MICHIGAN COUNTY ENGINEER'S WORKSHOP

The Role of 811, Private Utility Locating and Mapping, and Subsurface Utility Engineering in your Projects.

UTILITILITIES ARE A RISK


IN PURSUIT OF 100%
SUBSURFACE
DAMAGE
PREVENTION

GPRS®

VISUALIZING THE BUILT WORLD™

ABOVE AND BELOW GROUND

AGENDA & PURPOSE

- Utility Strike Statistics
- Public & Private Utilities
- Locating Timeline
- Miss Dig Overview
- Private Utility Locating Overview
- Subsurface Utility Engineering Overview
- Best Practices

UTILITY STRIKE STATISTICS

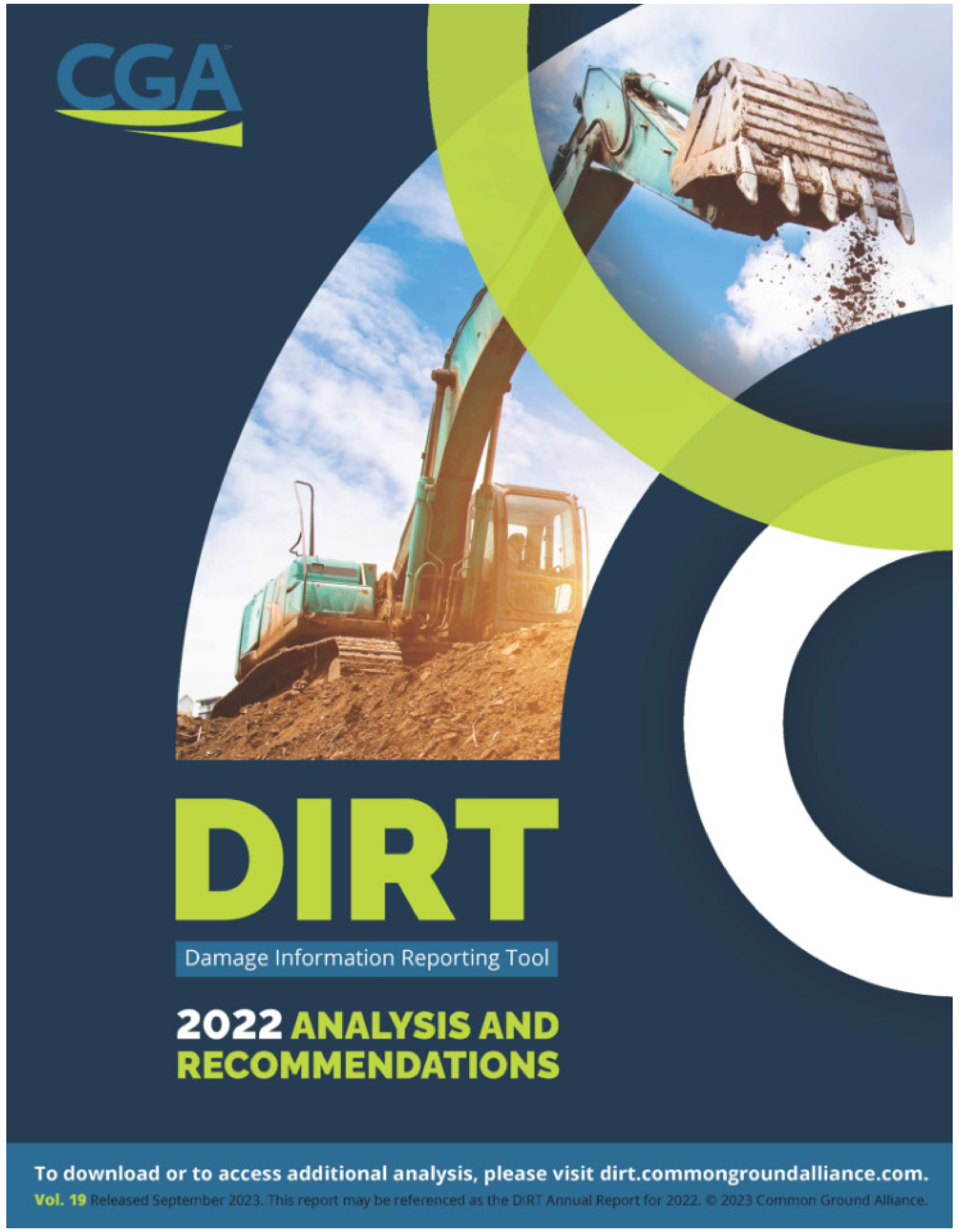
- Over **20 million miles of active underground utilities throughout the United States**
- On average, it is estimated a utility line is damaged **every 90 seconds** in the United States
- CGA came out with a 20-year study that showed utility strikes have resulted in **1906 injuries and 421 deaths**
- Estimated **65%** of underground utilities in the United States are **privately owned**.

CGA Common Ground Alliance

UTILITY STRIKE STATISTICS – NATIONAL

For the last 20 years, annual reports are published by the CGA analyzing utility strike damages, near miss events, root causes, and makes recommendations back to the industry where safety can be improved.

- **2022 resulted in 213,792 damadges** reported in the US
- The hundreds of thousands of individual damages that occur across the country each year cost communities approximately **$30 billion annually**



CGA Common Ground Alliance

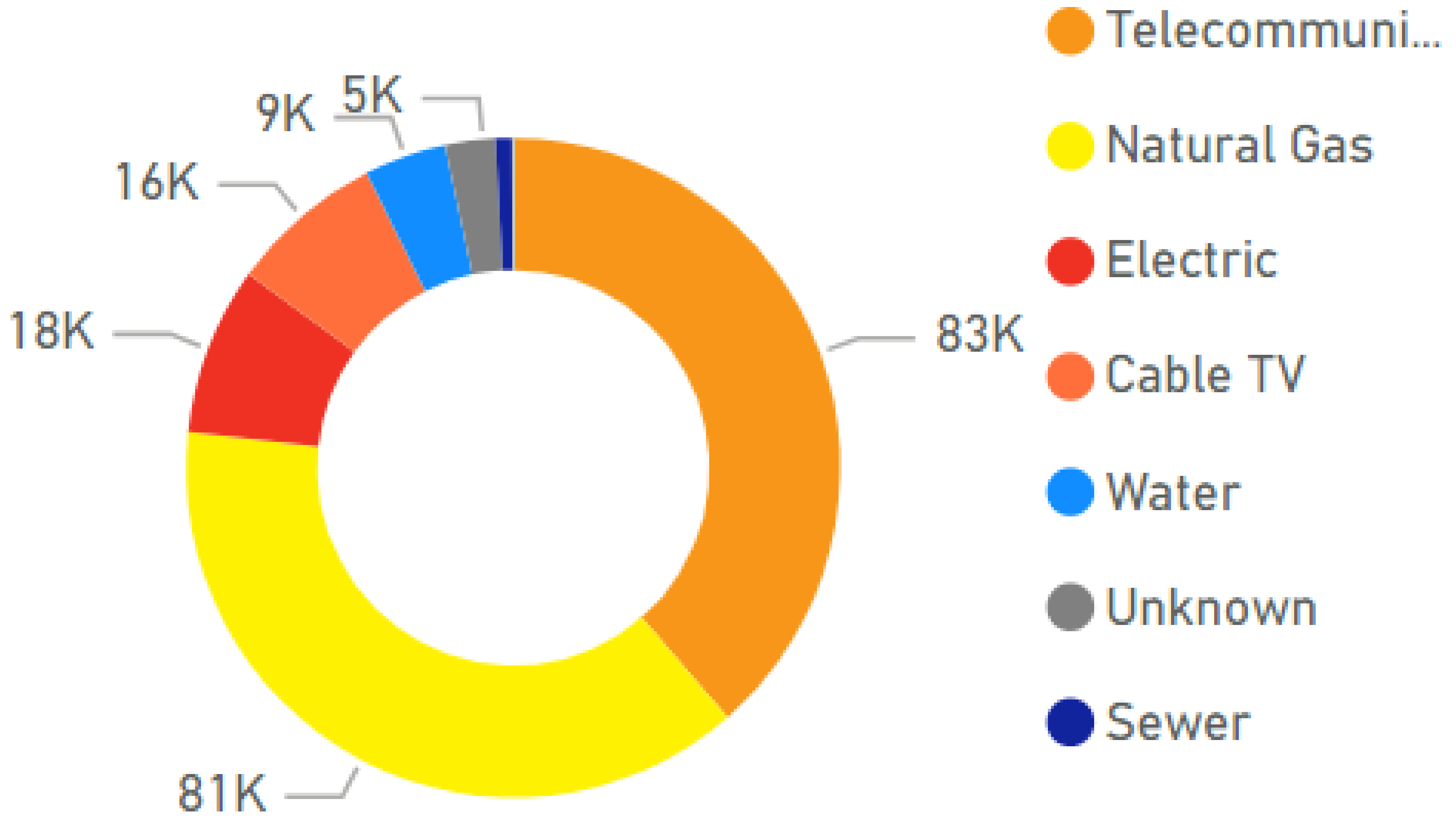
UTILITY STRIKE STATISTICS – NATIONAL

<u>Top Four Utilities Damaged</u>

1) Telecommunication Lines
2) Natural Gas Lines
3) Electric
4) Cable TV Lines

<u>Top Three Root Cause Groups</u>

1) Insufficient Locating Practices
2) Excavation Practices
3) Notification was **NOT** made



Common Ground Alliance

UTILITY STRIKE STATISTICS – MICHIGAN

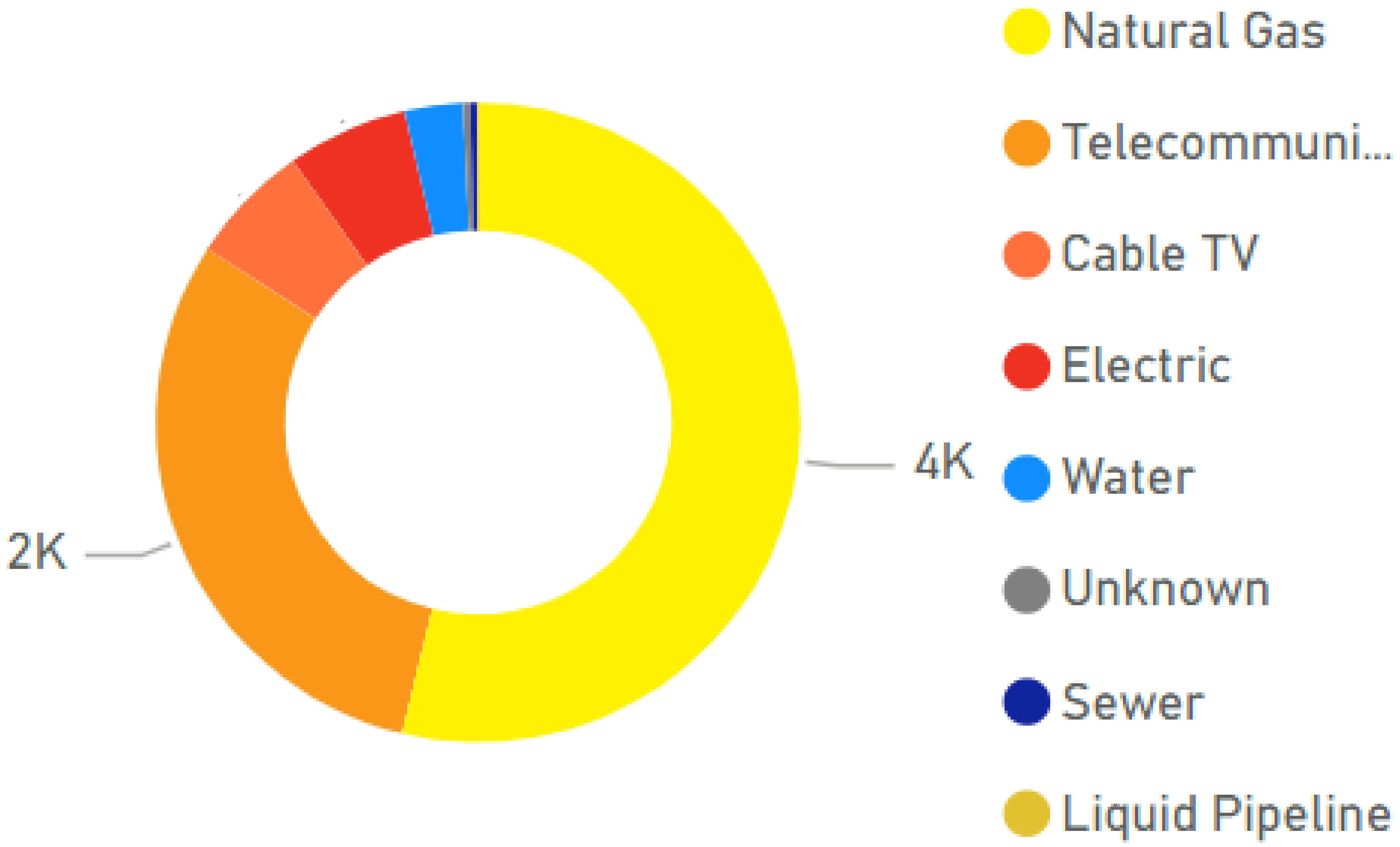
7,596 reported damages in 2022

Top Four Utilities Damaged

1) Natural Gas Lines
2) Telecommunication Lines
3) Cable TV
4) Electric

Top Three Root Causes

1) Insufficient Locating Practices
2) Excavation Practices
3) Notification was **NOT** made



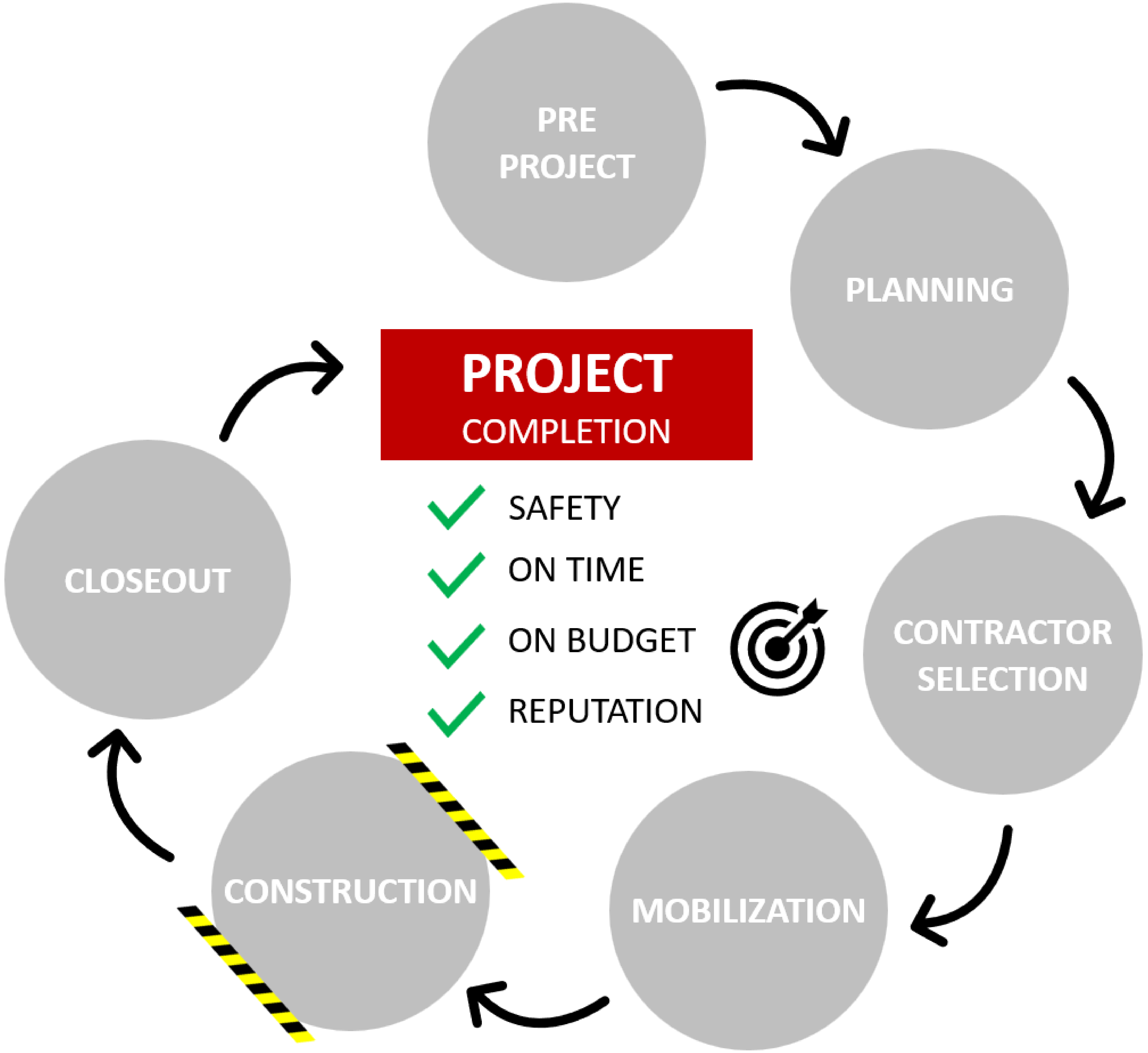
CGA Common Ground Alliance

AS-~~INTENDED~~ BUILT PLANS

AS-INTENDED

AS-BUILT

PROJECT PHASES



PUBLIC UTILITIES

PRIVATE UTILITIES

PUBLIC & PRIVATE UTILITIES

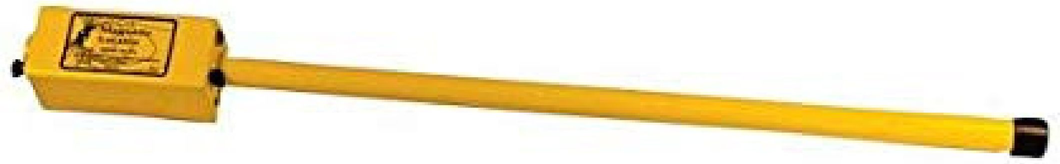
" I notified 811, won't they mark out all the utilities on my jobsite"

" Well, that's why we hired you and that is why you're out here…"

- **811 SERVICES ONLY LOCATES AND MARKS OUT PUBLIC UTILITES, THEY DO NOT MARK OUT PRIVATELY OWNED UTILITIES**
  - A public utility line is owned and maintained by a utility company
  - A private utility line is owned and maintained by the property owner themselves
    * Electric lines, site lighting, communication lines, fire suppression system….

CALL 811 – IT'S THE LAW!

COMMON LOCATING TECHNOLOGIES

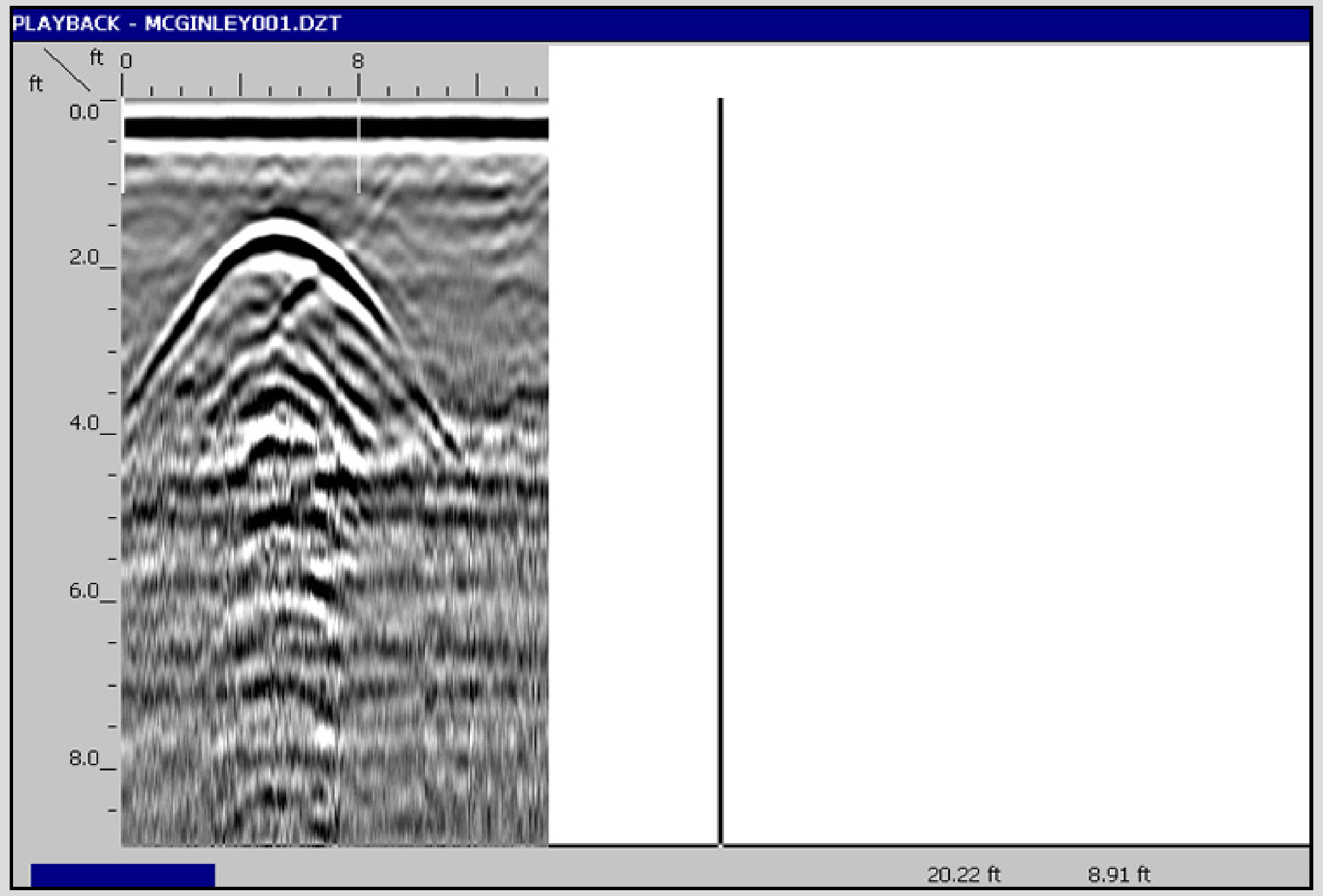


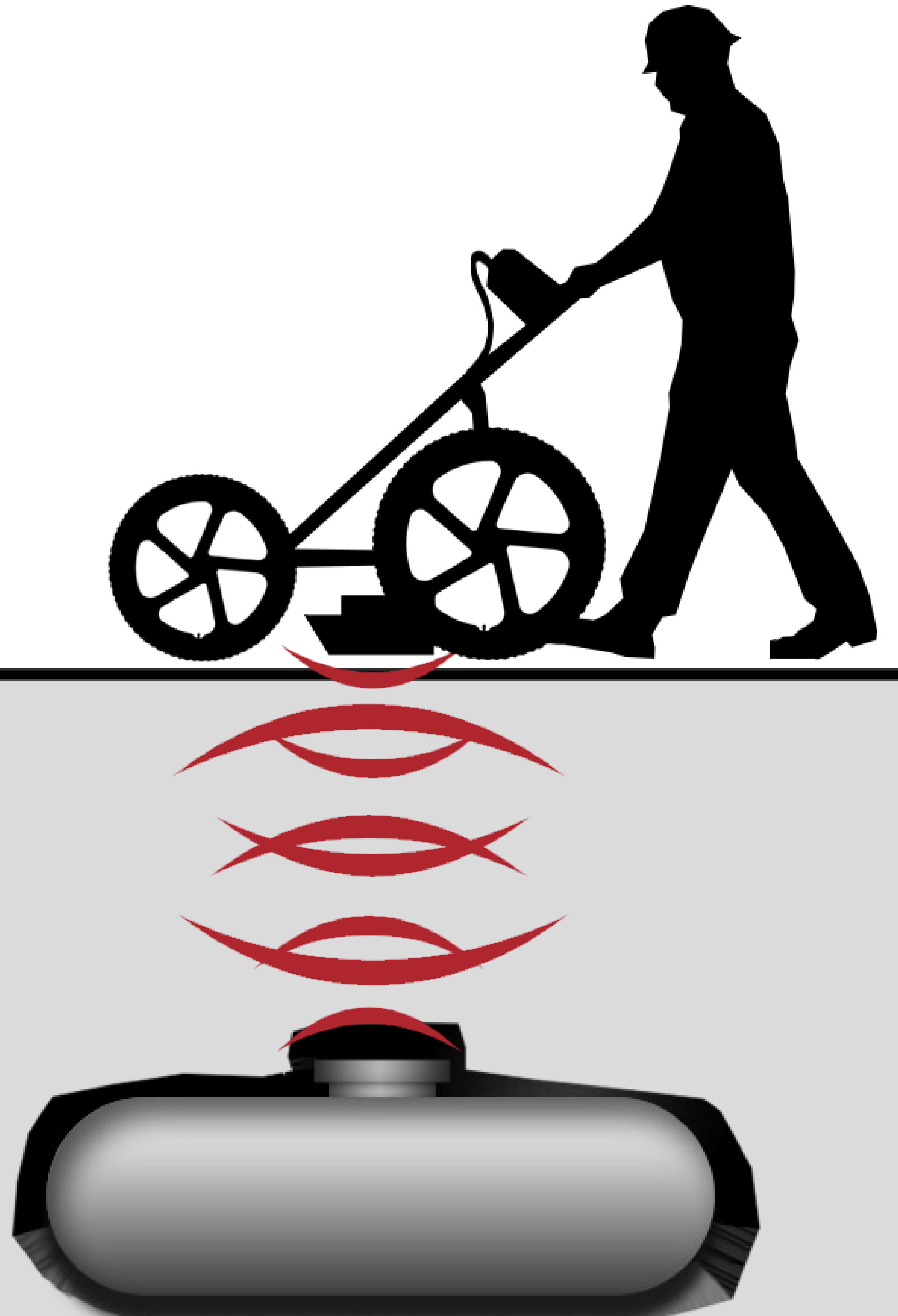
ELECTROMAGNETIC (EM) LOCATOR

- Used for tracing known metallic utility lines
- Consist of a transmitter, receiver and detects utilities via induction, conduction, and passive modes with known utilities
- Detects live power and RF signals underground
- Poor Conductors - dependent on the ability of facilities or tracer wires to conduct a current
- Interfering Sources - Common sources of interference are overhead power lines
- Congested areas, signal bleeding off to nearby utilities

GROUND PENETRATING RADAR

- GPR works by sending electro magnetic pulses from an antenna into a particular medium to image the subsurface
- When the radar pulse contacts something other than the material, it generates a reflection back to the antenna.
- This reflection is displayed in real time for the operator to mark the item at the surface and item depth is noted





GROUND PENETRATING RADAR

- Both metallic & non-metallic materials
- GPR has a typical depth penetration of 3’-8’ deep throughout Michigan (4’-5’ on average)
- Typically, a target (utility) must be at least 1” in diameter per 1’ of depth in order for it to be located with GPR technologies.
- Clay soils, wet soil, or soil which contains high amounts of debris can limit the effectiveness of GPR.
- Surface conditions such as brush, standing water, metal plating, or anything which blocks direct access to the area to be scanned will limit the ability to perform GPR

Four Pass ROW Process:

- Step 1 (Analyze): Review any maps, structures, and markers
- Step 2 (RD): multiple frequency sweeps and connections
- Step 3 (GPR): scan area in specific pattern to cover all angles

Utility
Scan Area
RD Radio Scan
RD Power Scan
RD CPS Scan
GPR Scan Pattern

GPRS

VIDEO PIPE INSPECTION: MAPPING & MODELING

PUT YOUR PROJECT ON THE MAP

WinCan

Project Date	10/5/2020

Pipe Segment Reference		Upstream MH	MH 2
City		Downstream MH	MH 2.1
Street		Shape	Circular 10inch
Total Length		Material	Polyvinyl Chloride

	Distance	PACP Code	Observation
1	0.0	AMH	Manhole
2	0.0	MWL	Water Level, 5% of the vertical dimension
3	63.8	MWL	Water Level, 15% of the vertical dimension
4	109.4	TF	Tap Factory Made at 10 o'clock, dia/height: 2inch
5	110.6	MWL	Water Level, 5% of the vertical dimension
6	152.8	VC	Vermin Cockroach
7	159.4	TF	Tap Factory Made at 10 o'clock, dia/height: 2inch
8	161.9	VC	Vermin Cockroach
9	173.9	HSV	Hole Soil Visible at 12 o'clock
10	177.1	TF	Tap Factory Made at 12 o'clock, dia/height: 2inch
11	204.7	TF	Tap Factory Made at 9 o'clock, dia/height: 2inch
12	204.7	DAZ	Deposits Attached Other, 5% of cross sectional area from 5 o'clock to 7 o'clock, Start
13	204.7	DAZ	Deposits Attached Other, 5% of cross sectional area at 5 o'clock, Start
14	210.9	MGO	Miscellaneous General Observation
15	227.8	DSZ	Deposits Settled Other, 15% of cross sectional area from 6 o'clock to 7 o'clock
16	229.7	ISSRH	Intruding Sealing Material Sealing Ring Hanging, 5% of cross sectional area from 12 o'clock to 1 o'clock
17	237.0	DAZ	Deposits Attached Other, 5% of cross sectional area from 5 o'clock to 7 o'clock, Finish
18	237.0	DAZ	Deposits Attached Other, 5% of cross sectional area at 5 o'clock, Finish
19	259.1	BSV	Broken Soil Visible from 11 o'clock to 12 o'clock
20	278.4	DAZ	Deposits Attached Other, 5% of cross sectional area at 7 o'clock, Start
21	278.4	DAZ	Deposits Attached Other, 5% of cross sectional area at 5 o'clock, Start
22	291.8	DAZ	Deposits Attached Other, 5% of cross sectional area at 7 o'clock, Finish
23	291.8	DAZ	Deposits Attached Other, 5% of cross sectional area at 5 o'clock, Finish
24	297.1	OBI	Obstruction Intruding Through Wall, 5% of cross sectional area from 11 o'clock to 12 o'clock
25	325.8	DSZ	Deposits Settled Other, 5% of cross sectional area at 5 o'clock
26	345.3	MWL	Water Level, 10% of the vertical dimension
27	345.4	TF	Tap Factory Made at 9 o'clock, dia/height: 2inch
28	357.8	DSF	Deposits Settled Fine, 10% of cross sectional area at 6 o'clock
29	368.0	MWL	Water Level, 35% of the vertical dimension
30	369.9	MCU	Miscellaneous Camera Underwater, Start
31	369.9	MWL	Water Level, 25% of the vertical dimension
32	436.5	MCU	Miscellaneous Camera Underwater, Finish
33	436.5	MWL	Water Level, 25% of the vertical dimension
34	471.1	TF	Tap Factory Made at 12 o'clock, dia/height: 2inch
35	484.8	TF	Tap Factory Made at 10 o'clock, dia/height: 2inch
36			

Pipe Segment Reference		Upstream MH	MH 2
City		Downstream MH	MH 3
Street		Shape	Circular 10inch
Total Length		Material	Polyvinyl Chloride

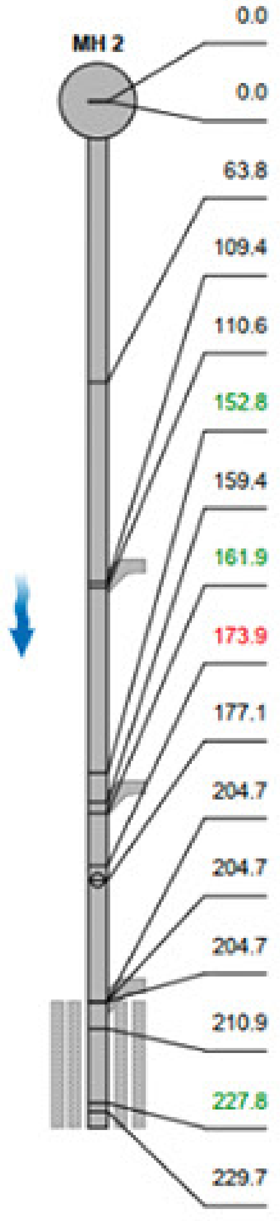
1	0.0	AMH	Manhole
2	0.0	MWL	Water Level, 5% of the vertical dimension
3	0.0	VC	Vermin Cockroach
4	22.0	VC	Vermin Cockroach
5	43.2	TFA	Tap Factory Activity at 12 o'clock, dia/height: 2inch

WinCan

Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
10/6/2020			Kyle Humphreys	U-419-070305346	
Year laid:	Pre-cleaning:	Direction:	Pipe Joint Length:	Total Length:	Length Surveyed:
	No Pre-Cleaning	Downstream		508.5 '	508.5 '

City:		Drainage Area:		Upstream MH:	MH 2
Street:		Media Label:		Up Rim to Invert:	0.0
Location Code		Flow Control:		Downstream MH:	MH 2.1
Location Detai		Sheet Number:		Down Rim to Invert:	0.0
Pipe shape:	Circular	Sewer Use:	Sanitary Sewage Pipe	Total gallons used:	0.0
Pipe size:	10 "	Sewer Category:	SEC	Joints passed:	0
Pipe material:	Polyvinyl Chloride	Purpose:		Joints failed:	0
Lining Method:		Owner:			
Additional Info:					



1:1762	Distance		Code	Observation	Counter	Photo	Grade
	0.0		AMH	Manhole / MH 2	00:00:00		
	0.0		MWL	Water Level, 5% of the vertical dimension	00:00:01		
	63.8		MWL	Water Level, 15% of the vertical dimension	00:05:00		
	109.4		TF	Tap Factory Made at 10 o'clock, dia/height: 2inch	00:08:49		
	110.6		MWL	Water Level, 5% of the vertical dimension	00:09:35		
	152.8		VC	Vermin Cockroach	00:15:03		M1
	159.4		TF	Tap Factory Made at 10 o'clock, dia/height: 2inch	00:15:55		
	161.9		VC	Vermin Cockroach	00:16:45		M1
	173.9		HSV	Hole Soil Visible at 12 o'clock	00:20:00		S5
	177.1		TF	Tap Factory Made at 12 o'clock, dia/height: 2inch	00:21:55		
	204.7		TF	Tap Factory Made at 9 o'clock, dia/height: 2inch	00:32:08		
	204.7	S01	DAZ	Deposits Attached Other, 5% of cross sectional area from 5 o'clock to 7 o'clock, Start / deposit buildup	00:32:41		
	204.7	S02	DAZ	Deposits Attached Other, 5% of cross sectional area at 5 o'clock, Start / deposit buildup	00:32:47		
	210.9		MGO	Miscellaneous General Observation / pipe bubbled	00:33:25		
	227.8		DSZ	Deposits Settled Other, 15% of cross sectional area from 6 o'clock to 7 o'clock / deposit settled	00:34:29		M3
	229.7		ISSRH	Intruding Sealing Material Sealing Ring Hanging, 5% of cross sectional area from 12 o'clock to 1 o'clock	00:35:13		M2

WinCan

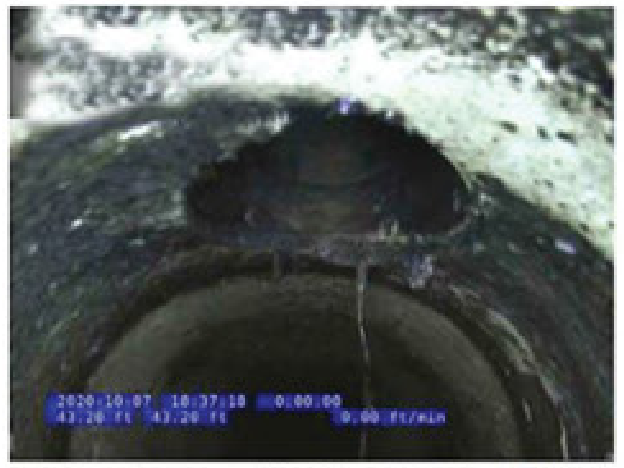
Section Pictures - 10/7/2020

Street	Date	Pipe Segment Reference	Section No.
central	10/7/2020		4

e1925f92-f33d-40e9-9189-635b35363b0a_20201007_093053_342.jpg, 00:00:00, 0.00ft
Water Level, 5% of the vertical dimension

b742d773-7b06-415d-8c83-54ae98028b0c_20201007_093159_027.jpg, 00:01:32, 0.00ft
Vermin Cockroach

f20c7480-47f2-4836-b6d0-7687b1981c9f_20201007_093620_160.jpg, 00:03:59, 22.01ft
Vermin Cockroach



a4a6b59e-fa56-41de-aec4-29695eb1dc05_20201007_093800_776.jpg, 00:05:15, 43.19ft
Tap Factory Activity at 12 o'clock, dia/height: 2inch

UTILITY LOCATING PROCESS

<u>Pre – Job Review</u>

Review plans and drawings, perform site walk and project scope meeting

<u>Pre - Scan Setup</u>

Calibrate locating technologies to site specific conditions

<u>Locating/Scanning Steps</u>

- Electromagnetic locating
  - Conductive, inductive, and passive sweeps
- GPR Locating
  - Grid scans to help to locate any unidentified or known utilities
- Additional locating technologies if needed

<u>Post – Locate Hand Off</u>

Conduct a post job walk and review of findings

<u>Deliverable Submittals</u>

Complete and email the JSR, KMZ and any other deliverable documentation

SUBSURFACE INVESTIGATION METHEDOLOGY

SUBSURFACE INVESTIGATION METHEDOLOGY

SIM
UNDERGROUND UTILITY DESIGNATION CHECKLIST

TRAININ
EQUIPME
METHOD

NONDESTRUCTIVE LOCATION AND MARKING OF UNDERGROUND UTILITIE

Site Name: Project #:
Site Address:
City: State: Zip:
Site Contact Name: Phone:
Contact Email: Site-Specific Notes:

- ☐ **Call 811 and submit markout ticket request for locate in public areas, Ticket#** ____
- ☐ **Collect site-specific data related to site history, previous excavation, past construction history and site usage.** ____

Contract with Qualified Private Utility Location Contractor:

- ☐ Scanning contractor shall submit record of certification of training that exceeds ASNT, "Practice SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing Lev GPR. 8 hours classroom /60 hours field GPR practice.
- ☐ Field personnel at minimum certified OSHA 10 Construction Safety Training. Specific safety may apply per site specifics.

Underground Utility Designation Work Scope:

- ☐ Locate and mark all underground utilities and anomalies in contractor/owner designated area utili least two different technologies for redundant results, Ground Penetrating RADAR GPR, EM Pipe Loc
- ☐ Confirm work scope communication with site contact.

EM System Model# ____ GPR System Model# ____

Anticipated Utilities:

- ☐ Water
- ☐ Gas
- ☐ Sanitary Sewer
- ☐ Electric
- ☐ Site Lighting
- ☐ Drainage
- ☐ Communications
- ☐ Industrial Process
- ☐ Steam
- ☐ Electric Other
- ☐ Gas Other

SIM Investigative Technologies:

- ☐ Ground Penetrating RADAR (GPR)
- ☐ EM Pipe Locator
- ☐ Traceable Rodder
- ☐ Traceable Sonde
- ☐ Metal Detector
- ☐ Sewer Push Camera
- ☐ Multiple GPR Antenna
- ☐ EMI/Split Box

SIM
UNDERGROUND UTILITY DESIGNATION CHECKLIST
SIMSP

SIM Pre-Investigation Checklist:

- ☐ Confirm Job Hazard Analysis (JSA), form review, or equal site safety review documentation.
- ☐ Confirm and sign site safety plan if applicable.
- ☐ Perform site walk and review project scope meeting, review scan locations. Note: Field technician to look for visible clues such as electrical rooms, service access ports like manholes and other utility boxes, visible conduits, etc.
- ☐ Perform site contact interview, review known utilities, discuss possible unknowns, and anticipated critical targets. Review site post scan scope of work. Suggest scan area options.
- ☐ Utilize job site information, available as-builts and prints/plans and previously detailed equipment to locate and mark out underground facilities and unknown anomalies.
- ☐ Review of equipment capabilities and potential job-site performance impedances.
- ☐ Confirm if GPR data samples be required for reporting.
- ☐ Confirm acceptable on-site type of markings (paint, flags, other), Specify ____
- ☐ Review client deliverable requirements, report format/documentation. GPS Mapping etc.

SIM Quality Assurance Procedures:

- ☐ Calibrate the GPR system to the conditions at each site per SIM spec guidelines.
- ☐ Perform several test scans through the scan area to determine the approximate maximum depth penetration and to gauge the probability of success in finding the desired targets.
- ☐ Review the clarity of the scan data. Adjustments in gain, depth range, filters, and other settings may be necessary.

SIM Investigation Methods for Complete Concrete Investigation:

- ☐ Trace all known utilities as reviewed in pre-scan meeting.
- ☐ Use EM Locator at visible features valve, manhole, riser, etc.
- ☐ Use direct connection method when possible. (Do not connect directly to potentially live electrical wires)
- ☐ Use induction clamp if direct connection is not possible.
- ☐ Use induction method if induction clamp is not possible.
- ☐ After connecting or inducing with the transmitter, use the receiver to complete a full 360° sweep around the connection point.
- ☐ Mark and trace all potential fields that are detected.
- ☐ During this sweep, measure mA levels on the receiver in order to assist in correctly identifying the target line.
- ☐ Identify the target line by tracing it to the connection point or at least to the next feature.
- ☐ After tracing and marking any utility, sweep parallel to the utility on both sides in order to check for laterals/T's.
- ☐ Insert traceable rodder or sonde into known sewer, storm and drain lines.
- ☐ Trace the rodder or sonde using the receiver.
- ☐ Use EM receiver to attempt to locate any unidentified, known utilities from features using passive modes (Power/Radio).
- ☐ Sweep using passive modes parallel to the utility on both sides in order to check for laterals/T's.

SIM
UNDERGROUND UTILITY DESIGNATION CHECKLIST
SIMSPEC.ORG

SIM Investigation Methods for Complete Underground Utility Investigation (GPR):

- ☐ Scan with GPR utility antenna, typical frequency 400 MHz or 350 Hyper stacking antenna.
- ☐ Calibrate GPR settings to current site conditions.
- ☐ Use GPR to attempt to locate any unidentified, known utilities.
- ☐ Collect scans with GPR parallel to any marked utility in order to check for laterals/T's.
- ☐ Document any known utilities that could not be located.
- ☐ Redundancy strategy, EM used in conjunction with GPR, perform passive sweeps with electromagnetic locator to locate unknown utilities.
- ☐ Redundancy strategy, EM used in conjunction with GPR, Sweep all areas in a grid with spacing determined by site conditions.
- ☐ Redundancy strategy, EM used in conjunction with GPR, Sweep separately with Power mode and Radio mode (and Cathodic Protection mode when applicable) Collect GPR scans to locate unknown utilities.
- ☐ Scan all areas in a grid with spacing determined by site conditions.
- ☐ Collect GPR scans across all previously located utilities to confirm locations and approximate depths. Document findings with photos and additional reporting/mapping if required.

SIM Post Investigation Hand Off:

- ☐ Conduct a recap and review of findings with site contact.
- ☐ Explain scan findings--Where did the technologies work well and where results were inconclusive due to interference and or soil conditions.
- ☐ Explain markings and depth estimates.
- ☐ Review original scope to confirm expectations were met/exceeded.

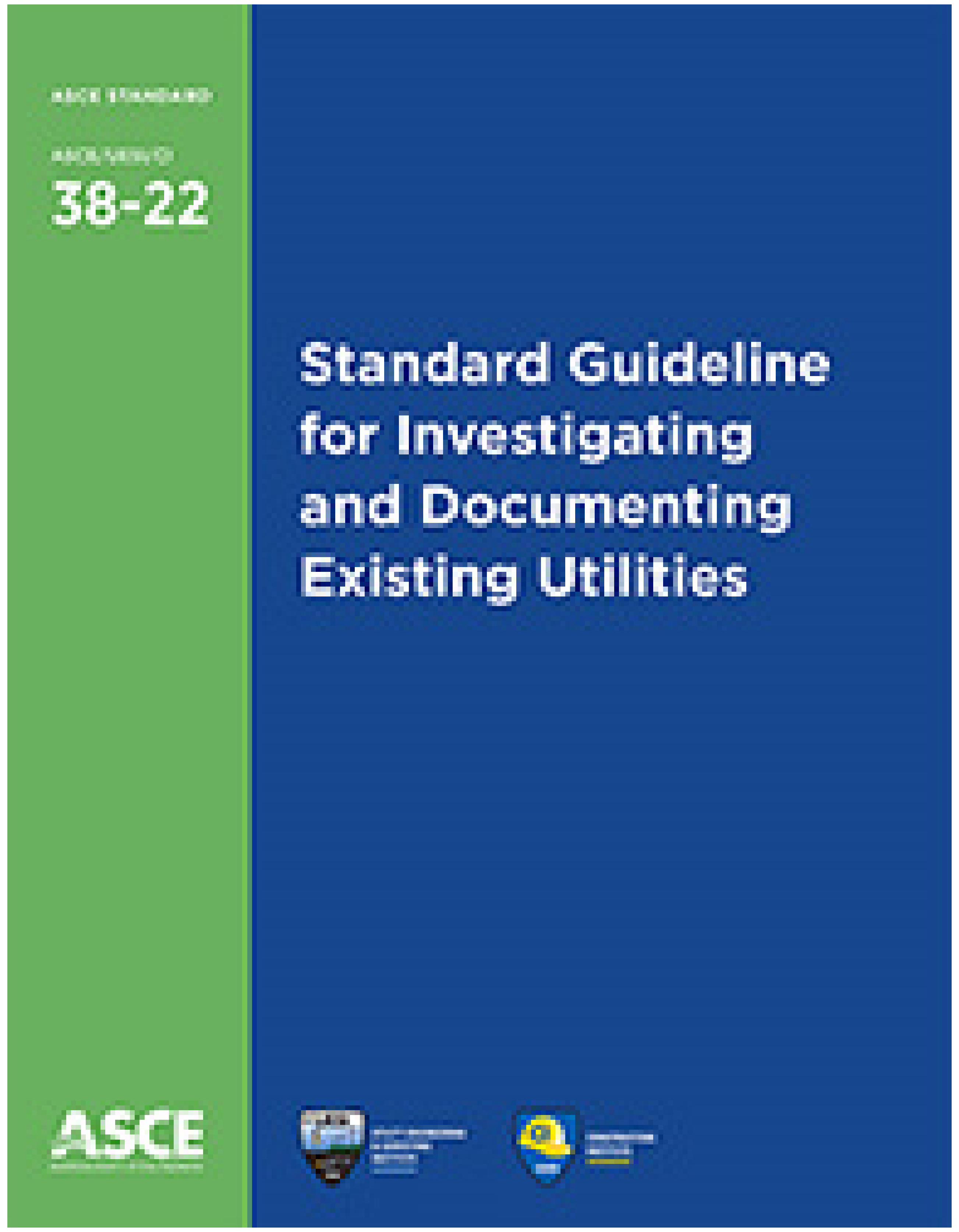
Notes Regarding Scan Data Collection and Quality:

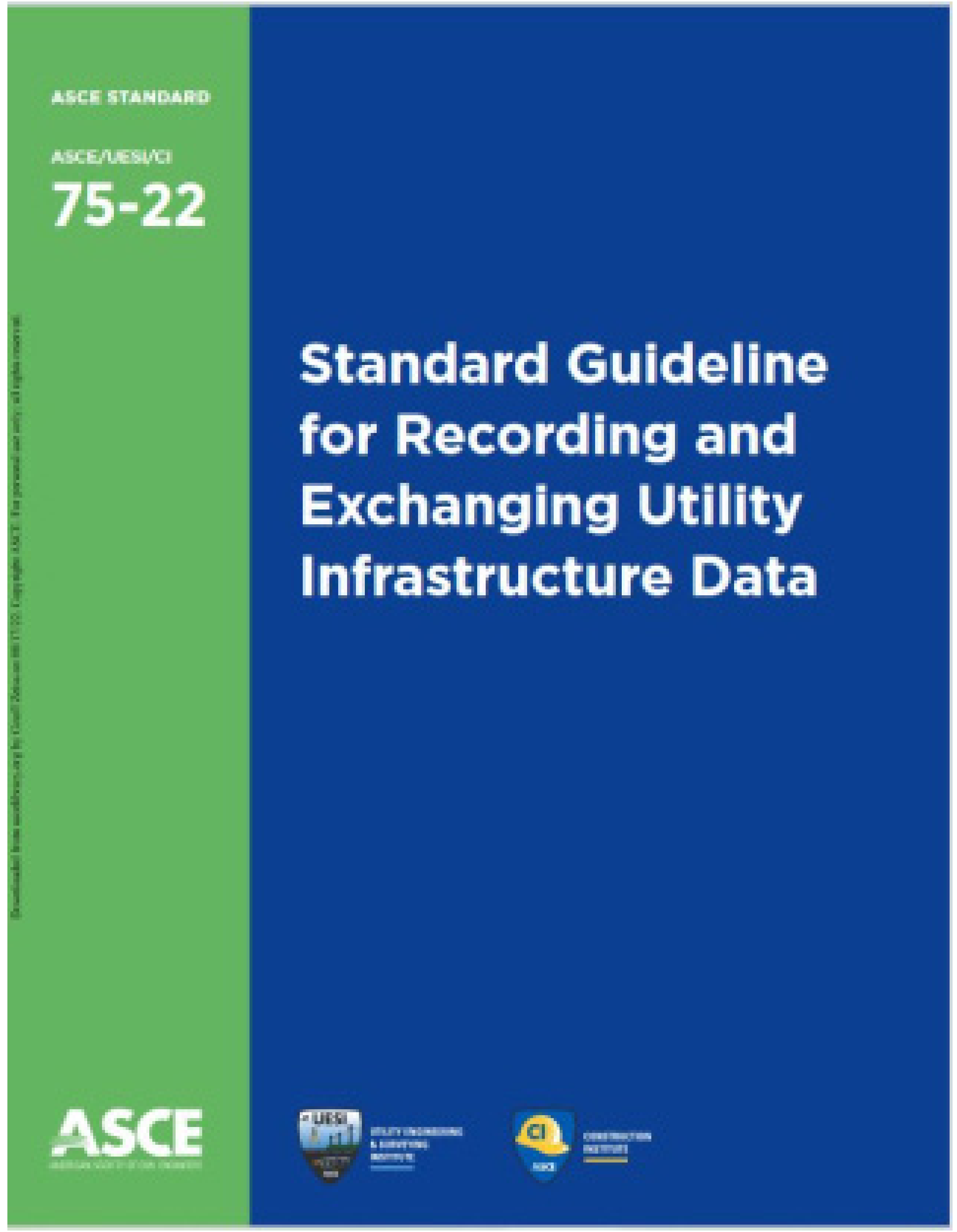
Additional Investigation Notes: ____

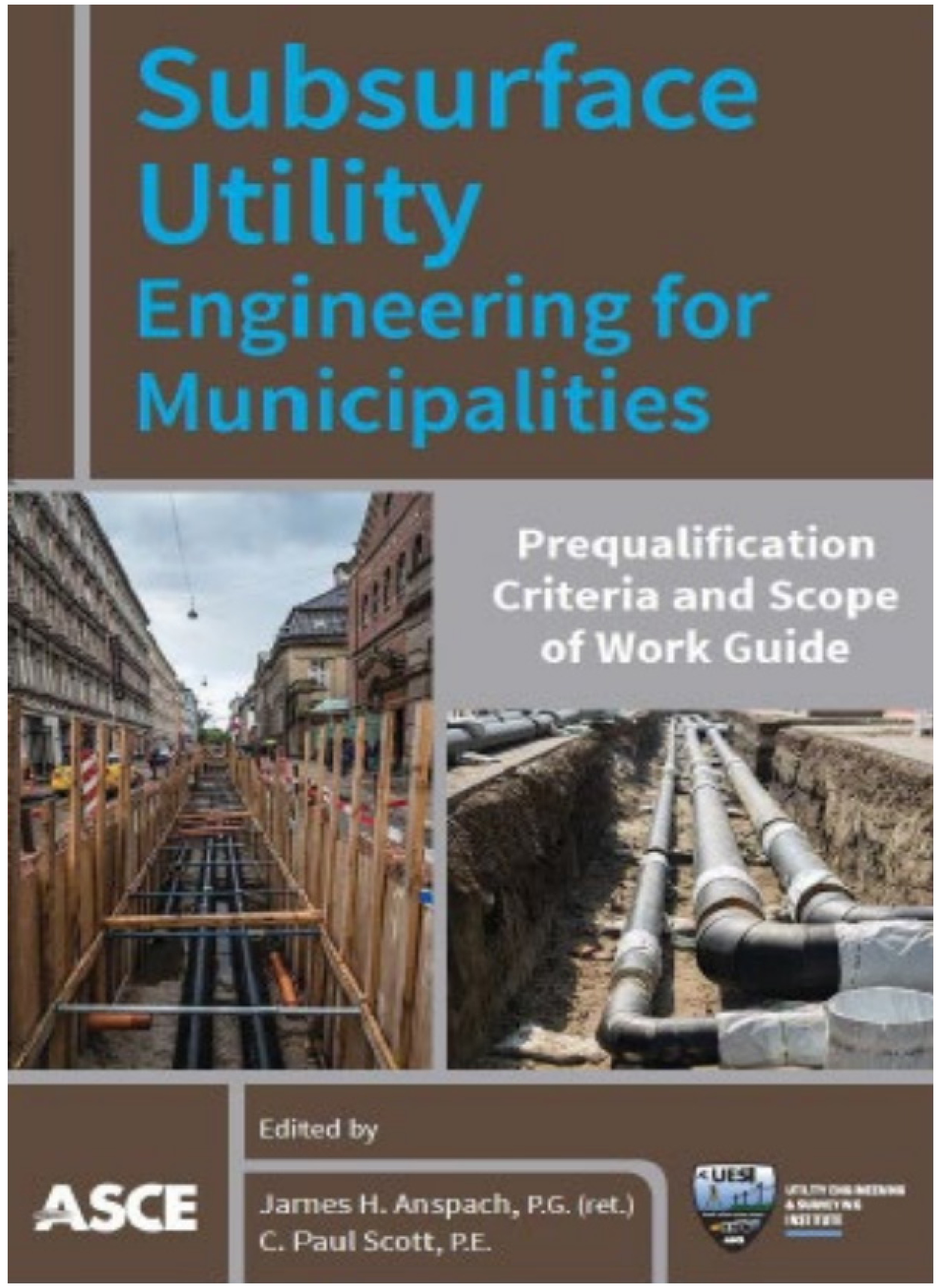
This checklist details steps and methods that ensure the best nondestructive underground utility location results. The SIM approach, (experienced-based training combined with multiple technologies, and step-by-step site methods) has proven to be consistently accurate and efficient in accounting for site variability.

Please visit www.simspec.org for more information and detailed SIM specification.

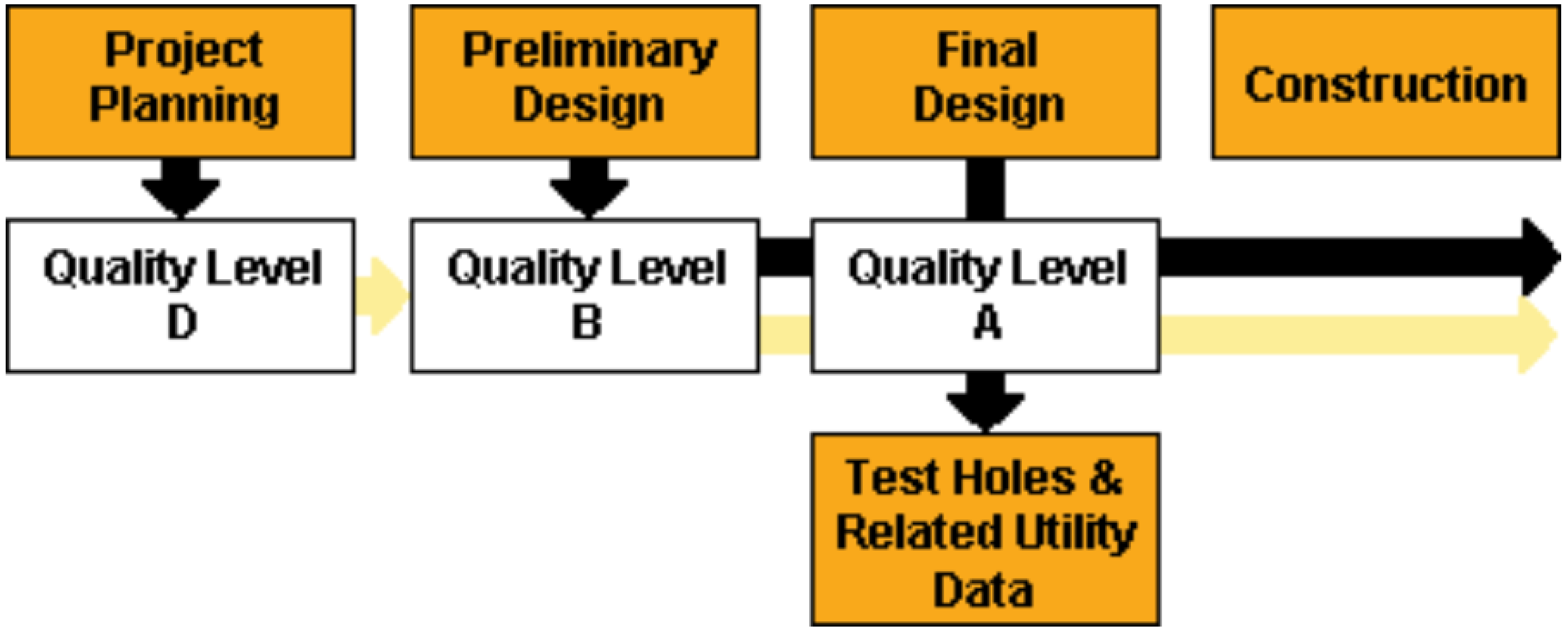
Subsurface utility engineering – asce dOCUMENTS







Sue Utility Investigation School



Utility Engineering and Surveying Institute (UESI)

BAMI-I

Buried Asset Management Institute - International

JIM ANSPACH, pg

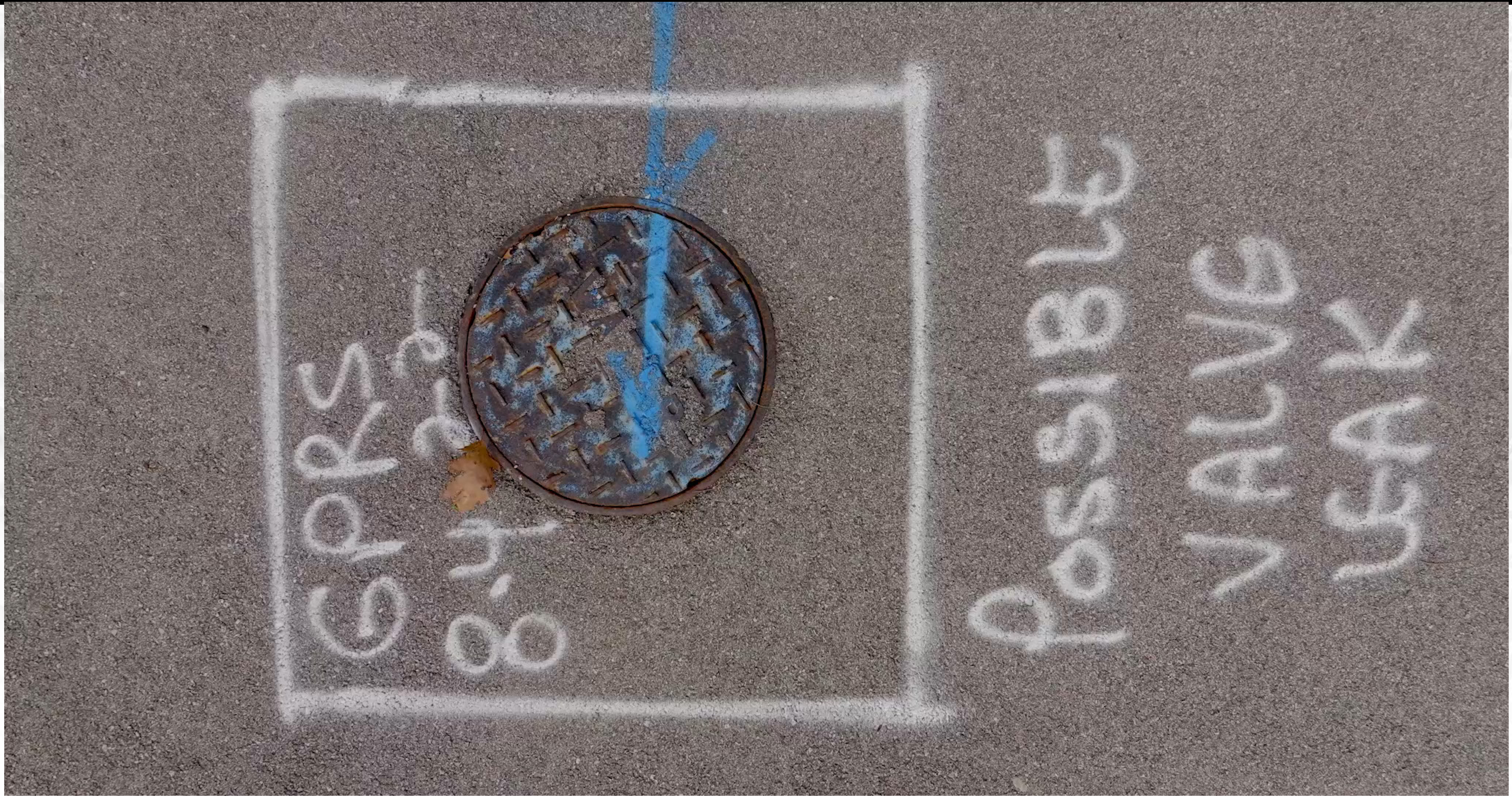
https://bami-i.com/utility-investigation-school/

Locating type COMPARISON CHART

	811 DESIGN TICKET	PRIVATE UTILITY LOCATE	811 DIG TICKET	SUE REPORTING
WHEN COMPLETED	design	Design and construction	construction	design
Plans provided	sometimes	Yes / depends	no	yes
cost	free	$	Free	$$$
Required by law or a project	no	no	yes	sometimes
All utilities identified	Yes, If registered with 811	Yes, if locatable using technology	Yes, If registered with 811	Yes, to the best of the ability of the engineer that signs and seals
Accuracy	Questionable. Depends on records.	18”=/- and with depth where active connection or gpr	48”=/- caution zone and 18” hand exposure zone. Typically No depths.	Based on quality level designated by the engineer.
What is involved	Either plans provided or field markings	Field marking and various deliverable	Field markings	Plan research record drawings, Field marking, and various deliverables
Tools	None or emi pipe locator	Emi pipe locator Some also implement gpr, vpi GPS or hand sketch	Emi pipe locator	Level d: Plan Research Level C: Total Station or GPS Level B: Emi pipe locator gpr, Vpi, thumper, others Level A: Hydro excavation / softdig
Guarantee in location	no	Yes / depends	Yes / depends	depends


SITEMAP
MATT MIKOLAJCZYK
Project Manager
Regina
Medicine Hat
Winnipeg
Dryden
Estevan
Winkler
ONTARIO
QUÉBEC
Chibougamau
Lebel-sur-Quévillon
Nanaimo
Victoria
WASH.
Great Falls
MONTANA
Missoula
Helena
Billings
N.D.
S.D.
Rapid City
IDAHO
ORE.
WYO.
Quebec
N.B.
Fredericton
Montreal
Saint John
Ottawa
MAINE
Toronto
London
NEBR.
NEV.
United States
San Francisco
Virginia Beach
N.M.
ARIZ.
Ensenada
B.C.
SON.
CHIH.
COA.
B.C.S.
Bermuda
Marsh Harbour
Miami
Bahamas
Gulf of
200 mi
© Mapbox © OpenStreetMap Improve this map © Maxar

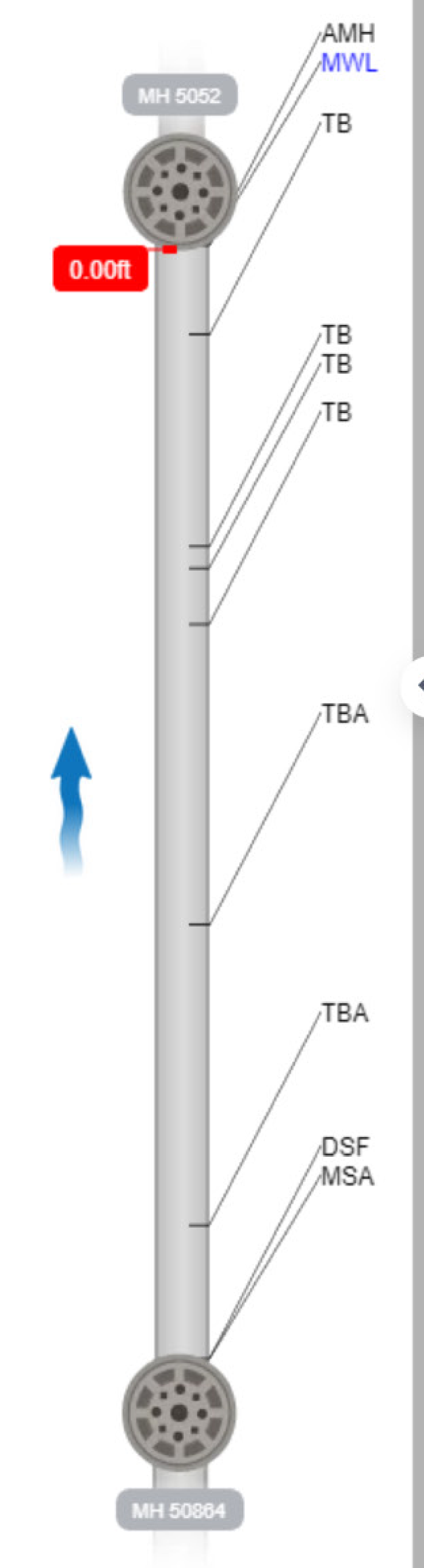

SITEMAP
MATT MIKOLAJCZYK
Project Manager
Ashland
Marquette
Munising
Sault Ste. Marie
Greater Sudbury
Elliot Lake
Espanola
North Bay
Blind River
Ottawa National Forest
Hiawatha National Forest
Manistique
Iron Mountain
Wikwemikong Unceded Indian Reserve
Algonquin Provincial Park
Rice Lake
Huntsville
Merrill
Antigo
WISCONSIN
Alpena
Traverse City
Barrie
Kawartha Lakes
Kincardine
Markham
Toronto
Kitchener
Oakville
Hamilton
Mount Pleasant
London
Welland
Chatham-Kent
Red Wing
Rochester
Waterloo
Dubuque
Marshalltown
Clinton
30 mi
© Mapbox © OpenStreetMap Improve this map


GPRS
8-4-22
POSSIBLE
VALVE
LEAK


SITEMAP
MATT MIKOLAJCZYK
Project Manager
Mercy Saint Vincent
Medical Center
30 ft
© Mapbox © OpenStreetMap Improve this map © Maxar


MATT MIKOLAICZYK
MATTERPORT
2023-04-24-56863-CUP-
SCANS-MOB-2
GPRS
30 ft
© Mapbox © OpenStreetMap Improve this map © Maxar

Locating type COMPARISON CHART



Reset filters | Show filters | Filter is active

SEARCH

SECTIONS | LATERALS | NODES

No.	Pipe Segm...	Total Leng...	City	Street	Upstream ...	~~	Downstrea...	Material	Shape
1	MH 50864...	1.750	Toledo OH	Cherry St	MH 5052	>	MH 5053	RCP	Circular 20...
3	MH 50864...	195.250	Toledo OH	Cherry St	MH 50864	>	MH 5052	RCP	Circular 20...
4	Dye test	168.670	Toledo OH	Cherry St	MH 5053	>	MH 5052	RCP	Circular 20...
5	ST MH 2 t...	77.210	Toledo OH	Cherry St	ST MH 1	>	ST MH 2	RCP	Circular 15...
6	ST MH 2 t...	141.260	Toledo OH	Cherry St	ST MH 2	>	ST MH 3	RCP	Circular 15...

1 2 3 4 5

28/02/2023 10:33

1	0.0	195.2	AMH	Manhole	00:00:01	MH 50864
2	0.0	195.2	MWL	Water Level,...	00:00:03	
3	16.0	179.3	TB	Tap Break-in...	00:01:10	
4	53.0	142.2	TB	Tap Break-in...	00:03:20	
5	56.6	138.7	TB	Tap Break-in...	00:03:48	
6	66.8	128.5	TB	Tap Break-in...	00:04:29	

AUTODESK Drive

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