ISSUE 39 | **Fall/Winter 2025**

Ear to the ground

Ontario Regional
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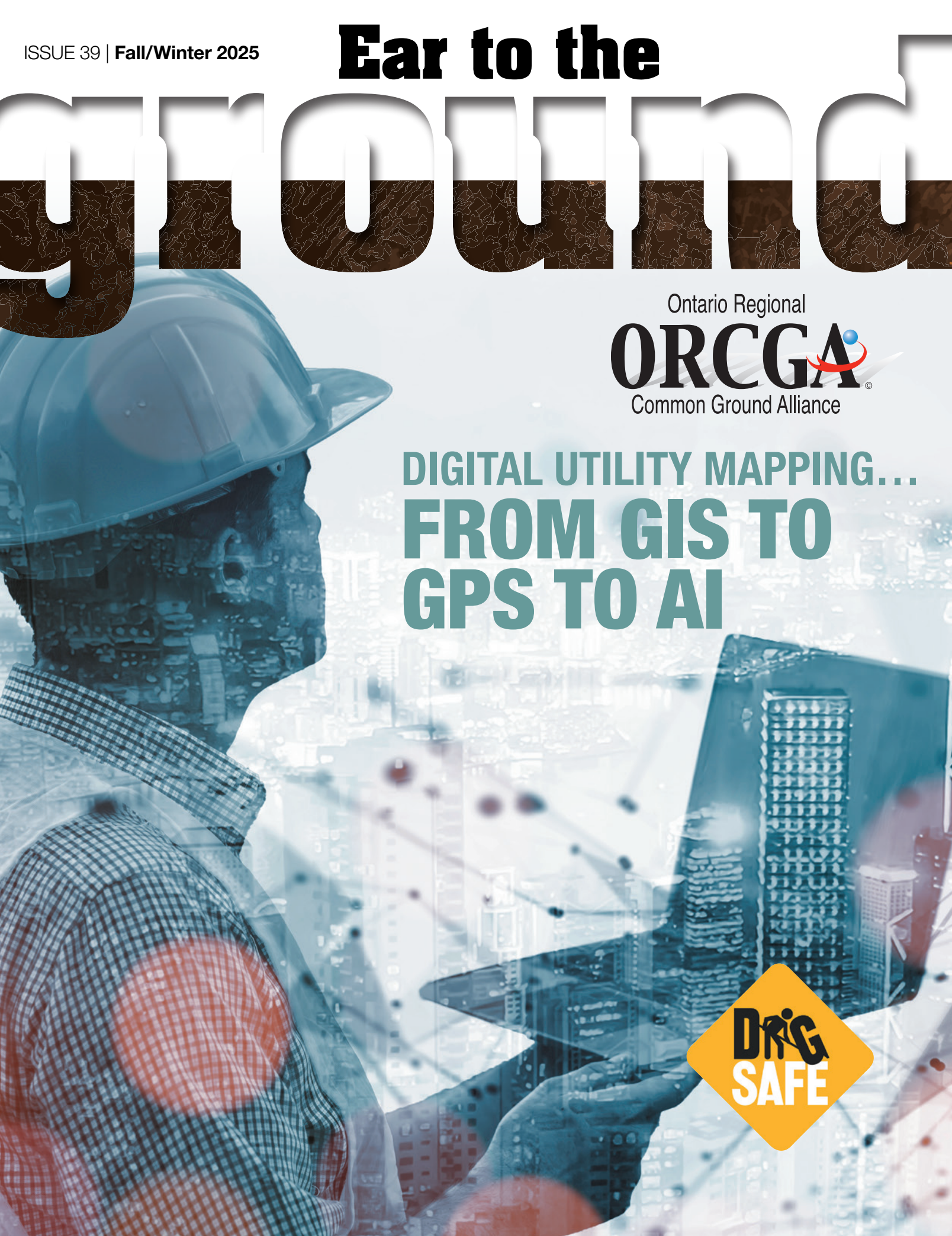
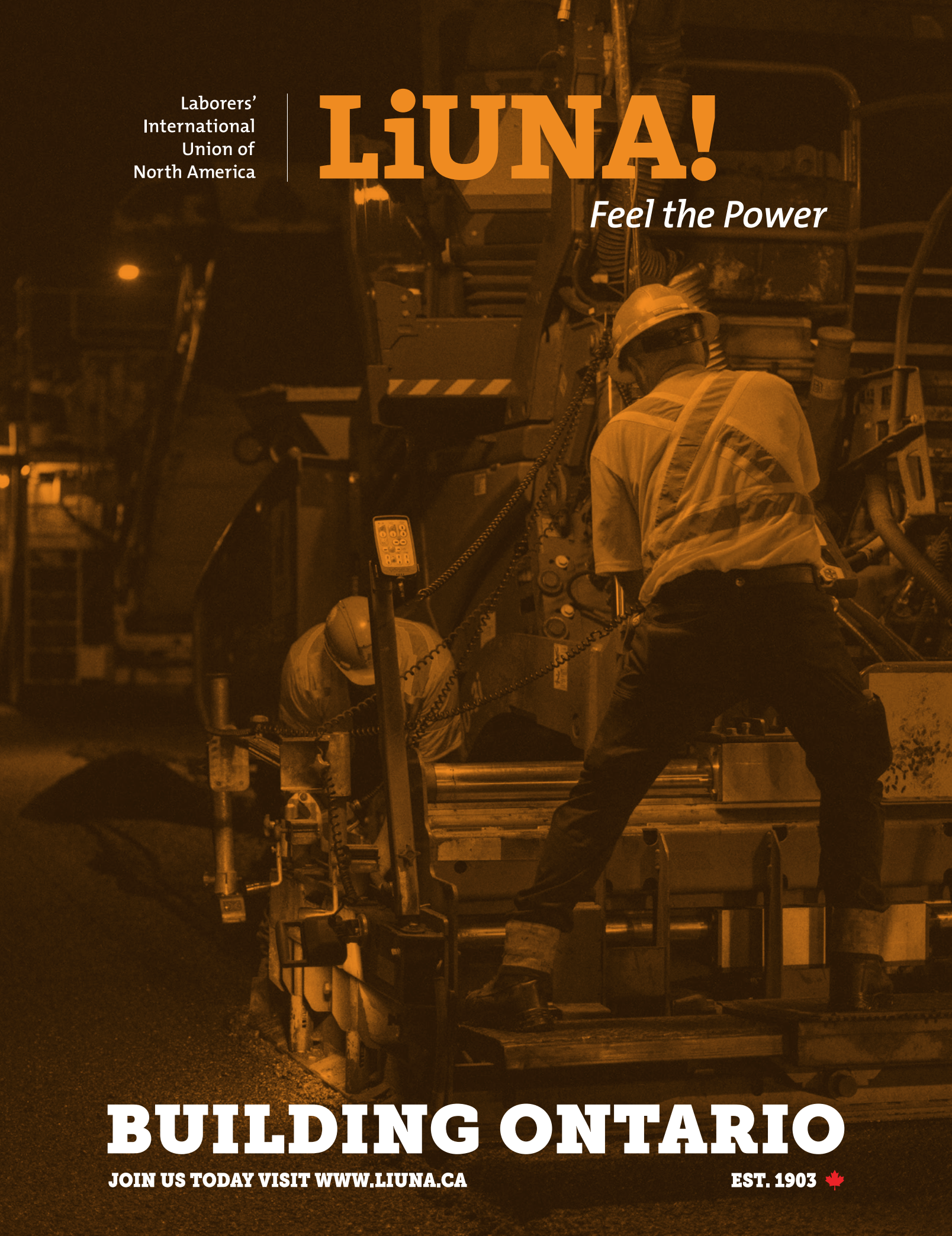
Common Ground Alliance

DIGITAL UTILITY MAPPING…
FROM GIS TO GPS TO AI

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Ontario Regional ORCGA Common Ground Alliance

DIG SAFE

ISSUE 39 | **Fall/Winter 2025**

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The Ontario Regional Common Ground Alliance (ORCGA) is an organization promoting efficient and effective damage prevention for Ontario's vital underground infrastructure. Through a unified approach and stakeholder consensus, ORCGA fulfills its motto of "Working Together to Build a Safer Ontario."

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Dig Safely this Season!

Doug Lapp, President and CEO, ORCGA

On behalf of the Board of Directors and staff of the ORCGA, we would like to thank all the participants and volunteers that attended the **ORCGA Golf Tournament** held at Bond Head in June as well as the **Locate Rodeo & Excavator Challenge** held at Brock University in August. Both events were sold out and a tremendous success this year! A special thanks to our event planner, Rebecca Leighton, who worked tirelessly with support from ORCGA staff Kim Sheppard and Lori O'Doherty to make these events successful for our sponsors, members, volunteers and participants!

Join us at the **ORCGA Fall Dig Safe Breakfasts** (DSB) get underway across the province starting in early October. Registration is now open for the Fall DSP on the ORCGA website, **ORCGA.com**, where dates and locations are listed.

Save the date for the **2026 ORCGA Damage Prevention Symposium**, to be held at the Niagara Falls Convention Centre Feb. 10-12, 2026. The annual symposium is the place to network with damage prevention professionals, attend informative education sessions and panel discussions. Our trademark damage prevention industry tradeshow features over 30 booths and vendors. The annual symposium is also where you can get involved with one of the ORCGA committees: Best Practices, Reporting and Evaluation or Events and Communication. Registration will open for this industry event in early fall.

The ORCGA provides construction industry training for damage prevention professionals. Programs include **Damage Prevention Technician (DPT)** training for locators, **Safe Excavation Training (SET)** training for construction workers covering safe excavation practices around buried utilities, as well as **Tailboard Talks (TBT)** for construction site tailgate meetings. Training dates for these programs are available on the website, **ORCGA.com**.

This edition of *Ear to the Ground* builds on the spring edition, continuing the conversation surrounding digital utility mapping. Three of our members take you on a journey through the evolution of facility maps and records — starting with handwritten logbooks, moving through paper maps and microfiche, and landing in the digital age with electronic maps and drawings that bring projects to life. The use of computerized drawings using tools such as AutoCAD, coupled with layering these utility files onto GIS base maps was just the beginning.

Thanks to GPS, utility assets can now be mapped with pinpoint accuracy down to the centimeter. This breakthrough has transformed mapping, yet it also raises new hurdles, from the difficulty of charting buried infrastructure to the high price tag of rolling it out on a wide scale. The recent advent and commercialization of artificial intelligence (AI) with digital utility mapping has brought forward new and potential streamlined processes to overcome some of these challenges.

With the need for accurate, timely and accessible utility maps and records, the potential for improved and accurate digital utility mapping is obtainable with these tools and technologies.

As we move into the fall construction season, we are all reminded of the requirement to **Click Before You Dig** with **Ontario One Call**; **it's the Law!** Let us all work together to make **"Every Dig, a Safe Dig!"**

FEATURE

GOOD INGREDIENTS FOR DIGITAL UTILITY MAPPING

Peter Lamb, OLS, B.Sc.
Chair, Underground Utilities Committee of the
Association of Ontario Land Surveyors (AOLS)

In his ETG 2025 article, *GPS Technology in Damage Prevention,* Jason Arnold gives a good review of the benefits of using GPS data and GIS software for managing underground utilities.

As an Ontario Land Surveyor (OLS) who helped draft Canada's national underground utility mapping standard, Canadian Standards Association (CSA) S250, I know there's a widespread desire of utility stakeholders — locators, engineers, owners, operators and contractors — to get a better handle on knowing what vital services are underground, and where!

Doing so helps not only reduce construction risk but also provides helpful information *before* design and construction planning, and for responding to emergencies.

I suggest three main ingredients for good mapping:

1. GOOD STANDARDS AND PRACTICES

The beauty of digital data is that it can be readily *shared* and *combined* with many other types of data. But sharing wisely means having a common understanding of such things as:

- How data was collected, or compiled from existing sources — when exactly, and by whom, and how accurate is it?
- What horizontal and vertical references are used to describe position?
- What grid mapping system and zone are coordinates in — UTM (typically for federal or MNR data) or MTM (as for the Ministry of Transportation)?
- How is data portrayed on digital plans: what do symbols, colours and text annotations mean? Are elevations to top of pipe/duct, or something else?

The CSA S250 (*Mapping of underground utility infrastructure*) standard (83 pp) provides:

- Basic requirements for field measurements.
- A consistent means of depicting features in CAD or GIS.
- Excellent best practices for the maintenance of map records.

I strongly recommend utility mappers get a copy to benefit from the many combined years' experience of the committee authors!

The American Society of Civil Engineers (ASCE) also has two good standards: One is 75-22 (*Standard Guideline for Recording and Exchanging Utility Infrastructure Data*), which is like CSA S250 but has more detail in some topics, and less in others. The other is 38-22 (*Standard Guideline for Investigating and Documenting Existing Utilities*) which clarifies the use of how investigative "quality levels" should be applied to data by Subsurface Utility Engineers and gives examples of 2-D and 3-D representations of infrastructure.

PHOTOS PROVIDED BY AUTHORS

2. GOOD FIELD SURVEY SKILLS

While it is relatively easy to obtain GPS coordinates from field equipment these days, there's a lot of science (geodesy) *behind* the technology of accurate positioning that considers the shape of the earth, gravity and satellite movement and signals.

One would be wise to know the fundamentals and "flavours" of GPS that vary in accuracy (from 2 cm to 2 m) and usage. NRTK, Differential, Post-processed and Precise Point Positioning are techniques that OLSs use in performing legal and topographic surveys, along with traditional optical "Total

Proposed widenings of Hwy 401

Stations" and digital levels that are capable of the most accurate measurements.

OLSs routinely access Ontario's COSINE database of physical horizontal control monuments and vertical control benchmarks. These brass caps provide an important reality check on "black box" GPS results.

Provincial surveyors regularly get professional development updates from federal NRCan geodesists to stay current with changes in standards, hardware and software.

Be aware that tectonic plates move a couple of centimetres per year, and so coordinates can change significantly over many years! Thus, the adjustment "epoch" of their origin can be important to note on maps and surveys that may be used many years after they're published.

Some Canadian organizations have already adopted a new vertical datum (CGVD2013) that is different from the older CGVD28 by tens of centimeters, so be aware of which is being held as the theoretic mean sea level from which elevations are measured.

3. GOOD SOFTWARE SKILLS

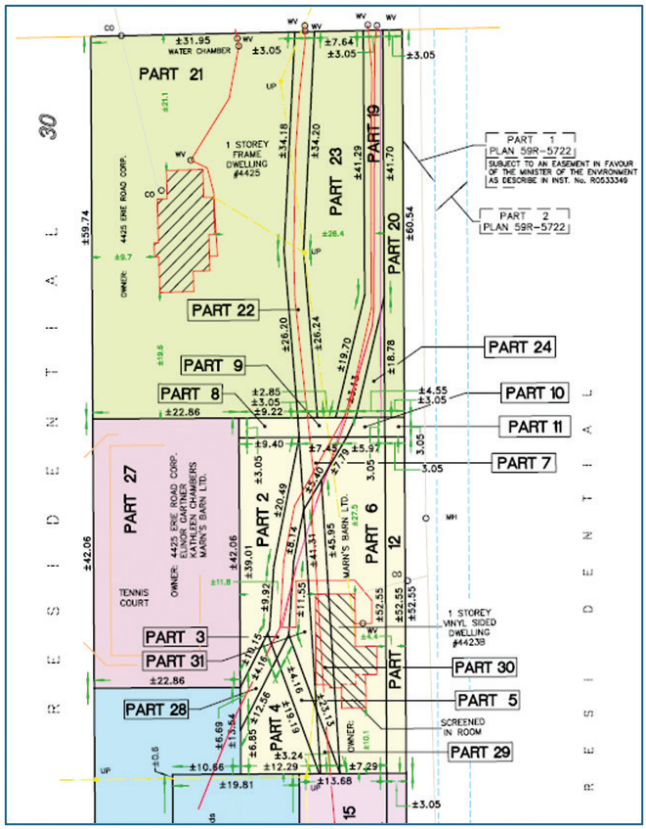
CAD and GIS software is complex and ever evolving and should be well understood. When converting angles and distances or GPS Lat/Long data to Northings and Eastings into digital graphics and tables, one should be aware and up to date with the nuances of how that's done.

CAD operators should also be aware of how local scale factors are used to relate ground distances to map distances, as well as the use of EPSG codes or other spatial referencing metadata that permits utility information to be exchanged reliably with others.

So, these are the three skills that I'd say are essential for good utility mapping, but do consider,

BOUNDARIES MAY BE CRITICAL

As architects and engineers design new works with respect to ownership boundaries, it's often important to know where boundaries are on the ground when mapping, and especially when installing, utilities.



Sample of complex easements for underground services (Courtesy of Lanthier & Gilmore Surveying Ltd.)

Strip or rectangularly shaped boundaries are created by OLS-signed legal reference plans ("R-plans"), specifically for utility placement, so that easement rights can be assigned to utility owners by legal documents in the land registry system.

Be cautious that the boundaries of municipal roads and provincial highways — often used to depict the position of underground utilities — are often subject to change from acquired road widenings, and one should never make hasty assumptions about legal monuments found in the ground that may or may not correspond to what is interpreted on boundary plans.

Also note that provincial boundary linework, the Ontario Parcel dataset, in many northern parts of Ontario may not align with actual boundaries on the ground for tens of meters, so caution should be exercised if combining that data with GPS data.

It's always good practice to contact your friendly local Ontario Land Surveyor if questions arise about boundaries, as they are trained and licensed under provincial statute to retrace them. Also, if project survey control or boundaries or utilities need to be professionally certified and shown on map products accurately, an OLS would be a good contact to make early if considering starting a project or a campaign of mapping old or new underground utilities.

BRIDGING THE DIVIDE:
UNIFYING GIS AND DAMAGE PREVENTION FOR A SAFER TOMORROW

Kris Philpott
Senior Vice President, Planview Utility Services Ltd.

The subterranean world beneath our feet is a complex web of essential infrastructure — gas lines, water mains, telecommunications cables, electrical cables, conduits and so much more. The accurate mapping and management of these buried assets are paramount for public safety, operational efficiency and the successful execution of new projects. However, a growing chasm often exists between the damage prevention industry, focused on "locate before you dig," and the Geographic Information System (GIS) departments within municipalities, utilities, telecoms and other infrastructure owners, who are responsible for maintaining comprehensive asset records. The time has come to bridge this divide, fostering a collaborative ecosystem where every locate becomes an opportunity to enrich a single, authoritative source of truth for buried infrastructure data.

PHOTOS PROVIDED BY AUTHORS

THE CURRENT LANDSCAPE: SILOS AND DISCREPANCIES

The damage prevention industry is increasingly adopting GPS technology for locating buried assets. On one hand, this presents an invaluable opportunity to collect new spatial data and improve existing records, especially in areas where detailed mapping is scarce. As noted in the *Spring/Summer 2025* edition of *Ear to the Ground*, integrating GPS into the field of utility locating is one of the most exciting trends in the damage prevention industry. The article goes on and highlights that this technology can make utility locates more efficient and precise, therefore delivering an enhanced service to the end user.

However, a significant challenge arises when this newly collected GPS data operates in isolation from existing robust GIS datasets maintained by infrastructure owners. Many utilities and municipalities have invested heavily in sophisticated GIS solutions that model their assets and are integral to their daily operations and asset management strategies. Introducing raw GPS data from a locate without a standardized workflow and rigorous quality control can lead to a host of issues, including:

- Conflicting Records: Discrepancies between field-collected GPS points and established GIS data can create confusion for future locators and excavators.
- Duplication and Redundancy: Without proper integration, GPS data can become a static, isolated dataset, prone to becoming stale and outdated. This creates duplicate records that require separate management and updates, increasing administrative burden and the likelihood of errors.
- Lack of Accountability and Governance: The critical question of who owns the risk when a locator relies on previously collected GPS data that was inaccurately captured by the LSP becomes paramount without a clear framework for data governance and quality control.

TOWARDS A UNIFIED VISION: EVERY LOCATE AS A VALIDATION OPPORTUNITY

The solution lies in fostering a collaborative ecosystem where the damage prevention and GIS worlds work hand-in-hand to achieve a common goal: a single, accurate and continuously updated source of truth for all buried

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infrastructure data. We need a collaborative solution leveraging the collective capabilities to establish a continuous improvement loop for buried infrastructure data quality. The core principle is simple yet powerful: Every utility locate presents an opportunity to validate and improve existing GIS records.

This collaborative approach involves:

- Field Verification and Feedback Loops: When a locator confirms the accuracy of existing records, this information should be systematically fed back to the infrastructure owner's GIS, acting as a direct validation. Conversely, if a discrepancy is identified, the locator can capture a GPS location of the actual utility. This data is then submitted for review and integration into the utility's GIS.
- Risk-Based Escalation to SUE: For significant discrepancies or high-risk areas, a structured process, potentially leveraging tools like Planview USL's Damage Prevention Risk Analysis Tool (DPRAT), should trigger a Subsurface Utility Engineering (SUE) investigation. SUE services provide highly accurate mapping of utilities, and this data should then be used to update the utility's GIS, ensuring data integrity.
- Standardized Spatial Accuracy: To avoid the pitfalls of varying positional accuracy, every dataset related to buried infrastructure should explicitly include the spatial accuracy of each asset. This is where standards like the CSA S250 (or similar provincial/national standards) become crucial. By documenting the precision and accuracy of data points, all stakeholders can understand the reliability of the information they are using. This ensures that even if a GPS device is precise (giving similar readings each time), it is also accurate (close to the true location).

THE ROLE OF AI AND DIGITAL MAPPING

Artificial intelligence (AI) and advanced digital mapping platforms are key enablers in this collaborative future.

Planview's mobile LiDAR rig in action — capturing ultra-accurate 3D point clouds and 360° street imagery for seamless GIS.

GIS software, such as Planview USL's MultiViewer, provides the tools to manage and integrate geospatial data from various sources. While reprojecting inaccurate data won't make it accurate these platforms are essential for ensuring data from different sources can be viewed and analyzed in a consistent and spatially accurate manner. The ultimate goal is to move towards a "utility digital twin," a comprehensive provincial hub for utility data that leverages these advancements.

CONCLUSION

The inaccurate buried infrastructure data that currently plagues the damage prevention industry is a shared problem, leading to safety risks, project delays and increased costs. Working in isolation, with separate GPS locate data competing with established GIS records, will only perpetuate confusion and inefficiencies. By embracing a collaborative ecosystem, where every locate is seen as an opportunity for data validation and improvement, and by mandating the inclusion of spatial accuracy standards like CSA S250, we can collectively build a single, reliable source of truth for buried assets. This unified approach will not only enhance safety and reduce damages but also pave the way for a more efficient, technologically advanced and collaborative future for all stakeholders in the damage prevention industry and beyond.

AI-POWERED ENCROACHMENT DETECTION:

A SMARTER WAY TO SAFEGUARD UTILITY CORRIDORS

J.D. Barnes Limited, First Base Solutions Inc., & OnSite Locates Inc.

Utility corridors vary significantly in scale and complexity. Some span hundreds of kilometres, crossing entire provinces to support high-voltage transmission lines and long-distance oil and gas infrastructure. Others run through local municipal easements, carrying services such as water, wastewater, stormwater and telecommunications. Regardless of location or size, all utility corridors must remain clear, secure and accessible to ensure infrastructure reliability and public safety.

As land development accelerates and urban boundaries expand, these corridors face mounting pressure from encroachments, some deliberate, others unintentional. Traditional inspection methods often struggle to manage these risks, particularly across vast or remote areas. Today, a smarter, scalable and cost-effective solution is available: combining high-resolution aerial imagery with artificial intelligence (AI) to proactively monitor and protect utility corridors.

Aerial imagery collected by First Base Solutions and utility locates by OnSite Locates within the corridor to support AI-powered encroachment detection.

PHOTOS PROVIDED BY AUTHORS

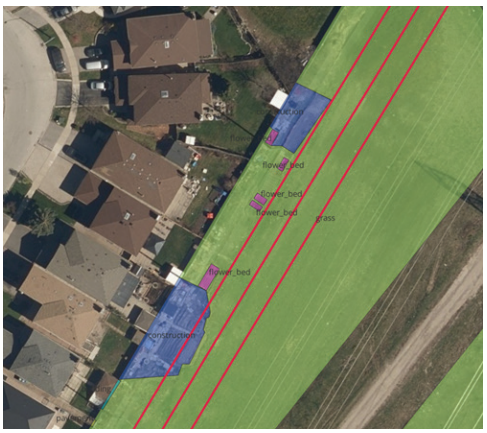
HIGH-RESOLUTION IMAGERY AND AI DETECTION

The process begins with collecting high-resolution aerial imagery using fixed-wing aircraft. This method provides wide-area coverage that is impractical with ground inspections or drone flights alone. Once captured, the imagery is processed through a trained AI model designed for land classification.

The AI distinguishes between natural and man-made features, identifying buildings, roads, paved areas, utility structures, excavation activity and construction zones. Natural classifications include vegetation, tree canopy, water bodies and bare soil. Attention is paid to unauthorized homeowner activity, including sheds, decks, garden beds, swimming pools or fencing that may extend into utility corridors and obstruct access to underground infrastructure.

AI can also detect early signs of disturbance such as trenching or site clearing. These areas are automatically flagged for human review. Professional analysts then determine whether existing agreements or legal justifications are in place, or if the flagged activity represents an encroachment that needs to be addressed.

AI-powered detection identified a pool within the utility corridor boundary. Automated tools help flag issues like this early for professional review.



Backyards spilling into the utility corridor: storage structures and flower beds placed directly over buried infrastructure, increasing the risk of access obstruction and damage during future maintenance or emergencies.

WHY THIS MATTERS: SAFETY, RISK MITIGATION, AND EFFICIENCY

Encroachments can severely impact access to utility infrastructure, complicating maintenance and delaying emergency repairs. Because this detection method is scalable and repeatable, utility owners can conduct seasonal or annual monitoring of unauthorized activities. This approach also helps ensure that appropriate permits are in place before work begins in a corridor.

- **Protection of Subsurface and Surface Utilities:** Early identification of encroachments helps prevent costly and dangerous damage to underground infrastructure, including pipelines, sewer lines, fiber optic cables and above-ground structures such as transmission towers, vaults and access roads. Detecting these issues in advance not only protects the integrity of utility networks but also serves as an important communication tool, informing homeowners and landowners about the potential hazards and legal implications of unauthorized building or modifying land within the corridor.
- **Emergency Readiness:** Access to up-to-date, high-resolution imagery improves emergency response by enabling quicker dispatch and clearer awareness of hazards on site.
- **Cost-Effective Oversight at Scale:** Compared to traditional ground inspections, this approach significantly reduces monitoring costs per kilometre. It allows for more frequent reviews, whether seasonal, annual, or post-weather event using fewer resources.
- **Change Detection Monitoring:** Each aerial capture contributes to a growing digital record. Comparing datasets over time (e.g., 2023 vs. 2025) provides insights into land-use changes, recurring risks and development trends. The system improves with each cycle and supports integration into GIS or digital twin platforms, enabling smarter, data-driven planning.

CLARIFYING ENCROACHMENT AND BOUNDARIES WITH CONFIDENCE

Ensuring accuracy in property boundaries is critical when assessing encroachments. While parcel mapping data is useful, it may not always align with legal survey lines. Where encroachments are suspected, especially near the edge of a corridor, the expertise of a licensed Ontario Land Surveyor is essential. Their role ensures that follow-up actions are based on legally verified boundaries.

As infrastructure networks grow and land pressures increase, scalable, data-driven tools like AI-powered monitoring will no longer be optional; they will become essential to daily operations.

A SMARTER FUTURE FOR CORRIDOR MONITORING

As infrastructure networks grow and land pressures increase, scalable, data-driven tools like AI-powered monitoring will no longer be optional; they will become essential to daily operations. Integrating artificial intelligence into routine workflows will enable utility managers to proactively manage risk, streamline inspections and make faster, more informed decisions. These advancements are not just beneficial for regulatory compliance but foundational to building safer, smarter utility systems across Ontario and beyond.

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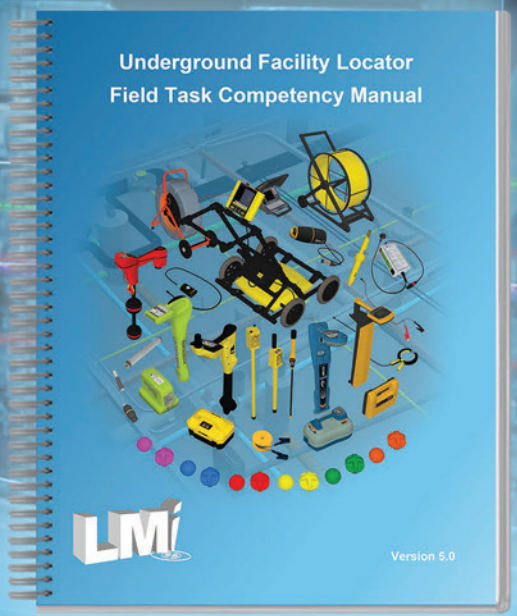

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