Renaissance Infrastructure Consulting

1815 McGee Street Suite 200
Kansas City, MO 64108
P: 816.800.0950
ric-consult.com

February 28, 2019

Mike Weisenborn
Project Manager, Development Center
City of Lee's Summit
220 SE Green Street
Lee's Summit, MO 64063

Re: **18-0251 Burton Townhomes Sanitary Sewer Impact Statement**

Mr. Weisenborn:
Per the requirements provided by the City of Lee's Summit's planning code regarding the preliminary development plan submittal for the proposed Burton Townhomes, a sanitary sewer impact analysis has been conducted. The following is a report of the analysis.

PROJECT DESCRIPTION

The proposed Burton Townhomes development is in the City of Lee's Summit, Jackson County, MO. The project is located on the southwest corner of NW Olive St and NW Orchard Dr and is 3.76 acres in size. A site location map has been provided as Exhibit A. The complex generally consists of nine primary townhomes and associated infrastructure. The entire site is located within the Cedar Creek Watershed. Refer to Exhibit B for a layout of the proposed complex.

METHODOLOGY

Based on the provisions outlined in the Lee's Summit Design and Construction Manual (LS DCM) 6500 for Sanitary Sewers, the peak sanitary sewer flow has been determined. Using as-builts and survey information on the existing sanitary sewer infrastructure, the existing sanitary sewer system has been analyzed to determine if the proposed flows will require any modifications to the existing system.

EXISTING PEAK FLOW

The existing sanitary sewer system services residential housing, two warehouses, a storage facility, a commercial lumber yard, an office building, a church, and a veterinarian complex. The existing residential area and surrounding non-residential developments were analyzed to determine the existing peak flowrate conditions. The LS DCM 6501.C was used to calculate peak sanitary sewer flowrates for the existing system. The peak sanitary sewer flow is the summation of the peak base flow, the peak infiltration, and peak inflow of the existing residential and non-residential developments. Jackson County Incentive Viewer was used to determine lot acreage. An existing sanitary sewer layout was provided by the City of Lee's Summit. Refer to Exhibit C (Existing Site) for a layout of the existing sanitary sewer and lot lines used to determine existing peak flowrates. A summary of the sanitary sewer peak flows calculated for the existing use has been provided in Table 1.

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Table 1. Summary of Existing Sanitary Sewer Peak Flows

	Contributing Residential and Non-Residential Developments	Area (Ac.)	EDU	Peak Base Flow (gpd)	Peak Infiltration	Peak Inflow				Peak Flow (gpd)	Peak Flow Rate (cfs)
						Time of Concentration T_c (min)	Intensity i (iph)	Peak Inflow Q (cfs)	Peak Inflow (gpd)		
East of RR	**Ex Residential 1**	1.33	-	2,000	667	19.96	6.27	0.025	16,209	**18,875**	**0.029**
	Lumber Yard	0.58	0.1	761	291	16.19	6.98	0.024	15,752	**16,804**	**0.026**
	Ex Residential 2	1.68	-	2523	841	21.16	6.12	0.031	19,957	**23,321**	**0.036**
	Office Building	0.07	0.3	257	33	9.33	8.13	0.003	2,069	**2,359**	**0.004**
	Church	0.10	0.5	675	52	10.47	7.84	0.005	3,141	**3,867**	**0.006**
	Animal Hospital	0.21	0.4	1,093	105	12.50	7.58	0.010	6,147	**7,345**	**0.011**
West of RR	**Ex Residential 3**	1.44	-	2,153	718	20.33	6.22	0.054	34,624	**37,495**	**0.058**
	Ex Residential 4	1.81	-	2,716	905	21.56	6.07	0.066	42,616	**46,237**	**0.072**
	Storage Unit Facility	6.72	0.1	8,780	3,359	30.02	4.98	0.201	129,753	**141,893**	**0.220**
	Ex Residential 5	1.48	-	2,226	742	20.50	6.02	0.054	34,645	**37,613**	**0.058**
	Warehouse 1	1.03	0.1	1,348	516	18.71	6.43	0.040	25,720	**27,584**	**0.043**
	Warehouse 2	0.68	0.1	889	340	16.84	6.67	0.027	17,590	**18,819**	**0.029**
	Ex Residential 6	2.07	-	3,109	1,036	22.31	5.97	0.074	47,987	**52,132**	**0.081**
	Total	19.2		9,462	9604			0.613	396,210	**415,275**	**0.672**

PROPOSED PEAK FLOW

The proposed sanitary sewer system will service a 3.76 acre of multi-family townhomes along NW Olive St. This residential development was analyzed to determine the proposed peak sanitary sewer flowrate conditions. The LS DCM 6501.C was used to calculate the peak sanitary sewer flow for the proposed multi-family townhomes. The peak sanitary sewer flow is the summation of the peak base flow, the peak infiltration, and the peak inflow of the proposed townhomes as well as existing residential and non-residential developments. A summary of the flows calculated for proposed use and existing use has been provided in Table 2. Refer to Exhibit D (Proposed Site) for details regarding the proposed peak sanitary sewer flow calculations.

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Table 2. Summary of Proposed Sanitary Sewer Peak Flows

	Contributing Residential and Non-Residential Developments	Area (Ac.)	EDU	Peak Base Flow (gpd)	Peak Infiltration	Peak Inflow				Peak Flow (gpd)	Peak Flow Rate (cfs)
						Time of Concentration T_c (min)	Intensity i (iph)	Peak Inflow Q (cfs)	Peak Inflow (gpd)		
East of RR	**Prop Townhomes**	3.76	-	5,280	1,760	25.50	5.56	0.059	37,948	**44,988**	**0.074**
	Ex Residential 1	1.33	-	2,000	667	19.96	6.27	0.025	16,209	**18,875**	**0.029**
	Lumber Yard	0.58	0.1	761	291	16.19	6.98	0.024	15,752	**16,804**	**0.026**
	Ex Residential 2	1.68	-	2523	841	21.16	6.12	0.031	19,957	**23,321**	**0.036**
	Office Building	0.07	0.3	257	33	9.33	8.13	0.003	2,069	**2,359**	**0.004**
	Church	0.10	0.5	675	52	10.47	7.84	0.005	3,141	**3,867**	**0.006**
	Animal Hospital	0.21	0.4	1,093	105	12.50	7.58	0.010	6,147	**7,345**	**0.011**
West of RR	**Ex Residential 3**	1.44	-	2,153	718	20.33	6.22	0.054	34,624	**37,495**	**0.058**
	Ex Residential 4	1.81	-	2,716	905	21.56	6.07	0.066	42,616	**46,237**	**0.072**
	Storage Unit Facility	6.72	0.1	8,780	3,359	30.02	4.98	0.201	129,753	**141,893**	**0.220**
	Ex Residential 5	1.48	-	2,226	742	20.50	6.02	0.054	34,645	**37,613**	**0.058**
	Warehouse 1	1.03	0.1	1,348	516	18.71	6.43	0.040	25,720	**27,584**	**0.043**
	Warehouse 2	0.68	0.1	889	340	16.84	6.67	0.027	17,590	**18,819**	**0.029**
	Ex Residential 6	2.07	-	3,109	1,036	22.31	5.97	0.074	47,987	**52,132**	**0.081**
	Total	**22.7**		**33,809**	**11364**			**0.672**	**434157**	**479,331**	**0.746**

SANITARY IMPACT ANALYSIS

The capacities of the existing sanitary sewer infrastructure have been modeled to verify that the existing infrastructure is adequate to support the estimated peak sanitary sewer flows from the proposed sites. Sanitary flows are conveyed to an existing 4' concrete sanitary sewer manhole north of the proposed site. Table 3 provides a summary of the existing pipes as well as pipe flow capacity in the system based on survey and provided as-built information. Flow capacities were calculated using Manning's Equation. The information for pipe 30-051 was provided via survey. Flowlines and length for pipes 30-068 through 30-009 were not provided by survey nor are reflected in the provided as-built information. Slopes for pipes 30-068 through 30-009 were assumed based on minimum requirements per LS DCM 6500 D.2.d. Pipe size was assumed to be 8" for pipes 30-068 through 30-010, and 10" for pipe 30-009. See Exhibit E for provided as-built information.

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Table 3. Summary of Existing Sanitary System & Flow Capacities

	Pipe ID	Pipe Length (ft)	US Flowline (ft)	DS Flowline (ft)	Pipe Slope (ft/ft)	Manning's n	Pipe Size (in)	Pipe Area (sf)	Flow Capacity (cfs)
East of RR	30-051	323.77	1007.25	1005.95	0.004	0.015	8	0.35	0.664
	30-031	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
	30-014	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
	30-013	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
	30-010	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
West of RR	30-047	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
	30-029	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
	30-068	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
	30-030	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
	30-026	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
	30-012	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
	30-005	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
	30-006	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
	30-007	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
	30-008	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813
	30-009	N/A	N/A	N/A	0.006	0.015	10	0.55	1.475

Table 4 provides a summary of the proposed system as well as pipe flow capacity in the proposed system based on Manning's Equation.

Table 4. Summary of Proposed Sanitary System & Flow Capacities

Pipe ID	Pipe Length (ft)	US Flowline (ft)	DS Flowline (ft)	Pipe Slope (ft/ft)	Manning's n	Pipe Size (in)	Pipe Area (sf)	Pipe Flow Capacity (cfs)
Prop. Pipe	N/A	N/A	N/A	0.006	0.015	8	0.35	0.813

The existing peak flow rate was modeled in the existing system to determine current capacity and service conditions. The location of contributing laterals from residential and non-residential developments were assumed based on the existing sanitary sewer layout. Table 5 gives a summary of the existing sanitary sewer impact under existing conditions. See Exhibit C for pipe performance models of the existing sanitary pipes under existing conditions.

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Table 5. Summary of Existing Sanitary Impact Under Existing Conditions

	Contributing Residential and Non-Residential Developments	Pipe ID	Pipe Slope (ft/ft)	Pipe Size (in)	Existing Flow Rate (cfs)	Depth (ft)	Accumulative Flow Rate (cfs)	Accumulative Depth (ft)	Pipe Velocity (ft/s)
East of RR	Ex Residential South + Lumber	30-051	0.004	8	0.055	0.13	0.055	0.13	1.14
	Ex Residential North	30-031	0.006	8	0.036	0.10	0.091	0.15	1.53
	Office, Church, Hospital	30-014	0.006	8	0.021	0.08	0.112	0.17	1.58
	N/A	30-013	0.006	8	0.021	0.08	0.112	0.17	1.58
	N/A	30-010	0.006	8	0.021	0.08	0.112	0.17	1.58
West of RR	Ex Residential 3	30-047	0.006	8	0.058	0.13	0.058	0.13	1.20
	Ex Residential 4	30-029	0.006	8	0.072	0.14	0.130	0.19	1.57
	Storage Unit Facility	30-068	0.006	8	0.220	0.24	0.220	0.24	1.93
	Ex Residential 5	30-030	0.006	8	0.058	0.13	0.407	0.34	2.25
	Warehouse 1	30-026	0.006	8	0.043	0.11	0.450	0.36	2.32
	Warehouse 2	30-012	0.006	8	0.029	0.09	0.479	0.37	2.39
	Ex Residential 6	30-005	0.006	8	0.081	0.15	0.081	0.15	1.36
	N/A	30-006	0.006	8	0.081	0.15	0.081	0.15	1.36
	N/A	30-007	0.006	8	0.110	0.17	0.560	0.41	2.47
	N/A	30-008	0.006	8	0.110	0.17	0.560	0.41	2.47
	N/A	30-009	0.006	10	0.131	0.17	0.672	0.40	2.60

The proposed peak flow rate (along with the existing peak flowrate) was modeled in the existing system to determine if it is adequate to receive and convey the flows from the proposed development. Table 6 gives a summary of the existing sanitary sewer impact under proposed conditions. See Exhibit D for pipe performance models of the existing sanitary pipes under proposed conditions.

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Table 6. Summary of Existing Sanitary Impact Under Proposed Conditions

	Contributing Residential and Non-Residential Developments	Pipe ID	Pipe Slope (ft/ft)	Pipe Size (in)	Existing Flow Rate (cfs)	Depth (ft)	Accumulative Flow Rate (cfs)	Accumulative Depth (ft)	Pipe Velocity (ft/s)
East of RR	Prop Townhomes	Prop. Pipe	0.006	8	0.070	0.14	0.070	0.14	1.31
	Ex Residential South + Lumber	30-051	0.004	8	0.055	0.13	0.125	0.20	1.40
	Ex Residential North	30-031	0.006	8	0.036	0.10	0.161	0.20	1.81
	Office, Church, Hospital	30-014	0.006	8	0.021	0.08	0.182	0.22	1.79
	N/A	30-013	0.006	8	0.021	0.08	0.182	0.22	1.79
	N/A	30-010	0.006	8	0.021	0.08	0.182	0.22	1.79
West of RR	Ex Residential 3	30-047	0.006	8	0.058	0.13	0.058	0.13	1.20
	Ex Residential 4	30-029	0.006	8	0.072	0.14	0.130	0.19	1.57
	Storage Unit Facility	30.068	0.006	8	0.220	0.24	0.220	0.24	1.93
	Ex Residential 5	30-030	0.006	8	0.058	0.13	0.407	0.34	2.25
	Warehouse 1	30-026	0.006	8	0.043	0.11	0.450	0.36	2.32
	Warehouse 2	30-012	0.006	8	0.029	0.09	0.479	0.37	2.39
	Ex Residential 6	30-005	0.006	8	0.081	0.15	0.081	0.15	1.36
	N/A	30-006	0.006	8	0.081	0.15	0.081	0.15	1.36
	N/A	30-007	0.006	8	0.110	0.17	0.560	0.41	2.47
	N/A	30-008	0.006	8	0.110	0.17	0.560	0.41	2.47
	N/A	30-009	0.006	10	0.131	0.17	0.742	0.42	2.69

SUMMARY

The proposed use identified herein results in an increase in the expected sanitary sewer flows as compared to the existing conditions. The existing infrastructure, however, is still adequate to receive and convey the sanitary sewer peak flows from the proposed townhome development in addition to the existing residential and non-residential developments peak flows. Table 7 provides a summary comparing the proposed system sanitary sewer peak flow rates to the existing sanitary sewer pipe capacities.

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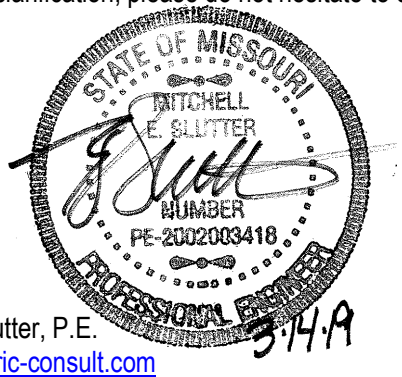
Table 7. Summary of Sanitary Sewer Flow Rates vs. Pipe Flow Capacities

	Contributing Residential and Non-Residential Developments	Pipe ID	Pipe Size (in)	Existing Flow Rate (cfs)	Accumulative Flow Rate (cfs)	Pipe Flow Capacity (cfs)
East of RR	Prop Townhomes	Prop. Pipe	8	0.070	0.070	0.813
	Ex Residential South + Lumber	30-051	8	0.055	0.125	0.664
	Ex Residential North	30-031	8	0.036	0.161	0.813
	Office, Church, Hospital	30-014	8	0.021	0.182	0.813
	N/A	30-013	8	0.021	0.182	0.813
	N/A	30-010	8	0.021	0.182	0.813
West of RR	Ex Residential 3	30-047	8	0.058	0.058	0.813
	Ex Residential 4	30-029	8	0.072	0.130	0.813
	Storage Unit Facility	30.068	8	0.220	0.220	0.813
	Ex Residential 5	30-030	8	0.058	0.407	0.813
	Warehouse 1	30-026	8	0.043	0.450	0.813
	Warehouse 2	30-012	8	0.029	0.479	0.813
	Ex Residential 6	30-005	8	0.081	0.081	0.813
	N/A	30-006	8	0.081	0.081	0.813
	N/A	30-007	8	0.110	0.560	0.813
	N/A	30-008	8	0.110	0.560	0.813
	N/A	30-009	10	0.131	0.742	1.475

It is our opinion that no modifications to the existing public sanitary sewer infrastructure will be required to accommodate the sanitary sewer peak flows from the proposed development. If you have any questions or need additional clarification, please do not hesitate to contact us.

Sincerely,



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RENAISSANCE INFRASTRUCTURE CONSULTING

Exhibit A

Site Location Maps

Exhibit A: Burton Townhomes Project Location Map

NORTH

1"=1000'

0 500' 1000'

Exhibit A
18-0251
Prepared: 12/11/18

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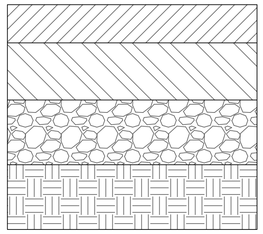
Exhibit B

Proposed General Layout



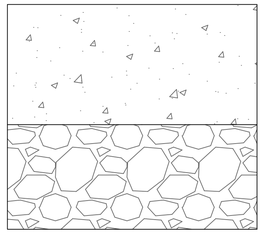
2" APWA Type 3 Asphaltic Concrete Surface Course

4" APWA Type 1 Asphaltic Base Course

6" MoDOT Type 5 Crushed Stone Base

6" Chemically Stabilized Subgrade

Asphaltic Pavement Section



6" PCC Surface

4" Aggregate Base

PCC Pavement Section

Roll Back Dry Curb & Gutter (Type CG-2 Dry)

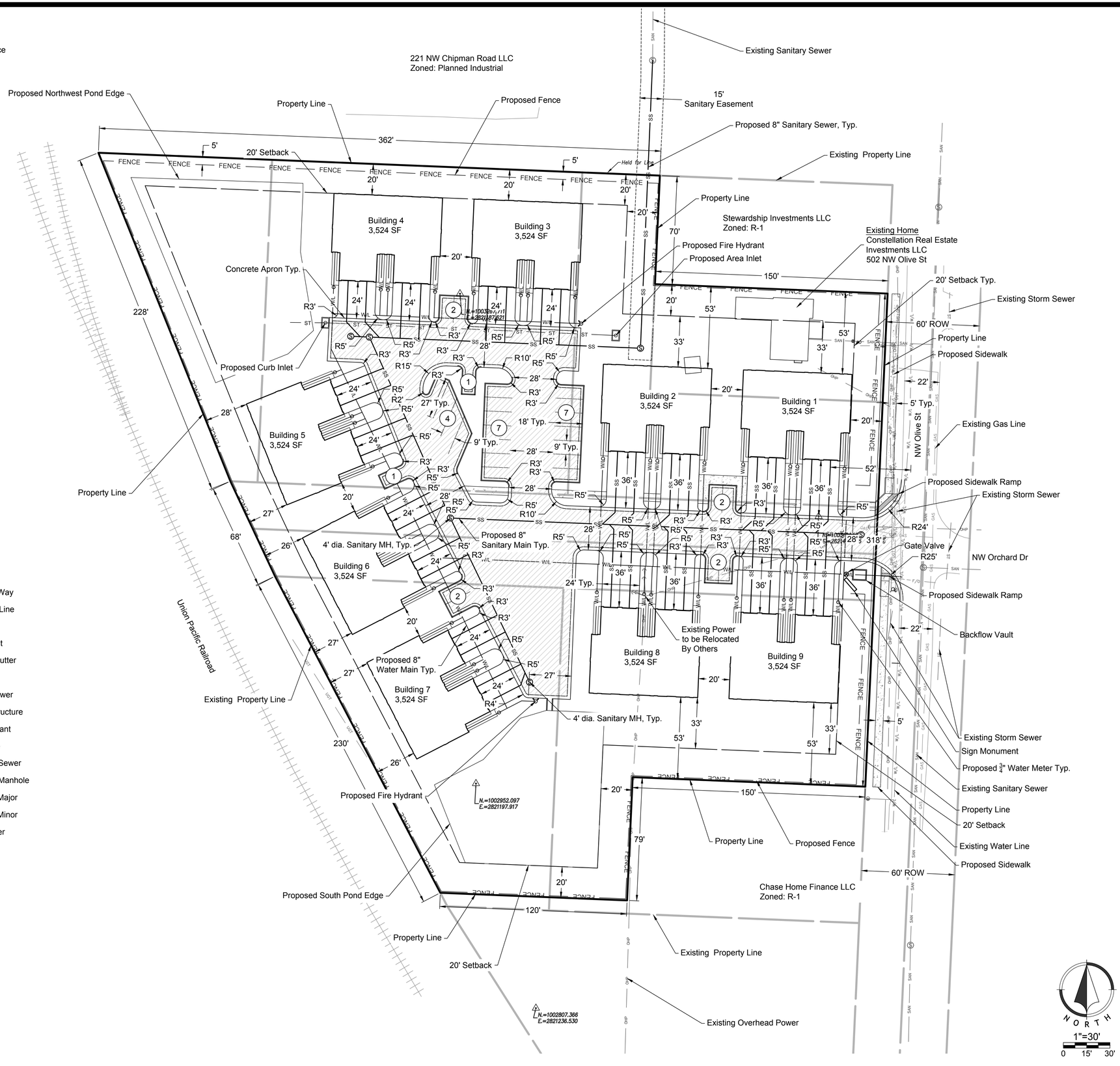
Straight Back Dry Curb & Gutter (Type CG-1 Dry)

LEGEND

Existing Section Line		R/W	Proposed Right-of-Way
Existing Right-of-Way Line		P/L	Proposed Property Line
Existing Lot Line		L/L	Proposed Lot Line
Existing Easement Line		U/E	Proposed Easement
Existing Curb & Gutter			Proposed Curb & Gutter
Existing Sidewalk			Proposed Sidewalk
Existing Storm Sewer			Proposed Storm Sewer
Existing Storm Structure			Proposed Storm Structure
W/L Existing Waterline			Proposed Fire Hydrant
GAS Existing Gas Main		WATER	Proposed Waterline
SAN Existing Sanitary Sewer		SS	Proposed Sanitary Sewer
Existing Sanitary Manhole			Proposed Sanitary Manhole
Existing Contour Major			Proposed Contour Major
Existing Contour Minor			Proposed Contour Minor
Proposed Asphaltic Pavement			Future Curb & Gutter

Lot Info
Lot Area: 3.76AC
Units: 36
Units per Acre: 9.57
Unit Size: 1,663 SF
Total Floor Area: 66,520 SF
Floor Area Ratio: .43
Impervious Area: 68,663 SF (44.8%)
Parking Required: 72 (2/Unit)
Parking Provided: 136 (3/Unit, & 28 Visitor Parking)

Note:
1) All fencing constructed adjacent to PI zoning districts shall conform to City of Lee's Summit UDO Section 8.890 minimum buffer screen requirements.



Sheet
C02

Preliminary Development Plans

18-0251
Burton Townhomes
Lee's Summit, Jackson County, Missouri

General Layout

NO.	BY	DATE	REVISION
2	JGD	MES	03/13/19	PER CITY COMMENT
1	JGD	MES	01/18/19	ORIGINAL SUBMITTAL

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MO Certificate of Authority: E-2010038630

Exhibit C

Existing Sanitary Sewer

Ex. Office + Church
+ Animal Hospital
Area: 0.38 Ac
EDU: 0.4 - 0.5

NW Olive St

Ex. Residential 2
Area: 1.68 Ac

Ex. Residential 1
Area: 1.33 Ac

NW Olive St

NW Chipman Rd

Pipe 30-031

Pipe 30-051

Pipe 30-014

Pipe 30-013

Pipe 30-010

Prop. Townhomes
Area: 3.76 Ac

Union Pacific Railroad

Ex. Lumber Yard
Building Area: 0.58 Ac
EDU: 0.1

Ex. Residential 5
Area: 1.48 Ac

Ex. Warehouse 1
Area: 1.03 Ac
EDU: 0.1

Pipe 30-009

Pipe 30-012

Pipe 30-068

Pipe 30-030

Pipe 30-026

Pipe 30-008

Pipe 30-007

Pipe 30-029

Ex. Storage Unit Facility
Building Area: 6.72 Ac
EDU: 0.1

Pipe 30-006

Ex. Warehouse 2
Area: 0.68 Ac
EDU: 0.1

Pipe 30-047

Ex. Residential 3
Area: 1.44 Ac

Pipe 30-005

Ex. Residential 6
Area: 2.07 Ac

NW Donovan Rd

Ex. Residential 4
Area: 1.81 Ac

1"=150'
0 75' 150'

Exhibit C

Existing Sanitary Sewer Layout

18-0251 Burton Townhomes
Lee's Summit, Jackson Co., Missouri

NO.	BY	DATE	REVISION
EDS	MES	2/28/19	ORIGINAL SUBMITTAL

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Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Feb 27 2019

Pipe 30-031 Existing Conditions

Circular

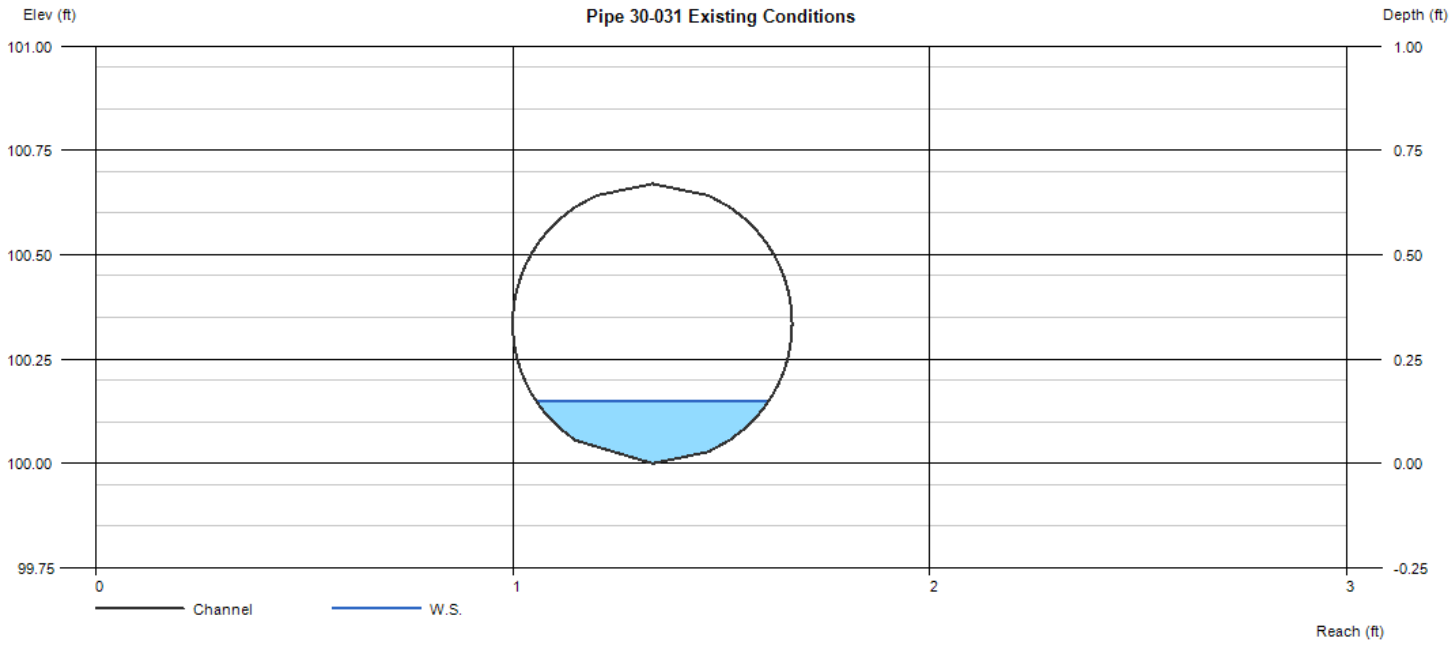
Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.09

Highlighted

Depth (ft)	= 0.15
Q (cfs)	= 0.091
Area (sqft)	= 0.06
Velocity (ft/s)	= 1.53
Wetted Perim (ft)	= 0.66
Crit Depth, Yc (ft)	= 0.14
Top Width (ft)	= 0.56
EGL (ft)	= 0.19



Channel Report

Pipe 30-014 Existing Conditions

Circular

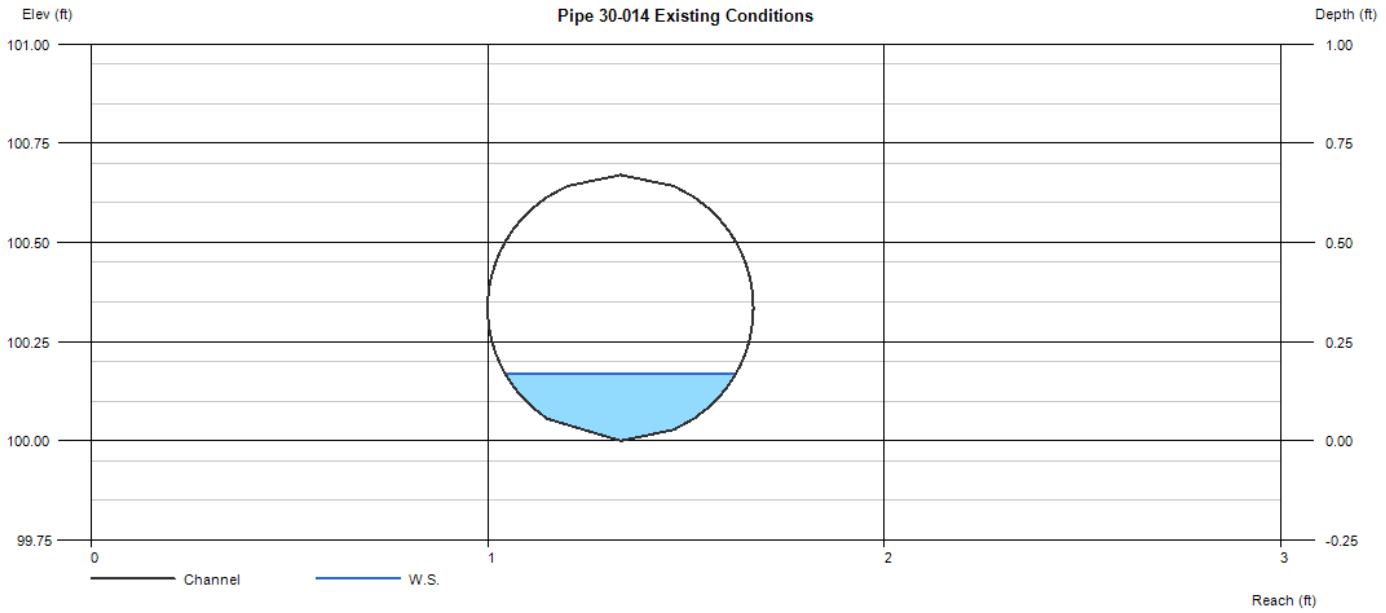
Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.11

Highlighted

Depth (ft)	= 0.17
Q (cfs)	= 0.112
Area (sqft)	= 0.07
Velocity (ft/s)	= 1.58
Wetted Perim (ft)	= 0.71
Crit Depth, Yc (ft)	= 0.16
Top Width (ft)	= 0.58
EGL (ft)	= 0.21



Channel Report

Pipe 30-051 Existing Conditions

Circular

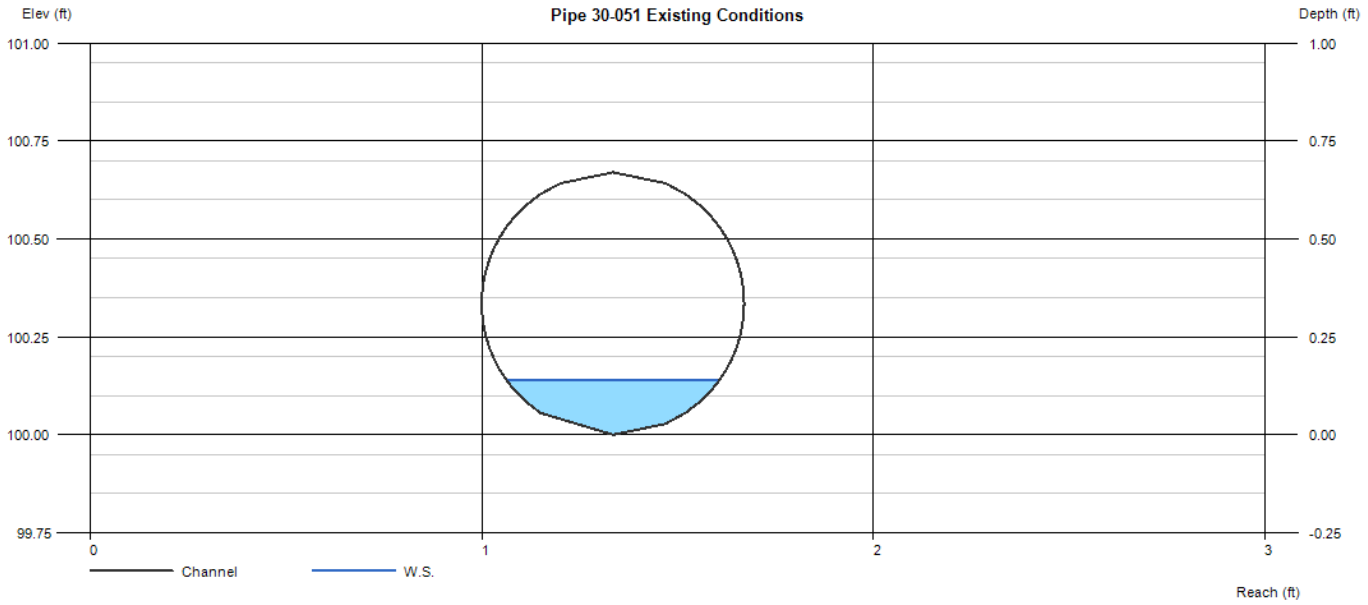
Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.40
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.06

Highlighted

Depth (ft)	= 0.13
Q (cfs)	= 0.055
Area (sqft)	= 0.05
Velocity (ft/s)	= 1.14
Wetted Perim (ft)	= 0.61
Crit Depth, Yc (ft)	= 0.11
Top Width (ft)	= 0.53
EGL (ft)	= 0.15



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Feb 6 2019

Pipe 30-009 Existing Conditions

Circular

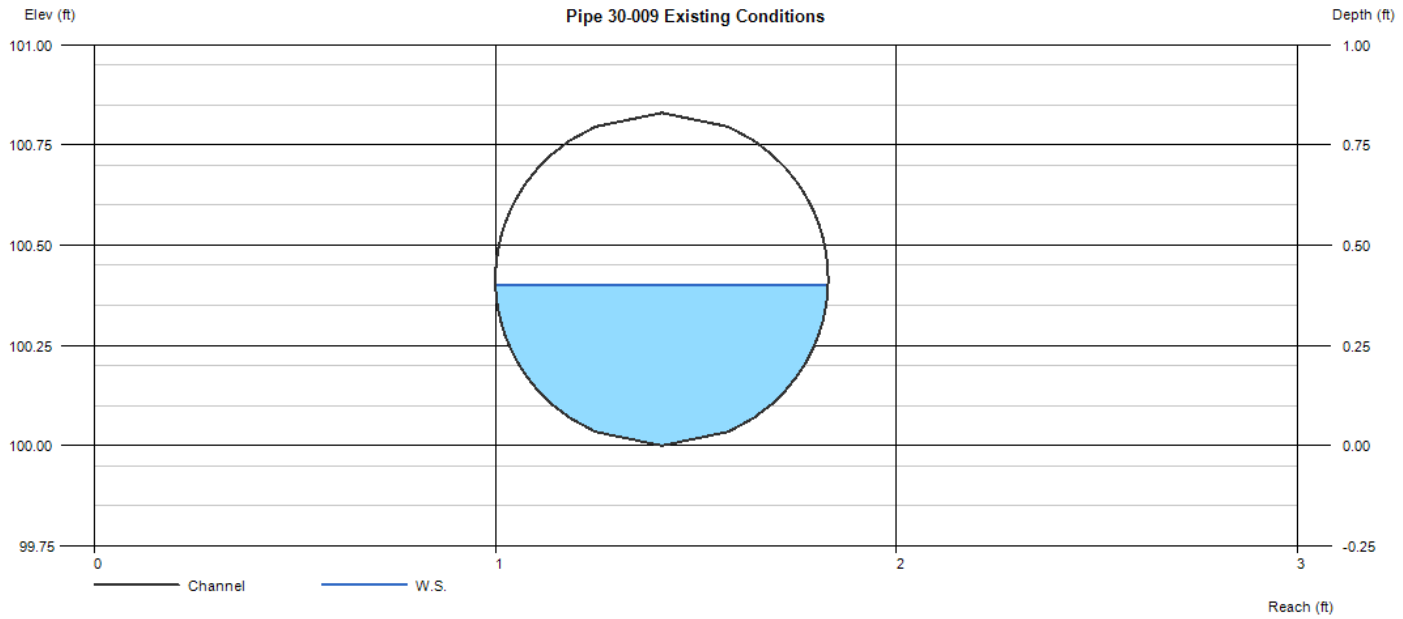
Diameter (ft)	= 0.83
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.67

Highlighted

Depth (ft)	= 0.40
Q (cfs)	= 0.672
Area (sqft)	= 0.26
Velocity (ft/s)	= 2.60
Wetted Perim (ft)	= 1.27
Crit Depth, Yc (ft)	= 0.37
Top Width (ft)	= 0.83
EGL (ft)	= 0.51



Channel Report

Pipe 30-007 Existing Conditions

Circular

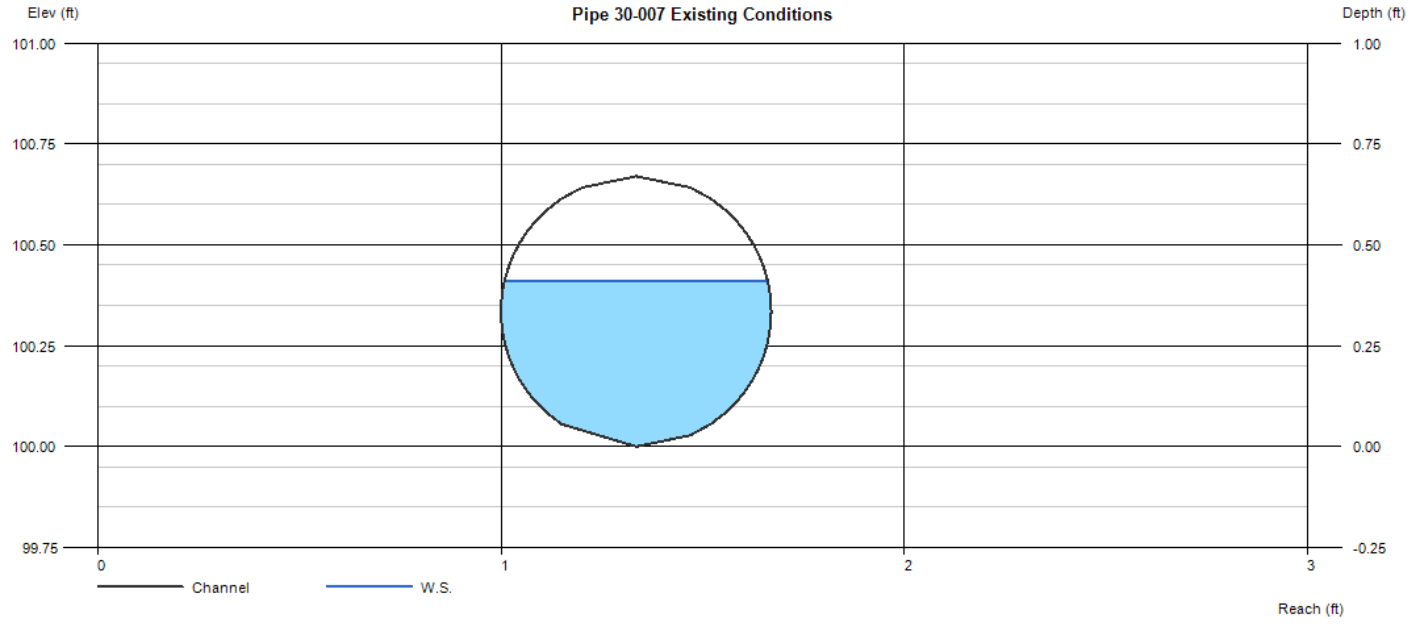
Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.56

Highlighted

Depth (ft)	= 0.41
Q (cfs)	= 0.560
Area (sqft)	= 0.23
Velocity (ft/s)	= 2.47
Wetted Perim (ft)	= 1.21
Crit Depth, Yc (ft)	= 0.35
Top Width (ft)	= 0.65
EGL (ft)	= 0.50



Channel Report

Pipe 30-012 Existing Conditions

Circular

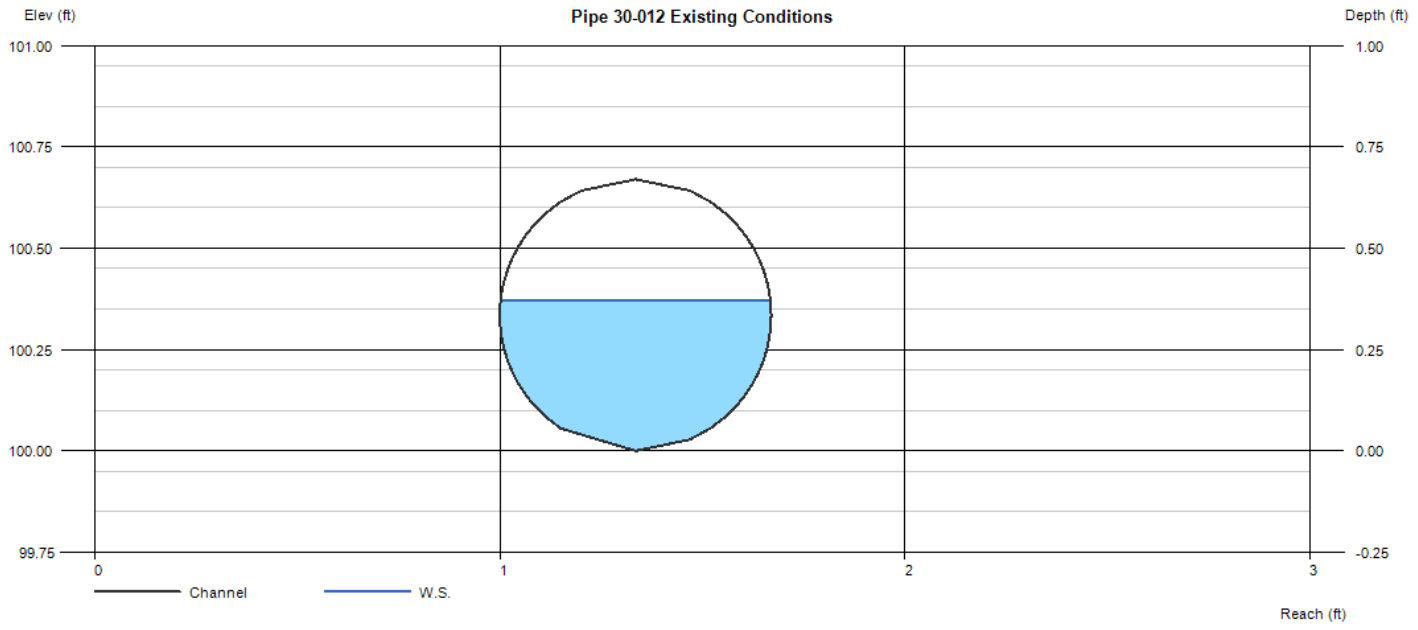
Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.48

Highlighted

Depth (ft)	= 0.37
Q (cfs)	= 0.479
Area (sqft)	= 0.20
Velocity (ft/s)	= 2.39
Wetted Perim (ft)	= 1.13
Crit Depth, Yc (ft)	= 0.33
Top Width (ft)	= 0.67
EGL (ft)	= 0.46



Channel Report

Pipe 30-026 Existing Conditions

Circular

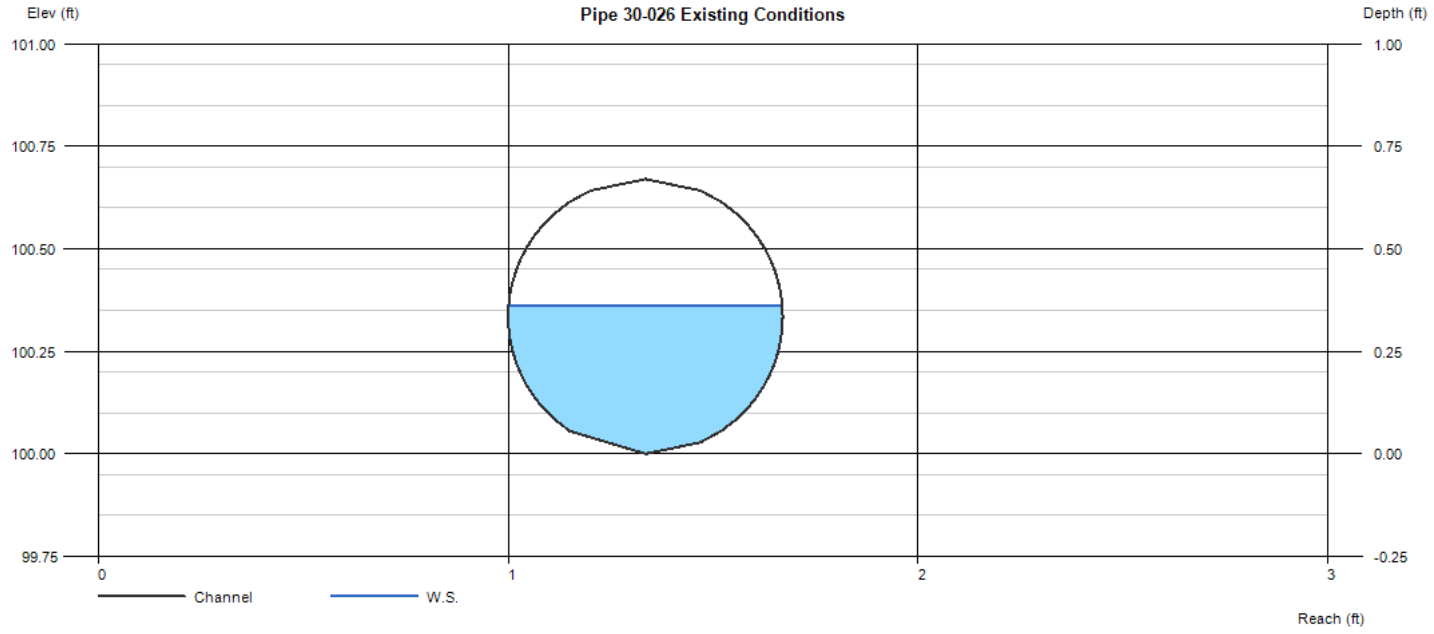
Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.45

Highlighted

Depth (ft)	= 0.36
Q (cfs)	= 0.450
Area (sqft)	= 0.19
Velocity (ft/s)	= 2.32
Wetted Perim (ft)	= 1.11
Crit Depth, Yc (ft)	= 0.32
Top Width (ft)	= 0.67
EGL (ft)	= 0.44



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Feb 6 2019

Pipe 30-068 Existing Conditions

Circular

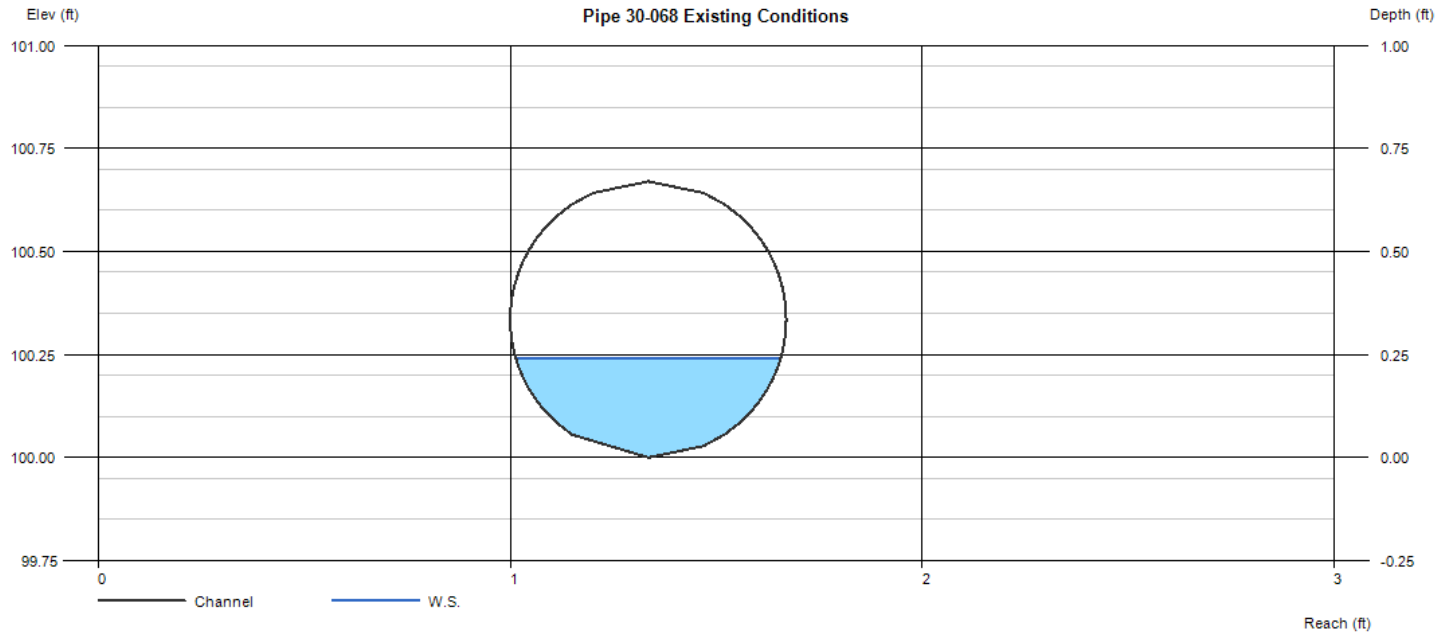
Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.22

Highlighted

Depth (ft)	= 0.24
Q (cfs)	= 0.220
Area (sqft)	= 0.11
Velocity (ft/s)	= 1.93
Wetted Perim (ft)	= 0.86
Crit Depth, Yc (ft)	= 0.22
Top Width (ft)	= 0.64
EGL (ft)	= 0.30



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Feb 27 2019

Pipe 30-005 Existing Conditions

Circular

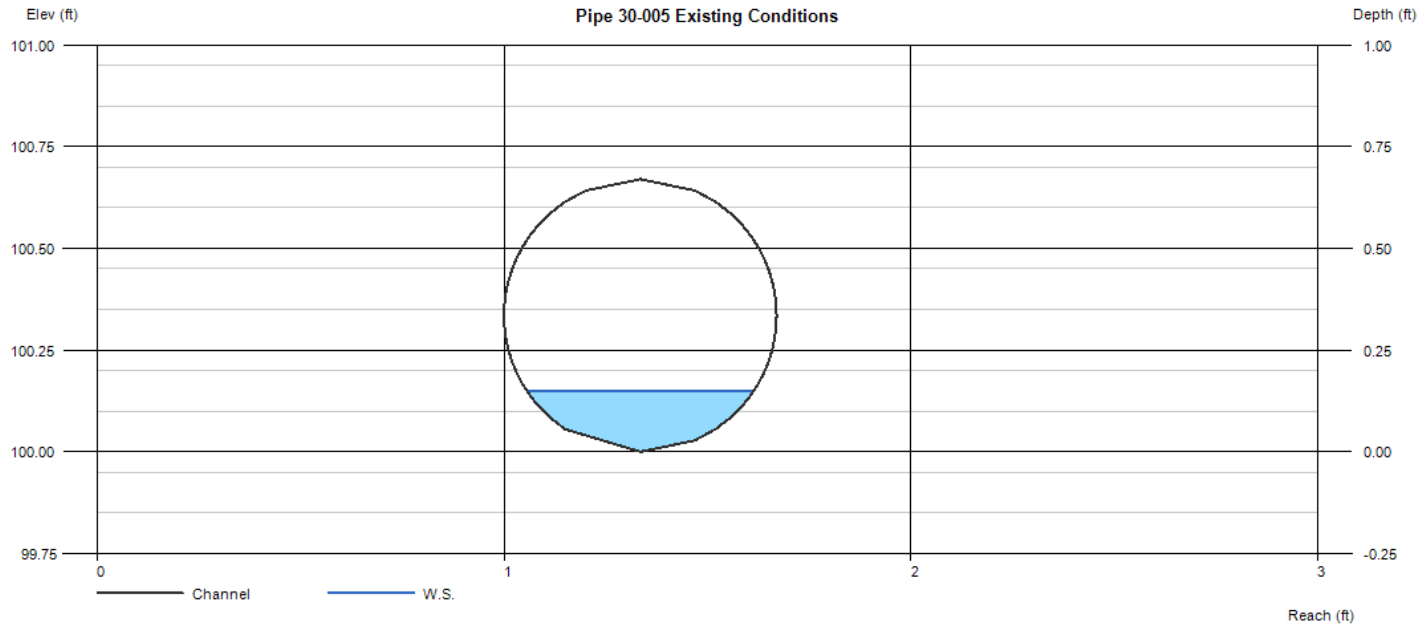
Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.08

Highlighted

Depth (ft)	= 0.15
Q (cfs)	= 0.081
Area (sqft)	= 0.06
Velocity (ft/s)	= 1.36
Wetted Perim (ft)	= 0.66
Crit Depth, Yc (ft)	= 0.13
Top Width (ft)	= 0.56
EGL (ft)	= 0.18



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Feb 6 2019

Pipe 30-047 Existing Conditions

Circular

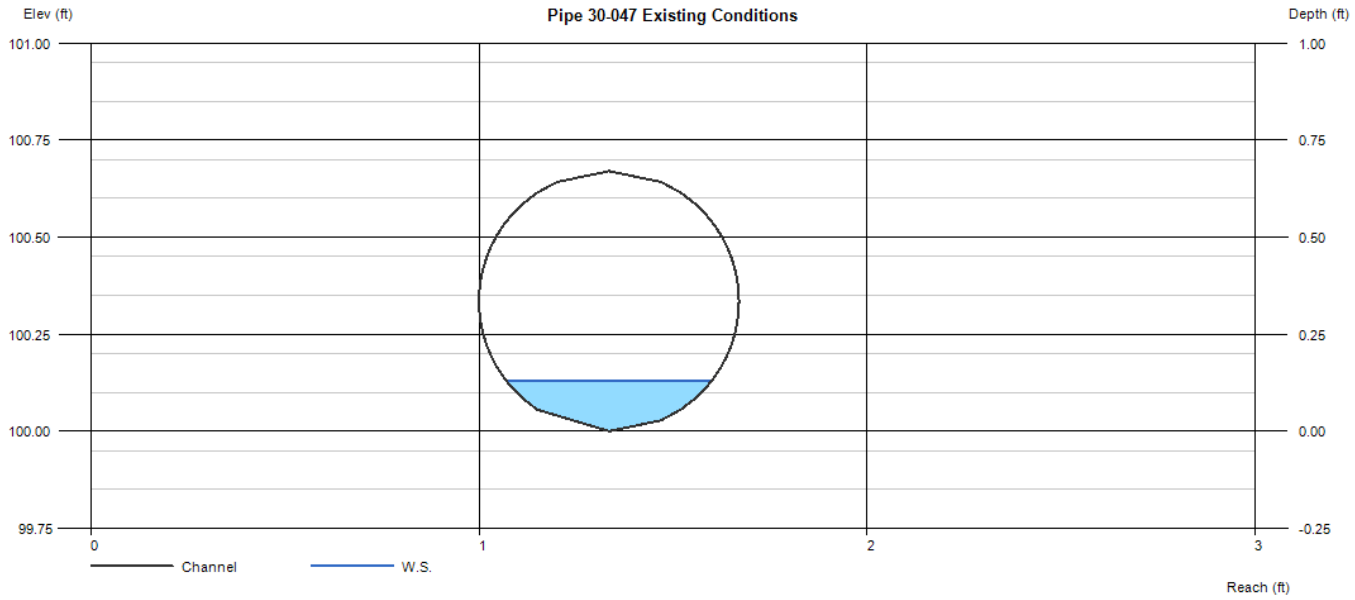
Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.06

Highlighted

Depth (ft)	= 0.13
Q (cfs)	= 0.058
Area (sqft)	= 0.05
Velocity (ft/s)	= 1.20
Wetted Perim (ft)	= 0.61
Crit Depth, Yc (ft)	= 0.11
Top Width (ft)	= 0.53
EGL (ft)	= 0.15



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Feb 6 2019

Pipe 30-030 Existing Conditions

Circular

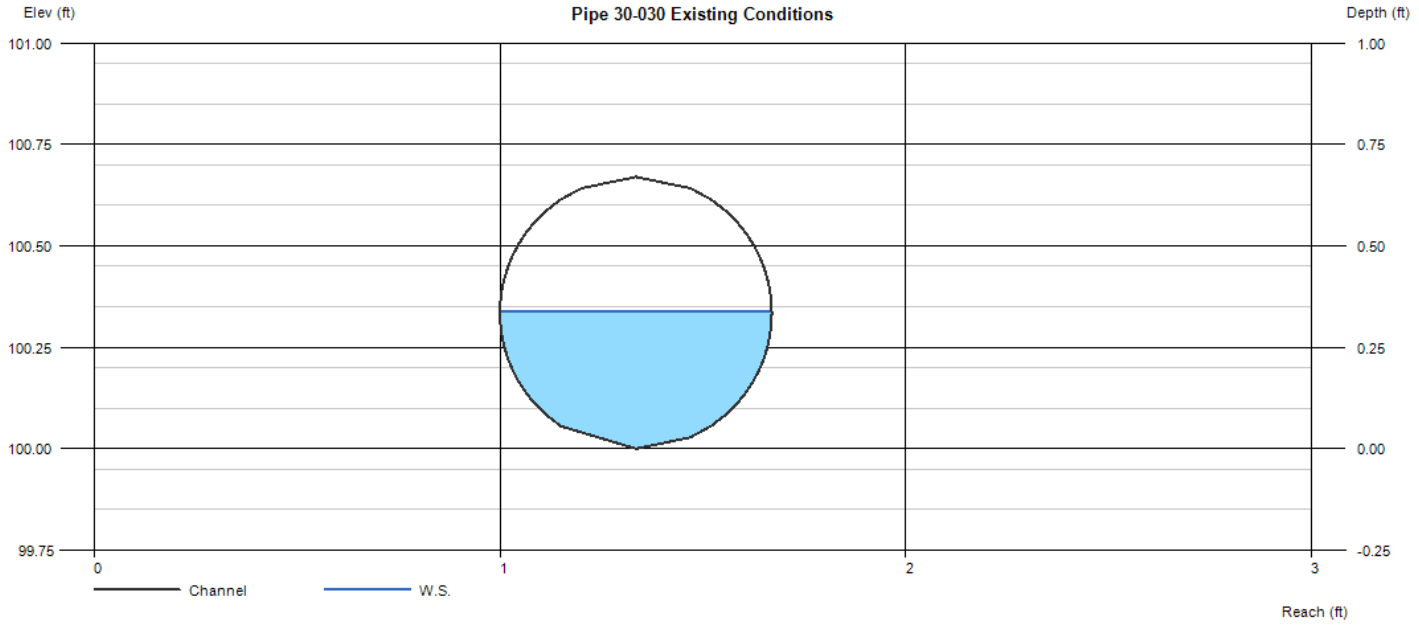
Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.41

Highlighted

Depth (ft)	= 0.34
Q (cfs)	= 0.407
Area (sqft)	= 0.18
Velocity (ft/s)	= 2.25
Wetted Perim (ft)	= 1.07
Crit Depth, Yc (ft)	= 0.30
Top Width (ft)	= 0.67
EGL (ft)	= 0.42



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Feb 6 2019

Pipe 30-029 Existing Conditions

Circular

Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.13

Highlighted

Depth (ft)	= 0.19
Q (cfs)	= 0.130
Area (sqft)	= 0.08
Velocity (ft/s)	= 1.57
Wetted Perim (ft)	= 0.75
Crit Depth, Yc (ft)	= 0.17
Top Width (ft)	= 0.60
EGL (ft)	= 0.23

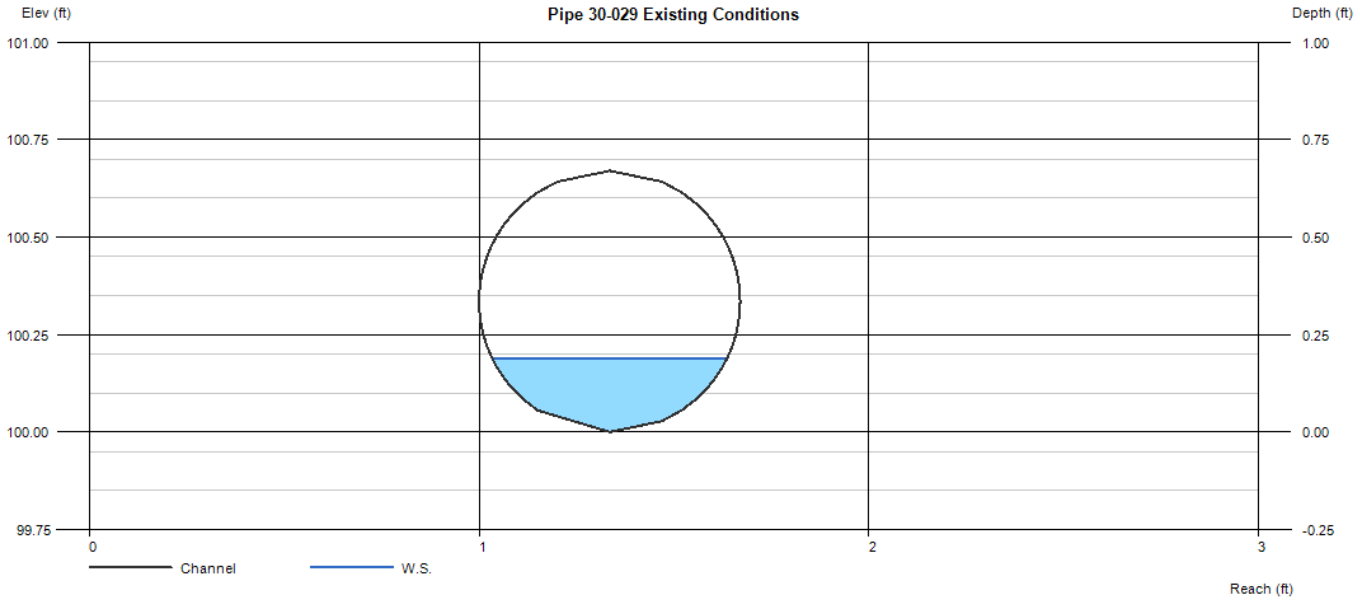


Exhibit D

Proposed Sanitary Sewer

Install 35.00 LF 4" SDR-26 PVC
From Main to Building

Install 35.00 LF 4" SDR-26 PVC
From Main to Building

Install 33.00 LF 4" SDR-26 PVC
From Main to Building

Install 4' Conc MH (B1)
Top Elev = 1014.80
Install 12.00 LF 8" SDR-26 PVC
FlOut (E) 8" PVC = 1011.18

Install 4' Conc MH (A2)
Top Elev = 1014.99
Install 175.00 LF 8" SDR-26 PVC
FlIn (SE) 8" PVC = 1010.61
FlIn (W) 8" PVC = 1011.11
FlOut (E) 8" PVC = 1010.11

Install 40.00 LF 4" SDR-26 PVC
From Main to Building

Install 35.50 LF 4" SDR-26 PVC
From Main to Building

Install 36.00 LF 4" SDR-26 PVC
From Main to Building

Install 4' Conc MH (A3)
Top Elev = 1017.68
Install 130.00 LF 8" SDR-26 PVC
FlIn (SE) 8" PVC = 1012.38
FlIn (W) 8" PVC = 1011.88
FlOut (NW) 8" PVC = 1011.38

Install 4' Conc MH (C1)
Top Elev = 1017.34
Install 118.00 LF 8" SDR-26 PVC
FlOut (NW) 8" PVC = 1013.32

Install 55.00 LF 4" SDR-26 PVC
From Main to Building

Install 4' Conc MH (A1)
Top Elev = 1019.09
Install 186.00 LF 8" SDR-26 PVC
FL In (W) 8" PVC = 1009.06
FL Out (N) 8" PVC = 1008.56

Existing 4' Conc MH
Cover Elev = 1013.80
FL In (S) 8" PVC = 1007.45
FL Out (N) 8" VCP=1007.25

Install 51.00 LF 4" SDR-26 PVC
From Main to Building

Install 55.00 LF 4" SDR-26 PVC
From Main to Building

Install 51.00 LF 4" SDR-26 PVC
From Main to Building

Install 4' Conc MH (A4)
Top Elev = 1018.91
Install 266.00 LF 8" SDR-26 PVC
FL Out (W) 8" PVC = 1014.00

Building 1
Building 2
Building 3
Building 4
Building 5
Building 6
Building 7
Building 8
Building 9

NW Olive St
NW Orchard Dr

NORTH
1"=30'
0 15' 30'

NOT FOR CONSTRUCTION

Sheet
Exhibit D

18-0251
Burton Townhomes

Proposed Sanitary Layout

NO.	BY	CKD	MES	3/13/19	ORIGINAL SUBMITTAL
	JGD			DATE	REVISION

Renaissance Infrastructure Consulting
1815 McGee Street, Suite 200
Kansas City, Missouri 64108
816.800.0950
www.ric-consult.com
MO Certificate of Authority: E-2010033630

Channel Report

Pipe 30-014 Proposed Conditions

Circular

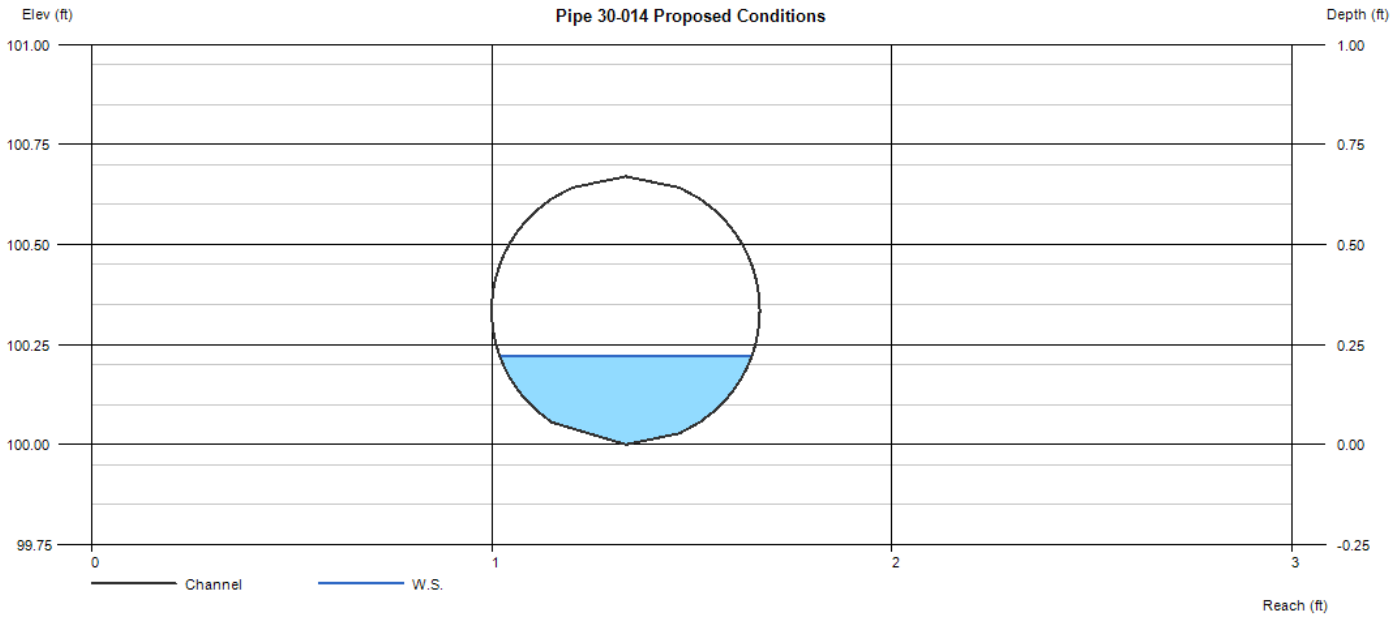
Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.18

Highlighted

Depth (ft)	= 0.22
Q (cfs)	= 0.182
Area (sqft)	= 0.10
Velocity (ft/s)	= 1.79
Wetted Perim (ft)	= 0.82
Crit Depth, Yc (ft)	= 0.20
Top Width (ft)	= 0.63
EGL (ft)	= 0.27



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Feb 27 2019

Pipe 30-009 Proposed Conditions

Circular

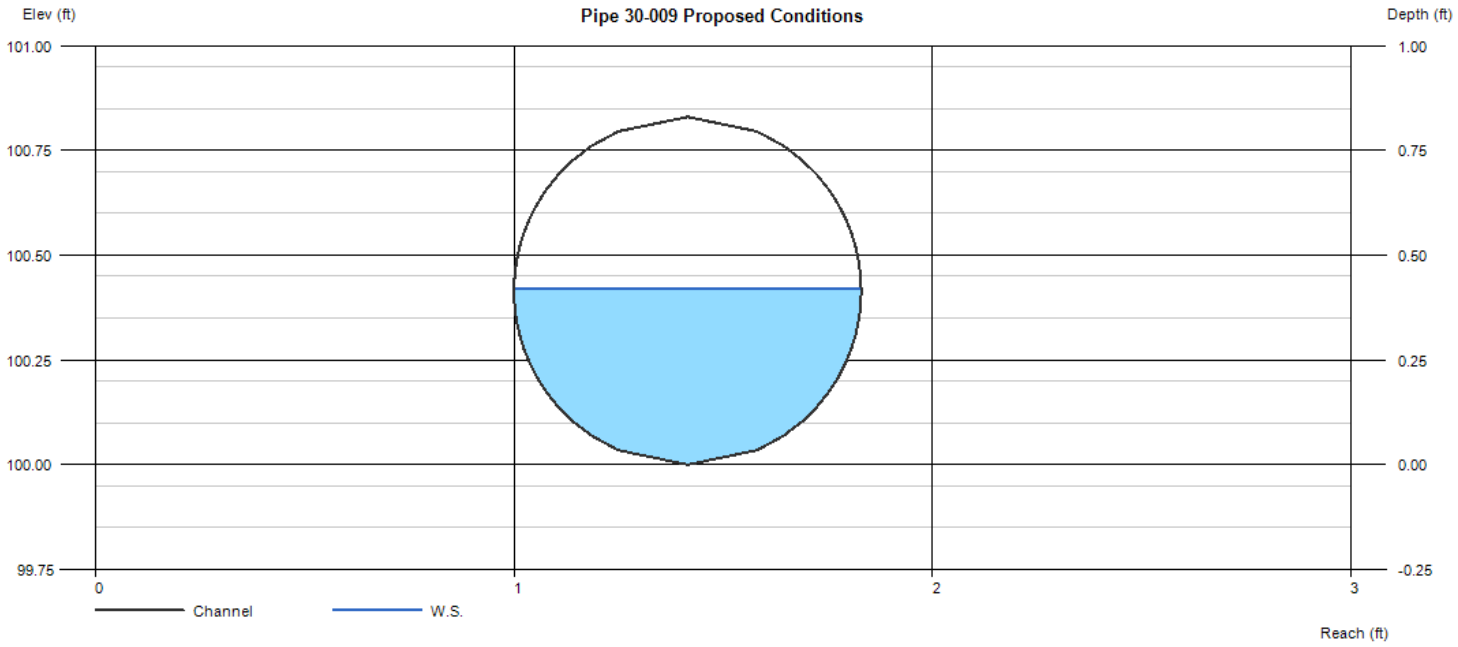
Diameter (ft)	= 0.83
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.74

Highlighted

Depth (ft)	= 0.42
Q (cfs)	= 0.742
Area (sqft)	= 0.28
Velocity (ft/s)	= 2.69
Wetted Perim (ft)	= 1.32
Crit Depth, Yc (ft)	= 0.38
Top Width (ft)	= 0.83
EGL (ft)	= 0.53



Channel Report

Pipe 30-031 Proposed Conditions

Circular

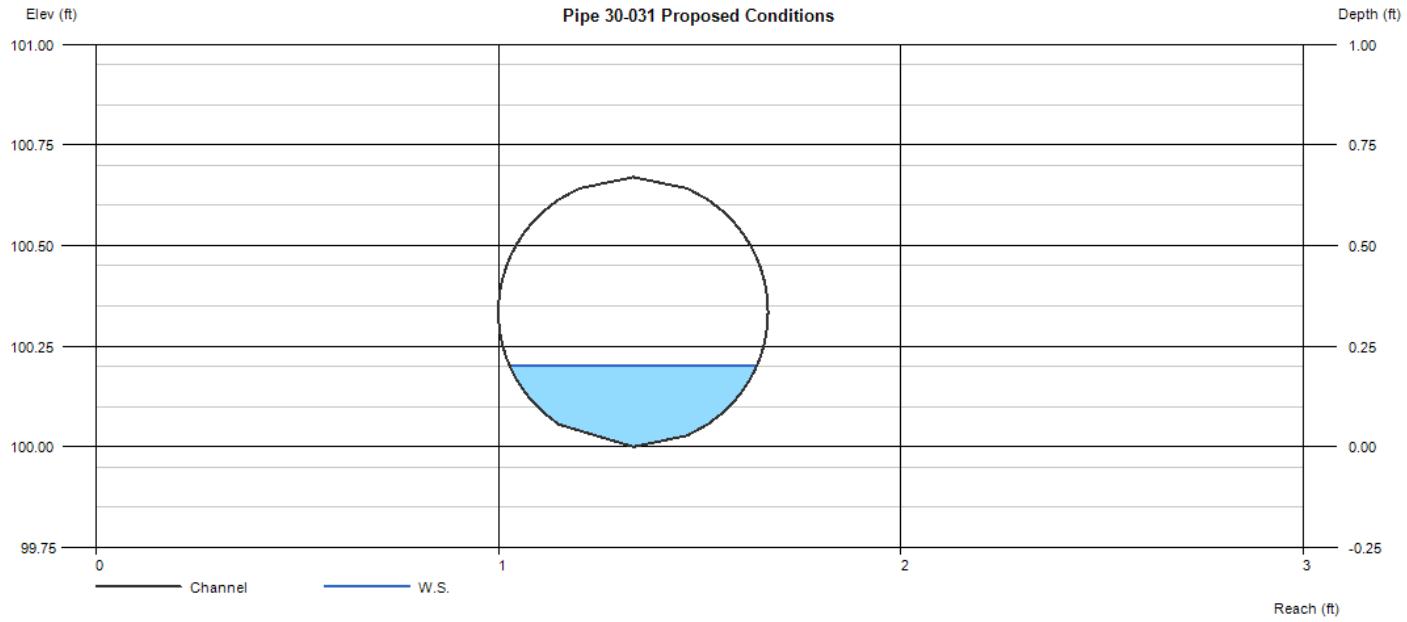
Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.16

Highlighted

Depth (ft)	= 0.20
Q (cfs)	= 0.161
Area (sqft)	= 0.09
Velocity (ft/s)	= 1.81
Wetted Perim (ft)	= 0.78
Crit Depth, Yc (ft)	= 0.19
Top Width (ft)	= 0.61
EGL (ft)	= 0.25



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Jan 14 2019

Prop. Pipe Proposed Conditions

Circular

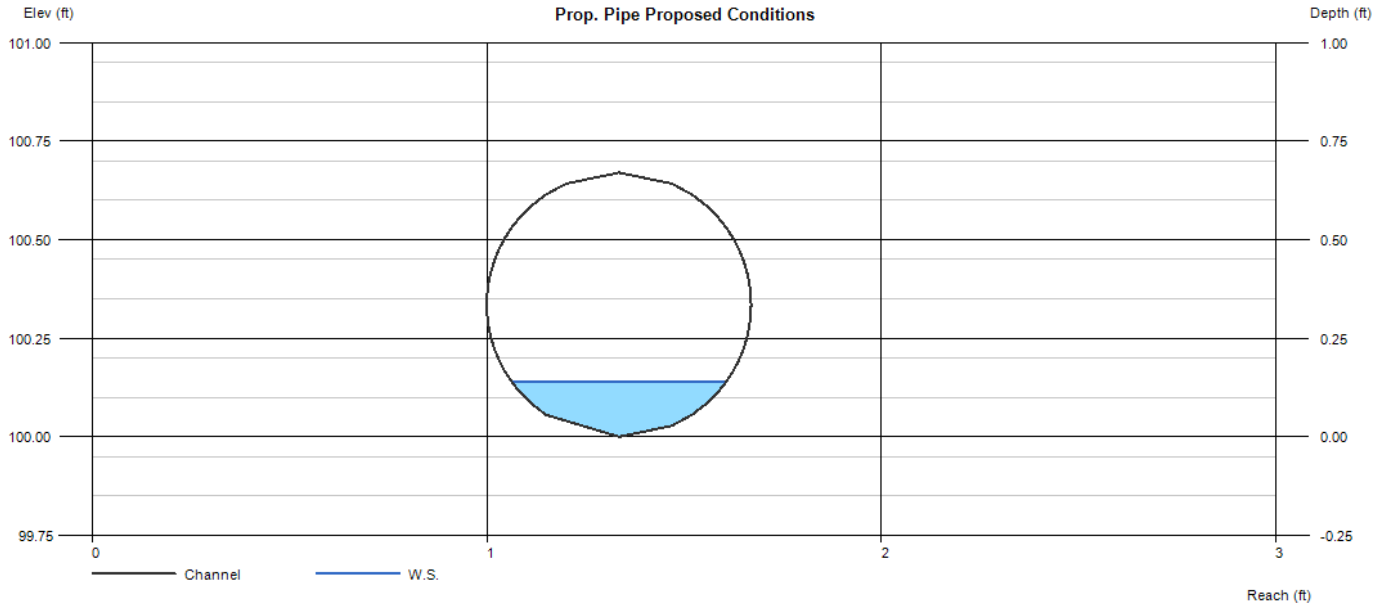
Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.07

Highlighted

Depth (ft)	= 0.14
Q (cfs)	= 0.070
Area (sqft)	= 0.05
Velocity (ft/s)	= 1.31
Wetted Perim (ft)	= 0.64
Crit Depth, Yc (ft)	= 0.12
Top Width (ft)	= 0.54
EGL (ft)	= 0.17



Channel Report

Pipe 30-051 Proposed Conditions

Circular

Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 0.40
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.13

Highlighted

Depth (ft)	= 0.20
Q (cfs)	= 0.125
Area (sqft)	= 0.09
Velocity (ft/s)	= 1.40
Wetted Perim (ft)	= 0.78
Crit Depth, Yc (ft)	= 0.17
Top Width (ft)	= 0.61
EGL (ft)	= 0.23