Underground Utilities Mapping Project Team

(UUMPT)

Minnesota Society of Professional Surveyors
2022 Annual Conference

February 24, 2022

Steve Swazee
Chair

MINNESOTA
GEOSPATIAL ADVISORY COUNCIL
EMERGENCY PREPAREDNESS COMMITTEE

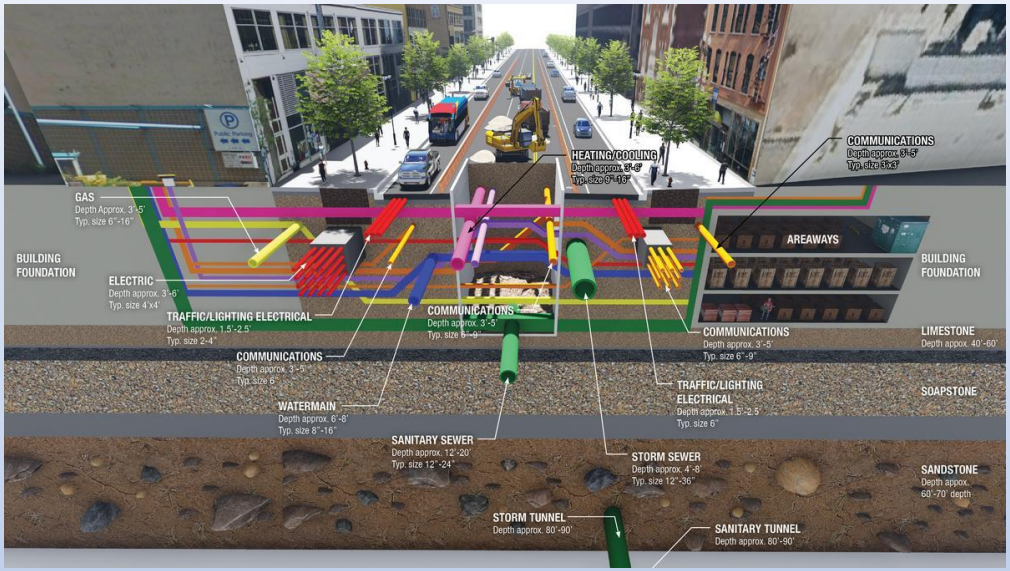
For Your Consideration

1. What's the Problem?
2. Underground Utility Mapping Project Team
3. Infrastructure Focus – Pipeline Threats
4. Minnesota Pipes
5. "The Plan"

More and More Stuff is Underground

Paul Cory, U.S. DOT

New York City - 1917



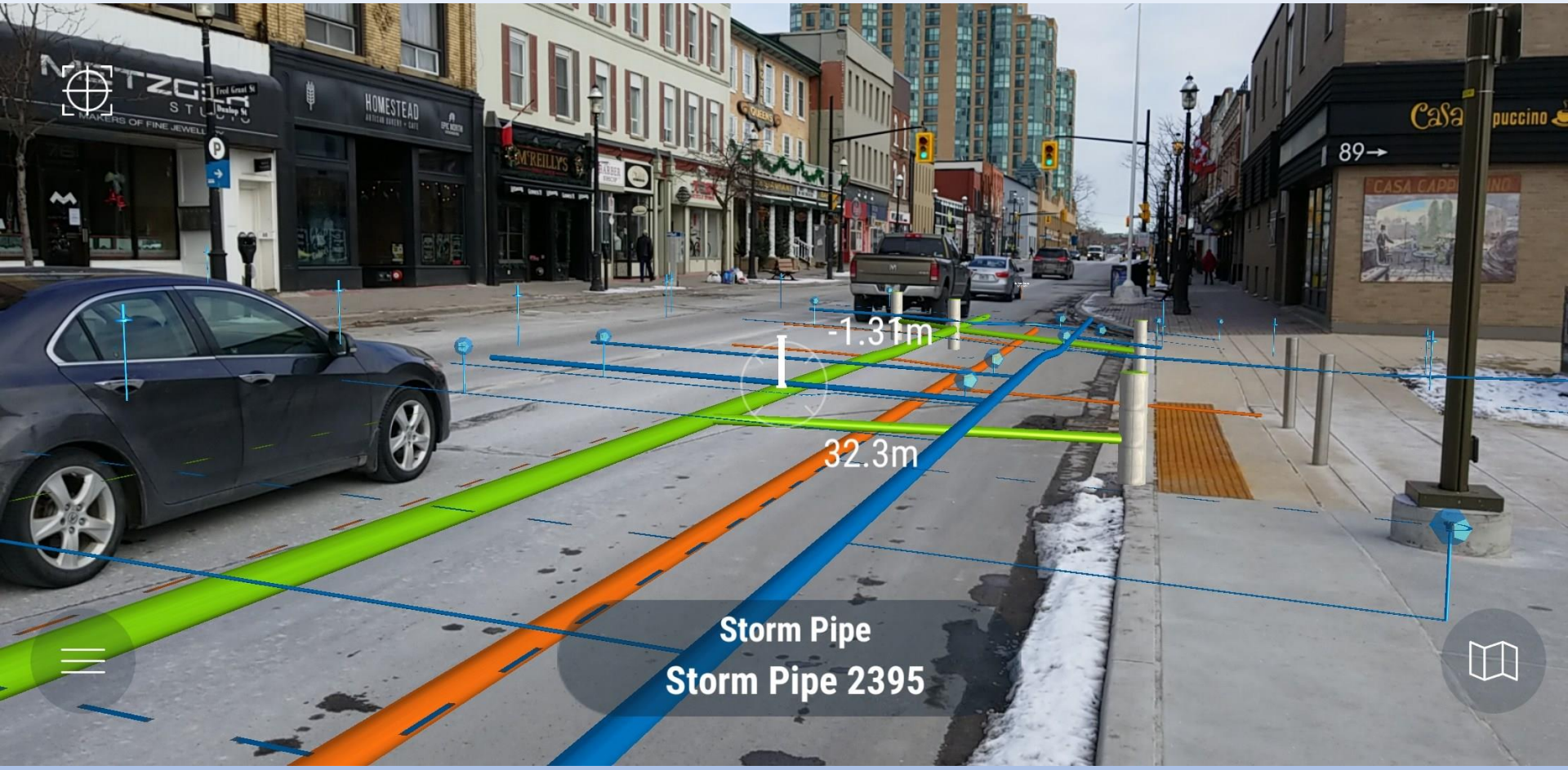
City of Minneapolis

Minneapolis - 2021

- Water
- Wastewater
- Storm sewer
- Heating/Cooling
- Electric
- Telephone
- Gas
- Oil
- Hazardous chemicals
- Street lighting
- Traffic signals
- Cable/Fiber

- Wood pipe
- Lead pipe
- Clay pipe
- Copper pipe
- Iron/steel pipe
- Plastic pipe

State of the Art?



Meemim, Inc. vGIS

What's the Problem?

Nationwide We Do Not *Comprehensively* Know What's Underground
Both the "What" and "Where" Element Are Lacking

- **Result**: Nationwide construction damage to **all types of utilities**
  - 2020 U.S. estimated damage was over $30 billion
  - Incident hits were steadily increasing until 2020 (1st time in 6 years a drop – due to the COVID pull back on construction)

- Gopher State One Call (GSOC)
  - **Created 1987 after pipeline hit and explosion in Mounds View**
  - 811 or "Call Before You Dig" function for the entire state

- Minnesota considered **one of the best states for damage prevention**
  - **Best guess** is there were 4,542 MN hits in **2020** (Dirt Report)
  - Top category was telecom; 2019 it was natural gas (apx. 2,000 hits)

What's the Problem?

Demand Versus Technology

- Monday, June 22, 2020: GSOC handled **7,000 calls for locates**
  - Must be marked within 48 hours
  - Good for only two weeks

- GIS and GPS tech have been ***rapidly evolving*** since GSOC was created
  - U.S. is well behind Europe in mapping underground infrastructure
  - **Although MN is rated as a top prevention state,** the greater GSOC community knows they need to leverage GIS tech to improve efficiency and safety

Finding What's There?

Superior Instrument

GSOC

GSOC

Piedmont Locating Services

Some of the Current Issues

1. Technical
    1. GSOC does not have a complete mapped view, nor do the utilities
    2. Just because data is in a GIS, doesn't mean it's accurate – and some utilities are still using paper
    3. Fragmentation inside organizations – water versus waste-water

2. Education
    1. No training standards for locators
    2. No training standard for equipment operators
    3. ***It is largely unknown that "collaborate, not collect" is possible***

3. Procedures/Standards
    1. No standards for capturing, storing or sharing locate data
    2. Abandoned and unknown lines are not being reported
    3. Liability!

Recognized Problem – BUT What to Do?

THE CGA 811 CONFERENCE & EXPO

"Technology is rapidly changing. Many of the best practices identified in this chapter could be obsolete in the near future. Although the following technologies are now used in other applications, **their use is not widespread in the damage prevention field**:

- Geographic Information System (GIS)
- Global Positioning System (GPS)
- Orthographic and satellite imagery…"

Best Practices Version 18.0, Mapping - Emerging Technologies, Common Ground Alliance

U.S. Department of Transportation
Pipeline and Hazardous Materials Safety Administration

A Study on Improving Damage Prevention Technology

August 2017 Report to Congress – Key Findings:

#3 of 5: ***Improve and implement GPS/GIS technologies in accurately locating and documenting the location of underground facilities.***

Is This Really a GIS Issue?
Looks More Like an Engineering Issue to Me!

Engineering Installation Standards!

(American Society of Civil Engineers - ASCE)

GIS Data Management Standards!

(Open Geospatial Consortium - OGC)

And it's cold, quenches thirst, makes you feel good, etc.

Underground Utilities Mapping Project Team = Collaborative Effort

GSOC
GOPHER STATE ONE CALL

=

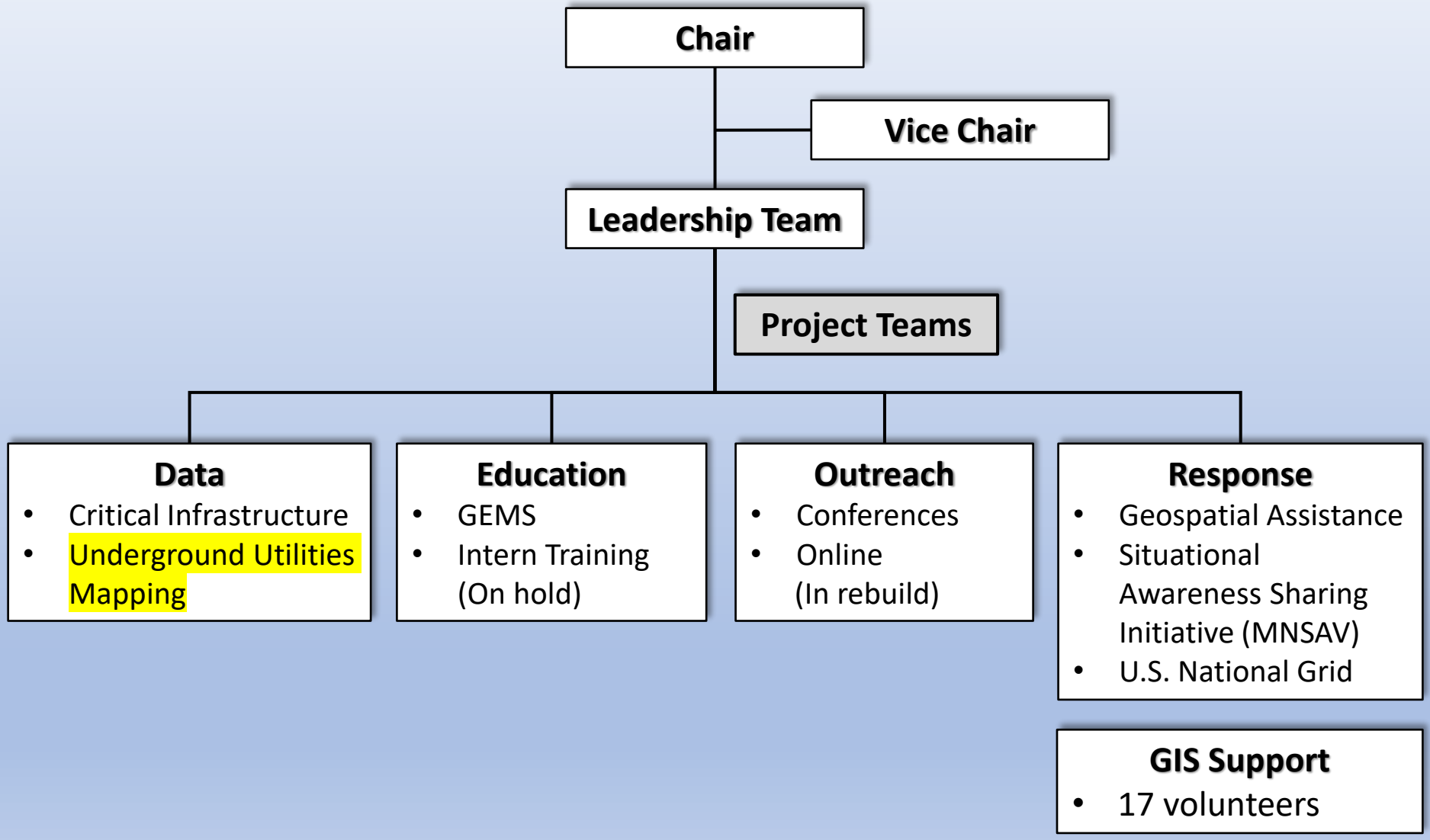
Chair - Barbara Cederberg
"Operational Control"

MINNESOTA
GEOSPATIAL ADVISORY COUNCIL
EMERGENCY PREPAREDNESS COMMITTEE

=

Vice Chair - Steve Swazee
"Administrative Control"

Emergency Preparedness Committee Structure



Mission Statement

The Underground Utilities Mapping Project Team will work to improve locate efficiencies and accuracy, reduce damage to the state's underground infrastructure, and improve operational and construction safety by leveraging current and emerging GIS technologies through cross community collaboration which develops best practices and promotes technology solutions.

Some Other Potential Beneficiaries

- MnDOT
- MN Office Pipeline Safety
- MnGeo
- MN construction community

- MDH
- MPCA (CWC)
- MnDNR
- MN business community

Public-Private Collaboration From the Start!

Barbara Cederberg	**COO, Gopher State One Call**
Steve Swazee	Chair, MGAC EPC; Executive Director, SharedGeo
Adam Worm	GIS Analyst, St Paul Regional Water Services
Andy Berg	Engineering & System Operations, Connexus Energy
Bob Basques*	GIS Systems Developer, City of St. Paul
Brad Anderson	GIS Manager, City of Moorhead
Brandon Keinath	GIS Programmer Analyst, Minnesota Power
Damon Nelton	GIS Manager, Ellingson Companies
Dave Hunstad	Electric Manager, Hutchinson Utility Commission
David Phillips	GIS Project Specialist, Major Projects, Enbridge Inc.
Dean Parker*	General Counsel - GSOC, Hinshaw & Culbertson LLP
Dr. Geoff Zeiss	Owner, Between the Poles
Gerry Sjerven	Environmental Services, ALLETE, Inc.
Joe Rubbelke	Utility Logic
Justin Lutterman	GIS Manager/Address Coordinator, Le Sueur County
Karin Strub*	Media Communications Manager, dp-PRO
Keith Novy	Manager, Damage Prevention Department, Center Point Energy
Keven Maxa	Engineering Supervisor, Austin Utilities
Mike Mendiola	Minnesota Office of Pipeline Safety
Nick Roehrdanz	GIS Manager, Technical Design Services
Justin Larson	Senior Operations Manager, Damage Prevention, Xcel Energy
Scott Landes	President, Infrastructure Resources/Rhino Markers
Travis Beran*	Subsurface Solutions
Troy Schultz	President, Technical Design Services

Four Functional Area Working Groups

- **Facility Operator Utility Mapping** (Travis Beran) - Locating, collecting and storing data – Where is that buried stuff?
- **Locate Data Flows & Mgt.** (Bob Basques) - Data maintenance and distribution – Telling others where the buried stuff is located
- **Outreach** (Leadership Team) - Finding the audience(s)/crafting the message – Creating engagement and improving safety awareness
- **Regulations/Security** (Dean Parker) - Restrictions on availability and use of GIS data – Current situation and path forward

The Project Team (25 members – 30 observers) and each working group meet once a month (2 meetings/month/each member)

Infrastructure Focus – Pipeline Threats

Pipe Spy

1 - Bad Geographic Information System Data

San Bruno, CA
September 9, 2010:

- To meet demand, PG&E boosted psi in Line 132
- Explosion registered as an earthquake
- 8 Dead/499 impacted
- $600 million in lawsuit settlements
- PUC fine – $1.6 billion
- Federal/state pending – $4.0 billion

Wikipedia

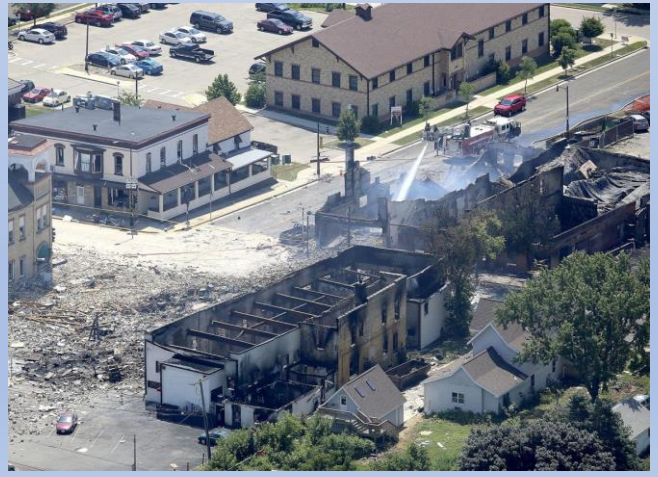
In his justification for boosting pressure, Arnett noted that Hoffman showed him a series of emails from 2009. In one, an engineer **cited "tons of errors in GIS" in the database** related to the San Bruno and other nearby lines. Another engineer's email that same year concluded: **"We do not trust GIS to be correct" but added, "got to trust something, though."**

Arnett admitted that he only made a "cursory review" of the GIS database when he authorized the spiking of the line.

2 - Construction Hit – Known Pipe

November 13, 2015: 1 Dead, 3 Injured
Bakersfield, CA - Bakersfield.com

October 31, 2016: 1 Dead, 5 Injured
Shelby County, AL - AP



July 10, 2018: 1 Dead, 2 Injured
Sun Prairie, WI - WI State Journal

February 6, 2019: No injuries
Downtown San Francisco, CA - Xpress

3 - Construction Hit – Abandoned Pipe

The Denver Post

April 17, 2017: Abandoned Collection Pipe Explosion, Firestone, Colorado

- 2 dead, 1 severally injured, $18.5 million fine, undisclosed settlement
- Pipe damaged when hit two (2) years earlier
- City allowed homes to be build over pipes which were not mapped

4 - Pipeline Structural Failure

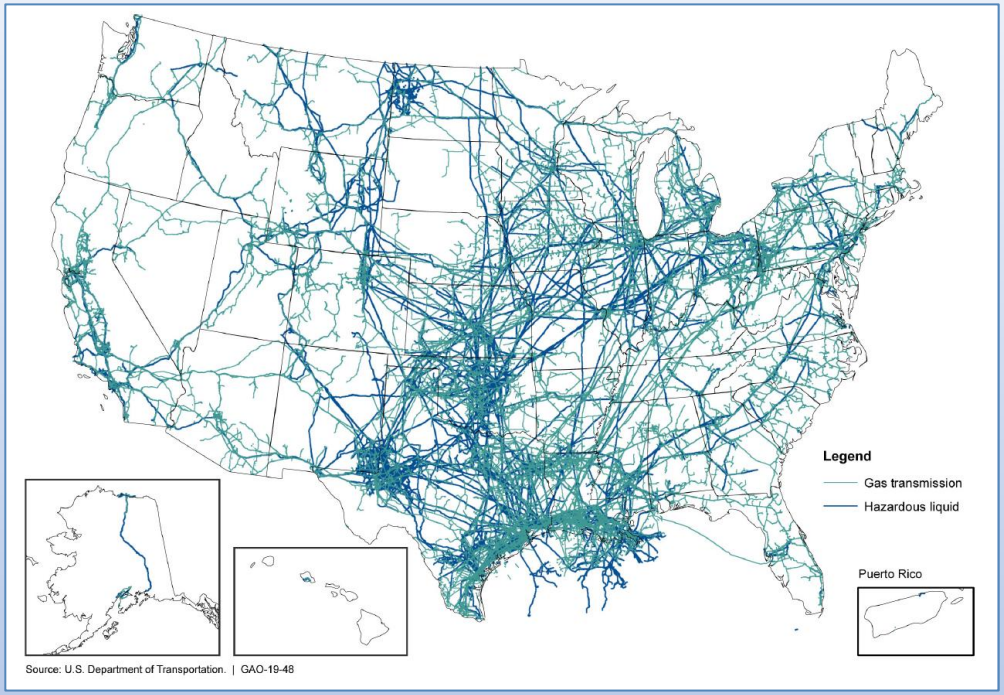
Duluth News Tribune

March 3, 1991
Largest inland oil spill in U.S. history
1.7 million gallons of crude
Prairie River
Grand Rapids, MN

NTSB

July 4, 2002
252,000 gallons of crude
Mississippi River Watershed
Cohasset, MN

Minnesota Petroleum Pipes –Transport



- Production/Collection – Not an issue in Minnesota
- Transport
  - 69,717 miles of interstate gas and liquid pipeline in Minnesota (17th)
  - MN Office of Pipeline Safety has oversight (PHMSA assigned)
  - Cap off/abandoned – locations known and maintained
- Distribution – Wild West legacy pipe – abandoned before 1998?

Minnesota Petroleum Pipes – Incidents

Minnesota natural gas pipeline hits in 2020: 1,652

Pipeline Incidents Caused by Excavation Damage Details - 2005 - Present
Time run: 2/21/2021 2:36:57 PM

Data Source: US DOT Pipeline and Hazardous Materials Safety Administration
Portal Data as of 2/19/2021 11:11:33 PM
STATE: MINNESOTA INCIDENT TYPE: All

State Name	Pipeline Type	Commodity	Incident Occurred Date	Operator ID	Operator Business Name	Location County	Excavator Type	Root Cause	# of Fatalities	# of Injuries	Significant Incident Flag	Total Property Damage
MINNESOTA	GAS DISTRIBUTION	NATURAL GAS	5/11/2020	31636	NORTHERN STATES POWER CO OF MINNESOTA	WASHINGTON	Private Excavator	Locating Practices Not Sufficient	0	0	Yes	1,556,941
MINNESOTA	GAS DISTRIBUTION	NATURAL GAS	11/19/2019	12350	CENTERPOINT ENERGY RESOURCES CORP., DBA CENTERPOINT ENERGY MINNESOTA GAS	STERNS	Private Excavator	Excavation Practices Not Sufficient	0	0	Yes	205,473
MINNESOTA	HAZARDOUS LIQUID	REFINED PP	1/8/2018	22610	MAGELLAN PIPELINE COMPANY, LP	DAKOTA	Private Excavator	Other	0	0	Yes	1,725,314
MINNESOTA	GAS TRANSMISSION	NATURAL GAS	3/14/2016	13750	NORTHERN NATURAL GAS CO	WRIGHT	Unknown Excavator	Previous Damage	0	0	Yes	300,000

Minnesota Petroleum Pipes – Incidents

December 11, 1998, St. Cloud, Minnesota: The Last “BIG ONE”

St. Cloud Times

4 Dead, 1 Seriously Injured, 10 Minor Injuries, 6 Buildings Destroyed

The Plan: Solutions – Not Problems!

Planning

- Create access and share data for job planning and design

Managing

- Plan for systems that will keep data current
- Deploy technologies that facilitate data sharing, easy connections and translation of existing databases
- Create standards for data accuracy and currency
- Anticipate needing GIS cooperatives for smaller entities
- Select a common base map
- Create a repository of utility data for historic and defunct businesses

Locating

- Enable universal view of data in the field
- Leverage technologies which facilitate upload of collected data
- Develop incentives for reporting unknown/abandoned lines
- End the need for physical white-lining as an outcome of the total effort

Security/Legal

- Ensure access is limited to only those with need and authorization
- Work to achieve voluntary sharing of data
- Develop the legal framework to codify and protect data sharing

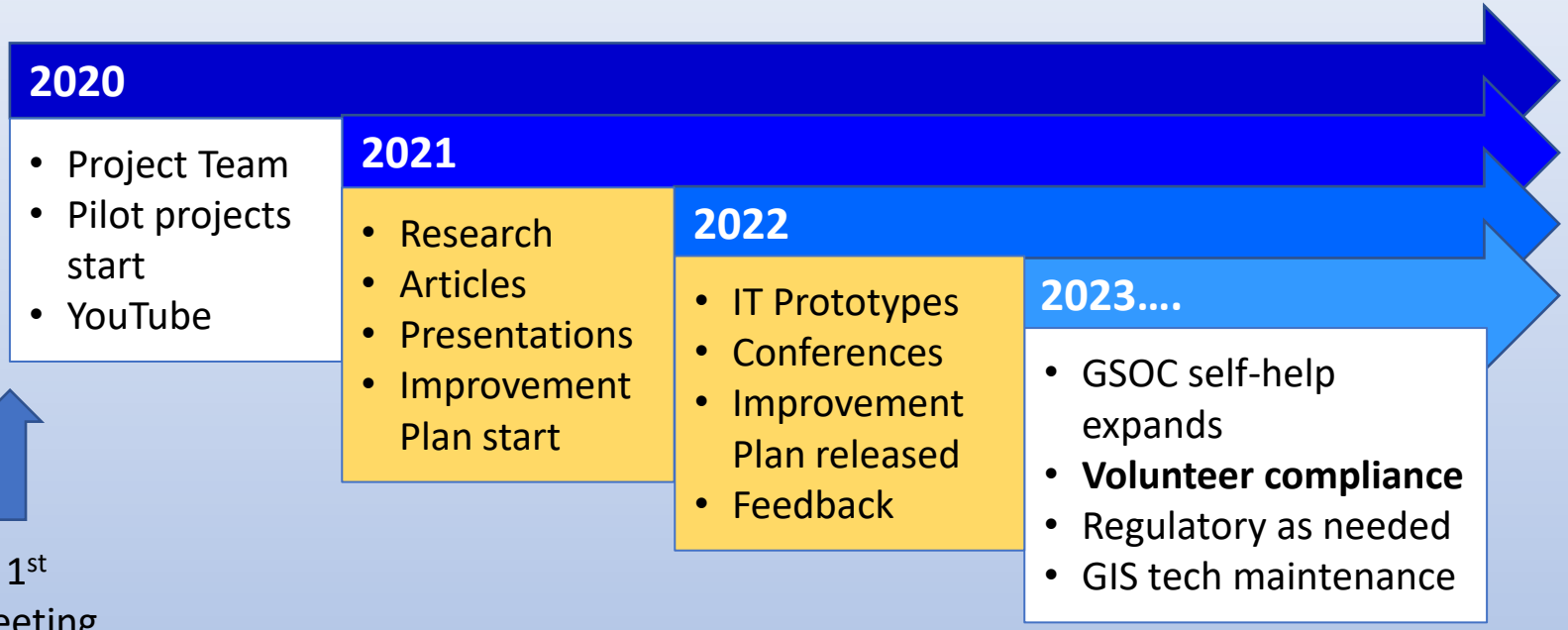
The Plan: Grow a Tree!

Not This

This

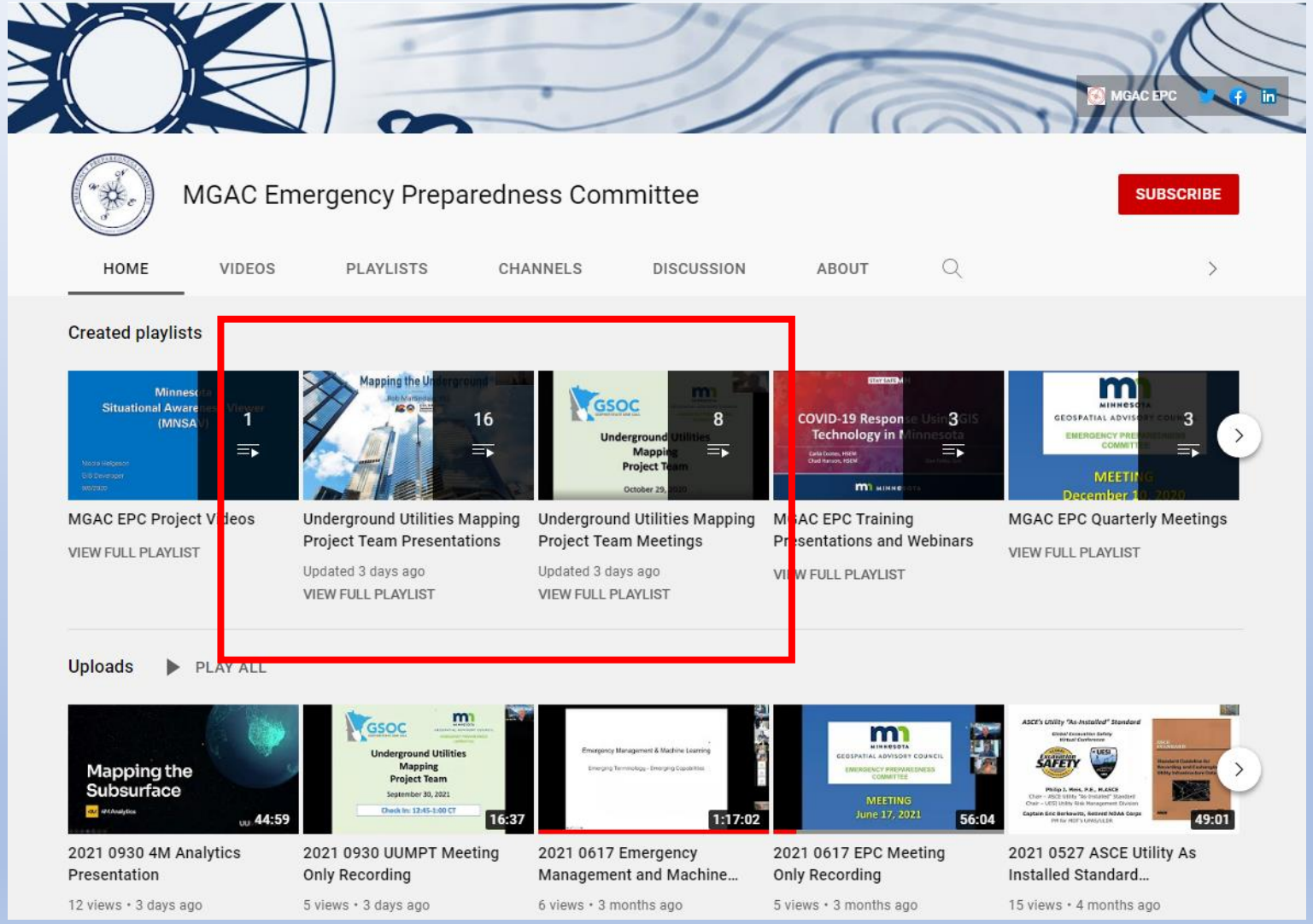
The Plan Going Forward: Action!

First In the Nation: Technology to Go From Reactive to Preventive



1. **More accurate maps**
2. **Ability to share data**
3. **Safer excavation**

The Plan: YouTube



Google: MGAC EPC Youtube

The Plan: Research – U.S.

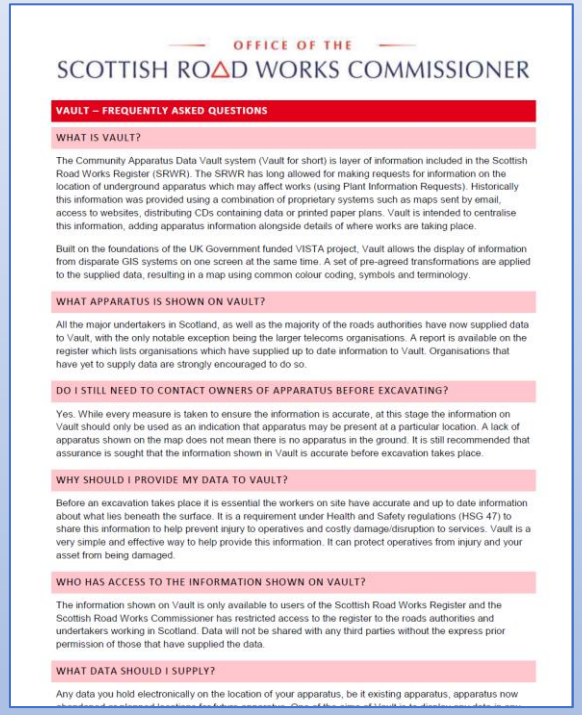
Other State Regulatory

- **Colorado - August 8, 2018 -** Colorado Revised Statutes 2018, TITLE 9 SAFETY – INDUSTRIAL AND COMMERCIAL (Colorado Call Center Law):
  - Enforcement: Safety Commission,
  - All underground facility owners and operators must be Tier 1 members of the Utility Notification Center of Colorado by 1/1/2021,
  - All new underground facilities – including services - must be electronically locatable when installed, and
  - Subsurface Utility Engineering (SUE) Required Project requirements put in place - CDOT already has a SUE Required Project Process.

- **Montana - May 7, 2019 -** Montana SB 76: GPS or as built survey must be filed with MT DOT within 90 days of completion of the utility installation in the Right of Way.

The Plan: Research - International

Overseas Data Sharing, Innovation, Plans



OFFICE OF THE
SCOTTISH ROAD WORKS COMMISSIONER

VAULT – FREQUENTLY ASKED QUESTIONS

WHAT IS VAULT?

The Community Apparatus Data Vault system (Vault for short) is layer of information included in the Scottish Road Works Register (SRWR). The SRWR has long allowed for making requests for information on the location of underground apparatus which may affect works (using Plant Information Requests). Historically this information was provided using a combination of proprietary systems such as maps sent by email, access to websites, distributing CDs containing data or printed paper plans. Vault is intended to centralise this information, adding apparatus information alongside details of where works are taking place.

Built on the foundations of the UK Government funded VISTA project, Vault allows the display of information from disparate GIS systems on one screen at the same time. A set of pre-agreed transformations are applied to the supplied data, resulting in a map using common colour coding, symbols and terminology.

WHAT APPARATUS IS SHOWN ON VAULT?

All the major undertakers in Scotland, as well as the majority of the roads authorities have now supplied data to Vault, with the only notable exception being the larger telecoms organisations. A report is available on the register which lists organisations which have supplied up to date information to Vault. Organisations that have yet to supply data are strongly encouraged to do so.

DO I STILL NEED TO CONTACT OWNERS OF APPARATUS BEFORE EXCAVATING?

Yes. While every measure is taken to ensure the information is accurate, at this stage the information on Vault should only be used as an indication that apparatus may be present at a particular location. A lack of apparatus shown on the map does not mean there is no apparatus in the ground. It is still recommended that assurance is sought that the information shown in Vault is accurate before excavation takes place.

WHY SHOULD I PROVIDE MY DATA TO VAULT?

Before an excavation takes place it is essential the workers on site have accurate and up to date information about what lies beneath the surface. It is a requirement under Health and Safety regulations (HSG 47) to share this information to help prevent injury to operatives and costly damage/disruption to services. Vault is a very simple and effective way to help provide this information. It can protect operatives from injury and your asset from being damaged.

WHO HAS ACCESS TO THE INFORMATION SHOWN ON VAULT?

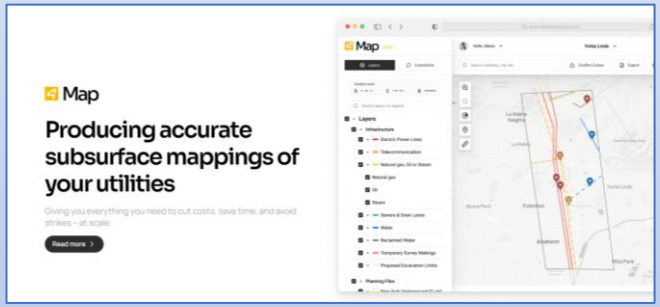
The information shown on Vault is only available to users of the Scottish Road Works Register and the Scottish Road Works Commissioner has restricted access to the register to the roads authorities and undertakers working in Scotland. Data will not be shared with any third parties without the express prior permission of those that have supplied the data.

WHAT DATA SHOULD I SUPPLY?

Any data you hold electronically on the location of your apparatus, be it existing apparatus, apparatus now

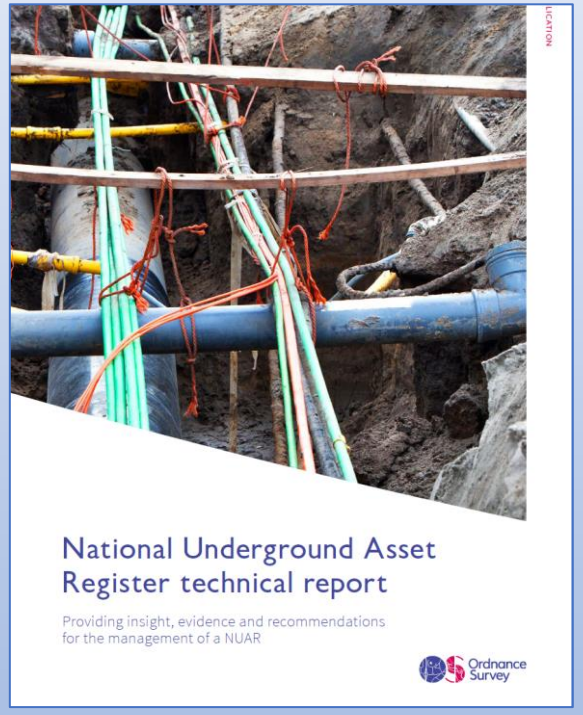
Vault

Vault (Scotland)



4M Analytics

4M Analytics (Israel)

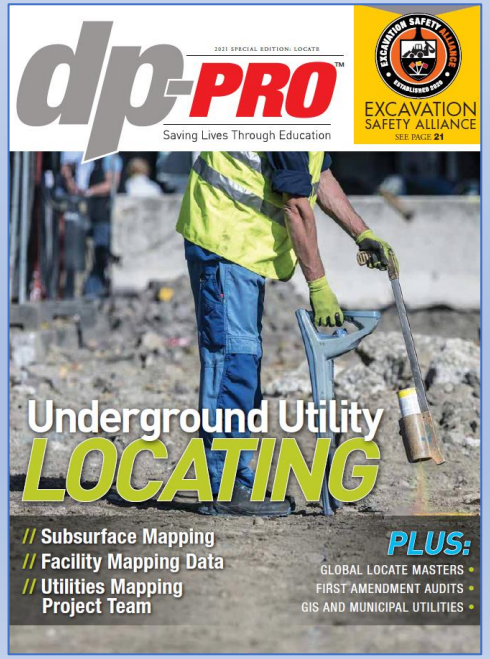


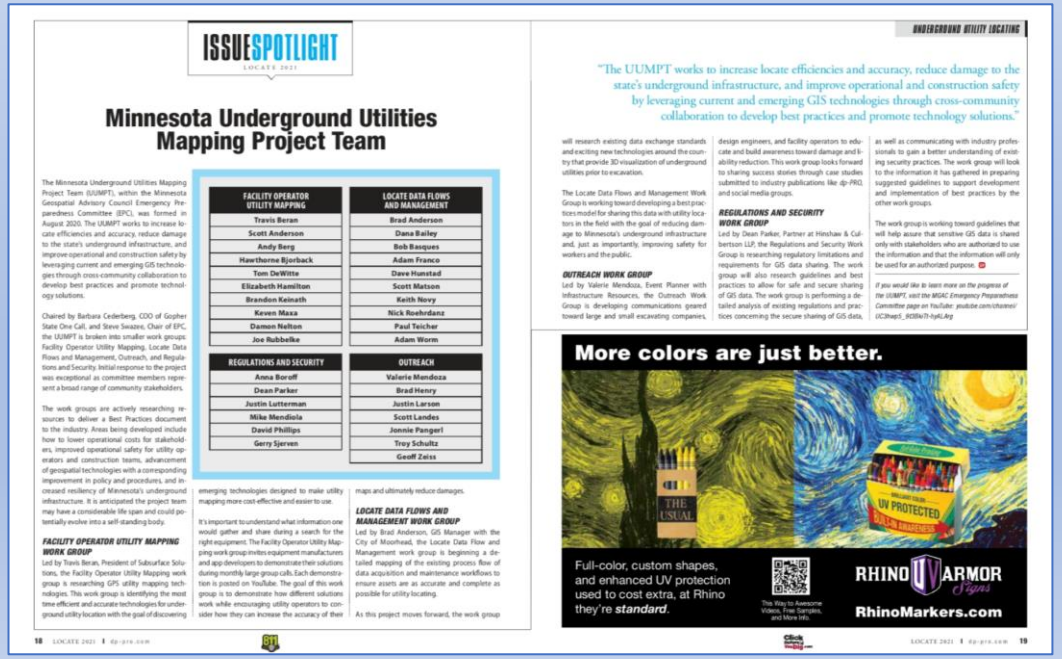
Restricted

NUAR (UK High Commission)

The Plan: Presentations/Articles

- Clean Water Council Policy Committee: Online, February 26, 2021
- Common Ground Alliance Conference: Orlando, October 13, 2021
- MN GIS/LIS: Online, October 29, 2021
- Minnesota Society of Professional Surveyors: Alexandria, February 24, 2022
- Global Excavation Safety Conference: Phoenix, March 3, 2022





The Plan: Legal/Security - Create Support

- Ongoing discussions with Europe and Canada
- Clean Water Council: October 18, 2021
- MGAC: December 1, 2021
- Association of Minnesota Counties (Environment & Natural Resources Policy Committee): December 6, 2021
- Multiple data sharing agreements in draft

Policy Statement Draft/Approved

Minnesota Underground Utilities Mapping Project
28 July 2021/18 October 2021

Policy Statement

To create an accurate inventory of Minnesota's underground utility infrastructure, the Clean Water Council (CWC) recommends that the State of Minnesota develop an accurate map of all underground utilities installed in the state and require Minnesota's public and private sectors to support sharing of necessary data in a secure and confidential manner.

The underground utility infrastructure mapping project supports the Clean Water Council's efforts to reduce the risk to drinkable, fishable, and swimmable water.

Problem

Damage to Minnesota's underground utilities can disrupt critical water infrastructure (drinking water and wastewater) and contaminate groundwater and surface water. In addition, without accurate mapping, public safety is a concern, especially when work is being done near petroleum and hazardous materials pipelines.

Damage most often results from data that is incomplete, inaccurate, or only exists on paper. This limits the ability of public and private entities from sharing data and ensuring its accuracy over time.

Examples of utilities that require accurate mapping include, but are not limited to:

- Drinking water supply pipes
- Wastewater pipes
- Stormwater pipes and stormwater storage
- Petroleum pipelines
- Hazardous materials pipelines
- Telecom infrastructure, and
- Abandoned infrastructure that could transport aquatic invasive species.

Much of this data is held by the private sector, and therefore is not in the public sector's possession. It is imperative that the sharing of data can be accomplished in a secure and confidential manner.

Solution

Improving the accuracy of Minnesota's underground utility maps will reduce these risks. Gopher State One Call (GSOC) and the Minnesota Geospatial Advisory Council Emergency Preparedness Committee (EPC) have formed the Underground Utility Mapping Project Team (UUMPT) to address this issue.

The mapping project works to improve locate efficiencies and accuracy, reduce damage to the state's underground infrastructure, and improve operational and construction safety by leveraging current and emerging GIS technologies through cross-community collaboration that develops best practices and promotes technology solutions.

With security and confidentiality being critical, the efforts will include protection of data from competitive intrusion and security threats using appropriate procedures and advancements in geospatial technology that facilitate sharing of data via secure and limited access.

The Plan: Locator Live Data Feed Pilot Project

Ticket information

Ticket number	212093750
Original call date	07/28/21 02:58 pm
Work to begin date	07/30/21 03:00 pm
Expiration date	08/13/21 03:00 pm
Type	NORMAL CALL
Past work start	Y
Locked	Y
Past due time	Y

Excavator information

Company name	GOPHER STATE ONE CALL
Address	123 TEST AVE WEST ST PAUL, MN 55118
Company phone	651-681-5705
Caller	JILL HAYES
Phone	333-333-3333
Contact	JILL HAYES
Contact phone	222-222-2222
Email address	jillhayes@occinc.com

Excavation information

Type of work	TEST

The Plan: IT Prototype #1-3

Minnesota UUMPT Blueprint for the Future – Version 4.2.1

Data Request Received at GSOC

1. Data request sent to Fusion View (FV)
6. Map data returned

Fusion View (FV) Processing

2. FV defined "Bounding Box" data request sent to Utility GIS Databases
4. FV transforms and fuses Utility GIS Database data replies "on-the-fly"
5. FV sends mapped data to requestor to support respective end use

Utility GIS Databases

3. FV request triggers return of data within Bounding Box for each utility

Vetting of inbound data

6 **Engineering Team**

- Design, construction survey, and as-built record
- Engineering section/firm sends final as-built data to client GIS and retains copy

6 **Locate Team**

- Locate, mark, and record
- Live data and reports of abandoned or unknown infrastructure sent to FV
- Locator sends final GPS locate data to client GIS and retains copy

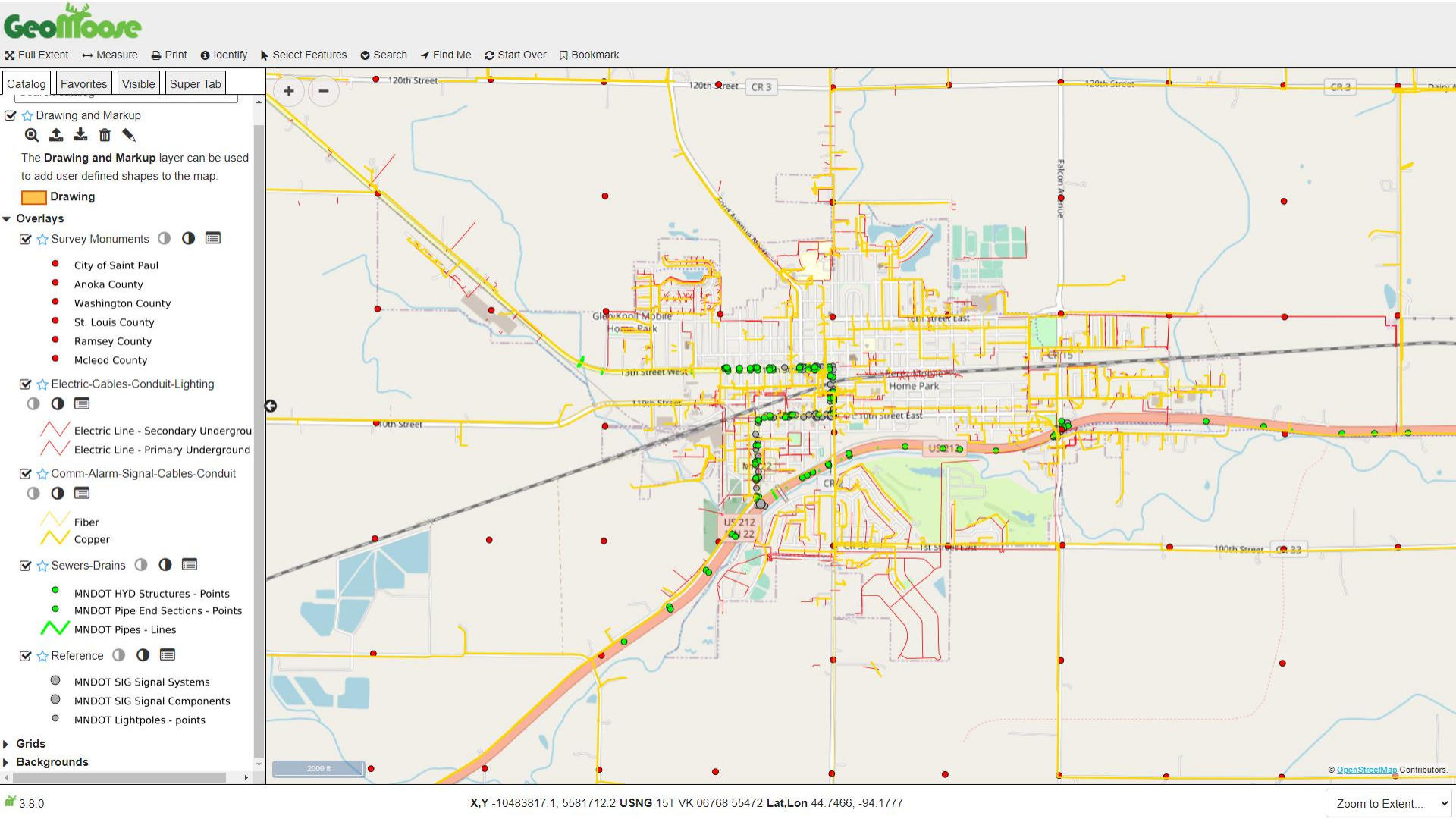
6 **Excavation Team**

- In field awareness and eventual Augmented Reality enablement
- Reports of abandoned or unknown infrastructure, and unintentionally hits sent to FV

Normal system data flows ——— As needed/available data flows - - -

Photo credits: Locator – American Geophysics, Inc.; Excavator – Volvo

The Plan: Prototype #1 – Glencoe, MN



The Rocket IS Going to Blow Up on the Launch Pad!

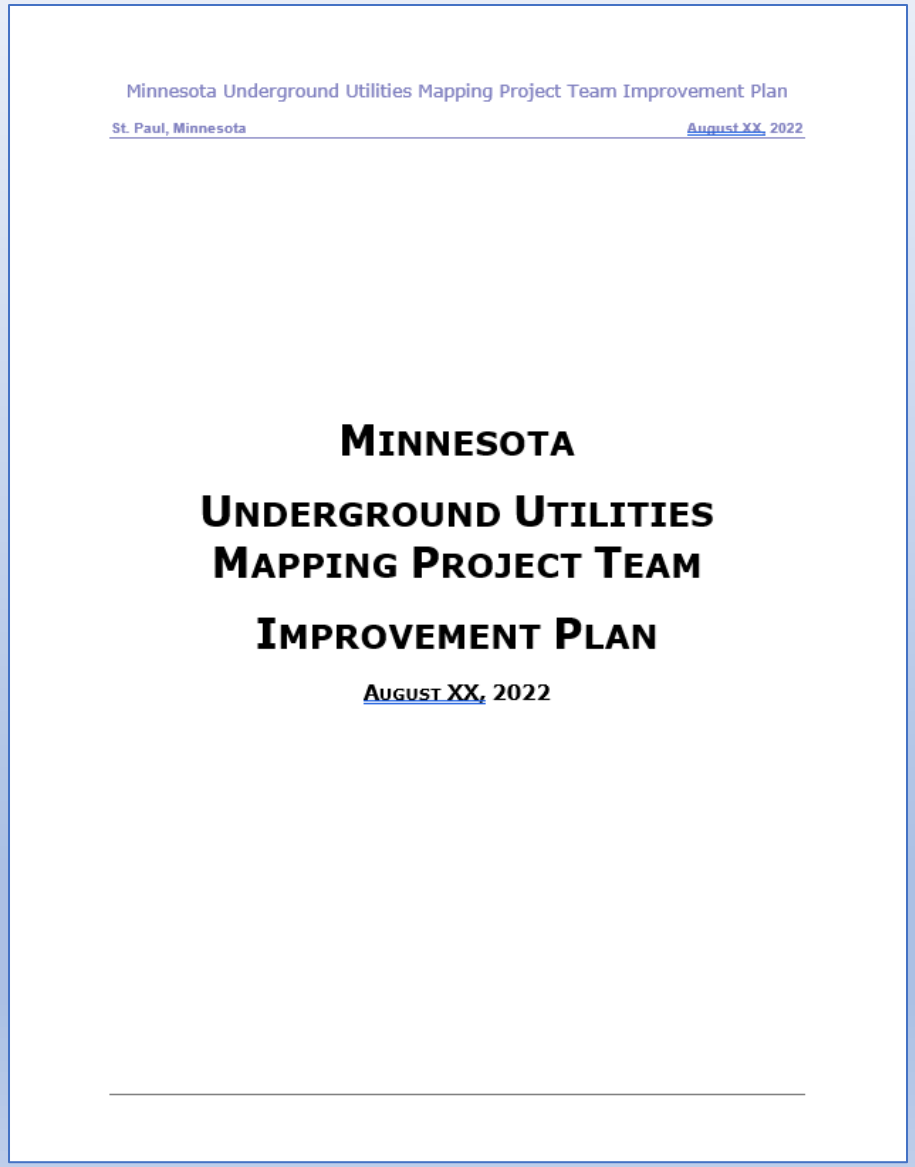
NASA

Space News

space.com

Taipei Times

The Plan: UUMPT Improvement Plan



MINNESOTA

UNDERGROUND UTILITIES MAPPING PROJECT TEAM

IMPROVEMENT PLAN

AUGUST XX, 2022

Tech - Where We Can Go With Good Data

Volvo

Leveraging emerging tech: AR, 3D, precision GPS

The technology is there, it’s a matter of will (and money)

Final Thought: Return on Investment

What's the value of:

- A life?
- Disruption to commerce?
- Slowed construction?
- Damage to the environment?
- Exposure to another "Big One"?

We need to be working toward the aviation standard –

Zero Accident Rate

Learn More (mgacepc.net)

- Next UUMPT – February 24, 1:00 pm CT

Questions?

Steve Swazee
Chair
MGAC Emergency Preparedness Committee
chair@mgacepc.org