2023 Infrastructure Evaluation And Capital Improvement Plan

Grand Traverse Commons

For: Grand Traverse Commons Joint Planning Commission

October 9, 2023
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HRC Job No. 20220549



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EXECUTIVE SUMMARY

The following report assesses the infrastructure within the Grand Traverse Commons, located within the City of Traverse City and Garfield Township Michigan. Analysis and justification for projects can be found within the corresponding sections of the report. This report provides a summary of projects deemed appropriate for construction to provide more dependable infrastructure within Grand Traverse Commons.

It has been determined that the majority of the sanitary, storm and water distribution utilities within Grand Traverse Commons are in working condition with some areas identified for rehabilitation. The construction activities required for rehabilitation do not always require open excavation. The capital improvement plan represents only replacing the utilities in situations where it is economically advantageous. Most of the Sewer rehabilitation should be covered under a single lining project for maximum cost benefit. This is represented in the project plan.

All water utility work determined to provide maximum benefit to the Commons water distribution infrastructure is outside the project limits of roadway deemed suitable for reconstruction. Aside from a few roadway crossings, the water main improvements will occur outside of the influence of the roadway. It is not economically beneficial to incorporate these projects into any roadway infrastructure improvements.

A GIS database was developed throughout the project to organize assets and their condition. Existing GIS data was merged from both Traverse City and Garfield Township; that data was expanded by digitizing available as-built plans and MISS DIG 811 data. Field and CCTV inspections investigated asset condition and discovered new sewer and water structures. This data was compiled into a file geodatabase and delivered to Traverse City and Garfield Township.

This infrastructure assessment and capital improvement plan provides the following:

- Mapping of all utilities and roadway/parking lot infrastructure focused within the Grand Traverse Commons Brownfield. Additionally, data from the entire Grand Traverse Commons boundary was incorporated as the area of influence for this study. See **Figure 1.1** for boundary map from Grand Traverse Commons Master Plan
- Physical evaluation of the current level of service of utilities and roadway/parking lot infrastructure.
- Utility analysis including:
    - The current water pressure for users and opportunities to increase pressure during high usage.
    - Predicted available water in case of fire and opportunities to increase available flow.
    - Predicted storm events and provides maximum predicted flow within the storm sewers.
    - Flow capacity of storm sewer and provides maintenance and rehabilitation recommendations.
    - Infiltration and Inflow of storm water into the sanitary sewers.
    - Flow capacity of sanitary sewer and provides maintenance and rehabilitation recommendations.
- Condition assessment of roads and parking lots including asphalt and concrete evaluation.
- Cost breakdown for improvements identified.
- Project recommendations for greatest benefit to the public.

SECTION 1.0 — INTRODUCTION

Hubbell Roth & Clark Inc. (HRC) and Gourdie Fraser, Inc. (GFA) were tasked with assessing the following infrastructure within the Grand Traverse Commons. The existing Grand Traverse Commons and influence area was deemed the project limit, this was provided by the Joint planning Commission. **Figure 1.1** provides Map of boundary and jurisdictions from Grand Traverse Commons Master Plan.

Directions for this report was provided through meetings with the Grand Traverse Commons infrastructure study working group as follows: John Sych (Garfield Township), Shawn Winters (City of Traverse City), Jennifer Hodges (GFA), Randy Wilcox (HRC), Devon Munsell (HRC) and Karyn Stickel (HRC)

Grand Traverse Commons Infrastructure

- Background

HRC & GFA performed initial research on the Grand Traverse Commons system to assist with the mapping and inventory of assets. The resources reviewed include the 2021 Traverse City Water reliability study, Grand Traverse Commons Trip Generation Information, Current Site Map with utilities, Grand Traverse Commons Master Plan, Grand Traverse Commons District Plan, Sanitary Sewer Report for Minervini Group, Traverse City Stormwater Asset Management Plan, Traverse City Sanitary Sewer System Asset Management Plan, Kids Creek Sub-watershed Action Plan, and previous construction plans/ as-builts within the boundary of Grand Traverse Commons.

- Water Distribution

HRC & GFA were tasked with field locating and mapping all above ground assets. Inventory and condition assessment were taken for all mapped assets additional hydrant and pressure checks were performed at critical locations, and modeling was performed to ensure that the system is operating within EGLE parameters with respect to pressure and fire flow. Break data for the water distribution system retrieved from City and Township records is included in the GIS submittal. Gate wells (if present) were located and assessed.

- Storm Sewer

Storm sewer structures were field located using GPS equipment and the condition was noted. Connectivity of the piping was determined where practical. For mapping the pipe diameter was based on record drawings with field verification when possible. CCTV was performed on sections of the system for evaluation of pipe condition.

- Sanitary Sewer

Sanitary sewer structures were field located using GPS equipment and the condition was noted. Connectivity of the piping was determined where practical. For mapping the pipe diameter was based on record drawings with field verification when possible. Flow metering was completed to allow for infiltration and inflow analysis. CCTV was performed on sections of the system for evaluation of pipe condition.

- Road, Sidewalk, and Parking Areas

As part of the infrastructure assessment, HRC & GFA evaluated the pavement conditions of the roads, sidewalks, and parking lot assets. The grades of various sidewalk landings and ramps were also field verified for compliance with the Americans with Disabilities Act (ADA). The condition assessment was completed by performing a visual survey of the existing pavement assets. The pavement assets consisted of concrete, asphalt, brick pavers, and gravel pavement types.

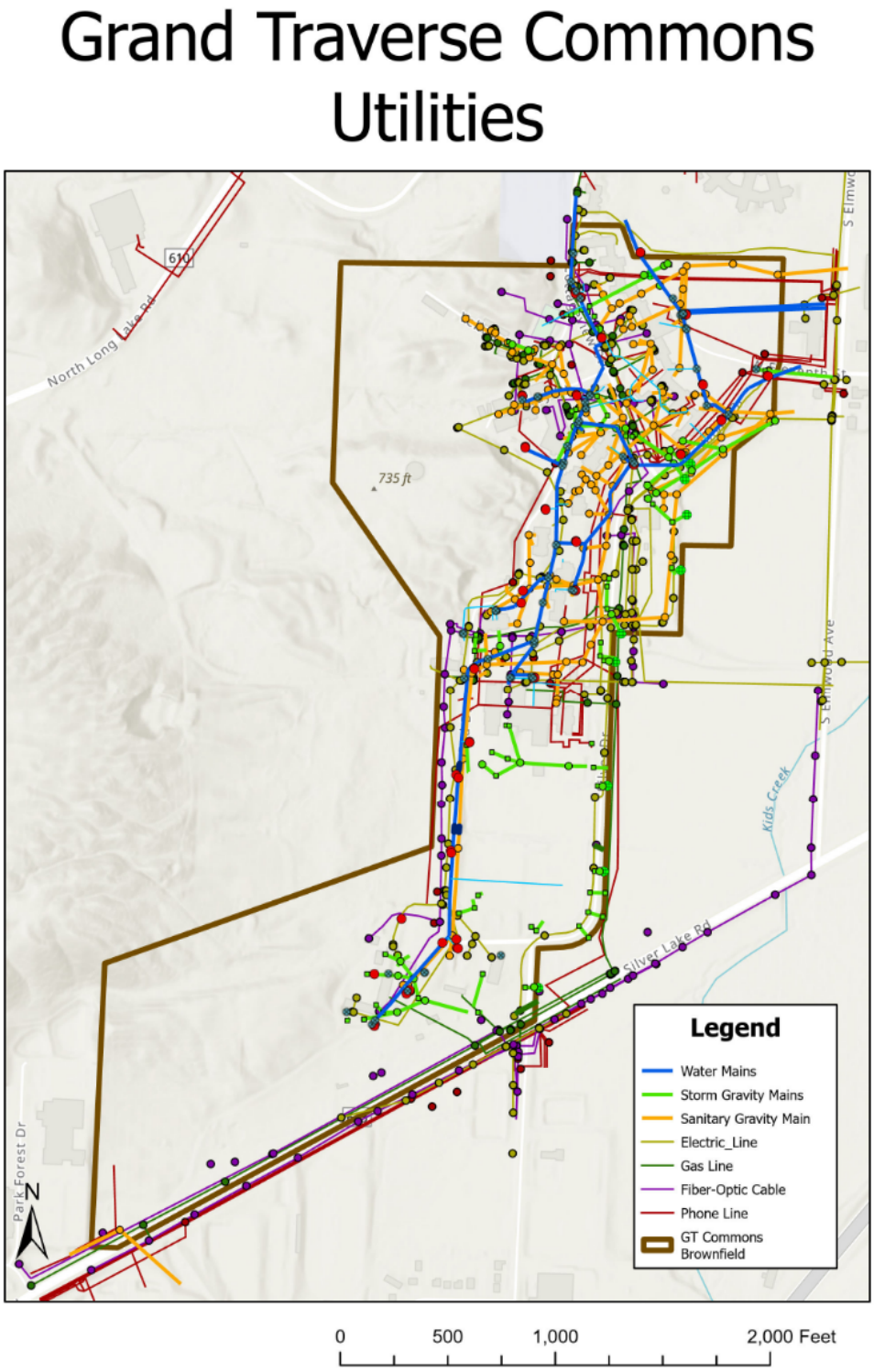
- Other Utilities

All other utilities were mapped through the use of existing plans and MISS DIG locate requests.

A map of the Grand Traverse Commons Utilities is provided in **Figure 1.2.** This report summarizes the evaluations to plan for necessary improvements. These improvements can be included in a Capital Improvements Program or Plan (CIP). **Appendix A** provides individual maps of each utility addressed within this study. All utility data shown in appendix A has been provided to the City of Traverse City and Grand Traverse County through GIS in the form of a file geodatabase.

Figure 1.1: ***Grand Traverse Commons Master Plan Boundary Map***

Figure 1.2: GTC Utilities Map



SECTION 2.0 — WATER DISTRIBUTION

2.1 INTRODUCTION

The existing Grand Traverse Commons water system and water service is provided by the City of Traverse City. It operates under a single pressure district; controlled by the City of Traverse water storage tank located on Barlow St. Garfield Township owns and operates a water system currently adjacent to this area however is not currently connected.

HRC & GFA were tasked with mapping out the existing Grand Traverse Commons water distribution system and evaluating its level of service. Mapping was completed through field locating water distribution system assets along with photos and documentation were taken for all undocumented hydrants and curb stops within the system and can be accessed through the geo database provided to the County and City. The incorporation of record drawings and reports of the system were included in the GIS; current mapping additional includes as follows:

4"-Water Main: 56-Ft

6"-Water Main: 3,945-Ft

8"-Water Main: 317-Ft

10"-Water Main: 2,828-Ft

12"-Water Main: 3,088-Ft

Hydrants: 53-Count

System Valves: 57-Count

Lateral Line: 4,008-Ft

Water Main Casing: 197-Ft

2.2 PROCEDURE

The system was analyzed using a computer model of the water distribution system. All the larger system water mains (6-inch to 12-inch), bypass valves, well sites, and storage facilities were input into the computer model to simulate existing distribution system hydraulics. The developed model is a schematic of the actual system and should be utilized as a tool to simulate actual system operations and reactions. The following results were obtained based on the calibrated existing and future improvements models.

The model simulates the entire Traverse City water distribution system to analyze the Grand Traverse Commons portion of the entire system. See Appendix B-1 for a map of the entire system. A design guideline was created from the recommendations within Recommended Standards for Waterworks – Great Lake – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers (Ten States Standards) and 2018 Michigan Plumbing Code. These design guidelines are as follows:

1. Ten States Standards:
    a. 35 psi minimum working pressure with 60-80 psi preferred range.
    b. Minimum 20 psi fire flow pressure.
2. 2018 Michigan Plumbing Code:
    a. Minimum 40 psi static pressure.
    b. Maximum 80 psi pressure at buildings.

2.2.1 Assumptions

It is important when developing a computer model to create the model based on the intended purpose of the study. Depending on the magnitude of the study, assumptions, and simplifications are necessary. The purpose of the study validates the assumptions and simplifications made. Therefore, based on the purpose and magnitude of this study, the following additional assumptions/model selections were made:

- Model selection: Hazen-Williams equation was used for calculations.
- Assumption: initial Hazen-Williams roughness value (C-factor) for each pipe segment was based on pipe age and material. The calibration process refines this C-factor.
- Assumption: losses occurring at bends and elbows are ignored.

2.2.2 Model Calibration

The existing hydraulic model has been calibrated and tested by analyzing physical hydrant flow test to the anticipated flows from model simulation. Pipes in this model were separated into different distinct groups, see **Table 2.1** and the C factor was adjusted to best fit the hydrant flows and **Table 2.2** presents the results of the model calibration.

Table 2.1 Calibration Groups

Calibration Group	Pipe Installation	Size	Normal Range[1]	C Factor
1	1965 and older	8-inch and smaller	21 - 49	35
2		12-inch and larger	39 -71	45
3	1965 to 1980	8-inch and smaller	30-58	50
4		12-inch and larger	48-78	60
5	1980 to 2000	8-inch and smaller	59-90	80
6		12-inch and larger	58-107	85
7	2000 to 2010	8-inch and smaller	83-106	95
8		12-inch and larger	97-120	110
9	2010 to 2020	8-inch and smaller	100-133	120
10		12-inch and larger	112-141	130

1. Water Distribution Modeling, T. Walski, D.V. Chase and D. Savic. 2001

Table 2.2 Model Calibration Results

Location Description	Gauge Hydrant ID	Gauge Hydrant Model Node	Flow Hydrant ID	Flow Hydrant Model Node	Hydrant Test			Model Simulation		
					Static (psi)	Residual (psi)	Fire Flow (gpm)	Static (psi)	Residual (psi)	Fire Flow (gpm)
Pine and Seventh	84	J-T237	83	J-T272A	55	49	961	55	49	931
Cass and Seventeenth Alley	156	J-T467	530	J-T465	55	49	859	55	51	843
305 West Front	68	J-T052	67	J-T053A	63	50	1,664	64	58	1,599
Front and Boardman	172	J-T028	171	J-T171	73	60	2,190	73	58	2,222
Randolph and Maple	12	J-T011	11	J-T014A	65	62	1,488	65	59	1,629
710 Carver	730	J-T447B	305	J-T447C	53	38	1,358	61	38	1,041
800 Hastings	449	J-T324	380	J-T350	58	46	1,358	61	46	1,335
Third and Spruce	997	J-T207	734	J-T207A	57	54	1,215	57	55	1,261
Front and Elmwood	997	J-T234A	36	J-T234B	55	42	2,148	56	41	2,445
Union and Thirteenth	144	J-T315A	136	J-T315B	55	35	1,358	58	33	1,385
Gray and Commons	790	J-41	1011	J-166	39	33	1,052	38	33	1,232
Aero Park	655	J-147	656	J-T220	60	44	1,664	60	40	1,785
M-72 Moorings (PD-2, PD-3, PD-4)	735	J-T560	974	J-T497	68	18	1,920	70	17	1,995
Historic Barns Park	1051	J-74	983	J-12	36	18	960	35	20	856
NW side of Northwest Educational Services (Arnell Engstrom School)	977	J-73	978	J-72	40	18	960	37	20	971

2.3 CONDITION ASSESSMENT

Currently the Grand Traverse Commons experiences low pressure due to the elevation of the Commons within the current pressure zone. In addition, the Grand Traverse Commons contains multiple story complexes that further decrease the available pressure on the top stories of these buildings. **Table 2.3** provides the existing pressures within the Grand Traverse Commons. Total average daily pumpage was obtained from historical water treatment plant monthly operating reports and daily water usage. Supervisory Control and Data Acquisition (SCADA) data were made available by the City of Traverse City. This provided booster and pump station information and tank level information. This data analysis was performed for the City of Traverse City 2021 Water Reliability Study and included average demand within the Grand Traverse Commons used within this report.

Assets were field located and inspected the remaining of the system mapping was completed through Township and City records. **Table 2.4 & 2.5** Provides examples of items noted during field data collection. 52 hydrants and 57 mainline system valves were surveyed and are included as data within the GIS deliverable.

Table 2.3 Existing System Pressures.

Grand Traverse Commons Pressure Range (psi)					
Average Day Demand[1]		Maximum Day Demand[2]		Peak Hour Demand[2]	
Min	Max	Min	Max	Min	Max
42	51	37	46	32	41

Notes:
1. Average day initial conditions with tank levels at average operating levels (Barlow Tanks 28-ft, Wayne Hill 12-ft)
2. Maximum day and peak hour demand simulated at minimum operating levels (Barlow Tanks 24-ft, Wayne Hill 7-ft

See appendix A-2 for system pressure for max day demand.

Low pressure and fire flow has been experienced and documented within the Historic Barns fire suppression located at the south end of the project boundary. Further hydrant tests have been completed and are presented in **Table 2.2.** These tests confirm the low pressure. Hydrant tests performed did not show the same low flow as the Historic barns fire suppression. Low flow test could be an outlier as there are a lot of variables in the timing of water demand, tank levels, pumps running vs not. Further testing of Historic Barns fire suppression is recommended. Improvements covered within this study are anticipated to increase pressure and fire flow within this area.

Table 2.4 Hydrants Survey Example Data

OBJECTID_1	48
FACILITYID	WHYD-2024
Project Number	22286
Project Name	commons utility collection
Inpsection Date	2022-10-25 18:22
Plan Sheet Number	
Hydrant Number	
Contractor	
Inspector_Name	Nate Dale
Manufacturer	EJW
Type	223-97
Main Valve Opening	
(MVO)/Valve	
Washer	
Inlet Size	
Inlet Type	
Operating Nut	Pentagon
No of Nozzles	3
Hose Outlet-Nozzle Size	2
Thread Type	
Pump Outlet-Nozzle Size	4
Bury	
Line Static Pressure	45
Location Description	intersection of silver st and eleventh st
Condition	
Position source type	Integrated (System) Location Provider
Receiver Name	Samsung SM-T390
Latitude	44.75584497
Longitude	-85.64117664
Altitude	159.9958473
Horizontal Accuracy (m)	0.012214445
Vertical Accuracy (m)	0.017509563
Fix Time	2022-10-25 18:21
Fix Type	GPS
Correction Age	
Station ID	
Number of Satellites	
PDOP	
HDOP	
VDOP	
Direction of travel (°)	64.61612701
Speed (km/h)	1.8777E-05
Compass reading (°)	135.4287313
Average Horizontal Accuracy (m)	
Average Vertical Accuracy (m)	
Averaged Positions	
Standard Deviation (m)	

Table 2.5 System Valve Survey Example Data

OBJECTID_1	16
OBJECTID	5
FACILITYID	WCB-20005
Project Number	22286
Project Name	commons utility collection
Inpsection Date	2022-10-20 14:05
Plan Sheet Number	
Valve Number	5
Contractor	
Inspector Name	Nate Dale
Valve Service Type	Domestic
Valve Size	
Valve Depth	
Location Description	north side of building
Valve Condition	
Valve Type	Box
Box or Well Condition	4
Operating Nut Type	Square
Service Address (if lead)	206
Position source type	Integrated (System) Location Provider
Receiver Name	Samsung SM-T390
Latitude	44.74812595
Longitude	-85.64780806
Altitude	169.7620014
Horizontal Accuracy (m)	0.019974863
Vertical Accuracy (m)	0.032269787
Fix Time	2022-10-20 14:04
Fix Type	GPS
Correction Age	
Station ID	
Number of Satellites	
PDOP	
HDOP	
VDOP	
Direction of travel (°)	100.2675934
Speed (km/h)	2.52741E-05
Compass reading (°)	203.4345789
Average Horizontal Accuracy (m)	
Average Vertical Accuracy (m)	
Averaged Positions	
Standard Deviation (m)	
NotesFromField	206

2.3.1 Fire Flow Analysis

In addition to providing normal flows, the water distribution system must be capable of supplying adequate fire flows at all locations throughout the Commons. The fire flow analysis is typically a tedious process that requires the water system modeler to iteratively apply fire flow demands at selected nodes within the model. Most water system models, including WaterGEMS, have a Fire Flow Analysis Module to simplify the process of the fire flow analysis. The Fire Flow Analysis Module gives the modeler the ability to select all or a portion of the available nodes for which fire flows are to be determined. The Module automatically performs an iterative analysis of each selected node to determine the maximum available fire flow available without dropping the lowest residual pressure in the system below 20-psi. It is important to note that the Industry Standard is to provide fire flow during maximum day demand conditions and with a residual pressure in the system of at least 20-psi. Typical fire flow requirements are specified by organizations such as the American Water Works Association (AWWA) and the Insurance Services Office (ISO). Fire flow requirements will vary by community based on density, land use, building size and materials of construction, and distance between buildings. Fire flows can be provided either through a combination of storage or pumping from the booster pumps. The City's minimum fire flow recommendations are summarized as follows:

- Single and Multi-family dwellings less than 3,500-sf: 1,000-gpm (2 hours)
- Apartment Buildings & Commercial w/fire suppression: 1,500-gpm (2 hours)

Most of the Grand Traverse Commons can be considered apartment buildings or commercial with fire suppression and the entirety of the system should allow for 1,500-gpm fire flow. Based on the fire flow modeling results, a majority of the system fails to meet the minimum recommended available fire flow. See appendix A-3 for results from model. Recent testing by AFP Specialties, Inc, of the interior fire pump within the historic barns located at the southern end of the Grand Traverse Commons provided results of 380 GPM fire flow at 10 psi. Documentation from Grand Traverse Metro Fire department cites the facility is not in compliance.

2.4 CORRECTIVE ACTIONS RECOMMENDED

The primary goal for improvement is to increase system pressure within the Grand Traverse Commons, a secondary goal that was determined to be necessary through this evaluation is an increase in available fire flow within the Grand Traverse Commons. Three corrective actions were assessed to solve the inadequacies of the system with respect to the design guidelines. Below provides an explanation of each solution. **Table 2.6** provides all combinations of project implementation and their effects on fire flow and system pressure.

2.4.1 Pressure District Isolation: Option 1

Construction of a new 8-in Pressure Reducing Valve (PRV) at the location of the abandoned Red Drive Booster Station to down feed from the Garfield Township Munson Pressure District (HGL 975-ft) to PD-9 (HGL = 825-ft), sourced from Garfield elevated storage tank. The estimated water age in this proposed district would increase due to the long travel times from the City's system to Garfield Township and the eventual back feed into the Commons and then to the city. Reduction in pressure to 78 psi from the available pressure at the PRV of 90 psi will be required. Five check valves would be required to be installed to isolate the Commons from PD-1. This solution would require metering as flow would be supplied from Garfield Township.

This solution will solve all low-pressure problems within the commons and greatly increase fire flow availability. However, further improvements will be required to increase the available fire flow to recommended Traverse City standards.

2.4.2 System Connection: Option 2

Connection to PD-GT Stone Ridge (HGL 875-ft) along Frank Road requiring 1,350-ft of 12" water main construction. Due to the losses within the system, water will enter the Commons at a desired pressure range and therefore no PRV will be required. The same five check valves will need to be installed as in the previous improvement. This is to isolate the Commons. This will avoid loss of pressure to the rest of the existing pressure district. This solution would require metering as flow would be supplied from Garfield Township. 50' of open cut road reconstruction required for crossing of Frank Road and 75' of Jack and Bore required for crossing of Silver Lake Road.

Addition of PRV and meter as outlined in Option 1 can be installed in addition to Option 2 for redundancy within the Commons system.

2.4.3 Water Main Replacement: Option 3

This improvement utilizes an increase in distribution mains diameter and provides a significant increase to available fire flow. Specifically, the 6-in mains were the targets for this improvement and the capital improvement figure presents the determined sizing changes for optimal results. This improvement will only increase the system pressure slightly and should therefore be considered in congruent with one of the other presented improvements.

2.4.1 Elevated Tank Rehab: Option 4

This improvement utilized the existing elevated storage tank located on Gray Drive. This option provides the greatest increase in available fire flow. However, this fails to increase pressure significantly throughout the system. Construction of a new elevated tank would allow for greater elevation head. However, cost would significantly increase and would not provide as great of a cost benefit as the other options provided. For this reason, this option should be compared with the option of replacing the 6-inch water mains within the system. Inspection of existing Elevated storage tank is advisable for cost comparison with increasing watermain diameter.

Table 2.6 Water Model Results

Scenario	Min Fire Flow Available (gpm)	Min Pressure under MDD Conditions (psi)	Max Pressure under MDD conditions (psi)	Cost
Existing system	680	35	46	$0
PRV (1)	956	72	79	$350,000
System Connection (2)	756	69	77	$465,000
Increasing pipe DI (3)	1,059	35	46	$405,000
Elevated Tank Rehab	1,150	37	47	NA
Option 1&2	999	73	79	$815,000
Option 1&3	1,360	72	79	$755,000
Option 2&3	1,876	69	77	$870,000
Option 1,2&3	2,247	73	79	$1,220,000

Notes:

1. MDD = Max Daily Demand
2. Existing system depicted the worst available FF / Pressure located at Historic barns at the southernmost part of the system (Hydrant 983)
3. Cost Savings for combination of Option 1&2 due to overlap in check valve installation work.

The best results shall be achieved through implementation of all three options. However no current funding is established, the recommendation of project priority is based on amount of funding allocated to these projects. Under low funding (approximately $500,000) it is recommended for the completion of Option 1. This will provide the greatest benefit to pressure and fire flow. With greater funding (approximately $1,000,000) Option 2 & 3 provide the greatest benefit in unison and are the recommended options.

SECTION 3.0 — STORM SYSTEM

3.1 INTRODUCTION

Currently records on the Commons storm system are limited. Inspection of all storm sewers and structures is required to gain a full understanding of network level of service and operations. Age and insight from the management team would suggest that the system needs assessing and restoration.

On December 12, 2022, representatives from Gourdie-Fraser, Inc inspected six (6) stormwater structures. HRC also discussed the stormwater system with the City to gain general knowledge on the system and standard operation and maintenance procedures. In addition, an onsite meeting completed on September 1, 2023, with representatives from the Minverini Group, Grand Traverse County and Drain Commission and GFA. The purpose of the meeting was for identify and discuss areas that have experienced known historical problems that warrant additional research and investigation.

Full fieldwork inspection data and photos can be accessed through the Grand Traverse Commons GIS. Photos from inspections can be viewed through GIS. The GIS was provided to the City of Traverse City and Grand Traverse County through a file geodatabase.

This Section additionally evaluated the condition and capacity of the existing Storm Drainage system within the Grand Traverse Commons.

Given the recent increase in the frequency of significant storms further inspections and improvements are recommended.

3.2 PROCEDURE

31 storm sewer structures were field located and inspected the remaining of the system mapping was completed through Township and City records. Additionally, 71 catch basins were surveyed, sewer gravity mains were inspected at the Manhole during structure surveys. All data has been incorporated into the GIS deliverable. Data tables of structure condition provided in **Appendix-C-1.**

(**Table 3.1 - 3.3)** Provides an example of items noted during field data collection.

Maximum flow was calculated through delineation of rainfall area to assess capacity of the system using the rational method assessing the maximum flow through the Silver Drive ditch. Current storm sewer reaches are relatively short and provide drainage for small areas before discharging into the Kids Creek tributaries and therefore will need to be assessed individually based on areas of concern.

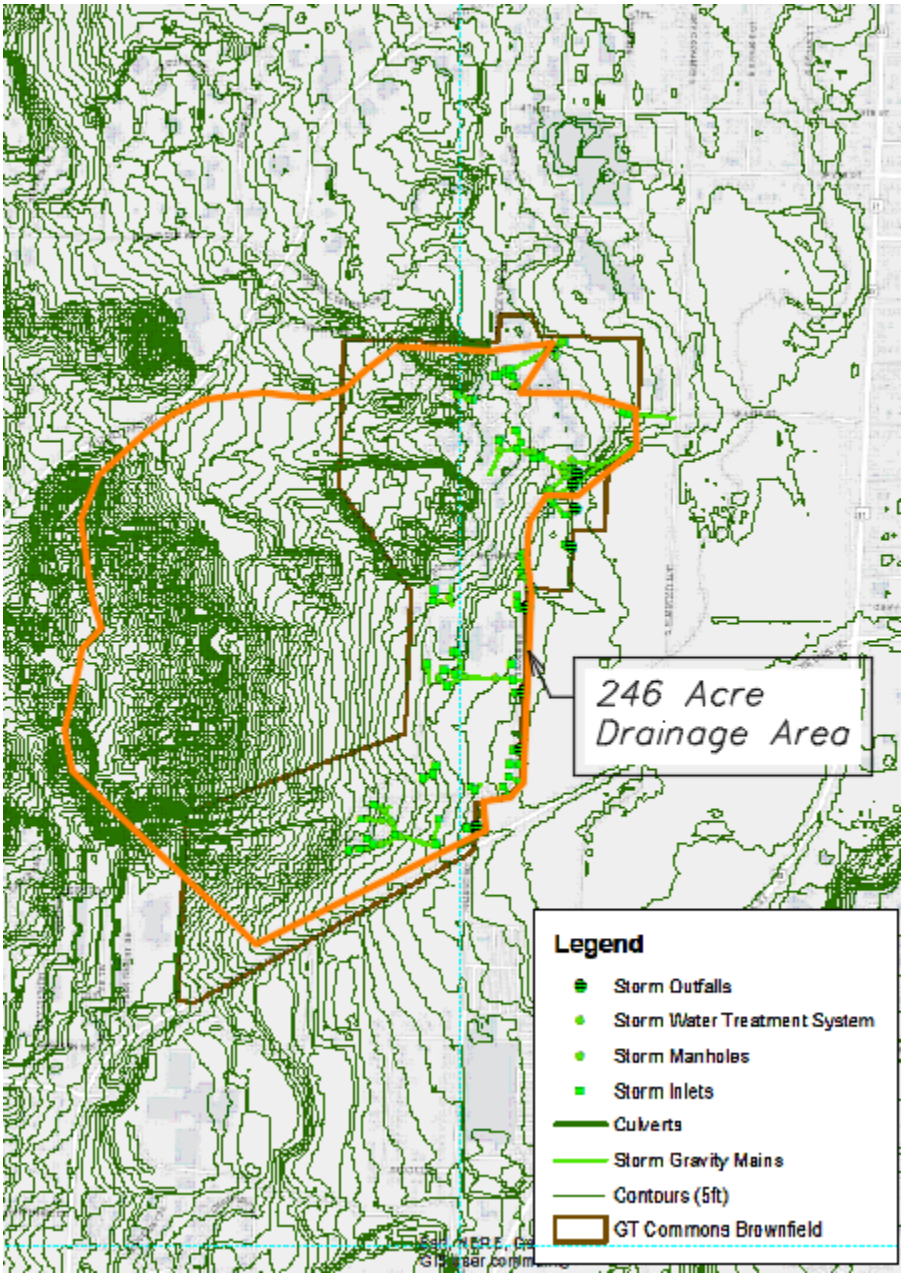
3.3 CONDITION ASSESSMENT

3.3.1 Capacity Results

Most of the storm system within the Commons discharges directly to the Silver Drive ditch. The capacity of the system should be calculated as the capacity of this Kids' Creek tributary. Currently the rain garden on Cottage View and Red Drive mitigate the high flows into Kids' Creek from the Grand Traverse Commons.

The maximum flow through the Silver Drive ditch leading to Kids Creek was calculated through delineation of the current watershed. The delineation is provided in **Figure 3.1** and calculations of maximum flow is provided in **Figure 3.2** flows through the Commons storm system are greatly influenced by the green space west of the Commons area and therefore should account for higher flows. During a 1 hour 100 year storm event the ditch east of the Grand Traverse Commons will incur 148.7-cfs flow this also contributes to the greater flow within the Kids Creek.

Figure 3.1 Grand Traverse Commons Overall Drainage Delineation



Of particular note is the area of former State Hospital Grounds which is of most important to understand and improve than the southern portions of the boundary limits. This area is the most densely developed with extensive

impervious infrastructure including buildings, parking lots and motorizing and non-motorized infrastructure both contributing to and subject to impacts from both above and below ground water. The potential impacts from flooding, seepage and runoff to private property are extremely concerning which is currently managed by aged, undersized and ill maintained surface and subsurface stormwater infrastructure. This area should have a greater priority for capital improvement planning than other areas. This area is serviced by what is referred to as Tributary "AA" and is depicted below in Figure 3.2 in red.

Historical records and observations during heavy rain events have been documented with recent event of note occurring in 2020. The neighborhood surrounding the Munson Medical Center campus was particularly hard-hit by flooding due to the overflow of Kids Creek and other tributaries. Several areas of The Village at Grand Traverse Commons experience flooding as streams and other watersheds in the adjacent woodlands rushed downhill and converged on campus roads, funneling into a flood that poured down Red Drive in front of Left Foot Charley.

Figure 3.2 Grand Traverse Commons Drainage Area of Concern

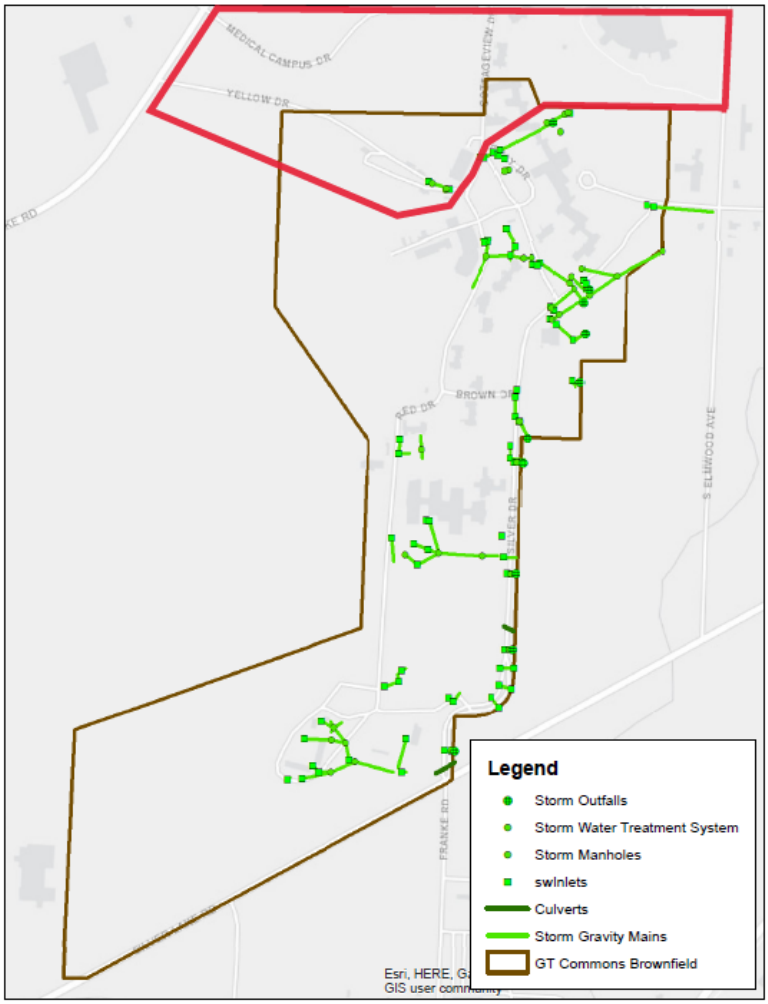


Figure 3.3 Max Flow Calculation 1 hour Storm

Rainfall intensity for Grand Traverse Commons 1 hour event retreved from NOAA ATLAS 14:
https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=pa

1 HOUR RAINFALL EVENT	
I_2	1.1
I_5	1.4
I_{25}	2.02
I_{100}	2.62

Q=CIA

LAND TYPE	Runoff Coef	AREA (ft^2)	AREA (Acres) (A)	C*A	Q_2	Q_5	Q_{25}	Q_{100}
Pavment	0.9	1073050	24.633838	22.17045	62.41139646	79.43268641	114.610019	148.6526
Residential	0.4	53652	1.231680	0.49267				
Wooded	0.1	8584405	197.070822	19.70708				
Appartment	0.55	1137900	26.122590	14.36742				
				Max (cfs)	62.41139646	79.43268641	114.610019	148.6526

Table 3.1 Storm Structure Survey Example Data

OBJECTID *	1
ASSETID_13	STM-163001
AssetOwner	Traverse City
DateSurveyed	12/12/2022 18:08
Surveyed_By	Gourdie-Fraser, Inc.
Located	Found
Inspection_Status	Descent Inspection
StructureType	Manhole
Structure Location	Light Highway
Wall_Material	Concrete (reinforced)
StructureCondition	Fair
StructureConditionComment	<Null>
Cover_Type	1040 Cover B (Vented)
Wall_Diameter_FT	48
Direction of Flow	N
Step_Number_89	3
ObservedProblem	No
ObservedProblemComment	<Null>
Top of Cone to Casting_FT	14
Notes	<Null>

Table 3.2 Storm Sewer Survey Example Data

OBJECTID	1
Asset ID	STP-4350
Surveyed By (1)	Gourdie-Fraser, Inc.
Date	2022-12-09 14:49
Cardinal Flow Direction	E
Type	Storm Gravity Main
US Structure ID	CB-2697
US Diameter (in)	12
US Material	Reinforced Concrete Pipe
US Rim to Invert (ft)	2.220000029
US Flow Status	Low
Traps	
DS Structure ID	TRT-17
DS Diameter (in)	12
DS Material	Reinforced Concrete Pipe
DS Rim to Invert (ft)	2.349999905
DS Flow Status	Low
Drop Present	No
Lower Drop Invert (ft)	
Drop Type	
Is Flow Arrow Correct?	
Data Collected	No
Comments	

Table 3.3 Storm Sewer Survey Example Data

OBJECTID	1
ASSETID_13	CB-2701
AssetOwner	Traverse City
DateSurveyed_8	2022-12-21 20:41
Surveyed_By_1	GFA
Located	Fnd
Inspection_Status_36	SD
StructureType	INCB
StructureLocation	D
Wall_Material78	PP
StructureCondition	Fair
StructureConditionComment	
Cover_Type_44	Bhive
Wall_Diameter_FT	30
DirectionofFlow	
Step_Number_89	
ObservedProblem	Y
ObservedProblemComment	needs cleaned
TopofConetoCasting_FT	
Notes	

3.4 CCTV

Due to limited information on the level of service of the Commons stormwater system. Two storm sewer reaches in locations deemed critical were CCTV'd for this project full CCTV reports can be found in **Appendix-C-2.** Video has been provided with GIS data. It is recommended to continue to CCTV and document the condition of the storm sewer. **Appendix C-3** provides a map of sewer CCTV'd within this project.

3.5 ACTIONS REQUIRED FOR MAINTENANCE AND REPAIR

Subsurface: It is assumed the storm system needs maintenance/repair. Due to limited records, currently there is very little reliability data on the condition or active status of the system. A full inspection of all subsurface storm structures and CCTV of storm sewer gravity mains should occur. Current CCTV has shown existing storm sewer to be structurally sound and rehabilitation cost within the capital improvement plan reflects this. More extensive research and field investigation is required for greater confidence of system mapping and cost of repair and improvements. All storm infrastructure that was successfully located within this study has been inventoried and added to the GIS.

Surface: Due to limited records, currently there is very little reliable data on the condition or active status of the system. Perhaps of more importance is an inventory and analysis of the surface water infrastructure servicing the northern boundary along Red Drive. This evaluation should include coordination with Munson, GT Watershed, and Grand Traverse County Drain Commission to obtain additional information on the existing storm systems in place, hydraulic modelling to evaluate integrity at varying storm events and identify improvements to improve function and prevent future flooding.

The 2017 Traverse City Stormwater Asset Management Plan was reviewed in the assessment of the Grand Traverse Commons stormwater system. The Level of service and long-term needs recommendations for the city were used as the standards required for the Grand Traverse Commons storm system to meet. It is recommended to clean storm sewers every 5 years. This process should also include inspection and televising where appropriate. These ongoing management practices are provided in **Table 3.2.** The quantity provided is the recommended yearly quantity to be cleaned and inspected to address all sewers and structures within a 5-year period. The cleaning schedule should be adjusted to consider the actual conditions in various parts of the storm system; routine cleaning can result in over-maintenance of the system. In most storm systems, some sections do not require frequent cleaning while other sections may require cleaning on a more frequent basis if they are susceptible to blockages. Information from the inspection program should be used to help identify problem areas in the gravity sewer system and related structure, quantify defects and problem areas, and develop a preventive maintenance sewer cleaning program based on actual conditions in a particular stormwater system.

Table 3.4 Stormwater Program

Procedure	Quantity	Unit Cost	Annual Cost
Sewer Cleaning	654-ft	$3.50 / foot	$2,300
Structure Cleaning	21 each	$300 / each	$6,300
Sewer Inspection (CCTV)	654-ft	$5 / foot	$3,300
Structure Inspection	21 each	$100 / each	$2,100

Notes:

1. Annual cost rounded to nearest $100

The current recommendations outlined in the Kids Creek Restoration Study have already been implemented within the Grand Traverse Commons.

SECTION 4.0 — SANITARY SYSTEM

4.1 INTRODUCTION

HRC & GFA were tasked with reviewing The Grand Traverse Commons' existing wastewater facilities. This work included assessments of the Commons collection system (Manholes and piping network). This report summarizes the inspections and evaluations to plan for necessary improvements as part of the Grand Traverse Commons' Capital Improvements Program (CIP).

The Sanitary Manholes within the Grand Traverse Commons were field located and inspected assessing all structural, operational and infiltration/inflow of each Sanitary Manhole providing appropriate improvements as addressed in section 4.4.

Full fieldwork inspection data can be accessed through the Grand Traverse Commons GIS. Photos from inspections can be viewed through GIS. The GIS was provided to the City of Traverse City and Grand Traverse County through a file geo database.

This Section additionally evaluated the condition and capacity of the existing sanitary system within the Grand Traverse Commons. Currently much of the flow within the system is due to inflow and infiltration and can be mitigated through recommended rehabilitation activities.

Sanitary Sewer Overflows (SSOs) are prohibited by EGLE and their standards typically require that communities be able to convey wet weather flows generated by a 25-year 24-hour design storm (under growth conditions, normal soil moisture, and average rainfall distribution). An analysis by EGLE indicates a community implementing this design will average less than one overflow every 10 years. Therefore, a 10-year 1-hour peak storm (1.49 inches per hour peak intensity) event was used as a conservative approximation of the estimated design peak hourly flow since this type of event produces a greater peak sewer flow rate than a 25-year, 24-hour event with a design storm (Huff Quartile 2 and 10% probability) which produces a peak intensity of approximately 0.8 inches per hour.

Given the recent increase in the frequency of significant storms and potential increase in flow from residents of the Grand Traverse Commons area rehabilitation work to minimize infiltration and inflow (I&I) to avoid potential Sanitary Sewer Overflows (SSOs).

4.2 PROCEDURE

The Sanitary system was field located and added to a GIS Database. Portions of the system were televised to determine location of excessive damage and overall system condition, and evaluation of flow to approximate infiltration and Inflow (I&I).

To collect existing flow data, HRC & GFA worked with the City to install a flow meter at SSM-1651 located approximately 400 feet south of the S Elmwood Drive/Medical Campus Drive intersection. The diameter of the sanitary sewer at the location of metered flow is 10-in pipe.

A rain gauge was also installed at the City fire department for the duration of this study and was used to develop unit hydrographs for dry and wet weather conditions. The attached **Appendix D-1** depicts the location of meter commons sanitary system and location of rain gauge.

4.3 CONDITION ASSESSMENT

4.3.1 Infiltration/Inflow Results

A rain gauge (rented from Hach) was installed at the City's Fire Station at 500 W Front St. Data was collected from August 2022 through February 2023. Within that time, six "significant" rain events were recorded. "Significant" rain events for this evaluation are defined as having total rain greater than 0.5 inches, or, where there was a noticeable peak in the meter data. **Table 4.1** lists the rain event data for each event including total rain, duration, peak intensity, and resultant recurrence interval of the rainfall rate. The recurrence interval is approximate and is based on the duration and total rain in reference to the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 rainfall recurrence intervals for the City of Traverse City area. The rain event hyetographs are provided in **Appendix D-2:** Rainfall Hyetographs. **Appendix D-3** also includes NOAA Atlas 14 table of rainfall recurrence intervals.

Table 4.1 Rain Event Data

Date	Rain (in)			
	Duration (hours)	Peak Intensity (in/hr)	Total Rain (in)	Recurrence Interval
08/01/22	2.00	0.77	0.86	< 1-Year
08/03/22	9.00	0.88	1.15	< 1-Year
08/07/22	15.00	0.44	0.86	< 1-Year
08/08/22	3.00	0.55	0.99	< 1-Year
09/11/22	11.00	0.50	1.21	< 1-Year
11/13/22	15.00	0.16	0.46	< 1-Year
11/23/22	5.00	0.11	0.22	< 1-Year
12/15/22	4.00	0.14	0.33	< 1-Year
01/16/23	6.00	0.04	0.16	< 1-Year
01/19/23	11.00	0.09	0.23	< 1-Year
02/07/23	6.00	0.09	0.30	< 1-Year
02/09/23	12.00	0.17	0.66	< 1-Year
Max	15	0.88	1.21	< 1-Year
Min	2	0.04	0.16	< 1-Year
Average	9	0.32	0.62	
Total Rain During Monitoring Period (in)			10.98	

Dry weather infiltration was evaluated by determining the dry weather flow (DWF) for each District. DWF is normal sanitary loading. Sanitary loading comes from a variety of sources such as residential, commercial, industrial, and recreational uses. For the Grand Traverse Commons in this study, the DWF was determined by taking the average of several typical weather weeks. Copies of the hydrographs that illustrate the dry weather flow calculated for each

meter are shown in **Appendix D-4**: Dry Weather Flow Hydrographs. **Table 4.2** lists the various calculated values of dry weather flow for The Commons. Since sewer infiltration is proportional to the sewer wall surface that is exposed to the ground, the most common way to express this is in terms of the flow rate per surface area (typically gallons per day per inch diameter per mile or gpd/ inch-mile (gpdim). A commonly acceptable rate of sewer infiltration for new sewers is 200 gpdim.

Table 4.2 Dry Weather Flow

Flow	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Max (mgd)	0.0237	0.0229	0.0230	0.0210	0.0264	0.0221	0.0208
Min (mgd)	0.0048	0.0056	0.0062	0.0056	0.0068	0.0062	0.0055
Avg (mgd)	0.0144	0.0138	0.0145	0.0133	0.0152	0.0133	0.0132

Wet weather infiltration and inflow are directly dependent upon rain and are commonly referred to as Rainfall Dependent Infiltration and Inflow (RDII). Rainfall-dependent inflow is considered to be a wet weather phenomenon that results from stormwater runoff entering a sewer system directly through foundation drains connected to sump pumps, openings in manholes located close to ground surfaces, leaks in sewer pipes, connected roof drains, etc. The term RDII includes the component of wet weather infiltration, however, in many sanitary sewer systems, the contribution from inflow (direct runoff) is substantial and often times significantly overshadows the contribution of wet weather infiltration. The wet weather infiltration component of RDII is not distinguishable and because the inflow component of RDII is the primary contributor, RDII is sometimes referred to as “inflow” only. The peak flow and inflow for each rain event is listed in **Table 4.3**.

Table 4.3 Peak Flow Per Rain Event

event #	date	Peak I	Total	Duration	Inflow (mgd)	Peak Flow per Event
1	8/1/2022	0.86	0.86	1	0.04	0.06
2	8/8/2022	0.55	0.97	2.5	0.03	0.05
3	11/13/2022	0.16	0.33	4	0.01	0.02
4	12/15/2022	0.17	0.33	3	0.02	0.02
5	1/3/2023	0.15	0.22	2.5	0.01	0.02
6	1/19/2023	0.09	0.43	8.5	0.01	0.02
7	2/7/2023	0.14	0.29	3.5	0.02	0.03
8	2/9/2023	0.18	0.54	5.5	0.02	0.03

The estimated rate of inflow was determined by fitting the peak wet weather flow and data with a logarithmic trend line and the line is then extended out to the desired storm intensity. The peak intensity for the design rainfall event is according to the NOAA Atlas 14 for a 10-yr, 1-hour intensity of 1.65-in/hr, The inflow and peek flow for this event was calculated to be Inflow of ***0.048-mgd*** and a peak flow of ***0.081-mgd***. The estimated peak inflow was divided by the population per District yielding the gallons per capita per day “gpcd” **Appendix D-5** shows correlation and prediction curve for future storm events.

4.3.2 Capacity Results

Utilizing the City of Traverse City GIS and the GIS data acquired within this project the areas of greatest flooding were determined with respect to subsurface infrastructure. This evaluation did not account for above ground surface conveyance. This analysis accounted for pipe size, slope, and predicted flows. It was determined that the worst reach directly servicing the Grand Traverse Commons to be SSGM-9473. This pipe reach connects the manholes SSM-1683 and SSM-1648. Maximum flow through this portion of the system utilizing Manning's equation assuming full pipe gravity flow is 0.462 million gallons a day. **Figure 4.1** provides the location where conditions including slope, material, flow and pipe diameter provides greatest flooding potential within the system.

Figure 4.1 Location of Greatest Flooding Potential

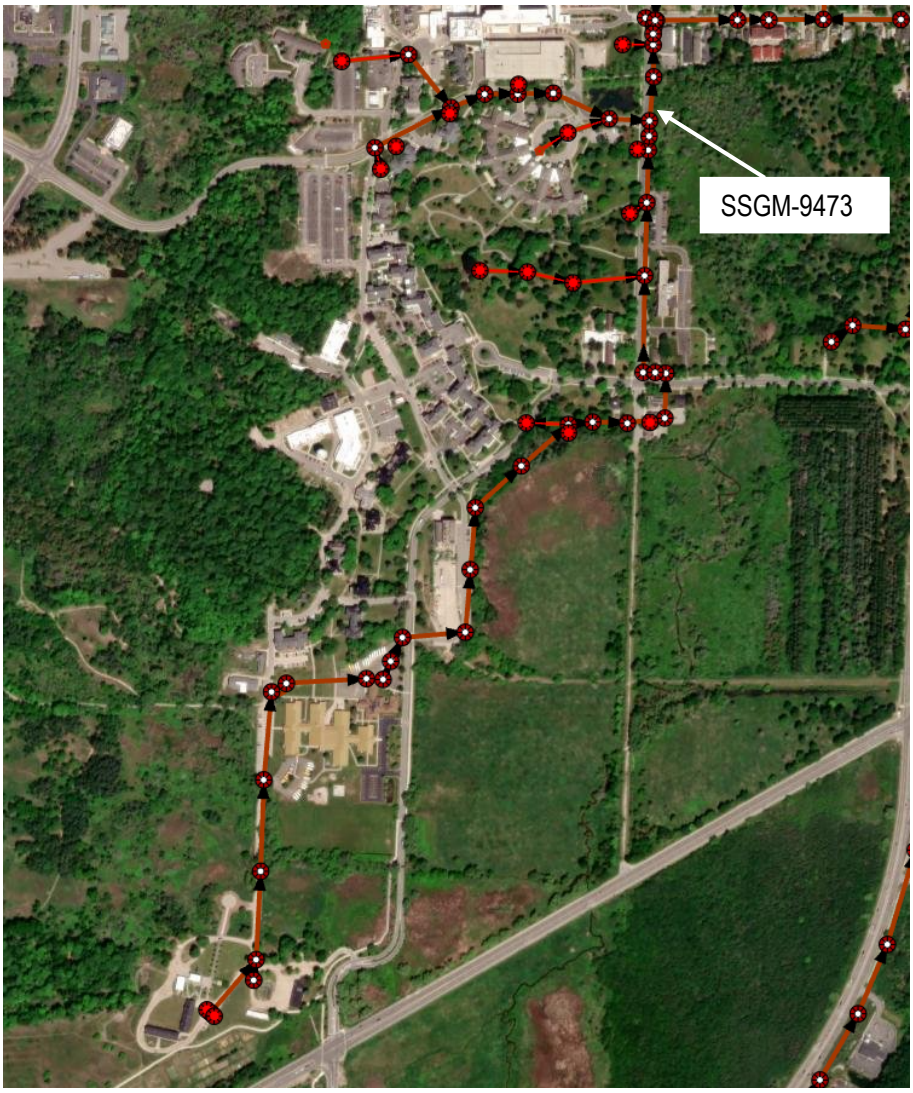


Table 4.4 Sanitary Structure Survey Example Data

OBJECTID	1
Asset ID	SSM-1662
City	tc
Street	silver st
Date	2022-11-09 18:31
Surveyed By	Gourdie-Fraser, Inc.
Weather	Light Rain
Inspection Status	Descent Inspection
MH Use	Sanitary
Location Code	Parking Lot
Surface Type	Asphalt
Rim to Grade (in)	
Cover Material	Iron
Cover Type	Solid
Cover Vent Hole Number	
Cover Shape	Circular
Cover Size (in)	24
Cover Size Width (in)	26
Cover Frame Fit	Good
Cover Condition	Corroded (pitted)
Evidence of Surcharge	Yes
Frame Material	Iron
Frame Condition	Corroded
Frame Offset Distance (in)	0
Frame Seal Inflow	Infil Weeper
Frame Seal Condition	Mortar Seal Cracking
Chimney Present	Yes
Chimney Material	Brick and Block
Chimney I/I	Infil Weeper
Chimney Height to Rim (ft)	12
Chimney Condition	Collapse/Missing
Cone Type	Conical centered
Cone Material	Concrete (precast)
Cone Condition	Sound
Wall Diameter (ft)	48
Wall Material	Concrete (precast)
Wall Condition	Sound
Bench Present	Yes
Bench Condition	Heavy Ragging
Channel Installed	Yes

Table 4.4 Sanitary Structure Survey Example Data Count.

Channel Material	Concrete (cast in place)
Channel Condition	Heavy Ragging
Step Number	2
Step Material	Metal
Step Condition	Corroded
Sump Present	No
Sump Depth (ft)	
Overall MH Condition	Poor
Rehab Status	Repairs/Maintenance Needed
Rehab Structural	Reconstruct Chimney_pave
Rehab I/I	
Rehab O&M	Clean Manhole_Vactor
Rehab Notes	
Problem Observed	
Comments	

Table 4.5 Ssanitary Sewer Survey Example Data.

OBJECTID	3
AssetID	SSGM-8235
Surveyed By	Gourdie-Fraser, Inc.
Date	2022-11-09 19:54
Cardinal Flow Direction	NE
Type	Sanitary Gravity Main
US Structure ID	SSM-1659
US Diameter (in)	12
US Material	Vitrified Clay Pipe
US Rim to Invert (ft)	13.56000042
US Flow Status	Steady
Traps	
DS Structure ID	SSM-1658
DS Diameter (in)	12
DS Material	Vitrified Clay Pipe
DS Rim to Invert (ft)	6.699999809
DS Flow Status	Steady
Drop Present	No
Lower Drop Invert (ft)	
Drop Type	
Is Flow Arrow Correct?	
Data Collected	No
Comments	

4.4 REQUIREMENTS FOR ACCEPTANCE

The current process for sewer acceptance from the City of Traverse City is as follows administered May 2004:

4.4.1 Sewer System Acceptance Procedure

- Complete evaluation and prepare recommendations and cost estimates.
- Owner to Apply for EGLE Part 41 Wastewater Permit.
- Recommended Improvements to be completed or Bond Posted in amount of recommended improvements.
- City to Receive Certification of Completed Improvements and Submits to EGLE.
- City Receives Easements for Sewers (20' wide).
- City Accepts Easements and Improved Sewer as Public Sewer.

4.4.2 Accepted Sewer System Evaluation

- Conduct video inspection:
  - Pipes are to be cleaned prior to video inspection.
  - Provide documentation of root intrusion evaluation.
  - Provide documentation of pipe condition evaluation.
- Conduct infiltration/inflow analysis:
  - Provide smoke testing for all system pipes.
  - Provide exfiltration testing for all system pipes.
- Visual inspection of manholes to occur and added to inventory checklist.

4.4.3 Sewer System Rehabilitation Options

One or multiple rehabilitation options shall be performed as recommended by the engineer, the following is a list of acceptable rehabilitation options:

- Pipe rehabilitation.
  - Pressure grout joints
  - Pipe burst with new carrier pipe.
  - Line with cured in place pipe.
  - Slipline existing carrier pipe.
  - Replace portions of pipe.
  - Pipe replacement.
- Manhole rehabilitation
  - Grouting.
  - Coating.
  - Structural Line.
  - Corrosion protection.
  - Step Replacement.
  - Flowline/Bench repair.
  - Replace manhole.

4.5 CCTV

Ten Sanitary sewer reaches were CCTVed for this project full CCTV reports can be found in **Appendix-D-6.** Video has been provided with GIS data. It is recommended to continue to CCTV and document the condition of the sanitary sewer as failed and compromised sewer pipe is the most common contributor to infiltration within a sanitary system. **Appendix D-7** provides map of CCTV.

4.6 ACTIONS REQUIRED FOR MAINTENANCE AND REPAIR

Based on the current condition assessment and items required for City of Traverse City Sewer System Acceptance Procedure, a plan for further CCTV and lining of sanitary sewer and structures is required. Current CCTV provides evidence that the of the existing sewer does not have any structural defects that would prevent lining and therefore omits the cost intensive procedure of replacing failing sewer.

The 2017 Traverse City Sanitary Sewer System Asset Management Plan was reviewed in the assessment of the Grand Traverse Commons stormwater system. The Level of service and long-term needs recommendations for the City were used as the standards required for the Grand Traverse Commons storm system to meet. It is recommended to clean storm sewers every 2 years. This process should also include inspection and televising of all sewers and structures every 5 years. These ongoing management practices are provided in **Table 4.5.** The quantity provided is the recommended yearly quantity to be cleaned and inspected to address all sewers and structures within the recommended period. The cleaning schedule should be adjusted to take into account the actual conditions in various parts of the sanitary system; routine cleaning can result in over-maintenance of the system. In most sanitary systems, some sections do not require frequent cleaning while other sections may require cleaning on a more frequent basis if they are susceptible to blockages. Information from the inspection program should be used to help identify problem areas in the gravity sewer system and related structure, quantify defects and problem areas, and develop a preventive maintenance sewer cleaning program based on actual conditions in a particular sanitary system.

Table 4.5 Sanitary Sewer System Program

Procedure	Quantity	Unit Cost	Annual Cost
Sewer Cleaning	9,200-ft	$3.50 / foot	$32,200
Structure Cleaning	59 each	$300 / each	$17,700
Sewer Inspection (CCTV)	3,700-ft	$5 / foot	$18,500
Structure Inspection	24 each	$100 / each	$2,400

Notes:
1. Annual cost rounded to nearest $100

SECTION 5.0 — ROAD, SIDEWALK, AND PARKING AREAS

5.1 INTRODUCTION

The Grand Traverse Commons (GTC) study area included 2.18 centerline miles of roadway with adjacent sidewalk and 28 parking lots. GTC is responsible for the maintenance, repair, and replacement activities for the roadway, sidewalk, and parking lot assets. As part of the infrastructure assessment, HRC & GFA evaluated the pavement conditions of these assets and field-verified the grade of various sidewalk landings and ramps for compliance with the Americans with Disabilities Act (ADA). The goal of the assessment was to evaluate how to best allocate resources to maintain, preserve, and improve the pavement-related assets under GTC's jurisdiction. **Figure 5.1** shows an overview of the study area.

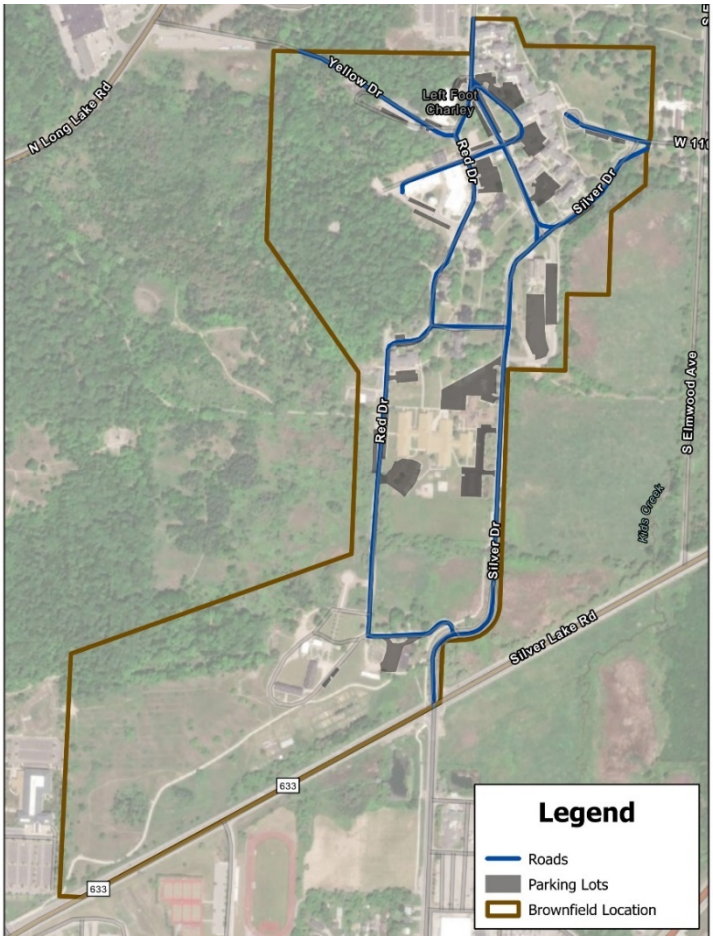


Figure 5.1: GTC Study Area Overview

To develop a capital improvement plan, HRC & GFA completed a condition assessment of all the roadways, adjacent sidewalks, and parking lots. The condition assessment was completed by performing a visual survey of the existing pavement assets. The sidewalk landing and ramp grades were also reviewed to verify they were less than two (2) and eight (8) percent, respectively, to meet ADA compliance. The condition assessment of the pavement, sanitary and storm sewers, and water distribution will all be considered for a holistic approach in developing a capital improvement plan.

5.2 SURFACE TYPES AND CHARACTERISTICS

The type of pavement used is determined by several different factors, such as cost of construction, cost of maintenance, frequency of maintenance, and type of maintenance. These factors can have benefits affecting asset life and typically there are tradeoffs for each surface type used. The pavement assets reviewed by HRC & GFA consisted of concrete, asphalt, brick paver, and gravel pavement types.

Concrete pavement is durable and has a longer service life than asphalt when properly constructed and maintained. Concrete pavement can also have longer service periods between maintenance activities, which can help reduce operational disruptions. Concrete pavement, however, has a higher cost than asphalt and can be challenging to rehabilitate and maintain at the end of its service life. Common distresses for concrete include surface defects (polishing, pop-outs, scaling), joint failures, pavement cracks (transverse, corner, meander), and pavement deformation (blow-ups, settlement, potholes). A typical concrete pavement design life will provide service for 30 years before major rehabilitation is required.

Asphalt pavement is less expensive to construct than concrete, but it requires more frequent maintenance activities to maximize its service life. Common distresses for asphalt include surface defects (raveling, flushing, polishing), pavement deformation (rutting, settling, frost heave), pavement cracks (transverse, block, alligator), and failed patches (potholes). A typical asphalt pavement design life will provide service for 18 years before major rehabilitation is necessary.

Brick pavers have been used in urban development areas for many years for pavement surfacing. Brick or block pavements are generally constructed on a sand stabilizing base. The bricks or blocks are typically laid without any joints (mortar) and filled with sand to fill up any irregularities. Common distresses for brick pavers include gaps, breaks, discoloration, settlement, and failed utility patches. History indicates brick streets have lasted over 100 years, since bricks themselves do not warp or buckle, but the condition of the sand or gravel base typically fails first.

Gravel (unpaved) pavement is typically found where low construction and maintenance costs exist. Gravel roads do not contain many of the inventory elements common to paved roads, so rating by surface condition is problematic. Gravel roads are assessed based on their major improvement-based features like surface width, drainage adequacy, and structural adequacy rather than maintenance features like cracking or joint failures.

5.3 ASSET RATING SYSTEM

HRC & GFA used the Pavement Surface Evaluation and Rating (PASER) system to evaluate the pavement conditions at GTC. The Michigan Transportation Asset Management Council (TAMC) and Michigan Department of Transportation (MDOT) have adopted the PASER system as the statewide standard for evaluating pavement conditions. The PASER system uses visual inspection conducted by a trained engineer and assigns a rating number based on the pavement type (concrete, asphalt, brick, gravel) and magnitude of deterioration present. The ratings for the existing pavement conditions were collected in November 2022 by HRC personnel trained and certified by the TAMC in PASER.

The rating systems for concrete and asphalt utilize a 10-point scale with 10 indicating the pavement is in excellent condition (new construction) and 1 meaning the pavement has failed. The rating system for brick is similar but utilizes a 4-point scale instead. The rating system for gravel utilizes a 10-point inventory-based rating (IBR) scale focusing on the surface width, drainage adequacy, and structural adequacy. A detailed description of the rating systems for concrete, asphalt, brick, and gravel is included in **Appendix E-1**.

Pavements in good condition are represented by a rating between 8 to 10 (4 for brick) and have very few, if any, defects. Pavements in this condition require routine maintenance, such as street sweeping or drainage cleaning, and have been newly constructed. **Figure 5.2** shows an image of a pavement in good condition with a rating of 9 on Red Drive between Gray Drive.

Figure 5.2: Image of Good Pavement with Rating of 9 on Red Drive

Pavements in fair condition are represented by a rating between 5 to 7 (2 for brick) and their surface is starting to deteriorate. Pavements in this condition require preventative maintenance, such as joint or crack sealants. **Figure 5.3** shows an image of a pavement in fair condition with a rating of 5 on Silver Drive between Red and Brown Drive.

Figure 5.3: Image of Fair Pavement with Rating of 5 on Silver Drive

Pavements in poor condition are represented by a rating between 1 to 4 (1 for brick) and exhibit evidence their underlying structure is failing. Pavements with a rating of 4 typically start showing the first signs of structural weakening. Pavements in this condition require structural improvements, such as rehabilitation or reconstruction. **Figure 5.4** shows an image of a pavement in poor condition with a rating of 2 on 11th Street west of Silver Drive.

Figure 5.4: Image of Poor Pavement with Rating of 2 on 11th Street

5.4 FINDINGS AND OBSERVATIONS

5.4.1 Roadway Conditions

The roadway network was broken down by segments that were created when there was an intersection, change in pavement type, or substantial change in rating. Ratings between 8 to 10 indicate the road is in good condition, while 5 to 7 indicate fair, and 1 to 4 indicate poor. Most of the roads consisted of asphalt pavement. The average rating for the roadway lane-miles in the study is 5.805. The rating indicates the road network on average is in fair condition. **Table 5.1** shows a summary of the total and percentage of roadway lane-miles associated with each rating.

Table 5.1: Roadway Rating Summary

Roadway Ratings											
Pavement Type	Poor Condition				Fair Condition			Good Condition			Total
	1	2	3	4	5	6	7	8	9	10	
Asphalt Lane Miles (PASER)	0.000	0.359	0.411	0.181	0.619	1.448	0.000	0.122	0.859	0.000	**3.999**
Concrete Lane Miles (PASER)	0.000	0.000	0.150	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.150**
Gravel Lane Miles (IBR)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.215	0.000	0.000	**0.215**
Total Lane Miles	0.000	0.359	0.561	0.181	0.619	1.448	0.000	0.337	0.859	0.000	**4.364**
Percentage of Lane Miles by Rating	0.0%	8.2%	12.9%	4.1%	14.2%	33.2%	0.0%	7.7%	19.7%	0.0%	**100.0%**
	25.2%				47.4%			27.4%			
										Average Roadway Rating	**5.805**

A complete roadway asset rating map showing a color-coded depiction of all the GTC roadway ratings is included in **Appendix E-2**. The map is intended to provide a relative indication of segments that are in good, fair, or poor condition. Road segments that are in good, fair, or poor condition are shown in green, yellow, or red, respectively.

5.4.2 Parking Lot Conditions

The parking lots were broken down by areas that were created when there was a change in pavement type or rating. Concrete, asphalt, and gravel ratings between 8 to 10 indicate the parking lot is in good condition, while 5 to 7 indicate fair, and 1 to 4 indicate poor. Since the brick paver ratings are based on a four-point scale, a 2.5 multiplier was used to convert them to a 10-point scale to match the concrete, asphalt, and gravel ratings. The average rating for the parking lot areas in the study is 5.272. The rating indicates the parking lots on average are in fair condition. **Table 5.2** shows a summary of the total and percentage of parking lot areas associated with each rating.

Table 5.2: Parking Lot Rating Summary

Parking Lot Ratings												
Pavement Type	Poor Condition				Fair Condition			Good Condition				Total
	1	2	3	4	5	6	7	7.5 *	8	9	10	
Asphalt Square Feet (PASER)	0	0	62,584	8,189	60,045	81,069	51,459	0	9,791	0	0	**273,137**
Concrete Square Feet (PASER)	0	21,700	0	4,329	0	611	4,178	0	0	0	0	**30,818**
Gravel Square Feet (IBR)	0	0	0	0	0	2,333	0	0	15,243	0	0	**17,576**
Brick Square Feet (PASER)	0	0	0	0	0	0	0	8,936	0	0	0	**8,936**
Total Square Feet	0	21,700	62,584	12,518	60,045	84,013	55,637	8,936	25,034	0	0	**330,467**
Percentage of Square Feet by Rating	0.0%	6.6%	18.9%	3.8%	18.2%	25.4%	16.8%	2.7%	7.6%	0.0%	0.0%	**100.0%**
	29.3%				60.4%			10.3%				
											Average Parking Lot Rating	**5.272**

*Brick pavers PASER rating of 3 (4-point scale) converted to 7.5 (10-point scale).

A complete set of parking lot asset rating maps showing a color-coded depiction of all the GTC parking lot areas is included in **Appendix E-3**. The maps are intended to provide a relative indication of parking lot areas that are in good, fair, or poor condition. Parking lot areas that are in good, fair, or poor condition are shown in green, yellow, or red, respectively.

5.4.3 Sidewalk Segment, Landing, and Ramp Conditions

The sidewalk segments adjacent to the roadway were rated to be in good, fair, or poor condition. The grade at the sidewalk landings and ramps adjacent to a crossing were also field verified using a level. Landings and ramps with grades at two (2) percent or less and eight (8) percent or less, respectively, meet ADA compliance. A sidewalk locations map with tables showing the condition (good, fair, poor) and grade at the landings and ramps is included in **Appendix E-4**.

SECTION 6.0 — SYSTEM MAPPING

6.1 PROCEDURE

The GIS system for the Grand Traverse Commons began with integrating the existing GIS data for the area from both Traverse City and Garfield Township. Water, storm, and sanitary sewer data was obtained from each municipality and merged into a single database. The final fields were modeled after Traverse City's data since most of the Commons area resides in the City's boundary. Recent Aerial photography was provided by Traverse City and used throughout the project to locate new assets.

Once the initial GIS datasets were merged and organized, a variety of resources were used to improve the data, filling in gaps of missing assets or their attributes such as size and material. As-built plans and studies were provided by the municipalities. These documents contained information about the location and details of a variety of utilities within the project area and new structures and pipes for sewer and water distribution systems were integrating into the existing GIS system.

While the available plans and current GIS data provided valuable information about public utilities such as storm, sanitary, and water systems – there were still several private utilities in the area that needed to be digitized into GIS. For these utilities, MISS DIG 811 requests were made for the project area. MISS DIG 811 operates as the Underground Utility Safety Notification System for the State of Michigan and includes private utilities missing in the initial GIS development. We received PDF maps of fiber optic, telephone, electric, and gas utilities from companies such as AT&T, Consumers Electric, DTE Energy, and Charter Communications. The PDFs were drawn in GIS by lining up the drawing with aerial photographs for above-ground structures and lines, while underground assets were located by referencing surrounding landmarks. Attributes available from the static maps were added where possible.

Roads were initially taken from the State of Michigan GIS Open Data portal, using the "All Roads" Version 17a feature class. The state-wide dataset was corrected where it did not match the aerial imagery. Parking lots were digitized manually using aerial photography.

After all available resources were studied and integrated in the GIS, field inspections began for transportation, water, storm, and sanitary sewer utilities using ArcGIS Collector and Field Maps mobile applications. Transportation field work included road, sidewalk, and parking lot inspections. Attributes such as material, PASER rating, and general conditions were reintegrated into the GIS system when inspections were complete and reviewed for quality. For the water system, fire hydrants and valves were inspected for condition and new assets were discovered. Similarly, sewer manholes were inspected for sanitary and storm sewers. Storm sewer inspections additionally included catch basins, detention basins, and retention basins. New assets that were discovered during inspections were then integrated into GIS along with attributes captured in the field.

New data from field inspections for the sanitary and storm sewer systems was consolidated and the project team decided which sewers would be televised using PACP inspection standards and CCTV technology. These CCTV inspections uncovered new assets and provided detailed condition information for the televised pipes. GIS was updated with this new information and reports and videos were linked to the associated GIS asset.

Finishing the CCTV inspections concluded the new information gathered for this project's scope. All inspection data was cleaned up and integrated into the database, which was then compressed to a zip file for delivery.

6.2 ASSUMPTIONS

While developing the GIS, it was assumed that the data we received from MISS DIG 811 requests included all assets within the study area. A combination of aerial imagery and GPS technology was used to locate newly found structures within the Commons and the GIS placement therefore is dependent on the accuracy of those resources. GIS assumes these limitations are minimal when proper technology and methods are used.

6.3 DELIVERABLES

Deliverables for GIS will include a file geodatabase containing utility data for all assets included in the study area. Record drawings, field inspection retrieved photographs and details about the makeup and condition of transportation, water, and sewer systems. Sewers inspected using CCTV cameras have reports, videos, and condition scores that are available in the GIS database. Appendix E provides GIS map data for water, storm, and sanitary systems within the Commons.

SECTION 7.0 — CAPITAL IMPROVEMENT PLAN

7.1 INFRASTRUCTURE ELEMENTS

A capital improvement plan (CIP) is a short-range list identifying projects, costs, and impacts to help a community determine the priority for implementation. A CIP usually includes suggested projects to implement within the next 5 to 10 years. A CIP also helps a community anticipate needs rather than reacting to problems. A CIP typically focuses on elements of infrastructure and allows for a systematic evaluation of all potential projects. A CIP for Grand Traverse Commons was developed to help address the needs for infrastructure improvements. No current funding and timeline is provided for improvments within the Grand Traverse Commons and therfore no timeline for project completion has been incorporated into the capital improvement plan.

The CIP for Grand Traverse Commons focused on improving the ammenities. A hollistic approach was taken considering the condition of various infrastructure elements. The condition of the following infrastructure elements was used to determine which ammenities to improve:

1. Water Distribution System
2. Storm Drainage System
3. Sanitary Sewer
4. Pavement

The storm and sanitary conditions observed were all within the structural limits of rehabilitation measures. These measures will not require open cut construction. Therefore, to be the most cost effective, locations where roadway rehabilitation does not require full depth reconstruction sewer should be CCTV's to determine if rehabilitation is recommended. For improved project cost it is recommended to combine rehabilitation of the sewer as a Commons-wide lining project. Minor improvements specifically to the structures were incorporated into the selected roadway and parking lot projects when economically efficient. Additionally, water distribution improvements identified occur outside the influence of the roadway. Combination of water distribution and pavement restoration was not identified to provide any economic benefit to the to the proposed project costs.

Out of the infrastructure elements, the deterioration of the pavement had the most influence in developing the CIP as roads requiring full reconstruction provide grounds for open cut utility replacement. Details of the pavement conditions for the roads and parking lots are included in **Appendices E-2** and **E-3**, respectively. Details of how the road and parking lot conditions relate to the storm and sanitary conditions are included in **Appendix F-1**.

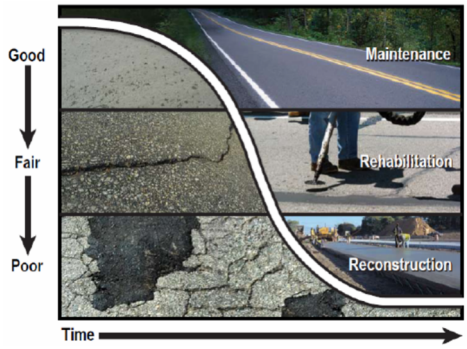
Since annual budget and specific funding sorces were not identified, this reports only identifies project to provide greatest benefit to the community in order of priority. This does not provide a timeline for project completion.

7.2 PAVEMENT DETERIORATION CURVE

Determination of pavement level of service is important for the incorporation of utility replacment within projects identified.

A deterioration curve describes how the condition of the pavement progresses over time. As pavement ages, it will deteriorate much more quickly at the end of its service life, which ends up costing much more to repair. Understanding how a deterioration curve works can assist the community to predict the future condition of their

roads and parking lots. It can also help determine how much the community should invest over time in their road and parking lot infrastructure. **Figure 7.1** shows a typical pavement deterioration curve for any road or parking lot area going from good to poor over time. It also shows the type of repair expected at each condition.



Source: Michigan's Roads and Bridges 2008 Annual Report, Michigan TAMC

Figure 7.1: Pavement Deterioration Curve

Analyzing deterioration curves specific to pavement can also help estimate its remaining service life (RSL). The RSL for pavement is defined as the amount of life left before it can no longer benefit from preventative maintenance and requires a total reconstruction. When using a deterioration curve to estimate RSL, it is the portion to the right of any given point on the curve before it bottoms out. The point at which the curve bottoms out is the critical distress point where the RSL is zero. The RSL for a road or parking lot typically approaches zero at a PASER rating of 3 or lower.

7.3 MIX OF FIXES

When selecting candidate improvement, there are a variety of treatment methods that can be applied. Applying the various treatment methods are often referred to as creating a mix of fixes. The mix of fixes approach applies the right fix, in the right place, at the right time. The mix of fixes approach is the centerpiece of an effective CIP in maximizing the service life of the infrastructure elements. All the infrastructure elements listed above have a mix of fixes associated with them depending on their condition. **Tables 7.1 – 7.3** show the estimated costs of recommended improvement types for the infrastructure elements based on their condition.

Table 7.1: Recommended Costs of Improvements for Water Distribution System

Water Distribution System		
Item	**Recommended Treatment**	**Cost to Improve**
Pressure Reducing Valve	Install	$18,000 / each
Check Valve	Install	$12,000 / each
12" Watermain	Install	$250 / foot
10" Water Main	Replace	$220 / foot
12" Watermain	Replace	$270 / foot
Road Crossing	Jack and Bore	$600 / foot
Road Crossing	Open Cut	$450 / foot

Table 7.2: Recommended Costs of Improvements for Sanitary/Storm Sewer

Sanitary/Storm Sewer		
Item	**Recommended Treatment**	**Cost to Improve**
Structure	MH Replacement	$5,000 / each
Structure	MH Lining	$1,000 / each
Sewer	Replacement	$115 / foot
Sewer	CIPP Lining	$5 / foot
Sewer	Pipe Bursting	$95 / foot

Table 7.3: Recommended Costs of Improvements for Roads

Roads		
PASER Rating	**Recommended Treatment**	**Cost to Improve (Per Lane Mile)**
5 - 6	Thin Overlay	$250,000
1 - 4	Reconstruction (Asphalt)	$1,000,000

Table 7.4: Recommended Costs of Improvements for Parking Lots

Parking Lots		
PASER Rating	**Recommended Treatment**	**Cost to Improve (Per Square Foot)**
7	Crack Seal	$0.50
5 - 6	Thin Overlay	$2.70
4	Mill & Overlay	$9.00
1 - 3	Reconstruction (Asphalt)	$18.00
1 - 3	Reconstruction (Concrete)	$21.00

7.4 CAPITAL IMPROVEMENT PLAN DEVELOPMENT

To help the community in achieving their goal of improving their infrastructure, we have developed separate CIPs for the roads, parking lots, water mains, storm, and sanitary. Each CIP shows a list of projects or scope the community should consider. The CIPs for the roads and parking lots have the project improvements organized by priority rather than start date since the community is unsure when these projects can be performed. When considering the conditions of the infrastructure elements, the good/fair/poor rating scale outlined in the previous sections was considered. Roads and parking lots having multiple infrastructure elements in poor condition were given priority. **Tables 7.4 – 7.8** show a list of projects or scope the community should consider. Detailed CIPs for the projects showing a breakdown of the pavement and utility types, treatments, and costs are included in **Appendix G**.

Table 7.5: Water Main CIP

Improvement	Estimated Cost
Pressure District Isolation	$350,000
Water Main Replacement	$474,000
System Connection	$405,000

Table 7.6: Storm CIP

Task	Estimated Cost
CCTV[1]	$32,815
Manhole Rehabilitation	$56,000
Sewer Rehabilitation[2]	$125,000

Notes:
1. Approximately 6,563 feet of untelevized sewer
2. Sewer rehab cost calculated based on cost associated with current CCTV inspected pipes and may differ significantly as more sewer is televised.

Table 7.7: Sanitary CIP

Task	Estimated Cost
CCTV[1]	$75,470
Manhole Rehabilitation	$271,430
Sewer Rehabilitation[2]	$537,800

Notes:
1. Approximately 15,094 feet of untelevized sewer
2. Sewer rehab cost calculated based on cost associated with current CCTV inspected pipes and may differ significantly as more sewer is televised.

Table 7.8: Road CIP

Project Priority	Segment	From	To	Ln Miles
1	Orange Dr	1,378 Ft North of Silver Dr	442 Ft South of Brown Dr	0.211
2	Red Dr	Gray Dr	Cottageview Dr	0.173
	Cottageview Dr	Gray Dr	North Limits	0.277
	Gray Dr	Red Dr	Cottageview Dr	0.078
3	11th St	Cul-de-sac	Silver Dr	0.148
4	Red Dr	Brown Dr	Gray Dr	0.214
5	Gray Dr	Red Dr	Red Dr	0.314
6	Silver Dr	Cottageview Dr	11th St	0.279
7	Brown Dr	Red Dr	Silver Dr	0.157
8	Silver Dr	Brown Dr	Cottageview Dr	0.216
9	Silver Dr	South Limits	Brown Dr	0.855
10	Orange Dr	442 Ft South of Brown Dr	Brown Dr	0.167

Table 7.9: Parking Lot CIP

Project Priority	Parking Lot	Area (Sft)
1	PL 1	31,917
2	PL 26	21,700
		12,681
3	PL 12	20,821
4	PL 3	47,980
5	PL 8	17,560
6	PL 9	20,750
7	PL 7	20,749
8	PL 2	28,240
9	PL 13	1,916
10	PL 21	2,706

The Projects are provided in order of recommended priority. A total of 12 projects have been determined as top priority for potential improvements. These can be used as a roadmap for future project implementation. An additional 12 roadway and parking lot projects not covered in the executive summary were deemed appropriate for long-term improvements and are included in the Capital Improvement tables. All projects are shown on a map of the Commons at the end of this section.

Project 1: Pressure District Isolation

Location: Red Drive Booster Station and Five (5) locations North and West of Grand Traverse Commons
Estimated Cost: $350,000
Proposed Work: Construction of a new 8-in PRV at the location of the Red Drive Booster Station. Construction of five (5) check valves along watermains connecting Grand Travers Commons to PD-1. Installation of master meter & demolition of existing Red Drive Booster Station.
Purpose: To increase the system water pressure during daily use.

Project 2: Orange (Red) Drive Road Reconstruction

Location: Orange Drive, 1,378 ft North of Silver Drive, 442 ft South of Brown Drive.
Estimated Cost: $220,000
Proposed Work: 530 feet of full depth roadway reconstruction with the additional removal and replacement of One (1) storm catch basin, three (3) sanitary structures and 40 Ft of 6" sanitary sewer.
Purpose: To increase the level of service of roadway and utilities within the project limits.

Project 3: Village Pavilion Roadway Reconstruction

Location: Northern limits of Cottageview Drive to Gray Drive, Gray Drive to Red Drive, Red Drive back to Cottageview Drive.
Estimated Cost: $572,000
Proposed Work: Full roadway reconstruction of all three roadway segments and the replacement of two (2) Storm catch basins. Replacement of 24-ft of storm sewer. Adjust and replace one (1) sanitary cover and frame.
Purpose: To increase the level of service of roadway and utilities within the project limits.

Project 4: Sanitary Rehabilitation

Location: Commons Wide
Estimated Cost: $885,000
Proposed Work: CCTV of remaining 15,094-ft of sanitary sewer. Cured in place pipe (CIPP) treatment of approximately 13,000-ft of sanitary sewer including pre cleaning and post CCTV. Lining of approximately 84 sanitary structures.
Purpose: To decrease infiltration and significantly decrease probability of structural failure.

Project 5: Storm Rehabilitation

Location: Commons Wide
Estimated Cost: $750,000
Proposed Work: CCTV of remaining 6,563-ft of storm sewer. Cured in place pipe (CIPP) treatment of approximately 2,500-ft of storm sewer including pre cleaning and post CCTV. Lining of approximately 56 storm structures. Additional work included research and inventory of additional private infrastructure records maintained by Munson, GT Watershed, etc. The project would include a regional hydraulic evaluation including modelling to evaluate surface infrastructure (ditches, streams, tributaries, etco that contribute to Kids Creek along with recommended improvements.
Purpose: To significantly decrease probability of structural failure and increase the flow capacity (decrease in friction factor). Furthermore prevent future multi-million dollar damage to Munson and surrounding businesses as a result of flooding.

Project 6: Water Main Replacement Project

Location: 11th Street from Silver Drive to Cul-de-sac
Estimated Cost: $474,000
Proposed Work: Removal of 2030-ft of 6-in watermain, construction of 1,486-ft of 10-in water main and construction of 544-ft of 12-in watermain. This project includes three (3) roadways crossings and construction will occur in place of the existing water main.
Purpose: To increase fire flow capacity of system to meet requirements for multi-story buildings.

Project 7: 11th Street Reconstruction

Location: 11th Street from Silver Drive to Cul-de-sac
Estimated Cost: $148,000
Proposed Work: 650-ft of full depth roadway reconstruction.
Purpose: To increase the level of service of roadway within the project limits.

Project 8: System Connection Project

Location: South Limits of Grand Traverse Commons to Frank Road water main
Estimated Cost: $465,000
Proposed Work: Construction of 1,350-ft of 12-in watermain crossing Silver Lake Road and Frank Road connecting to existing 8-in watermain 550-ft south of Silver Lake Road
Purpose: To increase fire flow capacity of system and increase system reliability (ability to continue water service in the event of a water main break)

Project 9: Red Drive Reconstruction

Location: Red Drive from Brown Drive to Gray Drive (South intersection)
Estimated Cost: $240,000
Proposed Work: 590-ft of full depth roadway reconstruction and replacement of one (1) sanitary structure with rim and cover.
Purpose: To increase the level of service of roadway and utilities within the project limits.

Project 10: PL 1

Location: 1100 Silver Drive parking lot
Estimated Cost: $587,000
Proposed Work: 31,917-sft of full depth asphalt reconstruction, replacement of storm structure and 113-ft of storm sewer replacement.
Purpose: To increase the level of service of parking lot and utilities.

Project 11: PL 26

Location: 911 Silver Drive South parking lot
Estimated Cost: $722,000
Proposed Work: Removal of 21,700-sft concrete parking lot, Construction of 34,680-sft concrete parking lot.
Purpose: To increase the level of service of the parking lot.

Project 12: Gray Drive Reconstruction

Location: Gray Drive loop from Red Drive to Red Drive
Estimated Cost: $84,000
Proposed Work: 935-ft mill and overlay roadway construction. Adjustment of sanitary structures within project limits. Replacement of 90-sft of sidewalk.
Purpose: To increase the level of service of roadway and utilities within the project limits.

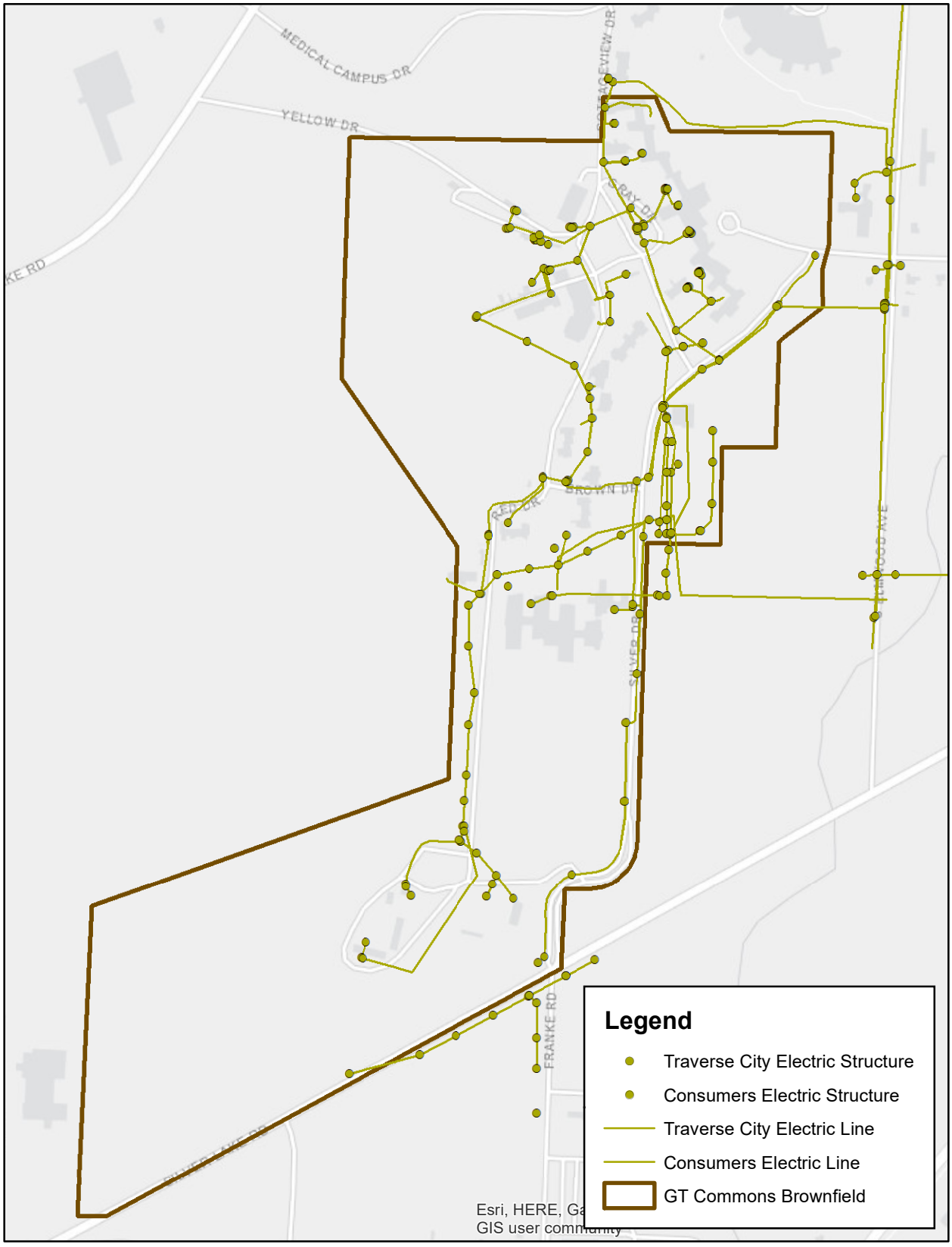
HRC & GFA also recommend the following actions to be taken by the community to ensure the Water Main, Storm, Sanitary, Road, and Parking Lot CIPs remain a useful tool and up to date:

- Combine the Water Main, Storm, Sanitary, Road, and Parking Lot CIPs with the community's familiarity of the area to most efficiently apply preventative maintenance, rehabilitation, and reconstruction.
- Annually review and update the treatments outlined in the CIPs based on previous improvements and new priorities.
- Reassess the condition of the roads, parking lots, and applicable utilities at least every three (3) years and record their respective condition (rating) to ascertain the effectiveness of implemented improvements.
- Implement routine cleaning and inspection of sanitary and stormwater systems as outlined in report.
- Regularly evaluate the budgeted amount of funding for treatments and increase as needed.

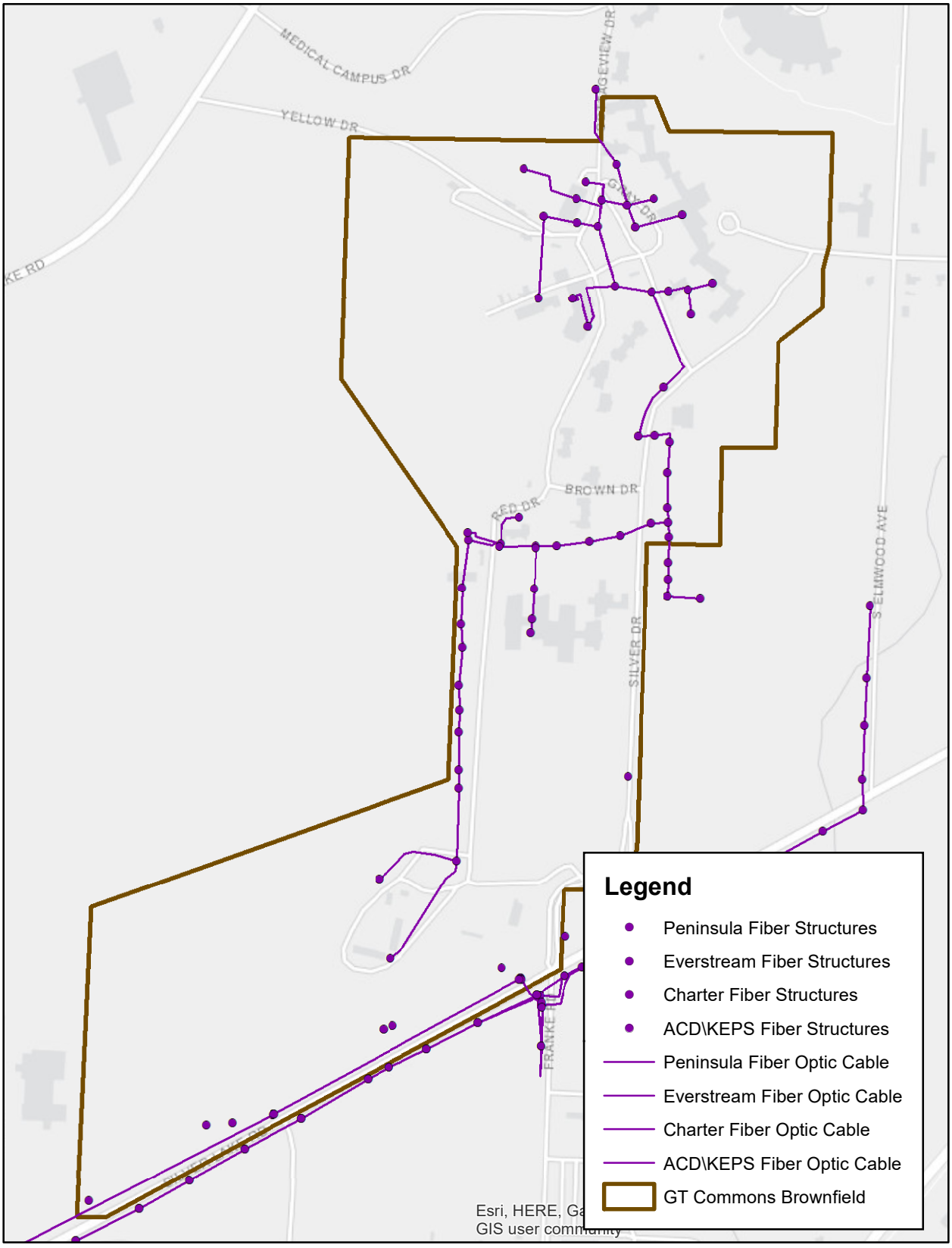
It is also important to note that the CIPs are working documents and should be continually reviewed and updated to reflect changes in community needs, priorities, and funding. The CIPs should always help in advancing the community's strategic and long-term goals and work towards improving the infrastructure conditions.

Appendix A —Utility Maps

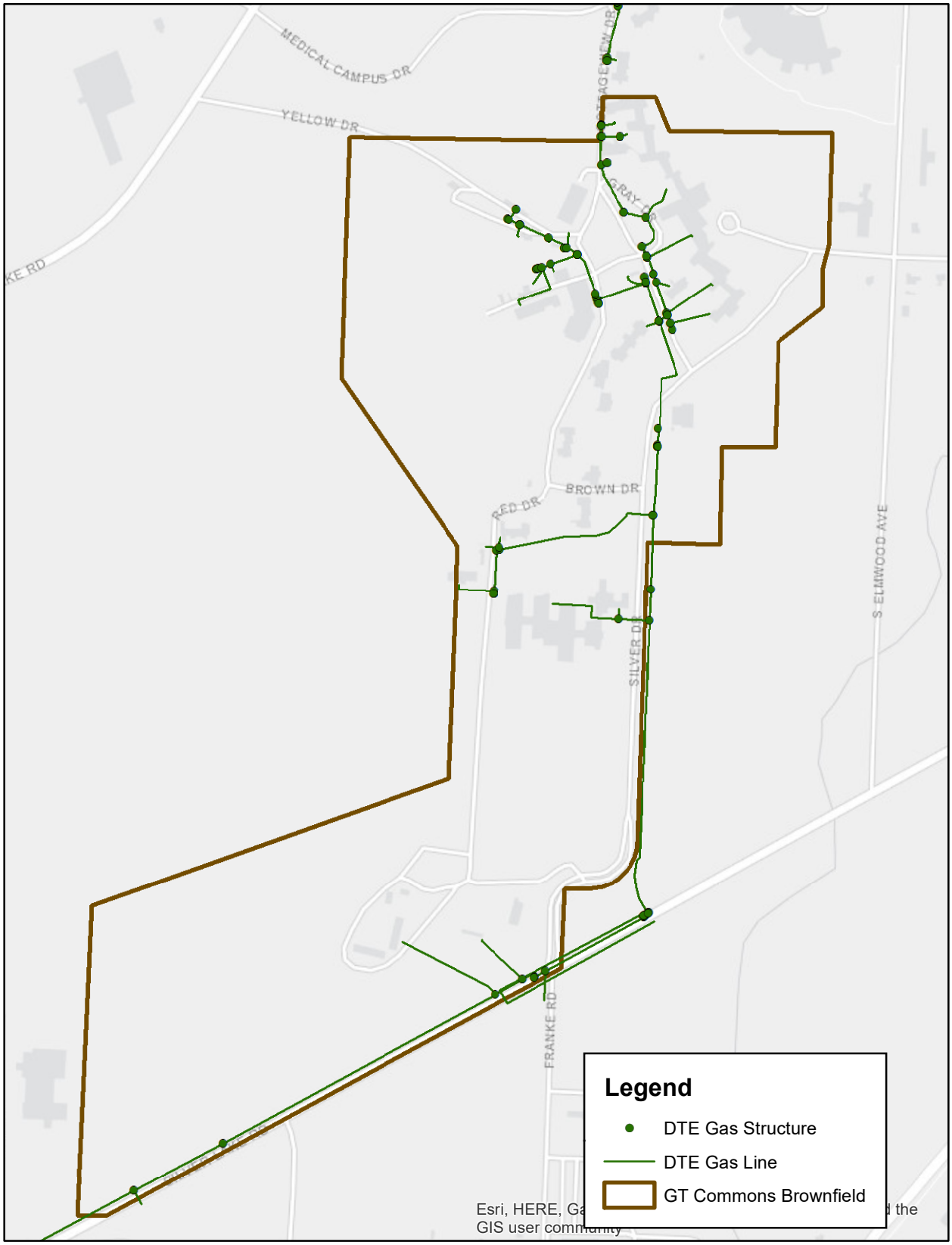
Grand Traverse Commons Utilities



Grand Traverse Commons Utilities

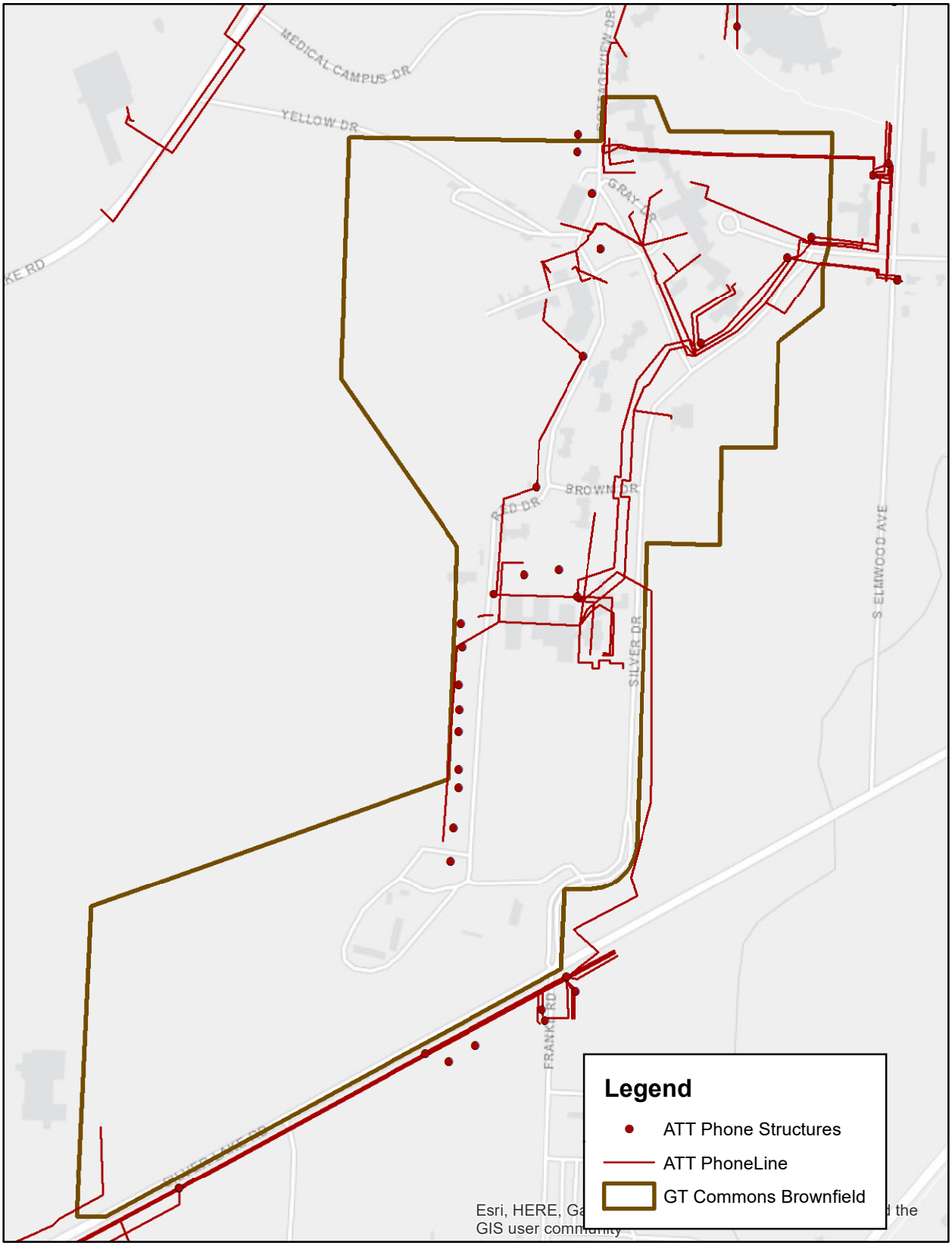


Grand Traverse Commons Utilities

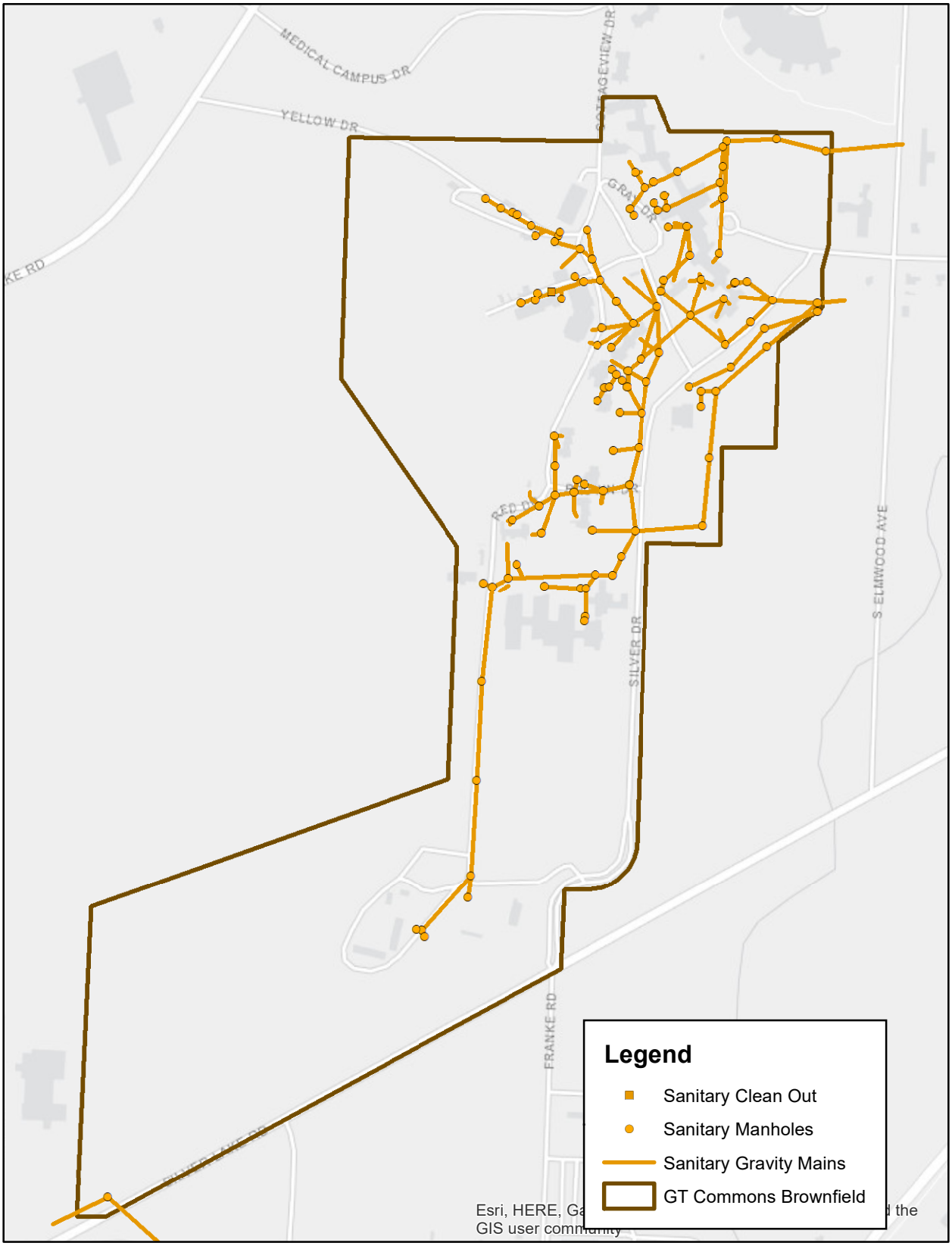


0 550 1,100 2,200 Feet

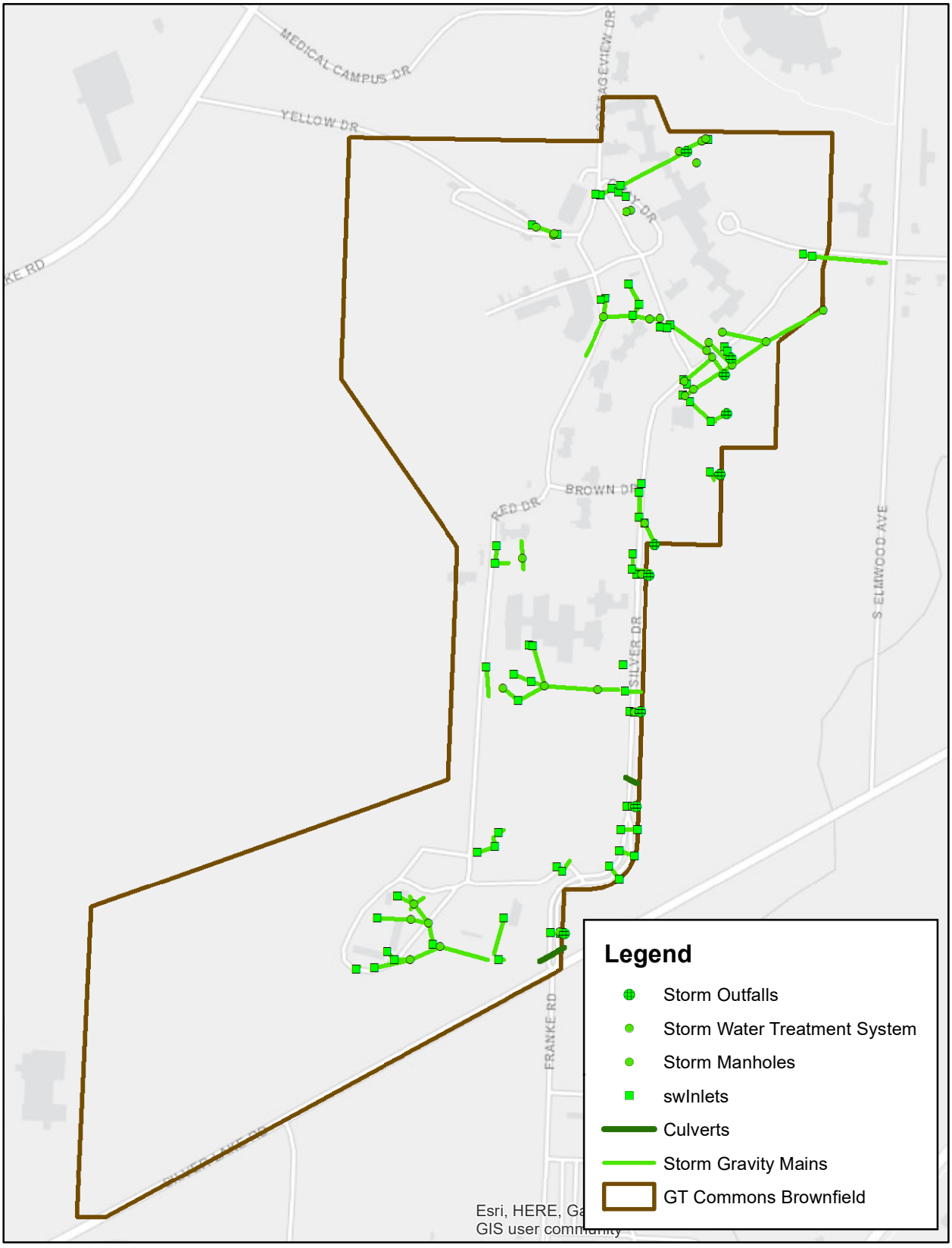
Grand Traverse Commons Utilities



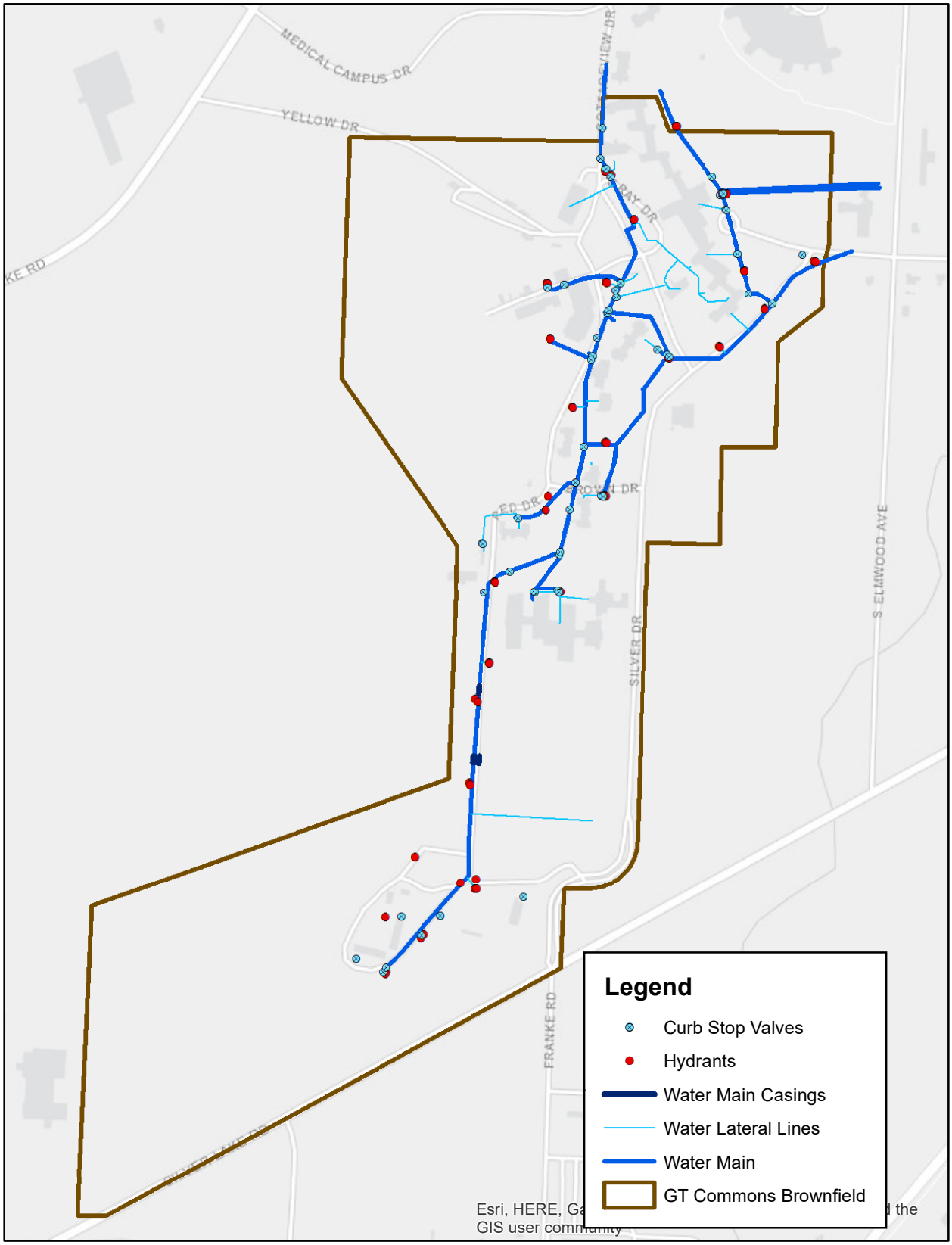
Grand Traverse Commons Utilities



Grand Traverse Commons Utilities



Grand Traverse Commons Utilities



Appendix B —Water Model Simulations

Appendix B-1 System Model

CITY of TRAVERSE CITY MICHIGAN

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

1925 BRETON ROAD SE SUITE 100
GRAND RAPIDS, MI 49506
(616) 454-4286
www.hrcengr.com

N
W E
S

0 500 1,000 2,000 Feet

West Arm of Grand Traverse Bay

East Arm of Grand Traverse Bay

Boardman Lake

PD-2 (825')
WCV-1340
WCV-1341
WCV-1328
PD-3 (885')
WCV-1329
PD-4 (1000')
WCV-1300

WAYNE HILL GROUND STORAGE TANK 1.3 MG 741' (HWL)

Grayhawk Booster Station (Abandoned?)
PD-GT_Munson (975')
Grayhawk (1200')

Copper Ridge PRV #2
PD-GT_Heritage (1090')
Copper Ridge PRV #1
SummerHill PRV
Silver Lake PRV
StoneRidge PRV
PD-GT_1 (875')
PD-GT_Stone Ridge (875')

VETERANS DRIVE MASTER METER (TO CITY)
Franke Road PRV
PD-8 (850')

CASS ROAD MASTER METER
PD-GT_Supply (750')
Cass Road PRV
Garfield #1 Booster Station

BARLOW GROUND STORAGE TANKS 6.0 MG 751' (HWL)
PD-GT_Birmley (875')
Garfield #2 Booster Station

GARFIELD MASTER METER

PD-PT_Huron_Hills (920')
PD-PT_1 (750')
PD-PT_Hidden_Ridge (850')
WCV-7
PD-7 (920')
WCV-6
PD-6 (850')
PD-5 (875')

Huron Hills Booster Station
WTP
Low Service Pump Station
RAW WATER INTAKE CRIB
WTP RESERVOIR 1.5 MG 610' (HWL)
PD-1 (750')

EAST BAY TOWNSHIP INTERCONNECTION (EMERGENCY ONLY NORMALLY CLOSED)

LEGEND

- Check Valve
- PRV
- Hydrant
- System Valve
- City/Township
- Water System Service Area
- County

Water Main

- 6"
- 8"
- 10"
- 12"
- 16"
- 18"
- 20"
- 24"
- 30"
- 36"

Pressure District HGL

- 750
- 751 - 825
- 826 - 884
- 885 - 999
- 1000 - 1090
- 1091 - 1200

TRAVERSE CITY WATER DISTRIBUTION SYSTEM

2020 WATER SYSTEM RELIABILITY STUDY UPDATE

Document Path: V:\2019\01\2019011\903_Studies\Working\Living

Date: 2/22/2021

Appendix B-2 MDD, Existing System Pressure

Static Pressure (PSI)

		Value
	<=	30
	<=	40
	<=	50
	<=	60
	<=	70
	<=	80
	<=	100
	<=	Other

Pipe DI (Inch)

		Value
	<=	4.0
	<=	6.0
	<=	8.0
	<=	10.0
	<=	12.0
	<=	16.0
	<=	24.0
	<=	30.0
	<=	Other

Appendix B-3 MDD, Pressure District Isolation

Static Pressure (PSI)		Value
	<=	30
	<=	40
	<=	50
	<=	60
	<=	70
	<=	80
	<=	100
	<=	Other

Pipe DI (Inch)		Value
	<=	4.0
	<=	6.0
	<=	8.0
	<=	10.0
	<=	12.0
	<=	16.0
	<=	24.0
	<=	30.0
	<=	Other

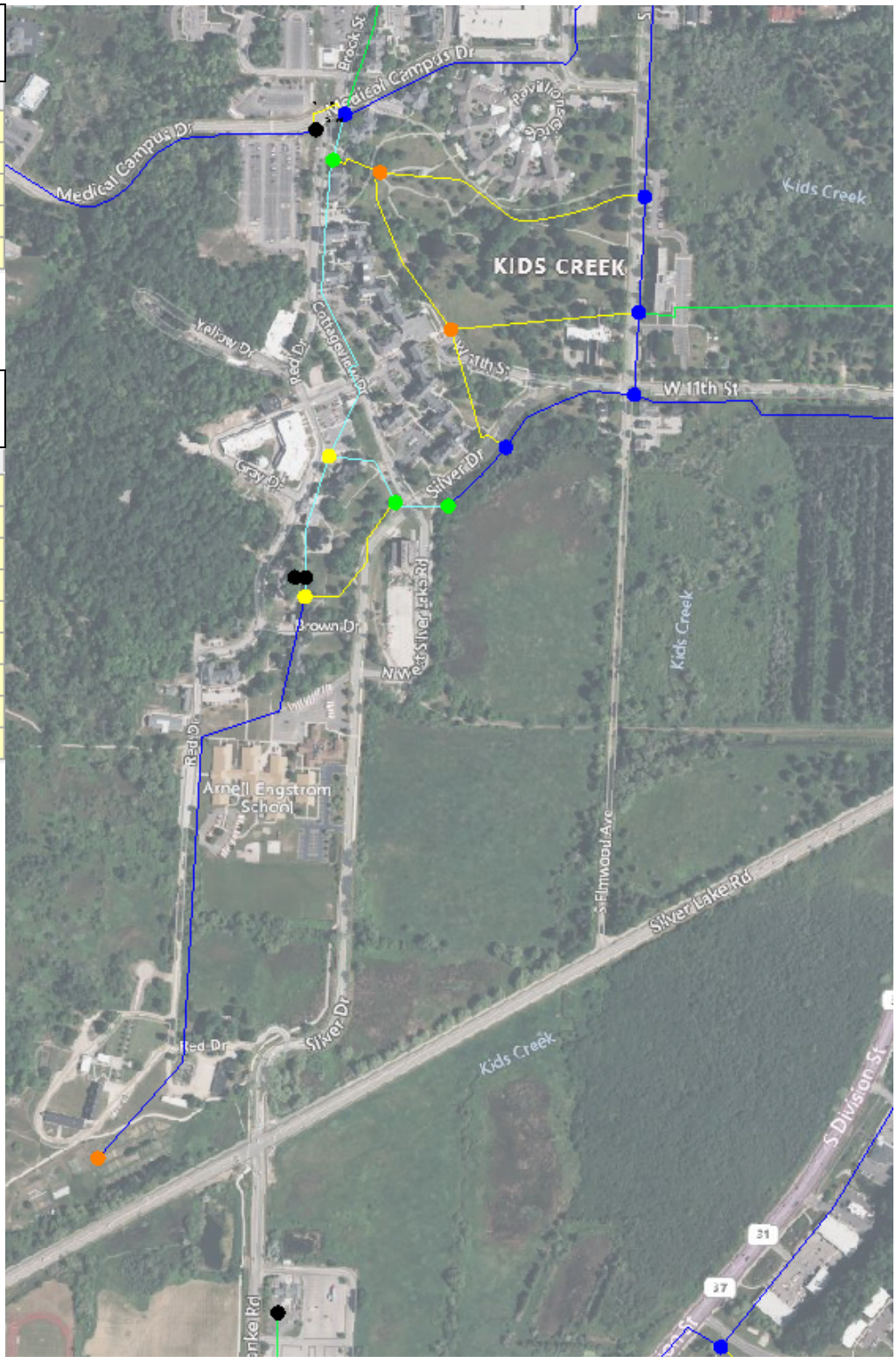
Appendix B-4 Existing Fire Flows

Available Fire Flow (GPM)

		Value
	<=	500
	<=	1,000
	<=	1,500
	<=	2,000
	<=	Other

Pipe DI (Inch)

		Value
	<=	4.0
	<=	6.0
	<=	8.0
	<=	10.0
	<=	12.0
	<=	16.0
	<=	24.0
	<=	30.0
	<=	Other



Appendix B-5 Fire Flow, Pressure District Isolation

Available Fire Flow (GPM)

		Value
	<=	500
	<=	1,000
	<=	1,500
	<=	2,000
	<=	Other

Pipe DI (Inch)

		Value
	<=	4.0
	<=	6.0
	<=	8.0
	<=	10.0
	<=	12.0
	<=	16.0
	<=	24.0
	<=	30.0
	<=	Other

Appendix B-6 Fire Flow, System Looping

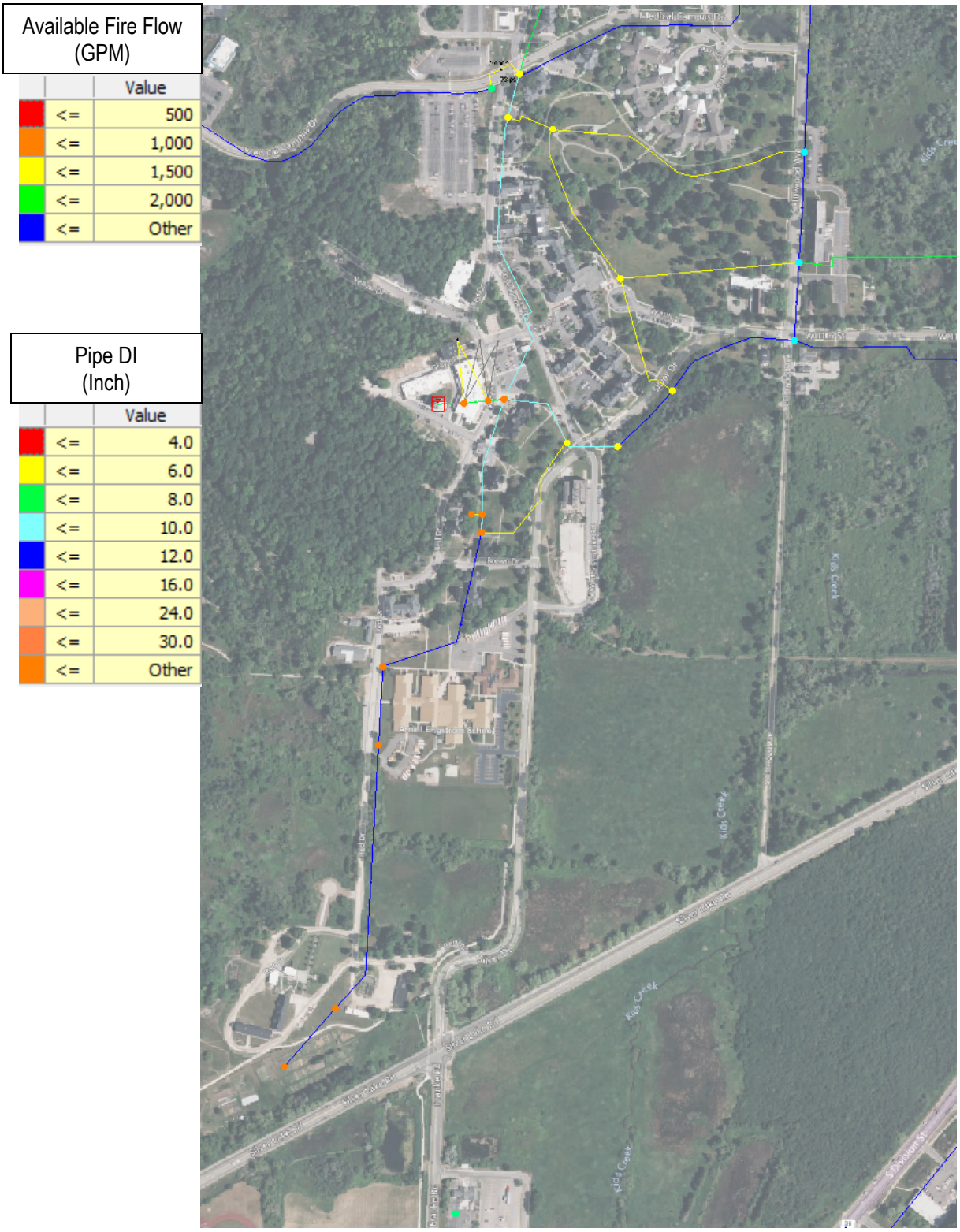
Available Fire Flow (GPM)

		Value
	<=	500
	<=	1,000
	<=	1,500
	<=	2,000
	<=	Other

Pipe DI (Inch)

		Value
	<=	4.0
	<=	6.0
	<=	8.0
	<=	10.0
	<=	12.0
	<=	16.0
	<=	24.0
	<=	30.0
	<=	Other

Appendix B-7 Tank Rehab



Appendix B-8 Fire Flow, Pressure District Isolation & System Looping

Available Fire Flow (GPM)

		Value
	<=	500
	<=	1,000
	<=	1,500
	<=	2,000
	<=	Other

Pipe DI (Inch)

		Value
	<=	4.0
	<=	6.0
	<=	8.0
	<=	10.0
	<=	12.0
	<=	16.0
	<=	24.0
	<=	30.0
	<=	Other

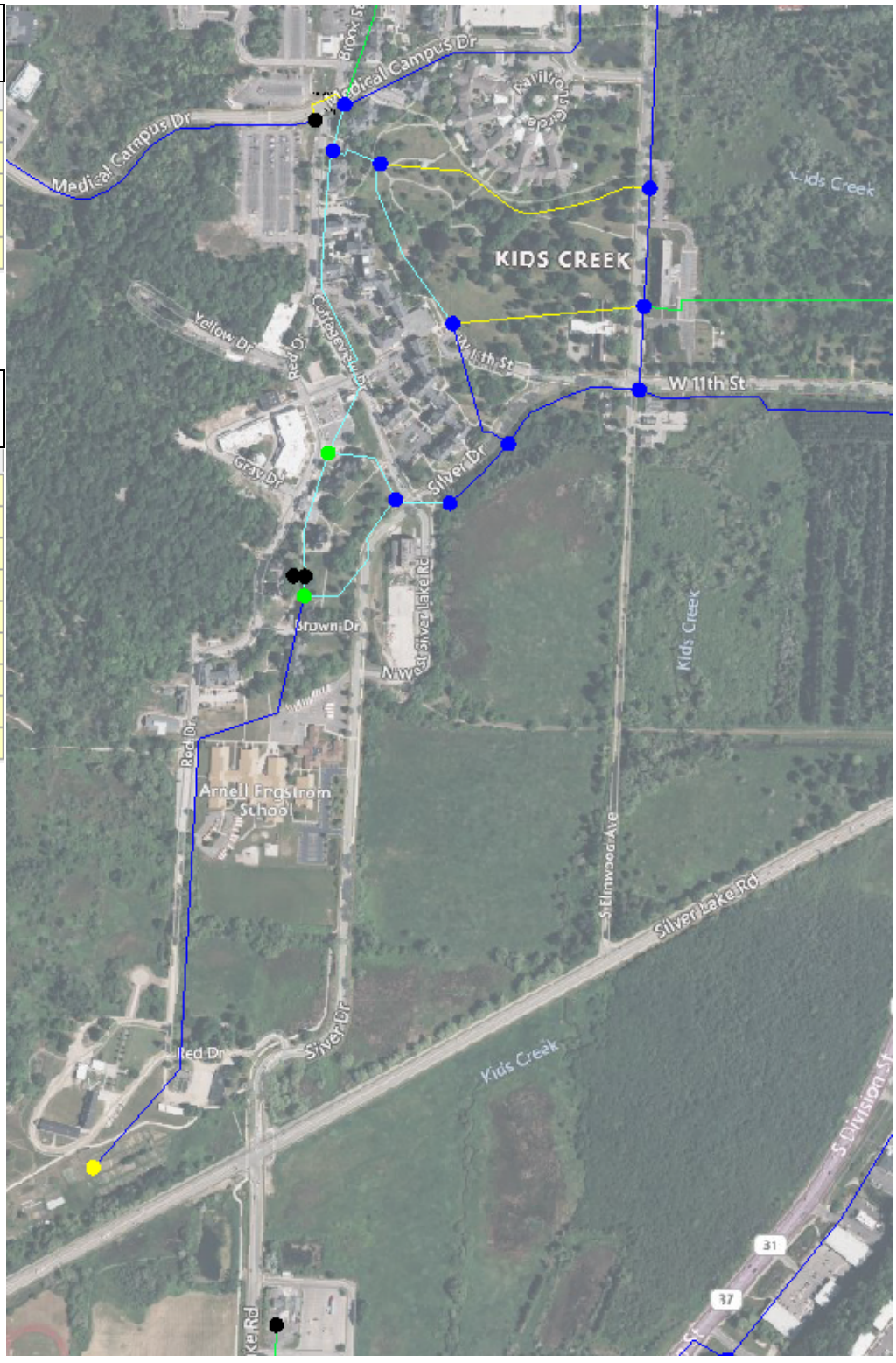
Appendix B-9 Fire Flow, Pressure District Isolation & Water Main Upsizing

Available Fire Flow (GPM)

		Value
	<=	500
	<=	1,000
	<=	1,500
	<=	2,000
	<=	Other

Pipe DI (Inch)

		Value
	<=	4.0
	<=	6.0
	<=	8.0
	<=	10.0
	<=	12.0
	<=	16.0
	<=	24.0
	<=	30.0
	<=	Other



Appendix B-10 Fire Flow, All System Recommendations

Available Fire Flow (GPM)

		Value
	<=	500
	<=	1,000
	<=	1,500
	<=	2,000
	<=	Other

Pipe DI (Inch)

		Value
	<=	4.0
	<=	6.0
	<=	8.0
	<=	10.0
	<=	12.0
	<=	16.0
	<=	24.0
	<=	30.0
	<=	Other

Appendix C —Storm System Figures

Appendix C-1 Storm Manhole Inspections and Improvement plan

Manhole ID	Inspection Status	Overall Condition	Recommended Improvements
STM-163001	Descent Inspection	Fair	
STM-163002	Descent Inspection	Fair	
STM-163003	Descent Inspection	Fair	
STM-193002	Descent Inspection	Fair	
STM-193003	Descent Inspection	Fair	
STM-193004	Descent Inspection	Poor	abandoned
STM-193005	Not Found		
STM-193006	Not Found		
STM-193007	Not Found		
STM-193008	Descent Inspection	Fair	
STM-193009	Descent Inspection	Fair	
STM-193010	Descent Inspection	Fair	
STM-193011	Descent Inspection	Fair	
STM-193012	Descent Inspection	Fair	
STM-193013	Descent Inspection	Fair	
STM-193014	No Access		
STM-193015	No Access		
STM-193016	Descent Inspection	Poor	cover cracked needs replaced
STM-193017	Descent Inspection	Fair	
STM-193018	Descent Inspection	Fair	
STM-193019	Descent Inspection	Fair	
STM-193020	Descent Inspection	Fair	
STM-193021	Descent Inspection	Other	
STM-193022	Descent Inspection	Other	
STM-193023	Descent Inspection	Other	
STM-193024	Descent Inspection	Other	
STM-193025	Descent Inspection	Other	
STM-193026	Descent Inspection	Other	
STM-193027	Descent Inspection	Fair	
STM-193028	Surface Inspection		
STM-193029	Descent Inspection	Fair	
CB-2701	SD	Fair	needs cleaned
CB-2702	SD	Fair	needs cleaned
CB-2703	SD	Fair	
CB-2704	SD	Fair	needs cleaned
CB-2705	SD	Fair	needs cleaned
CB-2706	SD	Fair	needs cleaned
CB-2697	Descent Inspection	Fair	
CB-2699	SD	Other	
CB-2707	SD	Fair	debris
CB-2710	SD	Other	full of debris

CB-2713	Descent Inspection	Other	debris
CB-2715	Descent Inspection	Fair	
CB-2716	Descent Inspection	Fair	
CB-2717	Descent Inspection	Fair	
CB-2718	Descent Inspection	Fair	
CB-2719	Descent Inspection	Fair	
CB-2720	Descent Inspection	Fair	
CB-2730	SD	Poor	filled with debris needs new cover
CB-2731	Not Inspected		
CB-2732	Not Found		
CB-2733	SD	Poor	filled with debris
CB-2734	Not Found		
CB-2735	Descent Inspection	Fair	
CB-2736	Descent Inspection	Fair	
CB-2737	Descent Inspection	Fair	
CB-2738	Not Found		
CB-2739	Descent Inspection	Fair	
TRT-17	SD	Fair	needs cleaned, lots of debris
TRT-18	SD	Fair	needs cleaned out
TRT-19	Descent Inspection	Fair	
TRT-20	Descent Inspection	Fair	
TRT-21	Descent Inspection	Fair	
CB-2740	Descent Inspection	Fair	
CB-2741	Descent Inspection	Fair	
CB-2742	Descent Inspection	Fair	
CB-2743	Descent Inspection	Fair	
CB-2744	Descent Inspection	Fair	
CB-2745	Descent Inspection	Fair	
CB-2746	Descent Inspection	Fair	
CB-2747	Surface Inspection	Fair	
CB-2748	Descent Inspection	Fair	
CB-2749	Descent Inspection	Fair	
CB-2750	Descent Inspection	Fair	
CB-2751	Descent Inspection	Fair	
CB-2752	Descent Inspection	Fair	
CB-2753	Descent Inspection	Fair	
CB-2754	Descent Inspection	Fair	
CB-2755	Descent Inspection	Fair	
CB-2756	Descent Inspection	Poor	grate is partially there
CB-2728	Descent Inspection	Fair	
CB-2729	Descent Inspection	Fair	
CB-2759	Surface Inspection	Poor	plugged up with debris
CB-2760	Descent Inspection	Fair	
CB-2761	Descent Inspection	Fair	
CB-2762	Descent Inspection	Fair	
CB-2763	Descent Inspection	Fair	
CB-2764	Descent Inspection	Fair	

CB-2765	Descent Inspection	Fair	
CB-2766	Descent Inspection	Fair	surcharge
CB-2767	Descent Inspection	Fair	
CB-2768	Descent Inspection	Fair	
CB-2769	Surface Inspection	Fair	
CB-2770	Descent Inspection	Fair	
CB-2771	Descent Inspection	Fair	
CB-2772	Descent Inspection	Fair	
CB-2773	Descent Inspection	Fair	
CB-2774	Descent Inspection	Fair	
CB-2775	Descent Inspection	Fair	
CB-2776	Surface Inspection	Other	
CB-2777	Descent Inspection	Fair	
CB-2778	Descent Inspection	Fair	

Appendix C-2 CCTV Storm Reports

TV with grading of PACP 7.0 inspection

2 to 1

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
STM1		CI	03/02/2023	08:35:57	Dry - No precipi...

Street	City	Owner
SILVER RD STP4370	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total l (ft)
	DAVE FERRIS	U-1115-07001933	153.700	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		12		Circular	RCP	N		SW

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
1				2			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>STM1_2395_03_02_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 2	
0.0	MWL		Miscellaneous Water Level					5.000					
153.7	AMH		Manhole									Finishing manhole: 1	
			<Complete Inspection>										

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TV with grading of PACP 7.0 inspection

2 to 1

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
STM1		CI	03/02/2023	08:35:57	Dry - No precipi...

Street	City	Owner
SILVER RD STP4370	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	153.700	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		12		Circular	RCP	N		SW

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
1				2			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>STM1_2395_03_02_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

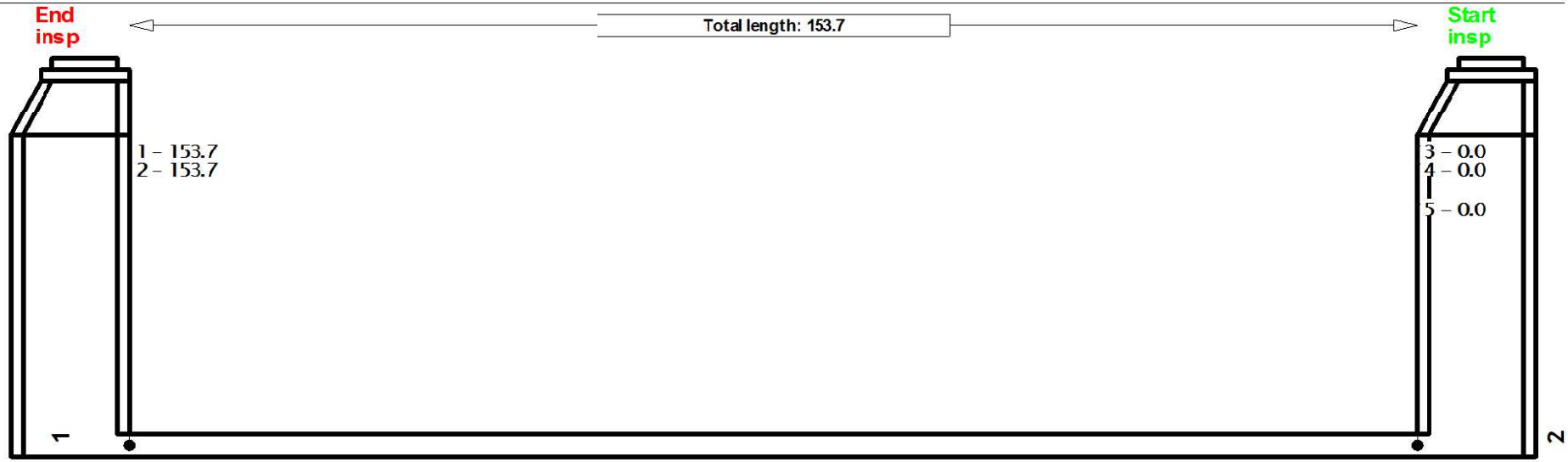
CrossSection of PACP 7.0 inspection

2 to 1

Upstream inspection

PSR	Street	City	Date	Time	Weather
STM1	SILVER RD STP4370	GT COMMONS TRAVERSE CITY MI	03/02/2023	08:35:57	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
12		Circular	RCP	153.700		Complete I...			1	#<dev>STM1_2395_03_02_2023.mpg



1 – 153.7 <Complete Inspection inspection> at 08:41:23
2 – 153.7 Manhole
Finishing manhole: 1
3 – 0.0 Miscellaneous Water Level 5.000%
4 – 0.0 Manhole
Starting manhole: 2
5 – 0.0 <Start inspection> at 08:35:57

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

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www.trio-vision.com

PlanView of PACP 7.0 inspection

2 to 1

Upstream inspection

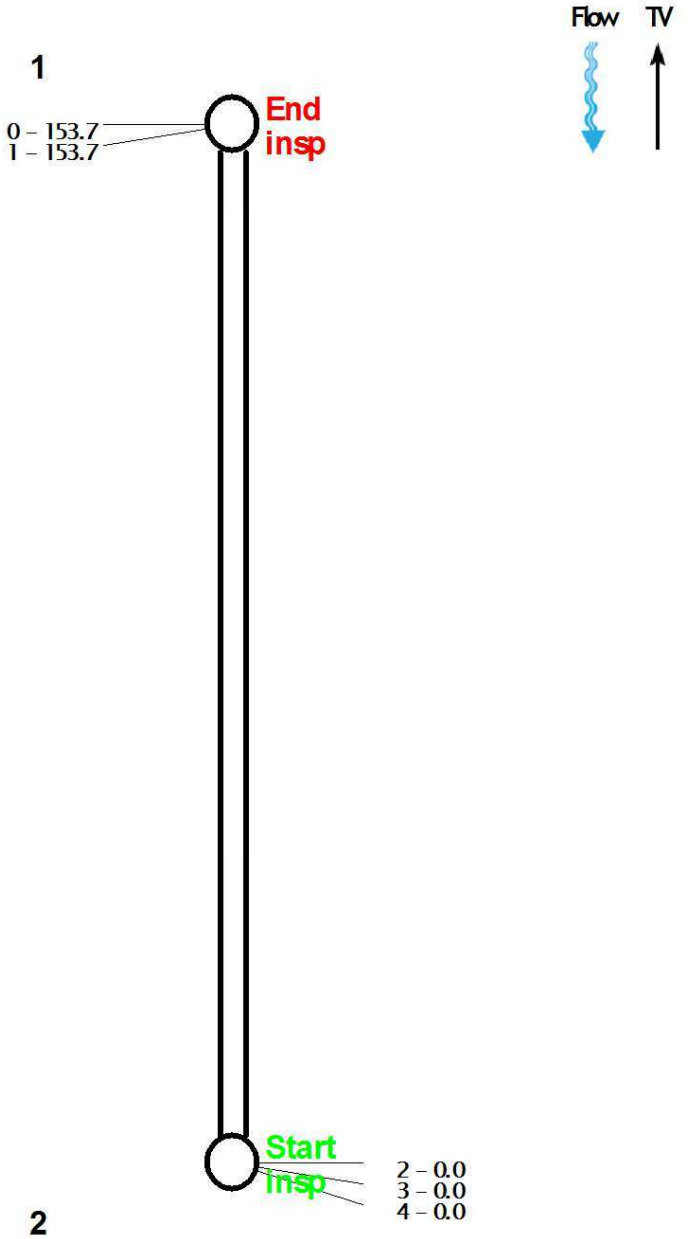
PSR	Street	City
STM1	SILVER RD STP4370	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
03/02/2023	08:35:57	Dry - No precip...	12		Circular	Reinforc...	153.700		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>STM1_2395_03_02_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 153.7 <Complete Inspection inspection> at 08:41...
1 – 153.7 Manhole
Finishing manhole: 1
2 – 0.0 Miscellaneous Water Level 5.000 %
3 – 0.0 Manhole
Starting manhole: 2
4 – 0.0 <Start inspection> at 08:35:57



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TV with grading of PACP 7.0 inspection

4 to 5

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
STM4		CI	03/02/2023	10:29:56	Dry - No precipi...

Street	City	Owner
SILVER RD STP4854	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	277.100	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		18		Circular	RCP	N		SW

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
4				5			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>STM4_2396_03_02_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 4	
0.0	MWL		Miscellaneous Water Level					0.000					
8.4	DSC	S01	Deposits Settled Hard/Com...	4	8			25.000		4			
175.4	RTJ		Roots Tap Joint	9				5.000		2	Y		
277.1	DSC	F01	Deposits Settled Hard/Com...	4	8			25.000		4			
277.1	AMH		Manhole									Finishing manhole: 5	
			<Complete Inspection>										

TV with grading of PACP 7.0 inspection

4 to 5

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
STM4		CI	03/02/2023	10:29:56	Dry - No precipi...

Street	City	Owner
SILVER RD STP4854	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	277.100	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		18		Circular	RCP	N		SW

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
4				5			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>STM4_2396_03_02_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	2	0	216	0	218.0	4121	4.0

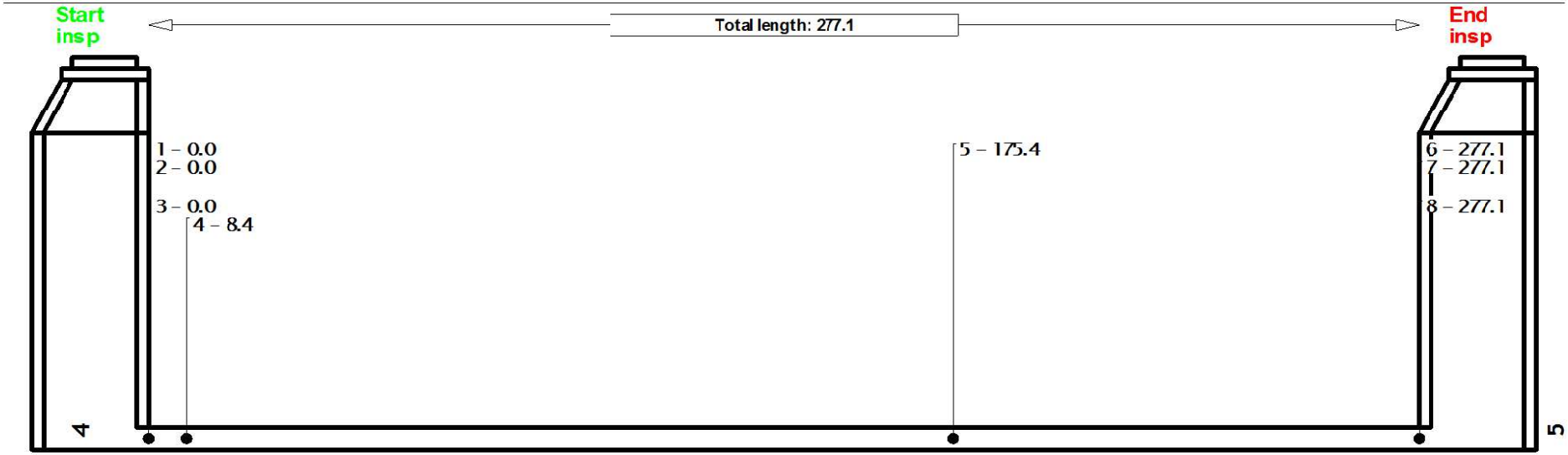
Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	2	0	216	0	218.0	4121	4.0

CrossSection of PACP 7.0 inspection

4 to 5
Downstream inspection

PSR	Street	City	Date	Time	Weather
STM4	SILVER RD STP4854	GT COMMONS TRAVERSE CITY MI	03/02/2023	10:29:56	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
18		Circular	RCP	277.100		Complete I...			1	#<dev>STM4_2396_03_02_2023.mpg



1 – 0.0 <Start inspection> at 10:29:56
2 – 0.0 Manhole
Starting manhole: 4
3 – 0.0 Miscellaneous Water Level 0.000 %
4 – 8.4 Deposits Settled Hard/Compacted 25.000 % At 4 To 8
5 – 175.4 Roots Tap Joint 5.000 % At 9 At Jnt
6 – 277.1 Deposits Settled Hard/Compacted 25.000 % At 4 To 8
7 – 277.1 Manhole
Finishing manhole: 5
8 – 277.1 <Complete Inspection inspection> at 10:40:57

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

4 to 5

Downstream inspection

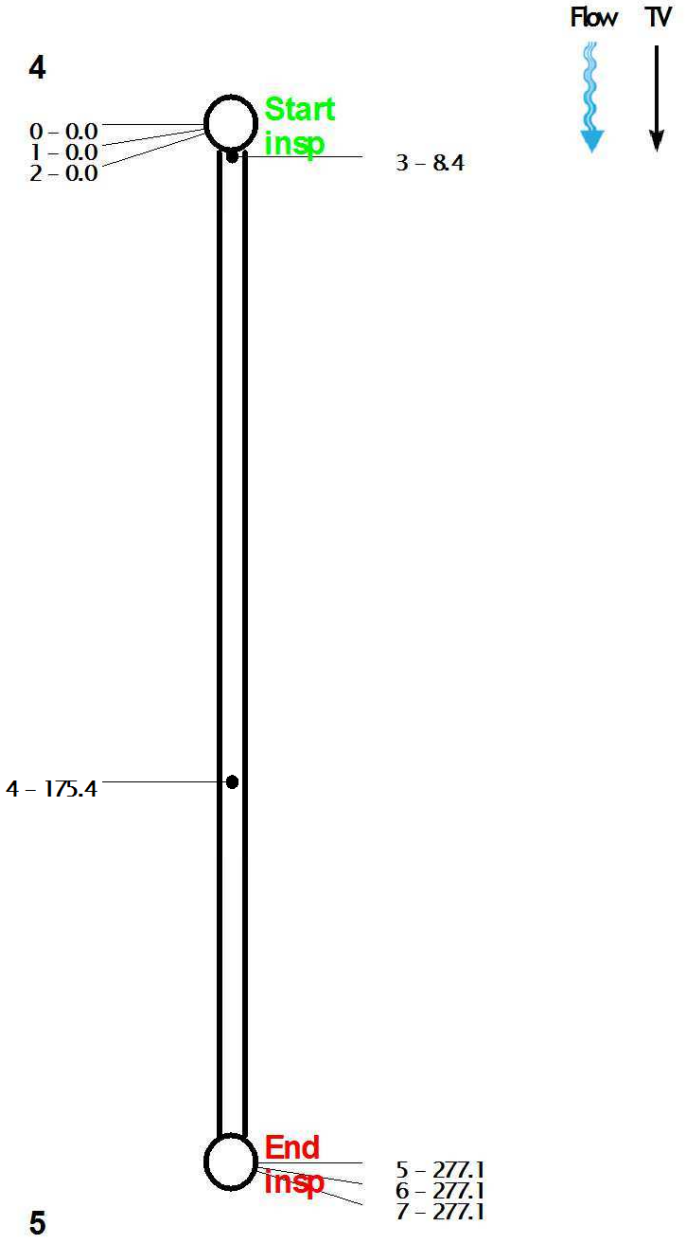
PSR	Street	City
STM4	SILVER RD STP4854	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
03/02/2023	10:29:56	Dry - No precip...	18		Circular	Reinforc...	277.100		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>STM4_2396_03_02_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 0.0 <Start inspection> at 10:29:56
1 – 0.0 Manhole
Starting manhole: 4
2 – 0.0 Miscellaneous Water Level 0.000 %
3 – 8.4 Deposits Settled Hard/Compacted 25.000 % A...
4 – 175.4 Roots Tap Joint 5.000 % At 9 At Jnt
5 – 277.1 Deposits Settled Hard/Compacted 25.000 %...
6 – 277.1 Manhole
Finishing manhole: 5
7 – 277.1 <Complete Inspection inspection> at 10:40...



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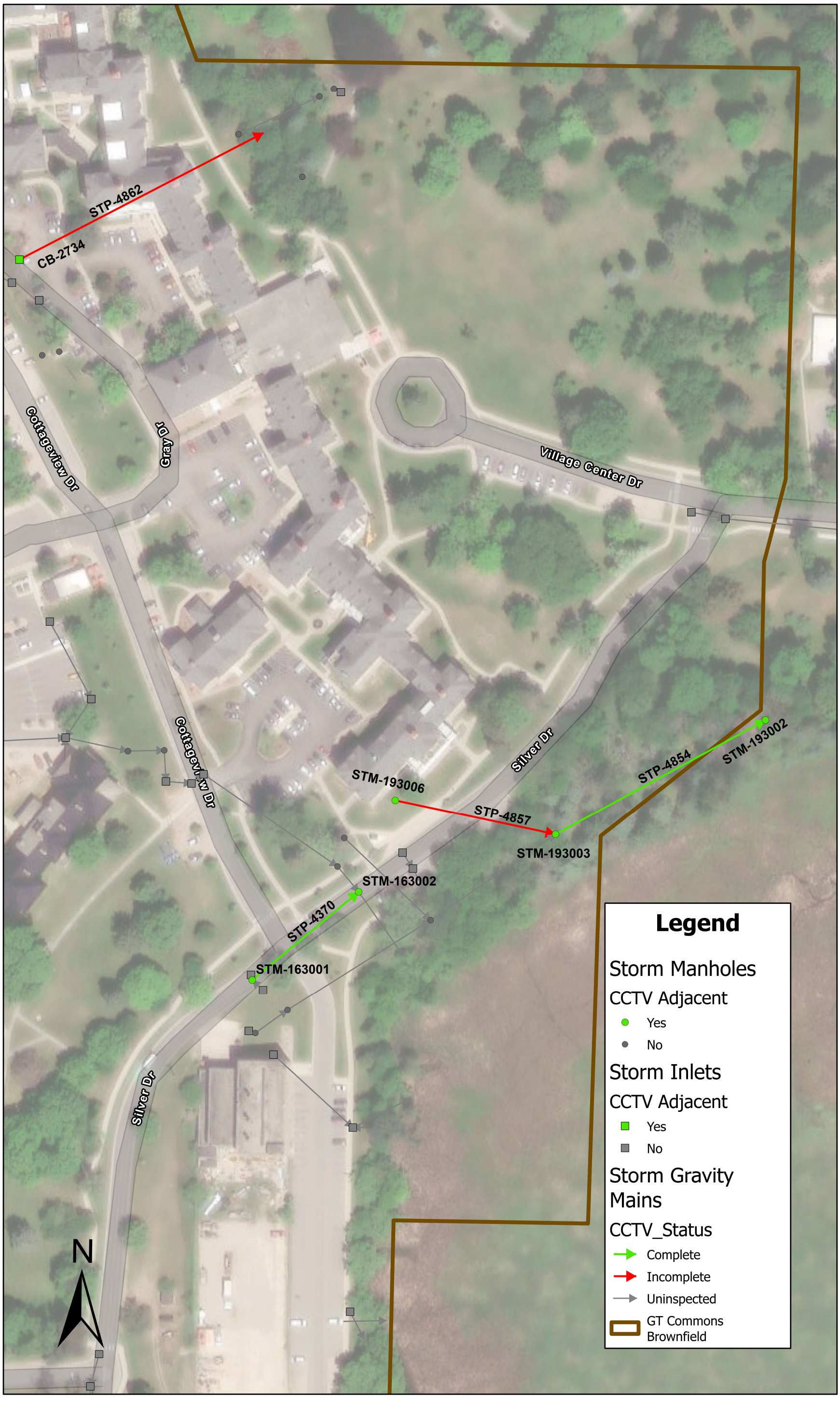
Appendix C-3 CCTV Storm Map

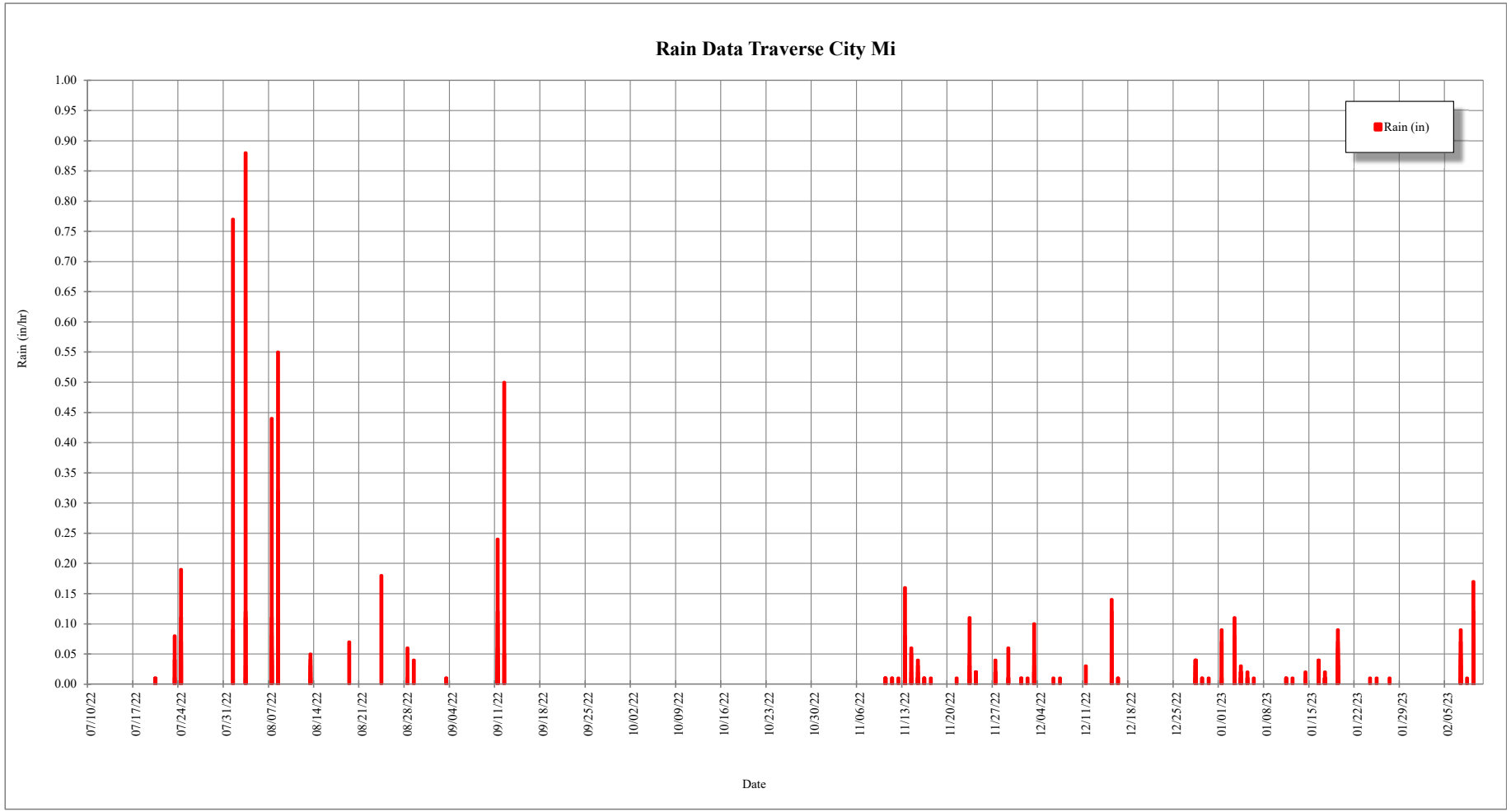
GT Commons Storm Sewer CCTV



Appendix D — Sanitary System Figures

Appendix D-1 Meter and Rain Gauge Location

Appendix D-2 Rain Hyetographs


Rain Data Traverse City Mi
Rain (in/hr)
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Rain (in)
07/10/22
07/17/22
07/24/22
07/31/22
08/07/22
08/14/22
08/21/22
08/28/22
09/04/22
09/11/22
09/18/22
09/25/22
10/02/22
10/09/22
10/16/22
10/23/22
10/30/22
11/06/22
11/13/22
11/20/22
11/27/22
12/04/22
12/11/22
12/18/22
12/25/22
01/01/23
01/08/23
01/15/23
01/22/23
01/29/23
02/05/23
Date

Appendix D-3 NOAA Atlas 14 rainfall table for Traverse City Michigan

Appendix D-3 NOAA Atlas 14 Rainfall Data for Grand Traverse Commons

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	3.32 (2.77-4.01)	3.95 (3.29-4.76)	4.99 (4.14-6.04)	5.87 (4.84-7.12)	7.09 (5.62-8.88)	8.05 (6.20-10.2)	9.04 (6.68-11.7)	10.0 (7.07-13.4)	11.4 (7.66-15.6)	12.4 (8.11-17.2)
10-min	2.44 (2.03-2.93)	2.89 (2.41-3.49)	3.65 (3.03-4.42)	4.30 (3.54-5.21)	5.20 (4.11-6.50)	5.90 (4.54-7.48)	6.61 (4.89-8.59)	7.35 (5.17-9.79)	8.33 (5.60-11.4)	9.10 (5.93-12.6)
15-min	1.98 (1.65-2.38)	2.35 (1.96-2.84)	2.97 (2.46-3.59)	3.49 (2.88-4.24)	4.22 (3.34-5.29)	4.80 (3.69-6.08)	5.38 (3.98-6.98)	5.97 (4.20-7.96)	6.78 (4.56-9.27)	7.39 (4.82-10.3)
30-min	1.41 (1.18-1.70)	1.69 (1.40-2.03)	2.14 (1.77-2.58)	2.52 (2.07-3.05)	3.04 (2.40-3.80)	3.44 (2.65-4.36)	3.85 (2.85-5.00)	4.27 (3.00-5.69)	4.83 (3.24-6.60)	5.25 (3.43-7.29)
60-min	0.928 (0.774-1.12)	1.10 (0.918-1.33)	1.40 (1.16-1.69)	1.65 (1.36-2.00)	2.02 (1.60-2.54)	2.31 (1.78-2.94)	2.62 (1.94-3.41)	2.94 (2.07-3.93)	3.38 (2.27-4.63)	3.72 (2.43-5.17)
2-hr	0.575 (0.484-0.686)	0.680 (0.572-0.812)	0.862 (0.722-1.03)	1.02 (0.851-1.23)	1.26 (1.01-1.58)	1.45 (1.13-1.84)	1.65 (1.24-2.14)	1.87 (1.33-2.49)	2.17 (1.47-2.96)	2.41 (1.58-3.32)
3-hr	0.430 (0.364-0.510)	0.504 (0.426-0.599)	0.637 (0.536-0.759)	0.758 (0.633-0.906)	0.939 (0.760-1.18)	1.09 (0.856-1.38)	1.25 (0.943-1.62)	1.43 (1.02-1.90)	1.68 (1.15-2.29)	1.88 (1.24-2.58)
6-hr	0.258 (0.220-0.303)	0.297 (0.253-0.350)	0.370 (0.314-0.437)	0.439 (0.370-0.520)	0.546 (0.448-0.681)	0.638 (0.506-0.803)	0.738 (0.561-0.950)	0.848 (0.613-1.12)	1.01 (0.695-1.36)	1.14 (0.756-1.55)
12-hr	0.149 (0.129-0.174)	0.169 (0.146-0.197)	0.207 (0.178-0.242)	0.243 (0.207-0.286)	0.300 (0.249-0.372)	0.349 (0.280-0.436)	0.403 (0.310-0.516)	0.463 (0.338-0.608)	0.550 (0.383-0.740)	0.621 (0.417-0.841)
24-hr	0.085 (0.074-0.098)	0.096 (0.083-0.111)	0.116 (0.100-0.134)	0.135 (0.116-0.157)	0.165 (0.138-0.203)	0.192 (0.155-0.237)	0.220 (0.171-0.279)	0.252 (0.186-0.328)	0.298 (0.209-0.398)	0.336 (0.227-0.451)
2-day	0.048 (0.042-0.054)	0.054 (0.047-0.061)	0.065 (0.057-0.074)	0.076 (0.066-0.087)	0.092 (0.078-0.112)	0.106 (0.087-0.130)	0.122 (0.095-0.153)	0.139 (0.103-0.180)	0.164 (0.116-0.217)	0.184 (0.126-0.246)
3-day	0.035 (0.030-0.039)	0.039 (0.034-0.044)	0.047 (0.041-0.053)	0.054 (0.047-0.062)	0.065 (0.055-0.079)	0.075 (0.062-0.092)	0.086 (0.068-0.107)	0.098 (0.073-0.126)	0.115 (0.082-0.152)	0.129 (0.088-0.171)
4-day	0.028 (0.025-0.032)	0.031 (0.028-0.035)	0.037 (0.033-0.042)	0.043 (0.037-0.049)	0.051 (0.044-0.062)	0.059 (0.048-0.071)	0.067 (0.053-0.083)	0.076 (0.057-0.097)	0.089 (0.063-0.117)	0.099 (0.068-0.132)
7-day	0.019 (0.017-0.021)	0.021 (0.019-0.024)	0.025 (0.022-0.028)	0.028 (0.025-0.032)	0.033 (0.028-0.039)	0.037 (0.031-0.045)	0.042 (0.033-0.052)	0.047 (0.035-0.060)	0.054 (0.039-0.071)	0.060 (0.042-0.079)
10-day	0.015 (0.014-0.017)	0.017 (0.015-0.019)	0.020 (0.018-0.022)	0.022 (0.020-0.025)	0.026 (0.022-0.030)	0.029 (0.024-0.034)	0.032 (0.026-0.039)	0.036 (0.027-0.045)	0.040 (0.029-0.052)	0.044 (0.031-0.058)
20-day	0.011 (0.010-0.012)	0.012 (0.010-0.013)	0.013 (0.012-0.015)	0.015 (0.013-0.016)	0.017 (0.015-0.019)	0.019 (0.015-0.022)	0.020 (0.016-0.024)	0.022 (0.017-0.027)	0.024 (0.018-0.031)	0.026 (0.018-0.034)
30-day	0.009 (0.008-0.010)	0.010 (0.009-0.010)	0.011 (0.010-0.012)	0.012 (0.011-0.013)	0.014 (0.012-0.015)	0.015 (0.012-0.017)	0.016 (0.013-0.019)	0.017 (0.013-0.021)	0.019 (0.014-0.024)	0.020 (0.014-0.026)
45-day	0.007 (0.007-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.009-0.011)	0.011 (0.010-0.013)	0.012 (0.010-0.014)	0.013 (0.010-0.015)	0.014 (0.010-0.017)	0.015 (0.011-0.018)	0.015 (0.011-0.020)
60-day	0.006 (0.006-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.009)	0.010 (0.008-0.011)	0.010 (0.009-0.012)	0.011 (0.009-0.013)	0.012 (0.009-0.014)	0.012 (0.009-0.016)	0.013 (0.009-0.017)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

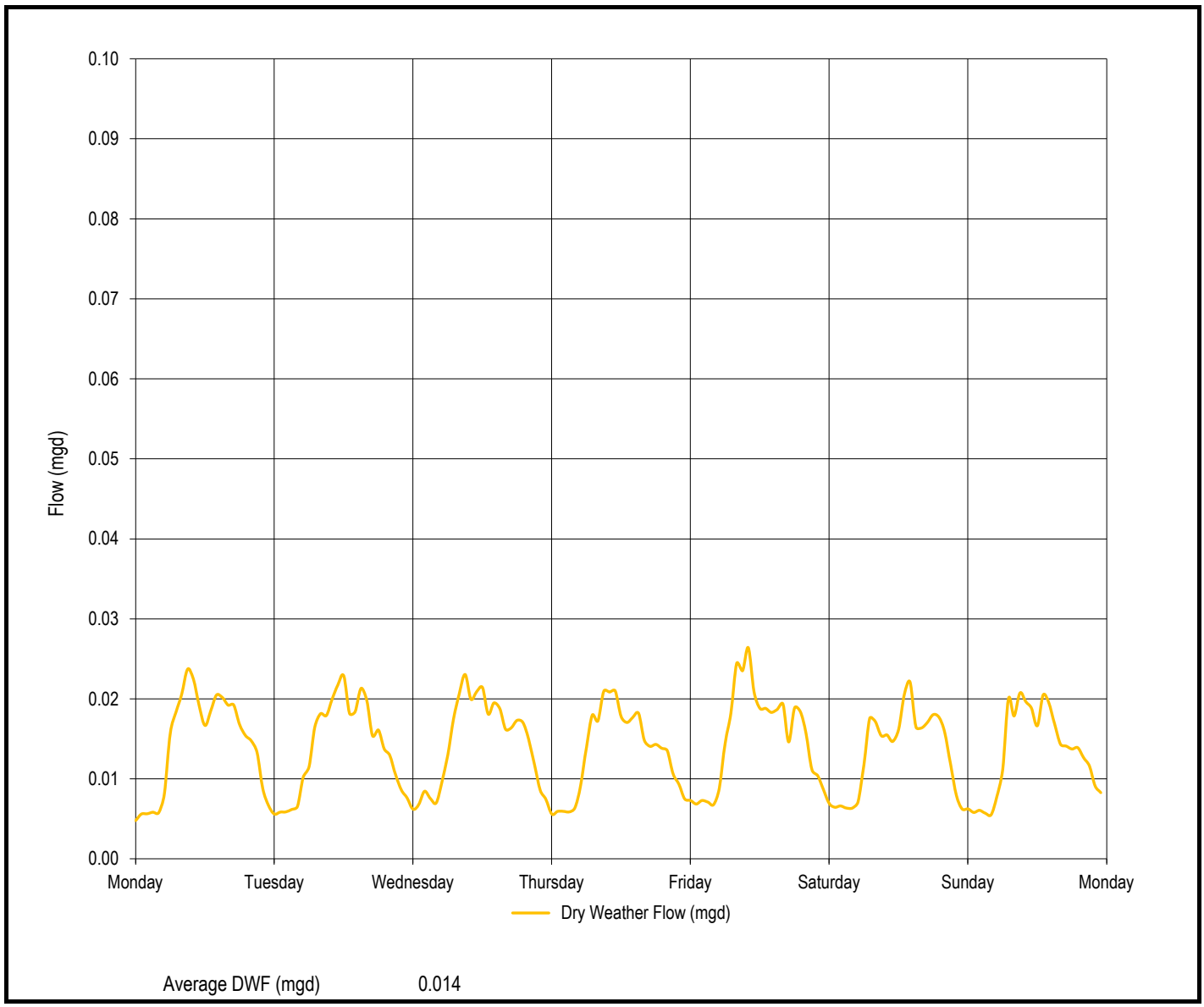
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Appendix D-4 Dry Weather Flow Hydrographs

Grand Traverse Commons - Dry Weather Flow

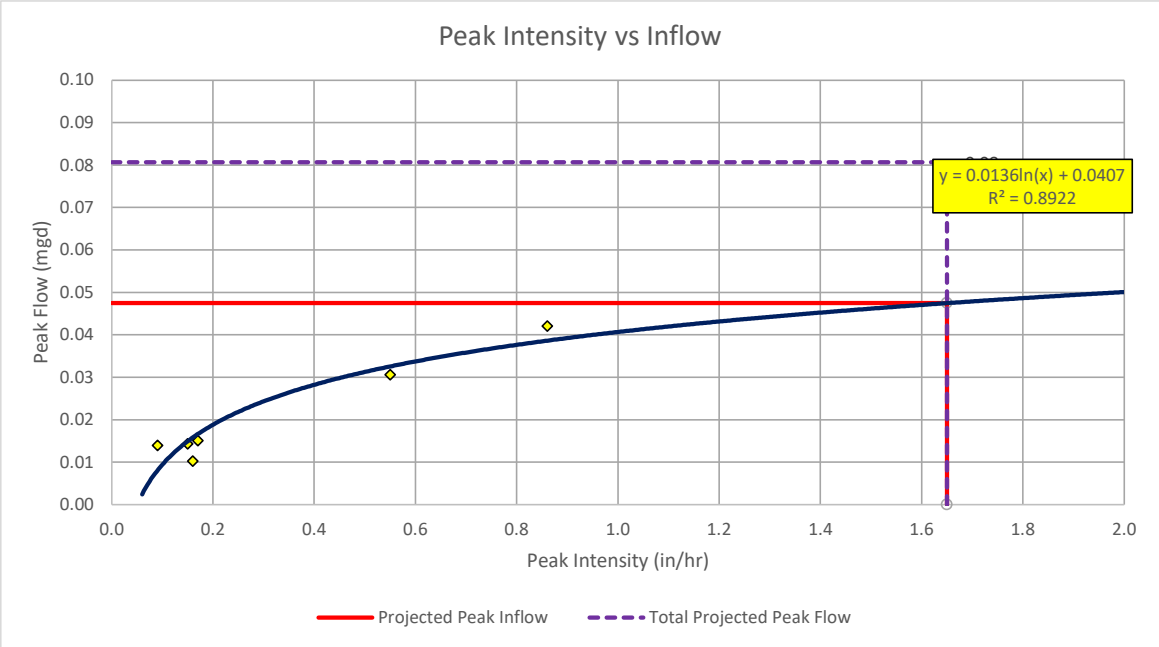
City of Traverse City
I/I Study



Average DWF (mgd) 0.014

Appendix D-5 RDII

Commons - 10-Year, 1-Hour Projected Peak Flow
Grand Traverse Commons
Sewer Capacity Evaluation



Event #	Date	Peak I	Total	Duration	Inflow (mgd)
1	8/1/2022	0.86	0.86	1	0.042
2	8/8/2022	0.55	0.97	2.5	0.031
3	11/13/2022	0.16	0.33	4	0.010
4	12/15/2022	0.17	0.33	3	0.015
5	1/3/2023	0.15	0.22	2.5	0.014
6	1/19/2023	0.09	0.43	8.5	0.014
7	2/7/2023	0.14	0.29	3.5	0.018
8	2/9/2023	0.18	0.54	5.5	0.022
9					
10					
11					
12					
13					
14					
15					
16					

Meter Name	SSM-1651	
Tributary Districts		
Meter District		
Pipe Size (in)	10	
Total Upstream Area (ac)		
Peak Hour Dry Weather Flow	0.033	mgd
(Projected Peak Hour Intensity	1.65	in/hr)
10-yr Projected Peak Inflow	0.05	mgd
Total Projected Peak Flow	0.08	mgd
Inch-miles	0.83	
RDII (gpd/inch-mile)	57242	
Approximate Population	400	pop
Inflow (gpcd)	118.8	gpcd
District	does NOT have excessive Infiltration	
Approximate Dry Weather Flow	0.01	mgd
Infiltration (gpcd)	33.5	gpcd
District	does NOT have excessive Infiltration	

Notes:

Appendix D-6 CCTV Sanitary Reports

TV with grading of PACP 7.0 inspection

4 to 5

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
4		CI	02/27/2023	10:07:52	Dry - No precipi...

Street	City	Owner
SILVER RD SSGM-8236	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	286.700	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		12		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
4				5			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>4_2385_02_27_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 4	
0.0	MWL		Miscellaneous Water Level					15.000					
0.4	FC		Fracture Circumferential	7	5				2				
72.9	JSL		Joint Separated Large						4				
72.9	ISSR		Intruding Sealing Material ...	6	6			0.000		2			
72.9	MMC		Miscellaneous Material Cha...									Material changes TO RCP	
174.1	MWL		Miscellaneous Water Level					25.000					
192.4	MWL		Miscellaneous Water Level					15.000					
234.4	MMC		Miscellaneous Material Cha...									Material changes TO VCP	
286.7	AMH		Manhole									Finishing manhole: 5	
			<Complete Inspection>										

TV with grading of PACP 7.0 inspection

4 to 5

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
4		CI	02/27/2023	10:07:52	Dry - No precipi...

Street	City	Owner
SILVER RD SSGM-8236	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	286.700	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		12		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
4				5			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>4_2385_02_27_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	2	0	4	0	6.0	4121	3.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	2	0	0	0	2.0	2100	2.0

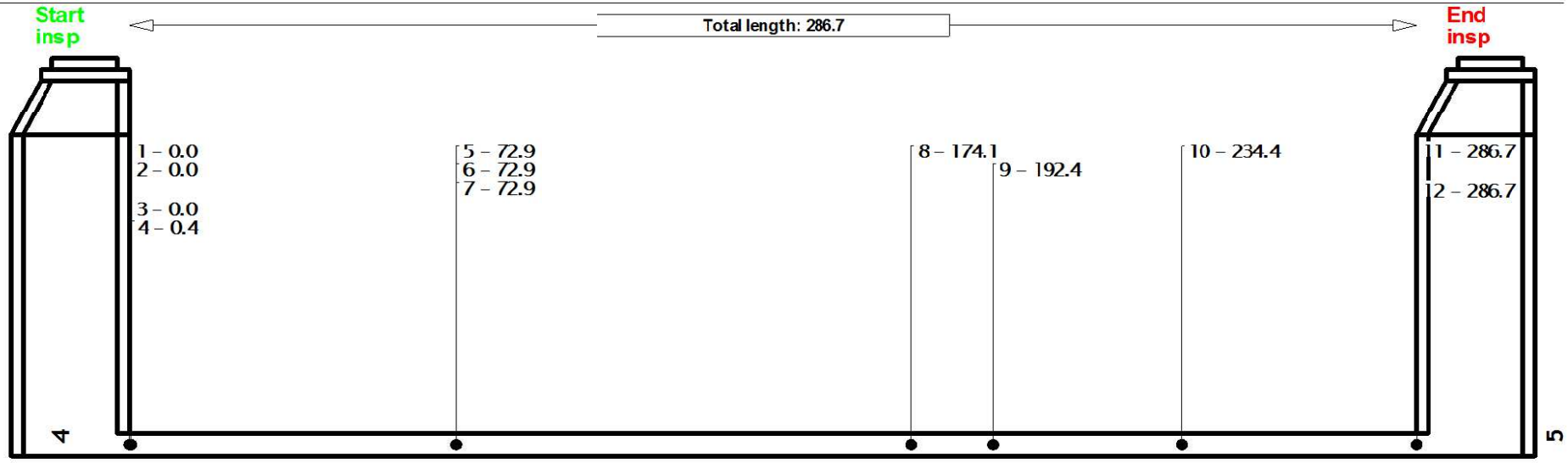
Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	4	0	4	0	8.0	4122	2.7

CrossSection of PACP 7.0 inspection

4 to 5
Downstream inspection

PSR	Street	City	Date	Time	Weather
4	SILVER RD SSGM-8236	GT COMMONS TRAVERSE CITY MI	02/27/2023	10:07:52	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
12		Circular	VCP	286.700		Complete I...			1	#<dev>4_2385_02_27_2023.mpg



1 – 0.0 <Start inspection> at 10:07:52
2 – 0.0 Manhole
Starting manhole: 4
3 – 0.0 Miscellaneous Water Level 15.000%
4 – 0.4 Fracture Circumferential At 7 To 5
5 – 72.9 Joint Separated Large
6 – 72.9 Intruding Sealing Material Ring 0.000% At 6 To 6
7 – 72.9 Miscellaneous Material Change
Material changes TO RCP
8 – 174.1 Miscellaneous Water Level 25.000%
9 – 192.4 Miscellaneous Water Level 15.000%
10 – 234.4 Miscellaneous Material Change
Material changes TO VCP
11 – 286.7 Manhole
Finishing manhole: 5
12 – 286.7 <Complete Inspection inspection> at 10:24:13

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

4 to 5

Downstream inspection

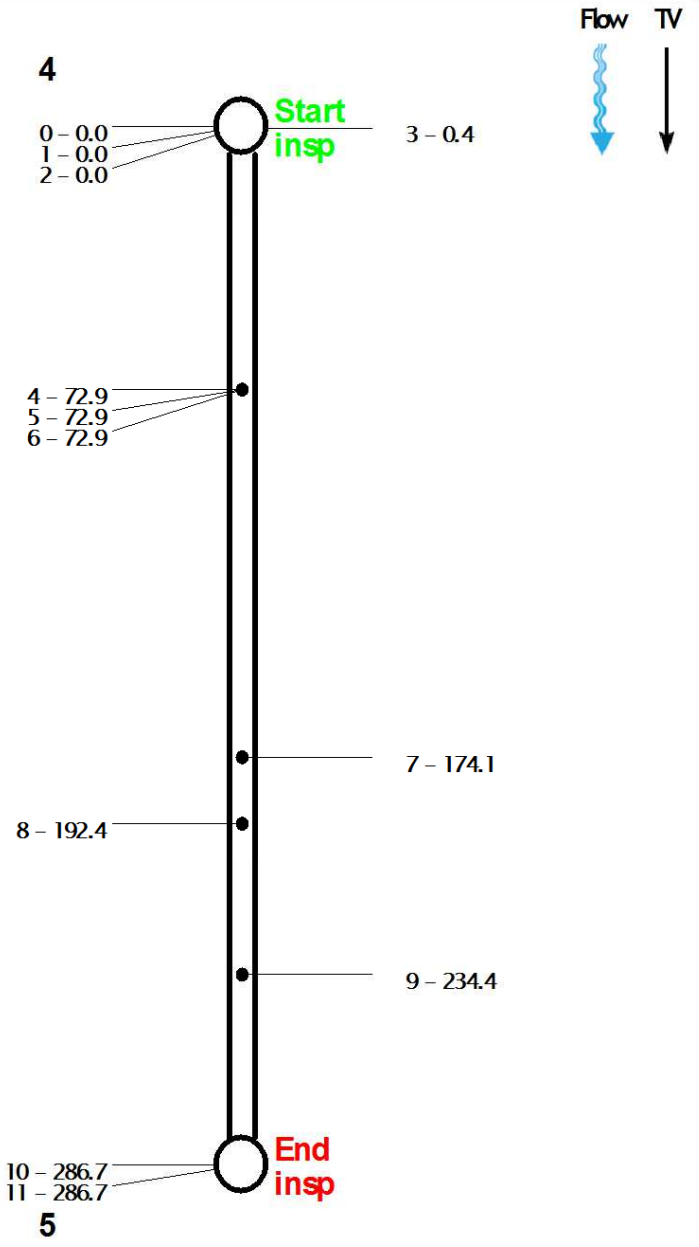
PSR	Street	City
4	SILVER RD SSGM-8236	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
02/27/2023	10:07:52	Dry - No precip...	12		Circular	Vitrified ...	286.700		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>4_2385_02_27_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 0.0 <Start inspection> at 10:07:52
1 – 0.0 Manhole
Starting manhole: 4
2 – 0.0 Miscellaneous Water Level 15.000 %
3 – 0.4 Fracture Circumferential At 7 To 5
4 – 72.9 Joint Separated Large
5 – 72.9 Intruding Sealing Material Ring 0.000 % At 6 ...
6 – 72.9 Miscellaneous Material Change
Material changes TO RCP
7 – 174.1 Miscellaneous Water Level 25.000 %
8 – 192.4 Miscellaneous Water Level 15.000 %
9 – 234.4 Miscellaneous Material Change
Material changes TO VCP
10 – 286.7 Manhole
Finishing manhole: 5
11 – 286.7 <Complete Inspection inspection> at 10:2...



TV with grading of PACP 7.0 inspection

1 to 2

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
2		CI	02/27/2023	09:11:57	Dry - No precipi...

Street	City	Owner
SILVER RD SSGM-8238	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	291.000	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		12		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
2				1			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>2_2384_02_27_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 1	
0.0	MWL		Miscellaneous Water Level					10.000					
6.5	FS		Fracture Spiral	3	6				3				
20.5	JAM		Joint Angular Medium						3				
23.2	MWL		Miscellaneous Water Level					45.000					
37.6	MWL		Miscellaneous Water Level					20.000					
46.0	DSZ	S01	Deposits Settled Other	3	9			30.000		4		DEBRI	
77.8	DSZ	F01	Deposits Settled Other	3	9			30.000		4		DEBRI	
96.8	MWL		Miscellaneous Water Level					10.000					
160.7	MWL		Miscellaneous Water Level					35.000					
291.0	AMH		Manhole									Finishing manhole: 2	
			<Complete Inspection>										

TV with grading of PACP 7.0 inspection

1 to 2

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
2		CI	02/27/2023	09:11:57	Dry - No precipi...

Street	City	Owner
SILVER RD SSGM-8238	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	291.000	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		12		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
2				1			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>2_2384_02_27_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	6	0	0	6.0	3200	3.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	24	0	24.0	4600	4.0

Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	6	24	0	30.0	4632	3.8

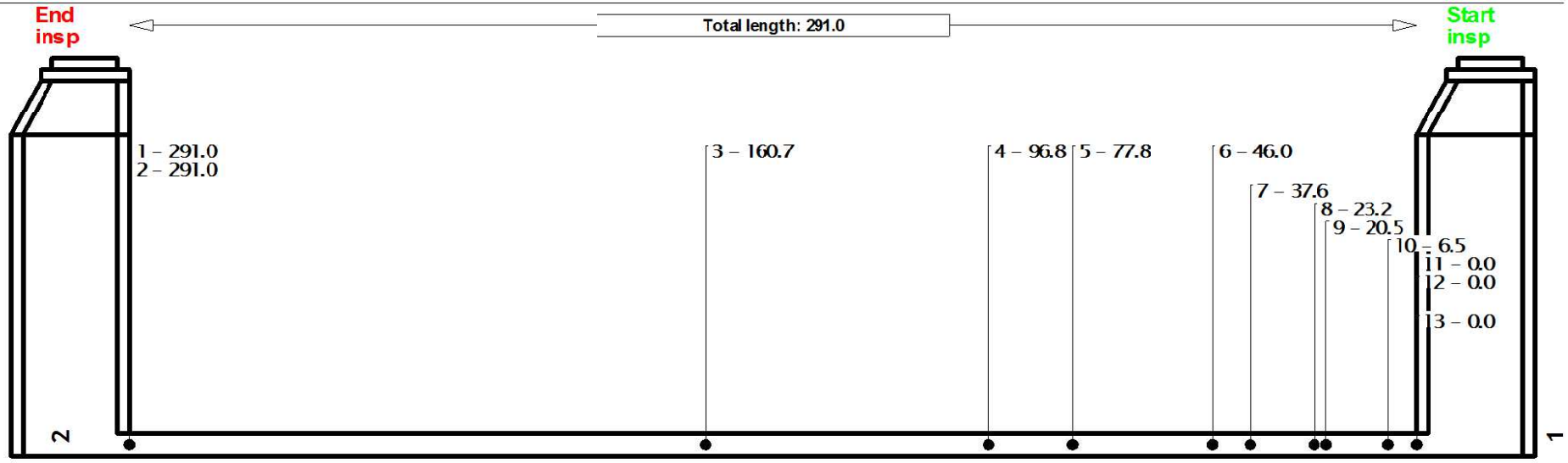
CrossSection of PACP 7.0 inspection

1 to 2

Upstream inspection

PSR	Street	City	Date	Time	Weather
2	SILVER RD SSGM-8238	GT COMMONS TRAVERSE CITY MI	02/27/2023	09:11:57	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
12		Circular	VCP	291.000		Complete I...			1	#<dev>2_2384_02_27_2023.mpg



1 – 291.0 <Complete Inspection inspection> at 09:42:47 13 – 0.0 <Start inspection> at 09:11:57
2 – 291.0 Manhole
Finishing manhole: 2
3 – 160.7 Miscellaneous Water Level 35.000%
4 – 96.8 Miscellaneous Water Level 10.000%
5 – 77.8 Deposits Settled Other 30.000% At 3 To 9
DEBRI
6 – 46.0 Deposits Settled Other 30.000% At 3 To 9
DEBRI
7 – 37.6 Miscellaneous Water Level 20.000%
8 – 23.2 Miscellaneous Water Level 45.000%
9 – 20.5 Joint Angular Medium
10 – 6.5 Fracture Spiral At 3 To 6
11 – 0.0 Miscellaneous Water Level 10.000%
12 – 0.0 Manhole
Starting manhole: 1

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

1 to 2

Upstream inspection

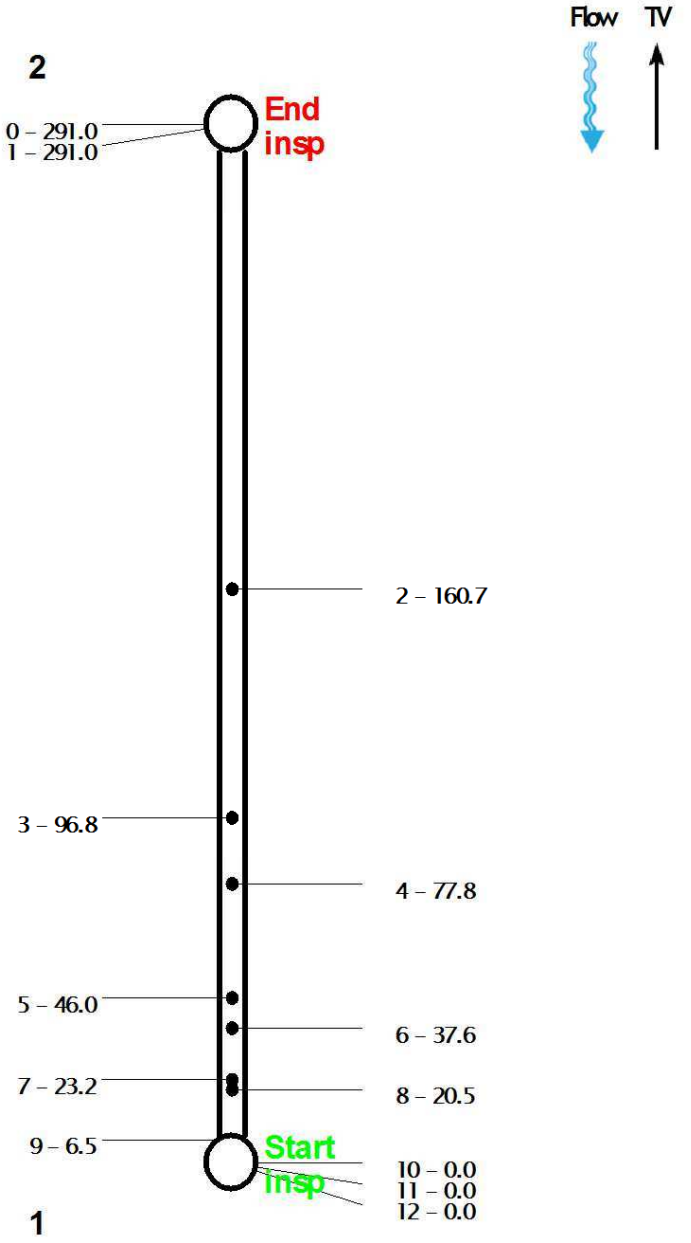
PSR	Street	City
2	SILVER RD SSGM-8238	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
02/27/2023	09:11:57	Dry - No precip...	12		Circular	Vitrified ...	291.000		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>2_2384_02_27_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 291.0 <Complete Inspection inspection> at 09:42...
1 – 291.0 Manhole
Finishing manhole: 2
2 – 160.7 Miscellaneous Water Level 35.000 %
3 – 96.8 Miscellaneous Water Level 10.000 %
4 – 77.8 Deposits Settled Other 30.000 % At 3 To 9 DEBRI
5 – 46.0 Deposits Settled Other 30.000 % At 3 To 9 DEBRI
6 – 37.6 Miscellaneous Water Level 20.000 %
7 – 23.2 Miscellaneous Water Level 45.000 %
8 – 20.5 Joint Angular Medium
9 – 6.5 Fracture Spiral At 3 To 6
10 – 0.0 Miscellaneous Water Level 10.000 %
11 – 0.0 Manhole
Starting manhole: 1
12 – 0.0 <Start inspection> at 09:11:57



trio-vision

AssetDMS Office (PACP+LACP 7.0) 10.1.54
www.trio-vision.com

TV with grading of PACP 7.0 inspection

2 to 1

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
2		CI	02/27/2023	10:31:32	Dry - No precipi...

Street	City	Owner
SILVER RD SSGM-8238	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	290.300	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		12		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
2				1			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>2_2386_02_27_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 2	
0.0	MWL		Miscellaneous Water Level					10.000					
71.4	MWL		Miscellaneous Water Level					30.000					
155.3	MWL		Miscellaneous Water Level					10.000					
270.1	JAM		Joint Angular Medium						3				
285.6	FS		Fracture Spiral	6	9				3		Y		
290.3	AMH		Manhole									Finishing manhole: 1	
			<Complete Inspection>										

trio-vision
AssetDMS Office (PACP+LACP 7.0) 10.1.54
www.trio-vision.com

TV with grading of PACP 7.0 inspection

2 to 1

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
2		CI	02/27/2023	10:31:32	Dry - No precipi...

Street	City	Owner
SILVER RD SSGM-8238	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	290.300	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		12		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
2				1			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>2_2386_02_27_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	6	0	0	6.0	3200	3.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

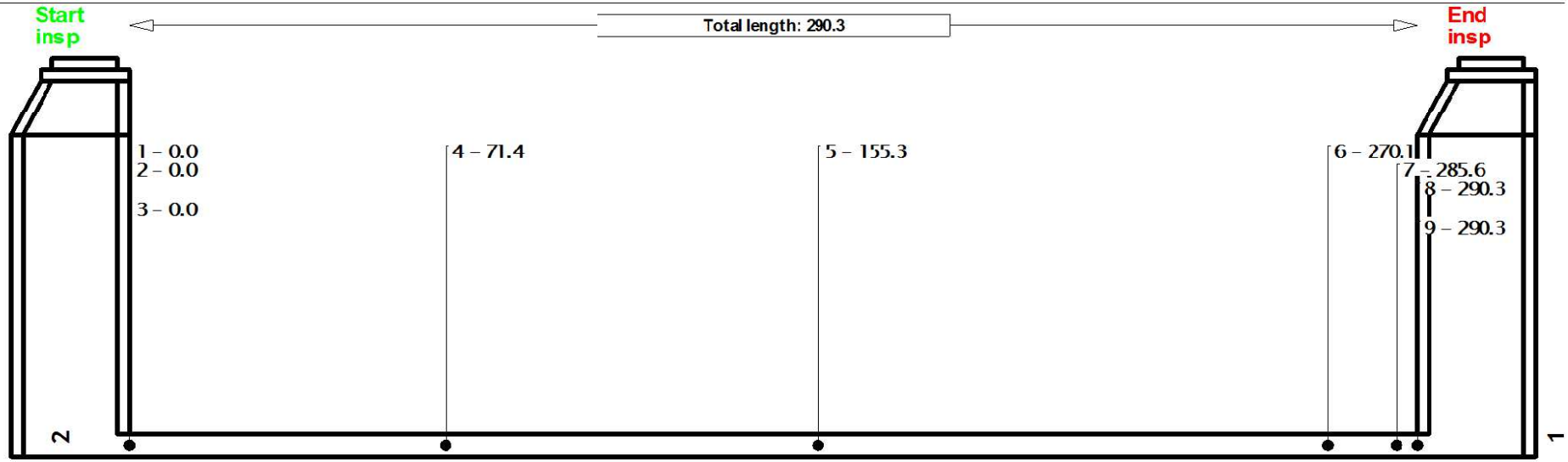
Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	6	0	0	6.0	3200	3.0

CrossSection of PACP 7.0 inspection

2 to 1
Downstream inspection

PSR	Street	City	Date	Time	Weather
2	SILVER RD SSGM-8238	GT COMMONS TRAVERSE CITY MI	02/27/2023	10:31:32	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
12		Circular	VCP	290.300		Complete I...			1	#<dev>2_2386_02_27_2023.mpg



1 – 0.0 <Start inspection> at 10:31:32
2 – 0.0 Manhole
Starting manhole: 2
3 – 0.0 Miscellaneous Water Level 10.000%
4 – 71.4 Miscellaneous Water Level 30.000%
5 – 155.3 Miscellaneous Water Level 10.000%
6 – 270.1 Joint Angular Medium
7 – 285.6 Fracture Spiral At 6 To 9 At Jnt
8 – 290.3 Manhole
Finishing manhole: 1
9 – 290.3 <Complete Inspection inspection> at 10:42:28

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

2 to 1

Downstream inspection

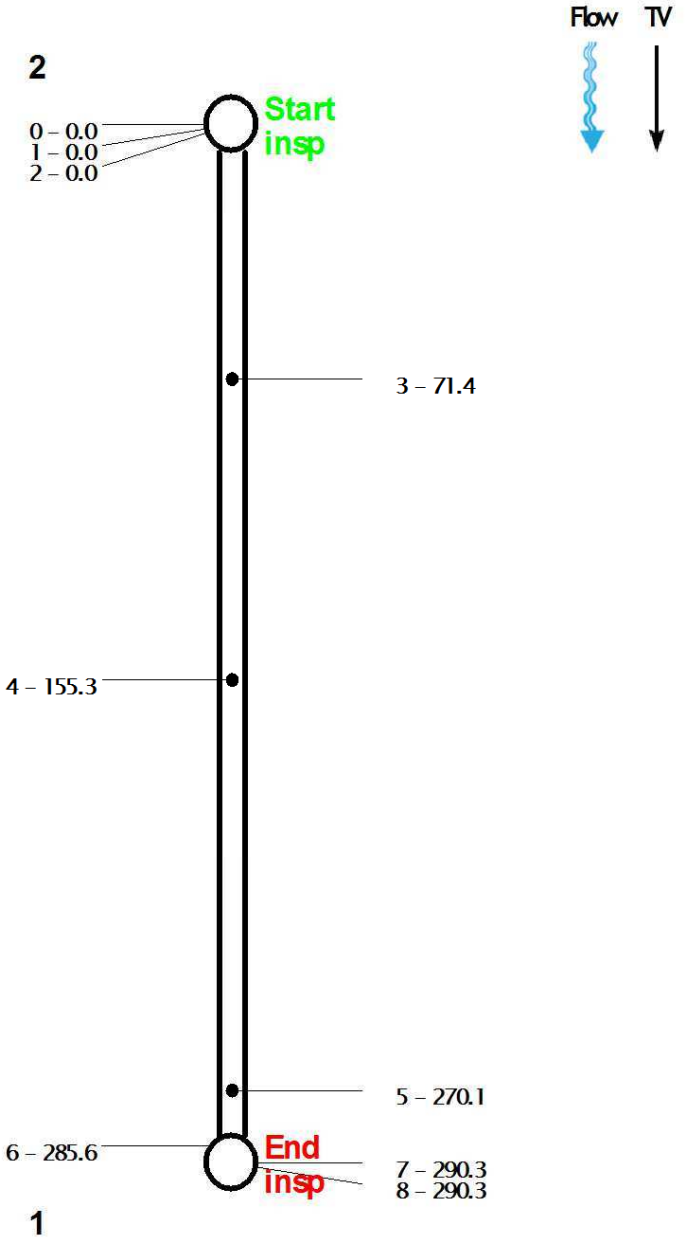
PSR	Street	City
2	SILVER RD SSGM-8238	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
02/27/2023	10:31:32	Dry - No precip...	12		Circular	Vitrified ...	290.300		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>2_2386_02_27_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 0.0 <Start inspection> at 10:31:32
1 – 0.0 Manhole
Starting manhole: 2
2 – 0.0 Miscellaneous Water Level 10.000 %
3 – 71.4 Miscellaneous Water Level 30.000 %
4 – 155.3 Miscellaneous Water Level 10.000 %
5 – 270.1 Joint Angular Medium
6 – 285.6 Fracture Spiral At 6 To 9 At Jnt
7 – 290.3 Manhole
Finishing manhole: 1
8 – 290.3 <Complete Inspection inspection> at 10:42...



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AssetDMS Office (PACP+LACP 7.0) 10.1.54
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TV with grading of PACP 7.0 inspection

7 to 6

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
6		CI	02/27/2023	11:27:50	Dry - No precipi...

Street	City	Owner
ORANGE RD SSGM-10727	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	405.300	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	PVC	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
6				7			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>6_2389_02_27_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 7	
0.0	MWL		Miscellaneous Water Level					5.000					
402.9	DSZ		Deposits Settled Other	4	8			20.000		3		DEBRI	
405.3	AMH		Manhole									Finishing manhole: 6	
			<Complete Inspection>										

TV with grading of PACP 7.0 inspection

7 to 6

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
6		CI	02/27/2023	11:27:50	Dry - No precipi...

Street	City	Owner
ORANGE RD SSGM-10727	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	405.300	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	PVC	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
6				7			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>6_2389_02_27_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	3	0	0	3.0	3100	3.0

Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	3	0	0	3.0	3100	3.0

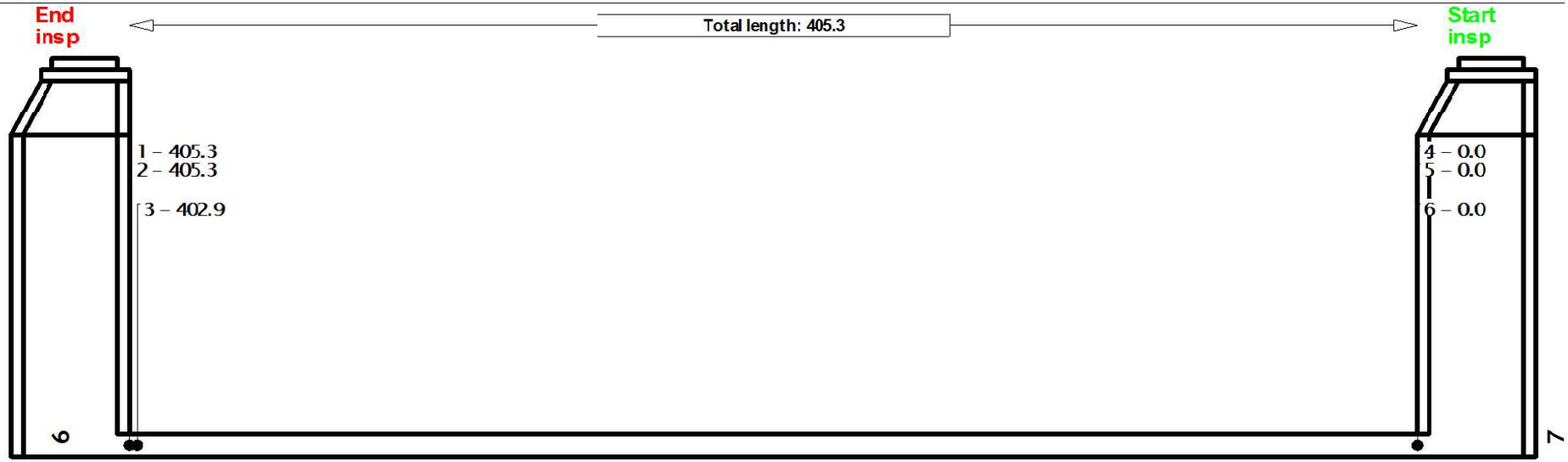
CrossSection of PACP 7.0 inspection

7 to 6

Upstream inspection

PSR	Street	City	Date	Time	Weather
6	ORANGE RD SSGM-10727	GT COMMONS TRAVERSE CITY MI	02/27/2023	11:27:50	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
8		Circular	PVC	405.300		Complete I...			1	#<dev>6_2389_02_27_2023.mpg



1 – 405.3 <Complete Inspection inspection> at 11:46:38
2 – 405.3 Manhole
Finishing manhole: 6
3 – 402.9 Deposits Settled Other 20.000 % At 4 To 8
DEBRI
4 – 0.0 Miscellaneous Water Level 5.000 %
5 – 0.0 Manhole
Starting manhole: 7
6 – 0.0 <Start inspection> at 11:27:50

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

7 to 6

Upstream inspection

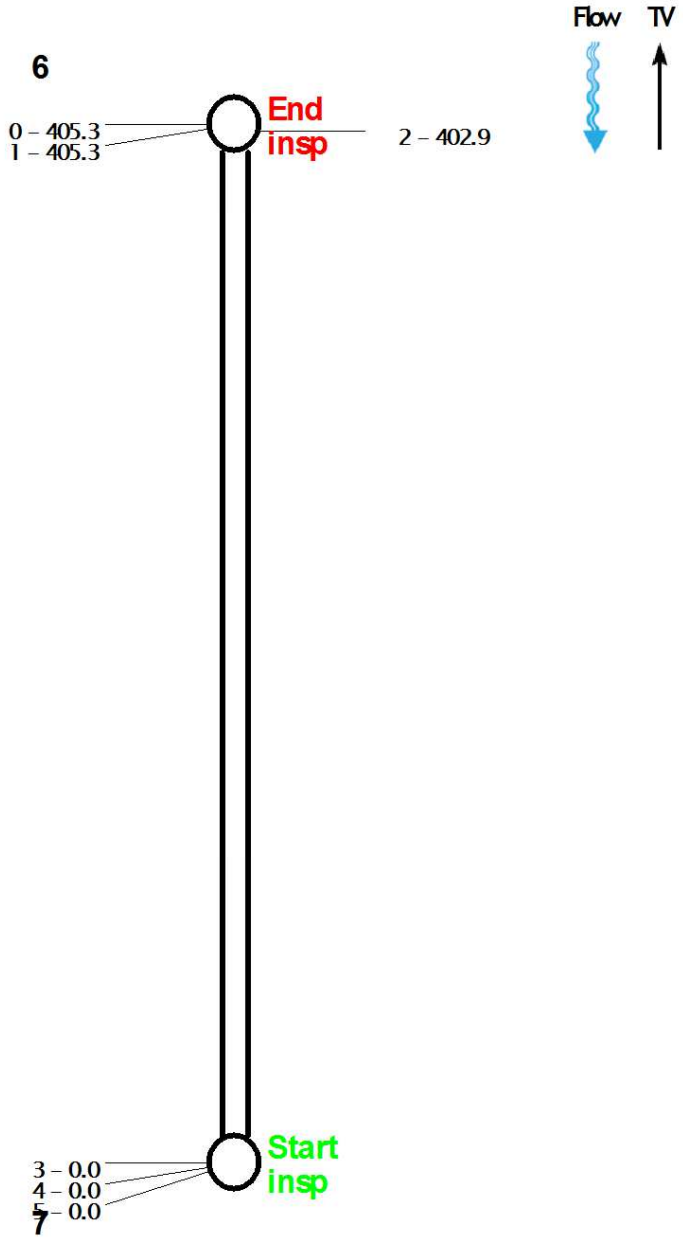
PSR	Street	City
6	ORANGE RD SSGM-10727	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
02/27/2023	11:27:50	Dry - No precip...	8		Circular	Polyvinyl...	405.300		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>6_2389_02_27_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 405.3 <Complete Inspection inspection> at 11:46...
1 – 405.3 Manhole
Finishing manhole: 6
2 – 402.9 Deposits Settled Other 20.000 % At 4 To 8 DEBRI
3 – 0.0 Miscellaneous Water Level 5.000 %
4 – 0.0 Manhole
Starting manhole: 7
5 – 0.0 <Start inspection> at 11:27:50



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TV with grading of PACP 7.0 inspection

12 to 14

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
14		CI	02/27/2023	14:33:15	Dry - No precipi...

Street	City	Owner
COTTAGEVIEW RD SSGM-11720	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	15.400	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		10		Circular	PVC	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
14				12			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>14_2394_02_27_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 1 2	
0.0	MWL		Miscellaneous Water Level					5.000					
11.2	RMJ		Roots Medium Joint	2	10			40.000		3	Y		
15.4	OBZ		Obstruction Other	2	10			65.000		5	Y	ROOTS	
15.4	AEP		Access Point End of Pipe									Finishing manhole: 14	
			<Complete Inspection>										

TV with grading of PACP 7.0 inspection

12 to 14

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
14		CI	02/27/2023	14:33:15	Dry - No precipi...

Street	City	Owner
COTTAGEVIEW RD SSGM-11720	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	15.400	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		10		Circular	PVC	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
14				12			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>14_2394_02_27_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	3	0	5	8.0	5131	4.0

Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	3	0	5	8.0	5131	4.0

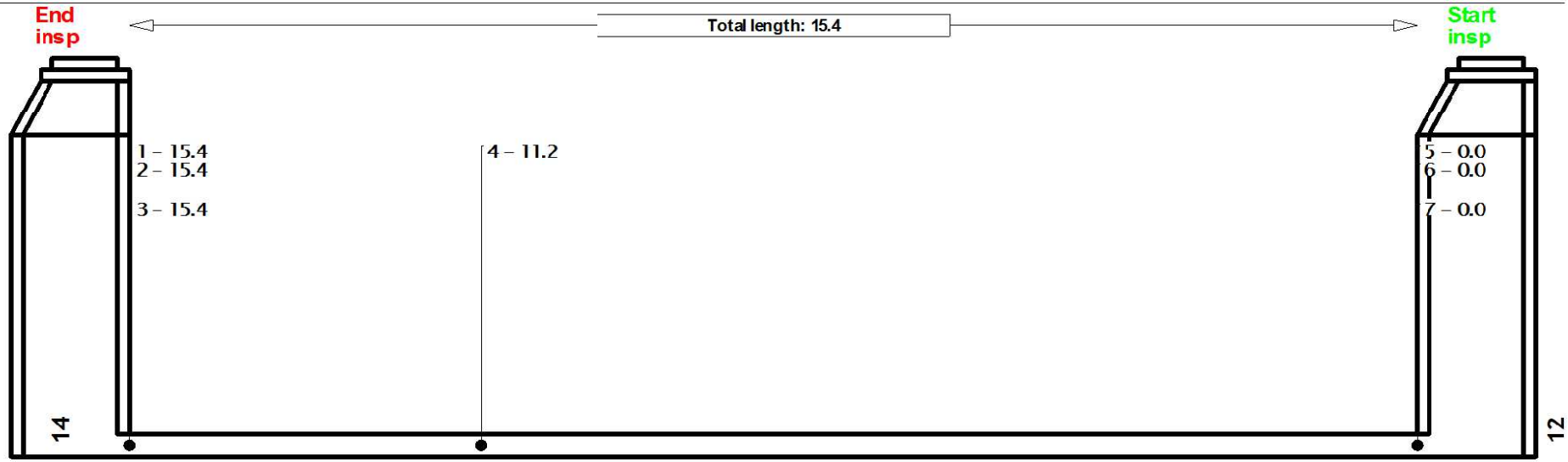
CrossSection of PACP 7.0 inspection

12 to 14

Upstream inspection

PSR	Street	City	Date	Time	Weather
14	COTTAGEVIEW RD SSGM-11720	GT COMMONS TRAVERSE CITY MI	02/27/2023	14:33:15	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
10		Circular	PVC	15.400		Complete I...			1	#<dev>14_2394_02_27_2023.mpg



1 – 15.4 <Complete Inspection inspection> at 14:37:45
2 – 15.4 Access Point End of Pipe
Finishing manhole: 14
3 – 15.4 Obstruction Other 65.000 % At 2 To 10 At Jnt
ROOTS
4 – 11.2 Roots Medium Joint 40.000 % At 2 To 10 At Jnt
5 – 0.0 Miscellaneous Water Level 5.000 %
6 – 0.0 Manhole
Starting manhole: 12
7 – 0.0 <Start inspection> at 14:33:15

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

12 to 14

Upstream inspection

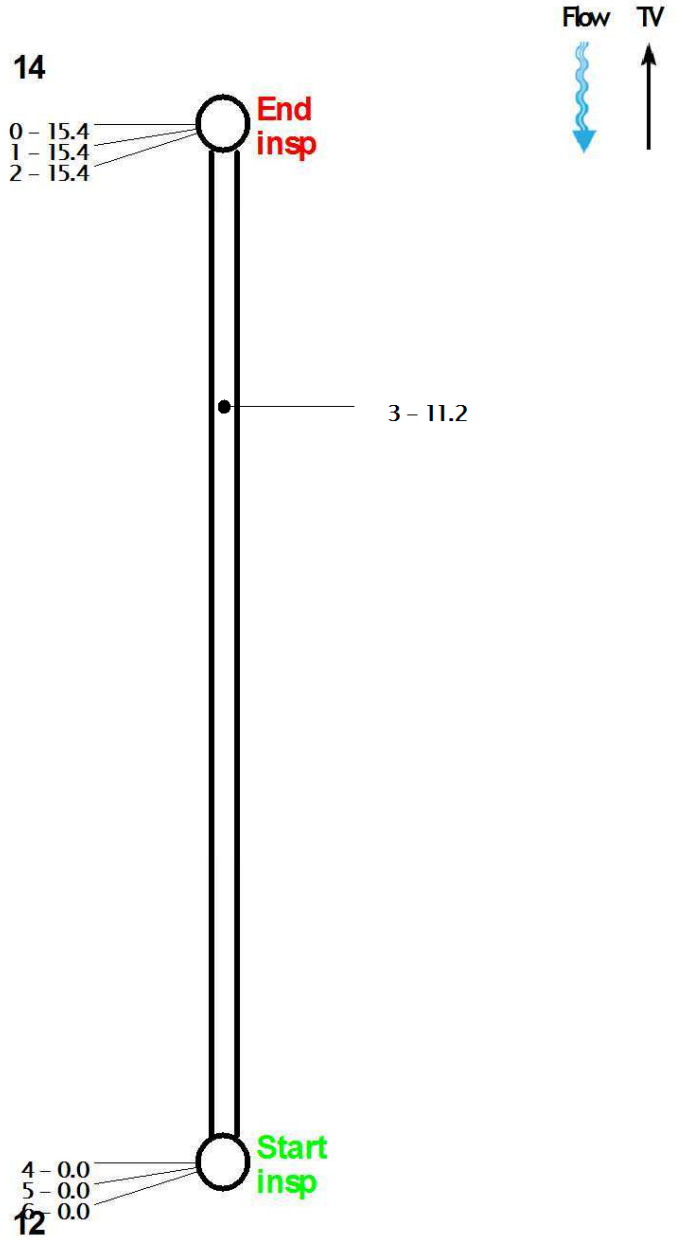
PSR	Street	City
14	COTTAGEVIEW RD SSGM-11720	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
02/27/2023	14:33:15	Dry - No precip...	10		Circular	Polyvinyl...	15.400		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>14_2394_02_27_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 15.4 <Complete Inspection inspection> at 14:37:45
1 – 15.4 Access Point End of Pipe
Finishing manhole: 14
2 – 15.4 Obstruction Other 65.000 % At 2 To 10 At Jnt ROOTS
3 – 11.2 Roots Medium Joint 40.000 % At 2 To 10 At Jnt
4 – 0.0 Miscellaneous Water Level 5.000 %
5 – 0.0 Manhole
Starting manhole: 12
6 – 0.0 <Start inspection> at 14:33:15



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TV with grading of PACP 7.0 inspection

20 to 21

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
21		CI	03/02/2023	11:25:34	Dry - No precipi...

Street	City	Owner
COTTAGEVIEW RD	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	8.000	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
21				20			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>21_2397_03_02_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 2 0	
0.0	MWL		Miscellaneous Water Level					0.000					
6.0	DSF		Deposits Settled Fine	3	9			35.000		5			
8.0	AEP		Access Point End of Pipe									Finishing manhole: 21	
			<Complete Inspection>										

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TV with grading of PACP 7.0 inspection

20 to 21

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
21		CI	03/02/2023	11:25:34	Dry - No precipi...

Street	City	Owner
COTTAGEVIEW RD	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	8.000	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
21				20			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>21_2397_03_02_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	5	5.0	5100	5.0

Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	5	5.0	5100	5.0

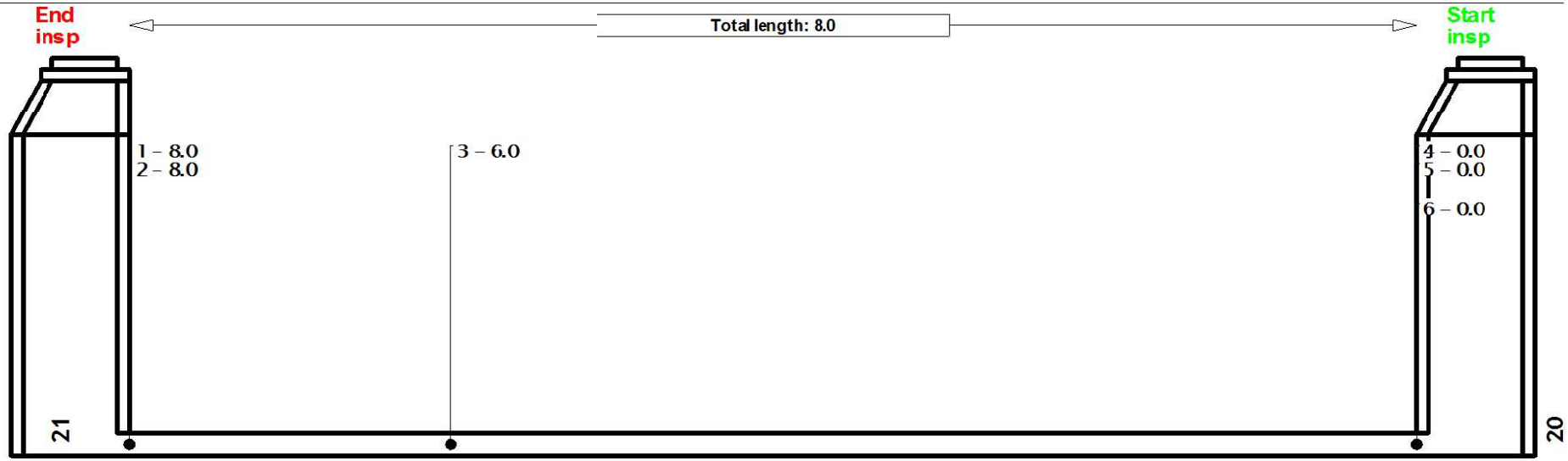
CrossSection of PACP 7.0 inspection

20 to 21

Upstream inspection

PSR	Street	City	Date	Time	Weather
21	COTTAGEVIEW RD	GT COMMONS TRAVERSE CITY MI	03/02/2023	11:25:34	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
8		Circular	VCP	8.000		Complete I...			1	#<dev>21_2397_03_02_2023.mpg



1 – 8.0 <Complete Inspection inspection> at 11:29:54
2 – 8.0 Access Point End of Pipe
Finishing manhole: 21
3 – 6.0 Deposits Settled Fine 35.000% At 3 To 9
4 – 0.0 Miscellaneous Water Level 0.000%
5 – 0.0 Manhole
Starting manhole: 20
6 – 0.0 <Start inspection> at 11:25:34

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

20 to 21

Upstream inspection

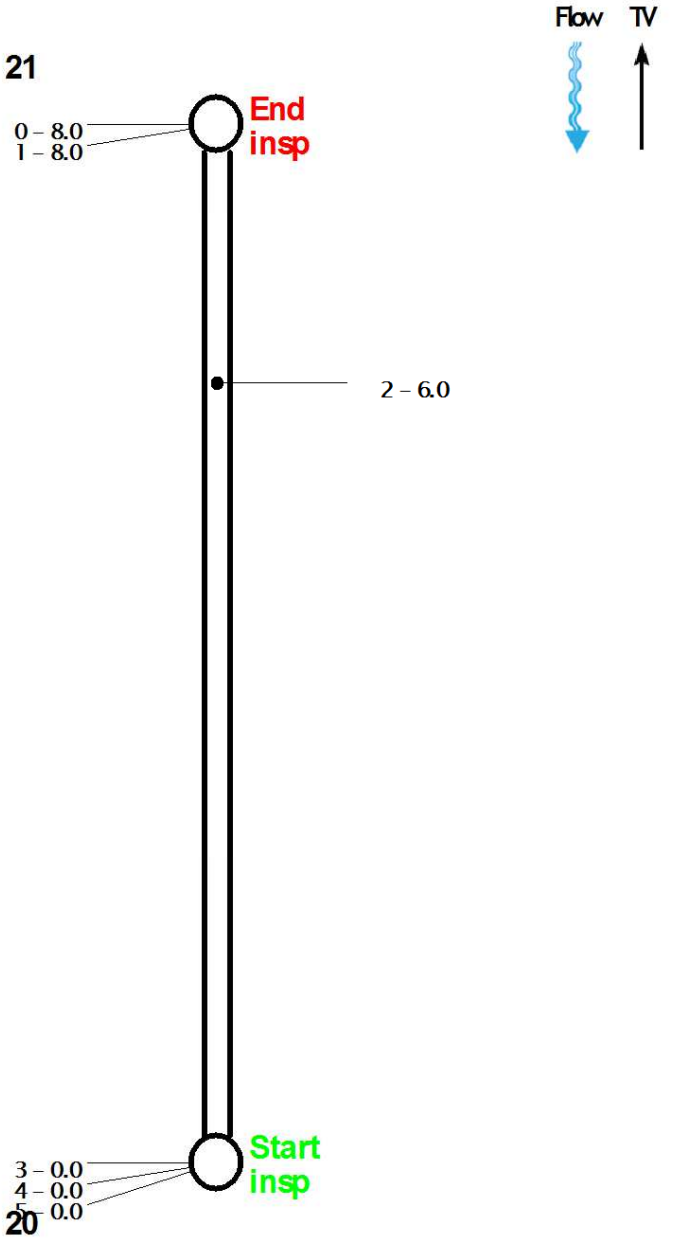
PSR	Street	City
21	COTTAGEVIEW RD	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
03/02/2023	11:25:34	Dry - No precip...	8		Circular	Vitrified ...	8.000		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>21_2397_03_02_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 8.0 <Complete Inspection inspection> at 11:29:54
1 – 8.0 Access Point End of Pipe
Finishing manhole: 21
2 – 6.0 Deposits Settled Fine 35.000 % At 3 To 9
3 – 0.0 Miscellaneous Water Level 0.000 %
4 – 0.0 Manhole
Starting manhole: 20
5 – 0.0 <Start inspection> at 11:25:34



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TV with grading of PACP 7.0 inspection

20 to 15

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
20		CI	03/02/2023	11:38:57	Dry - No precipi...

Street	City	Owner
COTTAGEVIEW RD	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	329.800	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		10		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
20				15			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>20_2398_03_02_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 2 0	
0.0	MWL		Miscellaneous Water Level					5.000					
6.2	B		Broken	11	3				4		Y		
10.6	FC		Fracture Circumferential	3	7				2		Y		
14.4	RFJ		Roots Fine Joint	8	10					1	Y		
16.2	RFJ		Roots Fine Joint	9	3					1	Y		
20.0	RFJ	S01	Roots Fine Joint	7	5					1	Y		
22.3	B		Broken	11	2				4		Y		
50.1	RMJ		Roots Medium Joint	8	4			15.000		3	Y		
148.3	TF		Tap Factory	12		0.000							
148.3	MMC		Miscellaneous Material Cha...									Material changes TO PVC	
190.2	B		Broken	1	5				4				
222.4	TB		Tap Break-in/Hammer	12		0.000							
307.3	RFJ	F01	Roots Fine Joint	7	5					1	Y		
307.3	MWL		Miscellaneous Water Level					50.000					
307.3	DSF	S02	Deposits Settled Fine	4	8			40.000		5			
329.8	DSF	F02	Deposits Settled Fine	4	8			40.000		5			
329.8	AMH		Manhole									Finishing manhole: 15	
			<Complete Inspection>										

TV with grading of PACP 7.0 inspection

20 to 15

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
20		CI	03/02/2023	11:38:57	Dry - No precipi...

Street	City	Owner
COTTAGEVIEW RD	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	329.800	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		10		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
20				15			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>20_2398_03_02_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	2	0	12	0	14.0	4321	3.5

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
59	0	3	0	20	82.0	5431	1.3

Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
59	2	3	12	20	96.0	5443	1.4

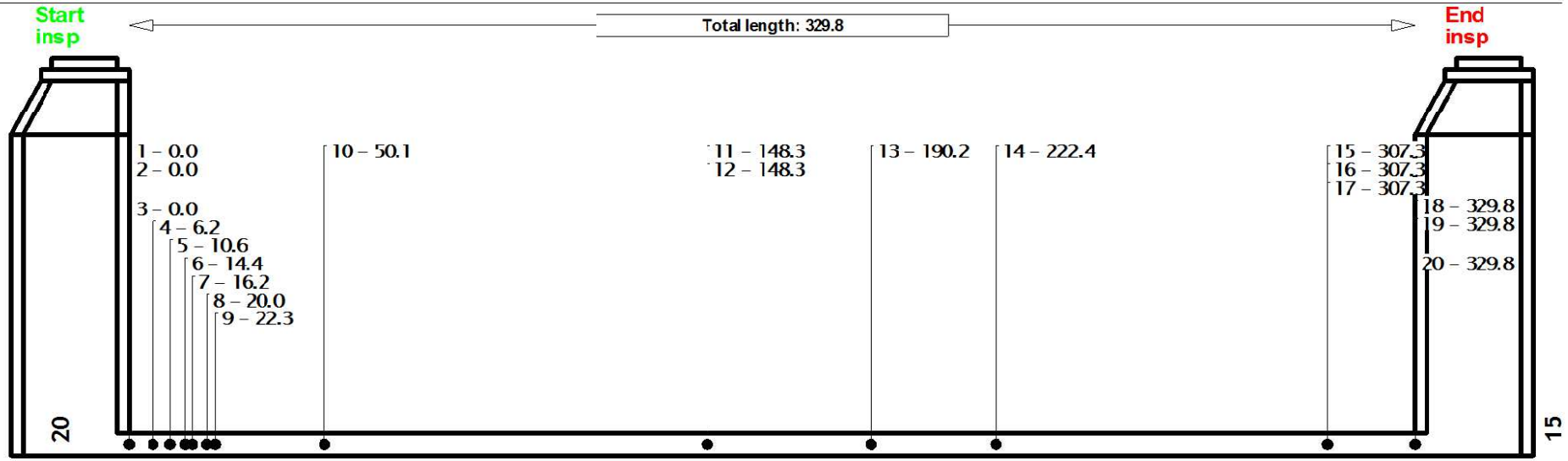
CrossSection of PACP 7.0 inspection

20 to 15

Downstream inspection

PSR	Street	City	Date	Time	Weather
20	COTTAGEVIEW RD	GT COMMONS TRAVERSE CITY MI	03/02/2023	11:38:57	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
10		Circular	VCP	329.800		Complete I...			1	#<dev>20_2398_03_02_2023.mpg



1 – 0.0 <Start inspection> at 11:38:57
2 – 0.0 Manhole
Starting manhole: 20
3 – 0.0 Miscellaneous Water Level 5.000%
4 – 6.2 Broken At 11 To 3 At Jnt
5 – 10.6 Fracture Circumferential At 3 To 7 At Jnt
6 – 14.4 Roots Fine Joint At 8 To 10 At Jnt
7 – 16.2 Roots Fine Joint At 9 To 3 At Jnt
8 – 20.0 Roots Fine Joint At 7 To 5 At Jnt
9 – 22.3 Broken At 11 To 2 At Jnt
10 – 50.1 Roots Medium Joint 15.000% At 8 To 4 At Jnt
11 – 148.3 Tap Factory At 12 Dia 0.000
12 – 148.3 Miscellaneous Material Change
Material changes TO PVC
13 – 190.2 Broken At 1 To 5
14 – 222.4 Tap Break-in/Hammer At 12 Dia 0.000
15 – 307.3 Roots Fine Joint At 7 To 5 At Jnt
16 – 307.3 Miscellaneous Water Level 50.000%
17 – 307.3 Deposits Settled Fine 40.000% At 4 To 8
18 – 329.8 Deposits Settled Fine 40.000% At 4 To 8
19 – 329.8 Manhole
Finishing manhole: 15
20 – 329.8 <Complete Inspection inspection> at 12:19:05

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

20 to 15

Downstream inspection

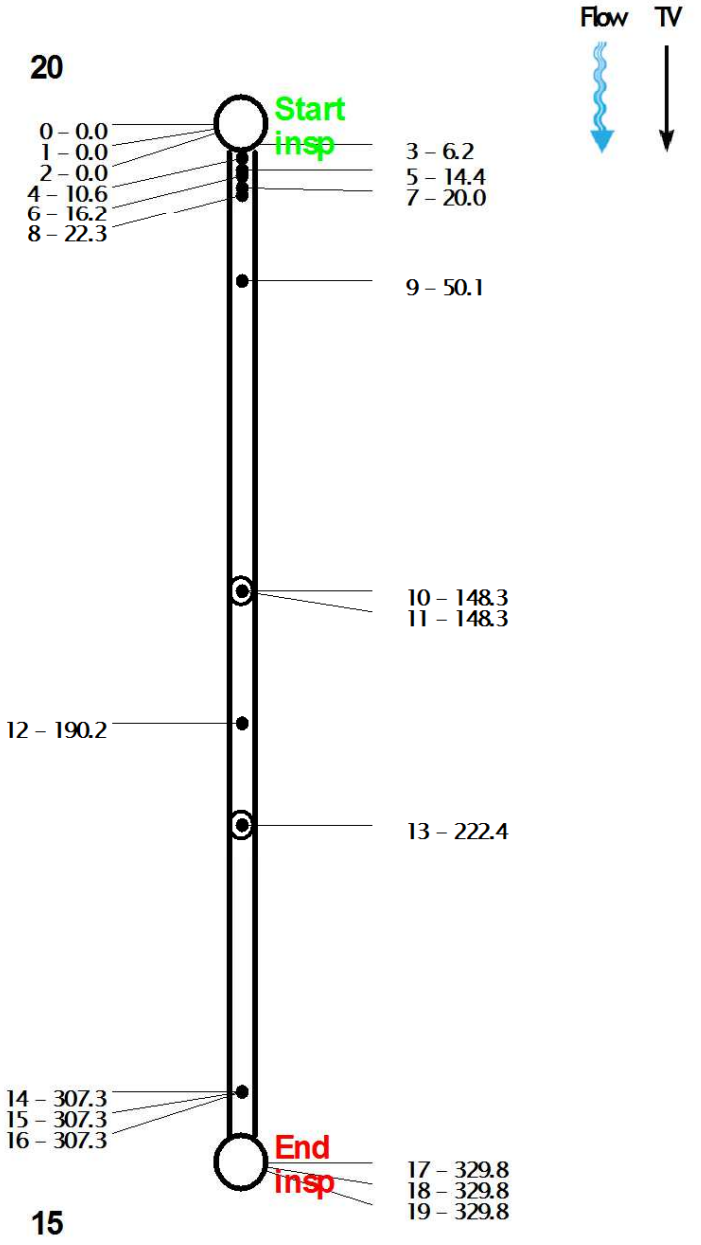
PSR	Street	City
20	COTTAGEVIEW RD	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
03/02/2023	11:38:57	Dry - No precip...	10		Circular	Vitrified ...	329.800		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>20_2398_03_02_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 0.0 <Start inspection> at 11:38:57
1 – 0.0 Manhole
Starting manhole: 20
2 – 0.0 Miscellaneous Water Level 5.000 %
3 – 6.2 Broken At 11 To 3 At Jnt
4 – 10.6 Fracture Circumferential At 3 To 7 At Jnt
5 – 14.4 Roots Fine Joint At 8 To 10 At Jnt
6 – 16.2 Roots Fine Joint At 9 To 3 At Jnt
7 – 20.0 Roots Fine Joint At 7 To 5 At Jnt
8 – 22.3 Broken At 11 To 2 At Jnt
9 – 50.1 Roots Medium Joint 15.000 % At 8 To 4 At Jnt
10 – 148.3 Tap Factory At 12 Dia 0.000
11 – 148.3 Miscellaneous Material Change
Material changes TO PVC
12 – 190.2 Broken At 1 To 5
13 – 222.4 Tap Break-in/Hammer At 12 Dia 0.000
14 – 307.3 Roots Fine Joint At 7 To 5 At Jnt
15 – 307.3 Miscellaneous Water Level 50.000 %
16 – 307.3 Deposits Settled Fine 40.000 % At 4 To 8
17 – 329.8 Deposits Settled Fine 40.000 % At 4 To 8
18 – 329.8 Manhole
Finishing manhole: 15
19 – 329.8 <Complete Inspection inspection> at 12:1...



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AssetDMS Office (PACP+LACP 7.0) 10.1.54
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TV with grading of PACP 7.0 inspection

3 to 2

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
3		NO	02/27/2023	10:56:41	Dry - No precipi...

Street	City	Owner
SILVER RD SSGM-11717	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933		

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
3				2			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
				1

TV with grading of PACP 7.0 inspection

3 to 2

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
3		NO	02/27/2023	10:56:41	Dry - No precipi...

Street	City	Owner
SILVER RD SSGM-11717	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933		

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
3				2			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0		0.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0		0.0

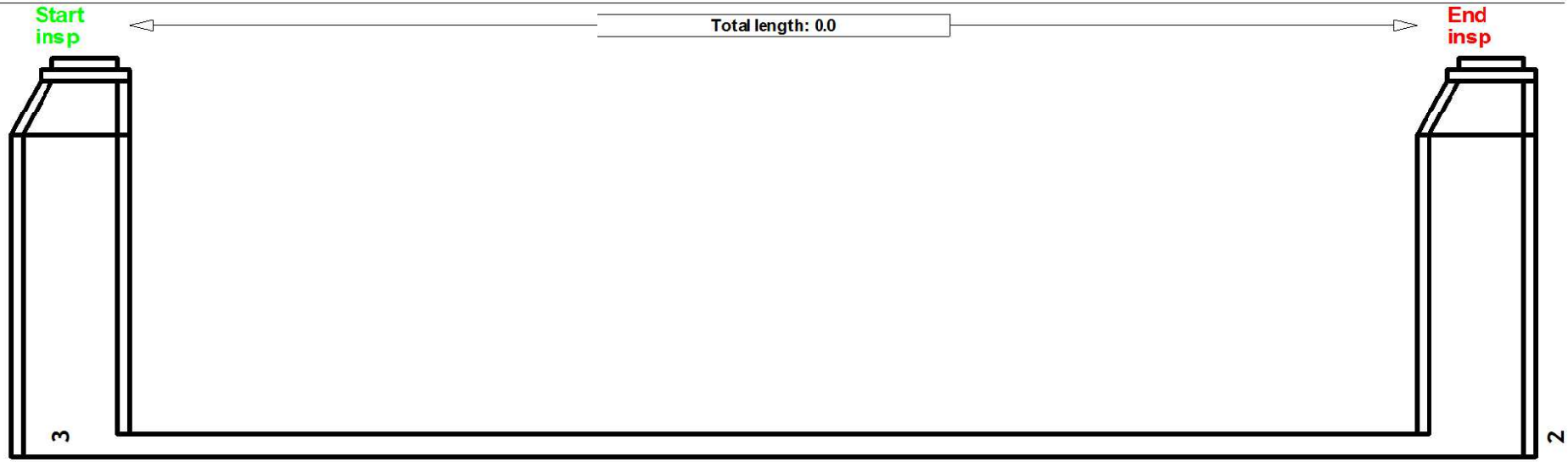
Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0		0.0

CrossSection of PACP 7.0 inspection

3 to 2
Downstream inspection

PSR	Street	City	Date	Time	Weather
3	SILVER RD SSGM-11717	GT COMMONS TRAVERSE CITY MI	02/27/2023	10:56:41	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
8		Circular	VCP			NotOpened			1	



☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

3 to 2

Downstream inspection

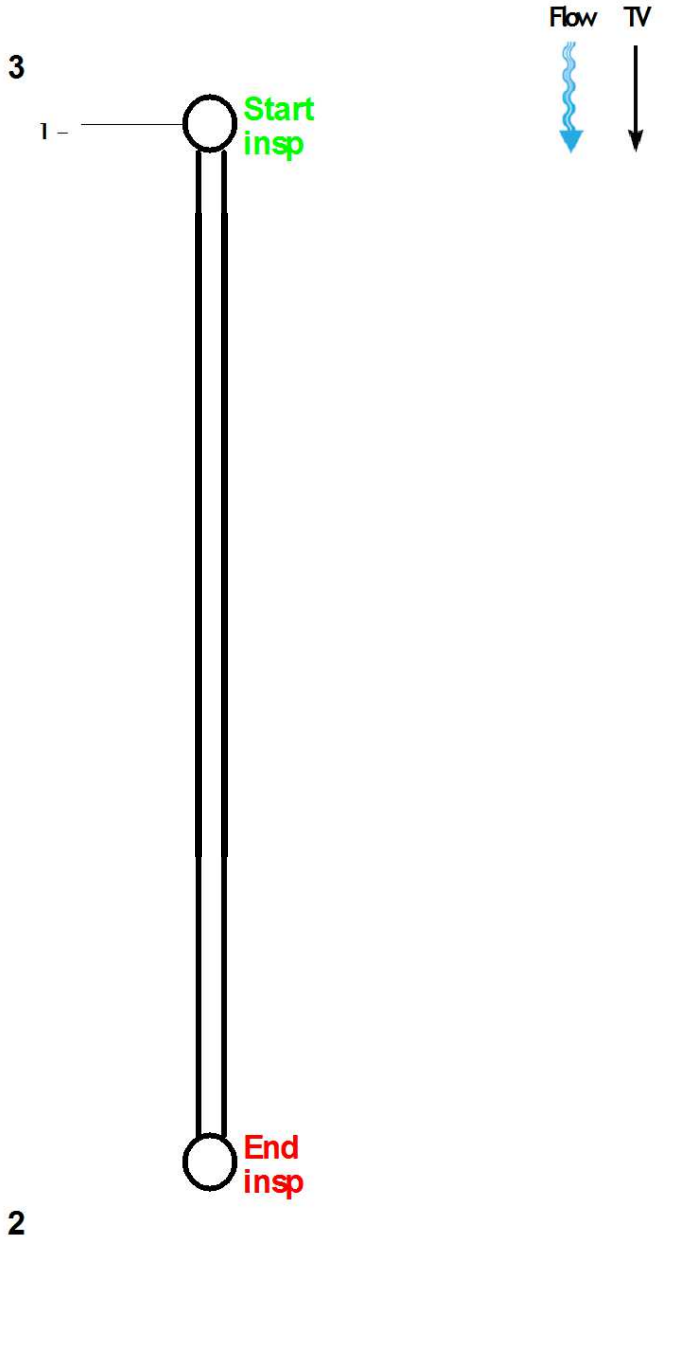
PSR	Street	City
3	SILVER RD SSGM-11717	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
02/27/2023	10:56:41	Dry - No precip...	8		Circular	Vitrified ...			Not Opened

Video	Additional info	Purpose	Sheet
			1

☒ - video attached
☒ - uninspected portion

1 –



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TV with grading of PACP 7.0 inspection

2 to 3

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
3		CI	02/27/2023	10:56:41	Dry - No precipi...

Street	City	Owner
SILVER RD SSGM-11717	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	9.400	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
3				2			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>3_2387_02_27_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 2	
0.0	MWL		Miscellaneous Water Level					5.000					
0.0	DSZ	S01	Deposits Settled Other	4	8			25.000		4		PAPER	
9.4	DSZ		Deposits Settled Other	2	10			75.000		5		PAPER & SLUDGE	
9.4	DSZ	F01	Deposits Settled Other	4	8			25.000		4		PAPER	
9.4	MSA		Miscellaneous Survey Aban...									Inspection abandoned:No Access	
			<Complete Inspection>										

TV with grading of PACP 7.0 inspection

2 to 3

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
3		CI	02/27/2023	10:56:41	Dry - No precipi...

Street	City	Owner
SILVER RD SSGM-11717	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	9.400	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	VCP	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
3				2			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>3_2387_02_27_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	8	5	13.0	5142	4.3

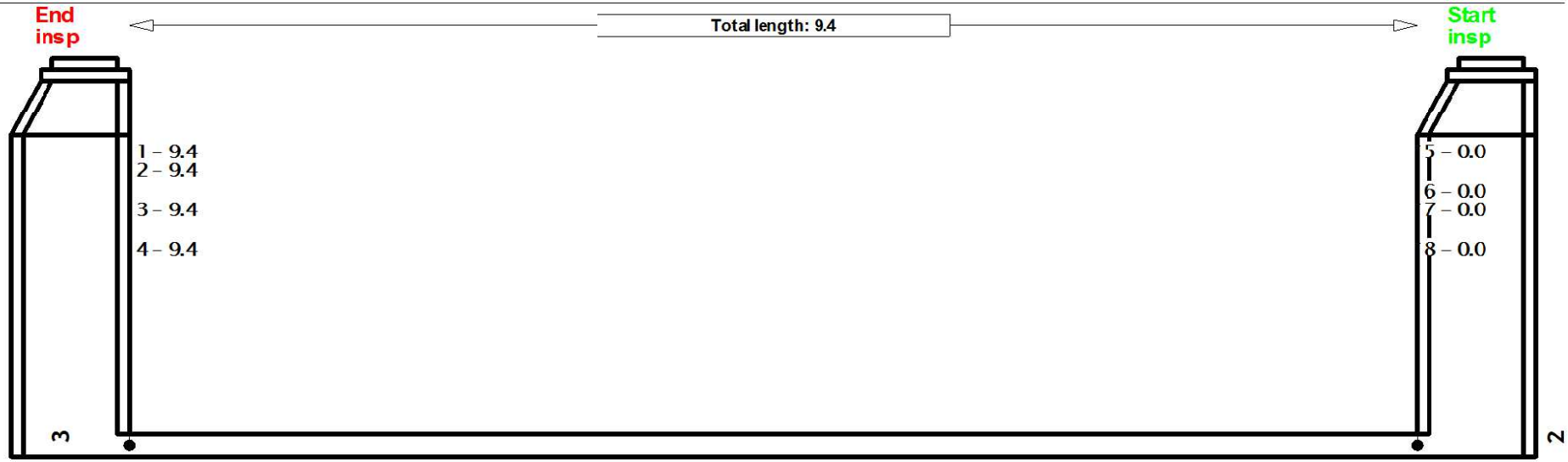
Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	8	5	13.0	5142	4.3

CrossSection of PACP 7.0 inspection

2 to 3
Upstream inspection

PSR	Street	City	Date	Time	Weather
3	SILVER RD SSGM-11717	GT COMMONS TRAVERSE CITY MI	02/27/2023	10:56:41	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
8		Circular	VCP	9.400		Complete I...			1	#<dev>3_2387_02_27_2023.mpg



1 – 9.4 <Complete Inspection inspection> at 11:00:34
2 – 9.4 Miscellaneous Survey Abandoned
Inspection abandoned:No A...
3 – 9.4 Deposits Settled Other 25.000 % At 4 To 8
PAPER
4 – 9.4 Deposits Settled Other 75.000 % At 2 To 10
PAPER & SLUDGE
5 – 0.0 Deposits Settled Other 25.000 % At 4 To 8
PAPER
6 – 0.0 Miscellaneous Water Level 5.000 %
7 – 0.0 Manhole
Starting manhole: 2
8 – 0.0 <Start inspection> at 10:56:41

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

2 to 3

Upstream inspection

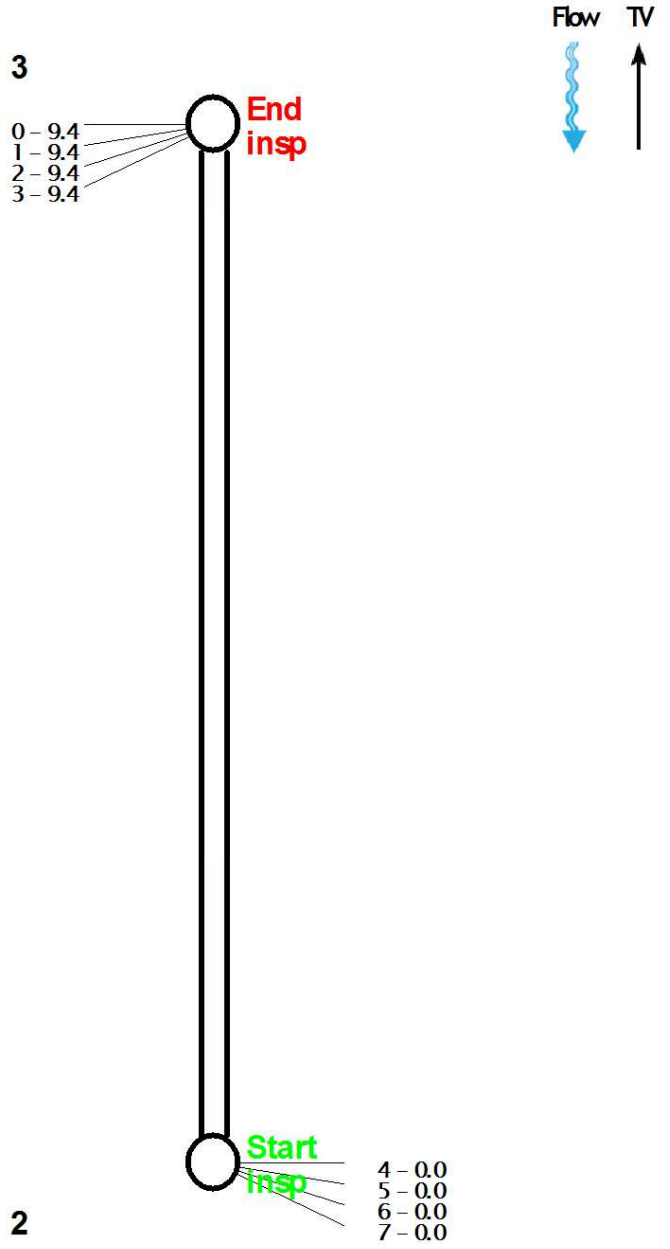
PSR	Street	City
3	SILVER RD SSGM-11717	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
02/27/2023	10:56:41	Dry - No precip...	8		Circular	Vitrified ...	9.400		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>3_2387_02_27_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 9.4 <Complete Inspection inspection> at 11:00:34
1 – 9.4 Miscellaneous Survey Abandoned
Inspection abandoned:No Access
2 – 9.4 Deposits Settled Other 25.000 % At 4 To 8 PAPER
3 – 9.4 Deposits Settled Other 75.000 % At 2 To 10 PAPER & SLUDGE
4 – 0.0 Deposits Settled Other 25.000 % At 4 To 8 PAPER
5 – 0.0 Miscellaneous Water Level 5.000 %
6 – 0.0 Manhole
Starting manhole: 2
7 – 0.0 <Start inspection> at 10:56:41



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TV with grading of PACP 7.0 inspection

12 to 13

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
12		CI	02/27/2023	14:05:30	Dry - No precipi...

Street	City	Owner
COTTAGEVIEW RD SSGM-11720	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	198.600	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		10		Circular	PVC	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
12				13			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>12_2393_02_27_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 1 2	
0.0	MWL		Miscellaneous Water Level					20.000					
8.4	MMC		Miscellaneous Material Cha...									Material changes TO VCP	
13.3	MSC		Miscellaneous Shape/Size ...			8.000							
29.7	JAM		Joint Angular Medium						3				
35.0	JAM		Joint Angular Medium						3				
90.4	FL		Fracture Longitudinal	4					3		Y		
99.4	RFJ		Roots Fine Joint	10	11					1	Y		
168.9	RFJ		Roots Fine Joint	8	10					1	Y		
168.9	RFJ		Roots Fine Joint	2	4					1	Y		
173.5	RFJ		Roots Fine Joint	8	4					1	Y		
198.6	AMH		Manhole									Finishing manhole: 13	
			<Complete Inspection>										

TV with grading of PACP 7.0 inspection

12 to 13

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
12		CI	02/27/2023	14:05:30	Dry - No precipi...

Street	City	Owner
COTTAGEVIEW RD SSGM-11720	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	198.600	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		10		Circular	PVC	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
12				13			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>12_2393_02_27_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	9	0	0	9.0	3300	3.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
4	0	0	0	0	4.0	1400	1.0

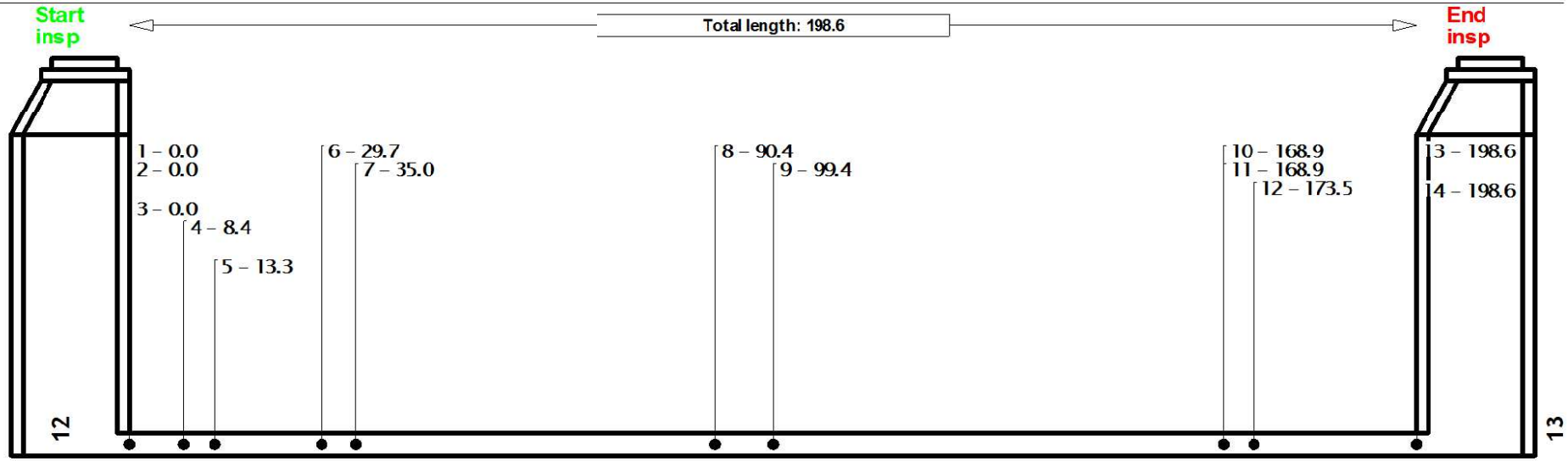
Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
4	0	9	0	0	13.0	3314	1.9

CrossSection of PACP 7.0 inspection

12 to 13
Downstream inspection

PSR	Street	City	Date	Time	Weather
12	COTTAGEVIEW RD SSGM-11720	GT COMMONS TRAVERSE CITY MI	02/27/2023	14:05:30	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
10		Circular	PVC	198.600		Complete I...			1	#<dev>12_2393_02_27_2023.mpg



1 – 0.0 <Start inspection> at 14:05:30
2 – 0.0 Manhole
Starting manhole: 12
3 – 0.0 Miscellaneous Water Level 20.000%
4 – 8.4 Miscellaneous Material Change
Material changes TO VCP
5 – 13.3 Miscellaneous Shape/Size Change Vert 8.000
6 – 29.7 Joint Angular Medium
7 – 35.0 Joint Angular Medium
8 – 90.4 Fracture Longitudinal At 4 At Jnt
9 – 99.4 Roots Fine Joint At 10 To 11 At Jnt
10 – 168.9 Roots Fine Joint At 8 To 10 At Jnt
11 – 168.9 Roots Fine Joint At 2 To 4 At Jnt
12 – 173.5 Roots Fine Joint At 8 To 4 At Jnt
13 – 198.6 Manhole
Finishing manhole: 13
14 – 198.6 <Complete Inspection inspection> at 14:20:23

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

12 to 13

Downstream inspection

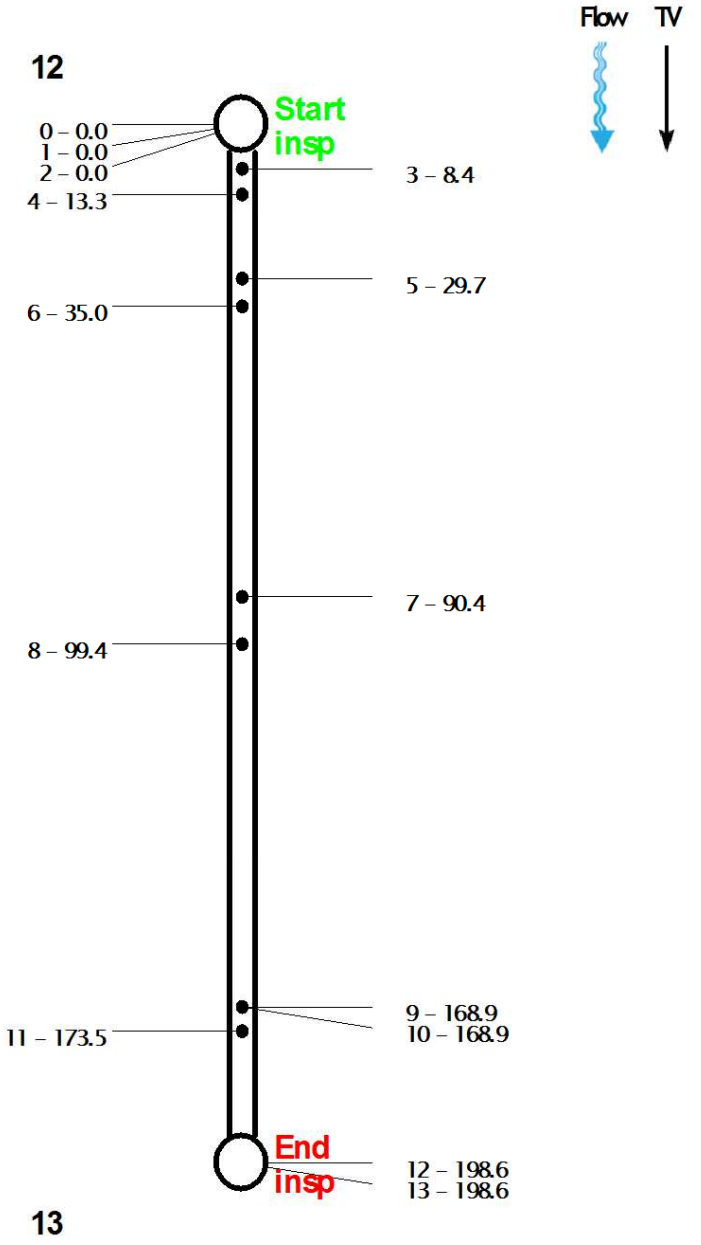
PSR	Street	City
12	COTTAGEVIEW RD SSGM-11720	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
02/27/2023	14:05:30	Dry - No precip...	10		Circular	Polyvinyl...	198.600		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>12_2393_02_27_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 0.0 <Start inspection> at 14:05:30
1 – 0.0 Manhole
Starting manhole: 12
2 – 0.0 Miscellaneous Water Level 20.000 %
3 – 8.4 Miscellaneous Material Change
Material changes TO VCP
4 – 13.3 Miscellaneous Shape/Size Change Vert 8.000
5 – 29.7 Joint Angular Medium
6 – 35.0 Joint Angular Medium
7 – 90.4 Fracture Longitudinal At 4 At Jnt
8 – 99.4 Roots Fine Joint At 10 To 11 At Jnt
9 – 168.9 Roots Fine Joint At 8 To 10 At Jnt
10 – 168.9 Roots Fine Joint At 2 To 4 At Jnt
11 – 173.5 Roots Fine Joint At 8 To 4 At Jnt
12 – 198.6 Manhole
Finishing manhole: 13
13 – 198.6 <Complete Inspection inspection> at 14:2...



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TV with grading of PACP 7.0 inspection

10 to 9

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
10		CI	02/27/2023	12:55:44	Dry - No precipi...

Street	City	Owner
YELLOW RD SSGM-11794	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	107.900	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	PVC	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
10				9			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>10_2392_02_27_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 1 0	
0.0	MWL		Miscellaneous Water Level					5.000					
57.9	JAM		Joint Angular Medium						3				
107.9	OBZ		Obstruction Other	12	12			95.000		5		WAD OF TOILET PAPER	
107.9	AEP		Access Point End of Pipe									Finishing manhole: 9	
			<Complete Inspection>										

TV with grading of PACP 7.0 inspection

10 to 9

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
10		CI	02/27/2023	12:55:44	Dry - No precipi...

Street	City	Owner
YELLOW RD SSGM-11794	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	107.900	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	PVC	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
10				9			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>10_2392_02_27_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	3	0	0	3.0	3100	3.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	5	5.0	5100	5.0

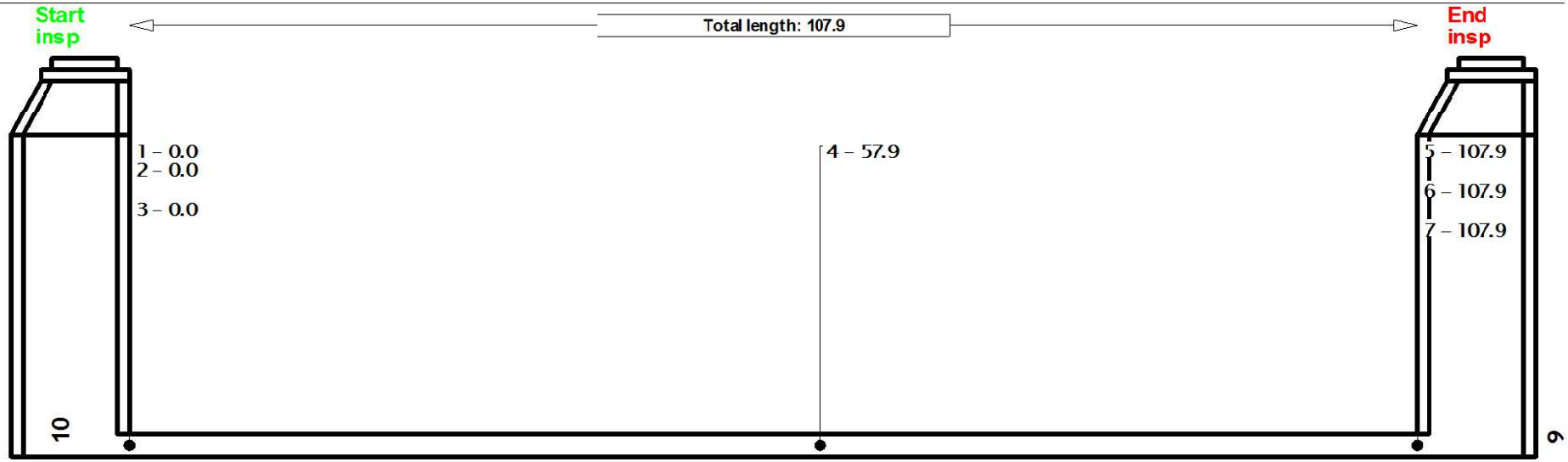
Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	3	0	5	8.0	5131	4.0

CrossSection of PACP 7.0 inspection

10 to 9
Downstream inspection

PSR	Street	City	Date	Time	Weather
10	YELLOW RD SSGM-11794	GT COMMONS TRAVERSE CITY MI	02/27/2023	12:55:44	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
8		Circular	PVC	107.900		Complete I...			1	#<dev>10_2392_02_27_2023.mpg



1 – 0.0 <Start inspection> at 12:55:44
2 – 0.0 Manhole
Starting manhole: 10
3 – 0.0 Miscellaneous Water Level 5.000%
4 – 57.9 Joint Angular Medium
5 – 107.9 Obstruction Other 95.000% At 12 To 12
WAD OF TOILET PAPER
6 – 107.9 Access Point End of Pipe
Finishing manhole: 9
7 – 107.9 <Complete Inspection inspection> at 13:02:35

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

10 to 9

Downstream inspection

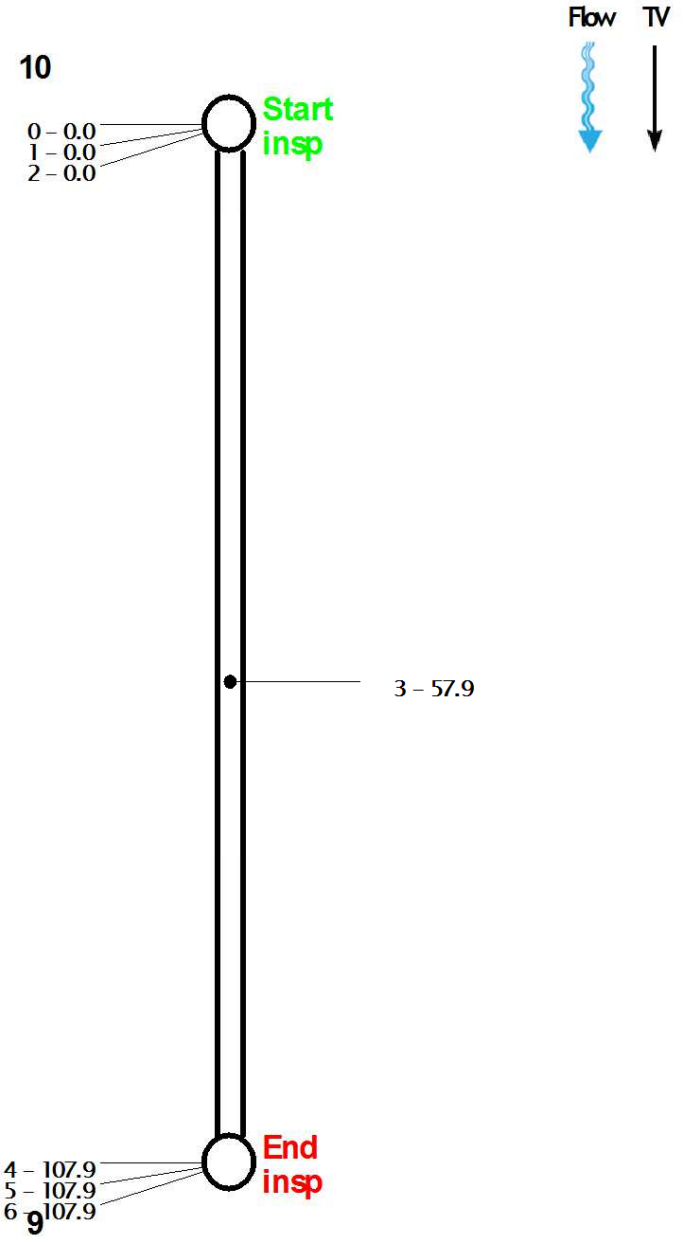
PSR	Street	City
10	YELLOW RD SSGM-11794	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
02/27/2023	12:55:44	Dry - No precip...	8		Circular	Polyvinyl...	107.900		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>10_2392_02_27_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 0.0 <Start inspection> at 12:55:44
1 – 0.0 Manhole
Starting manhole: 10
2 – 0.0 Miscellaneous Water Level 5.000 %
3 – 57.9 Joint Angular Medium
4 – 107.9 Obstruction Other 95.000 % At 12 To 12
WAD OF TOILET PAPER
5 – 107.9 Access Point End of Pipe
Finishing manhole: 9
6 – 107.9 <Complete Inspection inspection> at 13:02...



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TV with grading of PACP 7.0 inspection

11 to 10

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
11		CI	02/27/2023	12:33:35	Dry - No precipi...

Street	City	Owner
YELLOW RD SSGM-11794	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	2.000	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	PVC	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
11				10			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>11_2390_02_27_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 1 1	
0.0	MWL		Miscellaneous Water Level					0.000					
2.0	MSA		Miscellaneous Survey Aban...									Inspection abandoned:No Access	
			<Complete Inspection>										

TV with grading of PACP 7.0 inspection

11 to 10

Downstream inspection

PSR	PO number	Status	Date	Time	Weather
11		CI	02/27/2023	12:33:35	Dry - No precipi...

Street	City	Owner
YELLOW RD SSGM-11794	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	2.000	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	PVC	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
11				10			

Direction	Flow control	Drainage area	Lining method	Pjl (ft)	Year constr...	Year renewed
Downstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>11_2390_02_27_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

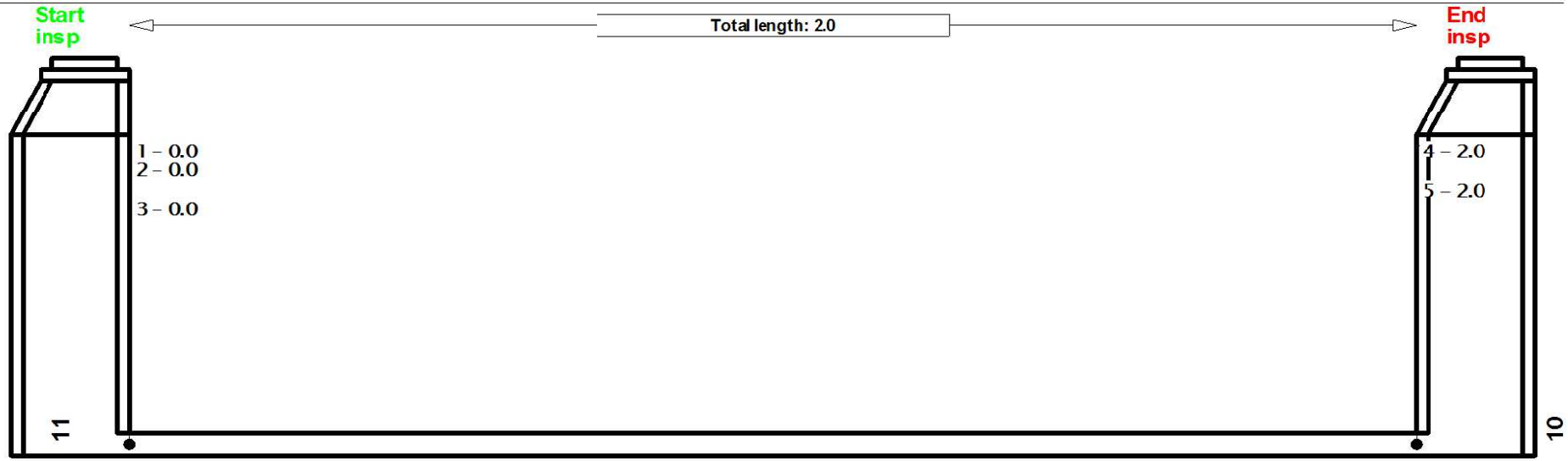
CrossSection of PACP 7.0 inspection

11 to 10

Downstream inspection

PSR	Street	City	Date	Time	Weather
11	YELLOW RD SSGM-11794	GT COMMONS TRAVERSE CITY MI	02/27/2023	12:33:35	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
8		Circular	PVC	2.000		Complete I...			1	#<dev>11_2390_02_27_2023.mpg



1 – 0.0 <Start inspection> at 12:33:35
2 – 0.0 Manhole
Starting manhole: 11
3 – 0.0 Miscellaneous Water Level 0.000%
4 – 2.0 Miscellaneous Survey Abandoned
Inspection abandoned:No A...
5 – 2.0 <Complete Inspection inspection> at 12:35:02

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

11 to 10

Downstream inspection

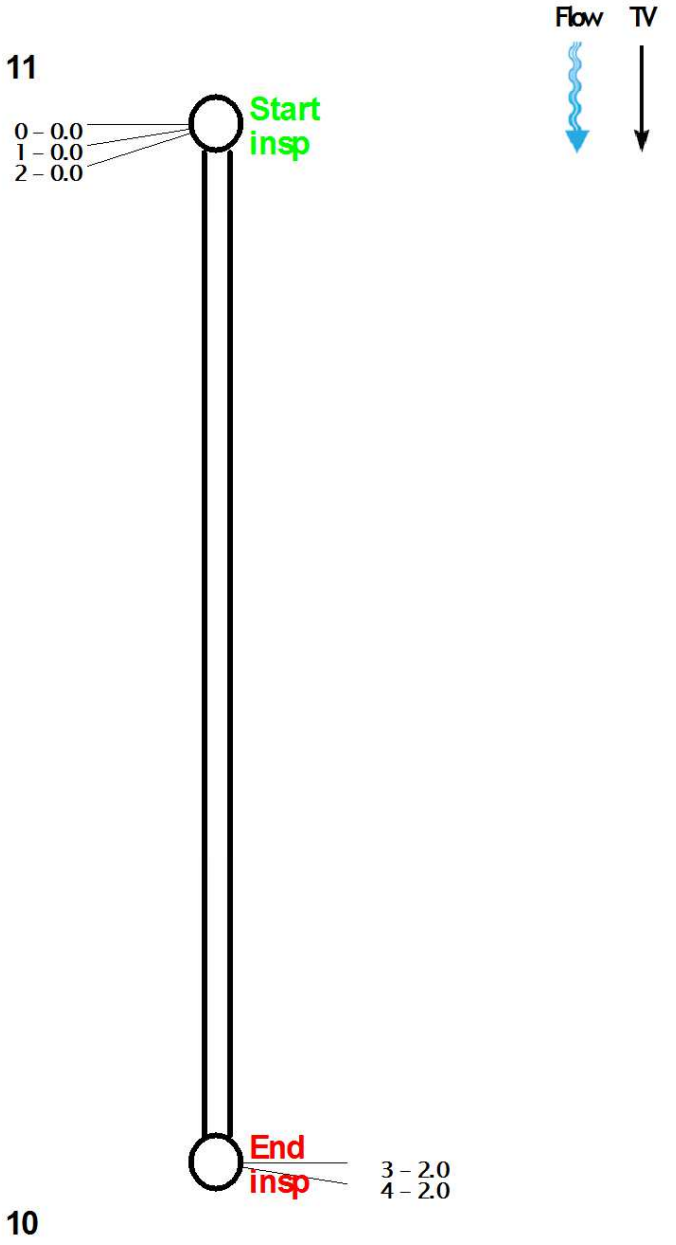
PSR	Street	City
11	YELLOW RD SSGM-11794	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
02/27/2023	12:33:35	Dry - No precip...	8		Circular	Polyvinyl...	2.000		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>11_2390_02_27_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 0.0 <Start inspection> at 12:33:35
1 – 0.0 Manhole
Starting manhole: 11
2 – 0.0 Miscellaneous Water Level 0.000 %
3 – 2.0 Miscellaneous Survey Abandoned
Inspection abandoned:No Access
4 – 2.0 <Complete Inspection inspection> at 12:35:02



trio-vision

AssetDMS Office (PACP+LACP 7.0) 10.1.54
www.trio-vision.com

TV with grading of PACP 7.0 inspection

10 to 11

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
11R		CI	02/27/2023	12:42:17	Dry - No precipi...

Street	City	Owner
YELLOW RD SSGM-11794	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	140.800	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	PVC	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
11				10			

Direction	Flow control	Drainage area	Lining method	PjI (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>11R_2391_02_27_2023.mpg				1

Dist (ft)	Code	CD	Observation	At		V1	V2	%	St	O&M	Jt	Remarks	Img
			<Start inspection>										
0.0	AMH		Manhole									Starting manhole: 1 0	
0.0	MWL		Miscellaneous Water Level					5.000					
70.3	TF		Tap Factory	2		0.000							
104.4	TF		Tap Factory	2		0.000							
140.8	AEP		Access Point End of Pipe									Finishing manhole: 11	
			<Complete Inspection>										

TV with grading of PACP 7.0 inspection

10 to 11

Upstream inspection

PSR	PO number	Status	Date	Time	Weather
11R		CI	02/27/2023	12:42:17	Dry - No precipi...

Street	City	Owner
YELLOW RD SSGM-11794	GT COMMONS TRAVERSE CITY MI	

Customer	Operator	Certificate number	L surv (ft)	Total I (ft)
	DAVE FERRIS	U-1115-07001933	140.800	

Location code	Location details	H (i)	W (i)	Shape	Material	Pre-cleaning	Date cleaned	Pipe use
		8		Circular	PVC	N		SS

Upstream MH	U R to I (ft)	U G to I (ft)	U R to G (ft)	Downstream MH	D R to I (ft)	D G to I (ft)	D R to G (ft)
11				10			

Direction	Flow control	Drainage area	Lining method	Pjl (ft)	Year constr...	Year renewed
Upstream	Not Controlled					

Video	Media label	Additional info	Purpose	Sheet
#<dev>11R_2391_02_27_2023.mpg				2

Structural							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

O&M							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

Overall							
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
0	0	0	0	0	0.0	0000	0.0

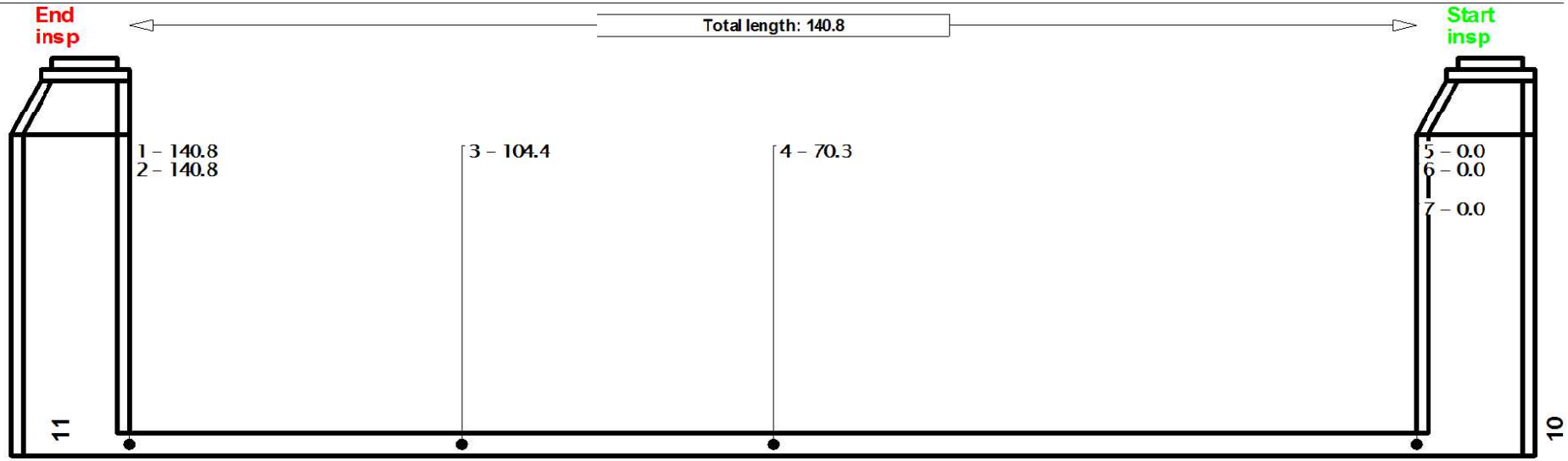
CrossSection of PACP 7.0 inspection

10 to 11

Upstream inspection

PSR	Street	City	Date	Time	Weather
11R	YELLOW RD SSGM-11794	GT COMMONS TRAVERSE CITY MI	02/27/2023	12:42:17	Dry - No pre...

H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status	Additional info	Purpose	Sheet	Video
8		Circular	PVC	140.800		Complete I...			1	#<dev>11R_2391_02_27_2023.mpg



1 – 140.8 <Complete Inspection inspection> at 12:50:40
2 – 140.8 Access Point End of Pipe
Finishing manhole: 11
3 – 104.4 Tap Factory At 2 Dia 0.000
4 – 70.3 Tap Factory At 2 Dia 0.000
5 – 0.0 Miscellaneous Water Level 5.000%
6 – 0.0 Manhole
Starting manhole: 10
7 – 0.0 <Start inspection> at 12:42:17

☐ - image attached
☒ - video attached
☒ - uninspected portion

Flow
TV

PlanView of PACP 7.0 inspection

10 to 11

Upstream inspection

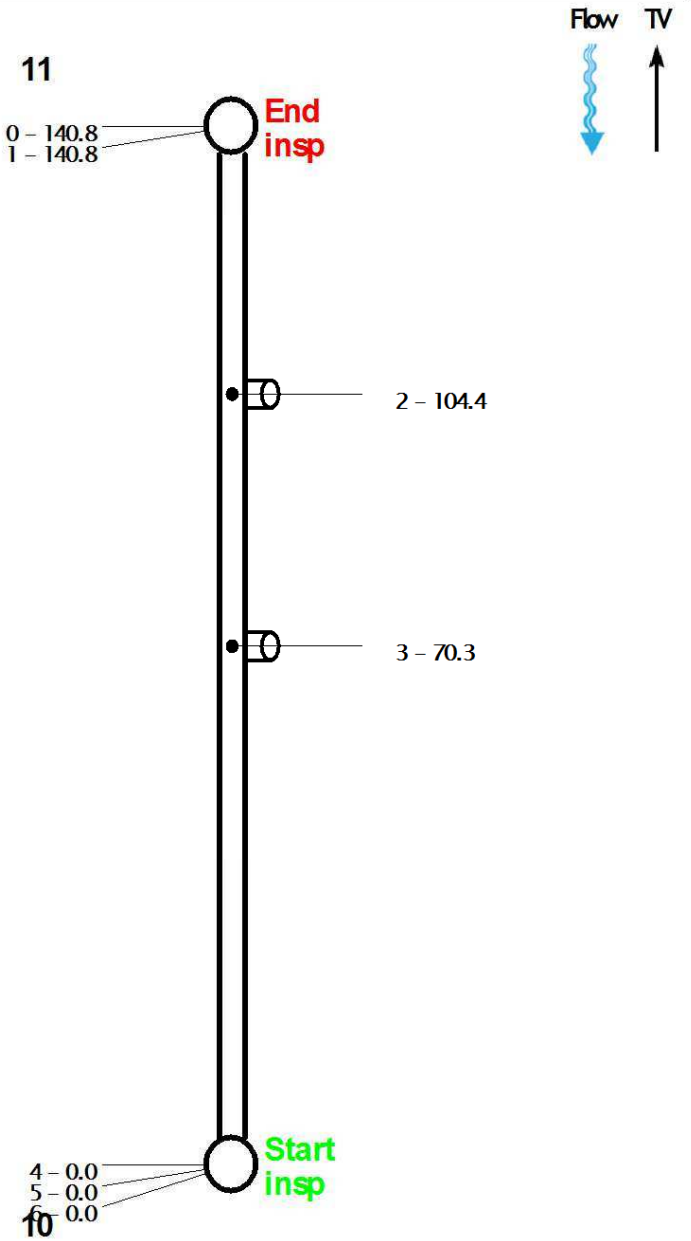
PSR	Street	City
11R	YELLOW RD SSGM-11794	GT COMMONS TRAVERSE CITY MI

Date	Time	Weather	H (i)	W (i)	Shape	Material	L surv (ft)	Total l (ft)	Status
02/27/2023	12:42:17	Dry - No precip...	8		Circular	Polyvinyl...	140.800		Complete ...

Video	Additional info	Purpose	Sheet
#<dev>11R_2391_02_27_2023.mpg			1

☒ - video attached
☒ - uninspected portion

0 – 140.8 <Complete Inspection inspection> at 12:50...
1 – 140.8 Access Point End of Pipe
Finishing manhole: 11
2 – 104.4 Tap Factory At 2 Dia 0.000
3 – 70.3 Tap Factory At 2 Dia 0.000
4 – 0.0 Miscellaneous Water Level 5.000 %
5 – 0.0 Manhole
Starting manhole: 10
6 – 0.0 <Start inspection> at 12:42:17



Appendix D-7 Sanitary Manhole Inspections and Improvement plan

Manhole ID	Install Date	Inspection Status	Overall Condition	Recommended Improvements
SSM-1612		Inspected	Fair	
SSM-1613		Inspected	Fair	
SSM-1614		Inspected	Fair	Reset/Adjust frame (Within Pavement) and Reseal
SSM-1615	7/1/2008	Inspected	Fair	
SSM-1616	7/1/2008	Inspected	Fair	
SSM-1617	7/1/2008	Inspected	Other	Clean Manhole
SSM-1618	7/1/2008	Inspected	Fair	
SSM-1619	7/1/2008	Inspected	Fair	
SSM-1620	7/1/2008	Inspected	Fair	
SSM-1621	7/1/2008	Inspected	Fair	
SSM-1657		Inspected	Fair	
SSM-1658	1/1/1968	Inspected	Poor	Reconstruct Manhole (Outside of pavement)
SSM-1659	1/1/1968	Inspected	Poor	Reconstruct Manhole (Outside of pavement)
SSM-1660	1/1/1968	Inspected	Poor	Reconstruct Manhole (Within Pavement)
SSM-1661	1/1/1968	Inspected	Other	Reconstruct Manhole (Outside of pavement)
SSM-1662		Inspected	Poor	Reconstruct Chimney (Within Pavement) and Clean Manhole
SSM-7274		Inspected	Fair	Clean Manhole
SSM-7275		Inspected	Fair	Clean Manhole
SSM-7276		Inspected	Fair	Clean Manhole
SSM-7316		Not Found		
SSM-7317		Inspected	Fair	
SSM-7318	8/10/1968	STMH	Fair	Reconstruct Chimney (Within Pavement), Reseal, and Clean Manhole
SSM-7319	8/10/1968	Inspected	Poor	Reset/Adjust frame (Outside of pavement)
SSM-7320	8/10/1968	Inspected	Poor	Reconstruct Chimney (Outside of Pavement)
SSM-7321		Not Found		
SSM-7322		Not Found		
SSM-7323		Not Found		
SSM-7324		Inspected	Fair	
SSM-7325		Inspected	Fair	
SSM-7326		Not Found		
SSM-7327		Not Found		
SSM-7328		Inspected	Fair	
SSM-7329		Inspected	Fair	

SSM-7330		Inspected	Poor	Reconstruct Manhole (Within Pavement)
SSM-7331		Not Found		
SSM-7332		Not Found		
SSM-7333		Not Found		
SSM-7334		Not Found		
SSM-7335		Not Found		
SSM-7336		Inspected	Fair	
SSM-7337	8/10/1968	Not Found		
SSM-7338	8/10/1968	Not Found		
SSM-7339		Not Found		
SSM-7340		Inspected	Other	
SSM-7341		Not Found		
SSM-7342		Inspected	Fair	Reconstruct Chimney (Within Pavement)
SSM-7343		Not Found		
SSM-7344		Inspected	Fair	
SSM-7345		Not Found		
SSM-7346		Inspected	Fair	
SSM-7347		Not Found		
SSM-7348		Not Found		
SSM-7349		Not Found		
SSM-7350		Not Found		
SSM-7351		Not Found		
SSM-7352		Not Found		
SSM-7353		Not Found		
SSM-7354		Not Found		
SSM-7355		Not Found		
SSM-7356		Inspected		
SSM-7357		Inspected	Fair	
SSM-7358		Not Found		
SSM-7359		Inspected	Fair	Reset/Adjust frame (Within Pavement)
SSM-7360		Not Found		
SSM-7361		Not Found		
SSM-7362		Not Found		
SSM-7363		Not Found		
SSM-7364		Not Found		
SSM-7365		Not Found		
SSM-7366		Not Found		
SSM-7367		Inspected	Fair	
SSM-7368	8/10/1968	Inspected	Poor	Replace (Outside of Pavement)
SSM-7369		Inspected		
SSMG-1001		Not Found		
SSMG-1002		Not Found		
SSMG-1003		Not Found		
SSMG-1004		Not Found		

SSMG-1005		Inspected	Fair	
SSMG-1006		Inspected	Fair	Reconstruct Manhole (Within Pavement)
SSMG-1007		Inspected	Fair	
SSMG-1008		Inspected	Fair	Reconstruct Chimney (Outside of Pavement)
SSMG-1009		Inspected		
SSMG-1010		Inspected	Fair	Clean Manhole
SSMG-1011		Inspected	Fair	
SSMG-1012		No Access		
SSMG-1013		Inspected	Fair	
SSMG-1014		Inspected	Fair	
SSMG-1015		No Access		
SSMG-1016		Inspected	Fair	
SSMG-1017		Inspected	Fair	
SSMG-1018		Inspected		
SSMG-1019		Inspected	Fair	
SSMG-1020		Inspected	Fair	
SSMG-1021		Inspected	Poor	Mortar Seal Joints and Reseal Manhole
SSMG-1022		Inspected	Fair	
SSMG-1023		Buried		
SSMG-1024		Buried		
SSMG-1025		Inspected	Fair	
SSMG-1026		Buried		
SSMG-1027		Inspected	Fair	
SSMG-1028		Inspected	Fair	
SSMG-1029		Not Found		
SSMG-1030		Inspected	Poor	Clean Manhole
SSMG-1031		Inspected	New	
SSMG-1032		Inspected	Fair	Reconstruct Chimney (Within Pavement)
SSMG-1033		Inspected	Poor	Clean Manhole
SSMG-1034		Inspected	Poor	Reconstruct Chimney (Within Pavement) and Clean Manhole
SSMG-1035		Inspected	Fair	
SSMG-1036		Inspected	Poor	Mortar Seal Joints
SSMG-1037		Inspected	Fair	
SSMG-1038		Inspected	Fair	
SSMG-1039		Inspected	Fair	
SSMG-1040		Inspected	Poor	Clean Manhole
SSMG-1041		Inspected	Fair	
SSMG-1042		Inspected	Fair	
SSMG-1043		Inspected	Fair	Clean Manhole
SSMG-1044		Inspected	Other	
SSMG-1045		Inspected	Fair	

Appendix D-8 Sanitary Pipe Inspections and Improvement plan

Pipe ID	Install Date	Material	Diameter	CCTV	Recommended Improvements
SSGM-10334	1/1/1995	Poly Vinyl Chloride	8		
SSGM-10335	1/1/1995	Poly Vinyl Chloride	8		
SSGM-10336	1/1/1995	Poly Vinyl Chloride	8		
SSGM-10716		Vitrified Pipe	8	Yes	Verify
SSGM-10717		Vitrified Pipe	8		
SSGM-10718		Vitrified Pipe	8	Yes	Verify
SSGM-10719	7/1/2008	Poly Vinyl Chloride	8		
SSGM-10721	7/1/2008	Poly Vinyl Chloride	8		
SSGM-10722	7/1/2008	Poly Vinyl Chloride	8		
SSGM-10724		Vitrified Pipe	6		
SSGM-10725	7/1/2008	Poly Vinyl Chloride	8		
SSGM-10726	7/1/2008	Poly Vinyl Chloride	8		
SSGM-10727	7/1/2008	Poly Vinyl Chloride	8	Yes	None Required
SSGM-10728	7/1/2008	Poly Vinyl Chloride	8		
SSGM-10729	7/1/2008	Poly Vinyl Chloride	8		
SSGM-11663		Poly Vinyl Chloride	10		
SSGM-11664		Vitrified Pipe	6		
SSGM-8233		Vitrified Pipe	10		
SSGM-8234	1/1/1968	Clay	12	Yes	Verify
SSGM-8235	1/1/1968	Clay	12		
SSGM-8236	1/1/1968	Clay	12	Yes	Line/Replace First 174’ of Sewer
SSGM-8237	1/1/1968	Clay	12		
SSGM-8238	1/1/1968	Clay	12	Yes	Line Sewer
SSGMG-1001		Poly Vinyl Chloride			
SSGMG-1002		Poly Vinyl Chloride			
SSGMG-1003	4/16/2010	Poly Vinyl Chloride	8		
SSGMG-1004		Vitrified Clay Pipe	10		
SSGMG-1005		Vitrified Clay Pipe	10		
SSGMG-1006		Vitrified Clay Pipe	8	Yes	Verify
SSGMG-1007		Vitrified Clay Pipe	6		
SSGMG-1008		Vitrified Clay Pipe	8		
SSGMG-1009		Vitrified Clay Pipe	8		
SSGMG-1010					
SSGMG-1011			6		
SSGMG-1012			6		
SSGMG-1013			6		
SSGMG-1014		Vitrified Clay Pipe	4	Yes	Verify
SSGMG-1015					
SSGMG-1016				Yes	Verify
SSGMG-1017		Poly Vinyl Chloride	6		

SSGMG-1018			4		
SSGMG-11665	8/10/1968	Vitrified Clay Pipe	10		
SSGMG-11668	8/10/1968	Vitrified Clay Pipe	8		
SSGMG-11669			8		
SSGMG-11670			8		
SSGMG-11671			4		
SSGMG-11672		Poly Vinyl Chloride	10	Yes	Remove roots
SSGMG-11673			8		
SSGMG-11674			10		
SSGMG-11675			10		
SSGMG-11676			10		
SSGMG-11677		Vitrified Clay Pipe	10		
SSGMG-11678		Vitrified Clay Pipe	10		
SSGMG-11679		Vitrified Clay Pipe	8	Yes	Clean Sewer
SSGMG-11680		Vitrified Clay Pipe	10	Yes	Replace Sewer
SSGMG-11681			8		
SSGMG-11682			8		
SSGMG-11683	8/10/1968	Vitrified Clay Pipe	8		
SSGMG-11684			10		
SSGMG-11685	8/10/1968	Vitrified Clay Pipe	6		
SSGMG-11686	8/10/1968		6		
SSGMG-11687			8		
SSGMG-11688			6		
SSGMG-11689			6		
SSGMG-11690			6		
SSGMG-11691	4/16/2010		10		
SSGMG-11692			6		
SSGMG-11693			6		
SSGMG-11694			6		
SSGMG-11695			6		
SSGMG-11696			6		
SSGMG-11698			12		
SSGMG-11699			12		
SSGMG-11700			12		
SSGMG-11701			6		
SSGMG-11702			6		
SSGMG-11703			6		
SSGMG-11704			6		
SSGMG-11706			8		
SSGMG-11707		Vitrified Clay Pipe	10		
SSGMG-11708			8		
SSGMG-11709			8		
SSGMG-11710			8		
SSGMG-11711			8		
SSGMG-11712			6		
SSGMG-11713			6		

SSGMG-11714			6		
SSGMG-11715		Vitrified Clay Pipe	8		
SSGMG-11716		Vitrified Clay Pipe	6		
SSGMG-11717	8/10/1968	Vitrified Clay Pipe	8	Yes	Clean Sewer
SSGMG-11718		Vitrified Clay Pipe	6		
SSGMG-11720			10		
SSGMG-11721			6		
SSGMG-11722		Vitrified Clay Pipe	6		
SSGMG-11723					
SSGMG-11724					
SSGMG-11725					
SSGMG-11726					
SSGMG-11727					
SSGMG-11728					
SSGMG-11729					
SSGMG-11730					
SSGMG-11731					
SSGMG-11732					
SSGMG-11733					
SSGMG-11734					
SSGMG-11735					
SSGMG-11736					
SSGMG-11737					
SSGMG-11738		Poly Vinyl Chloride	6		
SSGMG-11739		Poly Vinyl Chloride	6		
SSGMG-11740		Poly Vinyl Chloride	6		
SSGMG-11741		Poly Vinyl Chloride	6		
SSGMG-11742		Vitrified Clay Pipe	8		
SSGMG-11743		Poly Vinyl Chloride	8		
SSGMG-11744		Vitrified Clay Pipe	12		
SSGMG-11745		Poly Vinyl Chloride	8		
SSGMG-11746		Reinforced Plastic Pipe (Truss Pipe)	8		
SSGMG-11747		Vitrified Clay Pipe	8		
SSGMG-11748		Vitrified Clay Pipe	8		
SSGMG-11749		Vitrified Clay Pipe	8		
SSGMG-11750		Vitrified Clay Pipe	8		
SSGMG-11751		Vitrified Clay Pipe	8		
SSGMG-11752		Vitrified Clay Pipe	6		
SSGMG-11753		Poly Vinyl Chloride	12	Yes	Line Sewer
SSGMG-11754		Vitrified Clay Pipe	4		
SSGMG-11756		Vitrified Clay Pipe	6		
SSGMG-11757		Poly Vinyl Chloride	6		
SSGMG-11761		Poly Vinyl Chloride	8		
SSGMG-11762		Poly Vinyl Chloride	6		
SSGMG-11763		Poly Vinyl Chloride	6		

SSGMG-11764		Poly Vinyl Chloride	6		
SSGMG-11765		Vitrified Clay Pipe	10		
SSGMG-11766		Poly Vinyl Chloride	6		
SSGMG-11768		Poly Vinyl Chloride	6		
SSGMG-11769		Poly Vinyl Chloride	6		
SSGMG-11770		Poly Vinyl Chloride	6		
SSGMG-11771		Poly Vinyl Chloride	6		
SSGMG-11772		Poly Vinyl Chloride	6		
SSGMG-11773		Poly Vinyl Chloride	6		
SSGMG-11774		Poly Vinyl Chloride	6		
SSGMG-11775		Poly Vinyl Chloride	8		
SSGMG-11776		Poly Vinyl Chloride	6		
SSGMG-11777		Poly Vinyl Chloride	6		
SSGMG-11778		Vitrified Clay Pipe	6		
SSGMG-11779		Vitrified Clay Pipe	6		
SSGMG-11780		Vitrified Clay Pipe	6		
SSGMG-11781		Vitrified Clay Pipe	8		
SSGMG-11782		Poly Vinyl Chloride	8	Yes	Clean Sewer
SSGMG-11783		Poly Vinyl Chloride	6		
SSGMG-11784		Poly Vinyl Chloride	8	Yes	None Required
SSGMG-11785		Poly Vinyl Chloride	8		
SSGMG-11786		Poly Vinyl Chloride	6		
SSGMG-11787		Poly Vinyl Chloride	6		
SSGMG-11789		Vitrified Clay Pipe	10		
SSGMG-11790		Poly Vinyl Chloride	6		
SSGMG-11792		Reinforced Plastic Pipe (Truss Pipe)	8		

Appendix E —Road Sidewalk and Parking Areas

Appendix E-1 Rating Systems

Asphalt PASER

Modified for Michigan TAMC Data Collection

◆ Denotes Priority Distress

Good

Asphalt 10

New construction (< 1 year old)
No defects
Recent base improvement
Possible Action:
Proactive Preventative Maintenance (PPM)

Asphalt 9

Like new condition (> 1 year old)
No defects
Recent overlay with or without a crush and shape
Possible Action:
PPM

Asphalt 8

◆ Transverse cracks: > 40' apart
Cracks: tight (hairline) or sealed
Longitudinal cracks: few, on joints
Recent seal coat or slurry seal (*see below)
Possible Action:
Crack seal or PPM

Fair

Asphalt 7

◆ Transverse cracks: 10'-40' apart
Cracks: open < ¼"
Crack erosion: none or little
Surface raveling: none or little
Patches: none or few in excellent condition
First signs of wear
Possible Action:
Maintain with crack seal, fog seal

Asphalt 6

◆ Transverse cracks: < 10' apart
◆ Block cracking: 6'-10' Blocks (large, stable)
Cracks open ¼" – ½"
Surface raveling: slight
Patches: few in good condition
Polishing or flushing: slight, moderate
Sound structural condition
Possible Action:
Maintain with sealcoat

Asphalt 5

◆ Block cracking: 1' – 5' blocks
◆ Longitudinal cracks: first signs, at edge
◆ Secondary cracks: first signs
Cracks open > ½"
Surface raveling: moderate
Patching or wedging: good condition
Polishing & flushing: extensive, severe
Sound structural condition
Possible Action:
Maintain with sealcoat or thin overlay

Poor

Asphalt 4

◆ Block cracking: < 1' blocks
◆ Wheel-path cracking (longitudinal)
◆ Rutting: ½" - 1" deep
Transverse cracks: slight erosion
Longitudinal cracks: slight erosion
Surface raveling: severe
Patches: fair condition
First signs of structural weakening
Possible Action:
Structural overlay > 2"
Underseal

Asphalt 3

◆ Block cracking: severe (like alligator)
◆ Alligator cracking: initial, < 25%
◆ Rutting: 1"- 2" deep
Transverse cracks: extensive erosion
Longitudinal cracks: extensive erosion
Patches: fair/poor condition
Potholes: occasional
Possible Action:
Structural overlay > 2"
Patching & repair prior to an overlay
Milling to extend overlay life

Asphalt 2

◆ Alligator cracks: > 25%
◆ Rutting or distortion: > 2"
Cracks: closely spaced, with erosion
Patches: extensive, in poor condition
Potholes: frequent
Possible Action:
Reconstruction with base repair
Crush and shape

Asphalt 1

Like PASER 2 but with visible base and:
Surface distress: severe with loss of integrity
Possible Action:
Reconstruction with base repair

General Rating Tips

Rate surface distress, not ride quality. Be aware of cracks in the wheel path; they can be hard to see and do not affect the ride.

Disregard the shoulder. Rate only the driveable pavement, edge line to edge line.

Do not ignore reflective cracks. Rate by assessing the type of crack (e.g. transverse, longitudinal, alligator).

Rate the current surface condition. If construction is in progress (i.e., work is active) but you are driving on the old surface, rate the new surface. Some barrels by the roadside is ***not*** construction in progress.

Rate the lane with the worst condition when lanes have differing conditions. For variable surface types, rate the worst lane and select it as the *Surface Subtype*.

Rate what you see, not what distresses you think might happen in the future.

Rate roads with the same scrutiny regardless of their use, ownership, or functional class.

Rutting often has visual cues like plow scars. Get out and measure using a straight edge and tape measure. Use caution! Rutting measurement changes are detailed in the *TAMC Data Collection Training Manual*'s "Michigan-specific Asphalt Road Rating Guide" section, page 7.

Composite Pavement consists of a concrete pavement overlaid with asphalt; rate it based on the uppermost surface (e.g. asphalt); and note the *Surface Subtype* as composite. A repaired concrete pavement's highest rating is a 9. While it may have had concrete joint repairs, no other defects can be present and the condition is "like new". Note, this is ***not*** likely to occur.

Sealcoat pavements are sealcoat over gravel whereas sealcoat treatment is sealcoat applied over asphalt. See pages 6-7 of the TAMC Data Collection Manual for rating sealcoat pavements. *With proactive sealcoat treatments, do not downgrade an asphalt PASER 9 or 10 (no defects) to an asphalt PASER 8 because of the treatment. Rate it based on the distresses that are visible (see *TAMC Data Collection Training Manual*'s "Proactive Sealcoat Treatments on Asphalt PASER 9" section, page 8).

Concrete PASER

Modified for Michigan TAMC Data Collection
◆ Denotes Priority Distress

	Concrete 10	Concrete 9	Concrete 8
Good	New construction (< 1 year old) No defects <u>Recent reconstruction</u> *Possible Action:* *None*	Like new (> 1 year old) ◆ Joint rehabilitation: recent, only if no other defects are present Map cracks: slight Pop outs: few Surface wear: light, in wheel path <u>Recent concrete overlay</u> *Possible Action:* *None*	◆ Joint sealant: partial loss ◆ Joints: good condition ◆ Transverse cracks: none Meander cracks: isolated, well-sealed/tight Cracks: at manholes – isolated, well-sealed/tight Map cracks: minor Scaling: slight (first signs) Pop outs: minor Surface wear: light *Possible Action:* *Little to no maintenance*
	Concrete 7	**Concrete 6**	**Concrete 5**
Fair	◆ Full-depth repairs: excellent condition ◆ Transverse cracks: isolated Joints: some open Cracks: at manholes – some Settlement/heaves: isolated Scaling: minor Pop outs: could be extensive but sound *Possible Action:* *Seal open joints* *Spot repair surface defects*	◆ Transverse joints: open ¼” ◆ Longitudinal joints: open ¼” ◆ Transverse & meander cracks: open ¼” Cracks: at corners – several, well-sealed/tight Shallow reinforcement: cracking – first signs Scaling: < 25% surface *Possible Action:* *Seal open joints and cracks* *Overlay surface scaling areas*	◆ Joint/crack spalling: first signs ◆ Joint/crack faulting: up to ¼” Cracks: at corners – multiple, with broken pieces Shallow reinforcement: spalling Scaling: 25% to 50% surface Polishing: 25% to 50% surface *Possible Action:* *Some partial depth joint repairs or patching may be needed*
	Concrete 4	**Concrete 3**	**Concrete 2**
Poor	◆ Joint/crack spalling: open 1” on several slabs ◆ Joint/crack faulting: up to ½” ◆ Transverse or meander cracks: multiple Cracks: at corners – missing pieces or patches Pavement blowups Spalling: > 50% surface Map cracks: > 50 % surface Scaling: > 50% surface Polishing: > 50% surface *Possible Action:* *Some full depth repairs* *Asphalt overlay or extensive surface texturing of surface scaling*	◆ Joint, transverse, and meander cracks: open 1” on most slabs severely spalled ◆ Joint/crack faulting: up to 1” ◆ D-cracking: evident Patches: extensive, fair to poor condition *Possible Action:* *Extensive full depth repairs* *Some full slab replacements*	Joints: failed Settlement/heaves: extensive, severe Spalling (of slab cracks): extensive, severe Patches: extensive, failed condition *Possible Action:* *Recycle or rebuild pavement* **Concrete 1** Pavement integrity: total loss Potholes: extensive <u>Restricted speeds</u> *Possible Action:* *Total reconstruction*

- Structural distresses require full depth repairs
- Full depth repair treatment drops to 4

- Small treatment attempt = 2
- No treatment attempt = 1

Contact Information

Roadsoft & LDC Technical Support: 906-487-2102

TAMC Coordinator: Roger Belknap, 517-230-8192
belknapr@michigan.gov

TAMC Website: michigan.gov/tamc

Framework Issues:
517-335-3741, ask for the TAMC Help Desk

PASER Data Submission via the CSS IRT Website
https://milogintp.michigan.gov

Michigan Transportation Asset Management Council

Center for Technology & Training

Prepared by Center for Technology & Training—Michigan Technological University
on behalf of the Michigan Transportation Asset Management Council

Rating surface conditions of brick and block streets

The extent and severity of each type of defect are used to rate the street section's overall condition. Defects may gradually worsen with age or they may deteriorate rapidly, depending on the volume of heavy traffic and the road quality.

Inspecting and rating streets every year or two helps track the rate of deterioration and lets local officials plan for maintenance and improvement. The photographic examples will help you become familiar with the general patterns of each rating.

Surface rating	*General condition, defects, and recommended improvement*
4 **Very Good**	New condition. No defects.
3 **Good**	Very few defects. Good ride.
2 **Fair**	One or more types of defects present extending over 5% to 25% of the surface area. Ride may be uneven and rough. Sunken or settled areas. Broken bricks or blocks. Areas of poor drainage. Open joints. Spot repairs are recommended.
1 **Poor**	Defects cover more than 25% of the surface area. Very rough ride. Numerous patches in fair to poor condition. Poor drainage. Requires extensive repair or reconstruction.

☑ 4 – VERY GOOD

New condition. No defects.

New brick street.

☑ 3 – GOOD

Few defects. Good ride.

Good brick and block pavement.

Bricks providing good service.

☑ 2 – FAIR

One or more types of defects extending over 5 to 25% of the surface area.

Overall ride may be uneven and rough.

Sunken or settled areas.

Broken bricks or blocks.

Areas of poor drainage.

Open joints.

Spot repairs are recommended.

Settlement and missing bricks.

Twenty percent of surface needs improvement due to bad patches and rough ride.

Areas of poor drainage need repair.

Broken bricks need replacement.

☑ 1 – POOR

Defects cover more than 25% of the surface area.

Very rough ride.

Numerous patches in fair to poor condition.

Poor drainage.

Requires extensive repair or reconstruction.

Extensive patching in poor condition.

Broken bricks and rough surface over extensive area.

Severe brick deterioration.

Summary

Assessing street conditions is essential to good planning and efficient use of local street funds. The PASER pavement surface evaluation and rating procedure, described here and in other PASER Manuals, has proven effective in improving decision making and using street repair and improvement funds efficiently. For more information and training contact the Transportation Information Center.

Transportation Information Center
University of Wisconsin–Madison

Produced by the T.I.C. with support from the Federal Highway Administration, the Wisconsin Department of Transportation, and the University of Wisconsin-Extension. The T.I.C., part of the nationwide Local Technical Assistance Program (LTAP), is a Center of the College of Engineering, Department of Engineering Professional Development, University of Wisconsin–Madison.

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Susan Kummer
Artifax
designer

Inventory-based Rating System™ for Gravel Roads — Quick Guide

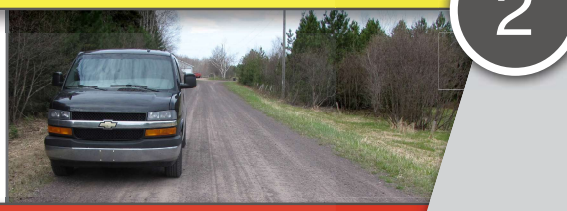
Surface Width

Good

22 ft or more
(6.7 m)

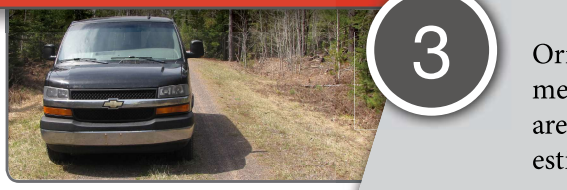
Fair

16 to 21 ft
(4.9 to 6.4 m)



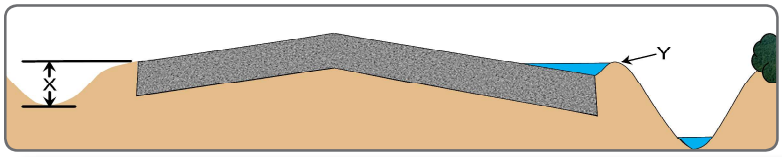
Poor

15 ft or less
(4.6 m)



1. Include any shoulder in the width that is suitable for travel
2. Be aware of trees and slopes that may influence your width perception
3. Orientate yourself by physically measuring the width until you are comfortable making accurate estimates from your vehicle

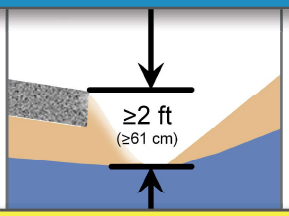
Drainage Adequacy



Good

X is 2 ft or more
(61 cm)

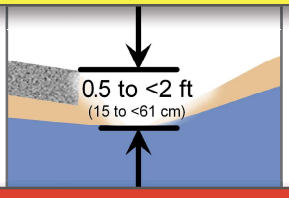
No secondary ditches (Y) present



Fair

X is 0.5 to <2 ft
(15 to <61 cm)

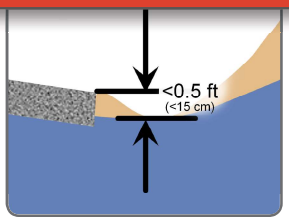
OR X is 2 ft or more AND secondary ditches present



Poor

X is <0.5 ft
(15 cm)

Secondary ditches may or may not be present

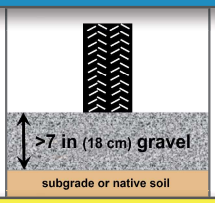


1. Note whether driveway culverts are present; if they are, then drainage is most likely good or fair
2. Be aware of conditions that would not warrant ditching (i.e., tops of hills) that may influence your perception of ditches
3. Measure the actual ditch depth until you are comfortable estimating accurately from your vehicle
4. Be aware of tall grass hiding ditches

Structural Adequacy

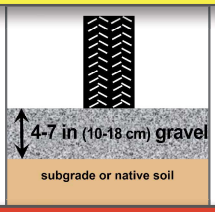
Good

>7 in of good gravel
(18 cm)



Fair

4-7 in of good gravel
(10 to 18 cm)



Poor

<4 in of good gravel
(10 cm)

1 Look into what is causing structural problems; more gravel is not a remedy for bad cross-slope drainage

2 If you do not know the segment's history, ask someone who does; otherwise, rate during thaw, wet, and/or dry periods to determine when the road is impassable and when ruts and potholes are present.

IF THICKNESS IS NOT KNOWN:

GOOD: NO STRUCTURAL DISTRESSES

FAIR: SOME | DURING WET PERIODS

RUTS: Prevalent, substantial, and ≥ 1-inch deep

POTHOLES: Prevalent, substantial, and ≥ 3-feet wide

POOR: MANY | THROUGHOUT THE ENTIRE YEAR

Rating Lookup Chart

Width	Drain	Struc	IBR #
Good	Good	Good	10*
Good	Good	Good	9
Good	Good	Fair	8
Good	Good	Poor	7
Good	Fair	Good	9
Good	Fair	Fair	8
Good	Fair	Poor	6
Good	Poor	Good	7
Good	Poor	Fair	6
Good	Poor	Poor	5
Fair	Good	Good	8
Fair	Good	Fair	7
Fair	Good	Poor	6
Fair	Fair	Good	7
Fair	Fair	Fair	6
Fair	Fair	Poor	5
Fair	Poor	Good	6
Fair	Poor	Fair	5
Fair	Poor	Poor	4
Poor	Good	Good	5
Poor	Good	Fair	4
Poor	Good	Poor	3
Poor	Fair	Good	4
Poor	Fair	Fair	3
Poor	Fair	Poor	2
Poor	Poor	Good	3
Poor	Poor	Fair	2
Poor	Poor	Poor	1

*Segment is < 1 year old

For more information, see *IBR System™ Training Manual* at ctt.mtu.edu/asset-management resources

Michigan Transportation Asset Management Council

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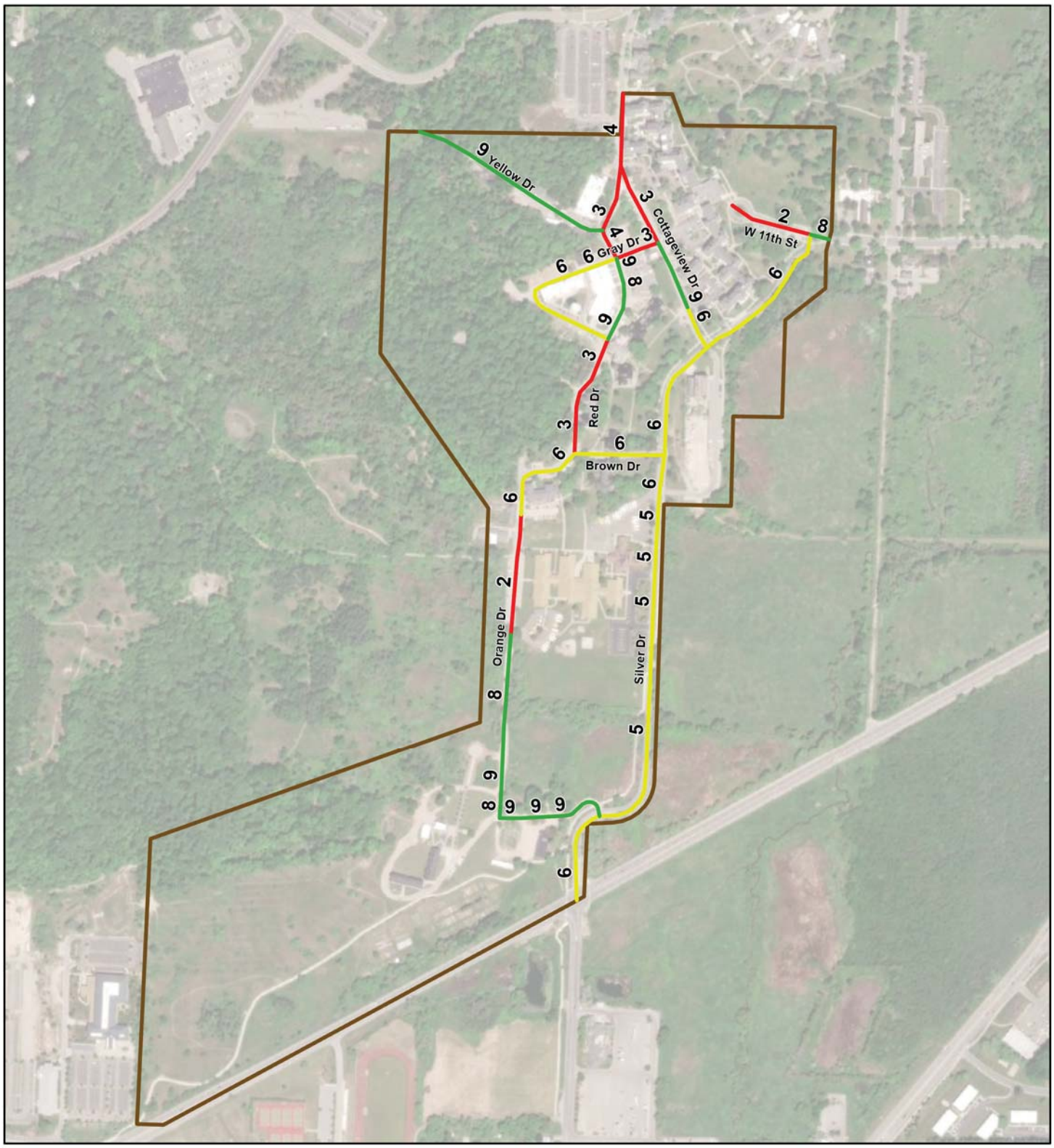
Appendix E-2 Road PASER Rating

Grand Traverse Commons 2022 PASER Rating



N

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

0 375 750 1,500
Feet

Legend

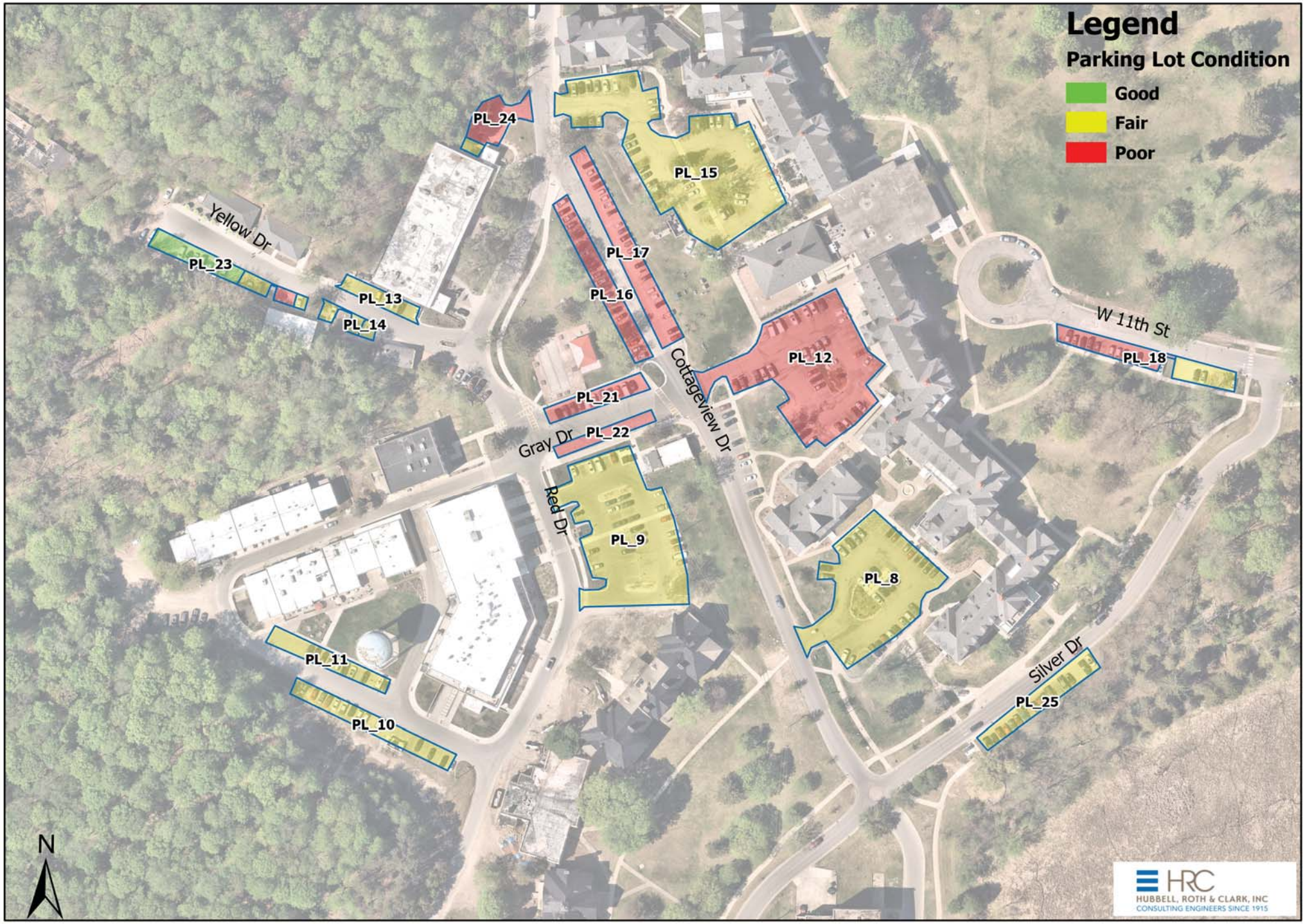
Project Area

PASER Rating

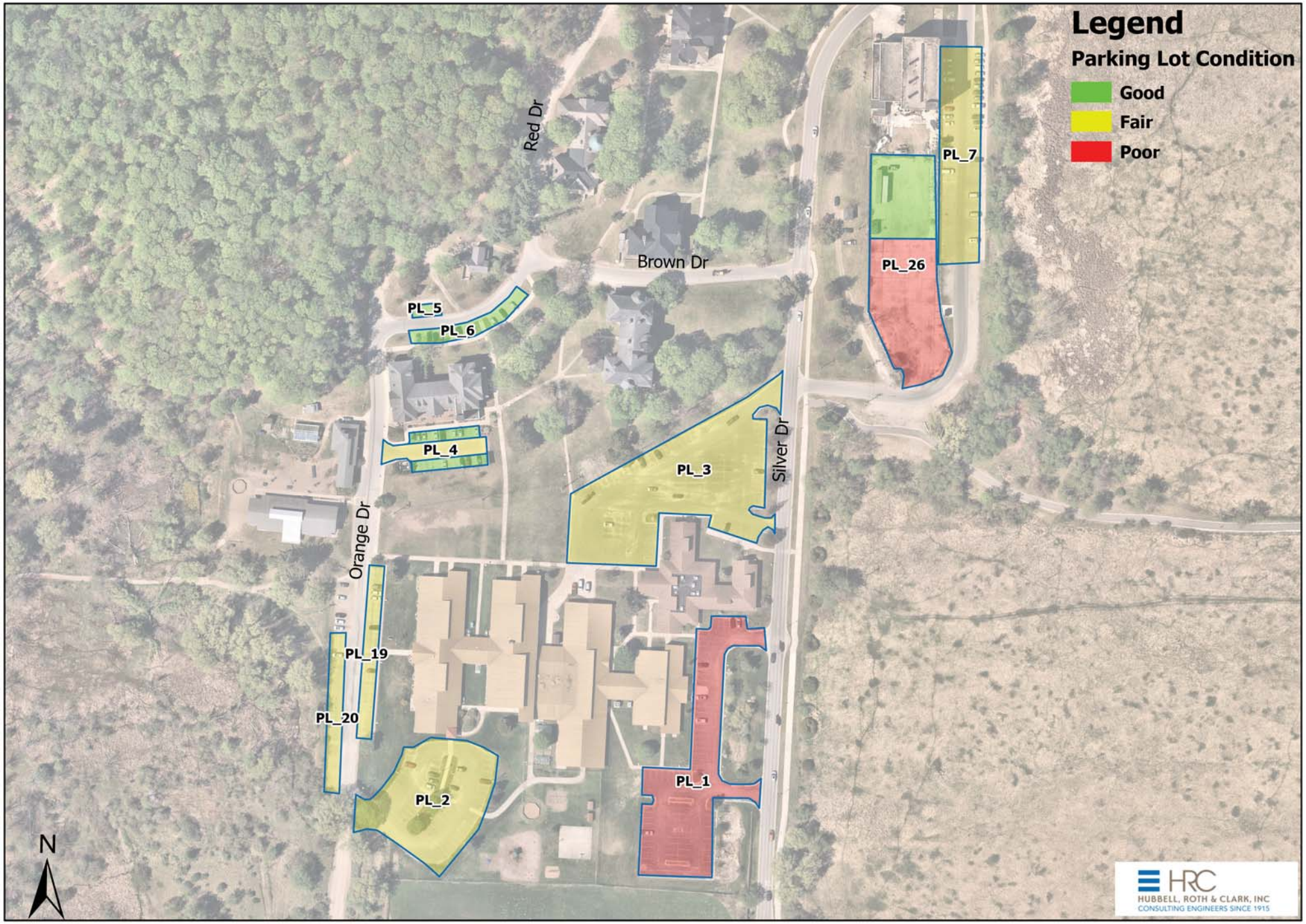
- Good: 8-10
- Fair: 5-7
- Poor: 1-4

Appendix E-3 Parking Lot Inspections

Grand Traverse Parking Lot Overall Map (North)



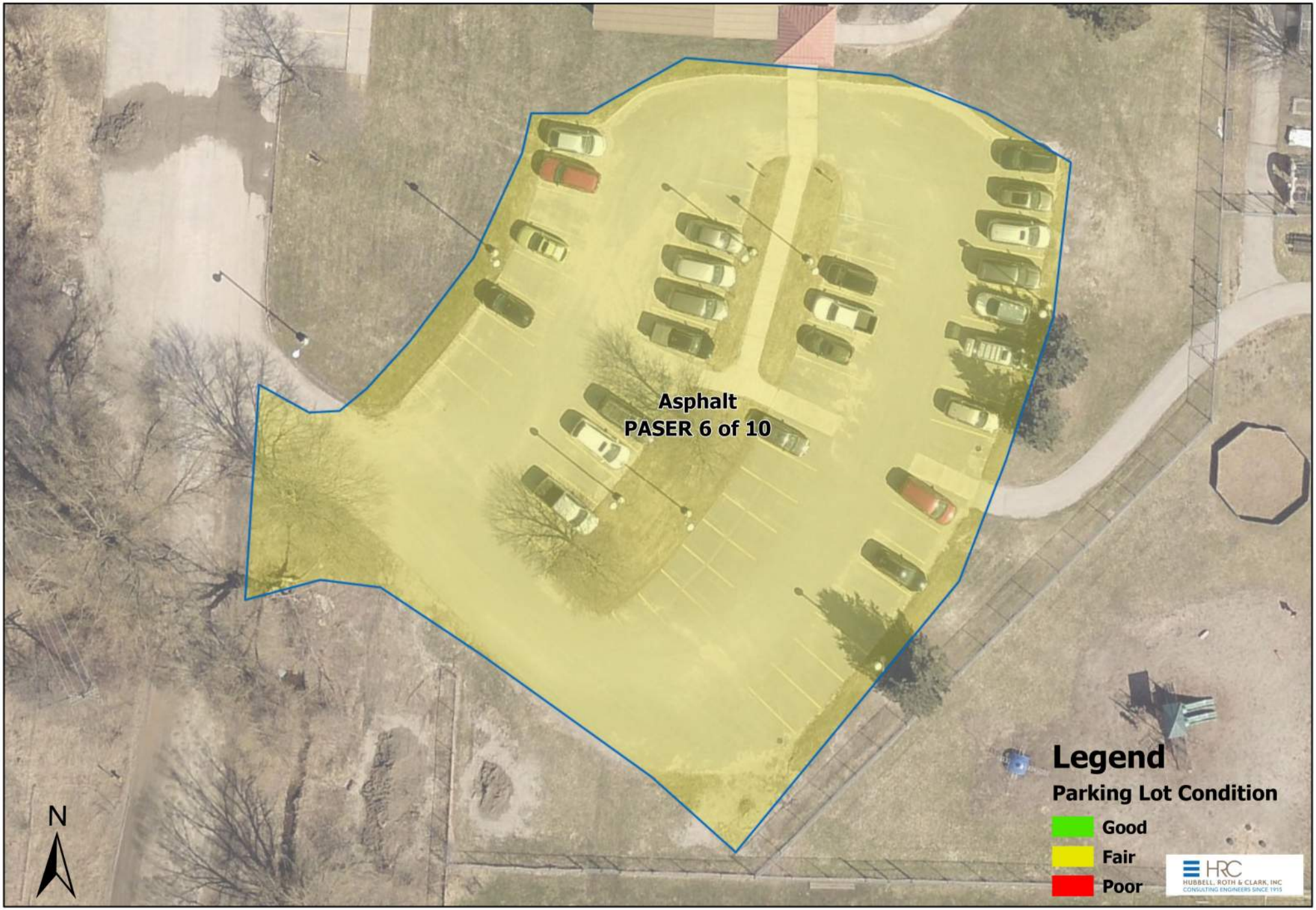
Grand Traverse Parking Lot Overall Map (Central)



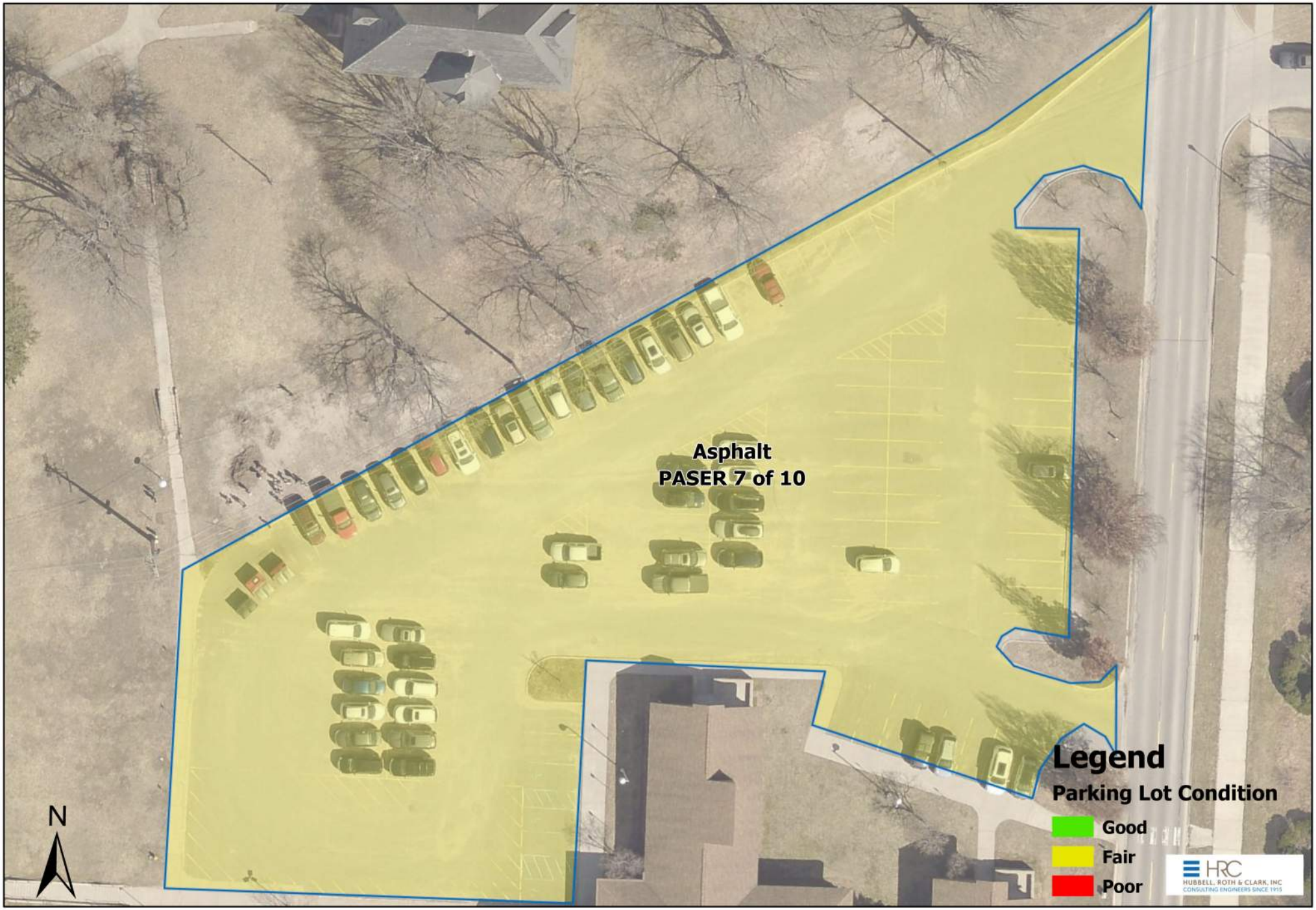
Grand Traverse Parking Lot Overall Map (South)

Grand Traverse Parking Lot Inspections PL_1

Grand Traverse Parking Lot Inspections PL_2



Grand Traverse Parking Lot Inspections PL_3

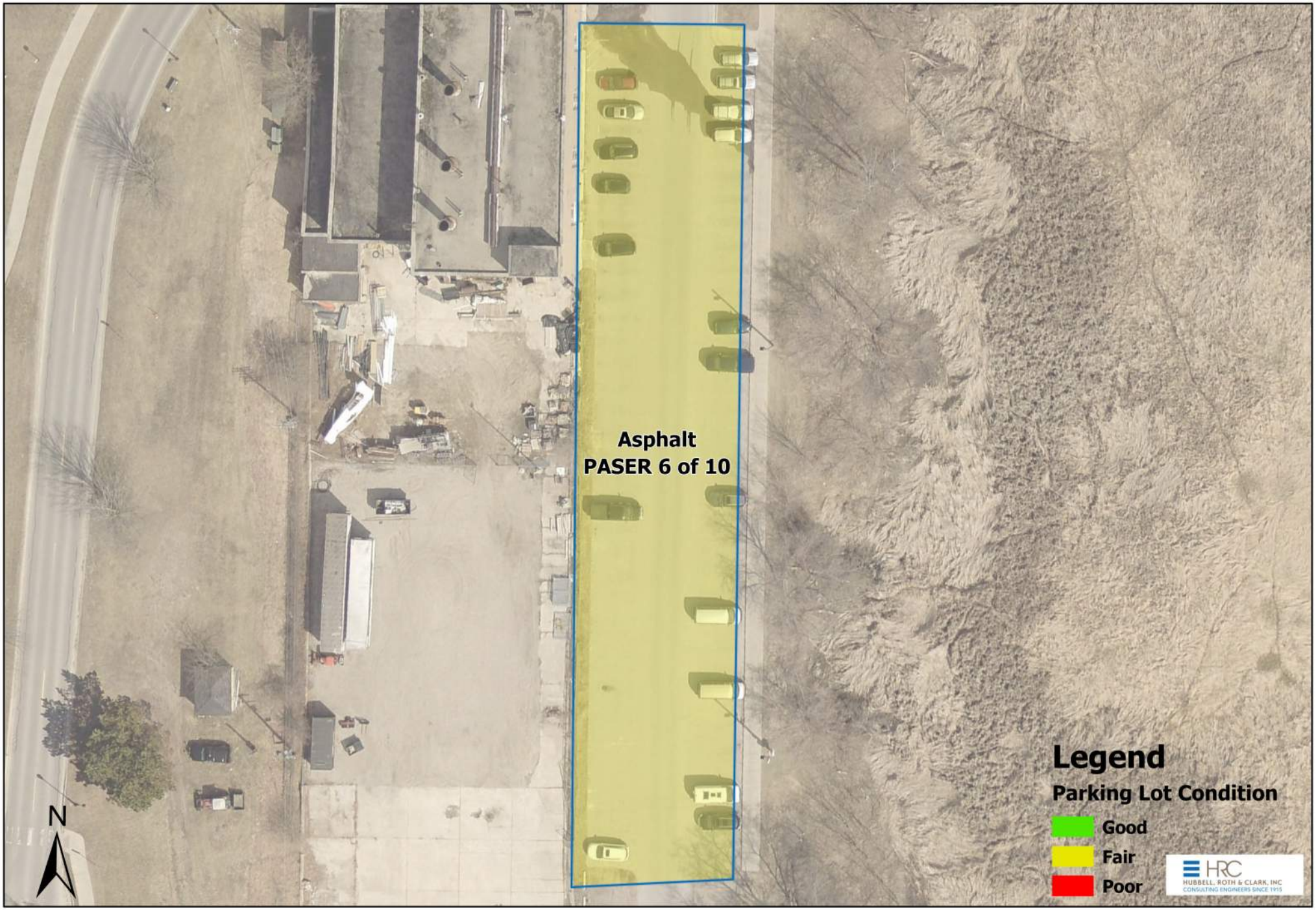


Grand Traverse Parking Lot Inspections PL_4

Grand Traverse Parking Lot Inspections PL_5

Grand Traverse Parking Lot Inspections PL_6

Grand Traverse Parking Lot Inspections PL_7



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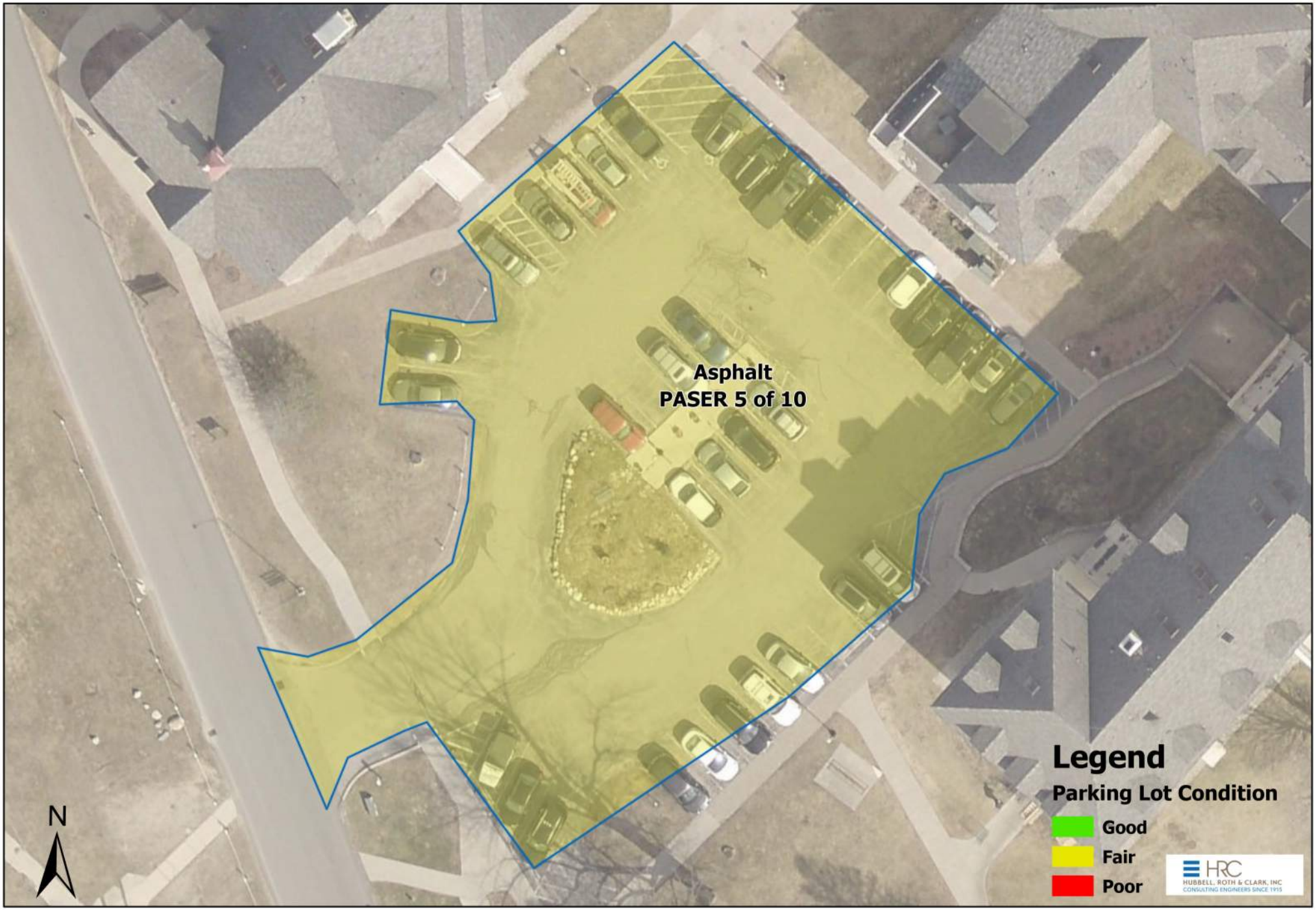
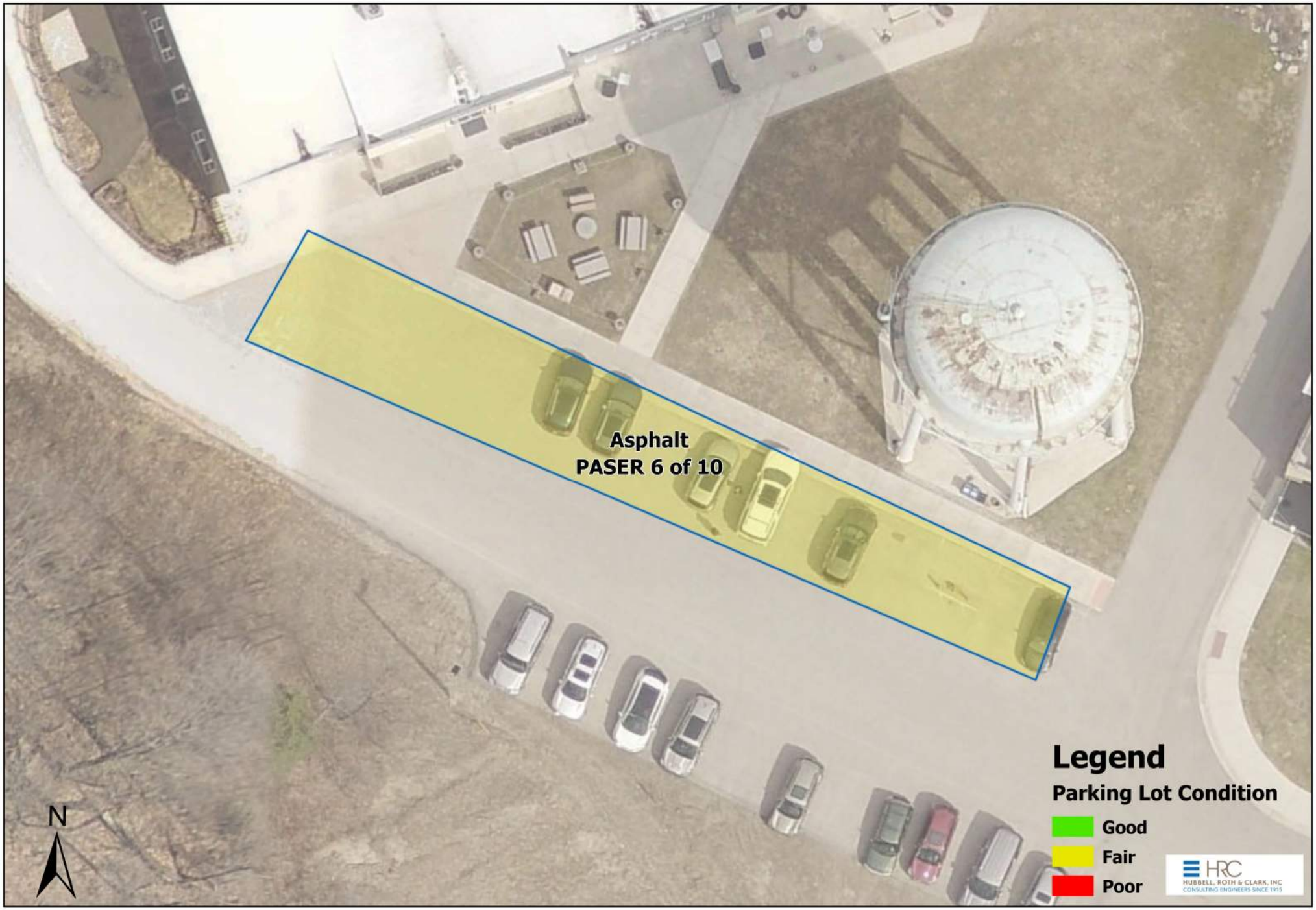


Grand Traverse Parking Lot Inspections PL_9

Grand Traverse Parking Lot Inspections PL_10

Grand Traverse Parking Lot Inspections PL_11



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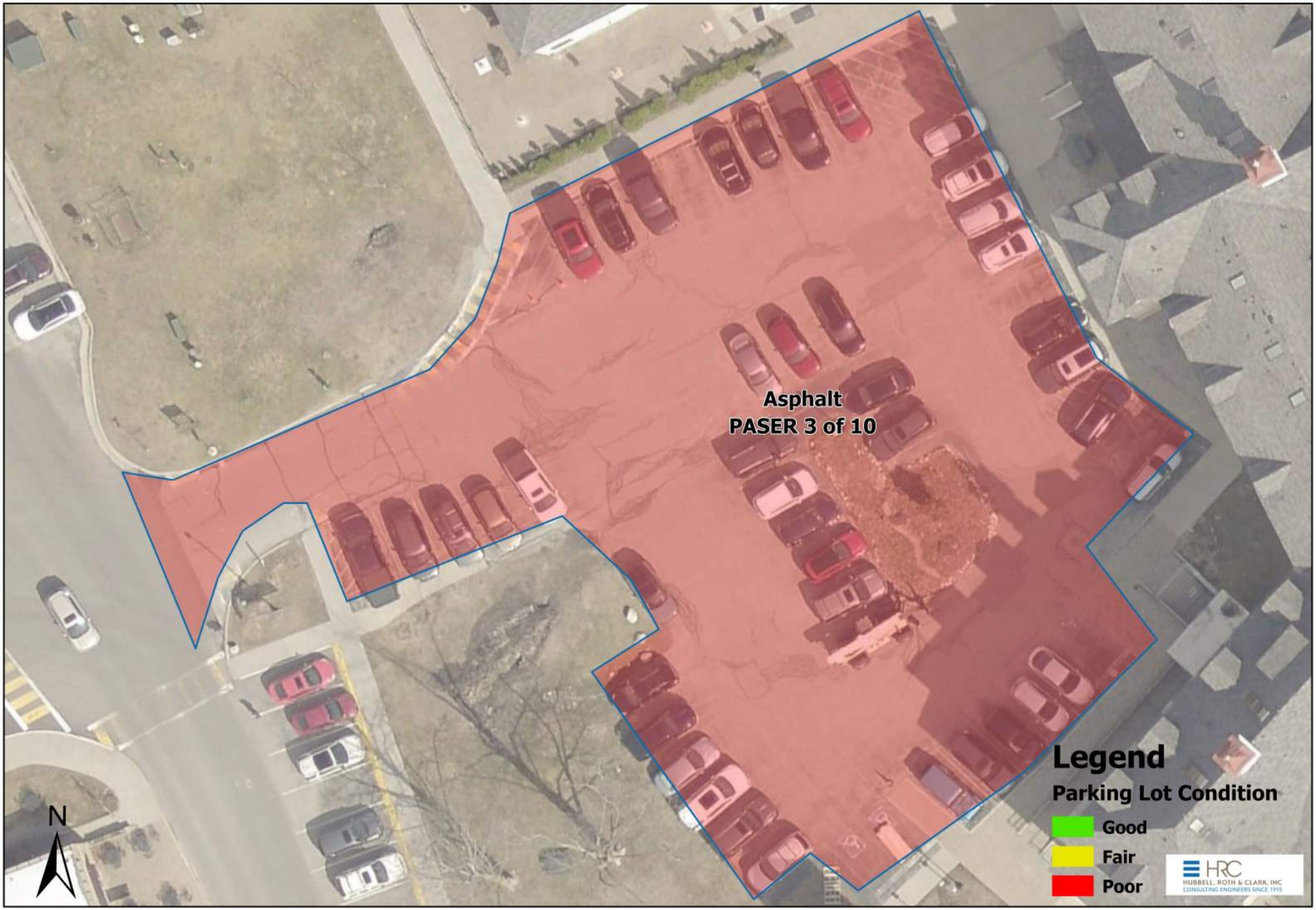
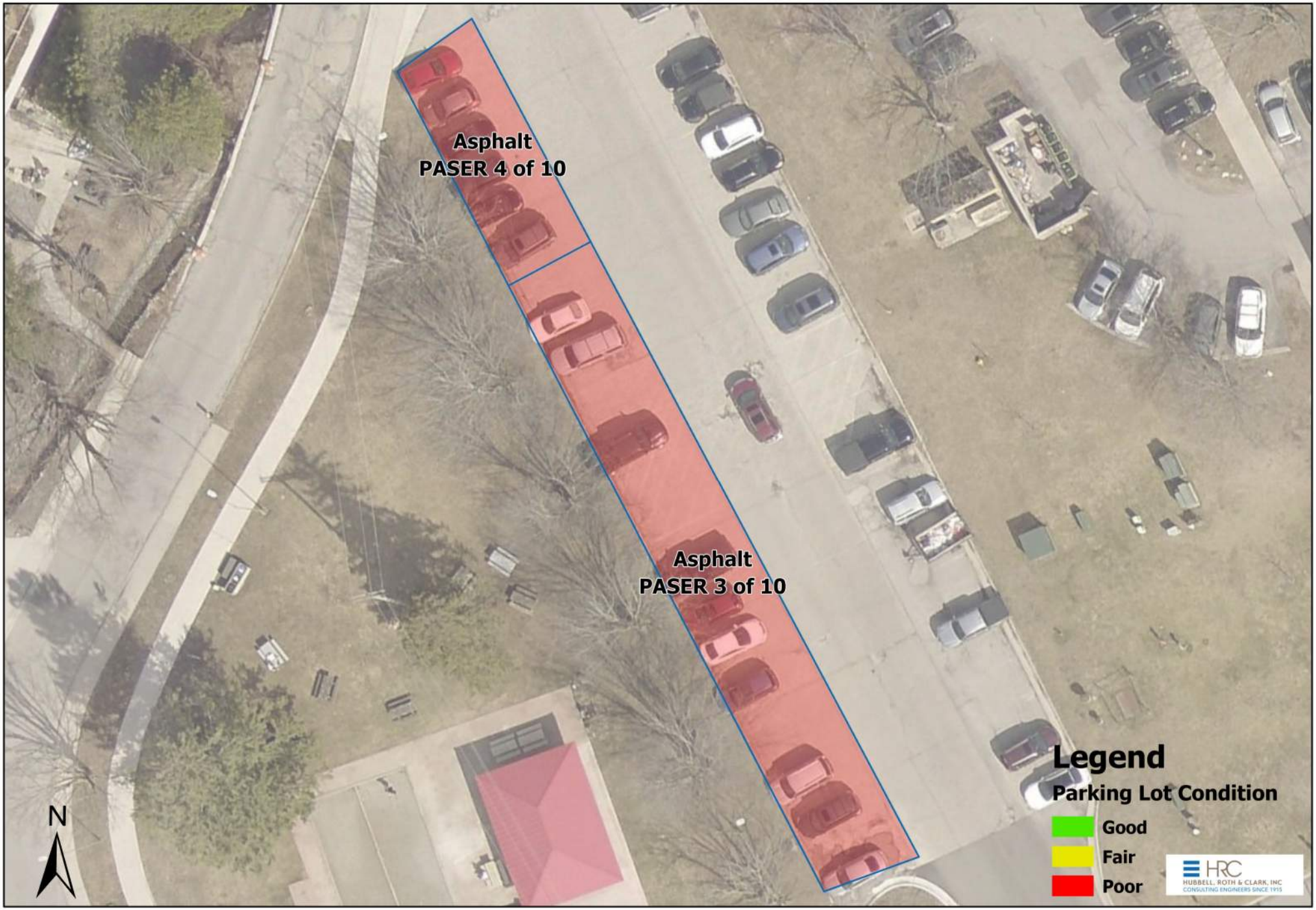


Grand Traverse Parking Lot Inspections PL_13

Grand Traverse Parking Lot Inspections PL_14

Grand Traverse Parking Lot Inspections PL_15

Grand Traverse Parking Lot Inspections PL_16



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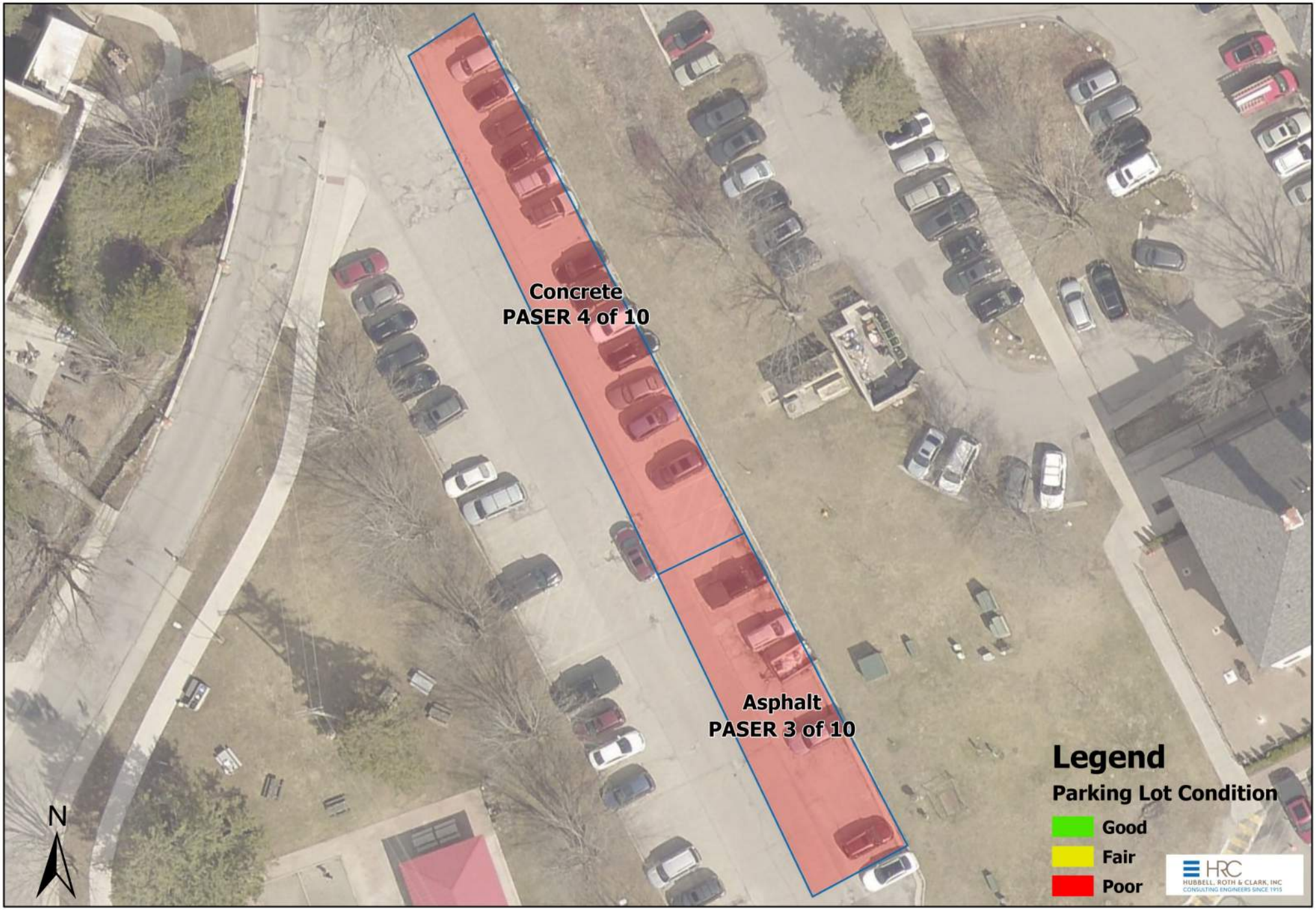

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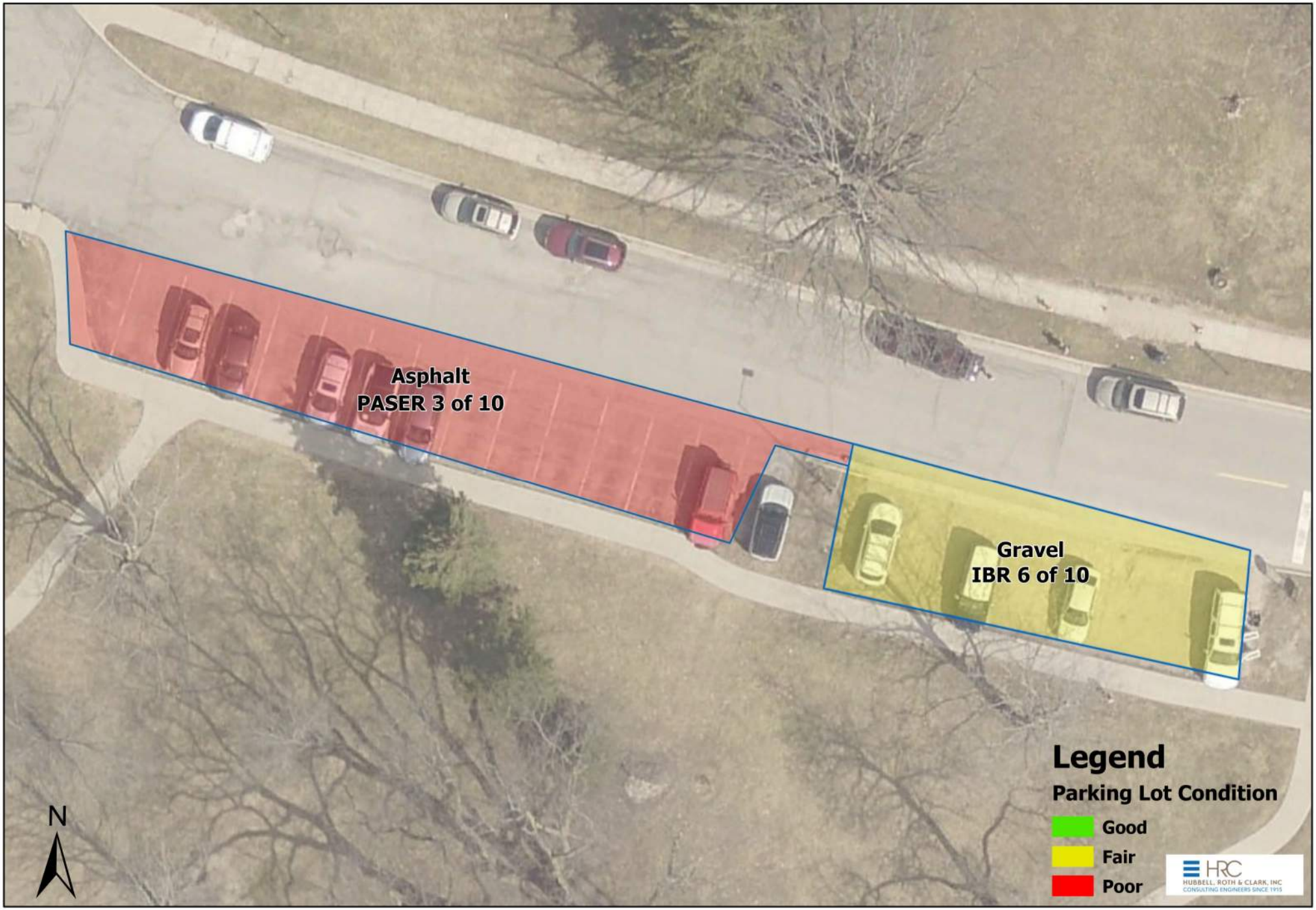

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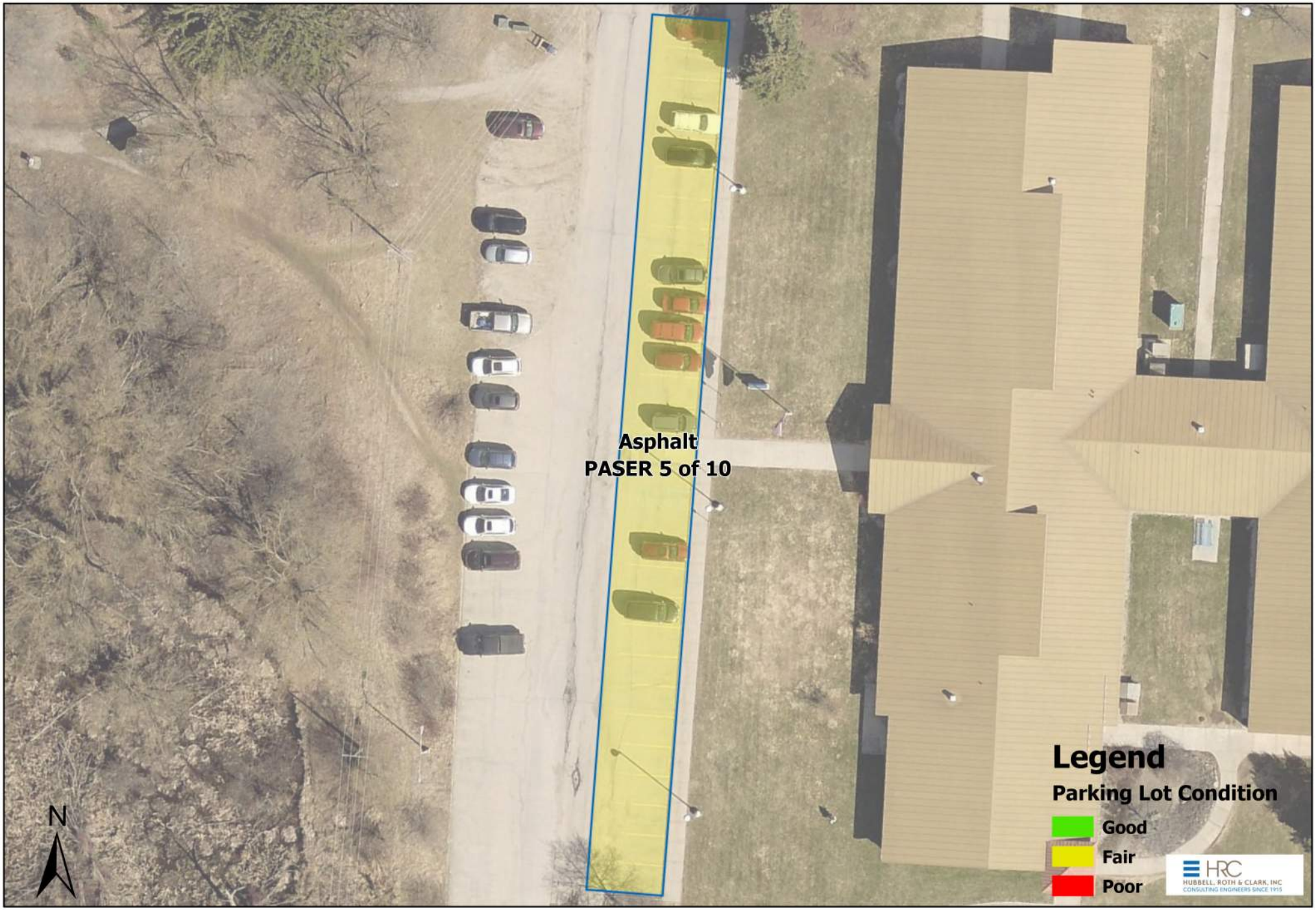

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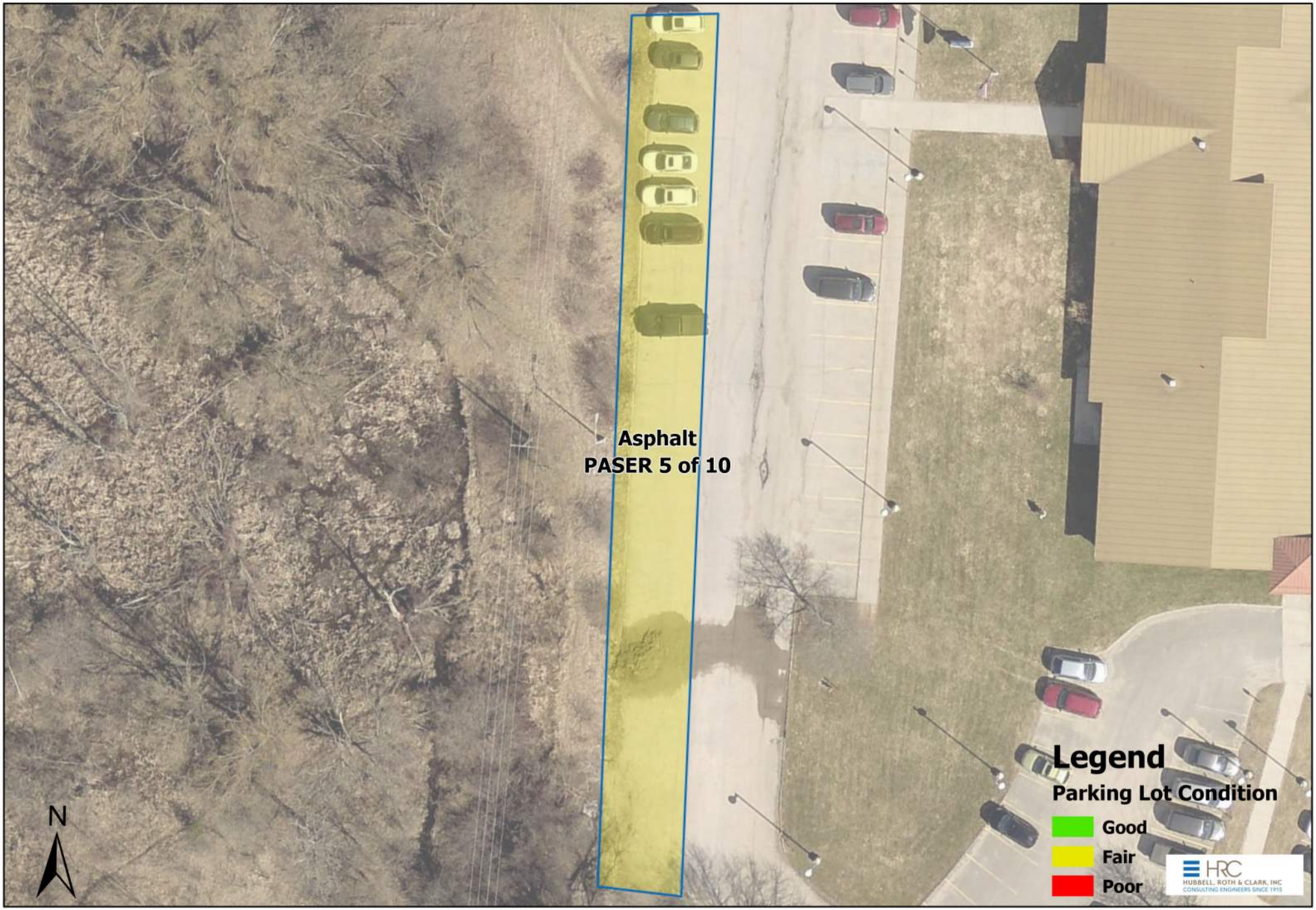

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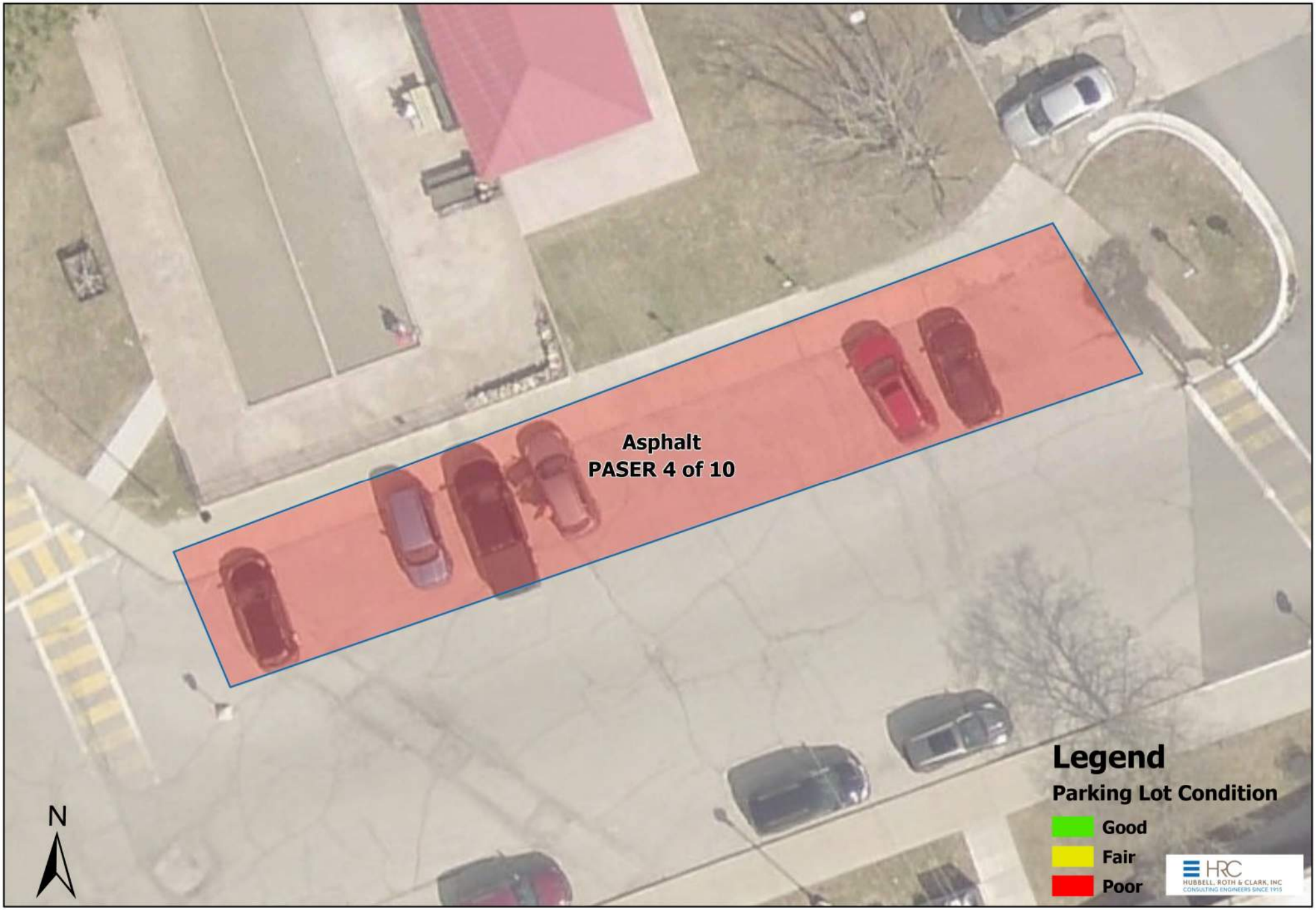
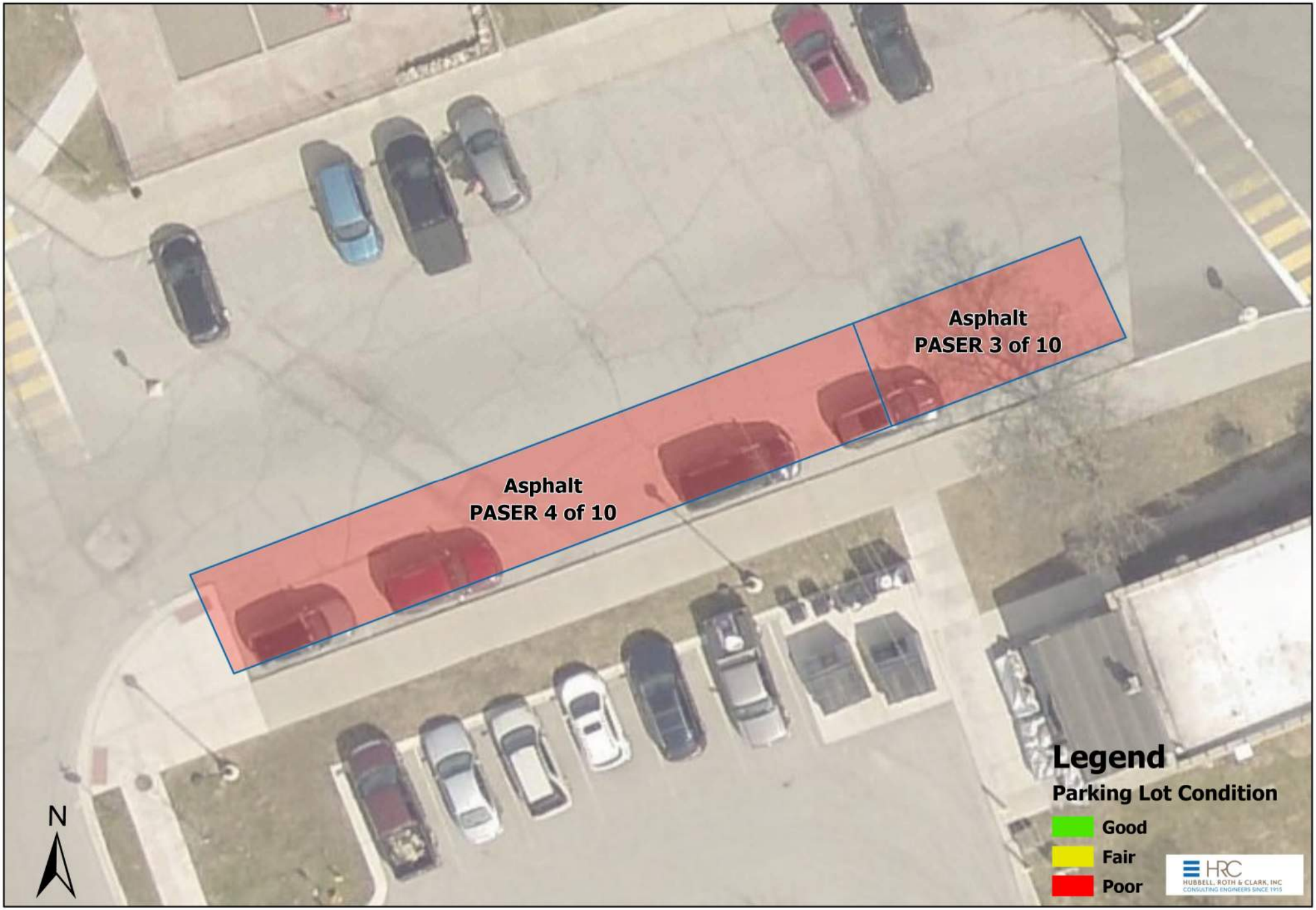
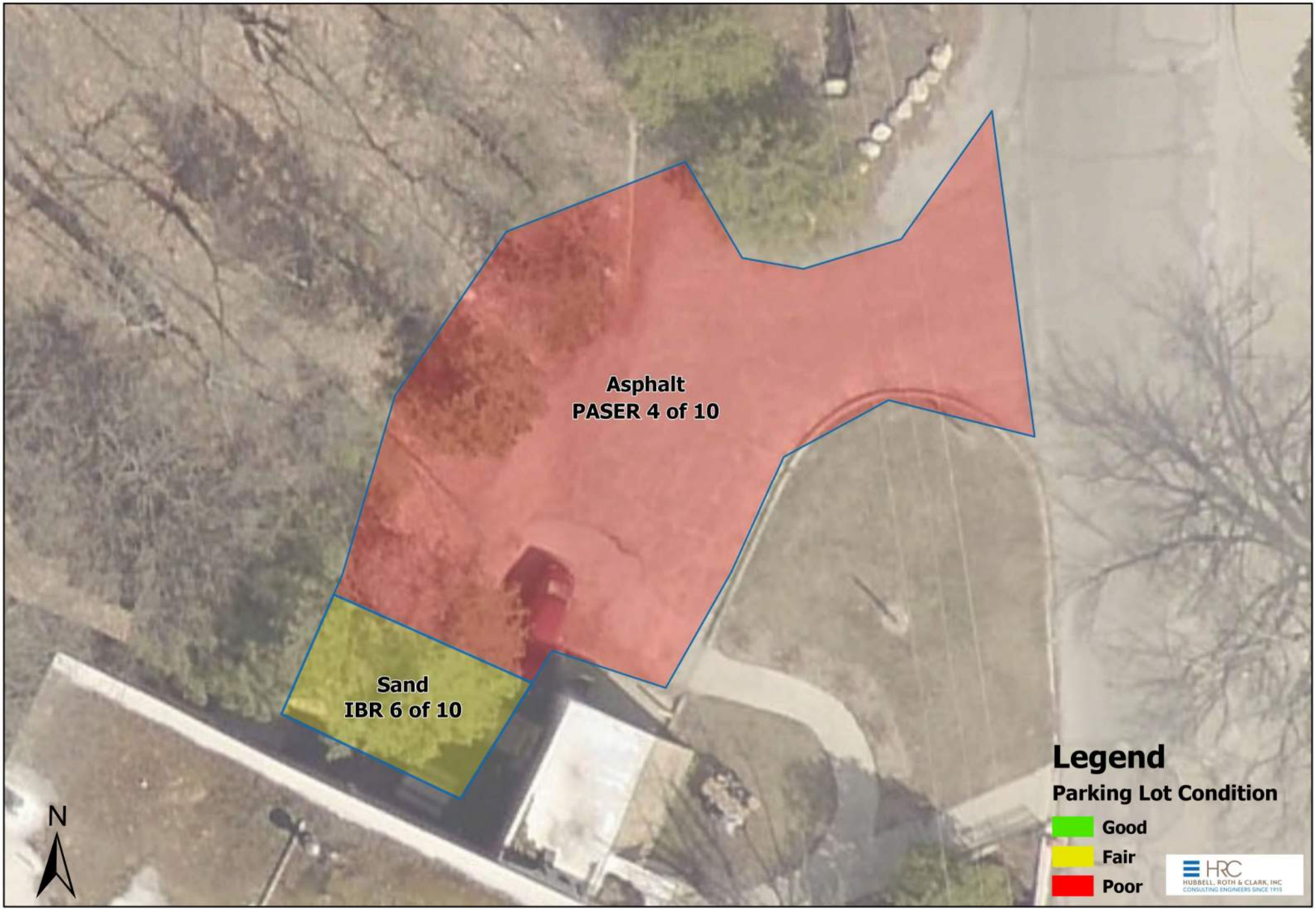


Grand Traverse Parking Lot Inspections PL_22



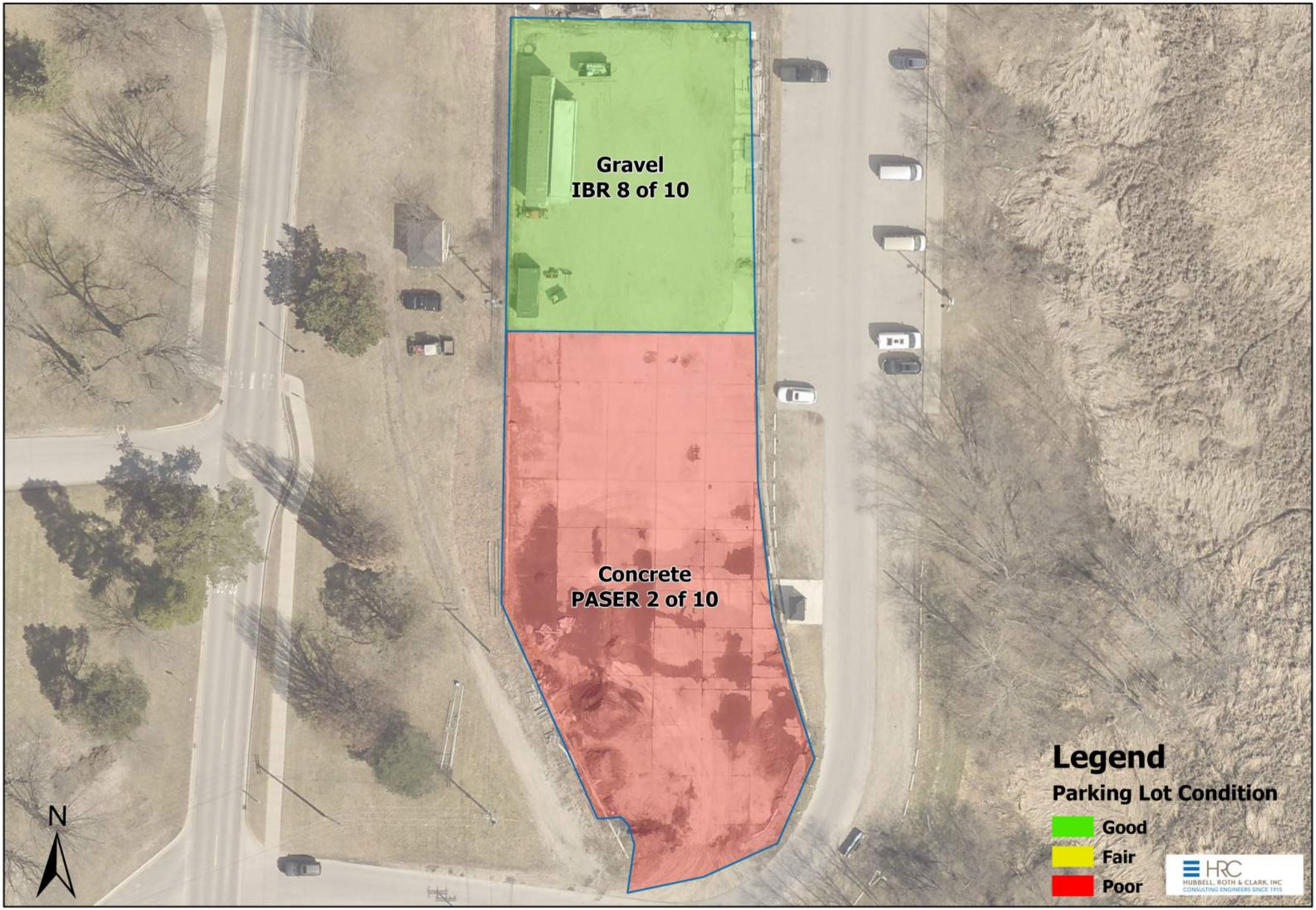
Grand Traverse Parking Lot Inspections PL_23

Grand Traverse Parking Lot Inspections PL_24



Grand Traverse Parking Lot Inspections PL_25

Grand Traverse Parking Lot Inspections PL_26

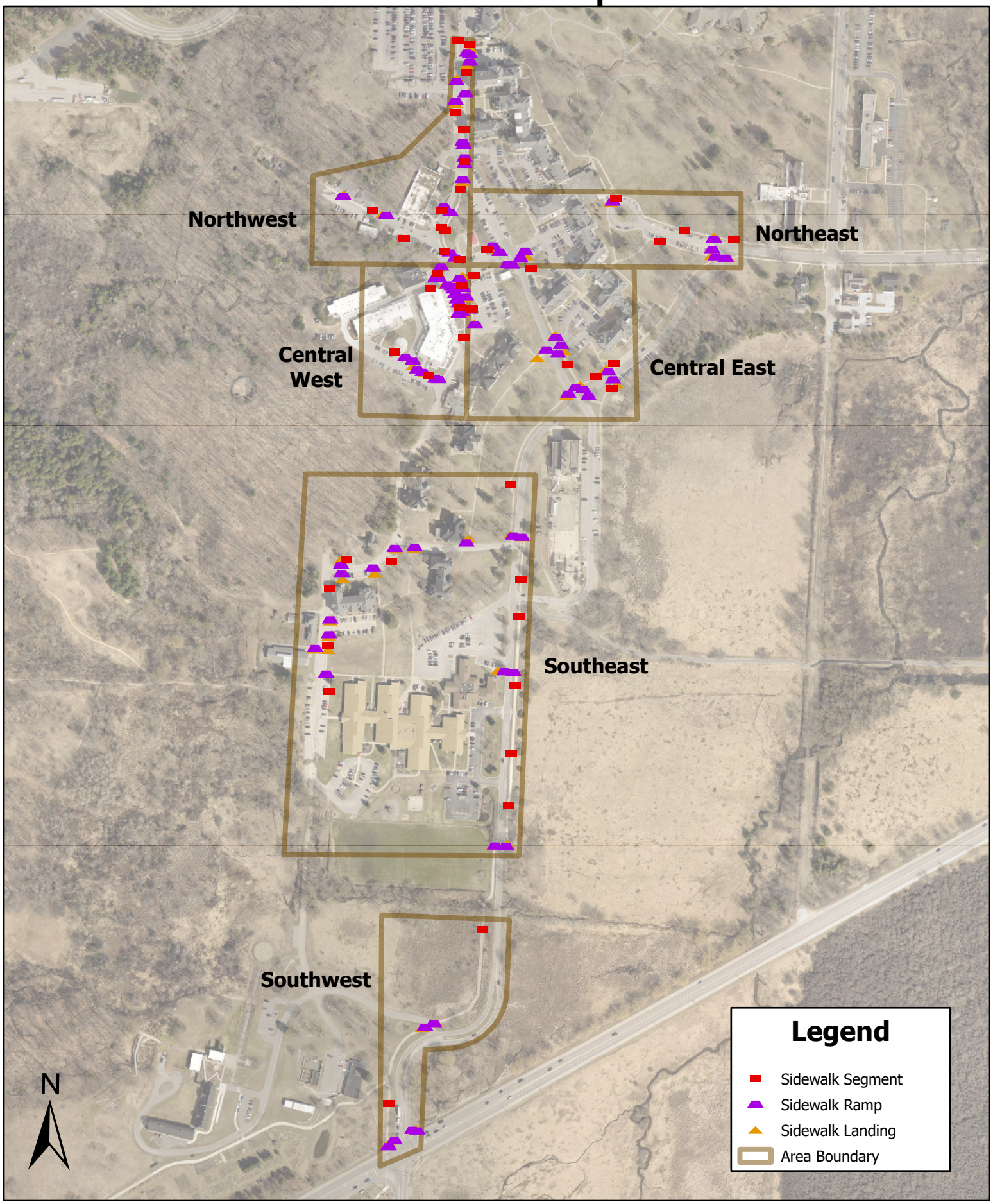


Grand Traverse Parking Lot Inspections PL_27

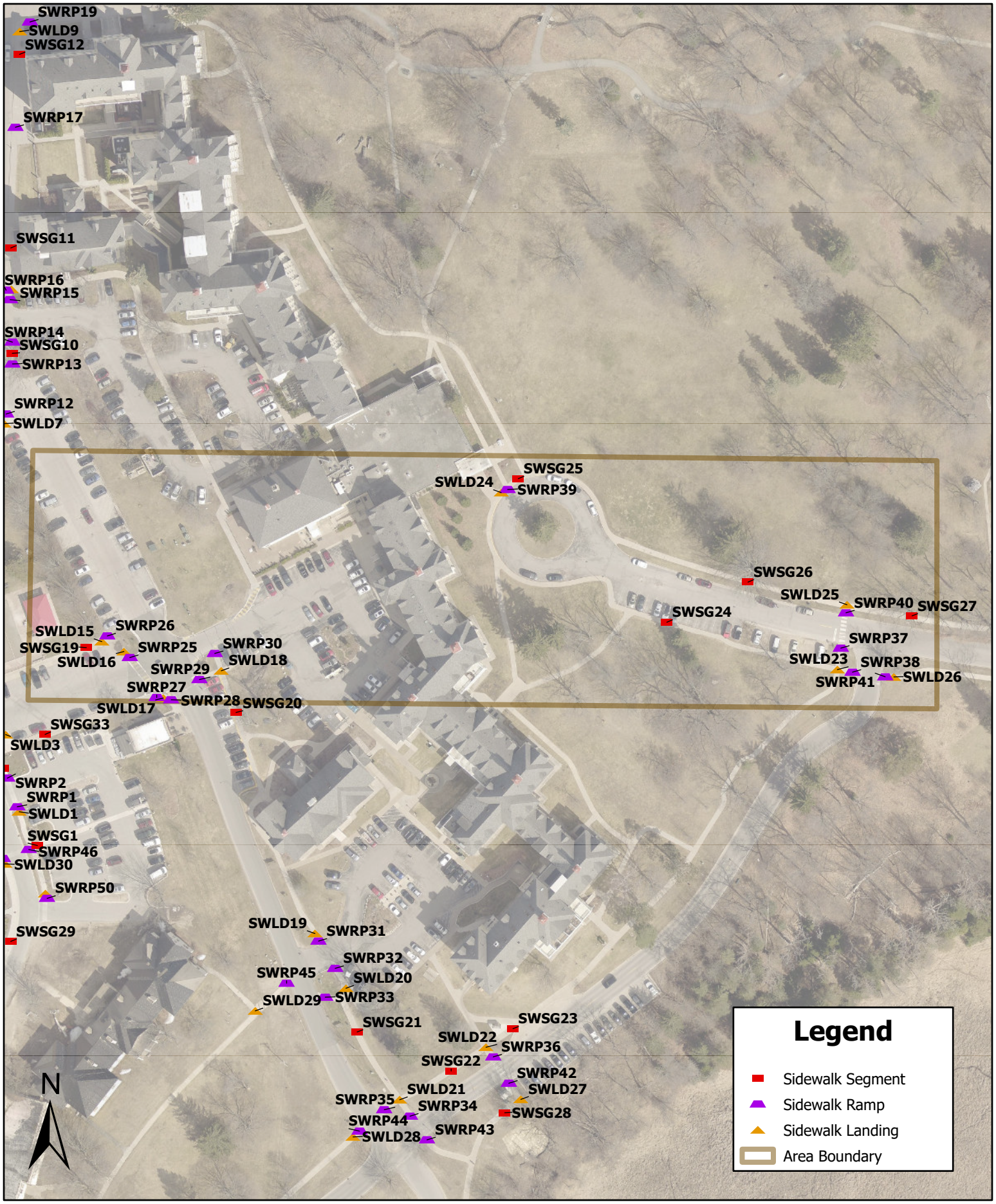
Grand Traverse Parking Lot Inspections PL_28

Appendix E-4 Sidewalk Inspections

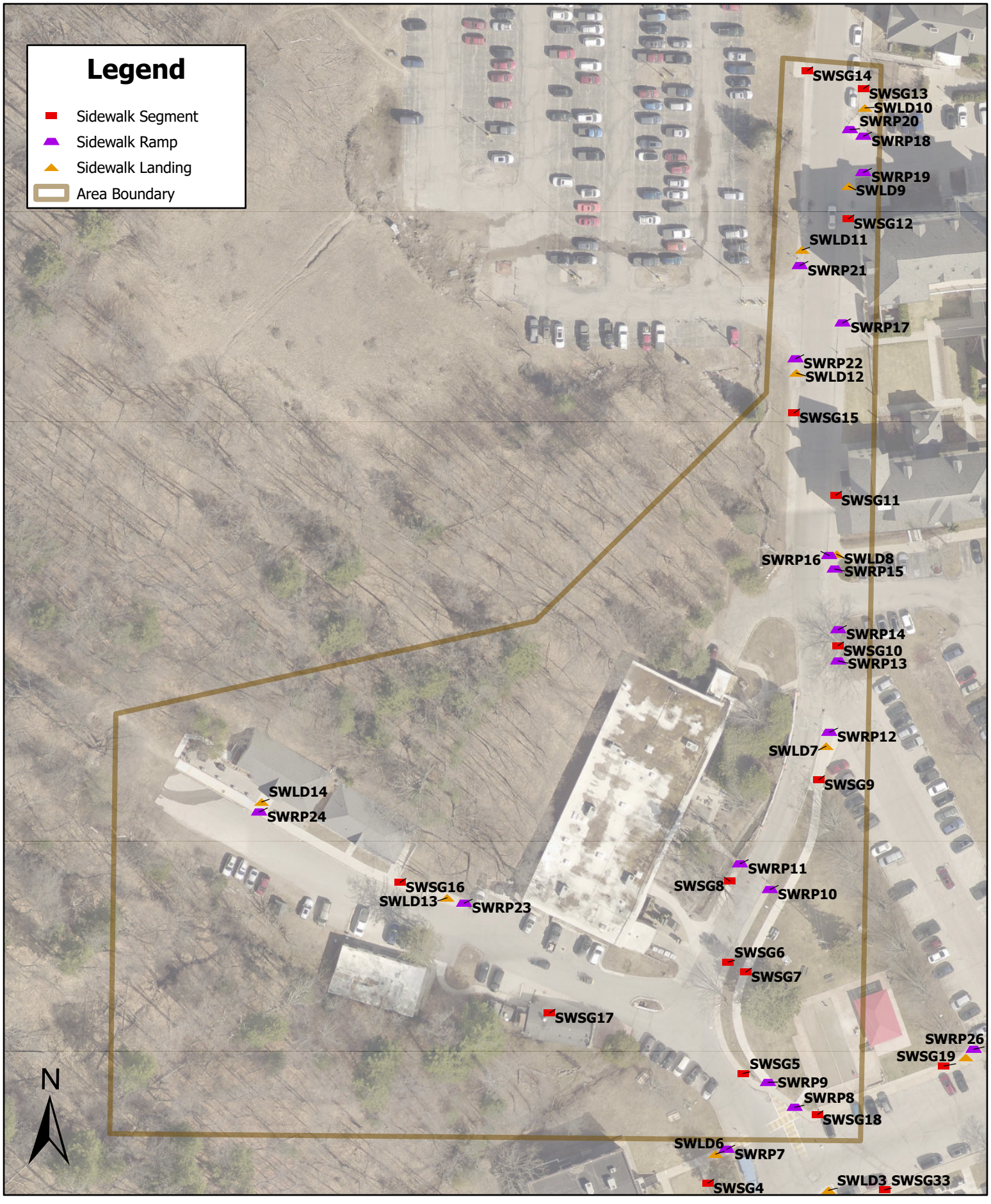
GT Commons Sidewalk Inspections Index Map



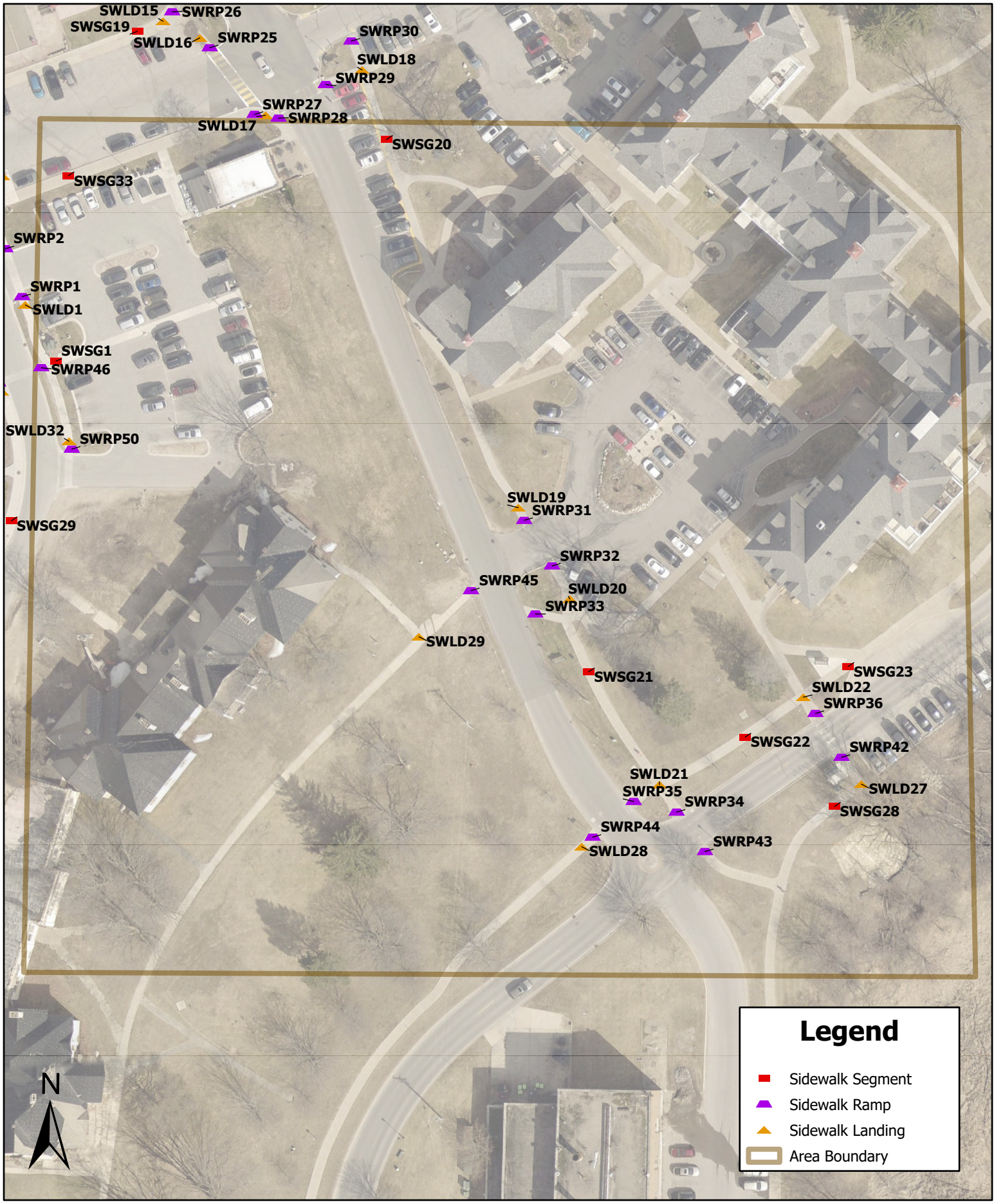
GT Commons Sidewalk Inspections Northeast



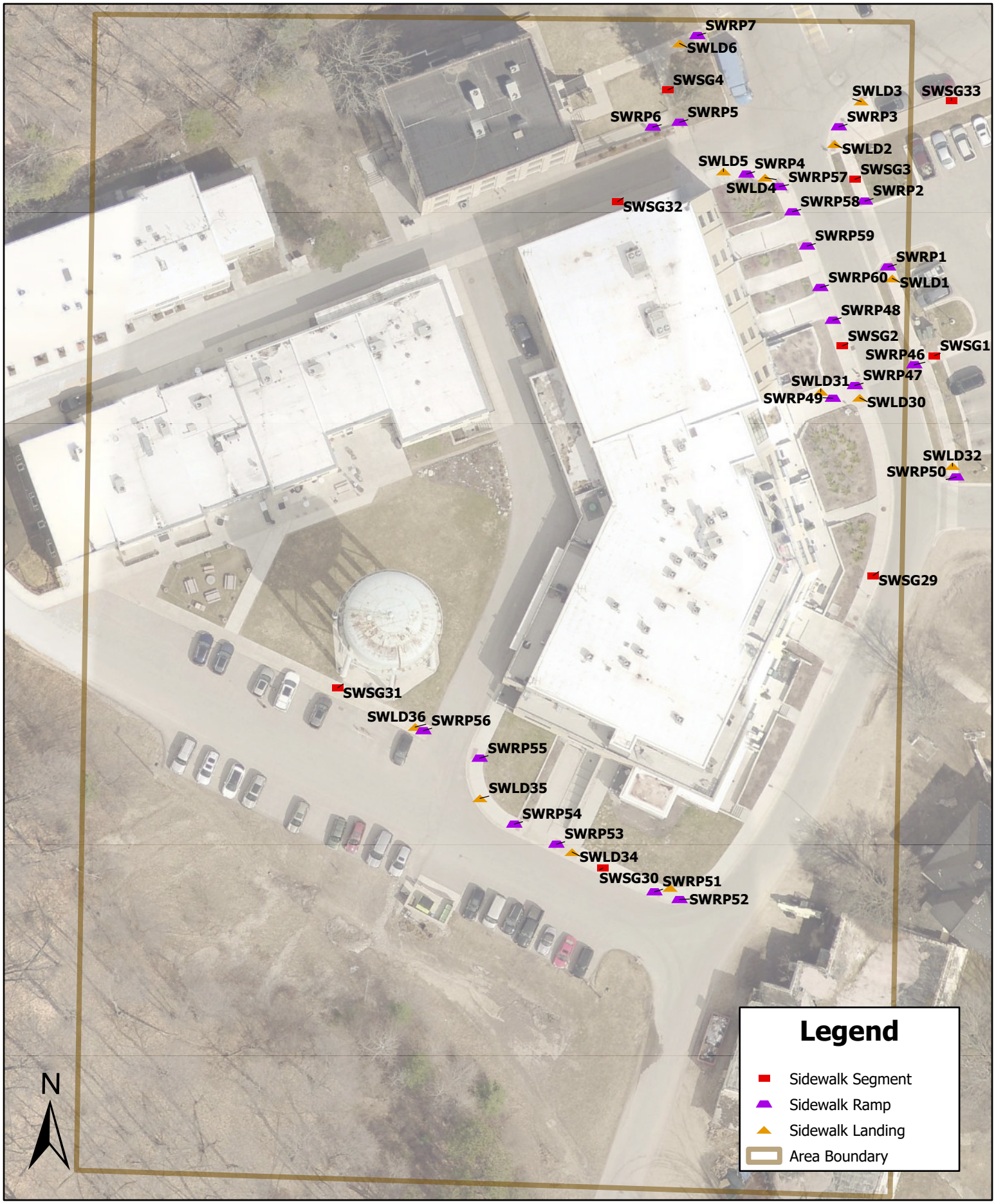
GT Commons Sidewalk Inspections Northwest



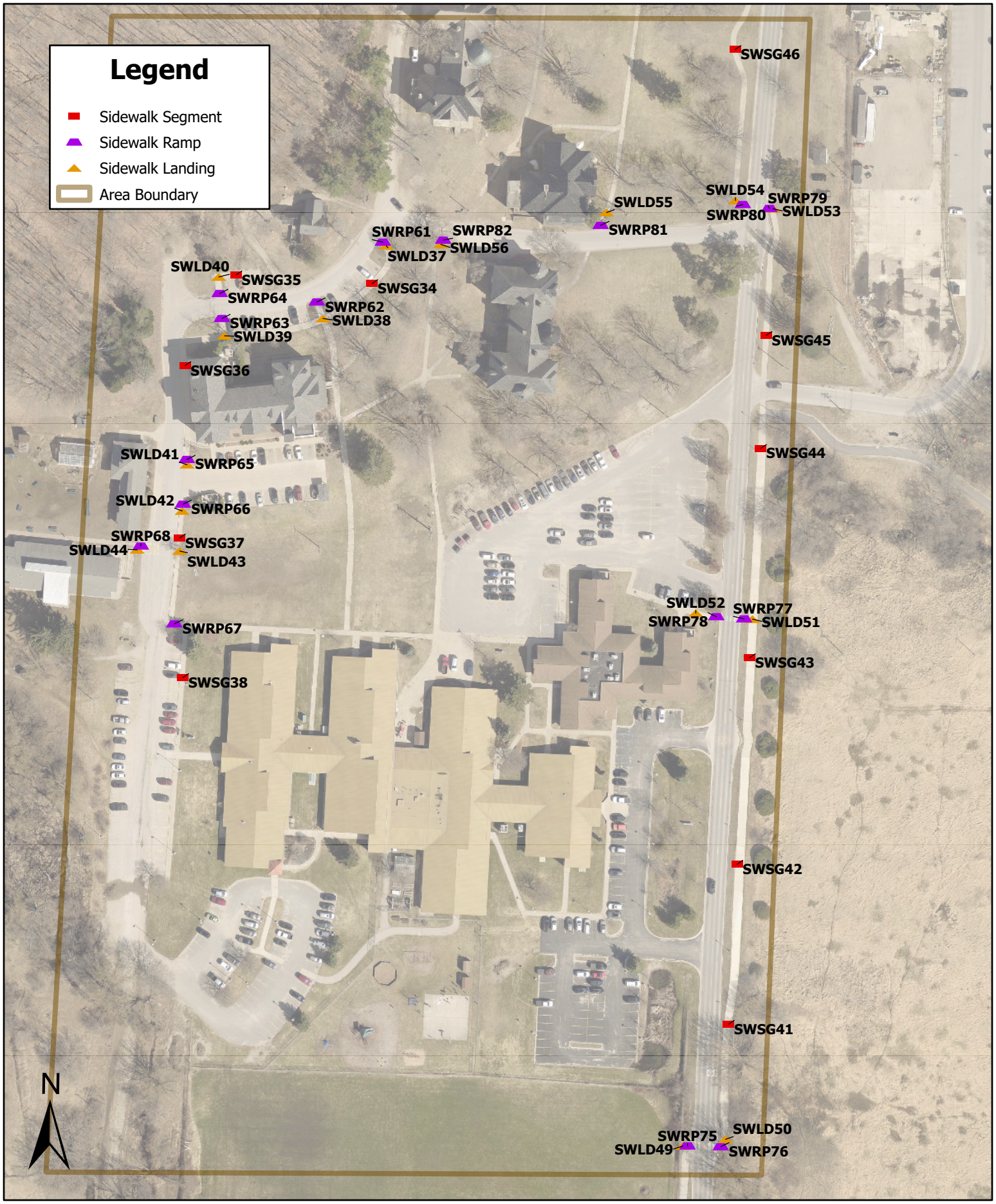
GT Commons Sidewalk Inspections Central East



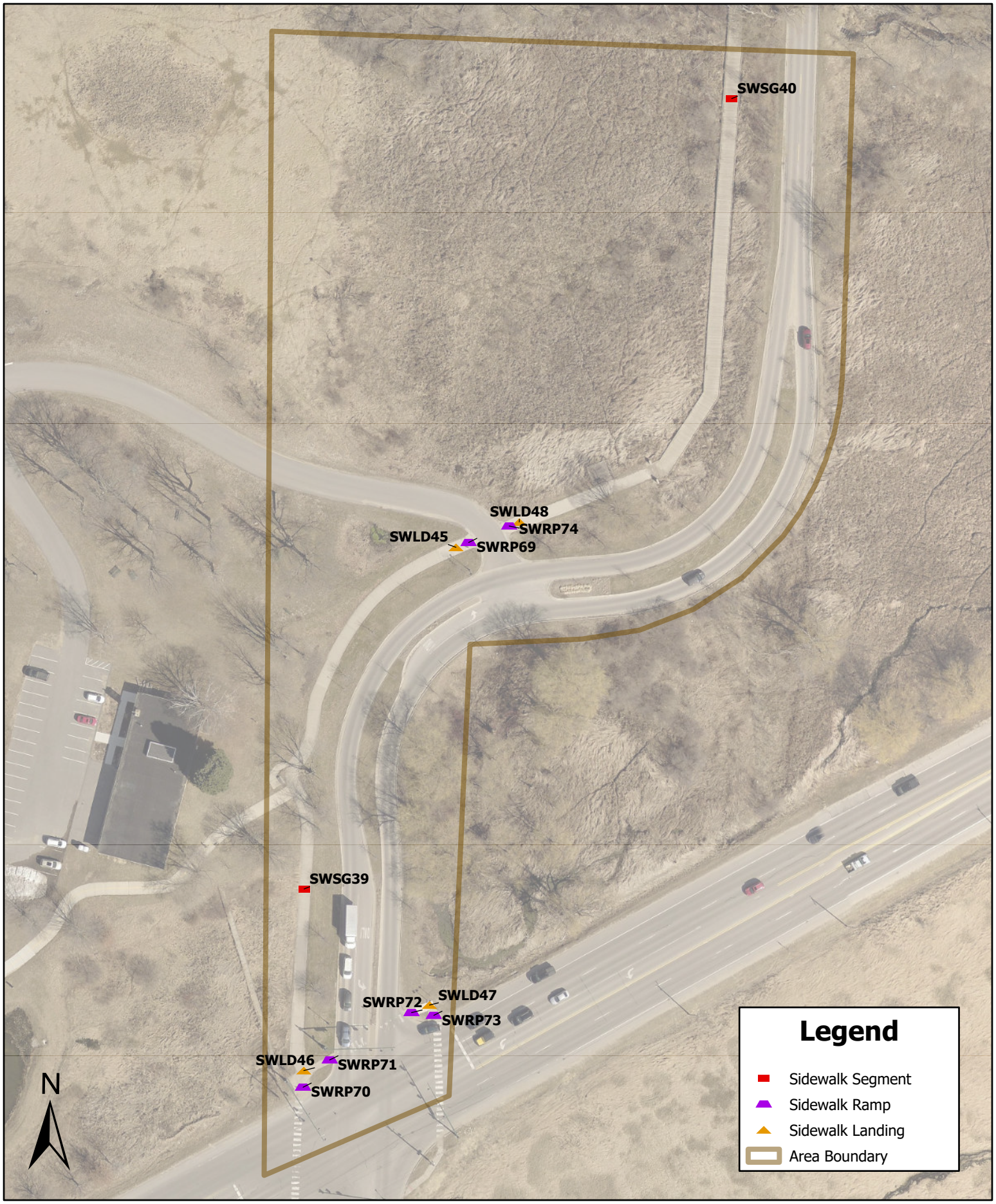
GT Commons Sidewalk Inspections
Central West



GT Commons Sidewalk Inspections Southeast



GT Commons Sidewalk Inspections Southwest



Grand Traverse Commons - Sidewalk Segment Conditions

AssetID	Pavement Condition
SWSG1	Good
SWSG2	Good
SWSG3	Good
SWSG4	Poor
SWSG5	Poor
SWSG6	Poor
SWSG7	Good
SWSG8	Fair
SWSG9	Good
SWSG10	Fair
SWSG11	Good
SWSG12	Good
SWSG13	Good
SWSG14	Poor
SWSG15	Poor
SWSG16	Good
SWSG17	Good
SWSG18	Poor
SWSG19	Fair
SWSG20	Fair
SWSG21	Good
SWSG22	Good
SWSG23	Fair
SWSG24	Fair
SWSG25	Poor
SWSG26	Good
SWSG27	Good
SWSG28	Good
SWSG29	Good
SWSG30	Good
SWSG31	Fair
SWSG32	Good
SWSG33	Good
SWSG34	Good
SWSG35	Fair
SWSG36	Good
SWSG37	Good
SWSG38	Fair
SWSG39	Good
SWSG40	Good
SWSG41	Good
SWSG42	Good
SWSG43	Good
SWSG44	Good
SWSG45	Good
SWSG46	Good

Grand Traverse Commons - Sidewalk Ramp Conditions

AssetID	Pavement Condition	Ramp Running Slope	Ramp Cross Slope	Detectable Warning Surface
SWRP1	Good	< 8%	< 2%	Yes
SWRP2	Good	< 8%	> 2%	Yes
SWRP3	Good	< 8%	< 2%	Yes
SWRP4	Good	< 8%	< 2%	Yes
SWRP5	Poor	< 8%	< 2%	No
SWRP6	Poor	< 8%	< 2%	No
SWRP7	Poor	< 8%	< 2%	No
SWRP8	Poor	< 8%	< 2%	No
SWRP9	Poor	< 8%	< 2%	No
SWRP10	Poor	< 8%	< 2%	No
SWRP11	Fair	< 8%	< 2%	No
SWRP12	Good	< 8%	< 2%	Yes
SWRP13	Fair	< 8%	< 2%	No
SWRP14	Fair	< 8%	> 2%	No
SWRP15	Fair	< 8%	< 2%	No
SWRP16	Fair	< 8%	< 2%	No
SWRP17	Good	< 8%	> 2%	No
SWRP18	Good	< 8%	< 2%	No
SWRP19	Good	< 8%	< 2%	No
SWRP20	Good	< 8%	< 2%	Yes
SWRP21	Poor	< 8%	< 2%	No
SWRP22	Poor	< 8%	< 2%	No
SWRP23	Good	< 8%	< 2%	No
SWRP24	Good	>8%	> 2%	No
SWRP25	Poor	< 8%	< 2%	No
SWRP26	Good	< 8%	< 2%	No
SWRP27	Good	< 8%	> 2%	No
SWRP28	Fair	< 8%	> 2%	No
SWRP29	Good	< 8%	< 2%	No
SWRP30	Poor	< 8%	< 2%	No
SWRP31	Fair	< 8%	< 2%	No
SWRP32	Poor	< 8%	< 2%	No
SWRP33	Good	< 8%	< 2%	No
SWRP34	Good	< 8%	< 2%	Yes
SWRP35	Good	< 8%	> 2%	Yes
SWRP36	Good	< 8%	< 2%	Yes
SWRP37	Good	>8%	> 2%	Yes
SWRP38	Fair	>8%	> 2%	Yes
SWRP39	Poor	>8%	< 2%	No
SWRP40	Good	< 8%	< 2%	Yes
SWRP41	Fair	< 8%	< 2%	Yes
SWRP42	Good	< 8%	< 2%	Yes
SWRP43	Good	< 8%	< 2%	Yes
SWRP44	Good	< 8%	> 2%	Yes
SWRP45	Poor	>8%	< 2%	No
SWRP46	Good	< 8%	< 2%	Yes
SWRP47	Good	< 8%	< 2%	Yes
SWRP48	Good	< 8%	< 2%	Yes

Grand Traverse Commons - Sidewalk Ramp Conditions

AssetID	Pavement Condition	Ramp Running Slope	Ramp Cross Slope	Detectable Warning Surface
SWRP49	Good	< 8%	< 2%	Yes
SWRP50	Good	< 8%	< 2%	Yes
SWRP51	Good	< 8%	< 2%	Yes
SWRP52	Good	< 8%	< 2%	No
SWRP53	Good	< 8%	< 2%	Yes
SWRP54	Good	< 8%	< 2%	Yes
SWRP55	Good	< 8%	< 2%	Yes
SWRP56	Good	< 8%	< 2%	Yes
SWRP57	Good	< 8%	< 2%	Yes
SWRP58	Good	< 8%	< 2%	Yes
SWRP59	Good	< 8%	< 2%	Yes
SWRP60	Good	< 8%	< 2%	Yes
SWRP61	Fair	< 8%	< 2%	No
SWRP62	Fair	< 8%	< 2%	Yes
SWRP63	Good	< 8%	< 2%	Yes
SWRP64	Fair	< 8%	< 2%	Yes
SWRP65	Good	< 8%	< 2%	No
SWRP66	Good	< 8%	> 2%	No
SWRP67	Good	< 8%	< 2%	No
SWRP68	Good	< 8%	< 2%	No
SWRP69	Fair	< 8%	< 2%	No
SWRP70	Fair	< 8%	< 2%	Yes
SWRP71	Good	< 8%	< 2%	Yes
SWRP72	Good	< 8%	< 2%	Yes
SWRP73	Fair	< 8%	< 2%	Yes
SWRP74	Good	< 8%	< 2%	No
SWRP75	Good	< 8%	< 2%	Yes
SWRP76	Good	< 8%	< 2%	Yes
SWRP77	Good	< 8%	< 2%	Yes
SWRP78	Good	< 8%	< 2%	Yes
SWRP79	Good	< 8%	< 2%	Yes
SWRP80	Good	< 8%	< 2%	Yes
SWRP81	Fair	< 8%	< 2%	No
SWRP82	Good	< 8%	> 2%	No

Grand Traverse Commons - Sidewalk Landing Conditions

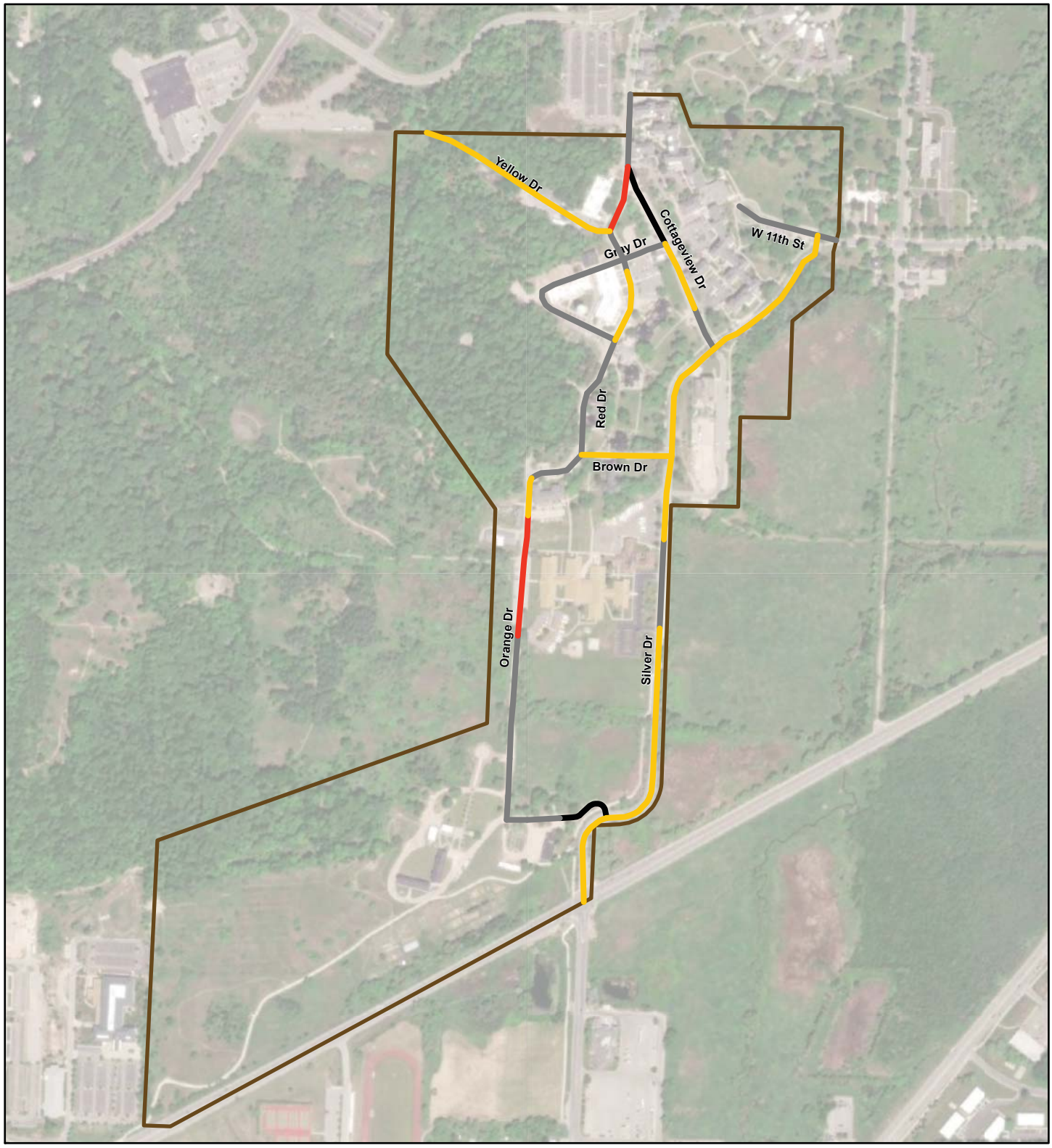
AssetID	Pavement Condition	Landing Slope
SWLD1	Good	< 2%
SWLD2	Good	< 2%
SWLD3	Fair	< 2%
SWLD4	Good	> 2%
SWLD5	Good	< 2%
SWLD6	Fair	> 2%
SWLD7	Good	> 2%
SWLD8	Fair	> 2%
SWLD9	Good	< 2%
SWLD10	Good	< 2%
SWLD11	Poor	< 2%
SWLD12	Poor	< 2%
SWLD13	Good	> 2%
SWLD14	Good	> 2%
SWLD15	Poor	< 2%
SWLD16	Good	< 2%
SWLD17	Fair	> 2%
SWLD18	Good	< 2%
SWLD19	Fair	< 2%
SWLD20	Fair	> 2%
SWLD21	Good	< 2%
SWLD22	Good	< 2%
SWLD23	Good	> 2%
SWLD24	Poor	> 2%
SWLD25	Good	> 2%
SWLD26	Fair	< 2%
SWLD27	Good	< 2%
SWLD28	Good	< 2%
SWLD29	Fair	> 2%
SWLD30	Good	< 2%
SWLD31	Good	< 2%
SWLD32	Good	< 2%
SWLD33	Good	< 2%
SWLD34	Good	< 2%
SWLD35	Good	< 2%
SWLD36	Good	< 2%
SWLD37	Good	< 2%
SWLD38	Good	< 2%
SWLD39	Good	< 2%
SWLD40	Fair	< 2%
SWLD41	Good	> 2%
SWLD42	Good	> 2%
SWLD43	Poor	< 2%
SWLD44	Good	< 2%

Grand Traverse Commons - Sidewalk Landing Conditions

AssetID	Pavement Condition	Landing Slope
SWLD45	Good	< 2%
SWLD46	Fair	< 2%
SWLD47	Good	< 2%
SWLD48	Good	< 2%
SWLD49	Good	< 2%
SWLD50	Good	< 2%
SWLD51	Good	< 2%
SWLD52	Good	< 2%
SWLD53	Good	< 2%
SWLD54	Good	< 2%
SWLD55	Fair	< 2%
SWLD56	Good	< 2%

Appendix F — Utility, Road and Parking Lot LOS Maps

Grand Traverse Commons Storm Conditions



Legend

Project Area

Storm Condition

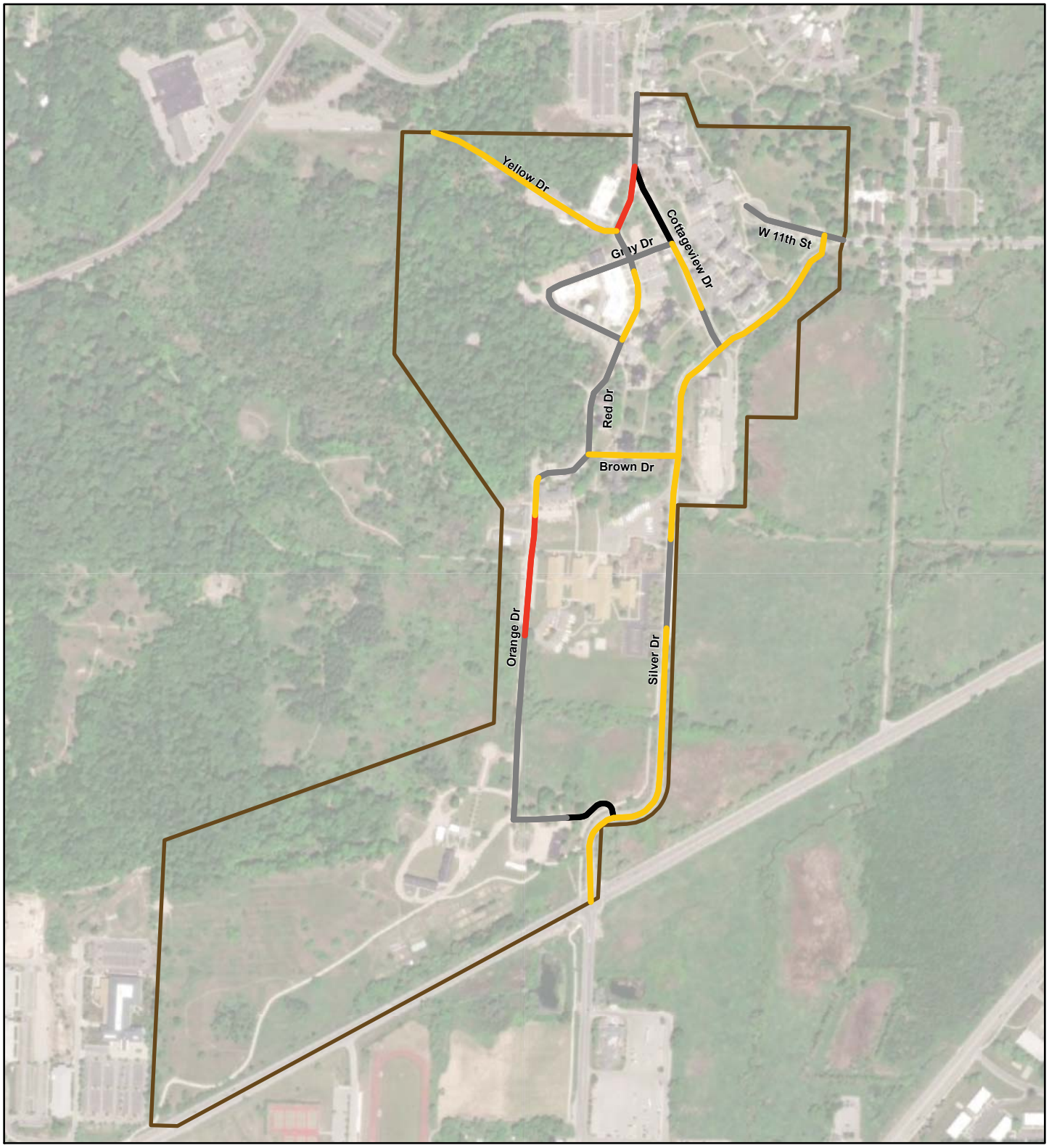
- None
- Poor
- Fair
- Good
- Uninspected

N

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

0 375 750 1,500 Feet

Grand Traverse Commons Sanitary Conditions



Legend

Project Area

Sanitary Condition

- None
- Poor
- Fair
- Good
- Uninspected

N

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

0 375 750 1,500 Feet

Grand Traverse Commons Parking Lot and Utility Conditions Map (North)

Legend

Storm Structures
- Good
- Fair
- Poor

Sanitary Manholes
- Good
- Fair
- Poor

Sanitary Gravity Mains
- Good
- Fair
- Poor

Parking Lots
- Good
- Fair
- Poor

N

0 75 150 300 Feet

HRC
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Grand Traverse Commons Parking Lot and Utility Conditions Map (Central)

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

Grand Traverse Commons Parking Lot and Utility Conditions Map (South)

N

0 75 150 300 Feet

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Appendix G — Capital Improvement Combined Project Cost Breakdown

Grand Traverse Commons - Road Capital Improvement Plan

Project Priority	Segment	From	To	Ln Miles	Pvmt Type	PASER Ratings	Road Treatment	Road Estimate	Storm Rating	Storm Treatment	Storm Estimate	Sanitary Rating	Sanitary Treatment	Sanitary Estimate	Total Estimate
1	Orange Dr	1,378 Ft North of Silver Dr	442 Ft South of Brown Dr	0.211	Asphalt	2	Reconstruction	$211,000	Poor	Replace cover and Adj	$8,600	Fair	Replace	$0	$219,600
2	Red Dr	Gray Dr	Cottageview Dr	0.173	Asphalt	3 & 4	Reconstruction	$173,000	Poor	Replace MH and Sewer	$16,120	Fair	Line & Adj	$27,530	$216,650
	Cottageview Dr	Gray Dr	North Limits	0.277	Asphalt & Concrete	3 & 4	Reconstruction	$277,000	None	None	$0	None	None	$0	$277,000
	Gray Dr	Red Dr	Cottageview Dr	0.078	Asphalt	3	Reconstruction	$78,000	None	None	$0	None	None	$0	$78,000
3	11th St	Cul-de-sac	Silver Dr	0.148	Asphalt	2	Reconstruction	$148,000	None	None	$0	None	None	$0	$148,000
4	Red Dr	Brown Dr	Gray Dr	0.214	Asphalt	3	Reconstruction	$214,000	None	None	$0	Fair	Repace & Adj	$26,000	$240,000
5	Gray Dr	Red Dr	Red Dr	0.314	Asphalt	6	Thin Overlay	$78,500	None	None	$0	Poor-Fair	Adj	$5,000	$83,500
6	Silver Dr	Cottageview Dr	11th St	0.279	Asphalt	6	Thin Overlay	$69,750	Fair	None	$0	Fair	Replace	$8,000	$77,750
7	Brown Dr	Red Dr	Silver Dr	0.157	Asphalt	6	Thin Overlay	$39,250	Fair	None	$0	Fair	Adj	$5,000	$44,250
8	Silver Dr	Brown Dr	Cottageview Dr	0.216	Asphalt	6	Thin Overlay	$54,000	Fair	None	$0	None	None	$0	$54,000
9	Silver Dr	South Limits	Brown Dr	0.855	Asphalt	5 & 6	Thin Overlay	$213,750	Fair	None	$0	None	None	$0	$213,750
10	Orange Dr	442 Ft South of Brown Dr	Brown Dr	0.167	Asphalt	6	Thin Overlay	$41,750	Fair	None	$0	None	Minor Rehab	$15,000	$56,750
														Total	$1,709,250

Grand Traverse Commons - Parking Lot Capital Improvement Plan

Project Priority	Parking Lot	Area (Sft)	Pvmt Type	PASER Ratings	Parking Lot Treatment	Parking Lot Estimate	Storm Structure Ratings	Storm Structure Treatment	Storm Structure Estimate	Sanitary Manhole Rating	Sanitary Manhole Treatment	Sanitary Manhole Estimate	Sanitary Gravity Main Rating	Sanitary Gravity Main Treatment	Sanitary Gravity Main Estimate	Total Estimate
1	PL 1	31,917	Asphalt	3	Reconstruction (Asphalt)	$574,506	Poor	Replace	$12,500	None	None	$0	None	None	$0	$587,006
2	PL 26	21,700	Concrete	2	Reconstruction (Concrete)	$722,001	None	None	$0	None	None	$0	Fair			$722,001
		12,681	Gravel	8												
3	PL 12	20,821	Asphalt	3	Reconstruction (Asphalt)	$374,778	None	None	$0	None	None	$0	None	None	$0	$374,778
4	PL 3	47,980	Asphalt	7	Crack Seal	$23,990	Fair	None	$0	Poor	Replace & Adjust	$15,000	Good & Fair	None	$0	$38,990
5	PL 8	17,560	Asphalt	5	Thin Overlay	$47,412	Fair	None	$0	None	None	$0	Poor	None	$0	$47,412
6	PL 9	20,750	Asphalt	6	Thin Overlay	$56,025	Fair	None	$0	Fair	Replace	$5,000	None	None	$0	$61,025
7	PL 7	20,749	Asphalt	6	Thin Overlay	$56,022	Fair	Adjust	$1,800	Poor	Adjust	$600	Poor	None	$0	$58,422
8	PL 2	28,240	Asphalt	6	Thin Overlay	$76,248	Fair	Adjust	$2,400	None	None	$0	None	None	$0	$78,648
9	PL 13	1,916	Asphalt	6	Thin Overlay	$5,173	Fair	Adjust	$1,200	Poor	Replace	$10,000	Fair	None	$0	$16,373
10	PL 21	2,706	Asphalt	4	Mill & Overlay	$24,354	None	None	$0	None	None	$0	None	None	$0	$24,354
															Total	$2,009,010