

Enhanced Data Integration: Next Generation Water Data Initiative and Decision Support Tools for Pecos Valley

Part 1: Technical Proposal

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Executive Summary

The Water Data Initiative (WDI) was established under the New Mexico Water Data Act to help coordinate numerous efforts among state, federal and local data providers to improve data accessibility. The WDI is convened by the New Mexico Bureau of Geology and Mineral Resources (NMBGMR) at the New Mexico Institute of Mining and Technology (NMIMT) in collaboration with several other state agencies. The WDI Program at the NMBGMR with the partnership and support of the Pecos Valley Artesian Conservancy District (PVACD), the New Mexico Office of the State Engineer (OSE), and the Interstate Stream Commission (ISC), will develop the next generation of three water and data management tools to improve access to water resources data for the Roswell Artesian Basin. Two of the tools are applications that were initially developed during a Pilot Project with PVACD. These include a groundwater dashboard to provide a quick snapshot of current groundwater level trends, and a meter manager application to support the maintenance of water meters and facilitate data communication between PVACD and OSE. The third tool is the developing data sharing platform for the WDI. The proposed project aims to develop version 2.0 of the groundwater dashboard and the meter manager applications, as well as continuing to develop the WDI data sharing platform, by increasing their ability for data integration. Additional water data sources, including additional groundwater monitoring wells, weather stations and municipal information from the city of Roswell, will be integrated and added to these existing tools to provide a more comprehensive understanding of groundwater conditions in the region. This will support local and regional water managers by providing improved access to hydrologic data to better manage water supply reliability, especially groundwater, the conjunctive use of ground and surface water, and the enhancement of modeling capabilities. The project will focus on data for Chaves and Eddy Counties, New Mexico, and is anticipated to be two years in length. The estimated project start date is April, 2024, with a completion date of September, 2026. The proposed project is not located on a Federal Facility.

Technical Project Description

This Type 3 (data) project, aims to improve access to and use of hydrologic data and to develop new types of data to inform water management decisions in the Pecos Valley. The applicant, the New Mexico Bureau of Geology and Mineral Resources (a division of New Mexico Institute of Mining and Technology), is a category B applicant, as a university/non-regulatory state agency. The category A partner for this application is the Pecos Valley Artesian Conservation District (PVACD). Applicant, partner, and supporting stakeholders are described in **Table 1**, below.

Table 1. Applicant and Partner Categories

Applicant or Partner	Category
Applicant: New Mexico Bureau of Geology and Mineral Resources at New Mexico Tech	B - University/Non-regulatory State Agency
Partner: Pecos Valley Artesian Conservancy District	A - Irrigation District <i>Letter of partnership included in Attachment 1</i>
Supporting Stakeholder: New Mexico Office of the State Engineer	A - State Agency <i>Letter of support included in Attachment 1</i>
Supporting Stakeholder: New Mexico Interstate Stream Commission	A - State Agency <i>Letter of support included in Attachment 1</i>

Background:

The proposed project was conceived of during the execution of a Pilot Project supported by an existing WaterSMART grant, *New Mexico Water Data Initiative and Regional Pilot Project for Improved Data Management and Decision Support Tool in the Lower Pecos Valley* (agreement R19AP00290). The existing project was awarded in August 2020 to the WDI team at NMBGMR at the New Mexico Institute of Mining and Technology (Category B) with supporting partners of PVACD (Category A) the ISC (Category A), and the OSE (Category A).

The goal of the Pilot Project was to improve the accessibility of local groundwater and surface water data in the lower Pecos Valley. This goal has been addressed in two parts: the existing, ongoing statewide activity of the WDI, and the development of two applications to address specific regional water management challenges: a groundwater dashboard to provide a quick snapshot of current groundwater level trends, and a meter manager application to support the maintenance of water meters and facilitate data communication between PVACD and OSE.

The proposed project aims to continue to enhance acquisition of hydrologic data in the Pecos Valley by improving upon the existing tools. This will include integrating new and previously unavailable data sources, adding new features based on user feedback, and continuing to host and develop these tools in order to ensure that they are useful and usable to PVACD and local stakeholders in the long-term.

The New Mexico Water Data Initiative

The proposed project will be led by the WDI Team at NMBGMR. New Mexico enacted the Water Data Act (NMSA 1978, § 72-4B) in 2019 with the goal of making water data more accessible to decision makers and the public. This collaborative project with five directing state agencies, along with local, regional, and federal partners, is referred to here as the Water Data Initiative or WDI. The WDI is convened by the NMBGMR, the applicant for this proposal. The WDI is a collaborative effort between NMBGMR and the four other state agencies named in the

Water Data Act: the New Mexico Environment Department (NMED); New Mexico Energy, Minerals and Natural Resources Department (EMNRD); the OSE; and ISC.

The Water Data Act directs that the named agencies must collaborate with other regional and national efforts to share, manage, and integrate water data. The WDI has identified several goals to advance the accessibility of water data. Three major goals are listed below:

- Increase methods of digital data entry among participating agencies. All of the named agencies have data collection methods that rely on paper forms. Many of those forms go into file cabinets, and the data are never accessible by computer. Using web-enabled data entry forms will increase the availability of machine-readable water data in New Mexico.
- Make digital data accessible on the internet via application programming interfaces (APIs). APIs provide a means for two or more computer programs to interact with each other and enable automated retrieval of data using a program rather than manually navigating websites. This is especially useful whenever ongoing access to data is required.
- Increase the number of integrated water datasets available for management and planning purposes. For example, multiple state and federal agencies produce data related to groundwater levels measured in a well: the US Geological Survey, NMBGMR, the OSE, and others. However, these datasets may have slightly different standards. One may provide water levels in feet below ground surface, while another provides water levels in elevation above sea level. An integrated dataset allows data from different agencies to be comparable, or interoperable. Using a consistent standard, and having a mechanism to perform data integration will be necessary to evaluate data from different agencies.

The proposed project will increase the accessibility of hydrologic data in the Pecos Valley, by working towards the WDI goals listed above.

PVACD Pilot Project

Partnering with regional agencies to work on specific water data sharing use cases is a way for the WDI team at NMBGMR to support water management agencies in New Mexico, while advancing the goals of the WDI. The Roswell Artesian Basin in the Pecos River Valley is one of the most intensively farmed areas in the state. The principal crops are alfalfa, cotton, sorghum, chiles, and pecans. Population centers including Roswell, rely primarily on groundwater for municipal and economic needs (See **Figure 3** for a project area map). The basin is underlain by a prolific artesian aquifer. In the early 20th century, it became apparent to local officials and irrigators that overuse was drawing down the aquifer and reducing the availability of groundwater for irrigation and municipal use.

The Pecos Valley Artesian Conservancy District (PVACD) was created in 1932 to conserve the waters of the Roswell-Artesian Basin, including the lands within the basin located in both

Chaves and Eddy Counties. A Decree was issued in 1966 requiring all groundwater use in the Roswell Artesian Basin to be metered and irrigation use limited to an annual diversion of 3 acre feet per acre. PVACD’s role is to provide water meters to irrigators in the region, and to maintain those meters. PVACD is also responsible for abandoning wells in the artesian aquifer when their integrity is compromised, causing them to lose water from the artesian aquifer, into the shallow alluvial aquifer. Finally, PVACD is a source of water resource information for irrigators in the region, providing regional water level information annually, and links to local stream gages.

In order to determine what tools would best support water management decisions in the Pecos Valley, the Pilot Project conducted a needs assessment, employing focus groups and a survey to gain a better understanding of barriers to water data modernization among the region’s stakeholder groups. Participants of the focus groups and survey included employees of state and federal agencies, regional water managers, irrigators, and employees of regional non-profits. Nineteen people participated in the focus groups and there were 53 respondents to the survey. A complete discussion of the results of the focus groups and surveys can be found in the *New Mexico Pecos Valley Region Water Data Infrastructure Needs Assessment Report*¹.

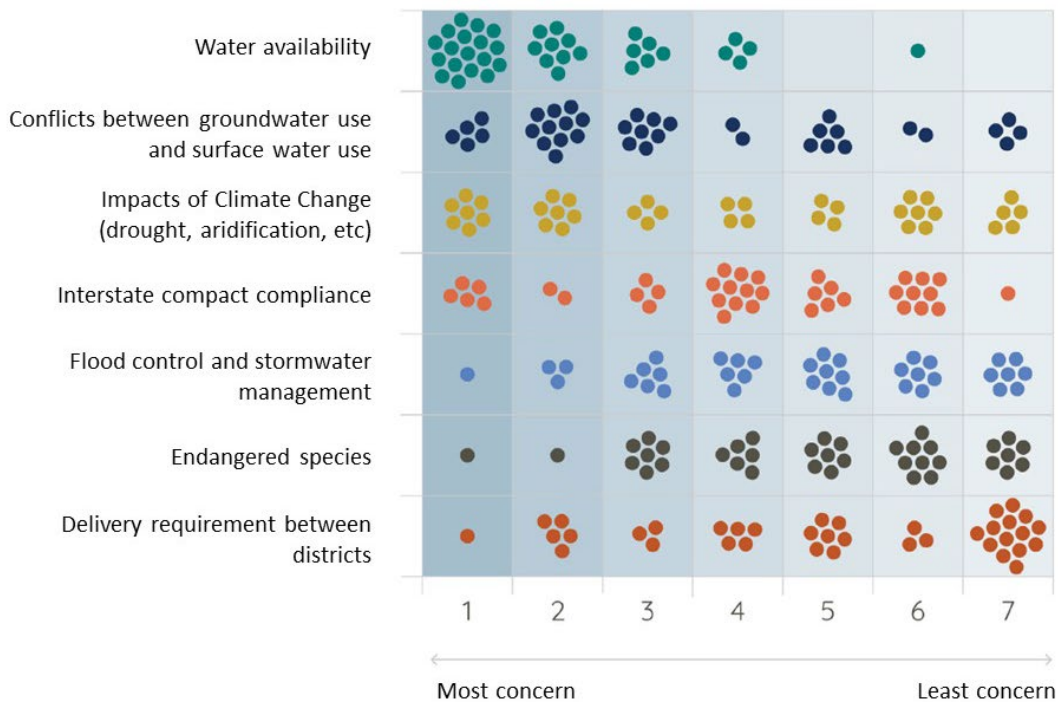


Figure 1. Participant ranking of concerns over water in the Pecos region. Colored dots represent the number of respondents who ranked each concern at a particular priority. For example, 18 respondents ranked water availability as number 1, or ‘most concern.’

¹ Internet of Water, 2021, Water Data Assessment Report: Pecos Valley, New Mexico. October https://newmexicowaterdata.org/wp-content/uploads/2021/10/Pecos_KeyTakeawaysNeedsAssessment_Final.pdf

The needs assessment identified key data needed by regional groups. When asked about their greatest concerns, water availability and conflicts between groundwater and surface water use made up the majority of participants' top concerns (47.4% and 29%, respectively, for a total of 76.4%). However, many respondents selected climate change and interstate compact compliance as important issues as well (18.4%) (See **Figure 1**). When asked how they would like to receive information about the Pecos region 76% of participants indicated a desire for an interactive dashboard. This was a significantly larger group of participants than those who would rather use a data catalog, receive email or text alerts, or rely on pdf reports, each at 8%.

Other key findings of the needs assessment include the following:

- A lack of *integrated* data in the region limits the ability to understand and communicate the impact that current practices have on the health and life of the aquifer.
- A large majority of participants (69.2%) indicated that they either cannot visualize or analyze data or that it is difficult to do so. This is in large part due to an inability to easily share and *integrate* data.
- Interestingly, while only 3% of participants indicate that they currently receive information from the WDI at the time of the survey, 29.3% indicated a desire to receive more information from this statewide initiative, indicating a willingness among participants to receive and trust information from the WDI.

The findings of the focus groups and needs assessment supported the continuation of work on New Mexico Water Data Act, through the data catalog and modern data-sharing practices. It also indicated a need for a groundwater dashboard that could integrate groundwater data from multiple sources throughout the region.

Focus group conversations with PVACD also indicated their need for a tool that would modernize their ability to track water meter maintenance and operations, and would also modernize their ability to communicate with the OSE about those operations. Water meters are used in the PVACD region, tracking water usage from approximately 1500 irrigation wells. These meters are maintained by PVACD, and measured by the water master at the OSE. Maintaining and reading meters for water use between PVACD and OSE requires close coordination and cooperation between agencies. Before the Pilot project, the PVACD was tracking all meter details and operations on a local MS Access database, which was not web-enabled and was only accessible from a single computer. The database created a choke point in meter management operations (as well as groundwater level data) because all information was entered by a single person. In addition, there was no back-up system if the existing system were to fail. Finally, communication between PVACD and OSE could only take place through phone calls, or scans of handwritten field logs. PVACD personnel indicated that they have a need for a tool that would resolve these issues.

The Water Data Catalog and Development of Version 1.0 Tools During Pilot Project

Based on the findings of the focus groups and the needs assessment as part of the Pilot project, WDI identified three major task areas that were advanced during the project:

- 1) Continue work towards the New Mexico Data Initiative goals of finding and integrating new data sources to make more data available for management and planning decisions.
- 2) Develop a groundwater dashboard to provide PVACD and local collaborators with a quick snapshot of groundwater conditions
- 3) Develop an open source, web based meter management application, which would allow PVACD to track meters and their maintenance, and which is equipped with an API so that communication can take place between PVACD and the OSE.

The Water Data Act mandated that the WDI develop ‘an integrated water data and information platform’; and identify available and unavailable water data. In response to this mandate, and as part of the Pilot Project, NMBGMR established the New Mexico Water Data Catalog (catalog.newmexicowaterdata.org). The data catalog is powered by the open source data sharing platform CKAN. At the beginning of the Pilot Project the stakeholder team provided input on datasets that were important to assemble on the data catalog that were of both statewide and regional importance. A statewide data inventory was completed for the WDI, with over 300 datasets from state, federal, and other sources identified. This included both available (through an application programming interface, known as API) and unavailable (in other formats, not online) data to support improved water resource management in New Mexico. Datasets found relevant to the Pecos Pilot region are listed on the WDI data catalog at:

<https://catalog.newmexicowaterdata.org/dataset/pecos-valley-data-inventory>.

Version 1.0 PVACD Groundwater Dashboard

The version 1.0 groundwater dashboard developed for the Pilot Project by the WDI Team at NMBGMR shares data from over 100 individual groundwater wells. Telemetry equipped water level meters were deployed at 10 PVACD groundwater monitoring wells. The groundwater dashboard includes the real-time data from these wells, as well as groundwater wells monitored by the OSE, NMBGMR, ISC, and the USGS. Users can select wells based on the aquifer they are screened in and view a hydrograph composed of historical measurements. The dashboard also provides a hydrograph of each of the ten PVACD wells, where users can select certain time periods to view more closely. A snapshot of the most recent measurements for each PVACD well is also shown, and users can download all historical data for the PVACD wells. The current version of the groundwater dashboard is accessible to the public at

<https://pvacddashboard.newmexicowaterdata.org/>.

The PVACD Groundwater dashboard has the following benefits for PVACD, irrigators, and water managers in the region:

- The instrumentation of monitoring wells lets stakeholders see groundwater level data in near real time.
- The categorization of wells by aquifer helps users understand conditions of individual water-bearing units
- Users can see historical data for each well to understand changes in aquifer conditions over time
- The dashboard integrates water level measurements from multiple sources for a single well. A user can see measurements taken by different agencies (e.g USGS and OSE) on a single hydrograph. This full integration of datasets is a leap forward for understanding of groundwater conditions in the region.

Version 1.0 Meter Manager Application

The version 1.0 meter manager application developed during the Pilot Project replaces PVACD's existing meter tracking database with a cloud-hosted database that is web accessible. The meter manager application provides a completely new database and new user interface for meter data. The features included in the meter manager application include:

- An activities page to record repairs and maintenance of meters. Maintenance and repair data can be entered by technicians in the field.
- A meters page that tracks the history for each meter and the parts used by each meter. This page allows an administrator to review the history or make edits to meter information.
- A parts page where an administrator is able to see an inventory of available parts.
- A groundwater wells page where an administrator can track manual water level measurements for groundwater wells against continuous water level measurements. New Manual water level measurements can be added to this page.
- A chlorides page where manual chloride measurements can be entered and tracked
- A wells page where the location information for a well can be viewed and updated
- An admin page where users can be added, and user permissions can be adjusted
- An API to support communication of information between OSE and PVACD

The API mentioned above is a key enhancement to PVACD's operations. Once completed, it will allow PVACD and OSE to directly transmit meter readings and information. This feature dovetails with an ongoing project at OSE District 2, which is working to be able to receive data electronically. This feature will benefit both PVACD, and the OSE, and may be able to be implemented at other water management districts in the southwest.

Proposed Work and Goals

Ongoing conversations and user feedback during development of the applications for the Pilot Project, have made it apparent that there are many opportunities for improvement and expansion

of the applications, and for the continued state-wide integration of datasets. In fact, it is a necessity for the WDI team at NMBGMR to continue to host and develop these tools in order to ensure that they are useful and usable to PVACD and other stakeholders in the long term. Working directly with PVACD and local stakeholders affords many opportunities for user feedback. The proposed work described in this proposal will focus on developing the next generation of the two tools described above, and continuing the WDI integration work.

Proposed Task 1: New Mexico Water Data Initiative Enhanced Data Integration

The goal of the continued work on the WDI is to enhance the ability to integrate water datasets statewide. The water data catalog is a useful and necessary repository for New Mexico Water datasets. The data catalog increases the findability and accessibility of water data for New Mexicans, and it's fairly easy to operate and maintain using open source tools. However, the data catalog has limitations in its functionality for integrating datasets. Increasing the number of datasets that are functionally interoperable, will be a huge leap forwards in increasing the usability of data available for water management and planning in the state.

Although standards development is one way to increase the interoperability of datasets, it will be beneficial to approach the problem from both ends. API management software can integrate multiple data sources, producing a consistently available, fully integrated dataset from multiple separate sources. The goal of the WDI's work under this grant will be to evaluate existing API management systems, and then select one to begin creating integrated datasets, as shown in **Figure 2**. The WDI team will continue to integrate datasets related to water *quantity* such as groundwater levels, but will also begin an initiative to integrate groundwater *quality* datasets, such as total dissolved solids. Once a significant number of datasets have been integrated, an example visualization will be created illustrating how datasets from different sources may be used within a single visualization while still maintaining the sovereignty of individual data providers.

Proposed Task 2: Version 2.0 PVACD Groundwater Dashboard

The goals of the next generation of the groundwater dashboard are to integrate more sources of data to create a more comprehensive understanding of local groundwater conditions, as well as data in the region which interact with groundwater (such as surface water and weather data). New sources of data will also be created by installing telemetry-equipped water level meters in six additional recorder wells. Additionally, the user interface will be enhanced and reworked based on user feedback.

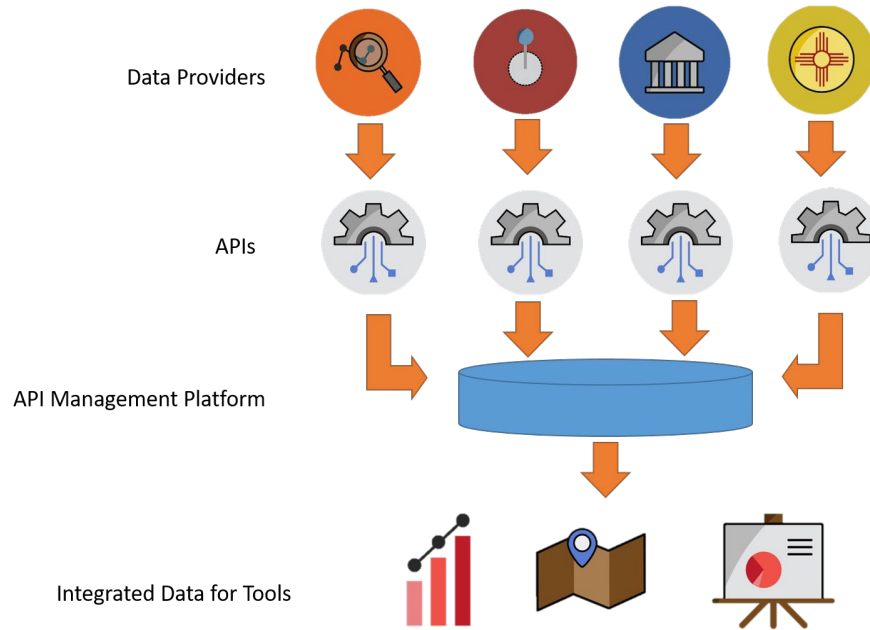


Figure 2. Pathway of data from provider through API management platform. The different data providers may be state, federal, local, or other sources, such as research data. Ideally, these data are shared from these sources using standardized APIs which can be integrated through an API Management Platform, in order to build tools or dashboards for direct use of data.

Table 2 lists the new sources of data to be added to the groundwater dashboard and their benefits. It is anticipated that additional data sources may be identified during the requirements gathering phase which are not yet listed below.

Table 2. New Sources of Data for Groundwater Dashboard

New Data Source for PVACD Groundwater Dashboard	Benefit to PVACD and Local Stakeholders
Instrumentation added to 6 new groundwater level monitoring locations in the Pecos Valley using satellite telemetry to make data available for dashboard	Enhanced understanding of groundwater conditions more broadly across the Pecos Valley
Chloride measurements from selected irrigation wells in the region	These data collected by PVACD can help enhance understanding of groundwater quality variations as part of the artesian aquifer, with variable salinity
Weather Data	Increased understanding of the immediate impact of precipitation events on groundwater conditions, surface water flow, and storm events which may impact infrastructure
City of Roswell Groundwater Data	Municipal Water Supply, groundwater level monitoring

Surface Water Data - stream gages provided by state or local data providers	Enhanced understanding of surface water and groundwater interactions
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User feedback gleaned during the Pilot Project provided insight into how users would like to access and visualize regional data. Specifically, mixing water data of different types, such as surface water and groundwater, was confusing to many users. The version 2.0 application will provide options to better view and visualize data types together or separately. Stakeholders also indicated that water use (as measured by meters) or weather data (such as precipitation or storm events) could also be useful. In the version 2.0 application, options for visualizing these additional datasets can also be incorporated. Users also indicated that the ability to download a .csv file of the raw data was a useful feature. Although this capability exists in the version 1.0 dashboard, it will be expanded during the development of version 2.0. User feedback also indicated that showing all OSE-permitted well locations, regardless of whether water-use data are available or not, would be beneficial to have a basic understanding of the magnitude of groundwater withdrawals in an area. This is another feature that may be added in the version 2.0 groundwater dashboard. The redesign of the user interface will take into account user feedback and the new sources of data to develop a comprehensive and intuitive dashboard that is usable and useful to project stakeholders.

Proposed Task 3: Version 2.0 Meter Manager Application

The goals of developing the next generation meter manager application are to continue to host and maintain the current application while finding ways to continuously improve its usability for the PVACD operations team, and also adding new features where appropriate. The beginning of the project will include a “requirements gathering” phase where existing and new user stories are identified for incorporation into the updates to the application. New features added to the meter manager application may include the following.

- The ability of technicians to take photos and save them as attachments to a maintenance event.
- The ability to identify irrigation wells that have been abandoned, or add newly installed irrigation wells.
- The ability to generate custom reports that provide PVACD with analytics on meter functionality, location, and use.
- The ability to generate work orders for specific tasks.
- The integration of telemetry data from a pilot test of telemetry-equipped water meters.
- Refinement of data sharing between PVACD and OSE.

The ability to generate custom reports will be a key feature as the application continues to develop. The meter manager application is supported by a SQL database, which will allow for the generation of potentially countless reports that can provide new insights into meter management activities. The continued development of the meter manager application and the groundwater dashboard will be user-focused. The WDI Team at NMBGMR has found that the

testing of applications naturally leads to new ideas to enhance their usability. It is anticipated that additional user stories will present themselves as the application continues to develop.

Project Location

The WDI includes water data for the entire state, which is housed and collected from many locations and agencies. The proposed project is located along the lower Pecos River watershed (also known as the Roswell Artesian Basin) in southeastern New Mexico as shown in **Figure 3**.

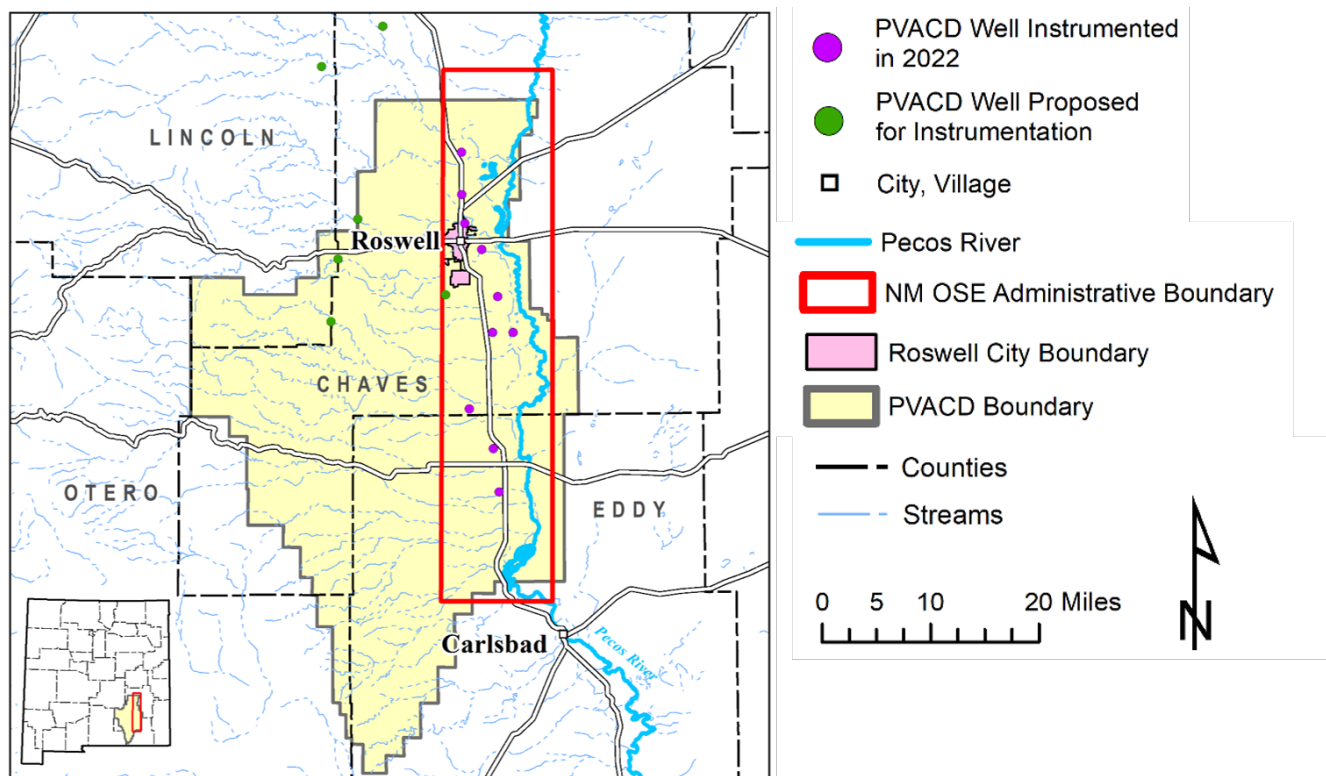


Figure 3. Project Area Map

Data Management Practices

For this project, the data is expected to be cloud-hosted in a federated data model using open source technology to the fullest extent possible. This means that the agencies/entities collecting the data will share and expose data for their agency, and that they will use their own internal best management practices for data management. To accomplish this for New Mexico and for the Pecos Valley region, the WDI team is setting up modernized data sharing services using Application Programming Interfaces (APIs). This project will work in a secure, cloud-based server environment, using open-source tools and technology to build a long-term sustainable data platform which accommodates numerous data providers and data users. Because data can be extracted and filtered from the API platform in common machine-readable formats, with

associated location information, the data will work readily in any geospatial platform or GIS software, as the project requires.

Evaluation Criteria

Evaluation Criteria A: Water Management Challenge

Describe the water management challenge. There are several water management challenges that PVACD and regional agencies face in the Roswell Artesian Basin which ultimately affect water supply reliability. For example, in many parts of the West, and New Mexico, the quantity of groundwater available is poorly understood or unknown. The southeast region of the state has been prone to severe drought, and is a region where groundwater (the Roswell Artesian Basin) and surface water (the Pecos River) are intimately connected. In previous drought years, water shortages have created conflict with neighboring irrigation districts and states, and have made interstate compact compliance difficult. In the PVACD region, water managers respond to groundwater level changes as quickly as possible, but may not have data readily available. In this region almost every drop of available water is used by agriculture, municipalities, or to meet downstream compact requirements with the state of Texas. Having access to hydrologic data to understand groundwater conditions is essential. By increasing the amount of data available for managers, the proposed work will help to address the uncertainty when making decisions related to water allocation.

Describe the concerns or outcomes if this water management challenge is not addressed. Global climate models project an average temperature increase across the state of New Mexico of between 5° and 7°F over the next 50 years. According to *Climate Change in New Mexico Over the Next 50 Years: Impacts on Water Resources*², the coupled trends of increasing temperature with no clear increasing trend in precipitation lead to a confident projection of increasingly arid conditions, including decreased soil moisture, stressed vegetation, and more severe droughts. Snowpack and associated runoff are projected to decline substantially by 2070, generating diminished headwater streamflow. Warmer temperatures will also cause lower river flows due to increased evaporation as rivers flow downstream. Understanding the interactions of surface water and groundwater in the region are essential, since surface water and groundwater are used conjunctively throughout New Mexico. Reduced surface water availability will indirectly lead to reduced groundwater availability, as groundwater is increasingly used as replacement for surface water.

² Dunbar, N.W., Gutzler, D.S., Pearthree, K.S., Phillips, F.M., Bauer, P.W., Allen, C.D., DuBois, D., Harvey, M.D., King, J.P., McFadden, L.D., Thomson, B.M., and Tillery, A.C., 2022, *Climate change in New Mexico over the next 50 years: Impacts on water resources*: New Mexico Bureau of Geology and Mineral Resources, Bulletin 164, 218 p. <https://doi.org/10.58799/B-164>

Groundwater managers in the Pecos Region, and throughout New Mexico have a fine line to walk. If the groundwater conditions are not understood then OSE, PVACD and local irrigators cannot make informed decisions about management for the Roswell Artesian Basin. If groundwater is over allocated, a precious resource could be wasted. If groundwater is under allocated, irrigators are needlessly restricted. In addition to water managers, irrigators in the region have to make decisions monthly, at a minimum, about what to grow, and how to use their water. If they too can have access to water data, similar to many management agencies, they are empowered to make decisions that are more beneficial to the long term sustainability of water resources.

How will this project address the water management issues identified above? The improvements to the WDI data sharing platform, the groundwater dashboard, and the meter manager application will provide water managers and irrigators in the project area with improved use and access to hydrologic data. This will allow stakeholders to have a greater understanding of aquifer conditions to support the conjunctive use of groundwater and surface water. Greater access to information to aid in decision making will lead to increased water supply reliability. By adding efficiencies to data collection and data management, with key visualizations of these data, we can improve the responsiveness of the PVACD and other water management entities, such as the OSE and ISC. Additional inputs are needed for predictive models at both the regional and state levels to forecast future availability of groundwater and surface water. The additional data to be made available by the version 2.0 PVACD groundwater dashboard (weather data, surface water data, groundwater data), and continued data integration of WDI datasets as a whole, will provide inputs that can enhance modeling capabilities at State and Federal agencies working in the Pecos Basin.

Evaluation Criteria B: Project Benefits

How was the need for the project identified? The project need was identified from conversations and user feedback from PVACD personnel, PVACD board members, OSE personnel, irrigators, and other regional stakeholders during the development of the existing tools. User feedback was solicited at both in-person visits to Roswell as well as numerous zoom meetings during the Pilot Project. These conversations about the development and testing of the groundwater dashboard and meter manager applications naturally led to ideas for their improvement and expansion. The WDI team at NMBGMR realized that more user feedback was being generated than could be incorporated within the Pilot Project timeframe. It is essential that the WDI team be able to continue to host and support these tools, and integrate additional data sources so that we can refine and enhance them based on continued user feedback. The improvements and expansions articulated in this proposal will enhance the ability of the existing tools to support water management decisions through improved use and access to hydrologic data related to groundwater conditions, which directly impacts water supply reliability, and the conjunctive use of ground and surface water for the region.

How will the tool be applied and when will it be applied? First draft tools are in development now and in use, and will continue to be used throughout the updates and improvements described in this proposal. The groundwater dashboard version 1.0 is currently available to the public. The meter manager application is currently being user tested by PVACD. The WDI has a fully functional data catalog. The proposed work will improve on the existing tools to add additional data sources and update the user interfaces.

Describe the extent of benefits that can be expected to occur upon implementation of the project. The Proposed project in the Pecos Valley region can continue to improve water supply reliability, particularly in drought times, by providing quicker, more efficient access to data, such as groundwater level measurements. Drought management requires tools and all water data available to support proactive and reactive decision-making. In a region such as the Pecos Valley, where the river in some sections is fed by artesian groundwater, having readily accessible data on regional trends can help managers address water needs of the endangered species, such as the Pecos Bluntnose Shiner, which requires year-round water supply. Simple tools that help visualize groundwater trends alongside surface water flows can help managers adjust to potential impacts to river flows from groundwater diversions (conjunctive use of ground and surface water). By building decision support tools, such as map visualizations or charts, water managers in the Pilot Project area and in other regions can begin to realize the greater benefit of the WDI. Having more direct access to key datasets will enable water resource managing agencies and the public to have the necessary information to aid in decision making, and in the development of predictive models, which can lead to increased water reliability.

The extent that this project in the Pecos Valley can impact water supply reliability can be realized when water managers experience and use visual tools developed with their input and guidance. They can participate in discussions to guide the tool refinement that are most relevant to their local challenges. The benefit of pursuing this project in this region also relates to water supply reliability in other regions of New Mexico. The proposed project will enhance the existing tools to make them more useful, usable, and sustainable. If successful, the project will support continued investment by the PVACD to improve both data collection and data management. The integration of multiple datasets through a single platform or application is a key capability that can be implemented in other regions. Throughout the west, many agencies are collecting and producing data, but these data are not always able to be easily compared. Being able to incorporate multiple data sources into a single dashboard or tool, while maintaining automatic updates from individual providers, is a feature that will be useful in almost any water management region. Letters of support from the OSE and ISC are included in **Attachment 1**.

Explain how your project complements other similar efforts in the area where the project is located. The New Mexico WDI is complementary to other national efforts (i.e. data.gov) to make data open and interoperable. This project complements a similar project related to drought

resiliency being performed by the City of Roswell. The city is working to add instrumentation to groundwater wells to actively monitor groundwater conditions. The data from the project in Roswell will be integrated into the proposed tools for this project. The project team is in direct contact with regional stakeholders, and as additional complimentary projects are identified, will reach out to collaborate. The WDI was created as New Mexico has no other related ongoing projects to integrate water management data in one location. Upon completion of this 2-year proposed project, the code for both the groundwater dashboard and the meter manager application will be publicly available. Other regions can begin to utilize similar processes and access public data available through the WDI products.

Evaluation Criteria C: Project Implementation

Methodology/Approach: The WDI Team at the NMBGMR performs work using an Agile delivery methodology. Agile project management is one of the best delivery methods for software development projects due to its flexibility, user-centric approach, and ability to adapt to changing requirements. The groundwater dashboard, the meter manager application, and any water data products will be developed with a focus on user-oriented design. The development process for each project will start with prototypes, and progress to basic versions for testing before becoming a live product. Each phase of the development process will incorporate user feedback in order to create an end product that is useful and usable by its key audience.

Work Plan and Project Schedule: As shown in the project schedule (**Figure 4**), the three main tasks will be performed concurrently. The project schedule identifies major milestones for each task and their start and end dates. Tasks will start at project award, and will end within two years of the award. Each task will begin with requirements gathering. The version 2.0 groundwater dashboard will progress with identifying data sources to connect, and then creating those connections to WDI's internal data pipeline. At this stage, instrumentation will be added to the six wells to allow water levels to be made available on the internet in near real time. While data connections are being developed and integrated, the user interface for the groundwater dashboard will be redesigned based on user requirements and feedback. The version 2.0 of the meter manager application will have a similar schedule. However, the work will be staggered to deploy the project team as efficiently as possible. The integrated data products for the Water Data program will be continuously developed throughout the two years of the project. At the end of the project, the work will be disseminated as described under Evaluation Criteria D.

Products: The work proposed aims to result in three products:

- Version 2.0 of the PVACD groundwater dashboard, that has additional data sources fully integrated, and a rebuilt user interface
- Version 2.0 of the meter manager application, which has additional features including the ability to assimilate telemetry data from water meters tracking irrigation

- A water data integration platform which supports regional data, but also includes broader statewide data connections. This may include enhancement of the existing data catalog, or the implementation of an API management platform.

Project Partners: The New Mexico Water Data Team at the Bureau of Geology will lead the work on this project and will ensure the delivery of products, manage costs, schedule and scope. PVACD will be the primary partner, and will provide user feedback on the dashboard and the meter manager application to ensure that these applications meet the needs of their team. PVACD will add the instrumentation to their six outside recorder wells and provide access to those data. PVACD will also help to coordinate focus groups with local irrigators to provide a wider testing audience for the dashboard. The IT group at the New Mexico Office of the State Engineer will continue to provide input on data provided through the meter manager API to make sure that it meets the needs of the team.

Project Staff: The project staff listed below are actively working on the current versions of the groundwater dashboard and meter manager application. They have developed a cohesive team that has a well-developed relationship with PVACD and OSE personnel. To ensure continuity, the same project team will continue to support the proposed project. No delays are anticipated to project commencement upon entering into the financial assistance agreement. These staff are listed below, and resumes are included in **Attachment 2**. In addition to the staff listed below, it is anticipated that a contractor will be engaged to support the further development of the user interface. The contractor RESPEC was utilized during the Pilot Project to support the development of the user interface for the meter manager application, and their support will continue for the proposed work. More details on contracting are provided in **Part 2** of this proposal, the Budget Detail and Narrative.

Executive Stakeholder: Stacy Timmons is the director of hydrogeology programs at NMBGMR. Stacy has been highly involved in the WDI since its inception. She co-led the original Pilot Project and has developed close relationships with PVACD and its board of directors, and OSE and ISC regional personnel. As a subject matter expert, Stacy will provide executive oversight and technical guidance for the project.

Project Manager: Rachel Hobbs, PG, PMP is a licensed professional geologist (Tennessee Lic. No. 5805), and a project management professional as certified by the Project Management Institute (Cert. No. 2243092). As the program manager for the WDI at NMBGMR, Ms. Hobbs is responsible for the delivery of all water data products. Ms. Hobbs will be responsible for stakeholder coordination, and scope schedule and budget control for the proposed project.

Technical Lead: Dr. Jake Ross, PhD is the principal developer, system architect and maintainer for WDI. He has significant experience developing software tools for analysis and visualization of water data. Dr. Ross will act as the lead developer for this project, and will oversee all technical aspects of software development, including platforms,

Evaluation Criteria E: Department of Interior Priorities

This project is directly applicable to the Department of the Interior Priority related to climate change. The majority of Roswell and Chaves County, New Mexico are identified as disadvantaged communities according to the U.S government’s climate and economic justice screening tool. A contributor to this categorization is these communities’ vulnerability to climate change. Fundamental to water management and adaptability is direct access to essential, high quality water data. Working to improve access to water data in a desert state like New Mexico, through the WDI, and specifically in the Pecos Valley region through the Pilot Project proposed here, provides these regions with science and tools to increase resilience to climate change. By providing data related to groundwater availability into the future, this project can help support long term resilience to drought.

Project Budget

A complete budget detail and narrative are provide as **Part 2** of this proposal.

Table 3. Summary of Non-Federal and Federal Funding Sources

FUNDING SOURCES	AMOUNT
Non-Federal Entities	
New Mexico Institute of Mining and Technology	\$196,386
Non-Federal Subtotal	\$196,386
REQUESTED RECLAMATION FUNDING	\$196,386

Environmental or Cultural Resources Compliance: The work proposed in this application is not anticipated to require any NEPA, ESA or NHPA resource evaluations. This project is entirely focused on data management and improving current management plans, and no construction or earth disturbing activities are anticipated. It does not include federal facilities.

Required Permits or Approvals: No permits or approvals are anticipated to be required for the work described in this proposal.

Overlap or Duplication of Effort Statement: There is no overlap between the proposed project and any other active or anticipated proposals or projects in terms of activities, costs, or commitment of key personnel. The proposal submitted for consideration under this program is not in any way duplicative of any proposal or project that has been or will be submitted for funding consideration to any other potential funding source. This proposal builds upon an existing WaterSMART grant, which was a Pilot project for this region in the Lower Pecos Valley.

Conflict of Interest Disclosure Statement: No known actual or potential conflicts of interest exist as of the submission of this proposal.

Uniform Audit Reporting Statement: Audit reports are available for the New Mexico Institute of Mining and Technology through the Federal Audit Clearinghouse website under EIN 85-6000-411.

Disclosure of Lobbying Activities: New Mexico Institute of Mining and Technology does not perform any lobbying activities.