

ALTA/NSPS LAND TITLE SURVEY

LOCATED IN THE SOUTHWEST QUARTER OF SECTION 19, TOWNSHIP 1 NORTH, RANGE 68 WEST 6TH P.M.
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO

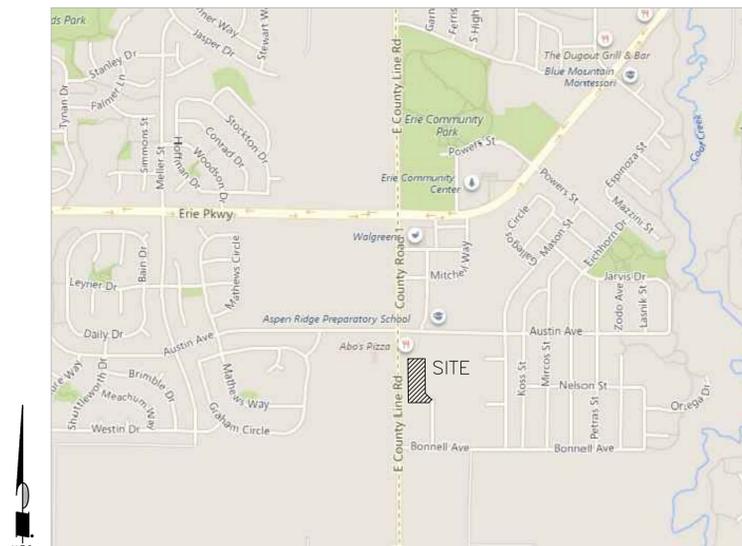
SHEET 1 OF 2

LEGAL DESCRIPTION

LOT 7, THE RIGHT MOVE SUBDIVISION REPLAT A, FINAL PLAT, COUNTY OF WELD, STATE OF COLORADO; AS CORRECTED BY AFFIDAVIT OF CORRECTION RECORDED DECEMBER 26, 2006 AT RECEPTION 3443717.

GENERAL NOTES

1. THIS SURVEY DOES NOT CONSTITUTE A TITLE SEARCH BY JEHN ENGINEERING TO DETERMINE OWNERSHIP OF EASEMENTS OF RECORD. FOR ALL INFORMATION REGARDING EASEMENTS, RIGHTS-OF-WAY AND TITLE OF RECORD, JEHN ENGINEERING RELIED UPON COMMITMENT FOR TITLE INSURANCE, COMMITMENT NO. 212560, ISSUED BY STEWART TITLE GUARANTY COMPANY AND HAVING AN EFFECTIVE DATE OF MAY 08, 2018 AT 8:00 A.M.
2. **NOTICE:** ACCORDING TO COLORADO LAW YOU MUST COMMENCE ANY LEGAL ACTION BASED UPON ANY DEFECT IN THIS SURVEY WITHIN THREE YEARS AFTER YOU FIRST DISCOVER SUCH DEFECT. IN NO EVENT MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE COMMENCED MORE THAN TEN YEARS FROM THE DATE OF CERTIFICATION SHOWN HEREON.
3. THIS SURVEY IS VALID ONLY IF PRINT HAS ORIGINAL SEAL AND SIGNATURE OF SURVEYOR.
4. **BASIS OF BEARINGS:** BEARINGS ARE BASED UPON THE WEST LINE OF THE SOUTHEAST QUARTER OF SECTION 19, AS BEARING S00°39'08"E, A DISTANCE OF 1326.81 FEET BETWEEN THE MONUMENTS SHOWN HEREON.
5. **UNITS:** ALL DIMENSIONS SHOWN HEREON ARE IN U.S. SURVEY FEET. ALL BEARINGS SHOWN HERE ON ARE IN DEGREE-MINUTES-SECONDS.
6. **ADDRESS (TABLE A #2):** 1012 CARBON COURT, ERIE, CO 80516
7. **FLOOD HAZARD (TABLE A #3):** SUBJECT PROPERTY FALLS WITHIN THE BOUNDARY OF THE FEDERAL EMERGENCY MANAGEMENT AGENCY FLOOD INSURANCE RATE MAP, COMMUNITY PANELS NOS. 08013C0443J AND 08013C0441J, AND LIES WITHIN ZONE X, AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN.
8. **GROSS LAND AREA (TABLE A #4):** THE SUBJECT PROPERTY IS 101,237 SQ. FT OR 2.324 ACRES ±.
9. **BENCHMARK FOR VERTICAL RELIEF (TABLE A #5)** SOUTHWEST CORNER OF SECTION 29, TOWNSHIP 1 NORTH, RANGE 68 WEST, 6TH P.M., BEING A 2"ALUMINUM CAP IN RANGE BOX, ELEVATION OF 5085.93' (NAVD88).
10. **UTILITIES (TABLE A #11)** UTILITIES SHOWN HEREON ARE FROM VISIBLE FIELD INFORMATION, CONSTRUCTION DOCUMENTS AND UTILITY LOCATES PROVIDED BY DIVERSIFIED UNDERGROUND. JEHN ENGINEERING DOES NOT GUARANTEE THESE LOCATIONS, OR THAT THE UTILITIES SHOWN HEREON COMPRISE ALL UTILITIES IN THIS AREA, EITHER IN SERVICE OR ABANDONED. FOR THE EXACT LOCATION OF ALL UNDERGROUND UTILITIES, CONTACT THE APPROPRIATE UTILITY COMPANY PRIOR TO CONSTRUCTION.



VICINITY MAP

TITLE COMMITMENT B2 EXCEPTION NOTES

THE SURVEYED PROPERTY IS SUBJECT TO THE TERMS, PROVISIONS, COVENANTS, CONDITIONS, RESTRICTIONS, OBLIGATIONS AND RESERVATIONS CONTAINED IN THE FOLLOWING RECORDED DOCUMENTS IN THE TITLE COMMITMENT AS REFERENCED IN GENERAL NOTE 1. (ITALIC TEXT IS THE SURVEYOR'S PARENTHETICAL NOTE)

- # -INDICATES THE EXCEPTION NUMBER WITHIN THE SCHEDULE B-2 OF THE TITLE COMMITMENT REFERENCED IN NOTE NUMBER 1 (EXCEPTIONS 1-8 ARE STANDARD EXCEPTIONS).
- 9. THE EFFECT OF INCLUSIONS IN ANY GENERAL OR SPECIFIC WATER CONSERVANCY, FIRE PROTECTION, SOIL CONSERVATION OR OTHER DISTRICT OR HOMEOWNERS ASSOCIATION OR INCLUSION IN ANY WATER SERVICE OR STREET IMPROVEMENT AREA. (DOCUMENT NOT PROVIDED BY TITLE COMMITMENT).
- 10. RESERVATION OF MINERALS AND ALL RIGHTS RESERVED AND EXCEPTED CONTAINED IN THE WARRANTY DEED RECORDED AUGUST 10, 1943 IN BOOK 1115 AT PAGE 165. (NOT PLOTTED, BLANKET IN NATURE, COVERS ALL OF SUBJECT PROPERTY).
- 11. RIGHT OF WAY EASEMENT TO MOUNTAIN STATES TELEPHONE AND TELEGRAPH CO. RECORDED JUNE 13, 1974 AT RECEPTION NO. 1638554. (EASEMENT IS LOCATED OUTSIDE THE BOUNDARY OF THE SUBJECT PARCEL, LYING WITHIN THE PRESENT RIGHT-OF-WAY OF COUNTY LINE ROAD) NOT PLOTTED.
- 12. AVIATION EASEMENT RECORDED MAY 11, 1978 AT RECEPTION NO. 1753139. (NOT PLOTTED, BLANKET IN NATURE, COVERS ALL OF SUBJECT PROPERTY).
- 13. ALL MATTERS SHOWN ON THE PLAT OF FALCON PROPERTIES RECORDED SEPTEMBER 27, 1994 AT RECEPTION NO. 2408278. (AS SHOWN HEREON).
- 14. ALL MATTERS SHOWN ON THE PLAT OF THE RIGHT TO MOVE SUBDIVISION RECORDED SEPTEMBER 13, 1999 AT RECEPTION NO. 2719874. (AS SHOWN HEREON).
- 15. ORDINANCE RECORDED SEPTEMBER 20, 1999 AT RECEPTION NO. 2721573. (NOT PLOTTED, BLANKET IN NATURE, COVERS ALL OF SUBJECT PROPERTY).
- 16. DEVELOPMENT AGREEMENT RECORDED AT SEPTEMBER 8, 2000 AT RECEPTION NO. 2719060. (NOT PLOTTED, BLANKET IN NATURE, COVERS ALL OF SUBJECT PROPERTY).
- 17. DEVELOPMENT AGREEMENT RECORDED AT SEPTEMBER 8, 2000 AT RECEPTION NO. 2719061. (NOT PLOTTED, BLANKET IN NATURE, COVERS ALL OF SUBJECT PROPERTY).
- 18. DEVELOPMENT AGREEMENT RECORDED AT DECEMBER 1, 2005 AT RECEPTION NO. 3343862. (DOCUMENT IS BLANKET IN NATURE, COVERS ALL OF SUBJECT PROPERTY, EXHIBIT A OF THE DOCUMENT IS "THE RIGHT MOVE SUBDIVISION REPLAT A FINAL PLAT", EXHIBIT A SHOWS AN ADDITIONAL EASEMENT NOT SHOWN ON THE RECORDED PLAT OF "THE RIGHT MOVE SUBDIVISION REPLAT A FINAL PLAT A REPLAT OF THE RIGHT MOVE SUBDIVISION LOT 1", ADDITIONAL EASEMENT NOT SHOWN).
- 19. AVIATION EASEMENT AGREEMENT RECORDED DECEMBER 1, 2005 AT RECEPTION NO. 3343864. (NOT PLOTTED, BLANKET IN NATURE, COVERS ALL OF SUBJECT PROPERTY).
- 20. ALL MATTERS SHOWN ON THE PLAT OF THE RIGHT TO MOVE SUBDIVISION REPLAT A FINAL RECORDED DECEMBER 1, 2005 AT RECEPTION NO. 3343865. (AS SHOWN HEREON).
- 21. REQUEST FOR NOTIFICATION OF SURFACE DEVELOPMENT RECORDED APRIL 21, 2006 AT RECEPTION 3381086. (NOT PLOTTED, BLANKET IN NATURE, COVERS ALL OF SUBJECT PROPERTY).
- 22. AFFIDAVIT OF CORRECTION RELATED TO PLAT RECORDED AT RECEPTION NO. 3343865 RECORDED DECEMBER 26, 2006 AT RECEPTION NO. 3443717. (INDICATES CORRECT LOT NUMBER FOR LOT 7 AND IS REFLECTED HEREON).
- 23. DECLARATION OF ADDRESS RECORDED SEPTEMBER 26, 2016 AT RECEPTION NO. 4239454. (NOT PLOTTED).

SURVEYOR'S CERTIFICATE

TO: GYS DEVELOPEMENT LLC, A COLORADO LIMITED LIABILITY COMPANY
STEWART TITLE COMPANY LLC, A COLORADO LIMITED LIABILITY COMPANY
CARBON, LLC, A COLORADO LIMITED LIABILITY COMPANY

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2016 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 1, 2, 3, 4, 5, 7A, 8, 9, AND 11 OF TABLE A THEREOF. THE ACCOMPANYING PLAT ACCURATELY AND PROPERLY WITHIN APPLICABLE STANDARDS OF PRACTICE SHOWS SAID SURVEY BASED UPON MY KNOWLEDGE, INFORMATION AND BELIEF. THIS SURVEY IS NOT A GUARANTY OR WARRANTY, EITHER EXPRESSED OR IMPLIED.

THE FIELD WORK WAS COMPLETED ON 8/22/18.
DATE OF PLAT OR MAP: 9/26/2018

MARK T. WILSON
REGISTERED COLORADO LAND SURVEYOR NO. 36062
FOR AND ON BEHALF OF JEHN ENGINEERING, INC.



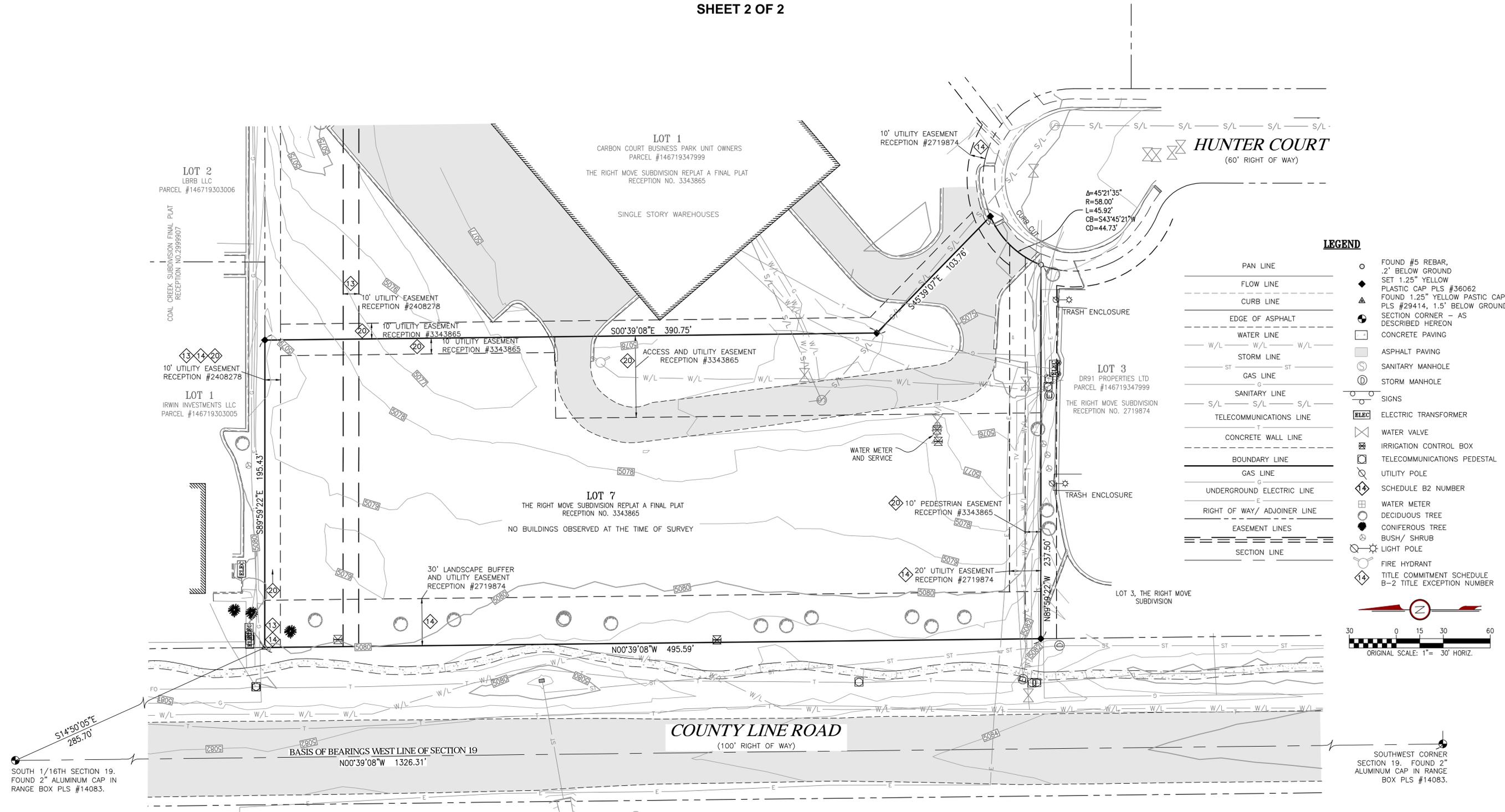
RICK
ENGINEERING COMPANY

5690 WEBSTER STREET, ARVADA, CO 80002
PH. (303) 423-6036 FAX (303) 467-9438

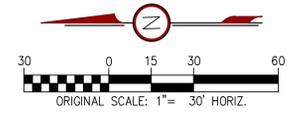
ALTA/NSPS LAND TITLE SURVEY

LOCATED IN THE SOUTHWEST QUARTER OF SECTION 19, TOWNSHIP 1 NORTH, RANGE 68 WEST 6TH P.M.
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO

SHEET 2 OF 2



- LEGEND**
- PAN LINE
 - FLOW LINE
 - CURB LINE
 - EDGE OF ASPHALT
 - WATER LINE
 - STORM LINE
 - GAS LINE
 - SANITARY LINE
 - TELECOMMUNICATIONS LINE
 - CONCRETE WALL LINE
 - BOUNDARY LINE
 - GAS LINE
 - UNDERGROUND ELECTRIC LINE
 - RIGHT OF WAY/ ADJOINER LINE
 - EASEMENT LINES
 - SECTION LINE



SOUTH 1/16TH SECTION 19.
FOUND 2" ALUMINUM CAP IN
RANGE BOX PLS #14083.

SOUTHWEST CORNER
SECTION 19. FOUND 2"
ALUMINUM CAP IN RANGE
BOX PLS #14083.



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WWW.RICKENGINEERING.COM



BUILDING E



BUILDING F



AERIAL OF SURROUNDINGS



BUILDING A



BUILDING B



BUILDING C



BUILDING D



PROPOSED BUILDING



AERIAL OF NEIGHBORHOOD



BLACK FOX -
ACCENT STUCCO
MEDIUM SAND TEXTURE



ELLIE GRAY -
STUCCO COLOR C
MEDIUM SAND TEXTURE



ACCESSIBLE BEIGE -
STUCCO COLOR A
MEDIUM SAND TEXTURE



SHOJI WHITE -
STUCCO COLOR B
MEDIUM SAND TEXTURE

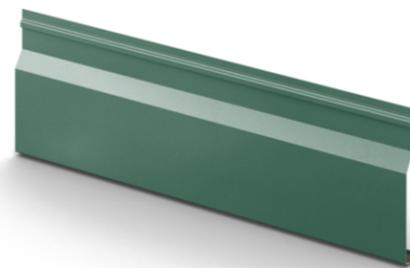
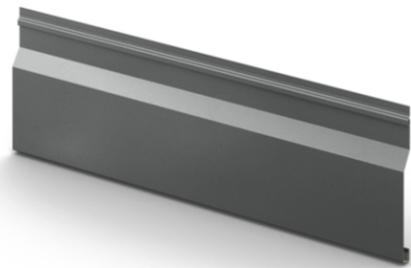


METAL PANEL - BERRIDGE
CHARCOAL GRAY

METAL PANEL - BERRIDGE
FOREST GREEN

CULTURED STONE VENEER - SUNSET STONE
COUNTRY LEDGE

STOREFRONT -
DARK BRONZE





Traffic Division

April 26, 2019

Town of Erie
Planning & Development Department
645 Holbrook Street
Erie, CO 80516
ATTN: Audem Gonzales, Planner

**SUBJECT: PARKING ASSESSMENT FOR THE PROPOSED ERIE BUSINESS PARK & SELF STORAGE, ERIE, COLORADO
(RICK ENGINEERING COMPANY JOB NUMBER 18423-T)**

Dear Mr. Gonzales:

The following parking analysis has been prepared to help determine the required parking supply for the proposed Business Park and Self-Storage located on County Line Road between Austin Avenue and Bonnell Avenue, within the Town of Erie, Colorado. Specifically, this study is focused on analyzing the parking demand for the self-storage facility as well as shared use analysis for the entire site. The results of the analysis will be summarized and compared to four parking supply calculation scenarios.

PROJECT DESCRIPTION

The project consists of developing a 3-story, approximately 100,000 square-foot mixed-use building on a 2.32-acre site on an existing vacant lot. The project contains an 8,025 square-foot general office space and a 650 unit self-storage facility with 1,050 square-foot of self-storage administration office inside a 90,075 square-foot building. There are 27 parking spaces proposed for general office space and 5 spaces for self-storage facility. Based on Institute of Transportation Engineer's (ITE) *Trip Generation 10th Edition* publication, the proposed self-storage facility (ITE Code 151) is estimated to generate 136 Average Daily Trips (ADT) with 9 (5 inbound/4 outbound) A.M. peak hour trips and 15 (7 inbound/8 outbound) P.M. peak hour trips.

Exhibit 1 shows the vicinity of the project. **Exhibit 2** shows the proposed site plan for the project.

PROPOSED PARKING ASSESSMENT

The parking supply was calculated for the proposed self-storage facility in the following scenarios:

Scenario A: Using Town of Erie's Unified Development Code (April 2018), section 10.6.6 Off-Street Parking and Loading standards (Schedule B) for indoor storage/warehousing facility 1 space per 1,500 sf for facilities over 50,001 sf.

Scenario B: Using ITE Parking Generation Manual, 5th Edition (January 2019) Weekday parking demand for mini-warehouse/self-storage facility (ITE Code 151) 1.36 space per 100 units.

Scenario C: Using ITE Parking Generation Manual, 5th Edition (January 2019) Saturday parking demand for mini-warehouse/self-storage facility (ITE Code 151) 0.94 space per 100 units.

Scenario D: Using nearby jurisdiction, City of Boulder’s Municipal Code, section 9-9-6 (Table 9-4) parking standards for a self-service storage facility, 3 spaces for visitor parking, plus parking for any floor area used as office space.

Table A summarizes the required parking supply for the four scenarios presented.

Scenario	References	Area (SF) or Storage Units	PARKING RATE	PARKING REQUIRED (100% occupancy)	PROVIDED
A	Town of Erie Unified Development Code	90,075	1 space /1,500 sf	60	5
B	ITE Parking Generation Manual, 5th Edition (Weekday)	650	1.36 space / 100 units	9	5
C	ITE Parking Generation Manual, 5th Edition (Saturday)	650	0.94 space / 100 units	6	5
D	City of Boulder	1,050 office space for storage facility	3 spaces for visitor plus parking for any floor area of office space ¹	6	5
¹ ITE Parking Generation Manual 5th Edition, Code 715, Single Tenant Office Building 3.10 space/1000 sf					

Scenario A results in 60 parking spaces required, Scenario B results in 9 parking spaces required and Scenarios C and D result in 6 parking spaces. The Town of Erie’s Unified Development Code section 10.6.6 D-3 states that due to the widely varying parking and loading demand characteristics referenced in Schedule B, the standards allow the use of ITE or other acceptable reliable sources to estimate minimum off-street parking requirements for comparable proposed uses. Therefore, Scenarios B, C or D provide more comparable parking rates for this project than Scenario A. More specifically, being the closest jurisdiction, Scenario D was used as a direct comparison to this project.

A shared parking analysis was also conducted for this study. According to the Urban Land Institute’s (ULI’s) *Shared Parking* 2nd Edition; shared parking is the use of parking space to serve two or more individual land uses without conflict or encroachment. Per ULI, the ability to share parking spaces is the result of two conditions; 1) variations in the accumulation of vehicles by hour, by day or by season at the individual land uses and, 2) relationships among the land uses that result in visiting multiple land uses on the same auto trip. Although the ULI did not provide hourly parking percentage rates for self-storage unit, ITE’s Parking Manual included hourly percentages for both the general office space and the self-storage facility.

Table B summarizes the hourly required parking supply for these uses, using parking rates per the Town of Erie for general office space (3.3 spaces/1000 sf) and City of Boulder’s parking rates for self-storage facility.

TABLE B SHARED PARKING DEMAND CALCULATION					
Land Use	General Office Space		Self Storage Facility		Shared Parking Demand
Size	8,025 SF		1,050 SF ²		
Parking Rate	3.33 / KSF ¹		City of Boulder ³		
Gross Spaces	27 Spaces		6 Spaces		
Time	% of Peak⁴	# of Spaces	% of Peak⁴	# of Spaces	
6:00 AM	0%	0	0%	0	0
7:00 AM	13%	3	0%	0	3
8:00 AM	48%	13	14%	1	14
9:00 AM	88%	24	71%	4	28
10:00 AM	100%	27	50%	3	30
11:00 AM	100%	27	79%	5	32
12:00 PM	85%	23	57%	3	26
1:00 PM	84%	22	64%	4	26
2:00 PM	93%	25	64%	4	29
3:00 PM	94%	25	79%	5	30
4:00 PM	85%	23	71%	4	27
5:00 PM	56%	15	100%	6	21
6:00 PM	20%	5	14%	1	6
7:00 PM	11%	3	0%	0	3
8:00 PM	0%	0	0%	0	0
9:00 PM	0%	0	0%	0	0
10:00 PM	0%	0	0%	0	0
11:00 PM	0%	0	0%	0	0
12:00 AM	0%	0	0%	0	0
	Peak General Office Parking Period			Peak Self Storage Parking Period	Peak Shared Parking Period
¹ Based on Town of Erie Unified Development Code Parking Rates					
² Administration Office Space for Self Storage Facility					
³ 3 Parking Spaces plus Any Floor Area of Office Space					
⁴ Based on percent weekday peak parking demand ITE Parking Manual 5th Edition					

Per the above table, peak parking demand for the general office building is expected to occur at 10:00 A.M. and 11:00 A.M. and at 5:00 P.M. for the self-storage facility. However, utilizing shared-use methodologies, the peak parking demand for the site is expected to occur at 11:00 A.M.

Mr. Gonzales
April 26, 2019
Page 4 of 4

CONCLUSIONS/RECOMMENDATIONS

Based on the assessment results above, the parking rates provided by ITE and nearby jurisdiction for a self-storage facility are more applicable to this project than the parking rates listed in Town of Erie's standards. More specifically, the City of Boulder's parking rates were used to analyze shared parking demand for the self-storage facility and the Town of Erie's rates for the general office space. As demonstrated in Table B, peak parking demand for each land use component occurs at different times of day. For the general office building, peak parking demand is expected to occur at 10:00 A.M. and 11:00 A.M. For the self-storage facility, peak parking demand is expected to occur at 5:00 P.M. The shared-use peak demand for both land uses occurs at 11:00 AM. requiring 27 parking spaces for the general office space and 5 spaces for the self-storage facility. In addition, where two or more adjacent uses have different peak parking usage periods, a reduction in the number of parking spaces can be applied. Therefore, the 27 spaces provided for the general office space and the 5 spaces provided for the self-storage facility is anticipated to be sufficient during the peak parking demand for the project site.

Appendix A contains Town of Erie Unified Development Code. **Appendix B** contains ITE Parking Generation Manual 5th Edition. **Appendix C** contains City of Boulder Municipal Code.

Sincerely,

RICK ENGINEERING COMPANY



Brian R. Stephenson, PE, TE, PTOE
Associate

Attachments





PROJECT SITE

© 2019 Rick Engineering Company

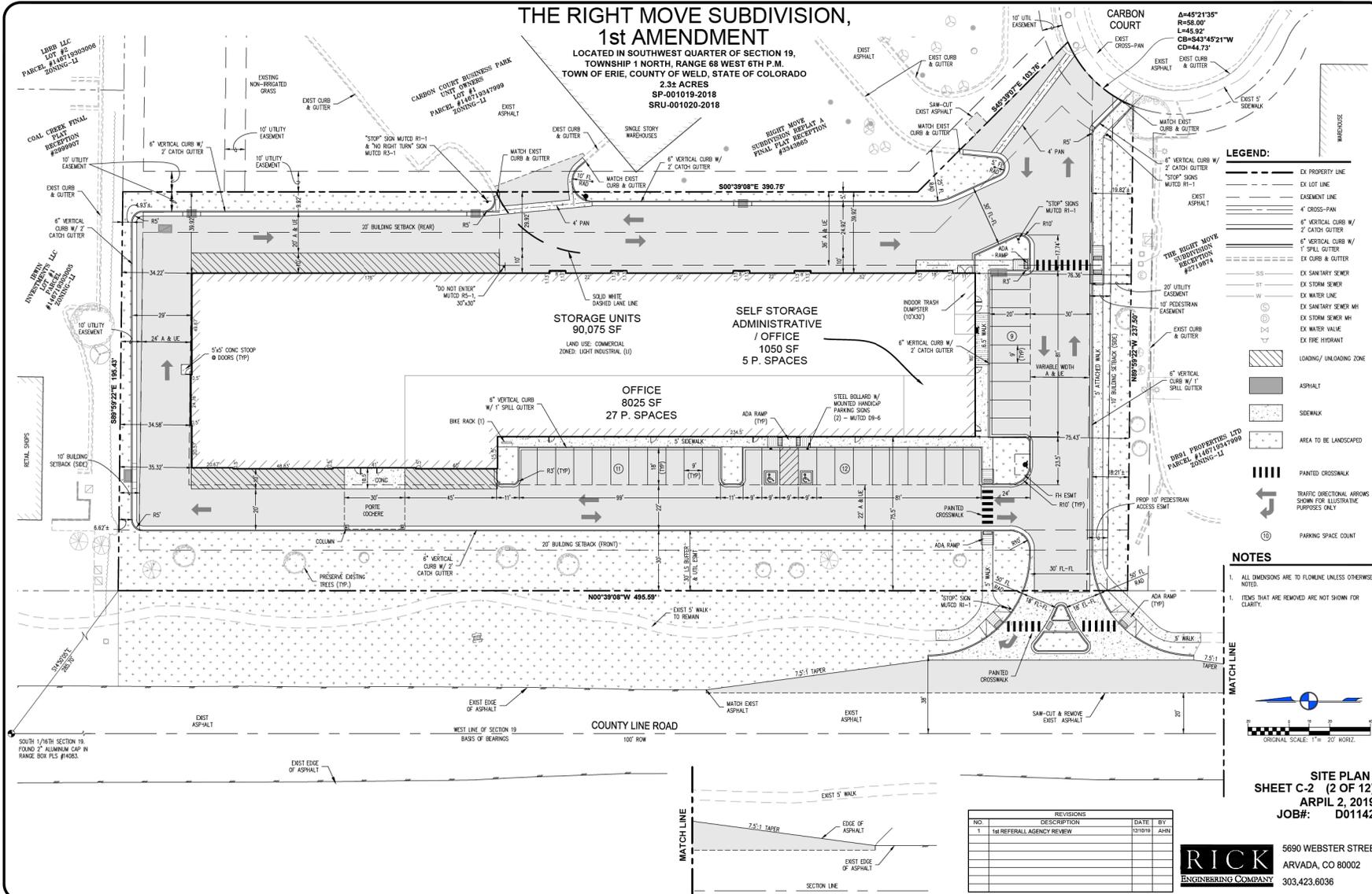


EXHIBIT 1
PROJECT LOCATION MAP

ERIE BUSINESS PARK AND SELF STORAGE FACILITY

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16-APR-2019 13:05

**THE RIGHT MOVE SUBDIVISION,
1st AMENDMENT**
LOCATED IN SOUTHWEST QUARTER OF SECTION 19,
TOWNSHIP 1 NORTH, RANGE 68 WEST 6TH P.M.
COUNTY OF WELD, STATE OF COLORADO
2.32 ACRES
SP-001019-2018
SRU-001020-2018



- LEGEND:**
- EX PROPERTY LINE
 - EX LOT LINE
 - EASEMENT LINE
 - 4" CROSS-PAN
 - 6" VERTICAL CURB W/ 2" CATCH GUTTER
 - 6" VERTICAL CURB W/ 1" SPILL GUTTER
 - EX CURB & GUTTER
 - SS EX SANITARY SEWER
 - ST EX STORM SEWER
 - W EX WATER LINE
 - EX SANITARY SEWER MH
 - EX STORM SEWER MH
 - EX WATER VALVE
 - EX FIRE HYDRANT
 - LOADING/UNLOADING ZONE
 - ASPHALT
 - SIDEWALK
 - AREA TO BE LANDSCAPED
 - PAINTED CROSSWALK
 - TRAFFIC DIRECTIONAL ARROWS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY
 - PARKING SPACE COUNT

- NOTES**
- ALL DIMENSIONS ARE TO FLOWLINE UNLESS OTHERWISE NOTED.
 - ITEMS THAT ARE REMOVED ARE NOT SHOWN FOR CLARITY.
- ORIGINAL SCALE: 1" = 20' HORIZ.

NO.	DESCRIPTION	DATE	BY
1	1st REFERRAL AGENCY REVIEW	12/10/19	AHN

RICK ENGINEERING COMPANY
 5690 WEBSTER STREET
 ARVADA, CO 80002
 303.423.6036

**SITE PLAN
SHEET C-2 (2 OF 12)
APRIL 2, 2019
JOB#: D01142**

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**EXHIBIT 2
SITE PLAN**

ERIE BUSINESS PARK AND SELF STORAGE FACILITY

APPENDIX A

Town of Erie Unified Development Code

TOWN OF ERIE, COLORADO

**UNIFIED
DEVELOPMENT
CODE**

APRIL 2018

TABLE 6.6-2: OFF-STREET PARKING SCHEDULE B	
Activity	Number of Spaces Required
Outdoor sales or display area (3,000 sq. ft. or less)	1 per 750 sq. ft.
Outdoor sales or display area (over 3,000 sq. ft.)	1 per 2,000 sq. ft.
Indoor storage/warehousing/vehicle service/manufacturing area	
1–3,000 sq. ft.	1 per 300 sq. ft.
3,001–5,000 sq. ft.	1 per 650 sq. ft.
5,001–10,000 sq. ft.	1 per 750 sq. ft.
10,001–50,000 sq. ft.	1 per 1,250 sq. ft.
50,001 sq. ft.+	1 per 1,500 sq. ft.

Any development with zoning or development approvals that permit a future change of use that will require additional parking to meet the standards of this Section shall provide an undeveloped area on the site that can accommodate any future parking needs. However, such area for future parking need not be paved or improved, but shall be landscaped as required by this UDC.

3. Parking Requirements for Miscellaneous Uses

Uses that reference this Section have widely varying parking and loading demand characteristics, making it impossible to specify a single off-street parking or loading standard. Upon receiving a development application for a use subject to this Section, the Building Official and the Community Development Director shall apply the off-street parking and loading standard specified for the listed use that is deemed most similar to the proposed use or establish minimum off-street parking requirements on the basis of a parking and loading study prepared by the applicant. Such a study shall include estimates of parking demand based on recommendations of the Institute of Transportation Engineers (ITE), or other acceptable estimates as approved by the Community Development Director, and should include other reliable data collected from uses or combinations of uses that are the same as or comparable with the proposed use. Comparability will be determined by density, scale, bulk, area, type of activity, and location. The study shall document the source of data used to develop the recommendations.

4. Maximum Number of Spaces Permitted

a. General Maximum Requirement

For any use categorized as a “Commercial” or “Industrial” use in Chapter 3, off-street vehicle parking spaces shall not be provided in an amount that is more than 125 percent of the minimum requirements established in Table 6.6-1, *Off-Street Parking Schedule A*. The maximum number of allowable parking spaces may be adjusted by the Community Development Director if the applicant provides written information documenting that the proposed commercial or industrial use would not be economically viable without such adjustment.

b. Exceptions

- i. If application of the maximum parking standard would result in less than 6 parking spaces, the development shall be permitted 6 parking spaces.
- ii. Exceptions to the maximum parking requirement may be permitted in situations that meet the following criteria by the Community Development Director:

APPENDIX B

ITE Parking Generation Manual 5th Edition

Land Use: 151 Mini-Warehouse

Description

A mini-warehouse is a building in which a number of storage units or vaults are rented for the storage of goods. They are typically referred to as “self-storage” facilities. Each unit is physically separated from other units, and access is usually provided through an overhead door or other common access point.

Time of Day Distribution for Parking Demand

The following table presents a time-of-day distribution of parking demand on a weekday (nine study sites) and a Saturday (one study site) in a general urban/suburban setting.

Hour Beginning	Percent of Peak Parking Demand	
	Weekday	Saturday
12:00–4:00 a.m.	0	–
5:00 a.m.	0	–
6:00 a.m.	0	–
7:00 a.m.	0	–
8:00 a.m.	14	–
9:00 a.m.	71	–
10:00 a.m.	50	–
11:00 a.m.	79	–
12:00 p.m.	57	–
1:00 p.m.	64	91
2:00 p.m.	64	27
3:00 p.m.	79	55
4:00 p.m.	71	100
5:00 p.m.	100	91
6:00 p.m.	14	27
7:00 p.m.	0	0
8:00 p.m.	0	–
9:00 p.m.	0	–
10:00 p.m.	0	–
11:00 p.m.	0	–

Additional Data

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in British Columbia (CAN), California, Massachusetts, Minnesota, and Texas.

Source Numbers

37, 314, 415, 556, 562

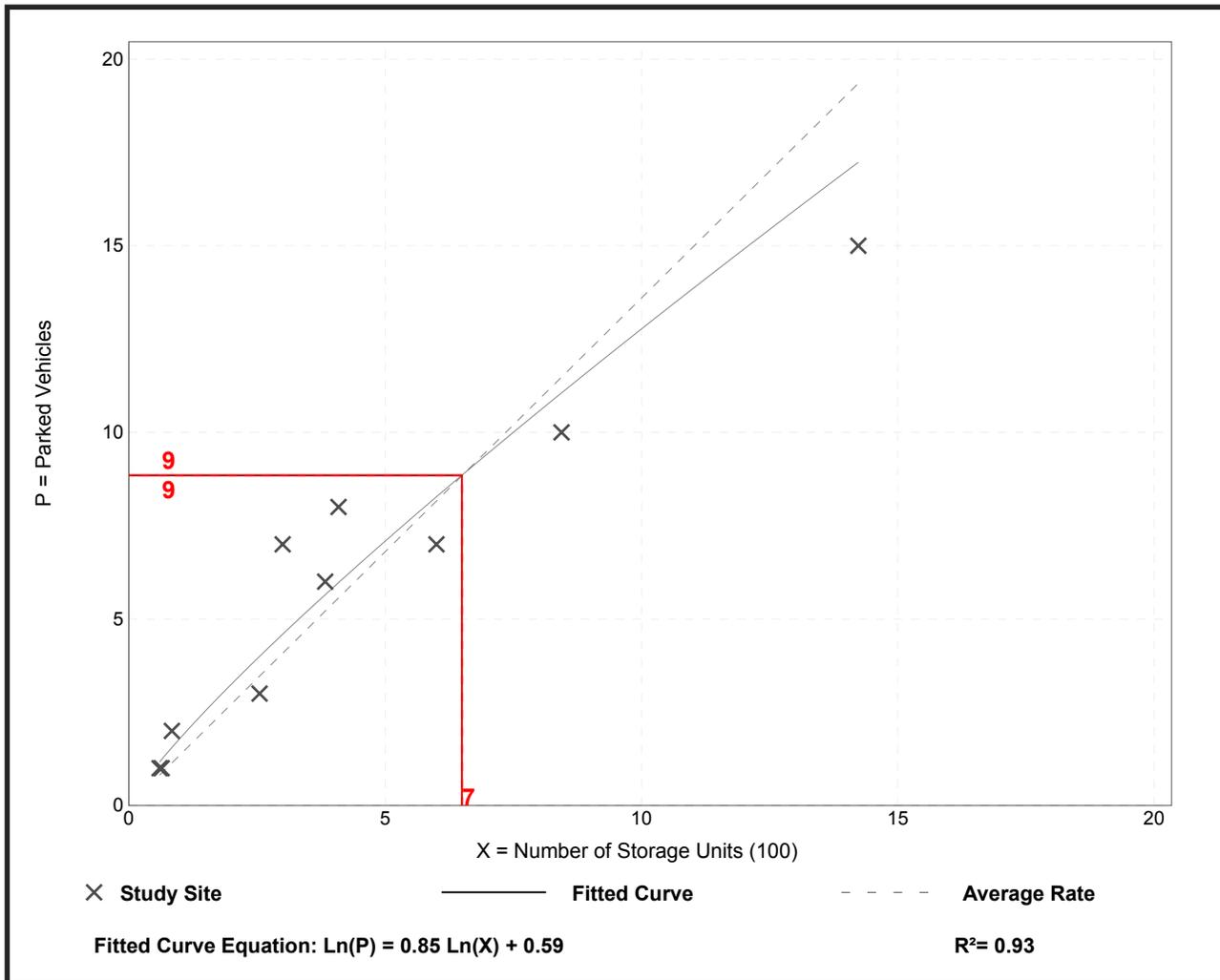
Mini-Warehouse (151)

Peak Period Parking Demand vs: Storage Units (100)
On a: Weekday (Monday - Friday)
Setting/Location: General Urban/Suburban
Peak Period of Parking Demand: 4:00 - 6:00 p.m.
 Number of Studies: 10
 Avg. Num. of Storage Units (100): 4.4

Peak Period Parking Demand per Storage Unit (100)

Average Rate	Range of Rates	33rd / 85th Percentile	95% Confidence Interval	Standard Deviation (Coeff. of Variation)
1.36	1.05 - 2.38	1.18 / 2.35	***	0.43 (32%)

Data Plot and Equation



Land Use: 710 General Office Building

Description

A general office building houses multiple tenants. It is a location where affairs of businesses, commercial or industrial organizations, or professional persons or firms are conducted. An office building or buildings may contain a mixture of tenants including professional services, insurance companies, investment brokers, and tenant services, such as a bank or savings and loan institution, a restaurant, or cafeteria and service retail facilities. A general office building with a gross floor area of 5,000 square feet or less is classified as a small office building (Land Use 712). Corporate headquarters building (Land Use 714), single tenant office building (Land Use 715), medical-dental office building (Land Use 720), office park (Land Use 750), and research and development center (Land Use 760) are additional related uses.

If information is known about individual buildings, it is suggested that the general office building category be used rather than office parks when estimating parking generation for one or more office buildings in a single development. The office park category is more general and should be used when a breakdown of individual or different uses is not known. If the general office building category is used and if additional buildings, such as banks, restaurants, or retail stores are included in the development, the development should be treated as a multiuse project. On the other hand, if the office park category is used, internal trips are already reflected in the data and do not need to be considered.

When the buildings are interrelated (defined by shared parking facilities or the ability to easily walk between buildings) or house one tenant, it is suggested that the total area or employment of all the buildings be used for calculating parking generation. When the individual buildings are isolated and not related to one another, it is suggested that parking generation be calculated for each building separately and then summed.

Time of Day Distribution for Parking Demand

The following table presents a time-of-day distribution of parking demand on a weekday at 30 study sites in a general urban/suburban setting and two study sites in a dense multi-use urban setting.

Hour Beginning	Percent of Weekday Peak Parking Demand	
	General Urban/Suburban	Dense Multi-Use Urban
12:00–4:00 a.m.	–	–
5:00 a.m.	–	–
6:00 a.m.	–	–
7:00 a.m.	13	26
8:00 a.m.	48	65
9:00 a.m.	88	95
10:00 a.m.	100	100
11:00 a.m.	100	100
12:00 p.m.	85	99
1:00 p.m.	84	99
2:00 p.m.	93	97
3:00 p.m.	94	94
4:00 p.m.	85	90
5:00 p.m.	56	–
6:00 p.m.	20	–
7:00 p.m.	11	–
8:00 p.m.	–	–
9:00 p.m.	–	–
10:00 p.m.	–	–
11:00 p.m.	–	–

Additional Data

The average parking supply ratios for the study sites with parking supply information are as follows:

- 2.9 spaces per 1,000 square feet GFA in a dense multi-use urban setting that is not within ½ mile of rail transit (seven sites)
- 3.3 spaces per 1,000 square feet GFA (73 sites) and 1.2 spaces per employee (20 sites) in a general urban/suburban setting that is not within ½ mile of rail transit
- 3.0 spaces per 1,000 square feet GFA (seven sites) and 0.8 spaces per employee (two sites) in a general urban/suburban setting that is within ½ mile of rail transit

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Arizona, California, Colorado, Connecticut, Georgia, Illinois, Massachusetts, Minnesota, Montana, New Jersey, New York, Oklahoma, Oregon, Pennsylvania, Texas, Utah, and Washington.

Source Numbers

21, 22, 47, 122, 124, 142, 172, 201, 202, 205, 211, 215, 216, 217, 227, 239, 241, 243, 276, 295, 399, 400, 425, 431, 433, 436, 438, 440, 516, 531, 540, 551, 555, 556, 557, 571, 572, 588

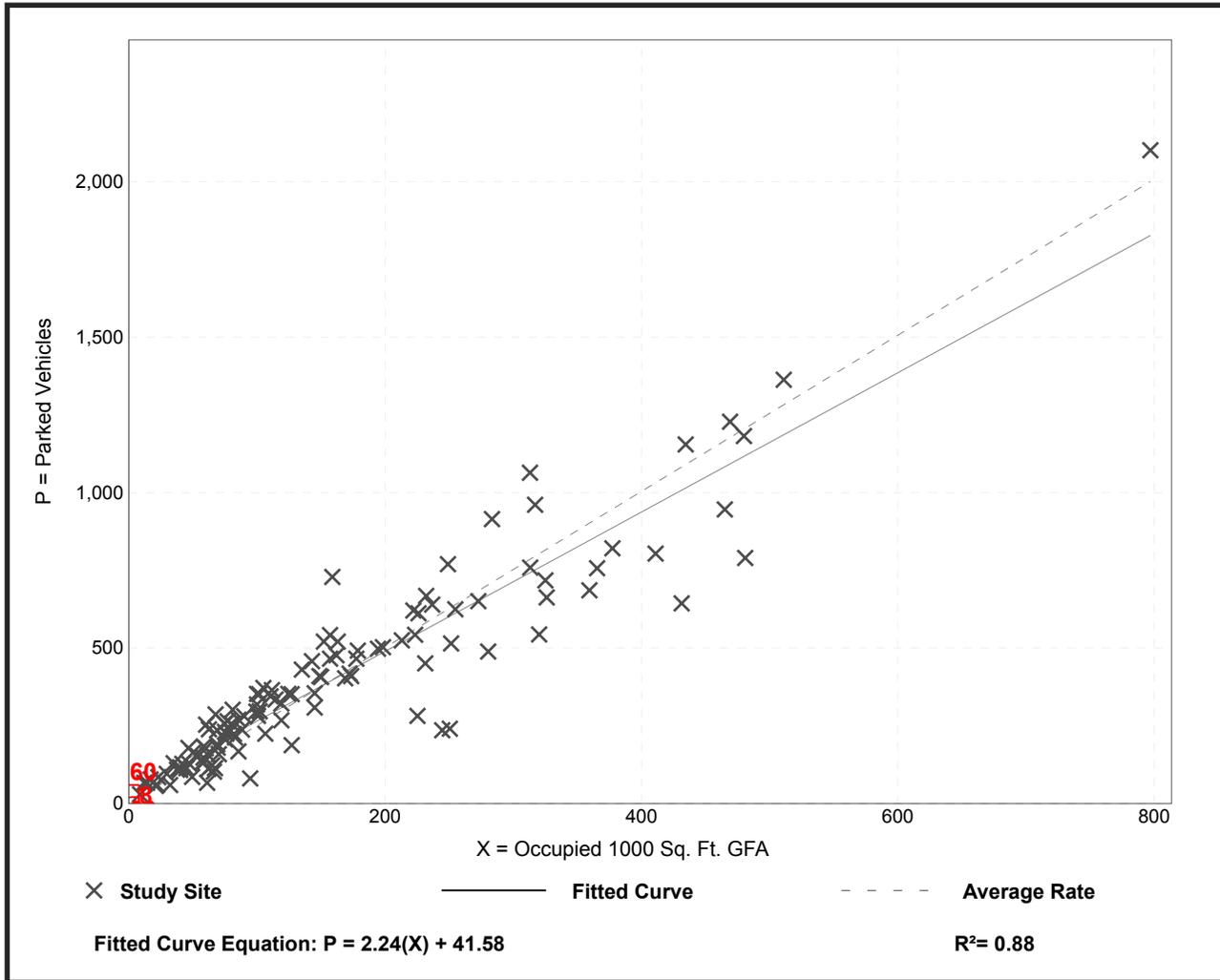
General Office Building (710)

Peak Period Parking Demand vs: Occupied 1000 Sq. Ft. GFA
On a: Weekday (Monday - Friday)
Setting/Location: General Urban/Suburban
Peak Period of Parking Demand: 9:00 a.m. - 3:00 p.m.
 Number of Studies: 124
 Avg. Occupied 1000 Sq. Ft. GFA: 156

Peak Period Parking Demand per Occupied 1000 Sq. Ft. GFA

Average Rate	Range of Rates	33rd / 85th Percentile	95% Confidence Interval	Standard Deviation (Coeff. of Variation)
2.51	0.86 - 5.58	2.46 / 3.42	2.39 - 2.63	0.66 (26%)

Data Plot and Equation



APPENDIX C

City of Boulder Municipal Code

Self-service storage facility	3 spaces for visitor parking, plus parking for any floor area used as office space or otherwise not used for self-service storage shall be provided consistent with Table 9-3.
Airport and aircraft hangers	1 space per outside airplane or glider tie down space;
	1 space per 1,000 square feet of floor area of private airplane hangar space (with or without external or internal walls);
	1 space per 2,000 square feet of floor area of commercial or executive airplane hangar space; and
	Parking for floor area used as office space or otherwise not used for airport hanger shall be provided consistent with the requirements of Table 9-3.

(c) General Parking Requirements:

- (1) Rounding Rule: For all motor vehicle and bicycle parking space requirements resulting in a fraction, the fraction shall be:
 - (A) Rounded to the next higher whole number when the required number of spaces is five or less;
 - (B) Rounded to the next lower whole number when the required number of spaces is more than five.
- (2) Parking Requirements for Lots in Two or More Zoning Districts: For lots that have more than one zoning designation, the required motor vehicle and bicycle parking for the use(s) on the lot may be provided on any portion of the lot, subject to the provisions of this title.

(d) Motor Vehicle Parking Design Standards:

- (1) Location of Open or Enclosed Parking: Open or enclosed parking areas are subject to the following requirements:
 - (A) No parking areas shall be located in any required landscaped setback abutting a street. However, in RR, RE, or RL zoning districts, if all off-street parking requirements of this chapter have been met, persons may park up to two additional vehicles in the driveway leading to the parking area. The requirements of this subsection may be varied to allow the required off-street parking to be located within the front yard setback pursuant to a variance being approved by the BOZA per Subsection 9-2-3(j), B.R.C. 1981.
 - (B) Required parking areas shall be located on the lot or parcel containing the use for which they are required.
 - (C) No parking areas shall be located closer than ten feet from a side yard adjacent to a public street in the BMS and MU-2 zoning districts.
- (2) Parking Stall Design Standards: Parking stalls shall meet the following standards, based on stall type. The minimum maneuvering area to the rear of any parking stall shall be no less than twenty-four feet except as specified in Table 9-5 below for parking at an angle other than the 90 degree category. If the proposed use anticipates long-term parking as the major parking demand, the city manager may reduce those minimum parking stall sizes.

TABLE 9-5: STANDARD PARKING DIMENSION STANDARDS

**GEOTECHNICAL SUBSURFACE EXPLORATION REPORT
PROPOSED 3-STORY SELF-STORAGE FACILITY
1012 CARBON COURT
ERIE, COLORADO
EEC PROJECT NO. 1182068**

Prepared for:

GYS Development, LLC
791 Copper Center Parkway
Colorado Springs, Colorado 80921

Attn: Mr. Tony Ollila (tony@growyourstorage.com)

Prepared by:

Earth Engineering Consultants, LLC
4396 Greenfield Drive
Windsor, Colorado 80550





September 27, 2018

GYS Development, LLC
791 Copper Center Parkway
Colorado Springs, Colorado 80921

Attn: Mr. Tony Ollila (tony@growyourstorage.com)

Re: Geotechnical Subsurface Exploration Report
Proposed 3-Story Erie Self-Storage Facility
1012 Carbon Court
Erie, Colorado
EEC Project No. 1182068

Mr. Ollila:

Enclosed, herewith, are the results of the subsurface exploration completed by Earth Engineering Consultants, LLC (EEC) for the referenced project. For this exploration, seven (7) soil borings were extended to depths of approximately 10 to 35 feet below existing site grades. This subsurface exploration was carried out in general accordance with our proposal dated June 29, 2018.

In summary, the subsurface conditions encountered beneath the surficial vegetation/topsoil layer in the test borings, generally consisted of lean clay with varying amounts of sand and/or clayey sand extending to the depths explored in a majority of the borings approximately 10 to 35 feet below the ground surface. The lean clay and/or clayey sand subsoils were generally moist in situ, stiff to very stiff/medium dense, and exhibited low to moderate swell potential at current moisture and density conditions. Interbedded claystone/siltstone/sandstone bedrock was encountered at a depth of approximately 28 feet in boring B-3 and extended to the depths explored, approximately 35 feet below the existing ground surface. The bedrock was generally weathered near surface and became hard with depth. Groundwater was encountered in the borings at depths of approximately 24 to 26½ feet below the ground surface.

Based on the encountered subsurface conditions, in our opinion, the proposed building could be supported on conventional spread footings bearing on approved native soils or on a zone of properly placed and compacted fill. Floor slabs, flatwork, and pavements could also be

EEC Project No. 1182068
September 27, 2018
Page 2

supported on a zone of prepared fill materials provided the recommendations as presented in the attached report are adhered to. Geotechnical recommendations concerning design and construction of the proposed site improvements are provided within the attached report.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the enclosed report, or if we can be of further service to you in any other way, please do not hesitate to contact us.

Very truly yours,
Earth Engineering Consultants, LLC



Erin Dunn, E.I.T.
Project Engineer

Reviewed by:



David A. Richer, P.E.
Senior Project Engineer

**GEOTECHNICAL SUBSURFACE EXPLORATION REPORT
PROPOSED 3-STORY SELF-STORAGE FACILITY
1012 CARBON COURT
ERIE, COLORADO
EEC PROJECT NO. 1182068**

September 27, 2018

INTRODUCTION

The geotechnical subsurface exploration for the proposed 3-story self-storage facility at 1012 Carbon Court in Erie, Colorado has been completed. To develop subsurface information in the proposed development area, seven (7) soil borings were drilled within the proposed building envelope and pavement areas to depths of approximately 10 to 35 feet below existing site grades. A site diagram indicating the approximate boring locations is included with this report.

We understand the proposed development will consist of a new approximate 32,480 square foot in plan-line dimension 3-story self-storage building and associated on-site pavement improvements. Various drives and parking areas are planned for construction encircling the proposed building. We anticipate maximum foundation loads will be relatively light to moderate with maximum wall and column loads less than 4 klf and 250 kips, respectively. Floor loads are expected to be light to moderate. We anticipate roadways/pavements would be utilized by low volumes of light duty traffic with areas designated for low volumes of heavier duty traffic. Small grade changes are expected to develop site grades for the proposed improvements.

The purpose of this report is to describe the subsurface conditions encountered in the test borings, analyze and evaluate the field and laboratory test data and provide geotechnical recommendations concerning design and construction of foundations and floor slabs and support of flatwork and pavements. Recommended pavement sections are also included.

EXPLORATION AND TESTING PROCEDURES

The test boring locations were selected and established in the field by EEC personnel by pacing and estimating angles from identifiable site features. The approximate locations of the borings are shown on the attached boring location diagram. The boring locations should be considered accurate only to the degree implied by the methods used to make the field measurements.

The test borings were advanced using a truck mounted, CME-55 drill rig equipped with a hydraulic head employed in drilling and sampling operations. The boreholes were advanced using 4-inch nominal diameter continuous flight augers. Samples of the subsurface materials encountered were obtained using split-barrel and California barrel sampling procedures in general accordance with ASTM Specifications D1586 and D3550, respectively.

In the split-barrel and California barrel sampling procedures, standard sampling spoons are advanced into the ground by means of a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the split-barrel and California barrel samplers is recorded and is used to estimate the in-situ relative density of cohesionless soils and, to a lesser degree of accuracy, the consistency of cohesive soils. In the California barrel sampling procedure, relatively intact samples are obtained in removable brass liners. All samples obtained in the field were sealed and returned to our laboratory for further examination, classification and testing.

Laboratory moisture content tests were completed on each of the recovered samples with unconfined compressive strength of appropriate samples estimated using a calibrated hand penetrometer. Atterberg limits and washed sieve analysis tests were completed on select samples to evaluate the quantity and plasticity of fines in the subgrades. Swell/consolidation testing was completed on select samples to evaluate the potential for the subgrade materials to change volume with variation in moisture content and load. Soluble sulfate tests were completed on selected samples to estimate the potential for sulfate attack on site cast concrete. Results of the outlined tests are indicated on the attached boring logs and summary sheets.

As part of the testing program, all samples were examined in the laboratory and classified in general accordance with the attached General Notes and the Unified Soil Classification System, based on the soil's texture and plasticity. The estimated group symbol for the Unified Soil Classification System is indicated on the boring logs and a brief description of that classification system is included with this report.

SITE AND SUBSURFACE CONDITIONS

The proposed 3-story self-storage facility is planned for construction at 1012 Carbon Court in Erie, Colorado. The lot is currently undeveloped with vegetation and topsoil at the surface and an

existing pavement drive on the east side of the site. Ground surface in this area is relatively flat. It should be noted that this parcel is in close proximity to previously known mining activities, as indicated on the enclosed mining site diagram figure for your reference.

EEC field personnel were on site during drilling operations to evaluate the subsurface conditions encountered and direct the drilling activities. Field logs prepared by EEC site personnel were based on visual and tactual observation of disturbed samples and auger cuttings. The final boring logs included with this report may contain modifications to the field logs based on results of laboratory testing and evaluation. Based on results of the field borings and laboratory testing, subsurface conditions can be generalized as follows.

From the ground surface, the subgrades underlying the surficial topsoil and vegetation consisted of lean clay with varying amount of sand/clayey sand extending to the depths explored in a majority of the borings approximately 10 to 35 feet below the ground surface. The lean clay/clayey sand was generally moist in situ, stiff to very stiff/medium dense, and exhibited low to moderate swell potential at current moisture and density conditions. Interbedded claystone/siltstone/sandstone bedrock was encountered at a depth of approximately 28 feet in boring B-3 and extended to the depths explored, approximately 35 feet below the existing ground surface. The bedrock was generally weathered near surface and became hard with depth.

The stratification boundaries indicated on the boring logs represent the approximate location of changes in soil types; in-situ, the transition of materials may be gradual and indistinct.

GROUNDWATER CONDITIONS

Observations were made while drilling and after completion of the borings to detect the presence and depth to hydrostatic groundwater. At the time of drilling and directly after, groundwater was observed at depths of approximately 24 to 26½ feet below the ground surface. The borings were backfilled upon completion of the drilling operations; therefore, subsequent groundwater measurements were not performed.

Fluctuations in groundwater levels can occur over time depending on variations in hydrologic conditions and other conditions not apparent at the time of this report. Longer term monitoring of

water levels in cased wells, which are sealed from the influence of surface water, would be required to more accurately evaluate fluctuations in groundwater levels at the site. We have typically noted deepest groundwater levels in late winter and shallowest groundwater levels in mid to late summer.

ANALYSIS AND RECOMMENDATIONS

Swell – Consolidation Test Results

The swell-consolidation test is performed to evaluate the swell or collapse potential of soils to help determine foundation, floor slab and pavement design criteria. In this test, relatively undisturbed samples obtained directly from the California sampler are placed in a laboratory apparatus and inundated with water under a predetermined load. The swell-index is the resulting amount of swell or collapse after the inundation period expressed as a percent of the sample's preload/initial thickness. After the inundation period, additional incremental loads are applied to evaluate the swell pressure and/or consolidation.

For this assessment, we conducted eight (8) swell-consolidation tests on relatively undisturbed soil samples obtained at various intervals/depths on the site. The swell index values for the in-situ soil samples analyzed revealed low to moderate swell characteristics as indicated on the attached swell test summaries. The (+) test results indicate the soil materials swell potential characteristics while the (-) test results indicate the soils materials collapse/consolidation potential characteristics when inundated with water. The following table summarizes the swell-consolidation laboratory test results for samples obtained during our field explorations for the subject site.

Table I – Laboratory Swell-Consolidation Test Results (Overall 20 Samples)								
No of Samples Tested	Pre-Load / Inundation Pressure, PSF	Description of Material	In-Situ Characteristics				Range of Swell – Index Test Results	
			Range of Moisture Contents, %		Range of Dry Densities, PCF		Low End (+/-) %	High End (+/-) %
			Low End, %	High End, %	Low End, PCF	High End, PCF		
2	150	Clayey Sand/Lean Clay	6.5	10.0	111.8	129.0	(+) 2.7	(+) 5.3
5	500	Clayey Sand/Lean Clay	4.6	12.3	100.9	122.5	(-) 1.7	(+) 2.9

Colorado Association of Geotechnical Engineers (CAGE) uses the following information to provide uniformity in terminology between geotechnical engineers to provide a relative correlation of slab

performance risk to measured swell. “The representative percent swell values are not necessarily measured values; rather, they are a judgment of the swell of the soil and/or bedrock profile likely to influence slab performance.” Geotechnical engineers use this information to also evaluate the swell potential risks for foundation performance based on the risk categories.

Table II - Recommended Representative Swell Potential Descriptions and Corresponding Slab Performance Risk Categories		
Slab Performance Risk Category	Representative Percent Swell (500 psf Surcharge)	Representative Percent Swell (1000 psf Surcharge)
Low	0 to < 3	0 < 2
Moderate	3 to < 5	2 to < 4
High	5 to < 8	4 to < 6
Very High	> 8	> 6

Based on the laboratory test results, the in-situ samples analyzed for this project were within the low to moderate range.

Site Preparation

Prior to placement of any fill and/or improvements, we recommend any existing topsoil, vegetation, and undocumented fill, and any unsuitable materials be removed from the planned development areas. Due to the low to moderate swell potential of the near surface lean clay soils, we recommend the lean clay soils be over excavated to a minimum depth of 2 feet below pavements, exterior flatwork, and floor slabs. In our opinion, spread footing foundations could be supported on approved native subsoils bearing at depths of at least 2½ feet below existing site grades. The recommended 2-foot over excavation should extend 8 inches laterally for every 12 inches of over excavation depth.

After removal of all topsoil, vegetation, and removal of unacceptable or unsuitable subsoils and prior to placement of fill, the exposed soils should be scarified to a depth of 9 inches, adjusted in moisture content to within $\pm 2\%$ of standard Proctor optimum moisture content and compacted to at least 95% of the material's standard Proctor maximum dry density as determined in accordance with ASTM Specification D698.

Fill materials to develop the subgrades should consist of approved, low-volume-change materials, which are free from organic matter and debris. It is our opinion either granular structural fill or on-site cohesive soils could be used as fill in these areas, provided adequate moisture treatment and compaction procedures are followed. The imported granular materials should be graded similarly to a CDOT Class 5, 6 or 7 aggregate base. Fill materials should be placed in loose lifts not to exceed 9 inches thick, adjusted in moisture content to within $\pm 2\%$ of standard Proctor optimum moisture content and compacted to at least 95% of the material's standard Proctor maximum dry density as determined in accordance with ASTM Specification D698. If the site lean clay with sand soils are used as fill material, care will be needed to maintain the recommended moisture content prior to and during construction of overlying improvements.

Care should be exercised after preparation of the subgrades to avoid disturbing the subgrade materials. Materials which are loosened or disturbed should be reworked prior to placement of foundations/flatwork.

Footing Foundations

Based on materials observed from the test boring locations, it is our opinion that the proposed structure could be supported on conventional footing foundations bearing on approved native undisturbed lean clay soils or properly placed and compacted fill material prepared as recommended in the section *Site Preparation*. For design of footing foundations bearing on properly prepared native subgrades, we recommend using a net allowable total load soil bearing pressure not to exceed 2,500 psf. In addition, where practical, the footings should be sized to maintain a minimum dead-load pressure of 500 psf. The design bearing pressure applies to dead loads plus 1/2 of design live load conditions.

In order to maintain the minimum dead-load pressure, it may be necessary to design and construct a system of grade beams and isolated footing pads. To maintain the minimum dead-load pressure on footings, a minimum 4-inch void space could be provided beneath the grade beams between footing pads (if utilized).

The net bearing pressure refers to the pressure at foundation bearing level in excess of the minimum surrounding overburden pressure. All footings should bear on a uniform, consistent zone to minimize the potential for differential movement of dissimilar material.

Exterior foundations and foundations in unheated areas should be located a minimum of 30 inches below adjacent exterior grade to provide frost protection. We recommend formed continuous footings have a minimum width of 12 inches and isolated column foundations have a minimum width of 24 inches. Trenched foundations should not be used.

No unusual problems are anticipated in completing the excavations required for construction of the footing foundations. Care should be taken during construction to avoid disturbing the foundation bearing materials. Materials which are loosened or disturbed by the construction activities or materials which become dry and desiccated or wet and softened should be removed and replaced prior to placement of foundation concrete.

We estimate the long-term settlement of footing foundations designed and constructed as outlined above would be 1 inch or less.

Floor Slabs and Exterior Flatwork

Subgrades for floor slabs, flatwork and site pavements should be prepared as outlined in the section *Site Preparation*. For structural design of concrete slabs-on-grade, a modulus of subgrade reaction of 150 pounds per cubic inch (pci) could be used for floors supported on 2 feet of approved fill materials.

Additional floor slab design and construction recommendations are as follows:

- Interior partition walls should be separated/floated from floor slabs to allow for independent movement.
- Positive separations and/or isolation joints should be provided between slabs and all foundations, columns, and utility lines to allow for independent movement.
- Control joints should be provided in slabs to control the location and extent of cracking.

- Interior trench backfill placed beneath slabs should be compacted in a similar manner as previously described for imported structural fill material.
- Floor slabs should not be constructed on frozen subgrade.
- Other design and construction considerations as outlined in the ACI Design Manual should be followed.

For interior floor slabs, depending on the type of floor covering and adhesive used, those material manufacturers may require that specific subgrade, capillary break, and/or vapor barrier requirements be met. The project architect and/or material manufacturers should be consulted with for specific under slab requirements.

Care should be exercised after development of the floor slab and exterior flatwork subgrades to prevent disturbance of the in-place materials. Subgrade soils which are loosened or disturbed by construction activities or soils which become wet and softened or dry and desiccated should be removed and replaced or reworked in place prior to placement of the overlying slabs.

Seismic

The site soil conditions generally consist of lean clay/clayey sand which extended to the underlying bedrock at a depth of 28 feet in boring B-3. For those site conditions, the International Building Codes indicates a Seismic Site Classification of D. Drilling to a greater depth could reveal a different site classification.

Pavements

Pavement subgrades should be prepared as outlined in the section *Site Preparation*. We anticipate the site pavements would include areas designated for low volumes of light weight automobiles (light duty) and areas of higher volumes of light weight automobiles and low volumes of trucks (heavy duty). An equivalent daily load application (EDLA) value of 7 was assumed for light duty areas, and an EDLA of 15 was assumed for heavy duty areas.

Proofrolling and recompacting the subgrade is recommended immediately prior to placement of the aggregate road base section. Soft or weak areas delineated by the proofrolling operations should be

undercut or stabilized in-place to achieve the appropriate subgrade support. Based on the subsurface conditions encountered at the site, an assumed R-value of 10 was used in design of the pavement sections.

Recommended minimum pavement sections are provided below in Table III. HBP sections may show rutting/distress in truck loading and drive areas; therefore, concrete pavements should be considered in these areas. The recommended pavement sections are considered minimum; thus, periodic maintenance should be expected.

Table III - Recommended Minimum Pavement Sections		
	Automobile Parking	Heavy Duty Areas
18-kip EDLA	7	15
18-kip ESAL's	51,100	109,500
Reliability	75%	85%
Resilient Modulus (R = 10)	3562 psi	3562 psi
PSI Loss	2.5	2.2
Design Structure Number	2.47	2.96
(A) Composite		
Hot Bituminous Pavement	4"	5"
Aggregate Base	7"	7"
(Design Structural Number)	(2.53)	(2.97)
(B) Composite with Fly Ash Treated Subgrade		
Hot Bituminous Pavement	3-1/2"	4"
Aggregate Base	6"	6"
Fly Ash Treated Subgrade	12"	12"
(Design Structure Number)	(2.80)	(3.02)
(C) PCC (Non-reinforced)	5-1/2"	6-1/2"

We recommend aggregate base meet a CDOT Class 5 or Class 6 aggregate base. Aggregate base should be adjusted in moisture content and compacted to achieve a minimum of 95% of standard Proctor maximum dry density.

HBP should be graded as SX or S and be prepared with 75 gyrations using a Superpave gyratory compactor in accordance with CDOT standards. The HBP should consist of PG 58-28 asphalt binder. HBP should be compacted to achieve 92 to 96% of the mix's theoretical maximum specific gravity (Rice Value).

Portland cement concrete should be an approved exterior pavement mix with a minimum 28-day compressive strength of 4,500 psi and should be air entrained. Wire mesh or fiber could be considered to reduce shrinkage cracking.

Longitudinal and transverse joints should be provided as needed in concrete pavements for expansion/contraction and isolation. The location and extent of joints should be based upon the final pavement geometry. Sawed joints should be cut in general accordance with ACI recommendations. All joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.

Water Soluble Sulfates – (SO₄)

The water-soluble sulfate (SO₄) content of the on-site overburden subsoils, taken during our subsurface exploration at random locations and intervals are provided below. Based on reported sulfate content test results, the Class/severity of sulfate exposure for concrete in contact with the on-site subsoils is provided in this report.

Sample Location	Description	Soluble Sulfate Content (mg/kg)	Soluble Sulfate Content (%)
B-1, S-2, at 4'	Lean Clay with Sand (CL)	200	0.02
B-3, S-1, at 4'	Clayey Sand (SC)	110	0.01
B-7, S-1, at 2'	Lean Clay with Sand (CL)	180	0.02

Based on the results as presented above, ACI 318, Section 4.2 indicates the site soils have a low risk of sulfate attack on Portland cement concrete, therefore, ACI Class 0 requirements should be followed. Foundation concrete should be designed in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 4.

Other Considerations

Positive drainage should be developed away from the structures and pavement areas with a minimum slope of 1 inch per foot for the first 10 feet away from the improvements in landscape areas. Care should be taken in planning of landscaping (if required) adjacent to the building to avoid features which would pond water adjacent to the foundations or stemwalls. Placement of plants which require irrigation systems or could result in fluctuations of the moisture content of the subgrade material should be avoided adjacent to site improvements. Irrigation systems should not be placed within 5 feet of the perimeter of the building and parking areas. Spray heads should be

designed not to spray water on or immediately adjacent to the structures or site pavements. Roof drains should be designed to discharge at least 5 feet away from the structure and away from the pavement areas.

Excavations into the on-site lean clay soils can be expected to stand on relatively steep, temporary slopes during construction. The individual contractor(s) should be made responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom. All excavations should be sloped or shored in the interest of safety following local and federal regulations, including current OSHA excavation and trench safety standards.

GENERAL COMMENTS

The analysis and recommendations presented in this report are based upon the data obtained from the soil borings performed at the indicated locations and from any other information discussed in this report. This report does not reflect any variations, which may occur between borings or across the site. The nature and extent of such variations may not become evident until construction. If variations appear evident, it will be necessary to re-evaluate the recommendations of this report.

It is recommended that the geotechnical engineer be retained to review the plans and specifications, so comments can be made regarding the interpretation and implementation of our geotechnical recommendations in the design and specifications. It is further recommended that the geotechnical engineer be retained for testing and observations during earthwork phases to help determine that the design requirements are fulfilled.

This report has been prepared for the exclusive use of GYS Development, LLC for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranty, express or implied, is made. In the event that any changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and the conclusions of this report are modified or verified in writing by the geotechnical engineer.

DRILLING AND EXPLORATION

DRILLING & SAMPLING SYMBOLS:

SS: Split Spoon - 13/8" I.D., 2" O.D., unless otherwise noted
 ST: Thin-Walled Tube - 2" O.D., unless otherwise noted
 R: Ring Barrel Sampler - 2.42" I.D., 3" O.D. unless otherwise noted
 PA: Power Auger
 HA: Hand Auger
 DB: Diamond Bit = 4", N, B
 AS: Auger Sample
 HS: Hollow Stem Auger

PS: Piston Sample
 WS: Wash Sample
 FT: Fish Tail Bit
 RB: Rock Bit
 BS: Bulk Sample
 PM: Pressure Meter
 WB: Wash Bore

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL : Water Level
 WCI: Wet Cave in
 DCI: Dry Cave in
 AB : After Boring

WS : While Sampling
 WD : While Drilling
 BCR: Before Casing Removal
 ACR: After Casting Removal

Water levels indicated on the boring logs are the levels measured in the borings at the time indicated. In pervious soils, the indicated levels may reflect the location of ground water. In low permeability soils, the accurate determination of ground water levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION

Soil Classification is based on the Unified Soil Classification system and the ASTM Designations D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as : clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Consistency
< 500	Very Soft
500 - 1,000	Soft
1,001 - 2,000	Medium
2,001 - 4,000	Stiff
4,001 - 8,000	Very Stiff
8,001 - 16,000	Very Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS:

N-Blows/ft	Relative Density
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50-80	Very Dense
80 +	Extremely Dense

PHYSICAL PROPERTIES OF BEDROCK

DEGREE OF WEATHERING:

Slight	Slight decomposition of parent material on joints. May be color change.
Moderate	Some decomposition and color change throughout.
High	Rock highly decomposed, may be extremely broken.

HARDNESS AND DEGREE OF CEMENTATION:

Limestone and Dolomite:

Hard	Difficult to scratch with knife.
Moderately	Can be scratched easily with knife.
Hard	Cannot be scratched with fingernail.
Soft	Can be scratched with fingernail.
<u>Shale, Siltstone and Claystone:</u>	
Hard	Can be scratched easily with knife, cannot be scratched with fingernail.
Moderately	Can be scratched with fingernail.
Hard	
Soft	Can be easily dented but not molded with fingers.

Sandstone and Conglomerate:

Well Cemented	Capable of scratching a knife blade.
Cemented	
Cemented	Can be scratched with knife.
Poorly Cemented	Can be broken apart easily with fingers.



UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests				Soil Classification			
				Group Symbol	Group Name		
Coarse - Grained Soils more than 50% retained on No. 200 sieve	Gravels more than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines	$Cu \geq 4$ and $1 < Cc \leq 3^E$	GW	Well-graded gravel ^F		
			$Cu < 4$ and/or $1 > Cc > 3^E$	GP	Poorly-graded gravel ^F		
	Sands 50% or more coarse fraction passes No. 4 sieve	Gravels with Fines more than 12% fines	Fines classify as ML or MH		GM	Silty gravel ^{G,H}	
			Fines Classify as CL or CH		GC	Clayey Gravel ^{F,G,H}	
		Clean Sands Less than 5% fines	$Cu \geq 6$ and $1 < Cc \leq 3^E$		SW	Well-graded sand ^I	
			$Cu < 6$ and/or $1 > Cc > 3^E$		SP	Poorly-graded sand ^I	
Sands with Fines more than 12% fines	Fines classify as ML or MH		SM	Silty sand ^{G,H,I}			
	Fines classify as CL or CH		SC	Clayey sand ^{G,H,I}			
Fine-Grained Soils 50% or more passes the No. 200 sieve	Sils and Clays Liquid Limit less than 50	inorganic	$PI > 7$ and plots on or above "A" Line	CL	Lean clay ^{K,L,M}		
			$PI < 4$ or plots below "A" Line	ML	Silt ^{K,L,M}		
		organic	Liquid Limit - oven dried	<0.75	OL	Organic clay ^{K,L,M,N}	
			Liquid Limit - not dried			Organic silt ^{K,L,M,O}	
	Sils and Clays Liquid Limit 50 or more	inorganic	PI plots on or above "A" Line	CH	Fat clay ^{K,L,M}		
			PI plots below "A" Line	MH	Elastic Silt ^{K,L,M}		
		organic	Liquid Limit - oven dried	<0.75	OH	Organic clay ^{K,L,M,P}	
			Liquid Limit - not dried			Organic silt ^{K,L,M,O}	
			Highly organic soils		Primarily organic matter, dark in color, and organic odor	PT	Peat

^ABased on the material passing the 3-in. (75-mm) sieve

^BIf field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^CGravels with 5 to 12% fines required dual symbols:
 GW-GM well graded gravel with silt
 GW-GC well-graded gravel with clay
 GP-GM poorly-graded gravel with silt
 GP-GC poorly-graded gravel with clay

^DSands with 5 to 12% fines require dual symbols:
 SW-SM well-graded sand with silt
 SW-SC well-graded sand with clay
 SP-SM poorly graded sand with silt
 SP-SC poorly graded sand with clay

$$^E C_u = D_{60} / D_{10} \quad C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^FIf soil contains $\geq 15\%$ sand, add "with sand" to

^GIf fines classify as CL-ML, use dual symbol GC-CM, or SC-SM.

^HIf fines are organic, add "with organic fines" to group name

^IIf soil contains $> 15\%$ gravel, add "with gravel" to group name

^JIf Atterberg limits plots shaded area, soil is a CL-ML, Silty clay

^KIf soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel", whichever is predominant.

^LIf soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

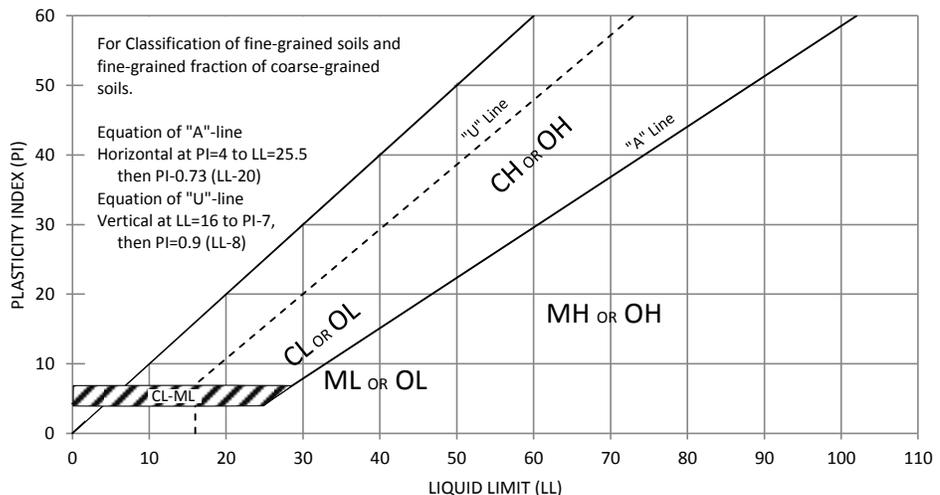
^MIf soil contains $\geq 30\%$ plus No. 200 predominantly gravel, add "gravelly" to group name.

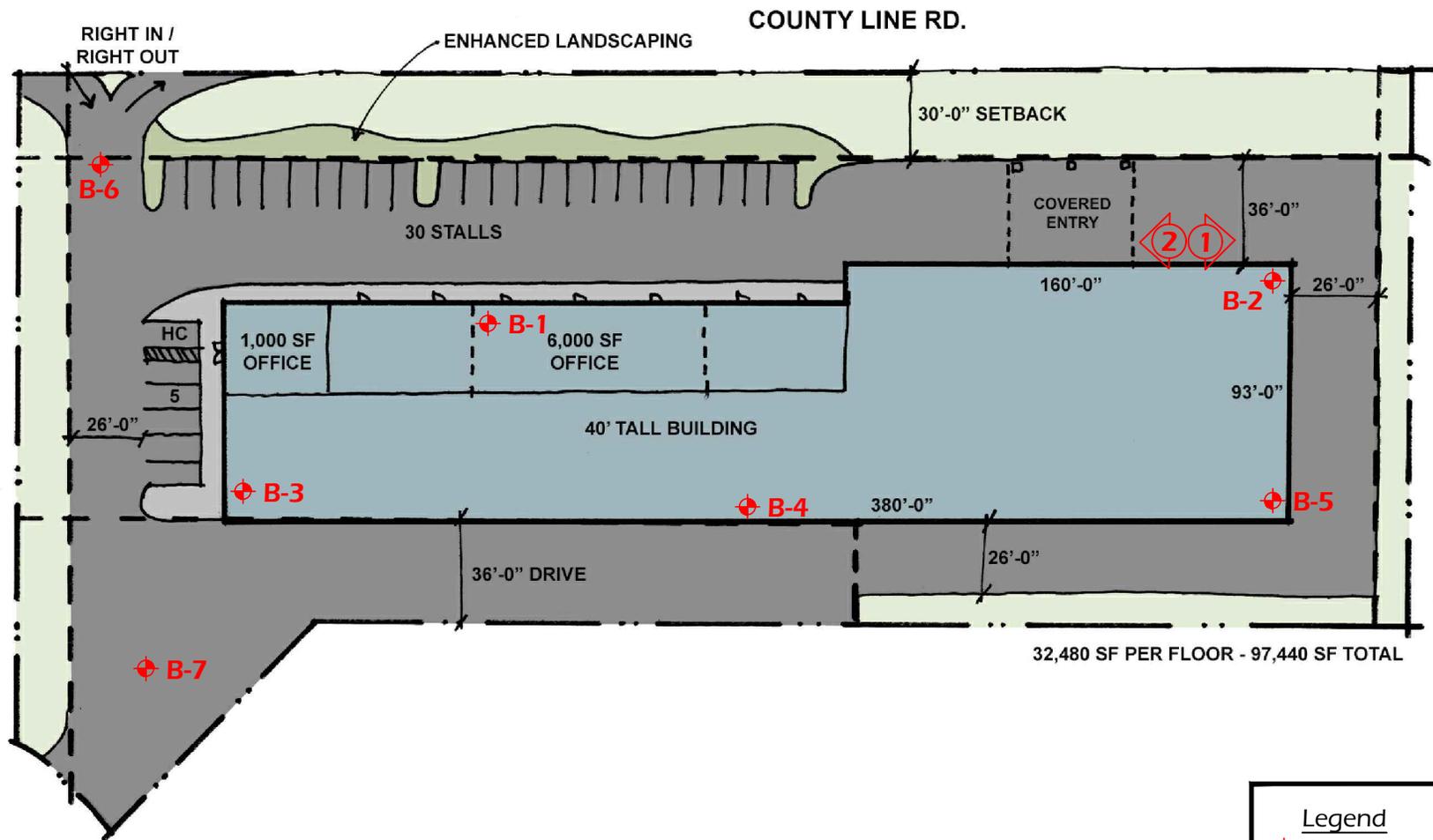
^N $PI \geq 4$ and plots on or above "A" line.

^O $PI \leq 4$ or plots below "A" line.

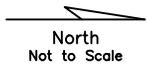
^P PI plots on or above "A" line.

^Q PI plots below "A" line.





- Legend**
- Approximate Boring Locations
 - Site Photos
(Photos taken in approximate location, in direction of arrow)



Boring Location Diagram
 Grow Your Storage - Erie, Colorado
 EEC Project Number: 1182068
 September 2018



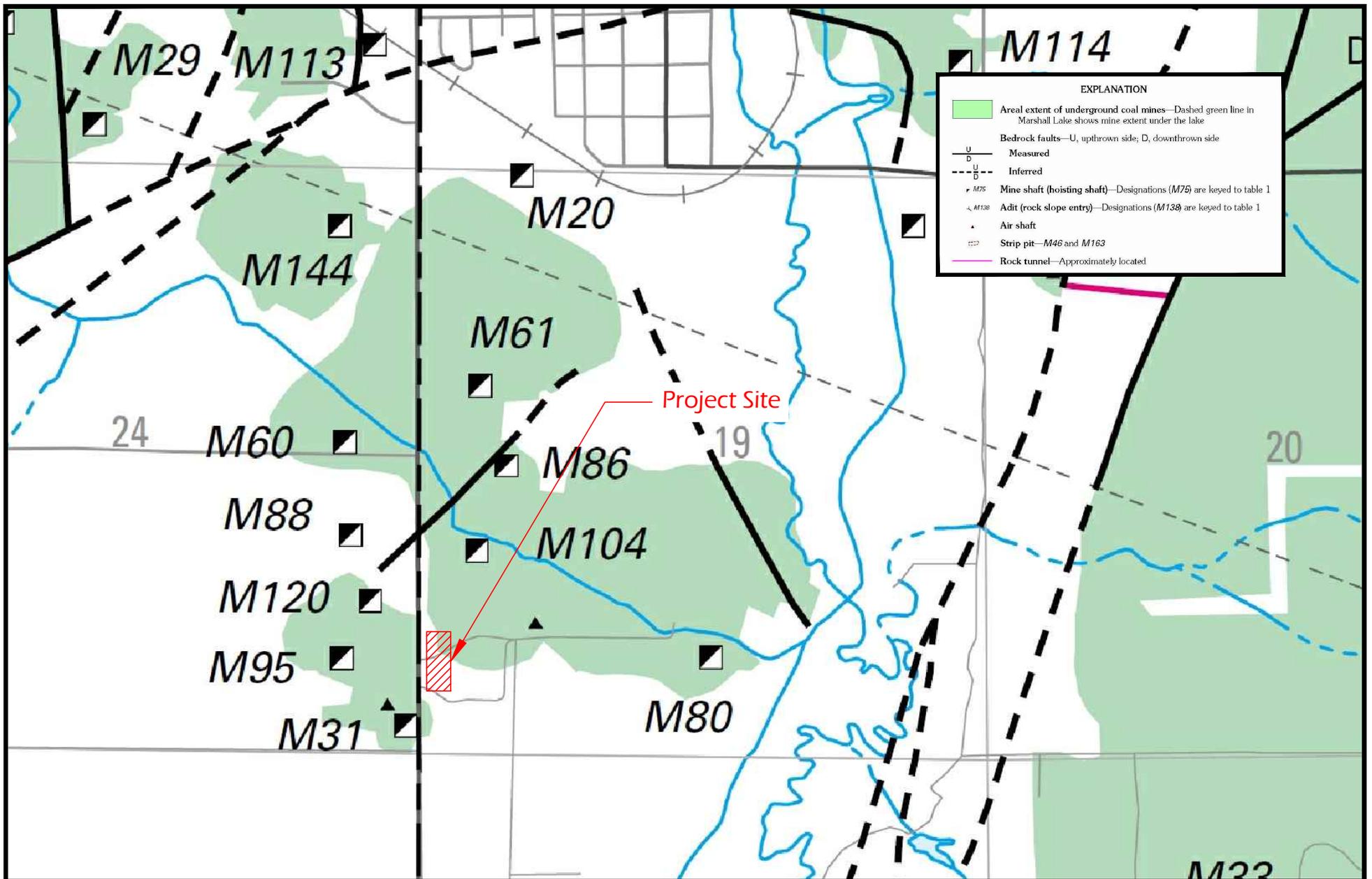
PHOTO # 1



PHOTO # 2

GROW YOUR STORAGE
ERIE, COLORADO
EEC PROJECT No. 1182068
SEPTEMBER 2018





EXPLANATION	
	Areal extent of underground coal mines—Dashed green line in Marshall Lake shows mine extent under the lake
	Bedrock faults—U, upthrown side; D, downthrown side
	Measured
	Inferred
	Mine shaft (hoisting shaft)—Designations (M75) are keyed to table 1
	Adit (rock slope entry)—Designations (M138) are keyed to table 1
	Air shaft
	Strip pit—M46 and M163
	Rock tunnel—Approximately located

Site Location Diagram
 Erie Business Park and Storage
 Erie, Colorado
 June 2018

North
 Not to Scale

GROW YOUR STORAGE

ERIE, COLORADO

PROJECT NO: 1182068		LOG OF BORING B-1				DATE: SEPTEMBER 2018					
RIG TYPE: CME55		SHEET 1 OF 1				WATER DEPTH					
FOREMAN: DG		START DATE	9/17/2018	WHILE DRILLING	None						
AUGER TYPE: 4" CFA		FINISH DATE	9/17/2018	AFTER DRILLING	N/A						
SPT HAMMER: AUTOMATIC		SURFACE ELEV	N/A	24 HOUR	N/A						
SOIL DESCRIPTION	D TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS		-200 (%)	SWELL	
							LL	PI		PRESSURE	% @ 500 PSF
SPARSE VEGETATION & TOPSOIL LEAN CLAY with SAND (CL) brown very stiff with calcareous deposits		1									
		2									
	CS	3	24	9000+	7.4	112.9	29	15	66.0	1800 psf	1.5%
		4									
	SS	5	26	6500	8.0						
		6									
		7									
		8									
		9									
	CS	10	17	9000+	12.5	114.2	31	18	70.8	700 psf	0.3%
		11									
		12									
		13									
		14									
	SS	15	18	7000	14.5						
		16									
		17									
		18									
		19									
	CS	20	16	7000	17.8	111.5					
BOTTOM OF BORING DEPTH 20.0'		21									
		22									
		23									
		24									
		25									

GROW YOUR STORAGE

ERIE, COLORADO

PROJECT NO: 1182068		LOG OF BORING B-2				DATE: SEPTEMBER 2018					
RIG TYPE: CME55		SHEET 1 OF 1				WATER DEPTH					
FOREMAN: DG		START DATE	9/17/2018	WHILE DRILLING	26.5'						
AUGER TYPE: 4" CFA		FINISH DATE	9/17/2018	AFTER DRILLING	N/A						
SPT HAMMER: AUTOMATIC		SURFACE ELEV	N/A	24 HOUR	N/A						
SOIL DESCRIPTION	D TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS		-200 (%)	SWELL	
							LL	PI		PRESSURE	% @ 500 PSF
SPARSE VEGETATION & TOPSOIL		1									
CLAYEY SAND (SC) brown / rust medium dense		2									
		3									
		4									
	CS	5	17	9000+	4.6	106.0	24	10	26.3	< 500 psf	None
		6									
		7									
		8									
		9									
SANDY LEAN CLAY (CL) brown very stiff with calcareous deposits	SS	10	22	3500	6.5				57.2		
		11									
		12									
		13									
		14									
	CS	15	24	9000+	10.9	117.4					
		16									
		17									
		18									
		19									
	SS	20	22	9000+	11.8						
		21									
		22									
		23									
		24									
with trace gravel	CS	25	17	8000	13.5	116.5					

Continued on Sheet 2 of 2

GROW YOUR STORAGE

ERIE, COLORADO

PROJECT NO: 1182068		LOG OF BORING B-2				DATE: SEPTEMBER 2018				
RIG TYPE: CME55		SHEET 2 OF 2				WATER DEPTH				
FOREMAN: DG		START DATE	9/17/2018	WHILE DRILLING	26.5'					
AUGER TYPE: 4" CFA		FINISH DATE	9/17/2018	AFTER DRILLING	N/A					
SPT HAMMER: AUTOMATIC		SURFACE ELEV	N/A	24 HOUR	N/A					
SOIL DESCRIPTION	D TYPE (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS		-200 (%)	SWELL	
						LL	PI		PRESSURE	% @ 500 PSF
Continued from Sheet 1 of 2	26									
SANDY LEAN CLAY (CL)	27									
brown / rust	28									
very stiff	29									
intermittent sand/gravel seams	30	23	1000	19.3						
	31									
	32									
	33									
	34									
GRAVEL (GP) / COBBLES	35	50/10"	--	28.3						
BOTTOM OF BORING DEPTH 35.0'	36									
	37									
	38									
	39									
	40									
	41									
	42									
	43									
	44									
	45									
	46									
	47									
	48									
	49									
	50									

GROW YOUR STORAGE

ERIE, COLORADO

PROJECT NO: 1182068		LOG OF BORING B-3				DATE: SEPTEMBER 2018					
RIG TYPE: CME55		SHEET 1 OF 1				WATER DEPTH					
FOREMAN: DG		START DATE	9/17/2018	WHILE DRILLING	24.0'						
AUGER TYPE: 4" CFA		FINISH DATE	9/17/2018	AFTER DRILLING	N/A						
SPT HAMMER: AUTOMATIC		SURFACE ELEV	N/A	24 HOUR	N/A						
SOIL DESCRIPTION	TYPE	D	N	QU	MC	DD	A-LIMITS		-200	SWELL	
		(FEET)	(BLOWS/FT)	(PSF)	(%)	(PCF)	LL	PI	(%)	PRESSURE	% @ 500 PSF
SPARSE VEGETATION & TOPSOIL		1									
CLAYEY SAND (SC)		2									
brown / rust		3									
medium dense		4									
	CS	5	28	9000+	6.3	119.5				< 500 psf	None
		6									
		7									
		8									
		9									
	SS	10	18	9000+	12.3						
SANDY LEAN CLAY (CL)		11									
brown		12									
very stiff		13									
		14									
	CS	15	17	9000+	14.5	114.4					
		16									
		17									
		18									
		19									
	SS	20	16	4500	19.5						
		21									
		22									
		23									
		24									
SAND / GRAVEL (SP/GP)	CS	25	50/10"	--	12.9	120.5					
brown / rust / gray, very dense											
Continued on Sheet 2 of 2											

GROW YOUR STORAGE

ERIE, COLORADO

PROJECT NO: 1182068		LOG OF BORING B-3					DATE: SEPTEMBER 2018			
RIG TYPE: CME55		SHEET 2 OF 2					WATER DEPTH			
FOREMAN: DG		START DATE	9/17/2018	WHILE DRILLING		24.0'				
AUGER TYPE: 4" CFA		FINISH DATE	9/17/2018	AFTER DRILLING		N/A				
SPT HAMMER: AUTOMATIC		SURFACE ELEV	N/A	24 HOUR		N/A				
SOIL DESCRIPTION	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS		-200 (%)	SWELL	
						LL	PI		PRESSURE	% @ 500 PSF
Continued from Sheet 1 of 2	26									
SAND / GRAVEL (SP/GP)	27									
brown / rust / gray, very dense	28									
SANDSTONE / SILTSTONE / CLAYSTONE	29									
brown / gray / rust	30	46	9000+	14.8						
weathered to hard	31									
with trace lignite or possible coal	32									
	33									
	34									
	35	50/3.5"	7000	23.6						
BOTTOM OF BORING DEPTH 35.5'	36									
	37									
	38									
	39									
	40									
	41									
	42									
	43									
	44									
	45									
	46									
	47									
	48									
	49									
	50									

GROW YOUR STORAGE

ERIE, COLORADO

PROJECT NO: 1182068		LOG OF BORING B-4				DATE: SEPTEMBER 2018					
RIG TYPE: CME55		SHEET 1 OF 1				WATER DEPTH					
FOREMAN: DG		START DATE	9/17/2018	WHILE DRILLING	None						
AUGER TYPE: 4" CFA		FINISH DATE	9/17/2018	AFTER DRILLING	N/A						
SPT HAMMER: AUTOMATIC		SURFACE ELEV	N/A		24 HOUR	N/A					
SOIL DESCRIPTION	D TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS		-200 (%)	SWELL	
							LL	PI		PRESSURE	% @ 500 PSF
SPARSE VEGETATION & TOPSOIL		1									
LEAN CLAY with SAND (CL)		2									
brown		3									
very stiff to medium stiff		4									
with calcareous deposits and organics	CS	5	50/11"	8500	8.6	108.0	28	14	73.8	3500 psf	2.9%
		6									
		7									
		8									
		9									
brown / rust	SS	10	8	6500	6.2						
		11									
		12									
		13									
		14									
	CS	15	17	9000+	15.7	114.5					
		16									
		17									
		18									
		19									
	SS	20	17	6000	17.0						
BOTTOM OF BORING DEPTH 20.5'		21									
		22									
		23									
		24									
		25									

GROW YOUR STORAGE

ERIE, COLORADO

PROJECT NO: 1182068		LOG OF BORING B-5				DATE: SEPTEMBER 2018					
RIG TYPE: CME55		SHEET 1 OF 1				WATER DEPTH					
FOREMAN: DG		START DATE	9/17/2018	WHILE DRILLING	None						
AUGER TYPE: 4" CFA		FINISH DATE	9/17/2018	AFTER DRILLING	N/A						
SPT HAMMER: AUTOMATIC		SURFACE ELEV	N/A	24 HOUR	N/A						
SOIL DESCRIPTION	D TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS		-200 (%)	SWELL	
							LL	PI		PRESSURE	% @ 500 PSF
SPARSE VEGETATION & TOPSOIL		1									
LEAN CLAY with SAND (CL)		2									
brown		3									% @ 150 psf
very stiff	CS	3	18	9000+	6.5	110.2				2100 psf	4.0%
with calcareous deposits		4									
	SS	5	19	2000	5.0						
		6									
		7									
		8									
		9									
brown / rust	CS	10	31	9000+	7.4	129.3					
		11									
		12									
		13									
		14									
	SS	15	15	4500	7.9						
		16									
		17									
		18									
		19									
brown / tan	CS	20	24	9000+	10.0	122.8					
BOTTOM OF BORING DEPTH 20.0'		21									
		22									
		23									
		24									
		25									

**GROW YOUR STORAGE
ERIE, COLORADO**

PROJECT NO: 1182068		LOG OF BORING B-6				DATE: SEPTEMBER 2018					
RIG TYPE: CME55		SHEET 1 OF 1				WATER DEPTH					
FOREMAN: DG		START DATE	9/17/2018	WHILE DRILLING	None						
AUGER TYPE: 4" CFA		FINISH DATE	9/17/2018	AFTER DRILLING	N/A						
SPT HAMMER: AUTOMATIC		SURFACE ELEV	N/A	24 HOUR	N/A						
SOIL DESCRIPTION	TYPE	D	N	QU	MC	DD	A-LIMITS		-200	SWELL	
		(FEET)	(BLOWS/FT)	(PSF)	(%)	(PCF)	LL	PI	(%)	PRESSURE	% @ 500 PSF
SPARSE VEGETATION & TOPSOIL		1									
LEAN CLAY with SAND (CL) brown very stiff with calcareous deposits	CS	2									
		3	18	9000+	10.0	120.6	29	16	71.1	2500 psf	5.3%
		4									
	SS	5	27	9000+	10.7						
		6									
		7									
		8									
		9									
	SS	10	16	8000	14.1						
BOTTOM OF BORING DEPTH 10.5'		11									
		12									
		13									
		14									
		15									
		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

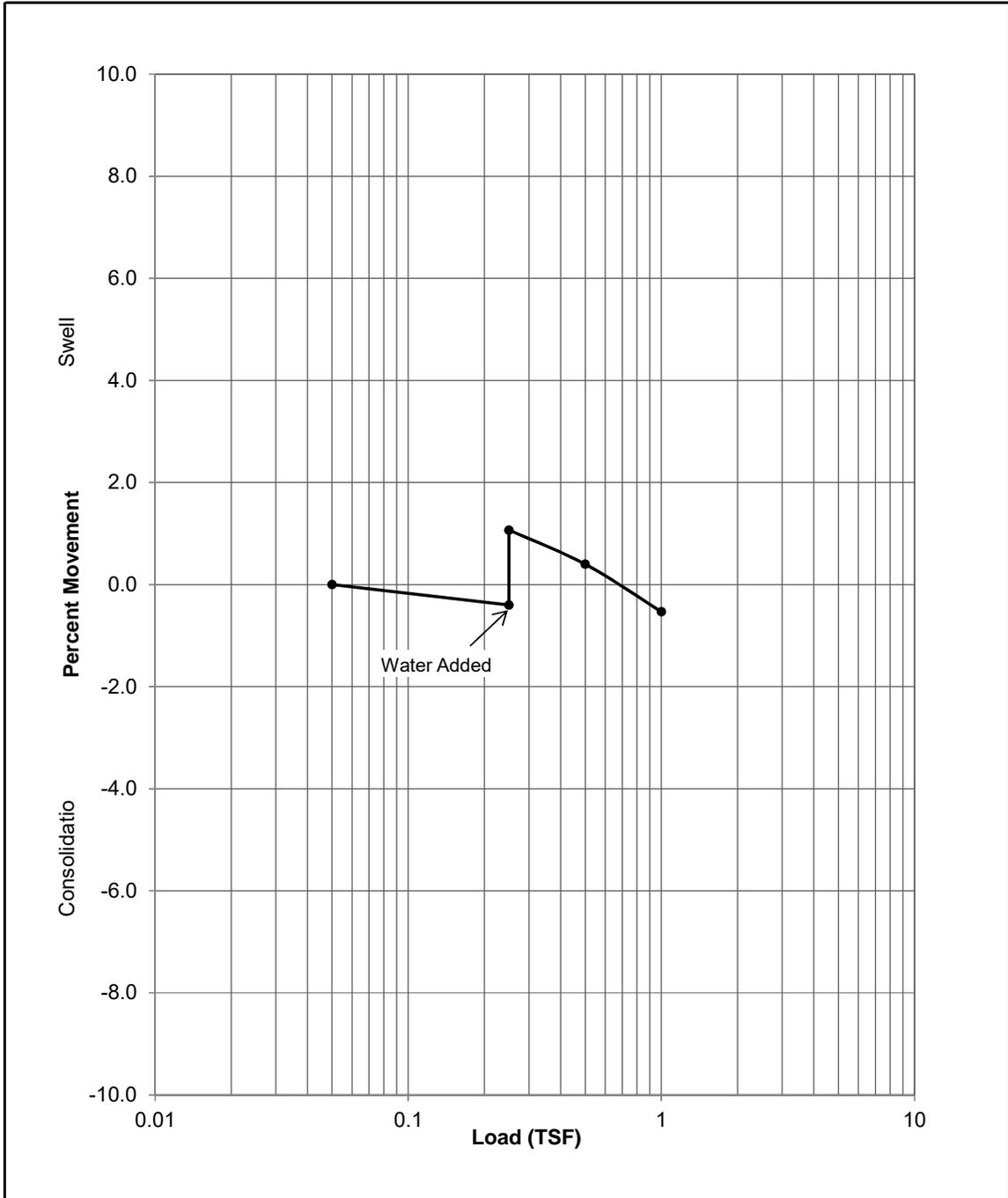
GROW YOUR STORAGE

ERIE, COLORADO

PROJECT NO: 1182068		LOG OF BORING B-7				DATE: SEPTEMBER 2018					
RIG TYPE: CME55		SHEET 1 OF 1				WATER DEPTH					
FOREMAN: DG		START DATE	9/17/2018	WHILE DRILLING	None						
AUGER TYPE: 4" CFA		FINISH DATE	9/17/2018	AFTER DRILLING	N/A						
SPT HAMMER: AUTOMATIC		SURFACE ELEV	N/A	24 HOUR	N/A						
SOIL DESCRIPTION	TYPE	D	N	QU	MC	DD	A-LIMITS		-200	SWELL	
		(FEET)	(BLOWS/FT)	(PSF)	(%)	(PCF)	LL	PI	(%)	PRESSURE	% @ 500 PSF
SPARSE VEGETATION & TOPSOIL		1									
LEAN CLAY with SAND (CL) brown very stiff to stiff	CS	2									% @ 150 psf
		3	16	9000+	9.2	115.6				2000 psf	2.7%
		4									
with trace gravel	SS	5	15	9000+	12.8						
		6									
		7									
		8									
		9									
	SS	10	12	5000	17.3						
BOTTOM OF BORING DEPTH 10.5'		11									
		12									
		13									
		14									
		15									
		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

SWELL / CONSOLIDATION TEST RESULTS

Material Description: Brown Lean Clay with Sand (CL)		
Sample Location: Boring 1, Sample 1, Depth 2'		
Liquid Limit: 29	Plasticity Index: 15	% Passing #200: 66.0%
Beginning Moisture: 7.4%	Dry Density: 118.3 pcf	Ending Moisture: 18.4%
Swell Pressure: 1800 psf		% Swell @ 500: 1.5%

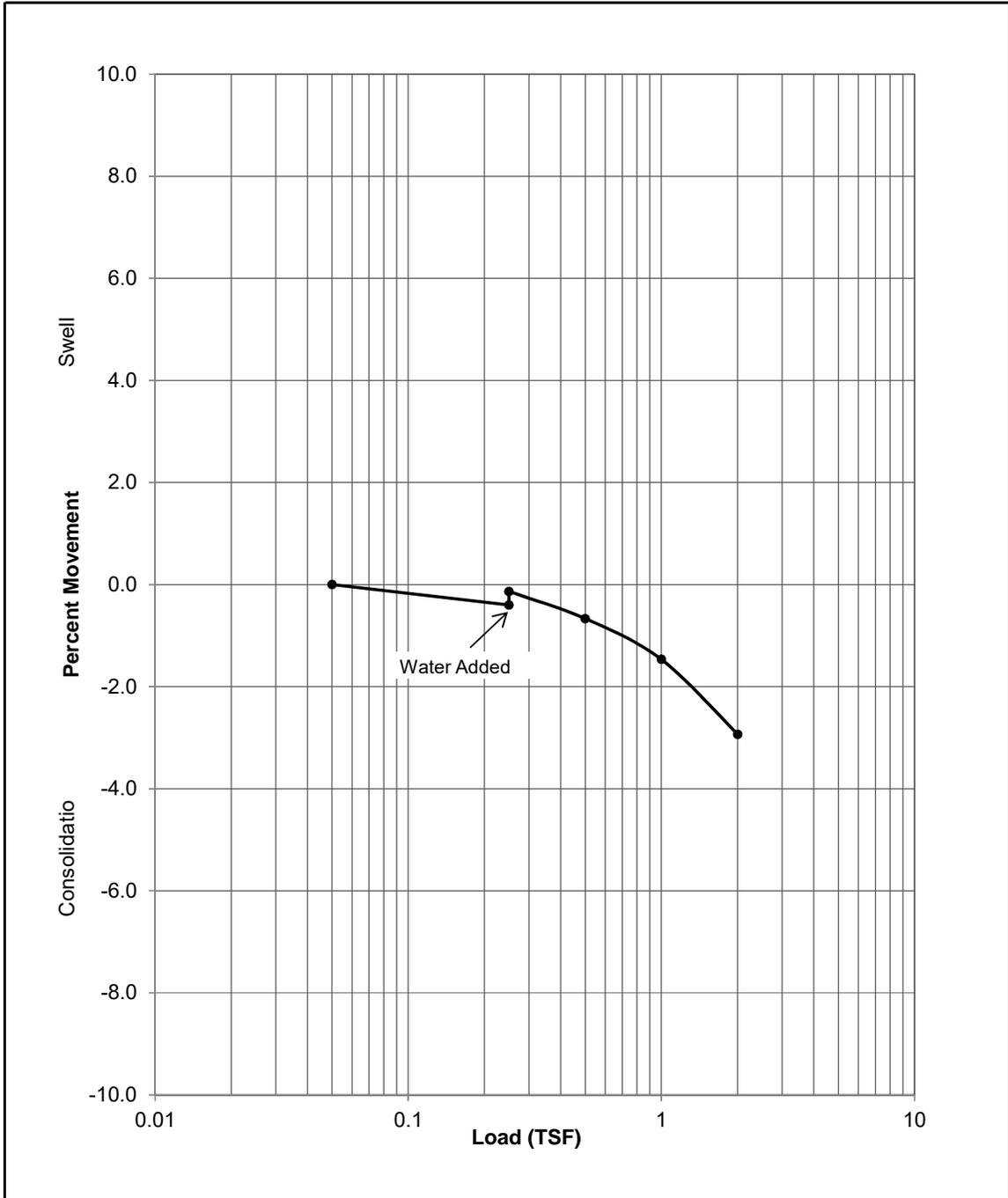


Project: Proposed 3-Story Self-Storage Facility
 Location: Erie, Colorado
 Project #: 1182068
 Date: September 2018



SWELL / CONSOLIDATION TEST RESULTS

Material Description: Brown Lean Clay with Sand (CL)		
Sample Location: Boring 1, Sample 3, Depth 9'		
Liquid Limit: 31	Plasticity Index: 18	% Passing #200: 70.8%
Beginning Moisture: 12.3%	Dry Density: 107 pcf	Ending Moisture: 19.1%
Swell Pressure: 700 psf		% Swell @ 500: 0.3%

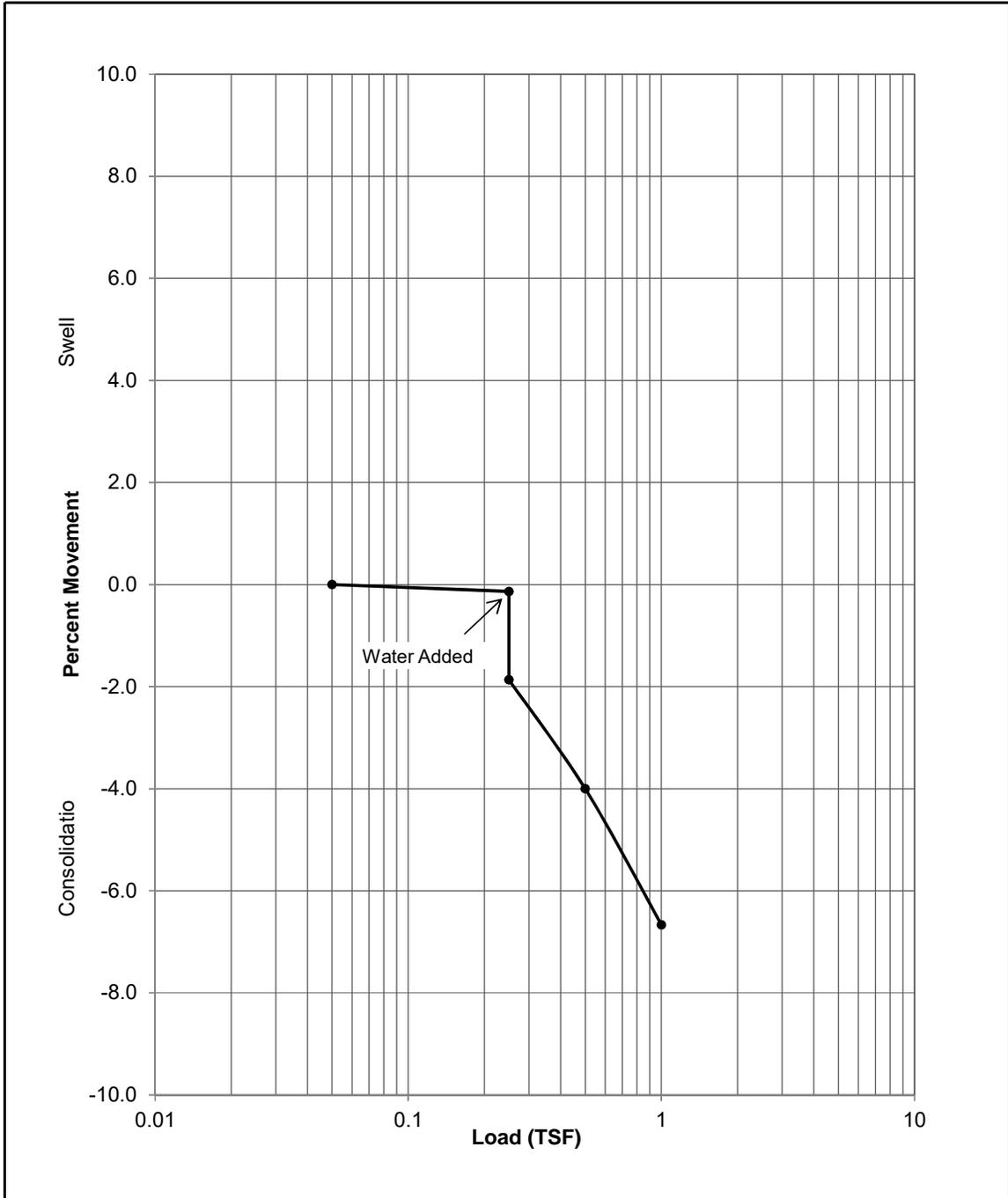


Project: Proposed 3-Story Self-Storage Facility
 Location: Erie, Colorado
 Project #: 1182068
 Date: September 2018



SWELL / CONSOLIDATION TEST RESULTS

Material Description: Brown / Rust Clayey Sand (SC)		
Sample Location: Boring 2, Sample 1, Depth 4'		
Liquid Limit: 24	Plasticity Index: 10	% Passing #200: 26.3%
Beginning Moisture: 4.6%	Dry Density: 100.9 pcf	Ending Moisture: 20.8%
Swell Pressure: < 500 psf		% Swell @ 500: None

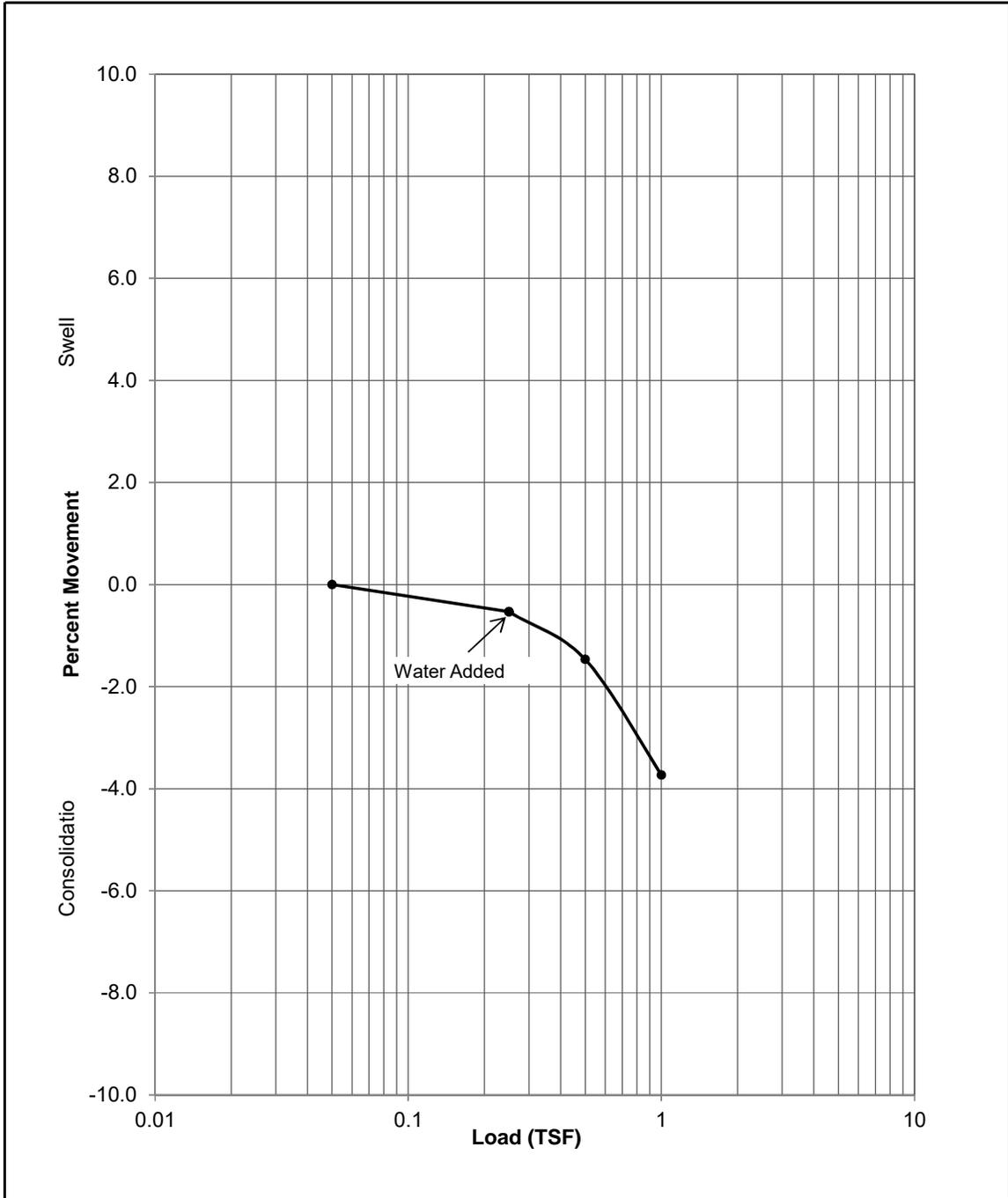


Project: Proposed 3-Story Self-Storage Facility
 Location: Erie, Colorado
 Project #: 1182068
 Date: September 2018



SWELL / CONSOLIDATION TEST RESULTS

Material Description: Brown / Rust Clayey Sand (SC)		
Sample Location: Boring 3, Sample 1, Depth 4'		
Liquid Limit: --	Plasticity Index: --	% Passing #200: --
Beginning Moisture: 6.3%	Dry Density: 115.4 pcf	Ending Moisture: 15.8%
Swell Pressure: < 500 psf		% Swell @ 500: None

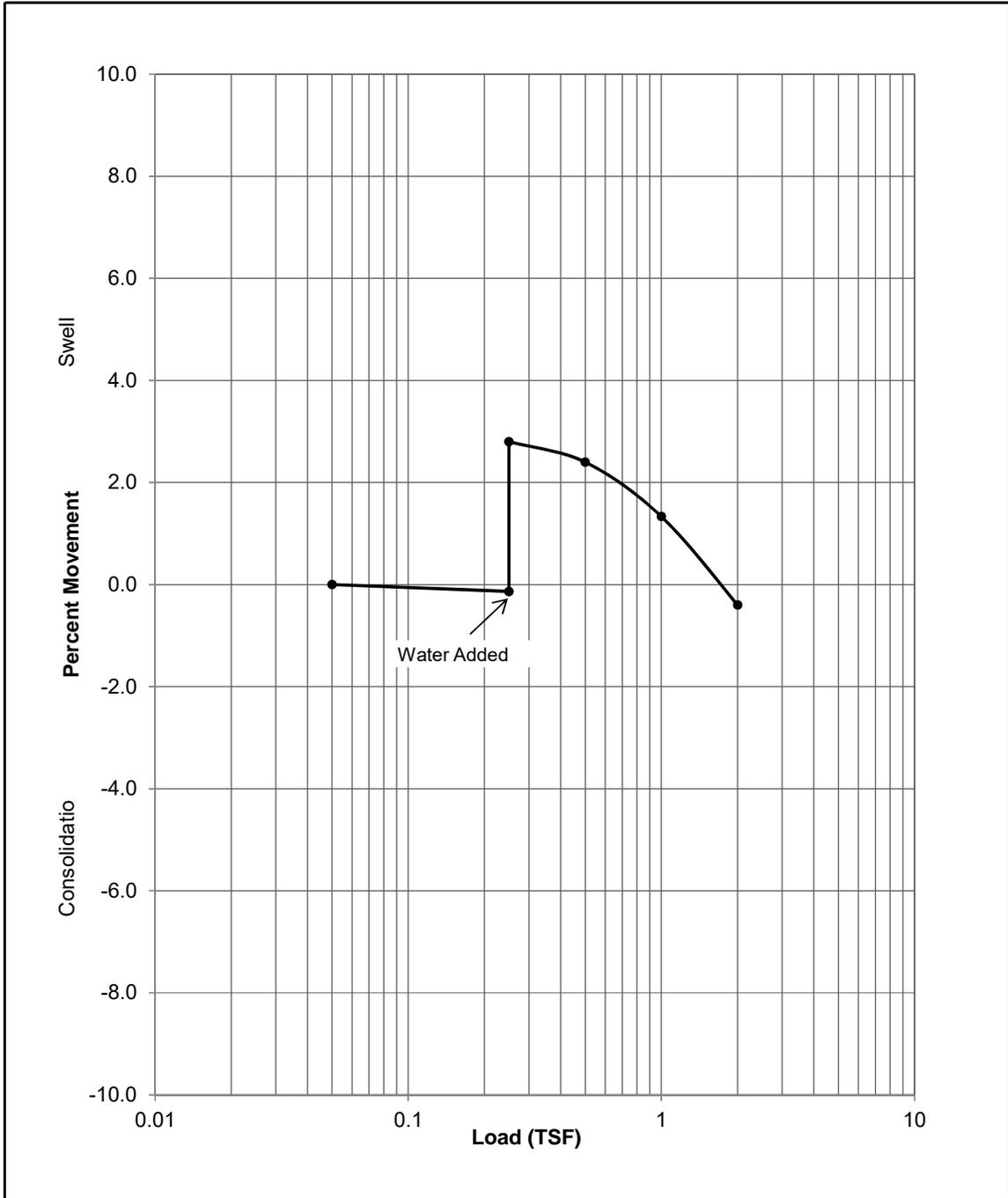


Project: Proposed 3-Story Self-Storage Facility
 Location: Erie, Colorado
 Project #: 1182068
 Date: September 2018



SWELL / CONSOLIDATION TEST RESULTS

Material Description: Brown Lean Clay with Sand (CL)		
Sample Location: Boring 4, Sample 1, Depth 4'		
Liquid Limit: 28	Plasticity Index: 14	% Passing #200: 73.8%
Beginning Moisture: 8.6%	Dry Density: 122.5 pcf	Ending Moisture: 18.2%
Swell Pressure: 3500 psf		% Swell @ 500: 2.9%

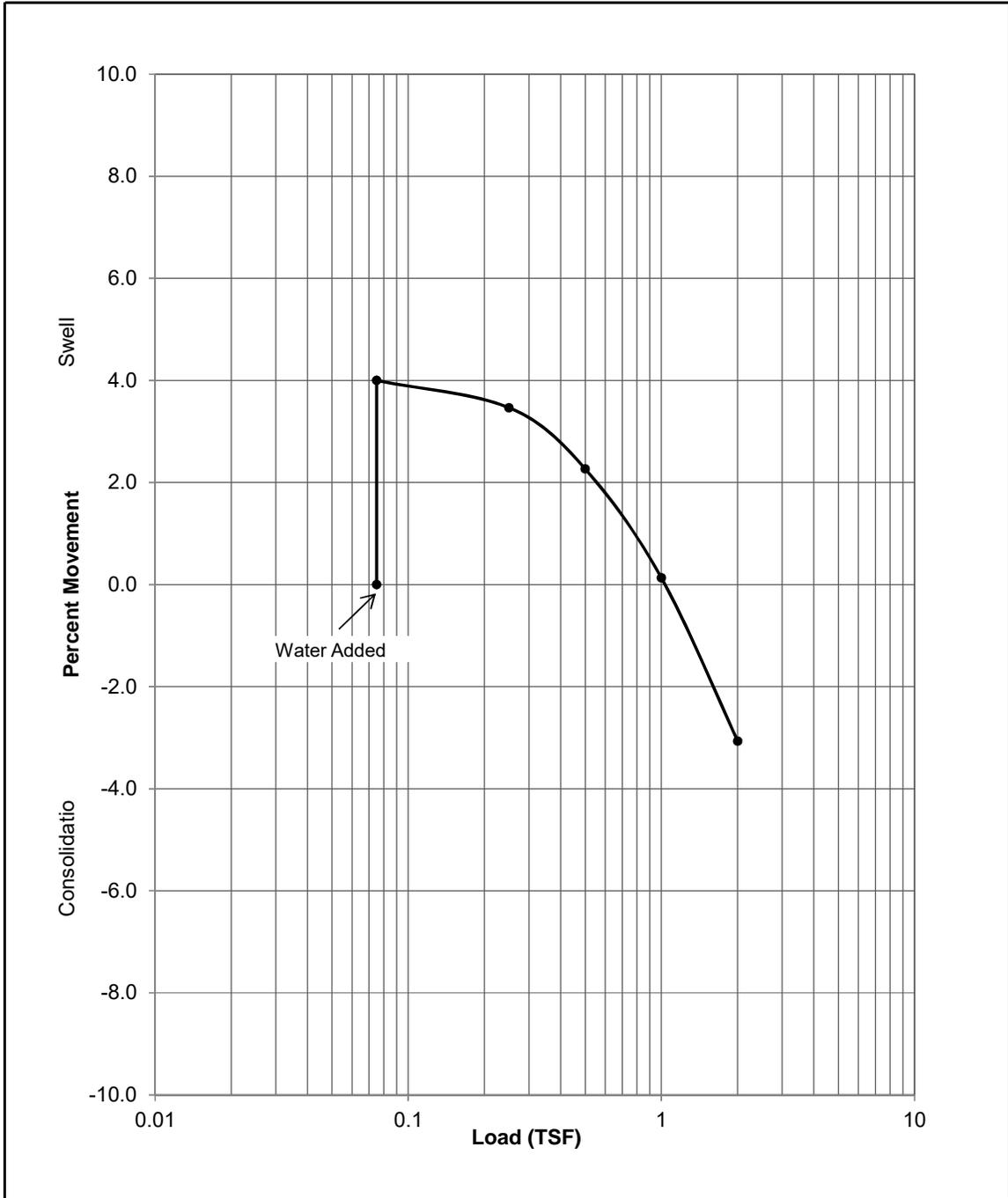


Project: Proposed 3-Story Self-Storage Facility
 Location: Erie, Colorado
 Project #: 1182068
 Date: September 2018



SWELL / CONSOLIDATION TEST RESULTS

Material Description: Brown Lean Clay with Sand (CL)		
Sample Location: Boring 5, Sample 1, Depth 2'		
Liquid Limit: --	Plasticity Index: --	% Passing #200: --
Beginning Moisture: 6.5%	Dry Density: 111.8 pcf	Ending Moisture: 19.4%
Swell Pressure: 2100 psf		% Swell @ 150: 4.0%

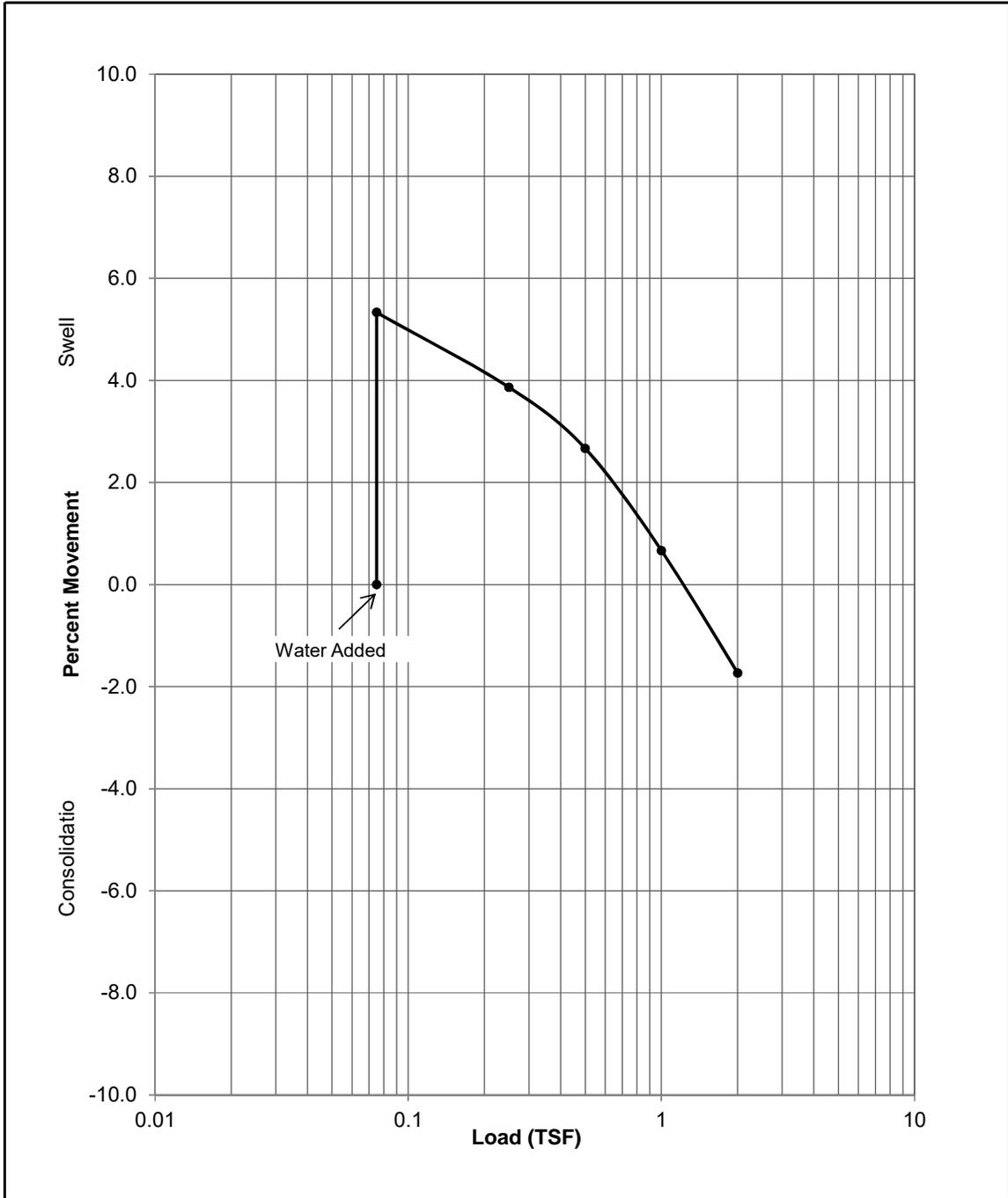


Project: Proposed 3-Story Self-Storage Facility
 Location: Erie, Colorado
 Project #: 1182068
 Date: September 2018



SWELL / CONSOLIDATION TEST RESULTS

Material Description: Brown Lean Clay with Sand (CL)		
Sample Location: Boring 6, Sample 1, Depth 2'		
Liquid Limit: 29	Plasticity Index: 16	% Passing #200: 71.1%
Beginning Moisture: 10.0%	Dry Density: 129 pcf	Ending Moisture: 18.0%
Swell Pressure: 2500 psf		% Swell @ 150: 5.3%

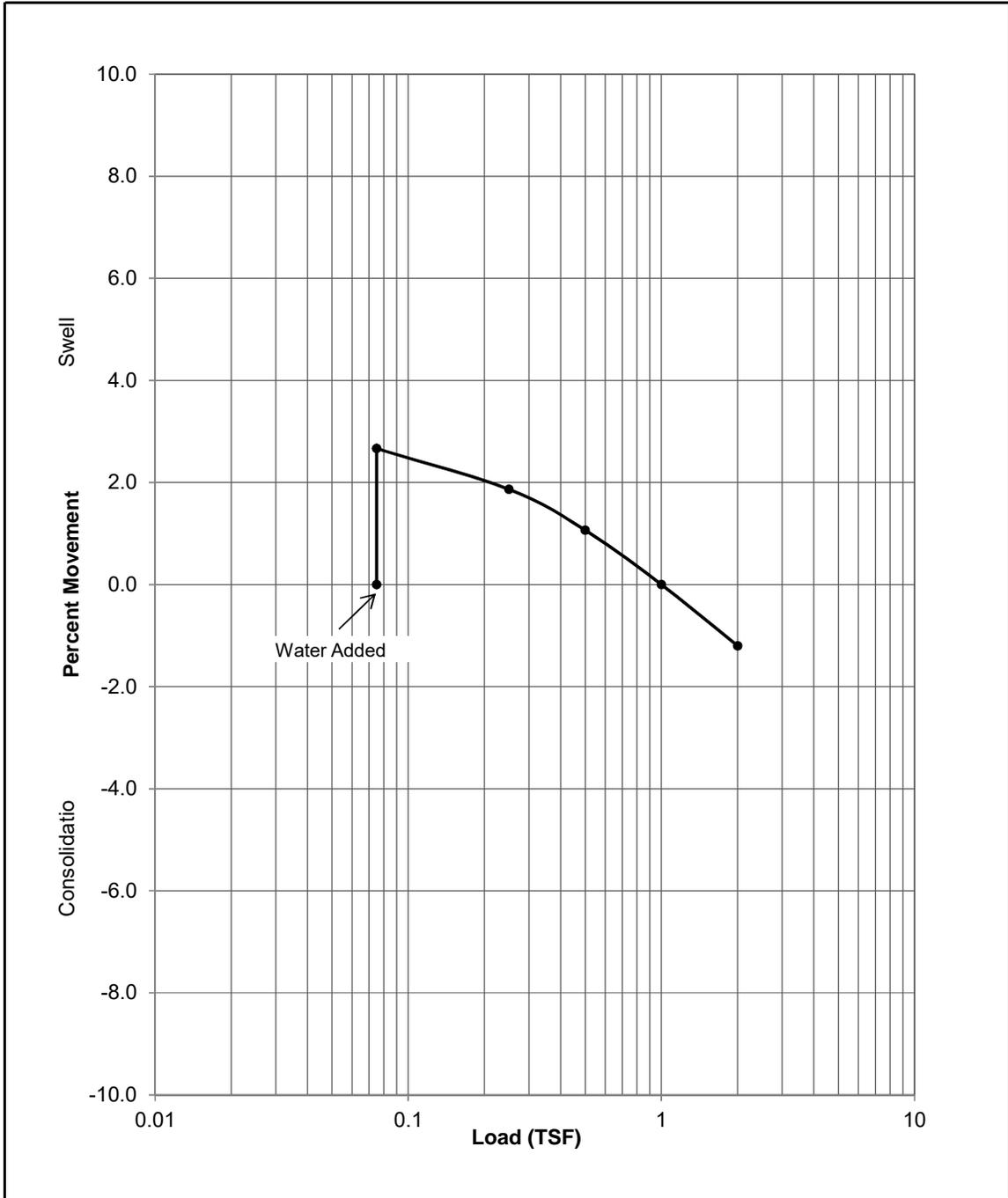


Project: Proposed 3-Story Self-Storage Facility
 Location: Erie, Colorado
 Project #: 1182068
 Date: September 2018



SWELL / CONSOLIDATION TEST RESULTS

Material Description:		
Sample Location: Boring 7, Sample 1, Depth 2'		
Liquid Limit: --	Plasticity Index: --	% Passing #200: --
Beginning Moisture: 9.2%	Dry Density: 115.7 pcf	Ending Moisture: 18.4%
Swell Pressure: 2000 psf		% Swell @ 150: 2.7%



Project: Proposed 3-Story Self-Storage Facility
 Location: Erie, Colorado
 Project #: 1182068
 Date: September 2018



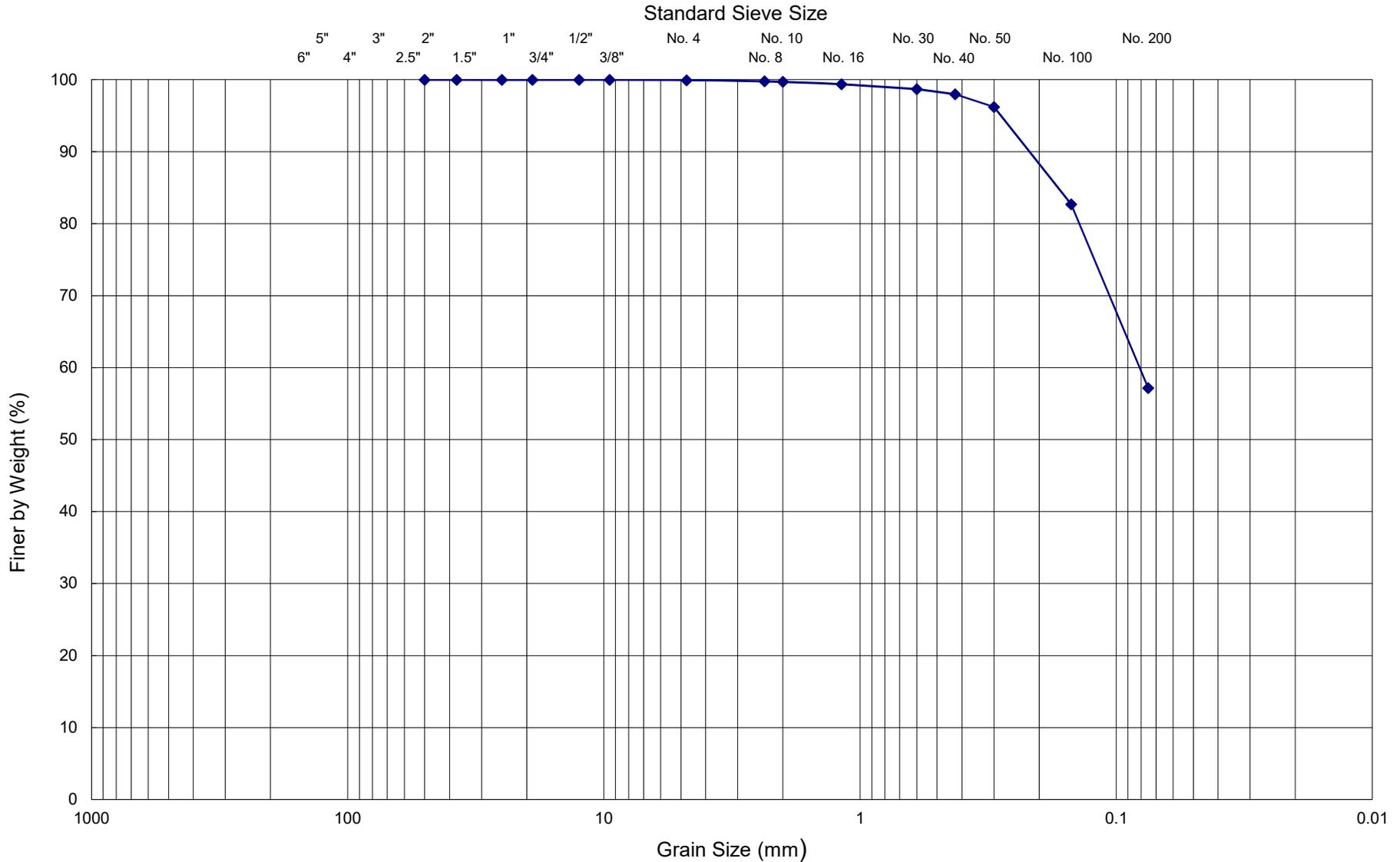
EARTH ENGINEERING CONSULTANTS, LLC
SUMMARY OF LABORATORY TEST RESULTS

Sieve Analysis (AASHTO T 11 & T 27 / ASTM C 117 & C 136)		
Sieve Size		Percent Passing
1 1/2"	(37.5 mm)	100
1"	(25 mm)	100
3/4"	(19 mm)	100
1/2"	(12.5 mm)	100
3/8"	(9.5 mm)	100
No. 4	(4.75 mm)	100
No. 8	(2.36 mm)	100
No. 10	(2 mm)	100
No. 16	(1.18 mm)	99
No. 30	(0.6 mm)	99
No. 40	(0.425 mm)	98
No. 50	(0.3 mm)	96
No. 100	(0.15 mm)	83
No. 200	(0.075 mm)	57.2

Project: Grow Your Storage Erie
Location: Erie, Colorado
Project No: 1182068
Sample ID: B-2, S-2, at 9'
Sample Desc.: Sandy Lean Clay (CL)
Date: September 2018



EARTH ENGINEERING CONSULTANTS, LLC
 Summary of Washed Sieve Analysis Tests (ASTM C117 & C136)



Cobble	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

Project: Grow Your Storage Erie
 Location: Erie, Colorado
 Project No: 1182068
 Sample ID: B-2, S-2, at 9'
 Sample Desc.: Sandy Lean Clay (CL)
 Date: September 2018

D ₁₀₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	C _u	C _c
4.75	0.08	---	---	---	---	---



WESTERN ENVIRONMENT AND ECOLOGY, INC

October 31, 2018

Russell Garrett P.E.
Jehn Engineering
5690 Webster Street
Arvada, Colorado 80002

Subject: **Mine Subsidence Evaluation**, 1012 Carbon Court, Southwest 1/4 of Section 19, Township 1 North, Range 69 West, Erie, Colorado. Western Environment and Ecology, Inc. Project Number 805-001-01.

Dear Mr. Garrett:

At your request and in accordance with Western Environment and Ecology, Inc's (Western Environment) Proposal Number P18-145 dated October 22nd, 2018, we are please to present the results of a mine subsidence assessment of the above referenced property. The following report contains the results of three mine subsidence investigations performed by Western Environment adjacent to 1012 Carbon Court in Erie, Colorado, Figure 1. The purpose of this assessment is to provide the owners our development recommendations regarding the mine subsidence potential of the site. No current plans were available regarding the proposed use of the commercial lot.

The referenced studies, which are on file with the Colorado Geological Survey (CGS), are entitled: "Mine Subsidence Investigation Austin Industrial Park Lot 2, Erie, Colorado, dated March 11, 1998: Mine Subsidence Investigation Coal Creek Commons Industrial Park, Erie, Colorado dated July 2, 2001 and Mine Subsidence Investigation Coal Creek Commons Industrial Park Erie, Colorado, dated June 10, 2013.

No drilling was conducted for this evaluation, all recommendations are based upon our interpretation of the results of the afore mentioned investigations as they relate to the subject project. The geo-physical and lithologic logs from the assessments used in the preparation of this report are attached in the Appendix.

The previously referenced projects were completed to investigate the workings of the Mitchell Mine. Records on file with the Colorado Division of Mines and the Colorado Geological Survey show it began operations in 1883 and continued through 1891. Total production was placed at 204,171 tons. Extraction occurred through a 110 foot deep two compartment shaft approximately 950 feet north of the 1012 Carbon Court property. An air shaft occurs 800 feet northeast of the site beneath Austin Avenue (Figure 2). The mine was officially closed and abandoned in June of 1891.

The Mitchell Mine operation was classified as a modified pillar retreat mine. Haulage ways were ten feet wide and were separated by 30 foot wide "chain pillars". Rooms had approximate widths of fifteen to twenty feet and lengths of 100 feet. The pillar retreat method of coal extraction developed a 100 foot working face (room) that was 15 to 20 feet wide. Following development of the rooms, the intervening pillars were mined leaving irregular stumps. This retreat was performed on a generally regular basis down each working face and then back along the adjacent unworked face (Figure 3). This method of mining resulted in extraction rates of 75 to 85% leaving only isolate stumps of coal. Tomlinson in a 1933 US Bureau of Mines report entitled "A Study of Falls of Roof and Coal in Northern Colorado, USBM RI 3199, reported that collapse and the resulting surface subsidence occurred within days or months of mining.

Ten borings, ranging in depth from 120 feet to 180 feet, were drilled under the supervision of Western Environment on the projects adjacent to the Carbon Court site (Table 1). These borings were completed using a truck mounted Mayhew 1500 mud rotary drill with a constructed mud pit. All of the borings were logged with a three arm caliper tool calibrated prior to each use to graphically show the diameter of the hole. The full extension of the arms would indicate a void of at least 21 inches. The drill will normally make a 5.125 inch hole. Therefore, a significantly larger or smaller hole could indicate mining activity. Lithologic strip logs were also made of cutting samples at five foot intervals.

Four distinct geologic units were encountered during drilling. The first unit penetrated was a clayey sand soil, likely of aeolian (wind blown) origin, occurring from 0 to 35 feet. The next unit was a clayey water saturated gravel occurring from 35 to 40 feet. The third unit, which had a transitional boundary between soil, weathered rock and fresh rock, was the interbedded claystone, siltstone, fine-grained quartzose sandstone and coals of the Cretaceous Age Laramie Formation. This Formation extended from approximately 40 to 160 feet in depth.

The “main” seam of the Mitchell Mine occurred at a depth of approximately 106 feet and averaged 5 feet thick. A second mined seam, referenced in this report as the “Lower Seam”, occurred between 148 and 155 feet in depth. The workings associated with this seam appear to occur near the intersection of Austin Avenue and Mason Street northeast of the Carbon Court site. The original mine maps (attached) are incomplete and likely inaccurate with incorrect orientation (north arrows). However, marginalia references “175 feet down” indicating a second Lower Seam. The fourth significant geologic unit was the fine grained quartzose sands of the Fox Hills Formation, encountered at 160 feet.

Two types of coal mine related subsidence have been observed in the Boulder/Weld Coal Field. The most extensive form is “trough” type where a broad shallow depression develops over the mine. This occurs with near total extraction of the coal seam as in the case with larger “pillar retreat” mines. The second type is “sinkhole or chimney” subsidence where a relatively small (tens of feet wide) hole suddenly appears. In his 1985 paper entitled “Observations on the Location of Chimney Subsidence Sinkhole Development Along the Colorado Front Range” (Proceedings of the 1985 Conference on Coal Mine Subsidence in the Rocky Mountain Region, Colorado Geological Survey Special Publication 31) Dr. Gordon Matheson, concludes that 95% of the sinkholes observed in the Front Range Coal Fields occurred above mine workings at depths of less than 110 feet. The Upper Seam of the Mitchell Mine is approximately 106 feet in depth, therefore, **sinkhole type subsidence is possible in undermined areas.**

All of the borings completed on the adjacent developments indicated collapse to be complete, **with no open voids.** However, due to the inherent uncertainties associated with abandoned mine subsidence prediction, Western Environment chose to perform a **worst case theoretical** strain analysis that assumes some additional collapse will occur. Therefore, to determine the amount of subsidence and resultant surface strain, Western Environment utilized the United Kingdom’s National Coal Board’s (NCB) graphical strain profiling system. This method of strain prediction was developed for on-going long wall mining operations. The adaptations applied to the analysis for “pillar retreat” mines, are therefore theoretical. However, in a publication of the Mountain Geologist (January 2009), and in a presentation to the 10th Congress of the International Association of Engineering Geologist Nottingham, England, 2007, Greg D. Sherman concludes that using the NCB method, with modifications for pillar retreat mining, the predicted amount of **theoretical** subsidence is 20% greater than the observed amount and as such is “a conservative” estimate of strain and subsidence.

To make the NCB method applicable to abandoned pillar retreat mines, several modifications and assumptions were made. The first modification is to define the thickness of the void space. The caliper probe graphically shows the diameter of the holes. The full extension of the arms would indicate a cavity of greater than 27 inches. The drill will normally

make a 5.125 inch hole. Therefore, a significantly larger or smaller hole could indicate mining activity. To perform a “worst case” strain analysis, the following assumption was made: **any increase in hole diameter greater than 50% (9 inches for 5 inch boring) will be treated as an open void.** The amount of “theoretical” open void for the 10 holes intercepting the Mitchell Mine was then averaged for both the Upper and Lower Seams (Table 1). This results in a “theoretical” void space for the Upper Seam of **1.5 feet** and **2.8 feet** for the Lower Seam.

The width of the extraction is also critical to the analysis. Several width options are available to use. They include distance between drill holes, actual width (length) of the workings, or arbitrary values to produce the maximum amount of subsidence. Western Environment chose to use the average width (length) of the rooms as shown on the mine map, which is approximately **100 feet**. The average depth to the top of the two seams **105.9 and 148.2 feet** was used.

The reader is here encouraged to review both the United Kingdom National Coal Board’s Subsidence Handbook, and the previous studies for the mechanics of the process. By using this information, the maximum “worst case” theoretical horizontal strains that would occur during collapse of the Mitchell Mine Upper Seam would be **0.41%** and collapse of the Lower Seam would be **0.63%**.

The original mine maps and the results of the borings indicate only a small portion of the 1012 Carbon Court property may be undermined. The greatest strain produced is from the Lower Seam. The strain profile (attached) indicates that 0% strains will occur 154 feet from the “center of the panel” and 0.2% strain will occur 79 feet from the “center of the panel”.

Using these strain limits, **no subsidence related development restrictions are required south of the 0.0% strain line shown on Figure 2. Structures with foundation lengths equal to or less than 97 feet can be built between the 0% and 0.2% strain limits shown on Figure 2. This size structure would be subject to less than “appreciable” damage in a theoretical “worst cast” subsidence event (Figure 3). No occupied structures should be built north of the 0.2% strain line without additional investigations.**

Thank you for the opportunity to provide these opinions. If your have any questions or require clarification, please do not hesitate to contact us.

Respectfully Submitted,

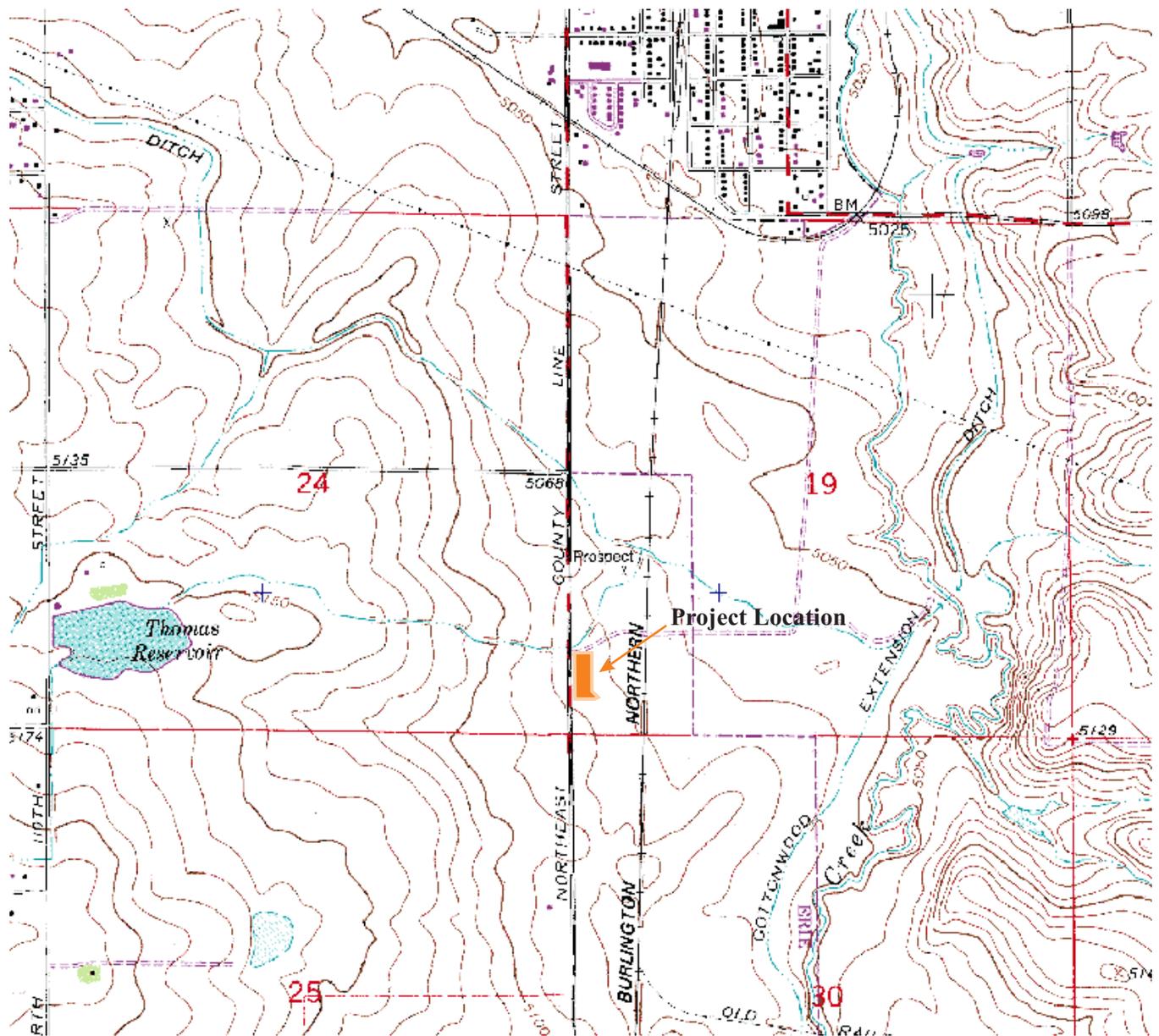
Greg D. Sherman P.G
President

att.

HOLE NUMBER	TOP OF MINED INTERVAL MITCHELL LOWER		THEORETICAL VOID MITCHELL LOWER	
CCC-West	102'	155'	0.0'	not mined
CCC-East	108'	150'	2.0'	not mined
CCC-3	108'	136'	not mined	4.0'
CCC-4	108'	150'	2.0'	0.0'
CCC-5	108'	unknown	0.0'	not mined
CCC-6	no coal	no coal	not mined	not mined
CCC-7	104'	150'	not mined	not mined
CCC-8	108'	148'	not mined	4.5'
B-1	105'	unknown	not mined	unknown
B-2	102'	unknown	2.0'	unknown
AVERAGE	105.9'	148.2'	1.2'	2.8'

CCC-West and CCC-East Western Environment, July, 2001.
CCC-3 through CCC-8 Western Environment, June, 2003
B-1 and B-2 Western Environment, March, 1998

not mined value not used to determine theoretical void



Western environment
and ecology, inc.
2217 West Powers Avenue
Littleton, Colorado 80120

Figure 1 - Project Location Map
1012 Carbon Court
Erie, Colorado



Scale in Feet

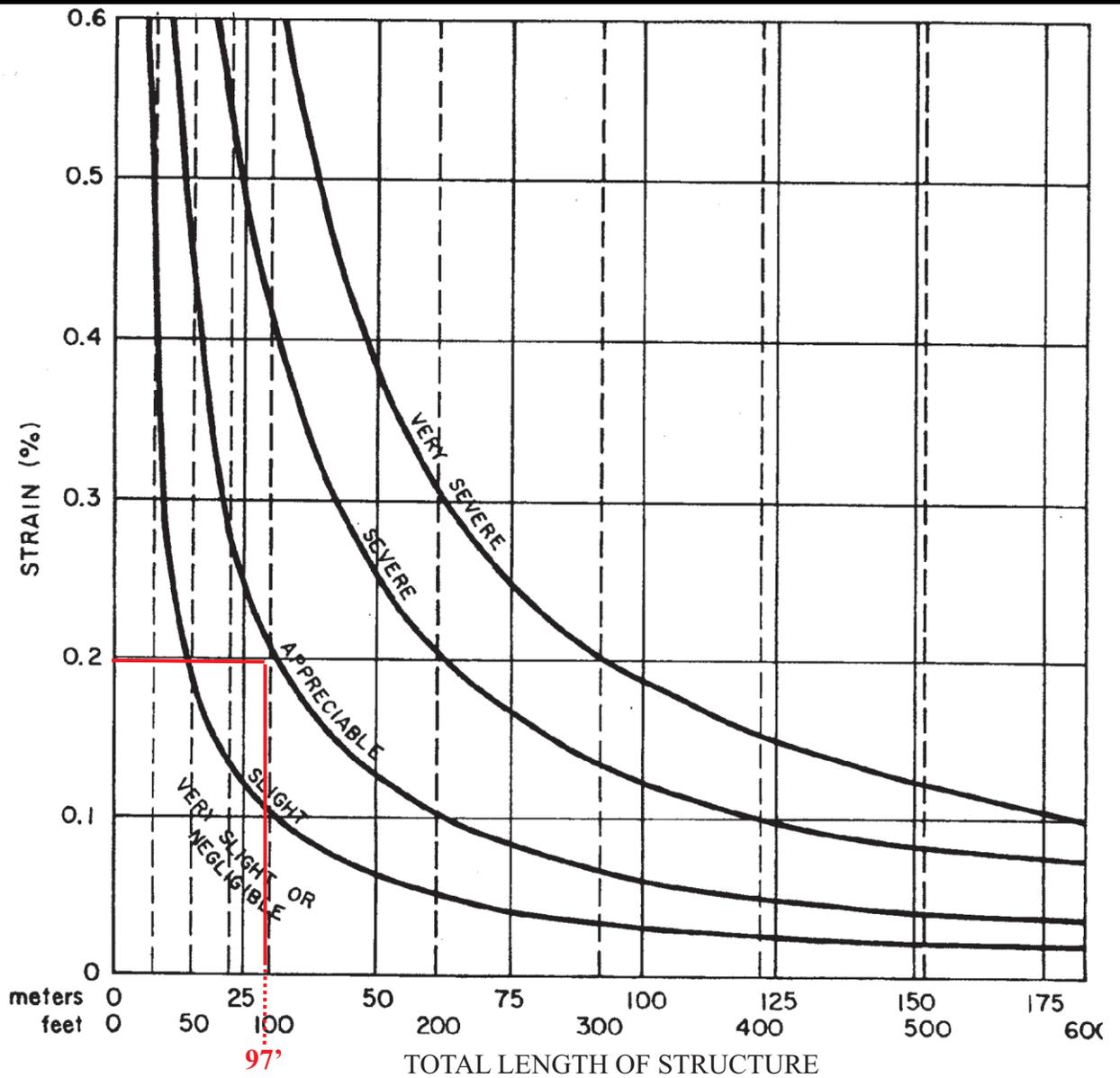
0 300



Aerial Photograph from GoogleEarth

Western Environment
and Ecology, Inc.
2217 West Powers Avenue,
Littleton, Colorado 80120

Figure 2 - Site Location Map,
1012 Carbon Court
Erie, Colorado



CLASS OF DAMAGE

VERY SLIGHT OR NEGLIGIBLE

SLIGHT

APPRECIABLE

SEVERE

VERY SEVERE

DESCRIPTION OF TYPICAL DAMAGE

SLIGHT CRACKS SHOWING IN WALLS AND CEILINGS INSIDE BUILDINGS, BUT NOT VISIBLE ON OUTSIDE.

SLIGHT CRACKS SHOWING INSIDE THE BUILDING. DOORS AND WINDOWS WILL NOT CLOSE.

SLIGHT CRACKS SHOWING BOTH OUTSIDE AND INSIDE BUILDING. DOORS AND WINDOWS WILL NOT CLOSE. DRAINS, SEWERS, AND GAS PIPES FRACTURE.

DRAINS, SEWERS, AND GAS PIPES FRACTURE. OPEN FRACTURES THROUGH WALLS OF BUILDING. WINDOW AND DOOR FRAMES DISTORTED, FLOORS NOTICEABLY SLOPING, WALLS LEANING OR BULGING NOTICEABLY. SOME LOSS OF BEARING OF BEAMS ON WALLS. PORTICOES AND FLOORS BUCKLE.

WORSE THAN ABOVE AND REQUIRING PARTIAL OR COMPLETE REBUILDING. ROOF AND FLOOR BEAMS LOSE BEARING AND WALLS LEAN BADLY AND NEED EXTERNAL SUPPORT. WINDOWS BROKEN AND DISTORTED. SEVERE SLOPES, BUCKLING AND BULGING OF ROOFS AND WALLS OCCUR.

(FROM N.C.B.)

WESTERN ENVIRONMENT
AND ECOLOGY, INC.
2217 WEST POWERS AVENUE
LITTLETON, COLORADO 80120

Figure 3 - Strain Percent to Length
of Structure
1012 Carbon Court
Erie, Colorado

BORE LOGS: - Coal Creek Commons: Mine Subsidence Investigation

HOLE NUMBER: CCC #1	LOCATION: Coal Creek Commons, Erie	STATE: Colorado
DRILLED BY: N.R. Bideau Drilling	LOGGED BY: Keith Gooldy	TOTAL DEPTH: 180'
DATE: 6/11/01	BIT SIZE: 5 1/8"	DRILLED WITH: AIR MUD X

DEPTH	SAMPLE DESCRIPTION
5	light brown sandy clay
10	light brown sandy clay
15	light brown sandy clay
20	light brown sandy clay with gravel
25	light brown sandy clay
30	light brown sandy clay
35	medium fine gravel with clay
40	medium fine gravel with clay
45	light gray claystone
50	medium grain sand
55	dark gray claystone
60	coal
65	medium gray claystone
70	medium gray clay stone
75	dark gray carbonaceous claystone
80	dark gray carbonaceous claystone
85	dark gray claystone
90	dark gray claystone
95	sand
100	sand
105	medium dark gray claystone
110	medium dark gray claystone
115	medium dark gray claystone
120	medium dark gray claystone
125	medium dark gray claystone
130	medium dark gray claystone
135	medium dark gray claystone
140	medium dark gray claystone

HOLE NUMBER: CCC #2	LOCATION: Coal Creek Commons, Erie	STATE: Colorado
DRILLED BY: N.R. Bideau Drilling	LOGGED BY: Keith Gooldy	TOTAL DEPTH: 180'
DATE: 6/11/01	BIT SIZE: 5 1/8"	DRILLED WITH: AIR MUD X

DEPTH	SAMPLE DESCRIPTION
5	light brown sandy clay
10	light brown sandy clay
15	light brown sandy clay
20	light brown sandy clay
25	light brown sandy clay
30	light brown sandy clay
35	sandy gravel
40	sandy gravel
45	light gray claystone
50	light gray claystone
55	light gray claystone
60	dark gray carbonaceous claystone
65	dark gray carbonaceous claystone
70	dark gray carbonaceous claystone
75	dark gray carbonaceous claystone
80	coal/claystone
85	dark gray claystone
90	dark gray claystone
95	dark gray claystone
100	dark gray claystone
105	dark gray claystone (soft drilling)
110	dark gray claystone (soft drilling)
115	light gray claystone (soft drilling)
120	light gray claystone
125	light gray claystone
130	light gray claystone
135	light gray claystone
140	light gray claystone
145	light gray claystone
150	light gray claystone

HOLE NUMBER: CCC #3	LOCATION: Coal Creek Commons, Erie	STATE: Colorado
DRILLED BY: N.R. Bideau Drilling	LOGGED BY: Adam Lusk	TOTAL DEPTH: 180'
DATE: 3/8/03	BIT SIZE: 5 1/8"	DRILLED WITH: AIR MUD X

DEPTH	SAMPLE DESCRIPTION
5	light brown sandy clay
10	light brown sandy clay
15	light brown sandy clay
20	light brown sandy clay
25	light brown sandy clay with gravel
30	light brown sandy clay
35	light gray claystone
40	light gray claystone
45	light gray claystone
50	light gray claystone
55	light gray claystone
60	med gray carbonaceous claystone
65	med gray carbonaceous claystone
70	med gray carbonaceous claystone
75	med gray carbonaceous claystone
80	dark gray claystone
85	dark gray claystone
90	light gray, very fine quartzose sandstone
95	light gray, very fine quartzose sandstone
100	med gray claystone
105	med gray claystone
110	med gray claystone with coal
115	med gray claystone with coal
120	med gray claystone
125	med gray claystone
130	med gray claystone
135	med gray claystone
140	med gray claystone Lost circulation @ 140'
145	no samples
150	no samples

HOLE NUMBER: CCC #4	LOCATION: Coal Creek Commons, Erie	STATE: Colorado
DRILLED BY: N.R. Bideau Drilling	LOGGED BY: Adam Lusk	TOTAL DEPTH: 180'
DATE: 3/8/03	BIT SIZE: 5 1/8"	DRILLED WITH: AIR MUD X

DEPTH	SAMPLE DESCRIPTION
5	light brown sandy clay
10	light brown sandy clay
15	light brown sandy clay
20	light brown sandy clay with gravel
25	light brown sandy clay
30	light brown sandy clay
35	light gray claystone
40	med gray claystone
45	med gray claystone
50	med gray claystone
55	med gray claystone
60	med gray carbonaceous claystone
65	dark gray carbonaceous claystone
70	med gray carbonaceous claystone
75	med gray carbonaceous claystone
80	med gray carbonaceous claystone
85	dark gray claystone
90	carbonaceous coal
95	carbonaceous coal
100	dark gray claystone
105	dark gray claystone (soft drilling)
110	dark gray claystone (soft drilling)
115	dark gray claystone (soft drilling)
120	vitreous coal
125	vitreous coal
130	dark gray claystone
135	dark gray claystone
140	dark gray claystone Lost circulation @ 140'
145	no samples
150	no samples

HOLE NUMBER: CCC #6	LOCATION: Coal Creek Commons, Erie	STATE: Colorado
DRILLED BY: N.R. Bideau Drilling	LOGGED BY: Adam Lusk	TOTAL DEPTH: 180'
DATE: 3/31/03	BIT SIZE: 5 1/8"	DRILLED WITH: AIR MUD X

DEPTH	SAMPLE DESCRIPTION
5	light brown sandy clay
10	light brown sandy clay
15	light brown sandy clay
20	light brown sandy clay
25	sandy gravel
30	sandy gravel
35	light gray claystone
40	dark gray claystone
45	dark gray claystone
50	med gray claystone
55	med gray claystone
60	dark gray claystone
65	dark gray claystone
70	dark gray claystone
75	fine-grained quartzose sandstone
80	dark gray claystone
85	coal/ carbonaceous claystone
90	coal/ carbonaceous claystone
95	fine-grained quartzose sandstone
100	fine-grained quartzose sandstone
105	fine-grained quartzose sandstone
110	light gray claystone
115	light gray claystone
120	med gray claystone
125	light gray claystone
130	med gray claystone
135	med gray claystone
140	dark gray claystone
145	dark gray claystone
150	med gray claystone

HOLE NUMBER: CCC #7	LOCATION: Coal Creek Commons, Erie	STATE: Colorado
DRILLED BY: N.R. Bideau Drilling	LOGGED BY: Adam Lusk	TOTAL DEPTH: 180'
DATE: 4/01/03	BIT SIZE: 5 1/8"	DRILLED WITH: AIR MUD X

DEPTH	SAMPLE DESCRIPTION
5	light brown sandy clay
10	light brown sandy clay
15	light brown sandy clay
20	light brown sandy clay
25	gravel
30	light gray claystone
35	light gray claystone
40	light gray claystone
45	light gray claystone
50	med gray claystone
55	med gray claystone
60	med gray claystone
65	med gray claystone
70	med gray claystone
75	med gray claystone
80	med gray claystone
85	med gray claystone
90	coal/ carbonaceous claystone
95	light gray claystone
100	light gray claystone
105	vitreous coal
110	vitreous coal
115	med gray claystone
120	med gray claystone
125	med gray claystone
130	dark gray claystone
135	dark gray claystone
140	dark gray claystone
145	dark gray claystone
150	dark gray claystone

HOLE NUMBER: CCC #8	LOCATION: Coal Creek Commons, Erie	STATE: Colorado
DRILLED BY: N.R. Bideau Drilling	LOGGED BY: Adam Lusk	TOTAL DEPTH: 180
DATE: 4/01/03	BIT SIZE: 5 1/8"	DRILLED WITH: AIR MUD X

DEPTH	SAMPLE DESCRIPTION
5	light brown sandy clay
10	light brown sandy clay
15	light brown sandy clay
20	light brown sandy clay
25	gravel
30	light gray claystone
35	light gray claystone
40	light gray claystone
45	light gray claystone
50	light gray claystone
55	light gray claystone
60	med gray claystone
65	med gray claystone
70	med gray claystone
75	light gray claystone
80	fine-grained quartzose sandstone
85	light gray claystone
90	coal/ carbonaceous claystone
95	coal/ carbonaceous claystone
100	light gray claystone
105	med gray claystone
110	vitreous coal
115	vitreous coal
120	vitreous coal
125	light gray claystone
130	light gray claystone
135	dark gray claystone
140	dark gray claystone
145	dark gray claystone
150	coal/ carbonaceous claystone

Lost circulation @ 150'

NUMBER B-1 LOCATION Fagre STATE: Colorado
 FILLED BY Ground Exploration LOGGED BY Brian Crandall TOTAL DEPTH 120'
 DATE March 6, 1998 BIT SIZE 6" DRILLED WITH Air

DEPTH	SAMPLE DESCRIPTION
5	SAND, light brown
10	SAND, light brown
15	SAND, light brown
20	SAND, light brown
25	SAND, light brown
30	CLAYSTONE, brown
35	CLAYSTONE, brown
40	CLAYSTONE, gray
45	COAL
50	CLAYSTONE, gray
55	CLAYSTONE, gray
60	CLAYSTONE, gray
65	CLAYSTONE, gray
70	COAL
75	CLAYSTONE, gray
80	SANDSTONE, light gray
85	SANDSTONE, light gray
90	CLAYSTONE, gray
95	COAL
100	CLAYSTONE, gray
105	COAL, water
110	COAL
115	CLAYSTONE, gray
120	CLAYSTONE, gray
125	
130	
135	
140	
145	TOTAL DEPTH 120'
150	MINED INTERVAL 100'-105'
155	
160	
165	
170	
175	
180	
185	
190	
195	
200	

NUMBER	B-2	LOCATION	Fagre	STATE:	Colorado
DRILLED BY	Ground Exploration	LOGGED BY	Brian Crandall	TOTAL DEPTH	120'
DATE	March 6, 1998	BIT SIZE	6 "	DRILLED WITH	Air

DEPTH	SAMPLE DESCRIPTION
5	SAND, light brown medium
10	SAND, light brown medium
15	SAND, light brown medium
20	SAND, light brown medium
25	SAND, light brown
30	SAND and GRAVEL
35	COAL
40	CLAYSTONE, gray
45	SANDSTONE, light gray
50	SANDSTONE, light gray
55	CLAYSTONE, dark gray carbonaceous
60	CLAYSTONE, gray
65	CLAYSTONE, dark gray / COAL
70	COAL / CLAYSTONE, gray
75	CLAYSTONE, gray
80	SANDSTONE, gray
85	CLAYSTONE, gray
90	CLAYSTONE / COAL
95	CLAYSTONE, gray
100	CLAYSTONE, gray
105	COAL
110	COAL
115	CLAYSTONE, gray sandy
120	CLAYSTONE, gray sandy
125	TOTAL DEPTH 120'
130	MINED INTERVAL 100'-105'
135	
140	
145	
150	
155	
160	
165	
170	
175	
180	
185	
190	
195	
200	

APPENDIX C
Caliper Data Sheets

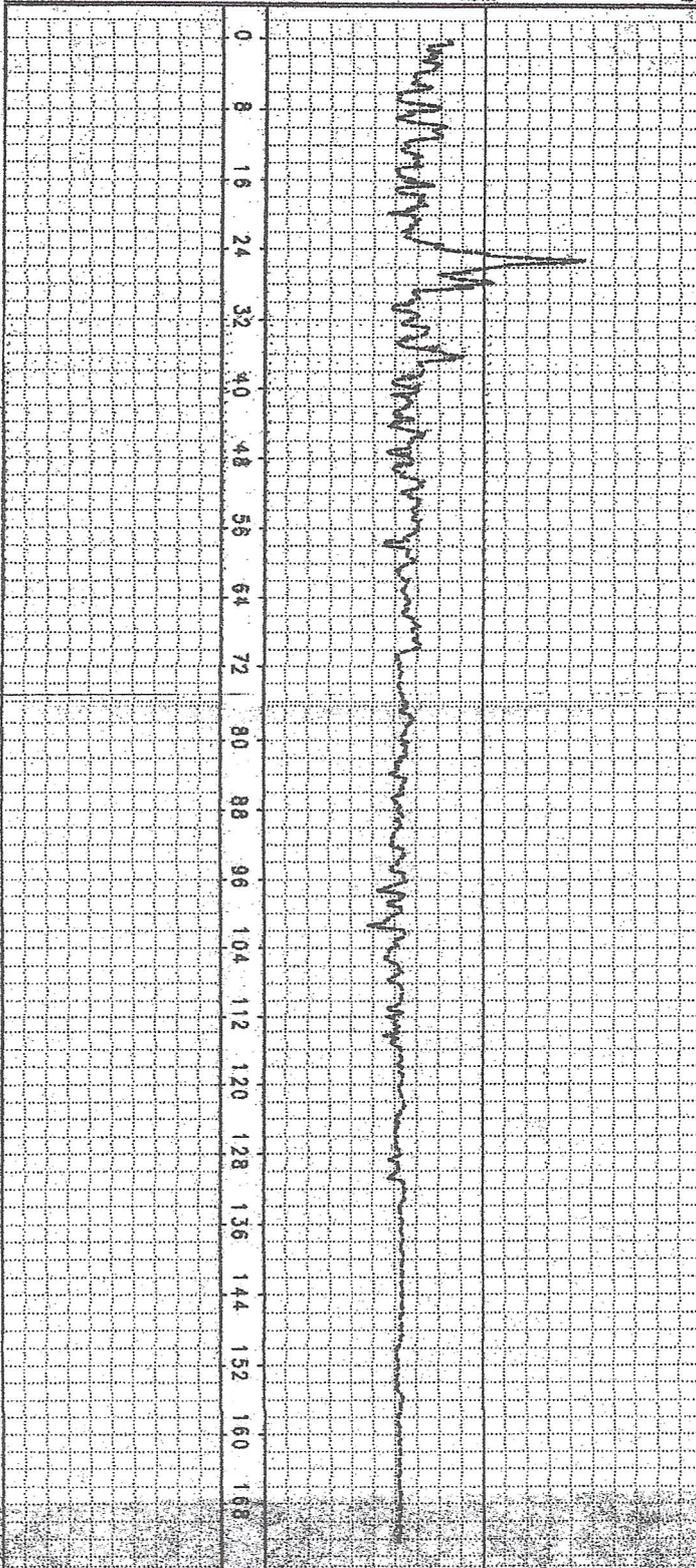
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CCC West

CGG

12

Caliper
Inches



(G: WESTERN AUSTRALIA)

CGG West

CGG

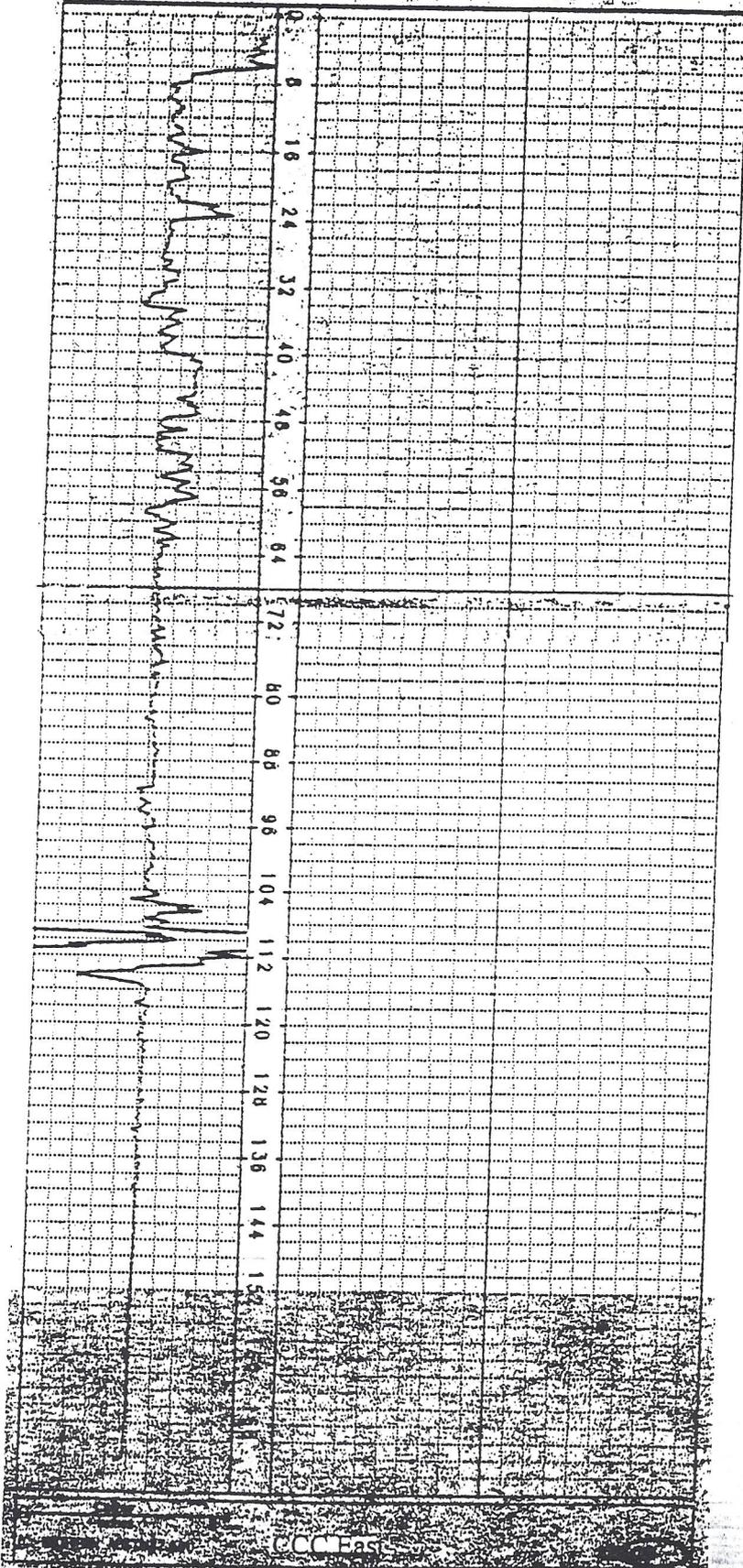
12

Caliper
Inches

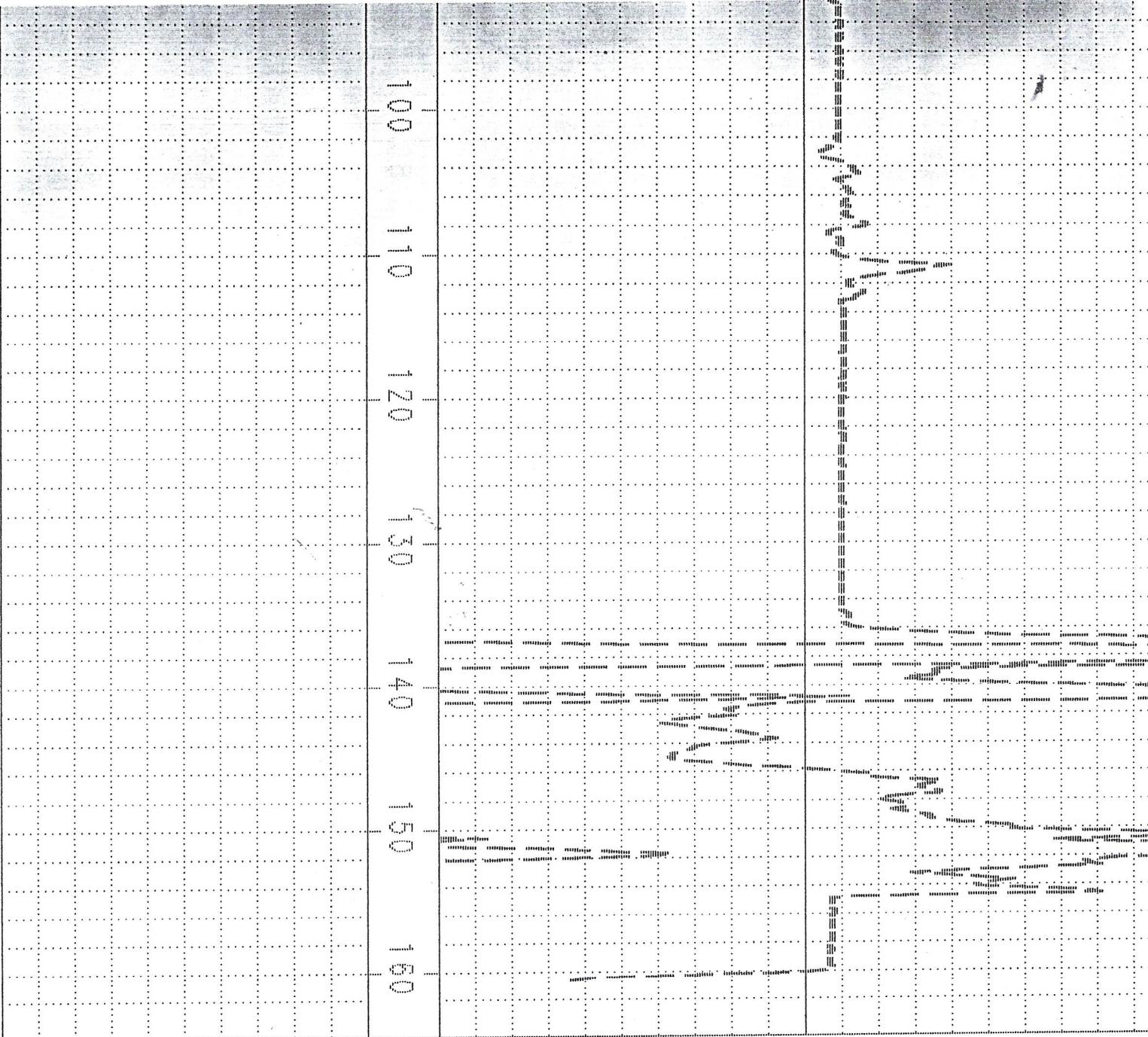
WESTERN AUSTRALIA

CCC-East

CCGE



CCC-East



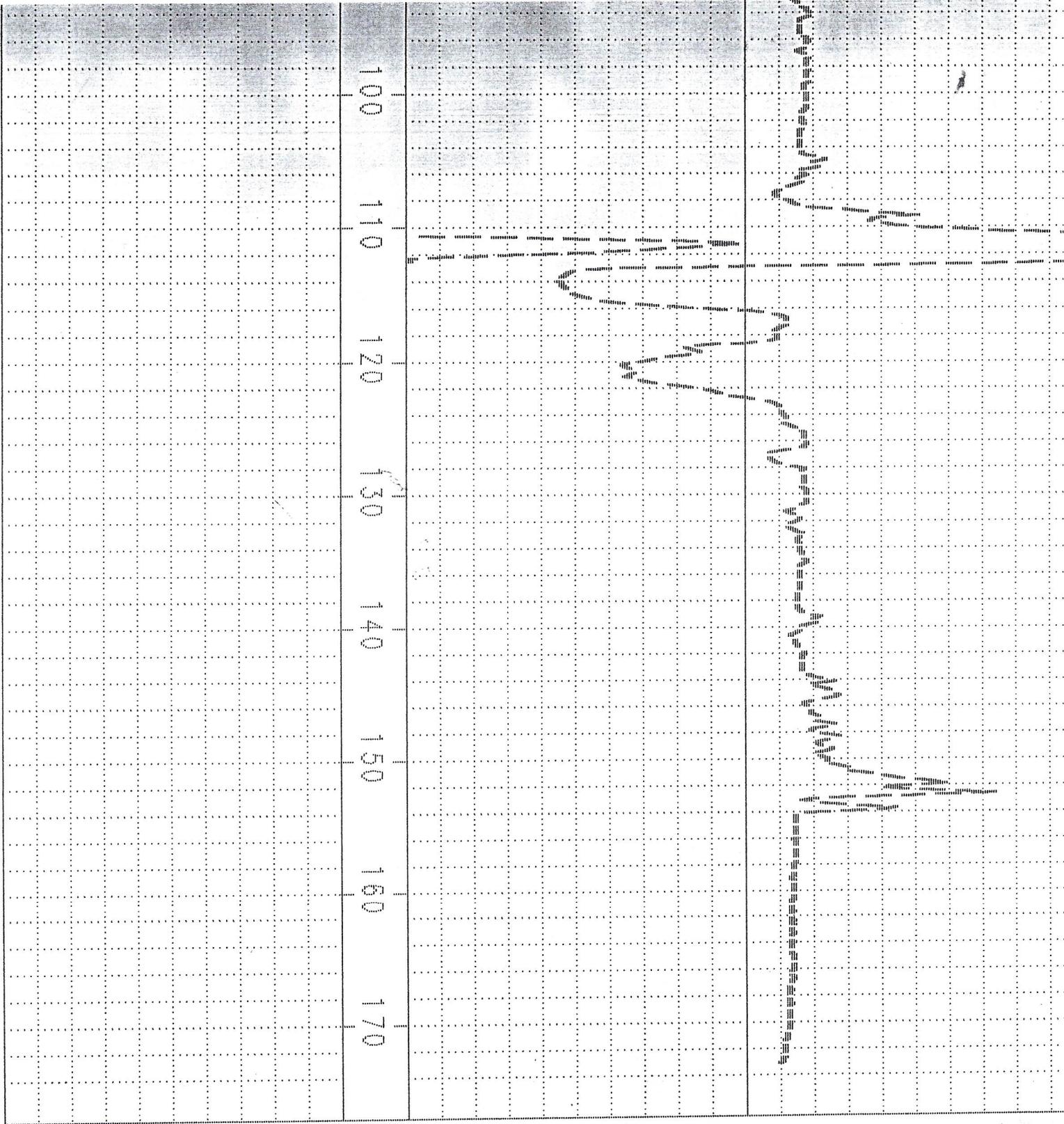
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Caliper
Inches

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(A: WESTERN A11AA1)

ccc 3



Caliper
Inches

10

CCC 4

(AS WESTERN #2.001)

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140
150
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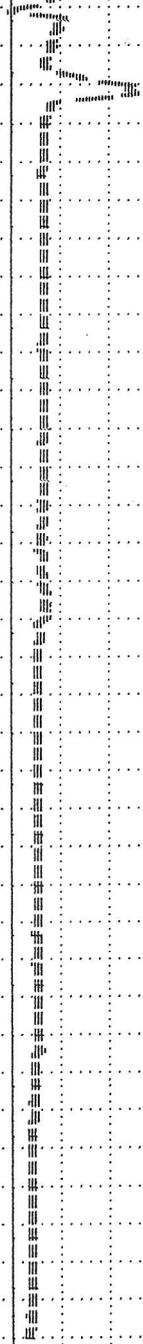
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Inches

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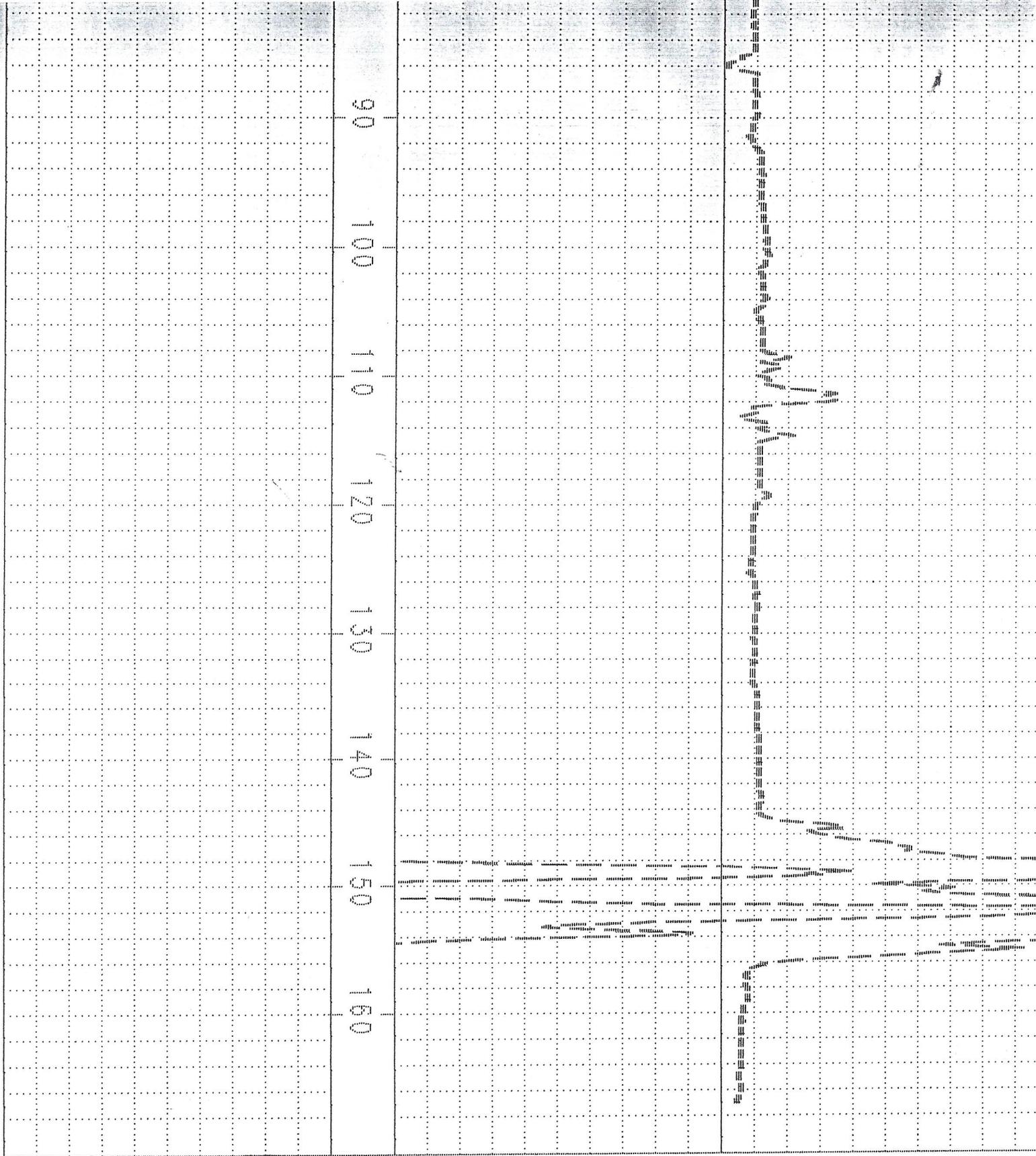
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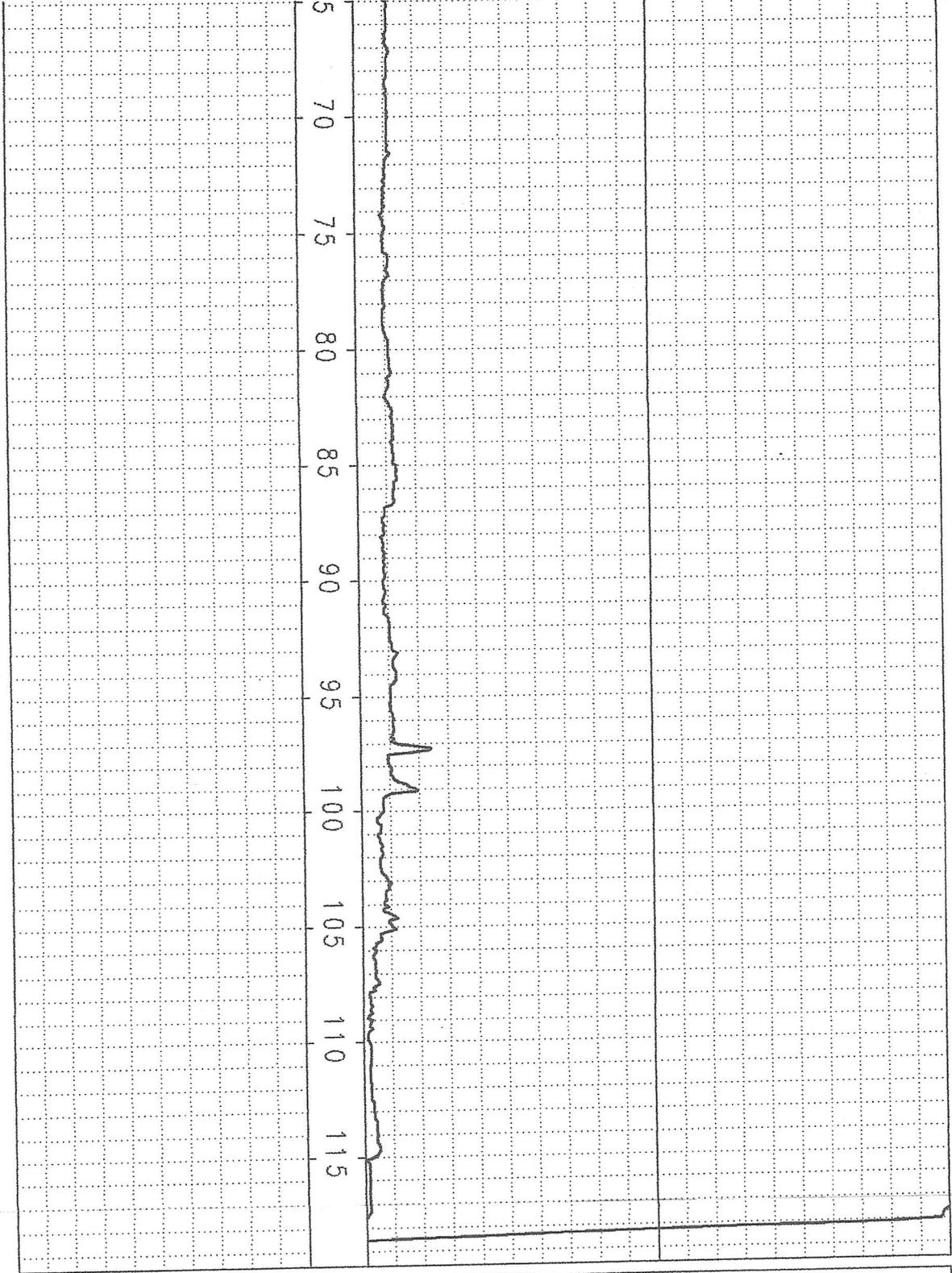
1/8

Caliper
Inches

000 7



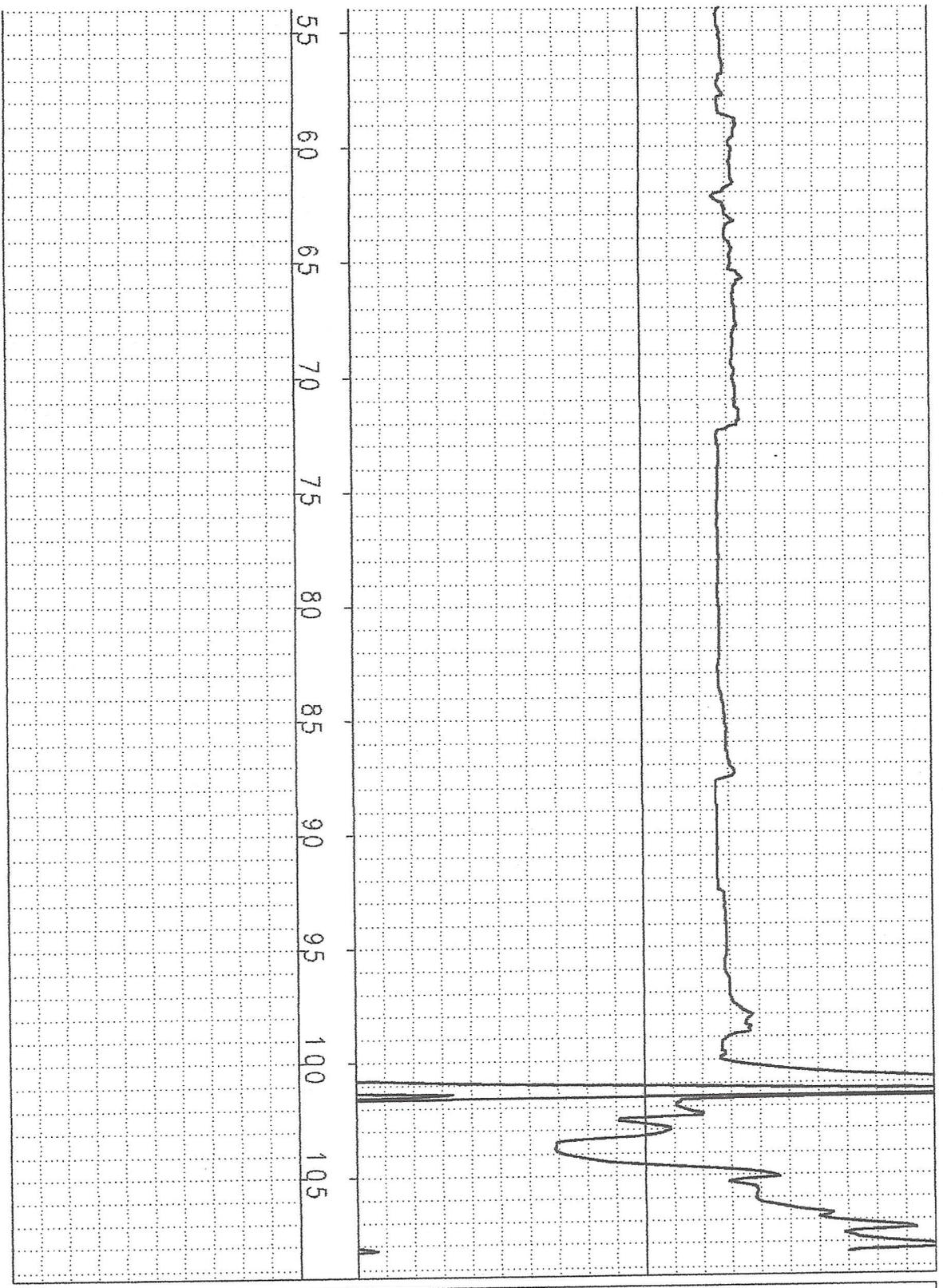
K₃ Caliper Inches 10
000 8



Well B1 Caliper Log March 6, 1998

Caliper
Inches

6 10



Well B2 Caliper Log March 6, 1998

Enter the depth of the mine workings:

105.9

Enter the width of the mine workings:

100

Enter the total open thickness of the mine workings:

1.2

Have multiple seams been worked at this mine?

No

Yes

Distance From Panel Center:

123	80	69	63	57	51	47	37
0.00	0.84	1.67	2.51	3.34	4.18	3.34	0.00

Strain (extension) X1000:

Distance From Panel Center:

37	34	32	28	25	19	9	4	0
0.00	0.75	1.50	2.25	3.00	3.75	3.00	2.25	1.50

Strain (compression) X1000:

Maximum Subsidence

Subsidence Profile

Strain Profile

Main Menu

Potential Damage

Print

Enter the depth of the mine workings:

105.9

Enter the width of the mine workings:

100

Enter the total open thickness of the mine workings:

1.2

Have multiple seams been worked at this mine?

No

Yes

Distance From Panel Center:

123	80	69	63	57	51	47	37
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Strain (extension) X1000:

0.00	0.84	1.67	2.51	3.34	4.18	3.34	0.00
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Distance From Panel Center:

37	34	32	28	25	19	9	4	0
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Strain (compression) X1000:

0.00	0.75	1.50	2.25	3.00	3.75	3.00	2.25	1.50
------	------	------	------	------	------	------	------	------

Maximum Subsidence

Subsidence Profile

Strain Profile

Main Menu

Potential Damage

Print

Enter the depth of the mine workings:

148.2

Enter the width of the mine workings:

100

Enter the total open thickness of the mine workings:

2.8

Have multiple seams been worked at this mine?

No

Yes

Distance From Panel Center:

154	95	79	70	64	54	47	36
0.00	1.00	2.00	3.00	4.00	5.01	4.00	0.00

Strain (extension) X1000:

Distance From Panel Center:

36	33	29	24	20	11	0	
0.00	1.25	2.50	3.75	5.01	6.26	5.01	

Strain (compression) X1000:

Maximum Subsidence

Subsidence Profile

Strain Profile

Main Menu

Potential Damage

Print

Enter the depth of the mine workings:

148.2

Enter the width of the mine workings:

100

Enter the total open thickness of the mine workings:

2.8

Have multiple seams been worked at this mine?

No

Yes

Distance From Panel Center:

154	72	57	48	42	36	30	26	20	14	0
0.00	0.10	0.21	0.31	0.41	0.52	0.62	0.72	0.83	0.93	1.03

Subsidence in Feet:

Maximum Subsidence

Subsidence Profile

Strain Profile

Main Menu

Potential Damage

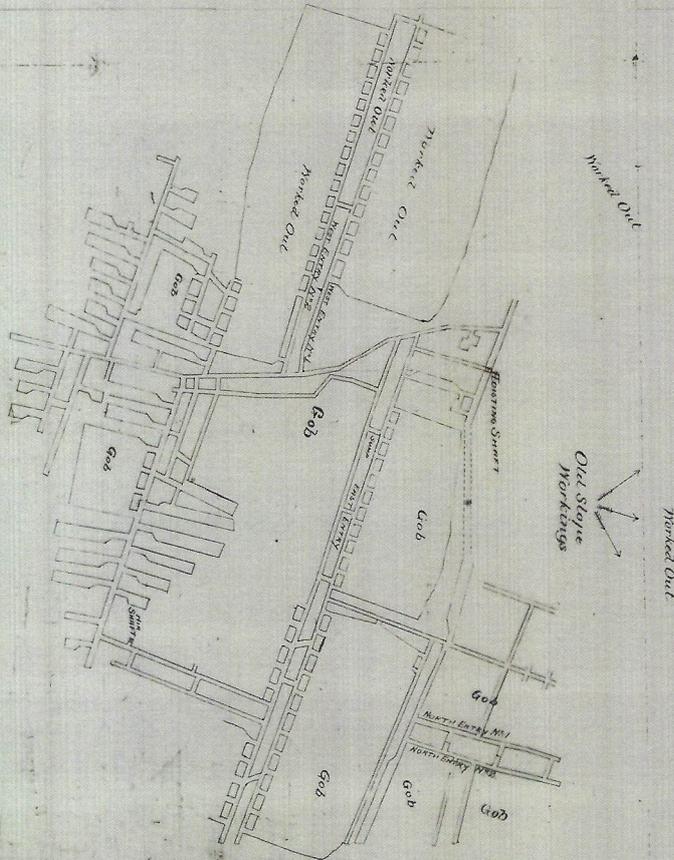
Print

Mine Name	Mitchell	Region & Field		Map Scale	1" = 100'	Map Date	1886
Also Known As		County		Sheet No.	1 of 1	Production Years	1883-1891
CMLRD ID No.		Legal Descrip.	1 / 1	Sec. 19	T. 1 N., R. 68 W.	Production Total	204,171 tons



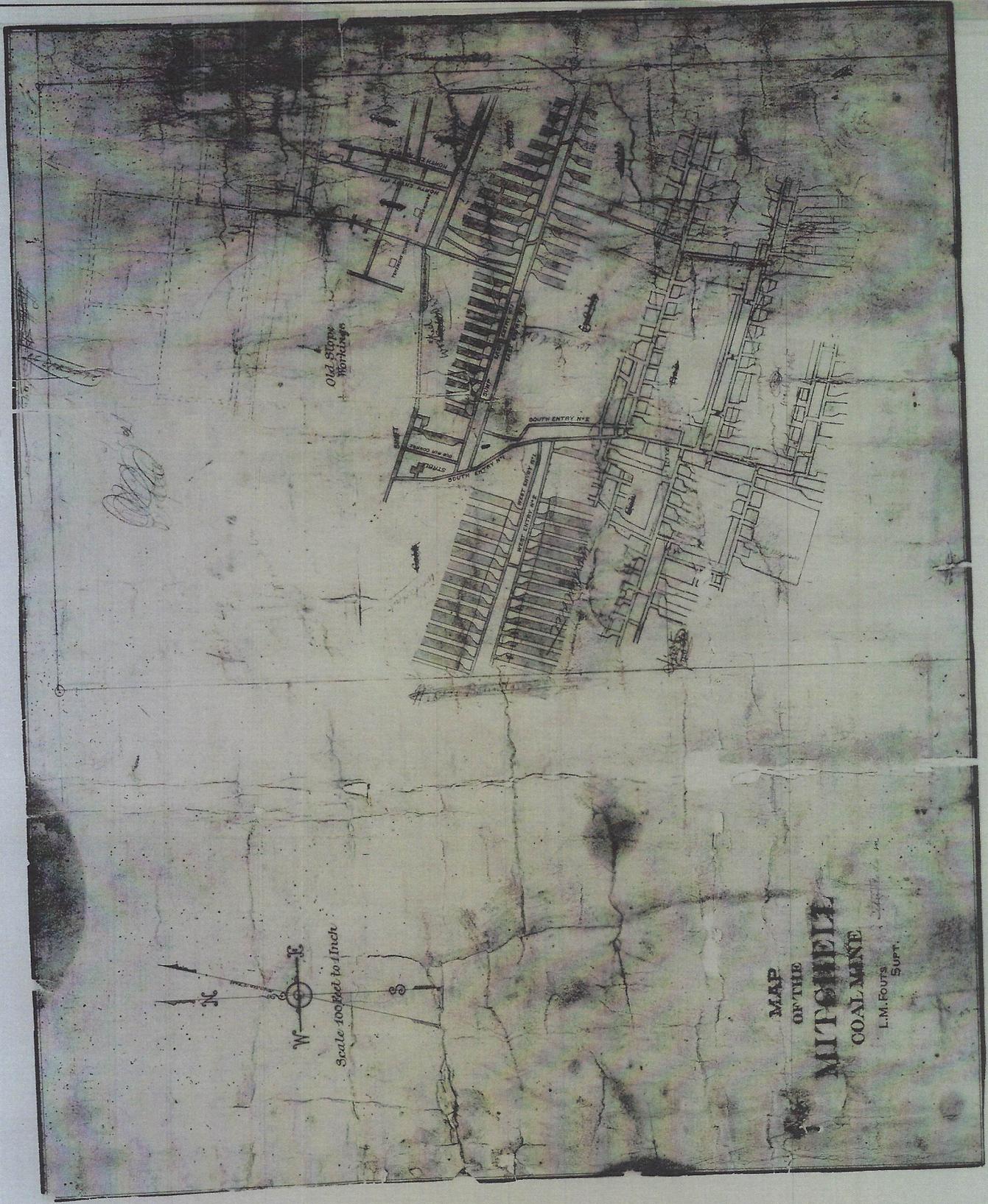
**MAP
OF THE
MITCHELL
COAL MINE**
S. W. Anderson
Alfred Peterson.

Scale 1 inch = 100 feet



Approximate
West 1/4
Corner
Sec 19
T18 R68W

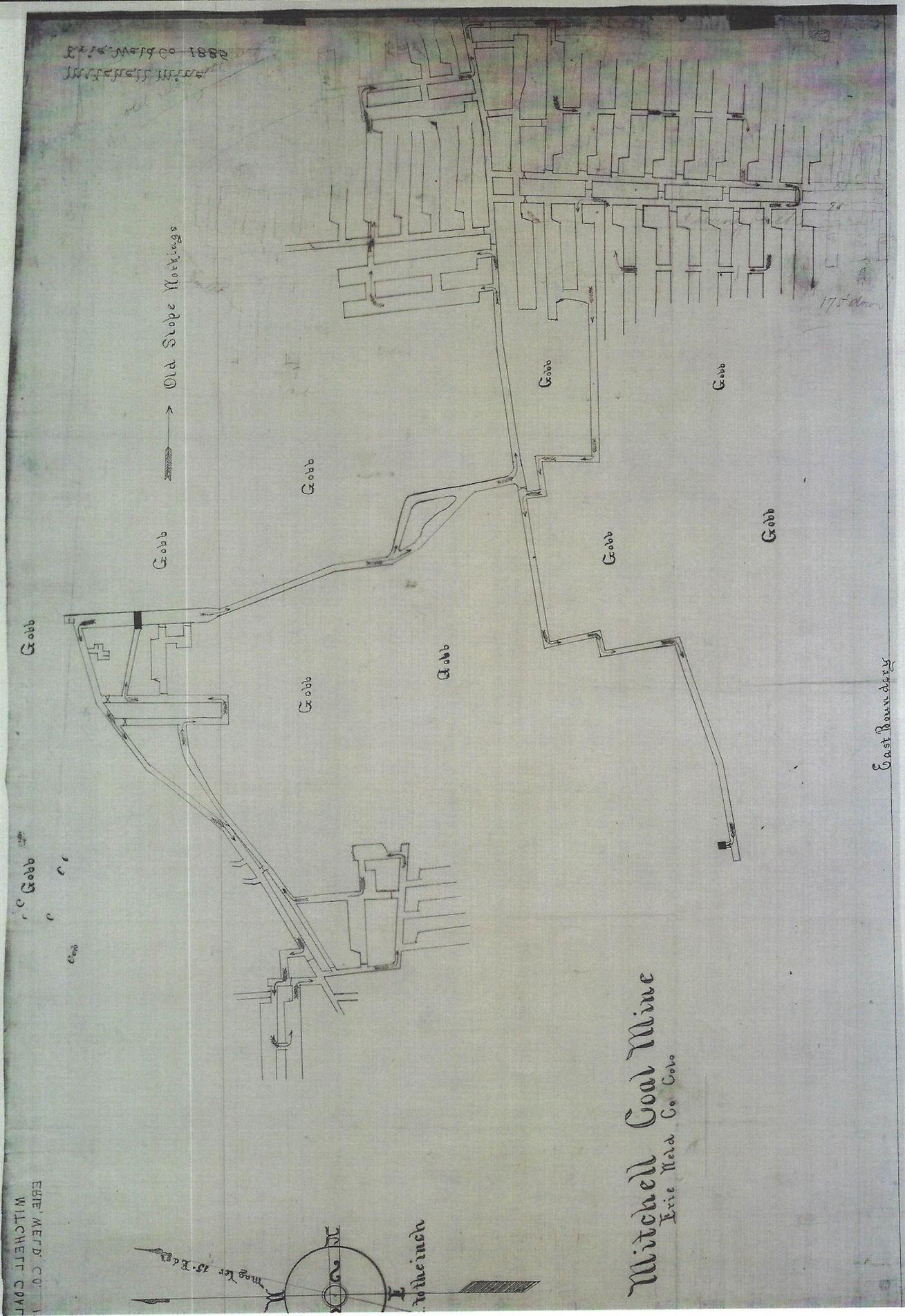
Mine Name	Mitchell	Region & Field	Denver-Boulder/Weld	Map Scale	1" = 100'	Map Date	1885
Also Known As		County	Weld	Sheet No.	1 of 1	Production Years	1883-1891
CMLRD ID No.		Legal Descrip.		Sec 19	T. 11N. R. 68W.	Production Total	204 171 tons



MAP
OF THE
MITCHELL
COAL MINE
L.M. FORTS
Supt.

COLORADO DIVISION OF MINES — DEPARTMENT OF NATURAL RESOURCES

Mine Name	Mitchell	Region & Field	Denver-Boulder/Weld	Map Scale	1" = 50'	Map Date	1885
Also Known As		County	Weld	Sheet No.	1 of 1	Production Years	1883-1891
GMLRD ID No.		Legal Descrip.	/ /	Sec	19 T. 11N. R. 48W	Production Total	204,171 tons



Mitchell Coal Mine
Erie Weld Co. Colo.

ERIE WELD CO. COLO.
MITCHELL COAL

**PHASE III DRAINAGE REPORT
FOR
RIGHT MOVE SUBDIVISION REPLAT A,
1ST AMENDMENT**

**Job Number: D01142
April 2019**

RICK ENGINEERING COMPANY

ENGINEERING COMPANY

RICK ENGINEERING CO

“I hereby that this Phase III Drainage Report for the design of Erie Business Park and Storage Facility 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 hereof. 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”

Arnold Niemeyer, PE
For and on behalf of
Rick Engineering
Registered Professional Engineer
State of Colorado No. 22281

Date

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 REMAIN THE SOLE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEAR HEREON.**

Accepted by: _____
Deputy Public Works Director

Date

If during the construction process or at any time within one year following the acceptance by the TOWN of the completed improvements, any deficiencies or errors are discovered in the construction plans, specifications, drainage reports, or the actual constructed improvements, the TOWN shall have the right to require the developer to make any and all corrections which may be deemed necessary by the TOWN. The costs associated with any such corrections shall be the sole responsibility of the developer.

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I. General Location and Description



Scale: 1" = 2000'

Site Location

The proposed Right Move Subdivision, Replat A, is located in the southwest quarter of Section 19, Township 1 North, Range 68 West, of the 6th Prime Meridian.

The site is bound by County Line Road (140' Right-of-Way) along the west, Lot 1 of Coal Creek Subdivision on the north, Lot 1 of The Right Move Subdivision on the east, and Lot 3 of The Right Move Subdivision on the south. On the southeast corner of the Site, there is an access from Carbon Court cul-de-sac.

Description of Property

The Site is approximately 2.32 Acres in size and does not currently contain any structures. It has existing utilities, pavement, and vegetation. There exists waterlines on site that provide irrigation for existing landscaping on site and along the Right of way in County Line Road.

A soils report was generated using the NRCS Web Soil Survey. The entirety of the Site is classified as Ascalon Sandy Loam which is classified as hydrologic soil group B. See Appendix B for the NRCS Soil Survey Report.

Within the site there is a paved road that provides drive access to the neighbor to the east and lies within an Access and Utility Easement. There are existing 10' Utility Easements along the Site property boundary; 10' Pedestrian Easement on the southern boundary; 20' Utility Easement on the southern boundary; and 30' Landscape Buffer and Utility Easement along the western boundary. Not on site are existing 10' Utility Easements on Lot 1 of The Right Move Subdivision (neighbor to the east). The property is proposed for commercial use.

Major Drainageways

There are no major drainageways on the Site. The closest major drainageway is Coal Creek which is located approximately 2,500 feet to the south. There is a Drainage Report for Right Move Lot 1 Site Improvement.

Proposed Project Description

There is a proposed building for this site. It is 3 stories with a total gross floor area of approximately 99,150 square feet and will be used for personal storage. The building will be surrounded with paved drive and curb and gutter. There will be access to the building from County Line Road and the neighbor to the east will maintain their access through the project site.

II. Drainage Basins and Sub-basins

Major Drainage Basin

The Site is part of the Coal Creek drainage basin per the Urban Drainage and Flood Control District's Regional Major Drainage Map. As shown on the FEMA FIRM Map Panel 08013C0441J last revised December 18, 2012, the subject site is outside of the 100-year flood zone. See Appendix A for the FEMA Firm Map.

The Right Move Subdivision Lot 1 has a drainage report done in 2005 by Hurst and Associated, Inc. According to this drainage report, a detention pond located in the northeast corner of Lot 1 was designed to account for the full Lot 7 of Right Move Subdivision (this project site). This detention pond now exists and will be referred to as "Lot 1 Pond".

Existing On-site and Off-site Drainage Basin Flow Patterns

The existing topography has grades of about 2%-5% and generally slopes from the top of an existing ridgeline from the western property boundary to the east; dropping about 6 feet from elevation 5082 to 5076. There exists a swale along the East County Line Road that drains to an existing Type 13 inlet in the right of way. This swale prevents runoff from County Line Road from draining onto the Site. There are existing trees on the west side of the Site. There are no existing drainage or water quality features on the Site.

EX-1: Is an off-site basin of landscape along the northern and western boundary. This basin historically flows on-site onto Basin H1.

EX-2: Is an off-site basin of landscape and existing concrete walks that lies within the right of way of County Line Road. It drains onsite from the ridgeline to the east onto Basin H2.

EX-3: Is an off-site basin of landscape along the southern boundary. This basin historically flows on-site onto Basin H2.

H1: Is the northern portion of the Site. It is comprised of landscape, portions of the existing paved drive, existing trees and shrubs. This basin (and Basin EX-1) drains to Lot 1 of The Right Move Subdivision in an existing swale at Design point H1 (DP-H1) towards Lot 1 Pond in the northeast corner of Lot 1.

H2: Is the southern portion of the Site. It is comprised of landscape, portions of the existing paved drive, existing trees and shrubs. This basin (and Basins EX-2 & EX-3) drains to Carbon Court cul-de-sac at Design Point H2 (DP-H2) and enters an existing inlet on the south side of Lot 1, which drains to Lot 1 Pond.

The existing drainage patterns generally follow the drainage patterns shown in The Right Move Lot 1 Drainage Report from 2005. The Lot 1 Pond was designed to provide water quality and detention for 8.08 acres which include this Site.

See the back pocket for the Existing Conditions drainage map and a copy of 2005 The Right Move Lot 1 Drainage Map.

Proposed On-site and Off-site Drainage Basin Flow Patterns

The proposed site has grades of up to 6% on the paved drive due to a large elevation change from the western property line to the eastern property boundary. The general drainage concept is for the roof of the proposed building to drain to the east and into down spouts that outfall onto splash-blocks for overland flow. Overland flow will drain to the north and east into inlets to be conveyed towards the Under-Ground Detention Facility on the north side of the site.

OS1: Is an off-site basin of landscape, portions of an existing and proposed concrete walk, and paved drive entrance along the western boundary, within the County Line Road right of way. Runoff flows from atop an existing ridgeline towards the east and will flow onto Basin A1.

OS2: Is an off-site basin of landscape and trees along the northern boundary. This basin flows to the south onto Basin A1.

OS3: Is an off-site basin of landscape and trees along the southern boundary. This basin is like existing basin EX-3, however it doesn't flow on-site. Instead, this basin and basin C1 create a swale that convey runoff to the east to an existing inlet at Carbon Court.

A1: Is a basin comprised of landscape, walks, asphalt drive, and curb and gutter. This basin receives runoff from Basins OS1 and OS2 and is conveyed via curb and gutter towards a proposed Inlet 1 at Design Point 1 (DP1).

B1: Is a basin comprised of landscape, walks, asphalt drive, and curb and gutter. This basin drains to Inlet 2.

B2: Is a basin comprised of roof runoff that enters down spouts to splash blocks for overland flow onto a paved drive. This Basin receives flow from Basin B3 and routed flows enter Inlet 3 at Design Point 4 (DP4).

B3: Is a basin comprised of roof runoff that enters down spouts to splash blocks for overland flow onto a paved drive and a concrete pan that conveys runoff from this basin to the south towards Basin B2.

B4: Is a basin comprised of roof runoff that enters down spouts to splash blocks for overland flow onto a paved drive and curb and gutter that conveys flow to Inlet 4 at Design Point 6 (DP6).

B5: Is a basin comprised of roof runoff that enters down spouts to splash blocks for overland flow onto a paved drive and curb and gutter that conveys flow to Inlet 5 at Design Point (DP8).

C1: Is an on-site basin that was unable to be graded to the proposed UGD, however, it will flow to the Lot 1 Pond. It is a basin comprised of asphalt, landscape, curb and gutter, and a cross pan that conveys runoff to Carbon Court and converges with flow from OS3 at an existing inlet at Design Point 10 (DP10).

C2: Is an on-site basin that was unable to be detained due to grading constraints. It is a basin comprised of landscape.

III. Drainage Design Criteria

The criteria being followed is per the Town of Erie Storm Drainage Manual (EDSM) and the Urban Drainage and Flood Control District (UDFCD) Drainage Criteria Manual. The StormTech Design Manual was used to assist in the design of the Under-Ground Detention (UGD) Facility.

See Appendix E for calculations to check criterion.

Hydrological Criteria

Per the EDSM, the design 1-hour rainfall depth of 2.68 inches and 1.11 inches, for the 100-yr and 5-yr storm events, respectively. The rational method was used to calculate runoff.

Hydraulic Criteria

Curb & Gutter and Cross-pans

Curb & gutter and cross-pans were used to convey overland flow towards the inlets. Capacity checks were performed for the 100-year runoff. Hydraflow Express Extension for Autodesk AutoCAD was used to perform those calculations.

Inlets

Inlets selections are in accordance with the EDSM. They will be used to convey flow towards the UGD Facility. Per EDSM, they were sized for the major storm event (100-yr) using the UDFCD Inlet spreadsheet version 4.05. and account for clogging as required by EDSM.

Storm Drains

Storm pipe and inlets are used to collect runoff from the inlets and roof down spouts to the UGD Facility. Storm sewer is also used to route restricted flows from the UGD Facility to Lot 1 Pond. Autodesk's Hydroflow Storm Sewer Extension program was used to calculate the hydraulic grade line (HGL) in the pipe. The HGL is more than 1 foot lower than the proposed grade.

Detention and Water Quality Criteria

Per the ESDM, the site will be required to provide 10-yr and 100-yr detention with water quality. This can be achieved with an Extended Detention Basin intended to reduce the flooding and stream degradation impacts associated with urban development by controlling peak flows in the stream for a range of events.

The Town has a maximum allowable release rate for detention ponds. The maximum allowable release rate for soil Type B (per ESDM Table 800.4) is 0.85 cfs/acre for the 100-year event and 0.23 cfs/acre for 10-year event.

Per ESDM Section 814.09, there are minimum detention volume criteria. Equations 802 and 803 are functions of imperviousness and tributary area and calculate minimum required 100-yr and 10-yr volumes. The calculated detention volumes using the ESDM criteria are compared with those computed using the UD-Detention spreadsheet and the more conservative values are used.

Per UDFCD Vol 3, water quality must be provided. Equation 3-1 was used to calculate the water quality required volume.

IV. Drainage Facility Design

Lot 1 Pond is designed to provide water quality and detention for 8.08 acres (which include the Site) at a weighted imperviousness of 67%. Its designed water quality volume is 0.08 ac-ft and total 10 & 100-yr detention volume of 0.58 & 0.94 ac-ft, respectively. The Site will have a different imperviousness than what was assumed in The Right Move Lot 1 drainage report from 2005, therefore an analysis was done to determine if the design volume Lot 1 Pond is sufficient. The tributary area was found to be 8.31 acres with a weighted imperviousness of 70.1% and requires a water quality volume of 0.19 ac-ft and a 10 & 100-yr detention volume of 0.73 & 1.12 ac-ft, respectively; which is greater than what was provided in Lot 1 Pond. Therefore, this project will provide on-site detention for the remaining water quality volume of 0.114 ac-ft, and 10 & 100-yr volume of 0.150 ac-ft & 0.175 ac-ft, respectively.

Due to the shape and size of the building and parking lot on the site, an above ground detention was not feasible, therefore an under-ground detention facility is proposed. The City of Erie has requested that a 25% increase in volume be provided, thus the proposed detention system has a 100-yr storage requirement of at least 0.218 ac-ft (25% of 0.175 ac-ft).

Under-Ground Detention Facility

Detention is provided by one on-site Under-Ground Detention (UGD) Facility that provides storage for the water quality volume, and 10- and 100-year storms events. The UGD Facility consists of a series of underground chambers (ADS Stormtech Model SC-740). The proposed chambers are laid

out in rows and columns at least two feet underground and are surrounded by aggregate with 40% stone porosity per manufacture standards. The storage volume is provided by the chambers and the voids within the surrounding aggregate. These chambers are equipped with a filter fabric which will allow sediment and pollutants to settle out of storm runoff from smaller storm events before entering the other chambers and aggregate. During larger storm events, runoff will overflow the control weir and flow into the remaining chambers.

The UGD Facility provides detention for 2.03 acres of the 2.32 acres. The remaining “C” basins (0.29 ac) will flow towards Lot 1 Pond for water quality and detention. Since the off-site basins OS1 & OS2 (0.18 ac) is part of the tributary area, they will be detained in the UGD and Lot 1 Pond.

Basin OS1 & OS2, Basin A1, and Basins B1-B5 will drain to the UGD Facility with an imperviousness of 74.2% and total of 2.27 acres. These values were entered in the UD- Detention spreadsheet and an orifice plate was designed to detain the required 0.175 ac-ft.

The flow in the UGD Facility will be controlled with an outlet structure and will exit the system through a 24” RCP that outfalls onto existing rip-rap just before entering Lot 1 Pond.

The UGD Facility is equipped with an outlet structure which will control release rates with an orifice plate for both the water quality and 10- year storm event. The water quality volume drains within the 40-hour minimum as recommended by UDFCD and is controlled by a series of vertical holes in the orifice plate. The 10-year is also controlled by the orifice plate. As a storm becomes larger, the plate will begin to act as a weir to control the 100-year.

The proposed UGD Facility will release at rates below or equal to the runoff calculated in the (2005) Right Move Subdivision Lots 1 & 7 Drainage Report. Per the 2005 report, the existing rip rap will receive flow from its corresponding Basin A1 at 10-yr = 2.6 cfs and 100-yr =6.8 cfs. The 24” RCP will outfall onto the existing riprap and convey 10 & 100- yr flow (released by the outlet structure) at rates of 0.1 cfs and 6.2 cfs.

The top of the orifice plate that controls the 100-year storm events also acts as a spillway for a larger than 100-year storm event. The top of the orifice plate is set at elevation 5073.8 to spill the full 100-year flow of 11.8 cfs. The overflow has a depth of 0.68 ft, creating an overflow water surface elevation of 5074.48, more than 1’ below the lowest finished grade over the system.

See Appendix E for stormwater detention and release calculations for the UGD Facility.

The development of the property, despite increasing impervious area for the property, does not adversely impact the surrounding area. The increased on-site runoff is detained by on-site UGD Facility and the Lot 1 Pond and released at rates at or below historic rates.

Maintenance & Inspection

The Under-Ground Detention Facility will be accessible to maintenance via manholes and inspection ports. A high-pressure water jetting process may be used for maintenance of isolator rows.

Downstream Impacts

Per the Right Move Subdivision Lot 1 & 7 Drainage Report, the existing inlet at Carbon Court receives 2.4 cfs from the site (100-yr at Design Point H2); with the proposed conditions of the site, that existing inlet will receive 1.6 cfs (100-yr at Design Point 10). The existing swale in Lot 1 at 100-yr Design Point H1 receives 3.3 cfs from the site; with the proposed conditions of the site, it will receive 0.1 cfs (100-yr at Basin U2).

V. Summary

According to the Right Move Subdivision Lots 1 & 7 (2005) Drainage Report, the Lot 1 Pond was designed to detain for this Site (Lot 7). However, the proposed Site has a greater imperviousness than was anticipated, therefore additional detention is required. For this additional required detention, an on-site Under Ground Detention basin was proposed. Despite the increased imperviousness of the proposed site, the reduced 100-yr release rate of 6.2 cfs is less than the existing runoff rate of 6.8 cfs, which will improve the current condition of that existing pond.

As requested by the City of Erie, the UGD Facility provides 0.219 ac-ft (and extra 25% of 0.715 ac-ft).

VI. References

1. Urban Storm Drainage and Flood Control District Drainage Criteria Manual, Volumes 1, 2, and 3, Denver Regional Council of Governments, Vol. 1 revised August 2018, Vol. 2 revised September 2017, Vol. 3 revised April 2018.
2. Flood Insurance Rate Map 08013C0441J, Federal Emergency Management Agency, December 2012.
3. Custom Soil Resource Report for Weld County. Southern Part, United States Department of Agriculture National Resources Conservation Service
4. Standards and Specifications for Design and Construction of Public Improvements 2019 Edition. Town of Erie, Colorado.
5. StormTech Design Manual for SC-740, A Division of ADS, www.stormtech.com,

APPENDIX A
FIRM MAP

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, NNGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

Base map information shown on this FIRM was provided by the FEMA Map Service Center and the Boulder Area Spatial Data Cooperative (BASDC). Additional input was provided by the Town of Erie and the City of Longmont. These data are current as of 2004.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfp>.

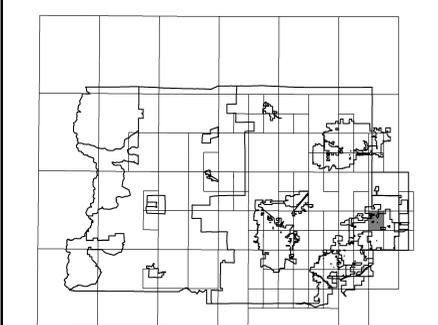
Accredited Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at <http://www.fema.gov/business/nfp.index.htm>

Boulder County Vertical Datum Offset Table

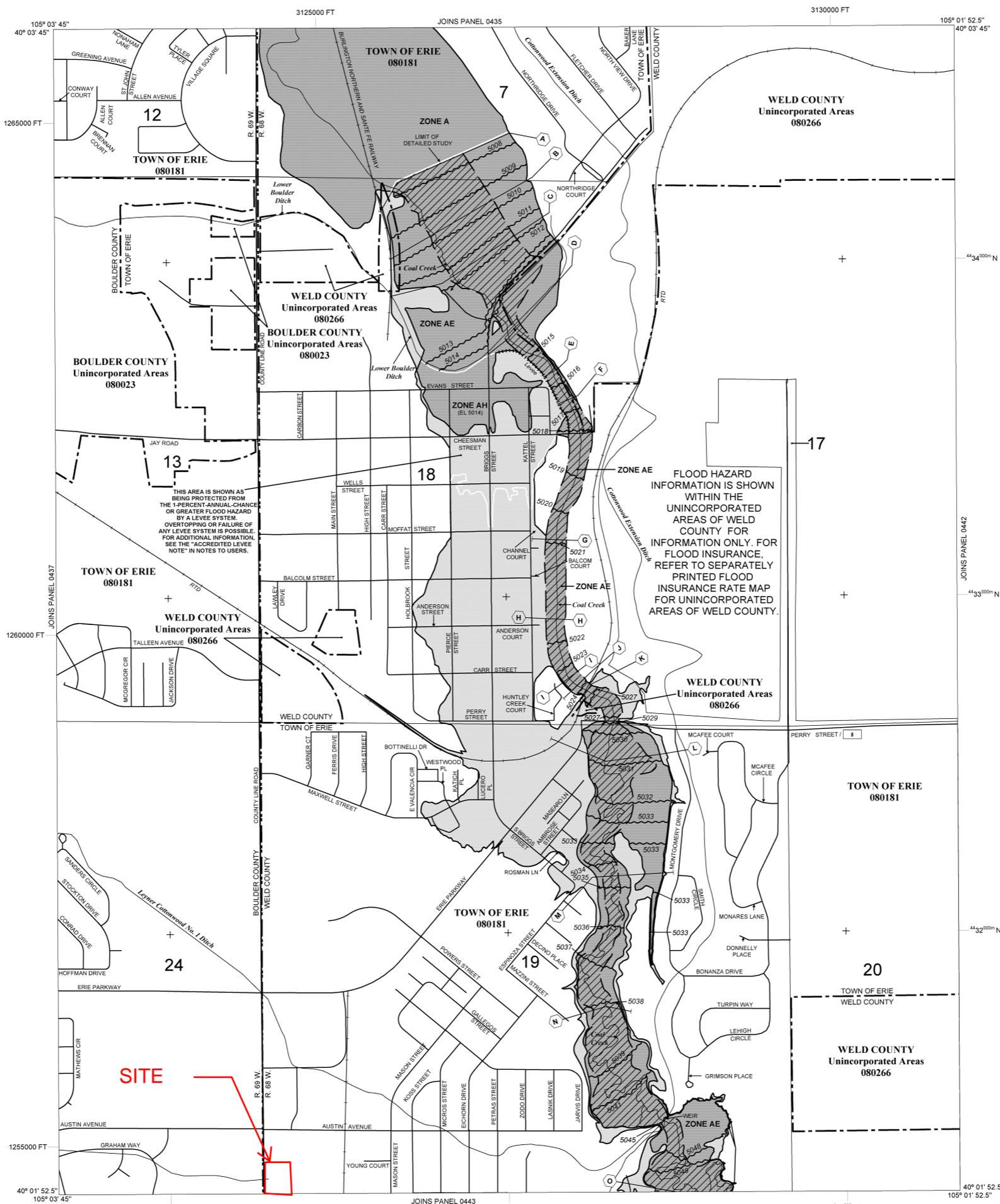
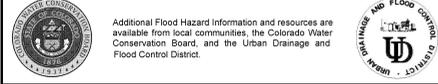
Flooding Source	Vertical Datum Offset (ft)
Coal Creek (Within Town of Erie)	3.0

Example: To convert Coal Creek elevations to NAVD 88, 3.0 feet were added to the NGVD 29 elevations.

Panel Location Map



This digital Flood Insurance Rate Map (FIRM) was produced through a cooperative partnership between the State of Colorado Water Conservation Board, the Urban Drainage and Flood Control District, and the Federal Emergency Management Agency (FEMA). The State of Colorado Water Conservation Board and the Urban Drainage and Flood Control District have implemented a long-term approach of floodplain management to reduce the costs associated with flooding. As part of this effort, both the State of Colorado and the Urban Drainage and Flood Control District have joined in Cooperating Technical Partner agreements with FEMA to produce this digital FIRM.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 1 NORTH, RANGE 68 WEST, AND TOWNSHIP 1 NORTH, RANGE 69 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently derelictified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513 Base Flood Elevation line and value; elevation in feet*
(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*
*Referenced to the North American Vertical Datum of 1988

A Cross section line
23 Transsect line
45° 02' 08", 63° 02' 12" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
499000m N 1000-meter Universal Transverse Mercator grid values, zone 13
3180000 FT 5000-foot ticks: Colorado State Plane North Zone (FIPS Zone 5051), Lambert Conformal Conic projection
DX5510 x Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 River Mile
MAP REPOSITORY Refer to listing of Map Repositories on Map Index
EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP June 2, 1995
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL May 6, 1996 - to incorporate previously issued Letters of Map Revision; to add roads and road names; and to update corporate limits; October 4, 2002 - to change base flood elevations; to change special flood hazard areas; to change zone designations; to update roads and road names; to reflect updated topographic information; to incorporate previously issued Letters of Map Revision; and to change floodway information; December 18, 2012 - to update corporate limits; to update roads and road names; to add Special Flood Hazard Areas previously shown on Town of Erie, Colorado Flood Insurance Rate Map dated December 2, 2004; and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

PANEL 0441J

FIRM FLOOD INSURANCE RATE MAP BOULDER COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 441 OF 615

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BOULDER COUNTY	080223	0441	J
ERIE, TOWN OF	080181	0441	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 08013C0441J

MAP REVISED DECEMBER 18, 2012

Federal Emergency Management Agency

APPENDIX B
NRCS SOIL SURVEY REPORT



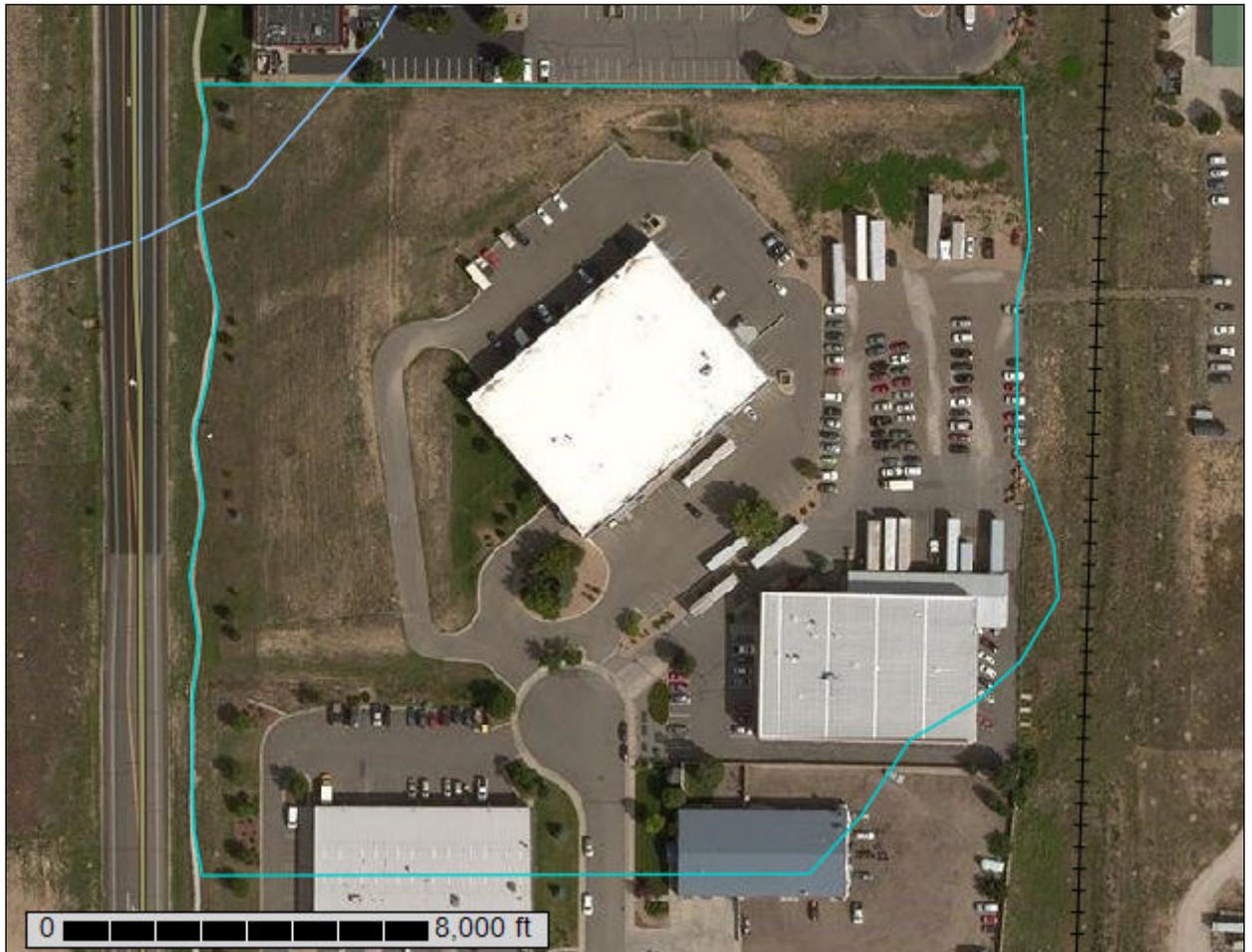
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

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

Custom Soil Resource Report for Weld County, Colorado, Southern Part



Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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How Soil Surveys Are Made

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

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

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

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

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

Custom Soil Resource Report

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

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

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

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

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

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

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

Custom Soil Resource Report

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

Soil Map

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

Custom Soil Resource Report Soil Map



Map Scale: 1:1,680 if printed on A landscape (11" x 8.5") sheet.

0 20 40 80 120 Meters

0 50 100 200 300 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 Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features

Water Features

 Streams and Canals

Transportation

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

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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: Weld County, Colorado, Southern Part
 Survey Area Data: Version 17, Sep 10, 2018

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
5	Ascalon sandy loam, 0 to 3 percent slopes	9.8	100.0%
Totals for Area of Interest		9.8	100.0%

Map Unit Descriptions

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

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

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

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

Custom Soil Resource Report

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

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

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

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

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

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

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

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

Weld County, Colorado, Southern Part

5—Ascalon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2swl3

Elevation: 3,870 to 5,960 feet

Mean annual precipitation: 12 to 16 inches

Mean annual air temperature: 46 to 57 degrees F

Frost-free period: 135 to 160 days

Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition

Ascalon and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ascalon

Setting

Landform: Interfluves

Landform position (two-dimensional): Summit

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Wind-reworked alluvium and/or calcareous sandy eolian deposits

Typical profile

Ap - 0 to 6 inches: sandy loam

Bt1 - 6 to 12 inches: sandy clay loam

Bt2 - 12 to 19 inches: sandy clay loam

Bk - 19 to 35 inches: sandy clay loam

C - 35 to 80 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum in profile: 10 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)

Sodium adsorption ratio, maximum in profile: 1.0

Available water storage in profile: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e

Land capability classification (nonirrigated): 4c

Hydrologic Soil Group: B

Ecological site: Sandy Plains (R067BY024CO)

Custom Soil Resource Report

Hydric soil rating: No

Minor Components

Olnest

Percent of map unit: 10 percent

Landform: Interfluves

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: Sandy Plains (R067BY024CO)

Hydric soil rating: No

Vona

Percent of map unit: 5 percent

Landform: Interfluves

Landform position (two-dimensional): Summit

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: Sandy Plains (R067BY024CO)

Hydric soil rating: No

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APPENDIX C
HYDROLOGIC CALCULATIONS



PROJECT: GYS ERIE (EXISTING CONDITIONS)
 SUBJECT: Existing Condition

JOB #: D01142
 DATE: 4/25/2019
 BY: EC

Basin Name	Square Footage	Acres	Lawns (sf)	Lawns (Acres)	Paved Streets (sf)	Paved Streets (Acres)	Walks (sf)	Walks (Acres)	Drives, Walks Roofs (sf)	Drives, Walks Roofs (Acres)	Soil Type "B" Composite Runoff Factors			
											C ₅	C ₁₀	C ₁₀₀	I %
											EX1	4,246	0.10	3,913
EX2	3,886	0.09	3,886	0.09	0	0.00	0	0.00	0	0.00	0.01	0.07	0.44	2.0
EX3	1,615	0.04	1,615	0.04	0	0.00	0	0.00	0	0.00	0.01	0.07	0.44	2.0
H1	44,614	1.02	40,304	0.93	2,092	0.05	1,321	0.03	896	0.02	0.08	0.15	0.48	11.0
H2	56,619	1.30	48,280	1.11	8,339	0.19	0	0.00	0	0.00	0.12	0.19	0.50	16.4
SITE	101,233	2.32	88,584	2.03	10,431	0.24	1,321	0.03	896	0.02	0.15	0.24	0.54	14.0

Land Use	Imp., I %
Lawns/ Field	2%
Paved Streets	100%
Drives, Walks, Roofs	90%

Erie Storm Drainage Facilities Section 800 Table 800-3

Runoff coefficient equations from UDFCD
 Vol 1., Chapter 6. Table 6-4



PROJECT: GYS ERIE (EXISTING CONDITIONS)
 SUBJECT: TIME OF CONCENTRATION

JOB #: D01142
 DATE: 4/25/2019
 BY: EC

TIME OF CONCENTRATION

			TIME (Ti) [Max. 300']					TRAVEL TIME (Tt)							Tc CHECK		FINAL Tc	Time to Peak**	Remarks	
Basin No.	Area (acres)	5Yr. co-eff.	Elevations		Dist. (ft)	Slope (%)	Ti (min)	Elevations		Dist. (ft)	Slope (%)	*	Vel. (fps)	Tt (min)	Tc		Tc (min)	Peak** Flow		
			Upstream	Downstream				Upstream	Downstream						Tc	(min)				
EX1	0.10	0.06	5079.3	5079	30	1.0	10.3												10.3	Developed
EX2	0.09	0.01	5082	5081.3	22	3.2	6.3												6.3	Developed
EX3	0.04	0.01	5078.3	5077.3	10	10.0	2.9												5.0	Developed
H1	1.02	0.08	5081	5079	82	2.4	12.5	5079	5076.00	121	2.5	3	1.1	1.8	14.3	25.3	14.3		14.3	Minimum Tc
H2	1.30	0.12	5081.8	5079	80	3.5	10.5	5079	5075.00	290	1.4	6	2.3	2.1	12.6	26.8	12.6		12.6	Minimum Tc

Per UDFCD Vol 1, Chapter 6, Table 6-2

* Type of Land Surface for Overland Travel Time

NRCS Conveyance Factor

- | | | |
|--|---|-----|
| 1 = Heavy Meadow | 1 | 2.5 |
| 2 = Tillage / Field | 2 | 5 |
| 3 = Short pasture & lawns | 3 | 7 |
| 4 = Nearly bare ground | 4 | 10 |
| 5 = Grassed waterway | 5 | 15 |
| 6 = Paved areas and shallow paved swales | 6 | 20 |



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

CALCULATED BY:
DATE:
CHECKED BY:

EC
4/25/19

P1= 1.11

JOB NO: D01142
PROJECT: GYS ERIE (EXISTING CONDITIONS)
DESIGN STORM: 5 YEAR

BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	Q (cfs)	Tc (min)	(CA) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	Tt (min)	
EX1			0.10	0.06	10.3	0.01	2.97	0.02									122	2.1	1.0		
EX2			0.09	0.01	6.3	0.00	3.53	0.004									204	2.9	1.2		
EX3			0.04	0.01	5.0	0.00	3.76	0.002									22	3.9	0.1		
H1			1.02	0.08	14.3	0.08	2.58	0.2	14.3	0.09	2.58	0.2								FLOW TO EXISTING SWALE IN LOT 1	
H2			1.30	0.12	12.6	0.16	2.73	0.4	12.6	0.16	2.73	0.4								FLOW TO EXISTING INLET IN HUNTER COURT	

* One-hour rainfall depth per Table 800-2 of Town of Erie Storm Drainage Facilities section 800

**Intensity (in/hr) per equation in Erie Storm Drainage Facilities (Section 800)



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

CALCULATED BY:
DATE:
CHECKED BY:

EC
4/25/19

*P1= 2.68

JOB NO: D01142
PROJECT: GYS ERIE (EXISTING CONDITIONS)
DESIGN STORM: 100 YEAR

BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE		TRAVEL TIME			REMARKS
		AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	**I (in/hr)	Q (cfs)	Tc (min)	(CA) (Acres)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	
EX1			0.10	0.47	10.3	0.05	7.18	0.3									122	2.2	0.9	
EX2			0.09	0.44	6.3	0.04	8.52	0.3									204	3.4	1.0	
EX3			0.04	0.44	5.0	0.02	9.09	0.1									22	2.1	0.2	
H1	H1		1.02	0.48	14.3	0.49	6.23	3.0	14.3	0.53	6.23	3.3								FLOW TO EXISTING SWALE IN LOT 1
H2	H2		1.30	0.50	12.6	0.65	6.59	4.3	12.6	0.71	6.59	4.7								FLOW TO EXISTING INLET IN HUNTER COURT

* One-hour rainfall depth per Table 800-2 of Town of Erie Storm Drainage Facilities section 800

**Intensity (in/hr) per equation in Erie Storm Drainage Facilities (Section 800)



PROJECT: GYS ERIE (PROPOSED CONDITION)
 SUBJECT: Proposed Condition

JOB #: D01142
 DATE: 4/26/2019
 BY: EC

Basin Name	Square Footage	Acres	Lawns (sf)	Lawns (Acres)	Paved Streets (sf)	Paved Streets (Acres)	Walks (sf)	Walks (Acres)	Roofs (sf)	Roofs (Acres)	Soil Type "B" Composite Runoff Factors			
											C ₅	C ₁₀	C ₁₀₀	I %
											OS1	7,645	0.18	4,766
OS2	2,254	0.05	2,254	0.05	0	0.00	0	0.00	0	0.00	0.01	0.07	0.44	2.0
OS3	1,615	0.04	1,615	0.04	0	0.00	0	0.00	0	0.00	0.01	0.07	0.44	2.0
A1	34,169	0.78	14,136	0.32	17,808	0.41	1,329	0.03	896	0.02	0.48	0.53	0.70	58.8
B1	6,615	0.15	382	0.01	4,726	0.11	1,507	0.03	0	0.00	0.79	0.80	0.86	92.1
B2	21,532	0.49	0	0.00	6,302	0.14	182	0.00	15,048	0.35	0.79	0.81	0.86	92.9
B3	7,141	0.16	0	0.00	2,089	0.05	0	0.00	5,052	0.12	0.79	0.81	0.86	92.9
B4	8,366	0.19	0	0.00	2,182	0.05	0	0.00	6,184	0.14	0.79	0.81	0.86	92.6
B5	11,201	0.26	614	0.01	3,800	0.09	0	0.00	6,787	0.16	0.75	0.77	0.84	88.6
C1	10,811	0.25	4,667	0.11	5,381	0.12	763	0.02	0	0.00	0.47	0.52	0.69	57.0
C2	1,385	0.03	1,385	0.03	0	0.00	0	0.00	0	0.00	0.01	0.07	0.44	2.0
TO INLET 6	22,688	0.52	11,769	0.27	10,919	0.25	0	0.00	0	0.00	0.40	0.46	0.66	49.2
SITE	101,220	2.32	21,183	0.49	42,287	0.97	3,781	0.09	33,968	0.78	0.66	0.69	0.79	75.8
*TO UDG	98,923	2.27	22,152	0.51	38,991	0.90	3,812	0.09	33,968	0.78	0.64	0.68	0.79	74.2

*TO UGD include all "A" basins, all "B" basins, and basins OS1 and OS2

Land Use	Imp., I %
Lawns/ Field	2%
Paved Streets	100%
Drives, Walks, Roofs	90%

Erie Storm Drainage Facilities Section 800 Table 800-3

Runoff coefficient equations from UDFCD
 Vol 1., Chapter 6. Table 6-4



PROJECT: GYS ERIE (PROPOSED CONDITION)
 SUBJECT: TIME OF CONCENTRATION

JOB #: D01142
 DATE: 4/26/2019
 BY: EC

TIME OF CONCENTRATION

			TIME (Ti) [Max. 300']					TRAVEL TIME (Tt)							Tc CHECK		FINAL Tc	Time to Peak**	Remarks	
Basin No.	Area (acres)	5Yr. co-eff.	Elevations		Dist. (ft)	Slope (%)	Ti (min)	Elevations		Dist. (ft)	Slope (%)	*	Vel. (fps)	Tt (min)	Tc		Tc (min)	Peak** Flow		
			Upstream	Downstream				Upstream	Downstream						Tc	(min)				
OS1	0.18	0.30	5082	5081.3	22	3.2	4.6												4.6	Developed
OS2	0.05	0.01	5079.3	5079	30	1.0	10.8												10.8	Developed
OS3	0.04	0.01	5078.3	5077.3	10	10.0	2.9												5.0	Developed
A1	0.78	0.48	5081.7	5079.8	44	4.3	4.6	5079.8	5077.90	400	0.5	6	1.3	5.1	9.7	21.5	9.7		9.7	Developed
B1	0.15	0.79	5082.9	5079.3	88	4.1	3.3	5079.3	5079.10	40	0.5	6	1.3	0.5	3.9	10.8	3.9		5.0	Minimum Tc
B2	0.49	0.79	5086	5079	80	8.8	2.4	5079	5077.20	35	5.1	6	5.2	0.1	2.5	10.3	2.5		5.0	Minimum Tc
B3	0.16	0.79	5086	5079	90	7.8	2.7	5079	5077.60	35	4.0	6	4.3	0.1	2.8	10.3	2.8		5.0	Minimum Tc
B4	0.19	0.79	5086	5079	90	7.8	2.7	5079	5077.90	35	3.1	6	3.5	0.2	2.9	10.4	2.9		5.0	Minimum Tc
B5	0.26	0.75	5089.7	5079.7	100	10.0	2.9	5079.7	5077.90	40	4.5	6	4.7	0.1	3.1	11.1	3.1		5.0	Minimum Tc
C1	0.25	0.47	5080.7	5077.95	60	4.6	5.4	5077.95	5074.60	50	6.7	6	5.6	0.1	5.5	16.5	5.5		5.5	Developed
C2	0.03	0.01	5078.65	5076.27	10	23.8	2.2												5.0	Minimum Tc
TO INLET 6	0.52	0.40	5088	5085.5	90	2.8	8.6	5085.5	5082.00	410	0.9	6	1.9	3.7	12.3	22.2	12.3		12.3	Developed

Per UDFCD Vol 1, Chapter 6, Table 6-2

* Type of Land Surface for Overland Travel Time

NRCS Conveyance Factor

- | | | |
|--|---|-----|
| 1 = Heavy Meadow | 1 | 2.5 |
| 2 = Tillage / Field | 2 | 5 |
| 3 = Short pasture & lawns | 3 | 7 |
| 4 = Nearly bare ground | 4 | 10 |
| 5 = Grassed waterway | 5 | 15 |
| 6 = Paved areas and shallow paved swales | 6 | 20 |



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

CALCULATED BY:
DATE:
CHECKED BY:

EC
4/26/19

P1= 1.11

JOB NO: D01142
PROJECT: GYS ERIE (PROPOSED CONDITION)
DESIGN STORM: 5 YEAR

BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE		TRAVEL TIME			REMARKS
		AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	Q (cfs)	Tc (min)	(CA) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	
OS1			0.18	0.30	4.6	0.05	3.84	0.2									455	2.0	3.8	OFFSITE FLOWS
OS2			0.05	0.01	10.8	0.00	2.92	0.0									61	1.6	0.6	OFFSITE FLOWS
OS3			0.04	0.01	5.0	0.00	3.76	0.0									40	1.6	0.4	OFFSITE FLOWS
A1	1	OS1+OS2+A1	0.78	0.48	9.7	0.38	3.04	1.2	11.4	0.43	2.85	1.2					145	3.2	0.8	FLOW AT INLET 1
B1			0.15	0.79	5.0	0.12	3.76	0.4									126	3.0	0.7	FLOW AT INLET 2
B2	4	B2+B3	0.49	0.79	5.0	0.39	3.76	1.5	5.6	0.52	3.65	1.9					89	3.4	0.4	FLOW IN INLET 3
	2	B1+DP4							5.7	0.64	3.62	2.3					15	2.0	0.1	COMBINED FLOWS AT JUNCTION
B3	3		0.16	0.79	5.0	0.13	3.76	0.5									130	3.6	0.6	FLOW IN 4' CROSSPAN
B4	6		0.19	0.79	5.0	0.15	3.76	0.6									72	1.9	0.6	FLOW IN INLET 4
	5	DP2+DP6							6.3	0.79	3.52	2.8					145	3.4	0.7	COMBINED FLOWS AT JUNCTION
B5	8		0.26	0.75	5.0	0.19	3.76	0.7									15	2.0	0.1	FLOW IN INLET 5
	9	DP1+DP5+DP8							12.1	1.42	2.77	3.9					134	3.5	0.6	COMBINED FLOWS AT JUNCTION
C1			0.25	0.47	5.5	0.12	3.67	0.4									140	3.2	0.7	COMBINED FLOWS AT JUNCTION
C2			0.03	0.01	5.0	0.00	3.76	0.0												
	10	C1+OS3							5.5	0.12	3.67	0.4								FLOW TO EXIST INLET HUNTER COURT
TO INLET 6			0.52	0.40	12.3	0.21	2.76	0.6												FLOW TO EAST
																				TO INLET 6

* One-hour rainfall depth per Table 800-2 of Town of Erie Storm Drainage Facilities section 800

**Intensity (in/hr) per equation in Erie Storm Drainage Facilities (Section 800)



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

CALCULATED BY:
DATE:
CHECKED BY:

EC
4/26/19

*P1= 2.68

JOB NO: D01142
PROJECT: GYS ERIE (PROPOSED CONDITION)
DESIGN STORM: 100 YEAR

BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE		TRAVEL TIME			REMARKS
		AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	**I (in/hour)	Q (cfs)	Tc (min)	(CA) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	
OS1			0.18	0.60	4.6	0.11	9.27	1.0									455	2.0	3.8	OFFSITE FLOWS
OS2			0.05	0.44	10.8	0.02	7.04	0.2									61	1.6	0.6	OFFSITE FLOWS
OS3			0.04	0.44	5.0	0.02	9.09	0.1									40	1.6	0.4	OFFSITE FLOWS
A1	1	OS1+OS2+A1	0.78	0.70	9.7	0.55	7.34	4.0	11.4	0.68	6.88	4.7					145	3.2	0.8	FLOW AT INLET 1
B1			0.15	0.86	5.0	0.13	9.09	1.2									126	3.0	0.7	FLOW AT INLET 2
B2	4	B2+B3	0.49	0.86	5.0	0.43	9.09	3.9	5.6	0.57	8.80	5.0					89	3.4	0.4	FLOW IN INLET 3
	2	B1+DP4							5.7	0.70	8.75	6.1					130	3.6	0.6	COMBINED FLOWS AT JUNCTION
B3	3		0.16	0.86	5.0	0.14	9.09	1.3									72	1.9	0.6	FLOW IN 4' CROSSPAN
B4	6		0.19	0.86	5.0	0.17	9.09	1.5	6.3	0.86	8.50	7.3					15	2.0	0.1	FLOW IN INLET 4
	5	DP2+DP6															145	3.4	0.7	COMBINED FLOWS AT JUNCTION
B5	8		0.26	0.84	5.0	0.22	9.09	2.0	12.1	1.76	6.69	11.8					134	3.5	0.6	FLOW IN INLET 5
	9	DP1+DP5+DP8															140	3.2	0.7	COMBINED FLOWS AT JUNCTION
C1			0.25	0.69	5.5	0.17	8.85	1.5												
C2			0.03	0.44	5.0	0.01	9.09	0.1												
	10	C1+OS3							5.5	0.19	8.85	1.7								FLOW TO EXIST INLET HUNTER COURT
TO INLET 6			0.52	0.66	12.3	0.34	6.66	2.3												FLOW TO EAST
																				TO INLET 6

* One-hour rainfall depth per Table 800-2 of Town of Erie Storm Drainage Facilities section 800

**Intensity (in/hr) per equation in Erie Storm Drainage Facilities (Section 800)

APPENDIX D
HYDRAULIC CALCULATIONS

Channel Report

CROSSPAN IN BASIN B3

User-defined

Invert Elev (ft) = 77.14
Slope (%) = 0.50
N-Value = 0.015

Highlighted

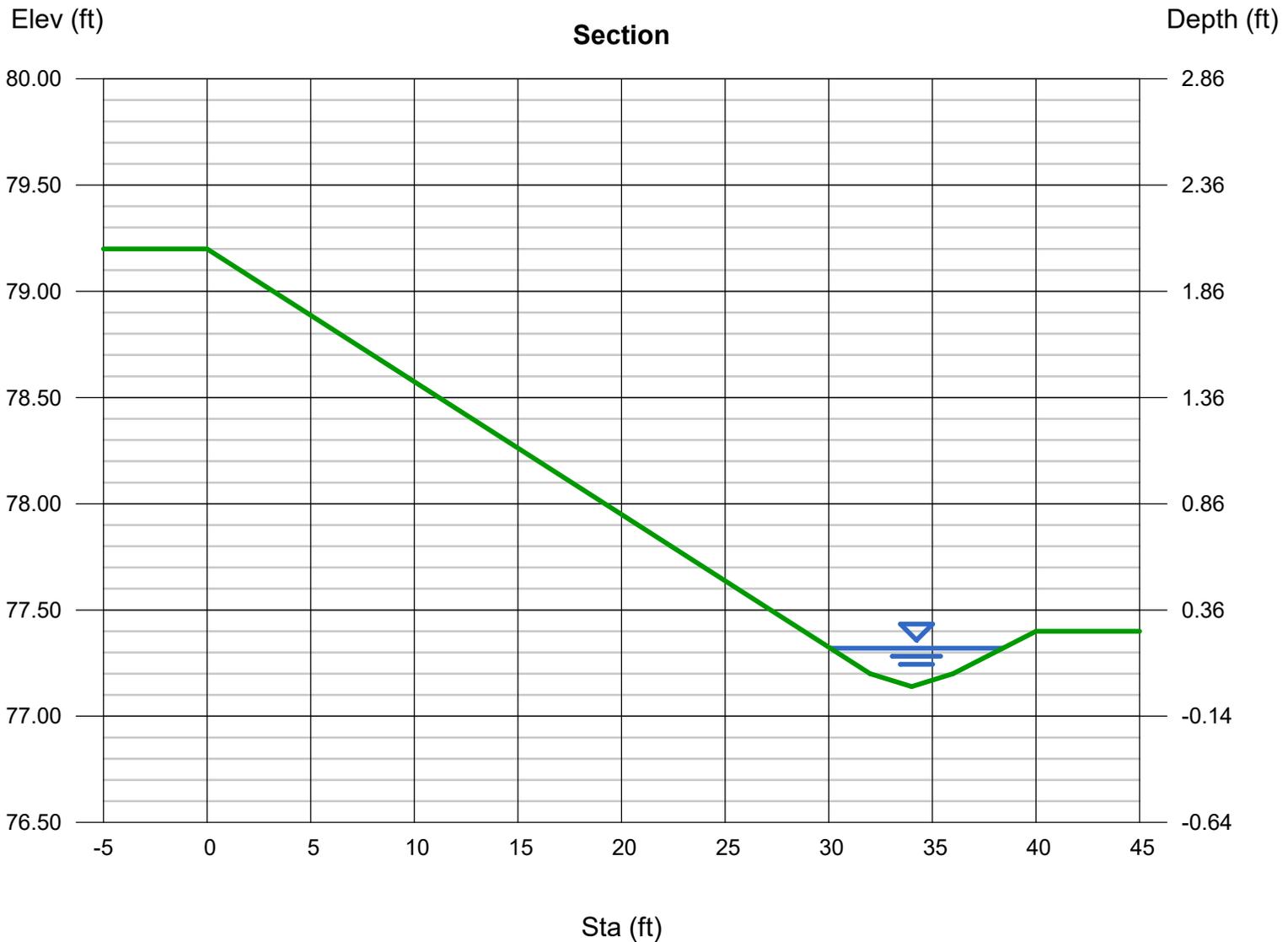
Depth (ft) = 0.18
Q (cfs) = 1.300
Area (sqft) = 0.86
Velocity (ft/s) = 1.51
Wetted Perim (ft) = 8.33
Crit Depth, Yc (ft) = 0.17
Top Width (ft) = 8.32
EGL (ft) = 0.22

Calculations

Compute by: Known Q
Known Q (cfs) = 1.30

(Sta, El, n)-(Sta, El, n)...

(0.00, 79.20)-(32.00, 77.20, 0.016)-(34.00, 77.14, 0.013)-(36.00, 77.20, 0.013)-(40.00, 77.40, 0.016)



INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 1	Inlet 2	Inlet 3	Inlet 4	Inlet 5	Inlet 6
Site Type (Urban or Rural)						RURAL
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	AREA
Hydraulic Condition	In Sump	In Sump	In Sump	In Sump	In Sump	Swale
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	Denver No. 16 Valley Gate	CDOT/Denver 13 Valley Gate	CDOT/Denver 13 Valley Gate	CDOT Type C

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{known} (cfs)	1.2	0.4	1.9	0.6	0.7	0.6
Major Q_{known} (cfs)	4.7	1.2	5.0	1.5	2.0	2.3

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	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)	0.0	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)	1.2	0.4	1.9	0.6	0.7	0.6
Major Total Design Peak Flow, Q (cfs)	4.7	1.2	5.0	1.5	2.0	2.3
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A	N/A	N/A	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A	N/A	N/A	0.0

Minor Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A	N/A
C_s	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, V_i	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, V_t	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, T_i	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, T_t	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

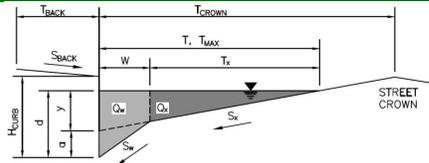
Major Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A	N/A
C_s	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, V_i	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, V_t	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, T_i	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, T_t	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

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

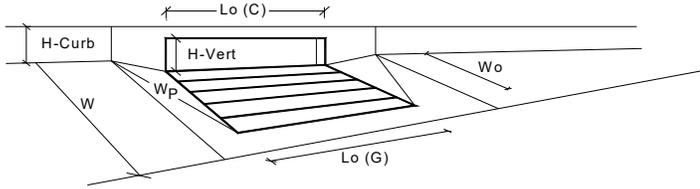
Project: _____
 Inlet ID: _____ **ERIE RETAIL** _____
 Inlet 1



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 6.0$ 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)	$n_{BACK} = 0.013$												
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches												
Distance from Curb Face to Street Crown	$T_{CROWN} = 28.0$ ft												
Gutter Width	$W = 2.00$ ft												
Street Transverse Slope	$S_x = 0.060$ 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)	$n_{STREET} = 0.016$												
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>$T_{MAX} =$</td> <td>8.0</td> <td>8.0</td> <td>ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td>6.0</td> <td>6.0</td> <td>inches</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} =$	8.0	8.0	ft	$d_{MAX} =$	6.0	6.0	inches
	Minor Storm	Major Storm											
$T_{MAX} =$	8.0	8.0	ft										
$d_{MAX} =$	6.0	6.0	inches										
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Check boxes are not applicable in SUMP conditions	<input type="checkbox"/> <input type="checkbox"/>												
MINOR STORM Allowable Capacity is based on Depth Criterion													
MAJOR STORM Allowable Capacity is based on Depth Criterion													
	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>$Q_{allow} =$</td> <td>SUMP</td> <td>SUMP</td> <td>cfs</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$Q_{allow} =$	SUMP	SUMP	cfs				
	Minor Storm	Major Storm											
$Q_{allow} =$	SUMP	SUMP	cfs										

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017

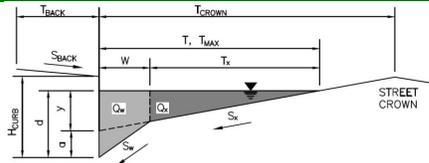


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type = CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		1	1	
Water Depth at Flowline (outside of local depression)		6.0	6.0	inches
Grate Information		MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		5.00	5.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth		N/A	N/A	ft
Depth for Curb Opening Weir Equation		0.33	0.33	ft
Combination Inlet Performance Reduction Factor for Long Inlets		0.77	0.77	RF _{Combination}
Curb Opening Performance Reduction Factor for Long Inlets		1.00	1.00	RF _{Curb}
Grated Inlet Performance Reduction Factor for Long Inlets		N/A	N/A	RF _{Grate}
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		5.4	5.4	cfs
		1.2	4.7	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

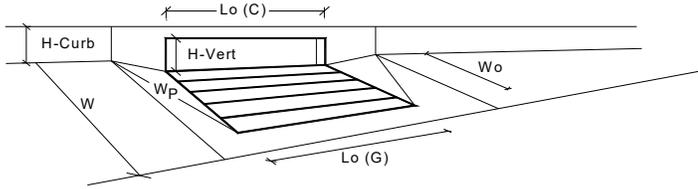
Project: ERIE RETAIL
 Inlet ID: Inlet 2



Gutter Geometry (Enter data in the blue cells)									
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="6.0"/> ft								
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.013"/>								
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches								
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="20.0"/> ft								
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.00"/> ft								
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft								
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.000"/> ft/ft								
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.016"/>								
Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;"></th> <th style="width: 25%; text-align: center;">Minor Storm</th> <th style="width: 25%; text-align: center;">Major Storm</th> <th style="width: 10%;"></th> </tr> <tr> <td style="padding: 5px;">$T_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="20.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="20.0"/></td> <td style="text-align: right;">ft</td> </tr> </table>		Minor Storm	Major Storm		$T_{MAX} = $	<input style="width: 50px;" type="text" value="20.0"/>	<input style="width: 50px;" type="text" value="20.0"/>	ft
	Minor Storm	Major Storm							
$T_{MAX} = $	<input style="width: 50px;" type="text" value="20.0"/>	<input style="width: 50px;" type="text" value="20.0"/>	ft						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;"></th> <th style="width: 25%; text-align: center;">Minor Storm</th> <th style="width: 25%; text-align: center;">Major Storm</th> <th style="width: 10%;"></th> </tr> <tr> <td style="padding: 5px;">$d_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="4.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="4.0"/></td> <td style="text-align: right;">inches</td> </tr> </table>		Minor Storm	Major Storm		$d_{MAX} = $	<input style="width: 50px;" type="text" value="4.0"/>	<input style="width: 50px;" type="text" value="4.0"/>	inches
	Minor Storm	Major Storm							
$d_{MAX} = $	<input style="width: 50px;" type="text" value="4.0"/>	<input style="width: 50px;" type="text" value="4.0"/>	inches						
Check boxes are not applicable in SUMP conditions	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;"><input type="checkbox"/></td> <td style="width: 50%; text-align: center;"><input type="checkbox"/></td> </tr> </table>	<input type="checkbox"/>	<input type="checkbox"/>						
<input type="checkbox"/>	<input type="checkbox"/>								
MINOR STORM Allowable Capacity is based on Depth Criterion									
MAJOR STORM Allowable Capacity is based on Depth Criterion									
$Q_{allow} = $	<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;"></th> <th style="width: 25%; text-align: center;">Minor Storm</th> <th style="width: 25%; text-align: center;">Major Storm</th> <th style="width: 10%;"></th> </tr> <tr> <td style="padding: 5px;">$Q_{allow} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: right;">cfs</td> </tr> </table>		Minor Storm	Major Storm		$Q_{allow} = $	<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs
	Minor Storm	Major Storm							
$Q_{allow} = $	<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs						

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017

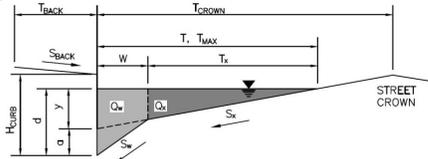


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1	1	
Water Depth at Flowline (outside of local depression)	4.0	4.0	inches
Grate Information	MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
Curb Opening Information	MINOR	MAJOR	
Length of a Unit Curb Opening	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
Low Head Performance Reduction (Calculated)	MINOR	MAJOR	
Depth for Grate Midwidth	N/A	N/A	ft
Depth for Curb Opening Weir Equation	0.17	0.17	ft
Combination Inlet Performance Reduction Factor for Long Inlets	0.52	0.52	
Curb Opening Performance Reduction Factor for Long Inlets	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)	MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	2.0	2.0	cfs
Q PEAK REQUIRED =	0.4	1.2	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

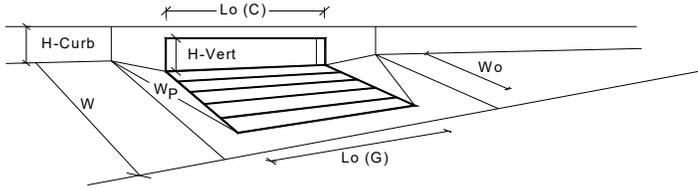
Project: _____
 Inlet ID: _____ **ERIE RETAIL** _____
 Inlet 3



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 6.0$ 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	$T_{CROWN} = 20.0$ ft												
Gutter Width	$W = 2.00$ ft												
Street Transverse Slope	$S_x = 0.060$ 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)	$n_{STREET} = 0.016$												
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>$T_{MAX} =$</td> <td>20.0</td> <td>20.0</td> <td>ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td>6.0</td> <td>6.0</td> <td>inches</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} =$	20.0	20.0	ft	$d_{MAX} =$	6.0	6.0	inches
	Minor Storm	Major Storm											
$T_{MAX} =$	20.0	20.0	ft										
$d_{MAX} =$	6.0	6.0	inches										
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Check boxes are not applicable in SUMP conditions	<input type="checkbox"/> <input type="checkbox"/>												
MINOR STORM Allowable Capacity is based on Depth Criterion													
MAJOR STORM Allowable Capacity is based on Depth Criterion													
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$Q_{allow} =$	SUMP	SUMP	cfs										

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



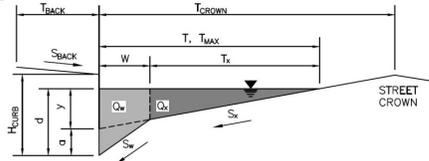
Design Information (Input)	MINOR	MAJOR	
Type of Inlet	Denver No. 16 Valley Grate		
Local Depression (additional to continuous gutter depression 'a' from above)	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1	1	
Water Depth at Flowline (outside of local depression)	6.0	6.0	inches
Grate Information	MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate	3.00	3.00	feet
Width of a Unit Grate	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	0.60	0.60	
Curb Opening Information	MINOR	MAJOR	
Length of a Unit Curb Opening	N/A	N/A	feet
Height of Vertical Curb Opening in Inches	N/A	N/A	inches
Height of Curb Orifice Throat in Inches	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	N/A	N/A	
Low Head Performance Reduction (Calculated)	MINOR	MAJOR	
Depth for Grate Midwidth	0.523	0.523	ft
Depth for Curb Opening Weir Equation	N/A	N/A	ft
Combination Inlet Performance Reduction Factor for Long Inlets	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	N/A	N/A	
Grated Inlet Performance Reduction Factor for Long Inlets	0.94	0.94	
Total Inlet Interception Capacity (assumes clogged condition)	MINOR	MAJOR	
Q_a	2.6	2.6	cfs
$Q_{PEAK REQUIRED}$	1.9	5.0	cfs

WARNING: Inlet Capacity less than Q Peak for Major Storm

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

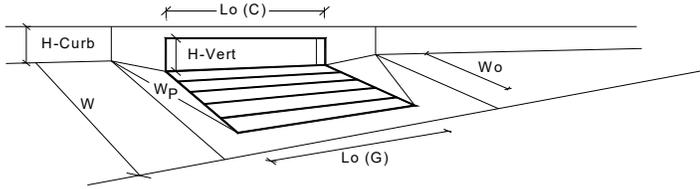
Project: ERIE RETAIL
 Inlet ID: Inlet 4



Gutter Geometry (Enter data in the blue cells)							
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 6.0$ 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	$T_{CROWN} = 20.0$ ft						
Gutter Width	$W = 2.00$ ft						
Street Transverse Slope	$S_x = 0.060$ 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)	$n_{STREET} = 0.016$						
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>ft</th> </tr> </thead> <tbody> <tr> <td>$T_{MAX} = 20.0$</td> <td>$T_{MAX} = 20.0$</td> <td></td> </tr> </tbody> </table>	Minor Storm	Major Storm	ft	$T_{MAX} = 20.0$	$T_{MAX} = 20.0$	
Minor Storm	Major Storm	ft					
$T_{MAX} = 20.0$	$T_{MAX} = 20.0$						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1"> <thead> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>inches</th> </tr> </thead> <tbody> <tr> <td>$d_{MAX} = 6.0$</td> <td>$d_{MAX} = 6.0$</td> <td></td> </tr> </tbody> </table>	Minor Storm	Major Storm	inches	$d_{MAX} = 6.0$	$d_{MAX} = 6.0$	
Minor Storm	Major Storm	inches					
$d_{MAX} = 6.0$	$d_{MAX} = 6.0$						
Check boxes are not applicable in SUMP conditions	<input type="checkbox"/> <input type="checkbox"/>						
MINOR STORM Allowable Capacity is based on Depth Criterion							
MAJOR STORM Allowable Capacity is based on Depth Criterion							
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Minor Storm	Major Storm	cfs					
$Q_{allow} = \text{SUMP}$	$Q_{allow} = \text{SUMP}$						

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



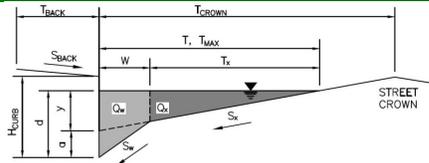
Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT/Denver 13 Valley Grate		
Local Depression (additional to continuous gutter depression 'a' from above)	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1	1	
Water Depth at Flowline (outside of local depression)	6.0	6.0	inches
Grate Information	MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate	3.00	3.00	feet
Width of a Unit Grate	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	0.60	0.60	
Curb Opening Information	MINOR	MAJOR	
Length of a Unit Curb Opening	N/A	N/A	feet
Height of Vertical Curb Opening in Inches	N/A	N/A	inches
Height of Curb Orifice Throat in Inches	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	N/A	N/A	
Low Head Performance Reduction (Calculated)	MINOR	MAJOR	
Depth for Grate Midwidth	0.523	0.523	ft
Depth for Curb Opening Weir Equation	N/A	N/A	ft
Combination Inlet Performance Reduction Factor for Long Inlets	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	N/A	N/A	
Grated Inlet Performance Reduction Factor for Long Inlets	0.94	0.94	
Total Inlet Interception Capacity (assumes clogged condition)	MINOR	MAJOR	
Q_a	2.6	2.6	cfs
Q _{PEAK REQUIRED}	0.6	1.5	cfs

Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

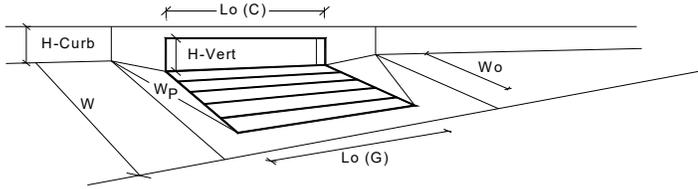
Project: ERIE RETAIL
 Inlet ID: Inlet 5



Gutter Geometry (Enter data in the blue cells)																	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="6.0"/> ft																
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft																
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/>																
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches																
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="20.0"/> ft																
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.00"/> ft																
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.060"/> ft/ft																
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft																
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.000"/> ft/ft																
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.016"/>																
Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;"></th> <th style="width: 25%; text-align: center;">Minor Storm</th> <th style="width: 25%; text-align: center;">Major Storm</th> <th style="width: 10%;"></th> </tr> </thead> <tbody> <tr> <td>$T_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="20.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="20.0"/></td> <td style="text-align: right;">ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="6.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="6.0"/></td> <td style="text-align: right;">inches</td> </tr> <tr> <td></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td></td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} = $	<input style="width: 50px;" type="text" value="20.0"/>	<input style="width: 50px;" type="text" value="20.0"/>	ft	$d_{MAX} = $	<input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="6.0"/>	inches		<input type="checkbox"/>	<input type="checkbox"/>	
	Minor Storm	Major Storm															
$T_{MAX} = $	<input style="width: 50px;" type="text" value="20.0"/>	<input style="width: 50px;" type="text" value="20.0"/>	ft														
$d_{MAX} = $	<input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="6.0"/>	inches														
	<input type="checkbox"/>	<input type="checkbox"/>															
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm																	
Check boxes are not applicable in SUMP conditions																	
MINOR STORM Allowable Capacity is based on Depth Criterion																	
MAJOR STORM Allowable Capacity is based on Depth Criterion																	
$Q_{allow} = $	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;"></th> <th style="width: 25%; text-align: center;">Minor Storm</th> <th style="width: 25%; text-align: center;">Major Storm</th> <th style="width: 10%;"></th> </tr> </thead> <tbody> <tr> <td></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: right;">cfs</td> </tr> </tbody> </table>		Minor Storm	Major Storm			<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs								
	Minor Storm	Major Storm															
	<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs														

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017

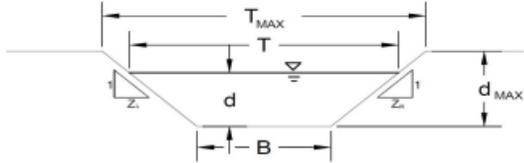


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT/Denver 13 Valley Grate		
Local Depression (additional to continuous gutter depression 'a' from above)	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1	1	
Water Depth at Flowline (outside of local depression)	6.0	6.0	inches
Grate Information	MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate	3.00	3.00	feet
Width of a Unit Grate	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	0.60	0.60	
Curb Opening Information	MINOR	MAJOR	
Length of a Unit Curb Opening	N/A	N/A	feet
Height of Vertical Curb Opening in Inches	N/A	N/A	inches
Height of Curb Orifice Throat in Inches	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	N/A	N/A	
Low Head Performance Reduction (Calculated)	MINOR	MAJOR	
Depth for Grate Midwidth	0.523	0.523	ft
Depth for Curb Opening Weir Equation	N/A	N/A	ft
Combination Inlet Performance Reduction Factor for Long Inlets	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	N/A	N/A	
Grated Inlet Performance Reduction Factor for Long Inlets	0.94	0.94	
Total Inlet Interception Capacity (assumes clogged condition)	MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	2.6	2.6	cfs
Q PEAK REQUIRED =	0.7	2.0	cfs

AREA INLET IN A SWALE

ERIE RETAIL

Inlet 6



This worksheet uses the NRCS vegetative retardance method to determine Manning's n.
For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method													
NRCS Vegetal Retardance (A, B, C, D, or E) Manning's n (Leave cell D16 blank to manually enter an n value) Channel Invert Slope Bottom Width Left Side Slope Right Side Slope Check one of the following soil types:	A, B, C, D or E B n = see details below S ₀ = 0.0100 ft/ft B = 1.00 ft Z1 = 10.00 ft/ft Z2 = 10.00 ft/ft												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Soil Type:</th> <th style="text-align: left;">Max. Velocity (V_{MAX})</th> <th style="text-align: left;">Max Froude No. (F_{MAX})</th> </tr> </thead> <tbody> <tr> <td>Non-Cohesive</td> <td>5.0 fps</td> <td>0.60</td> </tr> <tr> <td>Cohesive</td> <td>7.0 fps</td> <td>0.80</td> </tr> <tr> <td>Paved</td> <td>N/A</td> <td>N/A</td> </tr> </tbody> </table>	Soil Type:	Max. Velocity (V _{MAX})	Max Froude No. (F _{MAX})	Non-Cohesive	5.0 fps	0.60	Cohesive	7.0 fps	0.80	Paved	N/A	N/A	Choose One: <input checked="" type="checkbox"/> Non-Cohesive <input type="checkbox"/> Cohesive <input type="checkbox"/> Paved
Soil Type:	Max. Velocity (V _{MAX})	Max Froude No. (F _{MAX})											
Non-Cohesive	5.0 fps	0.60											
Cohesive	7.0 fps	0.80											
Paved	N/A	N/A											
Max. Allowable Top Width of Channel for Minor & Major Storm Max. Allowable Water Depth in Channel for Minor & Major Storm	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">Minor Storm</th> <th style="text-align: center;">Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>T_{MAX} =</td> <td style="text-align: center;">40.00</td> <td style="text-align: center;">40.00</td> <td style="text-align: right;">feet</td> </tr> <tr> <td>d_{MAX} =</td> <td style="text-align: center;">1.00</td> <td style="text-align: center;">1.00</td> <td style="text-align: right;">feet</td> </tr> </tbody> </table>		Minor Storm	Major Storm		T _{MAX} =	40.00	40.00	feet	d _{MAX} =	1.00	1.00	feet
	Minor Storm	Major Storm											
T _{MAX} =	40.00	40.00	feet										
d _{MAX} =	1.00	1.00	feet										
Allowable Channel Capacity Based On Channel Geometry MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">Minor Storm</th> <th style="text-align: center;">Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>Q_{allow} =</td> <td style="text-align: center;">3.3</td> <td style="text-align: center;">3.3</td> <td style="text-align: right;">cfs</td> </tr> <tr> <td>d_{allow} =</td> <td style="text-align: center;">1.00</td> <td style="text-align: center;">1.00</td> <td style="text-align: right;">ft</td> </tr> </tbody> </table>		Minor Storm	Major Storm		Q _{allow} =	3.3	3.3	cfs	d _{allow} =	1.00	1.00	ft
	Minor Storm	Major Storm											
Q _{allow} =	3.3	3.3	cfs										
d _{allow} =	1.00	1.00	ft										
Water Depth in Channel Based On Design Peak Flow Design Peak Flow Water Depth	<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td>Q_c =</td> <td style="text-align: center;">0.6</td> <td style="text-align: center;">2.3</td> <td style="text-align: right;">cfs</td> </tr> <tr> <td>d =</td> <td style="text-align: center;">0.50</td> <td style="text-align: center;">0.87</td> <td style="text-align: right;">feet</td> </tr> </tbody> </table>	Q _c =	0.6	2.3	cfs	d =	0.50	0.87	feet				
Q _c =	0.6	2.3	cfs										
d =	0.50	0.87	feet										
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'													

AREA INLET IN A SWALE

ERIE RETAIL

Inlet 6

Inlet Design Information (Input)

Type of Inlet

CDOT Type C

Inlet Type =

CDOT Type C

Angle of Inclined Grate (must be <= 30 degrees)

Width of Grate

Length of Grate

Open Area Ratio

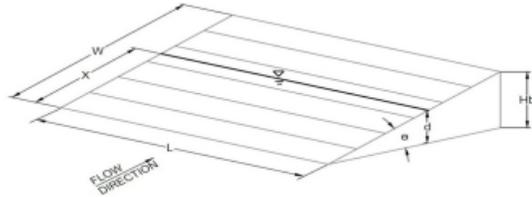
Height of Inclined Grate

Clogging Factor

Grate Discharge Coefficient

Orifice Coefficient

Weir Coefficient



θ =	0.00	degrees
W =	3.00	feet
L =	3.00	feet
A _{RATIO} =	0.70	
H _B =	0.00	feet
C _f =	0.50	
C _d =	0.96	
C _o =	0.64	
C _w =	2.05	

Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)

	MINOR	MAJOR
d =	0.50	0.87

Total Inlet Interception Capacity (assumes clogged condition)

	MINOR	MAJOR	
Q _a =	6.6	14.9	cfs

Bypassed Flow, Q_b =

0.0	0.0	cfs
-----	-----	-----

Capture Percentage = Q_a/Q_o = C%

100	100	%
-----	-----	---

Channel Report

SPILLWAY

Triangular

Side Slopes (z:1) = 200.00, 109.00
Total Depth (ft) = 0.35

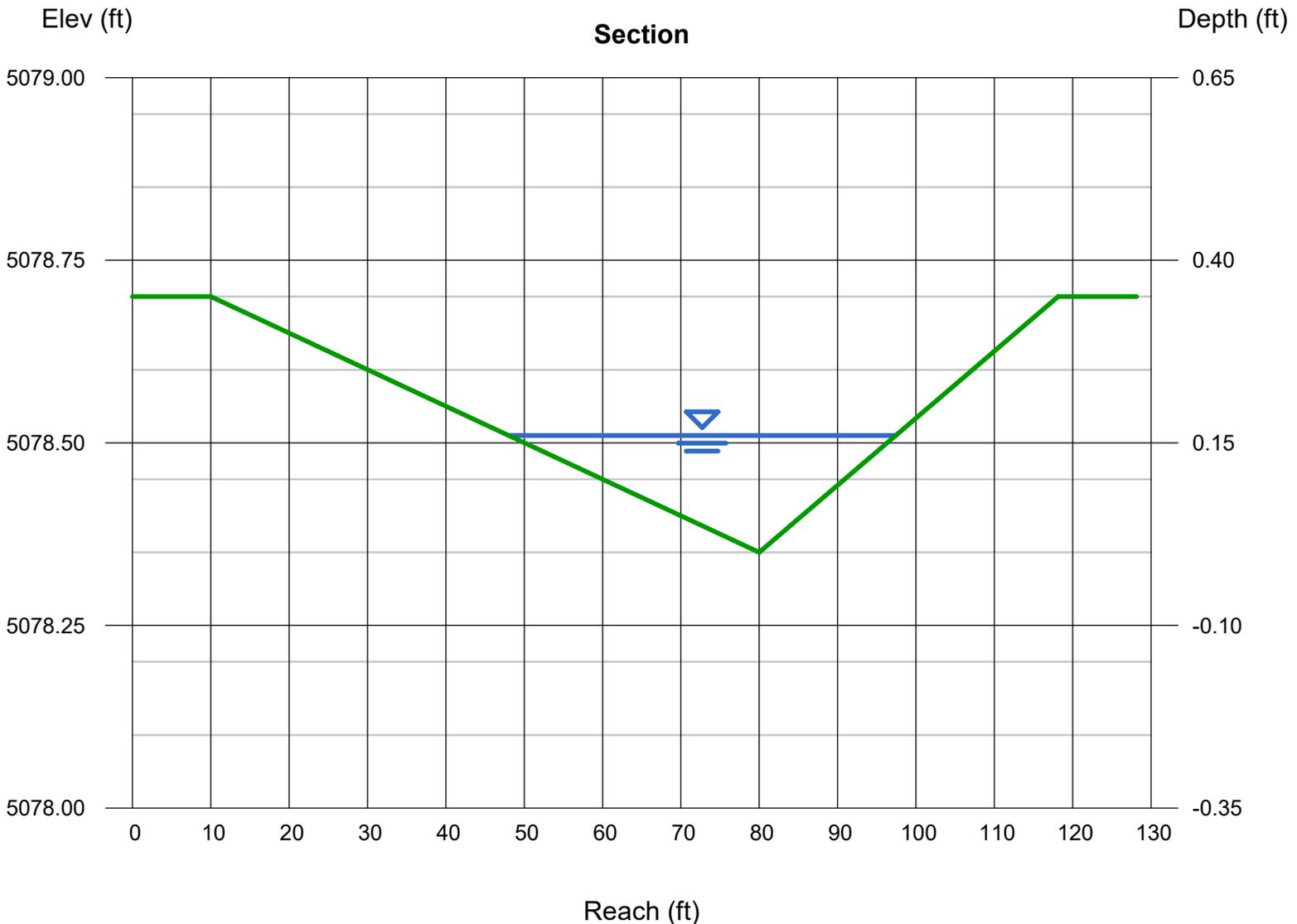
Invert Elev (ft) = 5078.35
Slope (%) = 2.00
N-Value = 0.013

Calculations

Compute by: Known Q
Known Q (cfs) = 11.60

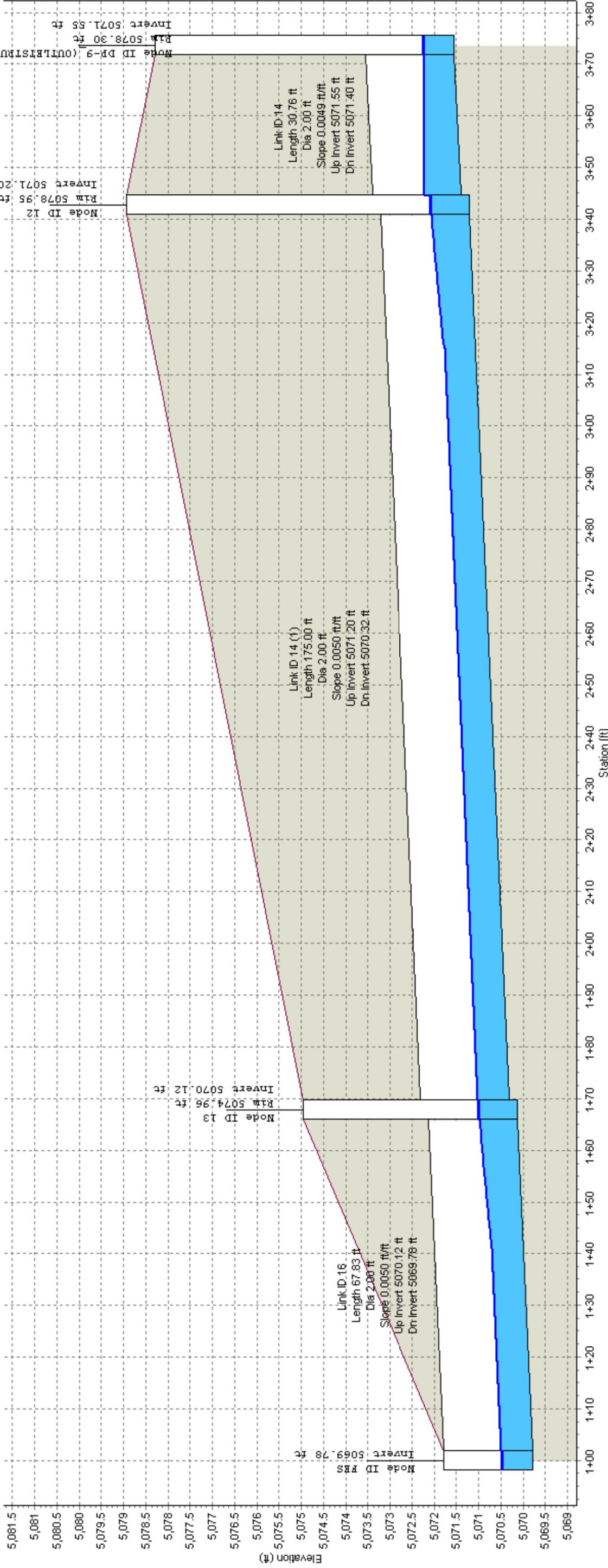
Highlighted

Depth (ft) = 0.16
Q (cfs) = 11.60
Area (sqft) = 3.96
Velocity (ft/s) = 2.93
Wetted Perim (ft) = 49.44
Crit Depth, Yc (ft) = 0.21
Top Width (ft) = 49.44
EGL (ft) = 0.29



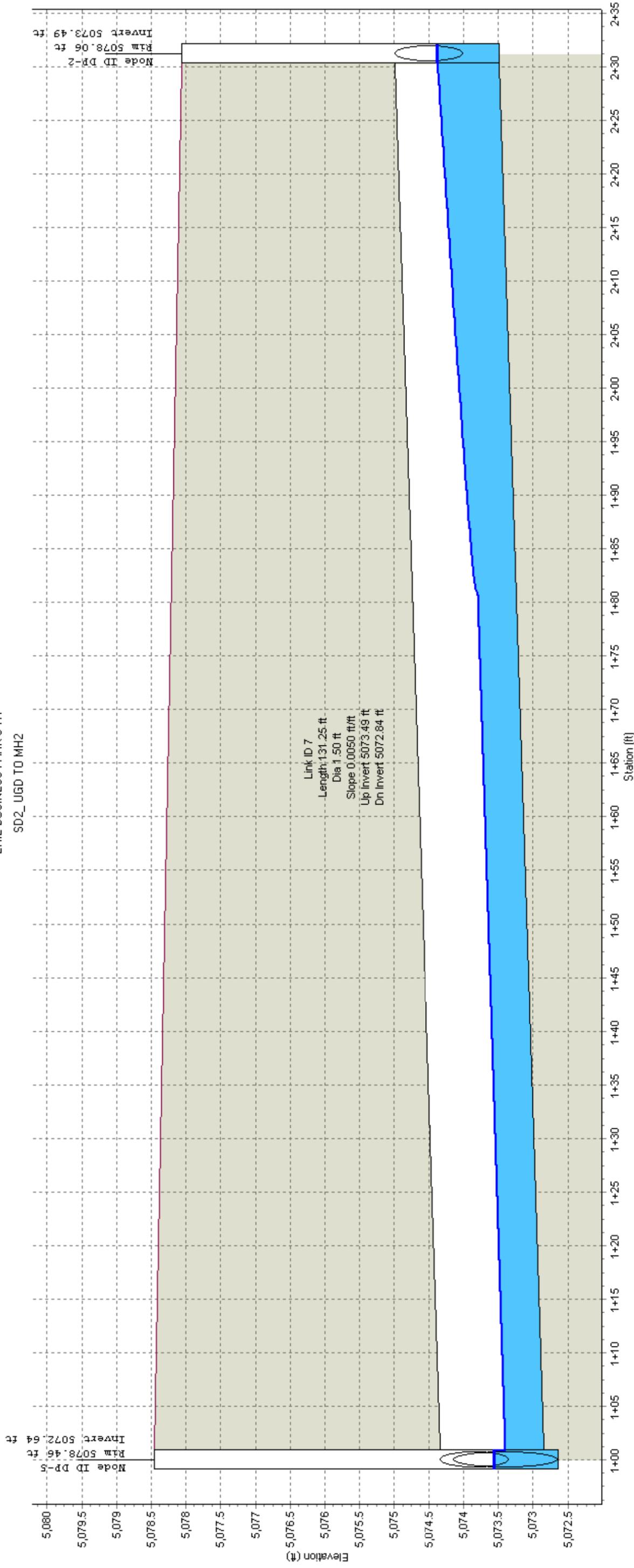
ERIE BUSINESS PARK-5 YR

SD-1



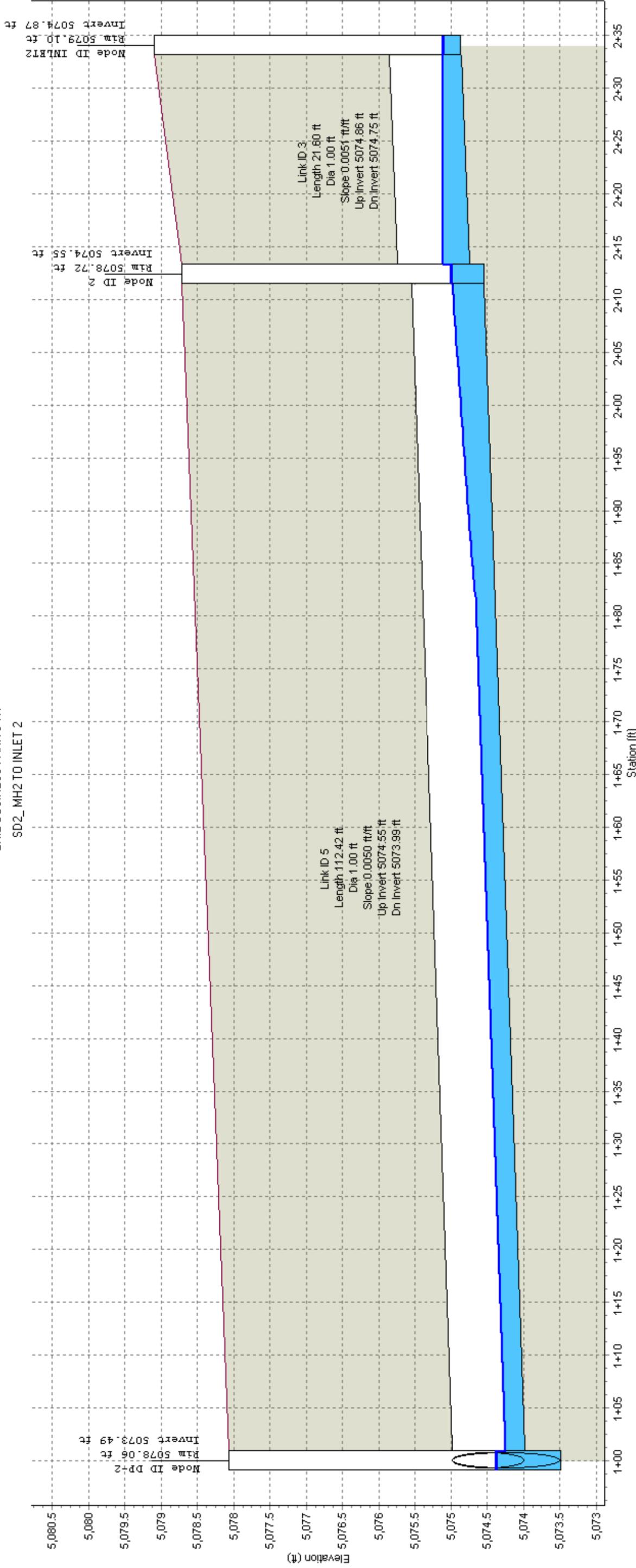
Node ID:	FES	13	12	14
Rim (ft):		5074.96	5078.95	5078.30
Invert (ft):		5070.12	5071.20	5071.55
Min Pipe Cover (ft):		2.64	5.55	4.75
Max HGL (ft):		5070.99	5072.13	5072.23
Link ID:		16	14 (1)	14
Length (ft):		67.83	175.00	30.76
Dia (ft):		2.00	2.00	2.00
Slope (ft/ft):		0.0050	0.0050	0.0049
Up Invert (ft):		5070.12	5071.20	5071.55
Dn Invert (ft):		5069.78	5070.32	5071.40
Max Q (cfs):		3.92	3.93	4.45
Max Vel (ft/s):		4.28	4.25	4.52
Max Depth (ft):		0.67	0.67	0.68

ERIE BUSINESS PARK-5 YR
SD2_UGD TO MH2



Node ID:	DP-5	DP-2
Rim (ft):	5078.46	5078.06
Invert (ft):	5072.64	5073.49
Min Pipe Cover (ft):	4.12	3.07
Max HGL (ft):	5073.56	5074.39
Link ID:	7	
Length (ft):	131.25	
Dia (ft):	1.50	
Slope (ft/ft):	0.0050	
Up Invert (ft):	5073.49	
Dn Invert (ft):	5072.84	
Max Q (cfs):	2.30	
Max Vel (ft/s):	4.18	
Max Depth (ft):	0.53	

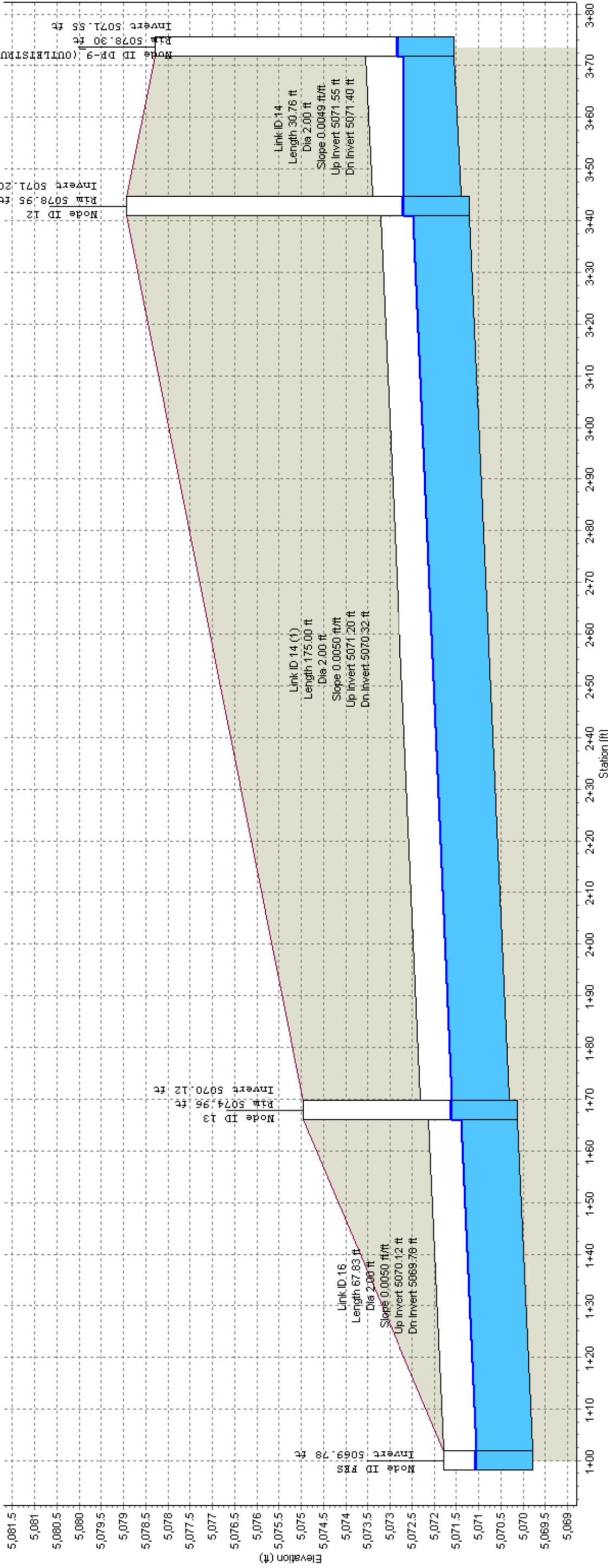
ERIE BUSINESS PARK-5 YR
SD2_MH2 TO INLET 2



Node ID:	DP-2	2	INLET 2
Rim (ft):	5078.06	5078.72	5079.10
Invert (ft):	5073.49	5074.55	5074.87
Min Pipe Cover (ft):	3.07	2.97	3.24
Max HGL (ft):	5074.39	5075.01	5075.11
Link ID:		5	3
Length (ft):		112.42	21.60
Dia (ft):		1.00	1.00
Slope (ft/ft):		0.0050	0.0051
Up Invert (ft):		5074.55	5074.86
Dn Invert (ft):		5073.99	5074.75
Max Q (cfs):		0.40	0.46
Max Vel (ft/s):		2.65	2.98
Max Depth (ft):		0.25	0.24

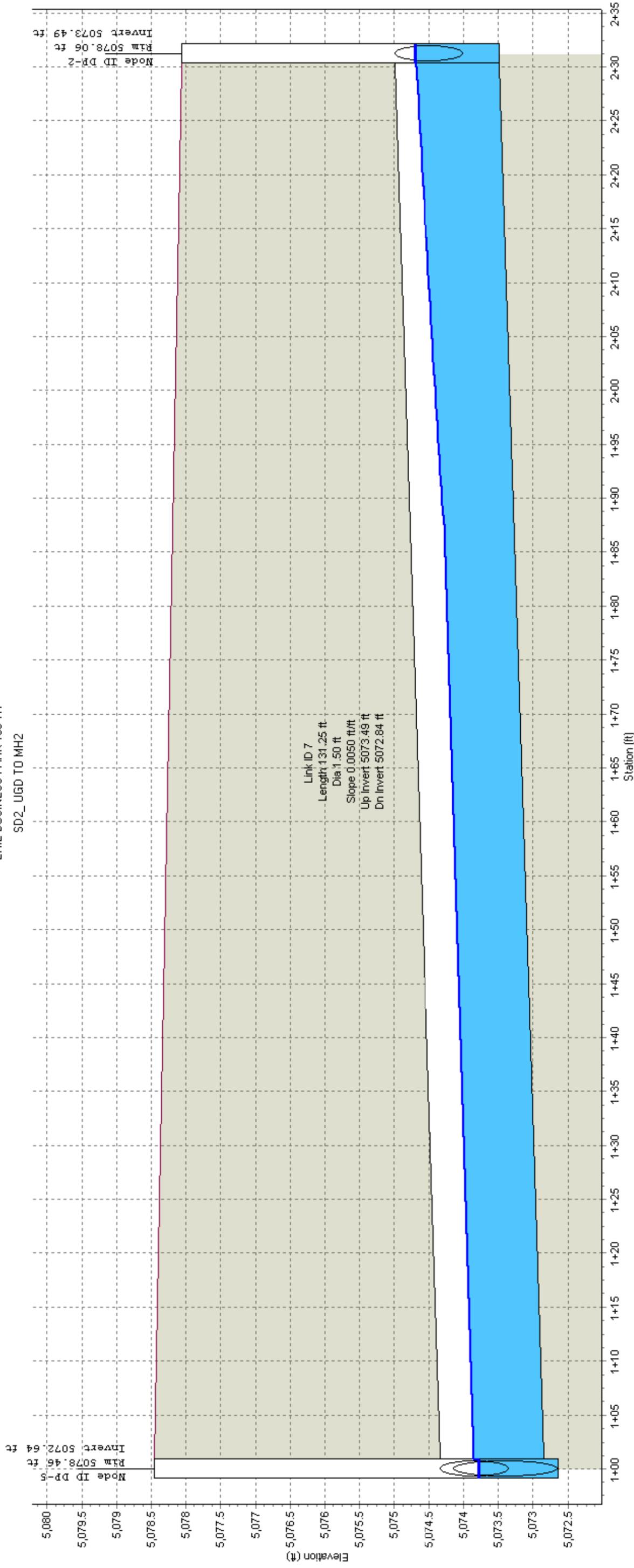
ERIE BUSINESS PARK-100 YR

SD1



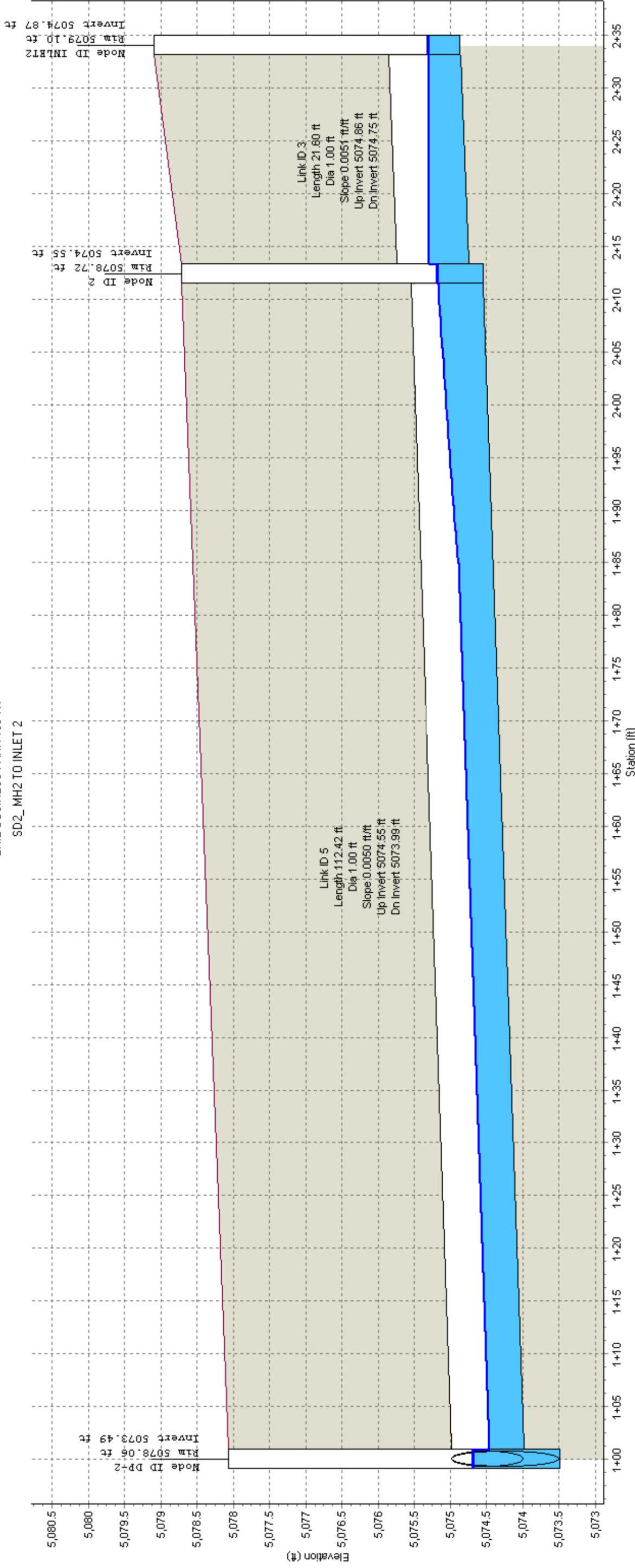
Node ID:	12		13		14 (1)	
Rim (ft):	5078.95	5078.30	5074.96	5070.12	5074.96	5078.30
Invert (ft):	5071.20	5071.55	5070.12	2.64	5070.12	5071.55
Min Pipe Cover (ft):	5.55	4.75	2.64		2.64	4.75
Max HGL (ft):	5072.80	5072.84	5071.63		5071.63	5072.84
Link ID:	14 (1)		16		14 (1)	
Length (ft):	30.76		67.83		175.00	
Dia (ft):	2.00		2.00		2.00	
Slope (ft/ft):	0.0049		0.0050		0.0050	
Up Invert (ft):	5071.55		5070.12		5071.20	
Dn Invert (ft):	5071.40		5069.78		5070.32	
Max Q (cfs):	13.23		11.99		12.26	
Max Vel (ft/s):	5.89		5.69		5.84	
Max Depth (ft):	1.29		1.28		1.28	

ERIE BUSINESS PARK-100 YR
SD2_UGD TO MH2



Node ID:	DP-5	DP-2
Rim (ft)	5078.46	5078.06
Invert (ft)	5072.64	5073.49
Min Pipe Cover (ft)	4.12	3.07
Max HGL (ft)	5073.78	5074.72
Link ID:	7	
Length (ft)	131.25	
Dia (ft)	1.50	
Slope (ft/ft)	0.0050	
Up Invert (ft)	5073.49	
Dn Invert (ft)	5072.84	
Max Q (cfs)	6.22	
Max Vel (ft/s)	5.39	
Max Depth (ft)	0.93	

ERIE BUSINESS PARK-100 YR
SD2_MH2 TO INLET 2



Node ID:	DP-2	2	INLET2
Rim (ft)	5078.06	5078.72	5079.10
Invert (ft)	5073.49	5074.55	5074.87
Min Pipe Cover (ft)	3.07	2.97	3.24
Max HGL (ft)	5074.72	5075.21	5075.30
Link ID:		5	3
Length (ft)		112.42	21.60
Dia (ft)		1.00	1.00
Slope (ft/ft)		0.0050	0.0051
Up Invert (ft)		5074.55	5074.86
Dn Invert (ft)		5073.99	5074.75
Max Q (cfs)		1.25	1.35
Max Vel (ft/s)		3.75	4.01
Max Depth (ft)		0.44	0.43

APPENDIX E
DETENTION AND WQCV CALCULATIONS

According to (2005) The Right Move Subdivision Lots 1 & 7 Master Drainage Plan, the existing pond in Lot 1 provides detention for Basins A1-A4 & B1= 8.08 ac and Imp= 67%.

Right Move Subdivision Lots 1 & 7 Drainage Report (2005) Area & Imp= **8.08** **67%**

Calculated Volumes for A=8.08ac & 67 % imp		
	Using UD Detention spreadsheet_v3.07	Using 2005 WQ equation & V=KA equation
Volume of WQCV=	0.176 ac-ft	0.08 ac-ft
10-yr Vol=		0.58 ac-ft
Total Detention Vol=	1.004 ac-ft	0.94 ac-ft

The Site (Erie Business Park & Storage) is made up of portions of Basins A1, A2, & A3 (from The Right Move Subdivision Lots 1&7)

From (2005) Right Move Subdivision Lots 1 & 7 Drainage Map			From Erie Business Park & Storage Proposed Drainage Plan		
Name	Acreage	Developed Imp	Name	Acreage	Imp
Basin A1	0.44	52.0%	Basins A1, B1 through B5, C1 & C2	0.93	75.8%
Basin A2	0.99	60.0%		1.37	
Basin A3	0.97	97.0%		0.02	
Basin A4	0.97	95.0%		-	-
Basin B1	2.39	55.0%		-	-
			OS1	0.18	37.9%
			OS2	0.05	2.0%
			Site Acreage and imp=	8.31	70.1%

Calculated Volumes for A=8.31ac & 70.1 % imp		
	Using UD Detention spreadsheet_v3.07	Using 2005 WQ equation & V=KA equation
Volume of WQCV=	0.191 ac-ft	0.19 ac-ft
10-yr Vol=		0.73 ac-ft
Total Detention Vol=	1.07 ac-ft	1.12 ac-ft

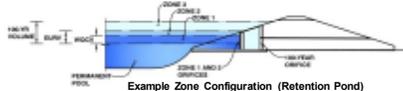
DELTA		
	Using UD Detention spreadsheet_v3.07	Using 2005 WQ equation & V=KA equation
Volume of WQCV=	0.015 ac-ft	0.114 ac-ft
10-yr Vol=		0.150 ac-ft
Total Detention Vol=	0.066 ac-ft	0.175 ac-ft

Per City of Erie request, add 25% to minimum total detention volume=	0.218 ac-ft 9516 cu-ft
--	---------------------------

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: _____
 Basin ID: UNDERGROUND DETENTION FACILITY



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	2.27	acres
Watershed Length =	500	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	74.20%	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) =	0.056	acre-feet
Excess Urban Runoff Volume (EURV) =	0.186	acre-feet
2-yr Runoff Volume (P1 = 0.81 in.) =	0.106	acre-feet
5-yr Runoff Volume (P1 = 1.11 in.) =	0.153	acre-feet
10-yr Runoff Volume (P1 = 1.39 in.) =	0.205	acre-feet
25-yr Runoff Volume (P1 = 1.84 in.) =	0.295	acre-feet
50-yr Runoff Volume (P1 = 2.24 in.) =	0.366	acre-feet
100-yr Runoff Volume (P1 = 2.68 in.) =	0.457	acre-feet
500-yr Runoff Volume (P1 = 3.89 in.) =	0.695	acre-feet
Approximate 2-yr Detention Volume =	0.100	acre-feet
Approximate 5-yr Detention Volume =	0.143	acre-feet
Approximate 10-yr Detention Volume =	0.193	acre-feet
Approximate 25-yr Detention Volume =	0.240	acre-feet
Approximate 50-yr Detention Volume =	0.270	acre-feet
Approximate 100-yr Detention Volume =	0.306	acre-feet

Optional User Override
 1-hr Precipitation
 inches
 inches
 inches
 inches
 inches
 inches

Stage-Storage Calculation

Zone 1 Volume (User Defined) =	0.114	acre-feet	WQCV not provided!
Zone 2 Volume (User Defined - Zone 1) =	0.036	acre-feet	Total detention volume is less than 100-year volume.
Zone 3 Volume (User Defined - Zones 1 & 2) =	0.025	acre-feet	
Total Detention Basin Volume =	0.175	acre-feet	
Initial Surcharge Volume (SV) =	user	ft³	
Initial Surcharge Depth (SD) =	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 _{sv}) =	user	ft²	
Surcharge Volume Length (L _{sv}) =	user	ft	
Surcharge Volume Width (W _{sv}) =	user	ft	
Depth of Basin Floor (H _{u,000}) =	user	ft	
Length of Basin Floor (L _{u,000}) =	user	ft	
Width of Basin Floor (W _{u,000}) =	user	ft	
Area of Basin Floor (A _{u,000}) =	user	ft²	
Volume of Basin Floor (V _{u,000}) =	user	ft³	
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	ft²	
Volume of Main Basin (V _{main}) =	user	ft³	
Calculated Total Basin Volume (V _{total}) =	user	acre-feet	

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (acre)	Volume (ft³)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	1,912	0.044	153	0.004
	--	0.08	--	--	--	1,912	0.044	306	0.007
	--	0.17	--	--	--	1,912	0.044	459	0.011
	--	0.25	--	--	--	1,912	0.044	631	0.014
	--	0.33	--	--	--	1,912	0.044	784	0.018
	--	0.42	--	--	--	1,912	0.044	937	0.022
	--	0.50	--	--	--	1,912	0.044	1,172	0.027
	--	0.58	--	--	--	3,564	0.082	1,457	0.033
	--	0.67	--	--	--	3,564	0.082	1,742	0.040
	--	0.75	--	--	--	3,524	0.081	2,060	0.047
	--	0.83	--	--	--	3,508	0.081	2,341	0.054
	--	0.92	--	--	--	3,488	0.080	2,621	0.060
	--	1.00	--	--	--	3,465	0.080	2,934	0.067
	--	1.08	--	--	--	3,447	0.079	3,210	0.074
	--	1.17	--	--	--	3,417	0.078	3,485	0.080
	--	1.25	--	--	--	3,390	0.078	3,792	0.087
	--	1.33	--	--	--	3,360	0.077	4,062	0.093
	--	1.42	--	--	--	3,329	0.076	4,330	0.099
	--	1.50	--	--	--	3,301	0.076	4,628	0.106
	--	1.58	--	--	--	3,262	0.075	4,891	0.112
	--	1.67	--	--	--	3,224	0.074	5,150	0.118
	--	1.75	--	--	--	3,184	0.073	5,439	0.125
	--	1.83	--	--	--	3,141	0.072	5,692	0.131
	--	1.92	--	--	--	3,096	0.071	5,942	0.136
	--	2.00	--	--	--	3,053	0.070	6,219	0.143
	--	2.08	--	--	--	3,000	0.069	6,462	0.148
	--	2.17	--	--	--	2,926	0.067	6,729	0.154
	--	2.25	--	--	--	2,859	0.066	6,960	0.160
	--	2.33	--	--	--	2,796	0.064	7,187	0.165
	--	2.42	--	--	--	2,716	0.062	7,435	0.171
	--	2.50	--	--	--	2,623	0.060	7,649	0.176
	--	2.58	--	--	--	2,512	0.058	7,855	0.180
	--	2.67	--	--	--	2,364	0.054	8,075	0.185
	--	2.75	--	--	--	2,123	0.049	8,254	0.189
	--	2.83	--	--	--	2,034	0.047	8,421	0.193
	--	2.92	--	--	--	1,953	0.045	8,601	0.197
	--	3.00	--	--	--	1,912	0.044	8,755	0.201
	--	3.08	--	--	--	1,912	0.044	8,908	0.205
	--	3.17	--	--	--	1,912	0.044	9,080	0.208
	--	3.25	--	--	--	1,912	0.044	9,233	0.212
	--	3.33	--	--	--	1,912	0.044	9,386	0.215
	--	3.42	--	--	--	1,912	0.044	9,558	0.219
	--	3.50	--	--	--				

Project: Erie Business Park & Storage



Chamber Model -
Units -

SC-740
Imperial [Click Here for Metric](#)

Number of chambers -
Voids in the stone (porosity) -
Base of STONE Elevation -
Amount of Stone Above Chambers -
Amount of Stone Below Chambers -
Area of system -

104
40 %
5071.75 ft
6 in
6 in
4779 sf

Include Perimeter Stone in Calculations

Min. Area - 3516 sf min. area

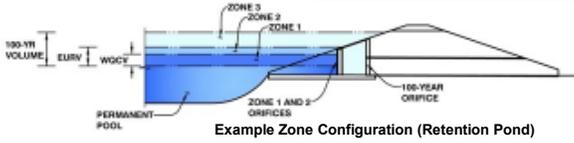
Height of System (inches)	Incremental Single Chamber (cubic feet)	Incremental Total Chamber (cubic feet)	Incremental Stone (cubic feet)	Incremental Ch & St (cubic feet)	Cumulative Chamber (cubic feet)	Elevation (feet)
42	0.00	0.00	159.30	159.30	9557.93	5075.25
41	0.00	0.00	159.30	159.30	9398.63	5075.17
40	0.00	0.00	159.30	159.30	9239.33	5075.08
39	0.00	0.00	159.30	159.30	9080.03	5075.00
38	0.00	0.00	159.30	159.30	8920.73	5074.92
37	0.00	0.00	159.30	159.30	8761.43	5074.83
36	0.05	5.72	157.01	162.73	8602.13	5074.75
35	0.16	16.94	152.52	169.47	8439.40	5074.67
34	0.28	29.32	147.57	176.89	8269.93	5074.58
33	0.60	62.81	134.18	196.99	8093.04	5074.50
32	0.80	83.38	125.95	209.33	7896.05	5074.42
31	0.95	98.87	119.75	218.62	7686.73	5074.33
30	1.07	111.75	114.60	226.35	7468.11	5074.25
29	1.18	122.77	110.19	232.96	7241.76	5074.17
28	1.27	131.63	106.65	238.28	7008.79	5074.08
27	1.36	140.92	102.93	243.85	6770.52	5074.00
26	1.45	151.23	98.81	250.04	6526.66	5073.92
25	1.52	158.57	95.87	254.44	6276.63	5073.83
24	1.58	164.56	93.48	258.04	6022.18	5073.75
23	1.64	170.80	90.98	261.78	5764.15	5073.67
22	1.70	176.75	88.60	265.35	5502.37	5073.58
21	1.75	182.30	86.38	268.68	5237.02	5073.50
20	1.80	187.49	84.30	271.80	4968.34	5073.42
19	1.85	192.92	82.13	275.05	4696.54	5073.33
18	1.89	196.88	80.55	277.43	4421.49	5073.25
17	1.93	201.14	78.85	279.98	4144.06	5073.17
16	1.97	205.40	77.14	282.54	3864.08	5073.08
15	2.01	209.03	75.69	284.72	3581.54	5073.00
14	2.04	212.68	74.23	286.91	3296.82	5072.92
13	2.07	215.80	72.98	288.78	3009.91	5072.83
12	2.10	218.91	71.74	290.65	2721.13	5072.75
11	2.13	221.71	70.62	292.32	2430.49	5072.67
10	2.15	224.00	69.70	293.70	2138.16	5072.58
9	2.18	226.41	68.73	295.15	1844.46	5072.50
8	2.20	228.63	67.85	296.48	1549.31	5072.42
7	2.21	229.56	67.48	297.04	1252.84	5072.33
6	0.00	0.00	159.30	159.30	955.80	5072.25
5	0.00	0.00	159.30	159.30	796.50	5072.17
4	0.00	0.00	159.30	159.30	637.20	5072.08
3	0.00	0.00	159.30	159.30	477.90	5072.00
2	0.00	0.00	159.30	159.30	318.60	5071.92
1	0.00	0.00	159.30	159.30	159.30	5071.83

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: _____

Basin ID: _____



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (User)	1.69	0.114	Orifice Plate
Zone 2 (User)	2.19	0.036	Orifice Plate
Zone 3 (User)	2.58	0.025	Rectangular Orifice
		0.175	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
 Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft²
 Underdrain Orifice Centroid = 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 = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = inches
 Orifice Plate: Orifice Area per Row = inches

Calculated Parameters for Plate

WQ Orifice Area per Row = ft²
 Elliptical Half-Width = feet
 Elliptical Slot Centroid = feet
 Elliptical Slot Area = ft²

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	0.83	1.67					
Orifice Area (sq. inches)	0.79	0.79	3.14					

	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)

	Zone 3 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.05	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	18.00	N/A	inches
Vertical Orifice Width =	76.25		inches

Calculated Parameters for Vertical Orifice

	Zone 3 Rectangular	Not Selected	
Vertical Orifice Area =	9.53	N/A	ft ²
Vertical Orifice Centroid =	0.75	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	N/A	N/A	feet
Overflow Weir Slope =	N/A	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	N/A	N/A	feet
Overflow Grate Open Area % =	N/A	N/A	% grate open area/total area
Debris Clogging % =	N/A	N/A	%

Calculated Parameters for Overflow Weir

	Not Selected	Not Selected	
Height of Grate Upper Edge, H ₁ =	N/A	N/A	feet
Over Flow Weir Slope Length =	N/A	N/A	feet
Grate Open Area / 100-yr Orifice Area =	N/A	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	N/A	N/A	ft ²
Overflow Grate Open Area w/ Debris =	N/A	N/A	ft ²

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	N/A	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Not Selected	Not Selected	
Outlet Orifice Area =	N/A	N/A	ft ²
Outlet Orifice Centroid =	N/A	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
 Spillway Crest Length = feet
 Spillway End Slopes = H:V
 Freeboard above Max Water Surface = feet

Calculated Parameters for Spillway

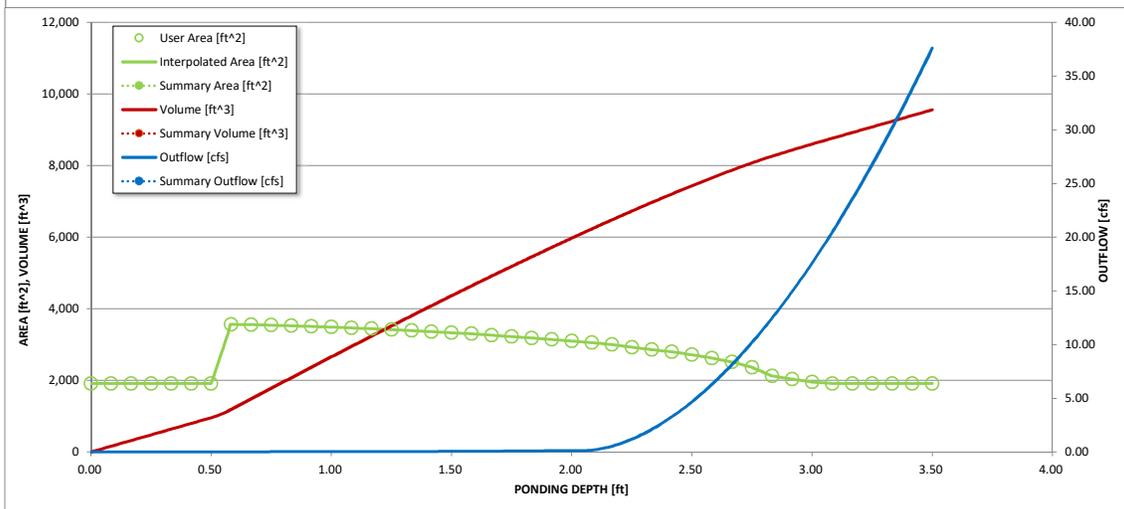
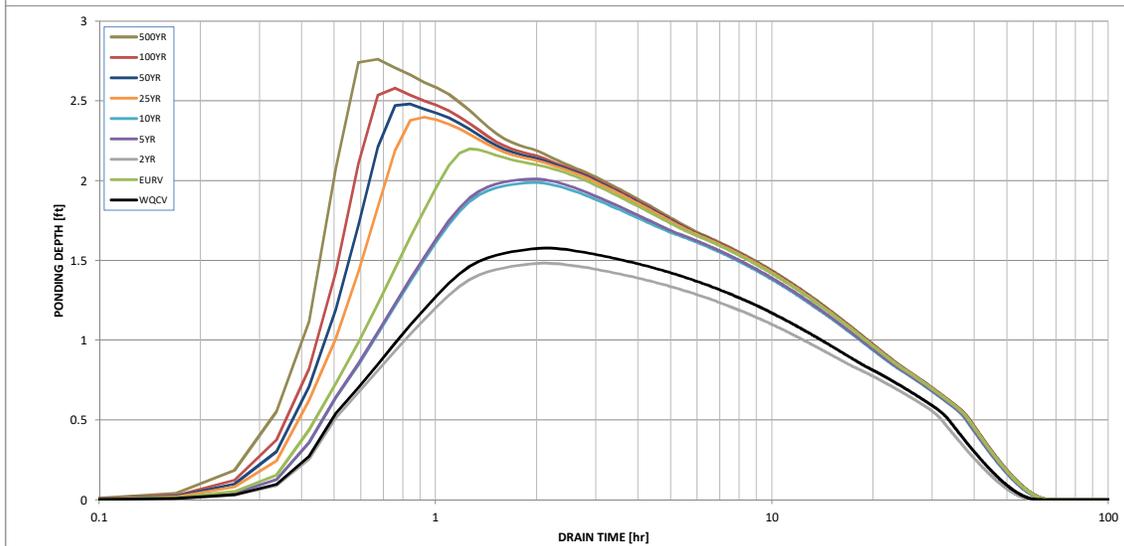
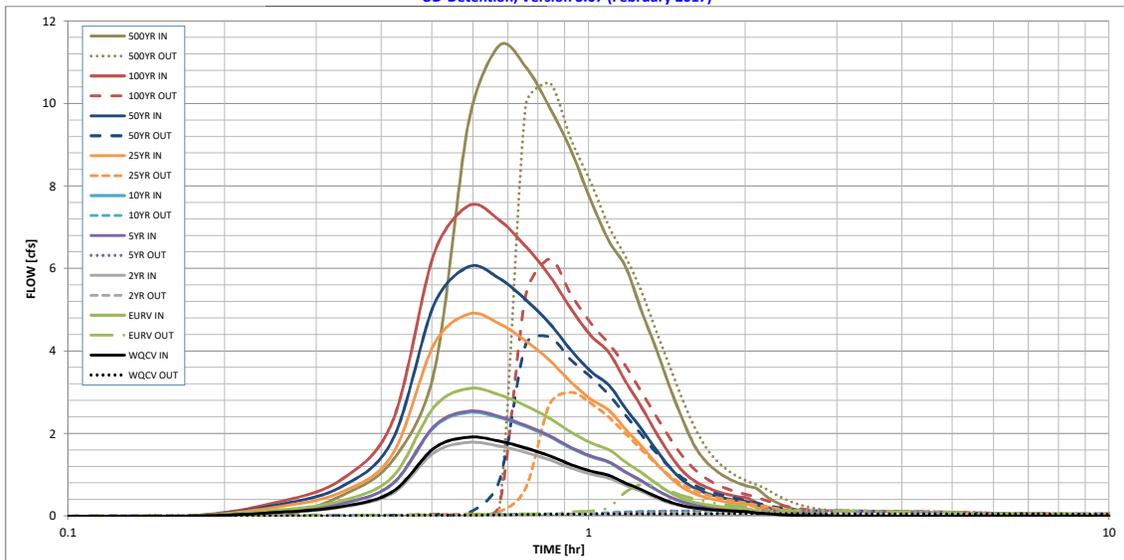
Spillway Design Flow Depth = feet
 Stage at Top of Freeboard = feet
 Basin Area at Top of Freeboard = acres

Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	0.81	1.11	1.39	1.84	2.24	2.68	3.89
Calculated Runoff Volume (acre-ft) =	0.056	0.186	0.106	0.153	0.205	0.295	0.366	0.457	0.695
OPTIONAL Override Runoff Volume (acre-ft) =	0.114				0.150				
Inflow Hydrograph Volume (acre-ft) =	0.114	0.185	0.106	0.152	0.150	0.295	0.365	0.456	0.694
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.16	0.60	0.90	1.30	2.23
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.4	1.4	2.0	2.9	5.1
Peak Inflow Q (cfs) =	1.9	3.1	1.8	2.5	2.5	4.9	6.0	7.5	11.4
Peak Outflow Q (cfs) =	0.1	0.8	0.1	0.1	0.1	3.0	4.3	6.2	10.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.7	0.4	2.2	2.1	2.1	2.1
Structure Controlling Flow =	Plate	Vertical Orifice 1	Plate	Plate	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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) =	51	53	50	54	54	49	47	45	40
Time to Drain 99% of Inflow Volume (hours) =	56	59	54	59	59	57	56	54	51
Maximum Ponding Depth (ft) =	1.58	2.20	1.48	2.01	1.99	2.40	2.48	2.58	2.76
Area at Maximum Ponding Depth (acres) =	0.08	0.07	0.08	0.07	0.07	0.06	0.06	0.06	0.05
Maximum Volume Stored (acre-ft) =	0.105	0.151	0.099	0.138	0.136	0.164	0.169	0.176	0.186

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			

Weir Report

SPILLWAY

Rectangular Weir

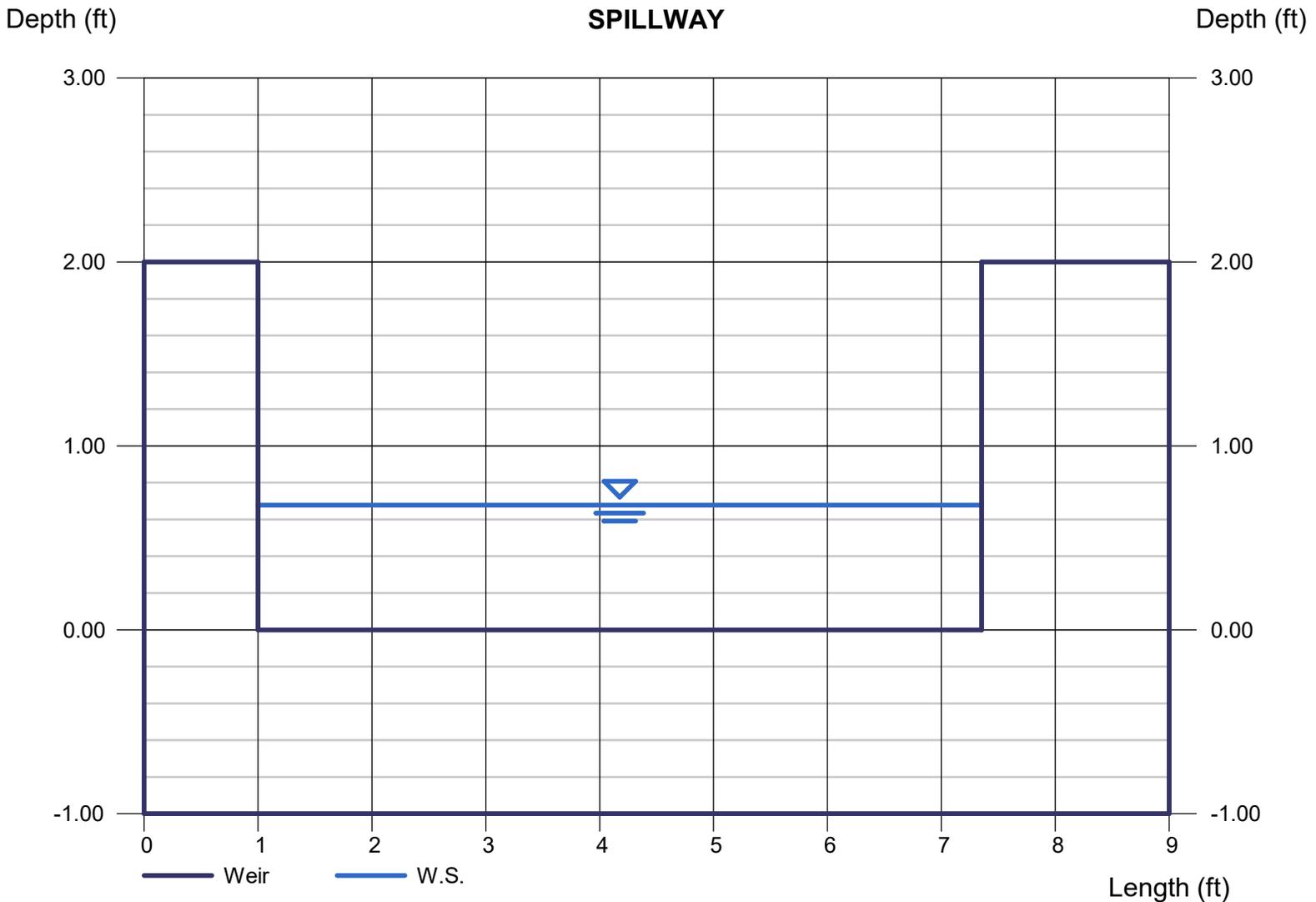
Crest = Sharp
Bottom Length (ft) = 6.35
Total Depth (ft) = 2.00

Highlighted

Depth (ft) = 0.68
Q (cfs) = 11.80
Area (sqft) = 4.30
Velocity (ft/s) = 2.74
Top Width (ft) = 6.35

Calculations

Weir Coeff. C_w = 3.33
Compute by: Known Q
Known Q (cfs) = 11.80



APPENDIX F
UNDERGROUND DETENTION O&M MANUAL

Isolator[®] Row O&M Manual



THE ISOLATOR[®] ROW

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-160LP, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160LP, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the overflow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

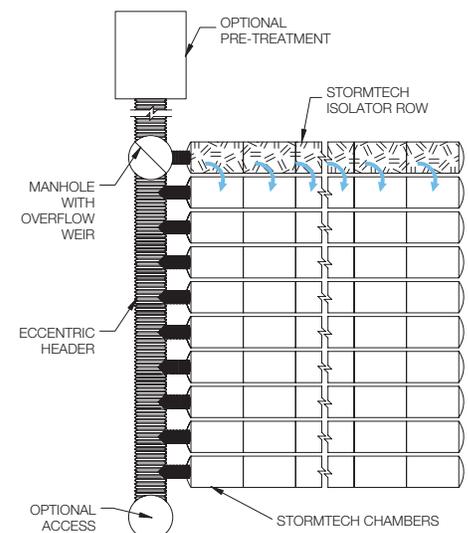
Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.



Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.



StormTech Isolator Row with Overflow Spillway (not to scale)





ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

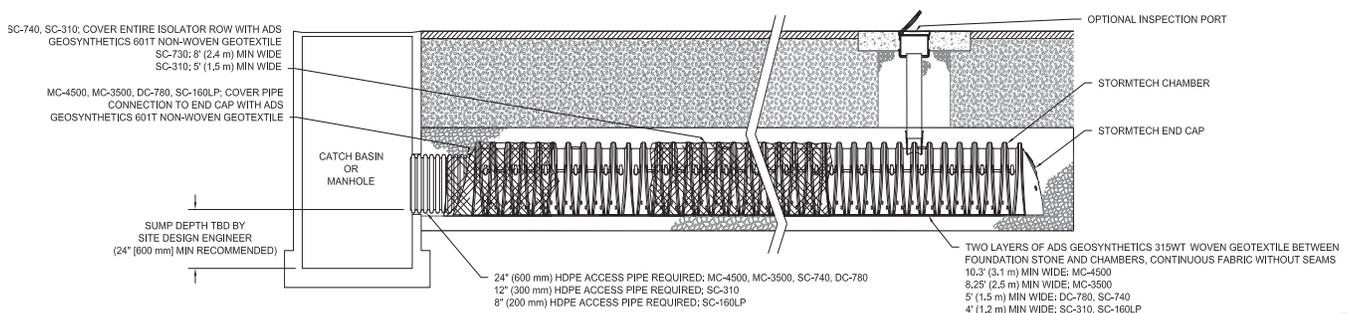
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1

Inspect Isolator Row for sediment.

- A) Inspection ports (if present)
 - i. Remove lid from floor box frame
 - ii. Remove cap from inspection riser
 - iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.
 - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Rows
 - i. Remove cover from manhole at upstream end of Isolator Row
 - ii. Using a flashlight, inspect down Isolator Row through outlet pipe
 - 1. Mirrors on poles or cameras may be used to avoid a confined space entry
 - 2. Follow OSHA regulations for confined space entry if entering manhole
 - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2

Clean out Isolator Row using the JetVac process.

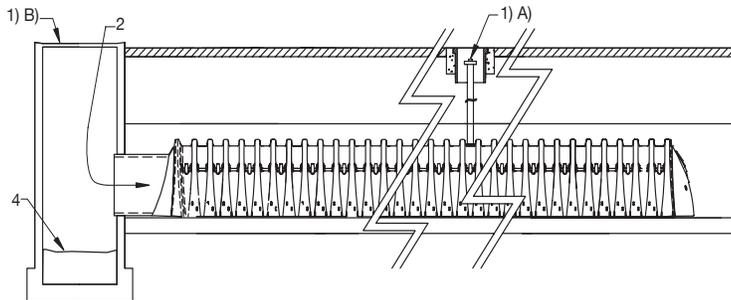
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

STEP 3

Replace all caps, lids and covers, record observations and actions.

STEP 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)-(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

APPENDIX G
UNDERGROUND DETENTION MAINTENANCE PLAN

UNDERGROUND DETENTION MAINTENANCE PLAN

The proposed underground detention for this project will be a system manufactured by StormTech (ADS) consisting of rows of underground storage chambers installed over a bed of porous stone. The initial row of chambers is called the isolator row. The isolator row serves a similar function as the forebay in a conventional surface detention pond in that it captures the sedimentation of the runoff before it is distributed to the remaining storage chambers. The isolator row incorporates a combination of inspection ports or manholes (inlets) to allow for periodical inspections and maintenance.

It will be the responsibility of the Homeowner's Association to perform the inspections and complete the maintenance on this system.

INSPECTION:

Inspection of the system shall be scheduled at regular intervals and shall occur every 6 months at minimum. Additional inspections will be required after significant storm events (5-year or greater) to determine if maintenance is required. Regular routine inspections will consist of visual inspection and measurement of sediment in the isolator chamber. Methods of measurement are described in the manufacturer's operating and maintenance manual.

A more detailed inspection of the entire system shall be performed every 3 years. These inspections shall be performed by means of video camera inserted in each chamber. Required maintenance and repair of the system will be determined from this video inspection.

It shall be the responsibility of the Homeowners Association to maintain records of the regularly scheduled and storm related inspections and provide these to the Town of Erie as required.

MAINTENANCE:

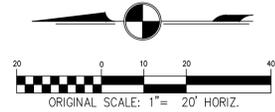
If upon visual inspection it is determined that sediment has accumulated, the depth of the sediment should be determined by inserting an stadia rod through the inspection port. When the average depth of sediment throughout the length of the isolator row exceeds an average of 3 inches, clean-out of the isolator row shall be performed.

Clean-out of the system will be accomplished with a JetVac process. The JetVac process utilizes a high-pressure water nozzle to scour and flush sediments from the isolator row. This process is described in the Operation and Maintenance manual provided by StormTech.

It shall be the responsibility of the Homeowners Association to maintain records of the maintenance operation and provide these to the Town of Erie as required.

FIGURES

EXISTING DRAINAGE PLAN

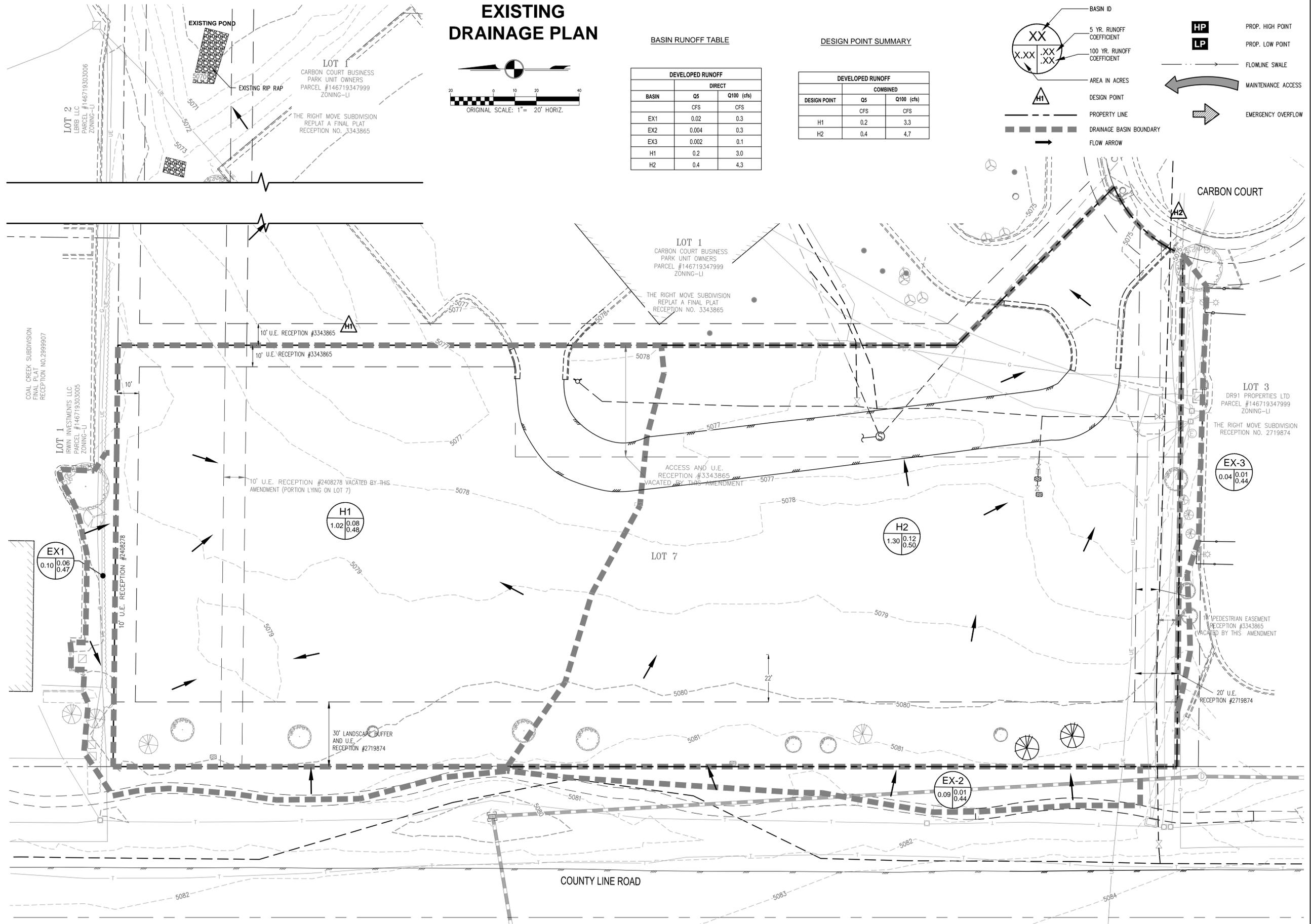
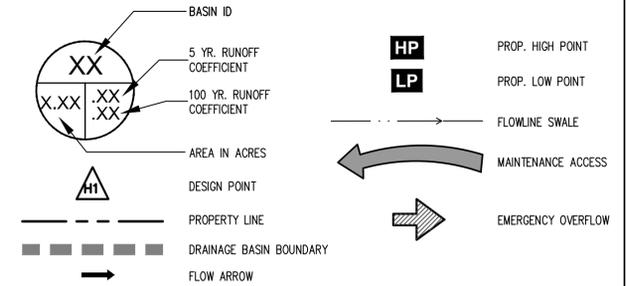


BASIN RUNOFF TABLE

BASIN	DEVELOPED RUNOFF	
	Q5	Q100 (cfs)
	CFS	CFS
EX1	0.02	0.3
EX2	0.004	0.3
EX3	0.002	0.1
H1	0.2	3.0
H2	0.4	4.3

DESIGN POINT SUMMARY

DESIGN POINT	DEVELOPED RUNOFF	
	Q5	Q100 (cfs)
	CFS	CFS
H1	0.2	3.3
H2	0.4	4.7



GYS DEVELOPMENT, LLC.

RICK
ENGINEERING COMPANY
5690 WEBSTER ST
ARVADA, CO 80002
303.423.6036
Locations: San Diego - Riverside - Chicago - Denver
Sacramento - San Luis Obispo - Phoenix - Las Vegas
rickengineering.com

REVIEWED FOR COMPLIANCE BY:

SIGNATURE	DATE
SIGNATURE	DATE

REVISIONS:

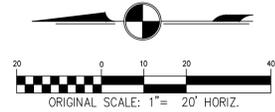
NO.	DESCRIPTION	DATE:
1	2nd AGENCY REVIEW	4/19/19

SCALE:
DATE: 04/19/2019
DRAWN BY: ECC
CHECKED BY: AHN
JOB NO: 001142

ERIE BUSINESS PARK & STORAGE
EXISTING DRAINAGE PLAN

PROJECT NO.
001142
DRAWING NO.
SHEET NO. **1** OF **2** SHEETS

PROPOSED DRAINAGE PLAN

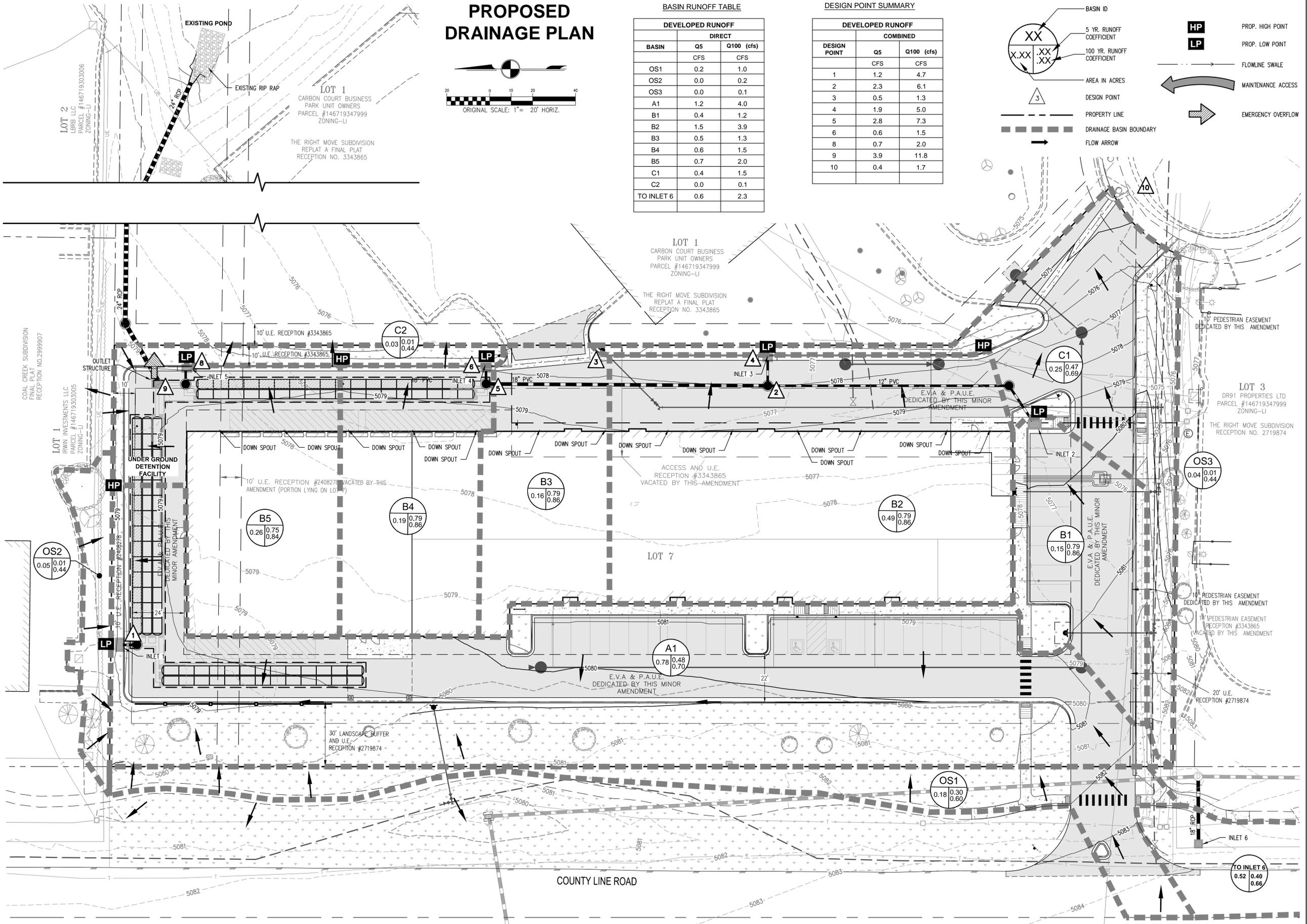
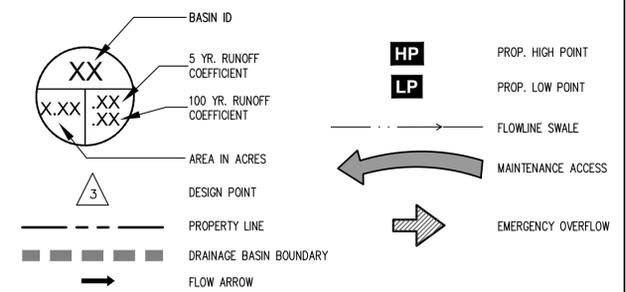


BASIN RUNOFF TABLE

BASIN	DEVELOPED RUNOFF	
	Q5	Q100 (cfs)
OS1	0.2	1.0
OS2	0.0	0.2
OS3	0.0	0.1
A1	1.2	4.0
B1	0.4	1.2
B2	1.5	3.9
B3	0.5	1.3
B4	0.6	1.5
B5	0.7	2.0
C1	0.4	1.5
C2	0.0	0.1
TO INLET 6	0.6	2.3

DESIGN POINT SUMMARY

DESIGN POINT	DEVELOPED RUNOFF	
	Q5	Q100 (cfs)
1	1.2	4.7
2	2.3	6.1
3	0.5	1.3
4	1.9	5.0
5	2.8	7.3
6	0.6	1.5
8	0.7	2.0
9	3.9	11.8
10	0.4	1.7



GYS DEVELOPMENT, LLC.

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ARVADA, CO 80002
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rickengineering.com

REVIEWED FOR COMPLIANCE BY:

SIGNATURE	DATE
SIGNATURE	DATE

REVISIONS:

NO.	DESCRIPTION	DATE:
1	2nd AGENCY REVIEW	4/19/19

SCALE:
DATE: 04/19/2019
DRAWN BY: ECC
CHECKED BY: AHN
JOB NO: D01142

ERIE BUSINESS PARK & STORAGE
PROPOSED DRAINAGE PLAN

PROJECT NO.
D01142
DRAWING NO.
SHEET NO. **2** OF **2** SHEETS

J:\D01142_GYS_Erie_Civil_DRAINAGE\FINAL\CAD FILES\P-1142_DRN.dwg, 4/26/2019 9:18:16 AM

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FOR REFERENCE
THE RIGHT MOVE SUBDIVISION
LOTS 1 & 7

SHEET 4 OF 8

Per Right Move Subdivision Lots 1&7, Basin A1 has a 10-yr flow of 2.6 cfs and 100-yr flow of 6.8 cfs

0.93 ac, imp=75.8%

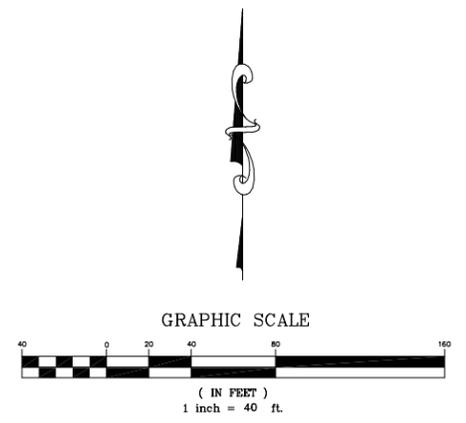
0.02 ac, imp 75.8%

1.37 ac, imp=75.8%

LEGEND	
●	Manhole
○	Existing Manhole
■	5' Type 'R' Inlet
■	10' Type 'R' Inlet
■	15' Type 'R' Inlet
▲	Flared End Section
■	Type 13 Inlet
■	ADS Inlet
—	Storm Pipe
—	Existing Storm Pipe
—	Existing Contours
—	Proposed Contours
- - -	Master Basin Boundary
- - -	Basin Boundary
→	Flow Arrow
S-28	Structure Number
A	Basin Designation

NOTE: ALL INLETS ARE 5' TYPE 'R' UNLESS OTHERWISE NOTED.

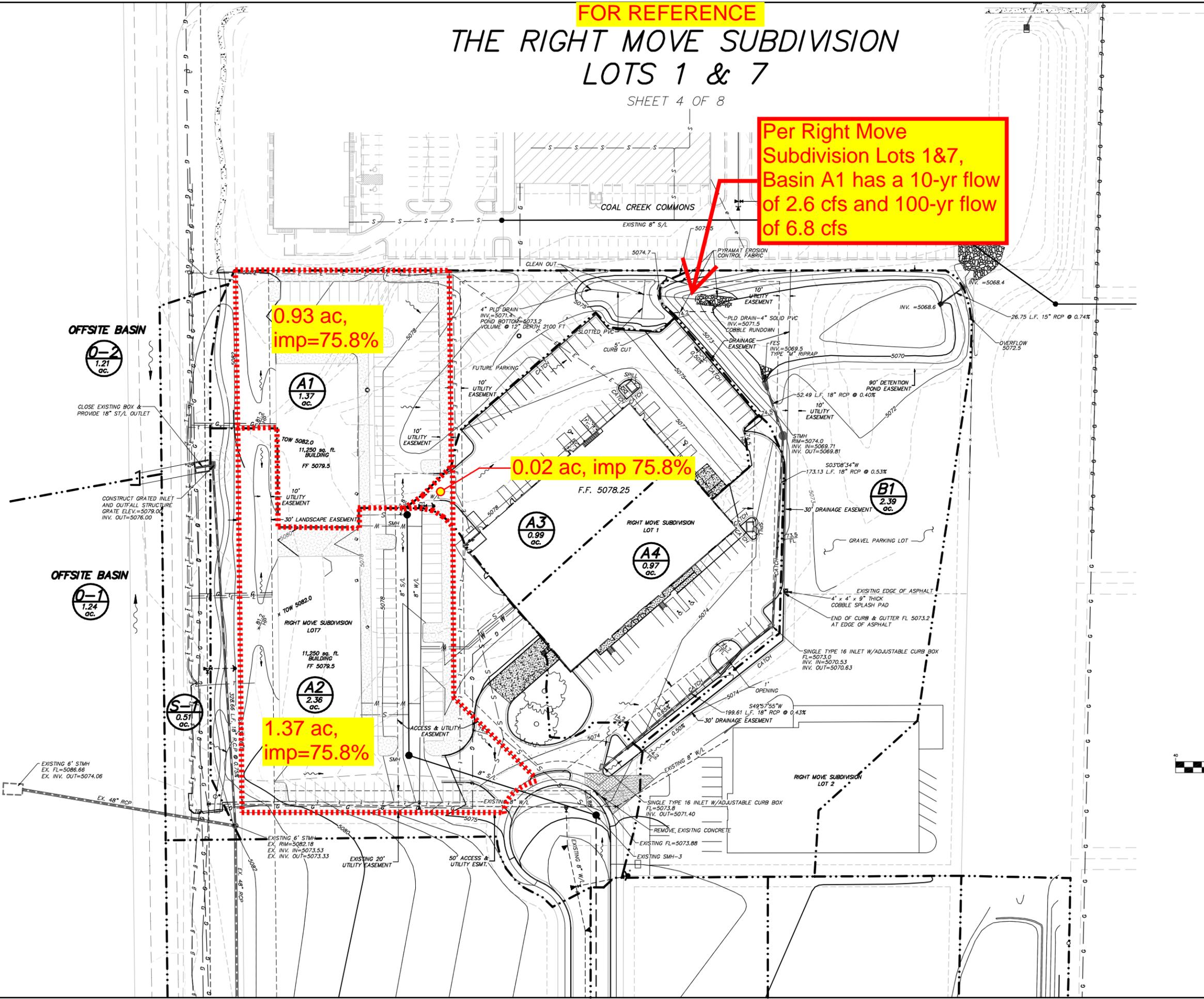
DETENTION POND	
STAGE (ELEV.)	STORAGE (CU. FT.)
5068.6	0
5069.0	840
5070.0	8990
5071.0	24,340
5072.0	46,040



72 HOURS BEFORE YOU DIG
 CALL THE UTILITY NOTIFICATION
 CENTER OF COLORADO (U.N.C.C.)
 1-800-922-1987
 GAS, ELECTRIC, TELEPHONE, CATV AND
 PANHANDLE EASTERN PIPELINE LOCATIONS

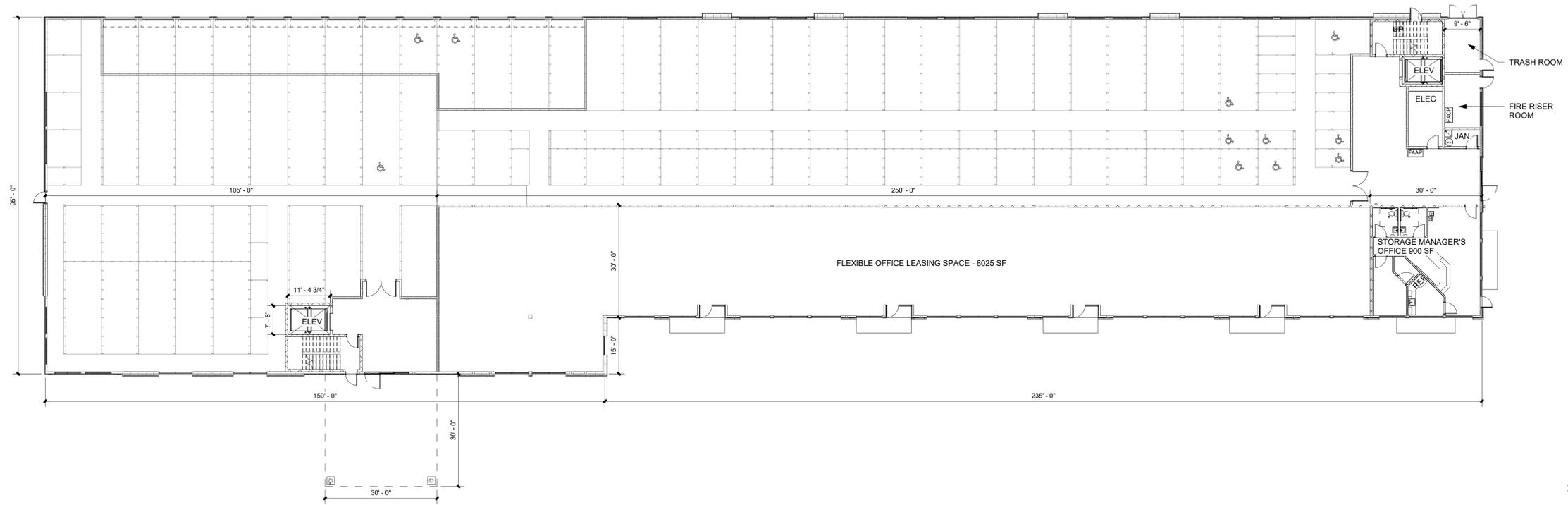
THE RIGHT MOVE SUBDIVISION
LOTS 1 & 7
MASTER DRAINAGE PLAN

SCALE HOR. 1"=40'	
VERT. N/A	
DESIGN/APPR. OCH	
DRAWN BY CT	
DATE 09/30/05	HURST & ASSOCIATES, INC. CONSULTING ENGINEERS 4999 Pearl East Circle, Suite 106 Boulder, Colorado 80504 (303) 448-9105
FILE G:\22741\CONST\741-MD	SHEET 4 OF 8



THE RIGHT MOVE SUBDIVISION, 1st AMENDMENT

LOCATED IN SOUTHWEST QUARTER OF SECTION 19,
TOWNSHIP 1 NORTH, RANGE 68 WEST 6TH P.M.
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
2.32 ACRES
SP-001019-2018
SRU-001020-2018



1 FIRST FLOOR PLAN
SCALE: 1/16" = 1'-0"

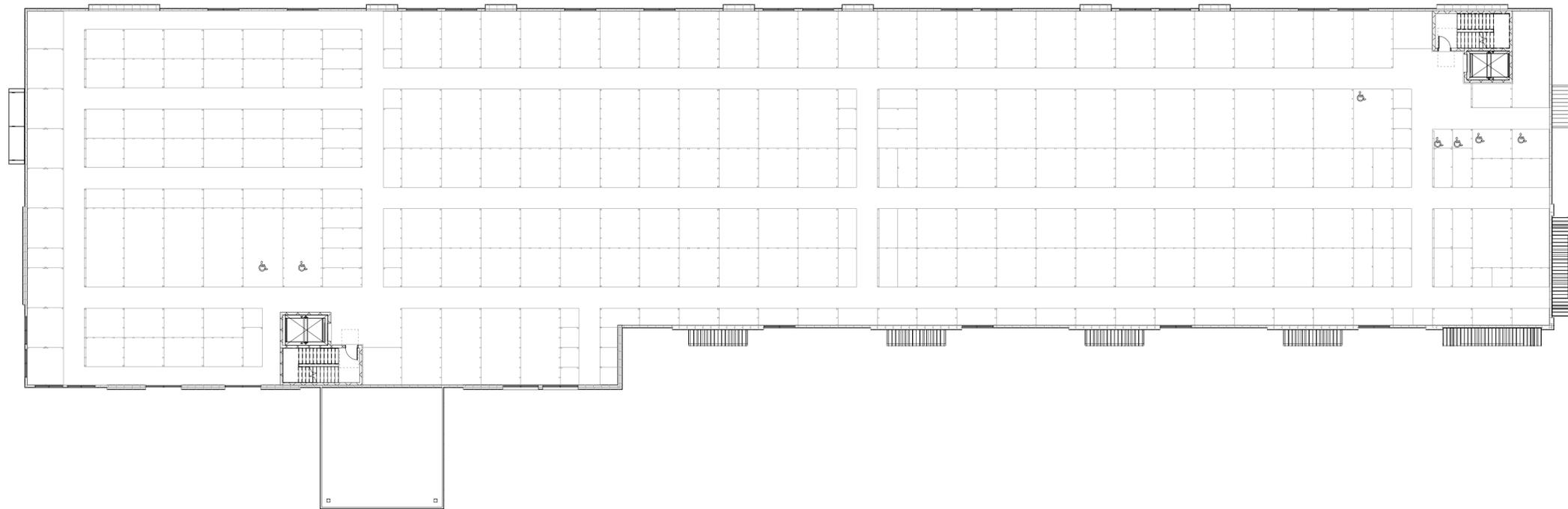
FIRST FLOOR PLAN
SHEET A1
APRIL 19, 2019
JOB#: D01142

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	1st REFERALL AGENCY REVIEW	12/10/19	AHN
2	2nd REFERALL AGENCY REVIEW	04/19/19	AHN

RICK
ENGINEERING COMPANY
5690 WEBSTER STREET
ARVADA, CO 80002
303.423.6036

THE RIGHT MOVE SUBDIVISION, 1st AMENDMENT

LOCATED IN SOUTHWEST QUARTER OF SECTION 19,
TOWNSHIP 1 NORTH, RANGE 68 WEST 6TH P.M.
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
2.32 ACRES
SP-001019-2018
SRU-001020-2018



1 SECOND FLOOR PLAN
SCALE: 1/16" = 1'-0"



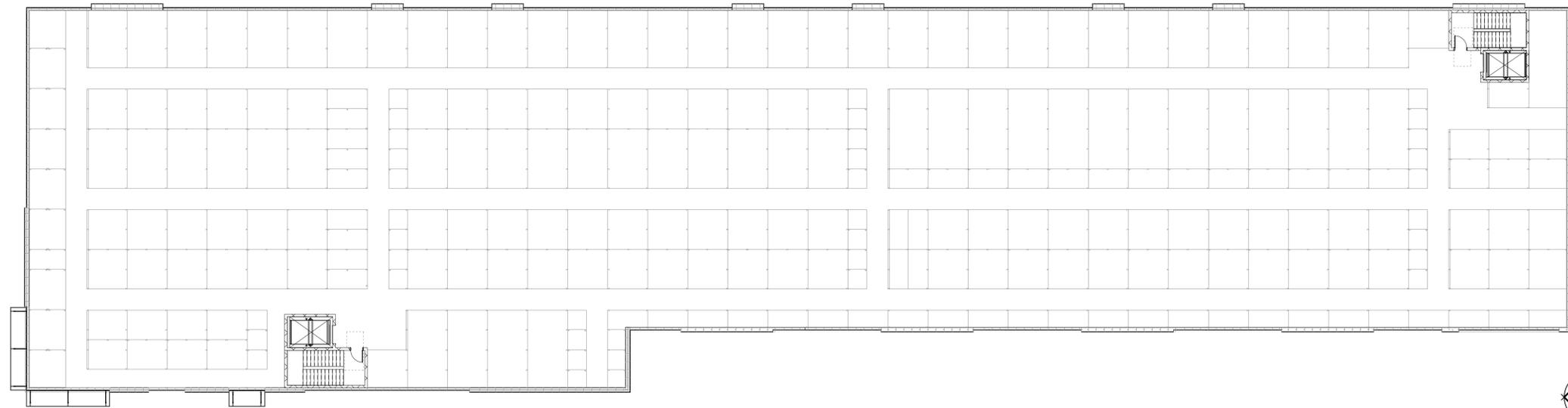
**SECOND FLOOR PLAN
SHEET A2
APRIL 19, 2019
JOB#: D01142**

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	1st REFERALL AGENCY REVIEW	12/10/19	AHN
2	2nd REFERALL AGENCY REVIEW	04/19/19	AHN

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THE RIGHT MOVE SUBDIVISION, 1st AMENDMENT

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TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
2.32 ACRES
SP-001019-2018
SRU-001020-2018



1 THIRD FLOOR PLAN
SCALE: 1/16" = 1'-0"

**THIRD FLOOR PLAN
SHEET A3
APRIL 19, 2019
JOB#: D01142**

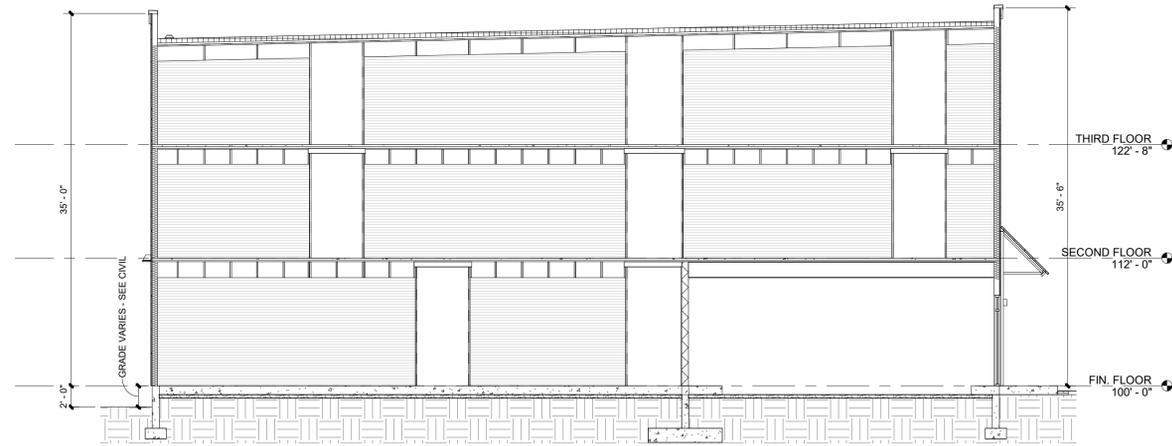
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NO.	DESCRIPTION	DATE	BY
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2	2nd REFERALL AGENCY REVIEW	04/19/19	AHN



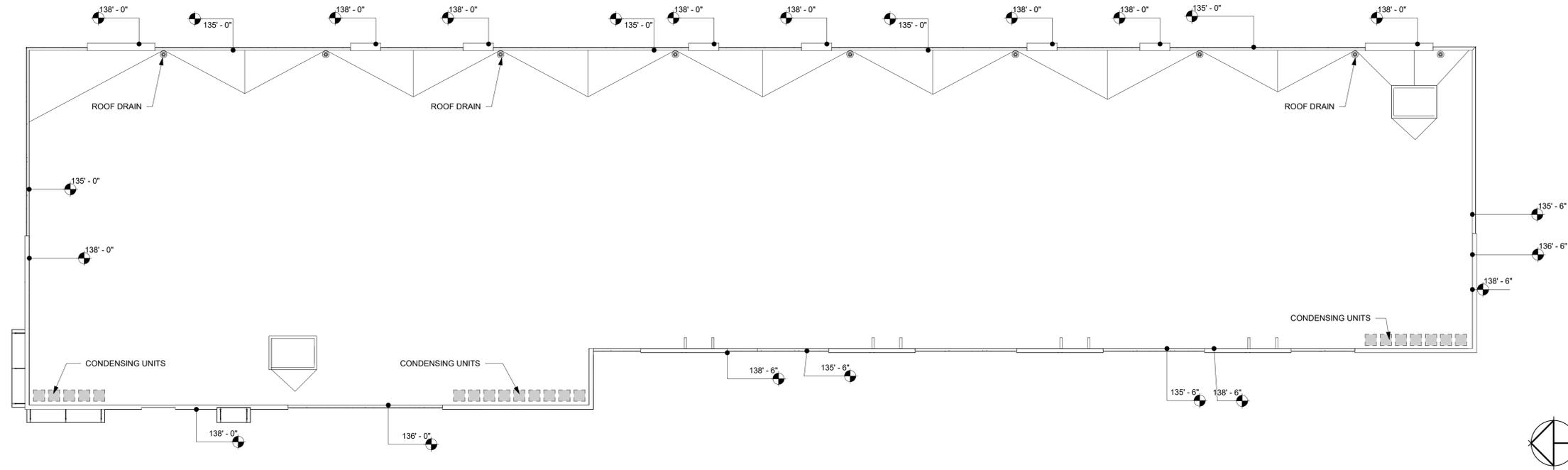
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TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
2.32 ACRES
SP-001019-2018
SRU-001020-2018



2 TYPICAL BUILDING SECTION
SCALE: 1/8" = 1'-0"



1 ROOF PLAN
SCALE: 1/16" = 1'-0"

**ROOF PLAN AND SECTION
SHEET A4
APRIL 19, 2019
JOB#: D01142**

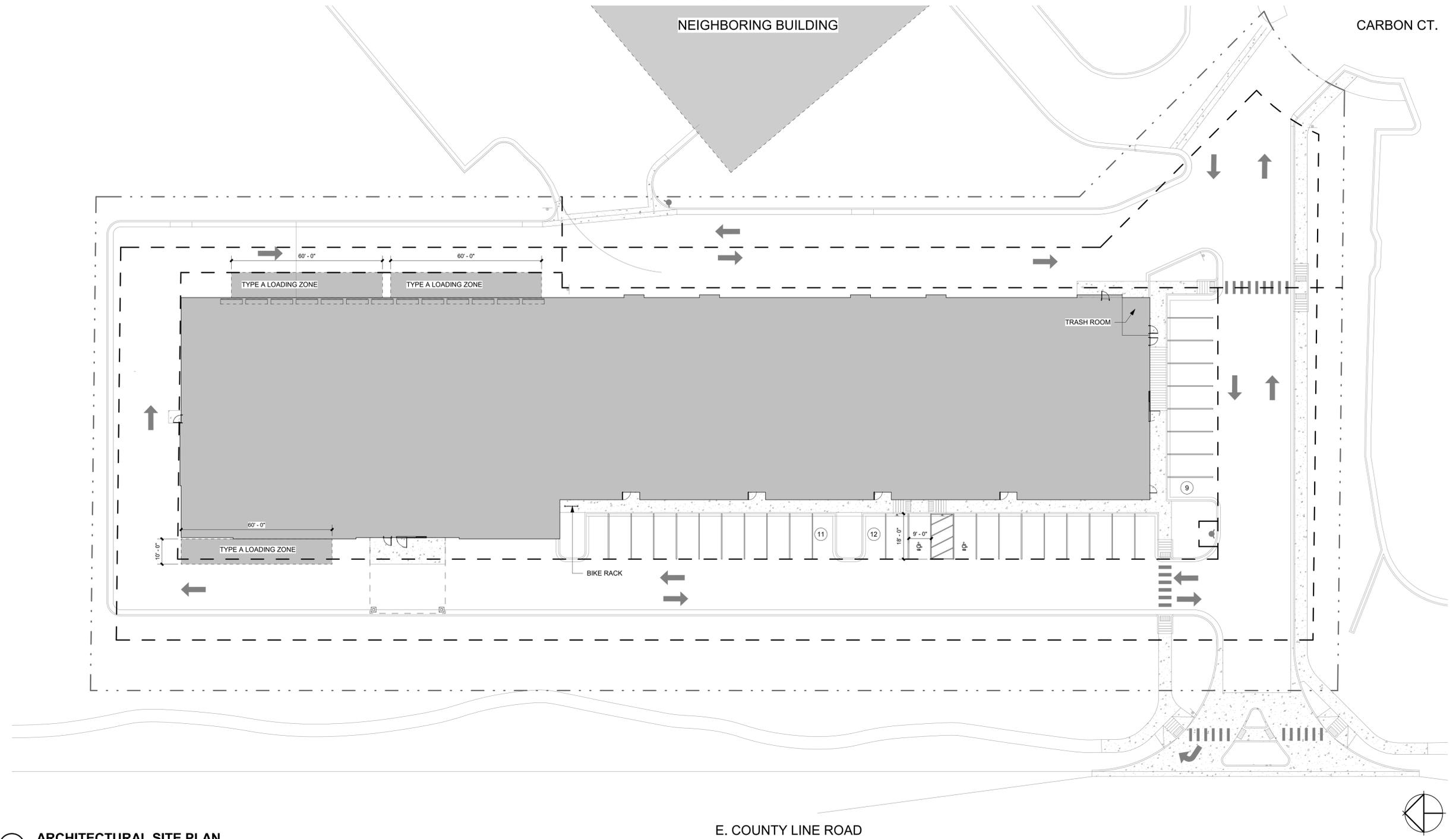
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NO.	DESCRIPTION	DATE	BY
1	1st REFERALL AGENCY REVIEW	12/10/19	AHN
2	2nd REFERALL AGENCY REVIEW	04/19/19	AHN



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TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
2.32 ACRES
SP-001019-2018
SRU-001020-2018



1 ARCHITECTURAL SITE PLAN
SCALE: 1" = 20'-0"

E. COUNTY LINE ROAD

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	1st REFERALL AGENCY REVIEW	12/10/19	AHN
2	2nd REFERALL AGENCY REVIEW	04/19/19	AHN

SITE PLAN
SHEET A5
APRIL 19, 2019
JOB#: D01142

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TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
2.32 ACRES
SP-001019-2018
SRU-001020-2018

Heights of near by Buildings



BUILDING B



BUILDING C



AERIAL OF SURROUNDINGS



PROPOSED BUILDING



BUILDING E

BUILDING HEIGHT ANALYSIS
SHEET A6
APRIL 19, 2019
JOB#: D01142

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	1st REFERALL AGENCY REVIEW	12/10/19	AHN
2	2nd REFERALL AGENCY REVIEW	04/19/19	AHN



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TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
2.32 ACRES
SP-001019-2018
SRU-001020-2018

Heights of near by Buildings



BUILDING A



AERIAL OF SURROUNDINGS



PROPOSED BUILDING



BUILDING D

BUILDING HEIGHT ANALYSIS
SHEET A7
APRIL 19, 2019
JOB#: D01142

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	1st REFERALL AGENCY REVIEW	12/10/19	AHN
2	2nd REFERALL AGENCY REVIEW	04/19/19	AHN



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THE RIGHT MOVE SUBDIVISION, 1st AMENDMENT

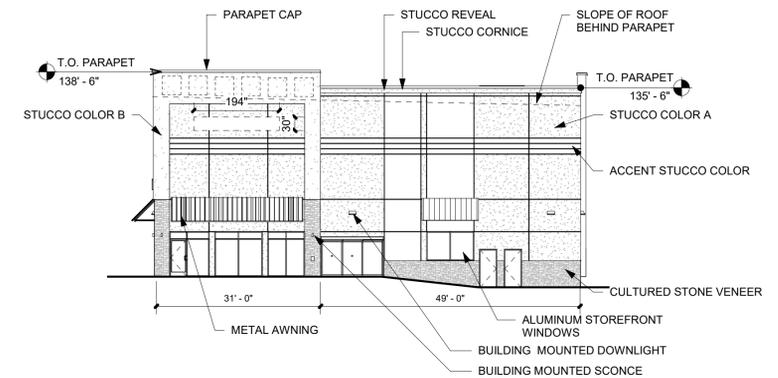
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TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
2.32 ACRES
SP-001019-2018
SRU-001020-2018

THE BUILDING ELEVATIONS SHOWN AND APPROVED HEREON ARE INTENDED TO DEMONSTRATE HOW ALL HVAC AND OTHER MECHANICAL EQUIPMENT SHALL BE SCREENED ACCORDING TO TOWN OF ERIE UNIFIED DEVELOPMENT CODE REQUIREMENTS. IT IS THE APPLICANT'S RESPONSIBILITY TO ENSURE THAT THIS APPROVED SCREENING OCCURS IN THE FIELD AS DEMONSTRATED BY THESE PLANS REGARDLESS OF CURB REQUIREMENTS, MECHANICAL PLAN CHANGES, OR OTHER CIRCUMSTANCES. FAILURE TO PROVIDE APPROVED SCREENING MAY RESULT IN DELAY OF FINAL INSPECTIONS AND/OR ISSUANCE OF A CERTIFICATE OF OCCUPANCY

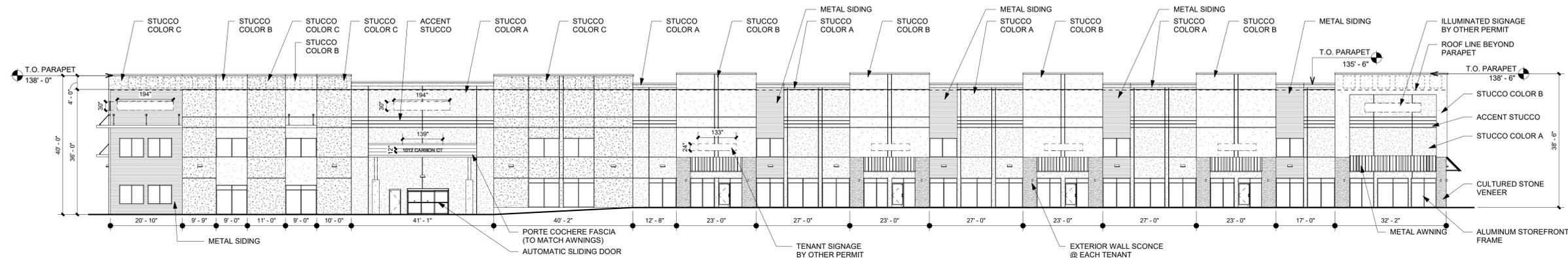
EXTERIOR FINISH SCHEDULE		
GENERAL NOTE: ALL EXTERIOR WALL MOUNTED LIGHTS TO BE FULL CUT-OFF.		
WALL MATERIAL	MANUFACTURER	COLOR
STUCCO COLOR A	SHERWIN WILLIAMS	BALANCED BEIGE
STUCCO COLOR B	SHERWIN WILLIAMS	SHOJI WHITE
STUCCO COLOR C	SHERWIN WILLIAMS	ELLIE GRAY
ACCENT STUCCO	SHERWIN WILLIAMS	BLACK FOX
CULTURED STONE VENEER	SUNSET STONE	COUNTRY LEDGE
METAL PANEL SIDING	BERRIDGE	CHARCOAL GRAY
MECHANICAL SCREENS	BERRIDGE	EVERGREEN
STOREFRONT	KAWNEER OR SIMILAR	DARK BRONZE
PARAPET CAPS	BERRIDGE	CHARCOAL GRAY
DOWNSPOUTS	BERRIDGE	TO MATCH STUCCO
STANDING SEAM ROOF	BERRIDGE	CITYSCAPE
AWNINGS	BERRIDGE	EVERGREEN



3 SOUTHWEST CORNER
SCALE:



2 SOUTH ELEVATION
SCALE: 1/16" = 1'-0"



1 WEST ELEVATION (FACING COUNTY LINE RD)
SCALE: 1/16" = 1'-0"

**BUILDING ELEVATIONS
SHEET A8
APRIL 19, 2019
JOB#: D01142**

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	1st REFERALL AGENCY REVIEW	12/10/19	AHN
2	2nd REFERALL AGENCY REVIEW	04/19/19	AHN



5690 WEBSTER STREET
ARVADA, CO 80002
303.423.6036

THE RIGHT MOVE SUBDIVISION, 1st AMENDMENT

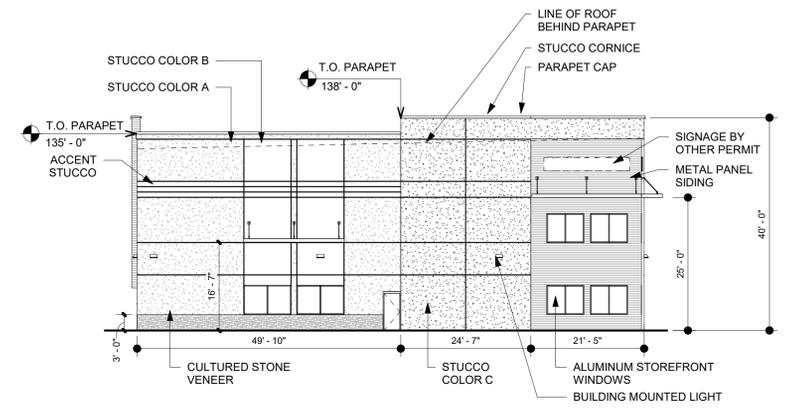
LOCATED IN SOUTHWEST QUARTER OF SECTION 19,
TOWNSHIP 1 NORTH, RANGE 68 WEST 6TH P.M.
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
2.32 ACRES
SP-001019-2018
SRU-001020-2018

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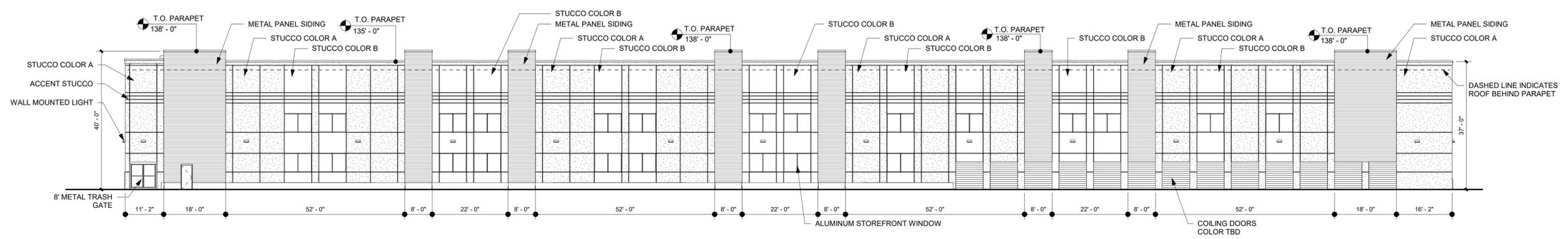
EXTERIOR FINISH SCHEDULE		
GENERAL NOTE: ALL EXTERIOR WALL MOUNTED LIGHTS TO BE FULL CUT-OFF.		
WALL MATERIAL	MANUFACTURER	COLOR
STUCCO COLOR A	SHERWIN WILLIAMS	BALANCED BEIGE
STUCCO COLOR B	SHERWIN WILLIAMS	SHOJI WHITE
STUCCO COLOR C	SHERWIN WILLIAMS	ELLIE GRAY
ACCENT STUCCO	SHERWIN WILLIAMS	BLACK FOX
CULTURED STONE VENEER	SUNSET STONE	COUNTRY LEDGE
METAL PANEL SIDING	BERRIDGE	CHARCOAL GRAY
MECHANICAL SCREENS	BERRIDGE	EVERGREEN
STOREFRONT	KAWNEER OR SIMILAR	DARK BRONZE
PARAPET CAPS	BERRIDGE	CHARCOAL GRAY
DOWNSPOUTS	BERRIDGE	TO MATCH STUCCO
STANDING SEAM ROOF	BERRIDGE	CITYSCAPE
AWNINGS	BERRIDGE	EVERGREEN



3 NORTHEAST CORNER
SCALE:



2 NORTH ELEVATION
SCALE: 1/16" = 1'-0"



1 EAST ELEVATION
SCALE: 1/16" = 1'-0"

**BUILDING ELEVATIONS
SHEET A9
APRIL 19, 2019
JOB#: D01142**

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	1st REFERALL AGENCY REVIEW	12/10/19	AHN
2	2nd REFERALL AGENCY REVIEW	04/19/19	AHN

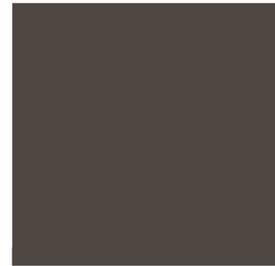
RICK
ENGINEERING COMPANY
5690 WEBSTER STREET
ARVADA, CO 80002
303.423.6036

THE RIGHT MOVE SUBDIVISION, 1st AMENDMENT

LOCATED IN SOUTHWEST QUARTER OF SECTION 19,
TOWNSHIP 1 NORTH, RANGE 68 WEST 6TH P.M.
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
2.32 ACRES
SP-001019-2018
SRU-001020-2018



MEDIUM SAND STUCCO TEXTURE
PROVIDED FOR REFERENCE



BLACK FOX -
ACCENT STUCCO
MEDIUM SAND TEXTURE



ELLIE GRAY -
STUCCO COLOR C
MEDIUM SAND TEXTURE



BALANCED BEIGE -
STUCCO COLOR A
MEDIUM SAND TEXTURE



SHOJI WHITE -
STUCCO COLOR B
MEDIUM SAND TEXTURE

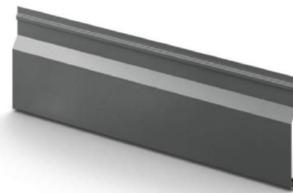


METAL PANEL - BERRIDGE
CHARCOAL GRAY

METAL PANEL - BERRIDGE
FOREST GREEN

STOREFRONT -
DARK BRONZE

CULTURED STONE VENEER - SUNSET STONE
COUNTRY LEDGE



EXTERIOR MATERIALS EXHIBIT

419 CANYON AVENUE STE 200 | FORT COLLINS, COLORADO | 970.224.1191 | 108 EAST LINCOLNWAY | CHEYENNE, WYOMING | 307.635.5710 | www.VFLA.com

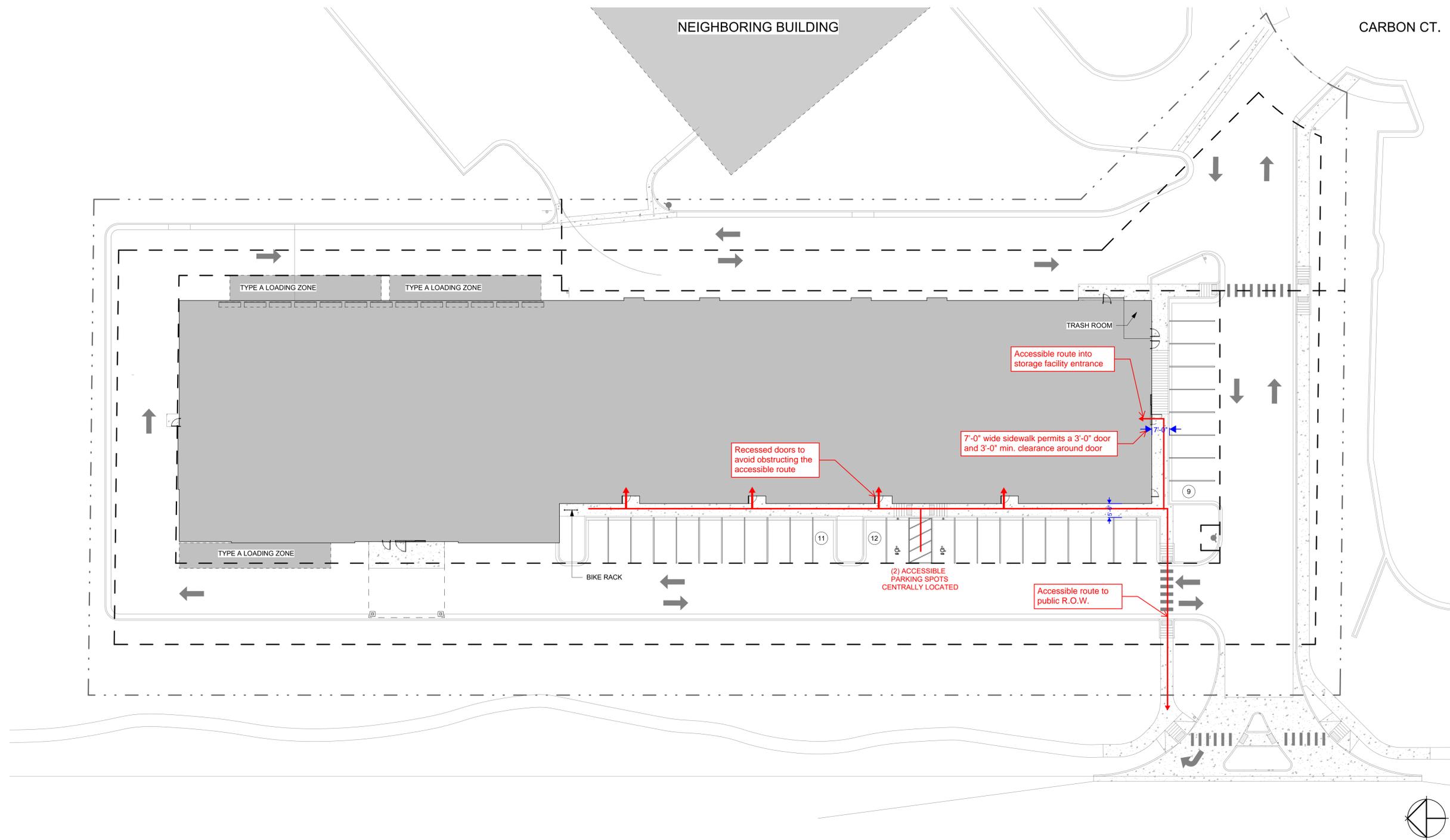
ERIE BUSINESS PARK & STORAGE | 02.14.19

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	1st REFERALL AGENCY REVIEW	12/10/19	AHN
2	2nd REFERALL AGENCY REVIEW	04/19/19	AHN

MATERIALS BOARD
SHEET A10
APRIL 19, 2019
JOB#: D01142



5690 WEBSTER STREET
ARVADA, CO 80002
303.423.6036





October 17, 2018

Mr. Audem Gonzales, Planner
Town of Erie
Planning & Development Department
645 Holbrook Street
Erie, CO 80516

SUBJECT: ERIE BUSINESS PARK & SELF STORAGE – ERIE, COLORADO TRIP GENERATION LETTER (RICK ENGINEERING COMPANY JOB NUMBER 18423)

Dear Mr. Gonzales:

The following Trip Generation Letter has been prepared to quantify the expected traffic generation for the above-referenced project located on County Line Road between Austin Avenue and Bonnell Avenue within the Town of Erie, Colorado.

INTRODUCTION

The project consists of developing a 3-story, approximately 100,000 square-foot mixed-use building containing office/retail spaces and self-storage on a 2.32-acre site. Access to the site will be taken from one proposed driveway on County Line Road, and a second access point will also be provided from an existing driveway along the Carbon Court cul-de-sac near the southeast corner of the project site. A right-turn deceleration lane will also be constructed along County Line Road to serve the proposed driveway.

Attachment A shows the project site plan and proposed improvements.

PROJECT ACCESS

The project proposes to construct a 30-foot wide driveway along County Line Road that will be restricted to right-in/right-out (RIRO) access. The existing driveway along the Carbon Court cul-de-sac will provide full access to and from the project site, and access will be shared with an existing warehouse building adjacent to the east boundary of the project site. The proposed RIRO driveway on County Line Road will also provide shared access between the project site and the adjacent existing warehouse building.

The right-turn deceleration lane on County Line Road shall have a minimum length of 370 feet including the turn pocket and taper per the *Town of Erie's Standards and Specifications for Design and Construction of Public Improvements* (2018, Section 500 Street Construction).

The following is a description of the existing roadways in the vicinity of the project site:

County Line Road is classified in the *Town of Erie's Comprehensive Plan 2015 Update (Figure 1:2030 Roadway System Plan)* as a two-lane north-south Minor Arterial roadway that currently provides one travel lane in each direction with a striped center median in the vicinity of the project site. The posted speed limit is 45 MPH and parking is prohibited.

Austin Avenue is classified in the *Town of Erie's Comprehensive Plan 2015 Update (Figure 1:2030 Roadway System Plan)* as a two-lane east-west Collector roadway that currently provides one travel lane in each direction with a two-way left-turn lane provided east of County Line Road. The posted speed limit is 25 MPH and parking is prohibited.

Bonnell Avenue is classified in the *Town of Erie's Comprehensive Plan 2015 Update (Figure 1:2030 Roadway System Plan)* as a two-lane east-west Collector roadway that currently provides one travel lane in each direction with a striped center median. The posted speed limit is 25 MPH and parking is prohibited.

Attachment B shows the following documents:

- *Figure 1:2030 Roadway System Plan* of the *Town of Erie's Comprehensive Plan 2015 Update*; and
- Page 500-11 of *Section 500 Street Construction* from the *Town of Erie's Standards and Specifications for Design and Construction of Public Improvements (2018)*.

PROJECT TRAFFIC GENERATION

Based on ITE (Institute of Transportation Engineer's) *Trip Generation* publication (10th Edition), the project is estimated to generate 268 ADT with 19 trips during the AM peak (14 inbound/5 outbound) and 28 trips during the PM peak (10 inbound/18 outbound) during a typical weekday. **Table 1** shows the traffic generation calculations for the proposed project.

Table 1
ERIE BUSINESS PARK TRIP GENERATION

ITE TRIP GENERATION RATES									
Land Use	Unit	Daily Trip Rate (Per Unit)	AM PEAK HOUR			PM PEAK HOUR			
			AM Trip Rate (per unit)	% In	% Out	PM Trip Rate (per unit)	% In	% Out	
Mini-Warehouse (ITE Code 151)	TSF	1.51	0.10	60%	40%	0.17	47%	53%	
Office (ITE Code 710)	TSF	11.46 ⁽¹⁾	1.16	86%	14%	1.15	16%	84%	
Retail (ITE Code 820)	TSF	37.75	0.94	62%	38%	3.81	48%	52%	
TRIP GENERATION CALCULATIONS									
Land Use	Size	Unit	Daily Trips	AM PEAK HOUR			PM PEAK HOUR		
				Total	In	Out	Total	In	Out
Mini-Warehouse (ITE Code 151)	90.075	TSF	136	9	5	4	15	7	8
Office (ITE Code 710)	8.025	TSF	92	9	8	1	9	1	8
Retail (ITE Code 820)	1.050	TSF	40	1	1	0	4	2	2
TOTAL PROJECT TRIPS			268	19	14	5	28	10	18

Source: Institute of Transportation Engineers (ITE) *Trip Generation Manual* (10th Edition, 2017)

Notes: TSF = Thousand Square Feet

⁽¹⁾ Daily vehicle trips for the office use are based on the following fitted curve equation: $\ln(\text{Trips}) = 0.97 \ln(\text{TSF}) + 2.50$. The average vehicle trip rates were used for the other uses and for the office AM and PM peak hours.

Attachment C contains the ITE (Institute of Transportation Engineer's) *Trip Generation* publication (10th Edition) rate sheets.

PROPOSED RECOMMENDATIONS IMPROVEMENTS/CONCLUSIONS

Table 1 shows that the proposed project is anticipated to generate 268 ADT with 19 trips during the AM peak (14 inbound/5 outbound) and 28 trips during the PM peak (10 inbound/18 outbound) during a typical weekday. It is anticipated that this generated traffic will have minimal impacts on the intersection and roadways in the vicinity of the project.

The following are recommendations to facilitate access to and from the project site:

- Construct a 30' wide driveway on County Line Road providing right-in/right-out (RIRO) access.
- Construct a right-turn deceleration lane on County Line Road with a minimum length of 370 feet including the turn pocket and taper.

Should you have any questions, please contact either David Mizell or me at (619) 291-0707.

Sincerely,

RICK ENGINEERING COMPANY



Brian R. Stephenson, PE, PTOE
Associate

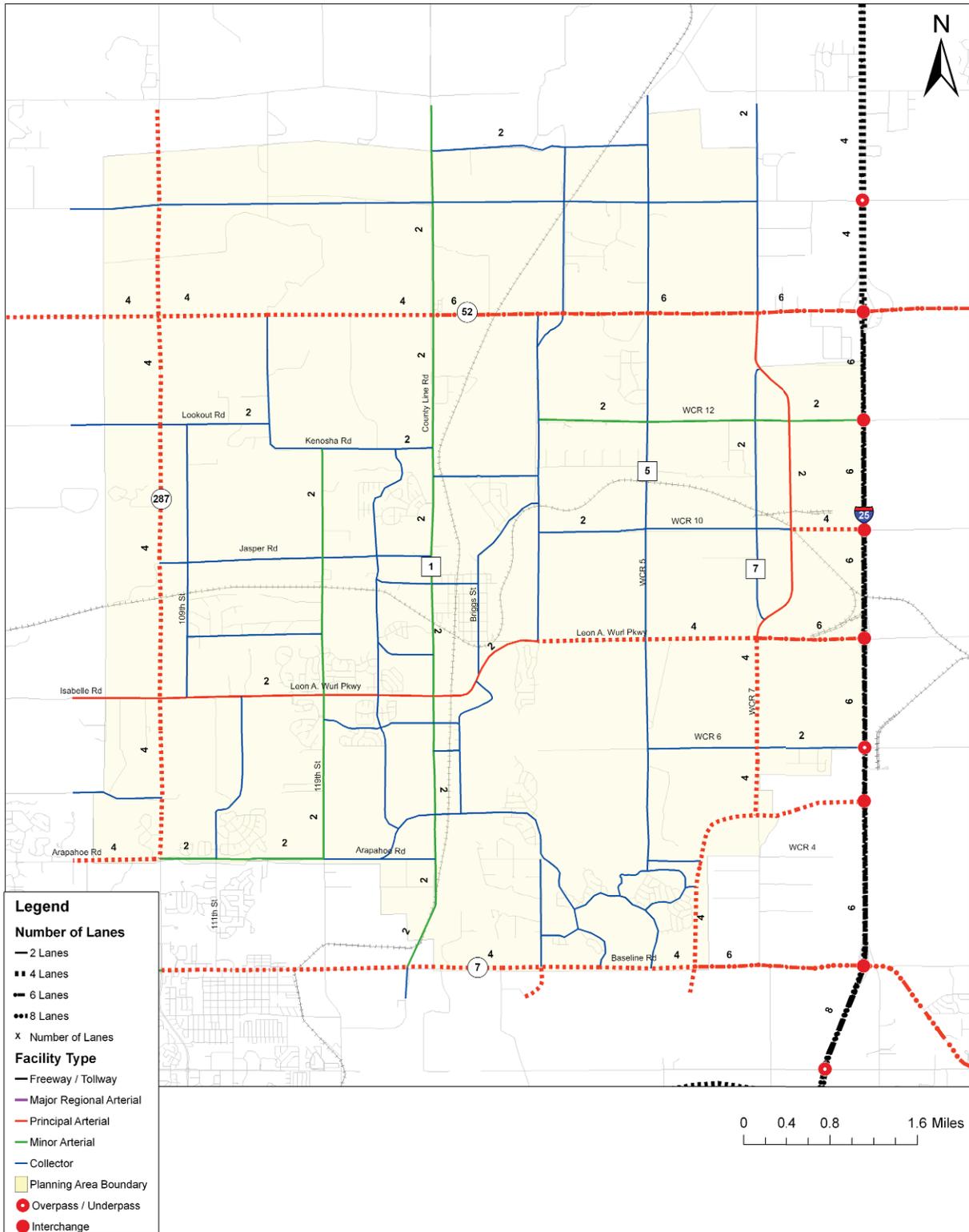
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Attachments

ATTACHMENT A

ATTACHMENT B

Figure 1: 2030 Roadway System Plan



TOWN STREET CONSTRUCTION

521.03.07 Intersection Plateau

The profile of the major highway generally takes precedence over the minor cross street. This results in a hump for the cross street profile which is particularly undesirable for signalized intersections where the cross street traffic may enter the intersections without stopping. In some instances the designer may determine that the cross street should receive the same profile considerations as the major highway due to similar traffic demands. To provide this "equal treatment", with respect to profile, a technique commonly known as intersection plateauing is applied. Plateauing refers to the transitioning of the roadway profiles and cross slopes at the approaches of an intersection.

521.03.08 Cross Slope

The rate of change in pavement cross slope, when warping side streets at intersections, shall not exceed one (1) percent every twenty five (25) feet horizontally on local streets/roads, one (1) percent every thirty seven and one half (37.5) feet horizontally on collector streets/roads, or one (1) percent every fifty six and one half (56.5) feet horizontally on arterial streets/roads to ensure public travel safe transition.

521.03.09 Auxiliary Lanes

Auxiliary lanes provide for the safe acceleration or deceleration of turning traffic on and off roadways and help reduce the accident potential of turning vehicles. All auxiliary lane requirements are based on the Colorado Department of Transportation's (CDOT) State Highway Access Code and the Town's Street Design Criteria found in Table 500-3 at the end of Section 500.

Right-turn Deceleration Lane

	Minimum Right-Turns to Require Deceleration Lane (vph)	Deceleration Lane and Taper Length (ft)	Taper Rate
Principal Arterial (CDOT NR-A)	25	435	13.5:1
Minor Arterial (CDOT NR-B)	25	370	12:1
Collector (CDOT NR-C)	50	310	10:1

ATTACHMENT C

Graph Look Up

Query Filter

DATA SOURCE:
ITE-TGM 10th Edition

SEARCH BY LAND USE CODE:
151

LAND USE CATEGORY:
(100-199) Industrial and Agricultural

LAND USE:
151 - Mini-Warehouse

INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

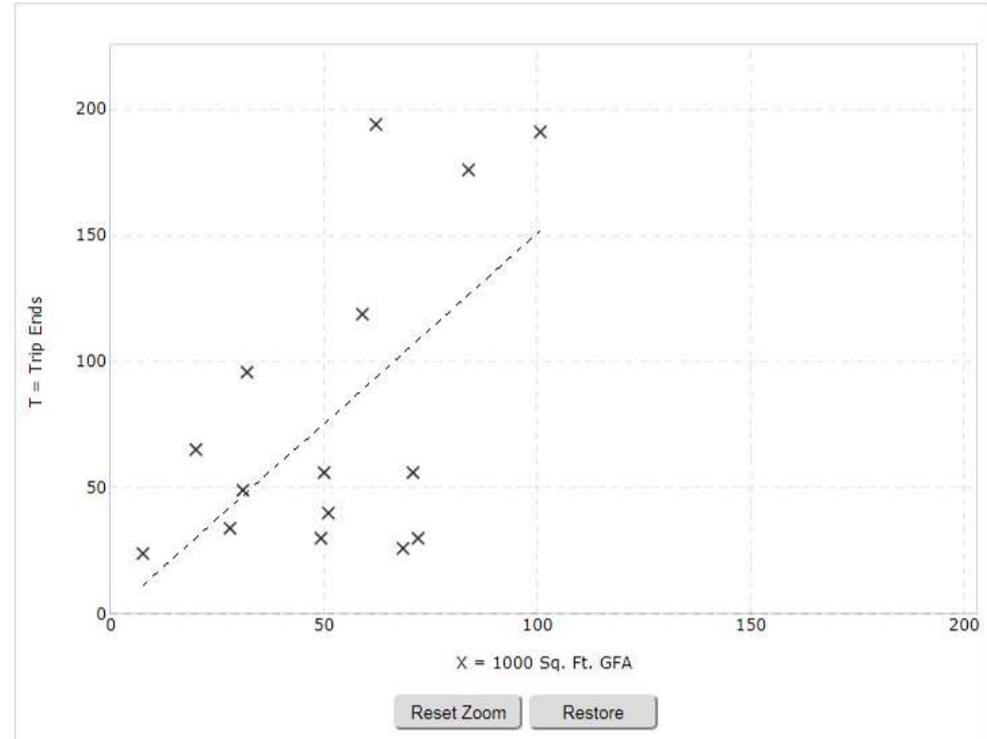
TIME PERIOD:
Weekday

SETTING/LOCATION:
General Urban/Suburban

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
 Calculate

Data Plot and Equation



x Study Site - - - Average Rate

Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:	Mini-Warehouse (151) Click for more details
Independent Variable:	1000 Sq. Ft. GFA
Time Period:	Weekday
Setting/Location:	General Urban/Suburban
Trip Type:	Vehicle
Number of Studies:	15
Avg. 1000 Sq. Ft. GFA:	52
Average Rate:	1.51
Range of Rates:	0.38 - 3.25
Standard Deviation:	0.95
Fitted Curve Equation:	Not Given
R ² :	****
Directional Distribution:	50% entering, 50% exiting

Graph Look Up

Query Filter

DATA SOURCE:
ITE-TGM 10th Edition

SEARCH BY LAND USE CODE:
151

LAND USE CATEGORY:
(100-199) Industrial and Agricultural

LAND USE:
151 - Mini-Warehouse

INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

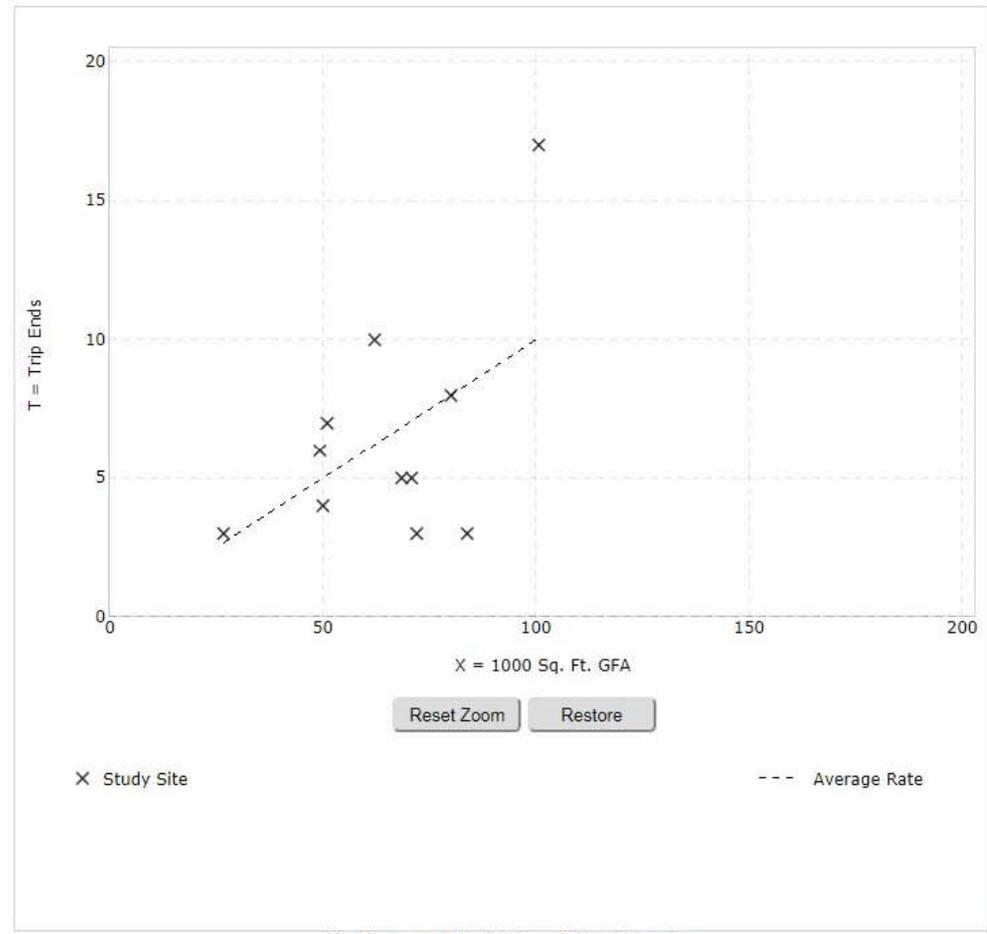
TIME PERIOD:
Weekday, Peak Hour of Adjacent Street Traffic

SETTING/LOCATION:
General Urban/Suburban

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
 Calculate

Data Plot and Equation



DATA STATISTICS	
Land Use:	Mini-Warehouse (151) Click for more details
Independent Variable:	1000 Sq. Ft. GFA
Time Period:	Weekday Peak Hour of Adjacent Street Traffic One Hour Between 7 and 9 a.m.
Setting/Location:	General Urban/Suburban
Trip Type:	Vehicle
Number of Studies:	11
Avg. 1000 Sq. Ft. GFA:	65
Average Rate:	0.10
Range of Rates:	0.04 - 0.17
Standard Deviation:	0.05
Fitted Curve Equation:	Not Given
R²:	****
Directional Distribution:	60% entering, 40% exiting

Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

Graph Look Up

Query Filter

DATA SOURCE:
 ITE-TGM 10th Edition

SEARCH BY LAND USE CODE:
 151

LAND USE CATEGORY:
 (100-199) Industrial and Agricultural

LAND USE :
 151 - Mini-Warehouse

INDEPENDENT VARIABLE (IV):
 1000 Sq. Ft. GFA

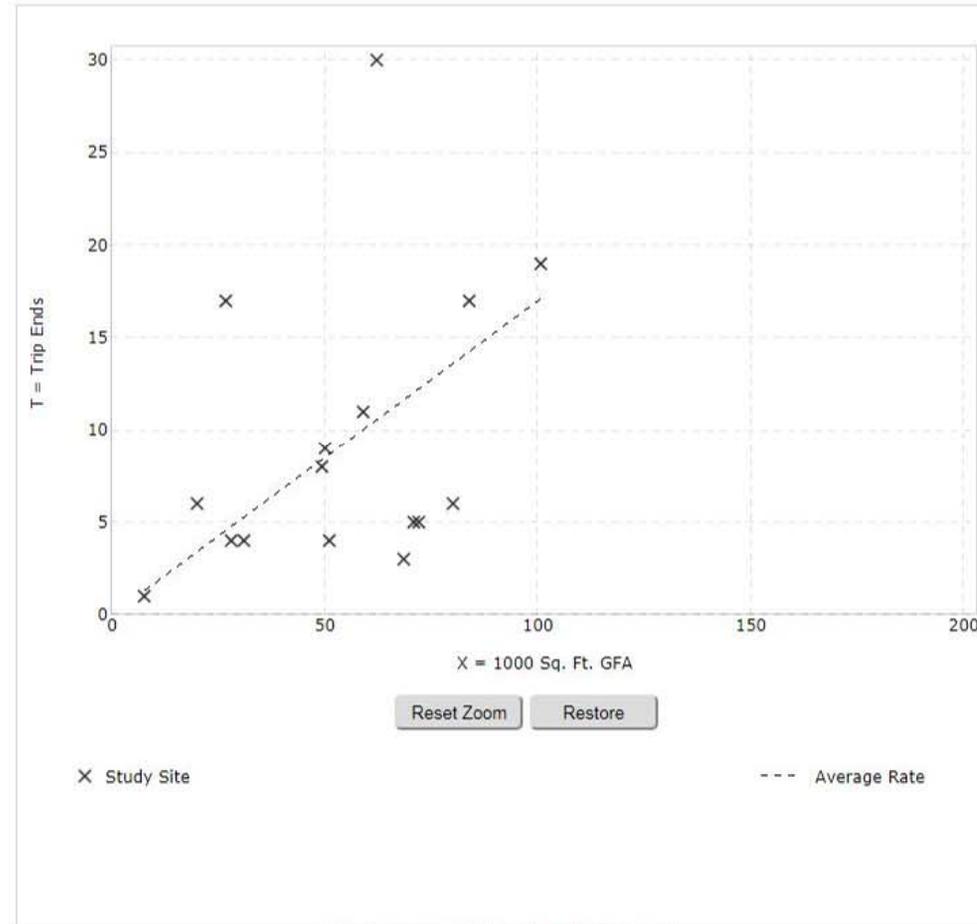
TIME PERIOD:
 Weekday, Peak Hour of Adjacent Street Traffic

SETTING/LOCATION:
 General Urban/Suburban

TRIP TYPE:
 Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:

Data Plot and Equation



DATA STATISTICS

Land Use:	Mini-Warehouse (151) Click for more details
Independent Variable:	1000 Sq. Ft. GFA
Time Period:	Weekday Peak Hour of Adjacent Street Traffic One Hour Between 4 and 6 p.m.
Setting/Location:	General Urban/Suburban
Trip Type:	Vehicle
Number of Studies:	16
Avg. 1000 Sq. Ft. GFA:	54
Average Rate:	0.17
Range of Rates:	0.04 - 0.64
Standard Deviation:	0.14
Fitted Curve Equation:	Not Given
R²:	****
Directional Distribution:	47% entering, 53% exiting

Use the mouse wheel to Zoom Out or Zoom In.
 Hover the mouse pointer on data points to view X and T values.

Graph Look Up

Query Filter

DATA SOURCE:
ITE-TGM 10th Edition

SEARCH BY LAND USE CODE:
710

LAND USE CATEGORY:
(700-799) Office

LAND USE:
710 - General Office Building

INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

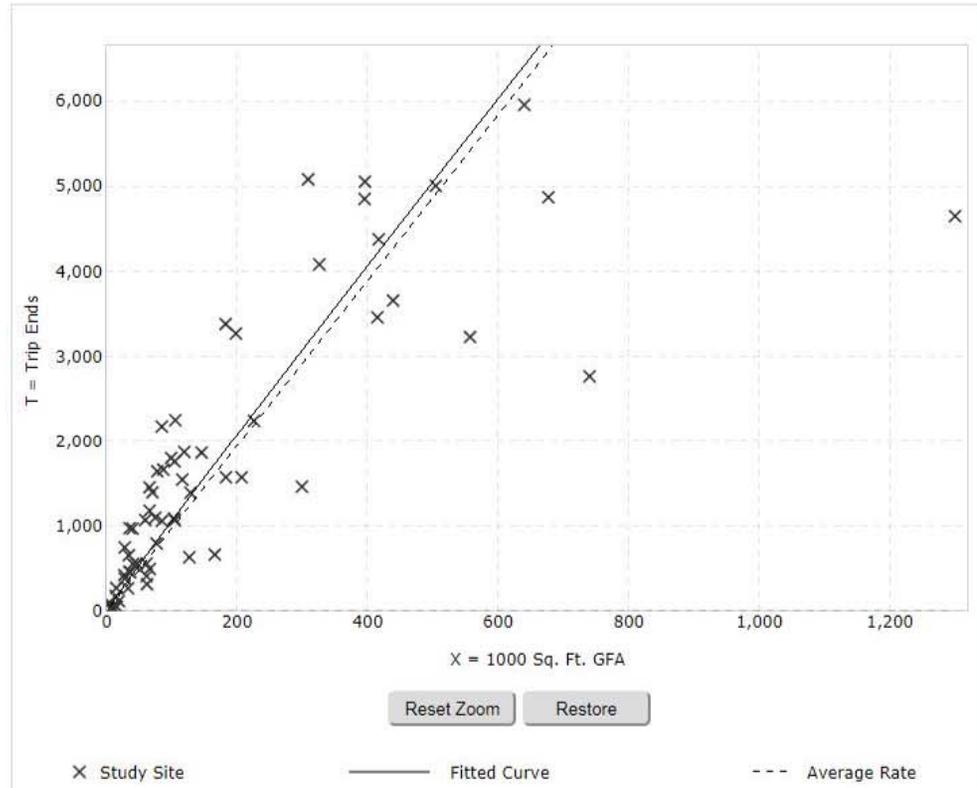
TIME PERIOD:
Weekday

SETTING/LOCATION:
General Urban/Suburban

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
 Calculate

Data Plot and Equation



DATA STATISTICS

Land Use:	General Office Building (710) Click for more details
Independent Variable:	1000 Sq. Ft. GFA
Time Period:	Weekday
Setting/Location:	General Urban/Suburban
Trip Type:	Vehicle
Number of Studies:	66
Avg. 1000 Sq. Ft. GFA:	171
Average Rate:	9.74
Range of Rates:	2.71 - 27.56
Standard Deviation:	5.15
Fitted Curve Equation:	$\ln(T) = 0.97 \ln(X) + 2.50$
R²:	0.83
Directional Distribution:	50% entering, 50% exiting

Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

Graph Look Up

Query Filter

DATA SOURCE:
ITE-TGM 10th Edition

SEARCH BY LAND USE CODE:
710

LAND USE CATEGORY:
(700-799) Office

LAND USE :
710 - General Office Building

INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

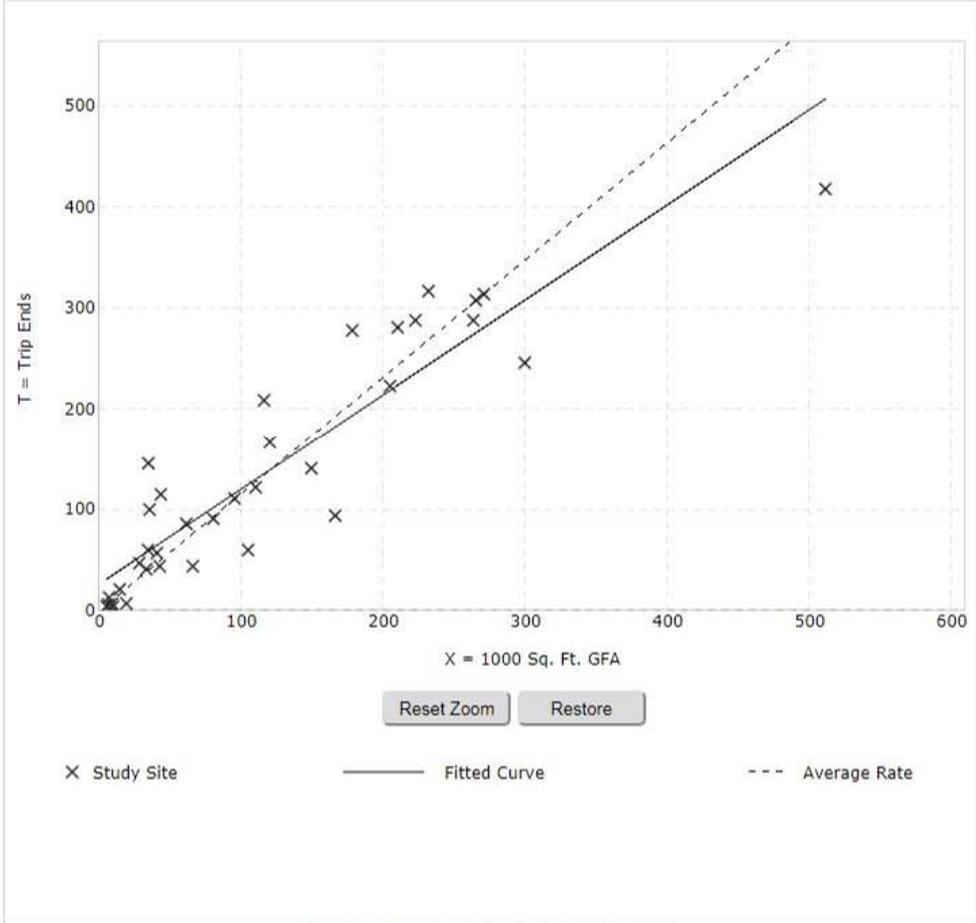
TIME PERIOD:
Weekday, Peak Hour of Adjacent Street Traffic

SETTING/LOCATION:
General Urban/Suburban

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
 Calculate

Data Plot and Equation



DATA STATISTICS

Land Use:	General Office Building (710) Click for more details
Independent Variable:	1000 Sq. Ft. GFA
Time Period:	Weekday Peak Hour of Adjacent Street Traffic One Hour Between 7 and 9 a.m.
Setting/Location:	General Urban/Suburban
Trip Type:	Vehicle
Number of Studies:	35
Avg. 1000 Sq. Ft. GFA:	117
Average Rate:	1.16
Range of Rates:	0.37 - 4.23
Standard Deviation:	0.47
Fitted Curve Equation:	$T = 0.94(X) + 26.49$
R²:	0.85
Directional Distribution:	86% entering, 14% exiting

Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

Graph Look Up

Query Filter

DATA SOURCE: ITE-TGM 10th Edition

SEARCH BY LAND USE CODE: 710

LAND USE CATEGORY: (700-799) Office

LAND USE: 710 - General Office Building

INDEPENDENT VARIABLE (IV): 1000 Sq. Ft. GFA

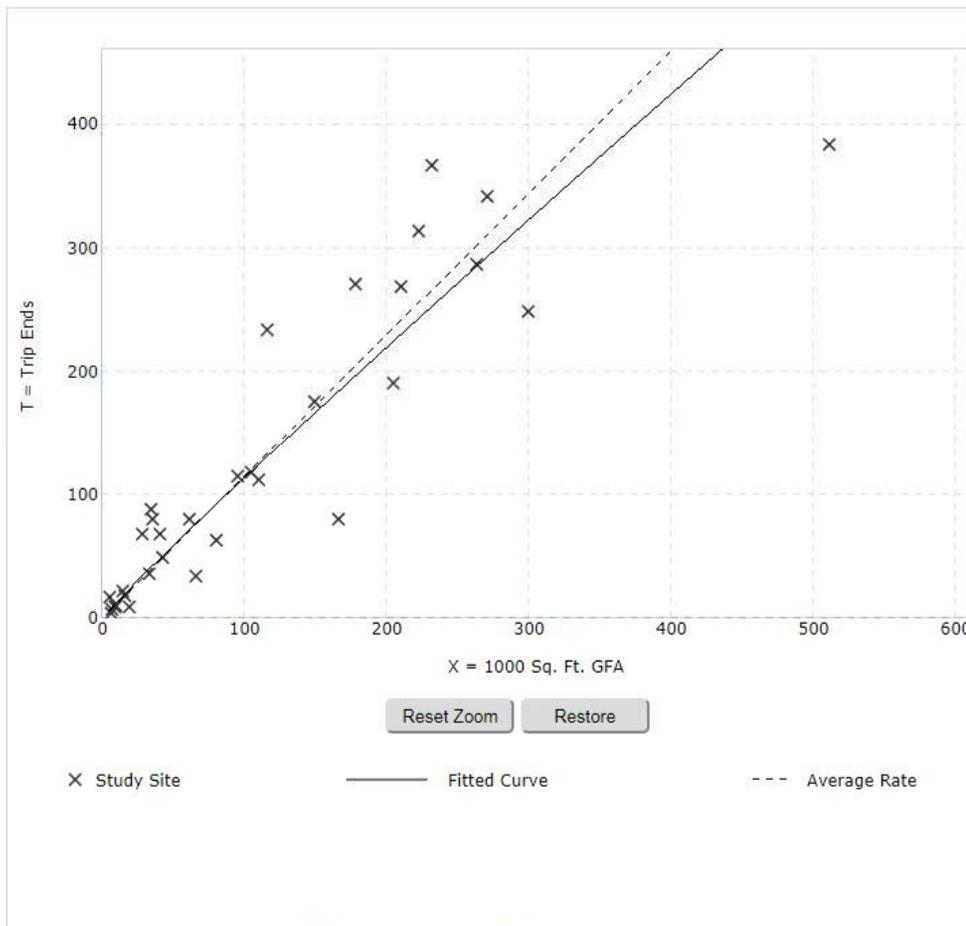
TIME PERIOD: Weekday, Peak Hour of Adjacent Street Traffic

SETTING/LOCATION: General Urban/Suburban

TRIP TYPE: Vehicle

ENTER IV VALUE TO CALCULATE TRIPS: Calculate

Data Plot and Equation



DATA STATISTICS

Land Use: General Office Building (710) [Click for more details](#)

Independent Variable: 1000 Sq. Ft. GFA

Time Period: Weekday
Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.

Setting/Location: General Urban/Suburban

Trip Type: Vehicle

Number of Studies: 32

Avg. 1000 Sq. Ft. GFA: 114

Average Rate: 1.15

Range of Rates: 0.47 - 3.23

Standard Deviation: 0.42

Fitted Curve Equation: $\ln(T) = 0.95 \ln(X) + 0.36$

R²: 0.88

Directional Distribution: 16% entering, 84% exiting

Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

Graph Look Up

Query Filter

DATA SOURCE:
ITE-TGM 10th Edition

SEARCH BY LAND USE CODE:
820

LAND USE CATEGORY:
(800-899) Retail

LAND USE:
820 - Shopping Center

INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GLA

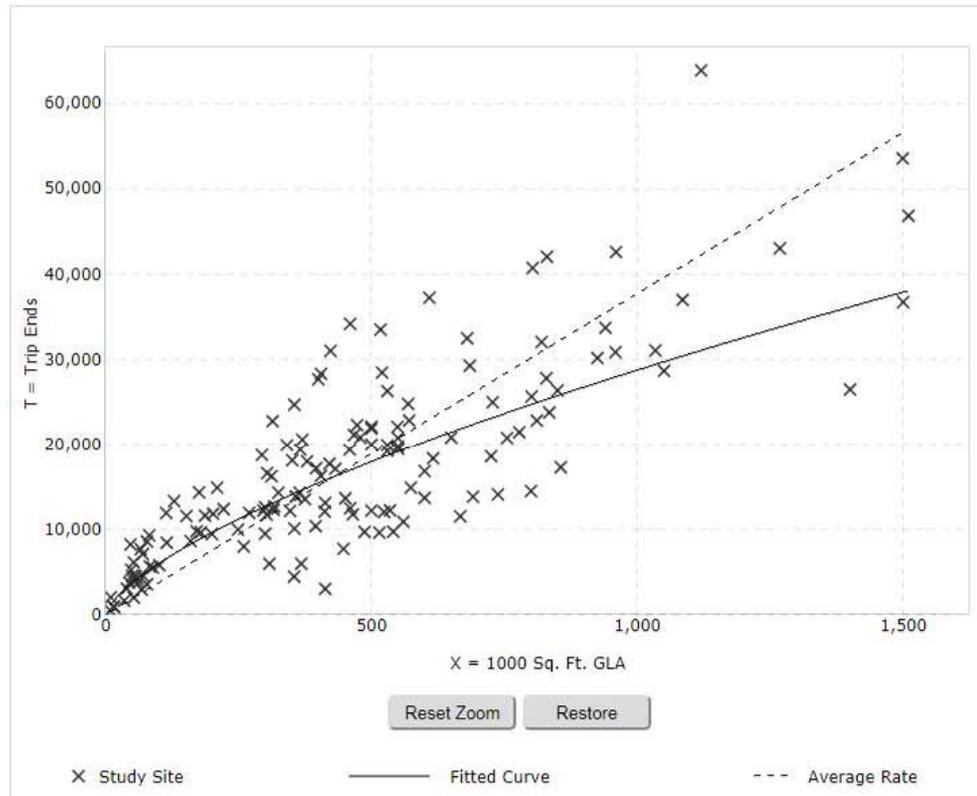
TIME PERIOD:
Weekday

SETTING/LOCATION:
General Urban/Suburban

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
Calculate

Data Plot and Equation



DATA STATISTICS

Land Use: Shopping Center (820) [Click for more details](#)

Independent Variable: 1000 Sq. Ft. GLA

Time Period: Weekday

Setting/Location: General Urban/Suburban

Trip Type: Vehicle

Number of Studies: 147

Avg. 1000 Sq. Ft. GLA: 453

Average Rate: 37.75

Range of Rates: 7.42 - 207.98

Standard Deviation: 16.41

Fitted Curve Equation: $\ln(T) = 0.68 \ln(X) + 5.57$

R²: 0.76

Directional Distribution: 50% entering, 50% exiting

Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

Graph Look Up

Query Filter

DATA SOURCE:
ITE-TGM 10th Edition

SEARCH BY LAND USE CODE:
820

LAND USE CATEGORY:
(800-899) Retail

LAND USE:
820 - Shopping Center

INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GLA

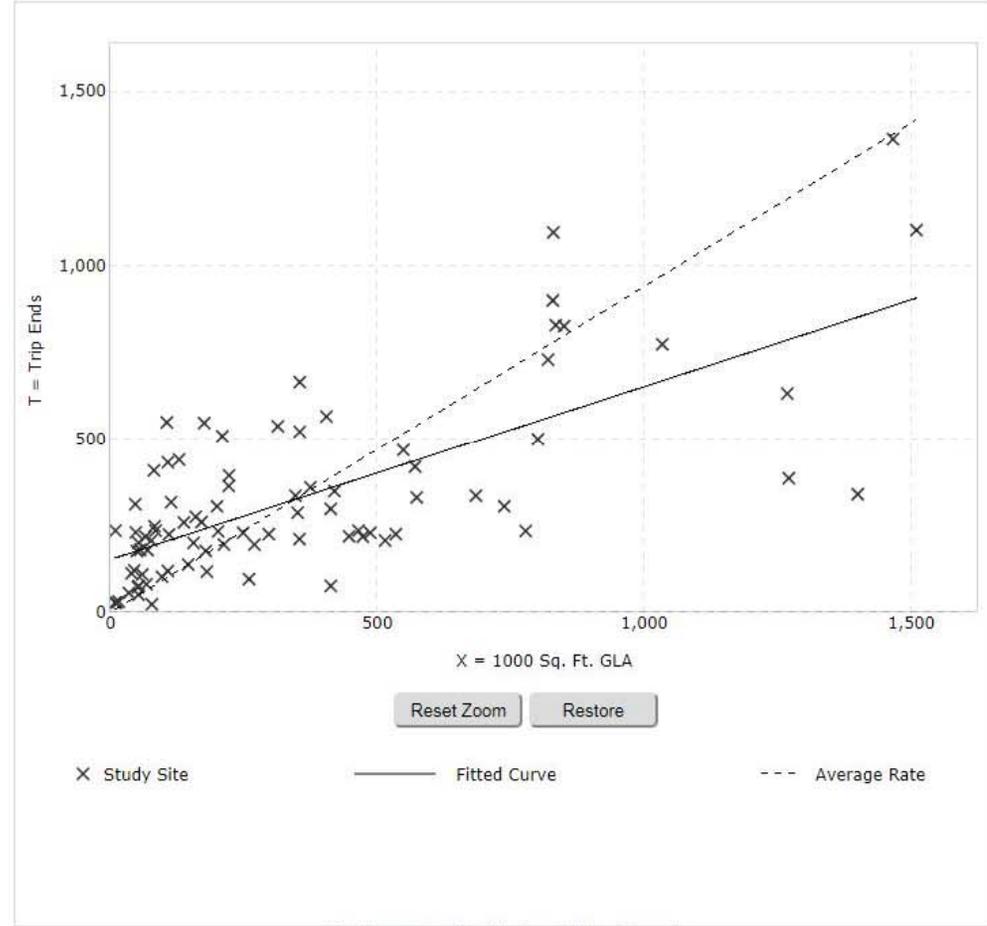
TIME PERIOD:
Weekday, Peak Hour of Adjacent Street Traffic

SETTING/LOCATION:
General Urban/Suburban

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
Calculate

Data Plot and Equation



DATA STATISTICS

Land Use:	Shopping Center (820) Click for more details
Independent Variable:	1000 Sq. Ft. GLA
Time Period:	Weekday Peak Hour of Adjacent Street Traffic One Hour Between 7 and 9 a.m.
Setting/Location:	General Urban/Suburban
Trip Type:	Vehicle
Number of Studies:	84
Avg. 1000 Sq. Ft. GLA:	351
Average Rate:	0.94
Range of Rates:	0.18 - 23.74
Standard Deviation:	0.87
Fitted Curve Equation:	$T = 0.50(X) + 151.78$
R²:	0.50
Directional Distribution:	62% entering, 38% exiting

Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

Graph Look Up

Query Filter

DATA SOURCE:
 ITE-TGM 10th Edition

SEARCH BY LAND USE CODE:
 820

LAND USE CATEGORY:
 (800-899) Retail

LAND USE:
 820 - Shopping Center

INDEPENDENT VARIABLE (IV):
 1000 Sq. Ft. GLA

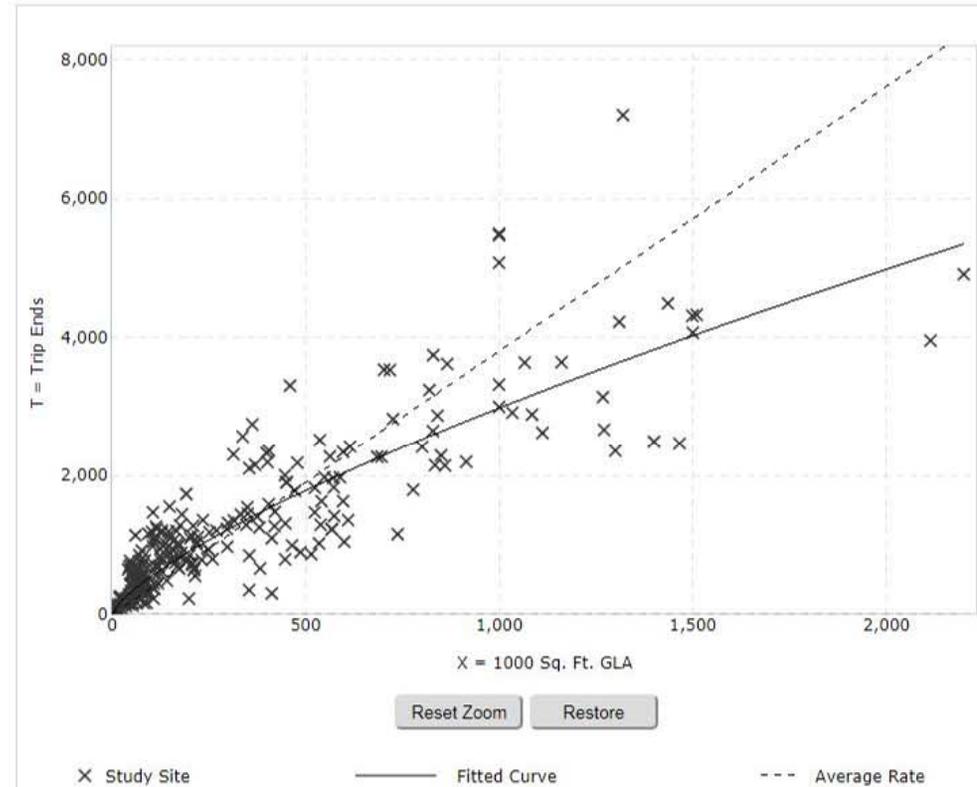
TIME PERIOD:
 Weekday, Peak Hour of Adjacent Street Traffic

SETTING/LOCATION:
 General Urban/Suburban

TRIP TYPE:
 Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:

Data Plot and Equation



DATA STATISTICS

Land Use:	Shopping Center (820) Click for more details
Independent Variable:	1000 Sq. Ft. GLA
Time Period:	Weekday Peak Hour of Adjacent Street Traffic One Hour Between 4 and 6 p.m.
Setting/Location:	General Urban/Suburban
Trip Type:	Vehicle
Number of Studies:	261
Avg. 1000 Sq. Ft. GLA:	327
Average Rate:	3.81
Range of Rates:	0.74 - 18.69
Standard Deviation:	2.04
Fitted Curve Equation:	$\ln(T) = 0.74 \ln(X) + 2.89$
R²:	0.82
Directional Distribution:	48% entering, 52% exiting

Use the mouse wheel to Zoom Out or Zoom In.
 Hover the mouse pointer on data points to view X and T values.

STORMWATER MANAGEMENT REPORT

PREPARED FOR:

**RIGHT MOVE SUBDIVISION REPLAT A,
1ST AMENDMENT**

ERIE, COLORADO

DATE: April, 2019

PREPARED FOR:

GYS Development LLC.
1705 Feagin Dr.
Lufkin, TX 75904

PREPARED BY:

RICK ENGINEERING
5690 Webster Street
Arvada, Colorado 80002
Attn: Arnold Niemeyer
(303) 403-2421

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INTRODUCTION

The primary objective of the plan is to identify Best Management Practices (BMPs), which, when implemented, will meet the terms and conditions of the permit, by minimizing or reducing the pollution of waters of the State of Colorado. This SWMP is for new construction activity in accordance with the requirements of the Colorado Discharge Permitting System (CDPS) permit. This plan addresses the construction of the storage facility and associated infrastructure such as stormwater and sewer drains, water and gas lines, and electric lines. This plan was prepared in accordance with good engineering, hydrologic, and pollution control practices. It is intended to be a dynamic document that will be updated as needed to address planned development, new disturbances, and other changes needed to manage stormwater and protect surface water quality.

1. SITE DESCRIPTION

The area of construction activities that this SWMP covers are those associated with the construction of a commercial retail/storage facility located on approximately 2.32 acres of land located in the SW ¼ of Section 19, Township 1 North, Range 68 West of the 6th PM in the Town of Erie, Weld County Colorado. The site is bounded on the west by County Line Road and is located at the northwest quadrant of the north terminus of Carbon Ct. Approximately 2.98 acres will be disturbed as part of the construction activities of this site.

a. Nature of Construction Activity

The project scope covers the construction of a 3 story building with offices, retail shops and self-storage units. Infrastructure construction to be performed in conjunction with the building will be grading, utility construction, construction of an underground detention facility and offsite storm sewer and asphalt paving. Activities associated with construction of the project that may affect stormwater include clearing and grading, vehicle operation, maintenance and fueling, concrete pouring, masonry, painting of above-ground facilities, sewer and underground detention, possible herbicide application to control noxious weeds, and vertical construction.

b. Proposed Sequence for Major Activities

The following activities were conducted, are being conducted, or will be conducted during construction:

- The construction site will be surveyed and staked.
- Perimeter erosion and sediment control BMPs will be installed.
- Overlot grading
- Utility construction
- Site Stabilization
- Removal of all temporary BMPs.

A schedule of activities and specific BMPs is summarized in Section 3, Table 1.

Sequencing of construction activities has been planned to progress as rapidly as practical to minimize the amount of time that portions of the site are disturbed. Inactive areas will be stabilized to reduce erosion potential, slow runoff velocity, and promote infiltration.

Construction will begin upon approval of this SWMP. An Inactivation Notice will be filed for the project once all of the construction activities have been completed and all areas have reached final stabilization.

c. Estimated Total Area of Site and Expected Disturbance

It is estimated that all 2.35 acres of the site will be disturbed. This includes area within property boundary and the construction of an offsite storm sewer line

d. Soils and Existing Potential for Soil Erosion

Runoff characteristics are based on site topography, soil type, and soil/vegetative cover. The site is currently vegetated with natural grasses and slopes west to east with slopes varying from 2-4%. The soil encountered on this site is classified as Ascalon sandy loam. Hydrologically, this soil is determined to be a Type B. Groundwater was not encountered during the site soils investigation and is not anticipated onsite.

e. Existing Vegetation and Percent Ground Cover

Lot vegetation consists of native grasses, and weeds. Existing vegetative cover is approximately 90%.

f. Potential Pollution Sources

Potential pollution sources associated with construction sites, specifically construction, includes:

- Sediment resulting from erosion of areas cleared of vegetation.
- Leakage of fuels and lubricants from equipment and spills resulting from fueling or equipment failures during earth moving activities to the ground surface.
- Concrete and asphalt work including washout.
- Trash and debris from clearing activities, construction materials, and workers.
- Off-site vehicle tracking.
- Temporary sanitation services for construction workers.

The most common source of pollution associated with project activities is sediment, which can be carried away from the work site with stormwater runoff and could impact the water quality of a receiving stream. Clearing, grading, and altering previously undisturbed land will increase the rate of soil erosion over pre-disturbance rates.

Petroleum products can also be potential stormwater pollutants. These products are used in construction and are used to lubricate equipment and include: fuel, gear oil, hydraulic oil, brake fluid, and grease.

Debris from lay down areas, residue from equipment cleaning and maintenance, and solid waste generated from land clearing operations and human activity (trees, brush, paper, trash, etc.) present other potential pollution sources within the construction site.

Other materials on-site may include compressed gasses used in welding.

g. Non-Stormwater Discharges

Non-stormwater discharges are **NOT** permitted under the conditions of this permit. Non-stormwater discharges from the construction activities associated with the storage facility include possible discharges during construction such as:

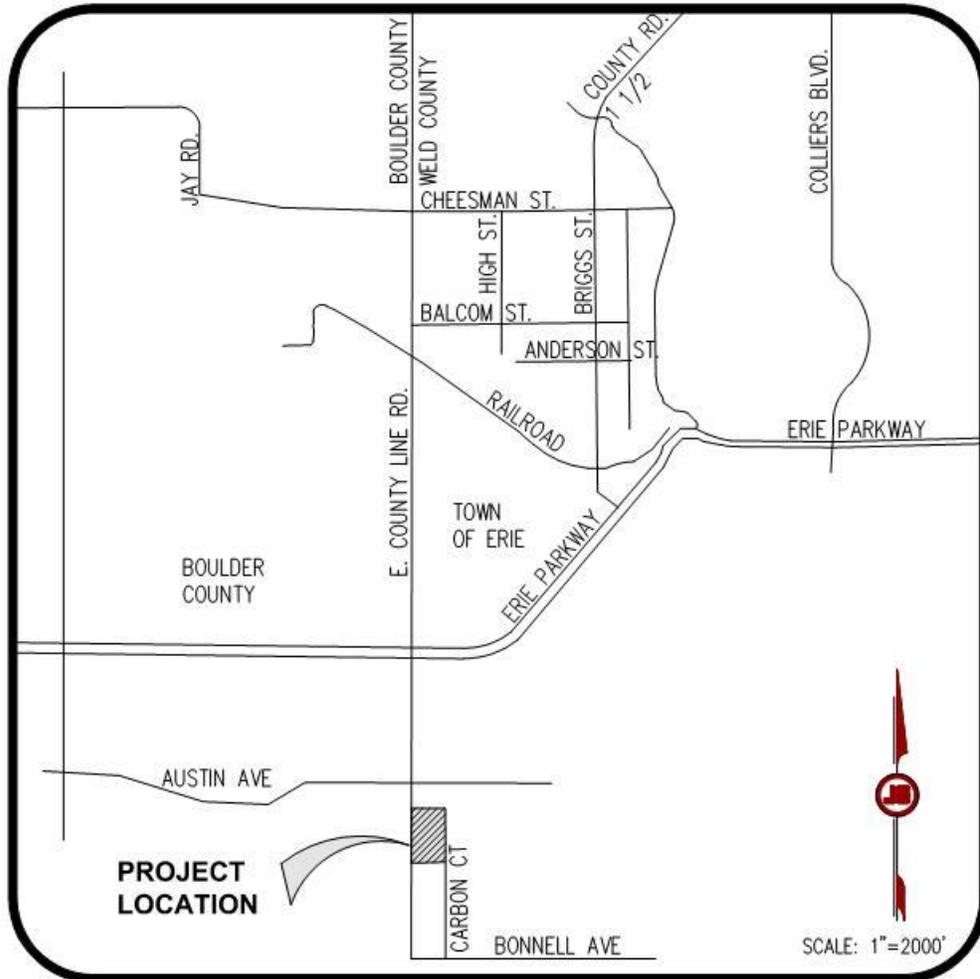
- Water used for dust control, cannot be allowed to drain off site.
- Dewatering of work areas is permitted under a ground water dewatering permit from CDPHE.
- If external building wash down is conducted, which does not include detergents, this water must be absorbed on site.
- The construction stormwater permit does not authorize discharges currently covered by a division Low Risk Guidance (including the Low Risk Discharge Guidance for Discharges of Uncontaminated Groundwater to Land)

h. Receiving Waters

The Project Area is located in the Rock Creek Drainage Basin

2. SITE MAP

Due to the large size of the site maps, they are not kept within the text of the SWMP. These maps will show the erosion control measures for this project and will be available in the field office and are accessible upon request. This field copy will be redlined to reflect changes in BMP practices, including installations and removals. A general 8.5"x11" location map is located below.



3. STORMWATER MANAGEMENT CONTROLS

a. Stormwater Management Plan Administrator

Stormwater management involves entities within GYS Development LLC., as well as outside contractors and consultants. This SWMP was designed on behalf of GYS Development LLC by Rick Engineering; however, the implementation and execution of the plan will be conducted by GYS Development LLC. or their designee. The authorized officer(s) for this SWMP are listed below.

Tony Ollila
 600 Gyrfalcon Ct.
 Windsor, CO 80550

b. Identification of Potential Pollutant Sources

Potential pollutant sources include those listed in the table in Appendix A. The site will be inspected on a regular basis and include:

- 1) All disturbed and stored soils associated with construction of the residential lots; There is a moderate potential for disturbed and stored soils to contribute pollutants to stormwater discharges; however, as part of the regular stormwater inspections,

all disturbed and stored soils will be monitored to ensure sediment transport is not occurring. BMPs will be installed and maintained along these areas.

- 2) Vehicle tracking of sediments associated with construction of the residential lots;
There is a moderate potential for vehicle tracking of sediments to contribute pollutants to stormwater discharges given the amount of equipment and vehicle traffic that will access and exit the Project Area; however, vehicle tracking or crushed aggregate will be placed in drive areas to minimize sediment transport.
- 3) Management of contaminated soils associated with construction of the residential lots;
There is a low potential for contaminated soils to contribute pollutants to stormwater discharges. Spill kits will be present on-site at the job-site trailer to contain any spill that may occur and any areas of contaminated soils will be disposed of in an approved manner. Where necessary and should a spill arise, soil sampling will be conducted to ensure contaminants are no longer on site. It is not anticipated that large volumes (over 1000 gallons) of fuel or chemicals will be stored on site.
- 4) Loading and unloading operations associated with construction of the residential lots;
There is a low potential for loading and unloading operations to contribute pollutants to stormwater discharges as BMPs will be installed before items necessary for building are put in place.
- 5) Outdoor storage activities (hazardous building materials, fertilizers, & chemicals) associated with the construction of the residential lots;
There is a low potential for outdoor storage activities to contribute pollutants to stormwater discharges. Fertilizers, chemicals, fluids for equipment maintenance, and potentially hazardous building materials kept on-site will be stored within a weather-proof structure or will be kept off the ground and will be covered to ensure precipitation does not make contact with the materials.
- 6) Vehicle and equipment maintenance and fueling associated with the construction of the residential lots;
There is a moderate potential for vehicle and equipment maintenance and fueling to contribute pollutants to stormwater discharges. Vehicle and equipment maintenance and fueling may take place within the Project Area, as equipment used for construction activities needs to be re-fueled and occasionally maintained during project activities. Maintenance and fueling that does occur on-site will be done in designated areas off of vegetation and away from any drainage areas.
- 7) Significant dust or particulate generating processes associated with the construction of the residential lots;
There is a moderate potential for dust or particulate generating processes to contribute pollutants to stormwater discharges due to the arid environment with the Project Area. During summer months especially, winds can pick up dust and sediment from construction activity or moving vehicles and deposit it along waterways; however, after construction activities, areas of disturbed soils will be stabilized by re-vegetation or will be hard surfaced. Non-stormwater discharges may be used to control dust and particulate matter such as water trucks to minimize

dust transport from wind and vehicle traffic. This water must be allowed to absorb naturally into the soil and not run off or into detention ponds.

- 8) Routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents, oils, etc. associated with the construction of the residential lots;
There is a moderate potential for routine maintenance activities to contribute pollutants to stormwater discharges due to the amount of vehicle activity during construction. Refueling is necessary during construction activities and occasionally equipment or part failures occur, such as hydraulic lines, and maintenance needs to occur on-site. Any fertilizers, pesticides, detergents, fuels, and fluids will be stored in secured storage areas and fueling that does occur on-site will be done in designated areas off of vegetation and away from any drainage areas. Non-stormwater discharges resulting from external building wash down may **NOT** occur. No detergents will be used in these maintenance operations and if there is a runoff potential from these operations, appropriate BMPs will be installed or runoff will be allowed to absorb into the surrounding soil.
- 9) On-site waste management practices (waste piles, liquid wastes, dumpsters, etc.) associated with the construction of the residential lots;
There is a low potential for on-site waste management practices to contribute pollutants to stormwater discharges. Waste piles will be contained using BMPs to minimize sediment transport.
- 10) Concrete truck/equipment washing, including the concrete truck chute and associated fixtures and equipment associated with the construction of the residential lots;
There is a moderate potential for concrete truck/equipment washing to contribute pollutants to stormwater discharges. Concrete washing will be done only in designated washout areas and will be disposed of properly.
- 11) Dedicated asphalt and concrete batch plants;
There is no potential for dedicated asphalt and concrete batch plants to contribute pollutants to stormwater discharges as there are no asphalt or concrete batch plants associated with the project.
- 12) Non-industrial waste sources such as worker trash and portable toilets associated with the construction of the residential lots;
There is a low potential for non-industrial waste sources to contribute pollutants to stormwater discharges. Dumpsters for worker trash will be kept on site and portable toilets will be staked down and will be located in a safe area where accidental tipping will not occur.
- 13) Other areas or procedures where potential spills can occur associated with the construction of the residential lots;
Spills may occur from vehicles that are accessing each location during construction and daily activities. Observations for soil staining will be conducted during the routine inspections. Any observations of spills will be cleaned up immediately.
- 14) Masonry containment with washout area associated with the construction of the residential lots;
There is a moderate potential for masonry material washing to contribute pollutants

to stormwater discharges. Masonry washing will be done only in designated washout areas and will be disposed of properly.

c. Best Management Practices for Stormwater Pollution Prevention

The selection of erosion and sediment control BMPs is contingent upon site specific conditions (e.g. construction, vegetation, precipitation, and evaporation). The objective of erosion and sediment controls is to minimize the release of sediments. This can be accomplished through the use of structure and/or nonstructural controls. The types and location of structural BMPs are shown under the stormwater inspections.

1) Structural Practice for Erosion and Sediment Control

There are a number of structural practices to be used during the construction of Estates on Gage Hill, including but not limited to:

- Construction Fence
- Silt fences
- Concrete Washout
- Stabilized Staging Area
- Gravel Bags or Rock Socks
- Vehicle tracking control
- Inlet Protection
- Sediment Basin

2) Non-Structural Practice for Erosion and Sediment Control

There are a number of non-structural practices used during the construction of Estates on Gage Hill, including but not limited to:

- Temporary and Permanent Seeding (See UDFCD detail EC-02)
- Mulching (See UDFCD detail EC-04)
- Street Sweeping (See UDFCD detail SM-07)

3) Phased BMP Implementation

BMPs will be implemented in three phases – initial construction, during construction, and final stabilization.

Initial Construction Activity

The initial construction phase includes, clearing grubbing and overlot grading. These activities will involve but will not be limited to: removing topsoil and other excess material from the site; BMPs for this phase are summarized in Table 1 below and on the Stormwater Management Plan.

During Construction

Activities during this phase include maintenance of erosion and sediment control structures that were installed during the First Construction Activity Phase. Construction of curb, gutter, and sidewalk will take place during this phase. Utility construction and drainage facilities will be installed. The sediment basin will be removed for the construction of the underground detention. During the construction of the underground detention facilities, drainage will be directed to the outlet structure that will be constructed during earlier offsite

storm construction. All measures to be installed or remain in-place are listed Table 1 below, and the Stormwater Management Plan. This phase also includes utility installation. Structural BMPs will be reinstalled until final stabilization occurs.

Final Stabilization

Final Stabilization will begin once all landscaping activities involving dirt work have been completed. All areas that have not been paved over will be seeded and mulched or have turf grass installed. The Vehicle tracking area will be removed during this phase. The seed mix is also included in Appendix B of this SWMP.

Table 1 – Phased BMP Implementation

Initial Phase	Construction	During Construction	Final Stabilization
Perimeter Silt Fence		Perimeter Silt Fence	Mulching
Stabilized Staging Area		Stabilized Staging Area	Street Sweeping
Vehicle Tracking Area		Vehicle Tracking Area	
Straw Wattles		Concrete Wash Out	Temporary/Permanent Seeding or Turf Grass Installation
Street Sweeping		Straw Wattles	Erosion Control Blanket
Sediment Basin		Street Sweeping	
Inlet Protection		Sediment Basin	
Diversion Ditch		Inlet Protection	
		Erosion Control Blanket	

4) Materials Handling and Spill Prevention

Spills at the construction site can be largely prevented through proper training and the conscientious efforts of construction personnel during the performance of routine activities. Efforts should be made to refuel equipment away from drainages and waterways, and if possible, attempt to use the same location such as a designated equipment refueling/staging area. If a release of a hazardous substance does occur during construction activities, construction personnel will take appropriate action to minimize the impact of the spill. This will be accomplished by using absorbent material that will be stored at the construction site. Absorbent material may consist of clay, sawdust, straw, kitty litter, booms, pads, or other suitable materials.

A list of all potentially toxic or hazardous chemicals (if any) used during the project will be maintained and kept on-site. Warning labels must be attached to all potentially toxic or hazardous chemicals. Material Safety Data Sheets (MSDS) and other safety information will be on file and accessible during all periods in which the substances are used or stored. If the site has more the 1,320 gallons of petroleum based fluid storage, a Spill Prevention, Control and Countermeasures (SPCC) Plan will be developed for this site.

In addition to maintaining an inventory of potentially toxic, hazardous materials and associated safety information, the following materials management practices will be followed:

- Materials will be handled in accordance with Occupational Safety and Health Administration (OSHA) requirements and manufacturers' instructions;
- Chemicals regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) will be reported and handled in accordance with relevant regulations;
- Materials stored at the construction site will be covered or otherwise protected from the elements;
- The quantity of fuel and lubricants stored on the construction site will be limited to the amount that is reasonable to support the specific construction or maintenance activity;
- Bulk storage areas for materials not used daily will be enclosed and protected from the elements and contained in a manner to prevent release to the environment;
- Petroleum products and fertilizers will be stored at separate facilities or isolated by impermeable barriers;
- Hypochlorite and other chlorine compounds, if stored on site, will be stored separately from other materials and kept dry;
- Selected construction site debris will be stored in trash containers and removed from the job site on a regular basis prior to overflowing.

Lubricant, hydraulic, and miscellaneous oils and solvents will be stored in 55-gallon or smaller containers. Pollutants from petroleum products used during construction activities adhere easily to soil particles and other surfaces. In the case of a spill or leak, soils contaminated with petroleum products will be contained and removed to a proper disposal site. Proposed soil erosion and sediment control practices will aid in retention of spills or leaks. Use of secondary containment and drip pans will reduce the likelihood of spills or leaks contacting the ground. Proposed maintenance and safe storage practices will reduce the chance of petroleum products contaminating on-site soils and drainages. Oily wastes such as crankcase oil, cans, rags, and paper containing oils will be placed in proper receptacles and disposed of or recycled. An additional source of petroleum contamination is leaks from equipment and vehicles. Routine daily inspections will be conducted to identify leaks and initiate corrective actions, if needed.

The following guidelines for storing petroleum products will be used:

- All product containers will be clearly labeled;
- Drums will be kept off the ground within secondary containment and stored under cover if needed;
- Emergency spill response procedures will be available on-site. Persons trained in handling spills will be on call at all times;
- Spill cleanup and containment materials (absorbent, shovels, etc.) will be easily accessible. Spills will be cleaned in a timely manner and reported as required in accordance with applicable regulations; and
- Contaminated materials will be properly stored on site until they can be disposed of in accordance with applicable regulations.

Storage areas and containers will be regularly monitored for leaks and repaired or replaced as necessary. Workers will be reminded about proper storage and handling of materials during weekly subcontractor or safety meetings.

In the event of a release of fuel, lubricant, or coolant from equipment occurs, efforts will be made to stop the release, and the spilled fluids will be cleaned up as soon as possible. Spill Incidents must be documented with the time and date, weather conditions, reasons for the spill and reporting requirements must be taken. All contaminated soils and spent/used clean up materials shall be containerized (drums or dumpsters) and stored on site, until appropriate disposal methods have been identified. The necessary repairs will be made to the equipment to prevent a continued release of potential pollutants.

A release of any chemical, petroleum product, or sewage which may enter waters of the State of Colorado will be immediately reported to CDPHE Emergency Management Program Hotline at 1-877-518-5608 immediately. Written notification must follow within five (5) days.

Effective implementation of good housekeeping practices is dependent on clear designation of personnel responsible for supervising and implementing good housekeeping programs, such as site cleanup and disposal of trash and debris, hazardous material management and disposal, vehicle and equipment maintenance, and other practices.

5) *Dedicated Concrete or Asphalt Batch Plants*

Concrete or asphalt batch plants will not be present on-site, although concrete washout will occur and will be done in a designated location as shown on the Stormwater Management Plans.

6) *Vehicle Tracking Controls*

Vehicle tracking controls (VTCs) are to be used at designated construction site access and exit areas. In this case, there will be one construction site access on 67th Avenue. Street sweeping will be performed during construction.

7) *Waste Management and Disposal*

Construction will generate various other wastes during the course of construction. Other wastes may include the following:

- Trees and shrubs from clearing operations.
- Trash, garbage, and refuse from construction materials and workers.
- Sanitary sewage.

Each of these wastes will be managed so as to not contribute to stormwater pollution. Trees and shrubs will be removed from the jobsite and properly disposed of. Construction trash and debris will be collected in containers and hauled off-site for disposal in suitable landfills. Sanitary waste will be containerized in portable toilets or other storage tanks with waste materials regularly pumped and transported off-site for disposal at approved facilities. Portable toilets will be located in safe areas away from waterways, and will be staked down so accidental tipping will not occur.

8) *Groundwater and Stormwater Dewatering*

- Groundwater was not encountered during the site soils investigation, and is not anticipated onsite. However, if groundwater is encountered during construction activities, dewater will be performed by applying to the land with no ponding and no runoff to the storm drain. If dewater is need in excess of this amount a groundwater dewatering permit will be acquired from CDPHE and monitoring will

be conducted in accordance with state requirements. The construction stormwater permit does not authorize discharges currently covered by a division Low Risk Guidance (including the Low Risk Discharge Guidance for Discharges of Uncontaminated Groundwater to Land)

4. FINAL STABILIZATION AND LONG-TERM STORMWATER MANAGEMENT

a. Final Stabilization Practices

Final stabilization is reached when construction activities have been completed, re-vegetation and interim reclamation have been completed, and the final stabilization criteria have been met. Final stabilization is defined as when all disturbed areas have been either built on, paved, stabilized as unpaved surfaces as needed and a uniform vegetative cover has been established with an individual plant density of at least 70 percent of pre-disturbance levels; or equivalent permanent, physical erosion reduction methods have been employed.

b. Seed Mix Application and Soil Stabilization

Final stabilization practices for obtaining a vegetative cover will include; selecting a seed mix and application methods, providing soil preparation, implementing soil stabilization practices and utilizing appropriate sediment control BMPs as needed until final stabilization is achieved. Disturbed areas will be graded and seeded, and landscaping will be installed. The seeding and stabilization practices may include drill or broadcast seeding, mulching and crimping, erosion control matting, hydro-seeding, or installing sod. The BMPs implemented may be modified as needed to assure site reclamation and stabilization to meet 70 percent of pre-disturbance vegetative cover. Seed mixes that have been applied to disturbance will be included in Appendix B.

c. Achieving Final Stabilization

Typically, final stabilization is reached when all ground surface disturbance activities at the site have been completed and vegetative cover has been established with at least 70 percent of pre-disturbance levels or equivalent permanent physical erosion reduction methods have been employed. Construction sites are considered finally stabilized when the above final stabilization criteria have been met and the site preparation and interim reclamation are complete.

Re-vegetation will be accomplished by installing sod, reseeding with hydro mulch or by simple broadcast techniques with seed mixtures approved by the appropriate Federal, State and/or Local agency, or other appropriate method.

Inactivation Notice

On a site-specific basis the permittee no longer requires coverage under this permit if all soil disturbing activities are complete along with one of the following:

1. All disturbed areas have been either built on, paved, or a uniform vegetative cover has been established with at least 70 percent of pre-disturbance levels or equivalent permanent, physical erosion reduction methods have been employed.
2. Areas needed for operation and maintenance of commissioned assets are developed as stabilized unpaved surfaces.

3. Responsibility of the site has been transferred to a second party by filing a "Notice of Reassignment of Permit Coverage".

At that time, the permittee will submit to the Administrator the Inactivation Notice.

After construction and stabilization, only permanent BMP's will remain such as the underground detention basin's outlet structure with its corresponding water quality plate. The inlets on the west side of the site will only receive flows from landscaping for water quality. The flow will be conveyed to level spreaders that will serve to settle sediment and spread flows to mimic existing flows to leave the site.

5. INSPECTION AND MAINTENANCE

Inspection Schedule and Requirements

To meet requirements of the General Permit, inspection and maintenance of erosion and sediment controls must occur during the project. Continued inspection and maintenance is required for specific structures after construction is completed. The inspection program will include the following:

1. A qualified person familiar with the SWMP and control measures will conduct the inspections.
2. Inspections will cover these areas of the construction site:
 - Disturbed areas with and without stabilization
 - Material storage areas;
 - BMPs
 - Surface water diversions
 - Down-gradient areas.
3. A log of inspections will be kept at the site.
4. Sediment control BMPs will be inspected for evidence of deterioration, undercutting, and build up of sediment. Sediment will be removed when it has built up one-third to one-half the height of the sediment retention structure.
5. Following each inspection, the SWMP will be updated as necessary to include additional controls designed to correct identified problems. Revisions to the SWMP will be made within 72 hours after the changes to BMP installations and/or implementations occur to the site.
6. An inspection report summarizing the scope of the inspection, the name of the person conducting the inspection, date of inspection, and observations relating to the implementation will be prepared and entered into the SWMP. Inspection reports will be retained for at least 3 years from the date that the site is finally stabilized.
7. Actions taken to modify any stormwater control measure will be recorded and maintained with the SWMP. Once adequate corrective action(s) have been taken, or where a report does not identify any incidents requiring corrective action, the report shall be signed indicating the site is in compliance. An

updated diagram will accompany each report.

a) Minimum Inspection Schedule

A thorough inspection will be made at least every 14 calendar days. Permittees must conduct the first site inspection within seven calendar days of the commencement of construction activities on site. Also, post-storm event inspections will be conducted within 24 hours after the end of any precipitation or snowmelt event that causes surface erosion. Provided the timing is appropriate, the post-storm inspections may be used to fulfill the 14-day routine inspection requirement. A more frequent inspection schedule than the minimum inspections described may be necessary to assure that BMPs continue to operate as needed to comply with the permit. The following conditional modifications to this minimum inspection schedule are allowed:

Post-Storm Event Inspections at Temporarily Idle Sites – If no construction activities will occur following a storm event, post-storm event inspections will be conducted prior to recommencing construction activities but no later than 72 hours following the storm event. The occurrence of any such delayed inspection will be documented in the inspection record. Routine inspections will still be conducted at least every 14 calendar days.

Inspections at Completed Sites/Areas – For sites or portions of sites that meet the following criteria but where final stabilization has not yet been achieved due to a vegetative cover that has not become established, an inspection will be conducted at least once every month and post-storm event inspections are not required. This reduced inspection schedule is allowed only if:

- All construction activities that will result in surface ground disturbance are completed.
- All activities required for final stabilization, in accordance with the SWMP, have been completed, with the exception of the application of seed that has not occurred due to seasonal conditions or the necessity for additional seed application to augment previous efforts.
- The SWMP must be amended to indicate those areas that will be inspected in accordance with the reduced schedule allowed for in this subsection.

Winter Conditions Inspections Exclusion – Inspections will not be performed at sites where construction activities are temporarily halted, snow cover exists over the entire site for an extended period and melting conditions posing a risk of surface erosion do not exist. This exception is applicable *only* during the period where melting conditions do not exist and applies to the routine 14-day and monthly inspections as well as post-storm event inspections. The following information will be documented in the inspection record for use of this exclusion: dates when snow cover occurred, date when construction ceased, and date melting conditions began. Inspections, as described above, are required at all other times.

Because there are several different construction activities that will be covered under the same permit, it will be common for different inspection frequencies to apply to different portions of the permitted area.

b) Inspections

Inspection Scope – The construction site perimeter, all disturbed areas, material and/or waste storage areas that are exposed to precipitation, discharge locations, and locations where vehicles access the site will be inspected for evidence of, or the potential for, pollutants leaving the construction site boundaries, entering the stormwater drainage system, or discharging to waters of the state. No potential pollutants are to be exposed to the elements. All erosion and sediment control practices identified in the SWMP will be evaluated to assure that they are operating correctly.

Inspection Report/Records – A record will be kept of inspections. Inspection reports will identify any incidents of non-compliance with the terms and conditions of the permit. Copies of the inspection reports shall be retained with the SWMP at the general contractor's off-site or field office during construction, interim and reclamation operations and for a minimum of 3 years following the completion of the activities. All reports will be provided to the Administrator upon request.

The inspection report includes:

- The inspection date.
- A description of the minimum inspection frequency that will be utilized.
- Weather conditions
- Phase of construction and acreage of disturbance at the time of inspection
- Name and title of the personnel conducting inspection.
- Location of discharges of sediment or other pollutants from the site.
- Location of BMPs that need to be maintained.
- Location of BMPs that failed to operate as designed or proved inadequate for a particular location.
- Location where additional BMPs may be needed.
- Deviations from the minimum inspection schedule.
- Description of corrective action for above items, date corrective action taken, and measures taken to prevent future violations, including requisite changes to the SWMP as necessary.
- After corrective action has been taken or where a report does not identify any incidents requiring corrective action, the report will contain a signed statement indicating that it is in compliance with the permit to the best of the signer's knowledge and belief.
- If it is infeasible to install or repair a control measure immediately after discovering the deficiency, the following information must be documented and kept on record:
 - Describe why it is infeasible to initiate the installation or repair immediately; and
 - Provide a schedule for installing or repairing the control measure and returning it to an effective operating condition as soon as possible.

c) Required Actions Following Site Inspections

Where site inspections note the need for BMP maintenance activities, BMPs will be maintained in accordance with the SWMP. Repair, replacement, or installation of new BMPs determined necessary during site inspections to address ineffective or inadequate BMPs will be conducted as described below.

After adequate corrective action(s) and maintenance have been taken, or where a report

does not identify any incidents requiring corrective action or maintenance, the report shall contain the following:

“I verify that, to the best of my knowledge and belief, all corrective action and maintenance items identified during the inspection are complete, and the site is currently in compliance with the permit”. This must be signed by the stormwater manager.

d) BMP Maintenance

All erosion and sediment control practices and other protective measures identified in the SWMP will be maintained in effective operating condition. Proper selection and installation of BMPs and installation of comprehensive inspection and maintenance procedures should be adequate to meet this condition. BMPs that are not adequately maintained in accordance with good engineering, hydrologic and pollution control practices including removal of collected sediment outside the acceptable tolerances of the BMPs and preparation for post-construction stormwater control are considered no longer operating effectively and will require immediate attention. A specific timeline for implementing maintenance procedures is not included in the permit because BMP maintenance is intended to be proactive, not responsive. Observations resulting in BMP maintenance activities can be made during a site inspection or during general observations of site conditions. Additional information regarding BMP maintenance is included.

e) Replacement of Failed BMPs

Adequate site assessment will be performed as part of a comprehensive inspection and maintenance procedures to assess the adequacy of BMPs at the site and the necessity of changes to those BMPs to assure continued effective performance. Where site assessment results in the determination that new or replacement BMPs are necessary, the BMPs will be installed to assure continuous implementation of BMPs. Where BMPs have failed, resulting in non-compliance with the permit, they must be addressed immediately to minimize the discharge of pollutants. When new BMPs are installed or BMPs are replaced with different BMPs, the SWMP must be updated.

f) SWMP Review and Changes

The SWMP should be considered a “living document” that will be continuously reviewed and modified. The SWMP will be updated whenever there is a change in design, construction, operation, or maintenance, which would require the implementation of new or revised BMPs. The SWMP will also be updated if it proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with construction activity. SWMP updates must be made no more than 72 hours after changes were made onsite.

APPENDIX A

Potential Contaminants of Concern

POTENTIAL CONTAMINANTS OF CONCERN

Implemented on site will be structural best management practices as well as nonstructural BMPs such as safe handling of chemicals, containment of fuels, spill response and availability of spill response supplies. Observe loading and unloading operations so issues or spills may be addressed immediately.

Trade Name Material	Stormwater Pollutants	Location/Use	BMP
Sediment	Sand, clay, rock, dust	At all graded locations	Implement BMPs as outlined in the SWMP including dust suppression. Contain and properly dispose of any contaminated soils encountered.
Pesticides	Chlorinated hydrocarbons, organophosphates, carbonates, arsenic	Herbicides used for noxious weed control	Apply according to manufacturer's directions.
Fertilizer	Nitrogen, phosphorous	Newly seeded areas	Apply according to manufacturer's directions.
Plaster	Calcium sulphate, calcium carbonate, sulfuric acid	Building construction	Contain and properly dispose of unused materials.
Masonry	Sand, limestone, paint	Building construction, brick, landscaping	Contain all materials and washout in predetermined washout areas.
Cleaning solvents	Perchloroethylene, methylene chloride, trichloroethylene, petroleum distillates	No equipment cleaning allowed in project limits	Not to be used.
Asphalt	Oil, petroleum distillates	Streets and roofing	Contain and properly dispose of excess.
Concrete	Limestone, sand, pH, chromium	Curb and gutter, building construction, sidewalks, concrete pads	No washout allowed except in predetermined washout areas.
Glue, adhesives	Polymers, epoxies	Building construction	Store under cover and immediately recap when not in use.
Paints	Metal oxides, Stoddard solvent, talc, calcium carbonate, arsenic	Building construction	Use only as directed and clean out paint supplies into predetermined waste areas.
Curing compounds	Naphtha	Curb and gutter, sidewalks,	Use only as directed.

		concrete pads	
Wood preservatives	Stoddard solvent, petroleum distillates, arsenic, copper, chromium	Timber pads and building construction	Store under cover and immediately recap when not in use.
Hydraulic oil/fluids	Mineral oil	Leaks or broken hoses from equipment	Routinely maintain equipment, check for leaks and immediately clean up all spills.
Gasoline	Benzene, ethyl benzene, toluene, xylene, MTBE	Secondary containment/staging area	Immediately clean up any and all spills.
Diesel Fuel	Petroleum distillate, oil & grease, naphthalene, xylenes	Secondary containment/staging area	Immediately clean up any and all spills.
Kerosene	Coal oil, petroleum distillates	Secondary containment/staging area	Immediately clean up any and all spills.
Antifreeze/coolant	Ethylene glycol, propylene glycol, heavy metals (copper, lead, zinc)	Leaks or broken hoses from equipment	Immediately clean up any and all spills.
Sanitary Toilets	Bacteria, parasites, and viruses	Staging area	Stake into the ground, maintain as necessary and immediately clean up any spills.
Trash	Paper, cardboard, plastics, glass, steel and aluminum cans	Blown in from other areas or originating from workers	Provide dumpsters or trash barrels. Cover is necessary.

APPENDIX B

SEED MIX

Minimum Drill Seeding Rates for Perennial Grasses Sand/Loamy/Clay Soil Seed Mix

Seedbed Preparation: The seedbed shall be friable enough to allow placement of seed at the proper depth. Soils that have been over-compacted by traffic or heavy equipment shall be ripped or tilled to break up restrictive layers and then harrowed or rolled to firm the seedbed. The prepared surface shall be relatively free from weeds, clods, stones, roots, sticks, rivulets and gullies.

Grass Seed Mixture: All disturbed lands shall use the following dry land grass mixture with seed being planted by a drill (when feasible) at a depth of 1/2 to 1 inches.

Common Name	Variety	Growth Season	Growth Form	PLS/Pound	Drilled Pounds of PLS/acre	Broadcast Pounds of PLS/acre
Big Bluestem	Kaw	Warm	Sod	130,000	1.1	3.3
Yellow Indiangrass	Cheyenne	Warm	Sod	141,000	1.0	3.0
Switchgrass	Blackewell	Warm	Sod	389,000	0.4	1.2
Sidecoats Grama	Vautghn	Warm	Bunch	191,000	1.8	5.4
Western Wheatgrass	Arriba	Cool	Sod	110,000	3.2	9.6
Blue Grama	Hachita	Warm	Bunch	825,000	0.6	1.8
Thickspike Wheatgrass	Critana	Cool	Sod	154,000	2.0	6.0
Prarie Sandreed	Goshen	Warm	Sod	273,000	1.4	4.2
Green Needlegrass	Lodorm	Cool	Bunch	181,000	2.0	6.0
Slender Wheatgrass	Pryor	Cool	Bunch	159,000	1.2	3.6
Streambank Wheatgrass	Sodar	Cool	Sod	156,000	1.2	3.6
				TOTAL	15.9	47.7

PLS = Pure Live Seed

One of the following annual cover crops will be added to the above perennial grass mix: *REGREEN* (*Triticum aestivum x Elytrigia elongate*) or *QUICKGUARD* (*Triticum aestivum x Secale ceerale*) at 15 pounds of drilled PLS/acre or 45 pounds of broadcast PLS/acre.

Drilled rates are for slopes 3H:1V or less and favorable topsoil. If the mixture is to be broadcasted, the soil must be raked to cover the seed after planting occurs.

Seed labeling, quality and testing shall be in accordance with Colorado Department of Agriculture Seed Laws, Chapter 35, Article 27. The seed shall be no more than six months old, contain no more than 0.1% weed seeds and be free from noxious weeds. Seed tags shall be attached to seed bags at the time of delivery to the site for verification and documentation.

Mulch: To increase erosion protection and to enhance germination rates, it is required that all planted lands be mulched. As a minimum, for slopes greater than 20H:1V, mulch shall be applied at a rate of 2 tons/acre on lands where seed has been planted. The hay or straw mulch shall be free of noxious weeds with at least 50% of the fiber being 10 inches or more in length. All mulch shall provide **80% to 100% coverage** of exposed ground and held in place by crimping or applying a tackifier. For slopes steeper than 3H:1V, use of a straw or straw-coconut blanket is required.

NOTE: Tackifier will be used on any areas not stabilized with Erosion Control Blankets.

Acceptance: Seeded areas shall be evaluated after one growing season to determine whether additional maintenance and/or weed control is required. Acceptance of seeded areas after the second growing season shall depend upon whether a satisfactory stand of grass is evident and weeds have been controlled. A satisfactory stand is where 90% of the seeded area has an even distribution of grass.

APPENDIX C

BMP DETAILS AND DESCRIPTIONS

Description

Concrete waste management involves designating and properly managing a specific area of the construction site as a concrete washout area. A concrete washout area can be created using one of several approaches designed to receive wash water from washing of tools and concrete mixer chutes, liquid concrete waste from dump trucks, mobile batch mixers, or pump trucks. Three basic approaches are available: excavation of a pit in the ground, use of an above ground storage area, or use of prefabricated haul-away concrete washout containers. Surface discharges of concrete washout water from construction sites are prohibited.



Photograph CWA-1. Example of concrete washout area. Note gravel tracking pad for access and sign.

Appropriate Uses

Concrete washout areas must be designated on all sites that will generate concrete wash water or liquid concrete waste from onsite concrete mixing or concrete delivery.

Because pH is a pollutant of concern for washout activities, when unlined pits are used for concrete washout, the soil must have adequate buffering capacity to result in protection of state groundwater standards; otherwise, a liner/containment must be used. The following management practices are recommended to prevent an impact from unlined pits to groundwater:

- The use of the washout site should be temporary (less than 1 year), and
- The washout site should be not be located in an area where shallow groundwater may be present, such as near natural drainages, springs, or wetlands.

Design and Installation

Concrete washout activities must be conducted in a manner that does not contribute pollutants to surface waters or stormwater runoff. Concrete washout areas may be lined or unlined excavated pits in the ground, commercially manufactured prefabricated washout containers, or aboveground holding areas constructed of berms, sandbags or straw bales with a plastic liner.

Although unlined washout areas may be used, lined pits may be required to protect groundwater under certain conditions.

Do not locate an unlined washout area within 400 feet of any natural drainage pathway or waterbody or within 1,000 feet of any wells or drinking water sources. Even for lined concrete washouts, it is advisable to locate the facility away from waterbodies and drainage paths. If site constraints make these

Concrete Washout Area	
Functions	
Erosion Control	No
Sediment Control	No
Site/Material Management	Yes

setbacks infeasible or if highly permeable soils exist in the area, then the pit must be installed with an impermeable liner (16 mil minimum thickness) or surface storage alternatives using prefabricated concrete washout devices or a lined aboveground storage area should be used.

Design details with notes are provided in Detail CWA-1 for pits and CWA-2 for aboveground storage areas. Pre-fabricated concrete washout container information can be obtained from vendors.

Maintenance and Removal

A key consideration for concrete washout areas is to ensure that adequate signage is in place identifying the location of the washout area. Part of inspecting and maintaining washout areas is ensuring that adequate signage is provided and in good repair and that the washout area is being used, as opposed to washout in non-designated areas of the site.

Remove concrete waste in the washout area, as needed to maintain BMP function (typically when filled to about two-thirds of its capacity). Collect concrete waste and deliver offsite to a designated disposal location.

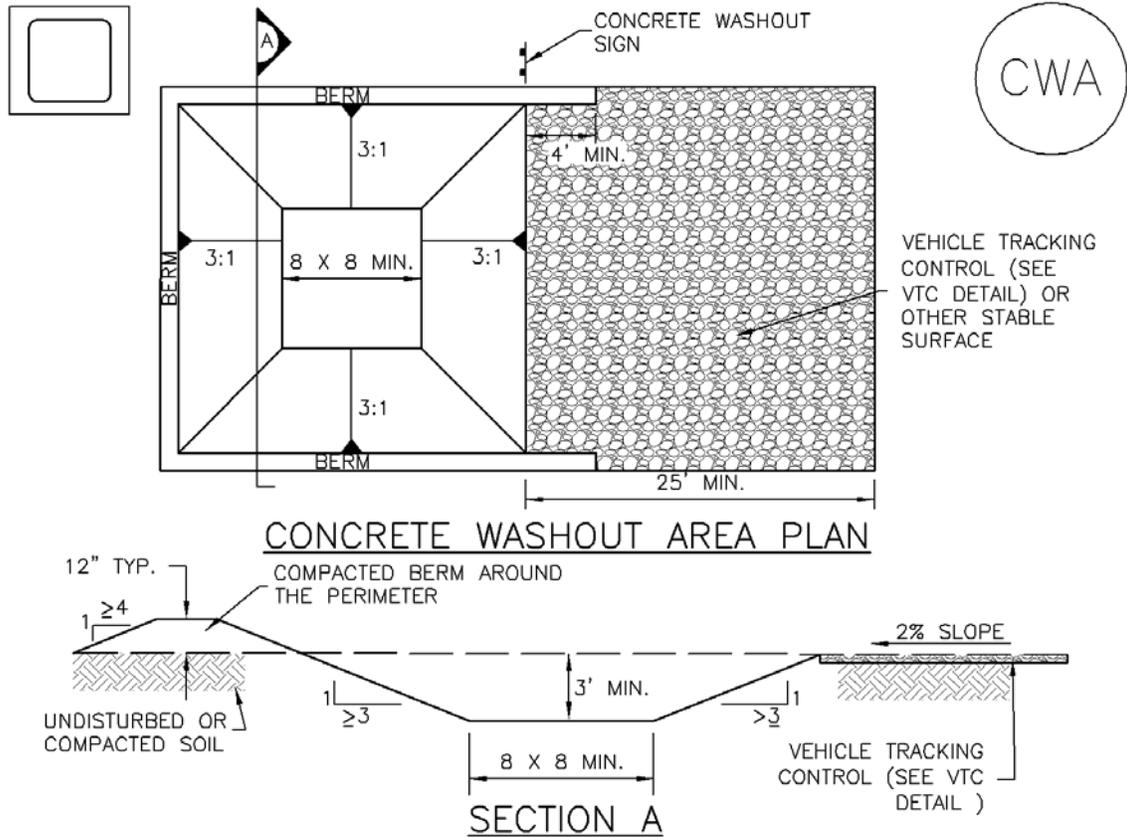
Upon termination of use of the washout site, accumulated solid waste, including concrete waste and any contaminated soils, must be removed from the site to prevent on-site disposal of solid waste. If the wash water is allowed to evaporate and the concrete hardens, it may be recycled.



Photograph CWA-2. Prefabricated concrete washout. Photo courtesy of CDOT.



Photograph CWA-3. Earthen concrete washout. Photo courtesy of CDOT.



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.

CWA 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. THE CWA SHALL BE REPAIRED, CLEANED, OR ENLARGED AS NECESSARY TO MAINTAIN CAPACITY FOR CONCRETE WASTE. CONCRETE MATERIALS, ACCUMULATED IN PIT, SHALL BE REMOVED ONCE THE MATERIALS HAVE REACHED A DEPTH OF 2'.

5. CONCRETE WASHOUT WATER, WASTED PIECES OF CONCRETE AND ALL OTHER DEBRIS IN THE SUBSURFACE PIT SHALL BE TRANSPORTED FROM THE JOB SITE IN A WATER-TIGHT CONTAINER AND DISPOSED OF PROPERLY.

6. THE CWA SHALL REMAIN IN PLACE UNTIL ALL CONCRETE FOR THE PROJECT IS PLACED.

7. WHEN THE CWA IS REMOVED, COVER THE DISTURBED AREA WITH TOP SOIL, SEED AND MULCH OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND THE CITY OF PARKER, 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.

Description

Stockpile management includes measures to minimize erosion and sediment transport from soil stockpiles.

Appropriate Uses

Stockpile management should be used when soils or other erodible materials are stored at the construction site. Special attention should be given to stockpiles in close proximity to natural or manmade storm systems.



Photograph SP-1. A topsoil stockpile that has been partially revegetated and is protected by silt fence perimeter control.

Design and Installation

Locate stockpiles away from all drainage system components including storm sewer inlets. Where practical, choose stockpile locations that that will remain undisturbed for the longest period of time as the phases of construction progress. Place sediment control BMPs around the perimeter of the stockpile, such as sediment control logs, rock socks, silt fence, straw bales and sand bags. See Detail SP-1 for guidance on proper establishment of perimeter controls around a stockpile. For stockpiles in active use, provide a stabilized designated access point on the upgradient side of the stockpile.

Stabilize the stockpile surface with surface roughening, temporary seeding and mulching, erosion control blankets, or soil binders. Soils stockpiled for an extended period (typically for more than 60 days) should be seeded and mulched with a temporary grass cover once the stockpile is placed (typically within 14 days). Use of mulch only or a soil binder is acceptable if the stockpile will be in place for a more limited time period (typically 30-60 days). Timeframes for stabilization of stockpiles noted in this fact sheet are "typical" guidelines. Check permit requirements for specific federal, state, and/or local requirements that may be more prescriptive.

Stockpiles should not be placed in streets or paved areas unless no other practical alternative exists. See the Stabilized Staging Area Fact Sheet for guidance when staging in roadways is unavoidable due to space or right-of-way constraints. For paved areas, rock socks must be used for perimeter control and all inlets with the potential to receive sediment from the stockpile (even from vehicle tracking) must be protected.

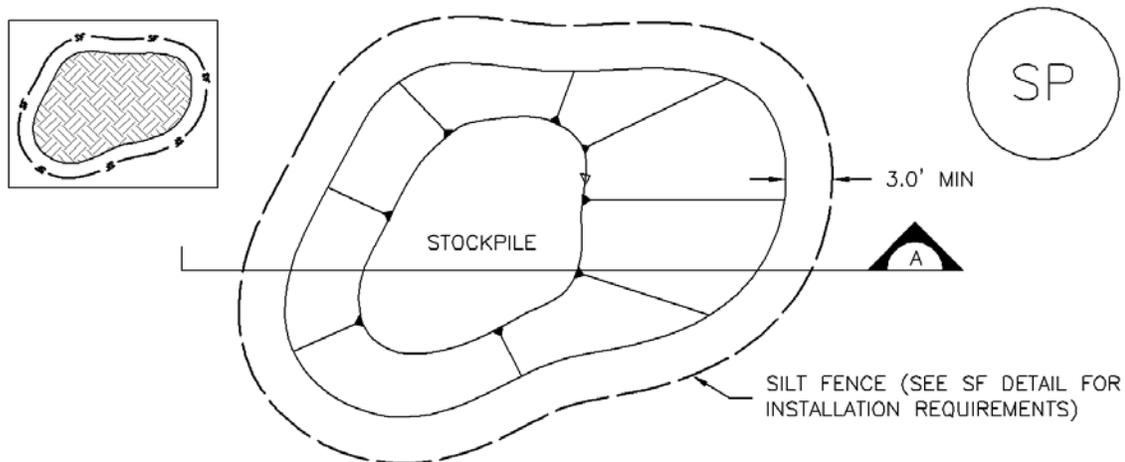
Maintenance and Removal

Inspect perimeter controls and inlet protection in accordance with their respective BMP Fact Sheets. Where seeding, mulch and/or soil binders are used, reseeding or reapplication of soil binder may be necessary.

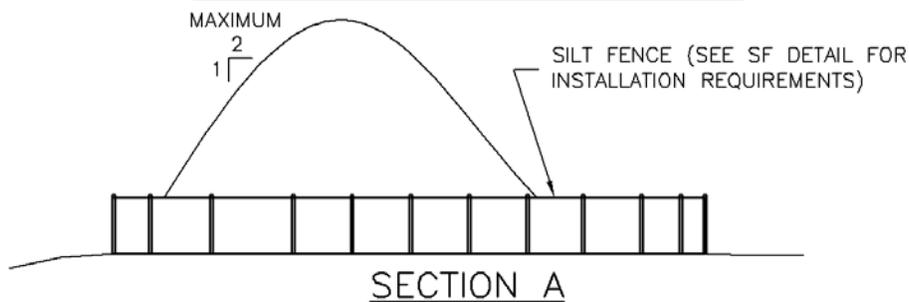
When temporary removal of a perimeter BMP is necessary to access a stockpile, ensure BMPs are reinstalled in accordance with their respective design detail section.

Stockpile Management	
Functions	
Erosion Control	Yes
Sediment Control	Yes
Site/Material Management	Yes

When the stockpile is no longer needed, properly dispose of excess materials and revegetate or otherwise stabilize the ground surface where the stockpile was located.



STOCKPILE PROTECTION PLAN



SP-1. STOCKPILE PROTECTION

STOCKPILE PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
 - LOCATION OF STOCKPILES.
 - TYPE OF STOCKPILE PROTECTION.

2. INSTALL PERIMETER CONTROLS IN ACCORDANCE WITH THEIR RESPECTIVE DESIGN DETAILS. SILT FENCE IS SHOWN IN THE STOCKPILE PROTECTION DETAILS; HOWEVER, OTHER TYPES OF PERIMETER CONTROLS INCLUDING SEDIMENT CONTROL LOGS OR ROCK SOCKS MAY BE SUITABLE IN SOME CIRCUMSTANCES. CONSIDERATIONS FOR DETERMINING THE APPROPRIATE TYPE OF PERIMETER CONTROL FOR A STOCKPILE INCLUDE WHETHER THE STOCKPILE IS LOCATED ON A PERVIOUS OR IMPERVIOUS SURFACE, THE RELATIVE HEIGHTS OF THE PERIMETER CONTROL AND STOCKPILE, THE ABILITY OF THE PERIMETER CONTROL TO CONTAIN THE STOCKPILE WITHOUT FAILING IN THE EVENT THAT MATERIAL FROM THE STOCKPILE SHIFTS OR SLUMPS AGAINST THE PERIMETER, AND OTHER FACTORS.

3. STABILIZE THE STOCKPILE SURFACE WITH SURFACE ROUGHENING, TEMPORARY SEEDING AND MULCHING, EROSION CONTROL BLANKETS, OR SOIL BINDERS. SOILS STOCKPILED FOR AN EXTENDED PERIOD (TYPICALLY FOR MORE THAN 60 DAYS) SHOULD BE SEEDING AND MULCHED WITH A TEMPORARY GRASS COVER ONCE THE STOCKPILE IS PLACED (TYPICALLY WITHIN 14 DAYS). USE OF MULCH ONLY OR A SOIL BINDER IS ACCEPTABLE IF THE STOCKPILE WILL BE IN PLACE FOR A MORE LIMITED TIME PERIOD (TYPICALLY 30-60 DAYS).

4. FOR TEMPORARY STOCKPILES ON THE INTERIOR PORTION OF A CONSTRUCTION SITE, WHERE OTHER DOWNGRADIENT CONTROLS, INCLUDING PERIMETER CONTROL, ARE IN PLACE, STOCKPILE PERIMETER CONTROLS MAY NOT BE REQUIRED.

STOCKPILE 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.

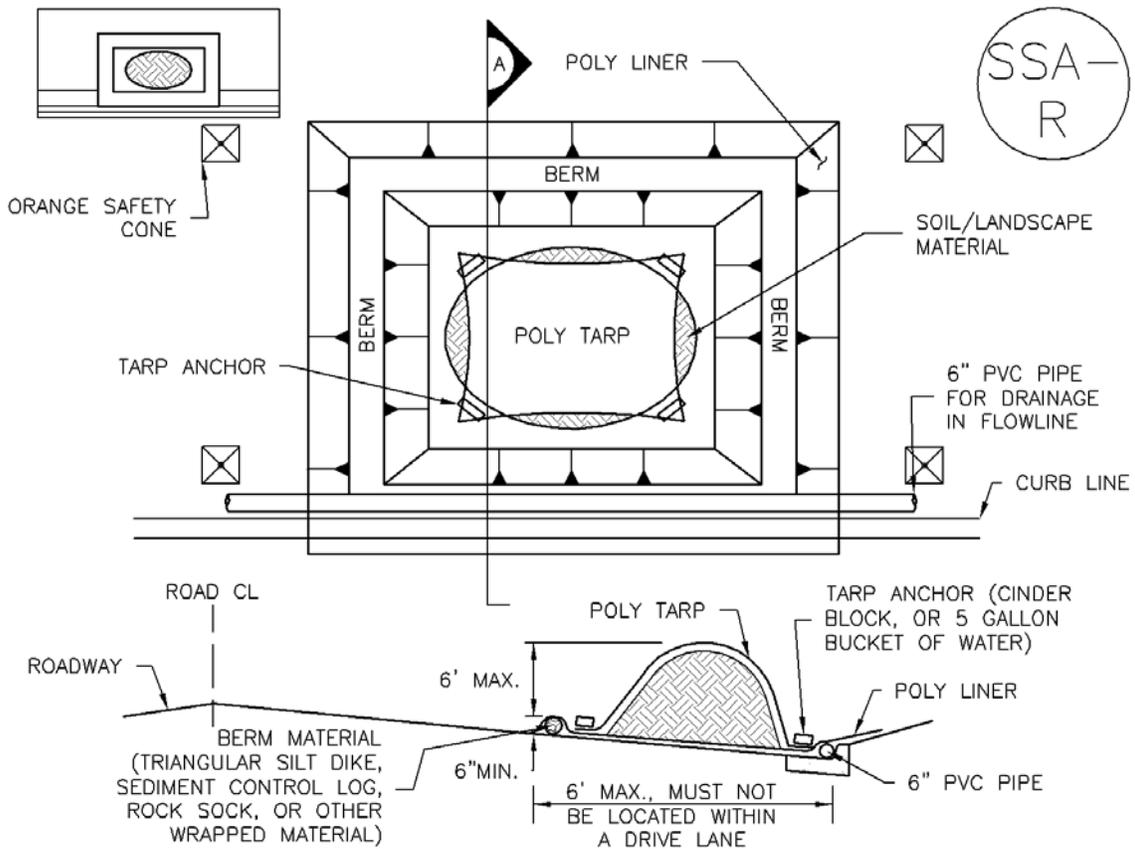
STOCKPILE PROTECTION MAINTENANCE NOTES

4. IF PERIMETER PROTECTION MUST BE MOVED TO ACCESS SOIL STOCKPILE, REPLACE PERIMETER CONTROLS BY THE END OF THE WORKDAY.

5. STOCKPILE PERIMETER CONTROLS CAN BE REMOVED ONCE ALL THE MATERIAL FROM THE STOCKPILE HAS BEEN USED.

(DETAILS ADAPTED FROM PARKER, 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.



SP-2. MATERIALS STAGING IN ROADWAY

MATERIALS STAGING IN ROADWAYS INSTALLATION NOTES

1. SEE PLAN VIEW FOR
 - LOCATION OF MATERIAL STAGING AREA(S).
 - CONTRACTOR MAY ADJUST LOCATION AND SIZE OF STAGING AREA WITH APPROVAL FROM THE LOCAL JURISDICTION.
2. FEATURE MUST BE INSTALLED PRIOR TO EXCAVATION, EARTHWORK OR DELIVERY OF MATERIALS.
3. MATERIALS MUST BE STATIONED ON THE POLY LINER. ANY INCIDENTAL MATERIALS DEPOSITED ON PAVED SECTION OR ALONG CURB LINE MUST BE CLEANED UP PROMPTLY.
4. POLY LINER AND TARP COVER SHOULD BE OF SIGNIFICANT THICKNESS TO PREVENT DAMAGE OR LOSS OF INTEGRITY.
5. SAND BAGS MAY BE SUBSTITUTED TO ANCHOR THE COVER TARP OR PROVIDE BERMING UNDER THE BASE LINER.
6. FEATURE IS NOT INTENDED FOR USE WITH WET MATERIAL THAT WILL BE DRAINING AND/OR SPREADING OUT ON THE POLY LINER OR FOR DEMOLITION MATERIALS.
7. THIS FEATURE CAN BE USED FOR:
 - UTILITY REPAIRS.
 - WHEN OTHER STAGING LOCATIONS AND OPTIONS ARE LIMITED.
 - OTHER LIMITED APPLICATION AND SHORT DURATION STAGING.

MATERIALS STAGING IN ROADWAY 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. INSPECT PVC PIPE ALONG CURB LINE FOR CLOGGING AND DEBRIS. REMOVE OBSTRUCTIONS PROMPTLY.
5. CLEAN MATERIAL FROM PAVED SURFACES BY SWEEPING OR VACUUMING.

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.

(DETAILS ADAPTED FROM AURORA, COLORADO)

Description

A silt fence is a woven geotextile fabric attached to wooden posts and trenched into the ground. It is designed as a sediment barrier to intercept sheet flow runoff from disturbed areas.

Appropriate Uses

A silt fence can be used where runoff is conveyed from a disturbed area as sheet flow. Silt fence is not designed to receive concentrated flow or to be used as a filter fabric. Typical uses include:

- Down slope of a disturbed area to accept sheet flow.
- Along the perimeter of a receiving water such as a stream, pond or wetland.
- At the perimeter of a construction site.



Photograph SF-1. Silt fence creates a sediment barrier, forcing sheet flow runoff to evaporate or infiltrate.

Design and Installation

Silt fence should be installed along the contour of slopes so that it intercepts sheet flow. The maximum recommended tributary drainage area per 100 lineal feet of silt fence, installed along the contour, is approximately 0.25 acres with a disturbed slope length of up to 150 feet and a tributary slope gradient no steeper than 3:1. Longer and steeper slopes require additional measures. This recommendation only applies to silt fence installed along the contour. Silt fence installed for other uses, such as perimeter control, should be installed in a way that will not produce concentrated flows. For example, a "J-hook" installation may be appropriate to force runoff to pond and evaporate or infiltrate in multiple areas rather than concentrate and cause erosive conditions parallel to the silt fence.

See Detail SF-1 for proper silt fence installation, which involves proper trenching, staking, securing the fabric to the stakes, and backfilling the silt fence. Properly installed silt fence should not be easily pulled out by hand and there should be no gaps between the ground and the fabric.

Silt fence must meet the minimum allowable strength requirements, depth of installation requirement, and other specifications in the design details. Improper installation of silt fence is a common reason for silt fence failure; however, when properly installed and used for the appropriate purposes, it can be highly effective.

Silt Fence	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No

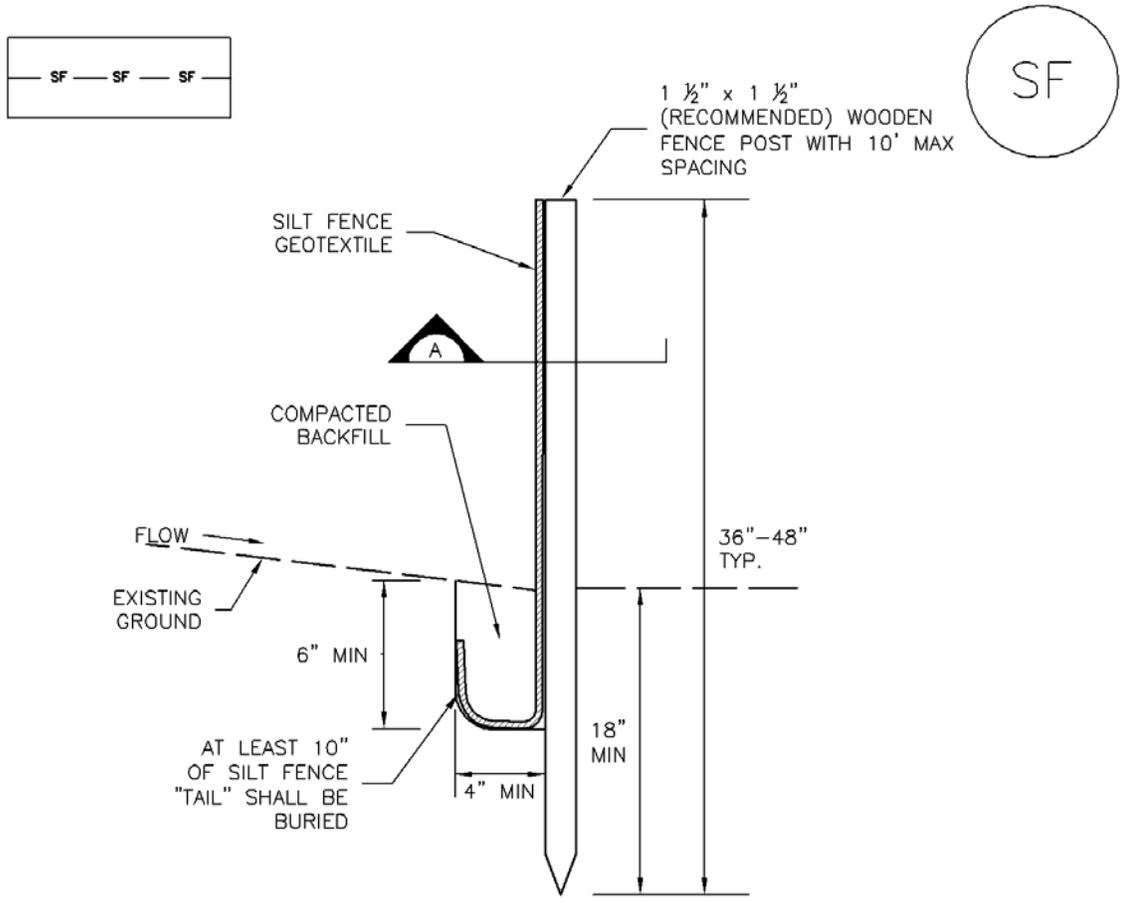
Maintenance and Removal

Inspection of silt fence includes observing the material for tears or holes and checking for slumping fence and undercut areas bypassing flows. Repair of silt fence typically involves replacing the damaged section with a new section. Sediment accumulated behind silt fence should be removed, as needed to maintain BMP effectiveness, typically before it reaches a depth of 6 inches.

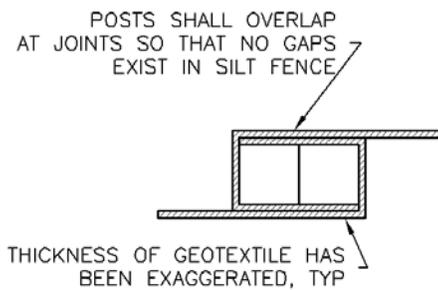
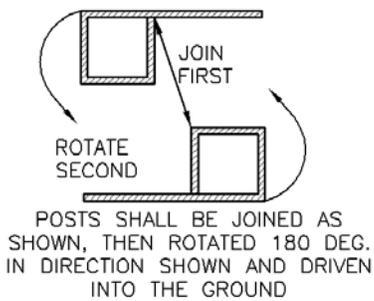
Silt fence may be removed when the upstream area has reached final stabilization.



Photograph SF-2. When silt fence is not installed along the contour, a "J-hook" installation may be appropriate to ensure that the BMP does not create concentrated flow parallel to the silt fence. Photo courtesy of Tom Gore.



SILT FENCE



SECTION A

SF-1. SILT FENCE

SILT FENCE INSTALLATION NOTES

1. SILT FENCE MUST BE PLACED AWAY FROM THE TOE OF THE SLOPE TO ALLOW FOR WATER PONDING. SILT FENCE AT THE TOE OF A SLOPE SHOULD BE INSTALLED IN A FLAT LOCATION AT LEAST SEVERAL FEET (2-5 FT) FROM THE TOE OF THE SLOPE TO ALLOW ROOM FOR PONDING AND DEPOSITION.
2. A UNIFORM 6" X 4" ANCHOR TRENCH SHALL BE EXCAVATED USING TRENCHER OR SILT FENCE INSTALLATION DEVICE. NO ROAD GRADERS, BACKHOES, OR SIMILAR EQUIPMENT SHALL BE USED.
3. COMPACT ANCHOR TRENCH BY HAND WITH A "JUMPING JACK" OR BY WHEEL ROLLING. COMPACTION SHALL BE SUCH THAT SILT FENCE RESISTS BEING PULLED OUT OF ANCHOR TRENCH BY HAND.
4. SILT FENCE SHALL BE PULLED TIGHT AS IT IS ANCHORED TO THE STAKES. THERE SHOULD BE NO NOTICEABLE SAG BETWEEN STAKES AFTER IT HAS BEEN ANCHORED TO THE STAKES.
5. SILT FENCE FABRIC SHALL BE ANCHORED TO THE STAKES USING 1" HEAVY DUTY STAPLES OR NAILS WITH 1" HEADS. STAPLES AND NAILS SHOULD BE PLACED 3" ALONG THE FABRIC DOWN THE STAKE.
6. AT THE END OF A RUN OF SILT FENCE ALONG A CONTOUR, THE SILT FENCE SHOULD BE TURNED PERPENDICULAR TO THE CONTOUR TO CREATE A "J-HOOK." THE "J-HOOK" EXTENDING PERPENDICULAR TO THE CONTOUR SHOULD BE OF SUFFICIENT LENGTH TO KEEP RUNOFF FROM FLOWING AROUND THE END OF THE SILT FENCE (TYPICALLY 10' - 20').
7. SILT FENCE SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

SILT FENCE 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 SILT FENCE SHALL BE REMOVED AS NEEDED TO MAINTAIN THE FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY 6".
5. REPAIR OR REPLACE SILT FENCE WHEN THERE ARE SIGNS OF WEAR, SUCH AS SAGGING, TEARING, OR COLLAPSE.
6. SILT FENCE IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION, OR IS REPLACED BY AN EQUIVALENT PERIMETER SEDIMENT CONTROL BMP.
7. WHEN SILT FENCE IS REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF AURORA, 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.

Description

A rock sock is constructed of gravel that has been wrapped by wire mesh or a geotextile to form an elongated cylindrical filter. Rock socks are typically used either as a perimeter control or as part of inlet protection. When placed at angles in the curb line, rock socks are typically referred to as curb socks. Rock socks are intended to trap sediment from stormwater runoff that flows onto roadways as a result of construction activities.



Photograph RS-1. Rock socks placed at regular intervals in a curb line can help reduce sediment loading to storm sewer inlets. Rock socks can also be used as perimeter controls.

Appropriate Uses

Rock socks can be used at the perimeter of a disturbed area to control localized sediment loading. A benefit of rock socks as opposed to other perimeter controls is that they do not have to be trenched or staked into the ground; therefore, they are often used on roadway construction projects where paved surfaces are present.

Use rock socks in inlet protection applications when the construction of a roadway is substantially complete and the roadway has been directly connected to a receiving storm system.

Design and Installation

When rock socks are used as perimeter controls, the maximum recommended tributary drainage area per 100 linear feet of rock socks is approximately 0.25 acres with disturbed slope length of up to 150 feet and a tributary slope gradient no steeper than 3:1. A rock sock design detail and notes are provided in Detail RS-1. Also see the Inlet Protection Fact Sheet for design and installation guidance when rock socks are used for inlet protection and in the curb line.

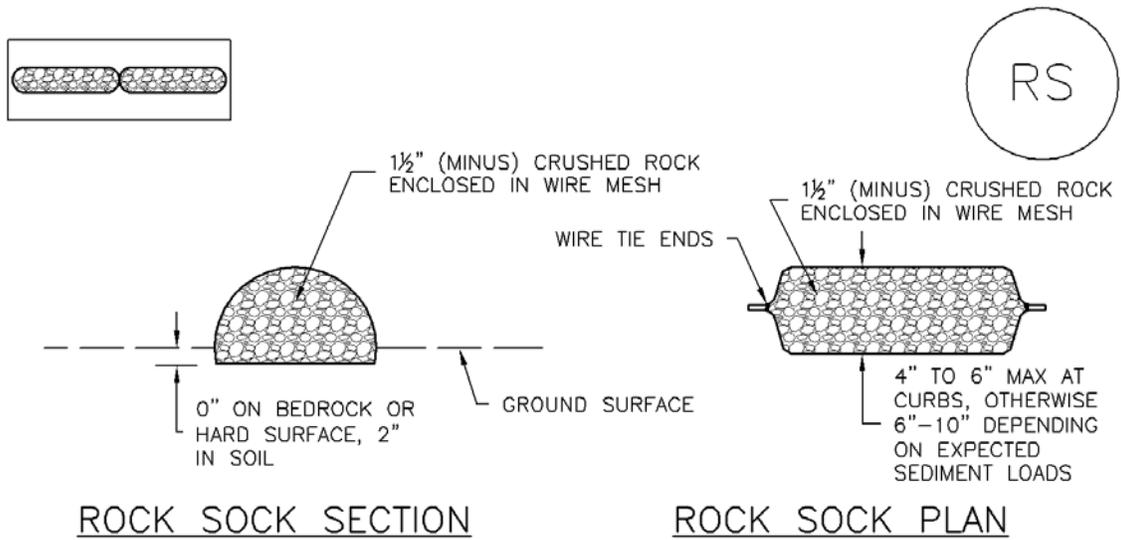
When placed in the gutter adjacent to a curb, rock socks should protrude no more than two feet from the curb in order for traffic to pass safely. If located in a high traffic area, place construction markers to alert drivers and street maintenance workers of their presence.

Maintenance and Removal

Rock socks are susceptible to displacement and breaking due to vehicle traffic. Inspect rock socks for damage and repair or replace as necessary. Remove sediment by sweeping or vacuuming as needed to maintain the functionality of the BMP, typically when sediment has accumulated behind the rock sock to one-half of the sock's height.

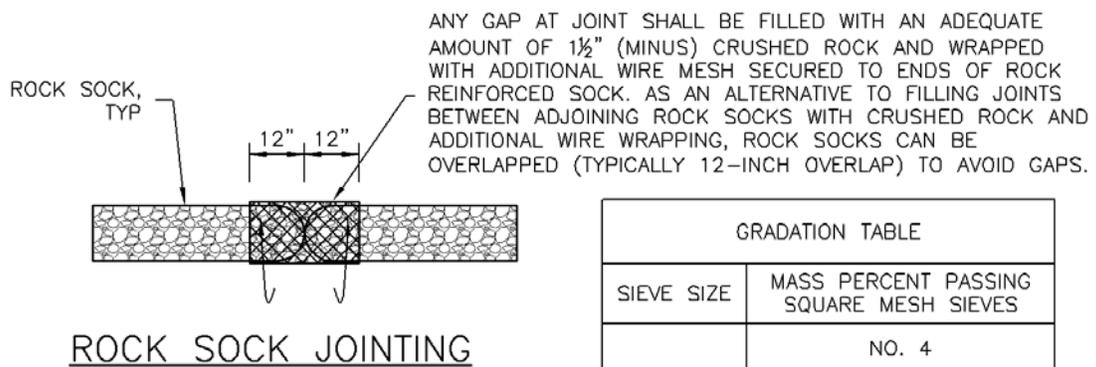
Once upstream stabilization is complete, rock socks and accumulated sediment should be removed and properly disposed.

Rock Sock	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No



ROCK SOCK SECTION

ROCK SOCK PLAN



ROCK SOCK JOINTING

GRADATION TABLE	
SIEVE SIZE	MASS PERCENT PASSING SQUARE MESH SIEVES
	NO. 4
2"	100
1½"	90 - 100
1"	20 - 55
¾"	0 - 15
⅜"	0 - 5

MATCHES SPECIFICATIONS FOR NO. 4 COARSE AGGREGATE FOR CONCRETE PER AASHTO M43. ALL ROCK SHALL BE FRACTURED FACE, ALL SIDES.

ROCK SOCK INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
-LOCATION(S) OF ROCK SOCKS.
2. CRUSHED ROCK SHALL BE 1½" (MINUS) IN SIZE WITH A FRACTURED FACE (ALL SIDES) AND SHALL COMPLY WITH GRADATION SHOWN ON THIS SHEET (1½" MINUS).
3. WIRE MESH SHALL BE FABRICATED OF 10 GAGE POULTRY MESH, OR EQUIVALENT, WITH A MAXIMUM OPENING OF ½", RECOMMENDED MINIMUM ROLL WIDTH OF 48"
4. WIRE MESH SHALL BE SECURED USING "HOG RINGS" OR WIRE TIES AT 6" CENTERS ALONG ALL JOINTS AND AT 2" CENTERS ON ENDS OF SOCKS.
5. SOME MUNICIPALITIES MAY ALLOW THE USE OF FILTER FABRIC AS AN ALTERNATIVE TO WIRE MESH FOR THE ROCK ENCLOSURE.

RS-1. ROCK SOCK PERIMETER CONTROL

ROCK SOCK 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. ROCK SOCKS SHALL BE REPLACED IF THEY BECOME HEAVILY SOILED, OR DAMAGED BEYOND REPAIR.
5. SEDIMENT ACCUMULATED UPSTREAM OF ROCK SOCKS SHALL BE REMOVED AS NEEDED TO MAINTAIN FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY $\frac{1}{2}$ OF THE HEIGHT OF THE ROCK SOCK.
6. ROCK SOCKS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.
7. WHEN ROCK SOCKS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF 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.

NOTE: THE DETAILS INCLUDED WITH THIS FACT SHEET SHOW COMMONLY USED, CONVENTIONAL METHODS OF ROCK SOCK INSTALLATION IN THE DENVER METROPOLITAN AREA. THERE ARE MANY OTHER SIMILAR PROPRIETARY PRODUCTS ON THE MARKET. UDFCD NEITHER NDORSES NOR DISCOURAGES USE OF PROPRIETARY PROTECTION PRODUCTS; HOWEVER, IN THE EVENT PROPRIETARY METHODS ARE USED, THE APPROPRIATE DETAIL FROM THE MANUFACTURER MUST BE INCLUDED IN THE SWMP AND THE BMP MUST BE INSTALLED AND MAINTAINED AS SHOWN IN THE MANUFACTURER'S DETAILS.

Description

Inlet protection consists of permeable barriers installed around an inlet to filter runoff and remove sediment prior to entering a storm drain inlet. Inlet protection can be constructed from rock socks, sediment control logs, silt fence, block and rock socks, or other materials approved by the local jurisdiction. Area inlets can also be protected by over-excavating around the inlet to form a sediment trap.



Photograph IP-1. Inlet protection for a curb opening inlet.

Appropriate Uses

Install protection at storm sewer inlets that are operable during construction. Consider the potential for tracked-out sediment or temporary stockpile areas to contribute sediment to inlets when determining which inlets must be protected. This may include inlets in the general proximity of the construction area, not limited to downgradient inlets. Inlet protection is not a stand-alone BMP and should be used in conjunction with other upgradient BMPs.

Design and Installation

To function effectively, inlet protection measures must be installed to ensure that flows do not bypass the inlet protection and enter the storm drain without treatment. However, designs must also enable the inlet to function without completely blocking flows into the inlet in a manner that causes localized flooding. When selecting the type of inlet protection, consider factors such as type of inlet (e.g., curb or area, sump or on-grade conditions), traffic, anticipated flows, ability to secure the BMP properly, safety and other site-specific conditions. For example, block and rock socks will be better suited to a curb and gutter along a roadway, as opposed to silt fence or sediment control logs, which cannot be properly secured in a curb and gutter setting, but are effective area inlet protection measures.

Several inlet protection designs are provided in the Design Details. Additionally, a variety of proprietary products are available for inlet protection that may be approved for use by local governments. If proprietary products are used, design details and installation procedures from the manufacturer must be followed. Regardless of the type of inlet protection selected, inlet protection is most effective when combined with other BMPs such as curb socks and check dams. Inlet protection is often the last barrier before runoff enters the storm sewer or receiving water.

Design details with notes are provided for these forms of inlet protection:

- IP-1. Block and Rock Sock Inlet Protection for Sump or On-grade Inlets
- IP-2. Curb (Rock) Socks Upstream of Inlet Protection, On-grade Inlets

Inlet Protection (various forms)	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No

IP-3. Rock Sock Inlet Protection for Sump/Area Inlet

IP-4. Silt Fence Inlet Protection for Sump/Area Inlet

IP-5. Over-excavation Inlet Protection

IP-6. Straw Bale Inlet Protection for Sump/Area Inlet

CIP-1. Culvert Inlet Protection

Proprietary inlet protection devices should be installed in accordance with manufacturer specifications.

More information is provided below on selecting inlet protection for sump and on-grade locations.

Inlets Located in a Sump

When applying inlet protection in sump conditions, it is important that the inlet continue to function during larger runoff events. For curb inlets, the maximum height of the protective barrier should be lower than the top of the curb opening to allow overflow into the inlet during larger storms without excessive localized flooding. If the inlet protection height is greater than the curb elevation, particularly if the filter becomes clogged with sediment, runoff will not enter the inlet and may bypass it, possibly causing localized flooding, public safety issues, and downstream erosion and damage from bypassed flows.

Area inlets located in a sump setting can be protected through the use of silt fence, concrete block and rock socks (on paved surfaces), sediment control logs/straw wattles embedded in the adjacent soil and stacked around the area inlet (on pervious surfaces), over-excavation around the inlet, and proprietary products providing equivalent functions.

Inlets Located on a Slope

For curb and gutter inlets on paved sloping streets, block and rock sock inlet protection is recommended in conjunction with curb socks in the gutter leading to the inlet. For inlets located along unpaved roads, also see the Check Dam Fact Sheet.

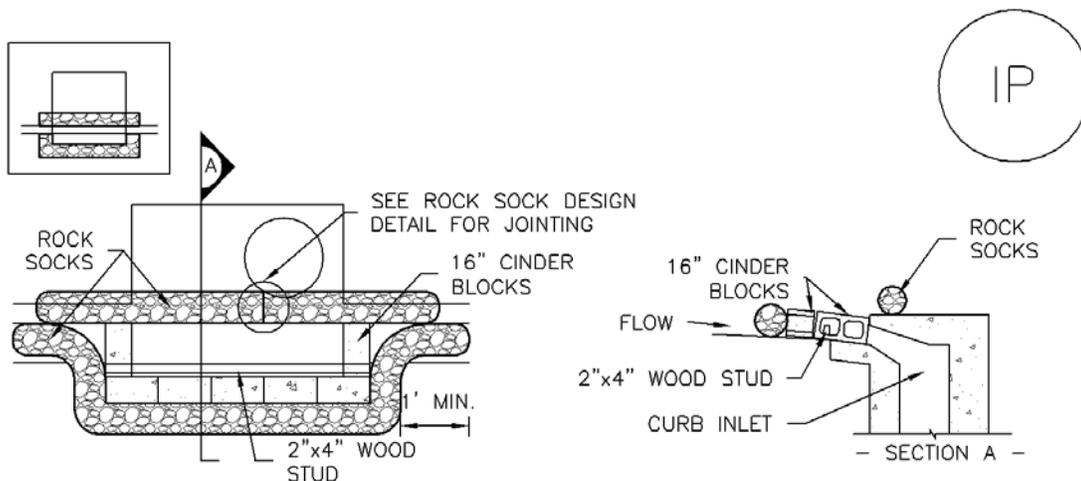
Maintenance and Removal

Inspect inlet protection frequently. Inspection and maintenance guidance includes:

- Inspect for tears that can result in sediment directly entering the inlet, as well as result in the contents of the BMP (e.g., gravel) washing into the inlet.
- Check for improper installation resulting in untreated flows bypassing the BMP and directly entering the inlet or bypassing to an unprotected downstream inlet. For example, silt fence that has not been properly trenched around the inlet can result in flows under the silt fence and directly into the inlet.
- Look for displaced BMPs that are no longer protecting the inlet. Displacement may occur following larger storm events that wash away or reposition the inlet protection. Traffic or equipment may also crush or displace the BMP.
- Monitor sediment accumulation upgradient of the inlet protection.

- Remove sediment accumulation from the area upstream of the inlet protection, as needed to maintain BMP effectiveness, typically when it reaches no more than half the storage capacity of the inlet protection. For silt fence, remove sediment when it accumulates to a depth of no more than 6 inches. Remove sediment accumulation from the area upstream of the inlet protection as needed to maintain the functionality of the BMP.
- Proprietary inlet protection devices should be inspected and maintained in accordance with manufacturer specifications. If proprietary inlet insert devices are used, sediment should be removed in a timely manner to prevent devices from breaking and spilling sediment into the storm drain.

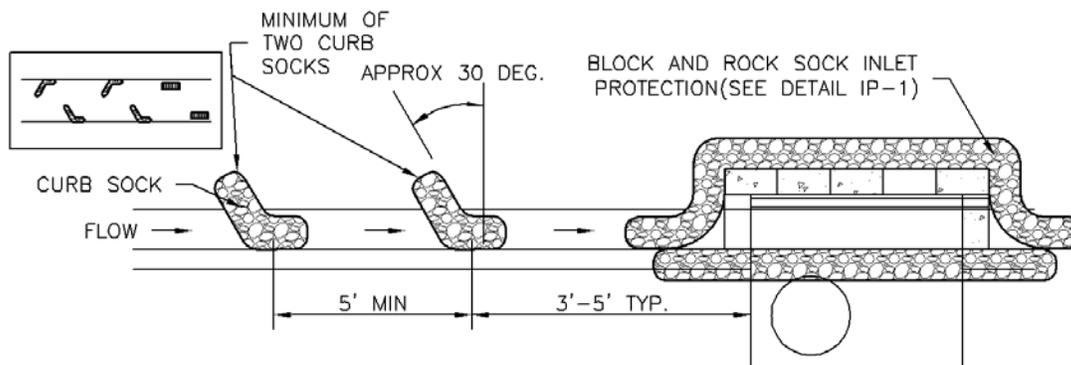
Inlet protection must be removed and properly disposed of when the drainage area for the inlet has reached final stabilization.



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

BLOCK AND CURB SOCK INLET PROTECTION INSTALLATION NOTES

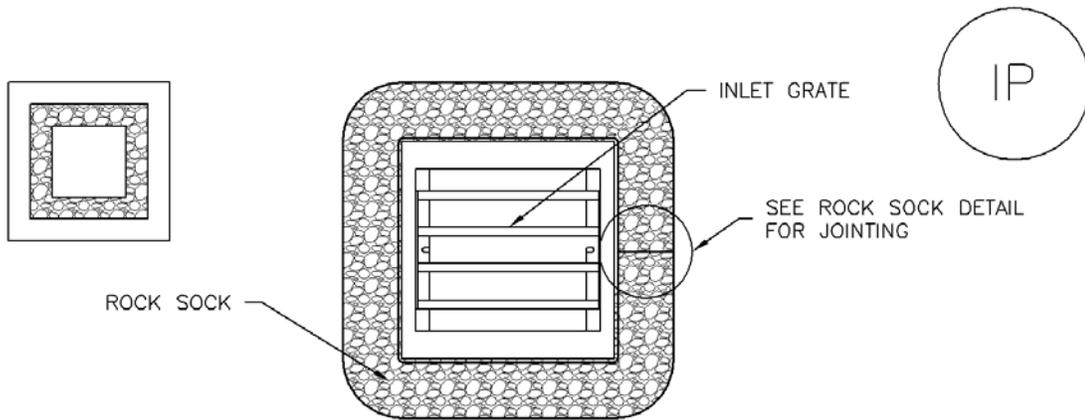
1. SEE ROCK SOCK DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.
2. CONCRETE "CINDER" BLOCKS SHALL BE LAID ON THEIR SIDES AROUND THE INLET IN A SINGLE ROW, ABUTTING ONE ANOTHER WITH THE OPEN END FACING AWAY FROM THE CURB.
3. GRAVEL BAGS SHALL BE PLACED AROUND CONCRETE BLOCKS, CLOSELY ABUTTING ONE ANOTHER 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

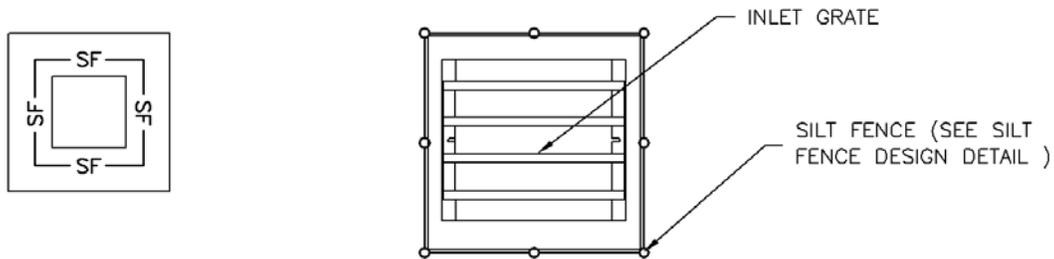
1. SEE ROCK SOCK DESIGN DETAIL INSTALLATION REQUIREMENTS.
2. PLACEMENT OF THE SOCK SHALL BE APPROXIMATELY 30 DEGREES FROM PERPENDICULAR IN THE OPPOSITE DIRECTION OF FLOW.
3. SOCKS ARE TO BE FLUSH WITH THE CURB AND SPACED A MINIMUM OF 5 FEET APART.
4. AT LEAST TWO CURB SOCKS IN SERIES ARE REQUIRED UPSTREAM OF ON-GRADE INLETS.



IP-3. ROCK SOCK SUMP/AREA INLET PROTECTION

ROCK SOCK SUMP/AREA INLET PROTECTION INSTALLATION NOTES

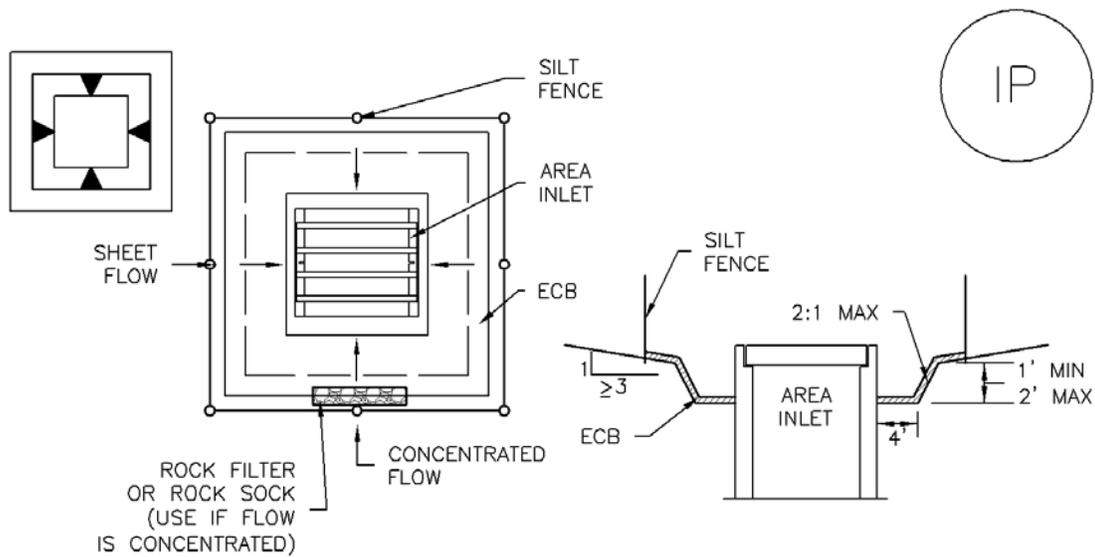
1. SEE ROCK SOCK DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.
2. STRAW WATTLES/SEDIMENT CONTROL LOGS MAY BE USED IN PLACE OF ROCK SOCKS FOR INLETS IN PERVIOUS AREAS. INSTALL PER SEDIMENT CONTROL LOG DETAIL.



IP-4. SILT FENCE FOR SUMP INLET PROTECTION

SILT FENCE INLET PROTECTION INSTALLATION NOTES

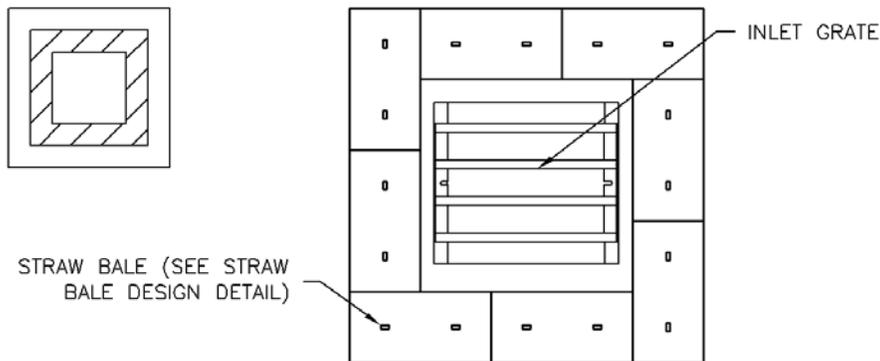
1. SEE SILT FENCE DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.
2. POSTS SHALL BE PLACED AT EACH CORNER OF THE INLET AND AROUND THE EDGES AT A MAXIMUM SPACING OF 3 FEET.
3. STRAW WATTLES/SEDIMENT CONTROL LOGS MAY BE USED IN PLACE OF SILT FENCE FOR INLETS IN PERVIOUS AREAS. INSTALL PER SEDIMENT CONTROL LOG DETAIL.



IP-5. OVEREXCAVATION INLET PROTECTION

OVEREXCAVATION INLET PROTECTION INSTALLATION NOTES

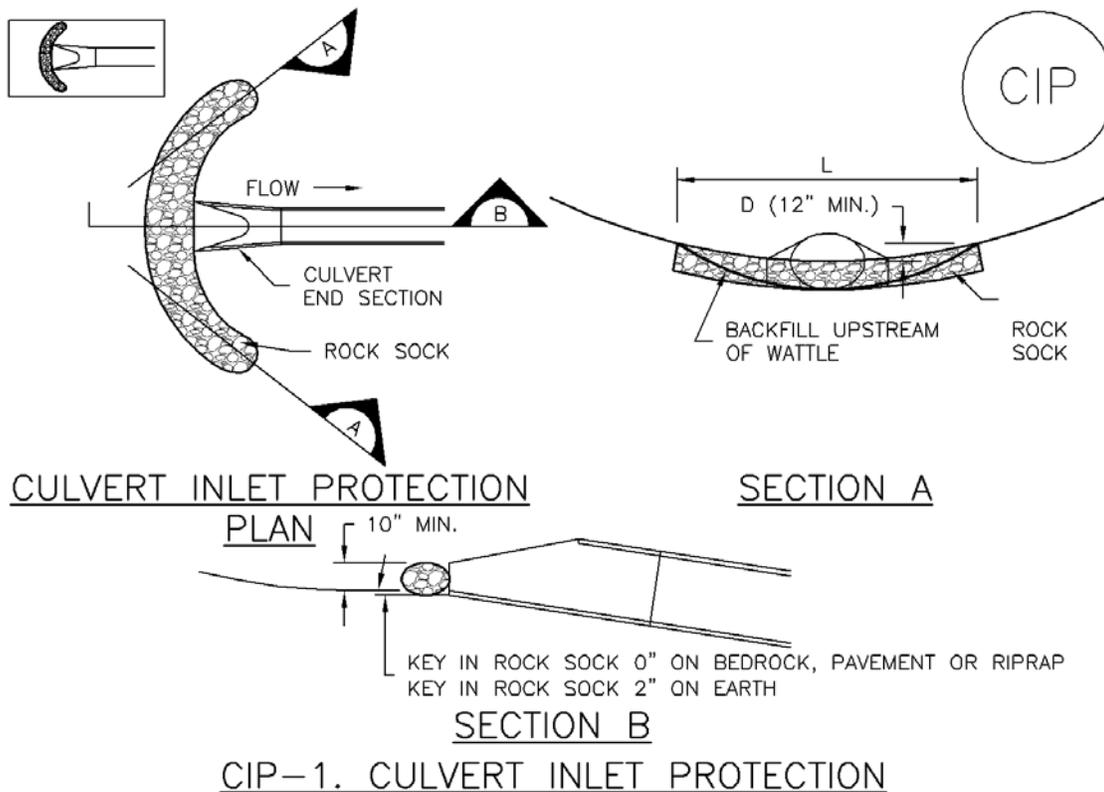
1. THIS FORM OF INLET PROTECTION IS PRIMARILY APPLICABLE FOR SITES THAT HAVE NOT YET REACHED FINAL GRADE AND SHOULD BE USED ONLY FOR INLETS WITH A RELATIVELY SMALL CONTRIBUTING DRAINAGE AREA.
2. WHEN USING FOR CONCENTRATED FLOWS, SHAPE BASIN IN 2:1 RATIO WITH LENGTH ORIENTED TOWARDS DIRECTION OF FLOW.
3. SEDIMENT MUST BE PERIODICALLY REMOVED FROM THE OVEREXCAVATED AREA.



IP-6. STRAW BALE FOR SUMP INLET PROTECTION

STRAW BALE BARRIER INLET PROTECTION INSTALLATION NOTES

1. SEE STRAW BALE DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.
2. BALES SHALL BE PLACED IN A SINGLE ROW AROUND THE INLET WITH ENDS OF BALES TIGHTLY ABUTTING ONE ANOTHER.



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 1/2 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.

GENERAL INLET PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
 - LOCATION OF INLET PROTECTION.
 - TYPE OF INLET PROTECTION (IP.1, IP.2, IP.3, IP.4, IP.5, IP.6)
2. INLET PROTECTION SHALL BE INSTALLED PROMPTLY AFTER INLET CONSTRUCTION OR PAVING IS COMPLETE (TYPICALLY WITHIN 48 HOURS). IF A RAINFALL/RUNOFF EVENT IS FORECAST, INSTALL INLET PROTECTION PRIOR TO ONSET OF EVENT.
3. 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.

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 INLET PROTECTION SHALL BE REMOVED AS NECESSARY TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN STORAGE VOLUME REACHES 50% OF CAPACITY, A DEPTH OF 6" WHEN SILT FENCE IS USED, OR ¼ OF THE HEIGHT FOR STRAW BALES.
5. INLET PROTECTION IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS PERMANENTLY STABILIZED, UNLESS THE LOCAL JURISDICTION APPROVES EARLIER REMOVAL OF INLET PROTECTION IN STREETS.
6. WHEN INLET PROTECTION AT AREA INLETS IS REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOP SOIL, SEEDED AND MULCHED, OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF 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.

NOTE: THE DETAILS INCLUDED WITH THIS FACT SHEET SHOW COMMONLY USED, CONVENTIONAL METHODS OF INLET PROTECTION IN THE DENVER METROPOLITAN AREA. THERE ARE MANY PROPRIETARY INLET PROTECTION METHODS ON THE MARKET. UDFCD NEITHER ENDORSES NOR DISCOURAGES USE OF PROPRIETARY INLET PROTECTION; HOWEVER, IN THE EVENT PROPRIETARY METHODS ARE USED, THE APPROPRIATE DETAIL FROM THE MANUFACTURER MUST BE INCLUDED IN THE SWMP AND THE BMP MUST BE INSTALLED AND MAINTAINED AS SHOWN IN THE MANUFACTURER'S DETAILS.

NOTE: SOME MUNICIPALITIES DISCOURAGE OR PROHIBIT THE USE OF STRAW BALES FOR INLET PROTECTION. CHECK WITH LOCAL JURISDICTION TO DETERMINE IF STRAW BALE INLET PROTECTION IS ACCEPTABLE.

Description

A sediment basin is a temporary pond built on a construction site to capture eroded or disturbed soil transported in storm runoff prior to discharge from the site. Sediment basins are designed to capture site runoff and slowly release it to allow time for settling of sediment prior to discharge. Sediment basins are often constructed in locations that will later be modified to serve as post-construction stormwater basins.



Photograph SB-1. Sediment basin at the toe of a slope. Photo courtesy of WWE.

Appropriate Uses

Most large construction sites (typically greater than 2 acres) will require one or more sediment basins for effective management of construction site runoff. On linear construction projects, sediment basins may be impractical; instead, sediment traps or other combinations of BMPs may be more appropriate.

Sediment basins should not be used as stand-alone sediment controls. Erosion and other sediment controls should also be implemented upstream.

When feasible, the sediment basin should be installed in the same location where a permanent post-construction detention pond will be located.

Design and Installation

The design procedure for a sediment basin includes these steps:

- **Basin Storage Volume:** Provide a storage volume of at least 3,600 cubic feet per acre of drainage area. To the extent practical, undisturbed and/or off-site areas should be diverted around sediment basins to prevent “clean” runoff from mixing with runoff from disturbed areas. For undisturbed areas (both on-site and off-site) that cannot be diverted around the sediment basin, provide a minimum of 500 ft³/acre of storage for undeveloped (but stable) off-site areas in addition to the 3,600 ft³/acre for disturbed areas. For stable, developed areas that cannot be diverted around the sediment basin, storage volume requirements are summarized in Table SB-1.
- **Basin Geometry:** Design basin with a minimum length-to-width ratio of 2:1 (L:W). If this cannot be achieved because of site space constraints, baffling may be required to extend the effective distance between the inflow point(s) and the outlet to minimize short-circuiting.
- **Dam Embankment:** It is recommended that embankment slopes be 4:1 (H:V) or flatter and no steeper than 3:1 (H:V) in any location.

Sediment Basins	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No

- **Inflow Structure:** For concentrated flow entering the basin, provide energy dissipation at the point of inflow.

Table SB-1. Additional Volume Requirements for Undisturbed and Developed Tributary Areas Draining through Sediment Basins

Imperviousness (%)	Additional Storage Volume (ft ³) Per Acre of Tributary Area
Undeveloped	500
10	800
20	1230
30	1600
40	2030
50	2470
60	2980
70	3560
80	4360
90	5300
100	6460

- **Outlet Works:** The outlet pipe shall extend through the embankment at a minimum slope of 0.5 percent. Outlet works can be designed using one of the following approaches:
 - **Riser Pipe (Simplified Detail):** Detail SB-1 provides a simplified design for basins treating no more than 15 acres.
 - **Orifice Plate or Riser Pipe:** Follow the design criteria for Full Spectrum Detention outlets in the EDB Fact Sheet provided in Chapter 4 of this manual for sizing of outlet perforations with an emptying time of approximately 72 hours. In lieu of the trash rack, pack uniformly sized 1½ - to 2-inch gravel in front of the plate or surrounding the riser pipe. This gravel will need to be cleaned out frequently during the construction period as sediment accumulates within it. The gravel pack will need to be removed and disposed of following construction to reclaim the basin for use as a permanent detention facility. If the basin will be used as a permanent extended detention basin for the site, a trash rack will need to be installed once contributing drainage areas have been stabilized and the gravel pack and accumulated sediment have been removed.
 - **Floating Skimmer:** If a floating skimmer is used, install it using manufacturer’s recommendations. Illustration SB-1 provides an illustration of a Faircloth Skimmer Floating Outlet™, one of the more commonly used floating skimmer outlets. A skimmer should be designed to release the design volume in no less than 48 hours. The use of a floating skimmer outlet can increase the sediment capture efficiency of a basin significantly. A floating outlet continually decants cleanest water off the surface of the pond and releases cleaner water than would discharge from a perforated riser pipe or plate.

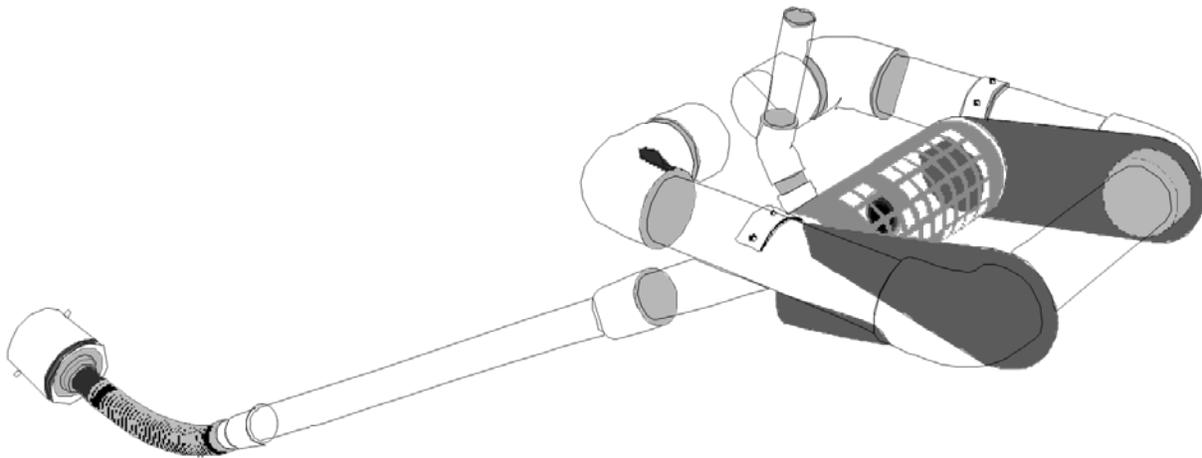


Illustration SB-1. Outlet structure for a temporary sediment basin - Faircloth Skimmer Floating Outlet. Illustration courtesy of J. W. Faircloth & Sons, Inc., FairclothSkimmer.com.

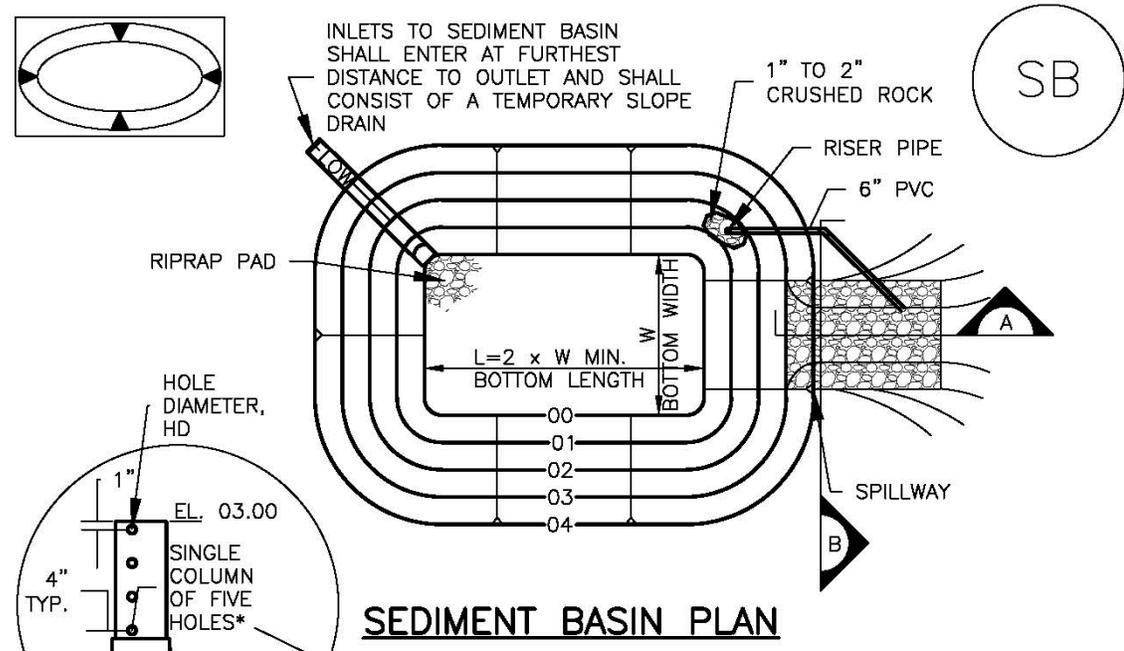
- **Outlet Protection and Spillway:** Consider all flow paths for runoff leaving the basin, including protection at the typical point of discharge as well as overtopping.
 - **Outlet Protection:** Outlet protection should be provided where the velocity of flow will exceed the maximum permissible velocity of the material of the waterway into which discharge occurs. This may require the use of a riprap apron at the outlet location and/or other measures to keep the waterway from eroding.
 - **Emergency Spillway:** Provide a stabilized emergency overflow spillway for rainstorms that exceed the capacity of the sediment basin volume and its outlet. Protect basin embankments from erosion and overtopping. If the sediment basin will be converted to a permanent detention basin, design and construct the emergency spillway(s) as required for the permanent facility. If the sediment basin will not become a permanent detention basin, it may be possible to substitute a heavy polyvinyl membrane or properly bedded rock cover to line the spillway and downstream embankment, depending on the height, slope, and width of the embankments.

Maintenance and Removal

Maintenance activities include the following:

- Dredge sediment from the basin, as needed to maintain BMP effectiveness, typically when the design storage volume is no more than one-third filled with sediment.
- Inspect the sediment basin embankments for stability and seepage.
- Inspect the inlet and outlet of the basin, repair damage, and remove debris. Remove, clean and replace the gravel around the outlet on a regular basis to remove the accumulated sediment within it and keep the outlet functioning.
- Be aware that removal of a sediment basin may require dewatering and associated permit requirements.
- Do not remove a sediment basin until the upstream area has been stabilized with vegetation.

Final disposition of the sediment basin depends on whether the basin will be converted to a permanent post-construction stormwater basin or whether the basin area will be returned to grade. For basins being converted to permanent detention basins, remove accumulated sediment and reconfigure the basin and outlet to meet the requirements of the final design for the detention facility. If the sediment basin is not to be used as a permanent detention facility, fill the excavated area with soil and stabilize with vegetation.



*EXCEPT WHERE THE HOLES EXCEED 1" DIAMETER, THEN UP TO TWO COLUMNS OF SAME SIZED HOLES MAY BE USED

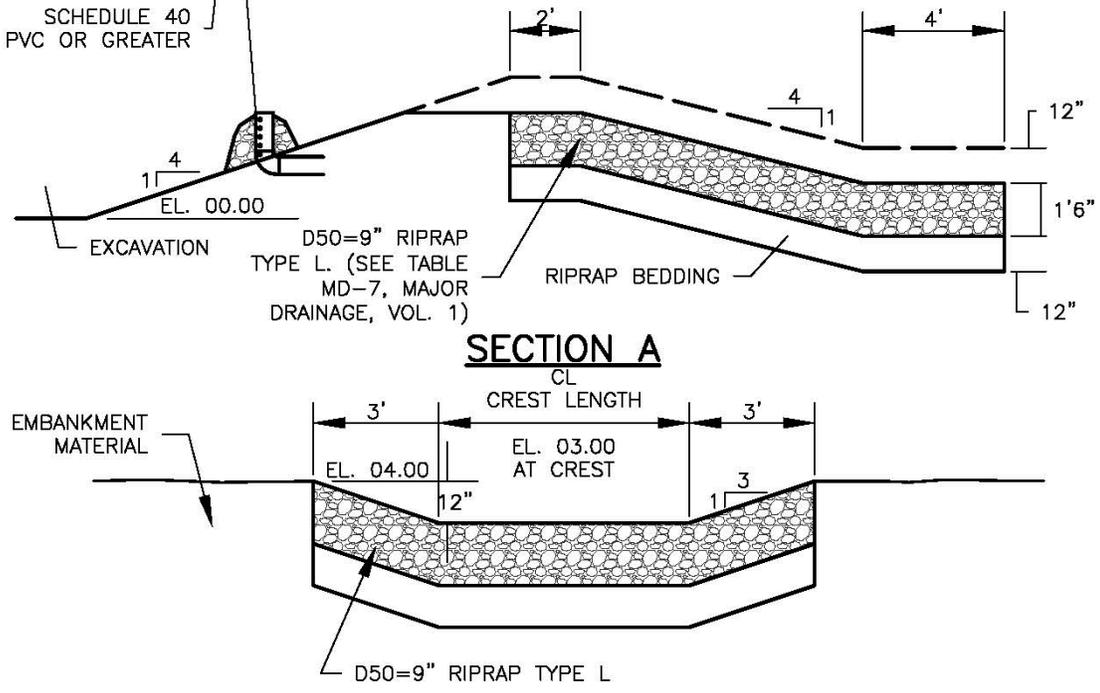


TABLE SB-1. SIZING INFORMATION FOR STANDARD SEDIMENT BASIN			
Upstream Drainage Area (rounded to nearest acre), (ac)	Basin Bottom Width (W), (ft)	Spillway Crest Length (CL), (ft)	Hole Diameter (HD), (in)
1	12 1/2	2	9/32
2	21	3	13/16
3	28	5	1/2
4	33 1/2	6	9/16
5	38 1/2	8	2 1/32
6	43	9	2 1/32
7	47 1/4	11	2 5/32
8	51	12	2 7/32
9	55	13	7/8
10	58 1/4	15	1 5/16
11	61	16	3 1/32
12	64	18	1
13	67 1/2	19	1 1/16
14	70 1/2	21	1 1/8
15	73 1/4	22	1 3/16

SEDIMENT BASIN INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
 - LOCATION OF SEDIMENT BASIN.
 - TYPE OF BASIN (STANDARD BASIN OR NONSTANDARD BASIN).
 - FOR STANDARD BASIN, BOTTOM WIDTH W, CREST LENGTH CL, AND HOLE DIAMETER, HD.
 - FOR NONSTANDARD BASIN, SEE CONSTRUCTION DRAWINGS FOR DESIGN OF BASIN INCLUDING RISER HEIGHT H, NUMBER OF COLUMNS N, HOLE DIAMETER HD AND PIPE DIAMETER D.
2. FOR STANDARD BASIN, BOTTOM DIMENSION MAY BE MODIFIED AS LONG AS BOTTOM AREA IS NOT REDUCED.
3. SEDIMENT BASINS SHALL BE INSTALLED PRIOR TO ANY OTHER LAND-DISTURBING ACTIVITY THAT RELIES ON ON BASINS AS AS A STORMWATER CONTROL.
4. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL FREE OF DEBRIS, ORGANIC MATERIAL, AND ROCKS OR CONCRETE GREATER THAN 3 INCHES AND SHALL HAVE A MINIMUM OF 15 PERCENT BY WEIGHT PASSING THE NO. 200 SIEVE.
5. EMBANKMENT MATERIAL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.
6. PIPE SCH 40 OR GREATER SHALL BE USED.
7. THE DETAILS SHOWN ON THESE SHEETS PERTAIN TO STANDARD SEDIMENT BASIN(S) FOR DRAINAGE AREAS LESS THAN 15 ACRES. SEE CONSTRUCTION DRAWINGS FOR EMBANKMENT, STORAGE VOLUME, SPILLWAY, OUTLET, AND OUTLET PROTECTION DETAILS FOR ANY SEDIMENT BASIN(S) THAT HAVE BEEN INDIVIDUALLY DESIGNED FOR DRAINAGE AREAS LARGER THAN 15 ACRES.

SEDIMENT BASIN 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 IN BASIN SHALL BE REMOVED AS NEEDED TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN SEDIMENT DEPTH REACHES ONE FOOT (I.E., TWO FEET BELOW THE SPILLWAY CREST).
5. SEDIMENT BASINS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS ACCEPTED BY THE LOCAL JURISDICTION.
6. WHEN SEDIMENT BASINS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO)

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.

Description

A construction fence restricts site access to designated entrances and exits, delineates construction site boundaries, and keeps construction out of sensitive areas such as natural areas to be preserved as open space, wetlands and riparian areas.

Appropriate Uses

A construction fence can be used to delineate the site perimeter and locations within the site where access is restricted to protect natural resources such as wetlands, waterbodies, trees, and other natural areas of the site that should not be disturbed.



Photograph CF-1. A construction fence helps delineate areas where existing vegetation is being protected. Photo courtesy of Douglas County.

If natural resource protection is an objective, then the construction fencing should be used in combination with other perimeter control BMPs such as silt fence, sediment control logs or similar measures.

Design and Installation

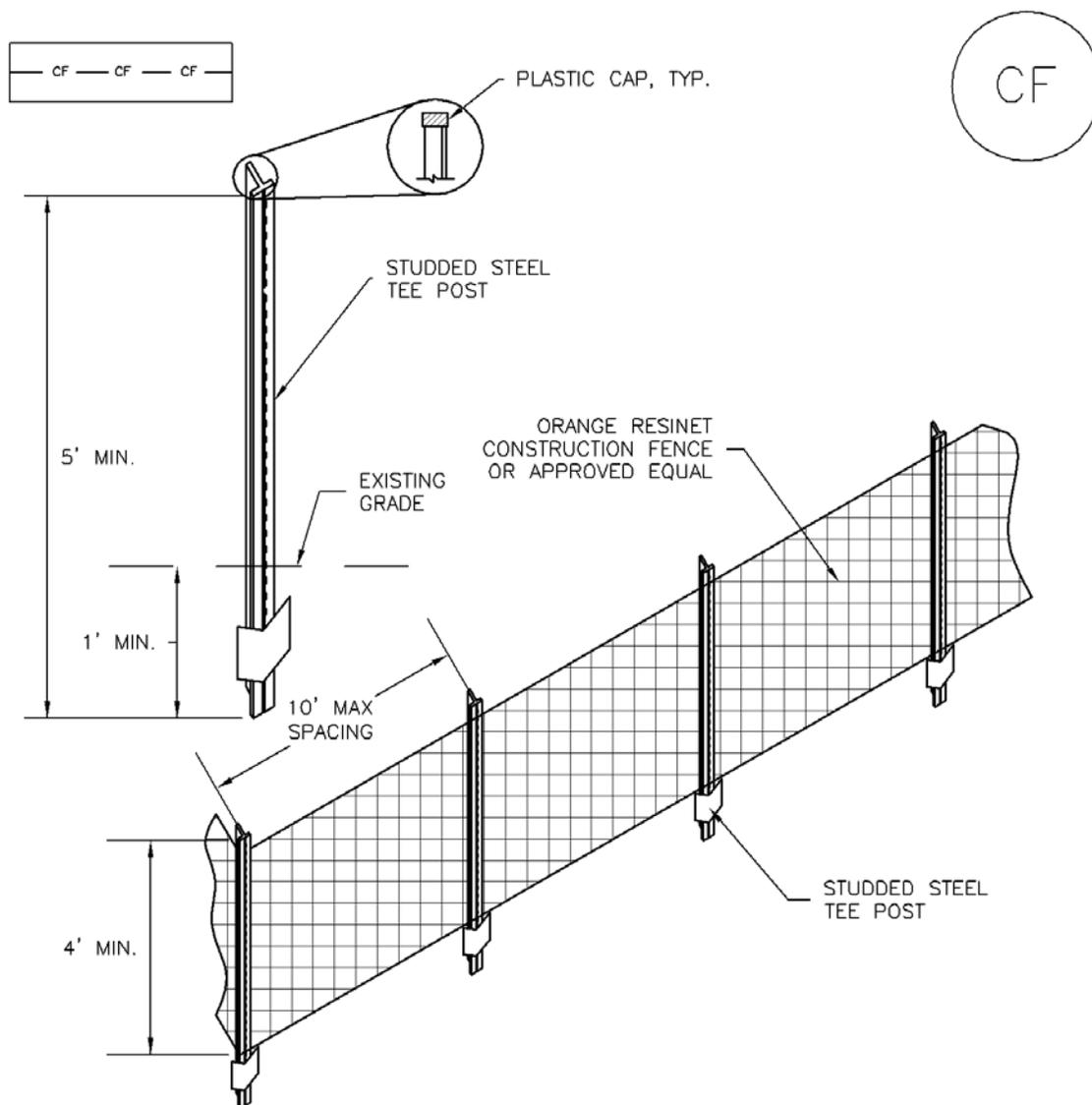
Construction fencing may be chain link or plastic mesh and should be installed following manufacturer’s recommendations. See Detail CF-1 for typical installations.

Do not place construction fencing in areas within work limits of machinery.

Maintenance and Removal

- Inspect fences for damage; repair or replace as necessary.
- Fencing should be tight and any areas with slumping or fallen posts should be reinstalled.
- Fencing should be removed once construction is complete.

Construction Fence	
Functions	
Erosion Control	No
Sediment Control	No
Site/Material Management	Yes



CF-1. PLASTIC MESH CONSTRUCTION FENCE

CONSTRUCTION FENCE INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
-LOCATION OF CONSTRUCTION FENCE.
2. CONSTRUCTION FENCE SHOWN SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.
3. CONSTRUCTION FENCE SHALL BE COMPOSED OF ORANGE, CONTRACTOR-GRADE MATERIAL THAT IS AT LEAST 4' HIGH. METAL POSTS SHOULD HAVE A PLASTIC CAP FOR SAFETY.
4. STUDED STEEL TEE POSTS SHALL BE UTILIZED TO SUPPORT THE CONSTRUCTION FENCE. MAXIMUM SPACING FOR STEEL TEE POSTS SHALL BE 10'.
5. CONSTRUCTION FENCE SHALL BE SECURELY FASTENED TO THE TOP, MIDDLE, AND BOTTOM OF EACH POST.

CONSTRUCTION FENCE 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. CONSTRUCTION FENCE SHALL BE REPAIRED OR REPLACED WHEN THERE ARE SIGNS OF DAMAGE SUCH AS RIPS OR SAGS. CONSTRUCTION FENCE IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.
5. WHEN CONSTRUCTION FENCES ARE REMOVED, ALL DISTURBED AREAS ASSOCIATED WITH THE INSTALLATION, MAINTENANCE, AND/OR REMOVAL OF THE FENCE SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED, OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

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.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD)

Description

Vehicle tracking controls provide stabilized construction site access where vehicles exit the site onto paved public roads. An effective vehicle tracking control helps remove sediment (mud or dirt) from vehicles, reducing tracking onto the paved surface.



Photograph VTC-1. A vehicle tracking control pad constructed with properly sized rock reduces off-site sediment tracking.

Appropriate Uses

Implement a stabilized construction entrance or vehicle tracking control where frequent heavy vehicle traffic exits the construction site onto a paved roadway. An effective vehicle tracking control is particularly important during the following conditions:

- Wet weather periods when mud is easily tracked off site.
- During dry weather periods where dust is a concern.
- When poorly drained, clayey soils are present on site.

Although wheel washes are not required in designs of vehicle tracking controls, they may be needed at particularly muddy sites.

Design and Installation

Construct the vehicle tracking control on a level surface. Where feasible, grade the tracking control towards the construction site to reduce off-site runoff. Place signage, as needed, to direct construction vehicles to the designated exit through the vehicle tracking control. There are several different types of stabilized construction entrances including:

VTC-1. Aggregate Vehicle Tracking Control. This is a coarse-aggregate surfaced pad underlain by a geotextile. This is the most common vehicle tracking control, and when properly maintained can be effective at removing sediment from vehicle tires.

VTC-2. Vehicle Tracking Control with Construction Mat or Turf Reinforcement Mat. This type of control may be appropriate for site access at very small construction sites with low traffic volume over vegetated areas. Although this application does not typically remove sediment from vehicles, it helps protect existing vegetation and provides a stabilized entrance.

Vehicle Tracking Control	
Functions	
Erosion Control	Moderate
Sediment Control	Yes
Site/Material Management	Yes

VTC-3. Stabilized Construction Entrance/Exit with Wheel Wash. This is an aggregate pad, similar to VTC-1, but includes equipment for tire washing. The wheel wash equipment may be as simple as hand-held power washing equipment to more advanced proprietary systems. When a wheel wash is provided, it is important to direct wash water to a sediment trap prior to discharge from the site.

Vehicle tracking controls are sometimes installed in combination with a sediment trap to treat runoff.

Maintenance and Removal

Inspect the area for degradation and replace aggregate or material used for a stabilized entrance/exit as needed. If the area becomes clogged and ponds water, remove and dispose of excess sediment or replace material with a fresh layer of aggregate as necessary.

With aggregate vehicle tracking controls, ensure rock and debris from this area do not enter the public right-of-way.

Remove sediment that is tracked onto the public right of way daily or more frequently as needed. Excess sediment in the roadway indicates that the stabilized construction entrance needs maintenance.

Ensure that drainage ditches at the entrance/exit area remain clear.

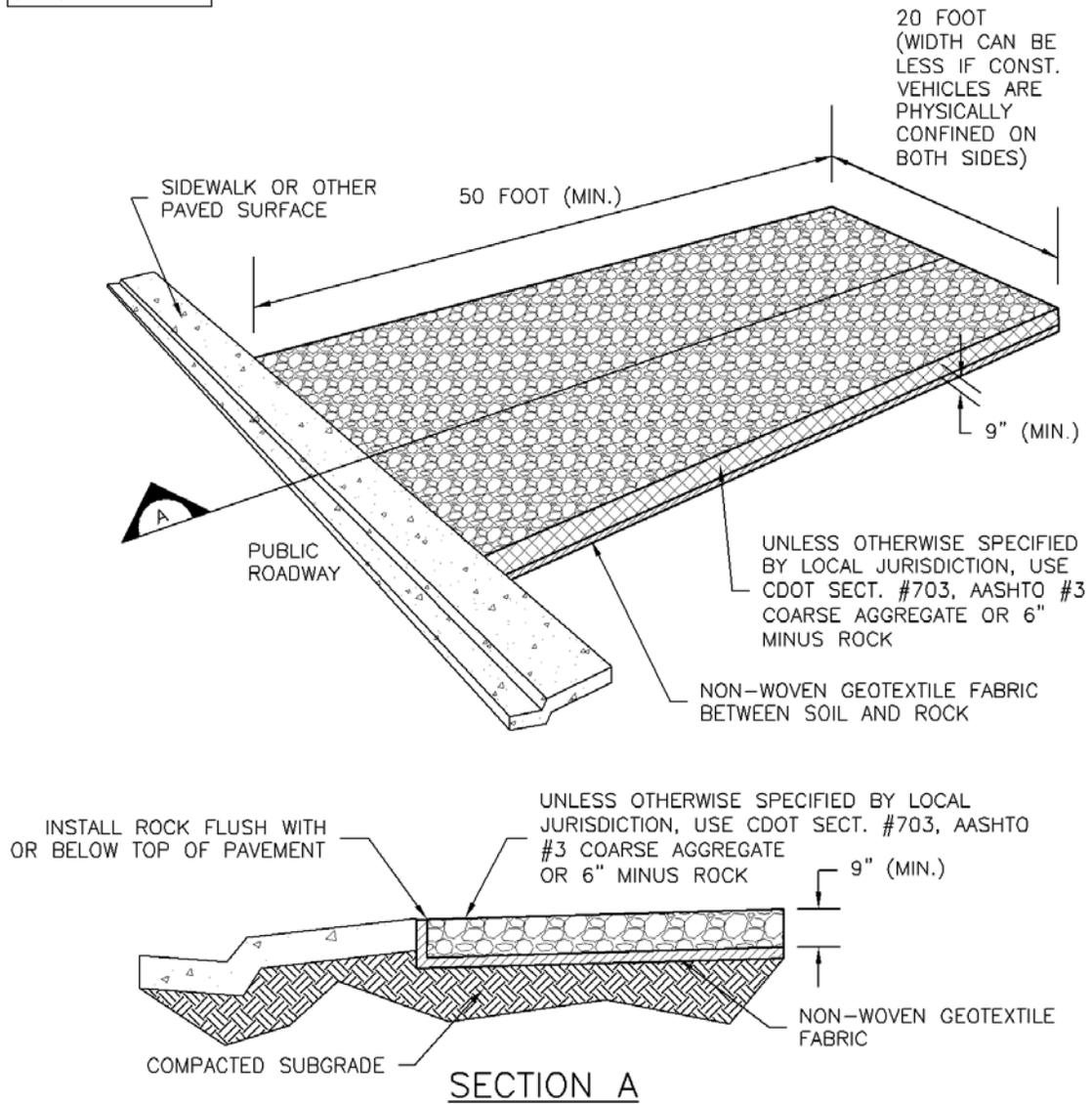
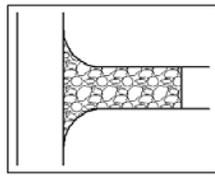
A stabilized entrance should be removed only when there is no longer the potential for vehicle tracking to occur. This is typically after the site has been stabilized.

When wheel wash equipment is used, be sure that the wash water is discharged to a sediment trap prior to discharge. Also inspect channels conveying the water from the wash area to the sediment trap and stabilize areas that may be eroding.

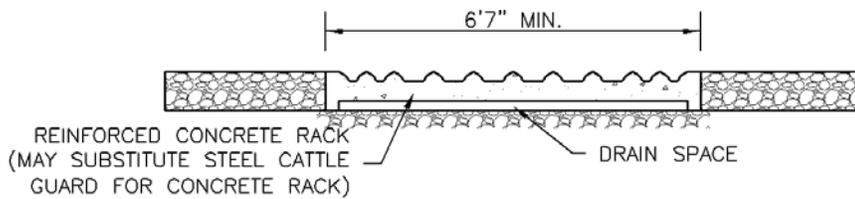
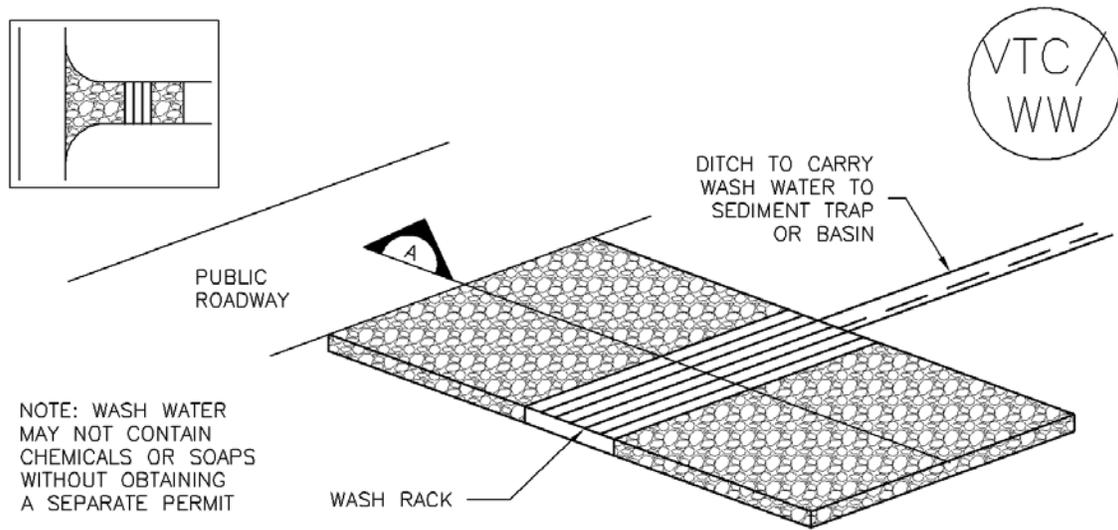
When a construction entrance/exit is removed, excess sediment from the aggregate should be removed and disposed of appropriately. The entrance should be promptly stabilized with a permanent surface following removal, typically by paving.



Photograph VTC-2. A vehicle tracking control pad with wheel wash facility. Photo courtesy of Tom Gore.

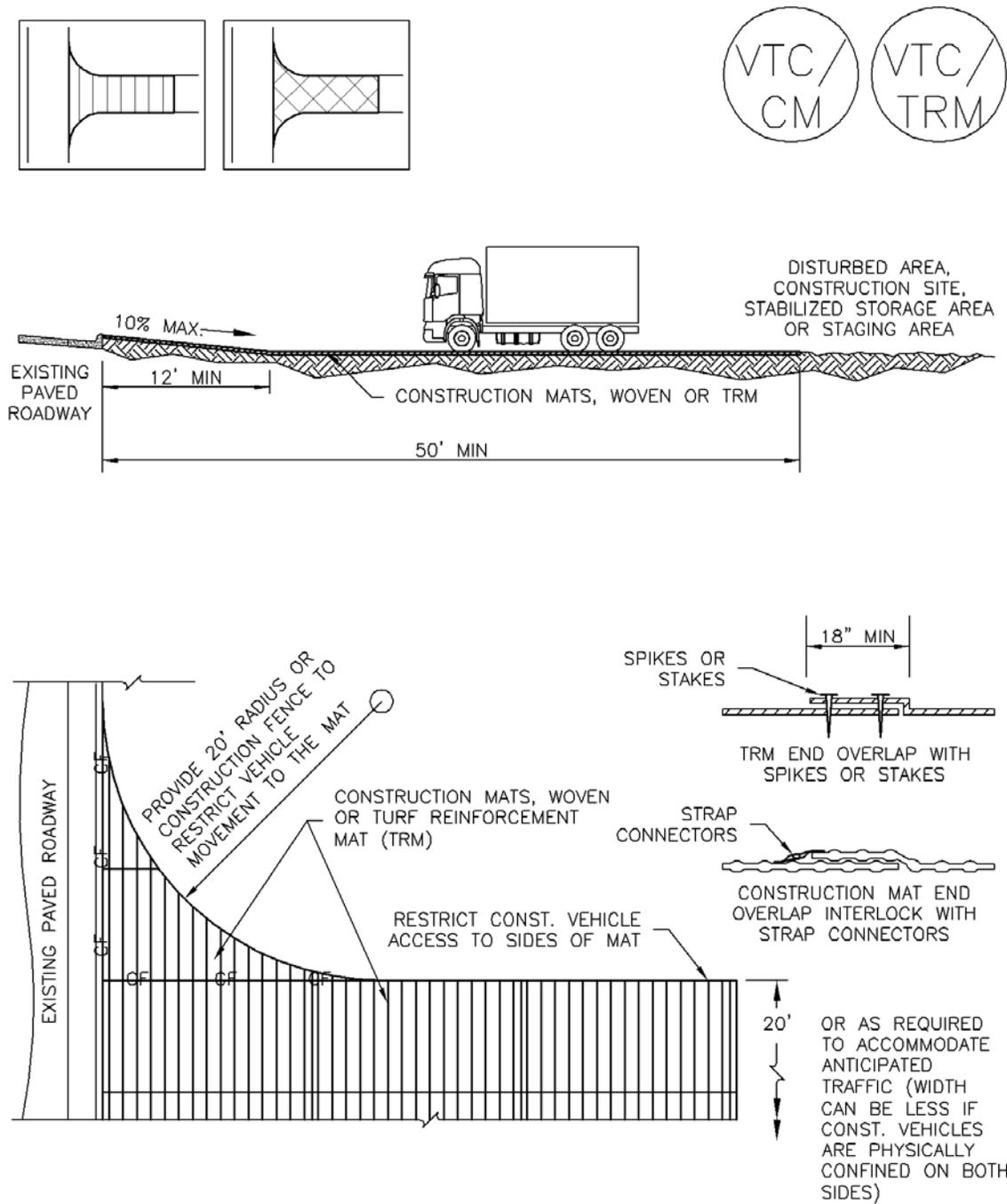


VTC-1. AGGREGATE VEHICLE TRACKING CONTROL



SECTION A

VTC-2. AGGREGATE VEHICLE TRACKING CONTROL WITH WASH RACK



VTC-3. VEHICLE TRACKING CONTROL W/ CONSTRUCTION MAT OR TURF REINFORCEMENT MAT (TRM)

STABILIZED CONSTRUCTION ENTRANCE/EXIT INSTALLATION NOTES

1. SEE PLAN VIEW FOR
 - LOCATION OF CONSTRUCTION ENTRANCE(S)/EXIT(S).
 - TYPE OF CONSTRUCTION ENTRANCE(S)/EXITS(S) (WITH/WITHOUT WHEEL WASH, CONSTRUCTION MAT OR TRM).
2. CONSTRUCTION MAT OR TRM STABILIZED CONSTRUCTION ENTRANCES ARE ONLY TO BE USED ON SHORT DURATION PROJECTS (TYPICALLY RANGING FROM A WEEK TO A MONTH) WHERE THERE WILL BE LIMITED VEHICULAR ACCESS.
3. A STABILIZED CONSTRUCTION ENTRANCE/EXIT SHALL BE LOCATED AT ALL ACCESS POINTS WHERE VEHICLES ACCESS THE CONSTRUCTION SITE FROM PAVED RIGHT-OF-WAYS.
4. STABILIZED CONSTRUCTION ENTRANCE/EXIT SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.
5. A NON-WOVEN GEOTEXTILE FABRIC SHALL BE PLACED UNDER THE STABILIZED CONSTRUCTION ENTRANCE/EXIT PRIOR TO THE PLACEMENT OF ROCK.
6. UNLESS OTHERWISE SPECIFIED BY LOCAL JURISDICTION, ROCK SHALL CONSIST OF DOT SECT. #703, AASHTO #3 COARSE AGGREGATE OR 6" (MINUS) ROCK.

STABILIZED CONSTRUCTION ENTRANCE/EXIT 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. ROCK SHALL BE REAPPLIED OR REGRADED AS NECESSARY TO THE STABILIZED ENTRANCE/EXIT TO MAINTAIN A CONSISTENT DEPTH.
5. SEDIMENT TRACKED ONTO PAVED ROADS IS TO BE REMOVED THROUGHOUT THE DAY AND AT THE END OF THE DAY BY SHOVELING OR SWEEPING. SEDIMENT MAY NOT BE WASHED DOWN STORM SEWER DRAINS.

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.

(DETAILS ADAPTED FROM CITY OF BROOMFIELD, COLORADO, NOT AVAILABLE IN AUTOCAD)

Description

A stabilized construction roadway is a temporary method to control sediment runoff, vehicle tracking, and dust from roads during construction activities.

Appropriate Uses

Use on high traffic construction roads to minimize dust and erosion.

Stabilized construction roadways are used instead of rough-cut street controls on roadways with frequent construction traffic.



Photograph SCR-1. Stabilized construction roadway.

Design and Installation

Stabilized construction roadways typically involve two key components: 1) stabilizing the road surface with an aggregate base course of 3-inch-diameter granular material and 2) stabilizing roadside ditches, if applicable. Early application of road base is generally suitable where a layer of coarse aggregate is specified for final road construction.

Maintenance and Removal

Apply additional gravel as necessary to ensure roadway integrity.

Inspect drainage ditches along the roadway for erosion and stabilize, as needed, through the use of check dams or rolled erosion control products.

Gravel may be removed once the road is ready to be paved. Prior to paving, the road should be inspected for grade changes and damage. Regrade and repair as necessary.

Stabilized Construction Roadway	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material Management	Yes

Description

A stabilized staging area is a clearly designated area where construction equipment and vehicles, stockpiles, waste bins, and other construction-related materials are stored. The contractor office trailer may also be located in this area. Depending on the size of the construction site, more than one staging area may be necessary.



Photograph SSA-1. Example of a staging area with a gravel surface to prevent mud tracking and reduce runoff. Photo courtesy of Douglas County.

Appropriate Uses

Most construction sites will require a staging area, which should be clearly designated in SWMP drawings. The layout of the staging area may vary depending on the type of construction activity. Staging areas located in roadways due to space constraints require special measures to avoid materials being washed into storm inlets.

Design and Installation

Stabilized staging areas should be completed prior to other construction activities beginning on the site. Major components of a stabilized staging area include:

- Appropriate space to contain storage and provide for loading/unloading operations, as well as parking if necessary.
- A stabilized surface, either paved or covered, with 3-inch diameter aggregate or larger.
- Perimeter controls such as silt fence, sediment control logs, or other measures.
- Construction fencing to prevent unauthorized access to construction materials.
- Provisions for Good Housekeeping practices related to materials storage and disposal, as described in the Good Housekeeping BMP Fact Sheet.
- A stabilized construction entrance/exit, as described in the Vehicle Tracking Control BMP Fact Sheet, to accommodate traffic associated with material delivery and waste disposal vehicles.

Over-sizing the stabilized staging area may result in disturbance of existing vegetation in excess of that required for the project. This increases costs, as well as requirements for long-term stabilization following the construction period. When designing the stabilized staging area, minimize the area of disturbance to the extent practical.

Stabilized Staging Area	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material	Yes

Minimizing Long-Term Stabilization Requirements

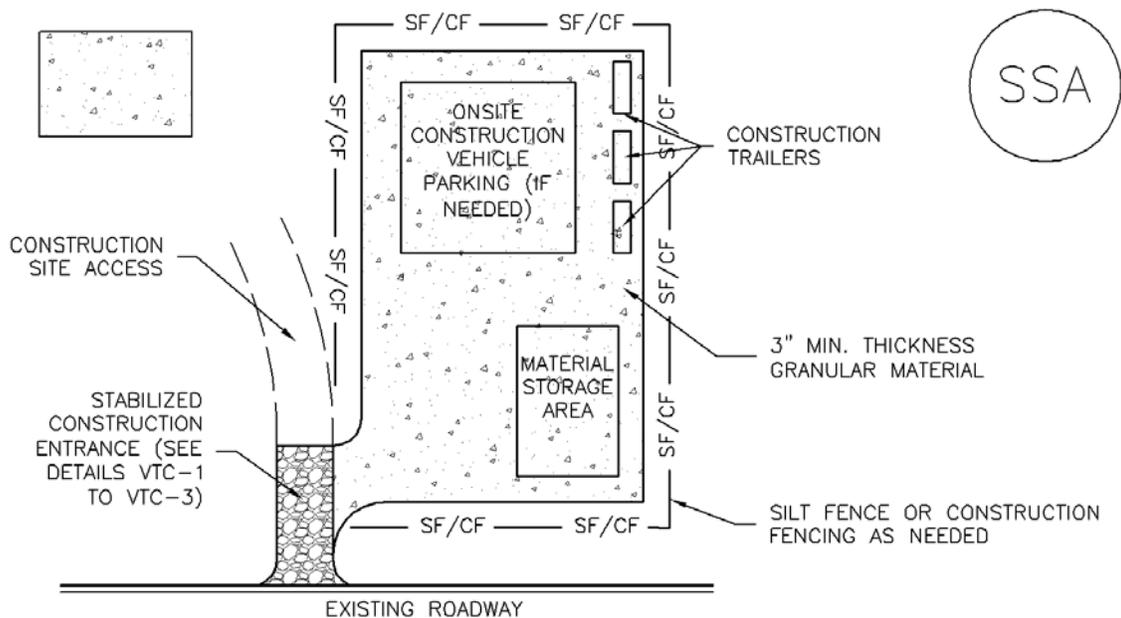
- Utilize off-site parking and restrict vehicle access to the site.
- Use construction mats in lieu of rock when staging is provided in an area that will not be disturbed otherwise.
- Consider use of a bermed contained area for materials and equipment that do not require a stabilized surface.
- Consider phasing of staging areas to avoid disturbance in an area that will not be otherwise disturbed.

See Detail SSA-1 for a typical stabilized staging area and SSA-2 for a stabilized staging area when materials staging in roadways is required.

Maintenance and Removal

Maintenance of stabilized staging areas includes maintaining a stable surface cover of gravel, repairing perimeter controls, and following good housekeeping practices.

When construction is complete, debris, unused stockpiles and materials should be recycled or properly disposed. In some cases, this will require disposal of contaminated soil from equipment leaks in an appropriate landfill. Staging areas should then be permanently stabilized with vegetation or other surface cover planned for the development.



SSA-1. STABILIZED STAGING AREA

STABILIZED STAGING AREA INSTALLATION NOTES

1. SEE PLAN VIEW FOR
 - LOCATION OF STAGING AREA(S).
 - CONTRACTOR MAY ADJUST LOCATION AND SIZE OF STAGING AREA WITH APPROVAL FROM THE LOCAL JURISDICTION.
2. STABILIZED STAGING AREA SHOULD BE APPROPRIATE FOR THE NEEDS OF THE SITE. OVERSIZING RESULTS IN A LARGER AREA TO STABILIZE FOLLOWING CONSTRUCTION.
3. STAGING AREA SHALL BE STABILIZED PRIOR TO OTHER OPERATIONS ON THE SITE.
4. THE STABILIZED STAGING AREA SHALL CONSIST OF A MINIMUM 3" THICK GRANULAR MATERIAL.
5. UNLESS OTHERWISE SPECIFIED BY LOCAL JURISDICTION, ROCK SHALL CONSIST OF DOT SECT. #703, AASHTO #3 COARSE AGGREGATE OR 6" (MINUS) ROCK.
6. ADDITIONAL PERIMETER BMPs MAY BE REQUIRED INCLUDING BUT NOT LIMITED TO SILT FENCE AND CONSTRUCTION FENCING.

STABILIZED STAGING AREA 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. ROCK SHALL BE REAPPLIED OR REGRADED AS NECESSARY IF RUTTING OCCURS OR UNDERLYING SUBGRADE BECOMES EXPOSED.

STABILIZED STAGING AREA MAINTENANCE NOTES

5. STABILIZED STAGING AREA SHALL BE ENLARGED IF NECESSARY TO CONTAIN PARKING, STORAGE, AND UNLOADING/LOADING OPERATIONS.

6. THE STABILIZED STAGING AREA SHALL BE REMOVED AT THE END OF CONSTRUCTION. THE GRANULAR MATERIAL SHALL BE REMOVED OR, IF APPROVED BY THE LOCAL JURISDICTION, USED ON SITE, AND THE AREA COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY LOCAL JURISDICTION.

NOTE: MANY MUNICIPALITIES PROHIBIT THE USE OF RECYCLED CONCRETE AS GRANULAR MATERIAL FOR STABILIZED STAGING AREAS DUE TO DIFFICULTIES WITH RE-ESTABLISHMENT OF VEGETATION IN AREAS WHERE RECYCLED CONCRETE WAS PLACED.

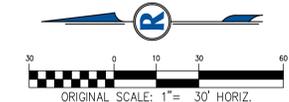
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(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO, NOT AVAILABLE IN AUTOCAD)

APPENDIX D

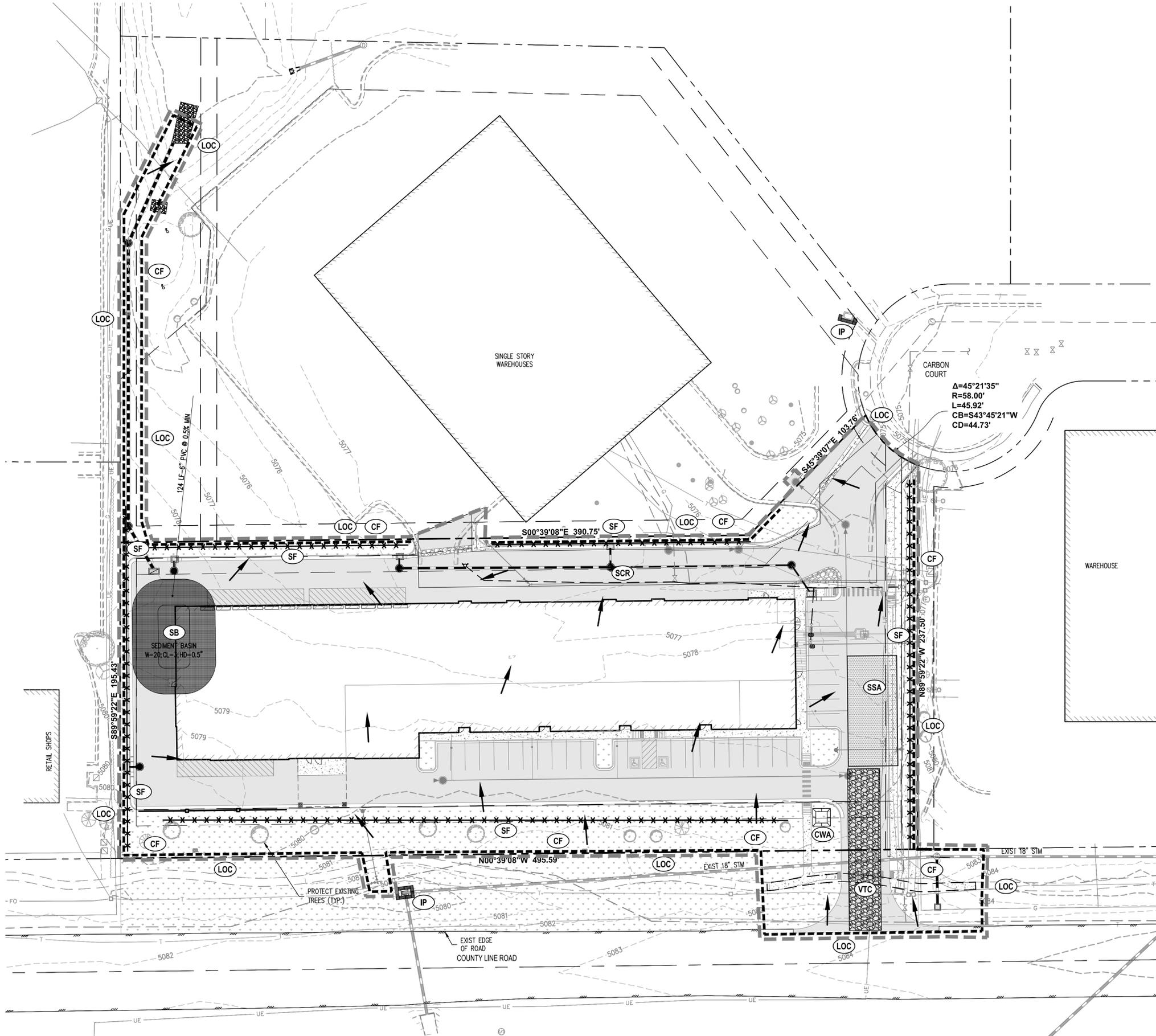
EROSION CONTROL PLANS

RICK ENGINEERING ASSUMES NO RESPONSIBILITY FOR UTILITY LOCATIONS. THE UTILITIES SHOWN ON THIS DRAWING HAVE BEEN PLOTTED FROM THE BEST AVAILABLE INFORMATION. IT IS, HOWEVER, THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION OF ALL UTILITIES PRIOR TO CONSTRUCTION.



BMP LEGEND

- EXISTING BOUNDARY LINE
- EXISTING SECTION LINE
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED STORM DRAIN
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- CONSTRUCTION FENCE
- CONCRETE WASHOUT AREA
- DIVERSION DITCH
- EROSION CONTROL BLANKET
- ROCK SOCK
- INLET PROTECTION
- LIMITS OF CONSTRUCTION
- PERMANENT SEEDING
- SEDIMENT BASIN
- STABILIZED CONST ROADWAY, 9" CLASS 6 GRAVEL ON COMPACTED SUBGRADE
- SEDIMENT CONTROL LOG
- SILT FENCE
- SEEDING AND MULCHING
- SURFACE ROUGHENING
- STABILIZED STAGING AREA
- VEHICLE TRACKING CONTROL



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REVIEWED FOR COMPLIANCE BY:

SIGNATURE	DATE
SIGNATURE	DATE

REVISIONS:

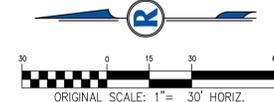
NO.	DESCRIPTION	DATE:
1	2nd AGENCY REVIEW	4/19/19

SCALE: 1"=30'
 DATE: 04/19/2019
 DRAWN BY: ECC
 CHECKED BY: AHN
 JOB NO: D01142

ERIE BUSINESS PARK & STORAGE
CONSTRUCTION PLANS
INITIAL EROSION CONTROL PLAN

PROJECT NO.
 D01142
 DRAWING NO.
 SHEET NO. 30 OF 36 SHEETS

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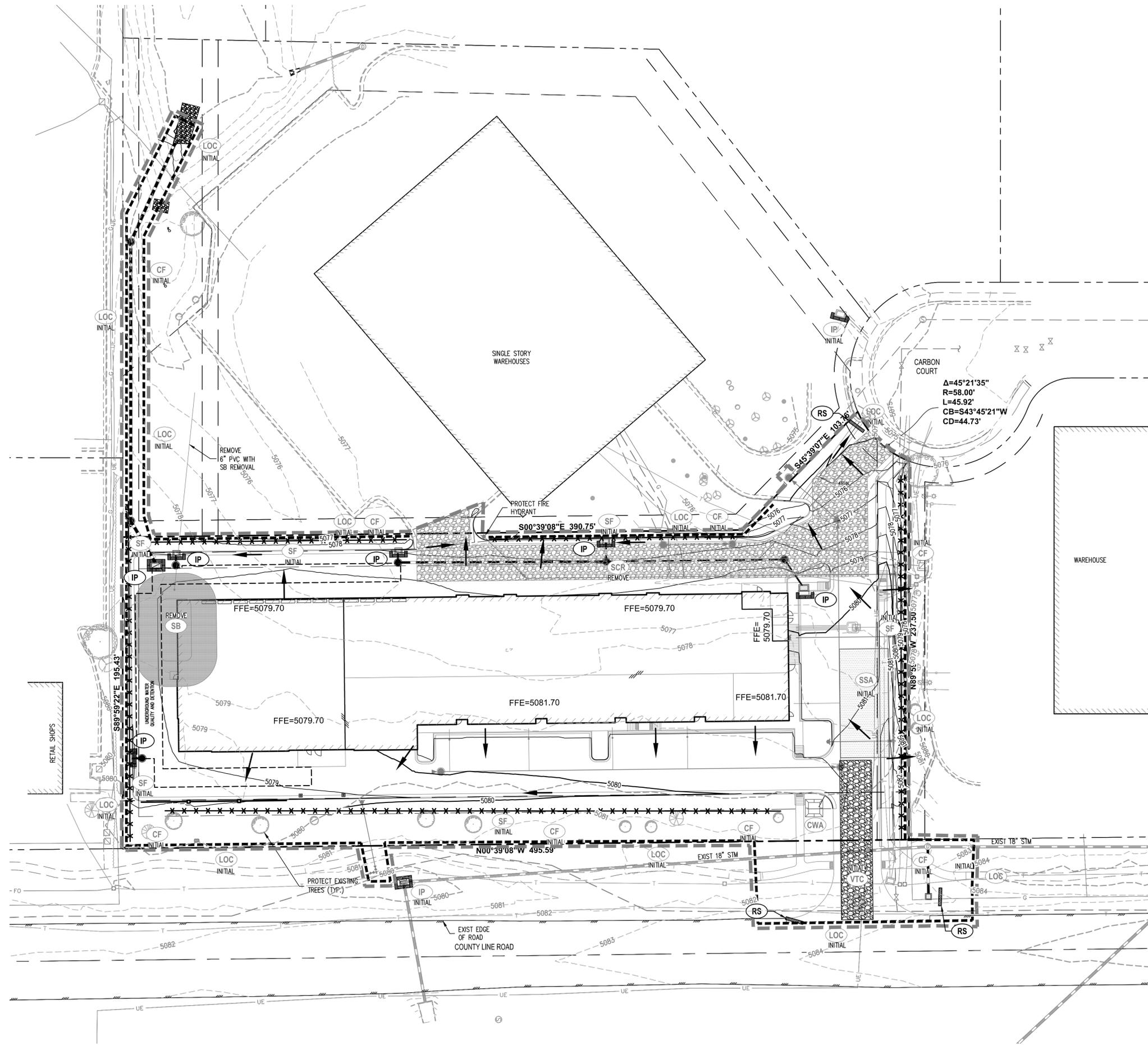


BMP LEGEND

- EXISTING BOUNDARY LINE
- - - EXISTING SECTION LINE
- 5400— PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED STORM DRAIN
- - -5400- - EXISTING MAJOR CONTOUR
- - - EXISTING MINOR CONTOUR
- (CF) CONSTRUCTION FENCE
- [] (CWA) CONCRETE WASHOUT AREA
- ← (DD) DIVERSION DITCH
- [] (ECB) EROSION CONTROL BLANKET
- [] (RS) ROCK SOCK
- [] (IP) INLET PROTECTION
- (LOC) LIMITS OF CONSTRUCTION
- [] (PS) PERMANENT SEEDING
- [] (SB) SEDIMENT BASIN
- [] (SCR) STABILIZED CONST ROADWAY, 9" CLASS 6 GRAVEL ON COMPACTED SUBGRADE
- (SCL) SEDIMENT CONTROL LOG
- (SF) SILT FENCE
- [] (SM) SEEDING AND MULCHING
- [] (SR) SURFACE ROUGHENING
- [] (SSA) STABILIZED STAGING AREA
- [] (VTC) VEHICLE TRACKING CONTROL

NOTES

1. STABILIZED CONSTRUCTED ROADWAY TO REMAIN IN PLACE UNTIL GRADING AND PAVING ARE IN PLACE FOR THIS AREA.



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SIGNATURE	DATE
SIGNATURE	DATE

REVISIONS:

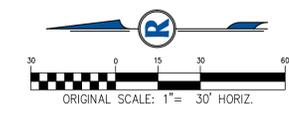
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ERIE BUSINESS PARK & STORAGE
CONSTRUCTION PLANS
INTERIM EROSION CONTROL PLAN

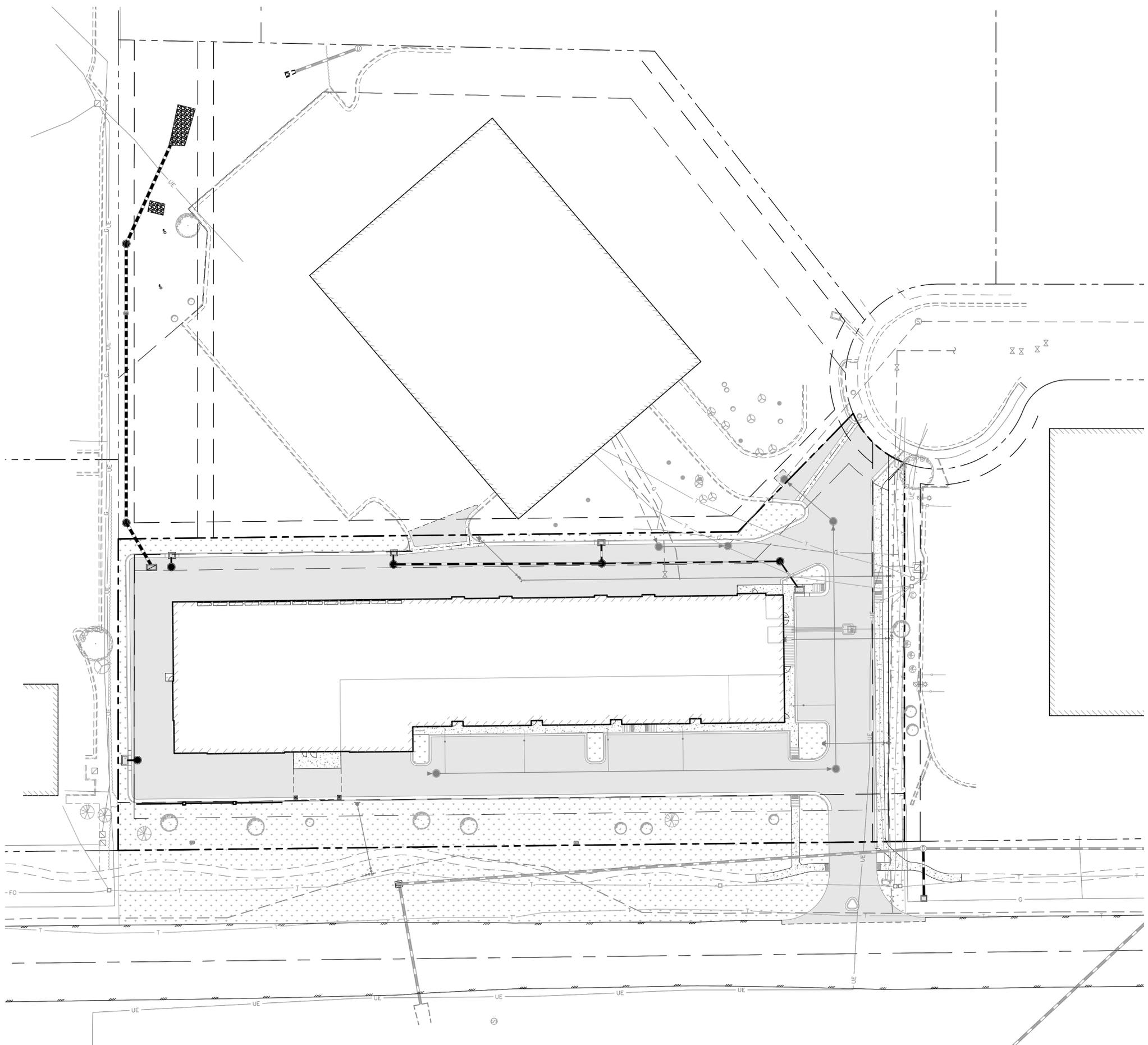
PROJECT NO.
 D01142
 DRAWING NO.
 SHEET NO. 31 OF 36 SHEETS

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BMP LEGEND

- EXISTING BOUNDARY LINE
- EXISTING SECTION LINE
- 5400--- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED STORM DRAIN
- 5400--- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- (CF) CONSTRUCTION FENCE
- (CWA) CONCRETE WASHOUT AREA
- ← (DD) DIVERSION DITCH
- ▨ (ECB) EROSION CONTROL BLANKET
- (RS) ROCK SOCK
- (IP) INLET PROTECTION
- (LOC) LIMITS OF CONSTRUCTION
- (PS) PERMANENT SEEDING
- (SB) SEDIMENT BASIN
- ▨ (SCR) STABILIZED CONST ROADWAY, 9" CLASS 6 GRAVEL ON COMPACTED SUBGRADE
- (SCL) SEDIMENT CONTROL LOG
- × × × × (SF) SILT FENCE
- (SM) SEEDING AND MULCHING
- (SR) SURFACE ROUGHENING
- ▨ (SSA) STABILIZED STAGING AREA
- ▨ (VTC) VEHICLE TRACKING CONTROL



J:\001142_GYS_Bldg_CIVIL_CONSTRUCTION\1142_EC_BN.dwg, 4/28/2019 12:12:03 PM

GYS DEVELOPMENT, LLC.

RICK
ENGINEERING COMPANY
5690 WEBSTER ST
ARVADA, CO 80002
303.423.6036
Locations: San Diego - Riverside - Chicago - Denver
Sacramento - San Luis Obispo - Phoenix - Las Vegas
rickengineering.com

REVIEWED FOR COMPLIANCE BY:

SIGNATURE	DATE
SIGNATURE	DATE

REVISIONS:

NO.	DESCRIPTION	DATE
1	2nd AGENCY REVIEW	4/19/19

SCALE: 1"=30'
DATE: 04/19/2019
DRAWN BY: ECC
CHECKED BY: AHN
JOB NO: D01142

ERIE BUSINESS PARK & STORAGE
CONSTRUCTION PLANS
FINAL EROSION CONTROL PLAN

PROJECT NO.	D01142
DRAWING NO.	
SHEET NO. 32 OF 36 SHEETS	

© 2019 Rick Engineering Company

Town of Erie Average Annual Water Demand Worksheet

Project Name:	Right Move Lot 7	Date:	November 6, 2018
Engineering Firm:		Developer:	
Contact Person:		Contact Person:	
Telephone:		Telephone:	

Lot or Tract Usage:		
Building footprint	-	SF
Hard surfaces	-	SF
Non-irrigated landscaping	-	SF
Irrigated Turf	-	SF
Irrigated Xeric Plants	-	SF
Special Irrigated uses	-	SF
Total Lot size	-	SF

A. Irrigation Demand for Lot or Tract:		
Number of lot or tracts	-	
Total turf irrigated area for lots	33,431.00	SF
Total xeric plant irrigated area for lots	5,590.00	SF
Trees in native areas	6.00	EA
Total special irrigated use for lots	-	SF
Total AF for irrigated turf (2.5 ft/yr)	1.92	AF
Total AF for irrigated xeric plant (1.33 ft/yr)	0.17	AF
Total AF for trees in native (.008 AF/yr)	0.05	AF
Total AF for special irrigated uses *	-	AF
Total irrigation for lots or tracts	2.14	AF

B. Other Irrigation Usage		
Irrigated turf in parks/tracts	-	acres
Irrigated turf in street R.O.W.	-	acres
Total Irrigated Turf	-	acres
Irrigated xeric plant area in parks/tracts	-	acres
Irrigated xeric plant area in street R.O.W.	-	acres
Total Irrigated Xeric Plant Area	-	acres
Special irrigated area in parks/tracts	-	acres
Special irrigated area in street R.O.W.	-	acres
Total Special Irrigated Area	-	acres
Trees in native areas		each
Irrigation demand for Turf Area (2.5 ft/yr)	0	AF
Irrigation demand for Xeric Plant Area (1.33 ft/yr)	0	AF
Irrigation demand for Special Irrigated Area *	0	AF
Irrigation demand for Trees in native (.008 AF/yr)	-	AF
Total Other Irrigation Usage	-	AF

* Annual rate for special irrigated uses ft/yr ft/ac

C. Total Irrigation Usage		
Total Irrigation Demand for Lots or Tracts	2.14	AF
Total Other Irrigation Usage	-	AF
TOTAL IRRIGATION USE	2.14	AF

Town of Erie
Summary of Average Annual Water Requirements

D. Inside Use

Type	Units/Area	Unit Requirement	Annual Requirement (acre feet)
1. Single Family Detached Homes	Lots	0.28 AF/lot	- AF
2. Multi-Family Units	Units	0.17 AF/unit	- AF
3. Commercial	1,050.00 SF	0.10 gpd/sq ft	0.12 AF
4. Office	8,025.00 SF	0.16 gpd/sq ft	1.44 AF
5. Light Industrial	SF	0.06 gpd/sq ft	- AF
6. Other (Warehouse)	90,075.00 SF	0.01 gpd/sq ft	1.01 AF
TOTAL INSIDE USE:			2.56 AF

TOTAL IRRIGATION AND INSIDE USE WITH 13% LINE AND TREATMENT LOSS **5.31 AF**

based on 0.5 AF per CBT the units of CBT are

10.63 CBT

E. Average Annual Consumptive Use

Inside Use	
Total demand (AF)	2.56 Subtotal of Box D
	x <u>0.05</u>
	0.13 AF
Irrigation Use	
Total irrigation demand (AF)	2.14 Subtotal of Box C
	<u>0.85</u>
	1.82 AF
TOTAL CONSUMPTIVE USE	
	1.94 AF

SFE for cost recovery of sanitary sewer
 Water dedication at \$15,300 per CBT is

9.16

\$ 162,592.63

APPLICANT: _____

By: _____

Date: _____



BOOK 1115 PAGE 165

WARRANTY DEED

Recorded AUG 10 1943 at 11⁰⁰ O'clock A.M.
Reception No. 922409 Ann Spomer, Recorder

THIS DEED, Made this 3rd day of August,
in the year of our Lord one thousand nine hundred and forty-
three, between THE COLORADO FUEL AND IRON CORPORATION, a corpora-
tion duly organized and existing under and by virtue of the laws
of the State of Colorado, of the first part, and CELIA R. MORANTZ
and A. MORANTZ, of the County of Los Angeles, State of
California, of the second part:

WITNESSETH, That the said party of the first part, for
and in consideration of the sum of Ten and No/100ths Dollars,
(\$10.00) and other valuable consideration to the said party of
the first part in hand paid by the said parties of the second
part, the receipt whereof is hereby confessed and acknowledged,
hath granted, bargained, sold and conveyed, and by these presents
doth grant, bargain, sell, convey and confirm unto the said
parties of the second part, their heirs and assigns forever, all
of the following described lots or parcels of land, situate, lying
and being in the County of Weld and State of Colorado, to-wit:

The SURFACE ONLY of the following described tracts of
land:

West Half of the Southwest Quarter ($W\frac{1}{2}SW\frac{1}{4}$) of Section
Nineteen (19);

West Half ($w\frac{1}{2}$) of Section Thirty (30);

West Half of West Half ($W\frac{1}{2}W\frac{1}{2}$) of Section Thirty-one
(31);

All in Township One (1) North, Range Sixty-eight (68)
West of the Sixth Principal Meridian.

Subject, however, to the right of way of the Chicago,
Burlington & Quincy Railroad Company now existing
across said tract with the right in said Railroad

Company to build or construct additional tracks or spurs. And subject also to the right of way of The Erie Coal Creek Ditch and Reservoir Company as granted by deed from The Colorado Fuel and Iron Company to The Erie Coal Creek Ditch and Reservoir Company, dated May 16, 1895 and recorded February 13, 1909 in Book 289 at Page 535 of the Weld County Records. And subject also to a right of way for the Zimmerman extension of the Leyner and Cottonwood Ditch as granted by a right of way agreement between Edward V. Cary and George Zimmerman, dated May 19, 1904. And subject also to a right of way for a public highway as granted by deed from The Colorado Fuel and Iron Corporation to Weld County, Colorado, dated November 1, 1938. And subject further to all lawful and existing rights of ways of whatsoever kind or nature over and across the demised premises.

EXCEPTING AND RESERVING unto the party of the first part, its successors or assigns, the right to occupy and use so much of the premises hereinbefore described as may be necessary in the judgment of the party of the first part, to mine or remove coal or other minerals under said premises, together with the necessary land for the construction of roads, railways, telephone and power lines, or any other necessary works or facilities as hereinafter more specifically set forth.

It is mutually understood and agreed that the party of the first part hereby conveys the surface rights as herein defined, only, on the premises above described. It is agreed, however, that the parties of the second part shall have the right to dig or bore such wells as may be necessary to supply domestic and irrigation water for said surface as herein defined, provided said well or wells shall be located and maintained in a manner which will avoid and prevent any damage to the property excepted and reserved herein as above described.

The party of the first part does hereby reserve unto

itself, its successors or assigns, the right to drill and prospect for coal, oil, gas and other minerals and the right to use such portion of the surface of said lands hereinbefore described as may be necessary, in its judgment, for the convenient and proper mining and removal of all coal or other minerals, including oil, gas, and including the right to use so much of the land as may be necessary for mines, mine dumps, tipples, right of ways for railroads, wagon roads, power, light or telephone lines, or for any other purpose which may be reasonably necessary for the enjoyment of the property reserved to the party of the first part and the proper and convenient removal of any coal or other minerals, including oil and gas therein found, together with the right of ingress and egress to and from the described premises for the purposes hereinbefore or hereafter stated, and the party of the first part does hereby reserve unto itself, its successors and assigns, the right to select and determine the point of location of any mine, dump, tipple, works, right of way or other agency necessary for said purpose, PROVIDED, HOWEVER, that the party of the first part, its successors or assigns, shall pay unto the parties of the second part, their heirs, administrators, executors or assigns, a rental for any portion of the surface of said lands so used in a sum per acre to be determined by arbitration, as hereinafter more specifically set forth. Upon the termination of such use by the party of the first part, its successors or assigns, if there remains as a result of such use any mine dump or debris which cannot conveniently be removed, or any excavation which cannot conveniently be filled, and thereby any portion of the surface of said tract is rendered permanently

incapable of any ordinary use, then, in that event, the party of the first part shall pay unto the parties of the second part, their heirs, executors, administrators or assigns, a price per acre to be determined by arbitration as hereinafter more specifically set forth for such number of acres of said surface as shall be so rendered unfit for any ordinary use, said sum to be in full settlement for any and all loss or damage occasioned by the existence and continuance of such dump, debris, excavation, et cetera, and the said party of the first part, its successors and assigns shall thereafter be fully relieved from any and all duty or liability in respect thereto.

Arbitration, as referred to herein, shall be in the following manner, to-wit: The party of the first part shall select one arbitrator, the parties of the second part shall select another and the two so selected shall select a third arbitrator, and the three so selected shall constitute the board of arbitration. The price for rental or for permanent damage to the land herein described shall be such as is decreed by any two of the three arbitrators appointed, and the price agreed upon by any two of said arbitrators shall constitute a final and binding obligation upon both parties hereto as to the price to be paid for such use or damage. The party of the first part does hereby reserve to itself, its successors and assigns the right, at its option, to mine and remove from the premises hereinbefore described, and for the consideration herein stated, all coal or other minerals, including oil and gas, underlying said land, and the said parties of the second part, for themselves, their heirs, administrators, executors or assigns, agree that all damages which may be in the future occasioned by the removal

of said coal or other minerals, specifically including any damages which may arise by reason of the subsidence of said land caused by removing the coal or other minerals therefrom is hereby definitely liquidated and discharged by the consideration upon which this deed is based, and the said parties of the second part, for themselves, their heirs, executors, administrators or assigns, hereby waive any further claim, right or demand of any kind or nature, for any damages whatsoever, occasioned to the surface of said lands or to the improvements thereon by reason of the removal of coal or other minerals therefrom.

The parties of the second part, for themselves, their heirs, executors, administrators or assigns do hereby covenant to and with the party of the first part that they will not use the surface of said land, nor permit others to use the surface of said land, in any manner whatsoever which will injure or interfere with the property rights of the said party of the first part herein reserved. PROVIDED, HOWEVER, that nothing herein contained shall be construed to deny unto the said parties of the second part the right to use water for irrigation for said land, provided such irrigation does not interfere with the property and rights of the party of the first part herein reserved.

TOGETHER with all and singular the hereditaments and appurtenances thereunto belonging, or in anywise appertaining, and the reversion or reversions, remainders, rents, issues and profits thereof; and all the estate, right, title, interest,

claim and demand whatsoever of the said party of the first part, either in law or equity, of, in and to the above bargained premises with the hereditaments and appurtenances.

TO HAVE AND TO HOLD the said premises above bargained and described, with the appurtenances unto the said parties of the second part, their heirs and assigns forever. And the said THE COLORADO FUEL AND IRON CORPORATION, party of the first part, for itself, and its successors, doth covenant, grant, bargain and agree to and with the said parties of the second part, their heirs and assigns, that at the time of the ensealing and delivery of these presents it is well seized of the premises above conveyed, as of a good, sure, perfect, absolute and indefeasible estate of inheritance, in law, in fee simple, and hath good right, full power and lawful authority to grant, bargain, sell and convey the same in manner and form aforesaid, and that the same are free and clear from all former and other grants, bargains, sales, liens, taxes, assessments and incumbrances of whatever kind or nature soever; EXCEPT taxes levied and assessed against the surface only of the land herein described subsequent to the First day of May, A. D. 1932, which said taxes are assumed by the parties of the second part and the above bargained premises in the quiet and peaceable possession of the said parties of the second part, their heirs and assigns, against all and every person or persons lawfully claiming or to claim the whole or any part thereof, the said party of the first part shall and will WARRANT AND FOREVER DEFEND.

IN WITNESS WHEREOF, The said party of the first part hath caused its corporate name to be hereunto subscribed by its

Vice President, and its corporate seal to be hereunto affixed, attested by its Secretary, the day and year first above written.

THE COLORADO FUEL AND IRON CORPORATION



By S. G. Pierson
Vice President

ATTEST:

D. C. McGrew
Secretary

4870

STATE OF COLORADO)
CITY AND COUNTY OF DENVER) ss

The foregoing instrument was acknowledged before me this 3rd day of August, 1943, by S. G. Pierson as Vice President and D. C. McGrew as Secretary of The Colorado Fuel and Iron Corporation, a corporation.

My notarial commission expires December 18, 1944.

Witness my hand and official seal.

Ruby L. Pearson
Notary Public.



ALTA COMMITMENT FOR TITLE INSURANCE

ISSUED BY
STEWART TITLE GUARANTY COMPANY

NOTICE

IMPORTANT - READ CAREFULLY: THIS COMMITMENT IS AN OFFER TO ISSUE ONE OR MORE TITLE INSURANCE POLICIES. ALL CLAIMS OR REMEDIES SOUGHT AGAINST THE COMPANY INVOLVING THE CONTENT OF THIS COMMITMENT OR THE POLICY MUST BE BASED SOLELY IN CONTRACT.

THIS COMMITMENT IS NOT AN ABSTRACT OF TITLE, REPORT OF THE CONDITION OF TITLE, LEGAL OPINION, OPINION OF TITLE, OR OTHER REPRESENTATION OF THE STATUS OF TITLE. THE PROCEDURES USED BY THE COMPANY TO DETERMINE INSURABILITY OF THE TITLE, INCLUDING ANY SEARCH AND EXAMINATION, ARE PROPRIETARY TO THE COMPANY, WERE PERFORMED SOLELY FOR THE BENEFIT OF THE COMPANY, AND CREATE NO EXTRACTIONAL LIABILITY TO ANY PERSON, INCLUDING A PROPOSED INSURED.

THE COMPANY'S OBLIGATION UNDER THIS COMMITMENT IS TO ISSUE A POLICY TO A PROPOSED INSURED IDENTIFIED IN SCHEDULE A IN ACCORDANCE WITH THE TERMS AND PROVISIONS OF THIS COMMITMENT. THE COMPANY HAS NO LIABILITY OR OBLIGATION INVOLVING THE CONTENT OF THIS COMMITMENT TO ANY OTHER PERSON.

COMMITMENT TO ISSUE POLICY

Subject to the Notice; Schedule B, Part I - Requirements; Schedule B, Part II - Exceptions; and the Commitment Conditions, STEWART TITLE GUARANTY COMPANY, a Texas corporation (the "Company"), commits to issue the Policy according to the terms and provisions of this Commitment. This Commitment is effective as of the Commitment Date shown in Schedule A for each Policy described in Schedule A, only when the Company has entered in Schedule A both the specified dollar amount as the Proposed Policy Amount and the name of the Proposed Insured.

If all of the Schedule B, Part I - Requirements have not been met within six months after the Commitment Date, this Commitment terminates and the Company's liability and obligation end.

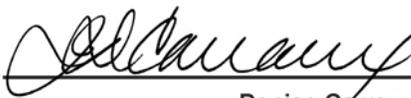


Authorized Countersignature
Stewart Title Company
3711 JFK Pkwy, Ste 210
Fort Collins, CO 80525





Matt Morris
President and CEO



Denise Carraux
Secretary

For purposes of this form the "Stewart Title" logo featured above is the represented logo for the underwriter, Stewart Title Guaranty Company.

This page is only a part of a 2016 ALTA® Commitment for Title Insurance. This Commitment is not valid without the Notice; the Commitment to Issue Policy; the Commitment Conditions; Schedule A; Schedule B, Part I - Requirements; and Schedule B, Part II - Exceptions; and a countersignature by the Company or its issuing agent that may be in electronic form.

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File No.: 212560

ALTA Commitment For Title Insurance 8-1-16

Page 1 of 3

COMMITMENT CONDITIONS

1. DEFINITIONS

- (a) "Knowledge" or "Known": Actual or imputed knowledge, but not constructive notice imparted by the Public Records.
- (b) "Land": The land described in Schedule A and affixed improvements that by law constitute real property. The term "Land" does not include any property beyond the lines of the area described in Schedule A, nor any right, title, interest, estate, or easement in abutting streets, roads, avenues, alleys, lanes, ways, or waterways, but this does not modify or limit the extent that a right of access to and from the Land is to be insured by the Policy.
- (c) "Mortgage": A mortgage, deed of trust, or other security instrument, including one evidenced by electronic means authorized by law.
- (d) "Policy": Each contract of title insurance, in a form adopted by the American Land Title Association, issued or to be issued by the Company pursuant to this Commitment.
- (e) "Proposed Insured": Each person identified in Schedule A as the Proposed Insured of each Policy to be issued pursuant to this Commitment.
- (f) "Proposed Policy Amount": Each dollar amount specified in Schedule A as the Proposed Policy Amount of each Policy to be issued pursuant to this Commitment.
- (g) "Public Records": Records established under state statutes at the Commitment Date for the purpose of imparting constructive notice of matters relating to real property to purchasers for value and without Knowledge.
- (h) "Title": The estate or interest described in Schedule A.

2. If all of the Schedule B, Part I - Requirements have not been met within the time period specified in the Commitment to Issue Policy, this Commitment terminates and the Company's liability and obligation end.

3. The Company's liability and obligation is limited by and this Commitment is not valid without:

- (a) the Notice;
- (b) the Commitment to Issue Policy;
- (c) the Commitment Conditions;
- (d) Schedule A;
- (e) Schedule B, Part I - Requirements;
- (f) Schedule B, Part II - Exceptions; and
- (g) a countersignature by the Company or its issuing agent that may be in electronic form.

4. COMPANY'S RIGHT TO AMEND

The Company may amend this Commitment at any time. If the Company amends this Commitment to add a defect, lien, encumbrance, adverse claim, or other matter recorded in the Public Records prior to the Commitment Date, any liability of the Company is limited by Commitment Condition 5. The Company shall not be liable for any other amendment to this Commitment.

5. LIMITATIONS OF LIABILITY

- (a) The Company's liability under Commitment Condition 4 is limited to the Proposed Insured's actual expense incurred in the interval between the Company's delivery to the Proposed Insured of the Commitment and the delivery of the amended Commitment, resulting from the Proposed Insured's good faith reliance to:
 - (i) comply with the Schedule B, Part I - Requirements;
 - (ii) eliminate, with the Company's written consent, any Schedule B, Part II - Exceptions; or
 - (iii) acquire the Title or create the Mortgage covered by this Commitment.
- (b) The Company shall not be liable under Commitment Condition 5(a) if the Proposed Insured requested the amendment or had Knowledge of the matter and did not notify the Company about it in writing.
- (c) The Company will only have liability under Commitment Condition 4 if the Proposed Insured would not have incurred the expense had the Commitment included the added matter when the Commitment was first delivered to the Proposed Insured.

This page is only a part of a 2016 ALTA® Commitment for Title Insurance. This Commitment is not valid without the Notice; the Commitment to Issue Policy; the Commitment Conditions; Schedule A; Schedule B, Part I - Requirements; and Schedule B, Part II - Exceptions; and a countersignature by the Company or its issuing agent that may be in electronic form.

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File No.: 212560

ALTA Commitment For Title Insurance 8-1-16

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AMERICAN
LAND TITLE
ASSOCIATION



- (d) The Company's liability shall not exceed the lesser of the Proposed Insured's actual expense incurred in good faith and described in Commitment Conditions 5(a)(i) through 5(a)(iii) or the Proposed Policy Amount.
- (e) The Company shall not be liable for the content of the Transaction Identification Data, if any.
- (f) In no event shall the Company be obligated to issue the Policy referred to in this Commitment unless all of the Schedule B, Part I - Requirements have been met to the satisfaction of the Company.
- (g) In any event, the Company's liability is limited by the terms and provisions of the Policy.

6. LIABILITY OF THE COMPANY MUST BE BASED ON THIS COMMITMENT

- (a) Only a Proposed Insured identified in Schedule A, and no other person, may make a claim under this Commitment.
- (b) Any claim must be based in contract and must be restricted solely to the terms and provisions of this Commitment.
- (c) Until the Policy is issued, this Commitment, as last revised, is the exclusive and entire agreement between the parties with respect to the subject matter of this Commitment and supersedes all prior commitment negotiations, representations, and proposals of any kind, whether written or oral, express or implied, relating to the subject matter of this Commitment.
- (d) The deletion or modification of any Schedule B, Part II - Exception does not constitute an agreement or obligation to provide coverage beyond the terms and provisions of this Commitment or the Policy.
- (e) Any amendment or endorsement to this Commitment must be in writing and authenticated by a person authorized by the Company.
- (f) When the Policy is issued, all liability and obligation under this Commitment will end and the Company's only liability will be under the Policy.

7. IF THIS COMMITMENT HAS BEEN ISSUED BY AN ISSUING AGENT

The issuing agent is the Company's agent only for the limited purpose of issuing title insurance commitments and policies. The issuing agent is not the Company's agent for the purpose of providing closing or settlement services.

8. PRO-FORMA POLICY

The Company may provide, at the request of a Proposed Insured, a pro-forma policy illustrating the coverage that the Company may provide. A pro-forma policy neither reflects the status of Title at the time that the pro-forma policy is delivered to a Proposed Insured, nor is it a commitment to insure.

9. ARBITRATION

The Policy contains an arbitration clause. All arbitrable matters when the Proposed Policy Amount is \$2,000,000 or less shall be arbitrated at the option of either the Company or the Proposed Insured as the exclusive remedy of the parties. A Proposed Insured may review a copy of the arbitration rules at <<http://www.alta.org/arbitration>>.

STEWART TITLE GUARANTY COMPANY

All notices required to be given the Company and any statement in writing required to be furnished the Company shall be addressed to it at P.O. Box 2029, Houston, Texas 77252-2029.

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ALTA Commitment For Title Insurance 8-1-16

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AMERICAN
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ASSOCIATION



ALTA COMMITMENT FOR TITLE INSURANCE SCHEDULE A

ISSUED BY
STEWART TITLE GUARANTY COMPANY

Transaction Identification Data for reference only:

Issuing Agent: Stewart Title Company
Issuing Office: 3711 JFK Pkwy, Ste 210, Fort Collins, CO 80525
ALTA® Universal ID:
Loan ID Number:
Commitment Number: 212560
Issuing Office File Number: 212560
Property Address: 1012 Carbon Court, Erie, CO 80516
Revision Number: C2

1. Commitment Date: January 29, 2018 at 8:00AM
2. Policy to be issued: Proposed Policy Amount
 - (a) ALTA Owner's Extended \$396,000.00
Proposed Insured: GYS Development LLC, a Colorado limited liability company
 - (b) ALTA Loan
Proposed Insured: TBD
3. The estate or interest in the Land described or referred to in this Commitment is:
FEE SIMPLE
4. Title to the said estate or interest in the Land is at the Commitment Date vested in:
CARBON, LLC, a Colorado limited liability company
5. The Land is described as follows:
See Exhibit "A" Attached Hereto

This page is only a part of a 2016 ALTA® Commitment for Title Insurance. This Commitment is not valid without the Notice; the Commitment to Issue Policy; the Commitment Conditions; Schedule A; Schedule B, Part I - Requirements; and Schedule B, Part II - Exceptions; and a countersignature by the Company or its issuing agent that may be in electronic form.

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File No.: 212560

ALTA Commitment For Title Insurance 8-1-16

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AMERICAN
LAND TITLE
ASSOCIATION



**ALTA COMMITMENT FOR TITLE INSURANCE
EXHIBIT "A"
LEGAL DESCRIPTION**

ISSUED BY
STEWART TITLE GUARANTY COMPANY

File No.: 212560

Lot 7,
THE RIGHT MOVE SUBDIVISION REPLAT A, FINAL PLAT, according to the plat recorded December 1,
2005 as Reception No. 334865; as corrected by the Affidavit of Correction recorded December 26, 2006
as Reception No. 3443717

County of Weld, State of Colorado.

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File No.: 212560

ALTA Commitment For Title Insurance 8-1-16
Page 2 of 7



ALTA COMMITMENT FOR TITLE INSURANCE SCHEDULE B PART I

ISSUED BY
STEWART TITLE GUARANTY COMPANY

File No.: 212560

Requirements

All of the following Requirements must be met:

1. The Proposed Insured must notify the Company in writing of the name of any party not referred to in this Commitment who will obtain an interest in the Land or who will make a loan on the Land. The Company may then make additional Requirements or Exceptions.
2. Pay the agreed amount for the estate or interest to be insured.
3. Pay the premiums, fees, and charges for the Policy to the Company.
4. Documents satisfactory to the Company that convey the Title or create the Mortgage to be insured, or both, must be properly authorized, executed, delivered, and recorded in the Public Records.
5. Payment to or for the account of the grantor(s) or mortgagor(s) of the full consideration for the estate or interest to be insured.
6. Proper instrument(s) creating the estate or interest to be insured must be executed and duly filed for record.
7. Evidence satisfactory to Stewart Title Guaranty Company of payment of all outstanding taxes and assessments as certified by the County Treasurer.
8. Execution of Affidavit as to Debts and Liens and its return to Stewart Title Guaranty Company.

NOTE: If work has been performed on, or in connection with, the subject property (architectural drawings, soils testing, foundation work, installation of materials), please notify the Company's escrow officer within 10 days of receipt of this title commitment.

9. Payment of any and all Homeowners assessments and expenses which may be assessed to the property.
10. THE FOLLOWING REQUIREMENT IS FOR DELETION OF SURVEY EXCEPTIONS 3 AND 4 OF THE OWNERS POLICY:
A SURVEY, meeting the minimum detail standards of the ALTA/ACSM, Survey prepared by a registered Colorado surveyor, after construction is completed, must be presented to Stewart Title Guaranty Company, for its approval prior to the deletion of any survey exceptions from the OWNERS POLICY.
11. Stewart Title Guaranty reserves the right to take exception to any adverse matters as shown on said survey, or make further inquiry or requirements relative thereto.
Said Survey, must be certified to Stewart Title of Colorado and/or Stewart Title Guaranty Company.
NOTE: WE HAVE RECEIVED A DRAFT SURVEY, WE NEED TO RECEIVE AN EXECUTED SURVEY.

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ALTA COMMITMENT FOR TITLE INSURANCE SCHEDULE B PART I

ISSUED BY
STEWART TITLE GUARANTY COMPANY

12. Deed from vested owner(s) vesting fee simple title in the purchaser(s).

NOTE: Notation of the legal address of the grantee must appear on the deed as per 1976 amendment to statute on recording of deeds CRS 38-35-109 (2).

NOTE: Statement of Authority for Carbon LLC recorded March 31, 2017 [as Reception No. 4290160](#), discloses the following persons as those authorized to transact business on behalf of said entity: Chris Jensen. If there have been any amendments or changes to the management of the entity, written documentation reflecting the changes and a new Statement of Authority will be required.

NOTE: The vesting deed is shown as follows:

Warranty Deed recorded March 31, 2017, [as Reception No. 4290161](#). Warranty Deed recorded September 15, 2016, [as Reception No. 4236830](#). Warranty Deed recorded March 6, 2009, [as Reception No. 3609495](#).

13. Deed of Trust from the Borrower to the Public Trustee for the use of the proposed lender to secure the loan.

Please be advised that our search did not disclose any open Deed of Trust of record. If you should have knowledge of any outstanding obligations, please contact the Title Department immediately for further review prior to closing.

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ALTA COMMITMENT FOR TITLE INSURANCE SCHEDULE B PART II

ISSUED BY
STEWART TITLE GUARANTY COMPANY

Exceptions

File No.: 212560

THIS COMMITMENT DOES NOT REPUBLISH ANY COVENANT, CONDITION, RESTRICTION, OR LIMITATION CONTAINED IN ANY DOCUMENT REFERRED TO IN THIS COMMITMENT TO THE EXTENT THAT THE SPECIFIC COVENANT, CONDITION, RESTRICTION, OR LIMITATION VIOLATES STATE OR FEDERAL LAW BASED ON RACE, COLOR, RELIGION, SEX, SEXUAL ORIENTATION, GENDER IDENTITY, HANDICAP, FAMILIAL STATUS, OR NATIONAL ORIGIN.

The Policy will not insure against loss or damage resulting from the terms and provisions of any lease or easement identified in Schedule A, and will include the following Exceptions unless cleared to the satisfaction of the Company:

1. Any defect, lien, encumbrance, adverse claim, or other matter that appears for the first time in the Public Records or is created, attaches, or is disclosed between the Commitment Date and the date on which all of the Schedule B, Part I - Requirements are met.
2. Rights or claims of parties in possession, not shown by the public records.
3. Easements, or claims of easements, not shown by the public records.
4. Any encroachment, encumbrance, violation, variation, or adverse circumstance affecting the title that would be disclosed by an accurate and complete land survey of the Land and not shown by the public records.
5. Any lien, or right to a lien, for services, labor or material heretofore or hereafter furnished, imposed by law and not shown by the public records.
6. (a) Unpatented mining claims; (b) reservations or exceptions in patents or in Acts authorizing the issuance thereof; (c) Minerals of whatsoever kind, subsurface and surface substances, in, on, under and that may be produced from the Land, together with all rights, privileges, and immunities relating thereto, whether or not the matters excepted under (a), (b) or (c) are shown by the Public Records or listed in Schedule B.
7. Water rights, claims or title to water.
8. Any and all unpaid taxes and assessments and any unredeemed tax sales.
9. The effect of inclusion in the following tax districts: Weld County; School Dist RE1J; Northern Colorado watr (NC); Erie Town; Mountain View Fire; High Plains Library.
10. Reservation of minerals and all rights reserved and excepted contained in the Warranty Deed recorded August 10, 1943 [in Book 1115 at Page 165](#).
11. Intentionally deleted.

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ALTA COMMITMENT FOR TITLE INSURANCE SCHEDULE B PART II

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STEWART TITLE GUARANTY COMPANY

12. Aviation Easement recorded May 11, 1978 [as Reception No. 1753139](#).
13. All matters shown on the plat of Falcon Properties recorded September 27, 1994 [as Reception No. 2408278](#).
14. All matters shown on the plat of The Right Move Subdivision recorded September 13, 1999 [as Reception No. 2719874](#).
15. Ordinance recorded September 20, 1999 [as Reception No. 2721573](#).
16. Development Agreement recorded September 8, 2000 [as Reception No. 2719060](#).
17. Development Agreement recorded September 8, 2000 [as Reception No. 2719061](#).
18. Development Agreement recorded December 1, 2005 [as Reception No. 3343862](#).
19. Avigation Easement Agreement recorded December 1, 2005 [as Reception No. 3343864](#).
20. All matters shown on the plat of The Right Move Subdivision Replat A final plat recorded December 1, 2005 [as Reception No. 3343865](#).
21. Request for Notification of Surface Development recorded April 21, 2006 [as Reception No. 3381086](#).
22. Affidavit of Correction related to the plat recorded as Reception No. 3343865 recorded December 26, 2006 [as Reception No. 3443717](#).
23. Intentionally deleted.
24. Intentionally deleted.
25. Pending such time as the improvements under construction on insured premises shall be completed, liability under this policy is limited to the purchase price paid for the land plus the cost of existing improvements, liability hereunder increasing as the improvements progress, in the amount of the cost thereof, up to the face amount of this policy. The effective date of this policy will not change and will be stated on Schedule "A" hereof.
26. Any rights, easements, interests or claims which may exist by reason of or reflected by the following facts shown on the [ALTA/NSPS Land Title Survey](#) by RICK Engineering Company dated 9/26/18: asphalt lying outside of the access and utility easement.

NOTE: Exception 2 may be deleted from the policies, provided the seller and buyer execute the Company's affidavits, as required herein, and the Company approves such deletions. If work has been performed on, or in connection with, the subject property (architectural drawings, soils testing, foundation work, installation of materials), and the Company has not reviewed and approved lien waivers and indemnitor financials, Standard Exception 5 (mechanic lien exception) will not be deleted and no mechanic lien coverage will be furnished. Exceptions 3 and 4 may be deleted from the policies, provided the Company receives and approves the survey or survey affidavit if required

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ALTA COMMITMENT FOR TITLE INSURANCE SCHEDULE B PART II

ISSUED BY
STEWART TITLE GUARANTY COMPANY

herein. Exception 1 will not appear on the policies, provided the Company, or its authorized agent, conducts the closing of the proposed transaction and is responsible for the recordation of the documents.

NOTE: Exception no. 8 will be amended to read: Taxes and assessments for the year 2018 and subsequent years, a lien not yet due and payable.

REVISED NOTE AS TO EXCEPTION NO. 5: Exception No. 5 above will be deleted, and in its stead the following will appear:

Any lien, or right to a lien, for services, labor or material heretofore or hereafter furnished, imposed by law and not shown by the public records, to the extent, but only to the extent such lien or claim of lien arises out of or is in connection with construction work performed on the insured premises by GYS Development LLC, a Colorado limited liability company or by any contractor or subcontractor on its behalf.

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ALTA COMMITMENT FOR TITLE INSURANCE

ISSUED BY
STEWART TITLE GUARANTY COMPANY

File No.: 212560C3

STATEMENT OF CHARGES

These charges are due and payable before a policy can be issued:

Reissue Rate	
2006 Owner's Policy:	\$655.00
Owner's Extended Coverage:	\$65.00
Tax Certificate:	\$25.00
Endorsement ALTA 35.1 (minerals)	\$131.00
2006 Loan Policy:	TBD

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DISCLOSURES

File No.: 212560

Pursuant to C.R.S. 10-11-122, notice is hereby given that:

- A. THE SUBJECT REAL PROPERTY MAY BE LOCATED IN A SPECIAL TAXING DISTRICT;
- B. A CERTIFICATE OF TAXES DUE LISTING EACH TAXING JURISDICTION SHALL BE OBTAINED FROM THE COUNTY TREASURER OR THE COUNTY TREASURER'S AUTHORIZED AGENT;
- C. 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: Colorado Division of Insurance Regulations 8-1-2, Section 5, Paragraph G requires that "Every title entity shall be responsible for all matters which appear of record prior to the time of recording whenever the title entity conducts the closing and is responsible for recording or filing of legal documents resulting from the transaction which was closed." Provided that Stewart Title Company conducts the closing of the insured transaction and is responsible for recording the legal documents from the transaction, exception number 5 will not appear on the Owner's Title Policy and the Lender's Title Policy when issued.

Note: 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 materialmen 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 unfiled Mechanic's and Materialmen'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.

To comply with the provisions of C.R.S. 10-11-123, the Company makes the following disclosure:

- 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: THIS DISCLOSURE APPLIES ONLY IF SCHEDULE B, SECTION 2 OF THE TITLE COMMITMENT HEREIN INCLUDES AN EXCEPTION FOR SEVERED MINERALS.

Notice of Availability of a Closing Protection Letter: Pursuant to Colorado Division of Insurance Regulation 8-1-3, Section 5, Paragraph C (11)(f), a closing protection letter is available to the consumer.

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.

Anti-Fraud Statement CRS 10-1-128

File No.: 212560

"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."

File No.: 212560

Stewart Title Guaranty Company Privacy Notice Stewart Title Companies

WHAT DO THE STEWART TITLE COMPANIES DO WITH YOUR PERSONAL INFORMATION?

Federal and applicable state law and regulations give consumers the right to limit some but not all sharing. Federal and applicable state law regulations also require us to tell you how we collect, share, and protect your personal information. Please read this notice carefully to understand how we use your personal information. This privacy notice is distributed on behalf of the Stewart Title Guaranty Company and its title affiliates (the Stewart Title Companies), pursuant to Title V of the Gramm-Leach-Bliley Act (GLBA).

The types of personal information we collect and share depend on the product or service that you have sought through us. This information can include social security numbers and driver's license number.

All financial companies, such as the Stewart Title Companies, need to share customers' personal information to run their everyday business—to process transactions and maintain customer accounts. In the section below, we list the reasons that we can share customers' personal information; the reasons that we choose to share; and whether you can limit this sharing.

Reasons we can share your personal information.	Do we share	Can you limit this sharing?
For our everyday business purposes — to process your transactions and maintain your account. This may include running the business and managing customer accounts, such as processing transactions, mailing, and auditing services, and responding to court orders and legal investigations.	Yes	No
For our marketing purposes — to offer our products and services to you.	Yes	No
For joint marketing with other financial companies	No	We don't share
For our affiliates' everyday business purposes — information about your transactions and experiences. Affiliates are companies related by common ownership or control. They can be financial and non-financial companies. <i>Our affiliates may include companies with a Stewart name; financial companies, such as Stewart Title Company</i>	Yes	No
For our affiliates' everyday business purposes — information about your creditworthiness.	No	We don't share
For our affiliates to market to you — For your convenience, Stewart has developed a means for you to opt out from its affiliates marketing even though such mechanism is not legally required.	Yes	Yes, send your first and last name, the email address used in your transaction, your Stewart file number and the Stewart office location that is handling your transaction by email to optout@stewart.com or fax to 1-800-335-9591.
For non-affiliates to market to you. Non-affiliates are companies not related by common ownership or control. They can be financial and non-financial companies.	No	We don't share

We may disclose your personal information to our affiliates or to non-affiliates as permitted by law. If you request a transaction with a non-affiliate, such as a third party insurance company, we will disclose your personal information to that non-affiliate. [We do not control their subsequent use of information, and suggest you refer to their privacy notices.]

SHARING PRACTICES

How often do the Stewart Title Companies notify me about their practices?	We must notify you about our sharing practices when you request a transaction.
How do the Stewart Title Companies protect my personal information?	To protect your personal information from unauthorized access and use, we use security measures that comply with federal law. These measures include computer, file, and building safeguards.
How do the Stewart Title Companies collect my personal information?	We collect your personal information, for example, when you request insurance-related services provide such information to us We also collect your personal information from others, such as the real estate agent or lender involved in your transaction, credit reporting agencies, affiliates or other companies.
What sharing can I limit?	Although federal and state law give you the right to limit sharing (e.g., opt out) in certain instances, we do not share your personal information in those instances.

Contact us: *If you have any questions about this privacy notice, please contact us at: Stewart Title Guaranty Company, 1980 Post Oak Blvd., Privacy Officer, Houston, Texas 77056*

**TOWN OF ERIE
AFFIDAVIT OF NEIGHBORHOOD MEETING NOTICE POSTING**

Erie Business Park & Storage

(PROJECT NAME & APPLICATION TYPE)



Facing Carbon Ct.



Facing County Line Rd.

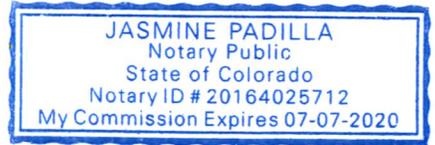
(Under each photo identify where the posting location is: example –Erie Parkway/County Line Road)

I, **Tony Ollila - GYS Development, LLC**, ATTEST THAT NOTICE WAS POSTED IN ACCORDANCE WITH THE ERIE MUNICIPAL CODE, TITLE 10.7.2 D. NOTICE WAS POSTED ON **11/20/18** FOR THE NEIGHBORHOOD MEETING ON **12/11/18** WHICH IS AT LEAST 15 DAYS BEFORE THE SCHEDULED NEIGHBORHOOD MEETING. THE PHOTOS, ABOVE, ARE A TRUE AND CORRECT REPRESENTATION OF THE NEIGHBORHOOD MEETING NOTICE SIGNS THAT HAVE BEEN POSTED.

Tony Ollila

(SIGNATURE OF PERSON THAT POSTED NOTICE)

STATE OF COLORADO)
) ss.
COUNTY OF Weld)



ACKNOWLEDGED BEFORE ME THIS 20 DAY OF November, 2018
BY Anthony AS _____

WITNESS MY HAND AND OFFICIAL SEAL

Jasmine Padilla

NOTARY PUBLIC

MY COMMISSION EXPIRES: 7/7/20