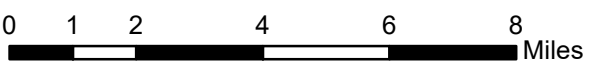
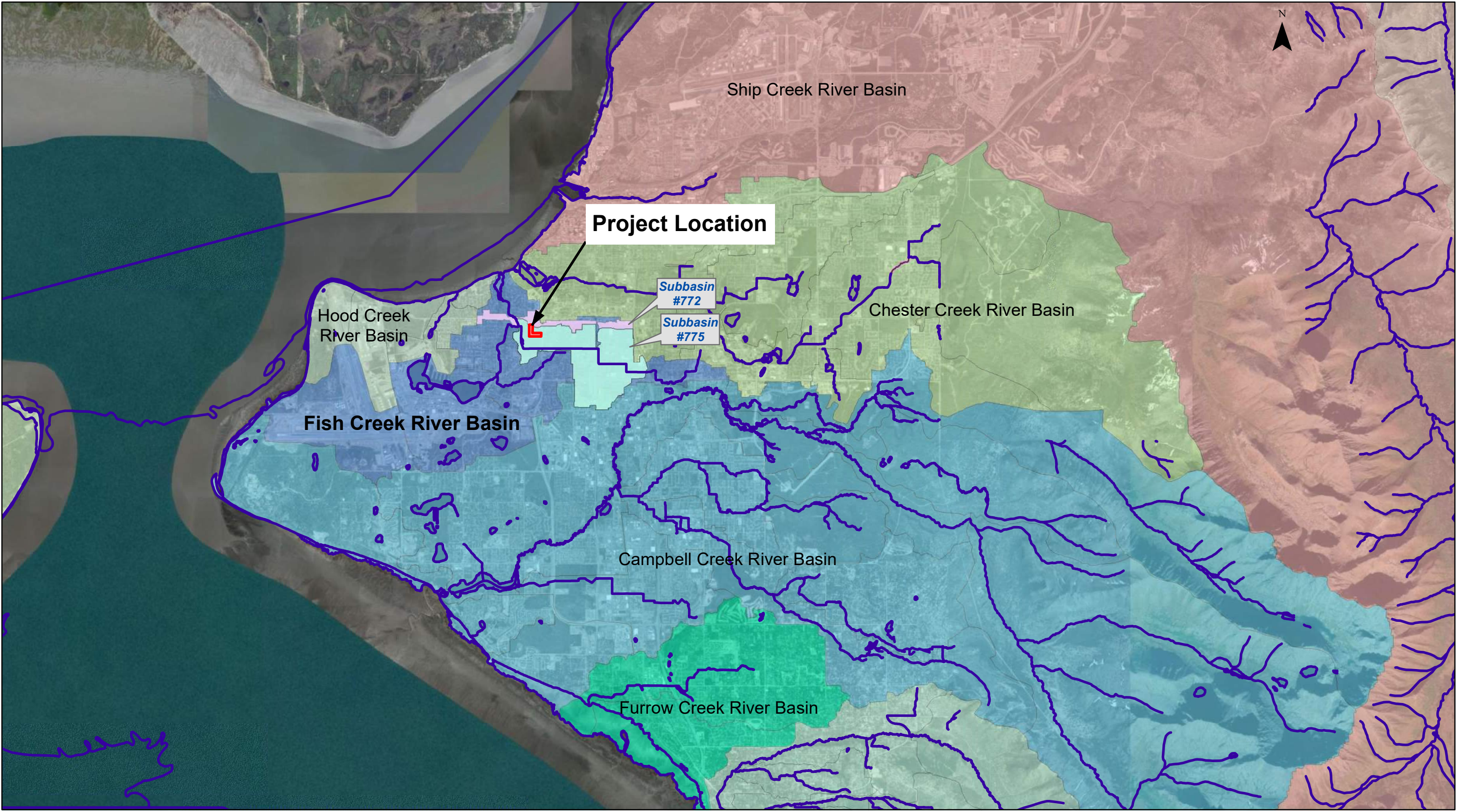


Storm Drain Modeling Data & CCTV Storm
Drain Condition Assessment Memorandum

Appendix D

J:\JobsData\10145.00 Lois Drive and W 32nd Ave Pathway\00 CADD 2019\04 GIS\StormFig1.mxd



Project Location and Subbasin Lois Drive & W. 32nd Avenue Pathway Design Study Report	Date: AUG 2020
	Figure: 1

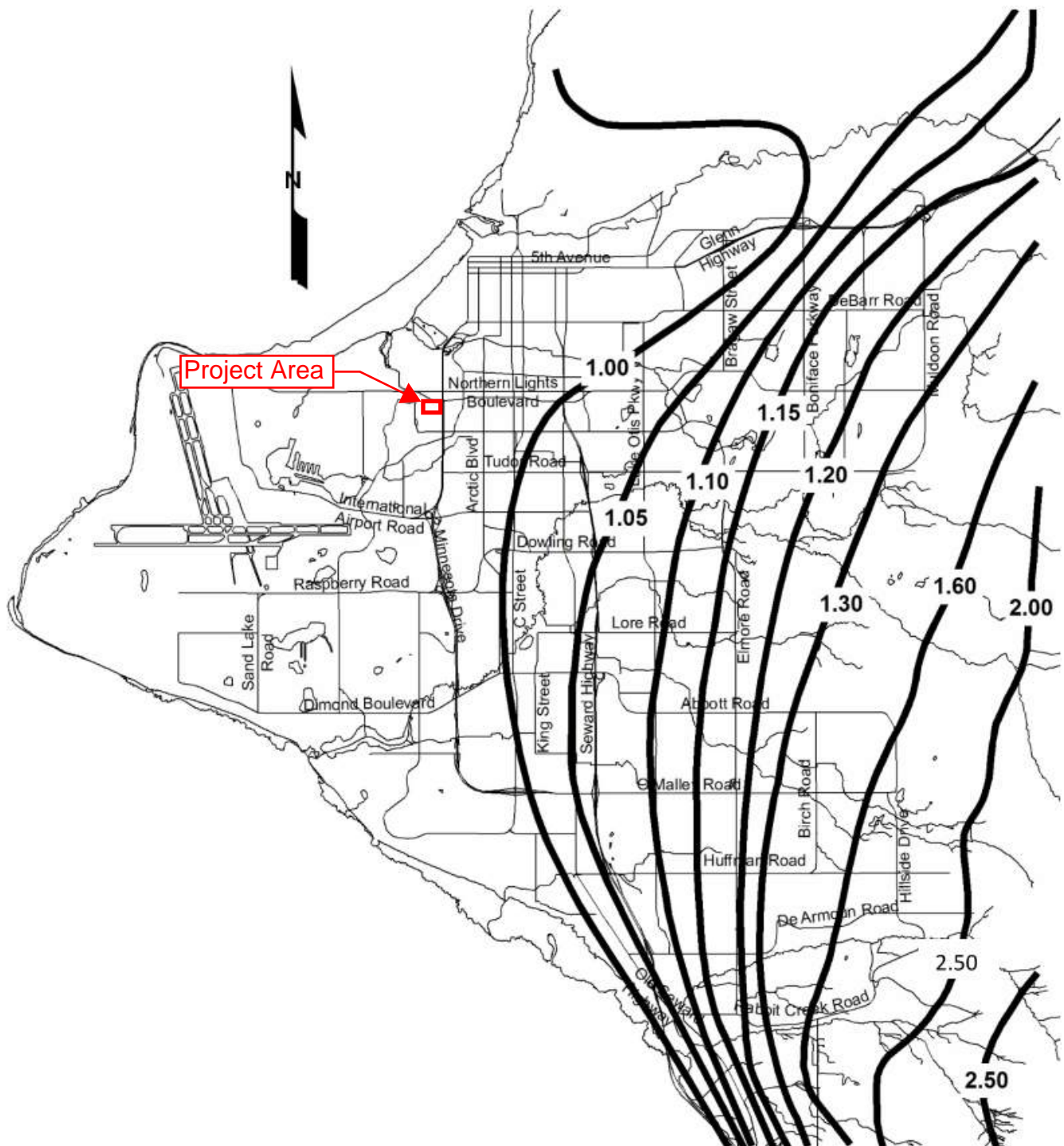
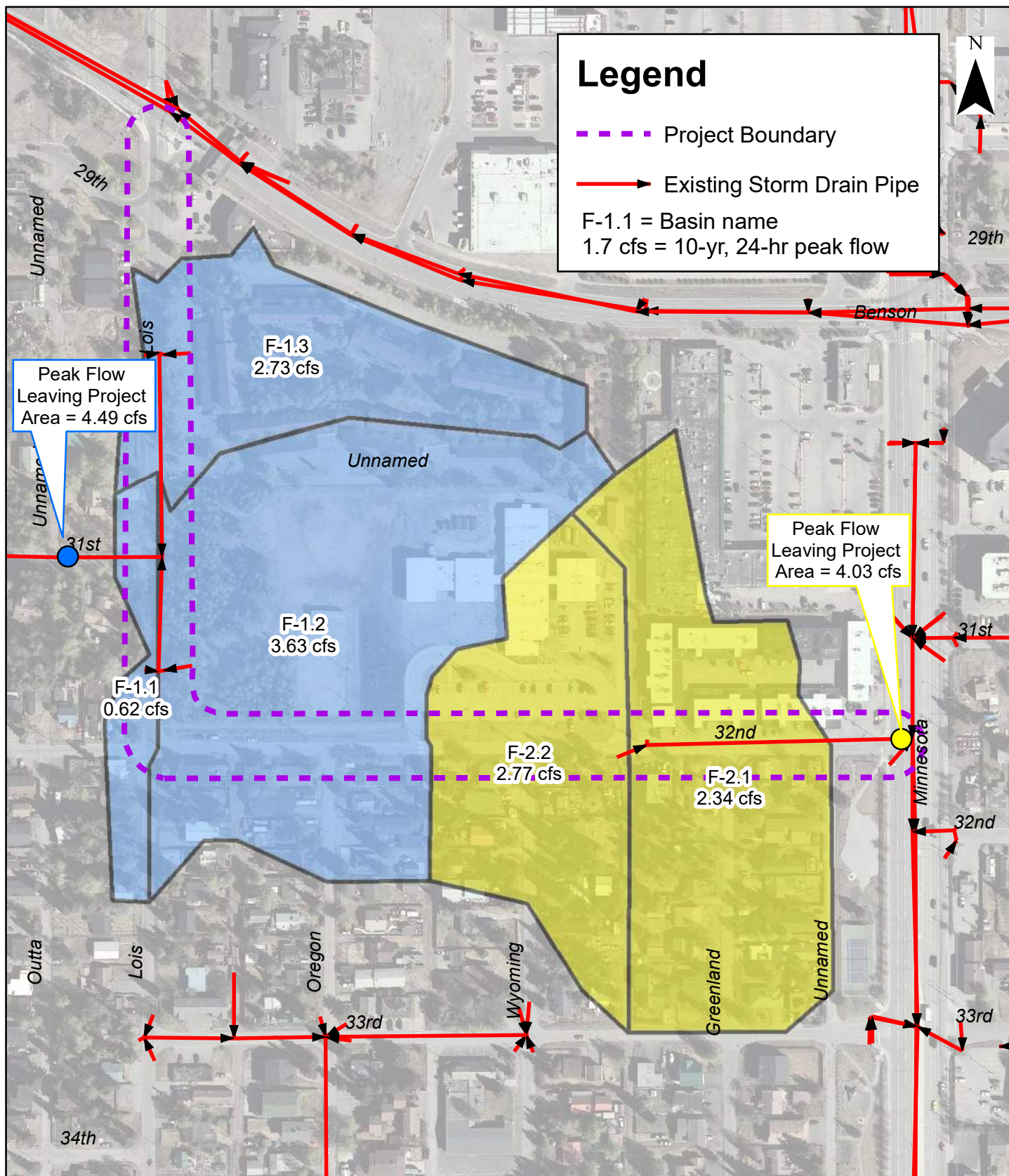


Figure 2: Orographic Factor Map (Anchorage)

J:\JobsData\10145.00 Lois Drive and W 32nd Ave Pathway\00 CADD 2019\04 GIS\Lois & 32nd Storm.mxd



0 62.5 125 250 375 500 Feet

Figure 3
Existing Stormwater System

Lois Drive & 32nd Avenue Pathway
Design Study Report

Date: AUG 2020



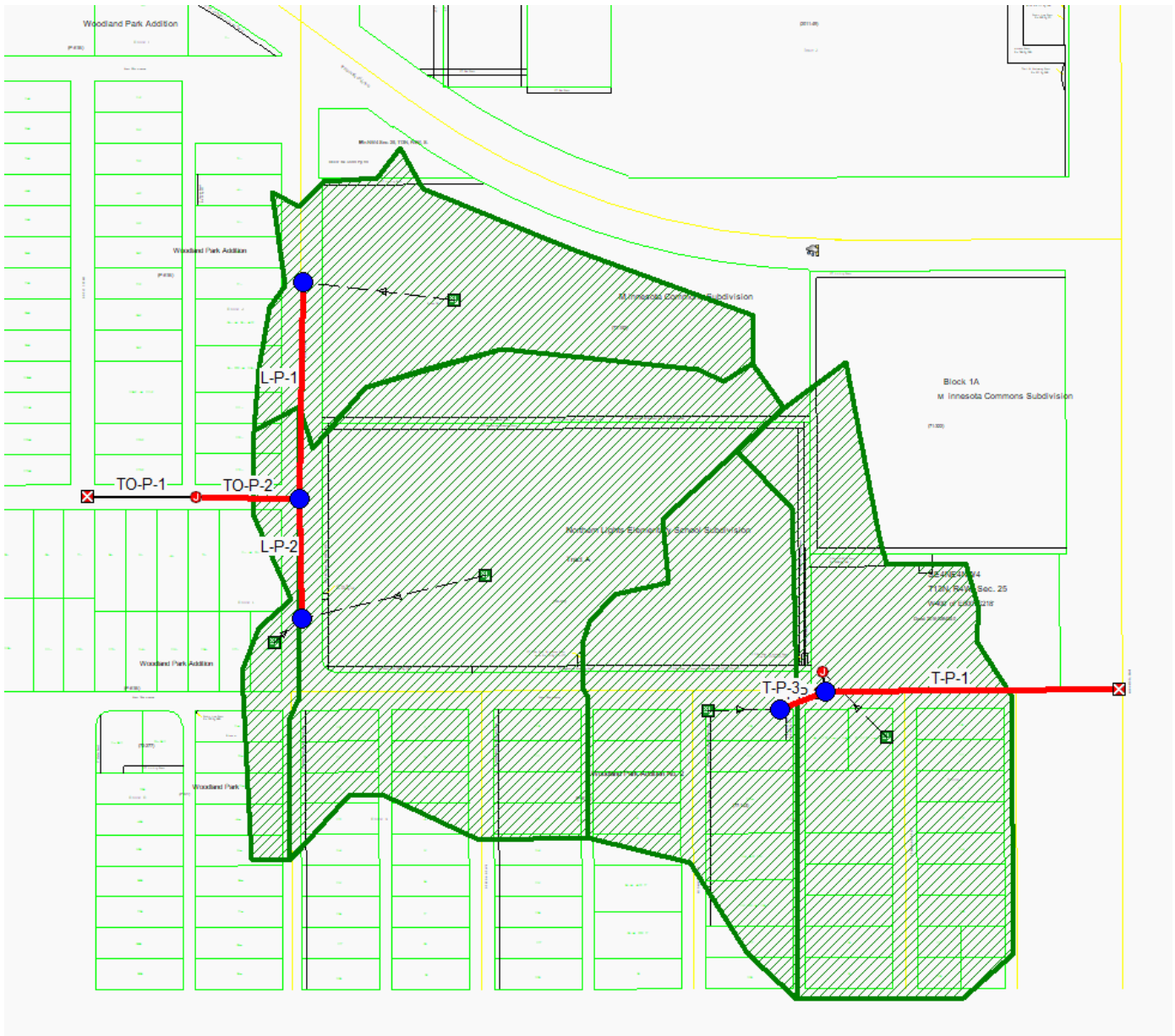


Figure 4: Existing Model Pipe Layout

Project Description

File Name 10145.00 Lois32ndStormExisting.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods NO

Analysis Options

Start Analysis On Apr 30, 2020 00:00:00
End Analysis On May 01, 2020 00:00:00
Start Reporting On Apr 30, 2020 00:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins.....	5
Nodes.....	9
<i>Junctions</i>	7
<i>Outfalls</i>	2
<i>Flow Diversions</i>	0
<i>Inlets</i>	0
<i>Storage Nodes</i>	0
Links.....	7
<i>Channels</i>	0
<i>Pipes</i>	7
<i>Pumps</i>	0
<i>Orifices</i>	0
<i>Weirs</i>	0
<i>Outlets</i>	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	10-year, 24-hour, Anchorage	Cumulative	inches				0.00	

Subbasin Summary

SN	Subbasin ID	Area	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	F-1.1	1.07	89.59	2.28	1.31	1.40	0.62	0 00:24:35
2	F-1.2	9.41	85.82	2.28	1.06	9.93	3.63	0 00:34:51
3	F-1.3	4.13	90.00	2.28	1.34	5.52	2.73	0 00:19:34
4	F-2.1	6.24	87.83	2.28	1.18	7.39	2.34	0 00:45:38
5	F-2.2	4.61	92.00	2.28	1.49	6.87	2.77	0 00:29:07

Subbasin Hydrology

Subbasin : F-1.1

Input Data

Area (ac) 1.07
Weighted Curve Number 89.59
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads with curbs & sewers	0.47	C	98.00
1/4 acre lots, 38% impervious	0.60	C	83.00
Composite Area & Weighted CN	1.07		89.59

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

$V = 16.1345 * (S_f^{0.5})$ (unpaved surface)
 $V = 20.3282 * (S_f^{0.5})$ (paved surface)
 $V = 15.0 * (S_f^{0.5})$ (grassed waterway surface)
 $V = 10.0 * (S_f^{0.5})$ (nearly bare & untilled surface)
 $V = 9.0 * (S_f^{0.5})$ (cultivated straight rows surface)
 $V = 7.0 * (S_f^{0.5})$ (short grass pasture surface)
 $V = 5.0 * (S_f^{0.5})$ (woodland surface)
 $V = 2.5 * (S_f^{0.5})$ (forest w/heavy litter surface)
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	38	0.00	0.00
Slope (%) :	2.63	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.50	0.00	0.00
Velocity (ft/sec) :	0.05	0.00	0.00
Computed Flow Time (min) :	12.96	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.019	0.00	0.00
Flow Length (ft) :	365	0.00	0.00
Channel Slope (%) :	.82	0.00	0.00
Cross Section Area (ft²) :	0.08	0.00	0.00
Wetted Perimeter (ft) :	4	0.00	0.00
Velocity (ft/sec) :	0.52	0.00	0.00
Computed Flow Time (min) :	11.63	0.00	0.00
Total TOC (min)	24.59		

Subbasin Runoff Results

Total Rainfall (in)	2.28
Total Runoff (in)	1.31
Peak Runoff (cfs)	0.62
Weighted Curve Number	89.59
Time of Concentration (days hh:mm:ss)	0 00:24:35

Subbasin : F-1.2

Input Data

Area (ac) 9.41
Weighted Curve Number 85.82
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Poor	1.74	C	77.00
> 75% grass cover, Good	1.68	C	74.00
1/8 acre lots, 65% impervious	3.44	C	90.00
Urban commercial, 85% imp	2.55	C	94.00
Composite Area & Weighted CN	9.41		85.82

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	106	0.00	0.00
Slope (%) :	.94	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.50	0.00	0.00
Velocity (ft/sec) :	0.09	0.00	0.00
Computed Flow Time (min) :	20.28	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	258	484	0.00
Slope (%) :	1.16	.83	0.00
Surface Type :	Paved	grass pasture	Unpaved
Velocity (ft/sec) :	2.19	0.64	0.00
Computed Flow Time (min) :	1.96	12.60	0.00
Total TOC (min)	34.85		

Subbasin Runoff Results

Total Rainfall (in) 2.28
Total Runoff (in) 1.06
Peak Runoff (cfs) 3.63
Weighted Curve Number 85.82
Time of Concentration (days hh:mm:ss) 0 00:34:51

Subbasin : F-1.3

Input Data

Area (ac) 4.13
Weighted Curve Number 90.00
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/8 acre lots, 65% Impervious	4.55	C	90.00
Composite Area & Weighted CN	4.55		90.00

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	44	0.00	0.00
Slope (%) :	2.27	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.50	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	7.05	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	276	0.00	0.00
Slope (%) :	.36	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	1.22	0.00	0.00
Computed Flow Time (min) :	3.77	0.00	0.00

	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.013	.03	0.00
Flow Length (ft) :	410	147	0.00
Channel Slope (%) :	.49	.68	0.00
Cross Section Area (ft²) :	.33	.5	0.00
Wetted Perimeter (ft) :	8	2.24	0.00
Velocity (ft/sec) :	0.96	1.51	0.00
Computed Flow Time (min) :	7.13	1.63	0.00
Total TOC (min)	19.58		

Subbasin Runoff Results

Total Rainfall (in) 2.28
Total Runoff (in) 1.34
Peak Runoff (cfs) 2.73
Weighted Curve Number 90.00
Time of Concentration (days hh:mm:ss) 0 00:19:35

Subbasin : F-2.1

Input Data

Area (ac) 6.24
Weighted Curve Number 87.83
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Urban commercial, 85% imp	2.74	C	94.00
1/4 acre lots, 38% impervious	3.50	C	83.00
Composite Area & Weighted CN	6.24		87.83

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	48	0.00	0.00
Slope (%) :	2.08	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.50	0.00	0.00
Velocity (ft/sec) :	0.05	0.00	0.00
Computed Flow Time (min) :	17.16	0.00	0.00

	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.023	0.00	0.00
Flow Length (ft) :	692	0.00	0.00
Channel Slope (%) :	.72	0.00	0.00
Cross Section Area (ft ²) :	.08	0.00	0.00
Wetted Perimeter (ft) :	4	0.00	0.00
Velocity (ft/sec) :	0.41	0.00	0.00
Computed Flow Time (min) :	28.48	0.00	0.00
Total TOC (min)	45.64		

Subbasin Runoff Results

Total Rainfall (in) 2.28
Total Runoff (in) 1.18
Peak Runoff (cfs) 2.34
Weighted Curve Number 87.83
Time of Concentration (days hh:mm:ss) 0 00:45:38

Subbasin : F-2.2

Input Data

Area (ac) 4.61
Weighted Curve Number 92.00
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/8 acre lots, 65% impervious	2.30	C	90.00
Urban commercial, 85% imp	2.31	C	94.00
Composite Area & Weighted CN	4.61		92.00

Time of Concentration

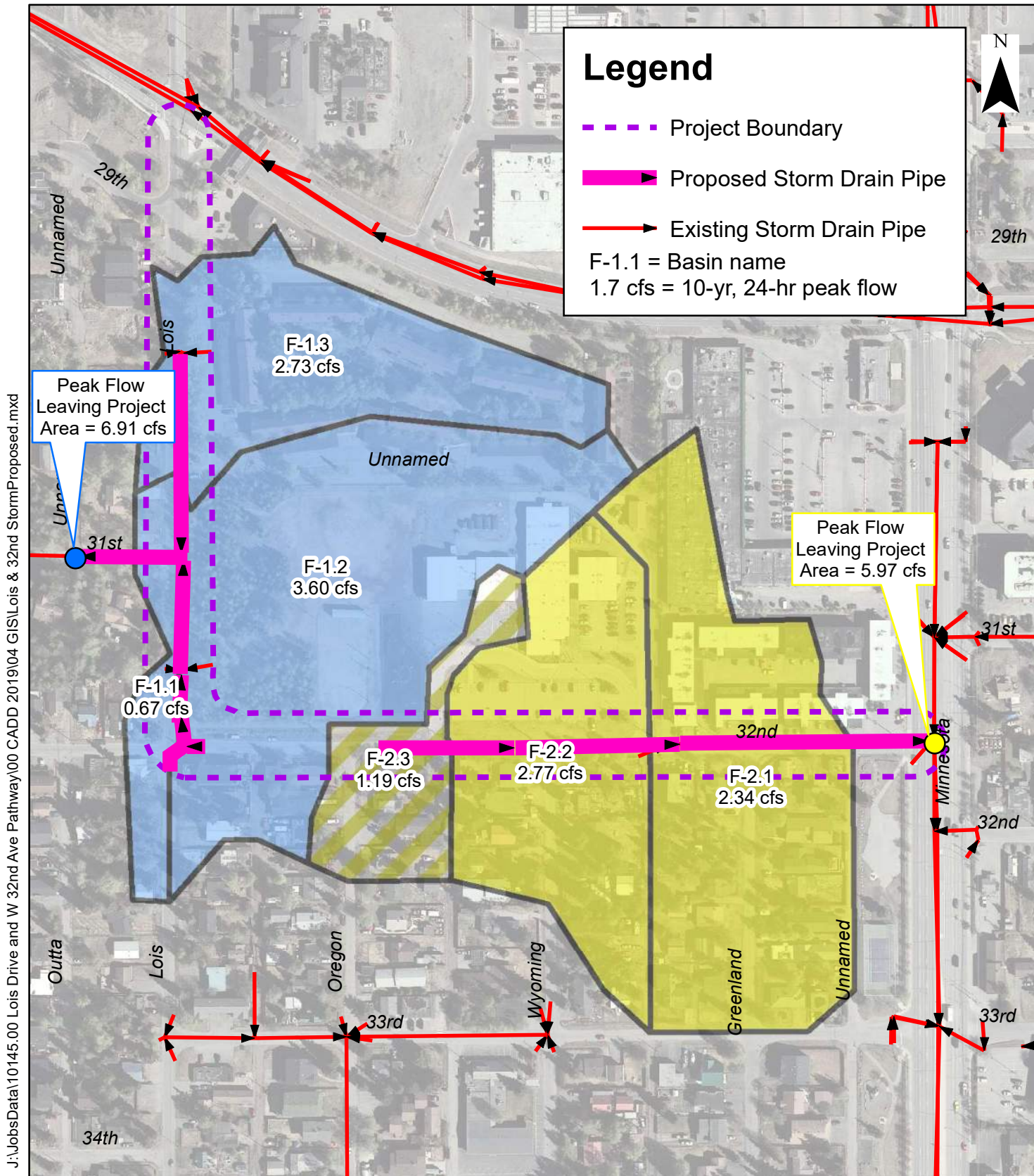
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	60	0.00	0.00
Slope (%) :	1.67	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.50	0.00	0.00
Velocity (ft/sec) :	0.05	0.00	0.00
Computed Flow Time (min) :	20.13	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	31	0.00	0.00
Slope (%) :	3.22	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.90	0.00	0.00
Computed Flow Time (min) :	0.18	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	.033	0.00	0.00
Flow Length (ft) :	349	0.00	0.00
Channel Slope (%) :	.29	0.00	0.00
Cross Section Area (ft ²) :	.167	0.00	0.00
Wetted Perimeter (ft) :	1.18	0.00	0.00
Velocity (ft/sec) :	0.66	0.00	0.00
Computed Flow Time (min) :	8.81	0.00	0.00
Total TOC (min)	29.12		

Subbasin Runoff Results

Total Rainfall (in) 2.28
Total Runoff (in) 1.49
Peak Runoff (cfs) 2.77
Weighted Curve Number 92.00
Time of Concentration (days hh:mm:ss) 0 00:29:07

Pipe Results

[illegible]



J:\JobsData\10145.00 Lois Drive and W 32nd Ave Pathway\00 CADD 2019\04 GIS\Lois & 32nd StormProposed.mxd

0 62.5 125 250 375 500 Feet

Figure 5
Proposed Stormwater System

Lois Drive & 32nd Avenue Pathway
Design Study Report

Date: AUG 2020



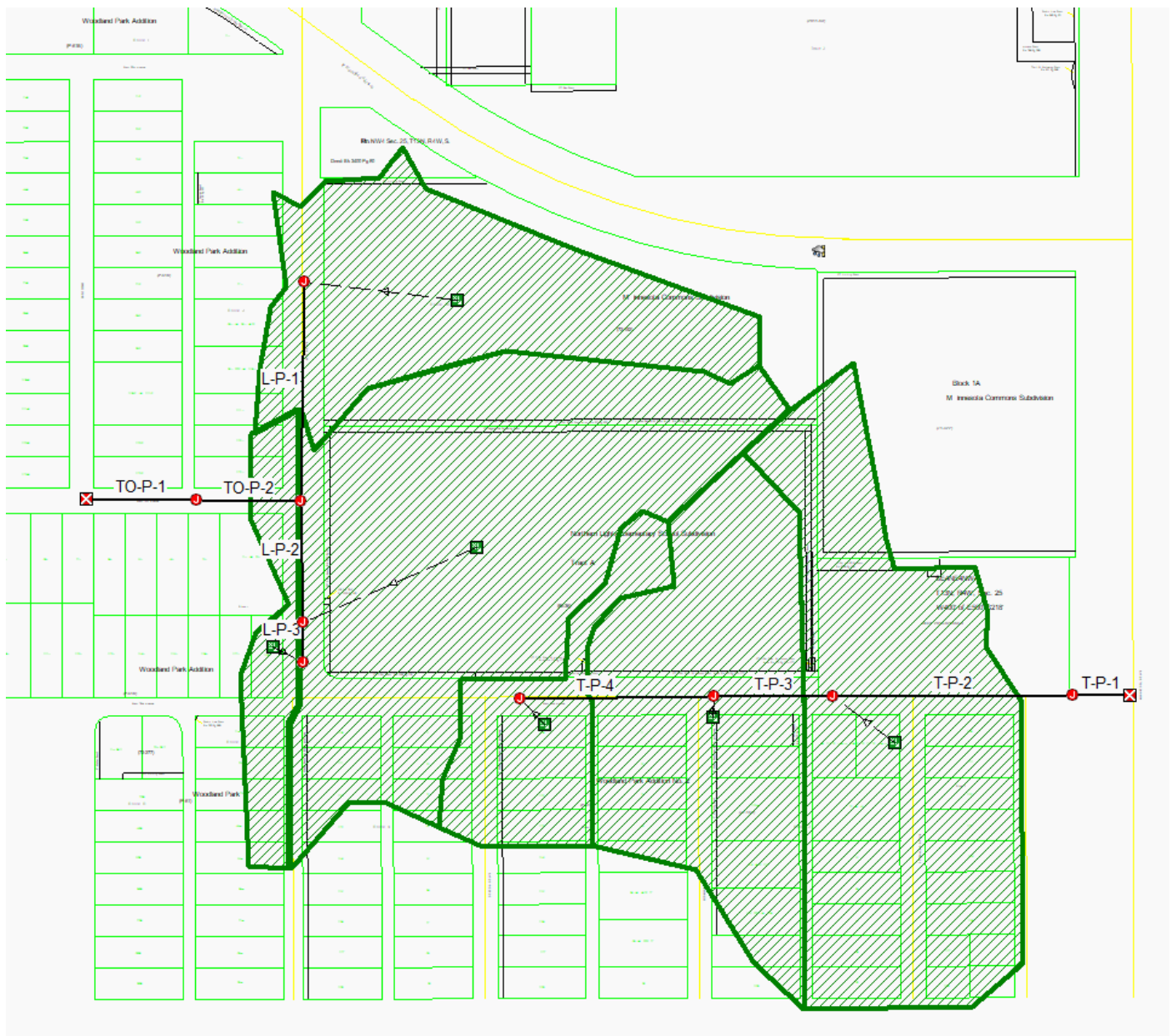


Figure 6: Proposed Model Pipe Layout

Project Description

File Name 10145.00 Lois32ndStormProposed.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods NO

Analysis Options

Start Analysis On Apr 30, 2020 00:00:00
End Analysis On May 01, 2020 00:00:00
Start Reporting On Apr 30, 2020 00:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 6
Nodes..... 11
 Junctions 9
 Outfalls 2
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 9
 Channels 0
 Pipes 9
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage	Data	Data Source	Rainfall	Rain	State	County	Return	Rainfall	Rainfall
	ID	Source	ID	Type	Units			Period	Depth	Distribution
								(years)	(inches)	
1	Rain Gage-01	Time Series	10-year, 24-hour, Anchorage	Cumulative	inches				0.00	

Subbasin Summary

SN	Subbasin ID	Area	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	F-1.1	1.07	89.59	2.28	1.31	1.40	0.67	0 00:20:38
2	F-1.2	7.69	84.44	2.28	0.97	7.48	3.60	0 00:20:16
3	F-1.3	4.13	90.00	2.28	1.34	5.52	2.73	0 00:19:34
4	F-2.1	6.24	87.83	2.28	1.18	7.39	2.34	0 00:45:38
5	F-2.2	4.61	92.00	2.28	1.49	6.87	2.77	0 00:29:07
6	F-2.3	1.72	94.00	2.28	1.66	2.86	1.19	0 00:26:39

Subbasin Hydrology

Subbasin : F-1.1

Input Data

Area (ac) 1.07
Weighted Curve Number 89.59
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads with curbs & sewers	0.47	C	98.00
1/4 acre lots, 38% impervious	0.60	C	83.00
Composite Area & Weighted CN	1.07		89.59

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

$V = 16.1345 * (S_f^{0.5})$ (unpaved surface)
 $V = 20.3282 * (S_f^{0.5})$ (paved surface)
 $V = 15.0 * (S_f^{0.5})$ (grassed waterway surface)
 $V = 10.0 * (S_f^{0.5})$ (nearly bare & untilled surface)
 $V = 9.0 * (S_f^{0.5})$ (cultivated straight rows surface)
 $V = 7.0 * (S_f^{0.5})$ (short grass pasture surface)
 $V = 5.0 * (S_f^{0.5})$ (woodland surface)
 $V = 2.5 * (S_f^{0.5})$ (forest w/heavy litter surface)
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{2/3})) * (S_f^{0.5}) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	38	0.00	0.00
Slope (%) :	2.63	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.50	0.00	0.00
Velocity (ft/sec) :	0.05	0.00	0.00
Computed Flow Time (min) :	12.96	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.019	0.00	0.00
Flow Length (ft) :	192	0.00	0.00
Channel Slope (%) :	.52	0.00	0.00
Cross Section Area (ft²) :	0.08	0.00	0.00
Wetted Perimeter (ft) :	4	0.00	0.00
Velocity (ft/sec) :	0.42	0.00	0.00
Computed Flow Time (min) :	7.68	0.00	0.00
Total TOC (min)	20.64		

Subbasin Runoff Results

Total Rainfall (in)	2.28
Total Runoff (in)	1.31
Peak Runoff (cfs)	0.67
Weighted Curve Number	89.59
Time of Concentration (days hh:mm:ss)	0 00:20:38

Subbasin : F-1.2

Input Data

Area (ac) 7.69
Weighted Curve Number 84.44
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Poor	1.74	C	77.00
> 75% grass cover, Good	1.68	C	74.00
1/8 acre lots, 65% impervious	2.58	C	90.00
Urban commercial, 85% imp	1.69	C	94.00
Composite Area & Weighted CN	7.69		84.44

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	106	0.00	0.00
Slope (%) :	.94	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.50	0.00	0.00
Velocity (ft/sec) :	0.09	0.00	0.00
Computed Flow Time (min) :	20.28	0.00	0.00
Total TOC (min)20.28			

Subbasin Runoff Results

Total Rainfall (in) 2.28
Total Runoff (in) 0.97
Peak Runoff (cfs) 3.60
Weighted Curve Number 84.44
Time of Concentration (days hh:mm:ss) 0 00:20:17

Subbasin : F-1.3

Input Data

Area (ac) 4.13
Weighted Curve Number 90.00
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/8 acre lots, 65% Impervious	4.55	C	90.00
Composite Area & Weighted CN	4.55		90.00

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	44	0.00	0.00
Slope (%) :	2.27	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.50	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	7.05	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	276	0.00	0.00
Slope (%) :	.36	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	1.22	0.00	0.00
Computed Flow Time (min) :	3.77	0.00	0.00

	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.013	.03	0.00
Flow Length (ft) :	410	147	0.00
Channel Slope (%) :	.49	.68	0.00
Cross Section Area (ft²) :	.33	.5	0.00
Wetted Perimeter (ft) :	8	2.24	0.00
Velocity (ft/sec) :	0.96	1.51	0.00
Computed Flow Time (min) :	7.13	1.63	0.00
Total TOC (min)	19.58		

Subbasin Runoff Results

Total Rainfall (in) 2.28
Total Runoff (in) 1.34
Peak Runoff (cfs) 2.73
Weighted Curve Number 90.00
Time of Concentration (days hh:mm:ss) 0 00:19:35

Subbasin : F-2.1

Input Data

Area (ac) 6.24
Weighted Curve Number 87.83
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Urban commercial, 85% imp	2.74	C	94.00
1/4 acre lots, 38% impervious	3.50	C	83.00
Composite Area & Weighted CN	6.24		87.83

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	48	0.00	0.00
Slope (%) :	2.08	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.50	0.00	0.00
Velocity (ft/sec) :	0.05	0.00	0.00
Computed Flow Time (min) :	17.16	0.00	0.00

	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.023	0.00	0.00
Flow Length (ft) :	692	0.00	0.00
Channel Slope (%) :	.72	0.00	0.00
Cross Section Area (ft ²) :	.08	0.00	0.00
Wetted Perimeter (ft) :	4	0.00	0.00
Velocity (ft/sec) :	0.41	0.00	0.00
Computed Flow Time (min) :	28.48	0.00	0.00
Total TOC (min)	45.64		

Subbasin Runoff Results

Total Rainfall (in) 2.28
Total Runoff (in) 1.18
Peak Runoff (cfs) 2.34
Weighted Curve Number 87.83
Time of Concentration (days hh:mm:ss) 0 00:45:38

Subbasin : F-2.2

Input Data

Area (ac) 4.61
Weighted Curve Number 92.00
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/8 acre lots, 65% impervious	2.30	C	90.00
Urban commercial, 85% imp	2.31	C	94.00
Composite Area & Weighted CN	4.61		92.00

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	60	0.00	0.00
Slope (%) :	1.67	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.50	0.00	0.00
Velocity (ft/sec) :	0.05	0.00	0.00
Computed Flow Time (min) :	20.13	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	31	0.00	0.00
Slope (%) :	3.22	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.90	0.00	0.00
Computed Flow Time (min) :	0.18	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	.033	0.00	0.00
Flow Length (ft) :	349	0.00	0.00
Channel Slope (%) :	.29	0.00	0.00
Cross Section Area (ft ²) :	.167	0.00	0.00
Wetted Perimeter (ft) :	1.18	0.00	0.00
Velocity (ft/sec) :	0.66	0.00	0.00
Computed Flow Time (min) :	8.81	0.00	0.00
Total TOC (min)	29.12		

Subbasin Runoff Results

Total Rainfall (in) 2.28
Total Runoff (in) 1.49
Peak Runoff (cfs) 2.77
Weighted Curve Number 92.00
Time of Concentration (days hh:mm:ss) 0 00:29:07

Subbasin : F-2.3

Input Data

Area (ac) 1.72
Weighted Curve Number 94.00
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/8 acre lots, 65% Impervious	0.86	C	90.00
Paved parking & roofs	0.86	C	98.00
Composite Area & Weighted CN	1.72		94.00

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	.2	0.00	0.00
Flow Length (ft) :	98	0.00	0.00
Slope (%) :	1.02	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.50	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	23.20	0.00	0.00

	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.019	.013	0.00
Flow Length (ft) :	106	48	0.00
Channel Slope (%) :	.94	2.08	0.00
Cross Section Area (ft ²) :	.08	.08	0.00
Wetted Perimeter (ft) :	4	1.18	0.00
Velocity (ft/sec) :	0.56	2.75	0.00
Computed Flow Time (min) :	3.15	0.29	0.00
Total TOC (min)	26.65		

Subbasin Runoff Results

Total Rainfall (in) 2.28
Total Runoff (in) 1.66
Peak Runoff (cfs) 1.19
Weighted Curve Number 94.00
Time of Concentration (days hh:mm:ss) 0 00:26:39

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	L-P-1	2.69	0 12:21	7.42	0.36	3.88	1.39	0.62	0.42	0.00		Calculated
2	L-P-2	4.24	0 12:20	7.43	0.57	4.35	0.66	0.81	0.54	0.00		Calculated
3	L-P-3	0.67	0 12:20	10.48	0.06	3.32	0.42	0.26	0.17	0.00		Calculated
4	TO-P-1	6.89	0 12:21	12.05	0.57	10.16	0.29	0.67	0.54	0.00		Calculated
5	TO-P-2	6.91	0 12:21	18.19	0.38	9.59	0.30	0.64	0.43	0.00		Calculated
6	T-P-1	5.97	0 12:29	12.45	0.48	3.92	0.28	0.98	0.49	0.00		Calculated
7	T-P-2	5.97	0 12:29	12.38	0.48	3.91	1.57	0.98	0.49	0.00		Calculated
8	T-P-3	3.92	0 12:25	5.78	0.68	3.52	0.77	0.91	0.60	0.00		Calculated
9	T-P-4	1.17	0 12:25	5.77	0.20	2.58	2.12	0.46	0.31	0.00		Calculated



Memorandum

Date: July 7, 2020
From: Joey Hegna, P.E. – CRW Engineering Group, LLC
Project: Lois Drive and 32nd Avenue Pathway – Benson Boulevard to Minnesota Drive
Project No: PM&E# 19-08 (CRW# 10145.00)
Subject: Storm Drain Condition Assessment (DRAFT)

This memorandum summarizes the findings of the storm drain pipe and structure inspections performed by Municipality of Anchorage (MOA) Street Maintenance and CRW Engineering Group, LLC (CRW) for the Lois Drive and 32nd Avenue Pathway – Benson Boulevard to Minnesota Drive project.

Project Background

The MOA Project Management & Engineering Department (PM&E) plans to upgrade Lois Drive and W. 32nd Avenue to improve non-motorized connectivity by constructing a new roadway. Improvements may include a new roadway section and surfacing, drainage improvements, pedestrian and/or bicycle facilities, traffic calming, signage, landscaping, lighting, and utility reconstruction. The existing storm drain infrastructure that could be impacted by these roadway upgrades was inspected to determine if replacement is necessary. See *Appendix A* for *Grid Map SW1628* that shows the project limits.

Purpose

The purpose of this condition assessment memo is to describe the condition of the existing storm drain pipe and structures along the project corridor. The results of this assessment will serve as a tool to determine if the existing pipe and structures should remain or be replaced in conjunction with the planned roadway upgrades. Some of the pipe segments inspected extend outside of the roadway upgrade limits. The pipe segments that are identified as needing replacement and are located outside the project corridor will not be upgraded by this project, but may be upgraded by MOA in the future as funding becomes available.

Pipe Inspection – Procedure

The closed circuit television (CCTV) data collection process works by operating a camera which is mounted on a self-propelled robotic crawler that is connected to a video monitor on the ground surface. The crawler is driven through the storm drain pipe to provide visual documentation of the condition of the interior walls of the pipe. The remotely controlled crawler and camera are typically inserted into the storm drain pipe from a manhole and are operated from the ground surface.

The purpose for collecting video images of the interior of the storm drain pipe is to identify obstructions, structural deficiencies, damaged areas, sags, and confirm the pipe size and material type. For the most comprehensive pipe assessment, it is preferred to collect CCTV data when no water is present in the piped system. This typically requires bypassing stormwater flows or the work is performed during dry conditions and has no base flow. In most cases, however, some stormwater is present during CCTV recording, preventing the observer from assessing the condition of the pipe invert.

The storm drain pipe within the project area and several downstream segments of pipe was inspected using a CCTV camera operated by MOA Street Maintenance from December 2019 to May 2020. MOA provided the CCTV data files to CRW for evaluation in late May 2020. A total of 9 pipes were inspected. See *Figures 1 & 2, Appendix A* showing the location of the pipes inspected for this project.

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Lois Drive and 32nd Avenue Pathway – Benson Boulevard to Minnesota Drive
Storm Drain Condition Assessment (DRAFT)

CRW evaluated the CCTV data provided by MOA using GraniteNet software. This software is an interface that allows the observer to view the CCTV video images in detail and assess the condition of the interior of the pipe. The observer can input pertinent information into the CCTV data file while performing the assessment, such as pipe size, pipe material, installation date, location and type of defects, date of inspection and any other notes relevant to the inspection. The findings and notes generated during the CCTV review process are then used to develop a comprehensive summary of the condition of each pipe segment.

The CCTV data provided by MOA Street Maintenance included video of approximately 1,660 linear feet (LF) of main line storm drain pipe. Only one catch basin lead (Pipe 28932) was inspected with CCTV, the remaining leads within the project limits were not. The assumption is that catch basin leads will likely need to be replaced regardless of condition, since new catch basins will be located to align with the proposed curb and gutter. The videoed pipe consisted of 1,636 LF of corrugated metal pipe (CMP) and 24 LF of reinforced concrete pipe (RCP). Approximately 375 LF of pipe was not videoed due to blockages in the pipe. The majority of pipe evaluated was installed in the late 1970's and early 1980's. The installation date of the 48 inch CMP located upstream of the Fish Creek outfall and west of Lois Drive is unknown as record drawings were not obtained for this pipe.

Pipe Inspection – Condition Summary

The condition of the storm drain pipe throughout the project corridor ranged widely from fair to poor. Some of the issues identified included blockages due to debris, joint offsets, metal loss, pipe damage, and mineralization/infiltration at pipe joints.

Refer to the *Storm Drain CCTV Inspection Summary Table, Appendix B* and the individual *CCTV Inspection Forms, Appendix C* for a detailed assessment for each pipe segment that was inspected. Corresponding *Storm Drain Infrastructure Inspection Maps (Figure 1 & 2, Appendix A)* provide an overview of the project area and the existing storm drain systems along Lois Drive and W. 32nd Avenue, as well as downstream systems. Note that the pipe identification numbers used throughout this memo and the appendices are based on the naming convention provided in MOA's GIS Stormwater Asset Map.



Photo 1 - Mineralization/Infiltration at Joint

The majority of the inspected pipes have significant debris (rocks, soil, mineralization, etc.) deposited within the pipe. These blockages reduce the overall capacity of the piping system and can further deteriorate the condition of the pipe. The *Storm Drain CCTV Inspection Summary Table, Appendix B* recommends several pipes to be cleaned to improve flow efficiency and extend the life of the piped system. While cleaning these pipes is recommended and good practice, it won't necessarily resolve the source of the debris entering into the pipe (joint offsets & holes). This is where lining, also known as cured in place pipe (CIPP), may be an option to repair these pipes and reduce the amount of debris entering the system. CIPP is a trenchless method (no excavation required) for rehabilitating existing pipe. CIPP consists of a liner that is constructed of a soft fabric tube that is impregnated with resin. After the tube is inserted into the

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existing (host) pipe, it is inflated with water or air and cured until hard. A CIPP liner provides a long-term fully structural repair to the host pipe. Further investigation would be required to determine if CIPP is a suitable repair option the identified pipes. The alternative is to remove and replace these pipes by conventional open cut excavation methods.

Several storm drain pipes (12828, 13603, 25204, 27764, 27885, 30570, & 33747) are identified as requiring complete replacement or CIPP lining. These pipes or certain segments of the pipe have significant enough defects where cleaning alone is not a suitable long-term fix.

Below is a list of some of the notable pipe defects identified during review of the CCTV data:

- Pipe 28932 & 12828: CCTV investigation not completed due to excessive debris in pipe. These type of blockages significantly reduce the capacity of these pipe. Additionally, Pipe 12828 exceeds 300 foot maximum spacing per the *Anchorage Stormwater Manual (ASM)*. MOA Street Maintenance are unable to clean pipes adequately in this type of situation.
- Pipe 27764: Mineralization/infiltration and root intrusion at several locations along this pipe segment, as well as a significant gouge in the pipe.
- Pipe 30570: Significant pipe joint separation.
- Pipe 13603: Moderate to significant mineralization and metal loss/corrosion near outlet end of pipe.
- Pipe 27885: Two blind connections deposit moderate to significant mineralization into interior of pipe. Per the CCTV operator, this pipe was previously lined and the liner is showing damage at several locations
- Pipe 33747: Crown of pipe deformed several inches. Several holes and metal loss/corrosion identified at multiple locations along pipe segment.



Photo 2 - Pipe Gouge

The MOA is dealing with increasing CMP failures throughout the City due to corrosion. With that in mind, it should be noted that the majority of the inspected pipe in the project area is CMP and approximately 40 years old, which is nearing the design life of this pipe material. While these pipes may appear to be in fair to good condition, it's possible the invert is failing. Most of the pipes inspected had a significant amount of debris and/or flow within the invert. This prevents the observer from assessing the condition of the pipe invert.

Structure Inspection – Procedure

An inspection was performed on all the accessible storm drain structures within the project area. The inspection is conducted by removing the manhole cover or catch basin inlet grate to view the interior of the structure. Each structure is assessed from the ground surface; no structures were entered for this effort. Any notable characteristics, irregularities, and/or defects are documented and photographed and are presented on the *Storm Drain Structure Inspection Forms, Appendix D*. The overall condition of the

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Lois Drive and 32nd Avenue Pathway – Benson Boulevard to Minnesota Drive
Storm Drain Condition Assessment (DRAFT)

components of each structure (e.g. lid, grade rings, barrel, ladder rungs, etc.) are scored between 1 and 4 (poor to good, respectively).

A total of 9 storm drain structures within the project corridor were inspected in June 2020 by CRW. The structures inspected included catch basins, catch basin manholes and standard manholes. These structures were installed as part of two separate projects in the late 1970's and early 1980's. The structure identification numbers used throughout this memo and the appendices are based on the naming convention provided in MOA's GIS Stormwater Asset Map. Note that all structures are located on MOA Storm Drain Grid SW1628, so structure names referenced were abbreviated (e.g. Structure 31628097 = 97). See *Figures 1 & 2, Appendix A* showing the location of the structures inspected for this project.



Photo 3 - Grout Loss at Pipe Penetration

Two catch basins (142 & 143) within the project corridor are located on private property and were not inspected. The manhole (45) located towards the north end of Lois Drive was also not inspected due to the cover being located under pavement preventing access.

Structure Inspection – Condition Summary

The condition of the storm drain structures throughout the project limits ranged from fair to poor, similar to the condition of the storm drain pipe. Some of the issues identified during the inspection process included missing components (grade rings, ladder rungs & frames), spalling at pipe penetrations, concrete cracking, and significant sediment build-up in sumps. Refer to the *Storm Drain Structure Inspection Forms, Appendix D* for a detailed assessment of each structure.

Below is a list of some of the defects or irregularities observed in the inspected structures:

- Catch Basins 28 & 29: Non-standard inlet, no grade rings (frame placed on reducing slab), and grout spalling at pipe penetration.
- Catch Basin 55: Cracking in grade ring and significant debris in sump.
- Catch Basin 56: Curb inlet and frame installed in skewed position in relation to curb and gutter and cracking present in grout above pipe penetration.
- Catch Basin 81: Catch basin set in location that is ineffective at intercepting runoff.



Photo 4 - Non-standard Manhole Lid

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- Catch Basin Manhole 82: Non-standard frame, offset between barrel and reducing slab, and sump and outlet pipe (east) full of debris/sediment.
- Manhole 44: Angle iron welded to non-standard lid that rests directly on reducing cone.
- Manhole 45: Manhole lid partially located under pavement, preventing access to structure for maintenance.
- Manhole 97: Spalling at grade ring constructed of brick, non-standard ladder rungs exceeding maximum spacing, non-standard frame & lid, and grout cracking at pipe penetration (west).
- Manhole 120: Manhole lid buried in gravel (difficult to locate), vertical cracking in grade ring, and grade ring offset from reducing cone & frame.

-End of Memorandum-

Appendix A

Project Location &
Storm Drain Infrastructure Inspection Maps

Legend

- Confined Space
- Manhole
- Catchbasin Manhole
- Clean-Out
- Catch Basin
- OGS
- Lift Station
- Diverter
- Drywell
- Weir
- Blind Connect
- Top Intake Manhole
- Roof Drain
- Bypass Outlet
- Curb Inlet
- End of Pipe
- Pipe Inlet
- Pipe Cap
- Inlet
- Pipe Outlet
- Control Inlet
- Control Outlet
- Other
- Outfall
- Outfall Major
- Outfall Minor
- Sink -(Closed Drainage Basin)
- Divide
- Feature Start
- Other

Storm Pipes

- ADOT
- ADOT-Airport
- Abandoned
- Fed_Military
- MOA-ASD
- MOA-Facility Maintenance
- MOA-Merrill Field
- MOA-Other
- MOA-Parks and Recreation
- MOA-Port of Anchorage
- MOA-M&O/CBERRRSA/LRSA/SA
- Private
- SOA-Alaska Railroad
- Unknown
- Bridge

Constructed Channels

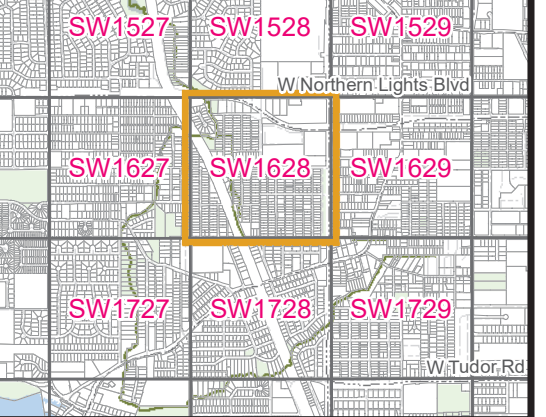
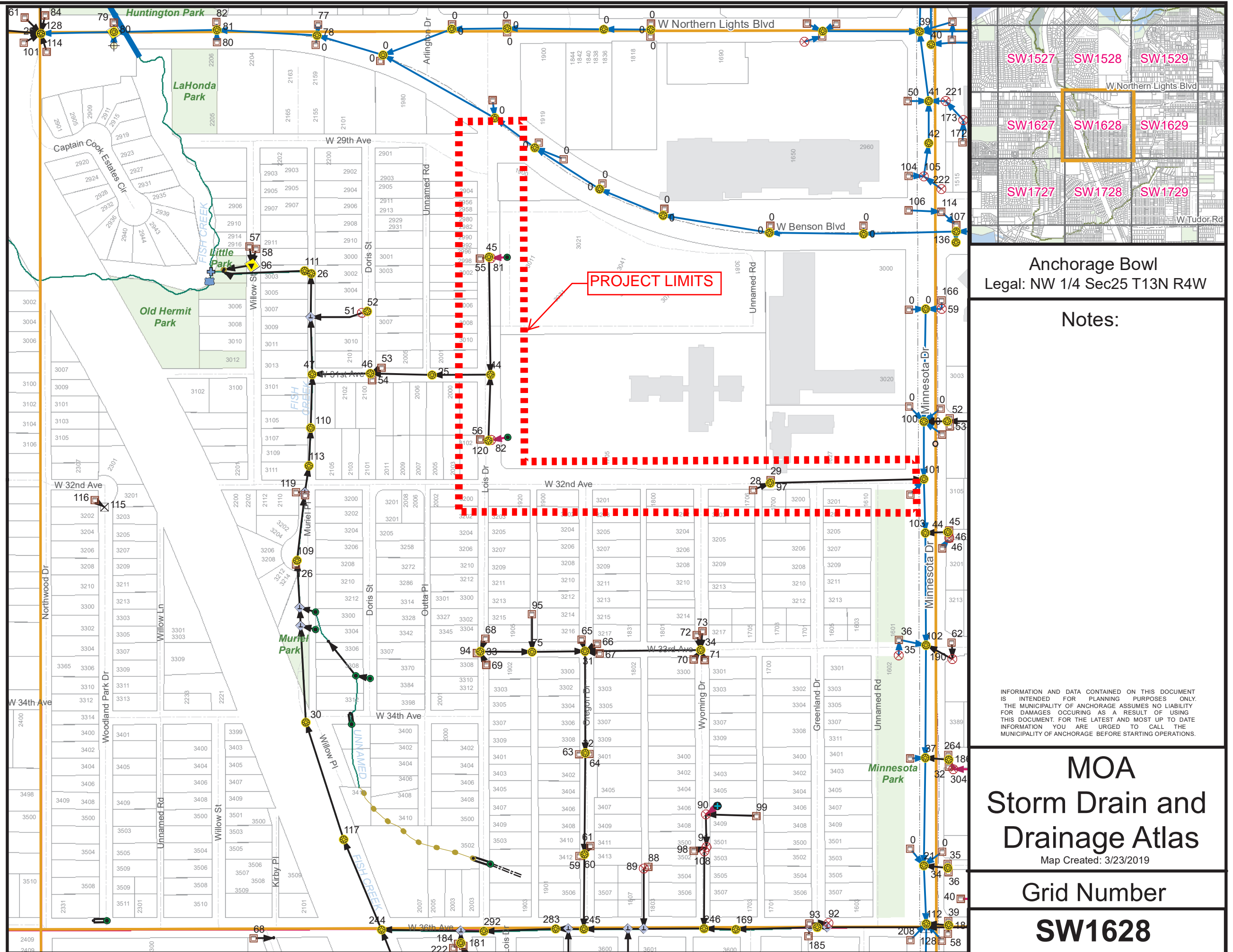
- ADOT
- MOA-Other
- MOA-Port of Anchorage
- MOA-M&O/CBERRRSA/LRSA/SA
- Private
- SOA-Alaska Railroad
- Unknown

Other Drainageways

- Other Drainageways



0 150 300 600
Feet



Anchorage Bowl
Legal: NW 1/4 Sec25 T13N R4W

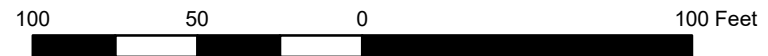
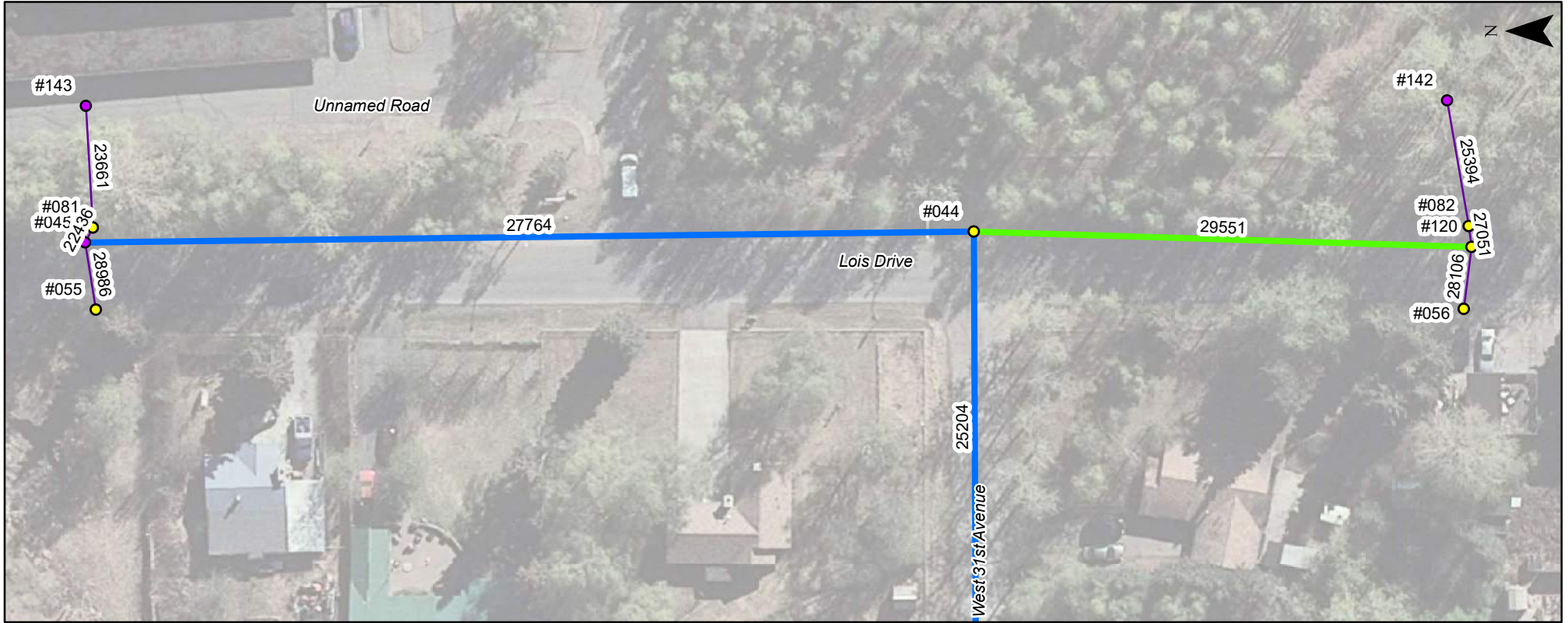
Notes:

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MOA
Storm Drain and
Drainage Atlas

Map Created: 3/23/2019

Grid Number
SW1628



Legend

- Existing Storm Drain Structures (Inspected)
- Existing Storm Drain Structures (Not Inspected)
- Existing Storm System Drain Pipe (Not Inspected)

Pipe Recommendation

- Cleaning Recommended
- Replace or CIPP Pipe Recommended

Storm Drain Infrastructure Inspection Map

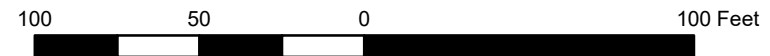
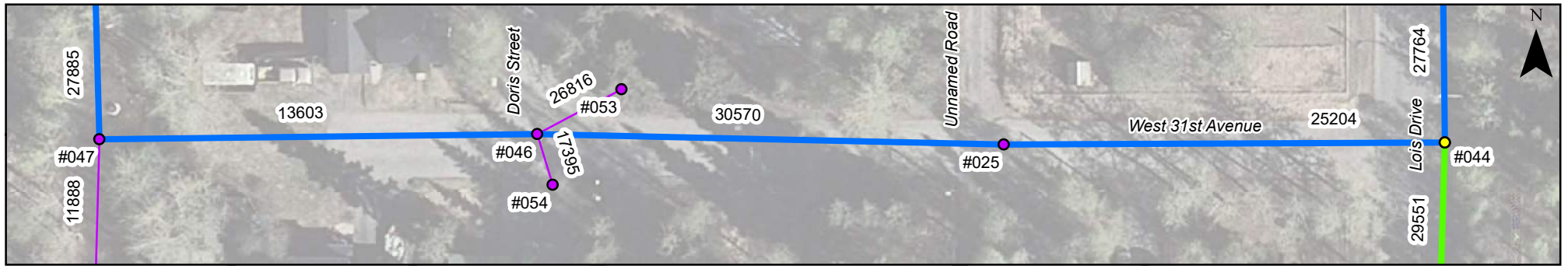
Lois Drive and 32nd Avenue Pathway
Benson Blvd to Minnesota Drive



Grid Number
SW1628

Date: JUL 2020

Figure 1



Legend

- Existing Storm Drain Structures (Inspected)
- Existing Storm Drain Structures (Not Inspected)
- Existing Storm System Drain Pipe (Not Inspected)

Pipe Recommendation

- Cleaning Recommended
- Replace or CIPP Pipe Recommended

Storm Drain Infrastructure Inspection Map

Lois Drive and 32nd Avenue Pathway
Benson Blvd to Minnesota Drive



Grid Number
SW1628

Date: JUL 2020

Figure 2

Appendix B

Storm Drain CCTV Inspection Summary Table

Lois Drive and 32nd Avenue Pathway - Benson Boulevard to Minnesota Drive (PM&E No. 19-08)
Storm Drain CCTV Inspection Summary Table

MOA Pipe Identification No.	Upstream Structure No.	Downstream Structure No.	Diameter (in)	Material	Install Date - Asbuilt No.	CCTV Date	CCTV Direction	CCTV Length (ft)	Asbuilt Length (ft)	Pipe Condition Comments	Recommendations
West 32nd Avenue											
28932	31628028	31628097	12	CMP	1978-777	4/30/2020	Upstream	24.1	28	CCTV abandoned at 24.1 feet due to significant debris in invert, minor to moderate debris from 6.3 feet to 19.7 feet.	Clean pipe
11367	31628029	31628097	12	CMP	1978-777	No CCTV	-	-	13	No CCTV completed for this catch basin lead.	
12828	31628097	31628101	15	RCP	1978-777	4/30/2020	Downstream	23.6	395	CCTV abandoned at 23.6 feet due to significant debris in invert, offset joints at 15.5 feet & 21.8 feet. Pipe exceeds 300 foot max. manhole spacing per MASS.	Replace or CIPP pipe
Lois Drive											
28986	31628055	31628045	10	CMP	1982-347	No CCTV	-	-	17	No CCTV completed for this catch basin lead.	
22436	31628081	31628045	10	CMP	1982-347	No CCTV	-	-	17	No CCTV completed for this catch basin lead.	
23661	31628143	31628081	-	-	-	No CCTV	-	-	-	No CCTV completed for this catch basin lead. No asbuilts of private pipe.	
27764	31628045	31628044	12	CMP	1982-347	12/19/2019	Upstream	341.7	345	Minor to moderate debris present throughout length of pipe. Mineralization/infiltration at pipe joints at 132.1 feet, 197.3 feet & 216.6 feet. Root intrusion at pipe joints at 216.6 feet & 317.0 feet. 1"x4" gouge through pipe at 12 o'clock position, soil visible.	Replace or CIPP pipe
28106	31628056	31628120	10	CMP	1982-347	No CCTV	-	-	17	No CCTV completed for this catch basin lead.	
27051	31628082	31628120	10	CMP	1982-347	No CCTV	-	-	17	No CCTV completed for this catch basin lead.	
25394	31628142	31628082	-	-	-	No CCTV	-	-	-	No CCTV completed for this catch basin lead. No asbuilts of private pipe.	
29551	31628120	31628044	12	CMP	1982-347	4/30/2020	Upstream	188.0	193	Minor debris present throughout remainder of pipe inspected. Mineralization/Infiltration at pipe joint at 45.3 feet and 65.4 feet.	Clean pipe
West 31st Avenue											
25204	31628044	31628025	15	CMP	1982-347	12/19/2019	Upstream	166.3	159	Minor to moderate debris present throughout length of pipe. Mineralization/infiltration at pipe joints at 39.6 feet, 59.9 feet, 120.6 feet & 161.0 feet. Significant joint separation at 140.7 feet.	Replace or CIPP pipe
30570	31628025	31628046	15	CMP	1982-347	12/19/2019	Downstream	180.4	182	Minor debris and metal loss/corrosion present throughout length of pipe. Offset joint at 152.1 feet. Mineralization/Infiltration at pipe joint at 6.4 feet, 21.5 feet, 72.3 feet and 121.8 feet. Joint separation at 41.7 feet.	Replace or CIPP pipe
26816	31628053	31628046	10	CMP	1982-347	No CCTV	-	-	64	No CCTV completed for this catch basin lead.	
17395	31628054	31628046	10	CMP	1982-347	No CCTV	-	-	19	No CCTV completed for this catch basin lead.	
13603	31628046	31628047	15	CMP	1982-347	12/19/2019	Downstream	176.0	178	Minor debris and metal loss/corrosion present from 0 feet to 143.1 feet. Moderate to significant mineralization and metal loss/corrosion present from 143.1 feet to end of pipe. Mineralization/infiltration near flow line at 4 o'clock position at 131.1 feet. Mineralization/infiltration near along CMP seam at 9 o'clock position at 132.6 feet. Significant mineralization/infiltration at pipe joints at 114.2 feet, 134.3 feet & 154.9 feet. Surface damage/corrosion at 10 o'clock & 2 o'clock at 55.0 feet.	Replace or CIPP pipe
Fish Creek Alignment											
27885	31628047	31628026	48	CMP/ Lined	Unknown	5/15/2020	Upstream	296.0	?	Moderate mineralization present throughout length of pipe. Significant debris/blockage at 260.5 feet. According to CCTV operator, this pipe was previously lined with CIPP. Operator noted lining failures at 32.9 feet, 60.3 feet, 131.6 feet & 182.1 feet. CPEP lateral at 9 o'clock position at 21.3 feet with significant mineralization at discharge point. CMP lateral at 11 o'clock position at 133.2 feet with moderate mineralization at discharge point.	Replace or re-line pipe
33747	31628026	31628127	48	CMP	Unknown	5/15/2020	Downstream	264	?	Moderate mineralization present throughout length of pipe. Multiple holes in pipe from 7 to 9 o'clock position at 7.1 to 11.3 feet. Tee connection at 12 o'clock position at 12.9 feet. Hole in pipe at 4 o'clock position at 45.9 feet. Crown of pipe deformed several inches at 112.4 feet. CCTV camera submerged at 129.5 feet. Joint separations at 148.0 feet, 168.6 feet & 189.0 feet. Angle point in pipe at 263.7 feet.	Replace or CIPP pipe

Appendix C

Storm Drain CCTV Inspection Forms

Lois Drive and 32nd Avenue Pathway MOA Pipe #28932 - W. 32nd Ave (west of Minnesota Dr)

General Inspection Data:

CCTV Date: 4/30/2020

CCTV Completed by: MOA Street Maintenance

CCTV Direction: Upstream

Pipe Data:

Diameter/Material: 12" CMP

Install Year: 1978

Flow Depth: No flow at time of CCTV

Debris/Obstructions: CCTV abandoned at 24.1 feet due to significant debris in invert, minor to moderate debris from 6.3 feet to 19.7 feet.

Miscellaneous/Defect Notes: Pipe appears to be in good condition, but leaf buildup is restricting flow. Looks like some root intrusion is possible along walls.

CCTV Images:



Lois Drive and 32nd Avenue Pathway MOA Pipe #12828 - W. 32nd Ave (west of Minnesota Dr)

General Inspection Data:

CCTV Date: 4/30/2020

CCTV Completed by: MOA Street Maintenance

CCTV Direction: Downstream

Pipe Data:

Diameter/Material: 15" RCP

Install Year: 1978

Flow Depth: < 25% of full pipe flow

Debris/Obstructions: CCTV abandoned at 23.6 feet due to significant debris in invert.

Miscellaneous/Defect Notes: Offset joints at 15.5 feet & 21.8 feet. Pipe exceeds 300 foot max. manhole spacing per MASS.

CCTV Images:



Lois Drive and 32nd Avenue Pathway MOA Pipe #27764 - Lois Dr (north of W. 31st Ave)

General Inspection Data:

CCTV Date: 12/19/2019

CCTV Completed by: MOA Street Maintenance

CCTV Direction: Upstream

Pipe Data:

Diameter/Material: 12" CMP

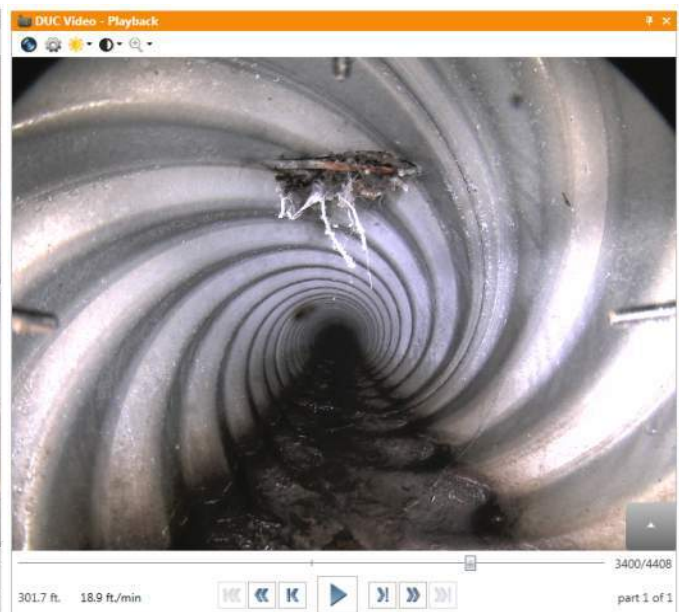
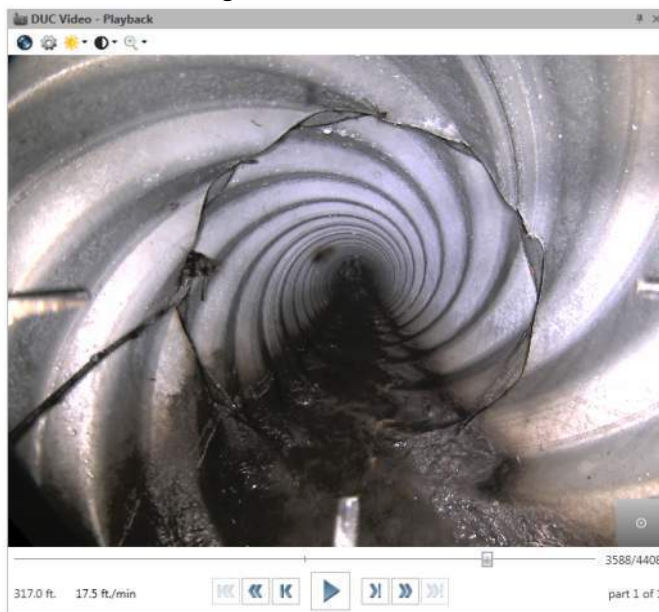
Install Year: 1982

Flow Depth: No flow at time of CCTV

Debris/Obstructions: Minor to moderate debris present throughout length of pipe.

Miscellaneous/Defect Notes: Mineralization/infiltration at pipe joints at 132.1 feet, 197.3 feet & 216.6 feet. Root intrusion at pipe joints at 216.6 feet & 317.0 feet. 1"x4" gouge through pipe at 12 o'clock position at 301.7 feet, soil visible.

CCTV Images:



Lois Drive and 32nd Avenue Pathway MOA Pipe #29551 - Lois Dr (south of W. 31st Ave)

General Inspection Data:

CCTV Date: 4/30/2020

CCTV Completed by: MOA Street Maintenance

CCTV Direction: Upstream

Pipe Data:

Diameter/Material: 12" CMP

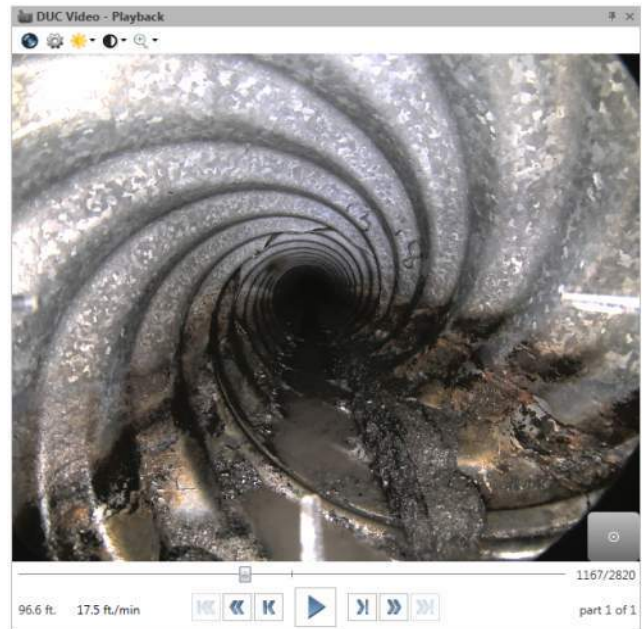
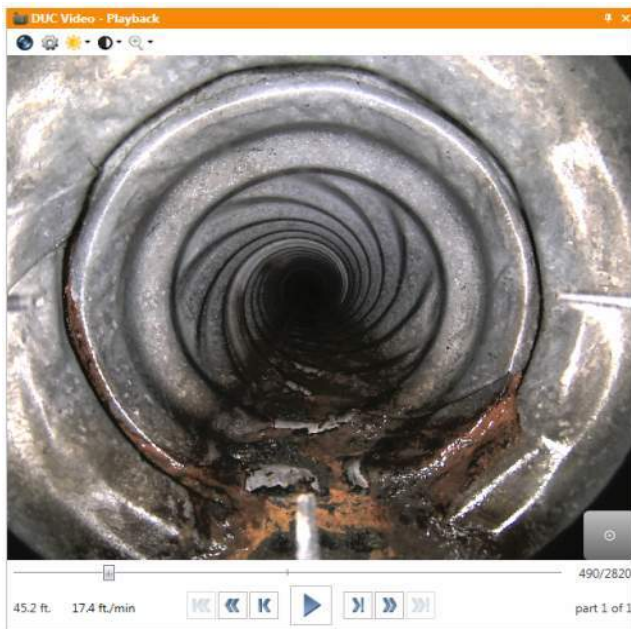
Install Year: 1982

Flow Depth: No flow at time of CCTV

Debris/Obstructions: CCTV abandoned at 98.8 feet due to severe debris in invert, minor to moderate debris present throughout remainder of pipe inspected.

Miscellaneous/Defect Notes: Mineralization/Infiltration at pipe joint at 45.3 feet and 65.4 feet.

CCTV Images:



Lois Drive and 32nd Avenue Pathway MOA Pipe #25204 - W. 31st Ave (west of Lois Dr)

General Inspection Data:

CCTV Date: 12/19/2019

CCTV Completed by: MOA Street Maintenance

CCTV Direction: Upstream

Pipe Data:

Diameter/Material: 15" CMP

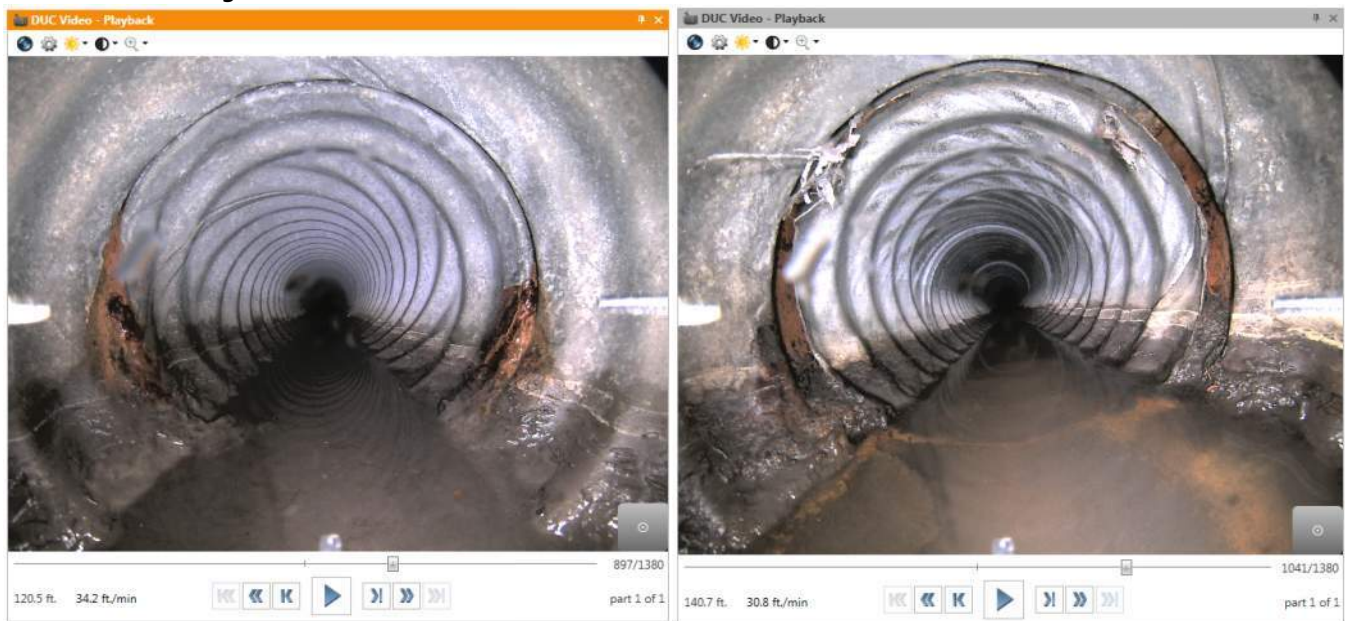
Install Year: 1982

Flow Depth: < 25% of full pipe flow

Debris/Obstructions: Minor to moderate debris present throughout length of pipe.

Miscellaneous/Defect Notes: Mineralization/infiltration at pipe joints at 39.6 feet, 59.9 feet, 120.6 feet & 161.0 feet. Significant joint separation at 140.7 feet.

CCTV Images:



Lois Drive and 32nd Avenue Pathway MOA Pipe #30570 - W. 31st Ave (east of Doris St)

General Inspection Data:

CCTV Date: 12/19/2019

CCTV Completed by: MOA Street Maintenance

CCTV Direction: Downstream

Pipe Data:

Diameter/Material: 15" CMP

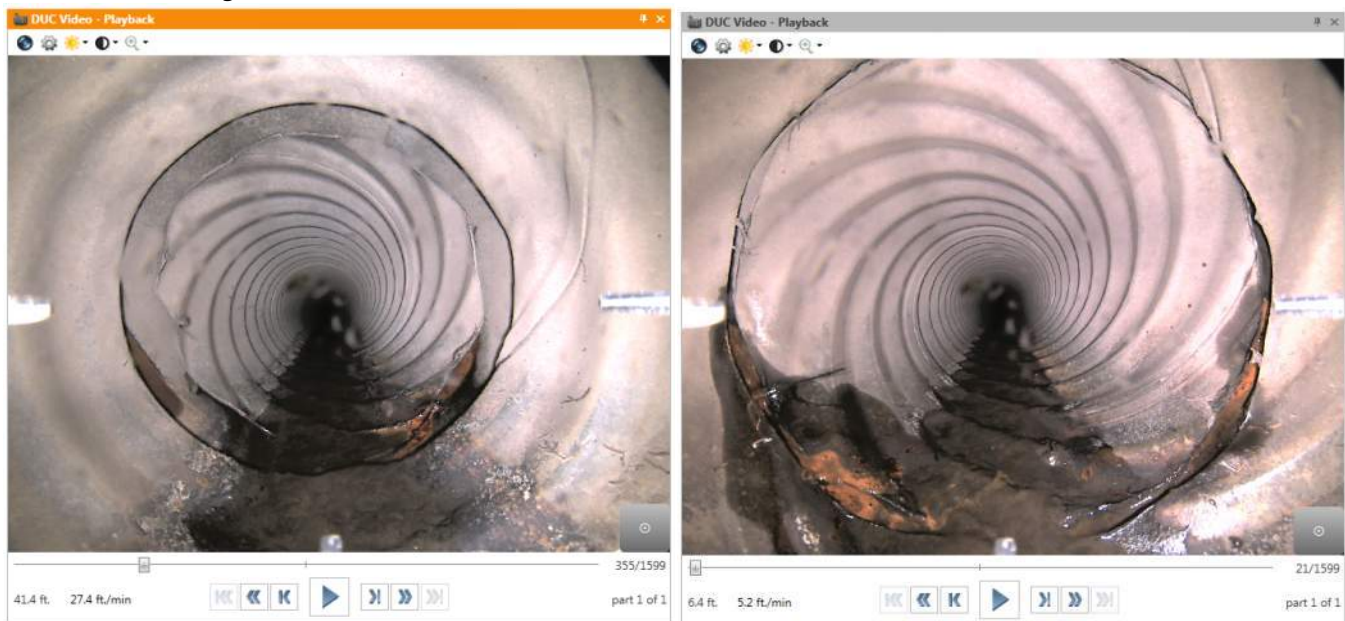
Install Year: 1982

Flow Depth: < 10% of full pipe flow

Debris/Obstructions: Minor debris present throughout length of pipe.

Miscellaneous/Defect Notes: Minor metal loss/corrosion present throughout length of pipe.
Offset joint at 152.1 feet. Mineralization/Infiltration at pipe joint
at 6.4 feet, 21.5 feet, 72.3 feet and 121.8 feet. Joint separation at
41.7 feet.

CCTV Images:



Lois Drive and 32nd Avenue Pathway MOA Pipe #13603 - W. 31st Ave (west of Doris St)

General Inspection Data:

CCTV Date: 12/19/2019

CCTV Completed by: MOA Street Maintenance

CCTV Direction: Downstream

Pipe Data:

Diameter/Material: 15" CMP

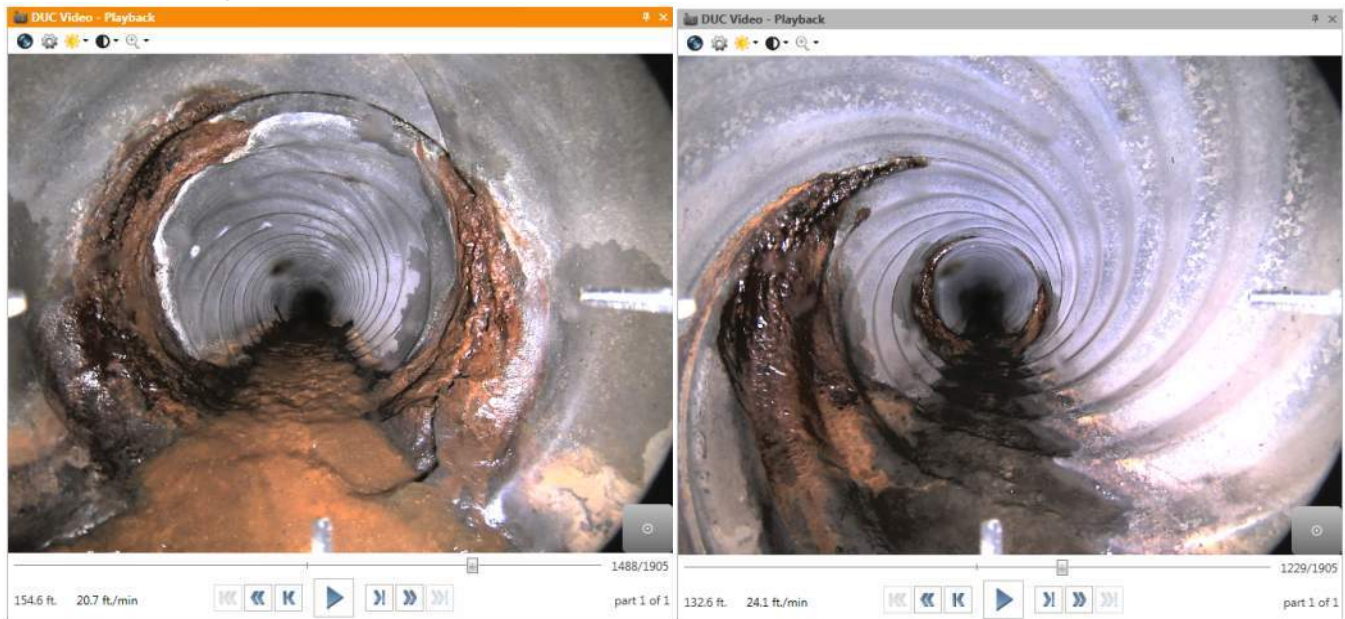
Install Year: 1982

Flow Depth: < 10% of full pipe flow

Debris/Obstructions: Minor debris present from 0 feet to 143.1 feet. Moderate to significant mineralization present from 143.1 feet to end of pipe.

Miscellaneous/Defect Notes: Minor metal loss/corrosion present from 0 feet to 143.1 feet. Moderate to significant metal loss/corrosion present from 143.1 feet to end of pipe. Mineralization/infiltration near flow line at 4 o'clock position at 131.1 feet. Mineralization/infiltration near along CMP seam at 9 o'clock position at 132.6 feet. Significant mineralization/infiltration at pipe joints at 114.2 feet, 134.3 feet & 154.9 feet. Surface damage/corrosion at 10 o'clock & 2 o'clock at 55.0 feet.

CCTV Images:



Lois Drive and 32nd Avenue Pathway

MOA Pipe #27885 - Fish Creek Alignment (between Willow St & Doris St)

General Inspection Data:

CCTV Date: 5/15/2020

CCTV Completed by: MOA Street Maintenance

CCTV Direction: Upstream

Pipe Data:

Diameter/Material: 48" CMP/Lined

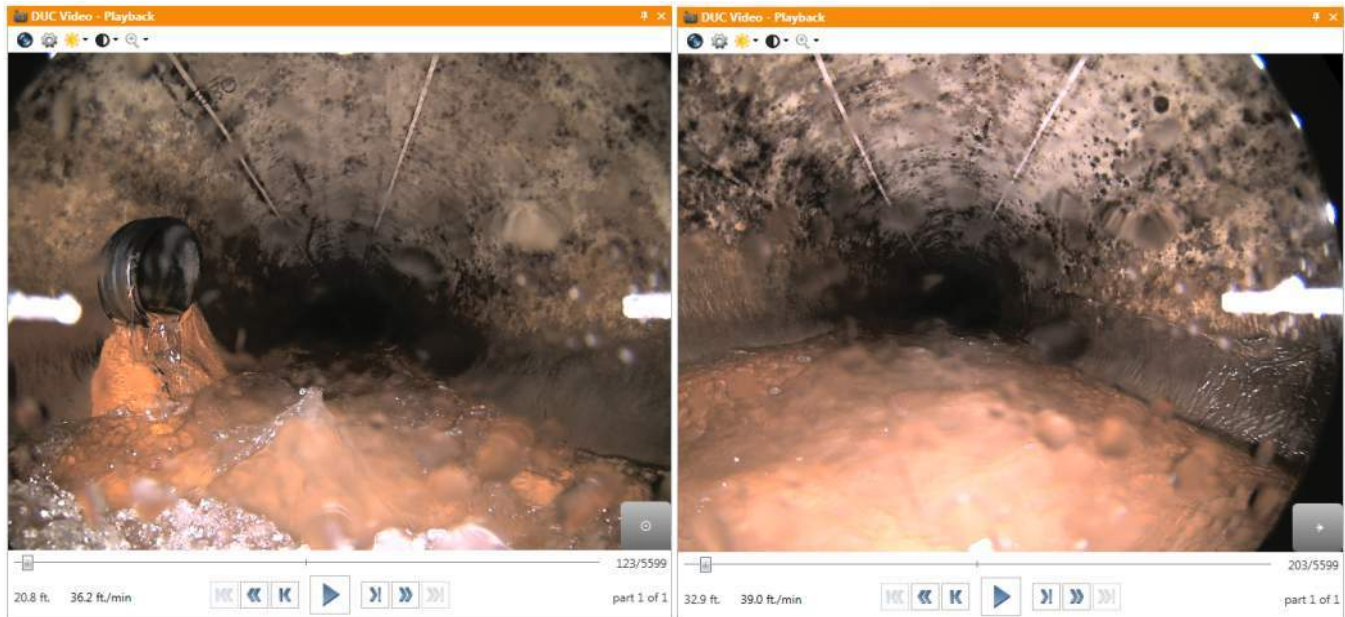
Install Year: Unknown

Flow Depth: < 25% of full pipe flow

Debris/Obstructions: Moderate mineralization present throughout length of pipe.
Significant debris/blockage at 260.5 feet.

Miscellaneous/Defect Notes: According to CCTV operator, this pipe was previously lined with CIPP. Operator noted lining failures at 32.9 feet, 60.3 feet, 131.6 feet & 182.1 feet. CPEP lateral at 9 o'clock position at 21.3 feet with significant mineralization at discharge point. CMP lateral at 11 o'clock position at 133.2 feet with moderate mineralization at discharge point.

CCTV Images:



Lois Drive and 32nd Avenue Pathway MOA Pipe #33747 - Fish Creek Alignment (crosses Willow St)

General Inspection Data:

CCTV Date: 5/15/2020

CCTV Completed by: MOA Street Maintenance

CCTV Direction: Downstream

Pipe Data:

Diameter/Material: 48" CMP

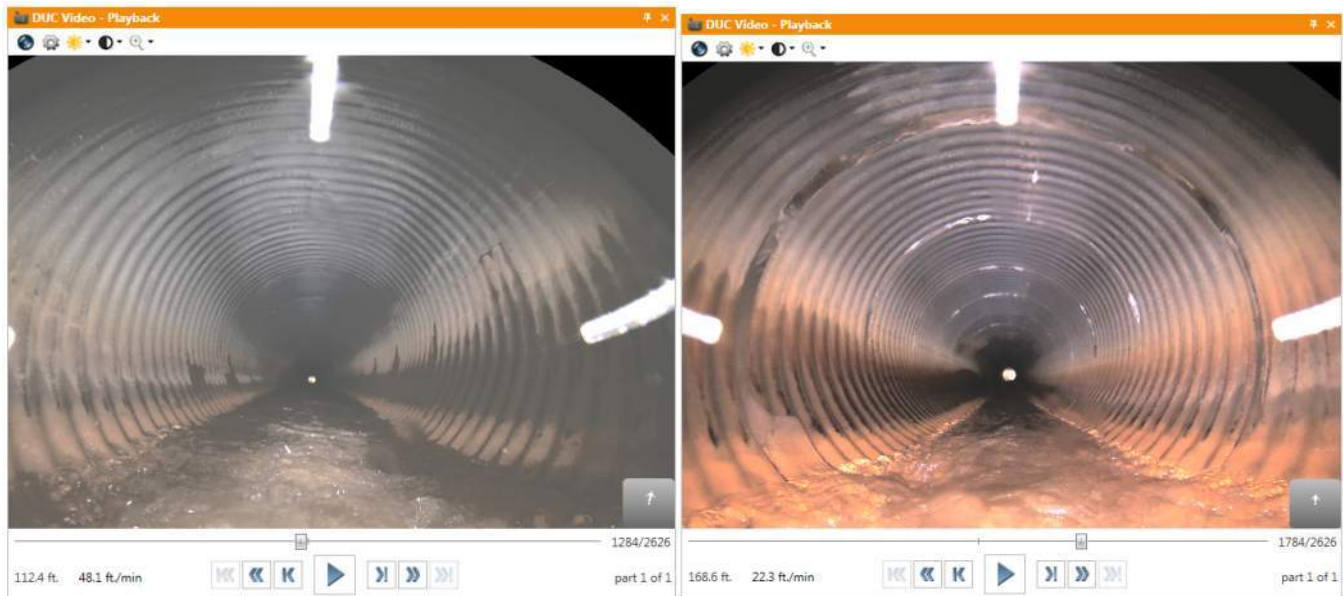
Install Year: Unknown

Flow Depth: < 25% of full pipe flow

Debris/Obstructions: Moderate mineralization present throughout length of pipe.

Miscellaneous/Defect Notes: Multiple holes in pipe from 7 to 9 o'clock position at 7.1 to 11.3 feet. Tee connection at 12 o'clock position at 12.9 feet. Hole in pipe at 4 o'clock position at 45.9 feet. Crown of pipe deformed several inches at 112.4 feet. CCTV camera submerged at 129.5 feet. Joint separations at 148.0 feet, 168.6 feet & 189.0 feet. Angle point in pipe at 263.7 feet.

CCTV Images:



Appendix D

Storm Drain Structure Inspection Forms

CRW ENGINEERING GROUP
STORM DRAIN STRUCTURE FIELD INSPECTION FORM
LOIS DRIVE AND 32ND AVENUE PATHWAY (PM&E No. 19-08)

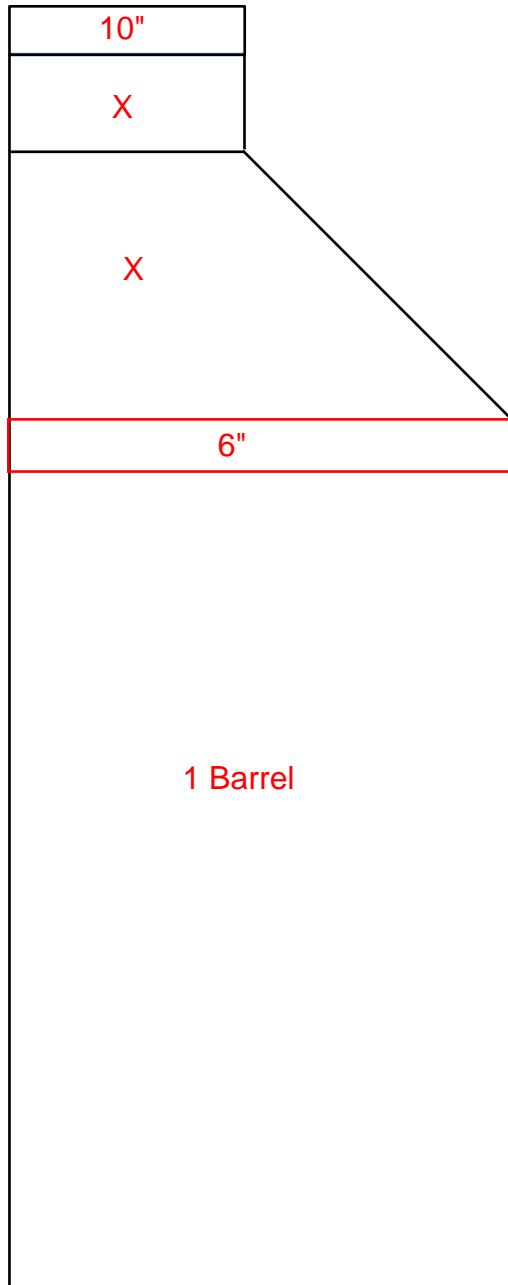
INSPECTION DATE: 6/10/20 INSPECTION TIME: 9:50 AM
 WEATHER: Sunny INSPECTED BY: Joey & Wayne
 MANHOLE NUMBER: CB #028 FIRST PHOTO NUMBER: _____
 APPROXIMATE LOCATION: Intersection of 32nd Ave & unnamed alley, SW corner. 142 feet
East of 32nd Ave & Wyoming Dr Intersection. Inlet lid in unpaved
alley

CONDITION	POOR	←————→		GOOD
CONDITION OF LID	1	2	3	4
CONDITION OF GRADE RINGS	1	2	3	4
CONDITION OF BARREL	1	2	3	4
CONDITION OF LADDER	1	2	3	4
CONDITION OF PIPE INLETS/OUTLETS	1	2	3	4
PRESENCE OF SOLIDS OR BUILDUP	YES		NO	
PRESENCE OF INFILTRATION/INFLOW	YES		NO	
DEPTH/VOLUME OF FLOW:	No flow			
DIAMETER OF MANHOLE:	4' Catchbasin			

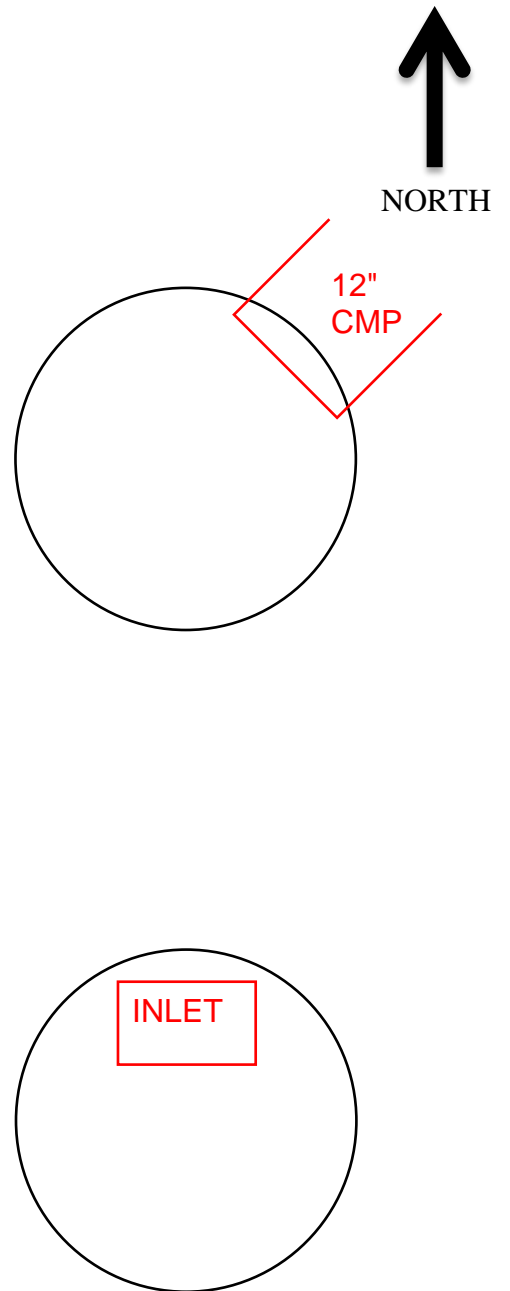
MANHOLE ASSESSMENT/CONDITION NOTES:

- Grout spalling at pipe penetration
- Non-standard inlet, 11.5" x 15", rectangular, frame depth 10"
- No grade rings, frame placed on reducing slab

MANHOLE SKETCH



PROFILE



PLAN

Lois Drive and 32nd Avenue Pathway (PM&E No. 19-08)

Manhole No. SW1628-028



Photo 1 - Structure Location Map



Photo 2 - Inlet / Surrounding Area



Photo 3 - Frame & Reducing Slab



Photo 4 - Outlet Pipe Penetration

CRW ENGINEERING GROUP
STORM DRAIN STRUCTURE FIELD INSPECTION FORM
LOIS DRIVE AND 32ND AVENUE PATHWAY (PM&E No. 19-08)

INSPECTION DATE: 6/10/20 INSPECTION TIME: 9:40 AM
WEATHER: _____ INSPECTED BY: Joey & Wayne
MANHOLE NUMBER: CB #029 FIRST PHOTO NUMBER: _____
APPROXIMATE LOCATION: Intersection of 32nd Ave & unnamed alley, NE Corner. 190 feet
East of 32nd Ave & Wyoming Dr Intersection. Inlet lid in
pavement.

CONDITION	POOR	←————→		GOOD
CONDITION OF LID	1	2	3	4
CONDITION OF GRADE RINGS	1	2	3	4
CONDITION OF BARREL	1	2	3	4
CONDITION OF LADDER	1	2	3	4
CONDITION OF PIPE INLETS/OUTLETS	1	2	3	4
PRESENCE OF SOLIDS OR BUILDUP	YES		NO	
PRESENCE OF INFILTRATION/INFLOW	YES		NO	
DEPTH/VOLUME OF FLOW:	No flow			
DIAMETER OF MANHOLE:	4' Catchbasin			

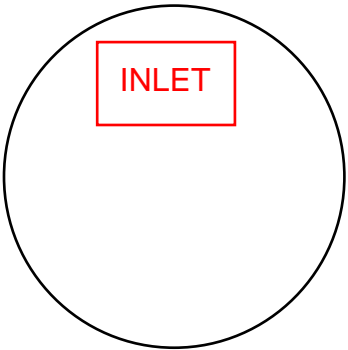
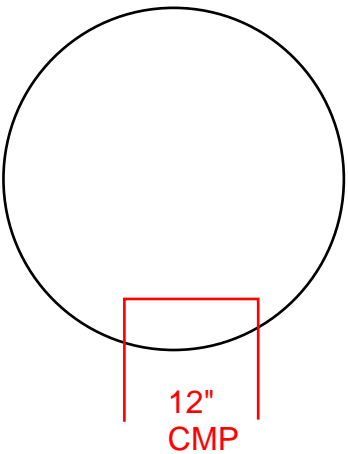
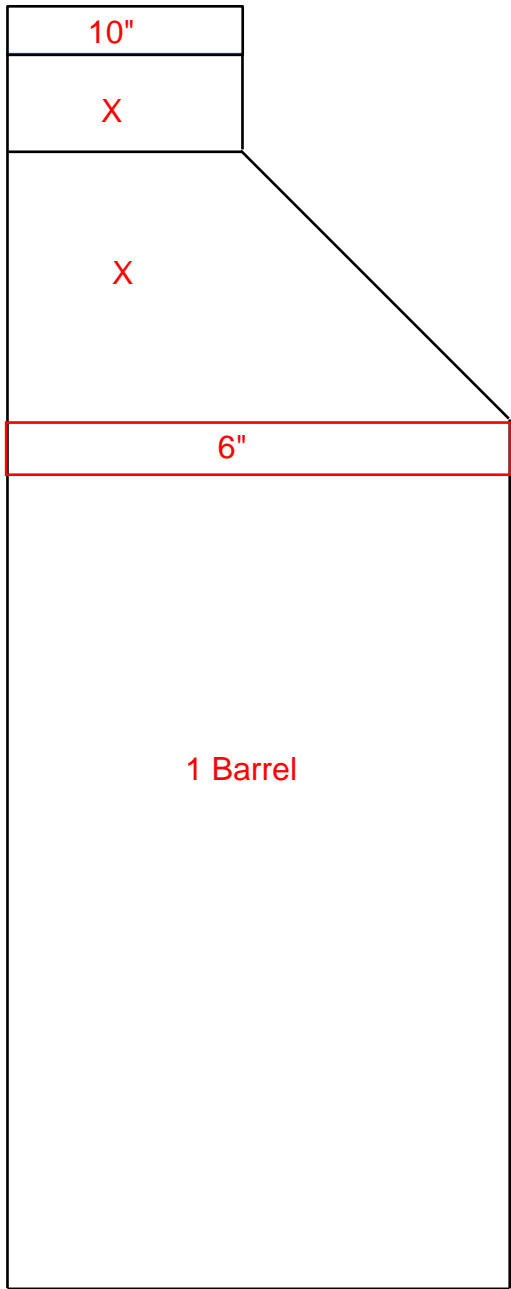
MANHOLE ASSESSMENT/CONDITION NOTES:

- Non-standard inlet, 11.5" x 15", rectangular, frame depth 10"
- No grade rings, frame placed on reducing slab
- Grout spalling around pipe penetration
- Metal loss at invert of pipe

MANHOLE SKETCH



NORTH



PROFILE

PLAN

Lois Drive and 32nd Avenue Pathway (PM&E No. 19-08)

Manhole No. SW1628-029

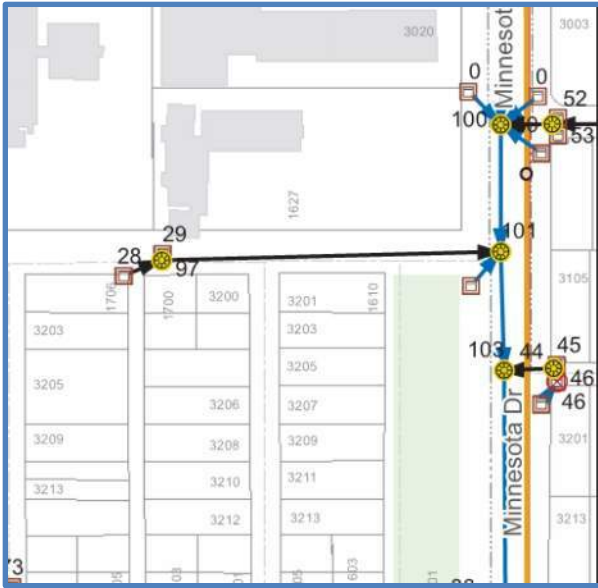


Photo 1 - Structure Location Map



Photo 2 - Inlet / Surrounding Area



Photo 3 - Inlet



Photo 4 - Frame & Reducing Slab

CRW ENGINEERING GROUP
STORM DRAIN STRUCTURE FIELD INSPECTION FORM
LOIS DRIVE AND 32ND AVENUE PATHWAY (PM&E No. 19-08)

INSPECTION DATE: 6/10/20 INSPECTION TIME: 11:05 AM
WEATHER: _____ INSPECTED BY: Joey & Wayne
MANHOLE NUMBER: CB #055 FIRST PHOTO NUMBER: _____
APPROXIMATE LOCATION: 335 feet North of Lois Drive & 31st Ave, West side of Lois Drive.
Inlet lid in grass road shoulder.

CONDITION	POOR	←————→		GOOD
CONDITION OF LID	1	2	3	4
CONDITION OF GRADE RINGS	1	2	3	4
CONDITION OF BARREL	1	2	3	4
CONDITION OF LADDER	1	2	3	4
CONDITION OF PIPE INLETS/OUTLETS	1	2	3	4
PRESENCE OF SOLIDS OR BUILDUP	YES			NO
PRESENCE OF INFILTRATION/INFLOW	YES			NO
DEPTH/VOLUME OF FLOW:	No flow			
DIAMETER OF MANHOLE:	4' Catchbasin			

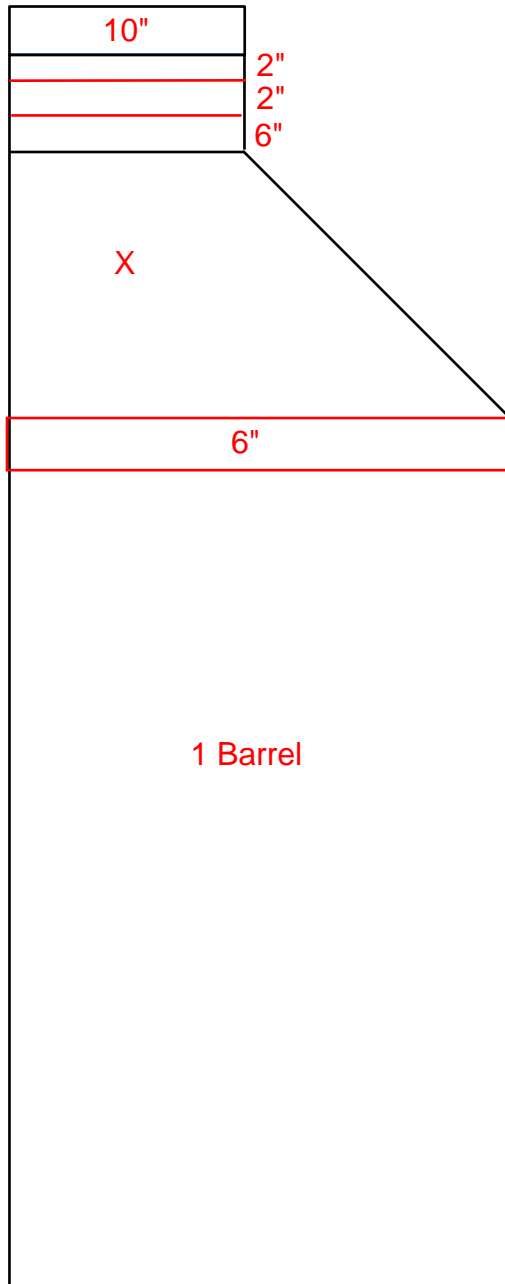
MANHOLE ASSESSMENT/CONDITION NOTES:

- Flat intake lid
- Minor vertical cracking in 6" grade ring
- Minor grout spalling in pipe penetration
- Significant debris in sump

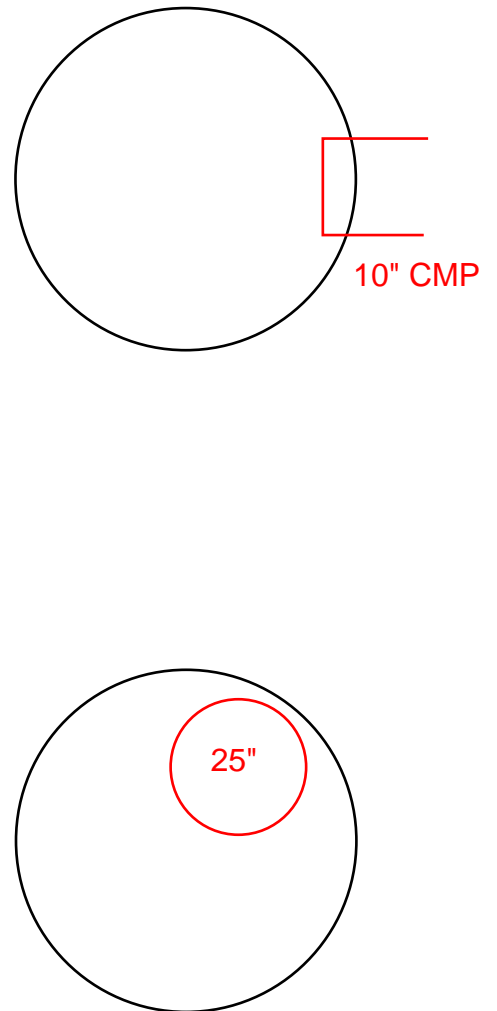
MANHOLE SKETCH



NORTH



PROFILE



PLAN

Lois Drive and 32nd Avenue Pathway (PM&E No. 19-08)

Manhole No. SW1628-055

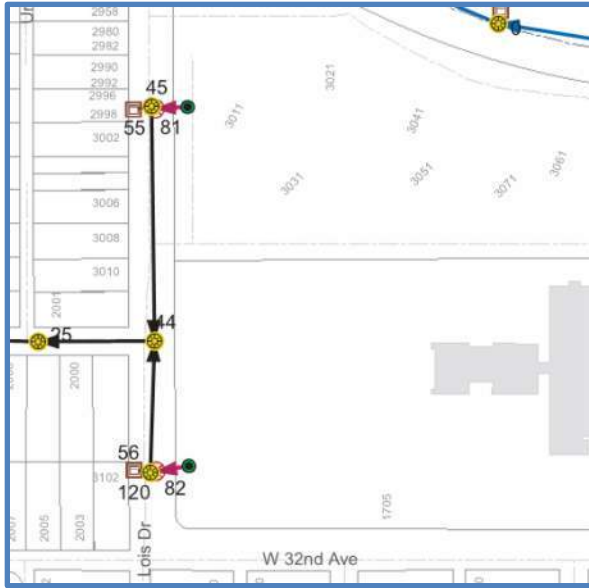


Photo 1 - Structure Location Map



Photo 2 - Inlet / Surrounding Area



Photo 3 - Frame, Grade Rings & Reducing Slab



Photo 4 - Outlet Pipe Penetration

CRW ENGINEERING GROUP
STORM DRAIN STRUCTURE FIELD INSPECTION FORM
LOIS DRIVE AND 32ND AVENUE PATHWAY (PM&E No. 19-08)

INSPECTION DATE: 6/10/20 INSPECTION TIME: 10:30 AM
WEATHER: _____ INSPECTED BY: Joey & Wayne
MANHOLE NUMBER: CB #056 FIRST PHOTO NUMBER: _____
APPROXIMATE LOCATION: 190 feet South of Lois Drive & 31st Ave, West side of Lois Drive.
Inlet lid in concrete driveway gutter.

CONDITION	POOR	←————→		GOOD
CONDITION OF LID	1	2	3	4
CONDITION OF GRADE RINGS	1	2	3	4
CONDITION OF BARREL	1	2	3	4
CONDITION OF LADDER	1	2	3	4
CONDITION OF PIPE INLETS/OUTLETS	1	2	3	4
PRESENCE OF SOLIDS OR BUILDUP	YES			NO
PRESENCE OF INFILTRATION/INFLOW	YES			NO
DEPTH/VOLUME OF FLOW:	No flow			
DIAMETER OF MANHOLE:	4' Catchbasin			

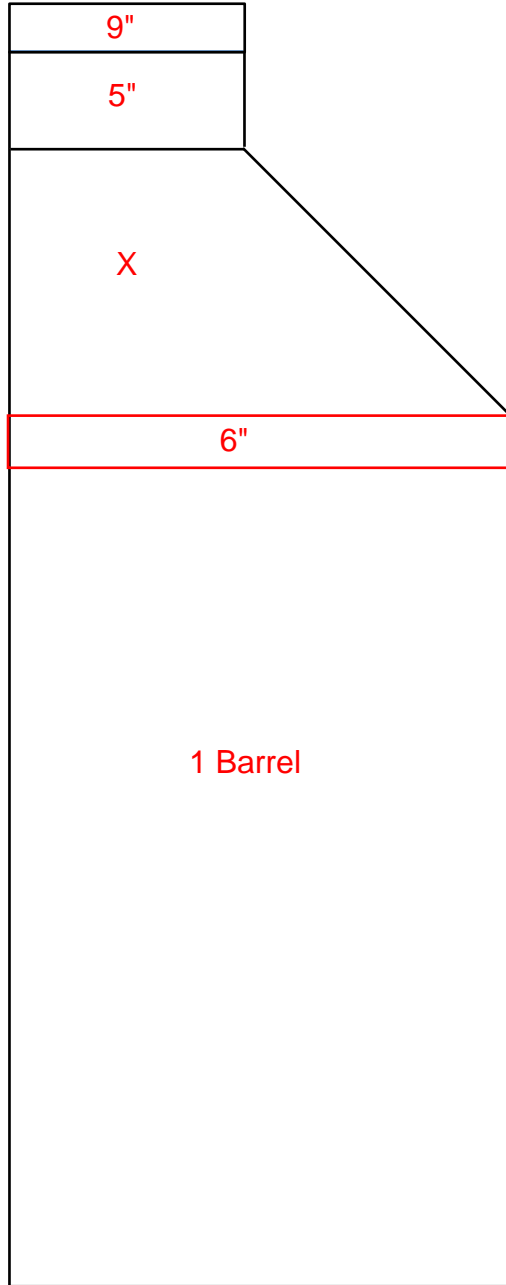
MANHOLE ASSESSMENT/CONDITION NOTES:

- Type 2 curb inlet, 24" x 18"
- Curb inlet is at skewed angle from curb line
- Grade ring placement is offset from frame and reducing slab
- Crack in grout above pipe penetration

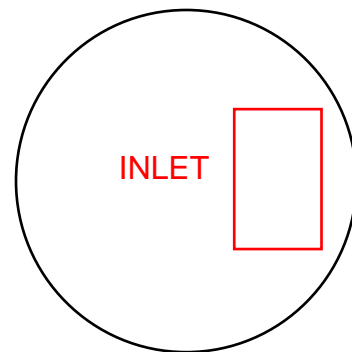
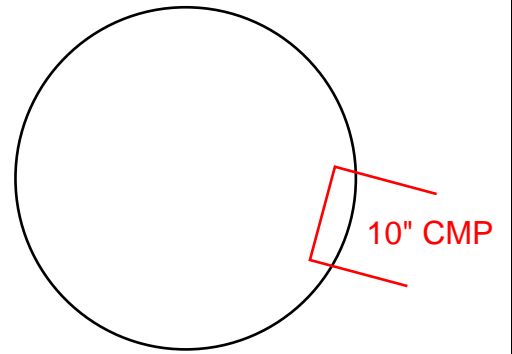
MANHOLE SKETCH



NORTH



PROFILE



PLAN

Lois Drive and 32nd Avenue Pathway (PM&E No. 19-08)

Manhole No. SW1628-056

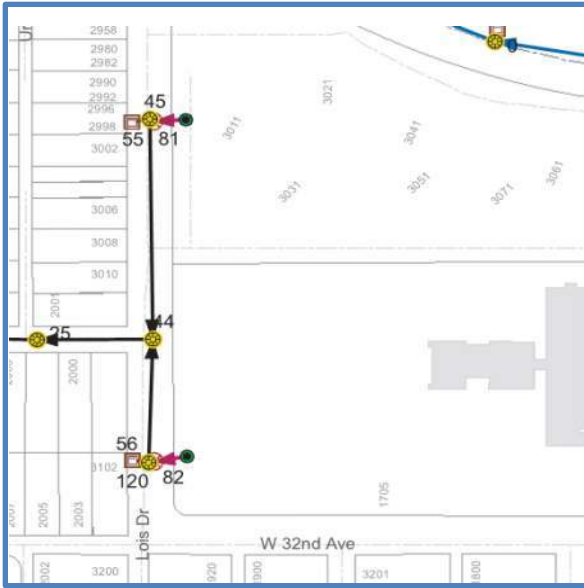


Photo 1 - Structure Location Map



Photo 2 - Inlet / Surrounding Area



Photo 3 – Frame, Grade Rings & Reducing Slab



Photo 4 – Outlet Pipe Penetration

CRW ENGINEERING GROUP
STORM DRAIN STRUCTURE FIELD INSPECTION FORM
LOIS DRIVE AND 32ND AVENUE PATHWAY (PM&E No. 19-08)

INSPECTION DATE: 6/10/20 INSPECTION TIME: 11:00 AM
 WEATHER: _____ INSPECTED BY: Joey & Wayne
 MANHOLE NUMBER: CB #081 FIRST PHOTO NUMBER: _____
 APPROXIMATE LOCATION: 335 feet North of Lois Drive & 31st Ave, East side of Lois Drive.
Inlet lid in grass.

CONDITION	POOR	←————→		GOOD
CONDITION OF LID	1	<u>2</u>	3	4
CONDITION OF GRADE RINGS	1	2	3	4
CONDITION OF BARREL	1	2	<u>3</u>	4
CONDITION OF LADDER	1	2	3	4
CONDITION OF PIPE INLETS/OUTLETS	1	2	<u>3</u>	4
PRESENCE OF SOLIDS OR BUILDUP	<u>YES</u>			NO
PRESENCE OF INFILTRATION/INFLOW	YES			<u>NO</u>
DEPTH/VOLUME OF FLOW:	<u>No flow</u>			
DIAMETER OF MANHOLE:	<u>4' catchbasin</u>			

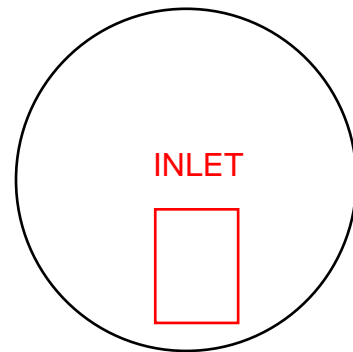
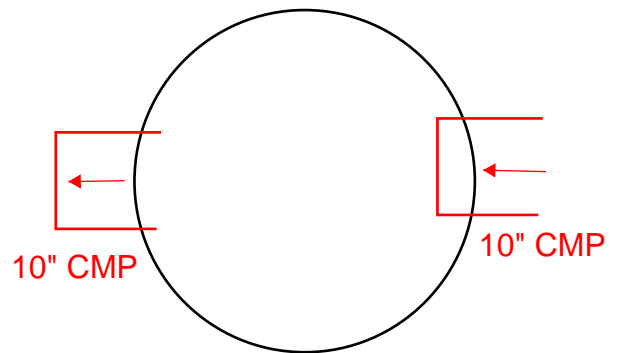
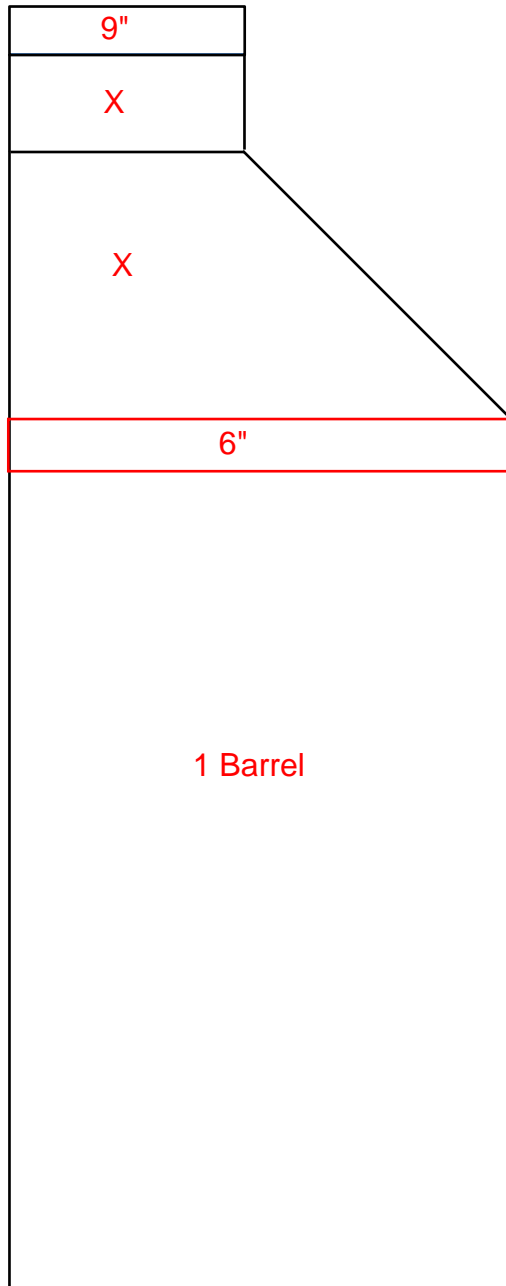
MANHOLE ASSESSMENT/CONDITION NOTES:

- Type 2 curb inlet, 24" x 18"
- Significant metal loss in west pipe's invert
- Debris in west pipe's invert

MANHOLE SKETCH



NORTH



PROFILE

PLAN

Lois Drive and 32nd Avenue Pathway (PM&E No. 19-08)

Manhole No. SW1628-081

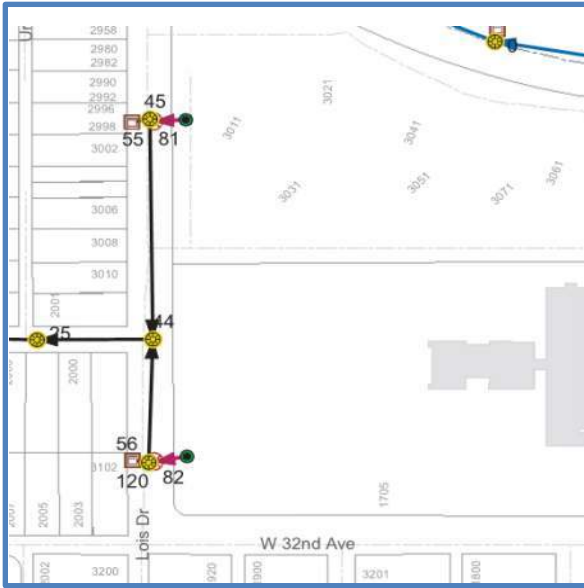


Photo 1 - Structure Location Map



Photo 2 - Inlet / Surrounding Area



Photo 3 – Frame & Reducing Slab



Photo 4 – Outlet Pipe Penetration

CRW ENGINEERING GROUP
STORM DRAIN STRUCTURE FIELD INSPECTION FORM
LOIS DRIVE AND 32ND AVENUE PATHWAY (PM&E No. 19-08)

INSPECTION DATE: 6/10/20 INSPECTION TIME: 10:10 AM
 WEATHER: _____ INSPECTED BY: Joey & Wayne
 MANHOLE NUMBER: CB #082 FIRST PHOTO NUMBER: _____
 APPROXIMATE LOCATION: 190 feet South of Lois Drive & 31st Ave, East side of Lois Drive.
Inlet lid in gravel shoulder.

CONDITION	POOR	←————→		GOOD
CONDITION OF LID	1	2	3	4
CONDITION OF GRADE RINGS	1	2	3	4
CONDITION OF BARREL	1	2	3	4
CONDITION OF LADDER	1	2	3	4
CONDITION OF PIPE INLETS/OUTLETS	1	2	3	4
PRESENCE OF SOLIDS OR BUILDUP	YES			NO
PRESENCE OF INFILTRATION/INFLOW	YES			NO
DEPTH/VOLUME OF FLOW:	No flow			
DIAMETER OF MANHOLE:	4' Catchbasin Manhole			

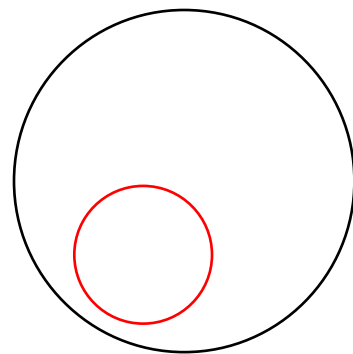
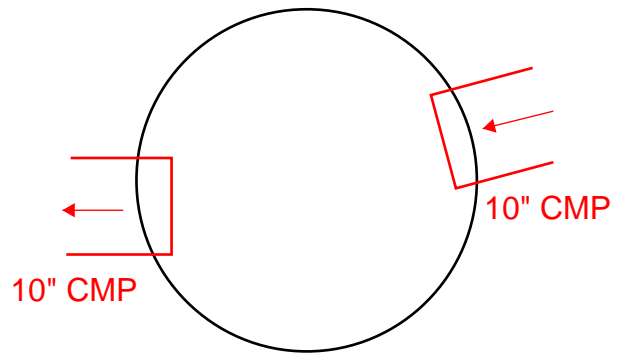
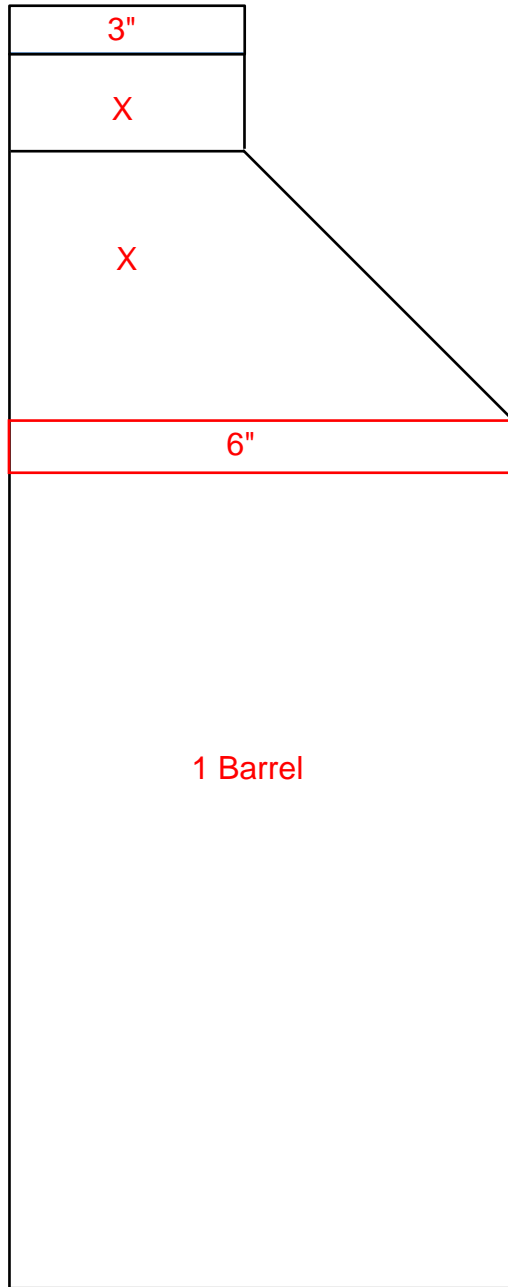
MANHOLE ASSESSMENT/CONDITION NOTES:

- Flat intake cover, 25" diameter
- Non-standard frame height 3"
- Minor offset between barrel & reducing slab
- Metal loss in west 10" CMP pipe invert
- East pipe full of debris
- Sump is full of debris

MANHOLE SKETCH



NORTH



PROFILE

PLAN

Lois Drive and 32nd Avenue Pathway (PM&E No. 19-08)

Manhole No. SW1628-082

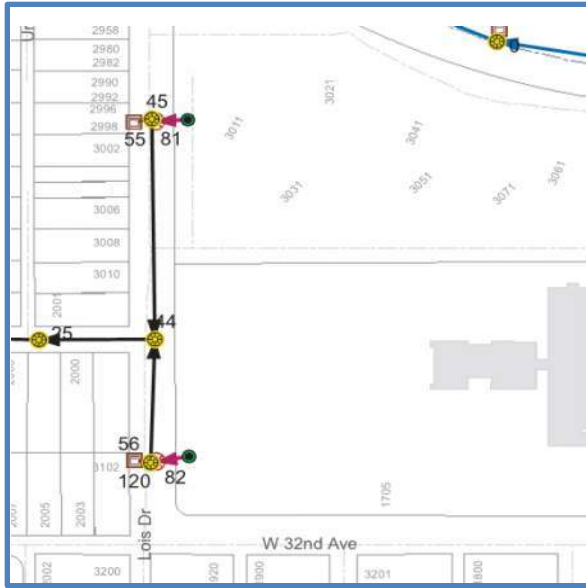


Photo 1 - Structure Location Map



Photo 2 - Inlet / Surrounding Area



Photo 3 - Frame, Reducing Slab & Outlet Pipe



Photo 4 - Inlet Pipe & Pipe Penetration

CRW ENGINEERING GROUP
STORM DRAIN STRUCTURE FIELD INSPECTION FORM
LOIS DRIVE AND 32ND AVENUE PATHWAY (PM&E No. 19-08)

INSPECTION DATE: 6/10/20

INSPECTION TIME: N/A

WEATHER: _____

INSPECTED BY: Joey & Wayne

MANHOLE NUMBER: CB #142

FIRST PHOTO NUMBER: _____

APPROXIMATE LOCATION: 190 feet South of Lois Drive & 31st Ave, East side of Lois Drive.

Inlet lid on private land's grass, 55 feet from Lois Drive's

Edge of pavement.

CONDITION	POOR	←————→		GOOD
CONDITION OF LID	1	2	3	4
CONDITION OF GRADE RINGS	1	2	3	4
CONDITION OF BARREL	1	2	3	4
CONDITION OF LADDER	1	2	3	4
CONDITION OF PIPE INLETS/OUTLETS	1	2	3	4
PRESENCE OF SOLIDS OR BUILDUP	YES		NO	
PRESENCE OF INFILTRATION/INFLOW	YES		NO	
DEPTH/VOLUME OF FLOW:	_____			
DIAMETER OF MANHOLE:	_____			

MANHOLE ASSESSMENT/CONDITION NOTES:

- Unable to locate in school yard. Did not assess CB #142.

CRW ENGINEERING GROUP
STORM DRAIN STRUCTURE FIELD INSPECTION FORM
LOIS DRIVE AND 32ND AVENUE PATHWAY (PM&E No. 19-08)

INSPECTION DATE: 6/10/20

INSPECTION TIME: _____

WEATHER: _____

INSPECTED BY: Joey & Wayne

MANHOLE NUMBER: CB #143

FIRST PHOTO NUMBER: _____

APPROXIMATE LOCATION: 335 feet North of Lois Drive & 31st Ave, East side of Lois Drive.
Inlet lid on private land's pavement, 50 feet from Lois Drive's
Edge of pavement.

CONDITION	POOR	←————→		GOOD
CONDITION OF LID	1	2	3	4
CONDITION OF GRADE RINGS	1	2	3	4
CONDITION OF BARREL	1	2	3	4
CONDITION OF LADDER	1	2	3	4
CONDITION OF PIPE INLETS/OUTLETS	1	2	3	4
PRESENCE OF SOLIDS OR BUILDUP	YES		NO	
PRESENCE OF INFILTRATION/INFLOW	YES		NO	
DEPTH/VOLUME OF FLOW:				
DIAMETER OF MANHOLE:				

MANHOLE ASSESSMENT/CONDITION NOTES:

- Catchbasin located on private property. Did not assess CB #143.

CRW ENGINEERING GROUP
STORM DRAIN STRUCTURE FIELD INSPECTION FORM
LOIS DRIVE AND 32ND AVENUE PATHWAY (PM&E No. 19-08)

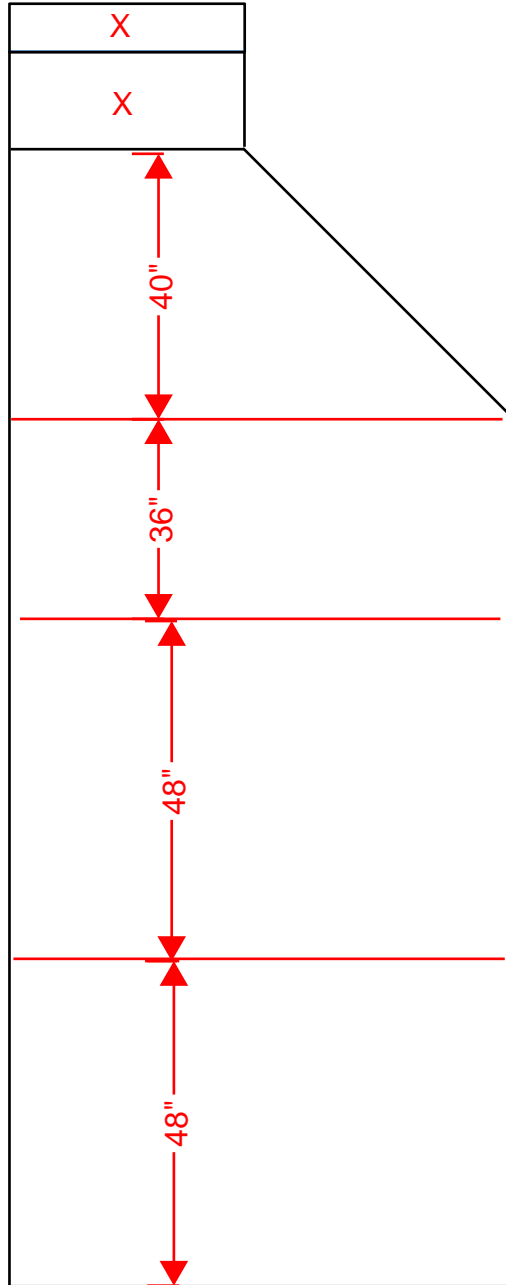
INSPECTION DATE: 6/10/20 INSPECTION TIME: 10:45 AM
WEATHER: _____ INSPECTED BY: Joey & Wayne
MANHOLE NUMBER: MH #044 FIRST PHOTO NUMBER: _____
APPROXIMATE LOCATION: Intersection of Lois Drive & 31st Ave, East side.
MH lid in gravel shoulder.

CONDITION	POOR	←————→		GOOD
CONDITION OF LID	1	2	3	4
CONDITION OF GRADE RINGS	1	2	3	4
CONDITION OF BARREL	1	2	3	4
CONDITION OF LADDER	1	2	3	4
CONDITION OF PIPE INLETS/OUTLETS	1	2	3	4
PRESENCE OF SOLIDS OR BUILDUP	YES			NO
PRESENCE OF INFILTRATION/INFLOW	YES			NO
DEPTH/VOLUME OF FLOW:	No Flow			
DIAMETER OF MANHOLE:	4' Manhole			

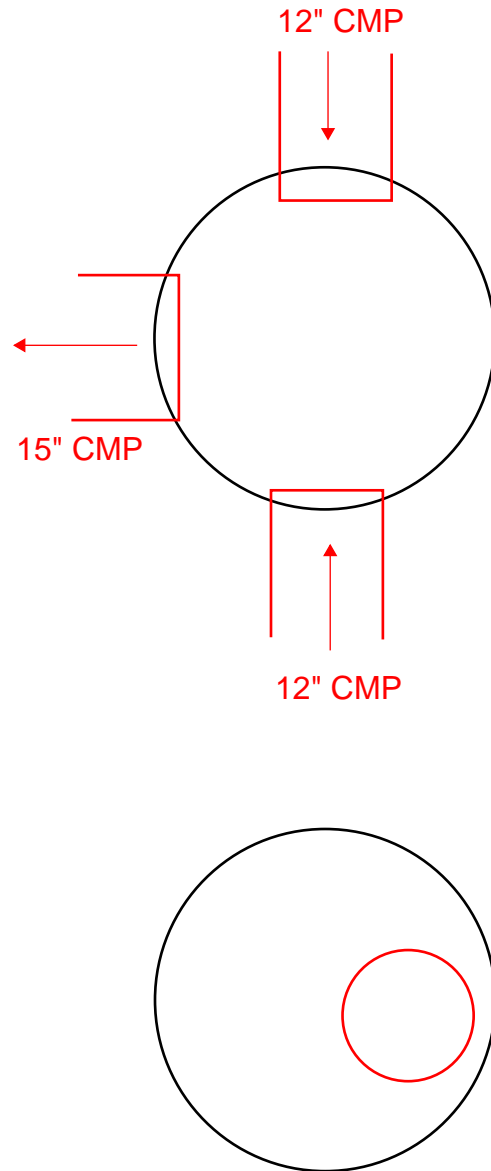
MANHOLE ASSESSMENT/CONDITION NOTES:

- Non-standard lid with 3 angle pieces welded onto lid
- 12 non-standard steel ladder rungs

MANHOLE SKETCH



PROFILE



PLAN

Lois Drive and 32nd Avenue Pathway (PM&E No. 19-08)

Manhole No. SW1628-044

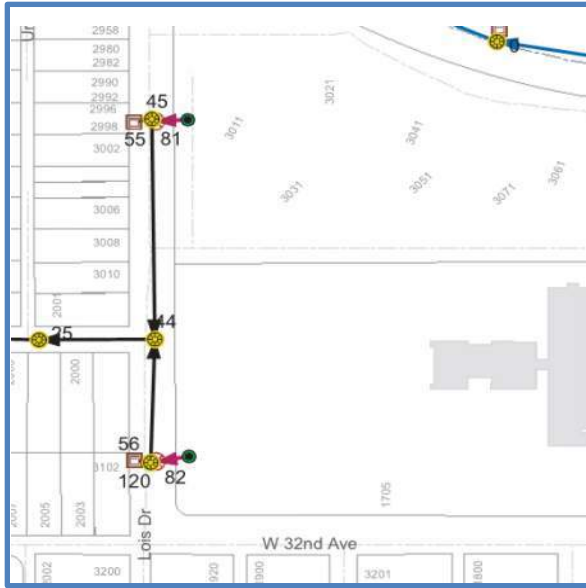


Photo 1 - Structure Location Map



Photo 2 – Manhole Lid / Surrounding Area



Photo 3 – Manhole Lid



Photo 4 – Manhole Cone & Ladder Rungs



Photo 5 – Inlet & Outlet Pipe Penetrations

CRW ENGINEERING GROUP
STORM DRAIN STRUCTURE FIELD INSPECTION FORM
LOIS DRIVE AND 32ND AVENUE PATHWAY (PM&E No. 19-08)

INSPECTION DATE: 6/10/20

INSPECTION TIME: _____

WEATHER: _____

INSPECTED BY: Joey & Wayne

MANHOLE NUMBER: MH #045

FIRST PHOTO NUMBER: _____

APPROXIMATE LOCATION: 335 feet North of Lois Drive & 31st Ave, East side of Lois Drive.

MH lid in gravel shoulder.

CONDITION	POOR	←————→		GOOD
CONDITION OF LID	1	2	3	4
CONDITION OF GRADE RINGS	1	2	3	4
CONDITION OF BARREL	1	2	3	4
CONDITION OF LADDER	1	2	3	4
CONDITION OF PIPE INLETS/OUTLETS	1	2	3	4
PRESENCE OF SOLIDS OR BUILDUP		YES		NO
PRESENCE OF INFILTRATION/INFLOW		YES		NO
DEPTH/VOLUME OF FLOW:	_____			
DIAMETER OF MANHOLE:	_____			

MANHOLE ASSESSMENT/CONDITION NOTES:

- Manhole lid is under pavement. Did not assess MH #045.

Lois Drive and 32nd Avenue Pathway (PM&E No. 19-08)

Manhole No. SW1628-045

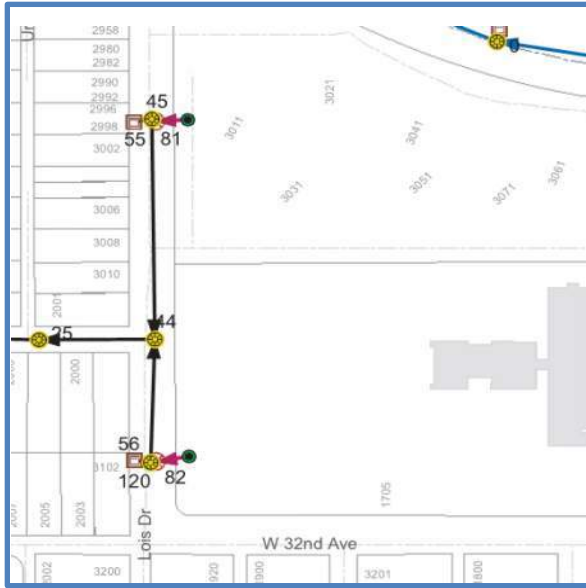


Photo 1 - Structure Location Map



Photo 2 - Manhole / Surrounding Area



Photo 3 – Manhole Lid Under Pavement

CRW ENGINEERING GROUP
STORM DRAIN STRUCTURE FIELD INSPECTION FORM
LOIS DRIVE AND 32ND AVENUE PATHWAY (PM&E No. 19-08)

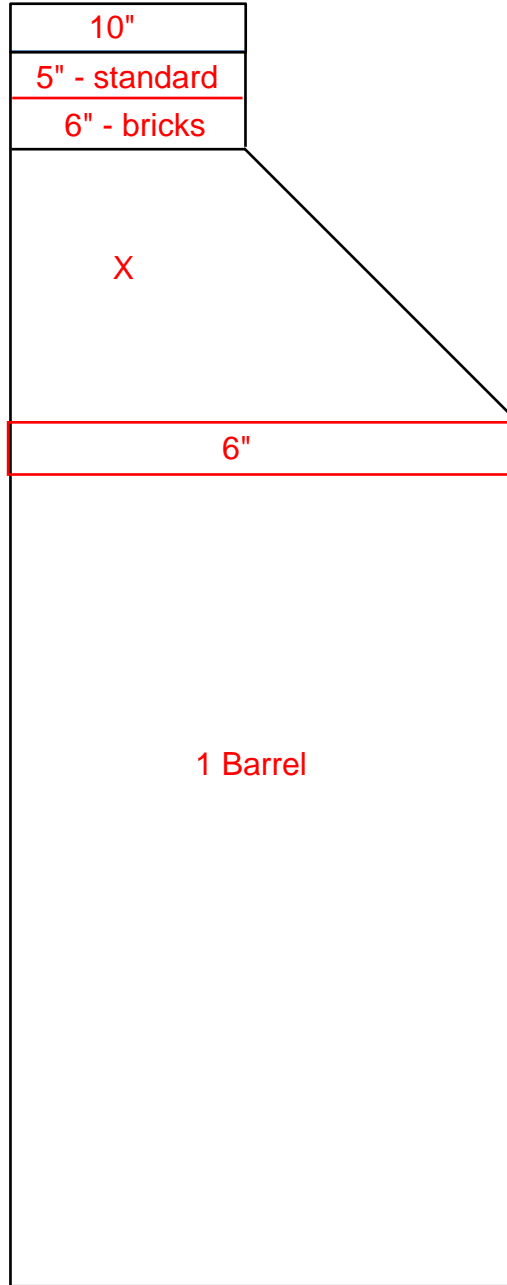
INSPECTION DATE: 6/10/20 INSPECTION TIME: 9:20 AM
WEATHER: _____ INSPECTED BY: Joey & Wayne
MANHOLE NUMBER: MH #097 FIRST PHOTO NUMBER: _____
APPROXIMATE LOCATION: Intersection of 32nd Ave & unnamed ally, NE corner. 190 feet East
of 32nd Ave & Wyoming Dr. Intersection. MH lid in pavement

CONDITION	POOR	←————→		GOOD
CONDITION OF LID	1	2	<u>3</u>	4
CONDITION OF GRADE RINGS	1	<u>2</u>	3	4
CONDITION OF BARREL	1	2	<u>3</u>	4
CONDITION OF LADDER	1	2	<u>3</u>	4
CONDITION OF PIPE INLETS/OUTLETS	1	<u>2</u>	3	4
PRESENCE OF SOLIDS OR BUILDUP		<u>YES</u>		NO
PRESENCE OF INFILTRATION/INFLOW		YES		<u>NO</u>
DEPTH/VOLUME OF FLOW:		<u>No flow</u>		
DIAMETER OF MANHOLE:		<u>4' Manhole</u>		

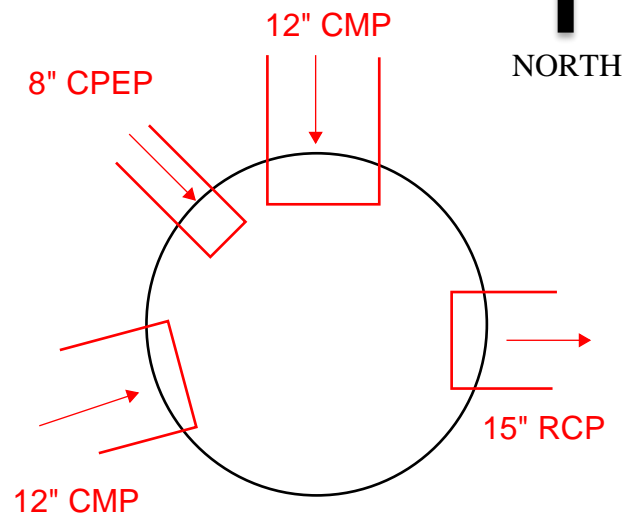
MANHOLE ASSESSMENT/CONDITION NOTES:

- 1 layer of non-standard grade ring is composed of bricks (in poor condition)
- No cone, grade rings on reducing slab
- 2 visible non-standard steel ladder rungs, 17" apart
- Non-standard frame with 10" height
- Non-standard lid
- Some sediment buildup in pipes
- Grout cracking at west pipe penetration
- NW pipe (8" plastic) was not shown in MOA record drawings and MOA drainage arcgis map

MANHOLE SKETCH



PROFILE



PLAN

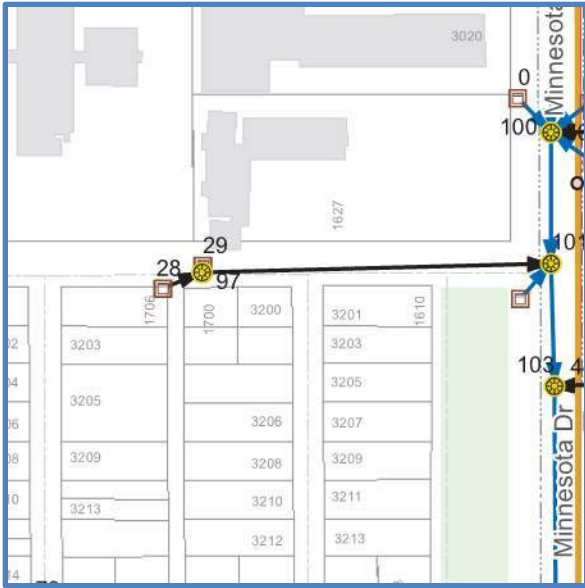


Photo 1 - Structure Location Map



Photo 2 - Manhole / Surrounding Area



Photo 3 – Frame, Brick Grade Ring, Reducing Slab, and Ladder Rung



Photo 4 – West Inlet Pipe, Unidentified Northwest Inlet Pipe & Pipe Penetrations

CRW ENGINEERING GROUP
STORM DRAIN STRUCTURE FIELD INSPECTION FORM
LOIS DRIVE AND 32ND AVENUE PATHWAY (PM&E No. 19-08)

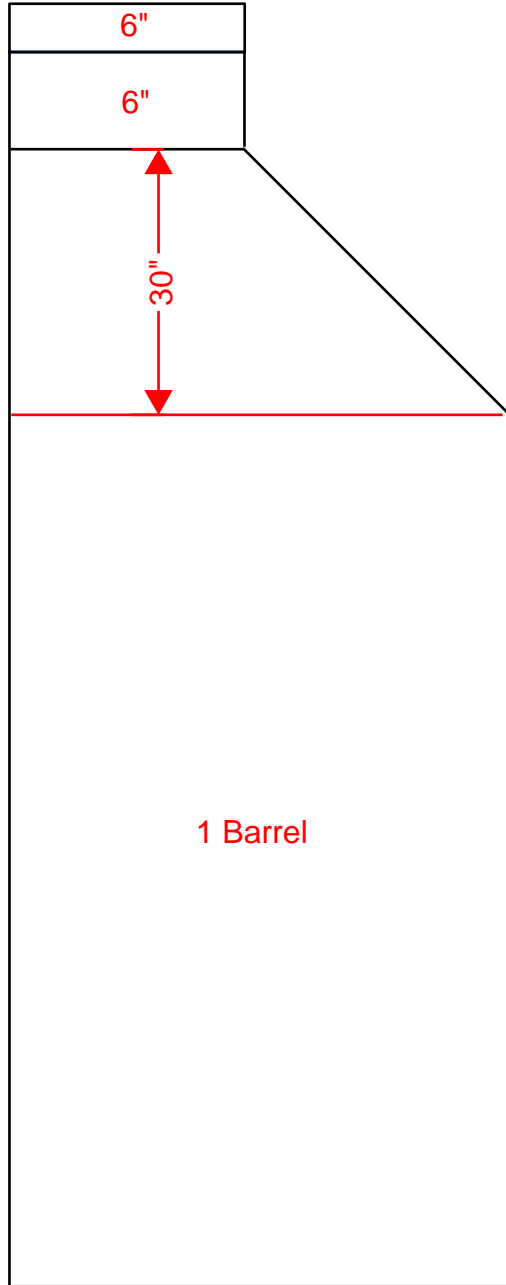
INSPECTION DATE: 6/10/20 INSPECTION TIME: 10:20 AM
WEATHER: _____ INSPECTED BY: Joey & Wayne
MANHOLE NUMBER: MH #120 FIRST PHOTO NUMBER: _____
APPROXIMATE LOCATION: 190 feet South of Lois Drive & 31st Ave, East side of Lois Drive.
MH lid in

CONDITION	POOR	←————→		GOOD
CONDITION OF LID	1	2	3	4
CONDITION OF GRADE RINGS	1	2	3	4
CONDITION OF BARREL	1	2	3	4
CONDITION OF LADDER	1	2	3	4
CONDITION OF PIPE INLETS/OUTLETS	1	2	3	4
PRESENCE OF SOLIDS OR BUILDUP	YES			NO
PRESENCE OF INFILTRATION/INFLOW	YES			NO
DEPTH/VOLUME OF FLOW:		No flow		
DIAMETER OF MANHOLE:		4' Manhole		

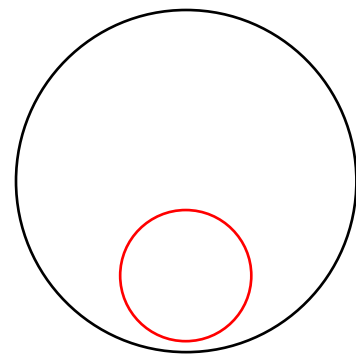
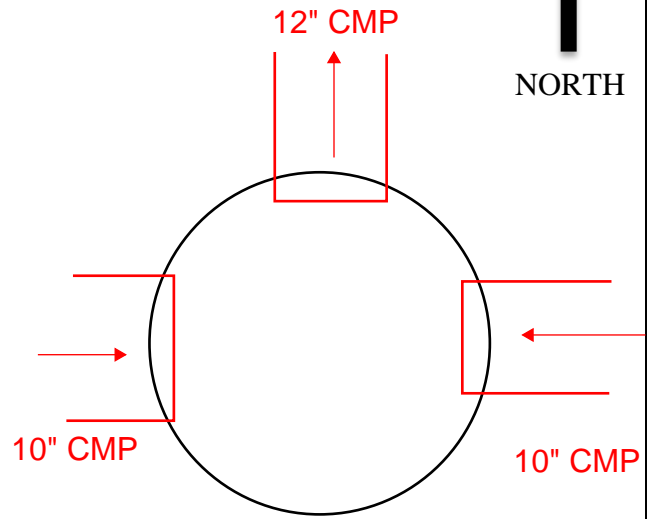
MANHOLE ASSESSMENT/CONDITION NOTES:

- 4 non-standard steel ladder rungs
- Buried MH cover in gravel
- Vertical cracking in grade ring
- Grade ring placement is offset from cone and frame

MANHOLE SKETCH



PROFILE



PLAN

Manhole No. SW1628-120

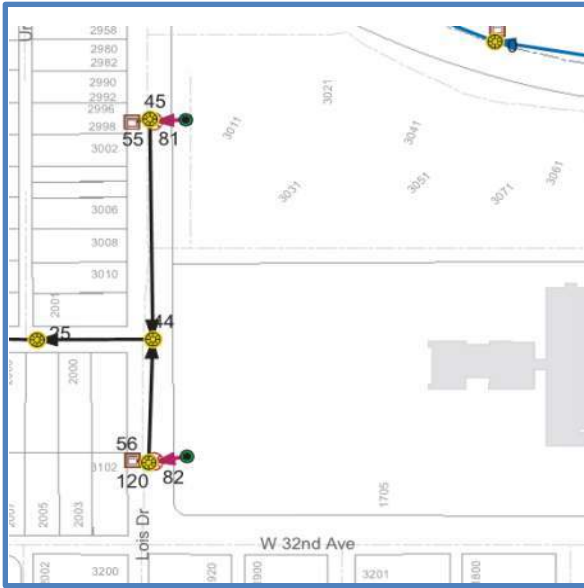


Photo 1 - Structure Location Map



Photo 2 - Manhole / Surrounding Area



Photo 3 - Cracking in Grade Ring



Photo 4 - Frame, Grade Ring & Manhole Cone



Photo 5 - Inlet & Outlet Pipe Penetrations & Ladder Rungs