

Title: Characterization of Produced Water In New Mexico
PI: Martha Cather
Institution: Petroleum Recovery Research Center/New Mexico Tech

Project Description:

The Petroleum Recovery Research Center (PRRC), a division of the New Mexico Institute of Mining and Technology, compiled data on quality and quantity of produced water (water produced as a byproduct of oil and gas production) into the NM WAIDS database. This database encompassed information on water quality/quantity in various producing regions of the state. Purposes of the original database included assessments of the amount and quality of produced water to support the design of water treatment systems to promote the use of produced water. Work on the database ceased about 10 years ago. The database is now out of date, and online access to the database is currently not available. The proposed project would update the NM WAIDS database, bring the database online, provide GIS user-friendly functionality and analysis tools, and identify and attempt to fill in data gaps in newly active plays in the San Juan and Permian basins.

The NMWAIDS database was taken offline in 2013 due to concerns about the security of the web pages and queries that accessed the database. In the ten years that have elapsed since the database was first put online, cyber security has become an increasingly important consideration and the old interface was becoming highly vulnerable. In addition, there is a need to obtain more data. Several oil and gas plays have come to the foreground since the bulk of the data was collected, including new horizontal plays in both southeast and northwest New Mexico.

Methodology:

The project objectives are:

- 1) Reactivate access to the current water quality/quantity database by recoding the web interface using current best practices,
- 2) Examine the existing produced water database to identify data gaps and make efforts to fill in those gaps,
- 3) Provide data access via online search queries, both text-based and through an online GIS based system if possible. Sufficient location information will be provided to enable users to map data in their own systems via a common format such as GIS shapefiles.

Results:

Major efforts in the quarter focused on cleaning data, obtaining, additional data, community outreach, and analysis.

Data cleaning

Approximately 215 samples in the NM WAIDS database that was online for ten years were lacking in any kind of identification information (API), or they had incorrect information that prevented them from being located in a GIS system. Most of these problems were due one of three reasons:

1. Wells were misidentified as being in New Mexico when they were actually in Colorado. A number of the original scanned forms had incorrect or confusing information, and while data on the forms was described as being in NM, or belonging to a field office in NM, the data was from wells in southern Colorado. Well names are not always unique; there are many wells with names such as State #1, or Ute #3. The advent of online well file images, along with better GIS availability for both NM and CO has helped sort out some of these problems. About 30 wells remain to be corrected.
2. Well information was incorrectly scanned and OCR'd. Forms were scanned and then converted to text using an Optical Character Recognition (OCR) program. Occasionally the OCR or scanning programs failed to correctly identify text and data that should have been located in (for example) T37E was listed as being in T3E. This, combined with subsequent well name changes, made correct identification of these wells nearly impossible. Once again, the availability of online well records and good search engines has made this possible - if any other useful information, such as a pool name or an old well name was recorded, use of search engines often enabled us to correctly identify the well.
3. All well information was correct but the names were old well names and other information has not been unique enough. These have proven to be the most difficult problems to correct and some of these may not be fixed.

In addition to these listed problems there are also likely remaining issues where wells were incorrectly identified. Examples might include

- A well with a non-unique name that is found both CO and NM, or two locations in NM and the data would actually refer to one well and we assumed it belonged to the other.
- Some data is actually from pits or batteries that serve several wells in a region
- Some of the numerical data was converted to text incorrectly and not caught in one of the original quality control efforts.

Obtaining additional data

A large set of new data was provided by one of our industry partners. This included data for about 2200 unique wells and 3900 records. 960 of these wells are new to the produced water database. One of the major advantages in this data set is that almost 2/3 of the samples were collected after 2001, and about 1300 of the samples were collected after 2013. Of these samples, about a thousand have the sampled formation identified. Many are from the Bone Spring, Avalon, Wolfcamp, and Delaware Mountain Group units, which are all newly-active plays that are under-represented in the older NM WAIDS database.

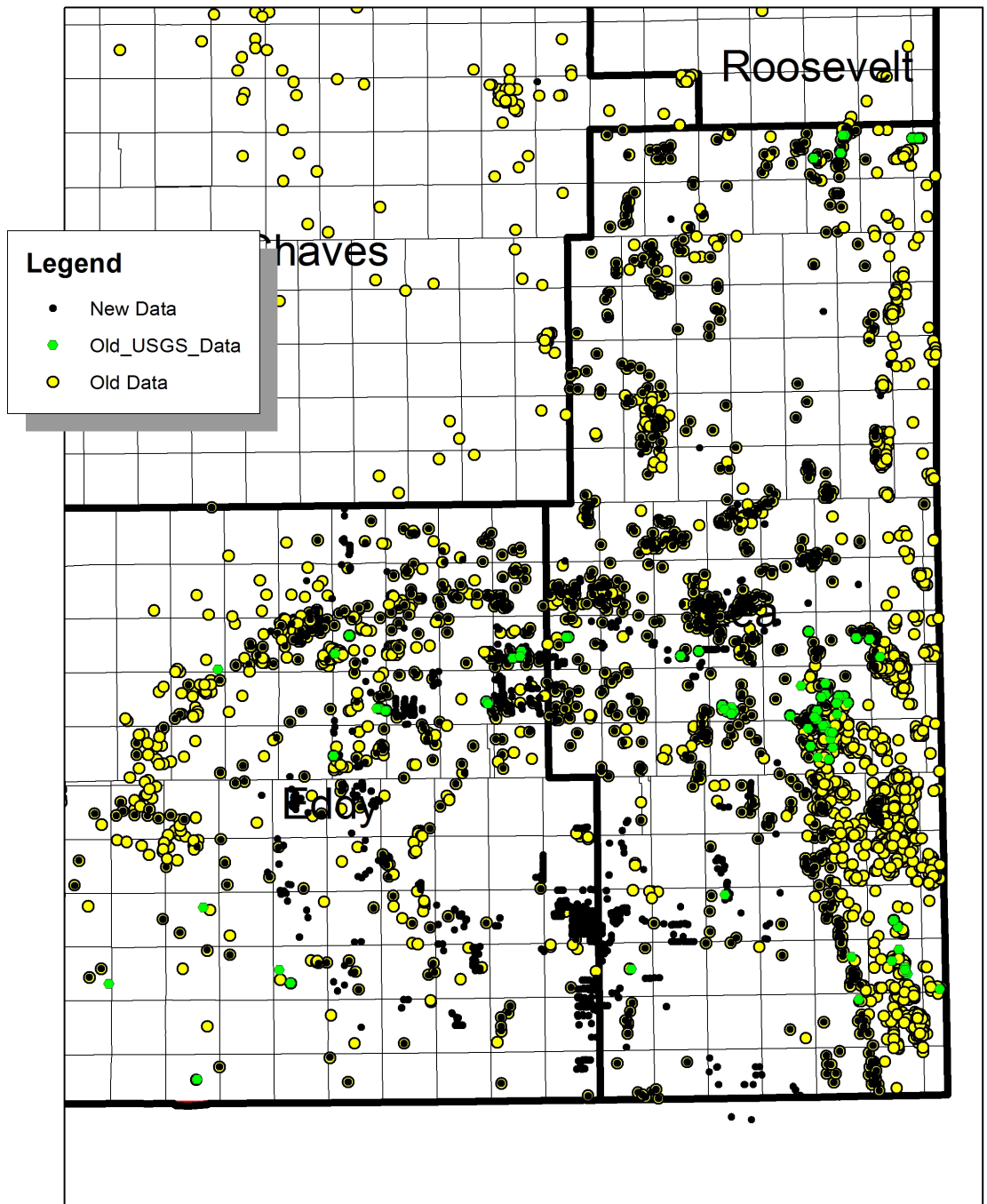
Community Outreach

During the previous quarter, NMT participated in four community outreach presentations organized by WRRI. Information for our part of the presentation included mapping of

produced water volumes, sample locations, and a description of the database and why it would be useful for water planning and resource assessment.

Data Analysis

The process of analyzing data for gaps in knowledge has begun. Figure 1 shows the location of three of the data sets in southeastern New Mexico. As can be seen, the black circles that are new sample points fill some important gaps, particularly along the common boundary of Lea and Eddy county in the central part of the Delaware basin, and into some of the newer Wolfcamp plays in central Eddy County. The older USGS data, as expected, is in areas where the database already has a significant number of samples, but it does provide useful additional information for purposes of data mining,



Remaining Work:

Several tasks remain to be completed in the final quarter of this project. These include: website deployment; combining all data sources into a single database; updating information with the newest-available location, well name, and producing formation data; and an analysis of the data gaps. Additionally, we will participate in one remaining community outreach meeting and help in the preparation of any final reports.

Student Participants:

Graduate Students:

Dongyi Chen – PhD, computer science

Cris Gallegos – Master's, computer science

Matt Bradley – Undergraduate, Technical Communication