Data Integration Using GIS Systems and Improved Risk Modeling Boardwalk Pipeline Partners

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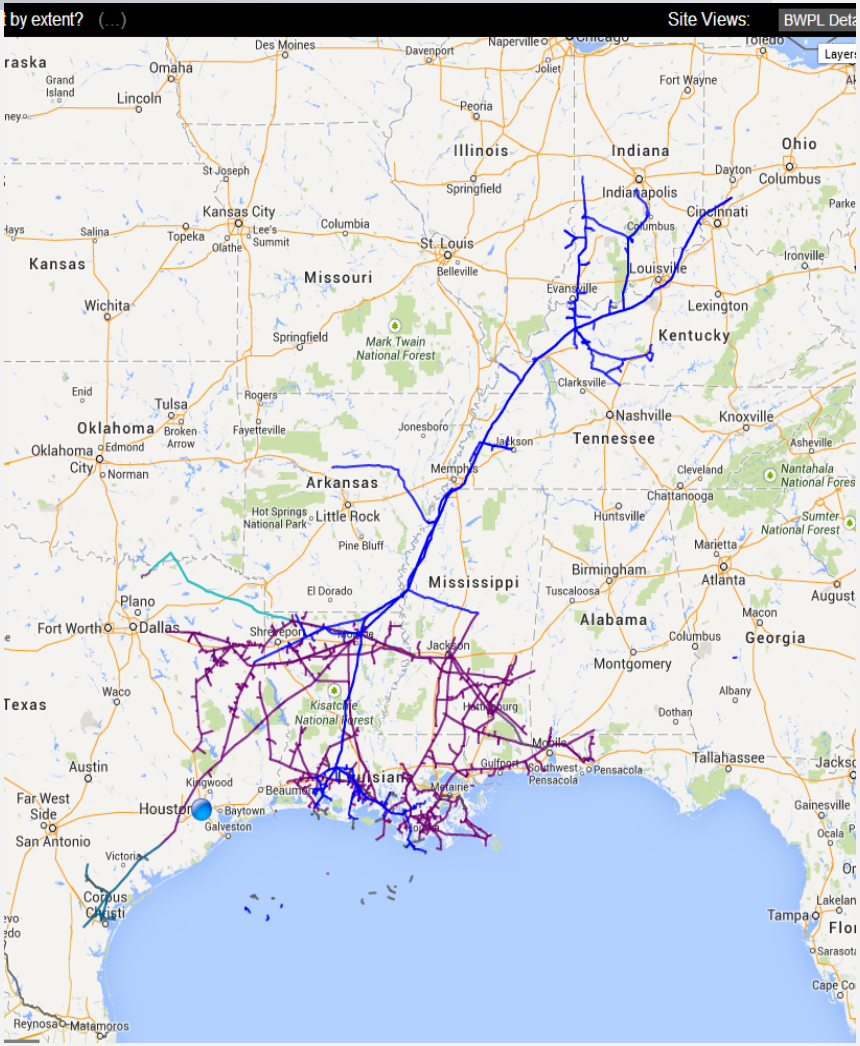
About Boardwalk

- Boardwalk Pipeline Partners is a midstream company consisting of:

  - Gulf South Pipeline
  - Texas Gas Pipeline
  - Gulf Crossing Pipeline
  - Boardwalk Field Services (*gas processing*)
  - Boardwalk Storage Company
  - Boardwalk Louisiana Midstream (*Liquids transmission and storage*)

  - 13 storage fields, 387 BCF working gas
  - 9 liquids storage salt domes, 31 MMbbls
  - 68 compressor stations
  - 14,500 miles of gas transmission piping
  - 580 miles of liquid piping



Know Your System !

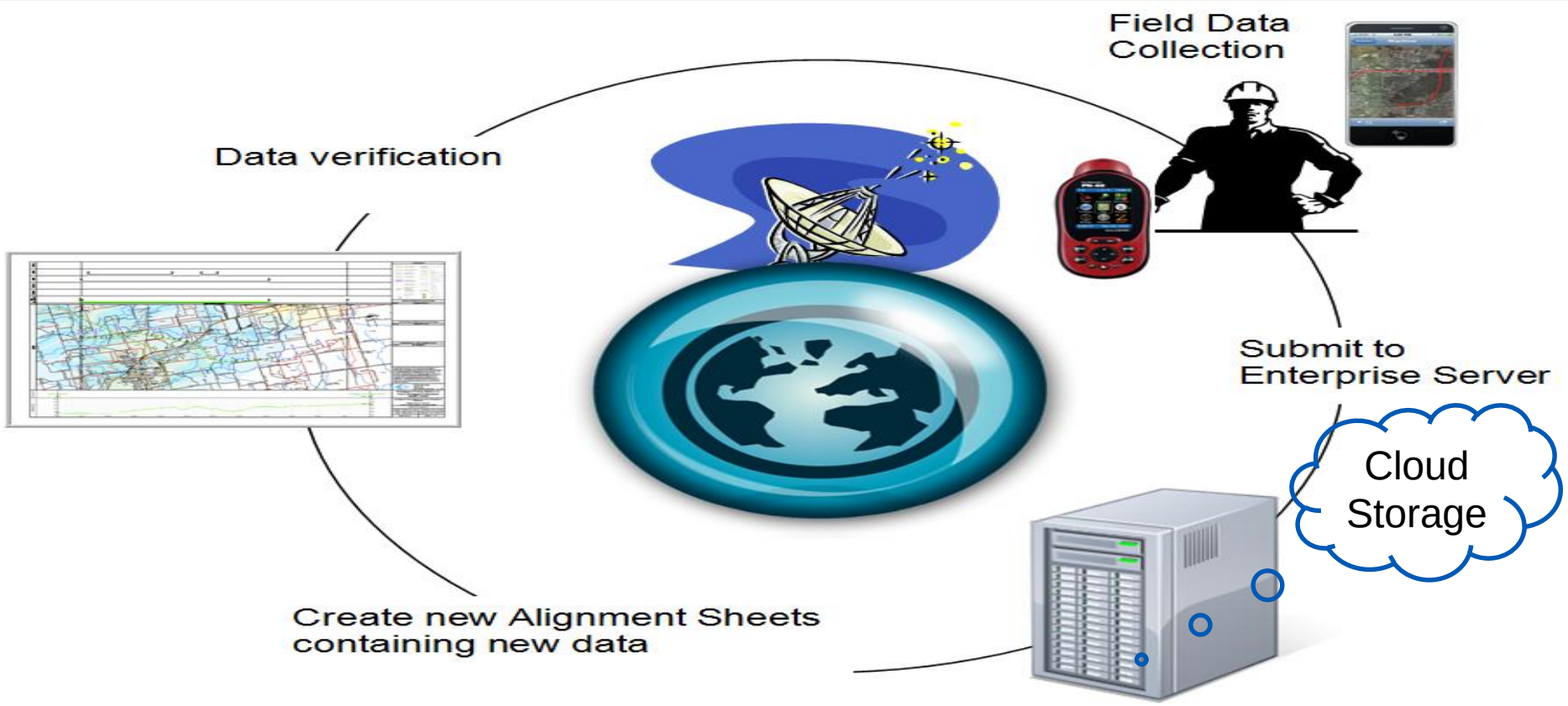
- Implement a Google-engine driven, cloud based GIS and Risk viewers to provide on-demand access to integrity data to ALL employees Anywhere, and on Any device (PC and mobile devices).
- Ability to view risk scores instantaneously.
- Ability to view updated alignment sheets and valve maps.
- Ability to view HCA boundaries, Class boundaries.
- Ability to view pipe material records, hydrotests, ILI anomalies, CIS data, etc.
- Develop and use Mobile Smart Forms to allow for accurate collection of data using iPhone or Ipad.

- KEYS – Simplicity, Efficiency, Accuracy

GIS System

Boardwalk GIS Implementation

Create an infrastructure that will modernize field data collection, simplify data validation efforts and data access, improve risk mitigation, and empower field Operations to know their systems, know the risks, and manage the integrity of their assets.



PODS ESRI Spatial Model

- 1) Migrated all subsidiaries to a uniform platform, PODS ESRI Spatial model.
- 2) Data verification, validation, and clean up – identify missing data elements
- 3) Allow the use of tools that are native to the ESRI environment
- 4) Integrated automated alignment sheets (Turboroute – Eagle/G2), HCA, MAOP, BAP, and Risk tools (Geonamic)

- Additional external data sources also synced with the new GIS:
  - Corrosion data (PCS/CPDM)
  - OneCall (IRTHnet) tickets for Third Party Damage data
  - In Line Inspection data
  - Pipeline maintenance and repair data
  - Close Interval Survey data

Implemented A Cloud Based Computing Data Solution

- Completely cloud based GIS
  - Amazon (EC2) Elastic Compute Cloud environment
  - Data-center, IT & Security teams supporting the BWP GIS infrastructure with Managed Service Level Agreements (SLA)
- Elasticity – Virtualized Hardware
  - If BWP needs more computer resources, BWP can add them rapidly
  - If fewer BWP computer resources are needed, BWP can reduce them rapidly
- All groups access GIS web viewer in the same way
  - Whether in Texas, Kentucky, Egypt or China …
  - If you have Internet, you have access to Visual GIS (explicit permission for Boardwalk employees only)

HCA and Class Tools

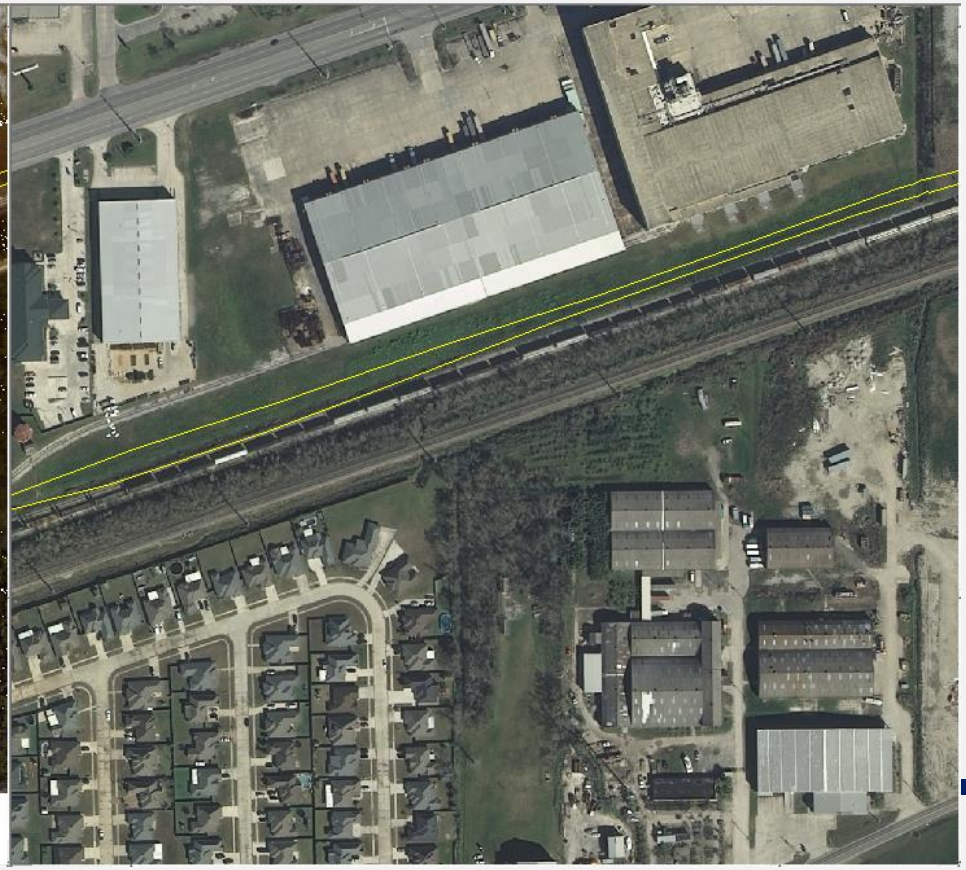
ROW Aerial Imagery Update

- **Previous USDA Imagery VS New Photo Science Hi-Res Imagery**
  (*2017 – a system-wide effort to re-validate all HCAs*)

PHMSA Bulletin - HCAs - 2016-2988

USDA Imagery

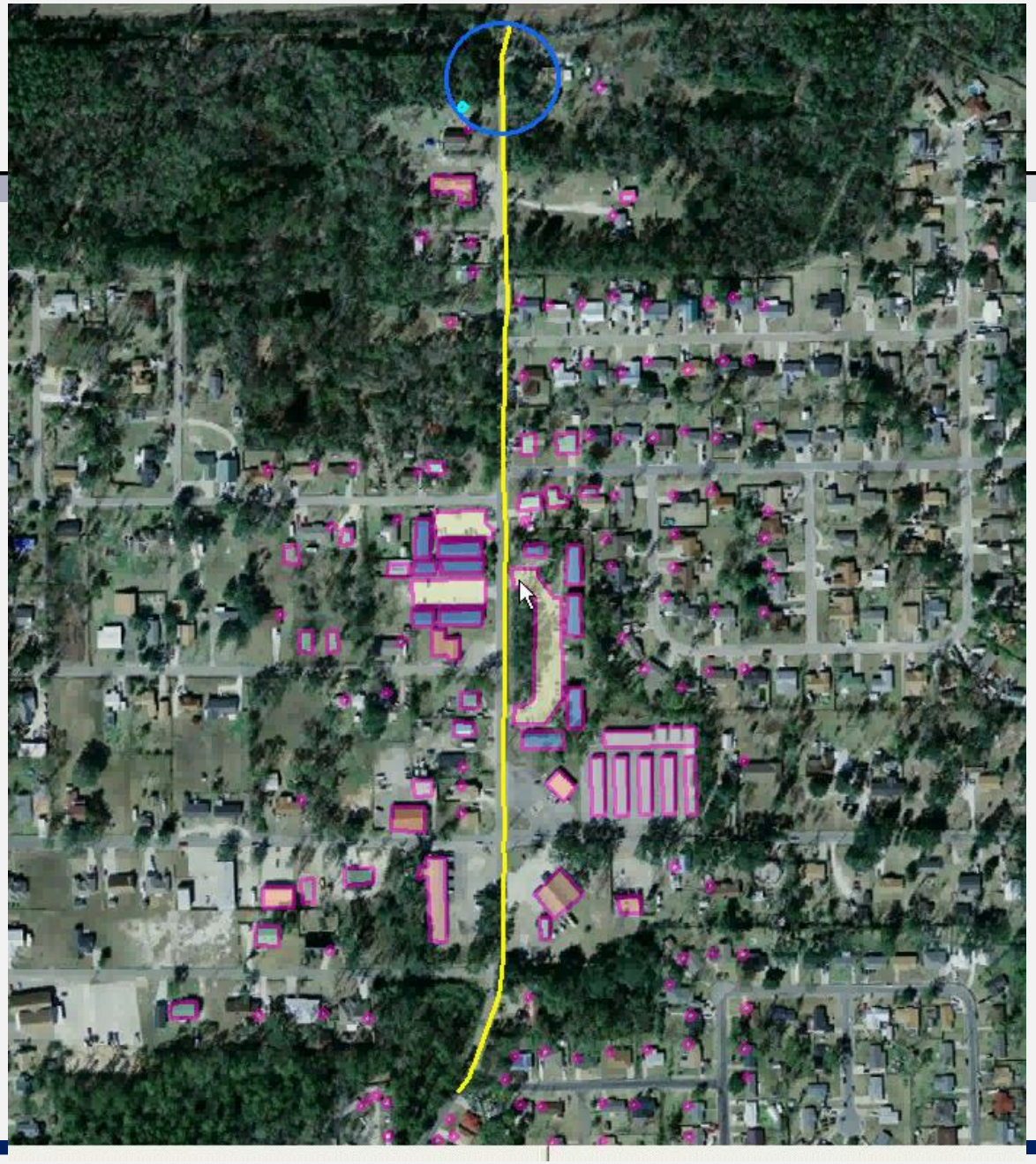
Hi-Res Imagery



Automated

HCA

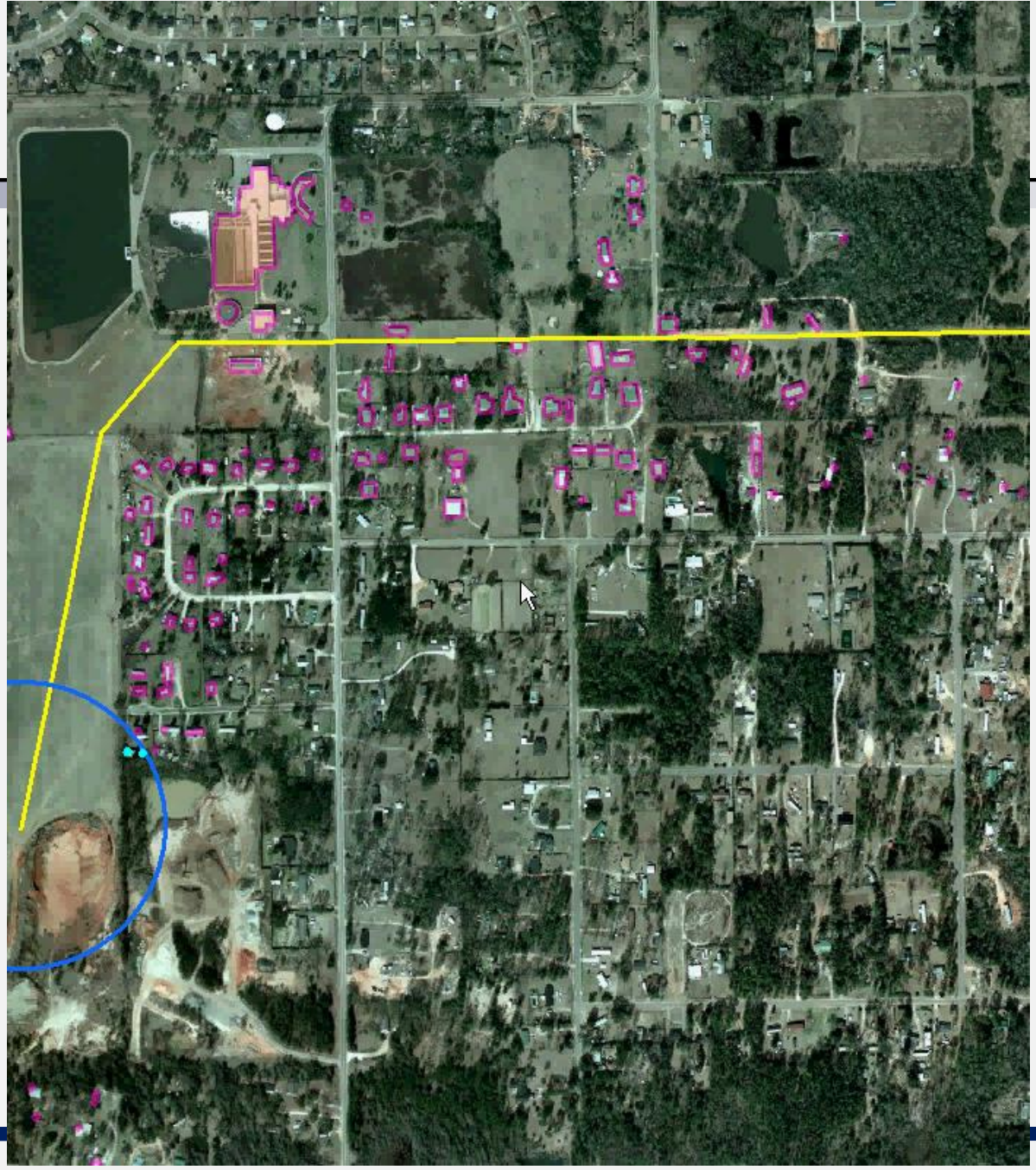
Calculator



Automated

CLASS

Calculator

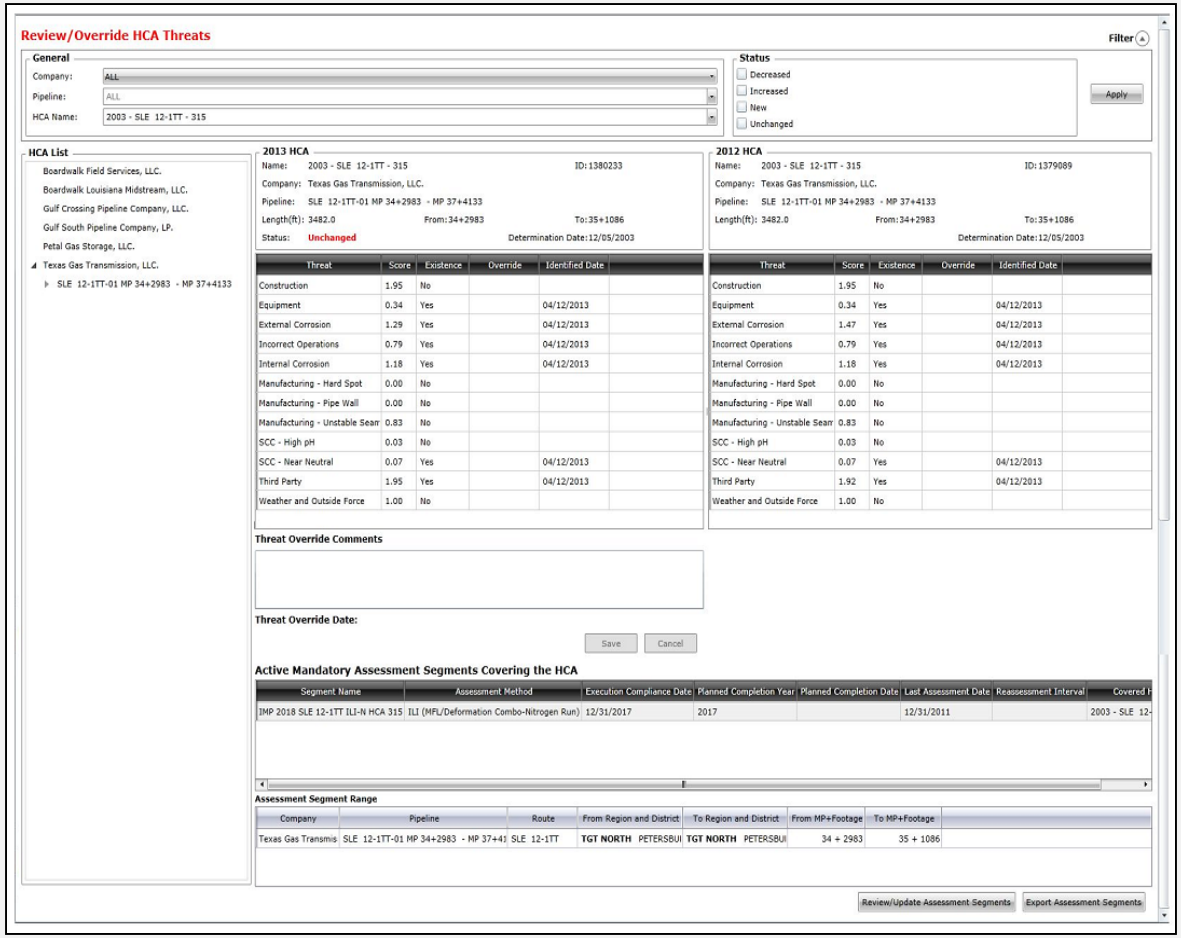


BAP Tool

Baseline Assessment Plan (BAP) Application

- Manages all integrity assessments for HCAs
- Fully integrated with the new Risk model
- Will review Risk and Threat scores, comparing changes from previous years
- Integrated with the Integrity Management Plans “rules” for proper assessment selections based on threats.

HCA review based on Risk and Threats



HCAs, MCAs, USAs

- It is not *only* about HCAs or MCAs, or USAs.

- Recent ruptures and failures in non-HCAs have been extremely costly to operating companies (examples)
  - Recent corrosion failure at girth weld
  - Recent corrosion failure in a casing
  - Recent hard spot failure

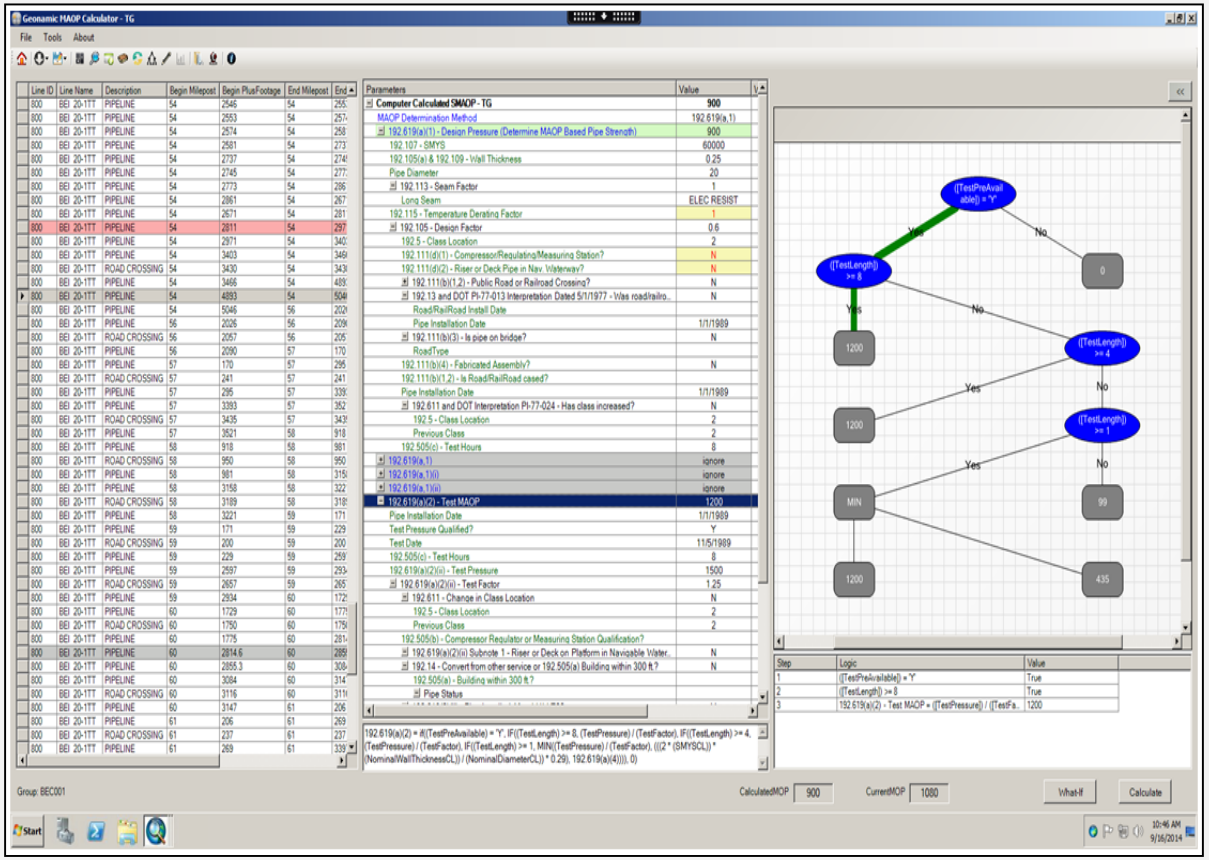
- It is about Safety: protecting the people, the environment, and greatly reducing risk for the company

MAOP Automatic Calculation
and
MAOP Validation Tool

Maximum Allowable Operating Pressure (MAOP) Application

- The tool has several screens to show the individual SMAOP calculations.
- Each section of the PHMSA code that has a bearing on a SMAOP calculation is represented.
- Every code section calculation is displayed, along with the limiting SMAOP basis.
- Graphics help the user understand the calculation paths.

Data and Graphics to Illustrate the Basis of Each MAOP Calculation

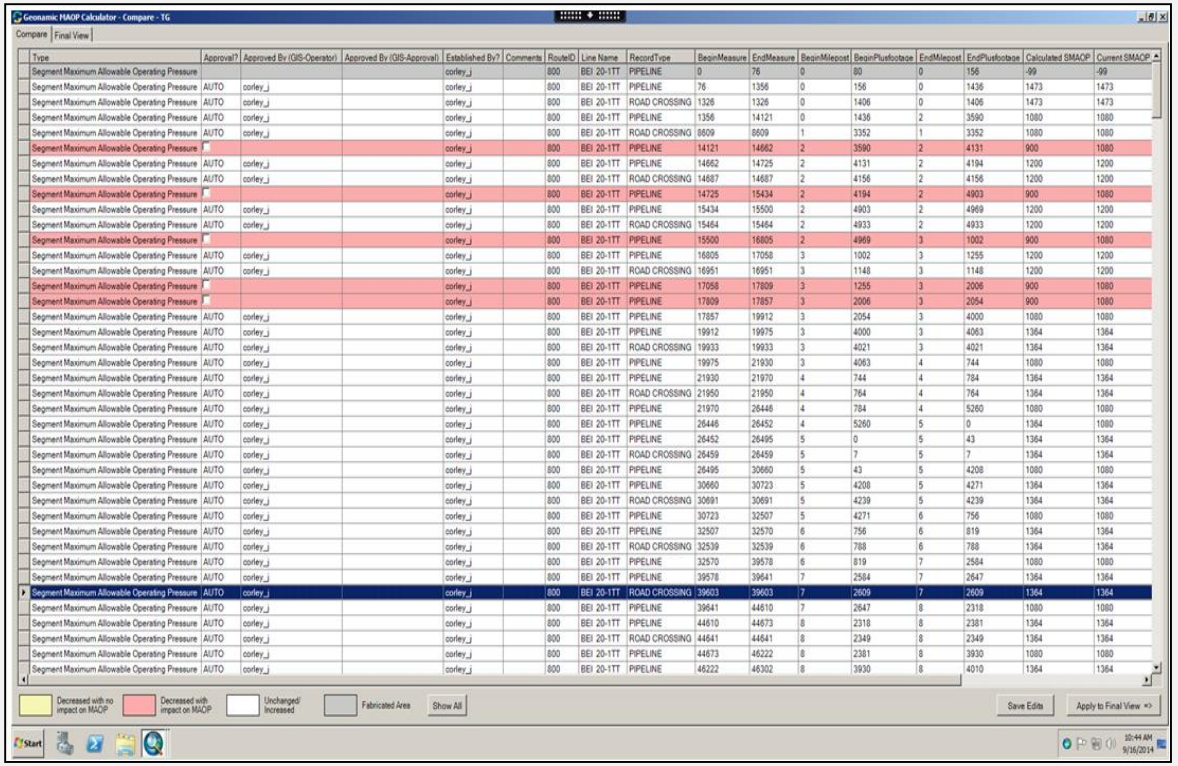


Maximum Allowable Operating Pressure (MAOP) Application

- The tool allows the user to understand not only the individual SMAOP calculations, but which SMAOP calculation may result in an overall lowering of a MAOP.

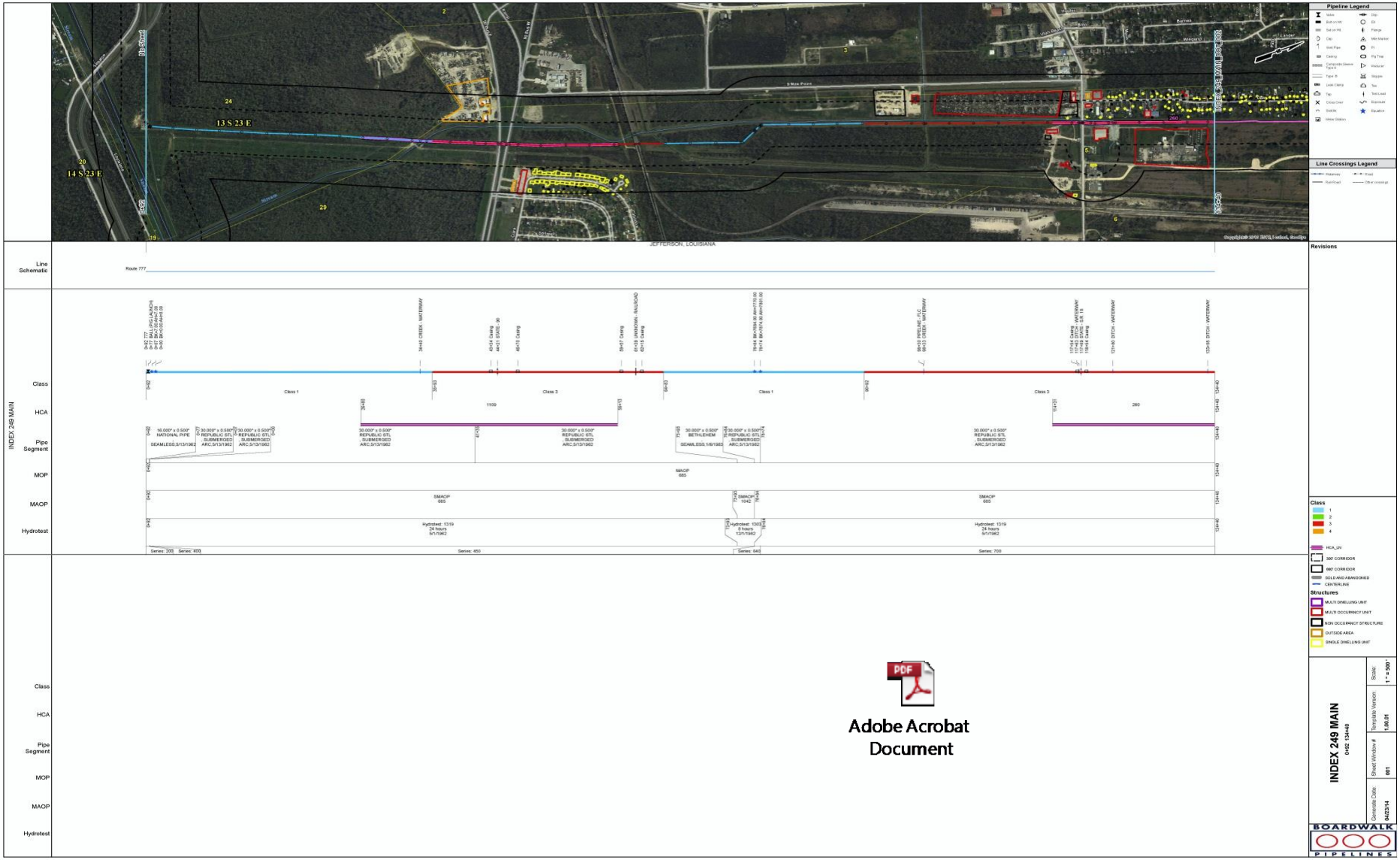
- 2-step approvals and publishing screens are built into the tool for safety and security

Reviewing the Results (each record in red has a calculated SMAOP lower than the current MAOP):



Automatic Alignment Sheet Generation

Automatic Alignment Sheets Generated



GIS Viewer

IntegraLink

Benefits of GIS Viewer

- Simple and easy access from anywhere.

- No more calls on “Where is the HCA? What class is it? What is the MAOP here? What type of pipe and coating? How old is this line? Do we have a valid hydrotest? Any line crossings? …

- Mobile “smartforms” to collect data (recoats, dig inspections, replacements, re-routes) and uploaded electronically to GIS QA server.

- Operational personnel are identifying errors in the records, alignment sheets, valve maps, etc. *That is Perfect! Now you have hundreds of eyes in the field to help validate your data.*

VLLA446 Original

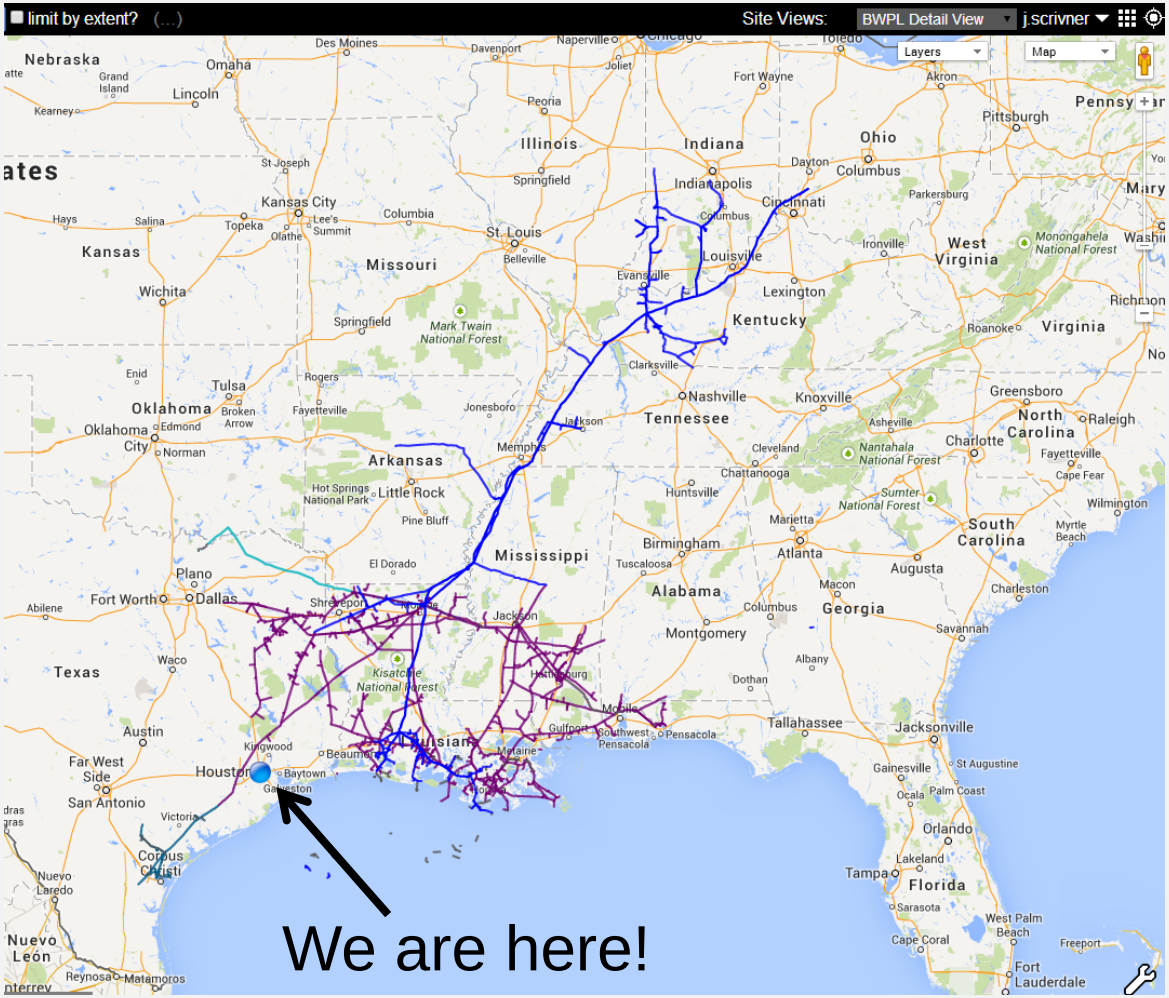
VLLA446 Updated

Original Delhi Map

Updated Delhi Map

Internet based GIS data viewer (or Integra Link)

- BWP GIS Viewer



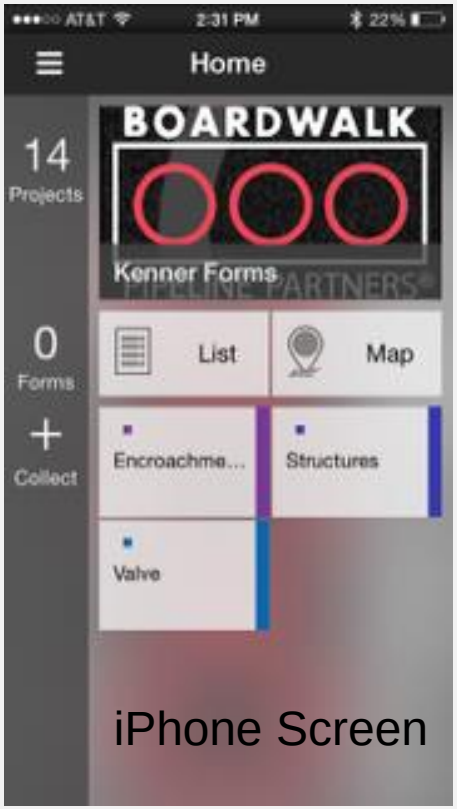
GIS Viewer – Main Features

- Separate Views to customize data access (Commercial, Integrity, Detail views by Company…)
- Ability to add KMZ file to views
- Alignment sheets (with geospatial data)
- Layers – OPP, valves, CP, HCA, class, ILI data, CIS data, 811 one calls, etc.
- Pictometry ortho 6” hi-res imagery
- Liquid HCAs
- Unlimited search capabilities (ex. Index 129 HCA)
- Report generation (in progress)
- Future enhancements planned.

Electronic Mobile Smart Form

Form Creation → Assignment → Sync → Field Capture → Sync → Load to Database

Trimble R1 Sub-meter GPS Unit



iPhone Screen

Mobile Smart Forms / As-Builts (New construction)

- TerraFlex is the software platform for mobile forms
- Forms are created/programmed in-house
- Available on all devices (iPhone, iPad)
- Bluetooth synced to R1 sub-meter GPS devices (no post processing needed)
- Automatic upload to QC server
- 3 forms currently in use. 12 scheduled for creation in 2017

- AS-BUILT – New Construction
  - PODS blank database provided to Survey company
  - Data returned to BWP GIS
  - Data verified against MTRs etc.
  - Uploaded to GIS
  - Process time reduced from 9-12 months to 1-2 months.

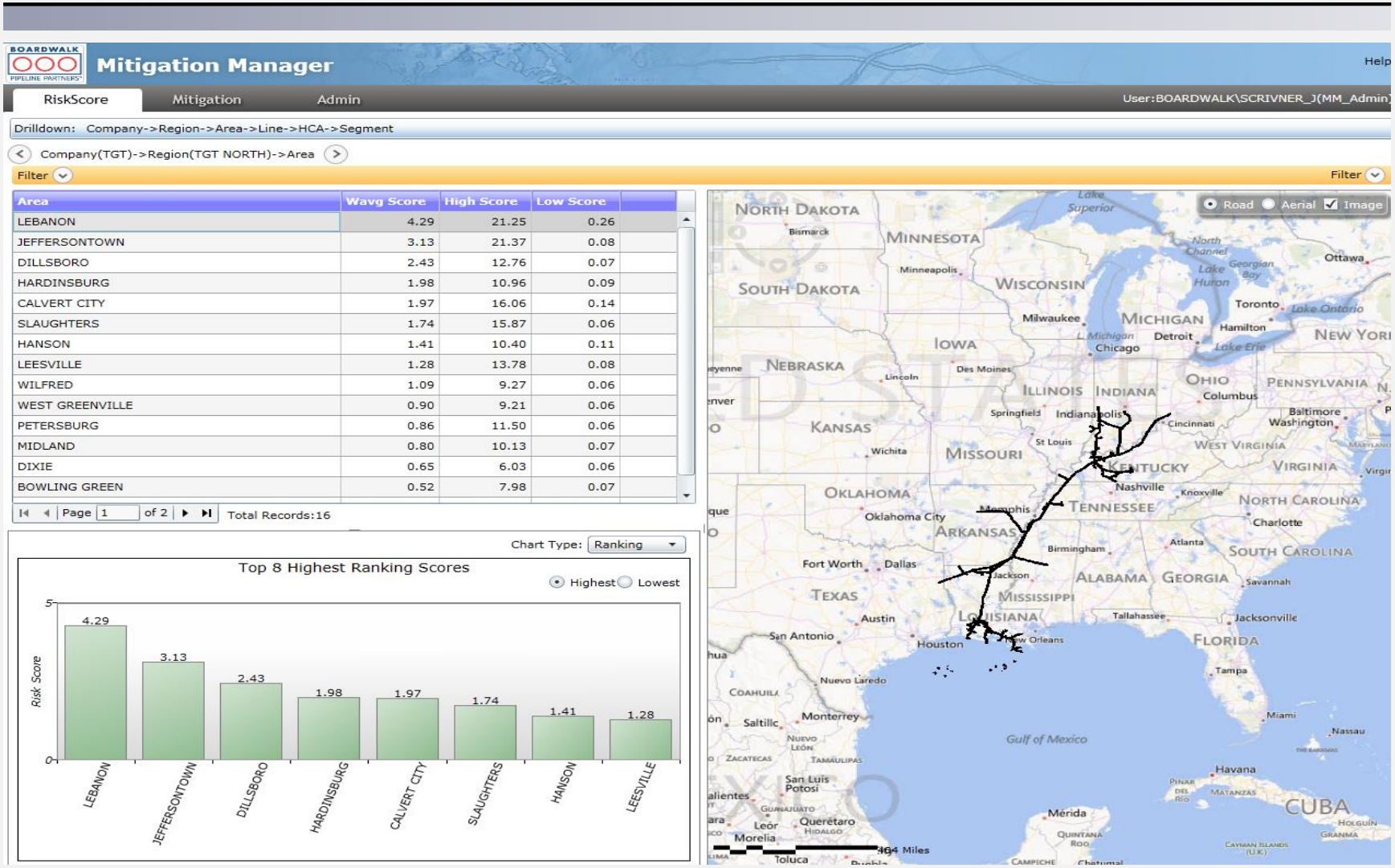
Risk Model

Risk Algorithm and Risk Dashboard

IMP App 01 Risk
orithm 0 Rev 11-2

- **D.R.I.P Model**
  - Drivers (data that provide information on specific failure component)
  - Resistors (data that indicates resistance to failure)
  - Indicators (data that indicates if a failure may or may not exist)
  - Preventers (data that indicate action taken to prevent failure)
- Provide an easy viewer for risk scores
- Provide ability to identify what risk is driving the score
- Provide what-if scenarios on how to reduce the risk score
- Accessible to all employees
- Used to standardize risk score across all assets, and aid in budgeting and maintenance activities

Mitigation Manager for Viewing Risk Results - *Risk Dashboard Web Access*



Questions – Open Discussion