Introduction

In the past years multiple U.S. operators have sold most of their conventional assets in order to finance their multibillion Oil and Gas shale projects (Erlingsen, 2017) as well as to cover debt obligations. Due to the rapid nature of these transactions, large volumes of data have been transferred from one company to another in different types of formats and structures.

During the acquisition of the subject field, multiple files containing geological, production, reservoir and completion data were delivered to the purchaser in both digital and hard copies. The objective of this project is to show a rather simple workflow to integrate this data to identify and evaluate the unquantified upside of the asset.

Workflow Summary

The workflow has been summarized in the following diagram and the details and each step will be described below

Field Regional Geological Setting

The Field lies along the Wilcox trend (Figure 1) that runs NE to SW on the northern Gulf of Mexico coastal plains. The main structure is a four-way closure bounded by 2 major down to the coast faults and the main reservoirs are in a marine dominated deltaic system with sand thickness that varies from 5 to up to 300 feet (Figure 2).

![Figure 1. The field is located on the northern coastal plain of the Gulf of Mexico Basin (Modified after Hackley, 2012) following the NE-SW Wilcox productive trend.](image-url)
The reservoir depths range from 8,000’ down to 14,000’ and based on rock properties, hydrocarbon type, completion methodology and pore pressure the total productive thickness has been separated into 3 main intervals Upper, Medium and Lower Wilcox, the table 1 summarizes each individual category and its respective properties.

<table>
<thead>
<tr>
<th>INTERVAL</th>
<th>AVG DEPTH (Ft)</th>
<th>AVG GROSS (Ft)</th>
<th>POROSITY (%)</th>
<th>PERMEABILITY (mD)</th>
<th>HYDROCARBON TYPE</th>
<th>PORE Pressure (PSI/ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPPER</td>
<td>9,000</td>
<td>500</td>
<td>5 - 25</td>
<td>1-50</td>
<td>Oil</td>
<td>0.43</td>
</tr>
<tr>
<td>MEDIUM</td>
<td>11,000</td>
<td>3,000</td>
<td>5 - 15</td>
<td>0.1-10</td>
<td>Gas &amp; Condensate</td>
<td>0.43</td>
</tr>
<tr>
<td>LOWER</td>
<td>13,500</td>
<td>1,000</td>
<td>5 - 15</td>
<td>0.01-1</td>
<td>Dry Gas</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Table 1. summary of reservoir Properties for each interval.

**Production Data Base**

The field was originally discovered in the 1940’s, however its major development took place between the 80’s and mid 90’s reaching peak production in the early 2000’s; a fewer wells and recompletions were done before its divestiture without a significant production uplift.

To be able to understand the productivity from each interval, previously defined in table 1, a data base was created by gathering proprietary daily production volumes (digital and hard copies) as well as public records (DrillingInfo), well tests, completion intervals, completion dates and wellbore histories. The main challenge during this step, as noticed in some previous work (Weber, 1999), was to isolate production performance for individual wells and sands...
before commingling operations, however this was achieved as accurate as possible by reviewing each individual well history (Figure 3).

![Graph A and B](image)

**Figure 3.** Graph A shows the uncategorized production of Well 1 that has produced ~ 277 MBOE. This production is then tied to completion depths, sands and dates to obtain Graph B. The production breakdown shown on B offers considerable information such as individual sands IP’s and EUR’s that can eventually be linked to reservoir and geology. The individual production performance for each sand would also help engineers that will need to plan for the proper completion techniques to reach efficient recoveries.

**Geological Data Base**

This data base consists of a summary of reservoir properties such as porosity, water saturation, reservoir thickness and pay sections that were obtained following a basic petrophysics workflow. Most of the well log LAS files were acquired from a service provider and data such as cores and DST, when available, were captured from well files.

A redefinition of productive reservoirs needed to be done since most of the petrophysics evaluations were done by analysts many years ago when the field was more active. The first step of this workflow consisted on selecting key wells with good data across the field to create Pickett plots with (Pickett, 1973), then adjust these plots using production numbers to identify productive sands characteristics and, sands that were completed and produced mostly water (Figure 4A). Sequentially, using the results from above, a controlled algorithm was created and applied to all wells to find potential productive sands within the limits of each interval, Figure 4B shows an example well after model was applied. Finally, a list of all wells with all productive sands and their respective properties were captured and listed for potential tests.

**Evaluation and Results**

By combining both data bases we were able to identify an upside that can be defined as multiple recompletion opportunities behind pipe and their potential recoverable volumes, undrained regions that may represent future drilling opportunities and new reservoirs that can not be easily mapped due to their complex stratigraphy.

To prove the potential reserves identified as behind pipe potential and to test the reservoirs not previously mapped a recompletion program was planned and executed for the top interval of the field.
Figure 4. Graph A shows a very simplified water saturation plot for Well 1 and a short section of its well logs. The scatter orange markers represent the completed sands whose production was identified in Figure 2B. Based on these sands properties, a program was run to find similar properties vertically and across the field and the result is shown on the track 4. The PROD curve displayed on green displays the completed depths as well as potential sands behind pipe. Figure B shows a well that was evaluated using the controlled algorithm, and eventually tested during the recompletion program, its initial production was better than expected above 100 BOED and currently showing low decline.

Conclusions

The creation and integration of the production and geological databases helped the company to identify an unquantified upside that added significant reserves to its portfolio. The recompletion program was able to prove the additional reserves from the top interval, and subsequent programs are on progress to continue to delineate the reserves from the deeper intervals.

References


