

# UNIVERSITY LANDS

## 3D web interface for visualizing complex subsurface well/lease relationships

Draft

ESRI Energy Resources  
GIS Conference

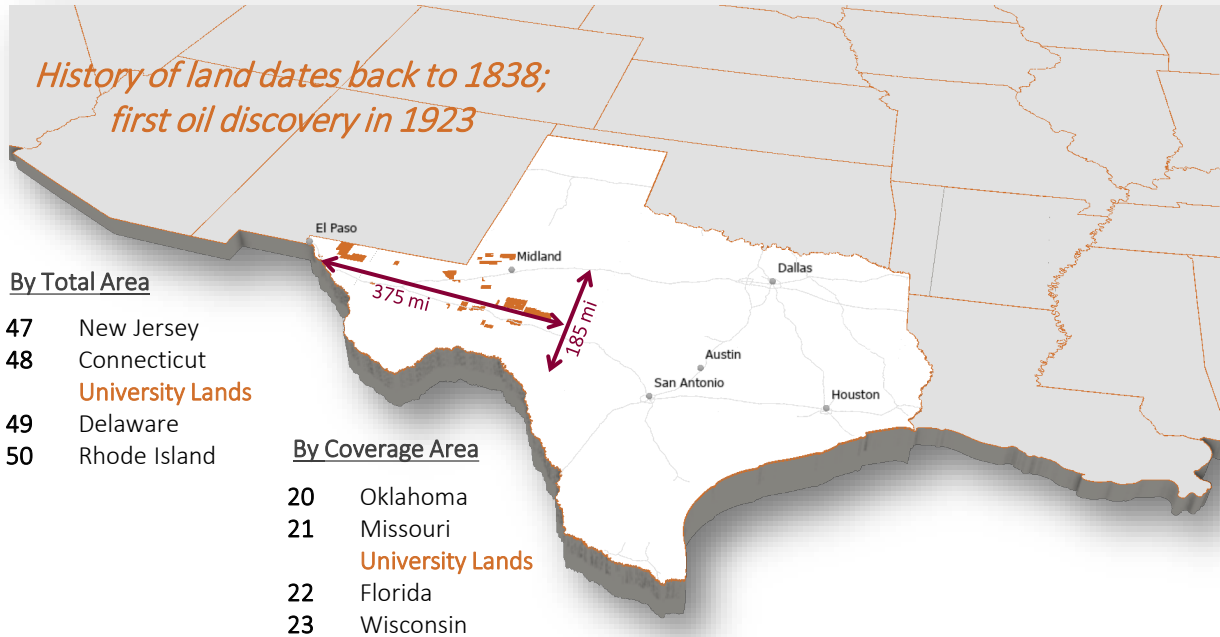
4-5 May 2022



# The PUF & University Lands Organization

University Lands (UL) manages the surface and mineral interests of 2.1 million acres of land across nineteen counties in West Texas for the benefit of the Permanent University Fund (PUF).

The PUF is the largest public university endowment in the U.S. and benefits more than 20 educational and health institutions across both The University of Texas System and Texas A&M University System.



24,400

Wells drilled  
to-date

9,800

Wells currently  
producing

250+

Operators

79,000

Acres of renewable  
energy leases

22,000

Miles of pipeline 7  
powerline easements

## SURFACE LEASES

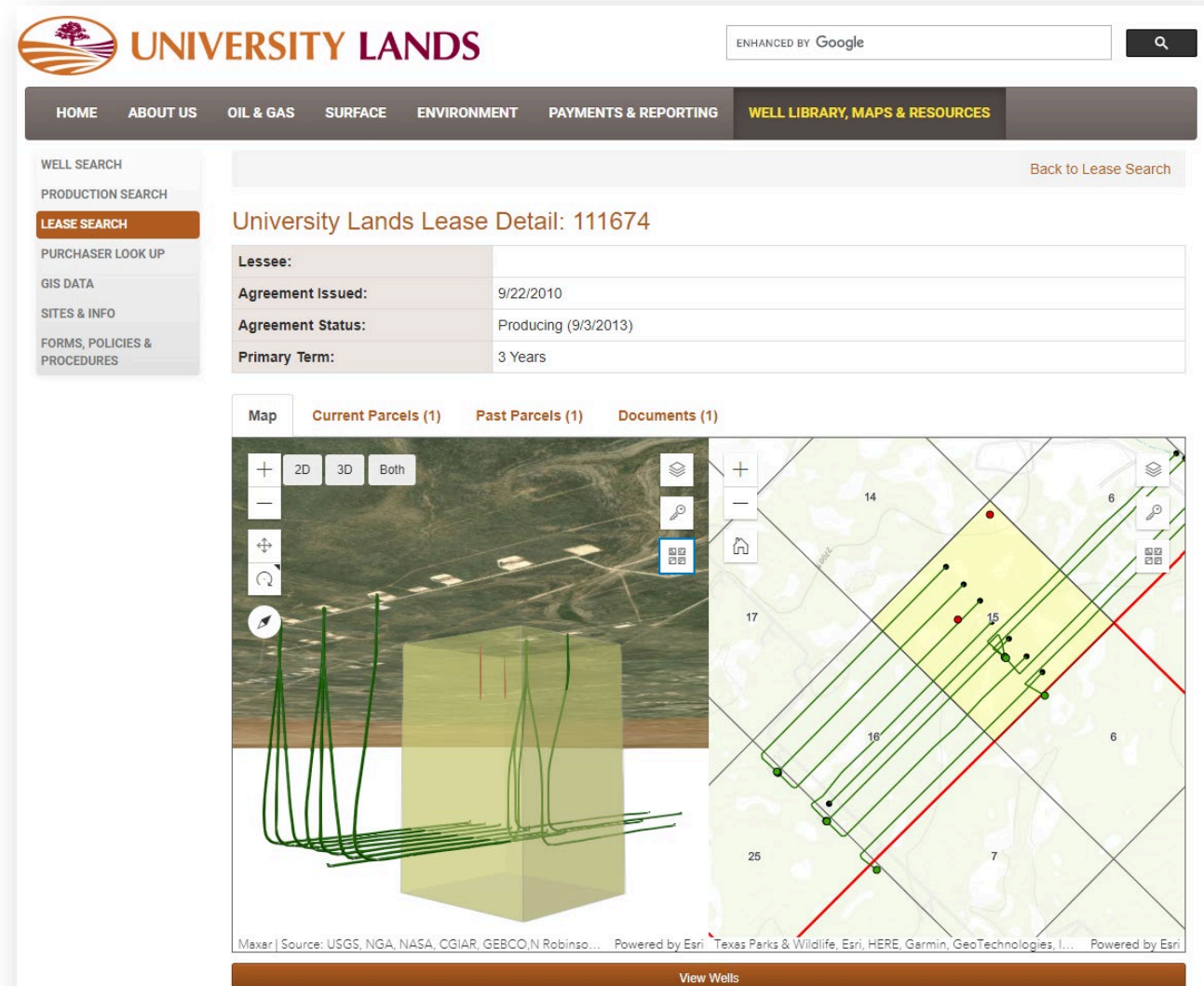
- Pipelines and power lines
- Grazing and ranching
- Renewables – wind and solar
- Groundwater sales
- Environmental programs

Primary revenue driver is  
mineral royalty revenue.

# Project Background - Drivers

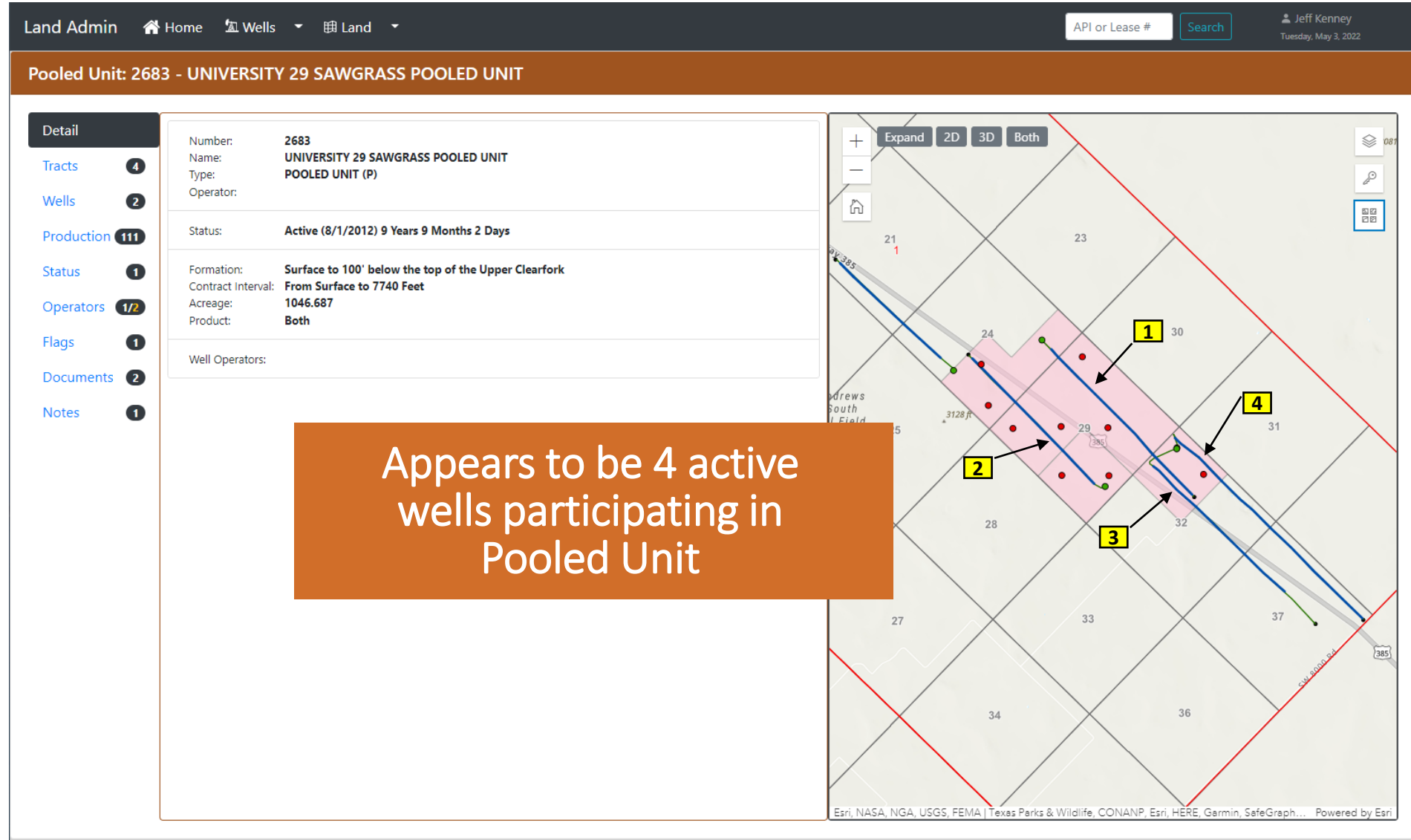
## Horizontal Drilling

- Wells across multiple leases
- Leases severed by depth
- Complex unit agreements

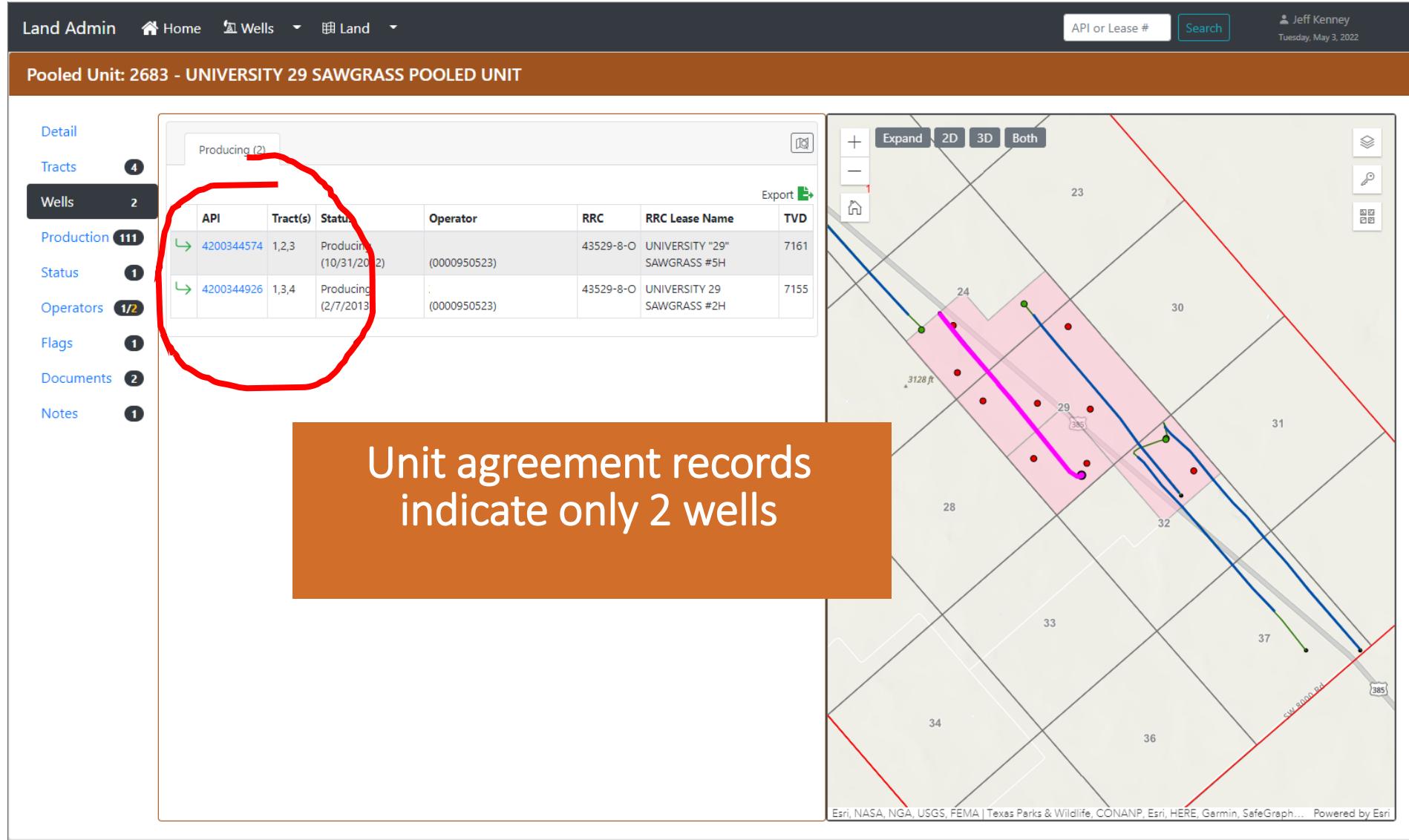




# Visualization Value



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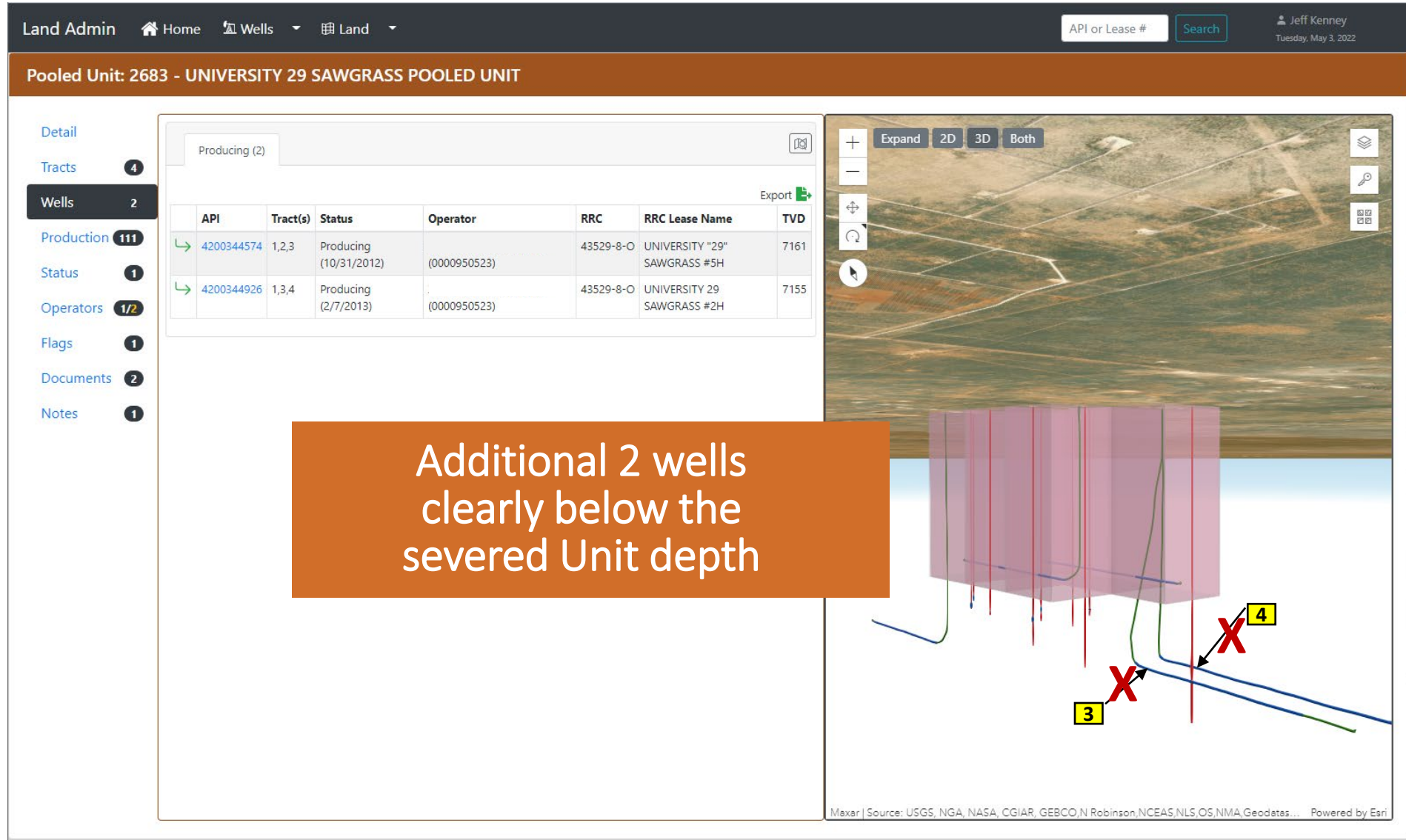
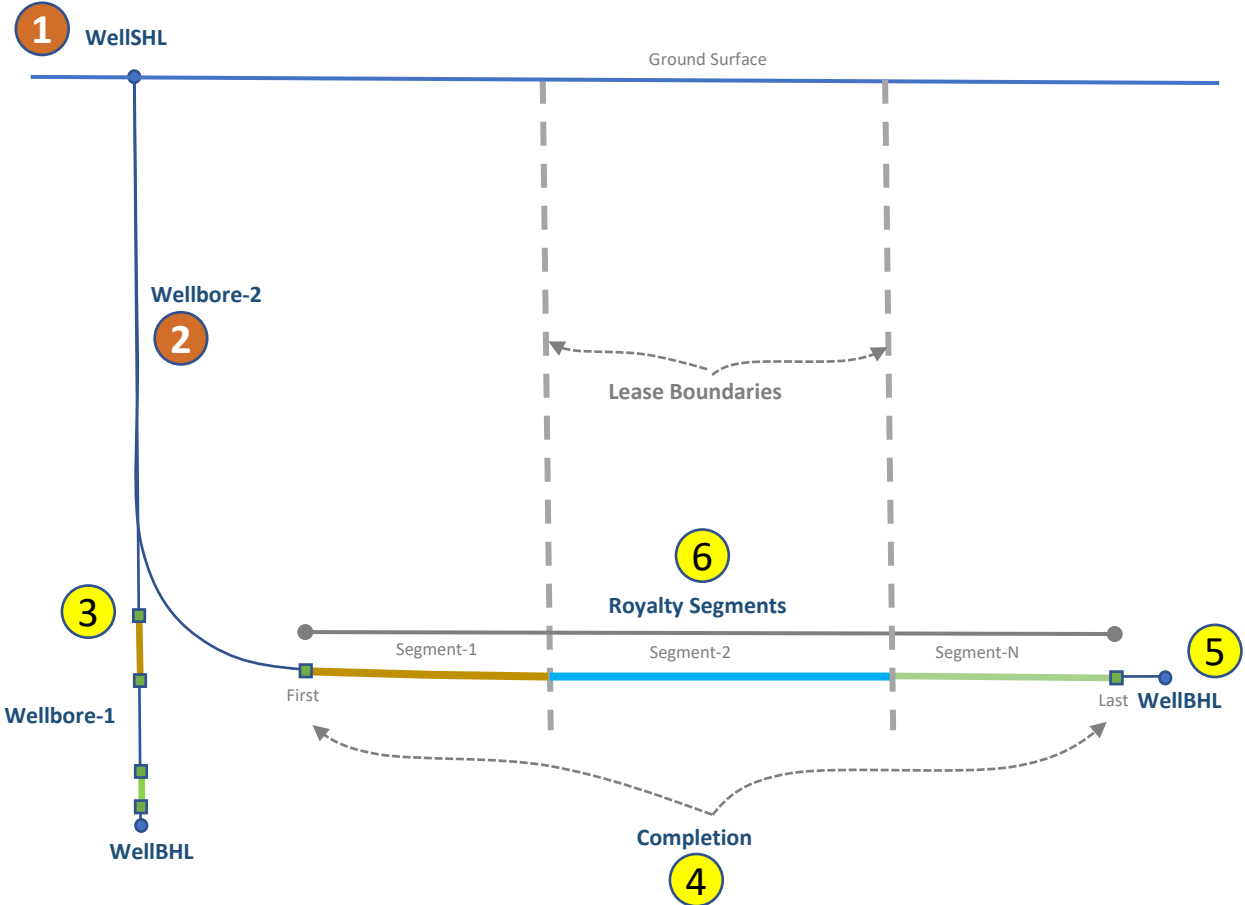


Figure 1

- ## Derivative Layers

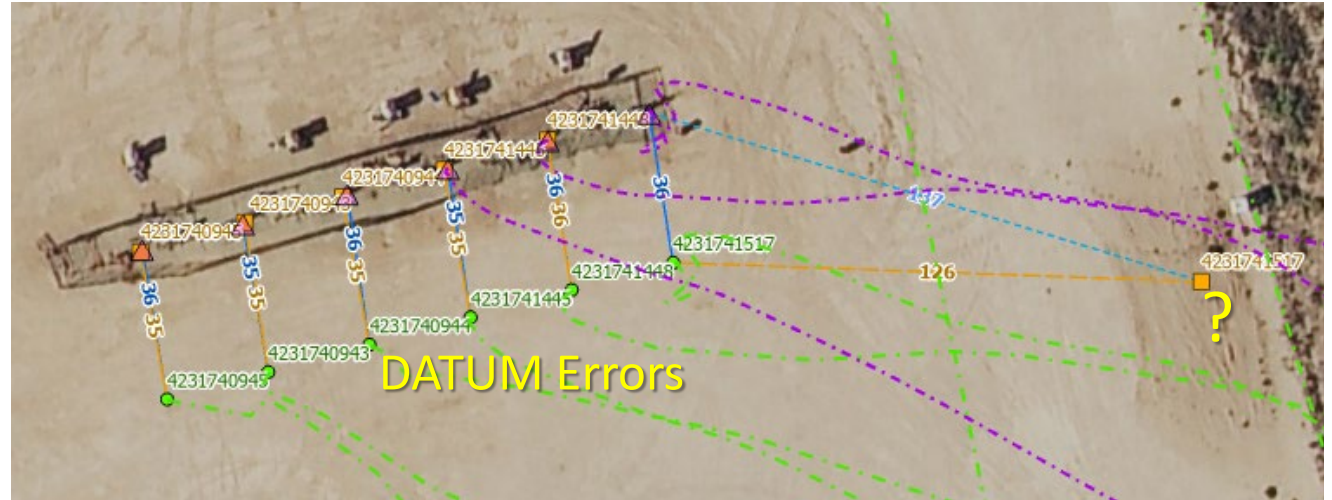
- 6



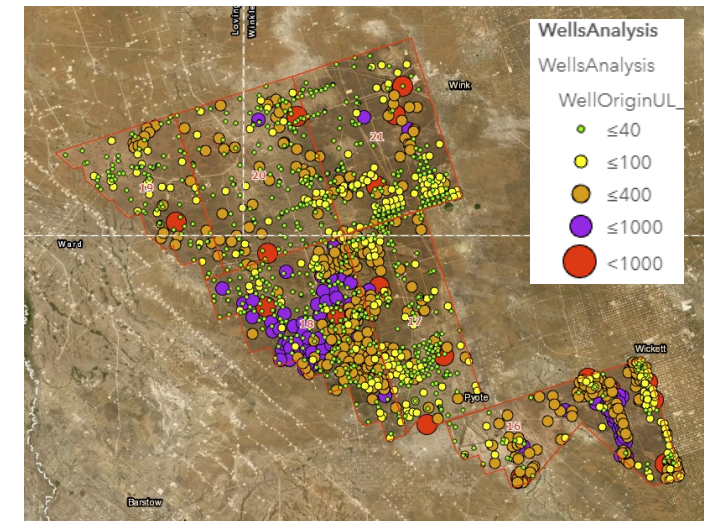
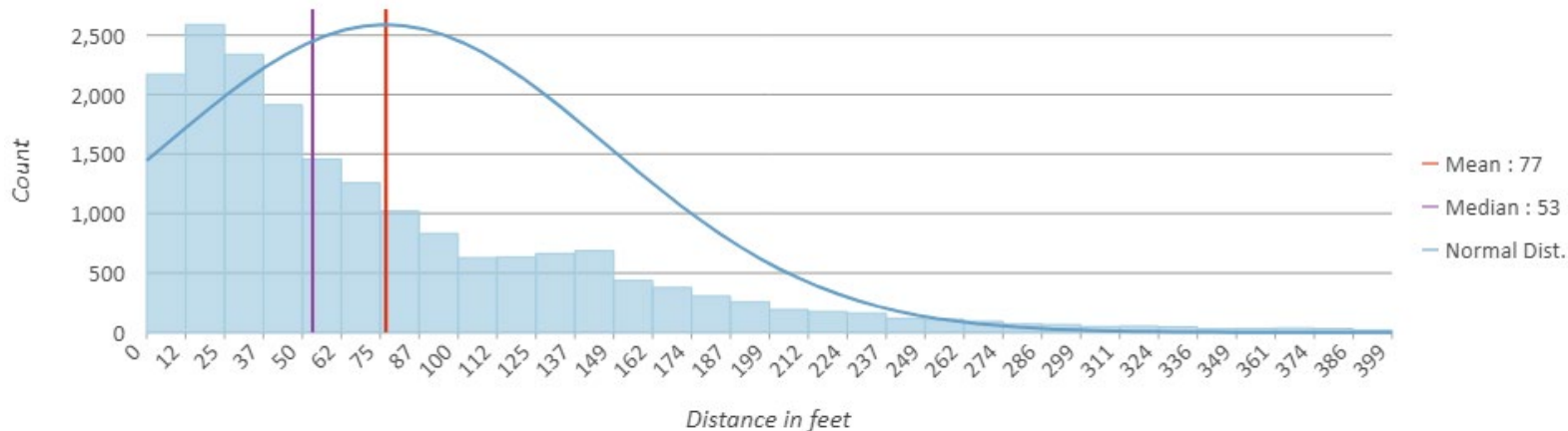
# Challenges – Data Quality

## Location Accuracy

A variety of Surface Hole Location (SHL) discrepancies between different well data sources.



Distribution of Distance - UL to RRC

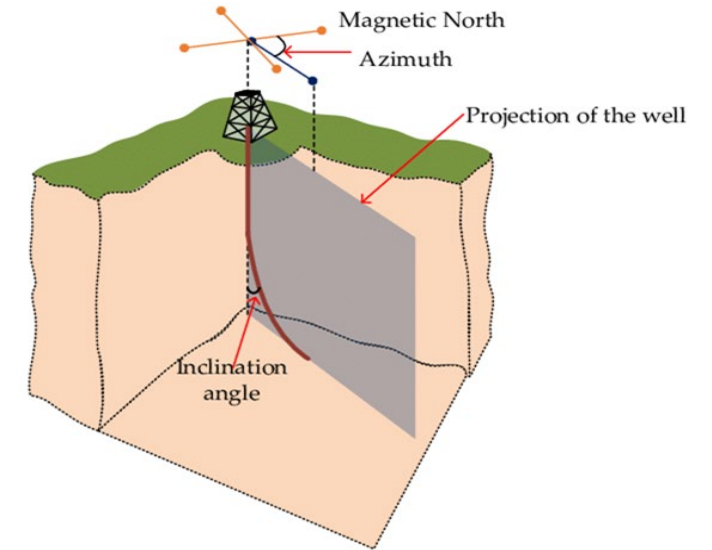
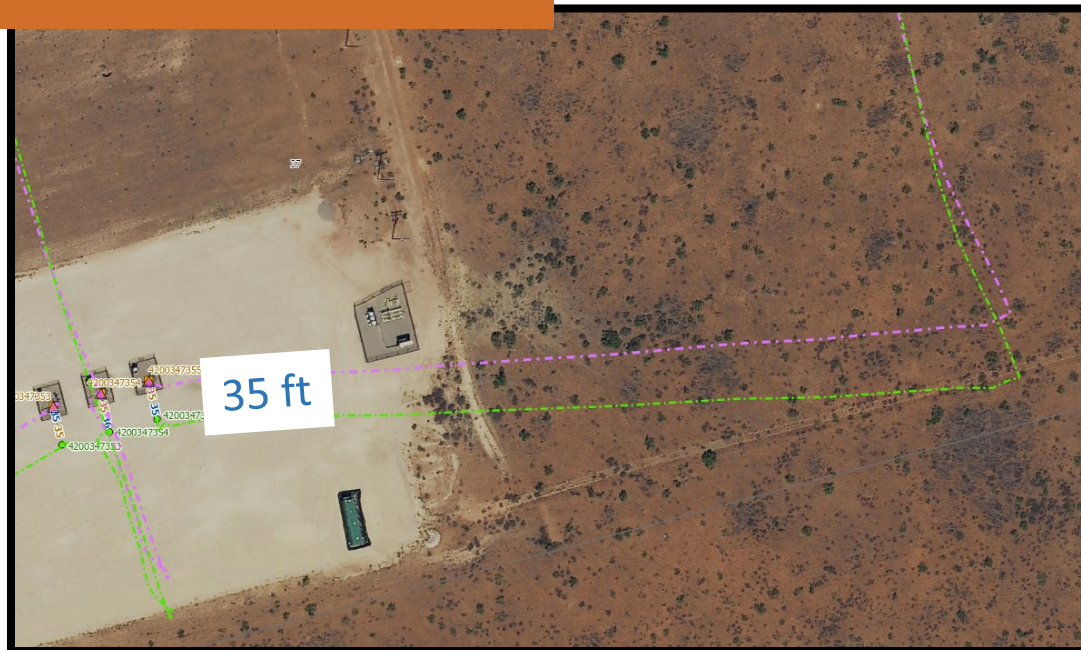
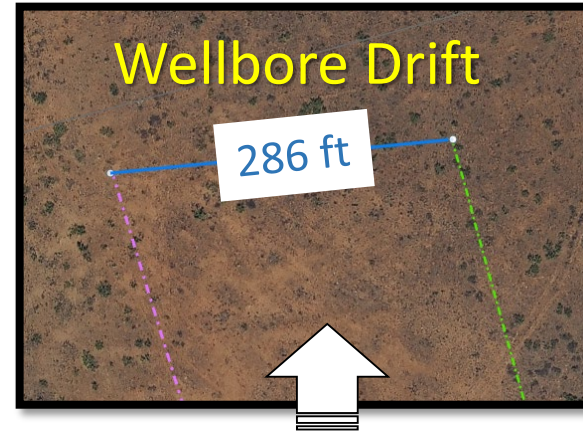




# Challenges – Data Quality

## Wellbore Build Process

Inconsistent in-house methods being used for building 3D wellbore features.



## Orientation (Azimuth & Inclination)

- Magnetic north
- Geographic north (latitude and longitude)
- Grid north [projected coordinate system]

## Measurement Methods

- Tangential
- Balanced Tangential
- Average Angle
- Curvature Radius
- Minimum Curvature

# Challenges – Data Quality

## Attributes

Missing, inaccurate, inconsistent...

## Validation Exceptions

Ground elevation missing

Ground Elevation out of tolerance with DEM

SHL Lat/Lon out of tolerance w/wellbore start node

SHL out of tolerance with other sources

Total Measure Depth (TD) missing

Total Vertical Depth (TVD) missing

TVD > TD

Perf(s) missing

Last Take < First Take

Last Take > Total Depth

Hole Direction missing

Hole Direction inconsistent with Wellbore feature

Etc...

# Responses - Data Quality

1. Master Data Management
2. Spatial Validations (FME)



Authoritative Wellbore Records


# Challenges - Development

Replace embedded maps  
in existing Well & Lease  
search applications

- Limited screen real estate
- How much functionality?
- Mix of 2D & 3D data



# Responses – Development

## Screen Real Estate

Added toggles for different display types

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HOME ABOUT US OIL & GAS SURFACE ENVIRONMENT PAYMENTS & REPORTING **WELL LIBRARY, MAPS & RESOURCES**

WELL SEARCH  
PRODUCTION SEARCH  
**LEASE SEARCH**  
PURCHASER LOOK UP  
GIS DATA  
SITES & INFO  
FORMS, POLICIES & PROCEDURES

Back to Lease Search

### University Lands Lease Detail: 111453

Lessee:	JAGGED PEAK ENERGY ET AL
Agreement Issued:	9/22/2010
Agreement Status:	Producing (12/22/2015)
Primary Term:	3 Years

Map Current Parcels (1) Documents (1)

Map view toggle: 2D (selected), 3D, Both

Map showing lease area (yellow) and surrounding parcels (numbered 8, 9, 11, 12, 13, 29, 30, 31, 43, 44, 45). WINKLEY WARD is labeled.

Bureau of Land Management, Texas Parks & Wildlife, Esri, HERE, Garmin, GeoTechnologies, Inc., USGS, METI/NASA, EPA, USDA

Powered by Esri

View Wells

# Responses – Development

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Map Current Parcels (1) Documents (1)

2D 3D Both

Maxar | Source: USGS, NGA, NASA, CGIAR, GEBCO, N Robinson, NCEAS, NLS, OS, NMA, Geodestasyrelsen and the GIS User Community | Esri, HERE, G... Powered by Esri

View Wells

# Responses – Development

## Screen Real Estate

Added toggles for different display types

The screenshot displays the University Lands website interface. At the top, the logo and navigation menu are visible. The main content area shows the 'University Lands Lease Detail: 111453' with a table of lease information. Below this, there are tabs for 'Map', 'Current Parcels (1)', and 'Documents (1)'. The 'Map' tab is active, showing a 3D view of the lease area. A blue arrow points from the 'Screen Real Estate' text to the 3D map toggle.

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Map Current Parcels (1) Documents (1)

2D 3D

Earthstar Geographics | Source: USGS, NGA, NASA, CGIAR, GE... Powered by Esri Bureau of Land Management, Texas Parks & Wildlife, Esri, HERE... Powered by Esri

View Wells



# Responses – Development

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Map Current Parcels (1) Documents (1)

2D 3D Both

**Lease Number 111453**

Lessee: JAGGED PEAK ENERGY ET AL  
Status: Producing  
County: Block: 17  
Section: 11  
Qtr/Qtr: E2,SW  
Top Depth: 0  
Bottom Depth: 99999  
Mineral Acres:  
Dat Search Map: [Map App](#)

Earthstar Geographics | Source: USGS, NGA, NASA, CGIAR, GE... Powered by Esri

View Wells

## Functionality Hand-off

Passes feature selections between embedded maps and GIS applications

**Oil & Gas Lease: 111453**

MapLesseeName	JAGGED PEAK ENERGY ET AL
LeaseStatus	Producing
DateBeginning	12/21/2015
BlockNbr	17
SectionNbr	11
QtrQuarter	E2,SW
DepthTop	0
DepthBottom	99,999
Availability	Leased

Zoom to \*\*\*



# Responses – Development

## Mix of 2D & 3D data

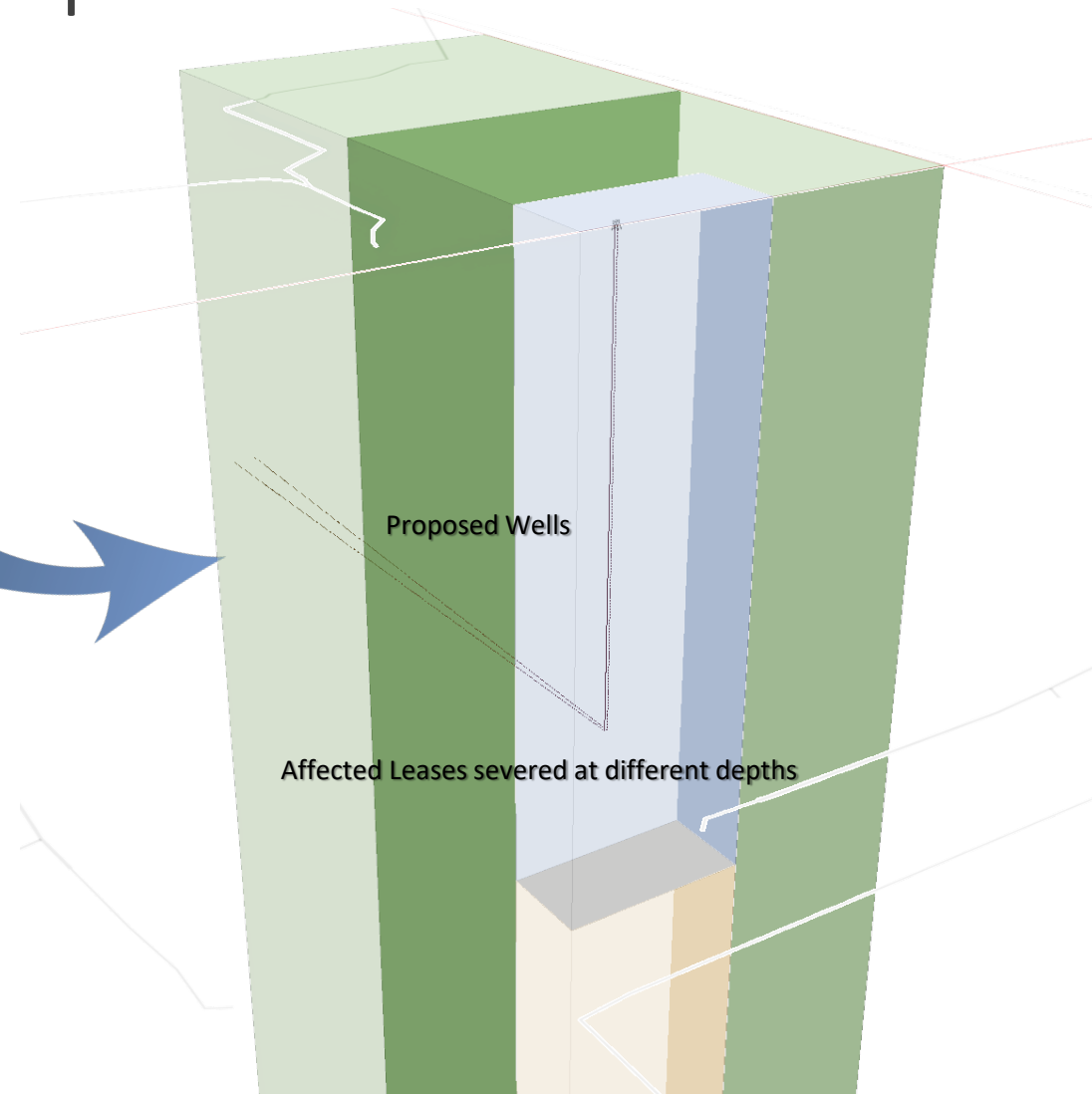
Needed to migrate all Well & Lease related features to accommodate 3D analysis

## Available Leases

Not stored in our Land Admin

## Permitted Wells

3D lines vs 2D draped on surface



# Key Take-Aways

1. Under estimated the data engineering effort
  - FME critical component
2. Pleasantly surprised with ArcGIS Enterprise
  - 3D web visualization performance out of the box
3. 3D visualization provides business value
  - if for no other reason than improved data quality

# Going Forward

## Validation

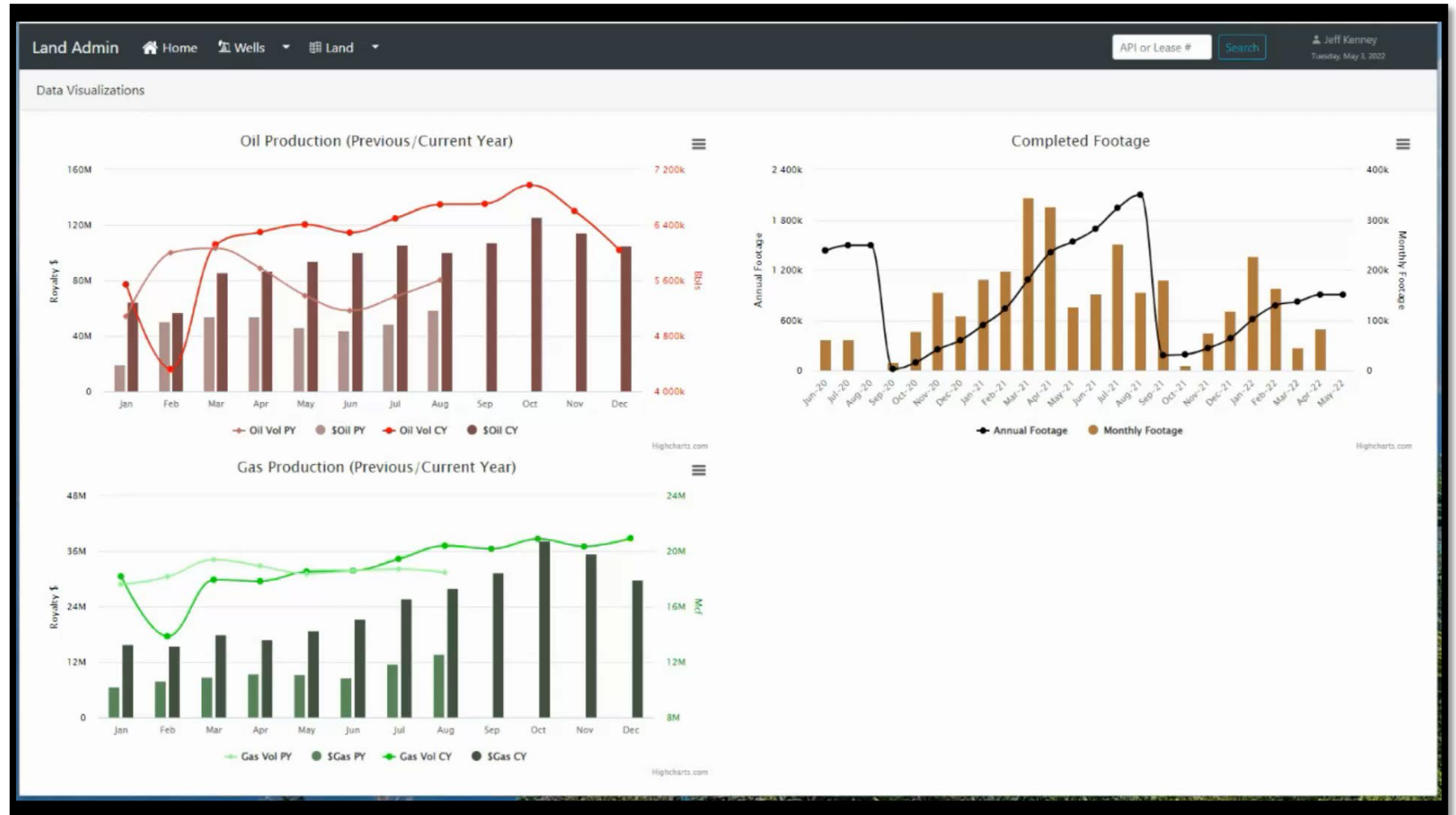
Expand on automated spatial validation

## Visualization

Incorporate data quality factors into display

## Cleanup

Embedded tools for in-place corrections



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