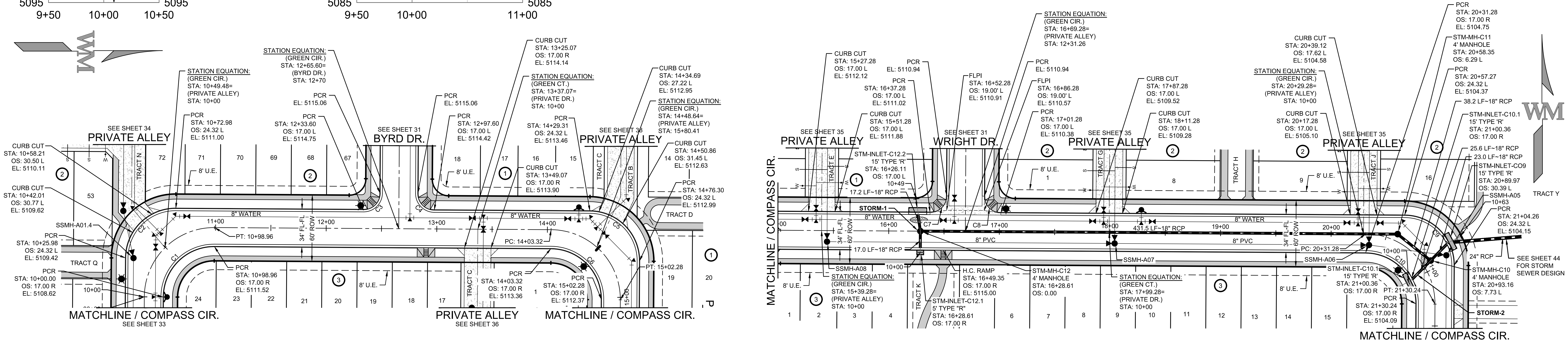
0 25 50 100

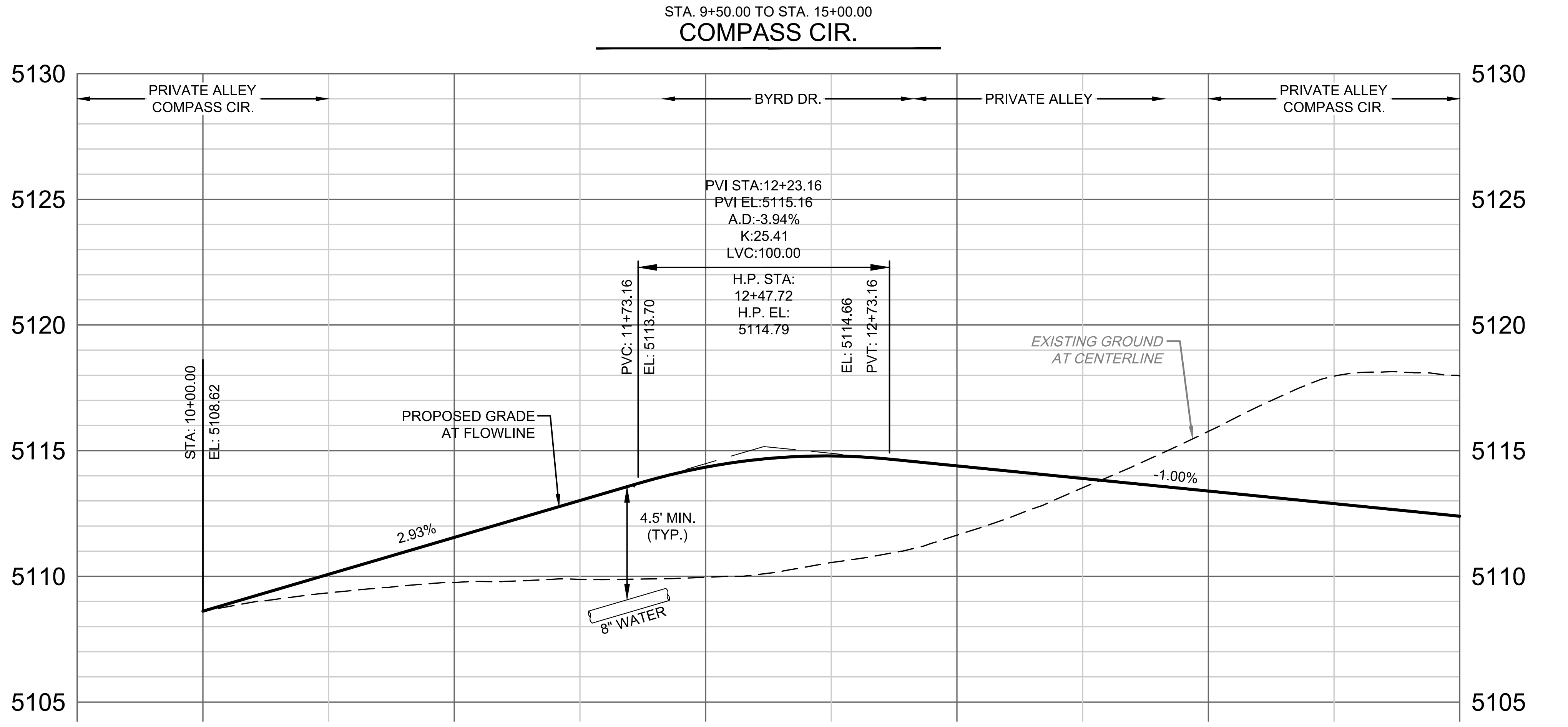
SCALE: Hor: 1" =50'
SCALE: Vert: 1" =5'
ORIGINAL GRAPHIC SCALE

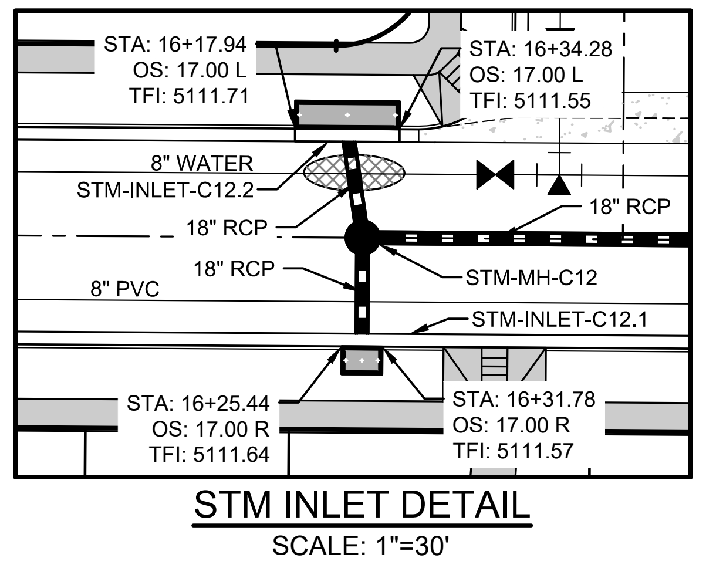


KEY MAP

N.T.S.

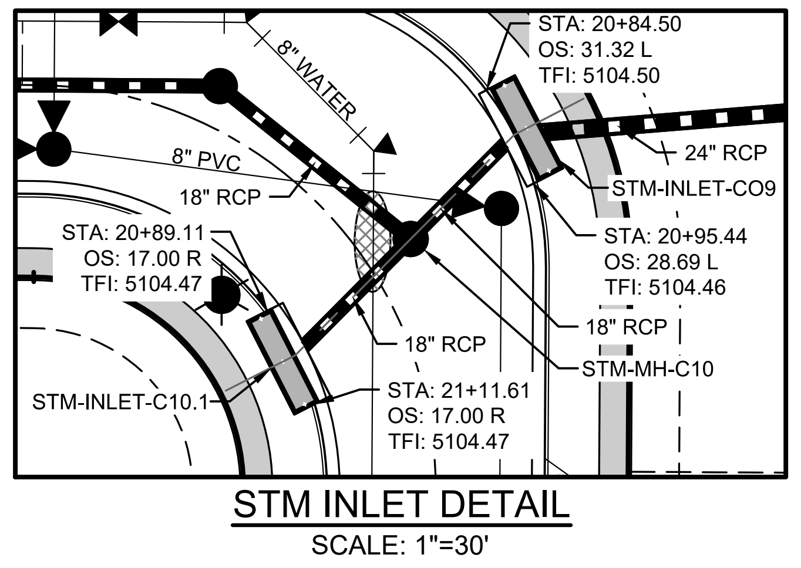






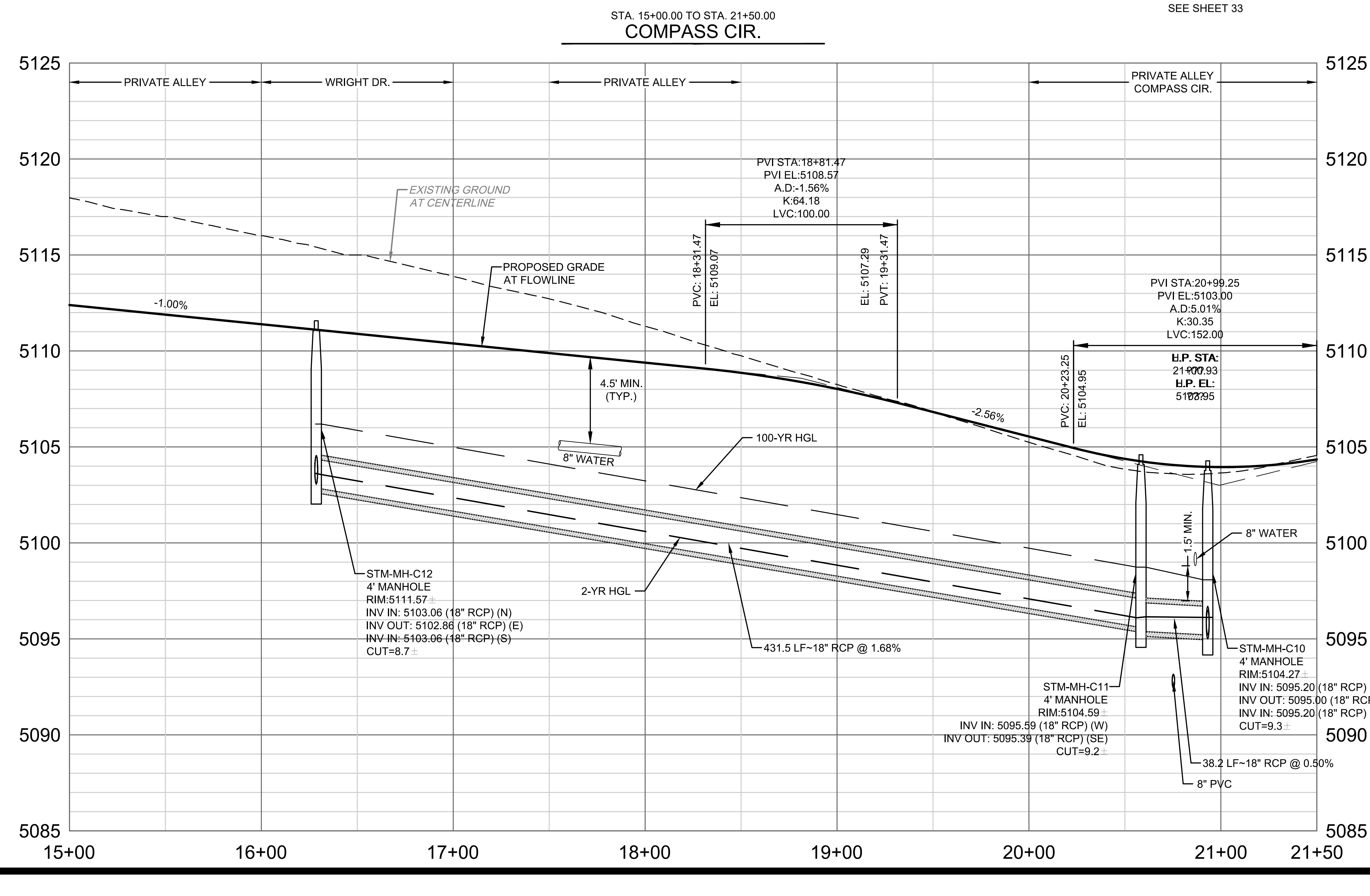
STM INLET DETAIL

SCALE: 1"=30'



STM INLET DETAIL

SCALE: 1"=30'



THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

COMPASS CIR.
STREET & STORM SEWER PLAN & PROFILE

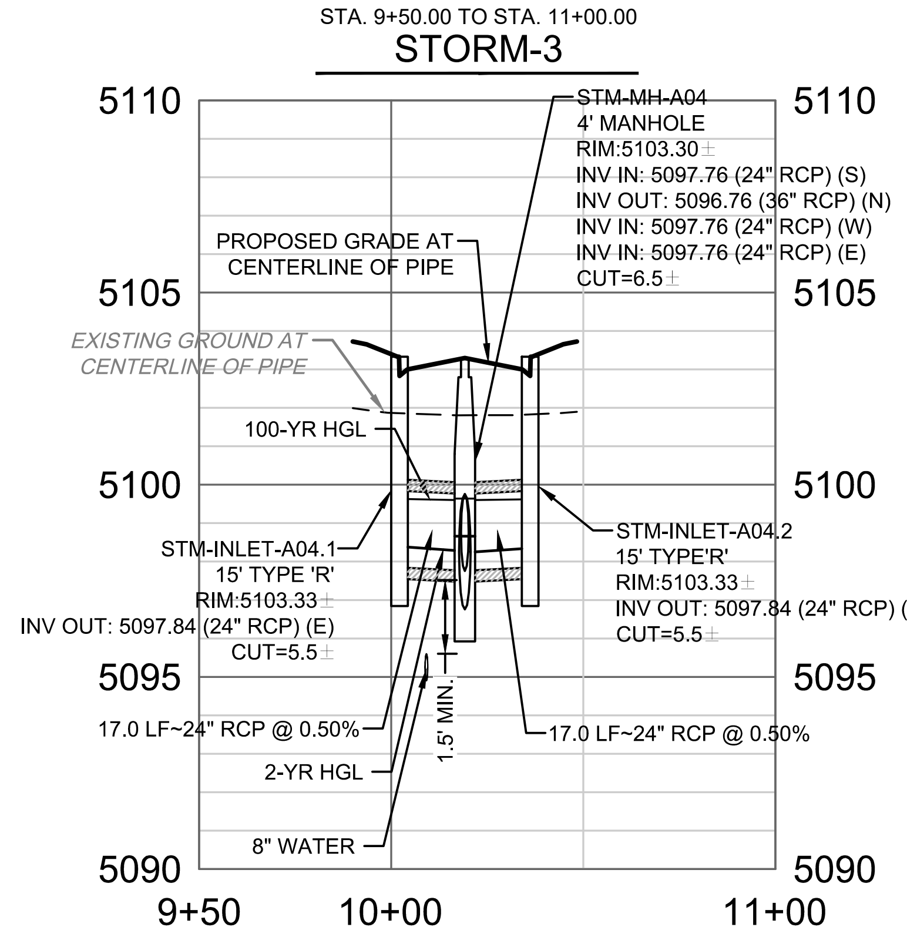
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

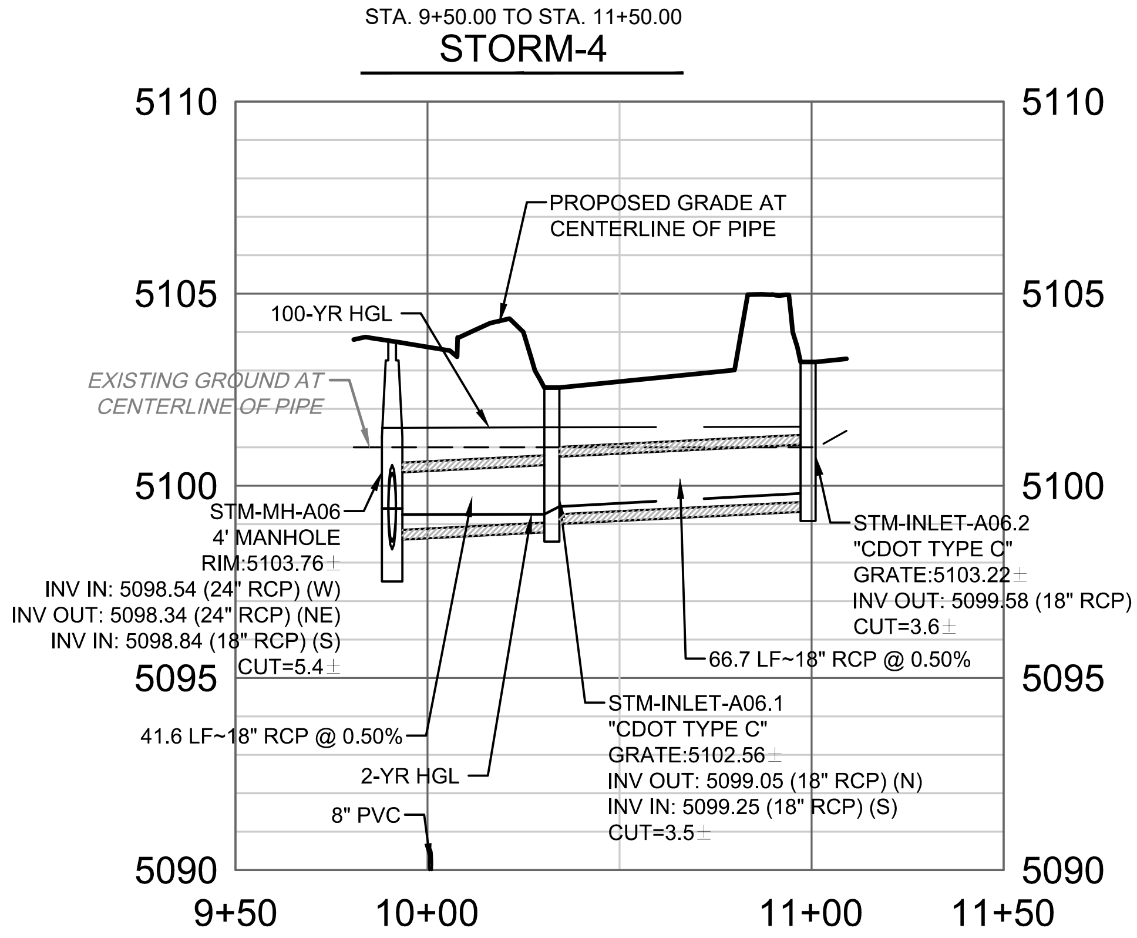
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

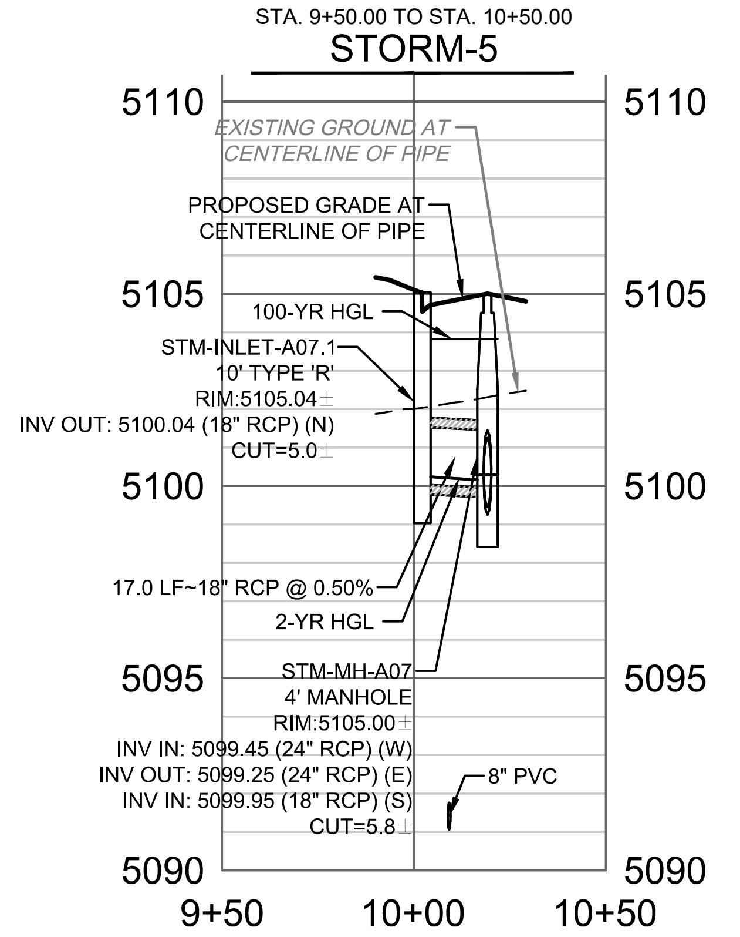
SHEET
PP02
Sheet 32 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



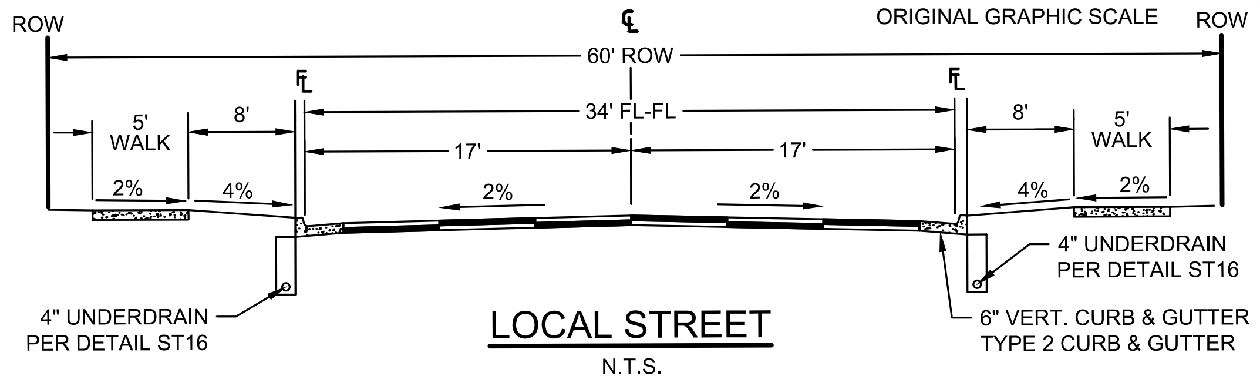




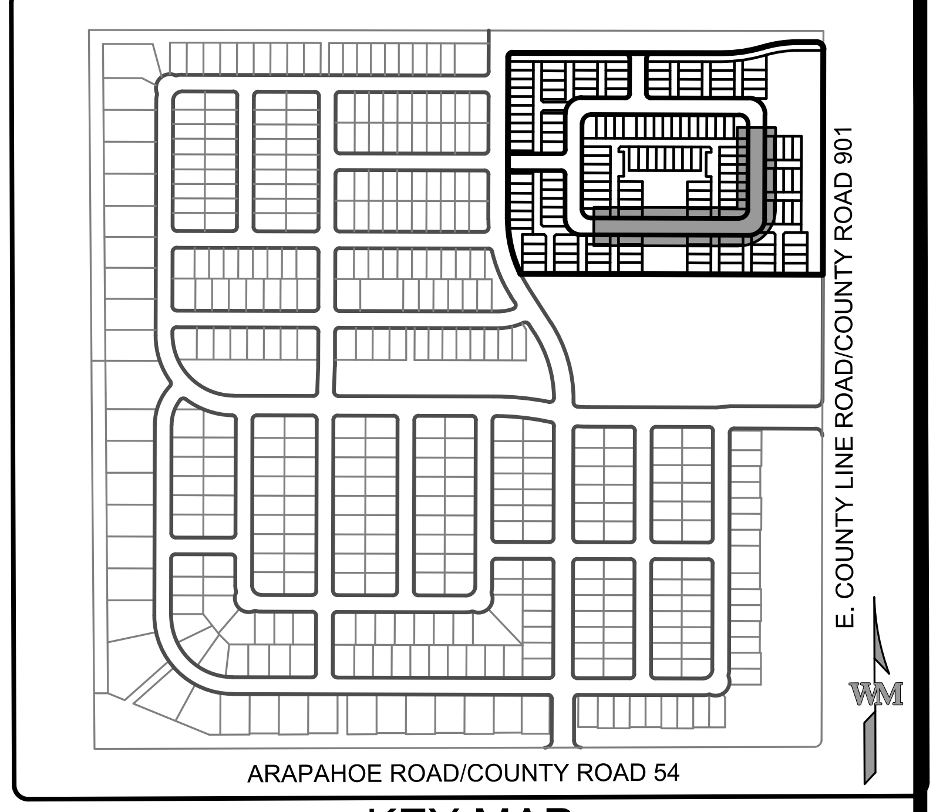
CURVE TABLE					
CURVE #	DELTA	RADIUS	ARC LENGTH	CHORD DIRECTION	CHORD LENGTH
C11	90°00'00"	45.00'	70.69'	N45°21'26"E	63.64'
C12	90°00'00"	46.00'	72.26'	N45°21'26"E	65.05'

CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION

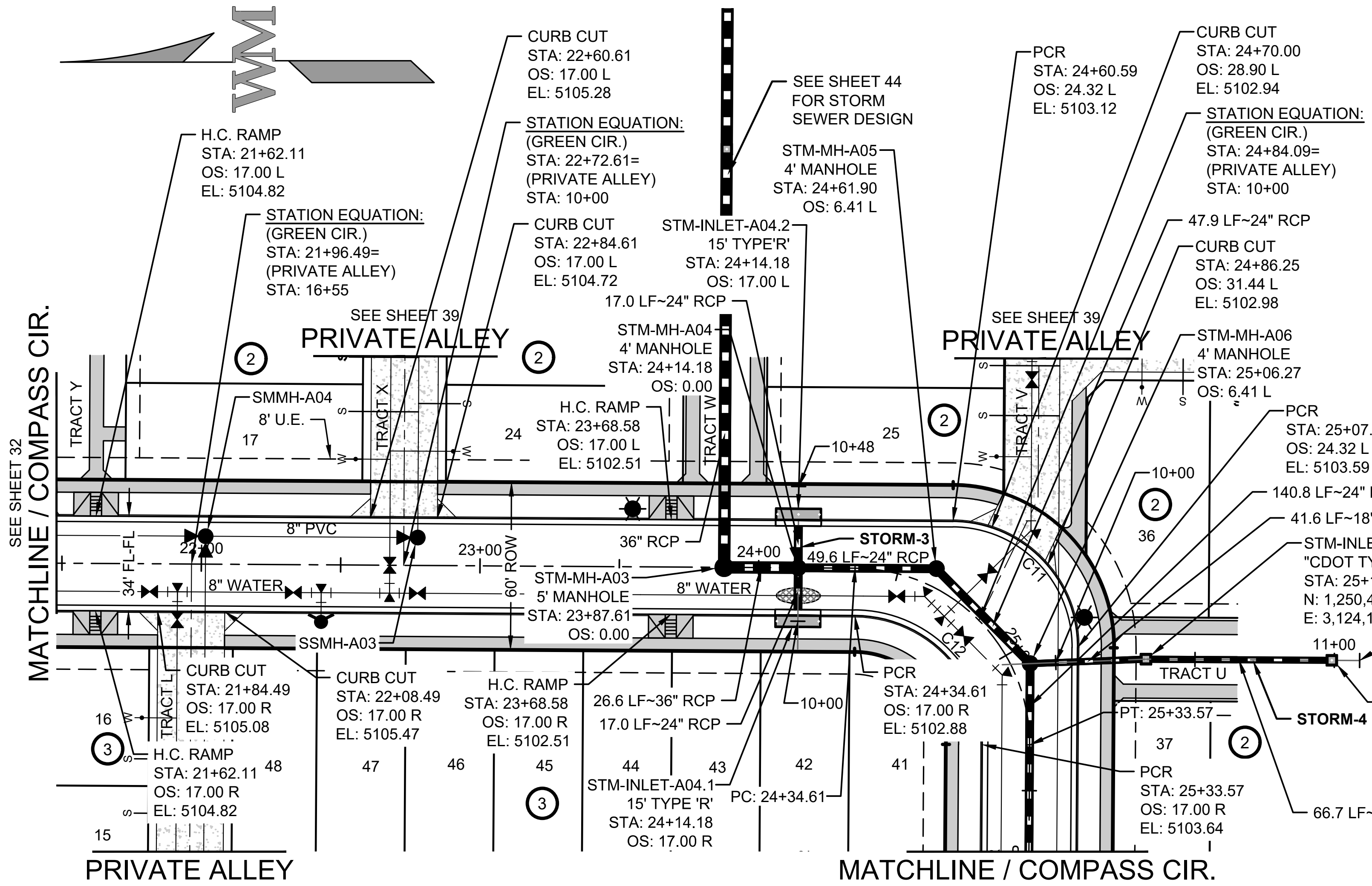
0 25 50 100
SCALE: Hor: 1" =50'
SCALE: Vert: 1" =5'
ORIGINAL GRAPHIC SCALE

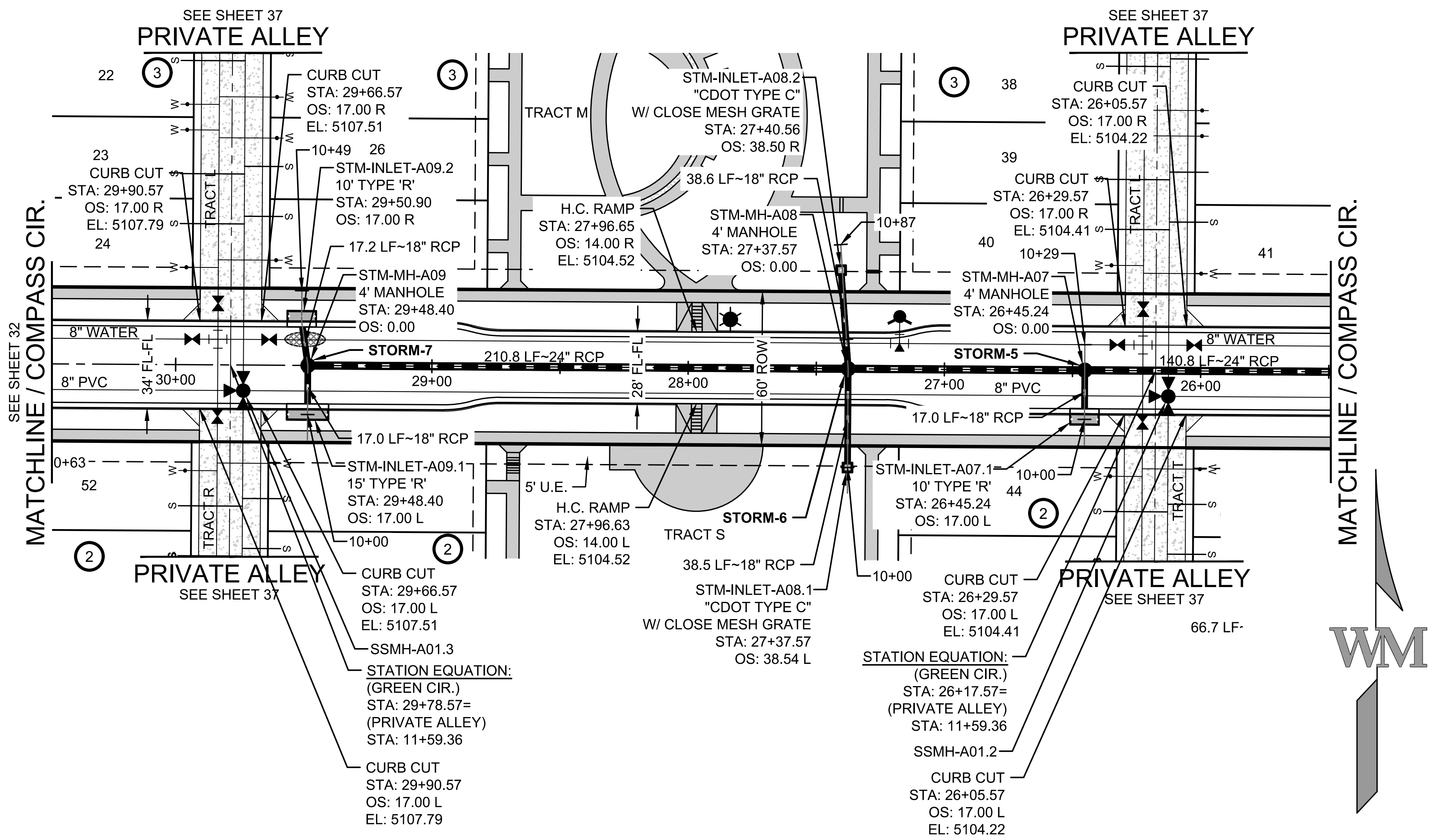


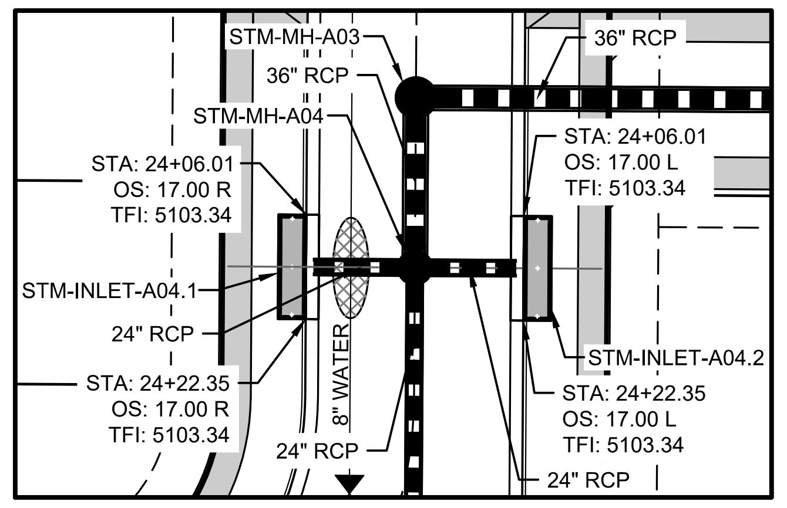
LOCAL STREET
N.T.S.



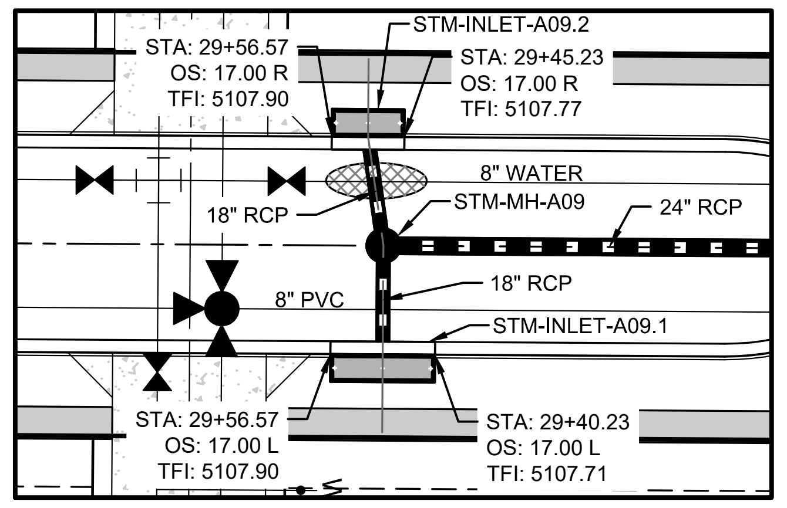
KEY MAP
N.T.S.



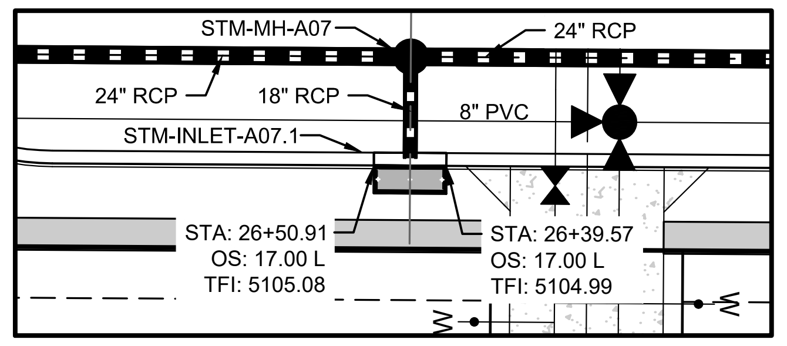




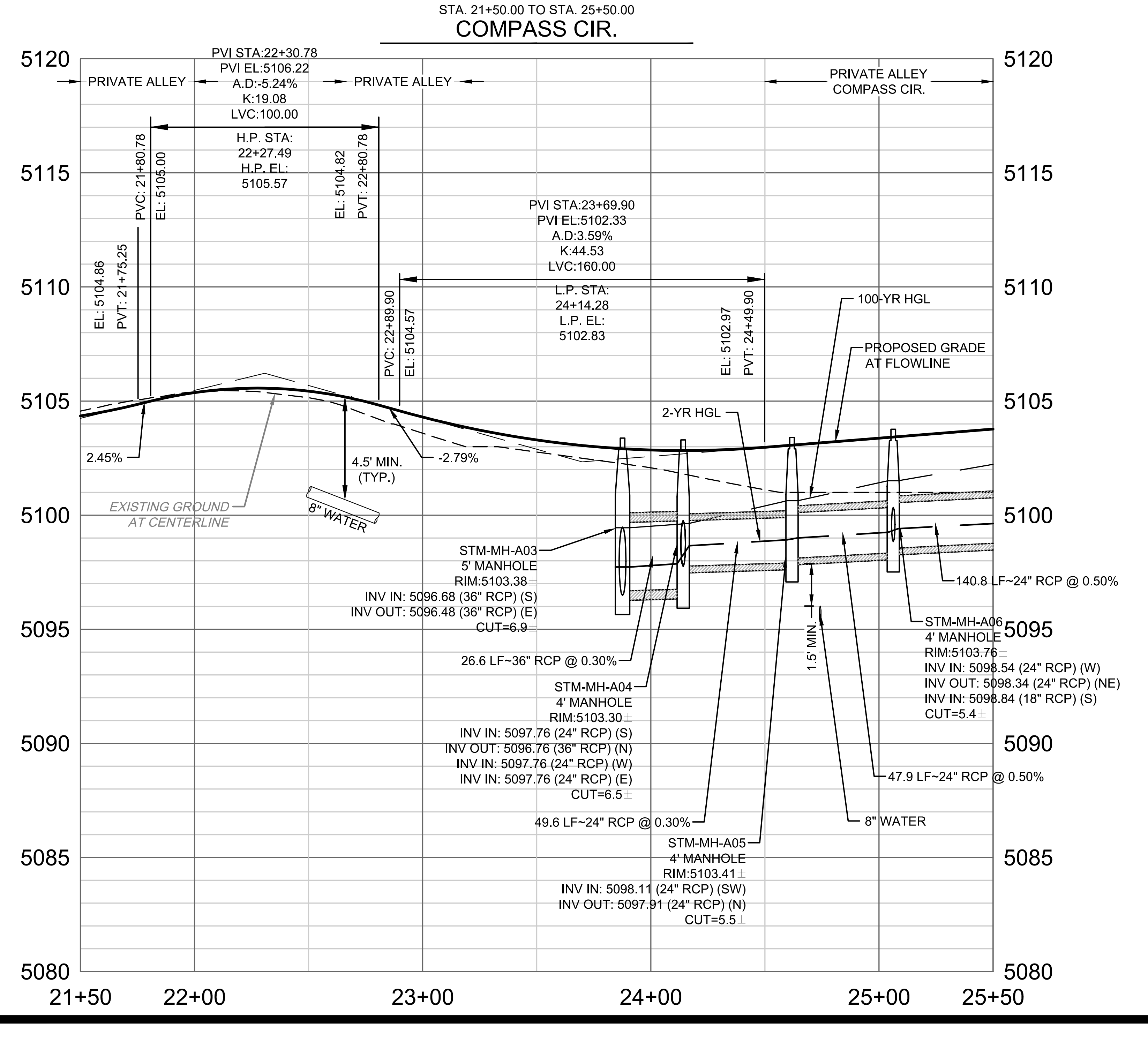
STM INLET DETAIL
SCALE: 1"=30'

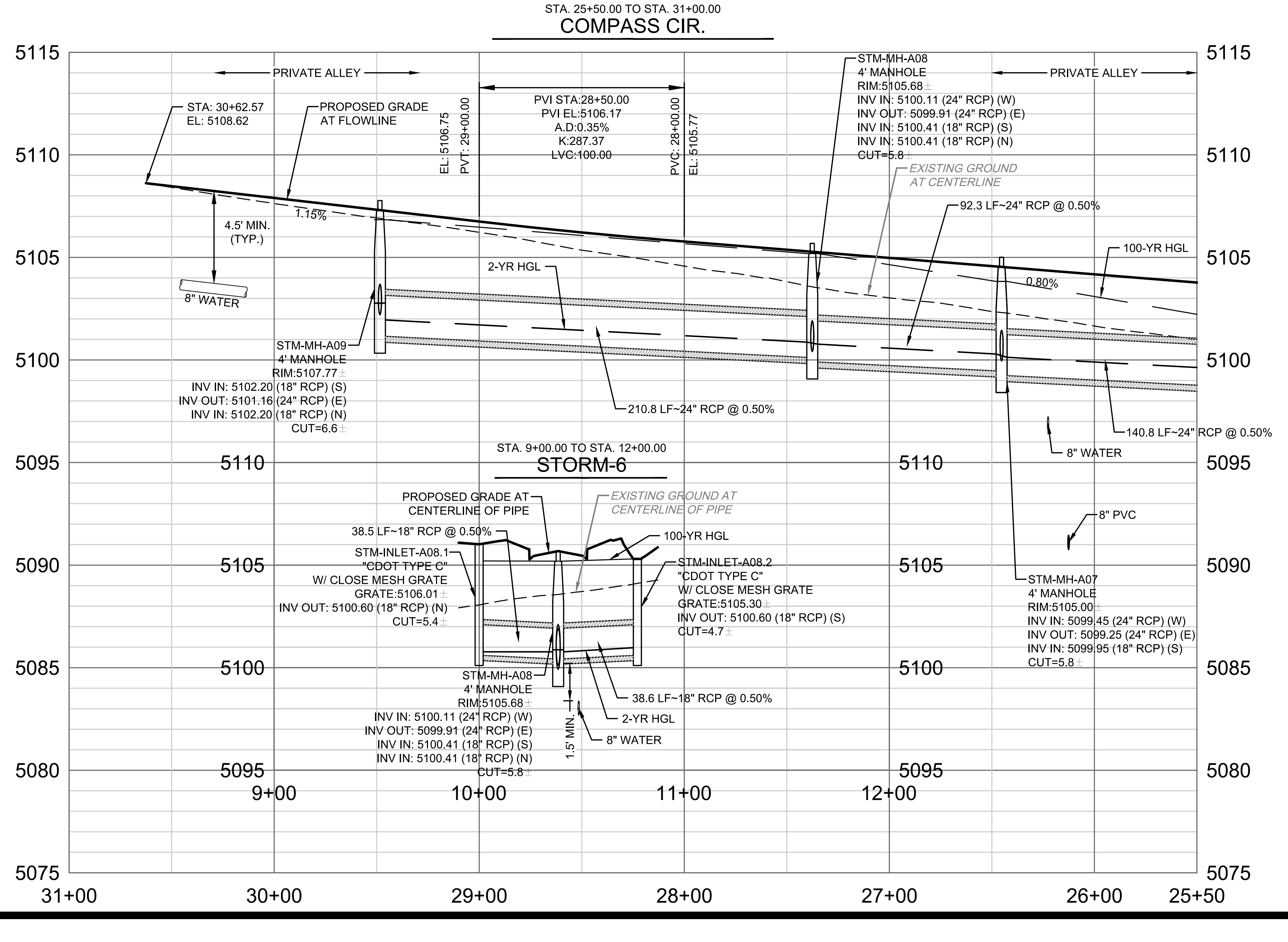


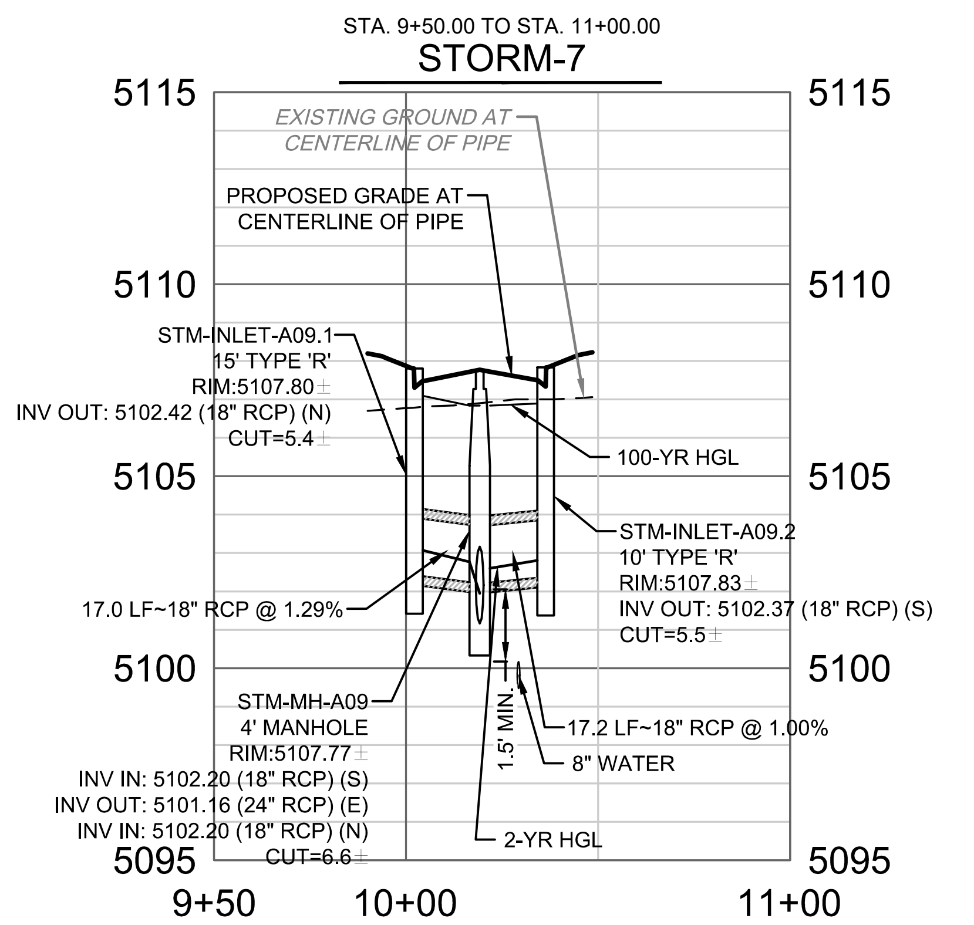
STM INLET DETAIL
SCALE: 1"=30'



STM INLET DETAIL
SCALE: 1"=30'







NOTES:

1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED.
2. 8' CROSS PANS TYPICAL UNLESS OTHERWISE NOTED.
3. STANDARD TOWN OF ERIE HANDICAP RAMPS ARE TO BE CONSTRUCTED AT ALL CURB RETURNS AND AT ALL "T" INTERSECTIONS, AND/OR AS OTHERWISE SHOWN ON THESE PLANS.
4. TFI GRADE AT INLETS IN PROFILE ARE AT MID POINT OF INLET, REFER TO STICK DETAIL FOR END OF INLET TFI GRADES.
5. CONTRACTOR IS RESPONSIBLE FOR ADJUSTING ALL EXISTING UTILITIES TO PROPOSED FINISHED GRADE.
6. ELEVATIONS ARE TO FLOWLINE UNLESS OTHERWISE NOTED.
7. MILL AND OVERLAY PER TOWN OF ERIE STANDARDS AND SPECS TO NEXT ADJACENT LANE LINE.
8. STORM SEWER AND SANITARY SEWER MANHOLE RIMS SHALL BE ROTATED TO PROVIDE A MINIMUM OF 2' (TYP.) OF CLEARANCE TO ADJACENT CONCRETE GUTTER.
9. ALL STORM SEWER IS CLASS III UNLESS OTHERWISE NOTED.
10. REFER TO DEMOLITION PLANS FOR MILL AND OVERLAY EXTENTS AND SAWCUT EXTENTS.
11. HANDICAP RAMPS SHALL BE INSTALLED PER ADA CRITERIA. SLOPES SHALL NOT EXCEED 8.3%.
12. OFFSETS ON INLETS ARE TO TFI (TOP FRONT OF INLET).

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

35942
THOMAS C. JANSEN
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

COMPASS CIR.
STREET & STORM SEWER PLAN & PROFILE

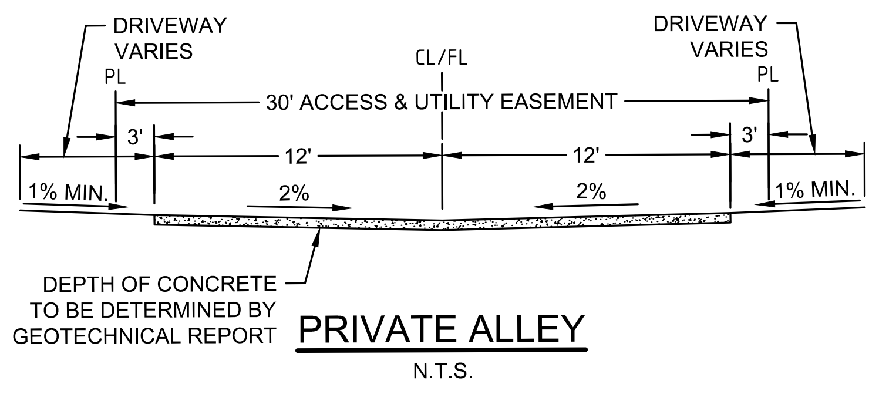
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
PP03
Sheet 33 of 74

NOT FOR CONSTRUCTION

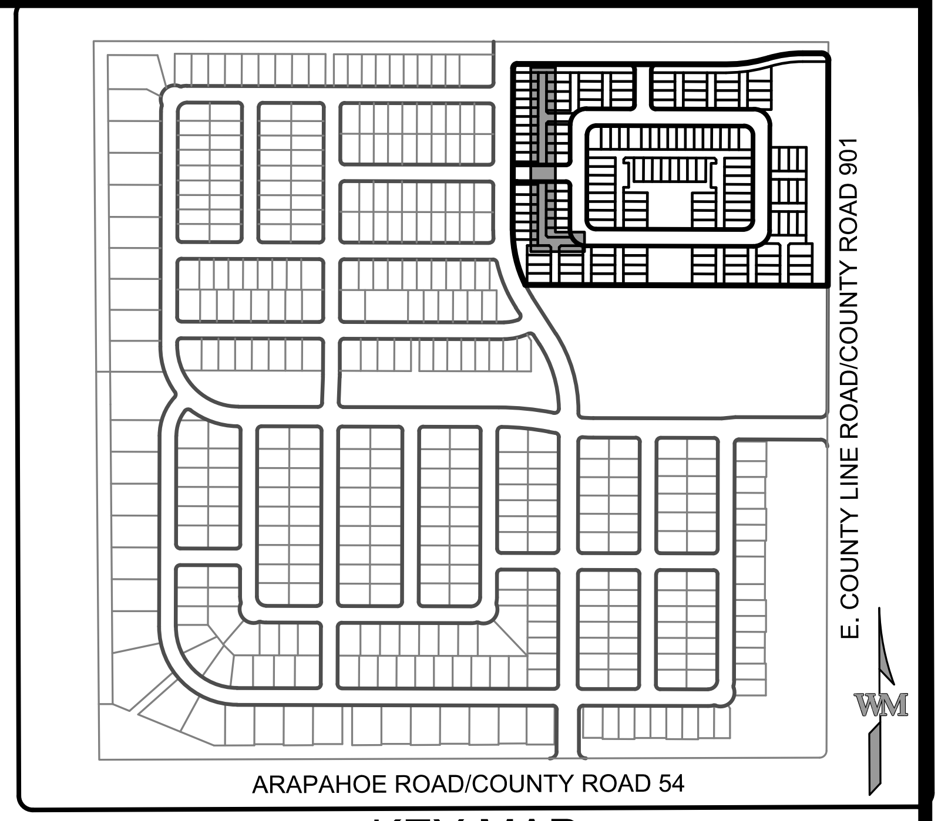
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



PRIVATE ALLEY

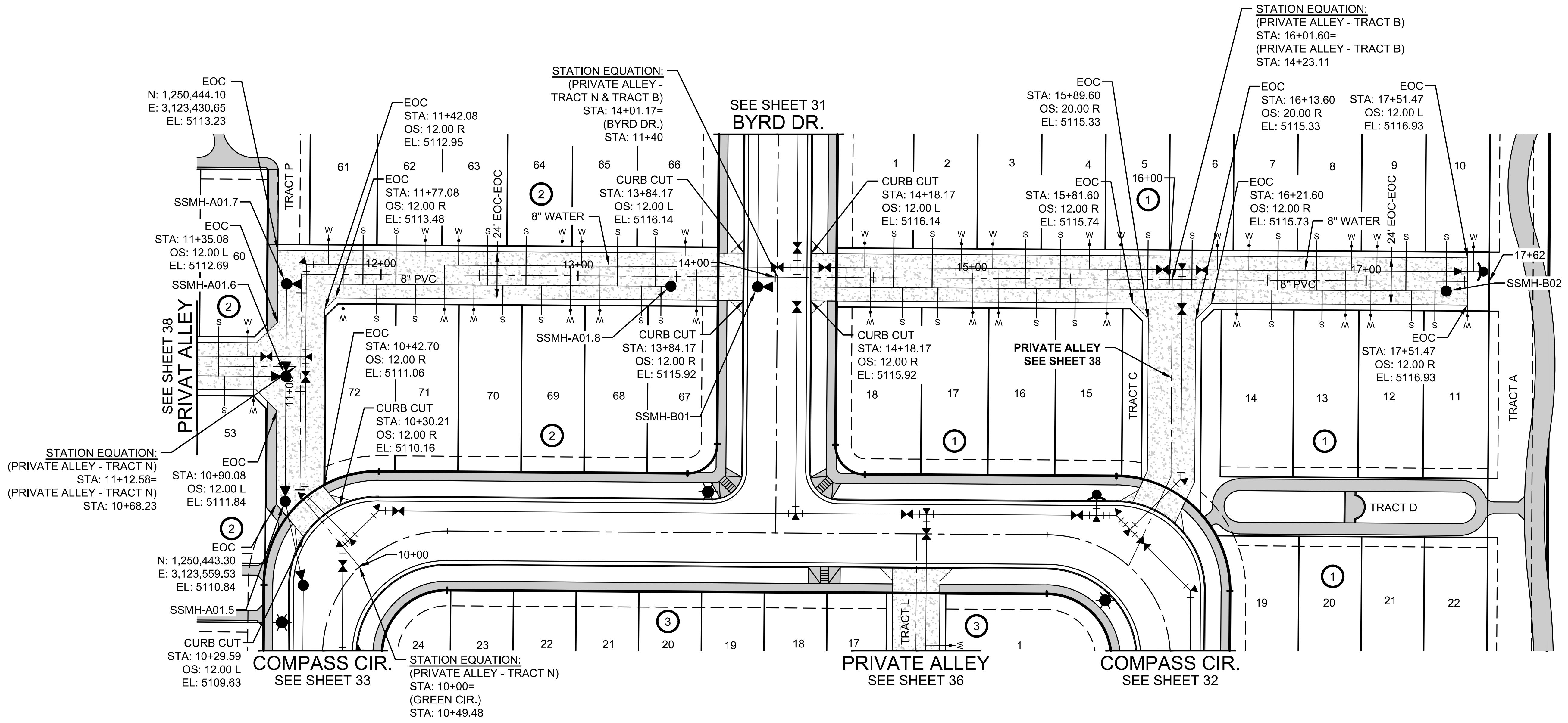
N.T.S.

CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION



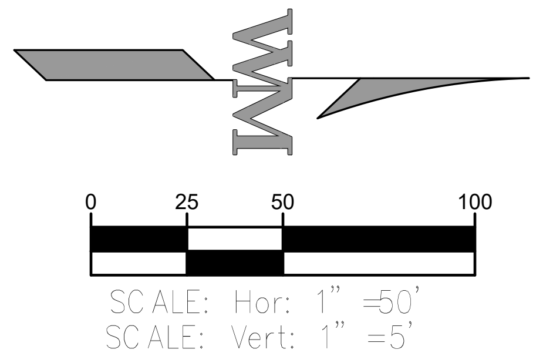
KEY MAP

N.T.S.



NOTES:

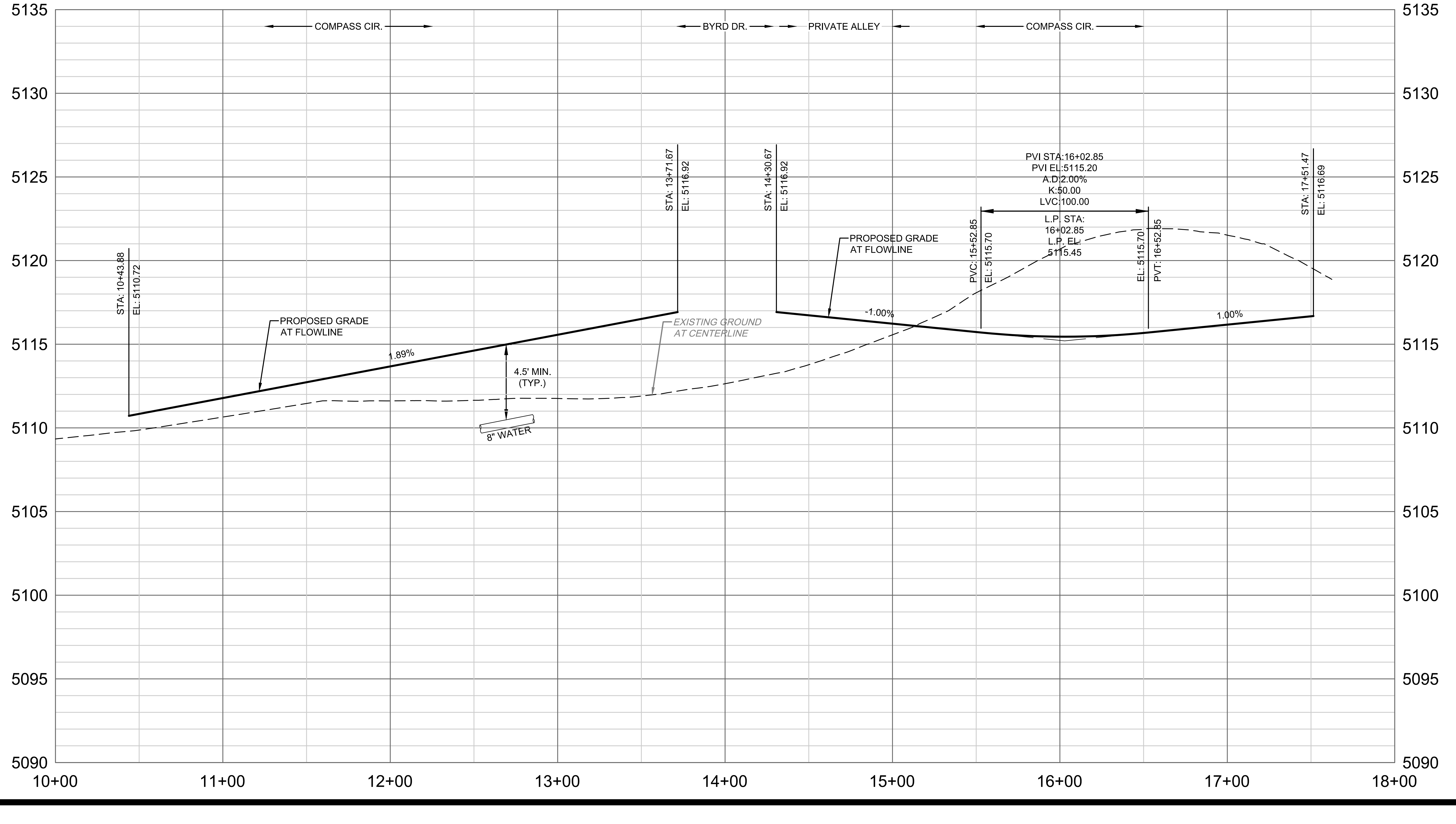
1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED.
2. 8' CROSS PANS TYPICAL UNLESS OTHERWISE NOTED.
3. STANDARD TOWN OF ERIE HANDICAP RAMPS ARE TO BE CONSTRUCTED AT ALL CURB RETURNS AND AT ALL "T" INTERSECTIONS, AND/OR AS OTHERWISE SHOWN ON THESE PLANS.
4. TFI GRADE AT INLETS IN PROFILE ARE AT MID POINT OF INLET, REFER TO STICK DETAIL FOR END OF INLET TFI GRADES.
5. CONTRACTOR IS RESPONSIBLE FOR ADJUSTING ALL EXISTING UTILITIES TO PROPOSED FINISHED GRADE.
6. ELEVATIONS ARE TO FLOWLINE UNLESS OTHERWISE NOTED.
7. MILL AND OVERLAY PER TOWN OF ERIE STANDARDS AND SPECS TO NEXT ADJACENT LANE LINE.
8. STORM SEWER AND SANITARY SEWER MANHOLE RIMS SHALL BE ROTATED TO PROVIDE A MINIMUM OF 2' (TYP.) OF CLEARANCE TO ADJACENT CONCRETE GUTTER.
9. ALL STORM SEWER IS CLASS III UNLESS OTHERWISE NOTED.
10. REFER TO DEMOLITION PLANS FOR MILL AND OVERLAY EXTENTS AND SAWCUT EXTENTS.
11. HANDICAP RAMPS SHALL BE INSTALLED PER ADA CRITERIA. SLOPES SHALL NOT EXCEED 8.3%.
12. OFFSETS ON INLETS ARE TO TFI (TOP FRONT OF INLET).



ORIGINAL GRAPHIC SCALE

STA. 10+00.00 TO STA. 18+00.00

PRIVATE ALLEY - TRACT B & TRACT N



THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

PRIVATE ALLEY - TRACT B & TRACT N
STREET & STORM SEWER PLAN & PROFILE

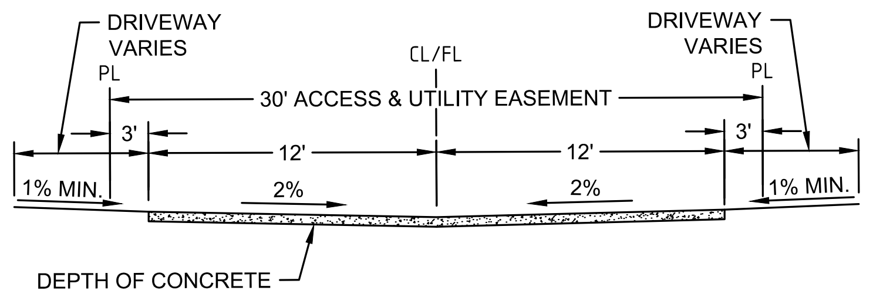
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
PP04

NOT FOR CONSTRUCTION

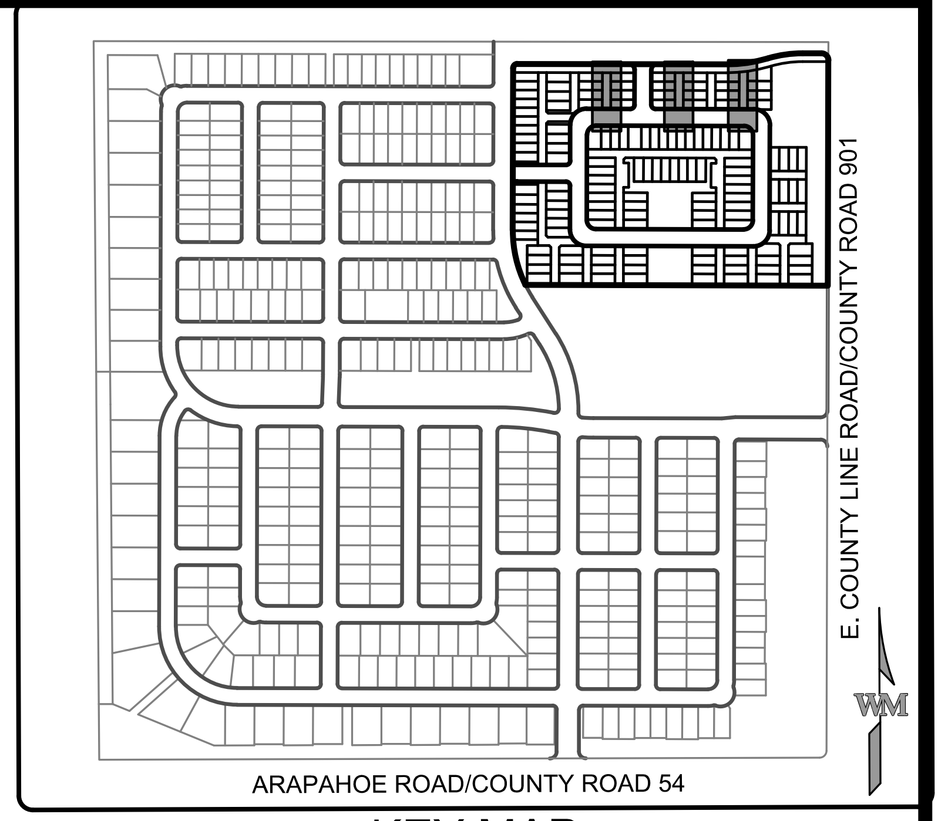
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



PRIVATE ALLEY

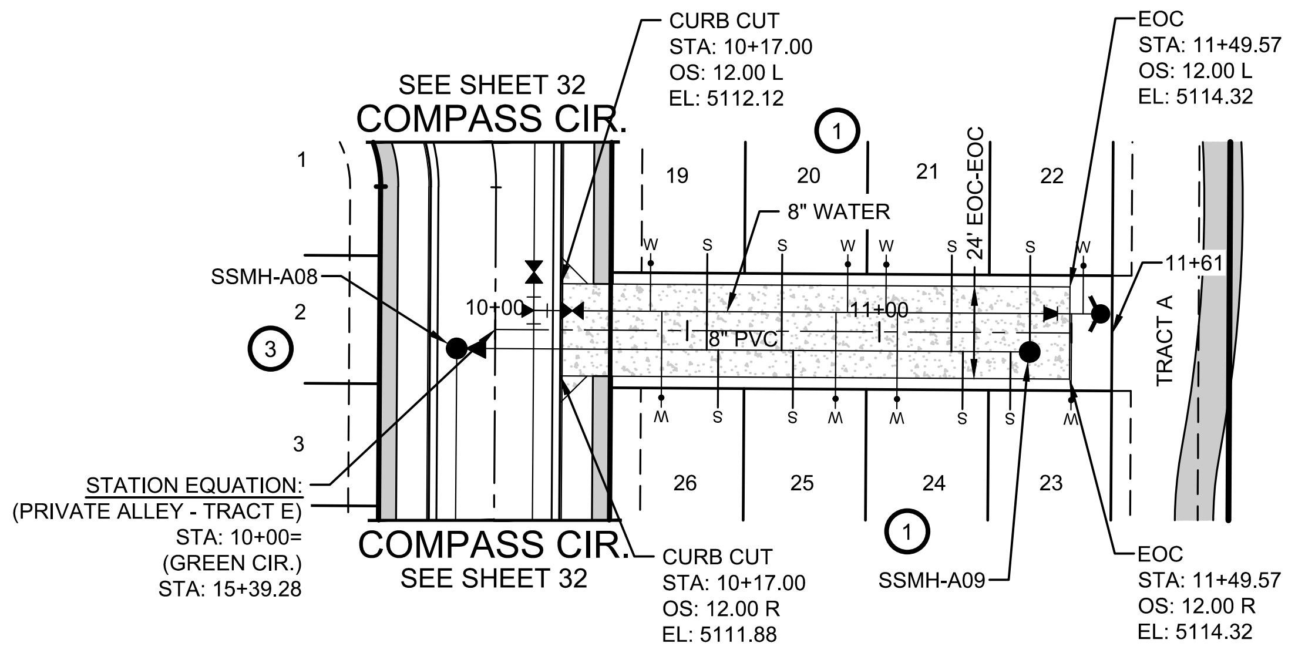
N.T.S.

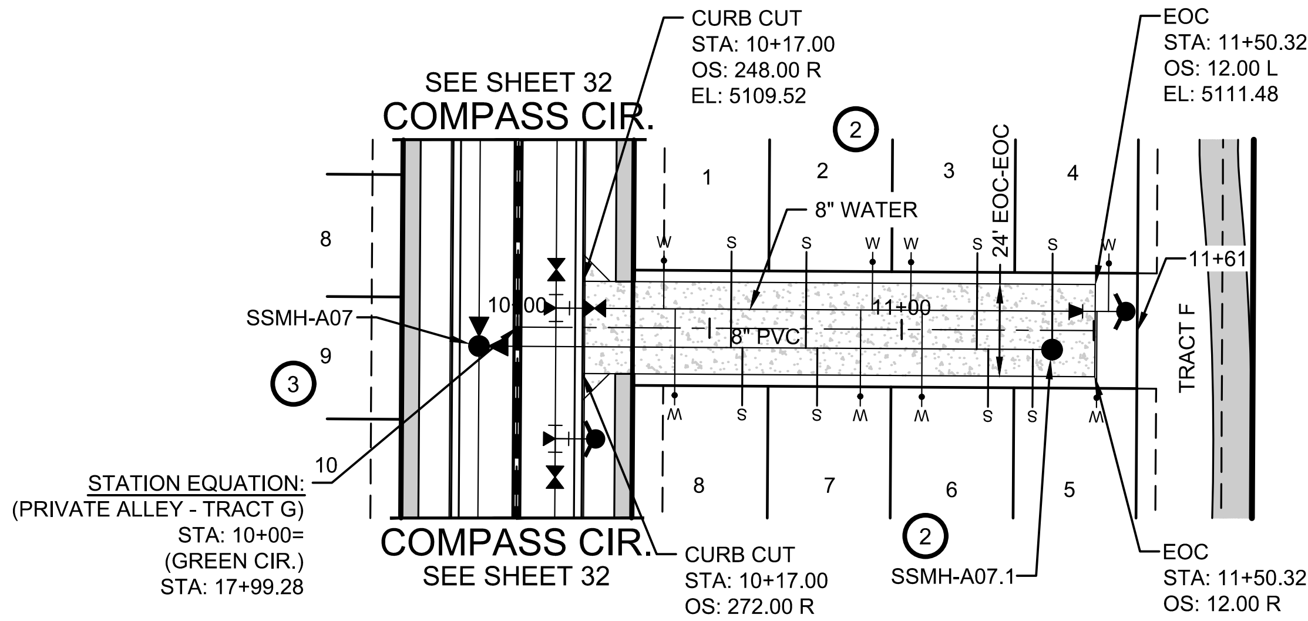
CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION

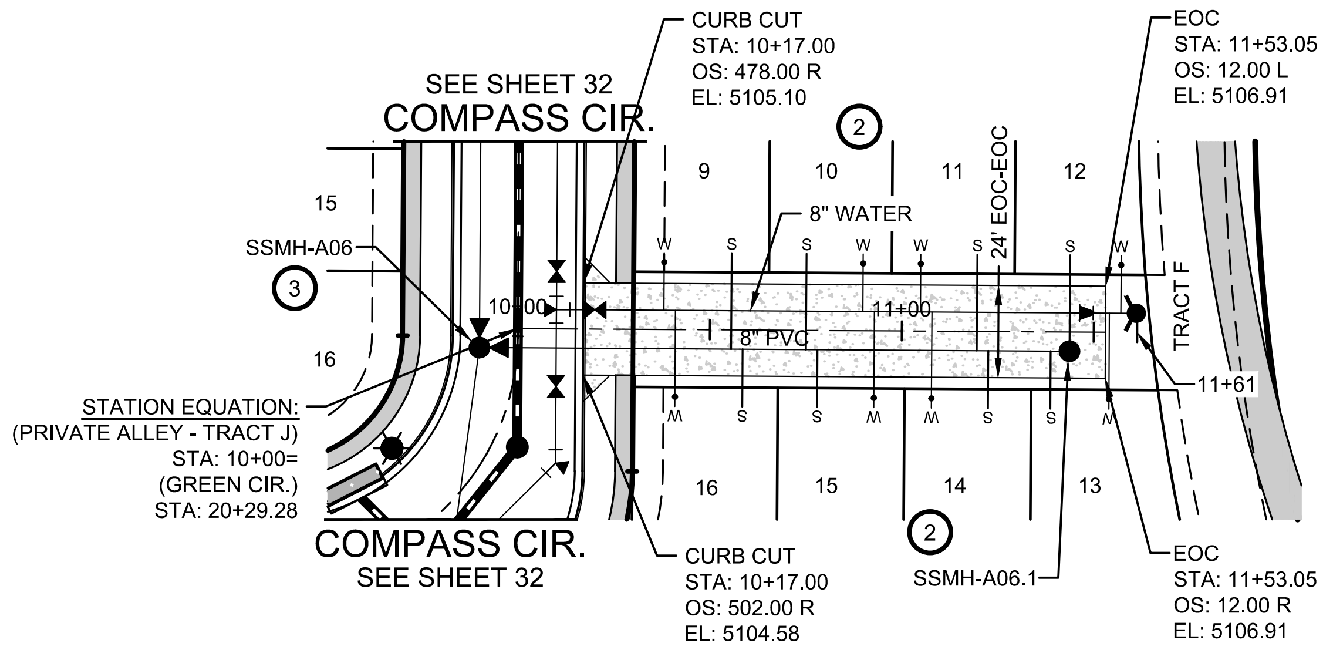


KEY MAP

N.T.S.







NOTES:

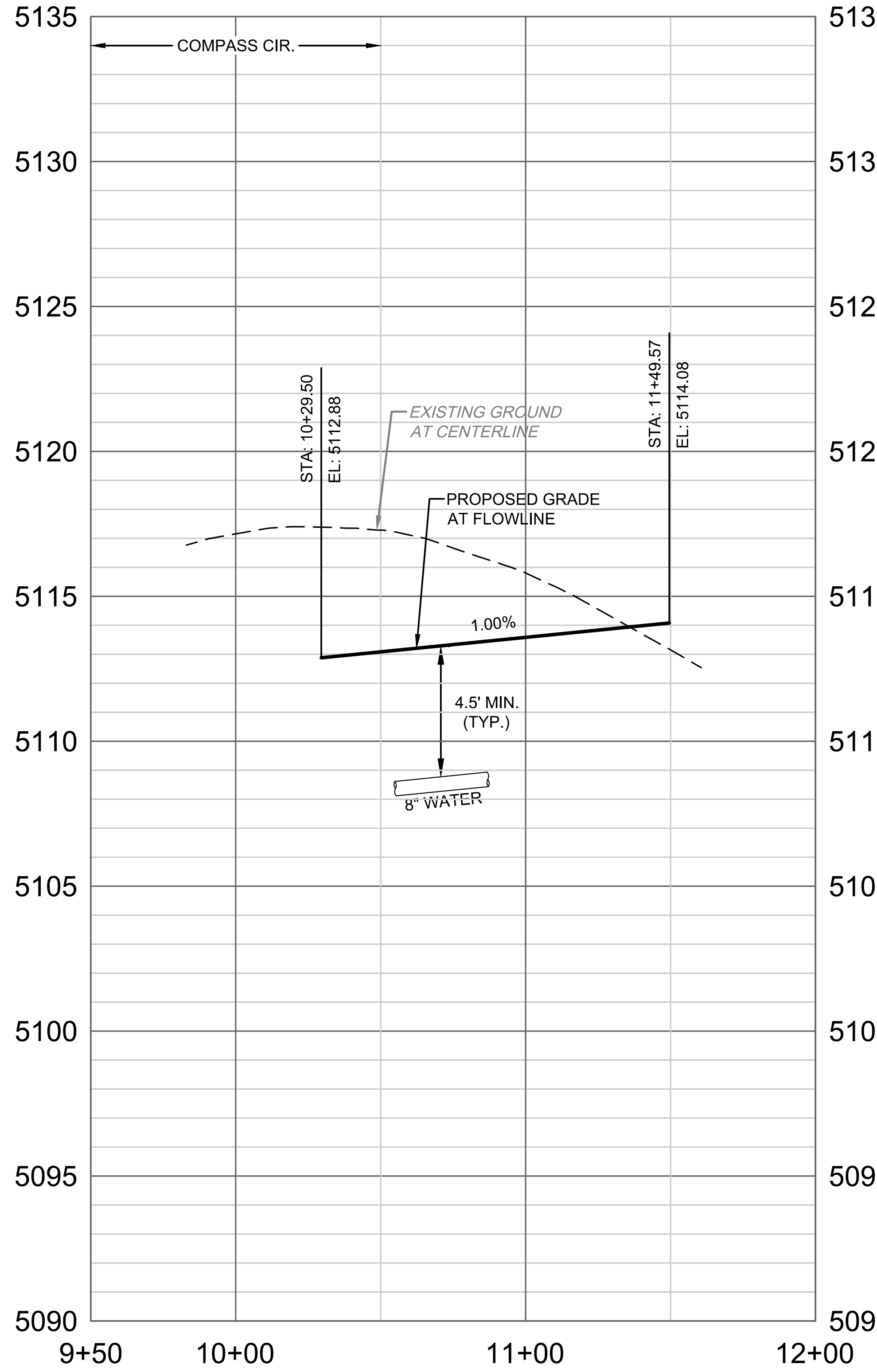
1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED.
2. 8' CROSS PANS TYPICAL UNLESS OTHERWISE NOTED.
3. STANDARD TOWN OF ERIE HANDICAP RAMPS ARE TO BE CONSTRUCTED AT ALL CURB RETURNS AND AT ALL "T" INTERSECTIONS, AND/OR AS OTHERWISE SHOWN ON THESE PLANS.
4. TFI GRADE AT INLETS IN PROFILE ARE AT MID POINT OF INLET, REFER TO STICK DETAIL FOR END OF INLET TFI GRADES.
5. CONTRACTOR IS RESPONSIBLE FOR ADJUSTING ALL EXISTING UTILITIES TO PROPOSED FINISHED GRADE.
6. ELEVATIONS ARE TO FLOWLINE UNLESS OTHERWISE NOTED.
7. MILL AND OVERLAY PER TOWN OF ERIE STANDARDS AND SPECS TO NEXT ADJACENT LANE LINE.
8. STORM SEWER AND SANITARY SEWER MANHOLE RIMS SHALL BE ROTATED TO PROVIDE A MINIMUM OF 2' (TYP.) OF CLEARANCE TO ADJACENT CONCRETE GUTTER.
9. ALL STORM SEWER IS CLASS III UNLESS OTHERWISE NOTED.
10. REFER TO DEMOLITION PLANS FOR MILL AND OVERLAY EXTENTS AND SAWCUT EXTENTS.
11. HANDICAP RAMPS SHALL BE INSTALLED PER ADA CRITERIA. SLOPES SHALL NOT EXCEED 8.3%.
12. OFFSETS ON INLETS ARE TO TFI (TOP FRONT OF INLET).

0 25 50 100

SCALE: Hor: 1" =50'
SCALE: Vert: 1" =5'
ORIGINAL GRAPHIC SCALE

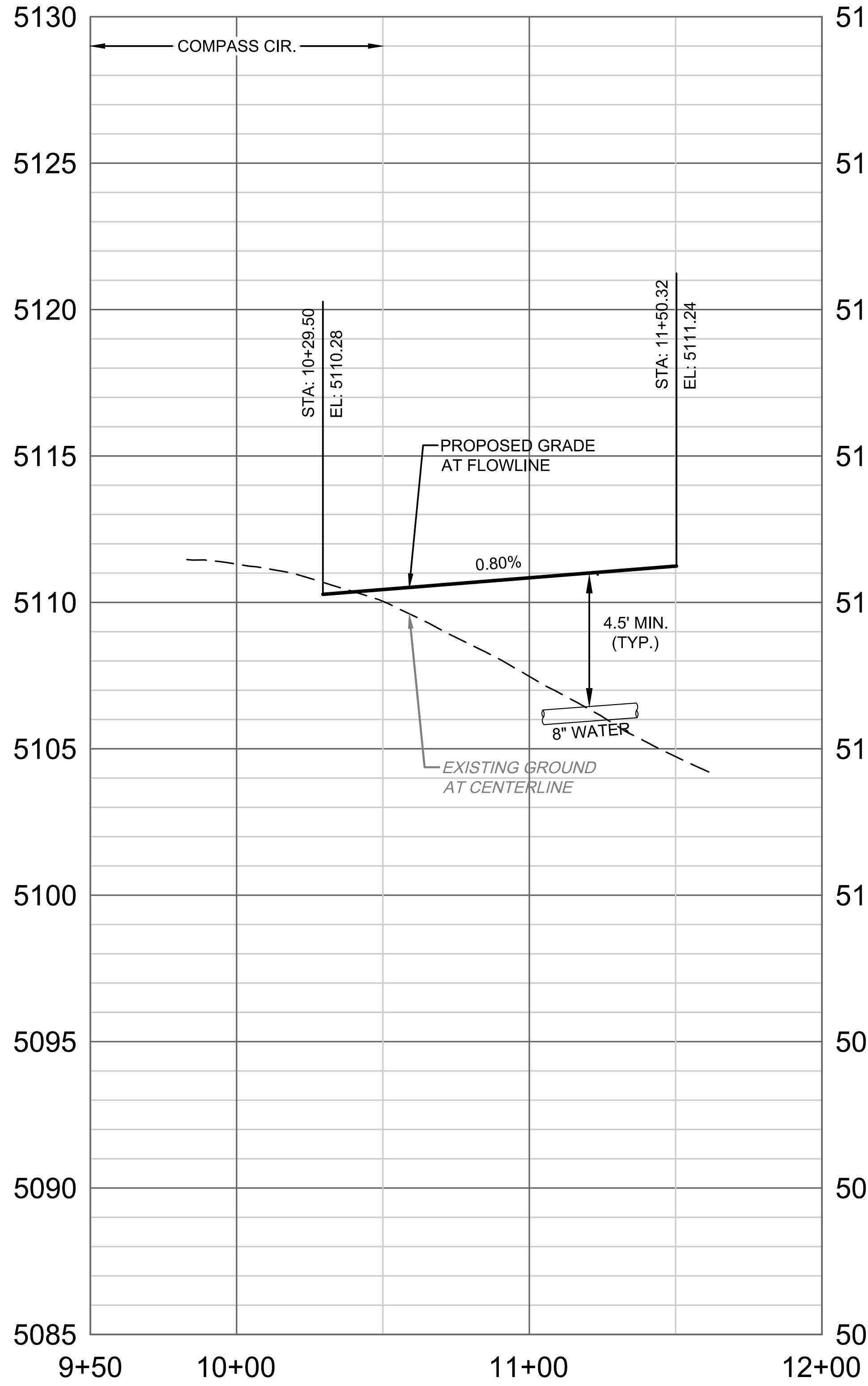
STA. 9+50.00 TO STA. 12+00.00

PRIVATE ALLEY - TRACT E



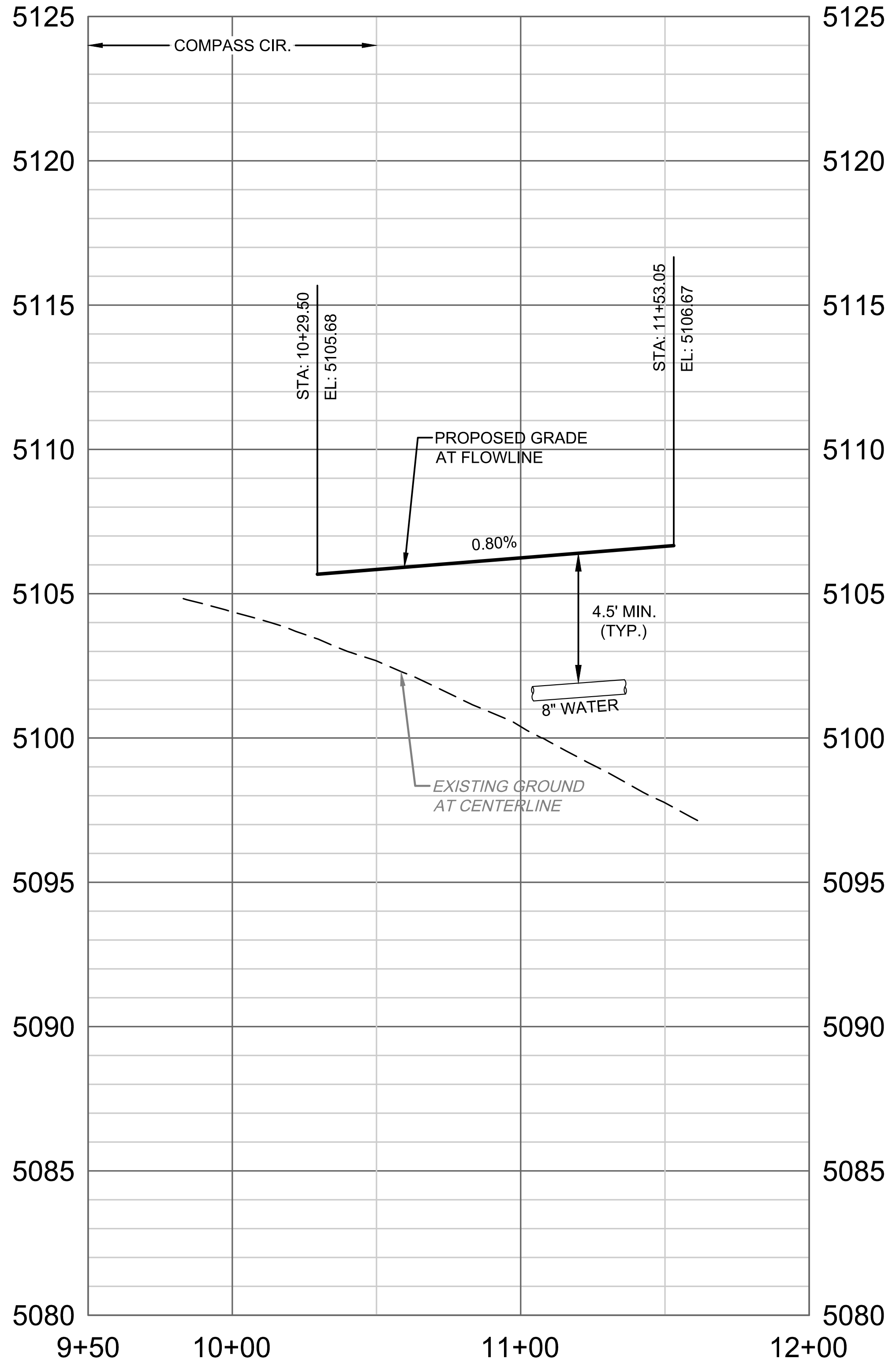
STA. 9+50.00 TO STA. 12+00.00

PRIVATE ALLEY - TRACT G



STA. 9+50.00 TO STA. 12+00.00

PRIVATE ALLEY - TRACT J



WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

35942
THOMAS C. JANSEN
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

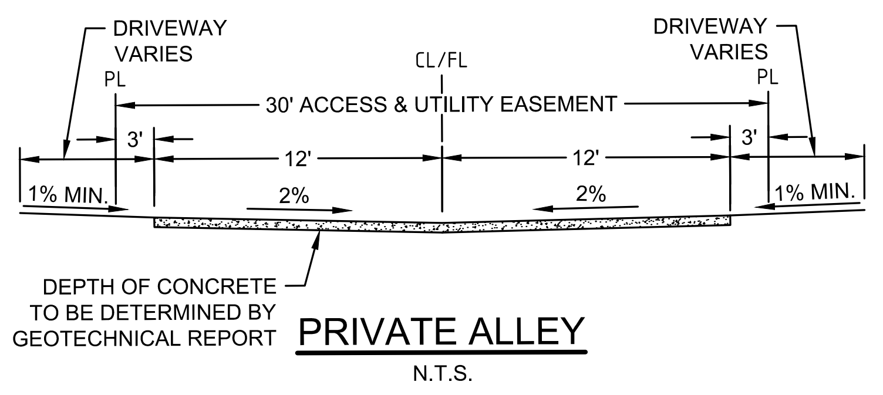
PRIVATE ALLEY - TRACT E, TRACT G & TRACT J
STREET & STORM SEWER PLAN & PROFILE

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

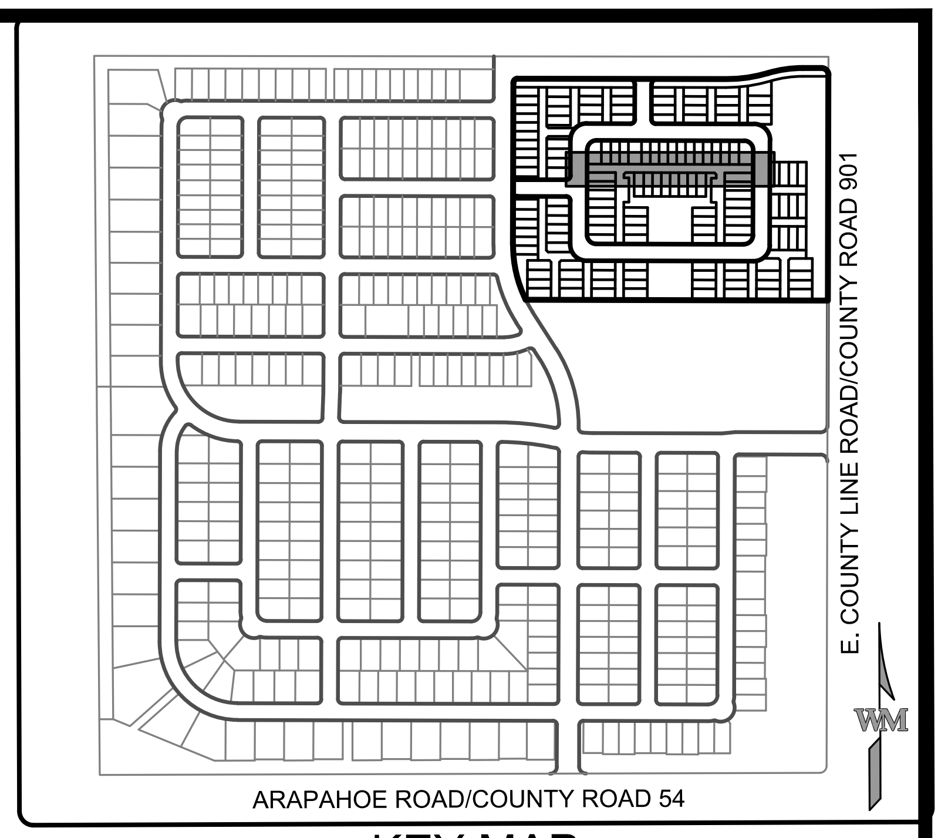
SHEET
PP05
Sheet 35 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



PRIVATE ALLEY
N.T.S.

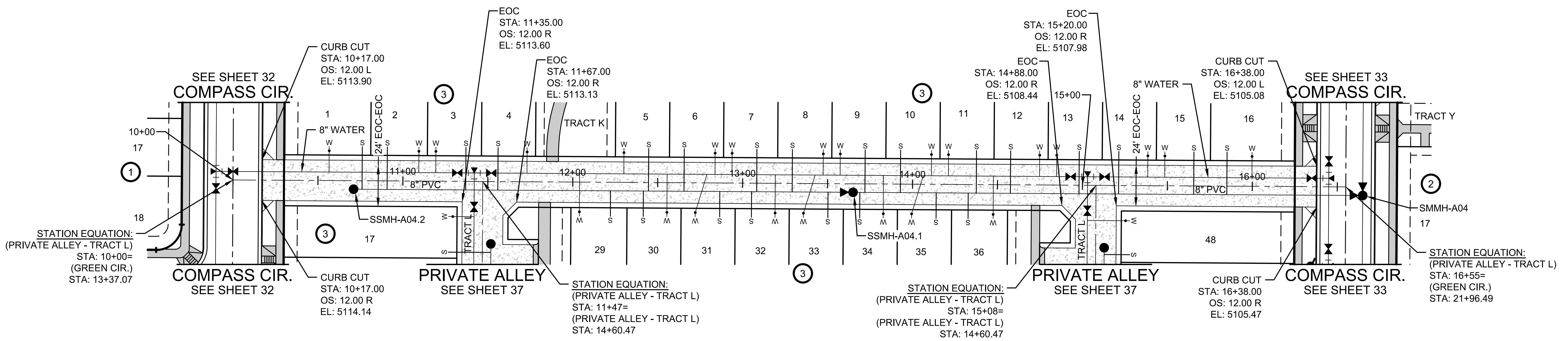
CONTRACTOR TO FIELD VERIFY LOCATION OF ALL EXISTING UTILITES PRIOR TO CONSTRUCTION

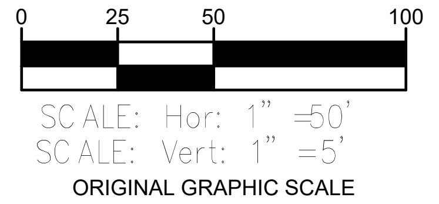


KEY MAP
N.T.S.

NOTES:

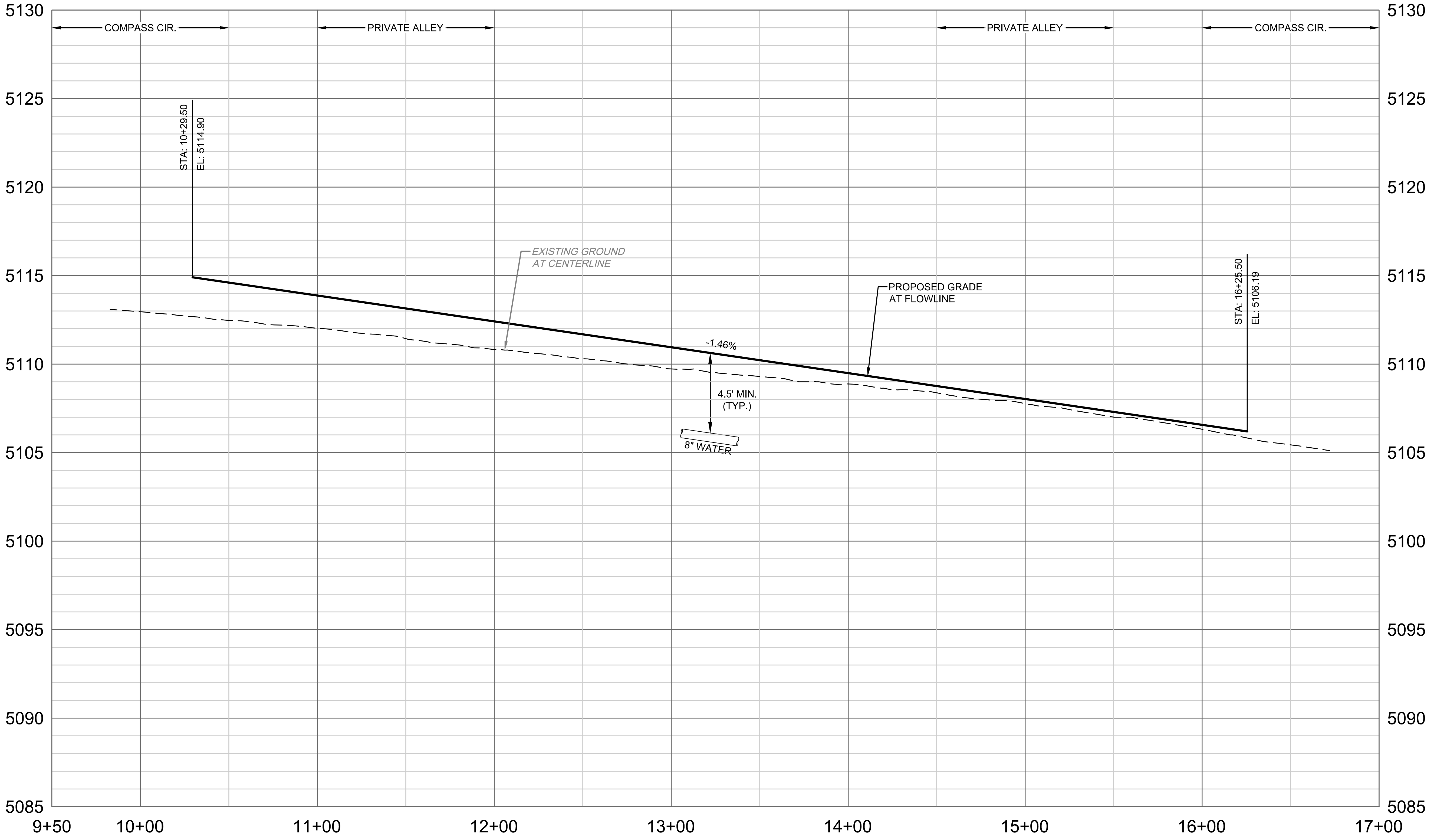
1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED.
2. 8' CROSS PANS TYPICAL UNLESS OTHERWISE NOTED.
3. STANDARD TOWN OF ERIE HANDICAP RAMPS ARE TO BE CONSTRUCTED AT ALL CURB RETURNS AND AT ALL "T" INTERSECTIONS, AND/OR AS OTHERWISE SHOWN ON THESE PLANS.
4. TFI GRADE AT INLETS IN PROFILE ARE AT MID POINT OF INLET, REFER TO STICK DETAIL FOR END OF INLET TFI GRADES.
5. CONTRACTOR IS RESPONSIBLE FOR ADJUSTING ALL EXISTING UTILITIES TO PROPOSED FINISHED GRADE.
6. ELEVATIONS ARE TO FLOWLINE UNLESS OTHERWISE NOTED.
7. MILL AND OVERLAY PER TOWN OF ERIE STANDARDS AND SPECS TO NEXT ADJACENT LANE LINE.
8. STORM SEWER AND SANITARY SEWER MANHOLE RIMS SHALL BE ROTATED TO PROVIDE A MINIMUM OF 2' (TYP.) OF CLEARANCE TO ADJACENT CONCRETE GUTTER.
9. ALL STORM SEWER IS CLASS III UNLESS OTHERWISE NOTED.
10. REFER TO DEMOLITION PLANS FOR MILL AND OVERLAY EXTENTS AND SAWCUT EXTENTS.
11. HANDICAP RAMPS SHALL BE INSTALLED PER ADA CRITERIA. SLOPES SHALL NOT EXCEED 8.3%.
12. OFFSETS ON INLETS ARE TO TFI (TOP FRONT OF INLET).





STA. 9+50.00 TO STA. 17+00.00

PRIVATE ALLEY - TRACT L



THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

PRIVATE ALLEY - TRACT L
STREET & STORM SEWER PLAN & PROFILE

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

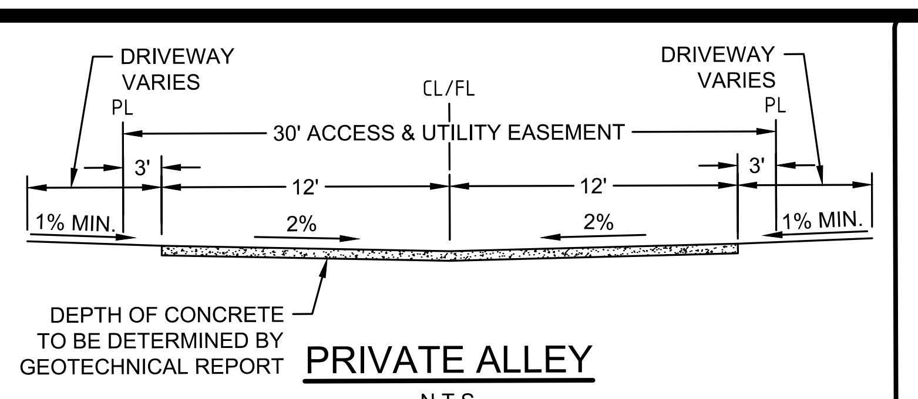
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
PP06
Sheet 36 of 74

NOT FOR CONSTRUCTION

NOTES:

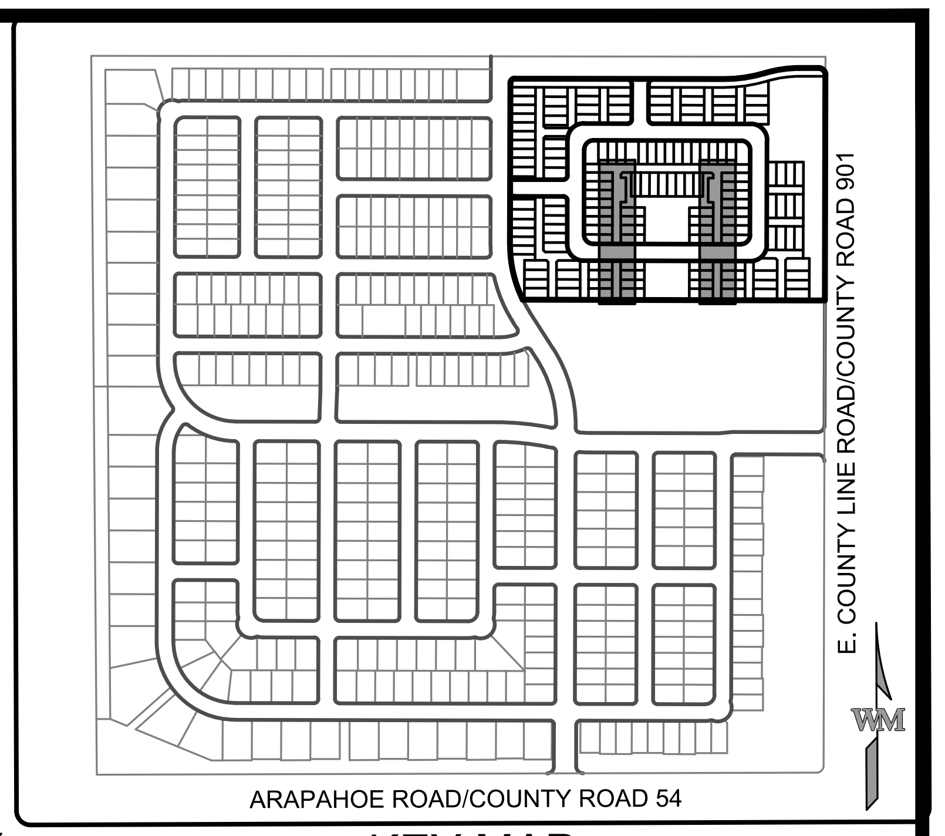
1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED.
2. 8' CROSS PANS TYPICAL UNLESS OTHERWISE NOTED.
3. STANDARD TOWN OF ERIE HANDICAP RAMPS ARE TO BE CONSTRUCTED AT ALL CURB RETURNS AND AT ALL "T" INTERSECTIONS, AND/OR AS OTHERWISE SHOWN ON THESE PLANS.
4. TFI GRADE AT INLETS IN PROFILE ARE AT MID POINT OF INLET, REFER TO STICK DETAIL FOR END OF INLET TFI GRADES.
5. CONTRACTOR IS RESPONSIBLE FOR ADJUSTING ALL EXISTING UTILITIES TO PROPOSED FINISHED GRADE.
6. ELEVATIONS ARE TO FLOWLINE UNLESS OTHERWISE NOTED.
7. MILL AND OVERLAY PER TOWN OF ERIE STANDARDS AND SPECS TO NEXT ADJACENT LANE LINE.
8. STORM SEWER AND SANITARY SEWER MANHOLE RIMS SHALL BE ROTATED TO PROVIDE A MINIMUM OF 2' (TYP.) OF CLEARANCE TO ADJACENT CONCRETE GUTTER.
9. ALL STORM SEWER IS CLASS III UNLESS OTHERWISE NOTED.
10. REFER TO DEMOLITION PLANS FOR MILL AND OVERLAY EXTENTS AND SAWCUT EXTENTS.
11. HANDICAP RAMPS SHALL BE INSTALLED PER ADA CRITERIA. SLOPES SHALL NOT EXCEED 8.3%.
12. OFFSETS ON INLETS ARE TO TFI (TOP FRONT OF INLET).



PRIVATE ALLEY

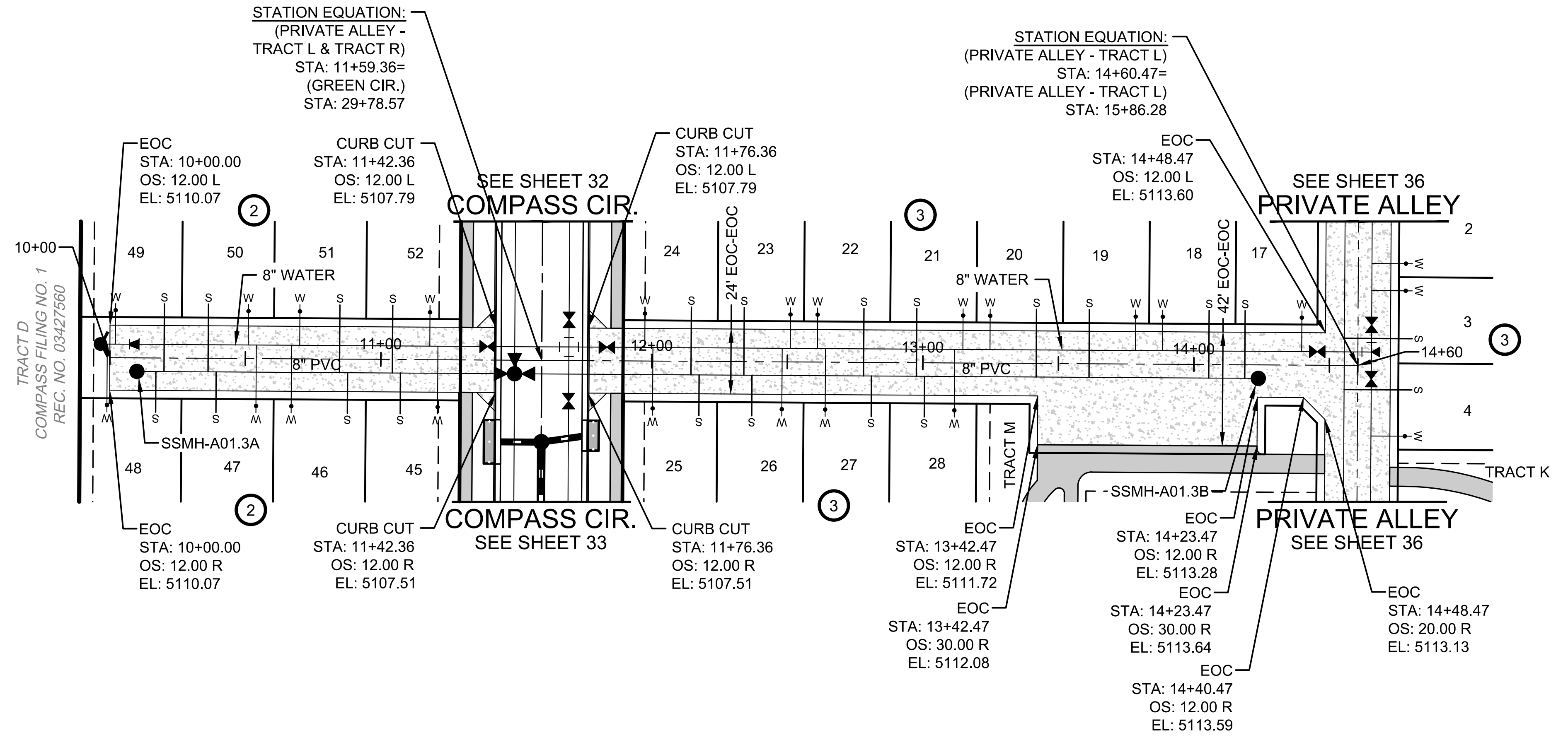
N.T.S.

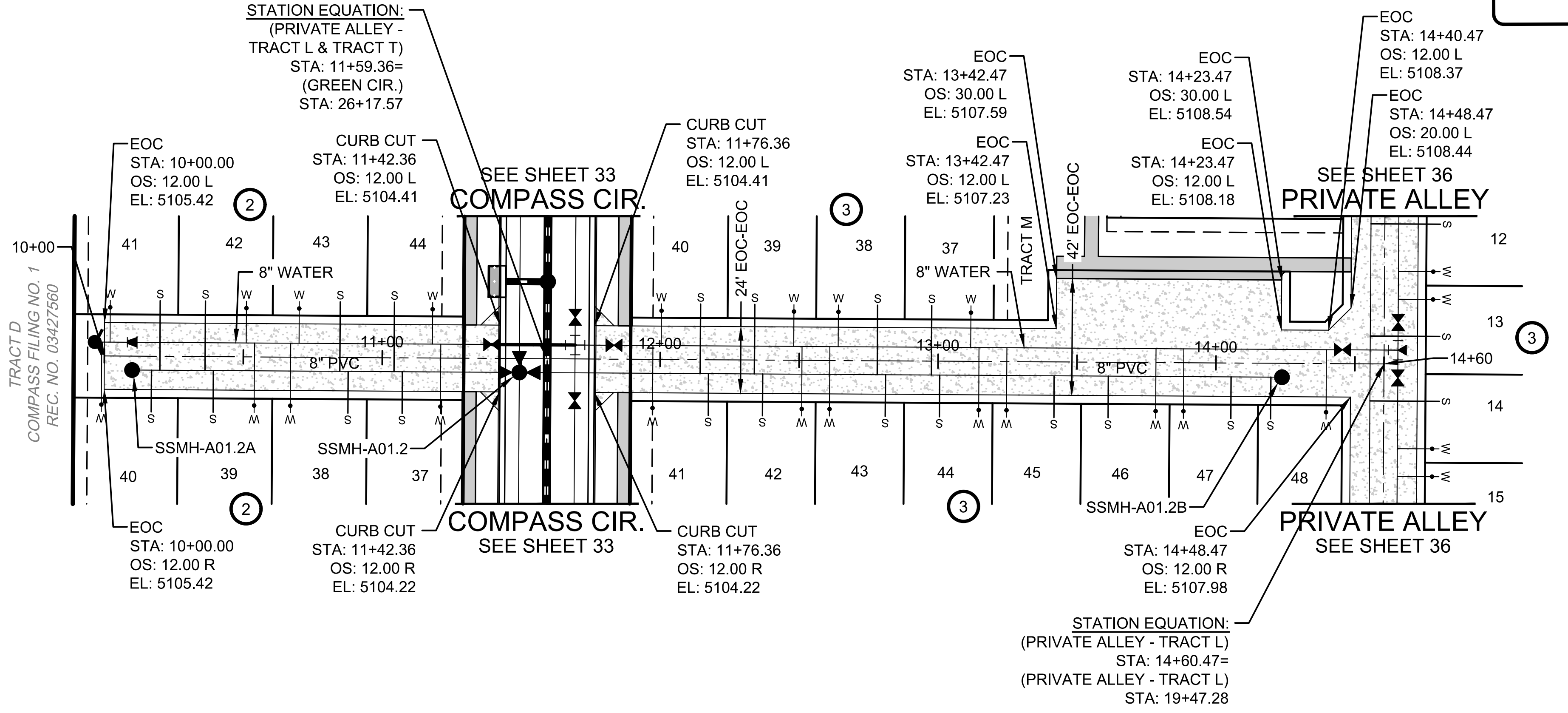
CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION

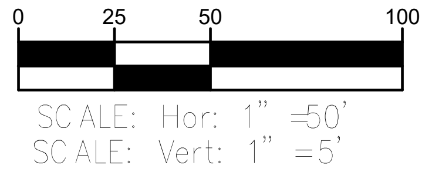


KEY MAP

N.T.S.



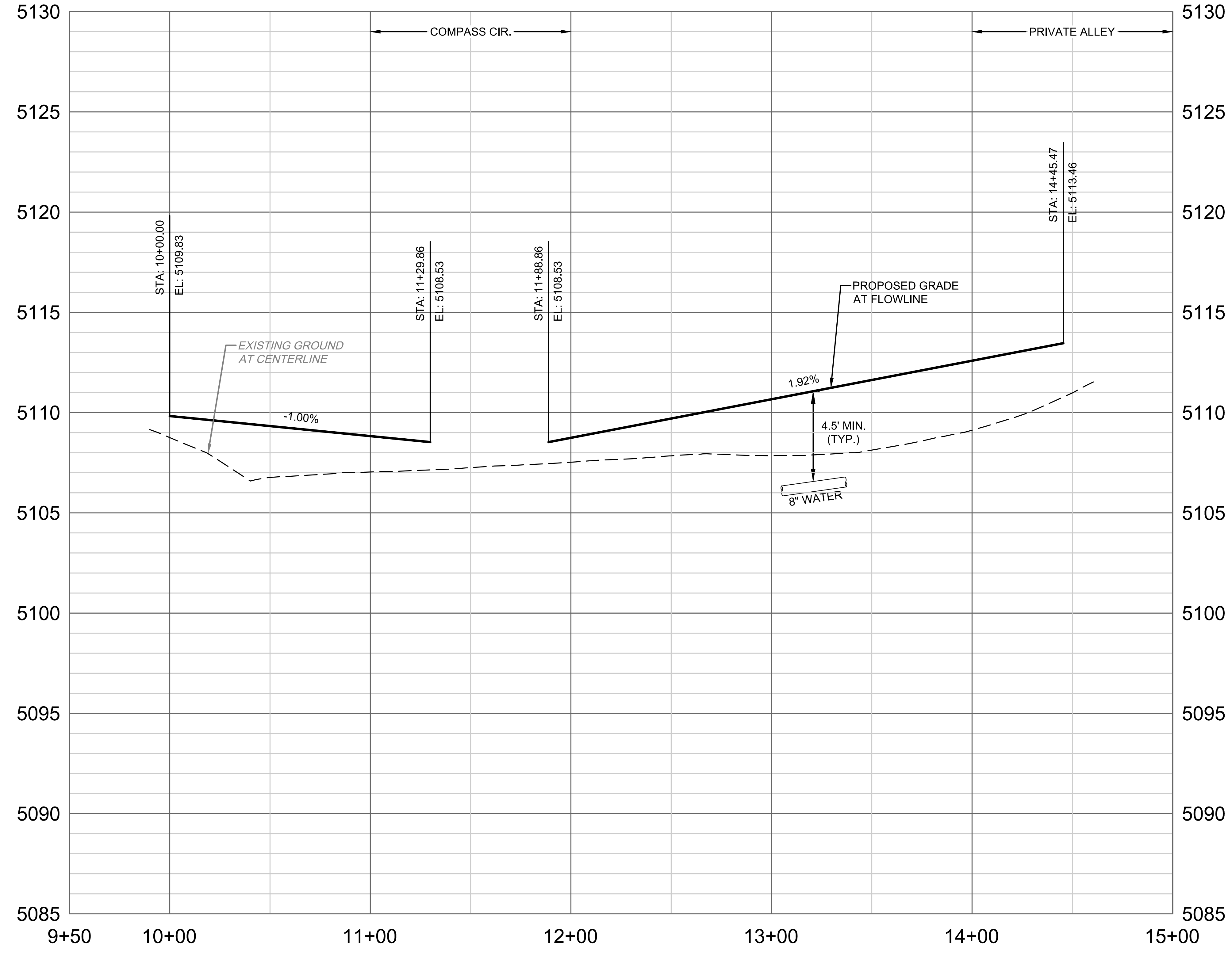




SCALE: Hor: 1" =50'
SCALE: Vert: 1" =5'
ORIGINAL GRAPHIC SCALE

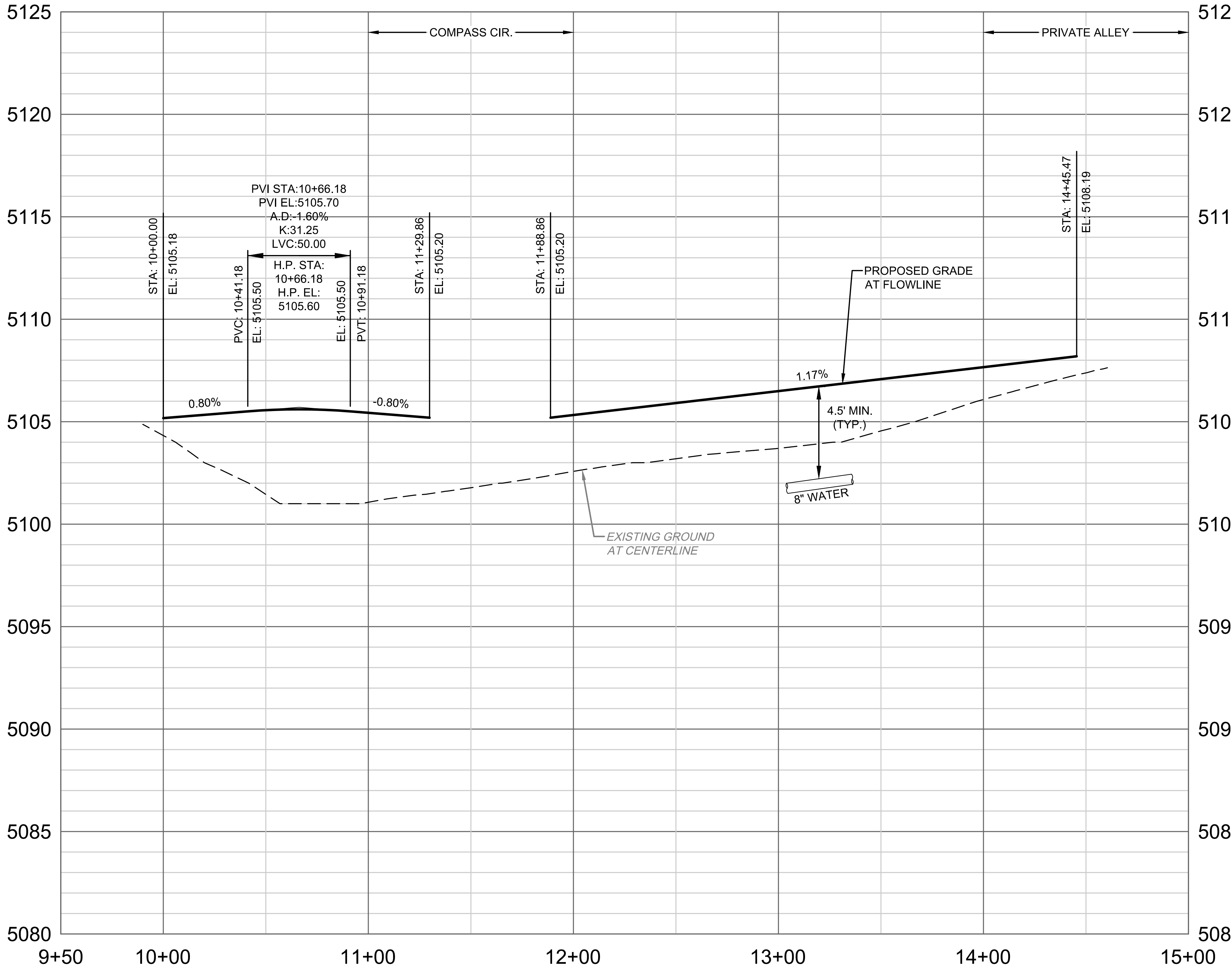
STA. 9+50.00 TO STA. 15+00.00

PRIVATE ALLEY - TRACT L & TRACT R



STA. 9+50.00 TO STA. 15+00.00

PRIVATE ALLEY - TRACT L & TRACT T



WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942

Dec 04, 2018

FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

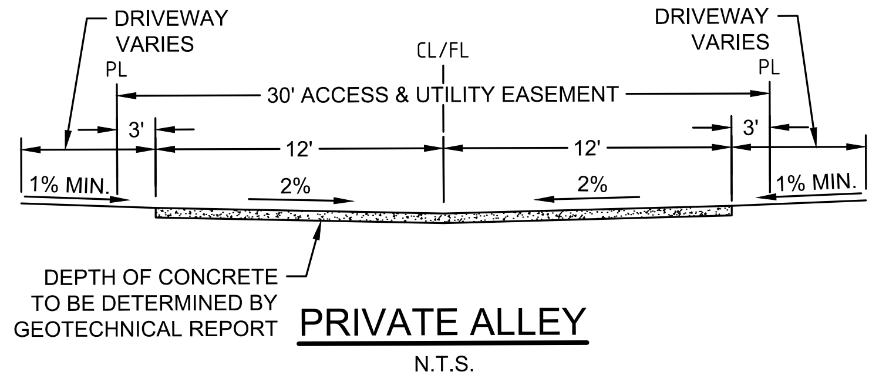
PRIVATE ALLEY - TRACT L, TRACT R & TRACT T STREET & STORM SEWER PLAN & PROFILE

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
PP07
Sheet 37 of 74

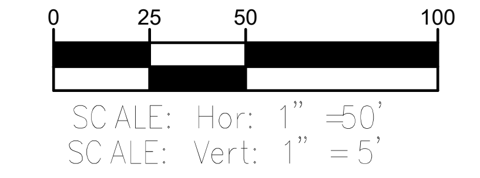
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



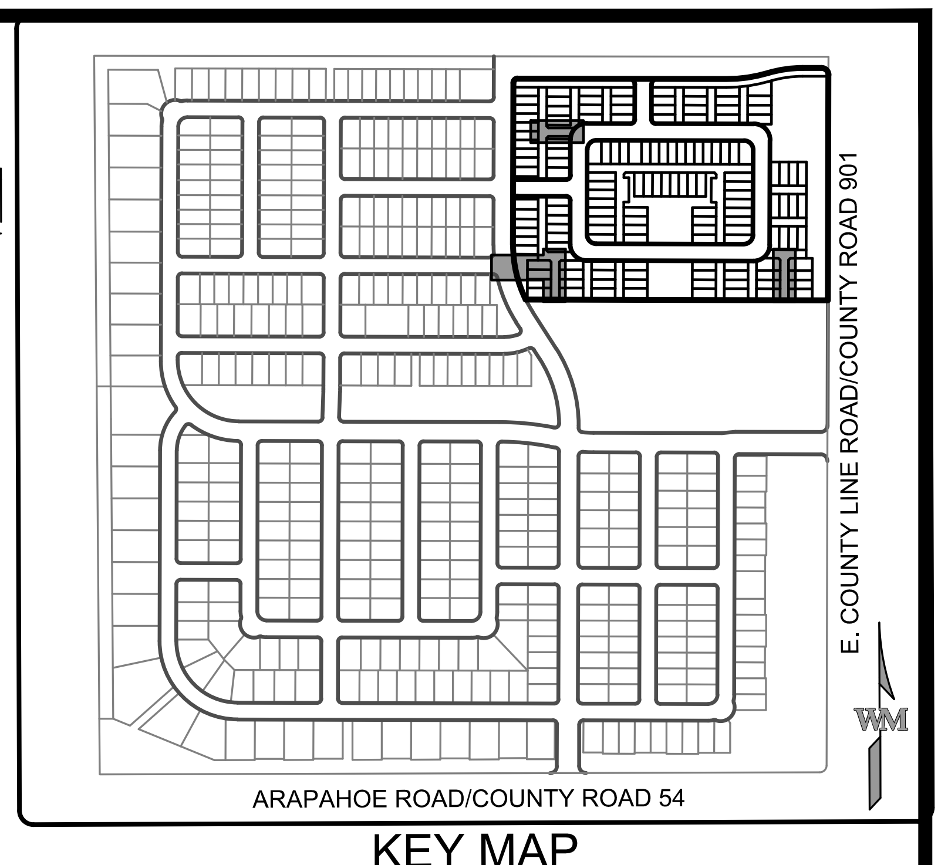
PRIVATE ALLEY

N.T.S.

CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION



ORIGINAL GRAPHIC SCALE

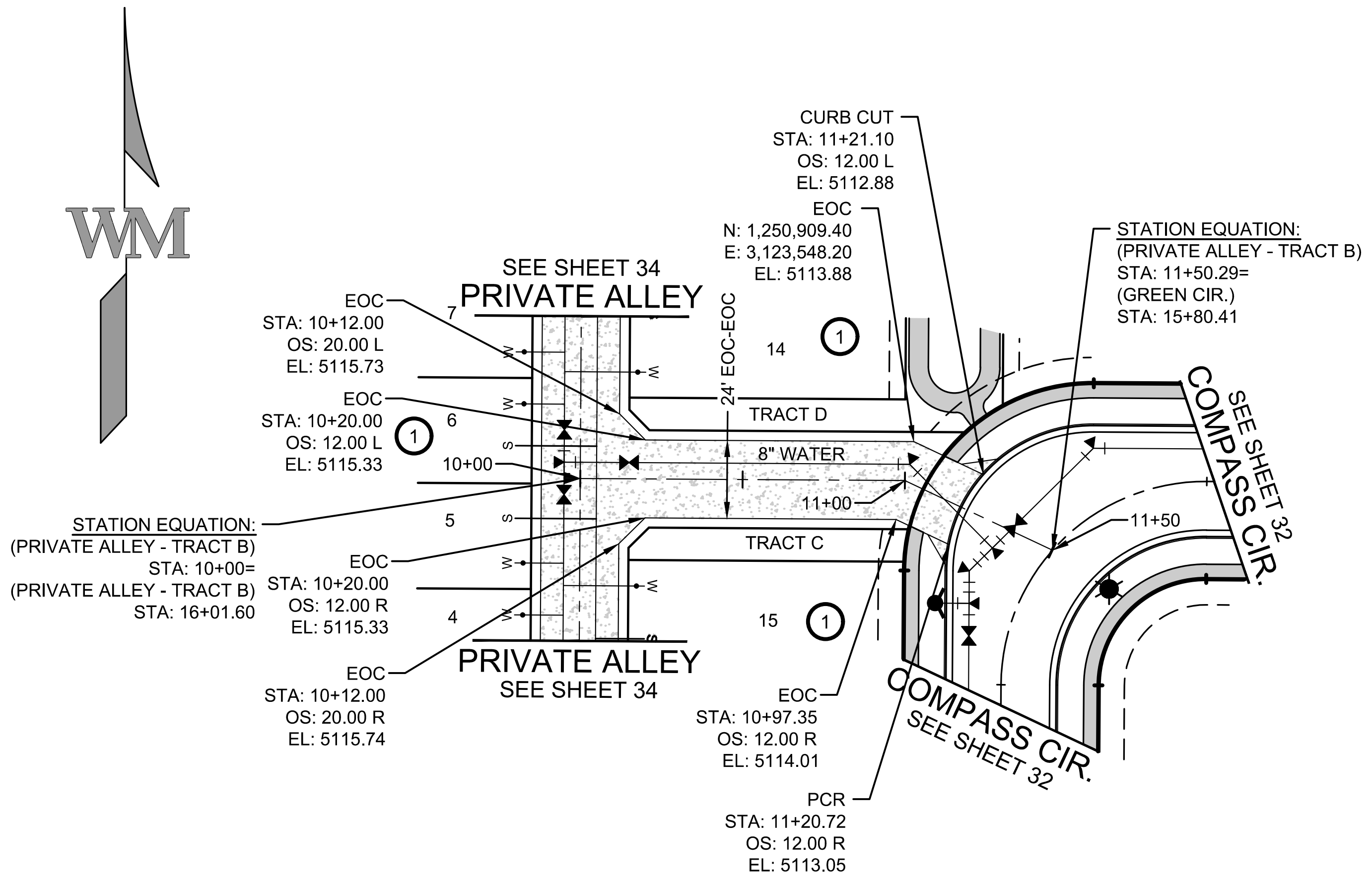


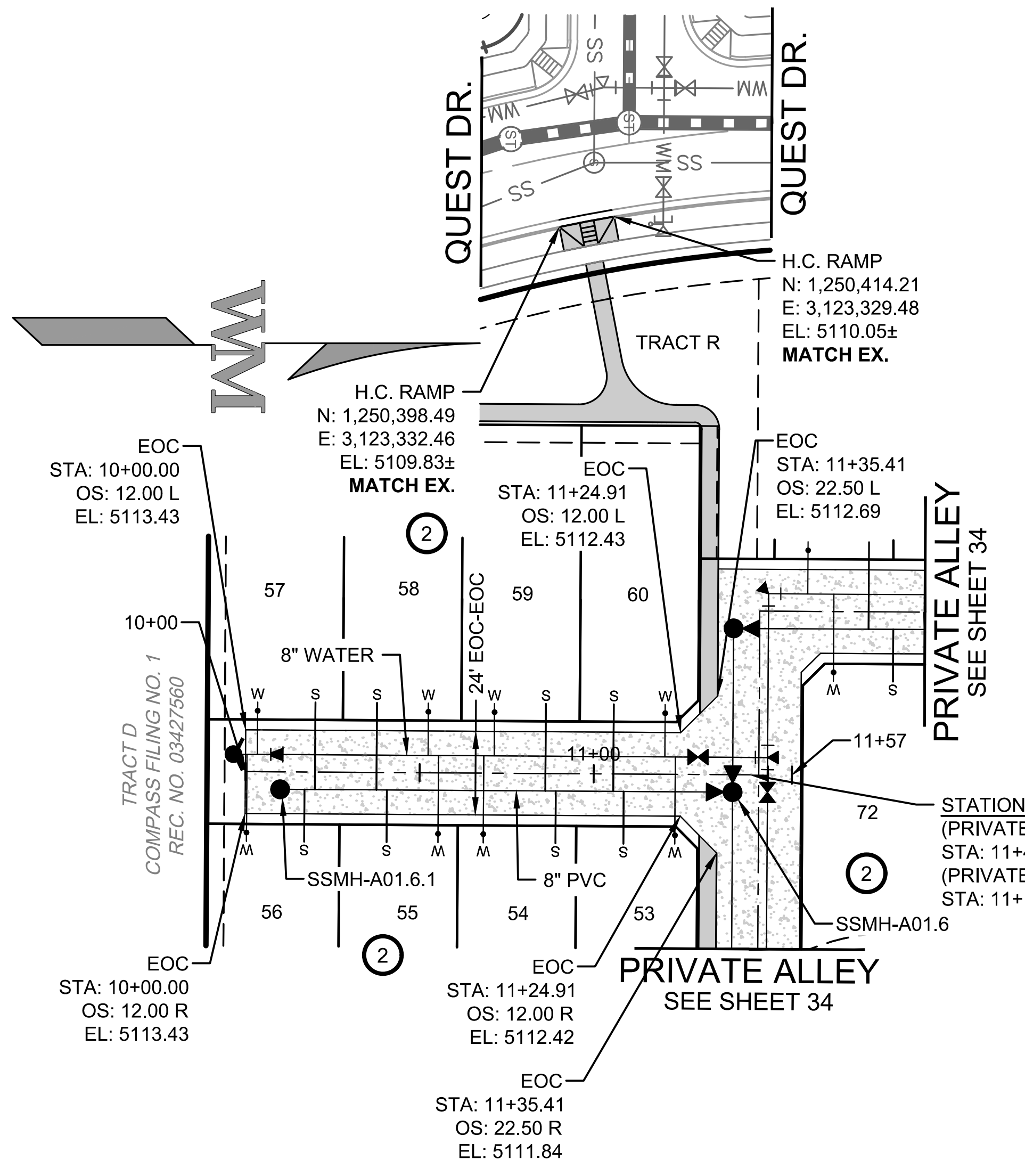
KEY MAP

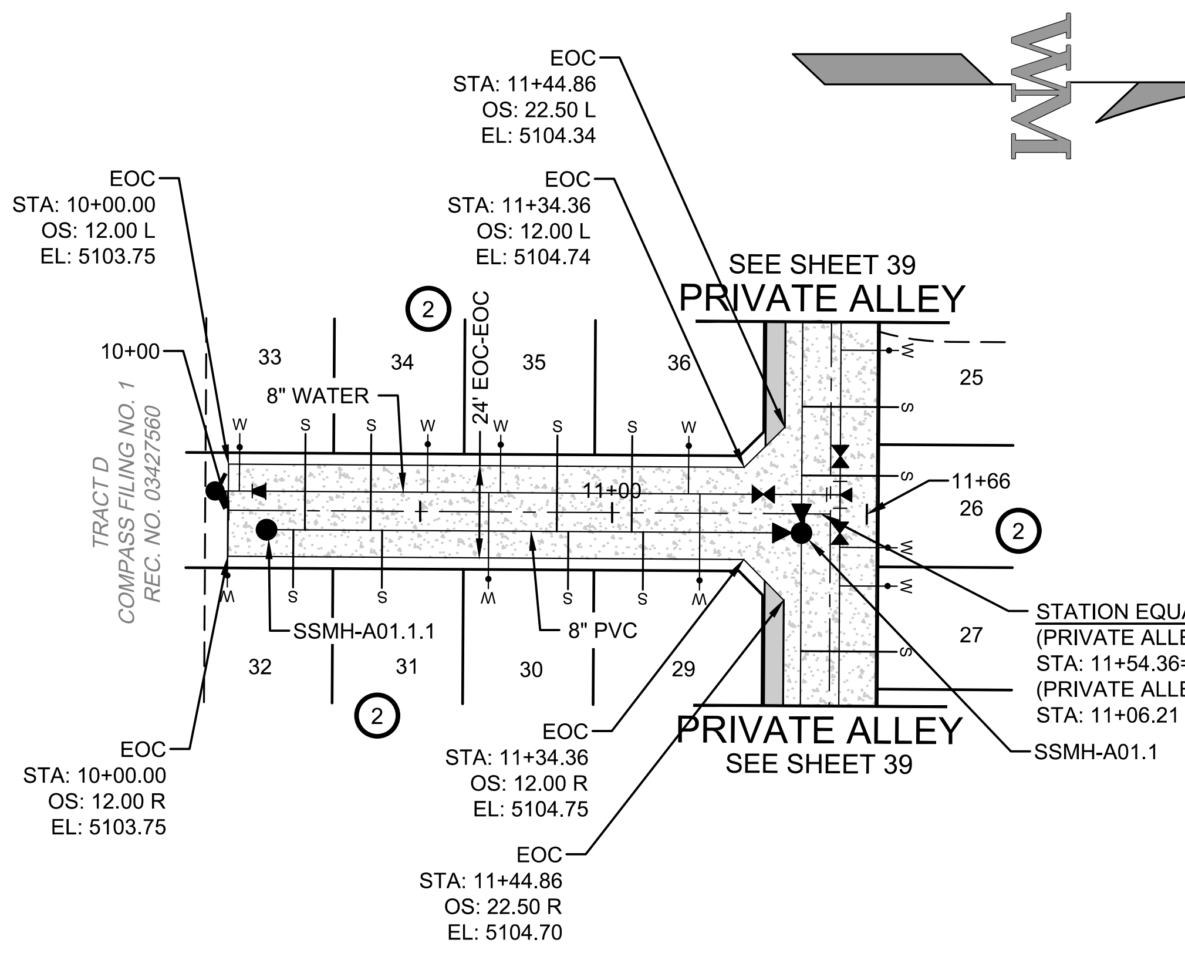
N.T.S.

NOTES:

1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED.
2. 8' CROSS PANS TYPICAL UNLESS OTHERWISE NOTED.
3. STANDARD TOWN OF ERIE HANDICAP RAMPS ARE TO BE CONSTRUCTED AT ALL CURB RETURNS AND AT ALL "T" INTERSECTIONS, AND/OR AS OTHERWISE SHOWN ON THESE PLANS.
4. TFI GRADE AT INLETS IN PROFILE ARE AT MID POINT OF INLET, REFER TO STICK DETAIL FOR END OF INLET TFI GRADES.
5. CONTRACTOR IS RESPONSIBLE FOR ADJUSTING ALL EXISTING UTILITIES TO PROPOSED FINISHED GRADE.
6. ELEVATIONS ARE TO FLOWLINE UNLESS OTHERWISE NOTED.
7. MILL AND OVERLAY PER TOWN OF ERIE STANDARDS AND SPECS TO NEXT ADJACENT LANE LINE.
8. STORM SEWER AND SANITARY SEWER MANHOLE RIMS SHALL BE ROTATED TO PROVIDE A MINIMUM OF 2' (TYP.) OF CLEARANCE TO ADJACENT CONCRETE GUTTER.
9. ALL STORM SEWER IS CLASS III UNLESS OTHERWISE NOTED.
10. REFER TO DEMOLITION PLANS FOR MILL AND OVERLAY EXTENTS AND SAWCUT EXTENTS.
11. HANDICAP RAMPS SHALL BE INSTALLED PER ADA CRITERIA. SLOPES SHALL NOT EXCEED 8.3%.
12. OFFSETS ON INLETS ARE TO TFI (TOP FRONT OF INLET).

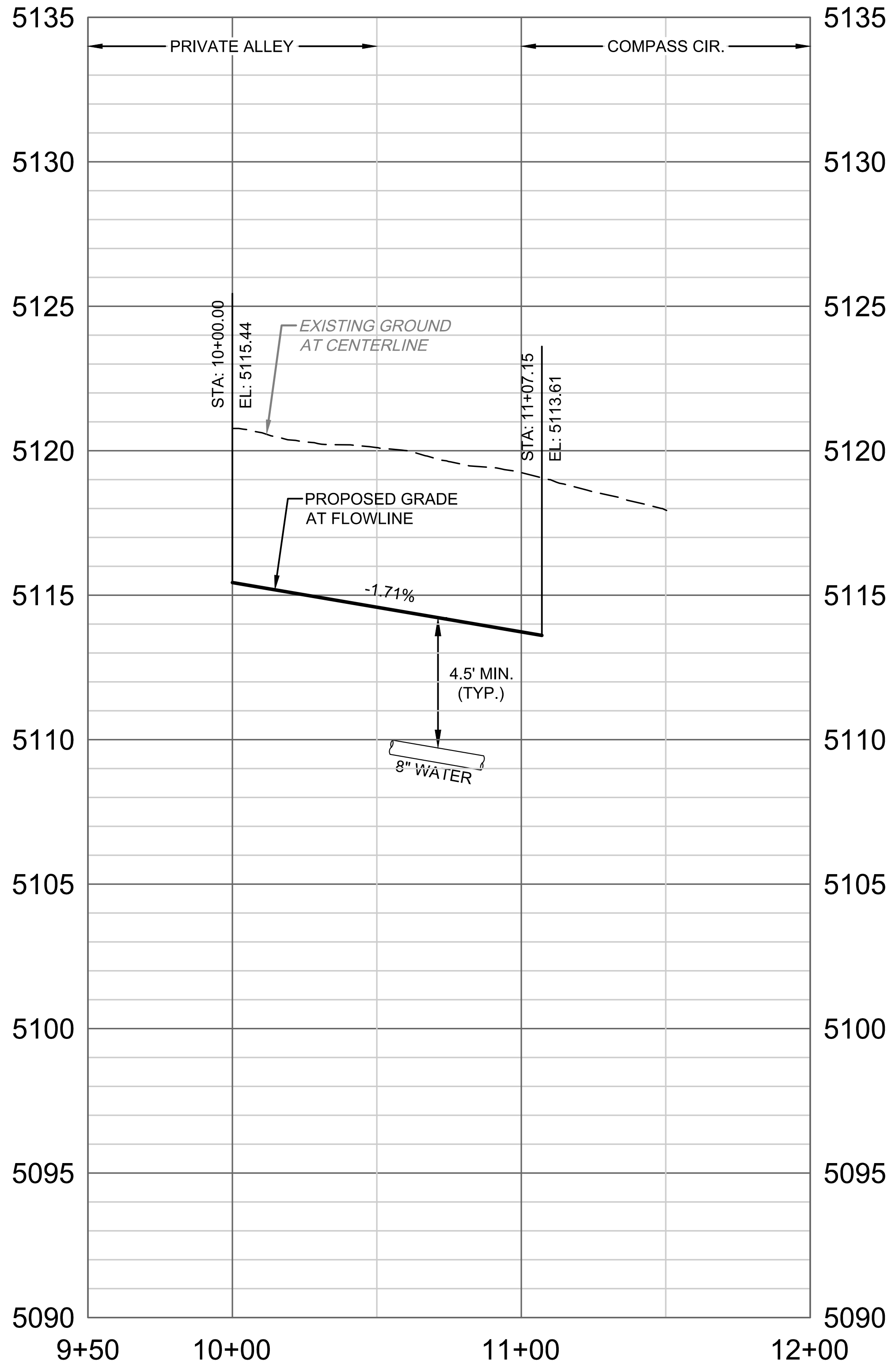






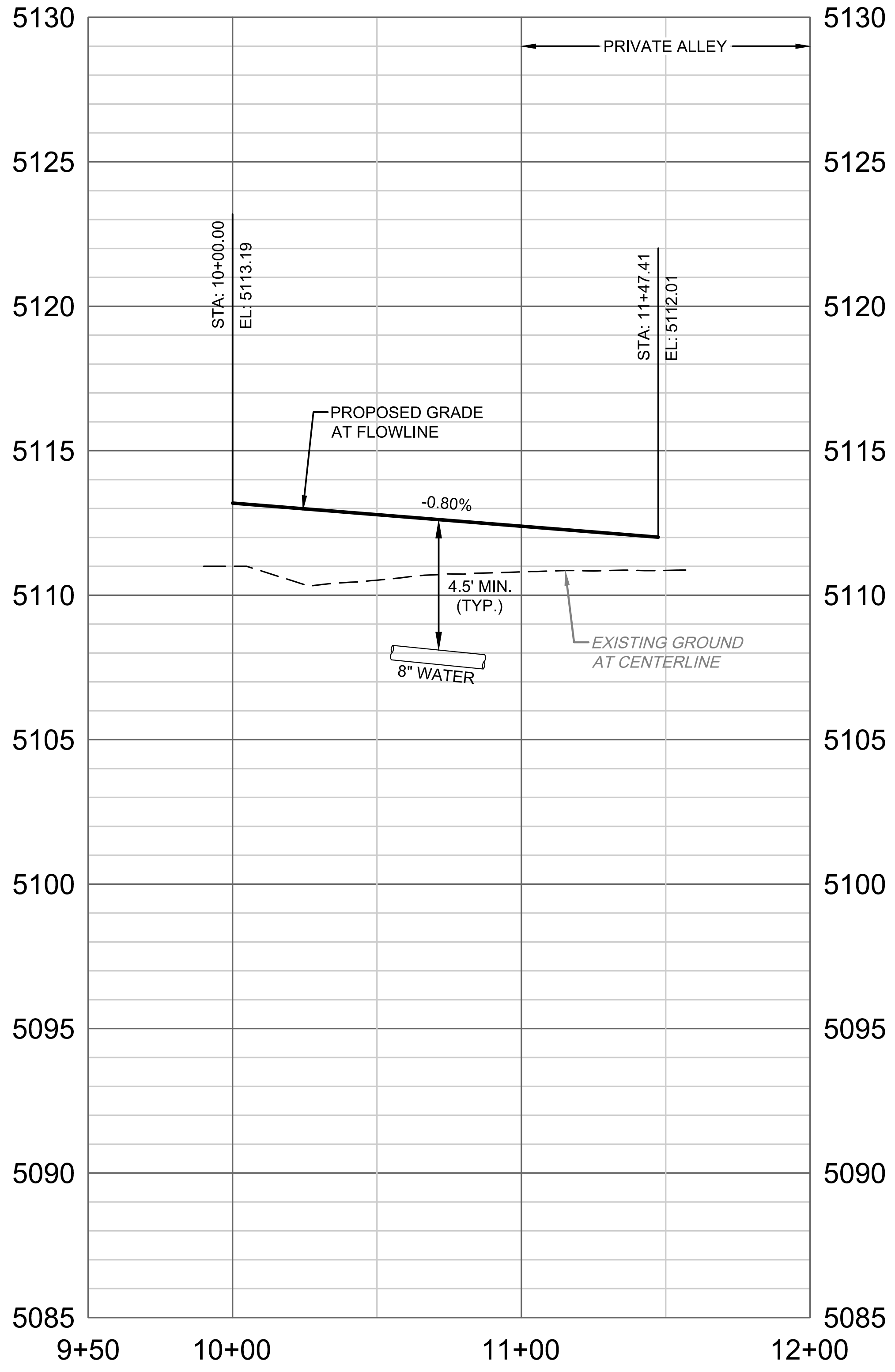
STA. 9+50.00 TO STA. 12+00.00

PRIVATE ALLEY - TRACT B



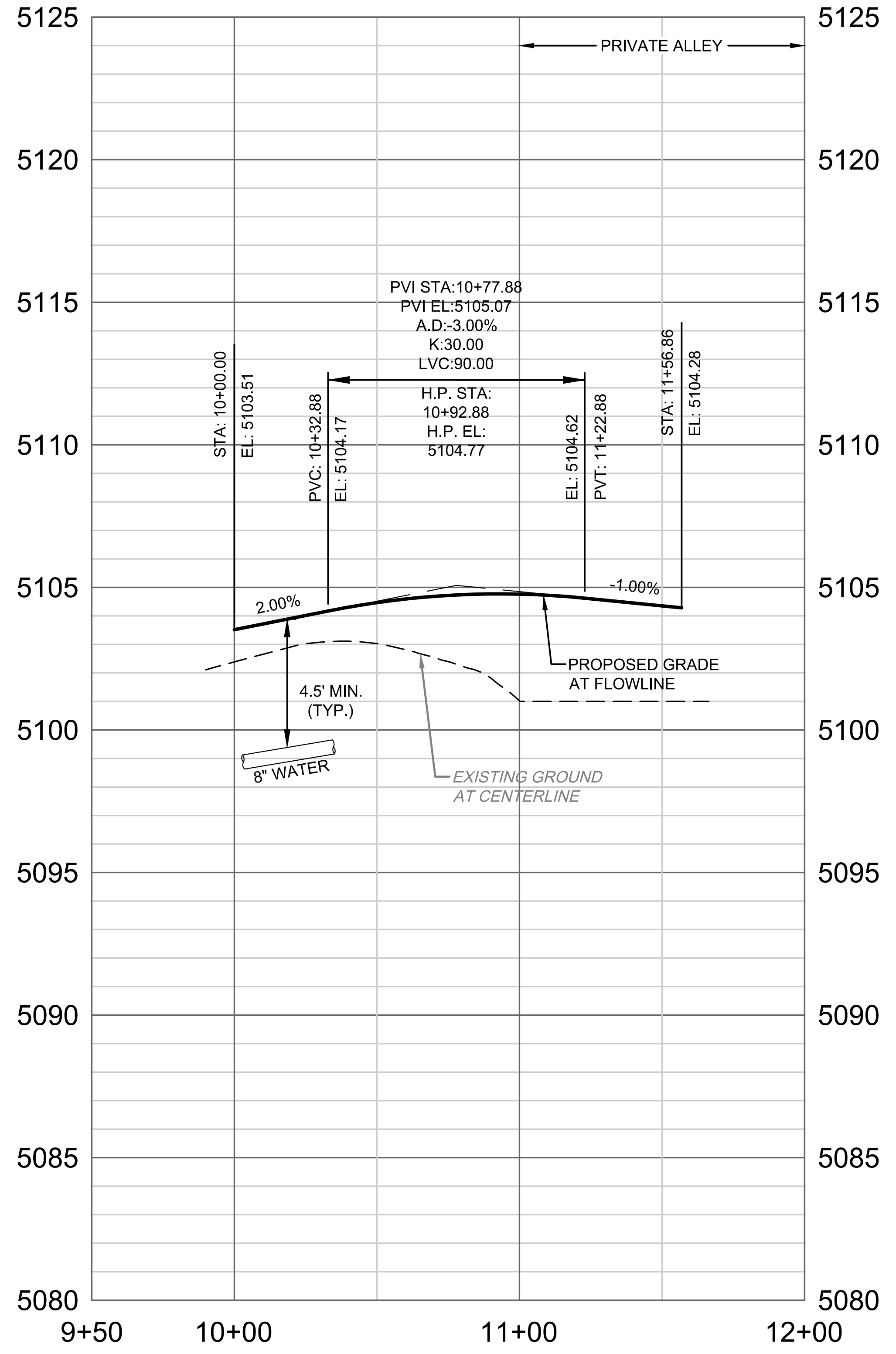
STA. 9+50.00 TO STA. 12+00.00

PRIVATE ALLEY - TRACT N



STA. 9+50.00 TO STA. 12+00.00

PRIVATE ALLEY - TRACT V



WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942

Dec 04, 2018

FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

PRIVATE ALLEY - TRACT B, TRACT N & TRACT V
STREET & STORM SEWER PLAN & PROFILE

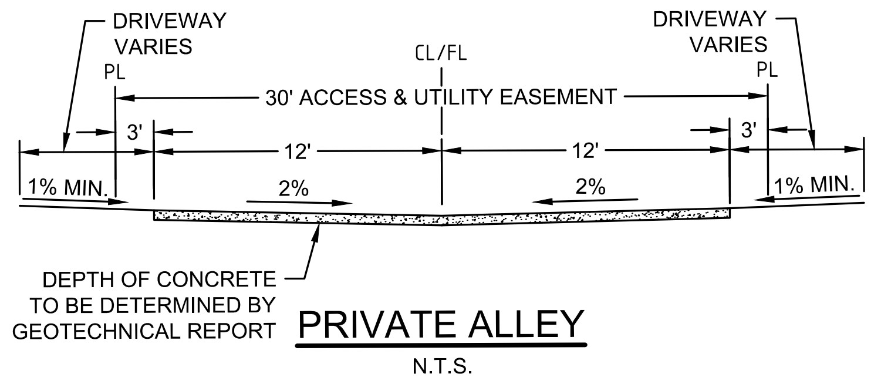
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
PP08
Sheet 38 of 74

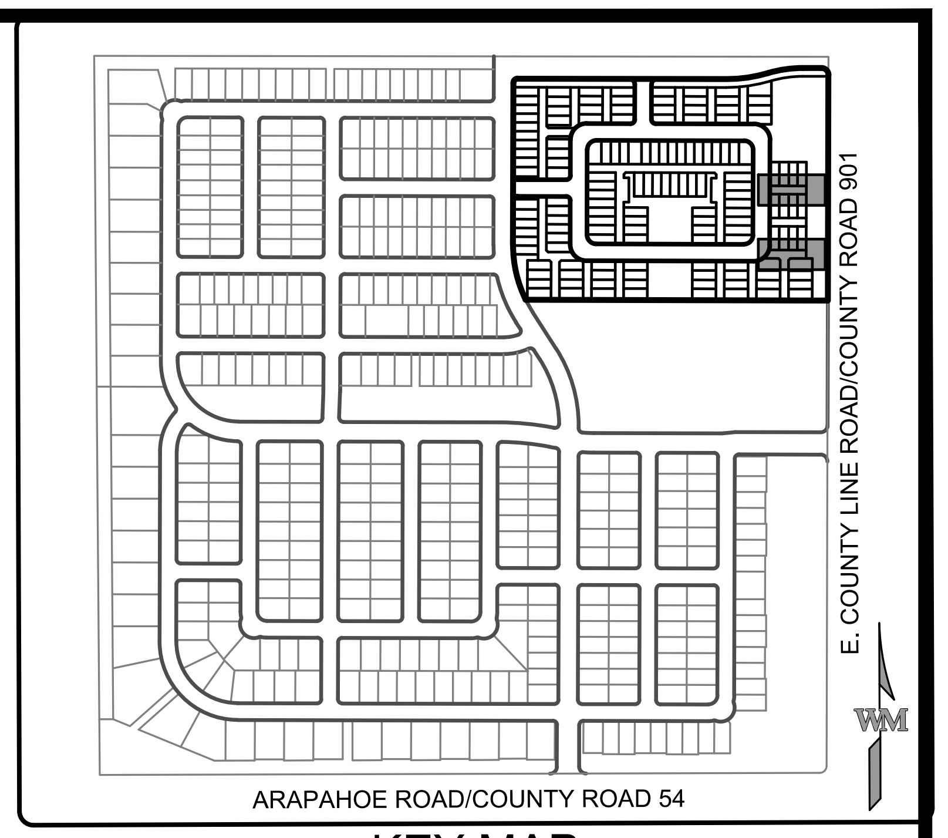
NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



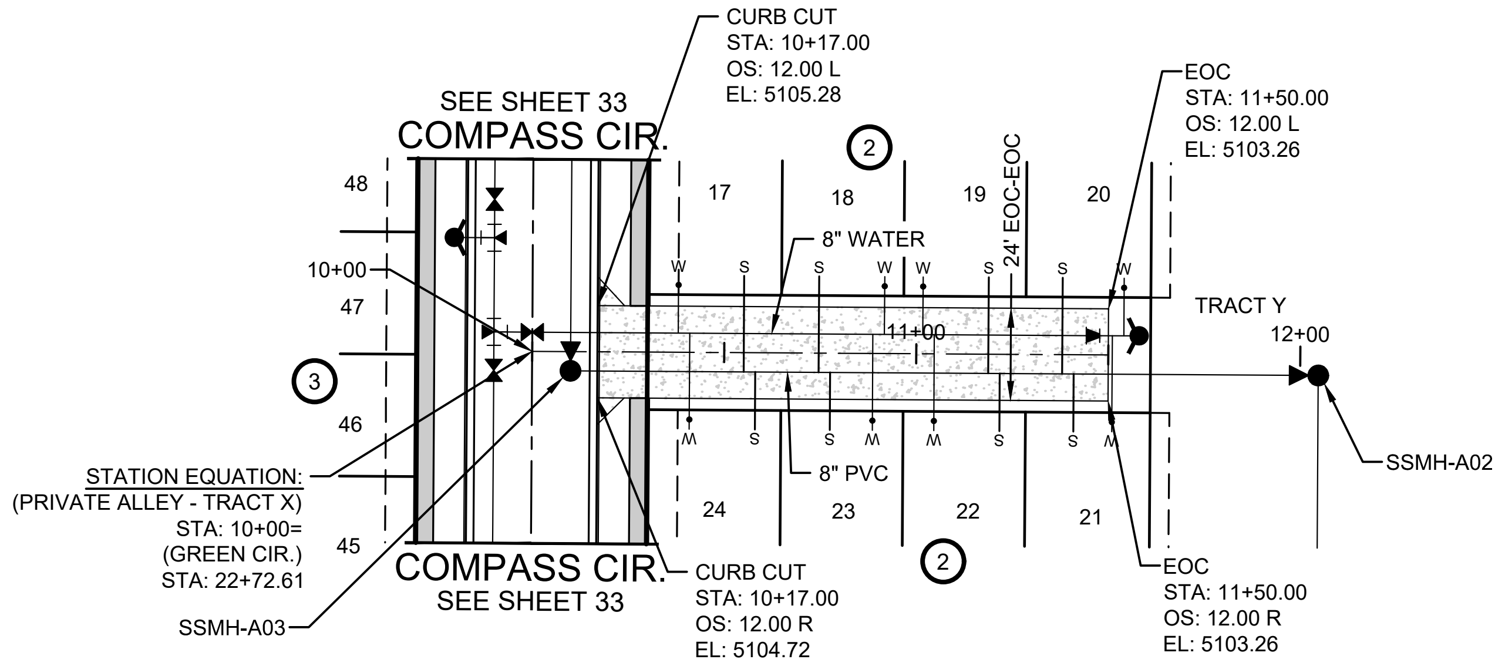
PRIVATE ALLEY
N.T.S.

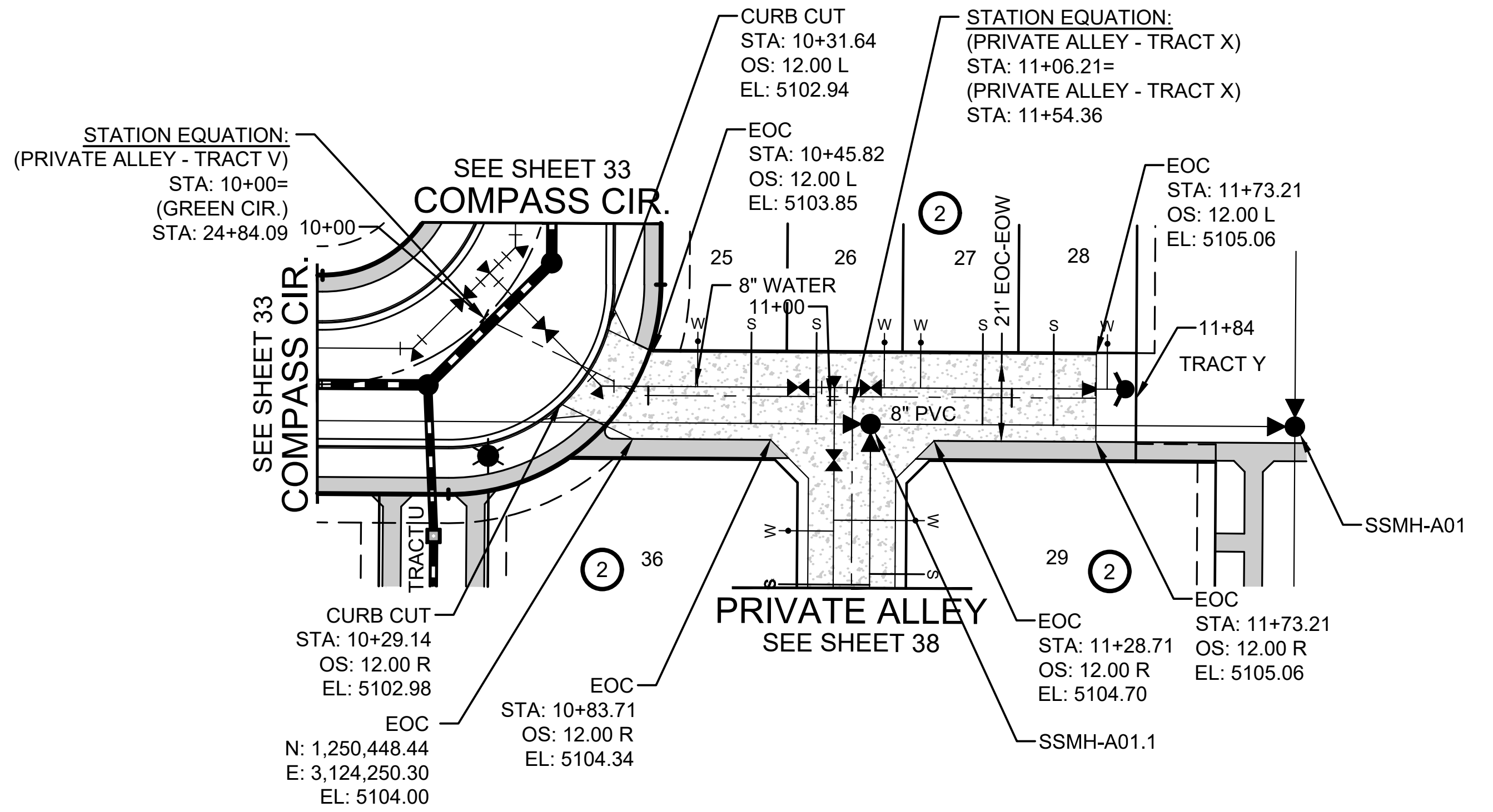
CONTRACTOR TO FIELD VERIFY LOCATION OF ALL EXISTING UTILITES PRIOR TO CONSTRUCTION



KEY MAP
N.T.S.

NOTES:
1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED.
2. 8' CROSS PANS TYPICAL UNLESS OTHERWISE NOTED.
3. STANDARD TOWN OF ERIE HANDICAP RAMPS ARE TO BE CONSTRUCTED AT ALL CURB RETURNS AND AT ALL "T" INTERSECTIONS, AND/OR AS OTHERWISE SHOWN ON THESE PLANS.
4. TFI GRADE AT INLETS IN PROFILE ARE AT MID POINT OF INLET, REFER TO STICK DETAIL FOR END OF INLET TFI GRADES.
5. CONTRACTOR IS RESPONSIBLE FOR ADJUSTING ALL EXISTING UTILITIES TO PROPOSED FINISHED GRADE.
6. ELEVATIONS ARE TO FLOWLINE UNLESS OTHERWISE NOTED.
7. MILL AND OVERLAY PER TOWN OF ERIE STANDARDS AND SPECS TO NEXT ADJACENT LANE LINE.
8. STORM SEWER AND SANITARY SEWER MANHOLE RIMS SHALL BE ROTATED TO PROVIDE A MINIMUM OF 2' (TYP.) OF CLEARANCE TO ADJACENT CONCRETE GUTTER.
9. ALL STORM SEWER IS CLASS III UNLESS OTHERWISE NOTED.
10. REFER TO DEMOLITION PLANS FOR MILL AND OVERLAY EXTENTS AND SAWCUT EXTENTS.
11. HANDICAP RAMPS SHALL BE INSTALLED PER ADA CRITERIA. SLOPES SHALL NOT EXCEED 8.3%.
12. OFFSETS ON INLETS ARE TO TFI (TOP FRONT OF INLET).





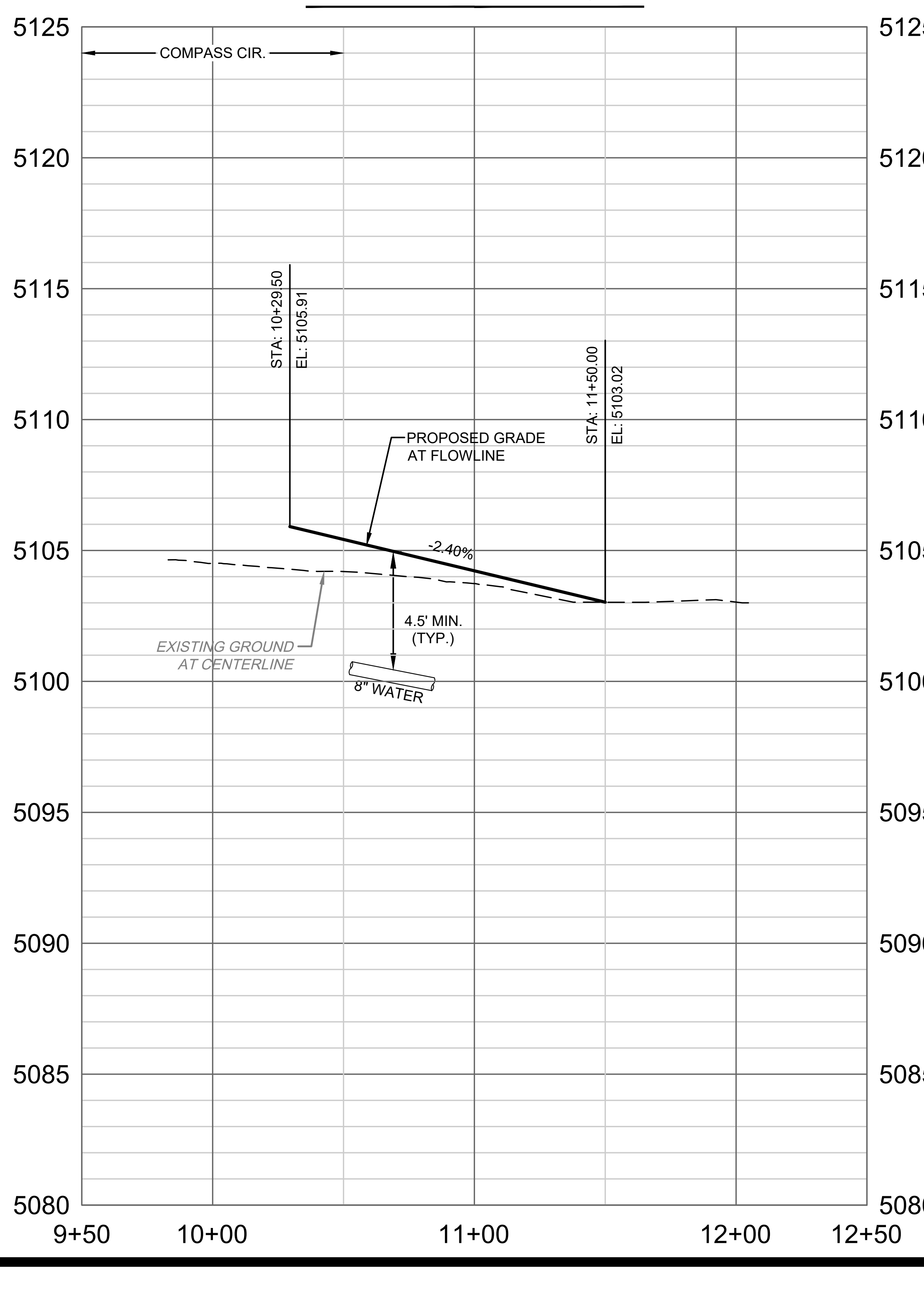
WM

0 25 50 100

SCALE: Hor: 1" =50'
SCALE: Vert: 1" = 5'
ORIGINAL GRAPHIC SCALE

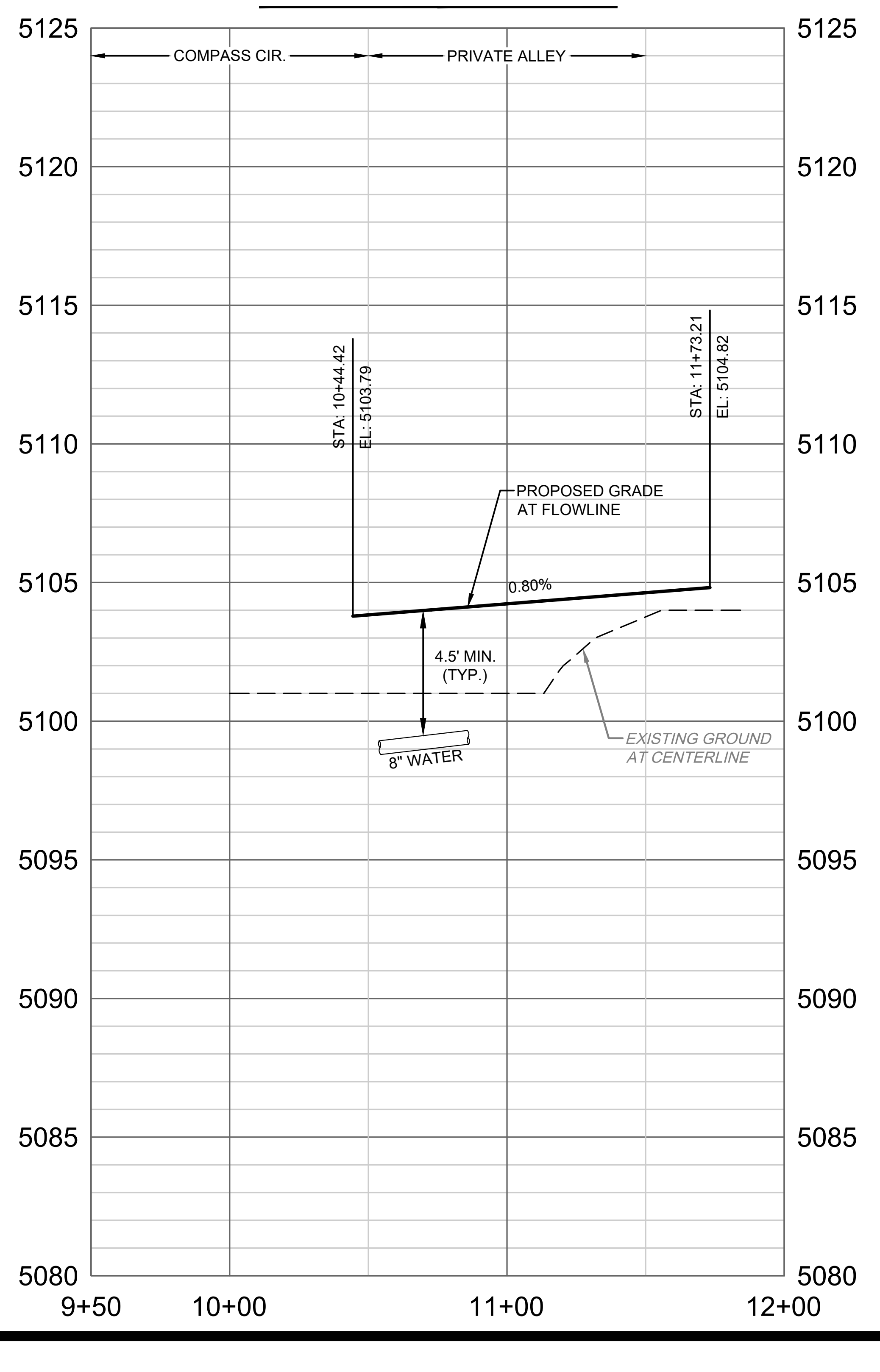
STA. 9+50.00 TO STA. 12+50.00

PRIVATE ALLEY - TRACT X



STA. 9+50.00 TO STA. 12+00.00

PRIVATE ALLEY - TRACT V



WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

PRIVATE ALLEY - TRACT X & TRACT V STREET & STORM SEWER PLAN & PROFILE

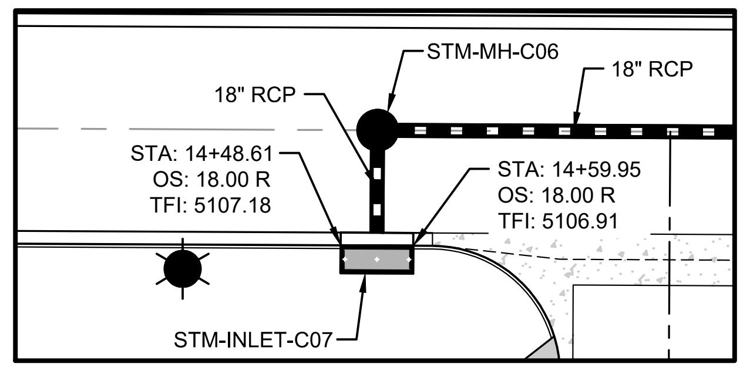
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

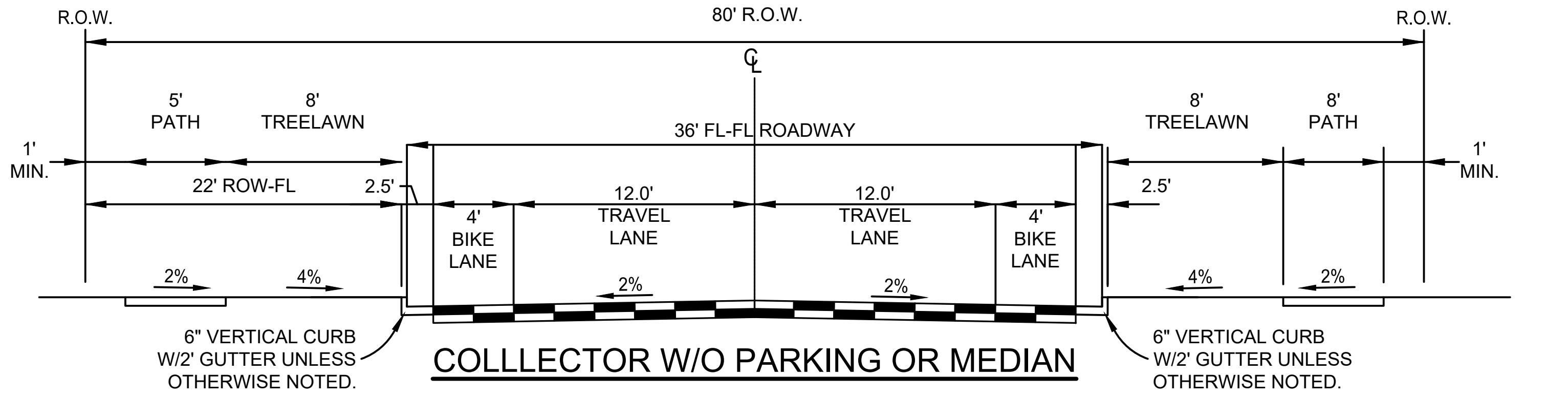
SHEET
PP09
Sheet 39 of 74

NOT FOR CONSTRUCTION

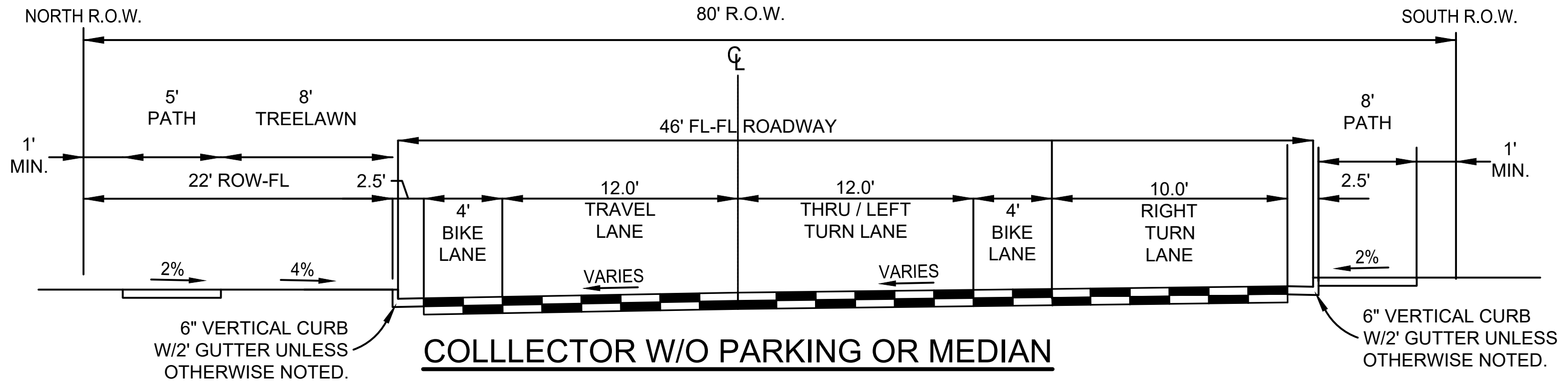
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



STM INLET DETAIL
SCALE: 1"=30'



COLLLECTOR W/O PARKING OR MEDIAN
80' RIGHT-OF-WAY
N.T.S.

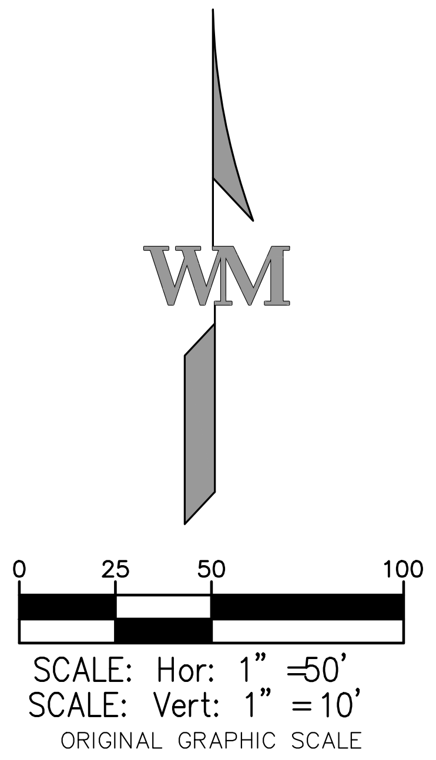


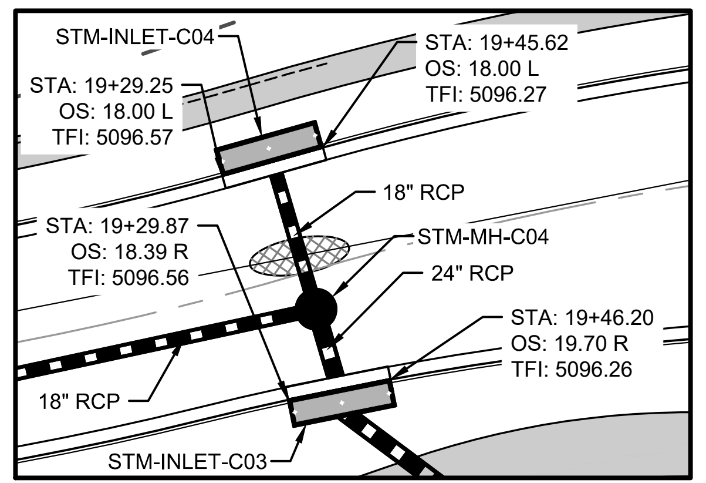
COLLLECTOR W/O PARKING OR MEDIAN
80' RIGHT-OF-WAY
N.T.S.

NOTES:
1. COUNTY LINE ROAD NORTH OF ARAPAHOE ROAD EXISTS TYPICALLY WITH LESS THAN 2% CROSS SLOPE. A MILL AND OVERLAY WILL BE REQUIRED TO ESTABLISH A 2% CROSS SLOPE. MILL AND OVERLAY OF EXISTING PAVEMENT SHALL EXTEND TO SECTION LINE. MILL AND OVERLAY SHALL BE 1 $\frac{1}{2}$" THICK MIN. AND SHALL PROVIDE A 2% FINISH CROSS SLOPE FROM EXISTING FINISH PAVEMENT AT SECTION LINE TO NEW EOA.
2. COUNTY LINE ROAD IS DESIGNED FROM EXISTING CENTER LINE TO NEW EOA WITH A 2% CROSS SLOPE UNLESS OTHERWISE NOTED OR SHOWN. SEE CROSS SECTIONS
3. THE EXISTING CROWN IS 2' TO 7' EAST OF SECTION/CENTER LINE.
4. COORDINATE WITH TOWN OF ERIE AND PROJECT GEOTECHNICAL ENGINEER FOR PAVEMENT SECTION REQUIREMENTS.

CURVE TABLE

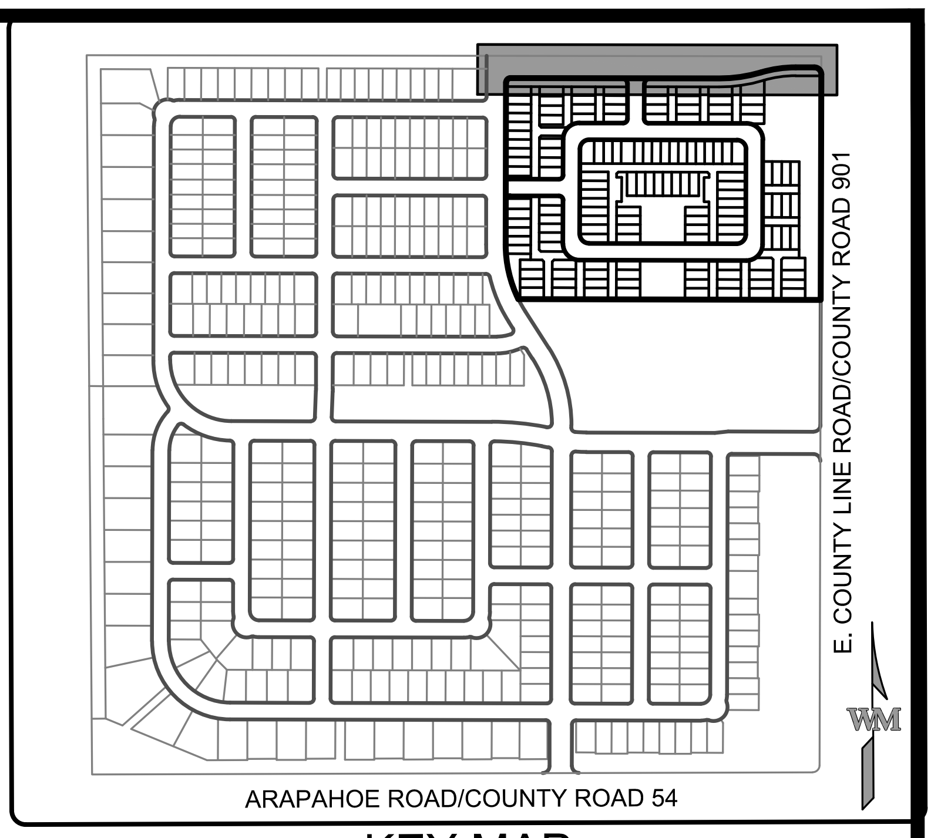
CURVE #	DELTA	RADIUS	ARC LENGTH	CHORD DIRECTION	CHORD LENGTH
C1	74°32'02"	30.00'	39.03'	N53°01'19"E	36.33'
C2	90°04'06"	30.00'	47.16'	S44°40'37"E	42.45'



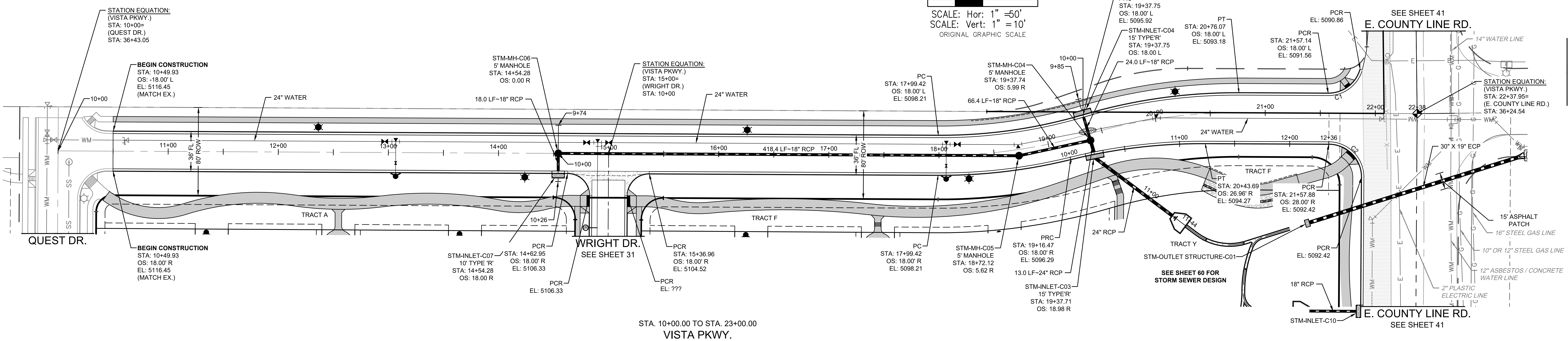


STM INLET DETAIL
SCALE: 1"=30'

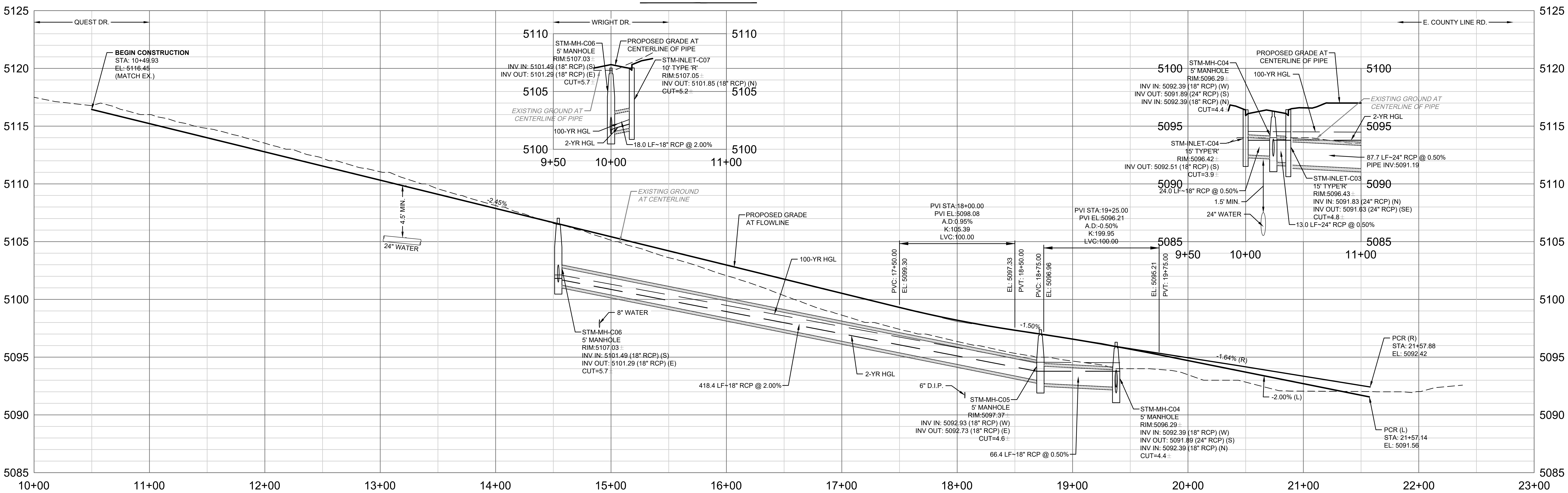
CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION



KEY MAP
N.T.S.



STA. 10+00.00 TO STA. 23+00.00
VISTA PKWY.



WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

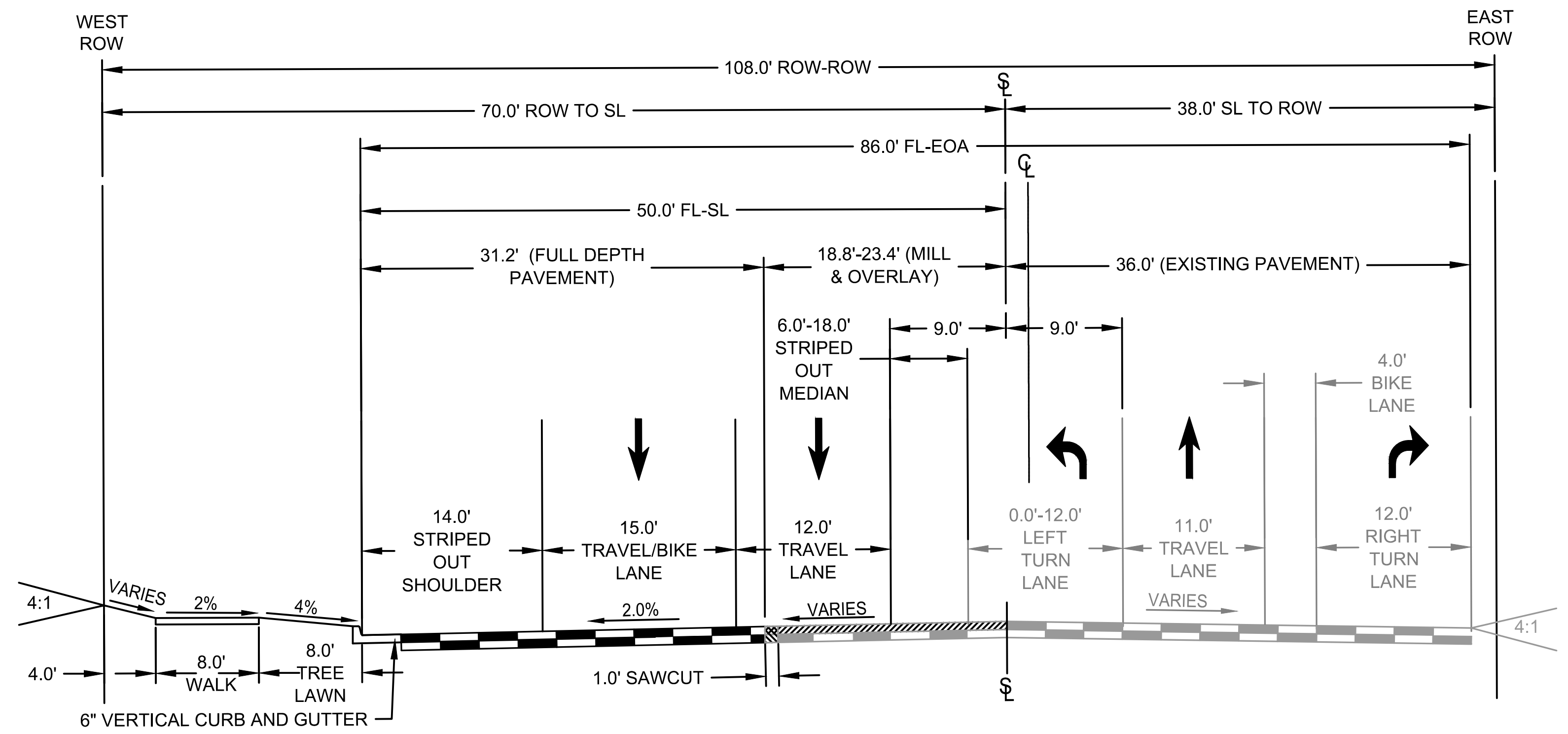
VISTA PKWY.
STREET & STORM SEWER PLAN & PROFILE

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

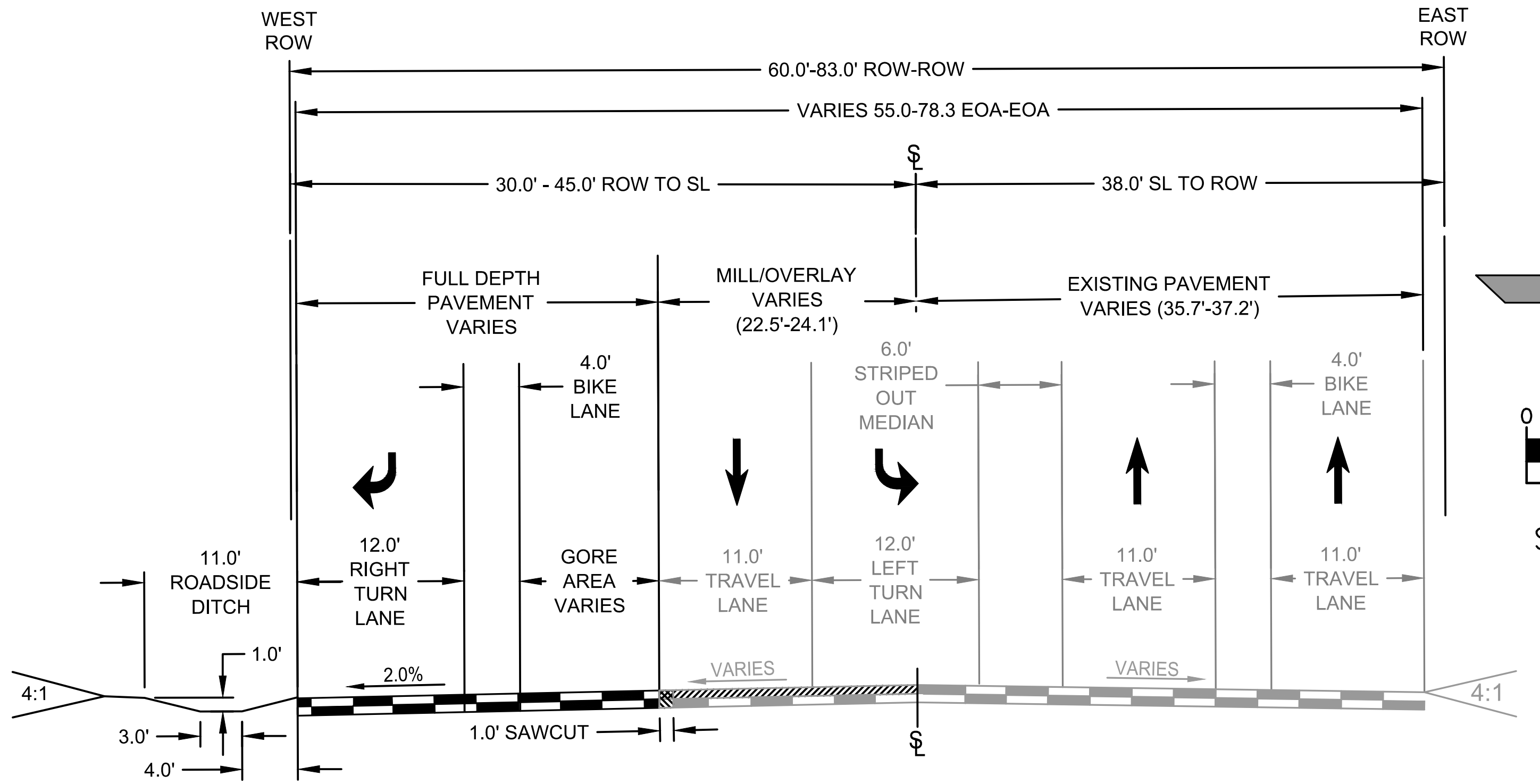
SHEET
PP10
Sheet 40 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



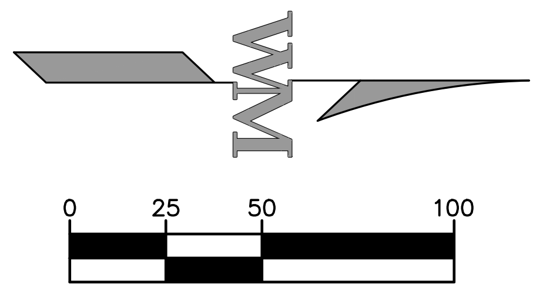
EAST COUNTY LINE ROAD - SOUTH OF VISTA PARKWAY - INTERIM

108' RIGHT-OF-WAY
(140' ROW ULTIMATE)
N.T.S.

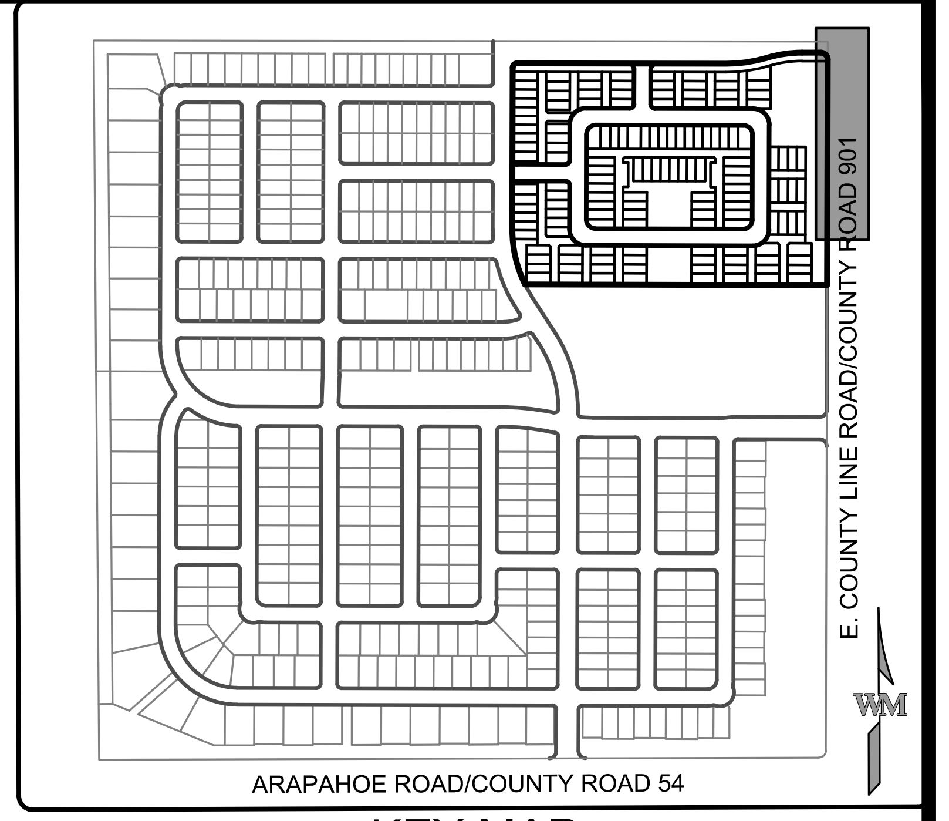


EAST COUNTY LINE ROAD - NORTH OF VISTA PARKWAY - INTERIM RIGHT TURN LANE

60'-83' RIGHT-OF-WAY
(140' ROW ULTIMATE)
N.T.S.



SCALE: Hor: 1" =50'
SCALE: Vert: 1" =10'
ORIGINAL GRAPHIC SCALE



KEY MAP

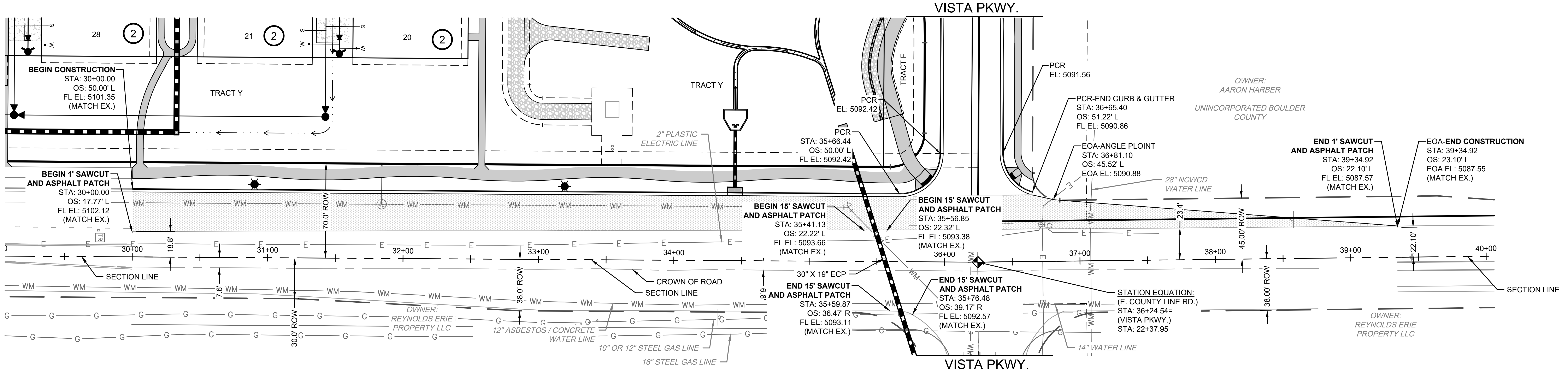
N.T.S.

NOTES:
1. COUNTY LINE ROAD NORTH OF ARAPAHOE ROAD EXISTS TYPICALLY WITH LESS THAN 2% CROSS SLOPE. A MILL AND OVERLAY WILL BE REQUIRED TO ESTABLISH A 2% CROSS SLOPE. MILL AND OVERLAY OF EXISTING PAVEMENT SHALL EXTEND TO SECTION LINE. MILL AND OVERLAY SHALL BE 1 $\frac{1}{2}$" THICK MIN. AND SHALL PROVIDE A 2% FINISH CROSS SLOPE FROM EXISTING FINISH PAVEMENT AT SECTION LINE TO NEW EOA.
2. COUNTY LINE ROAD IS DESIGNED FROM EXISTING CENTER LINE TO NEW EOA WITH A 2% CROSS SLOPE UNLESS OTHERWISE NOTED OR SHOWN. SEE CROSS SECTIONS
3. THE EXISTING CROWN IS 2' TO 7' EAST OF SECTION/CENTER LINE.
4. COORDINATE WITH TOWN OF ERIE AND PROJECT GEOTECHNICAL ENGINEER FOR PAVEMENT SECTION REQUIREMENTS.

LEGEND

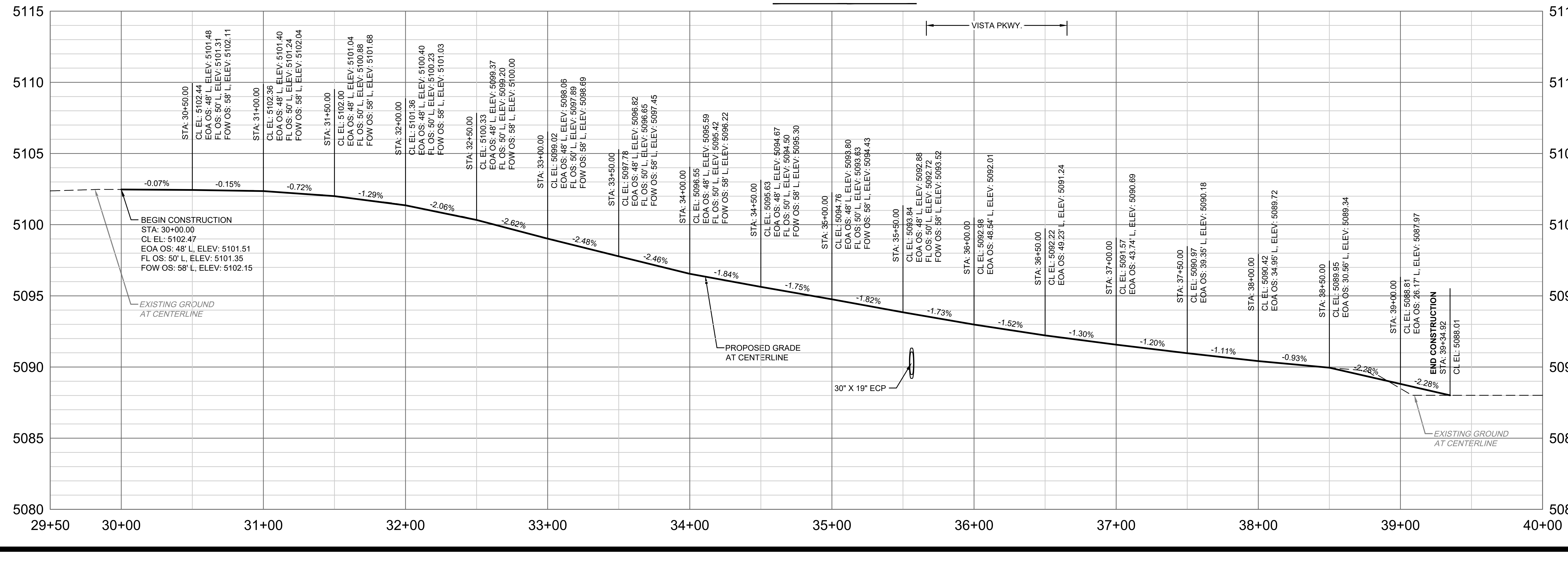
— — — —	UTILITY EASEMENT
▭	EXISTING ASPHALT
▨	PROPOSED ASPHALT
▩	PROPOSED MILL AND OVERLAY

CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION



STA. 29+50.00 TO STA. 40+00.00

EAST COUNTY LINE ROAD



THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

E. COUNTY LINE RD. STREET & STORM SEWER PLAN & PROFILE

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

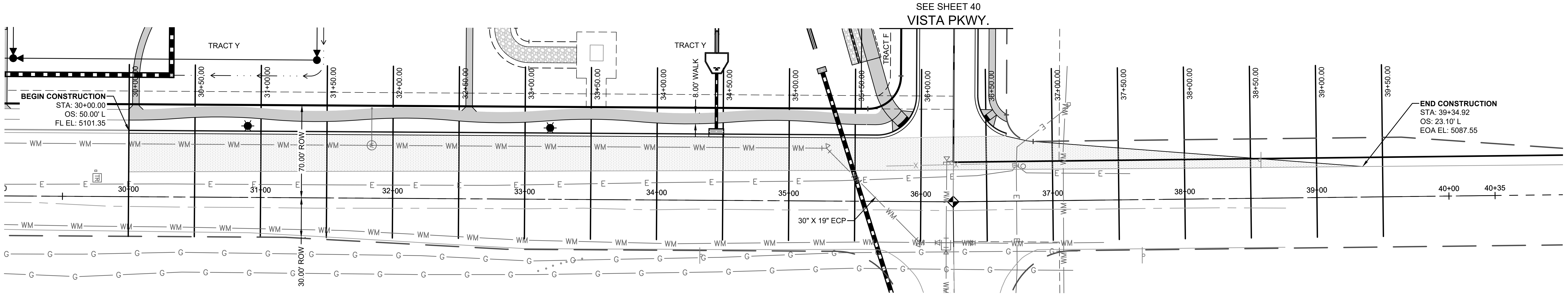
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
PP11
Sheet 41 of 74

NOT FOR CONSTRUCTION

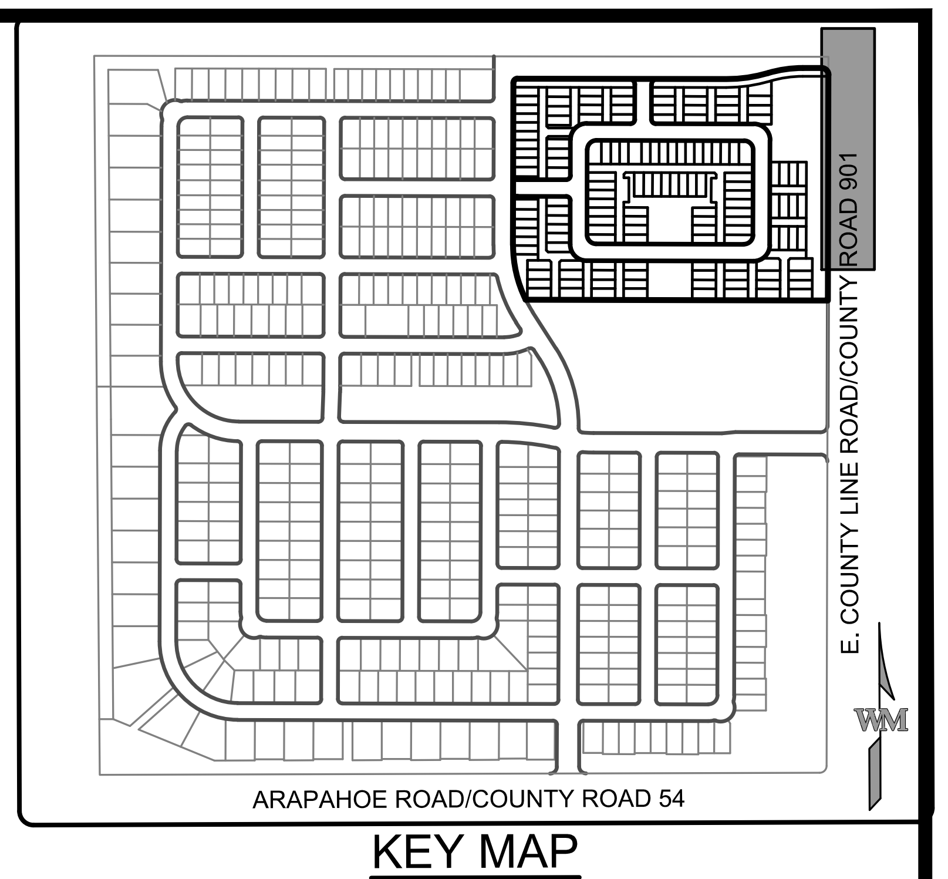
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT

SEE SHEET 40



BEGIN CONSTRUCTION
STA: 30+00.00
OS: 50.00' L
FL EL: 5101.35

END CONSTRUCTION
STA: 39+34.92
OS: 23.10' L
EOA EL: 5087.55



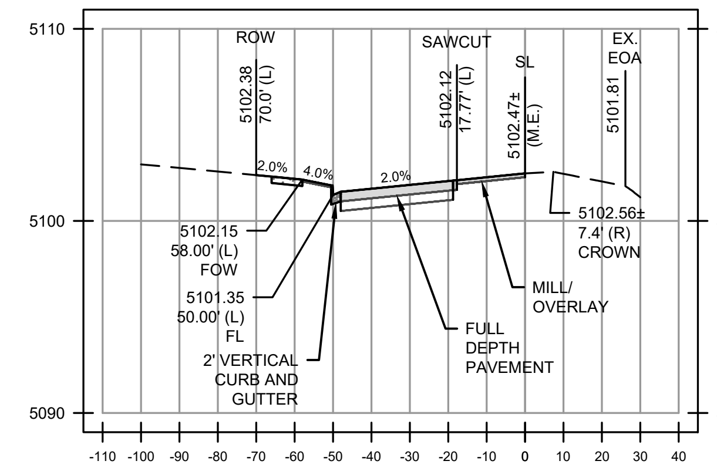
KEY MAP

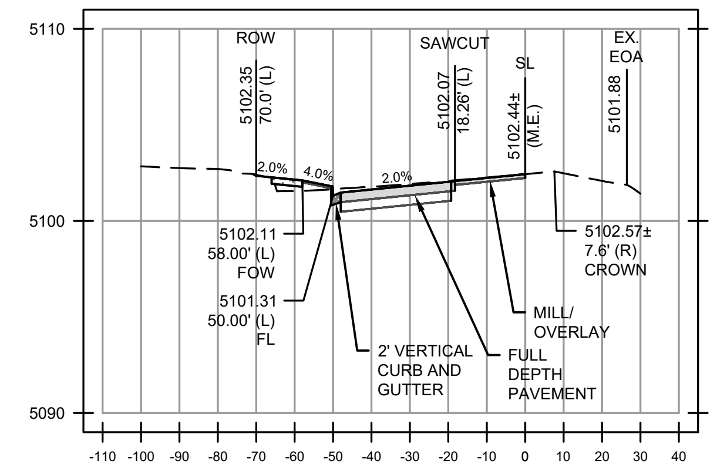
N.T.S.

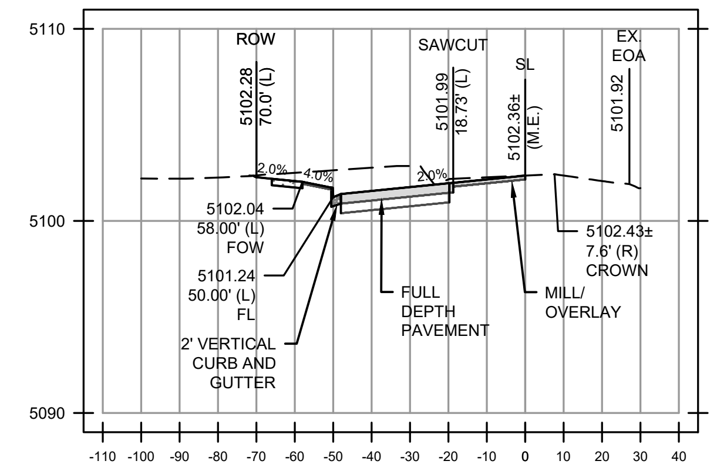
SCALE: Hor: 1" =50'
SCALE: Vert: 1" =10'
ORIGINAL GRAPHIC SCALE

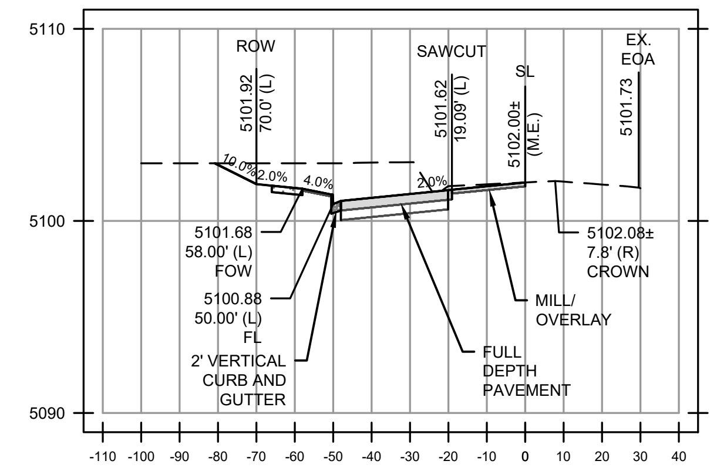
LEGEND

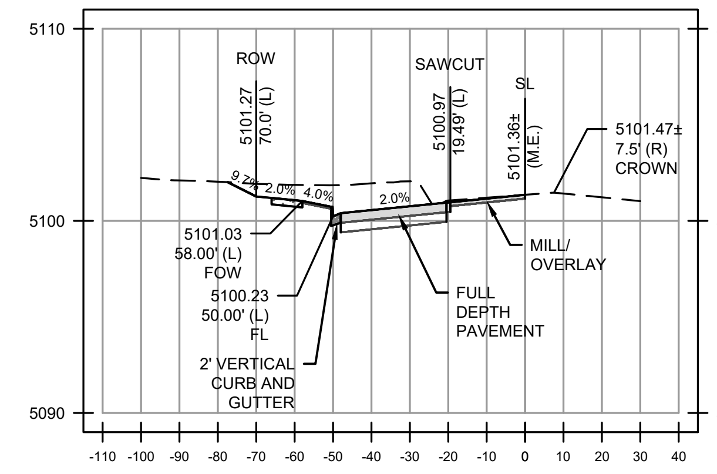
FOW	FRONT OF WALK
ROW	RIGHT OF WAY
SAWCUT	SAWCUT LINE
SL	SECTION LINE
CROWN	CROWN OF PAVEMENT
FL	FLOWLINE
EOA	EDGE OF ASPHALT
CL	CENTERLINE
CD	CENTER OF DITCH
EX	EXISTING
M.E.	MATCH EXISTING

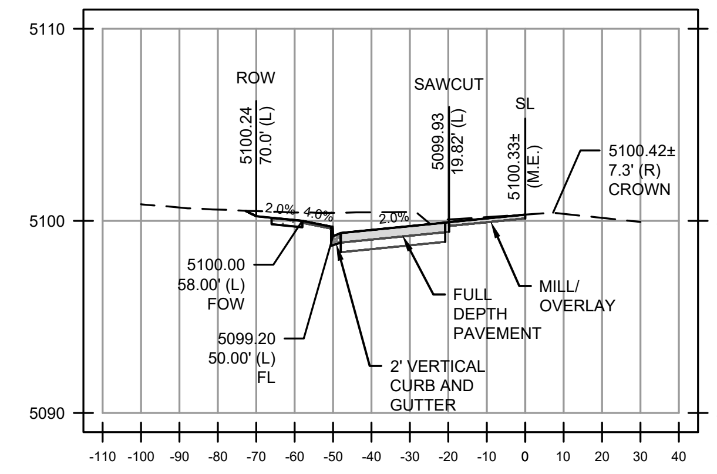

30+00.00

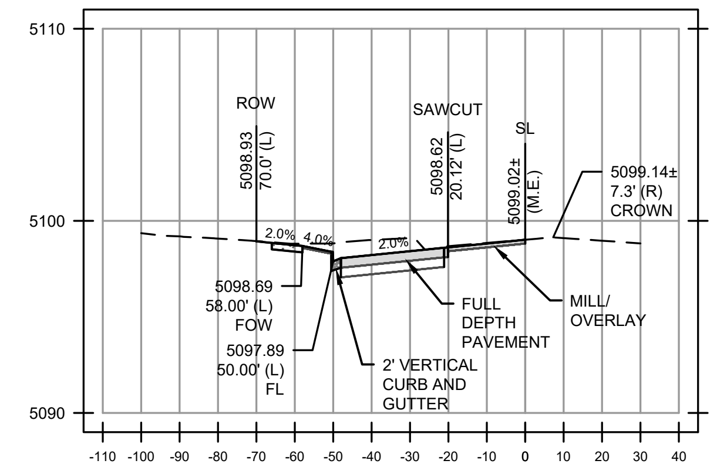

30+50.00

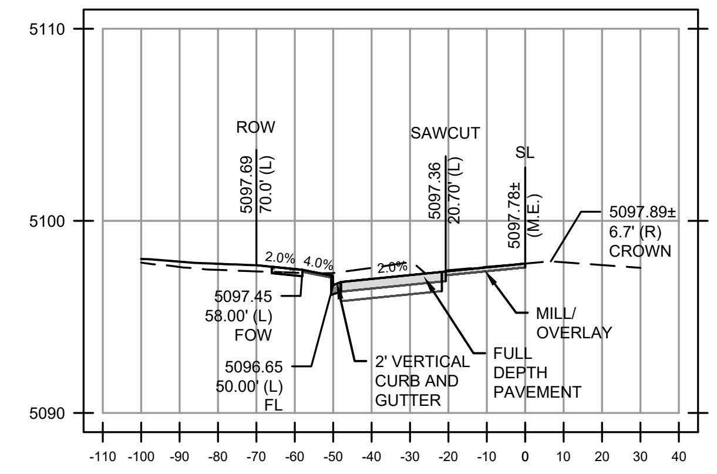

31+00.00

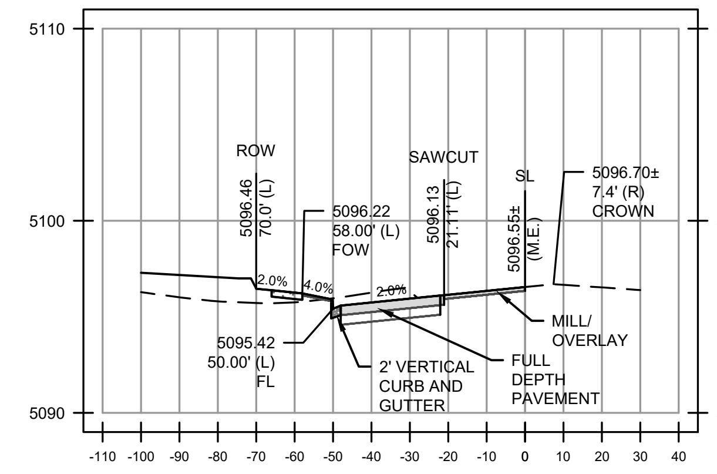

31+50.00

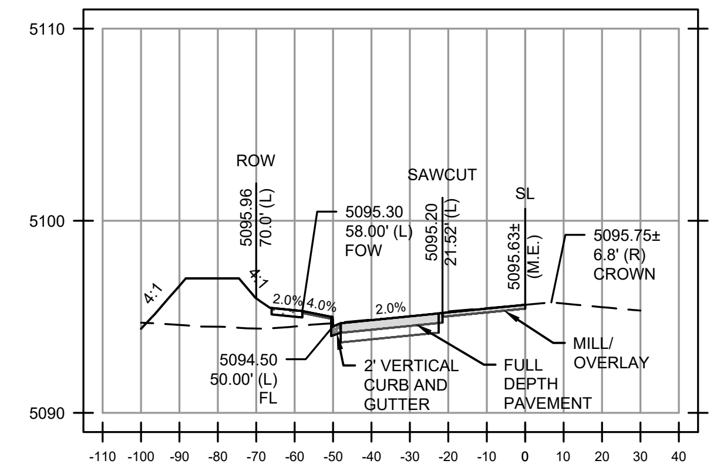

32+00.00

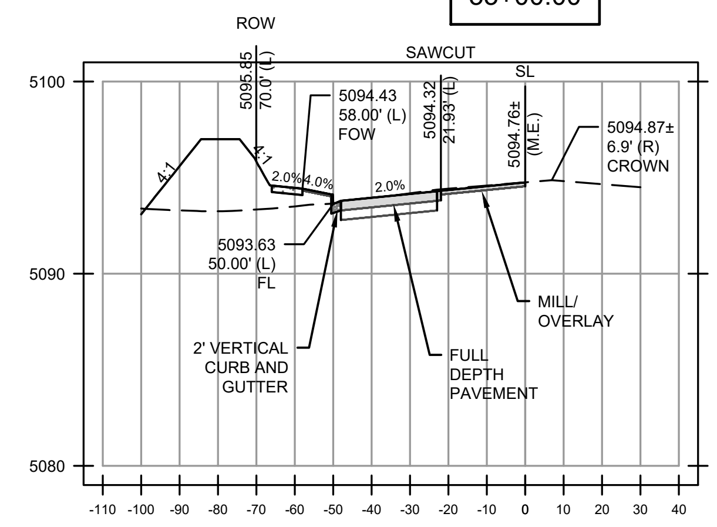

32+50.00

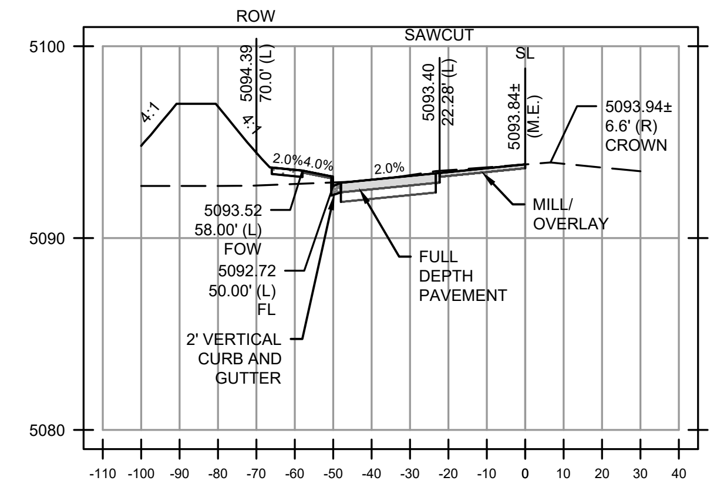

33+00.00

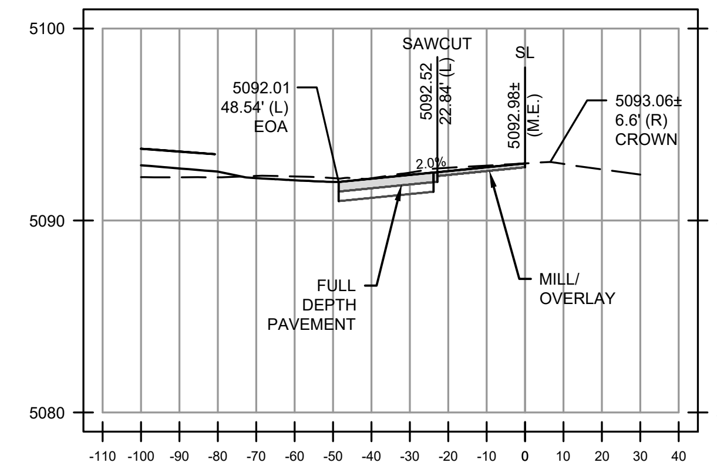

33+50.00

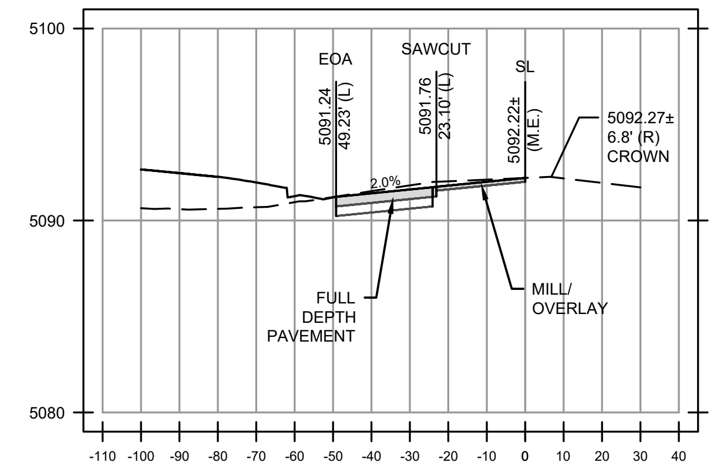

34+00.00

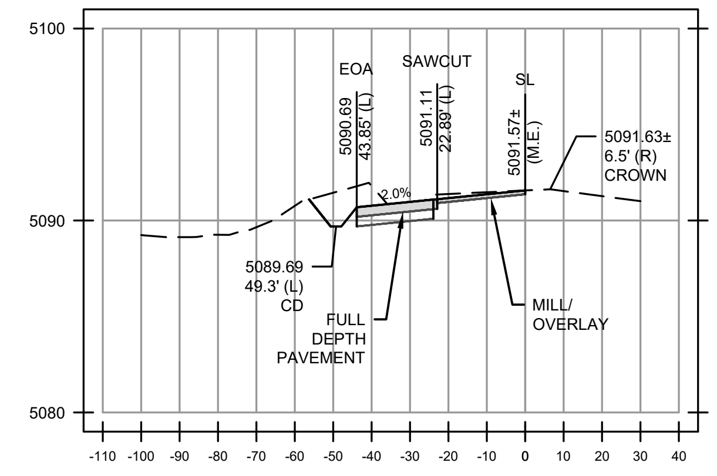

34+50.00

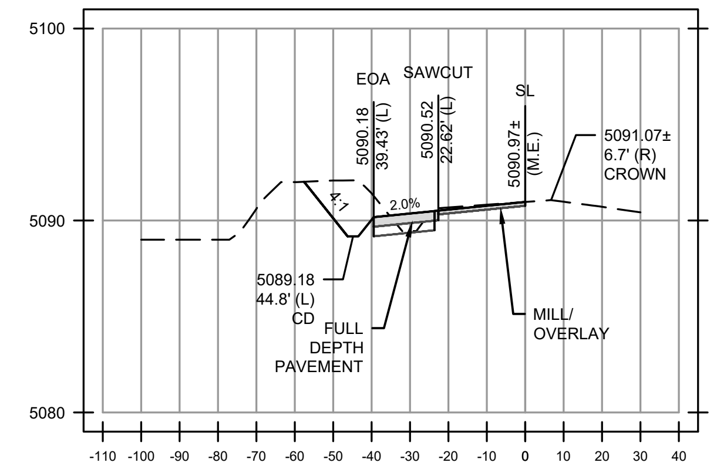

35+00.00

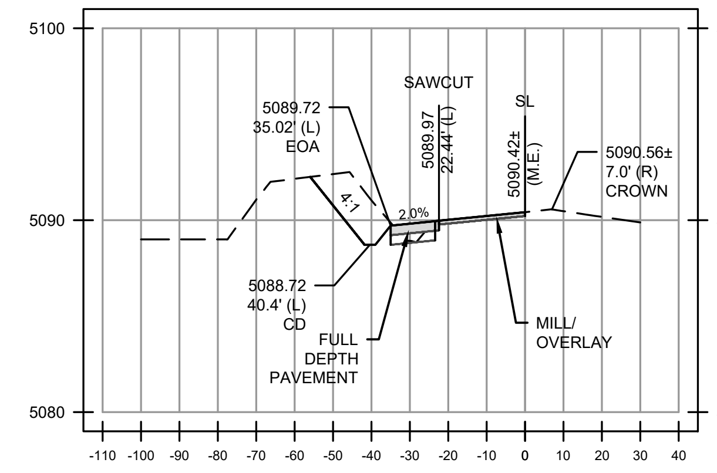

35+50.00

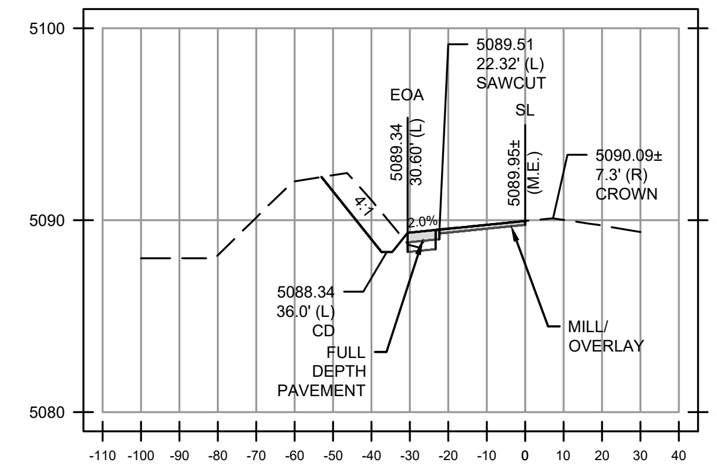

36+00.00

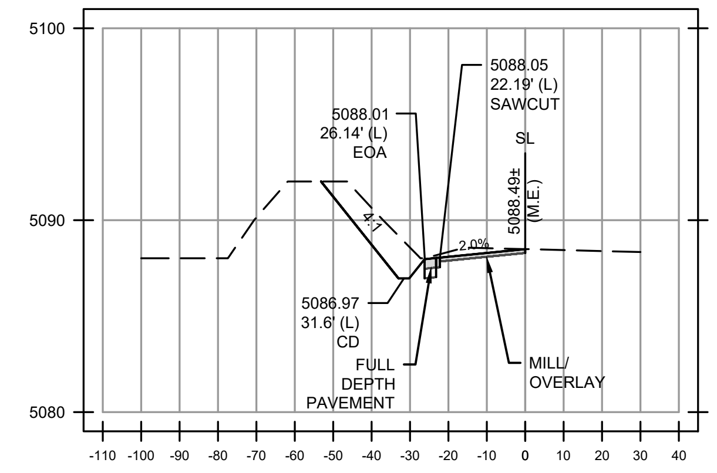

36+50.00

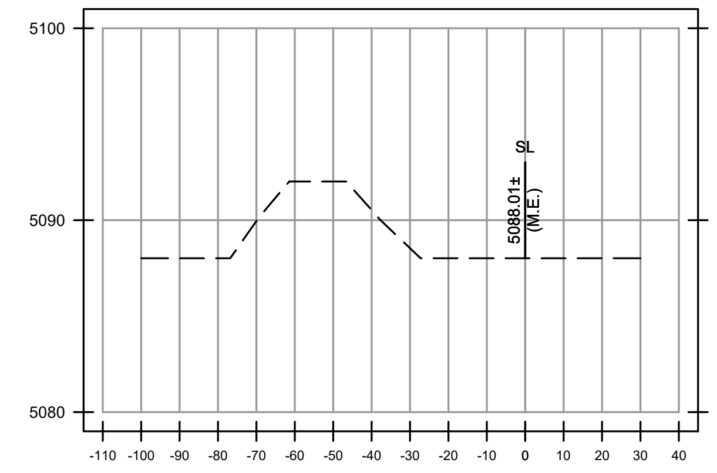

37+00.00


37+50.00


38+00.00


38+50.00


39+00.00


39+50.00

CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

E. COUNTY LINE RD.
CROSS SECTIONS

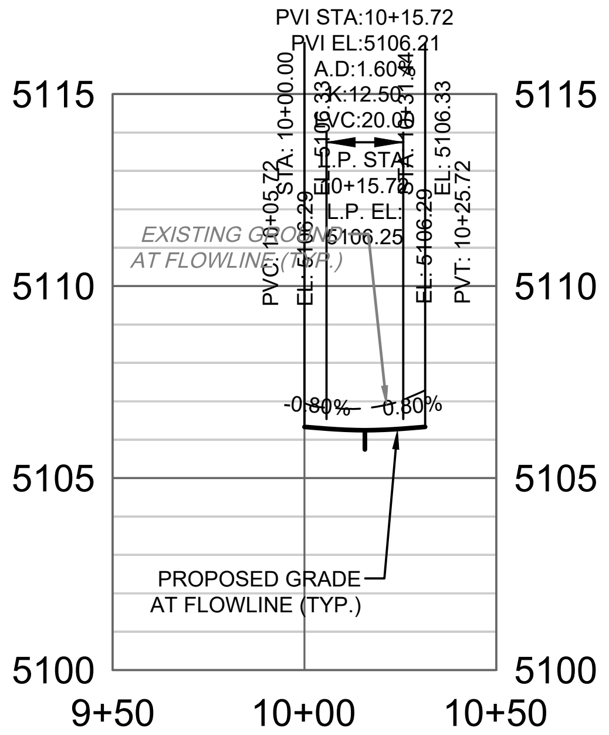
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

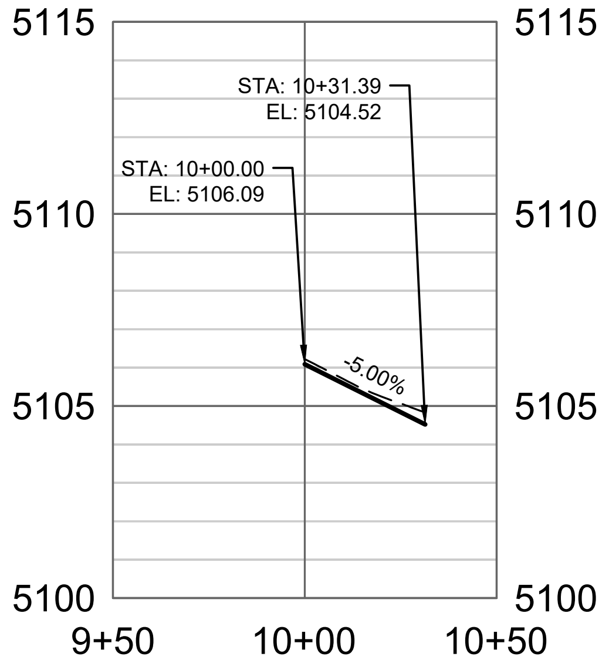
SHEET
XS01
Sheet 42 of 74

NOT FOR CONSTRUCTION

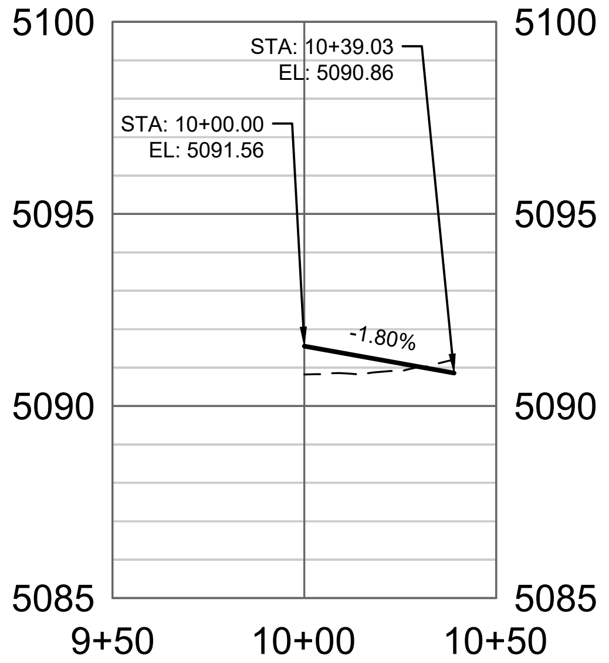
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



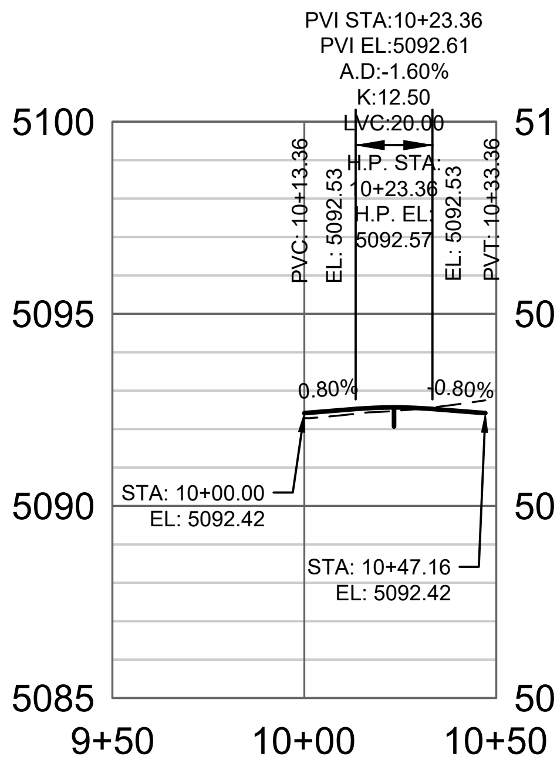
VISTA PKWY. & WRIGHT DR.
SOUTHWEST CURB RETURN



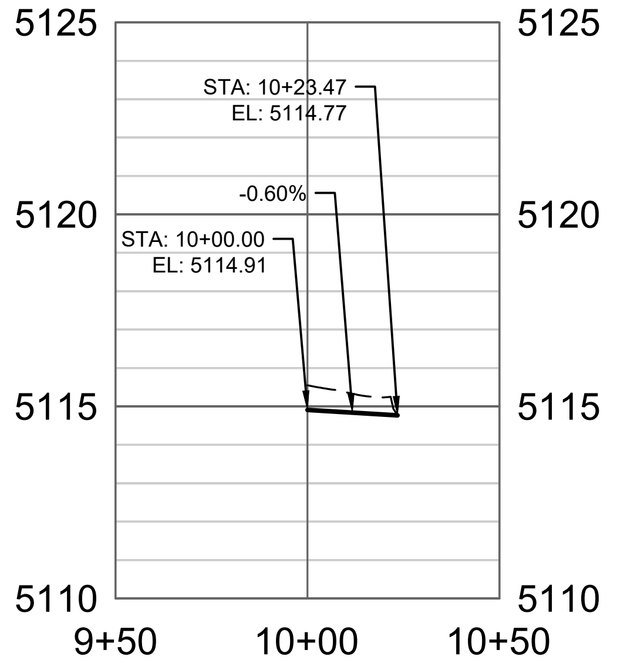
VISTA PKWY. & WRIGHT DR.
SOUTHEAST CURB RETURN



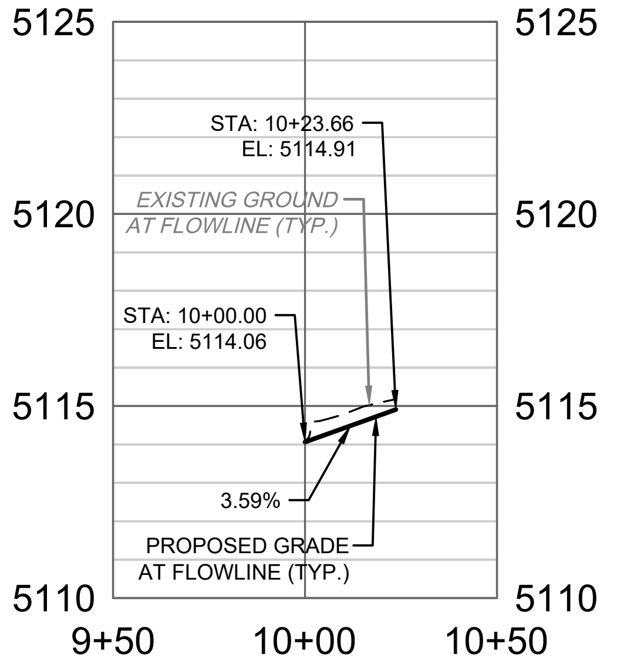
VISTA PKWY. & E. COUNTY LINE RD.
NORTHWEST CURB RETURN



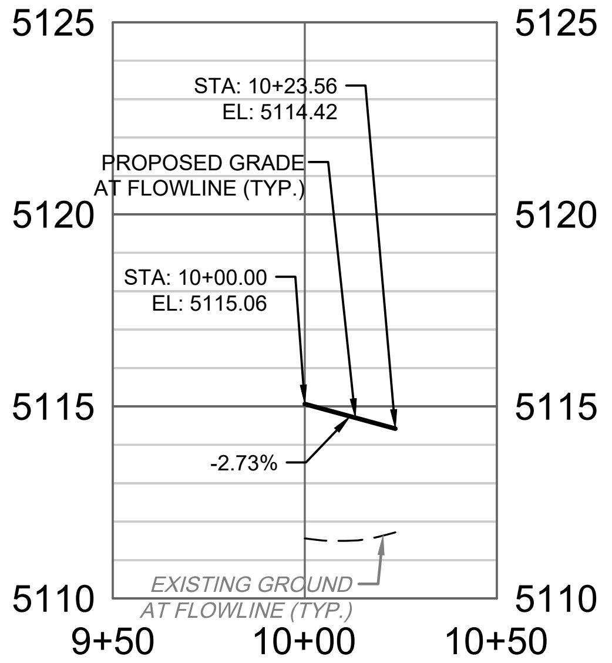
VISTA PKWY. & E. COUNTY LINE RD.
SOUTHWEST CURB RETURN



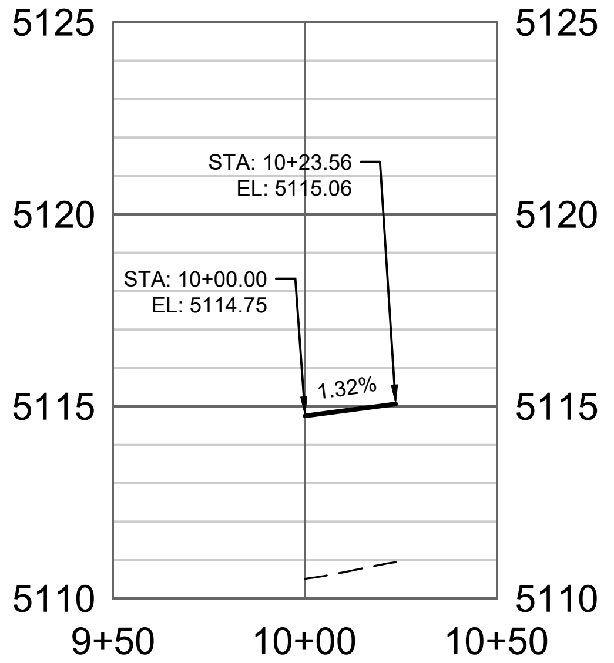
QUEST DR. & BYRD DR.
NORTHEAST CURB RETURN



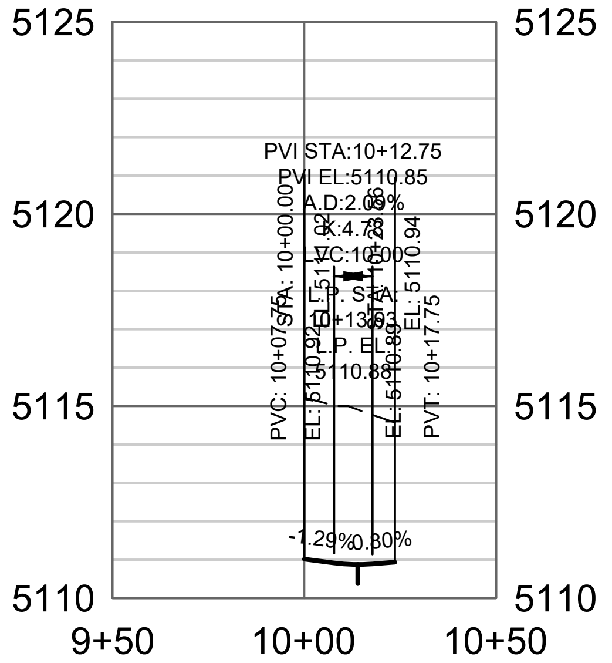
QUEST DR. & BYRD DR.
SOUTHEAST CURB RETURN



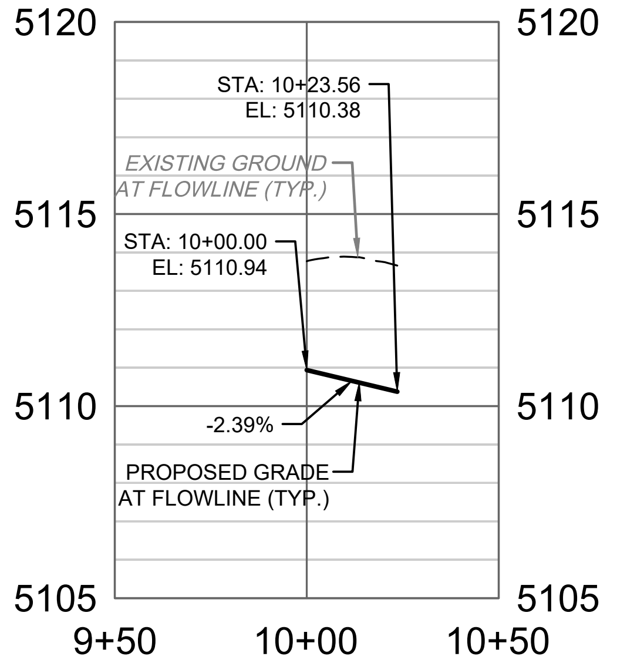
BYRD DR. & GREEN CIR.
NORTH CURB RETURN



BYRD DR. & GREEN CIR.
SOUTH CURB RETURN



GREEN CIR. & WRIGHT DR.
SOUTHWEST CURB RETURN



GREEN CIR. & WRIGHT DR.
SOUTHEAST CURB RETURN

0 25 50 100
SCALE: 1" = 50'
ORIGINAL GRAPHIC SCALE

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

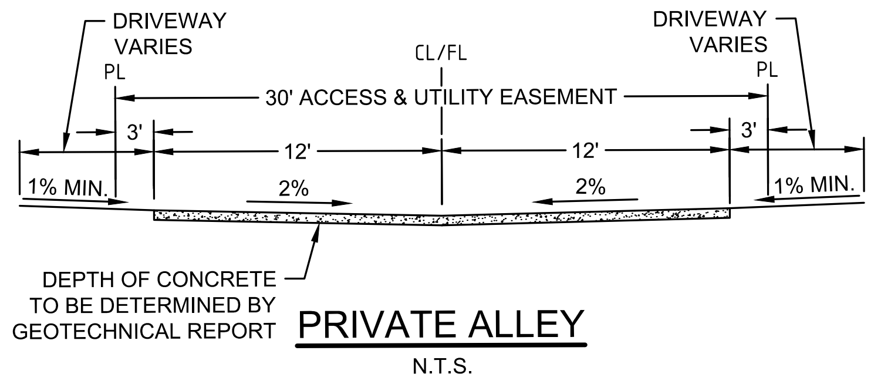
CURB RETURN PROFILES

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
CRP01
Sheet 43 of 74

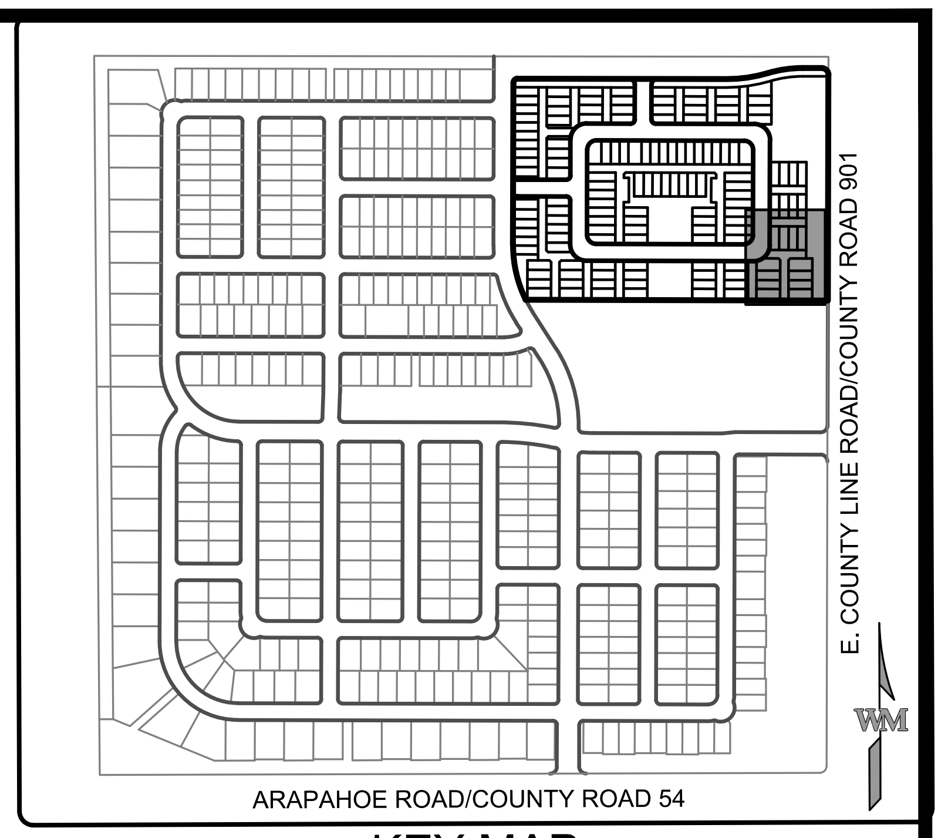
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



PRIVATE ALLEY

N.T.S.

CONTRACTOR TO FIELD VERIFY LOCATION OF ALL EXISTING UTILITES PRIOR TO CONSTRUCTION

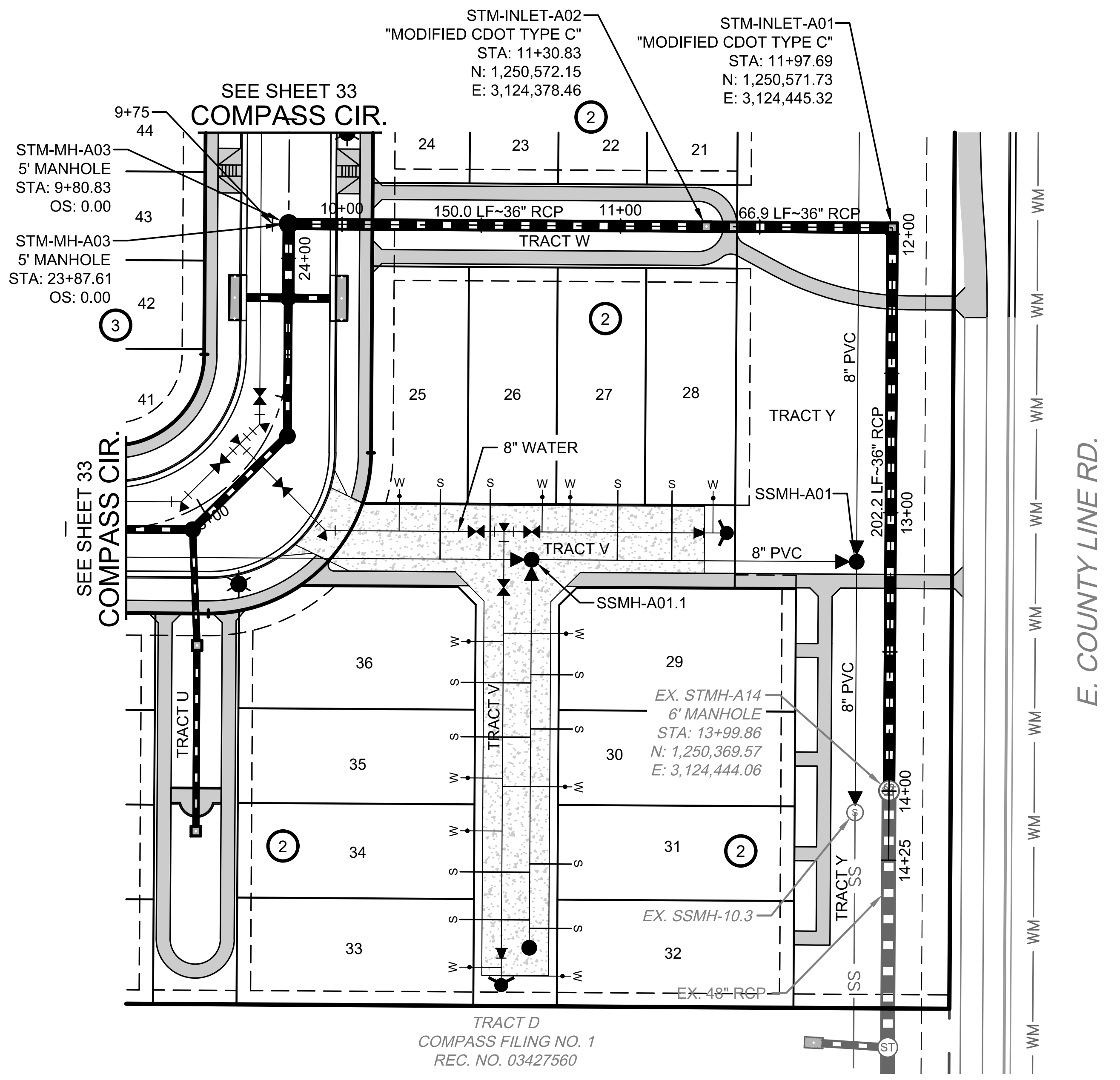


KEY MAP

N.T.S.

NOTES:

1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED.
2. 8' CROSS PANS TYPICAL UNLESS OTHERWISE NOTED.
3. STANDARD TOWN OF ERIE HANDICAP RAMPS ARE TO BE CONSTRUCTED AT ALL CURB RETURNS AND AT ALL "T" INTERSECTIONS, AND/OR AS OTHERWISE SHOWN ON THESE PLANS.
4. TFI GRADE AT INLETS IN PROFILE ARE AT MID POINT OF INLET, REFER TO STICK DETAIL FOR END OF INLET TFI GRADES.
5. CONTRACTOR IS RESPONSIBLE FOR ADJUSTING ALL EXISTING UTILITIES TO PROPOSED FINISHED GRADE.
6. ELEVATIONS ARE TO FLOWLINE UNLESS OTHERWISE NOTED.
7. MILL AND OVERLAY PER TOWN OF ERIE STANDARDS AND SPECS TO NEXT ADJACENT LANE LINE.
8. STORM SEWER AND SANITARY SEWER MANHOLE RIMS SHALL BE ROTATED TO PROVIDE A MINIMUM OF 2' (TYP.) OF CLEARANCE TO ADJACENT CONCRETE GUTTER.
9. ALL STORM SEWER IS CLASS III UNLESS OTHERWISE NOTED.
10. REFER TO DEMOLITION PLANS FOR MILL AND OVERLAY EXTENTS AND SAWCUT EXTENTS.
11. HANDICAP RAMPS SHALL BE INSTALLED PER ADA CRITERIA. SLOPES SHALL NOT EXCEED 8.3%.
12. OFFSETS ON INLETS ARE TO TFI (TOP FRONT OF INLET).



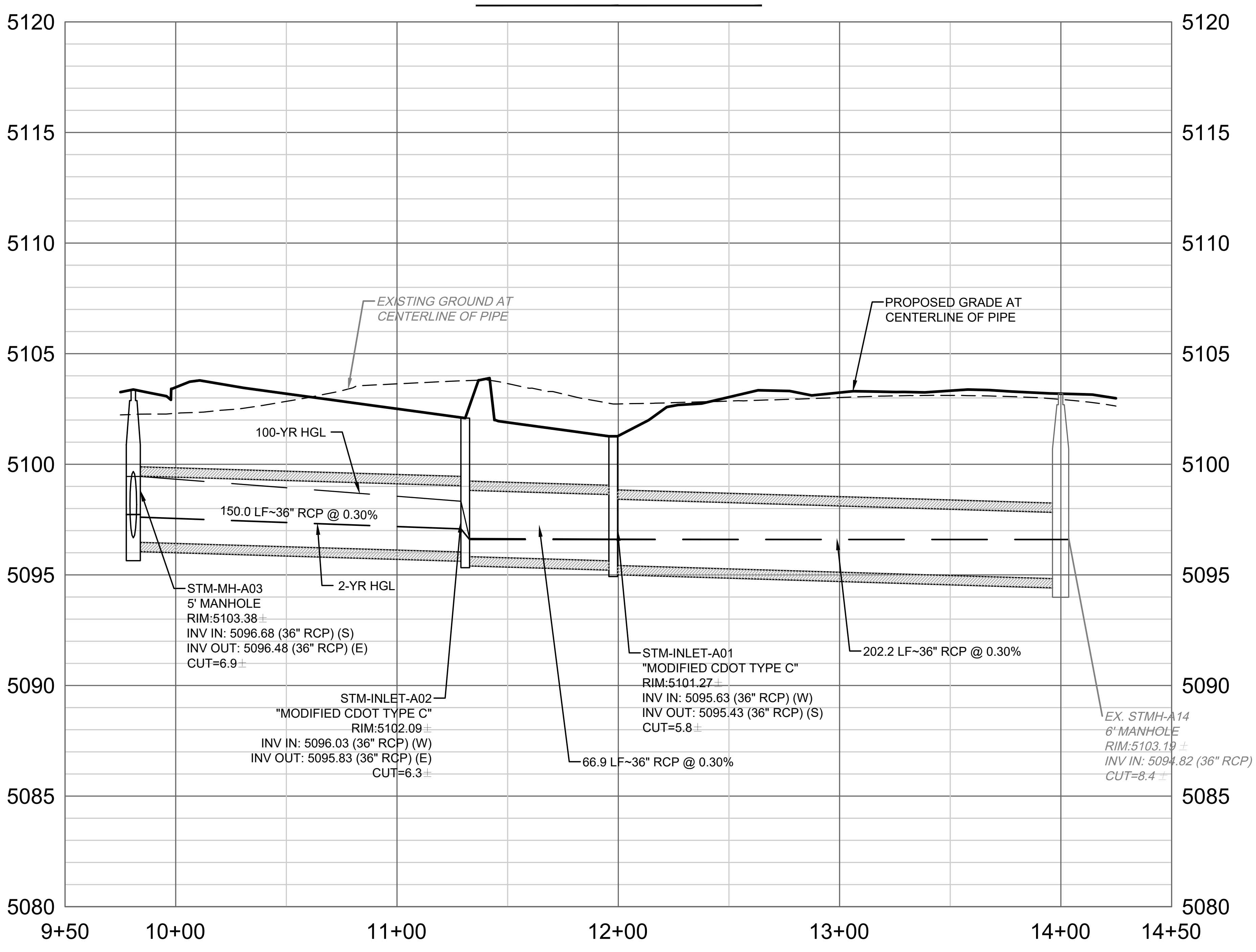
0 25 50 100

SCALE: Hor: 1" =50'
SCALE: Vert: 1" = 5'

ORIGINAL GRAPHIC SCALE

STA. 9+50.00 TO STA. 14+50.00

OFFSITE STORM SEWER



STM-MH-A03
5' MANHOLE
RIM:5103.38±
INV IN: 5096.68 (36" RCP) (S)
INV OUT: 5096.48 (36" RCP) (E)
CUT=6.9±

STM-INLET-A02
"MODIFIED CDOT TYPE C"
RIM:5102.09±
INV IN: 5096.03 (36" RCP) (W)
INV OUT: 5095.83 (36" RCP) (E)
CUT=6.3±

STM-INLET-A01
"MODIFIED CDOT TYPE C"
RIM:5101.27±
INV IN: 5095.63 (36" RCP) (W)
INV OUT: 5095.43 (36" RCP) (S)
CUT=5.8±

EX. STMH-A14
6' MANHOLE
RIM:5103.19 ±
INV IN: 5094.82 (36" RCP) (N)
CUT=8.4 ±

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

OFFSITE
STORM SEWER PLAN & PROFILE

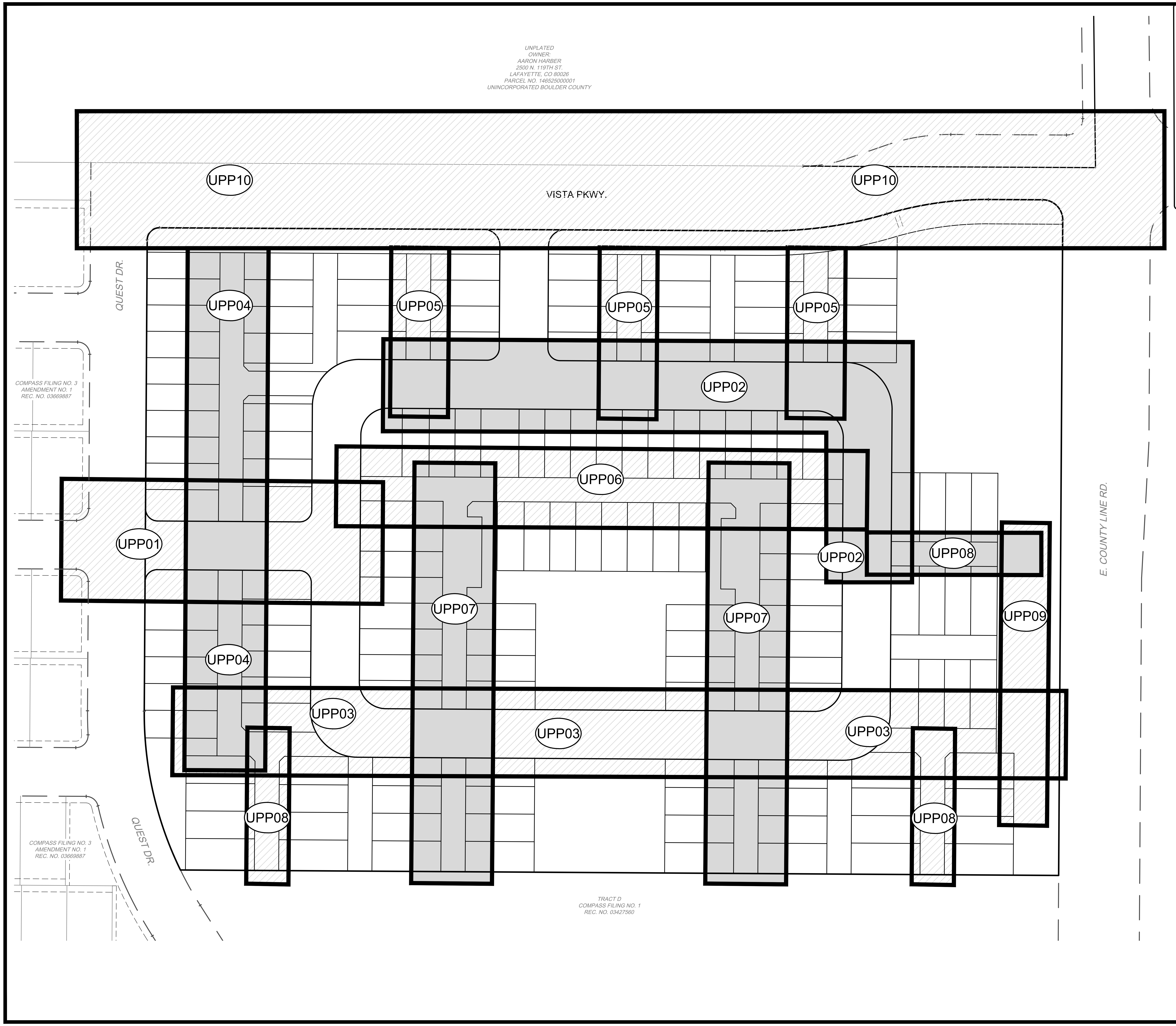
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

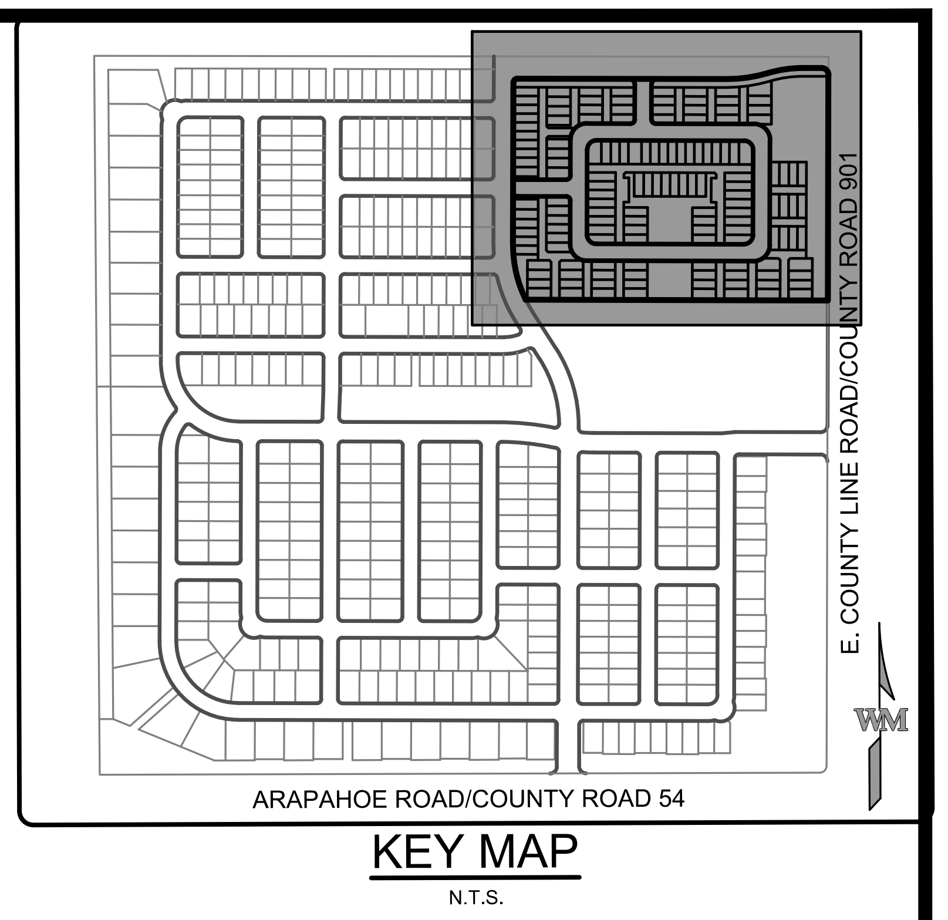
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
STM01
Sheet 44 of 74

NOT FOR CONSTRUCTION

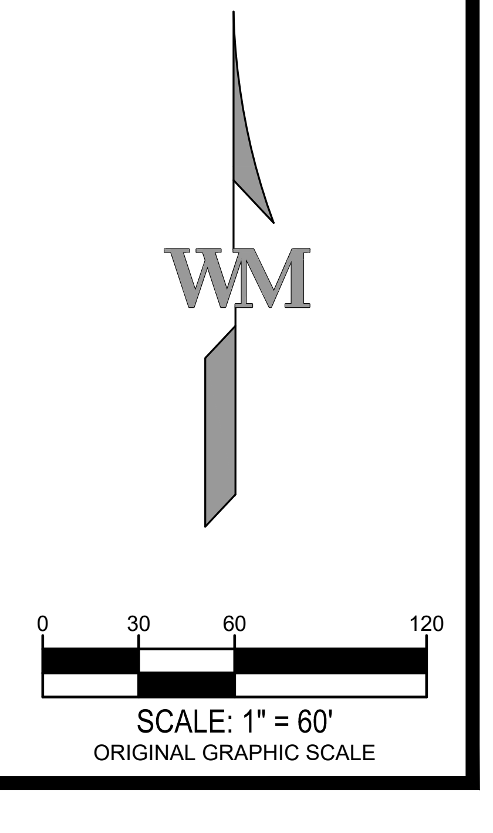
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP

N.T.S.



SCALE: 1" = 60'
ORIGINAL GRAPHIC SCALE

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018

FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

UTILITY PLAN & PROFILE INDEX SHEET

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

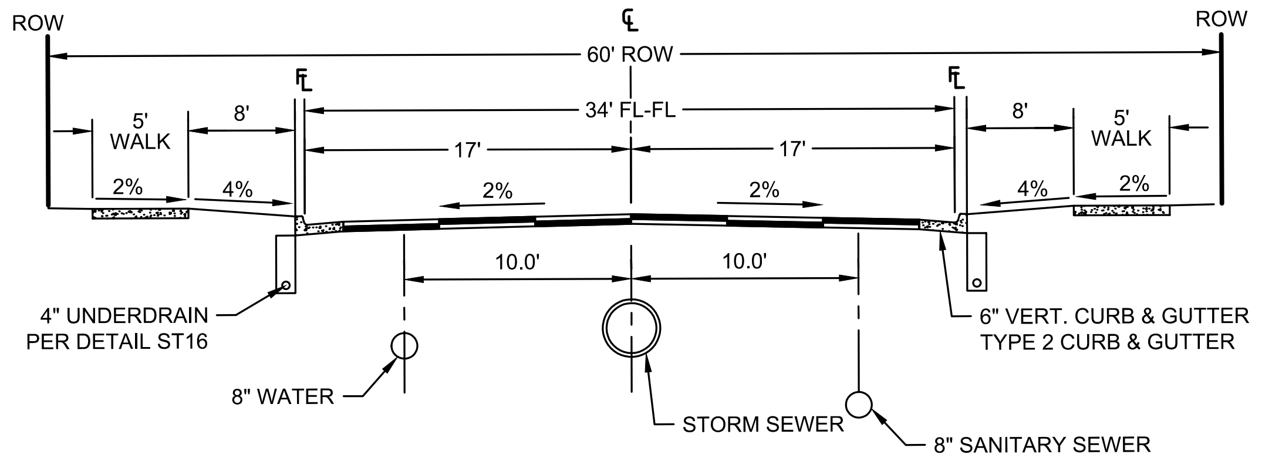
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
UPPI01

Sheet 45 of 74

NOT FOR CONSTRUCTION

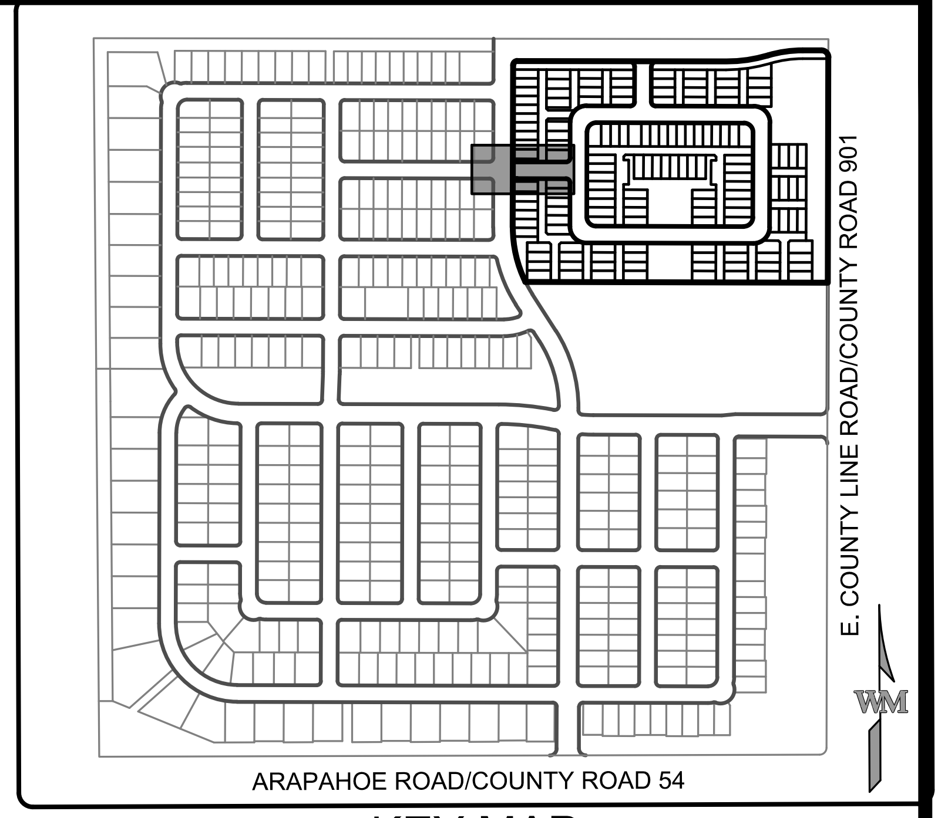
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



LOCAL STREET

N.T.S.

CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION

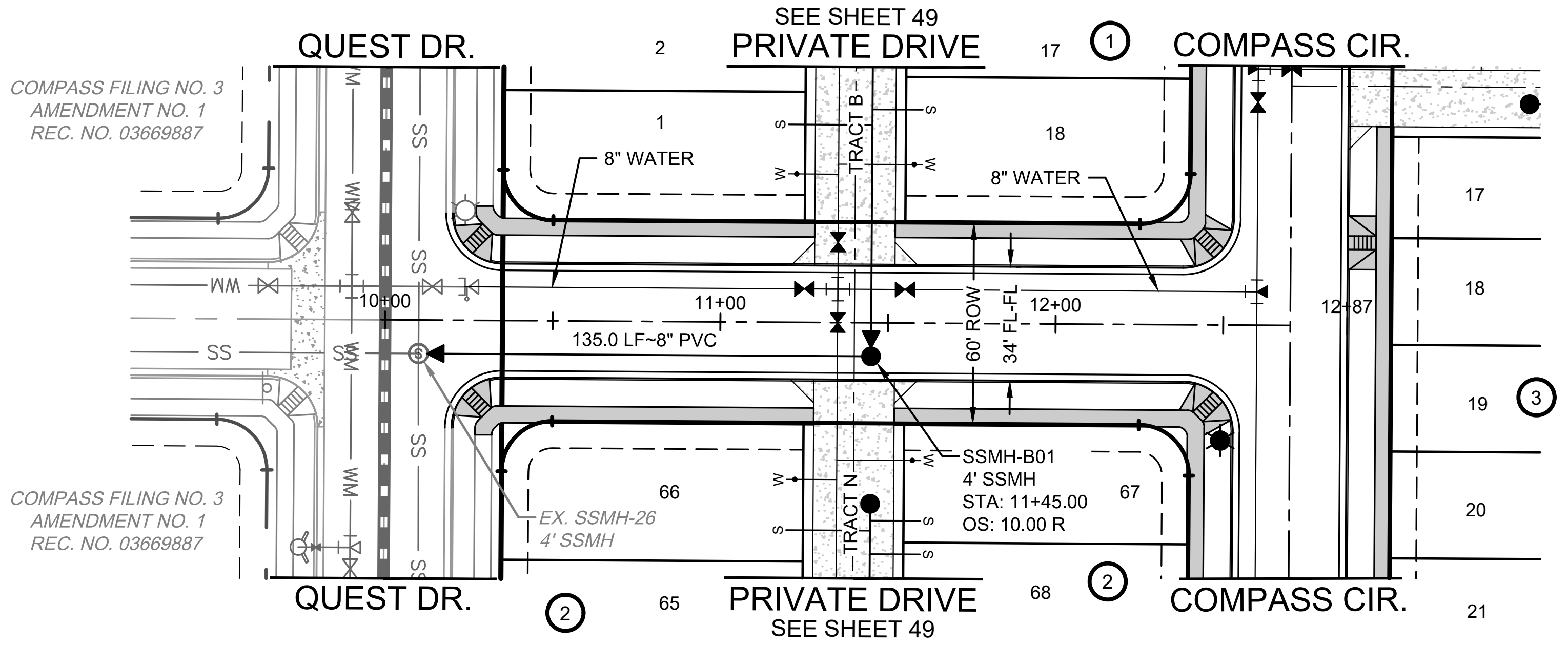


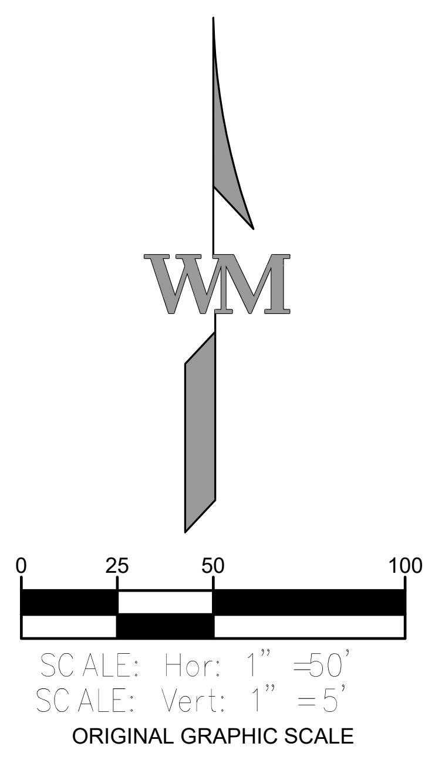
KEY MAP

N.T.S.

NOTES:

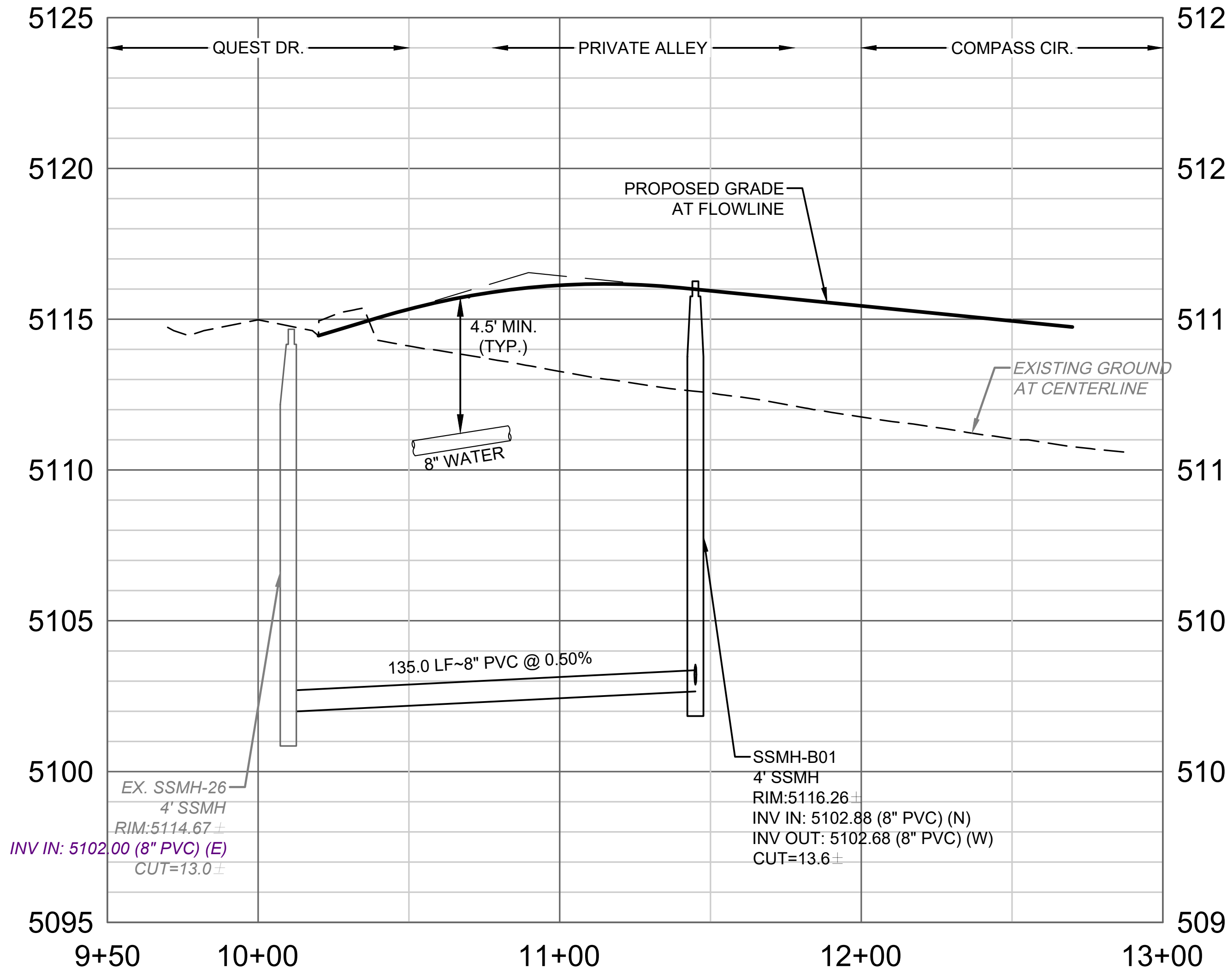
1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED ON PLANS.
2. REFER TO THE TOWN OF ERIE STANDARDS AND SPECIFICATION REGARDING THE CONSTRUCTION OF ALL PUBLIC ROADWAY AND UTILITY IMPROVEMENTS.
3. SANITARY SEWER LENGTHS ARE FROM CENTER OF STRUCTURE TO CENTER OF STRUCTURE TO DETERMINE SLOPE.
4. CONTRACTOR SHALL PROVIDE VERTICAL FITTINGS, THRUST BLOCKS, ETC. CONSTRUCTED IN ACCORDANCE WITH CITY STANDARDS AND SPECIFICATIONS AS REQUIRED TO MAINTAIN A MINIMUM OF 4.5 FEET OF COVER.





STA. 09+50.00 TO STA. 13+00.00

BYRD DR.



WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

BYRD DR.
UTILITY PLAN & PROFILE

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

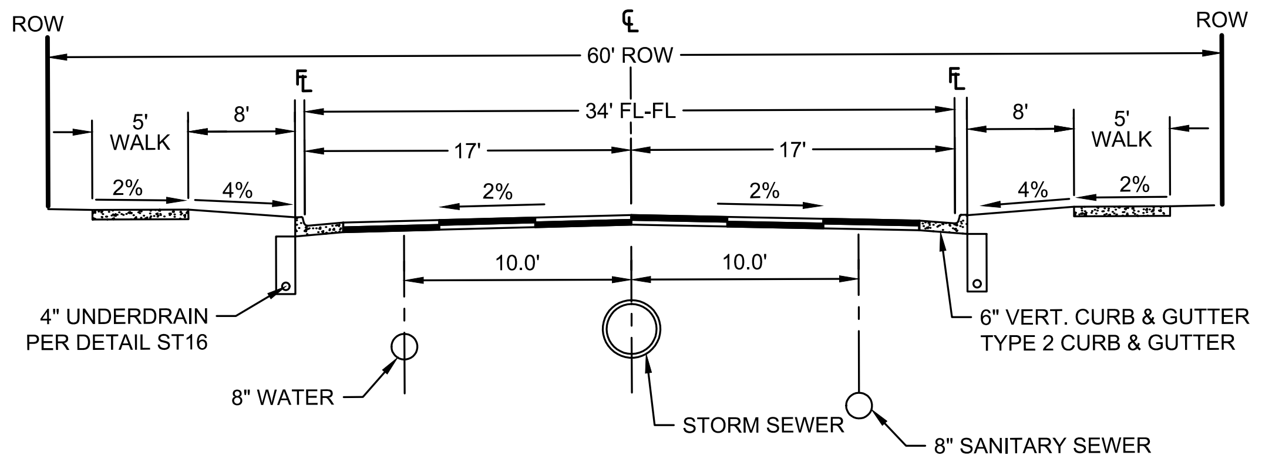
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
UPP01
Sheet 46 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT

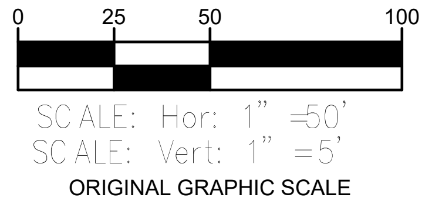
NOTES:

1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED ON PLANS.
2. REFER TO THE TOWN OF ERIE STANDARDS AND SPECIFICATION REGARDING THE CONSTRUCTION OF ALL PUBLIC ROADWAY AND UTILITY IMPROVEMENTS.
3. SANITARY SEWER LENGTHS ARE FROM CENTER OF STRUCTURE TO CENTER OF STRUCTURE TO DETERMINE SLOPE.
4. CONTRACTOR SHALL PROVIDE VERTICAL FITTINGS, THRUST BLOCKS, ETC. CONSTRUCTED IN ACCORDANCE WITH CITY STANDARDS AND SPECIFICATIONS AS REQUIRED TO MAINTAIN A MINIMUM OF 4.5 FEET OF COVER.

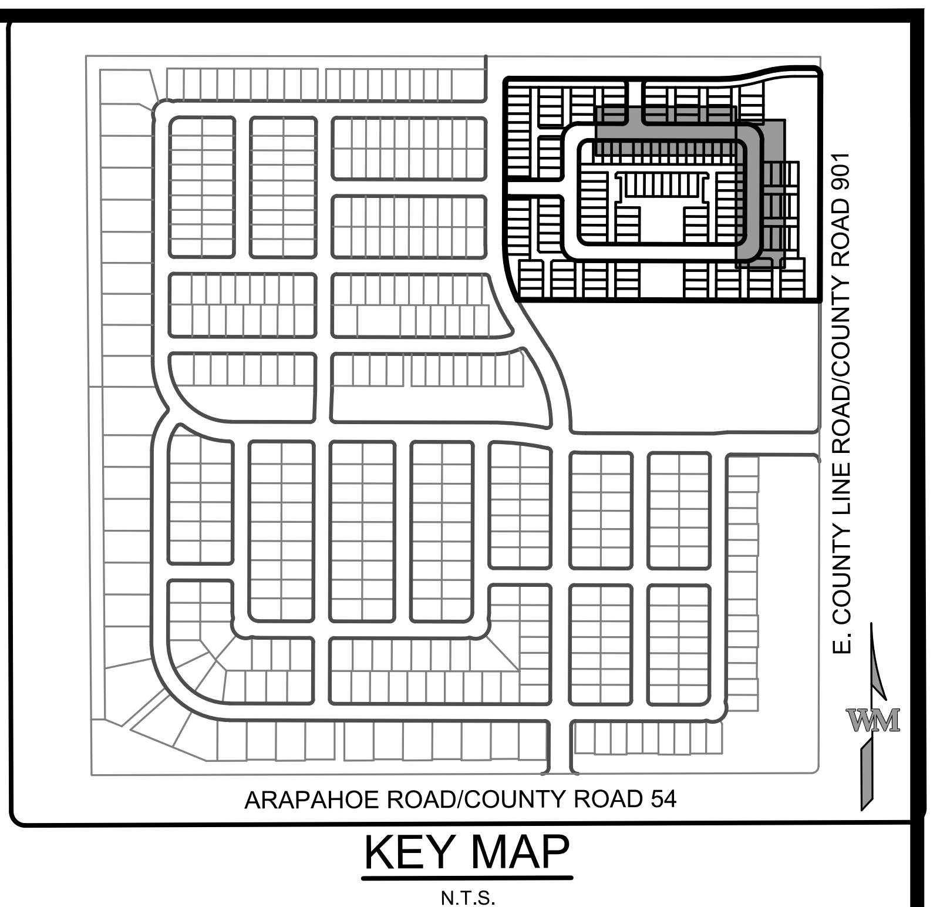


LOCAL STREET

N.T.S.

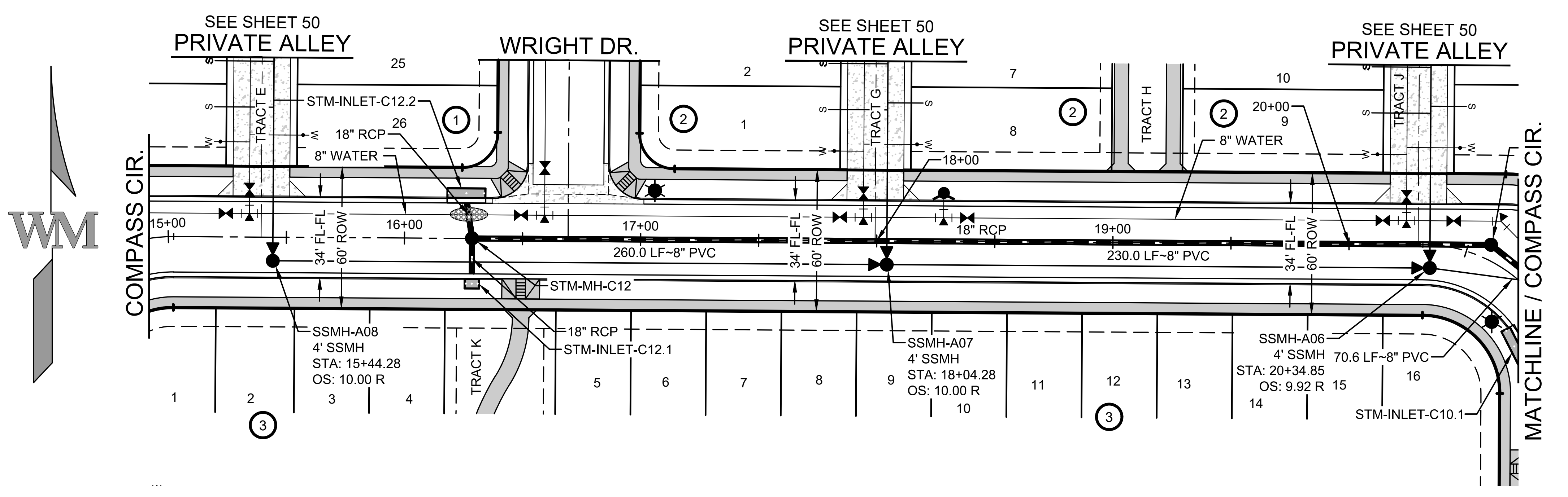


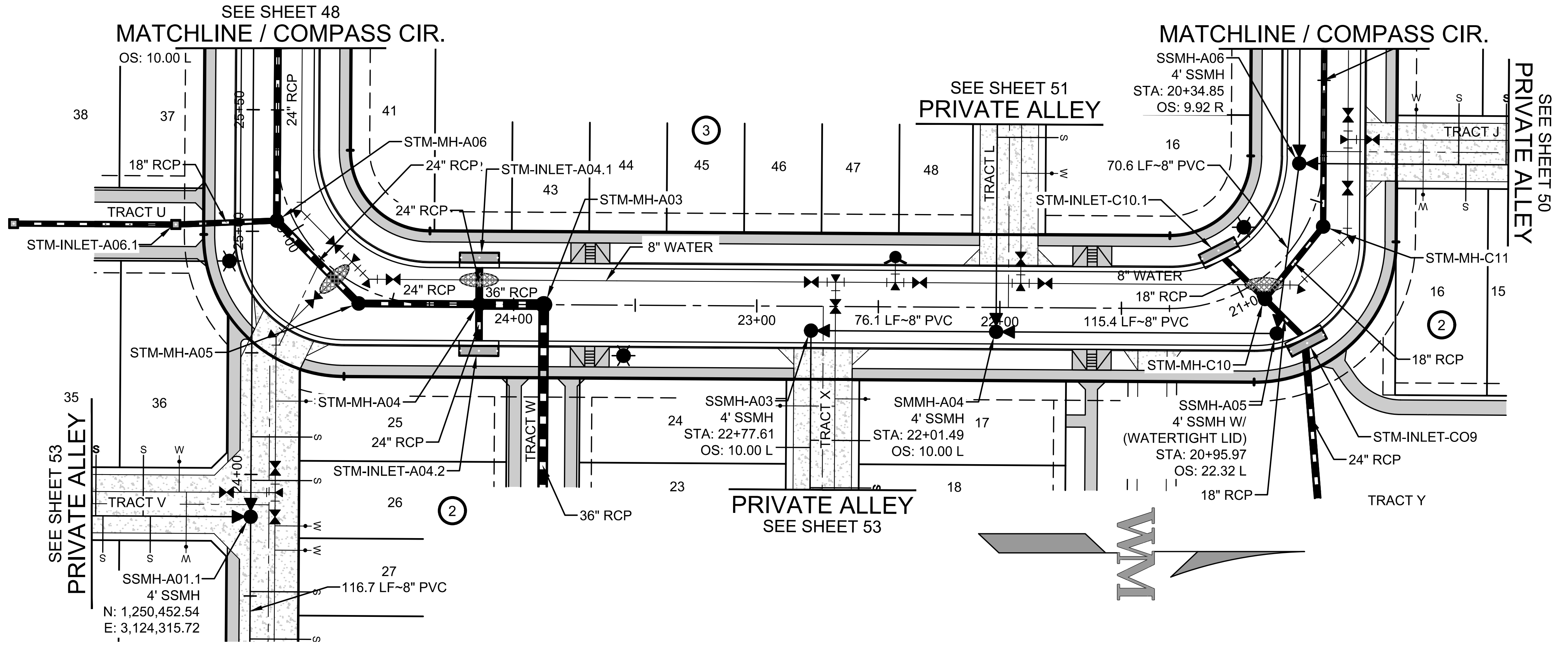
CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION



KEY MAP

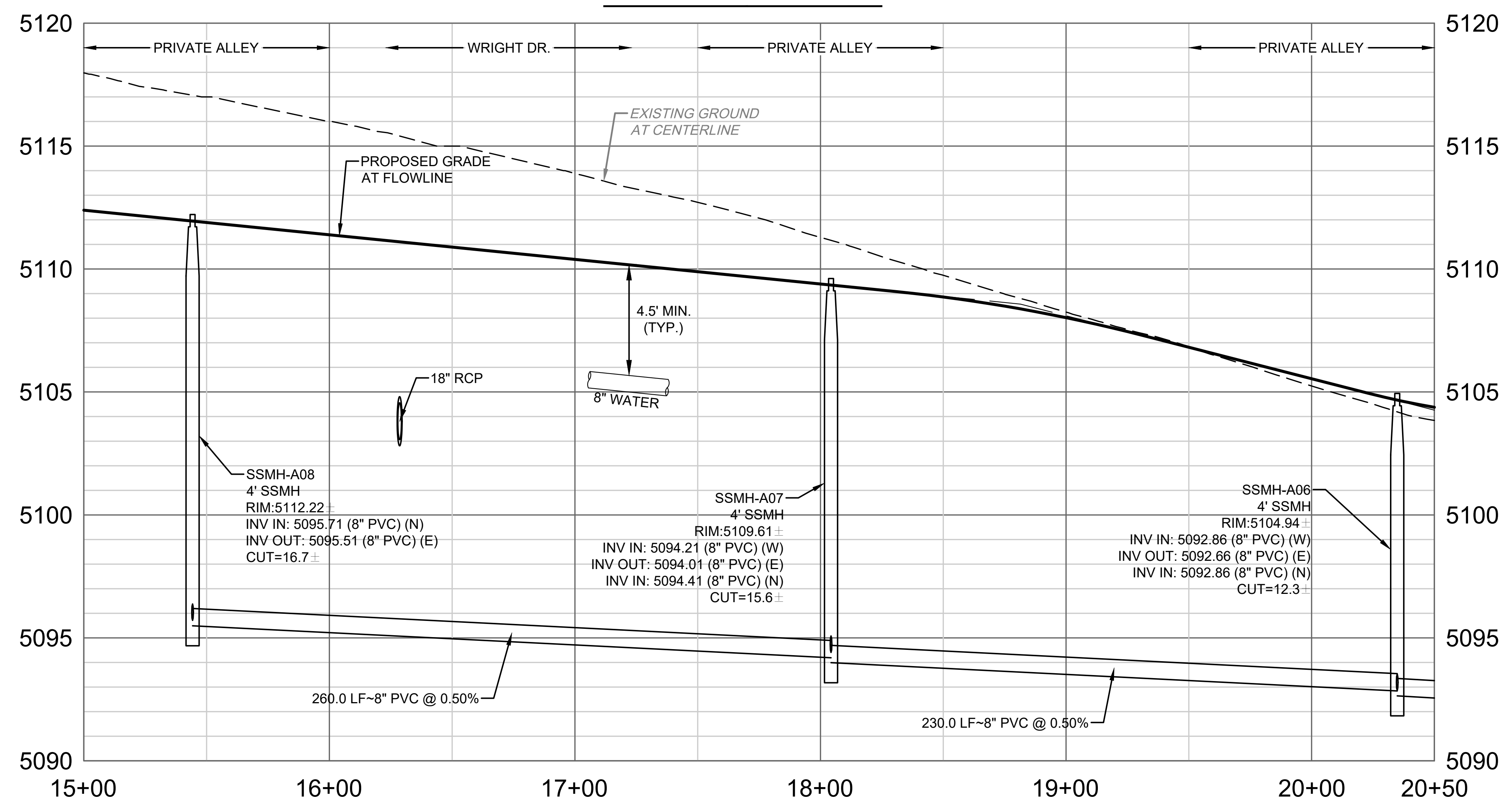
N.T.S.





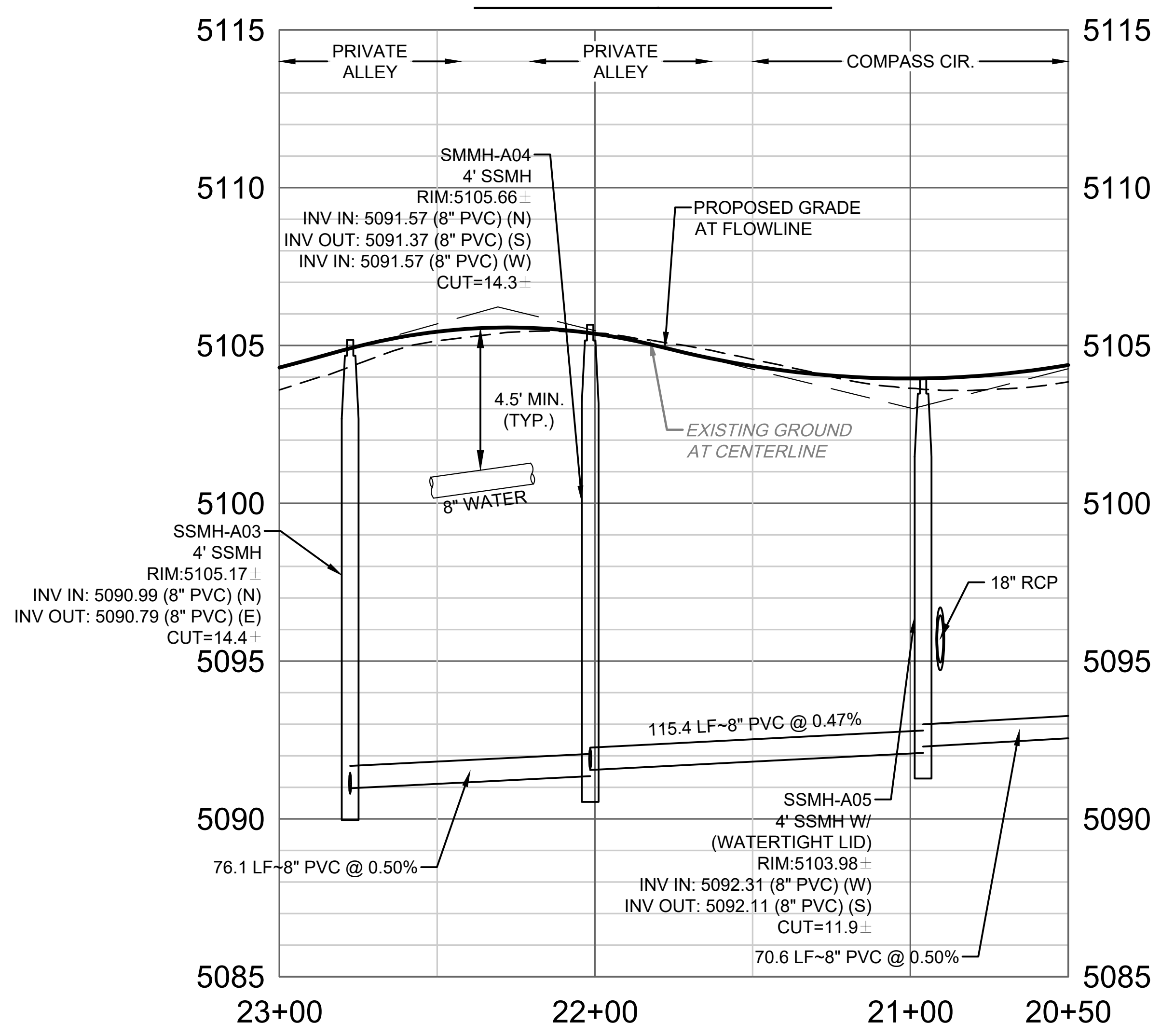
STA. 15+00.00 TO STA. 20+50.00

COMPASS CIR.



STA. 23+00.00 TO STA. 20+50.00

COMPASS CIR.



WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

COMPASS CIR.
UTILITY PLAN & PROFILE

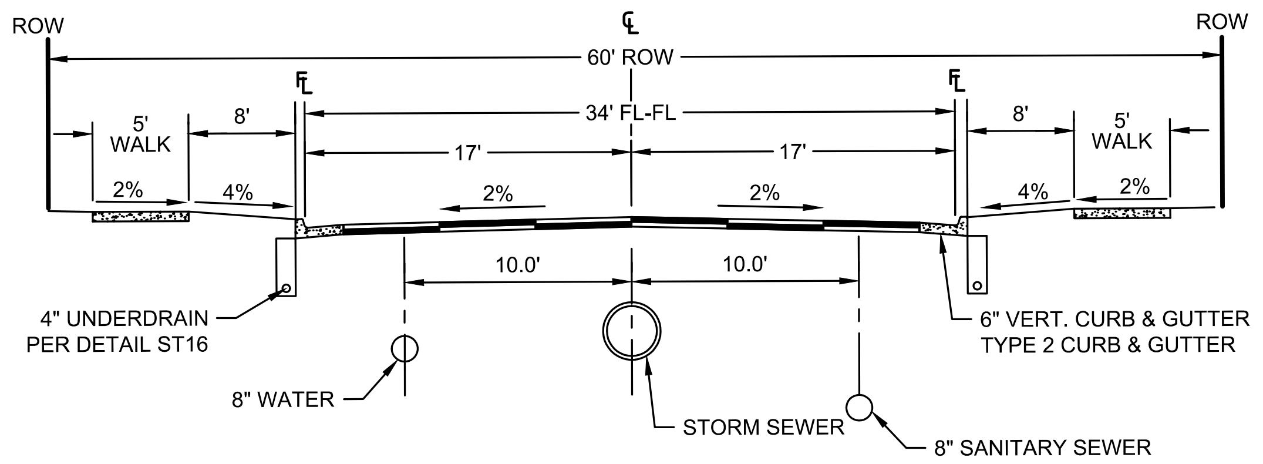
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
UPP02
Sheet 47 of 74

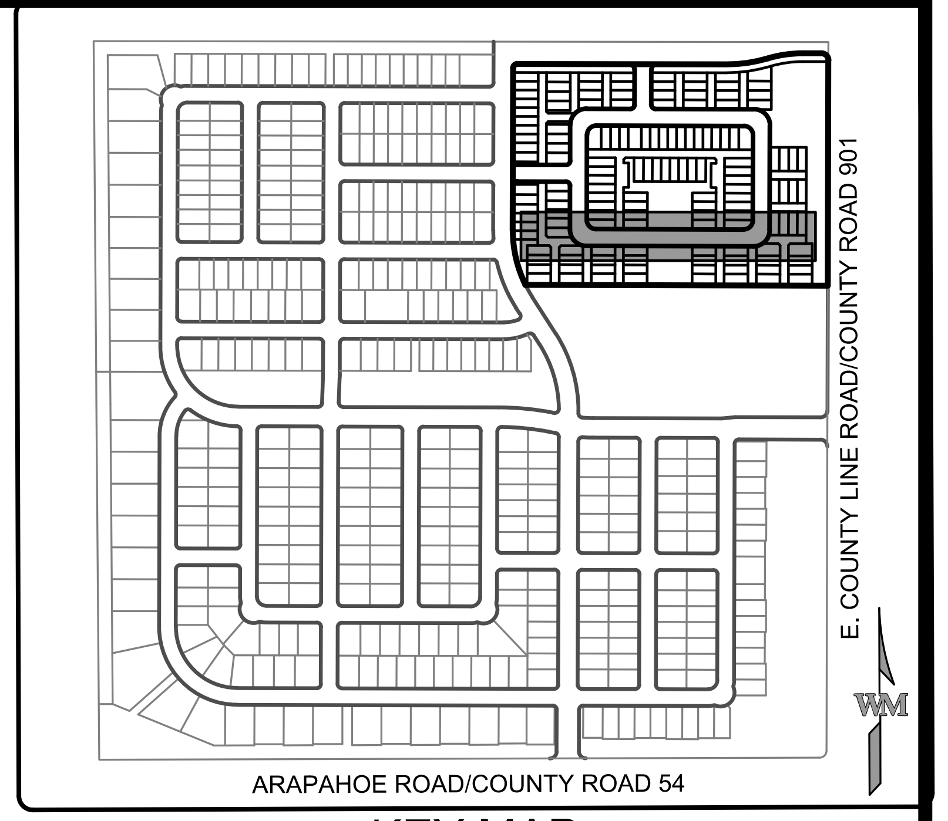
NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



LOCAL STREET

N.T.S.



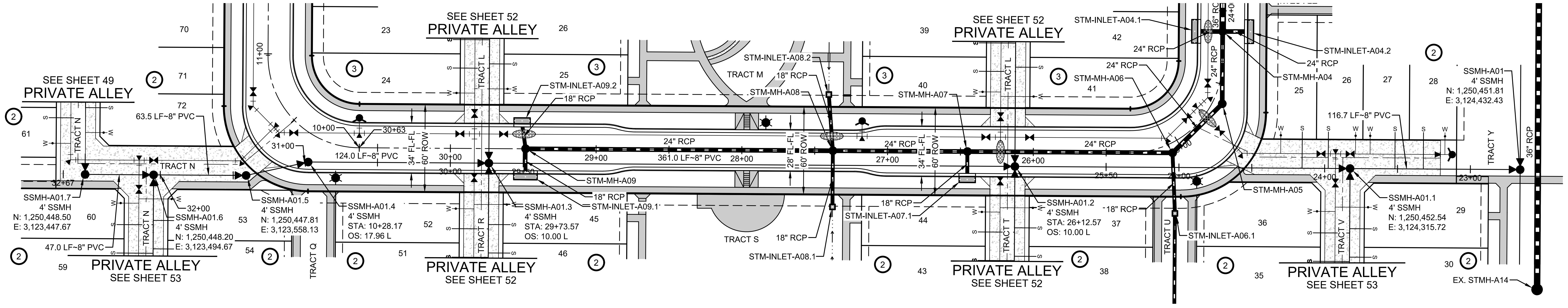
KEY MAP

N.T.S.

NOTES:

1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED ON PLANS.
2. REFER TO THE TOWN OF ERIE STANDARDS AND SPECIFICATION REGARDING THE CONSTRUCTION OF ALL PUBLIC ROADWAY AND UTILITY IMPROVEMENTS.
3. SANITARY SEWER LENGTHS ARE FROM CENTER OF STRUCTURE TO CENTER OF STRUCTURE TO DETERMINE SLOPE.
4. CONTRACTOR SHALL PROVIDE VERTICAL FITTINGS, THRUST BLOCKS, ETC. CONSTRUCTED IN ACCORDANCE WITH CITY STANDARDS AND SPECIFICATIONS AS REQUIRED TO MAINTAIN A MINIMUM OF 4.5 FEET OF COVER.

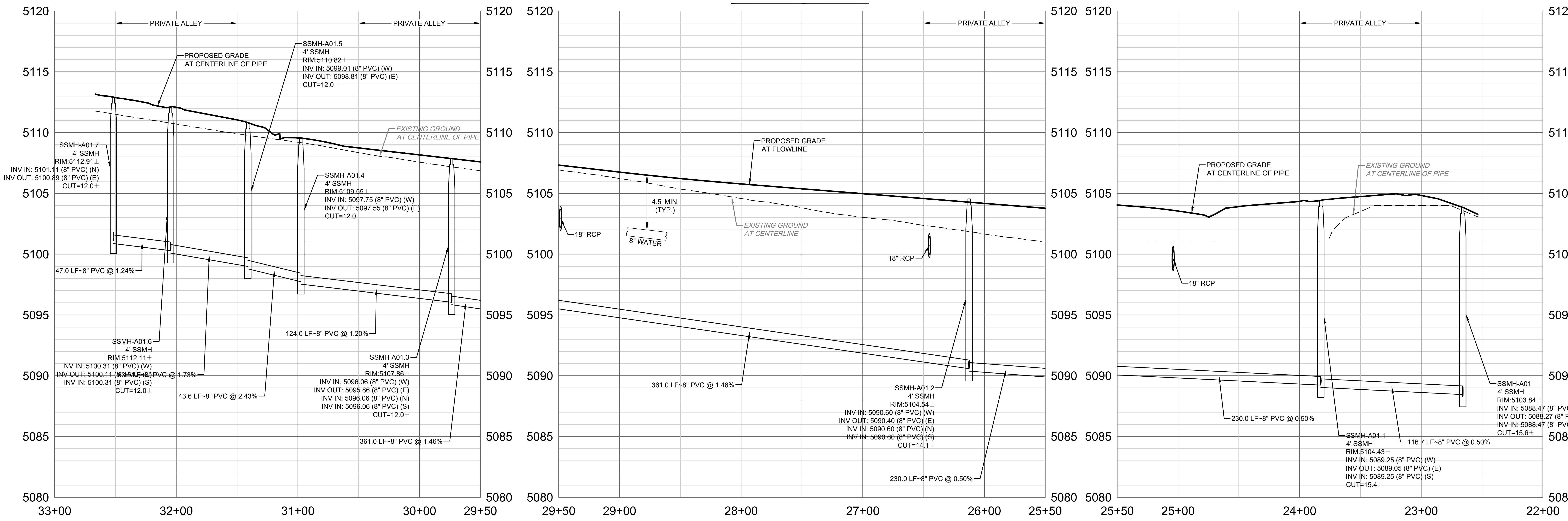
CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION

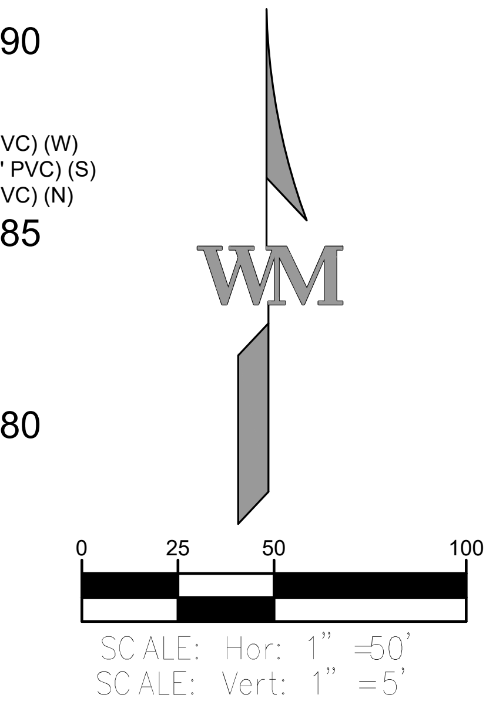


SANITARY SEWER SERVICE TABLE			
BLOCK	LOT	STATION	STUB INV
2	25	0+33	5091.1
2	26	0+15	5091.0
2	27	0+86	5090.6
2	28	0+66	5090.5

STA. 22+00.00 TO STA. 33+00.00

COMPASS CIR.





ORIGINAL GRAPHIC SCALE

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

COMPASS CIR.
UTILITY PLAN & PROFILE

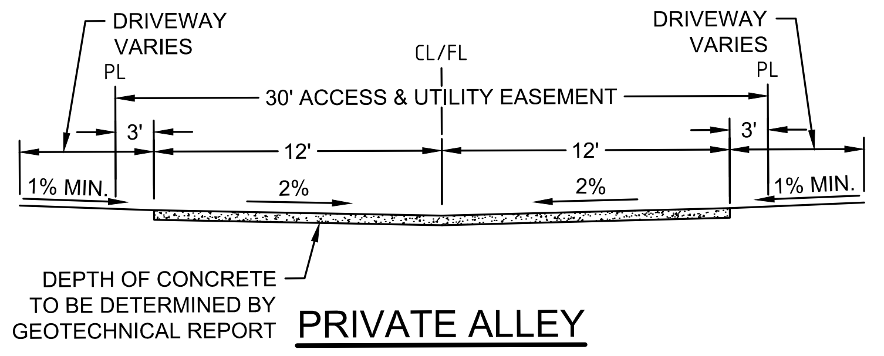
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
UPP03
Sheet 48 of 74

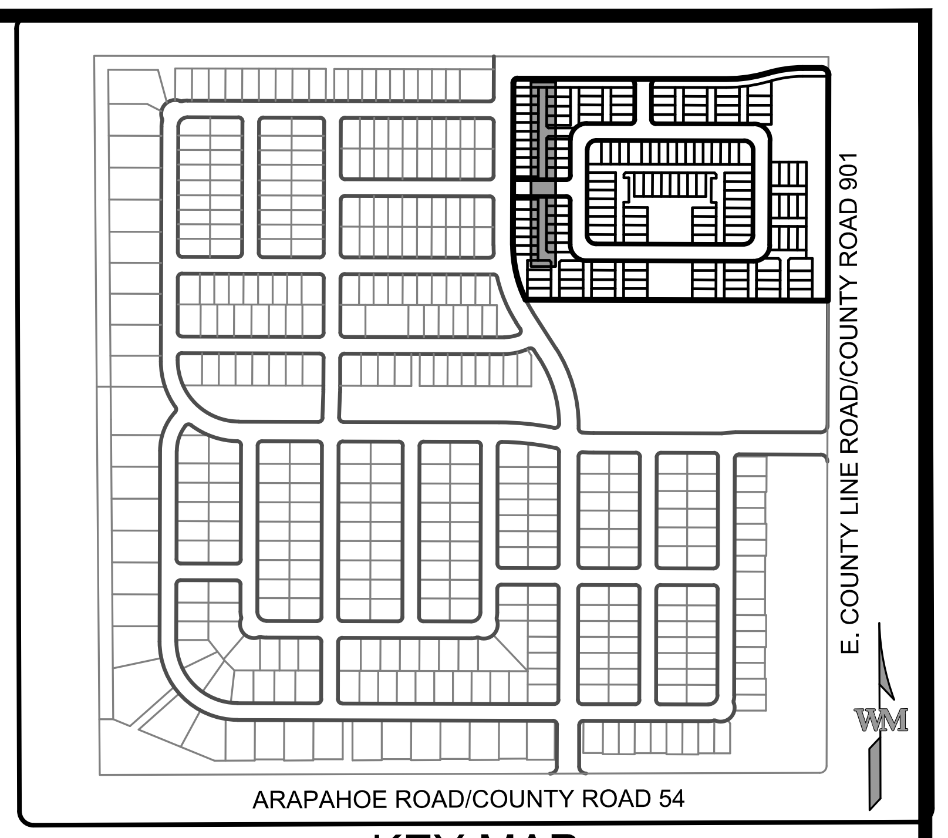
NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



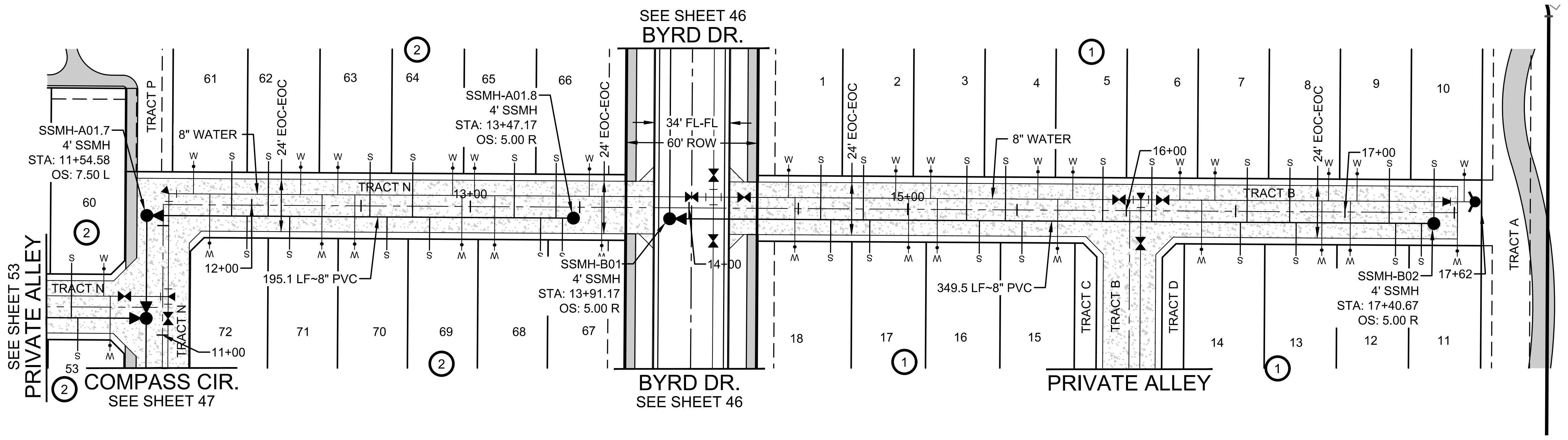
PRIVATE ALLEY

N.T.S.



KEY MAP

N.T.S.



NOTES:

1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED ON PLANS.
2. REFER TO THE TOWN OF ERIE STANDARDS AND SPECIFICATION REGARDING THE CONSTRUCTION OF ALL PUBLIC ROADWAY AND UTILITY IMPROVEMENTS.
3. SANITARY SEWER LENGTHS ARE FROM CENTER OF STRUCTURE TO CENTER OF STRUCTURE TO DETERMINE SLOPE.
4. CONTRACTOR SHALL PROVIDE VERTICAL FITTINGS, THRUST BLOCKS, ETC. CONSTRUCTED IN ACCORDANCE WITH CITY STANDARDS AND SPECIFICATIONS AS REQUIRED TO MAINTAIN A MINIMUM OF 4.5 FEET OF COVER.

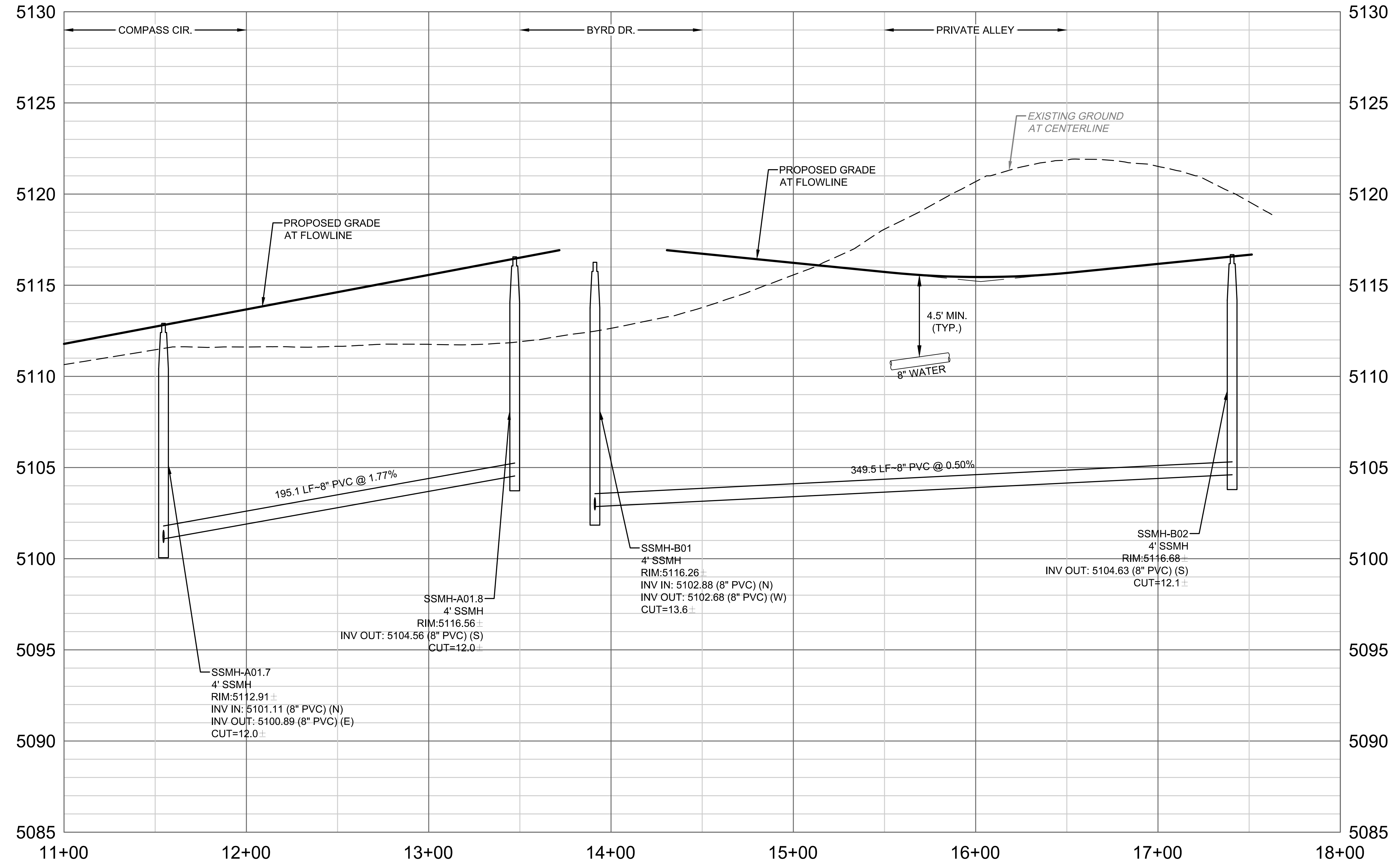
CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION

0 25 50 100

SCALE: Hor: 1" =50'
SCALE: Vert: 1" =5'
ORIGINAL GRAPHIC SCALE

STA. 11+00.00 TO STA. 18+00.00

PRIVATE ALLEY - TRACT N & TRACT B



SANITARY SEWER SERVICE TABLE			
BLOCK	LOT	STATION	STUB INV
2	61	0+39	5103.5
2	72	0+46	5103.4
2	62	0+55	5103.8
2	71	0+65	5103.8
2	63	1+02	5104.6
2	70	1+10	5104.5
2	64	1+21	5105.0
2	69	1+29	5104.9
2	65	1+68	5105.8
2	68	1+80	5105.8
2	66	1+87	5106.1
2	67	1+90	5106.0
1	1	0+69	5104.9
1	18	0+74	5104.7
1	2	0+89	5105.0
1	17	0+92	5104.8
1	3	1+36	5105.3
1	16	1+61	5105.2
1	4	1+54	5105.3
1	15	1+61	5105.2
1	5	1+98	5105.6
1	6	2+20	5105.7
1	14	2+61	5105.7
1	7	2+64	5105.9
1	8	2+84	5106.0
1	13	2+87	5105.8
1	9	3+29	5106.2
1	12	3+32	5106.0
1	11	3+44	5106.1
1	10	3+50	5106.3

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

PRIVATE ALLEY TRACT B & N
UTILITY PLAN & PROIFLE

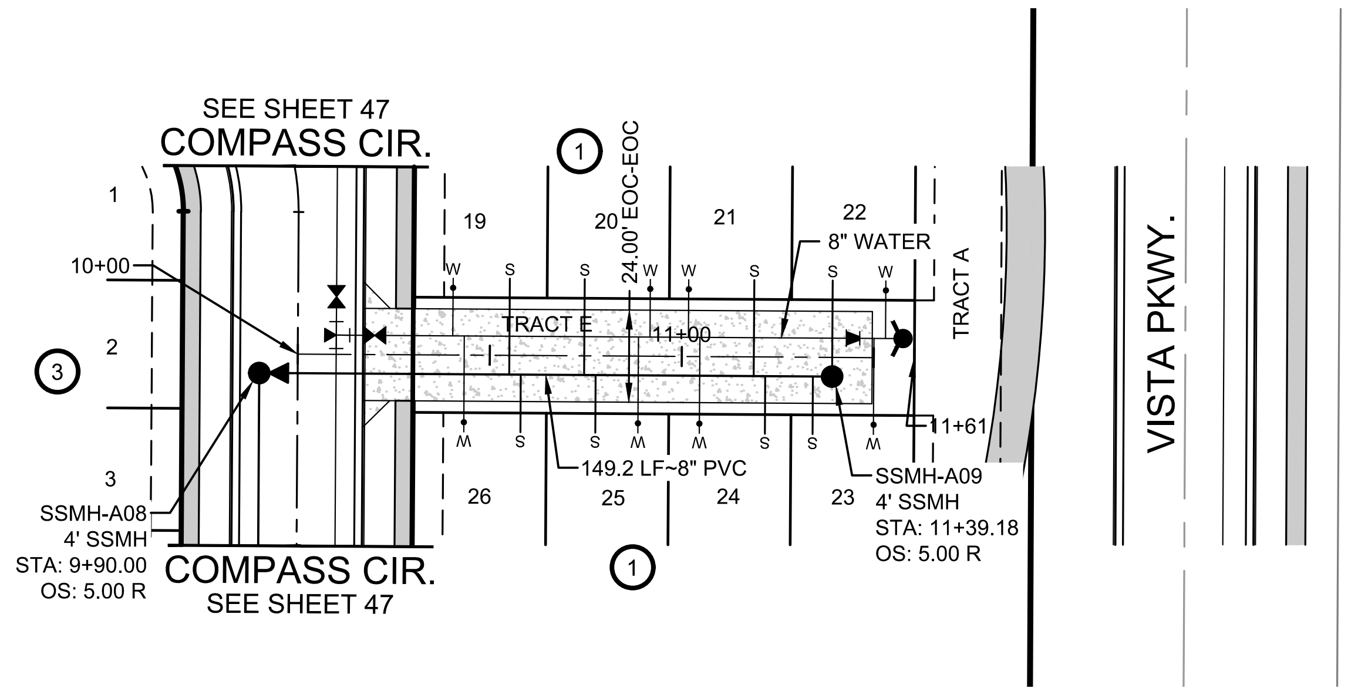
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

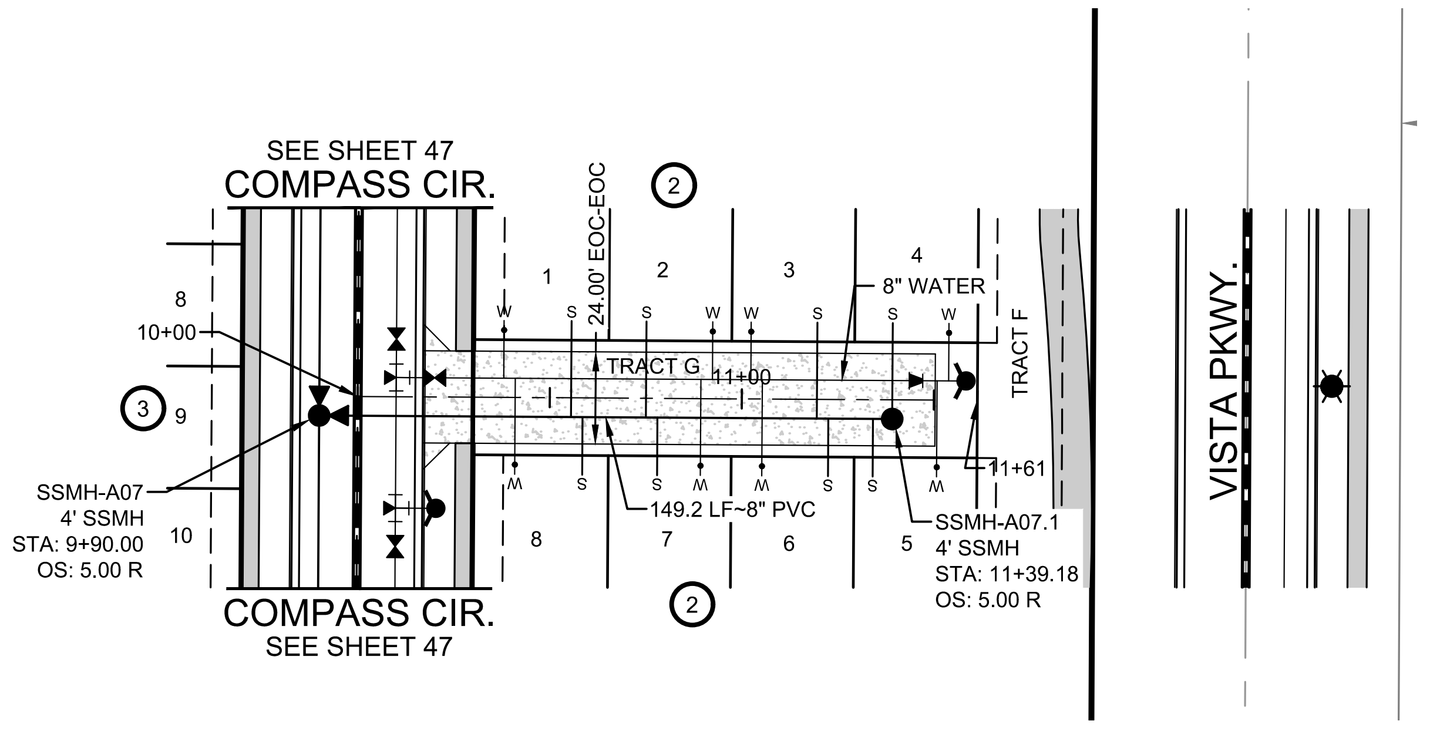
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

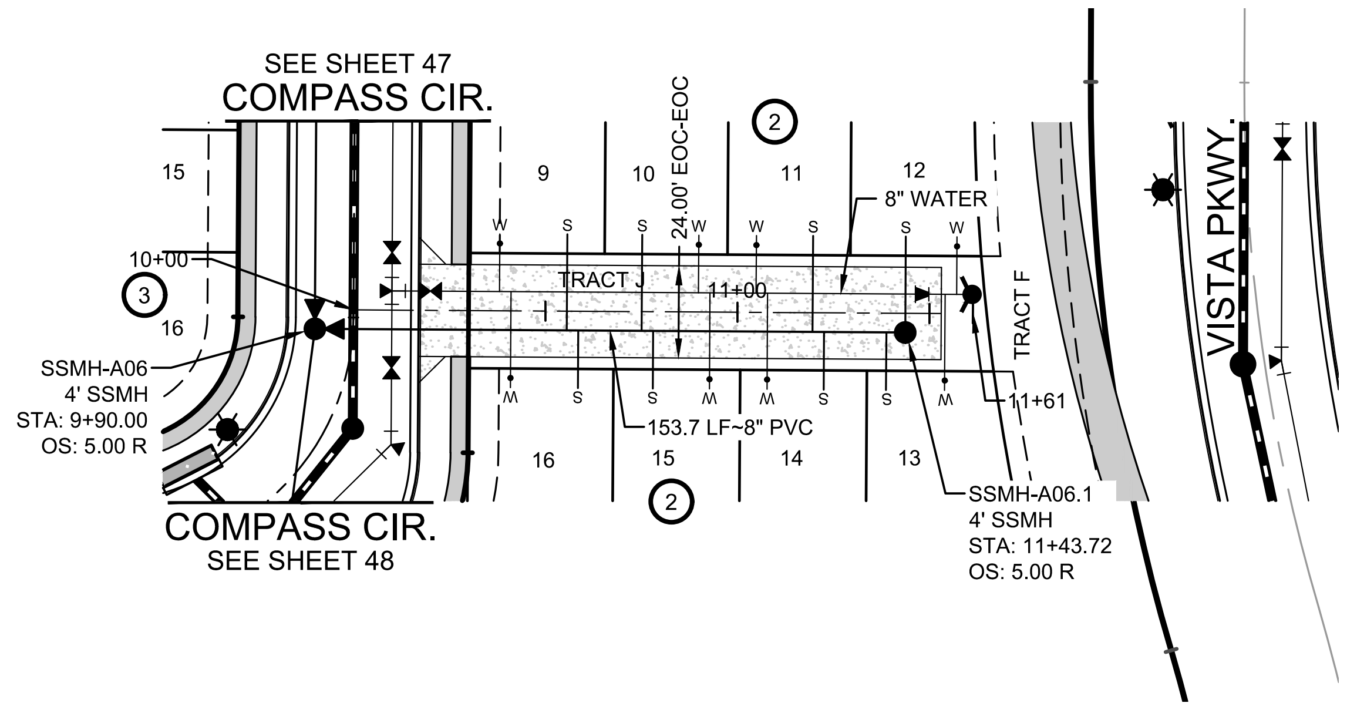
SHEET
UPP04
Sheet 49 of 74

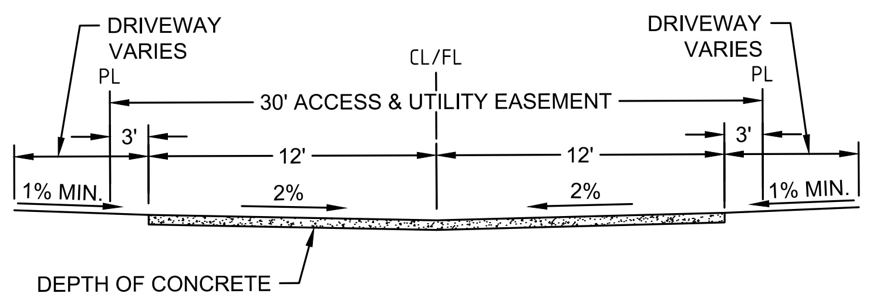
NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



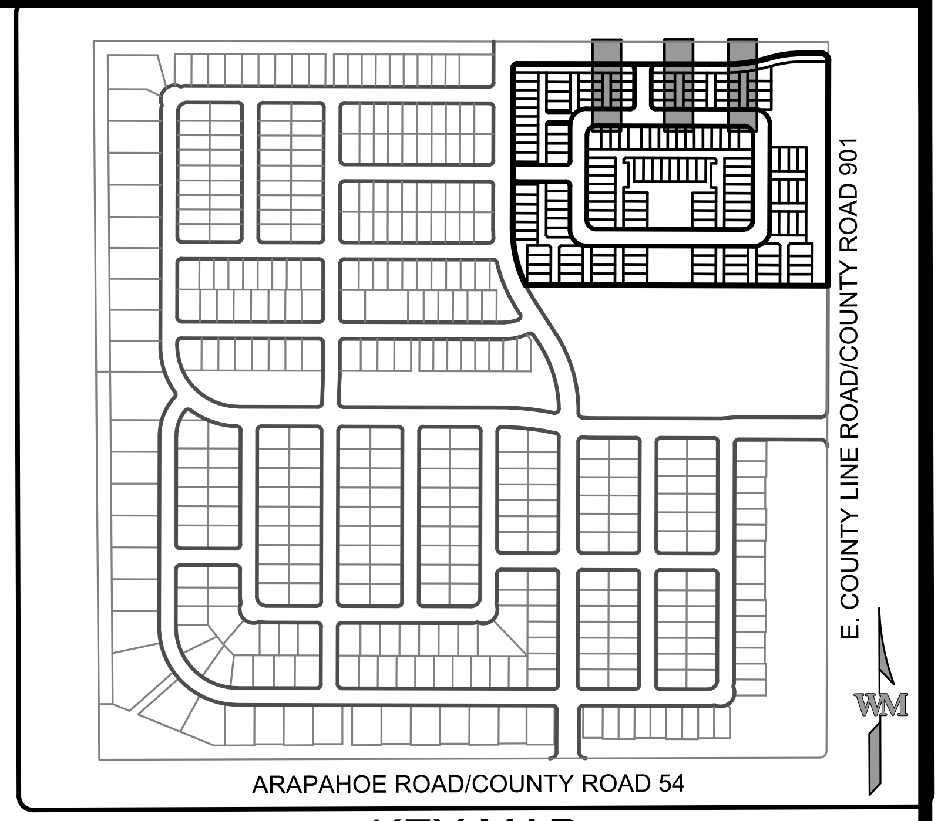






PRIVATE ALLEY

N.T.S.



KEY MAP

N.T.S.

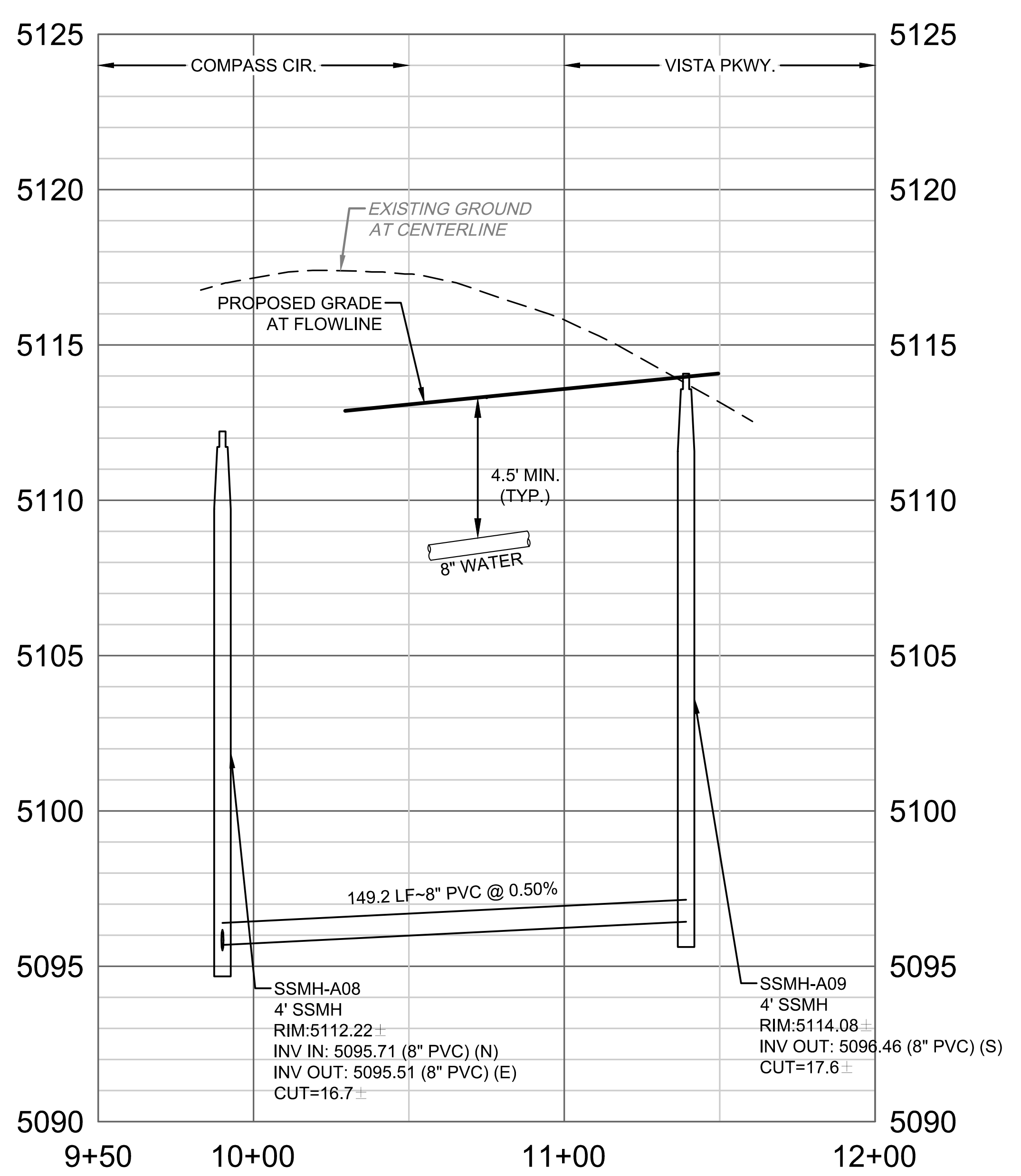
NOTES:

1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED ON PLANS.
2. REFER TO THE TOWN OF ERIE STANDARDS AND SPECIFICATION REGARDING THE CONSTRUCTION OF ALL PUBLIC ROADWAY AND UTILITY IMPROVEMENTS.
3. SANITARY SEWER LENGTHS ARE FROM CENTER OF STRUCTURE TO CENTER OF STRUCTURE TO DETERMINE SLOPE.
4. CONTRACTOR SHALL PROVIDE VERTICAL FITTINGS, THRUST BLOCKS, ETC. CONSTRUCTED IN ACCORDANCE WITH CITY STANDARDS AND SPECIFICATIONS AS REQUIRED TO MAINTAIN A MINIMUM OF 4.5 FEET OF COVER.

CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION

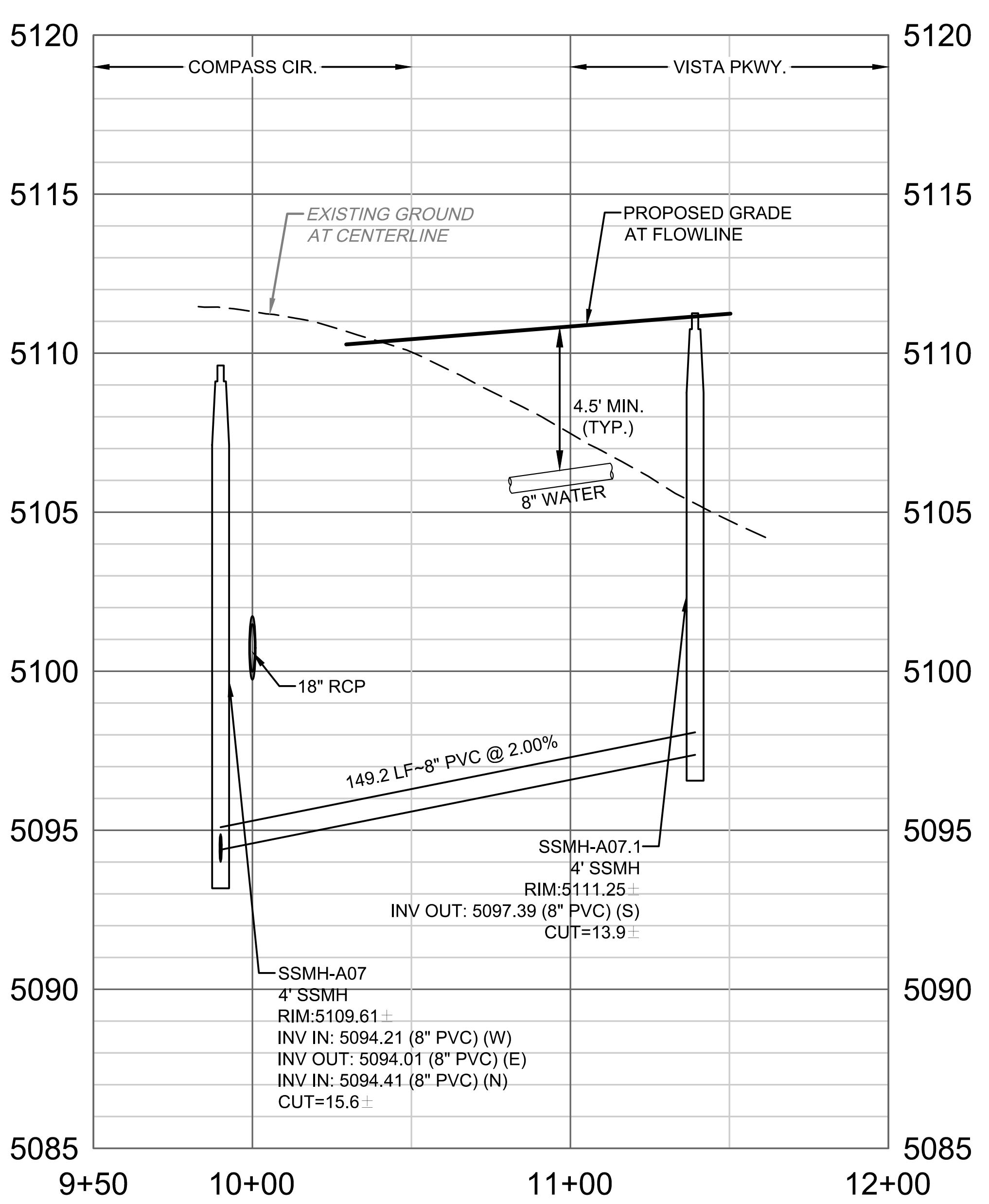
STA. 09+50.00 TO STA. 12+00.00

PRIVATE ALLEY - TRACT E



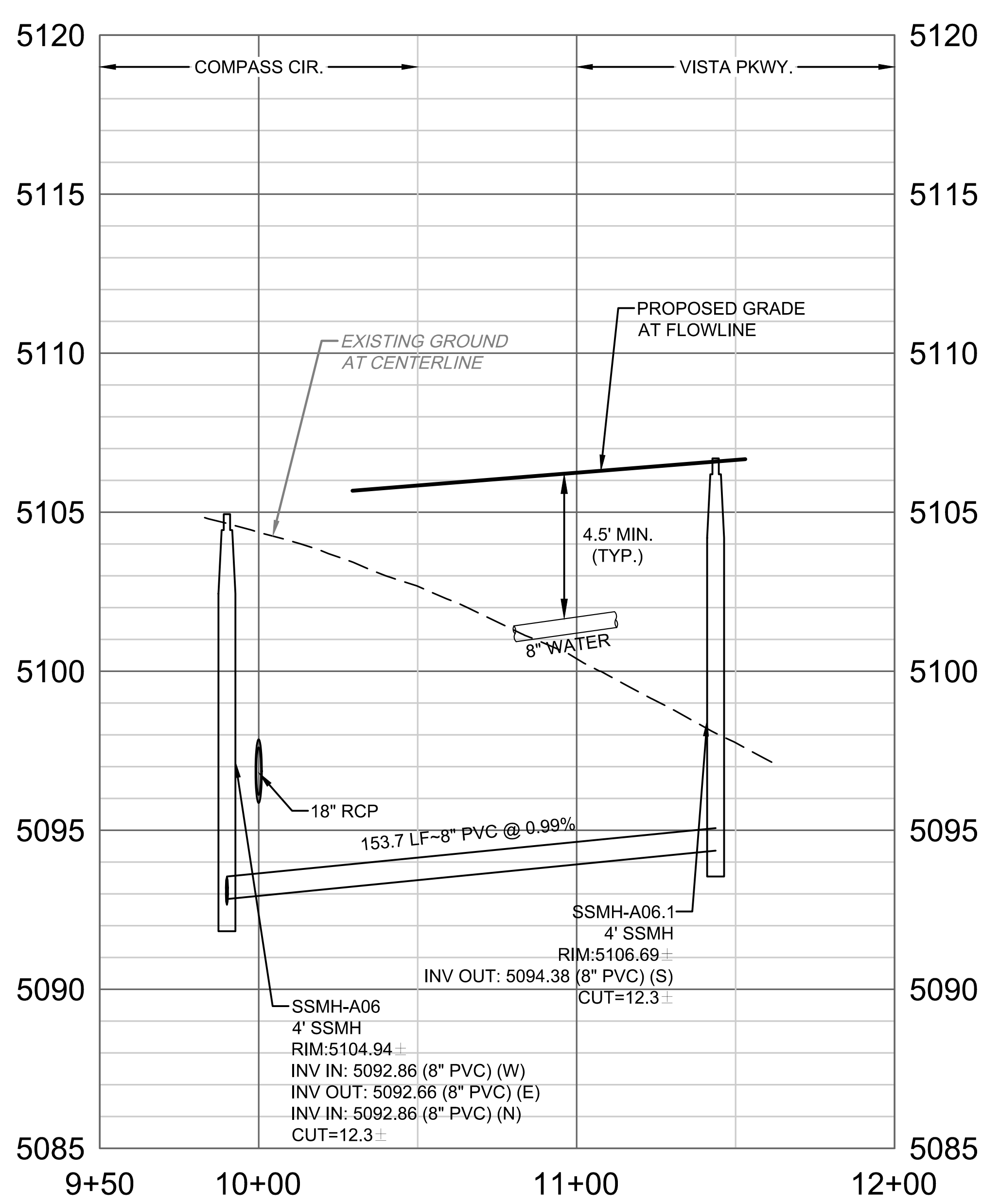
STA. 09+50.00 TO STA. 12+00.00

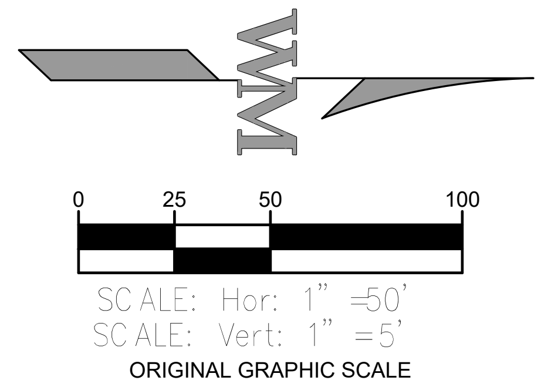
PRIVATE ALLEY - TRACT G



STA. 09+50.00 TO STA. 12+00.00

PRIVATE ALLEY - TRACT J





SANITARY SEWER SERVICE TABLE			
BLOCK	LOT	STATION	STUB INV
1	19	0+65	5097.7
1	26	0+68	5097.6
1	20	0+85	5097.8
1	25	0+88	5097.7
1	21	1+29	5098.1
1	24	1+32	5097.9
1	23	1+44	5097.9
1	22	1+49	5098.2
2	1	0+66	5097.4
2	8	0+69	5097.3
2	2	0+85	5097.8
2	7	0+88	5097.7
2	3	1+30	5098.7
2	6	1+33	5098.6
2	5	1+44	5098.8
2	4	1+49	5099.1
2	9	0+66	5095.2
2	16	0+69	5095.0
2	10	0+85	5095.4
2	15	0+88	5095.2
2	11	1+30	5095.9
2	14	1+33	5095.7
2	13	1+47	5095.8
2	12	1+52	5096.1

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

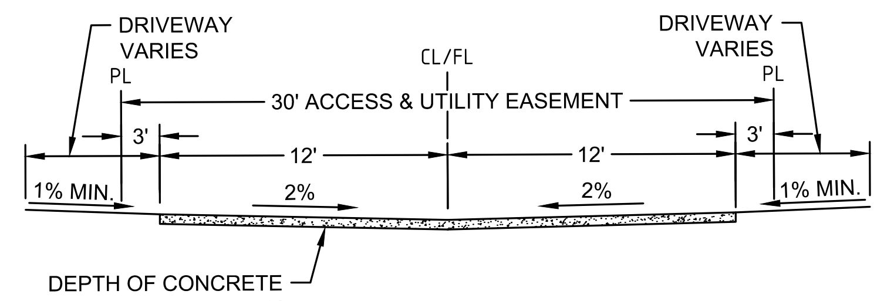
PRIVATE ALLEY TRACTS E, G, & J UTILITY PLAN & PROFILE

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

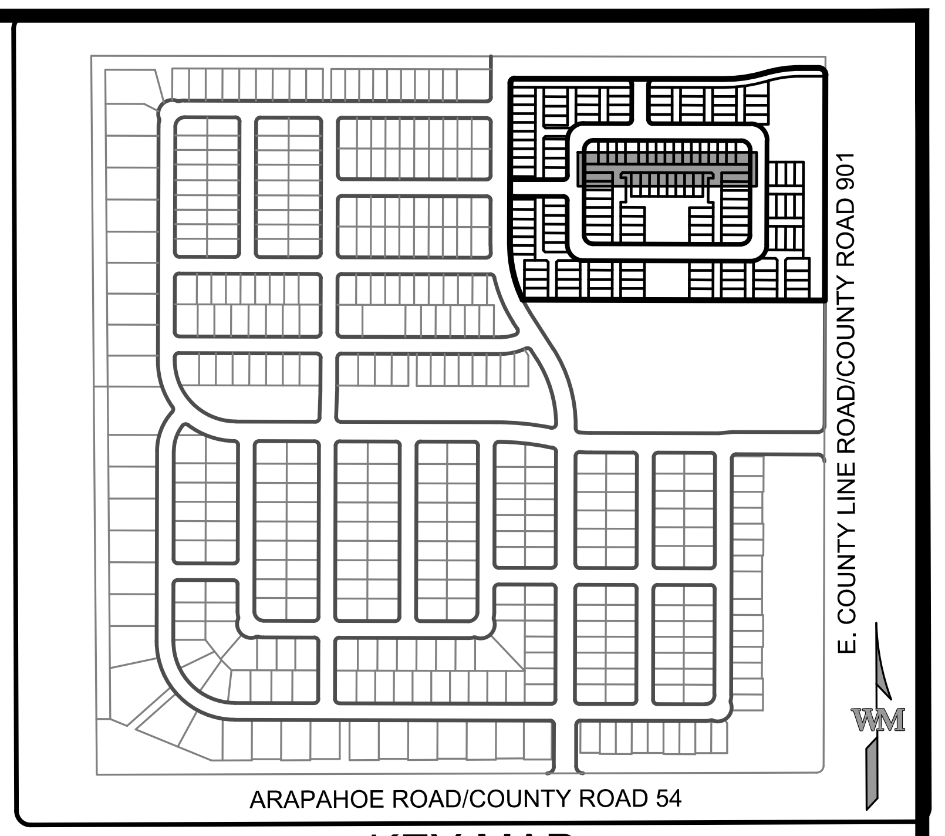
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
UPP05
Sheet 50 of 74

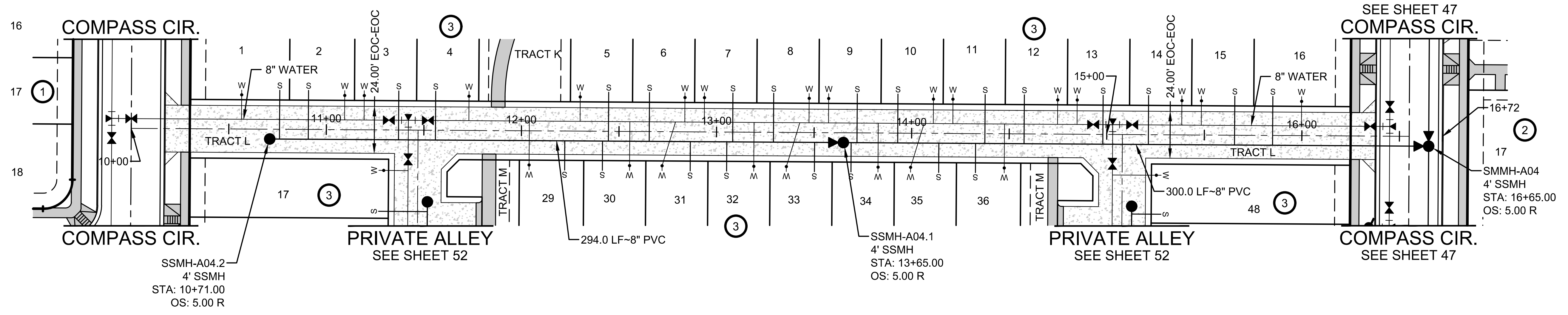
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



PRIVATE ALLEY
N.T.S.



KEY MAP
N.T.S.

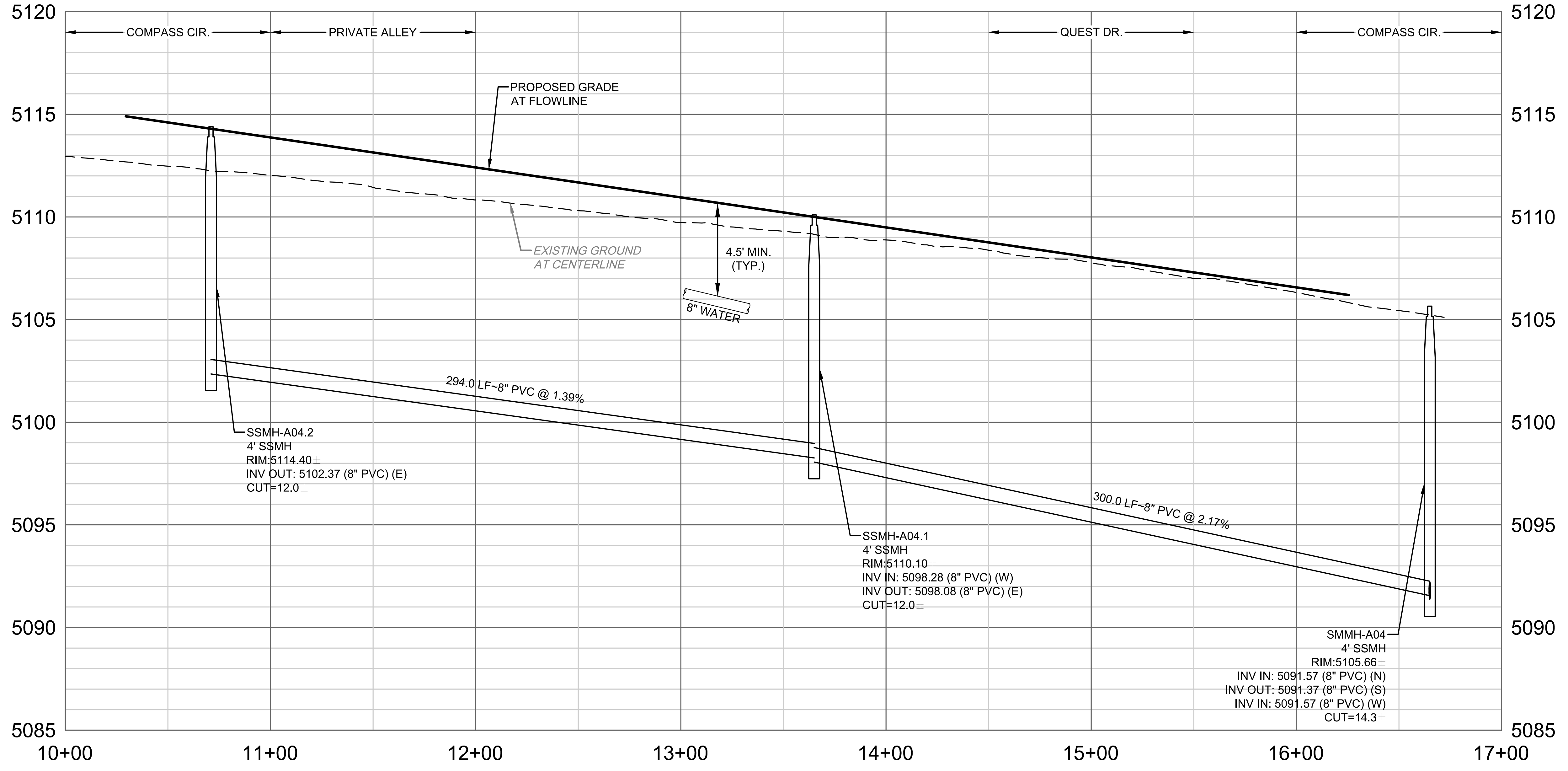


NOTES:

1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED ON PLANS.
2. REFER TO THE TOWN OF ERIE STANDARDS AND SPECIFICATION REGARDING THE CONSTRUCTION OF ALL PUBLIC ROADWAY AND UTILITY IMPROVEMENTS.
3. SANITARY SEWER LENGTHS ARE FROM CENTER OF STRUCTURE TO CENTER OF STRUCTURE TO DETERMINE SLOPE.
4. CONTRACTOR SHALL PROVIDE VERTICAL FITTINGS, THRUST BLOCKS, ETC. CONSTRUCTED IN ACCORDANCE WITH CITY STANDARDS AND SPECIFICATIONS AS REQUIRED TO MAINTAIN A MINIMUM OF 4.5 FEET OF COVER.

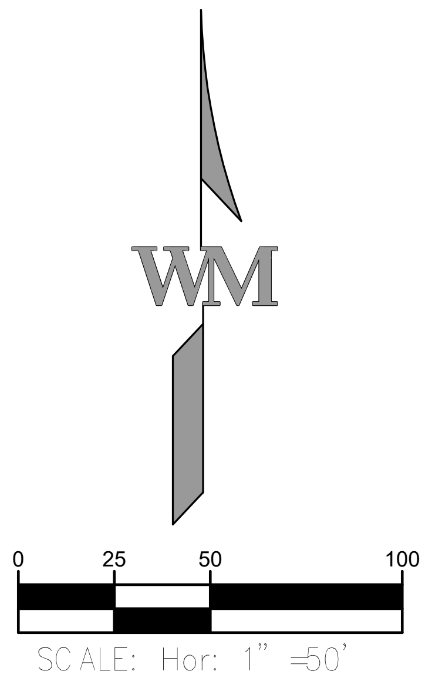
CONTRACTOR TO FIELD VERIFY LOCATION OF ALL EXISTING UTILITES PRIOR TO CONSTRUCTION

STA. 10+00.00 TO STA. 17+00.00
PRIVATE ALLEY - TRACT L



SANITARY SEWER SERVICE TABLE

BLOCK	LOT	STATION	STUB INV
3	16	0+80	5095.0
3	15	1+00	5095.4
3	14	1+44	5096.4
3	13	1+67	5096.9
3	12	2+07	5097.8
3	11	2+27	5098.2
3	36	2+32	5098.1
3	35	2+51	5098.5
3	10	2+72	5099.2
3	9	2+93	5099.6
3	34	2+96	5099.5
3	33	0+15	5100.0
3	8	0+36	5100.5
3	7	0+57	5100.8
3	32	0+60	5100.6
3	31	0+78	5100.9
3	6	1+00	5101.4
3	5	1+20	5101.7
3	30	1+23	5101.5
3	29	1+43	5101.8
3	4	2+09	5102.9
3	3	2+28	5103.1
3	2	2+74	5103.8
3	1	2+89	5104.0



SCALE: Hor: 1" =50'
SCALE: Vert: 1" =5'
ORIGINAL GRAPHIC SCALE

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

PRIVATE ALLEY TRACT L
UTILITY PLAN & PROFILE

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
UPP06
Sheet 51 of 74

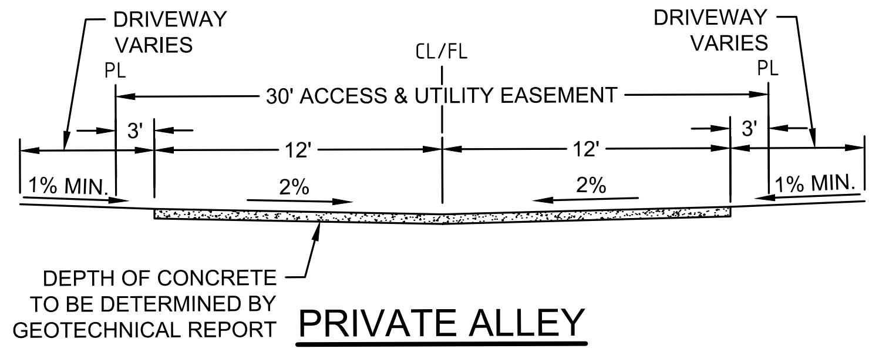
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT

NOTES:

1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED ON PLANS.
2. REFER TO THE TOWN OF ERIE STANDARDS AND SPECIFICATION REGARDING THE CONSTRUCTION OF ALL PUBLIC ROADWAY AND UTILITY IMPROVEMENTS.
3. SANITARY SEWER LENGTHS ARE FROM CENTER OF STRUCTURE TO CENTER OF STRUCTURE TO DETERMINE SLOPE.
4. CONTRACTOR SHALL PROVIDE VERTICAL FITTINGS, THRUST BLOCKS, ETC. CONSTRUCTED IN ACCORDANCE WITH CITY STANDARDS AND SPECIFICATIONS AS REQUIRED TO MAINTAIN A MINIMUM OF 4.5 FEET OF COVER.

0 25 50 100

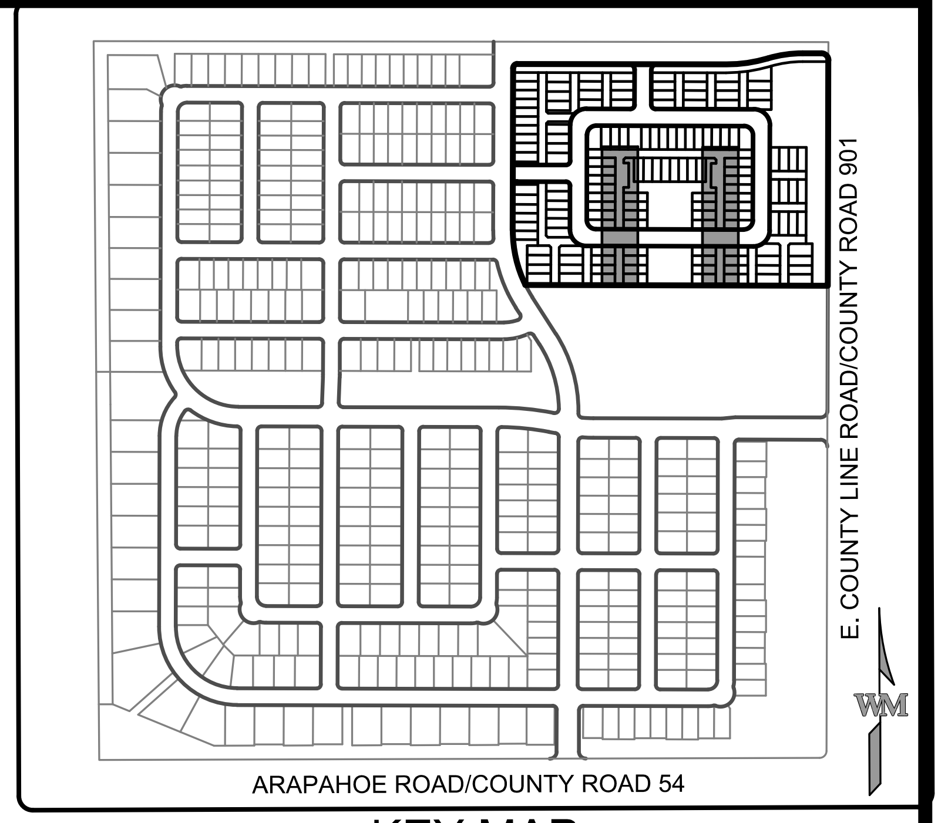
SCALE: Hor: 1" =50'
SCALE: Vert: 1" =5'
ORIGINAL GRAPHIC SCALE



PRIVATE ALLEY

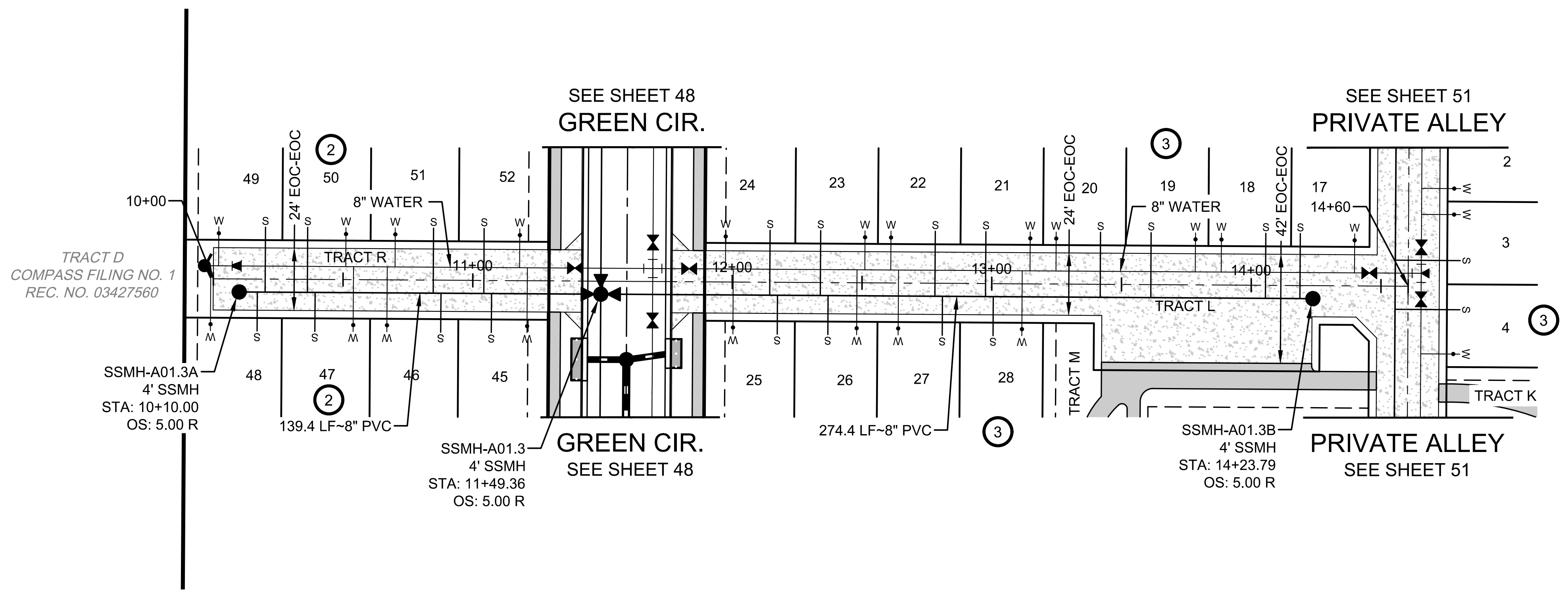
N.T.S.

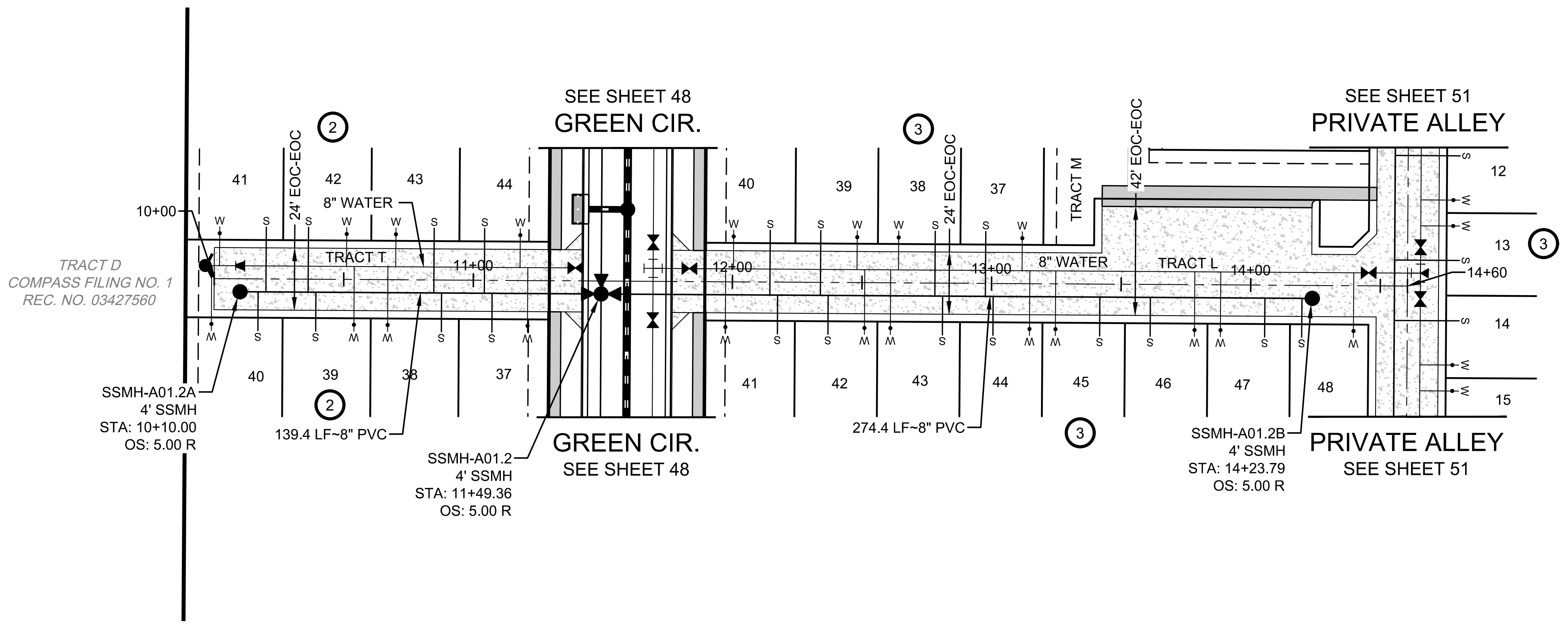
CONTRACTOR TO FIELD VERIFY LOCATION OF ALL EXISTING UTILITES PRIOR TO CONSTRUCTION



KEY MAP

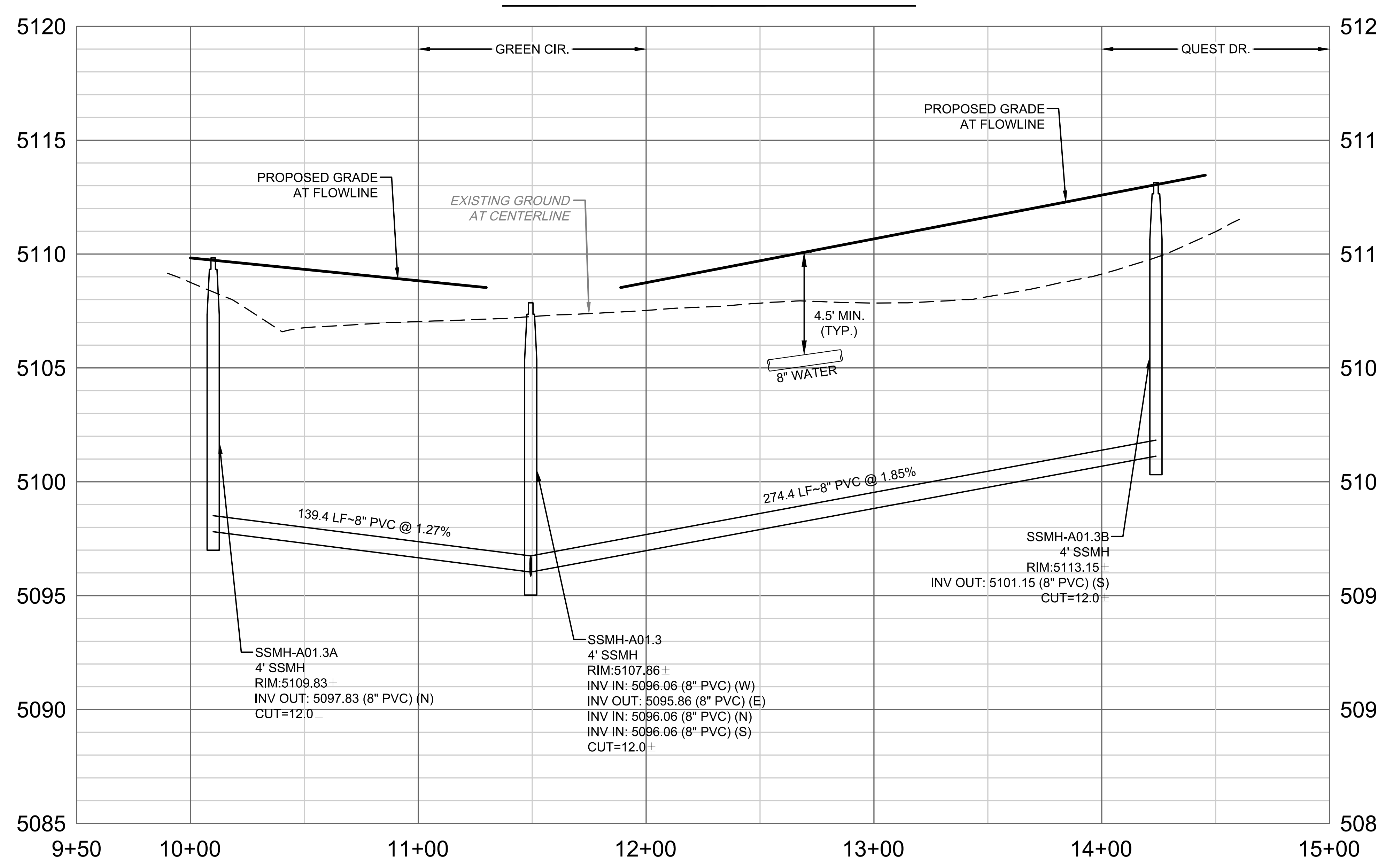
N.T.S.





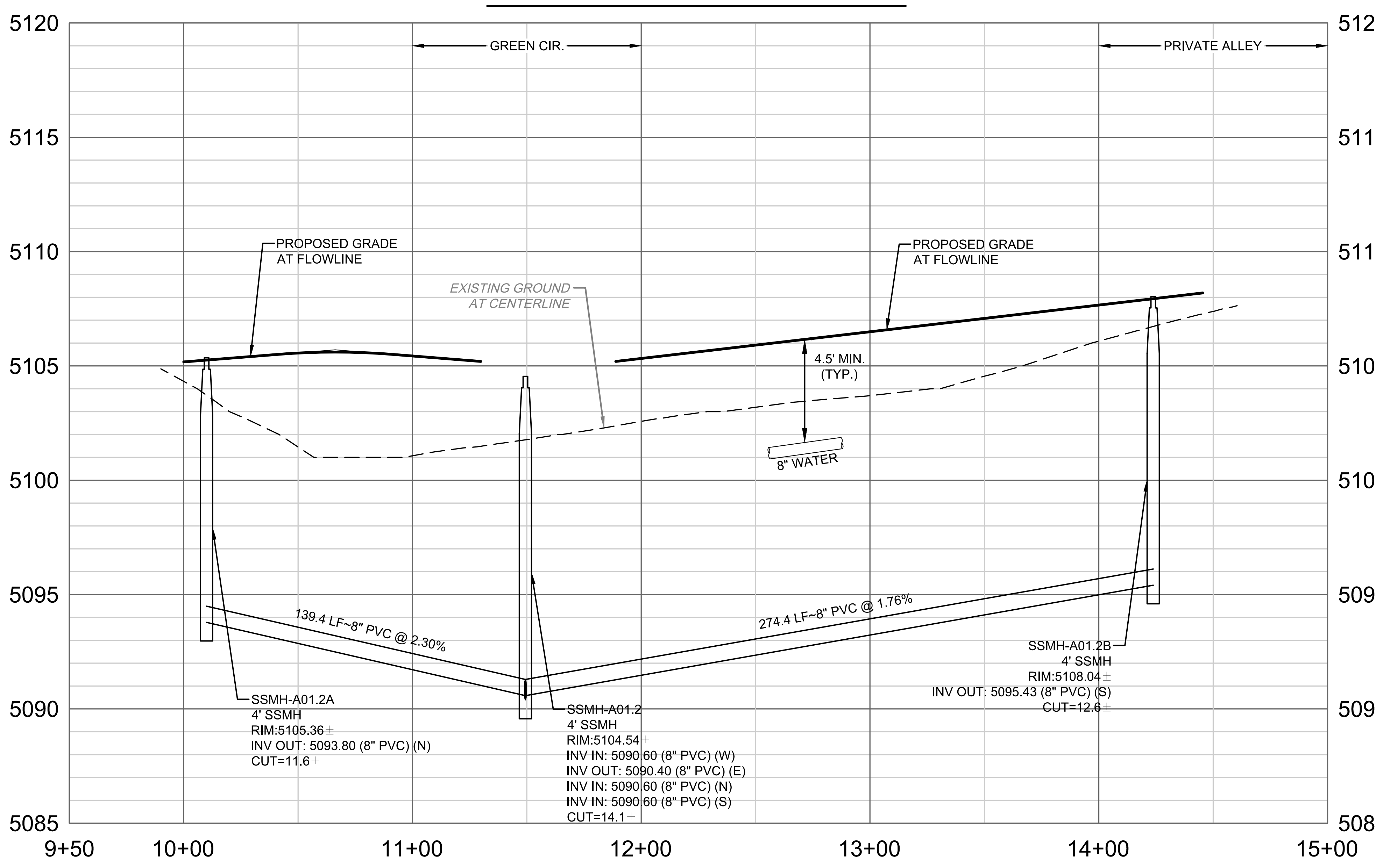
STA. 09+50.00 TO STA. 15+00.00

PRIVATE ALLEY - TRACT L & TRACT R



STA. 09+50.00 TO STA. 15+00.00

PRIVATE ALLEY - TRACT L & TRACT T



SANITARY SEWER SERVICE TABLE

BLOCK	LOT	STATION	STUB INV
2	45	0+42	5098.1
2	52	0+45	5098.3
2	46	0+62	5098.3
2	51	0+65	5098.6
2	47	1+10	5099.0
2	50	1+13	5099.2
2	49	1+29	5099.4
2	48	1+32	5099.2
3	24	0+65	5099.0
3	25	0+68	5098.8
3	23	0+55	5098.8
3	26	0+88	5099.2
3	22	1+29	5100.1
3	27	1+32	5100.0
3	21	1+48	5100.5
3	28	1+51	5100.4
3	20	1+92	5101.3
3	19	2+12	5101.7
3	18	2+56	5102.5
3	17	2+69	5102.7
2	37	0+42	5093.1
2	44	0+45	5093.3
2	38	0+62	5093.5
2	43	0+65	5093.8
2	39	1+10	5094.6
2	42	1+13	5094.9
2	41	1+29	5095.3
2	40	1+32	5095.1
3	40	0+65	5093.4
3	41	0+68	5093.3
3	39	0+85	5093.8
3	42	0+88	5093.6
3	38	1+29	5094.6
3	43	1+32	5094.4
3	37	1+48	5094.9
3	44	1+51	5094.8
3	45	1+92	5095.5
3	46	2+12	5095.8
3	47	2+56	5096.6
3	48	2+70	5096.9

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 03, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

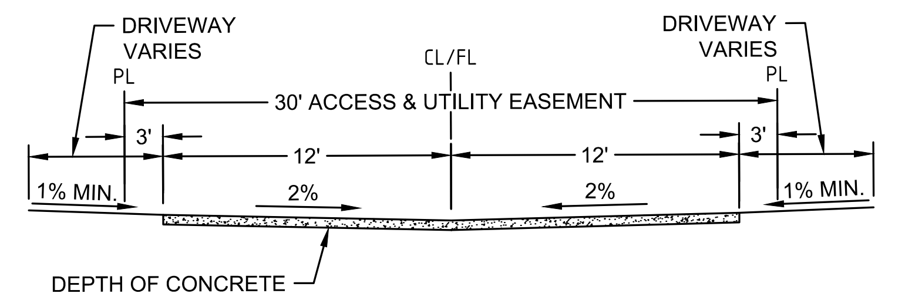
PRIVATE ALLEY TRACTS L, R, & T
UTILITY PLAN & PROFILE

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

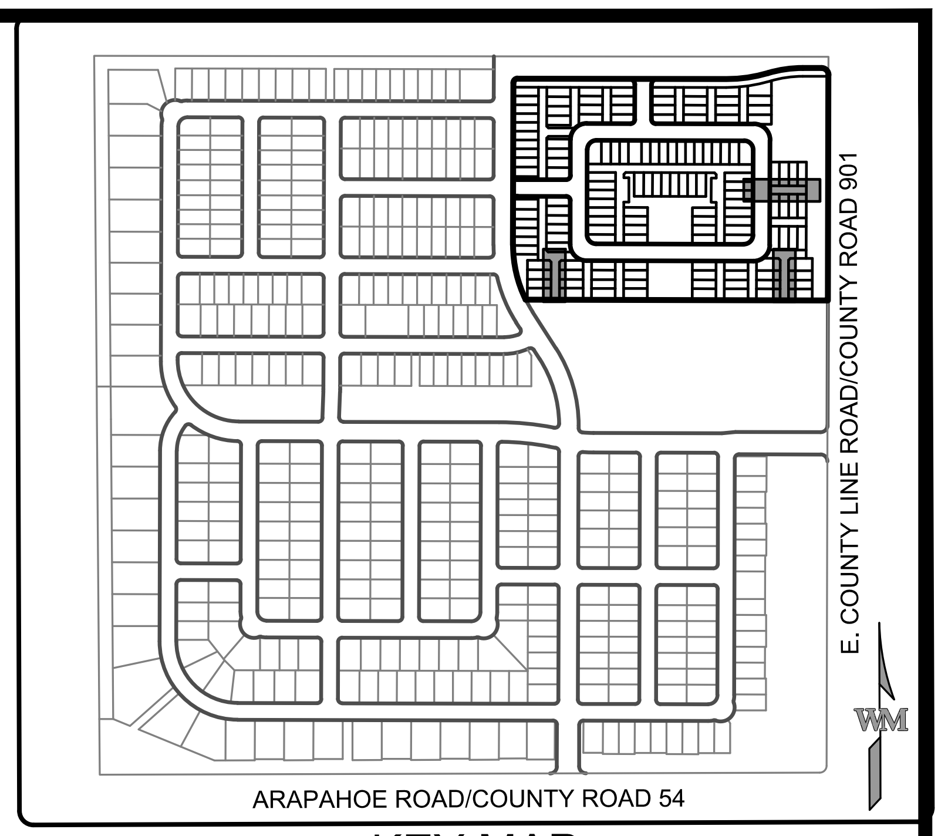
SHEET
UPP07
Sheet 52 of 74

NOT FOR CONSTRUCTION



PRIVATE ALLEY

N.T.S.



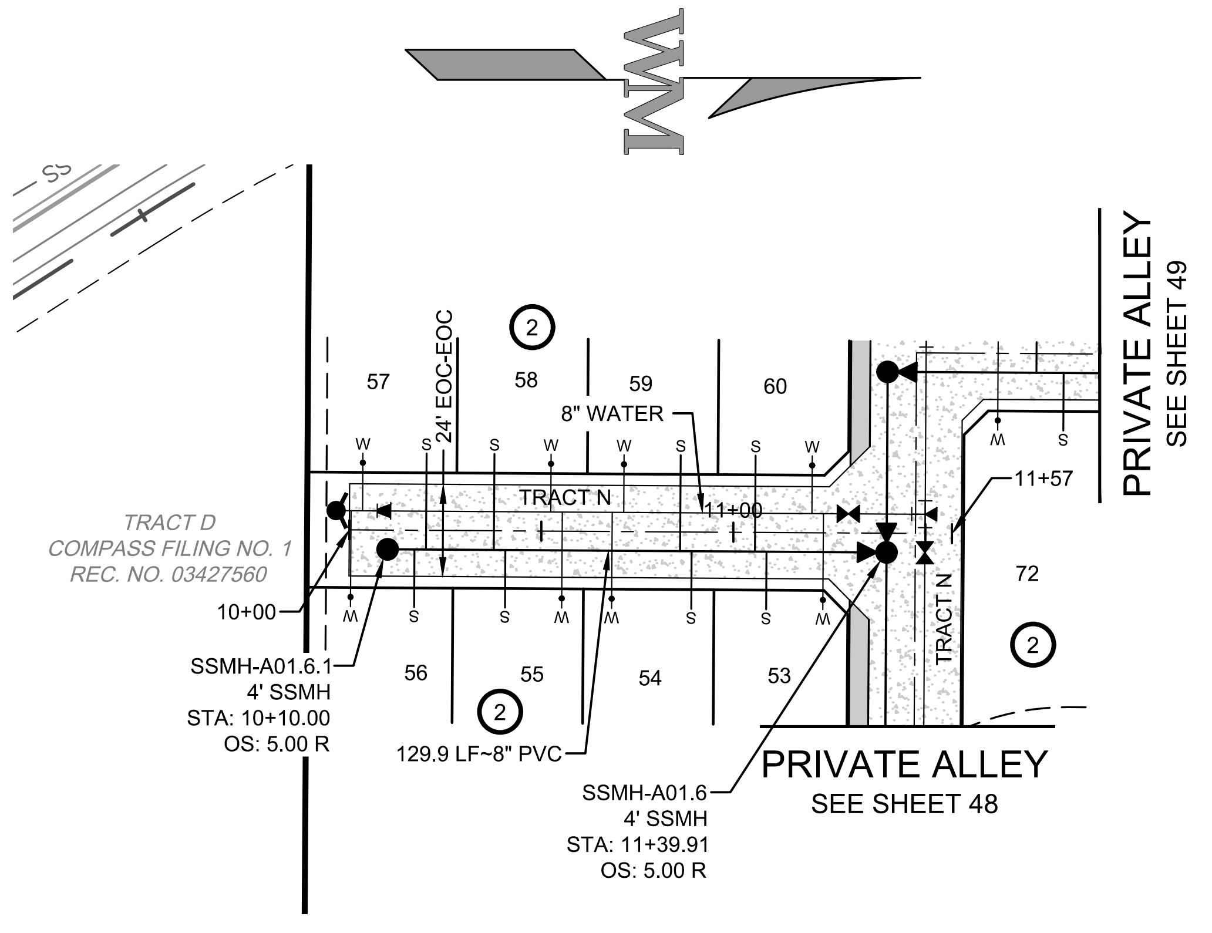
KEY MAP

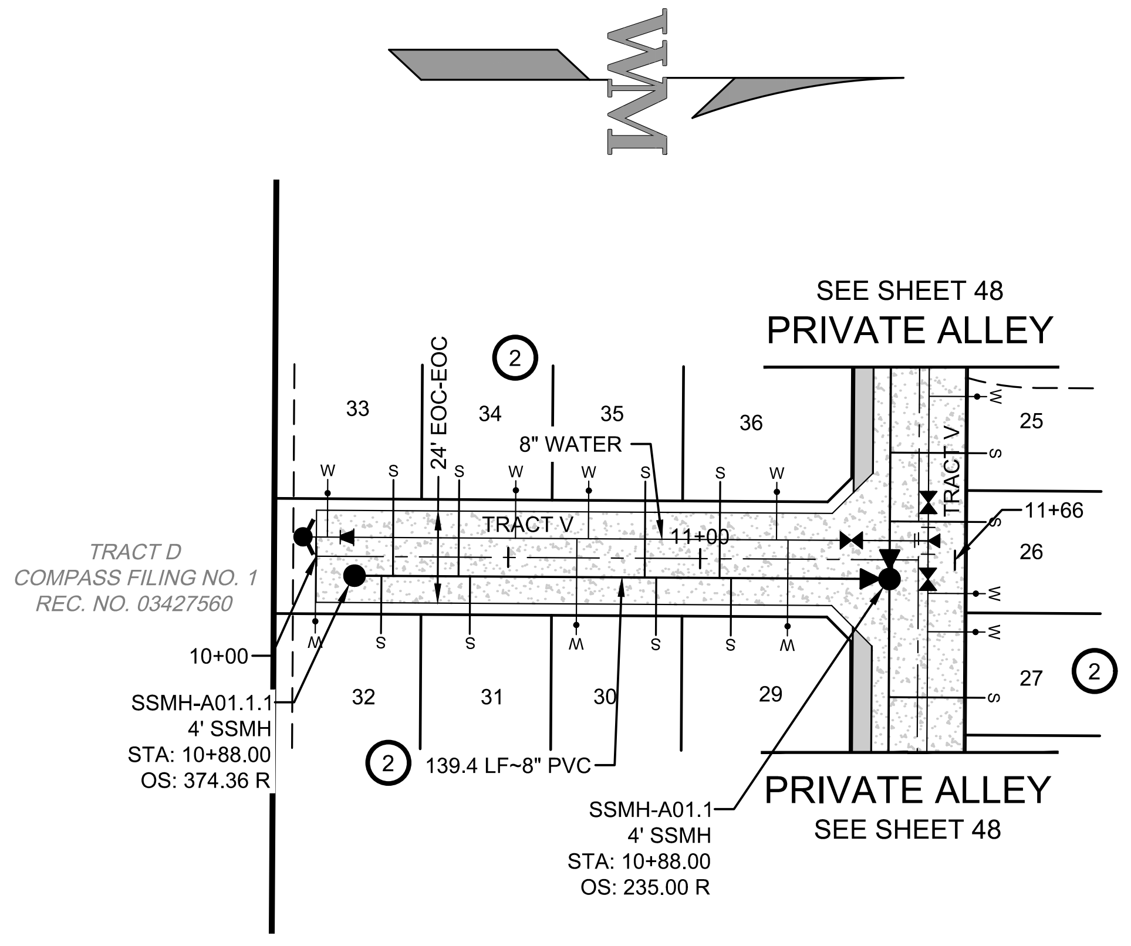
N.T.S.

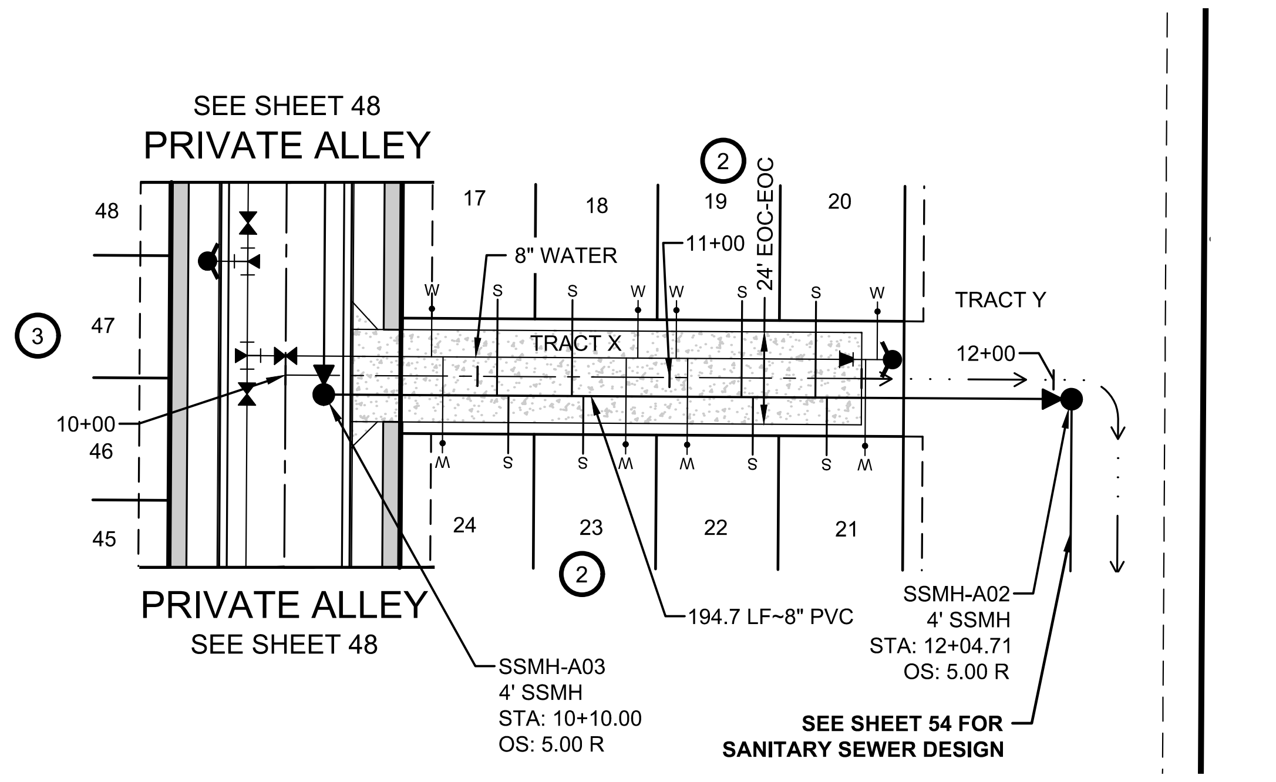
NOTES:

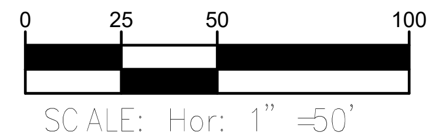
1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED ON PLANS.
2. REFER TO THE TOWN OF ERIE STANDARDS AND SPECIFICATION REGARDING THE CONSTRUCTION OF ALL PUBLIC ROADWAY AND UTILITY IMPROVEMENTS.
3. SANITARY SEWER LENGTHS ARE FROM CENTER OF STRUCTURE TO CENTER OF STRUCTURE TO DETERMINE SLOPE.
4. CONTRACTOR SHALL PROVIDE VERTICAL FITTINGS, THRUST BLOCKS, ETC. CONSTRUCTED IN ACCORDANCE WITH CITY STANDARDS AND SPECIFICATIONS AS REQUIRED TO MAINTAIN A MINIMUM OF 4.5 FEET OF COVER.

CONTRACTOR TO FIELD VERIFY LOCATION OF ALL EXISTING UTILITES PRIOR TO CONSTRUCTION







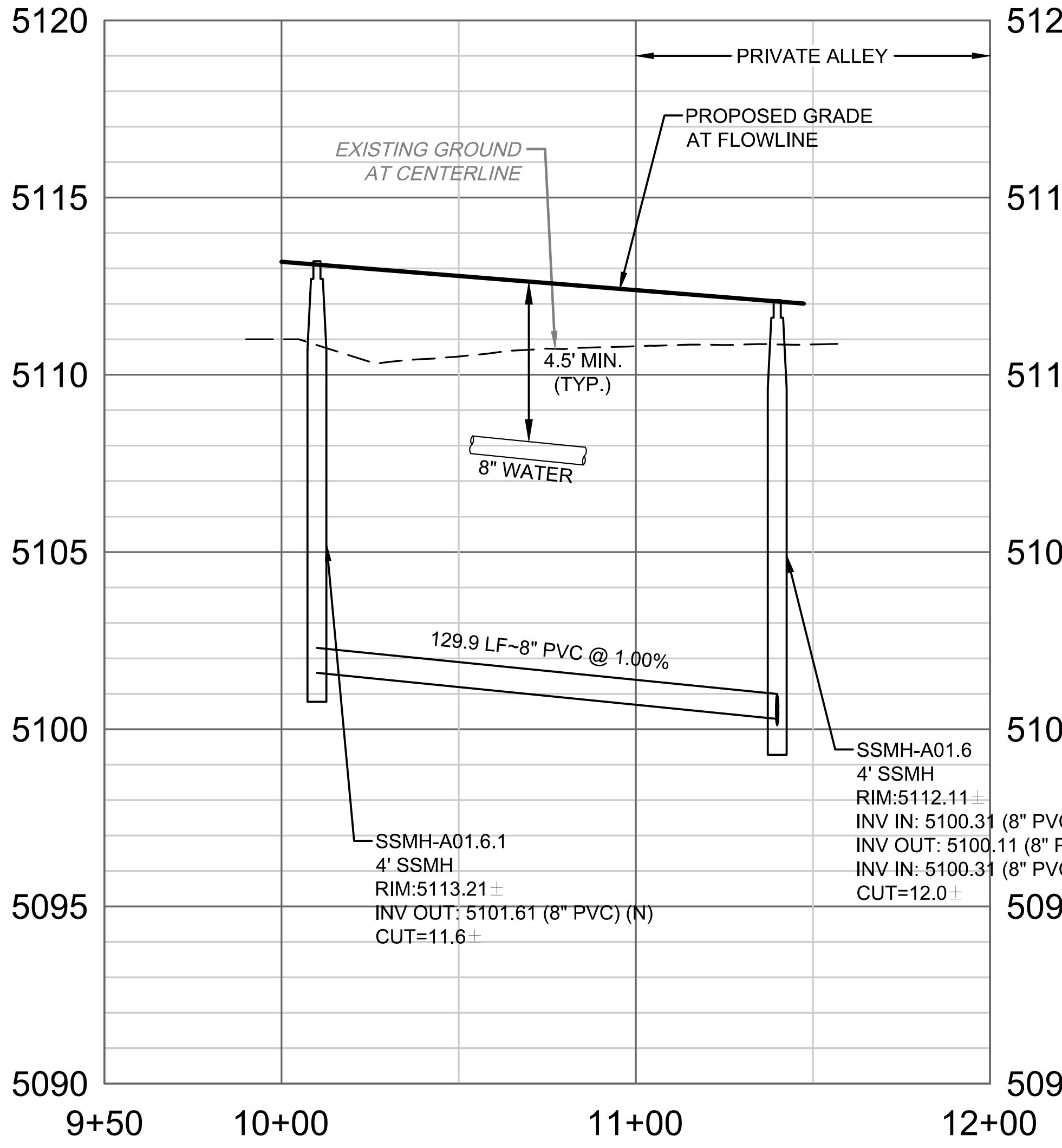


SCALE: Hor: 1" =50'
SCALE: Vert: 1" =5'
ORIGINAL GRAPHIC SCALE

SANITARY SEWER SERVICE TABLE			
BLOCK	LOT	STATION	STUB INV
2	21	0+64	5091.6
2	20	0+67	5091.9
2	22	0+83	5091.7
2	19	0+86	5091.9
2	23	1+24	5091.9
2	18	1+30	5092.2
2	24	1+47	5092.1
2	17	1+50	5092.3
2	29	0+41	5091.6
2	36	0+44	5091.8
2	30	0+61	5092.0
2	35	0+64	5092.2
2	31	1+09	5092.9
2	34	1+12	5093.2
2	33	1+29	5093.5
2	32	1+32	5093.4
2	53	0+31	5102.4
2	60	0+34	5102.7
2	54	0+51	5102.8
2	59	0+54	5103.1
2	55	0+99	5103.8
2	58	1+02	5104.1
2	57	1+20	5104.4
2	56	1+23	5104.3

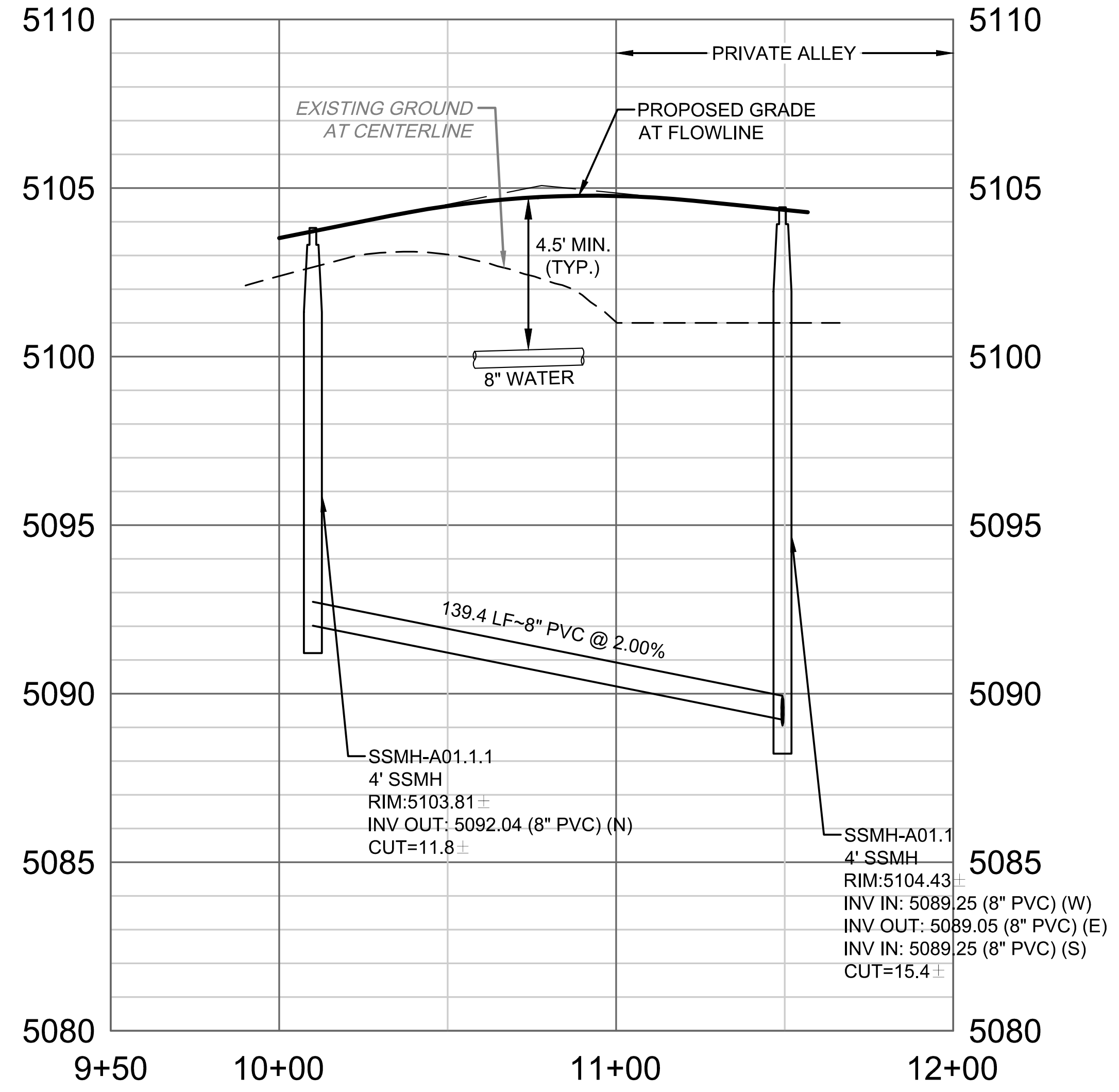
STA. 09+50.00 TO STA. 12+00.00

PRIVATE ALLEY - TRACT N



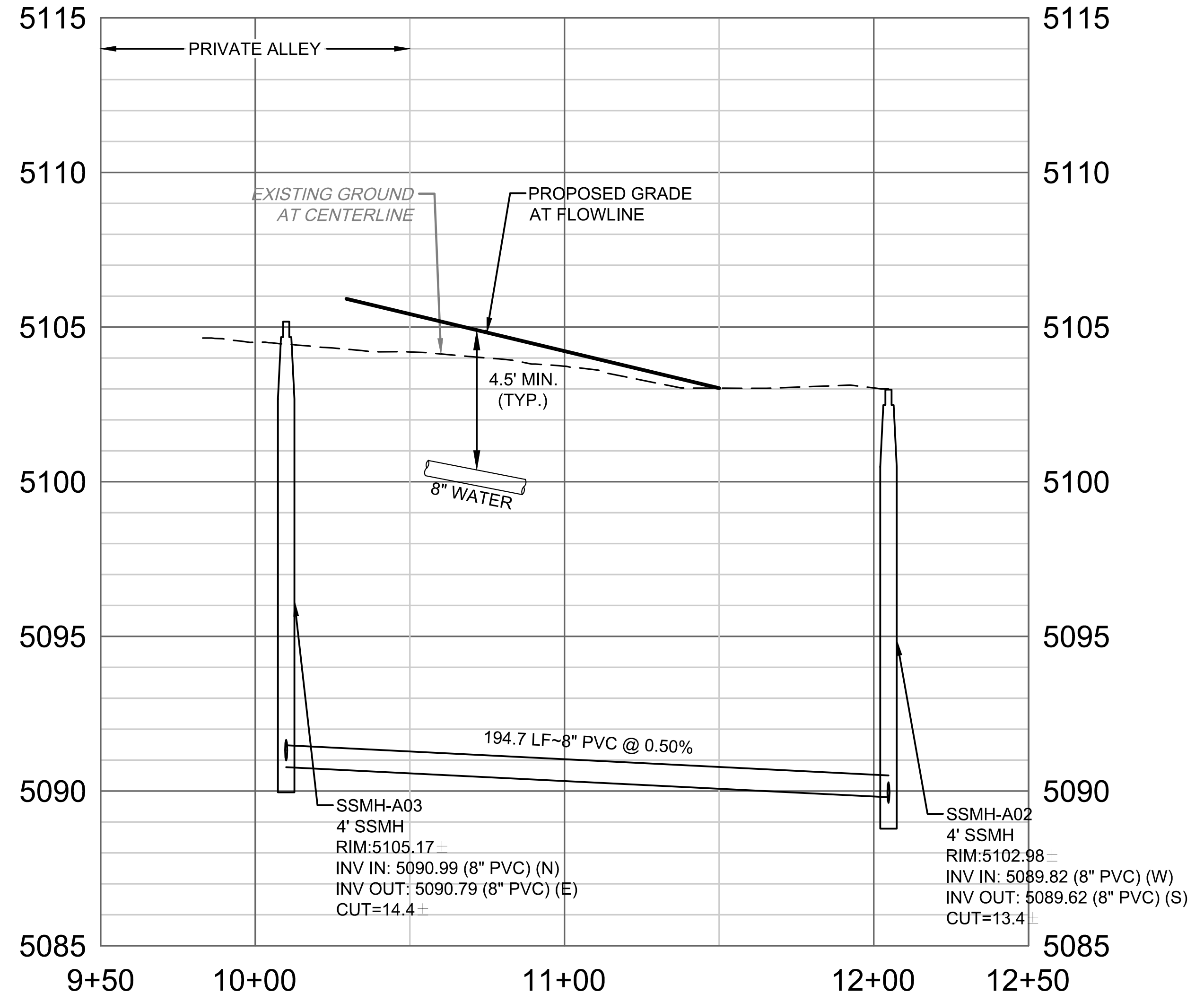
STA. 09+50.00 TO STA. 12+00.00

PRIVATE ALLEY - TRACT V



STA. 09+50.00 TO STA. 12+50.00

PRIVATE ALLEY - TRACT X



WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

PRIVATE ALLEY TRACTS N, V, & X
UTILITY PLAN & PROFILE

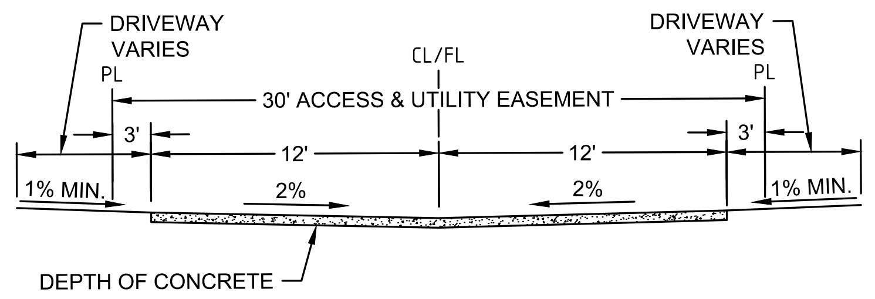
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
UPP08
Sheet 53 of 74

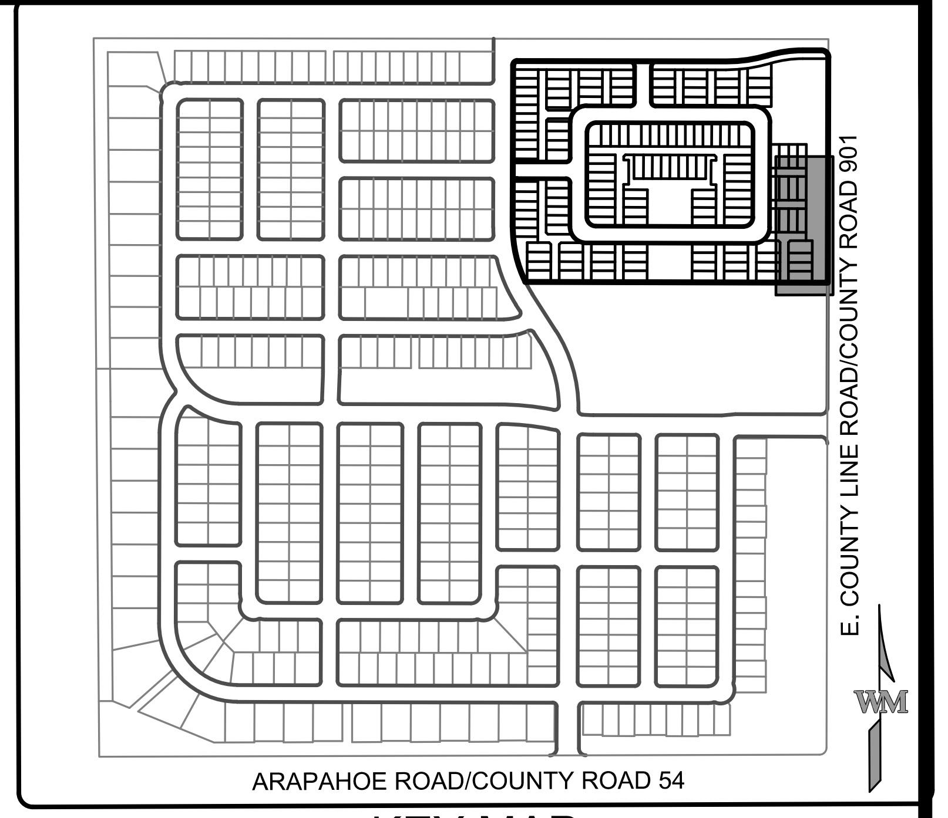
NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



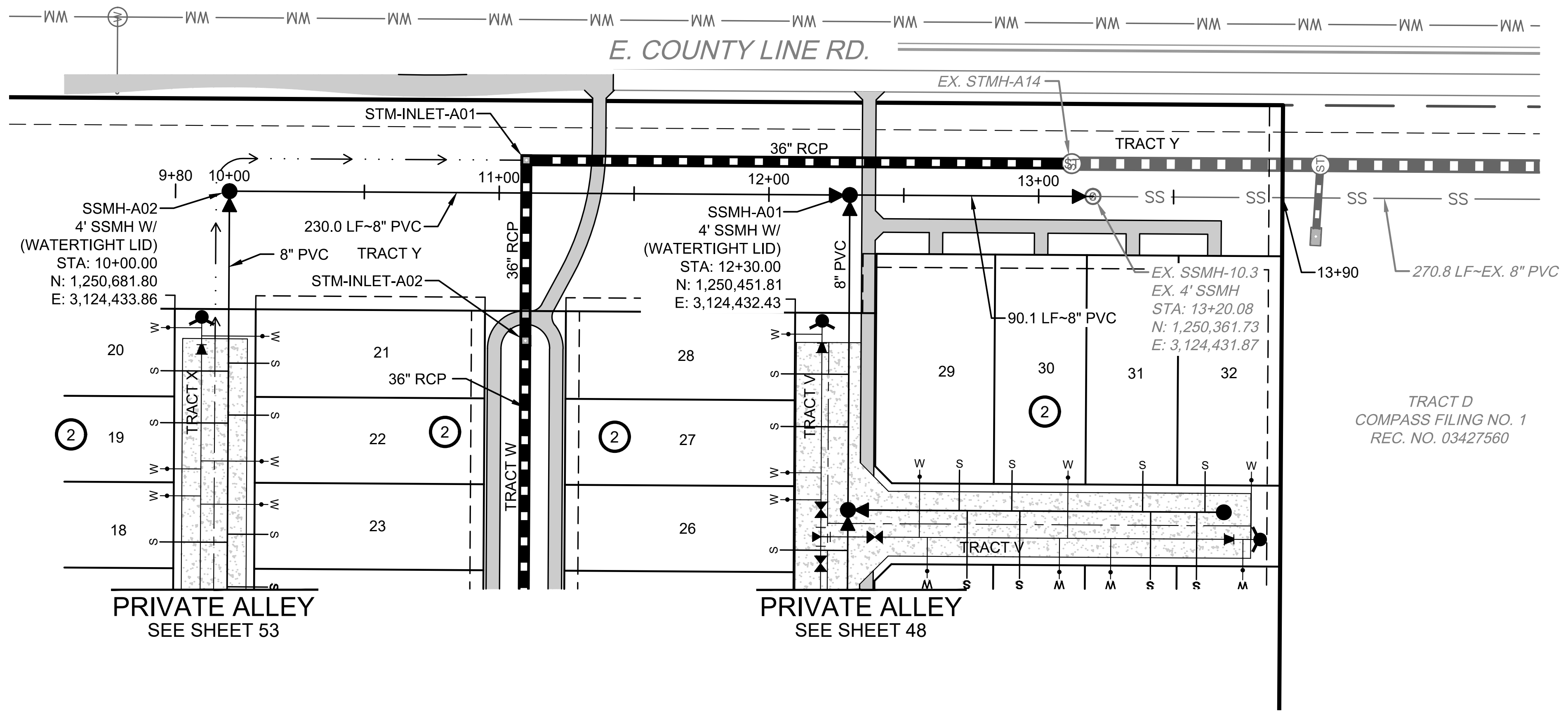
PRIVATE ALLEY

N.T.S.



KEY MAP

N.T.S.



NOTES:

1. ALL STATIONING IS ON CENTERLINE UNLESS OTHERWISE NOTED ON PLANS.
2. REFER TO THE TOWN OF ERIE STANDARDS AND SPECIFICATION REGARDING THE CONSTRUCTION OF ALL PUBLIC ROADWAY AND UTILITY IMPROVEMENTS.
3. SANITARY SEWER LENGTHS ARE FROM CENTER OF STRUCTURE TO CENTER OF STRUCTURE TO DETERMINE SLOPE.
4. CONTRACTOR SHALL PROVIDE VERTICAL FITTINGS, THRUST BLOCKS, ETC. CONSTRUCTED IN ACCORDANCE WITH CITY STANDARDS AND SPECIFICATIONS AS REQUIRED TO MAINTAIN A MINIMUM OF 4.5 FEET OF COVER.

CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION

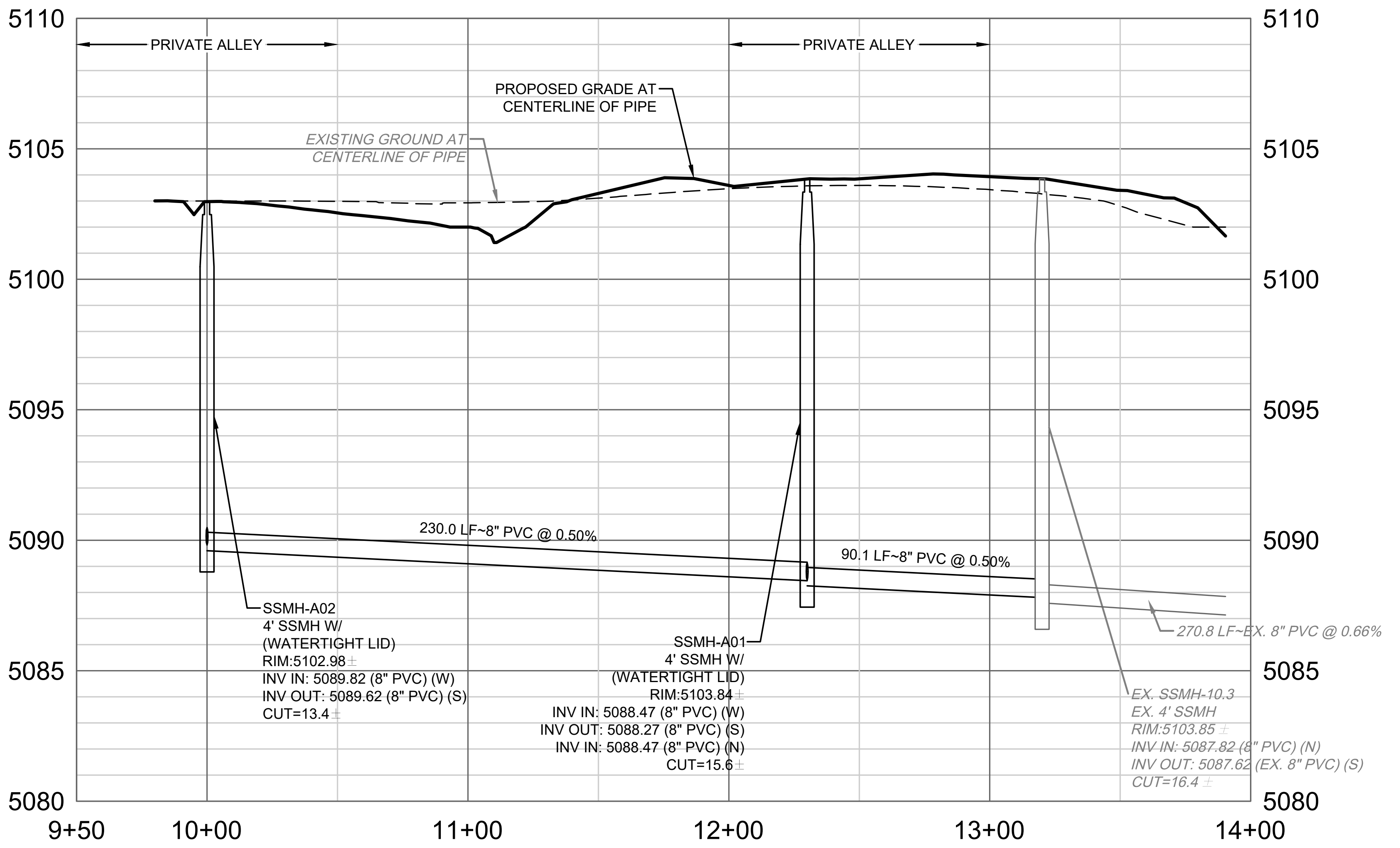
0 25 50 100

SCALE: Hor: 1" =50'
SCALE: Vert: 1" =5'

ORIGINAL GRAPHIC SCALE

STA. 09+50.00 TO STA. 14+00.00

OFFSITE SANITARY SEWER



WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942

Dec 03, 2018

FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

OFFSITE SANITARY SEWER
UTILITY PLAN & PROFILES

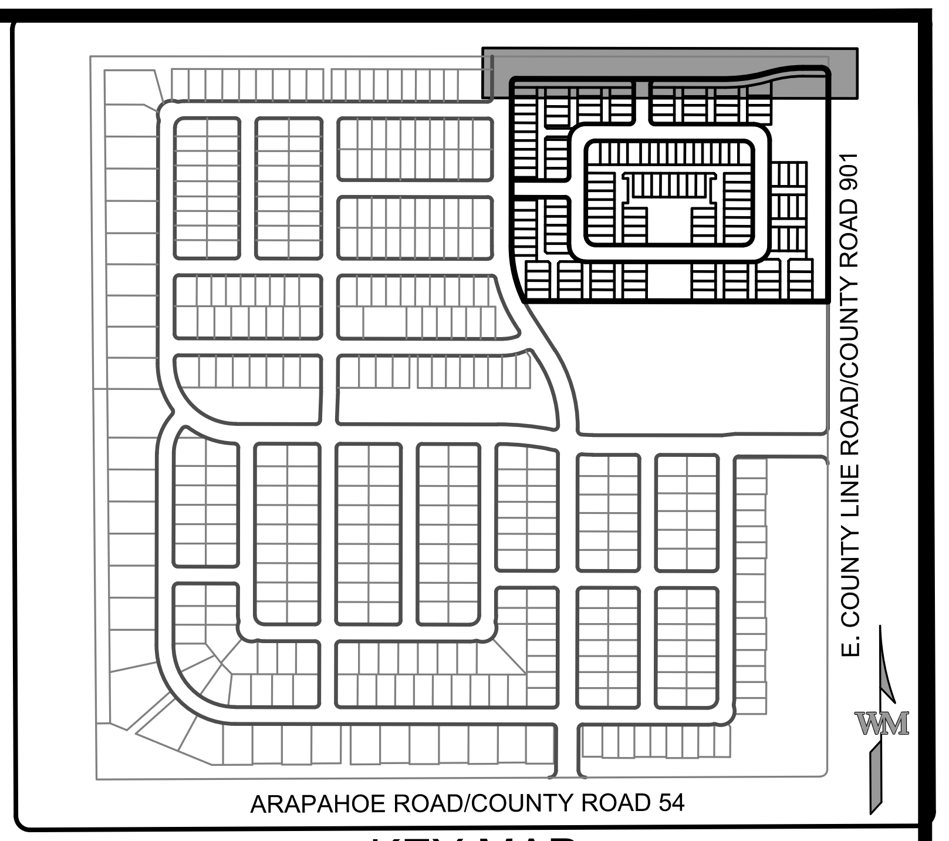
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET

UPP09

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



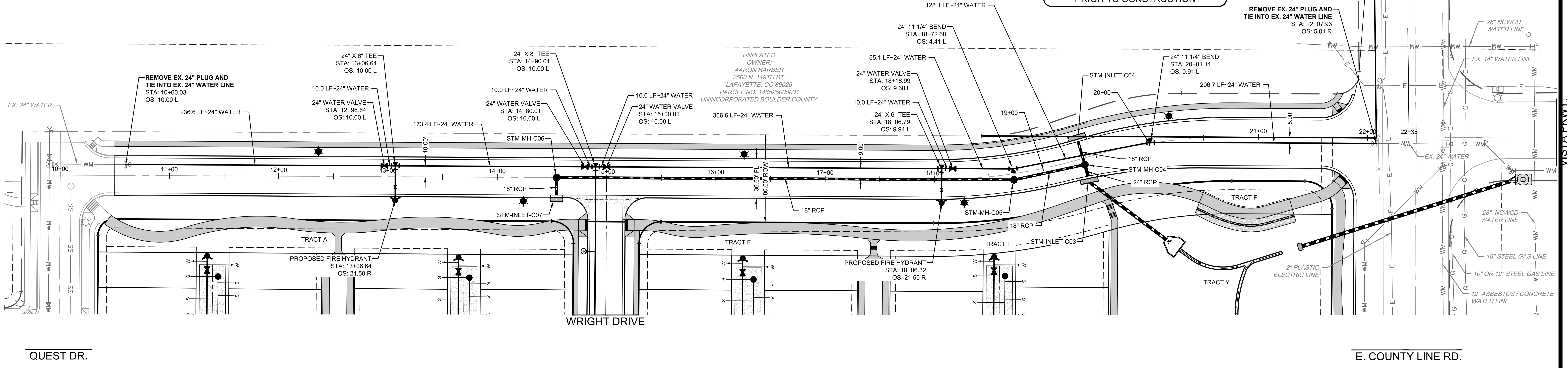
KEY MAP

N.T.S.

0 25 50 100

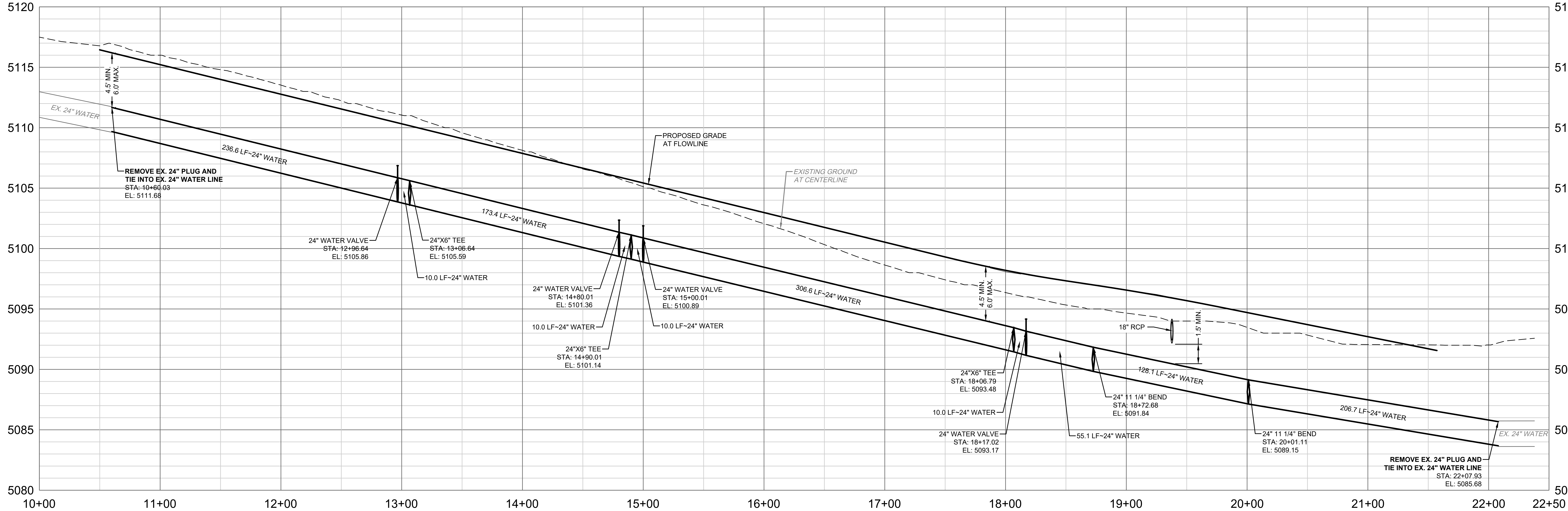
SCALE: Hor: 1" =50'
SCALE: Vert: 1" =10'
ORIGINAL GRAPHIC SCALE

CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION



STA. 10+00.00 TO STA. 22+50.00

VISTA PKWY.



WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

35942
THOMAS C. JANSEN
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

VISTA PKWY.
UTILITY PLAN & PROFILE

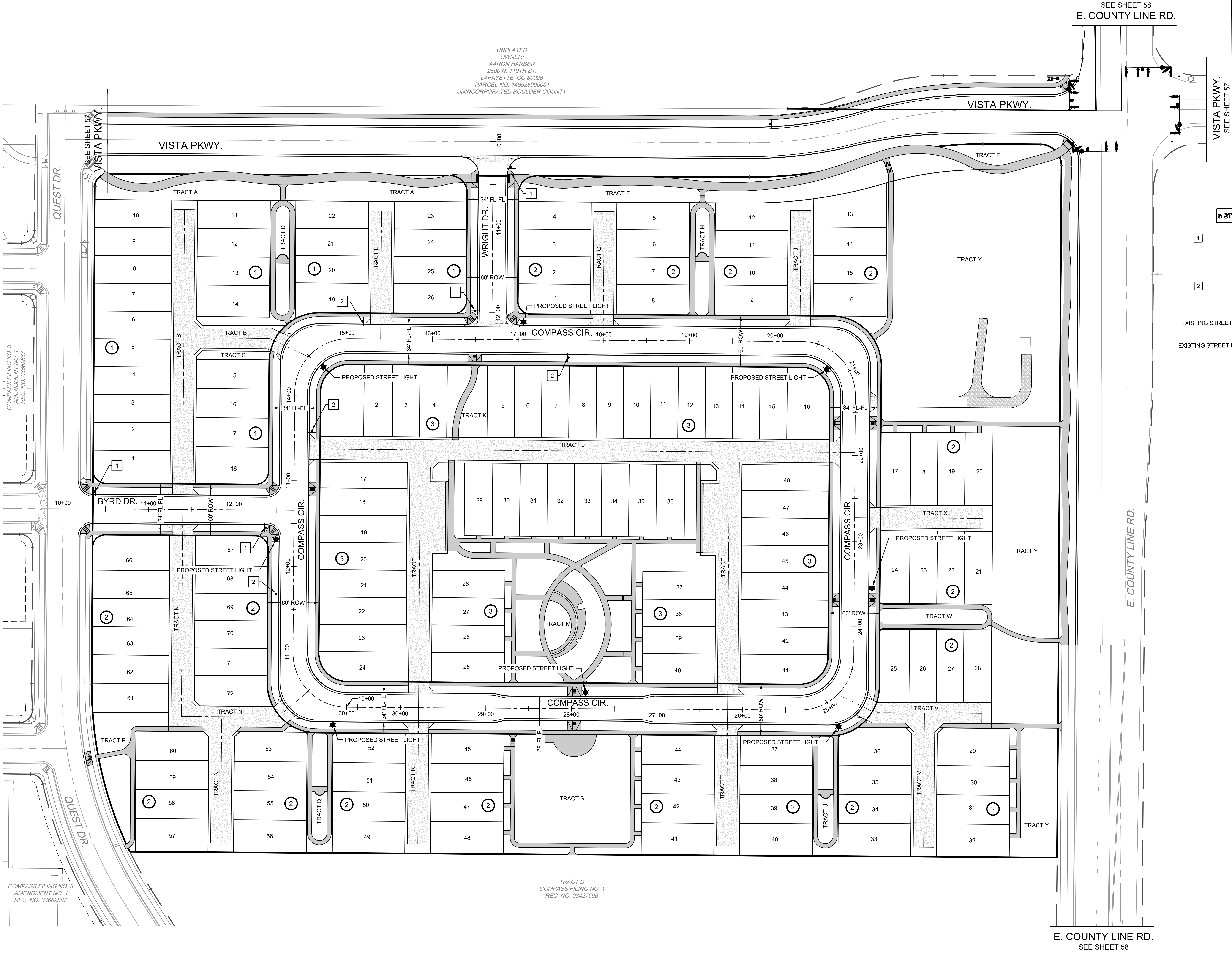
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

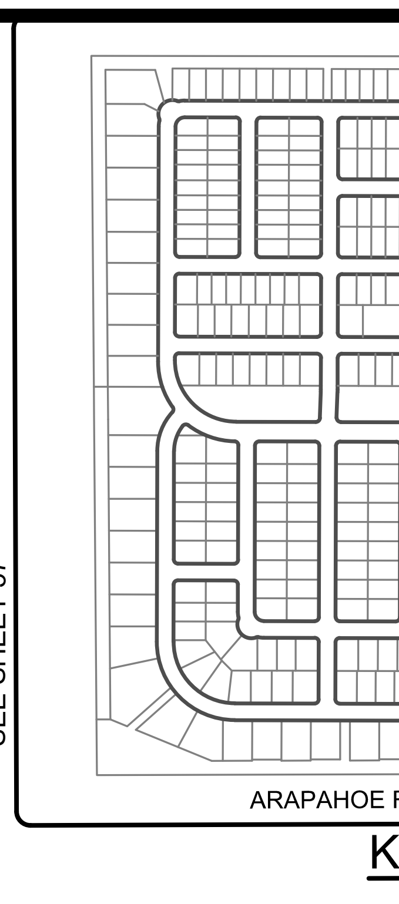
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
UPP10
Sheet 55 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT





KEY MAP

N.T.S.

LEGEND

D–3

1 STOP SIGN (R1-1) WITH STREET NAME SIGN (D-3). PROVIDE "4 WAY" AND "2 WAY" INFO SIGNS.

2 SPEED LIMIT SIGN R2 - 1 - 25

EXISTING STREET SIGN

EXISTING STREET LIGHT

STREET SIGN, SEE TOWN OF ERIE STANDARDS AND SPECIFICATIONS FOR SIGN REQUIREMENTS.

STREET LIGHT. ONSITE STREET LIGHTS TO BE "RECTILINEAR LUMINARE HPS" 100W HPS. LUMINAR CATALOG ID No. 54010. VERIFY AND COORDINATE WITH TOWN OF ERIE PUBLIC WORKS DEPARTMENT, OWNER AND XCEL ENERGY.

NOTES:

1. LETTERING HEIGHT FOR STREET NAME SIGNS SHALL BE IN CONFORMANCE WITH THE TOWN OF ERIE STANDARDS AND SPECIFICATIONS.
2. ALL SIGNAGE AND STRIPING SHALL CONFORM TO TOWN OF ERIE STANDARDS AND SPECIFICATIONS AND MUTCD.
3. RESIDENTIAL STREET LIGHTS AND ARTERIAL STREET LIGHT DETAILS AND STYLES ARE PER TOWN OF ERIE SPECIFICATIONS AND WILL BE PROVIDED BY EXCEL UTILITY PROVIDER.
4. DASHED LINES SHALL HAVE 3' SEGMENTS WITH 12' GAPS.
5. DOTTED LINES SHALL HAVE 2' SEGMENTS WITH 4' GAPS.
6. LANE LINES SHALL HAVE 10' SEGMENTS WITH 30' GAPS.
7. BIKE LANE/EDGE LANE LINE SHALL BE SOLID.
8. CENTER YELLOW LINES ARE TO BE SOLID.

0 30 60 120
SCALE: 1" = 60'
ORIGINAL GRAPHIC SCALE

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

SIGNAGE & STRIPING PLAN

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
SS01
Sheet 56 of 74

NOT FOR CONSTRUCTION

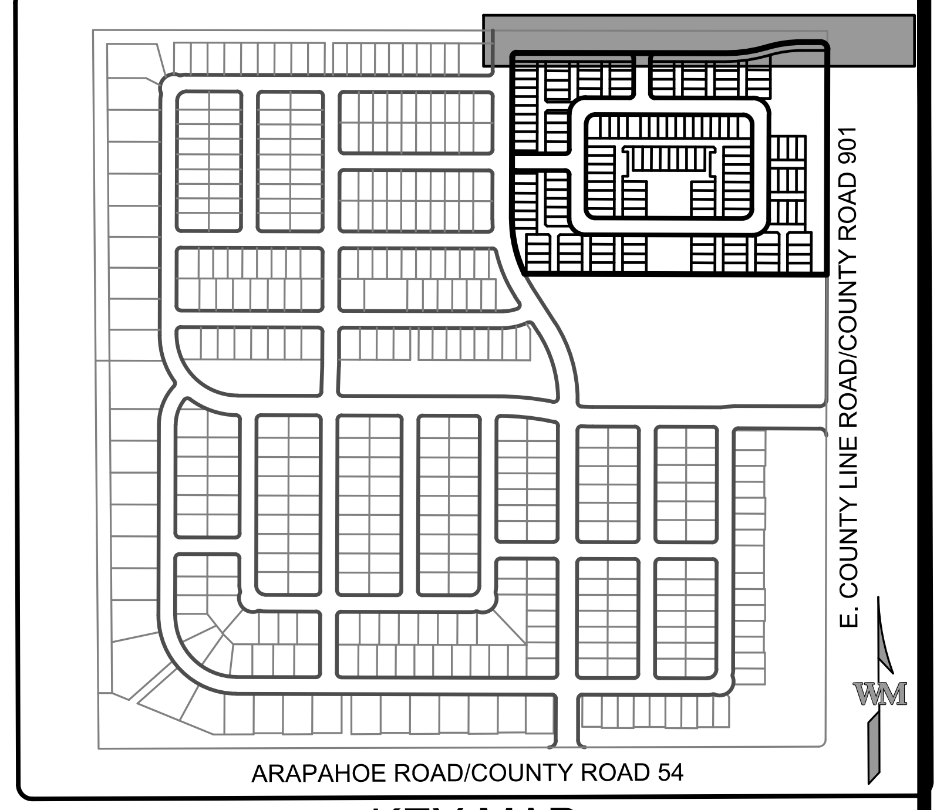
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT

LEGEND

1	SPEED LIMIT 35 R2−1	SPEED LIMIT SIGN R2 - 1 - 35
EXISTING STREET SIGN	━●━	STREET SIGN, SEE TOWN OF ERIE STANDARDS AND SPECIFICATIONS FOR SIGN REQUIREMENTS.
EXISTING STREET LIGHT	✹	STREET LIGHT. ONSITE STREET LIGHTS TO BE "RECTILINEAR LUMINARE HPS" 100W HPS. LUMINAR CATALOG ID No. 54010. VERIFY AND COORDINATE WITH TOWN OF ERIE PUBLIC WORKS DEPARTMENT, OWNER AND XCEL ENERGY.

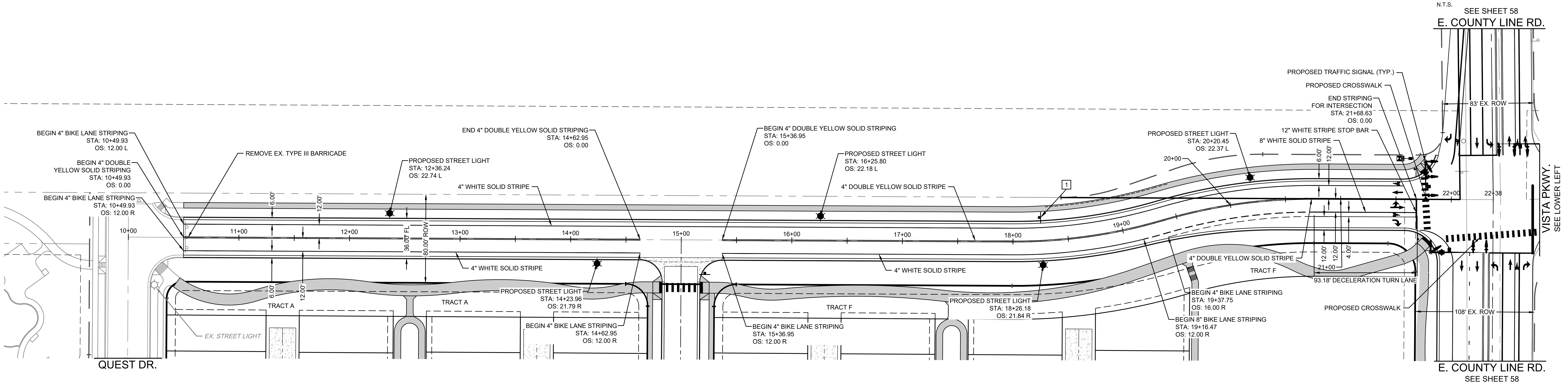
NOTES:

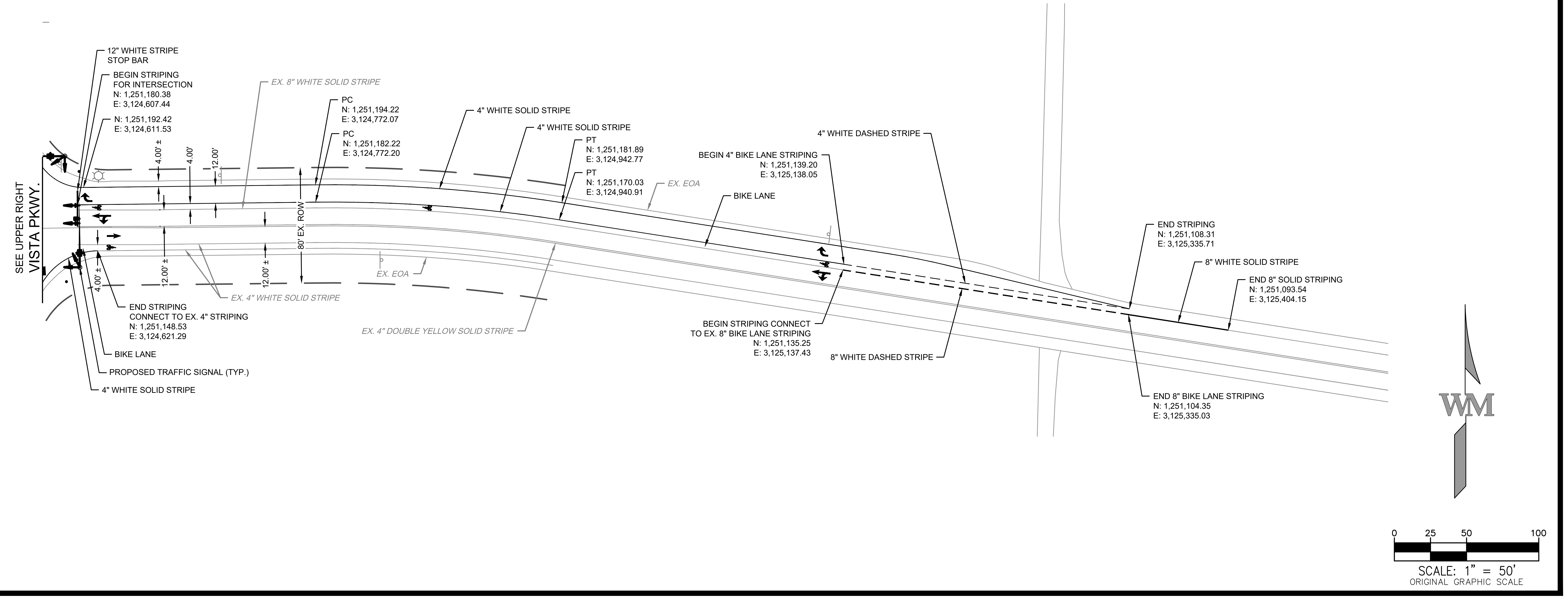
1. LETTERING HEIGHT FOR STREET NAME SIGNS SHALL BE IN CONFORMANCE WITH THE TOWN OF ERIE STANDARDS AND SPECIFICATIONS.
2. ALL SIGNAGE AND STRIPING SHALL CONFORM TO TOWN OF ERIE STANDARDS AND SPECIFICATIONS AND MUTCD.
3. RESIDENTIAL STREET LIGHTS AND ARTERIAL STREET LIGHT DETAILS AND STYLES ARE PER TOWN OF ERIE SPECIFICATIONS AND WILL BE PROVIDED BY EXCEL UTILITY PROVIDER.
4. DASHED LINES SHALL HAVE 3' SEGMENTS WITH 12' GAPS.
5. DOTTED LINES SHALL HAVE 2' SEGMENTS WITH 4' GAPS.
6. LANE LINES SHALL HAVE 10' SEGMENTS WITH 30' GAPS.
7.BIKE LANE/EDGE LANE LINE SHALL BE SOLID.
8. CENTER YELLOW LINES ARE TO BE SOLID.



KEY MAP

N.T.S.





WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

SIGNAGE & STRIPING PLAN
VISTA PKWY.

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
SS02

Sheet 57 of 74

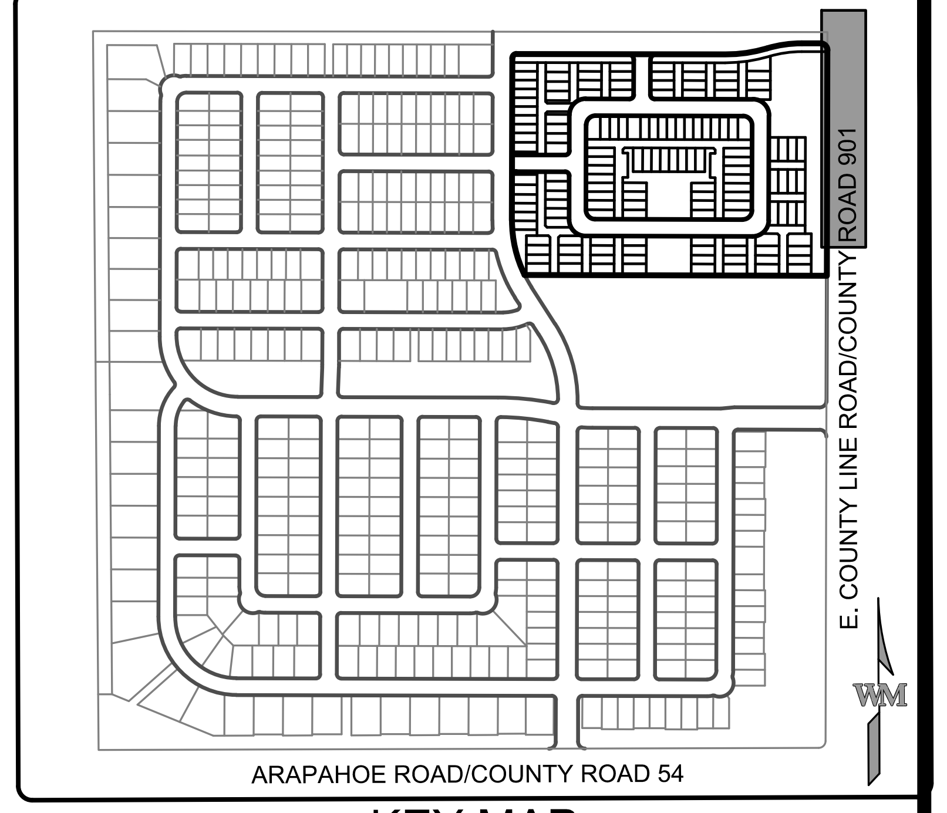
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT

LEGEND

1	SPEED LIMIT 50 R2−1	SPEED LIMIT SIGN R2 - 1 - 50
EXISTING STREET SIGN	━●━	STREET SIGN, SEE TOWN OF ERIE STANDARDS AND SPECIFICATIONS FOR SIGN REQUIREMENTS.
EXISTING STREET LIGHT	✹	STREET LIGHT. ONSITE STREET LIGHTS TO BE "RECTILINEAR LUMINARE HPS" 100W HPS. LUMINAR CATALOG ID No. 54010. VERIFY AND COORDINATE WITH TOWN OF ERIE PUBLIC WORKS DEPARTMENT, OWNER AND XCEL ENERGY.

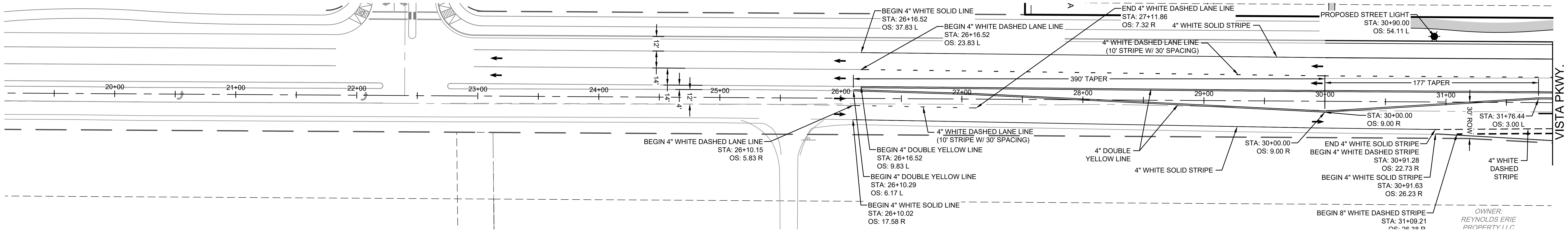
NOTES:

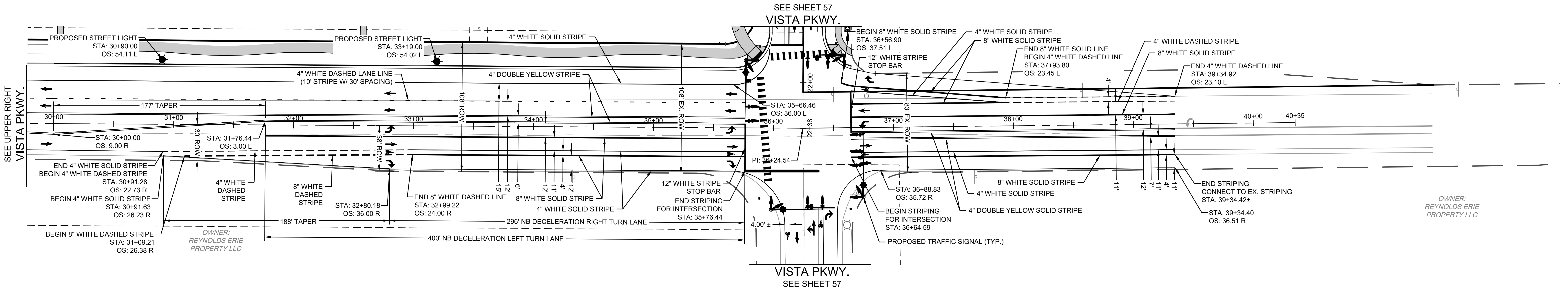
1. LETTERING HEIGHT FOR STREET NAME SIGNS SHALL BE IN CONFORMANCE WITH THE TOWN OF ERIE STANDARDS AND SPECIFICATIONS.
2. ALL SIGNAGE AND STRIPING SHALL CONFORM TO TOWN OF ERIE STANDARDS AND SPECIFICATIONS AND MUTCD.
3. RESIDENTIAL STREET LIGHTS AND ARTERIAL STREET LIGHT DETAILS AND STYLES ARE PER TOWN OF ERIE SPECIFICATIONS AND WILL BE PROVIDED BY EXCEL UTILITY PROVIDER.
4. DASHED LINES SHALL HAVE 3' SEGMENTS WITH 12' GAPS.
5. DOTTED LINES SHALL HAVE 2' SEGMENTS WITH 4' GAPS.
6. LANE LINES SHALL HAVE 10' SEGMENTS WITH 30' GAPS.
7.BIKE LANE/EDGE LANE LINE SHALL BE SOLID.
8. CENTER YELLOW LINES ARE TO BE SOLID.



KEY MAP

N.T.S.





0 25 50 100

SCALE: 1" = 50'

ORIGINAL GRAPHIC SCALE

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

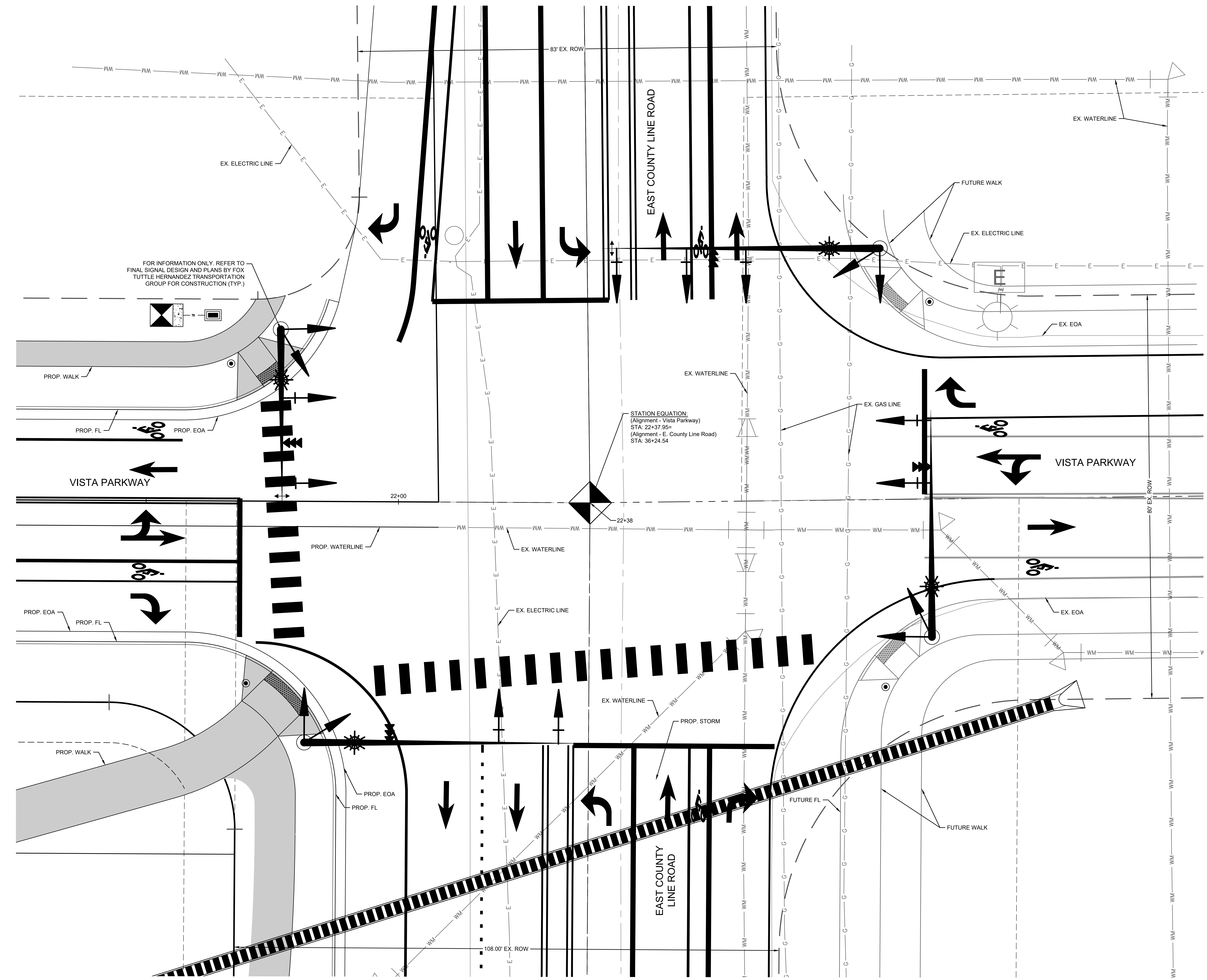
SIGNAGE & STRIPING PLAN
E. COUNTY LINE RD.

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

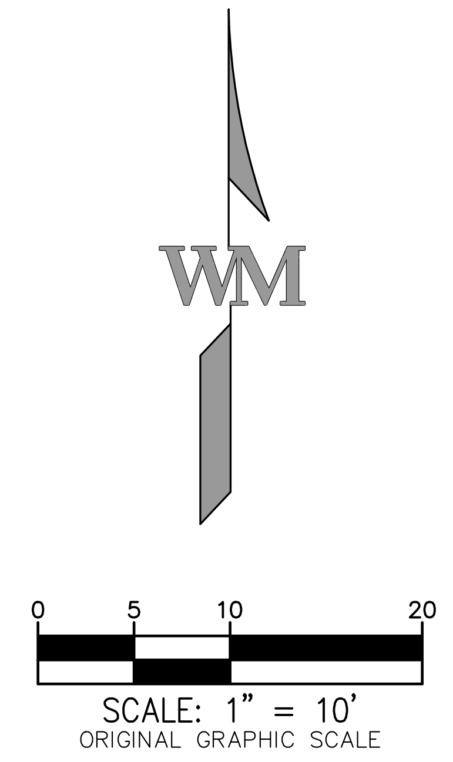
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
SS03
Sheet 58 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



KEY MAP
N.T.S.



SCALE: 1" = 10'
ORIGINAL GRAPHIC SCALE

CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

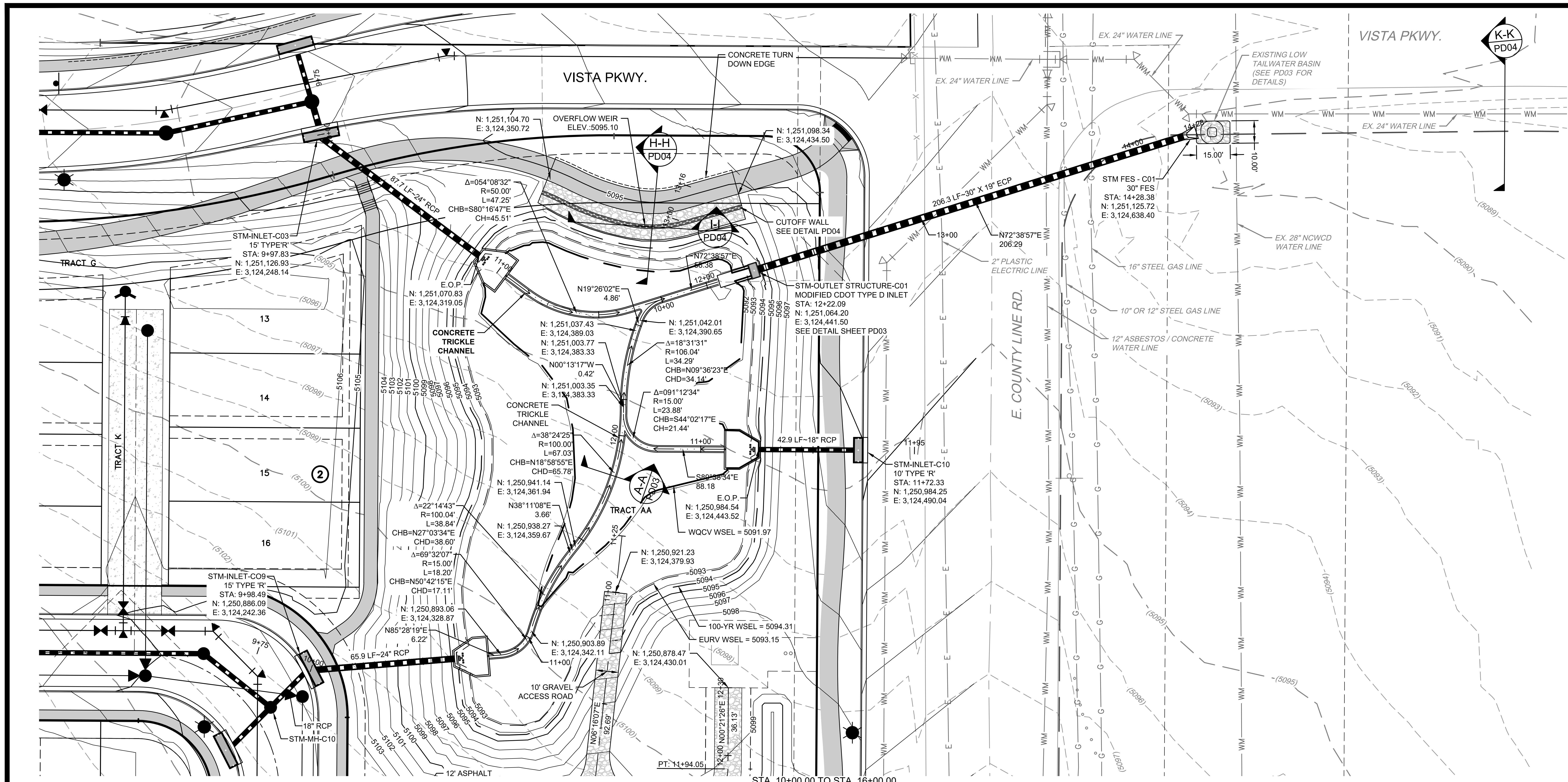
TRAFFIC SIGNAL PLAN

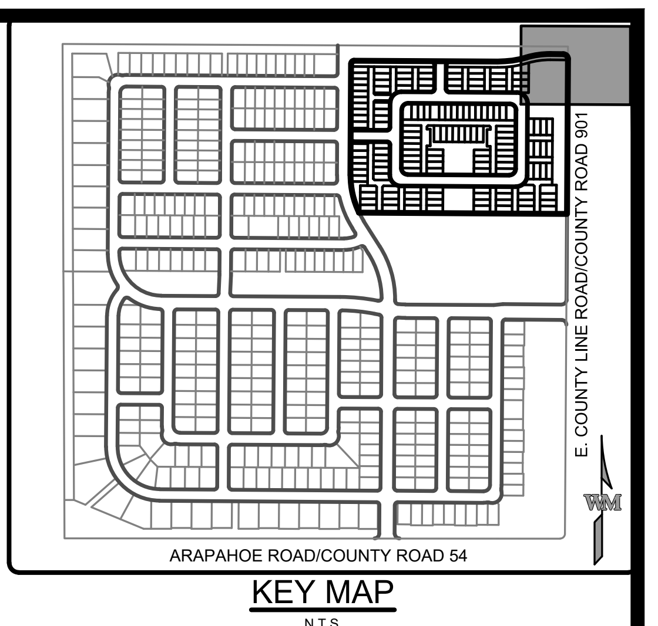
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
TSP01

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



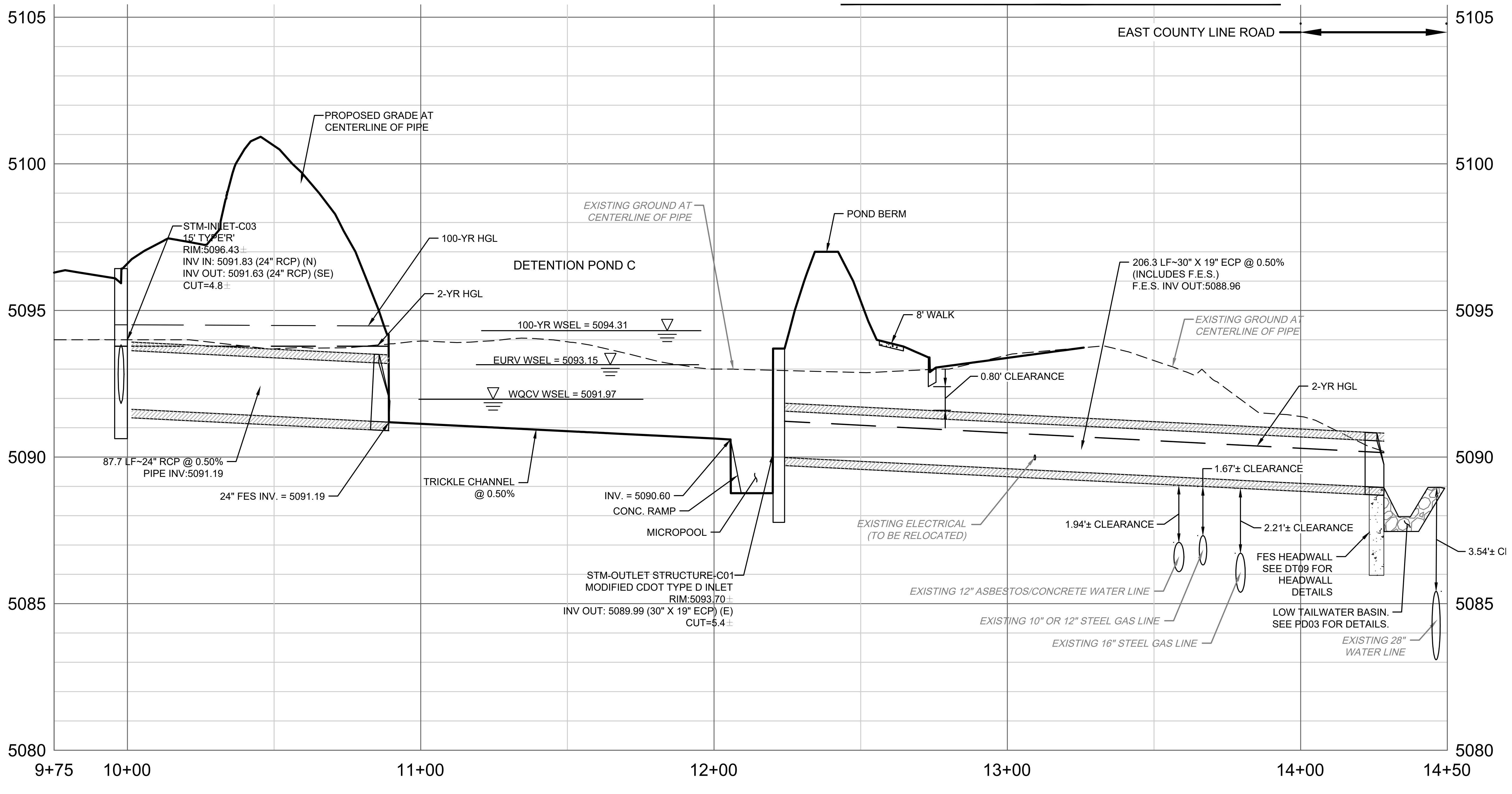


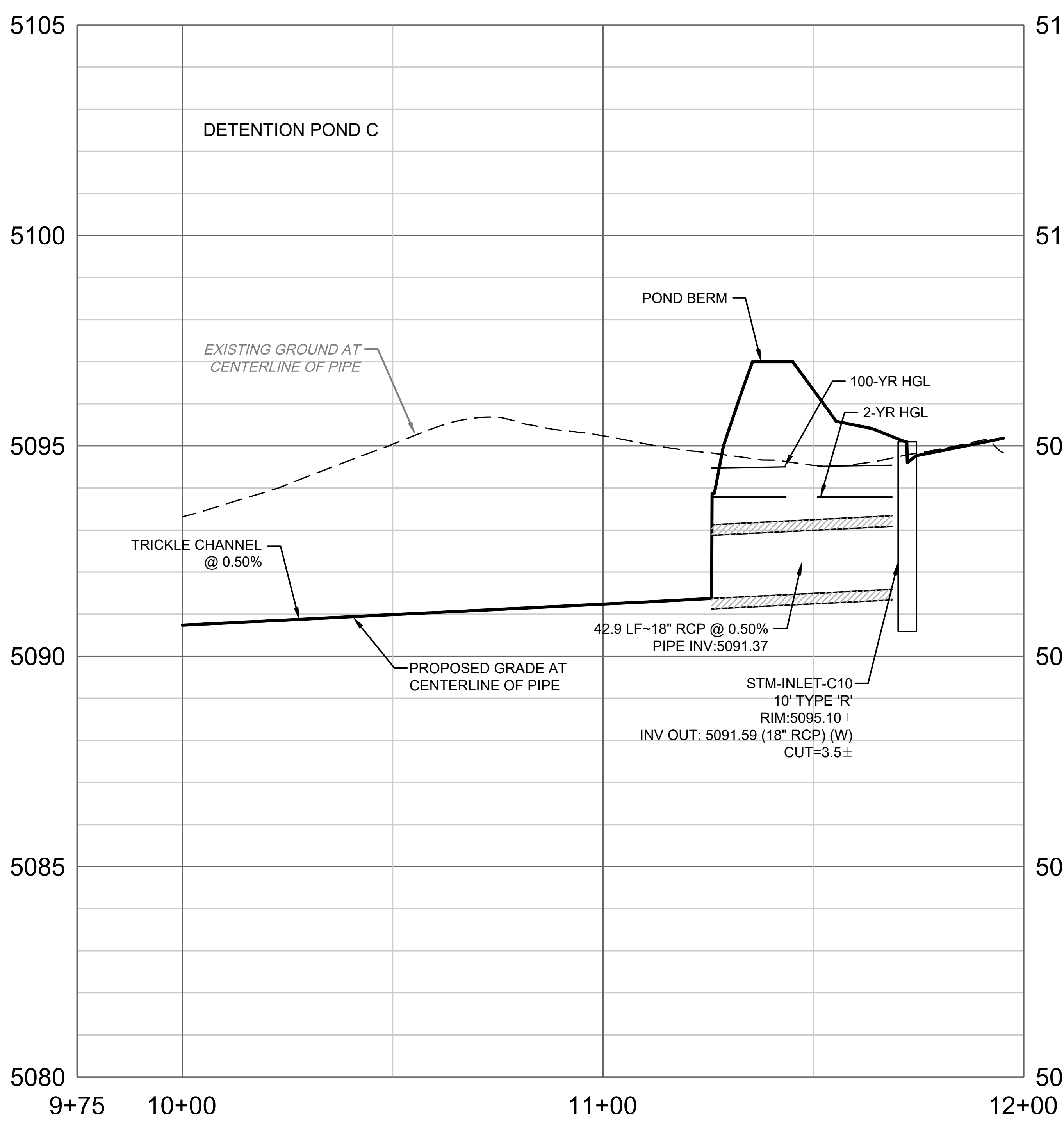
KEY MAP
N.T.S.

CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION

POND C DESCRIPTION		
	UNITS	
EURV VOLUME	AC-FT	0.77
EURV WSEL	FT	5093.57
100-YR VOLUME	AC-FT	1.32
100-YR WSEL	FT	5094.59
EMERGENCY SPILLWAY CREST	FT	5095.10
100-YR PEAK INFLOW	CFS	33.60
100-YR OUTFLOW	CFS	12.13

STA. 10+00.00 TO STA. 16+00.00
COMPASS FILING NO. 4 POND





THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

POND PLAN

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

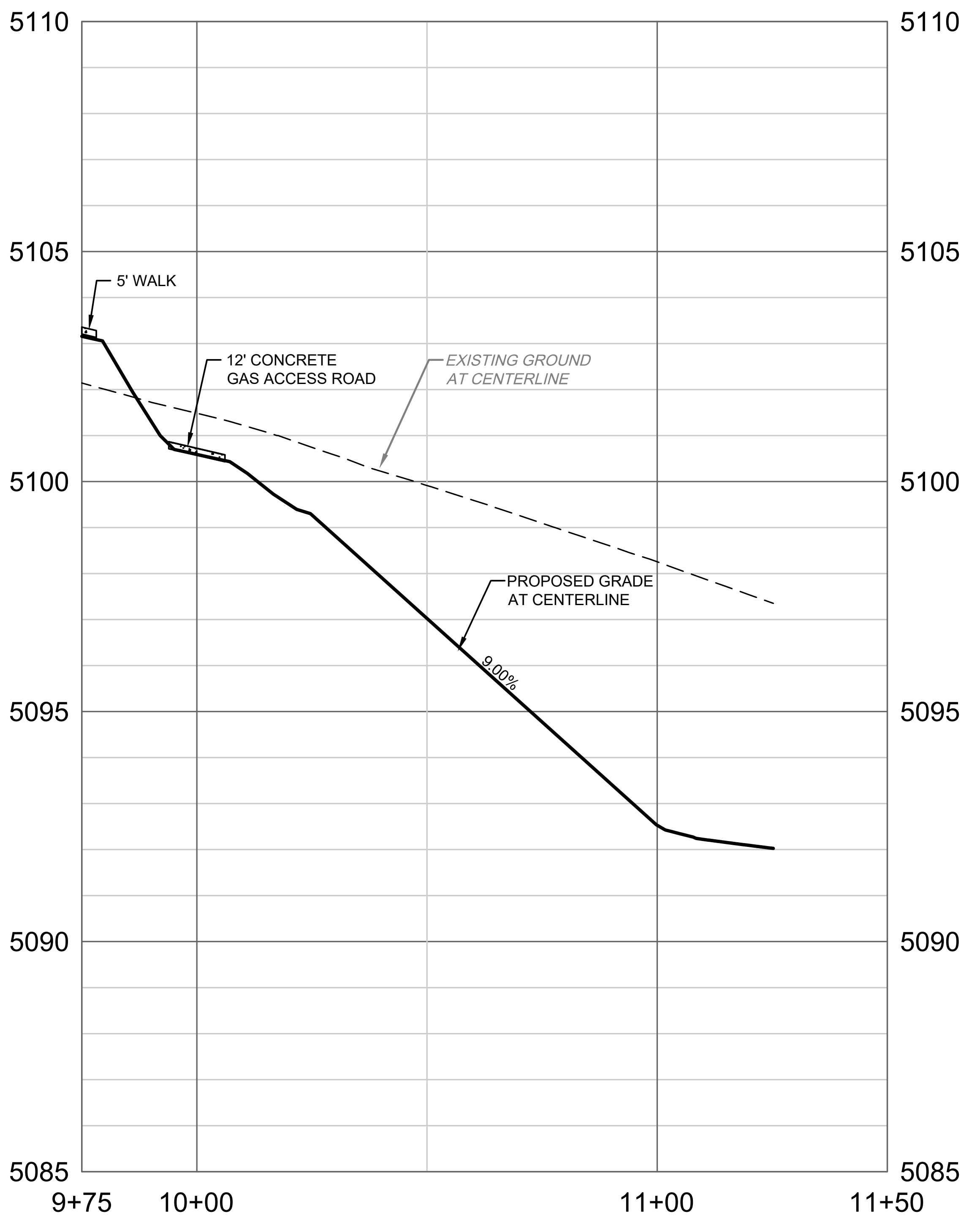
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

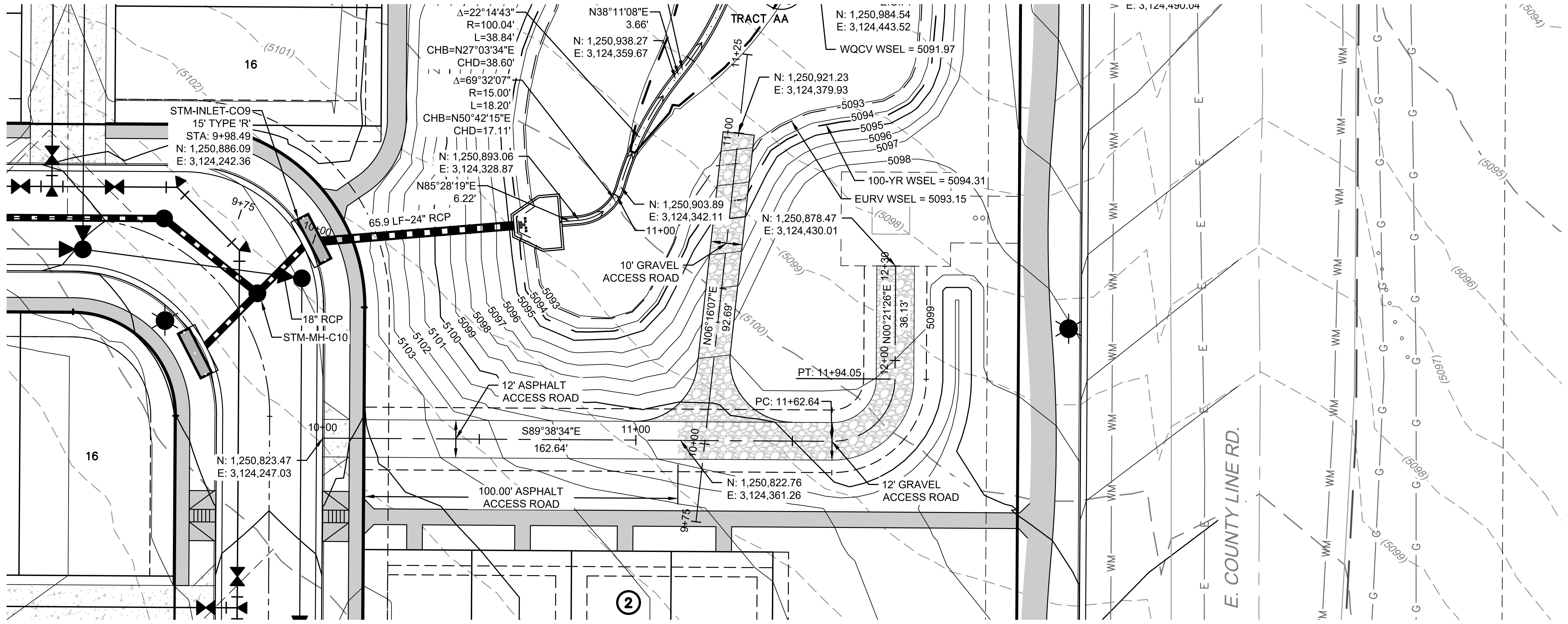
SHEET
PD01
Sheet 60 of 74

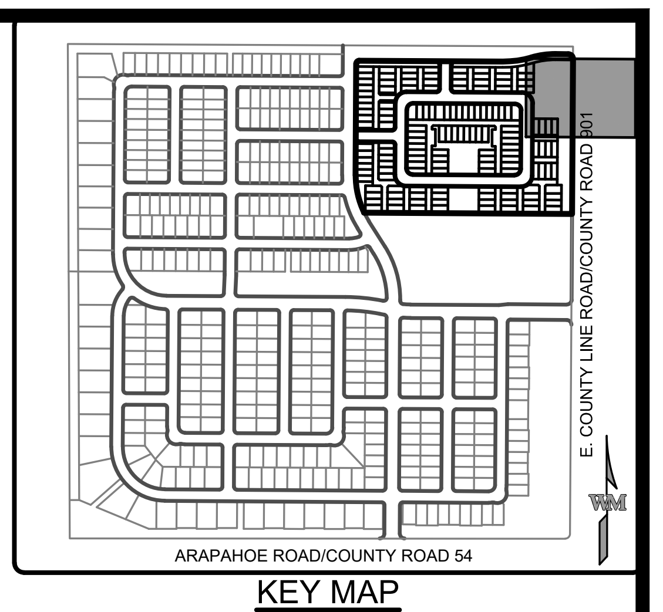
NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT

STA. 9+50.00 TO STA. 11+00.00
10' POND ACCESS PATH



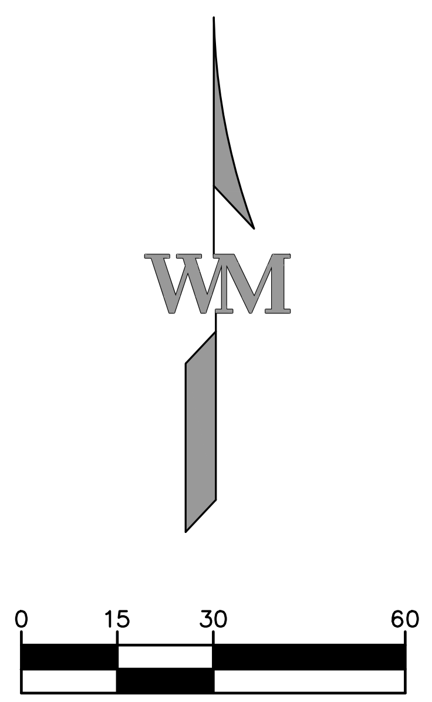




KEY MAP
N.T.S.

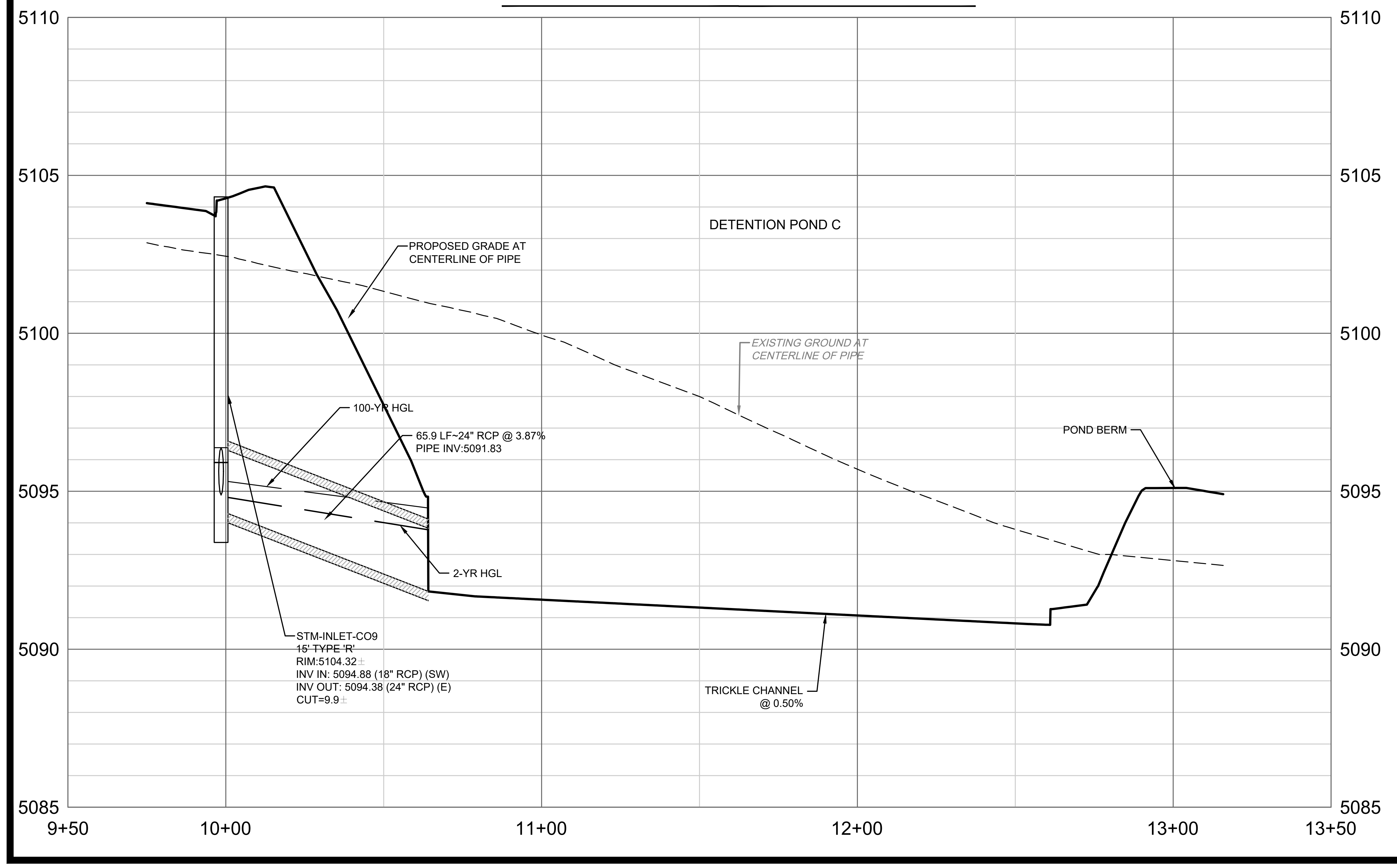
CONTRACTOR TO FIELD VERIFY
LOCATION OF ALL EXISTING UTILITES
PRIOR TO CONSTRUCTION

POND C DESCRIPTION		
	UNITS	
EURV VOLUME	AC-FT	0.78
EURV WSEL	FT	5093.65
100-YR VOLUME	AC-FT	1.24
100-YR WSEL	FT	5094.47
EMERGENCY SPILLWAY CREST	FT	5095.10
100-YR PEAK INFLOW	CFS	33.60
100-YR OUTFLOW	CFS	15.00

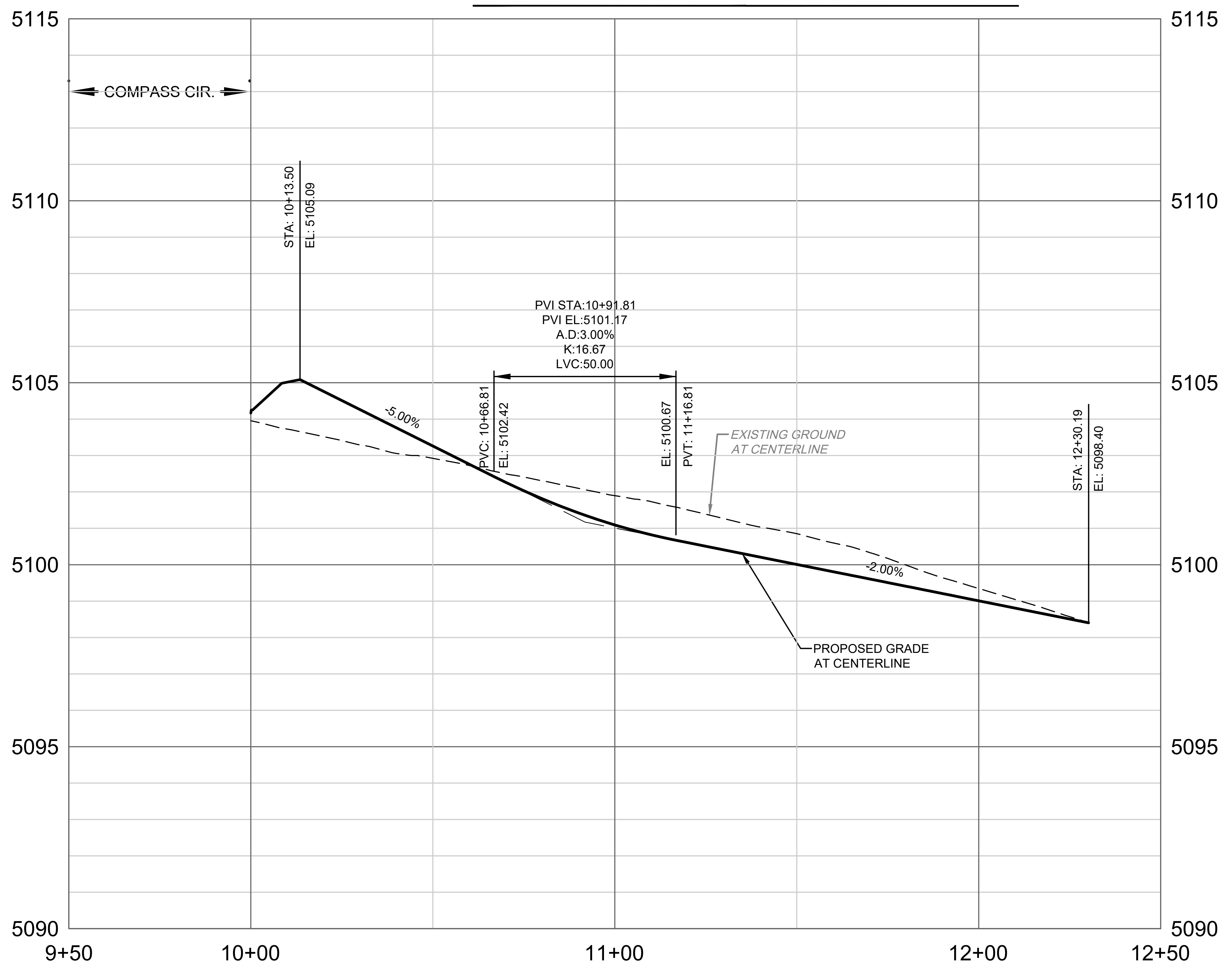


SCALE: Hor: 1" =30'
SCALE: Vert: 1" = 5'
ORIGINAL GRAPHIC SCALE

STA. 9+50.00 TO STA. 13+50.00
COMPASS FILING NO. 4 POND



STA. 9+50.00 TO STA. 13+00.00
12' CONCRETE GAS ACCESS ROAD



WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED
THOMAS C. JANSEN
35942
PROFESSIONAL ENGINEER
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

POND PLAN

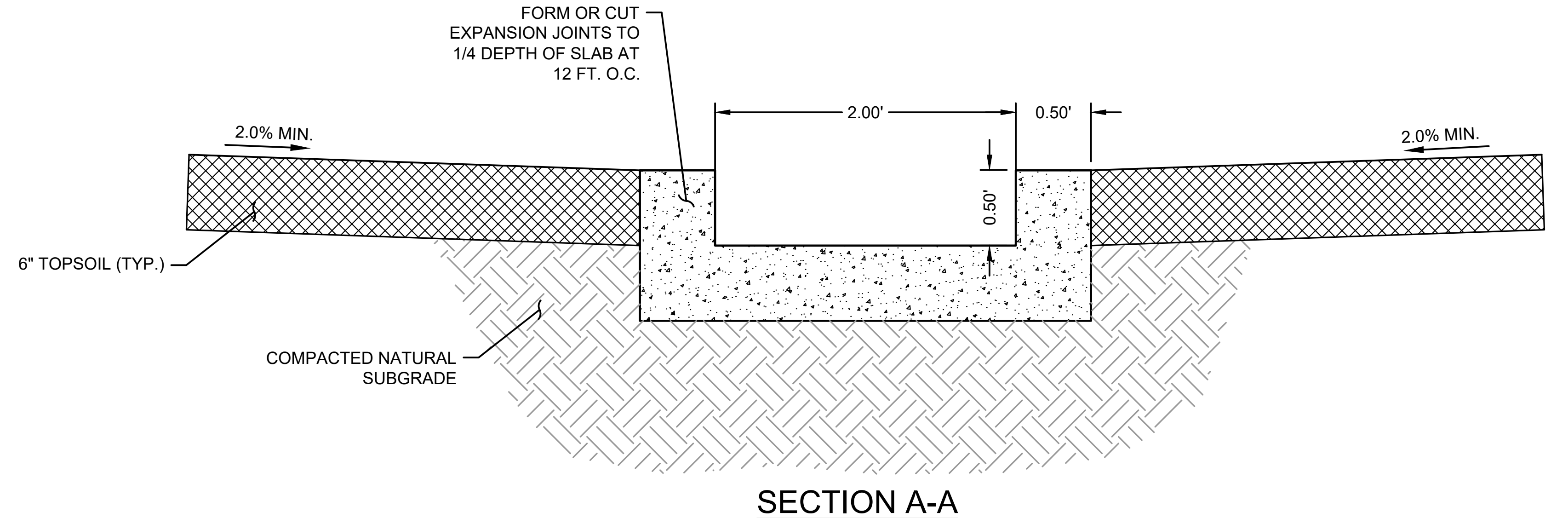
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

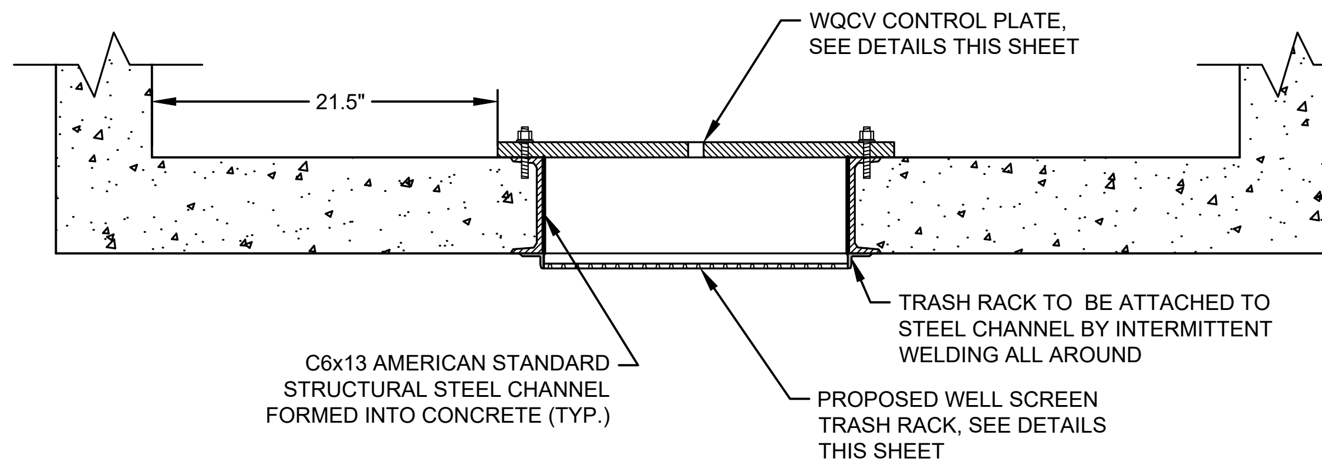
SHEET
PD02
Sheet 61 of 74

NOT FOR CONSTRUCTION

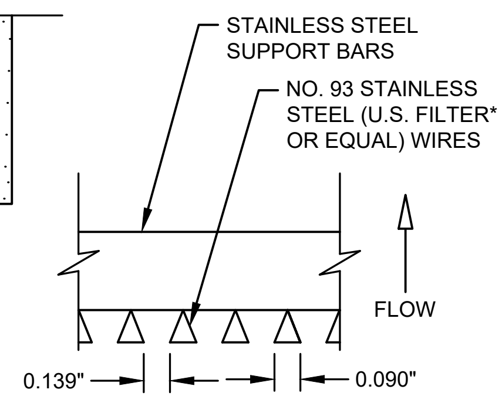
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



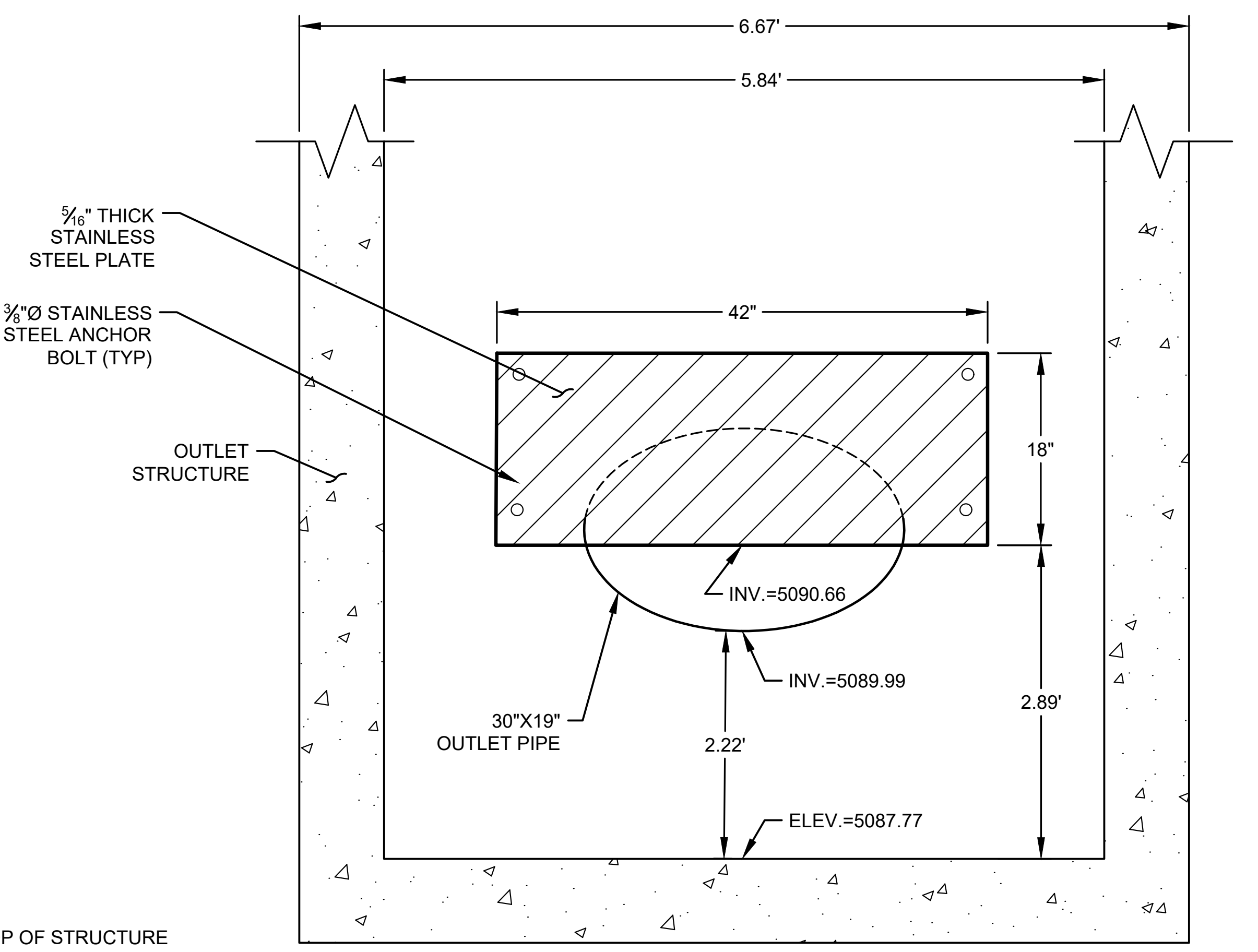
SECTION A-A
CONCRETE LINED TRICKLE CHANNEL
N.T.S.



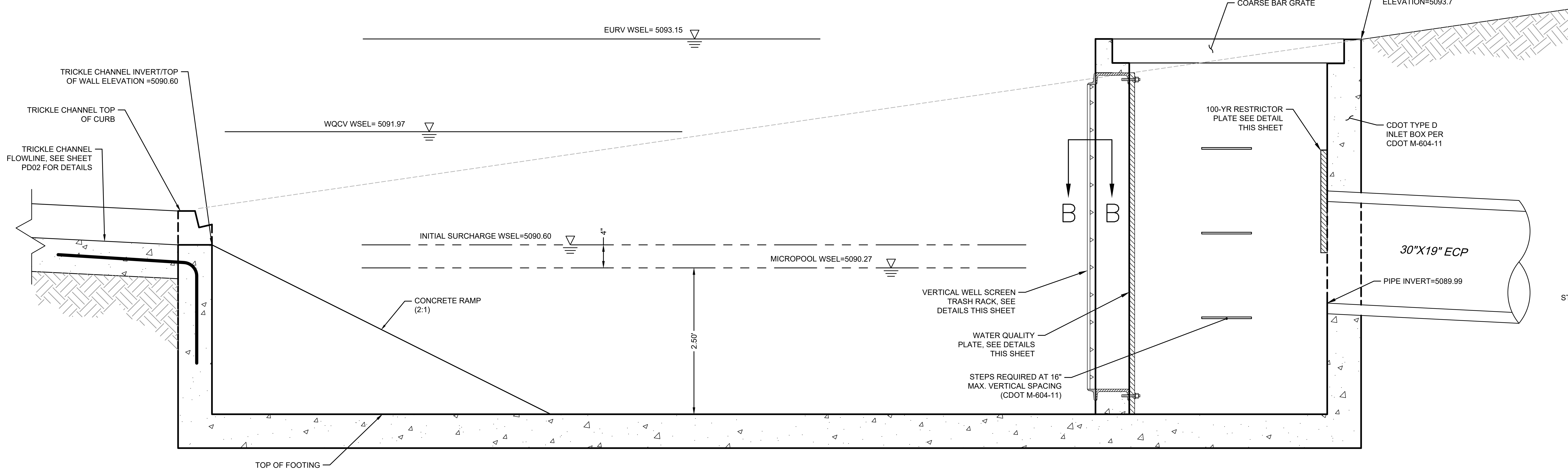
WQCV ORIFICE PLATE/TRASH RACK
PLAN VIEW
N.T.S.



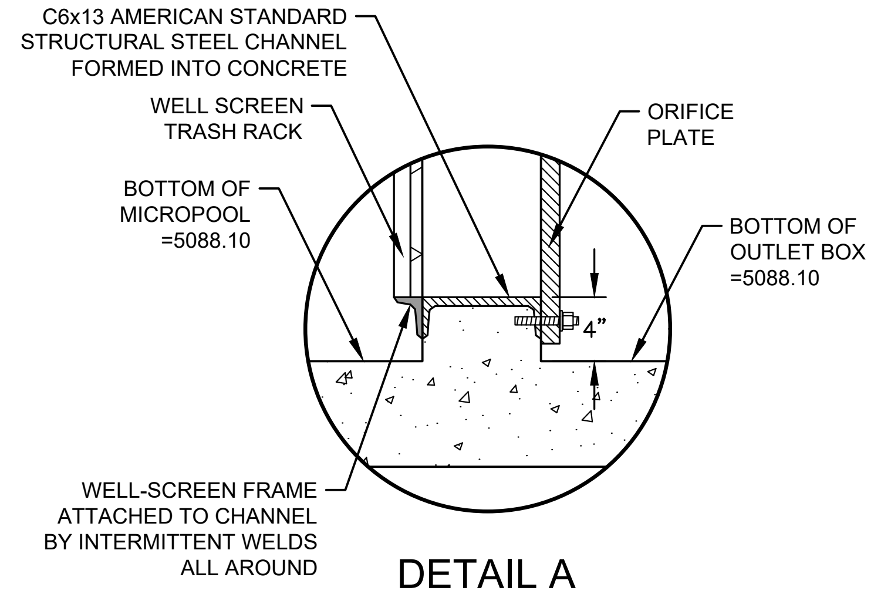
SECTION B-B
N.T.S.



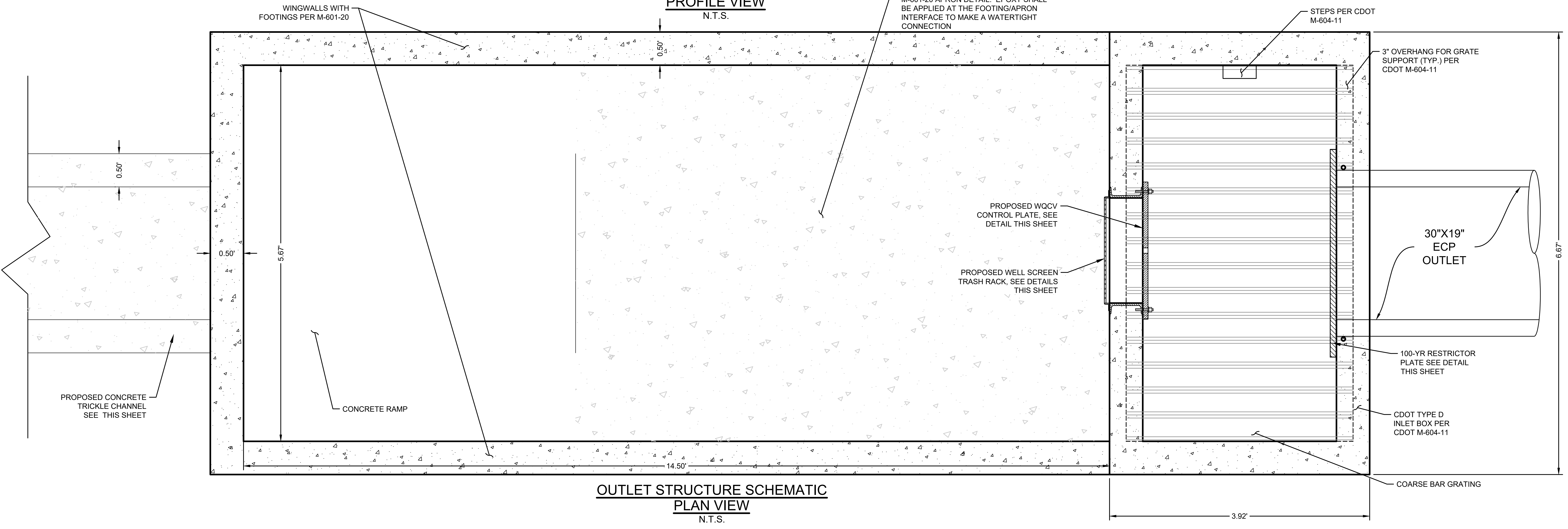
100-YR RESTRICTOR PLATE
DETAIL
N.T.S.



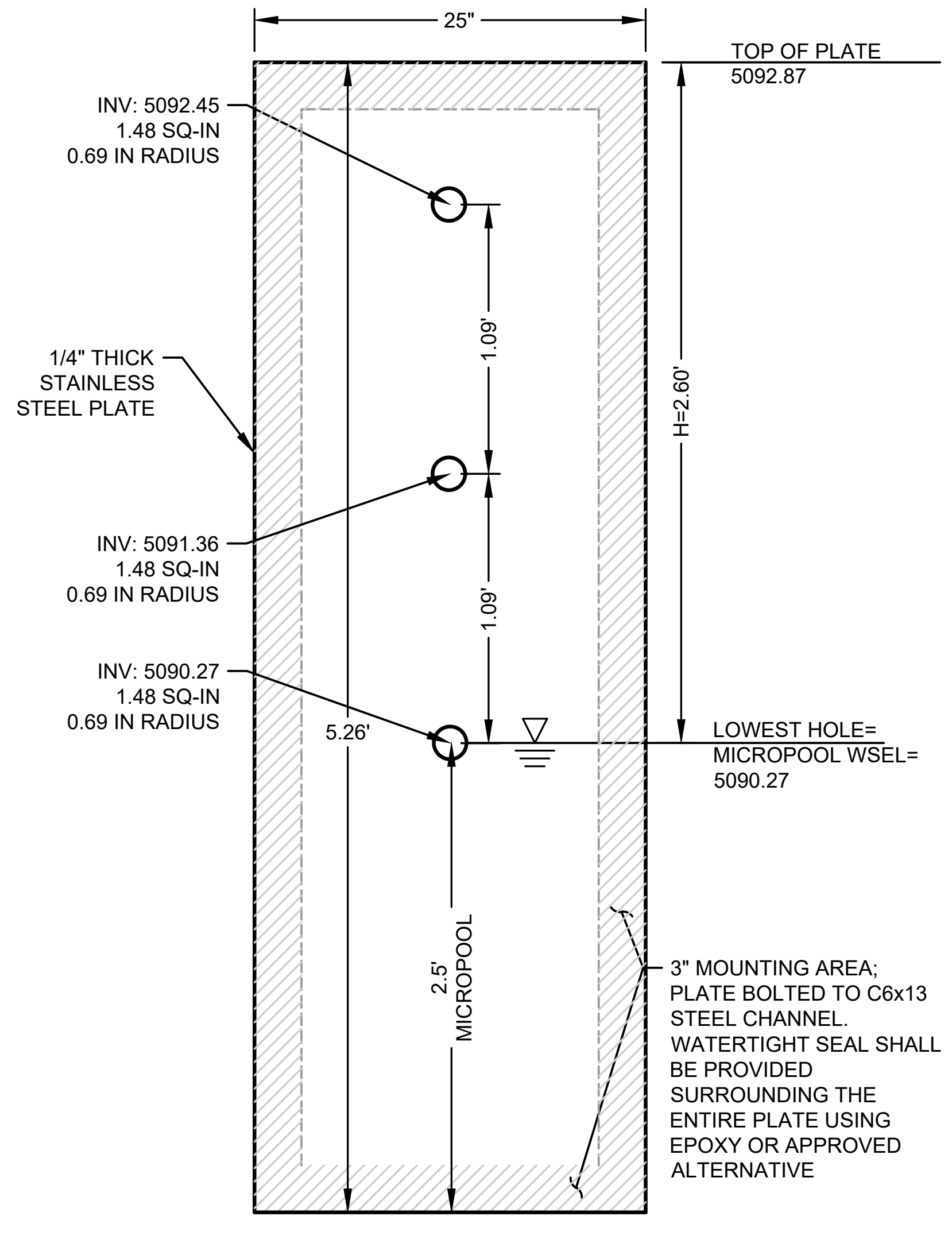
OUTLET STRUCTURE SCHEMATIC
PROFILE VIEW
N.T.S.



DETAIL A
N.T.S.



OUTLET STRUCTURE SCHEMATIC
PLAN VIEW
N.T.S.



EURV CONTROL PLATE DETAIL
EURV IS DRAINED IN 72-HOURS
N.T.S.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

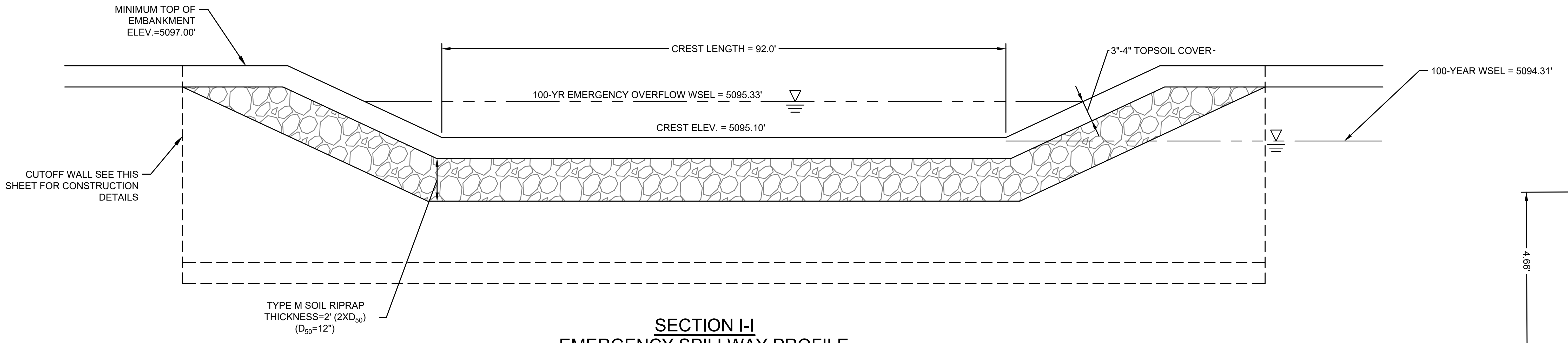
POND DETAILS

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

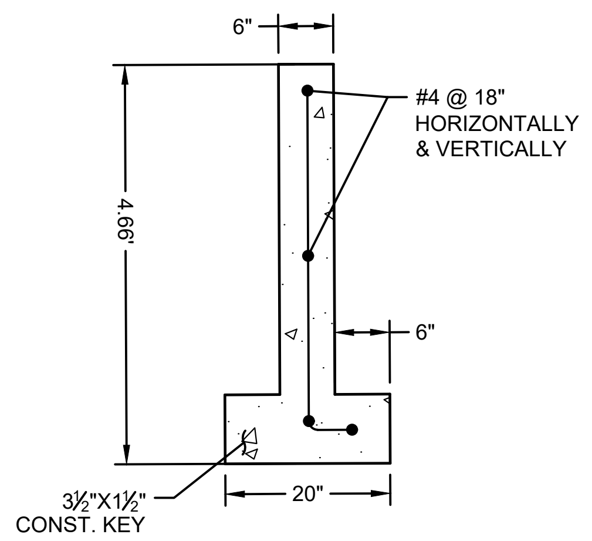
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
PD03
Sheet 62 of 74

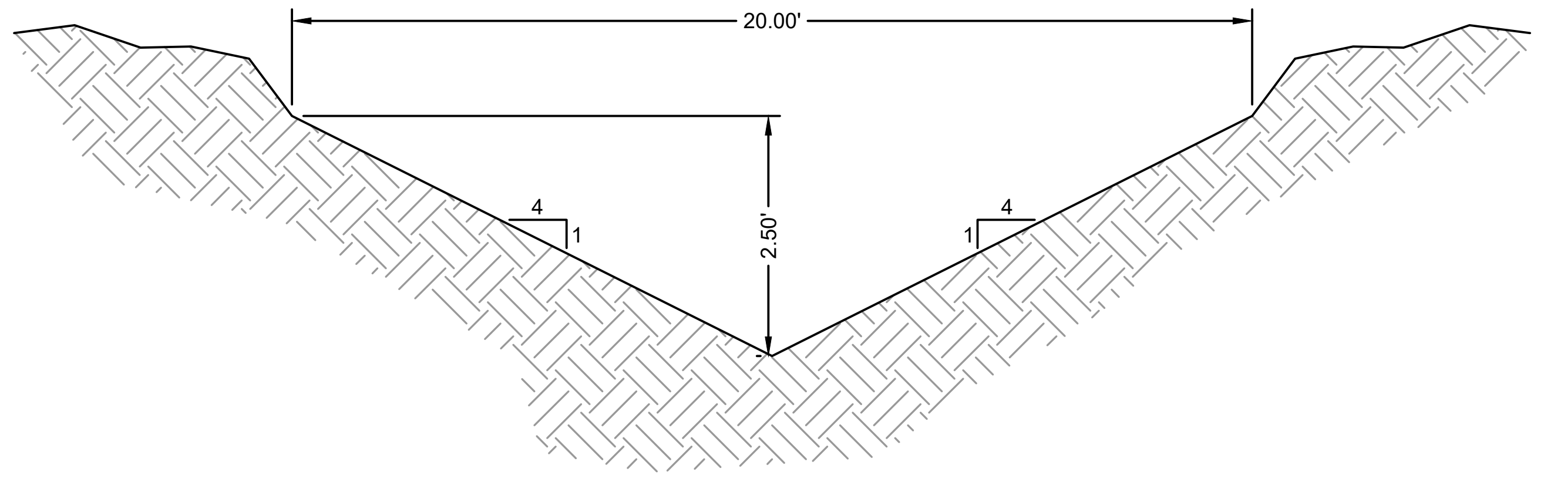
NOT FOR CONSTRUCTION



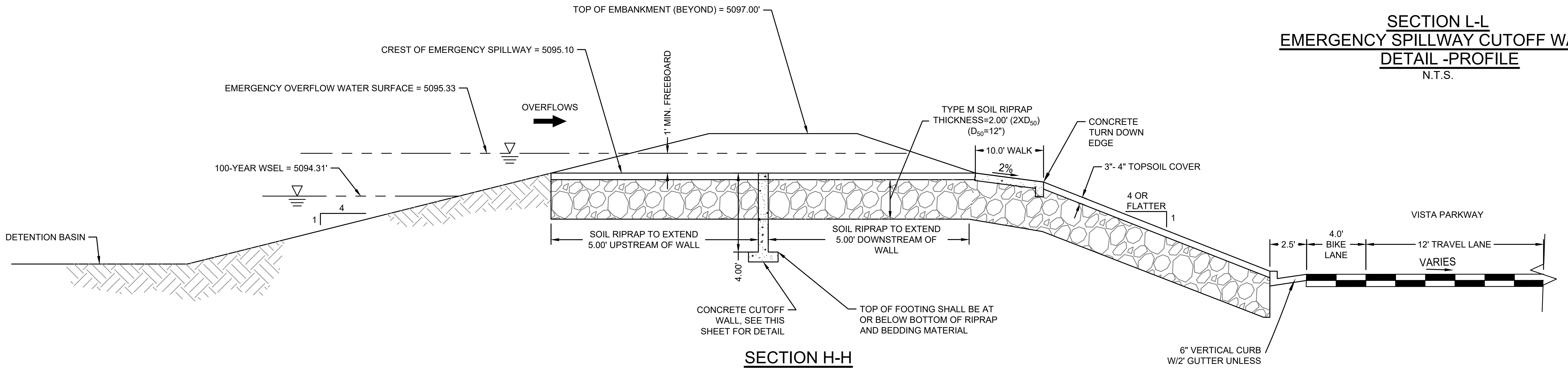
SECTION I-I
EMERGENCY SPILLWAY PROFILE
N.T.S.



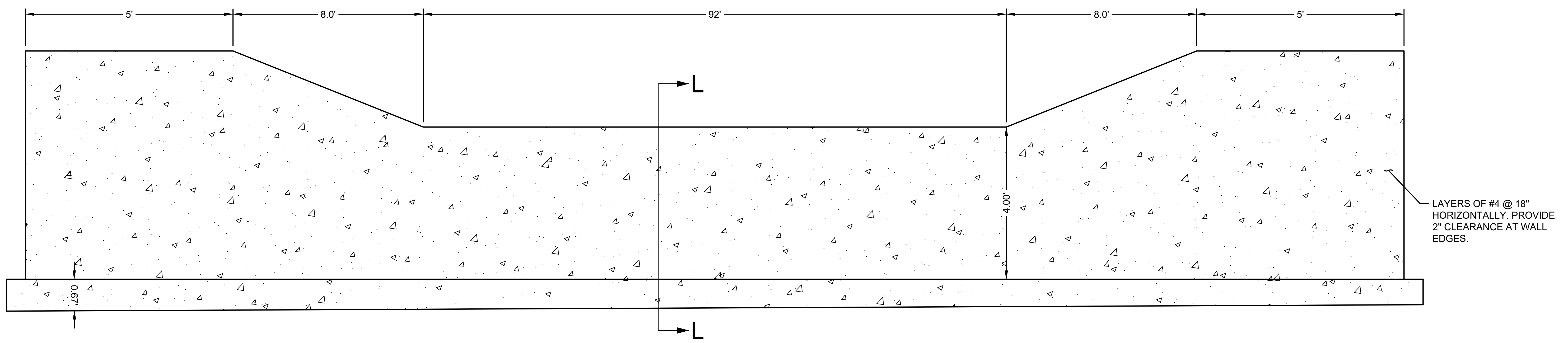
SECTION L-L
EMERGENCY SPILLWAY CUTOFF WALL DETAIL -PROFILE
N.T.S.



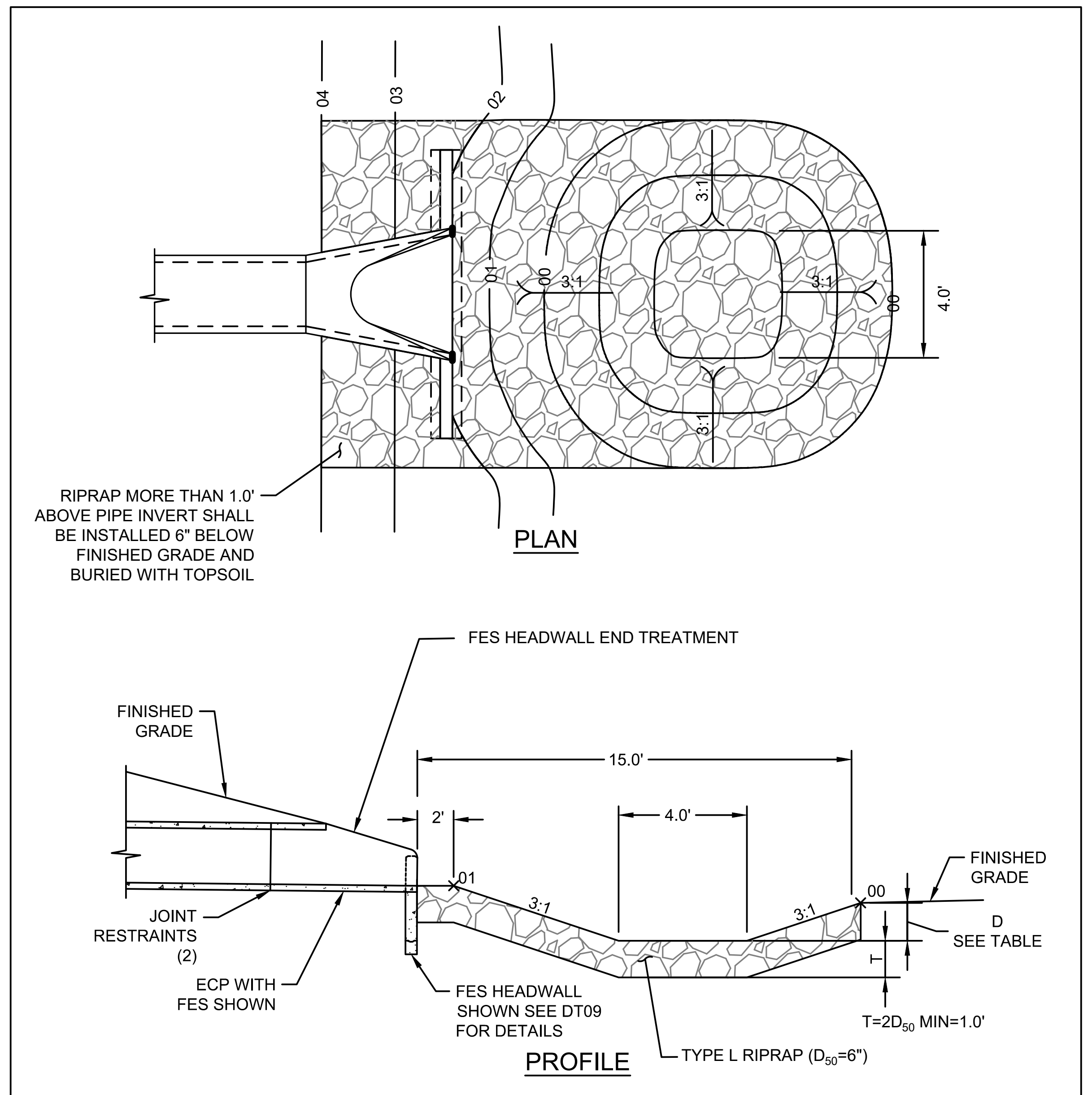
SECTION K-K
SECTION FOR ROADSIDE SWALE
N.T.S.



SECTION H-H
EMERGENCY SPILLWAY - CHANNEL SECTION
N.T.S.



SECTION J-J
EMERGENCY SPILLWAY CUTOFF WALL DETAIL
N.T.S.



PIPE SIZE OR BOX HEIGHT	D	W*	L
18" - 24"	1'-0"	4'	15'

* IF OUTLET PIPE IS A BOX CULVERT WITH A WIDTH GREATER THAN W, THEN W = CULVERT WIDTH

LOW TAILWATER RIPRAP BASIN

LOW TAILWATER RIPRAP BASIN
N.T.S.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

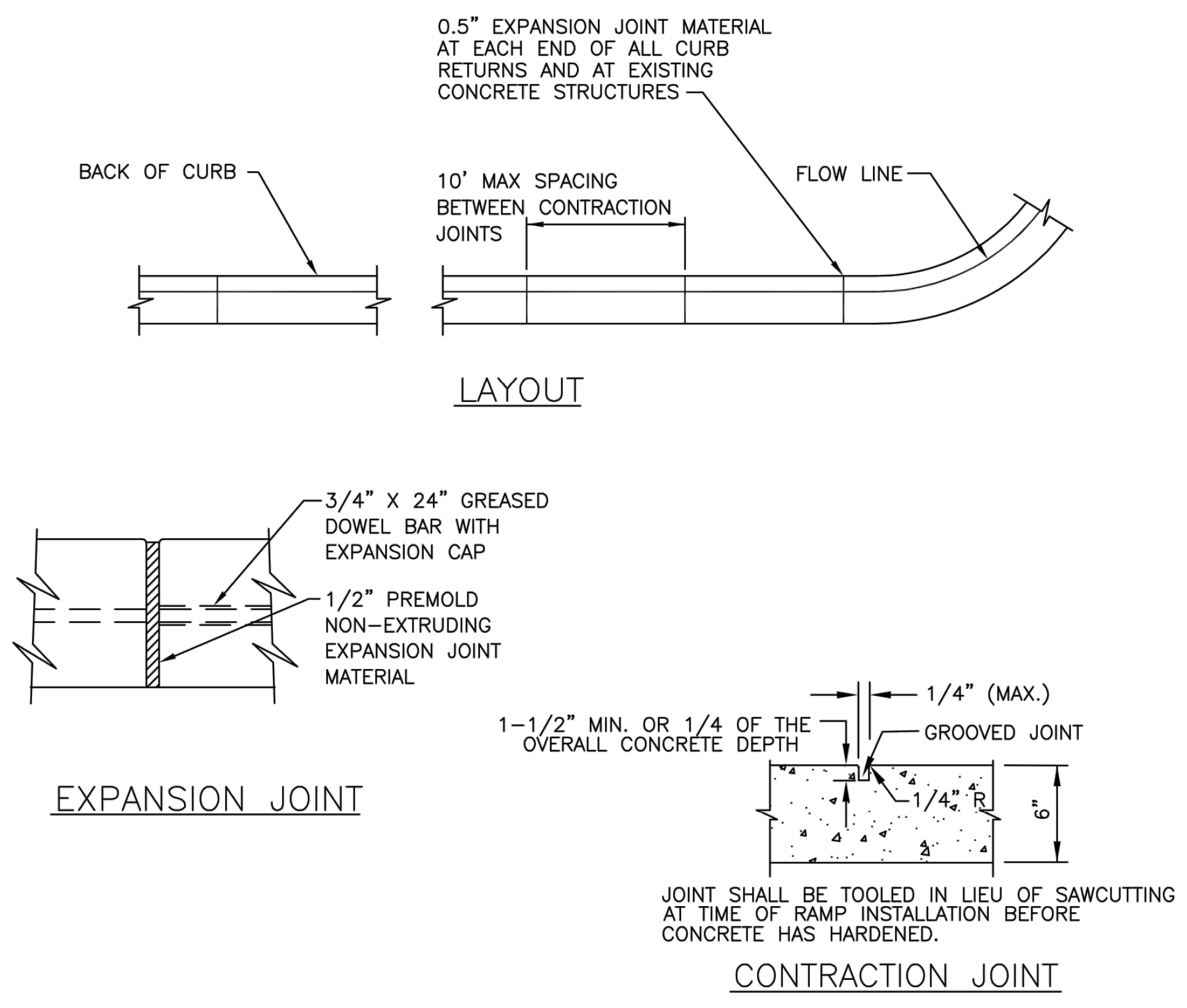
POND DETAILS

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
PD04
Sheet 63 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



LAYOUT

EXPANSION JOINT

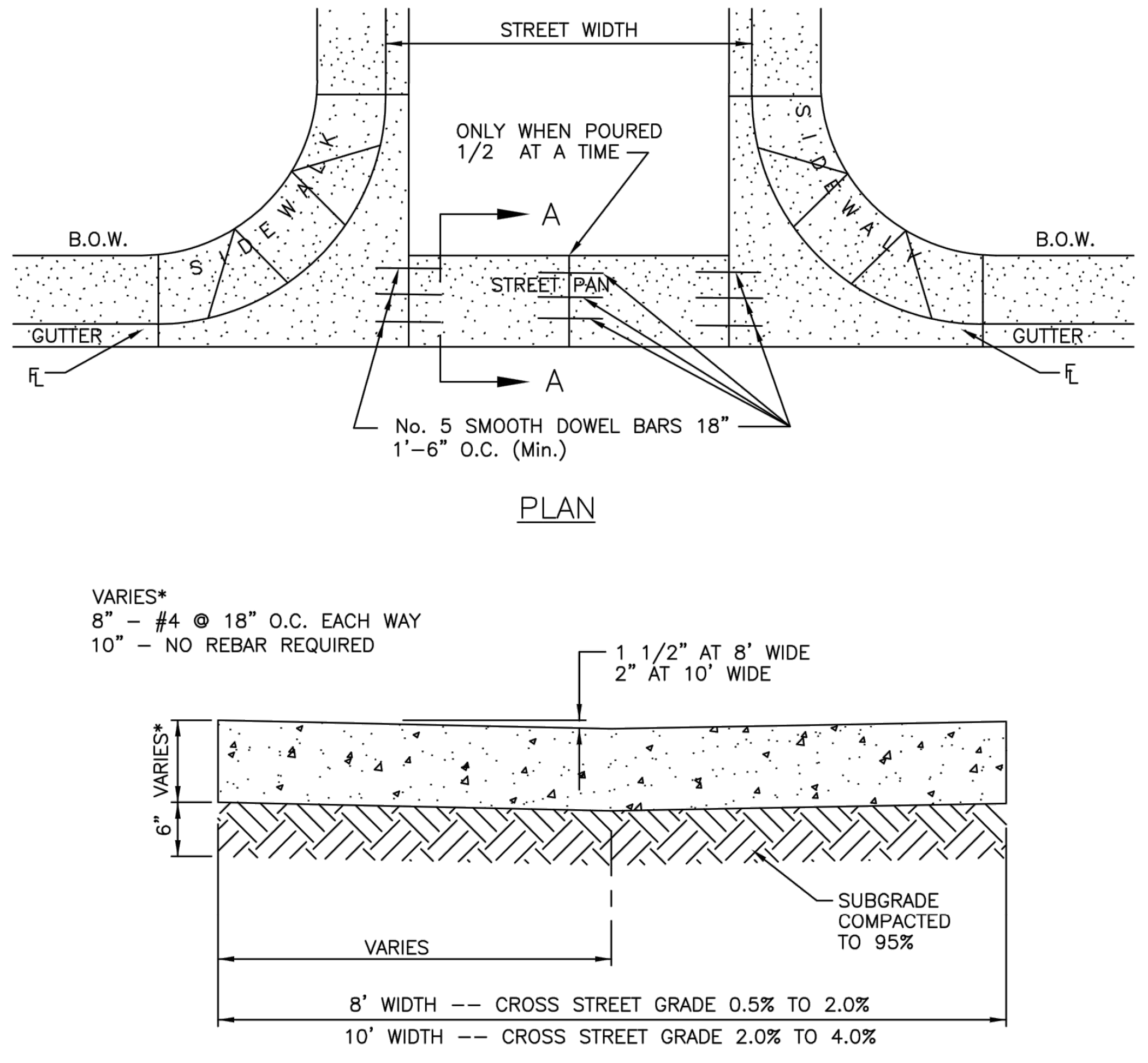
CONTRACTION JOINT

NOTES:

1. EXPANSION JOINT MATERIAL SHALL BE NON-EXTRUDING AND RESILIENT TYPE TO MEET AASHTO SPEC. M-213.
2. ANY OVER-EXCAVATION SHALL BE REPLACED BY GRANULAR BACKFILL COMPACTED TO 95% MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D-698.

The Town of ERIE COLORADO

DRAWING TITLE: CURB AND GUTTER JOINT DETAIL
DRAWING NUMBER: SW1
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2010



PLAN

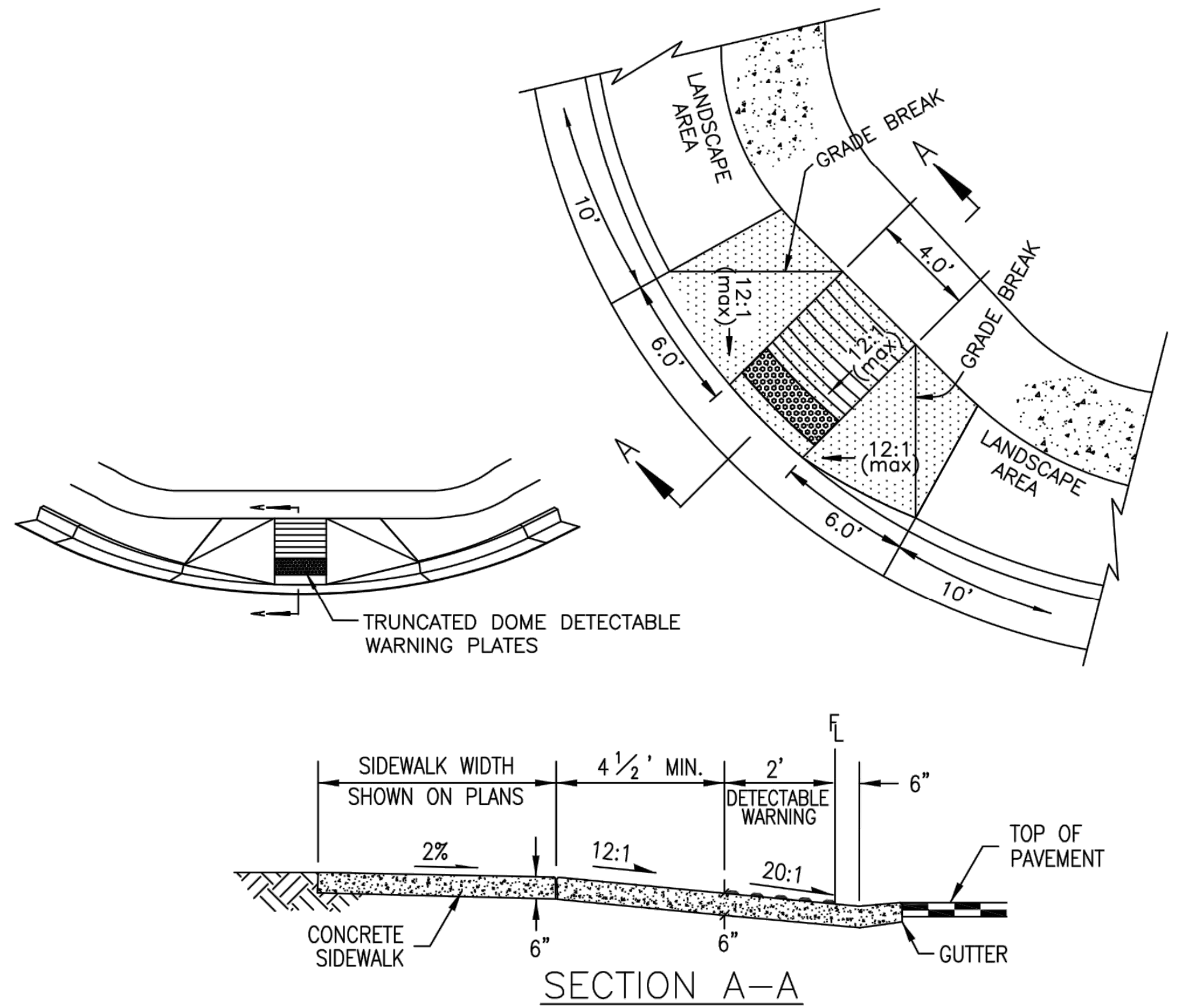
SECTION A–A

CONCRETE CROSS PAN

NOT TO SCALE

The Town of ERIE COLORADO

DRAWING TITLE: CONCRETE CROSS PAN
DRAWING NUMBER: SW3
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2010



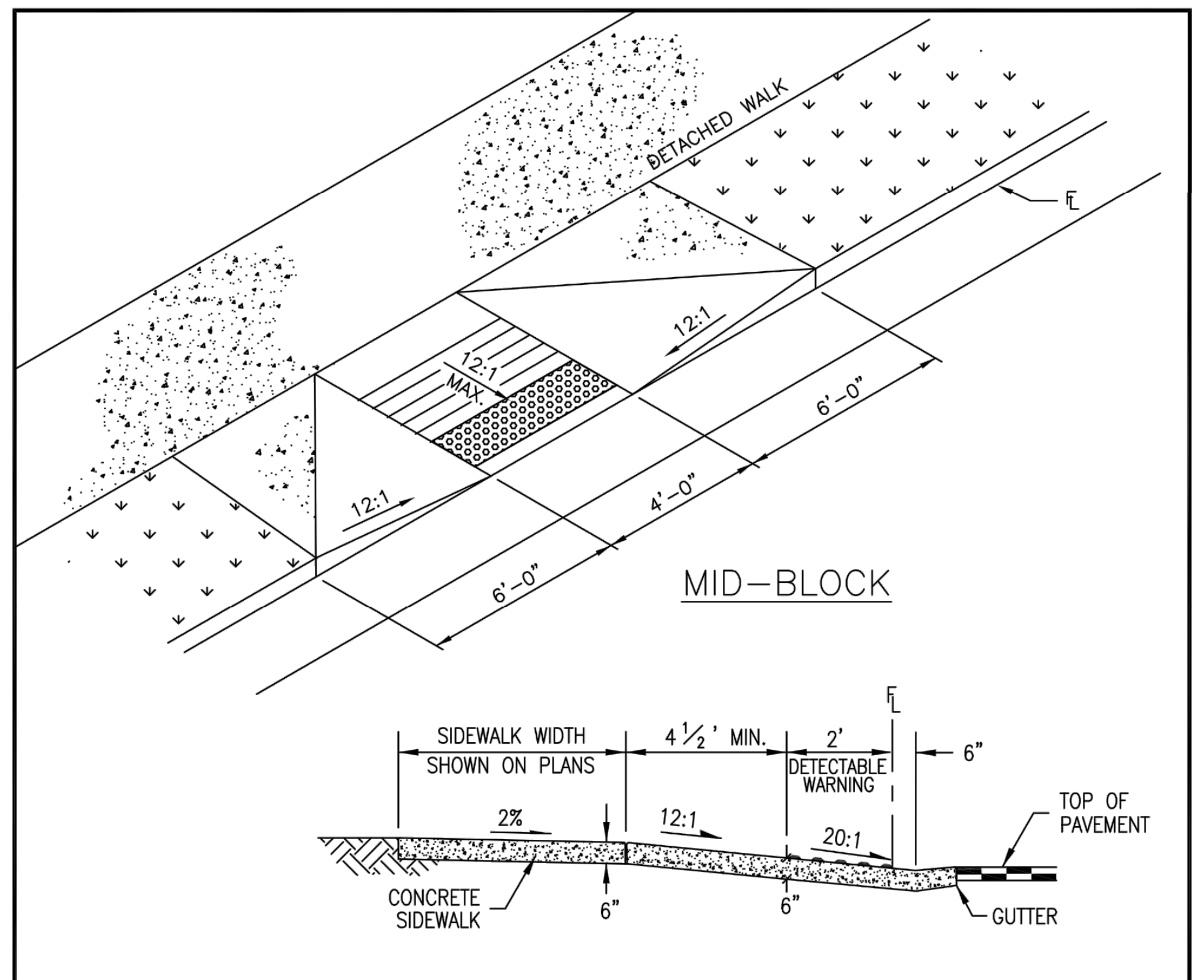
SECTION A–A

NOTES:

1. THERE SHALL BE NO LIP WHERE THE RAMP MEETS THE GUTTER.
2. CURB RAMPS SHALL BE PROVIDED AT ALL CORNERS OF STREET INTERSECTIONS AND AT "T" INTERSECTIONS WHERE THERE IS EXISTING OR PROPOSED SIDEWALK AND CURB.
3. RAMP SURFACE SHALL HAVE A COARSE BROOM FINISH WITH GROOVES PLACED PERPENDICULAR TO THE SLOPE AT 8" INTERVALS, 1/2" DEPTH.
4. CURB RAMPS SHALL BE POURED MONOLITHICALLY WITH THE CURB, GUTTER AND APRON.
5. RAMP DIMENSIONS SHALL BE SPECIFIED ON THE CONSTRUCTION PLANS, RAMP AND WING SLOPES SHALL NOT BE STEEPER THAN 12:1.
6. RAMP SLOPES SHALL NOT BE STEEPER THAN 12:1. THE DETECTABLE WARNING AREA SLOPE SHALL NOT BE STEEPER THAN 20:1.
7. DETECTABLE WARNINGS SHALL BE EAST JORDON IRON WORKS 7005 SERIES DETECTABLE WARNING PLATES OR APPROVED EQUAL.

The Town of ERIE COLORADO

DRAWING TITLE: CURB RAMP TYPE 4 DETACHED SIDEWALK
DRAWING NUMBER: SW8
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2015



MID–BLOCK

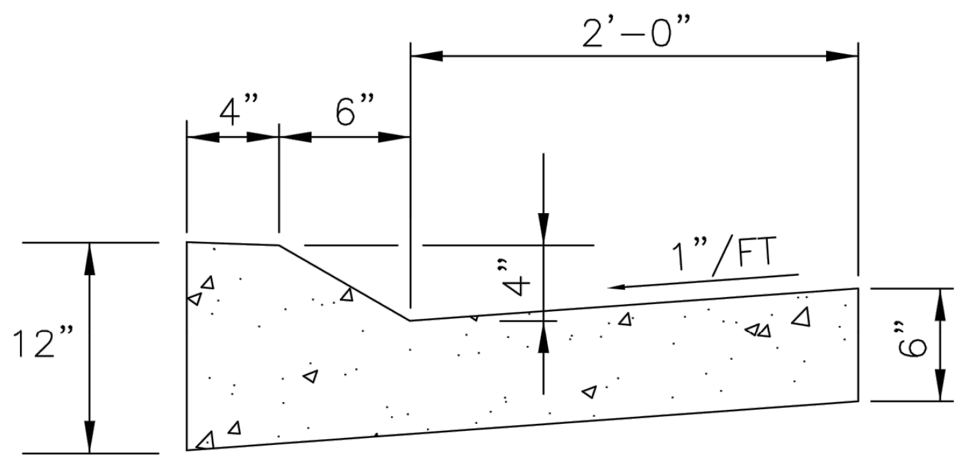
TYPICAL RAMP SECTION

NOTES:

1. THERE SHALL BE NO LIP WHERE THE RAMP MEETS THE GUTTER.
2. CURB RAMPS SHALL BE PROVIDED AT ALL CORNERS OF STREET INTERSECTIONS AND AT "T" INTERSECTIONS WHERE THERE IS EXISTING OR PROPOSED SIDEWALK AND CURB.
3. RAMP SURFACE SHALL HAVE A COARSE BROOM FINISH WITH GROOVES PLACED PERPENDICULAR TO THE SLOPE AT 8" INTERVALS, 1/2" DEPTH.
4. CURB RAMPS SHALL BE POURED MONOLITHICALLY WITH THE CURB, GUTTER AND APRON.
5. RAMP DIMENSIONS SHALL BE SPECIFIED ON THE CONSTRUCTION PLANS, RAMP AND WING SLOPES SHALL NOT BE STEEPER THAN 12:1.
6. RAMP SLOPES SHALL NOT BE STEEPER THAN 12:1. THE DETECTABLE WARNING AREA SLOPE SHALL NOT BE STEEPER THAN 20:1.
7. DETECTABLE WARNINGS SHALL BE EAST JORDON IRON WORKS 7005 SERIES DETECTABLE WARNING PLATES OR APPROVED EQUAL.

The Town of ERIE COLORADO

DRAWING TITLE: CURB RAMP MID BLOCK TYPE 1 DETACHED SIDEWALK
DRAWING NUMBER: SW10A
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2015



HOLLYWOOD

MOUNTABLE CURB & GUTTER

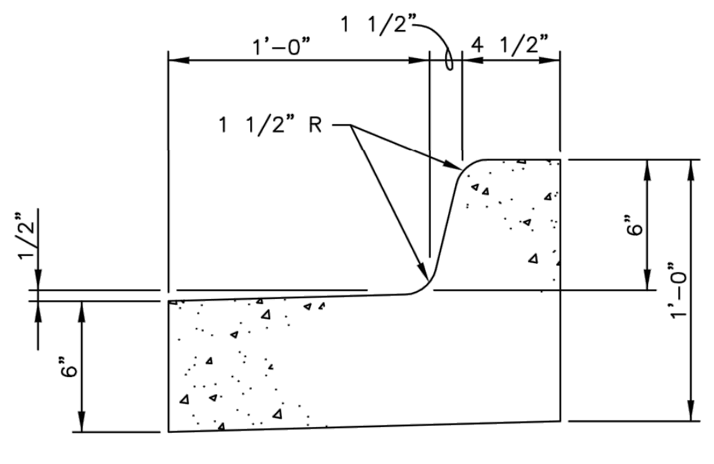
CATCH

NOTES:

1. SUBGRADE TO BE COMPACTED TO 95% MODIFIED PROCTOR.

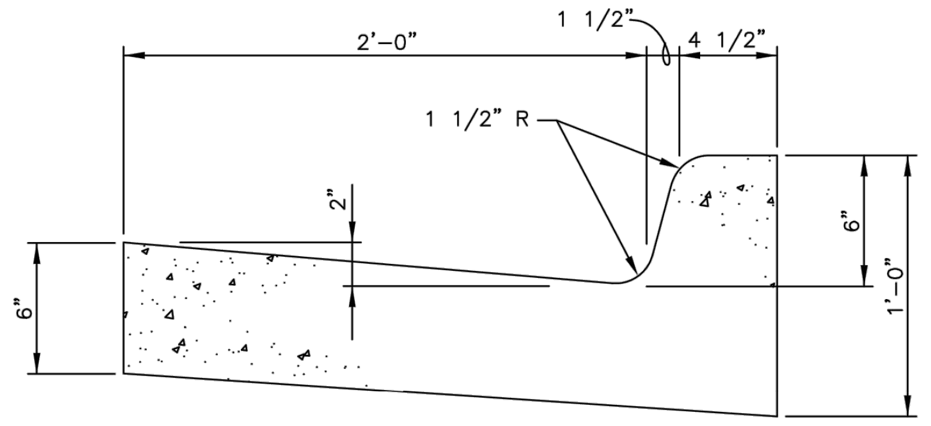
The Town of ERIE COLORADO

DRAWING TITLE: MOUNTABLE CURB SECTION
DRAWING NUMBER: SW11
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2010



MEDIAN CURB & GUTTER

SPILL



VERTICAL CURB & GUTTER

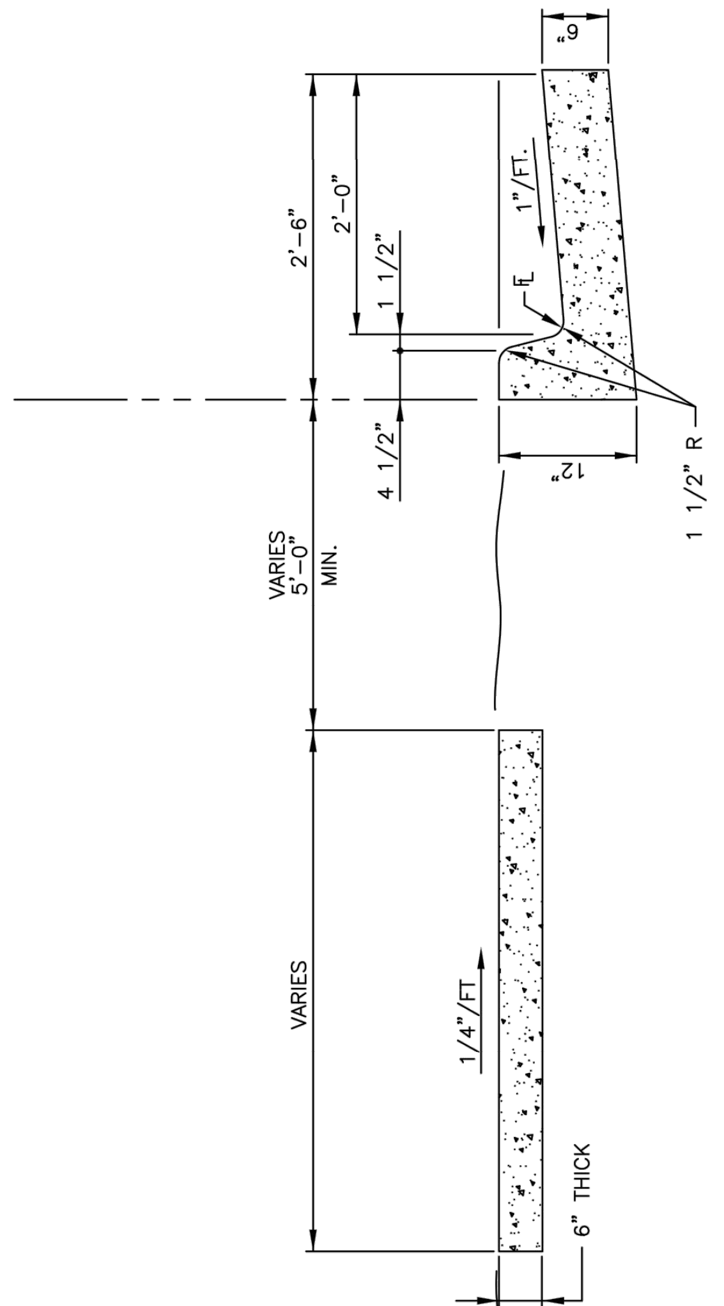
CATCH

NOTES:

1. SUBGRADE TO BE COMPACTED TO 95% MODIFIED PROCTOR.

The Town of ERIE COLORADO

DRAWING TITLE: VERTICAL CURB SECTION
DRAWING NUMBER: SW12
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2010

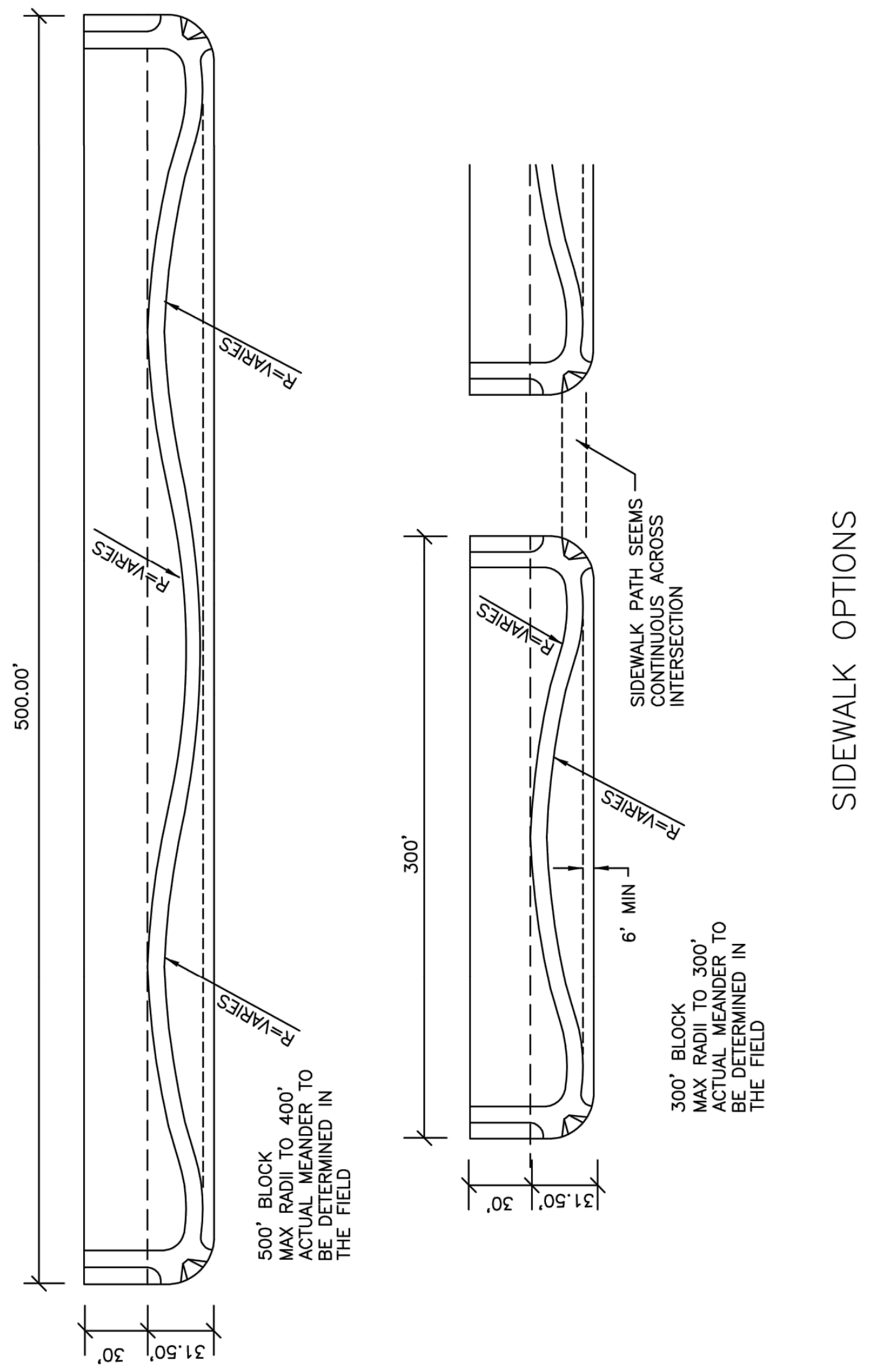


NOTES

1. SIDEWALK WIDTH SHALL BE SPECIFIED ON THE CONSTRUCTION PLANS.
2. LANDSCAPE TREATMENT MUST BE SPECIFIED.
3. 6" VERTICAL CURB, GUTTER, AND SIDEWALK IS REQUIRED FOR COLLECTOR AND ARTERIAL STREETS.

The Town of ERIE COLORADO

DRAWING TITLE: 6" VERTICAL CURB, GUTTER AND DETACHED SIDEWALK
DRAWING NUMBER: SW13
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2014



SIDEWALK OPTIONS

The Town of ERIE COLORADO

DRAWING TITLE: SIDEWALK DESIGN STANDARDS
DRAWING NUMBER: SW14
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2009

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

STREET DETAILS

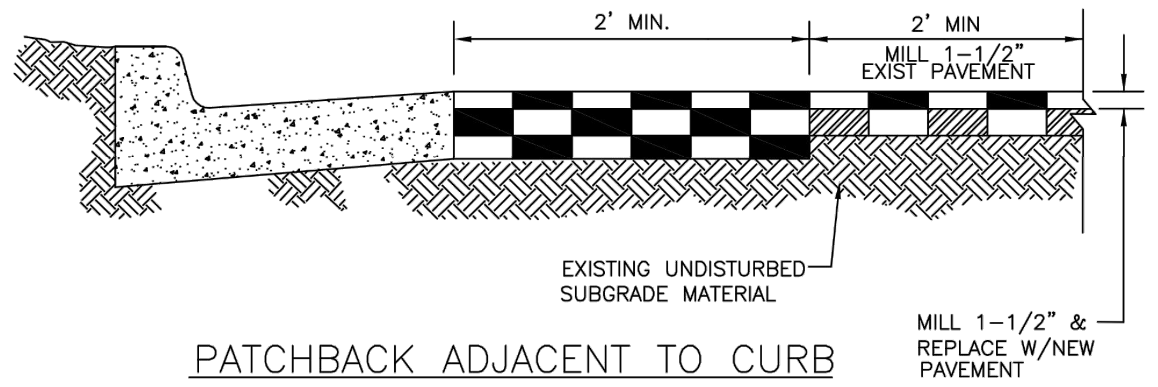
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

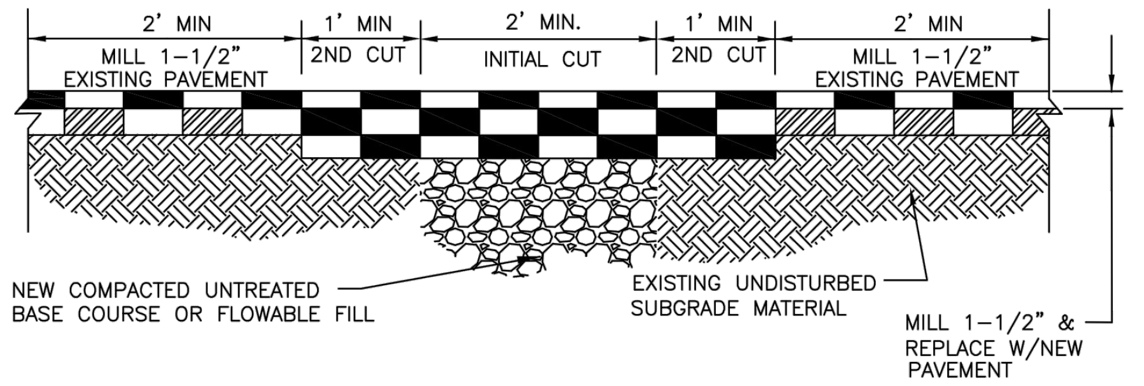
SHEET
DT01
Sheet 64 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



PATCHBACK ADJACENT TO CURB



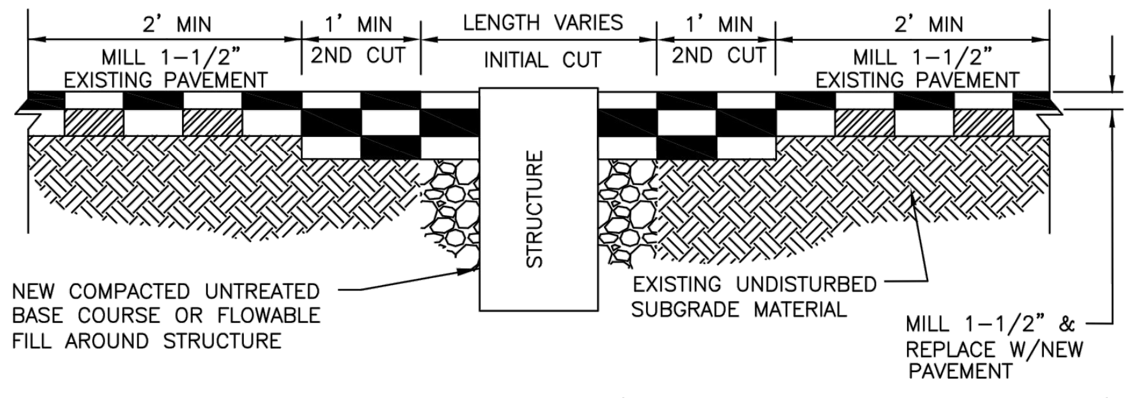
PATCHBACK FOR UTILITY AND SERVICE TRENCHES

NOTE:

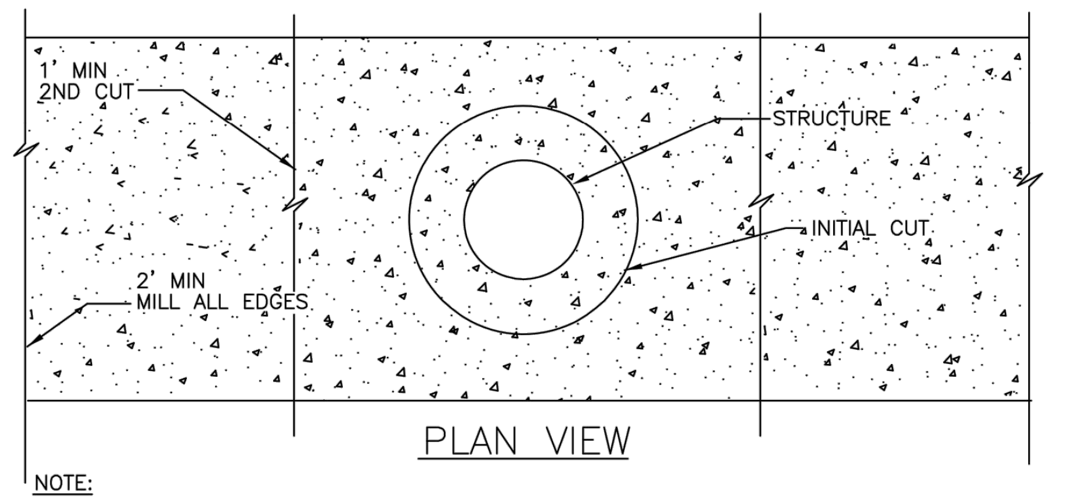
1. IF ASPHALT PATCH THICKNESS IS NOT IDENTIFIED ON PLANS USE 6-1/2" MIN ASPHALT PATCH OR MATCH EXISTING, WHICH EVER THICKNESS IS GREATER.
2. MINIMUM DEPTH OF WEARING COURSE SHALL BE 1-1/2" AND SHALL BE GRADING SX ASPHALT.
3. MINIMUM DEPTH OF INTERMEDIATE COURSE SHALL BE 5" AND BE INSTALLED IN 2 LIFTS. INTERMEDIATE COURSE SHALL BE GRADING S OR G ASPHALT.
4. PATCH SHALL BE PLACED AND COMPACTED IN LIFTS A MAXIMUM OF 3" IN DEPTH.
5. APPLY SS-I TACK COAT TO EXISTING ASPHALT AND/OR CONCRETE VERTICAL SURFACES.
6. TRENCHES LESS THAN 2' IN WIDTH MUST RECEIVE PRIOR APPROVAL FROM THE TOWN OF ERIE ENGINEERING DEPARTMENT AND SHALL BE FLOW-FILLED.
7. PROVIDE 28 DAY 60 PSI CONTROLLED LOW STRENGTH FLOWABLE FILL AS SPECIFIED. USE FILL THAT FLOWS EASILY AND VIBRATION IS NOT REQUIRED. CURE TO INITIAL SET BEFORE PLACING NEW UNTREATED BASE COURSE OR NEW ASPHALT PAVEMENT. USE FLOWABLE FILL IN EXCAVATIONS THAT ARE TOO NARROW TO RECEIVE COMPACTION EQUIPMENT.
8. REMOVE ADDITIONAL PAVEMENT TO A PAINTED LANE STRIPE, A LIP OF GUTTER, A CURB, AN EXISTING PAVEMENT PATCH, OR AN EDGE OF THE PAVEMENT IF SUCH STREET FEATURE IS WITHIN TWO FEET OF THE SECOND SAW CUT.
9. PROVIDE UNTREATED BASE COURSE MATERIAL. DO NOT USE GRAVEL OR WASHED ROCK. PLACE NEW MATERIAL IN LIFTS NOT EXCEEDING 8" AFTER COMPACTION. COMPACT TO A MODIFIED PROCTOR DENSITY OF 95% OR GREATER.
10. STRAIGHT SAWCUT OR BLADECUT THE EXISTING ASPHALT PAVEMENT WHEN JOINING WITH NEW ASPHALT PAVEMENT.

The Town of
ERIE
COLORADO

DRAWING TITLE: TRENCH AND CURB PATCH
DRAWING NUMBER: ST10
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 1/2014



PATCHBACK FOR STRUCTURES (MANHOLES, VALVES ETC)



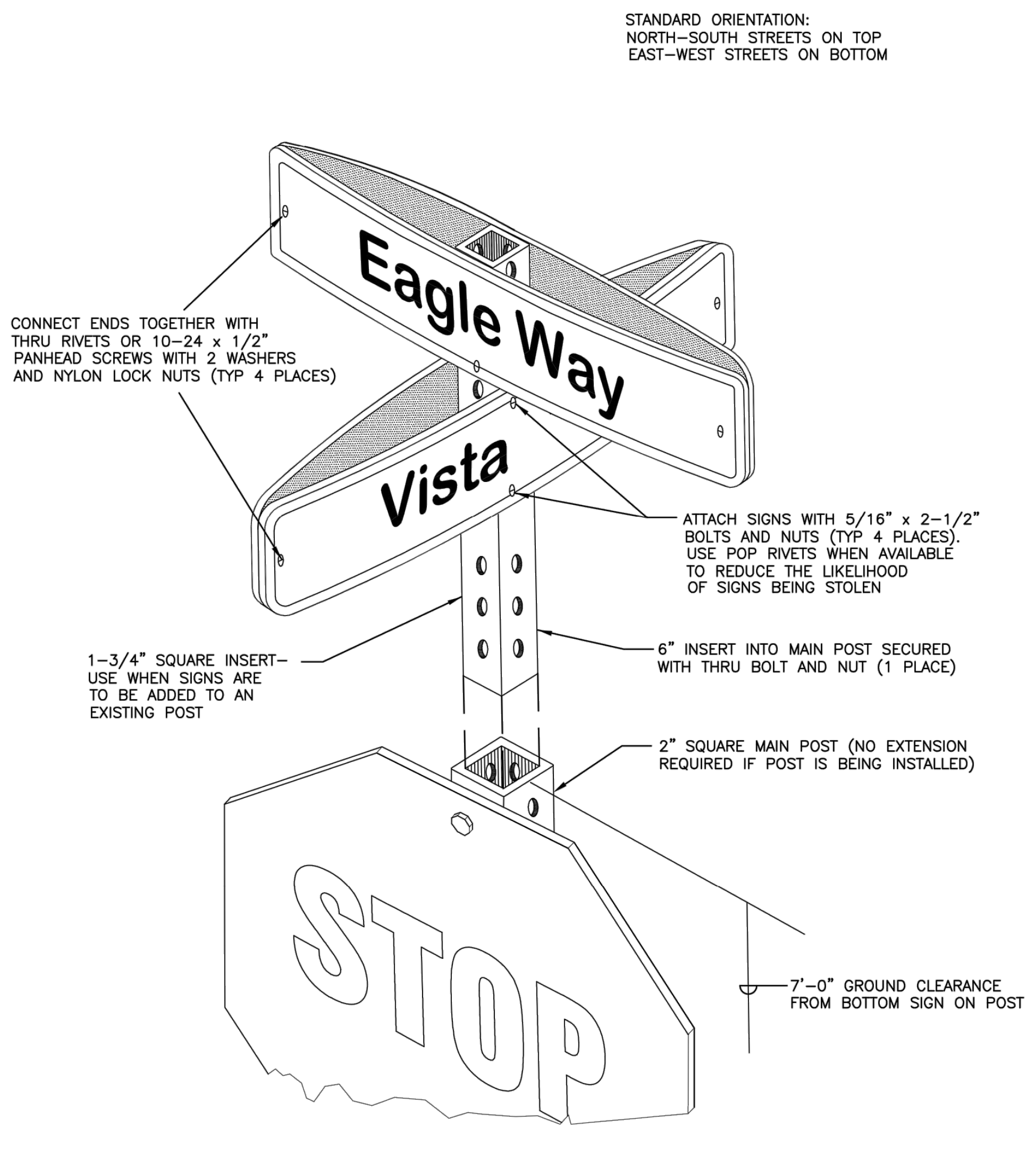
PLAN VIEW

NOTE:

1. IF ASPHALT PATCH THICKNESS IS NOT IDENTIFIED ON PLANS USE 6-1/2" MIN ASPHALT PATCH OR MATCH EXISTING, WHICH EVER THICKNESS IS GREATER.
2. MINIMUM DEPTH OF WEARING COURSE SHALL BE 1-1/2" AND SHALL BE GRADING SX ASPHALT.
3. MINIMUM DEPTH OF INTERMEDIATE COURSE SHALL BE 5" AND BE INSTALLED IN 2 LIFTS. INTERMEDIATE COURSE SHALL BE GRADING S OR G ASPHALT.
4. PATCH SHALL BE PLACED AND COMPACTED IN LIFTS A MAXIMUM OF 3" IN DEPTH.
5. APPLY SS-I TACK COAT TO EXISTING ASPHALT AND/OR CONCRETE VERTICAL SURFACES.
6. TRENCHES LESS THAN 2' IN WIDTH MUST RECEIVE PRIOR APPROVAL FROM THE TOWN OF ERIE ENGINEERING DEPARTMENT AND SHALL BE FLOW-FILLED.
7. PROVIDE 28 DAY 60 PSI CONTROLLED LOW STRENGTH FLOWABLE FILL AS SPECIFIED. USE FILL THAT FLOWS EASILY AND VIBRATION IS NOT REQUIRED. CURE TO INITIAL SET BEFORE PLACING NEW UNTREATED BASE COURSE OR NEW ASPHALT PAVEMENT. USE FLOWABLE FILL IN EXCAVATIONS THAT ARE TOO NARROW TO RECEIVE COMPACTION EQUIPMENT.
8. REMOVE ADDITIONAL PAVEMENT TO A PAINTED LANE STRIPE, A LIP OF GUTTER, A CURB, AN EXISTING PAVEMENT PATCH, OR AN EDGE OF THE PAVEMENT IF SUCH STREET FEATURE IS WITHIN TWO FEET OF THE SECOND SAW CUT.
9. PROVIDE UNTREATED BASE COURSE MATERIAL. DO NOT USE GRAVEL OR WASHED ROCK. PLACE NEW MATERIAL IN LIFTS NOT EXCEEDING 8" AFTER COMPACTION. COMPACT TO A MODIFIED PROCTOR DENSITY OF 95% OR GREATER.
10. STRAIGHT SAWCUT OR BLADECUT THE EXISTING ASPHALT PAVEMENT WHEN JOINING WITH NEW ASPHALT PAVEMENT.

The Town of
ERIE
COLORADO

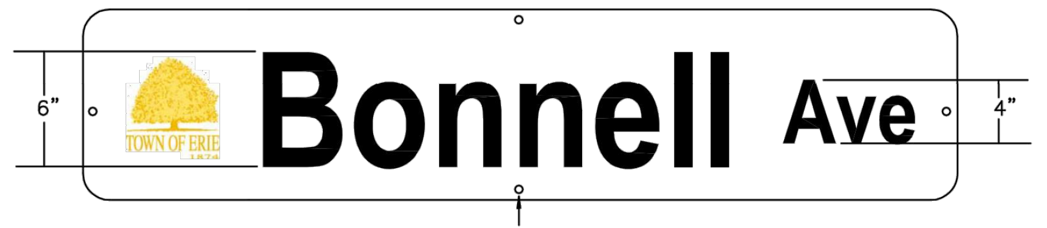
DRAWING TITLE: STRUCTURE PATCH
DRAWING NUMBER: ST11
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 1/2011



The Town of
ERIE
COLORADO

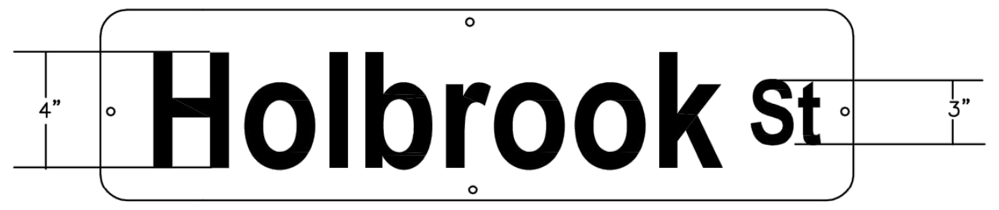
DRAWING TITLE: GROUND MOUNT STREET NAME SIGN INSTALLATION
DRAWING NUMBER: ST15A
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2013

8" STREET SIGN WITH TOWN OF ERIE LOGO



3/8" HOLE FOR MOUNTING (TYP)

6" STREET SIGN WITHOUT TOWN OF ERIE LOGO



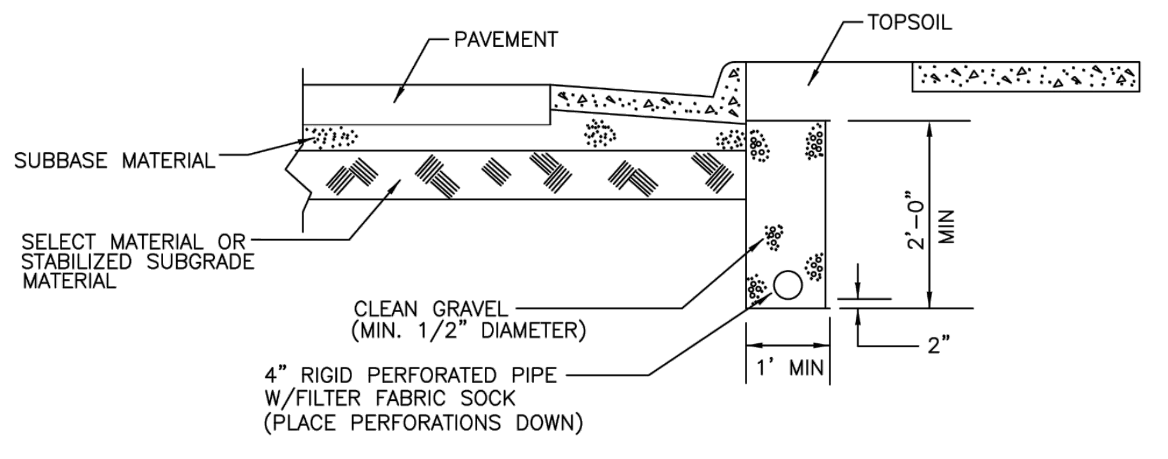
INTERSECTION TYPE	SIGN BLANK SIZE (30" MINIMUM ON ALL LENGTHS)	MOUNTING	RECOMMENDED MINIMUM			
			LETTER HEIGHT		SUFFIX (ST, AVE, CT ETC)	
			INITIAL UPPER CASE	LOWER CASE	INITIAL UPPER CASE	LOWER CASE
ARTERIALS AT SIGNAL LIGHTS WITH LOGO		OVERHEAD	12 INCHES	9 INCHES	6 INCHES	4.5 INCHES
MULTI LANE ARTERIALS AND ALL OTHERS DIRECTED BY PUBLIC WORKS DEPT WITH LOGO	10" X AS NEEDED	POST MOUNTED	8 INCHES	6 INCHES	4.5 INCHES	3.5 INCHES
ARTERIALS & COLLECTORS AND ALL OTHERS DIRECTED BY PUBLIC WORKS DEPT WITH LOGO	8" X AS NEEDED	POST MOUNTED	6 INCHES	4.5 INCHES	4 INCHES	3 INCHES
LOCAL/NO LOGO	8" X AS NEEDED	POST MOUNTED	6 INCHES	4.5 INCHES	4 INCHES	3 INCHES
*LOCAL/NO LOGO	6" X AS NEEDED	POST MOUNTED	4 INCHES	3 INCHES	3 INCHES	2.25 INCHES
*ON LOCAL TWO-LANE STREETS WITH SPEED LIMITS OF 25 MPH OR LESS, 4 INCH INITIAL UPPER-CASE LETTERS WITH 3 INCH LOWER CASE LETTERS MAY BE USED						
NO BORDERS EXCEPT ON OVERHEAD LIGHTED STREET SIGNS AT SIGNALIZED INTERSECTIONS						
WHEN LOGO IS DISPLAYED, THE HEIGHT AND WIDTH OF THE LOGO SHALL NOT EXCEED THE UPPER CASE LETTER HEIGHT OF THE PRINCIPAL LEGEND OF THE SIGN AND LOCATED LEFT OF THE STREET NAME						

NOTES:

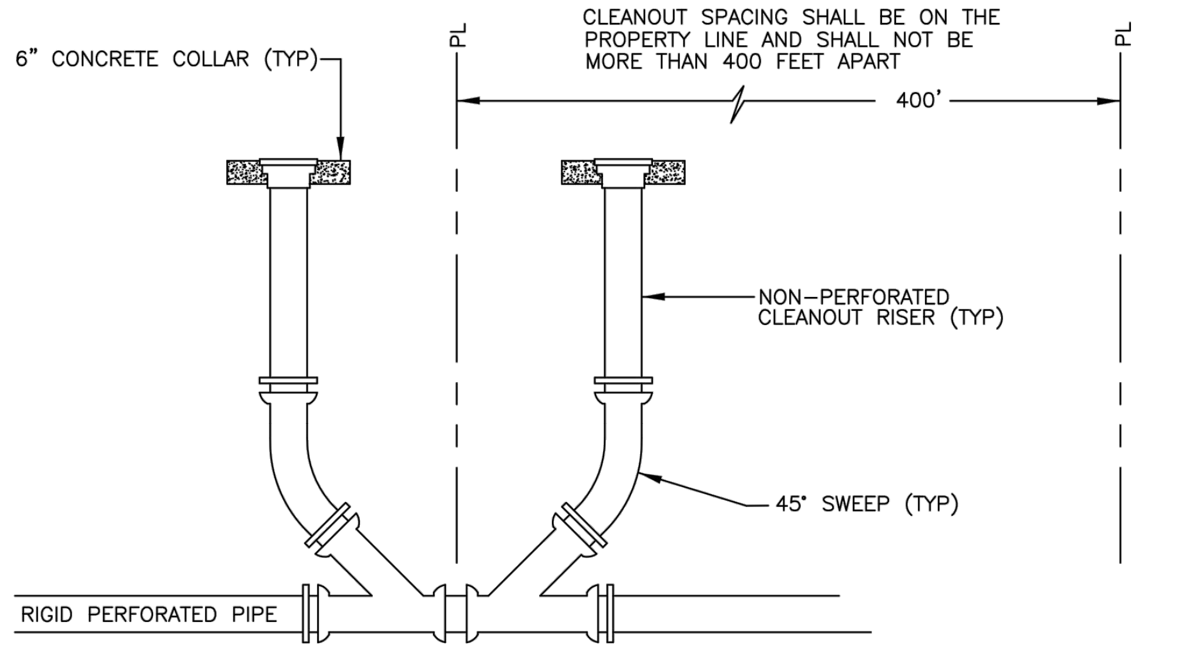
1. SIGN BLANKS SHALL BE 6061 OR 5052-H38 ALUMINUM ALLOY MIN .080" THICK.
2. FACING SHALL BE GREEN HI-INTENSITY RETROREFLECTIVE SHEETING.
3. LETTERS AND NUMBERS SHALL BE WHITE RETROREFLECTIVE SHEETING.
4. TOWN OF ERIE COLOR LOGO IS TO BE USED FOR COLLECTOR AND ARTERIAL STREET BLADES ONLY.
5. 30" MIN. LENGTH ON ALL STREET SIGNS, SINGLE FACE FOR BACK TO BACK INSTALLATION AND 1/4" HOLES FOR PINNING ENDS OF SIGNS TOGETHER

The Town of
ERIE
COLORADO

DRAWING TITLE: ROAD AND STREET NAME SIGNS
DRAWING NUMBER: ST15B
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2013



4" PERFORATED UNDERDRAIN DETAIL



NOTES

1. CURB STOP TO BE A MIN OF 1' BEHIND TRENCH.
2. PERFORATED DRAIN NEEDS TO DAYLIGHT INTO DRAINAGE SYSTEM.
3. PROVIDE PLUG ON UPSTREAM END OF PIPE.
4. PERFORATED PIPE SHALL FOLLOW ESTABLISHED GRADE AND HAVE POSITIVE FLOW.
5. THE NEED FOR UNDERDRAINS WILL BE DETERMINED BY SOILS TESTING.
6. WHERE THE BOTTOM OF SELECT MATERIAL IS GREATER THAN 4' BELOW PAVEMENT, THE UNDERDRAIN PIPE IS TO BE COINCIDENT WITH THE BOTTOM OF SELECT MATERIAL AND THE TRENCH DEPTH AND BACKFILL QUANTITY INCREASED ACCORDINGLY.
7. PLACE A VALVE BOX TOP WITH LID AND 6" THICK CONCRETE COLLAR AT ALL 4" PERFORATED UNDERDRAIN CLEANOUTS.
8. WHEN CURB & GUTTER IS IN PLACE THE CLEANOUTS SHALL BE MARKED ON THE CONCRETE CURB FACE WITH A "+".

The Town of
ERIE
COLORADO

DRAWING TITLE: 4" PERFORATED UNDERDRAIN
DRAWING NUMBER: ST16
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 1/2015

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING
990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

35942
THOMAS C. JANSEN
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

STREET DETAILS

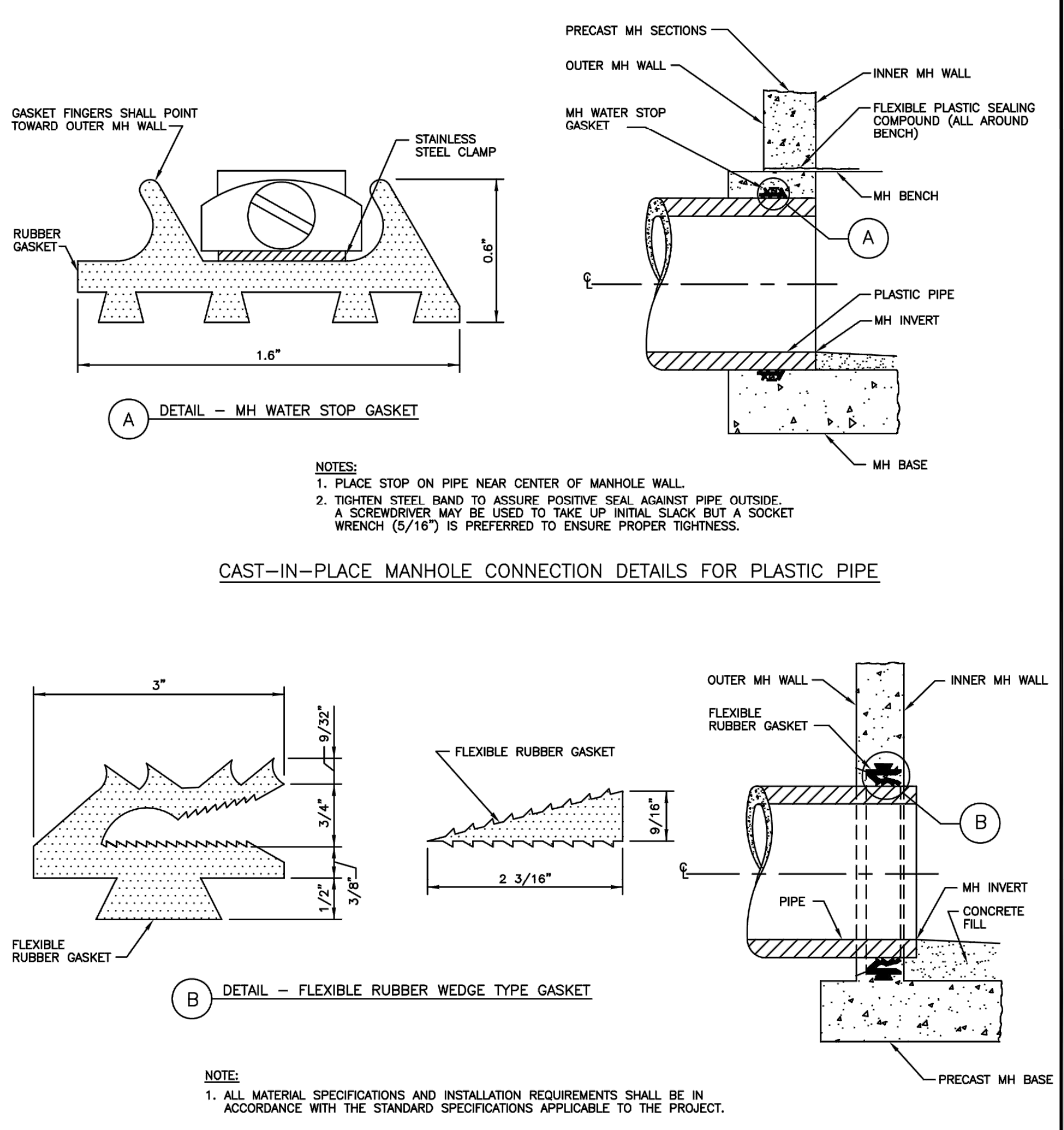
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
DT02
Sheet 65 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



Ⓐ DETAIL – MH WATER STOP GASKET

NOTES:

1. PLACE STOP ON PIPE NEAR CENTER OF MANHOLE WALL.
2. TIGHTEN STEEL BAND TO ASSURE POSITIVE SEAL AGAINST PIPE OUTSIDE. A SCREWDRIVER MAY BE USED TO TAKE UP INITIAL SLACK BUT A SOCKET WRENCH (5/16") IS PREFERRED TO ENSURE PROPER TIGHTNESS.

CAST–IN–PLACE MANHOLE CONNECTION DETAILS FOR PLASTIC PIPE

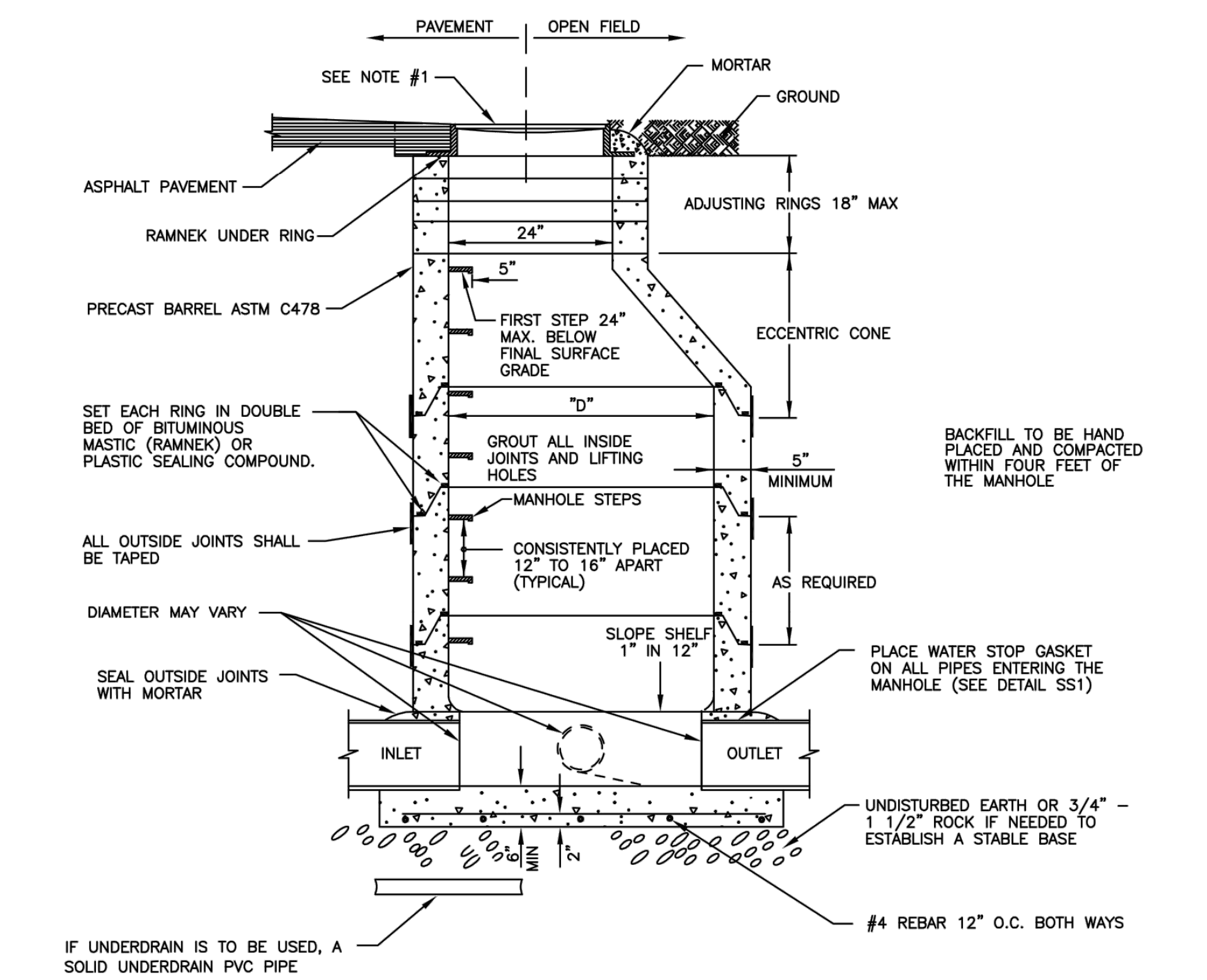
Ⓑ DETAIL – FLEXIBLE RUBBER WEDGE TYPE GASKET

NOTE:

1. ALL MATERIAL SPECIFICATIONS AND INSTALLATION REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS APPLICABLE TO THE PROJECT.

PRECAST MANHOLE CONNECTION DETAILS FOR ANY TYPE OF PIPE

The Town of ERIE COLORADO
DRAWING TITLE: MH/PIPE WATER STOP GASKET
DRAWING NUMBER: SS1
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004

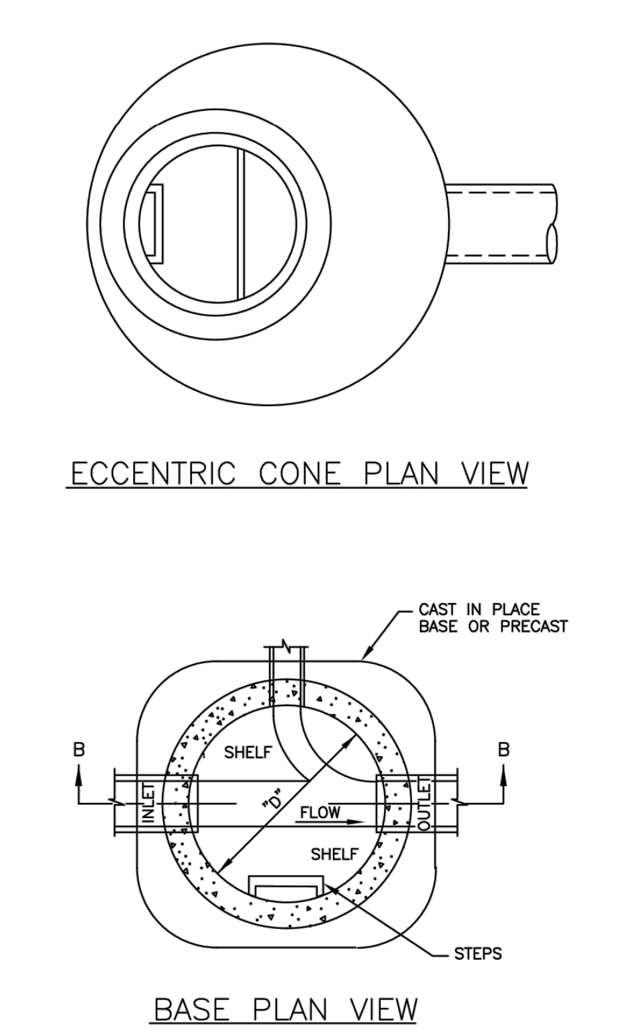


SECTION B–B

NOTES:

1. FINAL GRADE OF MANHOLE COVERS SHALL BE 1/4" LOWER THAN FINAL STREET.
2. ALL CHANNELS FLOWING INTO THE MAIN STREAM OF THE SEWER SHALL BE HAND FORMED INTO THE FLOW.
3. STEPS SHOULD BE PLACED OVER THE SHELF, NOT OVER THE FLOW. NO STEPS ALLOWED IN THE ADJUSTING RING AREA.
4. PRECAST CONCRETE SECTIONS SHALL CONFORM TO ASTM C–478.
5. BLOCK–OUTS, WHEN APPROVED, SHALL EXTEND A MAX. OF 6" PAST MANHOLE O.D. AND BE SATISFACTORILY PLUGGED AND SEALED.
6. BENCH MUST HAVE A BRUSHED, NON–SKID SURFACE.
7. BENCH IS TO BE EVEN WITH TOP OF PIPES
8. A MINIMUM OF 0.2' AND MAXIMUM OF 2' FALL REQUIRED FROM INLET TO OUTLET
9. MANHOLES NOT IN ASPHALT OR CONCRETE SHALL BE RAISED 6" ABOVE FINAL GRADE AND A CONCRETE COLLAR INSTALLED WITH A GREEN CARSONITE POST

The Town of ERIE COLORADO
DRAWING TITLE: STANDARD MANHOLE
DRAWING NUMBER: SS3A (1 OF 2)
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2010



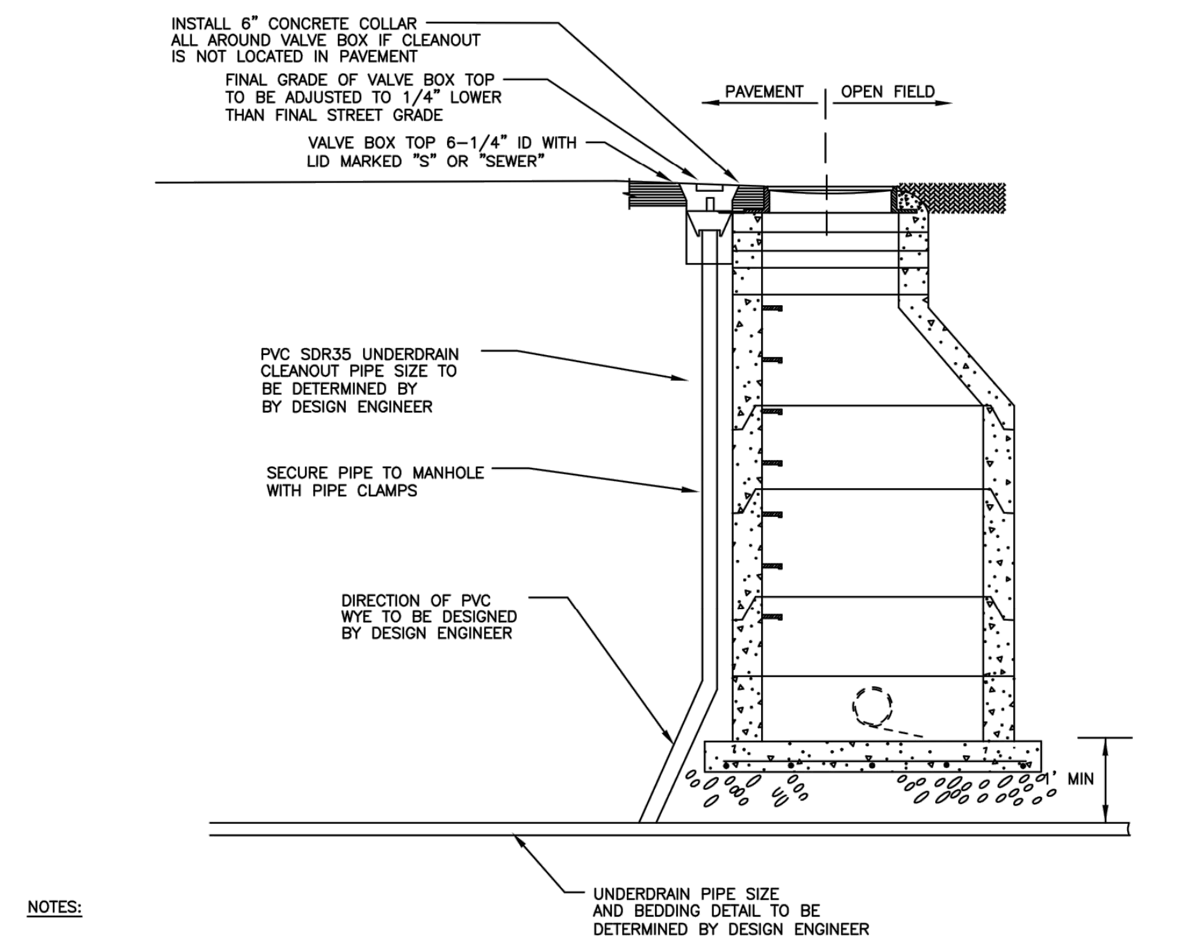
ECCENTRIC CONE PLAN VIEW

BASE PLAN VIEW

PIPE I.D.	MANHOLE I.D.	RING & COVER
18" & SMALLER	4'–0"▲	24"
21" TO 48"	5'–0"	30"
54"	6'–0"	30", 36" W/ 24"
60" & LARGER	SPECIAL DESIGN	INNER COVER

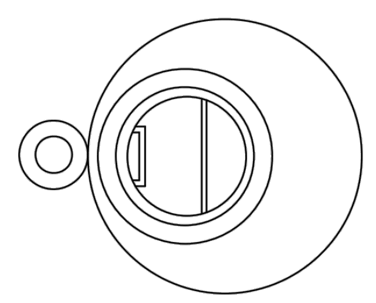
▲ WHENEVER MORE THAN A TWO WAY MANHOLE OF MAX. PIPE I.D. IS REQUIRED, THE MANHOLE SHOULD BE INCREASED TO LARGER DIA., EG. 18"x18"x18", REQUIRES 5'–0" I.D.

The Town of ERIE COLORADO
DRAWING TITLE: STANDARD MANHOLE
DRAWING NUMBER: SS3B (2 OF 2)
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004



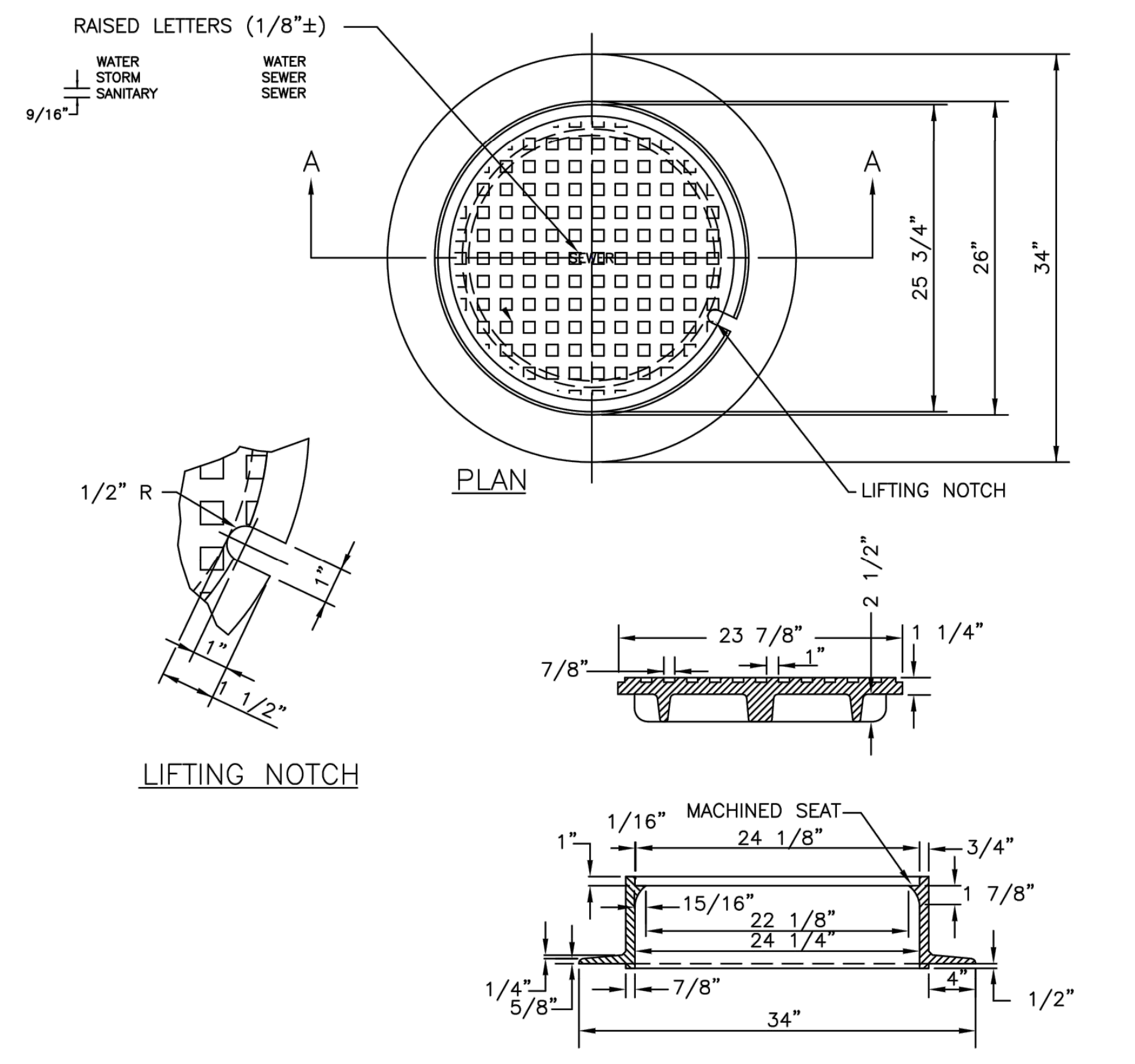
NOTES:

1. ALL UNDERDRAIN SYSTEMS SHALL BE PRIVATE AND NOT MAINTAINED BY THE TOWN OF ERIE
2. PLACE UNDERDRAIN COLLECTOR PIPE AROUND CONCRETE MANHOLE BASE
3. CLEANOUT TO BE PLACED UPSTREAM/DOWNSTREAM OF SANITARY MANHOLE AS DETERMINED BY DESIGN ENGINEER
4. SEE "TRENCH DETAIL WITH PRIVATE UNDERDRAIN" DETAIL FOR VERTICAL LOCATION OF UNDERDRAIN



PLAN VIEW

The Town of ERIE COLORADO
DRAWING TITLE: MANHOLE W/ PRIVATE UNDERDRAIN
DRAWING NUMBER: SS4
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2006



PLAN

LIFTING NOTCH

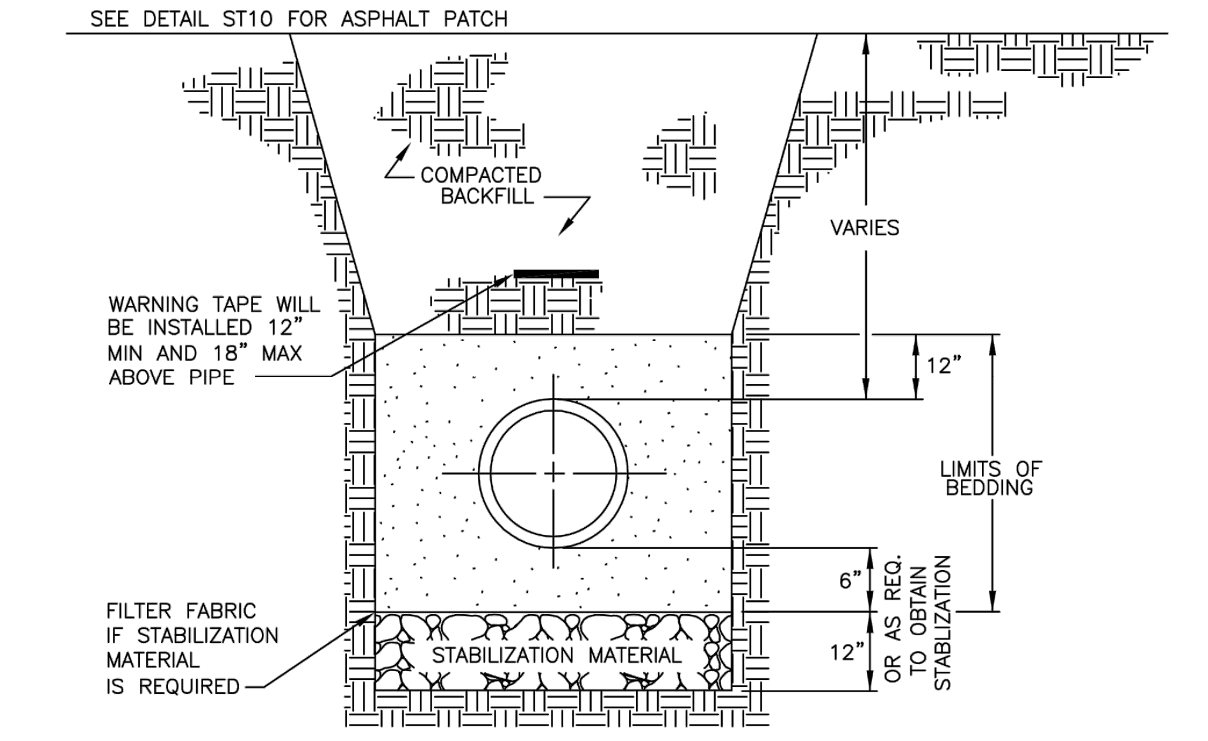
SECTION A–A

1. CASTING SPECIFICATIONS: ASTM A–48 WITH A MINIMUM TENSILE STRENGTH OF 25 KSI (CLASS 25)
2. ALL CASTINGS TO BE DIPPED IN ASPHALT BASE PAINT (OR APPROVED EQUAL)
3. CASTINGS SHALL BE AS SPECIFIED BELOW OR APPROVED EQUAL:

MANUFACTURERS	CAT. #
NEENAH	R–1706
CASTINGS, INC.	MH–400–24 C.I.
HUTCHINSON FDRY. & STL. INC.	MH–400

4. ALL NEW MANHOLES MUST INCLUDE A PLASTIC OR VINYL TAG ATTACHED TO THE TOP STEP STATING THE FOLLOWING "CAUTION CONFINED SPACE; ENTRY PERMIT REQUIRED.

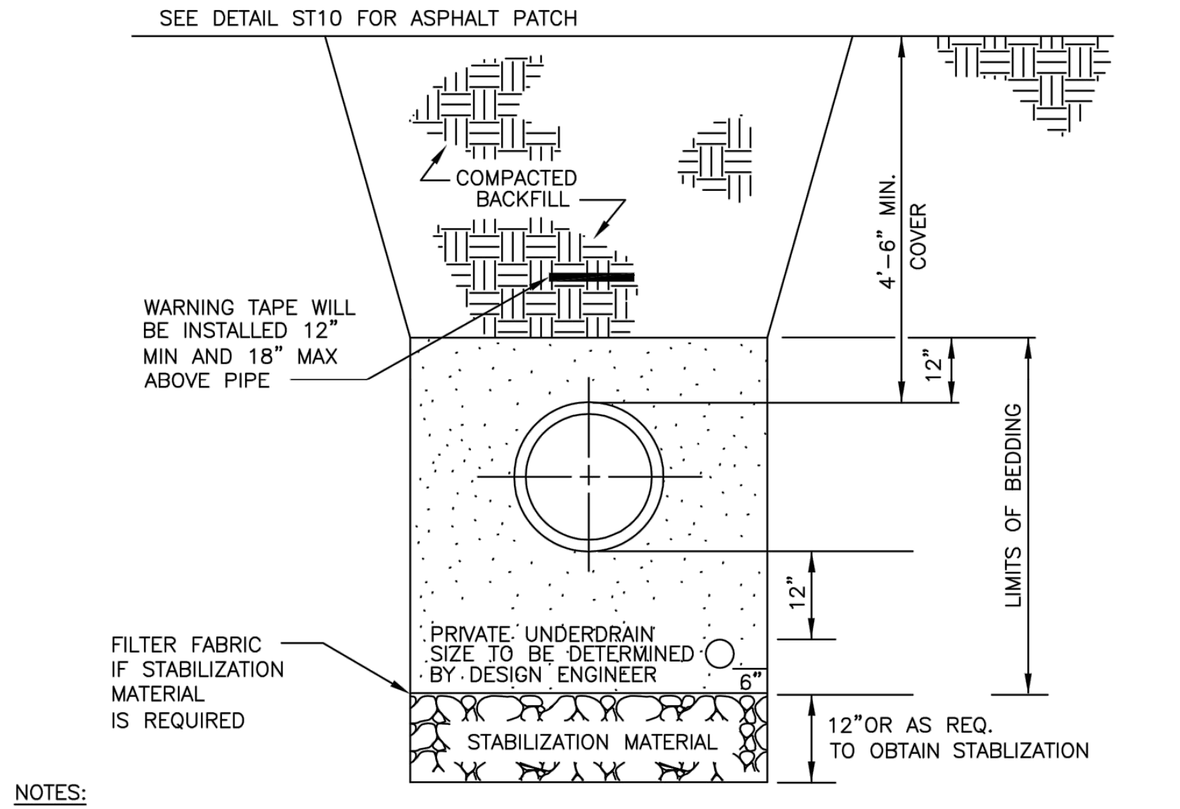
The Town of ERIE COLORADO
DRAWING TITLE: 24" MANHOLE RING AND COVER
DRAWING NUMBER: SS6
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 1/2015



NOTES:

1. COMPACTION SHALL BE AS FOLLOWS: PIPE ZONE BEDDING 6" UNDER AND 12" OVER PIPE WILL REQUIRE 90% S.P.D. TRENCH ZONE ABOVE BEDDING MATERIALS, FULL TRENCH SECTION IN ROADWAY OR STREET R.O.W. LIMITS WILL REQUIRE 95% S.P.D. TRENCH ZONE ABOVE BEDDING MATERIALS, OUTSIDE OF STREET R.O.W. WILL REQUIRE 90% S.P.D.
2. FILTER FABRIC IS REQUIRED IF STABILIZATION MATERIAL IS USED. THE FABRIC SHALL BE INSTALLED AS SHOWN IN THE DETAIL.
3. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE SAFETY OF THE WORKMEN AND PROTECTION OF OTHER UTILITIES IN ACCORDANCE WITH APPLICABLE LOCAL, STATE AND FEDERAL SAFETY REGULATIONS.
4. PIPE SHALL BE BEDDED FROM 6" BELOW THE BOTTOM OF THE PIPE TO 12" ABOVE THE TOP OF THE PIPE.
5. TRENCH WIDTH SHALL NOT BE MORE THAN 24" NOR LESS THAN 12" WIDER THAN THE LARGEST OUTSIDE DIAMETER OF THE PIPE.
6. SHOULD THE TRENCH BE EXCAVATED WIDER THAN ALLOWED, A CONCRETE CRADLE SHALL BE PLACED WITH 2500 P.S.I. CONCRETE FROM TRENCH BOTTOM TO PIPE SPRINGLINE.

The Town of ERIE COLORADO
DRAWING TITLE: SANITARY SEWER TRENCH DETAIL
DRAWING NUMBER: SS8
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2012

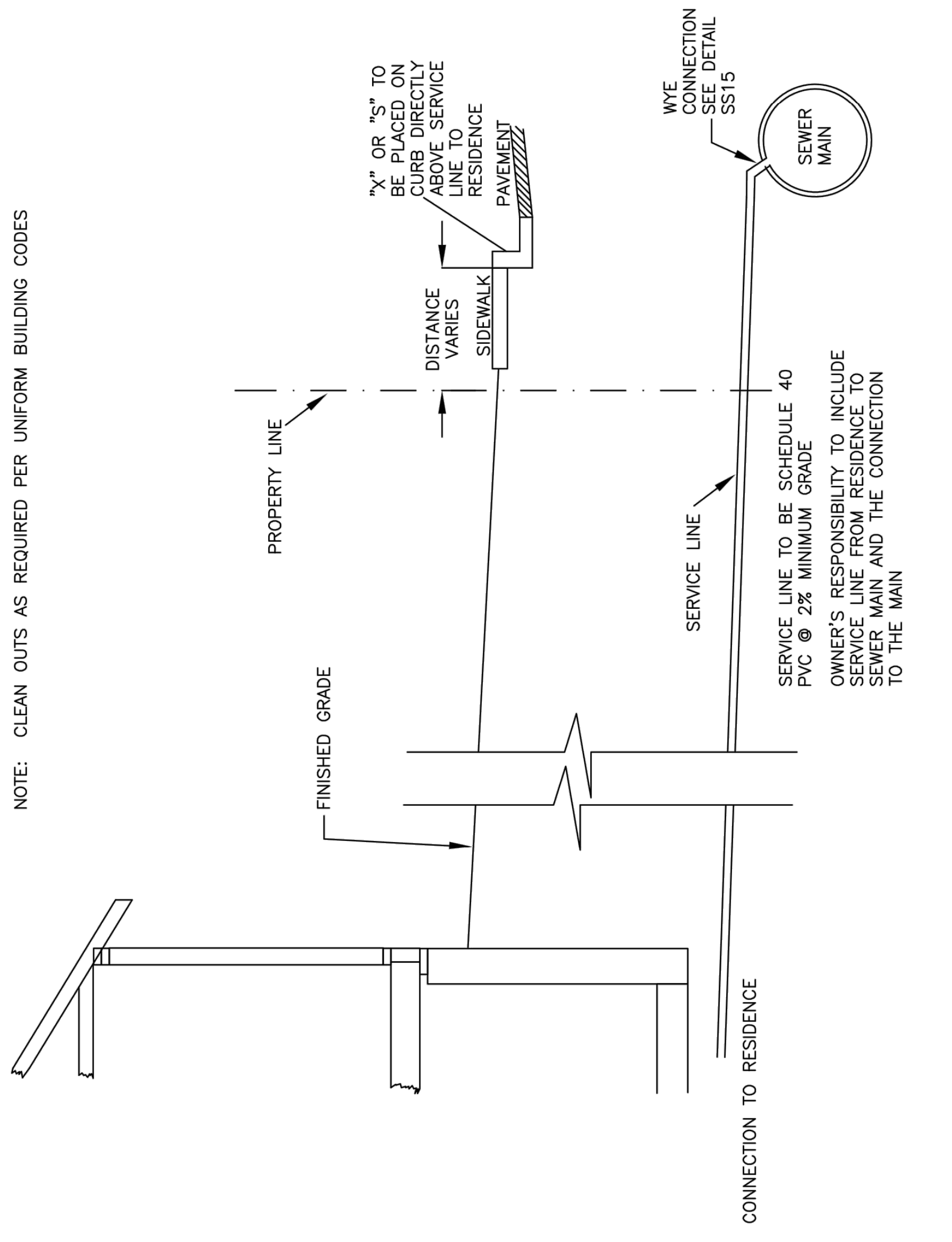


NOTES:

1. BACKFILL TO BE COMPACTED TO 95% ASTM D–698, OR 70% OF ASTM D–4253 AND 4254 RELATIVE DENSITY, IN ALL AREAS UNLESS OTHERWISE NOTED.
2. FILTER FABRIC IS REQUIRED IF STABILIZATION MATERIAL IS USED. THE FABRIC SHALL BE INSTALLED AS SHOWN IN THE DETAIL.
3. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE SAFETY OF THE WORKMEN AND PROTECTION OF OTHER UTILITIES IN ACCORDANCE WITH APPLICABLE LOCAL, STATE AND FEDERAL SAFETY REGULATIONS.
4. PIPE SHALL BE BEDDED FROM 6" BELOW THE BOTTOM OF THE PIPE TO 12" ABOVE THE TOP OF THE PIPE.
5. TRENCH WIDTH SHALL NOT BE MORE THAN 16" NOR LESS THAN 12" WIDER THAN THE LARGEST OUTSIDE DIAMETER OF THE PIPE.
6. COMPACTION SHALL BE AS FOLLOWS: PIPE ZONE BEDDING 6" UNDER AND 12" OVER PIPE WILL REQUIRE 90% S.P.D. TRENCH ZONE ABOVE BEDDING MATERIALS, FULL TRENCH SECTION IN ROADWAY OR STREET R.O.W. LIMITS WILL REQUIRE 95% S.P.D. TRENCH ZONE ABOVE BEDDING MATERIALS, OUTSIDE OF STREET R.O.W. WILL REQUIRE 90% S.P.D.
7. ALL UNDERDRAIN SYSTEMS SHALL BE PRIVATE AND WILL NOT BE MAINTAINED BY THE TOWN OF ERIE.

The Town of ERIE COLORADO
DRAWING TITLE: TRENCH W/PRIVATE UNDERDRAIN
DRAWING NUMBER: SS9
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2011

NOTE: CLEAN OUTS AS REQUIRED PER UNIFORM BUILDING CODES



The Town of ERIE COLORADO
DRAWING TITLE: SERVICE MAINTENANCE LINE
DRAWING NUMBER: SS10
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING
990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

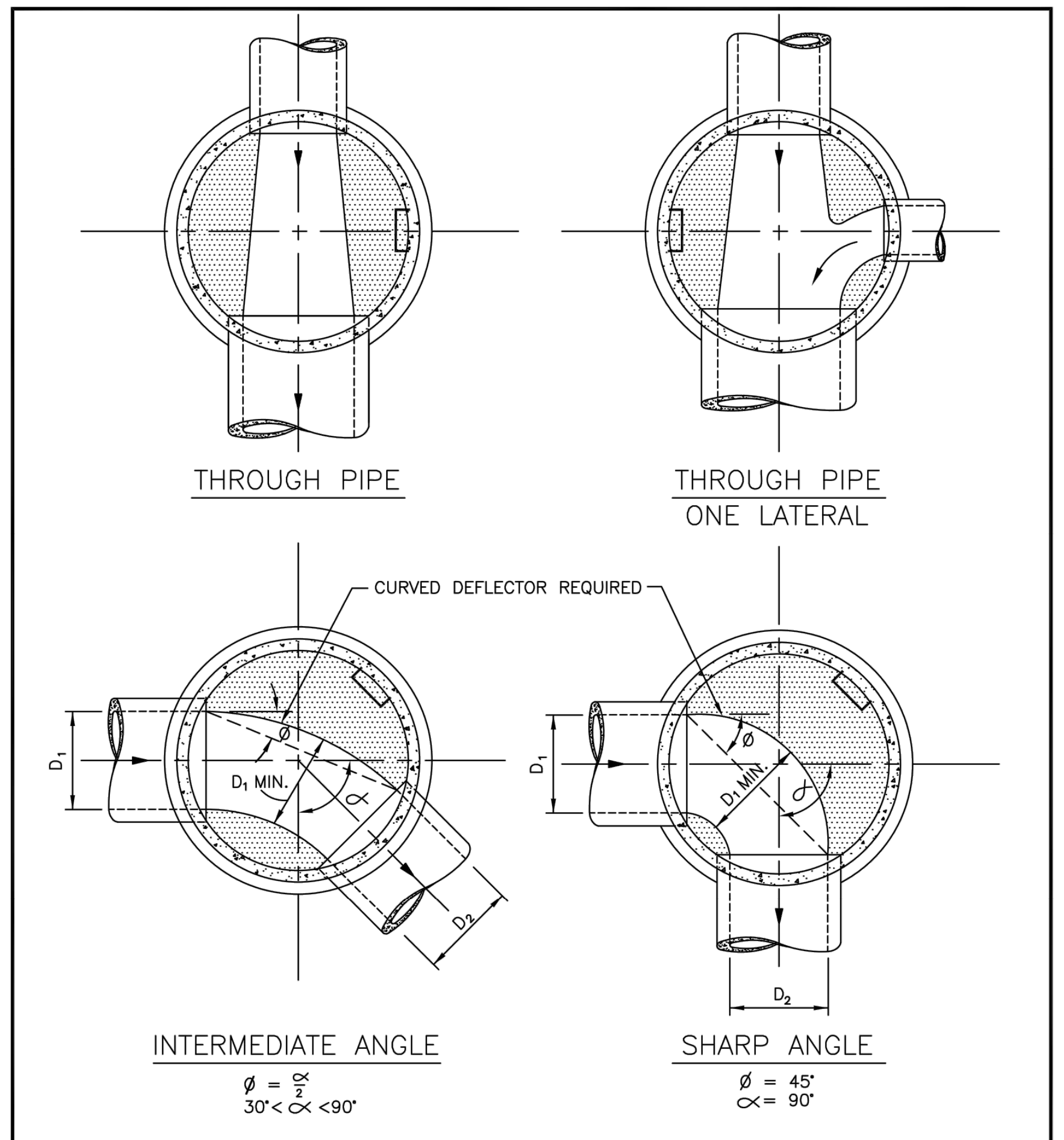
COMPASS FILING NO. 4

SANITARY SEWER DETAILS

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
DT03
Sheet 66 of 74



THROUGH PIPE

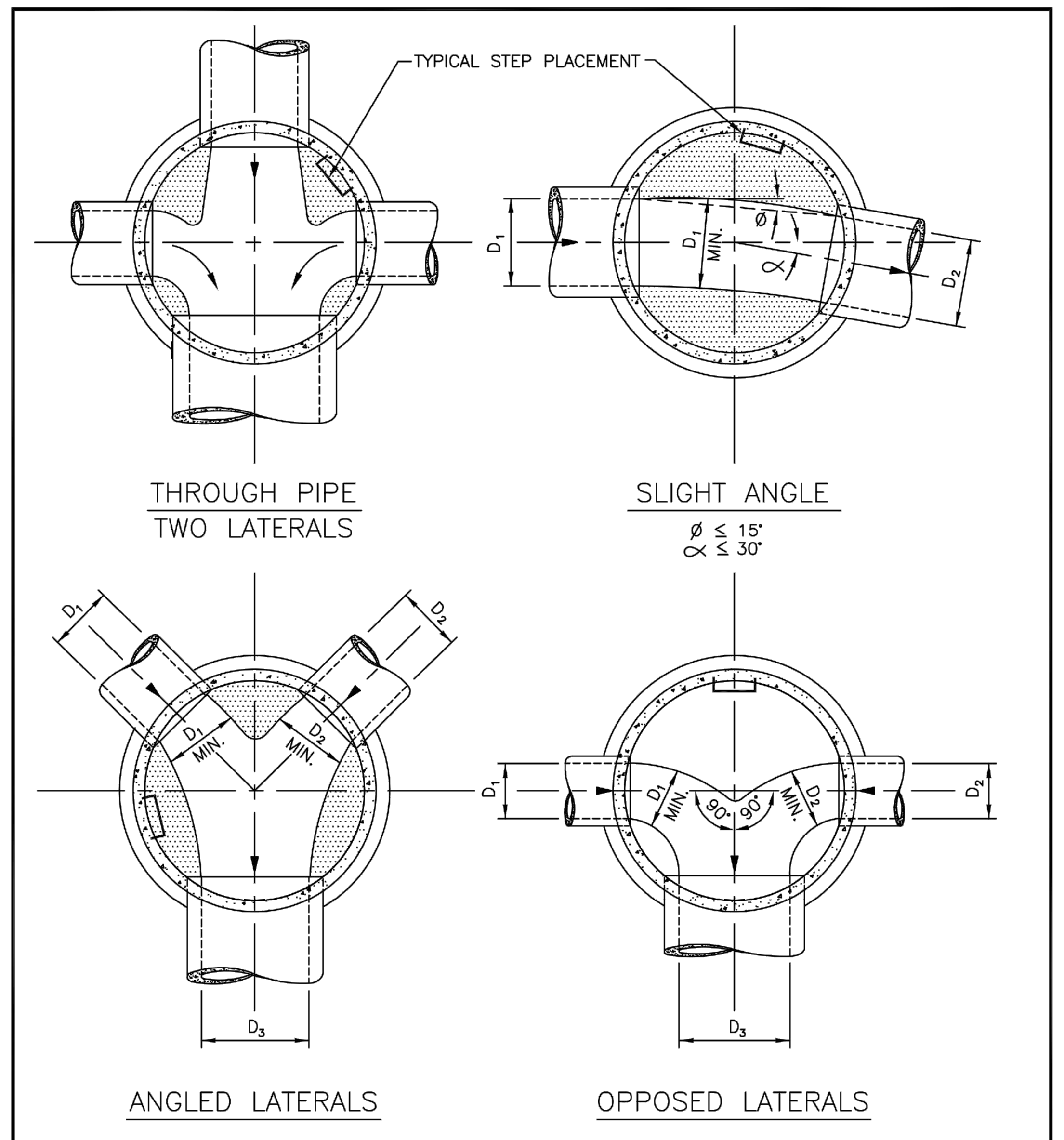
THROUGH PIPE
ONE LATERAL

INTERMEDIATE ANGLE
$\phi = \frac{\alpha}{2}$
$30° < \alpha < 90°$

SHARP ANGLE
$\phi = 45°$
$\alpha = 90°$

NOTES:
1. DETAILS SHOWN ARE TYPICAL ONLY FOR INSTALLATIONS WITH ALL INVERTS AT SAME RELATIVE ELEVATION.
2. FOR EXCESSIVE ELEVATION DIFFERENCE BETWEEN INVERTS, ETC. SPECIAL BASE/CHANNEL DETAILS SHALL BE SHOWN ON PLANS.
3. CHANNELIZATION DETAILS & STEP PLACEMENT TYPICAL FOR BOTH STORM AND SANITARY SEWER MH'S.
4. THE MINUMUM VERTICAL DROP THRU MANHOLE BASE SHALL BE 0.20 FOOT.
5. FOR VERTICAL DROPS IN EXCESS OF 1.5 FEET AN OUTSIDE DROP MANHOLE IS REQUIRED.

The Town of ERIE COLORADO
DRAWING TITLE: TYPICAL MH BASE CHANNELIZATION (1 OF 2)
DRAWING NUMBER: SS11A
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004



THROUGH PIPE
TWO LATERALS

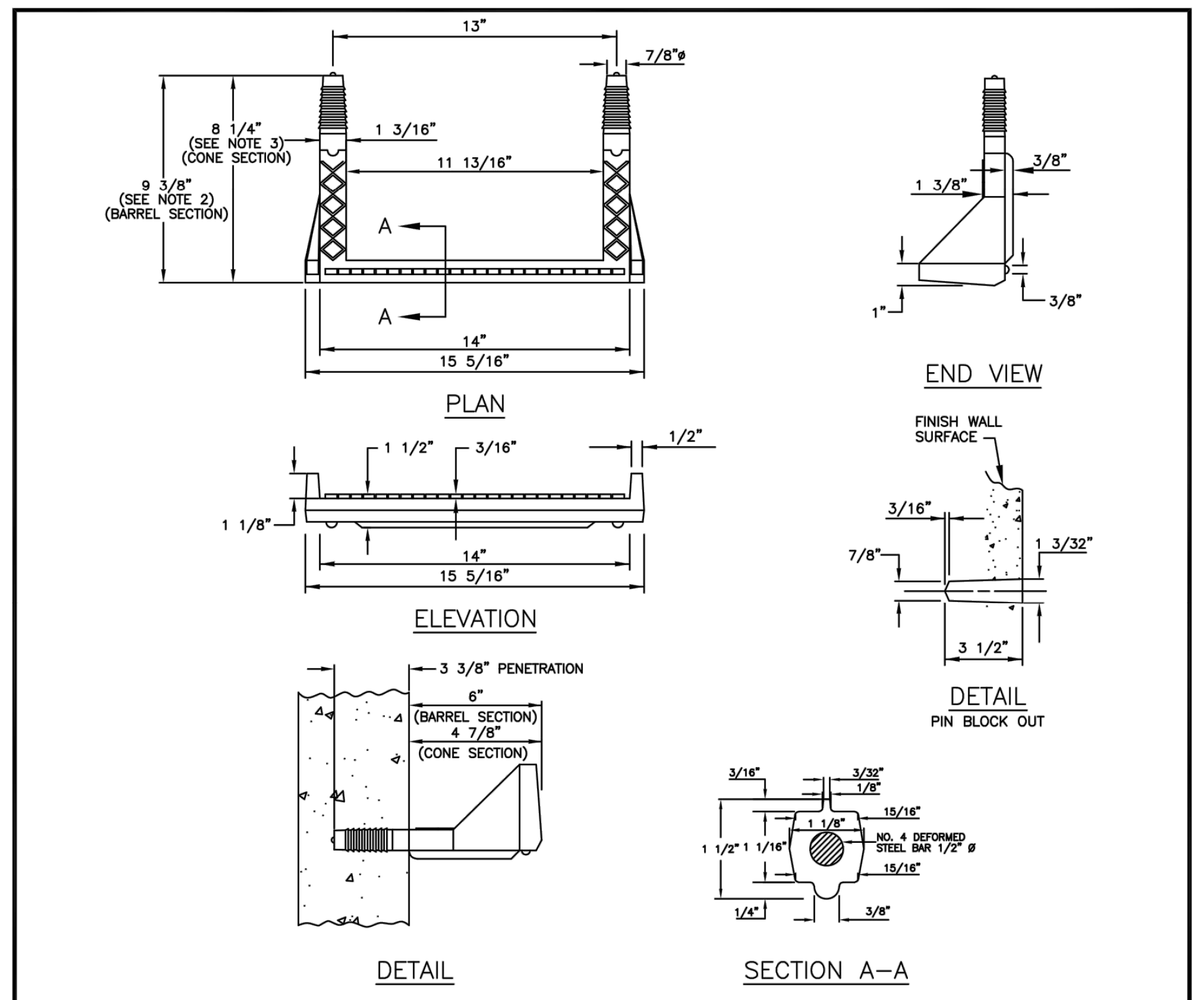
SLIGHT ANGLE
$\phi \le 15°$
$\alpha \le 30°$

ANGLED LATERALS

OPPOSED LATERALS

NOTES:
1. DETAILS SHOWN ARE TYPICAL ONLY FOR INSTALLATIONS WITH ALL INVERTS AT SAME RELATIVE ELEVATION.
2. FOR EXCESSIVE ELEVATION DIFFERENCE BETWEEN INVERTS, ETC. SPECIAL BASE/CHANNEL DETAILS SHALL BE SHOWN ON PLANS.
3. CHANNELIZATION DETAILS & STEP PLACEMENT TYPICAL FOR BOTH STORM AND SANITARY SEWER MH'S.
4. THE MINUMUM VERTICAL DROP THRU MANHOLE BASE SHALL BE 0.20 FOOT.
5. FOR VERTICAL DROPS IN EXCESS OF 1.5 FEET AN OUTSIDE DROP MANHOLE IS REQUIRED.

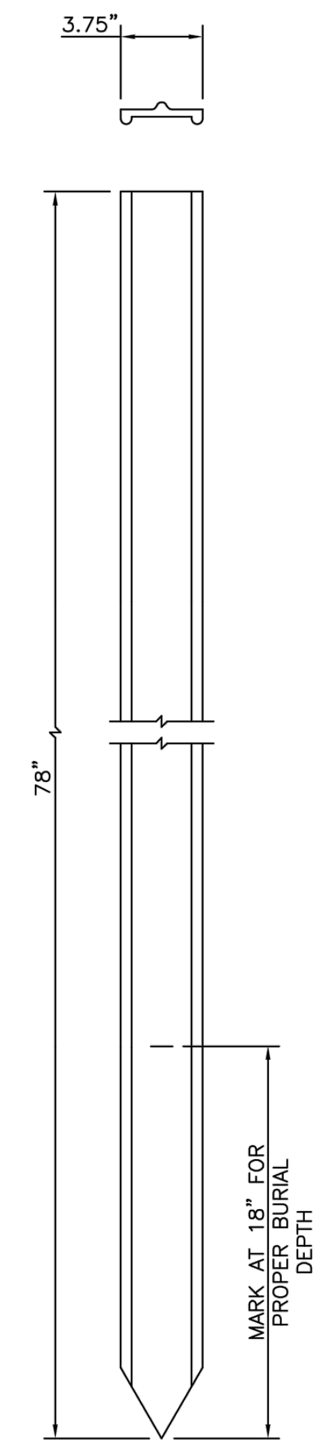
The Town of ERIE COLORADO
DRAWING TITLE: TYPICAL MH BASE CHANNELIZATION (2 OF 2)
DRAWING NUMBER: SS11B
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004



POLYPROPYLENE REINFORCED PLASTIC STEP

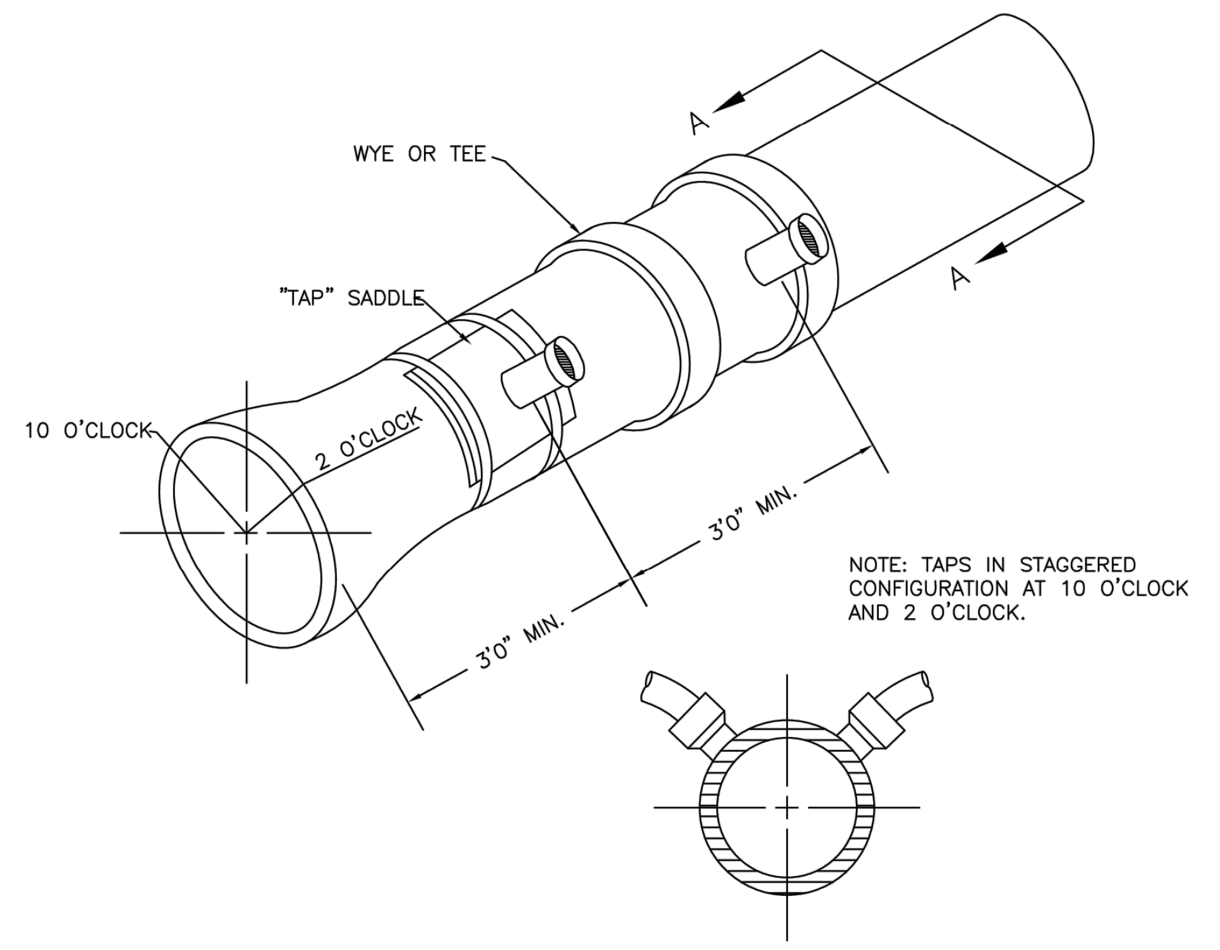
NOTES:
1. ASTM SPECIFICATIONS:
   A. ASTM C–478
   B. ASTM A–615 GRADE 60 (STEEL REBAR).
   C. ASTM 2146–69, TYPE III, GRADE 16906 (POLYPROPYLENE).
2. STEPS INSTALLED IN MANHOLE BARREL SECTIONS OR VERTICAL WALLS OF STRUCTURES SHALL HAVE A 9 3/8 INCH LEG AND SHALL PROJECT FROM THE WALL 6 INCHES.
3. STEPS INSTALLED IN MANHOLE CONE SECTIONS SHALL HAVE AN 8 1/4 INCH LEG AND SHALL PROJECT FROM THE WALL 4 7/8 INCHES.
4. ALL STEPS SHALL HAVE A PENETRATION DEPTH INTO THE WALL OF 3 3/8 INCHES.
5. STEPS SHALL BE INSTALLED BY THE "PRESS–FIT" METHOD UTILIZING A SPECIALLY TAPERED PIN TO FORM THE INSERT HOLE AS SHOWN, FOLLOWING MANUFACTURER'S RECOMMENDED PROCEDURE AND SHALL NOT BE GROUTED IN PLACE.
6. INSTALLED STEPS SHALL BE CAPABLE OF WITHSTANDING A PULL OUT FORCE OF 2500 LB. PER LEG FOR A MINIMUM PERIOD OF TWO MINUTES.
7. PINS MUST BE SMOOTH AND CONTINUOUSLY TAPERED. DIMENSIONS OF THE PIN AND THE INSERTED PORTION OF THE MANHOLE STEP ARE TYPICAL ONLY. W.M.D. INSTALLATIONS REQUIRE A MATCHED COMBINATION OF A TAPERED INSERT PIN AMD MANHOLE STEP, AS RECOMMENDED OR REQUIRED BY SPECIFIC MANUFACTURER OF THE STEP TO BE USED.
8. THIS STEP CAN ALSO BE USED IN TOE POCKET INSTALLATIONS PROVIDED 5" TOE CLEARANCE IS ALLOWED.

The Town of ERIE COLORADO
DRAWING TITLE: MANHOLE STEPS
DRAWING NUMBER: SS12
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004



NOTES:
1. UTILITY MARKER POST SHALL BE CARSONITE CUM–375 OR EQUAL WITH ANCHORS AND APPROPRIATE DECALS FOR SANITARY SEWER AND WATER.
2. COLOR FOR SANITARY SEWER–GREEN.

The Town of ERIE COLORADO
DRAWING TITLE: FIBERGLASS MARKER POST
DRAWING NUMBER: SS13
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004

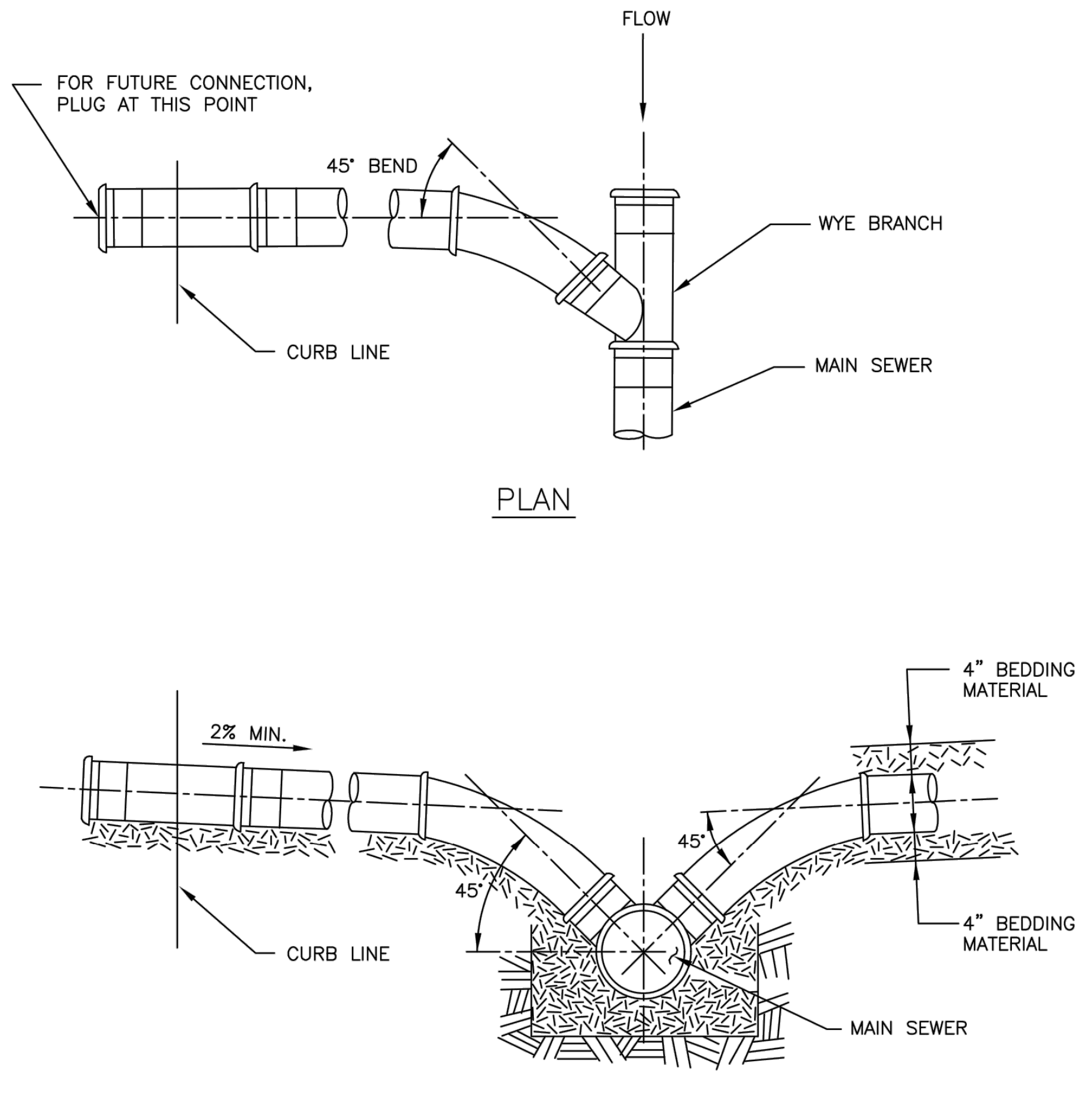


NOTE: TAPS IN STAGGERED CONFIGURATION AT 10 O'CLOCK AND 2 O'CLOCK.

SECTION A–A

NOTES:
1. SEWER SERVICE CONNECTIONS SHALL BE POSITIONED AT EITHER THE 2 O'CLOCK OR THE 10 O'CLOCK POSITION ON THE CIRCUMFERENCE OF THE SEWER MAIN.
2. ON NEW INSTALLATIONS, EITHER WYE OR TEE FITTINGS SHALL BE USED. WHEN TAPPING INTO AN EXISTING SEWER MAIN, A SADDLE CONNECTION AND APPROVED CORING METHOD SHALL BE USED.
3. THE MINIMUM DISTANCE BETWEEN SERVICE CONNECTIONS MADE ALONG THE PIPE SHALL BE 3–FEET. THE MINIMUM DISTANCE FROM EITHER THE BELL OR SPIGOT END OF A PIPE SHALL BE 3–FEET. THE MINIMUM DISTANCE FROM THE CENTER OF A MANHOLE TO A SERVICE CONNECTION SHALL BE EITHER 5–FEET OR THE TRANSITION POINT FROM THE MANHOLE TRENCH, WHICHEVER IS GREATER.
4. A MAXIMUM OF 4 SEWER SERVICE CONNECTIONS SHALL BE ALLOWED PER 20–FEET LENGTH OF PIPE. A SPECIFIC SOILS INVESTIGATIONS SHOULD BE CONDUCTED TO ASSURE THAT THE EXTERNAL LOADING WILL BE WITHIN ALLOWABLE LIMITS REGARDLESS OF THE NUMBER OF TAPS INVOLVED.

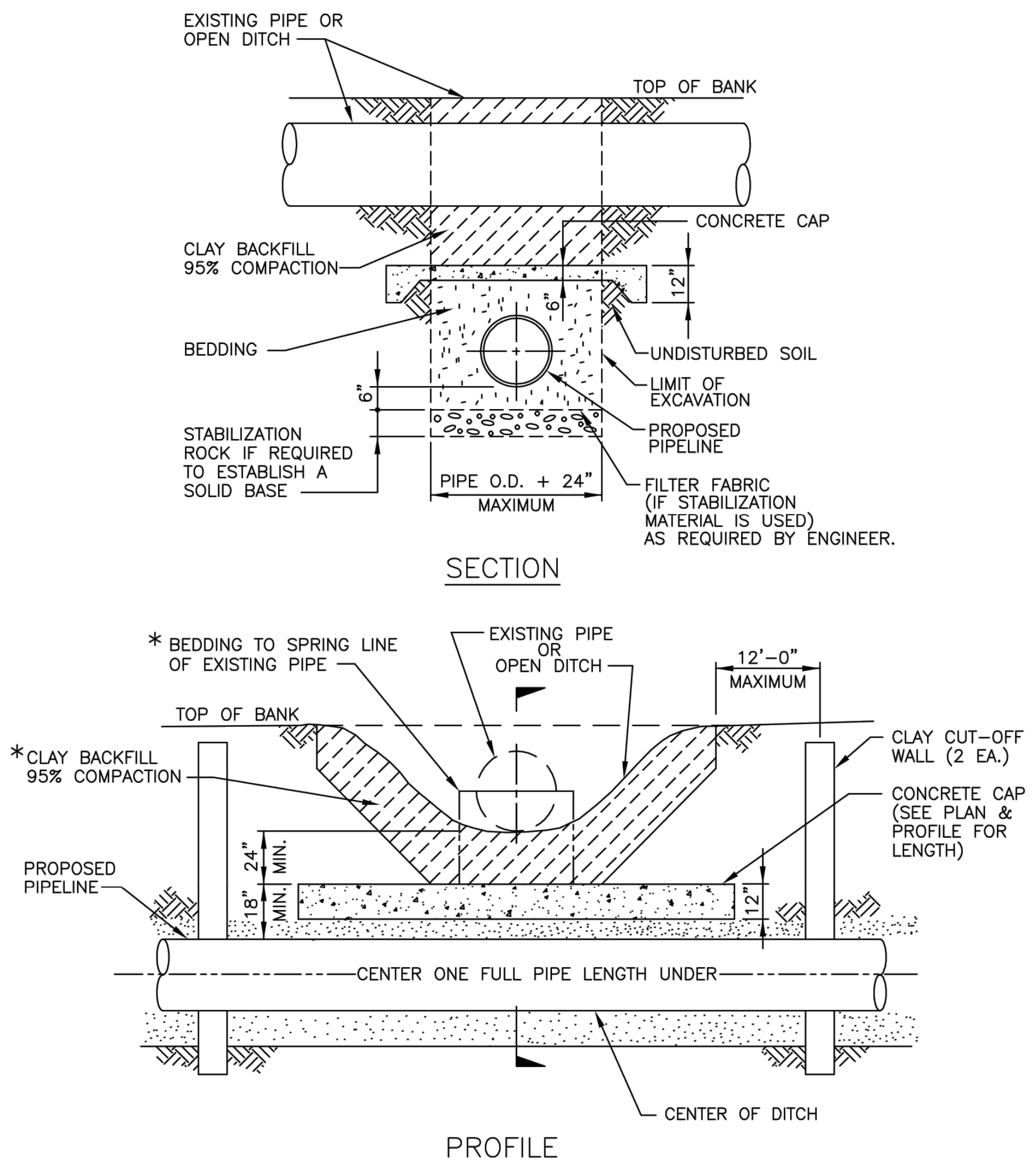
The Town of ERIE COLORADO
DRAWING TITLE: DOMESTIC SEWER TAPPING
DRAWING NUMBER: SS15
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004



PLAN

ELEVATION

The Town of ERIE COLORADO
DRAWING TITLE: SEWER SERVICE CONNECTION
DRAWING NUMBER: SS18
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004



* USE CLAY BACKFILL ONLY WHEN CROSSING OPEN DITCH. USE BEDDING MATERIAL TO SPRING LINE OF EXISTING PIPE WHEN CROSSING PIPE.

The Town of ERIE COLORADO
DRAWING TITLE: DITCH OR PIPE CROSSING
DRAWING NUMBER: SS21
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

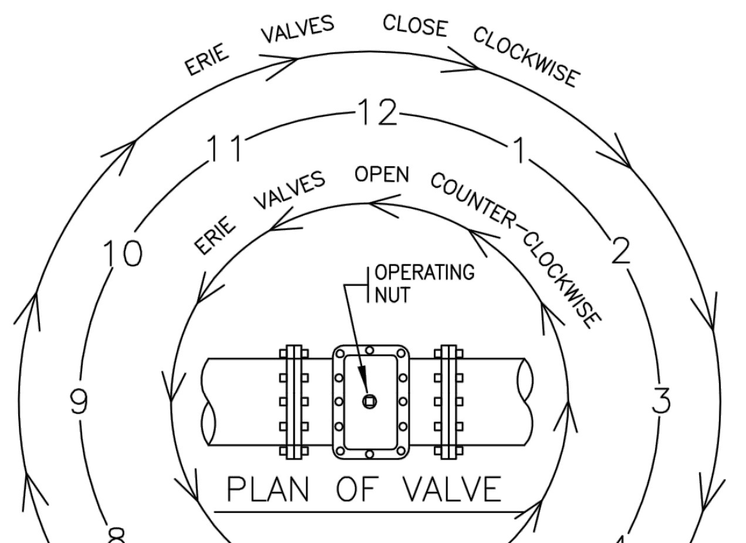
SANITARY SEWER DETAILS

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
DT04
Sheet 67 of 74

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT

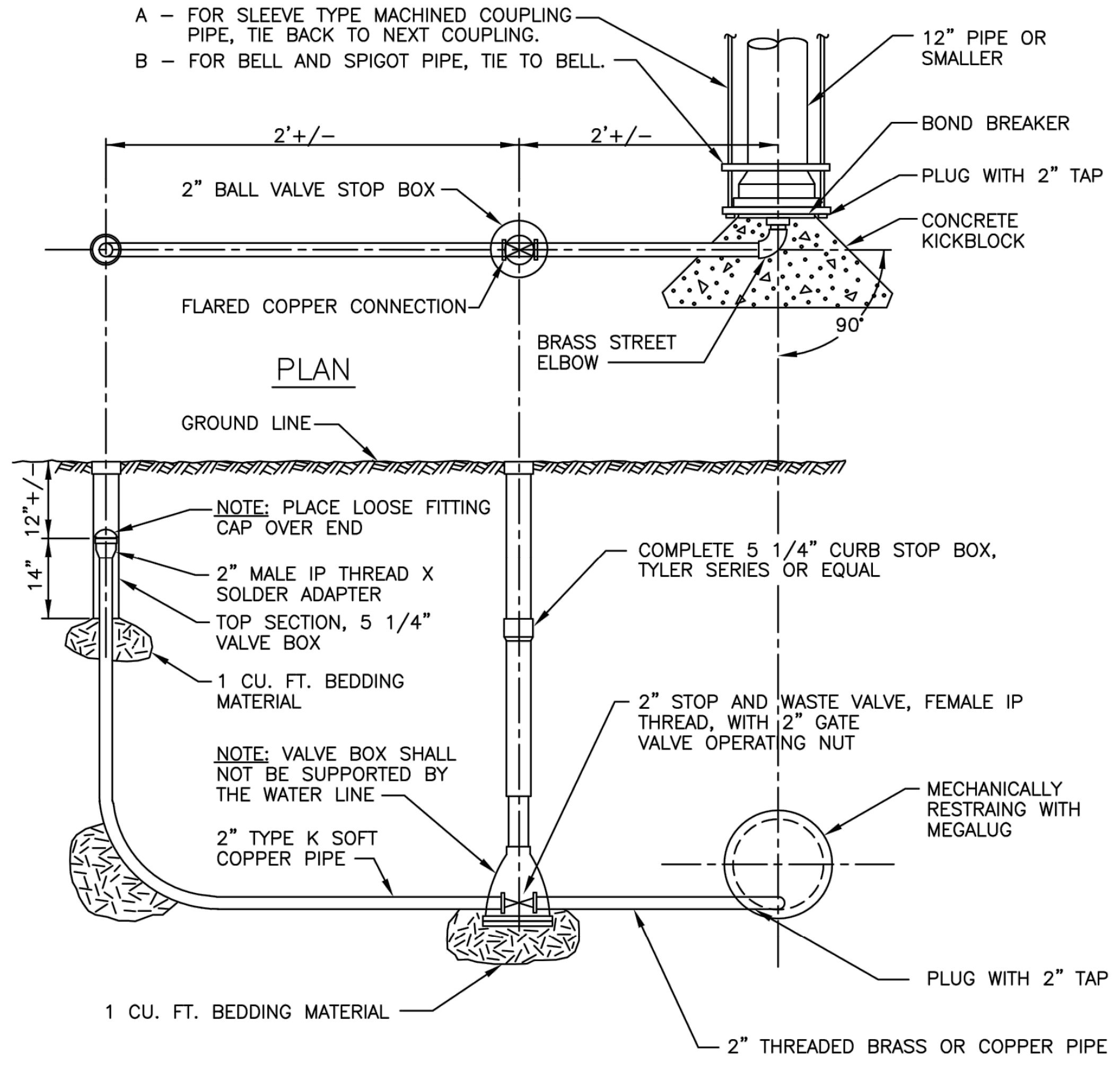


NOTE:
NORMALLY VALVES WITH A BLACK OPERATING NUT INDICATE A STANDARD ERIE VALVE. (OPEN LEFT)

VALVE OPENING & CLOSING PROCEDURE

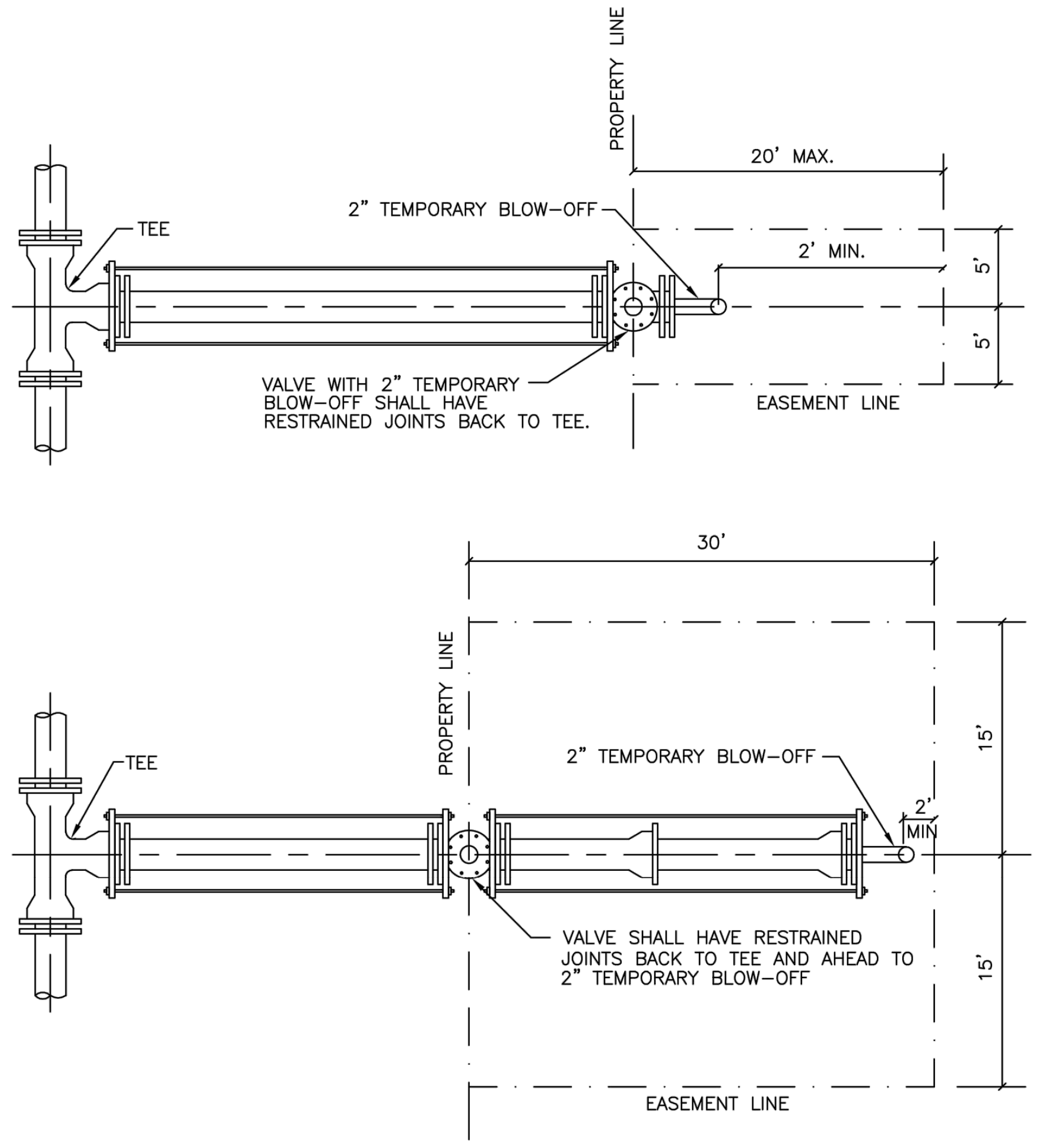
The Town of ERIE COLORADO
DRAWING TITLE: VALVE OPERATION
DRAWING NUMBER: W1
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2009

NOTE:
PLUG SHALL BE MECHANICALLY RESTRAINED:
A – FOR SLEEVE TYPE MACHINED COUPLING PIPE, TIE BACK TO NEXT COUPLING.
B – FOR BELL AND SPIGOT PIPE, TIE TO BELL.

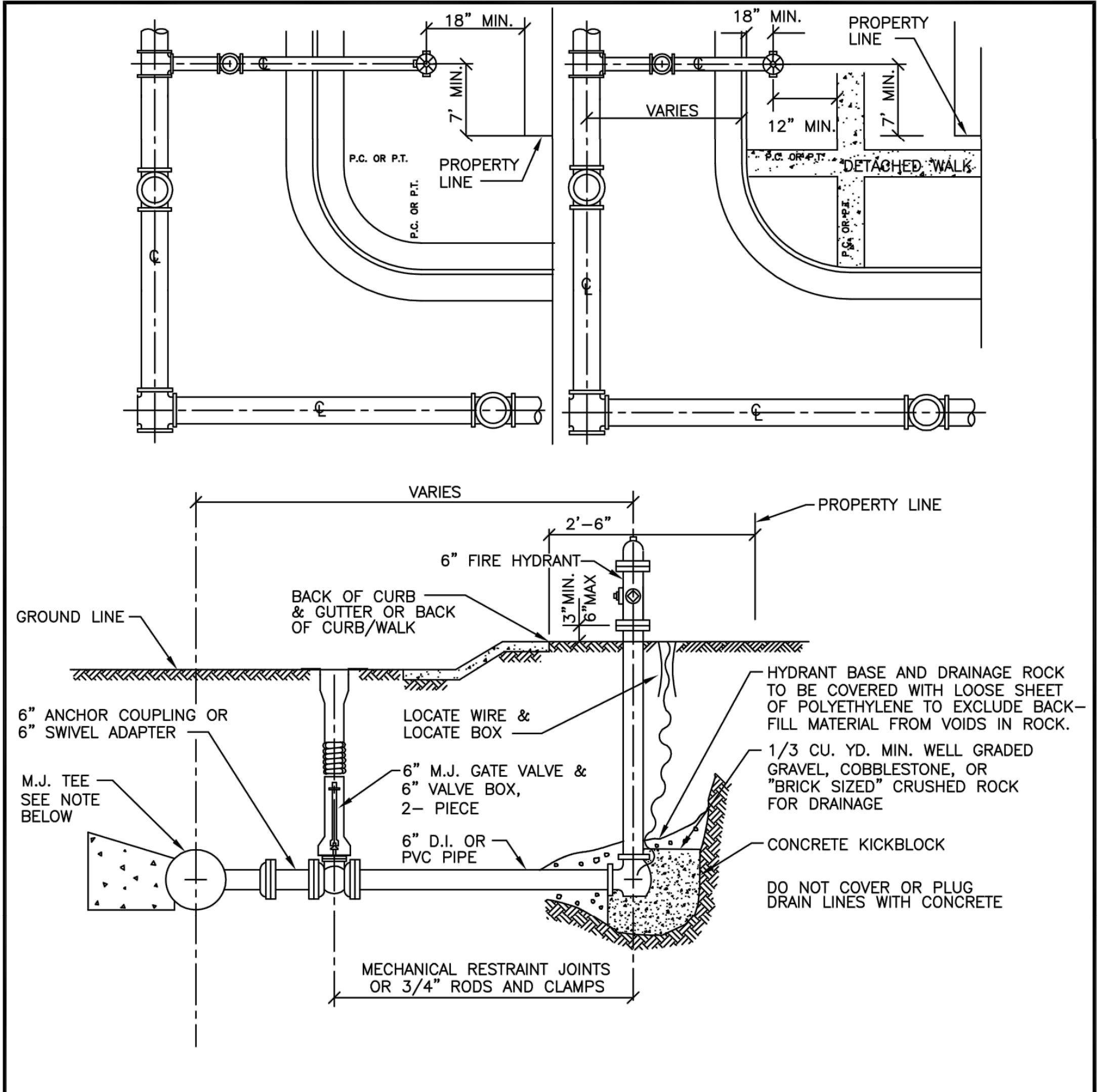


ELEVATION

The Town of ERIE COLORADO
DRAWING TITLE: BLOW–OFF INSTALLATION FOR 12" AND SMALLER PIPE
DRAWING NUMBER: W5
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2016

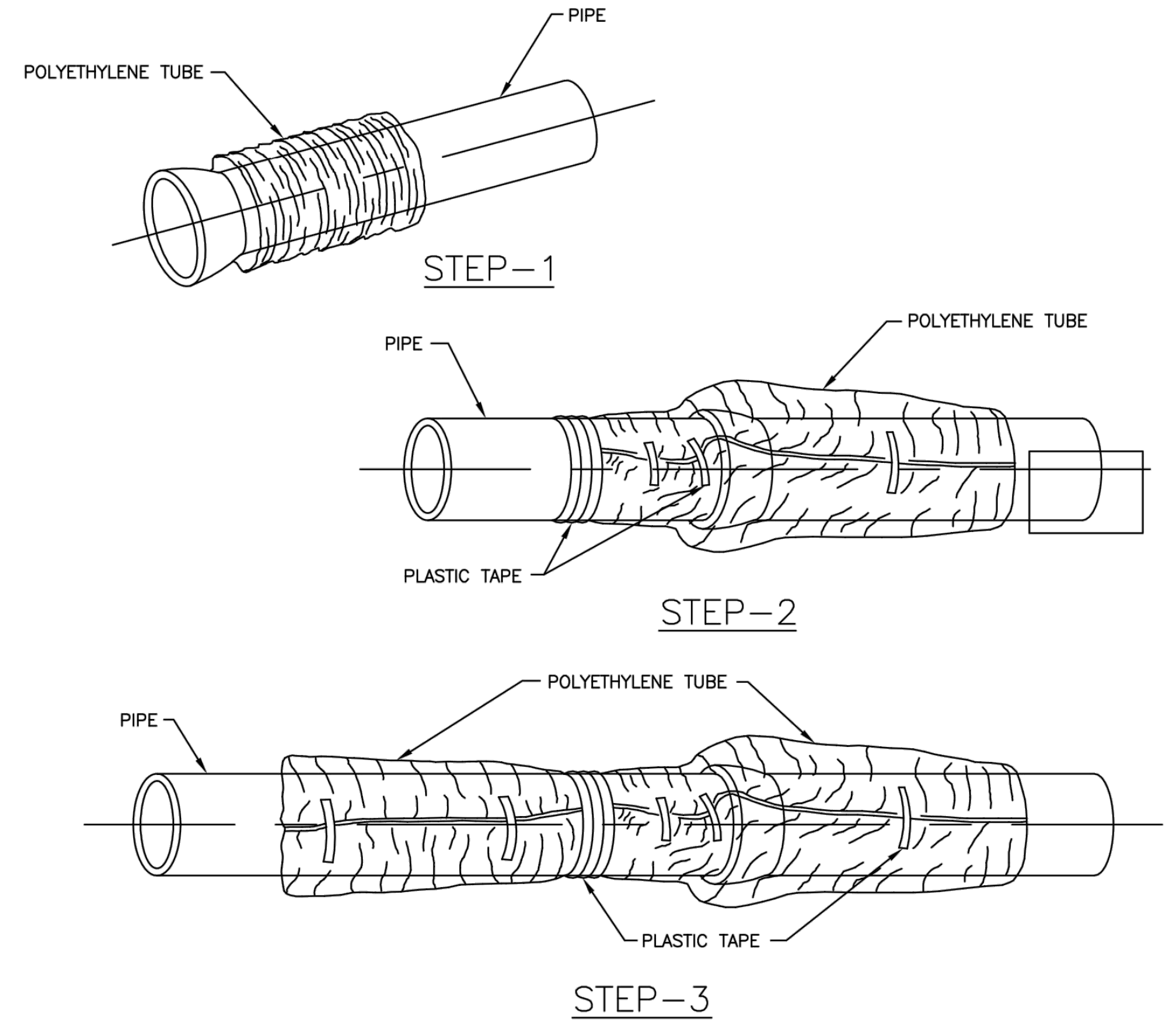


The Town of ERIE COLORADO
DRAWING TITLE: STUB–OUT CONFIGURATIONS
DRAWING NUMBER: W6A (1 of 2)
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004



NOTES:
1. ALTERNATE TO THE ABOVE: FASTEN M.J. VALVE DIRECTLY TO A M.J. ANCHOR TEE (ALSO CALLED SWIVEL TEE)
2. NO HORIZONTAL OR VERTICAL BENDS ARE ALLOWED IN FIRE HYDRANT BRANCH OR SPRINKLER LINES
3. MAXIMUM OF ONE FIRE HYDRANT EXTENSION
4. CONTRACTOR TO TAKE CARE NOT TO BLOCK WEEP HOLES
5. ALL DUCTILE IRON PIPE TO BE POLYETHYLENE WRAPPED

The Town of ERIE COLORADO
DRAWING TITLE: FIRE HYDRANTS, MAINS & VALVES
DRAWING NUMBER: W7
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2010



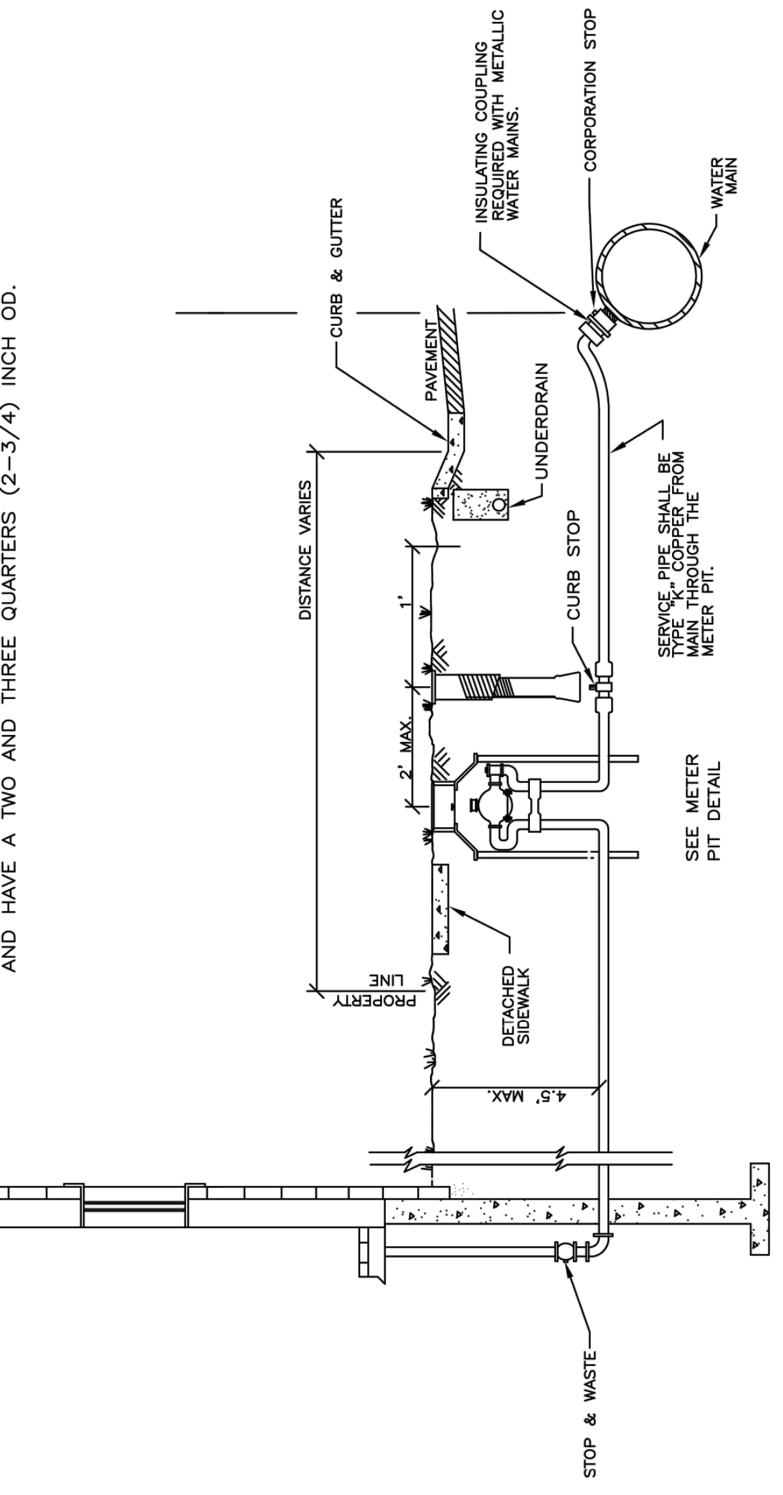
FIELD INSTALLATION–POLYETHYLENE WRAP

STEP–1	PLACE TUBE OF POLYETHYLENE MATERIAL AROUND PIPE PRIOR TO LOWERING PIPE INTO TRENCH.
STEP–2	PULL THE TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO PIPE AT JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH THREE CIRCUMFERENTIAL TURNS OF TWO–INCH WIDE PLASTIC TAPE TO HOLD PLASTIC TUBE AROUND SPIGOT END.
STEP–3	ADJACENT TUBE OVERLAPS FIRST TUBE AND IS SECURED WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE WILL BE LOOSE. EXCESS MATERIAL AND SHOULD BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED INTO AN OVERLAP ON TOP OF THE PIPE AND HELD IN PLACE BY MEANS OF PIECES OF THE PLASTIC TAPE AT APPROXIMATELY THREE TO FIVE FOOT INTERVALS.

NOTE: ALL RODDING TO BE ENCASED IN POLYETHYLENE SEPARATED FROM THE PIPE

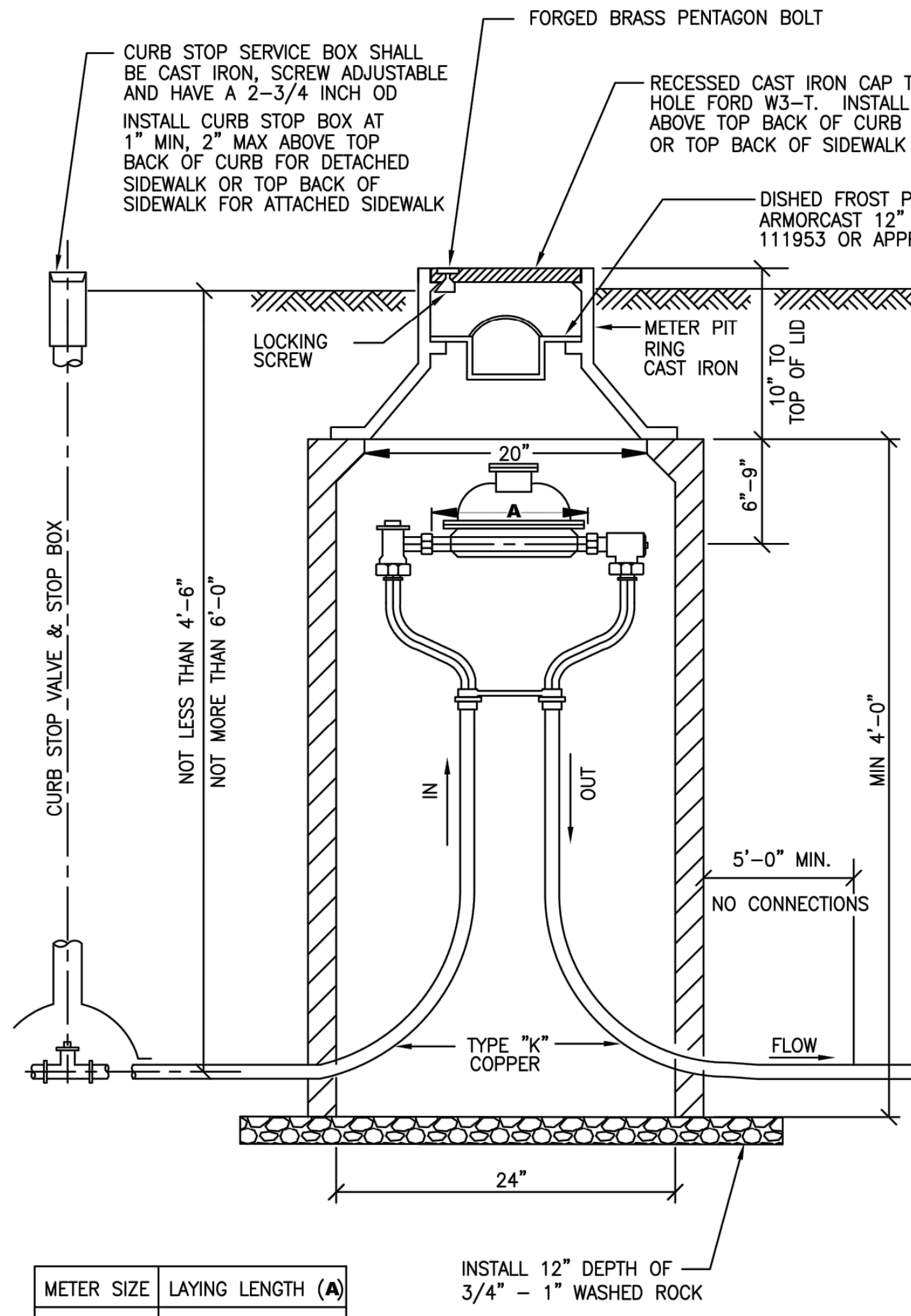
The Town of ERIE COLORADO
DRAWING TITLE: POLYETHYLENE WRAP
DRAWING NUMBER: W9
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004

NOTE:
1. ALL SERVICE LINE WORK FROM THE WATER MAIN TO THE METER PIT SHALL BE INSTALLED BY THE CONTRACTOR AND INSPECTED BY A TOWN OF ERIE CONSTRUCTION INSPECTOR PRIOR TO BACKFILLING. ALL PORTIONS OF THE SERVICE LINE TRENCH SHALL BE FILLED WITH SQUEEGEE TO A DEPTH OF 6" OVER THE TOP OF THE SERVICE LINE.
2. COVER FOR METER PIT SHALL BE INSTALLED & MAINTAINED AT A MIN. 2"/MAX. 4" ABOVE BACK OF CURB. STOP BOX SHALL BE INSTALLED & MAINTAINED AT A MIN. 1"/MAX. 2" ABOVE BACK OF CURB.
3. CURB STOP SERVICE BOXES SHALL BE CAST IRON, SCREW ADJUSTABLE, AND HAVE A TWO AND THREE QUARTERS (2–3/4) INCH OD.



DETACHED WALK

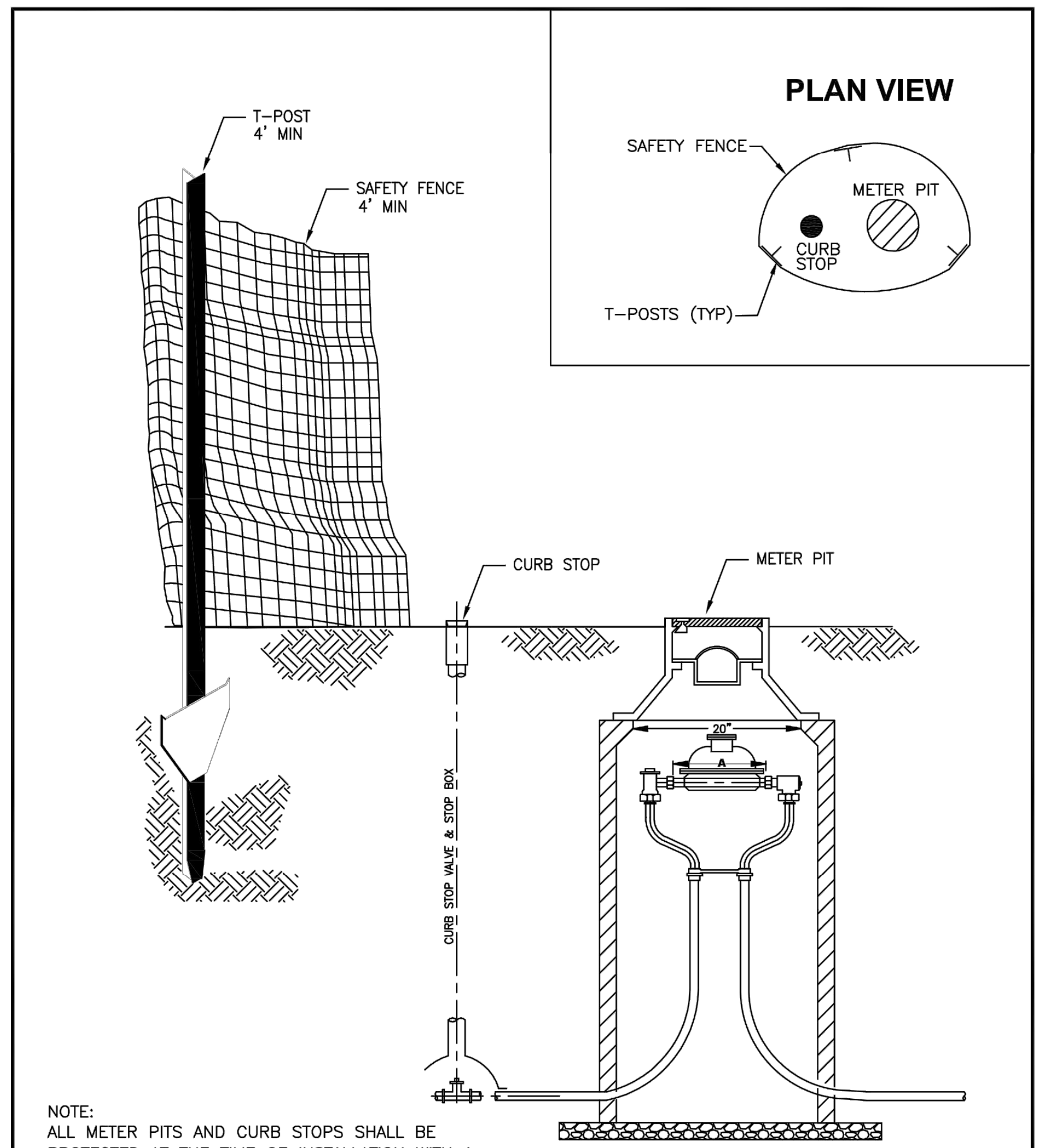
The Town of ERIE COLORADO
DRAWING TITLE: POTABLE SERVICE LINE DETACHED WALK
DRAWING NUMBER: W11B (2 OF 2)
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2015



METER SIZE	LAYING LENGTH (A)
5/8"x 3/4"	7–1/2"
1"	10–3/4"

GENERAL NOTES
1. POLYMER CONCRETE RING & LID ALLOWABLE.
2. METER PIT SHALL BE CONSTRUCTED OF MODIFIED POLYETHYLENE WITH MINIMUM WALL THICKNESS OF 0.50"
3. EXTENSIONS AND OFF GRADE EXTENSIONS SHALL BE INSERTED BETWEEN THE DOME AND TOP RING TO PUT LID TO GRADE.
4. NO CONNECTIONS OR CHANGES IN PIPE DIAMETER SHALL BE MADE IN THE METER PIT OR IN THE DISTANCE OF FIVE FEET BEYOND THE METER. PIT WALL ON THE OUTLET SIDE.
5. LAWN SPRINKLER CONNECTIONS SHALL BE A MINIMUM OF FIVE FEET FROM THE METER PIT WALL ON THE OUTLET SIDE.
6. ANY VARIATION OR DEVIATION FROM THIS STANDARD REQUIRES PREVIOUS APPROVAL PRIOR TO INSTALLATION FROM THE PUBLIC WORKS DEPT
7. METER PIT MUST BE INSTALLED IN LANDSCAPED AREA. PRIOR APPROVAL FROM PUBLIC WORKS DEPT. REQUIRED FOR ANY DEVIATION FROM THIS REQUIREMENT.

The Town of ERIE COLORADO
DRAWING TITLE: POTABLE WATER METER PIT 3/4" & 1" METER
DRAWING NUMBER: W12A
DRAWN BY: C. GERATY APPROVED BY: G. BEHLEN REV. DATE: 01/2016



NOTE:
ALL METER PITS AND CURB STOPS SHALL BE PROTECTED AT THE TIME OF INSTALLATION WITH A MINIMUM OF 3 T–POSTS AND ORANGE SAFETY FENCE. THE T–POSTS AND SAFETY FENCE SHALL REMAIN IN PLACE AND IN GOOD CONDITION UNTIL THE LANDSCAPING IS INSTALLED.

The Town of ERIE COLORADO
DRAWING TITLE: METER PIT & CURB STOP PROTECTION
DRAWING NUMBER: W12C
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2012

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

WATER DETAILS

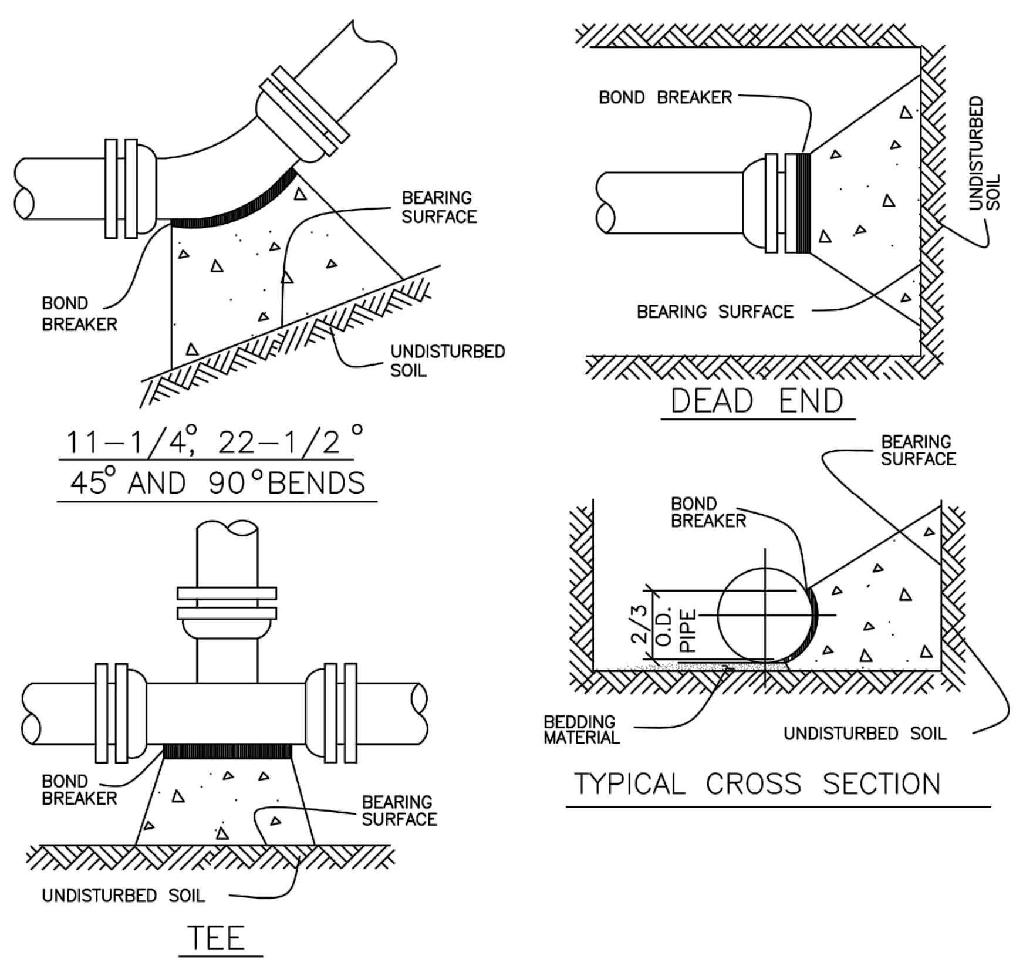
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
DT05
Sheet 68 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



NOTES:

1. SEE THRUST BLOCKING CHART FOR MINIMUM BEARING SURFACE AREAS
2. BASED ON 150 PSI INTERNAL PIPE PRESSURE PLUS WATER HAMMER
   4",6",8" AND 12" WATER HAMMER=110 P.S.I.
   16",20' AND 24" WATER HAMMER =70 P.S.I.
3. BASED ON 3,000 pfs SOIL BEARING CAPACITY
4. THRUST BLOCKING SHALL BE CAST AGAINST UNDISTURBED EARTH. FORMS SHALL BE USED AS REQUIRED TO OBTAIN ADEQUATE BEARING AND TO CONFINE THE CONCRETE. THRUST BLOCKING SHALL BEAR ON THE FITTING OR END CAP ONLY AND SHOULD NOT BE ALLOWED TO SPILL OVER THE JOINT OR AGAINST THE PIPE

The Town of
ERIE
COLORADO

DRAWING TITLE: THRUST BLOCK
DRAWING NUMBER: W14A
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2015

TABLE OF BEARING AREAS IN SQ. FT. FOR CONCRETE THRUST BLOCKING

FOR 100 P.S.I. INTERNAL STATIC PRESSURE AND 1,000 LBS. PER SQUARE FOOT SOIL BEARING CAPACITY.

SIZE	BENDS				TEES *	GATE VALVES	DEAD ENDS	CROSS W/ 1 BRANCH PLUGGED	CROSS W/ 2 BRANCHES PLUGGED
	90°	45°	22-1/2°	11-1/4°					
3	1.0	0.6	0.3	1.0	0.7	0.5	0.7	0.7	0.7
4	1.8	1.0	0.5	1.0	1.3	0.5	1.3	1.3	1.3
6	4.0	2.2	1.1	1.0	2.8	0.7	2.8	2.8	2.8
8	7.1	3.8	2.0	1.0	5.0	2.4	5.0	5.0	5.0
10	11.1	6.0	3.0	1.5	7.8	4.5	7.8	7.8	7.8
12	16.0	8.6	4.4	2.2	11.3	7.3	11.3	11.3	11.3
14	21.7	11.8	6.0	3.0	15.4	11.0	15.4	15.4	15.4
15	25.0	13.5	7.0	3.5	17.6	SPECIAL DESIGN	17.6	17.6	17.6
16	28.4	15.3	8.0	4.0	20.0		20.0	20.0	20.0
18	36.0	19.4	10.0	5.0	25.4		25.4	25.4	25.4
20	44.2	24.0	12.2	6.1	31.4		31.4	31.4	31.4
21	49.0	26.5	13.5	6.8	34.6		34.6	34.6	34.6
22	54.0	29.0	14.8	7.4	38.0		38.0	38.0	38.0
24	64.0	34.5	17.7	8.8	45.0		45.0	45.0	45.0
30	100.0	54.0	27.6	13.8	71.0		71.0	71.0	71.0
36	144.0	78.0	40.0	20.0	102.0		102.0	102.0	102.0

* SIZE IS BRANCH SIZE

AREAS GIVEN IN TABLE ARE BASED UPON AN INTERNAL STATIC PRESSURE OF 100 P.S.I. AND A SOIL BEARING CAPACITY OF 1,000 LBS. PER SQUARE FOOT. BEARING AREAS FOR ANY PRESSURE AND SOIL BEARING CAPACITY MAY BE OBTAINED BY MULTIPLYING THE TABULATED VALUES BY A CORRECTION FACTOR "F".

$$F = \frac{\text{ACTUAL SPECIFIED TEST PRESSURE IN HUNDRED OF LBS.}}{\text{ACTUAL SOIL BEARING CAPACITY IN THOUSANDS OF LBS.}}$$

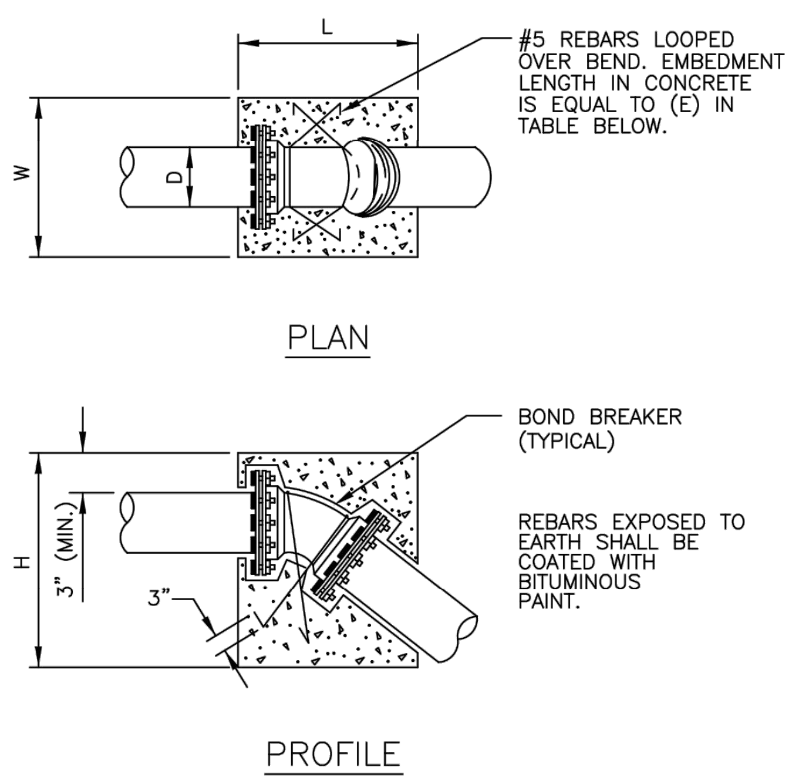
EXAMPLE: TO FIND BEARING AREA FOR 8" – 90° BEND WITH A STATIC INTERNAL PRESSURE OF 150 P.S.I. AND WITH A SOIL BEARING CAPACTIY OF 3,000 LBS. PER SQUARE FOOT.

F = 1.5 ÷ 3 = 0.5 TABULATED VALUE = 7.1 SQUARE FOOT.

0.5 x 7.1 = 3.56 SAY 4 SQUARE FEET OF 2 FOOT LONG BY 2 FOOT HIGH.

The Town of
ERIE
COLORADO

DRAWING TITLE: THRUST BLOCKING CHART
DRAWING NUMBER: W14B
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2015



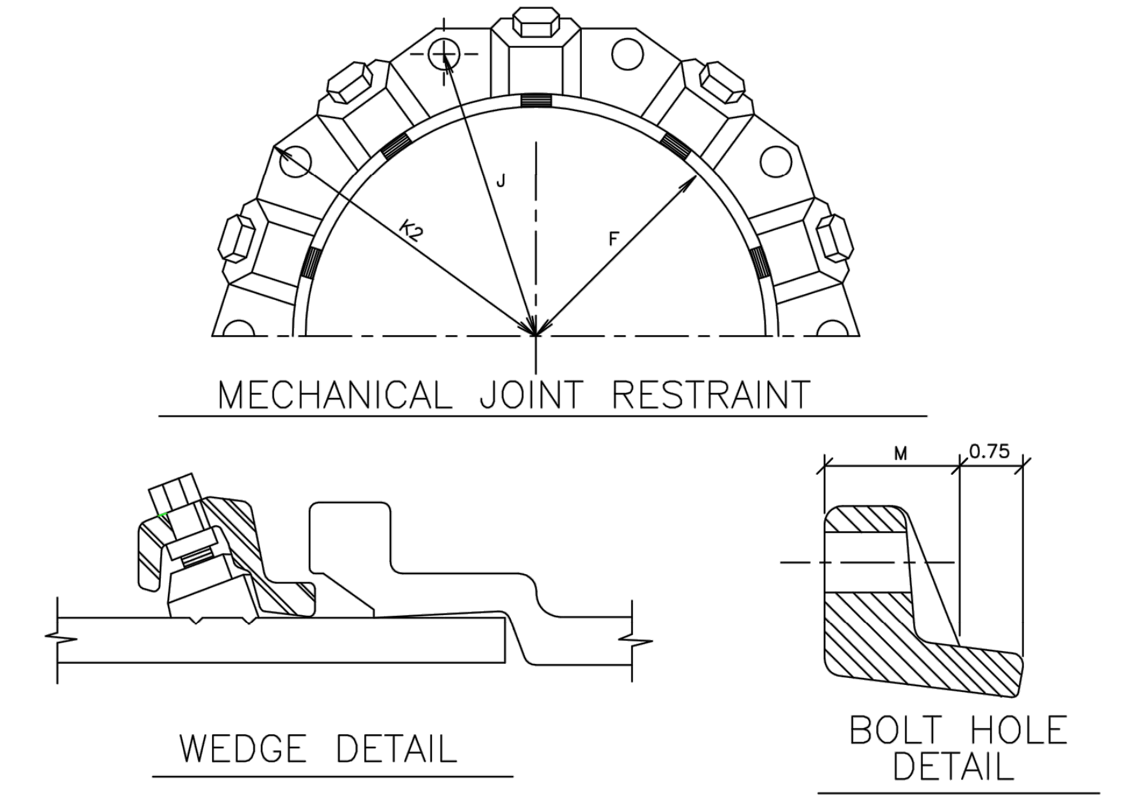
SIZE OF PIPE (D)	11 1/4 DEG.					22 1/2 DEG.					45 DEG.				
	L"	W"	H"	E"	VOL	L"	W"	H"	E"	VOL	L"	W"	H"	E"	VOL
4"	12	24	24	12	4	12	34	34	12	8	22	37	32	22	15
6"	18	32	27	18	9	15	52	40	15	18	28	64	32	28	33
8"	21	40	33	21	16	22	61	40	22	31	35	64	45	35	58
10"	24	50	36	24	25	30	59	48	30	49	42	72	52	42	90
12"	31	56	36	31	36	36	70	48	36	70	45	80	62	45	129

NOTES:

1. THRUST BLOCKING SHALL BE CAST AGAINST UNDISTURBED EARTH. FORMS SHALL BE USED AS REQUIRED TO OBTAIN ADEQUATE BEARING AND TO CONFINE THE CONCRETE. THRUST BLOCKING SHALL BEAR ON THE FITTING OR END CAP ONLY AND SHOULD NOT BE ALLOWED TO SPILL OVER THE JOINT OR AGAINST THE PIPE.
2. VOLUME IS IN CUBIC FEET.
3. ALL CONCRETE TO BE 4000 P.S.I. MIN.
4. BLOCKS TO BE CENTERED HORIZONTALLY ON THE BEND.
5. DESIGN BASED ON A TEST PRESSURE OF 150 P.S.I. AND SAFETY FACTOR (S_f) OF 1.5
6. $V_g = \frac{S_f \ PA \ SIN \ \theta}{W_m}$
7. $W_m = 140 \ \# \ / \ FT^3$
8. THE DESIGN ENGINEER IS RESPONSIBLE FOR VERIFYING THE ACTUAL SITE CONDITIONS WITH RESPECT TO THE ASSUMPTIONS LISTED ABOVE.

The Town of
ERIE
COLORADO

DRAWING TITLE: UPPER VERTICAL THRUST BLOCK
DRAWING NUMBER: W15
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2015



DIMENSIONS

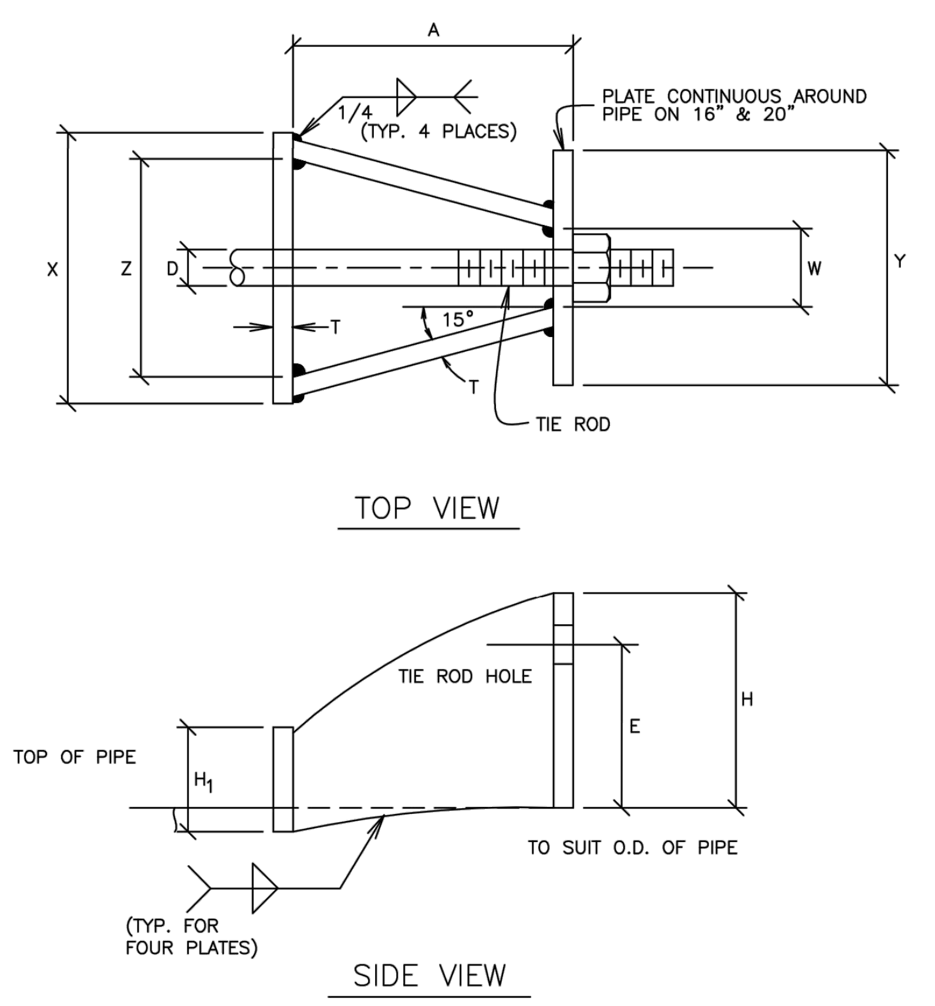
	NOMINAL PIPE SIZE	NO. OF BOLTS	NO. OF WEDGES	K2 INCHES	J INCHES	F INCHES	M INCHES	
PVC	4"	2	2					PVC
	6"	6	3	11.12	9.50	7.00	0.88	
	8"	6	4	13.37	11.75	9.15	1.00	
	10"	8	6	15.62	14.00	11.20	1.00	
	12"	8	8	17.88	16.25	13.30	1.25	
DI	4"	4	2					DI
	6"	6	3	11.12	9.50	7.00	0.88	
	8"	6	4	13.37	11.75	9.15	1.00	
	10"	8	6	15.62	14.00	11.20	1.00	
	12"	8	8	17.88	16.25	13.30	1.25	

NOTES:

1. DIMENSIONS FOR 16" AND 20" D.I. PIPE NOT SHOWN.
2. OTHER MECHANICAL JOINT RESTRAINT DEVICES MUST BE APPROVED BEFORE INSTALLATION.

The Town of
ERIE
COLORADO

DRAWING TITLE: MECHANICAL JOINT RESTRAINT DETAIL
DRAWING NUMBER: W17
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2009



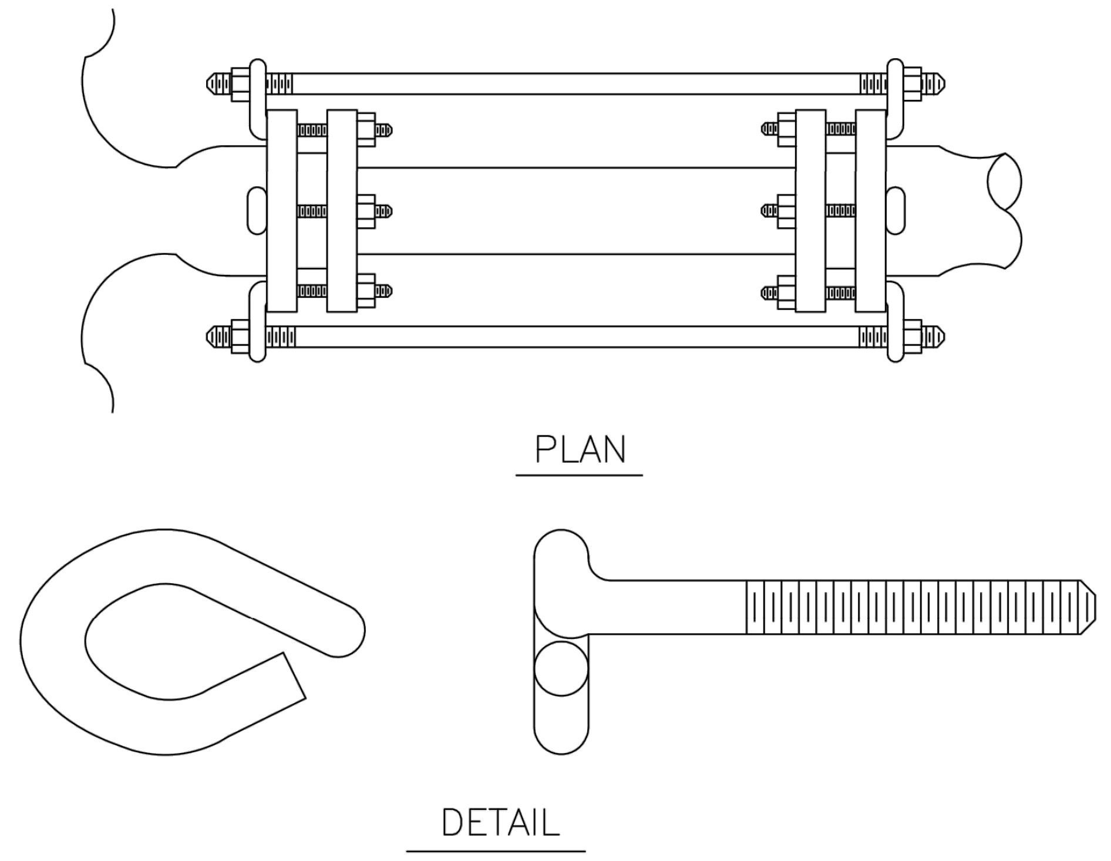
	CARRIER PIPE NOMINAL DIA.	STUD DIA. D	A	W	Z	T	H	E	H_1	Y	X
W/O FLANGED LUGS	4" TO 12"	3/4"	5"	1-1/2"	3-3/4"	3/8"	4-1/8"	3-1/8"	2"	4-1/2"	5"
	16"	1"	5-3/4"	1-3/4"	4-1/2"	1/2"	4-1/2"	3-1/4"	2"	RING	6"
	20"	1-1/4"	7-1/2"	2"	5-3/4"	5/8"	5"	3-3/4"	2-1/2"	RING	7-1/2"

NOTES:

1. USE TWO HIGH STRENGTH STEEL TIE RODS AT END OF CASING.
2. TIE ROD HOLE DIAMETER 1/8" LARGER THAN STUD DIAMETER.
3. BOTTOM EDGE OF ALL PLATES SHAPED TO FIT O.D. OF PIPE.
4. HARNESS LUGS AS PER AWWA MANUAL M-II.

The Town of
ERIE
COLORADO

DRAWING TITLE: COMBINATION FLANGED HARNESS LUG DETAIL
DRAWING NUMBER: W18
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2009



DIMENSIONS

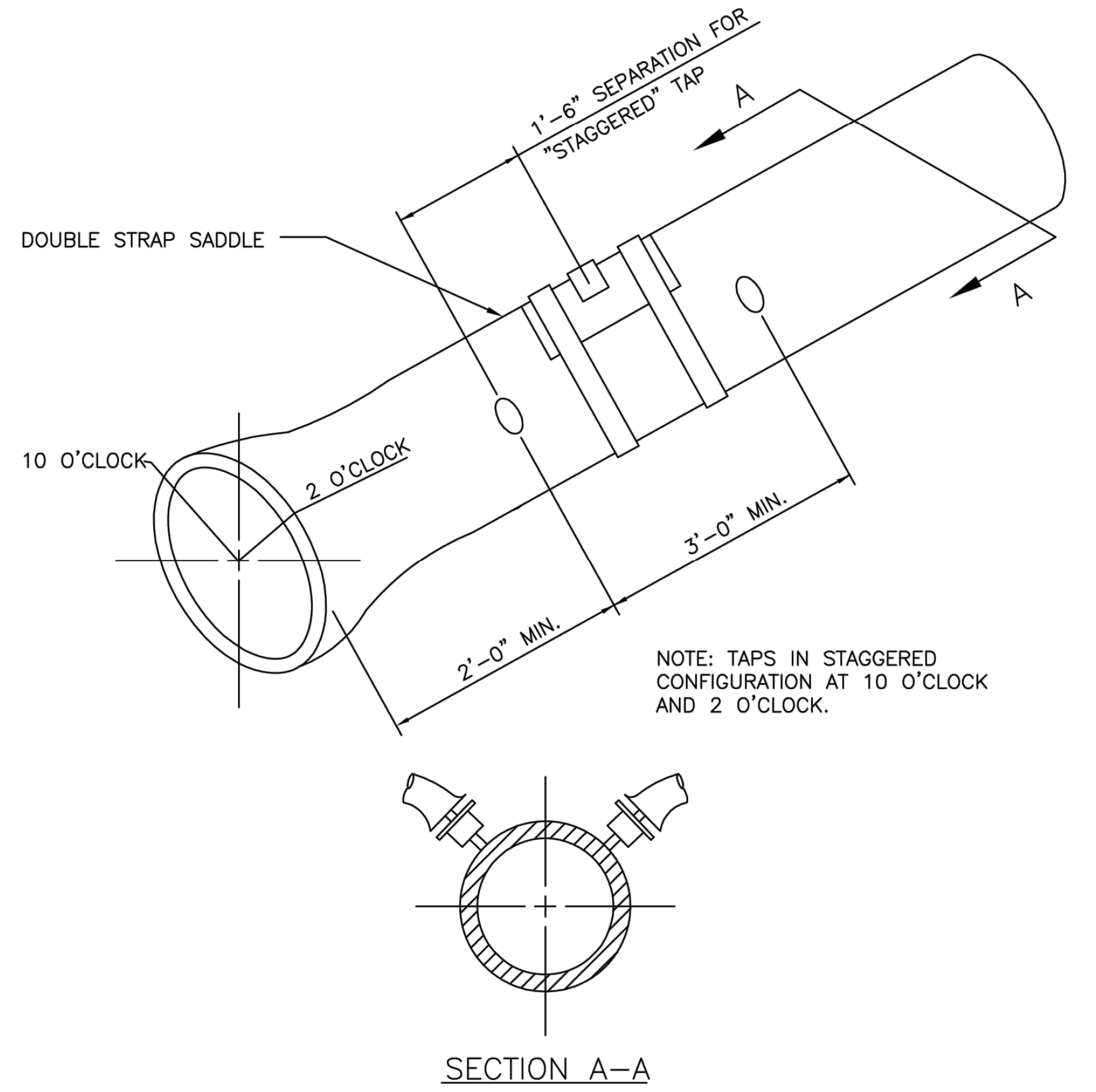
ALLOWABLE PIPE DIAMETER INCHES	BOLT SIZE	NO . OF BOLTS REQUIRED
4	3/4"	2
6	3/4"	2
8	3/4"	2
10	3/4"	4
12	3/4"	6

NOTES:

1. THE BOLT SHALL BE MANUFACTURED OF "COR-TEN" OR APPROVED EQUAL.
2. THE BOLT MAY BE HEAT TREATED.

The Town of
ERIE
COLORADO

DRAWING TITLE: JOINT RESTRAINT DETAIL
DRAWING NUMBER: W19
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2009



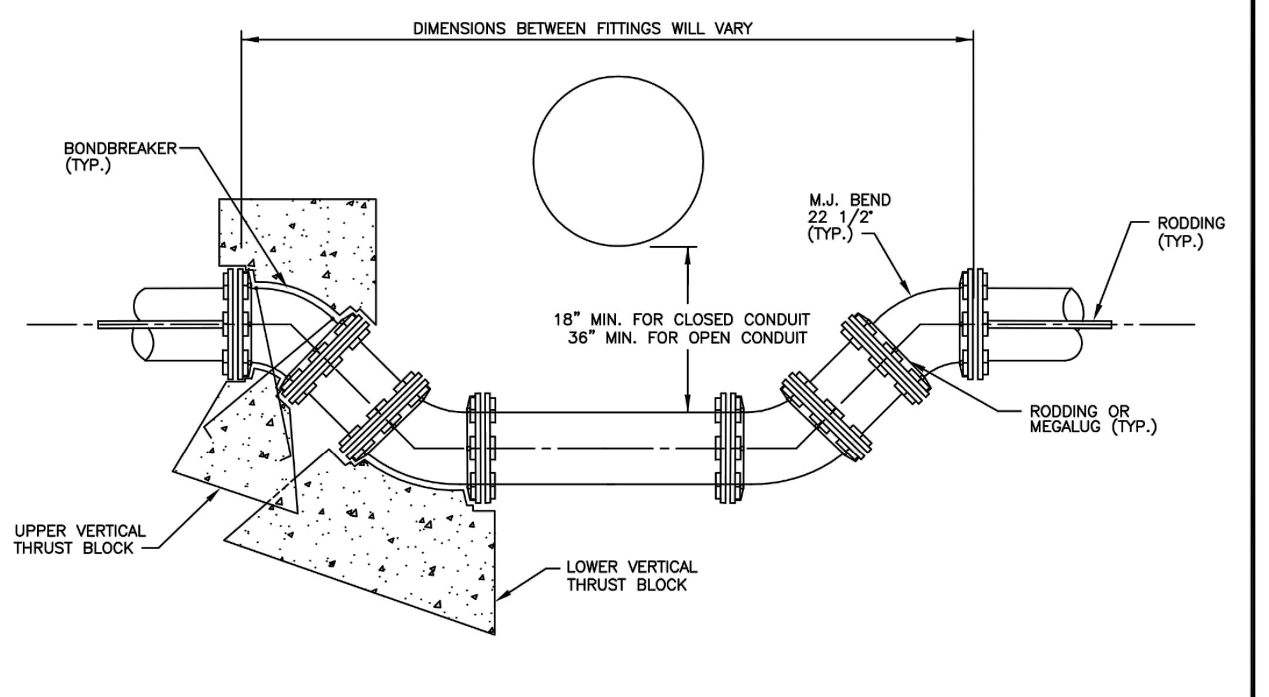
NOTE: TAPS IN STAGGERED CONFIGURATION AT 10 O'CLOCK AND 2 O'CLOCK.

NOTE:

SERVICE TAPS – WATER SERVICE TAPS SHALL BE MADE AT EITHER THE 2 O'CLOCK OR THE 10 O'CLOCK POSITION ON THE CIRCUMFERENCE OF A WATER MAIN. THE MINIMUM DISTANCE BETWEEN A TAP MADE AT THE 2 O'CLOCK POSITION AND THE ONE MADE AT THE 10 O'CLOCK POSITION SHALL BE 18-INCHES MEASURED ALONG THE PIPE. THE MINIMUM DISTANCE BETWEEN SUCCESSIVE TAPS MADE EITHER AT THE 2 O'CLOCK OR THE 10 O'CLOCK POSITION SHALL BE 3-FEET. THE MINIMUM DISTANCE FROM EITHER THE BELL OR THE SPIGOT END OF A PIPE TO A TAP SHALL BE 2-FEET. A MAXIMUM OF 4 WATER SERVICE TAPS SHALL BE ALLOWED PER LENGTH OF PIPE. DOUBLE STRAP SADDLE (ROMAC 202B OR APPROVED EQUAL) SHALL BE USED FOR ALL SERVICE TAPS.

The Town of
ERIE
COLORADO

DRAWING TITLE: DOMESTIC WATER TAPPING DETAIL
DRAWING NUMBER: W22
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2010



NOTES:

1. LOWERING OF THIS TYPE WILL BE RESTRAINED BY MEANS OF THRUST BLOCKING AND MEGALUGS OR RODDING.
2. FOR SIZING INFORMATION OF THRUST BLOCKS REFER TO THRUST BLOCK DETAILS.
3, WHEN RESTRAINING PIPE BY MEANS OF RODDING JOINTS, 3/4 " TIE RODS, NUTS, AND WASHERS WILL BE USED AND ARE TO BE MADE OF "COR-TEN" STEEL AS PER A.S.T.M. A242.
4, FOR FURTHER INFORMATION ON RODDING OF JOINTS REFER TO TABLE 1.
5. ALL METALLIC PIPE, FITTINGS, AND APPURTENANCES WILL BE WRAPPED IN POLYETHYLENE.
6. REQUIREMENTS FOR LARGER THAN 12" DIAMETER PIPE WILL BE DETERMINED ON A CASE BY CASE BASIS.
7. LENGTH OF EXTENSION OF PIPE AND RESTRAINED JOINTS SHALL BE IN ACCORDANCE WITH THE ENGINEERING STANDARDS.
8. CATHODIC PROTECTION SHALL BE AS REQUIRED IN ACCORDANCE WITH THE ENGINEERING STANDARDS.
9. A BORED CROSSING MAY BE REQUIRED BY THE ENGINEER.

TABLE 1

Pipe Size	Test Pressure	Mininum number of Tie Rods
10" and less	150	2
	200	2
12"	150	2
	200	4

The Town of
ERIE
COLORADO

DRAWING TITLE: 12" OR SMALLER WATERLINE, LOWERING DTL. FOR UTILITY CROSSINGS
DRAWING NUMBER: W27
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2011

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

WATER DETAILS

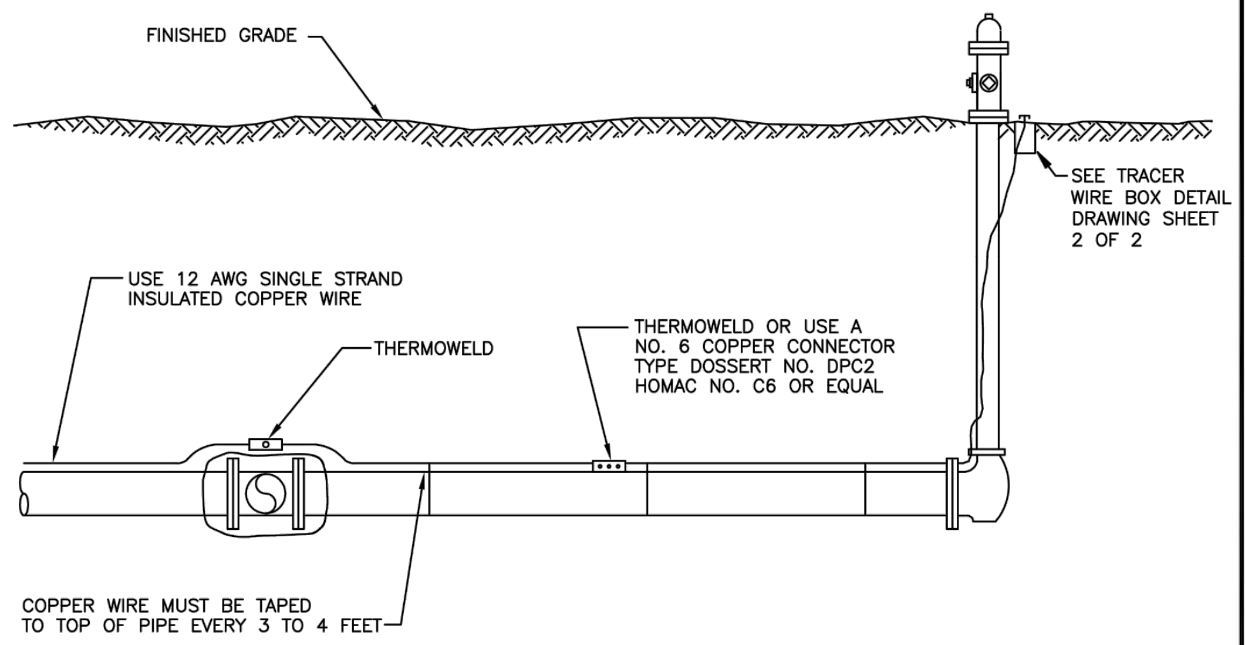
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

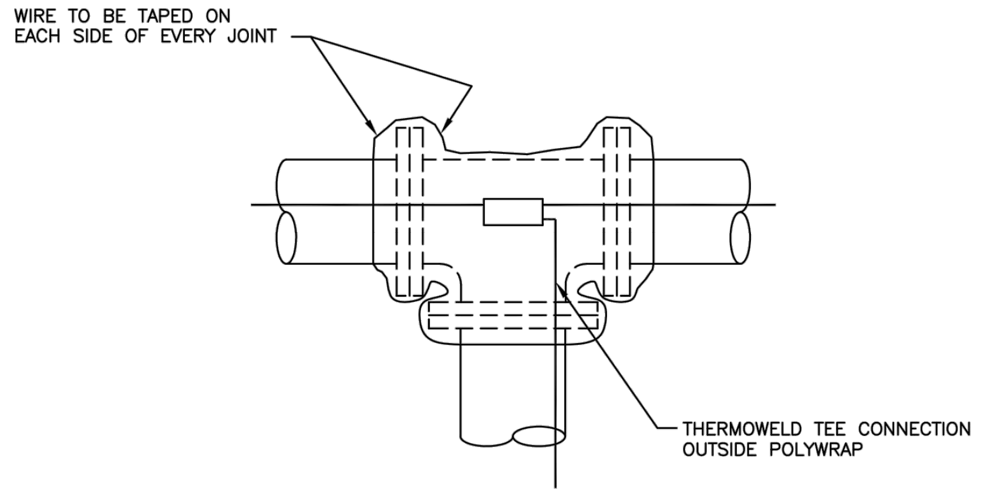
JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
DT06
Sheet 69 of 74

NOT FOR CONSTRUCTION

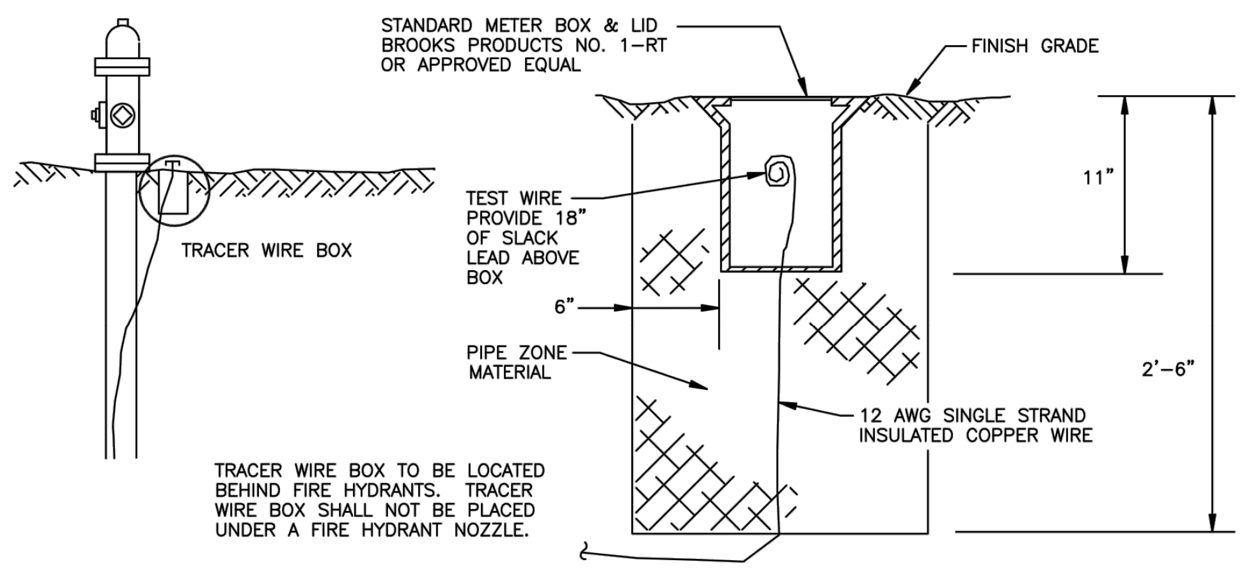
CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



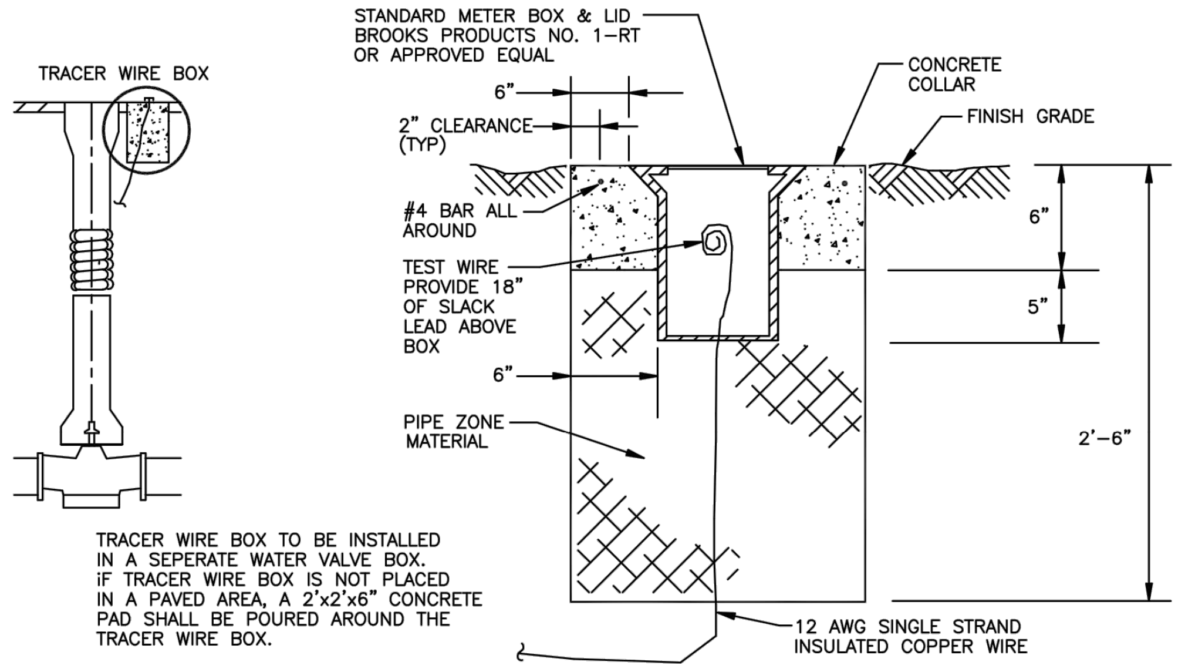


The Town of
ERIE
COLORADO

DRAWING TITLE: TRACER WIRE
DRAWING NUMBER: W32A (1 OF 2)
DRAWN BY: C. GERATY APPROVED BY: G. BEHLEN REV. DATE: 01/2016



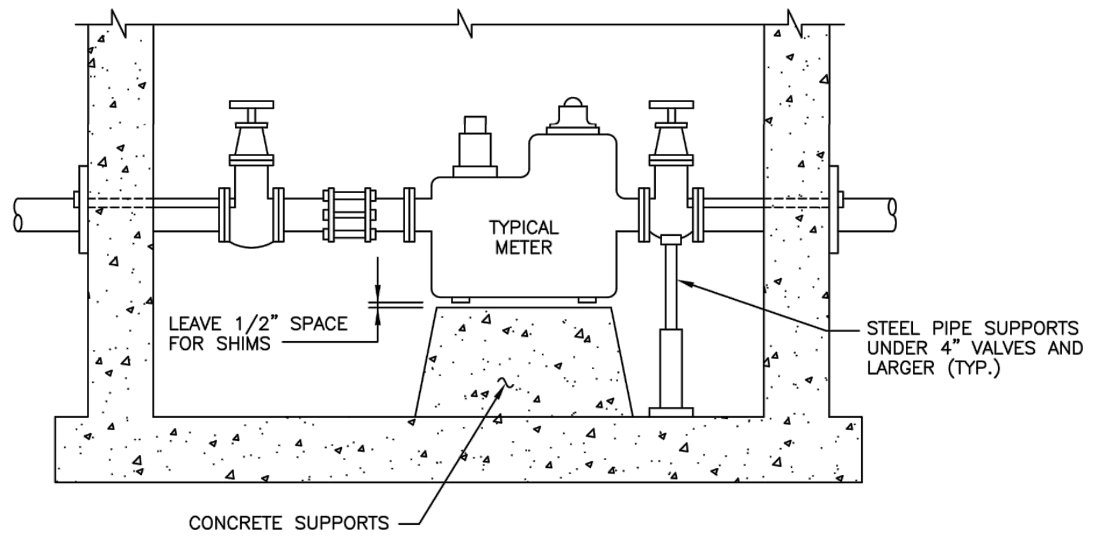
TRACER WIRE BOX AT FIRE HYDRANT



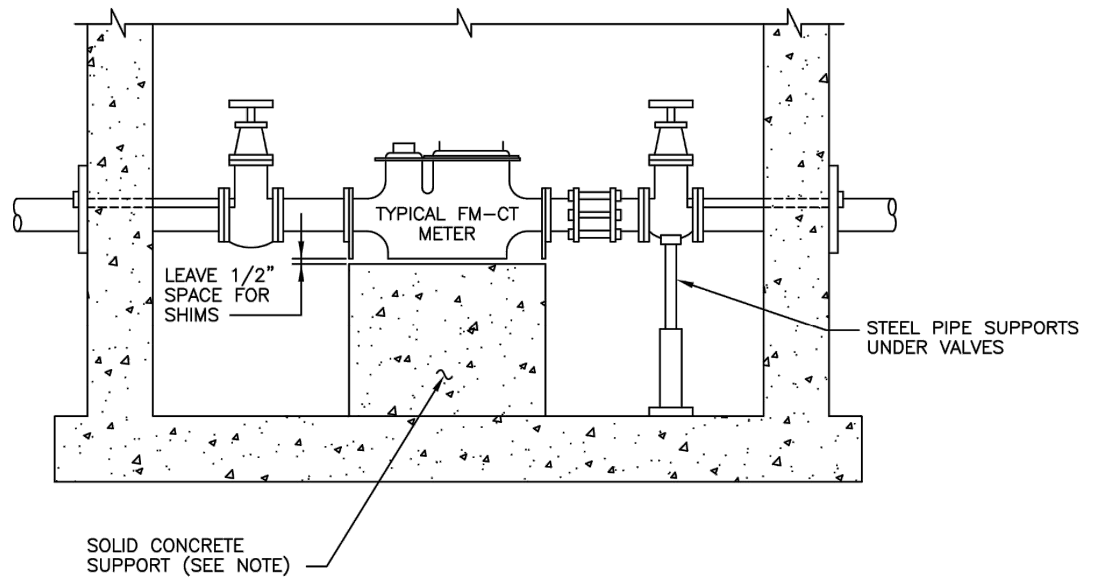
TRACER WIRE BOX FOR AREA WITH NO FIRE HYDRANT

The Town of
ERIE
COLORADO

DRAWING TITLE: TRACER WIRE
DRAWING NUMBER: W32B (2 OF 2)
DRAWN BY: C. GERATY APPROVED BY: G. BEHLEN REV. DATE: 01/2016



TYPICAL CONCRETE METER SUPPORTS
FOR 2", 3", 4", 6", 8", & 10" METERS



TYPICAL CONCRETE METER SUPPORTS
FOR F.M.-C.T. METERS

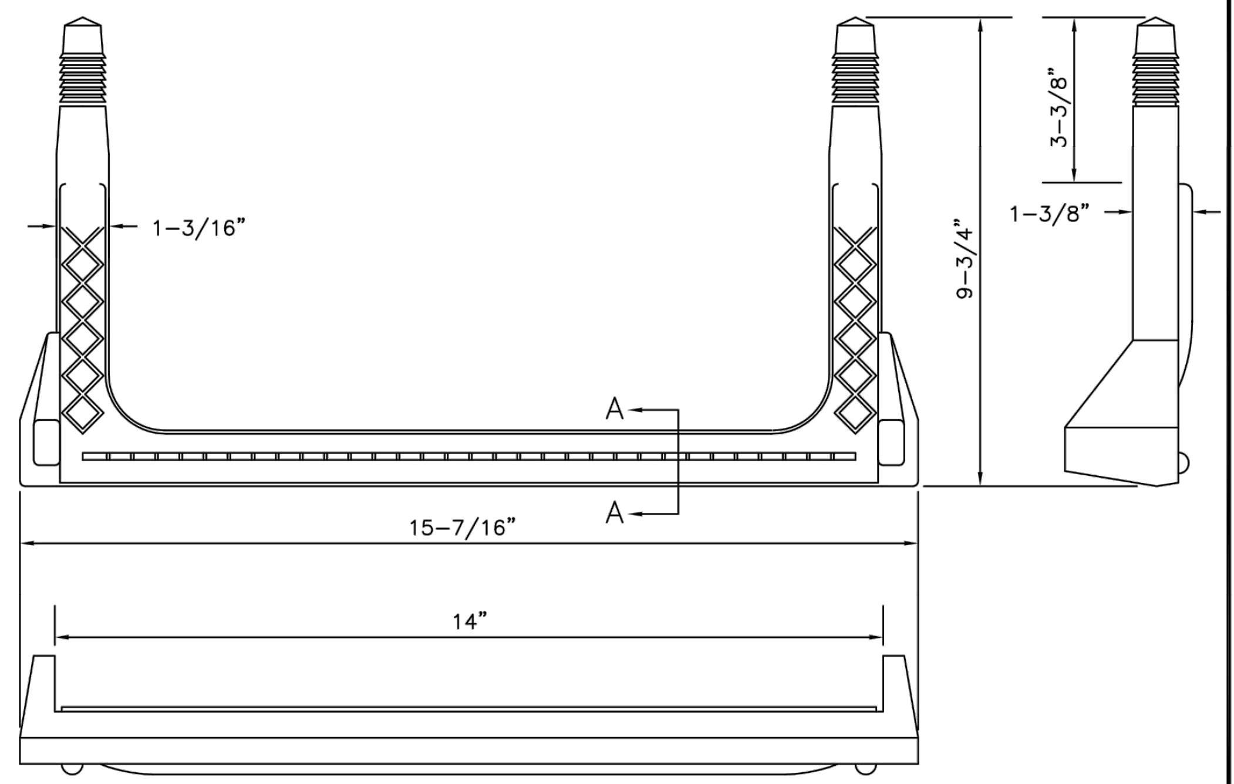
NOTE:
SOLID CONCRETE BASE EXTENDS UNDER THE FM-CT METER BY PASS FOR 6", 8", AND 10".

SIZE OF CONCRETE SUPPORT

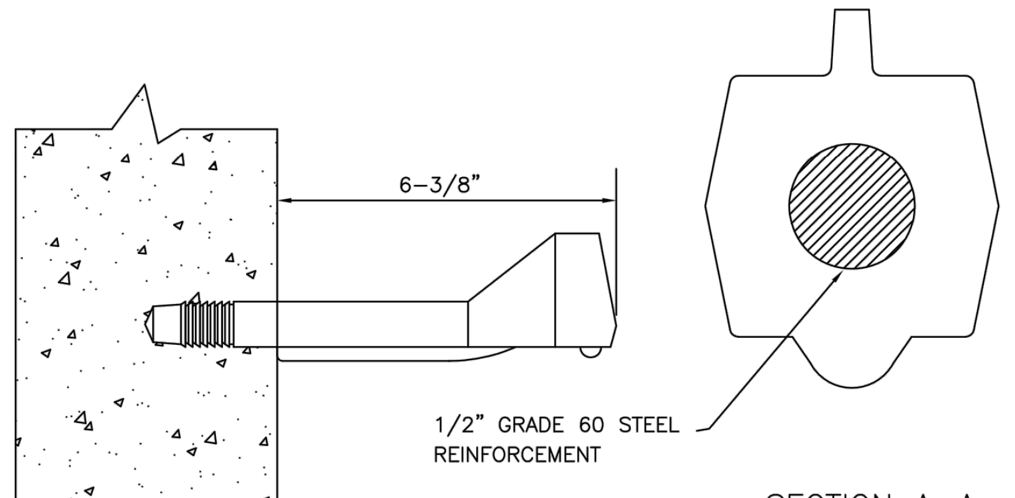
6" FM-CT	W=3'-9"	L=3'-0"
8" FM-CT	W=4'-5"	L=3'-8"
10" FM-CT	W=5'-8"	L=4'-8"

The Town of
ERIE
COLORADO

DRAWING TITLE: CONCRETE METER SUPPORTS
DRAWING NUMBER: W33
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2015



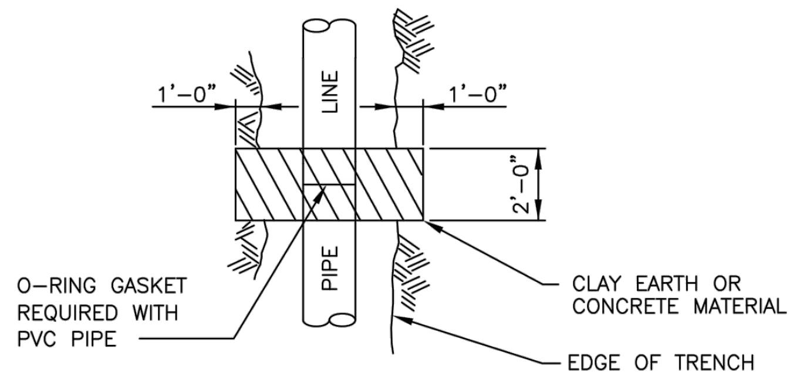
COPOLYMER POLYPROPYLENE PLASTIC



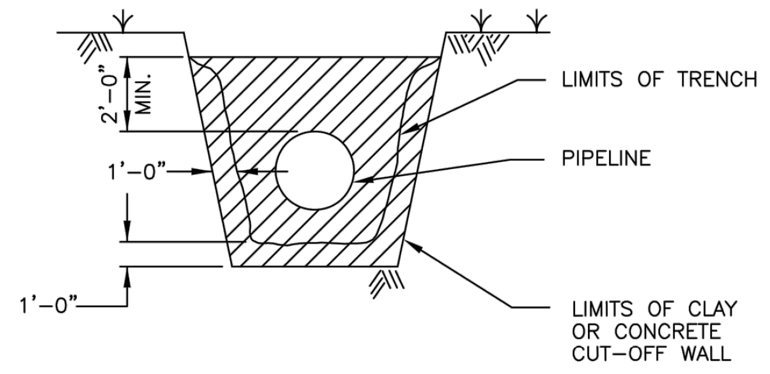
SECTION A-A

The Town of
ERIE
COLORADO

DRAWING TITLE: PLASTIC STEP
DRAWING NUMBER: W34
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2015



PLAN



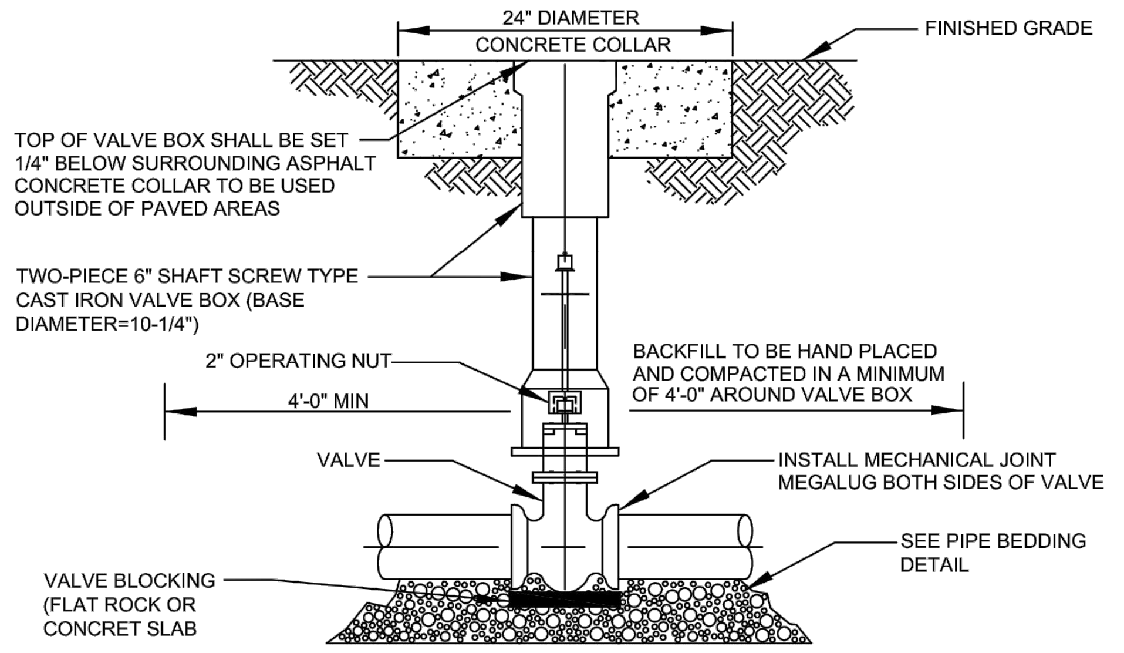
SECTION

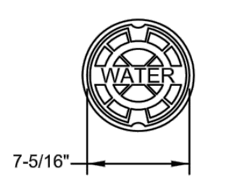
NOTES:

1. CLAY OR CONCRETE WALL EXTENDS A MINIMUM OF 12" INTO UNDISTURBED SOIL ON EACH SIDE AND ON BOTTOM OF TRENCH.
2. CLAY MATERIAL TO BE CLASSIFIED AS CL, CH, OR OH.
3. APPROVED FLOW-FILL MATERIAL MAY BE USED INSTEAD OF CLAY MATERIAL.

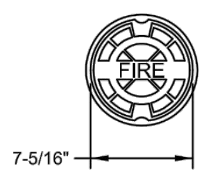
The Town of
ERIE
COLORADO

DRAWING TITLE: CLAY OR CONCRETE CUT-OFF WALL
DRAWING NUMBER: W37
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2015



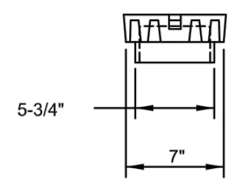


POTABLE VALVE
BOX COVER PLAN

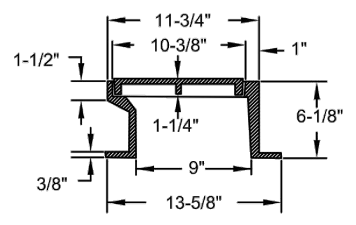


FIRE VALVE BOX
COVER PLAN

NON-POTABLE VALVE
BOX COVER PLAN



POTABLE & FIRE VALVE BOX
COVER ELEVATION



NON-POTABLE VALVE BOX
COVER ELEVATION

NOTES:

1. POTABLE & FIRE VALVE BOX LID RESTS INSIDE THE UPPER VALVE BOX SECTION.
2. NON-POTABLE VALVE BOX LID SLIDES OVER THE TOP OF THE UPPER VALVE BOX SECTION.
3. NON-POTABLE, WATER OR FIRE CAST IN TOP OF APPROPRIATE VALVE BOX COVER.
4. VALVE BOX SHALL NOT BE SUPPORTED BY WATER LINE.
5. VALVE BOX TO BE PLUMB AND CENTERED OVER NUT.
6. UTILIZING A VALVE BOX ALIGNMENT DEVICE IS OPTIONAL.
7. IF 2" OPERATING NUT IS MORE THAN 6' BELOW FINISHED GRADE, A VAULT NUT EXTENDER SHALL BE INSTALLED TO PUT THE VALVE NUT AT AN ELEVATION OF 4' BELOW FINISHED GRADE.

The Town of
ERIE
COLORADO

DRAWING TITLE: STANDARD VALVE AND BOX
DRAWING NUMBER: W38
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 1/2015

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

WATER DETAILS

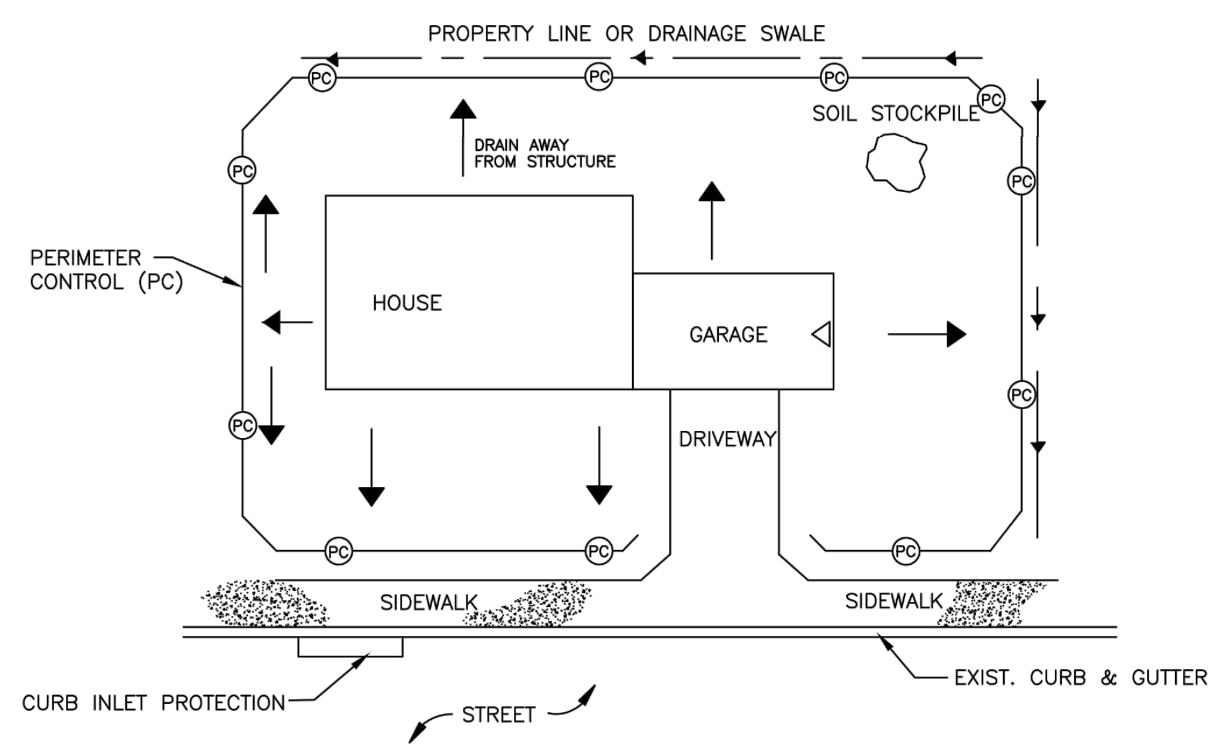
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
DT07
Sheet 70 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



EVERY BUILDING SITE IS UNIQUE AND POSES ITS OWN POTENTIAL EROSION HAZARDS. IN MANY INSTANCES, ADDITIONAL OR ALTERNATIVE CONTROL METHODS ARE NECESSARY IF THE LOT IS ADJACENT TO A CREEK, LAKE, OR WETLAND; SLOPES ARE GREATER THAN 6%; RECEIVES RUNOFF FROM ADJACENT AREAS; AND/OR MORE THAN ONE ACRE OF GROUND IS DISTURBED.

NOTES:

1. IT IS THE RESPONSIBILITY OF THE PROPERTY OWNER AND CONTRACTOR TO COMPLY WITH STATE LAWS AND LOCAL AND COUNTY ORDINANCES REGARDING CONSTRUCTION SITE EROSION AND SEDIMENT CONTROL. IT IS THEIR RESPONSIBILITY TO APPLY FOR ALL APPROPRIATE PERMITS.
2. THIS PLAN IS ONLY A SAMPLE PLAN AND IS NOT INTENDED TO BE ALL INCLUSIVE OR ADDRESS EVERY SITUATION, ADDITIONAL OR MODIFIED PRACTICES MAY BE REQUIRED ON SOME SITES.
3. EROSION OR SEDIMENT CONTROL MEASURES MUST BE FUNCTIONAL AND MAINTAINED THROUGHOUT CONSTRUCTION.
4. MAINTAIN POSITIVE DRAINAGE AWAY FROM THE STRUCTURE(S).

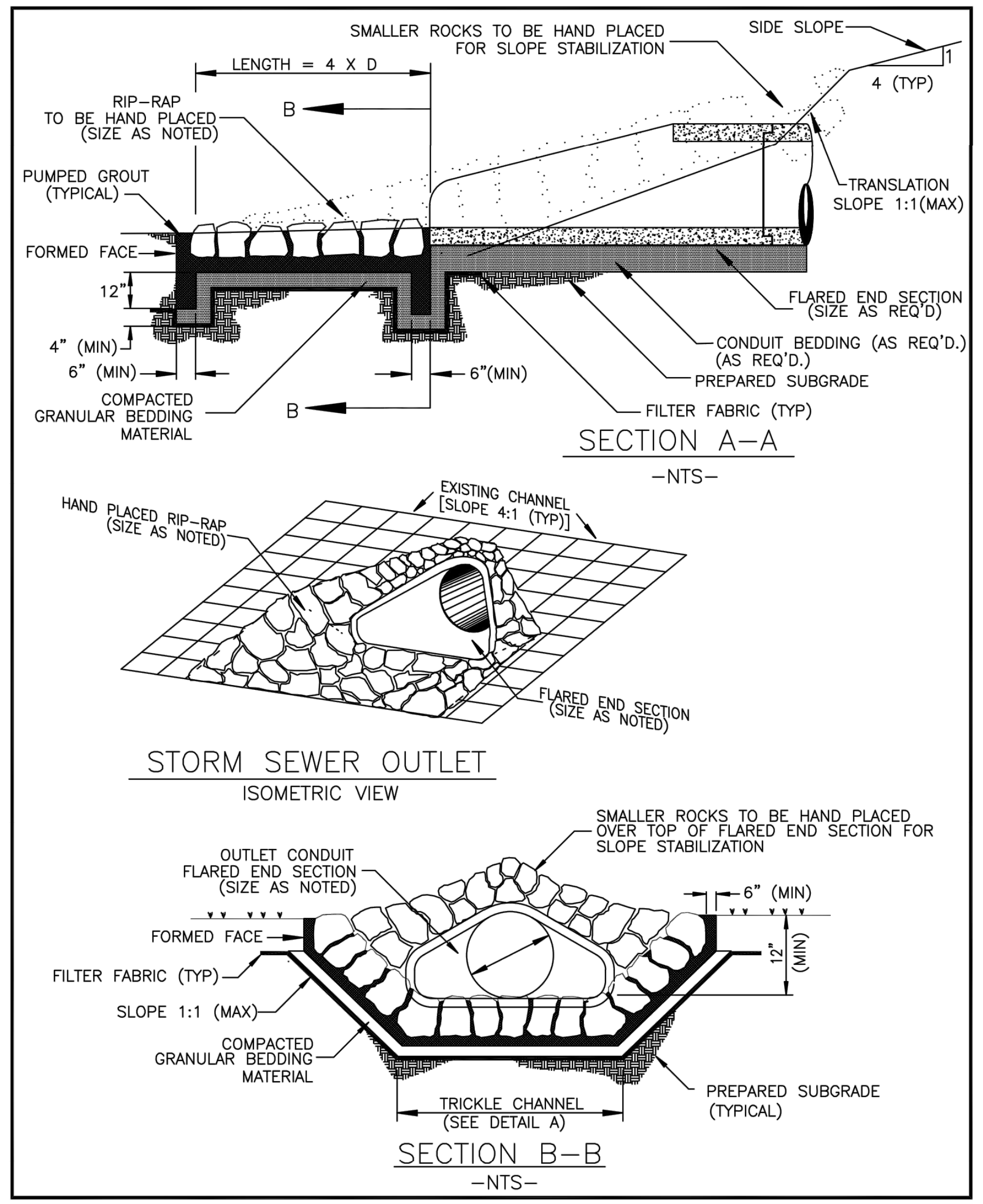
SILT FENCES

1. INSTALL SILT FENCE PARALLEL TO THE CONTOUR OF THE LAND.
2. EXTEND ENDS UPSLOPE TO ALLOW WATER TO POND BEHIND FENCE.
3. EXCAVATE A TRENCH 4 INCHES WIDE, 4 INCHES DEEP.
4. INSTALL FENCE WITH POSTS ON THE DOWN SLOPE SIDE.
5. PLACE 8 INCHES OF FABRIC IN THE TRENCH, EXTENDING THE BOTTOM 4 INCHES TOWARD THE UPSLOPE SIDE.
6. JOIN SILT FENCE SECTIONS BY USING A WRAP JOINT.
7. BACKFILL TRENCH WITH SOIL MATERIALS AND COMPACT.
8. INSPECT AT LEAST WEEKLY AND AFTER EACH STORM EVENT, REPAIRING AS NEEDED AND REMOVING SEDIMENT DEPOSITS WHEN THEY REACH ONE-HALF THE FENCE HEIGHT.

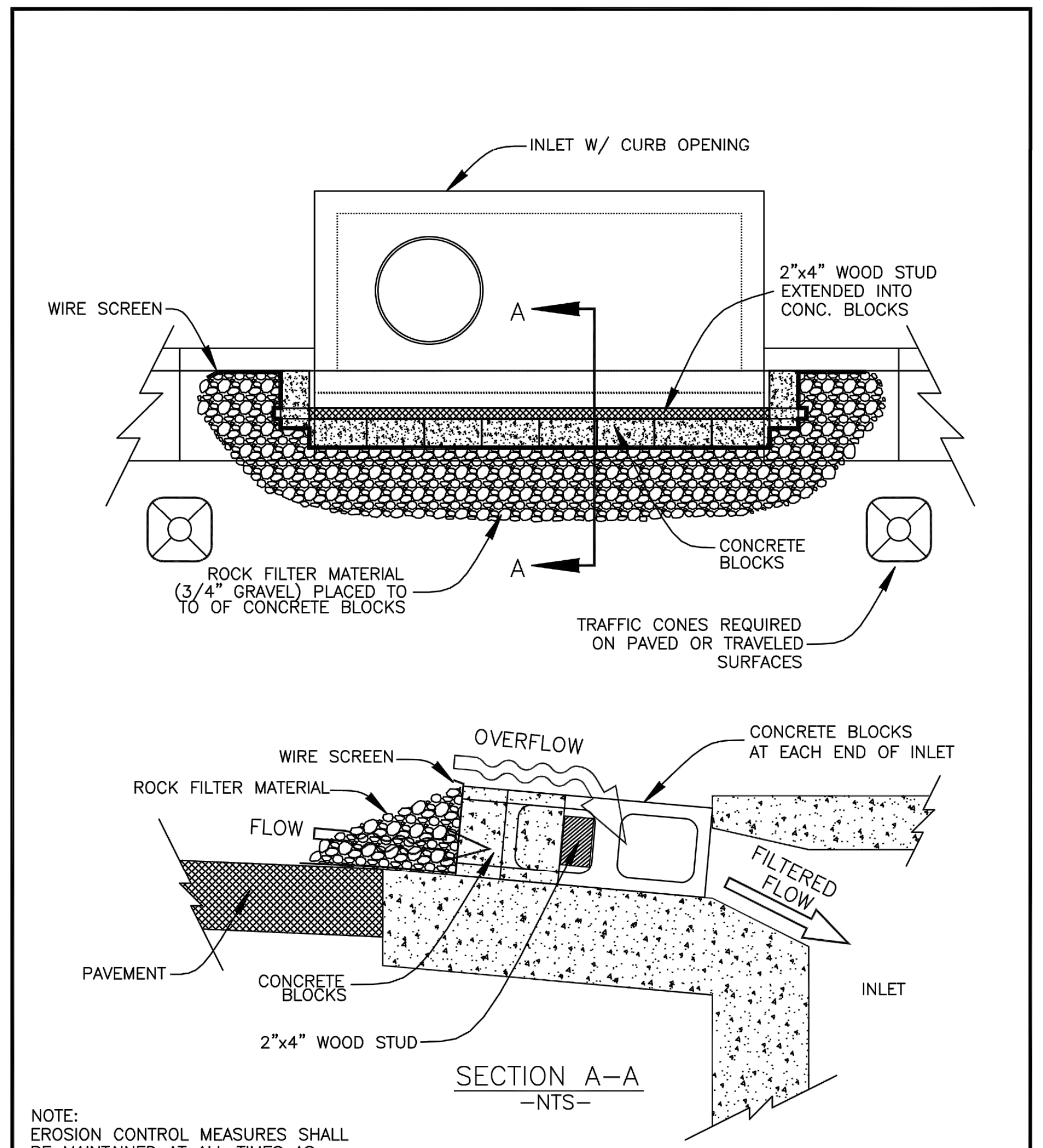
CONSTRUCTION TRAFFIC ENTRANCES

PROVIDE A SINGLE CONSTRUCTION TRAFFIC ENTRANCE THAT IS MAINTAINED IN A STABLE MANNER TO MINIMIZE SEDIMENT TRACKING TO TOWN STREETS.

The Town of ERIE COLORADO
DRAWING TITLE: SINGLE LOT EROSION CONTROL
DRAWING NUMBER: STM1
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2014

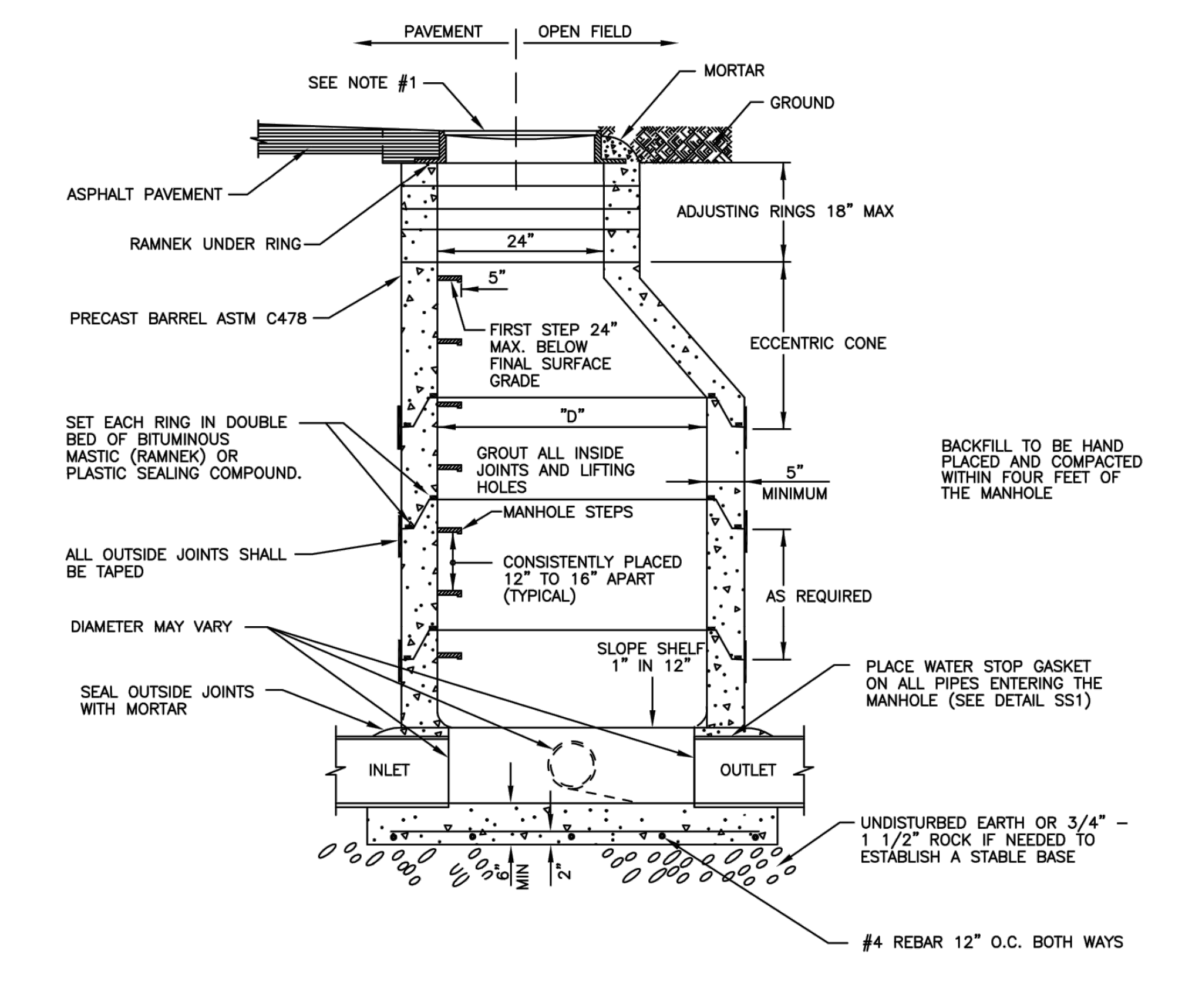


The Town of ERIE COLORADO
DRAWING TITLE: STORM SEWER OUTLET
DRAWING NUMBER: STM2
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004



NOTE:
EROSION CONTROL MEASURES SHALL BE MAINTAINED AT ALL TIMES AS DIRECTED BY THE CITY ENGINEER

The Town of ERIE COLORADO
DRAWING TITLE: CURB INLET GRAVEL FILTER
DRAWING NUMBER: STM3
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004

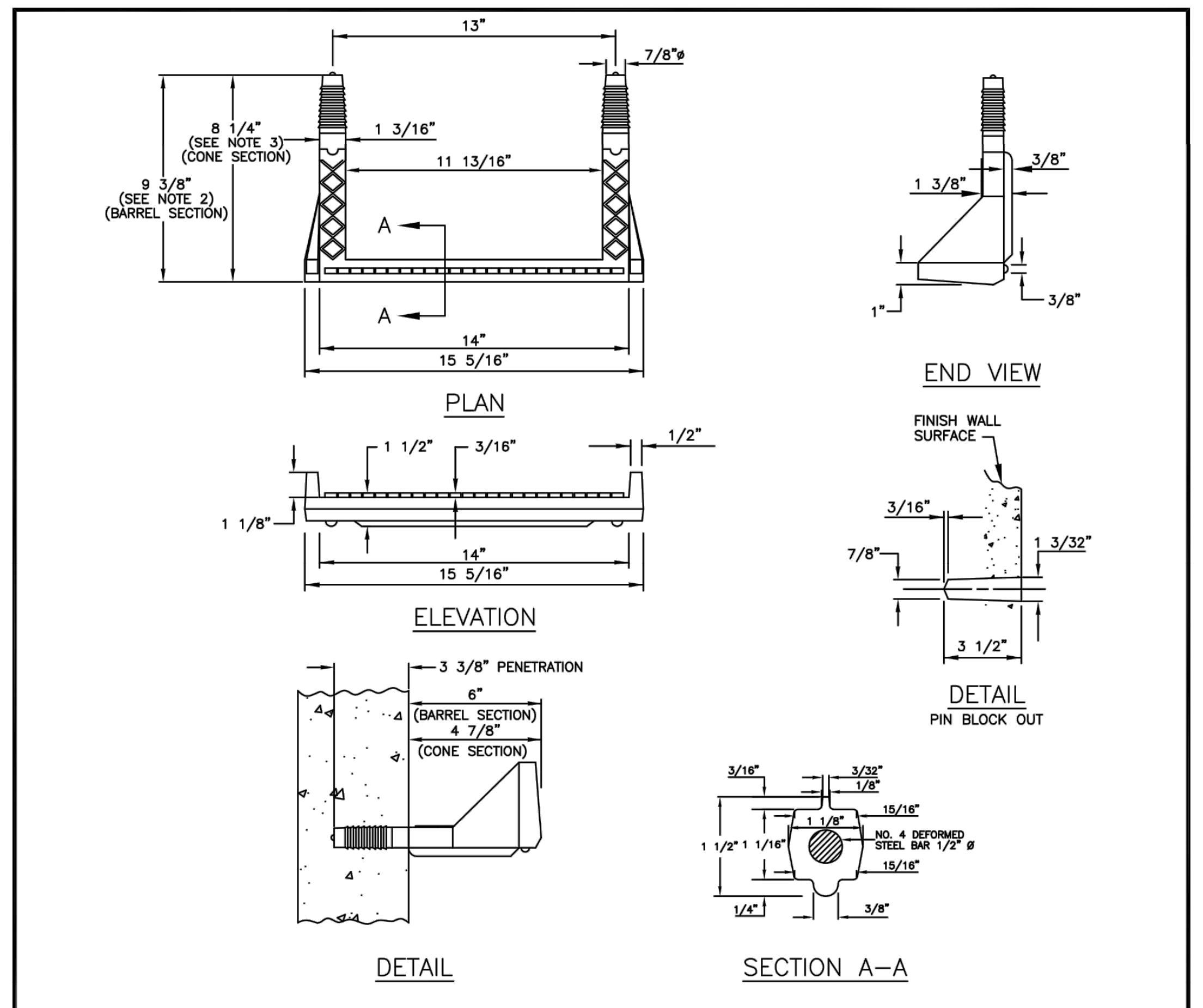


SECTION B-B

NOTES:

1. FINAL GRADE OF MANHOLE COVERS SHALL BE 1/4" LOWER THAN FINAL STREET.
2. STEPS SHOULD NOT BE PLACED OVER THE FLOW. NO STEPS ALLOWED IN THE ADJUSTING RING AREA.
3. PRECAST CONCRETE SECTIONS SHALL CONFORM TO ASTM C-478.
4. BLOCK-OUTS, WHEN APPROVED, SHALL EXTEND A MAX. OF 6" PAST MANHOLE O.D. AND BE SATISFACTORILY PLUGGED AND SEALED.
5. MANHOLES NOT IN ASPHALT OR CONCRETE SHALL BE RAISED 6" ABOVE FINAL GRADE AND A CONCRETE COLLAR INSTALLED WITH A GREEN CARSONITE POST

The Town of ERIE COLORADO
DRAWING TITLE: STANDARD MANHOLE
DRAWING NUMBER: STM8
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2012



POLYPROPYLENE REINFORCED PLASTIC STEP

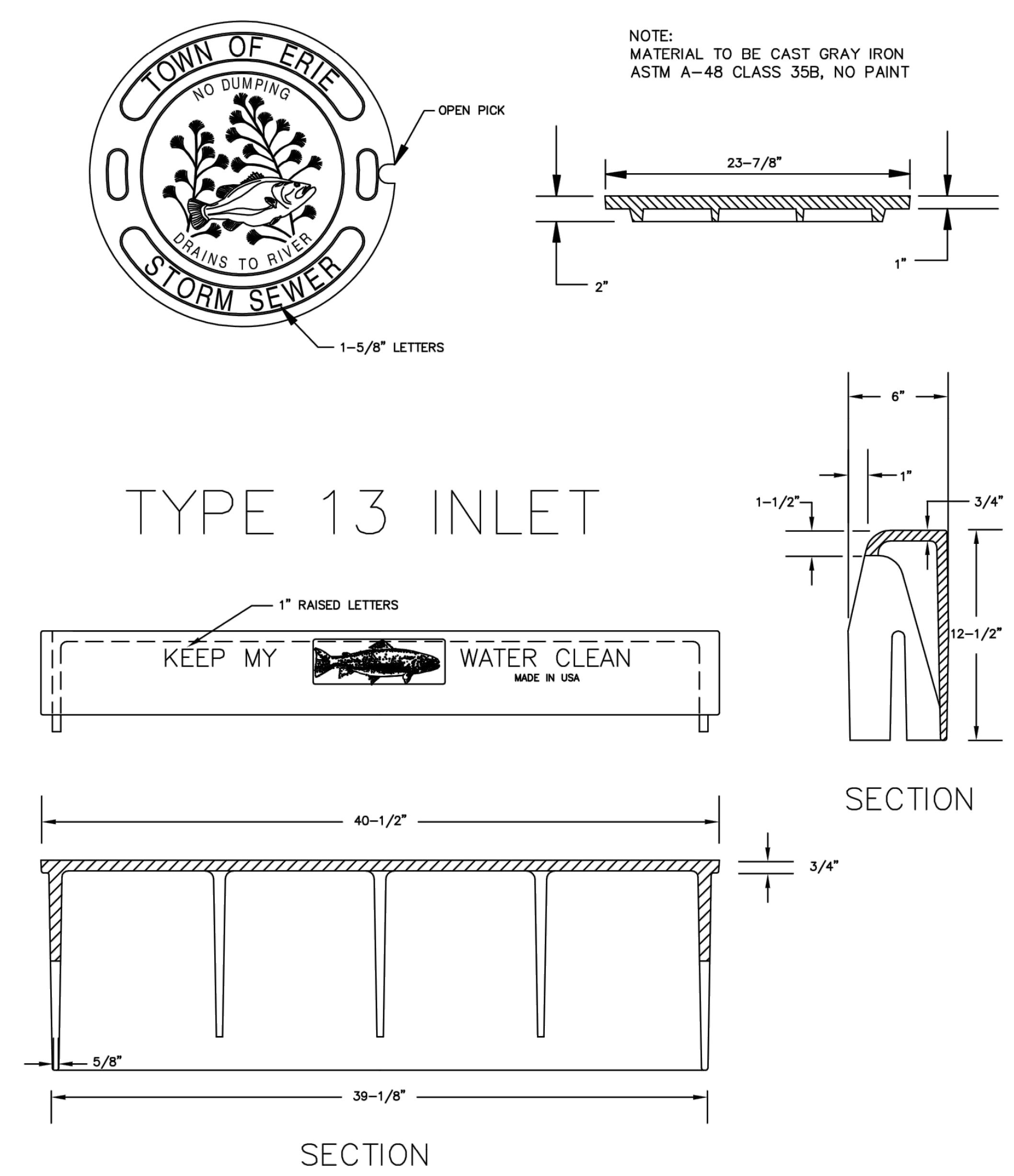
NOTES:

1. ASTM SPECIFICATIONS:
   - A. ASTM C-478
   - B. ASTM A-615 GRADE 60 (STEEL REBAR).
   - C. ASTM 2146-69, TYPE III, GRADE 16906 (POLYPROPYLENE).
2. STEPS INSTALLED IN MANHOLE BARREL SECTIONS OR VERTICAL WALLS OF STRUCTURES SHALL HAVE A 9 3/8 INCH LEG AND SHALL PROJECT FROM THE WALL 6 INCHES.
3. STEPS INSTALLED IN MANHOLE CONE SECTIONS SHALL HAVE AN 8 1/4 INCH LEG AND SHALL PROJECT FROM THE WALL 4 7/8 INCHES.
4. ALL STEPS SHALL HAVE A PENETRATION DEPTH INTO THE WALL OF 3 3/8 INCHES.
5. STEPS SHALL BE INSTALLED BY THE "PRESS-FIT" METHOD UTILIZING A SPECIALLY TAPERED PIN TO FORM THE INSERT HOLE AS SHOWN, FOLLOWING MANUFACTURER'S RECOMMENDED PROCEDURE AND SHALL NOT BE GROUTED IN PLACE.
6. INSTALLED STEPS SHALL BE CAPABLE OF WITHSTANDING A PULL OUT FORCE OF 2500 LB. PER LEG FOR A MINIMUM PERIOD OF TWO MINUTES.
7. PINS MUST BE SMOOTH AND CONTINUOUSLY TAPERED. DIMENSIONS OF THE PIN AND THE INSERTED PORTION OF THE MANHOLE STEP ARE TYPICAL ONLY. W.M.D. INSTALLATIONS REQUIRE A MATCHED COMBINATION OF A TAPERED INSERT PIN AMD MANHOLE STEP, AS RECOMMENDED OR REQUIRED BY SPECIFIC MANUFACTURER OF THE STEP TO BE USED.
8. THIS STEP CAN ALSO BE USED IN TOE POCKET INSTALLATIONS PROVIDED 5" TOE CLEARANCE IS ALLOWED.

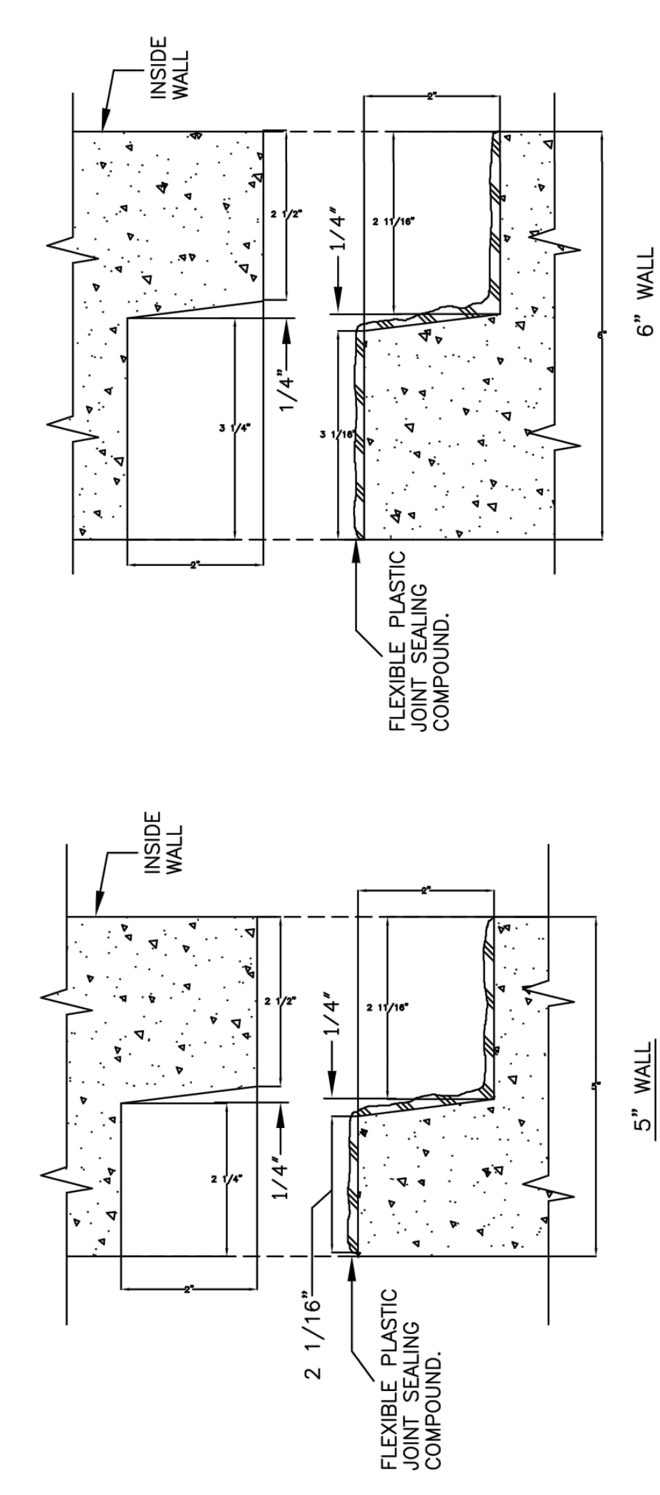
The Town of ERIE COLORADO
DRAWING TITLE: MANHOLE STEPS
DRAWING NUMBER: STM9
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004

TYPE R INLET COVER

NOTE:
MATERIAL TO BE CAST GRAY IRON ASTM A-48 CLASS 35B, NO PAINT



The Town of ERIE COLORADO
DRAWING TITLE: INLET & INLET COVER
DRAWING NUMBER: STM10
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2012

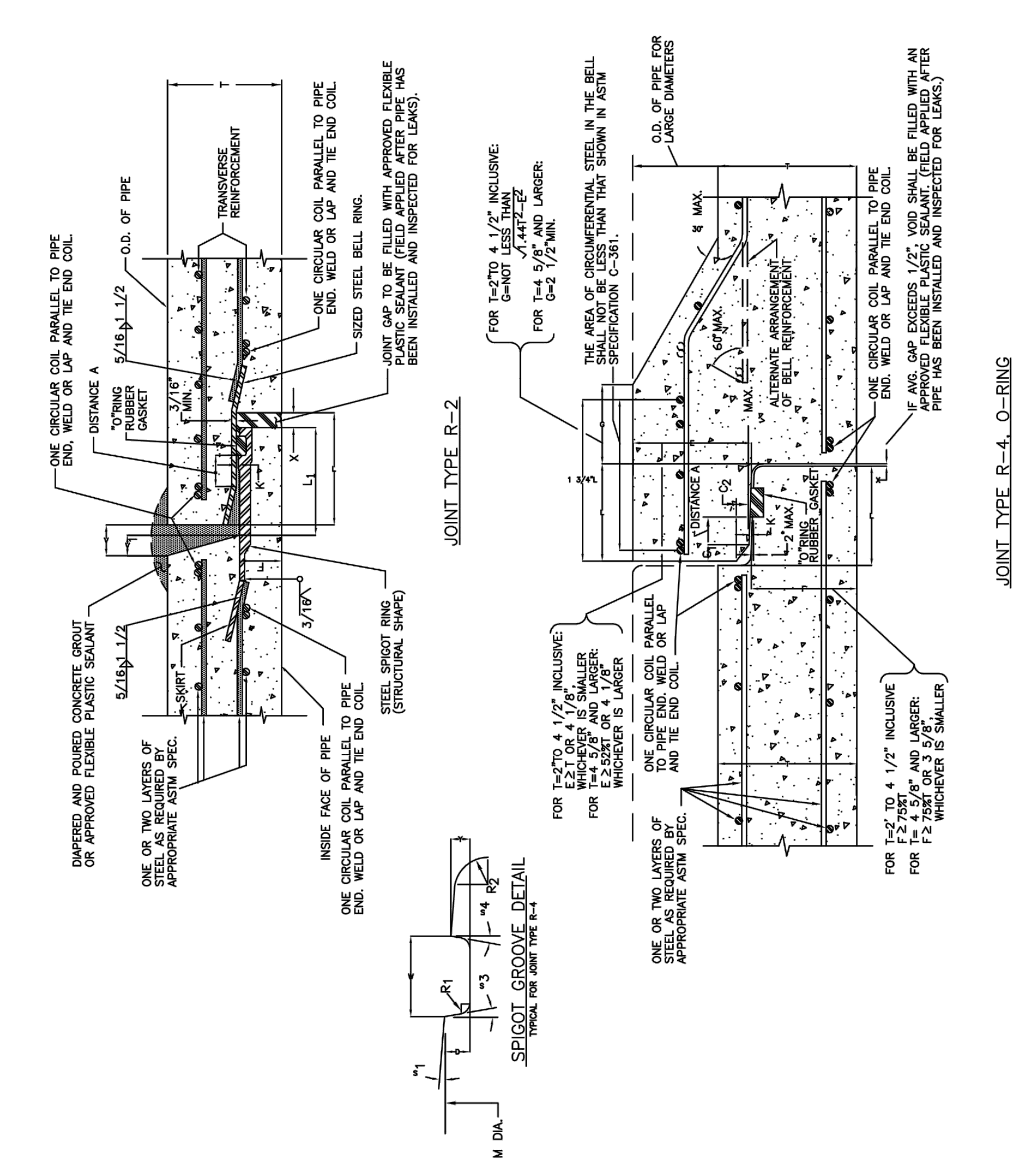


SHIPLAP JOINTS FOR REINFORCED CONCRETE M.H. SECTIONS
NO SCALE

NOTES:

1. T= WALL THICKNESS OF PIPE FURNISHED.
2. THE CONTRACTOR SHALL SUBMIT ALL TOLERANCES AND DIMENSIONS, REQUIRED BY THE SPECIFIC PIPE JOINT DETAILS SHOWN, TO THE ENGINEER PRIOR TO FABRICATION.
3. ALL DIMENSIONS SHALL BE GIVEN IN INCHES, UNLESS OTHERWISE NOTED, AND ARE FOR BELL AND SPIGOT IN CONCENTRIC POSITION. DEFLECTED PIPE JOINT TOLERANCES & DIMENSIONS SHALL ALSO BE FURNISHED.
4. JOINT CLEARANCE DIMENSION K IS AT CLOSEST POINT WITHIN DISTANCE A.
5. THESE JOINT CONFIGURATIONS ARE IN ACCORDANCE WITH BUREAU OF RECLAMATION'S "TYPE R" JOINT DETAILS.
6. RUBBER "O" RING GASKET SHALL BE IN CONFORMANCE W/ASTM C-443 OR C-361.
7. APPLICABLE CONCRETE PIPE JOINT SPECIFICATIONS:
   - A. ASTM C-76
   - B. ASTM C-361
8. STEEL REINFORCEMENT SHALL BE IN ACCORDANCE WITH THE APPROPRIATE ASTM SPECIFICATION FOR THE PIPE SIZE AND STRENGTH CLASS AS SPECIFIED ON PLAN/PROFILE DRAWINGS.

The Town of ERIE COLORADO
DRAWING TITLE: CONCRETE PIPE JOINTS - SHIPLAP
DRAWING NUMBER: STM11A (1 OF 2)
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2012



The Town of ERIE COLORADO
DRAWING TITLE: CONCRETE PIPE JOINTS - TYPE "R"
DRAWING NUMBER: STM11B (2 OF 2)
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2012

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

STORM SEWER DETAILS

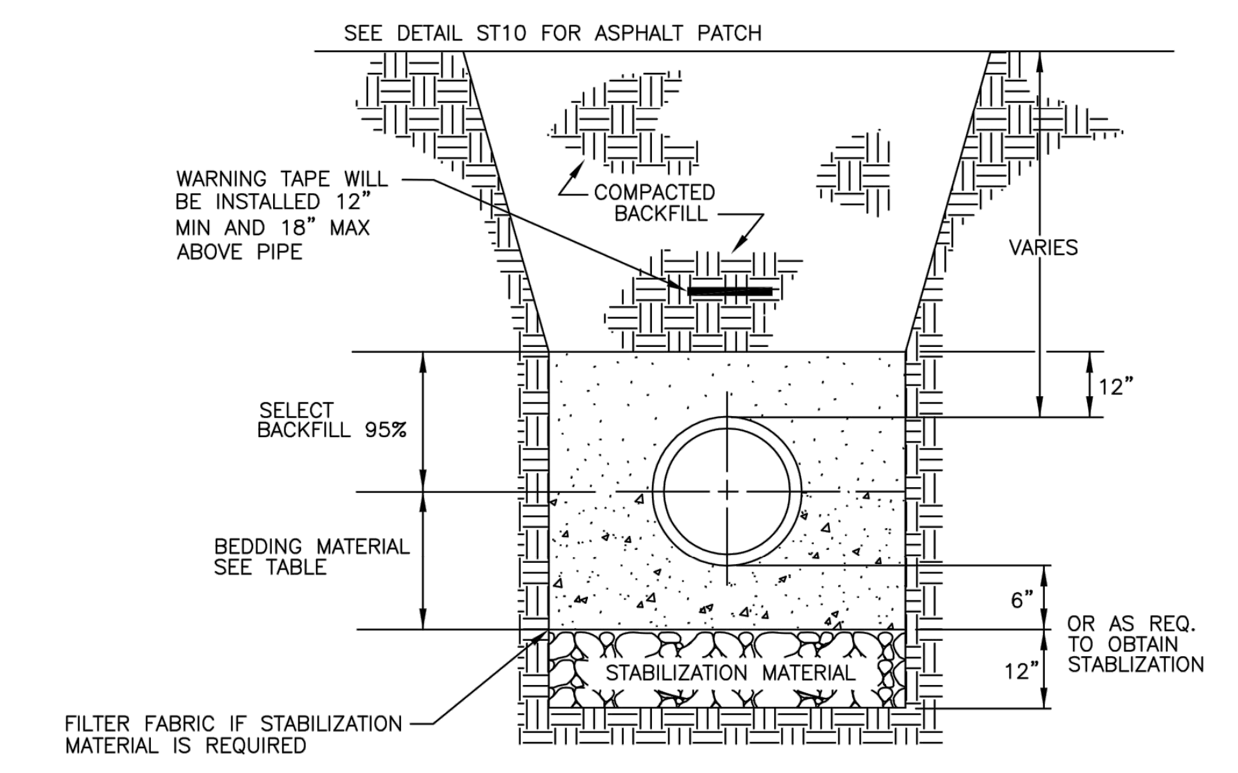
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
DT08
Sheet 71 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



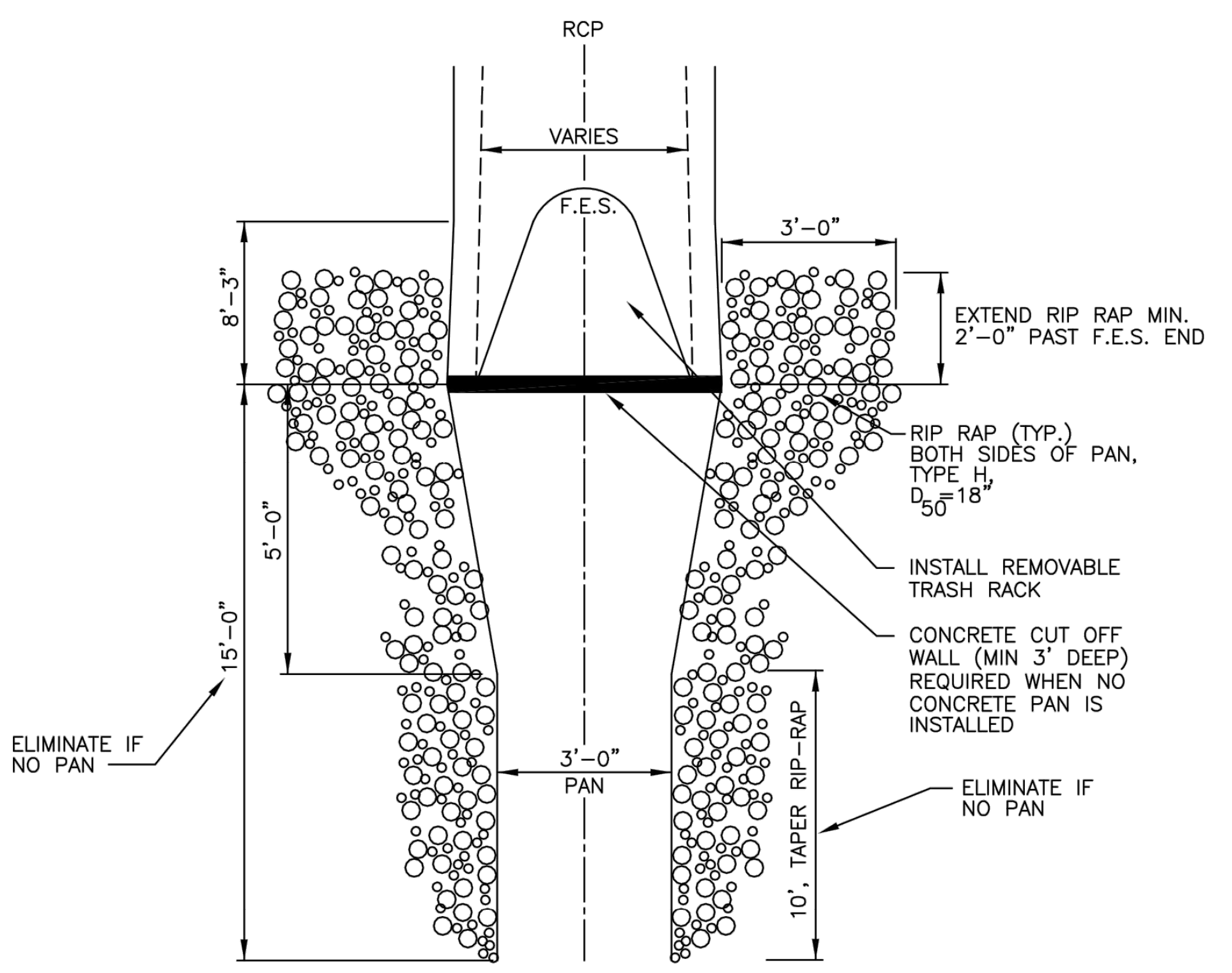
BEDDING MATERIAL GRADATION	
SIEVE SIZE	% BY WEIGHT
3/4"	90 – 100
3/8"	20 – 55
NO. 4	0 – 10
NO. 8	0 – 5

NOTES:

1. FULL TRENCH SECTION IN ROADWAY OR STREET R.O.W. LIMITS WILL REQUIRE 95% S.P.D. TRENCH ZONE ABOVE BEDDING MATERIALS, OUTSIDE OF STREET R.O.W. WILL REQUIRE 90% S.P.D.
2. FILTER FABRIC IS REQUIRED IF STABILIZATION MATERIAL IS USED. THE FABRIC SHALL BE INSTALLED AS SHOWN IN THE DETAIL.
3. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE SAFETY OF THE WORKMEN AND PROTECTION OF OTHER UTILITIES IN ACCORDANCE WITH APPLICABLE LOCAL, STATE AND FEDERAL SAFETY REGULATIONS.
4. PIPE SHALL BE BEDDED FROM 6" BELOW THE BOTTOM OF THE PIPE TO THE HORIZONTAL CENTERLINE OF THE PIPE. SEE TABLE FOR BEDDING MATERIAL GRADATION.
5. TRENCH WIDTH SHALL NOT BE MORE THAN 24" NOR LESS THAN 12" WIDER THAN THE LARGEST OUTSIDE DIAMETER OF THE PIPE.
6. SHOULD THE TRENCH BE EXCAVATED WIDER THAN ALLOWED, A CONCRETE CRADLE SHALL BE PLACED WITH 2500 P.S.I. CONCRETE FROM TRENCH BOTTOM TO PIPE SPRINGLINE.

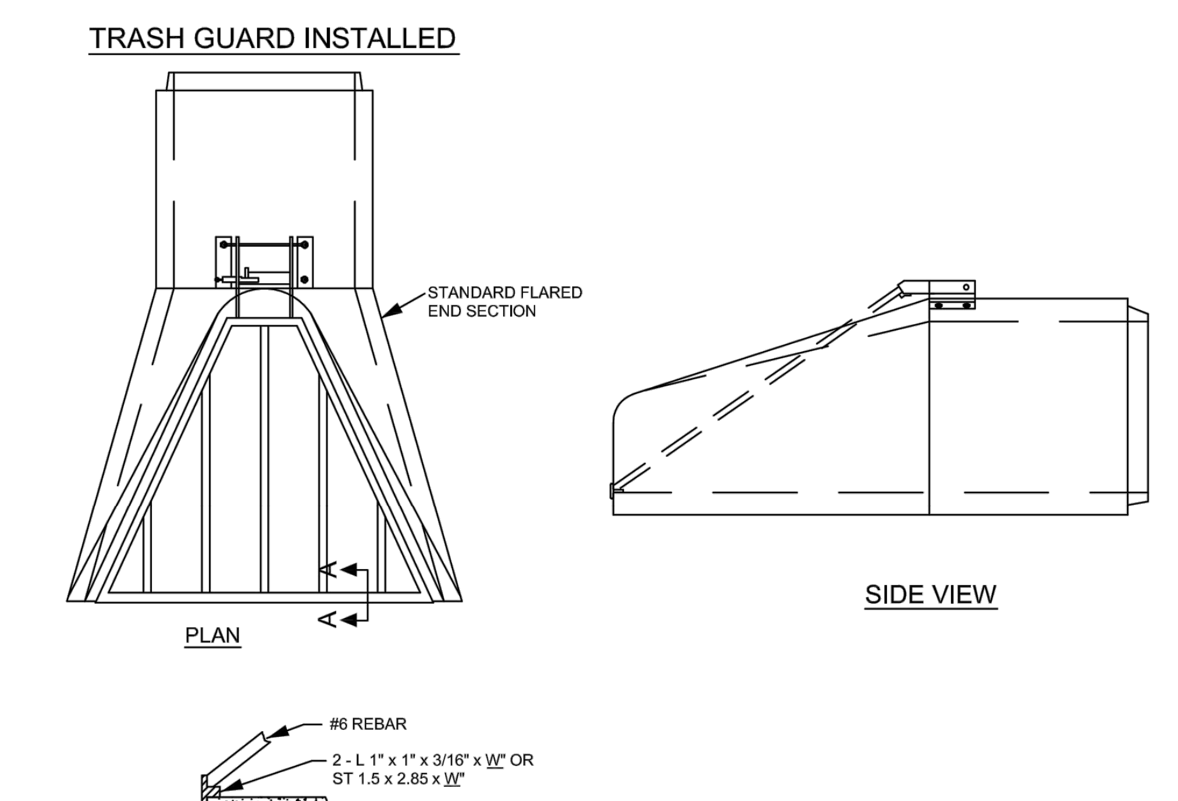
The Town of
ERIE
COLORADO

DRAWING TITLE: STORM SEWER TRENCH DETAIL
DRAWING NUMBER: STM12
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN REV. DATE: 01/2012



The Town of
ERIE
COLORADO

DRAWING TITLE: FLARED END SECTION RIPRAP
DRAWING NUMBER: STM14
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 01/2012



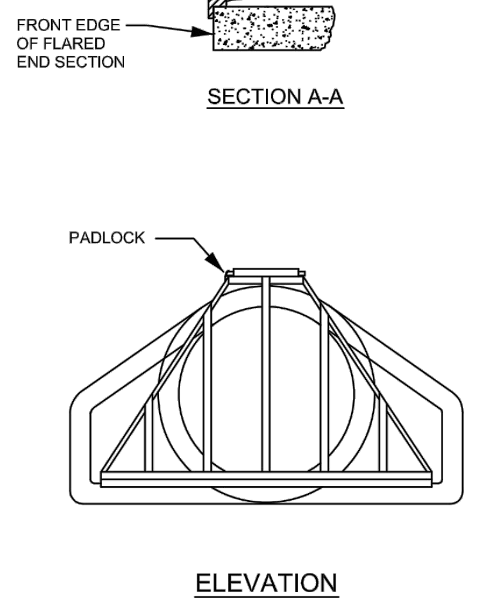


TABLE OF DIMENSIONS												
TRASH GUARD										MOUNTING		
INSIDE DIA	A	B	D	G	L	W	C	H	J	R	S	T
(INCHES)							(EA)	(DEGREE)		(INCHES)		
18	10	6-1/2	8	3	31	28	3	45	45	11-1/2	5	5
24	12	9-1/2	8	3	47-1/2	40	5	35	55	15	6-1/2	5-1/2
30	15	12-1/2	9	3	59-3/4	52	5	35	55	18-1/2	8	6
36	15	15-1/2	8-1/2	4	71-1/4	58	7	35	55	22	9-1/2	6-1/2
42	21	18-1/2	9	4	75	64	7	40	50	25-1/2	11	7
48	24	21-1/2	8	4	82-3/4	70	9	40	50	29	12-3/4	7-1/2

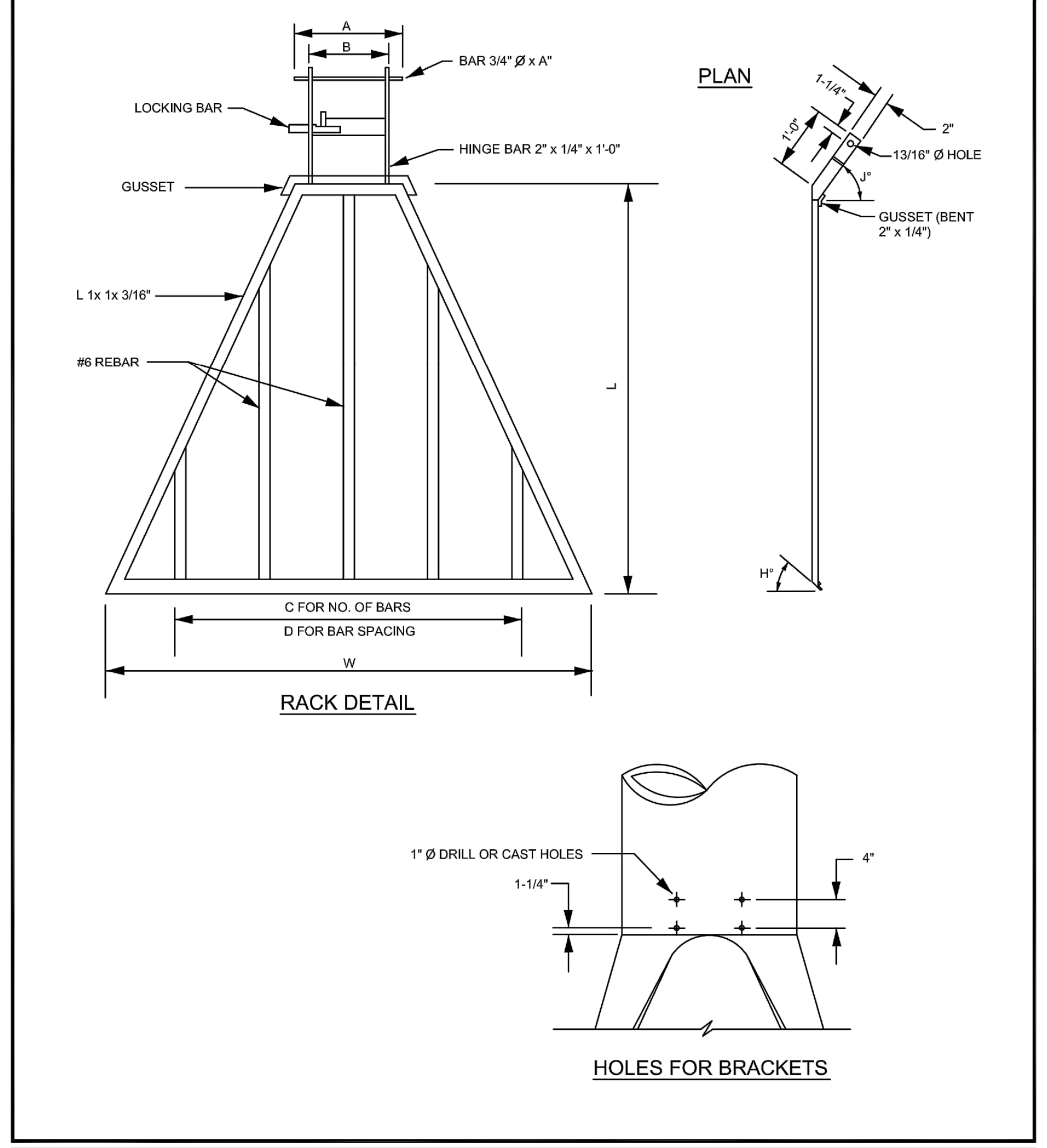
NOTE: AN INDEPENDENT DESIGN AND DETAIL WILL BE REQUIRED FOR PIPE DIAMETERS GREATER THAN 48"

GENERAL NOTES

1. TRASH GUARDS SHALL BE INSTALLED AT LOCATIONS SHOWN IN THE PLANS OR SPECIFIED BY THE ENGINEER
2. PADLOCKS FOR LOCKING BAR WILL BE FURNISHED AND INSTALLED BY THE CONTRACTOR AND KEYS SUBMITTED TO THE PUBLIC WORKS DEPT.
3. THE TRASH GUARDS ARE NOT DESIGNED TO CARRY WHEEL LOADINGS AND SUCH ARE NOT TO BE USED AS SAFETY GRATES
4. IF THE FLARED END DIMENSIONS VARY FROM THOSE SHOWN IN THE STANDARD PLANS, NECESSARY ADJUSTMENTS SHALL BE MADE TO THE TRASH GUARD DIMENSIONS

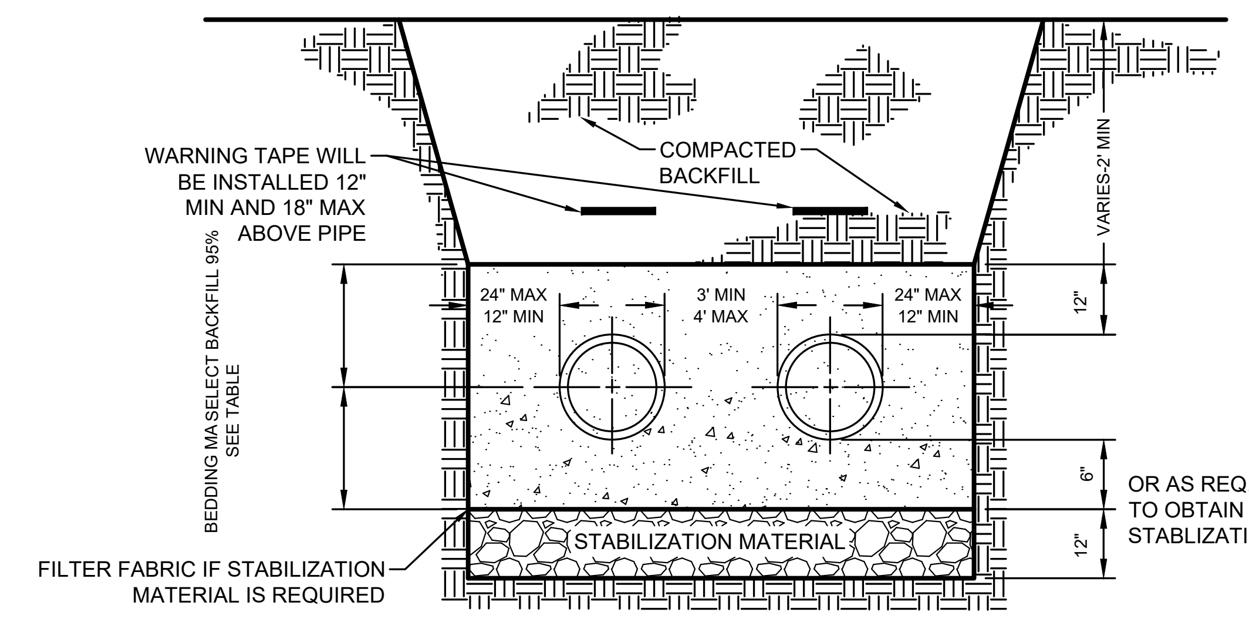
The Town of
ERIE
COLORADO

DRAWING TITLE: TRASH GUARD FOR CONDUIT (RCP)
DRAWING NUMBER: STM15A (1 OF 3)
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004



The Town of
ERIE
COLORADO

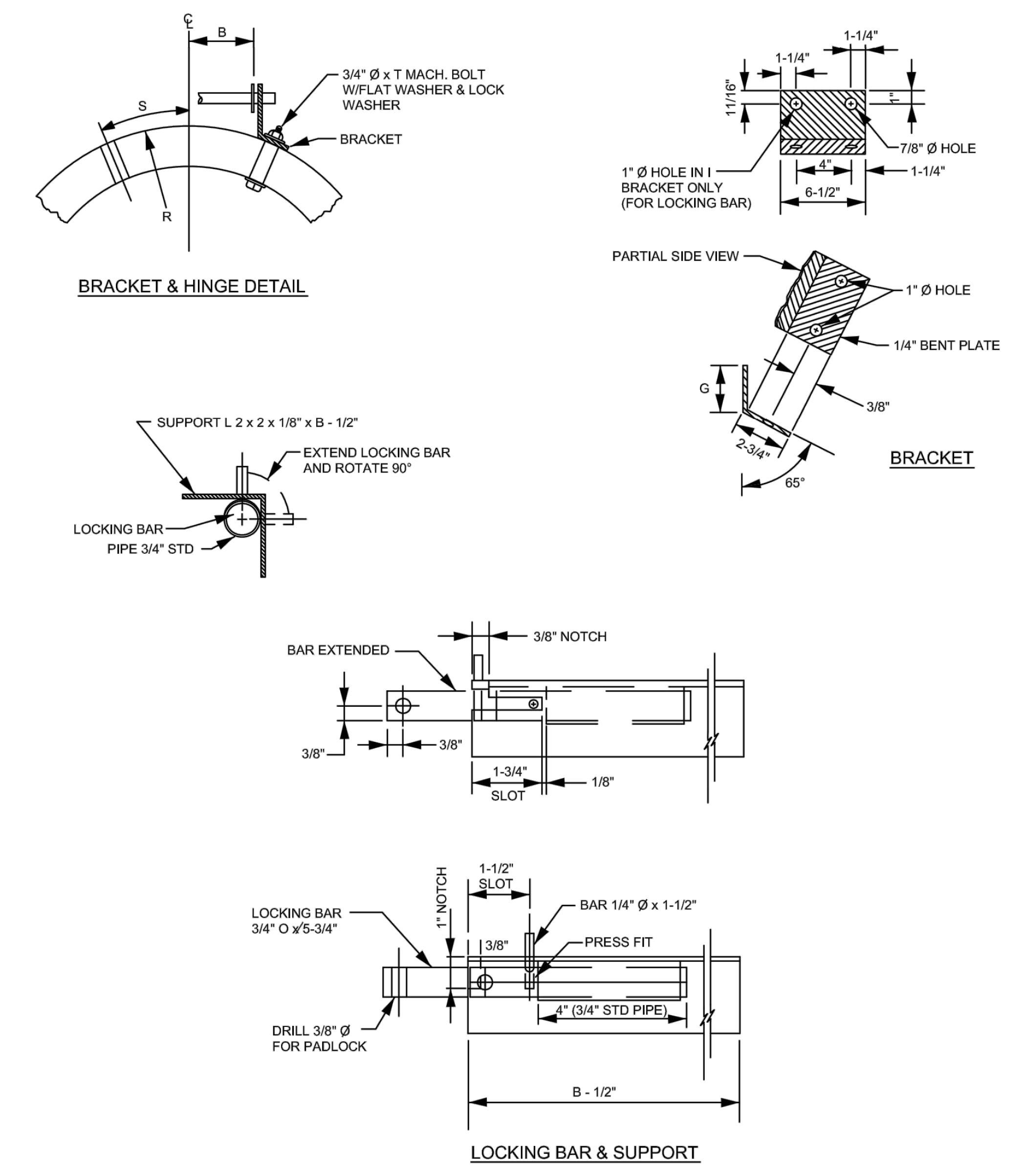
DRAWING TITLE: TRASH GUARD FOR CONDUIT (RCP)
DRAWING NUMBER: STM15B (2 OF 3)
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004



BEDDING MATERIAL GRADATION	
SIEVE SIZE	% BY WEIGHT
3/4"	90 - 100
3/8"	20 - 55
NO. 4	0 - 10
NO. 8	0 - 5

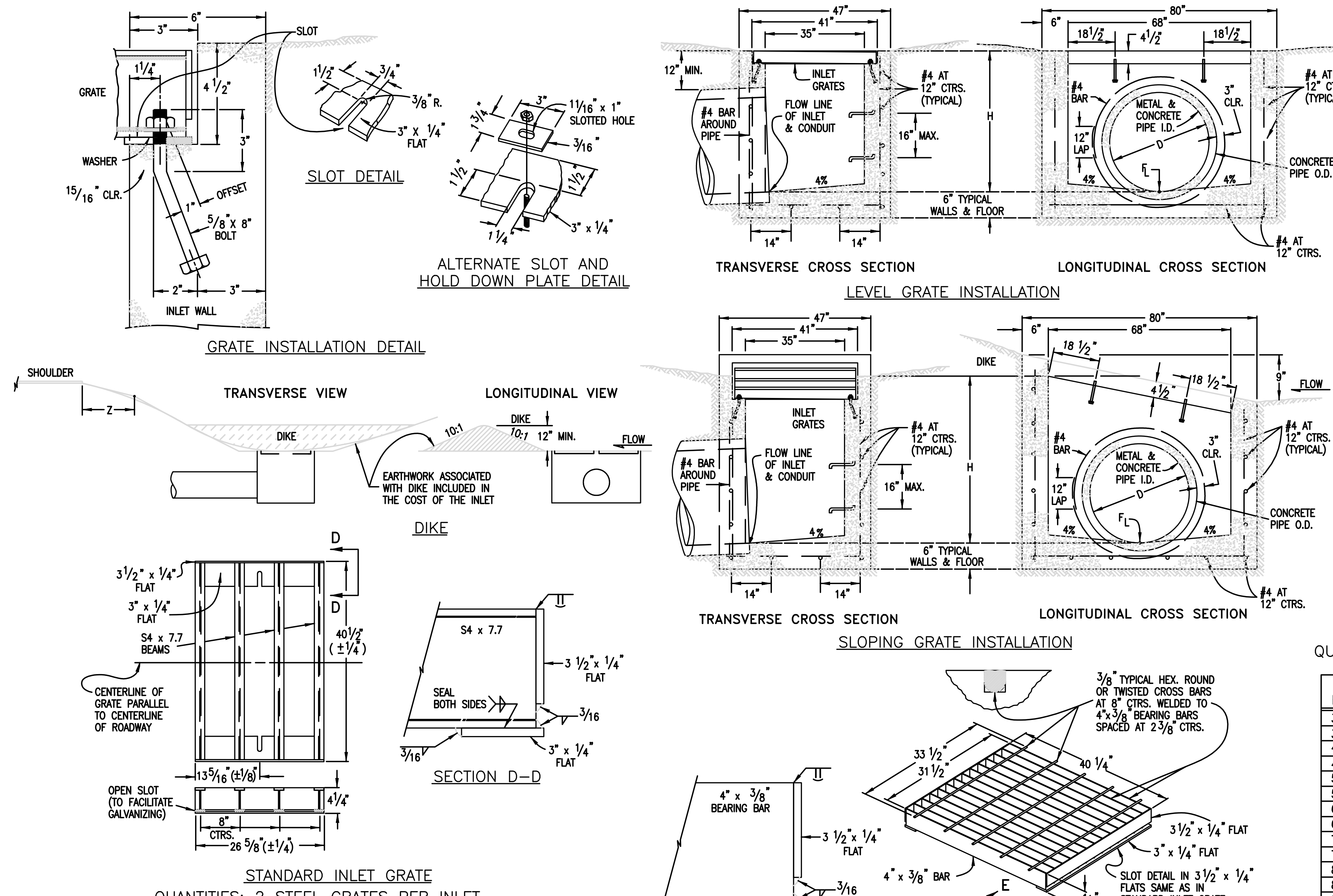
NOTES:

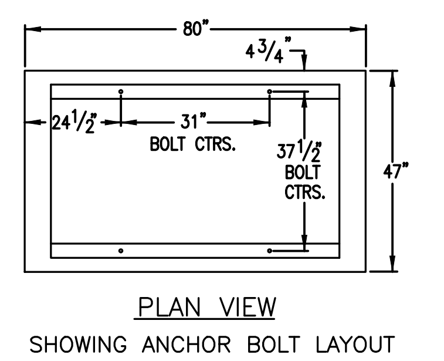
1. FULL TRENCH SECTION IN ROADWAY OR STREET R.O.W. LIMITS WILL REQUIRE 95% S.P.D. TRENCH ZONE ABOVE BEDDING MATERIALS, OUTSIDE OF STREET R.O.W. WILL REQUIRE 90% S.P.D.
2. FILTER FABRIC IS REQUIRED IF STABILIZATION MATERIAL IS USED. THE FABRIC SHALL BE INSTALLED AS SHOWN IN THE DETAIL.
3. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE SAFETY OF THE WORKMEN AND PROTECTION OF OTHER UTILITIES IN ACCORDANCE WITH APPLICABLE LOCAL, STATE AND FEDERAL SAFETY REGULATIONS.
4. PIPE SHALL BE BEDDED FROM 6" BELOW THE BOTTOM OF THE PIPE TO THE HORIZONTAL CENTERLINE OF THE PIPE. SEE TABLE FOR BEDDING MATERIAL GRADATION.
5. TRENCH WIDTH SHALL NOT BE MORE THAN 24" NOR LESS THAN 12" WIDER THAN THE LARGEST OUTSIDE DIAMETER OF THE PIPE.
6. SHOULD THE TRENCH BE EXCAVATED WIDER THAN ALLOWED, A CONCRETE CRADLE SHALL BE PLACED WITH 2500 P.S.I. CONCRETE FROM TRENCH BOTTOM TO PIPE SPRINGLINE.



The Town of
ERIE
COLORADO

DRAWING TITLE: TRASH GUARD FOR CONDUIT (RCP)
DRAWING NUMBER: STM15C (3 OF 3)
DRAWN BY: D. JENKINS APPROVED BY: G. BEHLEN DATE: 06/2004





PLAN VIEW
SHOWING ANCHOR BOLT LAYOUT

OUTLET PIPE D	MIN. H
1.5	3.0
2.0	3.0
2.5	3.5
3.0	4.0
3.5	4.5
4.0	5.0

GENERAL NOTES

1. CONCRETE SHALL BE CLASS B INLET. MAY BE CAST–IN–PLACE OR PRECAST.

   SEE PLANS FOR SIZE AND LOCATION OF CONDUIT.
2. STRUCTURAL STEEL FOR GRATES AND GRATE INSTALLATION HARDWARE SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH 712.06.
3. STANDARD INLET GRATES SHALL BE USED ON ALL TYPE D INLETS UNLESS CLOSE MESH GRATES ARE SPECIFIED ON THE PLANS.
4. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" EXCEEDS 3'–6" AND SHALL BE IN ACCORDANCE WITH AASHTO M 199.
5. REINFORCING BARS SHALL BE EPOXY COATED, AND DEFORMED, AND SHALL HAVE A 2" MINIMUM CLEARANCE.

HYDRAULICALLY INEFFICIENT, POOR TOLERANCE FOR DEBRIS AND ICE. USE IN PEDESTRIAN AND BICYCLE AREAS.

QUANTITIES: 2 STEEL GRATES PER INLET

NO. PIECES	DESCRIPTION	LENGTH	LB. PER FT.	WEIGHT (LBS.)
8	S4x7.7 BEAM	40"	7.70	206
4	3½"x½" FLAT	26⅝"	2.98	26
4	3"x½" FLAT	26⅝"	2.55	24
				TOTAL 256 LBS.

QUANTITIES FOR ONE INLET

H FT.	CONCRETE ▽ CU. YD.	STEEL ▽ LB.	PIPE RANGE, D IN. CSP	RCP
3.0	1.5	127	18	18
3.5	1.7	149	18–24	18–24
4.0	1.9	157	18–30	18–30
4.5	2.0	179	18–36	18–36
5.0	2.2	187	18–42	18–42
5.5	2.4	208	18–	18–
6.0	2.6	215	18–	18–
6.5	2.8	236	18–	18–
7.0	2.9	243	18–	18–
7.5	3.1	264	18–	18–
8.0	3.3	271	18–	18–
8.5	3.5	292	18–	18–
9.0	3.6	299	18–	18–
9.5	3.8	320	18–	18–
10.0	4.0	327	18–42	18–42

▽ CONCRETE AND STEEL QUANTITIES ARE FOR ONE ENTIRE INLET BEFORE DEDUCTION FOR VOLUME OCCUPIED BY PIPE. WEIGHT OF STEEL INCLUDES A RING FOR THE MAXIMUM PIPE DIAMETER.

Colorado Department of Transportation
4201 East Arkansas Avenue
Denver, Colorado 80222
Phone: (303) 757-9083 FAX: (303) 757-9820
Project Development Branch SD

Computer File Information
Path: www.dot.state.co.us/DevelopProjects/DesignSupport/MStandards/
Drawing File Name: 6040110101.dwg
Acad Version: R14 Scale: NA Units: English

Standard Plan Revised	
Date:	Comments:
05/01/01	Grammatical Correction

INLET, TYPE D

Issued By: Project Development Branch October 1, 2000

STANDARD PLAN NO.
M–604–11
Sheet No. 1 of 1

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED PROFESSIONAL ENGINEER
THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4
STORM SEWER DETAILS

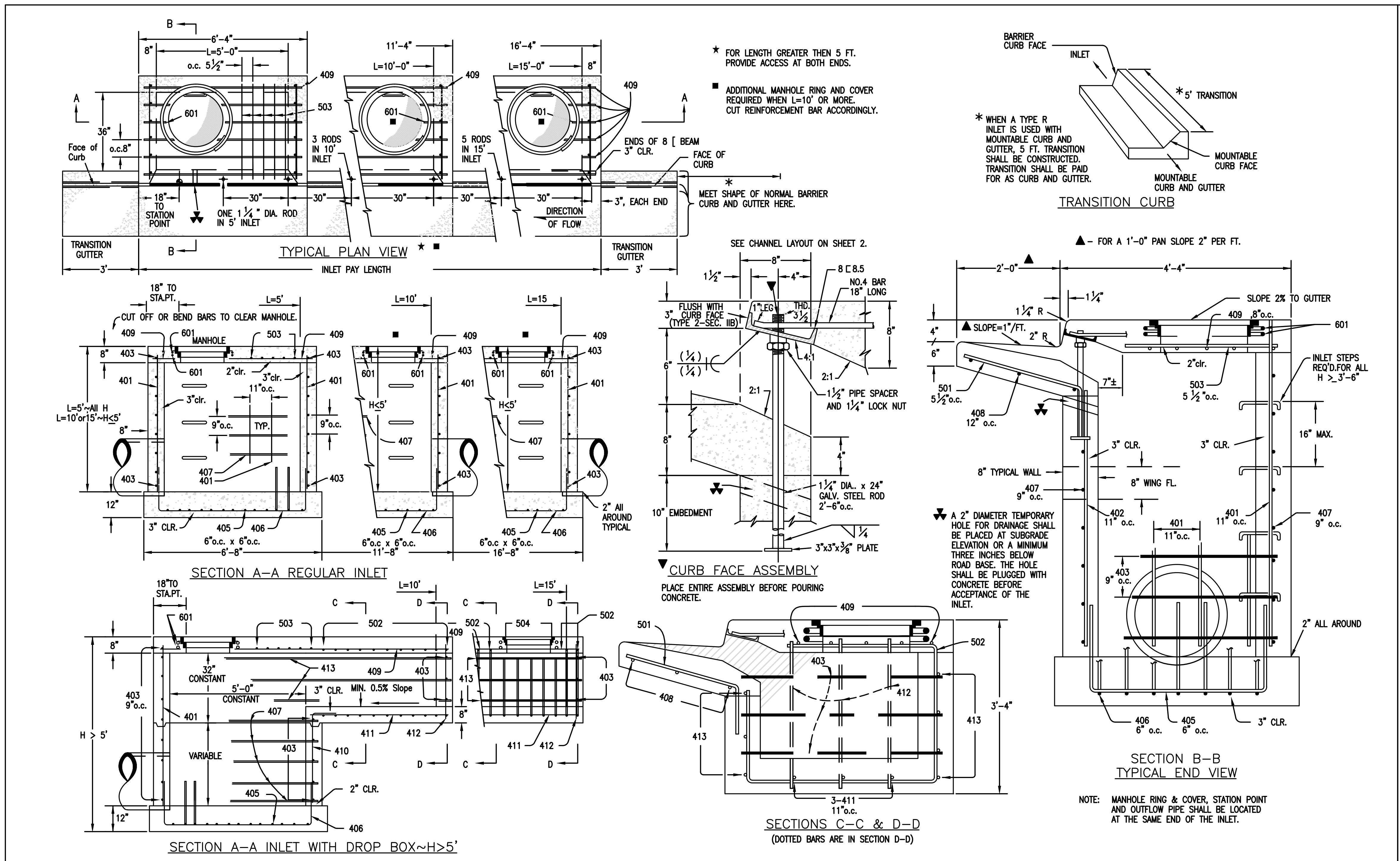
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
DT09
Sheet 72 of 74

NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



Colorado Department of Transportation
4201 East Arkansas Avenue
Denver, Colorado 80222
Phone: (303) 757-9083 FAX: (303) 757-9820
Project Development Branch SD

Computer File Information
Path: www.dot.state.co.us/DevelopProjects/DesignSupport/MStandards/
Drawing File Name: 6040120102.dwg
Acad Version: R14 Scale: NA Units: English

Standard Plan Revised
Date: Comments:

CURB INLET
TYPE R

Issued By: Project Development Branch October 1, 2000

STANDARD PLAN NO.
M-604-12
Sheet No. 1 of 2

TABLE ONE ~ BAR LIST FOR CURB INLETS, TYPE "R"

MARK	DIA IN.	O.C. SPACING	TYPE	ALL INLETS		INLETS. H ≯ 5'				INLETS, H > 5'			
				L= → 5'		10'		15'		10'		15'	
				NO.REQ'D.	LENGTH	NO.REQ'D.	LENGTH	NO.REQ'D.	LENGTH	NO.REQ'D.	LENGTH	NO.REQ'D.	LENGTH
401		11"	II	15	*	21	*	26	*	11	*	11	*
402		11"	II	7	*	13	*	18	*	7	*	7	*
403		9"	II	*	4'-10"	*	4'-0"	*	4'-0"	*	4'-0"	*	4'-10"
405		6"	VI	11	6'-10"	21	6'-10"	31	6'-10"	11	6'-10"	11	6'-10
406		6"	VIII	7	8'-10"	7	13'-10"	7	18'-10"	7	8'-10"	7	8'-10"
407	1/2"	9"	II	*	5'-10"	*	10'-10	*	15'-10"	*	5'-10"	*	5'-10"
408		12"	II	3	6'-10"	3	11'-0"	3	16'-0"	3	11'-0"	3	16'-0"
409		8"	II	6	5'-10"	6	10'-10"	6	15'-10"	6	10'-10"	6	15'-10"
410		11"	VII							3	*	3	*
411		11"	II							3	5'-2"	3	10'-2"
412		11"	II							3	2'-9"	3	2'-9"
413		9"	II							7	10'-10"	7	15'-10"
501		5 1/2"	IV	11	3'-4"	22	3'-4"	33	3'-4"	22	3'-4"	33	3'-4"
502	5/8"	5 1/2"	III							11	11'-5"	17	11'-5"
503		5 1/2"	II	5	3'-6"	16	3'-6"	27	3'-6"	6	3'-6"	6	3'-6"
504		5 1/2"	IX									5	8'-4"
	3/4"												
601		2 1/2"	V	2	8'-10"	2	8'-10"	2	8'-10"	2	8'-10"	4	8'-10"
ø8[8.5				1	5'-10"	1	10'-10"	1	15'-10"	1	10'-10"	1	15'-10"
				2BARS,1ROD	——	4BARS,3RODS	——	8BARS,5RODS	——	4BARS,3RODS	——	8BARS,5RODS	——

* VARIABLE, REFER TO TABLE TWO.
ø INCLUDE 18" NO. 4 BARS (SEE CHANNEL LAYOUT DETAIL).
▼ SEE CURB FACE ASSEMBLY ON SHEET 1 AND CHANNEL LAYOUT DETAILS ON THIS SHEET.

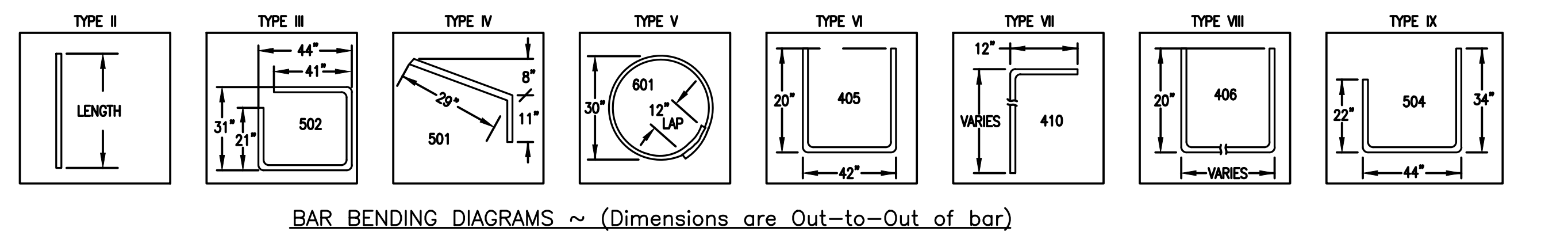
REGULAR INLETS
DROP BOX INLETS

TABLE TWO ~ BARS AND QUANTITIES VARIABLE WITH "H"

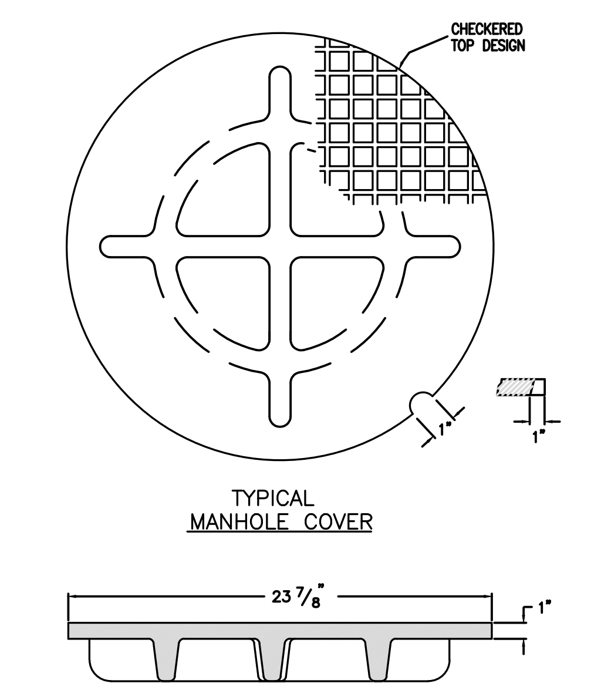
'H'	LENGTH			NO. REQ'D. REGULAR		NO. REQ'D. DROP BOX		L=5'		L=10'		L=15'	
	401	402	410	403	407	403	407	CU.YD.CONC.	LB.STEEL	CU.YD.CONC.	LB.STEEL	CU.YD.CONC.	LB.STEEL
3'-0"	2'-8"	1'-8"		10	7			3.2	285	5.3	497	7.4	706
3'-6"	3'-2"	2'-2"		10	7			3.4	305	5.7	528	7.9	747
4'-0"	3'-8"	2'-8"		12	9			3.7	326	6.0	559	8.4	786
4'-6"	4'-2"	3'-2"		12	9			3.9	334	6.4	571	8.8	803
5'-0"	4'-8"	3'-8"		14	11			4.1	354	6.7	602	9.3	844
5'-6"	5'-2"	4'-2"	3'-5"	16	13	15	6	4.4	375	6.0	607	7.4	850
6'-0"	5'-8"	4'-8"	3'-11"	16	13	16	6	4.6	382	6.2	616	7.6	860
6'-6"	6'-2"	5'-2"	4'-5"	18	15	18	8	4.8	402	6.4	637	7.8	880
7'-0"	6'-8"	5'-8"	4'-11"	20	17	19	10	5.0	423	6.6	654	8.0	897
7'-6"	7'-2"	6'-2"	5'-5"	20	17	20	10	5.3	430	6.9	664	8.3	907
8'-0"	7'-8"	6'-8"	5'-11"	22	19	22	12	5.5	451	7.1	684	8.5	927
8'-6"	8'-2"	7'-2"	6'-5"	24	21	23	14	5.7	471	7.3	702	8.7	944
9'-0"	8'-8"	7'-8"	6'-11"	24	21	24	14	6.0	479	7.6	711	9.0	954
9'-6"	9'-2"	8'-2"	7'-5"	26	23	26	16	6.2	499	7.8	732	9.2	974
10'-0"	9'-8"	8'-8"	7'-11"	28	25	27	18	6.4	520	8.0	749	9.4	992
10'-6"	10'-2"	9'-2"	8'-5"	28	25	28	18	6.7	527	8.3	759	9.7	1001
11'-0"	10'-8"	9'-8"	8'-11"	30	27	30	20	6.9	547	8.5	779	9.9	1022

NOTE: FOR L=5', L=10' AND L=15'
REGULAR INLETS: TOTAL QUANTITIES NEEDED ARE OUTSIDE OF THE HEAVY BLACK LINE.
DROP BOX INLETS: TOTAL QUANTITIES NEEDED ARE INSIDE OF THE HEAVY BLACK LINE

STEEL WEIGHTS DO NOT INCLUDE STRUCTURAL STEEL.

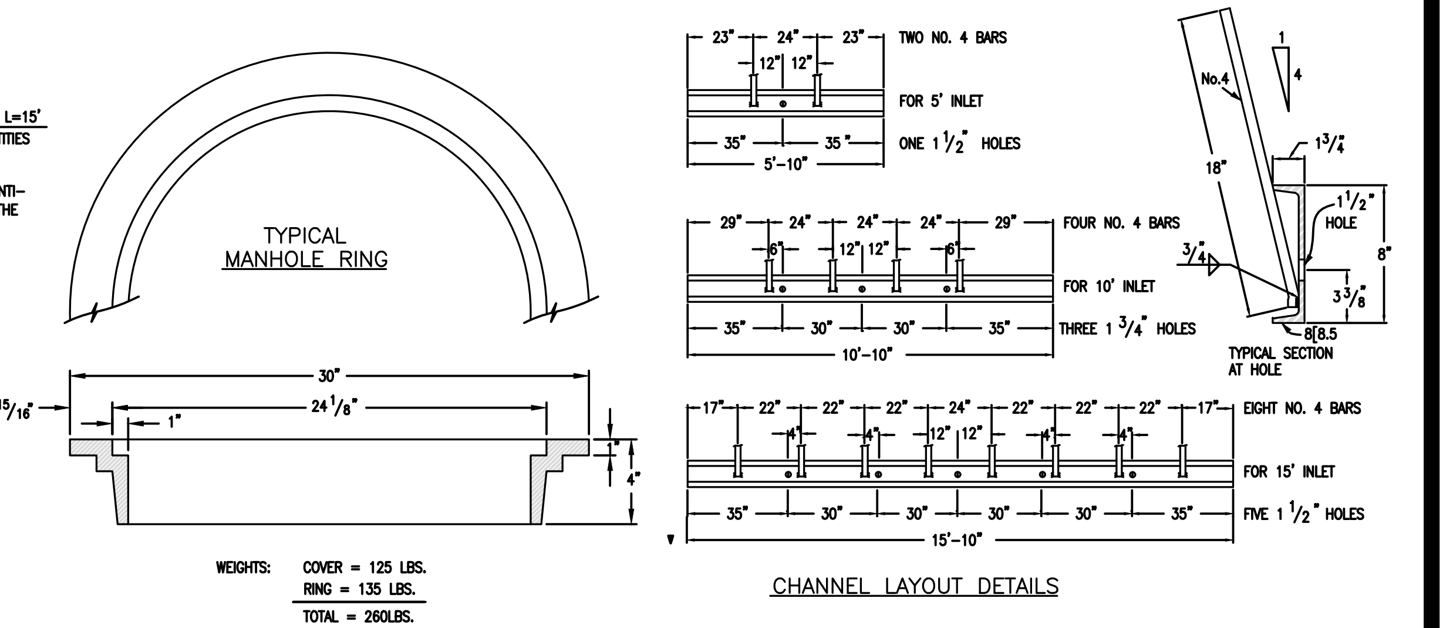


BAR BENDING DIAGRAMS ~ (Dimensions are Out-to-Out of bar)



GENERAL NOTES

1. ALL CONCRETE SHALL BE CLASS B.
2. CONCRETE WALLS SHALL BE FORMED ON BOTH SIDES AND SHALL BE 8 IN. THICK.
3. INLET STEPS SHALL BE IN ACCORDANCE WITH AASHTO M 199.
4. CURB FACE ASSEMBLY SHALL BE GALVANIZED AFTER WELDING.
5. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 3/4 IN. CURB AND GUTTER CORNERS SHALL BE FINISHED TO MATCH THE EXISTING CURB AND GUTTER BEYOND THE TRANSITION GUTTER.
6. REINFORCING BARS SHALL BE DEFORMED AND SHALL HAVE A 2 IN. MINIMUM CLEARANCE. ALL REINFORCING BARS SHALL BE EPOXY COATED.
7. DIMENSIONS AND WEIGHTS OF TYPICAL MANHOLE RING AND COVER ARE NOMINAL.
8. MATERIAL FOR MANHOLE RINGS AND COVERS SHALL BE GRAY OR DUCTILE CAST IRON CONFORMING TO 712.06.
9. SINCE PIPE ENTRIES INTO THE INLET ARE VARIABLE, THE DIMENSIONS SHOWN ARE TYPICAL. ACTUAL DIMENSIONS AND QUANTITIES FOR CONCRETE AND REINFORCEMENT SHALL BE AS REQUIRED IN THE WORK. QUANTITIES INCLUDE VOLUMES OCCUPIED BY PIPES.
10. STRUCTURAL STEEL SHALL BE GALVANIZED AND SHALL CONFORM TO THE REQUIREMENTS OF 712.06.



Colorado Department of Transportation
4201 East Arkansas Avenue
Denver, Colorado 80222
Phone: (303) 757-9083 FAX: (303) 757-9820
Project Development Branch SD

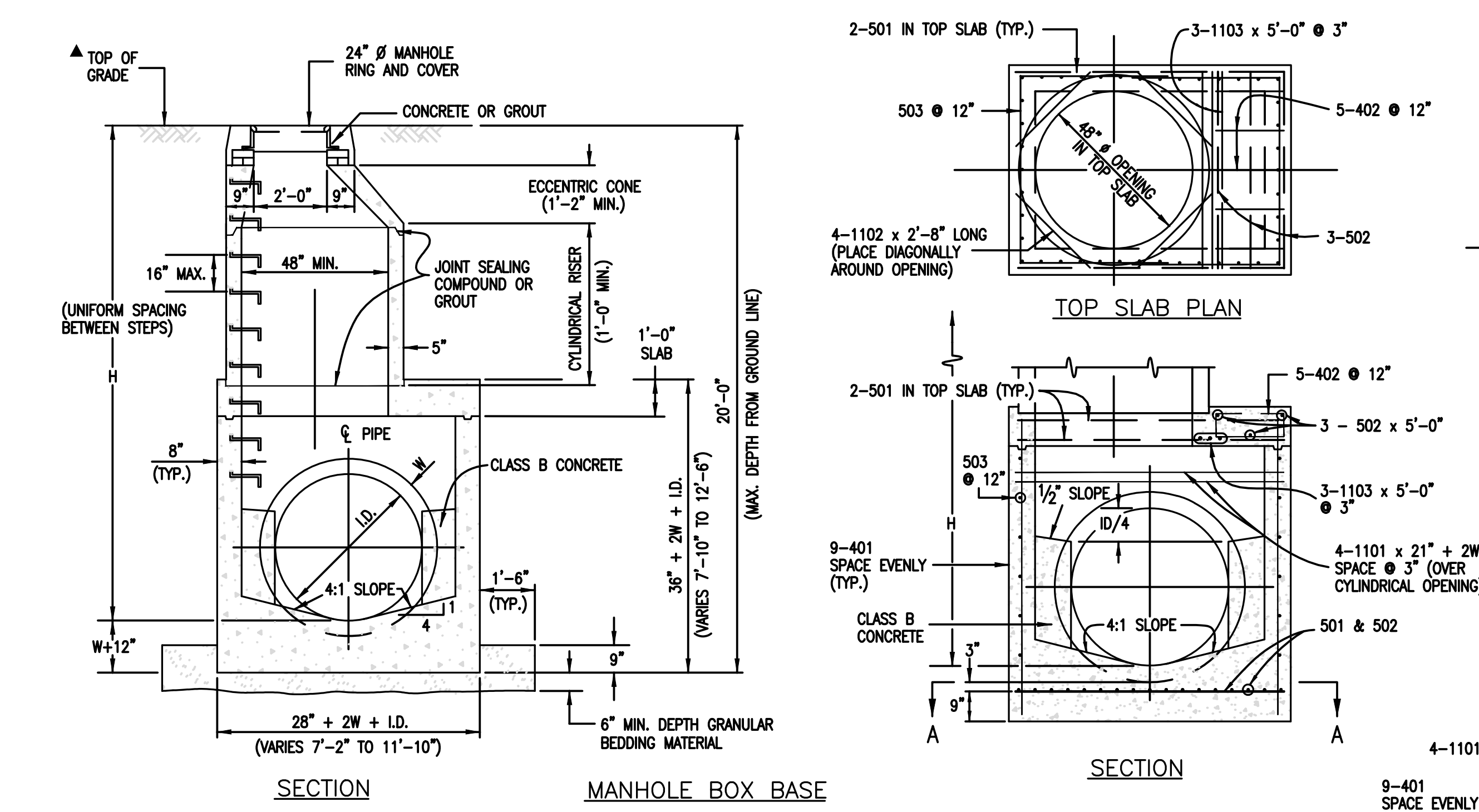
Computer File Information
Path: www.dot.state.co.us/DevelopProjects/DesignSupport/MStandards/
Drawing File Name: 6040120202.dwg
Acad Version: R14 Scale: NA Units: English

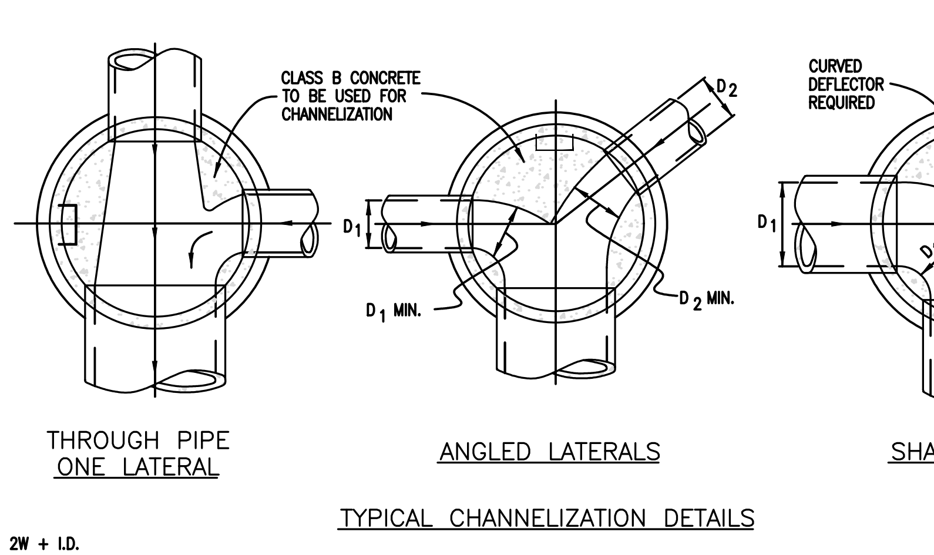
Standard Plan Revised
Date: Comments:

CURB INLET
TYPE R

Issued By: Project Development Branch October 1, 2000

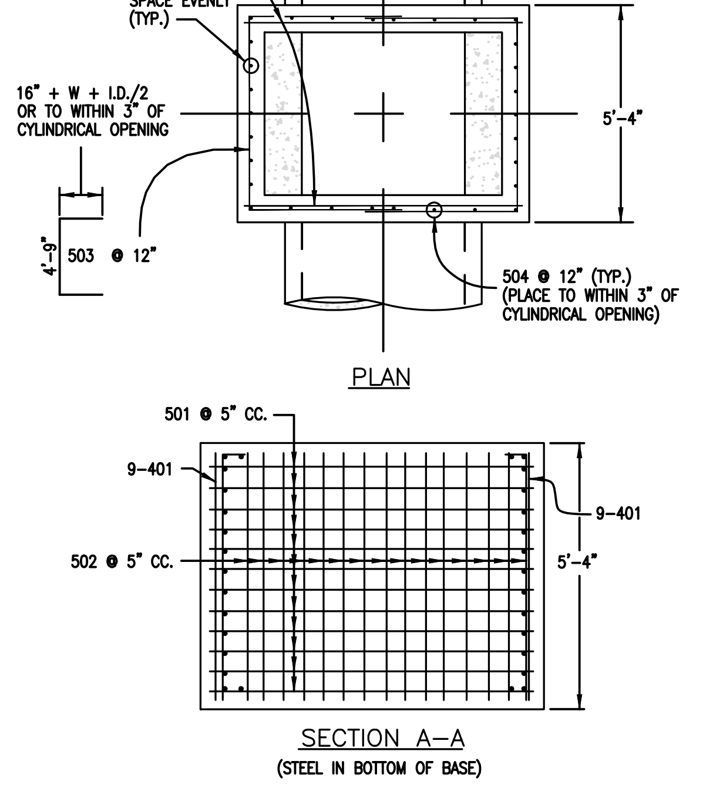
STANDARD PLAN NO.
M-604-12
Sheet No. 2 of 2





QUANTITIES FOR CONCRETE MANHOLE BOX BASE

MARK	SIZE	TYPE	WT. #/FT.	BARS	I.D.						FORMULAS
					54"	60"	66"	72"	84"	96"	
401	4	I	0.668	NO. REQ'D. LENGTH WEIGHT #	18 8'-1" 97.2	18 8'-8" 104.2	18 9'-3" 111.2	18 9'-10" 118.2	18 11'-0" 132.3	18 12'-2" 146.3	401 BAR LENGTH = 32"+2W+I.D.
402	4	III	0.668	NO. REQ'D. LENGTH WEIGHT #	5 5'-5" 18.1	5 6'-0" 20.0	5 6'-7" 22.0	5 7'-2" 23.9	5 8'-4" 27.8	5 9'-6" 31.7	402 BAR LENGTH = I.D. + 2W
501	5	I	1.043	NO. REQ'D. LENGTH WEIGHT #	17 7'-5" 131.5	17 8'-0" 141.8	17 8'-7" 152.2	17 9'-2" 162.5	17 10'-4" 183.2	17 11'-6" 203.9	501 BAR LENGTH = 24" + I.D. + 2W
502	5	I	1.043	NO. REQ'D. LENGTH WEIGHT #	22 5'-0" 114.7	23 5'-0" 119.9	25 5'-0" 130.4	26 5'-0" 135.6	29 5'-0" 151.2	32 5'-0" 166.9	502 NUMBER BARS REQ'D. = $3+\left(\frac{24+I.D.+2W}{@\ 5''}+1\right)$
503	5	II	1.043	NO. REQ'D. LENGTH WEIGHT #	16 12'-10" 214.2	16 13'-5" 223.9	18 14'-0" 262.8	18 14'-7" 273.8	20 15'-9" 328.5	24 16'-11" 423.5	503 NUMBER BARS REQ'D. = $2\left(\frac{13+I.D.+2W}{@\ 12''}+1\right)$ BAR LENGTH = 4'-9"+2(16+W+I.D./2)
504	5	I	1.043	NO. REQ'D. LENGTH WEIGHT #	12 8'-1" 101.2	14 8'-8" 126.6	14 9'-3" 135.1	16 9'-10" 164.1	18 11'-0" 206.5	20 12'-2" 253.8	504 NUMBER BARS REQ'D. = $2\left(\frac{2W+I.D.-4}{@\ 12''}+1\right)$ BAR LENGTH = 32"+2W+I.D.
1101	11	I	5.313	NO. REQ'D. LENGTH WEIGHT #	4 7'-2" 152.3	4 7'-9" 164.7	4 8'-4" 177.1	4 8'-11" 189.5	4 10'-1" 214.3	4 11'-3" 239.1	1101 BAR LENGTH = 21" + I.D. + 2W
1102	11	I	5.313	NO. REQ'D. LENGTH WEIGHT #	4 2'-8" 56.7	4 2'-8" 56.7	4 2'-8" 56.7	4 2'-8" 56.7	4 2'-8" 56.7	4 56.7 2'-8"	BENDING TYPE I STRAIGHT
1103	11	I	5.313	NO. REQ'D. LENGTH WEIGHT #	3 5'-0" 79.7	3 5'-0" 79.7	3 5'-0" 79.7	3 5'-0" 79.7	3 5'-0" 79.7	3 5'-0" 79.7	TYPE II 4'-9" 16"+W+I.D./2
REINFORCING STEEL TOTAL #					965.6	1,037.5	1,127.2	1,204.0	1,380.2	1,601.6	TYPE III 12" 12" 7" I.D.+2W-38"
CONCRETE – CUBIC YARDS – TOTAL					6.0	6.6	7.3	8.0	9.5	11.1	
NOTE: QUANTITIES ARE BASED ON SAME SIZE PIPE ENTRANCE TO AND EXIT FROM, BASE AND A 4 FT. MANHOLE ENTRANCE INTO TOP SLAB OF BASE.											



GENERAL NOTES

1. SINCE ALL PIPE ENTRIES INTO THE BASE ARE VARIABLE, THE DIMENSIONS SHOWN ARE TYPICAL. ACTUAL DIMENSIONS AND QUANTITIES FOR CONCRETE AND REINFORCEMENT SHALL BE AS REQUIRED IN THE WORK.
2. THE PRECAST FLAT TOP MAY BE USED ON ANY MANHOLE. THE ECCENTRIC CONE MAY BE USED WHEN THE MANHOLE "H" HEIGHT IS AT LEAST 8 FT.
3. THE MH RING (FRAME) SHALL BE SET IN A BED OF GROUT. THE FRAME SHALL BE SURROUNDED WITH A CEMENT GROUT IN UNPAVED AREA, OR A CONCRETE COLLAR IN PAVED AREA. SEE DETAILS ON SHEETS 2 AND 3.
4. DESIGN OF BOX BASE IS BASED ON STRAIGHT RUNS OF CONDUIT OR CHANGE IN DIRECTION OF LESS THAN 45°. SPECIAL DESIGN IS REQUIRED FOR 45° OR GREATER.
5. PRECAST MANHOLES AND REINFORCEMENT SHALL CONFORM TO ASTM C 478 (AASHTO M 199).
6. CAST-IN-PLACE MANHOLES SHALL BE CLASS B CONCRETE.
7. STEPS SHALL BE REQUIRED WHEN THE MANHOLE DEPTH EXCEEDS 3 FT.-6 IN. AND SHALL BE IN ACCORDANCE WITH AASHTO M 199.
8. ALL REINFORCING STEEL SHALL HAVE A MINIMUM YIELD STRENGTH OF 60,000 PSI. VERTICAL STEEL SHALL BE PLACED AT ℄ OF WALL. ALL BARS SHALL HAVE A 2 IN.MINIMUM CLEARANCE.
9. ALL PIPE ENTRIES INTO THE BASE OF MANHOLE SHALL BE CONNECTED BY OPEN CHANNELIZATION ADJUSTED FOR PIPE SIZE, SHAPE, SLOPE, AND DIRECTION OF FLOW. DETAILS SHOWN ARE TYPICAL FOR INSTALLATIONS WITH ALL INVERTS OF SAME RELATIVE ELEVATION. FOR EXCESSIVE ELEVATION DIFFERENCE BETWEEN INVERTS, SPECIAL BASE/CHANNEL DETAILS WILL BE SHOWN ON THE PLANS.
10. FLOW CHANNELS AND INVERTS SHALL BE FORMED BY SHAPING WITH CLASS B CONCRETE OR APPROVED GROUT.
11. STUB-OUTS SHALL EXTEND 2 FT. MINIMUM BEYOND OUTSIDE WALL SURFACE OF MANHOLE AND BE SATISFACTORILY PLUGGED.
12. CHECK WITH THE LOCAL GOVERNMENT AUTHORITY FOR ANY ADDITIONAL SANITARY SEWER SPECIFICATIONS, DETAILS, OR REGULATIONS.
13. THE SLOPE OF THE MANHOLE COVER SHALL MATCH THE ROADWAY PROFILE AND CROSS SLOPE.

Colorado Department of Transportation
4201 East Arkansas Avenue
Denver, Colorado 80222
Phone: (303) 757-9083 FAX: (303) 757-9820
Project Development Branch SD

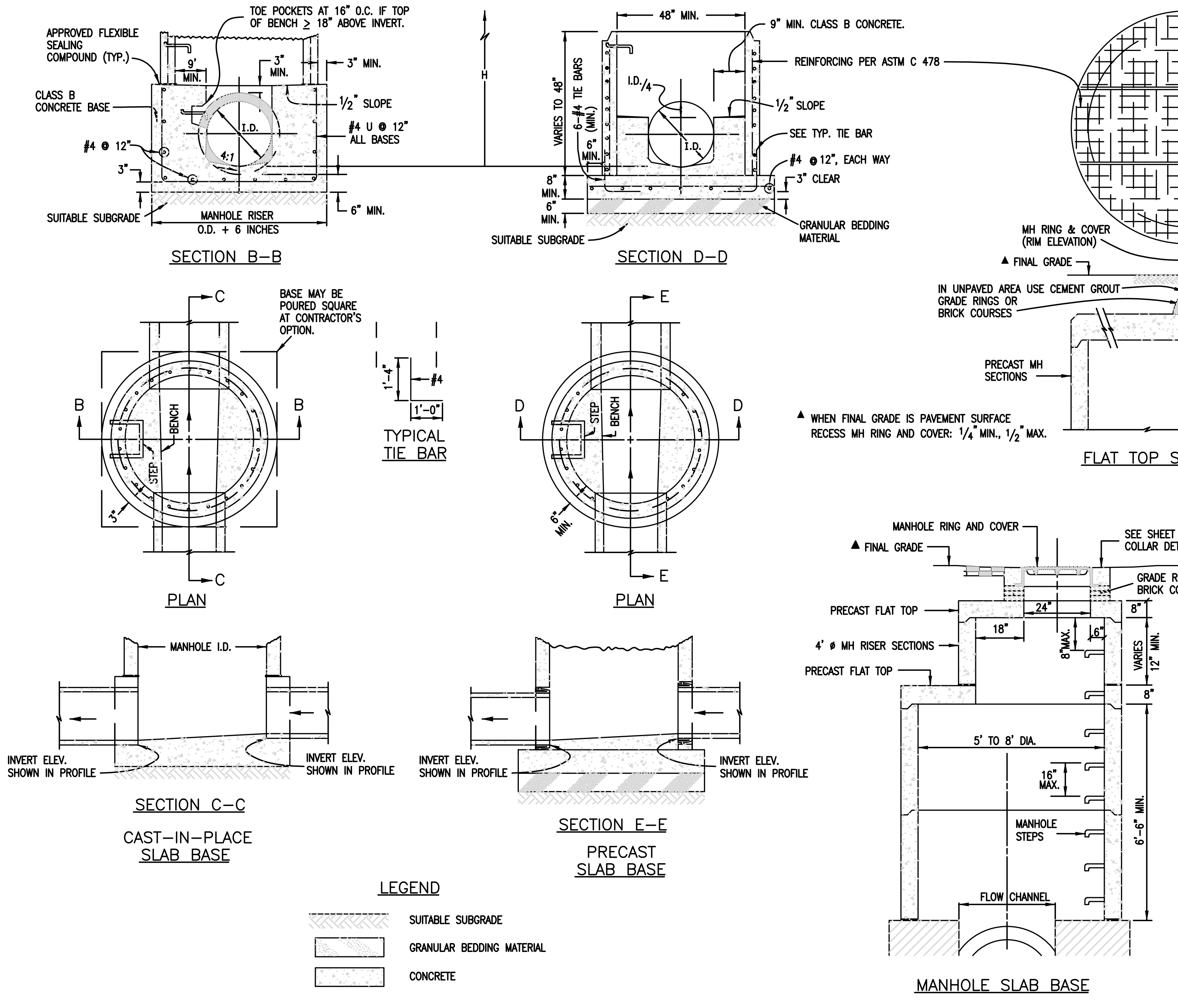
Computer File Information
Path: www.dot.state.co.us/DevelopProjects/DesignSupport/MStandards/
Drawing File Name: 6040200103.dwg
Acad Version: R14 Scale: NA Units: English

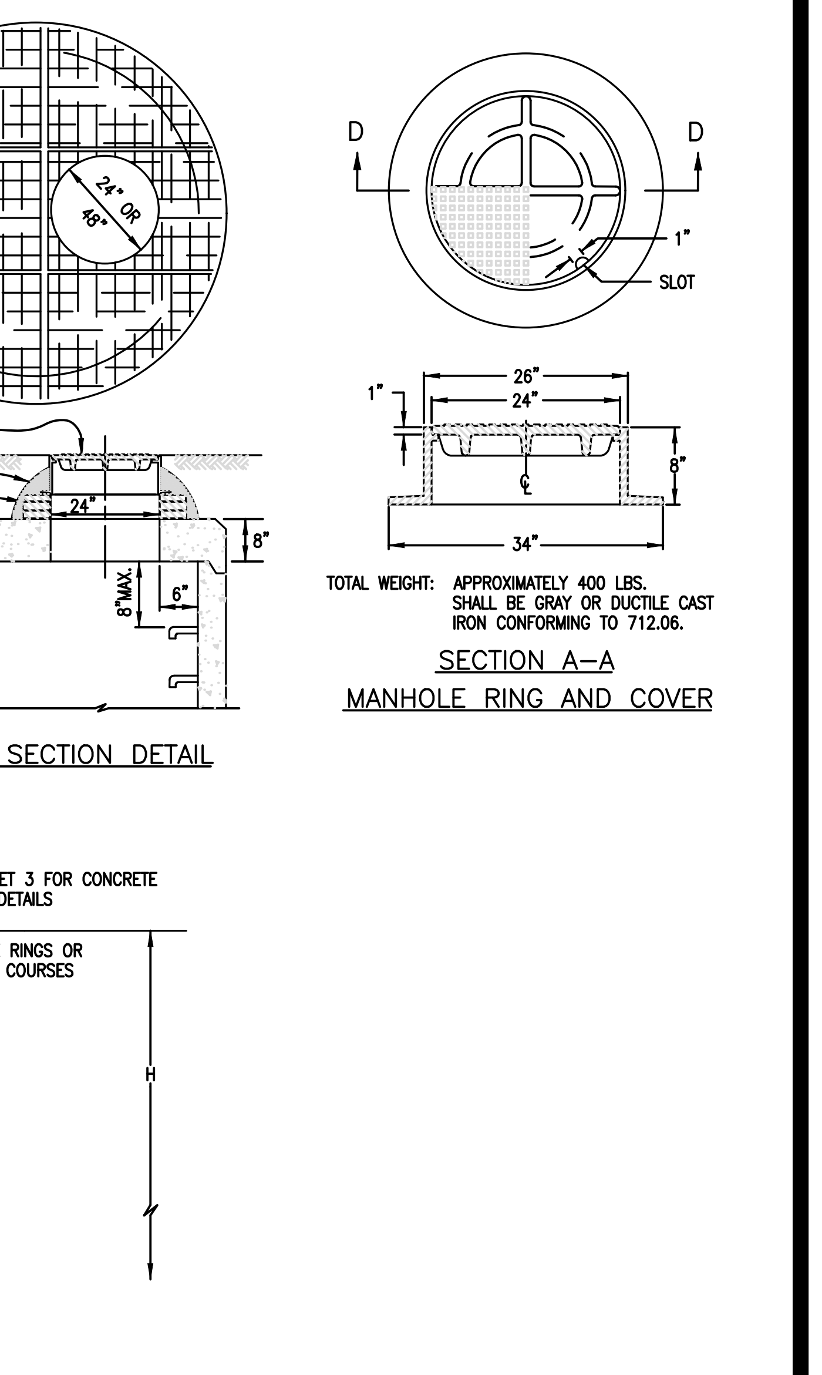
Standard Plan Revised
Date: Comments:

MANHOLES

Issued By: Project Development Branch October 1, 2000

STANDARD PLAN NO.
M-604-20
Sheet No. 1 of 3





PRECAST MANHOLE BASES:

1. THE BASE SLAB SHALL BE POURED MONOLITHICALLY WITH BOTTOM RISER SECTION.
2. PRECAST MANHOLE BASES SHALL FIT THE CONDITIONS AND LOCATIONS FOR WHICH THEY ARE INTENDED WITHOUT ANY FIELD MODIFICATIONS. ANY MANHOLE BASE WHICH REQUIRES FIELD CUTTING OR MODIFICATION IN ORDER TO FIT THE LOCATIONS INTENDED WILL BE REJECTED BY THE ENGINEER AND REMOVED AND REPLACED BY THE CONTRACTOR AT NO COST TO THE DEPARTMENT.
3. PRECAST MANHOLE BASES SHALL BE BEDDED ON AN APPROVED GRANULAR BEDDING MATERIAL AS SHOWN ABOVE.

Colorado Department of Transportation
4201 East Arkansas Avenue
Denver, Colorado 80222
Phone: (303) 757-9083 FAX: (303) 757-9820
Project Development Branch SD

Computer File Information
Path: www.dot.state.co.us/DevelopProjects/DesignSupport/MStandards/
Drawing File Name: 6040200203.dwg
Acad Version: R14 Scale: NA Units: English

Standard Plan Revised
Date: Comments:

MANHOLES

Issued By: Project Development Branch October 1, 2000

STANDARD PLAN NO.
M-604-20
Sheet No. 2 of 3

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

COLORADO LICENSED
THOMAS C. JANSEN
35942
PROFESSIONAL ENGINEER
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

STORM SEWER DETAILS

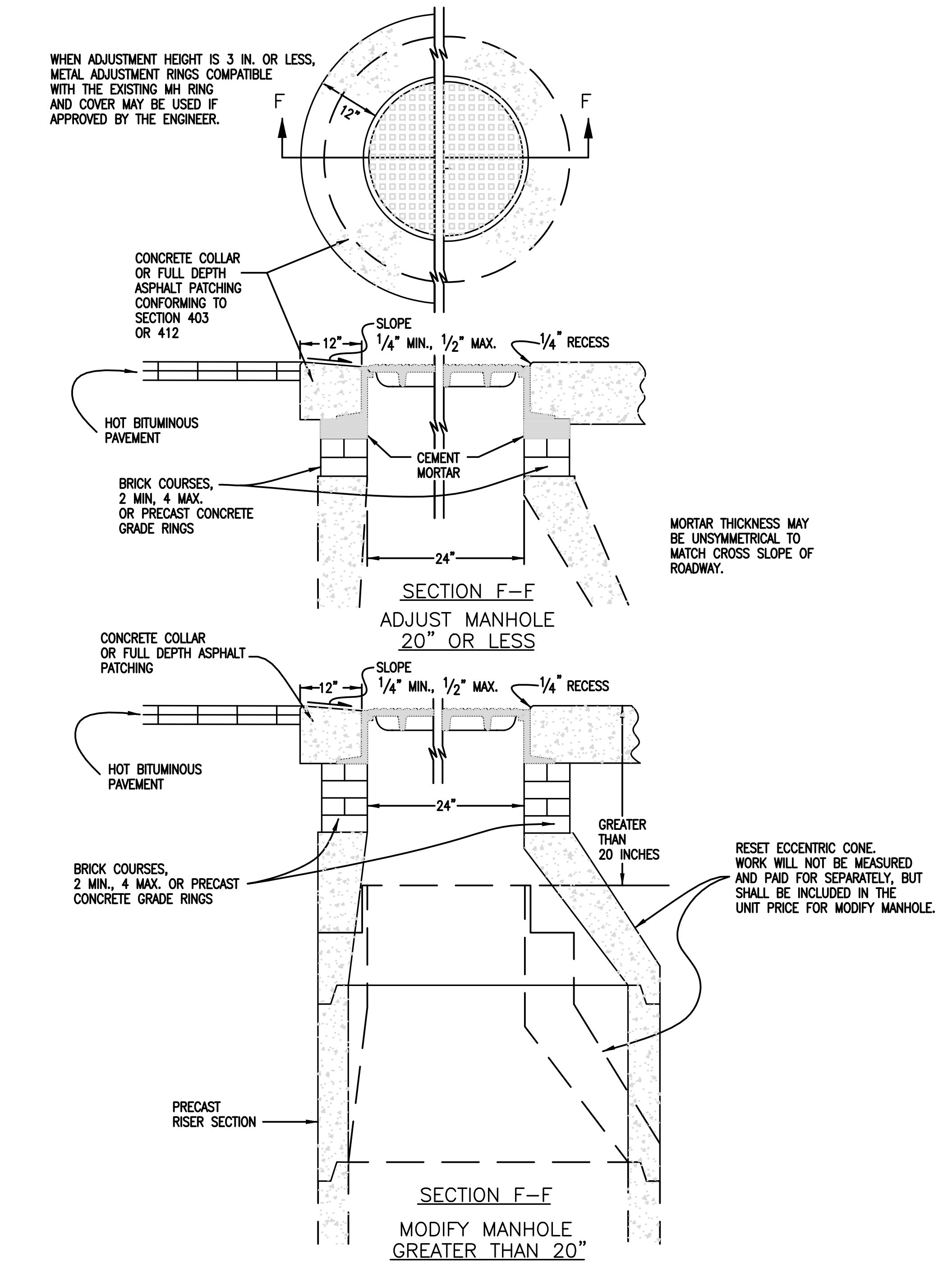
NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
DT10
Sheet 73 of 74

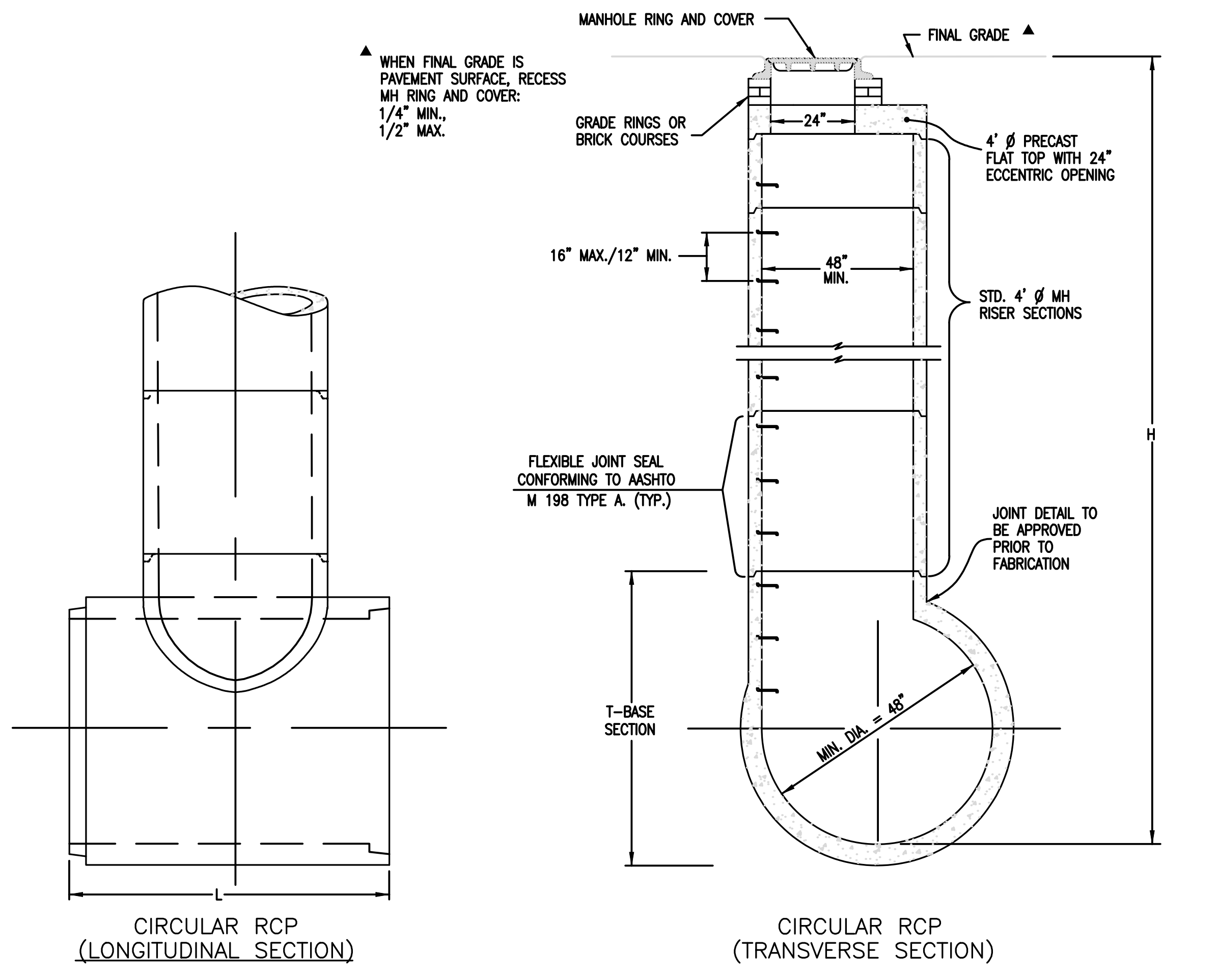
NOT FOR CONSTRUCTION

CAUTION: IF THIS SHEET IS NOT 22"x34" IT IS A REDUCED PRINT



T–BASE MANHOLES:

1. THE T–BASE SECTION SHALL BE SHOP–FABRICATED FOR DELIVERY TO THE CONSTRUCTION SITE AS A COMPLETE UNIT.
2. THESE DETAILS SHALL ONLY BE CONSTRUED TO SHOW CONCEPTUAL AND STANDARD DIMENSIONAL REQUIREMENTS FOR TYPE T–BASE MANHOLES. THE CONTRACTOR SHALL FURNISH DETAILED SHOP DRAWINGS FOR APPROVAL PRIOR TO FABRICATION. THE DETAILS SHOWN HEREIN APPLY ONLY TO 48–INCH DIAMETER PIPE AND LARGER.
3. EXCEPT FOR CLASS OF PIPE, SPECIFICATIONS TO BE MET FOR THE MANHOLE SHALL BE THE SAME AS THOSE REQUIRED FOR THE ADJOINING PIPE CULVERT OR SEWER.
4. THE T–BASE SECTION SHALL MAINTAIN ITS INTERNAL SHAPE AND FLOW AREA WITH ANY GROUTING, ETC. APPLIED SO AS TO NOT DISTURB THE NORMAL FLOW OR REDUCE THE AREA.



MANHOLE T–BASE

Colorado Department of Transportation
4201 East Arkansas Avenue
Denver, Colorado 80222
Phone: (303) 757–9083 FAX: (303) 757–9820
Project Development Branch SD

Computer File Information
Path: www.dot.state.co.us/DevelopProjects/DesignSupport/MStandards/
Drawing File Name: 6040200303.dwg
Acad Version: R14 Scale: NA Units: English

Standard Plan Revised	
Date:	Comments:

MANHOLES

Issued By: Project Development Branch October 1, 2000

STANDARD PLAN NO.
M–604–20
Sheet No. 3 of 3

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

THOMAS C. JANSEN
35942
Dec 04, 2018
FOR AND ON BEHALF OF WARE MALCOMB

COMPASS FILING NO. 4

STORM SEWER DETAILS

NO.	DATE	REMARKS
1	08-27-2018	TOWN COMMENTS

JOB NO.:	15075-1
PA / PM:	GB
DRAWN BY:	IH
DATE:	08-17-2018

SHEET
DT11
Sheet 74 of 74

NOT FOR CONSTRUCTION

JANSEN STRAWN
CONSULTING ENGINEERS
A WARE MALCOMB COMPANY

PHASE III FINAL DRAINAGE REPORT

Compass Filling No. 4

Erie, CO

November 27, 2018

JN: 15075-1

Prepared for:

CalAtlantic Homes
6161 S. Syracuse Way, Suite 340
Greenwood Village, CO 80111
P: (303) 486-5000

Prepared by:

Jansen Strawn Consulting Engineers
990 South Broadway Suite 230
Denver, CO 80209
P: 303.561.3333
F: 303.561.3339

Thomas C. Jansen, PE No. 35942
Principal

Engineer's Certification

"I hereby certify that this **Phase III Drainage Report** for the design of **Compass Filing 4** was prepared by me or under my direct supervision in accordance with the provisions of the *Town of Erie Standards and Specifications for Design and Construction* for the owners thereof. I understand that the Town of Erie does not and will not assume liability for drainage facilities designed by others, including the designs presented in this report."

Thomas C. Jansen
Registered Professional Engineer
State of Colorado No. **35942**

Town Acceptance

This report has been reviewed and found to be in general compliance with the *Town of Erie Standards and Specifications for Design and Construction* and other Town requirements. **THE ACCURACY AND VALIDITY OF THE ENGINEERING DESIGN, DETAILS, DIMENSIONS, QUANTITIES, AND CONCEPTS IN THIS REPORT REMAINS THE SOLE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEAR HEREON**.

Accepted by: ___________________________________ _____________
Deputy Public Works Director Date

TABLE OF CONTENTS

APPENDICES

I. GENERAL LOCATION AND DESCRIPTION

The purpose of this Phase III Drainage Report is to discuss the design of the Compass Filing No. 4 storm drainage facilities and how they are incorporated into the existing storm drainage system and detention Pond C Design as well as Regional Detention Pond 1053. This report will consider all phases of past and future onsite development but only details the onsite and offsite storm drainage facilities required for the development of Compass Filling No. 4.

A. Site Location

The site consists of developable land that is located in the Town of Erie and more specifically is the Southeast corner of Section 25, Township 1 North, Range 69 West of the 6th Principal Meridian. See Appendix A for the vicinity map.

The Compass Filing No. 4project site is located at the southwest corner of Vista Parkway (80 ft. right-of-way) and E. County Line Road (60' existing right-of-way, 140' proposed right-of-way, principal arterial). The site is bounded on the south by the Compass Filing No. 1 site, on the East by East County Line Road, on the west by the Compass Filing No. 3 site, and on the north by agricultural and open space uses in Boulder County.

No major drainage-ways exist onsite or upstream of the proposed development site. Coal Creek has been designated as the major drainage way that the project site development outfalls to by way of newly constructed storm drainage conveyance systems.

B. Site Description

The Compass Subdivision (Filing No. 1-4) total onsite project development area is 162 acres and is located within the Coal Creek major tributary. There is approximately 149.9 acres of onsite land that is shown in the Outfall Systems Plan (OSP) that is tributary to the constructed regional detention pond 1053. Compass Filing No. 4 is comprised of approximately 33.63 acres. The south half of Compass Filing No. 4 (21.51 AC) is tributary to the Regional Detention Pond 1053. The North half (12.12 AC) will drain to Detention Pond C. A portion of Detention Pond C will be constructed with the Vista Parkway construction (Compass Filing No. 3), and the remainder of the pond will be constructed with Compass Filing No. 4. The storm sewer tributary the regional pond for the final design phase of the Compass Project was designed and built in accordance with previous drainage reports for Compass Filing No. 1 and the 2014 OSP. Detention Pond 3 has been designed in accordance with the Town of Erie (Reference 10) and Urban Drainage standards (Reference 1).

Before the construction of Compass Filing No. 1, the majority of the property was farmed with rotating crops. Infrastructure for Filing No. 1 and Filing No.2has been constructed. Filing No. 3 is anticipated to be constructed at the time Filing No. 4 starts construction.

Soils onsite are entirely composed of Ascalon sandy loam (Hydrologic Soil Group B); according to the Web Soil Survey by the National Resources Conservation Service (NRCS) (Reference 2). The onsite and offsite slopes generally range between 1-3 percent as seen from the existing topography. Type B soils are characterized as soils that have a moderate infiltration rate when thoroughly wet and have a moderate rate of water transmission. Type B soils consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have a moderately fine texture to moderately coarse texture. The soil matrix consists of approximately 66% percent sand with a Kf factor of 0.24 which classifies the soil type as moderate to highly moderately susceptible to erosion during high volume run-off storm events. Refer to Appendix A for more detailed information on the physical soil properties shown in the Web Soil Survey description.

No existing major drainage ways exist onsite. As part of the 2014 OSP, a major regional detention facility has been constructed onsite as part of the tributary sub-basin. This pond included new conveyance infrastructure to convey onsite and offsite tributary stormwater runoff through the site to the major regional detention facility and finally to the Coal Creek major drainage way. The detention facility and the outfall to Coal Creek have been designed as part of the Compass Filing No. 1 drainage report and will be constructed under the Compass Filing No. 1 Development Agreement (Reference 8).

The site is within the Town of Erie city limits and zoned for single-family residential development. The Compass project, in its entirety, proposes to construct a total of 485 single family lots at full build-out with 146 multi-family lots being platted in the Filing No. 4 Phase. Public street, public sidewalk and public utilities which include storm sewer, detention pond, sanitary sewer, water, gas, electricity and other franchise utilities will be constructed as part of the 4 phase project as well. The Filing No. 4 phase will also provide permanent storm drainage tracts and a pocket park. Anticipated construction will consist of clearing and grubbing, over-lot grading, and construction of utility infrastructure for the proposed development of the site.

There are no known irrigation facilities on the project site. No known registered wetlands exist on site or with-in 150 feet of the site boundaries. No known registered wetlands exist within the proposed out fall drainage way to Coal Creek.

No oil/gas well exists on the Compass Filing No. 4 Site. An existing regulator easement is located on the southeast corner of Detention Pond C. The proposed grading will provide a berm around the regulator easement to shield it from the residential lots.

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Drainage Basin

This project is with-in the Coal Creek major drainage basin and has been analyzed as part of the Town of Erie Outfall Systems Plan (West of Coal Creek) Alternative Analysis Report, prepared by WRC Engineering, Inc., January 2014. Copies of the pages that relate to this area of the study can be found in Appendix A and have been reviewed for analysis of the proposed Compass Development.

The Town of Erie Outfall Systems Plan (West of Coal Creek) Baseline Hydrology Report (Reference 6), prepared by WRC Engineering, Inc., January 2014 (Reference 6), has been revised with the latest Town of Erie zoning and land use maps for this area. The UDFCD Accepted Town of Erie Outfall Systems Plan (West of Coal Creek) Alternative Analysis Report, prepared by WRC Engineering, Inc., April 2014 (Reference 7), was reviewed and recommendations were incorporated into the Filing 1 pond design. More discussion of the proposed design is detailed further in Section IV Drainage Facility Design portion of the Compass Filing No. 1 phase 3 drainage report (Reference 8). Routing was performed in this report to prove detention capacity.

Enclosed in Appendix A are FEMA Firm Map No. 08013C0443J (Reference 3). This maps show the site is located within a Non-Shaded Zone X area. Non-Shaded Zone X areas are defined as an area being entirely outside of the limits of the 100-year flood plain.

This project does not impact existing flood plain boundaries. The Filing No. 4 area and development were considered in the design of Proposed Pond C design and conveyance infrastructure. Proposed Pond C will be expanded to the south with the construction of Compass Filing No. 4 as well as having restrictor plates replaced with plates designed for additional flow from Compass Filing No. 4. See the Compass Filing 1 Phase III Drainage report (Reference 8) for details of the UDFCD Pond 1053 design.

SUMMARY OF OSP TRIBUTARY DRAINAGE BASINS:

a. The site is part of a collection of sub-basins located within the Coal Creek Major Drainage Basin. Drainage patterns within this portion of the Coal Creek basin are typical to Eastern Colorado plains farming land with slight rolling hills and slopes ranging from less than one percent to approximately 3 percent. The land generally slopes to the east from a ridge located approximately 4,000 feet to the west of the site, toward Coal Creek, which is located approximately 1,000 feet to the east of the site. Overland flows enter the western portion of the site property from offsite properties. The onsite and offsite tributary area generally slope toward two low-lying locations onsite. The southerly low-lying area has an existing 18-inch diameter culvert that is expected to convey runoff from minor storm events under East County Line Road to the east into existing roadside ditches that eventually channel the runoff into Coal Creek. The existing stormwater runoff from major storm events is expected to over top East County Line Road and continue east in roadside ditches and overland until eventually reaching Coal Creek.

b. The topographic maps show an east west ridge just south of the northern onsite property line. The north slope of the onsite north ridge slopes to the north toward OSP basin 451. The OSP analyzed this area as being part of a separate drainage basin located north of the site and the proposed onsite drainage design is to follow the OSP recommendations, however, during the preliminary plat design it was decided to provide onsite detention and water quality for the portions of onsite area that will continue discharge to the north. Detention Pond C has been designed to account for runoff generated in this area, and is expanded on further in this report.

c. The 2014 OSP analyzed the proposed development onsite area using a land use of single family residential consistent with the proposed development. The proposed development and zoning of this land is multi-family residential. The detention design volume and outflows have been included in this report to show how the Compass Filing No. 4 project is incorporated into the detention design and that the actual construction plans for Filing 4 do meet the analysis shown in the Filing 1 design of Pond 1053.

B. Sub-Basin and Site Drainage

There are approximately 162 onsite acres from OSP basins 444 and 446 tributary to OSP Regional Detention Facility 1053 with approximately 12 acres of onsite area located along the north property line of the site that is tributary to OSP Regional detention pond 1051 for a total of 168 acres at ultimate build out. Offsite runoff enters the property from the west in two main patterns. Sheet flow is anticipated to enter the site along the majority of the western property boundary from the 34 acres of remaining contributing area from OSP basins 444 and 446. Approximately 268 acres of offsite land is tributary to the southwest corner of the property at OSP DP-513 *from OSP basins 440, 441, 442, 443.* The OSP identifies that the future developed runoff rates from these basins to DP-513 are anticipated to be 3 cfs in the 2-year storm event and 279 cfs in the 100-year storm event. In the existing condition, this runoff is conveyed overland and in a roadside ditch along the north side of Arapahoe Road to the east and to the southern onsite low point on the west side East County Line Road to the existing 18-inch culvert.

The Filing No. 1 and Filing No. 2 developments have developed approximately 63 acres and 28 acres respectfully of OSP Basins 444 and 446. In the developed condition, the storm runoff from the undeveloped area of OSP Basins 444 and 446 is intercepted by inlets and drainage channels and conveyed through the site from west to east and discharge into the north and south end of OSP regional detention pond 1053.

Compass Filing No. 3 development proposes to develop about 45.30 total acres of land north of Compass Filing No. 1 & Filing No. 2 consisting of 156 lots. The Compass Filing No. 3 Plat consists of single family residential lots, street right-of-ways, storm drainage tracts and pocket parks. The 30 acres of offsite runoff from Basin 446 is proposed to be intercepted by a swale at the southwest boundary of Compass Filing No. 3 and conveyed through the site in permanent drainage tracts that are designed to direct flow east along the south property line and ultimately discharge into the north end of OSP regional detention pond 1053. The permanent drainage channels constructed as part of Filling No.1 were designed for the ultimate build out condition of the site.

Compass Filing No. 4 development proposes to develop about 22.96 total acres of land north of Compass Filing No. 1 consisting of 146 lots. The Compass Filing No. 4 Plat consists of multi-family residential lots, street right-of-ways, storm drainage tracts and pocket parks. Approximately 19.68 acres of OSP basins 444 & 446 tributary to Regional Pond 1053 will be intercepted by the proposed drainage system. 13.63 acres tributary to Regional Pond 1051 will be intercepted by a proposed storm system and detain in Pond C before outfalling to the east. The permanent drainage channels being constructed as part of Filling No.1 have been designed for the ultimate build out condition of the site.

The OSP identifies one regional detention pond (Pond 1053) that was designed and constructed under the Compass Filing No. 1 Development Agreement. The analysis of this pond has been included in the Compass Filing No. 1 (Reference 8) report. See the Compass Filing 1 Phase III drainage report for details of detention and water quality design details.

III. DRAINAGE DESIGN CRITERIA

A. Regulations

The regulations, guidelines and drainage design criteria used for this report are those contained within the Town of Erie Storm Drainage Facilities Manual for the Design and Construction of Public and Private Improvements (Reference 10) and the Urban Storm Drainage Criteria Manual, volume 1, 2 and 3 (Reference 1).

B. Hydrology Criteria

In accordance with the Town of Erie criteria, the design storms analyzed for this site were the 2-year storm (minor storm) and the 100-year storm (major storm). One-hour rainfalls of 0.81 and 2.65 inches have been used for the 2-Year and 100-Year runoff calculations respectively using the NOAA Atlas 14 Point Precipitation Frequency Estimates (Reference 11/12) for the Compass Filing No. 4 site. Refer to Appendix A for supporting information.

The peak discharge for sizing the onsite storm sewer and for the street capacity calculations was calculated using the following Rational Method formula:

$Q = CIA$

Where:
Q = peak discharge (cfs)
C = runoff coefficient
I = rainfall intensity (inches/hour)
A = drainage area (acres)

See Appendix B for Rational Method flow calculations.

These flows were routed through the site using the UDFCD SF-3 form to determine the total flow at respective design points. See Appendix B for routing spreadsheets.

The UDFCD Full-Spectrum Detention method was used to determine the required detention volume for Detention Pond C.

Stormwater quality and detention for Detention Pond C will be provided using the UDFCD methods for full spectrum detention in accordance with The Town of Erie Criteria - Urban Drainage Detention Basin Design Workbook (UD-Detention, Version 3.07). This includes providing storage for the Excess Urban Runoff Volume (EURV) and releasing that volume over a 72-hour period. The 100-year developed release rate for the pond will be restricted to 1.24 cfs per acre. Please refer to the EURV and 100-year detention volume calculations in Appendix B of this report.

C. Hydraulic Criteria

Urban Drainage Street and Inlet Hydraulics Spread Sheet (Version 4.05) was used to evaluate street capacity at the respective design points. Similarly, the Urban Drainage spread sheet was also used to calculate on-grade/sump inlet capacities for the 2-year and 100-year storm.

Street capacity for the minor storm was based on flows not overtopping the curb and gutter for the both local and collector streets. Flows in local streets can spread to the crown of the street.

For vertical curb and gutter, a flow depth of 6" was used for the 2-year storm and 6" flow depth was used for the 100-year storm. Please refer to the appendix for calculations.

D. Storm Sewer Configuration

Hydraulic-grade line & energy grade-line profiles and sizes of storm sewers have been determined using StormCAD Connect Edition, Version 10.00.00.40, by Bentley. The 2-year & 100-year hydraulic grade-lines have been shown on storm sewer profiles in the Construction Plans and design calculations have been provided in the appendices of this report. The 2-year and 100-year energy grade line design calculations have also been provided in the appendices of this report but are not shown on profiles in the construction plans.

E. Variance from Criteria

There are no variances requested with this project.

F. Hydraulic Criteria

The south half of Compass Filing No. 4 project will be connecting into the Compass Filing No. 1 (Reference 8) storm drainage system. This development project is not otherwise connecting to existing storm sewer piping or open conveyance systems that are not associated with the previous Compass filings.

G. Adaptations from Criteria

No known adaptations from general UDFCD, Town of Erie, or other known local, state or federal regulations have been proposed as part of this design.

H. DRAINAGE FACILITY DESIGN

A. General Concept

Stormwater runoff from Compass Filing No. 4 will be directed to two ponds. Pond 1053 is located within Compass Filing No. 1 and was constructed in 2016. Pond C is located at the northeast corner of Compass Filing No. 4 and was partially constructed as a temporary pond for Vista Parkway improvements. Stormwater will be conveyed to the ponds by surface flow or through both proposed and existing storm sewer systems. For Pond 1053 details please refer to Compass Filing No. 1 (Reference 8).

Pond C will provide full spectrum detention as required by the Town of Erie, and will outfall via storm system under East County Line Road towards an existing roadside ditch on the south side of the existing portion of Vista Parkway. This roadside ditch will eventually outfall into Coal Creek. Concrete Trickle Channel, Micropool, and Outlet Structure will all be designed for Pond C. Restrictor Plates for the Outlet Structure will be modified for Compass Filing No. 4 are designed to release the runoff from the 100-year storm at a controlled rate in accordance with Urban Drainage Manual Volume 2, Storage Chapter (Reference 1). This design can be found in Appendix A. Pond C has an emergency spillway designed to spill over to Vista Parkway. Pond C will be sized for compensatory Storage for the runoff that is not detained on site. A maintenance access ramp to the pond bottom has been designed with the Town of Erie standards.

Pond C is sized based on the contributing impervious which determined the water quality capture volume (Excess Urban Runoff Volume – EURV) plus the 100 year detention volumes. The EURV release rate is based on a drain time of 72 hours.

Pond C is designed to capture an initial surcharge volume. This initial surcharge volume is required by UDFCD to be at least 0.3% of the WQCV and have a depth of at least 4 inches. With a designed WQCV of 0.207 acre feet, the initial surcharge volume must be at least 27.05 cubic feet. The proposed design provides a volume of 27.405 cubic feet with a depth of 4 inches which is more than adequate for the purposes of Pond C.

Storm-water runoff within the developed residential portions of the site will have the following runoff characteristics: runoff within the individual lots will be conveyed from roofs through downspouts to shallow side lot swales and sheet flow to adjacent streets or tracts. Once runoff is within the street it will be conveyed within the street section to storm sewer inlets. Runoff captured in proposed inlets will be conveyed in storm sewer pipe to designated outfall into conveyance channels. Offsite runoff will be intercepted at the property line and directed into onsite conveyance channels and combined with onsite storm runoff.

All stormwater runoff will be conveyed from Proposed Pond C to Coal Creek. The Pond C outlet pipe is a 30”-19” elliptical storm pipe that outfalls to an existing roadside ditch along the south end of the existing Vista Parkway. The conveyance to Coal Creek is an existing roadside ditch along the south end of the existing Vista Parkway.

B. Summary of Storm Drainage Facilities

1. Mitigation for offsite drainage:

   The CUHP drainage basin maps define offsite as well as onsite drainage basins used for the CUHP analysis. For the Compass Filing No. 4 Development design, the onsite area was analyzed for full build out with the future proposed land use, which is multi-family residential. Compass Filing No. 4 will disturb how existing offsite storm water moves overland through the site. However, the north and east boundaries of Compass Filing No. 4 will continue to drain away from the site and therefore no measures will be taken to route this runoff through or onto Compass Filing No. 4. During minor storm events very little runoff is expected from the offsite area or the undeveloped onsite area. The permanent drainage channels that have been proposed as part of the Compass Filing No. 1 (Reference 8) and Compass Filing No. 2 (Reference 9) development were designed for the future ultimate condition and have been constructed for the full build out design. Existing offsite runoff west of the Compass Filing No. 3 development will be intercepted by a permanent drainage channel in Tract A. The undeveloped undisturbed offsite runoff north of the Compass Filing No. 1 will be intercepted by constructed permanent drainage channels in Filing 1 Plan Tract H conveyed to the regional detention pond.

The rational method was used to analyze the developed portions of Filing No. 4 development to size both inlets and storm sewer. The drainage channels were analyzed in the Filing No. 1 & Filing No. 2 (Reference 8 & 9) using both the CUHP and Rational methods and designed for the more conservative flow.

2. Detention Pond Storage and Outlet Design:
   a) Pond C has been designed and constructed as a part of Compass Filing No. 3 project (Reference 10). The pond was sized to detain the 100-year event in accordance with UDFCD criteria. The Town of Erie requested the use of the EURV in conjunction with Water Quality Volume as the preferred design for detention for storm events less than the 100-year event. It was also found that the analysis for the EURV and WQV of only the onsite full build out development area produced the largest amount of volume and runoff for the EURV and Water Quality design. This was anticipated because the S.C.S. Type B soils present do not produce significant runoff during lower intensity storm events and the imperviousness of the onsite area is much greater without including the offsite pervious area in the calculation.

   Access and Tracts for Drainage Facilities:

   Tracts have been provided for open drainage channels as wells as conveyance piping to the open drainage channels. A Tract has also been provided for the regional detention pond. All drainage infrastructure and facilities are either in the Right-of-Way or have been provided with a Public Tract. No access easements have been proposed or required. All drainage channels are either accessible from the Right-of-Way or by use of the 8-foot wide concrete trails.

   Downstream Impacts on Properties:

There are not any anticipated impacts on downstream properties from flow released from the site. 100-year flows coming from the pond are anticipated to be well under the capacity of the existing Vista Parkway swale to the east of the site. The runoff from the existing undeveloped land to the south is anticipated to drain well before the pond contributes any significant flow in the 100-year storm event. For the design check regarding this existing swale refer to the calculations in Appendix C of this report.

Impact on Existing Flood Plain or Major Drainage Way:

No impacts are anticipated to the flood plain. This project proposes to release storm water at flows that have been considered as part of the Major Drainage Plan and flood plain studies. The Compass Filing No. 1 project constructed a new outfall at the Coal Creek west bank and armoring with rock rip rap to reduce erosion impact, however Compass Filing No. 4 does not propose any other construction to the regional detention pond or outlet conveyance structures.

C. Basin A Detail Storm Drainage Facilities

Basin A (21.51 AC)

This basin makes up the southern half of the Compass Filing No. 4 site. The runoff from this basin will be directed to Pond 1053 through both proposed and existing storm sewer systems. Runoff from this basin will generally sheet flow to the south.

Basin A-10 (2.11 AC) Flows to DP110

Runoff from this basin follows the typical pattern in which it sheet flows across the rear portions of residential lots and tree lawn and enters the street curb and gutter of Quest Drive. Flows are then conveyed via curb and gutter to design point DP110 (Part of Compass Filing No. 3, Reference 9) at the northeast corner of the intersection of Quest Drive and Compass Parkway. From this inlet, runoff enters the existing storm sewer system and ultimately discharges into Pond 1053. The 15’ Type R Inlet (INLET A4 from Compass Filing No. 1) has been designed to collect all of the 2-year & 100-year storm events. If the inlet were to be plugged, emergency overflow will continue to the south until it reaches Compass Parkway. From there the flow will travel to the east until it reaches existing Inlet A14, where runoff will also ultimately enter existing storm sewer and the Regional Detention Pond 1053.

Basin A-13 (1.00 AC) Flows to DP113

Runoff from this basin follows the typical pattern in which it sheet flows across portions of residential lots and tree lawn and enters the street curb and gutter of Green Court. Flows are then conveyed via curb and gutter to design point DP113 at the northeast corner of the Green Court and Private Drive (Tract M) intersection. From this inlet, runoff enters the proposed storm sewer system and ultimately discharges into Pond 1053. The 10’ Type R On Grade inlet (STM INLET A09.2) has been designed to collect all of the 2-year storm event. An anticipated flow of 0.7 cfs is expected to bypass this inlet in the 100-year storm and into STM INLET A04.1. If the inlet were to be plugged, emergency overflow will continue east down Cabot Drive toward DP114 and to the proposed storm sewer located at the southeast of Filing No. 4, where runoff will ultimately enter existing storm sewer and the Regional Detention Pond 1053.

Basin A-14 (1.17 AC) Proposed Flows to DP114

Runoff from this basin follows the typical pattern in which it sheet flows across portion of residential lots and tree lawn and enters Tract N. Flows are then conveyed via sheet flow to a swale on the east side of the basin that ultimately flows to design point DP114 on the southeast portion of the basin. From this inlet, runoff enters the proposed storm sewer system and ultimately discharges into Pond 1053. The Type C Sump inlet (STM INLET A08.2) has been designed to collect all of the 2-year storm & 100-year storm events. If the inlet were to be plugged, emergency overflow will go over the sidewalk into Green Court and continue toward DP114.1 and ultimately to the existing storm sewer and the Regional Detention Pond 1053.

Basin A-14.1 (1.76 AC) Proposed Flows to DP114.1

Runoff from this basin follows the typical pattern in which it sheet flows across portions of residential lots and tree lawn and enters the street curb and gutter of Green Court. Flows are then conveyed via curb and gutter to design point DP114.1 on the east portion of Green Court. From this inlet, runoff enters the proposed storm sewer system and ultimately discharges into Pond 1053. The 15’ Type R Sump inlet (STM INLET A04.1) has been designed to collect all of the 2-year storm event. An anticipated flow of 0.3 cfs is expected to bypass this inlet in the 100-year storm and into STM INLET A04.2. If the inlet were to be plugged, emergency overflow will go over the crown of Green Court and continue toward DP116 and ultimately to the existing storm sewer and the Regional Detention Pond 1053.

Basin A-15 (2.72 AC) Proposed Flows to DP115

Runoff from this basin follows the typical pattern in which it sheet flows across portions of residential lots, alleys, and tree lawn and enters the street curb and gutter of Green Court. Flows are then conveyed via curb and gutter to design point DP115 at the southeast corner of Green Court and Private Drive (Tract T) intersection. From this inlet, runoff enters the proposed storm sewer system and ultimately discharges into Pond 1053. The 15’ Type R On Grade inlet (STM INLET A09.1) has been designed to collect all of the 2-year storm event. An anticipated flow of 2.4 cfs is expected to bypass this inlet in the 100-year storm and into STM INLET A07.1. If the inlet were to be plugged, emergency overflow will continue east down Green Court to DP116 and ultimately to the existing storm sewer and the Regional Detention Pond 1053.

Basin A-15.1 (0.48 AC) Proposed Flows to DP115.1

Runoff from this basin follows the typical pattern in which it sheet flows across portions of open space towards a small swale on the east side of the basin. Flows are then conveyed via the swale to design point DP115.1. From this inlet, runoff enters the proposed storm sewer system and ultimately discharges into Pond 1053. The Type C Sump inlet (STM INLET A08.1) has been designed to collect all of the 2-year storm & 100-year storm events. If the inlet were to be plugged, emergency overflow will continue north over the sidewalk into Green Court curb and gutter until reaching DP116 and ultimately to the existing storm sewer and the Regional Detention Pond 1053.

Basin A-15.2 (0.22 AC) Proposed Flows to DP115.2

Runoff from this basin follows the typical pattern in which it sheet flows across tree lawn and enters the street curb and gutter of Green Court. Flows are then conveyed via curb and gutter to design point DP115.2. From this inlet, runoff enters the proposed storm sewer system and ultimately discharges into Pond 1053. The 10' Type R On Grade inlet (STM INLET A07.1) has been designed to collect all of the 2-year storm event. An anticipated flow of 2.4 cfs is expected to bypass STM-INLET-A09.1. If the inlet were to be plugged, emergency overflow will continue east down Green Court to DP116 and ultimately to the existing storm sewer and the Regional Detention Pond 1053.

Basin A-16 (1.66 AC) Proposed Flows to DP116

Runoff from this basin follows the typical pattern in which it sheet flows across portions of residential lots and tree lawn and enters the street curb and gutter of Green Court. Flows are then conveyed via curb and gutter to design point DP116 at the east side of Green Court. From this inlet, runoff enters the proposed storm sewer system and ultimately discharges into Pond 1053. The 15' Type R Sump inlet (STM INLET A04.2) has been designed to collect all of the 2-year & 100-year storm events. An anticipated overflow of 0.3 cfs is expected to reach this inlet and has been sized to accommodate the additional flows from across Basin A. If the inlet were to be plugged, emergency overflow will overtop the curb at this location and flow into the open space to the east to the area inlet at DP116.2 and ultimately into the Regional Detention Pond 1053.

Basin A-16.1 (4.19 AC) Flows to DP116.1

Runoff from this basin follows the typical pattern in which it sheet flows across open space until it reaches DP116.1 at the southeast corner of the development of Compass Filing No. 4. From this existing inlet, runoff enters the existing storm sewer system and ultimately discharges into Pond 1053. The Type '13' Inlet (INLET A12 from Compass Filing No. 1) has been designed to collect all of the 2-year & 100-year storm events. If the inlet were to be plugged, emergency overflow will overtop the curb at this location and flow into the open space to the south of the site and ultimately into East County Line Road. From East County Line Road flows will continue to the north until it will reach a roadside ditch on the west side of the East County Line Road.

Basin A-16.2 (1.32 AC) Flows to DP116.2

Runoff from this basin follows the typical pattern in which it sheet flows across residential lots, private drives, and open space and enters proposed swale. Flows are then conveyed to design point DP116.2 on the east portion of the site. From this proposed Type C Inlet, runoff enters the existing storm sewer system and ultimately discharges into Pond 1053. The proposed Type C Inlet (INLET A01) has been designed to collect all of the 2-year & 100-year storm events. Two identical type C inlets have been placed within this basin, both inlets are capable of accepting all of the 100-year flow. The system is overdesigned for safety measures. If both inlets were to be plugged, emergency overflow will go to the east and into East County Line Road.

Basin A-16.3 (0.38 AC) Flows to DP116.3

Runoff from this basin follows the typical pattern in which it sheet flows across residential lots and open space and enters proposed swale. Flows are then conveyed to design point DP116.3 on the southeast portion of the site. From this proposed Type C Inlet, runoff enters the proposed storm sewer system and ultimately connects to existing storm sewer and discharges into Pond 1053. The proposed Type C Inlet (INLET A06.1) has been designed to collect all of the 2-year & 100-year storm events. Two identical type C inlets have been placed within this basin, both inlets are capable of accepting all of the 100-year flow. The other proposed Type C Inlet (Inlet A06.2) is located directly south of Inlet A06.1 and is being used to prevent stormwater flow across the proposed walk in Basin A-16.3. Inlet A06.2 has been designed to collect all of the 2-year & 100-year storm events. The system is overdesigned for safety measures. If both inlets were to be plugged, emergency overflow will go to the north and into STM-INLET-A04.2.

Basin A-17 (4.49 AC) Flows to DP117

Runoff from this basin follows the typical pattern in which it sheet flows across open space and enters street curb and gutter of Compass Parkway. Flows are then conveyed via curb and gutter to design point DP117 at the northwest corner of Compass Parkway and East County Line Road. From this existing inlet, runoff enters the existing storm sewer system and ultimately discharges into Pond 1053. The existing 15’ Type R Inlet (INLET A14 from Compass Filing No. 1) has been designed to collect all of the 2-year & 100-year storm events. If the inlet were to be plugged, emergency overflow will overtop the crown of Compass Parkway and continue to the south until reaching existing Inlet A15 from Compass Filing No. 1 and ultimately to the existing storm sewer and the Regional Detention Pond 1053.

Basin C (12.12 AC)

This basin makes up the northern half of Compass Filing No. 4 site. The runoff from this basin will be directed to Detention Pond C through both proposed and existing storm sewer systems. Runoff from this basin will generally sheet flow to the north.

Basin C-1 (1.90 AC) Flows to DP301

Basin C is comprised of Pond C. Pond C has already been partially constructed with Compass Filing No. 3 and Vista Parkway. Pond C will be expanded to the south as a part of Compass Filing No. 4. It is located at the northwest corner of the Compass Filing No. 4. Pond C will detain all runoff from the developed Basins C2-C8. The drainage area planned to be detained by Pond C is 12.12 acres. The 100-year storage volume (including WQCV) is 1.51 acre-ft. The 100-year water surface elevation is 5094.93, with a total 100-year release rate of 13.90. Pond C will discharge to the east to a roadside ditch on the south side of Vista Parkway.

Basin C-2 (0.69 AC) Flows to DP302

Runoff from this basin follows the typical pattern in which it sheet flows across portions of residential lots and tree lawn and enters the street curb and gutter of Vista Parkway. Flows are then conveyed via curb and gutter to design point DP302 at the west corner of Vista Parkway and Wright Drive. From this inlet, runoff enters the existing storm sewer system and ultimately discharges into Proposed Detention Pond C. The 10’ Type R On Grade Inlet (INLET C07 from Compass Filing No. 3) has been designed to collect all of the 2-year & 100-year storm events. If the inlet were to be plugged, emergency overflow will continue to the east through the cross pan at the intersection of Vista Parkway and Wright Drive until reaching existing Inlet C03 (from Compass Filing No. 3) and ultimately the runoff would enter Proposed Detention Pond C.

Basin C-3 (2.53 AC) Flows to DP303

Runoff from this basin follows the typical pattern in which it sheet flows across portions of residential lots and tree lawn and enters the street curb and gutter of Green Court. Flows are then conveyed via curb and gutter to design point DP303 at the west portion of the Green Court and Wright Drive intersection. From this inlet, runoff enters the proposed storm sewer system and ultimately discharges into Proposed Detention Pond C. The 15’ Type R On Grade Inlet (STM-INLET-C12.2) has been designed to collect all of the 2-year storm event. An anticipated flow of 1.6 cfs is expected to bypass this inlet in the 100-year storm and into STM INLET-C09. If this inlet were to be plugged, emergency overflow will overtop the curb at this location and flow directly into Proposed Detention Pond C.

Basin C-4 (0.99 AC) Flows to DP304

Runoff from this basin follows the typical pattern in which it sheet flows across portions of residential lots and tree lawn and enters the street curb and gutter of Wright Drive and Vista Parkway. Flows are then conveyed via curb and gutter to design point DP304 at the south side of Vista Parkway. From this inlet, runoff enters the proposed storm sewer system and ultimately the proposed Pond C. The 15’ Type R On Grade Inlet (STM-INLET-C03) has been designed to collect all of the 2-year & 100-year storm events. If the inlet were to be plugged, emergency overflow will overtop the curb at this location and sheet flow directly into proposed Pond C.

Basin C-5 (1.51 AC) Flows to DP305

Runoff from this basin follows the typical pattern in which it sheet flows across portions of residential lots and tree lawn and enters the street curb and gutter of Green Court. Flows are then conveyed via curb and gutter to design point DP305 at the northeast corner of Green Court. From this inlet, runoff enters the proposed storm sewer system and ultimately discharges into Proposed Detention Pond C. The 15’ Type R Sump Inlet (STM-INLET-C09) has been designed to collect all of the 2-year & 100-year storm events. An anticipated overflow of 5.3 cfs is expected to reach this inlet in the 100-year storm and has been sized to capture this additional flow. If the inlet were to be plugged, emergency overflow will overtop the curb at this location and flow directly into Proposed Detention Pond C.

Basin C-6 (2.16 AC) Flows to DP306

Runoff from this basin follows the typical pattern in which it sheet flows across portions of residential lots and tree lawn and enters the street curb and gutter of Green Court. Flows are then conveyed via curb and gutter to design point DP306 at the southwest portion of Green Court. From this inlet, runoff enters the proposed storm sewer system and ultimately discharges into Proposed Detention Pond C. The 15’ Type R Sump Inlet (STM-INLET-C10.1) has been designed to collect all of the 2-year storm event. An anticipated flow of 3.7 cfs is expected to bypass this inlet in the 100-year storm and into STM INLET C09. If the inlet were to be plugged, emergency overflow will overtop the curb at this location and flow directly into Proposed Detention Pond C.

Basin C-7 (0.29 AC) Flows to DP307

Runoff from this basin follows the typical pattern in which it sheet flows across open space and tree lawn and enters the street curb and gutter of Green Court. Flows are then conveyed via curb and gutter to design point DP307 on the south portion of Green Court. From this inlet, runoff enters the proposed storm sewer system and ultimately discharges into Proposed Detention Pond C. The 5’ Type R On Grade Inlet (INLET C12.1 from Compass Filing No. 3) has been designed to collect all of the 2-year storm event. An anticipated flow of 0.1 is expected to bypass this inlet in the 100-year storm and into STM INLET C10.1. From this inlet, runoff enters the existing storm sewer system and ultimately the proposed Pond C. If the inlet C12.1 were to be plugged, emergency overflow will continue to the east on the Green Court curb and gutter until reaching STM-INLET-C10.1 and eventually into proposed Detention Pond C.

Basin C-8 (0.78 AC) Flows to DP308

Runoff from this basin follows the typical pattern in which it sheet flows across portions of detached sidewalk and tree lawn and enters the street curb and gutter of Vista Parkway. Flows are then conveyed via curb and gutter to design point DP308 on the north side of Vista Parkway. From this inlet, runoff enters the storm sewer system and ultimately discharges into Proposed Detention Pond C. The 15’ Type R On Grade Inlet (STM-INLET-C04) has been designed to collect all of the 2-year & 100-year storm events. If the inlet were to be plugged, emergency overflow will continue to the east in the Vista Parkway curb and gutter until reaching East County Line Road at which it will enter the existing roadside ditch and will travel north along East County Line road.

Basin C-9 (0.74 AC) Flows to DP309

Basin C-9 Flow from proposed Filing No. 4 will flow to the east until reaching the west side of the intersection of East County Line Road and Vista Parkway located at DP309. Flow from here will then flow to the north and into the roadside ditch on the west side of East County Line and offsite. Since no water from this sub-basin will be detained, compensatory volume has been added to Pond C.

Basin OS-1 (0.54 AC) Flows to DP310

Basin OS-1 Flow from existing East County Line Road will flow to the north until reaching the existing storm sewer system and ultimately discharges into Proposed Detention Pond C. The 10’ Type R On Grade Inlet (INLET C10 from Compass Filing No. 3) has been designed to collect all of the 2-year & 100-year storm events. If the inlet were to be plugged, emergency overflow will continue to the north along East County Line Road until it reaches the intersection with Vista Parkway at which point it will enter the existing roadside ditch and will travel north along East County Line road.

I. CONCLUDING SUMMARY

This report was prepared in accordance with the procedures and concepts outlined in the Town of Erie’s Standards and Specifications for Design and Construction of Public Improvements (Reference 4), the Urban Drainage and Flood Control District’s Urban Storm Drainage Criteria Manual, Volumes, I, II, and III (Reference 1), the Compass Filing No. 1, Phase III Drainage Report (Reference 8), the Compass Filing No. 2, Phase III Drainage Report (Reference 9) and the Compass Filing No. 3, Phase III Drainage Report (Reference 10). The drainage patterns and methods described in this Phase III Drainage Report are consistent with the 2014 Outfall Systems Planning Reports (Reference 7) and with reasonable drainage engineering design.

No adverse effects to surrounding properties are anticipated from the development of this site. Drainage facilities will be designed to convey, release and protect the quality of storm water runoff, up to and including the 100-year storm event, in a safe manner to protect life and minimize damage to property.

J. REFERENCES

1. *Urban Storm Drainage Criteria Manual, volumes 1, 2, and 3*, Urban Drainage and Flood Control District, March 2017.

2. *Natural Resources Conservation Center Web Soil Survey*, United States Department of Agriculture, site visited April 2013.

3. *Federal Emergency Management Agency Flood Insurance Rate Map*, Community-Panel Number 08013C0439J, Map Revised December 18, 2012.

4. *Standards and Specifications for Design and Construction of Public Improvements-2012 Edition*, Town of Erie, CO

5. *Erie Outfall Systems Planning – Preliminary Design – Erie and Adjacent Boulder and Weld County Areas*, Town of Erie and UDFCD, May 2001.

6. *Town of Erie Outfall Systems Plan (West of Coal Creek) – Baseline Hydrology Report – Urban Drainage & Flood Control District, Town of Erie, Colorado, January 2013*.

7. *Town of Erie Outfall Systems Plan (West of Coal Creek) – Alternative Analysis Report– Urban Drainage & Flood Control District, Town of Erie, Colorado, January 2014*.

8. *Compass Filing No. 1, Phase III Drainage Report-Jansen Strawn Consulting Engineers 2014.*

9. *Compass Filing No. 2, Phase III Drainage Report-Jansen Strawn Consulting Engineers 2014.*

10. *Standards and Specifications for Design and Construction of Public Improvements-2017 Edition*, Town of Erie, CO

11. *Compass Filing No. 3, Phase III Drainage Report-Jansen Strawn Consulting Engineers 2017.*

12. *NOAA's National Weather Service, Hydrometeorological Design Studies Center, Precipitation Frequency Data Server (PFDS), site visited March 2017.*

APPENDIX A

Land Use Maps

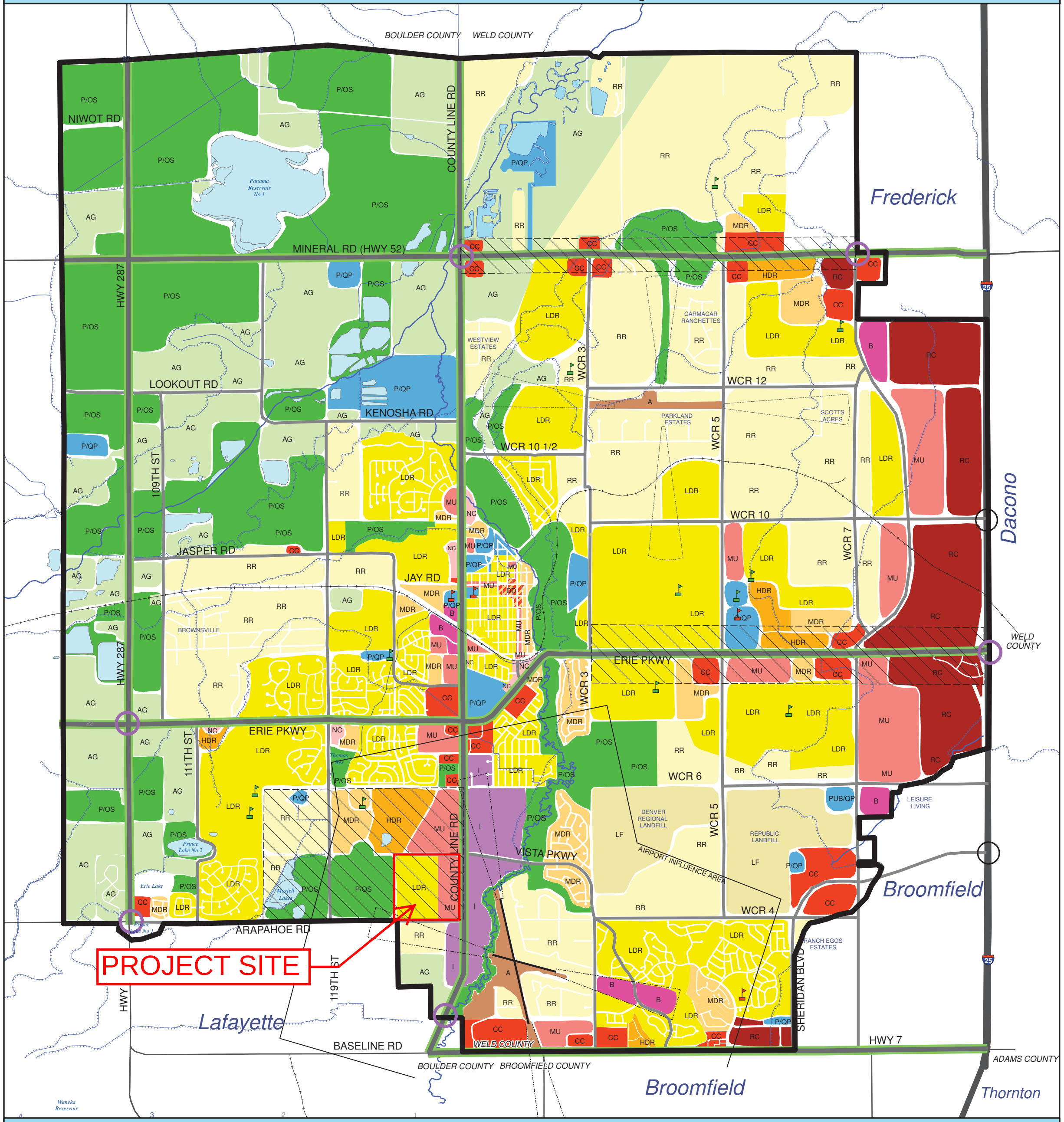
Vicinity Map

Soil Classification Map

FEMA FIRM Panel

Drainage Design Criteria

Town of Erie, Colorado
2005 Comprehensive Plan
Land Use Plan Map



Land Use Plan Legend

AG	Agriculture
P/OS	Parks/Public Open Space
P/QP	Public/Quasi Public
LF	Landfill
A	Airport
RR	Rural Residential (0-2 du/ac)
LDR	Low Density Residential (2-6 du/ac)
MDR	Medium Density Residential (6-12 du/ac)
HDR	High Density Residential (12-20 du/ac)
DD	Downtown District
NC	Neighborhood Commercial
CC	Community Commercial
RC	Regional Commercial
MU	Mixed Use
B	Business
I	Industrial
🟦	Reservoirs
⬚	County Boundary
▭	Planning Area Boundary
▨	Areas of Special Consideration
⋯	Canal/Ditch
┼	Railroad
○	Community Gateways
○	I-25 Interchange (Future)
⚑	Elementary School
⚑	Middle School
⚑	High School

0 0.25 0.5 1 Miles

Sources: Boulder CO GIS, Weld CO GIS, CDOT, Town of Erie

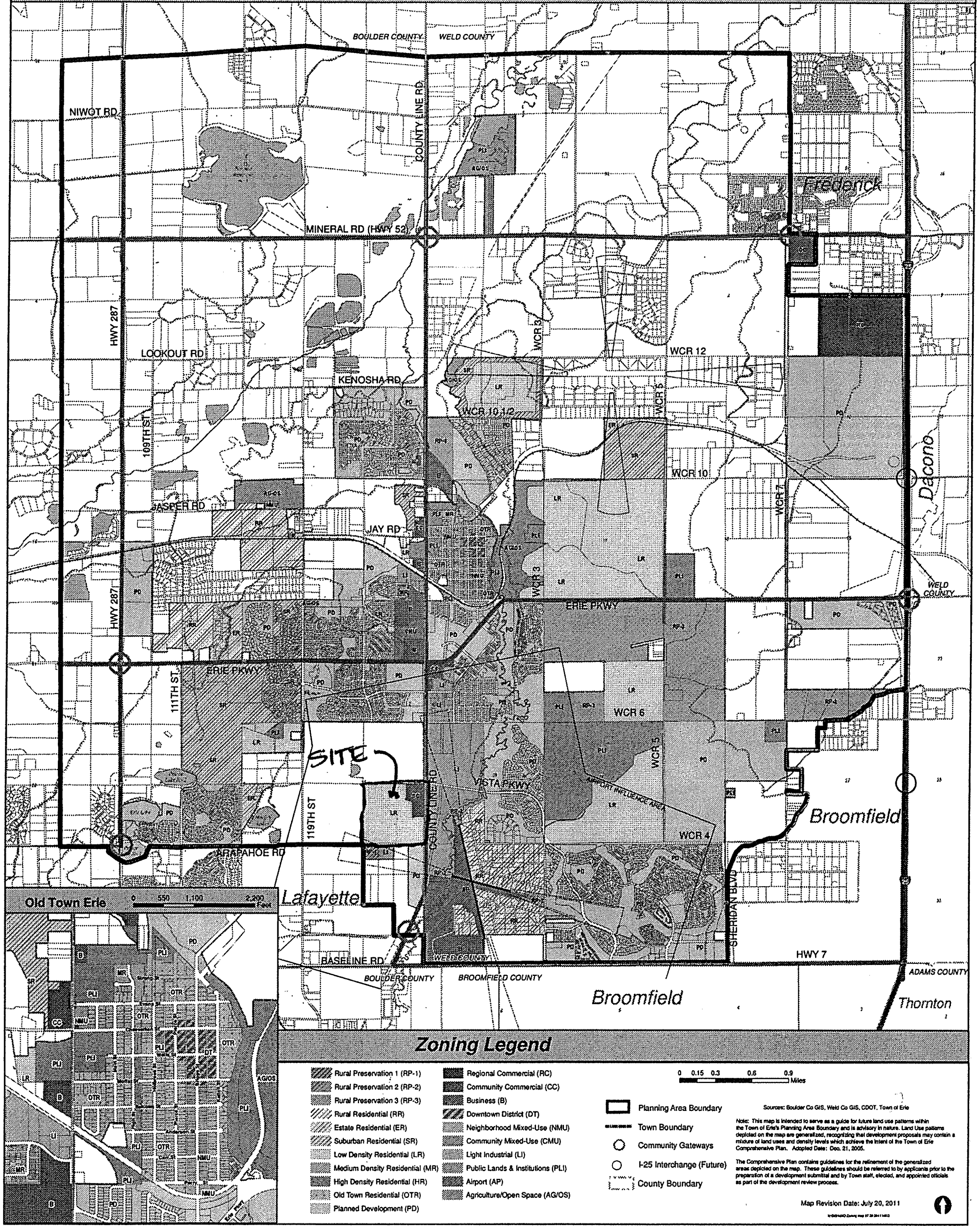
Note: This map is intended to serve as a guide for future land use patterns within the Town of Erie's Planning Area Boundary and is advisory in nature. Land Use patterns depicted on the map are generalized, recognizing that development proposals may contain a mixture of land uses and density levels which achieve the intent of the Town of Erie Comprehensive Plan. Adopted Date: Dec. 21, 2005.

The Comprehensive Plan contains guidelines for the refinement of the generalized areas depicted on the map. These guidelines should be referred to by applicants prior to the preparation of a development submittal and by Town staff, elected, and appointed officials as part of the development review process.

Town Boundary Not Shown - Refer to Zoning Map for Town Boundary

Map Revision Date: JULY 20, 2011

Town of Erie, Colorado
Zoning Map

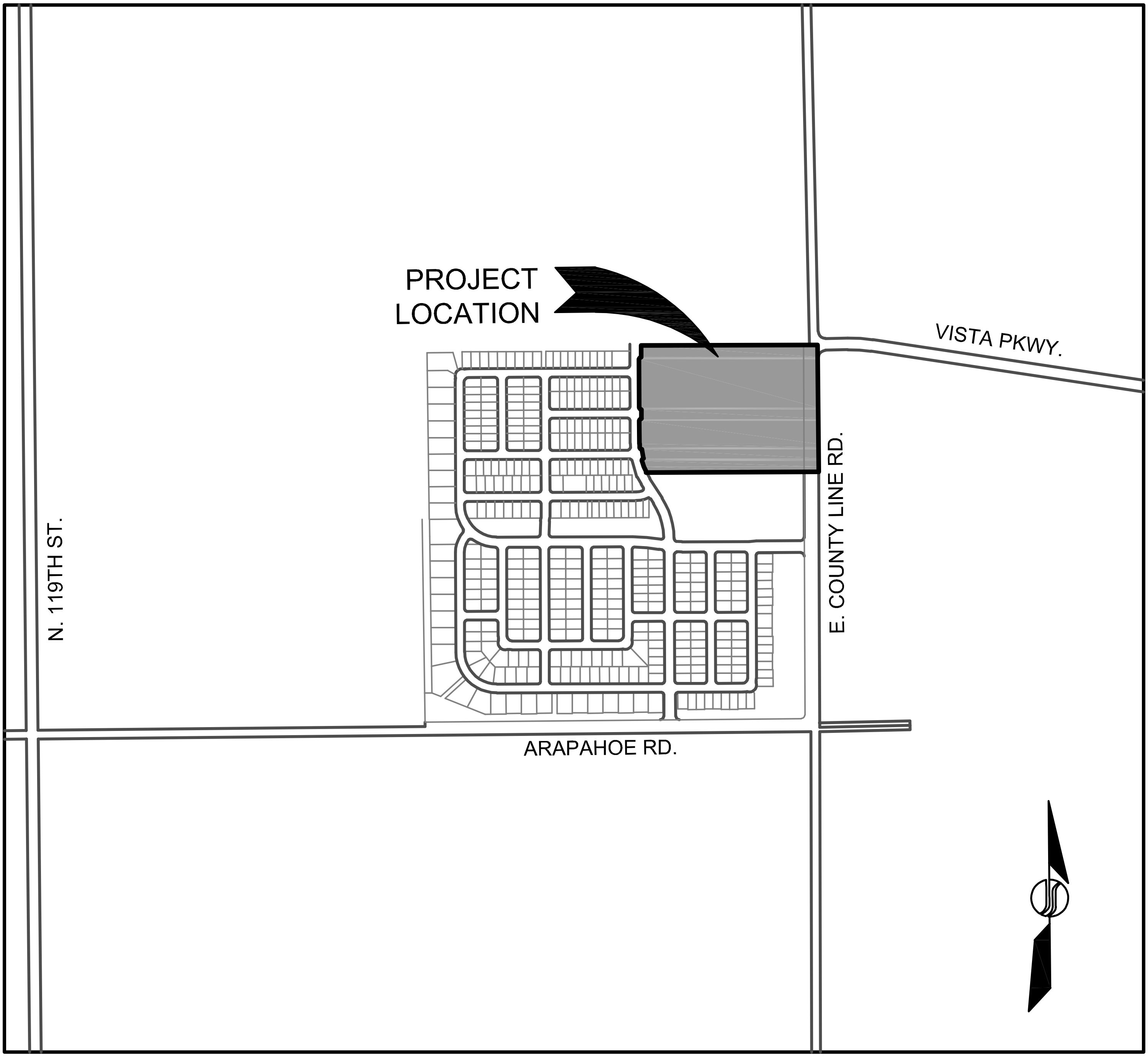


Sources: Boulder Co GIS, Weld Co GIS, CDOT, Town of Erie

Note: This map is intended to serve as a guide for future land use patterns within the Town of Erie's Planning Area Boundary and is advisory in nature. Land Use patterns depicted on the map are generalized, recognizing that development proposals may contain a mixture of land uses and density levels which achieve the intent of the Town of Erie Comprehensive Plan. Adopted Date: Dec. 21, 2005.

The Comprehensive Plan contains guidelines for the refinement of the generalized areas depicted on the map. These guidelines should be referred to by applicants prior to the preparation of a development submittal and by Town staff, elected, and appointed officials as part of the development review process.

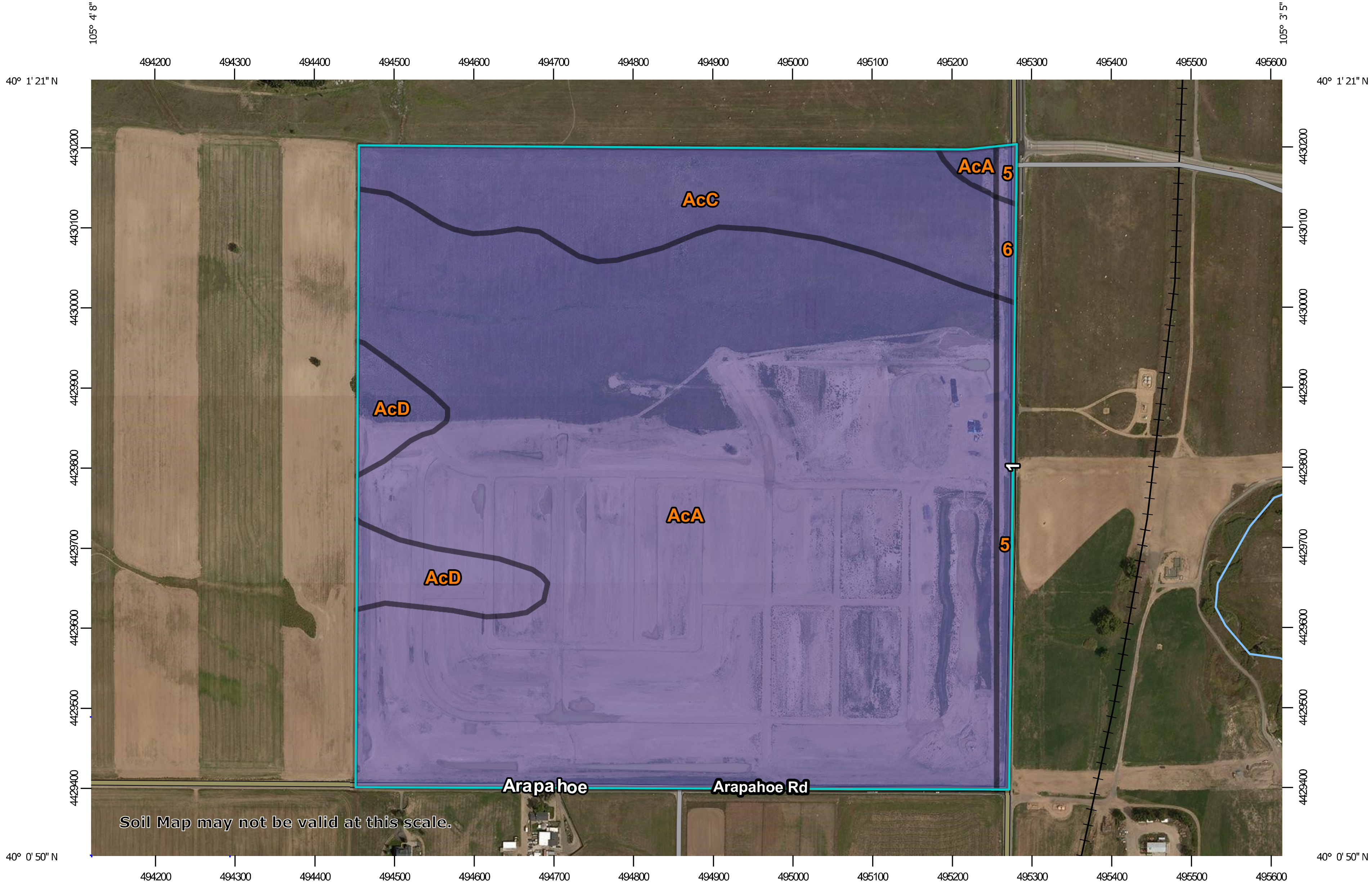
Map Revision Date: July 20, 2011



VICINITY MAP

N.T.S.

Hydrologic Soil Group—Boulder County Area, Colorado; and Weld County, Colorado, Southern Part



Map Scale: 1:6,830 if printed on A landscape (11" x 8.5") sheet.

N

0 100 200 400 600 Meters

0 300 600 1200 1800 Feet

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 scales ranging from 1:20,000 to 1:24,000.

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: Boulder County Area, Colorado
Survey Area Data: Version 13, Sep 23, 2016

Soil Survey Area: Weld County, Colorado, Southern Part
Survey Area Data: Version 15, Sep 22, 2016

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Aug 30, 2014—Sep 18, 2014

MAP LEGEND

MAP INFORMATION

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Boulder County Area, Colorado (CO643)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AcA	Ascalon sandy loam, 0 to 3 percent slopes	B	129.8	79.4%
AcC	Ascalon sandy loam, 3 to 5 percent slopes	B	22.7	13.9%
AcD	Ascalon sandy loam, 5 to 9 percent slopes	B	7.1	4.3%
Subtotals for Soil Survey Area			**159.5**	**97.6%**
Totals for Area of Interest			**163.5**	**100.0%**

Hydrologic Soil Group— Summary by Map Unit — Weld County, Colorado, Southern Part (CO618)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
5	Ascalon sandy loam, 0 to 3 percent slopes	B	3.2	2.0%
6	Ascalon sandy loam, 3 to 5 percent slopes	B	0.7	0.4%
Subtotals for Soil Survey Area			**3.9**	**2.4%**
Totals for Area of Interest			**163.5**	**100.0%**

Description

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.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

RUSLE2 Related Attributes

This report summarizes those soil attributes used by the Revised Universal Soil Loss Equation Version 2 (RUSLE2) for the map units in the selected area. The report includes the map unit symbol, the component name, and the percent of the component in the map unit. Soil property data for each map unit component include the hydrologic soil group, erosion factors Kf for the surface horizon, erosion factor T, and the representative percentage of sand, silt, and clay in the surface horizon.

Report—RUSLE2 Related Attributes

RUSLE2 Related Attributes– Boulder County Area, Colorado

Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
AcB—Ascalon sandy loam, 1 to 3 percent slopes								
Ascalon	90	—	B	.24	5	66.6	23.4	10.0
Otero	9	—	—	—	—	—	—	—
Aquic haplustolls	1	—	—	—	—	—	—	—
AcC—Ascalon sandy loam, 3 to 5 percent slopes								
Ascalon	90	—	B	.24	5	66.6	23.4	10.0
Otero	7	—	—	—	—	—	—	—
Kim	2	—	—	—	—	—	—	—
Aquic haplustolls	1	—	—	—	—	—	—	—
AcD—Ascalon sandy loam, 5 to 9 percent slopes								
Ascalon	80	—	B	.24	5	66.6	23.4	10.0
Olney	10	—	—	—	—	—	—	—
Terry	5	—	—	—	—	—	—	—
Otero	4	—	—	—	—	—	—	—
Aquic haplustolls	1	—	—	—	—	—	—	—
AoD—Ascalon-Otero complex, 5 to 9 percent slopes								
Ascalon	50	—	B	.24	5	66.6	23.4	10.0
Otero	35	—	B	.28	5	65.9	19.1	15.0
Kim	8	—	—	—	—	—	—	—
Terry	5	—	—	—	—	—	—	—
Aquic haplustolls	1	—	—	—	—	—	—	—
Cascajo	1	—	—	—	—	—	—	—

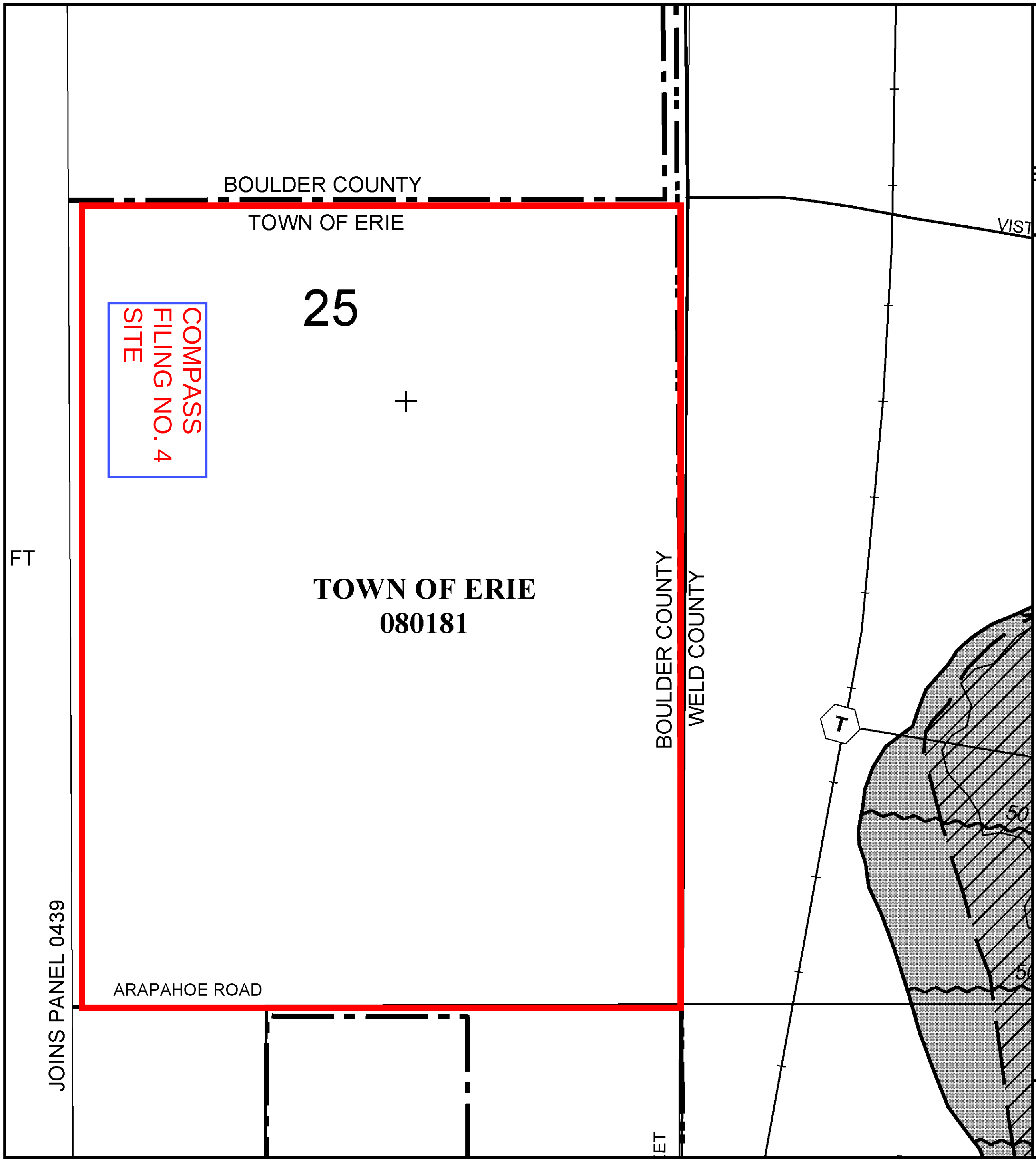
RUSLE2 Related Attributes– Boulder County Area, Colorado								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
W—Water								
Water	95	—	—	—	—	—	—	—
Aquolls	5	—	—	—	—	—	—	—

RUSLE2 Related Attributes– Weld County, Colorado, Southern Part								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
5—Ascalon sandy loam, 1 to 3 percent slopes								
Ascalon	90	—	B	.24	5	66.6	23.4	10.0
Stoneham	10	—	—	—	—	—	—	—
6—Ascalon sandy loam, 3 to 5 percent slopes								
Ascalon	90	—	B	.24	5	66.6	23.4	10.0
Stoneham	10	—	—	—	—	—	—	—
20—Colombo clay loam, 1 to 3 percent slopes								
Colombo	85	—	B	.17	5	35.4	33.6	31.0
Dacono	5	—	—	—	—	—	—	—
Heldt	5	—	—	—	—	—	—	—
Nunn	5	—	—	—	—	—	—	—
40—Nunn loam, 1 to 3 percent slopes								
Nunn	85	—	C	.24	5	39.2	37.3	23.5
Dacono	5	—	—	—	—	—	—	—
Heldt	4	—	—	—	—	—	—	—
Altvan	3	—	—	—	—	—	—	—
Platner	3	—	—	—	—	—	—	—
48—Olney fine sandy loam, 3 to 5 percent slopes								
Olney	85	—	B	.28	5	65.4	19.6	15.0
Zigweid	9	—	—	—	—	—	—	—
Vona	6	—	—	—	—	—	—	—

Data Source Information

Soil Survey Area: Boulder County Area, Colorado
Survey Area Data: Version 9, May 1, 2009

Soil Survey Area: Weld County, Colorado, Southern Part
Survey Area Data: Version 11, Aug 27, 2009



MAP SCALE 1" = 500'

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0443J

FIRM

FLOOD INSURANCE RATE MAP
BOULDER COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 443 OF 615

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BOULDER COUNTY	080023	0443	J
ERIE, TOWN OF	080181	0443	J
LAFAYETTE, CITY OF	080026	0443	J

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08013C0443J

MAP REVISED
DECEMBER 18, 2012

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

4.0 Intensity-Duration Curves for Rational Method

To develop depth-duration curves or intensity-duration curves for the Rational Method of runoff analysis take the 1-hour depth(s) obtained from NOAA Atlas 14 and apply Equation 5-1 for the duration (or durations) of interest:

$$I = \frac{28.5\,P_1}{(10 + T_d)^{0.786}}$$ Equation 5-1

Where:

I = rainfall intensity (inches per hour)

P_1 = 1-hour point rainfall depth (inches)

T_d = storm duration (minutes)

Statistical analyses may be used in certain situations outside the UDFCD boundary. The use of this approach requires the availability of acceptable, appropriate, and adequate data.

Table 6-1. Applicability of hydrologic methods

Watershed Size (acres)	Is the Rational Method Applicable?	Is CUHP Applicable?
0 to 90	Yes	Yes
90 to 160	No	Yes
160 to 3,000	No	Yes[1]
Greater than 3,000	No	Yes (subdividing into smaller catchments required)[1]

1. Subdividing into smaller subcatchments and routing the resultant hydrographs using SWMM may be needed to accurately model a catchment with areas of different soil types or percentages of imperviousness.

When modeling large watersheds, the subcatchment sizes can influence results. If heterogeneous land uses are "lumped" together into large subcatchments, the models may not accurately account for the "flashy" nature of runoff from impervious surfaces and peak rates of runoff may be underestimated. On the other hand, defining very small subcatchments can lead to complicated and unrealistic routing that can overestimate peak rates of runoff.

The quantity of stormwater runoff from an urban site is also related to site characteristics (e.g., lot size, soil type, slope, vegetation, impervious area) and stormwater measures used to control runoff from the site (e.g., site grading, disconnecting impervious areas from the drainage system, detention facilities, buffer zones, low impact development practices, and other structural and nonstructural best management practices). Implementation of Low Impact Development (LID) strategies, including measures to "minimize directly connected impervious areas" (MDCIA), reduces runoff peaks and volumes from urban areas. These practices involve site planning to minimize impacts to sensitive site features, methods to reduce the overall amount of impervious areas, and routing of runoff from impervious surfaces over permeable areas to slow runoff (increase time of concentration) and promote onsite storage and infiltration. Volume 3 of the USDCM contains additional information on LID practices.

2.0 Rational Method

For urban catchments that are not complex and are generally 90 acres or less in size, it is acceptable to use the Rational Method for design storm analysis. Most engineering offices in the United States continue to use this method originally introduced in 1889. Even though this method has frequently come under academic criticism for its simplicity, no other practical drainage design method has evolved to such a level of general acceptance by the practicing engineer. The Rational Method, properly understood and applied, can produce satisfactory results for urban storm drain design and small on-site detention design and for sizing of street inlets and storm drains.

2.1 Rational Formula

The Rational Method is based on the Rational Formula:

$$Q = CIA \qquad \text{Equation 6-1}$$

Where:

Q = the peak rate of runoff (cfs)

C = Runoff coefficient–a non-dimensional coefficient equal to the ratio of runoff volume to rainfall volume

I = average intensity of rainfall for a duration equal to the time of concentration, t_c (inches/hour)

A = tributary area (acres).

Actually, Q has a unit of inches per hour per acre (in/hour/ac); however, since this rate of acre-inches/hour differs from cubic feet per second (cfs) by less than one percent, the more common units of cfs are used. The time of concentration is defined as the time required for water to flow from the most remote point of the tributary area to the design point, and is determined for the selected flow length that represents the longest waterway through a rural watershed or the most representative flow path through the impervious portion in an urban catchment.

The general procedure for Rational Method calculations for a single catchment is as follows:

1. Delineate the catchment boundary and determine its area.
2. Define the flow path from the upper-most portion of the catchment to the design point. Divide the flow path into reaches of similar flow type (e.g., overland flow, shallow swale flow, gutter flow, etc.). Determine the length and slope of each reach.
3. Determine the time of concentration, t_c, for the selected waterway.
4. Find the rainfall intensity, I, for the design storm using the calculated t_c and the rainfall intensity-duration-frequency curve (see *Rainfall* chapter).
5. Determine the runoff coefficient, C.
6. Calculate the peak flow rate, Q, from the catchment using Equation 6-1.

2.2 Assumptions

The basic assumptions for the application of the Rational Method include:

1. The computed maximum rate of runoff to the design point is a function of the average rainfall rate during the time of concentration to that point.
2. The hydrologic losses in the catchment are homogeneous and uniform. The runoff coefficients vary with respect to type of soils, imperviousness percentage, and rainfall frequencies. These coefficients represent the average antecedent soil moisture condition.
3. The depth of rainfall used is one that occurs from the start of the storm to the time of concentration. The design rainfall depth during that period is converted to the average rainfall intensity for that period.
4. The maximum runoff rate occurs when the entire area is contributing flow. This assumption is not valid where a more intensely developed portion of the catchment with a shorter time of concentration produces a higher rate of runoff than the entire catchment with a longer time of concentration.

2.3 Limitations

The Rational Method is the simplistic approach for estimating the peak flow rate and total runoff volume from a design rainstorm in a given catchment. Under the assumption of uniform hydrologic losses, the method is limited to catchments smaller than 90 acres. Under the condition of composite soils and land uses, use an area-weighted method to derive the catchment's hydrologic parameters.

The greatest drawback to the Rational Method is that it normally provides only one point (the peak flow rate) on the runoff hydrograph. When the areas become complex and where subcatchments come together, the Rational Method will tend to overestimate the actual flow, which results in oversizing of drainage facilities. The Rational Method provides no means or methodology to generate and route hydrographs through drainage facilities. One reason the Rational Method is limited to small areas is that good design practice requires the routing of hydrographs for larger catchments to achieve an economically sound design.

Another disadvantage of the Rational Method is that with typical design procedures, one normally assumes that all of the design flow is collected at the design point and that there is no water running overland to the next design point. This is not an issue of the Rational Method but of the design procedure. Use additional analysis to account for this scenario.

2.4 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is linearly proportional to the average rainfall intensity during the time required for water to flow from the most remote part of the drainage area to the design point. In practice, the time of concentration is empirically estimated along the selected waterway through the catchment.

To calculate the time of concentration, first divide the waterway into overland flow length and channelized flow lengths, according to the channel characteristics. For urban areas (tributary areas of greater than 20 percent impervious), the time of concentration, t_c, consists of an initial time or overland flow time, t_i, plus the channelized flow travel time, t_t, through the storm drain, paved gutter, roadside ditch, or channel. For non-urban areas, the time of concentration consists of an overland flow time, t_i, plus the time of travel in a defined drainage path, such as a swale, channel, or stream. Estimate the channelized travel time portion, t_t, of the time of concentration from the hydraulic properties of the conveyance element. Initial or overland flow time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. Compute the time of concentration for both urban and non-urban areas using Equation 6-2:

$$t_c = t_i + t_t \qquad \text{Equation 6-2}$$

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

2.4.1 Initial or Overland Flow Time

The initial or overland flow time, t_i, may be calculated using Equation 6-3:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{\ 0.33}}$$ Equation 6-3

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

Equation 6-3 is adequate for distances up to 300 feet in urban areas and 500 feet in rural areas. Note that in a highly urbanized catchment, the overland flow length is typically shorter than 300 feet due to effective man-made drainage systems that collect and convey runoff.

2.4.2 Channelized Flow Time

The channelized flow time (travel time) is calculated using the hydraulic properties of the conveyance element. The channelized flow time, t_t, is estimated by dividing the length of conveyance by the velocity. The following equation, Equation 6-4 (Guo 2013), can be used to determine the flow velocity in conjunction with Table 6-2 for the conveyance factor.

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$ Equation 6-4

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

The time of concentration, t_c, is the sum of the initial (overland) flow time, t_i, and the channelized flow time, t_t, as per Equation 6-2.

2.4.3 First Design Point Time of Concentration in Urban Catchments

Equation 6-4 was solely determined by the waterway characteristics and using a set of empirical formulas. A calibration study between the Rational Method and the Colorado Urban Hydrograph Procedure (CUHP) suggests that the time of concentration shall be the lesser of the values calculated by Equation 6-2 and Equation 6-5 (Guo and Urbonas 2013).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}} \qquad \text{Equation 6-5}$$

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Equation 6-5 is the regional time of concentration that warrants the best agreement on peak flow predictions between the Rational Method and CUHP when the imperviousness of the tributary area is greater than 20 percent. It was developed using the UDFCD database that includes 295 sample urban catchments under 2-, 5-, 10-, 50, and 100-yr storm events (MacKenzie 2010). It suggests that both initial flow time and channelized flow velocity are directly related to the catchment's imperviousness (Guo and MacKenzie 2013).

The first design point is defined as a node where surface runoff enters the storm drain system. For example, all inlets are "first design points" because inlets are designed to accept flow into the storm drain.

Typically, but not always, Equation 6-5 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, add the travel time for each relevant segment downstream.

2.4.4 Minimum Time of Concentration

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

2.4.5 Common Errors in Calculating Time of Concentration

A common mistake in urbanized areas is to assume travel velocities that are too slow. Another common error is to not check the runoff peak resulting from only part of the catchment. Sometimes a lower portion of the catchment or a highly impervious area produces a larger peak than that computed for the whole catchment. This error is most often encountered when the catchment is long or the upper portion contains grassy open land and the lower portion is more developed.

2.5 Rainfall Intensity

The calculated rainfall intensity, *I*, is the average rainfall rate in inches per hour for the period of maximum rainfall having a duration equal to the time of concentration.

After the design storm recurrence frequency has been selected, a graph should be made showing rainfall intensity versus time. The procedure for obtaining the local data and plotting such a graph is explained and illustrated in the *Rainfall* chapter of the USDCM. The UD-Rain Excel workbook can also be used for calculating the intensity. This workbook is available for download at www.udfcd.org.

Photograph 6-2. Urbanization (impervious area) increases runoff volumes, peak discharges, frequency of runoff, and receiving stream degradation.

2.5.1 Runoff Coefficient

Each part of a watershed can be considered as either pervious or impervious. The pervious part is the area where water can readily infiltrate into the ground. The impervious part is the area that does not readily allow water to infiltrate into the ground, such as areas that are paved or covered with buildings and sidewalks or compacted unvegetated soils. In urban hydrology, the percentage of pervious and impervious land is important. Urbanization increases impervious area causing rainfall-runoff relationships to change significantly. In the absence of stormwater management methods such as low impact development and green infrastructure, the total runoff volume increases, the time to the runoff peak rate decreases, and the peak runoff rate increases.

When analyzing a watershed for planning or design purposes, the probable future percent of impervious area must be estimated. A complete tabulation of recommended values of the total percent of imperviousness is provided in Table 6-3.

The runoff coefficient, *C*, represents the integrated effects of infiltration, evaporation, retention, and interception, all of which affect the volume of runoff. The determination of *C* requires judgment based on experience and understanding on the part of the engineer.

Volume-based runoff coefficients were derived to establish the optimal consistency between CUHP and the Rational Method for peak flow predictions (Guo, 2013). Using the percentage imperviousness, the equations in Table 6-4 can be used to calculate the runoff coefficients for hydrologic soil groups A, B, and C/D for various storm return periods.

Table 6-3. Recommended percentage imperviousness values

Land Use or Surface Characteristics	Percentage Imperviousness (%)
Business:	
Downtown Areas	95
Suburban Areas	75
Residential lots (lot area only)**:**	
Single-family	
2.5 acres or larger	12
0.75 – 2.5 acres	20
0.25 – 0.75 acres	30
0.25 acres or less	45
Apartments	75
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	10
Playgrounds	25
Schools	55
Railroad yard areas	50
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group		Storm Return Period					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A=$ $0.84i^{1.302}$	$C_A=$ $0.86i^{1.276}$	$C_A=$ $0.87i^{1.232}$	$C_A =$ $0.84i^{1.124}$	$C_A =$ $0.85i+0.025$	$C_A =$ $0.78i+0.110$	$C_A =$ $0.65i+0.254$
B	$C_B=$ $0.84i^{1.169}$	$C_B =$ $0.86i^{1.088}$	$C_B=$ $0.81i+0.057$	$C_B =$ $0.63i+0.249$	$C_B=$ $0.56i+0.328$	$C_B =$ $0.47i+0.426$	$C_B =$ $0.37i+0.536$
C/D	$C_{C/D}=$ $0.83i^{1.122}$	$C_{C/D}=$ $0.82i+0.035$	$C_{C/D} =$ $0.74i+0.132$	$C_{C/D} =$ $0.56i+0.319$	$C_{C/D} =$ $0.49i+0.393$	$C_{C/D} =$ $0.41i+0.484$	$C_{C/D} =$ $0.32i+0.588$

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

The values for various catchment imperviousness and storm return periods are presented graphically in Figures 6-1 through 6-3, and are tabulated in Table 6-5. These coefficients were developed for the Denver region to work in conjunction with the time of concentration recommendations in Section 2.4. Use of these coefficients and this procedure outside of the semi-arid climate found in the Denver region may not be valid. The UD-Rational Excel workbook performs all the needed calculations to find the runoff coefficient given the soil type and imperviousness and the reader may want to take advantage of this macro-enabled Excel workbook that is available for download from the UDFCD's website www.udfcd.org.

See Examples 7.1 and 7.2 that illustrate the Rational Method.

Table 6-5. Runoff coefficients, *c*

Total or Effective % Impervious	NRCS Hydrologic Soil Group A						
	2-Year	**5-Year**	**10-Year**	**25-Year**	**50-Year**	**100-Year**	**500-Year**
2%	0.01	0.01	0.01	0.01	0.04	0.13	0.27
5%	0.02	0.02	0.02	0.03	0.07	0.15	0.29
10%	0.04	0.05	0.05	0.07	0.11	0.19	0.32
15%	0.07	0.08	0.08	0.1	0.15	0.23	0.35
20%	0.1	0.11	0.12	0.14	0.2	0.27	0.38
25%	0.14	0.15	0.16	0.19	0.24	0.3	0.42
30%	0.18	0.19	0.2	0.23	0.28	0.34	0.45
35%	0.21	0.23	0.24	0.27	0.32	0.38	0.48
40%	0.25	0.27	0.28	0.32	0.37	0.42	0.51
45%	0.3	0.31	0.33	0.36	0.41	0.46	0.54
50%	0.34	0.36	0.37	0.41	0.45	0.5	0.58
55%	0.39	0.4	0.42	0.45	0.49	0.54	0.61
60%	0.43	0.45	0.47	0.5	0.54	0.58	0.64
65%	0.48	0.5	0.51	0.54	0.58	0.62	0.67
70%	0.53	0.55	0.56	0.59	0.62	0.65	0.71
75%	0.58	0.6	0.61	0.64	0.66	0.69	0.74
80%	0.63	0.65	0.66	0.69	0.71	0.73	0.77
85%	0.68	0.7	0.71	0.74	0.75	0.77	0.8
90%	0.73	0.75	0.77	0.79	0.79	0.81	0.84
95%	0.79	0.81	0.82	0.83	0.84	0.85	0.87
100%	0.84	0.86	0.87	0.88	0.88	0.89	0.9
Total or Effective % Impervious	**NRCS Hydrologic Soil Group B**						
	2-Year	**5-Year**	**10-Year**	**25-Year**	**50-Year**	**100-Year**	**500-Year**
2%	0.01	0.01	0.07	0.26	0.34	0.44	0.54
5%	0.03	0.03	0.1	0.28	0.36	0.45	0.55
10%	0.06	0.07	0.14	0.31	0.38	0.47	0.57
15%	0.09	0.11	0.18	0.34	0.41	0.5	0.59
20%	0.13	0.15	0.22	0.38	0.44	0.52	0.61
25%	0.17	0.19	0.26	0.41	0.47	0.54	0.63
30%	0.2	0.23	0.3	0.44	0.49	0.57	0.65
35%	0.24	0.27	0.34	0.47	0.52	0.59	0.66
40%	0.29	0.32	0.38	0.5	0.55	0.61	0.68
45%	0.33	0.36	0.42	0.53	0.58	0.64	0.7
50%	0.37	0.4	0.46	0.56	0.61	0.66	0.72
55%	0.42	0.45	0.5	0.6	0.63	0.68	0.74
60%	0.46	0.49	0.54	0.63	0.66	0.71	0.76
65%	0.5	0.54	0.58	0.66	0.69	0.73	0.77
70%	0.55	0.58	0.62	0.69	0.72	0.75	0.79
75%	0.6	0.63	0.66	0.72	0.75	0.78	0.81
80%	0.64	0.67	0.7	0.75	0.77	0.8	0.83
85%	0.69	0.72	0.74	0.78	0.8	0.82	0.85
90%	0.74	0.76	0.78	0.81	0.83	0.84	0.87
95%	0.79	0.81	0.82	0.85	0.86	0.87	0.88
100%	0.84	0.86	0.86	0.88	0.89	0.89	0.9

DESIGN STORM RETURN PERIODS

Land Use or Zoning	Design Storm Return Period	
	Initial Storm	Major Storm
Residential	2-year	100-year
Business	5-year	100-year
Public Building Areas	5-year	100-year
Parks, Greenbelts, etc.	2-year	100-year
Open Channels and Drainage ways	10 year	100-year
Detention Facilities	Water Quality and 10 year	100-year

813.03 Runoff Computations, Colorado Urban Hydrograph Procedure (CUHP)

The CUHP method is generally applicable to basins greater than 90 acres. However, the CUHP is required for watershed areas larger than 160-acres. The procedures for the CUHP, as explained in the Urban Storm Drainage Criteria Manual, shall be followed in the preparation of drainage reports and storm drainage facility designs in the Town. The CUHP program requires the input of a design storm, either as a detailed hyetograph or as a 1-hour rainfall depth. The program for the latter using the 2-hour storm distribution recommended in the Urban Storm Drainage Criteria Manual generates a detailed hyetograph distribution. The 1-hour rainfall depths for the Town of Erie are presented in Table 800-2.

REFER TO NOAA ATLAS 14
FOR RAINFALL DEPTH
USED FOR POND C DESIGN

Table 800-2
TOWN OF ERIE
ONE-HOUR RAINFALL DEPTH

Design Storm	Rainfall Depth (in.)
2-Year	1.01
5-Year	1.43
10-Year	1.73
50-Year	2.40
100-Year	2.70

The hydrograph from the CUHP program must be routed through any proposed conveyance facility using UDSWM or a similar method.

813.04 Runoff Computations, Rational Method

The Rational Method will be utilized for sizing storm sewers and for determining runoff magnitude from un-sewered areas. The limit of application of the Rational Method is approximately 160 acres. When the drainage basin exceeds 160 acres, the CUHP method shall be used.

The procedures for the Rational Method, as explained in the Urban Storm Drainage Criteria Manual, shall be followed in the preparation of drainage reports in the Town.

Slopes on earthen embankments shall not be steeper than 4 (horizontal) to 1 (vertical). The geotechnical engineer for the project shall verify slope stability. All earthen slopes shall be covered with topsoil and re-vegetated. For irrigated grassed detention facilities the minimum bottom slope shall be 2% measured perpendicular to the trickle channel. Wet bottom detention facilities shall be reviewed on a case-by-case basis.

When proposed lot grading has three or more lots draining to a shared lot line swale to a roadway, a sidewalk chase drain will be installed to convey drainage through the sidewalk to the gutter. In areas with detached sidewalk and trees lawns, the chase will continue through the tree lawn and curb to the gutter.

814.04 Freeboard Requirements

The minimum required freeboard for grassed and parking lot detention facilities is one (1) foot above the computed 100-year water surface.

814.05 Trickle Flow Control

All grassed detention ponds shall include a trickle channel.

The base flow shall be carried in a trickle channel. The minimum capacity shall be one (1) percent to three (3) percent of the 100-year flow, but not less than one (1) cfs. Trickle channel shall be constructed of concrete or other approved materials to minimize erosion, to facilitate maintenance and to aesthetically blend with the adjacent vegetation and soils.

814.06 Outlet Configuration

Refer to the Urban Storm Drainage Criteria Manual for outlet configuration.

814.07 Embankment Protection

Whenever a detention pond uses an embankment to contain water, the embankment shall be protected from catastrophic failure due to overtopping. Overtopping can occur when the pond outlets become obstructed or when a larger than 100-year storm occurs. Failure protection for the embankment may be provided in the form of a buried heavy riprap layer (Type H) on the entire downstream face of the embankment or a separate emergency spillway having a minimum capacity of twice the maximum release rate for the 100-year storm. Structures shall not be permitted in the path of the emergency spillway or overflow. The invert of the emergency spillway should be set equal to or above the 100-year water surface elevation.

814.08 Release Rates

The maximum allowable unit release rates are summarized in Table 800-4. Refer to Urban Storm Drainage Criteria Manual Volume III for water quality release rates.

TABLE 800-5
MINIMUM VALUES OF ROUGHNESS COEFFICIENT (n)

Type of Channel and Description Closed Conduits:			Minimum
	Concrete Pipe:		
		Culverts with bends, connections & debris	0.013
		Storm sewer	0.013
		Subdrain with open joints	0.016
	PVC Pipe		0.011
	Concrete Surfaces (bottom & sides):		
		Smooth finish	0.015
		Unfinished	0.017
	Concrete Bottom (with sides of):		
		Mortared stone	0.020
		Dry rubble or riprap	0.030
	Gravel Bottom (with sides of):		
		Formed concrete	0.020
		Dry rubble or riprap	0.04
Excavated or Dredged Channels and Ditches:			
	Earthen, Straight & Uniform, no brush or debris:		
		Grassed, less than 6" high with:	
		Depth of flow < 2.0 feet	0.035
		Depth of flow > 2.0 feet	0.030
		Grassed, approx. 12" high with:	
		Depth of flow < 2.0 feet	0.060
		Depth of flow > 2.0 feet	0.035
		Grassed, approx. 24" high with:	
		Depth of flow < 2.0 feet	0.070
		Depth of flow > 2.0 feet	0.035
		Earth bottom with riprap on sides	0.040
	Rock or Shale Cuts:		
		Smooth and uniform	0.035
		Jagged and irregular	0.040
Curb and Gutter (concrete)			0.016

815.02 Street Flow Capacities

Except as modified herein, the criteria set forth in the Urban Storm Drainage Criteria Manual will be used in analyzing and approving the adequacy of streets as a function of the drainage system. The street classifications for Drainage Purposes are listed in Table 800-6.

TABLE 800-7
ALLOWABLE PAVEMENT ENCROACHMENT AND DEPTH OF FLOW FOR INITIAL STORM RUNOFF

Street Classification	Maximum Encroachment*
Local	No curb overtopping; flow may spread to crown of street.
Collector	No curb overtopping; flow spread must leave the equivalent of one 10-foot driving lane clear of water.
Arterials	No curb overtopping; flow spread must leave the equivalent of two 10-foot driving lanes clear of water - one lane in each direction.
Freeways	No encroachment is allowed on any traffic lane.

* Where no curbing exists, encroachment will not extend past property lines.

The storm sewer system will commence at the point where the maximum allowable encroachment occurs.

C. In relation to street capacity for major storm, the allowable depth of flow and inundated area for the major design storm will not exceed the limitations set forth in Table 800-8:

TABLE 800-8
ALLOWABLE DEPTH OF FLOW AND INUNDATED AREA FOR MAJOR STORM RUNOFF

Street Classification	Allowable Depth and Inundated Areas
Local & Collector	Residential dwellings and public, commercial, and industrial buildings should be no less than 12 inches above the 100-year flood at the ground line or lowest water entry of the building. The depth of water over the gutter flow line will not exceed 18 inches and 12 inches for collector streets.
Arterial & Freeway	Residential dwellings and public, commercial, and industrial buildings should be no less than 12 inches above the 100-year flood at the ground line or lowest water entry of the building. The depth of water should not exceed the street crown to allow operation of emergency vehicles. The depth of water over gutter flow line should not exceed twelve (12).inches

Cross street flow: Cross street flow will occur by one of the following methods. One method is runoff which has been flowing in a gutter and then flows across the street to the opposite gutter or inlet. The second case is flow from some external source, such as a drainage way or conduit, which will flow across the crown of the street when the conduit capacity is exceeded. Allowable Cross Street Flow is set forth in Table 800 –9.

TABLE 800-9

ALLOWABLE CROSS STREET FLOW

Street Classification	Initial Storm Flow	Major Storm Flow
Local	6 inches of depth in crosspan.	18 inches of depth above gutter flow line.
Collector	Where cross-pans allowed, depth of flow should not exceed 6 inches.	12 inches of depth above gutter flow line.
Arterial/Freeway	None.	No cross flow. Maximum depth at upstream gutter on road edge of 12 inches.

815.03 Storm Sewers and Storm Inlets

Except as subsequently modified, the design of storm sewers and inlets shall conform to the criteria set forth in the Urban Storm Drainage Criteria Manual. Storm sewers and inlets will be of sufficient capacity to adequately carry the expected runoff from the initial design storm. The storm sewer system and subsequent storm inlets will commence at all locations where the allowable street capacity is exceeded or wherever ponding of water is likely to occur. No bubblers will be allowed. The minimum allowable pipe size to be used in storm sewers and laterals will be as listed in Table 800-10:

TABLE 800-10
MINIMUM ALLOWABLE PIPE SIZE

Type of Conduit	Min. Inside Pipe Dia.
Main Trunk Sewer	18"
Short Laterals	15"

Arch pipes will be allowed where design conditions dictate, provided that the minimum cross-sectional areas will not be less than those specified above. All storm sewer conduits will be of sufficient structural strength to withstand an H-20 design load.

The maximum allowable distance between manholes or other suitable appurtenances for cleanouts will not exceed those listed in Table 800-11:

TABLE 800-11
MAXIMUM ALLOWABLE MANHOLE SPACING

Inside Diameter or Minimum Head Room	Maximum Allowable Distance Between Manholes & Cleanouts
18” - 36"	400 feet
42" - 60"	500 feet
60" & Larger	750 feet

The capacities of conduits will be computed using the criteria set forth in the Urban Storm Drainage Manual Friction, lateral, bend, exit and entrance losses shall be included in the design. The storm sewer design shall include tailwater conditions. The value of the roughness coefficient (n) to be used will not be less than those specified in Section 815.01(l) of these STANDARDS AND SPECIFICATIONS. The average flow velocity for the initial storm conduits will not be less than two (2) feet per second.

Allowable storm inlets will be curb opening inlets, type "R" or combination curb/grate inlets, type “13”, similar and equal to the Town's Standard Storm Water Inlets or as approved by the Public Works Director. Inlets will be utilized at all points where ponding or sump conditions exist. Refer to the Standard Drawings for details.

The theoretical capacity and spacing of storm inlets will be analyzed using the criteria set forth in the Urban Storm Drainage Criteria Manual. Other methods, such as nomographs, may be used to design inlets. The Public Works Director must approve other design methods.

The allowable inlet capacity will be determined using the reduction factors. These reduction factors compensate for debris plugging, pavement overlaying, variations in design assumptions or other factors that decrease inlet capacities.

The size of outlet pipes from storm water inlets will be based on the theoretical capacity of the inlet.

Computations for storm sewer design and storm inlet designs shall be submitted on forms similar to those included in these specifications for acceptance. Adequate details of the proposed storm sewer system, including plan and profile, details of inlets, manholes and other appurtenances will be included in the overall drainage plan submitted for acceptance.

The storm sewer outlet shall be protected for the major storm. The protection shall be designed as called out in the Urban Storm Drainage Criteria Manual.

815.04 Culverts

Culvert capacities shall be at least equal to the capacities of culverts designed in accordance with the procedures outlined in the Urban Drainage Storm Criteria Manual. Culverts may be of any shape and construction required by existing topographic features, provided, however, the size, shape, location, and type of construction of culverts will be subject to acceptance by the Public Works Director.

842.08.01 Riprap

Rock used for riprap shall be hard, durable, angular in shape, and be free from cracks, overburden, shale and organic matter. Neither breadth nor thickness of single stone shall be less than one-third (1/3) its length and rounded stone will not be accepted. The rock shall sustain abrasion test (Los Angeles machine - ASTM C0535-69) and shall sustain a loss of not more than ten percent (10%) after twelve (12) cycles of freezing and thawing (AASHTO test 103 for ledge rock procedure A). The rock shall have a minimum specific gravity of 2.50. Classification and gradation for riprap are shown in Table 800-14.

The riprap designation and total thickness of riprap shall be as shown on the accepted plans. The maximum stone size shall not be larger than the thickness of the riprap.

TABLE 800-14
CLASSIFICATION AND GRADATION OF RIPRAP

Riprap Designation	% Smaller Than Given Size By Weight	Intermediate Rock Dimension (Inches)	d(50)* (Inches)
Type VL	70-100	12	
	50-70	9	
	35-50	6	6**
	2-10	2	
Type L	70-100	15	
	50-70	12	
	35-50	9	9**
	2-10	3	
Type M	70-100	21	
	50-70	18	
	35-50	12	12
	2-10	4	
Type H	70-100	30	
	50-70	24	
	35-50	18	18
	2-10	6	
Type VH	70-100	42	
	50-70	33	
	35-50	24	24
	2-10	9	

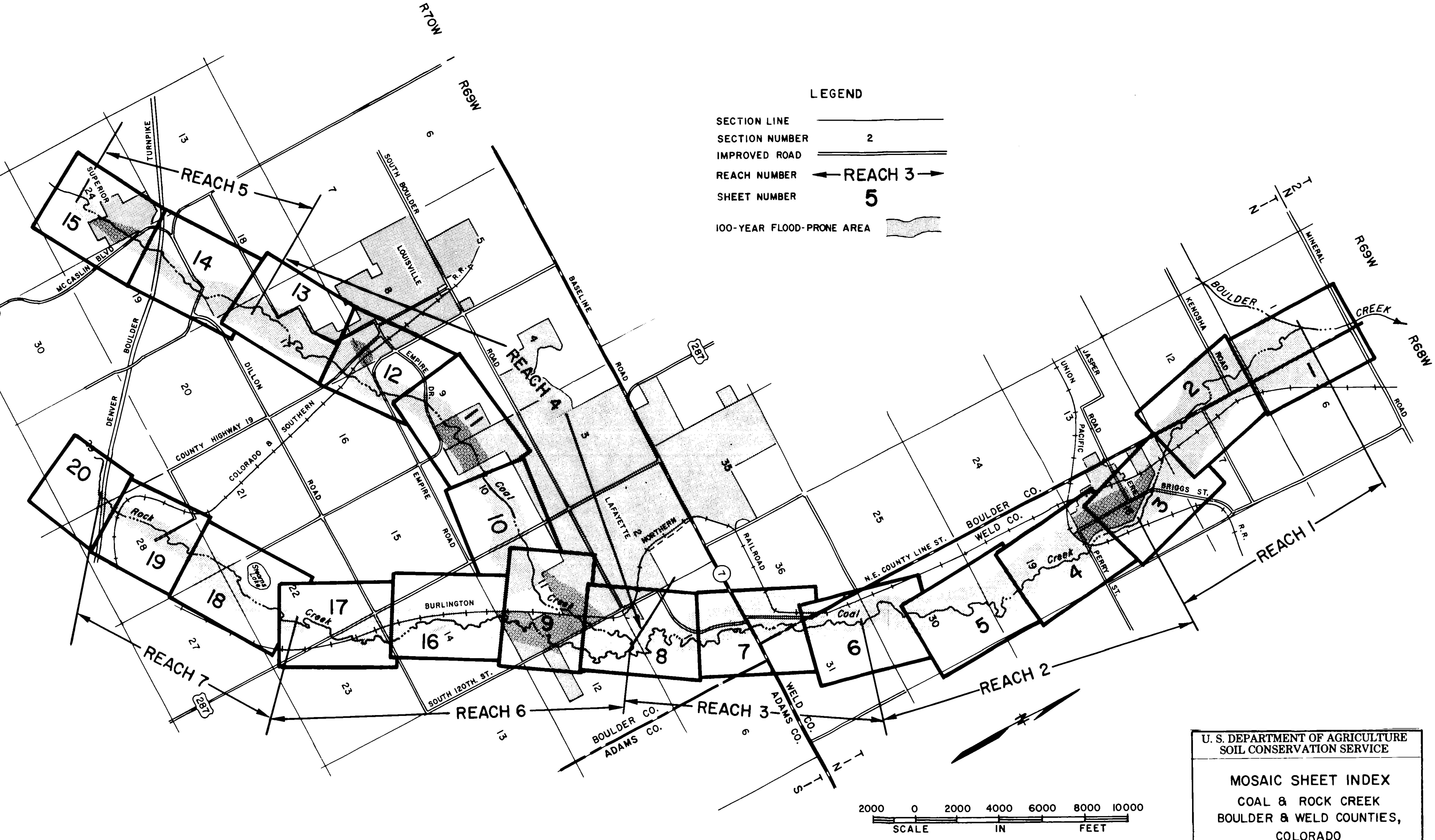
*d(50) = Mean particle size

** Bury Types VL and L with native topsoil and re-vegitate to protect from vandalism.

APPENDIX B

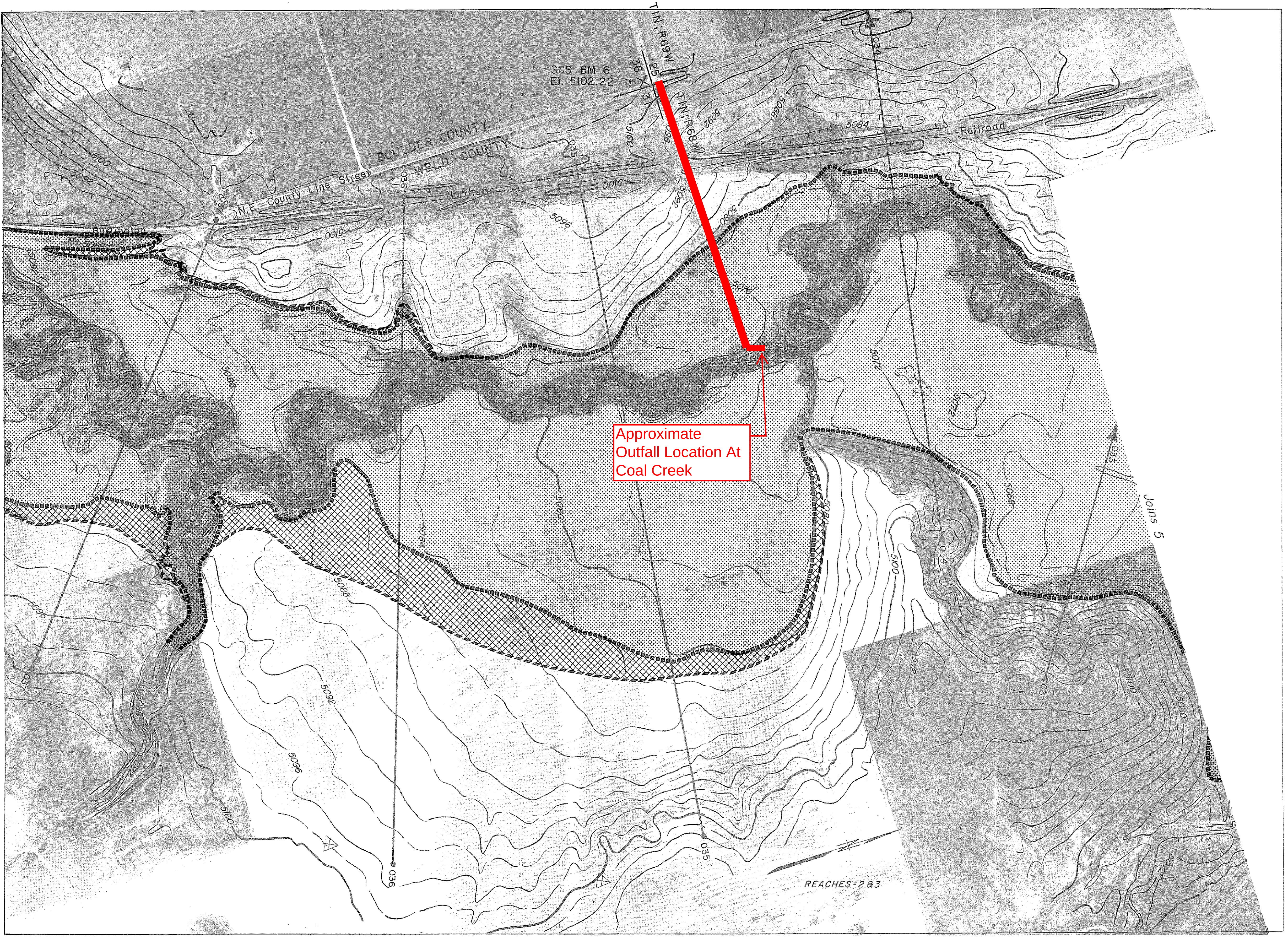
1976 FHAD

2014 OSP Excerpts



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MOSAIC SHEET INDEX
COAL & ROCK CREEK
BOULDER & WELD COUNTIES,
COLORADO



LEGEND

FLOOD PLAIN LIMITS

100 YEAR FLOOD

500 YEAR FLOOD

GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM — 5300

CONTOUR, Index 4.0'

CONTOUR, Interpolated 2.0'

CROSS SECTION — 007 007

CROSS SECTION CONTINUED — 010 010

INTERMITTENT STREAM

PANEL

AERIAL PHOTOGRAPHY, FLOOD HAZARD AREAS, AND TOPOGRAPHY ARE FOR EXISTING CONDITIONS —— JULY 1974.

FLOOD AREA OUTLINES WERE DETERMINED BY MATCHING WATER SURFACE PROFILE ELEVATIONS WITH TOPOGRAPHY.

NOTE: TOPOGRAPHIC DETAIL WAS COMPILED BY PHOTOGRAMMETRIC METHODS TO MEET NATIONAL MAP ACCURACY STANDARDS. THE PHOTOGRAPHIC IMAGE CONTAINS DISPLACEMENTS DUE TO RELIEF AND IT DOES NOT MATCH THE TOPOGRAPHIC DETAIL IN ALL AREAS.

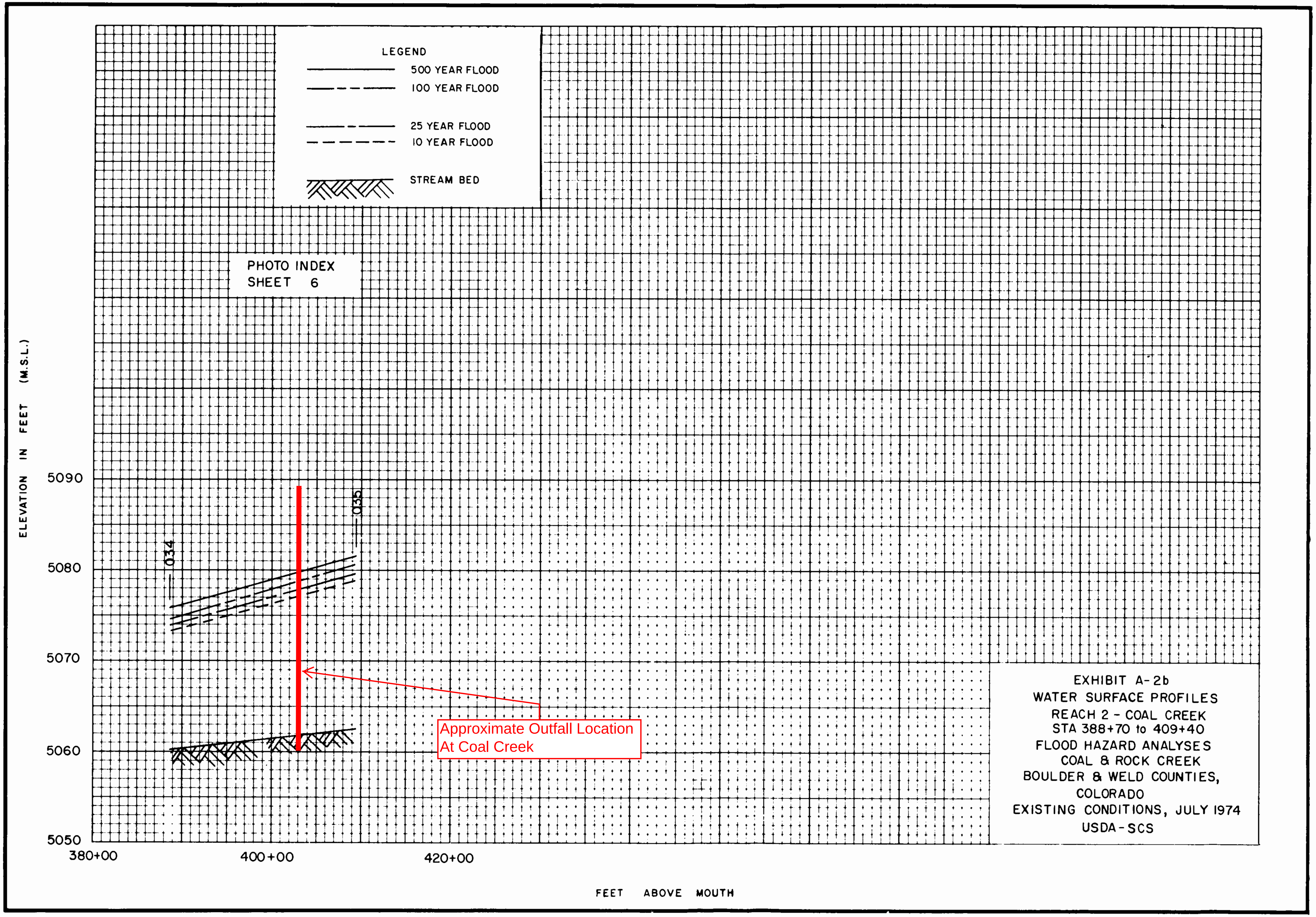
REVISION	DATE	BY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FLOOD HAZARD AREAS
COAL & ROCK CREEK
BOULDER & WELD COUNTIES, COLORADO

200 0 200 400 600
APPROXIMATE SCALE IN FEET

OCTOBER 1975 SHEET 6 OF 20



Approximate Outfall Location
At Coal Creek

EXHIBIT A-2b
WATER SURFACE PROFILES
REACH 2 - COAL CREEK
STA 388+70 to 409+40
FLOOD HAZARD ANALYSES
COAL & ROCK CREEK
BOULDER & WELD COUNTIES,
COLORADO
EXISTING CONDITIONS, JULY 1974
USDA-SCS

Table 3-2
Model Conversion and Baseline Hydrology Results
Coal Creek Tributaries

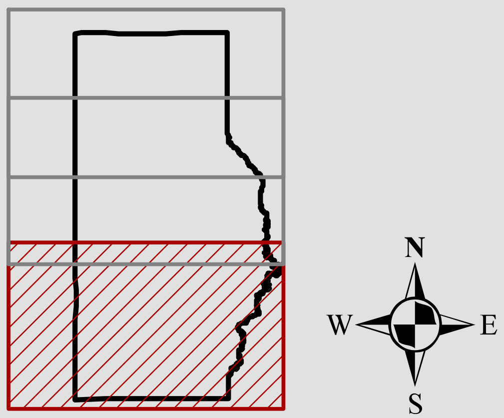
Coal Creek Tributaries			100-year Peak Discharge (cfs) - Future Development						
SWMM Node	Location Description	Drainage Area (acres)	2001 OSP	Updated to CUHP/SWMM	Difference (Updated - 2001 OSP)	% Difference (Updated - 2001 OSP)	Baseline Hydrology	Difference (Baseline - 2001 OSP)	% Difference (Baseline - 2001 OSP)
500	U.S. Highway 287	157	530	599	69	13%	515	-15	-3%
501	N. 111th Street	334	975	980	5	1%	1,059	84	9%
502		528	1,498	1,389	-109	-7%	1,352	-146	-10%
503	N. 119th Street	658	1,713	1,594	-119	-7%	1,523	-190	-11%
900	Coal Creek	716	2,891	2,497	-394	-14%	2,353	-538	-19%
901	Coal Creek	26	50	40	-10	-19%	31	-19	-37%
902	Coal Creek	13	57	31	-26	-45%	20	-37	-65%
504	N. 119th Street	64	240	230	-10	-4%	86	-154	-64%
505	E. County Line Road	314	721	592	-129	-18%	406	-315	-44%
903	Coal Creek	319	496	442	-54	-11%	415	-81	-16%
904	Coal Creek	31	82	56	-26	-32%	115	33	40%
506	N. 119th Street	111	210	186	-24	-11%	158	-52	-25%
507		217	331	313	-18	-5%	278	-53	-16%
508	E. County Line Road	284	431	409	-22	-5%	377	-54	-12%
905	Coal Creek	303	454	447	-7	-2%	402	-52	-11%
509	N. 119th Street	56	113	78	-35	-31%	74	-39	-34%
510	E. County Line Road	184	290	227	-63	-22%	191	-99	-34%
906	Coal Creek	211	334	257	-77	-23%	221	-113	-34%
511	N. 119th Street	104	95	147	52	55%	120	25	26%
512	N. 119th Street	42	70	50	-20	-29%	48	-22	-32%
513		266	362	303	-59	-16%	279	-83	-23%
514	E. County Line Road	327	482	422	-60	-12%	372	-110	-23%
907	Coal Creek	341	505	446	-59	-12%	389	-116	-23%
515	E. County Line Road	119	491	554	63	13%	261	-230	-47%
908	Coal Creek	136	537	587	50	9%	315	-222	-41%
909	Coal Creek	65	192	245	53	28%	314	122	64%
516		42	126	78	-48	-38%	111	-15	-12%
517	E. County Line Road	156	674	618	-56	-8%	618	-56	-8%
910	Coal Creek	222	826	793	-33	-4%	758	-68	-8%
911	Coal Creek	47	206	196	-10	-5%	112	-94	-46%
518		202	731	761	30	4%	763	N/A	N/A

LEGEND

- ▭ Study Area Boundary
- 🟦 Town of Erie
- 🟥 City of Lafayette
- ▭ Subbasin Boundary
- ▬ Major Watershed Boundary
- ▨ Regional Detention Ponds

XXX — Subbain ID
XX — % Impervious (Existing Land Use)
X / X — % Impervious (Future Land Use)
Area (Acres)

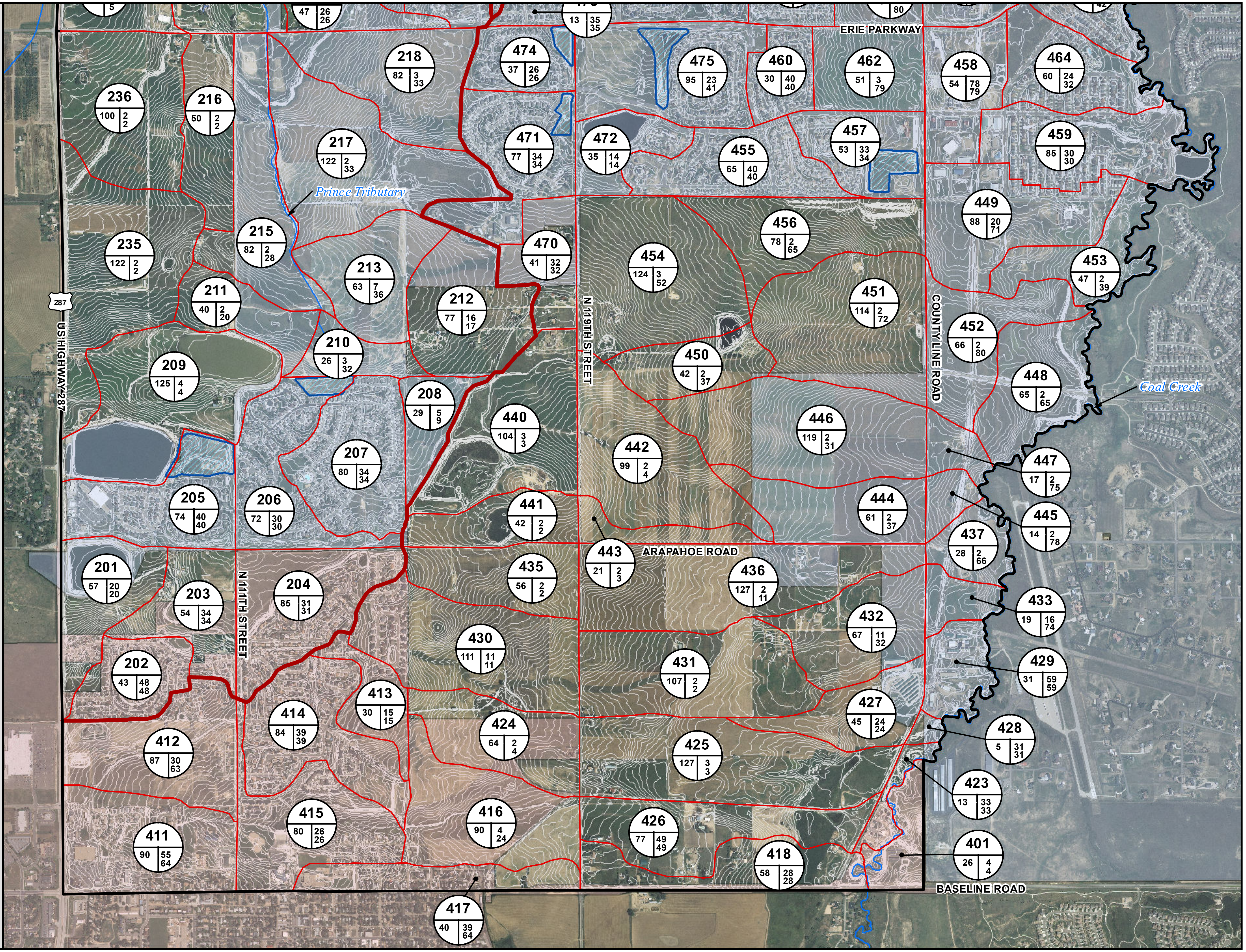
KEY MAP



0 750 1,500 3,000 Feet

1 " = 1,500 FT

M:\2234\GIS\2234.MXD - 12/12/12 - NRT



WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80246
PHONE: 303-757-8513
FAX: 303-758-3208

TOWN OF ERIE
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

TOWN OF ERIE OUTFALL SYSTEMS PLAN
(WEST OF COAL CREEK)

SUBBASIN MAP

FIGURE
B-2

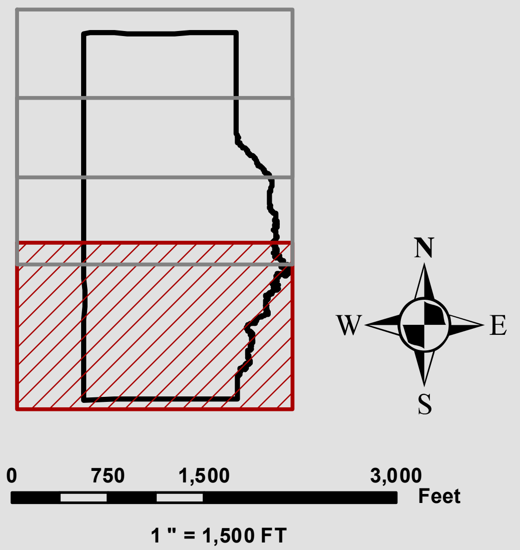
LEGEND

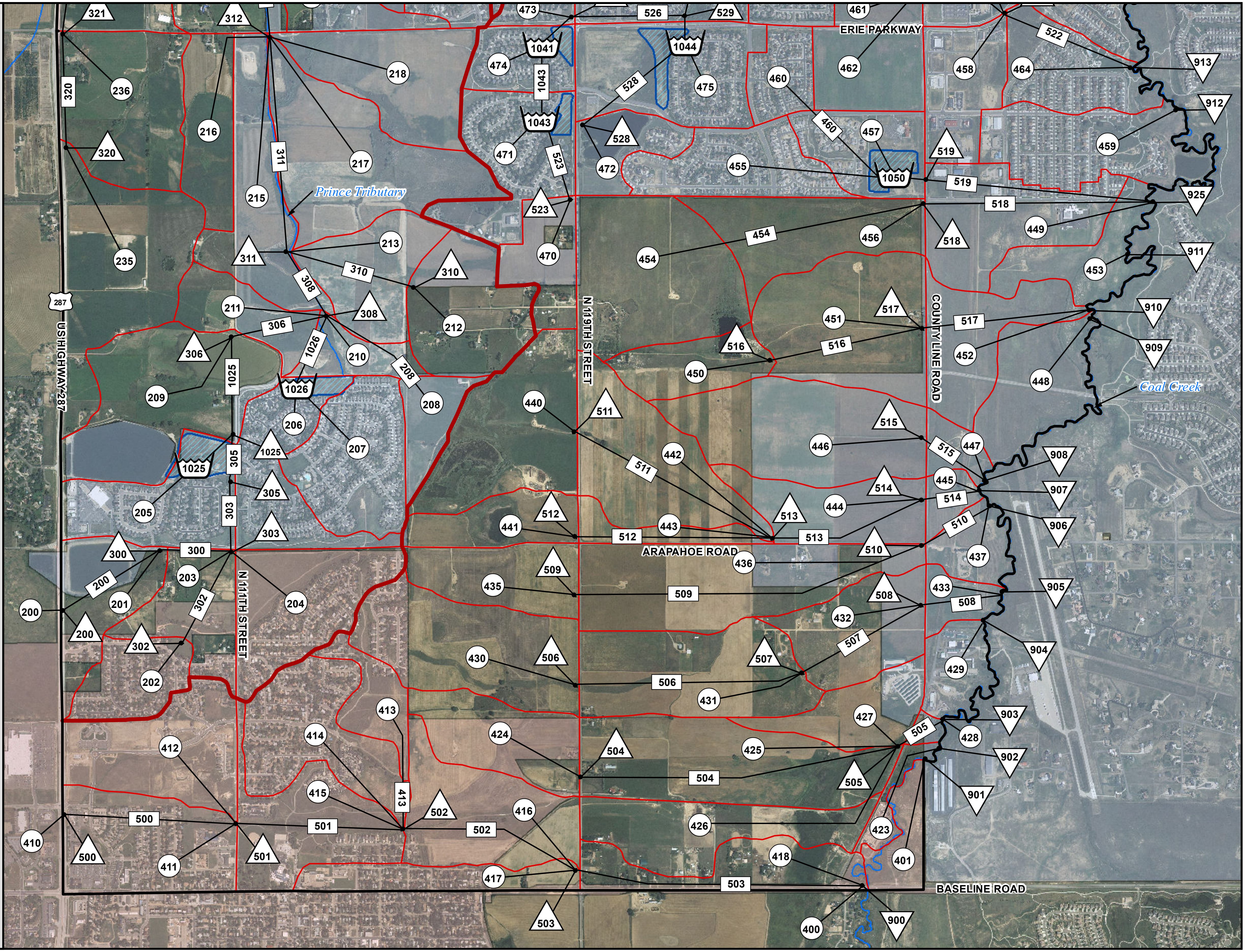
- ▭ Study Area Boundary
- 🟦 Town of Erie
- 🟥 City of Lafayette
- ▭ Subbasin Boundary
- ▬ Major Watershed Boundary
- ▨ Regional Detention Ponds

SWMM Elements

- ○ xxx Subbasin
- △ xxx Design Point
- ▭ xxx Conveyance Element
- xxx Detention Facility
- ▽ xxx Outfall

KEY MAP





M:\2234\GIS\2234.MXD - 12/12/12 - NRT

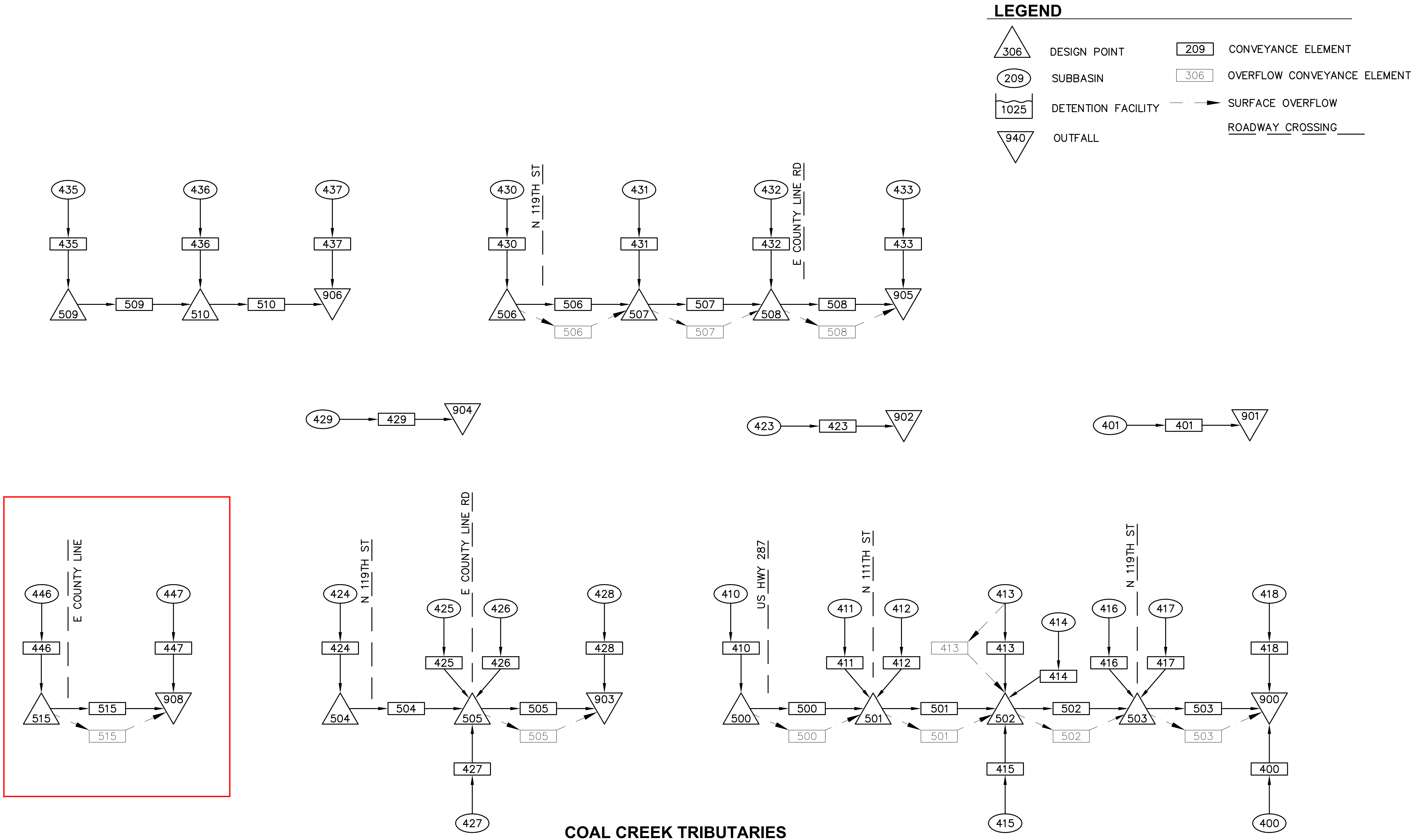
WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80246
PHONE: 303-757-8513
FAX: 303-758-3208

TOWN OF ERIE
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

TOWN OF ERIE OUTFALL SYSTEMS PLAN
(WEST OF COAL CREEK)

SWMM ROUTING MAP

FIGURE
B-6



COAL CREEK TRIBUTARIES

WRC ENGINEERING, INC.

950 SOUTH CHERRY STREET
SUITE 404
DENVER, COLORADO 80246
PHONE NO: (303) 757-8513
FAX NO: (303) 758-3208

DESIGNED NRT
DRAWN JHN
CHECKED NRT
DATE 1/29/13
AS-BUILT

NO.	BY	DATE	REVISION DESCRIPTION
.	.	.	.

TOWN OF ERIE
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

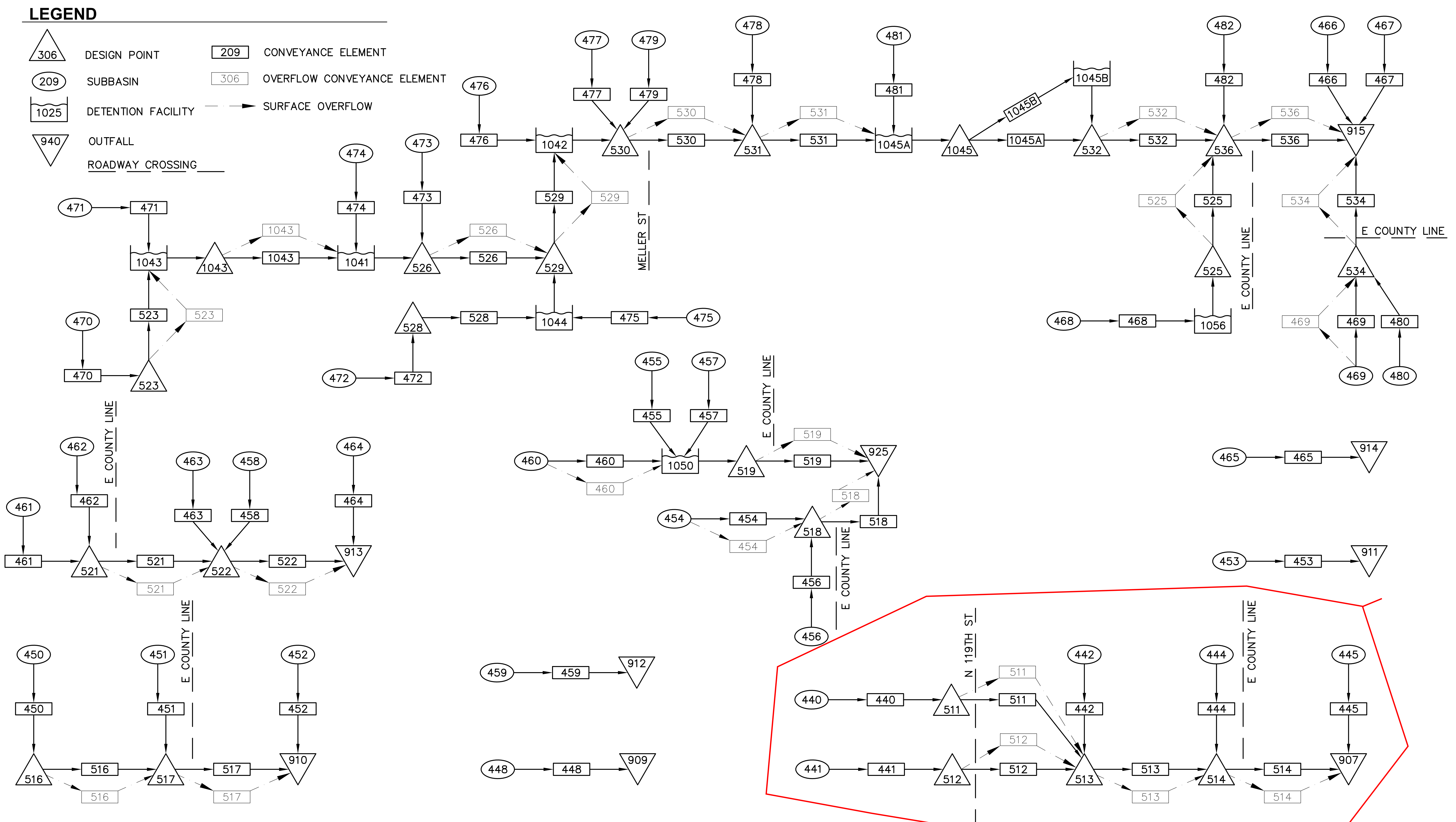
TOWN OF ERIE
OUTFALL SYSTEMS PLAN
(WEST OF COAL CREEK)

SWMM SCHEMATIC
COAL CREEK TRIBUTARIES

PROJECT NUMBER
2234

FIGURE B-9

2234\DWG\SWMM SCHEMATICS.DWG, COAL CREEK 1 - 11/29/13 - JHN



COAL CREEK TRIBUTARIES

2234\DWG\SWMM SCHEMATIC.DWG, COAL CREEK 2 - 1/29/13 - JHN

WRC ENGINEERING, INC.

950 SOUTH CHERRY STREET
SUITE 404
DENVER, COLORADO 80246
PHONE NO: (303) 757-8513
FAX NO: (303) 758-3208

DESIGNED NRT
DRAWN JHN
CHECKED NRT
DATE 1/29/13
AS-BUILT

NO.	BY	DATE	REVISION DESCRIPTION
.	.	.	.

TOWN OF ERIE
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

TOWN OF ERIE
OUTFALL SYSTEMS PLAN
(WEST OF COAL CREEK)

SWMM SCHEMATIC
COAL CREEK TRIBUTARIES

PROJECT NUMBER
2234

FIGURE B-10

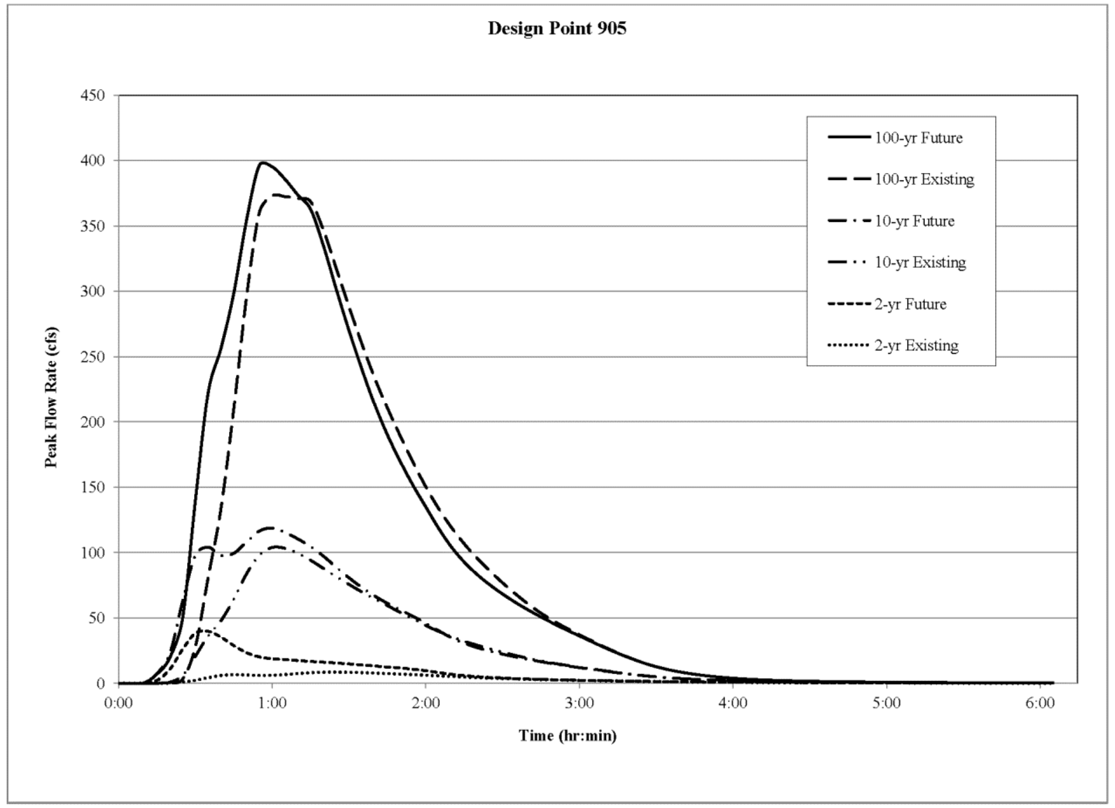
Table B-1
CUHP Input

Subbasin	Area (mi^2)	Distance to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness		Depression Storage		Horton's Infiltration Parameters		
					Existing Land Use	Future Land Use	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)
424	0.100	0.259	0.608	0.024	2.0	3.7	0.38	0.10	4.50	0.0018	0.60
425	0.199	0.541	1.000	0.015	2.7	2.7	0.38	0.10	4.34	0.0018	0.59
426	0.120	0.539	0.911	0.013	49.0	49.0	0.38	0.10	4.14	0.0018	0.58
427	0.071	0.359	0.756	0.008	24.1	24.1	0.38	0.10	4.19	0.0018	0.58
428	0.008	0.056	0.136	0.021	31.0	31.0	0.38	0.10	4.44	0.0018	0.60
429	0.048	0.236	0.368	0.017	58.5	58.5	0.38	0.10	4.45	0.0018	0.60
430	0.173	0.378	0.724	0.024	10.8	10.8	0.38	0.10	4.50	0.0018	0.60
431	0.166	0.361	0.728	0.017	2.0	2.1	0.38	0.10	4.50	0.0018	0.60
432	0.105	0.198	0.511	0.013	11.4	32.2	0.38	0.10	4.50	0.0018	0.60
433	0.029	0.130	0.271	0.026	16.1	74.2	0.38	0.10	4.50	0.0018	0.60
435	0.088	0.236	0.545	0.021	2.2	2.2	0.38	0.10	4.50	0.0018	0.60
436	0.199	0.632	1.068	0.016	2.0	11.1	0.38	0.10	4.50	0.0018	0.60
437	0.043	0.097	0.253	0.029	2.0	66.2	0.38	0.10	4.50	0.0018	0.60
440	0.162	0.187	0.353	0.014	2.7	2.7	0.38	0.10	4.50	0.0018	0.60
441	0.065	0.229	0.520	0.014	2.0	2.0	0.38	0.10	4.50	0.0018	0.60
442	0.154	0.446	0.837	0.021	2.0	4.2	0.38	0.10	4.50	0.0018	0.60
443	0.033	0.347	0.634	0.027	2.0	2.8	0.38	0.10	4.50	0.0018	0.60
444	0.095	0.265	0.651	0.019	2.0	36.9	0.38	0.10	4.50	0.0018	0.60
445	0.022	0.096	0.241	0.030	2.0	77.7	0.38	0.10	4.50	0.0018	0.60
446	0.186	0.372	0.852	0.022	2.0	30.7	0.38	0.10	4.50	0.0018	0.60
447	0.026	0.134	0.283	0.025	2.0	74.9	0.38	0.10	4.50	0.0018	0.60
448	0.102	0.177	0.400	0.023	2.0	64.6	0.38	0.10	4.36	0.0018	0.59
449	0.137	0.436	0.673	0.011	19.9	71.5	0.38	0.10	4.49	0.0018	0.60
450	0.066	0.243	0.521	0.026	2.0	37.3	0.38	0.10	4.50	0.0018	0.60
451	0.178	0.237	0.545	0.033	2.0	71.7	0.38	0.10	4.50	0.0018	0.60
452	0.102	0.386	0.649	0.016	2.0	79.7	0.38	0.10	4.05	0.0018	0.57
453	0.073	0.282	0.592	0.015	2.1	38.8	0.38	0.10	4.49	0.0018	0.60
454	0.194	0.288	0.538	0.026	2.5	52.1	0.38	0.10	4.50	0.0018	0.60
455	0.101	0.393	0.734	0.020	39.6	39.6	0.38	0.10	4.50	0.0018	0.60
456	0.122	0.366	0.742	0.022	2.3	65.3	0.38	0.10	4.50	0.0018	0.60
457	0.082	0.170	0.465	0.019	33.4	34.4	0.38	0.10	4.50	0.0018	0.60
458	0.084	0.267	0.570	0.009	78.2	79.4	0.38	0.10	4.50	0.0018	0.60
459	0.134	0.294	0.623	0.013	30.1	30.1	0.38	0.10	4.25	0.0018	0.58
460	0.046	0.121	0.276	0.012	39.9	40.2	0.38	0.10	4.50	0.0018	0.60
461	0.044	0.159	0.294	0.028	2.4	79.5	0.38	0.10	4.50	0.0018	0.60
462	0.079	0.204	0.404	0.023	2.8	79.1	0.38	0.10	4.50	0.0018	0.60
463	0.064	0.175	0.355	0.010	45.3	50.1	0.38	0.10	4.50	0.0018	0.60
464	0.093	0.249	0.499	0.013	24.4	31.9	0.38	0.10	4.07	0.0018	0.57
465	0.080	0.166	0.388	0.018	16.2	42.2	0.38	0.10	4.50	0.0018	0.60
466	0.095	0.460	0.711	0.012	2.3	32.7	0.38	0.10	4.42	0.0018	0.59
467	0.107	0.320	0.627	0.012	10.9	45.6	0.38	0.10	4.17	0.0018	0.58

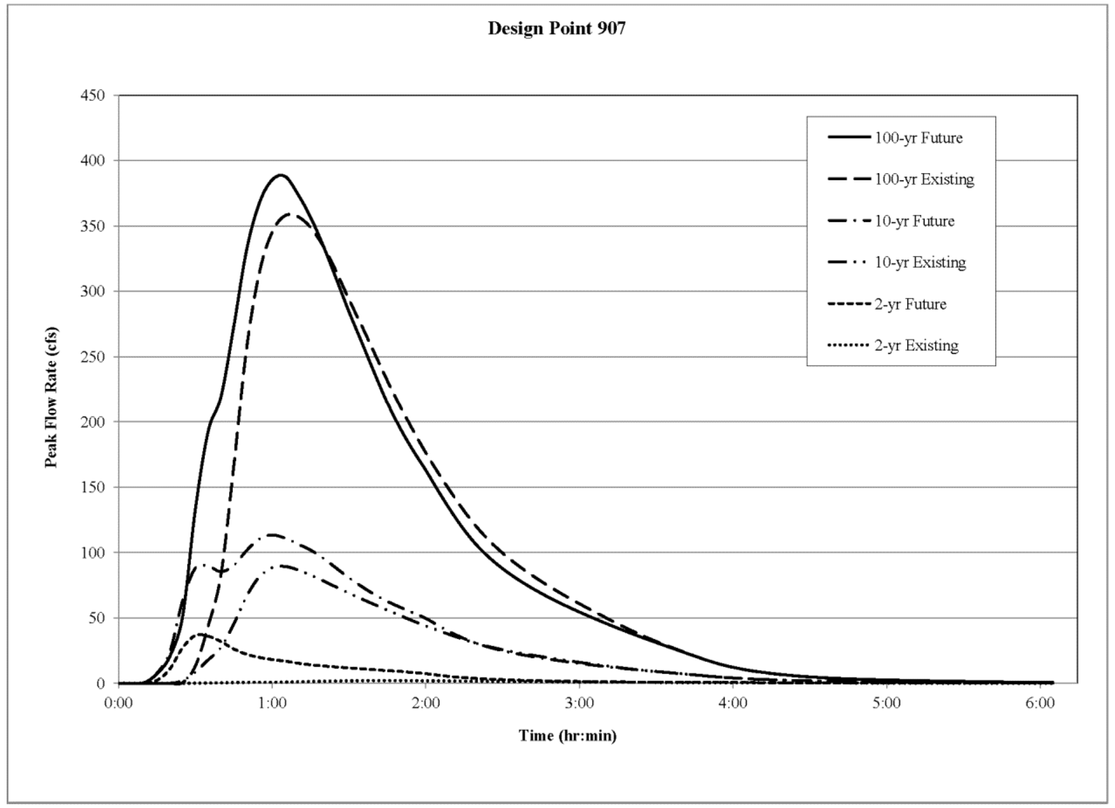
Table B-2
Peak Flow Summary

Coal Creek Tributaries			Peak Discharge (cfs) - Existing Development						Peak Discharge (cfs) - Future Development					
SWMM Node	Location Description	Drainage Area (acres)	2-Year	5-Year	10-Year	25-Year	50-year	100-Year	2-Year	5-Year	10-Year	25-Year	50-year	100-Year
500	U.S. Highway 287	157	38	93	120	194	246	296	117	214	260	365	446	515
501	N. 111th Street	334	110	245	308	479	604	726	242	451	540	772	927	1,059
502		528	155	362	460	723	865	1,050	285	567	669	956	1,151	1,352
503	N. 119th Street	658	160	396	510	789	983	1,190	314	605	720	1,059	1,275	1,523
900		716	191	504	718	1,123	1,408	1,708	502	971	1,221	1,637	1,974	2,353
901		26	1	7	10	19	25	31	1	7	10	19	25	31
902		13	2	6	8	13	16	20	2	6	8	13	16	20
504	N. 119th Street	64	1	15	23	50	67	85	1	16	24	51	68	86
505	E. County Line Road	314	42	104	140	251	326	405	42	105	140	252	327	406
903		319	43	107	143	256	332	414	43	108	144	257	334	415
904		31	26	47	58	81	100	115	26	47	58	81	100	115
506	N. 119th Street	111	7	34	49	96	126	158	7	34	49	96	126	158
507		217	6	49	76	163	219	278	6	50	76	163	219	278
508	E. County Line Road	284	8	62	97	210	282	351	22	73	110	225	301	377
905		303	9	67	104	224	302	373	40	83	119	239	318	402
509	N. 119th Street	56	1	13	20	44	59	74	1	13	20	44	59	74
510	E. County Line Road	184	1	26	44	102	139	182	6	33	51	110	148	191
906		211	1	31	51	120	164	216	40	70	87	127	169	221
511	N. 119th Street	104	1	21	32	71	94	120	1	21	32	71	94	120
512	N. 119th Street	42	0	8	13	28	37	48	0	8	13	28	37	48
513		266	2	45	73	165	218	278	3	46	74	166	219	279
514	E. County Line Road	327	2	52	86	199	266	342	22	70	106	223	293	372
907		341	2	54	90	208	278	359	37	75	113	232	305	389
515	E. County Line Road	119	1	26	41	88	118	149	31	79	103	169	217	261
908		136	1	29	46	100	135	171	45	102	130	207	262	315
909		65	1	22	33	68	90	113	78	139	166	221	268	314
516		42	0	9	14	31	42	53	16	37	47	74	92	111
517	E. County Line Road	156	2	41	64	141	190	241	158	272	324	434	527	618
910		222	2	49	80	178	240	305	214	369	444	576	669	758
911		47	0	8	13	29	39	50	17	38	48	75	94	112

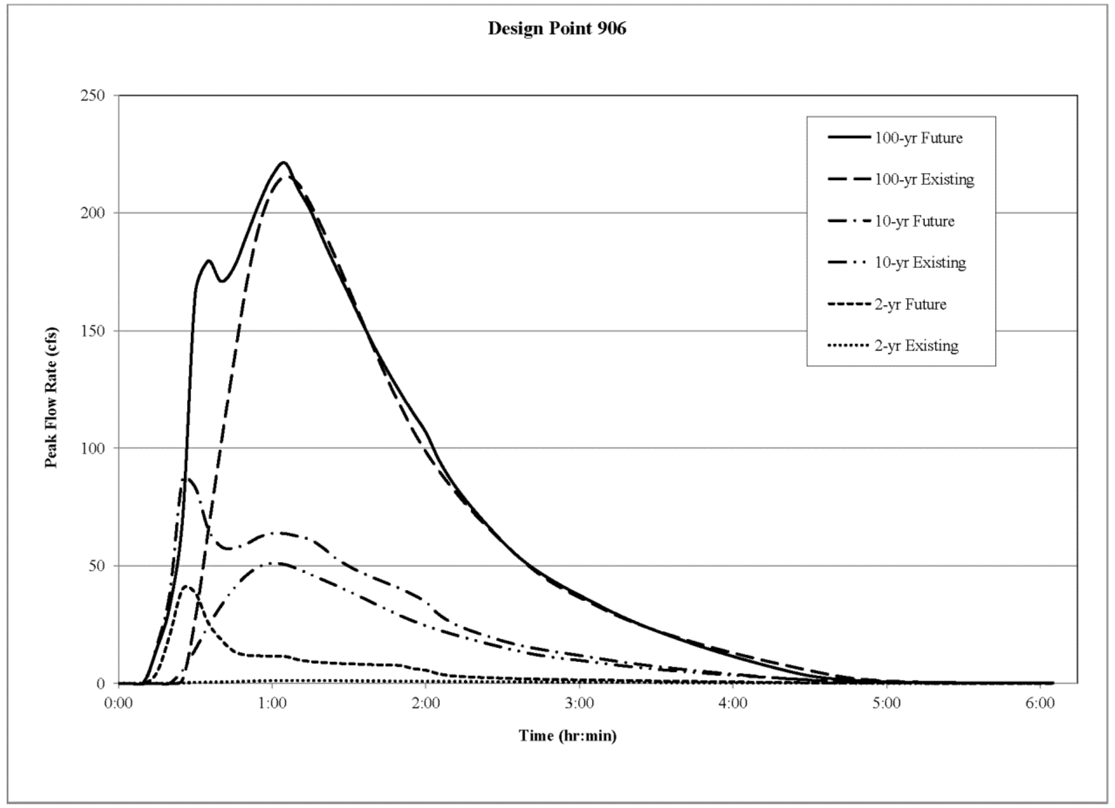
Figure B-18
Design Point Hydrographs – Existing and Future Conditions



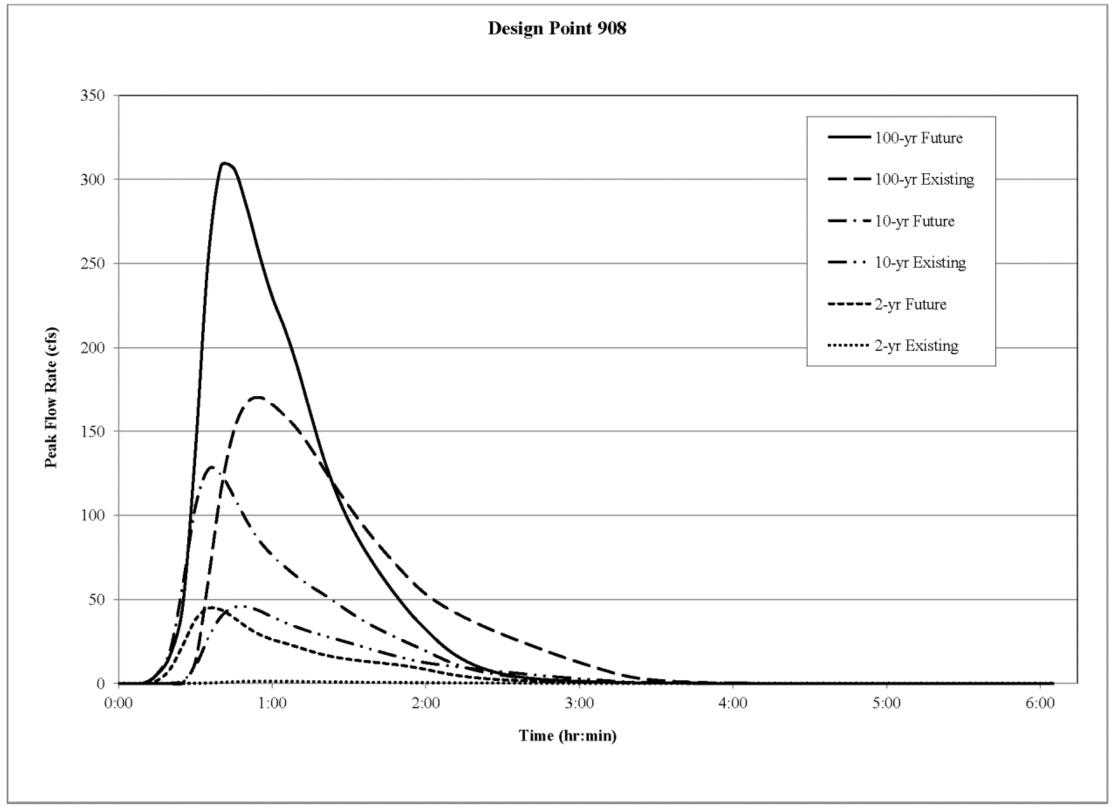
Design Point 905



Design Point 907



Design Point 906



Design Point 908

```
JUNCT_608        4988.62    0          0          0          0
JUNCT_609        4985.59    0          0          0          0
JUNCT_610        4986.25    0          0          0          0
JUNCT_611        4998.95    0          0          0          0
JUNCT_612        4981.85    0          0          0          0
JUNCT_613        5124.32    0          0          0          0
JUNCT_614        5027.96    0          0          0          0
JUNCT_615        5027.96    0          0          0          0
JUNCT_616        5052.49    0          0          0          0
JUNCT_617        5052.49    0          0          0          0
JUNCT_618        5013.88    0          0          0          0
JUNCT_619        5013.88    0          0          0          0
JUNCT_620        4996.12    0          0          0          0
JUNCT_621        4996.12    0          0          0          0
JUNCT_622        4986.05    0          0          0          0
JUNCT_623        4975.81    0          0          0          0
JUNCT_624        4972.48    0          0          0          0
JUNCT_627        5055.94    0          0          0          0
JUNCT_628        5075.78    0          0          0          0
JUNCT_629        5026.64    0          0          0          0
JUNCT_630        5026.64    0          0          0          0
JUNCT_631        5026.64    0          0          0          0
JUNCT_633        5002.18    0          0          0          0
JUNCT_634        4973.82    0          0          0          0
JUNCT_638        5020.62    0          0          0          0
JUNCT_639        5003.94    0          0          0          0
JUNCT_640        4979.49    0          0          0          0
JUNCT_641        4968.61    0          0          0          0
JUNCT_645        4981.95    0          0          0          0
JUNCT_646        4976.29    0          0          0          0
JUNCT_647        4961.01    0          0          0          0
JUNCT_648        4965.05    0          0          0          0
JUNCT_650        5014.28    0          0          0          0
JUNCT_651        4967.96    0          0          0          0
JUNCT_652        4959.41    0          0          0          0
JUNCT_655        4955.79    0          0          0          0
JUNCT_656        4950.07    0          0          0          0
JUNCT_657        4949.33    0          0          0          0
JUNCT_658        5058.46    0          0          0          0
JUNCT_659        4959.50    0          0          0          0
JUNCT_660        4948.38    0          0          0          0
JUNCT_661        4956.99    0          0          0          0
JUNCT_700        5021.12    0          0          0          0
JUNCT_701        5071.81    0          0          0          0
JUNCT_702        5015.83    0          0          0          0
JUNCT_704        4998.94    0          0          0          0
JUNCT_715        5020.61    0          0          0          0
JUNCT_718        4981.94    0          0          0          0
JUNCT_720        5014.27    0          0          0          0
JUNCT_205        5207.35    0          0          0          0

[OUTFALLS]
;;               Invert     Outfall    Stage/Table      Tide
;;Name           Elev.      Type       Time Series      Gate
;;-------------- ---------- ---------- ---------------- ----
OUTFALL_900      5086.34    FREE                        NO
OUTFALL_901      5085.40    FREE                        NO
OUTFALL_902      5079.04    FREE                        NO
OUTFALL_903      5077.76    FREE                        NO
OUTFALL_904      5072.77    FREE                        NO
OUTFALL_905      5068.22    FREE                        NO
OUTFALL_906      5068.22    FREE                        NO
OUTFALL_907      5065.70    FREE                        NO
OUTFALL_908      5064.45    FREE                        NO
OUTFALL_909      5053.07    FREE                        NO
OUTFALL_910      5048.38    FREE                        NO
OUTFALL_911      5040.71    FREE                        NO
OUTFALL_912      5032.24    FREE                        NO
OUTFALL_913      5024.28    FREE                        NO
OUTFALL_914      5019.89    FREE                        NO
OUTFALL_915      5015.83    FREE                        NO
OUTFALL_917      5000.57    FREE                        NO
OUTFALL_919      4987.73    FREE                        NO
OUTFALL_920      4982.64    FREE                        NO
OUTFALL_921      4983.75    FREE                        NO
OUTFALL_922      4982.78    FREE                        NO
OUTFALL_923      4956.05    FREE                        NO
OUTFALL_924      4959.43    FREE                        NO
OUTFALL_925      5041.47    FREE                        NO
OUTFALL_940      4997.40    FREE                        NO
OUTFALL_950      5004.37    FREE                        NO
OUTFALl_951      5004.92    FREE                        NO
OUTFALL_952      4994.44    FREE                        NO
OUTFALL_953      4987.84    FREE                        NO
```

```
OUTFALL_954      4987.83    FREE                        NO
OUTFALL_955      4985.58    FREE                        NO
OUTFALL_956      4986.24    FREE                        NO
OUTFALL_957      4981.84    FREE                        NO
OUTFALL_958      4975.80    FREE                        NO
OUTFALL_959      4972.47    FREE                        NO
OUTFALL_960      4973.81    FREE                        NO
OUTFALL_961      4968.60    FREE                        NO
OUTFALL_962      4961.00    FREE                        NO
OUTFALL_963      4965.04    FREE                        NO
OUTFALL_964      4959.40    FREE                        NO
OUTFALL_965      4955.78    FREE                        NO
OUTFALL_966      4950.06    FREE                        NO
OUTFALL_967      4949.32    FREE                        NO
OUTFALL_968      4948.37    FREE                        NO
OUTFALL_969      4956.98    FREE                        NO
OUTFALL_999      5058.45    FREE                        NO

[DIVIDERS]
;;               Invert     Diverted         Divider
;;Name           Elev.      Link             Type       Parameters
;;-------------- ---------- ---------------- ---------- ----------
JUNCT_1020       5068.05    1020_OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1025       5207.32    1025_OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1026       5183.21    1026_OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1043       5148.52    1043_OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1045       5046.02    1045B            TABULAR    DIVERSION_1045   0          0          0          0

JUNCT_200        5262.09    200_OVERFLOW     CUTOFF     0          0          0          0          0
JUNCT_221        5060.50    221_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_300        5248.56    300_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_303        5228.11    303_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_306        5173.32    306_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_308        5163.74    308_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_310        5176.39    310_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_311        5150.95    311_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_312        5095.37    312_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_313        5068.07    313_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_315        5051.97    315_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_317        5036.75    317_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_318        5025.97    318_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_319        5013.48    319_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_320        5109.88    320_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_322        5050.45    322_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_413        5201.91    413_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_454        5149.68    454_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_460        5122.34    460_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_469        5064.35    469_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_479        5096.62    479_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_498        5025.32    498_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_500        5303.68    500_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_501        5231.97    501_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_502        5187.28    502_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_503        5149.82    503_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_505        5092.31    505_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_506        5165.50    506_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_507        5114.69    507_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_508        5099.92    508_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_511        5195.97    511_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_512        5194.82    512_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_513        5125.98    513_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_514        5099.74    514_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_515        5099.46    515_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_516        5141.61    516_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_517        5075.04    517_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_518        5086.17    518_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_519        5071.49    519_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_521        5065.79    521_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_522        5048.92    522_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_523        5179.15    523_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_525        5046.53    525_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_526        5138.78    526_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_529        5121.73    529_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_530        5080.00    530_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_531        5067.60    531_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_532        5046.00    532_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_534        5052.68    534_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_536        5040.47    536_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_538        5035.85    538_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_539        5012.40    539_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_540        5007.80    540_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_541        4991.21    541_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_542        5020.03    542_OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_543        5017.91    543_OVERFLOW     OVERFLOW   0          0          0          0
```

Arapahoe Road 1 – Reach 2

7. No Improvements Recommended

The Arapahoe Road 1, Reach 2, outfall is located entirely in the City of Lafayette planning area, outside of the Town of Erie planning area. The area is primarily zoned as open space. No improvements are recommended.

Arapahoe Road 2 – Reach 1

2. Regional Detention with 100-Year Conveyance

The recommended plan is to provide conveyance of the 100-year storm event with additional regional detention. Regional detention ponds are sized to reduce 100-year peak flows from future development conditions to existing conditions. At this location, the difference between the two is negligible, 191 cfs versus 182 cfs.

The recommended plan is to provide detention to reduce flows below existing development conditions in order to minimize the size of the proposed storm sewer and downstream channel. A detention pond was sized at 4 acre-feet which reduced the 100-year peak discharge to 160 cfs. The results are as follows:

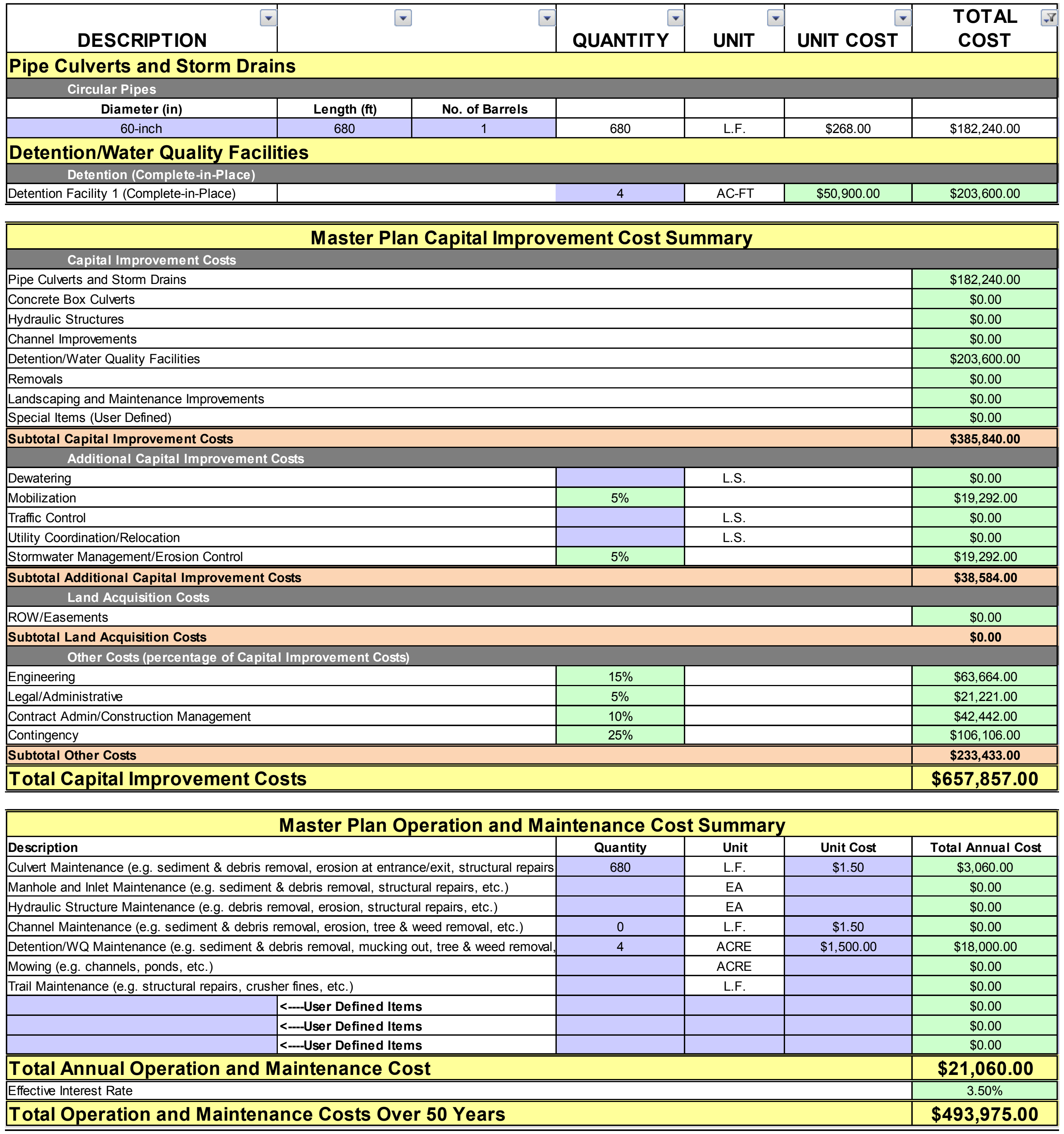
Detention Pond: V = 4 acre-feet
Storm Sewer: Q = 160 cfs, pipe size = 60" RCP

Arapahoe Road 2 – Reach 2

7. No Improvements Recommended

The Arapahoe Road 2, Reach 2, outfall is located entirely in the City of Lafayette planning area, outside of the Town of Erie planning area. The area is primarily zoned as open space. No improvements are recommended.

Arapahoe Road 1 – Reach 2 – Recommended Plan



DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	**Length (ft)**	**No. of Barrels**				
60-inch	680	1	680	L.F.	$268.00	$182,240.00
Detention/Water Quality Facilities						
Detention (Complete-in-Place)						
Detention Facility 1 (Complete-in-Place)			4	AC-FT	$50,900.00	$203,600.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$182,240.00
Concrete Box Culverts			$0.00
Hydraulic Structures			$0.00
Channel Improvements			$0.00
Detention/Water Quality Facilities			$203,600.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$0.00
Subtotal Capital Improvement Costs			**$385,840.00**
Additional Capital Improvement Costs			
Dewatering		L.S.	$0.00
Mobilization	5%		$19,292.00
Traffic Control		L.S.	$0.00
Utility Coordination/Relocation		L.S.	$0.00
Stormwater Management/Erosion Control	5%		$19,292.00
Subtotal Additional Capital Improvement Costs			**$38,584.00**
Land Acquisition Costs			
ROW/Easements			$0.00
Subtotal Land Acquisition Costs			**$0.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$63,664.00
Legal/Administrative	5%		$21,221.00
Contract Admin/Construction Management	10%		$42,442.00
Contingency	25%		$106,106.00
Subtotal Other Costs			**$233,433.00**
Total Capital Improvement Costs			**$657,857.00**

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	680	L.F.	$1.50	$3,060.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)		EA		$0.00
Hydraulic Structure Maintenance (e.g. debris removal, erosion, structural repairs, etc.)		EA		$0.00
Channel Maintenance (e.g. sediment & debris removal, erosion, tree & weed removal, etc.)	0	L.F.	$1.50	$0.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal,	4	ACRE	$1,500.00	$18,000.00
Mowing (e.g. channels, ponds, etc.)		ACRE		$0.00
Trail Maintenance (e.g. structural repairs, crusher fines, etc.)		L.F.		$0.00
<----User Defined Items				$0.00
<----User Defined Items				$0.00
<----User Defined Items				$0.00
Total Annual Operation and Maintenance Cost				**$21,060.00**
Effective Interest Rate				3.50%
Total Operation and Maintenance Costs Over 50 Years				**$493,975.00**

Erie Farms 1 – Reach 1

2. Regional Detention with 100-Year Conveyance

The recommended plan is to provide conveyance of the 100-year storm event with additional regional detention. A regional detention pond is proposed on the west side of County Line Road as part of the planned Erie Farms Development, detention pond 1053. In order to reduce the 100-year peak flow from future development conditions to existing conditions, a detention pond volume of 14 acre-feet is required.

The recommended plan includes detention pond 1054 joining the outlet from detention pond 1053 prior to the pipes crossing County Line Road. This is intended to minimize crossings of County Line Road. Therefore, the proposed channel east of County Line Road includes the discharges from both detention ponds 1053 and 1054.

A trapezoidal channel was designed with a target velocity of 5 ft/s, depth of 5', and 4:1 side slopes. The channel extends from the east side of County Line Road to the outfall at Coal Creek. The results are as follows:

Detention Pond: V = 14 acre-feet
Channel: Q = 640 cfs, slope = 0.36%, bottom width = 6', top width = 46', drop height = 24 feet
Culvert (County Line Road): Q = 640 cfs, 4' x 8' RCBC

Master Plan Operation and Maintenance Cost Summary

Description		Quantity	Unit	Unit Cost	Total Annual Cost
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs		70	L.F.	$1.50	$315.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)			EA		$0.00
Hydraulic Structure Maintenance (e.g. debris removal, erosion, structural repairs, etc.)			EA		$0.00
Channel Maintenance (e.g. sediment & debris removal, erosion, tree & weed removal, etc.)		798	L.F.	$1.50	$3,591.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal,		14	ACRE	$1,500.00	$63,000.00
Mowing (e.g. channels, ponds, etc.)			ACRE		$0.00
Trail Maintenance (e.g. structural repairs, crusher fines, etc.)			L.F.		$0.00
	<----User Defined Items				$0.00
	<----User Defined Items				$0.00
	<----User Defined Items				$0.00
Total Annual Operation and Maintenance Cost					**$66,906.00**
Effective Interest Rate					3.50%
Total Operation and Maintenance Costs Over 50 Years					**$1,569,322.00**

Erie Farms 1 – Reach 1 – Recommended Plan

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Concrete Box Culverts						
Box Culvert Pipe						
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**			
8	4	1	70	L.F.	$736.17	$51,531.90
Headwall and Toewalls						
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**				
8	1	10.00	2	EA	$796.75	$1,593.50
Wingwalls (includes wingwalls on either side of channel and concrete apron)						
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**				
8	4	1	2	EA	$7,420.37	$14,840.74
Hydraulic Structures						
Sloping Drop Structures						
Height (ft)	**Bottom Width (ft)**	**Yn (ft)**				
3	6	5	8	EA	$64,606.52	$516,852.16
Channel Improvements						
Excavation, Low Range			5320	C.Y.	$12.00	$63,840.00
Soil Riprap, Type VL			1270	C.Y.	$56.00	$71,120.00
Detention/Water Quality Facilities						
Detention (Complete-in-Place)						
Detention Facility 1 (Complete-in-Place)			14	AC-FT	$50,900.00	$712,600.00
Land Acquisition						
Easement/ROW Acquisition			1.54	ACRE	$20,000.00	$30,800.00

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs			
Pipe Culverts and Storm Drains			$0.00
Concrete Box Culverts			$67,966.00
Hydraulic Structures			$516,852.00
Channel Improvements			$134,960.00
Detention/Water Quality Facilities			$712,600.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$0.00
Subtotal Capital Improvement Costs			**$1,432,378.00**
Additional Capital Improvement Costs			
Dewatering		L.S.	$0.00
Mobilization	5%		$71,619.00
Traffic Control		L.S.	$0.00
Utility Coordination/Relocation		L.S.	$0.00
Stormwater Management/Erosion Control	5%		$71,619.00
Subtotal Additional Capital Improvement Costs			**$143,238.00**
Land Acquisition Costs			
ROW/Easements			$30,800.00
Subtotal Land Acquisition Costs			**$30,800.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$236,342.00
Legal/Administrative	5%		$78,781.00
Contract Admin/Construction Management	10%		$157,562.00
Contingency	25%		$393,904.00
Subtotal Other Costs			**$866,589.00**
Total Capital Improvement Costs			**$2,473,005.00**

Erie Farms 1 – Reach 2

7. No Improvements Recommended

The Erie Farms 1, Reach 2, outfall is zoned as open space and will not experience an increase in 100-year peak flows from existing development conditions to future development, therefore no improvements are recommended.

Erie Farms 2 – Reach 1

The Erie Farms 2, Reach 1, outfall will be combined with the Erie Farms 1 outfall as proposed in the Erie Farms Phase III Drainage Report, dated October 30, 2012. The hydrologic model has been revised to reflect this and the improvements proposed in the Erie Farms 1, Reach 1, are designed using the revised hydrologic results.

Gold Run – Reach 1

2. Regional Detention with 100-Year Conveyance

This alternative provides conveyance of the 100-year storm event with additional regional detention. In order to reduce the 100-year peak flow from future development conditions to existing conditions, a detention pond volume of 15 acre-feet is required. A trapezoidal channel was designed with a target velocity of 5 ft/s, depth of 3', and 4:1 side slopes. The channel extends from the east side of County Line Road to the outfall at Coal Creek. The results are as follows:

Detention Pond: V = 15 acre-feet
Channel: Q = 241 cfs, slope = 0.70%, bottom width = 4', top width = 28', drop height = 20 feet
Culvert (County Line Road): Q = 241 cfs, 2 - 48" RCP

Master Plan Operation and Maintenance Cost Summary				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Annual Cost**
Culvert Maintenance (e.g. sediment & debris removal, erosion at entrance/exit, structural repairs	70	L.F.	$1.50	$315.00
Manhole and Inlet Maintenance (e.g. sediment & debris removal, structural repairs, etc.)		EA		$0.00
Hydraulic Structure Maintenance (e.g. debris removal, erosion, structural repairs, etc.)		EA		$0.00
Channel Maintenance (e.g. sediment & debris removal, erosion, tree & weed removal, etc.)	2546	L.F.	$1.50	$11,457.00
Detention/WQ Maintenance (e.g. sediment & debris removal, mucking out, tree & weed removal,	15	ACRE	$1,500.00	$67,500.00
Mowing (e.g. channels, ponds, etc.)		ACRE		$0.00
Trail Maintenance (e.g. structural repairs, crusher fines, etc.)		L.F.		$0.00
<----User Defined Items				$0.00
<----User Defined Items				$0.00
<----User Defined Items				$0.00
Total Annual Operation and Maintenance Cost				**$79,272.00**
Effective Interest Rate				3.50%
Total Operation and Maintenance Costs Over 50 Years				**$1,859,374.00**

Gold Run – Reach 1 – Recommended Plan

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	**Length (ft)**	**No. of Barrels**				
48-inch	70	2	140	L.F.	$161.00	$22,540.00
Flare End Sections						
Diameter (in)	**Applicable**	**No. of Barrels**				
48-inch	Yes	2	4	EA	$2,300.00	$9,200.00
Hydraulic Structures						
Sloping Drop Structures						
Height (ft)	**Bottom Width (ft)**	**Yn (ft)**				
3	4	3	7	EA	$39,333.87	$275,337.09
Channel Improvements						
Excavation, Low Range			7540	C.Y.	$12.00	$90,480.00
Soil Riprap, Type VL			4050	C.Y.	$56.00	$226,800.00
Detention/Water Quality Facilities						
Detention (Complete-in-Place)						
Detention Facility 1 (Complete-in-Place)			15	AC-FT	$50,900.00	$763,500.00
Land Acquisition						
Easement/ROW Acquisition			3.86	ACRE	$20,000.00	$77,200.00

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$31,740.00
Concrete Box Culverts			$0.00
Hydraulic Structures			$275,337.00
Channel Improvements			$317,280.00
Detention/Water Quality Facilities			$763,500.00
Removals			$0.00
Landscaping and Maintenance Improvements			$0.00
Special Items (User Defined)			$0.00
Subtotal Capital Improvement Costs			**$1,387,857.00**
Additional Capital Improvement Costs			
Dewatering		L.S.	$0.00
Mobilization	5%		$69,393.00
Traffic Control		L.S.	$0.00
Utility Coordination/Relocation		L.S.	$0.00
Stormwater Management/Erosion Control	5%		$69,393.00
Subtotal Additional Capital Improvement Costs			**$138,786.00**
Land Acquisition Costs			
ROW/Easements			$77,200.00
Subtotal Land Acquisition Costs			**$77,200.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$228,996.00
Legal/Administrative	5%		$76,332.00
Contract Admin/Construction Management	10%		$152,664.00
Contingency	25%		$381,661.00
Subtotal Other Costs			**$839,653.00**
Total Capital Improvement Costs			**$2,443,496.00**

LEGEND

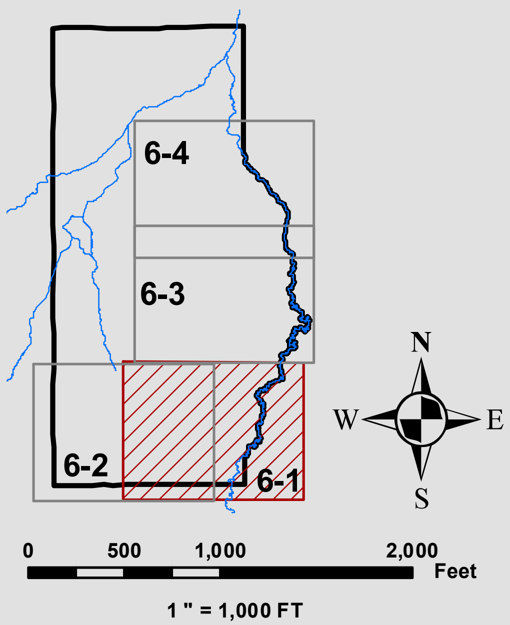
- ☐ Study Area Boundary
- ☐ Erie Planning Area Boundary
- 🟦 Town of Erie
- 🟥 City of Lafayette
- 🟩 100-Year Floodplain (FIS)
- ▨ Existing Detention Ponds
- — Existing Outfall Alignment
  (Outfall Name)

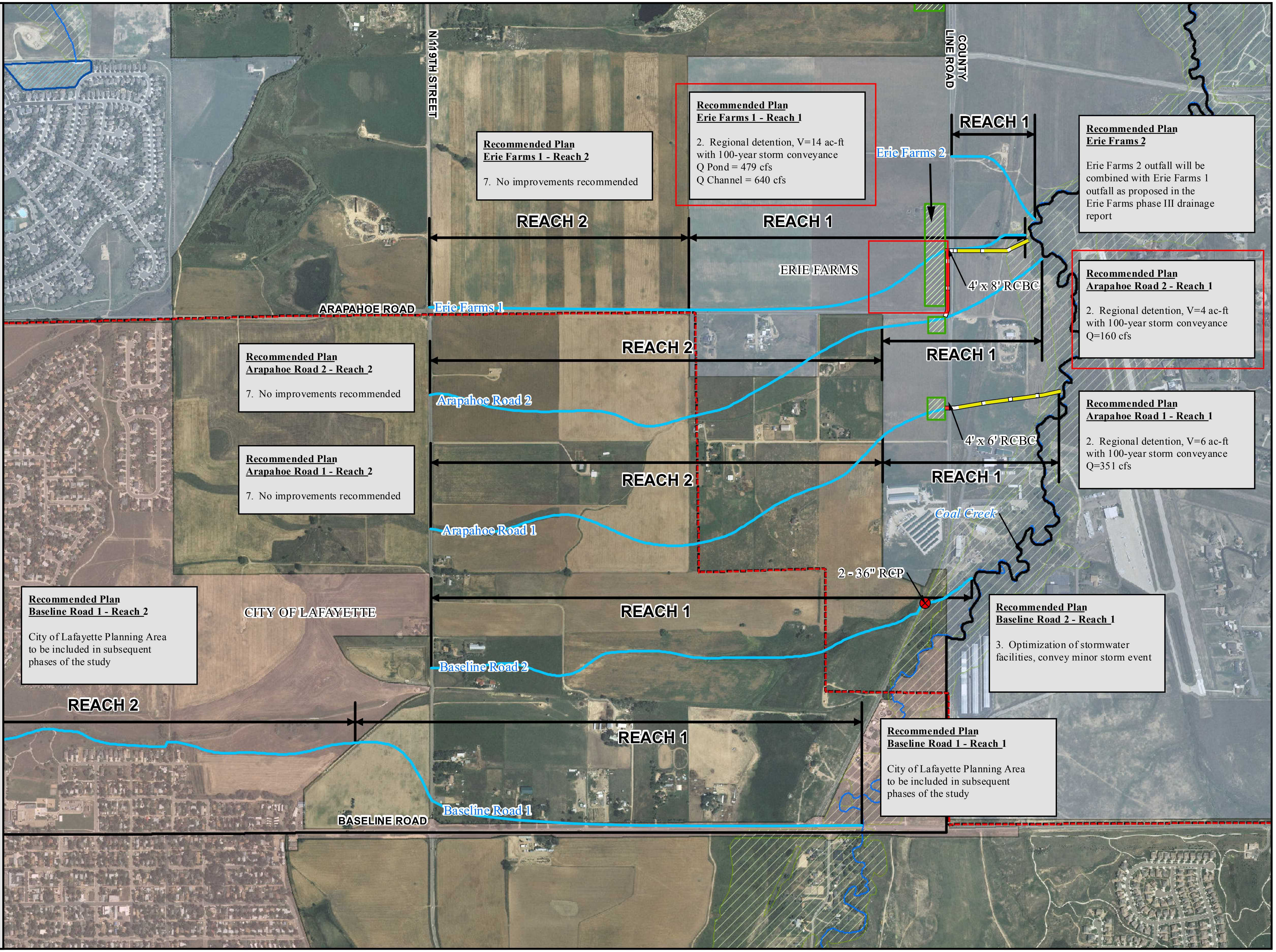
Note: 100-Year floodplain information from Boulder County Flood Insurance Study (FIS), FEMA, December 18, 2012

ALTERNATIVES

- — Storm Sewer
- — Channel
- ☐ Regional Detention
- ⊗ Culvert/Bridge Improvements
- — Bank Stabilization
- ▨ Property Acquisition

KEY MAP





Recommended Plan
Erie Farms 1 - Reach 2

7. No improvements recommended

Recommended Plan
Erie Farms 1 - Reach 1

2. Regional detention, V=14 ac-ft with 100-year storm conveyance
Q Pond = 479 cfs
Q Channel = 640 cfs

Recommended Plan
Erie Farms 2

Erie Farms 2 outfall will be combined with Erie Farms 1 outfall as proposed in the Erie Farms phase III drainage report

Recommended Plan
Arapahoe Road 2 - Reach 2

7. No improvements recommended

Recommended Plan
Arapahoe Road 2 - Reach 1

2. Regional detention, V=4 ac-ft with 100-year storm conveyance
Q=160 cfs

Recommended Plan
Arapahoe Road 1 - Reach 2

7. No improvements recommended

Recommended Plan
Arapahoe Road 1 - Reach 1

2. Regional detention, V=6 ac-ft with 100-year storm conveyance
Q=351 cfs

Recommended Plan
Baseline Road 1 - Reach 2

City of Lafayette Planning Area to be included in subsequent phases of the study

Recommended Plan
Baseline Road 2 - Reach 1

3. Optimization of stormwater facilities, convey minor storm event

Recommended Plan
Baseline Road 1 - Reach 1

City of Lafayette Planning Area to be included in subsequent phases of the study

M:\2234\GIS\2234 ALTERNATIVES.MXD - 3/1/13 - NRT

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80246
PHONE: 303-757-8513
FAX: 303-758-3208

TOWN OF ERIE
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

TOWN OF ERIE OUTFALL SYSTEMS PLAN
(WEST OF COAL CREEK)

RECOMMENDED PLAN
COAL CREEK TRIBUTARIES

FIGURE
6-1

APPENDIX C

SF2 & SF3 Rational Method Spreadsheets

StormCAD HGL Reports

Inlet Reports

Pond Design Information

Existing Vista Parkway Roadside Swale

JANSEN STRAWN
CONSULTING ENGINEERS
A WARE MALCOMB COMPANY

PROJECT: Compass Fil. 4
JOB NO.: 15075-1
CALC. BY: SL
DATE: 5/30/2017

🟩 = FORMULA CELLS
🟦 = USER INPUT CELLS

IDF Rainfall Data

	P_1: 1-hour Rainfall Depths (inches)	
	Minor Storm	**Major Storm**
T_d	2-Year	100-Year
Minutes	**0.81**	**2.65**
5	2.75	8.99
10	2.19	7.17
20	1.59	5.21
30	1.27	4.16
40	1.07	3.49
50	0.92	3.02
60	0.82	2.68
120	0.50	1.65

Equation 5-1 $I=(28.5*P_1)/(10+T_d)^{\wedge 0.786}$

I = rainfall intensity (inches per hour)

P_1 = 1-hour point rainfall depth (inches)

T_d = storm duration (minutes)

Reference:

1) Urban Drainage and Flood Control District - Urban Storm Drainage Criteria Manual Volume 1, 2017
2) NOAA Atlas 14, Volume 8, Version 2
http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=co

PROJECT: Compass Fil. 4
JOB NO.: 15075-1
CALC. BY: SL
DATE: 5/30/2017

JANSEN STRAWN
CONSULTING ENGINEERS
A WARE MALCOMB COMPANY

Impervious Percentages - from Urban Drainage Table 6-3

Multi-Family	75%
Landscaping	2%
Paved	100%
Parks	10%

Walks	90%
Playground	25%
Historic	2%
Gravel	40%

SOIL TYPE: B (use equation from Table 6-4)

🟩 = FORMULA CELLS
🟦 = USER INPUT CELLS

PROPOSED COMPOSITE IMPERVIOUSNESS

		Weighted Impervious and C Values					Areas (ac)							
Basin	**Area (ac)**	**Imp.**	**C_2**	**C_5**	**C_{10}**	**C_{100}**	**Multi-Family**	**Landscaping**	**Paved**	**Parks**	**Walks**	**Playground**	**Historic**	**Gravel**
A-13	1.00	80%	0.65	0.68	0.71	0.80	0.59	0.04	0.32		0.04			
A-14	1.17	48%	0.35	0.38	0.44	0.65	0.45	0.49	0.03		0.20			
A-14.1	1.76	72%	0.57	0.60	0.64	0.76	0.91	0.26	0.45		0.14			
A-15	2.72	76%	0.61	0.63	0.67	0.78	1.82	0.20	0.58		0.12			
A-15.1	0.48	17%	0.10	0.12	0.19	0.50		0.40			0.08			
A-15.2	0.22	71%	0.57	0.60	0.64	0.76		0.06	0.12		0.04			
A-16	1.66	78%	0.63	0.66	0.69	0.79	1.03	0.10	0.43		0.11			
A-16.1	4.19	2%	0.01	0.01	0.07	0.44		4.19						
A-16.2	1.32	30%	0.20	0.23	0.30	0.57	0.38	0.85	0.09					
A-16.3	0.38	58%	0.44	0.47	0.52	0.70	0.29	0.09						
A-17	4.49	2%	0.01	0.01	0.07	0.44		4.49						
A-10	2.11	3%	0.01	0.02	0.08	0.44		2.09			0.02			
Total Basin A	**21.50**	**33%**	**0.23**	**0.26**	**0.32**	**0.58**	**5.47**	**13.26**	**2.02**	**0.00**	**0.75**	**0.00**	**0.00**	**0.00**
C-1	1.90	14%	0.08	0.10	0.17	0.49	0.27	1.60			0.03			
C-2	0.69	44%	0.32	0.35	0.41	0.63		0.39	0.24		0.06			
C-3	2.53	75%	0.60	0.63	0.66	0.78	1.57	0.24	0.55		0.17			
C-4	0.99	57%	0.43	0.47	0.52	0.69	0.13	0.39	0.34		0.13			
C-5	1.51	75%	0.60	0.63	0.67	0.78	0.78	0.17	0.43		0.13			

PROJECT: Compass Fil. 4
JOB NO.: 15075-1
CALC. BY: SL
DATE: 5/30/2017

JANSEN STRAWN
CONSULTING ENGINEERS
A WARE MALCOMB COMPANY

Impervious Percentages - from Urban Drainage Table 6-3

Multi-Family	75%		Walks	90%
Landscaping	2%		Playground	25%
Paved	100%		Historic	2%
Parks	10%		Gravel	40%

SOIL TYPE: B (use equation from Table 6-4)

🟩 = FORMULA CELLS
🟦 = USER INPUT CELLS

PROPOSED COMPOSITE IMPERVIOUSNESS

		Weighted Impervious and C Values					Areas (ac)							
Basin	**Area (ac)**	**Imp.**	**C_2**	**C_5**	**C_{10}**	**C_{100}**	**Multi-Family**	**Landscaping**	**Paved**	**Parks**	**Walks**	**Playground**	**Historic**	**Gravel**
C-6	2.16	78%	0.63	0.66	0.69	0.79	1.16	0.17	0.65		0.18			
C-7	0.29	73%	0.58	0.61	0.65	0.77	0.14	0.04	0.09		0.02			
C-8	0.78	61%	0.47	0.50	0.55	0.71		0.30	0.38		0.10			
C-9	0.74	75%	0.60	0.63	0.66	0.78		0.18	0.48		0.09			
Total Basin C	**11.58**	**61%**	**0.47**	**0.50**	**0.55**	**0.71**	**4.05**	**3.47**	**3.16**	**0.00**	**0.90**	**0.00**	**0.00**	**0.00**
OS-1	0.54	83%	0.67	0.70	0.73	0.81		0.09	0.39		0.06			

JANSEN STRAWN
CONSULTING ENGINEERS
A WARE MALCOMB COMPANY

STANDARD FORM SF-2

TIME OF CONCENTRATION SUMMARY

Calculated By: SL
Date: 5/30/2017

Project: Compass Fil. 4
Job No.: 15075-1
Checked By: GDB

SUB-BASIN DATA				INITIAL/OVERLAND TIME (t_i)			TRAVEL TIME (t_t)					t_c CHECK (URBANIZED BASINS)				FINAL t_c	REMARKS
Basin (1)	i (2)	C_5 (3)	AREA Ac (4)	LENGTH Ft (5)	SLOPE % (6)	t_i Min (7)	LENGTH Ft (8)	Cv	SLOPE % (9)	VEL. FPS (10)	t_t Min (11)	COMP. t_c (12)	TOT. LENGTH Ft (13)	S_o % (14)	tc (Equation 6-5) Min (15)	Min (16)	
A-10	0.03	0.02	2.11	200	1.0	28.0	400	7	1.0	0.7	9.5	37.6	400	1.00	32.6	32.6	
A-13	0.80	0.68	1.00	105	2.3	6.0	310	20	1.1	2.1	2.5	8.5	310	1.10	14.8	8.5	
A-14	0.48	0.38	1.17	50	2.0	7.4	350	20	1.7	2.6	2.2	9.6	350	1.70	20.8	9.6	
A-14.1	0.72	0.60	1.76	15	2.0	2.8	515	20	0.8	1.8	4.7	7.5	515	0.84	18.7	7.5	
A-15	0.76	0.63	2.72	100	1.0	8.5	540	20	1.3	2.3	3.9	12.5	540	1.30	17.2	12.5	
A-15.1	0.17	0.12	0.48	15	2.0	5.5	250	20	2.4	3.1	1.3	6.8	250	2.44	25.5	6.8	
A-15.2	0.71	0.60	0.22	15	2.0	2.8	305	20	0.9	1.9	2.7	5.6	305	0.86	16.7	5.6	
A-16	0.78	0.66	1.66	145	1.0	9.8	530	20	1.2	2.2	4.0	13.8	530	1.20	16.7	13.8	
A-16.1	0.02	0.01	4.19	290	1.4	30.4	530	7	1.4	0.8	10.7	41.0	530	1.40	33.7	33.7	
A-16.2	0.30	0.23	1.32	30	0.5	11.0	60	7	0.5	0.5	2.0	13.0	60	0.50	22.0	13.0	
A-16.3	0.58	0.47	0.38	40	0.5	9.2	120	7	0.5	0.5	4.0	13.2	120	0.50	17.9	13.2	
A-17	0.02	0.01	4.49	240	0.9	32.0	500	20	0.8	1.8	4.7	36.7	500	0.80	35.7	35.7	
C-1	0.14	0.10	1.90	50	2.0	10.3	200	7	2.0	1.0	3.4	13.7	200	2.00	25.8	13.7	
C-2	0.44	0.35	0.69	80	1.5	10.7	400	20	2.5	3.2	2.1	12.8	400	2.50	21.3	12.8	
C-3	0.75	0.63	2.53	130	0.5	12.5	180	20	1.0	2.0	1.5	14.0	180	1.00	14.9	14.0	
C-4	0.57	0.47	0.99	45	1.0	7.8	700	20	2.0	2.8	4.1	11.9	700	2.00	21.2	11.9	
C-5	0.75	0.63	1.51	115	0.5	11.6	460	20	2.0	2.8	2.7	14.4	460	2.00	16.0	14.4	
C-6	0.78	0.66	2.16	13	0.5	3.7	375	20	1.9	2.8	2.3	6.0	375	1.90	15.0	6.0	
C-7	0.73	0.61	0.29	20	3.5	2.6	890	20	1.0	2.0	7.4	10.0	890	1.00	21.3	10.0	
C-8	0.61	0.50	0.78	150	2.0	10.6	410	20	2.3	3.0	2.3	12.9	410	2.30	18.1	12.9	
C-9	0.75	0.63	0.74	20	2.0	3.1	380	20	2.5	3.2	2.0	5.1	380	2.50	15.3	5.1	
OS-1	0.83	0.70	0.54	20	2.0	2.6	330	20	2.5	3.2	1.7	4.4	330	2.50	13.6	5.0	

Equation 6-3 $t_i=((0.39(1.1-C_5)SQRT(L))/(S_o\text{^}0.33))$

Equation 6-5 $t_c=(26-17i)+(L_t/(60(14i+9)SQRT(S_o)))$

🟩 = FORMULA CELLS
🟦 = USER INPUT CELLS

Cv Table	
Short Pasture and Lawns	7
Nearly Bare Ground	10
Grassed Waterway	15
Paved Areas and Shallow Paved Swales	20

Calculated By: SL
Date: 5/30/2017
Checked By: GDB
2-Year
1-hour rainfall= 0.81

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Project: Compass Fil. 4
Job No.: 15075-1
Design Storm: 2-Year

🟩 = FORMULA CELLS
🟦 = USER INPUT CELLS

BASIN	DIRECT RUNOFF								TOTAL RUNOFF				STREET		PIPE						REMARKS
	DESIGN POINT	AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I (IN/HR)	Q (CFS)	t_c (MIN)	S (C * A) (CA)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW	DESIGN FLOW (CFS)	SLOPE (%)	PIPE DIAM. (IN.)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
A-10	110		2.11	0.01	32.6	0.03	1.21	**0.0**													Overland flow to offsite inlet at DP110
									32.6	0.0	1.21	**0.04**									Overland flow to offsite inlet at DP110
A-13	113		1.00	0.65	8.5	0.65	2.33	**1.5**													Street flow to Inlet at DP113
									8.5	0.7	2.33	**1.52**									Street flow to Inlet at DP113
A-14	114		1.17	0.35	9.6	0.41	2.23	**0.9**													Street flow to inlet at DP114
									9.6	0.4	2.23	**0.92**									Street flow to inlet at DP114
A-14.1	114.1		1.76	0.57	7.5	1.00	2.43	**2.4**													Street flow to inlet at DP114.1
									7.5	1.0	2.43	**2.44**									Street flow to inlet at DP114.1
A-15	115		2.72	0.61	12.5	1.65	2.00	**3.3**													Street flow to inlet at DP115
									12.5	1.6	2.00	**3.30**									Street flow to inlet at DP115
A-15.1	115.1		0.48	0.10	6.8	0.05	2.51	**0.1**													Street flow to inlet at DP115.1
									6.8	0.0	2.51	**0.12**									Street flow to inlet at DP115.1
A-15.2	115.2		0.22	0.57	5.6	0.12	2.67	**0.3**													Street flow to inlet at DP115.2
									5.6	0.1	2.67	**0.33**									Street flow to inlet at DP115.2
A-16	116		1.66	0.63	13.8	1.04	1.91	**2.0**													Street flow to inlet at DP116
									13.8	1.0	1.91	**2.00**									Street flow to inlet at DP116
A-16.1	116.1		4.19	0.01	33.7	0.04	1.19	**0.0**													Overland flow to offsite inlet at DP116.1
									33.7	0.0	1.19	**0.04**									Overland flow to offsite inlet at DP116.1
A-16.2	116.2		1.32	0.20	13.0	0.27	1.96	**0.5**													Overland flow to onsite inlet at DP116.2
									13.0	0.3	1.96	**0.53**									Overland flow to onsite inlet at DP116.2
A-16.3	116.3		0.38	0.44	13.2	0.17	1.95	**0.3**													Overland flow to onsite inlet at DP116.3
									13.2	0.2	1.95	**0.32**									Overland flow to onsite inlet at DP116.3
A-17	117		4.49	0.01	35.7	0.04	1.14	**0.0**													Overland flow to offsite inlet at DP117
									35.7	0.0	1.14	**0.04**									Overland flow to offsite inlet at DP117
C-1	301		1.90	0.08	13.7	0.16	1.92	**0.3**													Pond
																					Pond
C-2	302		0.69	0.32	12.8	0.22	1.97	**0.4**													Street flow to inlet at DP302

Calculated By: SL
Date: 5/30/2017
Checked By: GDB
2-Year 1-hour rainfall= 0.81

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Project: Compass Fil. 4
Job No.: 15075-1
Design Storm: 2-Year

🟩 = FORMULA CELLS
🟦 = USER INPUT CELLS

	DIRECT RUNOFF								TOTAL RUNOFF				STREET		PIPE						
BASIN	DESIGN POINT	AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I (IN/HR)	Q (CFS)	t_c (MIN)	S (C * A) (CA)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW	DESIGN FLOW (CFS)	SLOPE (%)	PIPE DIAM. (IN.)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	REMARKS
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
									12.8	0.2	1.97	**0.44**									Street flow to inlet at DP302
C-3	303		2.53	0.60	14.0	1.51	1.90	**2.9**													Street flow to inlet at DP303
									14.0	1.5	1.90	**2.87**									Street flow to inlet at DP303
C-4	304		0.99	0.43	11.9	0.43	2.04	**0.9**													Street flow to inlet at DP304
									11.9	0.4	2.04	**0.88**									Street flow inlet at DP304
C-5	305		1.51	0.60	14.4	0.91	1.88	**1.7**													Street flow to inlet at DP305
									14.4	0.9	1.88	**1.70**									Street flow to inlet at DP305
C-6	306		2.16	0.63	6.0	1.36	2.62	**3.6**													Street flow to inlet at DP306
									6.0	1.4	2.62	**3.55**									Street flow to inlet at DP306
C-5, C-6												**5.25**									Flow to sump inlets at DP305 and DP306
C-7	307		0.29	0.58	10.0	0.17	2.19	**0.4**													Street flow to inlet at DP307
									10.0	0.2	2.19	**0.37**									Street flow to inlet at DP307
C-8	308		0.78	0.47	12.9	0.37	1.97	**0.7**													Street flow to inlet at DP308
									12.9	0.4	1.97	**0.73**									Street flow to inlet at DP308
C-9	309		0.74	0.60	5.1	0.44	2.74	**1.2**													Street flow to DP309
OS-1	310		0.54	0.67	5.0	0.36	2.75	**1.0**													Street flow to inlet at DP310

Calculated By: SL
Date: 5/30/2017
Checked By: GDB
100-Year 1-hour rainfall= 2.65

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Project: Compass Fil. 4
Job No.: 15075-1
Design Storm: 100-Year

🟩 = FORMULA CELLS
🟦 = USER INPUT CELLS

BASIN	DIRECT RUNOFF								TOTAL RUNOFF				STREET		PIPE						REMARKS
	DESIGN POINT	AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I (IN/HR)	Q (CFS)	t_c (MIN)	S (C * A) (CA)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW	DESIGN FLOW (CFS)	SLOPE (%)	PIPE DIAM. (IN.)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
A-10	110		2.11	0.44	32.6	0.93	3.96	**3.7**													Overland flow to offsite inlet at DP110
									32.6	0.9	3.96	**3.7**									Overland flow to offsite inlet at DP110
A-13	113		1.00	0.80	8.5	0.80	7.63	**6.1**													Street flow to Inlet at DP113
									8.5	0.8	7.63	**6.1**									Street flow to Inlet at DP113
A-14	114		1.17	0.65	9.6	0.76	7.28	**5.5**													Street flow to inlet at DP114
									9.6	0.8	7.28	**5.5**									Street flow to inlet at DP114
A-14.1	114.1		1.76	0.76	7.5	1.34	7.96	**10.7**													Street flow to inlet at DP114.1
									7.5	1.3	7.96	**10.7**									Street flow to inlet at DP114.1
A-15	115		2.72	0.78	12.5	2.13	6.54	**13.9**													Street flow to inlet at DP115
									12.5	2.1	6.54	**13.9**									Street flow to inlet at DP115
A-15.1	115.1		0.48	0.50	6.8	0.24	8.21	**2.0**													Street flow to inlet at DP115.1
									6.8	0.2	8.21	**2.0**									Street flow to inlet at DP115.1
A-15.2	115.2		0.22	0.76	5.6	0.17	8.73	**1.5**													Street flow to inlet at DP115.2
									5.6	0.2	8.73	**1.5**									Street flow to inlet at DP115.2
A-16	116		1.66	0.79	13.8	1.32	6.26	**8.2**													Street flow to inlet at DP116
									13.8	1.3	6.26	**8.2**									Street flow to inlet at DP116
A-16.1	116.1		4.19	0.44	33.7	1.82	3.88	**7.1**													Overland flow to offsite inlet at DP116.1
									33.7	1.8	3.88	**7.1**									Overland flow to offsite inlet at DP116.1
A-16.2	116.2		1.32	0.57	13.0	0.75	6.42	**4.8**													Overland flow to onsite inlet at DP116.2
									13.0	0.7	6.42	**4.8**									Overland flow to onsite inlet at DP116.2
A-16.3	116.3		0.38	0.70	13.2	0.26	6.38	**1.7**													Overland flow to onsite inlet at DP116.3
									13.2	0.3	6.38	**1.7**									Overland flow to onsite inlet at DP116.3
A-17	117		4.49	0.44	35.7	1.95	3.74	**7.3**													Overland flow to offsite inlet at DP117
									35.7	2.0	3.74	**7.3**									Overland flow to offsite inlet at DP117
C-1	301		1.90	0.49	13.7	0.93	6.28	**5.9**													Pond
																					Pond
C-2	302		0.69	0.63	12.8	0.44	6.46	**2.8**													Street flow to inlet at DP302

Calculated By: SL
Date: 5/30/2017
Checked By: GDB
100-Year 1-hour rainfall= 2.65

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Project: Compass Fil. 4
Job No.: 15075-1
Design Storm: 100-Year

🟩 = FORMULA CELLS
🟦 = USER INPUT CELLS

BASIN	DIRECT RUNOFF								TOTAL RUNOFF				STREET		PIPE						REMARKS
	DESIGN POINT (2)	AREA DESIGN (3)	AREA (AC) (4)	RUNOFF COEFF (5)	t_c (MIN) (6)	C * A (AC) (7)	I (IN/HR) (8)	Q (CFS) (9)	t_c (MIN) (10)	S (C * A) (CA) (11)	I (IN/HR) (12)	Q (CFS) (13)	SLOPE (%) (14)	STREET FLOW (15)	DESIGN FLOW (CFS) (16)	SLOPE (%) (17)	PIPE DIAM. (IN.) (18)	LENGTH (FT) (19)	VELOCITY (FPS) (20)	t_t (MIN) (21)	(22)
									12.8	0.4	6.46	**2.8**									Street flow to inlet at DP302
C-3	303		2.53	0.78	14.0	1.96	6.21	**12.2**													Street flow to inlet at DP303
									14.0	2.0	6.21	**12.2**									Street flow to inlet at DP303
C-4	304		0.99	0.69	11.9	0.69	6.67	**4.6**													Street flow to inlet at DP304
									11.9	0.7	6.67	**4.6**									Street flow inlet at DP304
C-5	305		1.51	0.78	14.4	1.17	6.14	**7.2**													Street flow to inlet at DP305
									14.4	1.2	6.14	**7.2**									Street flow to inlet at DP305
C-6	306		2.16	0.79	6.0	1.71	8.56	**14.7**													Street flow to inlet at DP306
									6.0	1.7	8.56	**14.7**									Street flow to inlet at DP306
C-5, C-6												**21.9**									Flow to sump inlets at DP305 amd DP306
C-7	307		0.29	0.77	10.0	0.22	7.16	**1.6**													Street flow to inlet at DP307
									10.0	0.2	7.16	**1.6**									Street flow to inlet at DP307
C-8	308		0.78	0.71	12.9	0.56	6.45	**3.6**													Street flow to inlet at DP308
									12.9	0.6	6.45	**3.6**									Street flow to inlet at DP308
C-9	309		0.74	0.78	5.1	0.58	8.95	**5.2**													Street flow to DP309
OS-1	310		0.54	0.81	5.0	0.44	8.99	**3.9**													Street flow to DP310

2-Year Storm

FlexTable: Conduit Table

Label	Start Node	Stop Node	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Velocity (ft/s)	Material	Depth (Out) (ft)	Capacity (Full Flow) (cfs)	Length (User Defined) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Flow (cfs)	Manning's n
PIPE - 14	STM-INLET-CO9	O-1	5,094.39	5,091.84	0.039	24.0	6.81	Concrete	1.94	44.47	66.0	5,094.84	5,093.78	5,095.00	5,093.78	1.70	0.013
PIPE - 24	STM-INLET-C03	O-2	5,091.55	5,091.11	0.005	24.0	0.29	Concrete	2.67	16.00	88.8	5,093.78	5,093.78	5,093.78	5,093.78	0.90	0.013
PIPE - 26	STM-INLET-C10	O-3	5,091.42	5,091.16	0.005	18.0	0.57	Concrete	2.62	7.43	52.1	5,093.78	5,093.78	5,093.79	5,093.79	1.00	0.013
PIPE - 10	STM-INLET-C12.2	STM-MH-C12	5,103.24	5,103.07	0.010	18.0	5.06	Concrete	0.55	10.45	17.2	5,103.89	5,103.62	5,104.13	5,104.00	2.90	0.013
PIPE - 15	STM-INLET-C12.1	STM-MH-C12	5,103.24	5,103.07	0.010	18.0	2.86	Concrete	0.49	10.50	17.0	5,103.55	5,103.56	5,103.58	5,103.57	0.40	0.013
PIPE - 11	STM-MH-C12	STM-MH-C11	5,102.87	5,095.60	0.017	18.0	6.35	Concrete	0.50	13.63	431.6	5,103.56	5,096.10	5,103.83	5,096.73	3.30	0.013
PIPE - 9	STM-INLET-A09.2	STM-MH-A09	5,102.38	5,102.21	0.010	18.0	4.21	Concrete	0.39	10.50	17.2	5,102.84	5,102.60	5,103.01	5,102.86	1.50	0.013
PIPE - 1	STM-INLET-A09.1	STM-MH-A09	5,102.43	5,102.21	0.013	18.0	5.78	Concrete	0.56	11.95	17.0	5,103.12	5,102.77	5,103.39	5,103.23	3.30	0.013
PIPE - 2	STM-MH-A09	STM-MH-A08	5,101.17	5,100.12	0.005	24.0	4.45	Concrete	0.75	16.00	210.8	5,101.95	5,100.87	5,102.23	5,101.18	4.80	0.013
PIPE - 20	STM-INLET-C07	STM-MH-C06	5,102.01	5,101.65	0.020	18.0	3.64	Concrete	0.17	14.85	18.0	5,102.24	5,101.82	5,102.32	5,102.03	0.40	0.013
PIPE - 21	STM-MH-C06	STM-MH-C05	5,101.45	5,092.84	0.020	18.0	3.64	Concrete	0.94	14.85	430.5	5,101.68	5,093.78	5,101.76	5,093.78	0.40	0.013
PIPE - 30	STM-INLET-A08.1	STM-MH-A08	5,100.61	5,100.42	0.005	18.0	1.48	Concrete	0.35	7.43	38.5	5,100.77	5,100.77	5,100.79	5,100.77	0.10	0.013
PIPE - 2 (2)	STM-MH-A08	STM-MH-A07	5,099.92	5,099.46	0.005	24.0	4.68	Concrete	0.83	16.00	92.3	5,100.77	5,100.29	5,101.09	5,100.63	5.80	0.013
PIPE - 31	STM-INLET-A08.2	STM-MH-A08	5,100.61	5,100.42	0.005	18.0	2.84	Concrete	0.35	7.42	38.6	5,100.97	5,100.77	5,101.09	5,100.90	0.90	0.013
PIPE - 17	STM-INLET-A07.1	STM-MH-A07	5,100.05	5,099.96	0.005	18.0	2.06	Concrete	0.20	7.43	17.0	5,100.25	5,100.16	5,100.32	5,100.23	0.30	0.013
PIPE - 2 (1)	STM-MH-A07	STM-MH-A06	5,099.26	5,098.56	0.005	24.0	4.75	Concrete	0.86	16.00	140.8	5,100.13	5,099.41	5,100.47	5,099.76	6.10	0.013
PIPE - 12	STM-MH-C11	STM-MH-C10	5,095.40	5,095.21	0.005	18.0	4.08	Concrete	0.91	7.43	38.2	5,096.15	5,096.12	5,096.37	5,096.25	3.30	0.013
PIPE - 16	STM-INLET-C10.1	STM-MH-C10	5,095.34	5,095.21	0.005	18.0	4.17	Concrete	0.91	7.43	25.6	5,096.14	5,096.12	5,096.36	5,096.28	3.60	0.013
PIPE - 13	STM-MH-C10	STM-INLET-CO9	5,095.01	5,094.89	0.005	18.0	4.77	Concrete	1.02	7.43	23.0	5,096.12	5,095.91	5,096.49	5,096.36	6.90	0.013
PIPE - 3	STM-MH-A06	STM-MH-A05	5,098.36	5,098.12	0.005	24.0	4.81	Concrete	0.88	16.00	47.9	5,099.25	5,099.00	5,099.59	5,099.35	6.40	0.013
PIPE - 18	STM-INLET-A06.1	STM-MH-A06	5,099.06	5,098.85	0.005	18.0	2.06	Concrete	0.40	7.43	41.6	5,099.26	5,099.25	5,099.33	5,099.26	0.30	0.013
PIPE - 4	STM-MH-A05	STM-MH-A04	5,097.92	5,097.77	0.003	24.0	3.98	Concrete	0.90	12.39	49.6	5,098.92	5,098.66	5,099.18	5,099.01	6.40	0.013
PIPE - 4 (1)	STM-MH-A04	STM-MH-A03	5,096.77	5,096.69	0.003	36.0	4.50	Concrete	1.04	36.53	26.6	5,097.87	5,097.73	5,098.20	5,098.11	10.80	0.013
PIPE - 7	STM-MH-A03	STM-INLET-A02	5,096.49	5,096.04	0.003	36.0	4.50	Concrete	1.04	36.53	150.0	5,097.61	5,097.08	5,097.92	5,097.46	10.80	0.013
PIPE - 5	STM-INLET-A04.1	STM-MH-A04	5,097.86	5,097.77	0.005	24.0	3.66	Concrete	0.52	16.00	17.0	5,098.39	5,098.29	5,098.59	5,098.50	2.40	0.013
PIPE - 28	STM-INLET-A04.2	STM-MH-A04	5,097.86	5,097.77	0.005	24.0	3.47	Concrete	0.48	16.00	17.0	5,098.35	5,098.25	5,098.52	5,098.44	2.00	0.013
PIPE - 29	STM-INLET-A06.2	STM-INLET-A06.1	5,099.59	5,099.26	0.005	18.0	2.06	Concrete	0.20	7.43	66.7	5,099.80	5,099.46	5,099.87	5,099.53	0.30	0.013
PIPE - 8	STM-INLET-A01	O-4	5,095.44	5,094.83	0.003	36.0	1.82	Concrete	1.77	36.53	202.2	5,096.60	5,096.60	5,096.60	5,096.60	0.50	0.013
PIPE - 7 (1)	STM-INLET-A02	STM-INLET-A01	5,095.84	5,095.64	0.003	36.0	1.82	Concrete	0.96	36.53	66.9	5,096.60	5,096.60	5,096.60	5,096.60	0.50	0.013
PIPE - 22	STM-MH-C05	STM-MH-C04	5,092.64	5,092.31	0.005	18.0	2.24	Concrete	1.47	7.43	66.4	5,093.78	5,093.78	5,093.78	5,093.78	0.40	0.013
PIPE - 23	STM-MH-C04	STM-INLET-C03	5,091.81	5,091.75	0.005	24.0	2.92	Concrete	2.04	16.00	13.0	5,093.78	5,093.78	5,093.78	5,093.78	1.10	0.013
PIPE - 25	STM-INLET-C04	STM-MH-C04	5,092.43	5,092.31	0.005	18.0	2.64	Concrete	1.47	7.43	24.0	5,093.78	5,093.78	5,093.79	5,093.78	0.70	0.013
PIPE - 27	STM-OUTLET STRUCTURE-C01	STM FES - C01	5,090.00	5,088.97	0.005		5.82	Concrete	1.18	15.42	206.3	5,091.22	5,090.15	5,091.75	5,090.72	15.00	0.013

2-Year Storm

FlexTable: Catch Basin Table

Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Length (ft)	Width (ft)	Hydraulic Grade Line (In) (ft)	External CA (acres)	External Tc (hours)	Inlet Location	Flow (Total Out) (cfs)
STM-INLET-C12.2	5,111.64	5,111.64	5,103.24	15.00	3.00	5,103.89	0.000	0.000	On Grade	2.90
STM-INLET-C12.1	5,111.62	5,111.62	5,103.24	5.00	3.00	5,103.55	0.000	0.000	On Grade	0.40
STM-INLET-C10.1	5,104.46	5,104.46	5,095.34	15.00	3.00	5,096.14	0.000	0.000	In Sag	3.60
STM-INLET-CO9	5,104.33	5,104.33	5,094.39	15.00	3.00	5,094.84	0.000	0.000	In Sag	1.70
STM-INLET-A09.2	5,107.84	5,107.84	5,102.38	10.00	3.00	5,102.84	0.000	0.000	On Grade	1.50
STM-INLET-A09.1	5,107.81	5,107.81	5,102.43	15.00	3.00	5,103.12	0.000	0.000	On Grade	3.30
STM-INLET-A08.1	5,106.02	5,106.02	5,100.61	2.92	2.92	5,100.77	0.000	0.000	In Sag	0.10
STM-INLET-A08.2	5,105.31	5,105.31	5,100.61	2.92	2.92	5,100.97	0.000	0.000	In Sag	0.90
STM-INLET-A07.1	5,105.05	5,105.05	5,100.05	10.00	3.00	5,100.25	0.000	0.000	On Grade	0.30
STM-INLET-A06.2	5,103.23	5,103.23	5,099.59	2.92	2.92	5,099.80	0.000	0.000	In Sag	0.30
STM-INLET-A06.1	5,102.57	5,102.57	5,099.06	2.92	2.92	5,099.26	0.000	0.000	In Sag	0.30
STM-INLET-A04.1	5,103.34	5,103.34	5,097.86	15.00	3.00	5,098.39	0.000	0.000	In Sag	2.40
STM-INLET-A04.2	5,103.34	5,103.34	5,097.86	15.00	3.00	5,098.35	0.000	0.000	In Sag	2.00
STM-INLET-A02	5,102.10	5,102.10	5,095.84	2.92	2.92	5,096.60	0.000	0.000	In Sag	0.50
STM-INLET-A01	5,101.28	5,101.28	5,095.44	2.92	2.92	5,096.60	0.000	0.000	In Sag	0.50
STM-INLET-C07	5,107.35	5,107.35	5,102.01	10.00	3.00	5,102.24	0.000	0.000	On Grade	0.40
STM-INLET-C04	5,096.43	5,096.43	5,092.43	15.00	3.00	5,093.78	0.000	0.000	On Grade	0.70
STM-INLET-C03	5,096.44	5,096.44	5,091.55	15.00	3.00	5,093.78	0.000	0.000	On Grade	0.90
STM-INLET-C10	5,095.11	5,095.11	5,091.42	10.00	3.00	5,093.78	0.000	0.000	On Grade	1.00
STM-OUTLET STRUCTURE-C01	5,093.89	5,093.89	5,088.61	5.67	2.92	5,091.22	0.000	0.000	In Sag	15.00

2-Year Storm

FlexTable: Manhole Table

Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
STM-MH-C12	5,111.58	5,111.58	5,103.07	3.30	0.69	5,103.56	5,103.56
STM-MH-A09	5,107.78	5,107.78	5,102.21	4.80	0.77	5,101.95	5,101.95
STM-MH-C06	5,107.34	5,107.34	5,101.65	0.40	0.23	5,101.68	5,101.68
STM-MH-A08	5,105.69	5,105.69	5,100.12	5.80	0.85	5,100.77	5,100.77
STM-MH-A07	5,105.01	5,105.01	5,099.46	6.10	0.87	5,100.13	5,100.13
STM-MH-C11	5,104.60	5,104.60	5,095.60	3.30	0.74	5,096.15	5,096.15
STM-MH-C10	5,104.28	5,104.28	5,095.21	6.90	1.11	5,096.12	5,096.12
STM-MH-A06	5,103.77	5,103.77	5,098.56	6.40	0.90	5,099.25	5,099.25
STM-MH-A05	5,103.42	5,103.42	5,098.12	6.40	1.01	5,098.92	5,098.92
STM-MH-A03	5,103.39	5,103.39	5,096.69	10.80	1.12	5,097.61	5,097.61
STM-MH-A04	5,103.31	5,103.31	5,097.77	10.80	1.11	5,097.87	5,097.87
STM-MH-C05	5,097.38	5,097.38	5,092.84	0.40	1.14	5,093.78	5,093.78
STM-MH-C04	5,096.30	5,096.30	5,092.31	1.10	1.97	5,093.78	5,093.78

100-Year Storm

FlexTable: Conduit Table

Label	Start Node	Stop Node	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Velocity (ft/s)	Material	Depth (Out) (ft)	Capacity (Full Flow) (cfs)	Length (User Defined) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Flow (cfs)	Manning's n
PIPE - 14	STM-INLET-CO9	O-1	5,094.39	5,091.84	0.039	24.0	10.41	Concrete	2.63	44.47	66.0	5,095.34	5,094.47	5,095.71	5,094.55	7.20	0.013
PIPE - 24	STM-INLET-C03	O-2	5,091.55	5,091.11	0.005	24.0	1.46	Concrete	3.36	16.00	88.8	5,094.51	5,094.47	5,094.54	5,094.50	4.60	0.013
PIPE - 26	STM-INLET-C10	O-3	5,091.42	5,091.16	0.005	18.0	2.21	Concrete	3.31	7.43	52.1	5,094.54	5,094.47	5,094.62	5,094.55	3.90	0.013
PIPE - 10	STM-INLET-C12.2	STM-MH-C12	5,103.24	5,103.07	0.010	18.0	6.90	Concrete	3.12	10.45	17.2	5,106.42	5,106.19	5,107.17	5,106.93	12.20	0.013
PIPE - 15	STM-INLET-C12.1	STM-MH-C12	5,103.24	5,103.07	0.010	18.0	0.91	Concrete	3.12	10.50	17.0	5,106.20	5,106.19	5,106.21	5,106.21	1.60	0.013
PIPE - 11	STM-MH-C12	STM-MH-C11	5,102.87	5,095.60	0.017	18.0	7.81	Concrete	3.14	13.63	431.6	5,106.19	5,098.74	5,107.14	5,099.69	13.80	0.013
PIPE - 9	STM-INLET-A09.2	STM-MH-A09	5,102.38	5,102.21	0.010	18.0	3.45	Concrete	4.63	10.50	17.2	5,106.90	5,106.84	5,107.08	5,107.02	6.10	0.013
PIPE - 1	STM-INLET-A09.1	STM-MH-A09	5,102.43	5,102.21	0.013	18.0	7.87	Concrete	4.63	11.95	17.0	5,107.14	5,106.84	5,108.10	5,107.80	13.90	0.013
PIPE - 2	STM-MH-A09	STM-MH-A08	5,101.17	5,100.12	0.005	24.0	6.37	Concrete	5.07	16.00	210.8	5,106.84	5,105.19	5,107.47	5,105.82	20.00	0.013
PIPE - 20	STM-INLET-C07	STM-MH-C06	5,102.01	5,101.65	0.020	18.0	6.45	Concrete	0.47	14.85	18.0	5,102.65	5,102.12	5,102.89	5,102.67	2.80	0.013
PIPE - 21	STM-MH-C06	STM-MH-C05	5,101.45	5,092.84	0.020	18.0	6.45	Concrete	1.72	14.85	430.5	5,102.09	5,094.56	5,102.33	5,094.60	2.80	0.013
PIPE - 30	STM-INLET-A08.1	STM-MH-A08	5,100.61	5,100.42	0.005	18.0	1.13	Concrete	4.77	7.43	38.5	5,105.20	5,105.19	5,105.22	5,105.21	2.00	0.013
PIPE - 2 (2)	STM-MH-A08	STM-MH-A07	5,099.92	5,099.46	0.005	24.0	8.75	Concrete	4.37	16.00	92.3	5,105.19	5,103.83	5,106.38	5,105.02	27.50	0.013
PIPE - 31	STM-INLET-A08.2	STM-MH-A08	5,100.61	5,100.42	0.005	18.0	3.11	Concrete	4.77	7.42	38.6	5,105.30	5,105.19	5,105.45	5,105.34	5.50	0.013
PIPE - 17	STM-INLET-A07.1	STM-MH-A07	5,100.05	5,099.96	0.005	18.0	0.85	Concrete	3.87	7.43	17.0	5,103.83	5,103.83	5,103.84	5,103.84	1.50	0.013
PIPE - 2 (1)	STM-MH-A07	STM-MH-A06	5,099.26	5,098.56	0.005	24.0	9.23	Concrete	2.96	16.00	140.8	5,103.83	5,101.51	5,105.15	5,102.84	29.00	0.013
PIPE - 12	STM-MH-C11	STM-MH-C10	5,095.40	5,095.21	0.005	18.0	7.81	Concrete	2.87	7.43	38.2	5,098.74	5,098.08	5,099.69	5,099.03	13.80	0.013
PIPE - 16	STM-INLET-C10.1	STM-MH-C10	5,095.34	5,095.21	0.005	18.0	8.32	Concrete	2.87	7.43	25.6	5,098.58	5,098.08	5,099.66	5,099.16	14.70	0.013
PIPE - 13	STM-MH-C10	STM-INLET-CO9	5,095.01	5,094.89	0.005	18.0	16.13	Concrete	1.49	7.43	23.0	5,098.08	5,096.38	5,102.13	5,100.43	28.50	0.013
PIPE - 3	STM-MH-A06	STM-MH-A05	5,098.36	5,098.12	0.005	24.0	9.77	Concrete	2.51	16.00	47.9	5,101.51	5,100.63	5,103.00	5,102.11	30.70	0.013
PIPE - 18	STM-INLET-A06.1	STM-MH-A06	5,099.06	5,098.85	0.005	18.0	0.96	Concrete	2.66	7.43	41.6	5,101.52	5,101.51	5,101.54	5,101.53	1.70	0.013
PIPE - 4	STM-MH-A05	STM-MH-A04	5,097.92	5,097.77	0.003	24.0	9.77	Concrete	1.87	12.39	49.6	5,100.63	5,099.64	5,102.11	5,101.21	30.70	0.013
PIPE - 4 (1)	STM-MH-A04	STM-MH-A03	5,096.77	5,096.69	0.003	36.0	7.02	Concrete	2.76	36.53	26.6	5,099.60	5,099.45	5,100.40	5,100.27	49.60	0.013
PIPE - 7	STM-MH-A03	STM-INLET-A02	5,096.49	5,096.04	0.003	36.0	7.02	Concrete	2.29	36.53	150.0	5,099.45	5,098.33	5,100.22	5,099.47	49.60	0.013
PIPE - 5	STM-INLET-A04.1	STM-MH-A04	5,097.86	5,097.77	0.005	24.0	5.45	Concrete	1.83	16.00	17.0	5,099.63	5,099.60	5,099.83	5,099.80	10.70	0.013
PIPE - 28	STM-INLET-A04.2	STM-MH-A04	5,097.86	5,097.77	0.005	24.0	5.12	Concrete	1.83	16.00	17.0	5,099.62	5,099.60	5,099.74	5,099.72	8.20	0.013
PIPE - 29	STM-INLET-A06.2	STM-INLET-A06.1	5,099.59	5,099.26	0.005	18.0	0.96	Concrete	2.26	7.43	66.7	5,101.54	5,101.52	5,101.55	5,101.54	1.70	0.013
PIPE - 8	STM-INLET-A01	O-4	5,095.44	5,094.83	0.003	36.0	3.58	Concrete	1.77	36.53	202.2	5,096.62	5,096.60	5,096.67	5,096.62	4.80	0.013
PIPE - 7 (1)	STM-INLET-A02	STM-INLET-A01	5,095.84	5,095.64	0.003	36.0	3.58	Concrete	0.98	36.53	66.9	5,096.65	5,096.62	5,096.80	5,096.71	4.80	0.013
PIPE - 22	STM-MH-C05	STM-MH-C04	5,092.64	5,092.31	0.005	18.0	1.58	Concrete	2.21	7.43	66.4	5,094.56	5,094.52	5,094.60	5,094.56	2.80	0.013
PIPE - 23	STM-MH-C04	STM-INLET-C03	5,091.81	5,091.75	0.005	24.0	2.04	Concrete	2.76	16.00	13.0	5,094.52	5,094.51	5,094.58	5,094.57	6.40	0.013
PIPE - 25	STM-INLET-C04	STM-MH-C04	5,092.43	5,092.31	0.005	18.0	2.04	Concrete	2.21	7.43	24.0	5,094.55	5,094.52	5,094.61	5,094.58	3.60	0.013
PIPE - 27	STM-OUTLET STRUCTURE-C01	STM FES - C01	5,090.00	5,088.97	0.005		5.82	Concrete	1.18	15.42	206.3	5,091.22	5,090.15	5,091.75	5,090.72	15.00	0.013

100-Year Storm

FlexTable: Catch Basin Table

Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Length (ft)	Width (ft)	Hydraulic Grade Line (In) (ft)	External CA (acres)	External Tc (hours)	Inlet Location	Flow (Total Out) (cfs)
STM-INLET-C12.2	5,111.64	5,111.64	5,103.24	15.00	3.00	5,106.42	0.000	0.000	On Grade	12.20
STM-INLET-C12.1	5,111.62	5,111.62	5,103.24	5.00	3.00	5,106.20	0.000	0.000	On Grade	1.60
STM-INLET-C10.1	5,104.46	5,104.46	5,095.34	15.00	3.00	5,098.58	0.000	0.000	In Sag	14.70
STM-INLET-CO9	5,104.33	5,104.33	5,094.39	15.00	3.00	5,095.34	0.000	0.000	In Sag	7.20
STM-INLET-A09.2	5,107.84	5,107.84	5,102.38	10.00	3.00	5,106.90	0.000	0.000	On Grade	6.10
STM-INLET-A09.1	5,107.81	5,107.81	5,102.43	15.00	3.00	5,107.14	0.000	0.000	On Grade	13.90
STM-INLET-A08.1	5,106.02	5,106.02	5,100.61	2.92	2.92	5,105.20	0.000	0.000	In Sag	2.00
STM-INLET-A08.2	5,105.31	5,105.31	5,100.61	2.92	2.92	5,105.30	0.000	0.000	In Sag	5.50
STM-INLET-A07.1	5,105.05	5,105.05	5,100.05	10.00	3.00	5,103.83	0.000	0.000	On Grade	1.50
STM-INLET-A06.2	5,103.23	5,103.23	5,099.59	2.92	2.92	5,101.54	0.000	0.000	In Sag	1.70
STM-INLET-A06.1	5,102.57	5,102.57	5,099.06	2.92	2.92	5,101.52	0.000	0.000	In Sag	1.70
STM-INLET-A04.1	5,103.34	5,103.34	5,097.86	15.00	3.00	5,099.63	0.000	0.000	In Sag	10.70
STM-INLET-A04.2	5,103.34	5,103.34	5,097.86	15.00	3.00	5,099.62	0.000	0.000	In Sag	8.20
STM-INLET-A02	5,102.10	5,102.10	5,095.84	2.92	2.92	5,096.65	0.000	0.000	In Sag	4.80
STM-INLET-A01	5,101.28	5,101.28	5,095.44	2.92	2.92	5,096.62	0.000	0.000	In Sag	4.80
STM-INLET-C07	5,107.35	5,107.35	5,102.01	10.00	3.00	5,102.65	0.000	0.000	On Grade	2.80
STM-INLET-C04	5,096.43	5,096.43	5,092.43	15.00	3.00	5,094.55	0.000	0.000	On Grade	3.60
STM-INLET-C03	5,096.44	5,096.44	5,091.55	15.00	3.00	5,094.51	0.000	0.000	On Grade	4.60
STM-INLET-C10	5,095.11	5,095.11	5,091.42	10.00	3.00	5,094.54	0.000	0.000	On Grade	3.90
STM-OUTLET STRUCTURE-C01	5,093.89	5,093.89	5,088.61	5.67	2.92	5,091.22	0.000	0.000	In Sag	15.00

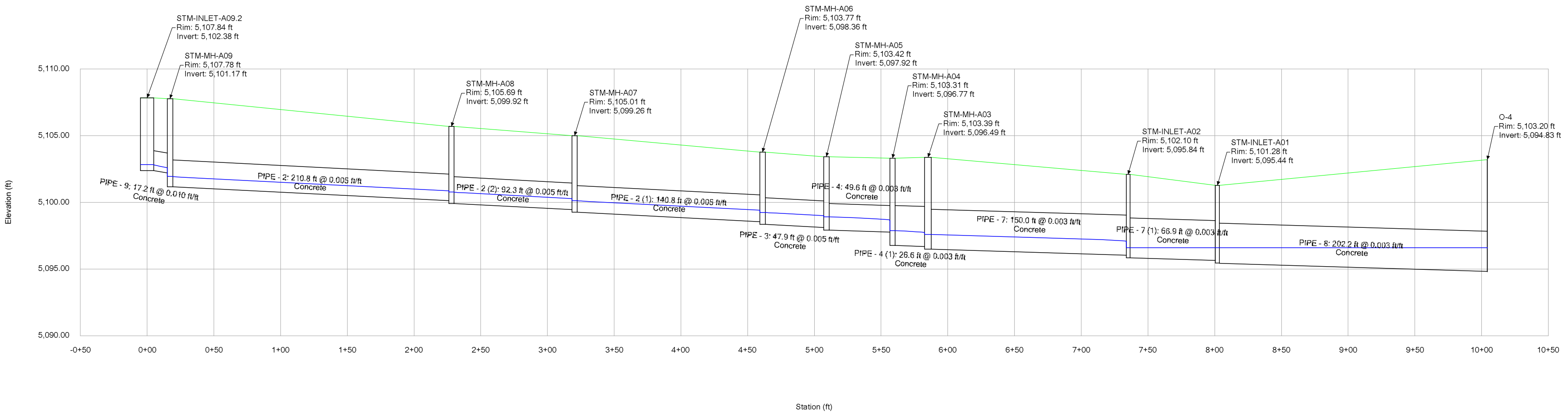
100-Year Storm

FlexTable: Manhole Table

Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
STM-MH-C12	5,111.58	5,111.58	5,103.07	13.80	3.32	5,106.19	5,106.19
STM-MH-A09	5,107.78	5,107.78	5,102.21	20.00	5.66	5,106.84	5,106.84
STM-MH-C06	5,107.34	5,107.34	5,101.65	2.80	0.64	5,102.09	5,102.09
STM-MH-A08	5,105.69	5,105.69	5,100.12	27.50	5.27	5,105.19	5,105.19
STM-MH-A07	5,105.01	5,105.01	5,099.46	29.00	4.57	5,103.83	5,103.83
STM-MH-C11	5,104.60	5,104.60	5,095.60	13.80	3.34	5,098.74	5,098.74
STM-MH-C10	5,104.28	5,104.28	5,095.21	28.50	3.08	5,098.08	5,098.08
STM-MH-A06	5,103.77	5,103.77	5,098.56	30.70	3.16	5,101.51	5,101.51
STM-MH-A05	5,103.42	5,103.42	5,098.12	30.70	2.71	5,100.63	5,100.63
STM-MH-A03	5,103.39	5,103.39	5,096.69	49.60	2.96	5,099.45	5,099.45
STM-MH-A04	5,103.31	5,103.31	5,097.77	49.60	2.84	5,099.60	5,099.60
STM-MH-C05	5,097.38	5,097.38	5,092.84	2.80	1.92	5,094.56	5,094.56
STM-MH-C04	5,096.30	5,096.30	5,092.31	6.40	2.71	5,094.52	5,094.52

Profile Report

Engineering Profile - STM-INLET-A09.2 to O-4 (15075-1 StormCAD 2 Year.stsw)



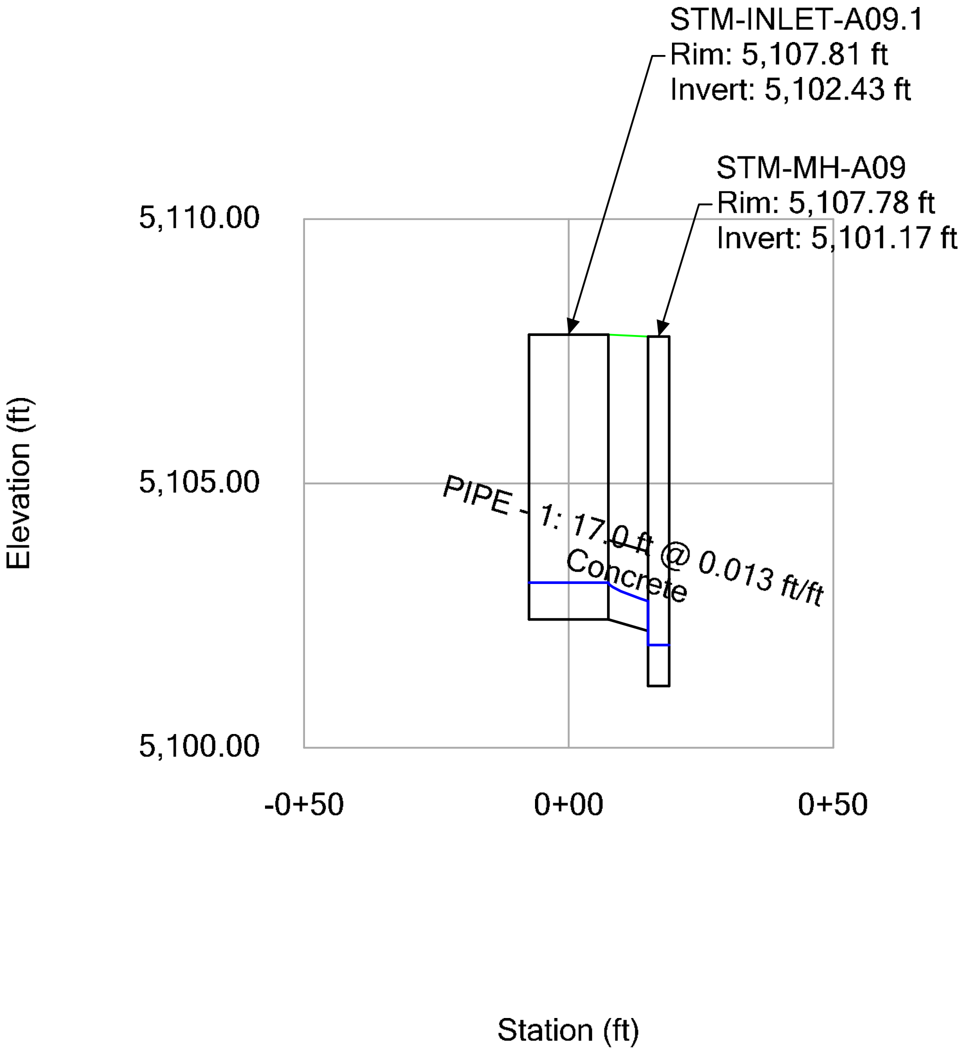
15075-1 StormCAD 2 Year.stsw
8/22/2018

Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Bentley StormCAD CONNECT Edition
[10.01.00.70]

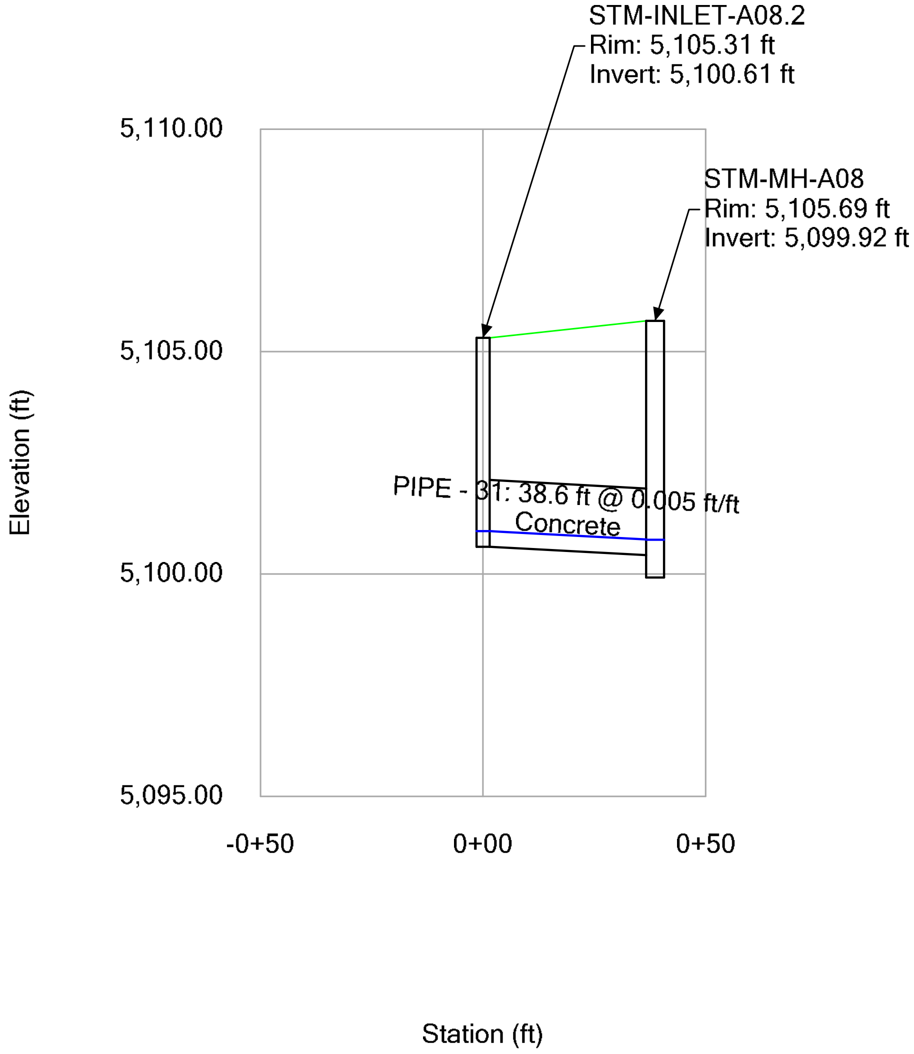
Profile Report

Engineering Profile - STM-INLET-A09.1 to STM-MH-A09 (15075-1 StormCAD 2 Year.stsw)



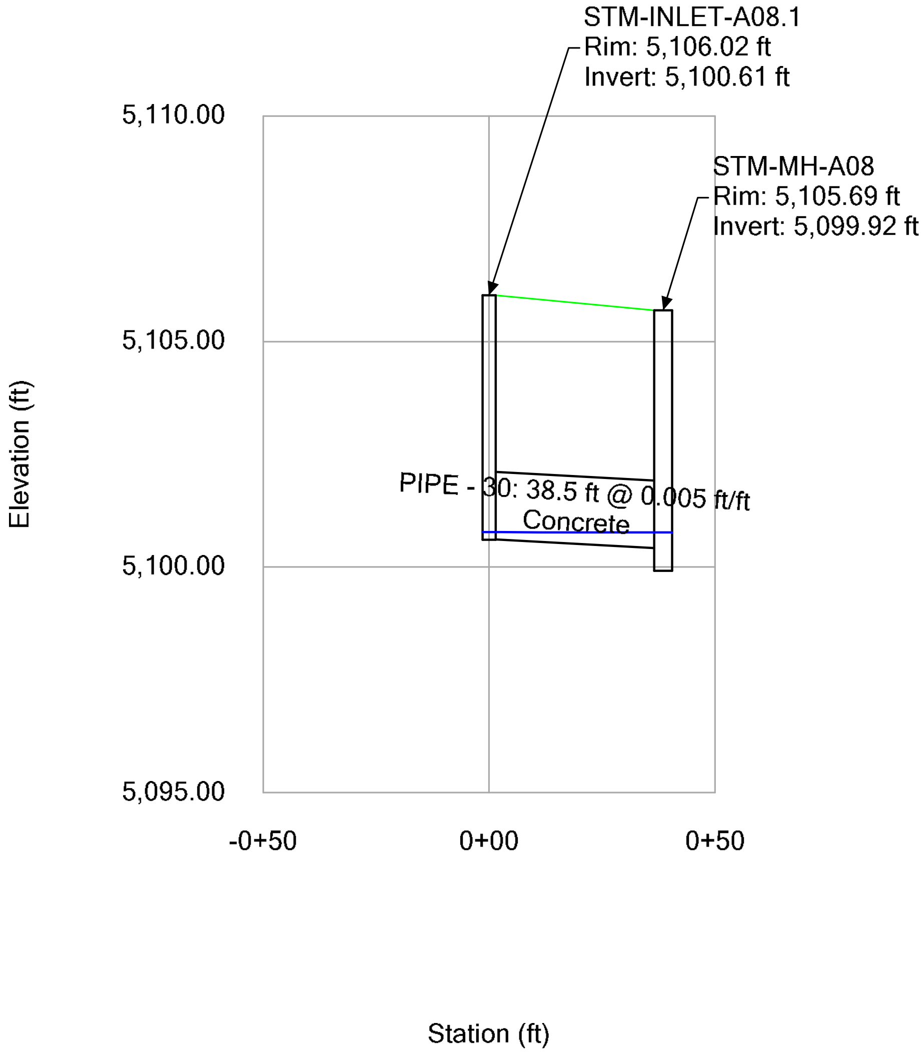
Profile Report

Engineering Profile - STM-INLET-A08.2 to STM-MH-A08 (15075-1 StormCAD 2 Year.stsw)

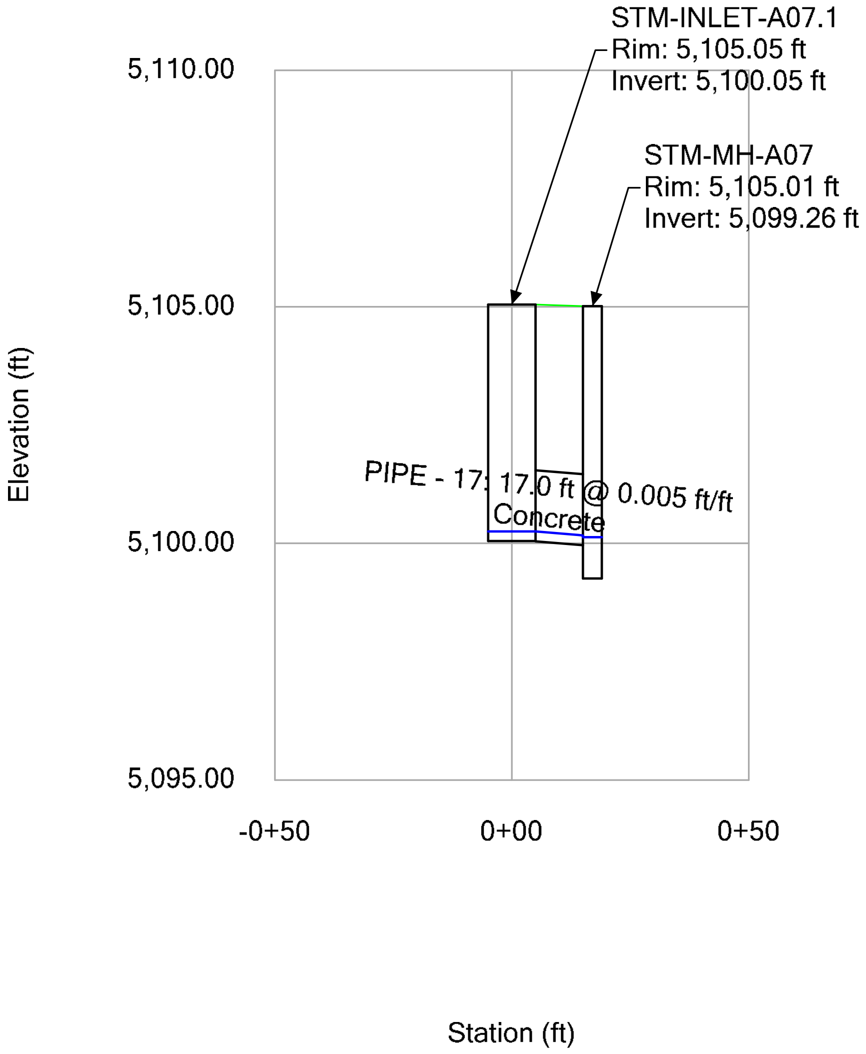


Profile Report

Engineering Profile - STM-INLET-A08.1 to STM-MH-A08 (15075-1 StormCAD 2 Year.stsw)

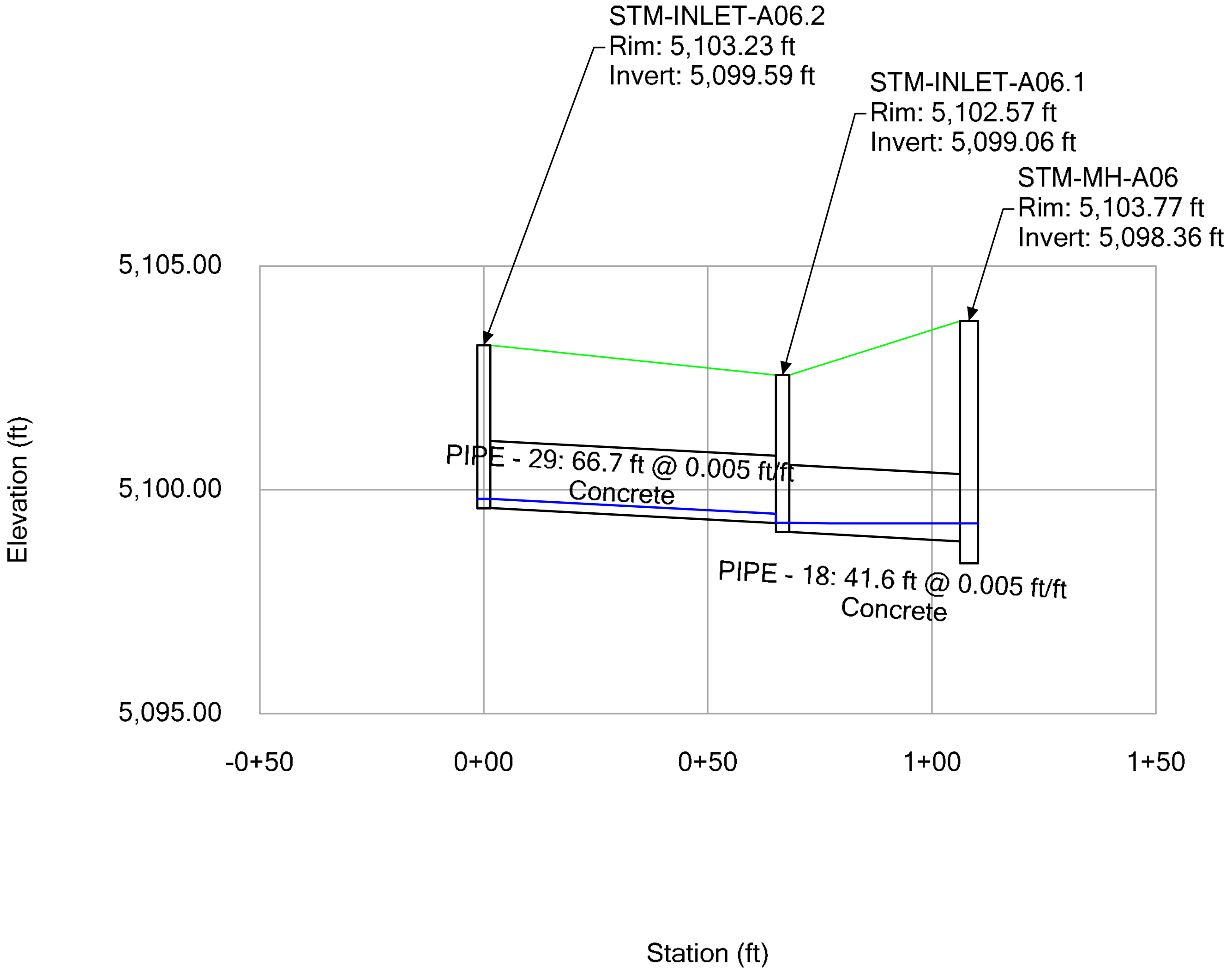


Profile Report
Engineering Profile - STM-INLET-A07.1 to STM-MH-A07 (15075-1 StormCAD 2 Year.stsw)



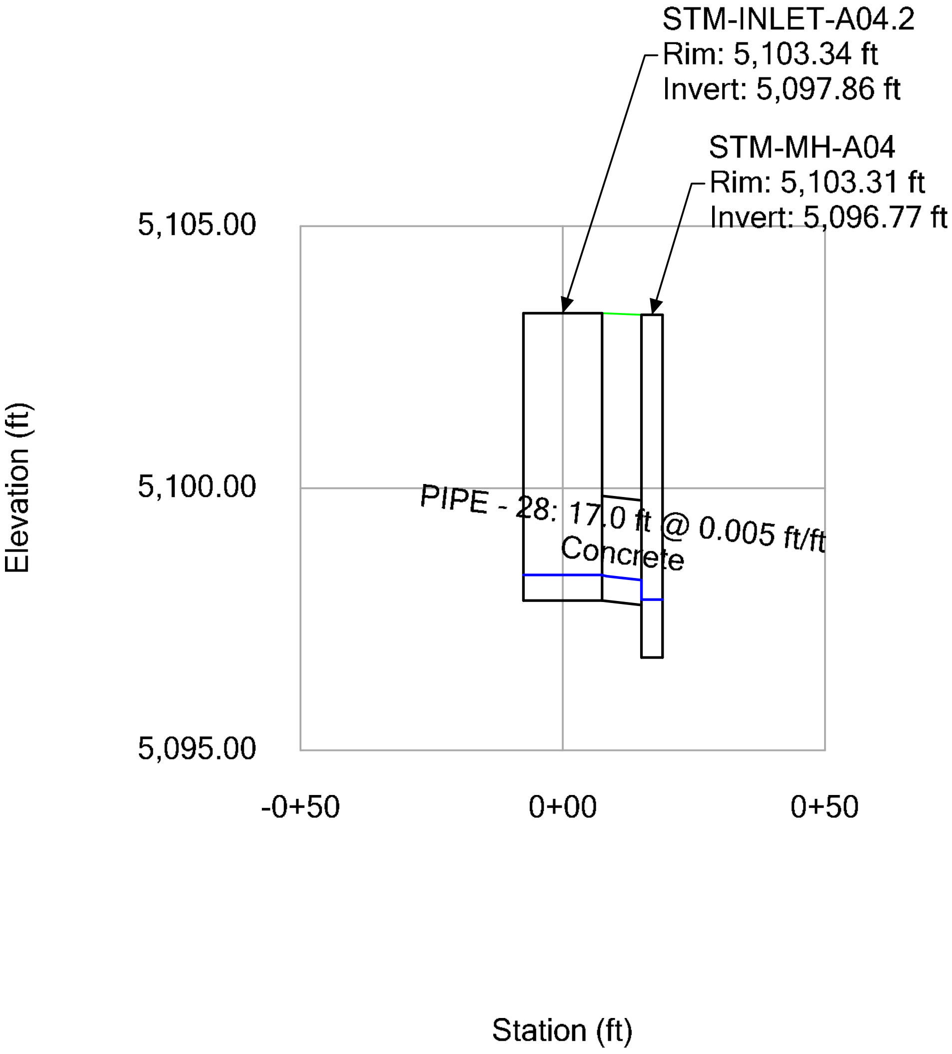
Profile Report

Engineering Profile - STM-INLET-A06.2 to STM-MH-A06 (15075-1 StormCAD 2 Year.stsw)



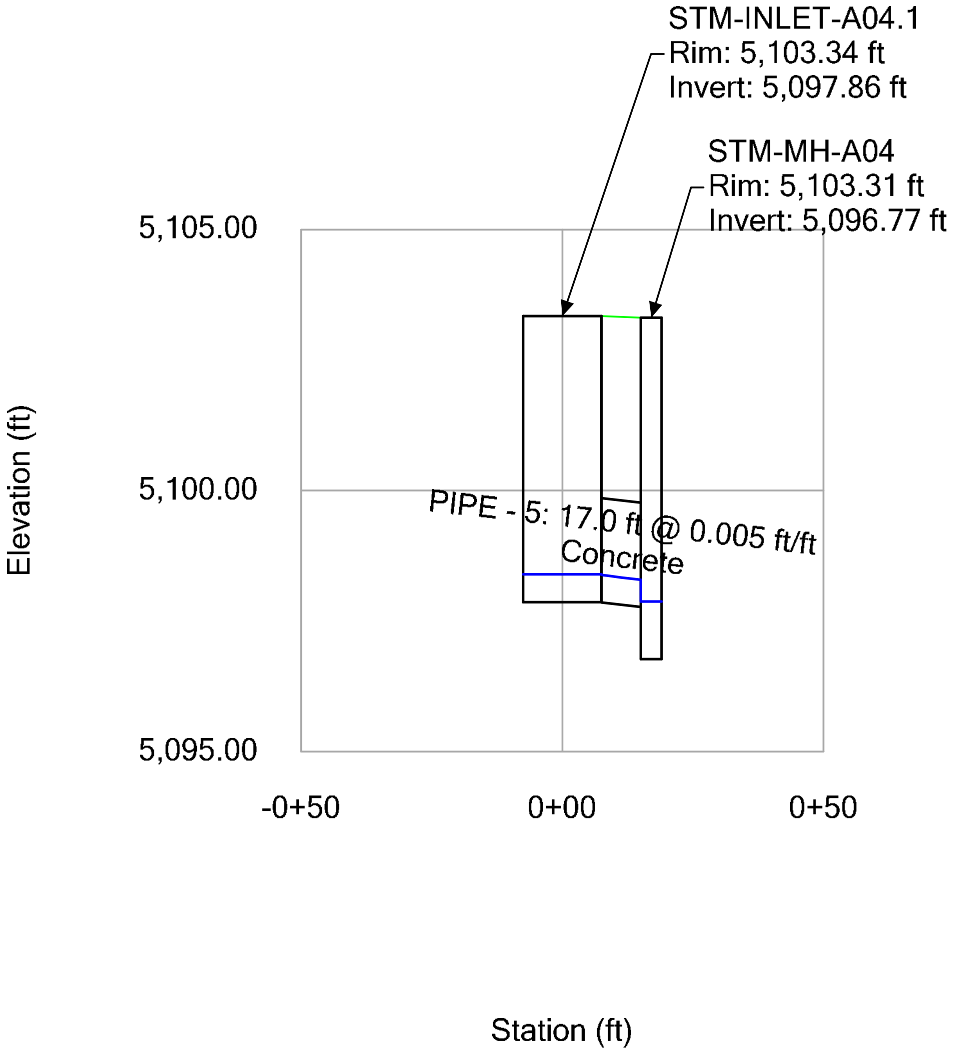
Profile Report

Engineering Profile - STM-INLET-A04.2 to STM-MH-A04 (15075-1 StormCAD 2 Year.stsw)

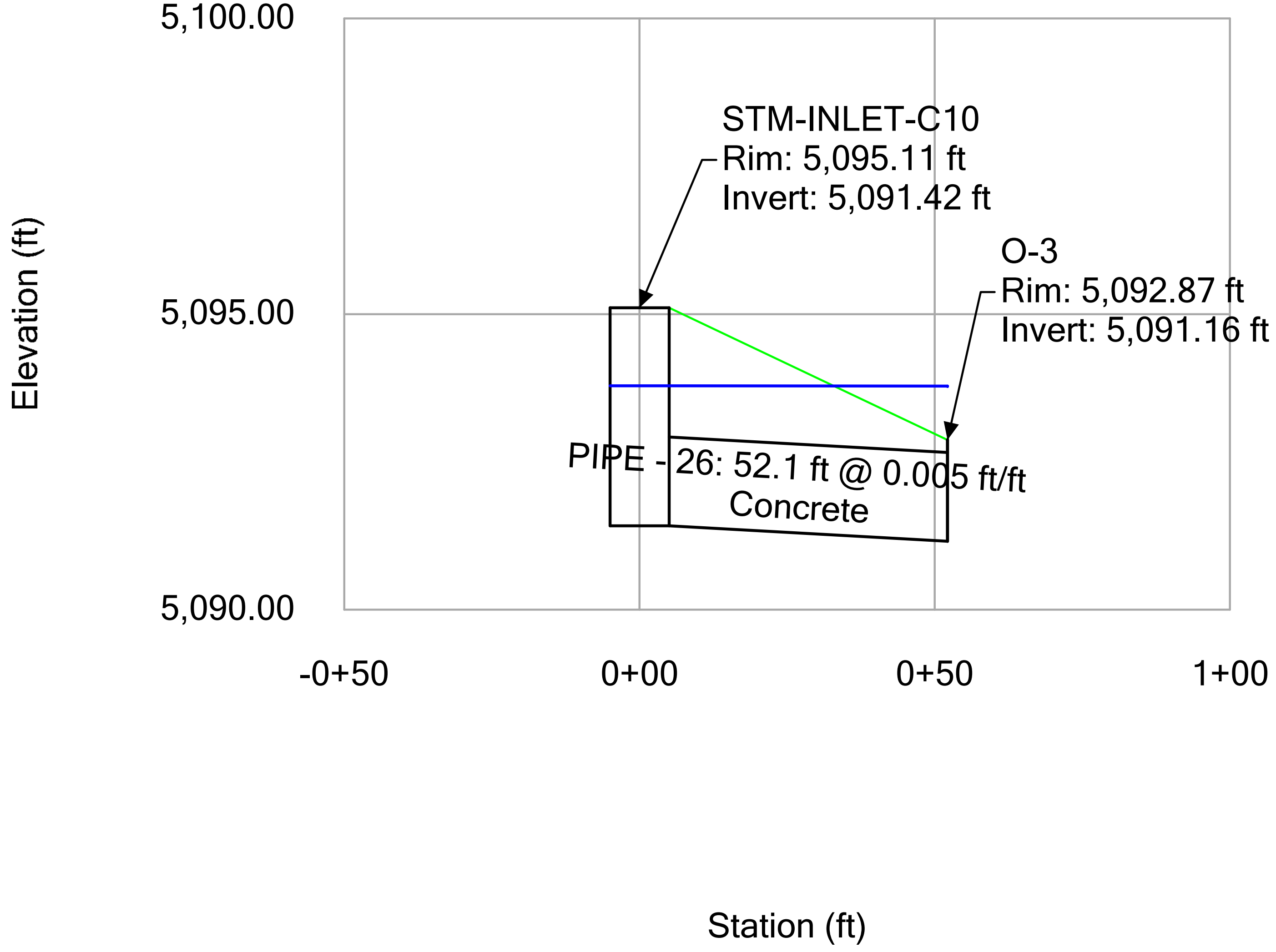


Profile Report

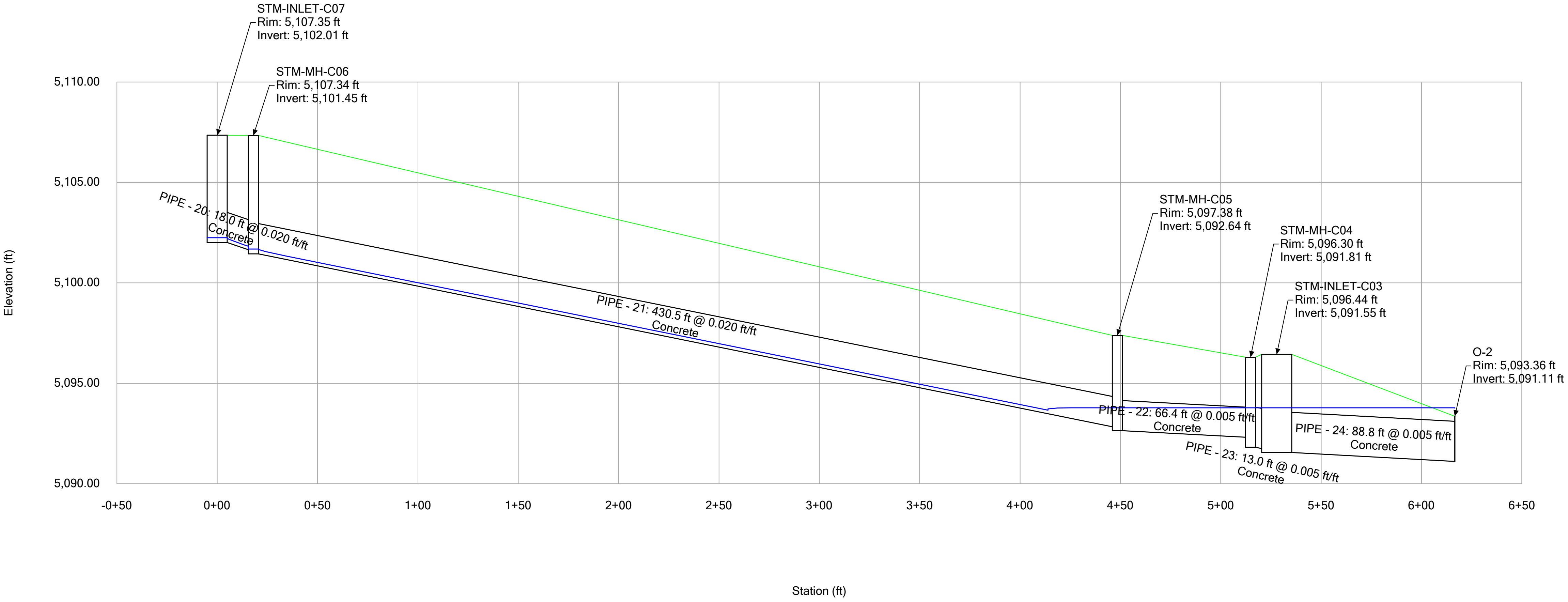
Engineering Profile - STM-INLET-A04.1 to STM-MH-A04 (15075-1 StormCAD 2 Year.stsw)



Profile Report
Engineering Profile - STM-INLET-C10 to O-3 (15075-1 StormCAD 2 Year.stsw)

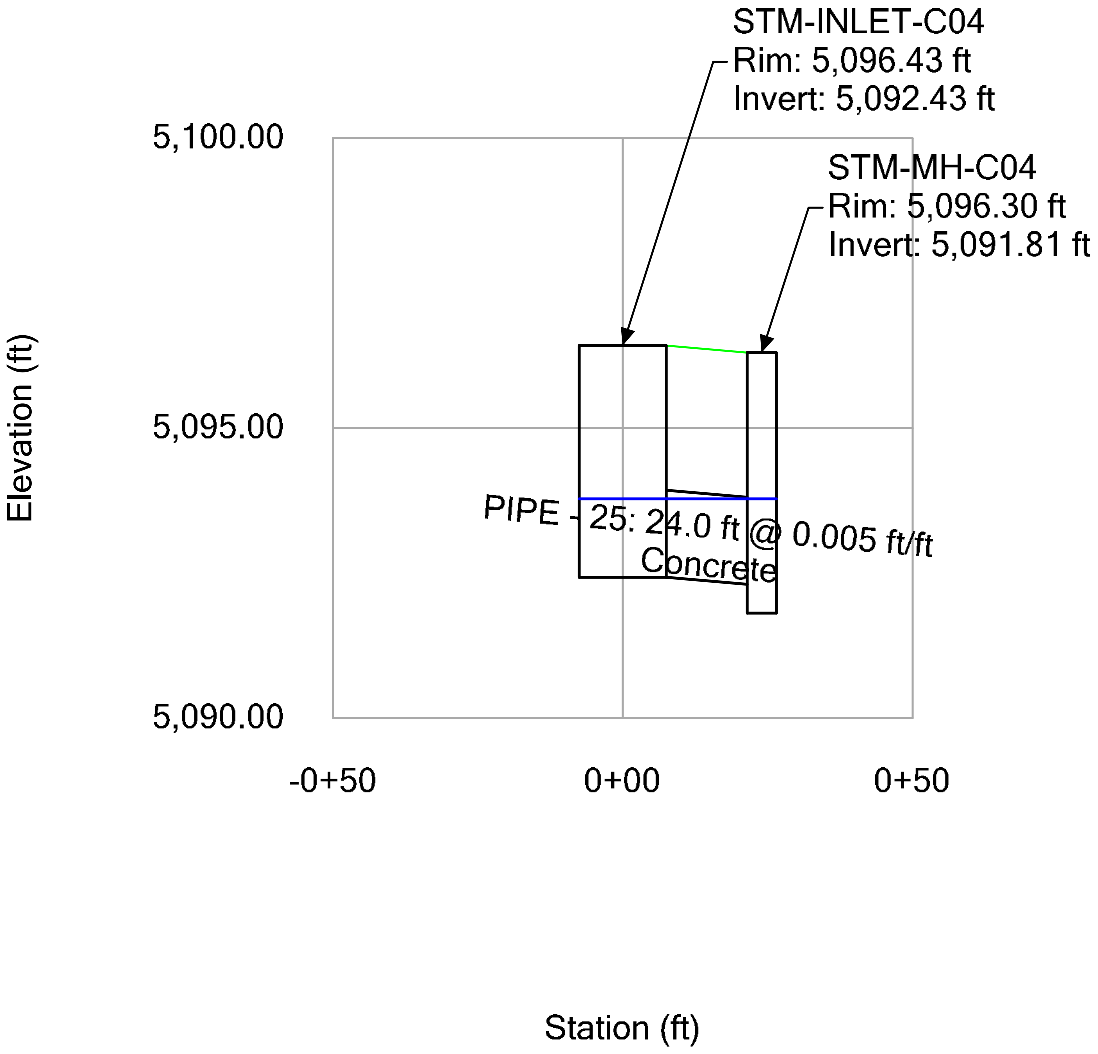


Profile Report
Engineering Profile - STM-INLET-C07 to O-2 (15075-1 StormCAD 2 Year.stsw)



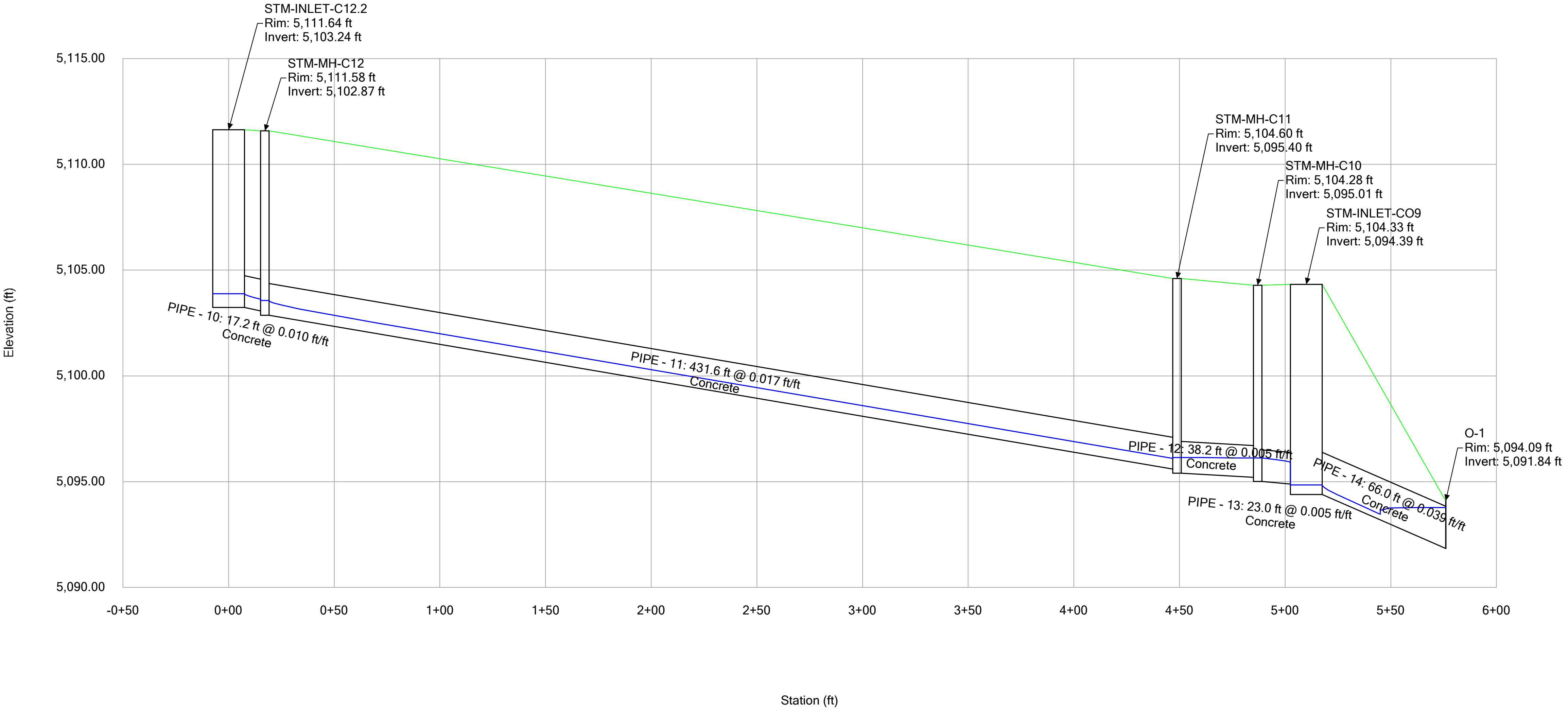
Profile Report

Engineering Profile - STM-INLET-C04 to STM-MH-C04 (15075-1 StormCAD 2 Year.stsw)



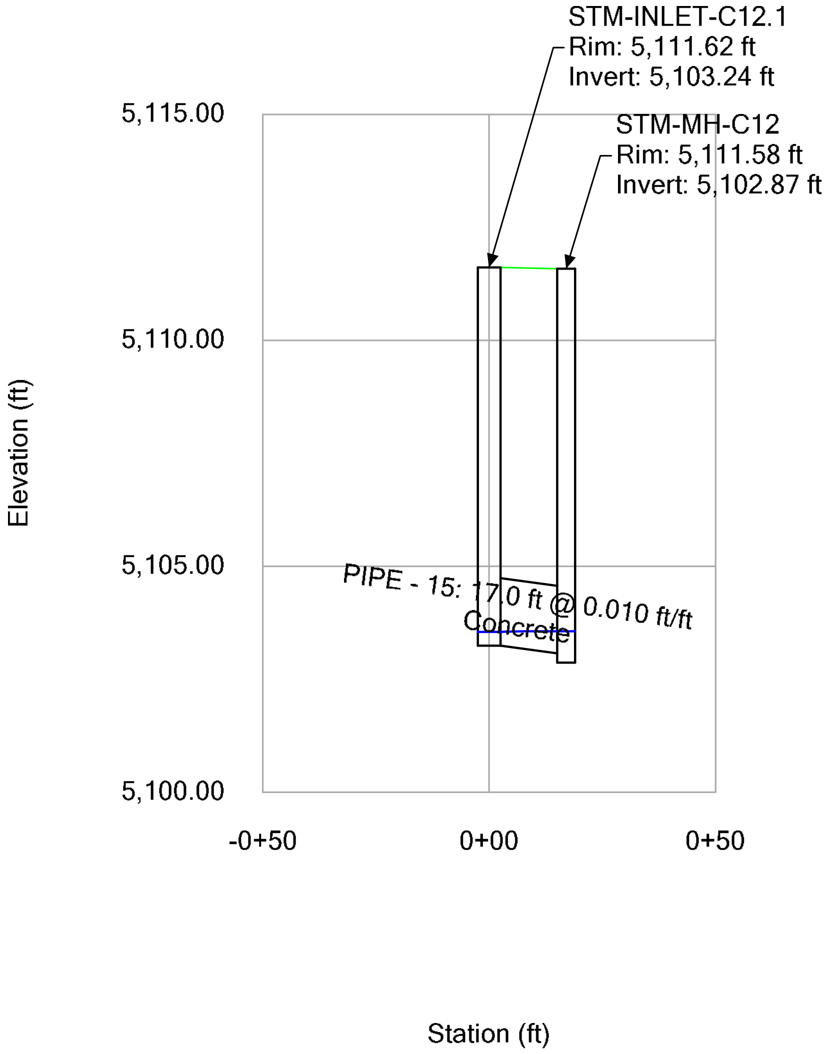
Profile Report

Engineering Profile - STM-INLET-C12.2 to O-1 (15075-1 StormCAD 2 Year.stsw)



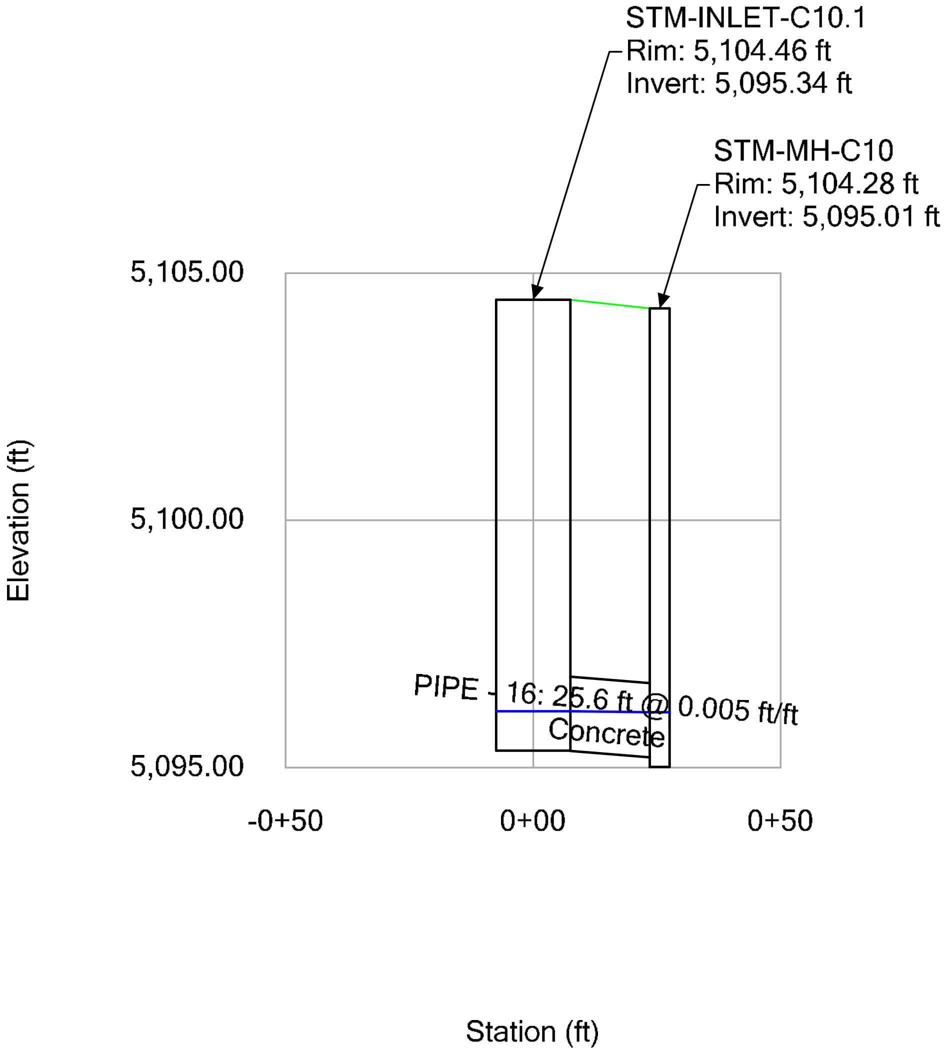
Profile Report

Engineering Profile - STM-INLET-C12.1 to STM-MH-C12 (15075-1 StormCAD 2 Year.stsw)



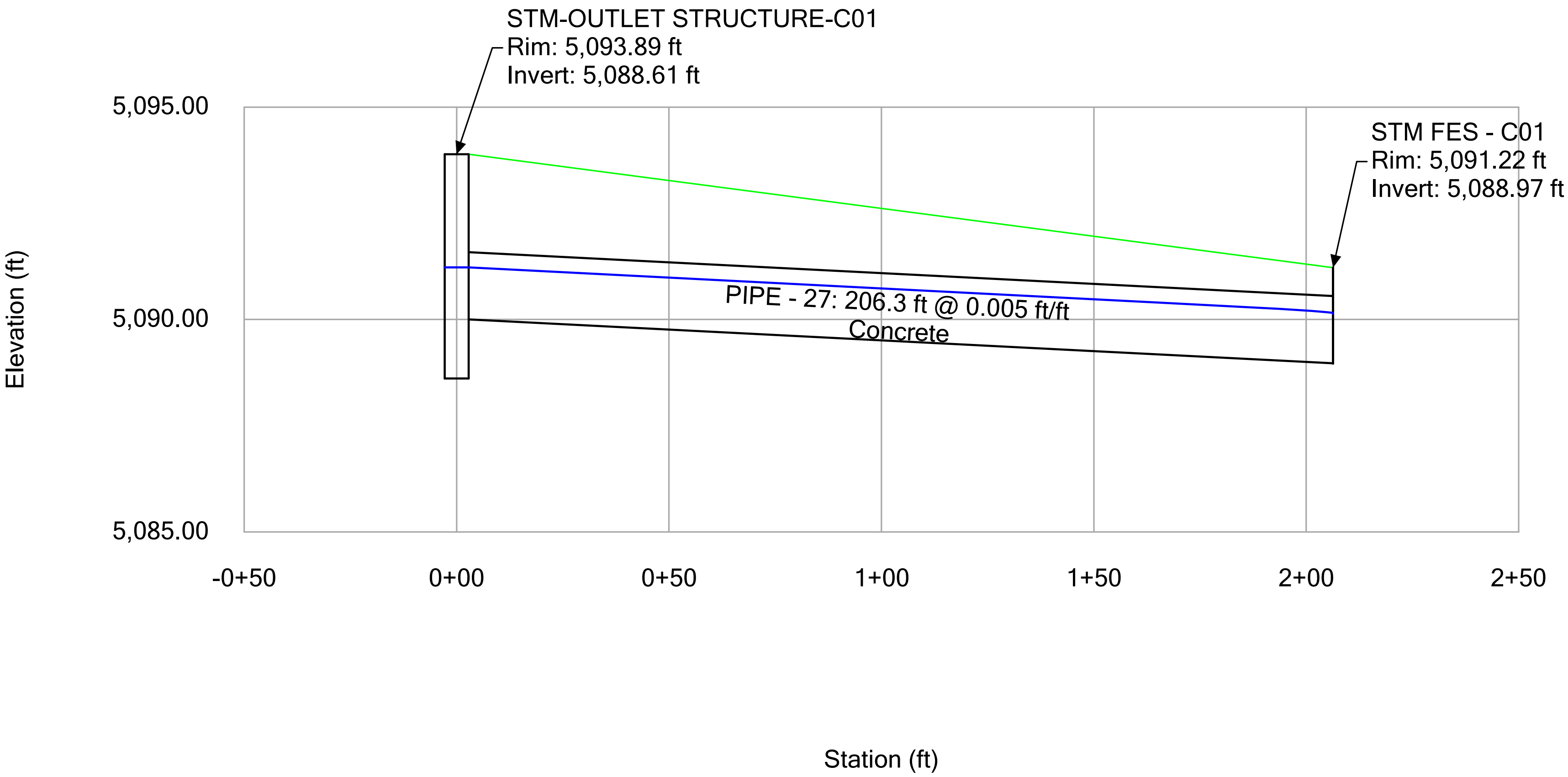
Profile Report

Engineering Profile - STM-INLET-C10.1 to STM-MH-C10 (15075-1 StormCAD 2 Year.stsw)



Profile Report

Engineering Profile - STM-OUTLET STRUCTURE-C01 to STM FES - C01 (15075-1 StormCAD 2 Year.stsw)



100-Year Storm

FlexTable: Conduit Table

Label	Start Node	Stop Node	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Velocity (ft/s)	Material	Depth (Out) (ft)	Capacity (Full Flow) (cfs)	Length (User Defined) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Flow (cfs)	Manning's n
PIPE - 14	STM-INLET-CO9	O-1	5,094.39	5,091.84	0.039	24.0	10.41	Concrete	2.63	44.47	66.0	5,095.34	5,094.47	5,095.71	5,094.55	7.20	0.013
PIPE - 24	STM-INLET-C03	O-2	5,091.55	5,091.11	0.005	24.0	1.46	Concrete	3.36	16.00	88.8	5,094.51	5,094.47	5,094.54	5,094.50	4.60	0.013
PIPE - 26	STM-INLET-C10	O-3	5,091.42	5,091.16	0.005	18.0	2.21	Concrete	3.31	7.43	52.1	5,094.54	5,094.47	5,094.62	5,094.55	3.90	0.013
PIPE - 10	STM-INLET-C12.2	STM-MH-C12	5,103.24	5,103.07	0.010	18.0	6.90	Concrete	3.12	10.45	17.2	5,106.42	5,106.19	5,107.17	5,106.93	12.20	0.013
PIPE - 15	STM-INLET-C12.1	STM-MH-C12	5,103.24	5,103.07	0.010	18.0	0.91	Concrete	3.12	10.50	17.0	5,106.20	5,106.19	5,106.21	5,106.21	1.60	0.013
PIPE - 11	STM-MH-C12	STM-MH-C11	5,102.87	5,095.60	0.017	18.0	7.81	Concrete	3.14	13.63	431.6	5,106.19	5,098.74	5,107.14	5,099.69	13.80	0.013
PIPE - 9	STM-INLET-A09.2	STM-MH-A09	5,102.38	5,102.21	0.010	18.0	3.45	Concrete	4.63	10.50	17.2	5,106.90	5,106.84	5,107.08	5,107.02	6.10	0.013
PIPE - 1	STM-INLET-A09.1	STM-MH-A09	5,102.43	5,102.21	0.013	18.0	7.87	Concrete	4.63	11.95	17.0	5,107.14	5,106.84	5,108.10	5,107.80	13.90	0.013
PIPE - 2	STM-MH-A09	STM-MH-A08	5,101.17	5,100.12	0.005	24.0	6.37	Concrete	5.07	16.00	210.8	5,106.84	5,105.19	5,107.47	5,105.82	20.00	0.013
PIPE - 20	STM-INLET-C07	STM-MH-C06	5,102.01	5,101.65	0.020	18.0	6.45	Concrete	0.47	14.85	18.0	5,102.65	5,102.12	5,102.89	5,102.67	2.80	0.013
PIPE - 21	STM-MH-C06	STM-MH-C05	5,101.45	5,092.84	0.020	18.0	6.45	Concrete	1.72	14.85	430.5	5,102.09	5,094.56	5,102.33	5,094.60	2.80	0.013
PIPE - 30	STM-INLET-A08.1	STM-MH-A08	5,100.61	5,100.42	0.005	18.0	1.13	Concrete	4.77	7.43	38.5	5,105.20	5,105.19	5,105.22	5,105.21	2.00	0.013
PIPE - 2 (2)	STM-MH-A08	STM-MH-A07	5,099.92	5,099.46	0.005	24.0	8.75	Concrete	4.37	16.00	92.3	5,105.19	5,103.83	5,106.38	5,105.02	27.50	0.013
PIPE - 31	STM-INLET-A08.2	STM-MH-A08	5,100.61	5,100.42	0.005	18.0	3.11	Concrete	4.77	7.42	38.6	5,105.30	5,105.19	5,105.45	5,105.34	5.50	0.013
PIPE - 17	STM-INLET-A07.1	STM-MH-A07	5,100.05	5,099.96	0.005	18.0	0.85	Concrete	3.87	7.43	17.0	5,103.83	5,103.83	5,103.84	5,103.84	1.50	0.013
PIPE - 2 (1)	STM-MH-A07	STM-MH-A06	5,099.26	5,098.56	0.005	24.0	9.23	Concrete	2.96	16.00	140.8	5,103.83	5,101.51	5,105.15	5,102.84	29.00	0.013
PIPE - 12	STM-MH-C11	STM-MH-C10	5,095.40	5,095.21	0.005	18.0	7.81	Concrete	2.87	7.43	38.2	5,098.74	5,098.08	5,099.69	5,099.03	13.80	0.013
PIPE - 16	STM-INLET-C10.1	STM-MH-C10	5,095.34	5,095.21	0.005	18.0	8.32	Concrete	2.87	7.43	25.6	5,098.58	5,098.08	5,099.66	5,099.16	14.70	0.013
PIPE - 13	STM-MH-C10	STM-INLET-CO9	5,095.01	5,094.89	0.005	18.0	16.13	Concrete	1.49	7.43	23.0	5,098.08	5,096.38	5,102.13	5,100.43	28.50	0.013
PIPE - 3	STM-MH-A06	STM-MH-A05	5,098.36	5,098.12	0.005	24.0	9.77	Concrete	2.51	16.00	47.9	5,101.51	5,100.63	5,103.00	5,102.11	30.70	0.013
PIPE - 18	STM-INLET-A06.1	STM-MH-A06	5,099.06	5,098.85	0.005	18.0	0.96	Concrete	2.66	7.43	41.6	5,101.52	5,101.51	5,101.54	5,101.53	1.70	0.013
PIPE - 4	STM-MH-A05	STM-MH-A04	5,097.92	5,097.77	0.003	24.0	9.77	Concrete	1.87	12.39	49.6	5,100.63	5,099.64	5,102.11	5,101.21	30.70	0.013
PIPE - 4 (1)	STM-MH-A04	STM-MH-A03	5,096.77	5,096.69	0.003	36.0	7.02	Concrete	2.76	36.53	26.6	5,099.60	5,099.45	5,100.40	5,100.27	49.60	0.013
PIPE - 7	STM-MH-A03	STM-INLET-A02	5,096.49	5,096.04	0.003	36.0	7.02	Concrete	2.29	36.53	150.0	5,099.45	5,098.33	5,100.22	5,099.47	49.60	0.013
PIPE - 5	STM-INLET-A04.1	STM-MH-A04	5,097.86	5,097.77	0.005	24.0	5.45	Concrete	1.83	16.00	17.0	5,099.63	5,099.60	5,099.83	5,099.80	10.70	0.013
PIPE - 28	STM-INLET-A04.2	STM-MH-A04	5,097.86	5,097.77	0.005	24.0	5.12	Concrete	1.83	16.00	17.0	5,099.62	5,099.60	5,099.74	5,099.72	8.20	0.013
PIPE - 29	STM-INLET-A06.2	STM-INLET-A06.1	5,099.59	5,099.26	0.005	18.0	0.96	Concrete	2.26	7.43	66.7	5,101.54	5,101.52	5,101.55	5,101.54	1.70	0.013
PIPE - 8	STM-INLET-A01	O-4	5,095.44	5,094.83	0.003	36.0	3.58	Concrete	1.77	36.53	202.2	5,096.62	5,096.60	5,096.67	5,096.62	4.80	0.013
PIPE - 7 (1)	STM-INLET-A02	STM-INLET-A01	5,095.84	5,095.64	0.003	36.0	3.58	Concrete	0.98	36.53	66.9	5,096.65	5,096.62	5,096.80	5,096.71	4.80	0.013
PIPE - 22	STM-MH-C05	STM-MH-C04	5,092.64	5,092.31	0.005	18.0	1.58	Concrete	2.21	7.43	66.4	5,094.56	5,094.52	5,094.60	5,094.56	2.80	0.013
PIPE - 23	STM-MH-C04	STM-INLET-C03	5,091.81	5,091.75	0.005	24.0	2.04	Concrete	2.76	16.00	13.0	5,094.52	5,094.51	5,094.58	5,094.57	6.40	0.013
PIPE - 25	STM-INLET-C04	STM-MH-C04	5,092.43	5,092.31	0.005	18.0	2.04	Concrete	2.21	7.43	24.0	5,094.55	5,094.52	5,094.61	5,094.58	3.60	0.013
PIPE - 27	STM-OUTLET STRUCTURE-C01	STM FES - C01	5,090.00	5,088.97	0.005		5.82	Concrete	1.18	15.42	206.3	5,091.22	5,090.15	5,091.75	5,090.72	15.00	0.013

100-Year Storm

FlexTable: Catch Basin Table

Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Length (ft)	Width (ft)	Hydraulic Grade Line (In) (ft)	External CA (acres)	External Tc (hours)	Inlet Location	Flow (Total Out) (cfs)
STM-INLET-C12.2	5,111.64	5,111.64	5,103.24	15.00	3.00	5,106.42	0.000	0.000	On Grade	12.20
STM-INLET-C12.1	5,111.62	5,111.62	5,103.24	5.00	3.00	5,106.20	0.000	0.000	On Grade	1.60
STM-INLET-C10.1	5,104.46	5,104.46	5,095.34	15.00	3.00	5,098.58	0.000	0.000	In Sag	14.70
STM-INLET-CO9	5,104.33	5,104.33	5,094.39	15.00	3.00	5,095.34	0.000	0.000	In Sag	7.20
STM-INLET-A09.2	5,107.84	5,107.84	5,102.38	10.00	3.00	5,106.90	0.000	0.000	On Grade	6.10
STM-INLET-A09.1	5,107.81	5,107.81	5,102.43	15.00	3.00	5,107.14	0.000	0.000	On Grade	13.90
STM-INLET-A08.1	5,106.02	5,106.02	5,100.61	2.92	2.92	5,105.20	0.000	0.000	In Sag	2.00
STM-INLET-A08.2	5,105.31	5,105.31	5,100.61	2.92	2.92	5,105.30	0.000	0.000	In Sag	5.50
STM-INLET-A07.1	5,105.05	5,105.05	5,100.05	10.00	3.00	5,103.83	0.000	0.000	On Grade	1.50
STM-INLET-A06.2	5,103.23	5,103.23	5,099.59	2.92	2.92	5,101.54	0.000	0.000	In Sag	1.70
STM-INLET-A06.1	5,102.57	5,102.57	5,099.06	2.92	2.92	5,101.52	0.000	0.000	In Sag	1.70
STM-INLET-A04.1	5,103.34	5,103.34	5,097.86	15.00	3.00	5,099.63	0.000	0.000	In Sag	10.70
STM-INLET-A04.2	5,103.34	5,103.34	5,097.86	15.00	3.00	5,099.62	0.000	0.000	In Sag	8.20
STM-INLET-A02	5,102.10	5,102.10	5,095.84	2.92	2.92	5,096.65	0.000	0.000	In Sag	4.80
STM-INLET-A01	5,101.28	5,101.28	5,095.44	2.92	2.92	5,096.62	0.000	0.000	In Sag	4.80
STM-INLET-C07	5,107.35	5,107.35	5,102.01	10.00	3.00	5,102.65	0.000	0.000	On Grade	2.80
STM-INLET-C04	5,096.43	5,096.43	5,092.43	15.00	3.00	5,094.55	0.000	0.000	On Grade	3.60
STM-INLET-C03	5,096.44	5,096.44	5,091.55	15.00	3.00	5,094.51	0.000	0.000	On Grade	4.60
STM-INLET-C10	5,095.11	5,095.11	5,091.42	10.00	3.00	5,094.54	0.000	0.000	On Grade	3.90
STM-OUTLET STRUCTURE-C01	5,093.89	5,093.89	5,088.61	5.67	2.92	5,091.22	0.000	0.000	In Sag	15.00

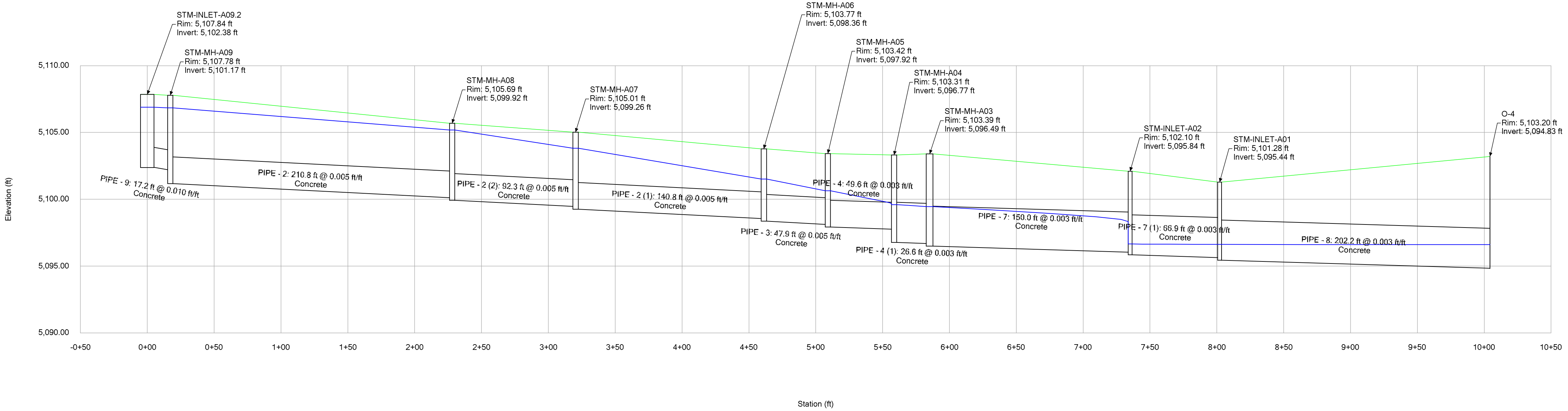
100-Year Storm

FlexTable: Manhole Table

Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
STM-MH-C12	5,111.58	5,111.58	5,103.07	13.80	3.32	5,106.19	5,106.19
STM-MH-A09	5,107.78	5,107.78	5,102.21	20.00	5.66	5,106.84	5,106.84
STM-MH-C06	5,107.34	5,107.34	5,101.65	2.80	0.64	5,102.09	5,102.09
STM-MH-A08	5,105.69	5,105.69	5,100.12	27.50	5.27	5,105.19	5,105.19
STM-MH-A07	5,105.01	5,105.01	5,099.46	29.00	4.57	5,103.83	5,103.83
STM-MH-C11	5,104.60	5,104.60	5,095.60	13.80	3.34	5,098.74	5,098.74
STM-MH-C10	5,104.28	5,104.28	5,095.21	28.50	3.08	5,098.08	5,098.08
STM-MH-A06	5,103.77	5,103.77	5,098.56	30.70	3.16	5,101.51	5,101.51
STM-MH-A05	5,103.42	5,103.42	5,098.12	30.70	2.71	5,100.63	5,100.63
STM-MH-A03	5,103.39	5,103.39	5,096.69	49.60	2.96	5,099.45	5,099.45
STM-MH-A04	5,103.31	5,103.31	5,097.77	49.60	2.84	5,099.60	5,099.60
STM-MH-C05	5,097.38	5,097.38	5,092.84	2.80	1.92	5,094.56	5,094.56
STM-MH-C04	5,096.30	5,096.30	5,092.31	6.40	2.71	5,094.52	5,094.52

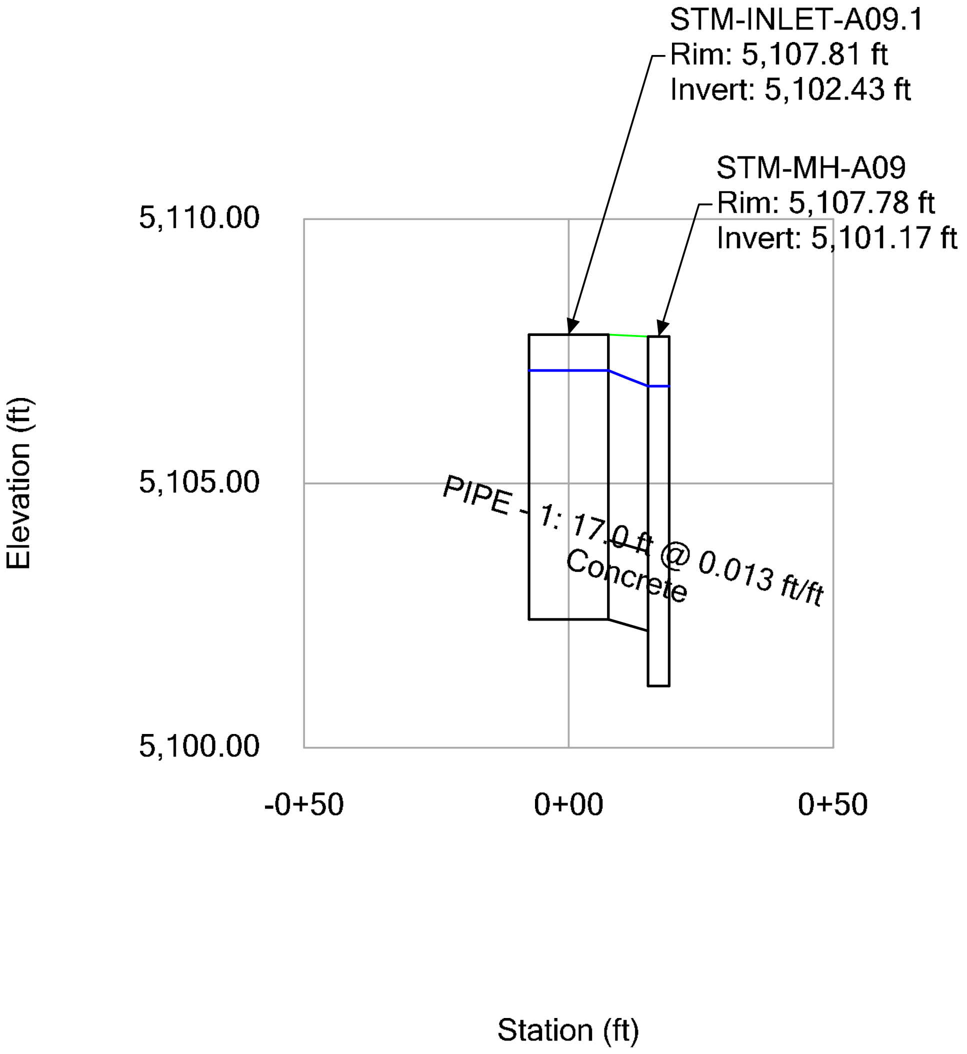
Profile Report

Engineering Profile - STM-INLET-A09.2 to O-4 (15075-1 StormCAD 100 Year.stsw)



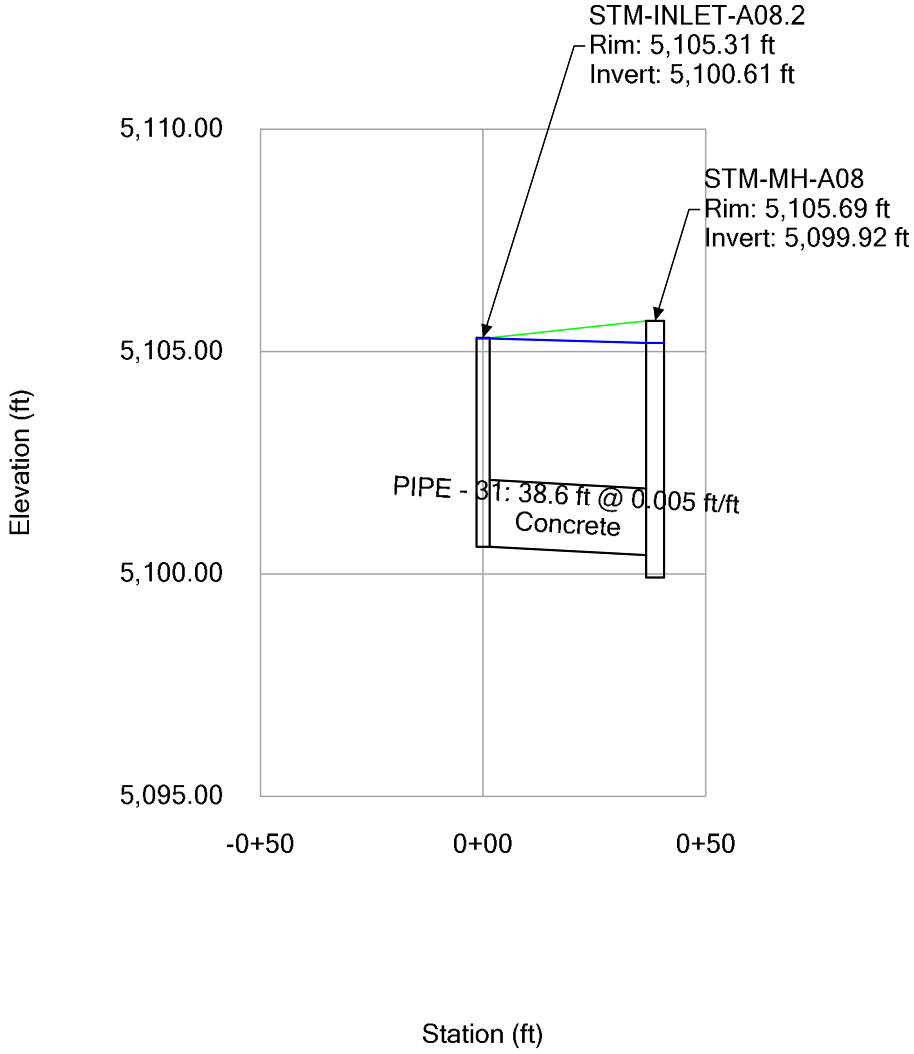
Profile Report

Engineering Profile - STM-INLET-A09.1 to STM-MH-A09 (15075-1 StormCAD 100 Year.stsw)



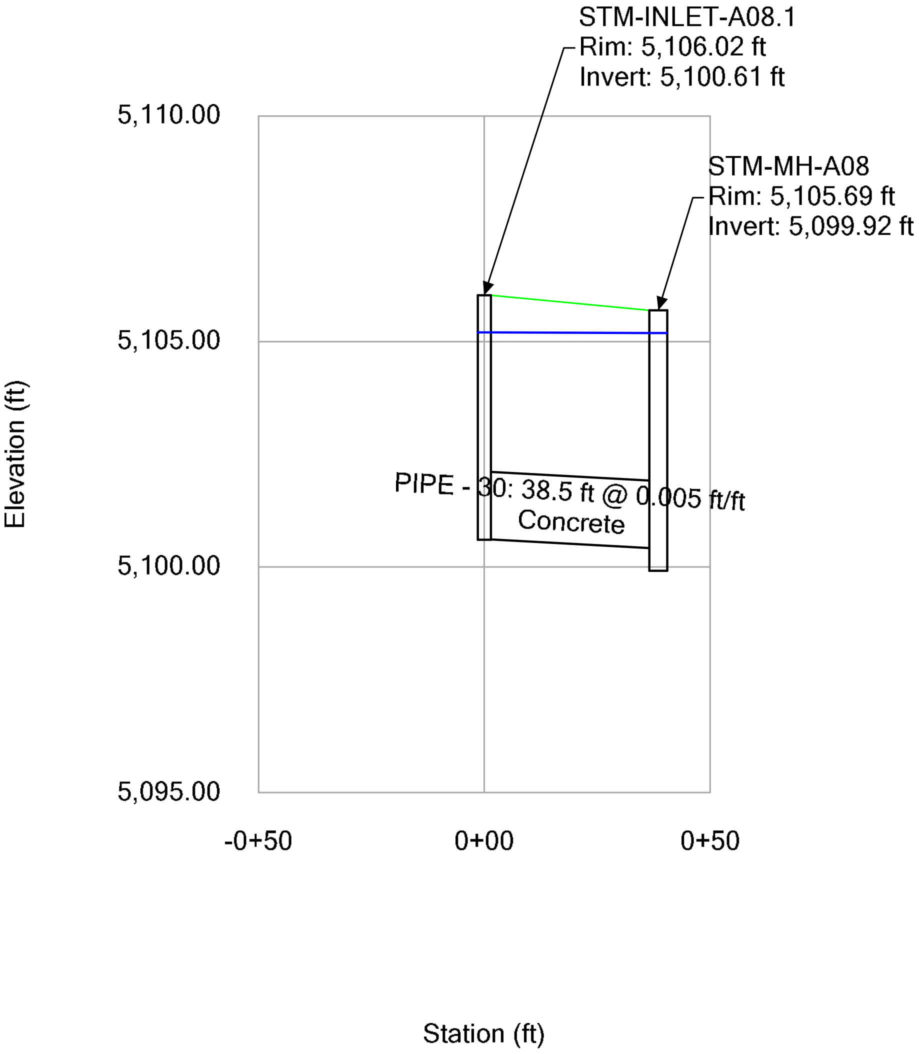
Profile Report

Engineering Profile - STM-INLET-A08.2 to STM-MH-A08 (15075-1 StormCAD 100 Year.stsw)



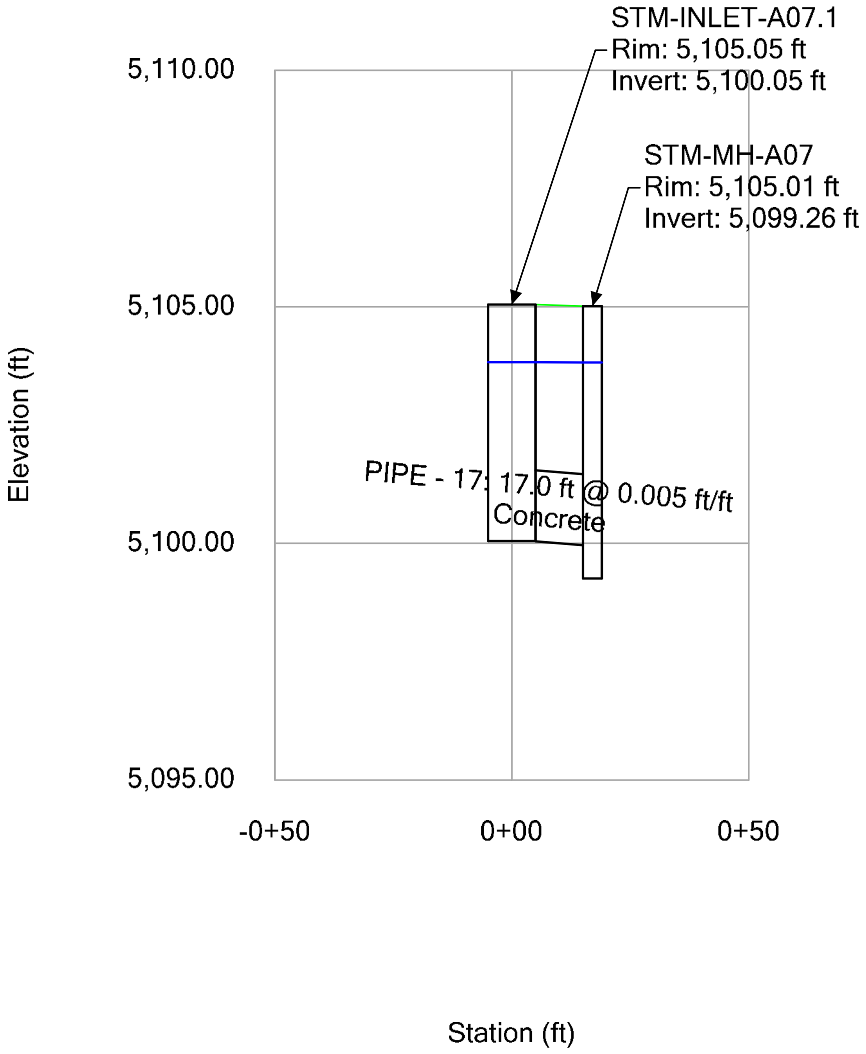
Profile Report

Engineering Profile - STM-INLET-A08.1 to STM-MH-A08 (15075-1 StormCAD 100 Year.stsw)



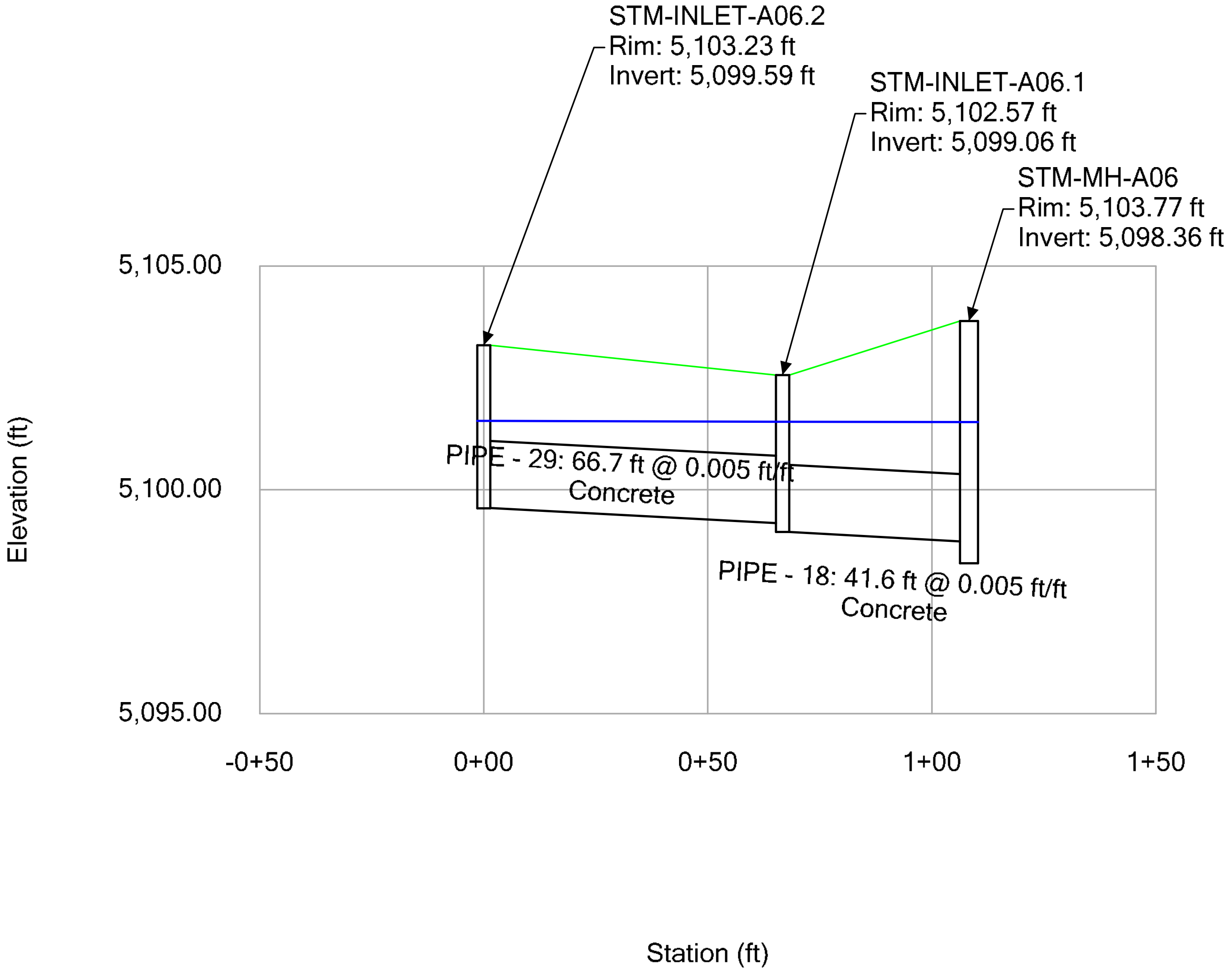
Profile Report

Engineering Profile - STM-INLET-A07.1 to STM-MH-A07 (15075-1 StormCAD 100 Year.stsw)



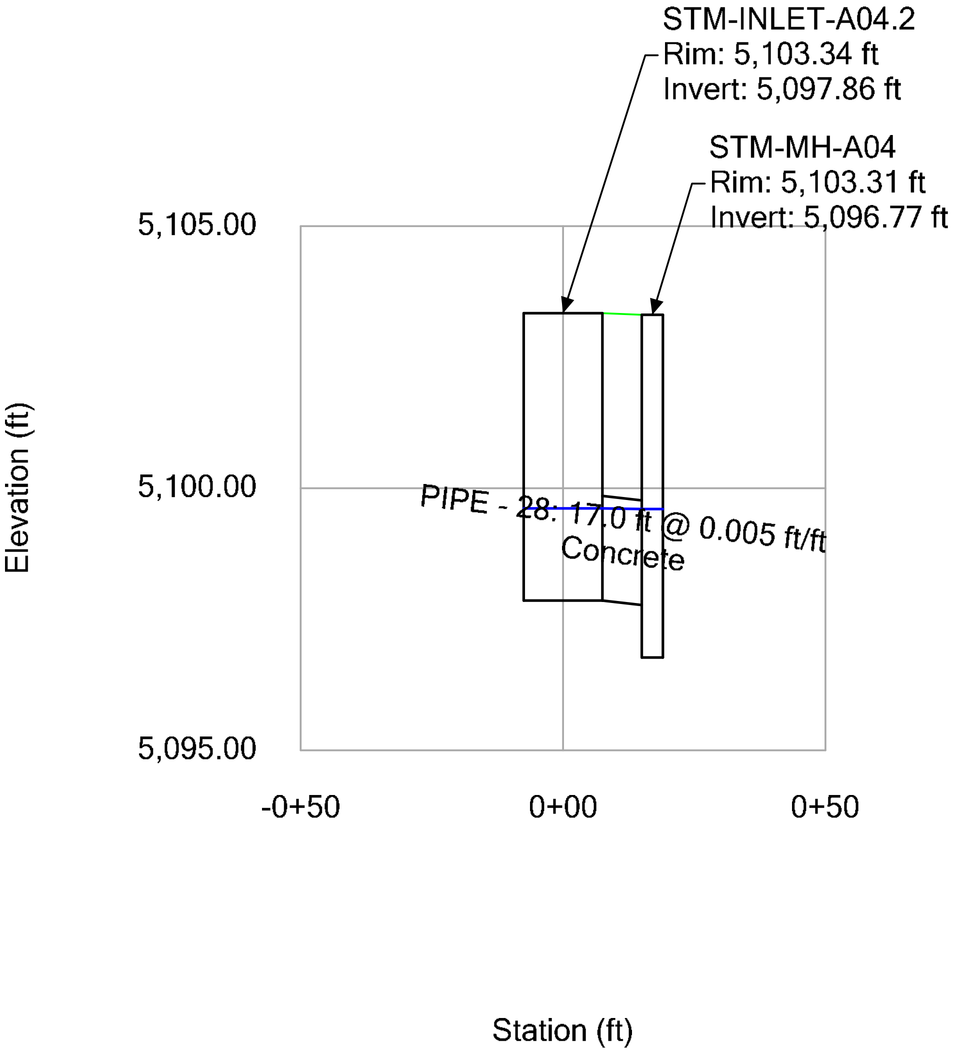
Profile Report

Engineering Profile - STM-INLET-A06.2 to STM-MH-A06 (15075-1 StormCAD 100 Year.stsw)

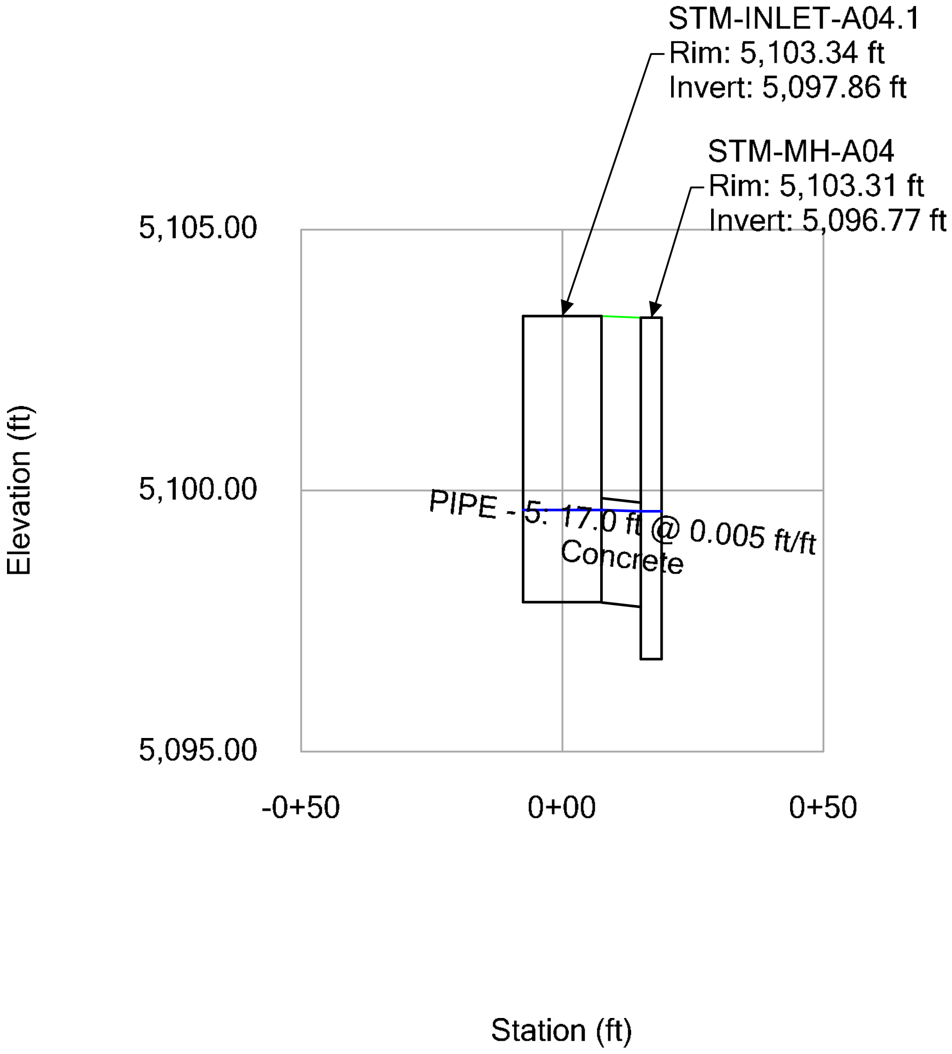


Profile Report

Engineering Profile - STM-INLET-A04.2 to STM-MH-A04 (15075-1 StormCAD 100 Year.stsw)

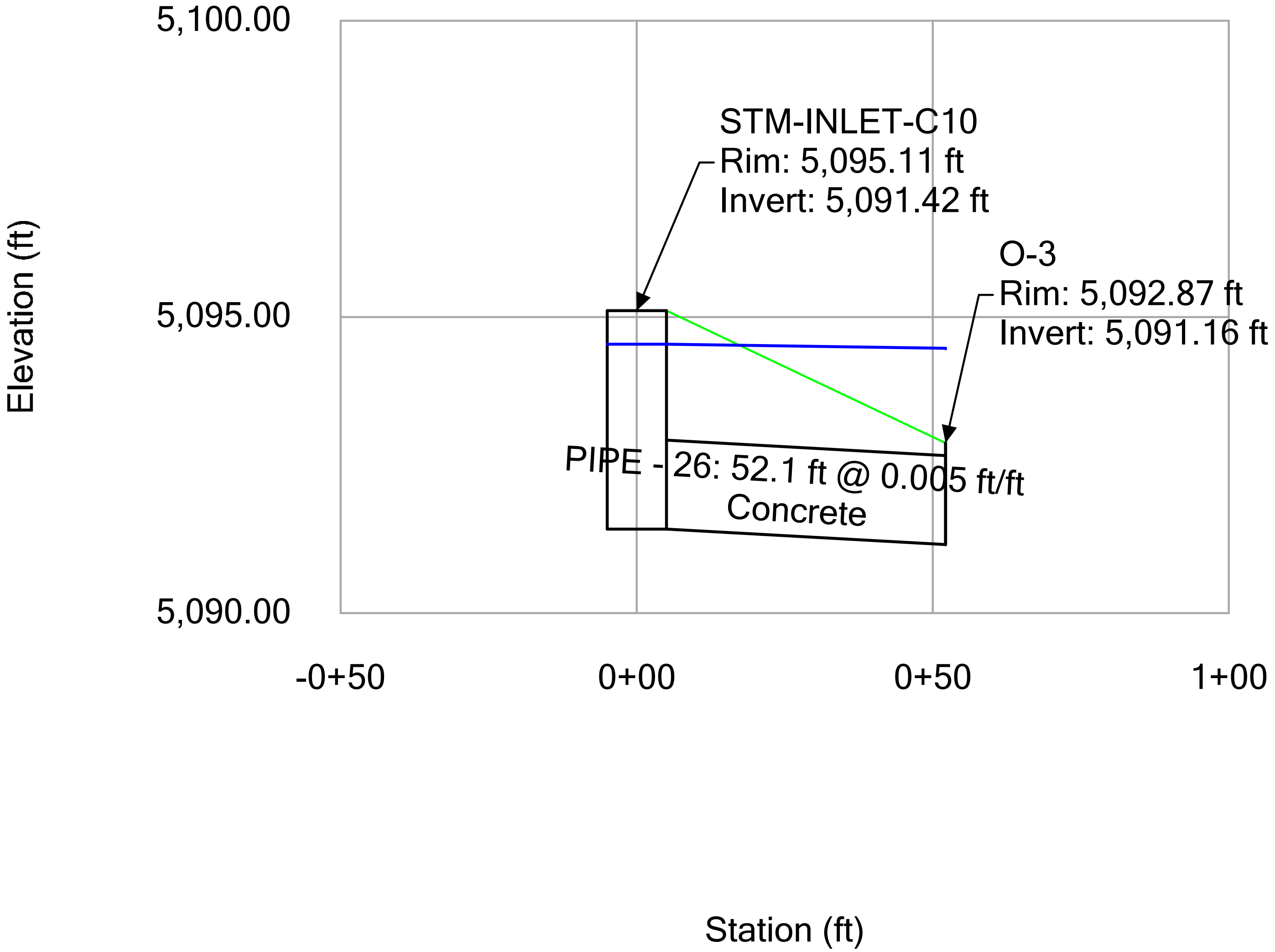


Profile Report
Engineering Profile - STM-INLET-A04.1 to STM-MH-A04 (15075-1 StormCAD 100 Year.stsw)



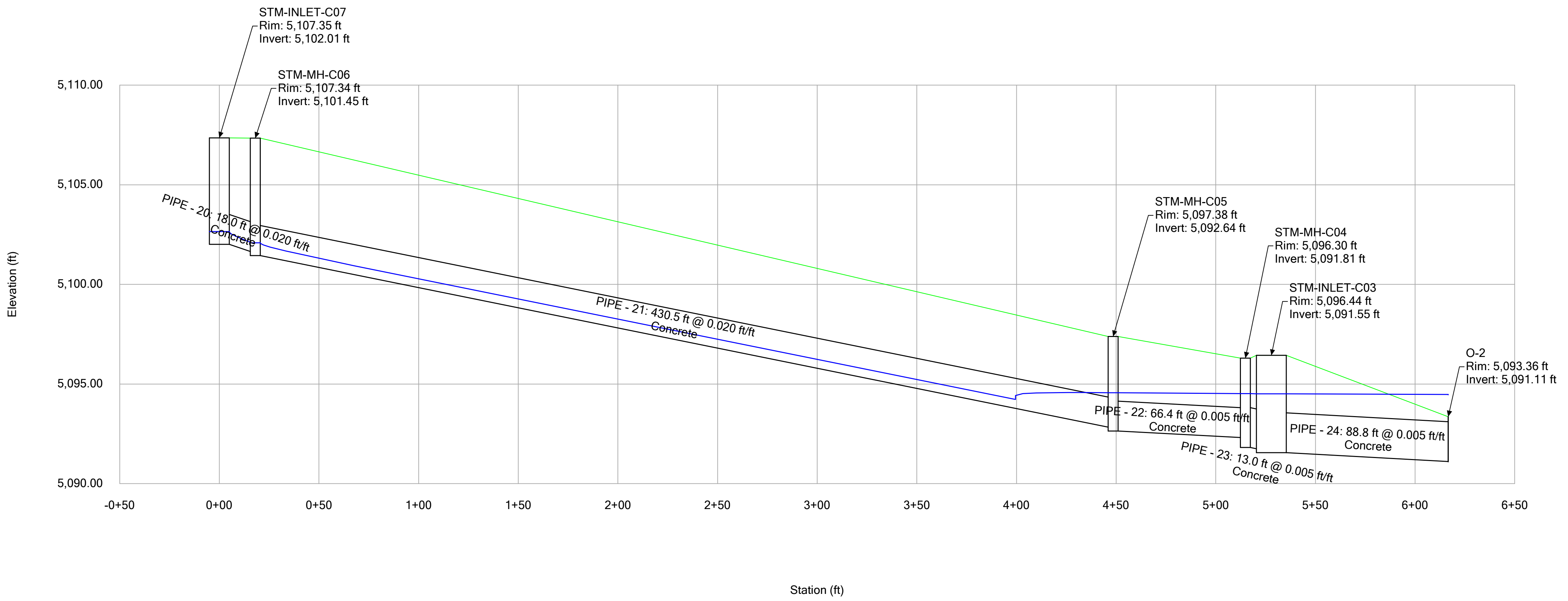
Profile Report

Engineering Profile - STM-INLET-C10 to O-3 (15075-1 StormCAD 100 Year.stsw)



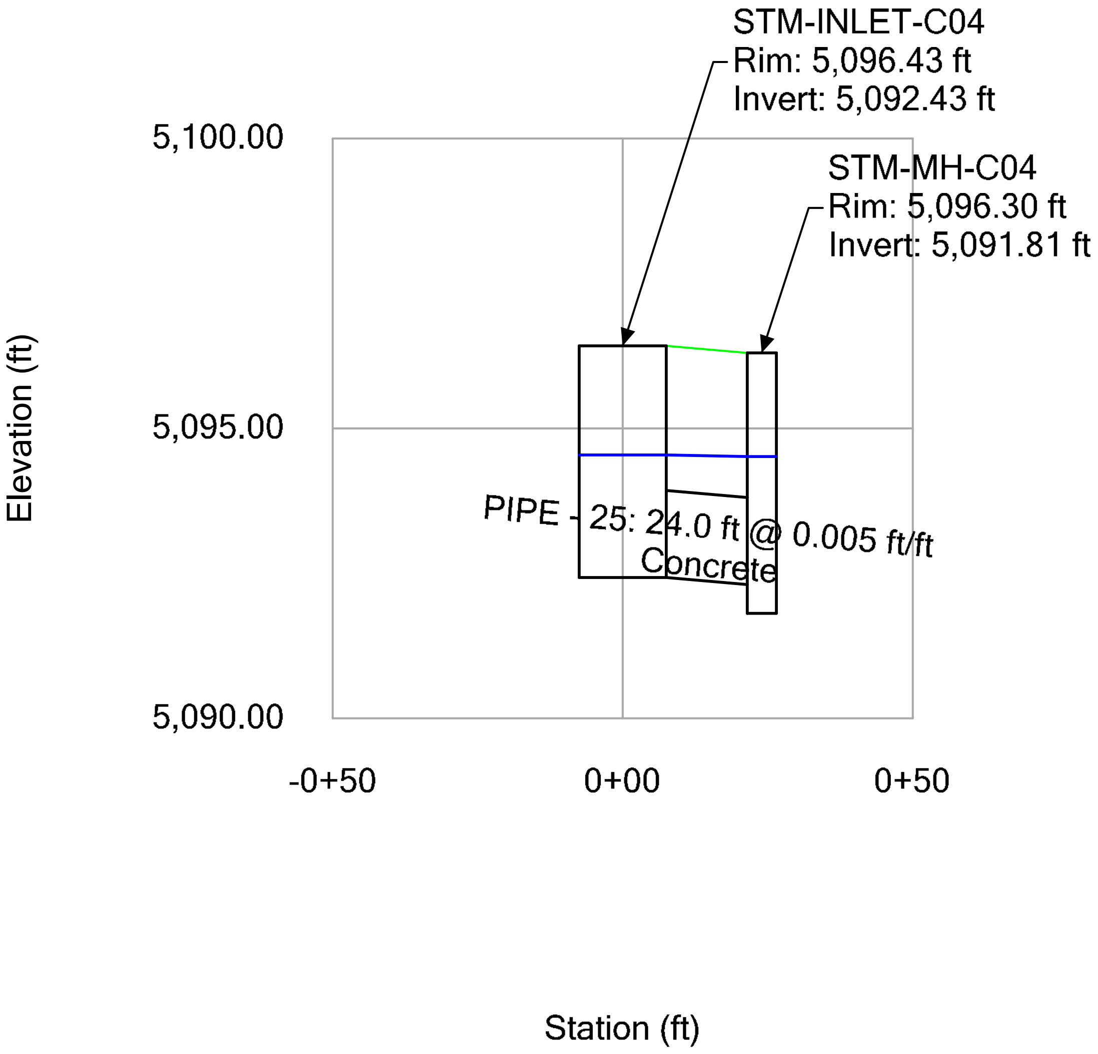
Profile Report

Engineering Profile - STM-INLET-C07 to O-2 (15075-1 StormCAD 100 Year.stsw)



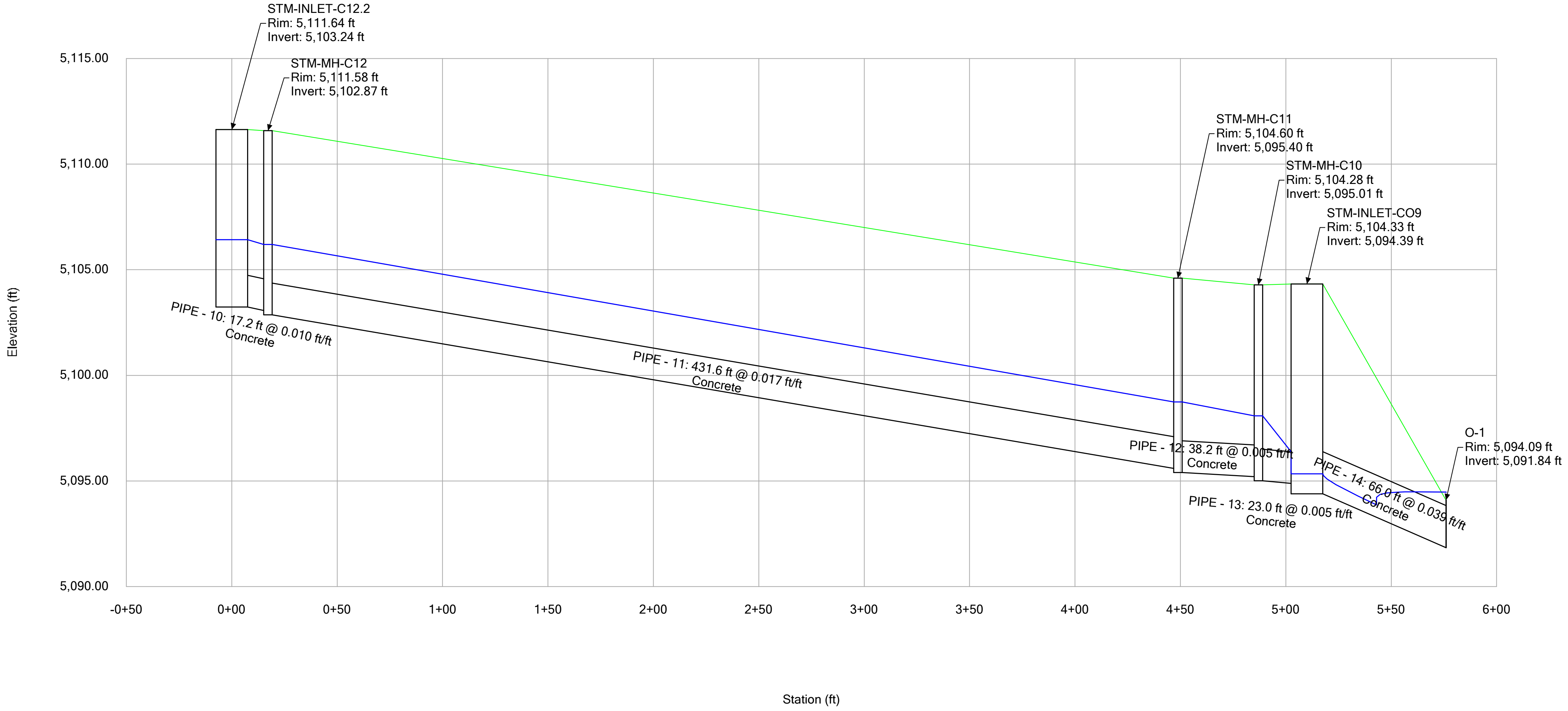
Profile Report

Engineering Profile - STM-INLET-C04 to STM-MH-C04 (15075-1 StormCAD 100 Year.stsw)



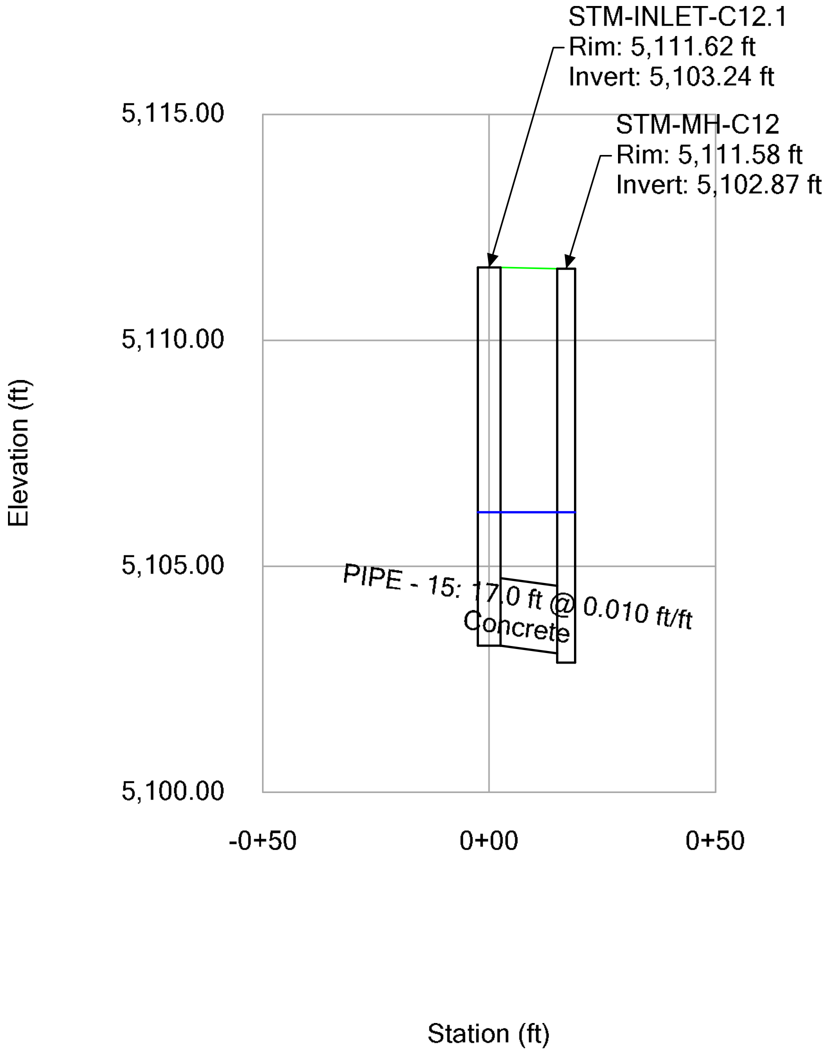
Profile Report

Engineering Profile - STM-INLET-C12.2 to O-1 (15075-1 StormCAD 100 Year.stsw)



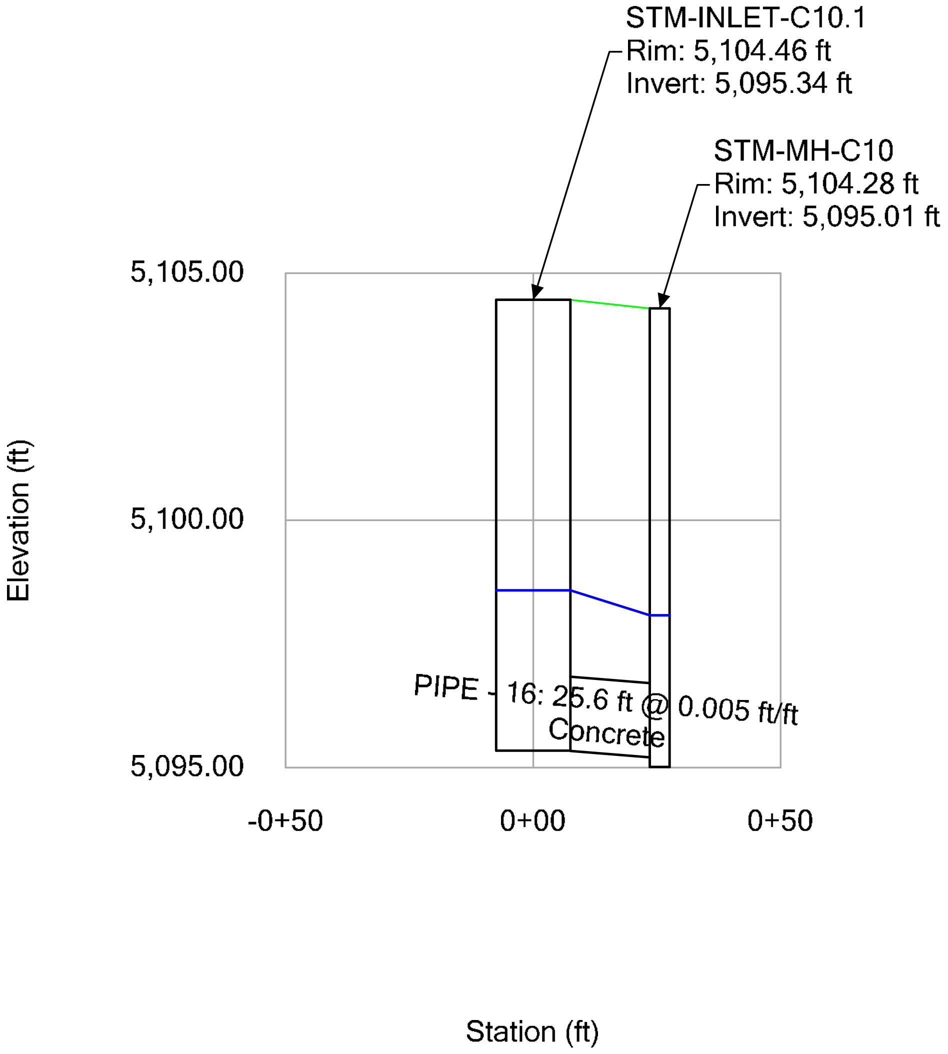
Profile Report

Engineering Profile - STM-INLET-C12.1 to STM-MH-C12 (15075-1 StormCAD 100 Year.stsw)



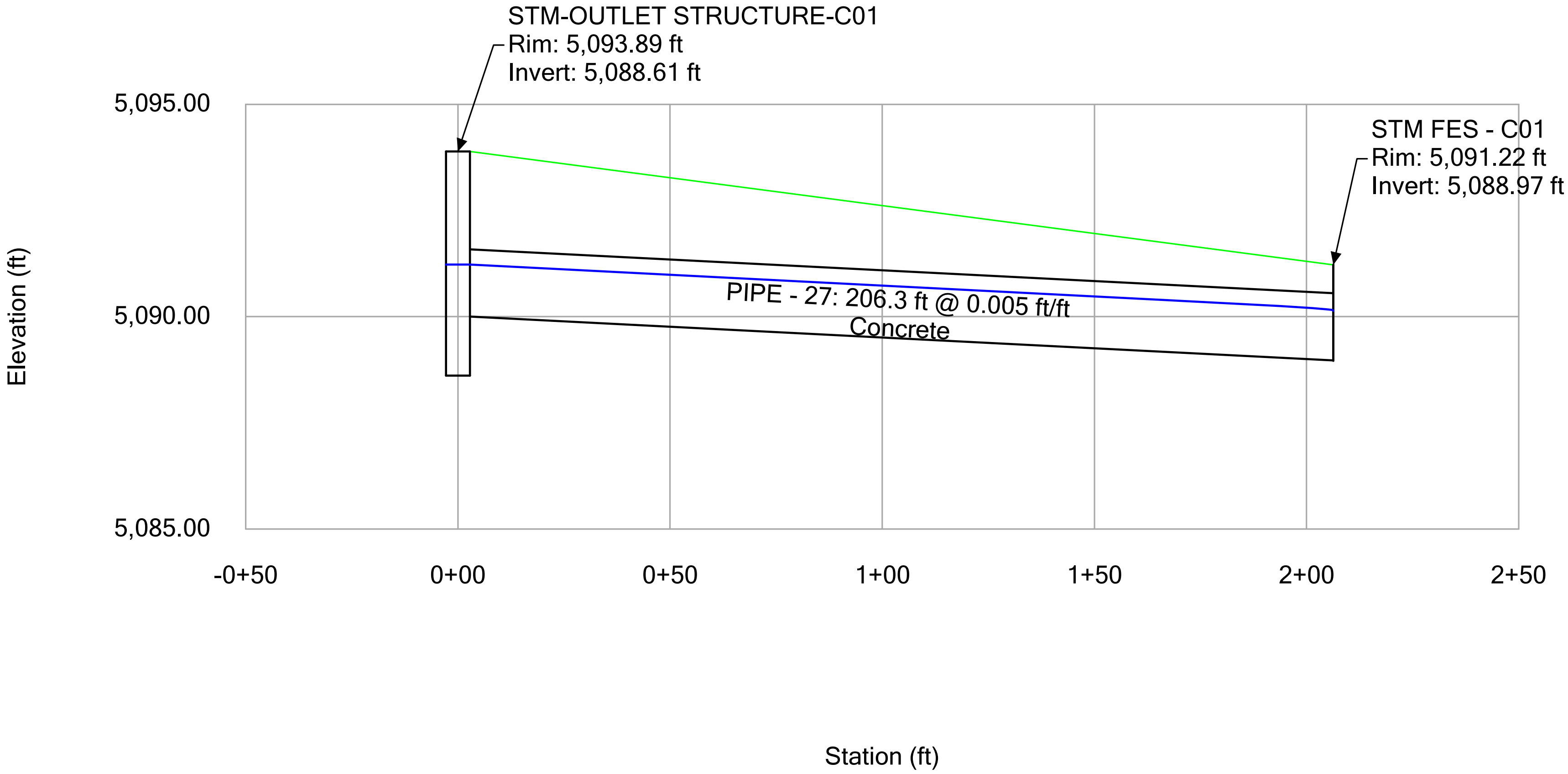
Profile Report

Engineering Profile - STM-INLET-C10.1 to STM-MH-C10 (15075-1 StormCAD 100 Year.stsw)



Profile Report

Engineering Profile - STM-OUTLET STRUCTURE-C01 to STM FES - C01 (15075-1 StormCAD 100 Year.stsw)



Version 4.05 Released March 2017

INLET MANAGEMENT

Worksheet Protected

INLET NAME	STM-INLET-C09	STM-INLET-C10.1	STM-INLET-C12.1	STM-INLET-C12.2	STM-INLET-C03	STM-INLET-C04
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	On Grade	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.7	3.6	0.4	2.9	0.9	0.7
Major Q_{Known} (cfs)	7.2	14.7	1.6	12.2	4.6	3.6

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	STM-INLET-C12.2	STM-INLET-C12.1	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	1.6	0.1	0.0	0.0	0.0	0.0

STM-INLET-C09 ALSO RECIEVES CARRY-OVER FLOW FROM STM-INLET-C10.1:
MINOR BYPASS: 0.0 CFS
MAJOR BYPASS: 3.7 CFS
TOTAL FLOW TO STM-INLET-C09:
MINOR Q: 1.7 CFS
MAJOR Q: 12.5 CFS
MINOR CAPACITY: 11.1 CFS
MAJOR CAPACITY: 16.7 CFS

Watershed Characteristics

Subcatchment Area (acres)						
Percent Impervious						
NRCS Soil Type						

Watershed Profile

Overland Slope (ft/ft)						
Overland Length (ft)						
Channel Slope (ft/ft)						
Channel Length (ft)						

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.7**	**3.6**	**0.4**	**2.9**	**0.9**	**0.7**
Major Total Design Peak Flow, Q (cfs)	**8.8**	**14.8**	**1.6**	**12.2**	**4.6**	**3.6**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	0.0	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	0.1	1.6	0.0	0.0

Minor Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Major Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Version 4.05 Released March 2017

INLET MANAGEMENT

INLET NAME	STM-INLET-C07	STM-INLET-A01 & A02	STM-INLET-A04.2	STM-INLET-A04.1	STM-INLET-A09.1	STM-INLET-A07.1
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	In Sump	In Sump	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type C Grate	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.4	0.5	2.0	2.4	3.3	0.3
Major Q_{Known} (cfs)	2.8	4.8	8.2	10.7	13.9	1.5

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	STM-INLET-A09.2	No Bypass Flow Received	STM-INLET-A09.1
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.7	0.0	2.4

Watershed Characteristics

Subcatchment Area (acres)						
Percent Impervious						
NRCS Soil Type						

Watershed Profile

Overland Slope (ft/ft)						
Overland Length (ft)						
Channel Slope (ft/ft)						
Channel Length (ft)						

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**0.4**	**0.5**	**2.0**	**2.4**	**3.3**	**0.3**
Major Total Design Peak Flow, Q (cfs)	**2.8**	**4.8**	**8.2**	**11.4**	**13.9**	**3.9**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A	N/A	N/A	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A	N/A	N/A	2.4	0.0

Minor Storm (Calculated) Analysis of Flow Ti

C	N/A	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Major Storm (Calculated) Analysis of Flow Ti

C	N/A	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Version 4.05 Released March 2017

INLET MANAGEMENT

Worksheet Protected

INLET NAME		Combined Sump C09 C10.1	STM-INLET-A06.1 & A06.2	STM-INLET-A09.2	STM-INLET-A08.2	STM-INLET-A08.1
Site Type (Urban or Rural)		URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)		STREET	STREET	STREET	STREET	STREET
Hydraulic Condition		In Sump	In Sump	On Grade	In Sump	In Sump
Inlet Type		CDOT Type R Curb Opening	CDOT Type C Grate	CDOT Type R Curb Opening	CDOT Type C Grate	CDOT Type C Grate

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)		4.9	0.2	1.5	0.9	0.1
Major Q_{Known} (cfs)		20.7	2.0	6.1	5.5	2.0

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:		No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)		0.0	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)		0.0	0.0	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)						
Percent Impervious						
NRCS Soil Type						

Watershed Profile

Overland Slope (ft/ft)						
Overland Length (ft)						
Channel Slope (ft/ft)						
Channel Length (ft)						

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)		**4.9**	**0.2**	**1.5**	**0.9**	**0.1**
Major Total Design Peak Flow, Q (cfs)		**20.7**	**2.0**	**6.1**	**5.5**	**2.0**
Minor Flow Bypassed Downstream, Q_b (cfs)		N/A	N/A	0.0	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)		N/A	N/A	0.7	N/A	N/A

Minor Storm (Calculated) Analysis of Flow Ti

C		N/A	N/A	N/A	N/A	N/A
C_5		N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi		N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt		N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti		N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt		N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c		N/A	N/A	N/A	N/A	N/A
Regional T_c		N/A	N/A	N/A	N/A	N/A
Recommended T_c		N/A	N/A	N/A	N/A	N/A
T_c selected by User		N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I		N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p		N/A	N/A	N/A	N/A	N/A

Major Storm (Calculated) Analysis of Flow Ti

C		N/A	N/A	N/A	N/A	N/A
C_5		N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi		N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt		N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti		N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt		N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c		N/A	N/A	N/A	N/A	N/A
Regional T_c		N/A	N/A	N/A	N/A	N/A
Recommended T_c		N/A	N/A	N/A	N/A	N/A
T_c selected by User		N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I		N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p		N/A	N/A	N/A	N/A	N/A

Version 4.05 Released March 2017

INLET MANAGEMENT

Worksheet Protected

INLET NAME	STM-INLET-C10
Site Type (Urban or Rural)	URBAN
Inlet Application (Street or Area)	STREET
Hydraulic Condition	On Grade
Inlet Type	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.0
Major Q_{Known} (cfs)	3.9

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0

Watershed Characteristics

Subcatchment Area (acres)	
Percent Impervious	
NRCS Soil Type	

Watershed Profile

Overland Slope (ft/ft)	
Overland Length (ft)	
Channel Slope (ft/ft)	
Channel Length (ft)	

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)	
One-Hour Precipitation, P_1 (inches)	

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)	
One-Hour Precipitation, P_1 (inches)	

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.0**
Major Total Design Peak Flow, Q (cfs)	**3.9**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0

Minor Storm (Calculated) Analysis of Flow Ti

C	N/A
C_5	N/A
Overland Flow Velocity, Vi	N/A
Channel Flow Velocity, Vt	N/A
Overland Flow Time, Ti	N/A
Channel Travel Time, Tt	N/A
Calculated Time of Concentration, T_c	N/A
Regional T_c	N/A
Recommended T_c	N/A
T_c selected by User	N/A
Design Rainfall Intensity, I	N/A
Calculated Local Peak Flow, Q_p	N/A

Major Storm (Calculated) Analysis of Flow Ti

C	N/A
C_5	N/A
Overland Flow Velocity, Vi	N/A
Channel Flow Velocity, Vt	N/A
Overland Flow Time, Ti	N/A
Channel Travel Time, Tt	N/A
Calculated Time of Concentration, T_c	N/A
Regional T_c	N/A
Recommended T_c	N/A
T_c selected by User	N/A
Design Rainfall Intensity, I	N/A
Calculated Local Peak Flow, Q_p	N/A

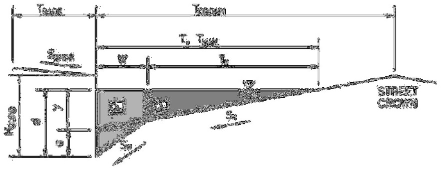
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**

Inlet ID: **STM-INLET-C09**



Gutter Geometry (Enter data in the blue cells)

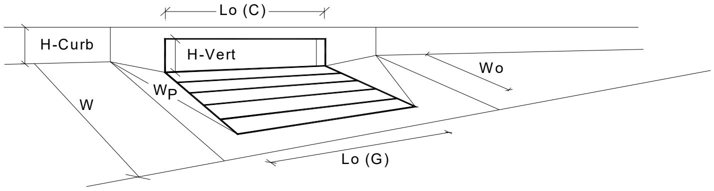
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



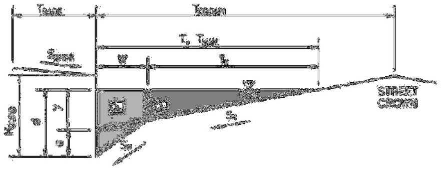
Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	6.5	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.38	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.61	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.76	0.82	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**11.1**	**16.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.7	8.8	cfs

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**
Inlet ID: **STM-INLET-C10.1**

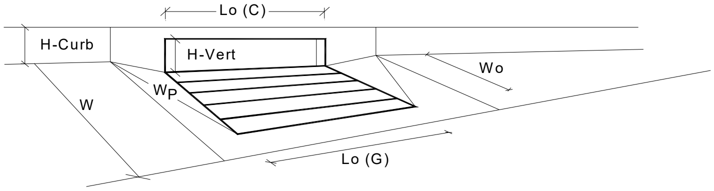


Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.6	5.6	inches
Grate Information			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.53	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.76	0.76	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

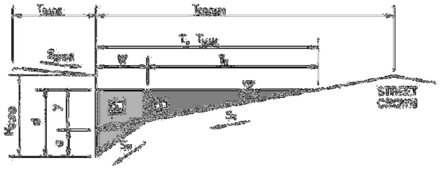
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**11.1**	**11.1**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	3.6	14.8	cfs

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**
Inlet ID: **STM-INLET-C12.1**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

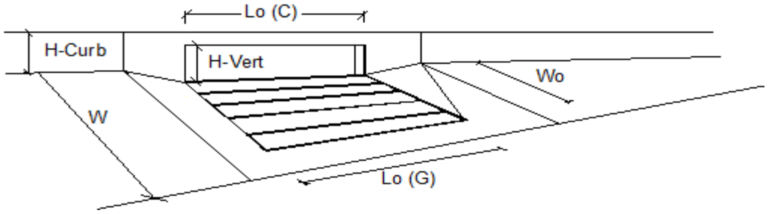
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**10.9**	**10.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



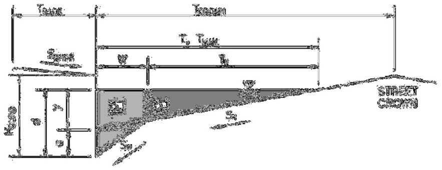
Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**0.4**	**1.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**93**	**%**

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**
Inlet ID: **STM-INLET-C12.2**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	1.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

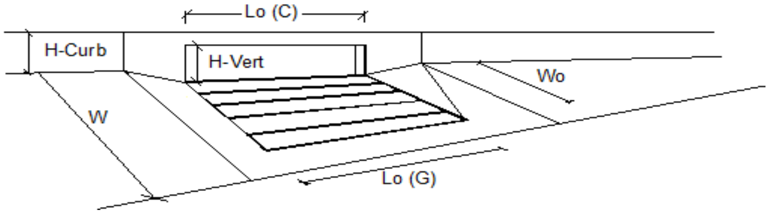
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**10.9**	**10.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet CDOT Type R Curb Opening ▾	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.9**	**10.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**87**	**%**

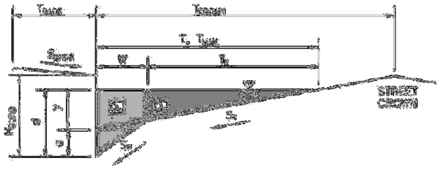
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**

Inlet ID: **STM-INLET-C03**



<u>Gutter Geometry (Enter data in the blue cells)</u>

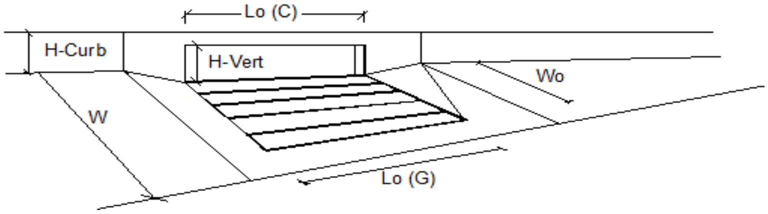
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.024		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**16.8**	**16.8**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



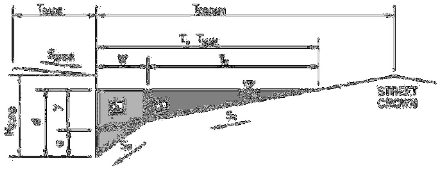
Design Information (Input)	CDOT Type R Curb Opening ▼		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**0.9**	**4.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**100**	**%**

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Compass Filing No.4
Inlet ID: STM-INLET-C04



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.024	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

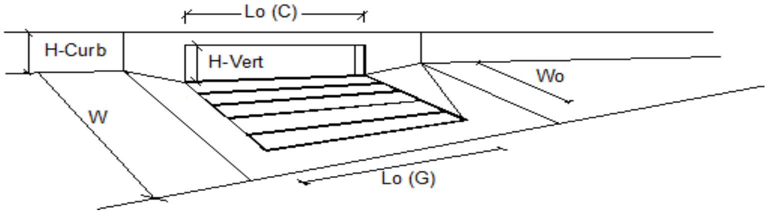
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**16.8**	**16.8**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	

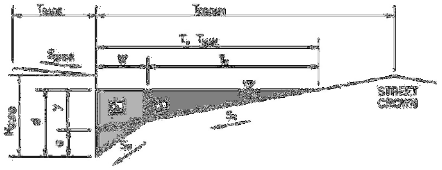
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.7**	**3.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**
Inlet ID: **STM-INLET-C07**

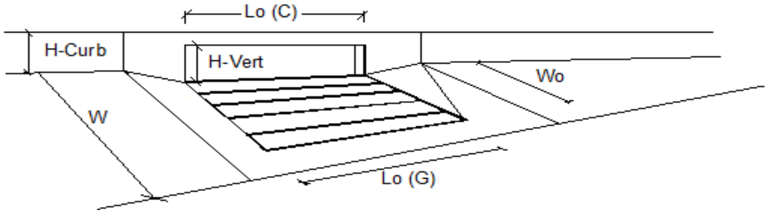


Gutter Geometry (Enter data in the blue cells)				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.024		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**16.8**	**16.8**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



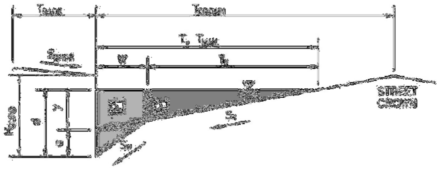
Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**0.4**	**2.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**100**	**%**

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**
Inlet ID: **STM-INLET-A01 & A02**



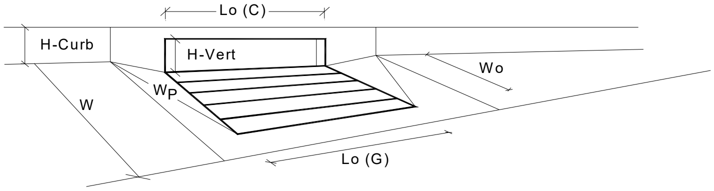
<u>Gutter Geometry (Enter data in the blue cells)</u>

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



	Design Information (Input)	CDOT Type C Grate ▾	MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type C Grate		
	Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	9.00	9.00	inches
	Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
	Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	7.0	inches
	Grate Information		MINOR	MAJOR	☑ Override Depths
	Length of a Unit Grate	L_o (G) =	2.92	2.92	feet
Warning 5	Width of a Unit Grate	W_o =	2.92	2.92	feet
	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.70	0.70	
	Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
	Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	2.41	2.41	
	Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.67	0.67	
	Curb Opening Information		MINOR	MAJOR	
	Length of a Unit Curb Opening	L_o (C) =	N/A	N/A	feet
	Height of Vertical Curb Opening in Inches	H_{vert} =	N/A	N/A	inches
	Height of Curb Orifice Throat in Inches	H_{throat} =	N/A	N/A	inches
	Angle of Throat (see USDCM Figure ST-5)	Theta =	N/A	N/A	degrees
	Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	N/A	N/A	feet
	Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	N/A	N/A	
	Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	N/A	N/A	
	Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	N/A	N/A	
	Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
	Depth for Grate Midwidth	d_{Grate} =	0.581	0.665	ft
	Depth for Curb Opening Weir Equation	d_{Curb} =	N/A	N/A	ft
	Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
	Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
	Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.95	1.00	
			MINOR	MAJOR	
	Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**3.7**	**4.8**	**cfs**
	Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	0.5	4.8	cfs

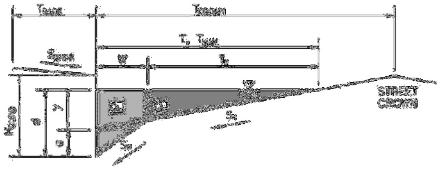
Warning 5: The width of unit is greater than the gutter width.

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**
Inlet ID: **STM-INLET-A04.2**



Gutter Geometry (Enter data in the blue cells)

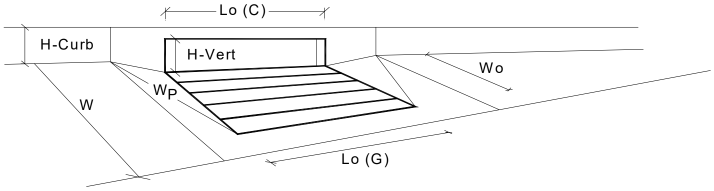
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow}** =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening ▾ Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	5.6	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.53	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.76	0.76	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**11.1**	**11.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.0	8.2	cfs

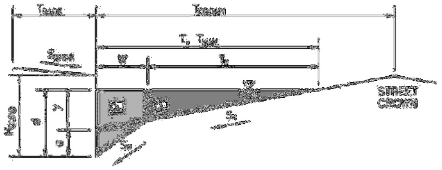
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**

Inlet ID: **STM-INLET-A04.1**

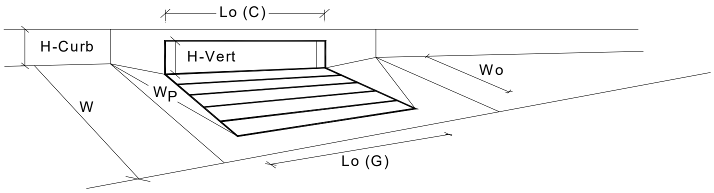


Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



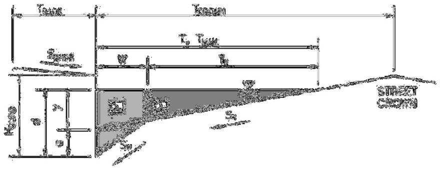
Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening ▾	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.6	5.6	inches
Grate Information			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.30	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.53	0.53	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.76	0.76	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**11.1**	**11.1**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	2.4	11.4	cfs

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**
Inlet ID: **STM-INLET-A09.1**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.011	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

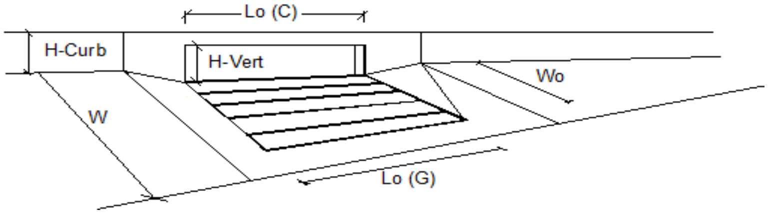
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**11.4**	**11.4**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



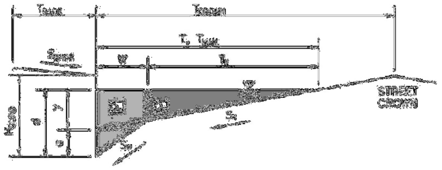
Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening ▼	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**3.3**	**11.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**2.4**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**82**	**%**

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**
Inlet ID: **STM-INLET-A07.1**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.012	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

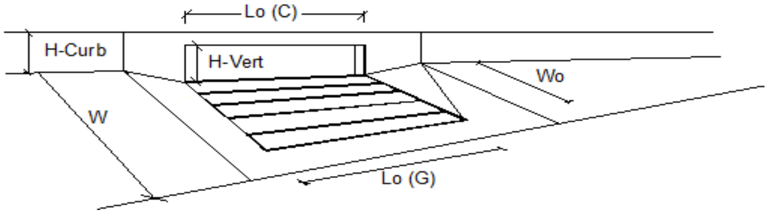
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**11.9**	**11.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



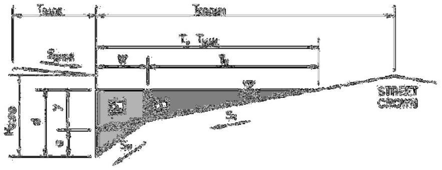
Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**0.3**	**3.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**99**	**%**

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**
Inlet ID: **Combined Sump C09 C10.1**



Gutter Geometry (Enter data in the blue cells)

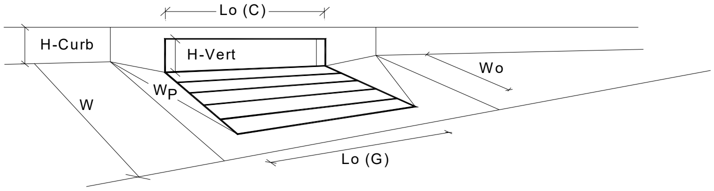
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening ▾	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	6	6	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.6	5.6	inches
Grate Information			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Warning 1 Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	6.00	6.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.30	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.53	0.53	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.76	0.76	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**22.7**	**22.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	4.9	20.7	cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

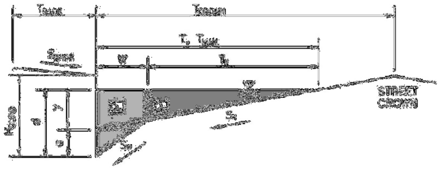
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**

Inlet ID: **STM-INLET-A06.1 & A06.2**



Gutter Geometry (Enter data in the blue cells)

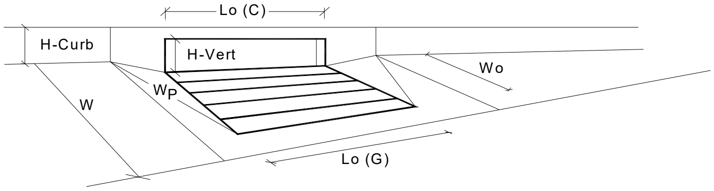
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	6.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



CDOT Type C Grate

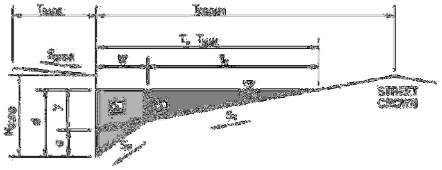
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type C Grate		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	0.00	0.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.5	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	2.92	2.92	feet
Width of a Unit Grate	W_o =	2.92	2.92	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.70	0.70	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	2.41	2.41	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.67	0.67	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	N/A	N/A	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	N/A	N/A	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	N/A	N/A	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.379	0.420	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	N/A	N/A	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.95	1.00	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.0**	**2.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	0.2	2.0	cfs

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**
Inlet ID: **STM-INLET-A09.2**

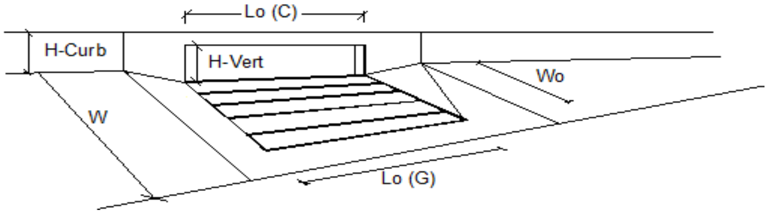


Gutter Geometry (Enter data in the blue cells)				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.011		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes
MINOR STORM Allowable Capacity is based on Spread Criterion		Minor Storm	Major Storm	
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**11.4**	**11.4**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



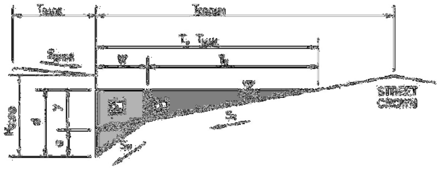
Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening ▾	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.5**	**5.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.7**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**88**	**%**

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**
Inlet ID: **STM-INLET-A08.2**

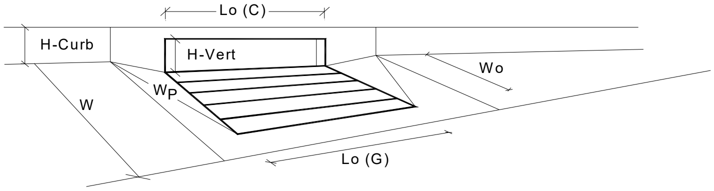


Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft	
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft	
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches	
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft	
Gutter Width	W =	6.00	ft	
Street Transverse Slope	S_X =	0.020	ft/ft	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft	
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft	
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



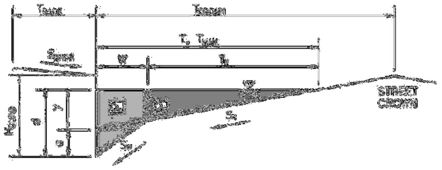
Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type C Grate	Type =	CDOT Type C Grate		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	0.00	0.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	12.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	2.92	2.92	feet
Width of a Unit Grate		W_o =	2.92	2.92	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	0.70	0.70	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	2.41	2.41	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	0.67	0.67	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	N/A	N/A	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	N/A	N/A	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	N/A	N/A	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	0.379	0.879	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	N/A	N/A	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	N/A	N/A	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	0.95	1.00	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**2.0**	**7.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	0.9	5.5	cfs

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Compass Filing No.4**
Inlet ID: **STM-INLET-A08.1**



Gutter Geometry (Enter data in the blue cells)

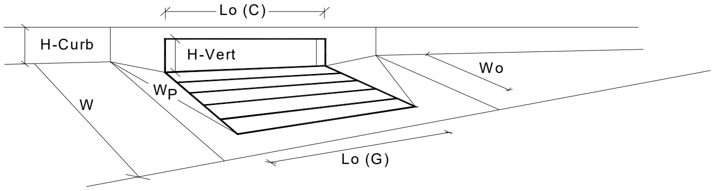
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	6.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow}** =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



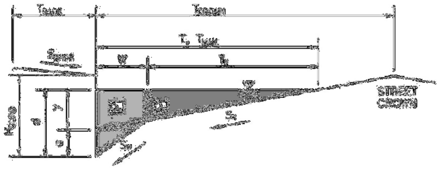
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	CDOT Type C Grate	Type =	CDOT Type C Grate	
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	0.00	0.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.5	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	2.92	2.92	feet
Width of a Unit Grate	W_o =	2.92	2.92	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.70	0.70	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	2.41	2.41	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.67	0.67	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	N/A	N/A	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	N/A	N/A	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	N/A	N/A	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.379	0.420	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	N/A	N/A	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.95	1.00	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**2.0**	**2.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	0.1	2.0	cfs

Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Compass Filing No.4
Inlet ID: STM-INLET-C10



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	56.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.018	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

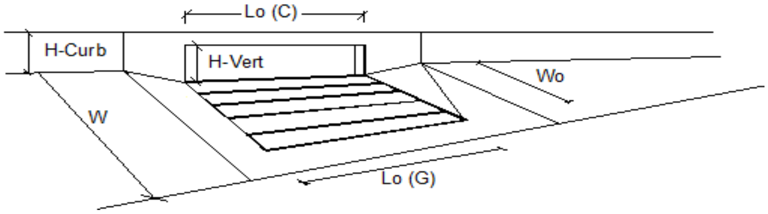
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	56.0	56.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**18.5**	**21.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

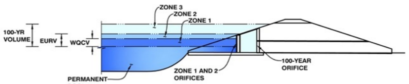
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.0**	**3.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**99**	**%**

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Compass F4

Basin ID: Pond C



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	11.58	acres		
Watershed Length =	1,175	ft		
Watershed Slope =	0.020	ft/ft		
Watershed Imperviousness =	61.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	Erie			
Water Quality Capture Volume (WQCV) =	0.231	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.767	acre-feet		
2-yr Runoff Volume (P1 = 0.81 in.) =	0.431	acre-feet		inches
5-yr Runoff Volume (P1 = 1.11 in.) =	0.627	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	0.876	acre-feet		inches
25-yr Runoff Volume (P1 = 1.84 in.) =	1.330	acre-feet		inches
50-yr Runoff Volume (P1 = 2.24 in.) =	1.684	acre-feet		inches
100-yr Runoff Volume (P1 = 2.65 in.) =	2.119	acre-feet	2.65	inches
500-yr Runoff Volume (P1 = 3.89 in.) =	3.332	acre-feet		inches
Approximate 2-yr Detention Volume =	0.403	acre-feet		
Approximate 5-yr Detention Volume =	0.590	acre-feet		
Approximate 10-yr Detention Volume =	0.814	acre-feet		
Approximate 25-yr Detention Volume =	1.018	acre-feet		
Approximate 50-yr Detention Volume =	1.148	acre-feet		
Approximate 100-yr Detention Volume =	1.322	acre-feet		

Stage-Storage Calculation

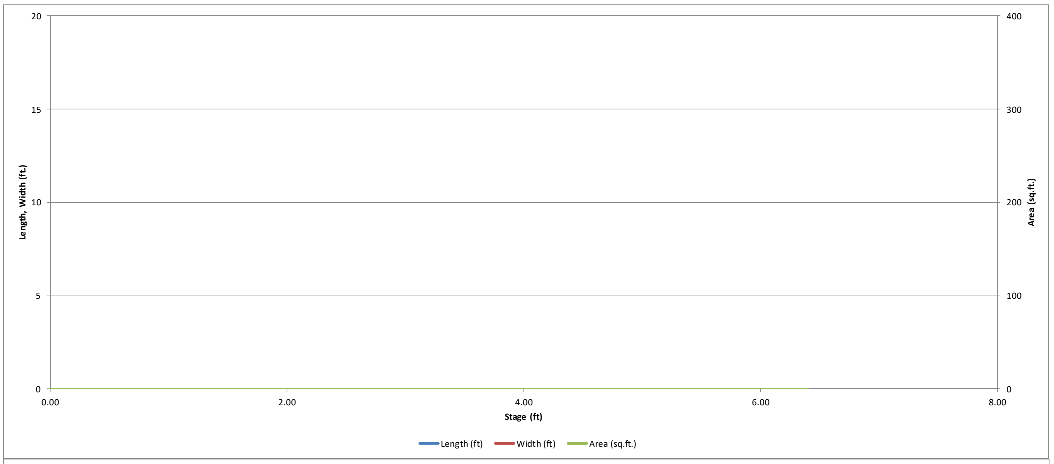
Zone 1 Volume (WQCV) =	0.231	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.536	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.554	acre-feet
Total Detention Basin Volume =	1.322	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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

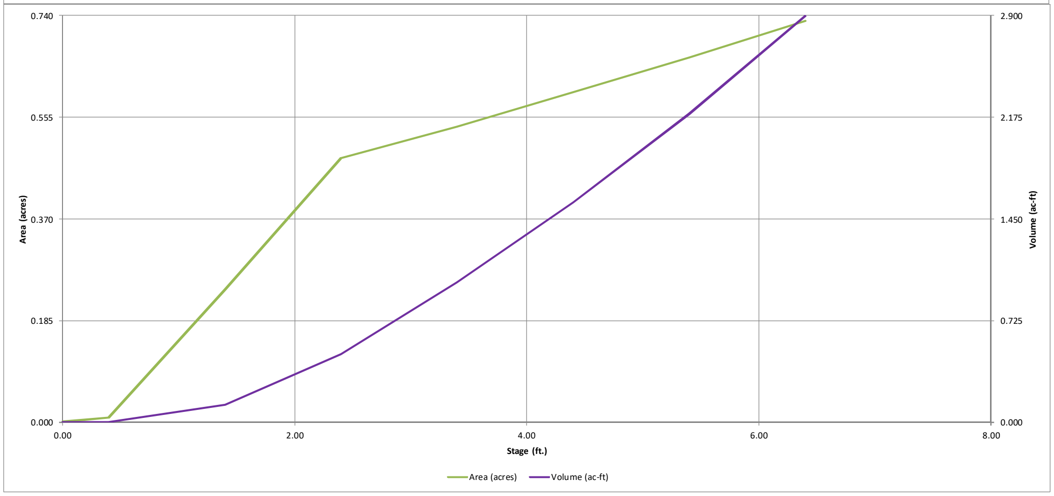
Depth Increment = ft

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	--	--	--	42	0.001		
	--	0.40	--	--	--	364	0.008	78	0.002
	--	1.40	--	--	--	10,535	0.242	5,426	0.125
	--	2.40	--	--	--	20,910	0.480	21,253	0.488
	--	3.40	--	--	--	23,433	0.538	43,425	0.997
	--	4.40	--	--	--	26,146	0.600	68,214	1.566
	--	5.40	--	--	--	28,901	0.663	95,738	2.198
	--	6.40	--	--	--	31,790	0.730	126,083	2.894
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

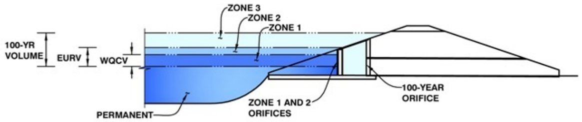




Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Compass F4
Basin ID: Pond C



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.77	0.231	Orifice Plate
Zone 2 (EURV)	2.97	0.536	Orifice Plate
Zone 3 (100-year)	3.99	0.554	Weir&Pipe (Restrict)
		1.322	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.97	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	1.48	sq. inches (diameter = 1-3/8 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.028E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.09	2.18					
Orifice Area (sq. inches)	1.48	1.48	1.48					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.43	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.67	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.92	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.43	N/A	feet
Over Flow Weir Slope Length =	2.92	N/A	feet
Grate Open Area / 100-yr Orifice Area =	9.23	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	11.59	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.79	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.28	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	10.10		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.26	N/A	ft^2
Outlet Orifice Centroid =	0.49	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.41	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.83	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	92.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

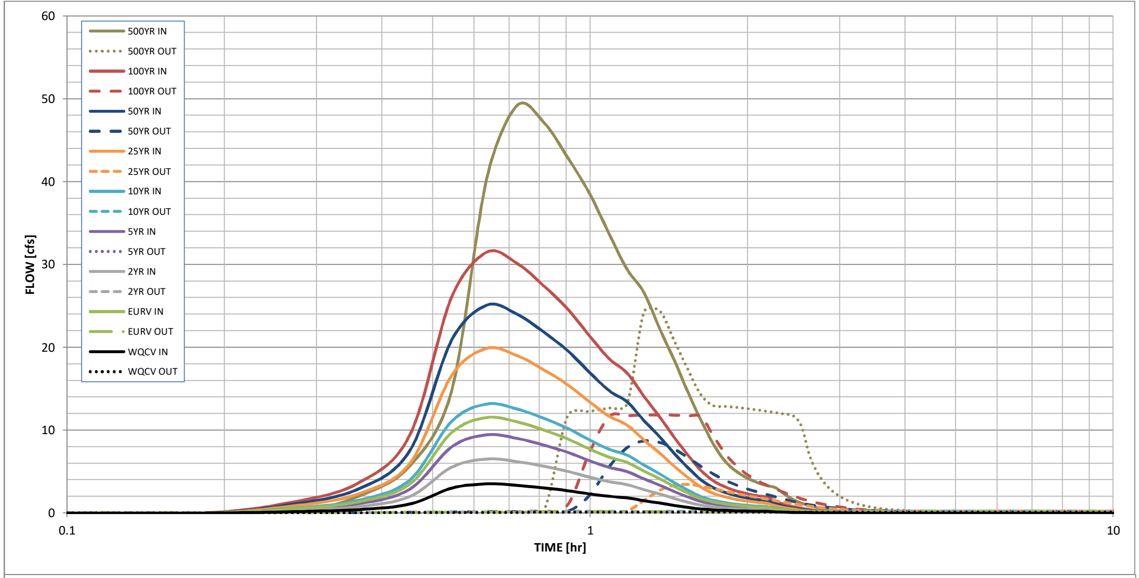
Spillway Design Flow Depth=	0.23	feet
Stage at Top of Freeboard =	6.06	feet
Basin Area at Top of Freeboard =	0.71	acres

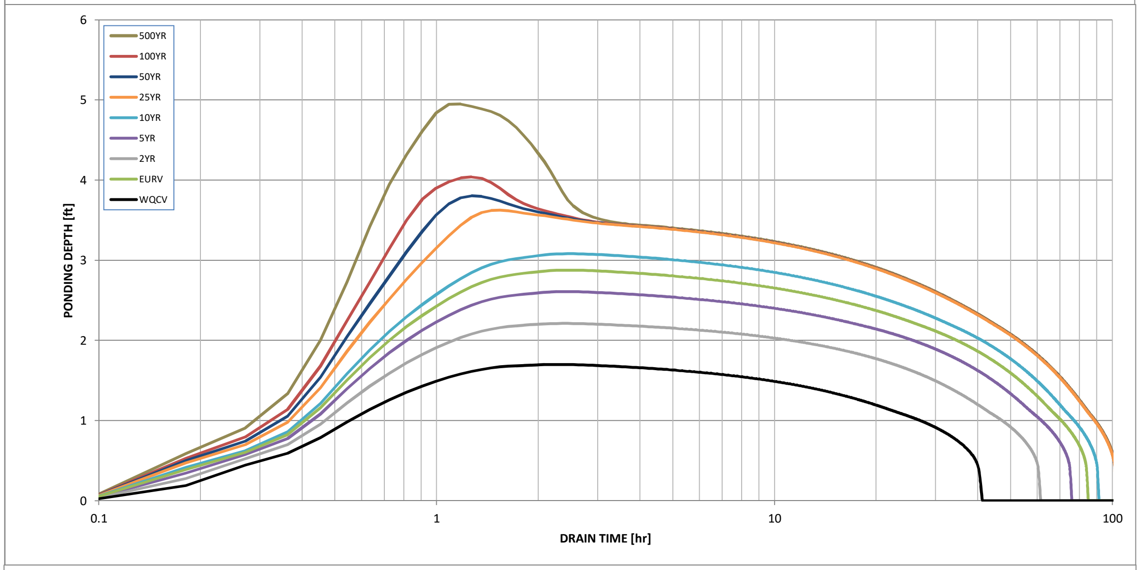
Routed Hydrograph Results

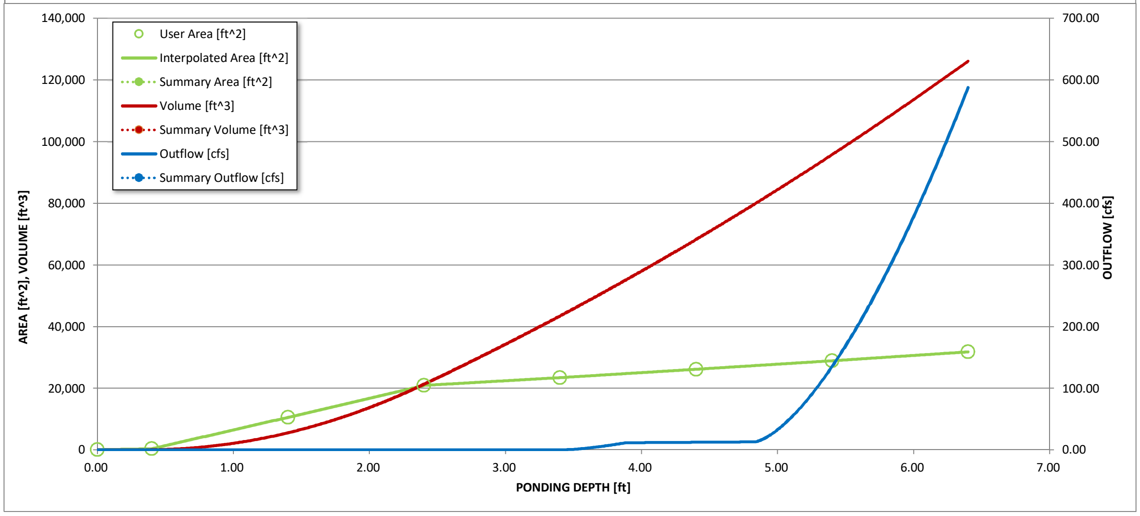
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.81	1.11	1.39	1.84	2.24	2.65	3.89
Calculated Runoff Volume (acre-ft) =	0.231	0.767	0.431	0.627	0.876	1.330	1.684	2.119	3.332
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.227	0.756	0.424	0.618	0.863	1.311	1.659	2.088	3.282
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.01	0.14	0.54	0.81	1.16	2.03
Predevelopment Peak Q (cfs) =	0.0	0.0	0.1	0.2	1.6	6.3	9.4	13.5	23.5
Peak Inflow Q (cfs) =	3.5	11.5	6.5	9.4	13.2	19.9	25.1	31.5	49.2
Peak Outflow Q (cfs) =	0.1	0.2	0.1	0.2	0.2	3.4	8.7	11.8	24.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.1	0.1	0.5	0.9	0.9	1.0
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.3	0.7	1.0	1.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	78	57	70	83	91	89	86	80
Time to Drain 99% of Inflow Volume (hours) =	**40**	82	60	74	88	98	97	96	93
Maximum Ponding Depth (ft) =	1.70	2.88	2.21	2.61	3.08	3.63	3.80	4.04	4.95
Area at Maximum Ponding Depth (acres) =	0.31	0.51	0.43	0.49	0.52	0.55	0.56	0.58	0.63
Maximum Volume Stored (acre-ft) =	0.207	0.720	0.401	0.585	0.828	1.117	1.217	1.354	1.899

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

User-Defined Time Interval
5.43 min

Hydrograph Constant
0.907

SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:10:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:16:17	0.16	0.51	0.29	0.42	0.58	0.86	1.08	1.35	2.07
0:21:43	0.42	1.37	0.78	1.13	1.56	2.35	2.95	3.69	5.72
0:27:09	1.09	3.53	2.01	2.90	4.02	6.03	7.59	9.48	14.67
0:32:35	3.00	9.69	5.52	7.96	11.03	16.57	20.83	26.03	40.25
0:38:01	3.51	11.53	6.51	9.45	13.15	19.87	25.09	31.48	49.16
0:43:26	3.34	11.01	6.21	9.02	12.56	19.01	24.01	30.15	47.19
0:48:52	3.04	10.02	5.65	8.21	11.44	17.30	21.86	27.44	42.94
0:54:18	2.70	8.96	5.04	7.33	10.23	15.51	19.61	24.65	38.66
0:59:44	2.32	7.74	4.34	6.33	8.85	13.45	17.03	21.44	33.76
1:05:10	2.02	6.74	3.78	5.51	7.70	11.69	14.79	18.64	29.43
1:10:35	1.83	6.11	3.43	4.99	6.98	10.60	13.42	16.89	26.61
1:16:01	1.49	5.05	2.82	4.12	5.78	8.81	11.17	14.09	22.26
1:21:27	1.21	4.13	2.29	3.36	4.73	7.24	9.20	11.63	18.42
1:26:53	0.91	3.19	1.75	2.59	3.66	5.64	7.20	9.12	14.55
1:32:19	0.67	2.38	1.30	1.93	2.74	4.26	5.46	6.96	11.20
1:37:44	0.49	1.72	0.94	1.40	1.98	3.11	4.00	5.13	8.33
1:43:10	0.38	1.33	0.73	1.08	1.53	2.38	3.05	3.89	6.27
1:48:36	0.32	1.10	0.60	0.89	1.26	1.94	2.49	3.16	5.06
1:54:02	0.27	0.93	0.51	0.76	1.07	1.64	2.10	2.67	4.26
1:59:28	0.24	0.82	0.45	0.66	0.93	1.44	1.84	2.33	3.71
2:04:53	0.21	0.73	0.41	0.60	0.84	1.29	1.65	2.09	3.32
2:10:19	0.20	0.68	0.38	0.55	0.77	1.19	1.51	1.92	3.04
2:15:45	0.15	0.50	0.28	0.40	0.57	0.87	1.12	1.42	2.26
2:21:11	0.11	0.36	0.20	0.30	0.42	0.64	0.81	1.03	1.64
2:26:37	0.08	0.27	0.15	0.22	0.31	0.47	0.60	0.76	1.21
2:32:02	0.06	0.20	0.11	0.16	0.23	0.35	0.44	0.56	0.90
2:37:28	0.04	0.14	0.08	0.11	0.16	0.25	0.32	0.41	0.66
2:42:54	0.03	0.10	0.05	0.08	0.11	0.18	0.23	0.29	0.47
2:48:20	0.02	0.07	0.04	0.06	0.08	0.13	0.17	0.21	0.34
2:53:46	0.01	0.05	0.03	0.04	0.05	0.09	0.11	0.15	0.24
2:59:11	0.01	0.03	0.01	0.02	0.03	0.05	0.07	0.09	0.15
3:04:37	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.09
3:10:03	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.04
3:15:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
3:20:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:26:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:31:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:37:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:42:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:48:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:53:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:58:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:04:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:09:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:26:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:31:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:36:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:42:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:47:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:53:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:58:39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:04:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:09:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:14:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:31:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:36:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:42:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:47:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:52:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:58:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:03:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:09:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:14:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:20:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:25:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:30:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Nov 7 2018

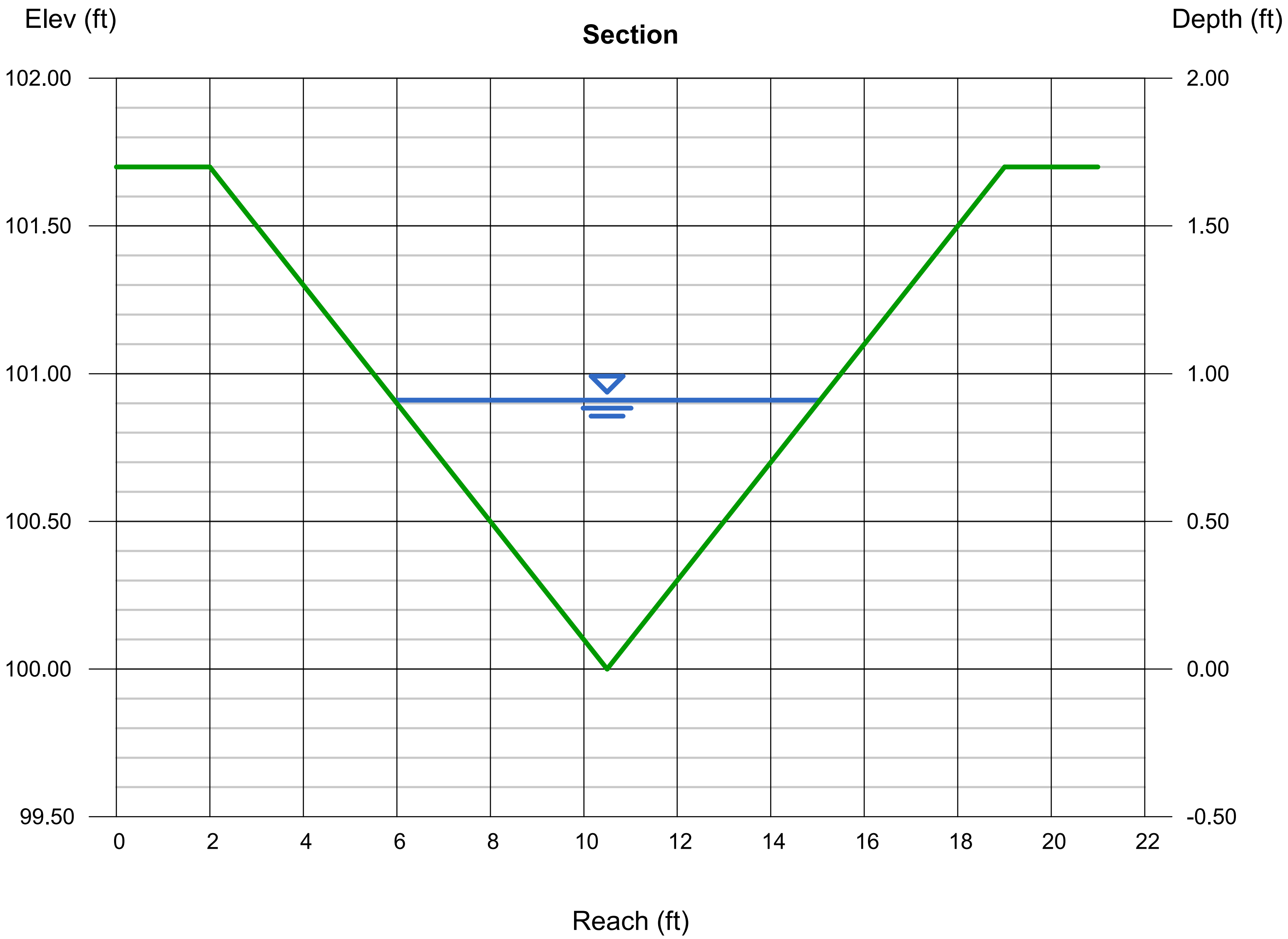
Existing Vista Parkway Roadside Swale

Triangular
Side Slopes (z:1) = 5.00, 5.00
Total Depth (ft) = 1.70

Invert Elev (ft) = 100.00
Slope (%) = 1.33
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 11.80

Highlighted
Depth (ft) = 0.91
Q (cfs) = 11.80
Area (sqft) = 4.14
Velocity (ft/s) = 2.85
Wetted Perim (ft) = 9.28
Crit Depth, Yc (ft) = 0.81
Top Width (ft) = 9.10
EGL (ft) = 1.04



APPENDIX D

SWMM Pairs and Pond Volume Inputs

CUHP and EPA SWMM

Coal Creek Outfall Design

PROJECT : Compass PHASE III FINAL DRAINAGE RPRT
PROJECT NO. : 13042

10/16/2014
CJD

SWMM Pairs - POND 1053

WQCV WSEL = 5089.6 (elevation, per pond volume calculation)
EURV WSEL = 5091.2 (elevation, per pond volume calculation)
EURV Orifice Invert Elev.= 5086.50
EURV Outlet Dia. 3.50 ft (maximum release rate = 80cfs from analysis
Grated EURV Outlet Structure Dimensions (ft) : w = 10.00 L = 10.00
100-yr WSEL = 5096.2 (elevation, per pond volume calculation)
100-yr Outlet Invert = 5089.07 (elevation)
100-yr Wier Control = w = 65.00 ft
Weir Crest Elevation = 5091.2 (elevation)

FLOWS GREATER THAN EURV ARE FROM HYDRAULIC MODEL WHERE 42" AND 96" HGL'S MATCH

			EURV Box Release				100-Year Release	FROM UD-CULVERT VERSION 3.00	FLOWS INPUT TO EPA SWMM
Elevation	Stage	EURV Release (cfs)	*Weir Control (box)*	*Orifice Control (box, 50% clogged)*	*Orifice Control Outltet Pipe*	EURV Release (cfs)	*Weir Control*	*Inlet Control, 96" PIPE*	100-Year Release (cfs)
5086.00	0.00	0.3	*0*	*0*	*0*	0.3	*0*	*0.0*	0.3
5086.50	0.50	0.5	*0*	*0*	*0*	0.5	*0*	*0.0*	0.5
5087.00	1.00	0.7	*0*	*0*	*0*	0.7	*0*	*0.0*	0.7
5087.50	1.50	1.0	*0*	*0*	*0*	1.0	*0*	*0.0*	1.0
5088.00	2.00	1.3	*0*	*0*	*0*	1.3	*0*	*0.0*	1.3
5088.50	2.50	1.6	*0*	*0*	*0*	1.6	*0*	*0.0*	1.6
5089.00	3.00	2.0	*0*	*0*	*0*	2.0	*0*	*0.0*	2.0
5089.50	3.50	2.4	*0*	*0*	*0*	2.4	*0*	*2.0*	2.4
5090.00	4.00	2.7	*0*	*0*	*0*	2.7	*0*	*8.4*	2.7
5090.25	4.25	2.8	*0*	*0*	*0*	2.8	*0*	*15.6*	2.8
5090.50	4.50	3.0	*0*	*0*	*0*	3.0	*0*	*18.7*	3.0
5090.60	4.60	3.1	*0*	*0*	*0*	3.1	*0*	*23.0*	3.1
5090.70	4.70	3.1	*0*	*0*	*0*	3.1	*0*	*27.3*	3.1
5090.80	4.80	3.2	*0*	*0*	*0*	3.2	*0*	*31.5*	3.2
5090.90	4.90	3.2	*0*	*0*	*0*	3.2	*0*	*35.8*	3.2
5091.00	5.00	3.3	*0*	*0*	*0*	3.3	*0*	*40.1*	3.3
5091.17	5.17	3.4	*0.0*	*15.0*	*85.7*	3.4	*0.1*	*47.6*	3.5
5091.50	5.50	3.5	*19.2*	*150.6*	*90.4*	22.7	*41.4*	*61.8*	64.2
5092.00	6.00	3.7	*76.0*	*238.1*	*97.1*	75.0	*164.6*	*87.7*	162.7
5092.50	6.50	3.9	*153.8*	*301.2*	*103.4*	75.0	*336.9*	*117.6*	192.6
5093.00	7.00	4.1	*248.0*	*353.1*	*109.3*	75.0	*550.2*	*151.1*	226.1
5093.50	7.50	4.3	*356.1*	*398.4*	*114.9*	75.0	*800.3*	*180.3*	255.3
5093.54	7.54	4.3	*365.3*	*401.8*	*115.4*	75.0	*821.8*	*182.8*	257.8
5094.00	8.00	4.5	*476.4*	*439.0*	*120.3*	75.0	*1084.9*	*211.6*	286.6
5094.16	8.16	4.5	*517.4*	*451.2*	*121.9*	75.0	*1183.0*	*223.2*	298.2
5094.48	8.48	4.7	*602.5*	*474.7*	*125.2*	75.0	*1389.2*	*244.0*	319.0
5094.50	8.50	4.7	*608.0*	*476.2*	*125.4*	75.0	*1402.5*	*245.3*	320.3
5094.61	8.61	4.7	*638.3*	*484.0*	*126.5*	75.0	*1476.7*	*253.5*	328.5
5094.69	8.69	4.7	*660.7*	*489.6*	*127.3*	75.0	*1531.6*	*258.9*	333.9
5094.78	8.78	4.8	*686.2*	*495.8*	*128.2*	75.0	*1594.3*	*265.2*	340.2

5095.00	9.00	4.8	*749.8*	*510.6*	*130.3*	75.0	*1752.0*	*280.9*	355.9
5095.21	9.21	4.9	*812.2*	*524.4*	*132.3*	75.0	*1908.2*	*296.5*	371.5
5095.50	9.50	5.0	*901.1*	*542.9*	*135.1*	80.0	*2132.8*	*317.8*	397.8
5095.51	9.51	5.0	*904.3*	*543.5*	*135.2*	85.0	*2140.7*	*318.6*	403.6
5095.57	9.57	5.0	*923.1*	*547.3*	*135.7*	90.0	*2188.5*	*323.0*	413.0
5095.71	9.71	5.0	*967.4*	*555.9*	*137.0*	90.0	*2301.9*	*333.5*	423.5
5095.79	9.79	5.1	*993.1*	*560.8*	*137.7*	90.0	*2367.7*	*339.5*	429.5
5096.00	10.00	5.1	*1061.5*	*573.4*	*139.6*	90.0	*2544.2*	*355.4*	445.4
5096.35	10.35	5.2	*1178.9*	*593.8*	*142.8*	75.0	*2850.4*	*381.4*	456.4
5096.50	10.50	5.3	*1230.4*	*602.3*	*144.1*	75.0	*2986.1*	*392.6*	467.6
5097.00	11.00	5.4	*1407.5*	*629.9*	*148.4*	75.0	*3458.2*	*428.9*	503.9
5097.30	11.30	5.5	*1517.4*	*645.9*	*150.9*	75.0	*3755.8*	*449.9*	524.9
5097.50	11.50	5.6	*1592.3*	*656.4*	*152.6*	75.0	*3960.2*	*463.9*	538.9
5098.00	12.00	5.7	*1784.5*	*681.8*	*156.6*	75.0	*4492.2*	*497.2*	572.2
5098.02	12.02	5.7	*1792.3*	*682.8*	*156.8*	75.0	*4514.1*	*498.5*	573.5
5098.03	12.03	5.7	*1796.2*	*683.3*	*156.9*	75.0	*4525.1*	*499.1*	574.1
5098.50	12.50	5.8	*1983.9*	*706.3*	*160.6*	75.0	*5054.1*	*529.0*	604.0
5099.00	13.00	6.0	*2190.2*	*730.0*	*164.5*	75.0	*5645.9*	*559.1*	634.1
5099.50	13.50	6.1	*2403.2*	*752.9*	*168.2*	75.0	*6267.7*	*587.8*	662.8
5100.00	14.00	6.2	*2622.7*	*775.2*	*171.9*	75.0	*6919.4*	*615.1*	690.1

PROJECT : Compass PHASE III FINAL DRAINAGE RPRT
PROJECT NO. : 13042

DATE : 10/16/2014
BY : CJD

WQ / Detention Calculations 20% CLOGGING - POND 1053

Required Volume

Tributary Area (ac)		% Impervious		
156.19		**34.0%**	Used for WQ and EURV Calculations	
WQCV =	**2.55**	**ac-ft**	*(WQCV provided Online, Minimum 40 hr release)*	
WQCV =	111,165	cu-ft		
2yr-Detention =	**4.07**	**ac-ft**	*(from SWMM Analysis)*	
2yr-Detention =	177,415	cu-ft	Q_2 = 2.95cfs	
EURV Detention =	**5.59**	**ac-ft**	*(from UD-DETENTION, 72 hr RELEASE, Analysis)*	
EURV Detention =	243,644	cu-ft		
10-YR Detention =	**7.63**	**ac-ft**	*(from SWMM Analysis)*	
10-YR Detention =	332,335	cu-ft		
100-yr Detention =	**19.86**	**ac-ft**	*(from SWMM Analysis)*	424 Acres 13% Impervious
100-yr Detention =	865,152	cu-ft		
Total Required Volume =	**19.86**	**ac-ft**	*(V100 includes WQCV)*	
=	**865,152**	**cu-ft**		

Max Allowable Release Rate				**Actual Release Rate**		
Q_{10} =	192.00	cfs	*(from Outfall Systems Pla*	Q_{10} =	147.28	cfs
Q_{100} =	480.00	cfs	*(from Outfall Systems Pla*	Q_{100} =	376.81	cfs

Provided Volume

	Contour Elevation	Ft^2	A1*ΔD+[(A2-A1)/(D2-D1)]*ΔD*ΔD/2	Total Volume (ft^3)	Total Volume (ac-ft)
0.0	5086.00	474	0	0	0.00
1.0	5087.00	9000	4,737	4,737	0.11
2.0	5088.00	29565	19,283	24,020	0.55
3.0	5089.00	64845	47,205	71,225	1.64
4.0	5090.00	76860	70,853	142,077	3.26
5.0	5091.00	92696	84,778	226,855	5.21
6.0	5092.00	108745	100,721	327,576	7.52
7.0	5093.00	121660	115,203	442,778	10.16
7.5	5093.49	127879	61,137	503,915	11.57
8.0	5094.00	134352	66,869	570,784	13.10
8.8	5094.78	141877	107,729	678,513	15.58
9.0	5095.00	144000	31,447	709,960	16.30
9.2	5095.19	145814	27,532	706,046	16.21
9.7	5095.71	150807	77,122	787,082	18.07
10.0	5096.00	153588	44,137	754,097	17.31
11.0	5097.00	163572	158,580	912,677	20.95
12.0	5098.00	174162	168,867	1,081,544	24.83
13.0	5099.00	185827	179,995	1,261,539	28.96
14.0	5100.00	198966	192,397	1,453,935	33.38

	WSEL	Depth (ft)	
WQCV =	5089.56	3.56	
2-yr WSEL=	5090.42	4.42	
EURV WSEL =	5091.17	5.17	*(EURV includes WQCV)*
10-yr WSEL =	5092.04	6.04	*(V10 includes EURV)*
100-yr WSEL =	5096.70	10.70	*(V100 includes WQCV)*

JANSEN STRAWN
CONSULTING ENGINEERS

PROJECT : Compass PHASE III FINAL DRAINAGE RPRT
PROJECT NO. : 13042

10/16/2014
CJD

SWMM Pairs - POND 1053

WQCV WSEL = 5089.6 (elevation, per pond volume calculation)
EURV WSEL = 5091.2 (elevation, per pond volume calculation)
EURV Orifice Invert Elev.= 5085.50
EURV Outlet Dia. 3.50 ft
Grated EURV Outlet Structure Dimensions (ft) : w = 10.00 L = 10.00
100-yr WSEL = 5096.7 (elevation, per pond volume calculation)
100-yr Outlet Invert = 5085.07 (elevation)
100-yr Wier Control = w = 65.00 ft
Weir Crest Elevation = 5091.2 (elevation)

FLOWS GREATER THAN EURV ARE FROM HYDRAULIC MODEL WHERE 42" AND 96" HGL'S MATCH

FLOWS INPUT TO EPA SWMM

			EURV Box Release				100-Year Release		
Elevation	Stage	EURV Release (cfs)	*Weir Control (box)*	*Orifice Control (box, 50% clogged)*	*Orifice Control Outltet Pipe*	EURV Release (cfs)	*Weir Control*	*Inlet Control, 96" PIPE W/ 20% CLOGGING*	100-Year Release (cfs)
5086.00	0.00	0.3	*0*	*0*	*0*	0.3	*0*	*0.0*	0.3
5086.50	0.50	0.5	*0*	*0*	*0*	0.5	*0*	*0.0*	0.5
5087.00	1.00	0.7	*0*	*0*	*0*	0.7	*0*	*0.0*	0.7
5087.50	1.50	1.0	*0*	*0*	*0*	1.0	*0*	*0.0*	1.0
5088.00	2.00	1.3	*0*	*0*	*0*	1.3	*0*	*0.0*	1.3
5088.50	2.50	1.6	*0*	*0*	*0*	1.6	*0*	*0.0*	1.6
5089.00	3.00	2.0	*0*	*0*	*0*	2.0	*0*	*0.0*	2.0
5089.50	3.50	2.4	*0*	*0*	*0*	2.4	*0*	*1.6*	2.4
5090.00	4.00	2.7	*0*	*0*	*0*	2.7	*0*	*6.7*	2.7
5090.25	4.25	2.8	*0*	*0*	*0*	2.8	*0*	*12.5*	2.8
5090.50	4.50	3.0	*0*	*0*	*0*	3.0	*0*	*15.0*	3.0
5090.60	4.60	3.1	*0*	*0*	*0*	3.1	*0*	*18.4*	3.1
5090.70	4.70	3.1	*0*	*0*	*0*	3.1	*0*	*21.8*	3.1
5090.80	4.80	3.2	*0*	*0*	*0*	3.2	*0*	*25.2*	3.2
5090.90	4.90	3.2	*0*	*0*	*0*	3.2	*0*	*28.7*	3.2
5091.00	5.00	3.3	*0*	*0*	*0*	3.3	*0*	*32.1*	3.3
5091.50	5.50	3.5	*19.2*	*150.6*	*103.4*	22.7	*41.4*	*49.4*	64.1
5092.00	6.00	3.7	*76.0*	*238.1*	*109.3*	75.0	*163.9*	*70.2*	145.2
5092.50	6.50	3.9	*153.8*	*301.2*	*114.9*	75.0	*334.7*	*94.1*	169.1
5093.00	7.00	4.1	*248.0*	*353.1*	*120.3*	75.0	*545.3*	*120.9*	195.9
5093.50	7.50	4.3	*356.1*	*398.4*	*125.4*	75.0	*791.4*	*144.2*	219.2
5093.54	7.54	4.3	*365.3*	*401.8*	*125.8*	75.0	*812.5*	*146.2*	221.2
5094.00	8.00	4.5	*476.4*	*439.0*	*130.3*	75.0	*1070.4*	*169.3*	244.3
5094.16	8.16	4.5	*517.4*	*451.2*	*131.9*	75.0	*1166.4*	*178.5*	253.5
5094.48	8.48	4.7	*602.5*	*474.7*	*134.9*	75.0	*1367.8*	*195.2*	270.2
5094.50	8.50	4.7	*608.0*	*476.2*	*135.1*	75.0	*1380.7*	*196.2*	271.2
5094.61	8.61	4.7	*638.3*	*484.0*	*136.1*	75.0	*1453.1*	*202.8*	277.8
5094.69	8.69	4.7	*660.7*	*489.6*	*136.8*	75.0	*1506.6*	*207.1*	282.1
5094.78	8.78	4.8	*686.2*	*495.8*	*137.6*	75.0	*1567.7*	*212.2*	287.2
5095.00	9.00	4.8	*749.8*	*510.6*	*139.6*	75.0	*1721.2*	*224.7*	299.7

5095.21	9.21	4.9	*812.2*	*524.4*	*141.5*	75.0	*1872.9*	*237.2*	312.2
5095.50	9.50	5.0	*901.1*	*542.9*	*144.1*	75.0	*2090.9*	*254.2*	329.2
5095.51	9.51	5.0	*904.3*	*543.5*	*144.2*	80.0	*2098.6*	*254.8*	334.8
5095.57	9.57	5.0	*923.1*	*547.3*	*144.7*	85.0	*2144.9*	*258.4*	343.4
5095.71	9.71	5.0	*967.4*	*555.9*	*145.9*	90.0	*2254.7*	*266.8*	356.8
5095.79	9.79	5.1	*993.1*	*560.8*	*146.6*	90.0	*2318.5*	*271.6*	361.6
5096.00	10.00	5.1	*1061.5*	*573.4*	*148.4*	90.0	*2489.2*	*284.3*	374.3
5096.35	10.35	5.2	*1178.9*	*593.8*	*151.3*	90.0	*2784.9*	*305.2*	395.2
5096.50	10.50	5.3	*1230.4*	*602.3*	*152.6*	75.0	*2915.8*	*314.1*	389.1
5097.00	11.00	5.4	*1407.5*	*629.9*	*156.6*	75.0	*3370.2*	*343.1*	418.1
5097.30	11.30	5.5	*1517.4*	*645.9*	*159.0*	75.0	*3656.1*	*359.9*	434.9
5097.50	11.50	5.6	*1592.3*	*656.4*	*160.6*	75.0	*3852.1*	*371.1*	446.1
5098.00	12.00	5.7	*1784.5*	*681.8*	*164.5*	75.0	*4361.5*	*397.8*	472.8
5098.02	12.02	5.7	*1792.3*	*682.8*	*164.6*	75.0	*4382.5*	*398.8*	473.8
5098.03	12.03	5.7	*1796.2*	*683.3*	*164.7*	75.0	*4393.0*	*399.3*	474.3
5098.50	12.50	5.8	*1983.9*	*706.3*	*168.2*	75.0	*4898.2*	*423.2*	498.2
5099.00	13.00	6.0	*2190.2*	*730.0*	*171.9*	75.0	*5462.1*	*447.3*	522.3
5099.50	13.50	6.1	*2403.2*	*752.9*	*175.6*	75.0	*6053.1*	*470.2*	545.2
5100.00	14.00	6.2	*2622.7*	*775.2*	*179.1*	75.0	*6671.3*	*492.1*	567.1

PROJECT : Compass PHASE III FINAL DRAINAGE RPRT
PROJECT NO. : 13042

DATE : 10/16/2014
BY : CJD

WQ / Detention Calculations 80% Clogging - POND 1053

Required Volume

Tributary Area (ac)		% Impervious		
156.19		34.0%	Used for WQ and EURV Calculations	
WQCV =	**2.55**	**ac-ft**	*(WQCV provided Online, Minimum 40 hr release)*	
WQCV =	111,165	cu-ft		
2yr-Detention =	**4.07**	**ac-ft**	*(from SWMM Analysis)*	
2yr-Detention =	177,415	cu-ft	Q_2 = 2.95cfs	
EURV Detention =	**5.59**	**ac-ft**	*(from UD-DETENTION, 72 hr RELEASE, Analysis)*	
EURV Detention =	243,644	cu-ft		
10-YR Detention =	**9.66**	**ac-ft**	*(from SWMM Analysis)*	
10-YR Detention =	420,747	cu-ft		
100-yr Detention =	**32.20**	**ac-ft**	*(from SWMM Analysis)*	424 Acres 13% Impervious
100-yr Detention =	1,402,711	cu-ft		

Total Required Volume = 32.20 ac-ft *(V100 includes WQCV)*
= 1,402,711 cu-ft

Max Allowable Release Rate				**Actual Release Rate**		
Q_{10} =	192.00	cfs	*(from Outfall Systems Pla*	Q_{10} =	98.50	cfs
Q_{100} =	480.00	cfs	*(from Outfall Systems Pla*	Q_{100} =	189.07	cfs

Provided Volume

	Contour Elevation	Ft^2	A1*ΔD+[(A2-A1)/(D2-D1)]*ΔD*ΔD/2	Total Volume (ft^3)	Total Volume (ac-ft)
0.0	5086.00	474	0	0	0.00
1.0	5087.00	9000	4,737	4,737	0.11
2.0	5088.00	29565	19,283	24,020	0.55
3.0	5089.00	64845	47,205	71,225	1.64
4.0	5090.00	76860	70,853	142,077	3.26
5.0	5091.00	92696	84,778	226,855	5.21
6.0	5092.00	108745	100,721	327,576	7.52
7.0	5093.00	121660	115,203	442,778	10.16
7.5	5093.49	127879	61,137	503,915	11.57
8.0	5094.00	134352	66,869	570,784	13.10
8.8	5094.78	141877	107,729	678,513	15.58
9.0	5095.00	144000	31,447	709,960	16.30
9.2	5095.19	145814	27,532	706,046	16.21
9.7	5095.71	150807	77,122	787,082	18.07
10.0	5096.00	153588	44,137	754,097	17.31
11.0	5097.00	163572	158,580	912,677	20.95
12.0	5098.00	174162	168,867	1,081,544	24.83
13.0	5099.00	185827	179,995	1,261,539	28.96
14.0	5100.00	198966	192,397	1,453,935	33.38

	WSEL	Depth (ft)	
WQCV =	5089.56	3.56	
2-yr WSEL=	5090.42	4.42	
EURV WSEL =	5091.17	5.17	*(EURV includes WQCV)*
10-yr WSEL =	5092.81	6.81	*(V10 includes EURV)*
100-yr WSEL =	5099.73	13.73	*(V100 includes WQCV)*

JANSEN STRAWN
CONSULTING ENGINEERS

PROJECT : Compass PHASE III FINAL DRAINAGE RPRT — 10/16/2014
PROJECT NO. : 13042 — CJD

SWMM Pairs - POND 1053

WQCV WSEL = 5089.6 (elevation, per pond volume calculation)
EURV WSEL = 5091.2 (elevation, per pond volume calculation)
EURV Orifice Invert Elev.= 5085.50
EURV Outlet Dia. 3.50 ft
Grated EURV Outlet Structure Dimensions (ft) : w = 10.00 L = 10.00
100-yr WSEL = 5099.7 (elevation, per pond volume calculation)
100-yr Outlet Invert = 5085.07 (elevation)
100-yr Wier Control = w = 65.00 ft
Weir Crest Elevation = 5091.2 (elevation)

FLOWS GREATER THAN EURV ARE FROM HYDRAULIC MODEL WHERE 42" AND 96" HGL'S MATCH

FLOWS INPUT TO EPA SWMM

			EURV Box Release				100-Year Release		
Elevation	Stage	EURV Release (cfs)	*Weir Control (box)*	*Orifice Control (box, 50% clogged)*	*Orifice Control Outltet Pipe*	EURV Release (cfs)	*Weir Control*	*Inlet Control, 96" PIPE W/ 80% CLOGGING*	100-Year Release (cfs)
5086.00	0.00	0.3	*0*	*0*	*0*	0.3	*0*	*0.0*	0.3
5086.50	0.50	0.5	*0*	*0*	*0*	0.5	*0*	*0.0*	0.5
5087.00	1.00	0.7	*0*	*0*	*0*	0.7	*0*	*0.0*	0.7
5087.50	1.50	1.0	*0*	*0*	*0*	1.0	*0*	*0.0*	1.0
5088.00	2.00	1.3	*0*	*0*	*0*	1.3	*0*	*0.0*	1.3
5088.50	2.50	1.6	*0*	*0*	*0*	1.6	*0*	*0.0*	1.6
5089.00	3.00	2.0	*0*	*0*	*0*	2.0	*0*	*0.0*	2.0
5089.50	3.50	2.4	*0*	*0*	*0*	2.4	*0*	*0.4*	2.4
5090.00	4.00	2.7	*0*	*0*	*0*	2.7	*0*	*1.7*	2.7
5090.25	4.25	2.8	*0*	*0*	*0*	2.8	*0*	*3.1*	2.8
5090.50	4.50	3.0	*0*	*0*	*0*	3.0	*0*	*3.7*	3.0
5090.60	4.60	3.1	*0*	*0*	*0*	3.1	*0*	*4.6*	3.1
5090.70	4.70	3.1	*0*	*0*	*0*	3.1	*0*	*5.5*	3.1
5090.80	4.80	3.2	*0*	*0*	*0*	3.2	*0*	*6.3*	3.2
5090.90	4.90	3.2	*0*	*0*	*0*	3.2	*0*	*7.2*	3.2
5091.00	5.00	3.3	*0*	*0*	*0*	3.3	*0*	*8.0*	3.3
5091.50	5.50	3.5	*19.2*	*150.6*	*103.4*	22.7	*41.4*	*12.4*	35.1
5092.00	6.00	3.7	*76.0*	*238.1*	*109.3*	75.0	*163.9*	*17.5*	92.5
5092.50	6.50	3.9	*153.8*	*301.2*	*114.9*	75.0	*334.7*	*23.5*	98.5
5093.00	7.00	4.1	*248.0*	*353.1*	*120.3*	75.0	*545.3*	*23.0*	98.0
5093.50	7.50	4.3	*356.1*	*398.4*	*125.4*	75.0	*791.4*	*36.1*	111.1
5093.54	7.54	4.3	*365.3*	*401.8*	*125.8*	75.0	*812.5*	*36.6*	111.6
5094.00	8.00	4.5	*476.4*	*439.0*	*130.3*	75.0	*1070.4*	*42.3*	117.3
5094.16	8.16	4.5	*517.4*	*451.2*	*131.9*	75.0	*1166.4*	*44.6*	119.6
5094.48	8.48	4.7	*602.5*	*474.7*	*134.9*	75.0	*1367.8*	*48.8*	123.8
5094.50	8.50	4.7	*608.0*	*476.2*	*135.1*	75.0	*1380.7*	*49.1*	124.1
5094.61	8.61	4.7	*638.3*	*484.0*	*136.1*	75.0	*1453.1*	*50.7*	125.7
5094.69	8.69	4.7	*660.7*	*489.6*	*136.8*	75.0	*1506.6*	*51.8*	126.8
5094.78	8.78	4.8	*686.2*	*495.8*	*137.6*	75.0	*1567.7*	*53.0*	128.0
5095.00	9.00	4.8	*749.8*	*510.6*	*139.6*	75.0	*1721.2*	*56.2*	131.2

5095.21	9.21	4.9	*812.2*	*524.4*	*141.5*	75.0	*1872.9*	*59.3*	134.3
5095.50	9.50	5.0	*901.1*	*542.9*	*144.1*	75.0	*2090.9*	*63.6*	138.6
5095.51	9.51	5.0	*904.3*	*543.5*	*144.2*	80.0	*2098.6*	*63.7*	143.7
5095.57	9.57	5.0	*923.1*	*547.3*	*144.7*	85.0	*2144.9*	*64.6*	149.6
5095.71	9.71	5.0	*967.4*	*555.9*	*145.9*	90.0	*2254.7*	*66.7*	156.7
5095.79	9.79	5.1	*993.1*	*560.8*	*146.6*	90.0	*2318.5*	*67.9*	157.9
5096.00	10.00	5.1	*1061.5*	*573.4*	*148.4*	90.0	*2489.2*	*71.1*	161.1
5096.35	10.35	5.2	*1178.9*	*593.8*	*151.3*	90.0	*2784.9*	*76.3*	166.3
5096.50	10.50	5.3	*1230.4*	*602.3*	*152.6*	75.0	*2915.8*	*78.5*	153.5
5097.00	11.00	5.4	*1407.5*	*629.9*	*156.6*	75.0	*3370.2*	*85.8*	160.8
5097.30	11.30	5.5	*1517.4*	*645.9*	*159.0*	75.0	*3656.1*	*90.0*	165.0
5097.50	11.50	5.6	*1592.3*	*656.4*	*160.6*	75.0	*3852.1*	*92.8*	167.8
5098.00	12.00	5.7	*1784.5*	*681.8*	*164.5*	75.0	*4361.5*	*99.4*	174.4
5098.02	12.02	5.7	*1792.3*	*682.8*	*164.6*	75.0	*4382.5*	*99.7*	174.7
5098.03	12.03	5.7	*1796.2*	*683.3*	*164.7*	75.0	*4393.0*	*99.8*	174.8
5098.50	12.50	5.8	*1983.9*	*706.3*	*168.2*	75.0	*4898.2*	*105.8*	180.8
5099.00	13.00	6.0	*2190.2*	*730.0*	*171.9*	75.0	*5462.1*	*111.8*	186.8
5099.50	13.50	6.1	*2403.2*	*752.9*	*175.6*	75.0	*6053.1*	*117.6*	192.6
5100.00	14.00	6.2	*2622.7*	*775.2*	*179.1*	75.0	*6671.3*	*123.0*	198.0

PROJECT : Compass PHASE III FINAL DRAINAGE RPRT

PROJECT NO. : 13042

DATE : 10/16/2014

BY :

THIS IS ONLY TO SHOW THAT ALLOWING THE EXISTING FLOW FROM THE AREA SOUTH OF ARAPAHOE ROAD TRIBUTARY TO POND 1053 DOES NOT ADVERSLY EFFECT THE FUNCTION OR OUTFLOW OF THE POND DURING LARGE STORMS

Required Volume

Tributary Area

156.19

WQCV = 2.55 ac-ft (WQCV provided Online, Minimum 40 hr release)

WQCV = 111,165 cu-ft

2yr-Detention = 4.07 ac-ft *(from SWMM Analysis)*

2yr-Detention = 177,415 cu-ft Q_2 = 2.95cfs

EURV Detention = 5.59 ac-ft *(from UD-DETENTION, 72 hr RELEASE, Analysis)*

EURV Detention = 243,644 cu-ft

10-YR Detention = 7.47 ac-ft *(from SWMM Analysis)*

10-YR Detention = 325,485 cu-ft

100-yr Detention = 18.32 ac-ft *(from SWMM Analysis)* 608 Acres 11% Impervious

100-yr Detention = 798,217 cu-ft

Total Required Volume = 18.32 ac-ft *(V100 includes WQCV)*

= 798,217 cu-ft

Max Allowable Release Rate				Actual Release Rate		
Q_{10} =	192.00	cfs	*(from Outfall Systems Pla*	Q_{10} =	155.67	cfs
Q_{100} =	480.00	cfs	*(from Outfall Systems Pla*	Q_{100} =	415.35	cfs

Provided Volume

	Contour Elevation	Ft^2	A1*ΔD+[(A2-A1)/(D2-D1)]*ΔD*ΔD/2	Total Volume (ft^3)	Total Volume (ac-ft)
0.0	5086.00	474	0	0	0.00
1.0	5087.00	9000	4,737	4,737	0.11
2.0	5088.00	29565	19,283	24,020	0.55
3.0	5089.00	64845	47,205	71,225	1.64
4.0	5090.00	76860	70,853	142,077	3.26
5.0	5091.00	92696	84,778	226,855	5.21
6.0	5092.00	108745	100,721	327,576	7.52
7.0	5093.00	121660	115,203	442,778	10.16
7.5	5093.49	127879	61,137	503,915	11.57
8.0	5094.00	134352	66,869	570,784	13.10
8.8	5094.78	141877	107,729	678,513	15.58
9.0	5095.00	144000	31,447	709,960	16.30
9.2	5095.19	145814	27,532	706,046	16.21
9.7	5095.71	150807	77,122	787,082	18.07
10.0	5096.00	153588	44,137	754,097	17.31
11.0	5097.00	163572	158,580	912,677	20.95
12.0	5098.00	174162	168,867	1,081,544	24.83
13.0	5099.00	185827	179,995	1,261,539	28.96
14.0	5100.00	198966	192,397	1,453,935	33.38

	WSEL	Depth (ft)	
WQCV =	5089.56	3.56	
2-yr WSEL=	5090.42	4.42	
EURV WSEL =	5091.17	5.17	*(EURV includes WQCV)*
10-yr WSEL =	5091.98	5.98	*(V10 includes EURV)*
100-yr WSEL =	5096.28	10.28	*(V100 includes WQCV)*

PROJECT : Compass PHASE III FINAL DRAINAGE RPRT 10/16/2014
PROJECT NO. : 13042 0

SWMM Pairs - POND 1053

WQCV WSEL = 5089.6 (elevation, per pond volume calculation)
EURV WSEL = 5091.2 (elevation, per pond volume calculation)
EURV Orifice Invert Elev.= 5085.50
EURV Outlet Dia. 3.50 ft (maximum release rate = 80cfs from analysis
Grated EURV Outlet Structure Dimensions (ft) : w = 10.00 L = 10.00
100-yr WSEL = 5096.3 (elevation, per pond volume calculation)
100-yr Outlet Invert = 5089.07 (elevation)
100-yr Wier Control = w = 65.00 ft
Weir Crest Elevation = 5091.2 (elevation)

			EURV Box Release				100-Year Release		
Elevation	Stage	EURV Release (cfs)	*Weir Control (box)*	*Orifice Control (box, 50% clogged)*	*Orifice Control Outltet Pipe*	EURV Release (cfs)	*Weir Control*	*Inlet Control, 96" PIPE*	100-Year Release (cfs)
5086.00	0.00	0.3	*0*	*0*	*0*	0.3	*0*	*0.0*	0.3
5086.50	0.50	0.5	*0*	*0*	*0*	0.5	*0*	*0.0*	0.5
5087.00	1.00	0.7	*0*	*0*	*0*	0.7	*0*	*0.0*	0.7
5087.50	1.50	1.0	*0*	*0*	*0*	1.0	*0*	*0.0*	1.0
5088.00	2.00	1.3	*0*	*0*	*0*	1.3	*0*	*0.0*	1.3
5088.50	2.50	1.6	*0*	*0*	*0*	1.6	*0*	*0.0*	1.6
5089.00	3.00	2.0	*0*	*0*	*0*	2.0	*0*	*0.0*	2.0
5089.50	3.50	2.4	*0*	*0*	*0*	2.4	*0*	*2.0*	2.4
5090.00	4.00	2.7	*0*	*0*	*0*	2.7	*0*	*8.4*	2.7
5090.25	4.25	2.8	*0*	*0*	*0*	2.8	*0*	*15.6*	2.8
5090.50	4.50	3.0	*0*	*0*	*0*	3.0	*0*	*18.7*	3.0
5090.60	4.60	3.1	*0*	*0*	*0*	3.1	*0*	*23.0*	3.1
5090.70	4.70	3.1	*0*	*0*	*0*	3.1	*0*	*27.3*	3.1
5090.80	4.80	3.2	*0*	*0*	*0*	3.2	*0*	*31.5*	3.2
5090.90	4.90	3.2	*0*	*0*	*0*	3.2	*0*	*35.8*	3.2
5091.00	5.00	3.3	*0*	*0*	*0*	3.3	*0*	*40.1*	3.3
5091.17	5.17	3.4	*0.0*	*15.0*	*99.3*	3.4	*0.1*	*47.6*	3.5
5091.50	5.50	3.5	*19.2*	*150.6*	*103.4*	22.7	*41.4*	*61.8*	64.1
5092.00	6.00	3.7	*76.0*	*238.1*	*109.3*	75.0	*163.9*	*87.7*	162.7
5092.50	6.50	3.9	*153.8*	*301.2*	*114.9*	75.0	*334.7*	*117.6*	192.6
5093.00	7.00	4.1	*248.0*	*353.1*	*120.3*	75.0	*545.3*	*151.1*	226.1
5093.50	7.50	4.3	*356.1*	*398.4*	*125.4*	75.0	*791.4*	*180.3*	255.3
5093.54	7.54	4.3	*365.3*	*401.8*	*125.8*	75.0	*812.5*	*182.8*	257.8
5094.00	8.00	4.5	*476.4*	*439.0*	*130.3*	75.0	*1070.4*	*211.6*	286.6
5094.16	8.16	4.5	*517.4*	*451.2*	*131.9*	75.0	*1166.4*	*223.2*	298.2
5094.48	8.48	4.7	*602.5*	*474.7*	*134.9*	75.0	*1367.8*	*244.0*	319.0
5094.50	8.50	4.7	*608.0*	*476.2*	*135.1*	75.0	*1380.7*	*245.3*	320.3
5094.61	8.61	4.7	*638.3*	*484.0*	*136.1*	75.0	*1453.1*	*253.5*	328.5
5094.69	8.69	4.7	*660.7*	*489.6*	*136.8*	75.0	*1506.6*	*258.9*	333.9
5094.78	8.78	4.8	*686.2*	*495.8*	*137.6*	75.0	*1567.7*	*265.2*	340.2

5095.00	9.00	4.8	749.8	510.6	139.6	75.0	1721.2	280.9	355.9
5095.21	9.21	4.9	812.2	524.4	141.5	75.0	1872.9	296.5	371.5
5095.50	9.50	5.0	901.1	542.9	144.1	80.0	2090.9	317.8	397.8
5095.51	9.51	5.0	904.3	543.5	144.2	85.0	2098.6	318.6	403.6
5095.57	9.57	5.0	923.1	547.3	144.7	90.0	2144.9	323.0	413.0
5095.71	9.71	5.0	967.4	555.9	145.9	90.0	2254.7	333.5	423.5
5095.79	9.79	5.1	993.1	560.8	146.6	90.0	2318.5	339.5	429.5
5096.00	10.00	5.1	1061.5	573.4	148.4	90.0	2489.2	355.4	445.4
5096.35	10.35	5.2	1178.9	593.8	151.3	75.0	2784.9	381.4	456.4
5096.50	10.50	5.3	1230.4	602.3	152.6	75.0	2915.8	392.6	467.6
5097.00	11.00	5.4	1407.5	629.9	156.6	75.0	3370.2	428.9	503.9
5097.30	11.30	5.5	1517.4	645.9	159.0	75.0	3656.1	449.9	524.9
5097.50	11.50	5.6	1592.3	656.4	160.6	75.0	3852.1	463.9	538.9
5098.00	12.00	5.7	1784.5	681.8	164.5	75.0	4361.5	497.2	572.2
5098.02	12.02	5.7	1792.3	682.8	164.6	75.0	4382.5	498.5	573.5
5098.03	12.03	5.7	1796.2	683.3	164.7	75.0	4393.0	499.1	574.1
5098.50	12.50	5.8	1983.9	706.3	168.2	75.0	4898.2	529.0	604.0
5099.00	13.00	6.0	2190.2	730.0	171.9	75.0	5462.1	559.1	634.1
5099.50	13.50	6.1	2403.2	752.9	175.6	75.0	6053.1	587.8	662.8
5100.00	14.00	6.2	2622.7	775.2	179.1	75.0	6671.3	615.1	690.1

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 1 of 4

Designer: CJD
Company: JANSEN STRAWN CONSULTING ENGINEERS
Date: July 12, 2013
Project: 13025-COMPASS FILING No. 1 (BASIN A FOREBAY OUTFALL INTO EDB)
Location: TOWN OF ERIE

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a

I_a = 33.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)

i = 0.330

C) Contributing Watershed Area

Area = 99.380 ac

BASIN A APPROXIMATE AREA FOR SIZING FOREBAY

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm

d_6 = ______ in

E) Design Concept
(Select EURV when also designing for flood control)

Choose One
○ Water Quality Capture Volume (WQCV)
● Excess Urban Runoff Volume (EURV)

F) Design Volume (1.2 WQCV) Based on 40-hour Drain Time
(V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area * 1.2)

V_{DESIGN}= 1.595 ac-ft

G) For Watersheds Outside of the Denver Region,
Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER}$ = (d_6*(V_{DESIGN}/0.43))

$V_{DESIGN\ OTHER}$= ______ ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume
(Only if a different WQCV Design Volume is desired)

$V_{DESIGN\ USER}$= ______ ac-ft

I) Predominant Watershed NRCS Soil Group

Choose One
○ A
● B
○ C / D

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: EURVA = (0.1878i - 0.0104)*Area
For HSG B: $EURV_B$ = (0.1178i - 0.0042)*Area
For HSG C/D: $EURV_{C/D}$ = (0.1043i - 0.0031)*Area

EURV = 3.446 ac-f t

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.)

L : W = 10.5 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Z = 4.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

CONCRETE FOREBAY WITH BAFFLES

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

Designer: CJD
Company: JANSEN STRAWN CONSULTING ENGINEERS
Date: July 12, 2013
Project: 13025-COMPASS FILING No. 1 (BASIN A FOREBAY OUTFALL INTO EDB)
Location: TOWN OF ERIE

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 3% of the WQCV)
V_{FMIN} = 0.040 ac-ft

B) Actual Forebay Volume
V_F = 0.065 ac-ft

BASIN A FOREBAY SIZE INCREASED TO ACCOMODATE ENERGY DISSIPATION BAFFLES

C) Forebay Depth
(D_F = 30 inch maximum)
D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge
Q_{100} = 325.00 cfs

ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$)
Q_F = 6.50 cfs

E) Forebay Discharge Design

Choose One
○ Berm With Pipe
● Wall with Rect. Notch
○ Wall with V-Notch Weir

F) Discharge Pipe Size (minimum 8-inches)
Calculated D_P = in

G) Rectangular Notch Width
Calculated W_N = 16.4 in

6. Trickle Channel

A) Type of Trickle Channel

Choose One
● Concrete
Bottom

F) Slope of Trickle Channel
0.0050 ft / ft

SEE FULL SITE EDB FOR MICROPOOL DESIGN

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum)
D_M = ft

B) Surface Area of Micropool (10 ft^2 minimum)
A_M = sq ft

C) Outlet Type

Choose One
○ Orifice Plate
○ Other (Describe):

D) Depth of Design Volume (EURV or 1.2 WQCV) Based on the Design Concept Chosen Under 1.E.
H = feet

E) Volume to Drain Over Prescribed Time
EURV = 3.446 ac-ft

F) Drain Time
(Min T_D for WQCV= 40 hours; Max T_D for EURV= 72 hours)
T_D = hours

G) Recommended Maximum Outlet Area per Row, (A_o)
A_o = square inches

H) Orifice Dimensions:
i) Circular Orifice Diameter or
ii) Width of 2" High Rectangular Orifice
$D_{orifice}$ = inches
$W_{orifice}$ = inches

I) Number of Columns
n_c = number

J) Actual Design Outlet Area per Row (A_o)
A_o = square inches

K) Number of Rows (n_r)
n_r = number

L) Total Outlet Area (A_{ot})
A_{ot} = square inches

M) Depth of WQCV (H_{WQCV})
(Estimate using actual stage-area-volume relationship and V_{WQCV})
H_{WQCV} = feet

N) Ensure Minimum 40 Hour Drain Time for WQCV
$T_{D\ WQCV}$ = hours

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 1 of 4

Designer: CJD
Company: JANSENSTRAWN CONSULTING ENGINEERS
Date: July 12, 2013
Project: 13025-COMPASS FILING No. 1 (BASIN B FOREBAY DESIGN)
Location: TOWN OF ERIE

BASIN B APPROXIMATE AREA FOR SIZING FOREBAY

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 33.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.330
C) Contributing Watershed Area	Area = 57.720 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One ○ Water Quality Capture Volume (WQCV) ● Excess Urban Runoff Volume (EURV)
F) Design Volume (1.2 WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area * 1.2)$	V_{DESIGN}= 0.926 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One ○ A ● B ○ C / D
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = (0.1878i - 0.0104)*Area$ For HSG B: $EURV_B = (0.1178i - 0.0042)*Area$ For HSG C/D: $EURV_{C/D} = (0.1043i - 0.0031)*Area$	EURV = 2.001 ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 10.5. : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	CONCRETE FOREBAY WITH ENERGY DISSIPATION BAFFLES

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

Designer: CJD
Company: JANSENSTRAWN CONSULTING ENGINEERS
Date: July 12, 2013
Project: 13025-COMPASS FILING No. 1 (BASIN B FOREBAY DESIGN)
Location: TOWN OF ERIE

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 3% of the WQCV)
V_{FMIN} = 0.023 ac-ft

B) Actual Forebay Volume
V_F = 0.040 ac-ft

BASIN B FOREBAY SIZE INCREASED TO ACCOMODATE ENERGY DISSIPATION BAFFLES

C) Forebay Depth
(D_F = 18 inch maximum)
D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge
Q_{100} = 135.00 cfs

ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$)
Q_F = 2.70 cfs

E) Forebay Discharge Design

Choose One
○ Berm With Pipe
● Wall with Rect. Notch
○ Wall with V-Notch Weir

(flow too small for berm w/ pipe)

F) Discharge Pipe Size (minimum 8-inches)
Calculated D_P = in

G) Rectangular Notch Width
Calculated W_N = 8.9 in

6. Trickle Channel

A) Type of Trickle Channel

Choose One
● Concrete
○ Soft Bottom

F) Slope of Trickle Channel
S = 0.0050 ft / ft

7. Micropool and Outlet Structure

SEE FULL SITE EDB FOR MICROPOOL DESIGN

A) Depth of Micropool (2.5-feet minimum)
ft

B) Surface Area of Micropool (10 ft^2 minimum)
sq ft

C) Outlet Type

Choose One
○ Orifice Plate
○ Other (Describe):

D) Depth of Design Volume (EURV or 1.2 WQCV) Based on the Design Concept Chosen Under 1.E.
H = feet

E) Volume to Drain Over Prescribed Time
EURV = 2.001 ac-ft

F) Drain Time
(Min T_D for WQCV= 40 hours; Max T_D for EURV= 72 hours)
T_D = hours

G) Recommended Maximum Outlet Area per Row, (A_o)
A_o = square inches

H) Orifice Dimensions:
i) Circular Orifice Diameter or
ii) Width of 2" High Rectangular Orifice
$D_{orifice}$ = inches
$W_{orifice}$ = inches

I) Number of Columns
n_c = number

J) Actual Design Outlet Area per Row (A_o)
A_o = square inches

K) Number of Rows (nr)
n_r = number

L) Total Outlet Area (A_{ot})
A_{ot} = square inches

M) Depth of WQCV (H_{WQCV})
(Estimate using actual stage-area-volume relationship and V_{WQCV})
H_{WQCV} = feet

N) Ensure Minimum 40 Hour Drain Time for WQCV
$T_{D\ WQCV}$ = hours

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 1 of 4

Designer: CJD
Company: JANSENSTRAWN CONSULTING ENGINEERS
Date: July 12, 2013
Project: 13025-COMPASS FILING No. 1 DESIGN OF MICRO POOL FOR BASIN A & BASIN B
Location: TOWN OF ERIE

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a

I_a = 34.0 %

ONSITE AREA FOR W.Q. & EURV ANALYSIS

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)

i = 0.340

C) Contributing Watershed Area

Area = 156.190 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm

d_6 = ______ in

E) Design Concept
(Select EURV when also designing for flood control)

Choose One
○ Water Quality Capture Volume (WQCV)
● Excess Urban Runoff Volume (EURV)

F) Design Volume (1.2 WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area * 1.2)$

V_{DESIGN}= 2.552 ac-ft

G) For Watersheds Outside of the Denver Region,
Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$

$V_{DESIGN\ OTHER}$= ______ ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume
(Only if a different WQCV Design Volume is desired)

$V_{DESIGN\ USER}$= ______ ac-ft

I) Predominant Watershed NRCS Soil Group

Choose One
○ A
● B
○ C / D

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: EURVA = (0.1878i - 0.0104)*Area
For HSG B: $EURV_B$ = (0.1178i - 0.0042)*Area
For HSG C/D: $EURV_{C/D}$ = (0.1043i - 0.0031)*Area

EURV = 5.600 ac-f t

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.)

L : W = 10.5. : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Z = 4.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

CONCRETE FOREBAYS WITH CONCRETE ENERGY DISSIPATION BAFFLES

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

Designer: **CJD**
Company: **JANSENSTRAWN CONSULTING ENGINEERS**
Date: **July 12, 2013**
Project: **13025-COMPASS FILING No. 1 DESIGN OF MICRO POOL FOR BASIN A & BASIN B**
Location: **TOWN OF ERIE**

5. Forebay

A) Minimum Forebay Volume
(V$_{FMIN}$ = 3% of the WQCV)
V$_{FMIN}$ = 0.064 ac-ft

B) Actual Forebay Volume
V$_F$ = 0.064 ac-ft

C) Forebay Depth
(D$_F$ = 30 inch maximum)
D$_F$ = 18.0 in

SEE BASIN A AND BASIN B FOREBAY DESIGNS.

D) Forebay Discharge

i) Undetained 100-year Peak Discharge
Q$_{100}$ = 460.00 cfs

ii) Forebay Discharge Design Flow
(Q$_F$ = 0.02 * Q$_{100}$)
Q$_F$ = 9.20 cfs

E) Forebay Discharge Design

Choose One
○ Berm With Pipe
● Wall with Rect. Notch
○ Wall with V-Notch Weir

F) Discharge Pipe Size (minimum 8-inches)
Calculated D$_P$ = in

G) Rectangular Notch Width
Calculated W$_N$ = 21.6 in

6. Trickle Channel

A) Type of Trickle Channel

Choose One
● Concrete
○ Soft Bottom

F) Slope of Trickle Channel
S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum)
D$_M$ = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum)
A$_M$ = 454 sq ft

C) Outlet Type

Choose One
● Orifice Plate
○ Other (Describe):

D) Depth of Design Volume (EURV or 1.2 WQCV) Based on the Design Concept Chosen Under 1.E.
H = 5.00 feet

E) Volume to Drain Over Prescribed Time
EURV = 5.600 ac-ft

F) Drain Time
(Min T$_D$ for WQCV= 40 hours; Max T$_D$ for EURV= 72 hours)
T$_D$ = 72 hours

G) Recommended Maximum Outlet Area per Row, (A$_o$)
A$_o$ = 3.49 square inches

H) Orifice Dimensions:
i) Circular Orifice Diameter or
ii) Width of 2" High Rectangular Orifice
D$_{orifice}$ = 1 - 7 / 16 inches
W$_{orifice}$ = inches

COMPARE TO UD-DETENTION OF 1.5". USED 1- 7/16" FOR CONSTRUCTION.

I) Number of Columns
n$_c$ = 2 number

J) Actual Design Outlet Area per Row (A$_o$)
A$_o$ = 3.25 square inches

K) Number of Rows (nr)
n$_r$ = 15 number

L) Total Outlet Area (A$_{ot}$)
A$_{ot}$ = 48.7 square inches

M) Depth of WQCV (H$_{WQCV}$)
(Estimate using actual stage-area-volume relationship and V$_{WQCV}$)
H$_{WQCV}$ = 3.6 feet

N) Ensure Minimum 40 Hour Drain Time for WQCV
T$_{D\ WQCV}$ = 42.4 hours

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 3 of 4

Designer: **CJD**
Company: **JANSENSTRAWN CONSULTING ENGINEERS**
Date: **July 12, 2013**
Project: **13025-COMPASS FILING No. 1 DESIGN OF MICRO POOL FOR BASIN A & BASIN B**
Location: **TOWN OF ERIE**

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume
(Minimum recommended depth is 4 inches)

D_{IS} = 7.5 in

B) Minimum Initial Surcharge Volume
(Minimum volume of 0.3% of the WQCV)

V_{IS} = 277.9 cu ft

C) Initial Surcharge Provided Above Micropool

V_s= 283.8 cu ft

OVER SIZED TO ACCOMODATE EURV CONTROL BOX

9. Trash Rack

A) Type of Water Quality Orifice Used

Choose One
● Circular (up to 2" diameter)
○ Rectangular (2" high)

B) Water Quality Screen Open Area: $A_t = 38.5*(e^{-0.095D})*A_{ot}$

A_t = 1,635 square inches

C) For 2", or Smaller, **Circular Opening** (See Fact Sheet T-12):

i) Width of Water Quality Screen and Concrete Opening ($W_{opening}$)

$W_{opening}$ = 31.0 inches

ii) Height of Water Quality Screen (H_{TR})

H_{TR} = 88.0 inches

iii) Type of Screen, Describe if "Other"

Choose One
● S.S. Well Screen with 60% Open Area*
○ Other (Describe):

D) For 2" High **Rectangular Opening**:

i) Width of Rectangular Opening ($W_{orifice}$)

W = inches

ii) Width of Water Quality Screen Opening ($W_{opening}$)

$W_{opening}$ = ft

iii) Height of Water Quality Screen (H_{TR})

H_{TR} = ft

iv) Type of Screen, Describe if "Other"

Choose One
○ Aluminum Amico-Klemp SR Series (or equal)
○ Other (Describe):

v) Cross-bar Spacing

inches

vi) Minimum Bearing Bar Size

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 4 of 4

Designer: **CJD**
Company: **JANSENSTRAWN CONSULTING ENGINEERS**
Date: **July 12, 2013**
Project: **13025-COMPASS FILING No. 1 DESIGN OF MICRO POOL FOR BASIN A & BASIN B**
Location: **TOWN OF ERIE**

10. Overflow Embankment	
A) Describe embankment protection for 100-year and greater overtopping:	RIP-RAP OVER FLOW WIER. THIS POND REQUIRES TO HAVE OVER 80% OF THE OUTLET RELEASE PIPES CLOGGED TO BEGIN OVERTOPING THE POND LOW BANK ELEV AND HAS 2 TIMES THE DETENTION VOLUME.
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z_E = 4.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ○ Not Irrigated
12. Access	
A) Describe Sediment Removal Procedures	8' WIDE CONCRETE TRAIL TO 10' WIDE CLASS 6 ROAD BASE ACCESS ROAD . THE ACCESS ROAD LONGITUDINAL SLOPE IS AT 10% AND CROSS SLOPE 2%

Notes:

2YR CUHP

Printouts for User Selected Storm Hydrographs

flow in cfs

time in minutes	OS-1	Basin A	OS-2	OS-3	OS-4	Basin B East	Basin B West
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.25	0.00	0.00	0.00	0.13	0.03
15	0.00	2.45	0.00	0.00	0.00	1.16	0.31
20	0.00	7.71	0.00	0.01	0.00	3.28	1.02
25	0.04	21.14	0.01	0.16	0.02	8.61	2.97
30	0.12	35.23	0.02	0.53	0.08	12.56	5.39
35	0.20	41.08	0.04	0.99	0.15	12.79	6.90
40	0.23	39.59	0.05	1.38	0.23	11.53	7.40
45	0.24	35.29	0.06	1.63	0.29	9.77	7.16
50	0.24	30.68	0.06	1.73	0.33	8.14	6.63
55	0.22	26.89	0.06	1.73	0.35	6.83	6.11
60	0.20	23.78	0.06	1.67	0.36	5.84	5.64
65	0.19	21.01	0.06	1.57	0.36	5.16	5.26
70	0.18	18.32	0.06	1.46	0.36	4.41	4.91
75	0.16	16.00	0.05	1.36	0.35	3.67	4.51
80	0.15	14.12	0.05	1.27	0.34	3.01	4.12
85	0.14	12.54	0.05	1.18	0.32	2.43	3.73
90	0.13	11.10	0.04	1.08	0.30	1.98	3.37
95	0.12	9.70	0.04	1.00	0.29	1.72	3.06
100	0.11	8.36	0.04	0.94	0.27	1.60	2.84
105	0.10	7.14	0.04	0.88	0.26	1.53	2.67
110	0.09	6.21	0.04	0.82	0.25	1.49	2.52
115	0.08	5.47	0.03	0.77	0.24	1.34	2.36
120	0.07	4.56	0.03	0.72	0.23	1.05	2.13
125	0.06	3.61	0.03	0.66	0.21	0.78	1.88
130	0.06	2.84	0.03	0.61	0.20	0.58	1.63
135	0.05	2.23	0.03	0.55	0.19	0.43	1.40
140	0.05	1.74	0.03	0.50	0.19	0.31	1.18
145	0.05	1.34	0.02	0.45	0.18	0.22	0.97
150	0.04	1.03	0.02	0.41	0.17	0.16	0.77
155	0.04	0.80	0.02	0.38	0.16	0.11	0.60
160	0.04	0.61	0.02	0.36	0.16	0.07	0.45
165	0.03	0.46	0.02	0.34	0.15	0.04	0.36
170	0.03	0.34	0.02	0.32	0.14	0.02	0.29
175	0.03	0.23	0.02	0.30	0.14	0.00	0.24
180	0.02	0.14	0.01	0.28	0.13	0.00	0.20
185	0.02	0.08	0.01	0.26	0.12	0.00	0.16
190	0.02	0.03	0.01	0.24	0.11	0.00	0.13
195	0.02	0.01	0.01	0.22	0.11	0.00	0.11
200	0.01	0.00	0.01	0.21	0.10	0.00	0.09
205	0.01	0.00	0.01	0.19	0.09	0.00	0.07
210	0.01	0.00	0.01	0.17	0.09	0.00	0.06
215	0.00	0.00	0.01	0.15	0.08	0.00	0.04
220	0.00	0.00	0.01	0.13	0.08	0.00	0.03
225	0.00	0.00	0.01	0.12	0.08	0.00	0.02

230	0.00	0.00	0.01	0.10	0.07	0.00	0.01
235	0.00	0.00	0.01	0.08	0.07	0.00	0.01
240	0.00	0.00	0.01	0.06	0.07	0.00	0.00
245	0.00	0.00	0.01	0.04	0.06	0.00	0.00
250	0.00	0.00	0.01	0.03	0.06	0.00	0.00
255	0.00	0.00	0.01	0.01	0.06	0.00	0.00
260	0.00	0.00	0.01	0.01	0.06	0.00	0.00
265	0.00	0.00	0.01	0.01	0.06	0.00	0.00
270	0.00	0.00	0.00	0.00	0.05	0.00	0.00
275	0.00	0.00	0.00	0.00	0.05	0.00	0.00
280	0.00	0.00	0.00	0.00	0.05	0.00	0.00
285	0.00	0.00	0.00	0.00	0.05	0.00	0.00
290	0.00	0.00	0.00	0.00	0.04	0.00	0.00
295	0.00	0.00	0.00	0.00	0.04	0.00	0.00
300	0.00	0.00	0.00	0.00	0.04	0.00	0.00
305	0.00	0.00	0.00	0.00	0.04	0.00	0.00
310	0.00	0.00	0.00	0.00	0.03	0.00	0.00
315	0.00	0.00	0.00	0.00	0.03	0.00	0.00
320	0.00	0.00	0.00	0.00	0.03	0.00	0.00
325	0.00	0.00	0.00	0.00	0.03	0.00	0.00
330	0.00	0.00	0.00	0.00	0.02	0.00	0.00
335	0.00	0.00	0.00	0.00	0.02	0.00	0.00
340	0.00	0.00	0.00	0.00	0.02	0.00	0.00
345	0.00	0.00	0.00	0.00	0.02	0.00	0.00
350	0.00	0.00	0.00	0.00	0.02	0.00	0.00
355	0.00	0.00	0.00	0.00	0.01	0.00	0.00
360	0.00	0.00	0.00	0.00	0.01	0.00	0.00
365	0.00	0.00	0.00	0.00	0.01	0.00	0.00
370	0.00	0.00	0.00	0.00	0.01	0.00	0.00
375	0.00	0.00	0.00	0.00	0.00	0.00	0.00
380	0.00	0.00	0.00	0.00	0.00	0.00	0.00
385	0.00	0.00	0.00	0.00	0.00	0.00	0.00
390	0.00	0.00	0.00	0.00	0.00	0.00	0.00
395	0.00	0.00	0.00	0.00	0.00	0.00	0.00
400	0.00	0.00	0.00	0.00	0.00	0.00	0.00
405	0.00	0.00	0.00	0.00	0.00	0.00	0.00
410	0.00	0.00	0.00	0.00	0.00	0.00	0.00
415	0.00	0.00	0.00	0.00	0.00	0.00	0.00
420	0.00	0.00	0.00	0.00	0.00	0.00	0.00
425	0.00	0.00	0.00	0.00	0.00	0.00	0.00
430	0.00	0.00	0.00	0.00	0.00	0.00	0.00
435	0.00	0.00	0.00	0.00	0.00	0.00	0.00
440	0.00	0.00	0.00	0.00	0.00	0.00	0.00
445	0.00	0.00	0.00	0.00	0.00	0.00	0.00
450	0.00	0.00	0.00	0.00	0.00	0.00	0.00
455	0.00	0.00	0.00	0.00	0.00	0.00	0.00
460	0.00	0.00	0.00	0.00	0.00	0.00	0.00
465	0.00	0.00	0.00	0.00	0.00	0.00	0.00
470	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2YR CUHP

Printouts for User Selected Unit Hydrographs

flow in cfs

time in minutes	OS-1	Basin A	OS-2	OS-3	OS-4	Basin B East	Basin B West
5	7.69	114.85	1.34	27.61	3.75	53.95	15.95
10	17.66	196.89	3.56	77.85	11.26	66.85	31.21
15	21.95	187.09	4.98	120.61	19.39	49.34	33.58
20	21.89	142.65	5.48	146.03	25.42	37.58	31.47
25	20.99	115.60	5.44	154.05	29.35	29.56	27.01
30	19.38	93.73	5.34	151.73	31.09	23.04	23.32
35	17.07	78.85	5.17	145.12	31.11	16.51	20.53
40	15.53	63.96	4.93	134.22	30.74	12.45	17.75
45	14.26	49.07	4.62	119.02	30.07	10.28	15.79
50	12.99	38.08	4.24	109.32	29.08	8.11	14.21
55	11.72	33.12	3.97	101.58	27.80	5.93	12.63
60	10.70	28.16	3.76	93.85	26.20	3.76	11.05
65	9.97	23.20	3.56	86.11	24.30	1.59	9.47
70	9.24	18.24	3.35	78.38	22.83	0.00	7.89
75	8.52	13.27	3.15	73.45	21.85		6.60
80	7.79	8.31	2.94	69.11	20.87		6.08
85	7.06	3.35	2.74	64.77	19.89		5.55
90	6.33	0.00	2.62	60.43	18.90		5.02
95	5.60		2.50	56.09	17.92		4.50
100	4.87		2.38	51.75	16.94		3.97
105	4.33		2.26	47.41	15.96		3.44
110	4.08		2.14	43.08	15.24		2.91
115	3.84		2.02	38.74	14.68		2.39
120	3.60		1.90	34.40	14.12		1.86
125	3.35		1.78	30.56	13.56		1.33
130	3.11		1.66	29.11	13.00		0.81
135	2.87		1.55	27.67	12.44		0.28
140	2.62		1.43	26.22	11.88		0.00
145	2.38		1.31	24.78	11.32		
150	2.14		1.19	23.33	10.76		
155	1.89		1.09	21.88	10.20		
160	1.65		1.05	20.44	9.63		
165	1.41		1.01	18.99	9.07		
170	1.17		0.97	17.55	8.51		
175	0.92		0.93	16.10	7.95		
180	0.68		0.89	14.65	7.39		
185	0.44		0.85	13.21	6.83		
190	0.19		0.81	11.76	6.27		
195	0.00		0.77	10.31	6.06		
200			0.73	8.87	5.87		
205			0.69	7.42	5.69		
210			0.65	5.98	5.50		
215			0.61	4.53	5.31		
220			0.57	3.08	5.13		
225			0.53	1.64	4.94		

230			0.49	0.19	4.75		
235			0.45	0.00	4.57		
240			0.41		4.38		
245			0.37		4.19		
250			0.33		4.01		
255			0.29		3.82		
260			0.25		3.63		
265			0.21		3.44		
270			0.17		3.26		
275			0.13		3.07		
280			0.09		2.88		
285			0.05		2.70		
290			0.01		2.51		
295			0.00		2.32		
300					2.14		
305					1.95		
310					1.76		
315					1.58		
320					1.39		
325					1.20		
330					1.02		
335					0.83		
340					0.64		
345					0.45		
350					0.27		
355					0.08		
360					0.00		

2 YEAR CUHP

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 1.3.3

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph		
Catchment Name/ID	User Comment for Catchment	Ct	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)
OS-1	Off Site to Basin A	0.284	0.208	51.2	9.68	26.6	6.84	16.1	22	87,585	0.01	1,087	45.0	0	1,087
Basin A	Onsite Basin A	0.116	0.291	23.4	6.73	12.2	4.76	11.2	200	362,419	0.34	124,193	35.0	41	124,231
OS-2	Offsite to Basin B	0.386	0.179	76.9	12.10	40.0	8.55	20.2	5	32,618	0.01	405	50.0	0	405
OS-3	Offsite to Basin B	0.158	0.286	61.0	14.88	31.7	10.51	24.8	154	727,162	0.01	9,026	55.0	2	9,022
OS-4	Offsite to Basin B	0.211	0.240	94.3	18.89	49.0	13.35	31.5	31	227,674	0.01	2,826	65.0	0	2,826
Basin B East	Onsite Basin B East	0.174	0.245	18.2	4.92	9.4	3.48	8.2	68	96,180	0.35	33,996	35.0	13	33,820
Basin B West	Oniste Basin B West	0.180	0.227	36.3	7.82	18.9	5.53	13.0	34	95,019	0.32	30,534	40.0	7	30,520

Summary of CUHP Input Parameters (Version 1.3.3)

2 YEAR CUHP

							Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
OS-1	COMPASS2YR	0.038	0.128	0.916	0.035	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.26
Basin A	COMPASS2YR	0.156	0.280	0.800	0.020	33.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.66	0.18	28.59
OS-2	COMPASS2YR	0.014	0.131	0.811	0.035	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.26
OS-3	COMPASS2YR	0.313	0.571	1.390	0.018	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.26
OS-4	COMPASS2YR	0.098	0.593	1.490	0.025	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.26
Basin B East	COMPASS2YR	0.041	0.137	0.292	0.020	34.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.68	0.18	29.67
Basin B West	COMPASS2YR	0.041	0.225	0.597	0.020	31.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.62	0.17	26.46

10YR CUHP

Printouts for User Selected Storm Hydrographs

flow in cfs

time in minutes	OS-1	Basin A	OS-2	OS-3	OS-4	Basin B East	Basin B West
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	1.23	0.00	0.00	0.00	0.61	0.15
15	0.00	5.67	0.00	0.01	0.00	2.52	0.73
20	0.02	18.06	0.00	0.09	0.01	7.50	2.50
25	1.03	63.06	0.18	3.76	0.51	26.09	9.15
30	3.40	107.98	0.66	14.21	2.03	37.70	17.11
35	5.64	120.57	1.21	27.90	4.29	35.85	21.18
40	6.76	110.28	1.58	39.61	6.58	30.70	21.89
45	7.08	97.29	1.76	47.12	8.43	26.47	20.76
50	6.99	86.00	1.82	50.46	9.70	22.39	19.34
55	6.57	76.20	1.83	50.96	10.37	18.60	17.95
60	6.08	67.30	1.80	49.59	10.63	16.25	16.64
65	5.69	59.30	1.74	46.67	10.71	14.66	15.69
70	5.35	54.13	1.67	43.58	10.65	13.23	14.91
75	5.02	50.68	1.59	41.26	10.49	11.86	14.14
80	4.69	46.23	1.53	39.10	10.21	9.86	13.15
85	4.36	40.18	1.46	36.74	9.79	7.52	11.88
90	4.05	33.81	1.39	34.16	9.31	6.01	10.55
95	3.74	28.02	1.32	31.75	8.89	5.12	9.55
100	3.45	22.91	1.24	29.71	8.51	4.51	8.78
105	3.15	18.76	1.16	27.81	8.14	4.06	8.12
110	2.87	16.37	1.10	25.98	7.77	3.76	7.51
115	2.59	14.75	1.04	24.21	7.40	3.45	6.92
120	2.30	12.52	0.99	22.49	7.03	2.71	6.21
125	2.05	9.91	0.94	20.78	6.65	1.93	5.40
130	1.86	7.62	0.89	19.08	6.31	1.37	4.59
135	1.72	5.84	0.84	17.39	6.02	0.97	3.82
140	1.60	4.41	0.80	15.72	5.77	0.68	3.11
145	1.48	3.27	0.75	14.14	5.54	0.48	2.46
150	1.37	2.38	0.70	12.93	5.31	0.34	1.88
155	1.27	1.73	0.66	12.09	5.08	0.22	1.48
160	1.16	1.30	0.61	11.35	4.86	0.13	1.20
165	1.06	0.96	0.57	10.66	4.64	0.07	0.98
170	0.97	0.68	0.52	10.02	4.42	0.02	0.80
175	0.87	0.44	0.48	9.38	4.20	0.00	0.65
180	0.78	0.25	0.45	8.76	3.99	0.00	0.52
185	0.69	0.12	0.42	8.16	3.77	0.00	0.41
190	0.59	0.03	0.40	7.57	3.56	0.00	0.32
195	0.50	0.00	0.39	7.00	3.35	0.00	0.25
200	0.41	0.00	0.37	6.45	3.14	0.00	0.19
205	0.32	0.00	0.35	5.90	2.93	0.00	0.14
210	0.23	0.00	0.33	5.35	2.72	0.00	0.11
215	0.14	0.00	0.32	4.80	2.55	0.00	0.08
220	0.09	0.00	0.30	4.26	2.44	0.00	0.05
225	0.06	0.00	0.29	3.71	2.34	0.00	0.03

230	0.05	0.00	0.27	3.16	2.25	0.00	0.02
235	0.03	0.00	0.26	2.62	2.16	0.00	0.01
240	0.03	0.00	0.24	2.07	2.08	0.00	0.00
245	0.02	0.00	0.23	1.53	2.00	0.00	0.00
250	0.01	0.00	0.21	0.98	1.92	0.00	0.00
255	0.01	0.00	0.19	0.60	1.85	0.00	0.00
260	0.00	0.00	0.18	0.41	1.77	0.00	0.00
265	0.00	0.00	0.16	0.30	1.70	0.00	0.00
270	0.00	0.00	0.15	0.22	1.63	0.00	0.00
275	0.00	0.00	0.13	0.17	1.56	0.00	0.00
280	0.00	0.00	0.12	0.12	1.49	0.00	0.00
285	0.00	0.00	0.10	0.08	1.42	0.00	0.00
290	0.00	0.00	0.09	0.05	1.35	0.00	0.00
295	0.00	0.00	0.07	0.03	1.28	0.00	0.00
300	0.00	0.00	0.06	0.02	1.21	0.00	0.00
305	0.00	0.00	0.04	0.01	1.14	0.00	0.00
310	0.00	0.00	0.03	0.01	1.07	0.00	0.00
315	0.00	0.00	0.02	0.01	0.99	0.00	0.00
320	0.00	0.00	0.01	0.00	0.92	0.00	0.00
325	0.00	0.00	0.01	0.00	0.85	0.00	0.00
330	0.00	0.00	0.01	0.00	0.78	0.00	0.00
335	0.00	0.00	0.00	0.00	0.71	0.00	0.00
340	0.00	0.00	0.00	0.00	0.64	0.00	0.00
345	0.00	0.00	0.00	0.00	0.57	0.00	0.00
350	0.00	0.00	0.00	0.00	0.50	0.00	0.00
355	0.00	0.00	0.00	0.00	0.43	0.00	0.00
360	0.00	0.00	0.00	0.00	0.36	0.00	0.00
365	0.00	0.00	0.00	0.00	0.29	0.00	0.00
370	0.00	0.00	0.00	0.00	0.22	0.00	0.00
375	0.00	0.00	0.00	0.00	0.15	0.00	0.00
380	0.00	0.00	0.00	0.00	0.09	0.00	0.00
385	0.00	0.00	0.00	0.00	0.06	0.00	0.00
390	0.00	0.00	0.00	0.00	0.04	0.00	0.00
395	0.00	0.00	0.00	0.00	0.03	0.00	0.00
400	0.00	0.00	0.00	0.00	0.02	0.00	0.00
405	0.00	0.00	0.00	0.00	0.02	0.00	0.00
410	0.00	0.00	0.00	0.00	0.01	0.00	0.00
415	0.00	0.00	0.00	0.00	0.01	0.00	0.00
420	0.00	0.00	0.00	0.00	0.00	0.00	0.00
425	0.00	0.00	0.00	0.00	0.00	0.00	0.00
430	0.00	0.00	0.00	0.00	0.00	0.00	0.00
435	0.00	0.00	0.00	0.00	0.00	0.00	0.00
440	0.00	0.00	0.00	0.00	0.00	0.00	0.00
445	0.00	0.00	0.00	0.00	0.00	0.00	0.00
450	0.00	0.00	0.00	0.00	0.00	0.00	0.00
455	0.00	0.00	0.00	0.00	0.00	0.00	0.00
460	0.00	0.00	0.00	0.00	0.00	0.00	0.00
465	0.00	0.00	0.00	0.00	0.00	0.00	0.00
470	0.00	0.00	0.00	0.00	0.00	0.00	0.00

10YR CUHP

Printouts for User Selected Unit Hydrographs

flow in cfs

time in minutes	OS-1	Basin A	OS-2	OS-3	OS-4	Basin B East	Basin B West
5	7.74	122.19	1.35	27.81	3.78	57.05	17.05
10	17.72	207.48	3.58	78.35	11.34	69.79	33.04
15	21.95	193.39	4.99	121.07	19.50	50.40	35.26
20	21.86	145.50	5.47	146.29	25.51	37.33	32.64
25	20.96	115.36	5.44	153.95	29.41	29.49	27.18
30	19.35	94.25	5.34	151.54	31.09	22.27	23.78
35	17.04	77.75	5.17	144.87	31.08	15.06	20.67
40	15.52	61.26	4.93	133.94	30.71	12.19	17.65
45	14.25	44.76	4.62	118.74	30.03	9.79	15.90
50	12.98	37.47	4.24	109.18	29.04	7.39	14.14
55	11.71	31.97	3.96	101.46	27.75	4.98	12.39
60	10.70	26.47	3.76	93.74	26.16	2.58	10.64
65	9.97	20.97	3.56	86.02	24.26	0.17	8.88
70	9.24	15.47	3.35	78.30	22.80	0.00	7.13
75	8.51	9.97	3.15	73.39	21.82		6.53
80	7.78	4.47	2.94	69.06	20.84		5.94
85	7.06	0.00	2.74	64.73	19.87		5.36
90	6.33		2.62	60.40	18.89		4.77
95	5.60		2.50	56.07	17.91		4.19
100	4.87		2.38	51.73	16.93		3.60
105	4.33		2.26	47.40	15.95		3.02
110	4.08		2.14	43.07	15.23		2.43
115	3.84		2.02	38.74	14.67		1.85
120	3.60		1.90	34.41	14.11		1.26
125	3.35		1.78	30.55	13.55		0.68
130	3.11		1.66	29.11	12.99		0.09
135	2.87		1.55	27.67	12.43		0.00
140	2.63		1.43	26.22	11.87		
145	2.38		1.31	24.78	11.31		
150	2.14		1.19	23.33	10.75		
155	1.90		1.09	21.89	10.19		
160	1.66		1.05	20.45	9.63		
165	1.41		1.01	19.00	9.07		
170	1.17		0.97	17.56	8.51		
175	0.93		0.93	16.12	7.95		
180	0.68		0.89	14.67	7.39		
185	0.44		0.85	13.23	6.83		
190	0.20		0.81	11.78	6.27		
195	0.00		0.77	10.34	6.06		
200			0.73	8.90	5.87		
205			0.69	7.45	5.69		
210			0.65	6.01	5.50		
215			0.61	4.56	5.31		
220			0.57	3.12	5.13		
225			0.53	1.68	4.94		

230			0.49	0.23	4.75		
235			0.45	0.00	4.57		
240			0.41		4.38		
245			0.37		4.19		
250			0.33		4.01		
255			0.29		3.82		
260			0.25		3.63		
265			0.21		3.45		
270			0.17		3.26		
275			0.13		3.07		
280			0.09		2.89		
285			0.05		2.70		
290			0.01		2.51		
295			0.00		2.33		
300					2.14		
305					1.96		
310					1.77		
315					1.58		
320					1.40		
325					1.21		
330					1.02		
335					0.84		
340					0.65		
345					0.46		
350					0.28		
355					0.09		
360					0.00		

10 YEAR CUHP

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 1.3.3)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph		
Catchment Name/ID	User Comment for Catchment	Ct	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)
OS-1	Off Site to Basin A	0.283	0.207	51.2	9.63	26.6	6.81	16.1	22	87,585	0.38	33,078	45.0	7	33,067
Basin A	Onsite Basin A	0.115	0.302	22.2	6.66	11.6	4.71	11.1	210	362,419	0.98	356,874	35.0	121	357,069
OS-2	Offsite to Basin B	0.384	0.178	76.9	12.03	40.0	8.50	20.1	5	32,618	0.38	12,319	55.0	2	12,318
OS-3	Offsite to Basin B	0.157	0.284	61.0	14.80	31.7	10.46	24.7	154	727,162	0.38	274,628	55.0	51	274,522
OS-4	Offsite to Basin B	0.210	0.239	94.3	18.78	49.1	13.27	31.3	31	227,674	0.38	85,986	65.0	11	85,986
Basin B East	Onsite Basin B East	0.172	0.254	17.3	4.88	9.0	3.45	8.1	72	96,180	1.00	95,921	30.0	38	95,290
Basin B West	Oniste Basin B West	0.177	0.235	34.5	7.73	18.0	5.46	12.9	36	95,019	0.96	91,176	40.0	22	90,989

Summary of CUHP Input Parameters (Version 1.3.3)

10 YEAR CUHP

							Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
OS-1	COMPASS10YR	0.038	0.128	0.916	0.035	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.51
Basin A	COMPASS10YR	0.156	0.280	0.800	0.020	33.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.66	0.18	30.07
OS-2	COMPASS10YR	0.014	0.131	0.811	0.035	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.51
OS-3	COMPASS10YR	0.313	0.571	1.390	0.018	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.51
OS-4	COMPASS10YR	0.098	0.593	1.490	0.025	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.51
Basin B East	COMPASS10YR	0.041	0.137	0.292	0.020	34.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.68	0.18	31.12
Basin B West	COMPASS10YR	0.041	0.225	0.597	0.020	31.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.62	0.17	27.99

100YR CUHP

Printouts for User Selected Storm Hydrographs

flow in cfs

time in minutes	OS-1	Basin A	OS-2	OS-3	OS-4	Basin B East	Basin B West
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	1.53	0.00	0.00	0.00	0.76	0.19
15	0.00	5.87	0.00	0.01	0.00	2.54	0.77
20	0.01	15.48	0.00	0.03	0.00	6.23	2.17
25	0.21	49.16	0.04	0.78	0.11	20.12	7.16
30	5.21	147.07	0.93	19.14	2.62	58.67	22.15
35	13.87	237.45	2.75	60.06	8.68	80.72	38.74
40	20.85	264.94	4.55	107.37	16.84	78.66	47.77
45	24.60	251.05	5.80	147.81	24.86	70.59	50.29
50	26.45	228.93	6.53	175.29	31.68	62.69	48.87
55	26.87	206.89	6.95	190.77	36.68	53.82	46.54
60	26.13	185.68	7.18	197.81	39.83	46.04	43.84
65	25.35	166.26	7.28	198.22	41.92	41.24	41.37
70	24.28	143.57	7.21	191.52	43.15	34.50	38.56
75	22.70	122.25	6.93	182.73	43.47	27.44	35.11
80	20.85	102.23	6.59	172.76	42.92	20.70	31.27
85	19.08	84.15	6.25	161.46	41.61	14.74	27.30
90	17.52	68.30	5.91	149.53	39.65	10.34	23.67
95	16.11	54.28	5.58	137.49	37.63	7.71	20.65
100	14.83	41.56	5.25	127.09	35.85	6.09	18.38
105	13.61	30.83	4.93	118.08	34.17	4.95	16.50
110	12.44	24.02	4.61	110.10	32.53	4.19	14.82
115	11.30	19.71	4.35	102.64	30.93	3.64	13.30
120	10.19	15.62	4.13	95.51	29.35	2.71	11.73
125	9.10	11.54	3.92	88.58	27.81	1.84	10.09
130	8.13	8.22	3.72	81.83	26.32	1.30	8.52
135	7.41	5.79	3.52	75.27	25.02	0.93	7.03
140	6.81	4.07	3.33	68.75	23.90	0.65	5.62
145	6.27	2.95	3.15	62.26	22.87	0.45	4.27
150	5.79	2.14	2.97	56.12	21.90	0.32	3.07
155	5.35	1.59	2.79	51.61	20.97	0.20	2.24
160	4.93	1.20	2.61	47.94	20.07	0.12	1.67
165	4.55	0.87	2.43	44.71	19.19	0.05	1.24
170	4.18	0.59	2.25	41.81	18.34	0.01	0.91
175	3.81	0.37	2.07	39.13	17.50	0.00	0.66
180	3.45	0.19	1.91	36.62	16.66	0.00	0.48
185	3.08	0.08	1.79	34.29	15.82	0.00	0.35
190	2.72	0.01	1.69	32.09	14.98	0.00	0.26
195	2.35	0.00	1.60	29.91	14.14	0.00	0.20
200	1.99	0.00	1.52	27.74	13.30	0.00	0.16
205	1.63	0.00	1.44	25.57	12.46	0.00	0.12
210	1.26	0.00	1.38	23.40	11.62	0.00	0.09
215	0.90	0.00	1.31	21.24	10.79	0.00	0.06
220	0.57	0.00	1.25	19.07	10.17	0.00	0.04
225	0.37	0.00	1.19	16.91	9.68	0.00	0.02

230	0.24	0.00	1.13	14.74	9.25	0.00	0.01
235	0.15	0.00	1.07	12.58	8.87	0.00	0.00
240	0.09	0.00	1.01	10.41	8.52	0.00	0.00
245	0.05	0.00	0.95	8.25	8.19	0.00	0.00
250	0.02	0.00	0.89	6.09	7.88	0.00	0.00
255	0.01	0.00	0.83	3.96	7.59	0.00	0.00
260	0.00	0.00	0.77	2.55	7.31	0.00	0.00
265	0.00	0.00	0.71	1.68	7.03	0.00	0.00
270	0.00	0.00	0.66	1.09	6.75	0.00	0.00
275	0.00	0.00	0.60	0.67	6.47	0.00	0.00
280	0.00	0.00	0.54	0.38	6.19	0.00	0.00
285	0.00	0.00	0.48	0.18	5.91	0.00	0.00
290	0.00	0.00	0.42	0.06	5.63	0.00	0.00
295	0.00	0.00	0.36	0.03	5.35	0.00	0.00
300	0.00	0.00	0.30	0.02	5.07	0.00	0.00
305	0.00	0.00	0.24	0.01	4.79	0.00	0.00
310	0.00	0.00	0.18	0.01	4.51	0.00	0.00
315	0.00	0.00	0.12	0.01	4.23	0.00	0.00
320	0.00	0.00	0.08	0.00	3.95	0.00	0.00
325	0.00	0.00	0.05	0.00	3.67	0.00	0.00
330	0.00	0.00	0.03	0.00	3.39	0.00	0.00
335	0.00	0.00	0.02	0.00	3.11	0.00	0.00
340	0.00	0.00	0.01	0.00	2.83	0.00	0.00
345	0.00	0.00	0.01	0.00	2.56	0.00	0.00
350	0.00	0.00	0.00	0.00	2.28	0.00	0.00
355	0.00	0.00	0.00	0.00	2.00	0.00	0.00
360	0.00	0.00	0.00	0.00	1.72	0.00	0.00
365	0.00	0.00	0.00	0.00	1.44	0.00	0.00
370	0.00	0.00	0.00	0.00	1.16	0.00	0.00
375	0.00	0.00	0.00	0.00	0.88	0.00	0.00
380	0.00	0.00	0.00	0.00	0.60	0.00	0.00
385	0.00	0.00	0.00	0.00	0.38	0.00	0.00
390	0.00	0.00	0.00	0.00	0.25	0.00	0.00
395	0.00	0.00	0.00	0.00	0.16	0.00	0.00
400	0.00	0.00	0.00	0.00	0.10	0.00	0.00
405	0.00	0.00	0.00	0.00	0.06	0.00	0.00
410	0.00	0.00	0.00	0.00	0.03	0.00	0.00
415	0.00	0.00	0.00	0.00	0.01	0.00	0.00
420	0.00	0.00	0.00	0.00	0.00	0.00	0.00
425	0.00	0.00	0.00	0.00	0.00	0.00	0.00
430	0.00	0.00	0.00	0.00	0.00	0.00	0.00
435	0.00	0.00	0.00	0.00	0.00	0.00	0.00
440	0.00	0.00	0.00	0.00	0.00	0.00	0.00
445	0.00	0.00	0.00	0.00	0.00	0.00	0.00
450	0.00	0.00	0.00	0.00	0.00	0.00	0.00
455	0.00	0.00	0.00	0.00	0.00	0.00	0.00
460	0.00	0.00	0.00	0.00	0.00	0.00	0.00
465	0.00	0.00	0.00	0.00	0.00	0.00	0.00
470	0.00	0.00	0.00	0.00	0.00	0.00	0.00

100YR CUHP

Printouts for User Selected Unit Hydrographs

flow in cfs

time in minutes	OS-1	Basin A	OS-2	OS-3	OS-4	Basin B East	Basin B West
5	7.78	127.87	1.36	27.97	3.80	59.44	17.91
10	17.76	215.66	3.59	78.72	11.41	71.99	34.46
15	21.96	197.70	5.00	121.43	19.58	51.12	36.56
20	21.85	147.37	5.47	146.50	25.58	37.10	33.48
25	20.94	114.69	5.44	153.89	29.45	29.32	27.43
30	19.33	94.36	5.33	151.41	31.09	21.55	24.07
35	17.02	76.54	5.16	144.69	31.07	14.52	20.71
40	15.51	58.73	4.92	133.74	30.68	11.93	17.83
45	14.24	42.74	4.61	118.54	30.00	9.34	15.93
50	12.97	36.81	4.23	109.08	29.01	6.75	14.04
55	11.70	30.87	3.96	101.37	27.72	4.16	12.14
60	10.69	24.93	3.76	93.66	26.12	1.56	10.25
65	9.97	18.99	3.55	85.96	24.22	0.00	8.35
70	9.24	13.06	3.35	78.25	22.79		7.07
75	8.51	7.12	3.14	73.35	21.81		6.44
80	7.78	1.18	2.94	69.03	20.83		5.81
85	7.06	0.00	2.74	64.70	19.85		5.17
90	6.33		2.62	60.37	18.87		4.54
95	5.60		2.50	56.04	17.89		3.91
100	4.87		2.38	51.72	16.92		3.28
105	4.32		2.26	47.39	15.94		2.65
110	4.08		2.14	43.06	15.22		2.01
115	3.84		2.02	38.74	14.66		1.38
120	3.60		1.90	34.41	14.11		0.75
125	3.35		1.78	30.55	13.55		0.12
130	3.11		1.66	29.11	12.99		0.00
135	2.87		1.55	27.66	12.43		
140	2.63		1.43	26.22	11.87		
145	2.38		1.31	24.78	11.31		
150	2.14		1.19	23.34	10.75		
155	1.90		1.09	21.89	10.19		
160	1.66		1.05	20.45	9.63		
165	1.41		1.01	19.01	9.07		
170	1.17		0.97	17.57	8.51		
175	0.93		0.93	16.12	7.95		
180	0.69		0.89	14.68	7.39		
185	0.44		0.85	13.24	6.83		
190	0.20		0.81	11.80	6.28		
195	0.00		0.77	10.36	6.06		
200			0.73	8.91	5.87		
205			0.69	7.47	5.69		
210			0.65	6.03	5.50		
215			0.61	4.59	5.31		
220			0.57	3.14	5.13		
225			0.53	1.70	4.94		

230			0.49	0.26	4.75		
235			0.45	0.00	4.57		
240			0.41		4.38		
245			0.37		4.20		
250			0.33		4.01		
255			0.29		3.82		
260			0.25		3.64		
265			0.21		3.45		
270			0.17		3.26		
275			0.13		3.08		
280			0.09		2.89		
285			0.05		2.70		
290			0.02		2.52		
295			0.00		2.33		
300					2.14		
305					1.96		
310					1.77		
315					1.59		
320					1.40		
325					1.21		
330					1.03		
335					0.84		
340					0.65		
345					0.47		
350					0.28		
355					0.09		
360					0.00		

100 YEAR CUHP

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 1.3.3)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph		
Catchment Name/ID	User Comment for Catchment	Ct	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)
OS-1	Off Site to Basin A	0.281	0.206	51.2	9.60	26.6	6.78	16.0	22	87,585	1.50	131,355	55.0	27	131,308
Basin A	Onsite Basin A	0.114	0.311	21.4	6.61	11.1	4.67	11.0	218	362,419	2.07	751,588	40.0	265	751,932
OS-2	Offsite to Basin B	0.382	0.177	77.0	11.99	40.0	8.47	20.0	5	32,618	1.50	48,918	65.0	7	48,915
OS-3	Offsite to Basin B	0.157	0.283	61.0	14.74	31.7	10.42	24.6	154	727,162	1.50	1,090,559	65.0	198	1,090,123
OS-4	Offsite to Basin B	0.209	0.237	94.4	18.71	49.1	13.22	31.2	31	227,674	1.50	341,453	75.0	43	341,455
Basin B East	Onsite Basin B East	0.170	0.261	16.7	4.85	8.7	3.43	8.1	74	96,180	2.09	200,622	35.0	81	199,487
Basin B West	Oniste Basin B West	0.176	0.241	33.3	7.67	17.3	5.42	12.8	37	95,019	2.05	194,762	45.0	50	194,482

Summary of CUHP Input Parameters (Version 1.3.3)

100 YEAR CUHP

							Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
OS-1	COMPASS100YR	0.038	0.128	0.916	0.035	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.69
Basin A	COMPASS100YR	0.156	0.280	0.800	0.020	33.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.66	0.18	31.16
OS-2	COMPASS100YR	0.014	0.131	0.811	0.035	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.69
OS-3	COMPASS100YR	0.313	0.571	1.390	0.018	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.69
OS-4	COMPASS100YR	0.098	0.593	1.490	0.025	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.69
Basin B East	COMPASS100YR	0.041	0.137	0.292	0.020	34.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.68	0.18	32.19
Basin B West	COMPASS100YR	0.041	0.225	0.597	0.020	31.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.62	0.17	29.12

THIS IS A 100 YR ANALYSIS WHICH INCLUDES THE AREA ON THE SOUTH SIDE OF ARAPAHOE ROAD. THIS HAS BEEN PROVIDED TO SHOW THAT POND 1053 IS ABLE TO ACCEPT THE RUNOFF FLOWS AND PASS THEM THROUGH THE POND

Printouts for User Selected Storm Hydrographs

flow in cfs

time in minutes	OS-1	Basin A	OS-2	OS-3	OS-4	Basin B East	Basin B West	S Arapahoe Rd
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	1.53	0.00	0.00	0.00	0.76	0.19	0.00
15	0.00	5.87	0.00	0.01	0.00	2.54	0.77	0.02
20	0.01	15.48	0.00	0.03	0.00	6.23	2.17	0.05
25	0.21	49.16	0.04	0.78	0.11	20.12	7.16	0.11
30	5.21	147.07	0.93	19.14	2.62	58.67	22.15	0.64
35	13.87	237.45	2.75	60.06	8.68	80.72	38.74	1.99
40	20.85	264.94	4.55	107.37	16.84	78.66	47.77	3.98
45	24.60	251.05	5.80	147.81	24.86	70.59	50.29	7.31
50	26.45	228.93	6.53	175.29	31.68	62.69	48.87	12.49
55	26.87	206.89	6.95	190.77	36.68	53.82	46.54	18.99
60	26.13	185.68	7.18	197.81	39.83	46.04	43.84	25.77
65	25.35	166.26	7.28	198.22	41.92	41.24	41.37	32.42
70	24.28	143.57	7.21	191.52	43.15	34.50	38.56	38.09
75	22.70	122.25	6.93	182.73	43.47	27.44	35.11	41.97
80	20.85	102.23	6.59	172.76	42.92	20.70	31.27	44.04
85	19.08	84.15	6.25	161.46	41.61	14.74	27.30	44.61
90	17.52	68.30	5.91	149.53	39.65	10.34	23.67	43.98
95	16.11	54.28	5.58	137.49	37.63	7.71	20.65	42.62
100	14.83	41.56	5.25	127.09	35.85	6.09	18.38	40.83
105	13.61	30.83	4.93	118.08	34.17	4.95	16.50	38.67
110	12.44	24.02	4.61	110.10	32.53	4.19	14.82	36.60
115	11.30	19.71	4.35	102.64	30.93	3.64	13.30	34.63
120	10.19	15.62	4.13	95.51	29.35	2.71	11.73	32.71
125	9.10	11.54	3.92	88.58	27.81	1.84	10.09	30.92
130	8.13	8.22	3.72	81.83	26.32	1.30	8.52	29.34
135	7.41	5.79	3.52	75.27	25.02	0.93	7.03	27.81
140	6.81	4.07	3.33	68.75	23.90	0.65	5.62	26.31
145	6.27	2.95	3.15	62.26	22.87	0.45	4.27	24.95
150	5.79	2.14	2.97	56.12	21.90	0.32	3.07	23.71
155	5.35	1.59	2.79	51.61	20.97	0.20	2.24	22.57
160	4.93	1.20	2.61	47.94	20.07	0.12	1.67	21.51
165	4.55	0.87	2.43	44.71	19.19	0.05	1.24	20.54
170	4.18	0.59	2.25	41.81	18.34	0.01	0.91	19.59
175	3.81	0.37	2.07	39.13	17.50	0.00	0.66	18.65
180	3.45	0.19	1.91	36.62	16.66	0.00	0.48	17.72
185	3.08	0.08	1.79	34.29	15.82	0.00	0.35	16.78
190	2.72	0.01	1.69	32.09	14.98	0.00	0.26	15.85
195	2.35	0.00	1.60	29.91	14.14	0.00	0.20	14.92
200	1.99	0.00	1.52	27.74	13.30	0.00	0.16	14.00
205	1.63	0.00	1.44	25.57	12.46	0.00	0.12	13.09
210	1.26	0.00	1.38	23.40	11.62	0.00	0.09	12.23
215	0.90	0.00	1.31	21.24	10.79	0.00	0.06	11.41
220	0.57	0.00	1.25	19.07	10.17	0.00	0.04	10.64
225	0.37	0.00	1.19	16.91	9.68	0.00	0.02	10.01
230	0.24	0.00	1.13	14.74	9.25	0.00	0.01	9.48
235	0.15	0.00	1.07	12.58	8.87	0.00	0.00	9.02
240	0.09	0.00	1.01	10.41	8.52	0.00	0.00	8.64
245	0.05	0.00	0.95	8.25	8.19	0.00	0.00	8.31
250	0.02	0.00	0.89	6.09	7.88	0.00	0.00	7.99
255	0.01	0.00	0.83	3.96	7.59	0.00	0.00	7.67
260	0.00	0.00	0.77	2.55	7.31	0.00	0.00	7.36
265	0.00	0.00	0.71	1.68	7.03	0.00	0.00	7.04
270	0.00	0.00	0.66	1.09	6.75	0.00	0.00	6.73
275	0.00	0.00	0.60	0.67	6.47	0.00	0.00	6.42
280	0.00	0.00	0.54	0.38	6.19	0.00	0.00	6.11
285	0.00	0.00	0.48	0.18	5.91	0.00	0.00	5.80
290	0.00	0.00	0.42	0.06	5.63	0.00	0.00	5.49
295	0.00	0.00	0.36	0.03	5.35	0.00	0.00	5.18
300	0.00	0.00	0.30	0.02	5.07	0.00	0.00	4.87
305	0.00	0.00	0.24	0.01	4.79	0.00	0.00	4.56
310	0.00	0.00	0.18	0.01	4.51	0.00	0.00	4.25
315	0.00	0.00	0.12	0.01	4.23	0.00	0.00	3.95

320	0.00	0.00	0.08	0.00	3.95	0.00	0.00	3.64
325	0.00	0.00	0.05	0.00	3.67	0.00	0.00	3.33
330	0.00	0.00	0.03	0.00	3.39	0.00	0.00	3.02
335	0.00	0.00	0.02	0.00	3.11	0.00	0.00	2.71
340	0.00	0.00	0.01	0.00	2.83	0.00	0.00	2.40
345	0.00	0.00	0.01	0.00	2.56	0.00	0.00	2.09
350	0.00	0.00	0.00	0.00	2.28	0.00	0.00	1.79
355	0.00	0.00	0.00	0.00	2.00	0.00	0.00	1.48
360	0.00	0.00	0.00	0.00	1.72	0.00	0.00	1.18
365	0.00	0.00	0.00	0.00	1.44	0.00	0.00	0.90
370	0.00	0.00	0.00	0.00	1.16	0.00	0.00	0.65
375	0.00	0.00	0.00	0.00	0.88	0.00	0.00	0.42
380	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.26
385	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.14
390	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.07
395	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.03
400	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.02
405	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.01
410	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.01
415	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01
420	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
425	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
430	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
435	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
440	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
445	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
450	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
455	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
460	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
465	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
470	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

THIS IS A 100 YR ANALYSIS WHICH INCLUDES THE AREA ON THE SOUTH SIDE OF ARAPAHOE ROAD. THIS HAS BEEN PROVIDED TO SHOW THAT POND 1053 IS ABLE TO ACCEPT THE RUNOFF FLOWS AND PASS THEM THROUGH THE POND

Printouts for User Selected Unit Hydrographs

flow in cfs

time in minutes	OS-1	Basin A	OS-2	OS-3	OS-4	Basin B East	Basin B West	S Arapahoe Rd
5	7.78	127.87	1.36	27.97	3.80	59.44	17.91	11.42
10	17.76	215.66	3.59	78.72	11.41	71.99	34.46	34.18
15	21.96	197.70	5.00	121.43	19.58	51.12	36.56	59.16
20	21.85	147.37	5.47	146.50	25.58	37.10	33.48	78.14
25	20.94	114.69	5.44	153.89	29.45	29.32	27.43	90.76
30	19.33	94.36	5.33	151.41	31.09	21.55	24.07	96.82
35	17.02	76.54	5.16	144.69	31.07	14.52	20.71	97.21
40	15.51	58.73	4.92	133.74	30.68	11.93	17.83	95.95
45	14.24	42.74	4.61	118.54	30.00	9.34	15.93	93.51
50	12.97	36.81	4.23	109.08	29.01	6.75	14.04	89.89
55	11.70	30.87	3.96	101.37	27.72	4.16	12.14	85.10
60	10.69	24.93	3.76	93.66	26.12	1.56	10.25	79.13
65	9.97	18.99	3.55	85.96	24.22	0.00	8.35	72.59
70	9.24	13.06	3.35	78.25	22.79		7.07	69.27
75	8.51	7.12	3.14	73.35	21.81		6.44	65.94
80	7.78	1.18	2.94	69.03	20.83		5.81	62.62
85	7.06	0.00	2.74	64.70	19.85		5.17	59.29
90	6.33		2.62	60.37	18.87		4.54	55.97
95	5.60		2.50	56.04	17.89		3.91	52.65
100	4.87		2.38	51.72	16.92		3.28	49.32
105	4.32		2.26	47.39	15.94		2.65	47.17
110	4.08		2.14	43.06	15.22		2.01	45.29
115	3.84		2.02	38.74	14.66		1.38	43.40
120	3.60		1.90	34.41	14.11		0.75	41.52
125	3.35		1.78	30.55	13.55		0.12	39.63
130	3.11		1.66	29.11	12.99		0.00	37.75
135	2.87		1.55	27.66	12.43			35.86
140	2.63		1.43	26.22	11.87			33.98
145	2.38		1.31	24.78	11.31			32.09
150	2.14		1.19	23.34	10.75			30.21
155	1.90		1.09	21.89	10.19			28.33
160	1.66		1.05	20.45	9.63			26.44
165	1.41		1.01	19.01	9.07			24.56
170	1.17		0.97	17.57	8.51			22.67
175	0.93		0.93	16.12	7.95			20.79
180	0.69		0.89	14.68	7.39			19.29
185	0.44		0.85	13.24	6.83			18.66
190	0.20		0.81	11.80	6.28			18.03
195	0.00		0.77	10.36	6.06			17.40
200			0.73	8.91	5.87			16.78
205			0.69	7.47	5.69			16.15
210			0.65	6.03	5.50			15.52
215			0.61	4.59	5.31			14.89
220			0.57	3.14	5.13			14.26
225			0.53	1.70	4.94			13.64
230			0.49	0.26	4.75			13.01
235			0.45	0.00	4.57			12.38
240			0.41		4.38			11.75
245			0.37		4.20			11.12
250			0.33		4.01			10.50
255			0.29		3.82			9.87
260			0.25		3.64			9.24
265			0.21		3.45			8.61
270			0.17		3.26			7.98
275			0.13		3.08			7.35
280			0.09		2.89			6.73
285			0.05		2.70			6.10
290			0.02		2.52			5.47
295			0.00		2.33			4.84
300					2.14			4.21
305					1.96			3.59
310					1.77			2.96
315					1.59			2.33

320					1.40			1.70
325					1.21			1.07
330					1.03			0.45
335					0.84			0.00
340					0.65			
345					0.47			
350					0.28			
355					0.09			
360					0.00			

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 1.3.3

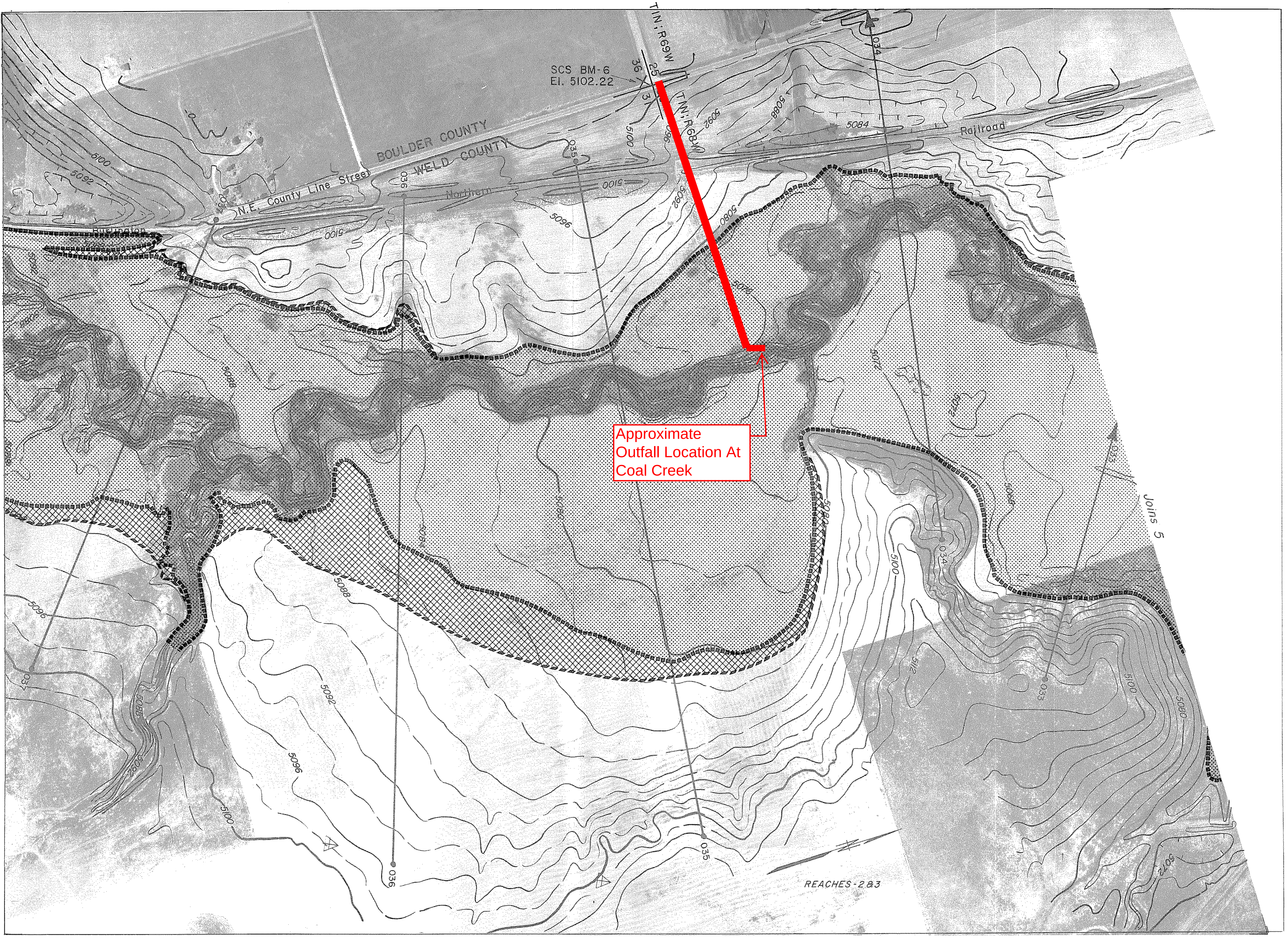
		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph		
Catchment Name/ID	User Comment for Catchment	Ct	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)
OS-1	Off Site to Basin A	0.281	0.206	51.2	9.60	26.6	6.78	16.0	22	87,585	1.50	131,355	55.0	27	131,308
Basin A	Onsite Basin A	0.114	0.311	21.4	6.61	11.1	4.67	11.0	218	362,419	2.07	751,588	40.0	265	751,932
OS-2	Offsite to Basin B	0.382	0.177	77.0	11.99	40.0	8.47	20.0	5	32,618	1.50	48,918	65.0	7	48,915
OS-3	Offsite to Basin B	0.157	0.283	61.0	14.74	31.7	10.42	24.6	154	727,162	1.50	1,090,559	65.0	198	1,090,123
OS-4	Offsite to Basin B	0.209	0.237	94.4	18.71	49.1	13.22	31.2	31	227,674	1.50	341,453	75.0	43	341,455
Basin B East	Onsite Basin B East	0.170	0.261	16.7	4.85	8.7	3.43	8.1	74	96,180	2.09	200,622	35.0	81	199,487
Basin B West	Oniste Basin B West	0.176	0.241	33.3	7.67	17.3	5.42	12.8	37	95,019	2.05	194,762	45.0	50	194,482
S Arapahoe Rd	Area South of Arapahoe Road	0.147	0.263	88.1	19.27	45.8	13.62	32.1	97	664,435	0.49	326,479	85.0	45	326,434

THIS IS A 100 YR ANALYSIS WHICH INCLUDES THE AREA ON THE SOUTH SIDE OF ARAPAHOE ROAD. THIS HAS BEEN PROVIDED TO SHOW THAT POND 1053 IS ABLE TO ACCEPT THE RUNOFF FLOWS AND PASS THEM THROUGH THE POND

Summary of CUHP Input Parameters (Version 1.3.3)

							Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
Catchment Name/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
OS-1	COMPASS100YR	0.038	0.128	0.916	0.035	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.69
Basin A	COMPASS100YR	0.156	0.280	0.800	0.020	33.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.66	0.18	31.16
OS-2	COMPASS100YR	0.014	0.131	0.811	0.035	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.69
OS-3	COMPASS100YR	0.313	0.571	1.390	0.018	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.69
OS-4	COMPASS100YR	0.098	0.593	1.490	0.025	2.0	0.40	0.05	4.50	0.60	0.0018	0.00	0.04	0.02	1.69
Basin B East	COMPASS100YR	0.041	0.137	0.292	0.020	34.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.68	0.18	32.19
Basin B West	COMPASS100YR	0.041	0.225	0.597	0.020	31.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.62	0.17	29.12
S Arapahoe Rd	COMPASS100YR	0.286	0.830	1.572	0.011	5.0	1.50	0.05	4.50	0.60	0.0018	0.00	0.10	0.05	4.27

THIS IS A 100 YR ANALYSIS WHICH INCLUDES THE AREA ON THE SOUTH SIDE OF ARAPAHOE ROAD. THIS HAS BEEN PROVIDED TO SHOW THAT POND 1053 IS ABLE TO ACCEPT THE RUNOFF FLOWS AND PASS THEM THROUGH THE POND



LEGEND

FLOOD PLAIN LIMITS

▨ 100 YEAR FLOOD

▨ 500 YEAR FLOOD

GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM — 5300 —

CONTOUR, Index 4.0'

CONTOUR, Interpolated 2.0'

CROSS SECTION ● 007 — 007 ●

CROSS SECTION CONTINUED ● 010 — 010 →

INTERMITTENT STREAM

PANEL △

AERIAL PHOTOGRAPHY, FLOOD HAZARD AREAS, AND TOPOGRAPHY ARE FOR EXISTING CONDITIONS — JULY 1974.

FLOOD AREA OUTLINES WERE DETERMINED BY MATCHING WATER SURFACE PROFILE ELEVATIONS WITH TOPOGRAPHY.

NOTE: TOPOGRAPHIC DETAIL WAS COMPILED BY PHOTOGRAMMETRIC METHODS TO MEET NATIONAL MAP ACCURACY STANDARDS. THE PHOTOGRAPHIC IMAGE CONTAINS DISPLACEMENTS DUE TO RELIEF AND IT DOES NOT MATCH THE TOPOGRAPHIC DETAIL IN ALL AREAS.

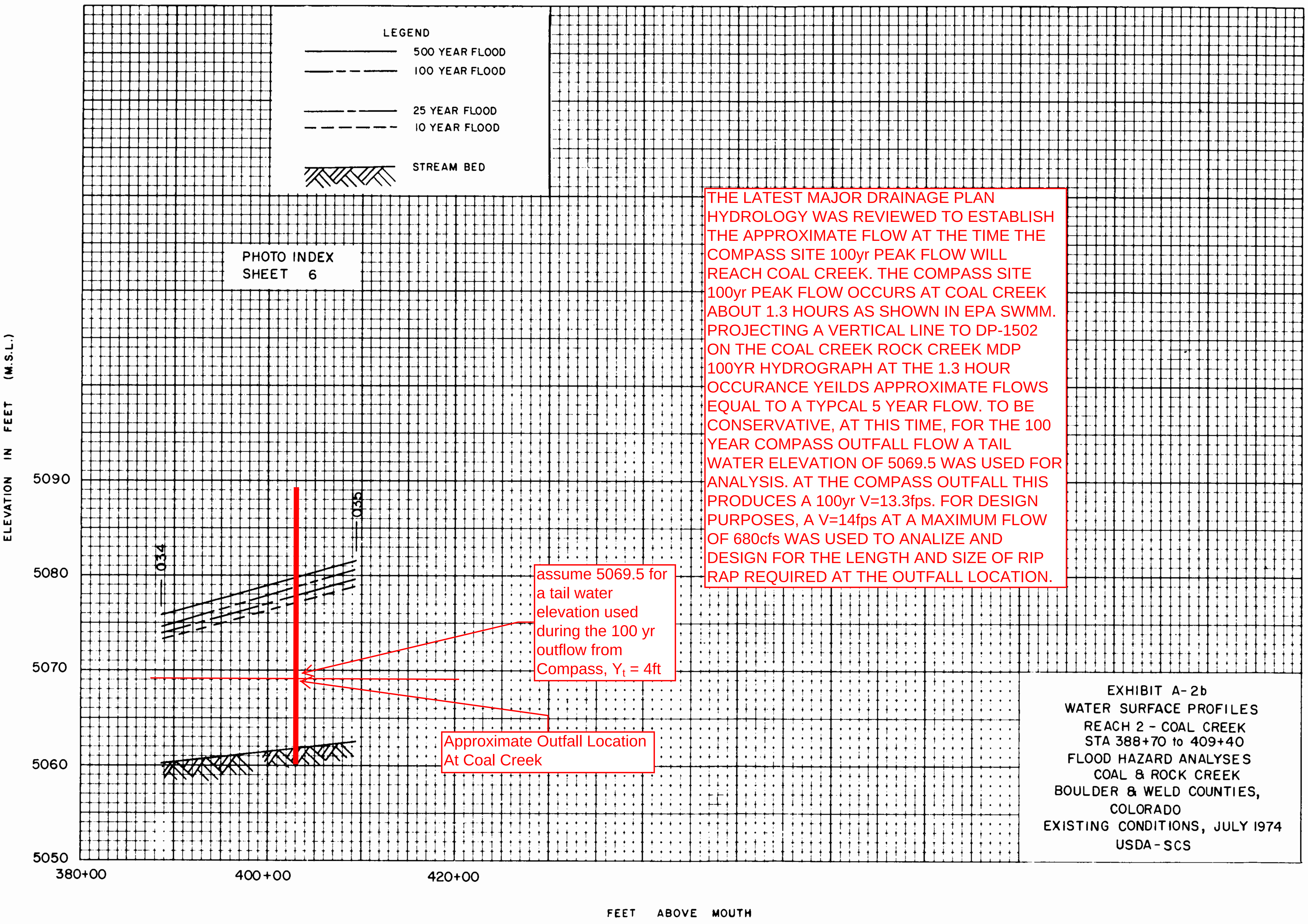
REVISION	DATE	BY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FLOOD HAZARD AREAS
COAL & ROCK CREEK
BOULDER & WELD COUNTIES, COLORADO

200 0 200 400 600
APPROXIMATE SCALE IN FEET

OCTOBER 1975 SHEET 6 OF 20



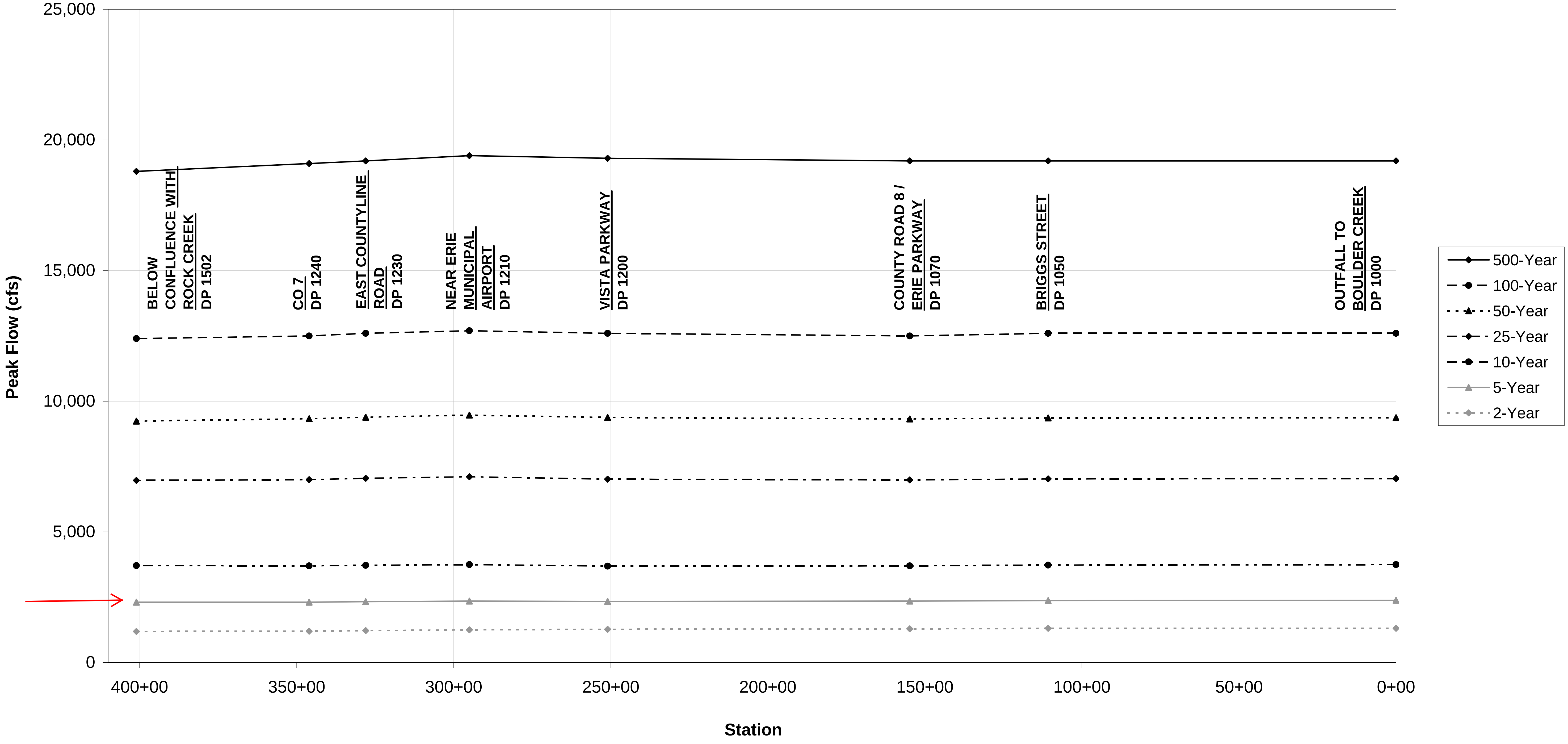
THE LATEST MAJOR DRAINAGE PLAN HYDROLOGY WAS REVIEWED TO ESTABLISH THE APPROXIMATE FLOW AT THE TIME THE COMPASS SITE 100yr PEAK FLOW WILL REACH COAL CREEK. THE COMPASS SITE 100yr PEAK FLOW OCCURS AT COAL CREEK ABOUT 1.3 HOURS AS SHOWN IN EPA SWMM. PROJECTING A VERTICAL LINE TO DP-1502 ON THE COAL CREEK ROCK CREEK MDP 100YR HYDROGRAPH AT THE 1.3 HOUR OCCURANCE YEILDS APPROXIMATE FLOWS EQUAL TO A TYPCAL 5 YEAR FLOW. TO BE CONSERVATIVE, AT THIS TIME, FOR THE 100 YEAR COMPASS OUTFALL FLOW A TAIL WATER ELEVATION OF 5069.5 WAS USED FOR ANALYSIS. AT THE COMPASS OUTFALL THIS PRODUCES A 100yr V=13.3fps. FOR DESIGN PURPOSES, A V=14fps AT A MAXIMUM FLOW OF 680cfs WAS USED TO ANALIZE AND DESIGN FOR THE LENGTH AND SIZE OF RIP RAP REQUIRED AT THE OUTFALL LOCATION.

assume 5069.5 for a tail water elevation used during the 100 yr outflow from Compass, $Y_t = 4$ft

Approximate Outfall Location At Coal Creek

EXHIBIT A-2b
WATER SURFACE PROFILES
REACH 2 - COAL CREEK
STA 388+70 to 409+40
FLOOD HAZARD ANALYSES
COAL & ROCK CREEK
BOULDER & WELD COUNTIES,
COLORADO
EXISTING CONDITIONS, JULY 1974
USDA-SCS

Figure B - 5
Future Peak Flow Profile
Lower Coal Creek



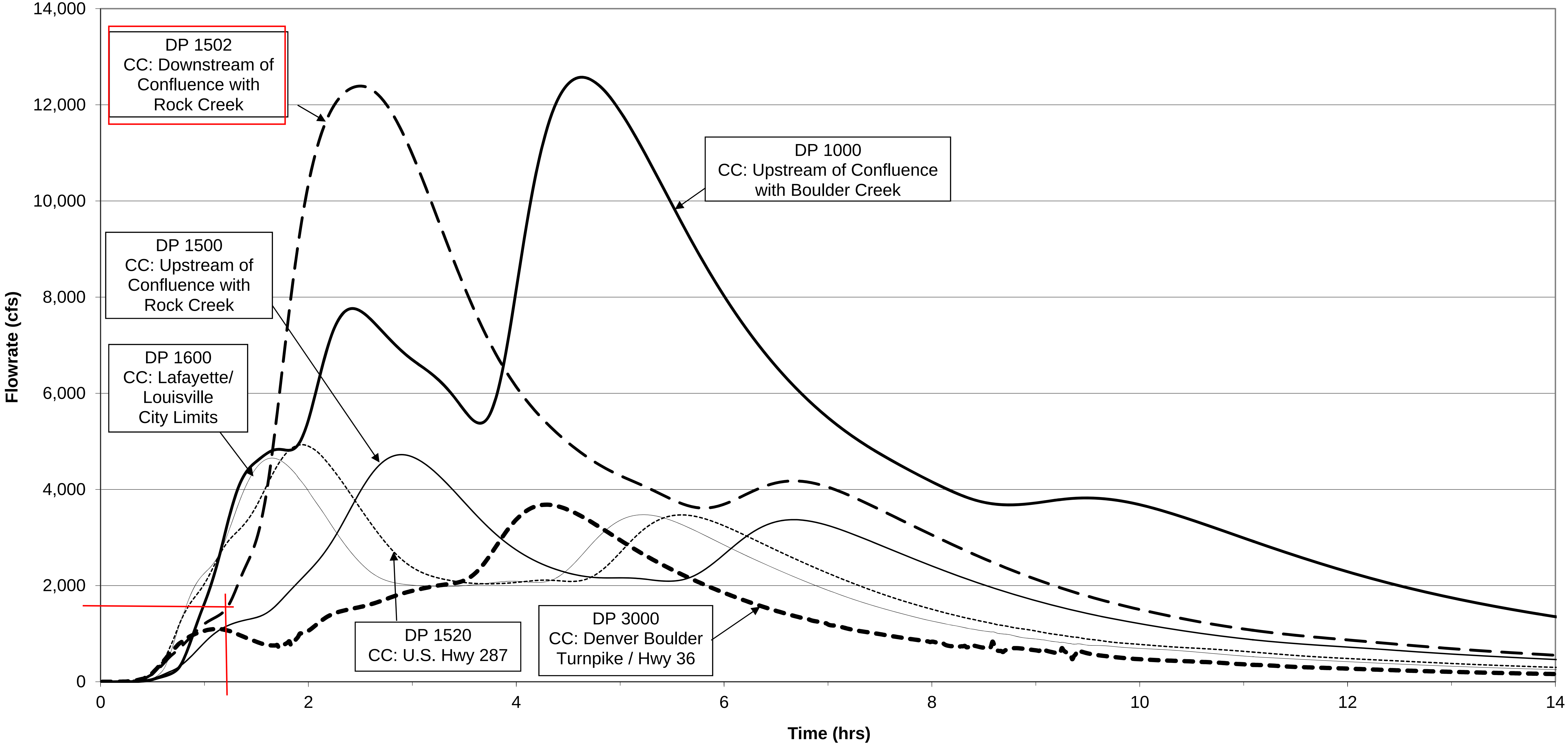
Z:\UDFCD PLANNING\Coal Creek-Rock Creek\01 HYDROLOGY\Baseline\Spreadsheets\Peak Flows\PeakFlowCharts (PFP LCC Fu)

Table B-5
Peak Flow Summary Table

					100-Year	2-Year		5-Year		10-Year		25-Year		50-Year		100-Year		500-Year	
	Design		Drainage Area		Runoff Volume	Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future	Existing	Future
Station	Point	Location	(acres)	(sq.mi.)	FuLU (ac-ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	1000	Coal Creek-Outfall to Boulder Creek	51,137	79.9	45.6	740	1,310	1,480	2,380	2,590	3,750	5,730	7,040	7,960	9,370	11,100	12,600	17,600	19,200
	1010	Coal Creek-Kenosha Road-DS Study Limit	50,946	79.6	45.4	740	1,310	1,490	2,390	2,600	3,760	5,750	7,060	7,980	9,390	11,200	12,600	17,700	19,300
	1020		50,562	79.0	45.0	740	1,310	1,490	2,380	2,600	3,750	5,740	7,050	7,960	9,380	11,100	12,600	17,600	19,200
	1030		50,279	78.6	44.7	740	1,310	1,490	2,380	2,600	3,750	5,740	7,040	7,970	9,380	11,100	12,600	17,600	19,200
	1040		50,066	78.2	44.5	740	1,310	1,490	2,380	2,600	3,740	5,740	7,040	7,970	9,370	11,100	12,600	17,600	19,200
	1050	Coal Creek-Briggs Street	49,694	77.6	44.1	740	1,310	1,490	2,370	2,600	3,730	5,740	7,030	7,970	9,360	11,100	12,600	17,600	19,200
	1060		48,469	75.7	42.7	740	1,300	1,490	2,350	2,590	3,710	5,740	7,000	7,960	9,330	11,100	12,500	17,600	19,200
	1062	Coal Creek-Union Pacific Railroad Near Erie	49,520	77.4	44.0	740	1,310	1,500	2,380	2,600	3,740	5,750	7,040	7,980	9,380	11,200	12,600	17,600	19,300
	1070	Coal Creek-County Road 8 / Erie Pkwy	48,210	75.3	42.4	740	1,290	1,490	2,350	2,590	3,700	5,740	6,990	7,960	9,320	11,100	12,500	17,600	19,200
	1080		47,912	74.9	42.1	750	1,300	1,500	2,350	2,600	3,700	5,760	7,000	7,980	9,340	11,100	12,600	17,600	19,200
	1100		47,297	73.9	41.4	750	1,300	1,510	2,360	2,620	3,710	5,790	7,030	8,030	9,380	11,200	12,600	17,700	19,300
	1102		47,558	74.3	41.7	750	1,300	1,500	2,350	2,610	3,700	5,760	7,010	7,990	9,350	11,200	12,600	17,600	19,200
	1104		47,694	74.5	41.9	750	1,300	1,500	2,350	2,600	3,700	5,760	7,000	7,980	9,340	11,100	12,600	17,600	19,200
	1150		46,187	72.2	40.2	760	1,280	1,530	2,350	2,640	3,710	5,820	7,040	8,070	9,390	11,300	12,600	17,800	19,300
	1152		46,665	72.9	40.8	750	1,300	1,510	2,350	2,620	3,710	5,790	7,020	8,030	9,370	11,200	12,600	17,700	19,300
	1200	Coal Creek-Vista Pkwy	45,885	71.7	39.7	760	1,270	1,530	2,340	2,640	3,690	5,830	7,020	8,070	9,380	11,300	12,600	17,700	19,300
	1210	Coal Creek-Near Erie Municipal Airport	43,661	68.2	38.0	760	1,250	1,550	2,350	2,720	3,750	5,920	7,110	8,170	9,470	11,300	12,700	17,800	19,400
	1212		44,124	68.9	38.4	760	1,260	1,540	2,350	2,720	3,760	5,920	7,110	8,180	9,490	11,400	12,700	17,800	19,400
	1214		45,650	71.3	39.5	760	1,260	1,530	2,330	2,640	3,690	5,810	7,010	8,050	9,360	11,200	12,600	17,700	19,300
	1220		43,409	67.8	37.8	760	1,250	1,550	2,340	2,720	3,740	5,910	7,090	8,140	9,440	11,300	12,700	17,700	19,300
	1230	Coal Creek-E County Line Road	41,606	65.0	35.6	760	1,220	1,560	2,330	2,730	3,720	5,920	7,050	8,140	9,390	11,300	12,600	17,600	19,200
	1240	Coal Creek-CO 7	40,816	63.8	34.8	750	1,200	1,550	2,310	2,720	3,700	5,890	7,000	8,090	9,330	11,200	12,500	17,500	19,100
	1242		41,169	64.3	35.2	760	1,210	1,560	2,320	2,730	3,710	5,900	7,020	8,110	9,350	11,200	12,600	17,500	19,100
	1250		39,369	61.5	33.1	770	1,190	1,600	2,320	2,760	3,700	5,910	7,000	8,090	9,310	11,200	12,500	17,400	19,100
	1500	Coal Creek-Above Confluence With Rock Creek	23,339	36.5	17.4	370	450	730	860	1,160	1,320	2,440	2,630	3,290	3,500	4,490	4,720	6,880	7,160
	1502	Coal Creek-Below Confluence With Rock Creek	37,525	58.6	31.9	790	1,190	1,620	2,310	2,820	3,710	5,920	6,970	8,060	9,240	11,100	12,400	17,100	18,800
	1510		22,851	35.7	16.5	360	440	730	860	1,150	1,310	2,430	2,630	3,270	3,510	4,480	4,740	6,840	7,170
	1512		23,137	36.2	17.2	380	460	740	880	1,170	1,340	2,460	2,670	3,310	3,550	4,530	4,790	6,920	7,250
	1520	Coal Creek-U.S. Highway 287	22,097	34.5	15.8	370	460	750	890	1,180	1,360	2,510	2,750	3,370	3,650	4,610	4,930	6,990	7,400
	1522		22,589	35.3	16.2	370	450	750	890	1,180	1,350	2,480	2,710	3,330	3,600	4,560	4,870	6,920	7,330
	1530		21,416	33.5	15.0	350	430	710	850	1,100	1,270	2,360	2,590	3,160	3,430	4,330	4,650	6,950	6,950
	1600	Coal Creek-Lafayette/Louisville City Limits	21,001	32.8	14.5	350	430	710	850	1,090	1,260	2,350	2,600	3,140	3,430	4,310	4,650	7,000	7,000
	1605		19,519	30.5	12.9	290	360	580	700	860	1,010	1,900	2,130	2,510	2,770	3,450	3,770	6,990	6,980
	1610	Coal Creek-S. 96th St	19,341	30.2	12.7	270	340	540	660	810	950	1,800	2,030	2,390	2,640	3,430	3,600	6,980	6,980
	1620	Coal Creek-Burlington Northern Railroad	19,129	29.9	13.0	270	340	540	660	820	970	1,810	2,030	2,390	2,640	3,620	3,640	7,270	7,270
	1630		18,565	29.0	12.3	330	420	610	760	890	1,080	1,860	2,120	2,400	2,700	3,710	3,730	7,470	7,460
	1640	Coal Creek-Dillon Road	17,472	27.3	10.9	140	180	270	330	370	460	920	1,040	1,730	1,750	3,670	3,690	7,390	7,390
	2000		1,051	1.6	1.3	110	330	210	560	360	790	770	1,410	1,000	1,740	1,300	2,180	1,870	3,020
	2010		812	1.3	1.0	110	260	200	440	330	630	690	1,130	890	1,400	1,140	1,740	1,630	2,420
	2020		182	0.3	0.2	59	83	100	150	150	200	300	360	380	450	470	560	670	800
	2030		294	0.5	0.4	43	130	77	200	120	270	250	450	310	550	400	680	560	920
	2032		475	0.7	0.6	88	190	160	310	240	440	480	750	610	920	770	1,140	1,090	1,570
	2040		136	0.2	0.2	16	120	29	180	49	230	110	330	140	400	180	470	250	630
	2050		262	0.4	0.3	3	95	17	160	72	260	190	440	250	550	330	680	490	950
	2100		478	0.7	0.7	34	330	67	520	130	670	300	1,010	390	1,210	520	1,450	750	1,900

Z:\UDFCD PLANNING\Coal Creek-Rock Creek\01 HYDROLOGY\Baseline\Spreadsheets\Peak Flows\PeakFlowSummaryTable.xls (Summary)

FIGURE B - 11
Coal Creek Future Land Use Hydrograph
100-Year Baseline Hydrology



Z:\UDFCD PLANNING\Coal Creek-Rock Creek\01 HYDROLOGY\Baseline\Spreadsheets\Peak Flows\BaselineHydrographs_Future.xls (CC Hydro)

7.3 Extent of Protection

The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be continued until the velocity has been reduced to an acceptable value. For purposes of outlet protection during major floods, the acceptable velocity is set at 5.5 ft/sec for very erosive soils and at 7.7 ft/sec for erosion resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, θ, of the jet. The velocity is related to the expansion factor, (1/(2tanθ)), which can be determined directly using Figure MD-23 or Figure MD-24, assuming that the expanding jet has a rectangular shape:

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \qquad \text{(MD-22)}$$

where:

L_p = length of protection (ft)

W = width of the conduit in (ft) (use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

and:

$$A_t = \frac{Q}{V} \qquad \text{(MD-23)}$$

where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

In certain circumstances, Equation MD-22 may yield unreasonable results. Therefore, in no case should L_p be less than $3H$ or $3D$, nor does L_p need to be greater than $10H$ or $10D$ whenever the Froude parameter, $Q/WH^{1.5}$ or $Q/D^{2.5}$, is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum L_p required by ¼ D_c or ¼ H for circular or rectangular culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.

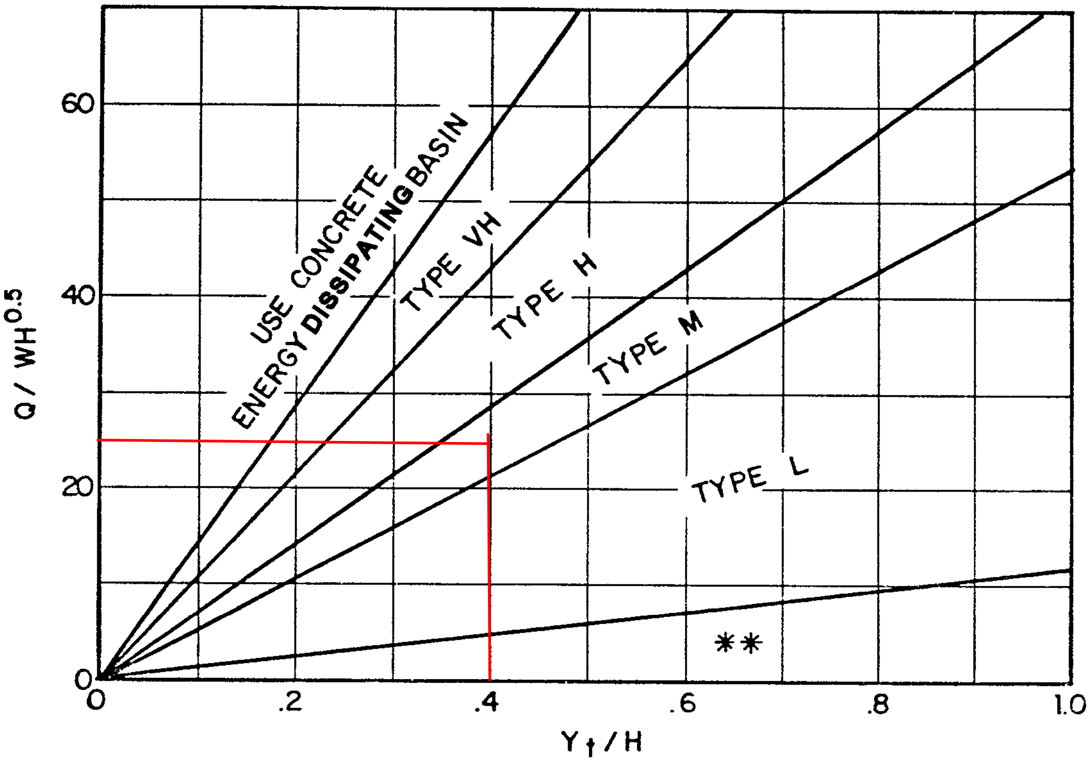
7.4 Multiple Conduit Installations

The procedures outlined in Sections 7.1, 7.2, and 7.3 can be used to design outlet erosion protection for multi-barrel culvert installations by hypothetically replacing the multiple barrels with a single hydraulically equivalent rectangular conduit. The dimensions of the equivalent conduit may be established as follows:

1. Distribute the total discharge, Q, among the individual conduits. Where all the conduits are hydraulically similar and identically situated, the flow can be assumed to be equally distributed; otherwise, the flow through each barrel must be computed.
2. Compute the Froude parameter $Q_i/D_{ci}^{2.5}$ (circular conduit) or $Q_i/W_iH_i^{1.5}$ (rectangular conduit), where the subscript i indicates the discharge and dimensions associated with an individual conduit.
3. If the installation includes dissimilar conduits, select the conduit with the largest value of the Froude parameter to determine the dimensions of the equivalent conduit.
4. Make the height of the equivalent conduit, H_{eq}, equal to the height, or diameter, of the selected individual conduit.
5. The width of the equivalent conduit, W_{eq}, is determined by equating the Froude parameter from the selected individual conduit with the Froude parameter associated with the equivalent conduit, $Q/W_iH_{eq}^{1.5}$.

FOR DOUBLE PIPES
Q=680cfs, Use Q=340cfs for each pipe, 6' dia, V=14fps.
$Q/(D^{2.5}) = 340/(6^{2.5}) = 3.86 < 6.0$ OK
H = 6', Set $3.86=Q/(w*H^{1.5})$, Solve for W
$W = Q/(3.86*H^{1.5}) = 680/(3.86*6^{1.5}) = 12$
$Q/(w*H^{1.5}) = 680/(12*6^{1.5}) =3.86 < 8.0$ OK
$Q/(w*H^{0.5}) = 680/(12*6^{0.5}) = 23.13$

FOR SINGLE PIPES
Q=340cfs, 6' dia, V=14fps.
$Q/(D^{2.5}) = 340/(6^{2.5}) = 3.86 < 6.0$ OK
$Q/(D^{1.5}) = 340/(6^{1.5}) = 23.13$



Use H_a instead of H whenever culvert has supercritical flow in the barrel.

**Use Type L for a distance of 3H downstream.

Figure MD-22—Riprap Erosion Protection at Rectangular Conduit Outlet Valid for $Q/WH^{1.5} \leq 8.0$

$Q/(w*H^{1.5}) = 340/(6*6^{1.5}) = 3.86 < 8.0$ OK

$Q/(w*H^{0.5}) = 340/(6*6^{0.5}) = 23.13$

100 yr Tail Water Depth, $Y_t / H = 2.4/6 = 0.4$

This yields a minimum of Type H Rip-Rap

$L_p = 2.2*(136/2.4 - 12) = 98\text{ft} > 10D = 10*6=60\text{ft}$

UDFCD Spread Sheet Yields, Type VH Rip-Rap size at Lp = 56 ft.

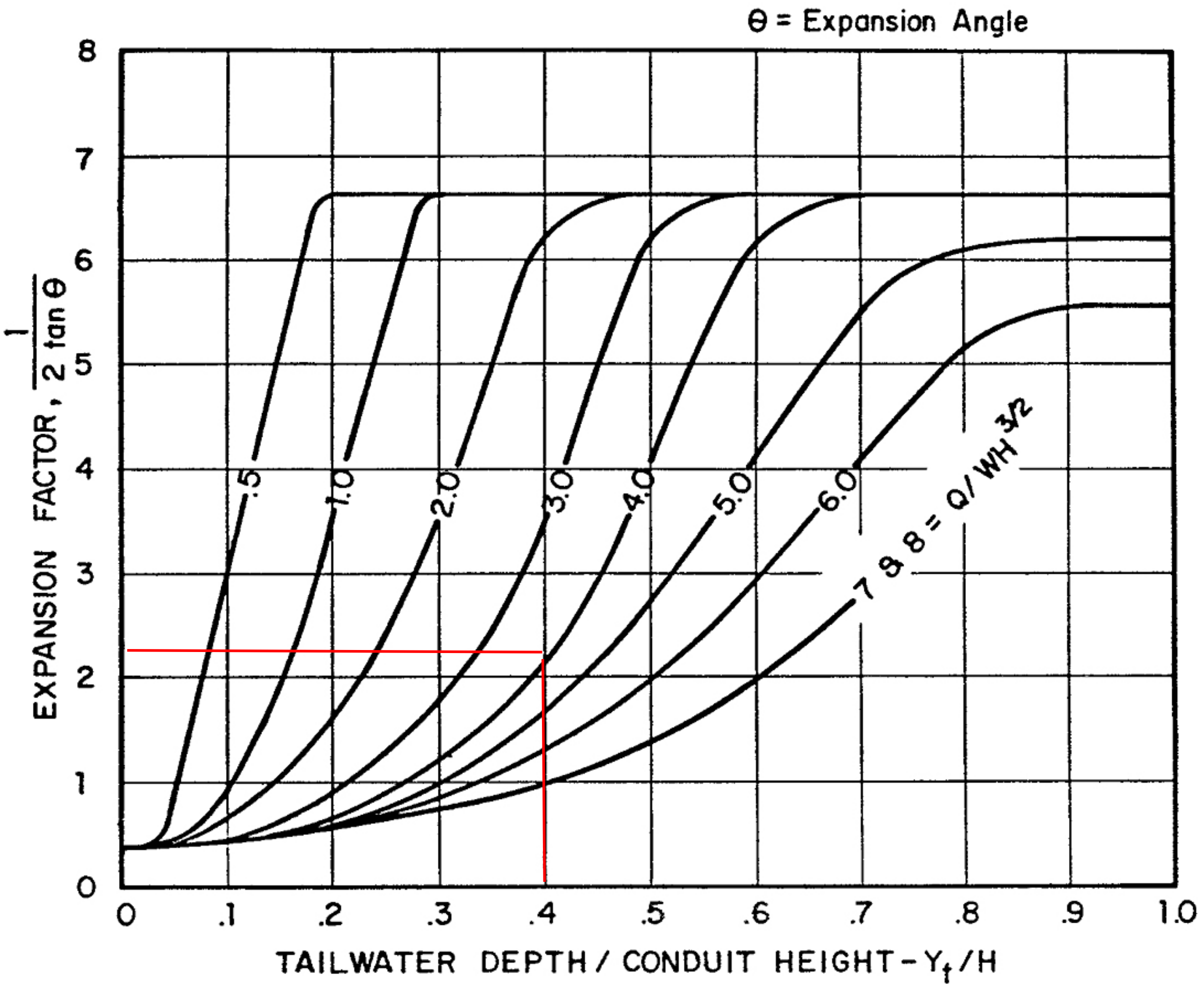


Figure MD-24—Expansion Factor for Rectangular Conduits

A_t=680cfs/5fps=136

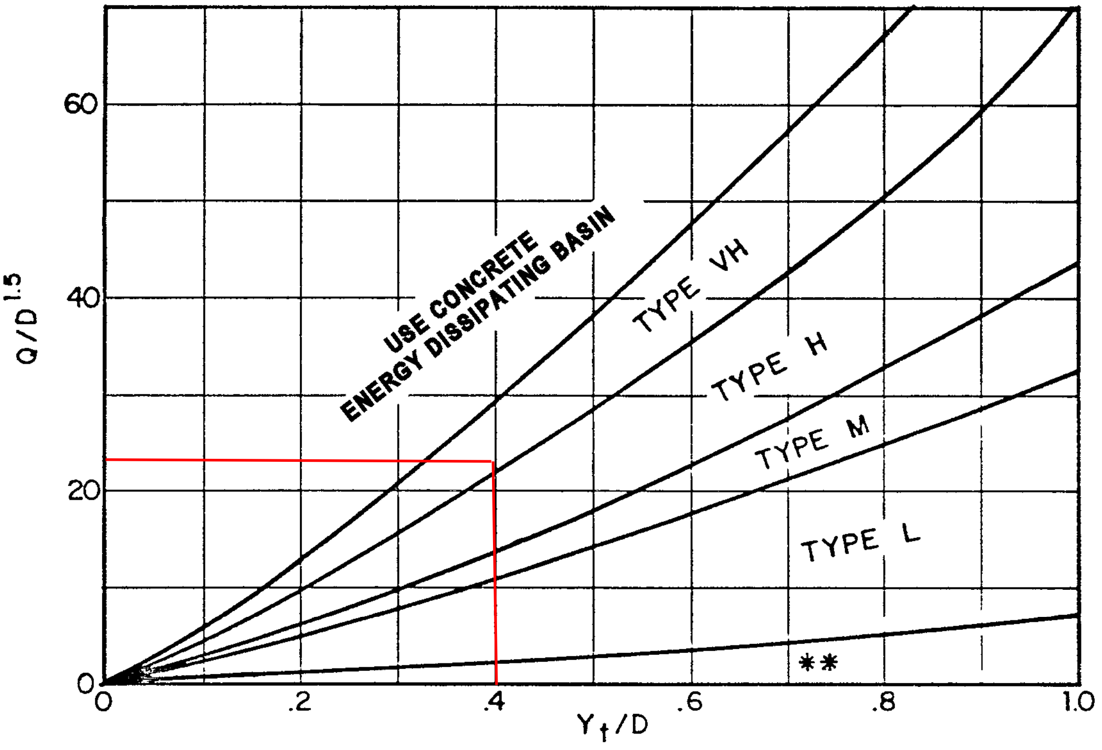
Y_t=2.4' Conservatively

W=12

Expansion Factor = 1.5

L_p = 2.2*(136/2.4 - 12) = 98ft > 10D = 10*6=60ft

UDFCD Spreadsheet Yields Lp = 56 ft w/ Type VH Rip-Rap



Use D_a instead of D whenever flow is supercritical in the barrel.
** Use Type L for a distance of 3D downstream.

Figure MD-21—Riprap Erosion Protection at Circular Conduit Outlet Valid for $Q/D^{2.5} \leq 6.0$

FOR SINGLE PIPE
$Q/(D^{2.5}) = 340/6^{2.5} = 3.86 < 6$
$Q/(D^{1.5}) = 340/6^{1.5} = 23.13$
$Y_t / D = 2.4/6 = 0.4$
Minimum Use Type VH Rip-Rap
L_p = 3.5*((68)/2.4 - 6) = 78 ft > 10D = 10*6=60 ft
UDFCD Outlet Protection Calculator Yields a Type VH Rip-Rap size at Lp = 56 ft.

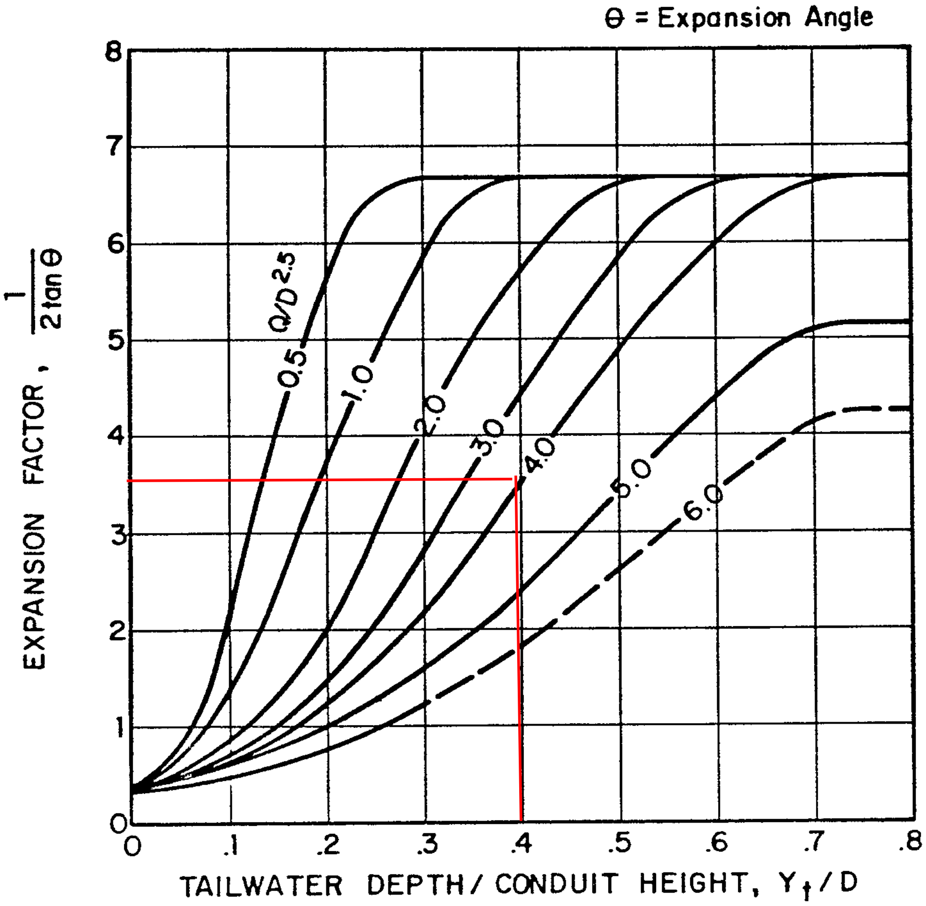
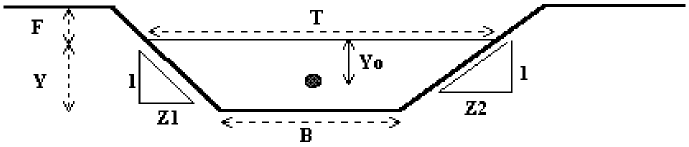


Figure MD-23—Expansion Factor for Circular Conduits

Design of Riprap Channel Cross Section

Project: 13025-COMPASS RESIDENTIAL
Channel ID: OFFSITE STORM OUTFALL CHANNEL TO COAL CREEK



ACTUAL SIDE SLOPES ARE VERTICAL FROM USE OF HEADWALL AND WING WALL

<u>Design Information (Input)</u>			
Channel Invert Slope	So =	0.0050	ft/ft
Bottom Width	B =	20.0	ft
Left Side Slope	Z1 =	2.0	ft/ft
Right Side Slope	Z2 =	2.0	ft/ft
Specific Gravity of Rock	Ss =	2.50	
Radius of Channel Centerline	Ccr =	600.0	ft
Design Disharge	**Q =**	**680.0**	**cfs**

<u>Flow Condition (Calculated)</u>			
Riprap Type (Straight Channel)	**Type =**	**VL**	
Intermediate Rock Diameter (Straight Channel)	**D50 =**	**6**	**inches**
Calculated Manning's n (Straight Channel)	**n =**	**0.0352**	
Riprap Type (Outside Bend of Curved Channel)	**Type =**	**VL**	
Intermediate Rock Dia. (O.B. of Curved Channel)	**D50 =**	**6**	**inches**
Calculated Manning's N (Curved Channel)	**n =**	**0.0352**	
Water Depth	Y =	3.98	ft
Top Width of Flow	T =	35.9	ft
Flow Area	A =	111.3	sq ft
Wetted Perimeter	P =	37.8	ft
Hydraulic Radius (A/P)	R =	2.9	ft
Average Flow Velocity (Q/A)	V =	6.1	fps
Hydraulic Depth (A/T)	D =	3.1	ft
Froude Number (max. = 0.8)	Fr =	0.62	
Channel Radius / Top Width	Ccr/T =	16.70	
Riprap Design Velocity Factor For Curved Channel	Kv =	1.00	
Riprap Sizing Velocity For Curved Channel	V_{Kv} =	6.2	fps
Riprap Sizing Paramenter for Straight Channel	**K =**	**1.91**	
Riprap Sizing Paramenter for Outside Bend of Curve	**K_{curve} =**	**1.91**	
Superelevation (dh)	dh =	0.00	ft
Discharge (Check)	**Q =**	**684.4**	**cfs**

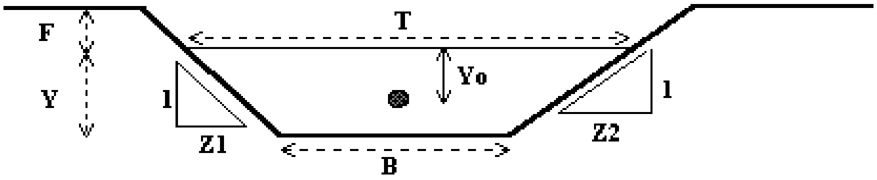
Warning 01: Sideslope steepness exceeds USDCM Volume I recommendation.

Check on Rock Size for Riprap

Range of K, K_{curve}	**Riprap**	**D50**
< 3.3	VL	6 inch
≥ 3.3 to < 4.0	L	9 inch
≥ 4.0 to < 4.6	M	12 inch
≥ 4.6 to < 5.6	H	18 inch
≥ 5.6 to 6.4	VH	24 inch

Normal Flow Analysis - Trapezoidal Channel

Project: 13025-COMPASS RESIDENTIAL
Channel ID: OFFSITE STORM OUTFALL TO COAL CREEK



Design Information (Input)

Channel Invert Slope	So =	0.0050	ft/ft
Manning's n	n =	0.035	
Bottom Width	B =	20.00	ft
Left Side Slope	Z1 =	0.00	ft/ft
Right Side Slope	Z2 =	0.00	ft/ft
Freeboard Height	F =	1.00	ft
Design Water Depth	Y =	**5.10**	ft

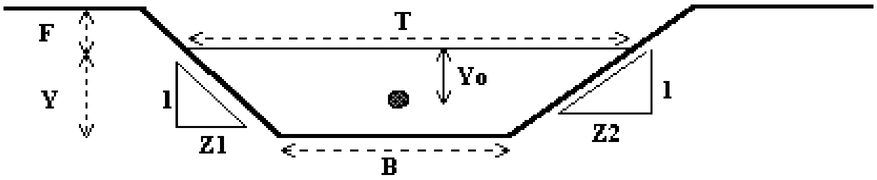
Normal Flow Condtion (Calculated)

Discharge	**Q =**	**691.49**	cfs
Froude Number	**Fr =**	**0.53**	
Flow Velocity	**V =**	**6.78**	fps
Flow Area	A =	102.03	sq ft
Top Width	T =	20.01	ft
Wetted Perimeter	P =	30.20	ft
Hydraulic Radius	R =	3.38	ft
Hydraulic Depth	D =	5.10	ft
Specific Energy	Es =	5.81	ft
Centroid of Flow Area	Yo =	2.55	ft
Specific Force	Fs =	25.32	kip

Critical Flow Analysis - Trapezoidal Channel

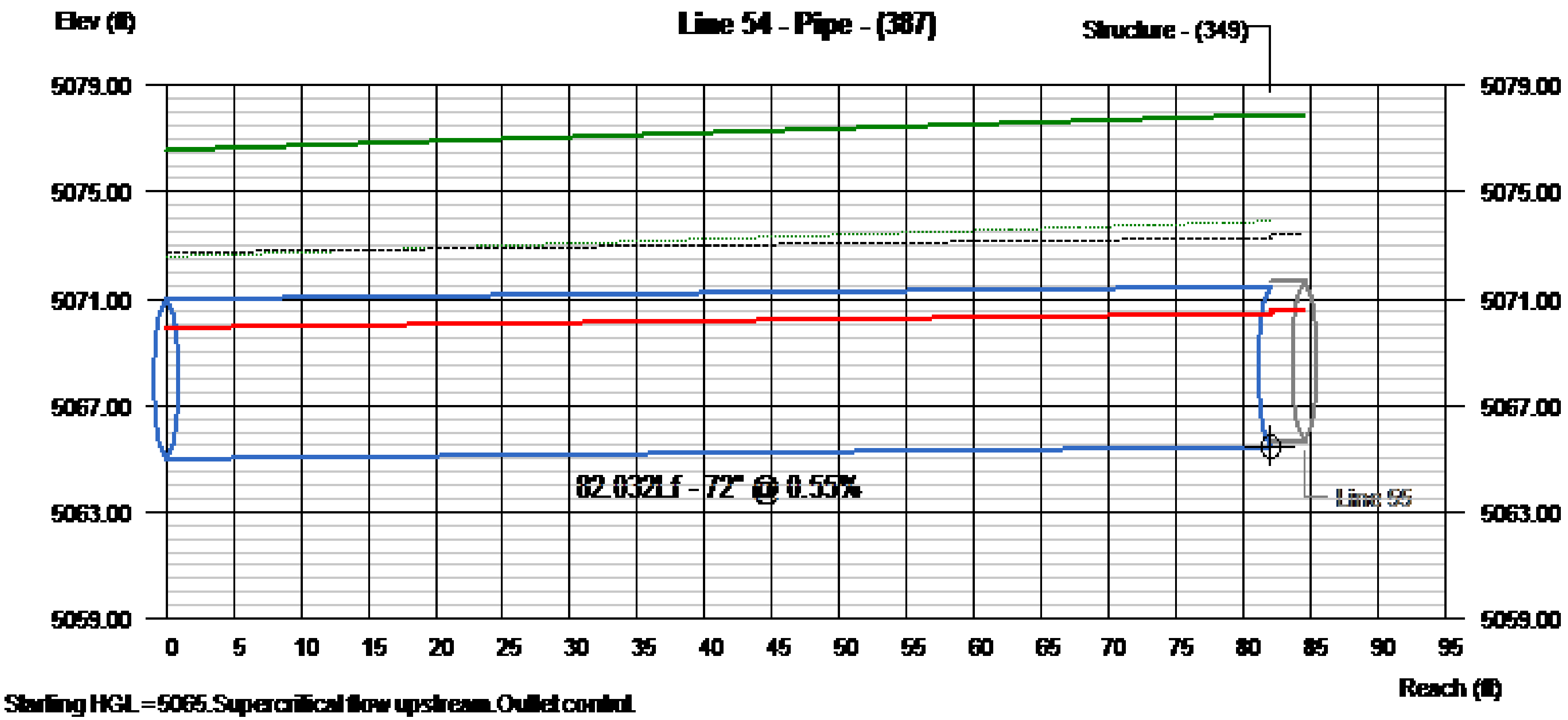
Project: 13025-COMPASS RESIDENTIAL

Channel ID: OFFSITE STORM OUTFALL TO COAL CREEK



Design Information (Input)			
Bottom Width	B =	20.00	ft
Left Side Slope	Z1 =	0.00	ft/ft
Right Side Slope	Z2 =	0.00	ft/ft
Design Discharge	Q =	**680.00**	cfs

Critical Flow Condition (Calculated)			
Critical Flow Depth	**Y =**	**3.29**	ft
Critical Flow Area	A =	65.91	sq ft
Critical Top Width	T =	20.01	ft
Critical Hydraulic Depth	D =	3.29	ft
Critical Flow Velocity	V =	10.32	fps
Froude Number	**Fr =**	**1.00**	
Critical Wetted Perimeter	P =	26.59	ft
Critical Hydraulic Radius	R =	2.48	ft
Critical (min) Specific Energy	Esc =	4.95	ft
Centroid on the Critical Flow Area	Yoc =	1.65	ft
Critical (min) Specific Force	Fsc =	20.39	kip



$1.486/0.012*28.3*1.50^{2/3} * 0.0052^{0.5}$ =331.59cfs

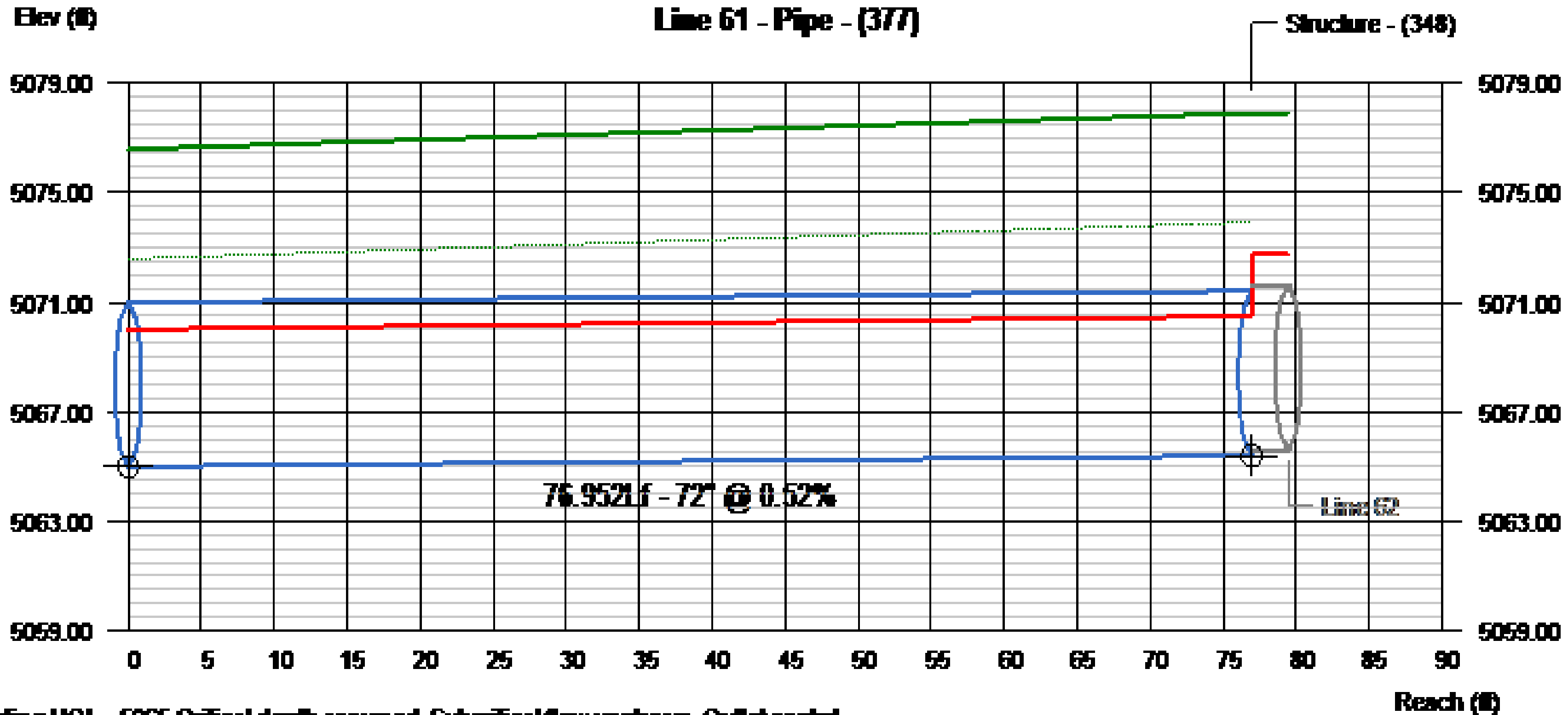
Q/Q_{full} = 340/331.59=1.02

V/V_{full} =1.14

V_{full} = 331.59/28.3 = 11.72 fps

V_{actual} = 11.72*1.16=13.6fps

See Hydraulic Ratios Chart.



Starting HGL =5065.Critical depth assumed. Subcritical flow upstream. Outlet control.

$1.486/0.012*28.3*1.50^{2/3} * 0.0052^{0.5}$ =331.59cfs

Q/Q_{full} = 340/331.59=1.02

V/V_{full} =1.14

V_{full} = 331.59/28.3 = 11.72 fps

V_{actual} = 11.72*1.16=13.6fps

See Hydraulic Ratios Chart.

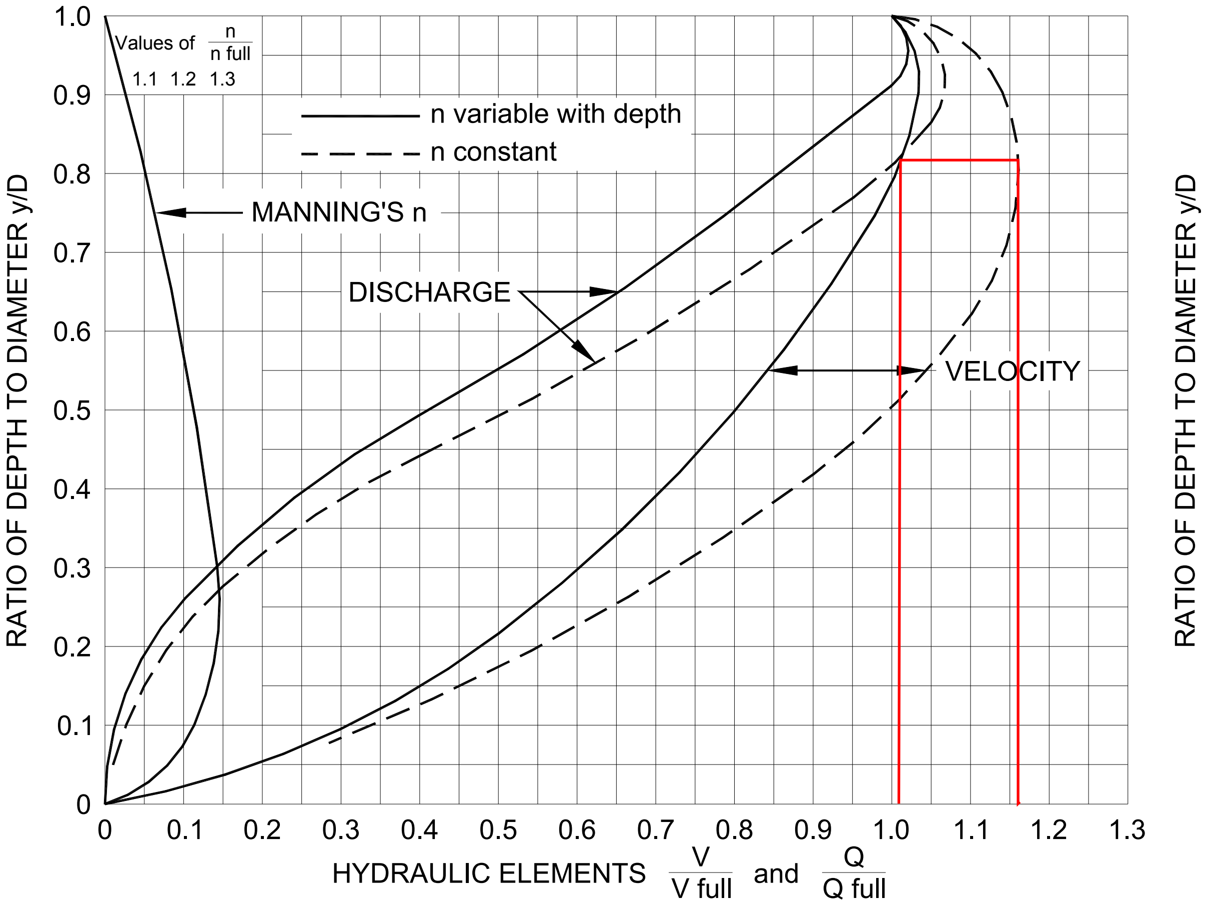


Figure MD-20—Hydraulic Properties of Pipes

(Steven, Simons, and Lewis 1976)

APPENDIX E

Drainage Maps

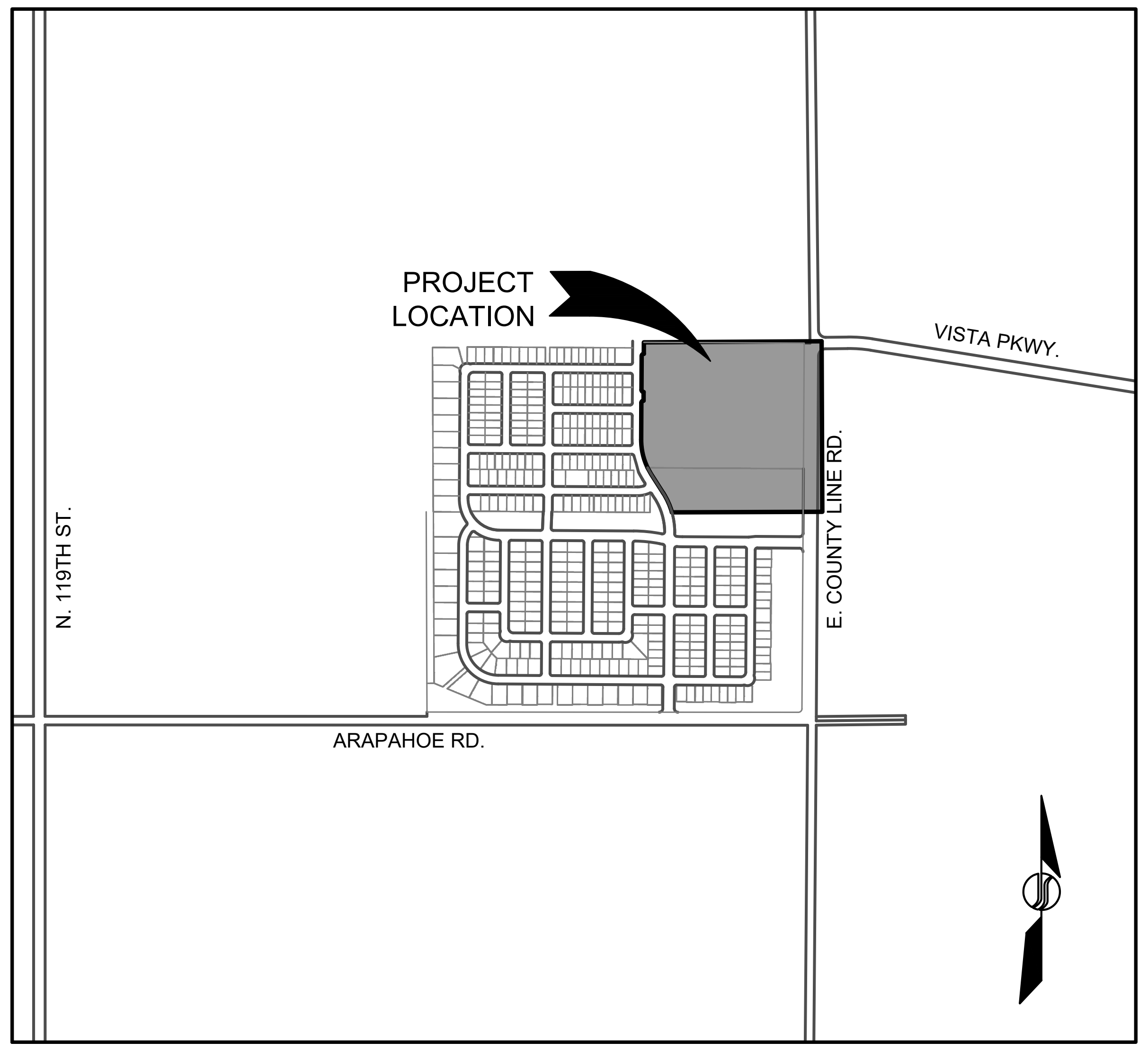
CAUTION: IF THIS SHEET IS NOT 24"x36" IT IS A REDUCED PRINT

COMPASS FILING NO. 4 DRAINAGE MAP

LOCATED IN THE SOUTHEAST QUARTER OF SECTION 25,
TOWNSHIP 1 NORTH, RANGE 69 WEST OF THE 6TH PRINCIPAL MERIDIAN,
TOWN OF ERIE, COUNTY OF BOULDER, STATE OF COLORADO
20.67 ACRES- 146 LOTS - 25 TRACTS
SK-000XXX-2017

RUNOFF SUMMARY

BASIN LABEL	DESIGN POINT	AREA	LOCAL (CFS)	
			Q2	Q100
A-10	110	2.11	0.0	3.7
A-13	113	1.00	1.5	6.1
A-14	114	1.17	0.9	5.5
A-14.1	114.1	1.76	2.4	10.7
A-15	115	2.72	3.3	13.9
A-15.1	115.1	0.48	0.1	2.0
A-15.2	115.2	0.22	0.3	1.5
A-16	116	1.66	2.0	8.2
A-16.1	116.1	4.19	0.0	7.1
A-16.2	116.2	1.32	0.5	4.8
A-16.3	116.3	0.38	0.3	1.7
A-17	117	4.49	0.0	7.3
C-1	301	1.90	0.3	5.9
C-2	302	0.69	0.4	2.8
C-3	303	2.53	2.9	12.2
C-4	304	0.99	0.9	4.6
C-5	305	1.51	1.7	7.2
C-6	306	2.16	3.6	14.7
C-7	307	0.29	0.4	1.6
C-8	308	0.78	0.7	3.6
C-9	309	0.74	1.2	5.2

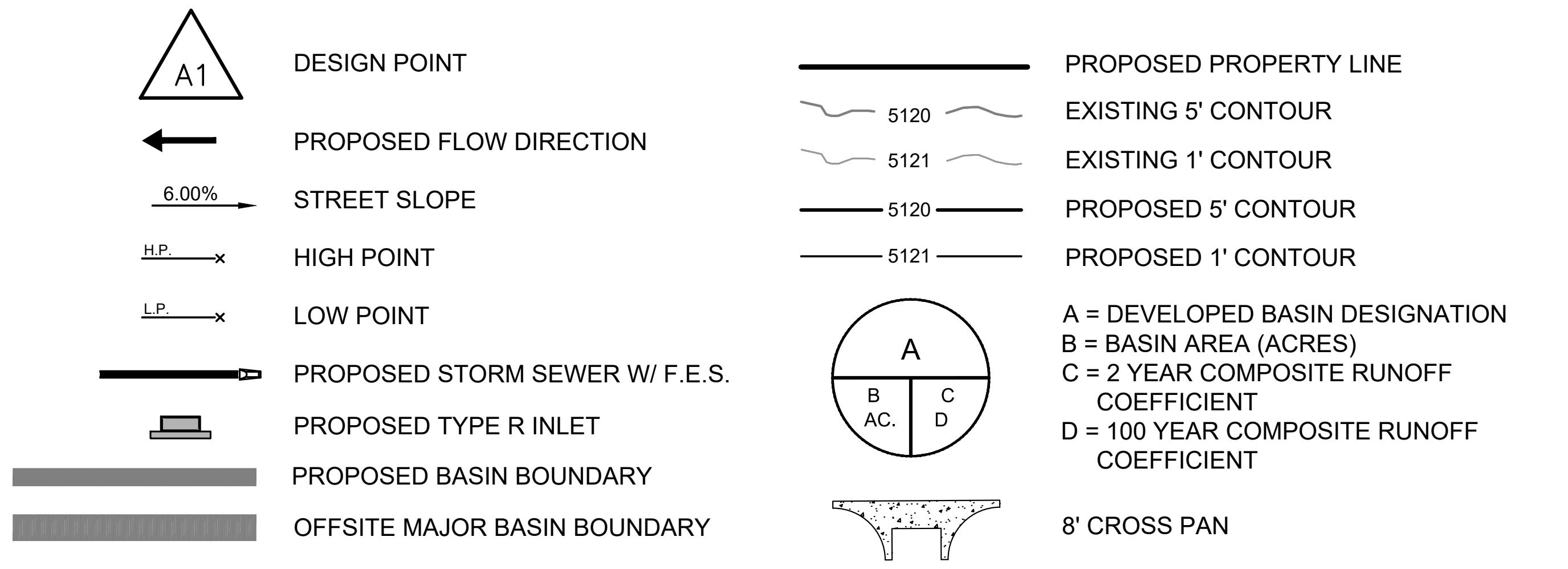


VICINITY MAP
SCALE 1"=1000'

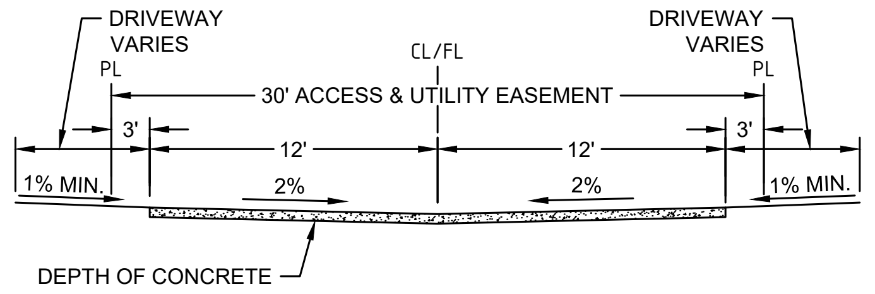
SHEET INDEX

1	DR01	COVER
2	DR02	HISTORIC DRAINAGE MAP
3	DR03	OVERALL DRAINAGE MAP
4	DR04	DRAINAGE MAP

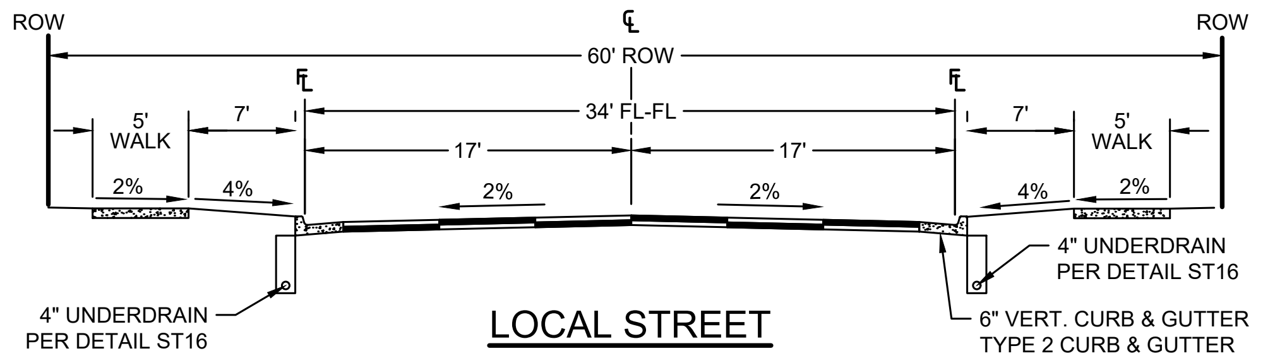
LEGEND



DESIGN POINT
PROPOSED FLOW DIRECTION
STREET SLOPE
HIGH POINT
LOW POINT
PROPOSED STORM SEWER W/ F.E.S.
PROPOSED TYPE R INLET
PROPOSED BASIN BOUNDARY
OFFSITE MAJOR BASIN BOUNDARY
PROPOSED PROPERTY LINE
EXISTING 5' CONTOUR
EXISTING 1' CONTOUR
PROPOSED 5' CONTOUR
PROPOSED 1' CONTOUR
A = DEVELOPED BASIN DESIGNATION
B = BASIN AREA (ACRES)
C = 2 YEAR COMPOSITE RUNOFF COEFFICIENT
D = 100 YEAR COMPOSITE RUNOFF COEFFICIENT
8' CROSS PAN



PRIVATE ALLEY
N.T.S.



LOCAL STREET
N.T.S.

ACCEPTANCE STATEMENT

I HEREBY CERTIFY THAT THIS CONSTRUCTION DOCUMENT FOR THE DESIGN OF COMPASS FILING NO. 3 WAS PREPARED BY ME (OR DIRECTLY UNDER MY SUPERVISION) IN ACCORDANCE WITH THE PROVISIONS OF THE TOWN OF ERIE STANDARDS AND SPECIFICATIONS FOR DESIGN AND CONSTRUCTION FOR THE OWNERS THEREOF. I UNDERSTAND THAT THE TOWN OF ERIE DOES NOT AND WILL NOT ASSUME LIABILITY FOR THE DRAINAGE FACILITIES DESIGNED BY OTHERS, INCLUDING THE DESIGNS PRESENTED IN THIS CONSTRUCTION DOCUMENT

THE ENGINEERING DESIGN AND CONCEPT REMAINS THE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEAR HEREON.

ACCEPTED BY: ______________________ ______________
DEPUTY DIRECTOR OF PUBLIC WORKS DATE

P:\15075-1_Compass_CalAtl\CAD\Drainage\15075-1_Drainage Cover.dwg, 8/21/2018 3:47:50 PM, AutoCAD PDF (High Quality Print).pc3

WARE MALCOMB
LEADING DESIGN FOR COMMERCIAL REAL ESTATE

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4
DRAINAGE MAP

NO.	DATE	REMARKS

JOB NO.:	15075-1
PA / PM:	TJ
DRAWN BY:	SL
DATE:	02/01/2018

SHEET
DR01
Sheet 1 of 4

CAUTION: IF THIS SHEET IS NOT 24"x36" IT IS A REDUCED PRINT

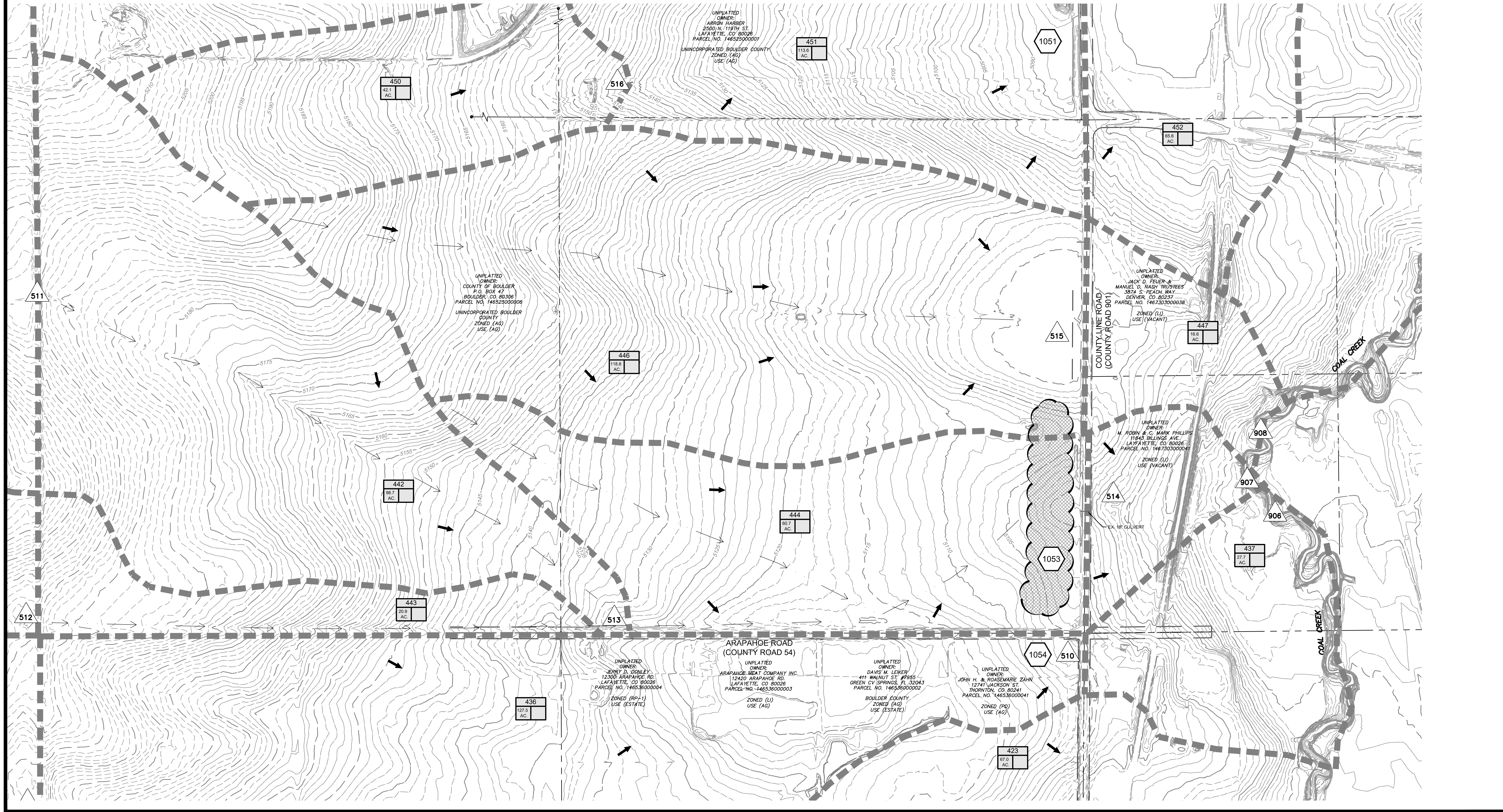
COMPASS FILING NO. 4 DRAINAGE MAP

LOCATED IN THE SOUTHEAST QUARTER OF SECTION 25,
TOWNSHIP 1 NORTH, RANGE 69 WEST OF THE 6TH PRINCIPAL MERIDIAN,
TOWN OF ERIE, COUNTY OF BOULDER, STATE OF COLORADO
20.67 ACRES- 146 LOTS - 25 TRACTS
SK-000XXX-2017

LEGEND

— — —	EXISTING CONTOURS
452 65.6 AC.	EXISTING BASIN LABEL (PER OSP)
516	DESIGN POINT
1051	OSP DETENTION FACILITY
➡	FLOW DIRECTION ARROW

0 125 250 500
SCALE: 1" = 250'
ORIGINAL GRAPHIC SCALE



WARE MALCOMB
LEADING DESIGN FOR COMMERCIAL REAL ESTATE

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

HISTORIC DRAINAGE MAP

NO.	DATE	REMARKS

JOB NO.:	15075-1
PA / PM:	TJ
DRAWN BY:	SL
DATE:	02/01/2018

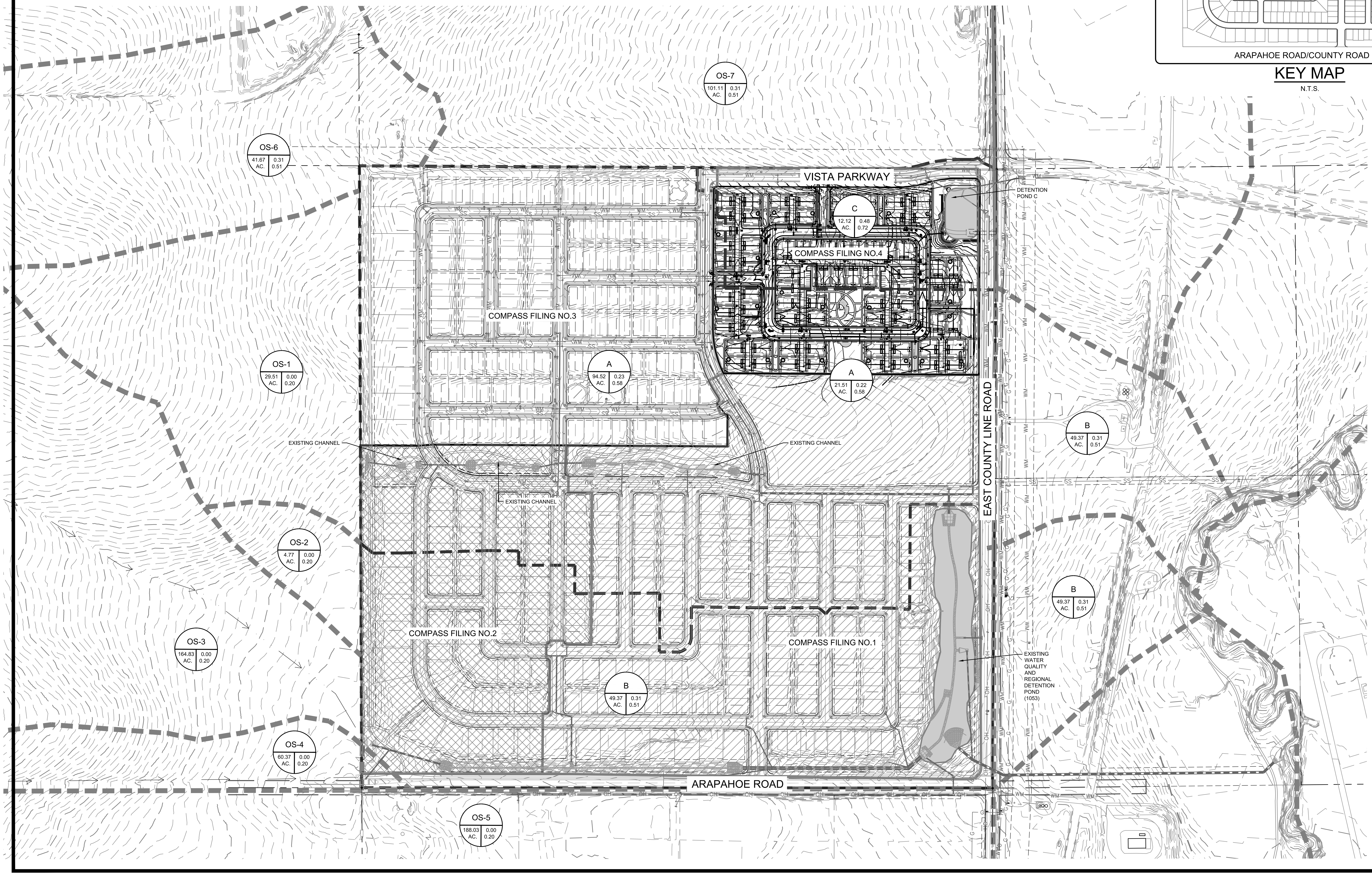
SHEET
DR02
Sheet 2 of 4

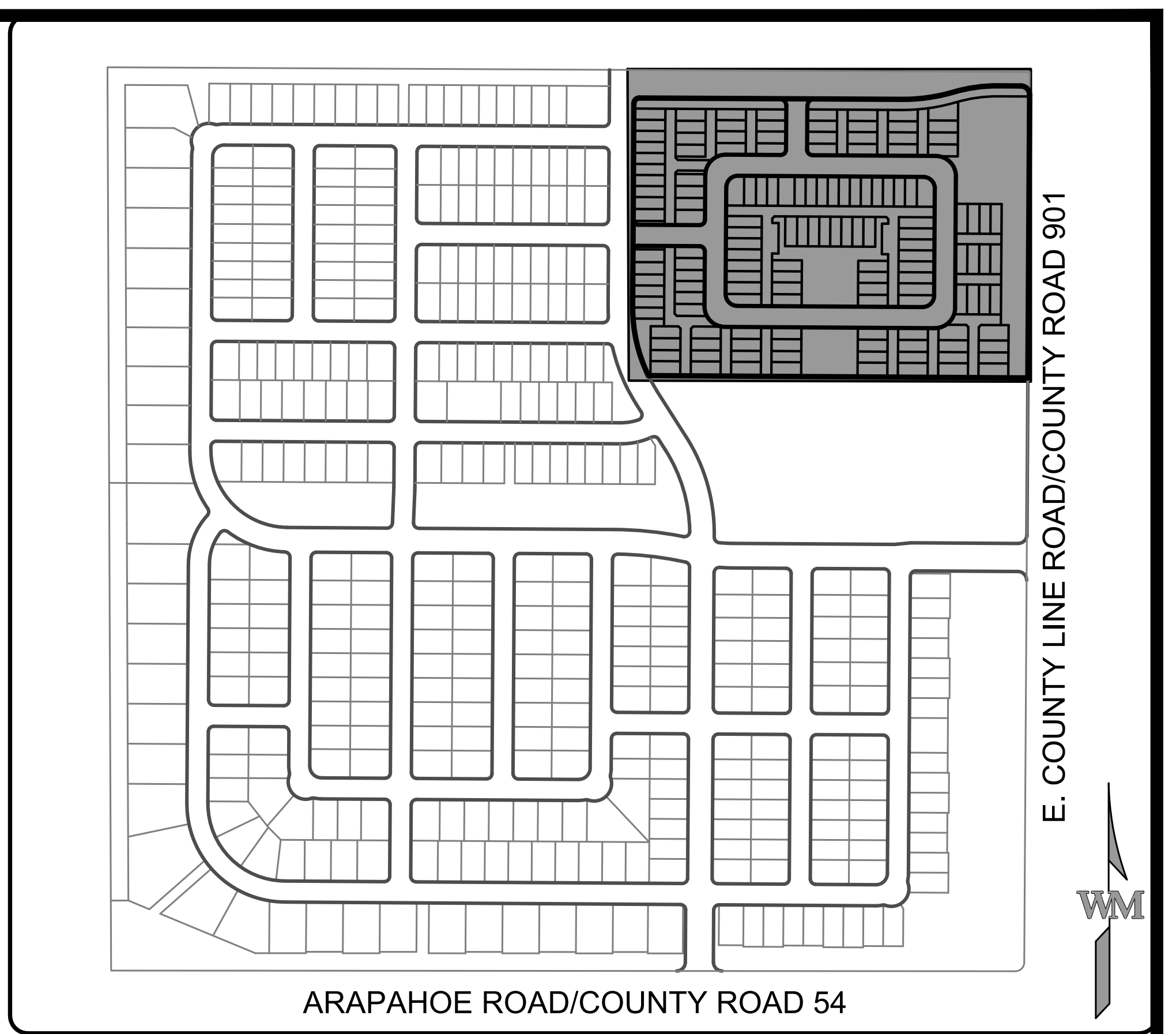
CAUTION: IF THIS SHEET IS NOT 24"x36" IT IS A REDUCED PRINT

COMPASS FILING NO. 4 DRAINAGE MAP

LOCATED IN THE SOUTHEAST QUARTER OF SECTION 25,
TOWNSHIP 1 NORTH, RANGE 69 WEST OF THE 6TH PRINCIPAL MERIDIAN,
TOWN OF ERIE, COUNTY OF BOULDER, STATE OF COLORADO
20.67 ACRES- 146 LOTS - 25 TRACTS
SK-000XXX-2017

0 100 200 400
SCALE: 1" = 200'
ORIGINAL GRAPHIC SCALE





KEY MAP
N.T.S.

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
LEADING DESIGN FOR COMMERCIAL REAL ESTATE

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

OVERALL DRAINAGE MAP

NO.	DATE	REMARKS

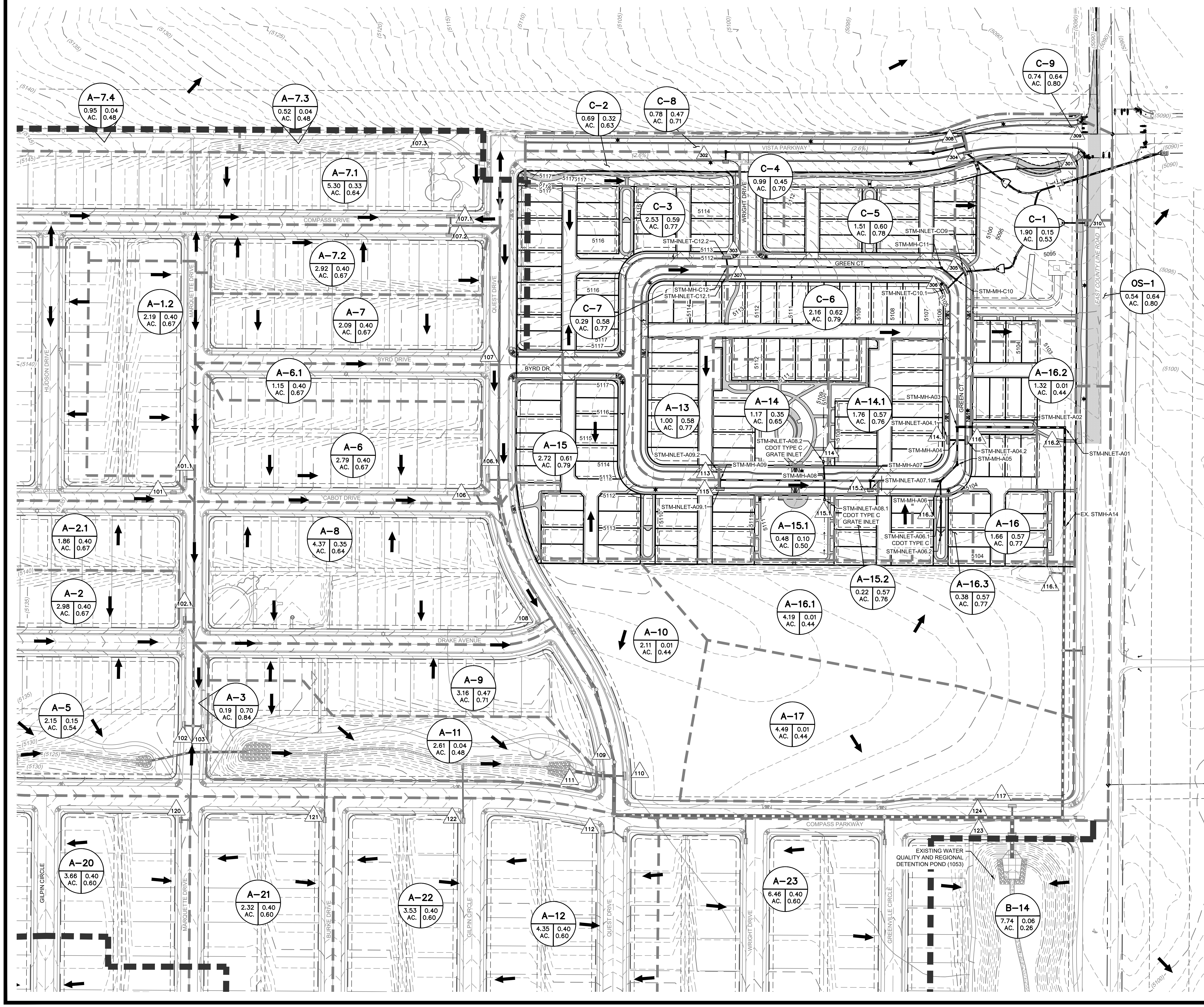
JOB NO.:	15075-1
PA / PM:	TJ
DRAWN BY:	SL
DATE:	02/01/2018

SHEET
DR03
Sheet 3 of 4

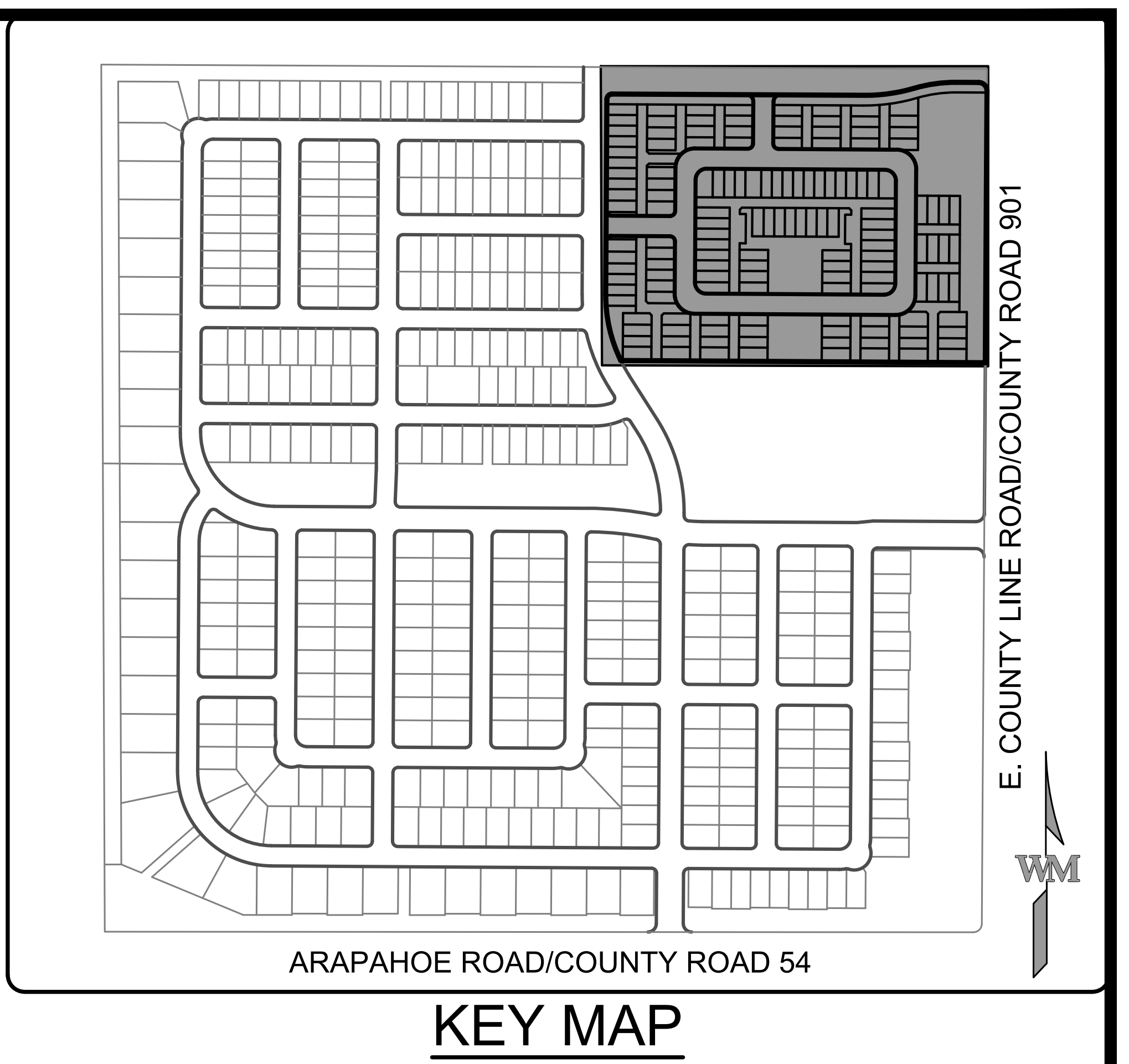
CAUTION: IF THIS SHEET IS NOT 24"x36" IT IS A REDUCED PRINT

COMPASS FILING NO. 4 DRAINAGE MAP

LOCATED IN THE SOUTHEAST QUARTER OF SECTION 25,
TOWNSHIP 1 NORTH, RANGE 69 WEST OF THE 6TH PRINCIPAL MERIDIAN,
TOWN OF ERIE, COUNTY OF BOULDER, STATE OF COLORADO
21.05 ACRES- 146 LOTS - 23 TRACTS
SK-000XXX-2017



0 50 100 200
SCALE: 1" = 100'
ORIGINAL GRAPHIC SCALE



KEY MAP
N.T.S.

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY AND COPYRIGHT OF WARE MALCOMB AND SHALL NOT BE USED ON ANY OTHER WORK EXCEPT BY AGREEMENT WITH WARE MALCOMB. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE JOB SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF WARE MALCOMB PRIOR TO THE COMMENCEMENT OF ANY WORK.

WARE MALCOMB
LEADING DESIGN FOR COMMERCIAL REAL ESTATE

990 south broadway
suite 230
denver, co 80209
p 303.561.3333
waremalcomb.com

FOR AND ON BEHALF
OF WARE MALCOMB

COMPASS FILING NO. 4

DRAINAGE MAP

NO.	DATE	REMARKS

JOB NO.:	15075-1
PA / PM:	TJ
DRAWN BY:	SL
DATE:	02/01/2018

SHEET
DR04
Sheet 4 of 4

GEOLOGIC AND PRELIMINARY GEOTECHNICAL INVESTIGATION
160-ACRE PARCEL
SOUTHEAST 1/4 OF SECTION 25, T1N, R69W
NORTHWEST CORNER OF ARAPAHOE ROAD AND EAST COUNTY LINE STREET
BOULDER, COLORADO

Prepared for:

Meadow Sweet Farm, LLC
2290 Cottonwood Place
Erie, Colorado 80516

Attention: Mr. Bill Young

Job No. 32,213

January 3, 2001

CTL/THOMPSON, INC.
CONSULTING ENGINEERS
1971 WEST 12TH AVENUE ■ DENVER, COLORADO 80204 ■ (303) 825-0777

TABLE OF CONTENTS

SCOPE

This report presents the results of our Geologic and Preliminary Geotechnical Investigation for a 160-acre property in the southeast 1/4 of Section 25, Township 1 North, Range 69 West, located northwest of East County Line Street and Arapahoe Road in Boulder County, Colorado (Fig. 1). We understand the property is being considered for residential, office/commercial, and school site development. This investigation was conducted to evaluate the subsurface conditions and to assist in site development and preliminary planning of the proposed construction. The report includes descriptions of site geology, subsurface conditions found in exploratory borings, and discussions of site development and construction as influenced by geotechnical considerations. The scope was described in our Proposal dated December 6, 2000. Assessment of environmental site conditions was not a part of the scope.

The discussions in this report are based on our understanding of the planned development, conditions disclosed by review of geologic maps and site reconnaissance, exploratory drilling, laboratory testing, engineering analysis of field and laboratory data and our experience. The criteria presented in the report are intended for planning purposes. Additional site specific investigations will be required to design building foundations, floor systems and pavements.

SUMMARY OF FINDINGS AND CONCLUSIONS

1. No geologic hazards were identified that would preclude development of this site. Subsurface conditions are comparatively favorable for the planned development. The test hole data indicate non-expansive sands and low to moderate swelling clays are present under the majority of the site. Most of the high and very high swelling clay and claystone bedrock was found relatively deep below the ground surface and is judged to have comparatively little impact on the development and construction. A preliminary evaluation of swell potential is

presented on Fig. 4. We believe the impact of the expansive soils and bedrock can be mitigated with proper planning, engineering, design, and construction.

2. The subsoils found in our borings consisted of sandy clays and slightly silty to clayey sands over weathered to comparatively unweathered bedrock. Bedrock consisting of claystone and sandstone was encountered in 12 test holes at depths of 13 to 33.5 feet below the existing ground surface (Fig. 2). The clays and claystone are expansive and exhibited low to very high measured swell. Some near surface clays and sands had low density and exhibited slight to moderate compression upon wetting.

3. Free ground water was encountered in 16 borings during drilling. Ground water was measured in 14 borings at depths between 10 and 26 feet when the holes were checked several weeks after drilling. Estimated ground water elevations are shown on Fig. 3. Ground water will likely affect drilled pier and underground utility installation in portions of the site.

4. We should review the site grading plans once available. Ground water was encountered at depths of 10 feet and 15 feet below the existing ground surface in the northwest and southwest corners of the site; respectively. Significant cuts should be avoided in these areas to reduce potential problems related to shallow ground water. If basements or below-grade constructions are planned, the site grading should be planned so that the ground water will be at least 3 feet and preferably 5 feet below the basement level. The use of underdrain systems below sewer mains and services is a common method to control ground water in response to development and, in some cases, to lower ground water.

5. We believe grading and utility installation can be accomplished using conventional construction techniques and heavy-duty equipment. Utility trenches should be properly sloped or braced to maintain stability and meet local, State, and OSHA safety standards and regulations. Ground water may be encountered in utility trenches and temporary dewatering should be anticipated under portions of the site. The dewatering can be accomplished by sloping the excavations to sumps and removing the water by pumping. Clay site grading fill should be moisture conditioned above optimum to reduce swell, and all fill should be properly compacted to reduce settlement. Permanent slopes should be seeded or mulched to reduce erosion.

6. Based on the preliminary data, we do not believe sub-excavation of high and very high swelling soils and bedrock and replacement with moisture treated fill is justified at this time. There were randomly distributed clays with moderate to high measured swell under the site. Sands and ground water were below these clays and above the comparatively deep bedrock. These subsoil conditions indicate potential difficulties and more cost for pier installation, because drilled friction piers may not be able to be installed with adequate pier length, and therefore long and cased drilled bedrock piers may be necessary. Sub-excavation may be considered to reduce the need for drilled piers and allow use of footings or pad type foundations and slab-on-grade basement floors in areas of moderate or high swell. Further investigations with closely spaced borings and swell tests in the areas of moderate and high swell potential (Fig. 4) may be considered to supplement this investigation and evaluate the merits of sub-excavation.

7. Preliminary information indicates structures on the site can be founded with footings or pads with minimum deadload, post-tensioned slab-on-grade foundations and drilled pier foundations. Footing and pad foundations can be used where comparatively low swelling soils and compacted fill are present to depths likely to influence foundation performance. We judge shallow foundations may be appropriate for approximately two thirds of the site. Drilled friction or bedrock piers may be required for the remainder of the site. The preliminary data suggest long and heavily reinforced piers may be required for about 5 to 10 percent of the site. Ground water and caving sands and sandstone may hamper pier installation and limit the length of drilled friction piers. Bedrock is comparatively deep. Long, temporarily cased piers and dewatering or placing concrete with a pump truck may be required. Post-tensioned slab-on-grade foundations will be a viable alternative for multi-family buildings with no basement construction. A detailed soils and foundation investigation should be performed after overlot grading to determine appropriate foundation types and to provide design criteria on a lot-by-lot basis.

8. Swell of the soils varies from low to high. We judge most building sites will be rated with low or moderate slab performance risk. Design details will be needed to mitigate the damages caused by movement of slabs. The use of structurally supported floors in basements should be anticipated on sites with high slab performance risk. Overlot grading will affect swell potential. We assume the site grading fill will be moisture conditioned to above optimum and properly compacted, thus yielding low to moderate swell. Site specific studies should be

performed after site grading to evaluate swell potential and risk of poor slab performance.

9. Required pavement thickness vary depending upon subgrade classification and traffic exposure. For planning purposes, we anticipate pavement sections for local, residential streets may consist of 6 to 7 inches of asphalt. Collector and arterial streets will require thicker sections. A design level pavement subgrade investigation and design should be performed after site grading to provide design and construction criteria.

10. Surface drainage should be designed to provide rapid run-off of surface water away from the proposed structures. Water should not be allowed to pond near the crest of slopes, on or adjacent to pavements, or adjacent to structures. Control of surface drainage will be critical to the performance of foundations, slabs-on-grade and pavements.

SITE CONDITIONS

The approximately 160-acre site comprises the southeast 1/4 of Section 25, Township 1 North, Range 69 West and is located northwest of the intersection of East County Line Street and Arapahoe Road in Boulder County, Colorado (Fig. 1). The site is presently farm land and is partially cultivated. The site slopes from the northwest and west down toward the east and southeast. Existing site contours are presented on Fig. 1. Topographic relief across the site is about 60 feet. A reservoir is located a few hundred feet northwest of the site. There was some water in the bottom of the reservoir during our investigation. Earth embankments of 5 to 10 feet in height surround the reservoir. A rusted metal tank is south of the reservoir. Property around the site is farmland.

An abandoned wood-framed, single story structure stands near the central, east border of the site (Fig. 1). East of the structure are a few trees and a large pile of debris including wood, concrete and timbers. A gas well and tank with an access road from the east are near the center of the site.

PROPOSED DEVELOPMENT

We understand the site will be planned for residential, office/commercial, and school construction. Residential construction is planned to include single-family and multi-family buildings. We anticipate the commercial, multi-family and school buildings will be 1 to 3 stories, typically without basements. Single-family residences will likely be 1 or 2-story, wood-framed structures with basements. Development will include site grading, installation of underground utilities and paving of street and parking areas. Development layout and grading plans were not available at the time of our investigation. We anticipate cuts and fills on the order of 5 feet or less will predominate for site grading.

SITE GEOLOGY AND GEOLOGIC HAZARDS

Site geology was investigated through review of published geologic maps, field observations by our geologist and engineer, and drilling 36 exploratory borings at the approximate locations shown on Fig. 1. This section is intended to discuss concerns related to geologic hazard review that occurs during planning and zoning for land use changes. Specific requirements of Colorado House Bill 1041 "Areas and Activities of State Interest" and Colorado Senate Bill 35 "County Planning and Building Codes" are addressed.

Geological mapping of the Erie Quadrangle by Roger B. Colton and Larry W. Anderson (USGS Map MF-882, 1977) indicates the surface soils consist of eolium (wind-deposited clay, silt and sand) of Pleistocene and Holocene Age. A geologic map was not prepared because the surficial geology of the site is one geologic unit. Eolian soils may be compressible due to low densities. Laboratory tests indicated compressible soils may be found at shallow depths on this site, and significant shrinkage of the soils during site grading may occur. Our borings suggest the eolium mantles sandy Broadway alluvium deposited by ancient courses of Coal Creek. The overburden soil deposits range in thickness from 13 feet to greater than the maximum depth drilled of 35 feet.

Bedrock of the Laramie Formation of Upper Cretaceous age is present below the overburden soils. The Laramie Formation consists of claystone, siltstone and sandstone comprised of volcanic ash and sediment eroded from the emerging Rocky Mountain west of the site and deposited in a deltaic environment at the edge of a regional structure known as the Denver Basin. Similar bedrock materials are known to underlie the site for hundreds of feet. No bedrock outcrops were observed on the site. The ridgeline about 1 mile east of the site contains bedrock outcrops consisting of scattered lenticular sandstone beds.

Lower portions of the Laramie Formation contain several economically important beds of coal. Underground mining within these coal beds has occurred but not within the site as indicated by "Coal Mine Subsidence and Land Use in the Boulder-Weld Coal field, Boulder and Weld Counties, Colorado" (Amuedo and Ivey, 1975). We believe mining of the coal is not economical in today's market and will remain so into the foreseeable future.

Many northeasterly-trending faults formed during and just after deposition of the Laramie Formation. These faults are not known to be seismically active. Colton and Anderson did not map any faults on this parcel; faults are mapped about ½ mile west and east of the site. The bedrock is reported to be essentially flat-lying, or may have a dip of up to six degrees.

The soil and bedrock units are not expected to respond unusually to seismic activity. The Denver area is considered by the 1997 Uniform Building Code (UBC) as Zone 1. Soil profile Type S_c and S_D are most likely on this site. Only minor damage to relatively new, properly designed and built construction would be expected. Wind loads, not seismic considerations, generally govern structural design in this area.

It is normal in the Front Range of Colorado and nearby Eastern Plains area to measure accumulations of radon gas in poorly ventilated spaced (i.e., full depth residential basements) in contact with soil or bedrock. Radon 222 gas is one of several radioactive products in the chain of natural decay of uranium into stable lead. Since radioactive nuclides are present in the soils and sedimentary rocks underlying the subject site, there is a potential for radon gas accumulation in poorly ventilated spaces. The amount of soil gas that can accumulate in an area is a function of many factors, including the radio nuclide activity of the soil and bedrock, construction methods and materials, soil gas pathways and accumulation areas. Typical mitigation methods consist of sealing soil gas entry areas and periodic ventilation of below-grade spaces. Radon rarely accumulates to significant levels in well-ventilated above-grade living spaces. The only method to fully evaluate the extend of a radon problem in a closed area is to perform testing after construction. We believe it is prudent to plan residential construction to allow active radon mitigation by providing access for venting of foundation drains.

Oil or gas wells exist and have existed on the site. It is possible contamination from these facilities may affect the site. Evaluation of the environmental condition of the site is not within the scope of this study.

Erosion potential on most of the site is low, due to vegetative cover and gentle slopes. Erosion potential can be expected to increase during construction, but should return to pre-construction rates or less if proper grading practices, surface drainage design and re-vegetation efforts are implemented.

Regional ground water flow is judged to be toward the east. Seepage from the reservoir to the northwest of the site may be responsible for the relatively shallow ground water noted in our boring TH-1. Ground water was found at depths which will likely affect utility and pier foundation installations under portions of the site.

The topography and physiography of the site indicates surface water would be expected to flow onto the site from the west. No developed drainages were noted. The flood potential appears low, should be determined by the civil engineer assisting in design of the development. Development typically increases the relative amount of impervious surfaces, which can lead to drainage problems and erosion if surface water flow is not adequately designed.

No geologic hazards which would preclude the proposed development were noted on the property. We believe all noted issues can be mitigated with proper engineering design and construction practices, as discussed in this report.

SUBSURFACE CONDITIONS

Subsurface conditions were explored by drilling 36 borings at the approximate locations shown on Fig. 1. The borings were drilled using 4-inch diameter, continuous flight auger and a truck-mounted drill rig. Our field representative supervised drilling operations, logged the soils and obtained samples for laboratory testing. Graphic logs of the soils found in the borings, results of penetration resistance tests and a portion of the laboratory data are presented in Appendix A. Results of laboratory testing are presented in Appendix B and summarized on Table B-1.

The subsoils found in our borings consisted of sandy clays and slightly silty to clayey sands over weathered to comparatively unweathered bedrock. The distribution of the clays and sands was random and erratic. Bedrock consisting of claystone and sandstone was encountered at depths of 13 to 33.5 feet below the existing ground surface in 12 test holes . Bedrock was not encountered in 24 of the 36 test holes to the depths explored of 25 to 35 feet. Estimated elevation contours of the bedrock surface are shown on Fig. 2. Field penetration resistance tests indicated the sandy clays were medium stiff to very stiff, the sands were loose to dense, and the claystone and sandstone were very stiff to very hard.

Typical samples of the sandy clays were tested in the laboratory. Clay samples exhibited compression and variable swell ranging from low to high (-3.5 compression to 5.5 percent swell) when wetted under loading of about 1,000 psf. Swell test results are summarized in Table A below. Atterberg limits testing performed on six samples indicated liquid limits of 25 to 42 percent and plasticity indices of 10 to 22 percent. Sixteen samples had 50 to 75 percent fines (percent passing the No. 200 Sieve).

TABLE A

SUMMARY OF SWELL TEST RESULTS

	Measured Swell*				
	Compression	Low 0 to <2%	Moderate 2 to <4%	High 4 to <6%	Very High ≥6%
Sandy Clays	15 35%	16 37%	8 19%	4 9%	0 0%
Sands	6 43%	8 57%	0 0%	0 0%	0 0%
Claystone	0 0%	3 37%	1 13%	2 25%	2 25%
Number of Samples	21	27	9	6	2
% of Tests	32%	42%	14%	9%	3%

*Swell measured upon wetting under an applied pressure of about 1,000 psf.

Slightly silty to clayey sands were also common above the bedrock. Atterberg limits testing performed on four samples indicated liquid limits of 26 to 43 percent and plasticity indices of 10 to 19 percent. Fifteen sand samples had 6 to 49 percent silt and clay fines (percent passing the No. 200 Sieve). Fourteen samples exhibited compression to low swell (4.1 percent compression to 0.7 percent swell) when wetted under loading of about 1,000 psf in swell tests.

Weathered and comparatively unweathered claystone samples had liquid limits of 29 to 70 percent, plasticity indices of 11 to 46 percent and 69 to 99 percent fines. Selected claystone samples exhibited low to very high swell (0.4 to 7.6 percent swell) when wetted under loading of about 1,000 psf. The sandstone is considered non-swelling.

The upper soils exhibited low and moderate swell under the majority of the site. High to very high swelling claystone was comparatively deep. Based on the subsoil profiles and laboratory swell test, we prepared a preliminary swell evaluation of the site as shown on Fig. 4. There were randomly distributed clays with high measured swell under the site. Site grading will affect the swell potential. Additional investigations with closely spaced test hole locations and more swell tests may reveal additional areas of high and very high swelling soils and bedrock.

Free ground water was encountered in 16 borings during drilling. Ground water was measured in 14 borings at depths between 10 and 26 feet when the holes were checked several weeks after drilling. Estimated ground water elevations are shown on Fig. 3. Ground water was not encountered in TH-1 during drilling, but was encountered at 10 feet when checked several days after drilling. Ground water in this area may be due to the seepage from the reservoir to the northwest and/or perched water conditions. Ground water will likely affect utility and drilled pier installations and may limit the depth of basement construction depending upon site grading.

SITE DEVELOPMENT

The impacts of geologic and geotechnical conditions on site development and residential construction should be considered during planning of the project. No geotechnical conditions were identified within the scope of this investigation which, in our opinion, preclude development of the site. The subsoil conditions are generally favorable when compared to other sites in the Denver Metropolitan area. The primary concern we believe will influence development of this site is expansive clays. The impacts of expansive soils can be mitigated through proper planning, design, construction and regular maintenance of the proposed construction. Site development recommendations to mitigate the geotechnical concerns are discussed in the following sections.

Site Grading

Site grading plans were not available at the time of this investigation. We anticipate cuts or fills on the order of 5 feet or less. Grading will impact foundations and performance of slabs-on-grade, exterior flatwork and pavements. We should review the site grading plans once available. Ground water was encountered at depths of 10 feet and 15 feet below the existing ground surface in the northwest and southwest corners of the site; respectively. Significant cuts should be avoided in these areas to reduce potential problems related to shallow ground water. If basements or below-grade constructions are planned, the site grading should be planned so that the ground water will be at least 3 feet and preferably 5 feet below the basement level.

Areas to receive overlot grading fill must be properly prepared. Prior to fill placement, all vegetation and soft, organic topsoil and debris should be removed. The topsoil thickness across the site should be on the order of 6 to 12 inches. The resulting clay and sand subsoils should be scarified to a depth of 8 to 12 inches, clay subgrade should be moisture conditioned from 0 to 3 percent above optimum and compacted to at least 95 percent of maximum standard Proctor dry density (ASTM D 698). Granular (sand) subgrade soils should be moisture conditioned to within 2 percent of optimum moisture content and compacted likewise.

We recommend permanent cut and fill slopes be designed with a maximum grade of 3:1 (horizontal:vertical); use of 4:1 slopes is preferable. If site constraints (property boundaries and streets) do not permit construction with recommended slopes, retaining walls or reinforced slopes may be considered. For the subsoils encountered in our test holes, we believe cut or fill slopes with heights of 15 feet or less should be stable. If higher slopes are planned, we should be contacted to evaluate the stability.

The properties of fill will affect the performance of foundations, slabs-on-grade, flatwork and pavements. We recommend clay and claystone fill be moisture treated to above optimum moisture content in order to reduce the swell of fill supporting structures and pavements. Fill should be placed in thin, loose lifts and compacted to at least 95 percent of standard Proctor (ASTM D 698) maximum dry density. Clay or claystone fill should be moisture conditioned from 0 to 3 percent above optimum moisture content. Granular soils can be moisture conditioned to within 2 percent of optimum moisture content. In order to reduce settlement of "deep" fills (fill depths greater than 16 feet, if any), we recommend these fills be moisture conditioned from -1 to +2 percent of optimum moisture content and compaction increased to at least 100 percent of maximum standard Proctor dry density (ASTM D 698). Guideline specifications for overlot grading procedure are presented in Appendix C. Placement and compaction of site grading fill should be inspected and tested during construction on a full-time basis.

Eolium, the predominate surficial geologic unit, consists of wind-deposited sand, silt, and clay. These soils may have low density. Laboratory tests indicated about one third of the clay samples and over 40 percent of the sand samples tested exhibited compression. More than normal shrinkage of the soils for site grading should be anticipated. Where compressible soils are encountered, the soils may be removed or stabilized prior to placing fill. Stabilization of soft subgrade soils can be accomplished by removal and recompaction or "crowding" crushed rock into the subgrade and wheel rolling with a large front-end loader until a firm surface is achieved. Site grading, building pad grading, and utility installation operations will likely remove most of these compressible soils.

Deep Sub-Excavation

The preliminary data indicate non-expansive sands and low or moderate swelling clays are present near the ground surface under a majority of the site. High to very high swelling claystone bedrock was found comparatively deep under the site, and is judged to have little impact to the planned development. A preliminary swell potential evaluation of the site is shown on Fig. 4. Based on the preliminary data, we do not believe sub-excavation of high and very high swelling soils and bedrock and replacement with moisture treated fill is justified at this time. There were randomly distributed clays with moderate to high measured swell under the site, and sands and ground water were below these clays and above the comparatively deep bedrock. These subsoil conditions indicate potential difficulties and more cost for pier installation, because it may not be feasible to install drilled friction piers with adequate length, and therefore long and cased drilled piers may be necessary. Sub-excavation may be considered to reduce the need for piers and allow use of footings or pad type foundations and slab-on-grade basement floors. Further investigations with closely spaced borings and swell tests in the areas of moderate and high swell potential (Fig. 4) may be considered to supplement this investigation and evaluate the merits of sub-excavation.

Utility Construction

The subsoils consist of clay and sand underlain by weathered and comparatively unweathered claystone and sandstone. We believe the clay soils on this site will classify as Type B or Type C soils, the sands as Type C, and the bedrock as Type A based on the Occupational Safety and Health Administration (OSHA) Standards governing excavations published in 29 CFR, Part 1926. Type A soils require a maximum slope inclination of 3/4:1 (horizontal:vertical), Type B soils require maximum slope inclination of 1:1, and Type C soils require maximum slope inclination of 1.5:1. Excavations below ground water, if present, will require flatter slopes or bracing. Temporary dewatering by sloping excavations to sumps and stabilizing the bottom of excavations may be necessary in deeper utility excavations. Sumps should bottom several feet below the bottom of the excavations to draw water through the soils rather than across the bottom of the excavation. The contractor should identify the soils encountered in excavations and refer to OSHA standards to determine appropriate slopes.

Deep utilities (if any) may penetrate bedrock. Cemented sandstone pockets of limited extent are common in the Laramie Formation and may occur anywhere in the bedrock. We recommend contract provisions consider rock excavation.

Water and sewer lines are usually constructed beneath paved roads. Compaction of trench backfill will have a significant effect on the life and serviceability of pavements. We recommend trench backfill consisting of clay be placed in thin, loose lifts, moisture conditioned to 0 to 3 percent above optimum moisture content and compacted to at least 95 percent of standard Proctor (ASTM D 698) maximum dry density. Granular backfill can be moisture conditioned within 2 percent of optimum moisture content and compacted to the same minimum level. The placement and compaction of fill and backfill should be observed and tested by a representative of our firm during construction.

Underdrain System

The use of underdrain systems below sewer mains and services is a common method to control ground water in response to development and, in some cases, to lower ground water. Where a positive gravity outlet is available, we recommend an underdrain system be incorporated into sanitary sewer and sewer collection systems. Underdrains should also be installed below sewer service lines to each residence planned in this area with connection to residence foundation drains.

The underdrain should consist of free-draining gravel surrounding a rigid PVC pipe. The pipe should be sized for anticipated flow. Guidelines for underdrain sizing are shown in Table B. The line should consist of smooth, perforated or slotted rigid PVC pipe laid at a grade of at least 0.5 percent. A gravel cross-section of at least 2 square feet should be placed around the pipe. A sewer underdrain detail is shown on Fig. 5. A positive cutoff collar (concrete) should be constructed around the sewer pipe and underdrain pipe immediately downstream of the point the underdrain pipe leaves the sewer trench. Solid pipe should be used down gradient of this collar to the daylight point. Clean-outs should be provided along the system. The entity responsible for maintenance should be identified and guidelines developed for maintenance. The underdrain should be designed to discharge to a gravity outfall provided with a permanent concrete headwall and trash rack, or to a storm sewer with a check valve to control water backing up into the underdrain system.

TABLE B
UNDERDRAIN SIZING

Slope = 0.005 (0.5 percent)				
Pipe Size (inches)	4	6	8	10
Maximum Number of Residences	50	100	200	300
Slope = 0.01 (1.0 percent)				
Pipe Size (inches)	4	6	8	10
Maximum Number of Residences	70	150	300	450
Slope = 0.02 (2.0 percent)				
Pipe Size (inches)	4	6	8	
Maximum Number of Residences	100	250	400	

Note: Minimum slopes of the underdrains will govern pipe sizes and maximum number of residences serviced.

Pavements

Pavement sections cannot be finalized until subgrade is cut and additional testing of the subgrade is performed. Our investigation indicates subgrade soils may include silty and clayey sands and sandy clays. From a pavement standpoint, the sands are comparatively good subgrade materials and the clays are relatively poor. For preliminary planning purposes, we anticipate pavement sections for residential streets may consist of 6 to 7 inches of asphalt in clay areas. Collector and arterial streets will require thicker sections. For expansive subgrade, sub-excavation, stabilization, or moisture treatment of at least 3 feet of clay/claystone subgrade to reduce swell potential may be considered. The final design thickness could change significantly, depending upon overlot grading and site preparation. A subgrade investigation and pavement design should be performed after overlot grading.

CONSTRUCTION CONSIDERATIONS

The property is planned for a mixed development of office/commercial, school and residential construction. Preliminary site plans were unavailable during this investigation. The field and laboratory data indicate the soil conditions vary somewhat across the site. The following discussions are preliminary and are not intended for design or construction. After grading is completed, detailed soils and foundation investigations should be performed.

Residential Foundations

Preliminary data suggest foundations for the proposed structures will likely be footings and pad foundations for about two thirds of the site, where low swelling natural clay, fill or natural sands are found at or near foundation levels. If soft or loose soils are encountered near footing levels, drilled piers or low pressure footings may be recommended. Drilled friction piers or piers bottomed in bedrock may be required for about one third of the site where moderate to high swelling soils or bedrock are encountered after site grading. As discussed above, ground water and sands below the moderate to high swelling clays will affect pier installation. Deep sub-excavation (if performed) will likely allow the use of more footing or pad type foundations. Post-tensioned slab-on-grade foundations are a viable foundation alternative for multi-family apartments or other buildings planned with no below-grade basement construction.

Residential Slab-on-Grade Construction

The use of slab-on-grade floors for unfinished basements should be limited to areas where soils within the depth likely to influence floor performance are low to moderate swelling. We estimate about 5 to 10 percent of residence sites will be rated as having high or very high swell. Structurally supported floor systems should be planned in all non-basement finished living areas and in basements where swell potential or slab performance risk is judged high or very high. Our firm also generally recommends structurally supported basement floors for moderate, high and very high swell sites where walkout and garden level basements are planned. Slab performance risk should be more thoroughly defined during design level Soils and Foundation Investigations.

The performance of garage floors, driveways, sidewalks and other surface flatwork will likely be erratic at this site. Environmental factors and varying soil swell characteristics influence these improvements. Performance problems will be more likely in parts of the site underlain by highly expansive soils.

The following will be required to reduce the risk for damage due to movement of slabs-on grade placed at this site:

1. Isolation of the slabs from foundation walls, columns or other slab penetrations;
2. Voiding in interior partition walls to allow for slab movement without transferring the movement to the structure;
3. Providing flexible water and gas connections to allow for slab movement. A flexible plenum above furnaces will also be required; and
4. Providing proper surface grading and foundation drains to reduce water availability to soils below slabs-on-grade.

Commercial and School Construction

We understand commercial and school development is planned. Preliminary data suggests the site is predominately underlain by nil to moderate swelling sandy clays and sands to significant depths. We expect footings or post-tensioned slab-on-grade foundations will be the predominate foundation type. If soft or loose soils are encountered near foundation levels, piers or low pressure foundations or subexcavation to remove the soft or loose soils may be recommended. Drilled pier foundations may be required to support heavy loads or in areas where design level investigations encounter moderate to highly expansive soils or bedrock.

Slab-on-grade floors can likely be used for most buildings. If expansive clays are found at elevations which could adversely affect slab performance, a 3 to 8-foot thick (or thicker) layer of granular or moisture treated fill may be required below slabs to provide better subgrade support, depending on the performance requirements of the owner. Similar slab-on-grade isolation measures to those described for residential construction will be required for commercial building construction.

Basements

Ground water is present below the site and may rise after development. Surface water can penetrate relatively permeable foundation backfill and collect at the bottom of relatively impermeable excavations causing wet or moist basement conditions. Foundation drains will be necessary around all below-grade areas. We suggest foundation drains be tied to a sewer underdrain system (if feasible). They should also discharge to sumps where water can be removed by pumping. In our opinion, underdrain systems offer more comprehensive control of ground water and better mitigate impacts of ground water and swelling soils on foundations, slabs and pavements.

Ground water is present below the site. Our investigation indicates ground water at depths of about 10 to 15 feet in the northwest and southwest corners of the site; respectively. Basement construction may be limited in these areas depending on finished grades. We recommend basement excavations be limited to a minimum of 3 feet, and preferably 5 feet above ground water levels. A gravel layer is typically recommended under the basement slabs where ground water will be within about 3 to 5 feet of the slabs. Basement excavations near ground water may encounter soft or loose soils requiring stabilization.

Surface Drainage

The ground surface around the structures should be shaped to provide for rapid run-off of surface water away from the structures and off of pavements. We generally recommend slopes of at least 12 inches in the first 10 feet for the landscaped areas surrounding residences, where practical. Roof downspouts and other water collection systems should discharge well beyond the limits of all backfill around the residences. Water should not be allowed to pond between residences or on or adjacent to pavement. Proper control of surface run-off is also important to prevent the erosion of surface soils. Sheet flow should not be directed over unprotected slopes. Water should not be allowed to pond at the crest of slopes and on or adjacent to pavements. Permanent overlot slopes should be seeded or mulched to reduce erosion.

RECOMMENDED FUTURE INVESTIGATIONS

Based on the results of this investigation and the proposed development, we recommend the following investigations be performed:

1. Review of development layout and site grading plans;
2. Design and sizing of the underdrain systems (if selected);
3. Additional investigation at individual parcels or sites to evaluate the merit of deep sub-excavation if desired;
4. Construction testing and inspection for site development and residential building construction;
5. Subgrade investigation and pavement design after grading; and

6. Design-level soils and foundation investigations after grading.

LIMITATIONS

Our borings were widely spaced to provide a general picture of subsurface conditions to assist in planning of site development and proposed construction. We believe this investigation was conducted in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing in this area at this time. No other warranty, express or implied, is made. If we can be of further service in discussing the contents of this report or analyses of the influence of subsurface conditions on the design of the proposed development, please call.

CTL/THOMPSON, INC.

Adam D. Tschida
Staff Engineer

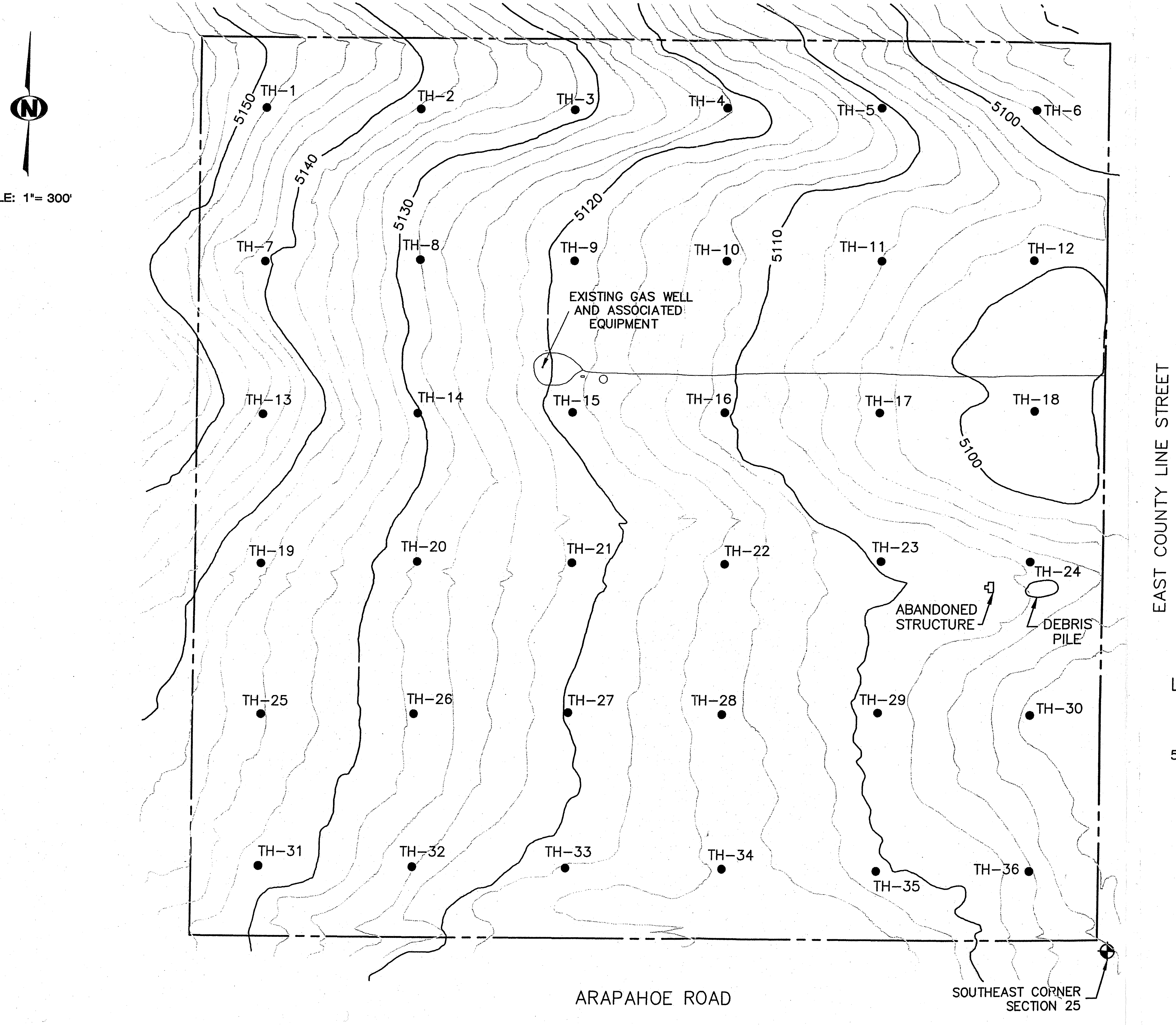
Reviewed by:

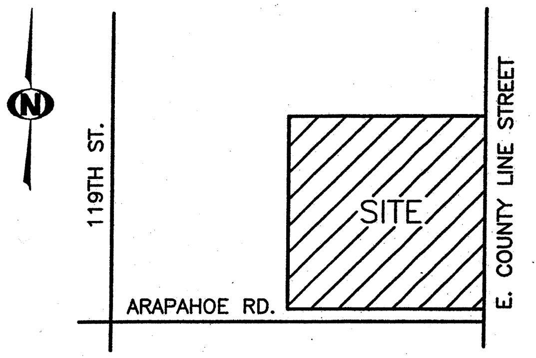
Nan-Ping Hsieh, P.E.
Project Manager

COLORADO REGISTERED
NAN-PING HSIEH
22924
1/3/01
PROFESSIONAL ENGINEER

David A. Glater, P.E., C.P.G.
Associate Geological Engineer

ADT:NPH:DAG/ha
(6 copies sent)





VICINITY MAP
NO SCALE

LEGEND:

TH-1 ● INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING

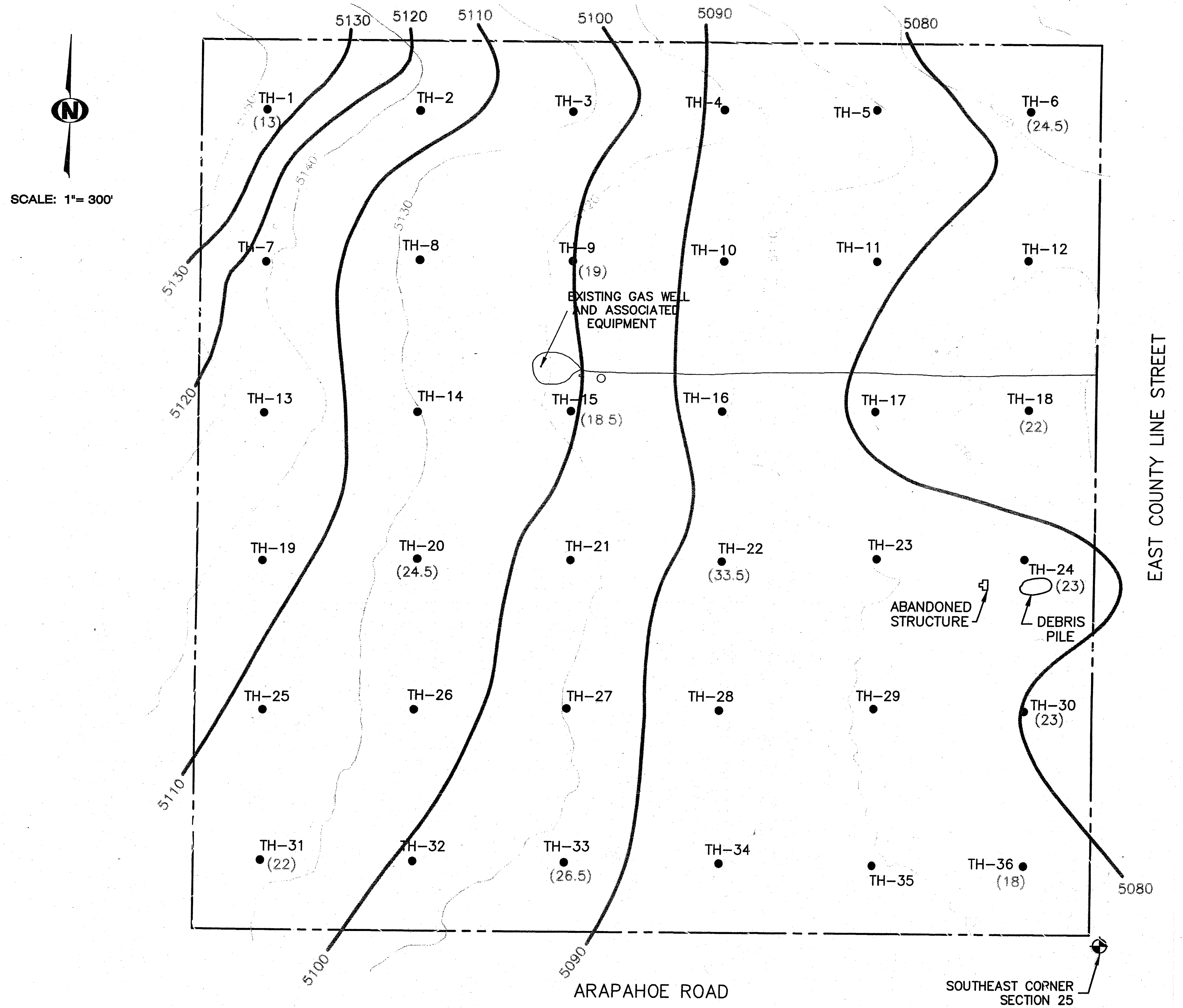
5100 — INDICATES EXISTING GROUND SURFACE ELEVATION (FEET)

32,213_f1 12/28/00 MB

Meadow Sweet Farm
Southeast 1/4 of Section 25, T1N, R69W
Job No. 32,213

Locations of Exploratory Borings

Fig. 1



LEGEND:

TH–1 ●	INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING
	INDICATES EXISTING GROUND SURFACE ELEVATION (FEET)
5100 ▬	INDICATES ESTIMATED ELEVATION OF BEDROCK SURFACE (FEET)
(13)	INDICATES DEPTH TO BEDROCK SURFACE FROM THE EXISTING GROUND SURFACE AT BORING LOCATION (FEET)

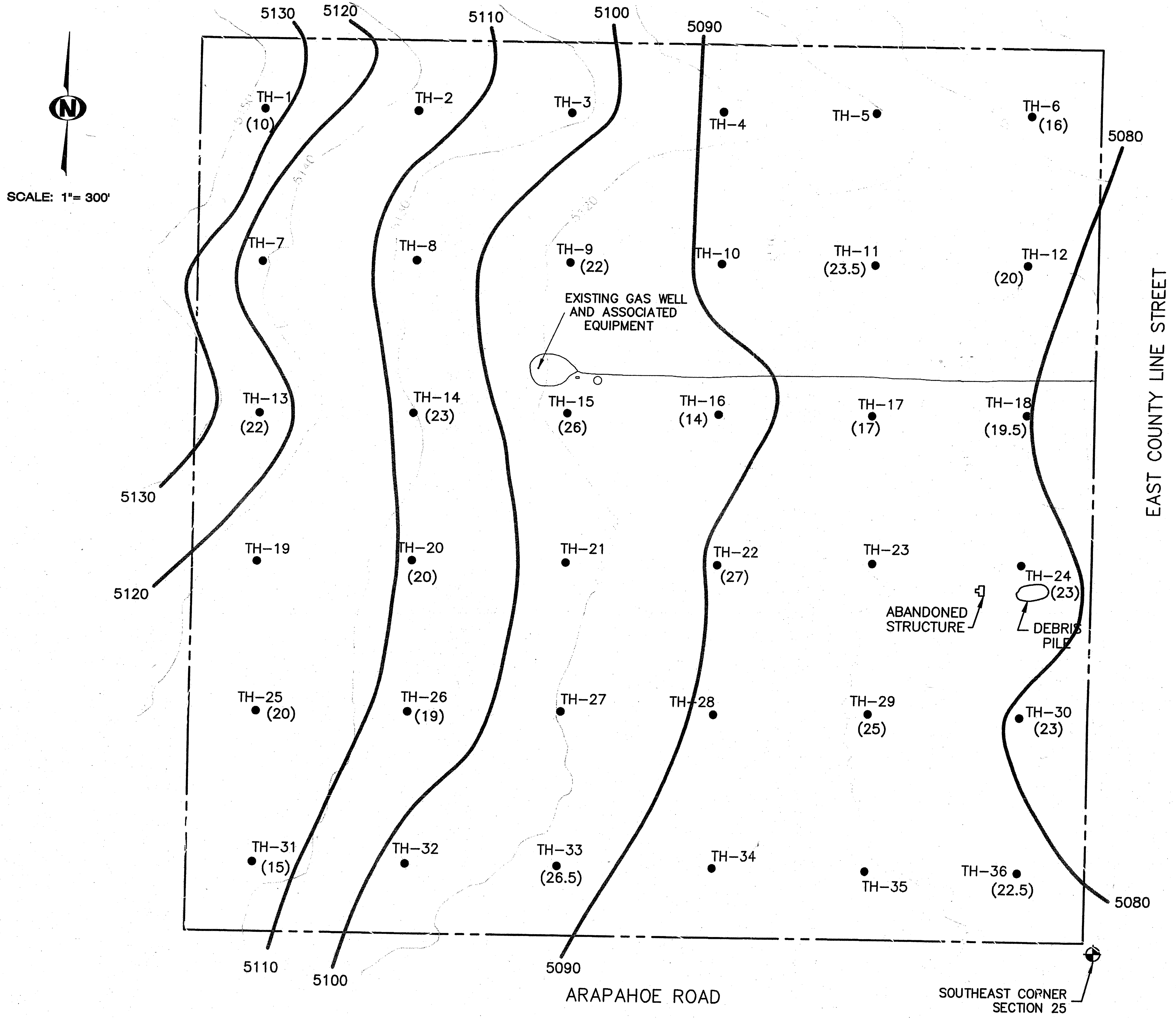
NOTE:
THIS ESTIMATE WAS BASED UPON A SUBJECTIVE ANALYSIS OF DRILL HOLE DATA AND MAY NOT REFLECT LOCAL VARIATIONS.

32,213_f2 1/02/01 MB

Meadow Sweet Farm
Southeast 1/4 of Section 25, T1N, R69W
Job No. 32,213

Estimated Elevation and Depth to Bedrock

Fig. 2



LEGEND:

TH-1 ●	INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING
	INDICATES EXISTING GROUND SURFACE ELEVATION (FEET)
5100 ▬	INDICATES ESTIMATED ELEVATION OF GROUND WATER SURFACE (FEET)
(10)	INDICATES MEASURED DEPTH TO GROUND WATER SURFACE FROM THE EXISTING GROUND SURFACE AT BORING LOCATION (FEET)

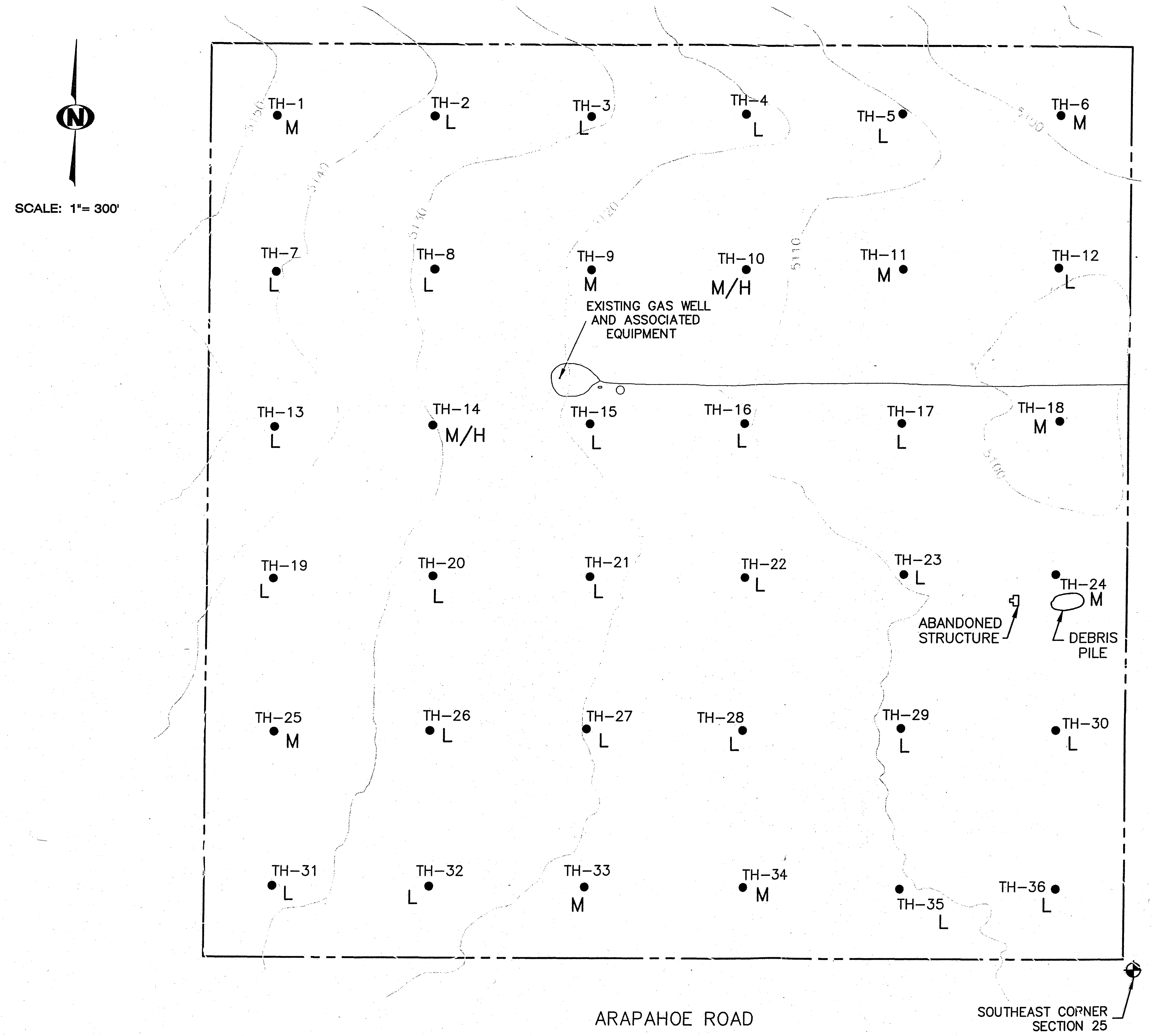
NOTE:
THIS ESTIMATE WAS BASED UPON A SUBJECTIVE ANALYSIS OF DRILL HOLE DATA AND MAY NOT REFLECT LOCAL VARIATIONS AND SEASONAL FLUCTUATIONS.

32,213_f3 1/02/01 MB

Meadow Sweet Farm
Southeast 1/4 of Section 25, T1N, R69W
Job No. 32,213

Estimated Elevation and Depth To Ground Water

Fig. 3



LEGEND:

TH-1 ●	INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING
5100	INDICATES EXISTING GROUND SURFACE ELEVATION (FEET)
L	LOW SWELL POTENTIAL
M	MODERATE SWELL POTENTIAL
M/H	MODERATE TO HIGH SWELL POTENTIAL

NOTE:
THIS ESTIMATE WAS BASED ON A SUBJECTIVE ANALYSIS OF LABORATORY TESTING RESULTS AND DRILL HOLE DATA. SWELL POTENTIAL IS LIKELY TO VARY BETWEEN BORINGS AND BE AFFECTED BY SITE GRADING.

32,213_f4 12/29/00 MB

Meadow Sweet Farm
Southeast 1/4 of Section 25, T1N, R69W
Job No. 32,213

Preliminary Swell Potential Evaluation

Fig. 4

CTL | THOMPSON
INCORPORATED

SUPPLEMENTAL
PRELIMINARY GEOTECHNICAL INVESTIGATION
COMPASS, FILING NO. 4
NORTHWEST OF ARAPAHOE ROAD AND
EAST COUNTY LINE ROAD
ERIE, COLORADO

Prepared for:

CALATLANTIC GROUP
d/b/a CalAtlantic Homes
6161 South Syracuse Way, Suite 200
Greenwood Village, Colorado 80111-4788

Attention: Kent Pedersen

Project No. DN48,913-115

June 5, 2017

TABLE OF CONTENTS

SCOPE

This report presents the results of our Supplemental Preliminary Geotechnical Investigation for Compass, Filing No. 4 located northwest of Arapahoe Road and East County Line Road in Erie, Colorado (Fig. 1). The purpose of our investigation was to evaluate the subsurface conditions to assist in planning of site development and residential construction. The report includes descriptions of soil and groundwater conditions found in our exploratory borings, and discussions of site development and construction as influenced by geotechnical considerations. The scope was described in a Proposal (DN17-0192) revised April 19, 2017.

This report is based on subsurface conditions found in our exploratory borings, results of field and laboratory tests, engineering analysis of field and laboratory data, previous investigations and our experience with similar projects. The report contains discussions of geologic hazards, recommendations for site development, and preliminary estimates for pavements, potential foundation and floor support alternatives, and surface and subsurface drainage. The preliminary discussions of foundation and floor system alternatives are intended for planning purposes only. Site (lot) specific investigations will be necessary to design residences. A brief summary of our conclusions and recommendations follows, with more detailed discussion in the report.

SUMMARY OF CONCLUSIONS

1. The site is judged favorable for residential development. The geologic hazard and geotechnical concerns include expansive and compressible soils. These concerns can be mitigated with proper planning, engineering, design and construction. We believe there are no geologic or geotechnical constraints at this site that would preclude development.

2. Strata encountered in our borings generally consisted of sandy clay and clayey sand and gravel to the maximum depth explored of 35 feet. Claystone bedrock was encountered in TH-24 at a depth of 23.5

feet below existing ground surface. The clayey soils varied from moderately compressible to moderately swelling. No distinguishable site-wide trends regarding compressible and expansive soils were found. The sand is largely non-expansive.

3. Groundwater was encountered at depths of 21 to 24 feet in three borings during drilling. When the holes were checked several days later, water was measured at depths of about 18.5 and 23 feet in two borings. The current groundwater levels should not affect construction. Groundwater levels will likely fluctuate seasonally and may rise in response to precipitation and landscape irrigation.

4. We estimate total potential ground heave could range from less than 0.5-inch to about 2.5 inches considering a depth of wetting of 24 feet after grading. The data from most borings indicate potential heave of less than 1 inch. We anticipate shallow foundations can be used across the site provided estimated movement is tolerable. Mass over-excavation does not appear to be merited. Over-excavation may be merited for a few structures.

5. Preliminary data suggests local residential streets will require at least 5.5 to 6 inches of asphalt or an equivalent composite section. A design-level subgrade investigation should be done prior to paving.

6. Control of surface and subsurface drainage will be critical to the performance of foundations, slabs-on-grade and pavements. Overall surface drainage should be designed to provide rapid run-off of surface water away from structures, and off of pavements and flatwork.

SITE CONDITIONS

Compass, Filing No. 4 is located northwest of Arapahoe Road and East County Line Road in Erie, Colorado (Fig. 1 and Photo 1). The site is bordered by East County Line Road to the east, land under development to the south and vacant farmland to the north and west. The site slopes gently to the east. The ground surface is covered with native grasses and weeds.

Photo 1. Google Earth© Aerial Site Photo 10/2015

SITE GEOLOGY AND GEOLOGIC HAZARDS

The geology and existence of geologic hazards on this parcel were evaluated using available literature and site reconnaissance. According to the Geologic mapping of the Erie Quadrangle (Roger B. Colton and Larry W. Anderson, USGS Map MF-882, 1977) the site is underlain by windblown deposits of clay, silt and sand overlying the Laramie Formation which consists of silty claystone and sandstone.

Our study identified potential geologic hazards including expansive and compressible clay, and expansive claystone bedrock. These hazards can be mitigated with proper planning, engineering, design and construction. No geotechnical constraints were identified within the scope of this investigation which, in our opinion, will preclude the residential development at the site. The hazards we identified include conceptual mitigation methods are discussed in the following sections.

Expansive and Compressible Clayey Soils

The clay is potentially expansive and wind-blown soils can compress when wetted. Data from our investigation indicates potential movements are low for most areas. There is risk that ground heave or settlement will damage pavements, slabs-on-grade, and foundations. Engineered design of grading, pavements, foundations, slabs-on-grade, and surface drainage can mitigate, but not eliminate, the effects of expansive and compressible soil.

Seismicity

Based on available mapping, we found no active faults within or near the site. The soil is not expected to respond unusually to seismic activity. According to the 2012 International Residential Code (IRC) for seismic design, we believe the site classifies as Site Class D due to deeper bedrock. Only minor damage to new, properly designed and constructed buildings would be expected. Wind loads, not seismic considerations, generally govern dynamic structural design in this area.

Radioactivity

It is normal in the Front Range of Colorado and nearby eastern plains area to measure radon gas in poorly ventilated spaces (e.g., full depth residential basements) in contact with soil or bedrock. Radon 222 gas is considered a health hazard and is just one of several radioactive products in the chain of the natural decay of uranium into lead. Radioactive nuclides are common in the soil underlying the subject site. Because these sources exist or will exist on most sites in the area, there is a potential for radon gas accumulation in poorly ventilated spaces. The concentration of radon that can develop is a function of many factors, including the radionuclide activity of the soil, construction methods and materials, soil gas pathways, and accumulation areas. The only reliable method to determine if a hazard exists is to perform radon testing of completed residential structures to determine the level of radon gas accumulation. Typical mitigation methods consist of sealing soil gas entry areas, ventilation of below-grade spaces, and venting from foundation drain systems. Radon rarely accumulates to significant levels in above-grade living spaces. We recommend provision for ventilation of foundation drain systems to allow mitigation if a radon issue is discovered.

Other Considerations

Erosion potential on the site is considered low due to the gentle slopes. Erosion potential will increase during construction, but should return to pre-construction rates or less if proper grading practices, surface drainage design, and re-vegetation efforts are implemented.

Development will increase the relative amount of impervious surfaces, which can lead to drainage problems and erosion if surface water flow is not adequately designed. Surface drainage design and evaluation of flood potential should be performed by a Civil Engineer as part of the project design.

There are coal seams within the lower portions of the Laramie formation. We reviewed the 1975 Amuedo and Ivey study of coalmines in the Boulder-Weld coal field, and the 1986 Dames & Moore study of Boulder County. No mines are indicated beneath the site or within a distance close enough to affect this site.

We did not identify significant mineral aggregate sources in our borings. It appears economically valuable aggregate resources would not be expected on the parcel. Economic coal or other energy minerals are not likely under the parcel.

PROPOSED DEVELOPMENT

We understand the project will be developed for paired townhome construction. It is unclear at this time whether the paired residences will have basements.

We anticipate cut and fill depths will likely be approximately 10 feet or less. We anticipate the residences will be one or two-story, wood-framed structures. The residences may have partial brick or stone veneer exterior wall treatments. Paved streets will provide access throughout the development.

PREVIOUS INVESTIGATIONS

We performed a Geologic and Preliminary Geotechnical Investigation for the overall, 160-acre Erie Farm site and presented results in a report dated January 3, 2001 (Job No. 32,213). Our investigation included drilling 36 borings, 6 of which were drilled in Filing No. 4. We found sandy clay and slightly silty to clayey sand over weathered and comparatively unweathered claystone and sandstone bedrock. Boring logs and a summary of laboratory data from this previous preliminary investigation are included in Appendix D.

CTL Thompson subsequently performed a Supplemental Preliminary Geotechnical Investigation for the Phase I area south and southwest of Filing No. 4 and presented results in a report dated April 15, 2013 (Project No. DN46,532-115-R1). We encountered sandy clay and silty to clayey sand underlain by claystone bedrock at depth.

CTL Thompson also performed a Supplemental Preliminary Geotechnical Investigation for Filing No. 3 adjacent to Filing No. 4 to the west and presented results in a report dated May 4, 2017 (Project No. DN46,532-115-R2). We encountered sandy clay and clayey sand and gravel underlain by weathered and comparatively unweathered claystone bedrock.

During subsequent design studies for Filing Nos. 1 and 2, we found variable collapsing and swelling soils. Pertinent data from the previous investigations were considered in preparation of this report.

INVESTIGATION

We investigated subsurface conditions by drilling 24 exploratory borings at the locations shown on Fig. 1. The boring locations and ground surface elevations were surveyed by Diamondback Engineering and Surveying prior to drilling. Before initiating our investigation, we contacted the Utility Notification Center of Colorado and local sewer and water districts to clear boring locations for conflicts with buried utilities. The borings were advanced to depths of 20 to 30 feet using solid stem, continuous-flight auger and a truck-mounted drill rig.

Samples of the soil and bedrock were obtained at 2 to 5-foot intervals using 2.5-inch diameter (O.D.) modified California barrel samplers driven by a 140-pound hammer falling 30 inches. Representatives of CTL | Thompson, Inc. were present during drilling to observe drilling operations, log the soil and obtain samples. Summary logs of the exploratory borings are presented in Appendix A.

Samples were returned to our laboratory where they were examined by our engineers. Laboratory tests included dry density, moisture content, percent silt and clay-sized particles (passing the No. 200 sieve), Atterberg limits, swell-consolidation, soil suction and water-soluble sulfate concentration. Swell-consolidation tests were performed by wetting the samples under approximate post-grading overburden pressures (the weight of the overlying soil). Results of laboratory tests are presented in Appendix B and are summarized on the logs of the exploratory borings.

SUBSURFACE CONDITIONS

Strata encountered in our borings generally consisted of sandy clay and clayey sand and gravel to the maximum depth explored of 35 feet. Claystone bedrock was encountered in TH-24 at a depth of 23.5 feet below existing ground surface. Pertinent engineering characteristics of the soils are presented in the following paragraphs.

Sand and Clay

Clean to clayey sand and sandy clay were encountered from the ground surface to depths of 20 to 30 feet in all borings. The sand was loose to very dense and the clay was medium stiff to very stiff based on results of field penetration resistance tests. Seventy-eight samples were tested for swell/consolidation, as summarized in Table A below. Low swell or compression (less than 2%) was measured on about 90% of the samples tested. We also evaluated the collapse potential of the soils tested using comparisons of dry density and moisture content, as described by White and Greenman[1] and identified 4 borings where soils classifying as moderate to high collapse potential were indicated and confirmed by swell tests. A chart showing the dry density and moisture content of the sand and clay samples and associated collapse susceptibility is provided below. No distinguishable trends regarding swell potential and collapse susceptibility were apparent. Ten samples contained 29 to 76 percent silt and clay-sized particles (passing No. 200 sieve) and exhibited low to moderate plasticity.

TABLE A – Summary of Swell/Consolidation Testing

Soil Type	Range of Measured Compression / Collapse (%)				Range of Measured Swell (%)		
	6 or more	4 to 5.9	2 to 3.9	0.1 to 1.9	0 to ≤1.9	2 to ≤3.9	4 or more
	Number of Samples and Percent						
Clay	0 0%	1 2%	3 5%	20 30%	36 55%	6 9%	0 0%
Sand	0 0%	1 8%	1 8%	6 50%	4 33%	0 0%	0 0%
Overall	0 0%	2 3%	4 5%	26 33%	40 51%	6 8%	0 0%

---

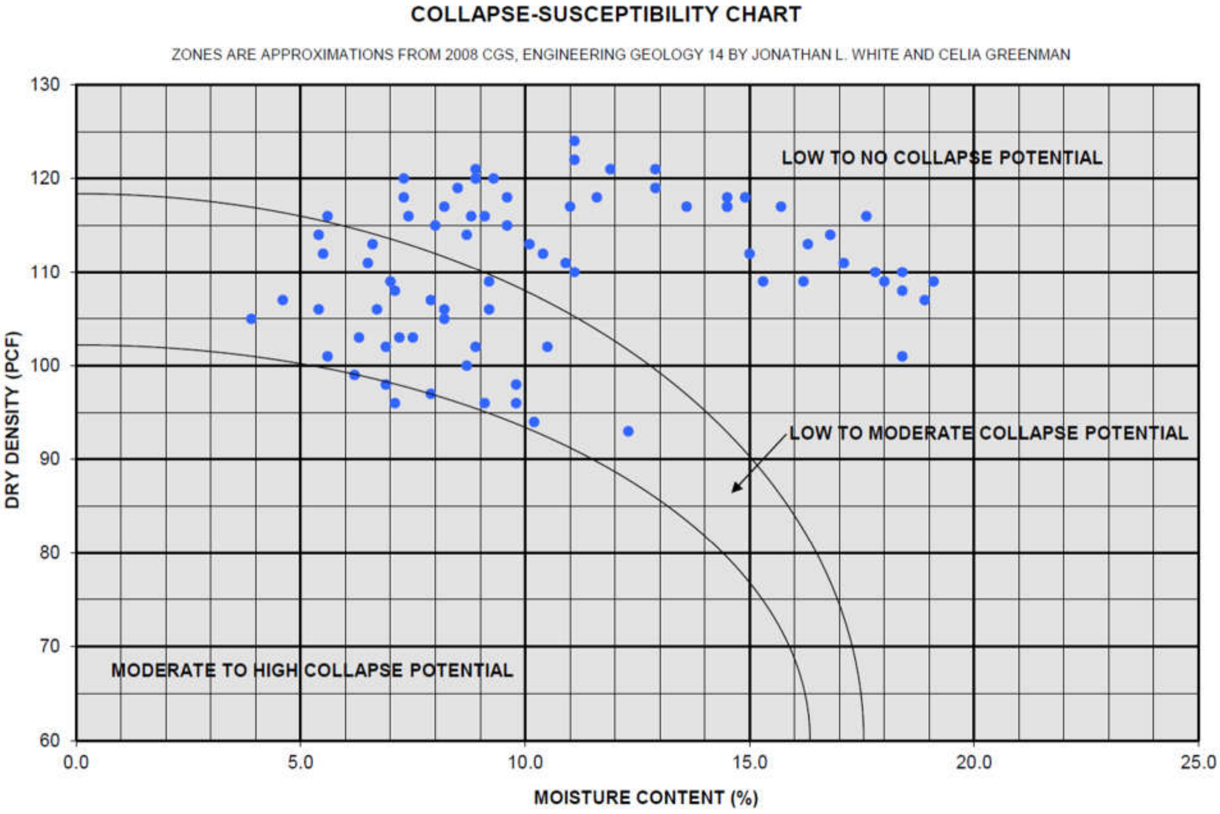
[1] White & Greenman, “Collapsible Soils in Colorado,” Colorado Geological Survey, Engineering Geology Publication 14, 2008

Gravel

Clayey gravel was encountered below the sand and clay in two borings. The gravel was medium dense to very dense. No gravel samples were tested. We judge the gravel is non-expansive.

Bedrock

Claystone bedrock was encountered in TH-24 at a depth of 23.5 feet below existing ground surface. The bedrock was medium hard. One claystone sample swelled 1.8 percent when wetted. The claystone is expansive but at depths unlikely to affect construction.



Groundwater

Groundwater was encountered at depths of 21 to 24 feet in three borings during drilling. When the holes were checked several days later, water was measured at depths of about 18.5 and 23 feet in two borings. The current groundwater levels should not affect construction. Groundwater levels will likely fluctuate seasonally and may rise in response to precipitation and landscape irrigation.

ESTIMATED POTENTIAL HEAVE

We used the results of swell tests to evaluate potential heave of the soils below the site. The analysis involves dividing the soil profile into layers and modeling the heave of each layer from representative swell tests. Based on the swell-consolidation test results and our experience, we estimate total potential heave at the ground surface after site grading could range from less than 0.5-inch to about 2.5 inches considering a depth of wetting of 24 feet. The data from most borings indicate potential heave of less than 1 inch. It is not certain the potential heave will occur. Overall, the site is judged favorable.

SITE DEVELOPMENT

The primary geotechnical concerns that we believe will influence development and building performance are the presence of expansive and compressible soils. The data indicate potential movement should be low. These concerns can be mitigated with proper planning, engineering, design and construction. We do not believe mass over-excavation is merited. It may be necessary to over-excavate individual building areas based on conditions found after site grading. We believe there are no geotechnical constraints that would preclude development. The following sections provide site development recommendations.

Site Grading

We believe grading can be accomplished using conventional heavy-duty construction equipment. The ground surface in areas to be filled should be stripped of vegetation, scarified, and moisture conditioned to between optimum and 3 percent above optimum moisture content for clay and within 2 percent of optimum for sand, and compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698). We anticipate stripping may require cuts of 2 to 5 inches for the majority of the site.

The properties of fill will affect the performance of foundations, slabs-on-grade, utilities, pavements, flatwork and other improvements. If imported soil is needed to achieve site grades, the material should be tested and approved by our firm prior to importing to the site. The on-site soils are suitable for use as site grading fill provided they are substantially free of debris, organics and other deleterious materials. Fill should be placed in thin loose lifts, moisture conditioned and compacted prior to placement of the next lift using the criteria presented in the previous paragraph. The placement and compaction of site grading fill should be observed and density tested by our representative during construction. Guideline grading specifications are presented in Appendix C.

Excavation

We believe the soils penetrated by our exploratory borings can be excavated with typical heavy-duty equipment. We recommend the owner and the contractor become familiar with applicable local, state and federal safety regulations, including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards. Based on our investigation and OSHA standards, we anticipate the onsite clayey soils will classify as Type B or C and granular, sandy soils will classify as Type C based on OSHA Standards governing excavations are published in 29 CFR, Part 1926. Type B and Type C soils require a 1:1

(horizontal:vertical) and 1½:1 slope, respectively, for temporary excavations in dry conditions. Excavation slopes specified by OSHA are dependent upon soil types and groundwater conditions encountered. The contractor's "competent person" should identify the soils encountered in the excavations and refer to OSHA standards to determine appropriate slopes. Stockpiles of soils and equipment should not be placed within a horizontal distance equal to one-half the excavation depth from the edge of the excavation. A professional engineer should design excavations deeper than 20 feet.

Utilities

Water and sewer lines are usually constructed beneath paved roads. Compaction of trench backfill can have a significant effect on the life and serviceability of pavements. Trench backfill should be placed in thin (8 inches or less), loose lifts and moisture conditioned to between optimum and 3 percent above optimum moisture content for clay, and compacted to at least 95 percent of maximum dry density (ASTM D 698). Sand fill should be moisture conditioned to within 2 percent of optimum moisture content and compacted to at least 95 percent of maximum dry density. The placement and compaction of utility trench backfill should be observed and tested by a representative of our firm during construction.

Our experience indicates use of a self-propelled compactor results in more reliable performance compared to backfill "compacted" by a sheepsfoot wheel attachment on a backhoe or trackhoe. The upper portion of the trenches should be widened to allow use of a self-propelled compactor. Special attention should be paid to backfill placed adjacent to manholes as we have seen instances where settlement in excess of 2 percent has occurred. Any improvements placed over backfill should be designed to accommodate movement.

Underdrain

Groundwater levels will fluctuate seasonally and may rise after development in response to landscape irrigation. We typically advocate an underdrain system installed below sanitary sewer mains and services to control groundwater that may accumulate in response to development and provide a gravity outlet for foundation drains. With current groundwater levels, we do not believe an underdrain system is mandatory.

Pavements

Pavement subgrade soils will likely consist of sandy clay, clayey sand or fill of similar composition. Clay soil is considered relatively poor pavement subgrade. Sand is considered better subgrade. A summary of anticipated minimum pavement sections is shown in the table below. Design-level subgrade investigations should be done prior to paving. The design may indicate marginally thicker pavements are necessary.

Roadway Classification	Asphalt	Asphalt Concrete (AC) + Aggregate Base Course (ABC)	Portland Cement Concrete (PCC)
Local Residential	5”	3” AC + 6” ABC	5” PCC
Minor Collectors	6”	3.5” AC + 7” ABC	6” PCC

BUILDING CONSTRUCTION CONSIDERATIONS

The following discussions are preliminary and are not intended for design or construction. After grading is completed, design-level investigations should be performed on a lot-specific basis.

Foundations

Clayey sand and sandy clay are present at depths likely to influence the performance of shallow foundations and slabs-on-grade. Shallow foundations such as footings can likely be used across the site. It may be necessary to sub-excavate a few building areas to mitigate potential movement. Additional investigation of each lot should be conducted after grading is completed.

Slab-On-Grade Construction

Slab-on-grade basement floors may be considered on low and some moderate risk sites where potential heave is acceptable to builders and home buyers. Structurally supported basement floors should be used on lots with high or very high risk of poor basement slab performance. We believe low risk conditions will predominate across the site.

The performance of garage floors, driveways, sidewalks, and other surface flatwork may be poor where expansive soils are present. The following precautions will be required to reduce the potential for damage due to movement of slabs-on-grade for this site.

1. Isolation of the slabs from foundation walls, columns and other slab penetrations;
2. Voiding of interior partition walls to allow for slab movement without transferring movement to the structure;
3. Flexible water and gas connections to allow for slab movement. A flexible plenum above furnaces will be required; and
4. Proper surface grading and foundation drain installation to reduce water availability to sub-slab and foundation soils

Below-Grade Areas

Surface water can penetrate relatively permeable loose backfill soils located adjacent to residences and collect at the bottom of relatively impermeable basement or crawl space excavations causing wet or moist conditions. Basement foundation walls and crawl space grade beams should be designed for lateral earth pressures. Foundation drains should be constructed around the lowest excavation levels and ideally should be connected to an underdrain system (if constructed) to provide a gravity outlet. The drains can be connected to a sump pit where water can be removed by pumping if an underdrain is not provided.

Surface Drainage

The performance of improvements will be influenced by surface drainage. When developing an overall drainage scheme, consideration should be given to drainage around each residence. The ground surface around the residences should be sloped to provide positive drainage away from the foundations. We recommend a slope of at least 10 percent for the first 10 feet surrounding residences with basements and 5 percent for residences with no basements, where practical. If the distance between houses is less than 20 feet, the slope in this area should be 10 percent to the swale between houses with basements. Where possible, drainage swales should slope at least 2 percent. Variation from these criteria is acceptable in some areas. For example, for basement lots graded to direct drainage from the rear yard to the front, it is difficult to achieve the recommended slope at the high point behind a house. We believe it is acceptable to use a slope of about 6 inches in the first 10 feet (5 percent) in this instance and others when achieving 10 percent is not practical. Roof downspouts and other water collection systems should discharge beyond the limits of all backfill around structures.

Proper control of surface runoff is also important to control the erosion of surface soils. Sheet flow should not be directed over unprotected slopes. Water should not be allowed to pond at the crest of slopes. Permanent slopes should be prepared in such a way to reduce erosion.

Attention should be paid to compact the soils behind curb and gutter adjacent to streets and in utility trenches during the development. If surface drainage between preliminary development and construction phases is neglected, performance of the roadways, flatwork and foundations may be poor.

Concrete

Concrete in contact with soil can be subject to sulfate attack. We measured water-soluble sulfate concentrations in five samples from this site. Concentrations were measured between 0.01 and 0.03 percent. For this level of sulfate concentration, ACI 332-08 *Code Requirements for Residential Concrete* indicates there are no special requirements for sulfate resistance.

Superficial damage may occur to the exposed surfaces of highly permeable concrete, even though sulfate levels are relatively low. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious materials ratio should not exceed 0.50 for concrete in contact with soils that are likely to stay moist due to surface drainage or high water tables. Concrete should have a total air content of 6 percent +/- 1.5 percent. We advocate all foundation walls and grade beams in contact with the subsoils (including the inside and outside faces of garage and crawl space grade beams) be damp-proofed.

RECOMMENDED FUTURE INVESTIGATIONS

We recommend the following investigations and services:

1. Construction testing and observation during site development, grading, and pavement construction.
2. Subgrade investigation and pavement design(s) after grading;
3. Design-level Soils and Foundation Investigation(s) after grading; and
4. Foundation installation observations.

CONSTRUCTION OBSERVATIONS

This report has been prepared for the exclusive use of CalAtlantic Group and your design and construction team to provide geotechnical design and construction criteria for development. The information, conclusions, and recommendations presented herein are based upon consideration of many factors including, but not limited to, the type of structures proposed, the geologic setting, and the subsurface conditions encountered.

We recommend that CTL | Thompson, Inc. provide construction observation services to allow us the opportunity to verify whether soil conditions are consistent with those found during this investigation. If others perform these observations, they must accept responsibility to judge whether the recommendations in this report remain appropriate.

GEOTECHNICAL RISK

The concept of risk is an important aspect with any geotechnical evaluation primarily because the methods used to develop geotechnical recommendations do not comprise an exact science. We never have complete knowledge of subsurface conditions. Our analysis must be tempered with engineering judgment and experience. Therefore, the recommendations presented in any geotechnical evaluation should not be considered risk-free. Our recommendations represent our judgment of those measures that are necessary to increase the chances that the structures will perform satisfactorily. It is critical that all recommendations in this report are followed during construction.

LIMITATIONS

Our borings were widely spaced to provide a general picture of subsurface conditions for preliminary planning of development and residence construction. Variations in the subsoil conditions not indicated by our borings are likely. We believe this investigation was conducted in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing in this area at this time. No warranty, express or implied, is made.

If we can be of further service in discussing either the contents of this report or the analysis of the influence of subsurface conditions on the design of the proposed development, please call.

CTL | THOMPSON, INC.

Ryan Lickteig

Ryan Lickteig, E.I.T.
Staff Engineer

Reviewed by:

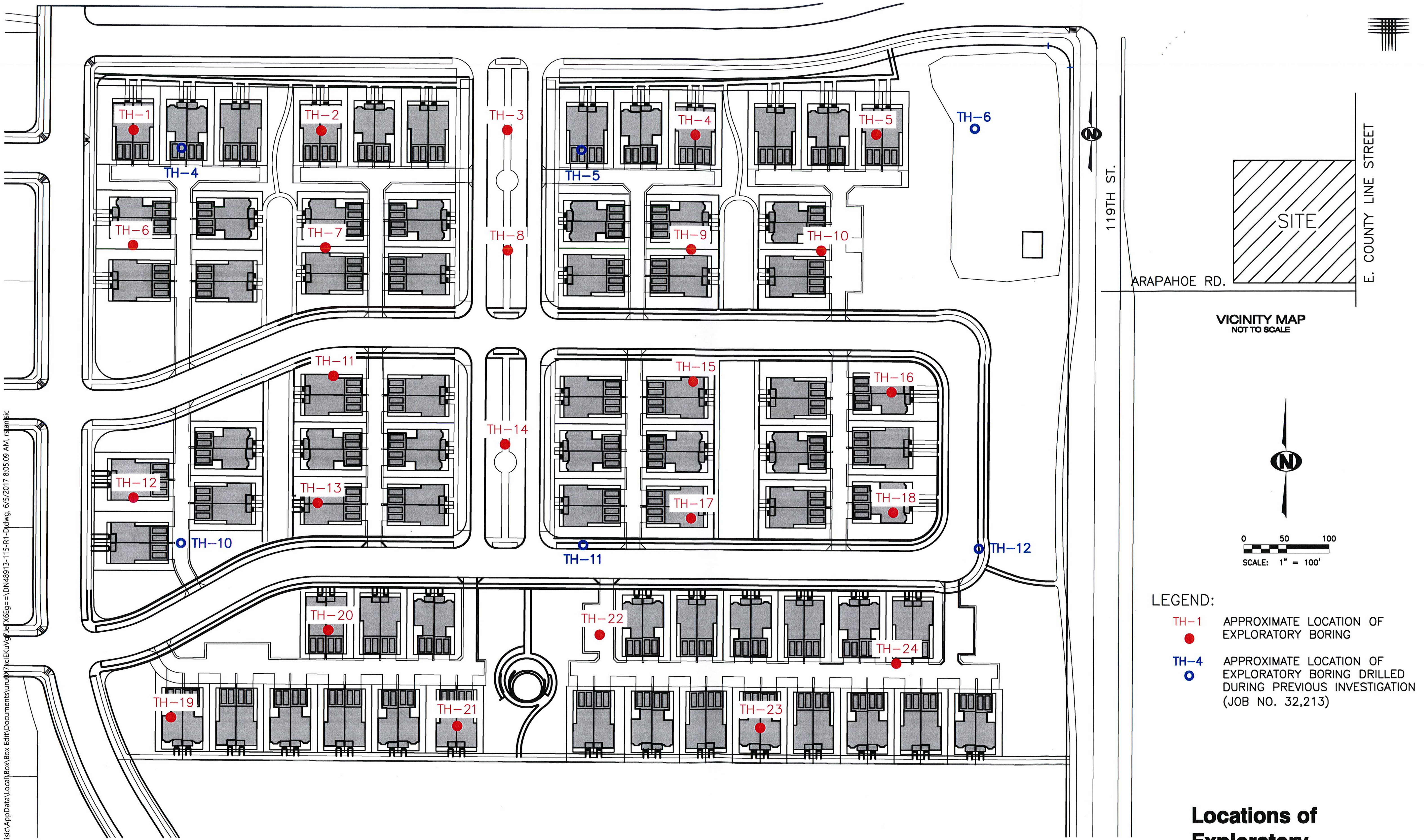
32516

Alan J. Lisowy, P.E.
Associate Engineer

6/5/17

RL:AJL/ot
(3 copies)

Via e-mail: kent.pedersen@calatl.com

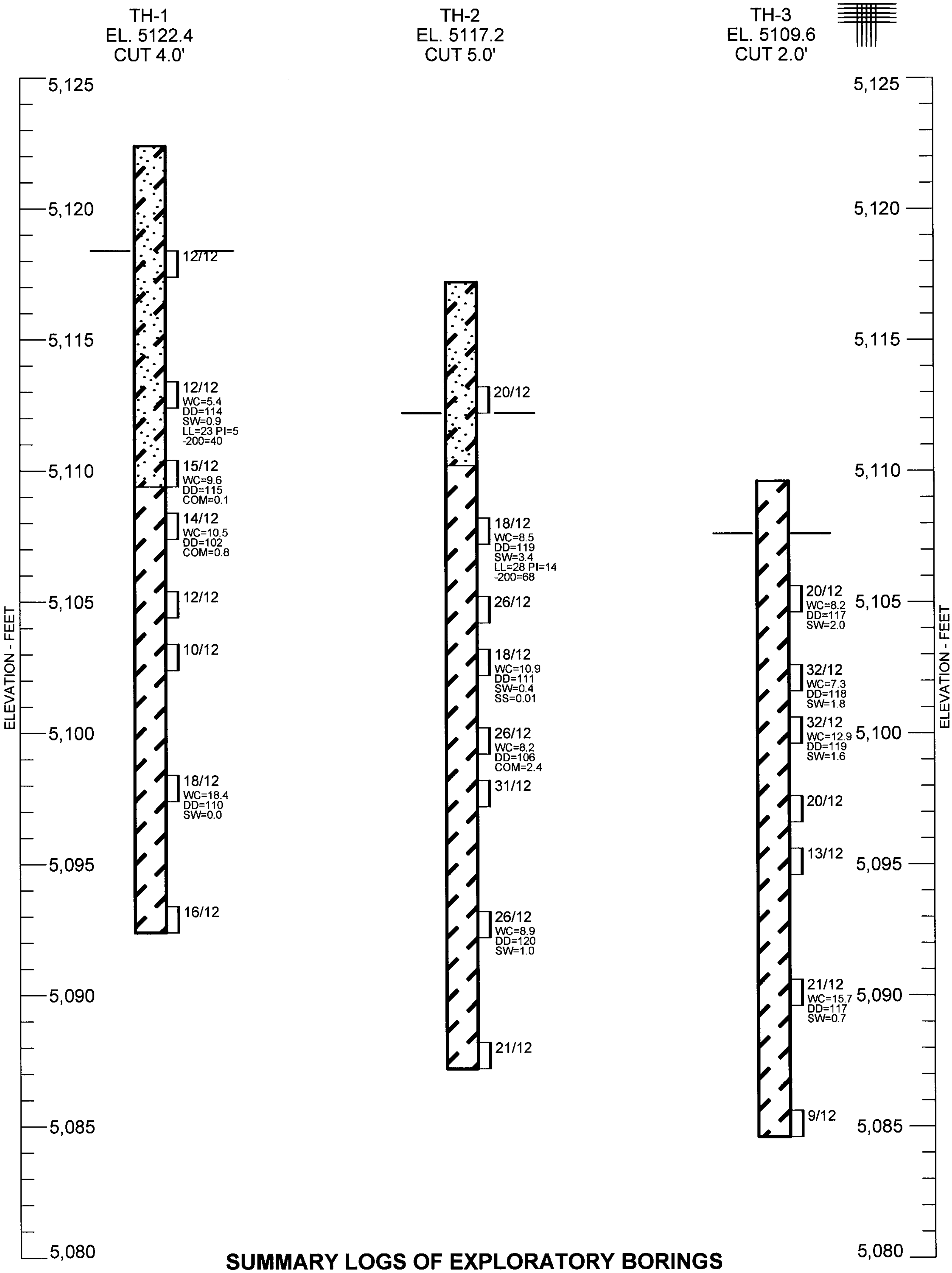


CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL\T Project No. DN48,913-115-R1

Locations of Exploratory Borings

Fig. 1

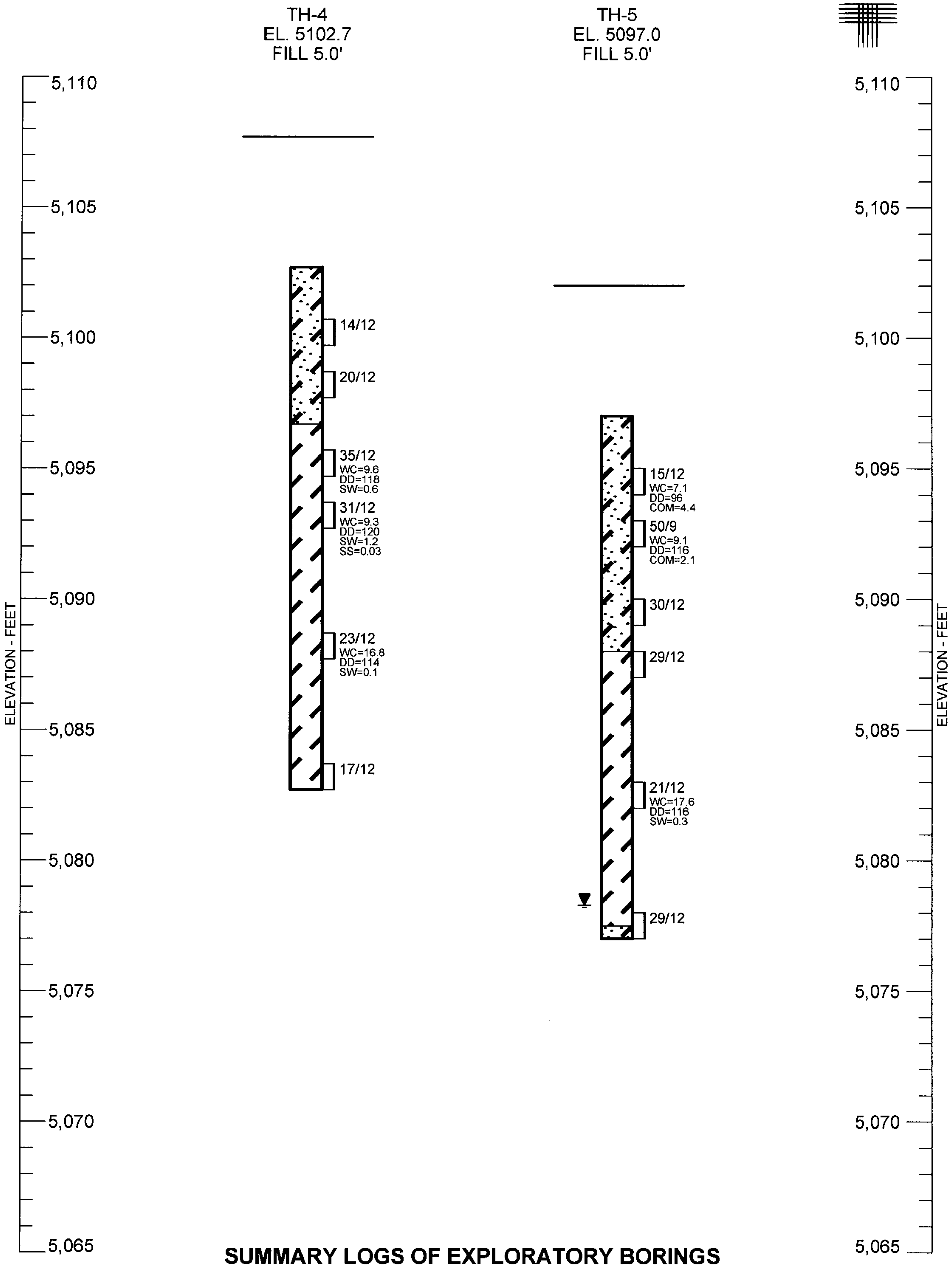
APPENDIX A
SUMMARY LOGS OF EXPLORATORY BORINGS



SUMMARY LOGS OF EXPLORATORY BORINGS

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

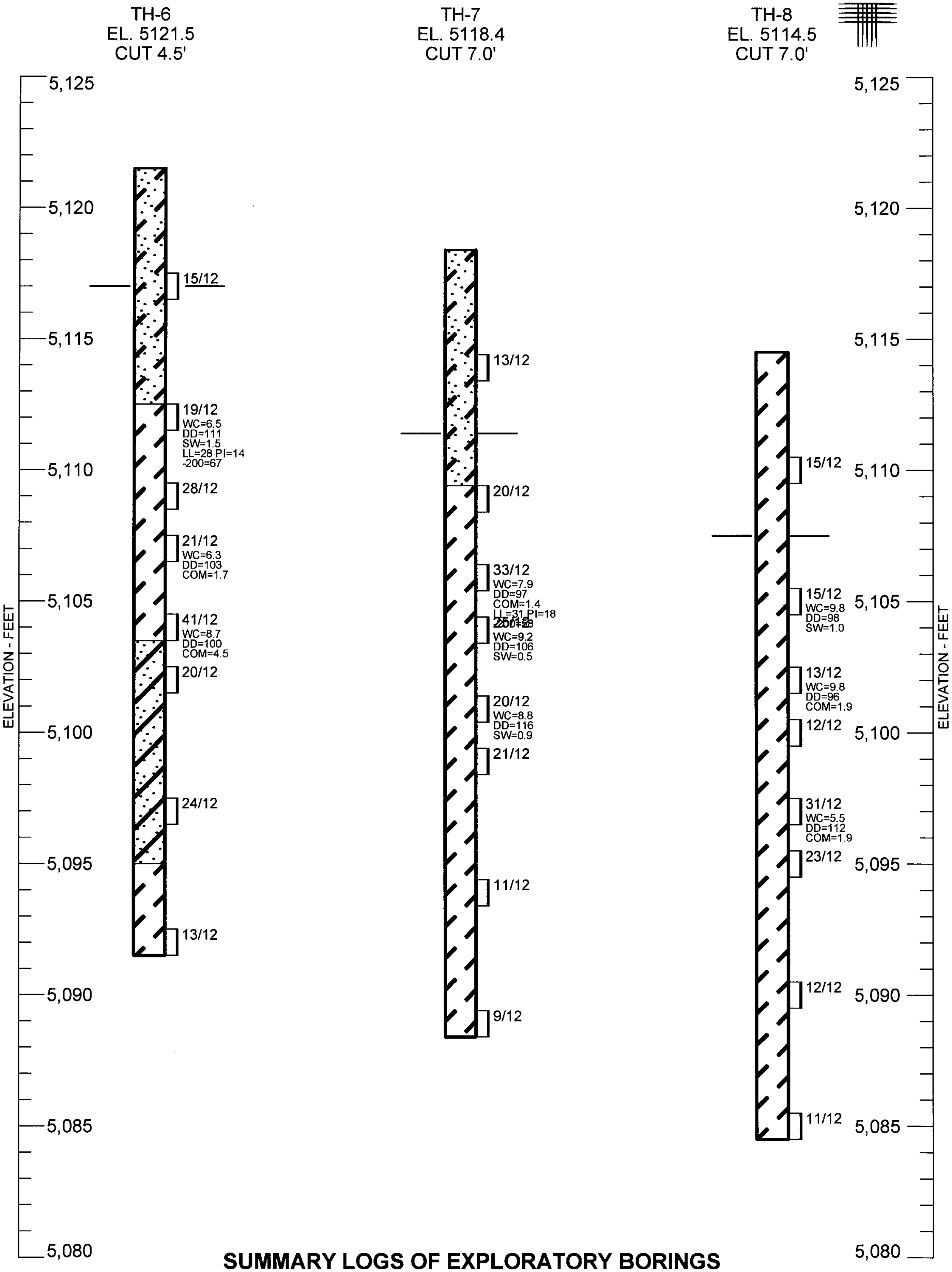
FIG. A- 1



SUMMARY LOGS OF EXPLORATORY BORINGS

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

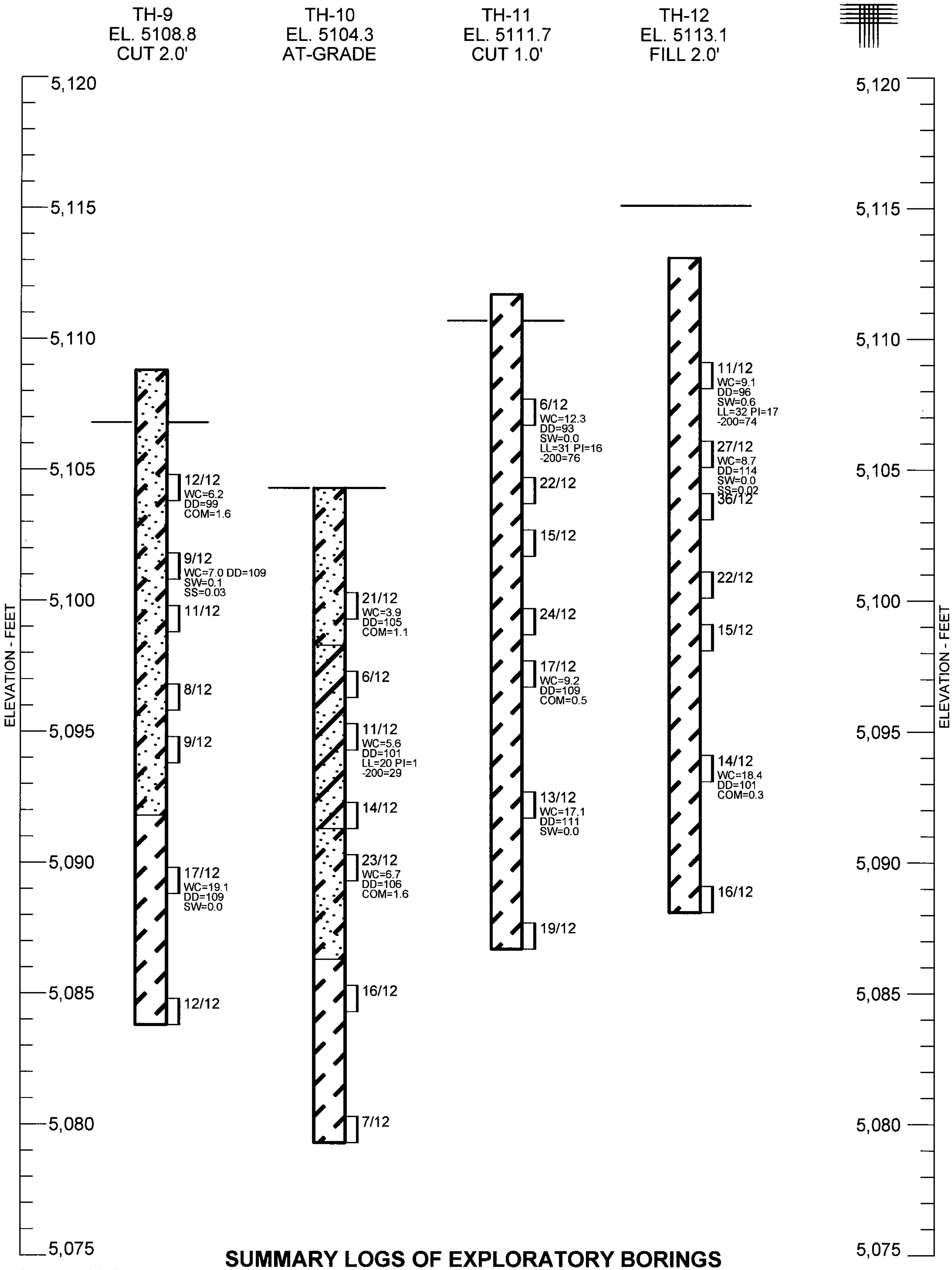
FIG. A- 2



SUMMARY LOGS OF EXPLORATORY BORINGS

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

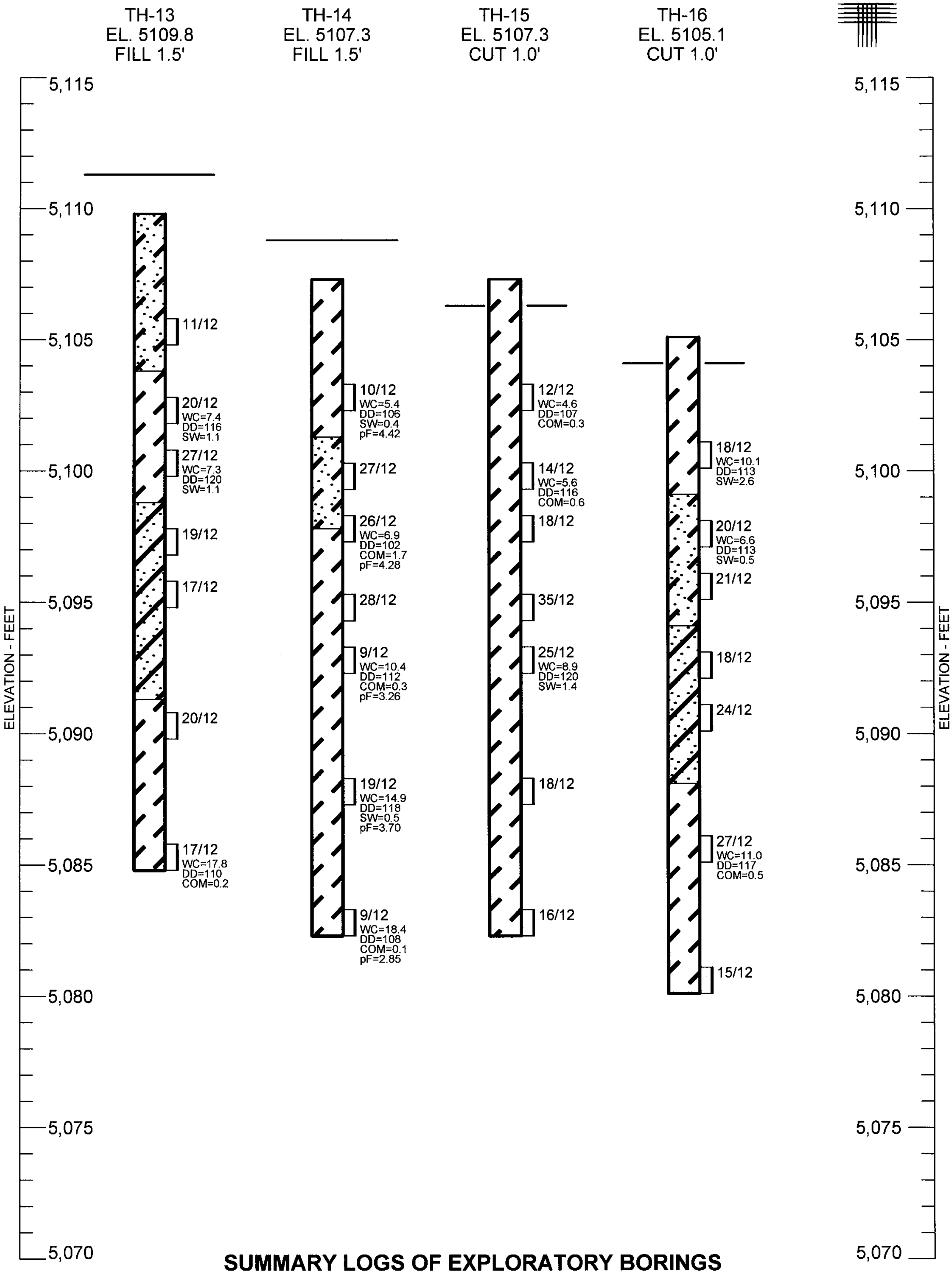
FIG. A- 3



SUMMARY LOGS OF EXPLORATORY BORINGS

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

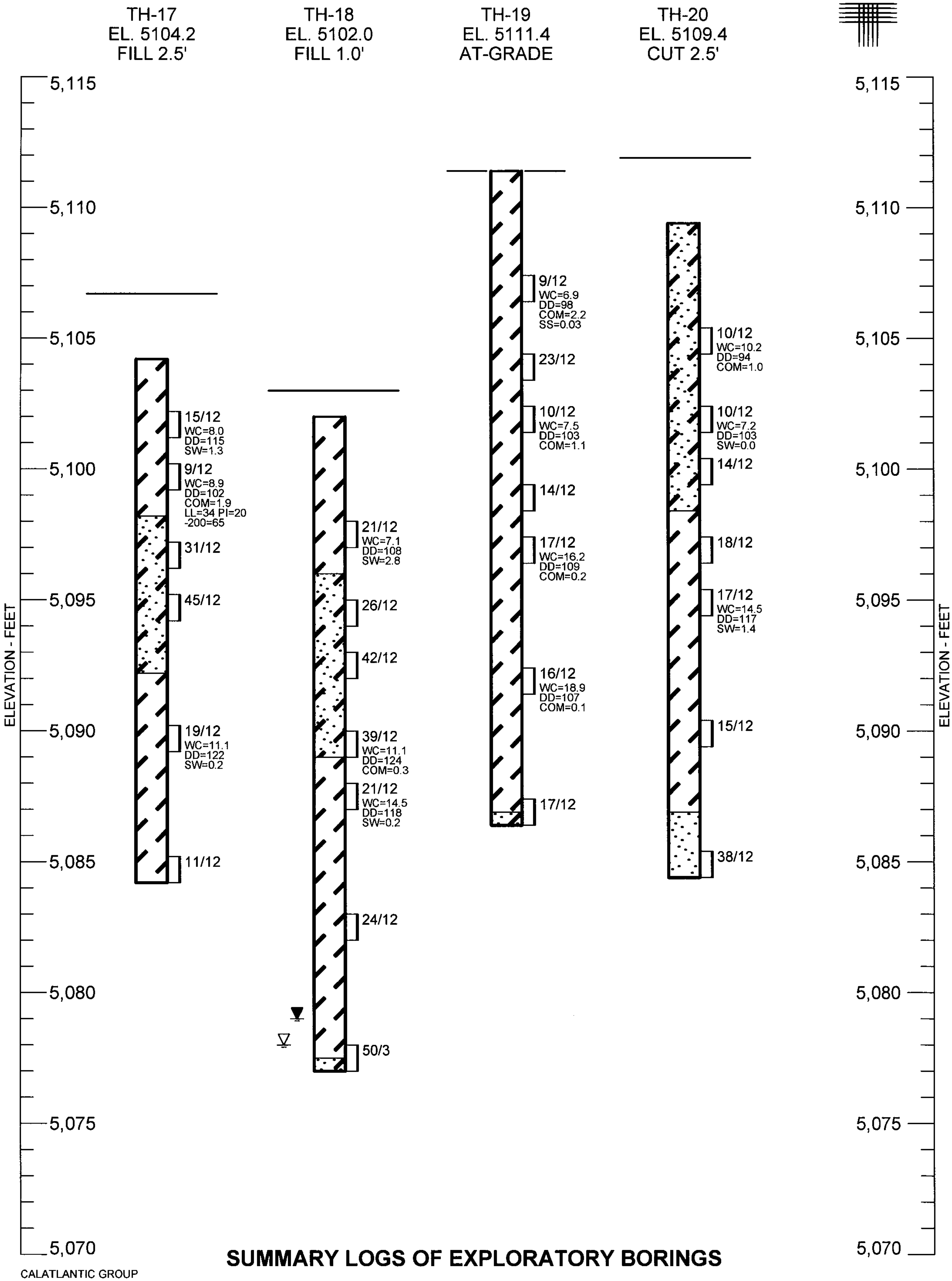
FIG. A- 4



SUMMARY LOGS OF EXPLORATORY BORINGS

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

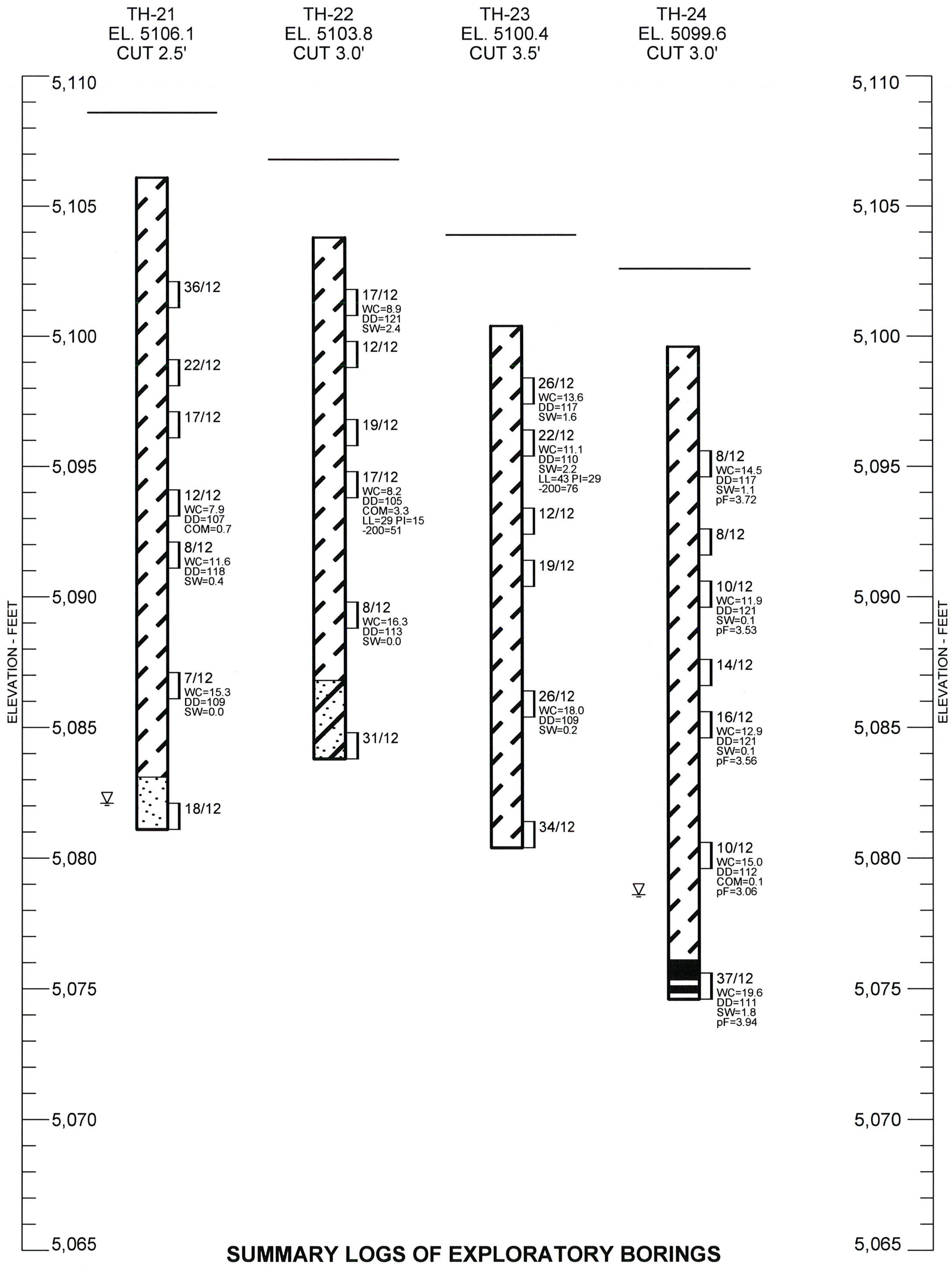
FIG. A- 5



SUMMARY LOGS OF EXPLORATORY BORINGS

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

FIG. A- 6



SUMMARY LOGS OF EXPLORATORY BORINGS

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

LEGEND:

▨ CLAY, SANDY, MEDIUM STIFF TO VERY STIFF, DRY TO MOIST, BROWN, TAN, RUST (CL).

▨ SAND, CLAYEY, LOOSE TO VERY DENSE, DRY TO SLIGHTLY MOIST, BROWN (SC).

▨ SAND, SILTY, LOOSE TO DENSE, DRY, BROWN, TAN (SM).

▨ SAND, CLEAN TO SLIGHTLY SILTY, MEDIUM DENSE TO DENSE, DRY TO SLIGHTLY MOIST, BROWN (SP, SP-SM).

▨ GRAVEL, CLAYEY, MEDIUM DENSE TO VERY DENSE, MOIST TO WET, BROWN (GC).

■ BEDROCK, CLAYSTONE, MEDIUM HARD, SLIGHTLY MOIST, GRAY, BROWN.

] DRIVE SAMPLE. THE SYMBOL 12/12 INDICATES 12 BLOWS OF AN AUTOMATIC 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.

∇ WATER LEVEL MEASURED AT TIME OF DRILLING.

▼ WATER LEVEL MEASURED AFTER DRILLING ON MAY 19, 2017.

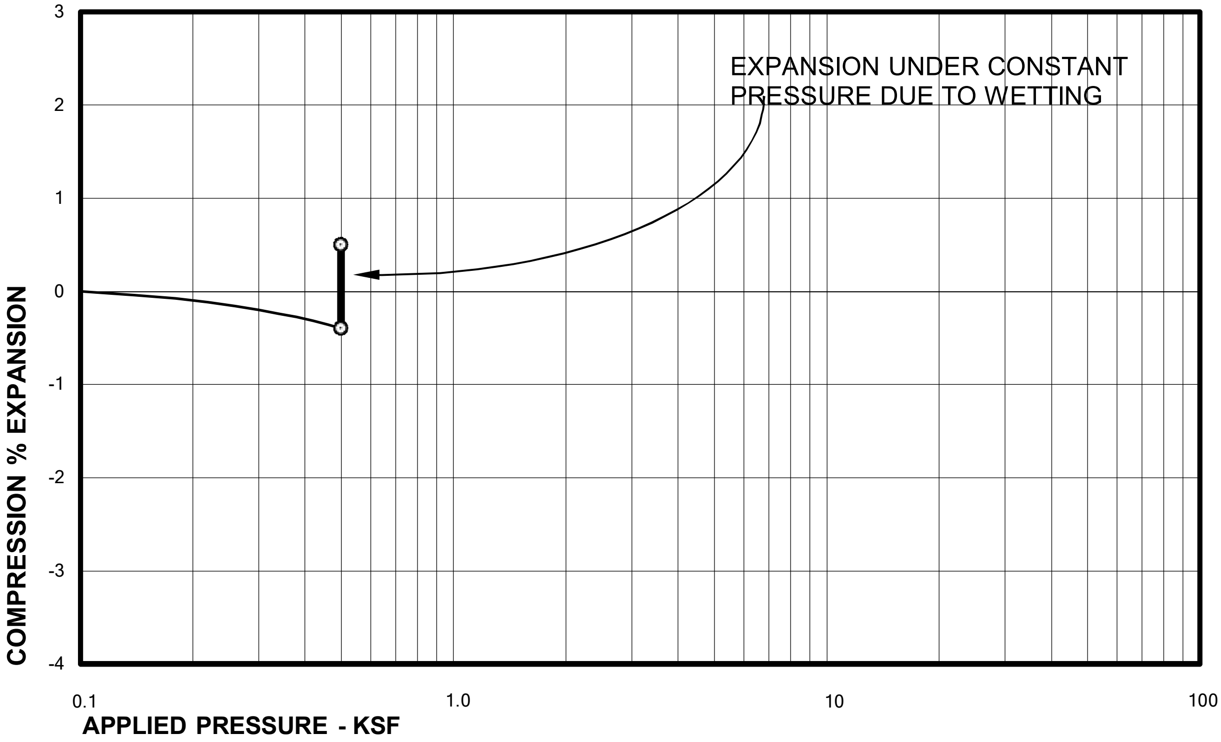
NOTES:

1. THE BORINGS WERE DRILLED BETWEEN MAY 12 AND 17, 2017 USING 4-INCH DIAMETER, CONTINUOUS-FLIGHT SOLID-STEM AUGER AND A TRUCK-MOUNTED CME-45 DRILL RIG.
2. BORING LOCATIONS AND ELEVATIONS WERE DETERMINED BY A REPRESENTATIVE OF OUR FIRM REFERENCING THE TEMPORARY BENCHMARK SHOWN ON FIG. 1.
3. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS CONTAINED IN THIS REPORT.

FIG. A- 7

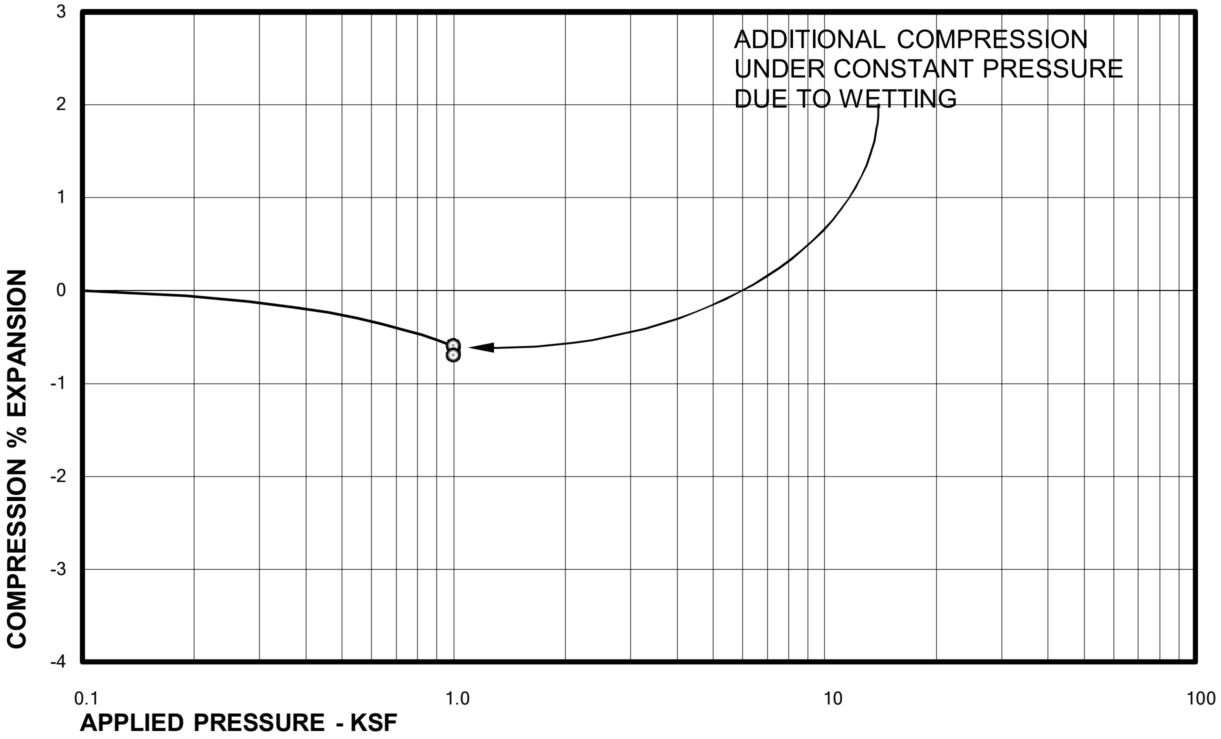
APPENDIX B

LABORATORY TEST RESULTS AND TABLE B-I



Sample of SAND, CLAYEY (SC)
From TH-1 AT 9 FEET

DRY UNIT WEIGHT= 114 PCF
MOISTURE CONTENT= 5.4 %



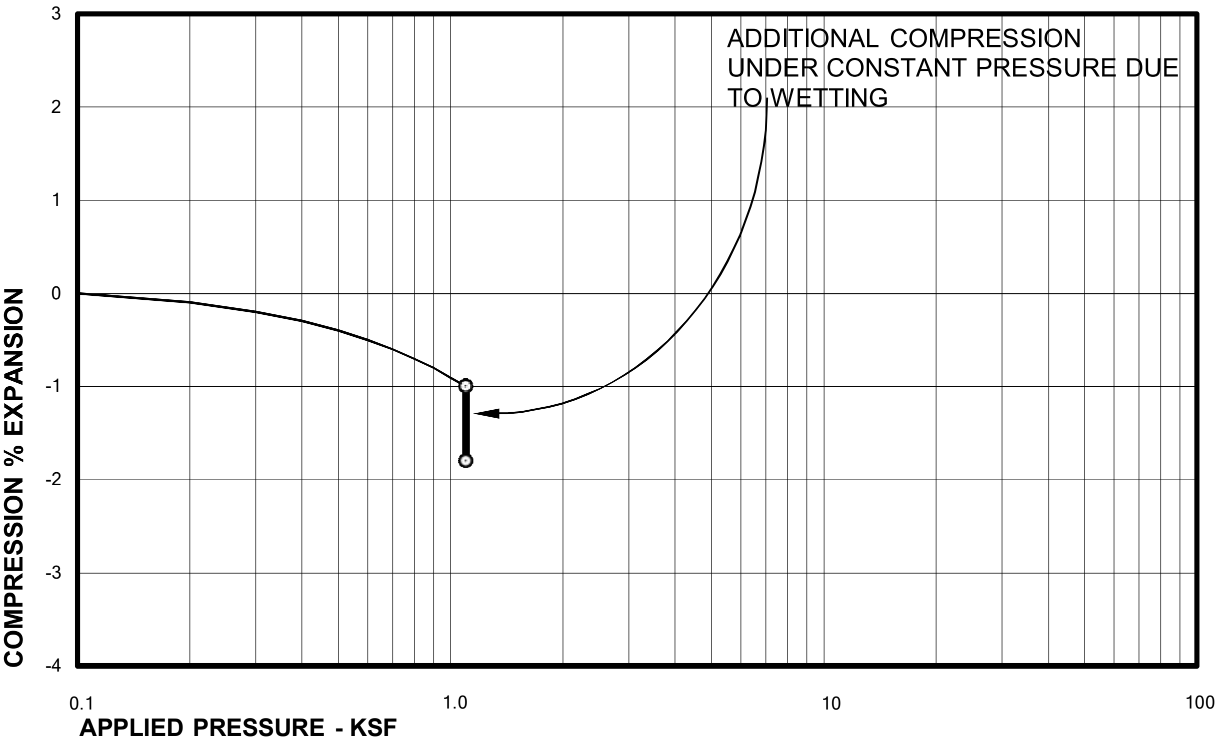
Sample of SAND, CLAYEY (SC)
From TH-1 AT 12 FEET

DRY UNIT WEIGHT= 115 PCF
MOISTURE CONTENT= 9.6 %

Swell Consolidation Test Results

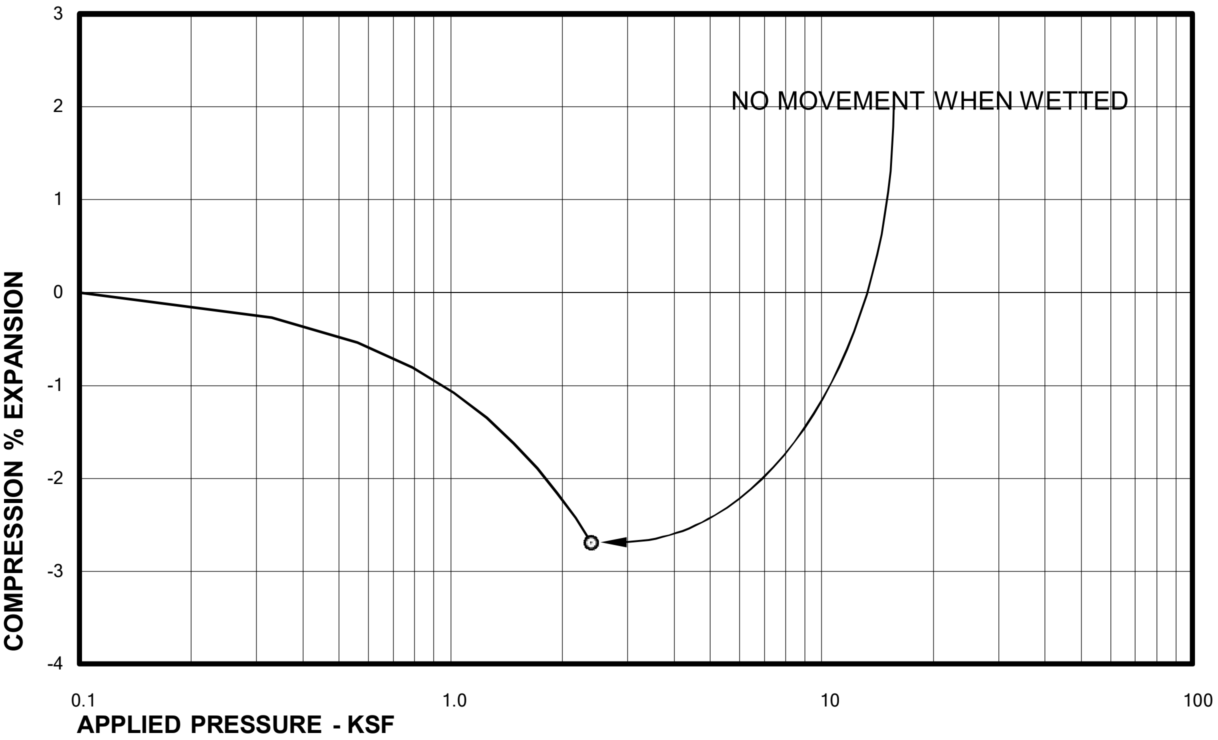
FIG. B-1

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of CLAY, SANDY (CL)
From TH-1 AT 14 FEET

DRY UNIT WEIGHT= 102 PCF
MOISTURE CONTENT= 10.5 %



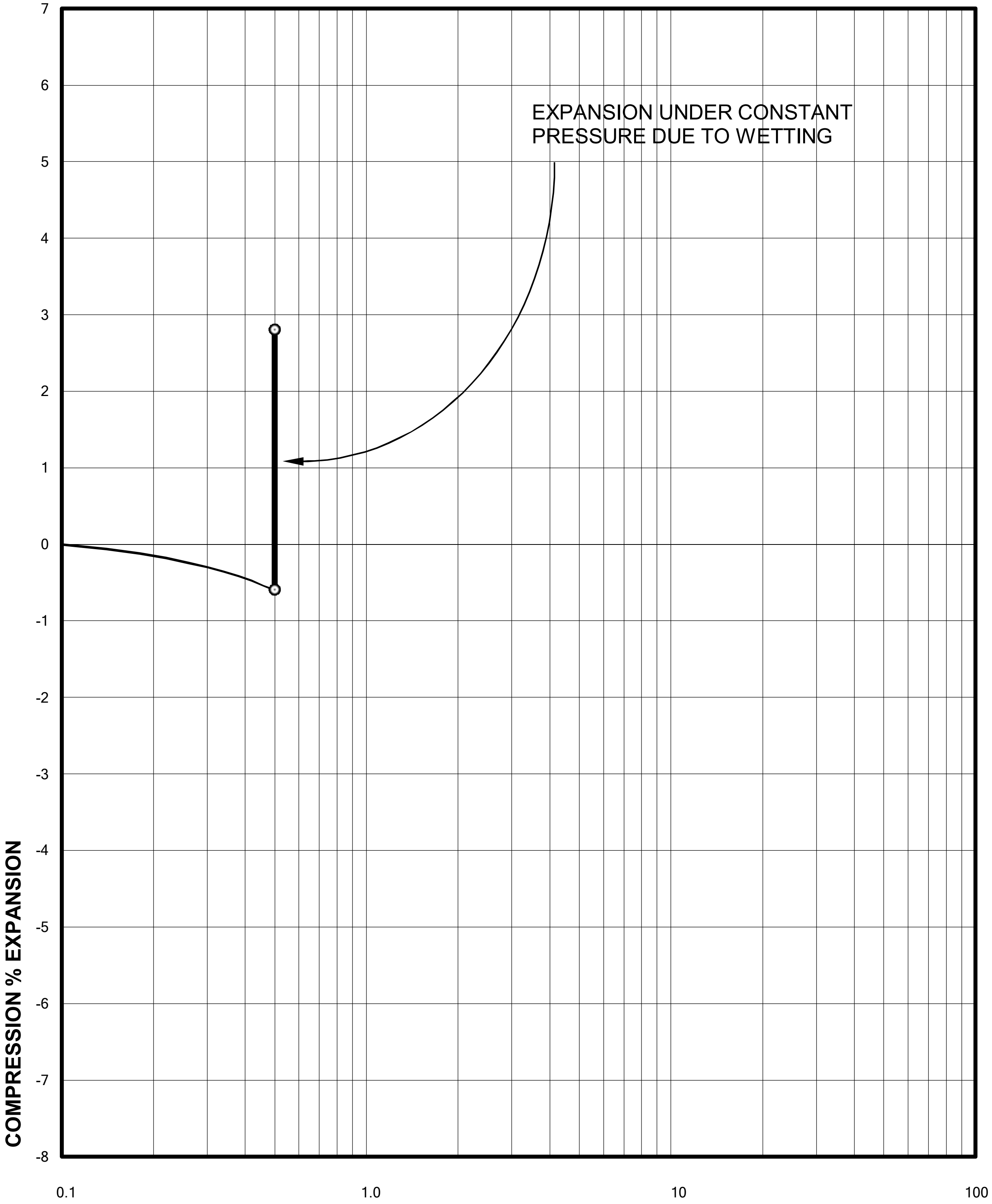
Sample of CLAY, SANDY (CL)
From TH-1 AT 24 FEET

DRY UNIT WEIGHT= 110 PCF
MOISTURE CONTENT= 18.4 %

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

Swell Consolidation Test Results

FIG. B-2



APPLIED PRESSURE - KSF

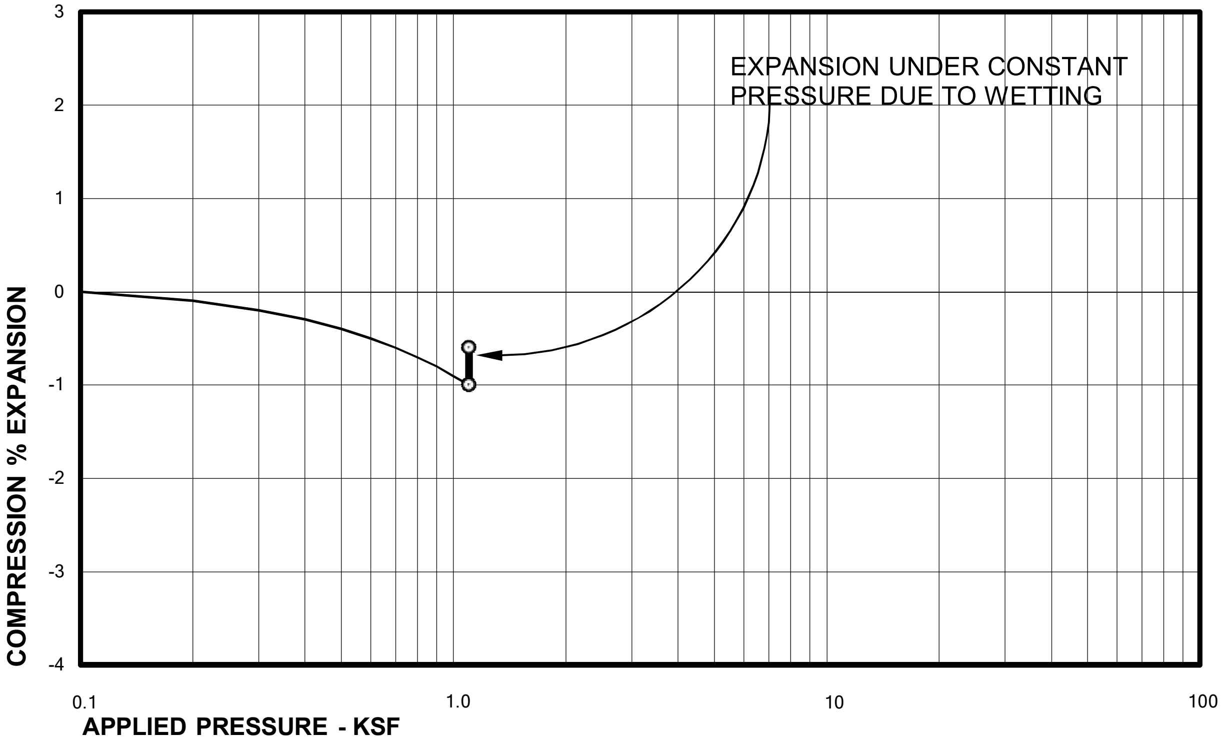
Sample of CLAY, SANDY (CL)
From TH-2 AT 9 FEET

DRY UNIT WEIGHT= 119 PCF
MOISTURE CONTENT= 8.5 %

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

Swell Consolidation Test Results

FIG. B-3

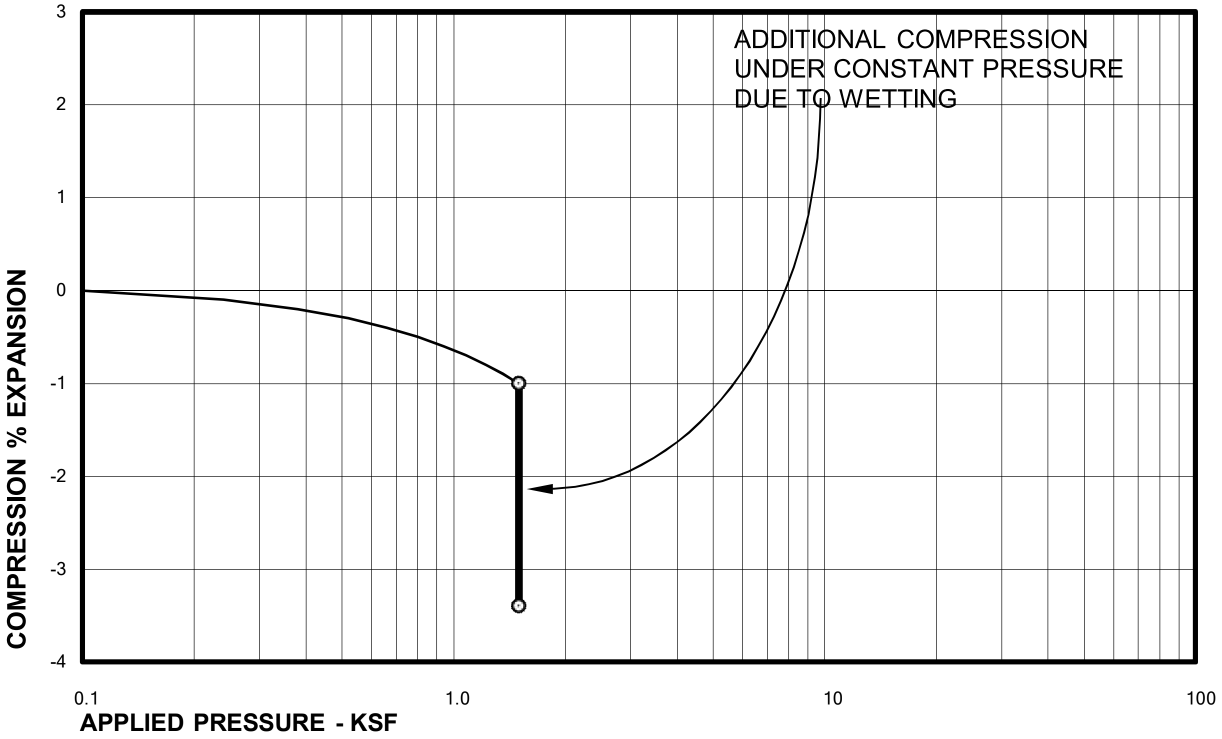


Sample of CLAY, SANDY (CL)

From TH-2 AT 14 FEET

DRY UNIT WEIGHT= 111 PCF

MOISTURE CONTENT= 10.9 %



Sample of CLAY, SANDY (CL)

From TH-2 AT 17 FEET

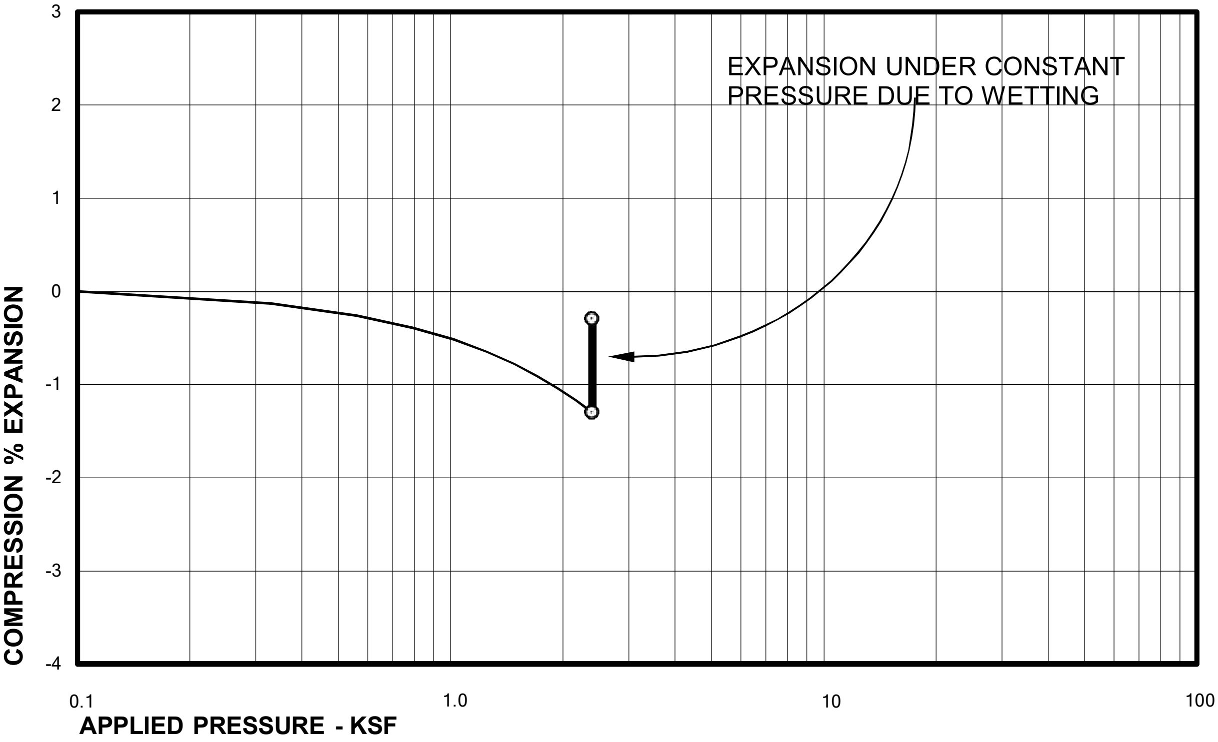
DRY UNIT WEIGHT= 106 PCF

MOISTURE CONTENT= 8.2 %

Swell Consolidation Test Results

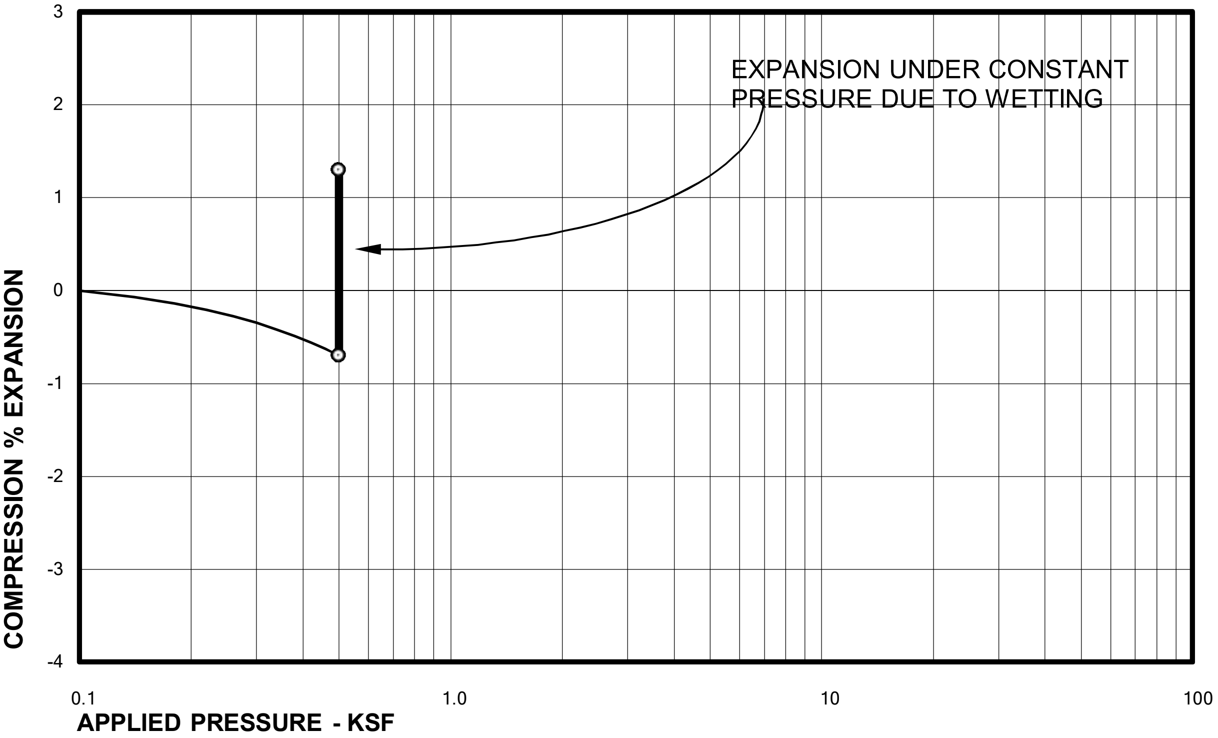
FIG. B-4

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of CLAY, SANDY (CL)
From TH-2 AT 24 FEET

DRY UNIT WEIGHT= 120 PCF
MOISTURE CONTENT= 8.9 %

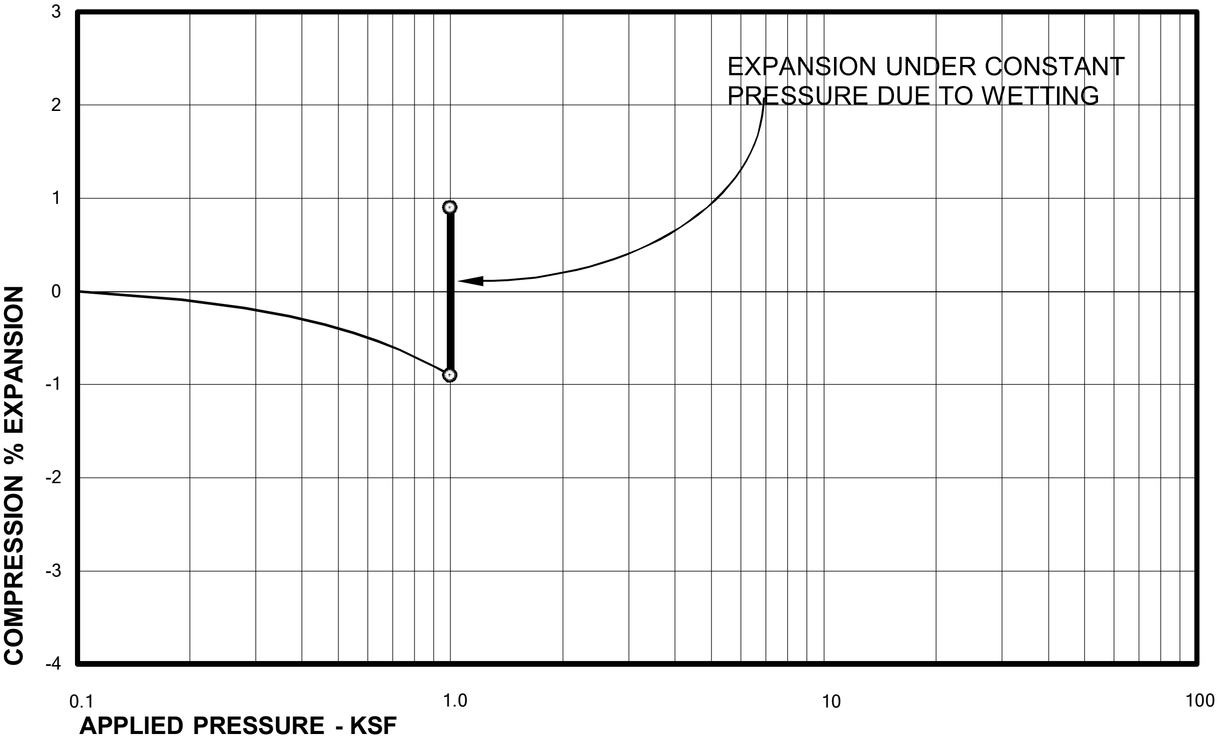


Sample of CLAY, SANDY (CL)
From TH-3 AT 4 FEET

DRY UNIT WEIGHT= 117 PCF
MOISTURE CONTENT= 8.2 %

Swell Consolidation Test Results

FIG. B-5

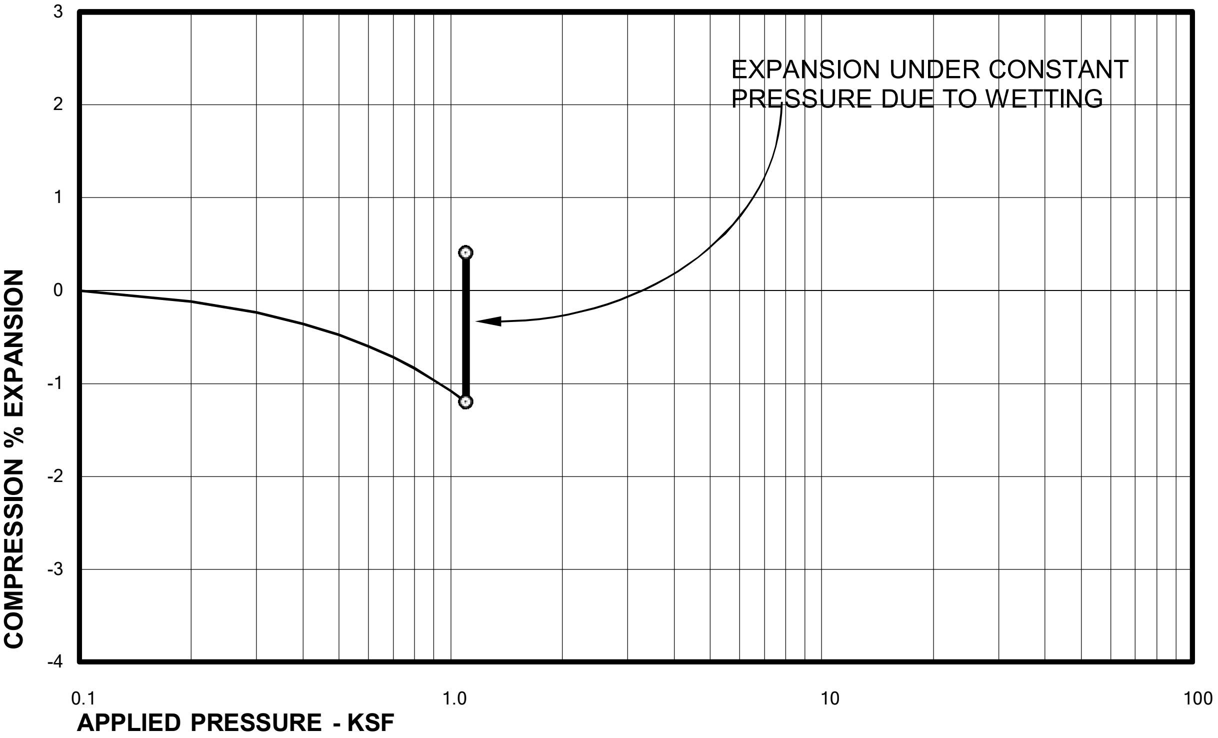


Sample of CLAY, SANDY (CL)

From TH-3 AT 7 FEET

DRY UNIT WEIGHT= 118 PCF

MOISTURE CONTENT= 7.3 %



Sample of CLAY, SANDY (CL)

From TH-3 AT 9 FEET

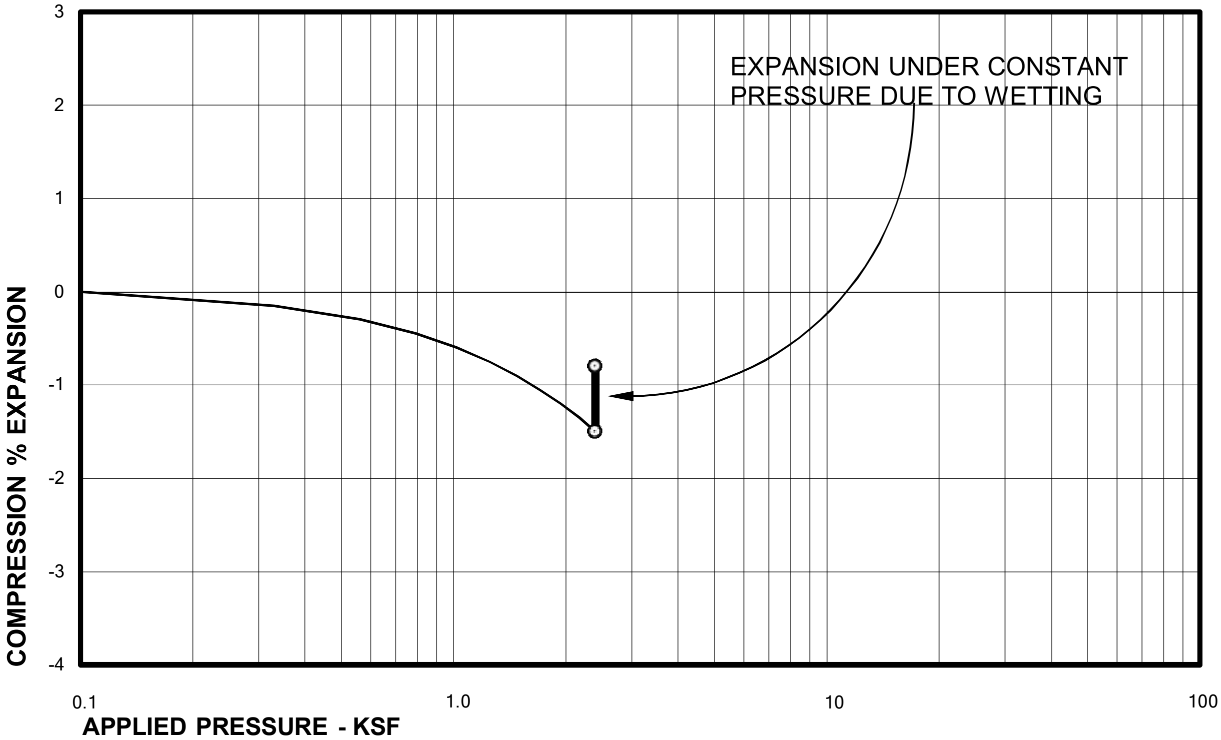
DRY UNIT WEIGHT= 119 PCF

MOISTURE CONTENT= 12.9 %

Swell Consolidation Test Results

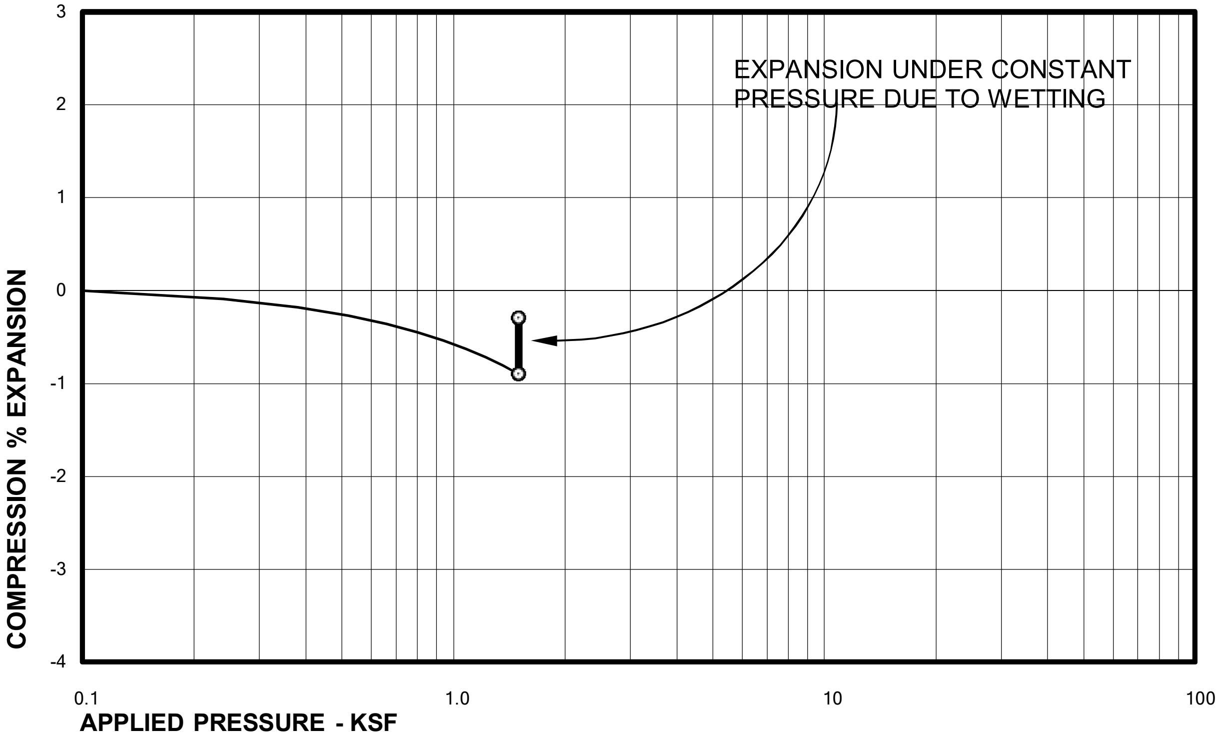
FIG. B-6

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of CLAY, SANDY (CL)
From TH-3 AT 19 FEET

DRY UNIT WEIGHT= 117 PCF
MOISTURE CONTENT= 15.7 %



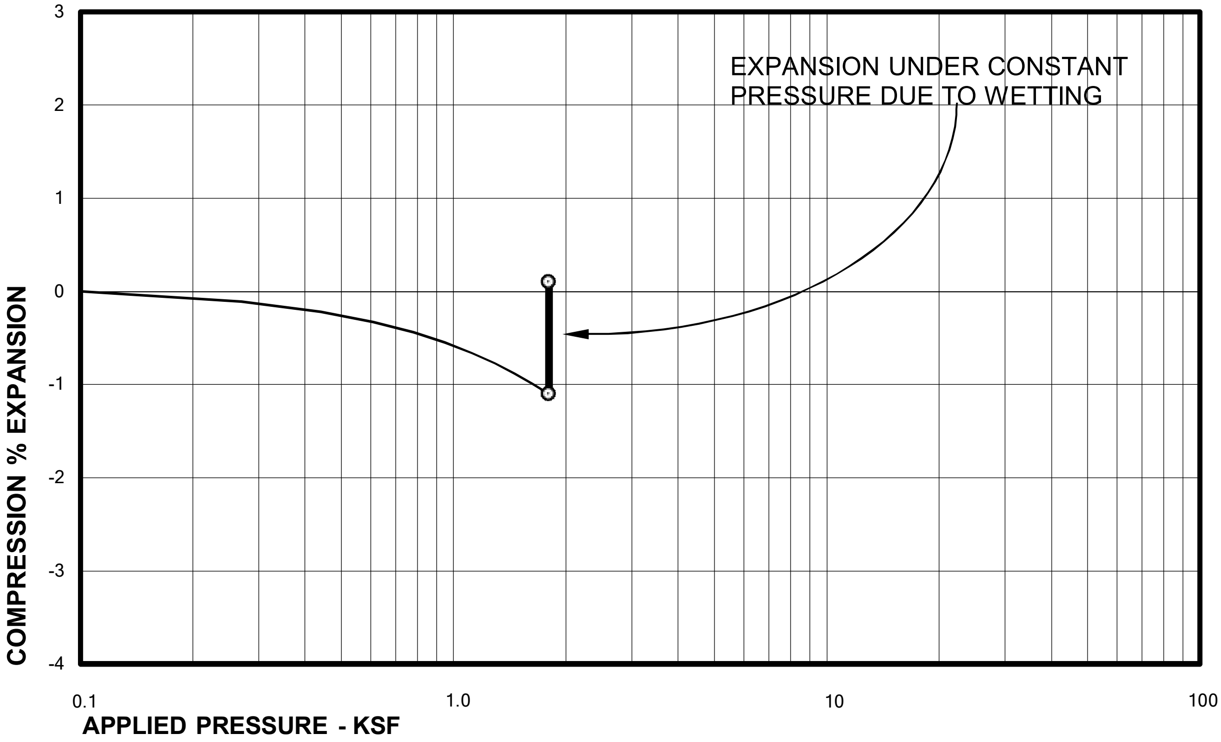
Sample of CLAY, SANDY (CL)
From TH-4 AT 7 FEET

DRY UNIT WEIGHT= 118 PCF
MOISTURE CONTENT= 9.6 %

Swell Consolidation Test Results

FIG. B-7

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

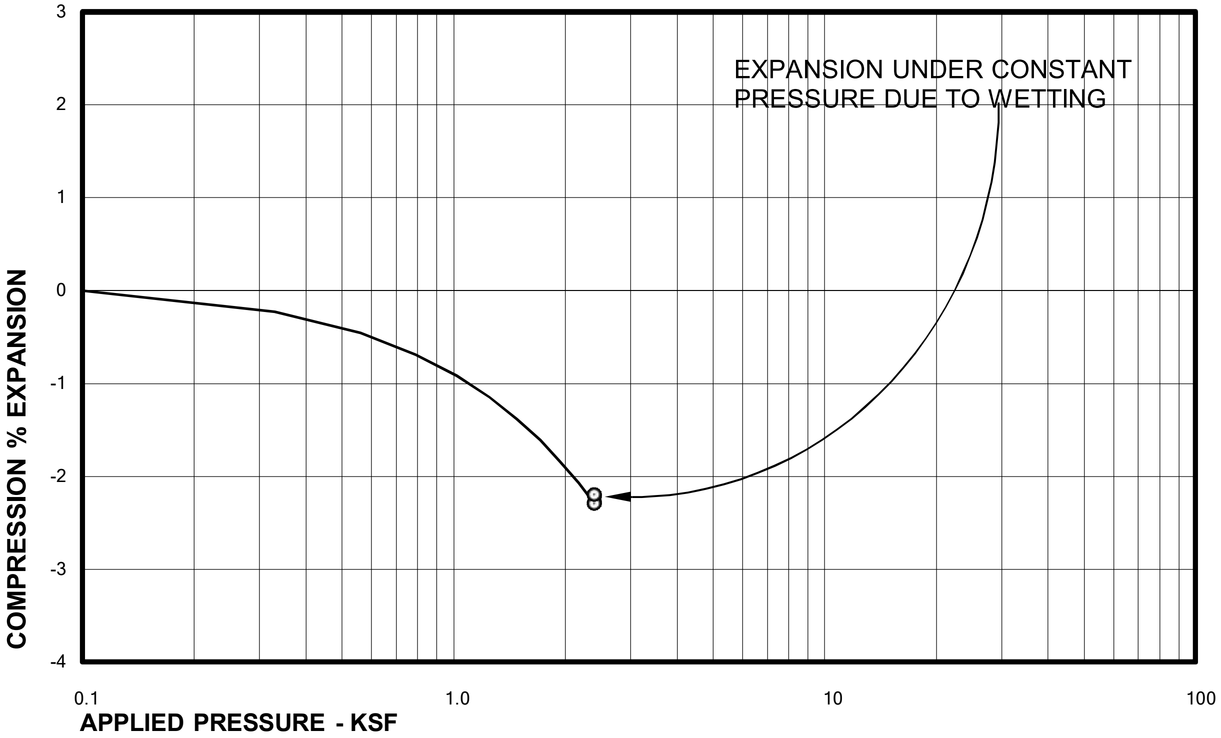


Sample of CLAY, SANDY (CL)

From TH-4 AT 9 FEET

DRY UNIT WEIGHT= 120 PCF

MOISTURE CONTENT= 9.3 %



Sample of CLAY, SANDY (CL)

From TH-4 AT 14 FEET

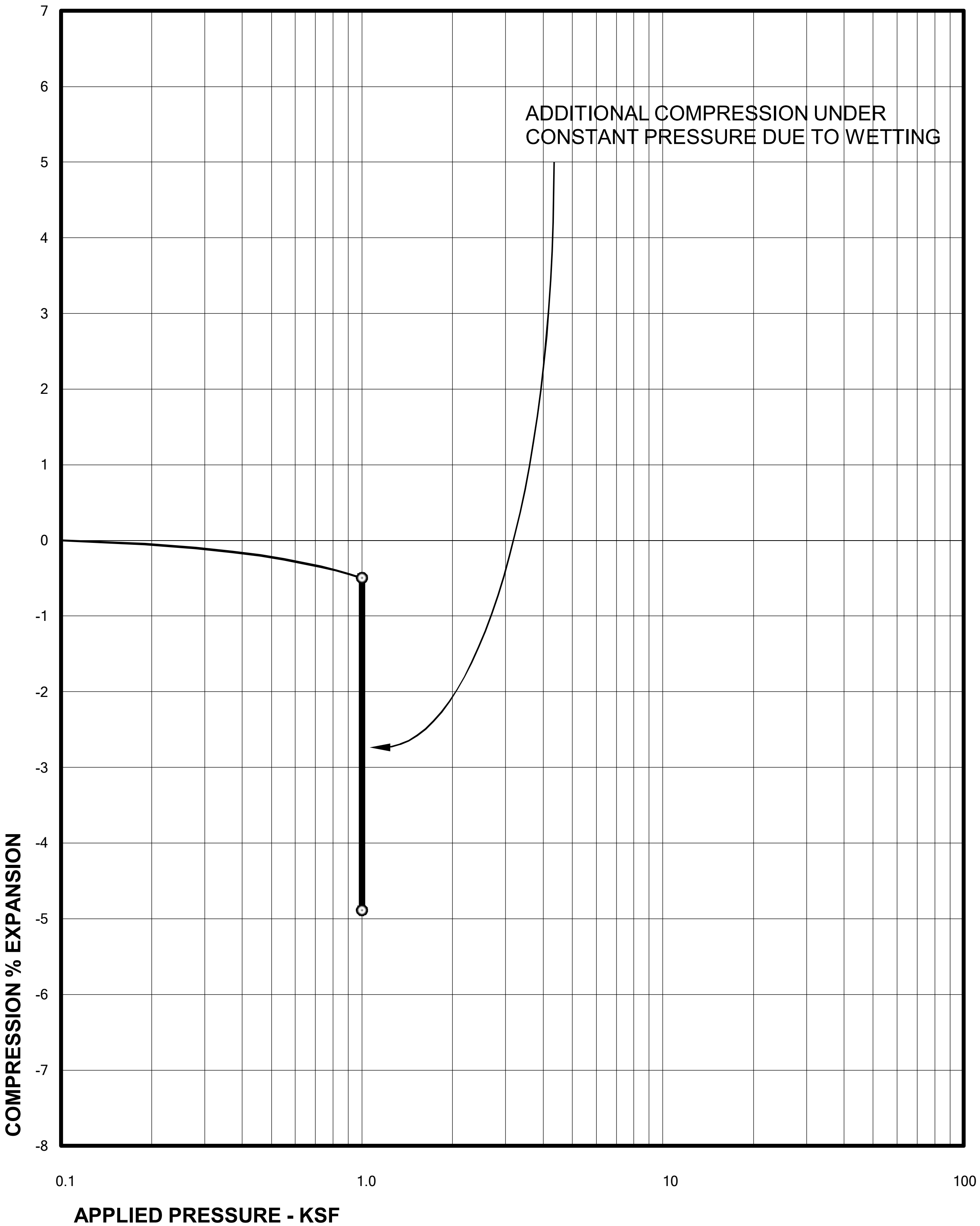
DRY UNIT WEIGHT= 114 PCF

MOISTURE CONTENT= 16.8 %

Swell Consolidation Test Results

FIG. B-8

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

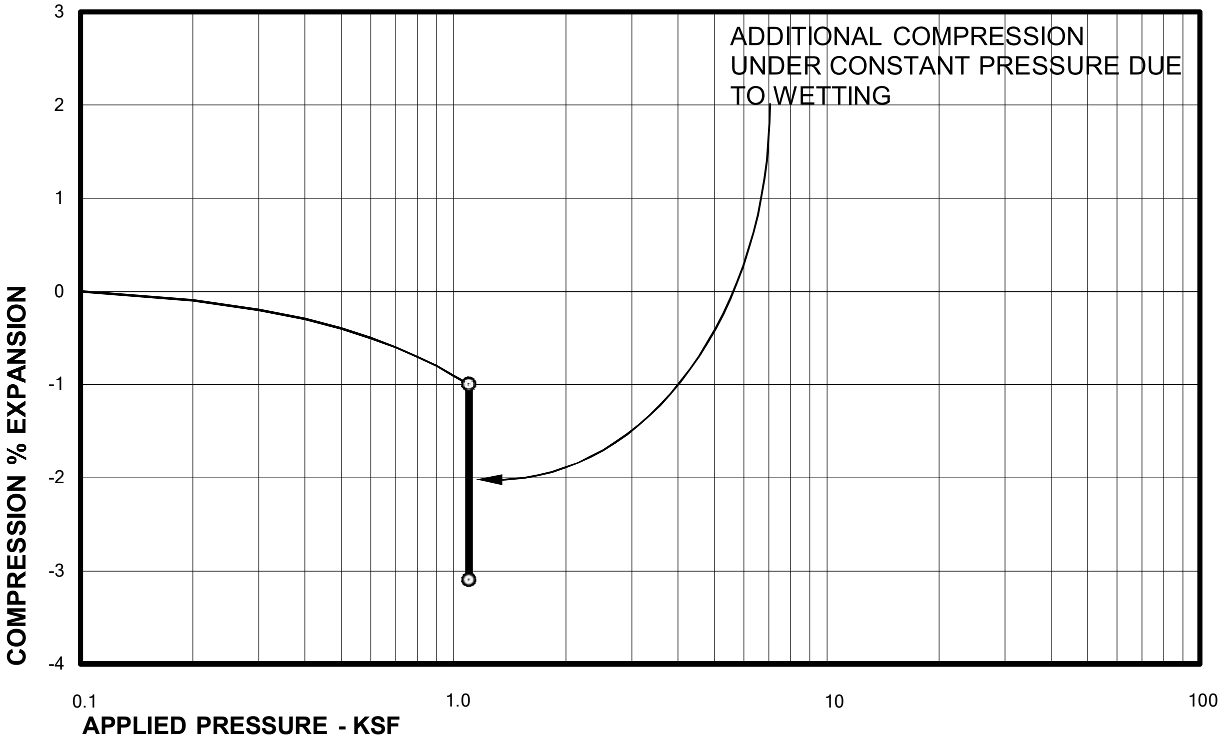


Sample of	SAND, CLAYEY (SC)	DRY UNIT WEIGHT=	96	PCF
From	TH-5 AT 2 FEET	MOISTURE CONTENT=	7.1	%

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

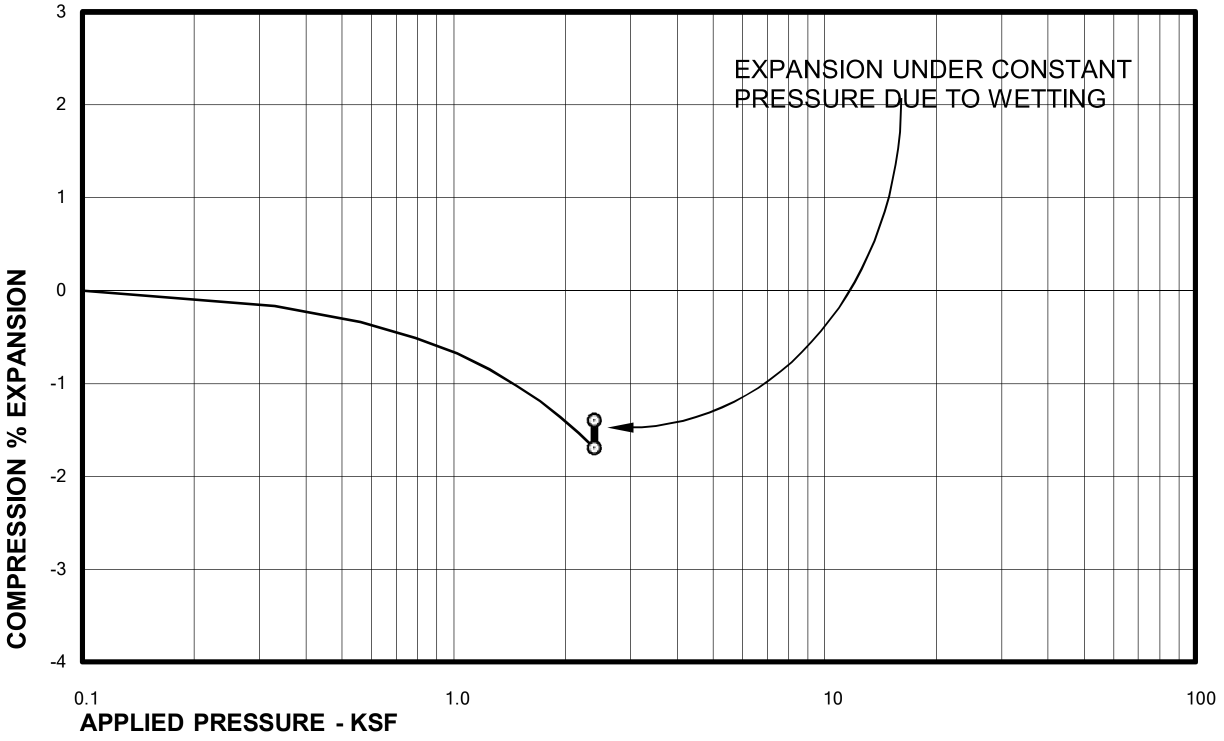
Swell Consolidation Test Results

FIG. B-9



Sample of SAND, CLAYEY (SC)
From TH-5 AT 4 FEET

DRY UNIT WEIGHT= 116 PCF
MOISTURE CONTENT= 9.1 %



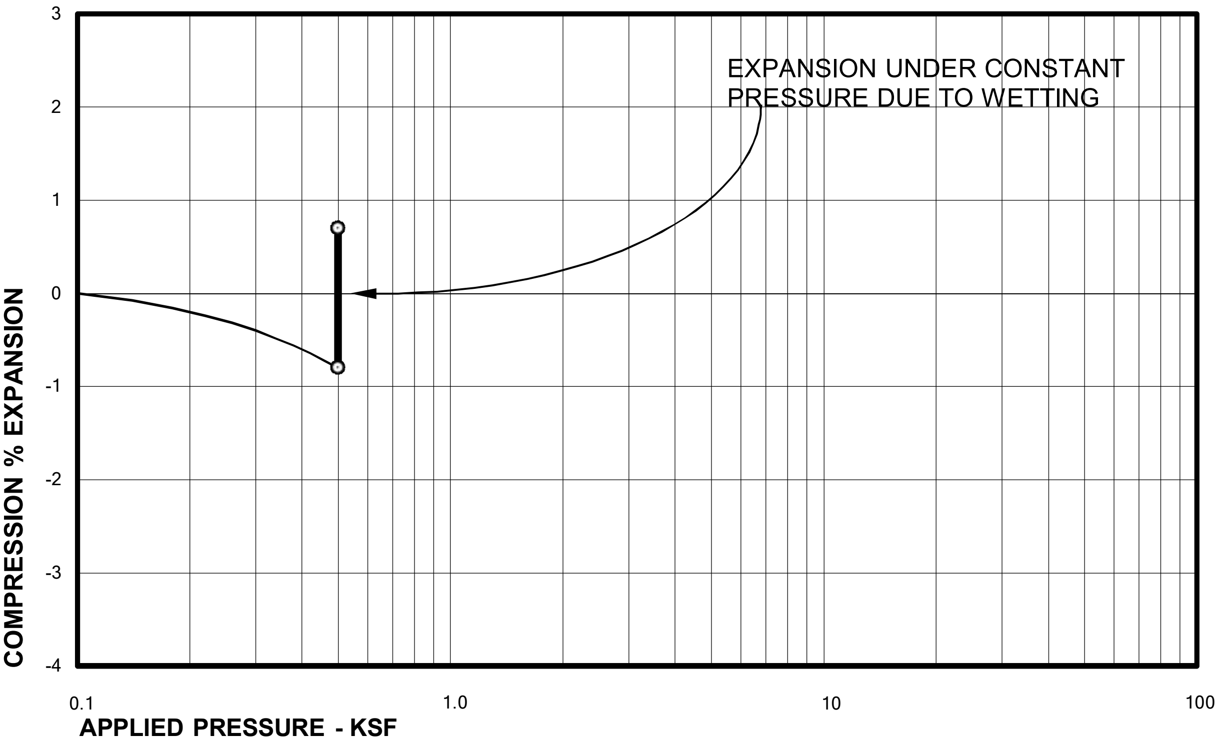
Sample of CLAY, SANDY (CL)
From TH-5 AT 14 FEET

DRY UNIT WEIGHT= 116 PCF
MOISTURE CONTENT= 17.6 %

Swell Consolidation Test Results

FIG. B-10

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

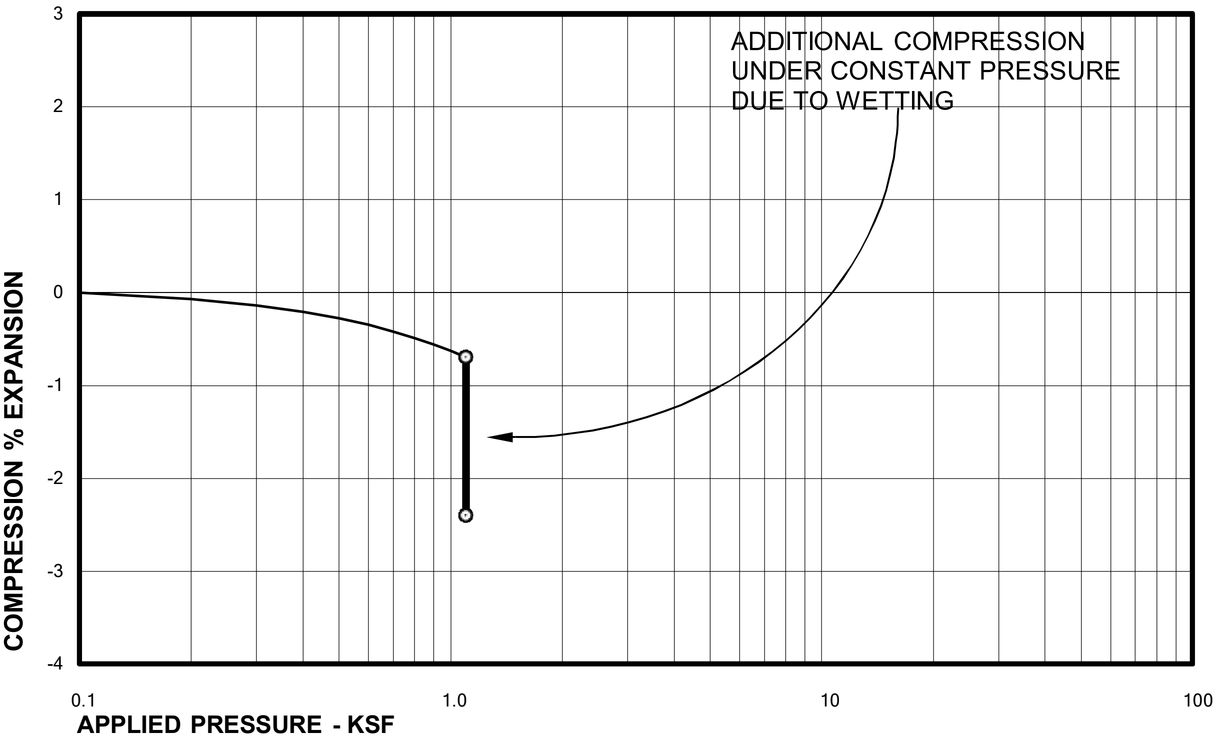


Sample of CLAY, SANDY (CL)

From TH-6 AT 9 FEET

DRY UNIT WEIGHT= 111 PCF

MOISTURE CONTENT= 6.5 %



Sample of CLAY, SANDY (CL)

From TH-6 AT 14 FEET

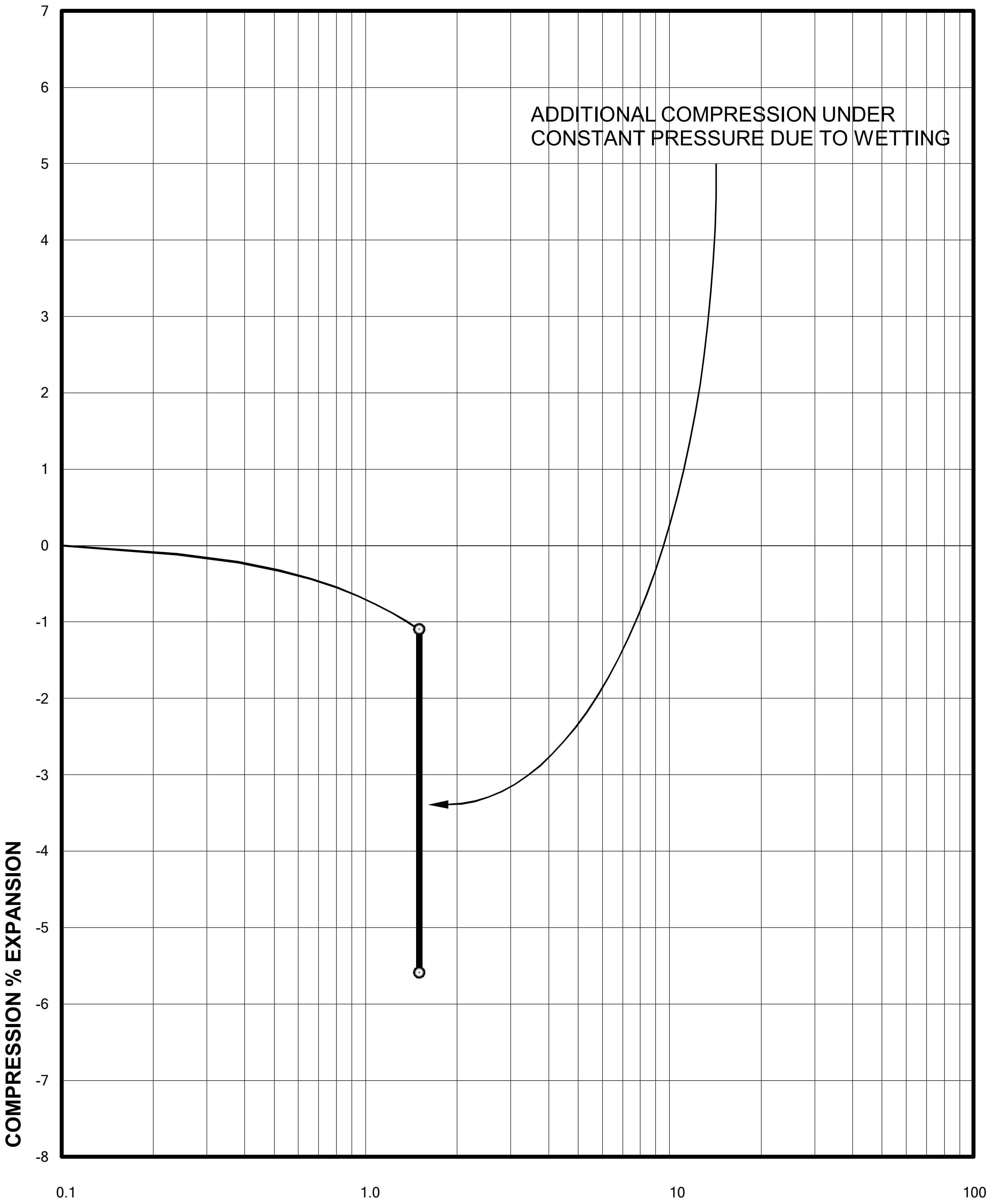
DRY UNIT WEIGHT= 103 PCF

MOISTURE CONTENT= 6.3 %

Swell Consolidation Test Results

FIG. B-11

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of CLAY, SANDY (CL)

From TH-6 AT 17 FEET

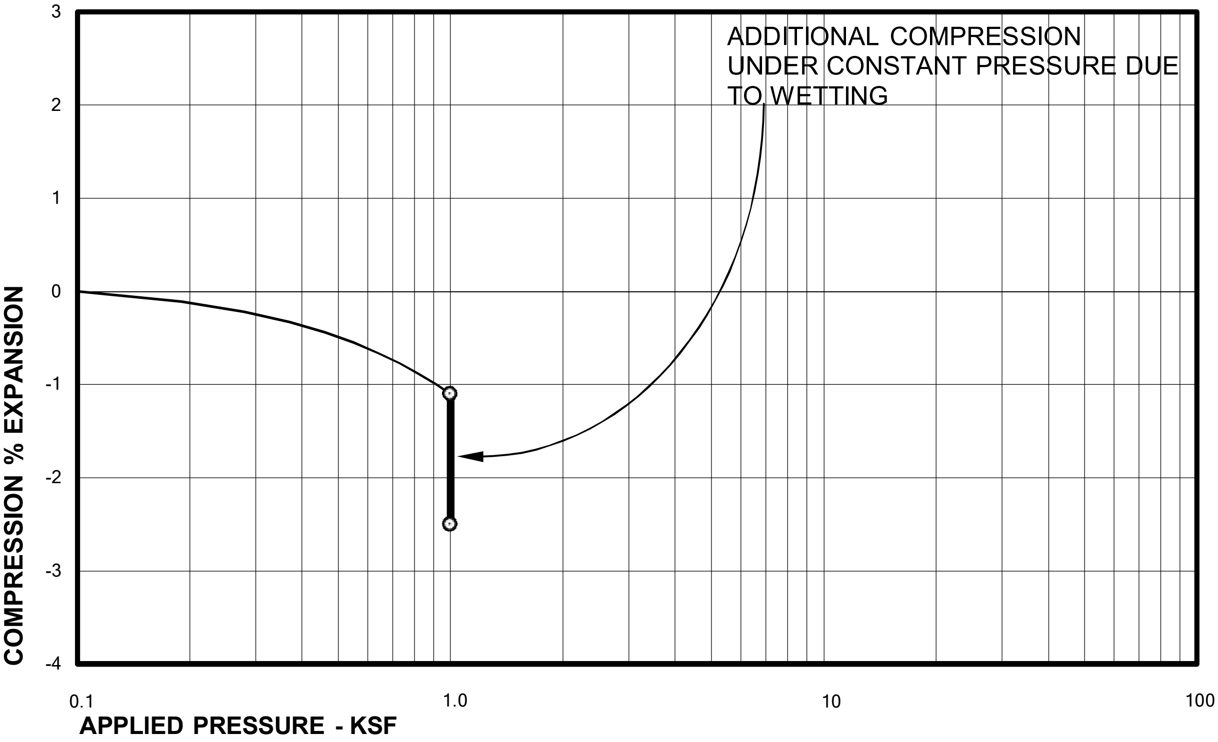
DRY UNIT WEIGHT= 100 PCF

MOISTURE CONTENT= 8.7 %

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

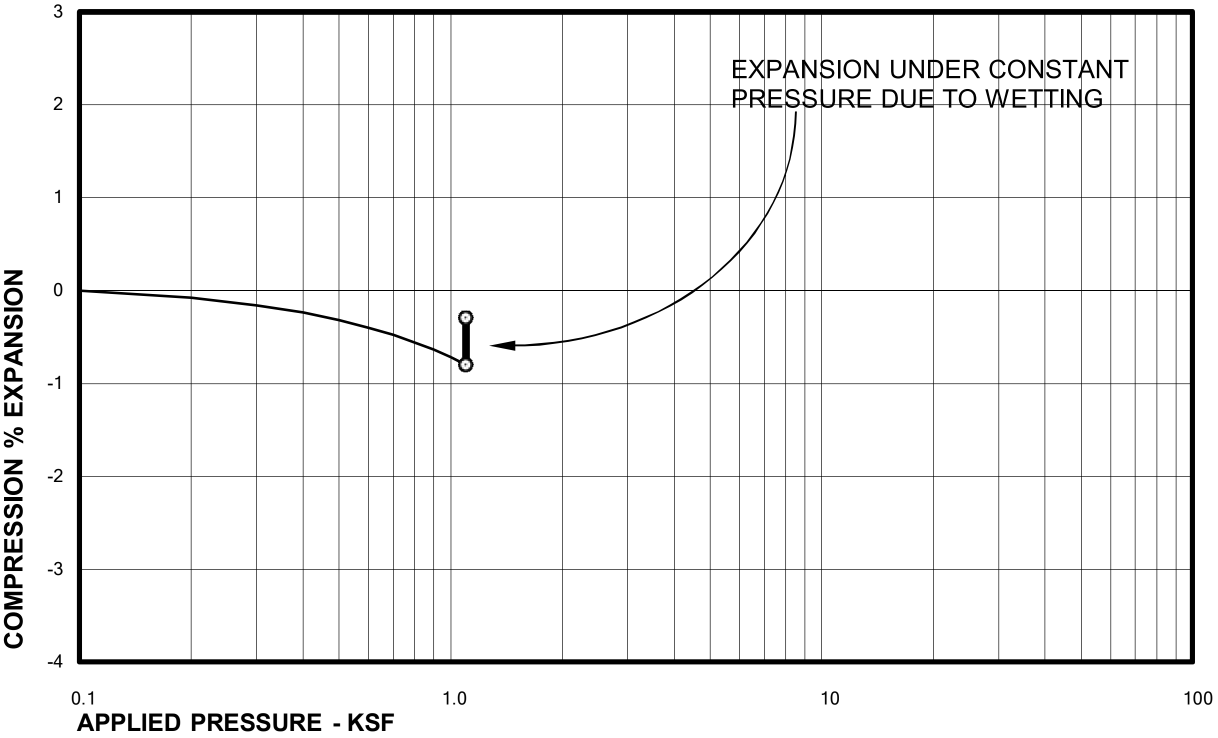
Swell Consolidation Test Results

FIG. B-12



Sample of CLAY, SANDY (CL)
From TH-7 AT 12 FEET

DRY UNIT WEIGHT= 97 PCF
MOISTURE CONTENT= 7.9 %



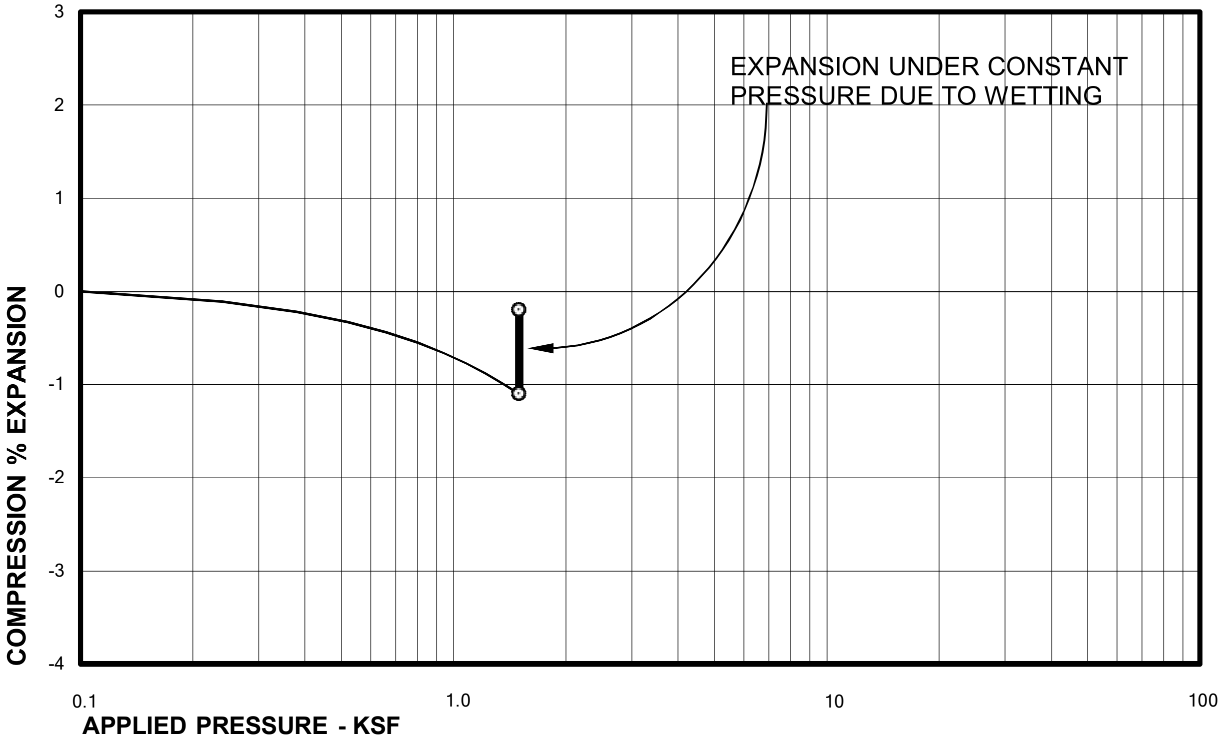
Sample of CLAY, SANDY (CL)
From TH-7 AT 14 FEET

DRY UNIT WEIGHT= 106 PCF
MOISTURE CONTENT= 9.2 %

Swell Consolidation Test Results

FIG. B-13

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

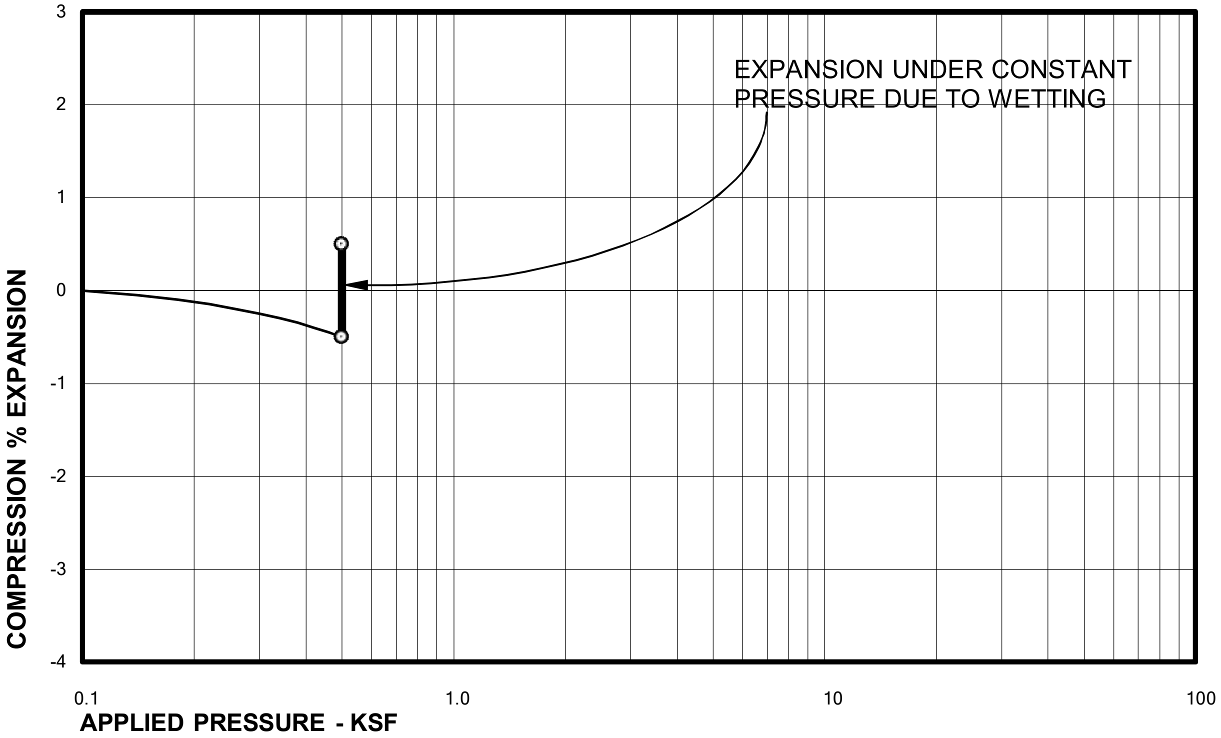


Sample of CLAY, SANDY (CL)

From TH-7 AT 17 FEET

DRY UNIT WEIGHT= 116 PCF

MOISTURE CONTENT= 8.8 %



Sample of CLAY, SANDY (CL)

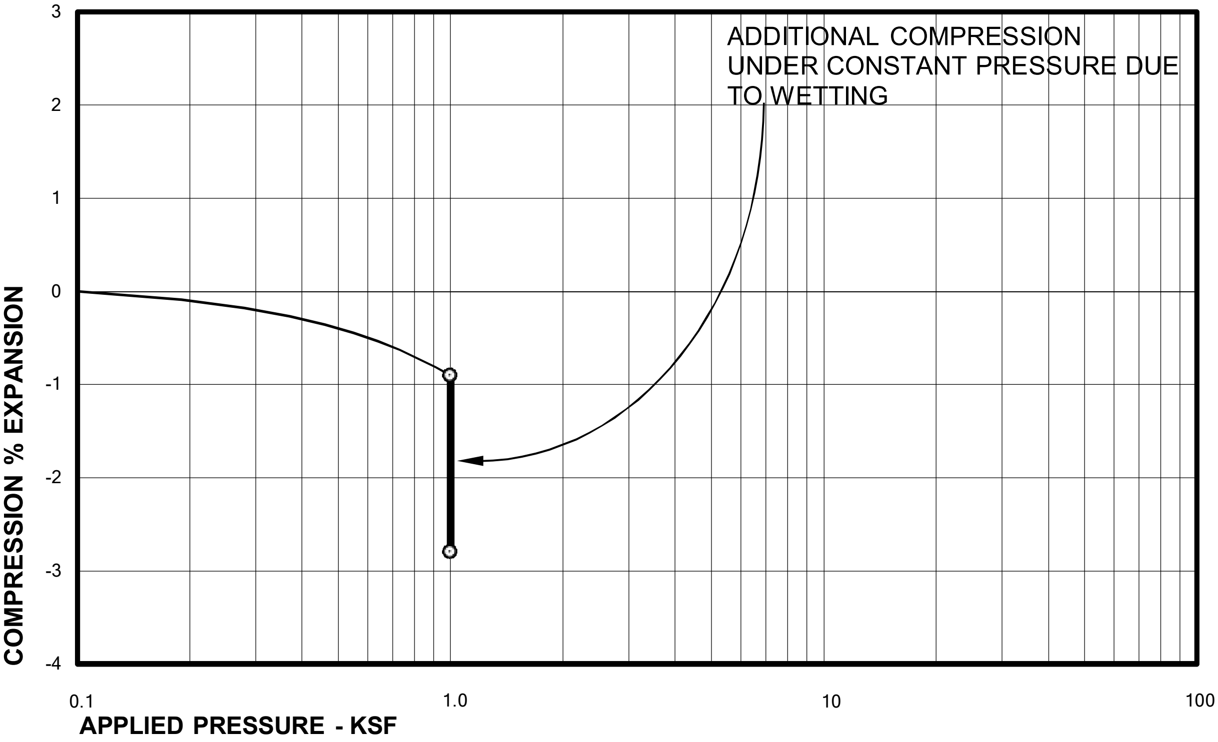
From TH-8 AT 9 FEET

DRY UNIT WEIGHT= 98 PCF

MOISTURE CONTENT= 9.8 %

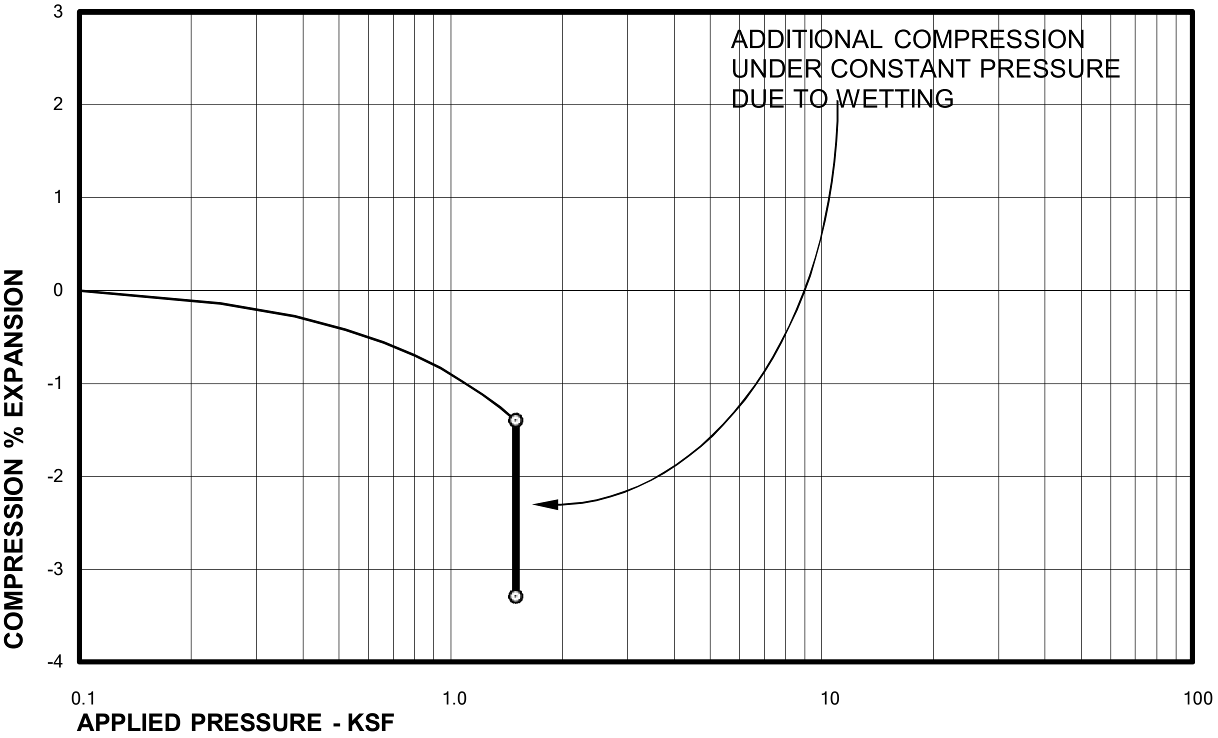
Swell Consolidation Test Results

FIG. B-14



Sample of CLAY, SANDY (CL)
From TH-8 AT 12 FEET

DRY UNIT WEIGHT= 96 PCF
MOISTURE CONTENT= 9.8 %



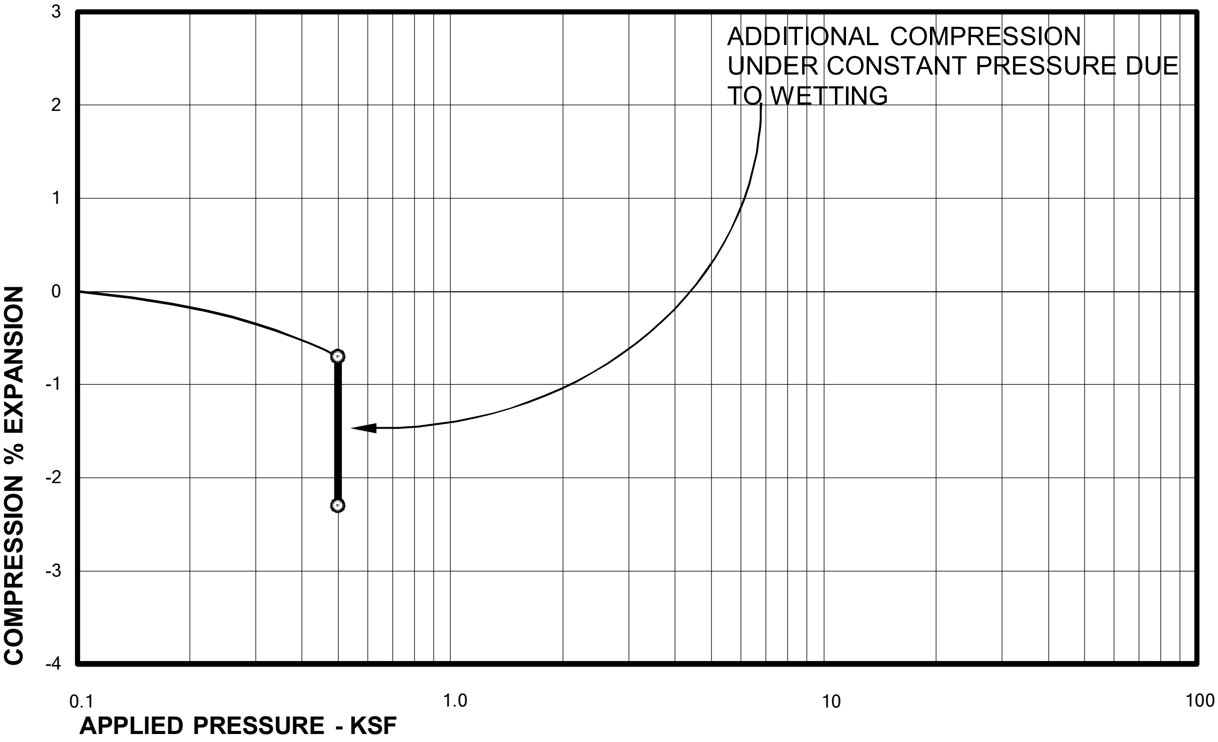
Sample of CLAY, SANDY (CL)
From TH-8 AT 17 FEET

DRY UNIT WEIGHT= 112 PCF
MOISTURE CONTENT= 5.5 %

Swell Consolidation Test Results

FIG. B-15

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

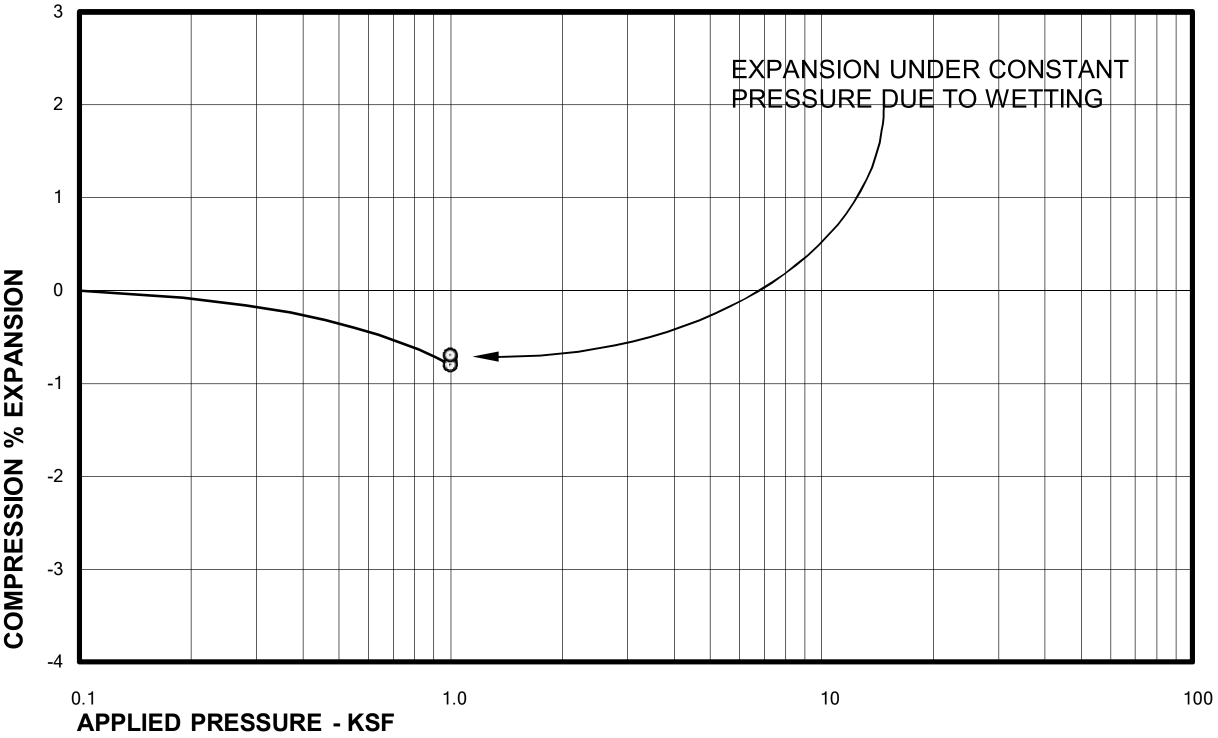


Sample of SAND, CLAYEY (SC)

From TH-9 AT 4 FEET

DRY UNIT WEIGHT= 99 PCF

MOISTURE CONTENT= 6.2 %



Sample of SAND, CLAYEY (SC)

From TH-9 AT 7 FEET

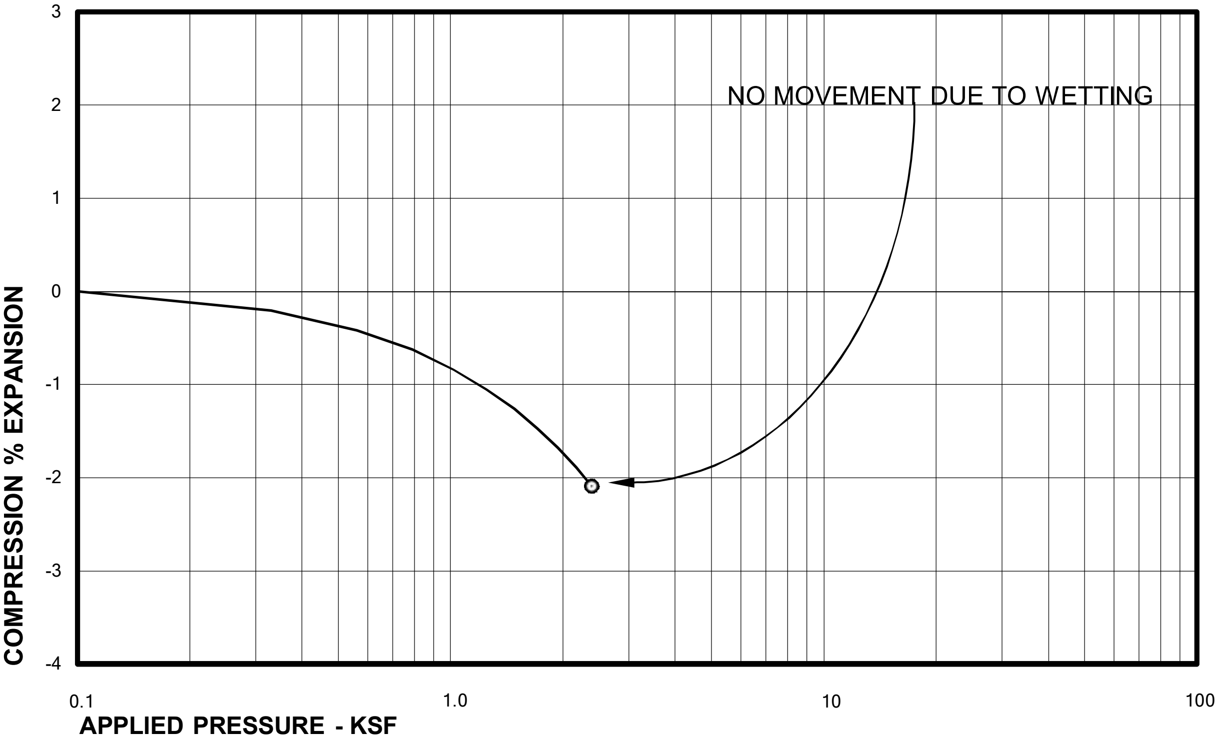
DRY UNIT WEIGHT= 109 PCF

MOISTURE CONTENT= 7.0 %

Swell Consolidation Test Results

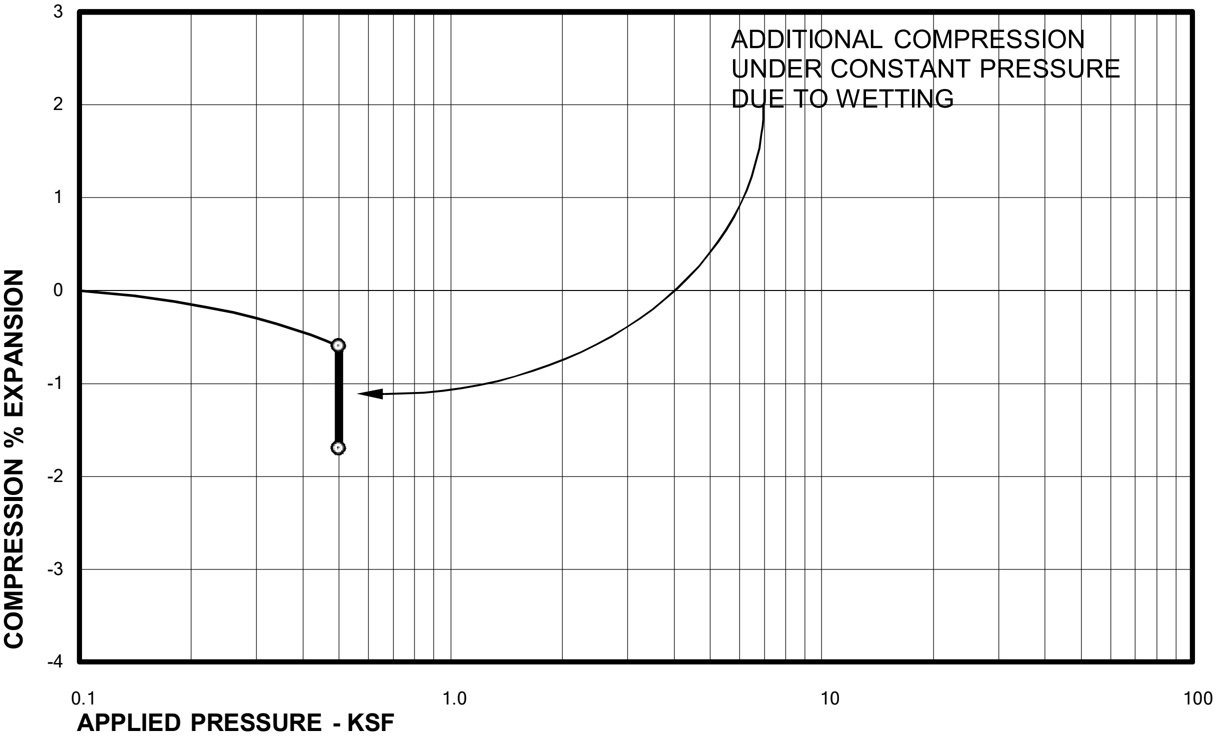
FIG. B-16

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of CLAY, SANDY (CL)
From TH-9 AT 19 FEET

DRY UNIT WEIGHT= 109 PCF
MOISTURE CONTENT= 19.1 %



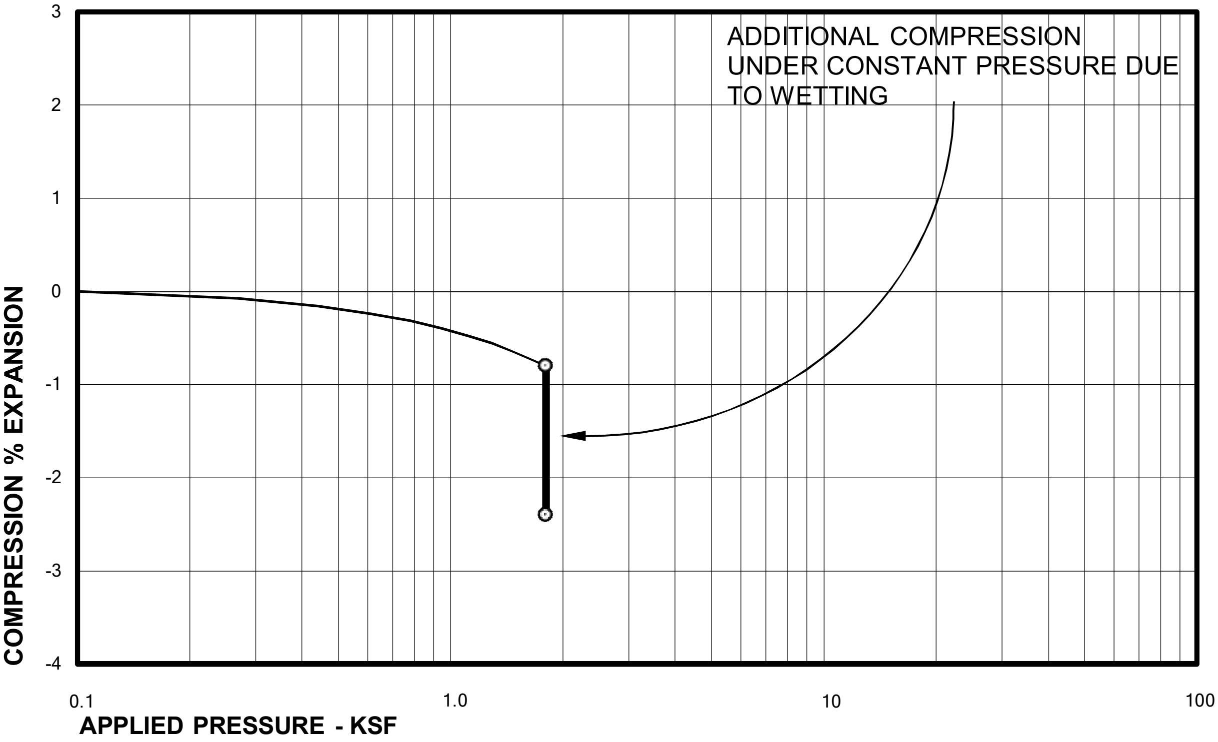
Sample of SAND, CLAYEY (SC)
From TH-10 AT 4 FEET

DRY UNIT WEIGHT= 105 PCF
MOISTURE CONTENT= 3.9 %

Swell Consolidation Test Results

FIG. B-17

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

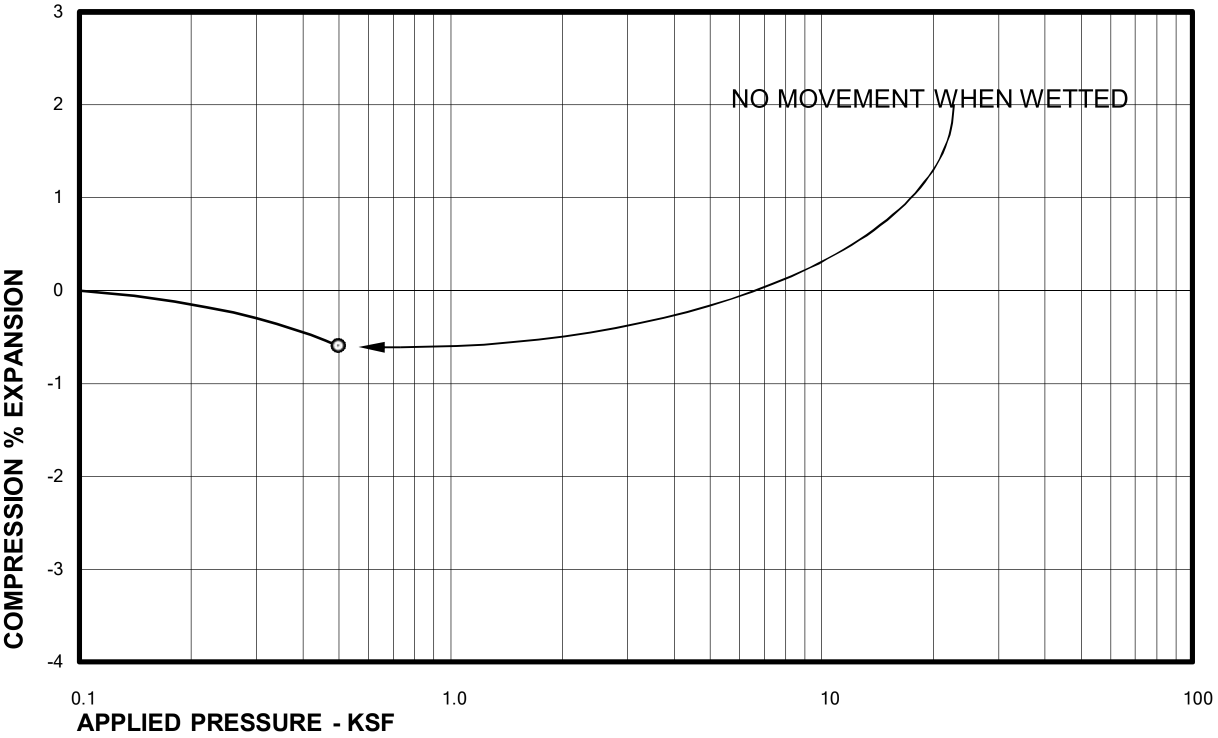


Sample of SAND, CLAYEY (SC)

From TH-10 AT 14 FEET

DRY UNIT WEIGHT= 106 PCF

MOISTURE CONTENT= 6.7 %



Sample of CLAY, SANDY (CL)

From TH-11 AT 4 FEET

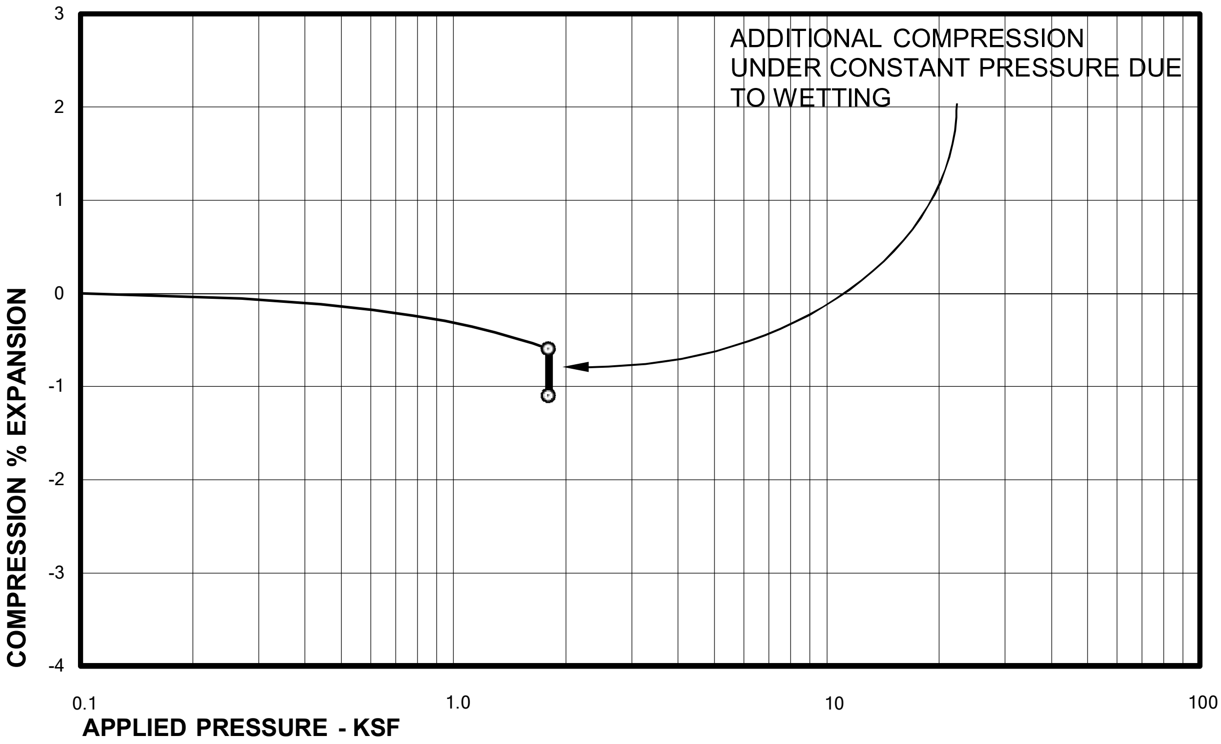
DRY UNIT WEIGHT= 93 PCF

MOISTURE CONTENT= 12.3 %

Swell Consolidation Test Results

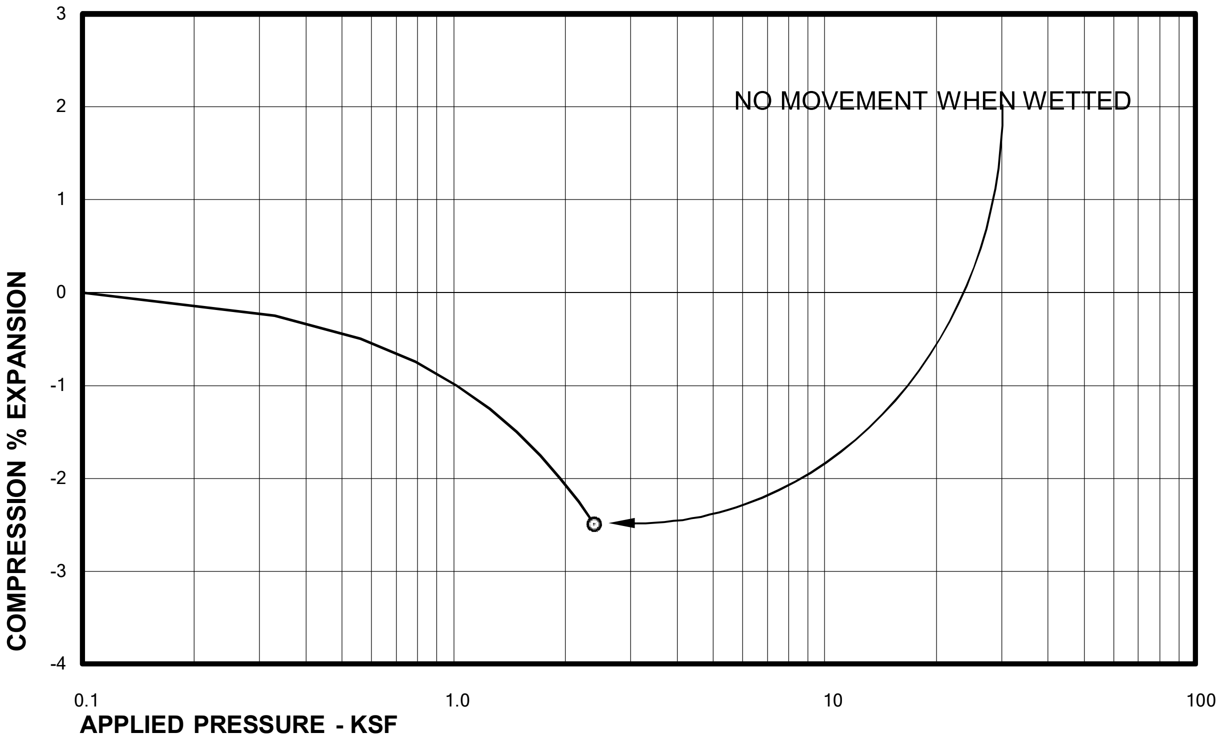
FIG. B-18

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of CLAY, SANDY (CL)
From TH-11 AT 14 FEET

DRY UNIT WEIGHT= 109 PCF
MOISTURE CONTENT= 9.2 %



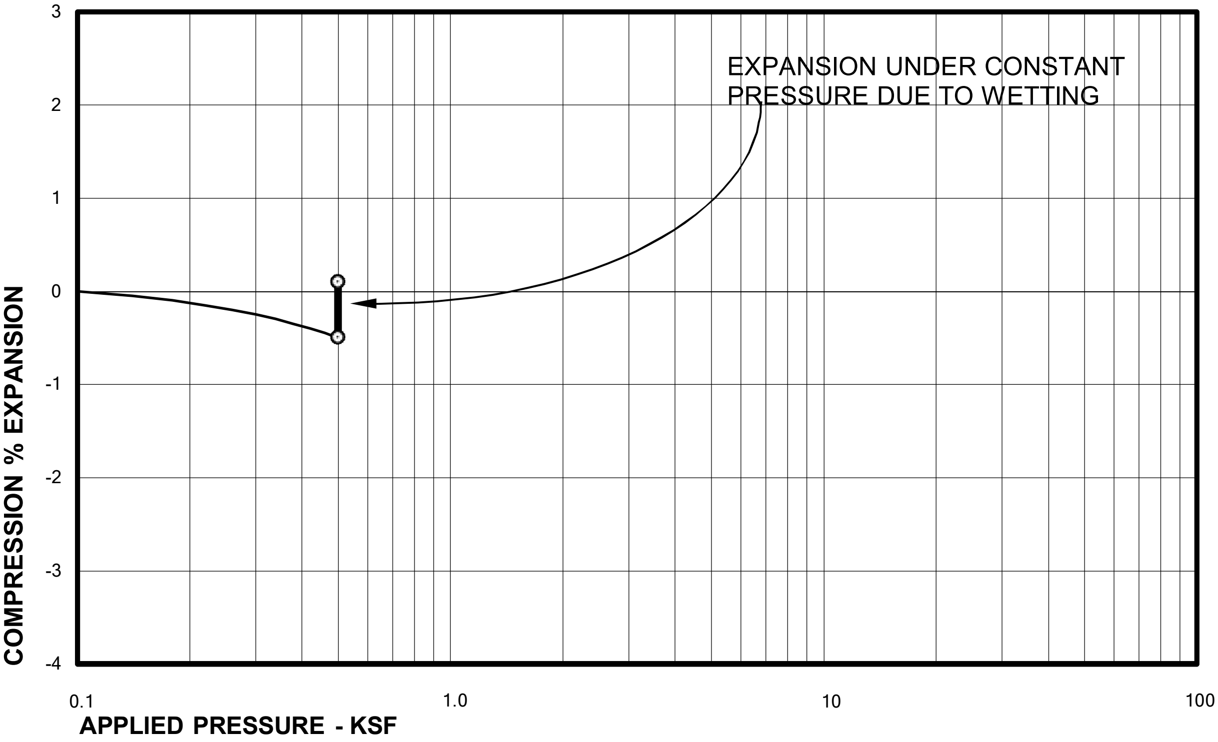
Sample of CLAY, SANDY (CL)
From TH-11 AT 19 FEET

DRY UNIT WEIGHT= 111 PCF
MOISTURE CONTENT= 17.1 %

Swell Consolidation Test Results

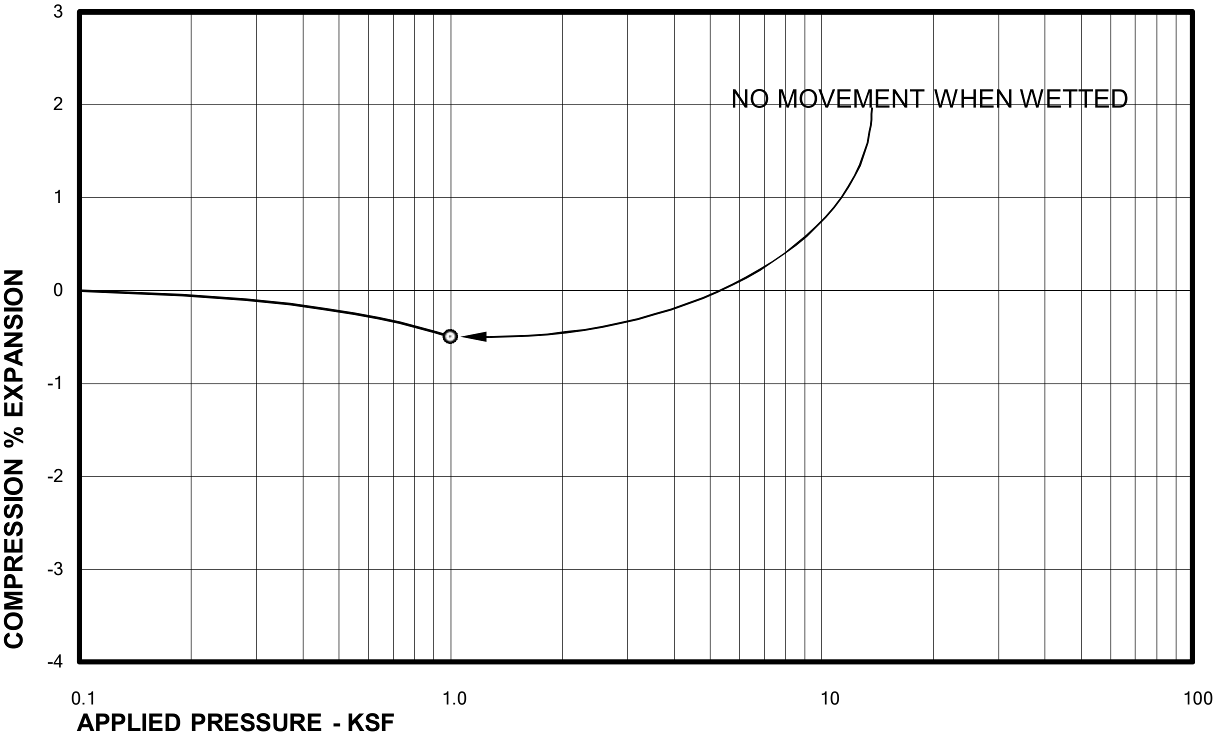
FIG. B-19

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of CLAY, SANDY (CL)
From TH-12 AT 4 FEET

DRY UNIT WEIGHT= 96 PCF
MOISTURE CONTENT= 9.1 %



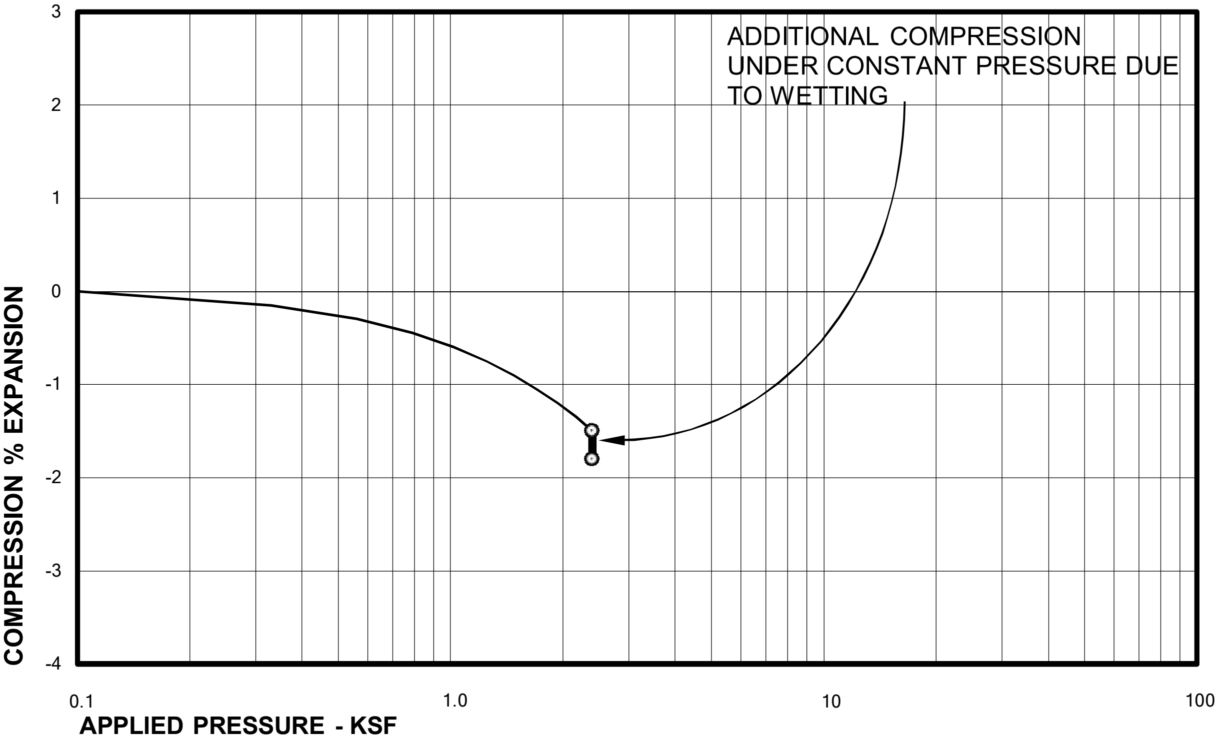
Sample of CLAY, SANDY (CL)
From TH-12 AT 7 FEET

DRY UNIT WEIGHT= 114 PCF
MOISTURE CONTENT= 8.7 %

Swell Consolidation Test Results

FIG. B-20

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

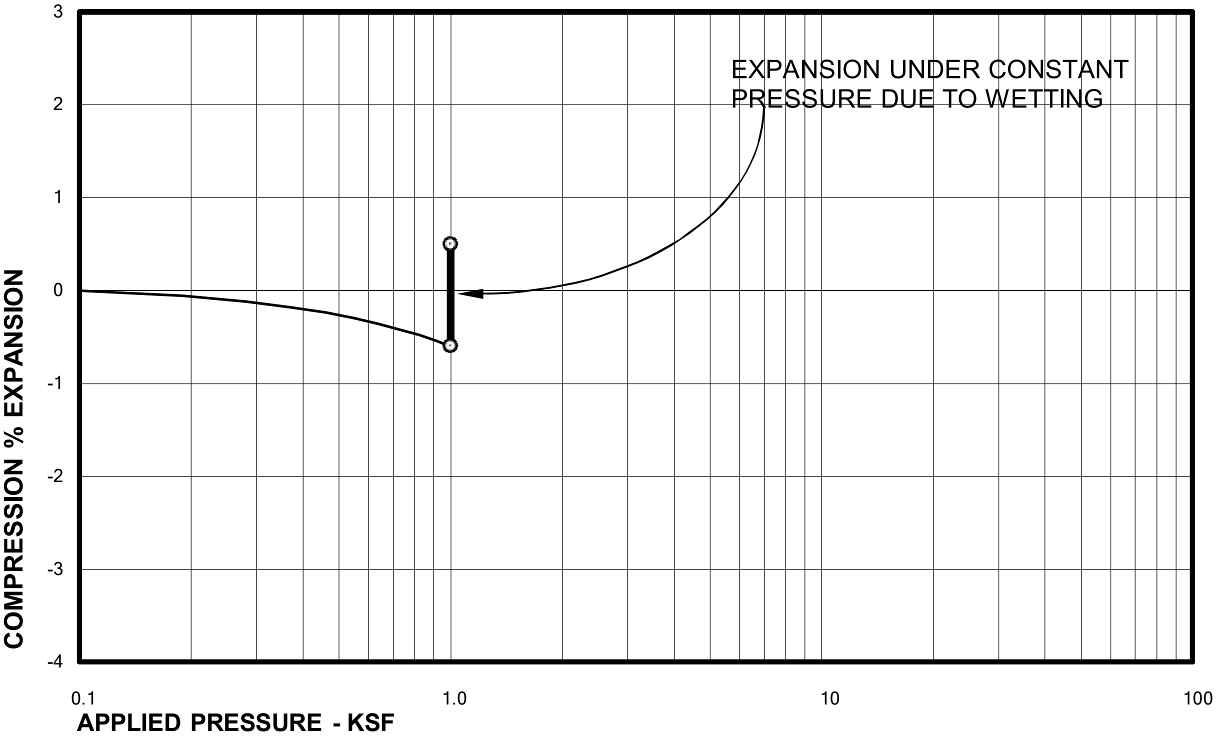


Sample of CLAY, SANDY (CL)

From TH-12 AT 19 FEET

DRY UNIT WEIGHT= 101 PCF

MOISTURE CONTENT= 18.4 %



Sample of CLAY, SANDY (CL)

From TH-13 AT 7 FEET

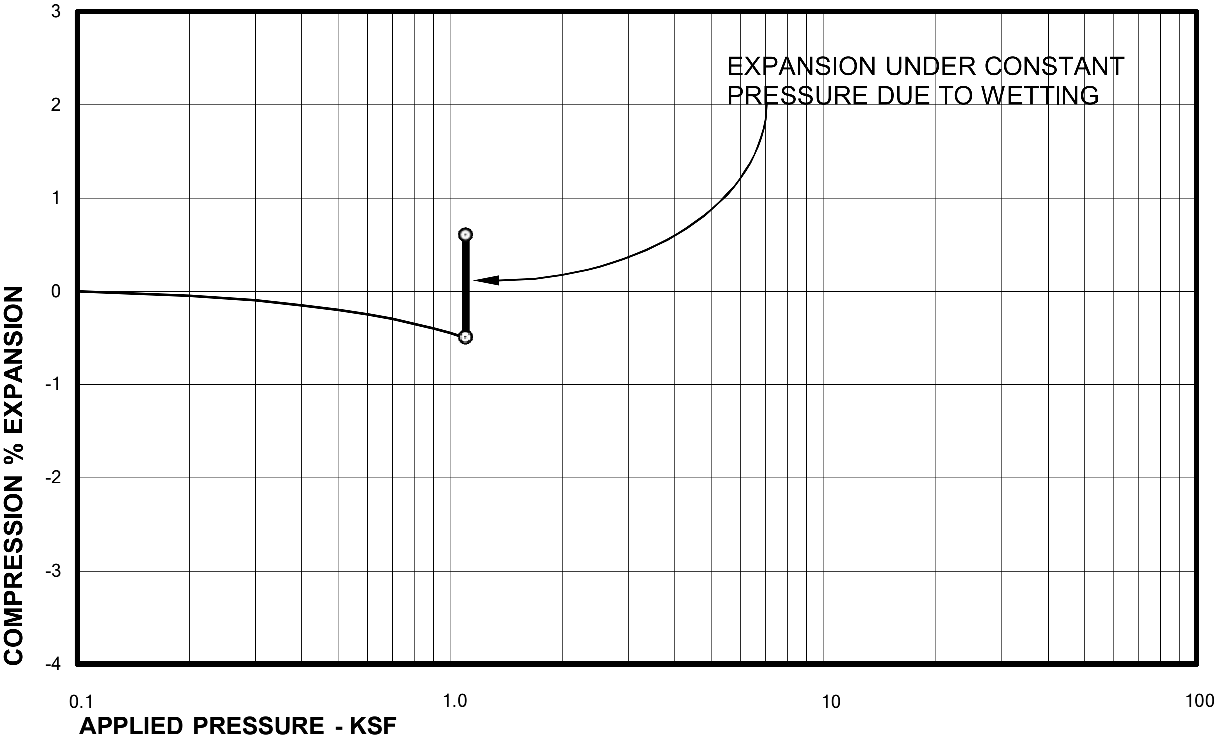
DRY UNIT WEIGHT= 116 PCF

MOISTURE CONTENT= 7.4 %

Swell Consolidation Test Results

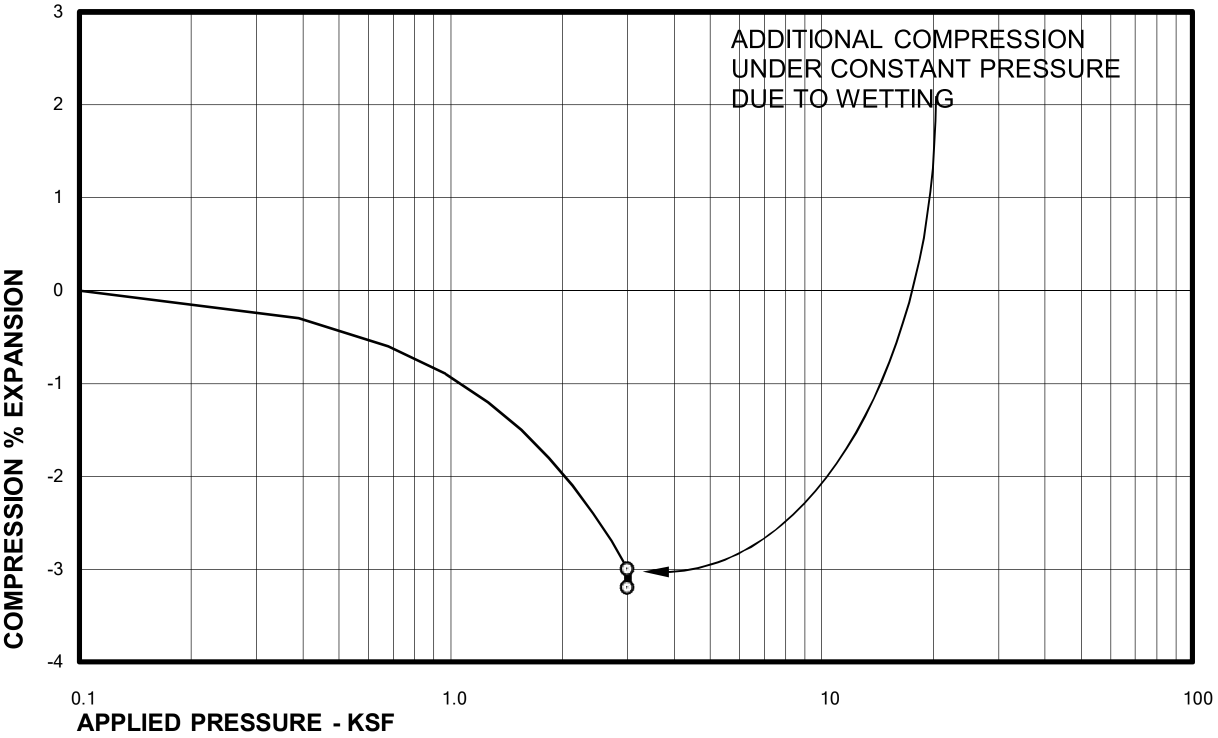
FIG. B-21

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of CLAY, SANDY (CL)
From TH-13 AT 9 FEET

DRY UNIT WEIGHT= 120 PCF
MOISTURE CONTENT= 7.3 %



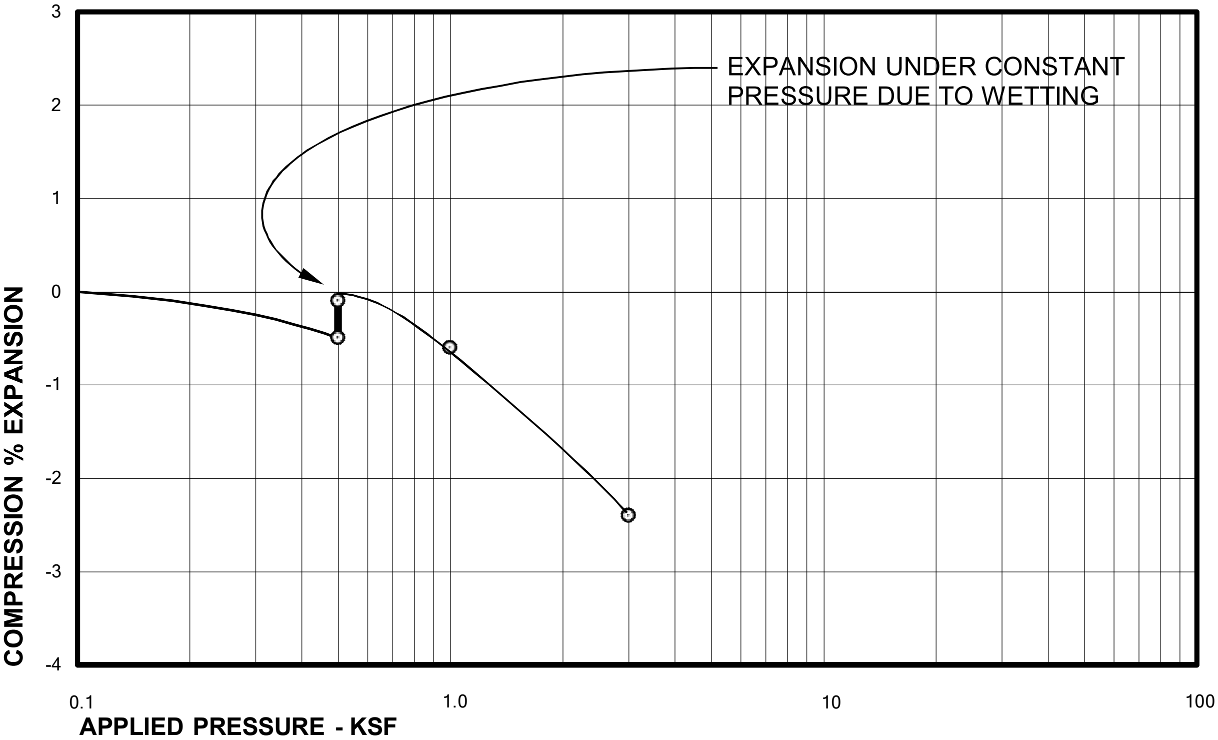
Sample of CLAY, SANDY (CL)
From TH-13 AT 24 FEET

DRY UNIT WEIGHT= 110 PCF
MOISTURE CONTENT= 17.8 %

Swell Consolidation Test Results

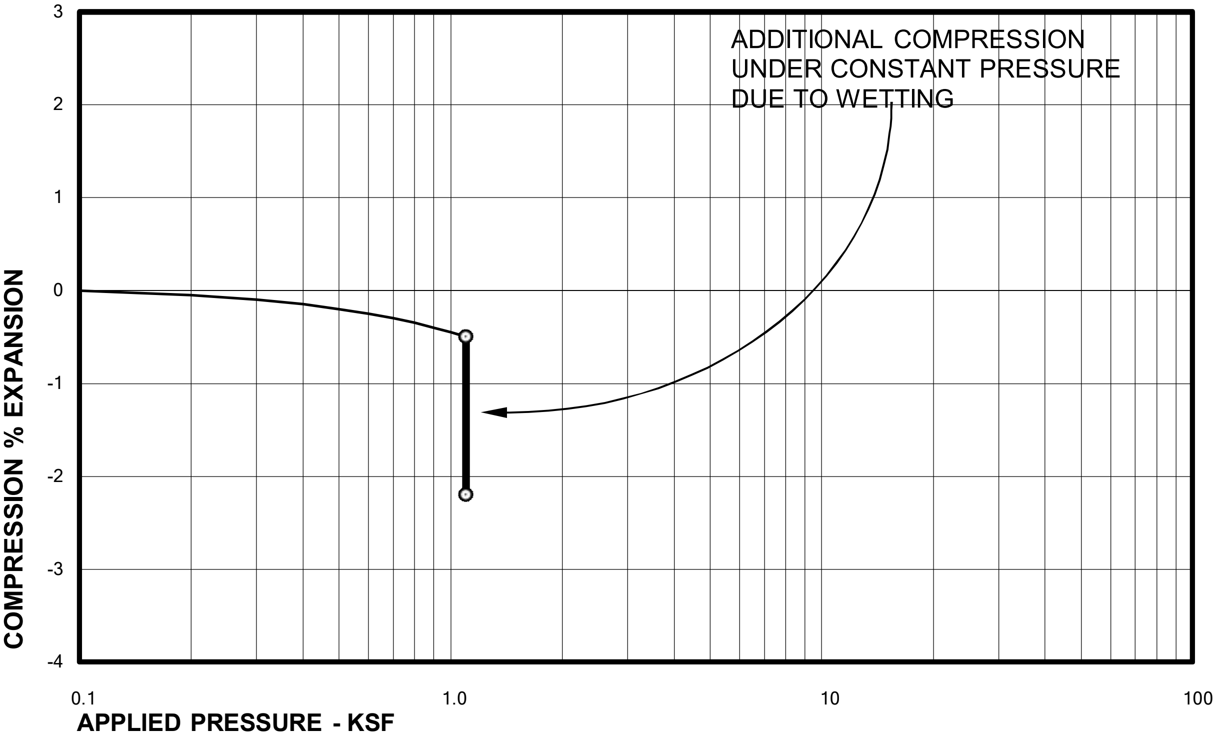
FIG. B-22

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of CLAY, SANDY (CL)
From TH-14 AT 4 FEET

DRY UNIT WEIGHT= 106 PCF
MOISTURE CONTENT= 5.4 %



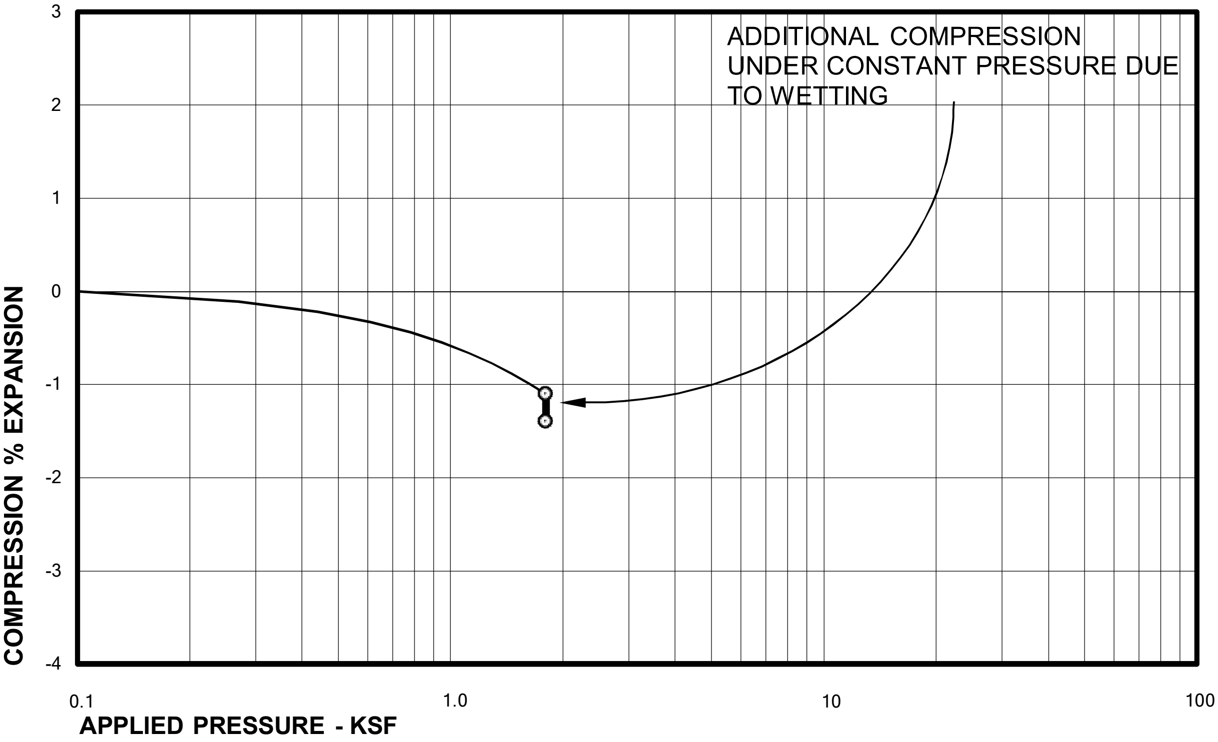
Sample of CLAY, SANDY (CL)
From TH-14 AT 9 FEET

DRY UNIT WEIGHT= 102 PCF
MOISTURE CONTENT= 6.9 %

Swell Consolidation Test Results

FIG. B-23

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

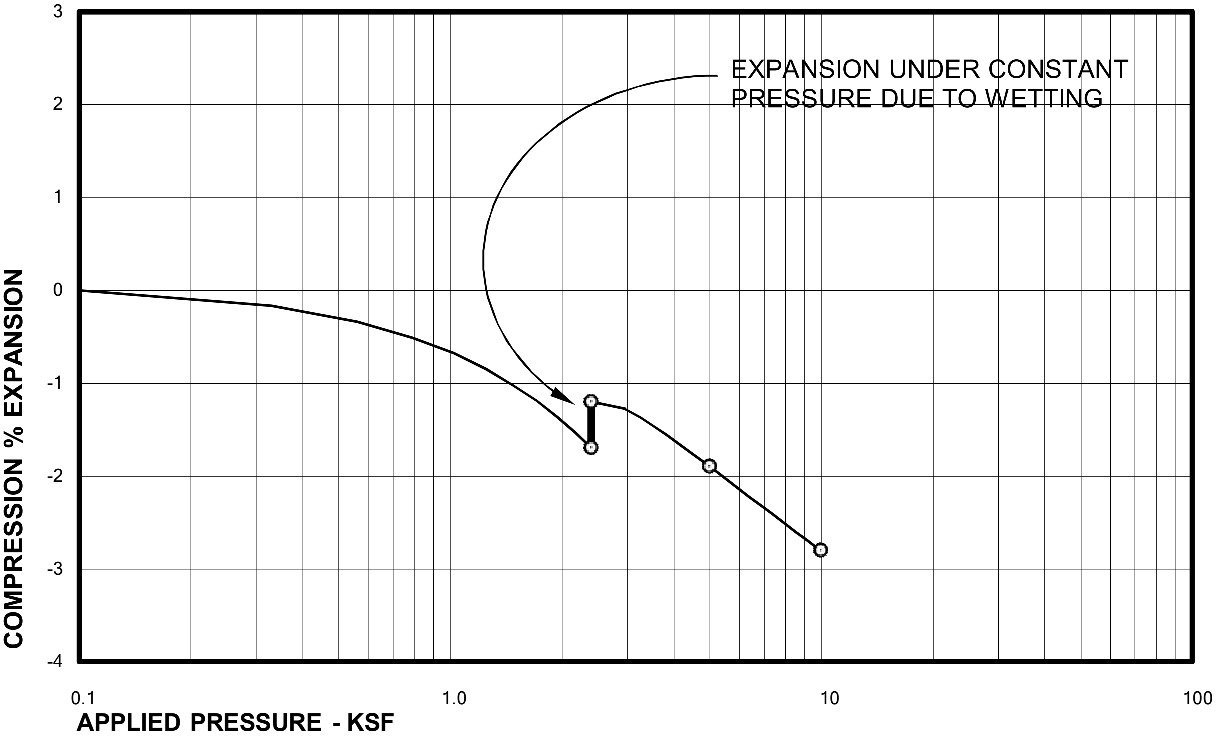


Sample of CLAY, SANDY (CL)

From TH-14 AT 14 FEET

DRY UNIT WEIGHT= 112 PCF

MOISTURE CONTENT= 10.4 %



Sample of CLAY, SANDY (CL)

From TH-14 AT 19 FEET

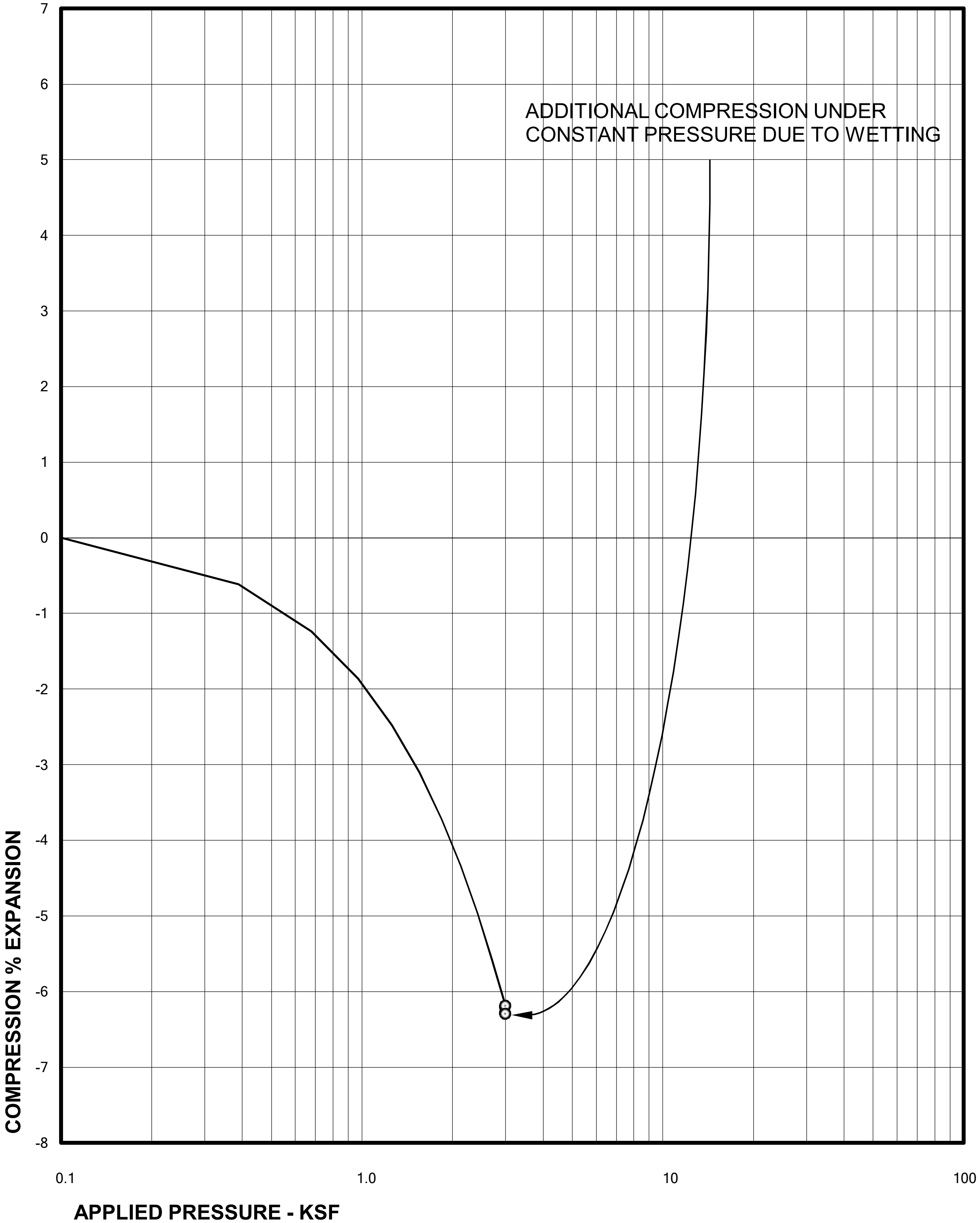
DRY UNIT WEIGHT= 118 PCF

MOISTURE CONTENT= 14.9 %

Swell Consolidation Test Results

FIG. B-24

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

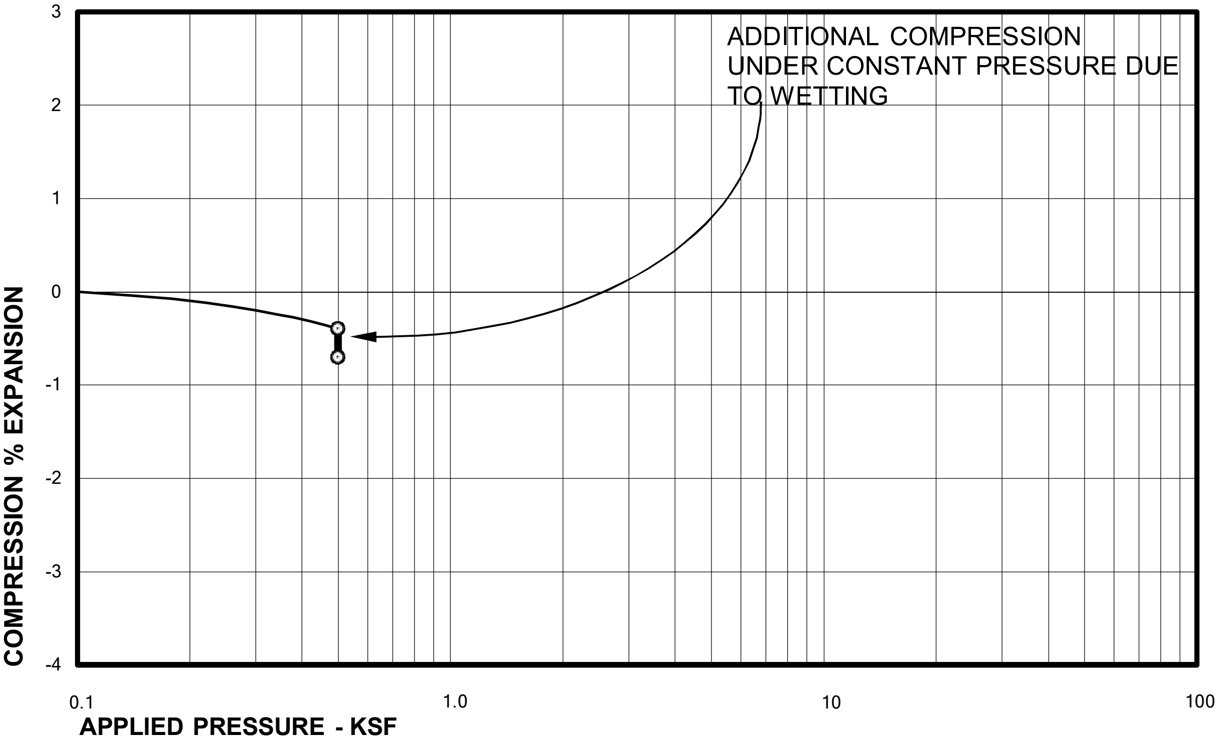


Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	108	PCF
From	TH-14 AT 24 FEET	MOISTURE CONTENT=	18.4	%

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

Swell Consolidation Test Results

FIG. B-25

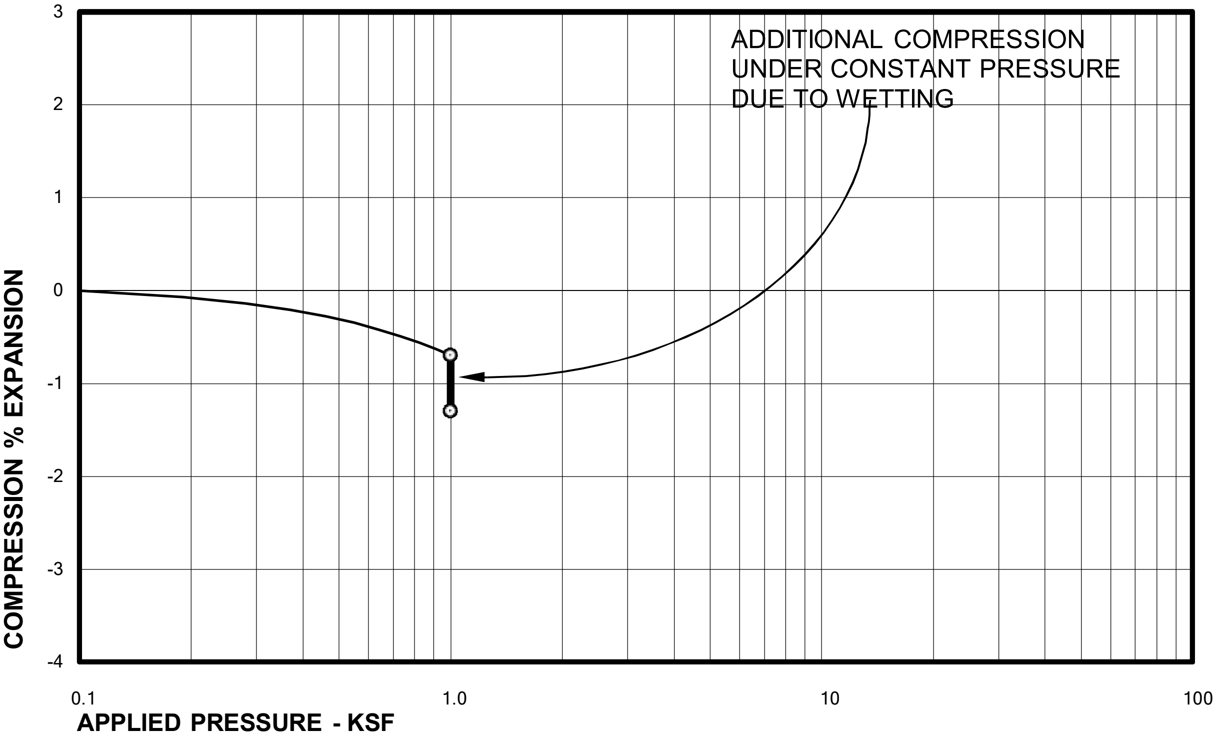


Sample of CLAY, SANDY (CL)

From TH-15 AT 4 FEET

DRY UNIT WEIGHT= 107 PCF

MOISTURE CONTENT= 4.6 %



Sample of CLAY, SANDY (CL)

From TH-15 AT 7 FEET

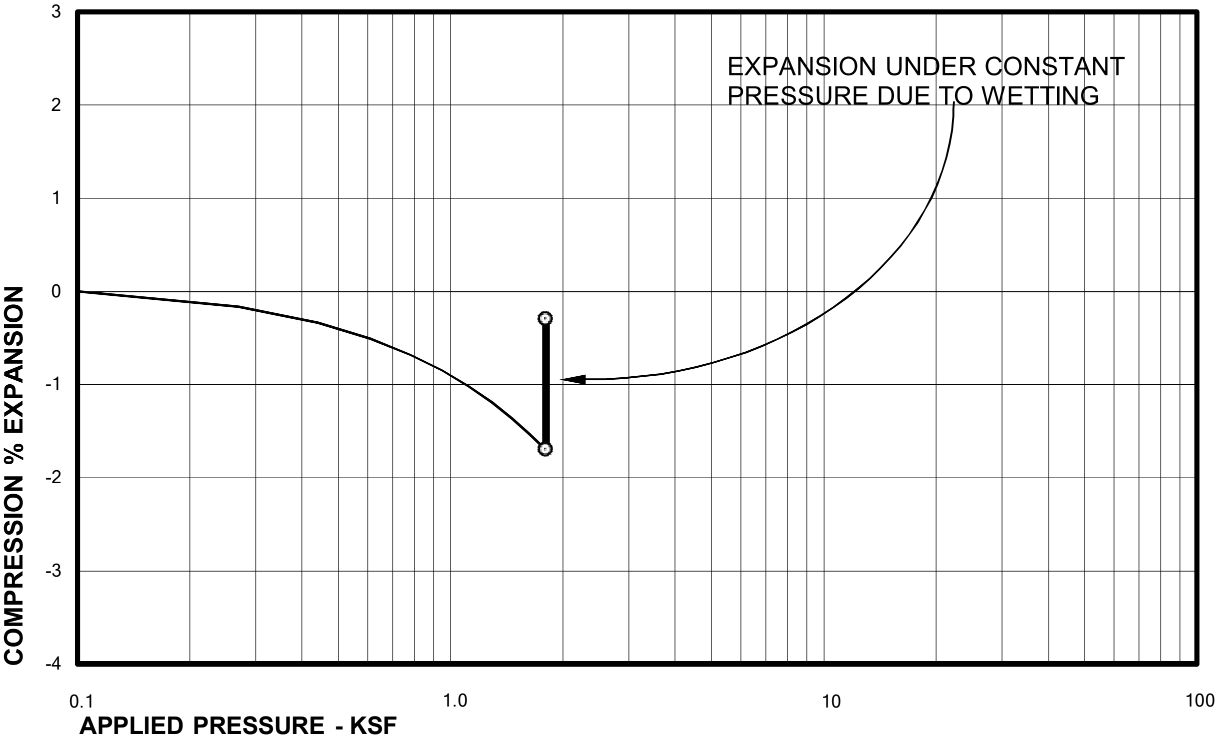
DRY UNIT WEIGHT= 116 PCF

MOISTURE CONTENT= 5.6 %

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

Swell Consolidation Test Results

FIG. B-26

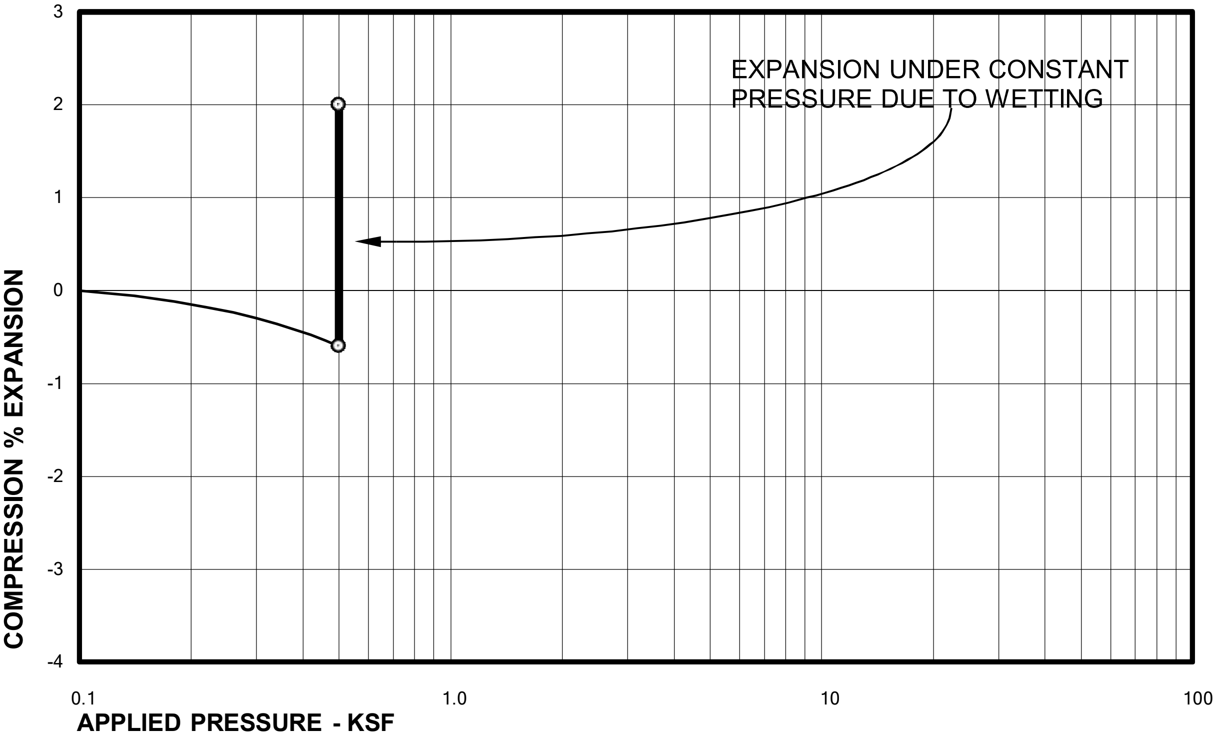


Sample of CLAY, SANDY (CL)

From TH-15 AT 14 FEET

DRY UNIT WEIGHT= 120 PCF

MOISTURE CONTENT= 8.9 %



Sample of CLAY, SANDY (CL)

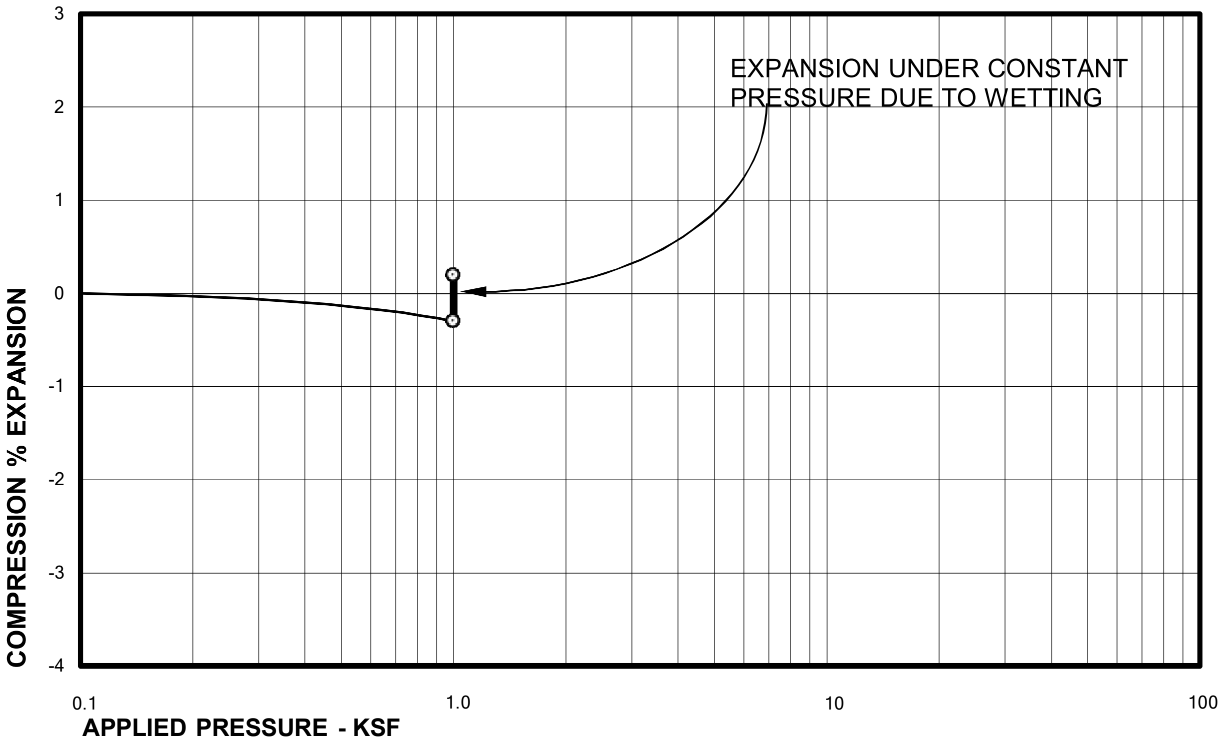
From TH-16 AT 4 FEET

DRY UNIT WEIGHT= 113 PCF

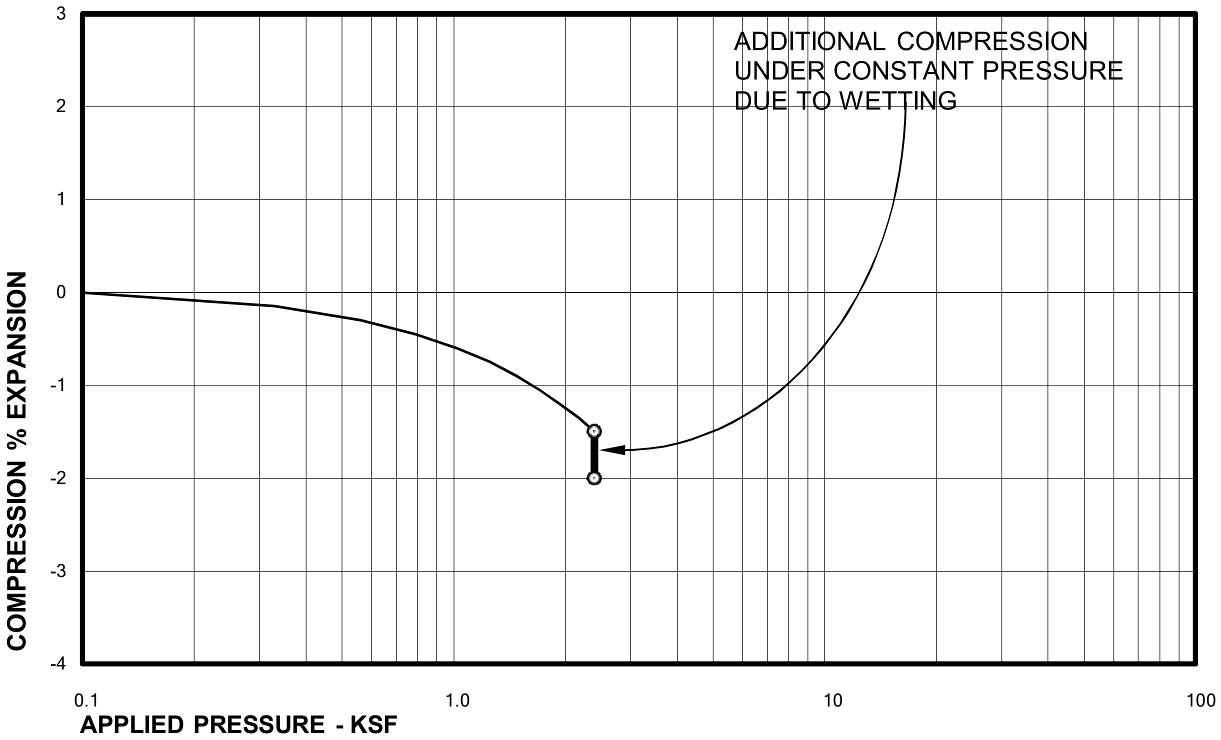
MOISTURE CONTENT= 10.1 %

Swell Consolidation Test Results

FIG. B-27



Sample of	SAND, CLAYEY (SC)	DRY UNIT WEIGHT=	113	PCF
From	TH-16 AT 7 FEET	MOISTURE CONTENT=	6.6	%

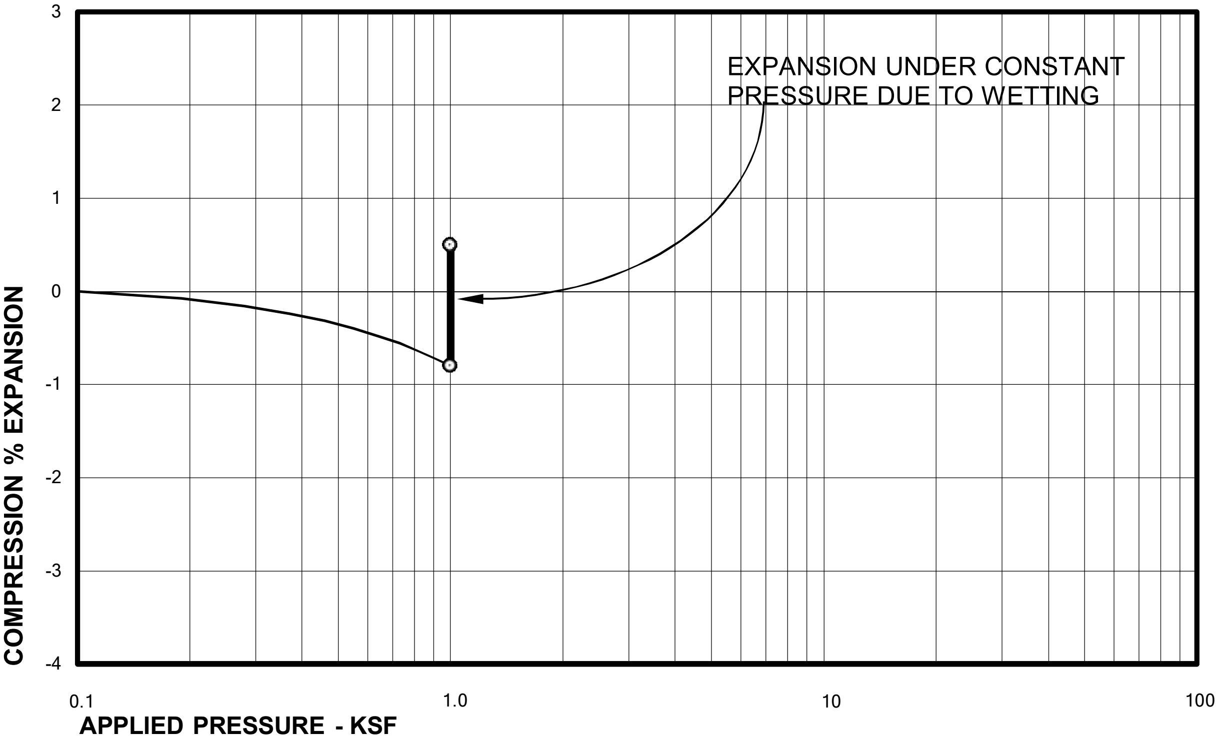


Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	117	PCF
From	TH-16 AT 19 FEET	MOISTURE CONTENT=	11.0	%

Swell Consolidation Test Results

FIG. B-28

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

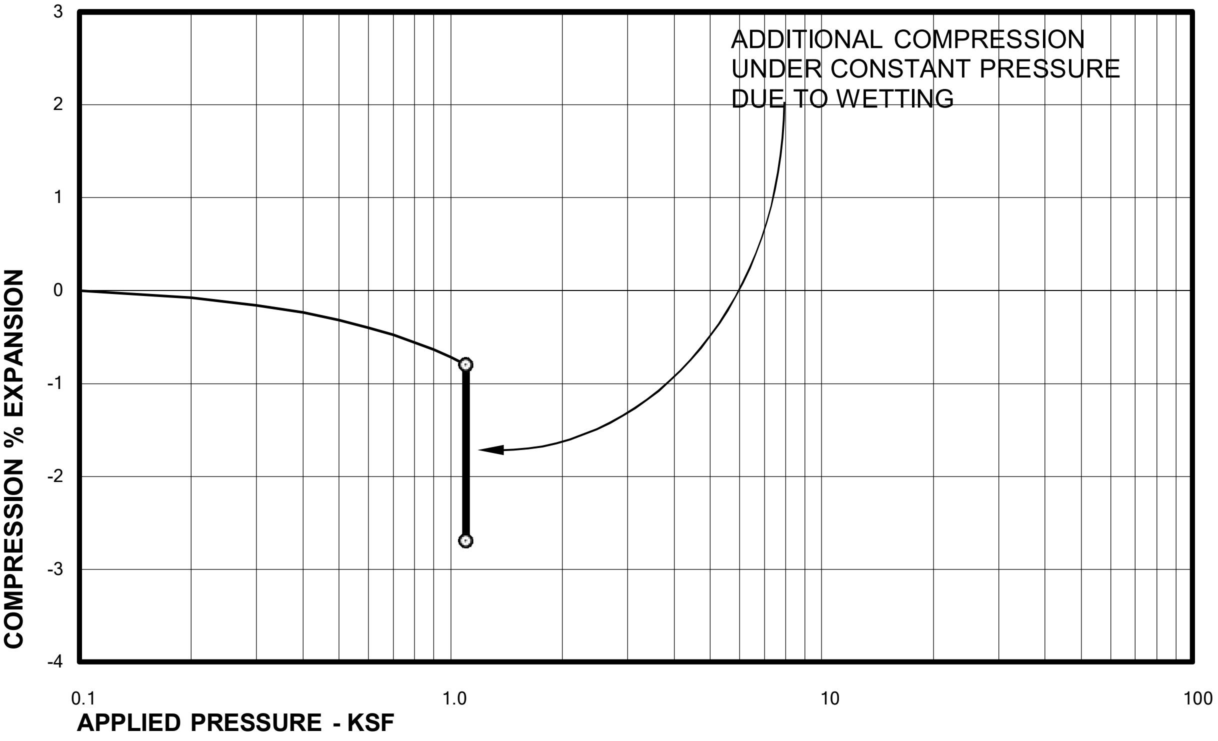


Sample of CLAY, SANDY (CL)

From TH-17 AT 2 FEET

DRY UNIT WEIGHT= 115 PCF

MOISTURE CONTENT= 8.0 %



Sample of CLAY, SANDY (CL)

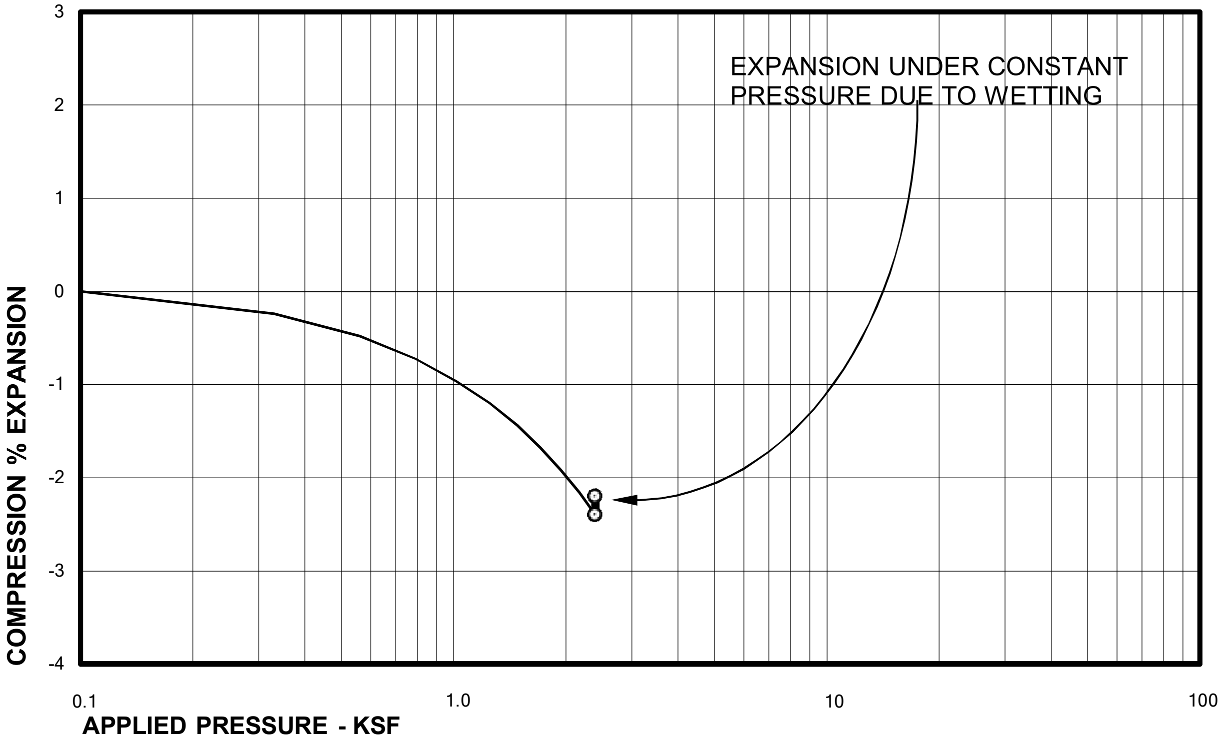
From TH-17 AT 4 FEET

DRY UNIT WEIGHT= 102 PCF

MOISTURE CONTENT= 8.9 %

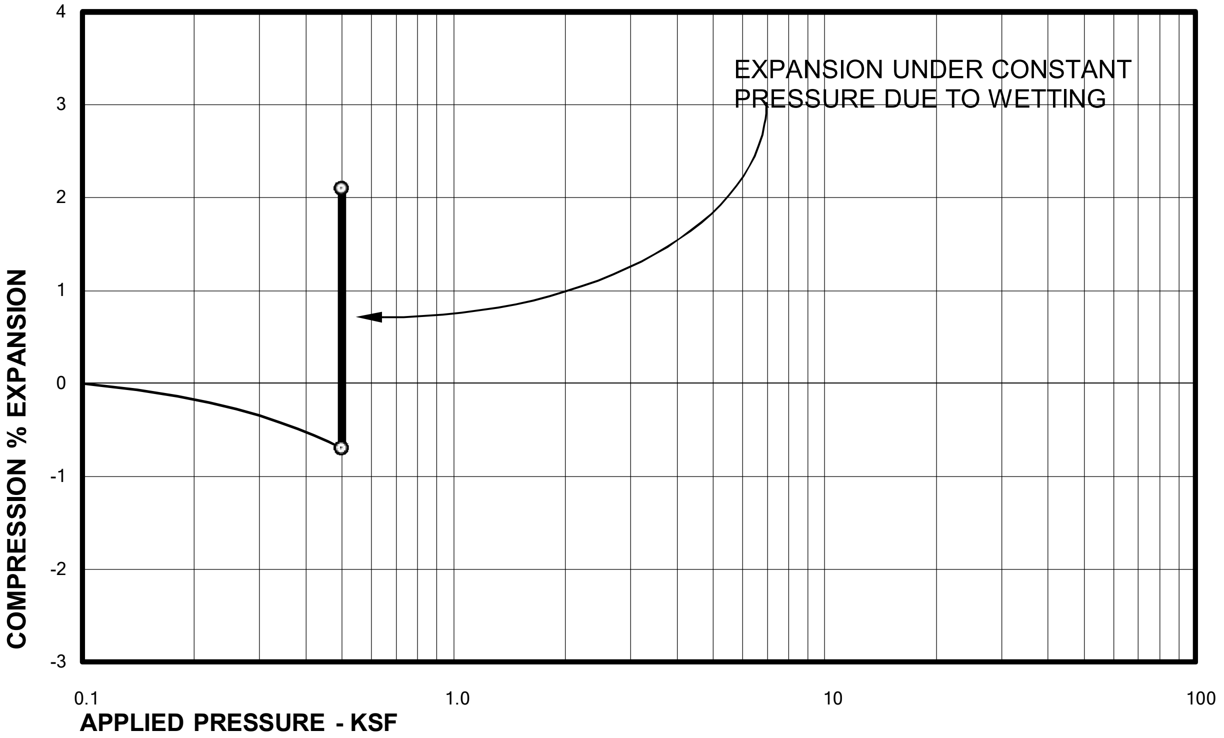
Swell Consolidation Test Results

FIG. B-29



Sample of CLAY, SANDY (CL)
From TH-17 AT 14 FEET

DRY UNIT WEIGHT= 122 PCF
MOISTURE CONTENT= 11.1 %



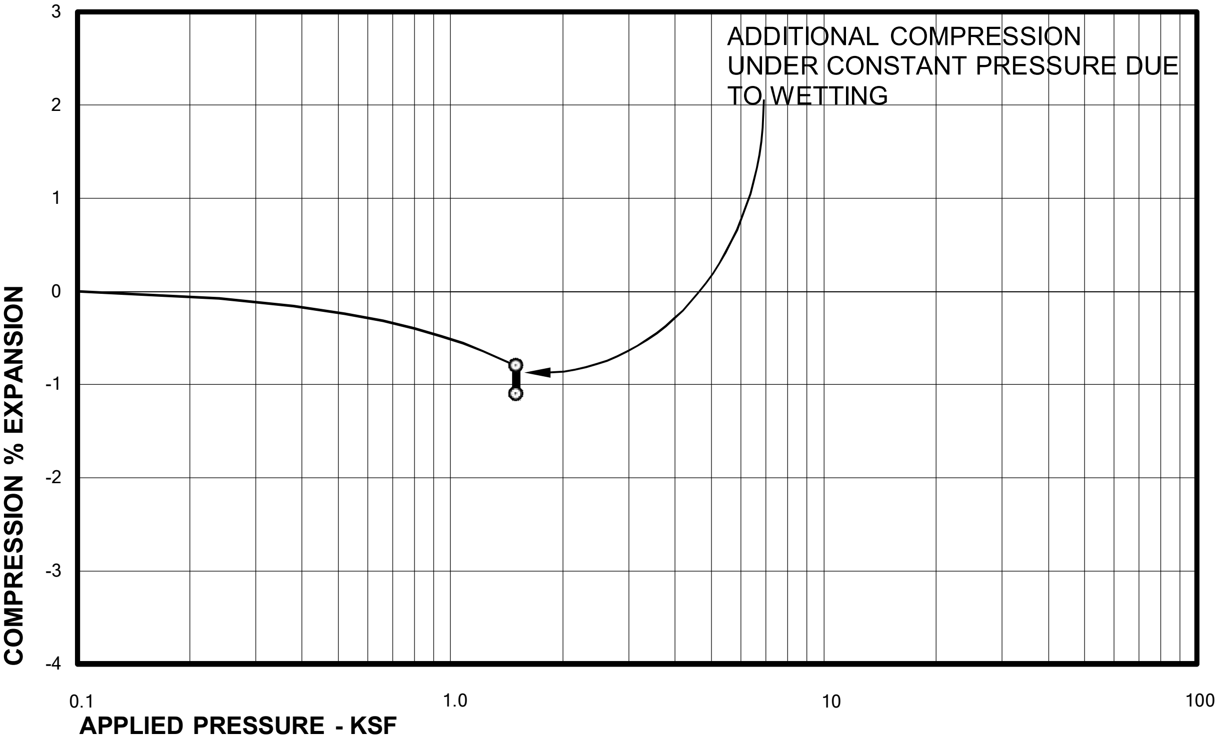
Sample of CLAY, SANDY (CL)
From TH-18 AT 4 FEET

DRY UNIT WEIGHT= 108 PCF
MOISTURE CONTENT= 7.1 %

Swell Consolidation Test Results

FIG. B-30

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

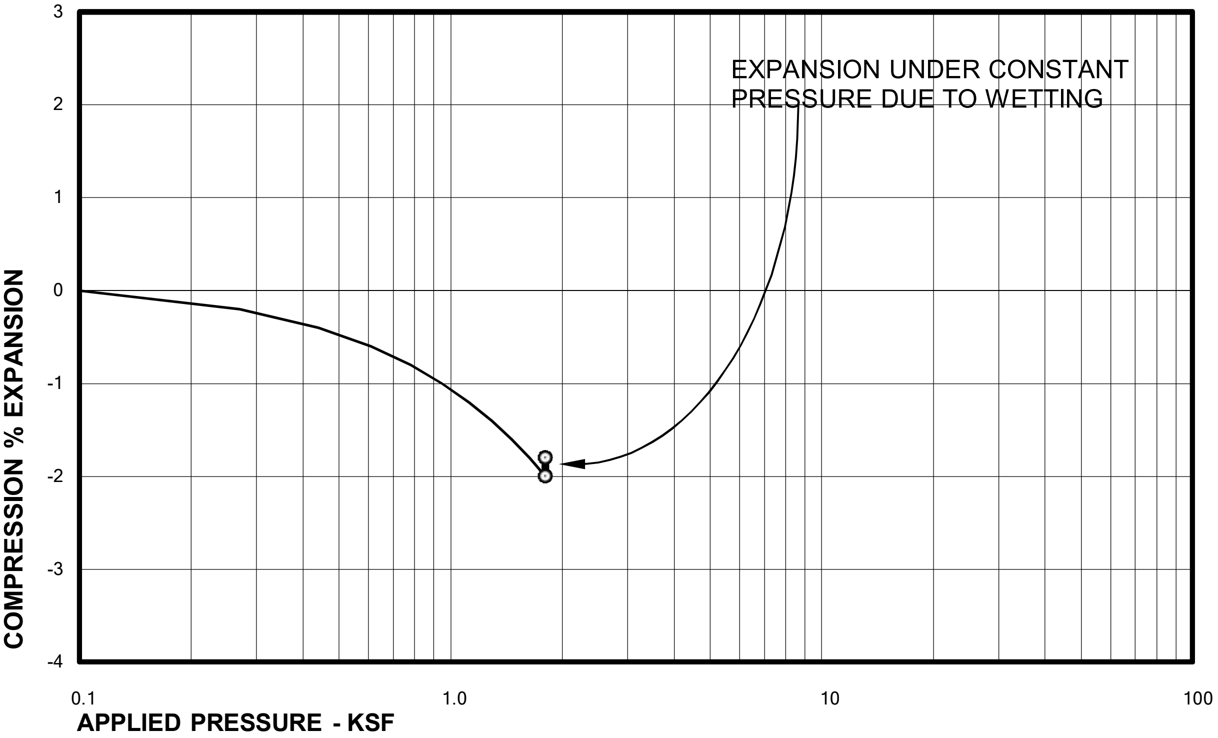


Sample of SAND, CLAYEY (SC)

From TH-18 AT 12 FEET

DRY UNIT WEIGHT= 124 PCF

MOISTURE CONTENT= 11.1 %



Sample of CLAY, SANDY (CL)

From TH-18 AT 14 FEET

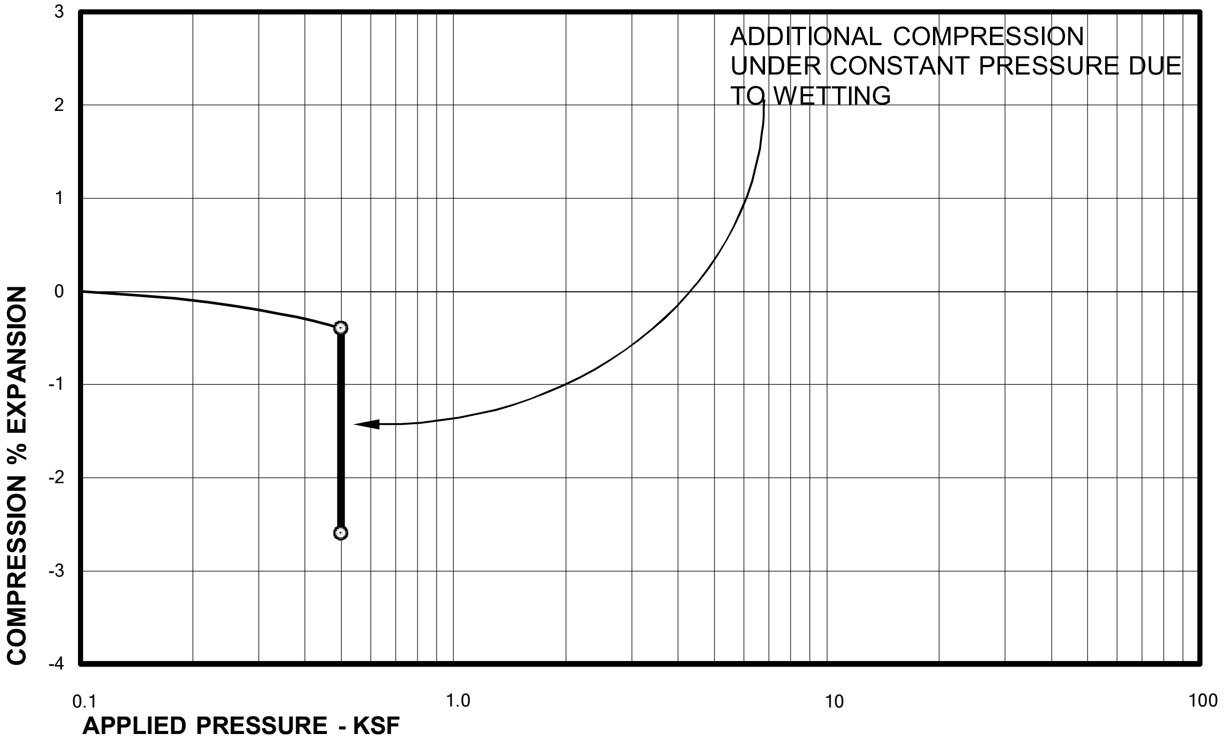
DRY UNIT WEIGHT= 118 PCF

MOISTURE CONTENT= 14.5 %

Swell Consolidation Test Results

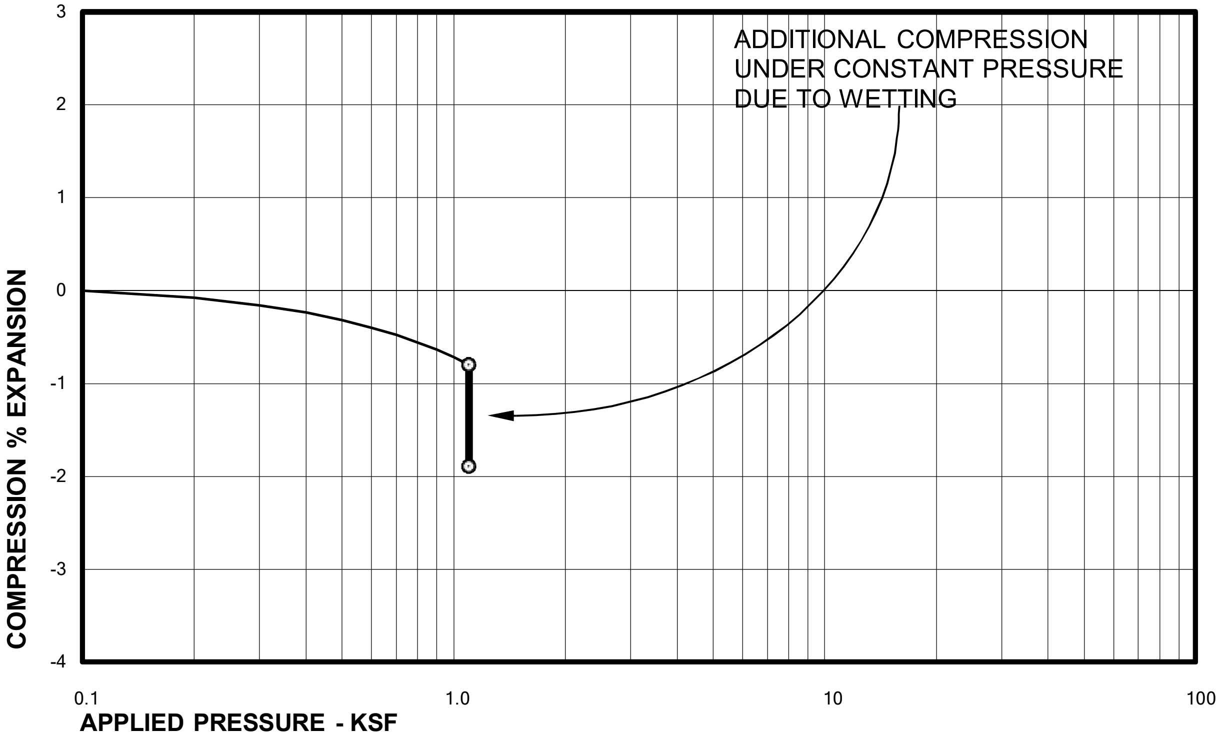
FIG. B-31

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of CLAY, SANDY (CL)
From TH-19 AT 4 FEET

DRY UNIT WEIGHT= 98 PCF
MOISTURE CONTENT= 6.9 %

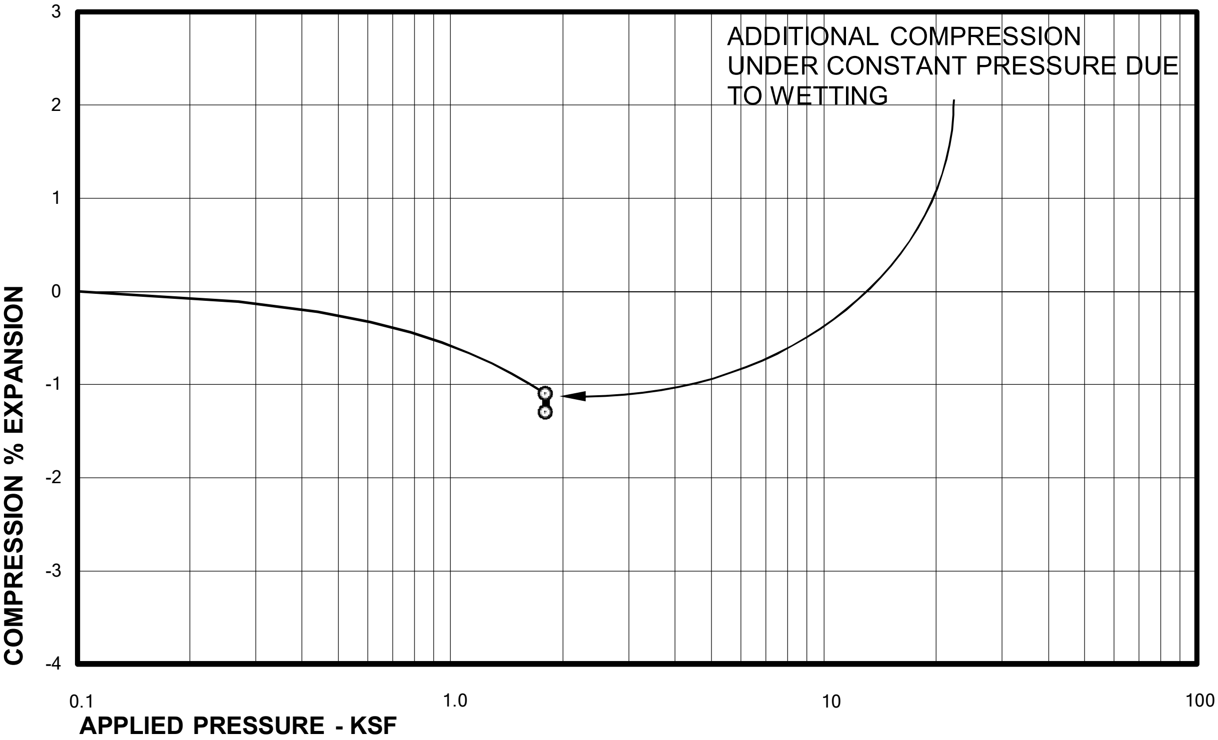


Sample of CLAY, SANDY (CL)
From TH-19 AT 9 FEET

DRY UNIT WEIGHT= 103 PCF
MOISTURE CONTENT= 7.5 %

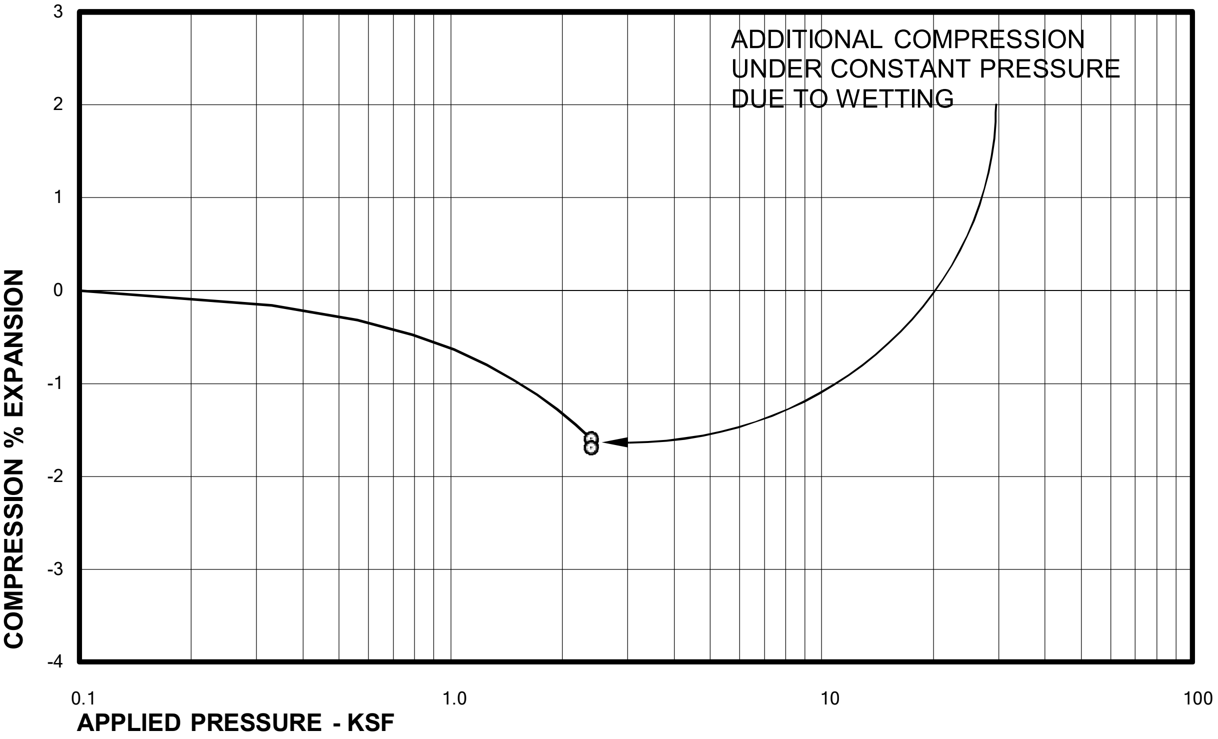
Swell Consolidation Test Results

FIG. B-32



Sample of CLAY, SANDY (CL)
From TH-19 AT 14 FEET

DRY UNIT WEIGHT= 109 PCF
MOISTURE CONTENT= 16.2 %



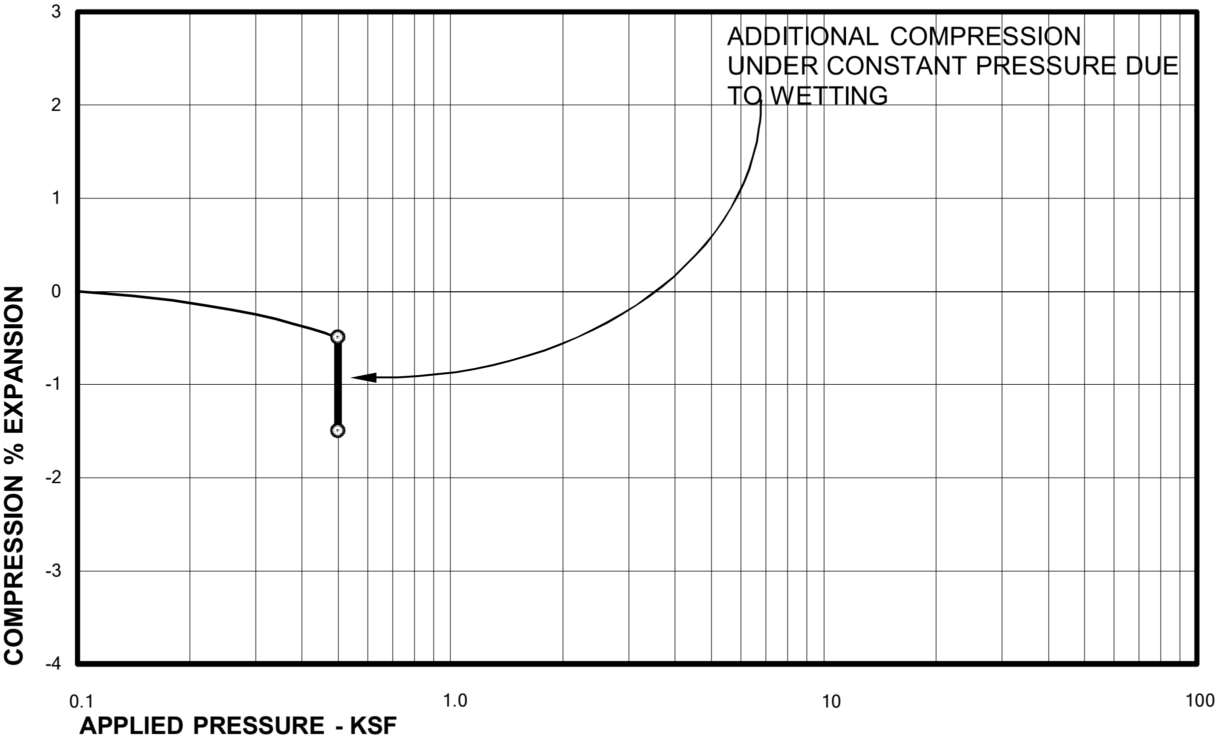
Sample of CLAY, SANDY (CL)
From TH-19 AT 19 FEET

DRY UNIT WEIGHT= 107 PCF
MOISTURE CONTENT= 18.9 %

Swell Consolidation Test Results

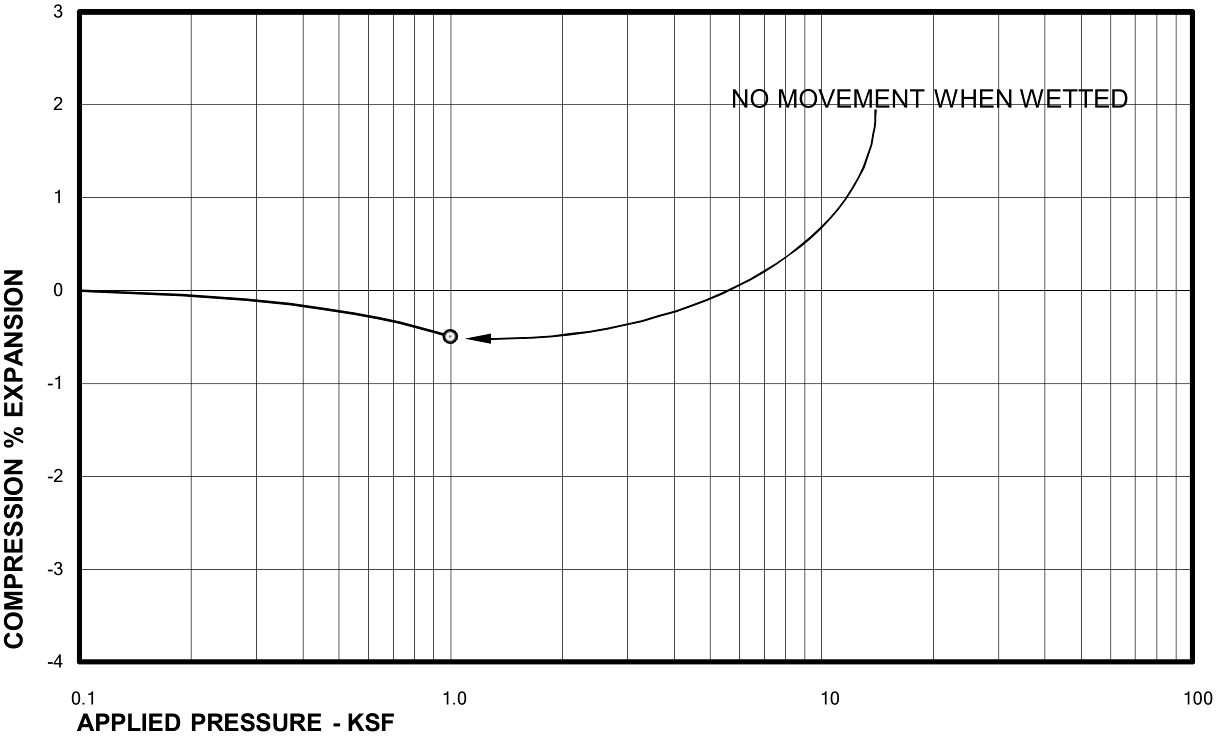
FIG. B-33

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of SAND, CLAYEY (SC)
From TH-20 AT 4 FEET

DRY UNIT WEIGHT= 94 PCF
MOISTURE CONTENT= 10.2 %



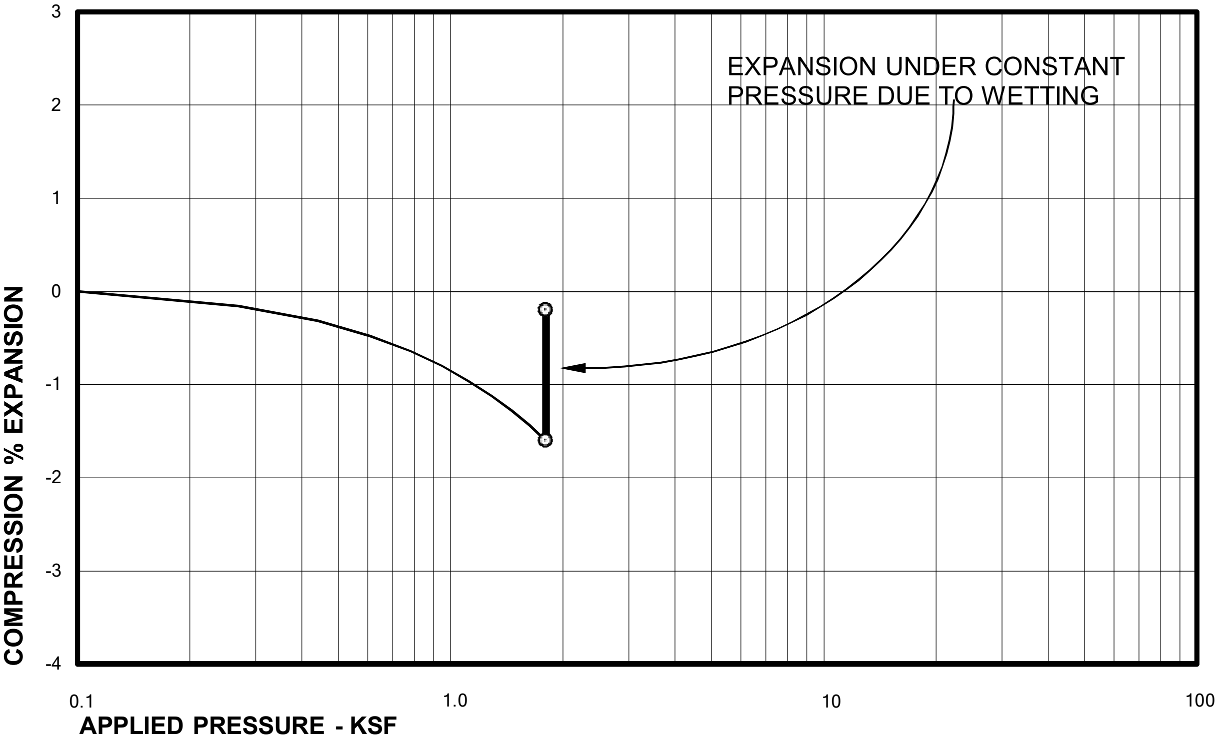
Sample of SAND, CLAYEY (SC)
From TH-20 AT 7 FEET

DRY UNIT WEIGHT= 103 PCF
MOISTURE CONTENT= 7.2 %

Swell Consolidation Test Results

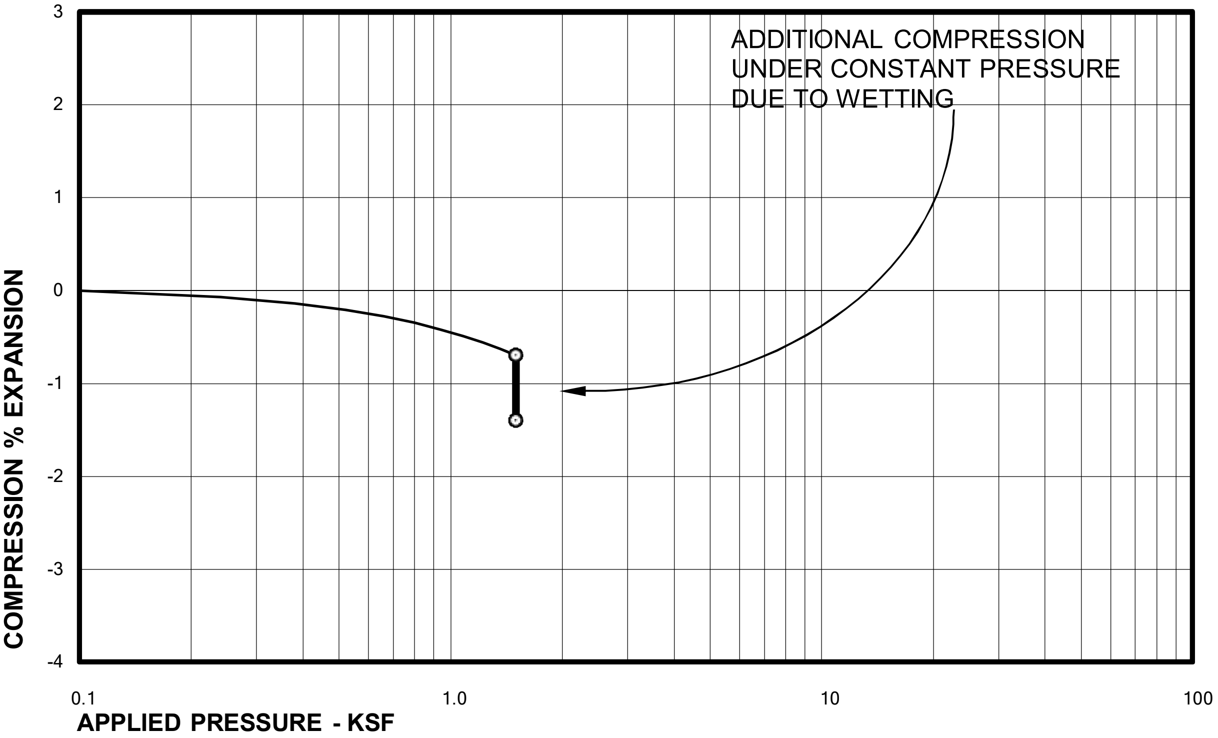
FIG. B-34

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of CLAY, SANDY (CL)
From TH-20 AT 14 FEET

DRY UNIT WEIGHT= 117 PCF
MOISTURE CONTENT= 14.5 %



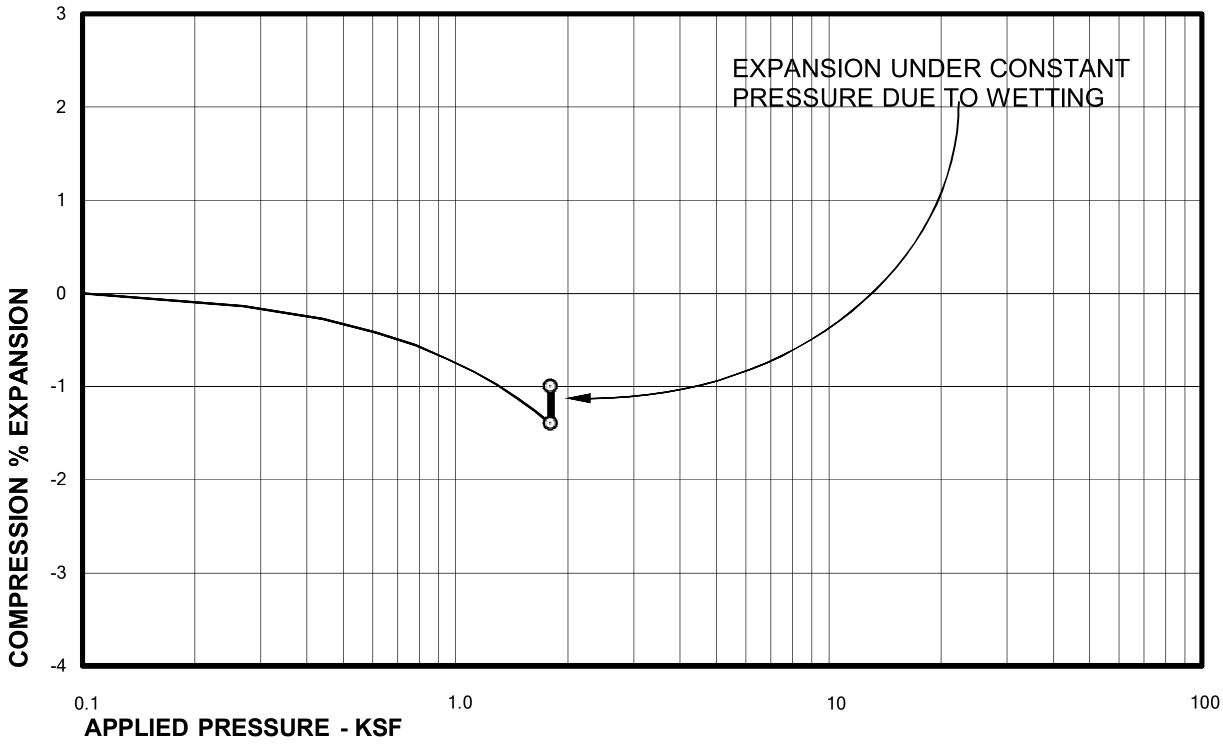
Sample of CLAY, SANDY (CL)
From TH-21 AT 12 FEET

DRY UNIT WEIGHT= 107 PCF
MOISTURE CONTENT= 7.9 %

Swell Consolidation Test Results

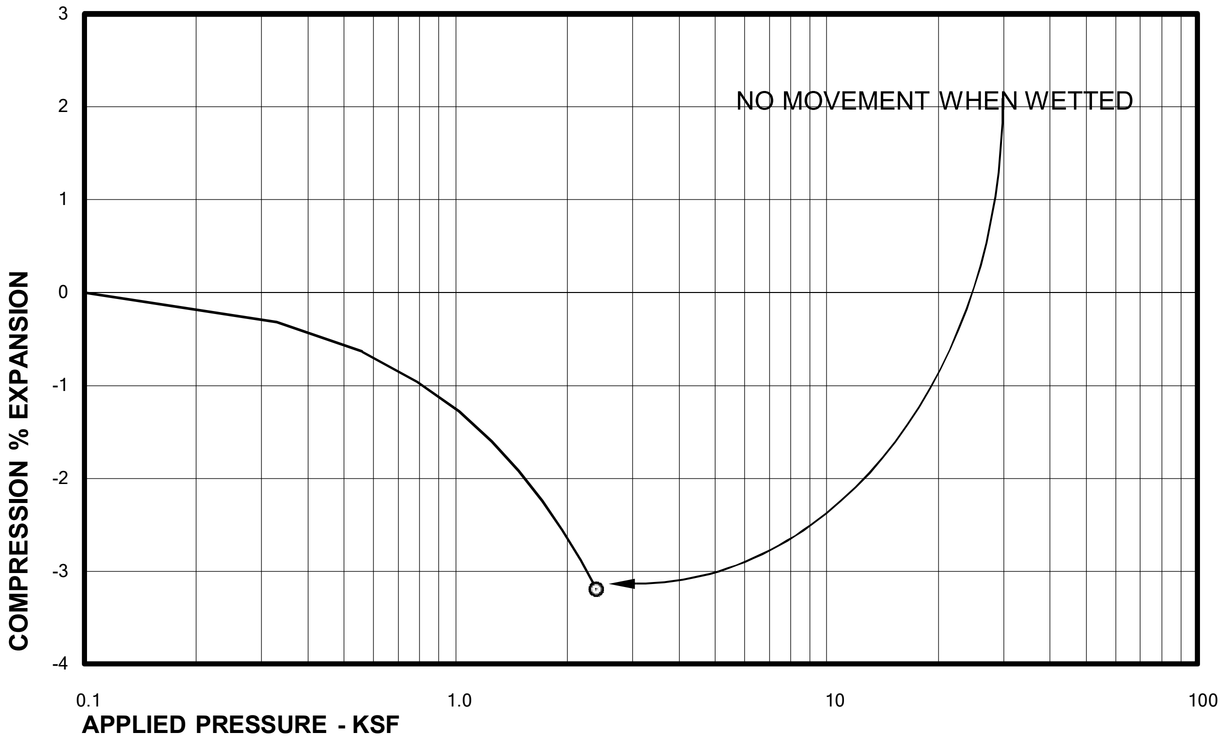
FIG. B-35

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of CLAY, SANDY (CL)
From TH-21 AT 14 FEET

DRY UNIT WEIGHT= 118 PCF
MOISTURE CONTENT= 11.6 %

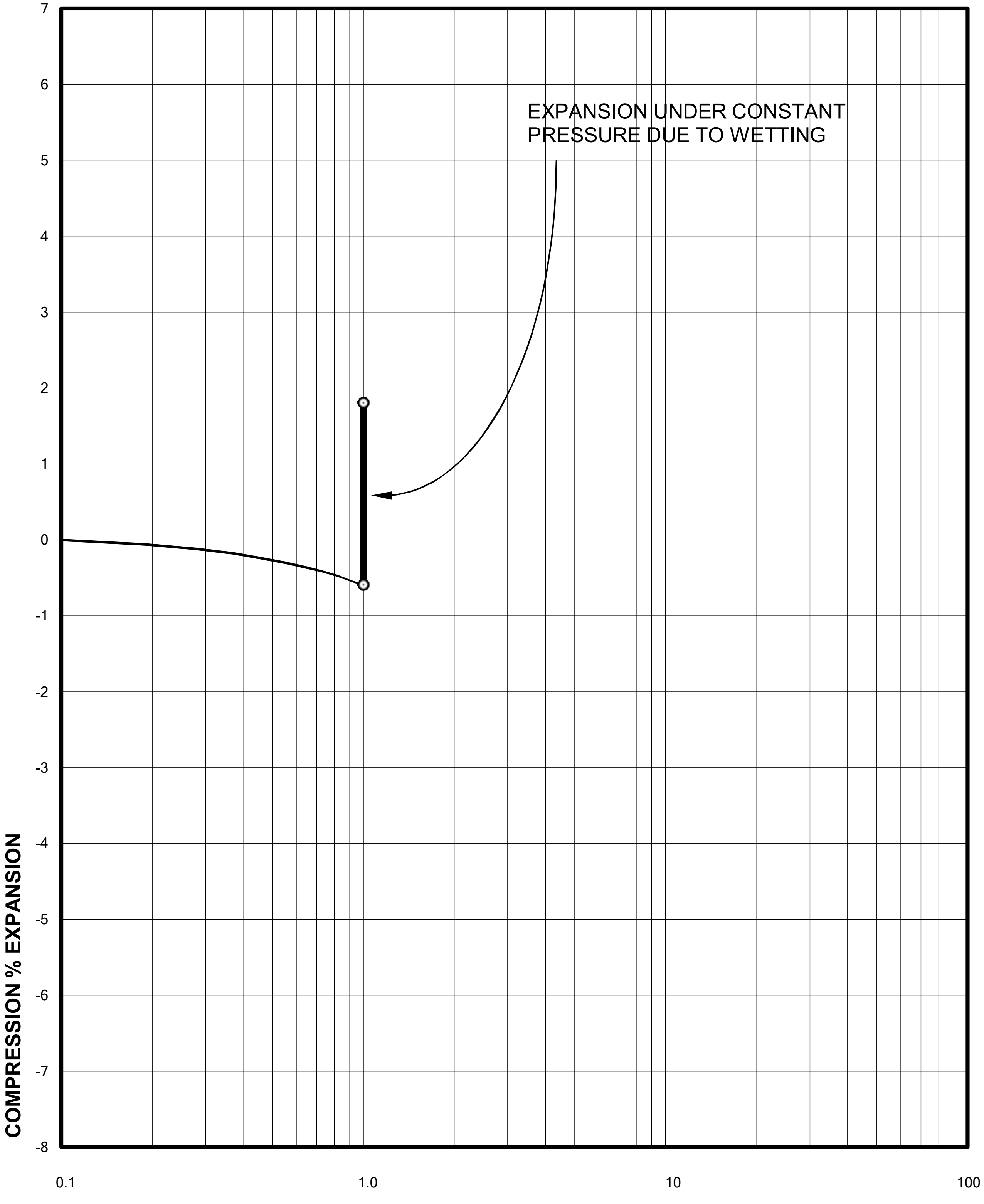


Sample of CLAY, SANDY (CL)
From TH-21 AT 19 FEET

DRY UNIT WEIGHT= 109 PCF
MOISTURE CONTENT= 15.3 %

Swell Consolidation Test Results

FIG. B-36



Sample of CLAY, SANDY (CL)

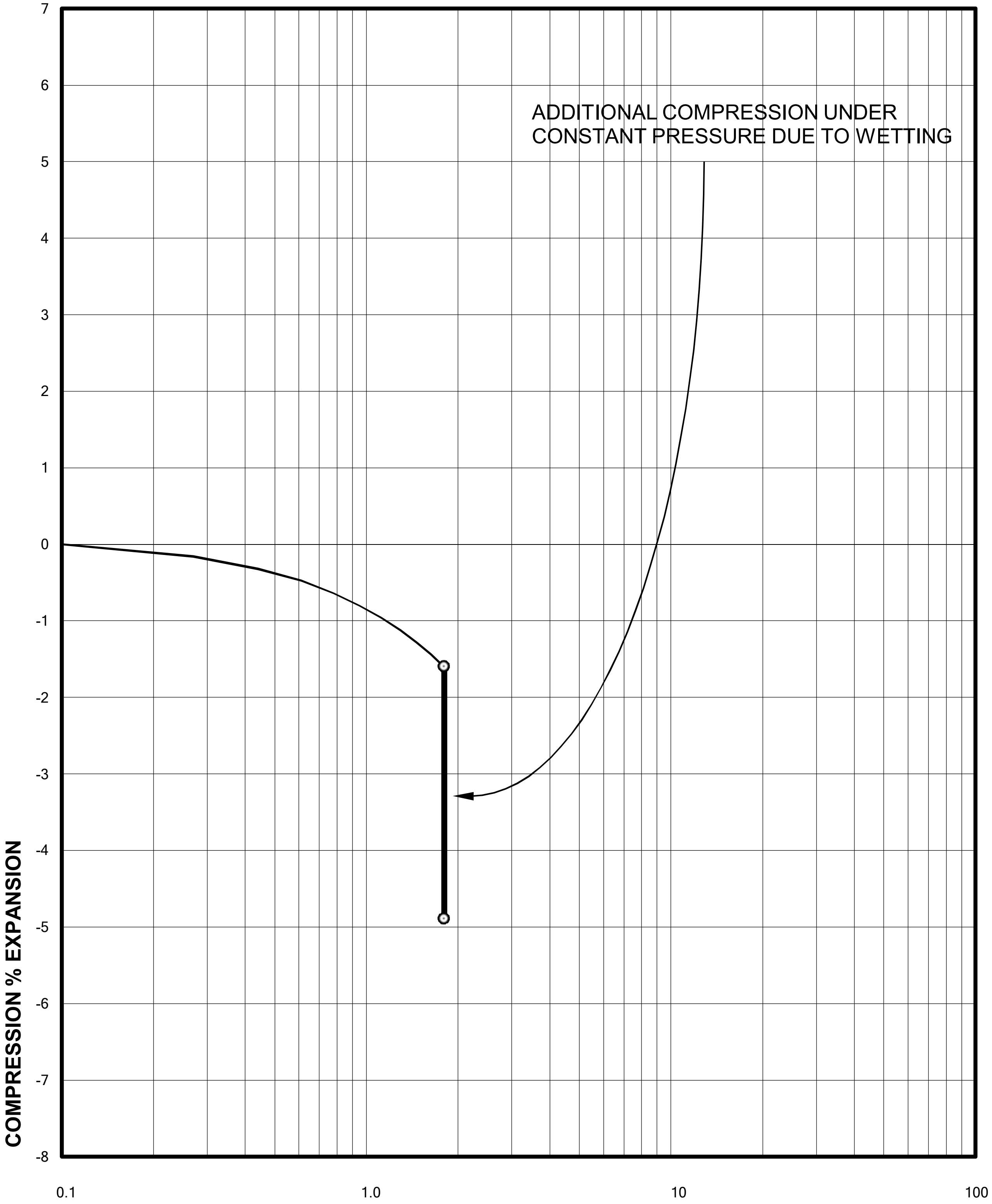
From TH-22 AT 2 FEET

DRY UNIT WEIGHT= 121 PCF

MOISTURE CONTENT= 8.9 %

Swell Consolidation Test Results

FIG. B-37



APPLIED PRESSURE - KSF

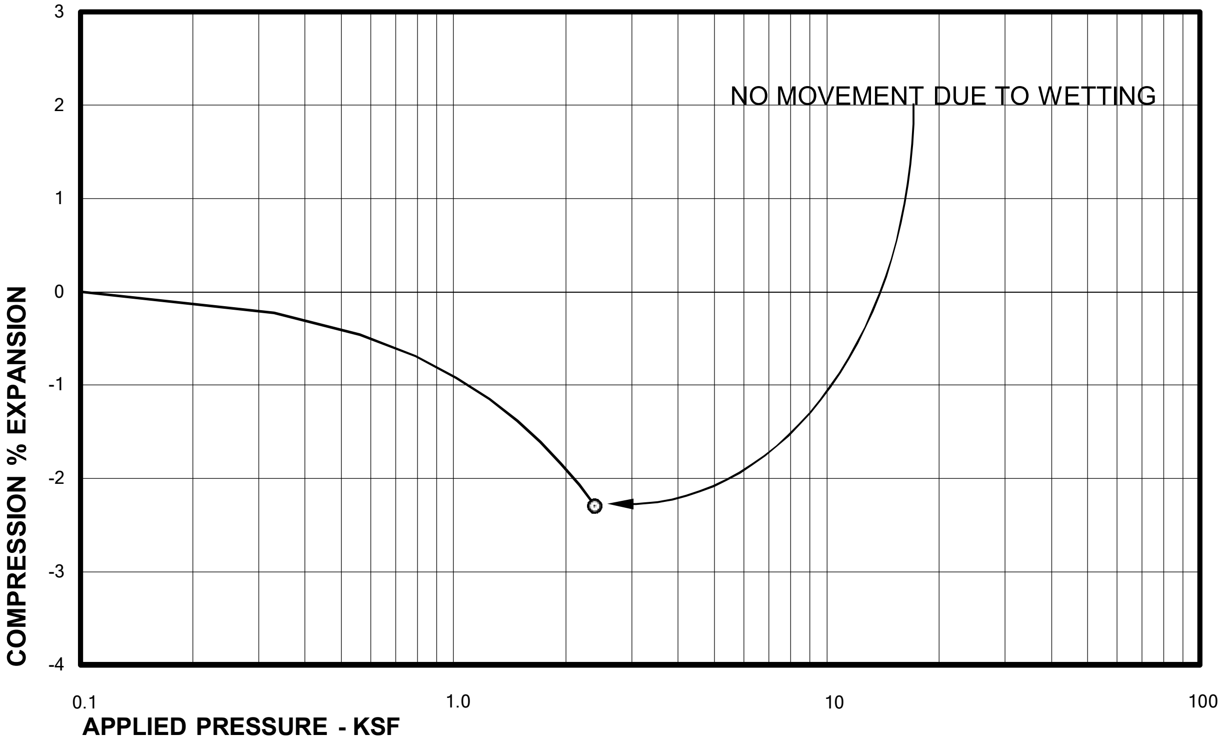
Sample of CLAY, SANDY (CL)
From TH-22 AT 9 FEET

DRY UNIT WEIGHT= 105 PCF
MOISTURE CONTENT= 8.2 %

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

Swell Consolidation Test Results

FIG. B-38

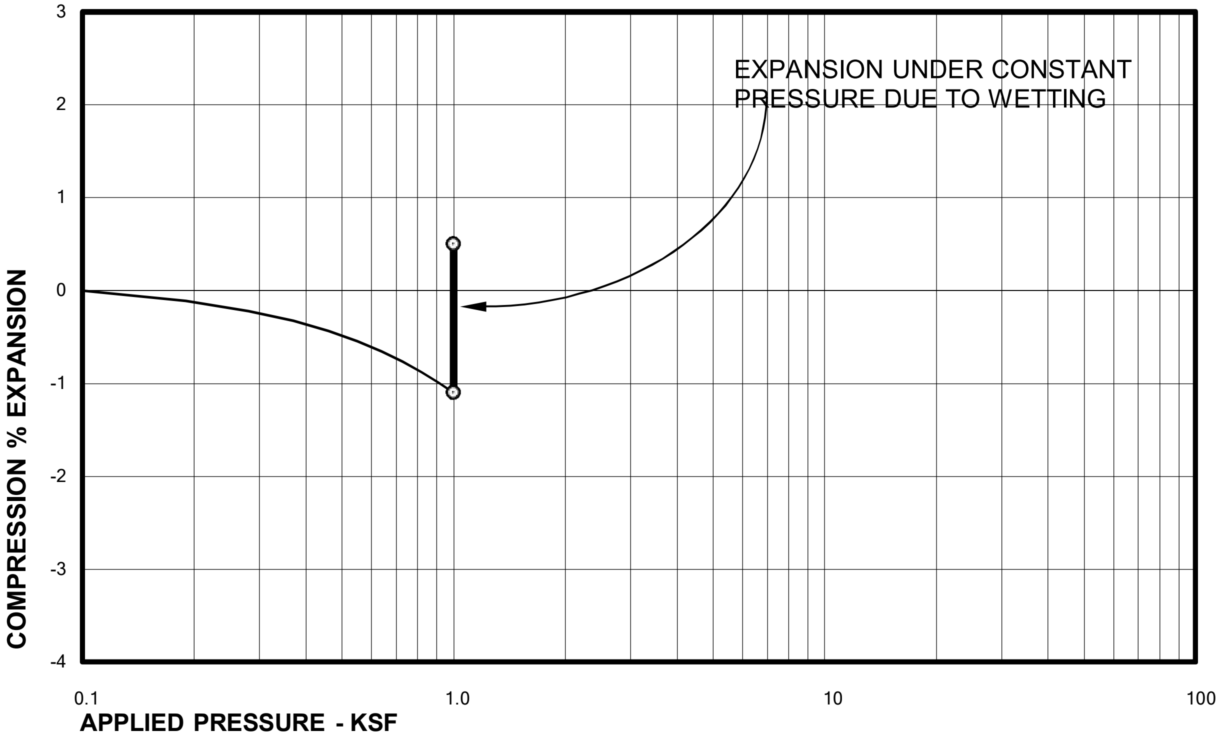


Sample of CLAY, SANDY (CL)

From TH-22 AT 14 FEET

DRY UNIT WEIGHT= 113 PCF

MOISTURE CONTENT= 16.3 %



Sample of CLAY, SANDY (CL)

From TH-23 AT 2 FEET

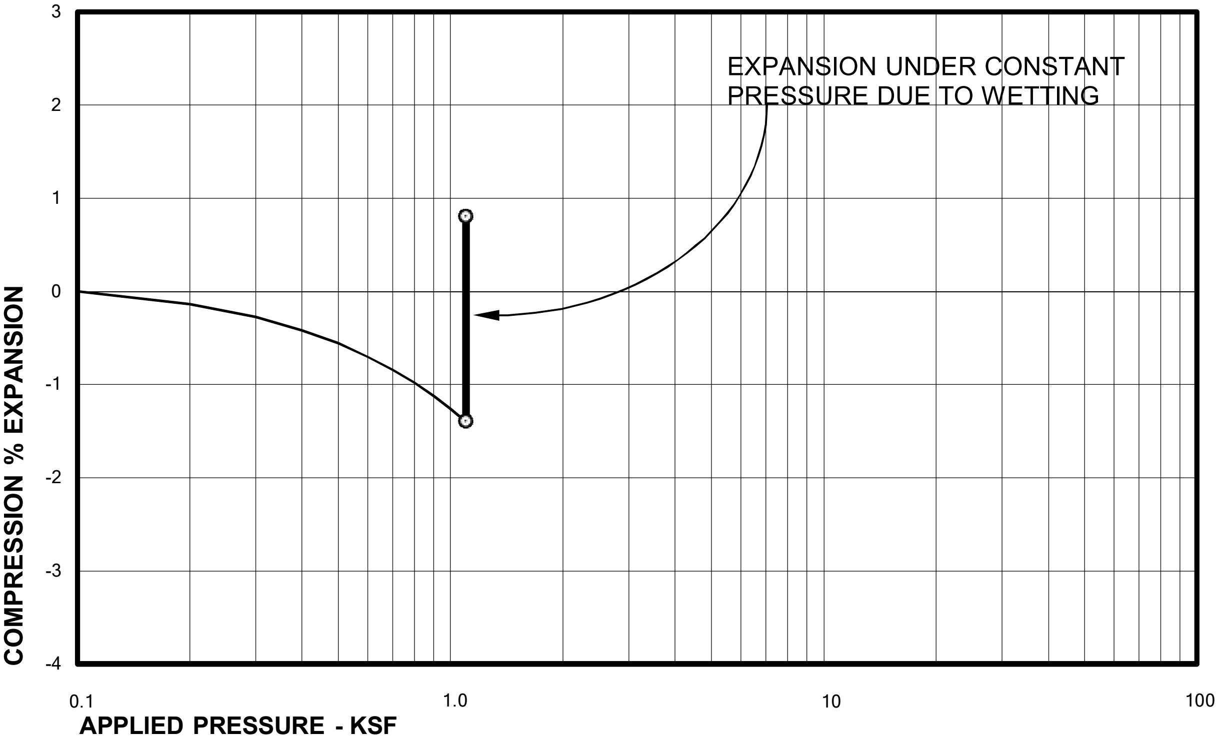
DRY UNIT WEIGHT= 117 PCF

MOISTURE CONTENT= 13.6 %

Swell Consolidation Test Results

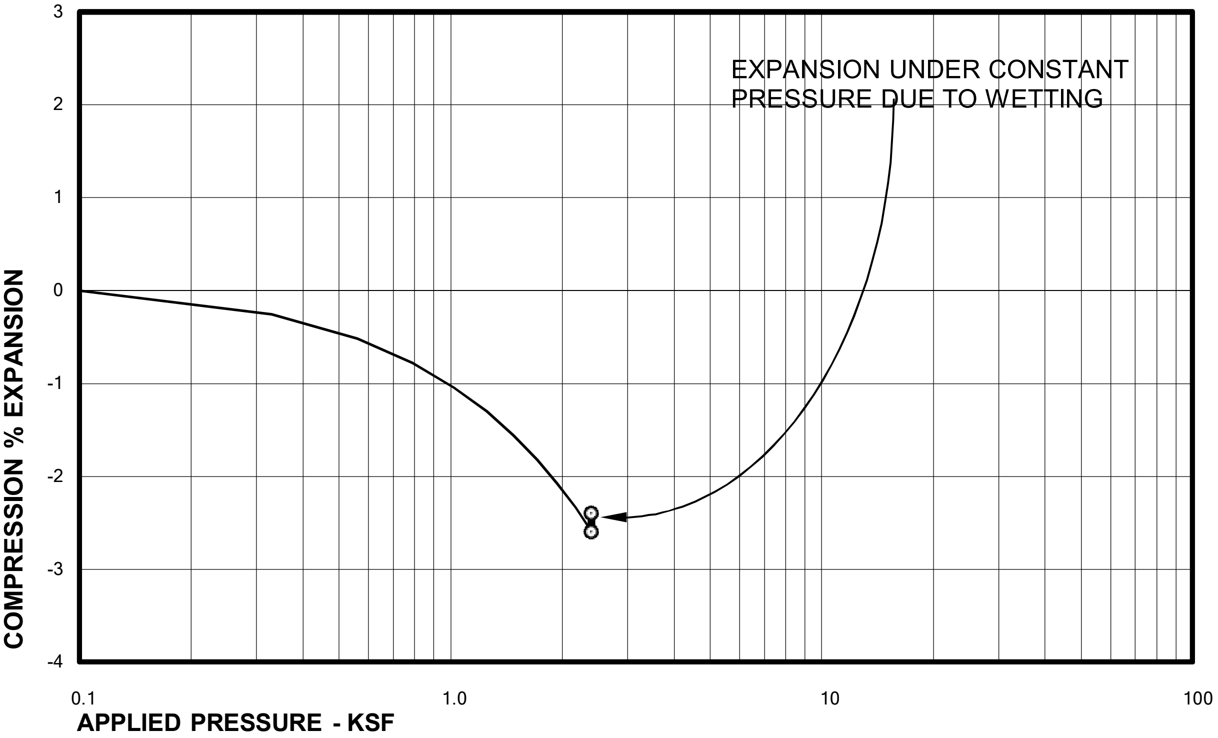
FIG. B-39

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



Sample of CLAY, SANDY (CL)
From TH-23 AT 4 FEET

DRY UNIT WEIGHT= 110 PCF
MOISTURE CONTENT= 11.1 %



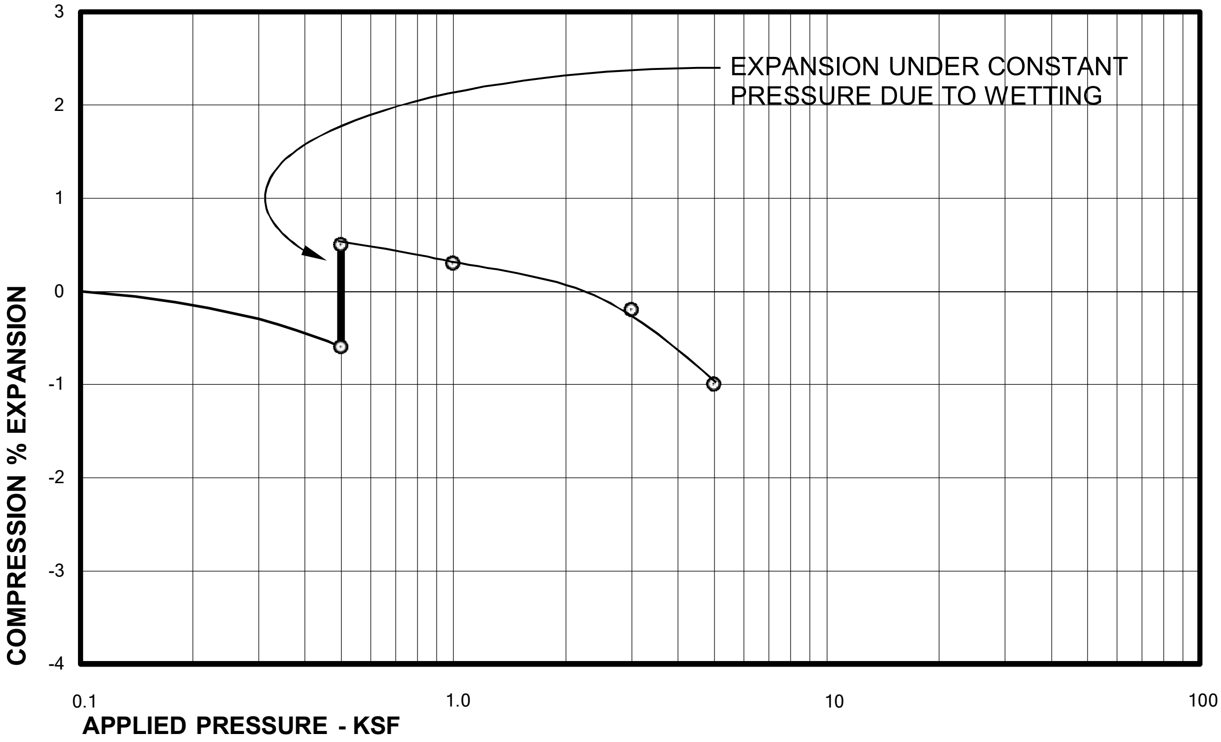
Sample of CLAY, SANDY (CL)
From TH-23 AT 14 FEET

DRY UNIT WEIGHT= 109 PCF
MOISTURE CONTENT= 18.0 %

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

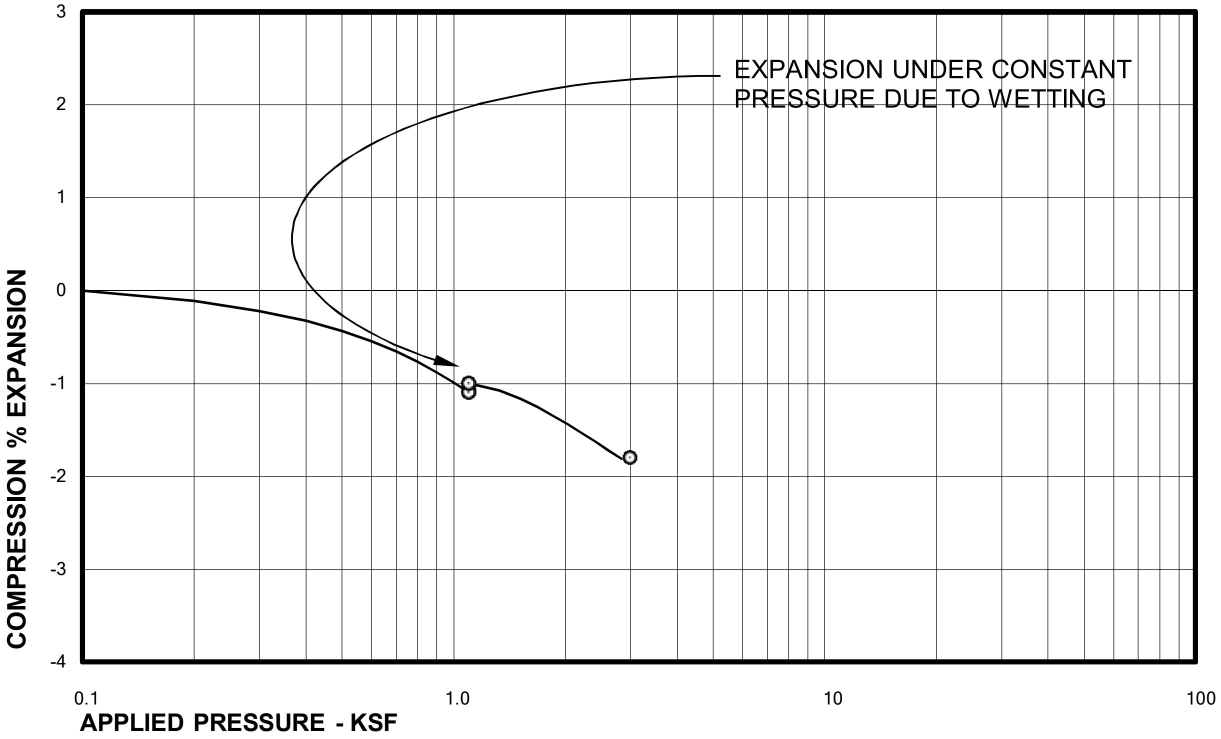
Swell Consolidation Test Results

FIG. B-40



Sample of CLAY, SANDY (CL)
From TH-24 AT 4 FEET

DRY UNIT WEIGHT= 117 PCF
MOISTURE CONTENT= 14.5 %



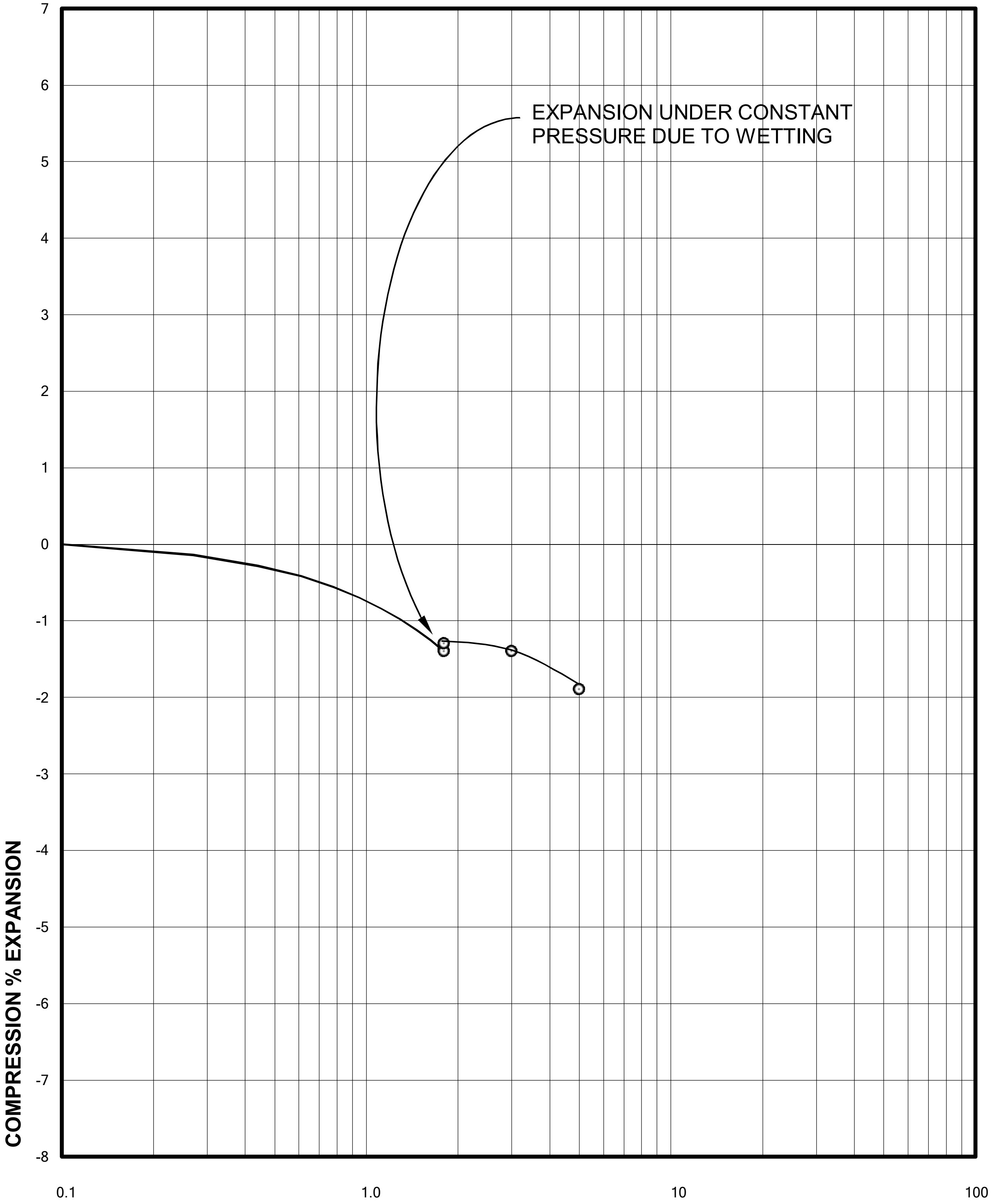
Sample of CLAY, SANDY (CL)
From TH-24 AT 9 FEET

DRY UNIT WEIGHT= 121 PCF
MOISTURE CONTENT= 11.9 %

Swell Consolidation Test Results

FIG. B-41

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1



APPLIED PRESSURE - KSF

Sample of CLAY, SANDY (CL)

From TH-24 AT 14 FEET

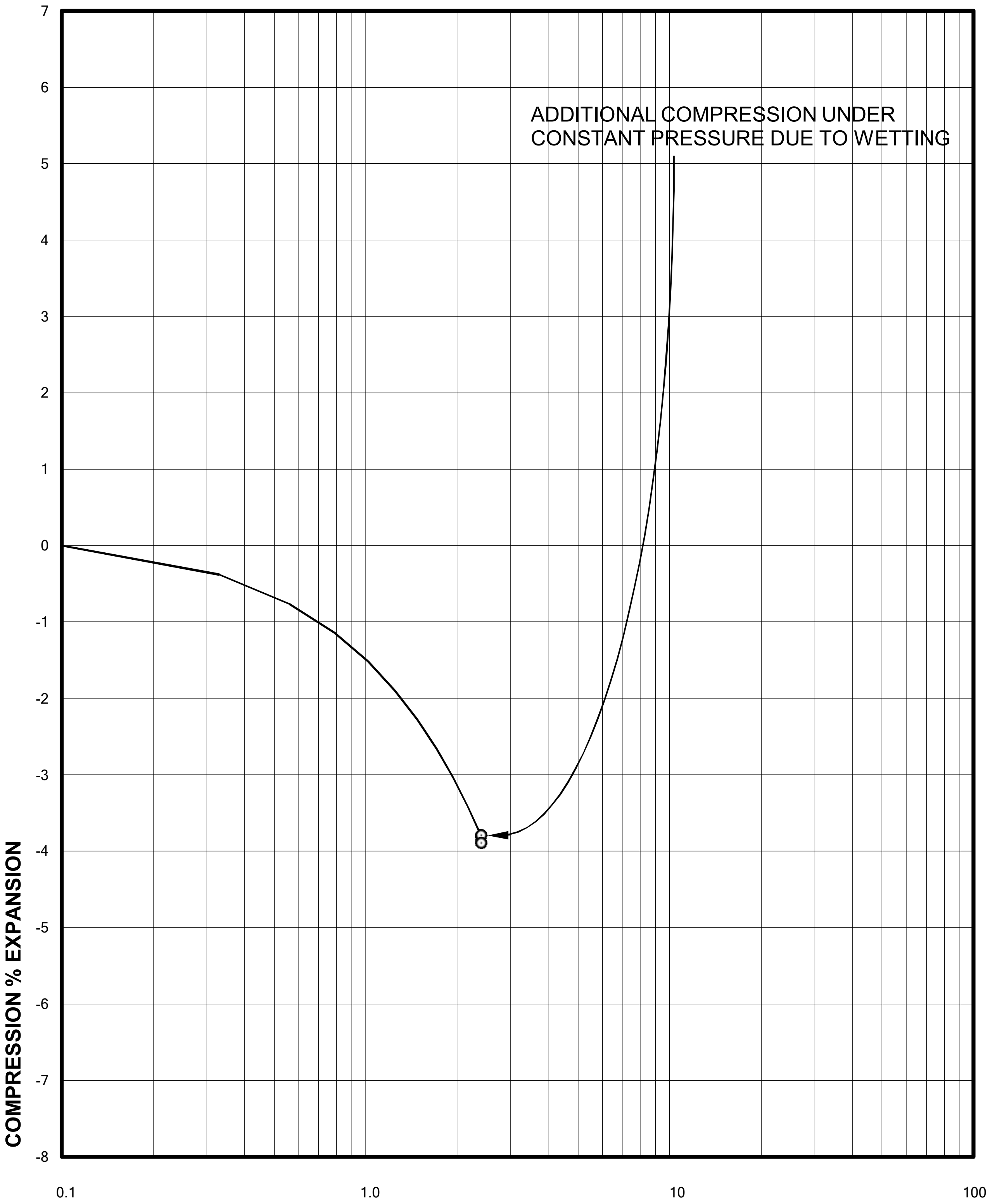
DRY UNIT WEIGHT= 121 PCF

MOISTURE CONTENT= 12.9 %

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

Swell Consolidation Test Results

FIG. B-42



Sample of CLAY, SANDY (CL)

From TH-24 AT 19 FEET

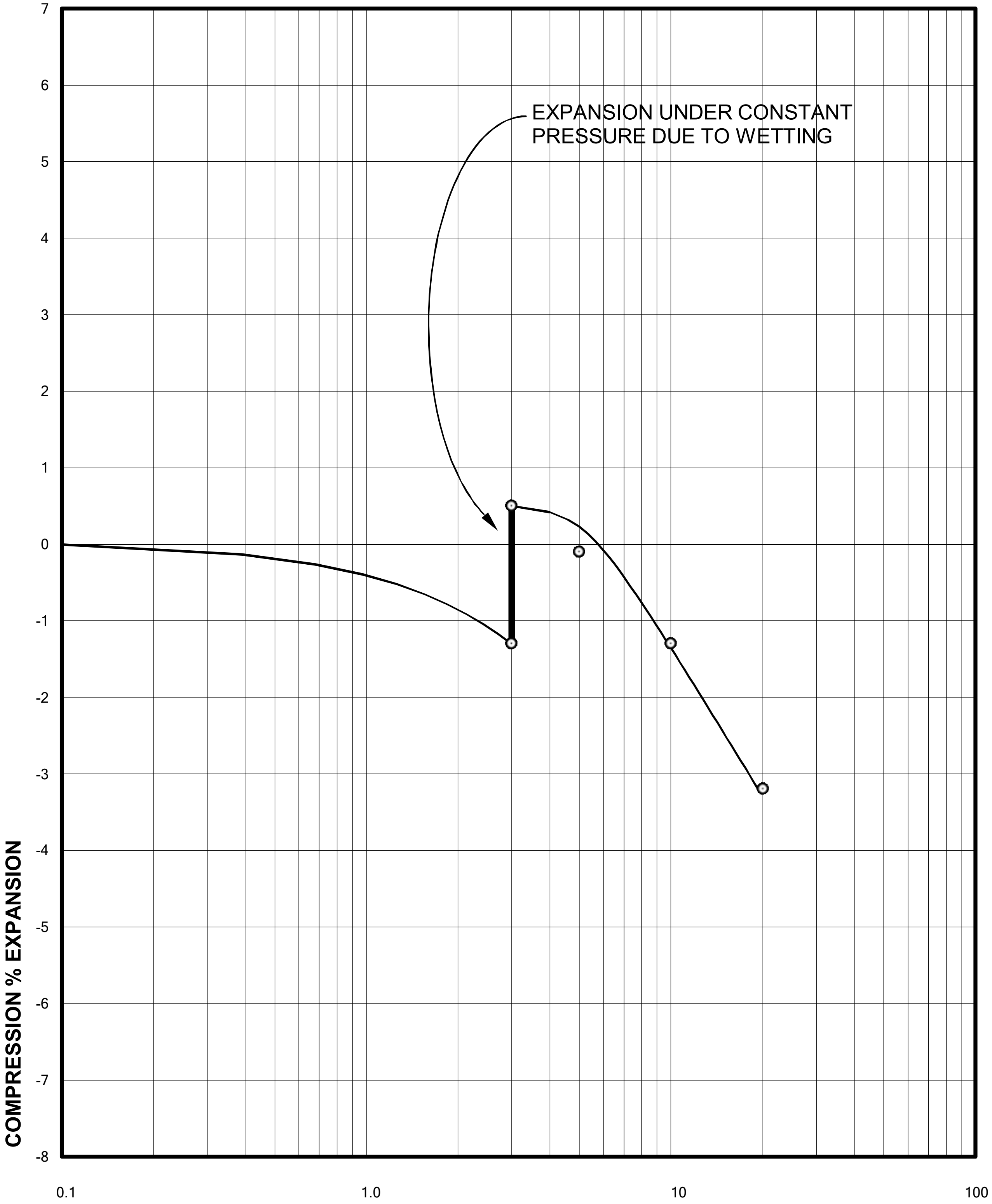
DRY UNIT WEIGHT= 112 PCF

MOISTURE CONTENT= 15.0 %

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

Swell Consolidation Test Results

FIG. B-43



APPLIED PRESSURE - KSF

Sample of	CLAYSTONE	DRY UNIT WEIGHT=	111	PCF
From	TH-24 AT 24 FEET	MOISTURE CONTENT=	19.6	%

CALATLANTIC GROUP
D/B/A CALATLANTIC HOMES
COMPASS, FILING NO. 4
CTL|T PROJECT NO. DN48,913-115-R1

Swell Consolidation Test Results

FIG. B-44

TABLE B - I

SUMMARY OF LABORATORY TEST RESULTS

				SWELL TEST DATA				SOIL	ATTERBERG LIMITS		SOLUBLE	PASSING	
BORING	DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SWELL (%)	COMPRESSION (%)	APPLIED PRESSURE (psf)	SWELL PRESSURE (psf)	SUCTION VALUE (pF)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	SULFATE CONTENT (%)	NO. 200 SIEVE (%)	SOIL TYPE
TH-1	9	5.4	114	0.9		500			23	5		40	SAND, CLAYEY (SC)
TH-1	12	9.6	115		0.1	1,000							SAND, CLAYEY (SC)
TH-1	14	10.5	102		0.8	1,100							CLAY, SANDY (CL)
TH-1	24	18.4	110	0.0		2,400							CLAY, SANDY (CL)
TH-2	9	8.5	119	3.4		500			28	14		68	CLAY, SANDY (CL)
TH-2	14	10.9	111	0.4		1,100					0.01		CLAY, SANDY (CL)
TH-2	17	8.2	106		2.4	1,500							CLAY, SANDY (CL)
TH-2	24	8.9	120	1.0		2,400							CLAY, SANDY (CL)
TH-3	4	8.2	117	2.0		500							CLAY, SANDY (CL)
TH-3	7	7.3	118	1.8		1,000							CLAY, SANDY (CL)
TH-3	9	12.9	119	1.6		1,100							CLAY, SANDY (CL)
TH-3	19	15.7	117	0.7		2,400							CLAY, SANDY (CL)
TH-4	7	9.6	118	0.6		1,500							CLAY, SANDY (CL)
TH-4	9	9.3	120	1.2		1,800					0.03		CLAY, SANDY (CL)
TH-4	14	16.8	114	0.1		2,400							CLAY, SANDY (CL)
TH-5	2	7.1	96		4.4	1,000							SAND, CLAYEY (SC)
TH-5	4	9.1	116		2.1	1,100							SAND, CLAYEY (SC)
TH-5	14	17.6	116	0.3		2,400							CLAY, SANDY (CL)
TH-6	9	6.5	111	1.5		500			28	14		67	CLAY, SANDY (CL)
TH-6	14	6.3	103		1.7	1,100							CLAY, SANDY (CL)
TH-6	17	8.7	100		4.5	1,500							CLAY, SANDY (CL)
TH-7	12	7.9	97		1.4	1,000			31	18		58	CLAY, SANDY (CL)
TH-7	14	9.2	106	0.5		1,100							CLAY, SANDY (CL)
TH-7	17	8.8	116	0.9		1,500							CLAY, SANDY (CL)
TH-8	9	9.8	98	1.0		500							CLAY, SANDY (CL)
TH-8	12	9.8	96		1.9	1,000							CLAY, SANDY (CL)
TH-8	17	5.5	112		1.9	1,500							CLAY, SANDY (CL)
TH-9	4	6.2	99		1.6	500							SAND, CLAYEY (SC)
TH-9	7	7.0	109	0.1		1,000					0.03		SAND, CLAYEY (SC)
TH-9	19	19.1	109	0.0		2,400							CLAY, SANDY (CL)
TH-10	4	3.9	105		1.1	500							SAND, CLAYEY (SC)
TH-10	9	5.6	101						20	1		29	SAND, SILTY (SM)
TH-10	14	6.7	106		1.6	1,800							SAND, CLAYEY (SC)
TH-11	4	12.3	93	0.0		500			31	16		76	CLAY, SANDY (CL)
TH-11	14	9.2	109		0.5	1,800							CLAY, SANDY (CL)
TH-11	19	17.1	111	0.0		2,400							CLAY, SANDY (CL)
TH-12	4	9.1	96	0.6		500			32	17		74	CLAY, SANDY (CL)
TH-12	7	8.7	114	0.0		1,000					0.02		CLAY, SANDY (CL)
TH-12	19	18.4	101		0.3	2,400							CLAY, SANDY (CL)
TH-13	7	7.4	116	1.1		1,000							CLAY, SANDY (CL)
TH-13	9	7.3	120	1.1		1,100							CLAY, SANDY (CL)
TH-13	24	17.8	110		0.2	3,000							CLAY, SANDY (CL)
TH-14	4	5.4	106	0.4		500	900	4.42					CLAY, SANDY (CL)
TH-14	9	6.9	102		1.7	1,100		4.28					CLAY, SANDY (CL)
TH-14	14	10.4	112		0.3	1,800		3.26					CLAY, SANDY (CL)
TH-14	19	14.9	118	0.5		2,400	4,200	3.70					CLAY, SANDY (CL)
TH-14	24	18.4	108		0.1	3,000		2.85					CLAY, SANDY (CL)
TH-15	4	4.6	107		0.3	500							CLAY, SANDY (CL)
TH-15	7	5.6	116		0.6	1,000							CLAY, SANDY (CL)

TABLE B - I

SUMMARY OF LABORATORY TEST RESULTS

BORING	DEPTH	MOISTURE	DRY	SWELL TEST DATA				SOIL	ATTERBERG LIMITS		SOLUBLE	PASSING	SOIL TYPE
	(ft)	CONTENT (%)	DENSITY (pcf)	SWELL (%)	COMPRESSION (%)	APPLIED PRESSURE (psf)	SWELL PRESSURE (psf)	SUCTION VALUE (pF)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	SULFATE CONTENT (%)	NO. 200 SIEVE (%)	
TH-15	14	8.9	120	1.4		1,800							CLAY, SANDY (CL)
TH-16	4	10.1	113	2.6		500							CLAY, SANDY (CL)
TH-16	7	6.6	113	0.5		1,000							SAND, CLAYEY (SC)
TH-16	19	11.0	117		0.5	2,400							CLAY, SANDY (CL)
TH-17	2	8.0	115	1.3		1,000							CLAY, SANDY (CL)
TH-17	4	8.9	102		1.9	1,100			34	20		65	CLAY, SANDY (CL)
TH-17	14	11.1	122	0.2		2,400							CLAY, SANDY (CL)
TH-18	4	7.1	108	2.8		500							CLAY, SANDY (CL)
TH-18	12	11.1	124		0.3	1,500							SAND, CLAYEY (SC)
TH-18	14	14.5	118	0.2		1,800							CLAY, SANDY (CL)
TH-19	4	6.9	98		2.2	500					0.03		CLAY, SANDY (CL)
TH-19	9	7.5	103		1.1	1,100							CLAY, SANDY (CL)
TH-19	14	16.2	109		0.2	1,800							CLAY, SANDY (CL)
TH-19	19	18.9	107		0.1	2,400							CLAY, SANDY (CL)
TH-20	4	10.2	94		1.0	500							SAND, CLAYEY (SC)
TH-20	7	7.2	103	0.0		1,000							SAND, CLAYEY (SC)
TH-20	14	14.5	117	1.4		1,800							CLAY, SANDY (CL)
TH-21	12	7.9	107		0.7	1,500							CLAY, SANDY (CL)
TH-21	14	11.6	118	0.4		1,800							CLAY, SANDY (CL)
TH-21	19	15.3	109	0.0		2,400							CLAY, SANDY (CL)
TH-22	2	8.9	121	2.4		1,000							CLAY, SANDY (CL)
TH-22	9	8.2	105		3.3	1,800			29	15		51	CLAY, SANDY (CL)
TH-22	14	16.3	113	0.0		2,400							CLAY, SANDY (CL)
TH-23	2	13.6	117	1.6		1,000							CLAY, SANDY (CL)
TH-23	4	11.1	110	2.2		1,100			43	29		76	CLAY, SANDY (CL)
TH-23	14	18.0	109	0.2		2,400							CLAY, SANDY (CL)
TH-24	4	14.5	117	1.1		500	3,900	3.72					CLAY, SANDY (CL)
TH-24	9	11.9	121	0.1		1,100	1,300	3.53					CLAY, SANDY (CL)
TH-24	14	12.9	121	0.1		1,800	3,100	3.56					CLAY, SANDY (CL)
TH-24	19	15.0	112		0.1	2,400		3.06					CLAY, SANDY (CL)
TH-24	24	19.6	111	1.8		3,000		3.94					CLAYSTONE

APPENDIX C

GUIDELINE SITE GRADING SPECIFICATIONS

GUIDELINE SITE GRADING SPECIFICATIONS

1. DESCRIPTION

This item shall consist of the excavation, transportation, placement and compaction of materials from locations indicated on the plans, or staked by the Engineer, as necessary to achieve preliminary street and overlot elevations. These specifications shall also apply to compaction of excess cut materials that may be placed outside of the subdivision and/or filing boundaries.

2. GENERAL

The Soils Representative shall be the Owner's representative. The Soils Representative shall approve fill materials, method of placement, moisture contents and percent compaction, and shall give written approval of the completed fill.

3. CLEARING JOB SITE

The Contractor shall remove all vegetation, trees, brush and rubbish before excavation or fill placement begins. The Contractor shall dispose of the cleared material to provide the Owner with a clean, neat appearing job site. Cleared material shall not be placed in areas to receive fill or where the material will support structures of any kind.

4. SCARIFYING AREA TO BE FILLED

Topsoil and vegetable matter shall be substantially removed from the ground surface upon which fill is to be placed. The surface shall then be plowed or scarified to a depth of 8 inches, moisture treated to above optimum moisture content, and compacted until the surface is free from ruts, hummocks or other uneven features, which would prevent uniform compaction by the equipment to be used.

5. COMPACTING AREA TO BE FILLED

After the foundation for the fill has been cleared and scarified, it shall be disked or bladed until it is free from large clods to a depth of 8 to 12 inches, brought to the proper moisture content (between optimum and 3 percent above optimum for clay and within 2 percent of optimum for sand) and compacted to not less than 95 percent of maximum density as determined in accordance with ASTM D 698. The foundation materials shall be worked, stabilized, or removed and replaced if necessary in accordance with the soils representative’s recommendations in preparation for fill.

6. FILL MATERIALS

Fill soils shall be substantially free from vegetable matter or other deleterious substances, and shall not contain rocks having a diameter greater than six (6) inches and claystone pieces larger than three (3) inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer.

On-site materials classifying as CL, CH, SC, SM, SW, SP, GP, GC and GM are acceptable. Concrete, asphalt, organic matter and other deleterious materials or debris shall not be used as fill.

7. MOISTURE CONTENT

For fill material classifying as CH, CL or SC, the fill shall be moisture treated to between optimum and 3 percent above optimum moisture content. Soils classifying as SM, SW, SP, GP, GC and GM shall be moisture treated to within 2 percent of optimum moisture content as determined from Proctor compaction tests. Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas.

The Contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Soils Representative, it is not possible to obtain uniform moisture content by adding water on the fill surface. The Contractor may be required to rake or disc the fill soils to provide uniform moisture content through the soils.

The application of water to embankment materials shall be made with any type of watering equipment approved by the Soils Representative, which will give the desired results. Water jets from the spreader shall not be directed at the embankment with such force that fill materials are washed out.

Should too much water be added to any part of the fill, such that the material is too wet to permit the desired compaction from being obtained, rolling and all work on that section of the fill shall be delayed until the material has been allowed to dry to the required moisture content. The Contractor will be permitted to rework wet material in an approved manner to hasten its drying.

8. COMPACTION OF FILL AREAS

Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density. Fill shall be compacted to at least 95 percent of the maximum density as determined in accordance with ASTM D 698. At the option of the Soils Representative, soils classifying as SW, GP, GC, or GM may be compacted to 95 percent of maximum density as determined in accordance with ASTM D 1557 or 70 percent relative density for cohesionless sand soils. Fill materials shall be placed such that the thickness of loose materials does not exceed 8 inches and the compacted lift thickness does not exceed 6 inches.

Compaction as specified above shall be obtained by the use of sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved for soils classifying as CL, CH, or SC. Granular fill shall be compacted using vibratory equipment or other approved equipment. Compaction shall be accomplished while the fill material is at the specified moisture content. Compaction of each layer shall be continuous over the entire area. Compaction equipment shall make sufficient passes to ensure that the required density is obtained.

9. COMPACTION OF SLOPES

Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction operations shall be continued until slopes are stable, but not too dense for planting, and there is not an appreciable amount of loose soils on the slopes. Compaction of slopes may be done progressively in increments of three to five feet (3' to 5') in height or after the fill is brought to its total height. Permanent fill slopes shall not exceed 3:1 (horizontal to vertical).

10. PLACEMENT OF FILL ON NATURAL SLOPES

Where natural slopes are steeper than 20 percent in grade and the placement of fill is required, cut benches shall be provided at the rate of one bench for each 5 feet in height (minimum of two benches). Benches shall be at least 10 feet in width. Larger bench widths may be required by the Engineer. Fill shall be placed on completed benches as outlined within this specification.

11. DENSITY TESTS

Field density tests shall be made by the Soils Representative at locations and depths of his choosing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in compacted material below the disturbed surface. When density tests indicate that the density or moisture content of any layer of fill or portion thereof is below that required, the particular layer or portion shall be reworked until the required density or moisture content has been achieved.

12. SEASONAL LIMITS

No fill material shall be placed, spread or rolled while it is frozen, thawing, or during unfavorable weather conditions. When work is interrupted by heavy precipitation, fill operations shall not be resumed until the Soils Representative indicates that the moisture content and density of previously placed materials are as specified.

13. NOTICE REGARDING START OF GRADING

The Contractor shall submit notification to the Soils Representative and Owner advising them of the start of grading operations at least three (3) days in advance of the starting date. Notification shall also be submitted at least 3 days in advance of any resumption dates when grading operations have been stopped for any reason other than adverse weather conditions.

14. REPORTING OF FIELD DENSITY TESTS

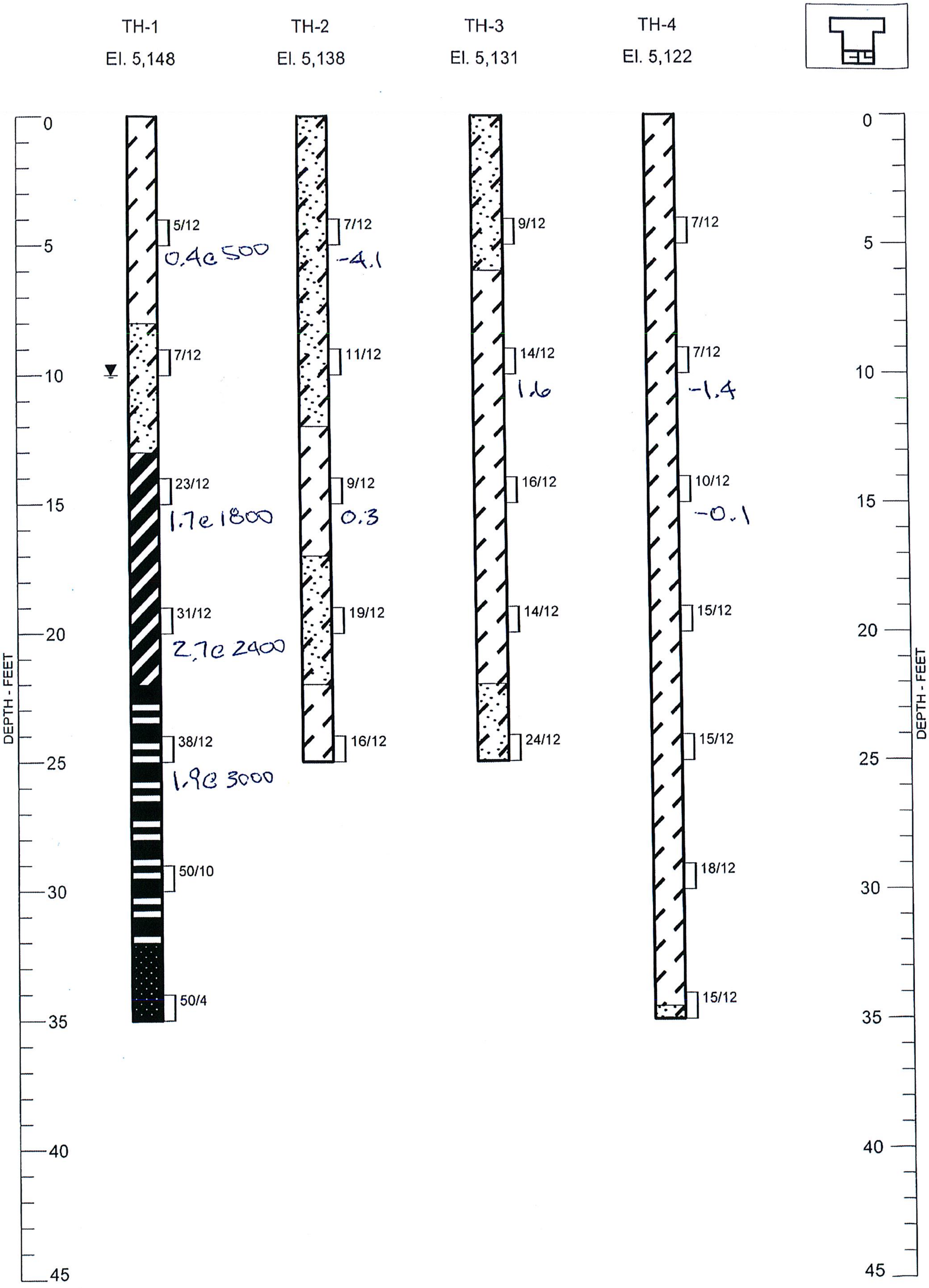
Density tests made by the Soils Representative, as specified under "Density Tests" above, shall be submitted progressively to the Owner. Dry density, moisture content, and percentage compaction shall be reported for each test taken.

15. DECLARATION REGARDING COMPLETED FILL

The Soils Engineer shall provide a written declaration stating that the site was filled with acceptable materials, and was placed in general accordance with the specifications.

APPENDIX D

BORING LOGS AND LABORATORY DATA FROM PREVIOUS INVESTIGATION (JOB NO. 32,213; DATED JANUARY 3, 2001)

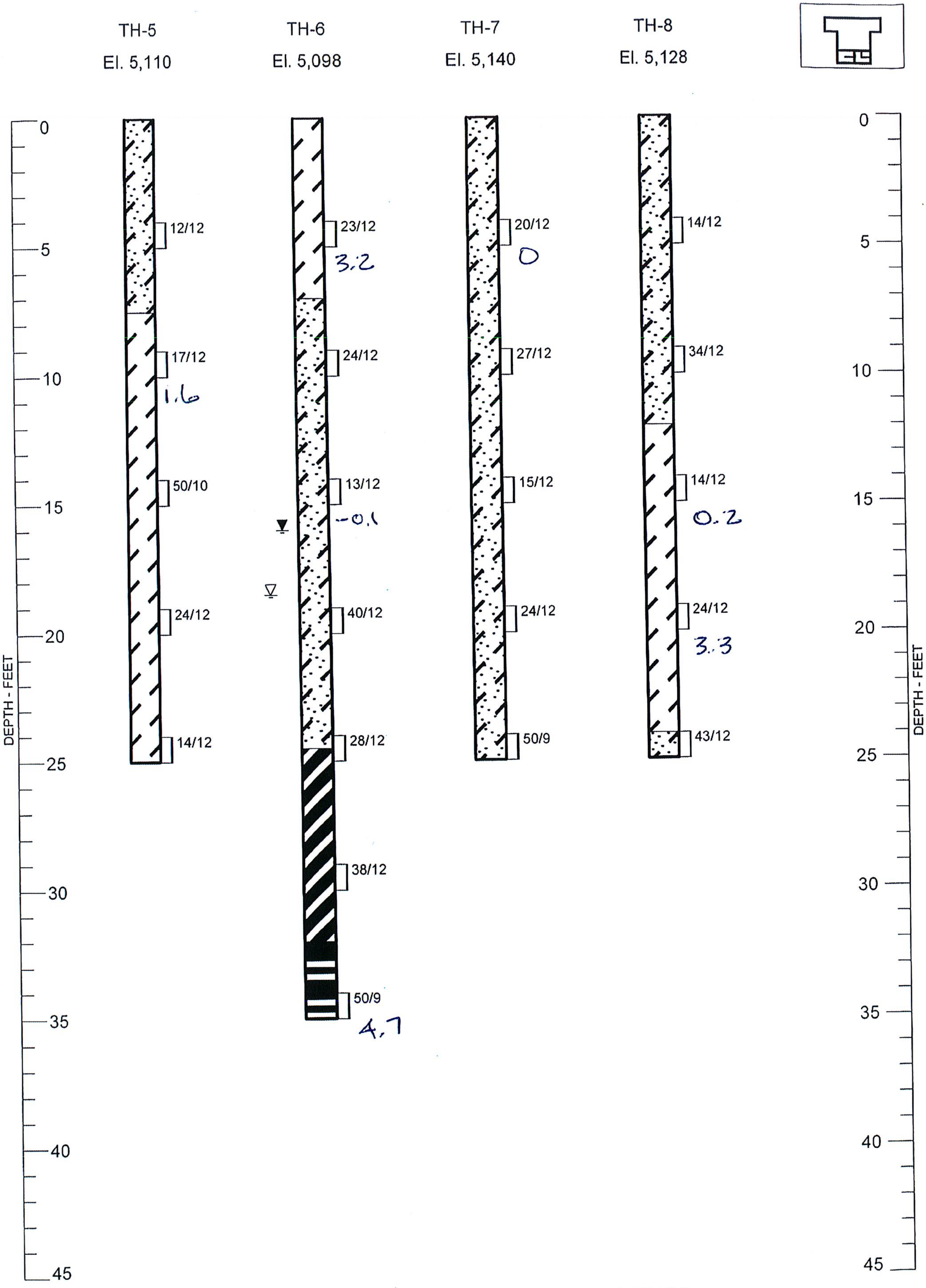


SUMMARY LOGS OF EXPLORATORY BORINGS

MEADOW SWEET FARM, LLC
SOUTHEAST 1/4, SECTION 25, T1N, R69W
JOB NO. 32,213

FIG. A - 1

LOGS BY DEPTH - LONG 32213NEW.GPJ CTLMAIN.GDT 12/28/00

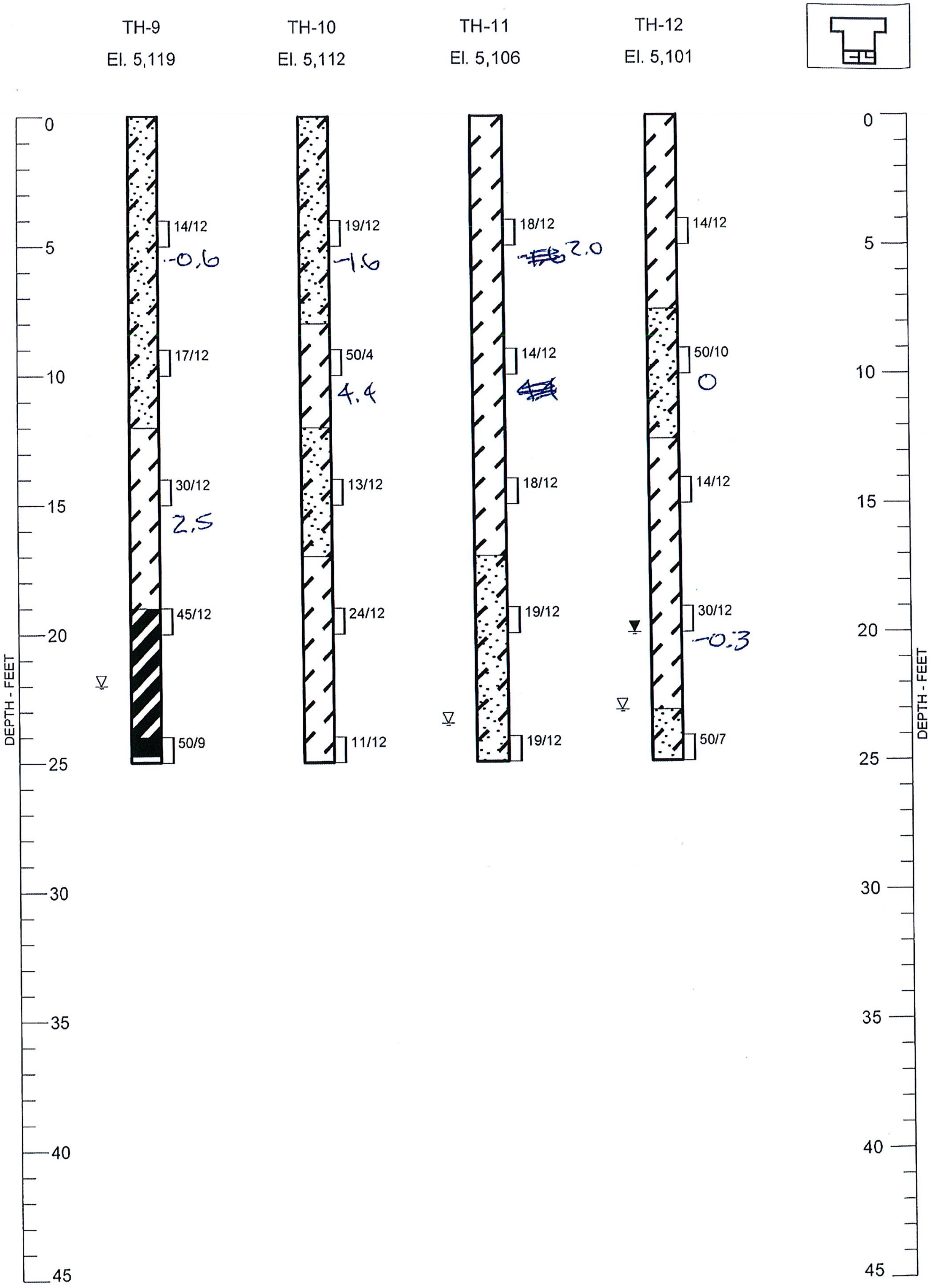


SUMMARY LOGS OF EXPLORATORY BORINGS

MEADOW SWEET FARM, LLC
SOUTHEAST 1/4, SECTION 25, T1N, R69W
JOB NO. 32,213

FIG. A - 2

LOGS BY DEPTH - LONG 32213NEW.GPJ CTLMAIN.GDT 12/28/00

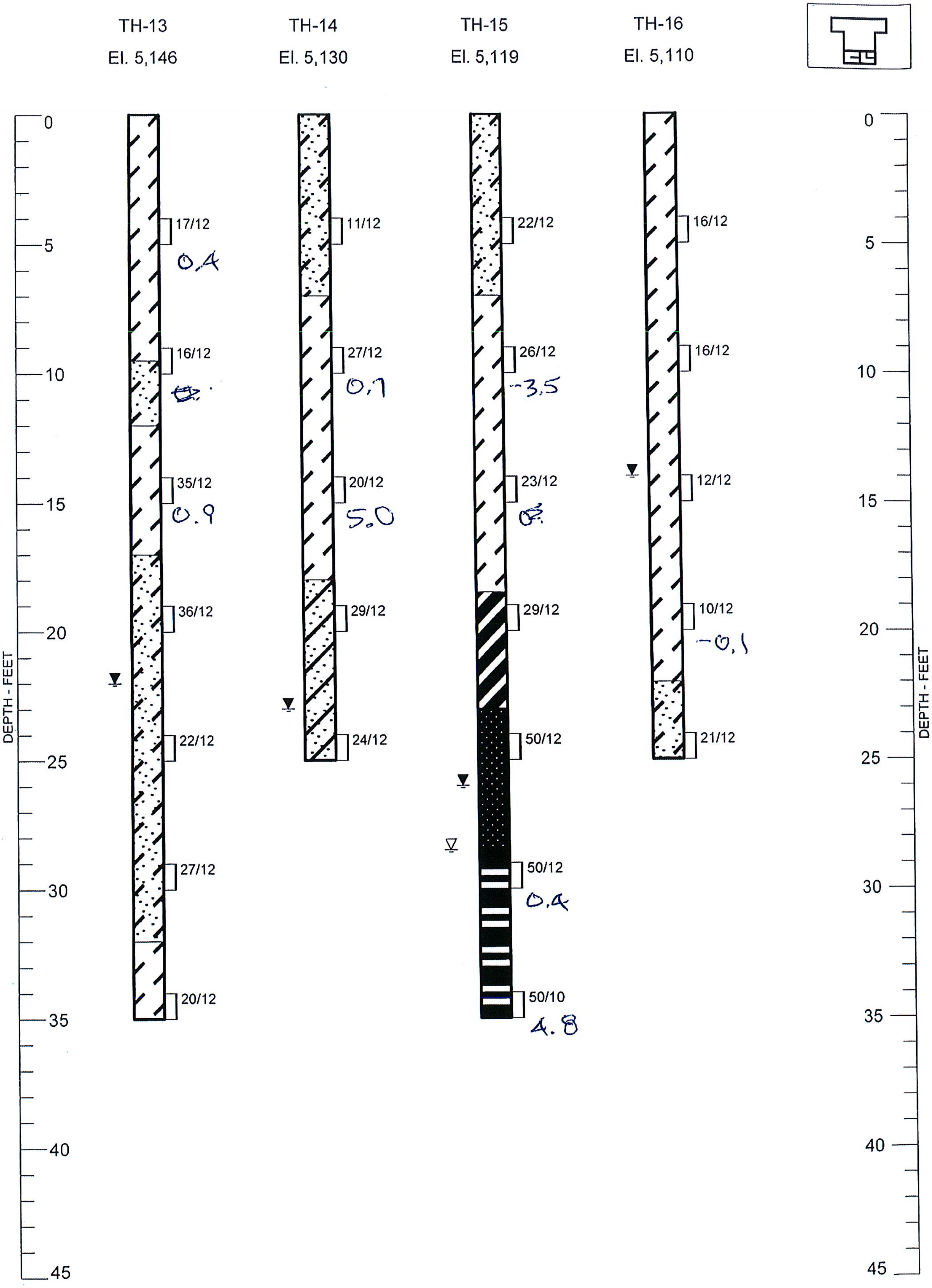


MEADOW SWEET FARM, LLC
SOUTHEAST 1/4, SECTION 25, T1N, R69W
JOB NO. 32,213

SUMMARY LOGS OF EXPLORATORY BORINGS

FIG. A - 3

LOGS BY DEPTH - LONG 32213NEW.GPJ CTLMAIN.GDT 12/28/00

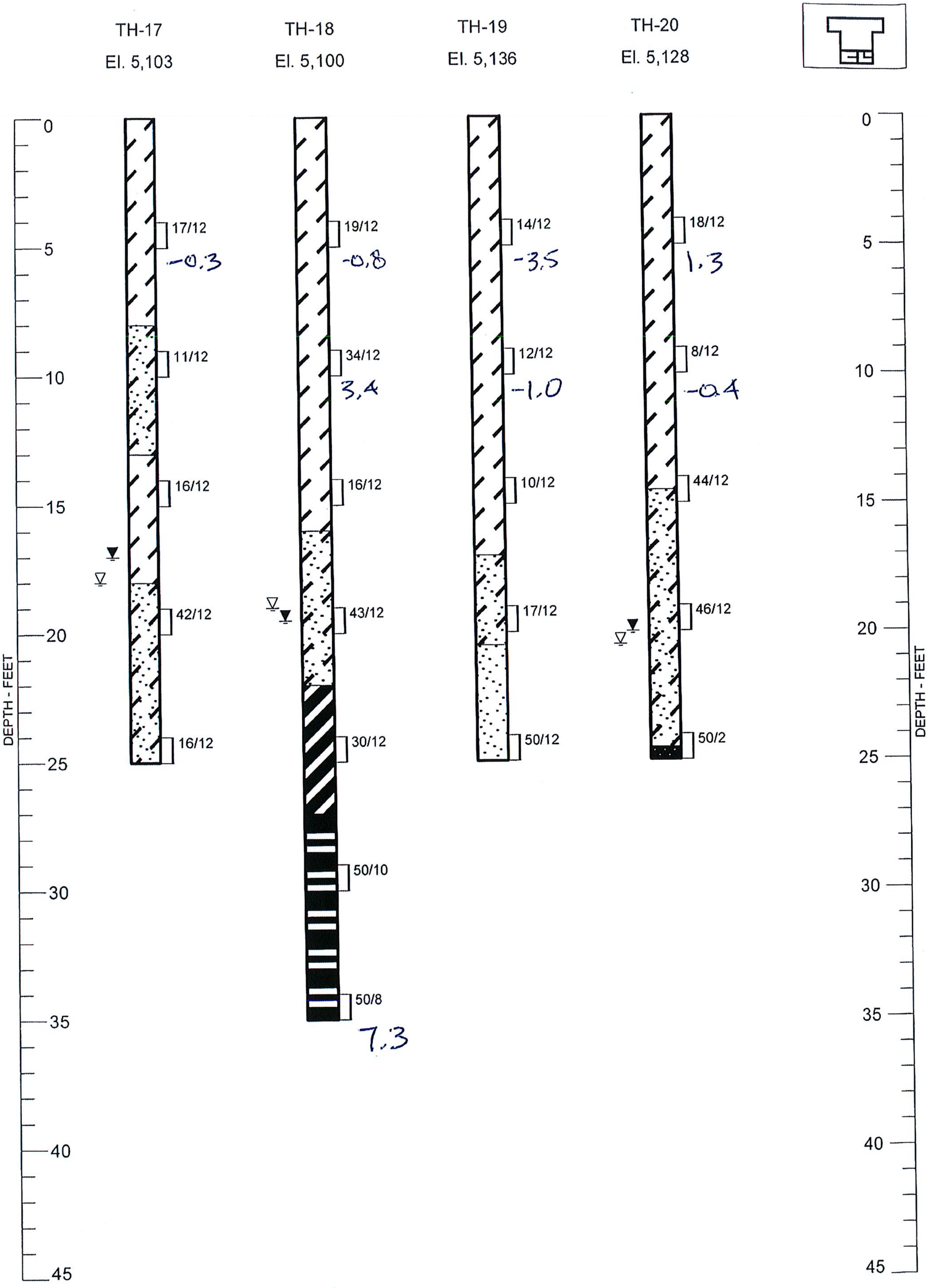


SUMMARY LOGS OF EXPLORATORY BORINGS

MEADOW SWEET FARM, LLC
SOUTHEAST 1/4, SECTION 25, T1N, R69W
JOB NO. 32,213

FIG. A - 4

LOGS BY DEPTH - LONG 32213NEW.GPJ CTLMAIN.GDT 12/28/00

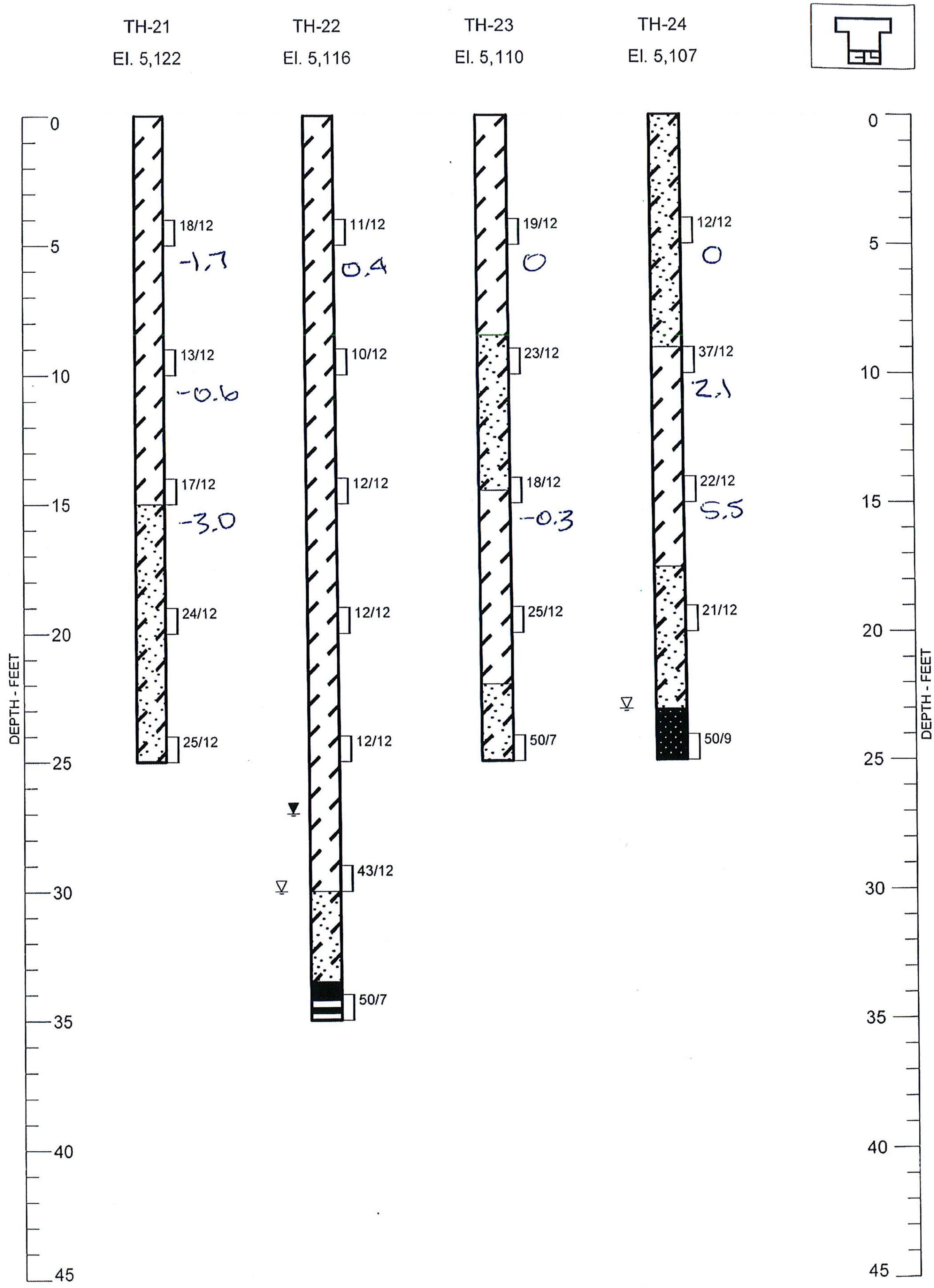


MEADOW SWEET FARM, LLC
SOUTHEAST 1/4, SECTION 25, T1N, R69W
JOB NO. 32,213

SUMMARY LOGS OF EXPLORATORY BORINGS

FIG. A - 5

LOGS BY DEPTH - LONG 32213NEW.GPJ CTLMAIN.GDT 12/28/00

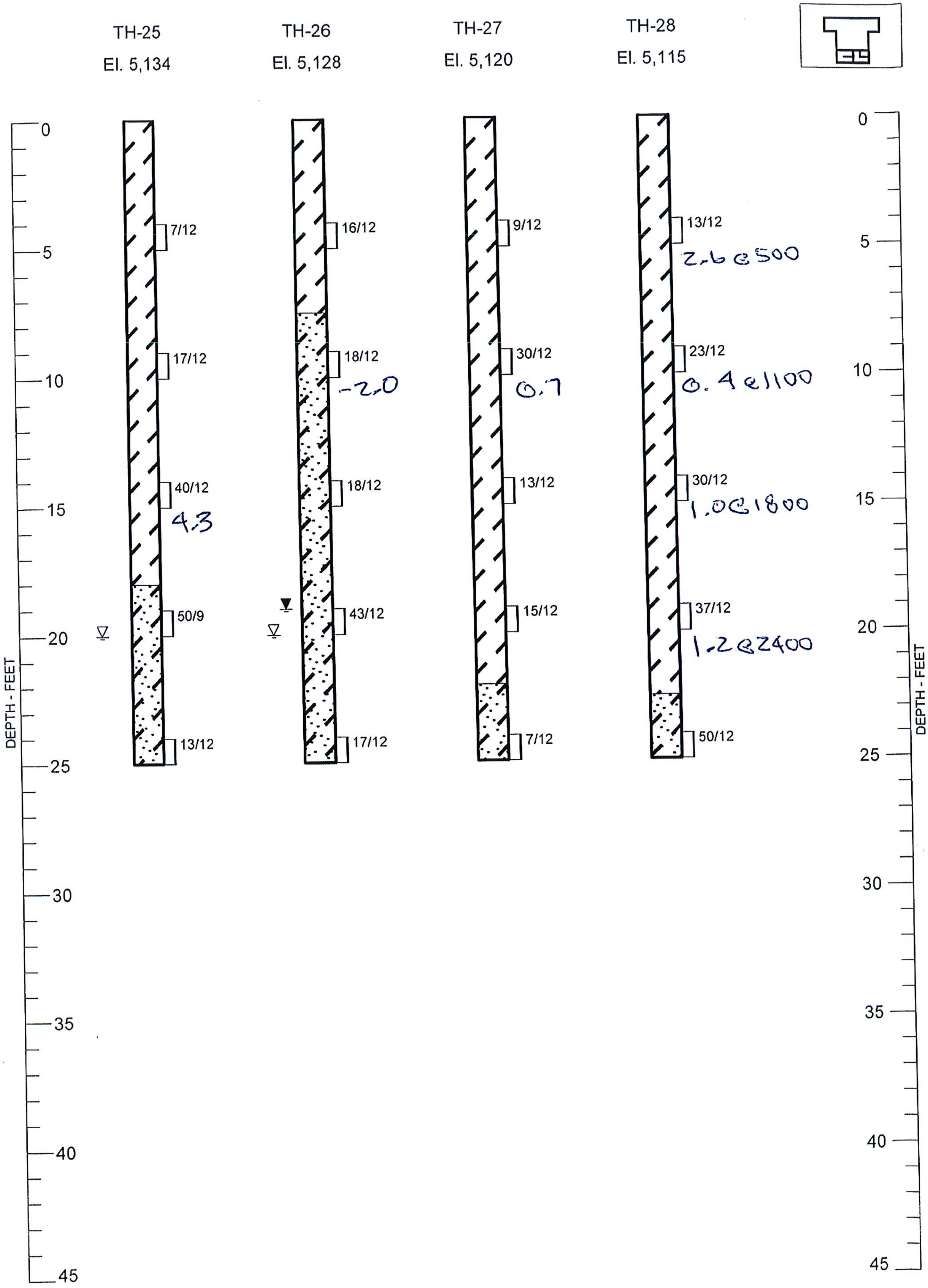


SUMMARY LOGS OF EXPLORATORY BORINGS

MEADOW SWEET FARM, LLC
SOUTHEAST 1/4, SECTION 25, T1N, R69W
JOB NO. 32,213

FIG. A - 6

LOGS BY DEPTH - LONG 32213NEW.GPJ CTLMAIN.GDT 12/28/00

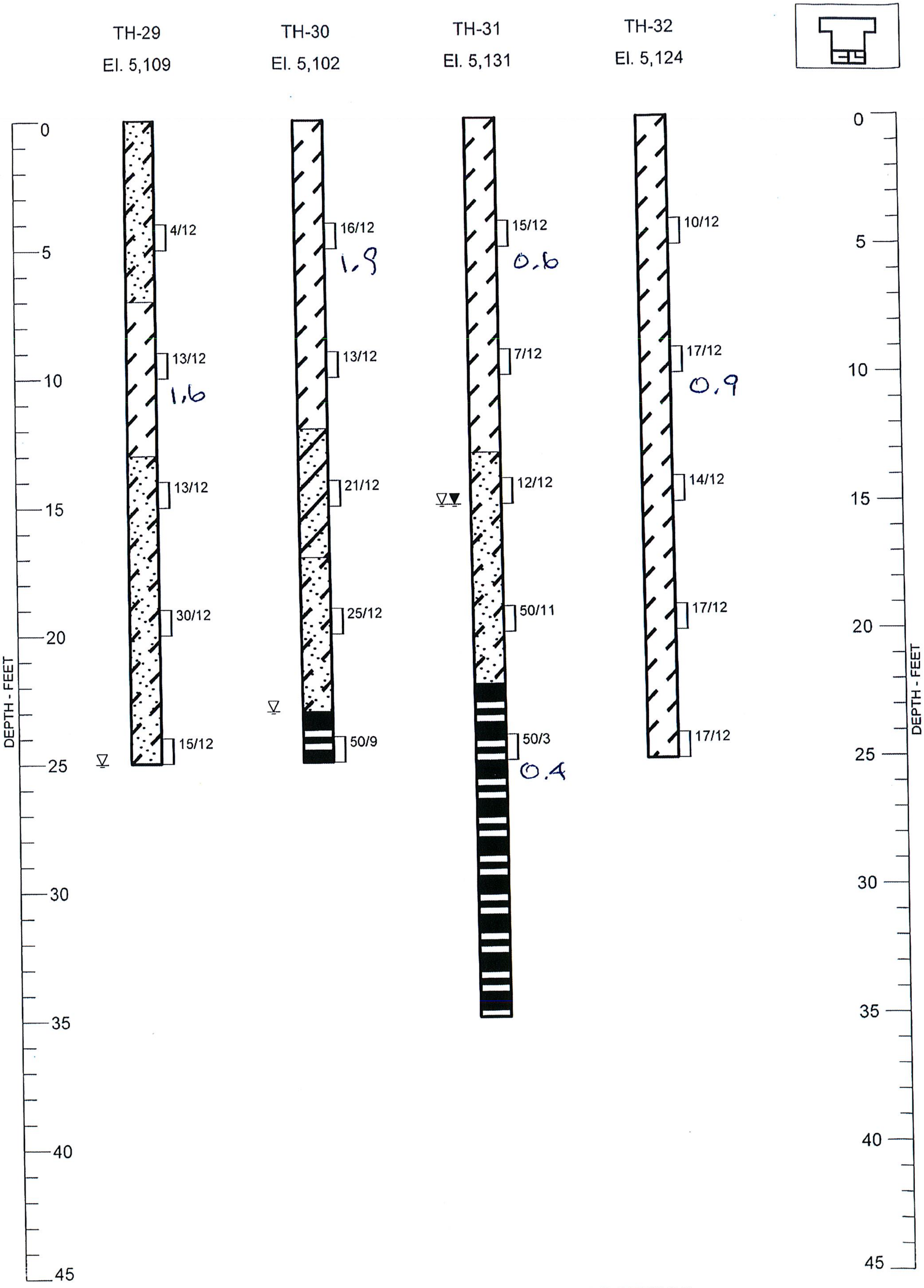


SUMMARY LOGS OF EXPLORATORY BORINGS

MEADOW SWEET FARM, LLC
SOUTHEAST 1/4, SECTION 25, T1N, R69W
JOB NO. 32,213

FIG. A - 7

LOGS BY DEPTH - LONG 32213NEW.GPJ CTLMAIN.GDT 12/28/00

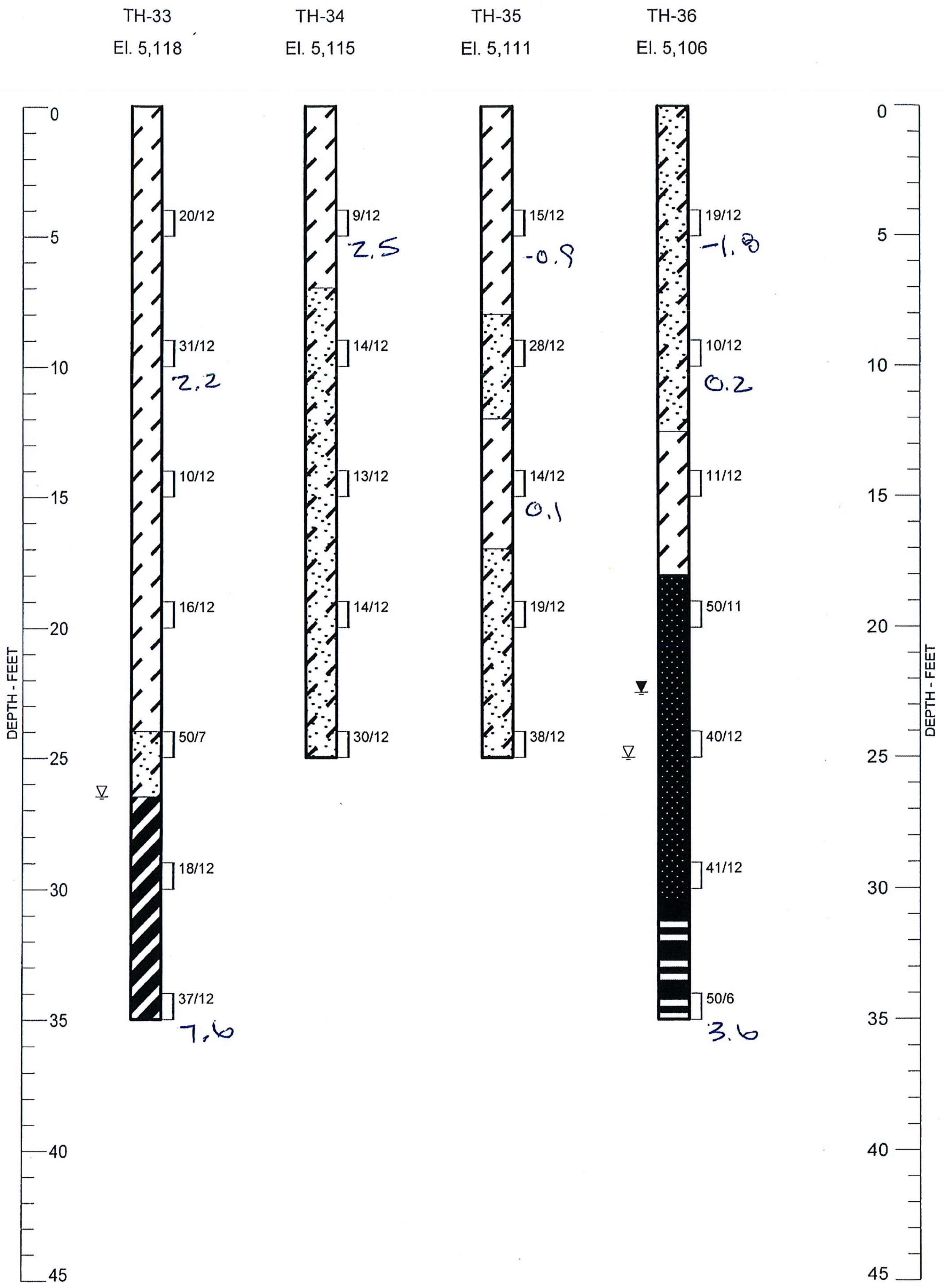


SUMMARY LOGS OF EXPLORATORY BORINGS

MEADOW SWEET FARM, LLC
SOUTHEAST 1/4, SECTION 25, T1N, R69W
JOB NO. 32,213

FIG. A - 8

LOGS BY DEPTH - LONG 32213NEW.GPJ CTLMAIN.GDT 12/28/00



LEGEND:

▨ CLAY, SANDY, MEDIUM STIFF, MOIST, BROWN (CL).

▒ SAND, CLAYEY, OCCASIONAL GRAVELS, LOOSE TO VERY DENSE, MOIST TO WET, LIGHT TO MEDIUM BROWN (SC).

▧ SAND, SILTY, MEDIUM DENSE, MOIST TO WET, BROWN, TAN (SM)

░ SAND, CLEAN TO SLIGHTLY SILTY, DENSE, SLIGHTLY MOIST, BROWN, GRAY (SP, SP-SM).

▰ WEATHERED CLAYSTONE, MEDIUM HARD, MOIST, BROWN, GRAY, RUST.

☰ BEDROCK, CLAYSTONE, MEDIUM HARD TO HARD, MOIST, OLIVE, BROWN, GRAY.

▓ BEDROCK, SANDSTONE, VERY HARD, MOIST, BROWN.

DRIVE SAMPLE.THE SYMBOL 5/12 INDICATES THAT 5 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.

▽ WATER LEVEL MEASURED AT TIME OF DRILLING.

▼ WATER LEVEL MEASURED SEVERAL DAYS AFTER DRILLING.

NOTES:

1. THE BORINGS WERE DRILLED BETWEEN OCTOBER 27 AND NOVEMBER 11, 2000 USING 4-INCH CONTINUOUS FLIGHT AND A TRUCK-MOUNTED DRILL RIG.
2. BORING ELEVATIONS AND LOCATIONS ARE APPROXIMATE. BORINGS WERE LOCATED WITH A HANDHELD GPS DEVICE. ELEVATIONS WERE ESTIMATED FROM TOPOGRAPHIC MAP SUPPLIED BY THE CLIENT.
3. THIS LOG IS SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS AS CONTAINED IN THIS REPORT.

SUMMARY LOGS OF EXPLORATORY BORINGS

MEADOW SWEET FARM, LLC
SOUTHEAST 1/4, SECTION 25, T1N, R69W
JOB NO. 32,213

TABLE B - I

SUMMARY OF LABORATORY RESULTS

BORING	DEPTH (ft)	NATURAL MOISTURE (%)	NATURAL DRY DENSITY (pcf)	SWELL TEST DATA			SOIL SUCTION VALUE (pF)	ATTERBERG LIMITS		SOLUBLE SULFATE CONTENT (%)	PASSING NO. 200 SIEVE (%)	SOIL TYPE
				SWELL (%)	APPLIED PRESSURE (psf)	SWELL PRESSURE (psf)		LIQUID LIMIT (%)	PLASTICITY INDEX (%)			
TH-1	4	11.9	116	0.4	500	800	3.54				52	CLAY, SANDY (CL)
TH-1	9	14.9	116					26	10		29	SAND, CLAYEY (SC)
TH-1	14	18.4	108	1.7	1,800	5,100	3.52					WEATHERED CLAYSTONE
TH-1	19	19.8	106	2.7	2,400	8,800	3.97					WEATHERED CLAYSTONE
TH-1	24	15.8	114	1.9	3,000	11,000	4.01					CLAYSTONE
TH-2	4	9.2	94	-4.1	1,000							SAND, CLAYEY (SC)
TH-2	14	11.0	116	0.3	1,000	1,900				0.002		CLAY, SANDY (CL)
TH-3	4	5.6	106								34	SAND, CLAYEY (SC)
TH-3	9	8.2	111	1.6	1,000							CLAY, SANDY (CL)
TH-3	14	27.0	94					29	16		75	CLAY, SANDY (CL)
TH-3	19										57	CLAY, SANDY (CL)
TH-4	9	8.1	98	-1.4	1,000							CLAY, SANDY (CL)
TH-4	14	8.9	119	-0.1	1,000							CLAY, SANDY (CL)
TH-5	9	9.1	122	1.6	1,000							CLAY, SANDY (CL)
TH-5	14	10.6	122							0.003	67	CLAY, SANDY (CL)
TH-6	4	7.1	123	3.2	1,000	10,000						CLAY, SANDY (CL)
TH-6	9	5.5	113								33	SAND, CLAYEY (SC)
TH-6	14	16.1	110	-0.1	1,000							SAND, CLAYEY (SC)
TH-6	34	15.3	117	4.7	1,000	18,000						CLAYSTONE
TH-7	4	6.6	107	0.0	1,000							SAND, CLAYEY (SC)
TH-7	9	14.7	116					35	19		49	SAND, CLAYEY (SC)
TH-8	14	6.9	113	0.2	1,000	2,000						CLAY, SANDY (CL)
TH-8	19	7.9	124	3.3	1,000							CLAY, SANDY (CL)
TH-9	4	8.2	108	-0.6	1,000							SAND, CLAYEY (SC)
TH-9	14	12.5	117	2.5	1,000	5,200				0.002		CLAY, SANDY (CL)
TH-10	4	6.1	102	-1.6	1,000							SAND, CLAYEY (SC)
TH-10	9	7.4	132	4.4	1,000							CLAY, SANDY (CL)
TH-10	14	10.3	123	0.4	1,000							SAND, CLAYEY (SC)
TH-11	4	7.7	113	2.0	1,000	6,200						CLAY, SANDY (CL)
TH-11	14	8.8	125								61	CLAY, SANDY (CL)

TABLE B - I

SUMMARY OF LABORATORY RESULTS

BORING	DEPTH (ft)	NATURAL MOISTURE (%)	NATURAL DRY DENSITY (pcf)	SWELL TEST DATA			SOIL SUCTION VALUE (pF)	ATTERBERG LIMITS		SOLUBLE SULFATE CONTENT (%)	PASSING NO. 200 SIEVE (%)	SOIL TYPE
				SWELL (%)	APPLIED PRESSURE (psf)	SWELL PRESSURE (psf)		LIQUID LIMIT (%)	PLASTICITY INDEX (%)			
TH-12	9	4.9	118	0.0	1,000							SAND, CLAYEY (SC)
TH-12	19	13.6	118	-0.3	1,000							CLAY, SANDY (CL)
TH-13	4	8.3	99	0.4	1,000			33	17		83	CLAY, SANDY (CL)
TH-13	14	9.5	124	0.9	1,000							CLAY, SANDY (CL)
TH-13	19	7.3	120								43	SAND, CLAYEY (SC)
TH-13	34	16.2	108								52	CLAY, SANDY (CL)
TH-14	9	11.1	110	0.7	1,000	2,000						CLAY, SANDY (CL)
TH-14	14	10.2	121	5.0	1,000							CLAY, SANDY (CL)
TH-14	19	4.9	110								13	SAND, SILTY (SM)
TH-15	4	5.7	112					27	12		38	SAND, CLAYEY (SC)
TH-15	9	3.1	111	-3.5	1,000					0.004		CLAY, SANDY (CL)
TH-15	29	13.0	124	0.4	1,000	1,700						CLAYSTONE
TH-15	34	14.5	123	4.8	1,000							CLAYSTONE
TH-16	9	8.8	124								57	CLAY, SANDY (CL)
TH-16	19	15.4	111	-0.1	1,000							CLAY, SANDY (CL)
TH-17	4	7.0	114	-0.3	1,000			30	15		66	CLAY, SANDY (CL)
TH-18	4	7.4	101	-0.8	1,000							CLAY, SANDY (CL)
TH-18	9	9.8	120	3.4	1,000	9,600						CLAY, SANDY (CL)
TH-18	34	18.5	108	7.3	1,000			66	44		98	CLAYSTONE
TH-19	4	8.7	95	-3.5	1,000							CLAY, SANDY (CL)
TH-19	9	8.8	104	-1.0	1,000							CLAY, SANDY (CL)
TH-19	24	1.5	111								6	SAND, SLIGHLTY SILTY (SP-SM)
TH-20	4	10.5	111	1.3	1,000							CLAY, SANDY (CL)
TH-20	9	20.2	96	-0.4	1,000			42	22		70	CLAY, SANDY (CL)
TH-21	4	11.3	96	-1.7	1,000							CLAY, SANDY (CL)
TH-21	9	9.8	102	-0.6	1,000							CLAY, SANDY (CL)
TH-21	14	6.8	101	-3.0	1,000							CLAY, SANDY (CL)
TH-22	4	9.6	109	0.4	1,000							CLAY, SANDY (CL)
TH-22	14	11.2	115								70	CLAY, SANDY (CL)
TH-23	4	9.5	112	0.0	1,000							CLAY, SANDY (CL)

TABLE B - I

SUMMARY OF LABORATORY RESULTS

BORING	DEPTH	NATURAL MOISTURE	NATURAL DRY DENSITY	SWELL TEST DATA			SOIL SUCTION VALUE	ATTERBERG LIMITS		SOLUBLE SULFATE CONTENT	PASSING NO. 200 SIEVE	SOIL TYPE
	(ft)	(%)	(pcf)	SWELL (%)	APPLIED PRESSURE (psf)	SWELL PRESSURE (psf)	(pF)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	(%)	(%)	
TH-23	9	3.7	109								17	SAND, CLAYEY (SC)
TH-23	14	10.6	123	-0.3	1,000							CLAY, SANDY (CL)
TH-24	4	7.3	109	0.0	1,000					0.002		SAND, CLAYEY (SC)
TH-24	9	5.4	121	2.1	1,000							CLAY, SANDY (CL)
TH-24	14	7.6	123	5.5	1,000							CLAY, SANDY (CL)
TH-25	9	11.3	119					25	10		53	CLAY, SANDY (CL)
TH-25	14	8.5	128	4.3	1,000							CLAY, SANDY (CL)
TH-26	9	5.9	106	-2.0	1,000						32	SAND, CLAYEY (SC)
TH-27	9	8.4	124	0.7	1,000	6,800						CLAY, SANDY (CL)
TH-27	14	10.6	119								62	CLAY, SANDY (CL)
TH-28	4	9.9	114	2.6	500		4.57					CLAY, SANDY (CL)
TH-28	9	6.8	114	0.4	1,100	5,800	4.67				50	CLAY, SANDY (CL)
TH-28	14	6.2	127	1.0	1,800	8,500	4.85					CLAY, SANDY (CL)
TH-28	19	9.2	125	1.2	2,400	6,400	4.56					CLAY, SANDY (CL)
TH-29	9	12.1	119	1.6	1,000			34	21		79	CLAY, SANDY (CL)
TH-29	14	7.9	117								46	SAND, CLAYEY (SC)
TH-30	4	8.9	120	1.9	1,000							CLAY, SANDY (CL)
TH-30	14	9.5	121					43	14		45	SAND, SILTY (SM)
TH-30	24	13.1	117					29	11		69	CLAYSTONE
TH-31	4	9.2	108	0.6	1,000							CLAY, SANDY (CL)
TH-31	9	13.2	114								62	CLAY, SANDY (CL)
TH-31	24	15.7	120	0.4	1,000							CLAYSTONE
TH-32	9	12.0	119	0.9	1,000							CLAY, SANDY (CL)
TH-33	9	8.9	124	2.2	1,000							CLAY, SANDY (CL)
TH-33	29	28.8	79					70	46		74	WEATHERED CLAYSTONE
TH-33	34	20.2	108	7.6	1,000							WEATHERED CLAYSTONE
TH-34	4	9.5	116	2.5	1,000					0.004		CLAY, SANDY (CL)
TH-34	19	10.4	122								44	SAND, CLAYEY (SC)
TH-35	4	11.8	95	-0.9	1,000							CLAY, SANDY (CL)

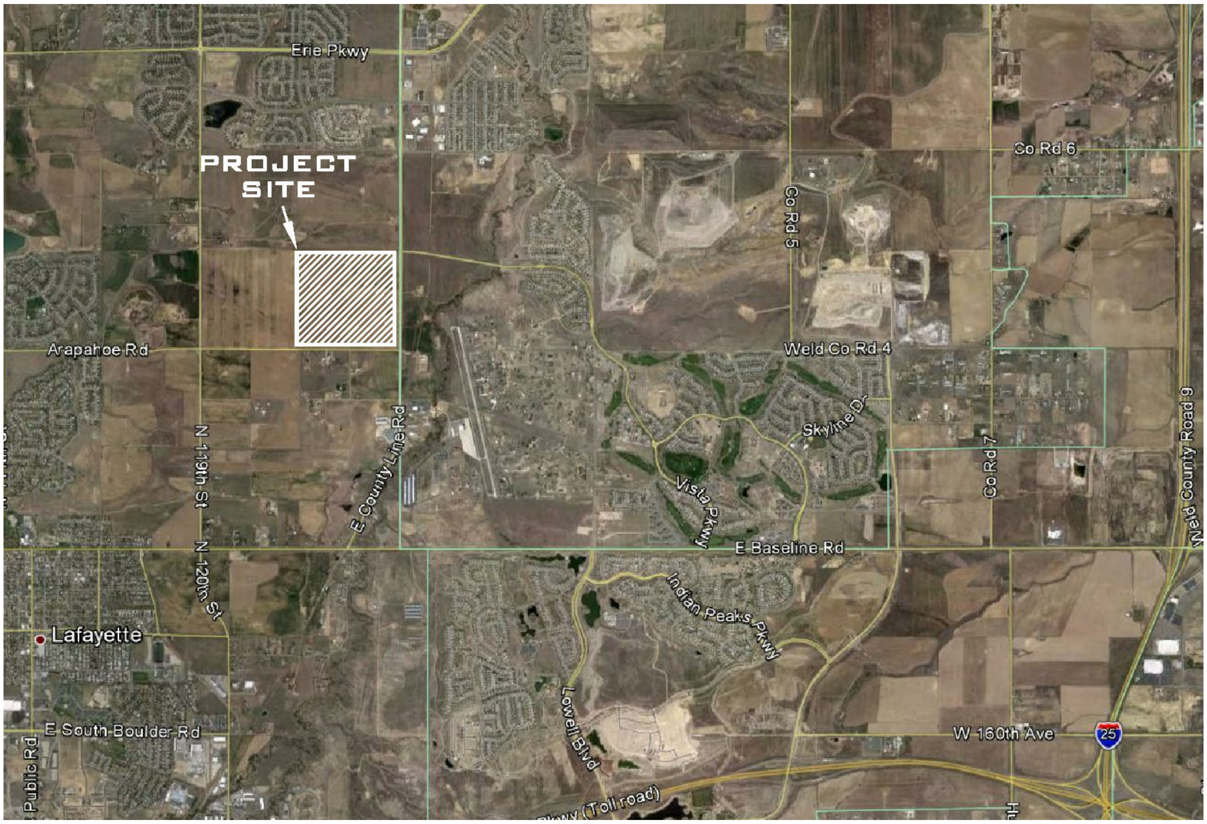
TABLE B - I

SUMMARY OF LABORATORY RESULTS

BORING	DEPTH (ft)	NATURAL MOISTURE (%)	NATURAL DRY DENSITY (pcf)	SWELL TEST DATA			SOIL SUCTION VALUE (pF)	ATTERBERG LIMITS		SOLUBLE SULFATE CONTENT (%)	PASSING NO. 200 SIEVE (%)	SOIL TYPE
				SWELL (%)	APPLIED PRESSURE (psf)	SWELL PRESSURE (psf)		LIQUID LIMIT (%)	PLASTICITY INDEX (%)			
TH-35	9	6.0	113								36	SAND, CLAYEY (SC)
TH-35	14	16.8	110	0.1	1,000							CLAY, SANDY (CL)
TH-35	19	6.7	115								27	SAND, CLAYEY (SC)
TH-36	4	7.3	105	-1.8	1,000							SAND, CLAYEY (SC)
TH-36	9	8.7	115	0.2	1,000							SAND, CLAYEY (SC)
TH-36	19	1.4	105								6	SANDSTONE
TH-36	34	15.2	126	3.6	1,000	10,000						CLAYSTONE

ERIE FARMS

TRAFFIC IMPACT STUDY



COLORADO REGISTERED PROFESSIONAL ENGINEER
STEVEN G. TUTTLE
34336
Steve Tuttle

PREPARED FOR:

JANSENSTRAWN CONSULTING ENGINEERS
45 WEST 2ND AVENUE
DENVER, CO 80223

PREPARED BY: STEVE TUTTLE, PE, PTOE
DATE: APRIL 3, 2013
FT PROJECT: #12020

FOX TUTTLE
TRANSPORTATION GROUP

P.O. BOX 19768, BOULDER, CO 80308-2768
PHONE: 303-652-3571 | FAX: 303-652-6574

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX

ERIE FARMS
TRAFFIC IMPACT STUDY

1.0 INTRODUCTION

This traffic impact study has been prepared by the Fox Tuttle Transportation Group for The Erie Farms project in the Town of Erie. The project is proposed at the northwest corner of the Arapahoe Road and County Line Road intersection. This project involves the development of 499 residential units on a currently vacant 158.7± acre parcel of land. Access to the site is planned along Arapahoe Road and County Line Road.

The purpose of this study is to assist in identifying potential traffic impacts within the general study area as a result of this development project. The traffic study addresses existing, near-term and long term peak hour intersection conditions in the study area. The information contained in this study is anticipated to be used by the Town in identifying any intersection or roadway deficiencies and potential improvements for both the short term and long term future scenarios.

The following studies and references were reviewed in the development of this impact study report:

- Town of Erie Comprehensive Plan, 2005.

2.0 PROJECT DESCRIPTION

The project proposes to develop a 357 single-family detached and 142 attached multi-family dwelling units on a vacant parcel located at the northwest corner of Arapahoe Road and County Line Road. A vicinity map is provided on **Figure 1**. The site plan is provided on **Figure 2**.

Access to the site is proposed as follows:

- Full-movement access along Arapahoe Road roughly 1,000' west of County Line Road
- Full-movement access along County Line Road roughly 1,240' north of Arapahoe Road
- Future internal access connections to the north as that site develops

3.0 EXISTING AND FUTURE BACKGROUND TRAFFIC CONDTIONS

3.1 Study Area

The study area boundaries took into consideration the amount of site traffic added to the surrounding street network and planned access.

3.2 Circulation Network

The existing study area street network consists of arterial, collector, and local access streets. The primary public roadways that serve the project site are discussed in the following text. The existing study area roadway network is illustrated on **Figure 1**.

County Line Road, adjacent to the site, is a two-lane roadway designated as a minor arterial in the 2015 and 2030 Roadway Network plans. The posted speed limit is 50 miles per hour (mph) adjacent to the site.

Arapahoe Road, adjacent to the site, is a two-lane roadway designated as a collector roadway in the Town's 2030 Roadway Network plan. The posted speed limit is 40 miles per hour (mph) adjacent to the site. The intersection of Arapahoe Road with County Line Road is controlled with a stop sign on the Arapahoe Road approach.

Vista Parkway is a two-lane roadway designated as a collector roadway in the 2015 and 2030 Network plans. The intersection of Vista Parkway with County Line Road is controlled with a stop sign on the Vista Parkway approach.

3.3 Existing Traffic Volumes

Daily roadway and AM and PM peak hour turning-movement volumes and daily roadway volumes were collected in October 2012 for this project. The existing traffic volumes are illustrated on **Figure 3**. The existing intersection geometry and traffic control are also shown on the traffic volume figure. Count data sheets are provided in the Appendix.

3.4 Existing Intersection Capacity Analysis

In determining the operational characteristics of an intersection, "Levels of Service" (LOS) A through F are applied, with LOS A indicating very good operations and LOS F indicating congested operations. The intersection LOS is represented as a delay in seconds per vehicle for the intersection as a whole and for each turning movement. A more detailed discussion of LOS methodology is contained in the Appendix for reference. Criteria contained in the Highway Capacity Manual (HCM)[1] was applied for these analyses in order to determine existing levels of service during peak hour periods.

---

[1] Highway Capacity Manual, Highway Research Board Special Report 209, Transportation Research Board, National Research Council, 2010. Synchro v. 8 software utilized.

The results of the LOS calculations for the intersections are summarized in **Table 1**. The intersection level of service worksheets are attached in the Appendix. The data in the tables show that all study area intersections are operating well (LOS B or better) overall.

3.5 Signal Warrant

Traffic signal warrant criteria contained in the Manual on Uniform Traffic Control Devices[2] (MUTCD) was applied to the existing peak hour traffic volumes to evaluate the need for signalization of the Arapahoe Road & County Line Road intersection. The peak hour traffic signal warrant is shown on **Figure 9**. While the peak hour signal warrant does not in itself determine the necessity of a traffic signal, it is often used as a planning tool to determine where a signal is likely needed. As indicated on this figure, this intersection meets minimum peak hour volume criteria for signalization at this location based on existing traffic volumes.

The location of this intersection is 1/2 mile from Vista Parkway and roughly 1 mile from SH 7. Half-mile spacing for traffic signals is ideal for an arterial corridor at this posted speed.

This intersection also exceeds typical thresholds for provision of right and left-turn auxiliary lanes. Per CDOT criteria, for example, the northbound left-turn at Arapahoe & County Line would require a left-turn deceleration lane at > 10 vph. The existing PM peak hour left-turn movement is 228 vph, far exceeding this threshold. Similarly a right-turn deceleration lane would be provided at > 25 vph. The existing southbound right-turn volume is 247 vph in the AM peak.

4.0 FUTURE TRAFFIC CONDITIONS WITHOUT PROPOSED DEVELOPMENT

4.1 Annual Growth Factor and Future Volume Methodology

In order to estimate future-year background traffic growth in the study area, the Denver Regional Council of Governments (DRCOG) regional traffic model was reviewed. The Year 2035 regional model provides the following projections for the study area roadways:

- County Line Road north of Arapahoe Road = 16,887 vpd
- Arapahoe Road west of County Line Road = 3,655 vpd

Using these projections, the existing daily traffic volume on County Line Road (nearly 10,000 vpd) is anticipated to grow by a factor of roughly 1.7 between 2012 and 2035. On Arapahoe Road, the DRCOG Year 2035 projection is less than the existing 5,100 vpd volume. The long term projections are indicative of current traffic patterns and congestion on State Highway (SH) 7 and anticipated future shift of existing/future east-west traffic to Erie Parkway, back to SH 7 with future improvements, and other developing regional corridors. It should be noted that the regional model does not assume the Vista Parkway extension west of County Line as shown on the Erie Transportation Plan.

---

[2] Manual on Uniform Traffic Control Devices. Federal Highway Administration. Washington, DC. 2009.

With respect to SH 7, there is currently a Planning and Environmental Linkage (PEL) Study in progress that is evaluating potential realignment of SH 7 through the site vicinity. The progression of the SH 7 PEL study will be important to follow as it relates to area traffic volumes patterns for the future.

Assumed Year 2035 traffic projections and lane geometry are provided on **Figure 4**. The traffic volumes are indicative of high growth along County Line Road and relatively flat growth on Arapahoe Road, consistent with the long-range regional model.

4.3 Conceptual Vista Parkway Connection

Per the Town Comprehensive Plan, a connection from Arapahoe Road to County Line Road (aligning with Vista Parkway to the east of County Line Road) is shown for the Year 2030 and Buildout Roadway Network plans. It is assumed that this conceptual connection/realignment of Arapahoe Road was proposed by Town planners when developing the Comprehensive Plan to provide an improved route for east-west traffic north of State Highway 7. The location of the Tri-County Airport creates a natural barrier to east-west connectivity through this area of the Town. The connection would divert traffic to a potential four-leg intersection (at Vista Parkway / County Line Road) rather than at two three-leg “T” intersections as currently exists with the Arapahoe Road / County Line Road and Vista Parkway / County Line Road intersections. Thus, with the connection, east-west travel through this area would be accommodated by through movements rather than turning movements at these intersections. As shown in the Comprehensive Plan (and illustrated on **Figure 3),** this connection would bisect the Young Parcel. This connection is referred to as the “Vista Parkway” connection in this study.

A previous traffic analysis was performed for this site in 2007 that determined that the Vista Parkway connection through this is not necessary to support long-term traffic projections. This connection is not modeled in the DRCOG regional traffic model and is not included in the background assumptions for this study. A copy of the previous study can be provided upon request.

4.4 Year 2035 Scenario Analysis (Without Proposed Development)

The study area intersections were evaluated to determine baseline operations for the 2035 scenario and to identify any capacity constraints associated with background traffic.

In determining the operational characteristics of an intersection, “Levels of Service” (LOS) A through F are applied, with LOS A indicating very good operations and LOS F indicating congested operations. The intersection LOS is represented as a delay in seconds per vehicle for the intersection as a whole and for each turning movement. A more detailed discussion of LOS methodology is contained in the Appendix for reference. Criteria contained in the Highway Capacity Manual (HCM) was applied for these analyses in order to determine existing levels of service during peak hour periods. As discussed in Section 3.5, the intersection of Arapahoe Road & County Line Road currently meets MUTCD peak hour signal warrant volume criteria.

Thus, it is assumed that this intersection would be signalized for the long-term, background traffic scenario.

The results of the LOS calculations for the intersections are summarized in **Table 1**. The intersection level of service worksheets are attached in the Appendix. The data Table 1 shows that the Arapahoe & County Line intersection will operate acceptably overall as a traffic signal in the Year 2035 background traffic scenario.

5.0 PROPOSED DEVELOPMENT TRAFFIC

5.1 Trip Generation

A trip generation estimate was made to determine the traffic characteristics of the planned use. The trip rates contained in the Institute of Transportation Engineers (ITE) Trip Generation manual[3] were applied to estimate proposed traffic for the site. Based on the current site plan prospective tenants, the following ITE uses are anticipated to occur:

- Single-Family Detached Housing (ITE 210) - 357 dwelling units
- Residential Condominium/Townhouse (ITE 23) - 142 dwelling units

The proposed and estimated land uses were applied to the applicable ITE trip rates to estimate the new site traffic as shown in **Table 2.** Based on ITE methodology and the assumptions discussed in this section, the project is anticipated to generate the following trips at build out:

- 4,241 weekday daily trips
- 330 weekday AM peak hour trips
- 435 weekday PM peak hour trips

5.2 Trip Distribution and Assignment

The estimated traffic volumes presented in **Table 2** was distributed onto the adjacent street network based on existing traffic characteristics of the area, as well as land use and traffic patterns in the area, existing and future traffic volumes in and around the study area, and according to traffic growth projections. The trip distribution percentages are summarized on **Figure 5**. With potential development of the area north of the site, this future connectivity and land use may draw some portion of site traffic to the north. Thus, a separate distribution plan is provided for the long-term scenario.

Using these distribution estimates, the projected site traffic was assigned to the study area roadway network for the weekday AM and PM peak hour periods. These volumes are shown on **Figure 6** for both the short-term and long-term distribution scenarios.

6.0 FUTURE TRAFFIC CONDITIONS WITH SITE DEVELOPMENT

This scenario analysis has been conducted in order to determine impacts associated with full development and occupancy of the site in the short and long-term scenarios.

---

[3] Trip Generation 8th Edition, Institute of Transportation Engineers, 2008.

6.1 Intersection Capacity Analysis for Existing + Project Scenario

The site-generated traffic volumes were added to the existing background volumes to analyze potential site impacts in the short-term build out scenario. The existing + site-generated traffic volumes are illustrated on **Figure 7**. The level of service criteria discussed in prior sections was applied to the study area intersections to determine impacts with the addition of site-build out traffic volumes in the short-term. The results of the LOS calculations for the intersections are summarized in **Table 1**.

The data contained in Table 1 illustrates that both site access intersections will operate well overall (LOS A overall) with the addition of site traffic at build out in the short-term. The intersection of Arapahoe Road & County Line Road is anticipated to operate at LOS F in the PM peak hour with stop-control. As discussed in Section 3.5, this intersection currently meets the MUTCD peak hour signal warrant. With signalization, as shown in Table 1, this intersection will operate at LOS overall with the addition of site traffic in the near term scenario.

The eastbound left-turn at the County Line access is anticipated to operate at LOS E in the PM peak hour, while the intersection is projected to operate well at LOS A overall. This level of approach delay is typical for a side-street approach to an arterial roadway and does not warrant mitigation.

6.2 Intersection Capacity Analysis for Year 2035 Total Volumes

The projected 2035 background volumes were added to the site generated volumes and are illustrated on **Figure 8**. The level of service criteria discussed in prior sections was applied to the study area intersections to determine impacts with the addition of site traffic in the Year 2035 scenario. The results of the LOS calculations for the intersections are summarized in **Table 1**.

The data contained in Table 1 illustrates that all study area intersections will continue to operate acceptably overall (LOS B or better overall) with the addition of site traffic in the 2035 scenario. As noted with the existing + project scenario in Section 6.1, the eastbound left-turn at the County Line access is anticipated to operate at LOS E in the PM peak hour, while the intersection is projected to operate well at LOS A overall. This level of approach delay is typical for a side-street approach to an arterial roadway and does not warrant mitigation.

6.3 Site Access and Circulation

The site plan was reviewed for site access and internal circulation for vehicular, bicycle and pedestrian traffic. The proposed roadway and intersection network can adequately service site traffic volumes. Sidewalk connections are shown throughout the development to service pedestrians and connect to adjacent (future) use. Adequate spacing is provided at the site access points on Arapahoe Road and County Line Road to allow for sufficient queue storage for vehicles waiting to turn out of the site. The proposed site accesses are well spaced (1,000'+) from existing off-site intersections at Arapahoe/County Line and Vista Parkway/County Line. A discussion of auxiliary lane needs at the site access locations is provided in the following section.

6.4 Site Roadway Classifications

Per discussions with Town staff, roadways serving the site will be designated and accommodated to meet the following classifications:

- Arapahoe Road is assumed to serve as a minor arterial roadway and sufficient ROW will be provided along the site frontage to meet this requirement
- The roadway that aligns with Vista Parkway as it extends west into the site will be an 80' ROW collector roadway
- The site access that extends north of Arapahoe Road and runs north-south through the site will be a neighborhood collector roadway
- The site access that extends west of County Line Road and runs east-west through the site will be a neighborhood collector roadway.

6.5 Auxiliary Lanes

The Year 2035 site volumes were evaluated to determine turn lane requirements to support project traffic. Auxiliary lane lengths are based on CDOT criteria and for the current posted speed. The following recommendations are provided:

- Site Access & County Line Road (50 mph) - Northbound Left-Turn Deceleration Lane - 395' full-width lane + 180' (15:1) taper = 575' total.
- Site Access & County Line Road (50 mph) - Southbound Right-Turn Deceleration Lane - 320' full-width lane + 180' (15:1) taper = 500' total.
- Site Access & Arapahoe Road (40 mph) - Eastbound Left-Turn Deceleration Lane - 100' full-width lane + 145' (12:1) taper = 245' total.
- Site Access & Arapahoe Road (40 mph) - Westbound Right-Turn Deceleration Lane - 75' full-width lane + 145' (12:1) taper = 220' total.
- Vista Pkwy & County Line Road (50 mph) – Northbound Left-Turn Deceleration Lane - 395' full-width lane + 180' (15:1) taper = 575' total.
- Vista Pkwy & County Line Road (50 mph) - Southbound Right-Turn Deceleration Lane - 320' full-width lane + 180' (15:1) taper = 500' total.

7.0 CONCLUSIONS

The Erie Farms project is proposed at the northwest corner of the Arapahoe Road and County Line Road intersection in the Town of Erie. This project proposes the development 357 single-family and 142 multi-family dwelling units. Access to the site is planned along Arapahoe Road and County Line Road.

The project will generate approximately 4,241 daily trips with 330 trips occurring in the AM peak hour and 435 trips occurring in the PM peak hour at build out. It was determined that the existing and proposed future roadway and intersection network can serve the site added traffic volumes in the near and long-term scenarios with minimal effects. Improvements identified include the following:

Background Traffic Related Improvements:

1. Arapahoe Road & County Line Road intersection improvements: This intersection currently meets peak hour signal warrant volumes (without the project) for signalization and also far exceeds typical thresholds for auxiliary lane improvements. The project will add to the need for signalization and auxiliary as site-added traffic increases volumes at the intersection. However, these improvements are warranted on background (non-site) traffic alone.

Project Traffic Related Improvements:

2. Construct a northbound left-turn deceleration lane and southbound right-turn deceleration at the site access and Vista Parkway intersections on County Line Road.

3. Construct an eastbound left-turn deceleration lane and westbound right-turn deceleration lane at the site access on Arapahoe Road

Table 1 - Intersection Level of Service Summary

Intersection and Critical Movements	Existing				Existing + Project				Year 2035 Background				Year 2035 + Project			
	AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
SIGNAL CONTROL																
Arapahoe Road & County Line Road	Analyzed as Stop Control				**5.1**	**A**	**10.0**	**A**	**4.6**	**A**	**9.8**	**A**	**5.8**	**A**	**10.5**	**B**
Eastbound Left					*25.8*	*C*	*23.8*	*C*	*19.2*	*B*	*17.1*	*B*	*36.1*	*D*	*34.2*	*C*
Eastbound Right					*24.4*	*C*	*18.3*	*B*	*17.6*	*B*	*13.4*	*B*	*32.9*	*C*	*25.1*	*C*
Northbound Left					*3.6*	*A*	*5.1*	*A*	*4.9*	*A*	*5.5*	*A*	*5.6*	*A*	*6.3*	*A*
Northbound Through					*2.1*	*A*	*6.4*	*A*	*2.9*	*A*	*9.9*	*A*	*1.9*	*A*	*5.8*	*A*
Southbound Through					*2.6*	*A*	*5.5*	*A*	*3.5*	*A*	*7.3*	*A*	*2.2*	*A*	*5.3*	*A*
Southbound Right					*2.2*	*A*	*4.4*	*A*	*2.6*	*A*	*4.8*	*A*	*2.2*	*A*	*4.6*	*A*
STOP CONTROL																
Arapahoe Road & County Line Road	**5.2**	**A**	**26.2**	**D**	**7.0**	**A**	**76.0**	**F**	Analyzed as Signal Control							
Eastbound Left+Right	*31.3*	*D*	*88.9*	*F*	*39.2*	*E*	*280.5*	*F*								
Northbound Left+Through	*6.8*	*A*	*1.4*	*A*	*7.3*	*A*	*2.7*	*A*								
Site Access & Arapahoe Road	---	---	---	---	**3.3**	**A**	**2.8**	**A**	---	---	---	---	**3.1**	**A**	**2.6**	**A**
Eastbound Left	---	---	---	---	*8.6*	*A*	*8.1*	*A*	---	---	---	---	*8.8*	*A*	*8.2*	*A*
Southbound Left	---	---	---	---	*15.4*	*C*	*18.2*	*C*	---	---	---	---	*17.2*	*C*	*19.9*	*C*
Southbound Right	---	---	---	---	*13.2*	*B*	*9.6*	*A*	---	---	---	---	*13.8*	*B*	*9.9*	*A*
Site Access & County Line Road	**---**	**---**	**---**	**---**	**2.5**	**A**	**2.1**	**A**	**---**	**---**	**---**	**---**	**1.5**	**A**	**1.4**	**A**
Eastbound Left	---	---	---	---	*20.4*	*C*	*35.3*	*E*	---	---	---	---	*31.7*	*D*	*45.9*	*E*
Eastbound Right	---	---	---	---	*13.8*	*B*	*11.6*	*B*	---	---	---	---	*12.7*	*B*	*11.4*	*B*
Northbound Left	---	---	---	---	*8.9*	*A*	*8.8*	*A*	---	---	---	---	*10.1*	*B*	*9.9*	*A*

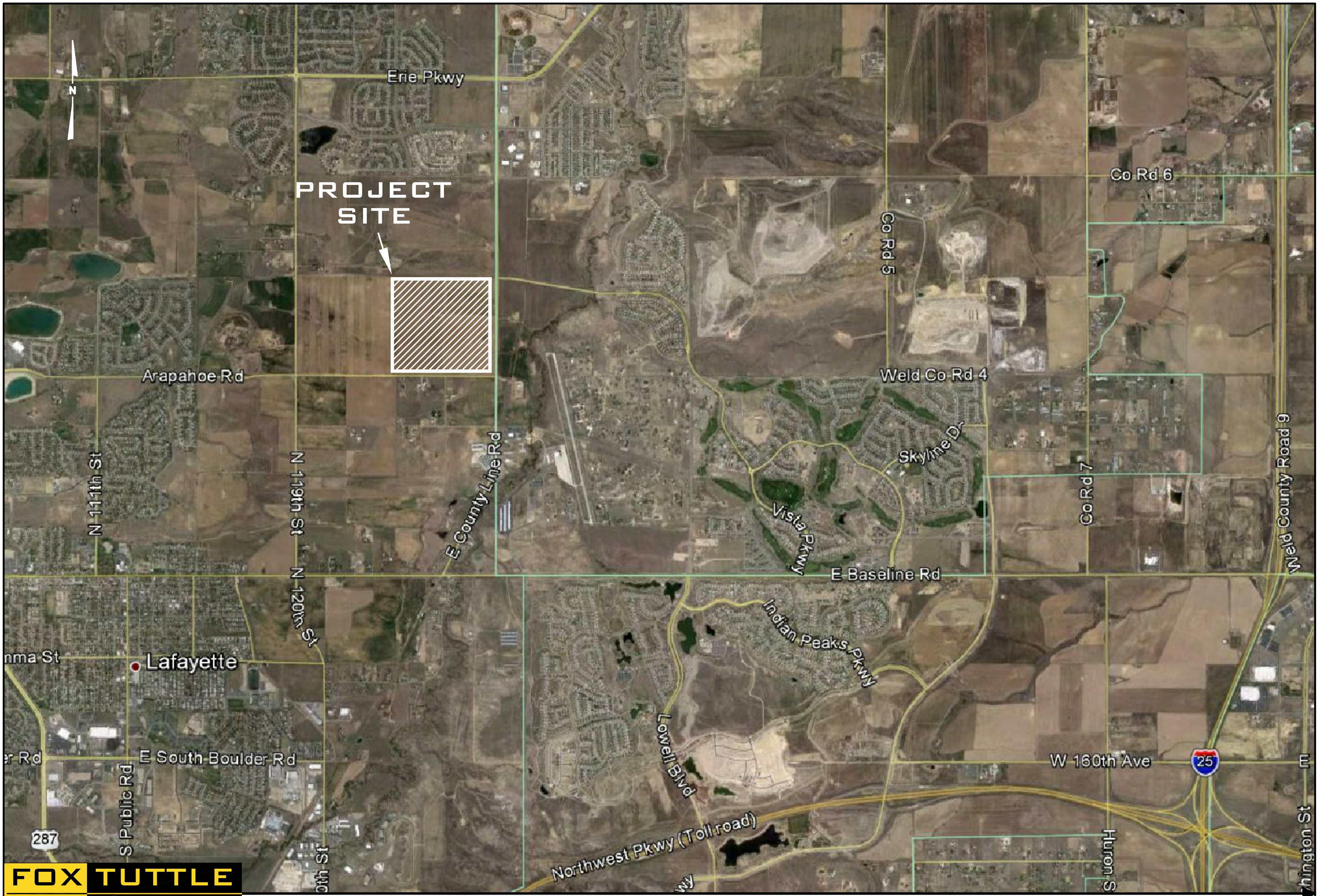
Note: Delay represented in average seconds per vehicle.

FOX TUTTLE
TRANSPORTATION GROUP

Table 2 - Trip Generation Estimate

Land Use	Size	Unit	Average Daily Trips				A.M. Peak Hour Trips				P.M. Peak Hour Trips			
			Rate	Total	In	Out	Rate	Total	In	Out	Rate	Total	In	Out
ITE 210 Single-Family Detached Housing	357	Dwelling Units	9.57	3416	1708	1708	0.75	268	67	201	1.01	361	227	134
ITE 230 Residential Condominium/Townhouse	142	Dwelling Units	5.81	825	413	412	0.44	62	11	51	0.52	74	50	24
Totals:	**499**			**4241**	**2121**	**2120**		**330**	**78**	**252**		**435**	**277**	**158**

Source: ITE Trip Generation 8th Edition. 2008.

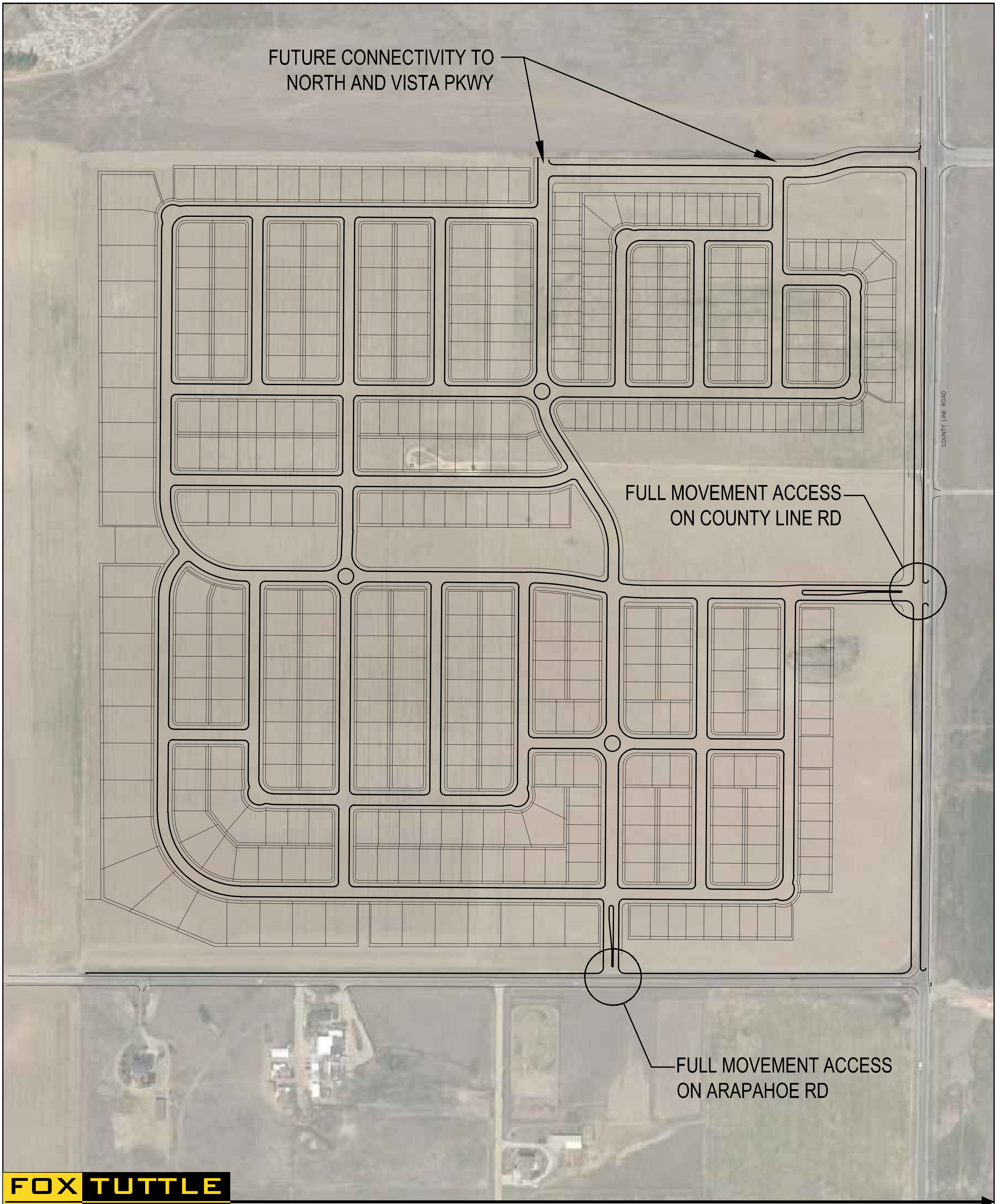


FOX TUTTLE
TRANSPORTATION GROUP

ERIE FARMS TRAFFIC IMPACT STUDY

VICINITY MAP

FT Project #	12020	Original Scale	1"=5000'	Date	10/25/12	Drawn by	SGT	Figure #	1

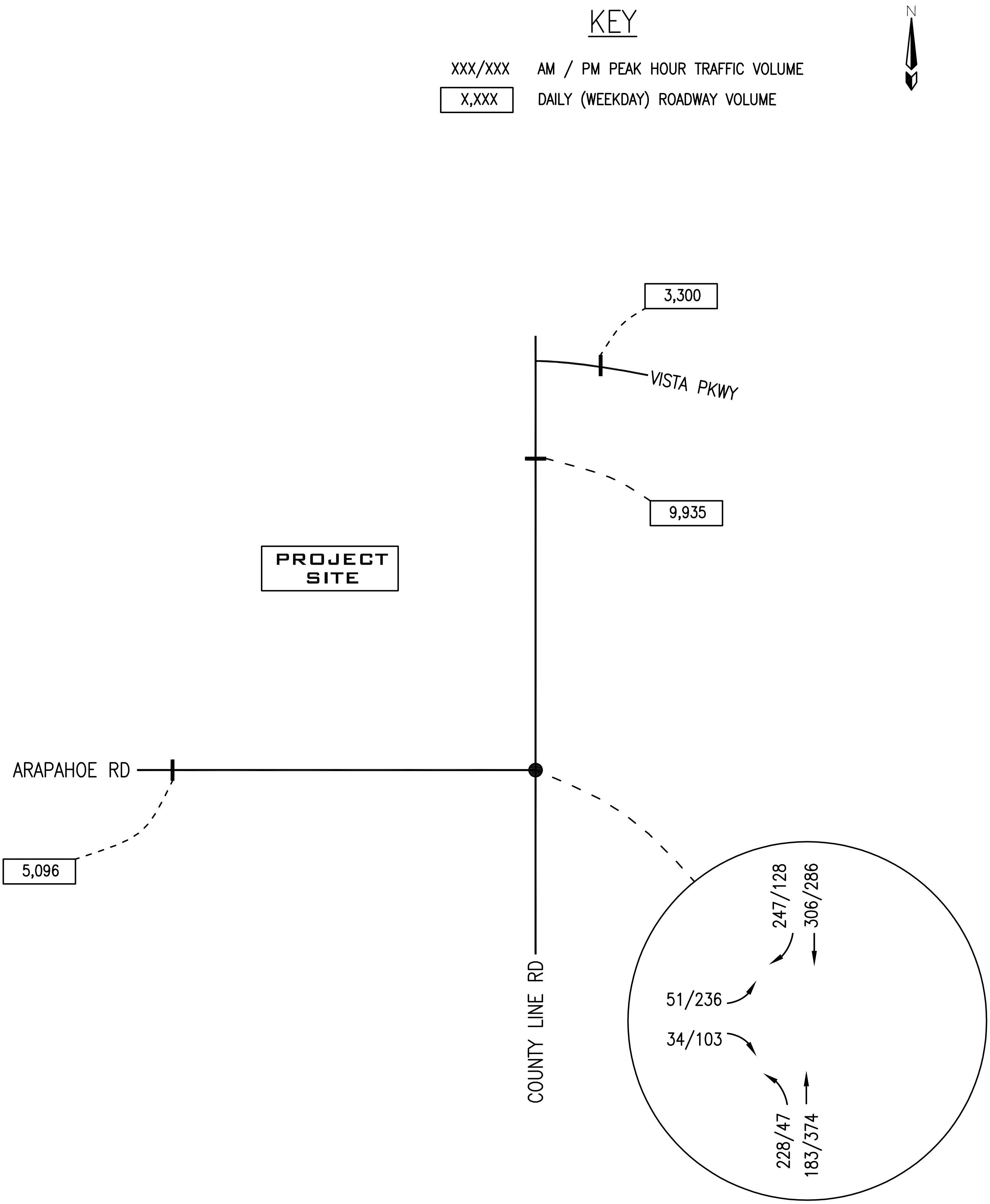


FOX TUTTLE
TRANSPORTATION GROUP

ERIE FARMS TRAFFIC IMPACT STUDY

SITE PLAN

FT Project #	12020	Original Scale	1"=400'	Date	4/3/13	Drawn by	SGT	Figure #	2

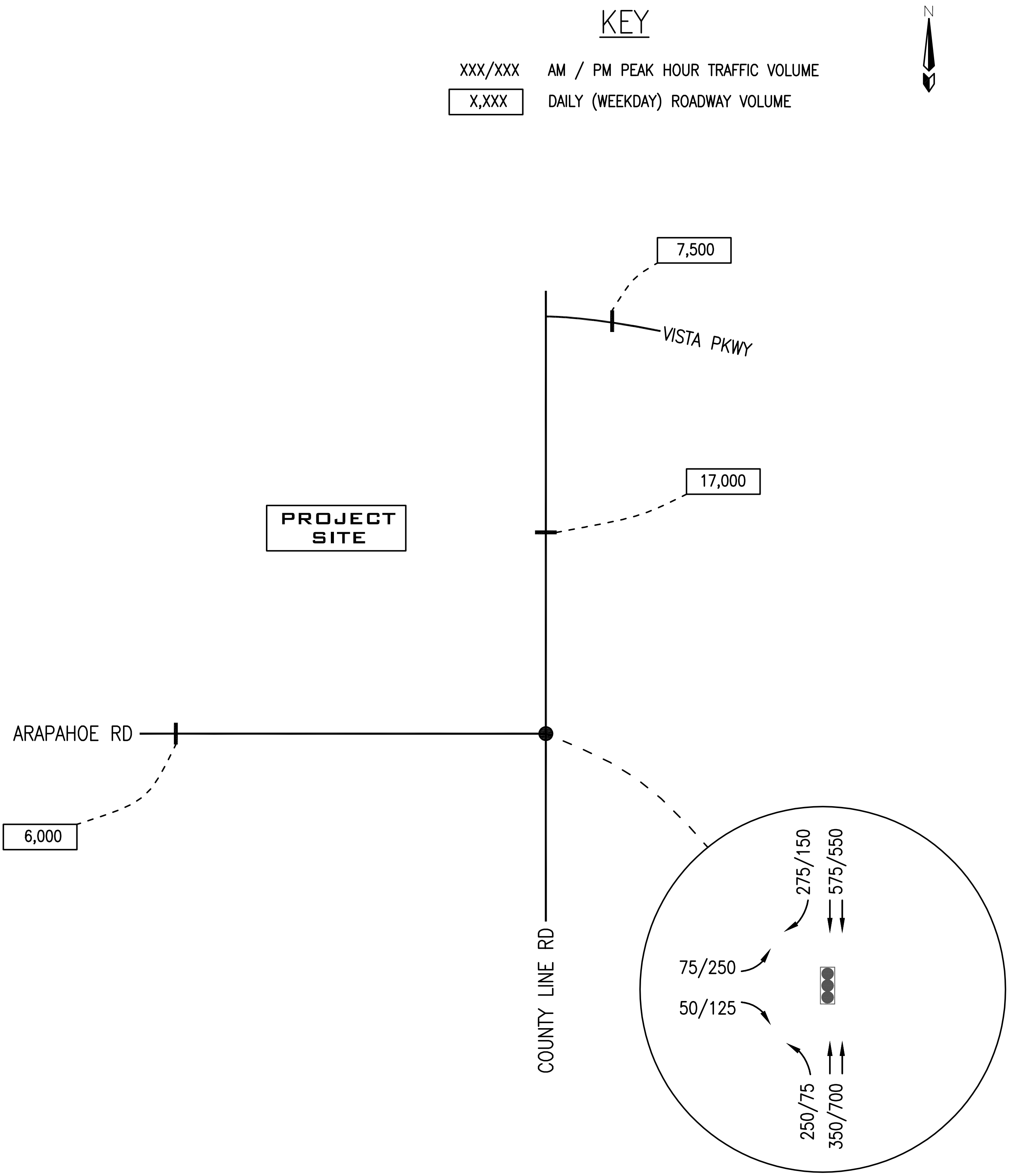


FOX TUTTLE
TRANSPORTATION GROUP

ERIE FARMS TRAFFIC IMPACT STUDY

EXISTING TRAFFIC VOLUMES

FT Project #	12020	Original Scale	NTS	Date	4/3/13	Drawn by	SGT	Figure #	3



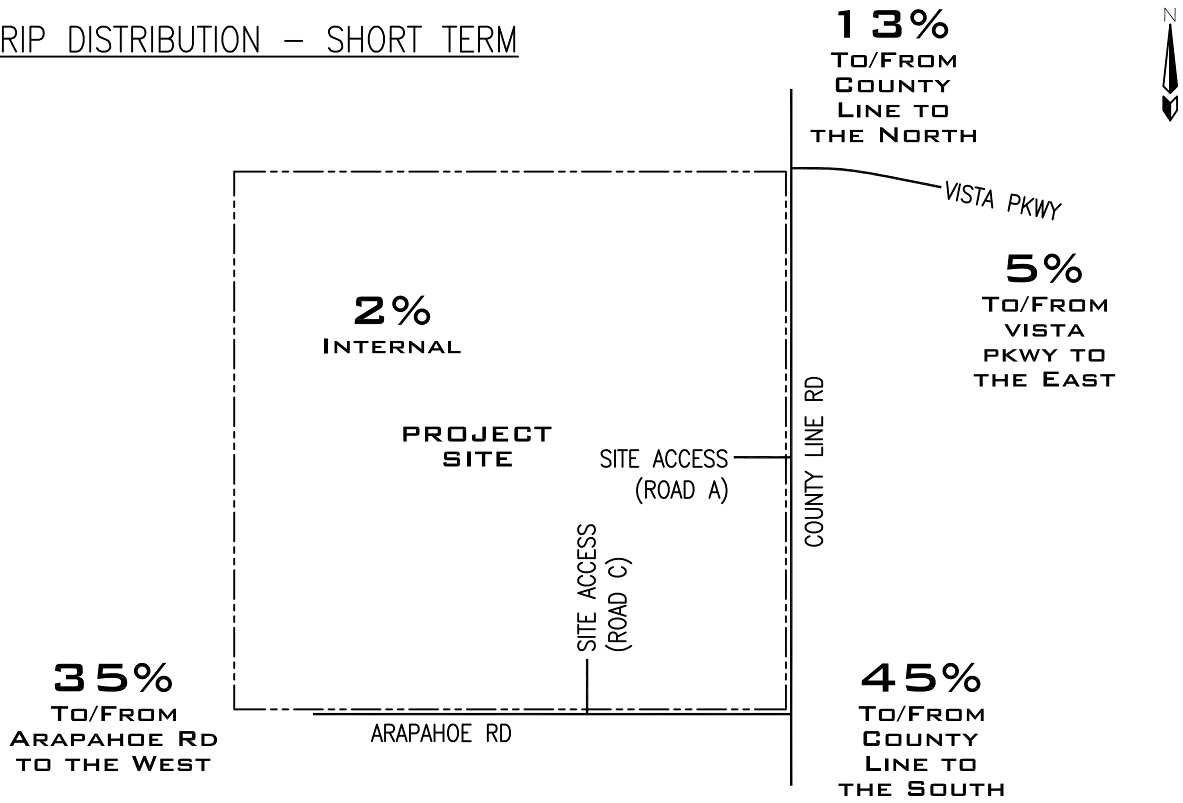
FOX TUTTLE
TRANSPORTATION GROUP

ERIE FARMS TRAFFIC IMPACT STUDY

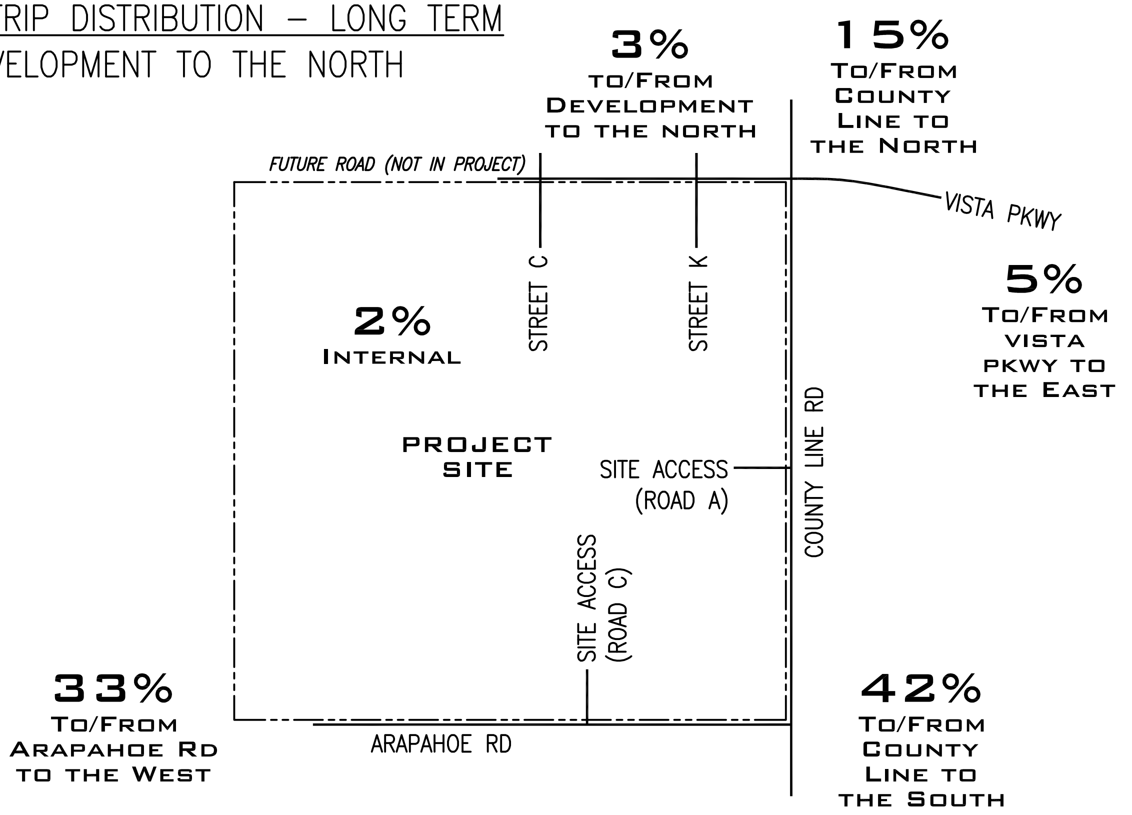
2035 BACKGROUND TRAFFIC VOLUMES

FT Project #	12020	Original Scale	NTS	Date	10/25/12	Drawn by	SGT	Figure #	4

SITE TRIP DISTRIBUTION – SHORT TERM



SITE TRIP DISTRIBUTION – LONG TERM
w/DEVELOPMENT TO THE NORTH

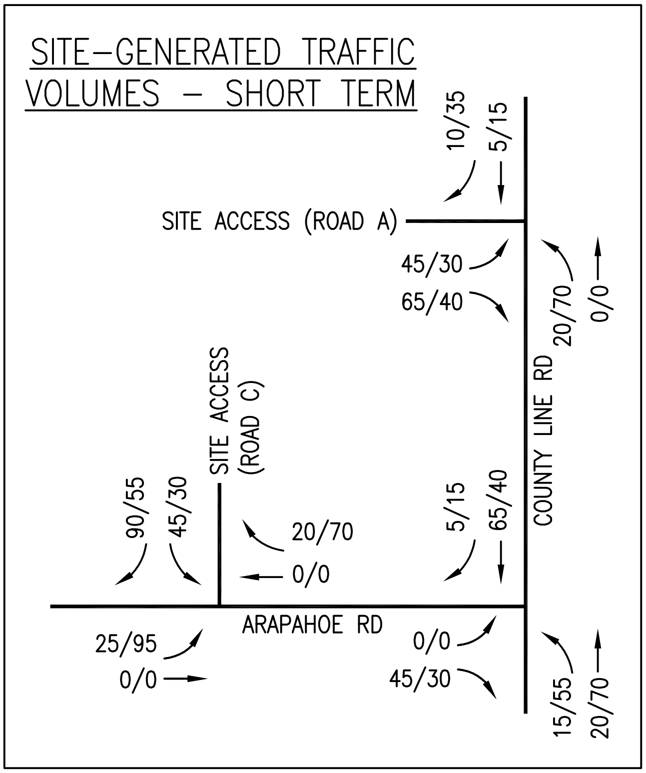


FOX TUTTLE
TRANSPORTATION GROUP

ERIE FARMS TRAFFIC IMPACT STUDY

SITE TRIP DISTRIBUTION

FT Project #	12020	Original Scale	NTS	Date	10/25/12	Drawn by	SGT	Figure #	5

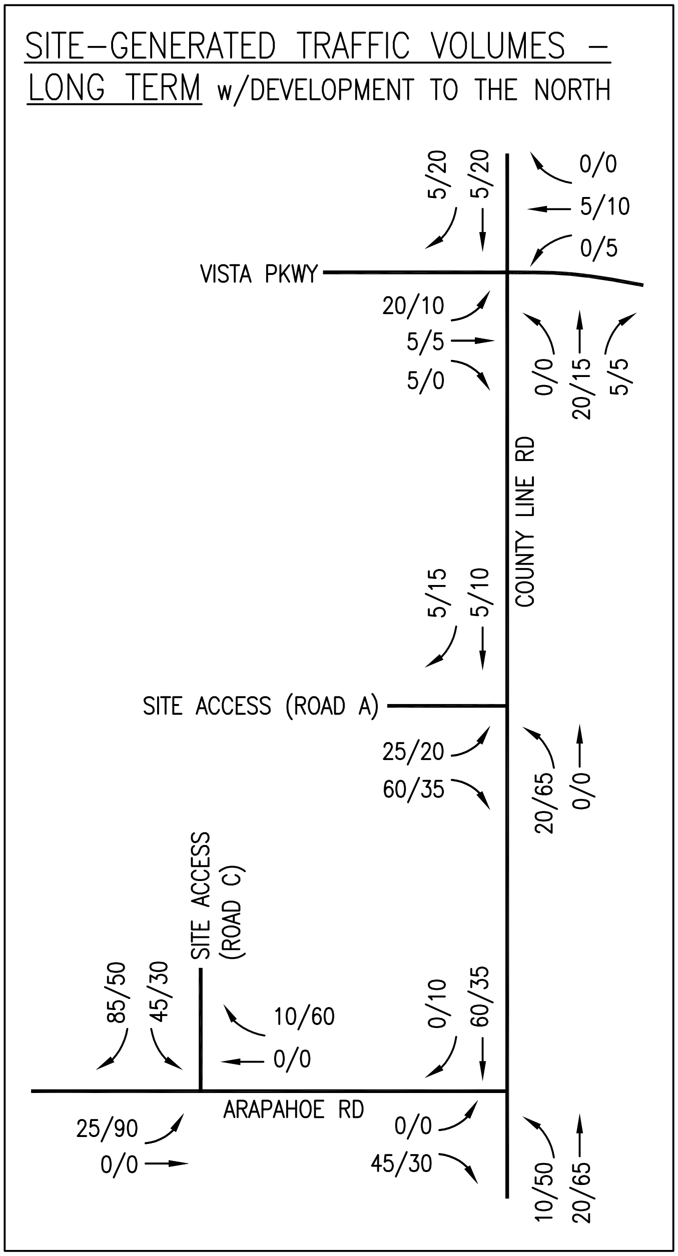

SITE-GENERATED TRAFFIC VOLUMES – SHORT TERM

KEY

XXX/XXX AM / PM PEAK HOUR TRAFFIC VOLUME

TRIP GENERATION ESTIMATES
(SEE TABLE 2 FOR ADDITIONAL DETAIL):

- AM PEAK HOUR: 78 IN, 252 OUT
- PM PEAK HOUR: 277 IN, 158 OUT

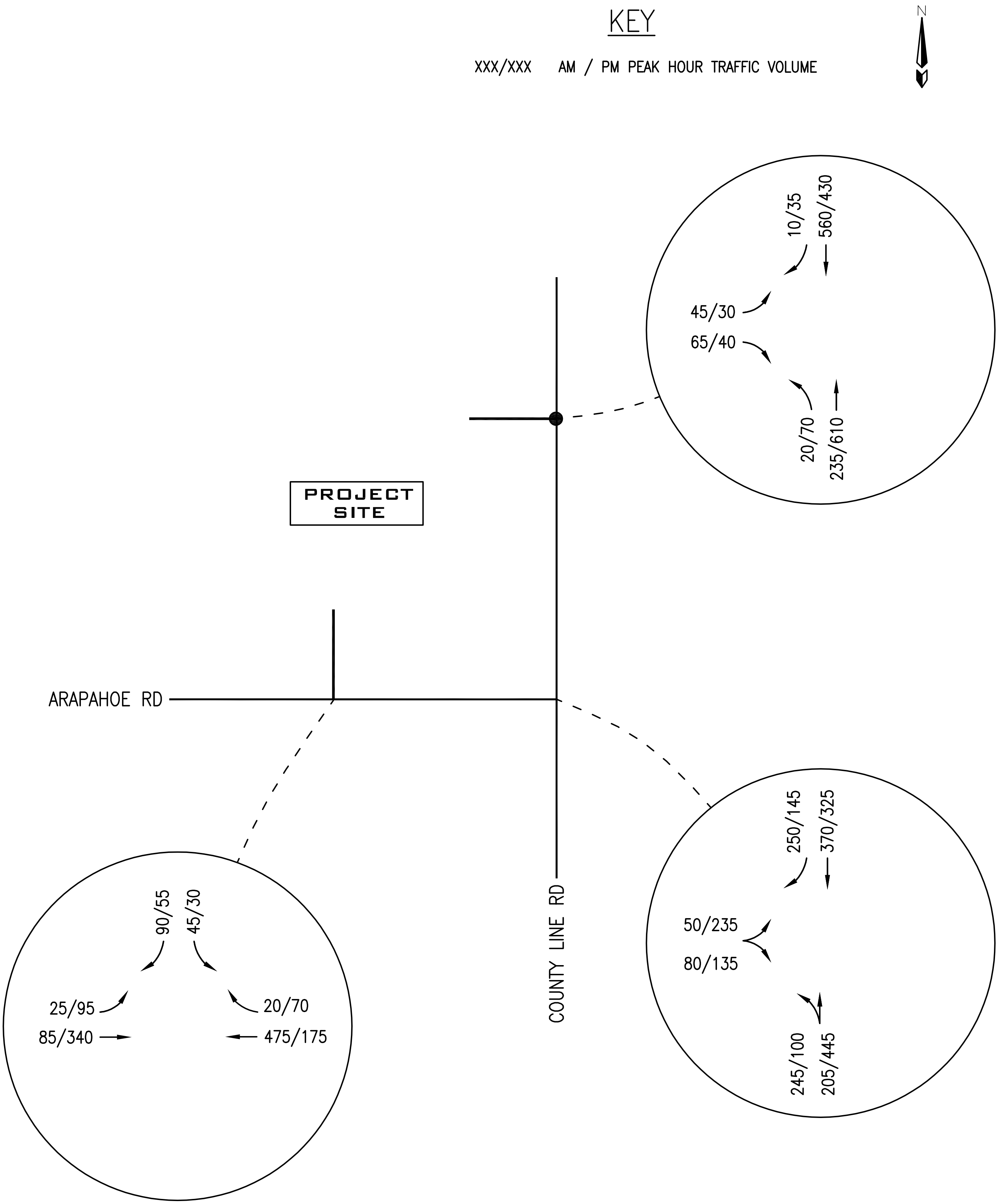

SITE-GENERATED TRAFFIC VOLUMES – LONG TERM w/DEVELOPMENT TO THE NORTH

FOX TUTTLE
TRANSPORTATION GROUP

ERIE FARMS TRAFFIC IMPACT STUDY

SITE-GENERATED TRAFFIC VOLUMES

FT Project # 12020	Original Scale NTS	Date 10/25/12	Drawn by SGT	Figure # 6

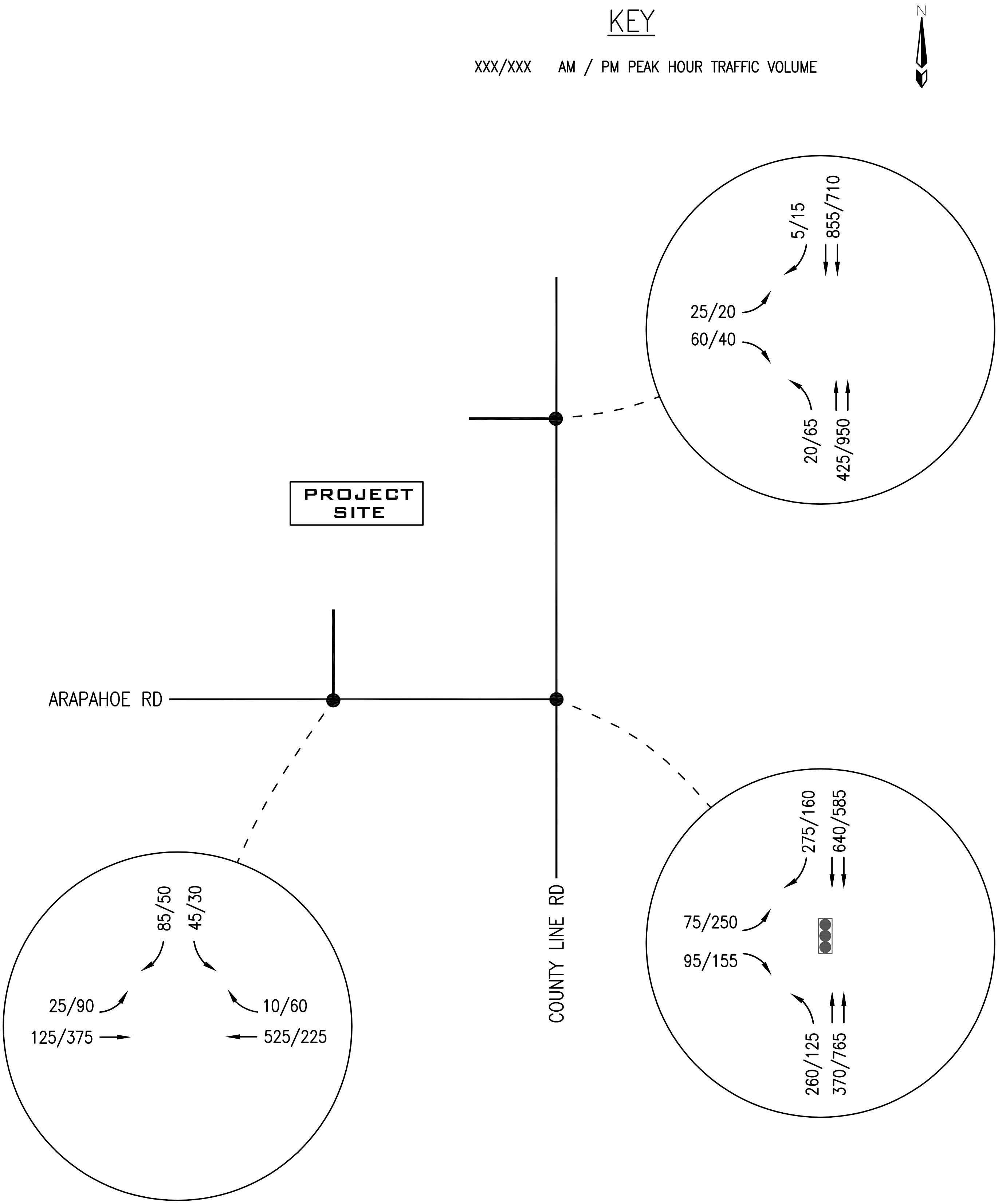


FOX TUTTLE
TRANSPORTATION GROUP

ERIE FARMS TRAFFIC IMPACT STUDY

EXISTING BACKGROUND + SITE-GENERATED TRAFFIC VOLUMES

FT Project #	12020	Original Scale	NTS	Date	10/25/12	Drawn by	SGT	Figure #	7



FOX TUTTLE
TRANSPORTATION GROUP

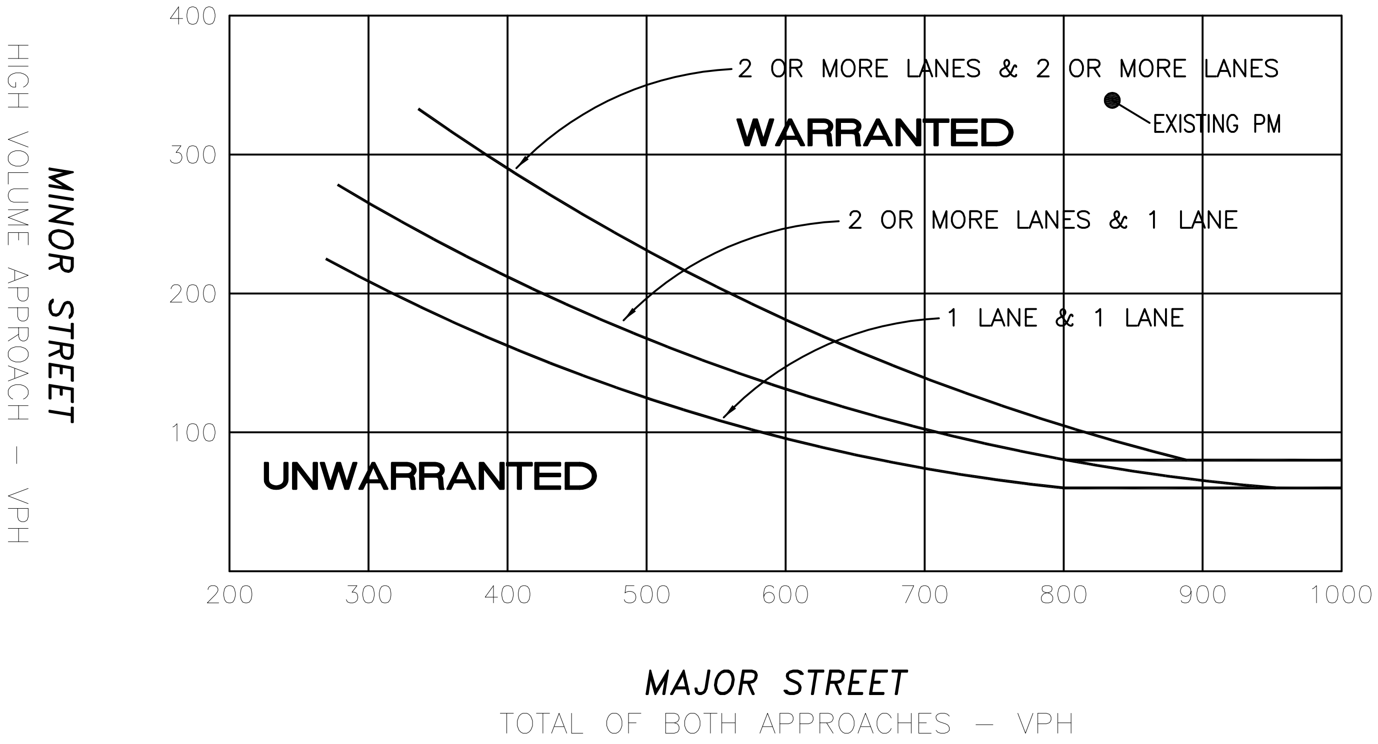
ERIE FARMS TRAFFIC IMPACT STUDY

YEAR 2035 BACKGROUND + SITE-GENERATED TRAFFIC VOLUMES

FT Project #	12020	Original Scale	NTS	Date	10/25/12	Drawn by	SGT	Figure #	8

FOUR HOUR VOLUME WARRANT

(COMMUNITY LESS THAN 10,000 POPULATION
OR ABOVE 40 MPH ON MAJOR STREET)



NOTE: 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 60 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

FOX TUTTLE
TRANSPORTATION GROUP

ERIE FARMS TRAFFIC IMPACT STUDY

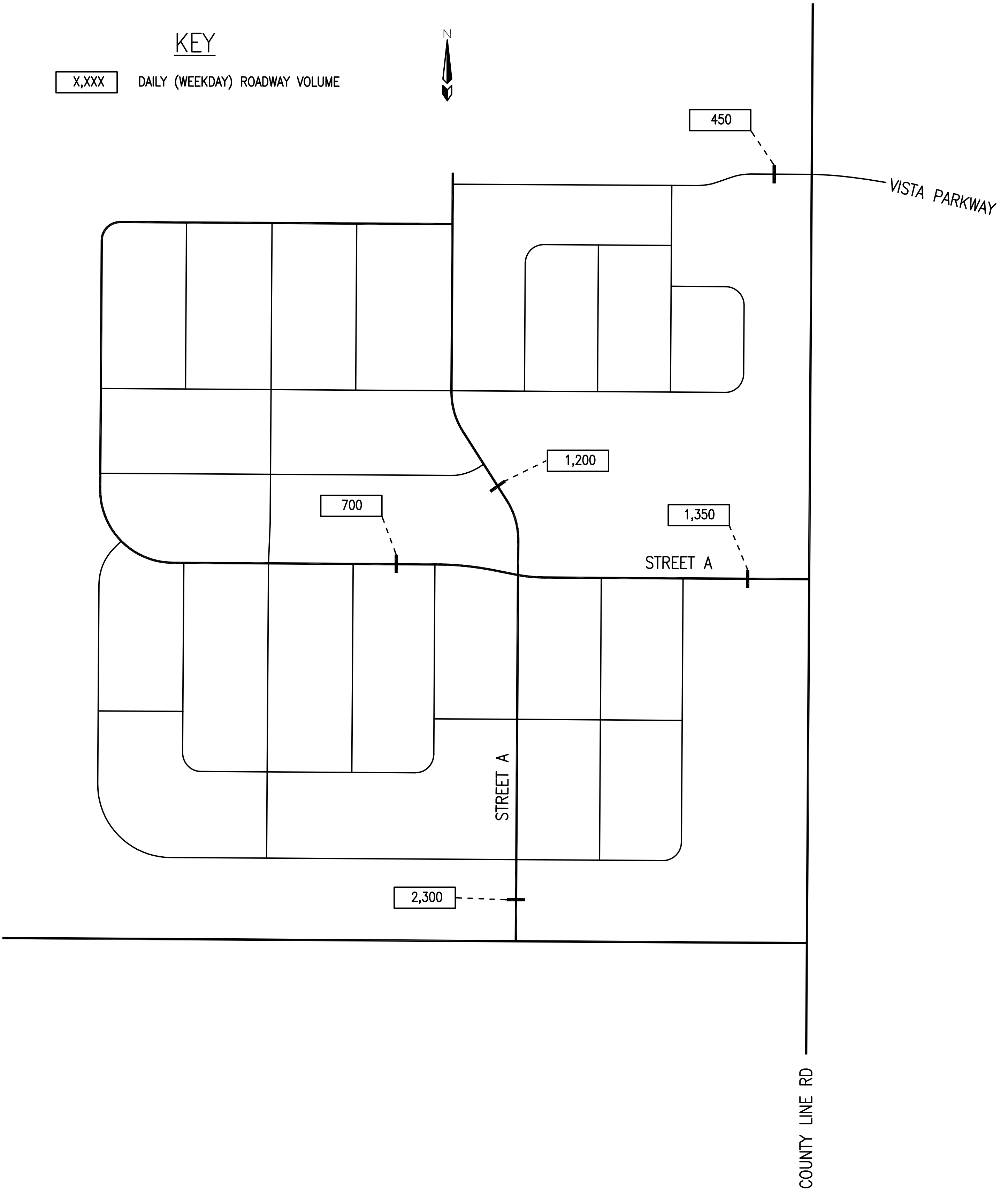
PEAK HOUR SIGNAL WARRANT

FT Project #	12020	Original Scale	Date	10/25/12	Drawn by	SGT	Figure #	9

APPENDIX

Internal Roadway Volume Projections
DRCOG 2035 Traffic Model Projections
Level of Service Definitions
Intersection Capacity Worksheets
Traffic Count Data Sheets

Internal Roadway Volume Projections



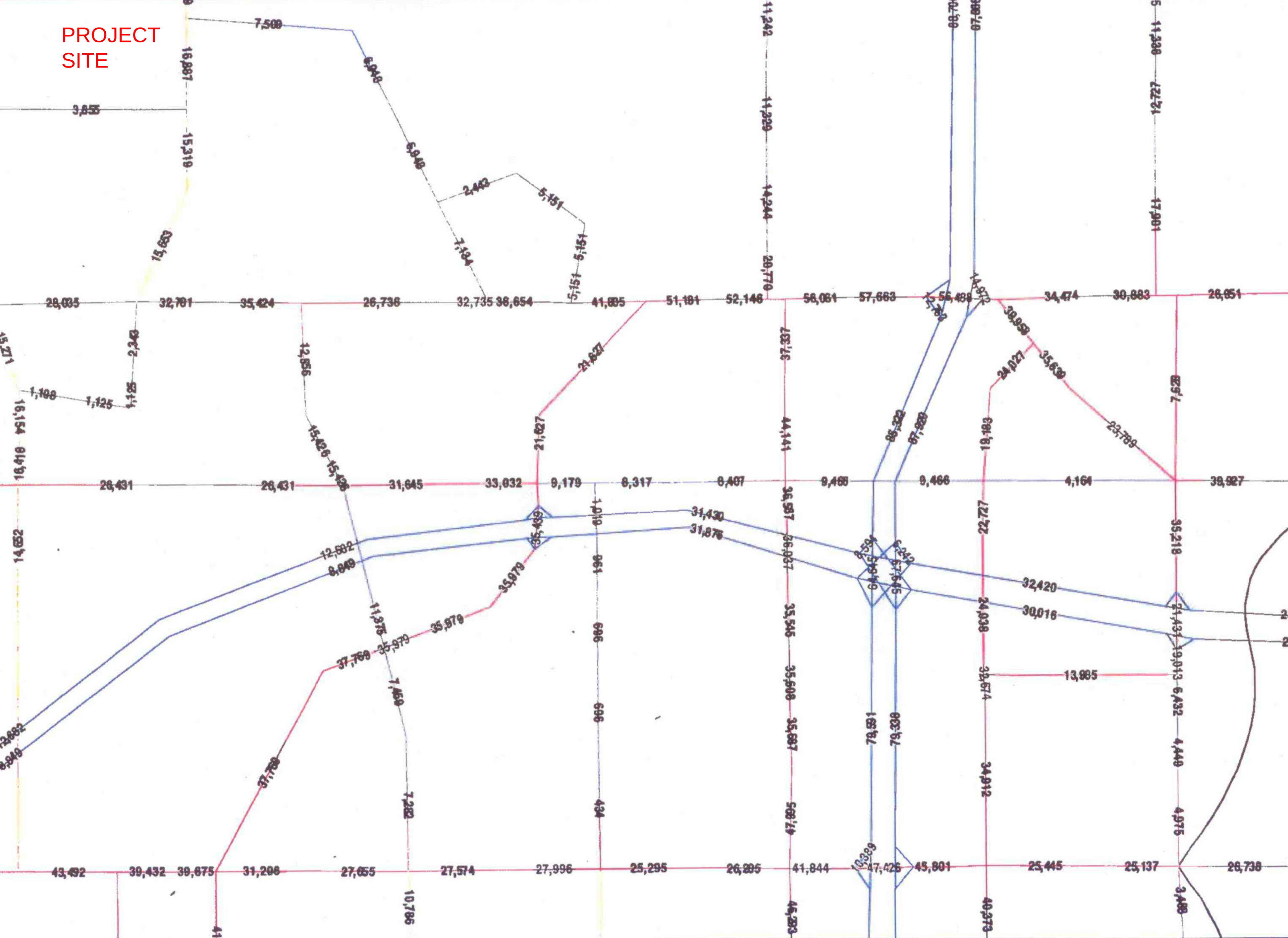
FOX TUTTLE
TRANSPORTATION GROUP

ERIE FARMS TRAFFIC IMPACT STUDY

SITE-GENERATED INTERNAL TRAFFIC VOLUMES

FT Project #	12020	Original Scale	NTS	Date	4/2/13	Drawn by	SGT	Figure #	A1

DRCOG 2035 Traffic Model Projections


PROJECT SITE
7,500
16,887
3,855
15,319
6,948
6,948
2,443
5,151
5,151
5,151
7,134
15,653
11,242
11,226
14,244
20,770
11,336
12,727
17,901
28,035
32,701
35,424
26,736
32,735
36,654
41,805
51,181
52,146
56,061
57,663
56,488
14,972
34,474
30,883
26,851
15,271
2,343
1,108
1,125
1,125
12,856
37,337
21,627
21,627
85,322
39,959
24,027
35,639
7,628
16,154
16,418
15,426
15,426
44,141
19,183
23,789
26,431
26,431
31,645
33,032
9,179
8,317
8,407
9,466
9,466
4,164
39,927
14,652
35,439
1,019
31,430
31,876
36,587
22,727
35,218
12,582
8,849
35,979
196
36,037
8,594
6,442
32,420
30,016
11,376
35,979
35,979
37,769
989
35,546
24,838
19,013
32,674
13,885
6,432
7,450
35,608
35,687
959
79,591
79,338
4,440
34,812
8,849
37,769
7,282
434
47,895
4,975
10,389
43,492
39,432
39,675
31,206
27,655
27,574
27,996
25,295
26,295
41,844
47,426
45,801
25,445
25,137
26,738
10,786
46,283
40,373
3,488

Level of Service Definitions

LEVEL OF SERVICE DEFINITIONS

In rating roadway and intersection operating conditions with existing or future traffic volumes, "Levels of Service" (LOS) A through F are used, with LOS A indicating very good operation and LOS F indicating poor operation. Levels of service at signalized and unsignalized intersections are closely associated with vehicle delays experienced in seconds per vehicle. More complete level of service definitions and delay data for signal and stop sign controlled intersections are contained in the following table for reference.

Level of Service Rating	**Delay in seconds per vehicle *(a)***		**Definition**
	Signalized	**Unsignalized**	
A	0.0 to 10.0	0.0 to 10.0	Low vehicular traffic volumes; primarily free flow operations. Density is low and vehicles can freely maneuver within the traffic stream. Drivers are able to maintain their desired speeds with little or no delay.
B	10.1 to 20.0	10.1 to 15.0	Stable vehicular traffic volume flow with potential for some restriction of operating speeds due to traffic conditions. Vehicle maneuvering is only slightly restricted. The stopped delays are not bothersome and drivers are not subject to appreciable tension.
C	20.1 to 35.0	15.1 to 25.0	Stable traffic operations, however the ability for vehicles to maneuver is more restricted by the increase in traffic volumes. Relatively satisfactory operating speeds prevail, but adverse signal coordination or longer vehicle queues cause delays along the corridor.
D	35.1 to 55.0	25.1 to 35.0	Approaching unstable vehicular traffic flow where small increases in volume could cause substantial delays. Most drivers are restricted in ability to maneuver and selection of travel speeds due to congestion. Driver comfort and convenience are low, but tolerable.
E	55.1 to 80.0	35.1 to 50.0	Traffic operations characterized by significant approach delays and average travel speeds of one-half to one-third the free flow speed. Vehicular flow is unstable and there is potential for stoppages of brief duration. High signal density, extensive vehicle queuing, or corridor signal progression/timing are the typical causes of vehicle delays at signalized corridors.
F	> 80.0	> 50.0	Forced vehicular traffic flow and operations with high approach delays at critical intersections. Vehicle speeds are reduced substantially and stoppages may occur for short or long periods of time because of downstream congestion.

(a) Delay ranges based on 2010 Highway Capacity Manual criteria.

Intersection Capacity Worksheets

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰	↱	
Volume (veh/h)	51	34	228	183	306	247
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	55	37	248	199	333	268
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1161	467	601			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1161	467	601			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	66	94	75			
cM capacity (veh/h)	161	596	976			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	92	447	601
Volume Left	55	248	0
Volume Right	37	0	268
cSH	227	976	1700
Volume to Capacity	0.41	0.25	0.35
Queue Length 95th (ft)	46	25	0
Control Delay (s)	31.3	6.8	0.0
Lane LOS	D	A	
Approach Delay (s)	31.3	6.8	0.0
Approach LOS	D		

Intersection Summary			
Average Delay	5.2		
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: Arapahoe Rd & County Line Rd

Existing
PM

	↗	↘	↖	↑	↓	↙
Movement	**EBL**	**EBR**	**NBL**	**NBT**	**SBT**	**SBR**
Lane Configurations	Y			↰	↱	
Volume (veh/h)	236	103	47	374	286	128
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	257	112	51	407	311	139
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	889	380	450			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	889	380	450			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	14	83	95			
cM capacity (veh/h)	299	667	1110			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	368	458	450
Volume Left	257	51	0
Volume Right	112	0	139
cSH	359	1110	1700
Volume to Capacity	1.03	0.05	0.26
Queue Length 95th (ft)	308	4	0
Control Delay (s)	88.9	1.4	0.0
Lane LOS	F	A	
Approach Delay (s)	88.9	1.4	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	26.2		
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

3: County Line Rd & Arapahoe Rd

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰	↱	
Volume (veh/h)	50	80	245	205	370	250
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	87	266	223	402	272
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1293	538	674			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1293	538	674			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	57	84	71			
cM capacity (veh/h)	127	543	917			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	141	489	674
Volume Left	54	266	0
Volume Right	87	0	272
cSH	241	917	1700
Volume to Capacity	0.59	0.29	0.40
Queue Length 95th (ft)	84	30	0
Control Delay (s)	39.2	7.3	0.0
Lane LOS	E	A	
Approach Delay (s)	39.2	7.3	0.0
Approach LOS	E		

Intersection Summary			
Average Delay	7.0		
Intersection Capacity Utilization	76.8%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Arapahoe Rd & Site Access

Existing + Project
AM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑	↱	↰	↱
Volume (veh/h)	25	85	475	20	45	90
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.75	0.92	0.92	0.75	0.75	0.75
Hourly flow rate (vph)	33	92	516	27	60	120
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	543				675	516
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	543				675	516
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				85	79
cM capacity (veh/h)	1026				406	559

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	33	92	516	27	60	120
Volume Left	33	0	0	0	60	0
Volume Right	0	0	0	27	0	120
cSH	1026	1700	1700	1700	406	559
Volume to Capacity	0.03	0.05	0.30	0.02	0.15	0.21
Queue Length 95th (ft)	3	0	0	0	13	20
Control Delay (s)	8.6	0.0	0.0	0.0	15.4	13.2
Lane LOS	A				C	B
Approach Delay (s)	2.3		0.0		13.9	
Approach LOS					B	

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	37.2%	ICU Level of Service	A
Analysis Period (min)	15		

9: County Line Rd & Site Access

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑	↑	↱
Volume (veh/h)	45	65	20	235	560	10
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.75	0.75	0.92	0.92	0.75
Hourly flow rate (vph)	60	87	27	255	609	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	917	609	622			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	917	609	622			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	80	83	97			
cM capacity (veh/h)	293	495	959			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	60	87	27	255	609	13
Volume Left	60	0	27	0	0	0
Volume Right	0	87	0	0	0	13
cSH	293	495	959	1700	1700	1700
Volume to Capacity	0.20	0.17	0.03	0.15	0.36	0.01
Queue Length 95th (ft)	19	16	2	0	0	0
Control Delay (s)	20.4	13.8	8.9	0.0	0.0	0.0
Lane LOS	C	B	A			
Approach Delay (s)	16.5		0.8		0.0	
Approach LOS	C					

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

3: County Line Rd & Arapahoe Rd

PM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑	↑	↱
Volume (vph)	50	80	245	205	370	250
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.52	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	977	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	87	266	223	402	272
RTOR Reduction (vph)	0	78	0	0	0	64
Lane Group Flow (vph)	54	9	266	223	402	208
Turn Type	NA	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	6.2	6.2	45.8	45.8	45.8	45.8
Effective Green, g (s)	6.2	6.2	45.8	45.8	45.8	45.8
Actuated g/C Ratio	0.10	0.10	0.76	0.76	0.76	0.76
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	182	163	745	1422	1422	1208
v/s Ratio Prot	c0.03			0.12	0.22	
v/s Ratio Perm		0.01	c0.27			0.13
v/c Ratio	0.30	0.06	0.36	0.16	0.28	0.17
Uniform Delay, d1	24.9	24.3	2.3	1.9	2.1	1.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.1	1.3	0.2	0.5	0.3
Delay (s)	25.8	24.4	3.6	2.1	2.6	2.2
Level of Service	C	C	A	A	A	A
Approach Delay (s)	24.9			3.0	2.5	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	5.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

3: County Line Rd & Arapahoe Rd
PM

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↑↱	
Volume (veh/h)	235	135	100	445	325	145
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	255	147	109	484	353	158
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1133	432	511			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1133	432	511			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	76	90			
cM capacity (veh/h)	201	623	1054			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	402	592	511
Volume Left	255	109	0
Volume Right	147	0	158
cSH	267	1054	1700
Volume to Capacity	1.50	0.10	0.30
Queue Length 95th (ft)	583	9	0
Control Delay (s)	280.5	2.7	0.0
Lane LOS	F	A	
Approach Delay (s)	280.5	2.7	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	76.0		
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		

7: Arapahoe Rd & Site Access

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑	↱	↰	↱
Volume (veh/h)	95	340	175	70	30	55
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.75	0.92	0.92	0.75	0.75	0.75
Hourly flow rate (vph)	127	370	190	93	40	73
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	284				813	190
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	284				813	190
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	90				87	91
cM capacity (veh/h)	1279				313	852

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	127	370	190	93	40	73
Volume Left	127	0	0	0	40	0
Volume Right	0	0	0	93	0	73
cSH	1279	1700	1700	1700	313	852
Volume to Capacity	0.10	0.22	0.11	0.05	0.13	0.09
Queue Length 95th (ft)	8	0	0	0	11	7
Control Delay (s)	8.1	0.0	0.0	0.0	18.2	9.6
Lane LOS	A				C	A
Approach Delay (s)	2.1		0.0		12.6	
Approach LOS					B	

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	27.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑	↑	↱
Volume (veh/h)	30	40	70	610	430	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.75	0.75	0.92	0.92	0.75
Hourly flow rate (vph)	40	53	93	663	467	47
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1317	467	514			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1317	467	514			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	75	91	91			
cM capacity (veh/h)	158	596	1051			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	40	53	93	663	467	47
Volume Left	40	0	93	0	0	0
Volume Right	0	53	0	0	0	47
cSH	158	596	1051	1700	1700	1700
Volume to Capacity	0.25	0.09	0.09	0.39	0.27	0.03
Queue Length 95th (ft)	24	7	7	0	0	0
Control Delay (s)	35.3	11.6	8.8	0.0	0.0	0.0
Lane LOS	E	B	A			
Approach Delay (s)	21.8		1.1		0.0	
Approach LOS	C					

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
3: County Line Rd & Arapahoe Rd

Existing + Project
PM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑	↑	↱
Volume (vph)	235	135	100	445	325	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.53	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	989	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	255	147	109	484	353	158
RTOR Reduction (vph)	0	113	0	0	0	57
Lane Group Flow (vph)	255	34	109	484	353	101
Turn Type	NA	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	13.8	13.8	38.2	38.2	38.2	38.2
Effective Green, g (s)	13.8	13.8	38.2	38.2	38.2	38.2
Actuated g/C Ratio	0.23	0.23	0.64	0.64	0.64	0.64
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	407	364	629	1186	1186	1007
v/s Ratio Prot	c0.14			c0.26	0.19	
v/s Ratio Perm		0.02	0.11			0.06
v/c Ratio	0.63	0.09	0.17	0.41	0.30	0.10
Uniform Delay, d1	20.8	18.2	4.5	5.4	4.9	4.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.0	0.1	0.6	1.0	0.6	0.2
Delay (s)	23.8	18.3	5.1	6.4	5.5	4.4
Level of Service	C	B	A	A	A	A
Approach Delay (s)	21.8			6.1	5.2	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	10.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	45.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑	↑	↱
Volume (vph)	75	50	250	350	575	275
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.38	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	709	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	54	272	380	625	299
RTOR Reduction (vph)	0	47	0	0	0	91
Lane Group Flow (vph)	82	7	272	380	625	208
Turn Type	NA	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	6.2	6.2	32.3	32.3	32.3	32.3
Effective Green, g (s)	6.2	6.2	32.3	32.3	32.3	32.3
Actuated g/C Ratio	0.13	0.13	0.69	0.69	0.69	0.69
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	236	211	492	1294	1294	1099
v/s Ratio Prot	c0.05			0.20	0.34	
v/s Ratio Perm		0.00	c0.38			0.13
v/c Ratio	0.35	0.03	0.55	0.29	0.48	0.19
Uniform Delay, d1	18.3	17.5	3.5	2.7	3.3	2.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.1	1.3	0.1	0.3	0.1
Delay (s)	19.2	17.6	4.9	2.9	3.5	2.6
Level of Service	B	B	A	A	A	A
Approach Delay (s)	18.6			3.7	3.2	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	4.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	46.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: County Line Rd & Arapahoe Rd

Year 2035 Background
PM

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑	↑	↱
Volume (vph)	250	125	75	700	550	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.34	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	628	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	272	136	82	761	598	163
RTOR Reduction (vph)	0	100	0	0	0	70
Lane Group Flow (vph)	272	36	82	761	598	93
Turn Type	NA	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	12.8	12.8	27.4	27.4	27.4	27.4
Effective Green, g (s)	12.8	12.8	27.4	27.4	27.4	27.4
Actuated g/C Ratio	0.27	0.27	0.57	0.57	0.57	0.57
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	470	420	356	1059	1059	899
v/s Ratio Prot	c0.15			c0.41	0.32	
v/s Ratio Perm		0.02	0.13			0.06
v/c Ratio	0.58	0.09	0.23	0.72	0.56	0.10
Uniform Delay, d1	15.4	13.3	5.2	7.6	6.6	4.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7	0.1	0.3	2.4	0.7	0.1
Delay (s)	17.1	13.4	5.5	9.9	7.3	4.8
Level of Service	B	B	A	A	A	A
Approach Delay (s)	15.9			9.5	6.8	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	48.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑↑	↑↑	↱
Volume (vph)	75	95	260	370	640	275
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.39	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	720	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	103	283	402	696	299
RTOR Reduction (vph)	0	93	0	0	0	59
Lane Group Flow (vph)	82	10	283	402	696	240
Turn Type	NA	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	7.9	7.9	64.1	64.1	64.1	64.1
Effective Green, g (s)	7.9	7.9	64.1	64.1	64.1	64.1
Actuated g/C Ratio	0.10	0.10	0.80	0.80	0.80	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	174	156	576	2835	2835	1268
v/s Ratio Prot	c0.05			0.11	0.20	
v/s Ratio Perm		0.01	c0.39			0.15
v/c Ratio	0.47	0.07	0.49	0.14	0.25	0.19
Uniform Delay, d1	34.1	32.7	2.6	1.8	2.0	1.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.0	0.2	3.0	0.1	0.2	0.3
Delay (s)	36.1	32.9	5.6	1.9	2.2	2.2
Level of Service	D	C	A	A	A	A
Approach Delay (s)	34.3			3.4	2.2	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	5.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

7: Arapahoe Rd & Site Access

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑	↱	↰	↱
Volume (veh/h)	25	125	525	10	45	85
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.75	0.92	0.92	0.75	0.75	0.75
Hourly flow rate (vph)	33	136	571	13	60	113
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			1010			
pX, platoon unblocked						
vC, conflicting volume	584				773	571
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	584				773	571
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				83	78
cM capacity (veh/h)	991				355	521

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	33	136	571	13	60	113
Volume Left	33	0	0	0	60	0
Volume Right	0	0	0	13	0	113
cSH	991	1700	1700	1700	355	521
Volume to Capacity	0.03	0.08	0.34	0.01	0.17	0.22
Queue Length 95th (ft)	3	0	0	0	15	21
Control Delay (s)	8.8	0.0	0.0	0.0	17.2	13.8
Lane LOS	A				C	B
Approach Delay (s)	1.7		0.0		15.0	
Approach LOS					B	

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	39.6%	ICU Level of Service	A
Analysis Period (min)	15		

9: County Line Rd & Site Access

	↗	↘	↖	↑	↓	↙
Movement	**EBL**	**EBR**	**NBL**	**NBT**	**SBT**	**SBR**
Lane Configurations	↰	↱	↰	↑↑	↑↑	↱
Volume (veh/h)	25	60	20	425	855	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.75	0.75	0.92	0.92	0.75
Hourly flow rate (vph)	33	80	27	462	929	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				1250		
pX, platoon unblocked						
vC, conflicting volume	1214	465	936			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1214	465	936			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	80	85	96			
cM capacity (veh/h)	168	544	727			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	33	80	27	231	231	465	465	7
Volume Left	33	0	27	0	0	0	0	0
Volume Right	0	80	0	0	0	0	0	7
cSH	168	544	727	1700	1700	1700	1700	1700
Volume to Capacity	0.20	0.15	0.04	0.14	0.14	0.27	0.27	0.00
Queue Length 95th (ft)	18	13	3	0	0	0	0	0
Control Delay (s)	31.7	12.7	10.1	0.0	0.0	0.0	0.0	0.0
Lane LOS	D	B	B					
Approach Delay (s)	18.3		0.6			0.0		
Approach LOS	C							

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	34.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
3: County Line Rd & Arapahoe Rd

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑↑	↑↑	↱
Volume (vph)	250	155	125	765	585	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.40	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	739	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	272	168	136	832	636	174
RTOR Reduction (vph)	0	131	0	0	0	56
Lane Group Flow (vph)	272	37	136	832	636	118
Turn Type	NA	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	17.6	17.6	54.4	54.4	54.4	54.4
Effective Green, g (s)	17.6	17.6	54.4	54.4	54.4	54.4
Actuated g/C Ratio	0.22	0.22	0.68	0.68	0.68	0.68
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	389	348	502	2406	2406	1076
v/s Ratio Prot	c0.15			c0.24	0.18	
v/s Ratio Perm		0.02	0.18			0.07
v/c Ratio	0.70	0.11	0.27	0.35	0.26	0.11
Uniform Delay, d1	28.8	24.9	5.0	5.4	5.0	4.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.4	0.1	1.3	0.4	0.3	0.2
Delay (s)	34.2	25.1	6.3	5.8	5.3	4.6
Level of Service	C	C	A	A	A	A
Approach Delay (s)	30.7			5.8	5.1	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	10.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
7: Arapahoe Rd & Site Access

Year 2035 + Project
PM

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑	↱	↰	↱
Volume (veh/h)	90	375	225	60	30	50
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.75	0.92	0.92	0.75	0.75	0.75
Hourly flow rate (vph)	120	408	245	80	40	67
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			1010			
pX, platoon unblocked						
vC, conflicting volume	325				892	245
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	325				892	245
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	90				86	92
cM capacity (veh/h)	1235				282	794

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	120	408	245	80	40	67
Volume Left	120	0	0	0	40	0
Volume Right	0	0	0	80	0	67
cSH	1235	1700	1700	1700	282	794
Volume to Capacity	0.10	0.24	0.14	0.05	0.14	0.08
Queue Length 95th (ft)	8	0	0	0	12	7
Control Delay (s)	8.2	0.0	0.0	0.0	19.9	9.9
Lane LOS	A				C	A
Approach Delay (s)	1.9		0.0		13.7	
Approach LOS					B	

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	30.2%	ICU Level of Service	A
Analysis Period (min)	15		

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑↑	↑↑	↱
Volume (veh/h)	20	40	65	950	710	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.75	0.75	0.92	0.92	0.75
Hourly flow rate (vph)	27	53	87	1033	772	20
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				1250		
pX, platoon unblocked	0.96					
vC, conflicting volume	1461	386	792			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1389	386	792			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	77	91	89			
cM capacity (veh/h)	114	612	825			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	27	53	87	516	516	386	386	20
Volume Left	27	0	87	0	0	0	0	0
Volume Right	0	53	0	0	0	0	0	20
cSH	114	612	825	1700	1700	1700	1700	1700
Volume to Capacity	0.23	0.09	0.11	0.30	0.30	0.23	0.23	0.01
Queue Length 95th (ft)	21	7	9	0	0	0	0	0
Control Delay (s)	45.9	11.4	9.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	E	B	A					
Approach Delay (s)	22.9		0.8			0.0		
Approach LOS	C							

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	36.6%	ICU Level of Service	A
Analysis Period (min)	15		

Traffic Count Data Sheets

COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: COUNTY LINE RD
E/W STREET: ARAPAHOE RD
CITY: ERIE
COUNTY: WELD

File Name : COUNARAP
Site Code : 00000005
Start Date : 10/18/2012
Page No : 1

Groups Printed- VEHICLES

	COUNTY LINE RD Southbound			*ARAPAHOE RD* Westbound			*COUNTY LINE RD* Northbound			Eastbound			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
07:00 AM	0	50	48	0	0	0	28	44	0	13	0	9	192
07:15 AM	0	76	64	0	0	0	45	35	0	12	0	7	239
07:30 AM	0	101	83	0	0	0	60	37	0	11	0	9	301
07:45 AM	0	69	62	0	0	0	64	57	0	12	0	11	275
Total	0	296	257	0	0	0	197	173	0	48	0	36	1007
08:00 AM	0	60	38	0	0	0	59	54	0	16	0	7	234
08:15 AM	0	63	54	0	0	0	30	45	0	21	0	7	220
08:30 AM	0	59	49	0	0	0	35	47	0	14	0	7	211
08:45 AM	0	56	34	0	0	0	25	32	0	10	0	7	164
Total	0	238	175	0	0	0	149	178	0	61	0	28	829
04:00 PM	0	61	37	0	0	0	6	67	0	46	0	20	237
04:15 PM	0	61	27	0	0	0	8	66	0	32	0	17	211
04:30 PM	0	54	27	0	0	0	14	83	0	52	0	30	260
04:45 PM	0	48	26	0	0	0	6	72	0	41	0	17	210
Total	0	224	117	0	0	0	34	288	0	171	0	84	918
05:00 PM	0	75	27	0	0	0	8	104	0	60	0	29	303
05:15 PM	0	79	23	0	0	0	16	106	0	70	0	23	317
05:30 PM	0	78	45	0	0	0	10	94	0	52	0	28	307
05:45 PM	0	54	33	0	0	0	13	70	0	54	0	23	247
Total	0	286	128	0	0	0	47	374	0	236	0	103	1174
Grand Total	0	1044	677	0	0	0	427	1013	0	516	0	251	3928
Apprch %	0.0	60.7	39.3	0.0	0.0	0.0	29.7	70.3	0.0	67.3	0.0	32.7	
Total %	0.0	26.6	17.2	0.0	0.0	0.0	10.9	25.8	0.0	13.1	0.0	6.4	

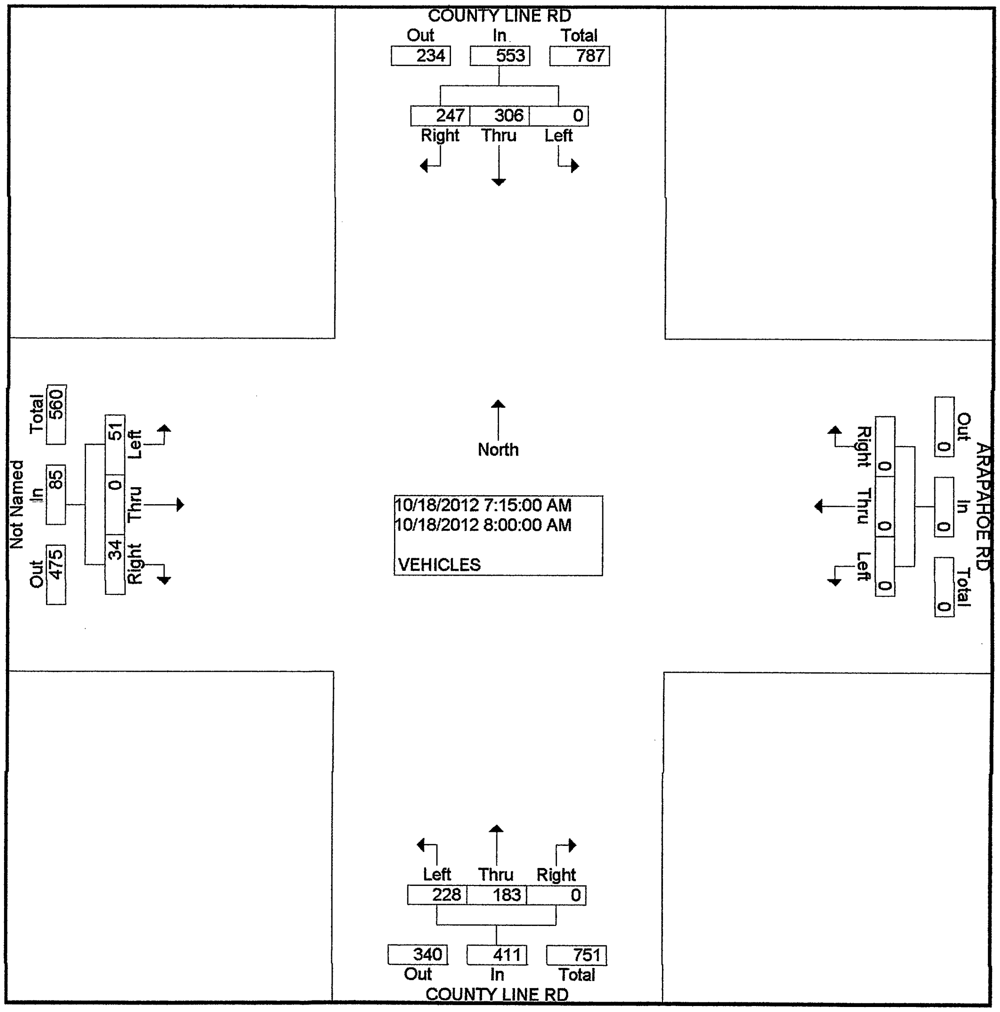
COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: COUNTY LINE RD
E/W STREET: ARAPAHOE RD
CITY: ERIE
COUNTY: WELD

File Name : COUNARAP
Site Code : 00000005
Start Date : 10/18/2012
Page No : 2

	COUNTY LINE RD Southbound				ARAPAHOE RD Westbound				COUNTY LINE RD Northbound				Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 07:00 AM to 09:00 AM - Peak 1 of 1																	
Intersection	07:15 AM																
Volume	0	306	247	553	0	0	0	0	228	183	0	411	51	0	34	85	1049
Percent	0.0	55.3	44.7		0.0	0.0	0.0		55.5	44.5	0.0		60.0	0.0	40.0		
07:30 Volume	0	101	83	184	0	0	0	0	60	37	0	97	11	0	9	20	301
Peak Factor																	0.871
High Int.	07:30 AM				6:45:00 AM				07:45 AM				07:45 AM				
Volume	0	101	83	184	0	0	0	0	64	57	0	121	12	0	11	23	
Peak Factor				0.751								0.849				0.924	



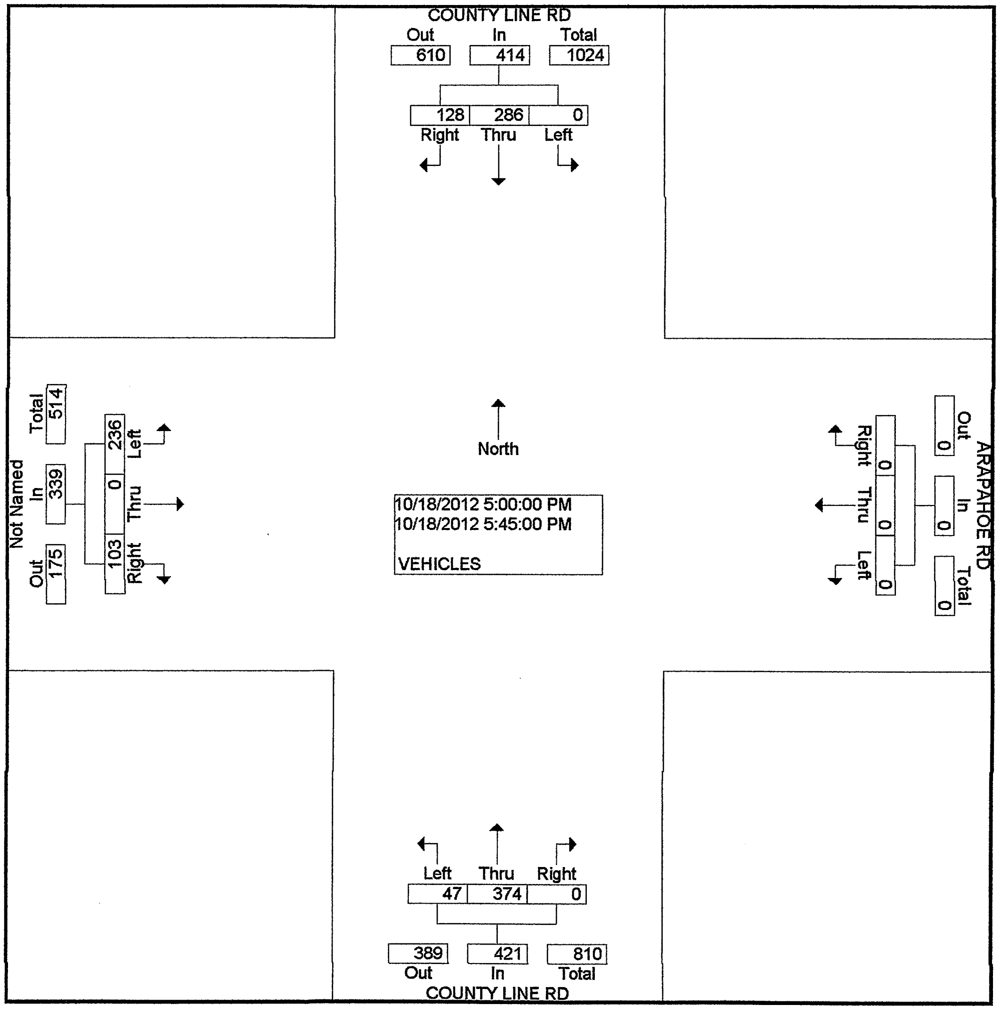
COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: COUNTY LINE RD
E/W STREET: ARAPAHOE RD
CITY: ERIE
COUNTY: WELD

File Name : COUNARAP
Site Code : 00000005
Start Date : 10/18/2012
Page No : 2

	COUNTY LINE RD Southbound				ARAPAHOE RD Westbound				COUNTY LINE RD Northbound				Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	05:00 PM																
Volume	0	286	128	414	0	0	0	0	47	374	0	421	236	0	103	339	1174
Percent	0.0	69.1	30.9		0.0	0.0	0.0		11.2	88.8	0.0		69.6	0.0	30.4		
05:15 Volume	0	79	23	102	0	0	0	0	16	106	0	122	70	0	23	93	317
Peak Factor																	0.926
High Int.	05:30 PM								05:15 PM				05:15 PM				
Volume	0	78	45	123	0	0	0	0	16	106	0	122	70	0	23	93	
Peak Factor				0.841								0.863				0.911	



Agency Name:Counter Measures

Site ID:101868000000
Station Name:
Description:COUNTY LINE RD N/O ARAPAHOE RD
City:ERIE
County:WELD

10/18/2012	Lane 1 (North)	Lane 2 (South)	All Lanes
00:00	23	6	29
01:00	25	4	29
02:00	6	4	10
03:00	10	9	19
04:00	11	33	44
05:00	29	98	127
06:00	122	257	379
07:00	226	553	779
08:00	239	413	652
09:00	201	366	567
10:00	240	298	538
11:00	224	317	541
12:00	263	298	561
13:00	287	267	554
14:00	317	272	589
15:00	370	389	759
16:00	459	341	800
17:00	610	414	1024
18:00	462	299	761
19:00	267	152	419
20:00	203	126	329
21:00	135	77	212
22:00	97	52	149
23:00	46	18	64
AM Peak Hour	10:00 - 10:59	11:00 - 11:59	11:00 - 11:59
AM Peak Value	240	317	541
PM Peak Hour	17:00 - 17:59	17:00 - 17:59	17:00 - 17:59
PM Peak Value	610	414	1024
Total	4872	5063	9935
Percentages	49.04%	50.96%	100.00%

Agency Name:Counter Measures

Site ID:101873000000
Station Name:
Description:ARAPAHOE RD W/O COUNTY LINE RD
City:ERIE
County:WELD

10/18/2012	Lane 1 (East)	Lane 2 (West)	All Lanes
00:00	10	6	16
01:00	5	0	5
02:00	5	2	7
03:00	6	3	9
04:00	7	6	13
05:00	14	43	57
06:00	28	156	184
07:00	67	438	505
08:00	87	292	379
09:00	104	199	303
10:00	112	142	254
11:00	116	164	280
12:00	150	144	294
13:00	136	126	262
14:00	174	139	313
15:00	221	149	370
16:00	290	150	440
17:00	335	160	495
18:00	239	128	367
19:00	138	62	200
20:00	103	49	152
21:00	46	34	80
22:00	56	28	84
23:00	19	8	27
AM Peak Hour	11:00 - 11:59	07:00 - 07:59	07:00 - 07:59
AM Peak Value	116	438	505
PM Peak Hour	17:00 - 17:59	17:00 - 17:59	17:00 - 17:59
PM Peak Value	335	160	495
Total	2468	2628	5096
Percentages	48.43%	51.57%	100.00%

MEMORANDUM

To: Chris Deslauriers, PE

From: Steve Tuttle, PE, PTOE

Date: September 6, 2013

Project: Compass/Erie Farms

Subject: Right-Turn Acceleration Lane on County Line Road

Fox Tuttle has reviewed the Town of Erie comments dated August 13, 2013 provided by Felsburg Holt & Ullevig (FHU), the Town's traffic engineering consultant. The FHU comments noted that a right-turn acceleration lane is justified at the Street A access intersection with County Line Road. Per FHU comments, this justification is based on application of the Colorado Department of Transportation (CDOT) State Highway Access Code (SHAC) criteria.

We reviewed the Town's current engineering standards and section 521.03.01 does refer to adherence with CDOT documents for the purposes of intersection design:

> *The guidelines presented in this document are based on the premise that the design of an intersection must conform in all respects to the provisions of the Colorado Statutes and rules, plus all authoritative references that have been adopted as standards by Colorado Department of Transportation (CDOT).*

The FHU comments are correct in that a right-turn acceleration lane would be required at the 50 mph posted speed with greater than 50 vehicles per hour turning right. However, this is only the case if assuming that County Line Road is classified as a Regional-Highway (R-A), Rural-Highway (R-B), or Non-Rural Principal Highway (NR-A) roadway. Classification of a non-CDOT roadway, such as County Line Road, is subjective and open to interpretation of the brief CDOT classification descriptions in the SHAC.

FHU cited application of R-A or R-B in this case for County Line Road, which we disagree with based on the CDOT descriptions. We called FHU's engineer to discuss this issue and gain a better understanding of their interpretation of the roadway classification. FHU stated that they should have cited County Line Road as NR-A, not R-A or R-B. We have since also learned that the Town has precedence in this matter in classifying County Line Road as an NR-A roadway, as a future six-lane major arterial and the highest classification roadway in their Transportation Plan.

As part of the CDOT description for NR-A, the SHAC states that this category is appropriate for use on non-rural highway "serving as important major arterials in smaller cities and Town". The SHAC also states that

NR-A classification is "normally assigned to National Highway System routes, and other routes of regional or state significance", which could be refuted given the lack of connectivity of County Line to the south of State Highway 7. However, given the precedence of County Line Road being classified by the Town as NR-A and the subjective nature of the CDOT access code descriptions, we cannot determine that County Line Road should undoubtedly be classified as an NR-B and not subject to the acceleration lane criteria referenced by FHU.

Based on this information, it is recommended that the acceleration lane be provided along County Line Road, with the following dimensions per the SHAC and based on an NR-A classification at 50 mph:

- 760' lane inclusive of a 15:1 taper. Thus, for a 12' lane width, 580' full lane width + 180' taper.

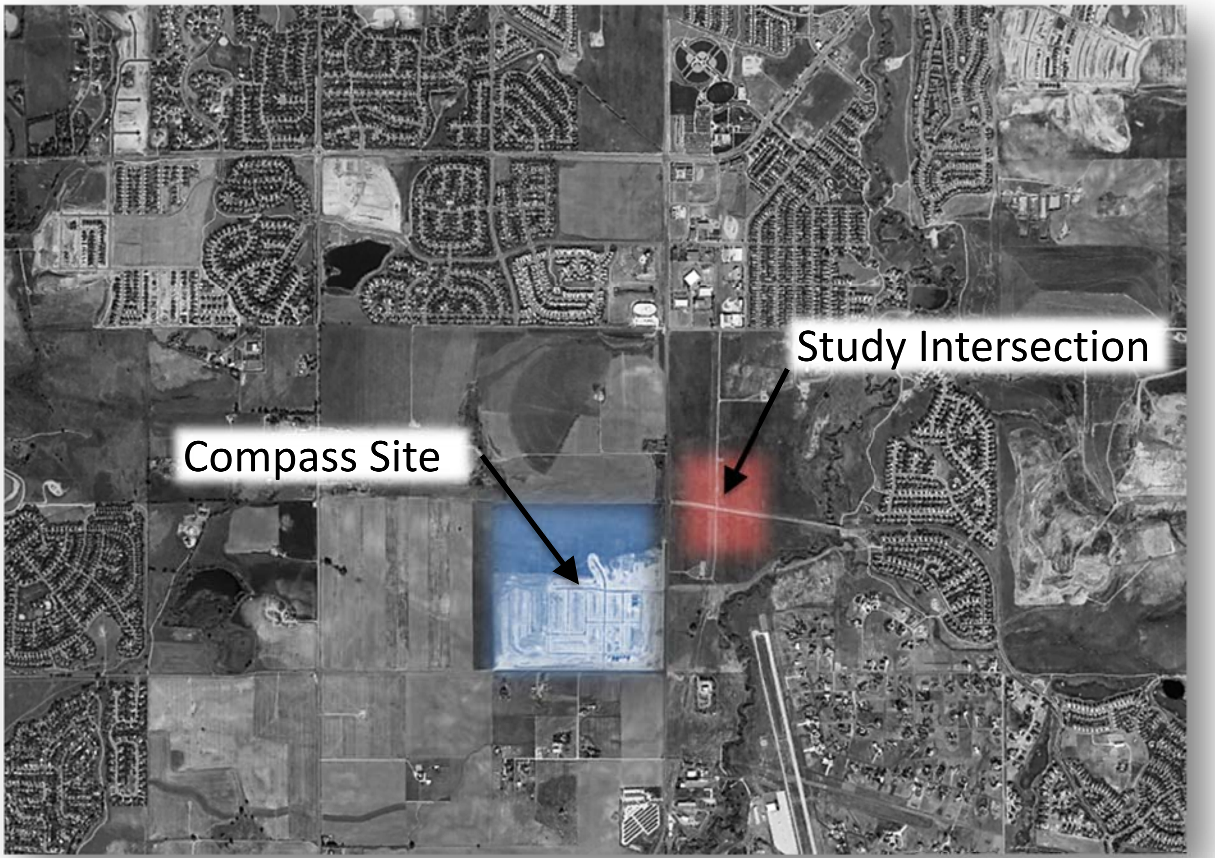
Please let me know if you need additional information.

/SGT

COUNTY LINE ROAD AT VISTA PARKWAY

SIGNAL WARRANT STUDY

ERIE, CO



PREPARED FOR:

Ware Molcomb
42 West 2nd Avenue | Denver, CO | 80223

CASSANDRA R. SLADE
44414

Cassandra Slade

PREPARED BY: CASSIE SLADE, PE
DATE: NOVEMBER 8, 2016
FTH PROJECT: #16075

FOX TUTTLE HERNANDEZ
TRANSPORTATION GROUP

P.O. BOX 19768, BOULDER, CO 80308-2768
PHONE: 303-652-3571 | FAX: 303-652-6574

TABLE OF CONTENTS

LIST OF TABLES

APPENDIX

Compass Trips (Source: Erie Farms Traffic Impact Study, 4/2016)

Eight-Hour Vehicular Warrant Evaluation

Four-Hour Vehicular Warrant Evaluation

Intersection Turning Movement Counts

Daily Traffic Counts

COMPASS FILING #4: COUNTY LINE ROAD AT VISTA PARKWAY

SIGNAL WARRANT STUDY

1.0 INTRODUCTION

The Fox Tuttle Hernandez Transportation Group has completed a traffic signal warrant study for the intersection of County Line Road at Vista Parkway in Erie, CO. The purpose of this report is to determine if a signal is warranted with the existing and future volumes, with and without the full build-out of the Compass development. The existing intersection is north of the Erie Municipal Airport and is currently a T-intersection with side-street stop-sign control on the Vista Parkway westbound approach. County Line Road is a minor arterial that travels north-south along the Boulder County – Weld County boundary. It provides access to Baseline Road, Erie Parkway, and Ken Pratt Boulevard. Along County Line Road is the Erie Community Center, urban and rural residential neighborhoods, retail centers, and Erie schools. Vista Parkway is the east leg and provides direct access to the Vista Pointe neighborhood. The Town's Comprehensive Plan (2008) proposes to expand Vista Parkway to the west to provide an east-west connection through Erie. **Figure 1** shows the location of the study intersection.

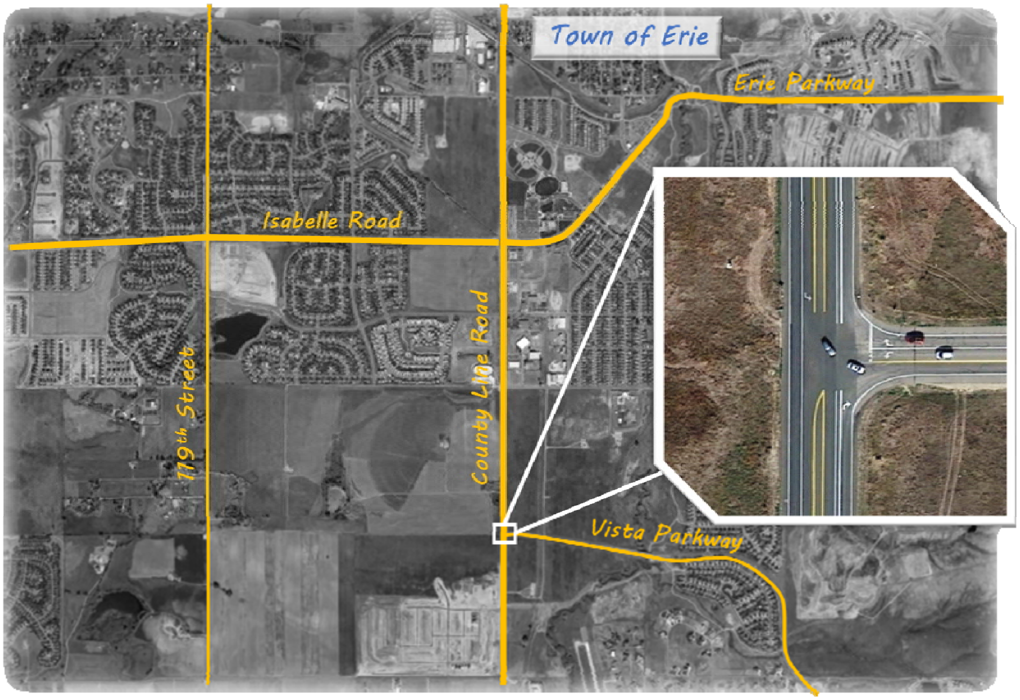


Figure 1: Vicinity Map of Study Intersection

The study evaluated the following scenarios:

1. Existing Volumes
2. 2019 Background Volumes
3. 2019 Background + Compass Development (completed and fully occupied)

2.0 DATA COLLECTION

2.1 Existing Traffic Data

Traffic count data was collected in October 2016 at the study intersection. Weekday AM and PM peak hour turning movement volumes were gathered on October 20th, while 72-hours of average daily traffic (ADT) counts were gathered on October 18th, 19th, and 20th. Existing traffic data is provided in the **Appendix**.

2.2 Future Growth Rate

In order to forecast the future peak hour traffic volumes, background traffic growth assumptions were estimated based on a comparison of count data and DRCOG Regional Traffic Models. The Year 2035 regional model volumes were compared to the existing counts and Year 2015 regional model volumes to determine the annual growth rate. **Table 1** summarizes the existing and forecasted traffic volumes in the study area, as well as the calculated annual growth rate.

Table 1: Current and Future Traffic Volumes

Location	Volume (vehicles per day)		Annual Growth
	Counts (Year 2016)	DRCOG Model (Year 2035)	
County Line Rd North of Vista Pkwy	14,000	17,859	1.3%
County Line Rd South of Vista Pkwy	12,000	15,737	1.4%
Vista Pkwy East of County Line Rd	4,400	3,368	0%

Based on the data in the regional model and the counts, it was assumed that the background growth will be a conservative 1.5% annual on all approaches to account for anticipated growth within and surrounding the Town of Erie.

2.3 Compass Development

The Compass development is located in the vacant property at the southwest corner of County Line Road and Vista Parkway. The southern half of the site, along Arapahoe Road, is currently under construction. The northern half of the site, near Vista Parkway, is currently in the development process under Filings #3 and #4. Vista Parkway will be extended to the west to become the northern boundary of the project site and serve as a secondary access on County Line Road. Trips generated by this residential neighborhood through the study intersection were provided in the *Erie Farms Traffic Impact Study (Fox Tuttle, April 2013)*. For the purpose of this signal warrant analysis, it was assumed the residential neighborhood was fully built-out and occupied.

Since the submittal of the original traffic study the design of the northern portion of Compass has increased by 20 single family homes. Utilizing the trip generation and distribution assumptions from the original traffic study, the additional daily and hourly traffic was assigned to the appropriate movements at County Line Road and Vista Parkway. The trip generation is summarized in **Table 2** (refer to the **Appendix**).

3.0 SIGNAL WARRANT ANALYSIS

In order to evaluate the need for a traffic signal, warrant criteria contained in the *Manual on Uniform Traffic Control Devices*[1] *(MUTCD)* was reviewed and applied to the intersection of County Line Road at Vista Parkway. Per the *MUTCD*, an engineering evaluation should be performed to determine if a traffic signal is warranted based on traffic data (vehicular) and physical characteristics of an intersection.

The *MUTCD* provides criteria for nine warrants related to the safety and operation of the intersection. The *MUTCD* traffic signal warrants are as follows:

- Warrant 1 – Eight Hour Vehicular Volume
- Warrant 2 – Four-Hour Vehicular Volume
- Warrant 3 – Peak Hour
- Warrant 4 – Pedestrian Volume

---

[1] Manual on Uniform Traffic Control Devices. Federal Highway Administration. Washington, D.C. 2009.

- Warrant 5 – School Crossing
- Warrant 6 – Coordinated Signal System
- Warrant 7 – Crash Experience
- Warrant 8 – Roadway Network
- Warrant 9 – Intersection Near a Grade Crossing (Railroad)

The *MUTCD* guidance states that a traffic signal should not be installed unless one or more of the warrants are met. Though, the satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a signal. The *MUTCD* also states that a traffic signal should not be installed unless an engineering study finds that installing a traffic signal will improve the overall safety and operation of the intersection.

3.1 Study Considerations

The criteria of the *MUTCD* signal warrants are based on the volume, speed limit, and number of approach lanes. The following existing conditions were used in the signal warrant analysis:

- **Major Street:** County Line Road
    - Posted speed: 50 mph
    - Two-lane approach
- **Minor Street:** Vista Parkway
    - Posted speed: 35 mph
    - Two-lane approach
- **70% Factor**: “Rural” roadway classification, which lowers the threshold traffic volumes in Warrants 1, 2, and 3 to account for a non-urban environment. The intersection of County Line Road at Vista Parkway meets the following MUTCD criteria for the 70% factor:
    - *‘…the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000…’*

3.2 Not Applicable Warrants

Seven of the *MUTCD* warrants were determined to be not-applicable for the intersection of County Line Road at Vista Parkway. The warrants that were not applied, along with the reasoning, are as follows:

Warrant 3 – Peak Hour – NOT APPLICABLE:

- Per the MUTCD, the Peak Hour warrant only applies for "unusual cases", such as office complexes manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.

- Although the intersection of County Line Road at Vista Parkway would easily exceed the minimum volume thresholds for this warrant, it is determined not applicable given the "unusual cases" description in the *MUTCD*.

- Although it was not applied for this analysis, the peak hour warrant is commonly applied for future planning analyses where four and eight-hour traffic data cannot be accurately projected, despite the "unusual cases" criteria.

- It should be noted that this intersection satisfies the need for a signal based on the existing peak hour volume warrant in the AM peak hour, if it were applied as such in this evaluation. For information purposes, the results of the peak hour evaluation are included in the summary on **Table 3** (refer to the end of the report).

Warrant 4 – Pedestrian Volume – NOT APPLICABLE:

- The *MUTCD* states that this warrant should not be applied where traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

- The lowest pedestrian volume threshold to meet the criteria is 75 people per hour (pph). There were no pedestrians observed during the data collection period and this is not considered a location that will attract a high volume of pedestrians in the future. Therefore, this warrant was determined not applicable.

Warrant 5 – School Crossing – NOT APPLICABLE:

- The *MUTCD* states that the intent of this warrant is for locations where the principal reason for consideration of installing a traffic signal is to assist school children crossing the major street.

Warrant 6 – Coordinated Signal System – NOT APPLICABLE:

- The *MUTCD* states that this warrant should not be applied where the resultant spacing of traffic control signals would be less than 1,000 feet.

- The closest signalized intersection is County Line Road at Erie Parkway, which is over one mile away. Therefore, this warrant was determined not applicable.

Warrant 7 – Crash Experience – NOT APPLICABLE:

- The *MUTCD* states that the intent of this warrant is for locations where the principal reason for consideration of installing a traffic signal is to mitigate the severity and frequency of crashes.

- Historical crash data was not provided for the study intersection; therefore, this warrant was not evaluated.

Warrant 8 – Roadway Network – NOT APPLICABLE:

- The *MUTCD* states that this warrant should be considered at the common intersection of two or more “major” routes. The *MUTCD* defines major routes as being part of the street or highway system that serve as the principal roadway network for through traffic flow.

- Since the side-street approaches do not meet the description of a “major” route, this warrant was determined not applicable.

Warrant 9 – Intersection Near a Grade Crossing (Railroad) – NOT APPLICABLE:

- Since there are no railroad crossings near this study intersection, this warrant was determined not applicable for this study.

3.3 Analysis of Applicable Warrants

Each of the applicable warrants was evaluated for the study intersection using existing traffic counts, estimated trips for the Compass development, and historical growth trends. A discussion of each of these warrant evaluations is provided in the following section. The details of the evaluation of the warrants are in the **Appendix.**

A summary of the *MUTCD* signal warrant evaluations are provided on **Table 3** and are provided in the following bullets:

Warrant 1 – Eight Hour Vehicular Volume

This warrant is applied at intersections that experience a large volume of intersecting traffic. The warrant is met if one of the three conditions is fulfilled during at least eight hours during one day:

1. Condition A (Minimum Vehicular Volume): Pertains to intersections where there is a high volume of intersecting vehicles on both roadways. If Condition A is met, then Condition B is not analyzed.
2. Condition B (Interruption of Continuous Traffic): Applicable where the minor street experiences excessive delays due to the high volume on the major street. If Condition B is met, then the combination of Conditions A and B is not analyzed.
3. Combination of Conditions A and B (80 percent) can be applied if other remedial measures that could reduce the delay and inconvenience to traffic do not resolve the traffic issues.

In summary, the "interruption of continuous traffic", Condition B, is met in with existing volumes for all three days analyzed. Each of the two days had volumes above the thresholds for eleven hours. **Table 4** summarizes the Warrant 1 evaluation.

Table 4: Summary of Warrant 1, Eight-Hour

Scenario	**Warrant 1: 8 Hour**					
	Day 1		**Day 2**		**Day 3**	
	Met?	**Condition?**	**Met?**	**Condition?**	**Met?**	**Condition?**
2016 Existing	**Yes**	B	**Yes**	B	**Yes**	B
2019 Background	**Yes**	B	**Yes**	B	**Yes**	B
2019 Background + Compass	**Yes**	B	**Yes**	B	**Yes**	B

Warrant 1 is MET under Existing Conditions

Warrant 2: Four-Hour Vehicular Volume

For at least four hours of an average day, the vehicular volumes must meet the minimum thresholds provided in the *MUTCD* (Figure 4C-2). To determine if the intersection satisfies Warrant 2, the major street volume (sum of both the approaches) and the corresponding highest-volume minor approach were plotted on the chart.

In summary, this warrant is met with existing condition during each of the three days analyzed. All three days had volumes above the thresholds for six hours. **Table 5** summarizes the Warrant 2 evaluation.

Table 5: Summary of Warrant 2, Four-Hour

Scenario	**Warrant 2: 4 Hour**		
	Day 1	**Day 2 Met?**	**Day 3**
2016 Existing	**Yes**	**Yes**	**Yes**
2019 Background	**Yes**	**Yes**	**Yes**
2019 Background + Compass	**Yes**	**Yes**	**Yes**

Warrant 2 is MET under Existing Conditions

4.0 CONCLUSION

Based on the evaluations of the *MUTCD* traffic signal warrants as summarized in this study, the intersection of County Line Road at Vista Parkway in Erie, CO **currently satisfies two of the MUTCD signal warrants and should be signalized for operational and safety benefits** regardless of the construction of the Compass development.

Tables:

FOX TUTTLE HERNANDEZ
TRANSPORTATION GROUP

Table 2 - Trip Generation Summary

			Average Daily Trips				AM Peak Hour Trips				PM Peak Hour Trips			
Land Use	**Size**	**Unit**	**Rate**	**Total**	**In**	**Out**	**Rate**	**Total**	**In**	**Out**	**Rate**	**Total**	**In**	**Out**
Original Trip Estimate (Source: Erie Farms Traffic Impact Study, April 2013)														
ITE 210 - Single Family Detached Housing	357	DU	9.57	3416	1708	1708	0.75	268	67	201	1.01	361	227	134
ITE 230 - Residential Condominium/Townhouse	142	DU	5.81	825	413	412	0.44	62	11	51	0.52	74	50	24
		Subtotal		***4241***	***2121***	***2120***		***330***	***78***	***252***		***435***	***277***	***158***
Additional Trips for Added Units														
ITE 210 - Single Family Detached Housing	20	DU	9.57	191	96	95	0.75	15	4	11	1.01	20	13	7
ITE 230 - Residential Condominium/Townhouse	0	DU	5.81	0	0	0	0.44	0	0	0	0.52	0	0	0
		Subtotal		***191***	***96***	***95***		***15***	***4***	***11***		***20***	***13***	***7***
		Total Site Trips	***Daily >***	***4432***	***2217***	***2215***	***AM >***	***345***	***82***	***263***	***PM >***	***455***	***290***	***165***

Source: ITE Trip Generation 9th Edition. 2012.

Table 3: MUTCD Signal Warrant Evaluation Summary

Compass: County Line Road at Vista Parkway (Erie, CO)

Scenario	Warrant 1: 8 Hour						Warrant 2: 4 Hour			Warrant 3: Peak Hour[1]	
	Day 1		Day 2		Day 3		Day 1	Day 2	Day 3	AM	PM
	Met?	Condition?	Met?	Condition?	Met?	Condition?		Met?		Met?	
2016 Existing	**Yes**	B	**Yes**	B	**Yes**	B	**Yes**	**Yes**	**Yes**	**Yes**	No
2019 Background	**Yes**	B	**Yes**	B	**Yes**	B	**Yes**	**Yes**	**Yes**	**Yes**	No
2019 Background + Compass	**Yes**	B	**Yes**	B	**Yes**	B	**Yes**	**Yes**	**Yes**	**Yes**	No

[1] Does not meet the "unusal cases" condition as specified in the MUTCD for the Peak Hour Warrant.

Appendix:

Compass Trips (Source: Erie Farms Traffic Impact Study, 4/2016)

Eight-Hour Vehicular Warrant Evaluation

Four-Hour Vehicular Warrant Evaluation

Intersection Turning Movement Counts

Daily Traffic Counts

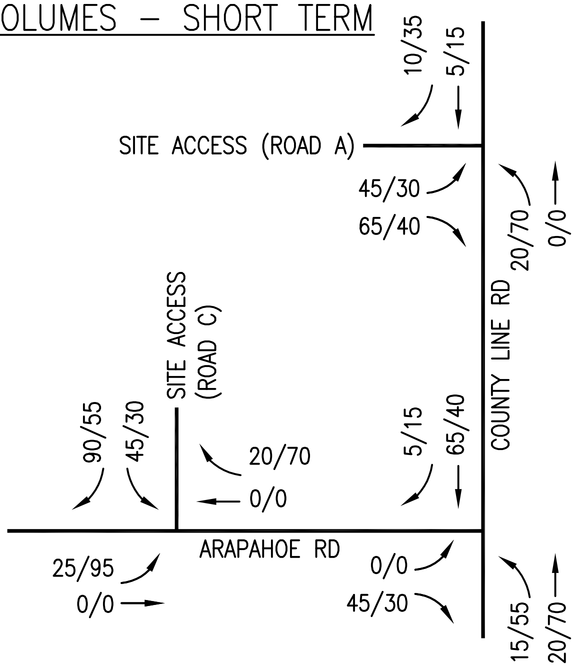
Compass Trips
(Source: Erie Farms Traffic Impact Study, 4/2016)

Table 2 - Trip Generation Estimate

			Average Daily Trips				A.M. Peak Hour Trips				P.M. Peak Hour Trips			
Land Use	**Size**	**Unit**	**Rate**	**Total**	**In**	**Out**	**Rate**	**Total**	**In**	**Out**	**Rate**	**Total**	**In**	**Out**
ITE 210 Single-Family Detached Housing	357	Dwelling Units	9.57	3416	1708	1708	0.75	268	67	201	1.01	361	227	134
ITE 230 Residential Condominium/Townhouse	142	Dwelling Units	5.81	825	413	412	0.44	62	11	51	0.52	74	50	24
Totals:	**499**			**4241**	**2121**	**2120**		**330**	**78**	**252**		**435**	**277**	**158**

Source: ITE Trip Generation 8th Edition. 2008.

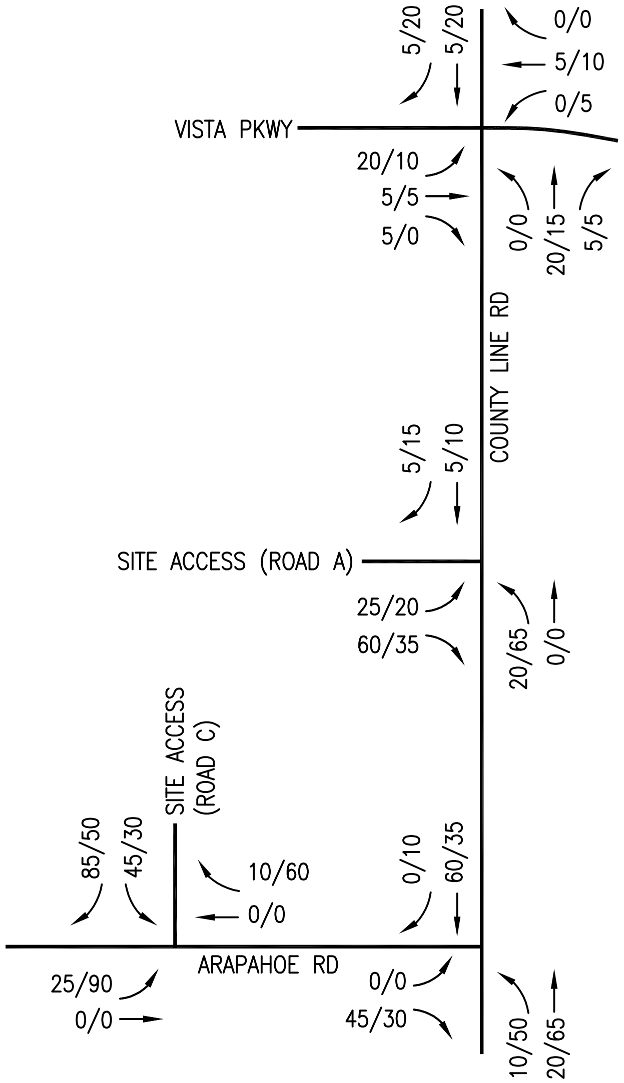
SITE-GENERATED TRAFFIC VOLUMES – SHORT TERM



KEY

XXX/XXX AM / PM PEAK HOUR TRAFFIC VOLUME

SITE-GENERATED TRAFFIC VOLUMES – LONG TERM w/DEVELOPMENT TO THE NORTH



TRIP GENERATION ESTIMATES
(SEE TABLE 2 FOR ADDITIONAL DETAIL):

- AM PEAK HOUR: 78 IN, 252 OUT
- PM PEAK HOUR: 277 IN, 158 OUT

FOX TUTTLE
TRANSPORTATION GROUP

ERIE FARMS TRAFFIC IMPACT STUDY

SITE-GENERATED TRAFFIC VOLUMES

FT Project #	12020	Original Scale	NTS	Date	10/25/12	Drawn by	SGT	Figure #	6

Eight-Hour Vehicular Warrant Evaluation

Compass Development
Signal Warrant Analysis

Warrant 1: 8 Hour Analysis - 2016 Existing Volumes

Day 1 10/18/2016	Major County Line Road EB / WB	Minor* Vista Pkwy WB	Warrant Type Street Designation	Condition A Major	Condition A Minor	Condition B Major	Condition B Minor	Condition A + B Major A	Condition A + B Minor A	Condition A + B Major B	Condition A + B Minor B
Time of Day	Number of Lanes 2	2	Vehicles per Hour Needed to Meet Warrant	420	140	630	70	336	112	504	56
0:00	20	1	Warrant is Met (yes/no)	no	no	no	no	no	no	no	no
1:00	13	2		no	no	no	no	no	no	no	no
2:00	14	2		no	no	no	no	no	no	no	no
3:00	28	1		no	no	no	no	no	no	no	no
4:00	45	6		no	no	no	no	no	no	no	no
5:00	165	29		no	no	no	no	no	no	no	no
6:00	418	98		no	no	no	yes	yes	no	no	yes
7:00	937	374		yes	yes	yes	yes	yes	yes	yes	yes
8:00	927	297		yes	yes	yes	yes	yes	yes	yes	yes
9:00	676	138		yes	no	yes	yes	yes	yes	yes	yes
10:00	572	94		yes	no	no	yes	yes	no	yes	yes
11:00	731	104		yes	no	yes	yes	yes	no	yes	yes
12:00	679	98		yes	no	yes	yes	yes	no	yes	yes
13:00	658	92		yes	no	yes	yes	yes	no	yes	yes
14:00	751	96		yes	no	yes	yes	yes	no	yes	yes
15:00	1,020	132		yes	no	yes	yes	yes	yes	yes	yes
16:00	1,195	173		yes	yes	yes	yes	yes	yes	yes	yes
17:00	1,406	198		yes	yes	yes	yes	yes	yes	yes	yes
18:00	1,011	146		yes	yes	yes	yes	yes	yes	yes	yes
19:00	603	56		yes	no	no	no	yes	no	yes	yes
20:00	371	36		no	no	no	no	yes	no	no	no
21:00	278	21		no	no	no	no	no	no	no	no
22:00	111	12		no	no	no	no	no	no	no	no
23:00	43	2		no	no	no	no	no	no	no	no
Total	12,672	2,208		5	Not Met	11	Met		7	Not Met	

** Vehicles per hour on higher-volume minor-street approach (one direction only)*

FOX TUTTLE HERNANDEZ
TRANSPORTATION GROUP

Compass Development
Signal Warrant Study

Warrant 1: 8 Hour Analysis - 2016 Existing Volumes

Day 2	Major	Minor*	Warrant Type	Condition A		Condition B		Condition A + B			
	County Line Road	Vista Pkwy	Street Designation	Major	Minor	Major	Minor	Major A	Minor A	Major B	Minor B
10/19/2016	EB / WB	WB									
Time of Day	Number of Lanes 2	2	Vehicles per Hour Needed to Meet Warrant	420	140	630	70	336	112	504	56
0:00	37	0	Warrant is Met (yes/no)	no	no	no	no	no	no	no	no
1:00	21	2		no	no	no	no	no	no	no	no
2:00	11	0		no	no	no	no	no	no	no	no
3:00	18	0		no	no	no	no	no	no	no	no
4:00	43	5		no	no	no	no	no	no	no	no
5:00	146	27		no	no	no	no	no	no	no	no
6:00	391	116		no	no	no	yes	yes	yes	no	yes
7:00	976	339		yes	yes	yes	yes	yes	yes	yes	yes
8:00	950	306		yes	yes	yes	yes	yes	yes	yes	yes
9:00	683	142		yes	yes	yes	yes	yes	yes	yes	yes
10:00	589	85		yes	no	no	yes	yes	no	yes	yes
11:00	695	96		yes	no	yes	yes	yes	no	yes	yes
12:00	764	92		yes	no	yes	yes	yes	no	yes	yes
13:00	713	94		yes	no	yes	yes	yes	no	yes	yes
14:00	801	81		yes	no	yes	yes	yes	no	yes	yes
15:00	1,045	166		yes	yes	yes	yes	yes	yes	yes	yes
16:00	1,165	182		yes	yes	yes	yes	yes	yes	yes	yes
17:00	1,384	213		yes	yes	yes	yes	yes	yes	yes	yes
18:00	1,052	174		yes	yes	yes	yes	yes	yes	yes	yes
19:00	611	62		yes	no	no	no	yes	no	yes	yes
20:00	398	45		no	no	no	no	yes	no	no	no
21:00	306	25		no	no	no	no	no	no	no	no
22:00	114	15		no	no	no	no	no	no	no	no
23:00	55	1		no	no	no	no	no	no	no	no
Total	12,968	2,268		7	Not Met	11	Met		7	Not Met	

** Vehicles per hour on higher-volume minor-street approach (one direction only)*

Warrant 1: 8 Hour Analysis - 2016 Existing Volumes

Day 3 10/20/2016	Major County Line Road EB / WB	Minor* Vista Pkwy WB	Warrant Type	Condition A		Condition B		Condition A + B			
			Street Designation	Major	Minor	Major	Minor	Major A	Minor A	Major B	Minor B
Time of Day	Number of Lanes 2	2	Vehicles per Hour Needed to Meet Warrant	420	140	630	70	336	112	504	56
0:00	22	7	Warrant is Met (yes/no)	no	no	no	no	no	no	no	no
1:00	13	1		no	no	no	no	no	no	no	no
2:00	12	0		no	no	no	no	no	no	no	no
3:00	18	2		no	no	no	no	no	no	no	no
4:00	51	4		no	no	no	no	no	no	no	no
5:00	140	32		no	no	no	no	no	no	no	no
6:00	444	90		yes	no	no	yes	yes	no	no	yes
7:00	977	362		yes	yes	yes	yes	yes	yes	yes	yes
8:00	942	259		yes	yes	yes	yes	yes	yes	yes	yes
9:00	674	140		yes	yes	yes	yes	yes	yes	yes	yes
10:00	612	120		yes	no	no	yes	yes	yes	yes	yes
11:00	726	82		yes	no	yes	yes	yes	no	yes	yes
12:00	759	86		yes	no	yes	yes	yes	no	yes	yes
13:00	662	98		yes	no	yes	yes	yes	no	yes	yes
14:00	797	104		yes	no	yes	yes	yes	no	yes	yes
15:00	1,038	163		yes	yes	yes	yes	yes	yes	yes	yes
16:00	1,157	188		yes	yes	yes	yes	yes	yes	yes	yes
17:00	1,239	168		yes	yes	yes	yes	yes	yes	yes	yes
18:00	1,064	136		yes	no	yes	yes	yes	yes	yes	yes
19:00	643	56		yes	no	yes	no	yes	no	yes	yes
20:00	428	54		yes	no	no	no	yes	no	no	no
21:00	285	38		no	no	no	no	no	no	no	no
22:00	144	10		no	no	no	no	no	no	no	no
23:00	60	6		no	no	no	no	no	no	no	no
Total	**12,907**	**2,206**		**6**	**Not Met**	**11**	**Met**		**8**	**Met**	

** Vehicles per hour on higher-volume minor-street approach (one direction only)*

Compass Development
Signal Warrant Study

Warrant 1: 8 Hour Analysis - 2019 Background Volumes

Day 1	**Major**	**Minor***	**Warrant Type**	**Condition A**		**Condition B**		**Condition A + B**			
	County Line Road	**Vista Pkwy**	**Street Designation**	**Major**	**Minor**	**Major**	**Minor**	**Major A**	**Minor A**	**Major B**	**Minor B**
10/18/2016	**EB / WB**	**WB**									
Time of Day	**Number of Lanes**		**Vehicles per Hour Needed to Meet Warrant**	**420**	**140**	**630**	**70**	**336**	**112**	**504**	**56**
	2	**2**									
0:00	21	1	Warrant is Met (yes/no)	no	no	no	no	no	no	no	no
1:00	13	2		no	no	no	no	no	no	no	no
2:00	14	2		no	no	no	no	no	no	no	no
3:00	29	1		no	no	no	no	no	no	no	no
4:00	47	6		no	no	no	no	no	no	no	no
5:00	173	30		no	no	no	no	no	no	no	no
6:00	438	103		yes	no	no	yes	yes	no	no	yes
7:00	980	391		yes	yes	yes	yes	yes	yes	yes	yes
8:00	970	311		yes	yes	yes	yes	yes	yes	yes	yes
9:00	707	144		yes	yes	yes	yes	yes	yes	yes	yes
10:00	598	98		yes	no	no	yes	yes	no	yes	yes
11:00	765	109		yes	no	yes	yes	yes	no	yes	yes
12:00	710	103		yes	no	yes	yes	yes	no	yes	yes
13:00	688	96		yes	no	yes	yes	yes	no	yes	yes
14:00	785	100		yes	no	yes	yes	yes	no	yes	yes
15:00	1,067	138		yes	no	yes	yes	yes	yes	yes	yes
16:00	1,250	181		yes	yes	yes	yes	yes	yes	yes	yes
17:00	1,471	207		yes	yes	yes	yes	yes	yes	yes	yes
18:00	1,057	153		yes	yes	yes	yes	yes	yes	yes	yes
19:00	631	59		yes	no	yes	no	yes	no	yes	yes
20:00	388	38		no	no	no	no	yes	no	no	no
21:00	290	22		no	no	no	no	no	no	no	no
22:00	116	13		no	no	no	no	no	no	no	no
23:00	45	2		no	no	no	no	no	no	no	no
Total	**13,253**	**2,310**		**6**	**Not Met**	**11**	**Met**		**7**	**Not Met**	

** Vehicles per hour on higher-volume minor-street approach (one direction only)*

Compass Development
Signal Warrant Study

Warrant 1: 8 Hour Analysis - 2019 Background Volumes

Day 2 ########	Major County Line Road EB / WB	Minor* Vista Pkwy WB	Warrant Type Street Designation	Condition A Major	Minor	Condition B Major	Minor	Condition A + B Major A	Minor A	Major B	Minor B
Time of Day	Number of Lanes 2	2	Vehicles per Hour Needed to Meet Warrant	420	140	630	70	336	112	504	56
0:00	38	0	Warrant is Met (yes/no)	no	no	no	no	no	no	no	no
1:00	22	2		no	no	no	no	no	no	no	no
2:00	11	0		no	no	no	no	no	no	no	no
3:00	19	0		no	no	no	no	no	no	no	no
4:00	45	5		no	no	no	no	no	no	no	no
5:00	152	28		no	no	no	no	no	no	no	no
6:00	409	121		no	no	no	yes	yes	yes	no	yes
7:00	1,021	355		yes	yes	yes	yes	yes	yes	yes	yes
8:00	994	320		yes	yes	yes	yes	yes	yes	yes	yes
9:00	714	149		yes	yes	yes	yes	yes	yes	yes	yes
10:00	616	89		yes	no	no	yes	yes	no	yes	yes
11:00	727	100		yes	no	yes	yes	yes	no	yes	yes
12:00	799	96		yes	no	yes	yes	yes	no	yes	yes
13:00	746	98		yes	no	yes	yes	yes	no	yes	yes
14:00	838	85		yes	no	yes	yes	yes	no	yes	yes
15:00	1,093	174		yes	yes	yes	yes	yes	yes	yes	yes
16:00	1,218	190		yes	yes	yes	yes	yes	yes	yes	yes
17:00	1,448	223		yes	yes	yes	yes	yes	yes	yes	yes
18:00	1,100	182		yes	yes	yes	yes	yes	yes	yes	yes
19:00	639	65		yes	no	yes	no	yes	no	yes	yes
20:00	416	47		no	no	no	no	yes	no	no	no
21:00	320	26		no	no	no	no	no	no	no	no
22:00	119	16		no	no	no	no	no	no	no	no
23:00	58	1		no	no	no	no	no	no	no	no
Total	13,562	2,372		7	Not Met	11	Met		7	Not Met	

** Vehicles per hour on higher-volume minor-street approach (one direction only)*

FOX TUTTLE HERNANDEZ
TRANSPORTATION GROUP

Compass Development
Signal Warrant Study

Warrant 1: 8 Hour Analysis - 2019 Background Volumes

Day 3 10/20/2016	Major County Line Road EB / WB	Minor* Vista Pkwy WB	Warrant Type	Condition A		Condition B		Condition A + B			
			Street Designation	Major	Minor	Major	Minor	Major A	Minor A	Major B	Minor B
Time of Day	Number of Lanes 2	2	Vehicles per Hour Needed to Meet Warrant	420	140	630	70	336	112	504	56
0:00	24	7	Warrant is Met (yes/no)	no	no	no	no	no	no	no	no
1:00	13	1		no	no	no	no	no	no	no	no
2:00	12	0		no	no	no	no	no	no	no	no
3:00	19	2		no	no	no	no	no	no	no	no
4:00	53	4		no	no	no	no	no	no	no	no
5:00	146	33		no	no	no	no	no	no	no	no
6:00	464	94		yes	no	no	yes	yes	no	no	yes
7:00	1,022	379		yes	yes	yes	yes	yes	yes	yes	yes
8:00	986	271		yes	yes	yes	yes	yes	yes	yes	yes
9:00	705	146		yes	yes	yes	yes	yes	yes	yes	yes
10:00	640	126		yes	no	yes	yes	yes	yes	yes	yes
11:00	759	86		yes	no	yes	yes	yes	no	yes	yes
12:00	794	90		yes	no	yes	yes	yes	no	yes	yes
13:00	692	103		yes	no	yes	yes	yes	no	yes	yes
14:00	834	109		yes	no	yes	yes	yes	no	yes	yes
15:00	1,086	170		yes	yes	yes	yes	yes	yes	yes	yes
16:00	1,211	197		yes	yes	yes	yes	yes	yes	yes	yes
17:00	1,296	176		yes	yes	yes	yes	yes	yes	yes	yes
18:00	1,113	142		yes	yes	yes	yes	yes	yes	yes	yes
19:00	672	59		yes	no	yes	no	yes	no	yes	yes
20:00	447	56		yes	no	no	no	yes	no	no	yes
21:00	298	40		no	no	no	no	no	no	no	no
22:00	151	10		no	no	no	no	no	no	no	no
23:00	63	6		no	no	no	no	no	no	no	no
Total	13,500	2,307		7	Not Met	12	Met		8	Met	

** Vehicles per hour on higher-volume minor-street approach (one direction only)*

Warrant 1: 8 Hour Analysis - 2019 Background + Project Volumes

Day 1 10/19/2016	Major County Line Road EB / WB	Minor* Vista Pkwy WB	Warrant Type Street Designation	Condition A Major	Condition A Minor	Condition B Major	Condition B Minor	Condition A + B Major A	Condition A + B Minor A	Condition A + B Major B	Condition A + B Minor B
Time of Day	Number of Lanes 2	2	Vehicles per Hour Needed to Meet Warrant	420	140	630	70	336	112	504	56
0:00	21	1	Warrant is Met (yes/no)	no	no	no	no	no	no	no	no
1:00	13	2		no	no	no	no	no	no	no	no
2:00	14	2		no	no	no	no	no	no	no	no
3:00	29	1		no	no	no	no	no	no	no	no
4:00	47	6		no	no	no	no	no	no	no	no
5:00	183	31		no	no	no	no	no	no	no	no
6:00	453	108		yes	no	no	yes	yes	no	no	yes
7:00	1,016	396		yes	yes	yes	yes	yes	yes	yes	yes
8:00	999	323		yes	yes	yes	yes	yes	yes	yes	yes
9:00	731	152		yes	yes	yes	yes	yes	yes	yes	yes
10:00	620	103		yes	no	no	yes	yes	no	yes	yes
11:00	792	116		yes	no	yes	yes	yes	yes	yes	yes
12:00	733	108		yes	no	yes	yes	yes	no	yes	yes
13:00	715	101		yes	no	yes	yes	yes	no	yes	yes
14:00	820	103		yes	no	yes	yes	yes	no	yes	yes
15:00	1,109	142		yes	yes	yes	yes	yes	yes	yes	yes
16:00	1,307	188		yes	yes	yes	yes	yes	yes	yes	yes
17:00	1,533	222		yes	yes	yes	yes	yes	yes	yes	yes
18:00	1,108	162		yes	yes	yes	yes	yes	yes	yes	yes
19:00	661	64		yes	no	yes	no	yes	no	yes	yes
20:00	405	40		no	no	no	no	yes	no	no	no
21:00	304	23		no	no	no	no	no	no	no	no
22:00	122	14		no	no	no	no	no	no	no	no
23:00	45	2		no	no	no	no	no	no	no	no
Total	**13,780**	**2,410**		**7**	**Not Met**	**11**	**Met**		**8**	**Met**	

** Vehicles per hour on higher-volume minor-street approach (one direction only)*

FOX TUTTLE HERNANDEZ
TRANSPORTATION GROUP

Compass Development
Signal Warrant Study

Warrant 1: 8 Hour Analysis - 2019 Background + Project Volumes

Day 2 10/19/2016	Major County Line Road EB / WB	Minor* Vista Pkwy WB	Warrant Type Street Designation	Condition A		Condition B		Condition A + B			
				Major	Minor	Major	Minor	Major A	Minor A	Major B	Minor B
Time of Day	Number of Lanes 2	2	Vehicles per Hour Needed to Meet Warrant	420	140	630	70	336	112	504	56
0:00	38	0	Warrant is Met (yes/no)	no	no	no	no	no	no	no	no
1:00	22	2		no	no	no	no	no	no	no	no
2:00	11	0		no	no	no	no	no	no	no	no
3:00	19	0		no	no	no	no	no	no	no	no
4:00	45	5		no	no	no	no	no	no	no	no
5:00	162	29		no	no	no	no	no	no	no	no
6:00	424	126		yes	no	no	yes	yes	yes	no	yes
7:00	1,057	360		yes	yes	yes	yes	yes	yes	yes	yes
8:00	1,023	332		yes	yes	yes	yes	yes	yes	yes	yes
9:00	738	157		yes	yes	yes	yes	yes	yes	yes	yes
10:00	638	94		yes	no	yes	yes	yes	no	yes	yes
11:00	754	107		yes	no	yes	yes	yes	no	yes	yes
12:00	822	101		yes	no	yes	yes	yes	no	yes	yes
13:00	773	103		yes	no	yes	yes	yes	no	yes	yes
14:00	873	88		yes	no	yes	yes	yes	no	yes	yes
15:00	1,135	178		yes	yes	yes	yes	yes	yes	yes	yes
16:00	1,275	197		yes	yes	yes	yes	yes	yes	yes	yes
17:00	1,510	238		yes	yes	yes	yes	yes	yes	yes	yes
18:00	1,151	191		yes	yes	yes	yes	yes	yes	yes	yes
19:00	669	70		yes	no	yes	yes	yes	no	yes	yes
20:00	433	49		yes	no	no	no	yes	no	no	no
21:00	334	27		no	no	no	no	no	no	no	no
22:00	125	17		no	no	no	no	no	no	no	no
23:00	58	1		no	no	no	no	no	no	no	no
Total	**14,089**	**2,472**		**7**	**Not Met**	**13**	**Met**		**7**	**Not Met**	

** Vehicles per hour on higher-volume minor-street approach (one direction only)*

Compass Development
Signal Warrant Study

Warrant 1: 8 Hour Analysis - 2019 Background + Project Volumes

Day 3 **10/20/2016**	**Major** **County Line Road** **EB / WB**	**Minor*** **Vista Pkwy** **WB**	**Warrant Type**	**Condition A**		**Condition B**		**Condition A + B**			
			Street Designation	**Major**	**Minor**	**Major**	**Minor**	**Major A**	**Minor A**	**Major B**	**Minor B**
Time of Day	**Number of Lanes** **2**	**2**	**Vehicles per Hour Needed to Meet Warrant**	**420**	**140**	**630**	**70**	**336**	**112**	**504**	**56**
0:00	24	7	Warrant is Met (yes/no)	no	no	no	no	no	no	no	no
1:00	13	1		no	no	no	no	no	no	no	no
2:00	12	0		no	no	no	no	no	no	no	no
3:00	19	2		no	no	no	no	no	no	no	no
4:00	53	4		no	no	no	no	no	no	no	no
5:00	156	34		no	no	no	no	no	no	no	no
6:00	479	99		yes	no	no	yes	yes	no	no	yes
7:00	1,058	384		yes	yes	yes	yes	yes	yes	yes	yes
8:00	1,015	283		yes	yes	yes	yes	yes	yes	yes	yes
9:00	729	154		yes	yes	yes	yes	yes	yes	yes	yes
10:00	662	131		yes	no	yes	yes	yes	yes	yes	yes
11:00	786	93		yes	no	yes	yes	yes	no	yes	yes
12:00	817	95		yes	no	yes	yes	yes	no	yes	yes
13:00	719	108		yes	no	yes	yes	yes	no	yes	yes
14:00	869	112		yes	no	yes	yes	yes	yes	yes	yes
15:00	1,128	174		yes	yes	yes	yes	yes	yes	yes	yes
16:00	1,268	204		yes	yes	yes	yes	yes	yes	yes	yes
17:00	1,358	191		yes	yes	yes	yes	yes	yes	yes	yes
18:00	1,164	151		yes	yes	yes	yes	yes	yes	yes	yes
19:00	702	64		yes	no	yes	no	yes	no	yes	yes
20:00	464	58		yes	no	no	no	yes	no	no	yes
21:00	312	41		no	no	no	no	no	no	no	no
22:00	157	11		no	no	no	no	no	no	no	no
23:00	63	6		no	no	no	no	no	no	no	no
Total	**14,027**	**2,407**		**7**	**Not Met**	**12**	**Met**		**9**	**Met**	

** Vehicles per hour on higher-volume minor-street approach (one direction only)*

FOX TUTTLE HERNANDEZ
TRANSPORTATION GROUP

Four-Hour Vehicular Warrant Evaluation

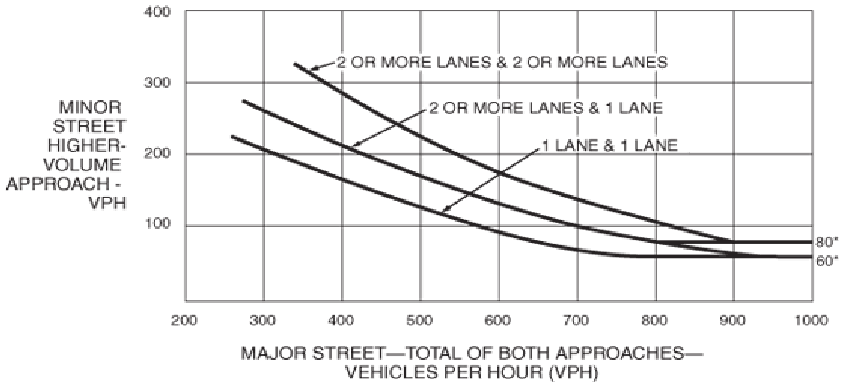
Warrant 2: 4 Hour Analysis - 2016 Existing Volumes

Day 1 10/18/2016	Major County Line Road EB / WB	Minor* Vista Pkwy WB		Warrant 2 (Figure 4C-1)
Time of Day	Number of Lanes 2	2		
0:00	20	1	Warrant is Met (yes/no)	no
1:00	13	2		no
2:00	14	2		no
3:00	28	1		no
4:00	45	6		no
5:00	165	29		no
6:00	418	98		no
7:00	937	374		yes
8:00	927	297		yes
9:00	676	138		no
10:00	572	94		no
11:00	731	104		no
12:00	679	98		no
13:00	658	92		no
14:00	751	96		no
15:00	1,020	132		yes
16:00	1,195	173		yes
17:00	1,406	198		yes
18:00	1,011	146		yes
19:00	603	56		no
20:00	371	36		no
21:00	278	21		no
22:00	111	12		no
23:00	43	2		no
Total	**12,672**	**2,208**	**6**	**Met**

*The minor volume used in this analysis comes from the minor approach with the higher total volume during the full study day.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

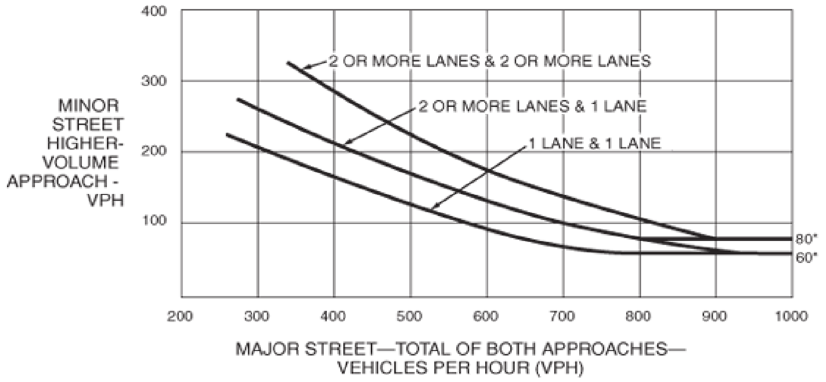
Warrant 2: 4 Hour Analysis - 2016 Existing Volumes

Day 2 **10/19/2016**	**Major** **County Line Road** **EB / WB**	**Minor*** **Vista Pkwy** **WB**		**Warrant 2 (Figure 4C-1)**
Time of Day	**Number of Lanes**			
	2	**2**		
0:00	37	0	Warrant is Met (yes/no)	no
1:00	21	2		no
2:00	11	0		no
3:00	18	0		no
4:00	43	5		no
5:00	146	27		no
6:00	391	116		no
7:00	976	339		yes
8:00	950	306		yes
9:00	683	142		no
10:00	589	85		no
11:00	695	96		no
12:00	764	92		no
13:00	713	94		no
14:00	801	81		no
15:00	1,045	166		yes
16:00	1,165	182		yes
17:00	1,384	213		yes
18:00	1,052	174		yes
19:00	611	62		no
20:00	398	45		no
21:00	306	25		no
22:00	114	15		no
23:00	55	1		no
Total	**12,968**	**2,268**	**6**	**Met**

*The minor volume used in this analysis comes from the minor approach with the higher total volume during the full study day.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

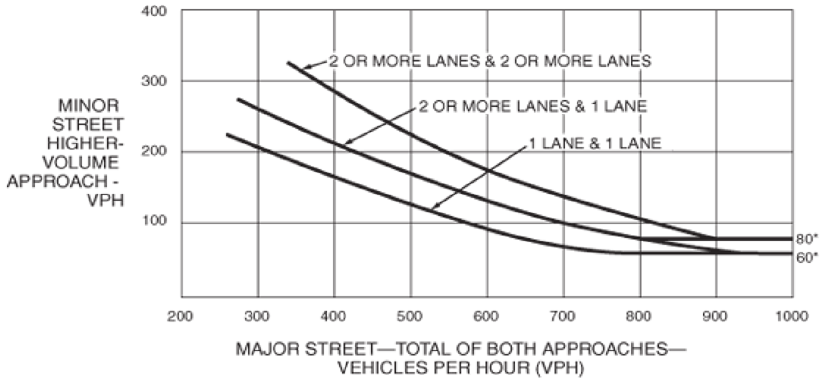
Warrant 2: 4 Hour Analysis - 2016 Existing Volumes

Day 3 10/20/2016	Major County Line Road EB / WB	Minor* Vista Pkwy WB		Warrant 2 (Figure 4C-1)
Time of Day	Number of Lanes			
	2	2		
0:00	22	7	Warrant is Met (yes/no)	no
1:00	13	1		no
2:00	12	0		no
3:00	18	2		no
4:00	51	4		no
5:00	140	32		no
6:00	444	90		no
7:00	977	362		yes
8:00	942	259		yes
9:00	674	140		no
10:00	612	120		no
11:00	726	82		no
12:00	759	86		no
13:00	662	98		no
14:00	797	104		no
15:00	1,038	163		yes
16:00	1,157	188		yes
17:00	1,239	168		yes
18:00	1,064	136		yes
19:00	643	56		no
20:00	428	54		no
21:00	285	38		no
22:00	144	10		no
23:00	60	6		no
Total	12,907	2,206	6	Met

*The minor volume used in this analysis comes from the minor approach with the higher total volume during the full study day.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

Compass Development
Signal Warrant Analysis

Warrant 2: 4 Hour Analysis - 2019 Backgroud Volumes

Day 1 10/18/2016	Major County Line Road EB / WB	Minor* Vista Pkwy WB		Warrant 2 (Figure 4C-1)
Time of Day	Number of Lanes			
	2	2		
0:00	21	1	Warrant is Met (yes/no)	no
1:00	13	2		no
2:00	14	2		no
3:00	29	1		no
4:00	47	6		no
5:00	173	30		no
6:00	438	103		no
7:00	980	391		yes
8:00	970	311		yes
9:00	707	144		yes
10:00	598	98		no
11:00	765	109		no
12:00	710	103		no
13:00	688	96		no
14:00	785	100		no
15:00	1,067	138		yes
16:00	1,250	181		yes
17:00	1,471	207		yes
18:00	1,057	153		yes
19:00	631	59		no
20:00	388	38		no
21:00	290	22		no
22:00	116	13		no
23:00	45	2		no
Total	**13,253**	**2,310**	**7**	**Met**

*The minor volume used in this analysis comes from the minor approach with the higher total volume during the full study day.

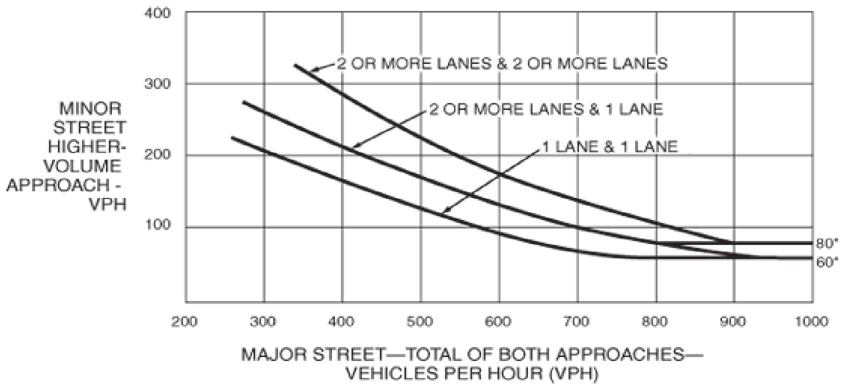


Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)

*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

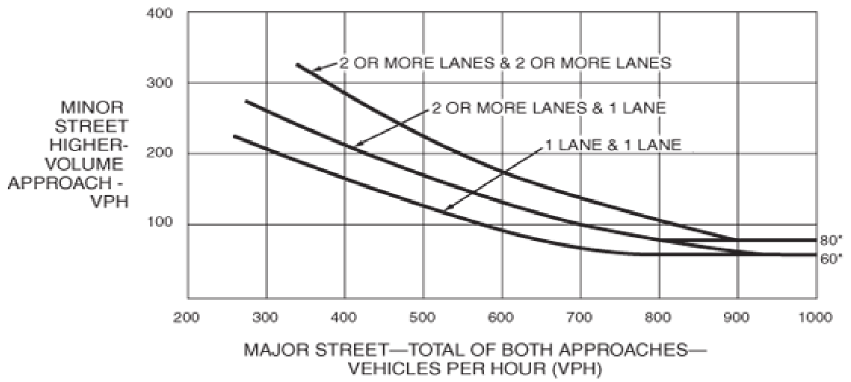
Warrant 2: 4 Hour Analysis - 2019 Backgroud Volumes

Day 2 10/19/2016	Major County Line Road EB / WB	Minor* Vista Pkwy WB		Warrant 2 (Figure 4C-1)
Time of Day	Number of Lanes			
	2	2		
0:00	38	0	Warrant is Met (yes/no)	no
1:00	22	2		no
2:00	11	0		no
3:00	19	0		no
4:00	45	5		no
5:00	152	28		no
6:00	409	121		no
7:00	1,021	355		yes
8:00	994	320		yes
9:00	714	149		yes
10:00	616	89		no
11:00	727	100		no
12:00	799	96		no
13:00	746	98		no
14:00	838	85		no
15:00	1,093	174		yes
16:00	1,218	190		yes
17:00	1,448	223		yes
18:00	1,100	182		yes
19:00	639	65		no
20:00	416	47		no
21:00	320	26		no
22:00	119	16		no
23:00	58	1		no
Total	**13,562**	**2,372**	**7**	**Met**

*The minor volume used in this analysis comes from the minor approach with the higher total volume during the full study day.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

Compass Development
Signal Warrant Analysis

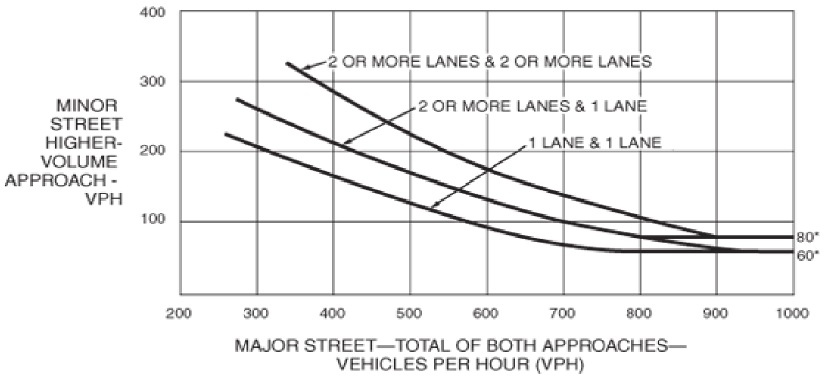
Warrant 2: 4 Hour Analysis - 2019 Backgroud Volumes

Day 3 10/20/2016	Major County Line Road EB / WB	Minor* Vista Pkwy WB		Warrant 2 (Figure 4C-1)
Time of Day	Number of Lanes 2	2		
0:00	24	7	Warrant is Met (yes/no)	no
1:00	13	1		no
2:00	12	0		no
3:00	19	2		no
4:00	53	4		no
5:00	146	33		no
6:00	464	94		no
7:00	1,022	379		yes
8:00	986	271		yes
9:00	705	146		yes
10:00	640	126		no
11:00	759	86		no
12:00	794	90		no
13:00	692	103		no
14:00	834	109		yes
15:00	1,086	170		yes
16:00	1,211	197		yes
17:00	1,296	176		yes
18:00	1,113	142		yes
19:00	672	59		no
20:00	447	56		no
21:00	298	40		no
22:00	151	10		no
23:00	63	6		no
Total	**13,500**	**2,307**	**8**	**Met**

*The minor volume used in this analysis comes from the minor approach with the higher total volume during the full study day.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

Compass Development
Signal Warrant Analysis

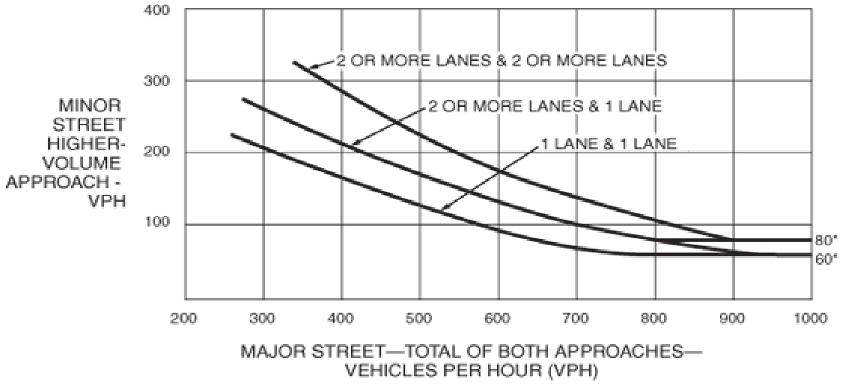
Warrant 2: 4 Hour Analysis - 2019 Bkgrd + Project Volumes

Day 1 10/18/2016	Major County Line Road EB / WB	Minor* Vista Pkwy WB		Warrant 2 (Figure 4C-1)
Time of Day	Number of Lanes			
	2	2		
0:00	21	1	Warrant is Met (yes/no)	no
1:00	13	2		no
2:00	14	2		no
3:00	29	1		no
4:00	47	6		no
5:00	184	31		no
6:00	453	108		no
7:00	1,015	396		yes
8:00	1,000	323		yes
9:00	732	152		yes
10:00	621	103		no
11:00	792	116		yes
12:00	734	108		no
13:00	715	101		no
14:00	819	105		yes
15:00	1,109	142		yes
16:00	1,307	189		yes
17:00	1,531	222		yes
18:00	1,108	162		yes
19:00	661	64		no
20:00	404	40		no
21:00	304	23		no
22:00	122	14		no
23:00	45	2		no
Total	**13,780**	**2,413**	**9**	**Met**

*The minor volume used in this analysis comes from the minor approach with the higher total volume during the full study day.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

Compass Development
Signal Warrant Analysis

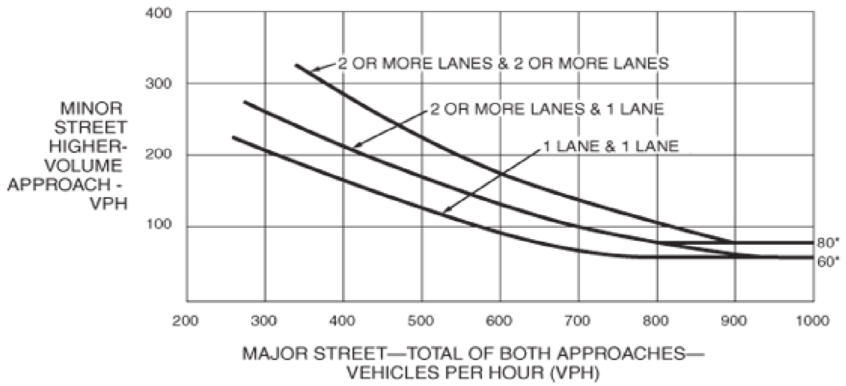
Warrant 2: 4 Hour Analysis - 2019 Bkgrd + Project Volumes

Day 2 10/19/2016	Major County Line Road EB / WB	Minor* Vista Pkwy WB		Warrant 2 (Figure 4C-1)
Time of Day	Number of Lanes			
	2	2		
0:00	38	0	Warrant is Met (yes/no)	no
1:00	22	2		no
2:00	11	0		no
3:00	19	0		no
4:00	45	5		no
5:00	163	29		no
6:00	424	126		no
7:00	1,056	360		yes
8:00	1,024	332		yes
9:00	739	157		yes
10:00	639	94		no
11:00	754	107		no
12:00	823	101		yes
13:00	773	103		no
14:00	872	90		no
15:00	1,135	178		yes
16:00	1,275	198		yes
17:00	1,508	238		yes
18:00	1,151	191		yes
19:00	669	70		no
20:00	432	49		no
21:00	334	27		no
22:00	125	17		no
23:00	58	1		no
Total	**14,089**	**2,475**	**8**	**Met**

*The minor volume used in this analysis comes from the minor approach with the higher total volume during the full study day.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

Compass Development
Signal Warrant Analysis

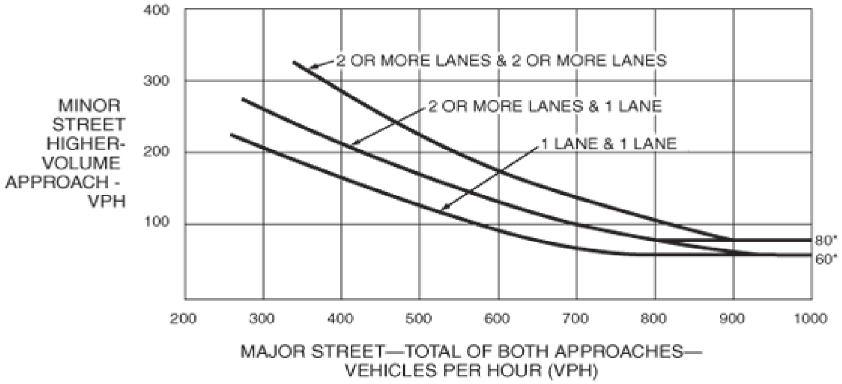
Warrant 2: 4 Hour Analysis - 2019 Bkgrd + Project Volumes

Day 3 10/20/2016	Major County Line Road EB / WB	Minor* Vista Pkwy WB		Warrant 2 (Figure 4C-1)
Time of Day	Number of Lanes			
	2	2		
0:00	24	7	Warrant is Met (yes/no)	no
1:00	13	1		no
2:00	12	0		no
3:00	19	2		no
4:00	53	4		no
5:00	157	34		no
6:00	479	99		no
7:00	1,057	384		yes
8:00	1,016	283		yes
9:00	730	154		yes
10:00	663	131		yes
11:00	786	93		no
12:00	818	95		no
13:00	719	108		no
14:00	868	114		yes
15:00	1,128	174		yes
16:00	1,268	205		yes
17:00	1,356	191		yes
18:00	1,164	151		yes
19:00	702	64		no
20:00	463	58		no
21:00	312	41		no
22:00	157	11		no
23:00	63	6		no
Total	**14,027**	**2,410**	**9**	**Met**

*The minor volume used in this analysis comes from the minor approach with the higher total volume during the full study day.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

Intersection Turning Movement Counts

COUNTER MEASURES INC.

1889 YORK STREET
DENVER.COLORADO
303-333-7409

N/S STREET: COUNTY LINE RD
E/W STREET: VISTA PKWY
CITY: ERIE
COUNTY: WELD

File Name : COUNVIST
Site Code : 00000001
Start Date : 10/20/2016
Page No : 1

Groups Printed- VEHICLES

	Southbound				Westbound				Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
07:00 AM	17	111	0	0	13	0	42	0	0	53	0	0	0	0	0	0	236
07:15 AM	15	143	0	0	40	0	42	0	0	58	4	0	0	0	0	0	302
07:30 AM	13	200	0	0	31	0	83	0	0	73	0	0	0	0	0	0	400
07:45 AM	19	179	0	0	29	0	80	0	0	87	3	0	0	0	0	0	397
Total	64	633	0	0	113	0	247	0	0	271	7	0	0	0	0	0	1335
08:00 AM	25	142	0	0	25	0	65	0	0	99	3	0	0	0	0	0	359
08:15 AM	26	129	0	0	13	0	69	0	0	79	1	0	0	0	0	0	317
08:30 AM	21	122	0	0	12	0	35	0	0	58	7	0	0	0	0	0	255
08:45 AM	19	119	0	0	8	0	29	0	0	51	5	0	0	0	0	0	231
Total	91	512	0	0	58	0	198	0	0	287	16	0	0	0	0	0	1162
04:00 PM	57	90	0	0	8	0	35	0	0	131	28	0	0	0	0	0	349
04:15 PM	35	77	0	0	8	0	27	0	0	118	21	0	0	0	0	0	286
04:30 PM	39	99	0	0	8	0	37	0	0	158	25	0	0	0	0	0	366
04:45 PM	59	100	0	0	9	0	54	0	0	105	6	0	0	0	0	0	333
Total	190	366	0	0	33	0	153	0	0	512	80	0	0	0	0	0	1334
05:00 PM	62	131	0	0	6	0	33	0	0	130	7	0	0	0	0	0	369
05:15 PM	62	138	0	0	9	0	34	0	0	104	7	0	0	0	0	0	354
05:30 PM	71	125	0	0	3	0	29	0	0	86	6	0	0	0	0	0	320
05:45 PM	61	122	0	0	5	0	48	0	0	107	15	0	0	0	0	0	358
Total	256	516	0	0	23	0	144	0	0	427	35	0	0	0	0	0	1401
Grand Total	601	2027	0	0	227	0	742	0	0	1497	138	0	0	0	0	0	5232
Apprch %	22.9	77.1	0.0	0.0	23.4	0.0	76.6	0.0	0.0	91.6	8.4	0.0	0.0	0.0	0.0	0.0	
Total %	11.5	38.7	0.0	0.0	4.3	0.0	14.2	0.0	0.0	28.6	2.6	0.0	0.0	0.0	0.0	0.0	

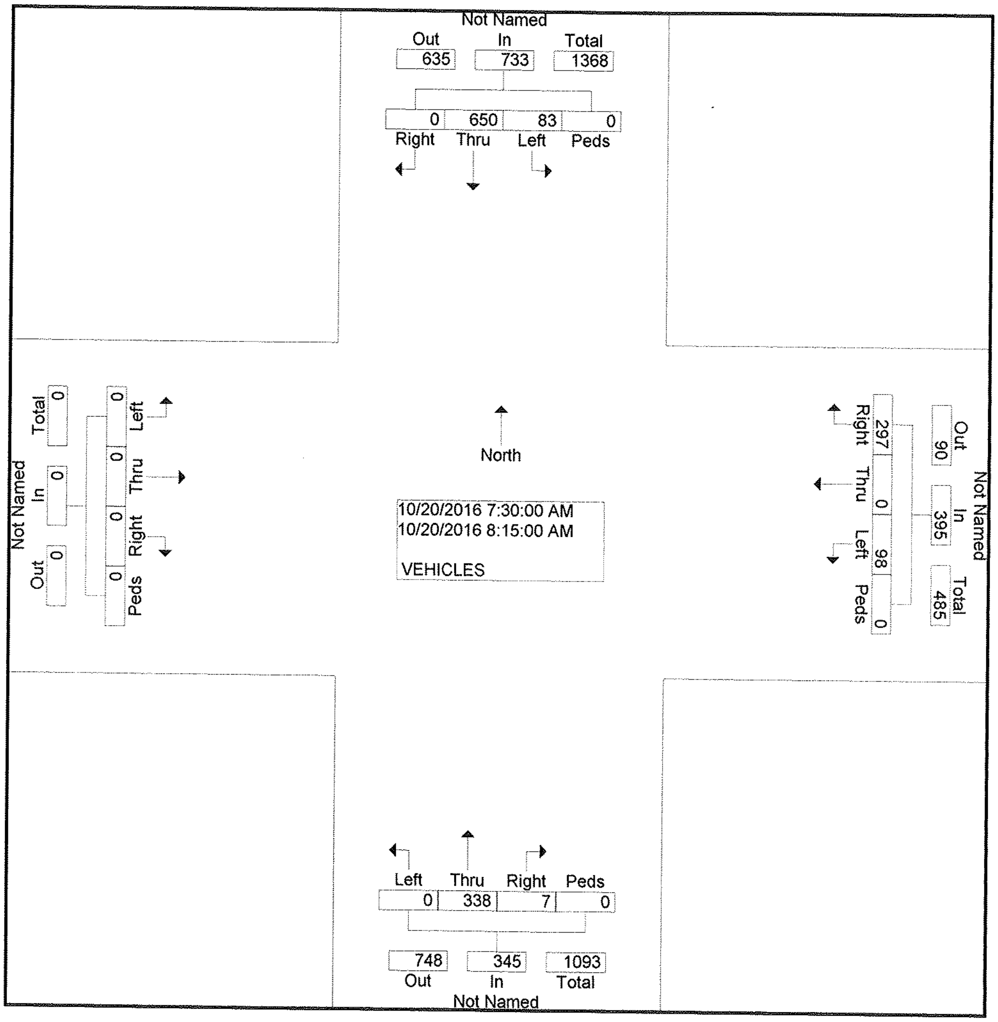
COUNTER MEASURES INC.

1889 YORK STREET
DENVER.COLORADO
303-333-7409

N/S STREET: COUNTY LINE RD
E/W STREET: VISTA PKWY
CITY: ERIE
COUNTY: WELD

File Name : COUNVIST
Site Code : 00000001
Start Date : 10/20/2016
Page No : 2

	Southbound					Westbound					Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 07:00 AM to 09:00 AM - Peak 1 of 1																					
Intersection	07:30 AM																				
Volume	83	650	0	0	733	98	0	297	0	395	0	338	7	0	345	0	0	0	0	0	1473
Percent	11.3	88.7	0.0	0.0		24.8	0.0	75.2	0.0		0.0	98.0	2.0	0.0		0.0	0.0	0.0	0.0		
07:30 Volume	13	200	0	0	213	31	0	83	0	114	0	73	0	0	73	0	0	0	0	0	400
Peak Factor																					0.921
High Int.	07:30 AM					07:30 AM					08:00 AM					6:45:00 AM					
Volume	13	200	0	0	213	31	0	83	0	114	0	99	3	0	102						
Peak Factor					0.860					0.866					0.846						



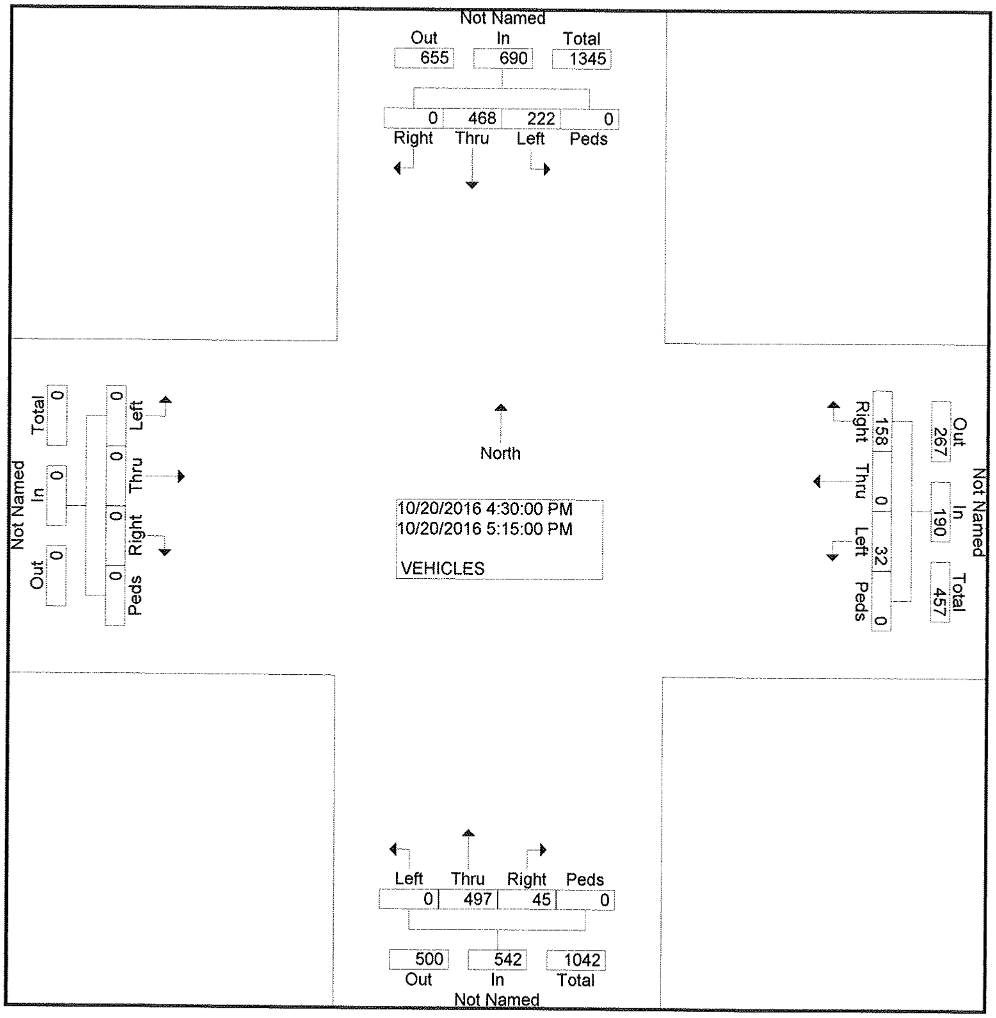
COUNTER MEASURES INC.

1889 YORK STREET
DENVER.COLORADO
303-333-7409

N/S STREET: COUNTY LINE RD
E/W STREET: VISTA PKWY
CITY: ERIE
COUNTY: WELD

File Name : COUNVIST
Site Code : 00000001
Start Date : 10/20/2016
Page No : 2

	Southbound					Westbound					Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Intersection	04:30 PM																				
Volume	222	468	0	0	690	32	0	158	0	190	0	497	45	0	542	0	0	0	0	0	1422
Percent	32.2	67.8	0.0	0.0		16.8	0.0	83.2	0.0		0.0	91.7	8.3	0.0		0.0	0.0	0.0	0.0		
05:00 Volume	62	131	0	0	193	6	0	33	0	39	0	130	7	0	137	0	0	0	0	0	369
Peak Factor																					0.963
High Int.	05:15 PM					04:45 PM					04:30 PM										
Volume	62	138	0	0	200	9	0	54	0	63	0	158	25	0	183						
Peak Factor					0.863					0.754					0.740						



COUNTER MEASURES INC.

1889 YORK STREET
DENVER.COLORADO
303-333-7409

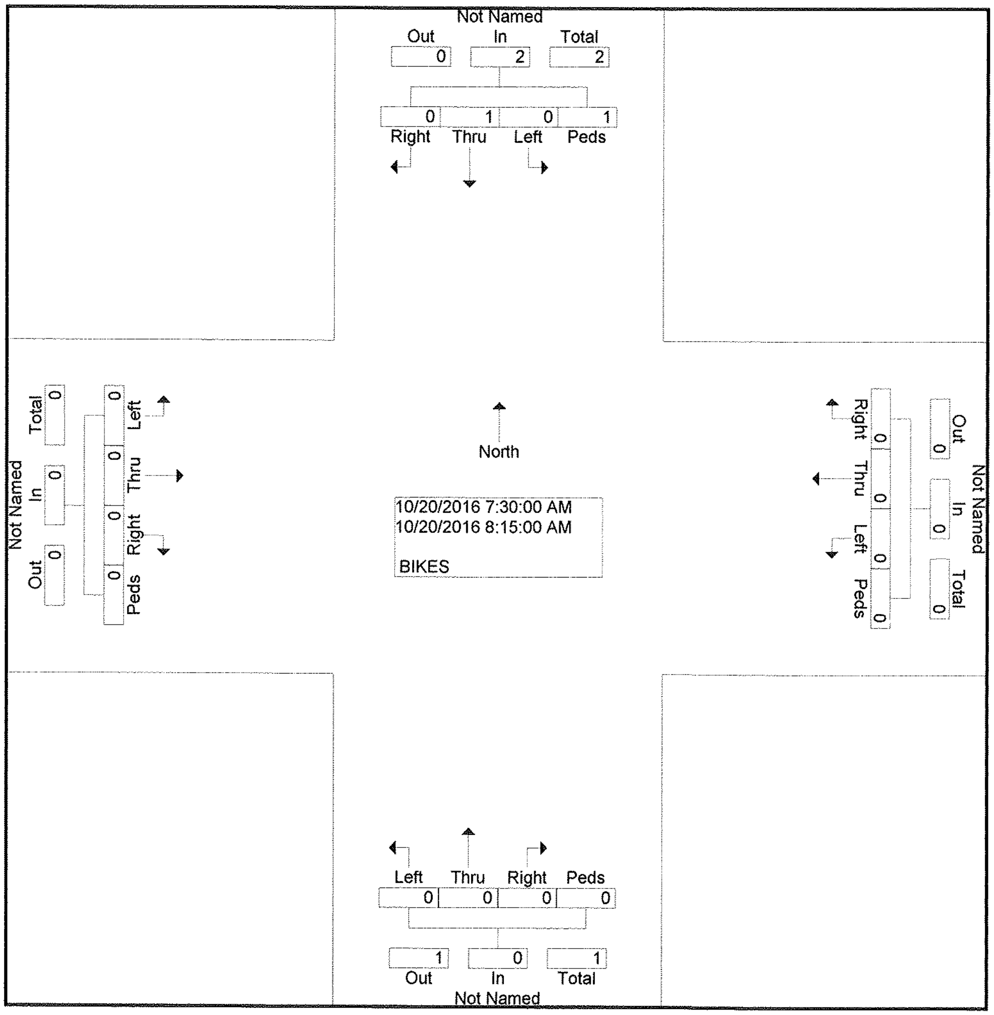
N/S STREET: COUNTY LINE RD
E/W STREET: VISTA PKWY
CITY: ERIE
COUNTY: WELD

File Name : COUNVIST
Site Code : 00000001
Start Date : 10/20/2016
Page No : 1

Groups Printed- BIKES

	Southbound				Westbound				Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
07:30 AM	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Total	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
04:00 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
04:30 PM	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	3
04:45 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	1	2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	5
05:30 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
05:45 PM	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
Total	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3
Grand Total	1	4	0	1	0	0	0	0	0	3	1	0	0	0	0	0	10
Apprch %	16.7	66.7	0.0	16.7	0.0	0.0	0.0	0.0	0.0	75.0	25.0	0.0	0.0	0.0	0.0	0.0	
Total %	10.0	40.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	30.0	10.0	0.0	0.0	0.0	0.0	0.0	

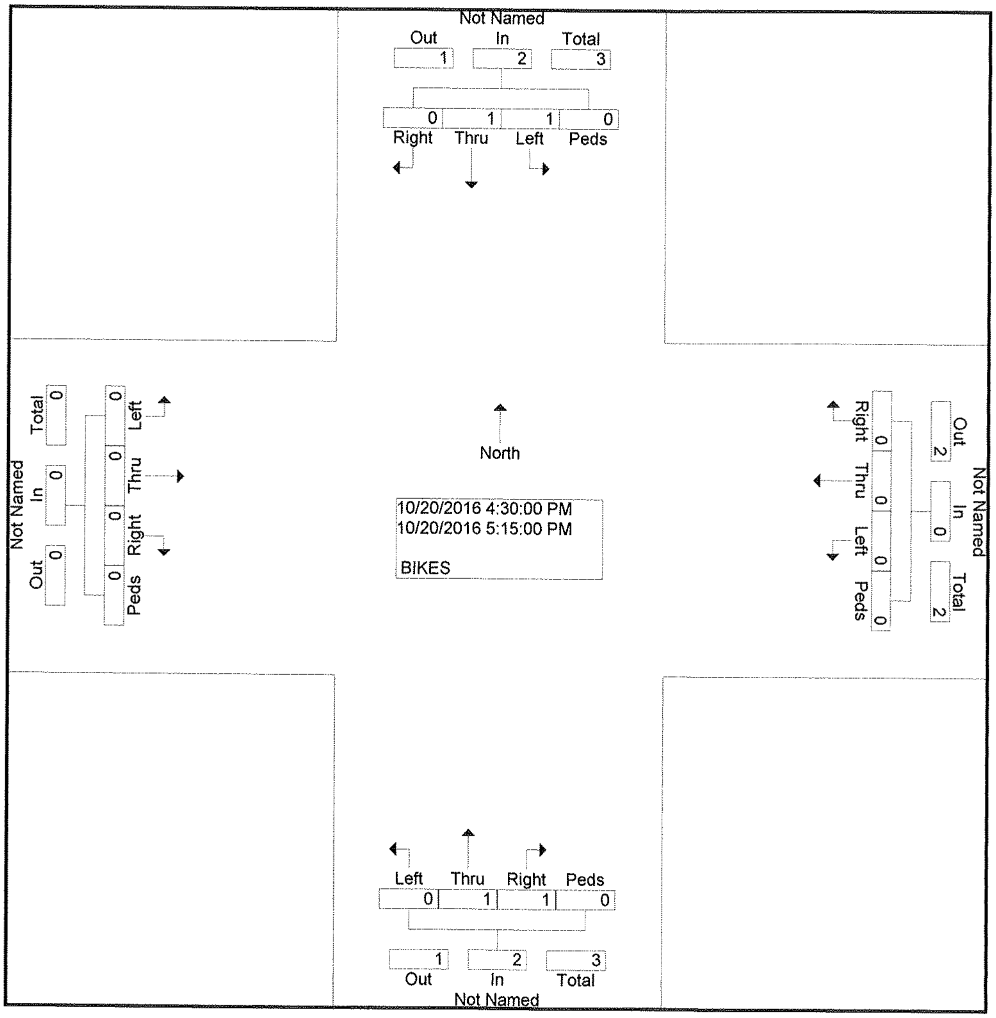
	Southbound					Westbound					Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 07:30 AM to 08:15 AM - Peak 1 of 1																					
Intersection	07:30 AM																				
Volume	0	1	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Percent	0.0	50.0	0.0	50.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		
07:30 Volume	0	1	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Peak Factor																					0.250
High Int.	07:30 AM																				
Volume	0	1	0	1	2																
Peak Factor					0.250																



N/S STREET: COUNTY LINE RD
E/W STREET: VISTA PKWY
CITY: ERIE
COUNTY: WELD

File Name : COUNVIST
Site Code : 00000001
Start Date : 10/20/2016
Page No : 2

	Southbound					Westbound					Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 04:30 PM to 05:15 PM - Peak 1 of 1																					
Intersection	04:30 PM																				
Volume	1	1	0	0	2	0	0	0	0	0	0	1	1	0	2	0	0	0	0	0	4
Percent	50.0	50.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	50.0	50.0	0.0		0.0	0.0	0.0	0.0		
04:30 Volume	1	0	0	0	1	0	0	0	0	0	0	1	1	0	2	0	0	0	0	0	3
Peak Factor																					0.333
High Int.	04:30 PM										04:30 PM										
Volume	1	0	0	0	1	0	0	0	0	0	0	1	1	0	2						
Peak Factor					0.500										0.250						



Daily Traffic Counts

COUNTER MEASURES INC.

1889 YORK STREET
DENVER,COLORADO 80206
303-333-7409

Location: VISTA PKWY E/O COUNTY LINE RD
City: ERIE
County: WELD
Direction: WESTBOUND-EASTBOUND

Site Code: 101709
Station ID: 101709

Start	17-Oct-16		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
Time	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB
12:00 AM	*	*	1	4	0	8	7	8	*	*	*	*	*	*	3	7
01:00	*	*	2	0	2	2	1	3	*	*	*	*	*	*	2	2
02:00	*	*	2	0	0	1	0	1	*	*	*	*	*	*	1	1
03:00	*	*	1	4	0	0	2	0	*	*	*	*	*	*	1	1
04:00	*	*	6	0	5	0	4	0	*	*	*	*	*	*	5	0
05:00	*	*	29	2	27	3	32	3	*	*	*	*	*	*	29	3
06:00	*	*	98	17	116	16	90	22	*	*	*	*	*	*	101	18
07:00	*	*	**374**	84	**339**	92	**362**	74	*	*	*	*	*	*	**358**	83
08:00	*	*	297	**128**	306	**136**	259	**110**	*	*	*	*	*	*	287	**125**
09:00	*	*	138	91	142	92	140	106	*	*	*	*	*	*	140	96
10:00	*	*	94	68	85	67	120	79	*	*	*	*	*	*	100	71
11:00	*	*	104	83	96	94	82	92	*	*	*	*	*	*	94	90
12:00 PM	*	*	98	99	92	90	86	106	*	*	*	*	*	*	92	98
01:00	*	*	92	94	94	104	98	94	*	*	*	*	*	*	95	97
02:00	*	*	96	111	81	104	104	106	*	*	*	*	*	*	94	107
03:00	*	*	132	203	166	216	163	192	*	*	*	*	*	*	154	204
04:00	*	*	173	246	182	252	**188**	271	*	*	*	*	*	*	181	256
05:00	*	*	**198**	**356**	**213**	**354**	168	**292**	*	*	*	*	*	*	**193**	**334**
06:00	*	*	146	244	174	234	136	250	*	*	*	*	*	*	152	243
07:00	*	*	56	161	62	163	56	179	*	*	*	*	*	*	58	168
08:00	*	*	36	64	45	109	54	112	*	*	*	*	*	*	45	95
09:00	*	*	21	60	25	82	38	66	*	*	*	*	*	*	28	69
10:00	*	*	12	26	15	17	10	25	*	*	*	*	*	*	12	23
11:00	*	*	2	8	1	14	6	16	*	*	*	*	*	*	3	13
Lane	0	0	2208	2153	2268	2250	2206	2207	0	0	0	0	0	0	2228	2204
Day	0		4361		4518		4413		0		0		0		4432	
AM Peak	-	-	07:00	08:00	07:00	08:00	07:00	08:00	-	-	-	-	-	-	07:00	08:00
Vol.	-	-	374	128	339	136	362	110	-	-	-	-	-	-	358	125
PM Peak	-	-	17:00	17:00	17:00	17:00	16:00	17:00	-	-	-	-	-	-	17:00	17:00
Vol.	-	-	198	356	213	354	188	292	-	-	-	-	-	-	193	334
Comb. Total	0		4361		4518		4413		0		0		0		4432	

ADT ADT 4,431 AADT 4,431

COUNTER MEASURES INC.

1889 YORK STREET
DENVER,COLORADO 80206
303-333-7409

Location: COUNTY LINE RD N/O VISTA PKWY
City: ERIE
County: WELD
Direction: NORTHBOUND-SOUTHBOUND

Site Code: 101710
Station ID: 101710

Start	17-Oct-16		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
Time	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
12:00 AM	*	*	14	5	22	9	15	11	*	*	*	*	*	*	17	8
01:00	*	*	10	4	16	5	5	5	*	*	*	*	*	*	10	5
02:00	*	*	6	8	5	6	6	6	*	*	*	*	*	*	6	7
03:00	*	*	4	22	4	14	2	16	*	*	*	*	*	*	3	17
04:00	*	*	22	23	15	28	22	30	*	*	*	*	*	*	20	27
05:00	*	*	44	130	40	114	46	112	*	*	*	*	*	*	43	119
06:00	*	*	172	298	179	278	185	310	*	*	*	*	*	*	179	295
07:00	*	*	506	**680**	493	**710**	**519**	**698**	*	*	*	*	*	*	506	**696**
08:00	*	*	**532**	623	**536**	634	486	605	*	*	*	*	*	*	**518**	621
09:00	*	*	310	432	322	444	298	446	*	*	*	*	*	*	310	441
10:00	*	*	266	356	284	357	325	356	*	*	*	*	*	*	292	356
11:00	*	*	382	405	333	421	344	412	*	*	*	*	*	*	353	413
12:00 PM	*	*	354	377	388	418	384	393	*	*	*	*	*	*	375	396
01:00	*	*	331	366	410	338	358	348	*	*	*	*	*	*	366	351
02:00	*	*	449	349	416	403	470	381	*	*	*	*	*	*	445	378
03:00	*	*	579	502	622	528	618	522	*	*	*	*	*	*	606	517
04:00	*	*	726	553	672	575	**666**	558	*	*	*	*	*	*	688	562
05:00	*	*	**829**	**664**	**794**	**676**	572	**773**	*	*	*	*	*	*	**732**	**704**
06:00	*	*	596	457	646	480	598	507	*	*	*	*	*	*	613	481
07:00	*	*	340	265	348	271	348	287	*	*	*	*	*	*	345	274
08:00	*	*	208	155	230	184	242	179	*	*	*	*	*	*	227	173
09:00	*	*	158	118	158	136	156	136	*	*	*	*	*	*	157	130
10:00	*	*	48	59	77	42	80	58	*	*	*	*	*	*	68	53
11:00	*	*	26	14	30	21	37	21	*	*	*	*	*	*	31	19
Lane	0	0	6912	6865	7040	7092	6782	7170	0	0	0	0	0	0	6910	7043
Day	0		13777		14132		13952		0		0		0		13953	
AM Peak	-	-	08:00	07:00	08:00	07:00	07:00	07:00	-	-	-	-	-	-	08:00	07:00
Vol.	-	-	532	680	536	710	519	698	-	-	-	-	-	-	518	696
PM Peak	-	-	17:00	17:00	17:00	17:00	16:00	17:00	-	-	-	-	-	-	17:00	17:00
Vol.	-	-	829	664	794	676	666	773	-	-	-	-	-	-	732	704

Comb. Total	0	13777	14132	13952	0	0	0	13953

ADT ADT 13,954 AADT 13,954

COUNTER MEASURES INC.
1889 YORK STREET
DENVER,COLORADO 80206
303-333-7409

Location: COUNTY LINE RD S/O VISTA PKWY
City: ERIE
County: WELD
Direction: SOUTHBOUND-NORTHBOUND

Site Code: 101706
Station ID: 101706

Start	17-Oct-16		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
Time	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB
12:00 AM	*	*	4	15	6	28	8	11	*	*	*	*	*	*	6	18
01:00	*	*	6	9	6	16	6	8	*	*	*	*	*	*	6	11
02:00	*	*	10	6	5	5	5	6	*	*	*	*	*	*	7	6
03:00	*	*	21	6	14	4	17	2	*	*	*	*	*	*	17	4
04:00	*	*	26	22	33	15	34	21	*	*	*	*	*	*	31	19
05:00	*	*	143	35	128	32	122	28	*	*	*	*	*	*	131	32
06:00	*	*	330	120	313	113	332	134	*	*	*	*	*	*	325	122
07:00	*	*	**742**	257	**736**	266	**930**	279	*	*	*	*	*	*	**803**	267
08:00	*	*	594	304	602	**316**	572	**337**	*	*	*	*	*	*	589	**319**
09:00	*	*	422	244	424	239	424	228	*	*	*	*	*	*	423	237
10:00	*	*	337	216	340	232	341	256	*	*	*	*	*	*	339	235
11:00	*	*	380	**326**	370	274	378	314	*	*	*	*	*	*	376	305
12:00 PM	*	*	336	302	385	346	374	366	*	*	*	*	*	*	365	338
01:00	*	*	334	292	315	375	317	314	*	*	*	*	*	*	322	327
02:00	*	*	304	402	355	398	344	416	*	*	*	*	*	*	334	405
03:00	*	*	408	518	408	517	433	516	*	*	*	*	*	*	416	517
04:00	*	*	446	642	440	590	406	**599**	*	*	*	*	*	*	431	610
05:00	*	*	**470**	**742**	**491**	**708**	**540**	466	*	*	*	*	*	*	**500**	**639**
06:00	*	*	326	554	360	572	383	557	*	*	*	*	*	*	356	561
07:00	*	*	173	338	180	340	195	356	*	*	*	*	*	*	183	345
08:00	*	*	132	216	114	214	134	249	*	*	*	*	*	*	127	226
09:00	*	*	87	160	90	170	108	149	*	*	*	*	*	*	95	160
10:00	*	*	48	52	34	72	47	86	*	*	*	*	*	*	43	70
11:00	*	*	11	29	18	34	16	39	*	*	*	*	*	*	15	34
Lane	0	0	6090	5807	6167	5876	6466	5737	0	0	0	0	0	0	6240	5807
Day	0		11897		12043		12203		0		0		0		12047	
AM Peak	-	-	07:00	11:00	07:00	08:00	07:00	08:00	-	-	-	-	-	-	07:00	08:00
Vol.	-	-	742	326	736	316	930	337	-	-	-	-	-	-	803	319
PM Peak	-	-	17:00	17:00	17:00	17:00	17:00	16:00	-	-	-	-	-	-	17:00	17:00
Vol.	-	-	470	742	491	708	540	599	-	-	-	-	-	-	500	639

Comb. Total	0	11897	12043	12203	0	0	0	12047

ADT ADT 12,048 AADT 12,048