Planning and Community Development Department
2880 International Circle
Colorado Springs, Colorado 80910
Phone: 719.520.6300
Fax: 719.520.6695
Website www.elpasoco.com

DEVIATION REQUEST AND DECISION FORM

Updated: 6/26/2019

PROJECT INFORMATION

Project Name :	**Villages at Sterling Ranch**
Schedule No.(s) :	52000-00-573
Legal Description :	See attached

APPLICANT INFORMATION

Company :	Classic SRJ Land, LLC
Name :	Loren Moreland
	☒ Owner ☐ Consultant ☐ Contractor
Mailing Address :	2138 Flying Horse Club Drive
	Colorado Springs, CO 80921
Phone Number :	719-592-9333
FAX Number :	N/A
Email Address :	Lmoreland@classichomes.com

ENGINEER INFORMATION

Company :	Classic Consulting		
Name :	Catherine M. Tessin, P.E.	Colorado P.E. Number :	45004
Mailing Address :	619 North Cascade Ave.		
	Colorado Springs, CO 80903		
Phone Number :	719-785-0790		
FAX Number :	N/A		
Email Address :	Ctessin@classicconsulting.net		

OWNER, APPLICANT, AND ENGINEER DECLARATION

To the best of my knowledge, the information on this application and all additional or supplemental documentation is true, factual and complete. I am fully aware that any misrepresentation of any information on this application may be grounds for denial. I have familiarized myself with the rules, regulations and procedures with respect to preparing and filing this application. I also understand that an incorrect submittal will be cause to have the project removed from the agenda of the Planning Commission, Board of County Commissioners and/or Board of Adjustment or delay review until corrections are made, and that any approval of this application is based on the representations made in the application and may be revoked on any breach of representation or condition(s) of approval.

V.P. 5/30/2025

Signature of owner (or authorized representative) Date

Engineer's Seal, Signature And Date of Signature

COLORADO LICENSED CATHERINE MARIE TESSIN 45004 PROFESSIONAL ENGINEER

06/16/25

PCD File No. SF2439

DEVIATION REQUEST (Attach diagrams, figures, and other documentation to clarify request)

A deviation from the standards of or in Section **8.2.3** of the Drainage Criteria Manual (DCM) is requested.

Identify the specific DCM standard which a deviation is requested:

Section 8.2.3 in the DCM – At changes in pipe size, match crowns of pipes

State the reason for the requested deviation:

Utility conflicts and providing the required 18” min. clearance at all utility crossings

Explain the proposed alternative and compare to the ECM standards (May provide applicable regional or national standards used as basis):

The proposed design does not match crown of pipes in all locations of pipe size change, however, still meets all other pipe design criteria related to slope and velocity and all pipe HGL design meets DCM criteria.

LIMITS OF CONSIDERATION
(At least one of the conditions listed below must be met for this deviation request to be considered.)

☐ The ECM standard is inapplicable to the particular situation.
☒ Topography, right-of-way, or other geographical conditions or impediments impose an undue hardship and an equivalent alternative that can accomplish the same design objective is available and does not compromise public safety or accessibility.
☐ A change to a standard is required to address a specific design or construction problem, and if not modified, the standard will impose an undue hardship on the applicant with little or no material benefit to the public.

Provide justification:

The proposed storm design meets utility crossing clearance criteria of 18" min. along with all other storm pipe design and HGL design criteria.

CRITERIA FOR APPROVAL

Per ECM section 5.8.7 the request for a deviation may be considered if the request is **not based exclusively on financial considerations**. The deviation must not be detrimental to public safety or surrounding property. The applicant must include supporting information demonstrating compliance with **all of the following criteria**:

The deviation will achieve the intended result with a comparable or superior design and quality of improvement.

The proposed storm design meets all other design criteria and most importantly provides the required safe HGL design.

The deviation will not adversely affect safety or operations.

The proposed pipe design remains in a standard location within the public roadway and thus has no affect on safety or operations.

PCD File No. SF2439

The deviation will not adversely affect maintenance and its associated cost.

The proposed storm design has no significant bearing , no adverse affects on maintenance/cost are anticipated as the storm pipe sizing is the same and the pipe locations are the same. Thus, the maintenance and associated cost on this system is not adversely affected.

The deviation will not adversely affect aesthetic appearance.

The nature of this deviation relates to a buried storm pipe and thus has no affect on aesthetic appearance.

The deviation meets the design intent and purpose of the ECM standards.

The proposed deviation indeed meets the design intent and purpose of the ECM standards by providing a safe HGL design for the proposed storm system along with providing all necessary utility pipe clearances of 18" min.

The deviation meets the control measure requirements of Part I.E.3 and Part I.E.4 of the County's MS4 permit, as applicable.

This deviation continues to provide a safe storm system design and thus meets the County's MS4 permit. The proposed design is a buried pipe system change and does not impact surface drainage or ponds. Thus, all El Paso County MS4 requirements on the surface (i.e. ponds, swales and other BMPs) are still being provided.

REVIEW AND RECOMMENDATION:

Approved by the ECM Administrator
This request has been determined to have met the criteria for approval. A deviation from Section **8.2.3** of the ECM is hereby granted based on the justification provided.

Gilbert LaForce, P.E.

Digitally signed by Gilbert LaForce, P.E.
Reason: Authorized signatory as County Engineer designee
Date: 2025.06.19 09:02:46-06'00'

Denied by the ECM Administrator
This request has been determined not to have met criteria for approval. A deviation from Section _____ of the ECM is hereby denied.

ECM ADMINISTRATOR COMMENTS/CONDITIONS:

PCD File No. SF2439

1.1. PURPOSE

The purpose of this resource is to provide a form for documenting the findings and decision by the ECM Administrator concerning a deviation request. The form is used to document the review and decision concerning a requested deviation. The request and decision concerning each deviation from a specific section of the ECM shall be recorded on a separate form.

1.2. BACKGROUND

A deviation is a critical aspect of the review process and needs to be documented to ensure that the deviations granted are applied to a specific development application in conformance with the criteria for approval and that the action is documented as such requests can point to potential needed revisions to the ECM.

1.3. APPLICABLE STATUTES AND REGULATIONS

Section 5.8 of the ECM establishes a mechanism whereby an engineering design standard can be modified when if strictly adhered to, would cause unnecessary hardship or unsafe design because of topographical or other conditions particular to the site, and that a departure may be made without destroying the intent of such provision.

1.4. APPLICABILITY

All provisions of the ECM are subject to deviation by the ECM Administrator provided that one of the following conditions is met:

- The ECM standard is inapplicable to a particular situation.
- Topography, right-of-way, or other geographical conditions or impediments impose an undue hardship on the applicant, and an equivalent alternative that can accomplish the same design objective is available and does not compromise public safety or accessibility.
- A change to a standard is required to address a specific design or construction problem, and if not modified, the standard will impose an undue hardship on the applicant with little or no material benefit to the public.

1.5. TECHNICAL GUIDANCE

The review shall ensure all criteria for approval are adequately considered and that justification for the deviation is properly documented.

1.6. LIMITS OF APPROVAL

Whether a request for deviation is approved as proposed or with conditions, the approval is for project-specific use and shall not constitute a precedent or general deviation from these Standards.

1.7. REVIEW FEES

A Deviation Review Fee shall be paid in full at the time of submission of a request for deviation. The fee for Deviation Review shall be as determined by resolution of the BoCC.

CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719) 785-0790

LEGAL DESCRIPTION

A PARCEL OF LAND LOCATED IN THE WEST HALF OF SECTION 34, TOWNSHIP 12 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, COUNTY OF EL PASO, STATE OF COLORADO; SAID PARCEL MORE PARTICULARLY DESCRIBED AS FOLLOWS WITH **BEARINGS REFERENCED** THE EASTERLY RIGHT-OF-WAY LINE OF STERLING RANCH ROAD AS DEDICATED IN HOMESTEAD NORTH AT STERLING RANCH FILING NO. 1 RECORDED ON MAY 19, 2023 UNDER RECEPTION NO. 223715150, BEING MONUMENTED AT EACH END BY NO.5 REBAR WITH 1-1/2" ALUMINUM SURVEYORS CAP STAMPED "JR ENG LS 38252" FOUND FLUSH WITH GRADE; DETERMINED FROM GPS OBSERVATIONS TO BEAR SOUTH 13°28'38" WEST, A DISTANCE OF 1168.84 FEET.

BEGINNING AT THE NORTHEASTERLY CORNER OF SAID STERLING RANCH ROAD ALSO BEING THE NORTHEAST END OF THE ABOVE-DESCRIBED BEARING REFERENCE;

THENCE ON THE EASTERLY RIGHT-OF-WAY LINE OF SAID STERLING RANCH ROAD, NORTH 58°28'29" EAST A DISTANCE OF 49.50 FEET;

THENCE SOUTH 76°31'31" EAST, ON SAID RIGHT-OF-WAY AND ITS SOUTHEASTERLY EXTENSION, A DISTANCE OF 1,434.77 FEET;

THENCE SOUTH 13°28'29" WEST A DISTANCE OF 310.01 FEET;

THENCE SOUTH 76°31'31" EAST A DISTANCE OF 66.21 FEET;

THENCE SOUTH 13°28'29" WEST A DISTANCE OF 690.84 FEET;

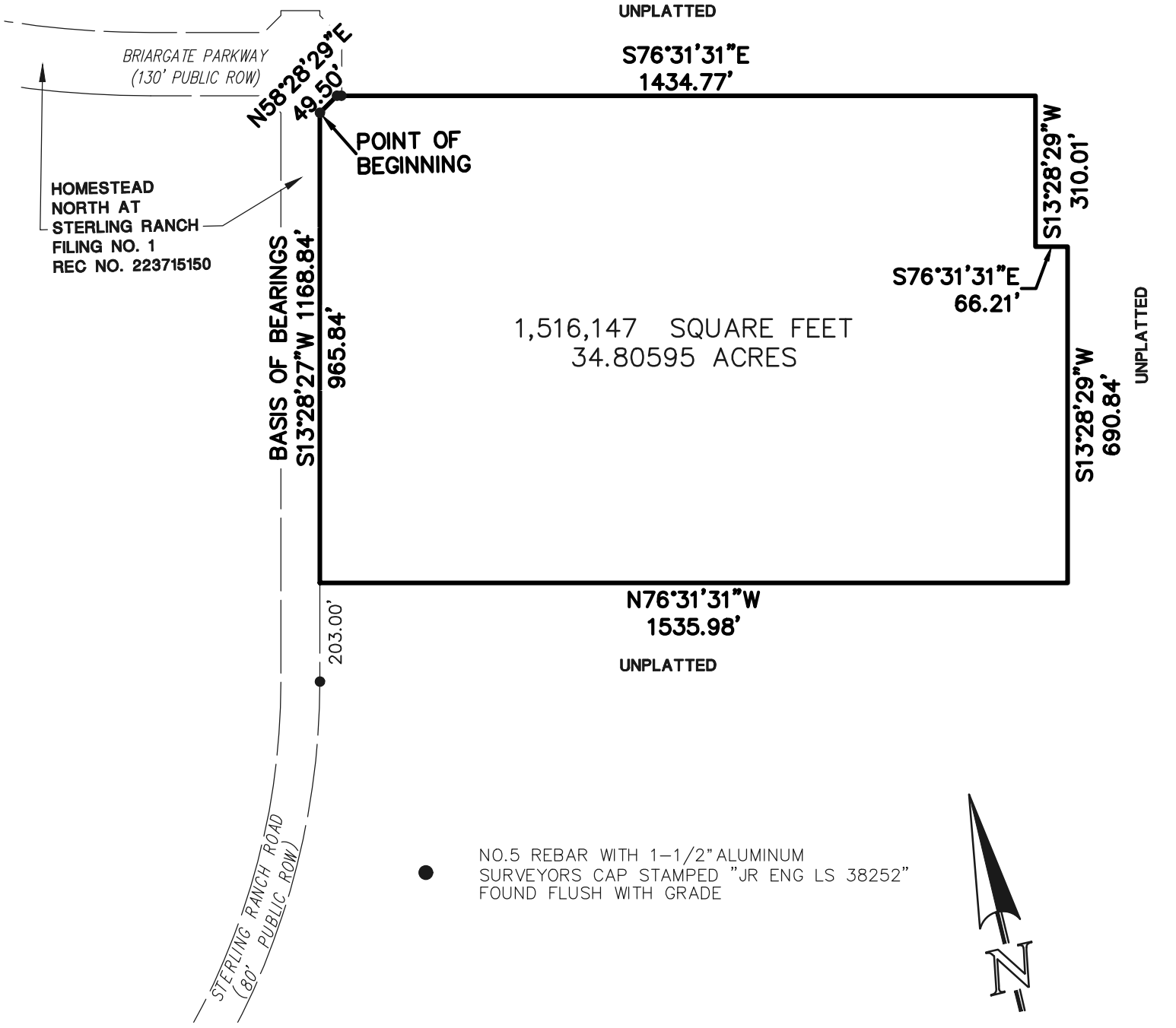
THENCE NORTH 76°31'31" WEST A DISTANCE OF 1,535.98 FEET TO SAID EASTERLY RIGHT-OF-WAY LINE;

THENCE NORTH 13°28'29" EAST, ON SAID EASTERLY RIGHT-OF-WAY LINE, A DISTANCE OF 965.84 FEET TO THE **POINT OF BEGINNING**.

THE ABOVE DESCRIPTION PRODUCES A CALCULATED AREA OF 1,516,147 SQUARE FEET (34.80595 ACRES) AND IS DEPICTED ON THE ATTACHED GRAPHICAL EXHIBIT FOR REFERENCE.

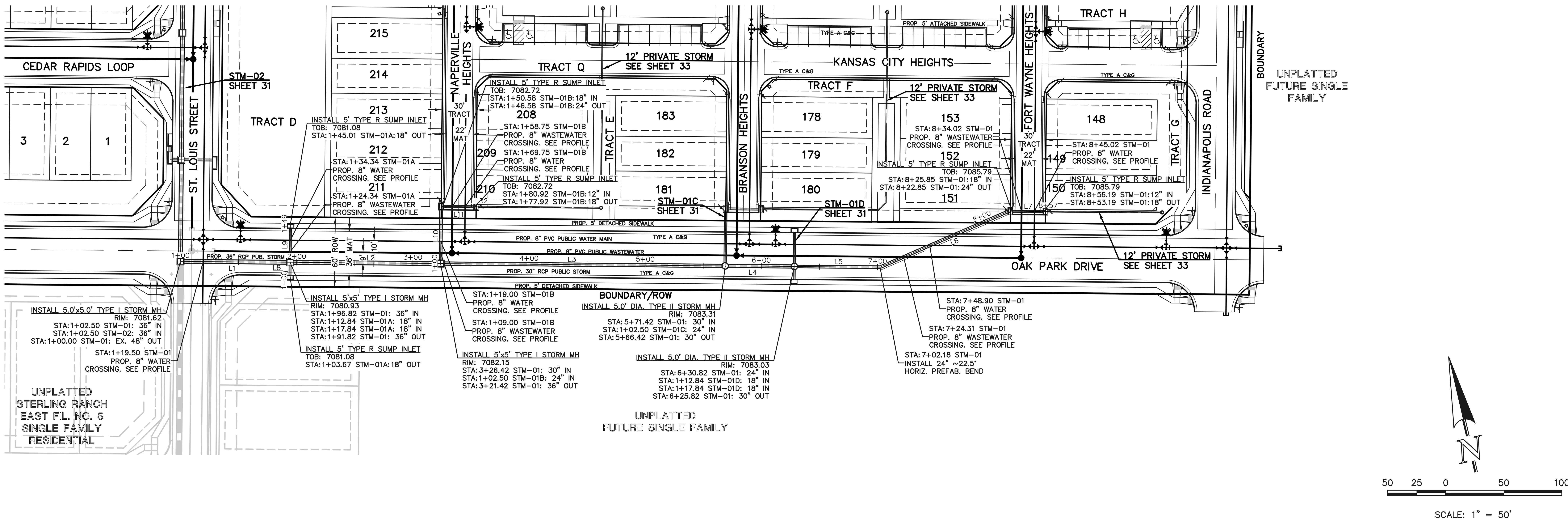
ROBERT L. MEADOWS JR., PLS 34977
PREPARED FOR AND ON BEHALF OF
CLASSIC CONSULTING ENGINEERS AND SURVEYORS

CLASSIC CONSULTING SM
619 North Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790



N:\118326\DRAWINGS\SURVEY\LEGALS\01-R2-VSR-BNDY\01-R2-118326B-BNDY.DWG

STORM CENTERLINE LINE TABLE		
LINE	LENGTH	BEARING
L1	88.82	S76°31'31"E
L2	124.60	S76°31'31"E
L3	240.00	S76°31'31"E
L4	54.40	S76°31'31"E
L5	71.36	S76°31'31"E
L6	120.67	N79°28'29"E
L7	27.34	S76°31'31"E
L8	9.17	N13°28'29"E
L9	27.17	N13°28'29"E
L10	44.08	N13°28'29"E
L11	27.34	S76°31'31"E



48 HOURS BEFORE YOU DIG,
CALL UTILITY LOCATORS
811
UTILITY NOTIFICATION CENTER OF COLORADO
IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE

REVIEW:

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

COLORADO LICENSED CATHERINE MARIE TESSIN 45004 PROFESSIONAL ENGINEER

[illegible] 05/12/25

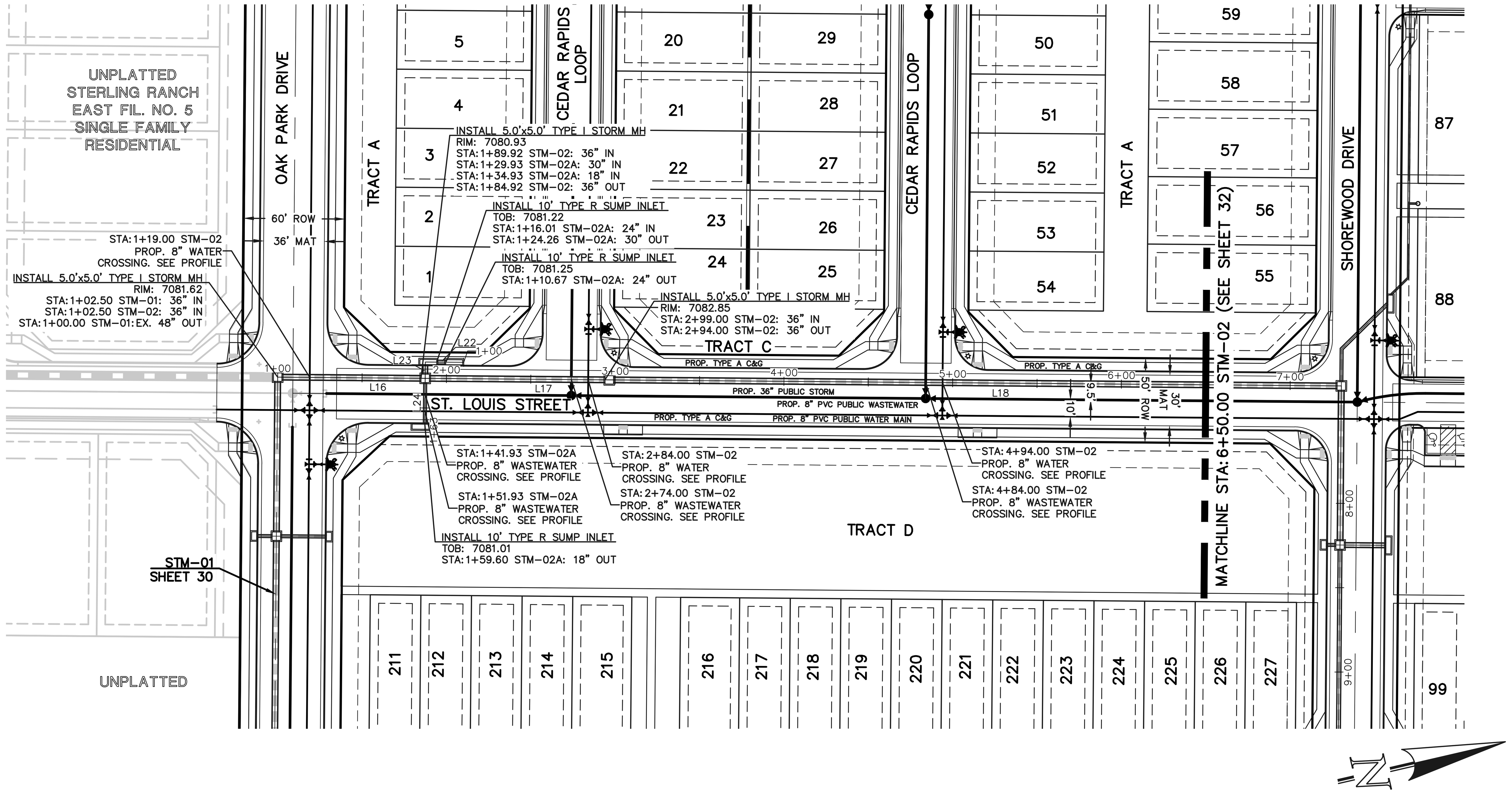
CATHERINE M. TESSIN, COLORADO P.E. #45004 DATE

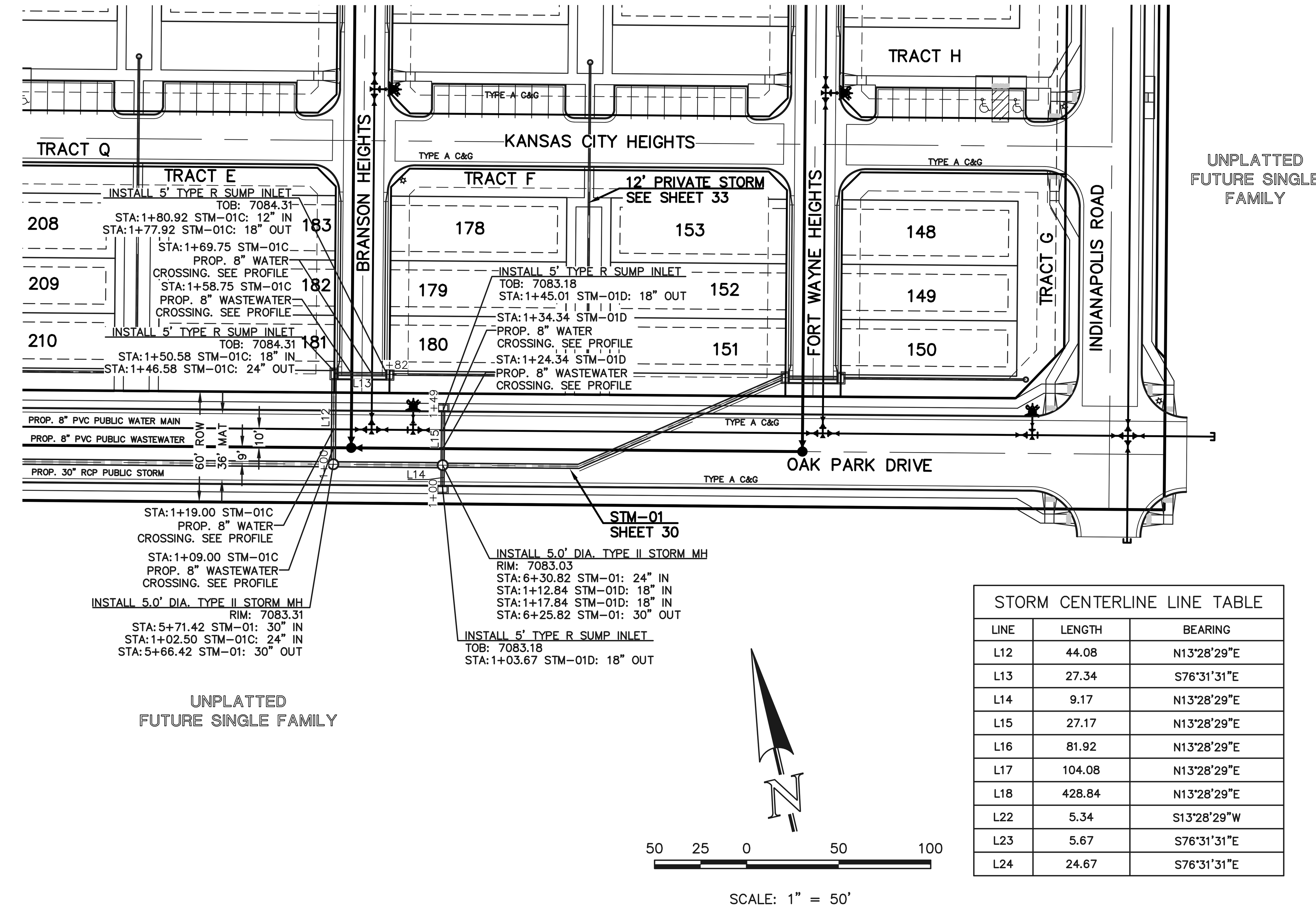
CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903

VILLAGES AT STERLING RANCH

PUBLIC STORM PLANS
OAK PARK DRIVE

DESIGNED BY	EAS	SCALE	DATE 11/01/2024
DRAWN BY	EAS	(H) 1"= 50'	SHEET 30 OF 35
CHECKED BY		(V) 1"= 5'	JOB NO. 1183.26





STORM CENTERLINE LINE TABLE

LINE	LENGTH	BEARING
L12	44.08	N13°28'29"E
L13	27.34	S76°31'31"E
L14	9.17	N13°28'29"E
L15	27.17	N13°28'29"E
L16	81.92	N13°28'29"E
L17	104.08	N13°28'29"E
L18	428.84	N13°28'29"E
L22	5.34	S13°28'29"W
L23	5.67	S76°31'31"E
L24	24.67	S76°31'31"E

48 HOURS BEFORE YOU DIG,
CALL UTILITY LOCATORS
811
UTILITY NOTIFICATION CENTER OF COLORADO
IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE

REVIEW:

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

COLORADO LICENSED
CATHERINE MARIE TESSIN
45004
PROFESSIONAL ENGINEER

[illegible]

CATHERINE M. TESSIN, COLORADO P.E. #45004 05/12/25 DATE

CLASSIC CONSULTING

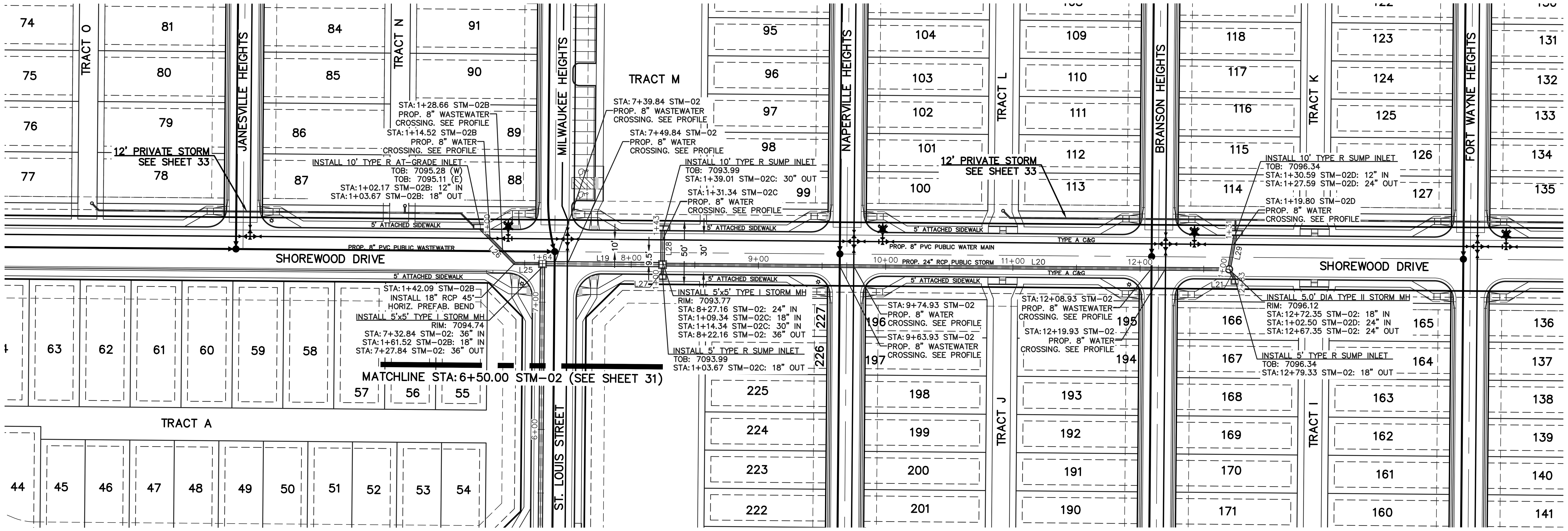
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903

VILLAGES AT STERLING RANCH

PUBLIC STORM PLANS
OAK PARK DRIVE & ST. LOUIS STREET

DESIGNED BY	EAS	SCALE	DATE 11/01/2024
DRAWN BY	EAS	(H) 1"= 50'	SHEET 31 OF 35
CHECKED BY		(V) 1"= 5'	JOB NO. 1183.26

CLASSIC CONSULTING



STORM CENTERLINE LINE TABLE		
LINE	LENGTH	BEARING
L18	428.84	N13°28'29"E
L19	89.32	S76°31'31"E
L20	440.20	S76°31'31"E
L21	6.97	S16°54'44"E
L25	19.42	N76°31'31"W
L26	38.42	N31°31'31"W
L27	5.67	N13°28'29"E
L28	24.67	N13°28'29"E
L29	25.09	N23°28'29"E

N

50 25 0 50 100

SCALE: 1" = 50'

48 HOURS BEFORE YOU DIG,
CALL UTILITY LOCATORS
811
UTILITY NOTIFICATION CENTER OF COLORADO
IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE

REVIEW:

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

COLORADO LICENSED PROFESSIONAL ENGINEER CATHERINE MARIE TESSIN 45004

05/12/25

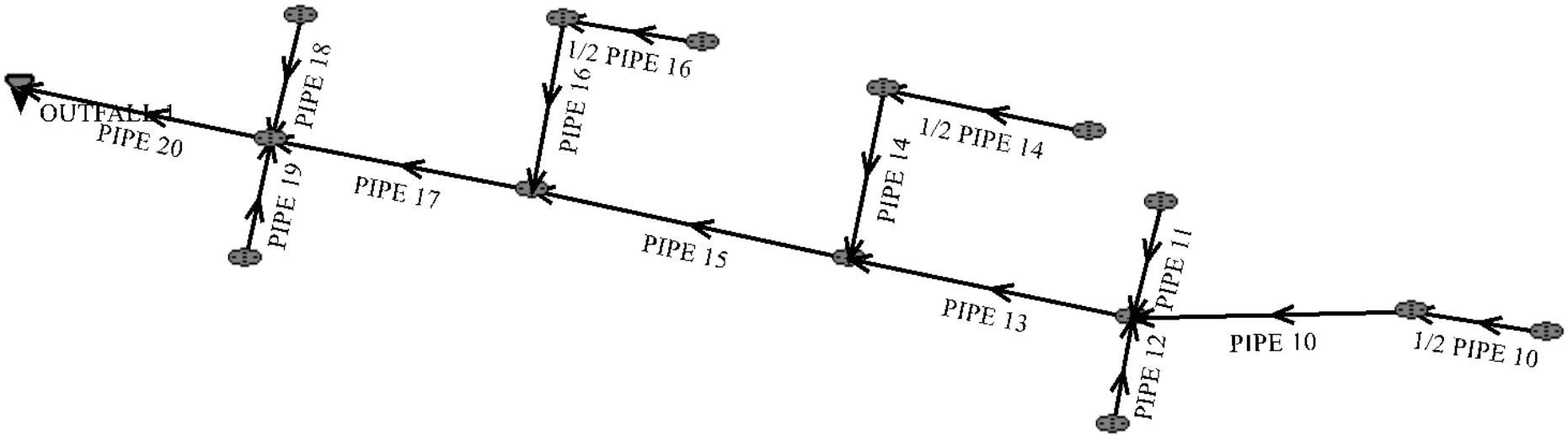
CATHERINE M. TESSIN, COLORADO P.E. #45004 — DATE

CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903

VILLAGES AT STERLING RANCH

PUBLIC STORM PLANS
SHOREWOOD DRIVE

DESIGNED BY	EAS	SCALE	DATE 11/01/2024
DRAWN BY	EAS	(H) 1"= 50'	SHEET 32 OF 35
CHECKED BY		(V) 1"= 5'	JOB NO. 1183.26


OUTFALL
PIPE 20
PIPE 19
PIPE 18
PIPE 17
PIPE 16
1/2 PIPE 16
PIPE 15
PIPE 14
1/2 PIPE 14
PIPE 13
PIPE 12
PIPE 11
PIPE 10
1/2 PIPE 10

System Input Summary – STM-01: 100-YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 4.0

Backwater Calculations:

Tailwater Elevation (ft): 7068.76

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	7081.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 20	7080.93	44.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 18	7081.08	7.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 19	7081.08	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 17	7082.15	35.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 15	7083.31	26.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 14	7084.31	9.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2 PIPE 14	7084.34	4.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 13	7083.03	16.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 10	7085.79	8.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2 PIPE 10	7085.79	4.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 11	7083.18	7.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 12	7083.18	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 16	7082.72	9.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2 PIPE 16	7082.72	4.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	23.03	1.92	0.24	44.30	

PIPE 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.30	
PIPE 18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.50	
PIPE 19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	
PIPE 17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.40	
PIPE 15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.10	
PIPE 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.40	
1/2 PIPE 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.70	
PIPE 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.60	
PIPE 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.60	
1/2 PIPE 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30	
PIPE 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.40	
PIPE 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
PIPE 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.30	
1/2 PIPE 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.60	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
PIPE 20	89.32	7068.76	0.5	7069.21	0.013	0.00	0.00	CIRCULAR	36.00 in	36.00 in
PIPE 18	27.17	7070.81	1.0	7071.08	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 19	9.17	7071.16	5.0	7071.62	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 17	124.60	7069.51	0.5	7070.13	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PIPE 15	240.00	7070.74	0.5	7071.94	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
PIPE 14	44.08	7072.91	0.5	7073.13	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
1/2 PIPE 14	27.34	7073.83	0.5	7073.97	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 13	54.40	7072.09	0.5	7072.37	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

PIPE 10	192.03	7073.82	0.5	7074.78	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
1/2 PIPE 10	27.34	7075.92	0.5	7076.06	0.013	0.14	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 11	27.17	7073.45	0.5	7073.58	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 12	9.17	7073.71	1.0	7073.80	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 16	44.08	7071.23	0.5	7071.45	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
1/2 PIPE 16	27.34	7072.05	0.5	7072.19	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
PIPE 20	47.48	6.72	26.02	8.10	27.55	7.63	0.89	Subcritical	44.30	0.00	
PIPE 18	10.50	5.94	12.73	5.61	11.25	6.46	1.27	Pressurized	7.50	27.17	
PIPE 19	23.59	13.35	6.40	3.55	3.54	8.13	3.16	Supercritical	2.00	0.00	
PIPE 17	47.18	6.67	23.20	7.35	23.27	7.33	0.99	Subcritical	35.40	0.00	
PIPE 15	29.08	5.92	20.90	7.15	22.20	6.70	0.89	Subcritical	26.10	0.00	
PIPE 14	16.01	5.10	13.14	5.34	13.22	5.30	0.99	Subcritical	9.40	0.00	
1/2 PIPE 14	7.54	4.27	9.99	4.66	10.29	4.50	0.95	Subcritical	4.70	0.00	
PIPE 13	29.52	6.01	16.52	5.99	16.09	6.19	1.05	Supercritical	16.60	0.00	
PIPE 10	16.04	5.11	12.55	5.18	12.51	5.19	1.01	Supercritical	8.60	0.00	
1/2 PIPE 10	7.54	4.27	9.54	4.52	9.74	4.41	0.96	Subcritical	4.30	0.00	
PIPE 11	7.28	4.12	18.00	4.19	18.00	4.19	0.00	Pressurized	7.40	27.17	
PIPE 12	10.43	5.90	7.18	3.80	6.00	4.85	1.41	Supercritical	2.50	0.00	
PIPE 16	16.03	5.10	13.07	5.32	13.12	5.29	0.99	Subcritical	9.30	0.00	
1/2 PIPE 16	7.54	4.27	9.88	4.63	10.15	4.48	0.95	Subcritical	4.60	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).

- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PIPE 20	44.30	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
PIPE 18	7.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 19	2.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 17	35.40	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
PIPE 15	26.10	CIRCULAR	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	4.91	
PIPE 14	9.40	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
1/2 PIPE 14	4.70	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 13	16.60	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
PIPE 10	8.60	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
1/2 PIPE 10	4.30	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 11	7.40	CIRCULAR	18.00 in	18.00 in	21.00 in	21.00 in	18.00 in	18.00 in	1.77	
PIPE 12	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 16	9.30	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
1/2 PIPE 16	4.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 7068.76

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
PIPE 20	7068.76	7069.21	0.00	0.00	7070.93	7071.55	7071.95	0.47	7072.42
PIPE 18	7070.81	7071.08	0.37	0.00	7072.51	7072.65	7072.79	0.14	7072.93
PIPE 19	7071.16	7071.62	0.03	0.00	7071.57	7072.41	7072.48	0.00	7072.48
PIPE 17	7069.51	7070.13	0.02	0.00	7071.91	7072.13	7072.44	0.47	7072.91
PIPE 15	7070.74	7071.94	0.02	0.00	7072.48	7073.88	7073.28	1.24	7074.51
PIPE 14	7072.91	7073.13	0.18	0.00	7074.51	7074.55	7074.70	0.09	7074.79
1/2 PIPE 14	7073.83	7073.97	0.14	0.00	7074.69	7074.82	7075.00	0.14	7075.14
PIPE 13	7072.09	7072.37	0.01	0.00	7074.32	7074.32	7074.52	0.05	7074.57
PIPE 10	7073.82	7074.78	0.01	0.00	7074.86	7075.83	7075.28	0.96	7076.24
1/2 PIPE 10	7075.92	7076.06	0.01	0.00	7076.71	7076.88	7077.03	0.14	7077.17
PIPE 11	7073.45	7073.58	0.36	0.00	7074.95	7075.08	7075.22	0.13	7075.36
PIPE 12	7073.71	7073.80	0.04	0.00	7074.51	7074.51	7074.62	0.04	7074.65
PIPE 16	7071.23	7071.45	0.18	0.00	7072.92	7072.96	7073.09	0.08	7073.17
1/2 PIPE 16	7072.05	7072.19	0.14	0.00	7073.13	7073.16	7073.30	0.08	7073.39

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

System Input Summary – STM-01: 5-YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 4.0

Backwater Calculations:

Tailwater Elevation (ft): 7068.76

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	7081.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 20	7080.93	20.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 18	7081.08	3.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 19	7081.08	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 17	7082.15	16.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 15	7083.31	12.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 14	7084.31	4.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2 PIPE 14	7084.34	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 13	7083.03	8.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 10	7085.79	3.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2 PIPE 10	7085.79	1.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 11	7083.18	3.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 12	7083.18	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 16	7082.72	4.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2 PIPE 16	7082.72	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	10.99	1.88	0.51	20.70	

PIPE 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.70	
PIPE 18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.30	
PIPE 19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.10	
PIPE 17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.60	
PIPE 15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.40	
PIPE 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.20	
1/2 PIPE 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.10	
PIPE 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.10	
PIPE 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.90	
1/2 PIPE 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.95	
PIPE 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.90	
PIPE 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40	
PIPE 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.20	
1/2 PIPE 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
PIPE 20	89.32	7068.76	0.5	7069.21	0.013	0.00	0.00	CIRCULAR	36.00 in	36.00 in
PIPE 18	27.17	7070.81	1.0	7071.08	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 19	9.17	7071.16	5.0	7071.62	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 17	124.60	7069.51	0.5	7070.13	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PIPE 15	240.00	7070.74	0.5	7071.94	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
PIPE 14	44.08	7072.91	0.5	7073.13	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
1/2 PIPE 14	27.34	7073.83	0.5	7073.97	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 13	54.40	7072.10	0.5	7072.37	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

PIPE 10	192.03	7073.82	0.5	7074.78	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
1/2 PIPE 10	27.34	7075.92	0.5	7076.06	0.013	0.14	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 11	27.17	7073.44	0.5	7073.58	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 12	9.17	7073.71	1.0	7073.80	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 16	44.08	7071.23	0.5	7071.45	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
1/2 PIPE 16	27.34	7072.05	0.5	7072.19	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
PIPE 20	47.29	6.69	17.53	6.06	16.66	6.47	1.10	Supercritical	20.70	0.00	
PIPE 18	10.53	5.96	8.30	4.14	6.92	5.27	1.42	Supercritical	3.30	0.00	
PIPE 19	23.55	13.33	4.70	3.00	2.65	6.81	3.08	Supercritical	1.10	0.00	
PIPE 17	47.29	6.69	15.62	5.64	14.73	6.10	1.12	Supercritical	16.60	0.00	
PIPE 15	29.08	5.92	14.18	5.43	13.68	5.69	1.07	Supercritical	12.40	0.00	
PIPE 14	16.04	5.11	8.63	4.13	8.38	4.30	1.06	Supercritical	4.20	0.00	
½ PIPE 14	7.45	4.21	6.56	3.60	6.54	4.02	1.01	Supercritical	2.10	0.00	
PIPE 13	29.08	5.92	11.36	4.76	10.83	5.07	1.10	Supercritical	8.10	0.00	
PIPE 10	16.04	5.11	8.31	4.04	8.06	4.21	1.06	Supercritical	3.90	0.00	
½ PIPE 10	7.45	4.21	6.31	3.53	6.29	4.02	1.01	Supercritical	1.95	0.00	
PIPE 11	7.45	4.21	9.06	4.37	9.25	4.26	0.96	Subcritical	3.90	0.00	
PIPE 12	10.53	5.96	5.32	3.21	4.43	4.14	1.43	Supercritical	1.40	0.00	
PIPE 16	16.04	5.11	8.63	4.13	8.38	4.30	1.06	Supercritical	4.20	0.00	
½ PIPE 16	7.45	4.21	6.56	3.60	6.54	4.02	1.01	Supercritical	2.10	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).

- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PIPE 20	20.70	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
PIPE 18	3.30	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 19	1.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 17	16.60	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
PIPE 15	12.40	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
PIPE 14	4.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
1/2 PIPE 14	2.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 13	8.10	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
PIPE 10	3.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
1/2 PIPE 10	1.95	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 11	3.90	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 12	1.40	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 16	4.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
1/2 PIPE 16	2.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

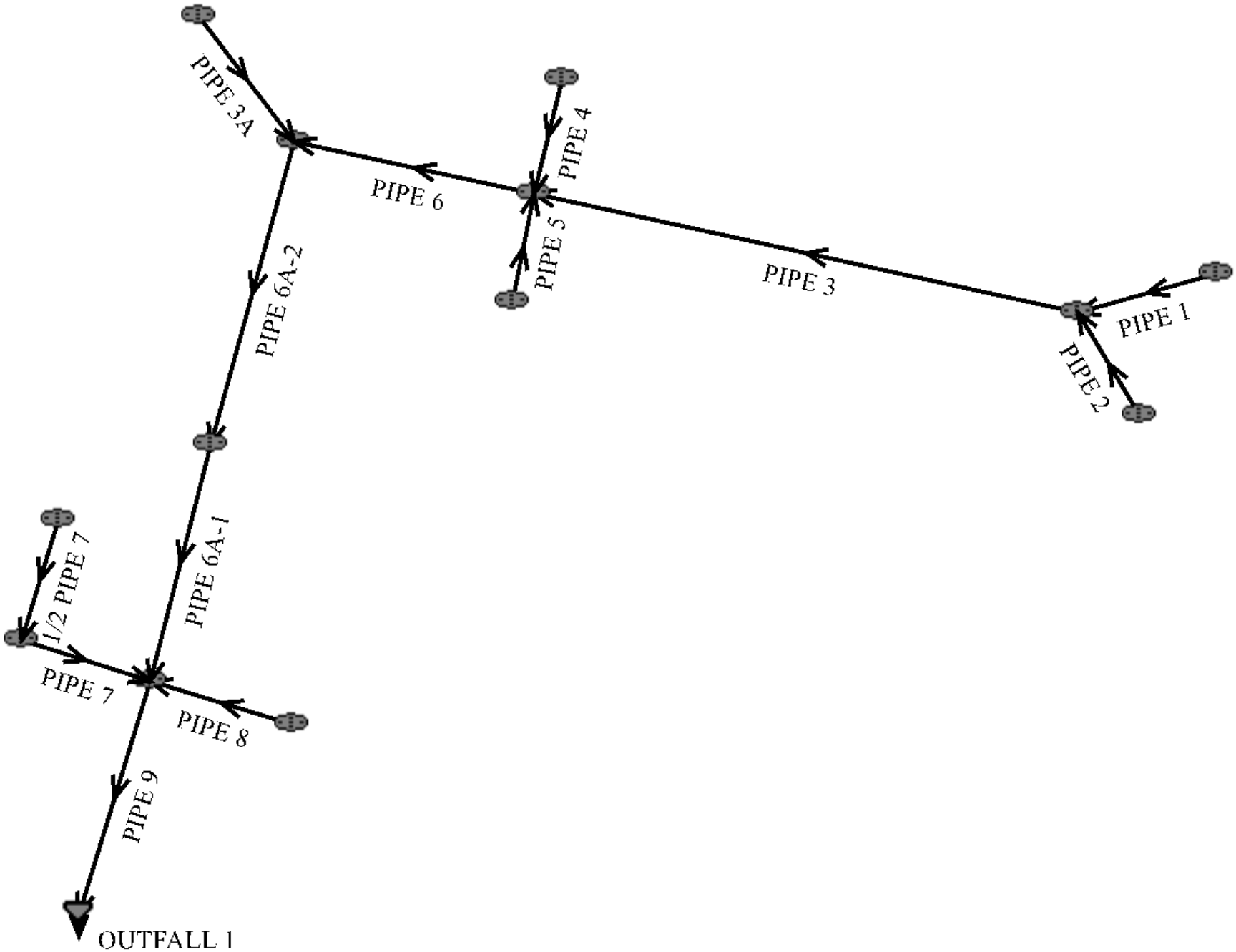
- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 7068.76

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
PIPE 20	7068.76	7069.21	0.00	0.00	7070.15	7070.67	7070.80	0.44	7071.24
PIPE 18	7070.81	7071.08	0.07	0.00	7071.38	7071.77	7071.82	0.22	7072.04
PIPE 19	7071.16	7071.62	0.01	0.00	7071.38	7072.01	7072.10	0.05	7072.15
PIPE 17	7069.51	7070.13	0.00	0.00	7070.73	7071.43	7071.31	0.61	7071.93
PIPE 15	7070.74	7071.94	0.00	0.00	7071.88	7073.12	7072.38	1.20	7073.58
PIPE 14	7072.91	7073.13	0.04	0.00	7073.61	7073.85	7073.90	0.22	7074.11
1/2 PIPE 14	7073.83	7073.97	0.03	0.00	7074.38	7074.52	7074.58	0.14	7074.72
PIPE 13	7072.10	7072.37	0.00	0.00	7073.44	7073.44	7073.58	0.11	7073.69
PIPE 10	7073.82	7074.78	0.00	0.00	7074.49	7075.47	7074.77	0.96	7075.73
1/2 PIPE 10	7075.92	7076.06	0.00	0.00	7076.45	7076.59	7076.64	0.14	7076.78
PIPE 11	7073.44	7073.58	0.10	0.00	7074.20	7074.36	7074.50	0.14	7074.63
PIPE 12	7073.71	7073.80	0.01	0.00	7074.08	7074.24	7074.34	0.06	7074.40
PIPE 16	7071.23	7071.45	0.04	0.00	7071.93	7072.17	7072.22	0.22	7072.43
1/2 PIPE 16	7072.05	7072.19	0.03	0.00	7072.60	7072.74	7072.80	0.14	7072.94

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.


PIPE 3A
PIPE 6
PIPE 4
PIPE 5
PIPE 3
PIPE 1
PIPE 2
PIPE 6A-2
PIPE 6A-1
1/2 PIPE 7
PIPE 7
PIPE 8
PIPE 9
OUTFALL 1

System Input Summary – STM-02: 100-YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 4.0

Backwater Calculations:

Tailwater Elevation (ft): 7069.16

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	7081.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 9	7080.93	61.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 6A-1	7082.85	39.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 6A-2	7094.74	39.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 3A	7095.11	10.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 6	7093.77	29.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 4	7093.99	15.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 5	7093.11	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 3	7096.12	14.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 2	7096.34	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 1	7096.34	13.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 7	7081.22	23.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2 PIPE 7	7081.25	11.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 8	7081.01	3.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	31.52	1.94	0.16	61.00	

PIPE 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61.00	
PIPE 6A-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.30	
PIPE 6A-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.30	
PIPE 3A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.10	
PIPE 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.20	
PIPE 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.30	
PIPE 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.10	
PIPE 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.40	
PIPE 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	
PIPE 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.40	
PIPE 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.00	
1/2 PIPE 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.50	
PIPE 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.90	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
PIPE 9	82.42	7069.17	1.0	7069.99	0.013	0.00	0.00	CIRCULAR	36.00 in	36.00 in
PIPE 6A-1	104.08	7070.62	0.5	7071.14	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PIPE 6A-2	428.84	7071.74	2.1	7080.96	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PIPE 3A	57.85	7083.46	2.0	7084.62	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 6	89.32	7081.52	0.5	7081.97	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
PIPE 4	24.67	7083.00	1.0	7083.25	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
PIPE 5	5.67	7084.09	3.0	7084.26	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 3	440.19	7083.15	0.6	7085.79	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
PIPE 2	6.98	7086.63	1.0	7086.70	0.013	0.63	0.00	CIRCULAR	18.00 in	18.00 in

PIPE 1	25.09	7086.09	1.0	7086.34	0.013	1.06	0.00	CIRCULAR	24.00 in	24.00 in
PIPE 7	5.67	7071.49	2.0	7071.60	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
1/2 PIPE 7	5.34	7072.44	1.0	7072.50	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
PIPE 8	24.67	7071.49	0.5	7071.61	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
PIPE 9	66.88	9.46	30.23	9.63	27.01	10.72	1.28	Supercritical	61.00	0.00	
PIPE 6A-1	47.29	6.69	24.49	7.68	25.06	7.48	0.96	Subcritical	39.30	0.00	
PIPE 6A-2	96.92	13.71	24.49	7.68	15.96	12.99	2.27	Supercritical	39.30	0.00	
PIPE 3A	14.90	8.43	14.69	6.54	10.87	9.06	1.83	Supercritical	10.10	0.00	
PIPE 6	47.29	6.69	20.99	6.82	20.46	7.04	1.05	Supercritical	29.20	0.00	
PIPE 4	41.13	8.38	15.83	5.82	12.67	7.76	1.53	Supercritical	15.30	0.00	
PIPE 5	18.24	10.32	4.70	3.00	3.00	5.69	2.41	Supercritical	1.10	0.00	
PIPE 3	17.57	5.59	16.41	6.29	16.53	6.24	0.99	Subcritical	14.40	0.00	
PIPE 2	10.53	5.96	4.91	3.07	4.10	4.05	1.42	Supercritical	1.20	0.00	
PIPE 1	22.68	7.22	15.81	6.10	13.27	7.52	1.40	Supercritical	13.40	0.00	
PIPE 7	57.25	11.66	19.58	6.78	13.23	11.03	2.12	Supercritical	23.00	0.00	
1/2 PIPE 7	24.06	7.66	14.61	5.75	11.69	7.57	1.53	Pressurized	11.50	5.34	
PIPE 8	7.45	4.21	9.06	4.37	9.25	4.26	0.96	Pressurized	3.90	24.67	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PIPE 9	61.00	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
PIPE 6A-1	39.30	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
PIPE 6A-2	39.30	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
PIPE 3A	10.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 6	29.20	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
PIPE 4	15.30	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
PIPE 5	1.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 3	14.40	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
PIPE 2	1.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 1	13.40	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
PIPE 7	23.00	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
1/2 PIPE 7	11.50	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
PIPE 8	3.90	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 7069.16

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
PIPE 9	7069.17	7069.99	0.00	0.00	7071.42	7072.51	7073.20	0.75	7073.95
PIPE 6A-1	7070.62	7071.14	0.02	0.00	7073.47	7073.72	7073.97	0.32	7074.29
PIPE 6A-2	7071.74	7080.96	0.02	0.00	7073.75	7083.00	7075.91	8.01	7083.92
PIPE 3A	7083.46	7084.62	0.67	0.00	7084.37	7085.84	7085.64	0.87	7086.51
PIPE 6	7081.52	7081.97	0.35	0.00	7083.90	7083.90	7084.27	0.21	7084.47
PIPE 4	7083.00	7083.25	0.20	0.00	7084.10	7084.57	7084.99	0.10	7085.10
PIPE 5	7084.09	7084.26	0.01	0.00	7084.37	7084.65	7084.72	0.07	7084.79
PIPE 3	7083.15	7085.79	0.02	0.00	7084.52	7087.18	7085.13	2.64	7087.77
PIPE 2	7086.63	7086.70	0.00	0.00	7087.77	7087.77	7087.78	0.00	7087.78
PIPE 1	7086.09	7086.34	0.30	0.00	7087.48	7087.66	7088.07	0.16	7088.24
PIPE 7	7071.49	7071.60	0.45	0.00	7072.96	7074.14	7074.48	0.00	7074.48
1/2 PIPE 7	7072.44	7072.50	0.27	0.00	7074.55	7074.56	7074.75	0.01	7074.77
PIPE 8	7071.49	7071.61	0.10	0.00	7073.97	7074.01	7074.05	0.03	7074.08

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

System Input Summary – STM-02: 5-YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 4.0

Backwater Calculations:

Tailwater Elevation (ft): 7069.16

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
OUTFALL 1	7081.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 9	7080.93	28.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 6A-1	7082.85	18.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 6A-2	7094.74	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 3A	7095.11	6.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 6	7093.77	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 4	7093.99	4.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 5	7093.11	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 3	7096.12	7.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 2	7096.34	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 1	7096.34	6.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 7	7081.22	10.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2 PIPE 7	7081.25	5.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 8	7081.01	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	14.99	1.91	0.34	28.60	
PIPE 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.60	
PIPE 6A-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.60	
PIPE 6A-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
PIPE 3A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.80	
PIPE 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
PIPE 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.90	
PIPE 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	
PIPE 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.20	
PIPE 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	
PIPE 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.60	
PIPE 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.90	
1/2 PIPE 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.45	
PIPE 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
PIPE 9	82.42	7069.17	1.0	7069.99	0.013	0.00	0.00	CIRCULAR	36.00 in	36.00 in
PIPE 6A-1	104.08	7070.62	0.5	7071.14	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PIPE 6A-2	428.84	7071.95	2.1	7080.96	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PIPE 3A	57.85	7083.46	2.0	7084.62	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 6	89.32	7081.52	0.5	7081.97	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
PIPE 4	24.67	7083.00	1.0	7083.25	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
PIPE 5	5.67	7084.09	3.0	7084.26	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 3	440.19	7083.15	0.6	7085.79	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
PIPE 2	6.98	7086.63	1.0	7086.70	0.013	0.63	0.00	CIRCULAR	18.00 in	18.00 in
PIPE 1	25.09	7086.09	1.0	7086.34	0.013	1.06	0.00	CIRCULAR	24.00 in	24.00 in
PIPE 7	5.67	7071.49	1.9	7071.60	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
1/2 PIPE 7	5.34	7072.44	1.1	7072.50	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
PIPE 8	24.67	7071.49	0.5	7071.61	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
PIPE 9	66.88	9.46	20.77	6.77	16.44	9.09	1.56	Supercritical	28.60	0.00	
PIPE 6A-1	47.29	6.69	16.58	5.85	15.69	6.29	1.11	Supercritical	18.60	0.00	
PIPE 6A-2	96.92	13.71	13.08	5.09	8.48	9.28	2.32	Supercritical	11.80	0.00	
PIPE 3A	14.90	8.43	12.11	5.38	8.54	8.24	1.96	Supercritical	6.80	0.00	
PIPE 6	47.29	6.69	13.08	5.09	12.26	5.56	1.13	Supercritical	11.80	0.00	
PIPE 4	41.13	8.38	8.76	4.11	6.99	5.64	1.55	Supercritical	4.90	0.00	
PIPE 5	18.24	10.32	3.45	2.54	2.24	4.75	2.34	Supercritical	0.60	0.00	
PIPE 3	17.57	5.59	11.43	4.88	10.70	5.31	1.13	Supercritical	7.20	0.00	
PIPE 2	10.53	5.96	3.73	2.65	3.14	4.08	1.40	Supercritical	0.70	0.00	
PIPE 1	22.68	7.22	10.92	4.74	8.87	6.26	1.49	Supercritical	6.60	0.00	
PIPE 7	56.69	11.55	13.26	5.21	8.92	8.92	2.15	Supercritical	10.90	0.00	
1/2 PIPE 7	23.79	7.57	9.88	4.47	7.81	6.14	1.57	Supercritical	5.45	0.00	
PIPE 8	7.45	4.21	5.70	3.33	5.67	4.03	1.01	Supercritical	1.60	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PIPE 9	28.60	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
PIPE 6A-1	18.60	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
PIPE 6A-2	11.80	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
PIPE 3A	6.80	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 6	11.80	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PIPE 4	4.90	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
PIPE 5	0.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 3	7.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
PIPE 2	0.70	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PIPE 1	6.60	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
PIPE 7	10.90	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
1/2 PIPE 7	5.45	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
PIPE 8	1.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 7069.16

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PIPE 9	7069.17	7069.99	0.00	0.00	7070.54	7071.72	7071.82	0.61	7072.43
PIPE 6A-1	7070.62	7071.14	0.01	0.00	7071.93	7072.52	7072.54	0.51	7073.05
PIPE 6A-2	7071.95	7080.96	0.00	0.00	7072.66	7082.05	7074.00	8.45	7082.45
PIPE 3A	7083.46	7084.62	0.30	0.00	7084.17	7085.63	7085.23	0.85	7086.08
PIPE 6	7081.52	7081.97	0.06	0.00	7082.54	7083.06	7083.02	0.44	7083.46
PIPE 4	7083.00	7083.25	0.02	0.00	7083.59	7083.98	7084.08	0.16	7084.24
PIPE 5	7084.09	7084.26	0.00	0.00	7084.28	7084.55	7084.63	0.02	7084.65
PIPE 3	7083.15	7085.79	0.00	0.00	7084.04	7086.74	7084.48	2.63	7087.11
PIPE 2	7086.63	7086.70	0.00	0.00	7086.86	7087.01	7087.11	0.01	7087.12
PIPE 1	7086.09	7086.34	0.07	0.00	7086.83	7087.25	7087.44	0.16	7087.60
PIPE 7	7071.49	7071.60	0.10	0.00	7072.42	7072.70	7073.09	0.04	7073.13
1/2 PIPE 7	7072.44	7072.50	0.06	0.00	7073.09	7073.48	7073.68	0.00	7073.68
PIPE 8	7071.49	7071.61	0.02	0.00	7071.96	7072.09	7072.13	0.12	7072.26

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.