

BUILDING A PIPELINE DESIGN SUPPORT SYSTEM WITH GIS

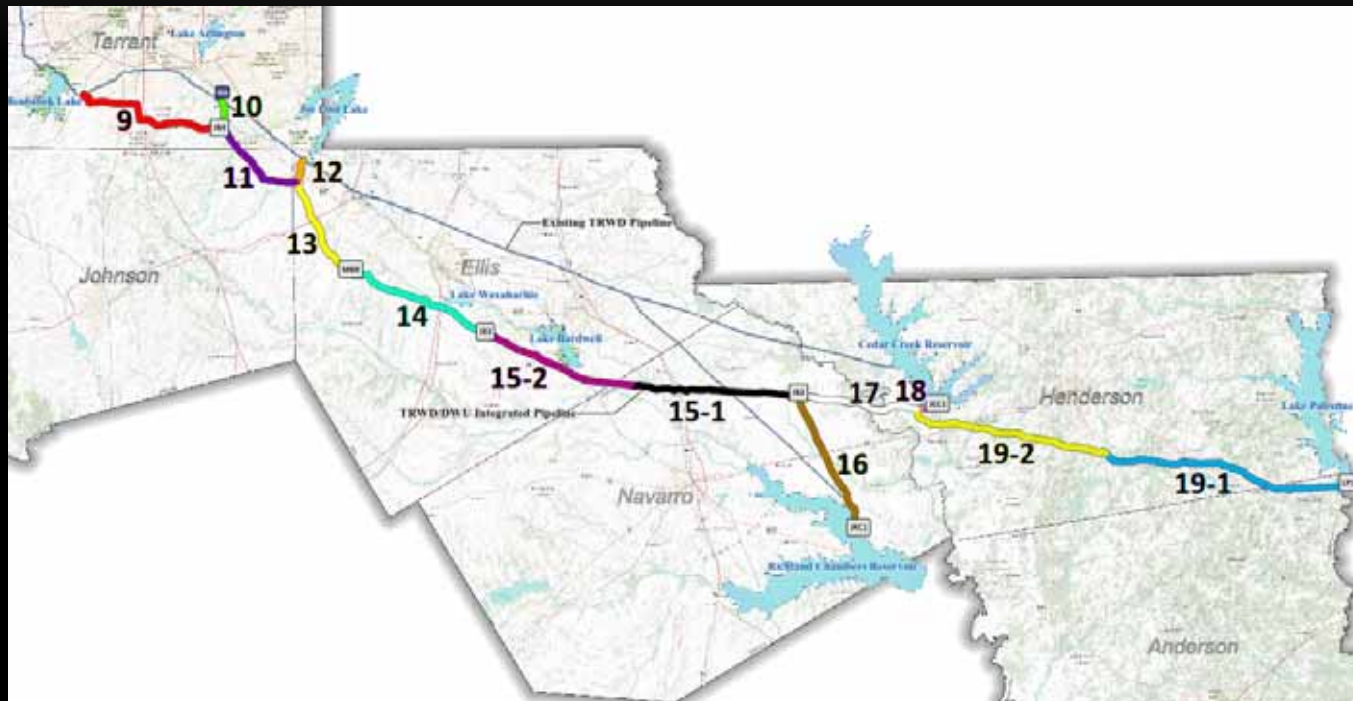
- John May
- Mark McGuire, GISP
- Jeff Coffey, GISP



OUR CHALLENGES

- Integrate geophysical survey data and associated interpretations into Tarrant Regional Water District's (TRWD) pipeline data model, a part of their immense enterprise GIS system
- Process vast amounts of geophysical survey data (over 140,000 features) and provide the data in a usable format to design teams for their decision making process

IPL PROJECT MAP



GEOPHYSICAL/GEOTECHNICAL DATA

- Data Collected
 - Electrical resistivity tomography (ERT) survey lines
 - Induced polarization survey lines
 - Borings



PIPELINE DATA MODEL

- Geotechnical Dataset Feature Classes
 - Borings
 - Geophysical Interpretations
 - Geophysical Survey Lines
 - Resistivity

PIPELINE DATA MODEL

IPL Project GIS Database - Physical Data Model (PDM) - Program Deliverable Data (4 of 4)

Geotechnical/Geophysical Feature Data Set

Feature Classes

Geotechnical/Geophysical - Locations

| Feature Class | Data Type | Index | Default Value | Domain | Length | Scale Length |
|----------------|-----------|-------|---------------|--------|--------|--------------|
| SHAPE | Geometry | Yes | | | | |
| SURVEY_ID | String | Yes | | | | |
| NORTHWARD_LINK | Double | Yes | 0 | | 8 | 8 |
| SOUTHWARD_LINK | Double | Yes | 0 | | 8 | 8 |
| STATION | String | Yes | | | | |
| SURVEY_ZONE | String | Yes | | | | |

Geotechnical/Geophysical - Interpretations

| Feature Class | Data Type | Index | Default Value | Domain | Length | Scale Length |
|--------------------------------|-----------|-------|---------------|--------------------------|--------|--------------|
| SHAPE | Geometry | Yes | | | | |
| SURVEY_ZONE_ID | String | Yes | | | | |
| NORTHWARD_LINK | Double | Yes | 0 | | 8 | 8 |
| SOUTHWARD_LINK | Double | Yes | 0 | | 8 | 8 |
| STATION | String | Yes | | | | |
| GROUND_SURFACE_ELEVATION | Double | Yes | 0 | | 8 | 8 |
| TOP_SOIL_LAYER_ELEVATION | Double | Yes | 0 | | 8 | 8 |
| TOP_MEDIUM_LAYER_ELEVATION | Double | Yes | 0 | | 8 | 8 |
| TOP_COMPLETION_LAYER_ELEVATION | Double | Yes | 0 | | 8 | 8 |
| CONCRETE_SURFACE_ELEVATION | Double | Yes | 0 | | 8 | 8 |
| SOIL_MOISTURE_FACTOR | Double | Yes | | Geotechnical/Geophysical | 8 | 8 |
| SOIL_MOISTURE_FACTOR_CODE | String | Yes | | | 10 | |
| SOIL_PROPERTIES | Double | Yes | | Geotechnical/Geophysical | 8 | 8 |
| CONCRETE_AREAS | Double | Yes | | Geotechnical/Geophysical | 8 | 8 |
| SOIL_MOISTURE_FACTOR_CODE | String | Yes | | Geotechnical/Geophysical | 10 | |
| PROBABLE_SOIL_TYPE | String | Yes | | Geotechnical/Geophysical | 20 | |
| DEPTH | Double | Yes | | | 8 | 8 |

Geophysical - Survey Lines

| Feature Class | Data Type | Index | Default Value | Domain | Length | Scale Length |
|---------------------------|-----------|-------|---------------|--------|--------|--------------|
| SHAPE | Geometry | Yes | | | | |
| SURVEY_ZONE_ID | String | Yes | | | | |
| SURVEY_ZONE_CODE | String | Yes | | | | |
| DEPTH_CODE | String | Yes | | | | |
| DEPTH_CODE_CODE | String | Yes | | | | |
| DEPTH_CODE_CODE_CODE | String | Yes | | | | |
| DEPTH_CODE_CODE_CODE_CODE | String | Yes | | | | |
| STATION | String | Yes | | | | |
| SURVEY_ZONE | String | Yes | | | | |

Geophysical - Resistivity

| Feature Class | Data Type | Index | Default Value | Domain | Length | Scale Length |
|---------------------------------|-----------|-------|---------------|--------|--------|--------------|
| SHAPE | Geometry | Yes | | | | |
| RESISTIVITY_CODE | String | Yes | | | | |
| RESISTIVITY_CODE_CODE | String | Yes | | | | |
| RESISTIVITY_CODE_CODE_CODE | String | Yes | | | | |
| RESISTIVITY_CODE_CODE_CODE_CODE | String | Yes | | | | |
| STATION | String | Yes | | | | |
| SURVEY_ZONE | String | Yes | | | | |

Domain Tables

Geotechnical/Geophysical - Soil Status

| Code | Description |
|------|--------------------------|
| 0 | Geotechnical/Geophysical |
| 1 | Geotechnical/Geophysical |
| 2 | Geotechnical/Geophysical |

Geotechnical/Geophysical - Soil Type

| Code | Description |
|------|--------------------------|
| 0 | Geotechnical/Geophysical |
| 1 | Geotechnical/Geophysical |
| 2 | Geotechnical/Geophysical |

Geotechnical/Geophysical - Soil Properties

| Code | Description |
|------|--------------------------|
| 0 | Geotechnical/Geophysical |
| 1 | Geotechnical/Geophysical |
| 2 | Geotechnical/Geophysical |

Geotechnical/Geophysical - Soil Moisture



| Code | Description |
|------|--------------------------|
| 0 | Geotechnical/Geophysical |
| 1 | Geotechnical/Geophysical |
| 2 | Geotechnical/Geophysical |

Geotechnical/Geophysical - Soil Areas

| Code | Description |
|------|--------------------------|
| 0 | Geotechnical/Geophysical |
| 1 | Geotechnical/Geophysical |
| 2 | Geotechnical/Geophysical |

Geotechnical/Geophysical - Soil Depth

| Code | Description |
|------|--------------------------|
| 0 | Geotechnical/Geophysical |
| 1 | Geotechnical/Geophysical |
| 2 | Geotechnical/Geophysical |


PROCESS

- Geophysical survey data is processed, checked, then loaded into a working geodatabase
- Survey data is displayed graphically on plan and profile sheets
 - ERT or IP profile image and values from the resistivity feature class and geophysical interpretations feature class
- Checked and interpreted by geophysical scientist/geologist
- Geophysical scientist/geologist draws interpreted lines on the ERT profile image

PROCESSED CONTINUED...

- Interpreted profiles are georeferenced, then digitized
- Elevation values are extracted and loaded into the working geodatabase
- Final plan and profile sheet checked and the data is loaded into a replica geodatabase
- Geodatabase feature classes checked and synchronized with the master geodatabase residing in TRWD's enterprise GIS system

File Edit View Bookmarks Insert Selection Tools Window Help

Georeferencing Layer 1250.p2 XTools Pro

Layer PhaseC Lines Points

Attributes of Master_Geo_Interpretations_Template Events

| OBJECTID* | DISTANCE | Dist_ssr | Load | PCI | NORTHING_GID* | EASTING_GID* | GROUND SURFACE ELEVATION | Res5 | Res10 | Res15 | Res20 | TOP SOIL ELEVATION | TOP WEATHERED ROCK ELEVATION | TOP COMPETENT ROCK ELEVATION | GROUNDWATER SURFACE ELEVATION | UNIQIF FEATURE1 | |
|-----------|----------|----------|--------|-----|---------------|--------------|--------------------------|--------|-------|-------|-------|--------------------|------------------------------|------------------------------|-------------------------------|-----------------|-----|
| 43003 | 0 | 0 | <None> | 1 | 8733899.9 | 2818831.3 | 486.3 | 80000 | 80000 | 80000 | 80000 | 486.3 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43008 | 50 | 50 | <None> | 1 | 8733896.2 | 2818831.1 | 485.3 | 872 | 137.7 | 261.7 | 454.7 | 485.3 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43013 | 100 | 100 | <None> | 1 | 8733891.9 | 2818831 | 485.3 | 1652 | 324.1 | 185.4 | 341 | 485.3 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43018 | 150 | 150 | <None> | 1 | 8733878.7 | 2818800.4 | 485.9 | 2788.3 | 328.4 | 265.5 | 377.9 | 485.9 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43023 | 200 | 200 | <None> | 1 | 8733875.4 | 2818800.5 | 486.6 | 2036.1 | 342.5 | 251.4 | 481.4 | 486.6 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43028 | 250 | 250 | <None> | 1 | 8733872 | 2818800.5 | 487.6 | 2260.3 | 308.5 | 210.3 | 200.7 | 487.6 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43033 | 300 | 300 | <None> | 1 | 8733868.4 | 2819130.2 | 488.8 | 1486 | 205.6 | 328.9 | 363.2 | 488.8 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43038 | 350 | 350 | <None> | 1 | 8733864.7 | 2819179.8 | 491.2 | 1555.9 | 323.2 | 184.4 | 263.8 | 491.2 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43043 | 400 | 400 | <None> | 1 | 8733861.2 | 2819229.2 | 492.2 | 1852.3 | 212.9 | 288.3 | 386 | 492.2 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43048 | 450 | 450 | <None> | 1 | 8733857.2 | 2819279.1 | 493.9 | 2102 | 348.4 | 216.8 | 282.8 | 493.9 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43053 | 500 | 500 | <None> | 1 | 8733853.3 | 2819328.9 | 495.8 | 1450.5 | 315.9 | 242.7 | 354.8 | 495.8 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43058 | 550 | 550 | <None> | 1 | 8733849.1 | 2819378.3 | 497.6 | 918.2 | 179.8 | 166.7 | 285.5 | 497.6 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43063 | 600 | 600 | <None> | 1 | 8733845.1 | 2819428 | 498.7 | 1131.8 | 273.3 | 194.8 | 271.5 | 498.7 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43068 | 650 | 650 | <None> | 1 | 8733841.6 | 2819477.4 | 499.9 | 1897.6 | 417 | 147.8 | 191 | 499.9 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43073 | 700 | 700 | <None> | 1 | 8733837.9 | 2819527 | 500.6 | 2281.4 | 311.2 | 296.8 | 493.8 | 500.6 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43078 | 750 | 750 | <None> | 1 | 8733833.8 | 2819576.8 | 500.4 | 1683.1 | 311.1 | 213.7 | 383.7 | 500.4 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43083 | 800 | 800 | <None> | 1 | 8733829.8 | 2819626.3 | 499.4 | 758.8 | 357.9 | 178.2 | 603.8 | 499.4 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43088 | 850 | 850 | <None> | 1 | 8733826.5 | 2819676.2 | 497.3 | 2817.5 | 730.3 | 311.4 | 245.5 | 497.3 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43093 | 900 | 900 | <None> | 1 | 8733822.9 | 2819726.2 | 496.2 | 3186.6 | 228.7 | 130.7 | 218.2 | 496.2 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43098 | 950 | 950 | <None> | 1 | 8733818.8 | 2819776.8 | 493.3 | 1253.2 | 223.9 | 348.3 | 882.3 | 493.3 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43103 | 1000 | 1000 | <None> | 1 | 8733814.5 | 2819826.3 | 491.9 | 968.7 | 189.9 | 188.3 | 282.8 | 491.9 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43108 | 1050 | 1050 | <None> | 1 | 8733811.2 | 2819876.3 | 490.9 | 848.9 | 156.1 | 138.1 | 207.8 | 490.9 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43113 | 1100 | 1100 | <None> | 1 | 8733807.1 | 2819926.1 | 489.5 | 1223.8 | 177 | 183.1 | 143.5 | 489.5 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43118 | 1150 | 1150 | <None> | 1 | 8733803.1 | 2819975.8 | 487.9 | 1653.1 | 166.1 | 81 | 83.4 | 487.9 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43123 | 1200 | 1200 | <None> | 1 | 8733799.2 | 2820025.4 | 488 | 839.6 | 182.5 | 142.5 | 188.9 | 488 | 80000 | 80000 | 80000 | 80000 | N/A |
| 43128 | 1250 | 1250 | <None> | 1 | 8733795.6 | 2820074.5 | 483.6 | 8888 | 8888 | 8888 | 8888 | 483.6 | 8888 | 8888 | 8888 | 8888 | N/A |

Record H 0 Show All Selected Records (0 out of 26 Selected) Options

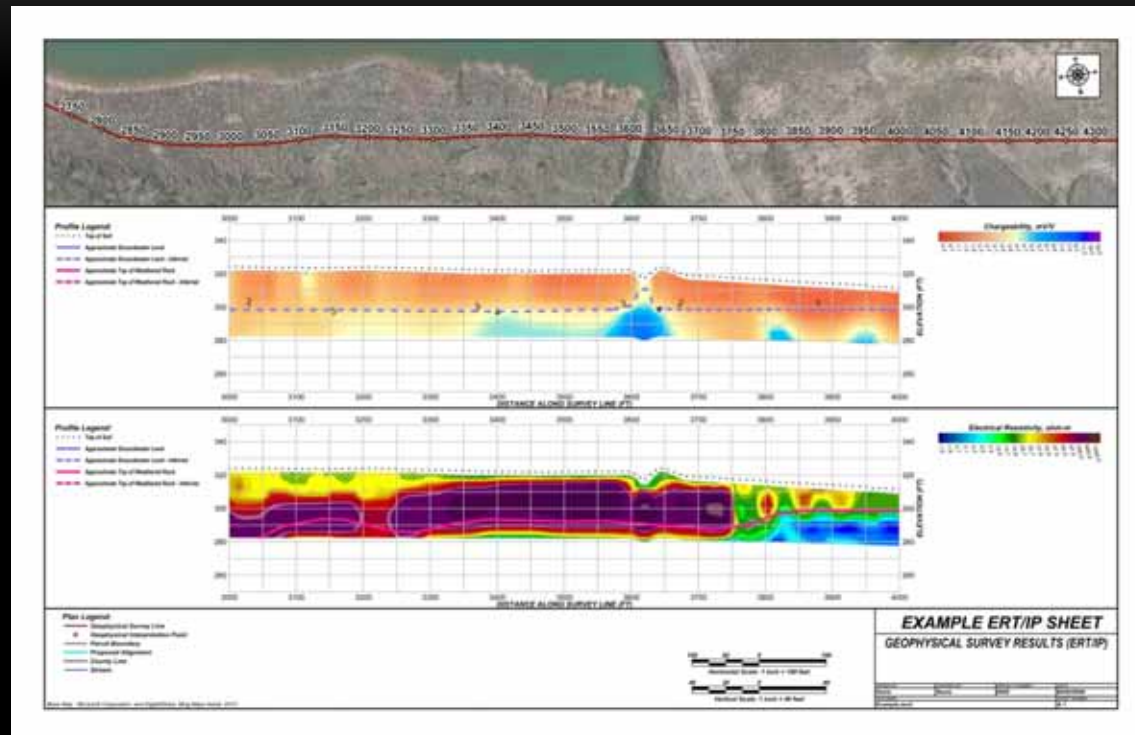
Display Show Properties

Editing Create New Feature Target

Drawing An



EXAMPLE PLAN AND PROFILE SHEET



BENEFITS

- By using GIS, it is a powerful alternative to the traditional bound report format because it enables the sharing of the geophysical data to support multiple users and their decision making process.
- Utilizing a dynamic system to support the long term operations and maintenance of the pipeline

QUESTIONS?

Mark McGuire, GISP

GIS Manager

mmcguire@ieaworld.com

John May

Technology Client Manager

jmay@ieaworld.com
