Emergence of New Data Types in Unconventional Plays*

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Abstract

Objective: The evolution of shale plays in the U.S. and internationally drives initiatives for standardized methods of storing and accessing critical data types for reservoir management workflows used by multidisciplinary asset teams. Some of these data types are newly derived, such as the True Stratigraphic Position of a horizontal wellbore relative to a drilling target, or have become more critical as specific plays mature, such as the geospatial location of water takeout and disposal locations for hydraulic fracturing. The proliferation and use of these data types will serve as a validating test of the adaptability of data management tools and processes included in data management maturity initiatives.

Procedure: This paper uses recent site assessments at U.S. shale players and recent advances in providing intelligent indexes to reservoir management to track the changing taxonomies of data types as asset teams in new plays use them. Recently adopted best practices for integrating these data types into existing and emerging data flows are analyzed to determine their impact on the maturity of data management solutions. Case studies are presented of the inclusion of these data types into search taxonomies and standardized data models and procedures, at different stages in the evolution of the unconventional plays.

Results: This study identified new mission critical data types that are neither strictly defined nor well handled in current data management applications for reservoir management. Suggestions are made for methodologies to incorporate these data types into workflows for asset teams working across geotechnical disciplines. The best practices are based on industry-accepted benchmarks for improving the maturity of data management applications and methodologies. They include the use and extension of industry standard data models and use of the data types as facets in search taxonomies.

Conclusions: Some standardized data models and processes can be adapted for use in new unconventional shale plays, and robust workflow modeling tools can be customized for these environments as the new plays expand. Geologists and geologic data managers should be aware of these new data types and how they can be utilized in asset team applications in order to create, customize, and optimize workflows for organizations. Efficient and proper handling of these new data types can provide a competitive advantage for operators in unconventional plays.

Emergence of New Data Types in Unconventional Plays

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Data Management Drivers – Mid-Size North America Operators

1) Growth through Mergers, Acquisitions, and Drilling

2) Focus on Operational Expenditure

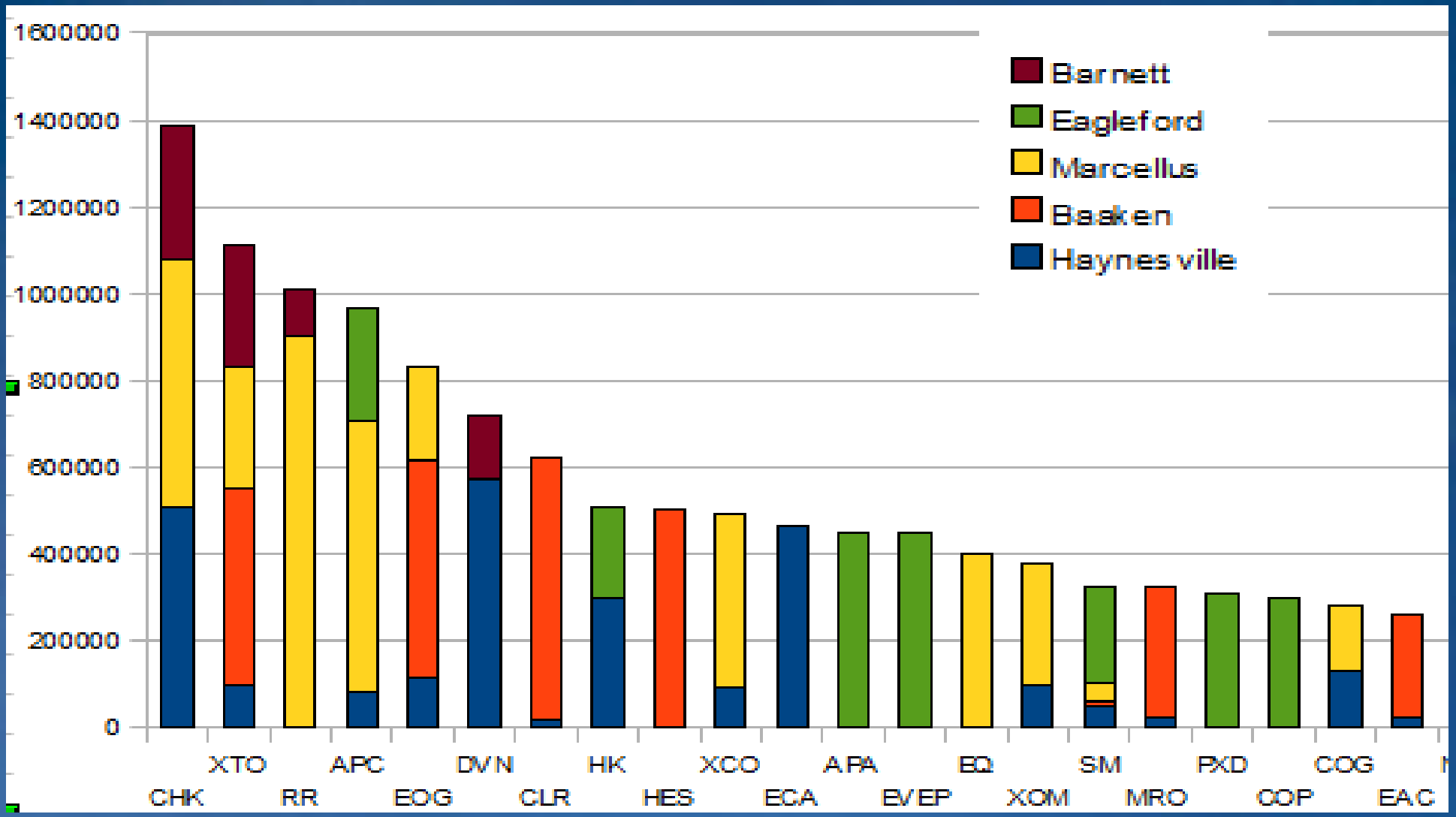
3) Lean data management staff

4) Locations under-served by major software suppliers

5) Real-Time data from long reach horizontal wells

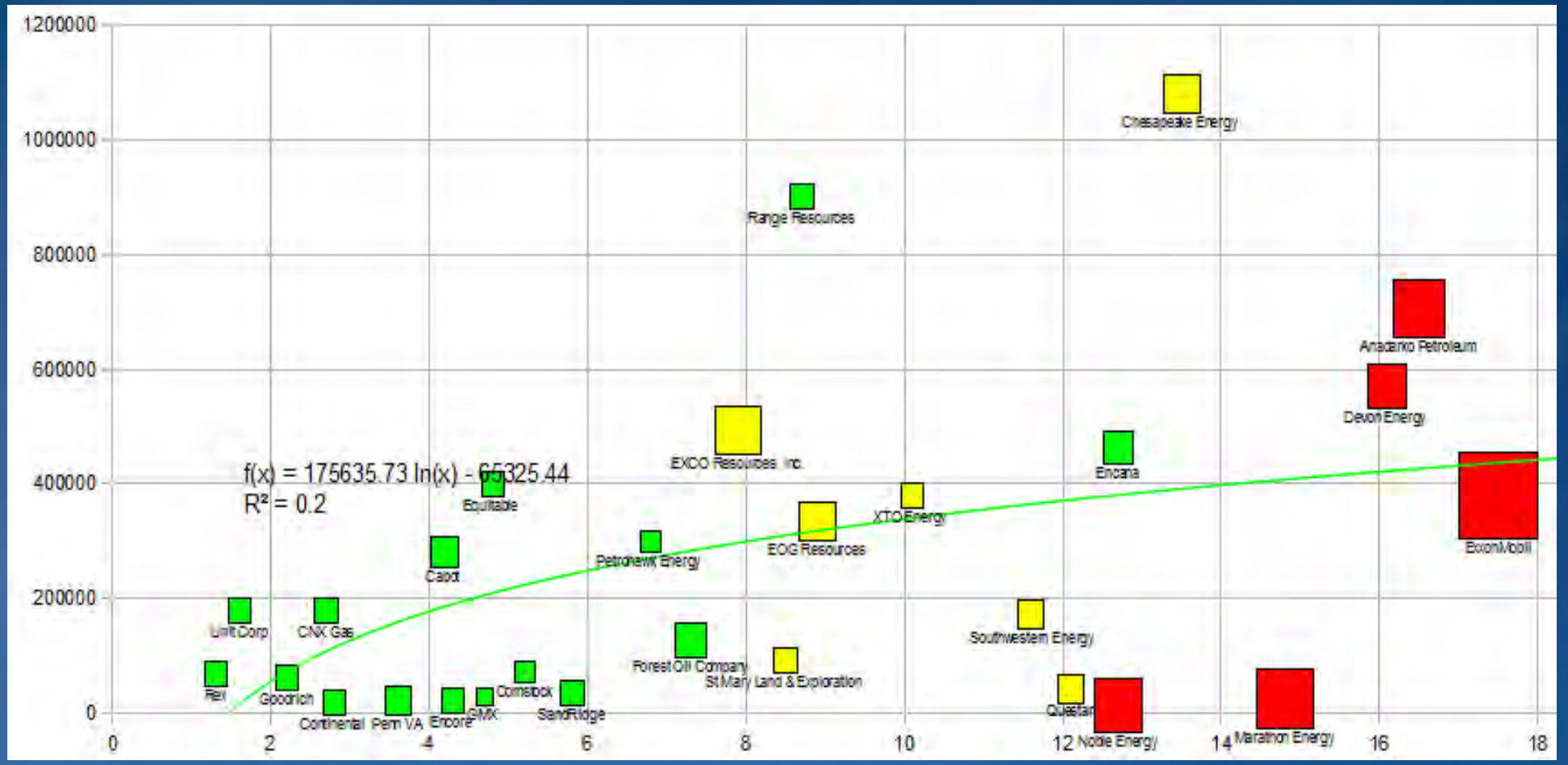
6) New data types:
True Stratigraphic Position, Water Resources

Shale Players – One year ago...

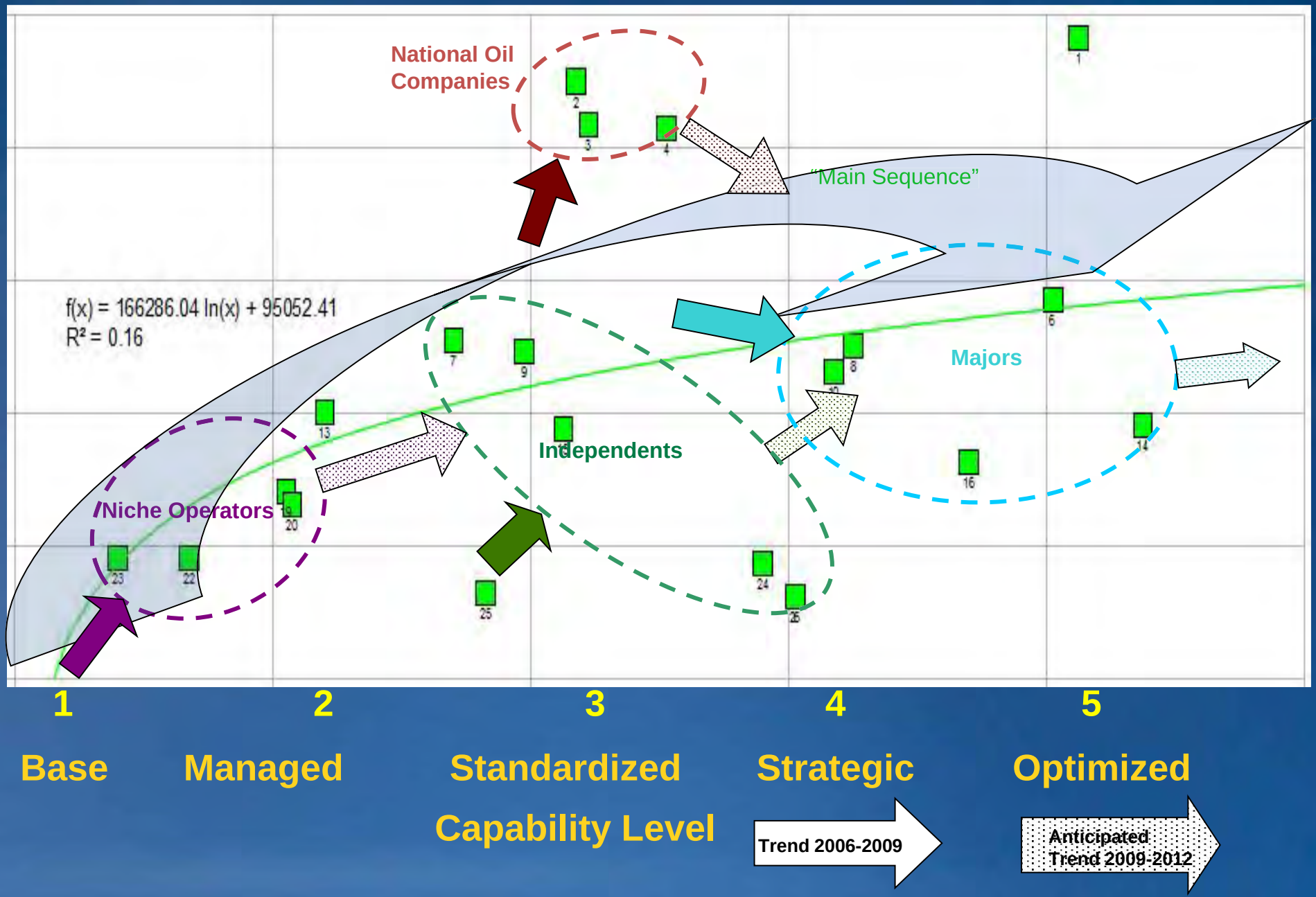


Publicly reported leasehold end of 3Q09 – not including pending M&A

Opportunity to Improve Performance Through Data Management Initiatives



Industry Information Management trends on a Capability Maturity Model



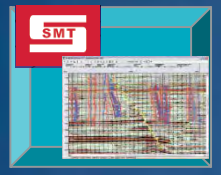
Data Management Challenges – Mid-Size North America Operators

1) Unstructured Data on Shared Drives

2) Interoperability of Legacy Applications

3) Nascent GIS Capabilities

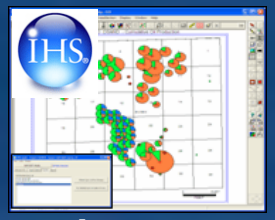
The Business Challenge:
Legacy Systems



Kingdom

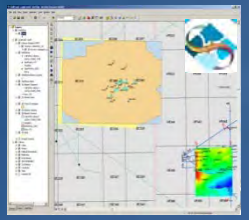
ascii file transfer

Petra



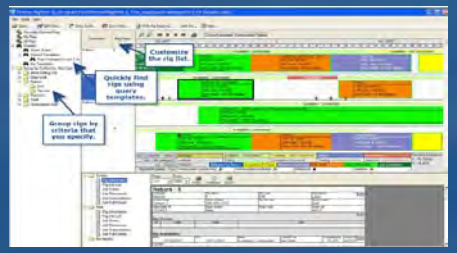
Enerdeq Browser

Tobin Web Viewer



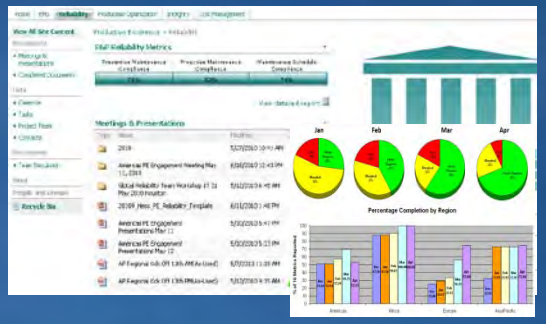
OpenSpirit

Geographix

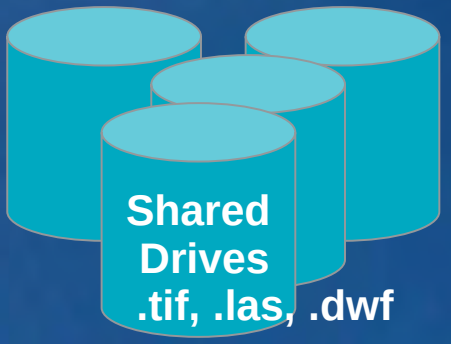


Peloton

ARC SDE 9.2



Sharepoint Portal



- Un-integrated point solutions
- Business processes not consistent across locations
- Only anecdotal understanding of value of data

= Maximum Level II (Managed) capabilities

Data Discovery – Interpretation – Reporting Cycle Time

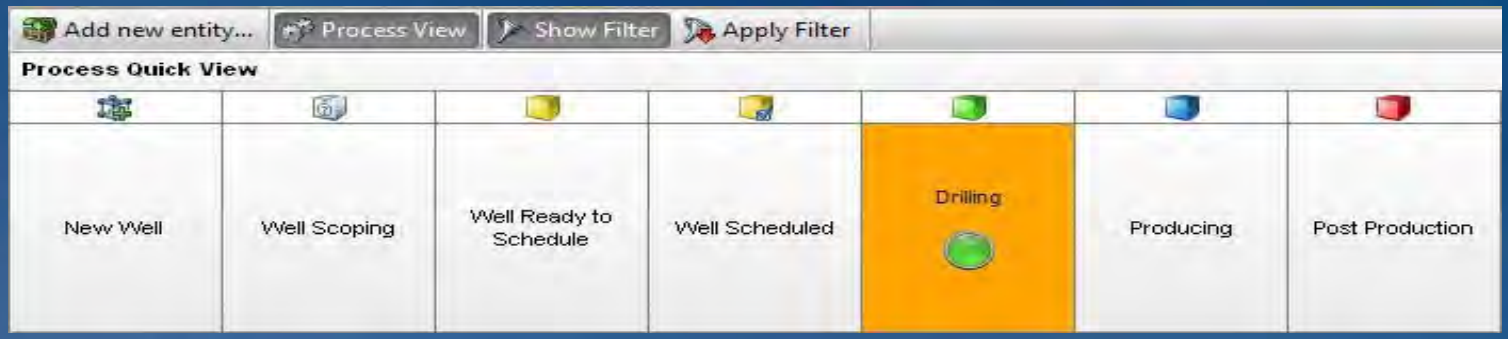
Inadequate Data Management

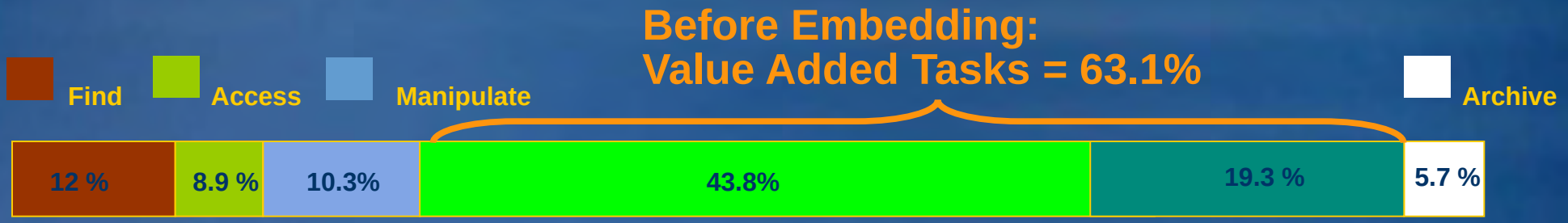
- *Extends the time required for data discovery*
- *Makes Interpretation Reporting more complex*
- *Takes time away from the interpreter of the data*

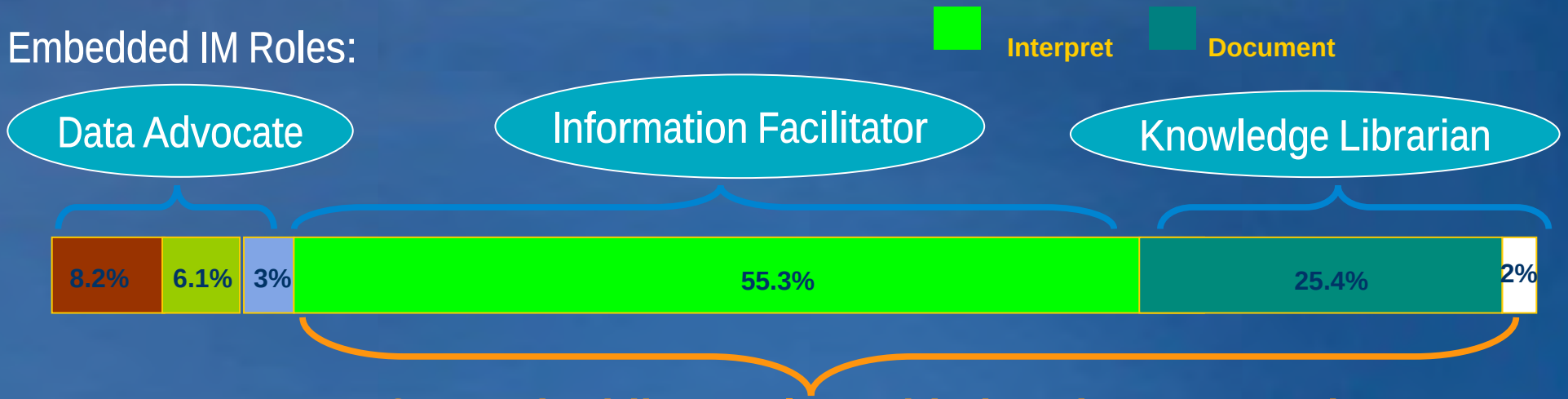
Solutions to Data Management

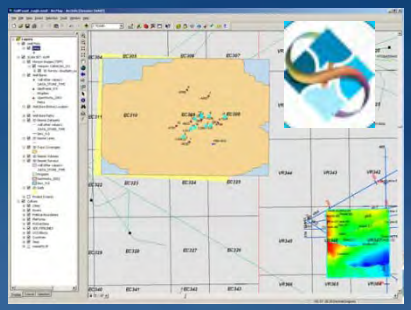
- *Rig Centric data flow*
- *Embed data managers within Interpretation groups*
- *Learn how the data will be used from the users*

How embedding IM tasks improves efficiency – case studies

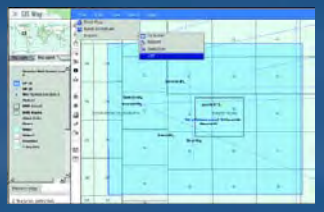




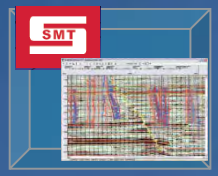


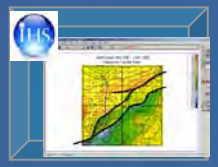


Middleware Data Connectors

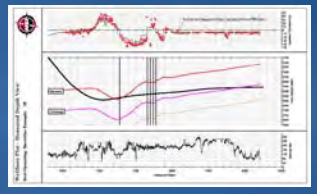


Enterprise Data Access

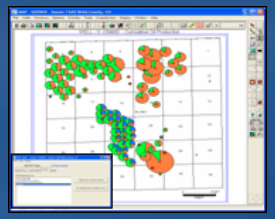




Legacy Apps
(Kingdom / PETRA)



LatnavNet



Browser

Web Viewer

- Partnering with Technology Providers
- Measuring Against Industry Standards
- Leveraging Best Practices

= Maximum Level III (Optimized) capabilities

ARC SDE 10

Geo-Tagging

The Law of Unintended Consequences Does Not just apply to Politics and Economics!

When more time is created to interpret data ….new things are discovered in the data

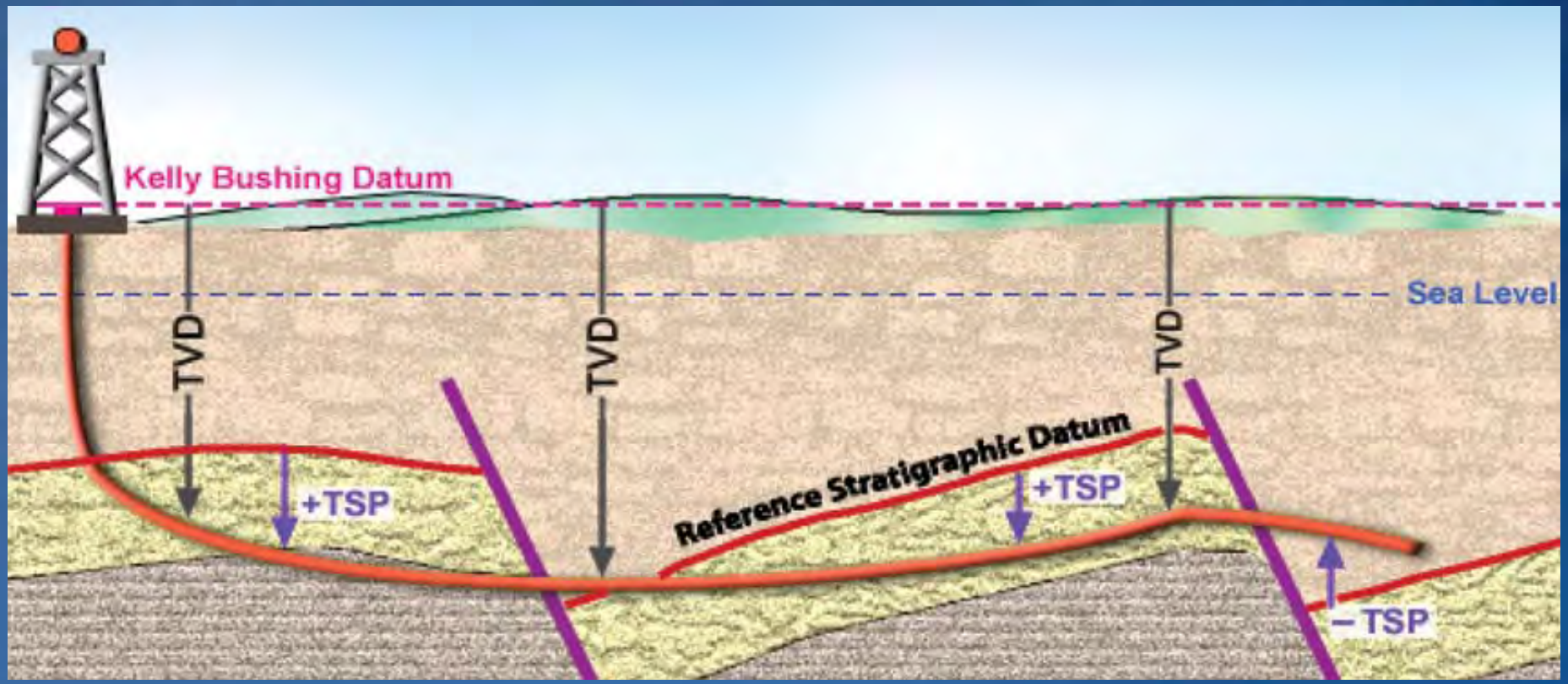
- *New data types in objects we thought were defined*
- *Integration of data that was not thought to be connected*
- *New ways to Report Data*

New Data Types in the wellbore information

Horizontal Wellbores Expose New Data Types and Data Structure

- *Multiple Formation Penetrations with Spatial Location Information*
- *True Stratigraphic Position (TSP)*
  - *Projected formation surfaces relative to the horizontal wellbore*
  - *Petrographic data versus TSP*
  - *Mapping using TSP (Zone Maps)*

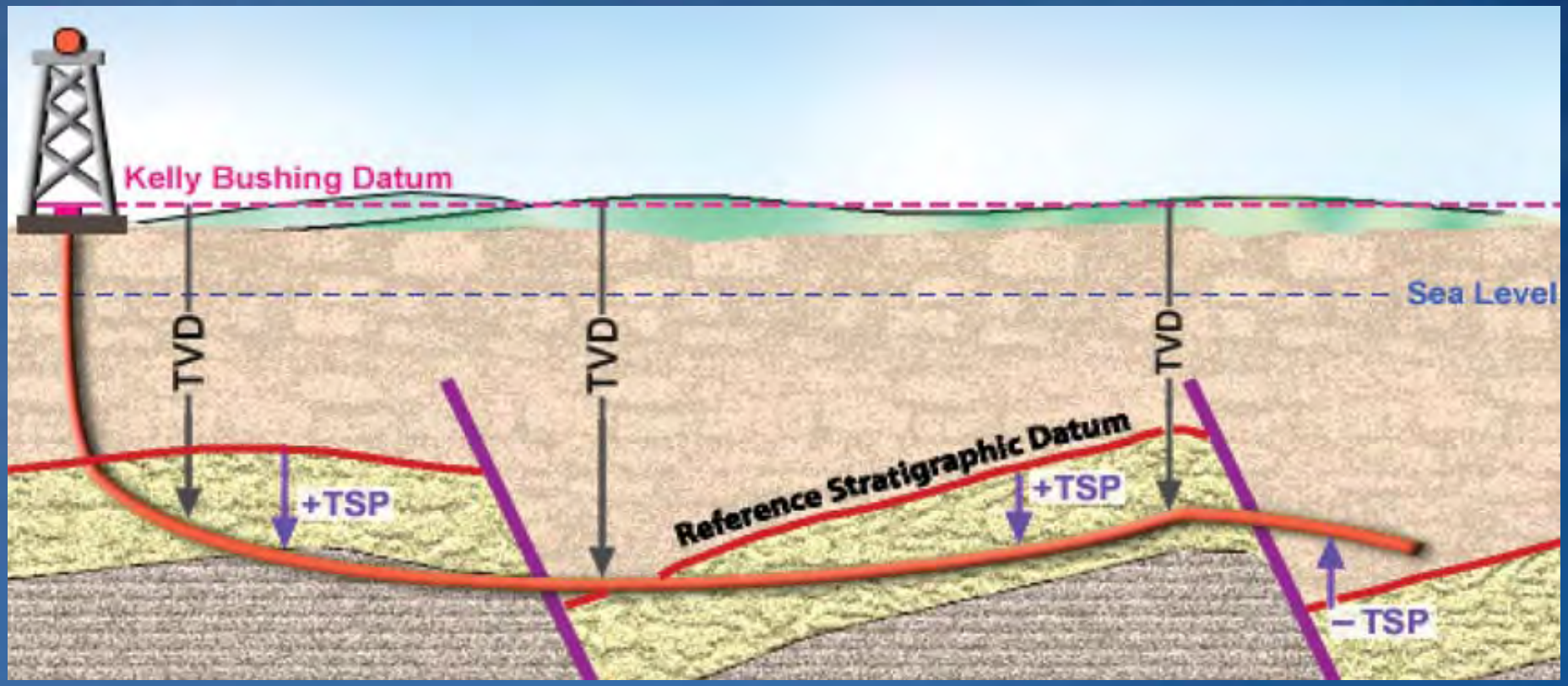
New Data Types in the wellbore information



New Data Types in the wellbore information

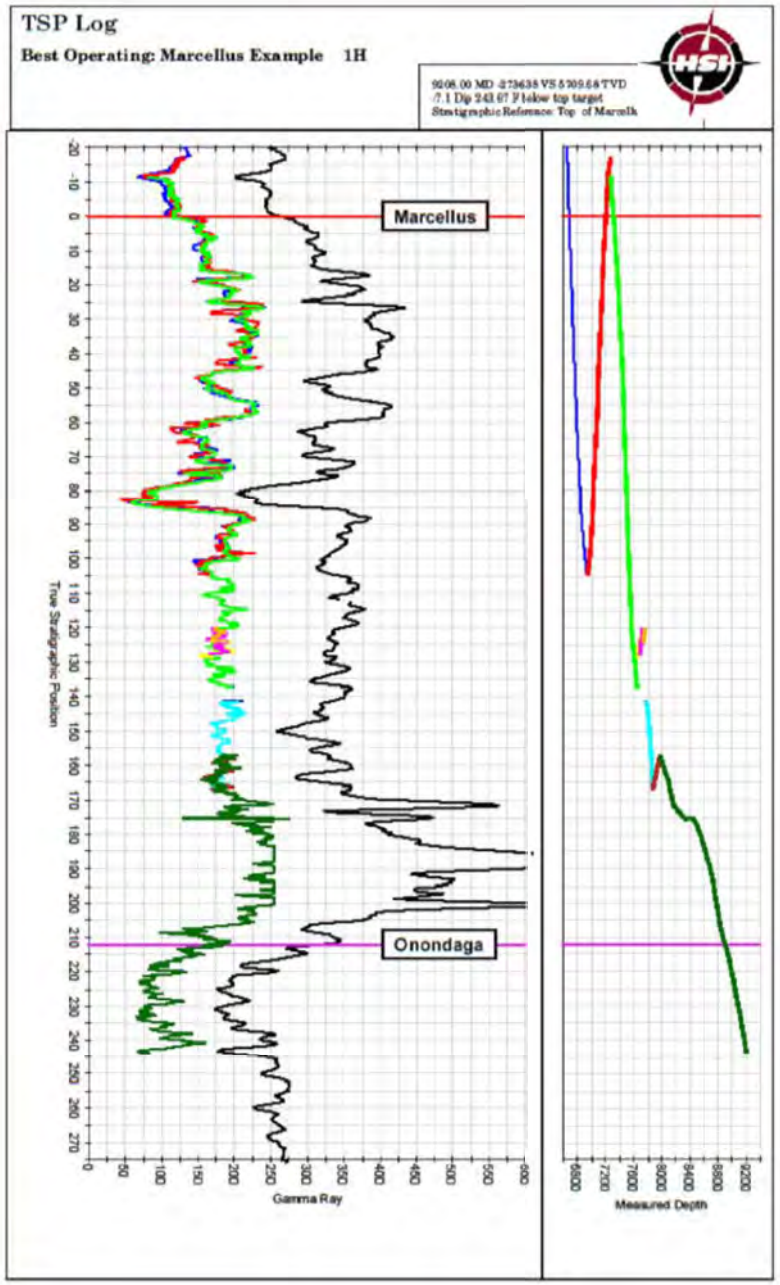
TSP is the position of the Wellbore, relative to a reference Stratigraphic Horizon such as the Top of Target.

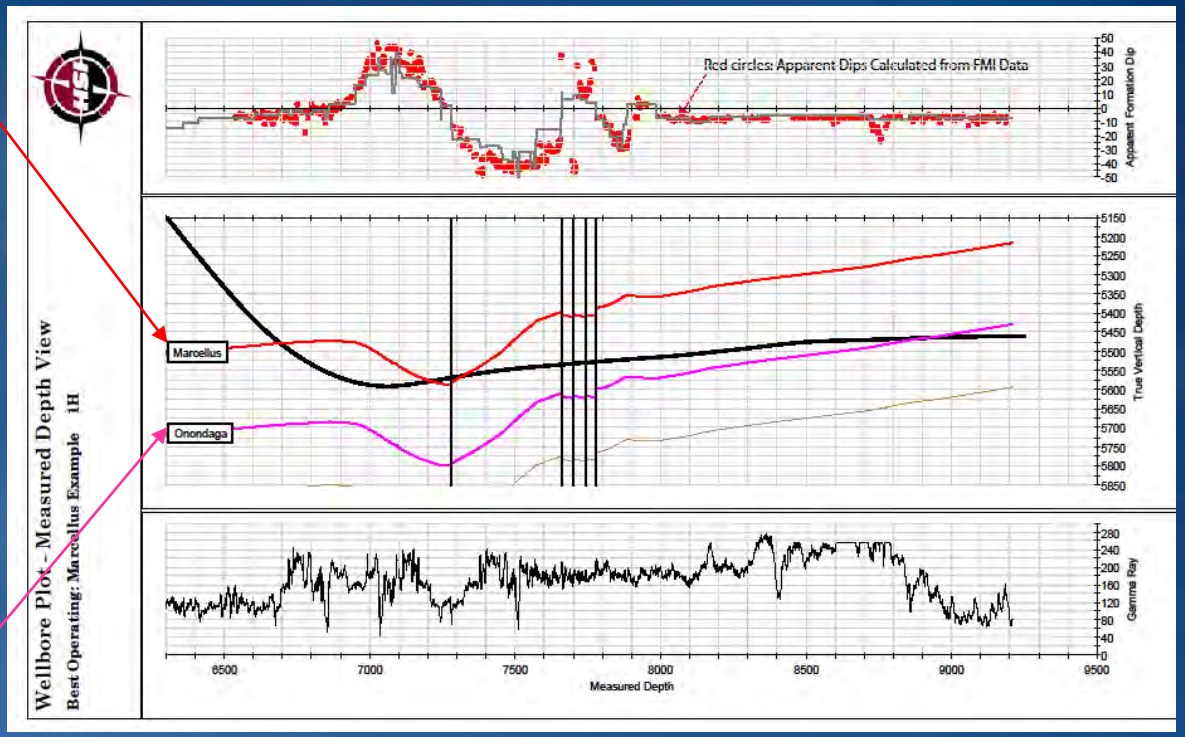
TSP is negative (-) when well is above datum and positive (+) when well is below datum.

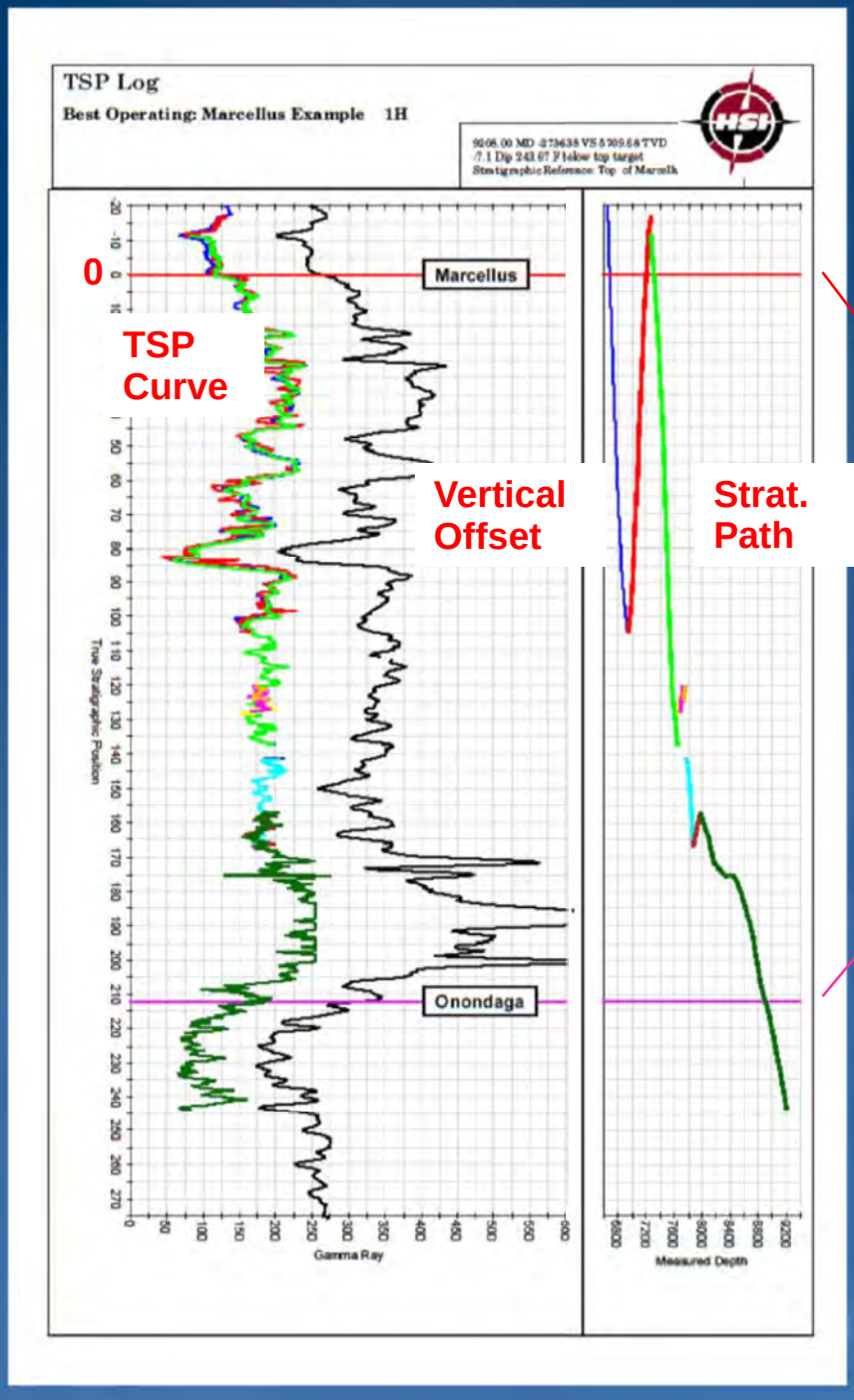


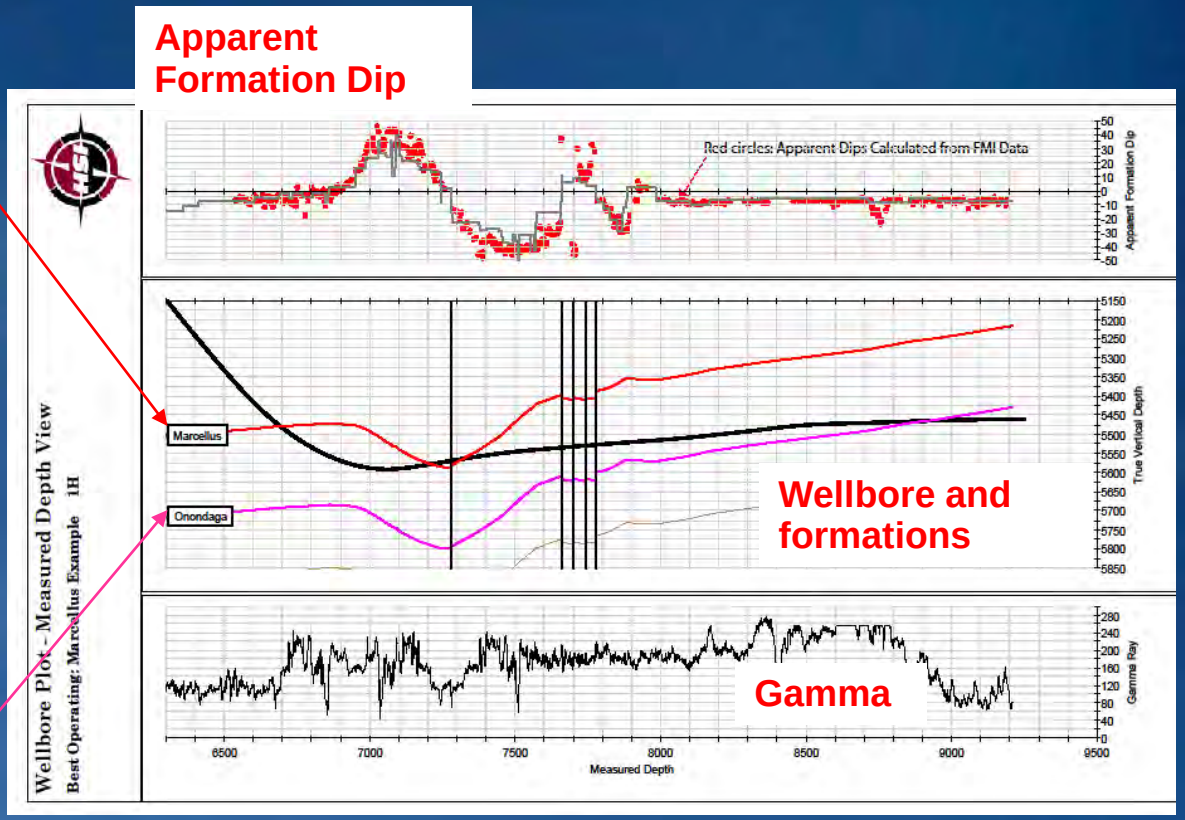
Zero (0)

TVD is the depth of the wellbore below the surface datum


TSP Log
Best Operating: Marcellus Example 1H
Marcellus
Onondaga
True Stratigraphic Position
Gamma Ray
Measured Depth

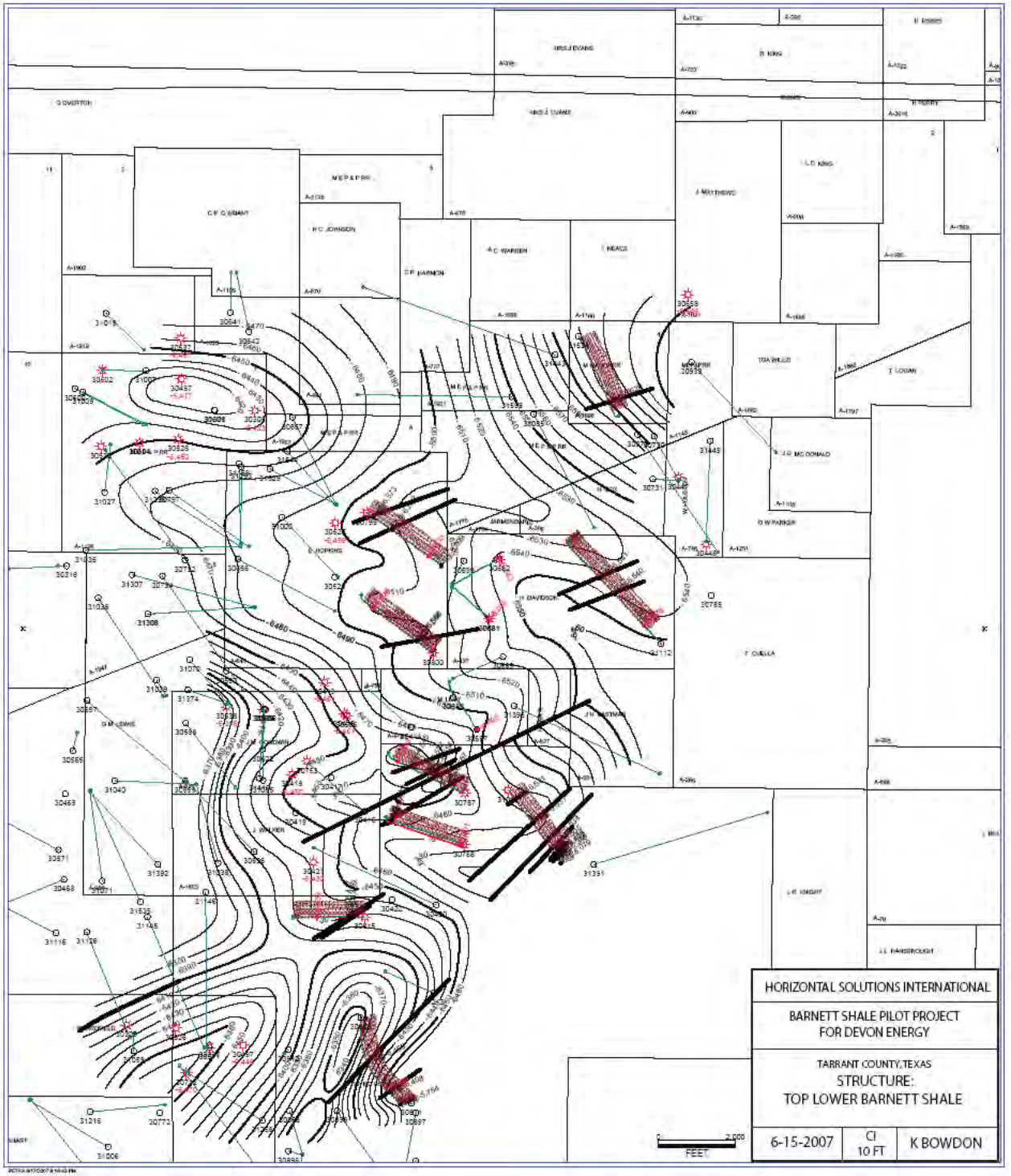

Wellbore Plot - Measured Depth View
Best Operating: Marcellus Example 1H
Red circles: Apparent Dips Calculated from FMI Data
Apparent Formation Dip
Marcellus
Onondaga
True Vertical Depth
Gamma Ray
Measured Depth


TSP Log
Best Operating: Marcellus Example 1H
0
Marcellus
Onondaga
TSP Curve
Vertical Offset
Strat. Path
Gamma Ray
Measured Depth
True Stratigraphic Position


Apparent Formation Dip
Red circles: Apparent Dips Calculated from FMI Data
Apparent Formation Dip
Marcellus
Onondaga
Wellbore and formations
True Vertical Depth
Gamma
Gamma Ray
Measured Depth
Wellbore Plot - Measured Depth View
Best Operating: Marcellus Example 1H

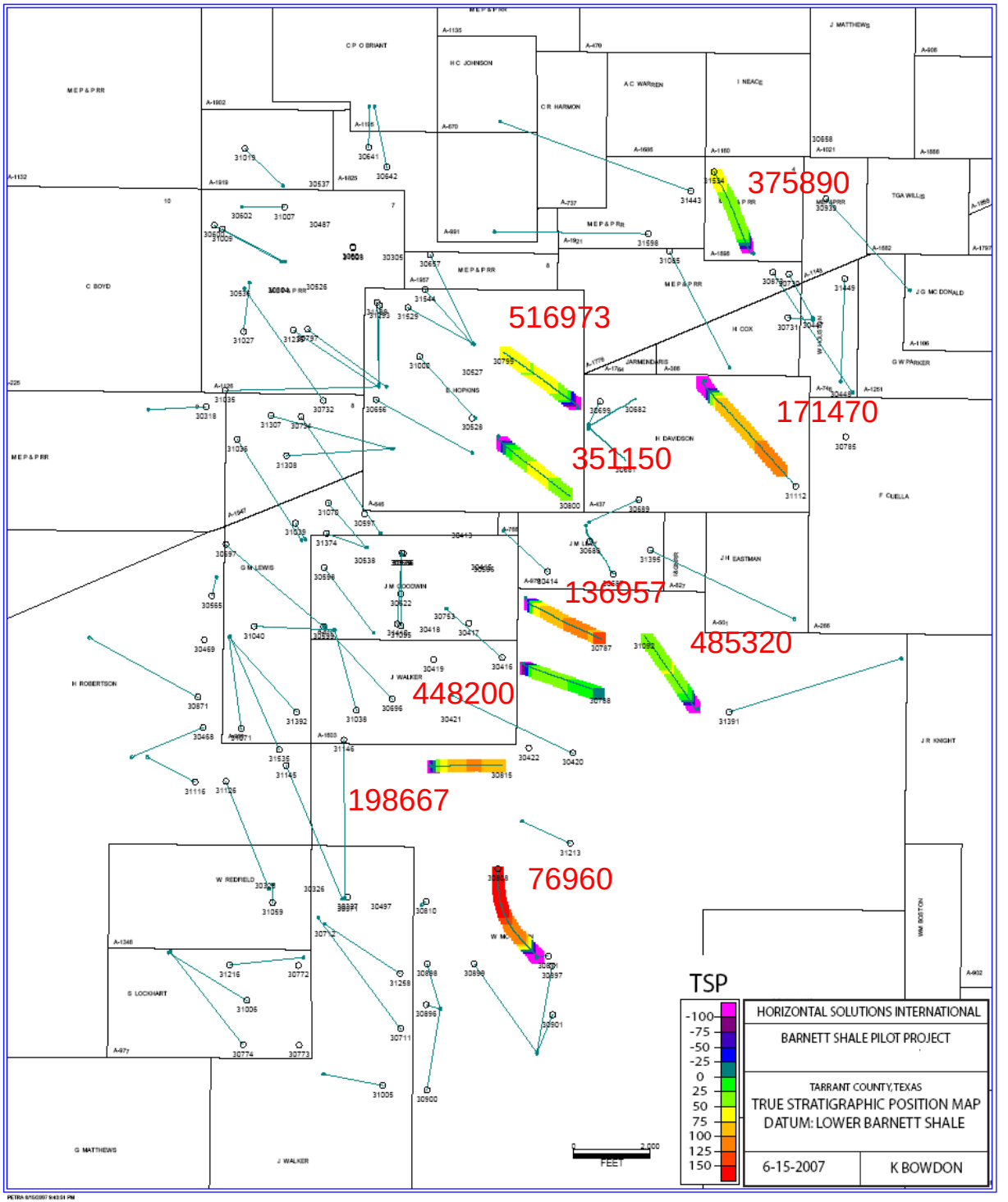
Mapped on Stratigraphic Datum

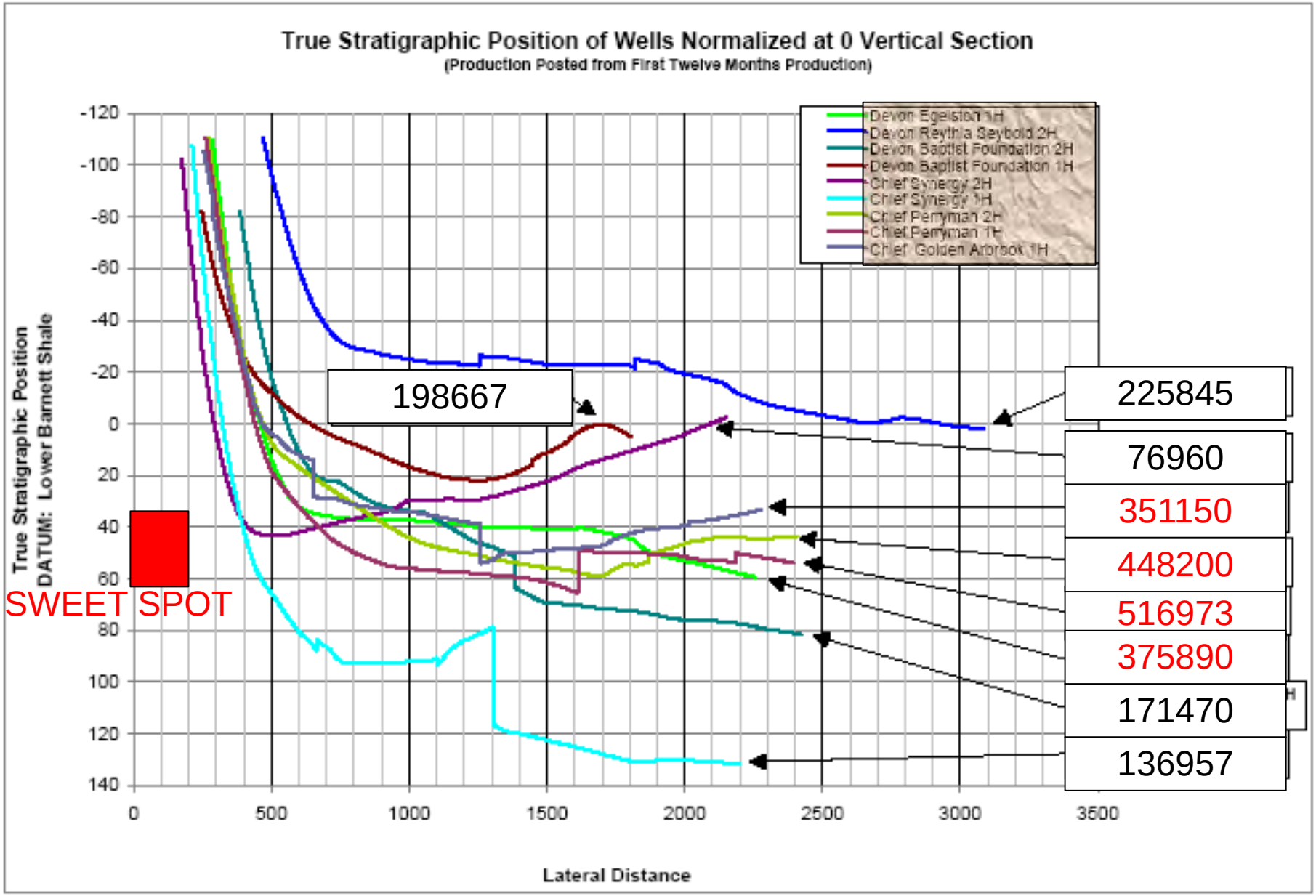
- *Structural data point every 100’*
- *Spatial position of fault plotted*



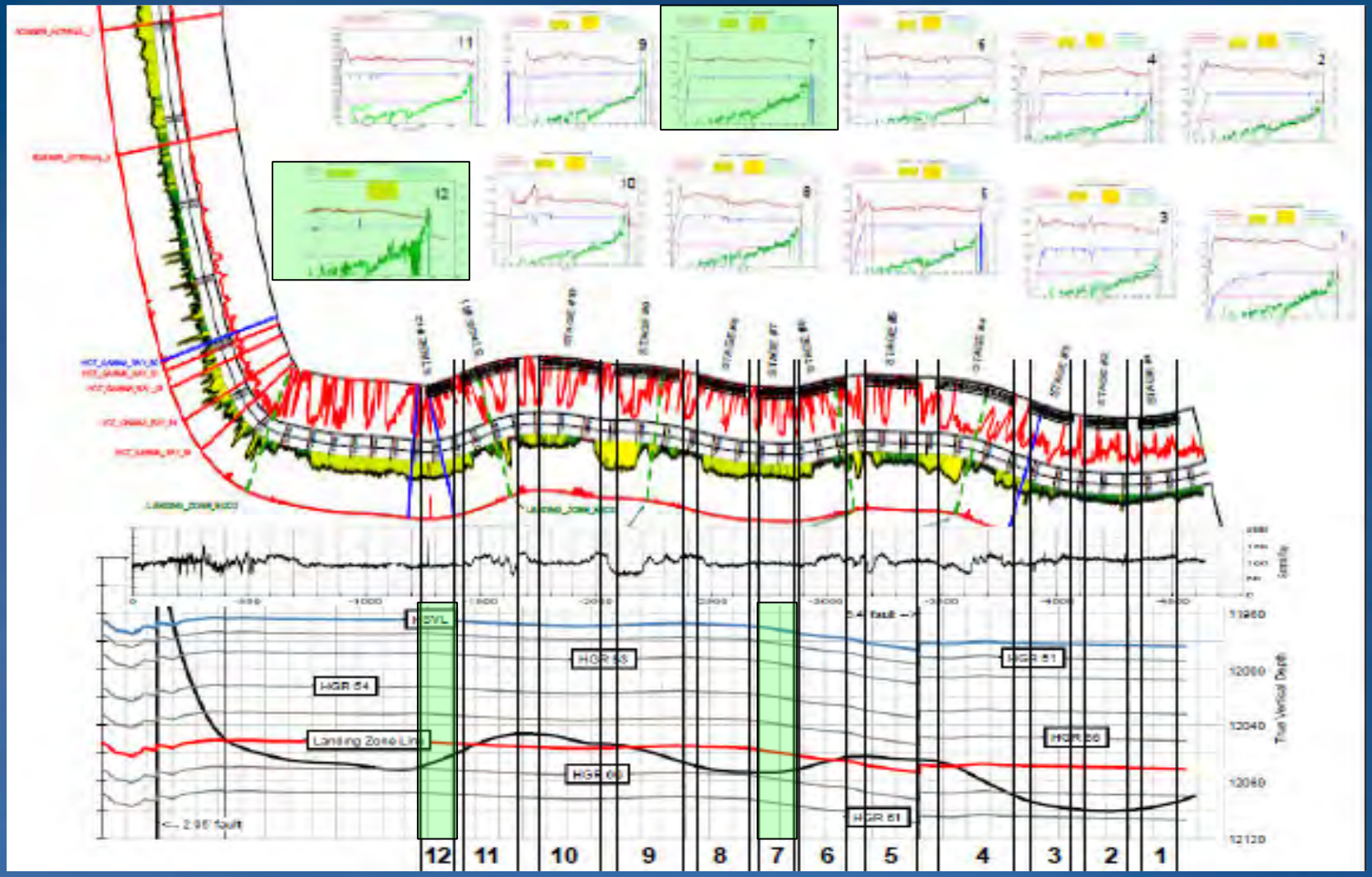
TSP Plotted (Zone Map)

- *Color Spectrum showing TSP*
- *Compare TSP with Production*
- *Target does make a difference*




True Stratigraphic Position of Wells Normalized at 0 Vertical Section
(Production Posted from First Twelve Months Production)
True Stratigraphic Position
DATUM: Lower Barnett Shale
-120
-100
-80
-60
-40
-20
0
20
40
60
80
100
120
140
0
500
1000
1500
2000
2500
3000
3500
Lateral Distance
Devon Egelston 1H
Devon Reyhla Seybold 2H
Devon Baptist Foundation 2H
Devon Baptist Foundation 1H
Chief Synergy 2H
Chief Synergy 1H
Chief Perryman 2H
Chief Perryman 1H
Chief Golden Arbor 1H
198667
225845
76960
351150
448200
516973
375890
171470
136957
SWEET SPOT

Cross-Domain Data Analytics - The Key to Improved Performance



An example of combining reservoir engineering data with geoscience domain data to better understand quantitative performance differences in horizontal frac jobs

Quick Wins and Best Practices - Where do I Start?

1) Data Discovery -
“You can't manage what you don't understand”

2) Automate data transfer processes

3) Standards and Naming Conventions

4) Data ownership and embedded data technicians

5) Make your data rig-centric for operations

6) Leverage the new data types from horizontal wells