ISSUE 26 | **Spring/Summer 2019**

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ORCGA
Editor-in-Chief
Jennifer Parent
Manager Growth, Councils and Membership Services
ORCGA

OFFICE
Ontario Regional
Common Ground Alliance
545 North Rivermede Road
Unit 102
Vaughan, ON L4K 4H1
Toll Free: 866.446.4493
Local: 905.532.9836
Web: www.orcga.com

NAYLOR
Group Publisher
Kim Davies

Editor
Shelly Neal

Project & Sales Manager
Angela McDougall

Marketing Account Specialist
Elyce Gronseth

Advertising Sales Representatives
Maria Antonation,
Ralph Herzberg, Brian Hoover

Project Coordinator
Alana Place

Layout & Design
Gufran Khan

NAYLOR
ASSOCIATION SOLUTIONS
1200 Portage Avenue, Suite 200
Winnipeg, MB R3G 0T5
Toll Free: 1.800.665.2456
Tel: 204.947.0222
Fax: 204.949.9092
Web: www.naylor.com

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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TOM FOWLER, SUPERINTENDENT, NPL CANADA

A few of these utilities were unknown and found while excavating. Read more about this story on Page 15.

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THE COSTS OF UNDERGROUND INFRASTRUCTURE DAMAGES

By Doug Lapp, President & CEO

In a dense urban neighbourhood, an excavator makes a rash decision to perform a 30m bore shot without obtaining locates, which results in an eight-inch natural gas line puncture.

This poor decision sets off a cascade of events. The loud hissing sound signals the release of gas into the air. Fire Rescue and Police Services are alerted. Traffic is diverted to avoid potential danger, snarling traffic for both the morning and evening rush hours. Local businesses are shutdown; schools and households are evacuated. Electricity in the area is immediately cut off. TSSA and natural gas facility personnel quickly arrive onsite to assess the damage. Ontario One Call is notified and dispatches an emergency locate. Gas crews are brought in to cap the leak. Homeowners and businesses have their gas appliances relit before being allowed to return.

Underground infrastructure damages, as described in the scenario above, have societal costs that go well beyond the direct cost of repairs.

Direct Costs arise from repairing the damage and are related to the:

- Costs of replacement materials used;
- Costs of materials used;
- Labour costs; and,
- Administrative costs needed to rehabilitate the damaged infrastructures.

Indirect Costs arise from the damage and its economic assessment of all resulting disruptions. They are varied and can cover a wide range of areas, such as:

- Service disruption following damages to infrastructures;
- Intervention of emergency services;
- Evacuating businesses and residential sectors;
- Risk of injury and death;
- Loss of product;
- Environmental impact;
- Economic impact on businesses and companies;
- Work delays;
- Administrative and legal costs;
- Negative impact for owner companies;
- Disturbances to neighbouring lands and infrastructures; and,
- Traffic disturbances.

In addition, there are direct and indirect costs that are related to employees, such as:

- Noncompliance fines and penalties;
- Reputation of company hurt by bad publicity;
- Poor morale and reduced productivity, particularly after an incident;
- Poor employee retention leading to increased new hires, onboarding, and training costs; and,
- Employee sick leaves and increased volume of illnesses and injuries.

Investing and participating in underground infrastructure damage prevention can reduce the cost of doing business and build a healthy bottom line for all ORCGA members and sponsors.

EXCAVATOR OF THE YEAR AWARDS

ORCGA recognizes ongoing achievement in our industry through our Awards Program.

These awards recognize excavators with the best in-class safe digging practices. Excavator of the Year is determined by each contractor's individual damage rate. A damage rate is a calculation dependent on the volume of locates requests, measured against the number of digging related damages to underground infrastructure. Input from infrastructure owners is also used in the determination. To qualify, excavators must have a minimum of 500 locate requests to Ontario One Call.

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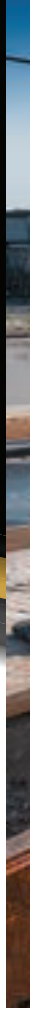

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Excavators and Damage Prevention: A Project Plan

Finch Avenue West natural gas pipeline relocation for City of Toronto Light Rail Transit expansion

By Marcel Singh
Vice President of Operations, NPL Canada

In 2017, NPL Canada partnered with Enbridge Gas Distribution (EGD) on the City of Toronto's multi-phased effort to expand its transit network with an 11-kilometre light rail transit line. As a result of the LRT route, a number of utilities had to be relocated, including numerous natural gas pipelines. NPL Canada was contracted by EGD to relocate nearly four kilometers of pipeline along Finch Avenue West, a primary thoroughfare in Toronto for thousands of people and vehicles daily. Given that the 30-inch vital pipeline traversed through multiple intersections and existing infrastructure in the congested urban environment, the significant excavation needed for such an installation posed a host of safety and damage prevention hazards.

In the two-year project's most recent phase, approximately 1,130 metres of 30-inch diameter steel pipe was installed in an open trench, cut into the road allowance (live-lanes) of traffic on Finch Avenue. As a major arterial road for commuters with many high volume intersections and a unique mix of commercial, industrial and residential communities, Finch Avenue is highly regulated by Toronto City Hall. Excavating in the high-risk area to depths up to nine meters required carefully planned safety and damage prevention controls accounting for vehicular traffic, pedestrian traffic, congestion of utilities, missed utility locates, driveway and sidewalk access and contaminated ground conditions.

"The safety of the public and our workers were top priority," said NPL Superintendent Tom Fowler. To protect

workers from vehicular traffic and to protect vehicular traffic and pedestrians from open excavations, a concrete barrier wall and fencing were installed to maintain a minimum one metre of separation between the work area and traffic. To further reduce the risk, NPL coordinated its work schedule so that work could be completed during off-peak times and overnight, with full-lane closures during long weekends to perform large tie-ins.

"It was an undertaking to manage safety with the existing community flow. The public had to be educated about the ongoing and evolving construction. NPL Canada had to implement a plan where we could safely perform the construction with the least amount of disruption," NPL Project Manager Tim Charron said. NPL management met continuously with local business associations, homeowners and city councilors to apprise them of the project schedule and explain the impacts of construction to their functions.

Generally, excavations were a minimum of three metres wide, engulfing the entire curb lane of traffic and often encroaching into the curb and boulevard. Furthermore, due to the limited working space, the passing lane was utilized for dump truck staging and loading, as spoil material was not permitted to remain at site. NPL managed 15 to 20 tri-axle dump trucks per day that would, in turn, complete approximately three trips per day to/from site. In places where deep excavation was planned, extensive and detailed shoring systems were designed to protect workers from cave-ins, including site-specific configurations for trench boxes, steel plates and sheet piling.

Locating existing utilities was another major concern during excavation. Due to an extensive underground network of existing and abandoned utilities, there were many instances of inaccurate or missed utility locates. While public locates were completed, supplemented with additional third-party sweeps to verify utilities, many were still missed. Adding to the complication was the ongoing issue of inaccurate and missing subsurface utility engineering (SUE) data regarding locations and depths. Abandoned utility lines with no records that could be misidentified as live lines, and overall congestion of buried infrastructure, posed an additional layer of utility locate complexity.

"We daylighted and verified everything ahead of the ditching crew and GIS mapped existing utilities with GPS survey equipment," said Charron. "I had a separate locate package for each of our 10 'live' locations with between 10 and 18 different utility providers each. That was then multiplied by two to account for public utility locates and private locate sweeps by us. All of these packages were updated monthly at a minimum unless a revision had to be made based on new findings, which occurred on a regular basis." Some exposed utilities required custom designed support systems, while others had to be relocated altogether.

Environmental protection considerations also presented a challenge. While NPL Canada adhered to strict Regional Conservation Authority protocols while performing construction, pre-existing soil contamination was discovered in some work areas. Tests identified several kinds of benzene. As a result, constant air monitoring with standard four-way monitors and two different types of benzene monitors were required. Workers were trained to use the specialized equipment, and half-mask respirators were required for any worker entering an excavation.

The project's challenges went beyond the planned scope of work, but despite the additional hazard to safety and damage prevention, work was completed incident free and on time. "The key contributor to the success of this project was the extensive pre-planning and a safety-first focus from the operations team," said Fowler. The successful execution of this complex pipeline project demonstrates the effectiveness of having a vigilant project team, careful planning and attention to detail, effective communication and engagement with all stakeholders, which, in turn, mitigate risks and prevent harm.

FEATURE

6 KEYS to Damage Prevention and Worry-Free Utility Installation

By Mike Henderson
General Manager, El-Con Construction

"**Ground saturation" doesn't** just mean waterlogged soil anymore. The term can also refer to ground so packed with utilities that it doesn't seem to provide any room for more. That's the situation being faced by many sewer and water utilities, electrical service providers, telecoms, municipal services and any other organizations jostling for space underground.

Safe excavation matters more than ever. Excavators must take care to protect the public and workers as well as underground infrastructure, and to avoid fines and work stoppages imposed by regulators. The rush to pour more fibre optic cable into the ground has caused its own challenges – partly because of the difficulty and expense of splicing or re-pulling fibre if there's a break. Add to this the fact that the rush to install fibre to the home is making it difficult for installers to always work at the right depth and within limits of locates. Here are some of the key measures that we use at El-Con Construction Inc., a full-service construction company specializing in underground utility construction for commercial, industrial, municipal, utility and residential customers, which operates as a wholly-owned subsidiary of Oakville Enterprises Corporation.

SELECTION AND ONGOING TRAINING OF CREWS

Even in a business with its share of employee turnover, it pays to select for the right skills and attitude, and to provide the right amount of ongoing training. That includes operating the equipment, but also identifying where the locates are, and health and safety measures. This is becoming a challenge as a generation of skilled Baby Boomers heads off into retirement. Many organizations simply have no plan on how to transfer the Boomers' knowledge into the heads of personnel stepping into their boots. There is a growing need for transferring not just the skills, but the detailed knowledge of how utilities have been installed. One of the most important skills to transfer is critical thinking and problem-solving. A crew member might look at a plan and think, "Here is the hydro, there is the gas. But wait a minute – where is the fibre? How is this place getting fed with cable TV?" A good operator would then know to look further for utilities that are not marked on the plans.

EQUIPMENT MAINTENANCE – HARDWARE AND SOFTWARE

Keeping equipment maintained and serviced is a big part of success, so that workers can count on it operating as expected. Some entities are more relaxed than they should be about updating various software, which can provide important updates and patches.

GET YOUR LOCATES RIGHT AND EARLY IN THE PROCESS

Having a clear picture of the underground environment in the area where you are working, early in the process, is vital.

That way you can plan the work effectively and understand where the challenges will lie. One of the best investments our company makes, in my opinion, is paying for a private locate service. El-Con usually uses other OEC companies for this, and although it's a cost for our company, it is money well spent. We often get faster service than a municipality can provide, and if there's a problem, we can call the locate service back again to take another look.

HORIZONTAL DIRECTIONAL DRILLING: WORTH IT IN THE LONG RUN

Ground saturation is one big reason we find ourselves using Horizontal Directional Drilling (HDD) more often these days. Trenching is right in some circumstances, but crossing other services at perpendicular angles using HDD is generally more problem-free in the long run. As well, there is less need to dig, refill and re-sod a trench, or cut across a sidewalk or roadway.

HYDROVAC TO DAYLIGHT POTENTIAL PROBLEMS

Closely related to HDD is the importance of opening up utilities to ensure that the HDD drill head crosses them at an appropriate distance. Ground saturation, and the risks that might come from a strike, mean that excavation by hand is less viable these days. In its place, we find ourselves relying on Hydrovac to daylight utility crossings. The cost is repaid in the reduced chance of a strike, and the small-diameter hole is easy to fill in again. Hydrovac is probably your best friend when it comes to damage prevention.

SUBSURFACE UTILITY ENGINEERING (SUE) HELPS PREVENT PROBLEMS

One of the more effective initiatives in recent years is Subsurface Utility Engineering (SUE). SUE provides designers and engineers with the tools to determine how the existing infrastructure will be affected by a project, so they can make adjustments and plan ahead to minimize impacts. SUE is currently being used mostly on larger projects, such as the light rail installations in the municipalities around the western end of Lake Ontario. SUE has proven so effective at helping avoid utility-related problems that it is seeing application in smaller projects as well.

Mike Henderson is General Manager of El-Con Construction, a member of the Oakville Enterprises group of companies. Contact: tel. 905-825-6371; mhenderson@el-con.ca.

The Jim Douglas Award of Excellence in Damage Prevention

Richard Durrer
Ontario One Call

Brad Gowan
Oakville Enterprises Corporation

FEATURE

Challenges of Deep Excavation around Complex Underground Infrastructure

By Raffaello Taurino
Health & Safety Manager, Clearway Group

Excavating contractors must organize and plan their jobs properly, thoroughly and safely. When it comes to ground disturbance and safe excavation practices, proper planning of the work is of the essence in order to minimize risks, especially given the fact that there is already an unavoidable degree of uncertainty about what it will be found underground once the excavation begins. However, contractors face many difficulties and constraints while on the job and are often pulled in many directions at once.

Contractors often have to juggle clients, municipalities, different municipal department requirements (such as transportation services), as well as other parties not necessarily contractually bound to the work (for example, private property owners, utility owners, etc.). Conflicts and constructability issues are not at all uncommon.

For example, a client might make job modifications, working conditions may fluctuate (including weather conditions), or the location of work could change due to conflicts not previously identified. Consequently, changes in design, staging plans and work plans happen frequently, sometimes leaving contractors with much less time to prepare the work.

Contractors also have to deal with late locates and sometimes poor quality of the locates; issues that are still present despite significant improvements that have been made.

Under these types of pressures, it's easier to make mistakes, such as missing an important detail hidden in a 60-page locate package, eventually not exercising the necessary due diligence.

According to *DIRT Report* statistics, sewer and water industry work continues to be involved in the majority of damage events reported, over the past few years. We hear about damages and that is often the "end of the story." But what about the actions that led up to the damage? Is there any merit in analyzing events that occur at the beginning of the story? Is there any merit in having different perspectives in the *DIRT Report*?

Safety can be compromised when positioned against schedules.

When damages occur, there are often undeniable direct causes, such as not following CCGA's *Best Practices Version 3.0*, and there are many contributing factors that also need to be considered if we want to greatly reduce the number and severity of incidents.

Sewer and water work require deep excavation and can be fairly inflexible and unforgiving, as compared to work performed at shallower depths. The deeper the excavation, the higher the risk related to presence of water, stability of adjacent structures, trench stability etc., all adding to the complexity of underground utility infrastructure.

As said before, a degree of uncertainty is to be expected when excavating, and contractors must be able to adapt without compromising safety. However, since ground disturbance and safety in general are shared responsibilities, all parties should collaborate to minimize the frequency of unforeseen conditions, conflicts and changes in

Examples of the complexity of the underground infrastructure.

A few of these utilities were unknown and found while excavating.

Shallow excavations like this one usually present less risks, however inaccurate locates can still lead to damages, as it happened in this case.

plans that not only increase the risk of having incidents, but will also often lead to work stoppages, loss of production and efficiency, ultimately building tension between clients, contract administrators and contractors.

Health and safety begins at the planning and design stage of the project. Increasing the utilization and accuracy of proper subsurface utility investigation as a part of planning and design will produce higher quality construction documents. This will help eliminate some of the challenges and avoid risks to the public, the workers and the infrastructure to travel downstream to the construction stage.

Excavation contractors face many challenges working on private property when hiring private locate contractors to provide locates for privately-owned buried infrastructure. Typically, the private locate contractor is contractually bound to excavator, however, the main challenge is that the private locate contractor usually does not have access to the utility records from the private landowner. The landowner has the records and knows the property or facility and is ultimately in the best position to locate their own buried infrastructure. The landowner should vet the private locate contractor according to their own standards. The ideal situation would have the private locate contractor being contractually bound to the private landowner instead.

The 2019 ORCGA Members of the Year

Margaret DeFazio
Hydro Ottawa

Dan Foucault
Union Gas

Stu Seaton
TSSA

FEATURE

Get More Out!

Apply Lean Thinking to Make Better Use of Your Crews and Equipment

By Barry Wood
CEO, Ontario Excavac Inc.

Sometimes stopping to look at how your company is operating and what you can do to eliminate wasteful activity can lead to more business and improved profits. At Ontario Excavac, we try to look at what we do each day from the customers' viewpoint by asking ourselves: "What is value-added in their eyes?" We look across our processes and workflows, evaluating where there are opportunities to eliminate non value-added activity. By applying concepts borrowed from lean manufacturing to the utilities construction services sector, Ontario Excavac is getting more out of each work day for our customers by doing more in less time and at lower cost. Working together with forward thinking customers, significant productivity improvements and cost savings are being achieved.

There are sources of waste that are epidemic to the construction sector. Non-productive wait time is rampant, i.e. people are constantly waiting for the preceding steps to be done before their own work commences. Excess transportation and excess motion are typical rather than the exception.

There are eight categories of waste that have been recognized through lean thinking. The waste categories, some general examples and specific examples found in the utilities sector are:

Waste	Examples	Utility Sector Examples
Defects	Errors, mistakes, rework	Improper installation or repair, billing errors, change orders
Overproduction	Processing too soon or too much	Request too many locates to be able to complete in time. Multiple forms with same information
Waiting	Employees or customers waiting to be served	Equipment failure, missing work tools/PPE, not sequencing work & resources effectively
Non-utilized or under-utilized resources/talent	Employees not leveraged to their potential	Journeymen being used to operate backhoe/dump truck
Transportation	Movement of items more than required	Disposal of hydrovac debris many miles from both site and vac shop
Inventory	More inventory than required	Field/office Supplies, items stored on vehicles, email
Motion	Movement of people/machinery that does not add value	Trying to find tools, misplaced items, wrong order of work steps
Excess Processing	Doing more work than required	Insufficient use of ALAs. Failure to use keyhole technology

Task	Lean Improvement (s) Implemented	Benefits Obtained
Ordering Locates	ALA's, prelim inspection- tighten locate and dig zones	Quicker access to field, less locate fieldwork, bigger execution time window improves planning opportunities
Work Planning and Scheduling	Sequential work planning based on task cycle-time, self-directed excavation (done without utility crew in attendance, e.g. day prior)	Elimination of wait time, more optimized usage of equipment, level-loaded work schedule
Vehicle Daily Inspection	Standard 2-copy inspection form, use of Vehicle Maintenance Request Form, air brake and wheel lug nut visual status flags	Consistent, documented completion of inspection, prioritization and tracking of repairs, accurate and quick indicators of brake/wheel compliance
Work Equipment and Tools	Crewman's Checklist to verify PPE, traffic controls, equipment and tools on board	"Ready to Dig" when arrive at site
Site Set-up	Site Hazard Checklist, Tailgate Checklist, use of green cones for overhead wires/overhead wire signs	Consistent, thorough evaluation of site potential hazards and how risks are being mitigated, visual reminder of overhead wire risk

As noted above, wait time is a major contributor to inefficiency in construction. Historically, Ontario Excavac crews would go out at the same time as the customers' crews. Ontario Excavac crews would excavate and then move aside, waiting and watching as the customers' crews did their work. After the customer crew was done, Ontario Excavac crews would then start restoration work.

This was one of the first and easier things for the customer and Ontario Excavac to change. Now Ontario Excavac goes to the job site the day before, performs the excavation work and secures the site. The next day, the customer's crew comes along and immediately does their work on the underground plant. Ontario Excavac coordinates their return to perform the restoration work as soon as the customer crew is done. Productivity for both companies increases significantly using this sequential work flow approach. There are no longer people waiting around for other work to be completed.

Ontario Excavac observed that as much as 40% of a customer's daily billing had been going to traveling to the work site, then traveling to a rural dump site, then traveling back to the shop! This is typical of the hydrovac industry. To eliminate waste transportation, Ontario Excavac moved their shop to a more central location in the Greater Toronto Area. Further significant reduction in waste transportation and wait-time resulted from Ontario Excavac locating their hydrovac soil recycling facility at their shop and designing the facility to

permit fast unloading, hydrovac tank clean-out and departure. By taking these steps, Ontario Excavac eliminated 50% of these wastes or more. For customers, the hourly charge-out rate is not nearly as important a measure as the *effective hourly charge-out rate*, i.e. the total $ invoiced to the customer divided by the on-site working hours invoiced. Ontario Excavac is not the lowest hourly rate hydro-excavator, but by applying lean principles to eliminate waste transportation and wait time, Ontario Excavac is confident it has the lowest effective hourly charge-out rate in the industry.

Task	Lean Improvement (s) Implemented	Benefits Obtained
Fieldwork- hydro-excavation, working on underground plant, restoration services	Standard operating procedures documented. Use of keyhole tools	Consistent order of steps, use of best technique to reduce cycle-time, smaller excavations, no need to get into excavation, consistent paperwork, safer operations, easier to train new people
Travel each day to worksite and from worksite to disposal site	Move to more central GTA site; build and operate a hydrovac soil recycling facility at the shop	Elimination of significant non-value added transportation saving labor and fuel costs, reduction in carbon footprint, re-use and recycling of soil and water materials
Inventory Control and Usage	Use of kanban/vendor managed inventory ("VMI") via vending machine for PPE	VMI vending machine controls min/max inventory levels, tracks usage by employee
Fuel Cost and Air/Noise Pollution	Reduction in gearing on PTO has engine running at lower RPM, use of acoustic cabinets	Lower operating cost, less air and noise pollution
Hydrovac Vehicle Design and Layout	Storage cabinets designed for ease of access, auto-tube feature	Cycle-time reduction for set-up, work execution, clean-up, ease of maintenance

Ontario Excavac has eliminated wastes in other portions of its business. Examples include:

Ontario Excavac realized that even though they were being paid hourly door-to-door for their services, it was very much in their customers' long-term best interest that non-value-added activities be reduced or eliminated. It was a leap of faith that in reducing time-based billings which in turn reduced Ontario Excavac's revenues that customers would reward Ontario Excavac with more work. Customers have in fact responded very positively by offering more business, pleased with Ontario Excavac's active efforts to contain costs and drive productivity improvement.

Any utility construction services company can make the changes Ontario Excavac has implemented- it just takes the right mindset. It starts with a determination that you are going to examine your business and begin to eliminate waste. A change and shift in culture and how things are done is required; it takes time, effort, discipline and commitment to do it. In return, the pay-off is significant. Ontario Excavac has put together a series of brief videos to teach the key concepts of lean. These are available to Ontario Excavac's customers.

Forward-thinking utility company customers can be powerful allies in driving dramatic improvements in productivity and cost savings. Who wouldn't be interested in getting way more out of every workday?

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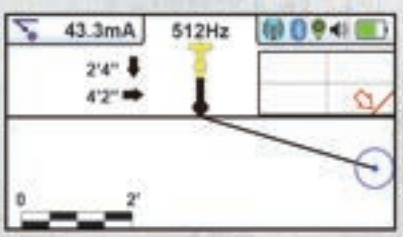
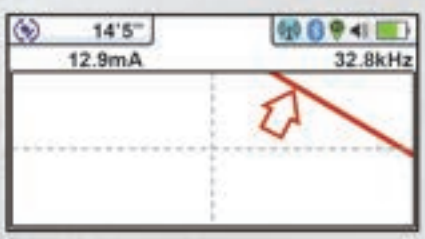
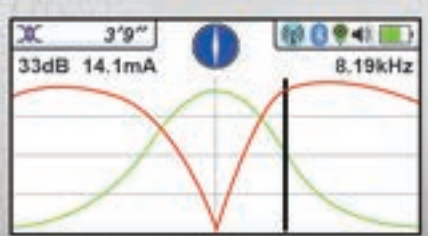


^ **Vector Locate** - shows orientation, line position, and distance relative to the locator in 3D

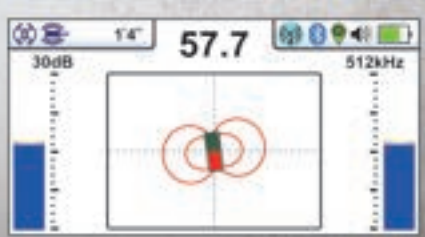


< **Plan View Screen** - displays the theoretical line in 2D from above ground in omnidirectional mode

v **Sonde Screen** - arrow guidance showing direction to the sonde and depth of cover



> **Transverse Plot Screen** - is used to display the peak and null to compare distortion shape



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