3-D LINE LOCATING LTD.

Line Locating • Hydro Vac • Ground Disturbance

25 YEARS OF EXCELLENCE

Web Base Mobile GIS Products & Services

How 3-D's GIS products & Services can aid in the construction and project management of pipeline Projects.

Introduction

3-D Line Locating is proposing to use an advanced web based and mobile GIS to aid in the construction and project management of pipeline Projects. The GIS will serve as a data and document repository for any information that may be required for the successful completion of projects as well as a collaboration tool for field and office staff. The GIS will also serve as a system of record for all data and documentation created or collected before, during and after the construction process.

Records Management

Any type of reports and data that are gathered during the construction process can be stored in the GIS database. This data can then be easily retrieved during the construction and operating phase of the pipeline. A complete record of all construction activities performed during the project will include the date, time and location in which these activities were performed. GIS features can be populated with attribute values and documents allowing users to retrieve all data and documents associated with a GIS feature. GIS features can be located using keyword searches or by navigating to their locations on the map interface. Information is easily retrieved and will remain connected to the spatial location in which the activity took place.

Document control

Using the GIS, all users access the same document versions based on the release schedule controlled by the client. In other words, only approved documents will be released and users will not be able to make changes to approved revisions. Once these approved documents are released and uploaded into the GIS, all web users will have immediate access to them and they are also available for offline synchronization by mobile users. This process drastically reduces the need for printing and distributing copies of updated plans and drawings and ensures that all outdated revisions are no longer available.

Management of Change

GIS users receive real time project data updates. For example, changes to environmentally sensitive areas, new land owner requests, updated governmental/regulatory requirements, first nations requests, geotechnical issues etc. can be captured in the field or added from the office and immediately displayed in the web GIS as well as made available for offline synchronization. Ensuring field users have the most up to date datasets can improve efficiency and reduce duplicated effort.

Collaboration, Coordination and Reporting

Field users can submit photos, comments or add new GIS features and datasets to the GIS database system of record. This includes information necessary to validate planned construction processes and activities, for example, pictures and supporting comments demonstrating that a buried utility has been appropriately daylighted before any excavation occurs. Users can also report progress and keep a record of important field events such as near misses, interactions with land owners and any other unforeseen safety, social, construction and environmental challenges.

GIS as a Deliverable

Client users can be provided access to the GIS during and after the construction phase to view progress and take advantage of the extensive system of record created by the GIS. Construction data can be transitioned into an operational dataset when construction is completed. If desired, the client can continue to use the GIS platform to manage operational data such as inline inspection results, SCT scanning data, investigative dig photos and reports, new crossing agreements etc. Alternatively, the dataset itself can be exported into standard GIS formats and offered as a deliverable to easily incorporate into the client's enterprise GIS for storage and future analysis.

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Web GIS

As a hosted service, the web GIS application can be accessed from any device (computer, phone, tablet etc.) using the latest versions of any popular web browser (Google Chrome, Microsoft Edge, Mozilla Firefox, Apple Safari) and requires no installation. The GIS database is hosted on a secure web server and uses Hyper Text Transfer Protocol Secure (HTTPS) to encrypt all data transmissions.

Typical Web GIS Data

- Construction footprint
  - o Easement
  - o Works space
  - o Temporary work space
  - o Log decks
  - o Stockpile sites
- Parcel/Cadastral mapping
- Crossing locations
- Approved Access
- Environmental layers
  - o Rare plant sites
  - o Archaeological sites
  - o Wildlife Sites
- Imagery
- Contours
- Slope classification mapping
- Open Street mapping
- First nation reserve boundaries
- Provincial and national parks
- County/municipal boundaries
- Asbuilt
  - o Welds
  - o Bends
  - o Individual Pipe joints
  - o Pipe protection
  - o Weights
  - o Test leads`

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Web GIS Functions

- **Map Tips:** By hovering the mouse cursor over a feature, key reference information regarding the feature will pop up.
- **Highlight:** By hovering the mouse cursor over a feature, the feature will be highlighted.
- **Identify:** Users can click the Identify button and then click on any visible GIS feature in the map. A window will appear displaying all attribute information for that feature. From this window, users can click an edit button to open the attribute editing window. Within the attribute editing window, users can edit the attribute data of the selected feature.
- **GIS Feature creation:** Create GIS features on the map including points, lines or polygons. These features can be drawn on the map or point files can be created using GPS coordinates (decimal degrees)
  - Customized attributes can be created to capture a variety of different values such as construction information and processes, personnel, safety and progress
  - Pick lists/drop down menus can be created for standardization of value entries such as vegetation, soil types, equipment make/model, utility crossing types, utility owners/operators, pipe data etc.
- **Spatial Editor:** Certain users can be given permission to modify the spatial location of existing GIS features. Once a features spatial location is edited and saved, these edits will be updated in the GIS database. This function is customizable to only allow certain layers to be made editable.
- **Hyperlinks:** Allows administrative or designated users to create links to additional sites that may contain important or relevant information to the project. An example of this might be a link to a specific page on the OGC website, or a company SharePoint site.
- **Document Links:** This function allows users to link documents to GIS features. These documents will also be made available offline when data sets are synchronized to the mobile GIS application.
- **Spatial Extent:** Users can create a project area from a larger dataset to be cached offline or this function can be used to assign task areas or areas of interest to specific users

- **Redline:** This function is used to mark up and add notes to the map interface.
- **Measure:** The measure tool allows users to measure linear distances, perimeters and areas within the map interface.
- **Spatial Search:** This search tool allows users to search any number of GIS features within a specified area.
- **Global Search:** The global search function allows users to search GIS features by keywords, for example, searching for a specific weld by the weld number, or searching for a joint of pipe by the pipe or heat number. Search criteria is customizable and any number of attribute values can be made searchable.
- **Print:** Users are able print the main map interface. The print tool also allows users to add a customizable legend, scale bar, north arrow, map title, overview map as well as include any red lining that has been completed. The print function allows users to select the map orientation and page size and export the customized map as a PDF document.
- **Login History:** Administrative users will be able to access a log of all users that have logged into the GIS system. The login history will include the date and time in which a user last logged in as well as the IP address they have logged in from. Administrators can also use this function to search the login times of specific users by entering their user name as well as select a start and end date in which to search.
- **360° Photo and LiDAR:** A truck-mounted mobile scanning system will be deployed to photograph and scan any road ways applicable to the project area. This scanning system will provide a 360° panoramic photo and 360° laser scan recorded approximately every 4m of travel. This function allows users to access a 360° street level view where data has been collected similar to google street view. In addition to viewing a 360° image, users can also use a number of tools within the 360° view to measure heights, areas and linear distances of any features captured within the street view. Users can also create GIS features from the street view that will be added to the GIS database and made available in the main map interface.

Mobile GIS + GPS

Any or all construction personnel can be outfitted with tablets capable of running the mobile GIS software. This will allow field users to access all of the GIS data and documentation regardless of network connection. When equipped with a GPS device, users will be able to see their spatial location on the map interface regardless of network connection. This will allow users to navigate the pipeline right of way and access routes with a clear picture of crossing locations, construction chainages, work space boundaries and locations of any other pertinent features along the project. The mobile GIS software will show the users "blue dot" on the map interface much like other industry standard navigation software i.e. google maps. Documentation necessary for construction activities is organized and attached to spatial features that are relevant to the location the documentation relates to i.e. a crossing drawing is attached to the GIS crossing feature, a construction alignment sheet is attached to the proposed centerline. This allows users to access documents using the location feature without having to sort through documents that are not relevant to the location they are currently working in. When GPS is available users will also be able to create GIS features using their location information, for example, a user retrieving information while standing at a hydrovac hole can log this information as a GIS point feature using their GPS location.

Mobile GIS Functions

- **Identify:** Users can click the Identify button and then click on any visible GIS feature in the map. A window will appear displaying all attribute information for that feature. From this window, users can click an edit button to open the attribute editing window. Within the attribute editing window, users can edit the attribute data of the selected feature.

- **Feature Search:** Users can search for features based on their attribute values. For example, if the features in a land parcel layer have an attribute containing the land owner's name, users can type land owner names into a search dialog and find all land parcel features whose owner attribute matches the typed name.

- **Create Features:** Users can create new features by selecting the type of feature they would like to add, drawing the feature on the map, and entering the new features attribute values or using their GPS location to add a point feature where they are standing, or track them as they move to create a line or polygon feature.

- **Photographs:** Users can attach photos to features in the map. These documents can be viewed, edited, and deleted by clicking on the features in the map.

- **Locate Me:** Users can view their location on the map.

- **Synchronize:** The mobile GIS is capable of working completely offline. To do this, a complete replica of the web GIS database is stored directly on the mobile device. This replica includes all of the data and documentation that exists. Users can synchronize the replica database with the master database on demand whenever the mobile device has a network connection. This synchronization also allows for mobile users who have created GIS features to upload their data to the web GIS database which is then available to all users or specified users.

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Project documentation

Any type of document can be added to the GIS including but not limited to:

- Construction alignment drawings
- Clearing alignment drawings
- Grade Plans
- Survey Base Plans
- Environmental Alignment Sheets
- Environmental site cards and aquatic assessments
- Crossing Agreements
- Encroachment agreements
- Proximity permit notifications
- Land owner title certificates
- Land/tract tables and landowner information (line list)
- Ownership Sketches
- Site specific drawings
- Stockpile packages
- Valve schematics
- Right of way configuration plans
- Sweep Sketches
- Major and typical crossing sketches
- Engineered crossings and detailed designs
- One call tickets and responses
- Ground disturbance permits
- HSSE documents
- Operating procedures and specifications

Approved document formats include word, excel, PDF and various image formats. Additional document formats can be added with minimal effort.

Simplified As-built Process

Mill database – The complete mill database for all pipe being used on the project will be required as a starting point for the master pipe log.

Pipe Data collection – This process involves validating the records found within the mill database. Strung pipe will be cross referenced with the pipe number, measured length and factory length to verify that has been properly corrected in the pipe log. Pipe data collection will also include any pups, and induction bends that are strung out along the right of way.

Pipe Verification – Once welding and bending have occurred, weld numbers, bend values and chainages will be inserted into the pipe log in the appropriate locations amongst the collected pipe data. The verification log validates that all drag sections do not contain any un-captured pups or welds as well as finalizes the order in which joints of pipe have been welded together if pipe has been moved since the pipe data collection. The verification log will also serve as the record used for lower in and tie in surveys.

Lower in and tie in surveys – During the lower in and tie in surveys, a survey crew will capture the geospatial location of all features along the pipe. This will include welds and weld numbers, bends and bend directions/degrees, and pipe appurtenances such as padding, rock shield, lagging, weights, screw anchors test leads.

All survey data is compiled and QC'd to create the final as-built. In addition to the final as-built which will include an excel version of the as-built spread sheet as well as as-built alignment drawings. The complete as-built will be converted into a GIS format that can be imported into the web GIS or offered as a deliverable in any standard GIS format i.e. shapefiles, geodatabase etc. The GIS as-built will contain all data within the standard as-built package but will be visually represented in the web GIS and combined with all additional construction data and documentation collected throughout the duration of the project. As-built records can be made searchable and identifiable in the web GIS allowing users to quickly and efficiently locate any necessary as-built information as well as the geospatial location of the assets the information pertains to.

Stress Concentration Tomography (SCT) Scanning After Hydrostatic Testing

The UNISCANTM SCTTM scanner uses patented stress magnetization field measurement and interpretation to identify the existence, severity, and location of localized corrosive, metallurgical and mechanical pipeline defects. UNISCANTM also generates a 3D map of the pipeline that includes depth of cover. After hydrostatic testing has been completed SCT scanning can be employed in addition to ID pig runs to validate ID findings as well as offer additional data regarding the locations and severity of any potential dents, ground movement, cracking, sagging or bending of the pipe as well as confirm the depth of cover. All SCT data collected is easily imported into the GIS for analysis.

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