



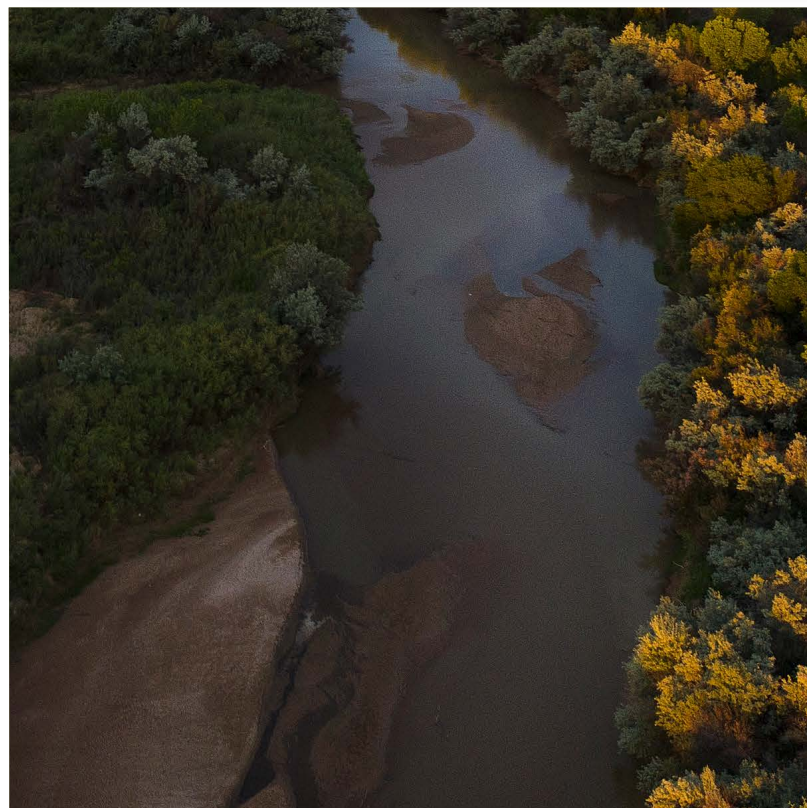
2021 Plan:

New Mexico Water Data Initiative

AUGUST 2021

Plan for continued implementation of the Water Data Act

This plan was prepared by the New Mexico Bureau of Geology and Mineral Resources, in partnership with the New Mexico Interstate Stream Commission; New Mexico Office of the State Engineer; New Mexico Environment Department; and New Mexico Energy, Minerals and Natural Resources Department.



Contents

Executive Summary	ii
Background.....	1
Assessment of Work Completed.....	2
Accomplishments Toward Goals.....	4
Funding Successes and Challenges	5
Modernizing Water Data: A Federated Approach	5
Solutions	8
Funding.....	8
Policy.....	8
Data Gaps	9
Goals, Actions, Targets, and Metrics.....	9
Roadmap.....	12
Budget Requirements.....	13
Impact to New Mexico.....	16
Appendix 1. Summary of Agency Responses	

Executive Summary

This Plan fulfills an annual requirement as part of the 2019 Water Data Act to provide information to the governor and legislators on the progress, goals, metrics, and budget requirements for improving New Mexico's water data. Implementation of the Water Data Act has been successful so far, working on a very small budget to build an online open data platform, grow new inter-agency collaborations, build an infrastructure plan, and set New Mexico as a visionary leader for modern water data services.

The Water Data Act fundamentally requires a paradigm shift in how New Mexico's agencies prioritize, manage, and share data. There is urgency to this effort as our state feels the direct impacts of increasing water uncertainty and drought. It is critical to act now, especially in terms of state funding to support the agencies involved in this work. The estimated costs of water data infrastructure are relatively small when compared to other physical infrastructure projects. Nevertheless, to fully realize and implement the Water Data Act, substantial annual funding is needed at the directing agencies for at least the next four years.

One of the largest benefits of the Water Data Act for New Mexico is that by taking steps to modernize our data management and improve how agencies share and utilize data, there will be tremendous improvements in the efficiency of state agencies and our water management efforts. Water may be our most limited resource and we can choose to manage it carefully and plan for an adaptable and resilient future for our people, land, and natural resources. This is a long-term commitment to changing how we view and work with data, and it will take time to build and integrate data.

This project is convened by the New Mexico Bureau of Geology and Mineral Resources, which is one of the directing agencies with the New Mexico Office of the State Engineer; Interstate Stream Commission; New Mexico Environment Department; and New Mexico Energy, Minerals and Natural Resources Department.

Background

New Mexico enacted the Water Data Act (NMSA 1978, § 72-4B) in 2019 to identify, share and integrate key water data for New Mexico. Pursuant to Section 3D of this statute:

*Within two hundred seventy-five days of enactment of the Water Data Act, and thereafter **annually by September 1 of each year** the agencies shall develop and submit a plan to the governor and the appropriate interim legislative committee that details: (1) an assessment of water data and information needs to support water management and planning; (2) goals, targets and actions to carry out the purposes of the Water Data Act in the upcoming fiscal year; (3) budgetary resources to carry out the purposes of the Water Data Act; and (4) metrics for achieving the purposes of the Water Data Act.*

The Water Data Initiative (WDI) is the collective project and people working to fulfill the Water Data Act. It is convened and managed by the New Mexico Bureau of Geology and Mineral Resources (NMBGMR), involving state “directing agencies” including the New Mexico Office of the State Engineer (OSE),

Interstate Stream Commission (ISC), New Mexico Environment Department (NMED), and New Mexico Energy, Minerals and Natural Resources Department (EMNRD). The legislation requires communication and collaboration among these agencies and others collecting or managing water data for the state. Other key partners and support currently include the Healy Foundation, the Internet of Water (at Duke University), and Sandia National Laboratories.

The following bullet points summarize the purpose of the Act:

- Integrate water data using consistent and standardized formats
- Identify key water data, information, and tools, as well as available and unavailable water data
- Ensure compliance with water data standards and best practices

The goal is to make finding water data simple.

We break down the groups of people seeking data into two main audiences with very different needs for water data and information. The groups include the “general public” and “technical data users.” Rather than seeking to download and work with raw data,

Water Data and Information

Data are the actual measurements or facts that describe features in water, whereas **information** is data that has been processed, interpreted, modeled, or synthesized in some way to answer questions.

The Water Data Act references water data and information describing the following:

- streamflow
- precipitation
- reservoir systems
- irrigation systems
- groundwater use
- groundwater levels
- municipal water use
- industrial water use
- agricultural water use
- natural systems water use
- land uses
- water rights
- water diversions
- water quality
- fish and aquatic data
- ecological data
- riparian systems

Although much of the data on these various features listed above are hosted within the directing agencies listed in the Act, these agencies do not completely host all these data. Collaboration with other local, regional, and national efforts is required to ensure coverage of all data in this list.

presented as numerical measurements, the general public often seeks the answer to a specific question, such as “Is my water safe to drink?” or “How much water is in my aquifer?” Answers to these seemingly straightforward questions depend upon multiple water data sets compiled as “information” that help to answer the questions. To build a data service for a general public audience, the first steps are actually to build the “backend” data infrastructure targeted for the technical data users, who may provide data to be used to answer common questions.

The WDI is working actively to build the basic infrastructure that can integrate all necessary water data, shared and hosted by each of the providing data agencies. Once water data are integrated, the data can then be utilized. Applications that address common questions can be developed and dynamic mapping tools can be built to help manage water, for example. To achieve this visionary goal, we are building a unified data and Information Technology (IT) architecture that will make water data open, easily shared, and interoperable. In this effort, New Mexico is moving in uncharted “waters,” and there are few examples to follow from other states. As we forge our path, and learn through the process, we are documenting the steps, assessing what is and is not successful.

Water Data Initiative: Vision and Goals

Vision:

New Mexicans will have accessible and useful data for water management and planning.

Goals:

We will have easy access to key water datasets.

We will have common water data standards and definitions.

Data gaps will be identified and prioritized.

We will ensure that accessible water data are useful, such as for decision making, research, public inquiry, management, and planning.

Assessment of Work Completed

Implementation of the 2019 Water Data Act (herein referred to as “the Act”), progressed quickly in 2019 and 2020 developing a governance structure, working groups, a vision statement, and overarching goals for the project. Meeting all of requirements outlined in the legislation for Year 1, the working groups and implementation team have identified key data, developed data standards, launched a data platform, and have created a data inventory to illuminate available data. Much of the work accomplished in inventorying data, reporting data needs, and planning for water data can be found from <https://newmexicowaterdata.org>.

To carry out the process of implementing the Act, each working group and team has taken on important roles. In 2020, maintaining connection during a pandemic year proved to be challenging but rewarding. This project helped maintain important connections between agencies and team members, as well as discussions with other states on data projects. A summary of each working group and team activity is captured in Table 1.

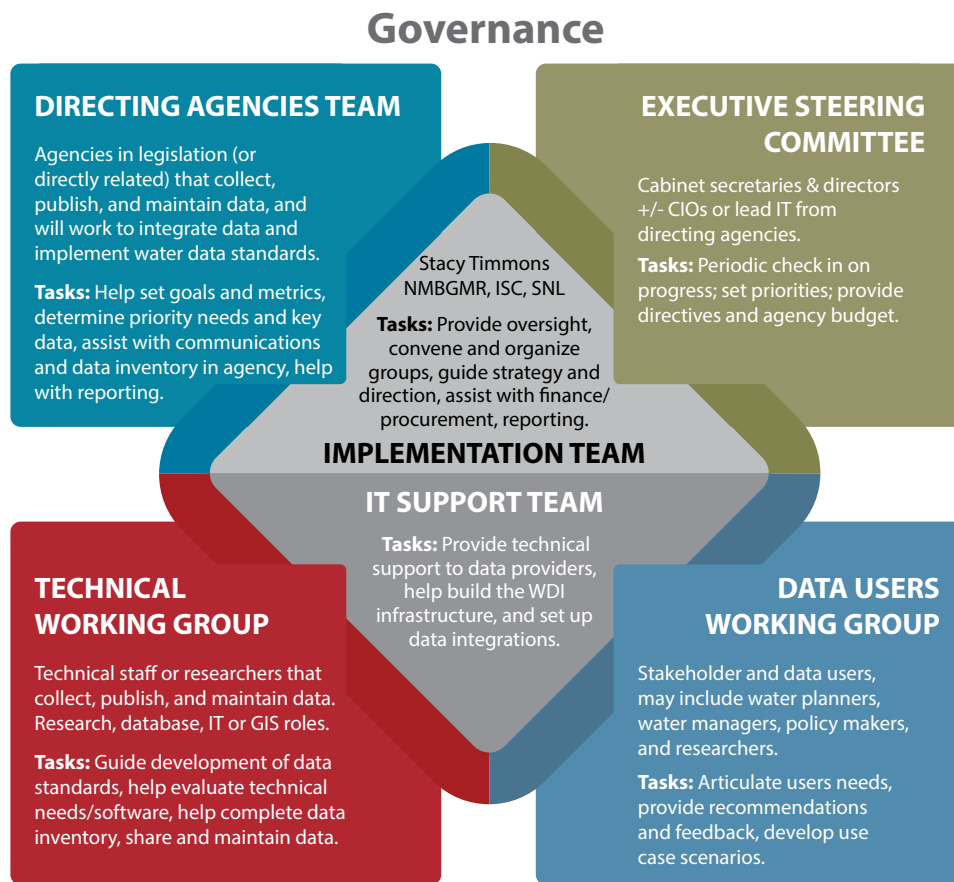


Table 1. Activities conducted by the working groups and teams related to the WDI in 2020-2021.

Working Group or Team	Activity in 2020-2021
Implementation Team	With bi-weekly meetings to check in with leaders of each working group/team, this team evaluates progress on annual goals, sets goals, reviews activities and challenges, and seeks/manages funding. This team works together to provide feedback, suggestions, and review on work accomplished in each working group.
Technical Working Group	This group meets monthly, has developed a first draft of data standards, and has been maintaining/expanding data inventory hosted in the data catalog.
Directing Agencies Working Group	This group meets as needed, typically quarterly, to work on goals of building data literacy and facilitating communications between agencies and within agencies. Annually, this group provides input, reviews, and comments on the draft plan.
Executive Steering Committee	This group was created this year, as requested by the Technical Working Group and Directing Agencies Working Group. It meets annually in the fall to provide updates on agency progress, help set priorities, provide directives, and address challenges within or between agencies.
Data Users Working Group	This group largely encompasses the interested water community of New Mexico. This year, the group was involved with a stakeholder questionnaire and interviews to improve understanding of perceived data needs related to priority water issues and creating resilient water resources in New Mexico over the next 50 years.
IT Support Team	This team meets every two weeks for “sprints” (focused effort on specific tasks that contribute to larger goals). The focus in 2020–2021 has been on building a robust IT infrastructure and data integration.

Accomplishments Toward Goals

Four goals were established in the April 2020 Plan and the working groups and teams have been successful in working to accomplish these goals over the past year. The outcomes of each goal are summarized in Table 2.

Table 2. Outcomes of goals established in April 2020 Plan.

Goals from April 2020	Accomplishments in 2020-2021
Provide IT support to improve data sharing	A small IT Support Team was built, supported in part by limited WDI funding. This team is composed of a 0.5 full-time employee (FTE) staff position at NMBGMR, two part-time contractors, and pro bono support from a data architect at Internet of Water. This team has tested options for data integration and had numerous calls with state agencies to provide recommendations and assistance when needed. Of the directing agencies, the NMED, NMBGMR, and OSE/ISC have established a data sharing service or public API connection for water data. Funding to support the WDI at NMBGMR has been provided by the Healy Foundation and a 3-year cooperative grant with the U.S. Bureau of Reclamation.
Develop robust IT and data infrastructure plan	A draft IT cyber-infrastructure plan has been shared to directing agencies IT staff for review in August 2021. This draft plan describes some water data scenarios observed in the directing agencies and provides several potential IT solutions. We also highlight some known gaps, including additional staff support, software, and potential funding needs for IT services. The working draft of the IT cyber-infrastructure plan can be found at: https://nmwaterdata.atlassian.net/l/c/jAtA1H62
Refine data standards	The Technical Working Group and IT Support Team have met regularly to evaluate the data standards needed for various types of water data, to create alignment with the preferred data model for WDI (Open Geospatial Consortium's SensorThings model). The working draft of the data standards can be found at: https://nmwaterdata.atlassian.net/wiki/spaces/TWG/overview
Continue stakeholder engagement opportunities	Water data stakeholders include staff and management at agencies, technical and general data users, as well as the public. Despite challenges of meeting in person for stakeholder engagement due to the COVID-19 pandemic, numerous WDI engagements were successful using the web meeting format. The range of these stakeholder and working group engagements are described in Table 1. During 2020, WDI hosted a webinar and invited water data leaders working in Colorado, California, and nationally on water data projects to present their data sharing and management activities, providing opportunities to engage with participants. Additionally, as we continue to grow the data sharing platform for a wide range of audiences and users, we continue to check in with water-interested community members. In the winter and spring of 2020-2021, we conducted web-based stakeholder questionnaires and interviews. A summary report of this stakeholder input is provided at https://newmexicowaterdata.org/wp-content/uploads/2021/08/StakeholderPerspectivesAugust2021.pdf

As New Mexico faces increasing water uncertainty—with numerous water management challenges and ambitious goals for water planning—it is essential that the Water Data Act be fully funded at each agency in order to keep pace with the current and future water challenges.

Funding Successes and Challenges

As New Mexico faces increasing water uncertainty—with numerous water management challenges and ambitious goals for water planning—it is essential that the Act be fully funded at each agency in order to keep pace with the current and future water challenges. The NMBGMR receives about \$100,000 annually to base funding to implement and convene the agencies participating in the Act. This funding in part supports the work of the NMBGMR and the Implementation Team for the Act, which is focused on and is successful in building additional funding, maintaining communications with directing agencies, inventorying data, establishing numerous cloud-hosted platforms and a website, evaluating data readiness and, generally, carrying out the purpose of the Act. This small state-fund has been increased with philanthropic funding (Healy Foundation) and federal funding (U.S. Bureau of Reclamation). In total, this amounts to a bit more than a full match, with approximately \$200,000 per year in total to support the project.

Although there has been rapid progress responding to many of the Act's statutory requirements, some of the more technical aspects of implementation and data integration have been slow. One fundamental gap we have identified is that the directing agencies lack the staff or resources to make some of the required data sharing improvements. None of the state agencies listed in the Act have received funding to improve current data systems, data management, or data sharing practices. Agencies have limited or no staff to support IT upgrades needed to meet the basic requirements for modern data management and sharing. With this plan we also provide funding requests for state agencies to meet the requirements of the Act.

Modernizing Water Data: A Federated Approach

The ideal approach for a modern data sharing concept is for each agency or data provider to host the water data that they are prepared to share and provide that data in an easily accessible and interoperable format. This is different than other data concepts that have been proposed in years past—which suggest building a “central database” where data providers place their data and periodically update it. In this older model, after data hand off, the agency loses data ownership, contribution of their expertise, and agency's responsibility for the data.

The modern approach is described as a “federated data model” – in which data providers keep the data ownership and maintain responsibility for their data, such as for data updates and QA/QC. The providers take an *active* role in making the data FAIR (Findable, Accessible, Interoperable, and Reusable).

With regard to FAIR data, a federated data model is dependent upon data being easily found. The WDI has already taken steps toward improved findability, such as the data catalog (<https://catalog.newmexicowaterdata.org/>). Many data providers in New Mexico are already able to make their data findable, such as through interactive maps or by using web services to query data. We are actively working on the next step in the process: gaining accessibility and interoperability. This means providing existing data available in “machine readable” formats, such as by using Application Programming Interfaces (APIs). APIs are a way of sharing data in a format that allow computers and web applications seamless access to data without the need to put data into another database. When using an API, data remain hosted by the data providers and are directly accessed by computers and applications. The data, the basic building blocks needed for applications or answering

As a leader in modernizing water data, New Mexico's selection of its water data model was part of the reason why the U.S. Geological Survey has also chosen to follow the same data model.

API: Application Programming Interface

An API is an interface to data that is built from a set of procedures or functions that sends information back and forth between a website or app and a user. APIs transmit data in the background of a website or application, making the web interactive and useful for people by automating data transfer actions.

Why is an API necessary?
We already share data publicly on the web via downloadable spreadsheets or interactive maps.

In order for all of the state's water data to be efficiently, accurately, and continuously

integrated, agencies hosting data need to change how we all think about sharing data. Instead of "websites for humans" we need to be thinking about "web services for computers." An API is a tool that allows computers to talk to one another in a specific way so that each computer perfectly understands what the other is saying. Behind the scenes, APIs are what make the web interactive and useful for people. The old methods of downloading spreadsheets or emailing data is cumbersome on the backend, meaning it requires a lot of manual human work involved. This human work introduces potential for data gaps and error.

How do I set up an API?

There are many ways to set up an API, and the solution for each agency may look different depending on their internal system. The good news is that APIs are everywhere, so there are many routes to solve this problem! The WDI suggests that agencies share their data via the SensorThings API.* Setting up an API does require some technical IT expertise at a host agency. If your agency is interested in hosting their data via SensorThings but needs guidance on how to do this, please contact us and we can discuss paths forward.

* SensorThings API is available at: <https://www.ogc.org/standards/sensorthings>

common questions, become more interoperable and reusable in a machine-readable format, such as API. Although data in each agency is collected for a specific purpose, this same data can be reused for many other purposes if it is accessible to a wider audience. For example, data collected to regulate drinking water quality can also help in tracking water quality changes in aquifers or examining baseline water quality prior to land use changes.

If adequately funded, the WDI IT Support Team could better assist each of the directing agencies in serving their data with the prescribed standardized approach and support the underlying technical aspects of onboarding each agency into the federated model. Ultimately, data-providing agencies must show the willingness and capacity to make their data available, iterate to find best options, and to fully participate in a federated open data model. Data-providing agencies will need to maintain and host the data they generate and provide data quality assurances.

This project is truly a paradigm shift in how New Mexico's agencies manage and share their data. There are no silver bullets for this work. No single software or application can accomplish the goals of the WDI, and certainly not with the funding that is presently allocated to this project. Therefore, we are building this for ourselves, in our own New Mexico way. The current draft IT infrastructure plan for the WDI is provided at this website (<https://nmwaterdata.atlassian.net/l/c/jAtA1H62>), and the schematic visual for this is shown in Figure 1. The plan depends upon agencies to collect and maintain their own data, then making that data available in machine-readable formats (i.e., APIs). To provide the most cost-effective and agile approach to the WDI, the IT infrastructure is built upon open-source and malleable tools and software. Here we acknowledge that New Mexico is "breaking trail" by building our own internal water data system. Using the skills and talent of the people of New Mexico, we are building a flexible open-source data platform that will grow and change as data needs are refined.

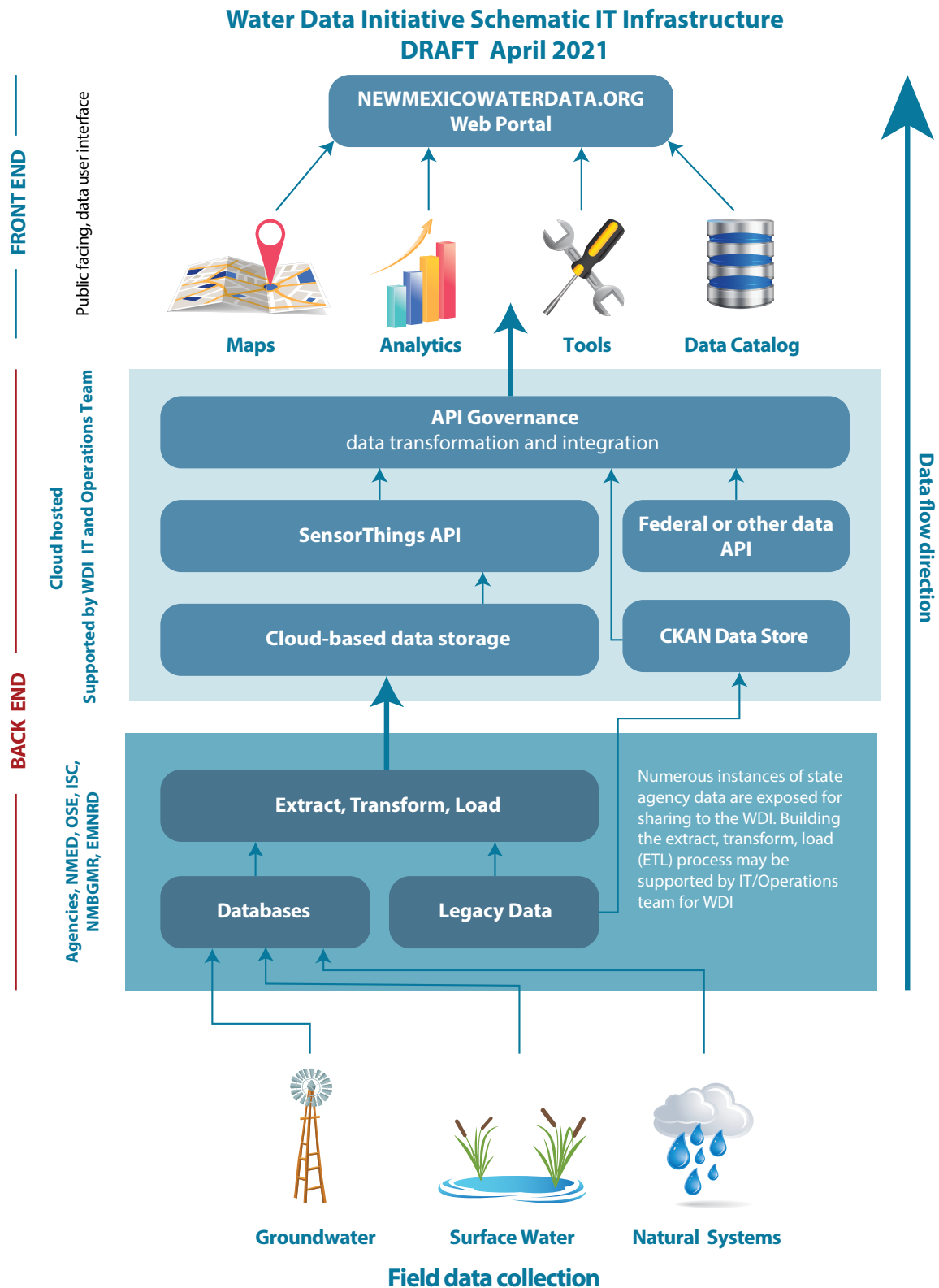


Figure 1. Schematic data flow from field data collection to website applications describes several of the back-end and front-end concepts for the WDI. Currently, in 2021, efforts are largely focused on the back-end, the lower portion of the image and data process.

Solutions

There is urgency to this effort. The impacts of climate change to water resources are severe, systemic, and accumulate over time, which is why it is critical to act now. Water may be our most limited resource and we can choose to manage it carefully and plan for an adaptable and resilient future for our people, land, and natural resources. As we identify next steps, we recognize that this is a long-term commitment to fundamentally changing how we view and work with data, and acknowledge that it will take time to build and integrate data. For example, in some cases, agency databases built on 25-year-old systems will take significant time and resources to upgrade to a modern water data infrastructure. This work on water data is directly tied to our need to adapt to climate change and to update outdated water and data infrastructure in New Mexico.

The following sections summarize the specific issues and ideas policy makers in New Mexico need to be aware of, as gathered in the stakeholder engagements and working groups over the past year.

Funding

- Support one-time and recurring budget suggestions from directing agencies provided in this plan in order for agencies to participate fully and efficiently in the Act.
- Work with New Mexico's Legislative Finance Council, the Department of Finance and Administration, and Department of Information Technology to encourage and fund C2 projects for state agencies to improve their water data management systems. (C2 Projects are specifically for IT special appropriation requests.)
- Provide funding for state agency requests related to the Act, initially to conduct a business analysis of current data management systems.
- Fund state agencies to build new data ingestion methods to accommodate digital data submittal from permit holders or other data providers.
- When possible, choose to fund local, regional, state, or collaboration with federal agencies working on water data, water management, and water planning projects.

Policy

- Treat data like the infrastructure that it is. To utilize any resource, an appropriate infrastructure must exist to collect, distribute, and use the resource. Data infrastructure, including data systems, data collection, data management, and data sharing platforms, must be built and maintained to modern and flexible standards. Data are the fundamental building blocks for water decisions and management. This may have application under Water Trust Board directives.
- Build on the Act by establishing requirements for state-contracted consultants collecting data with state funding to provide data electronically via methods and protocols established or provided by the WDI.
- Require that any new data management systems provided or established in New Mexico state agencies provide web services (specifically by API) as a data sharing option.
- Consider amendments to the Act, such as to include the New Mexico Department of Game and Fish, which holds aspects of New Mexico water data related to fish, aquatic, and riparian systems.
- Support or direct a policy review process or committee that addresses modernizing statutes around water data, water management, and water protection. State agency employees may recommend specific sections of statute that have been problematic for their work toward protection or managing water in New Mexico.
 - For example, there has been conflict with the Public Records Act (NMSA §14-3-15.1) and the Water Data Act (NMSA §72-4B) that has been mentioned as a problem for directing agency participation and data sharing.
 - Additionally, some state agencies require permit holders to submit periodic reports, which often include water data included in a form, letter, or PDF. To improve data flow from collection to sharing point, require

that data submitted to state agencies be provided in specific, machine-readable formats, in addition to or instead of traditional methods of using letters.

- Maintain, or in some places rebuild, federal and state support for data collection. Due to funding changes in recent years, long-standing data collection sites have been reduced in number, including groundwater monitoring, streamflow gages, and climate stations.

Data Gaps

- Create or participate in educational opportunities to build knowledge, awareness, and understanding of water and water data issues.
- Build a comprehensive groundwater monitoring program for New Mexico with multiple collaborating agencies. The largest data gaps we have found are in New Mexico's groundwater data where we lack sufficient data collection frequency, data quality, and spatial coverage. Statewide, groundwater remains largely unquantified, minimally characterized, and insufficiently monitored. As surface water resources are further challenged, groundwater resources are more likely to be explored (such as brackish water), developed, or exploited. We will need far more data to describe water quantity, water quality, and aquifer characteristics to make good decisions for resource use or conservation.
- Refine our ability to quantify, measure, and meter water uses. Despite the fact that this idea has been largely unpopular, we must face the reality of limited water resources and move toward more carefully tracking our water uses. Making this data FAIR will bring transparency and allow a wide range of water users to see the water from a similar perspective through data. Open data will enable more creative, resilient, and equitable solutions to water resource limitations.
- Improve the accuracy of the geospatial locations for data. Some older water rights and other state records have inaccurate location information. Also, as we explore mapping of data features, we can begin to see errors, overlap and duplication data records; these are places to improve efficiency. Additionally, with good locations for

This work on water data is directly tied to our need to adapt to climate change and to update outdated water and data infrastructure in New Mexico.

water data across the state, we can quickly see where spatial gaps exist in monitoring and metering data.

- Develop a prioritization schema and begin to digitize historical or paper records. Though we are first addressing digital data in the WDI, there is a large amount of water data in historical or paper records that is currently inaccessible.

Goals, Actions, Targets, and Metrics

Based on the goals, activities, and accomplishment in 2020–2021, we have learned several important lessons, a few of which are highlighted here. We have learned that it takes a significant amount of time to fully understand and characterize each of the directing agencies' data systems. We also see that there are limits to what the WDI can accomplish without full participation of the directing agencies. Although the agencies may be fully willing to share data, without the funding for IT staff and technical skills, data providers will struggle to fully meet the goals of the WDI. Recognizing that this process is taking a bit more time, we have adjusted our goals for this year.

Much of this project is a matter of learning through the process, following an agile development methodology, using low- or no-cost open-source technologies. This process has helped us refine and workout some of our data ingestion steps and sharing practices. Our process of moving in small steps to achieve incremental goals allows us to maximize our learning and successes while minimizing risk, time, and effort. Although this cautious and critical approach takes time, as data sharing challenges arise, we are situated to respond quickly to build forward in a truly collaborative fashion that works best for each partner.

Based on results of the 2020–2021 accomplishments and lessons learned, the following goals have been suggested in two categories: a) Goals for Directing Agencies and b) Goals for the WDI. The Directing Agencies were asked to help set goals through an online questionnaire. Further information on the directing agency responses is found in Appendix 1.

GOALS FOR DIRECTING AGENCIES

Goal 1: Increase efficiency of communications about water data with the directing agencies.

Action: Each directing agency will designate a staff member to be the designated “point of contact” (or POC) for the Act. This person will work between the WDI teams and periodically check in with their agency to evaluate progress on goals, data sharing, or to set plans for future years.

Target: Improved communication and understanding of the steps needed and designating consistent person for responsible communication/action in each agency.

Metric: Each of the directing agencies will name one person by December 2021 to act as POC for the agency.

Goal 2: Each directing agency establishes its own plan for implementing the Act.

Action: Each of the directing agencies will develop a Water Data Act Implementation plan or outline to describe how the agency will accomplish the goals of the Act over the next 5 years. This includes specifying budget and staff requirements.

Target: Directing agencies will set water data as an internal priority and will create a plan to engage. By making a plan, budget requests can be made and agency staff will know what to expect.

Metric: In lieu of the annual questionnaire from WDI, each of the directing agencies will submit the agency’s Water Data Act Implementation Plan draft outline or plan to WDI, including agency goals, budget, and staff requirements by April 1, 2022. Budget requests will be included in agency request for Fiscal Year 2024.

Goal 3: Each directing agency begins sharing, continues sharing, or shares new water data by web services (computer/ machine readable format and API).

Action: Agency POC works with staff in agency to select which water data features align with key data as discussed internally or with the Implementation Team. The POC works with the WDI team to set up a process for data sharing and seeks help as needed.

Target: To ensure progress on data sharing, while plan is being developed in Goal 2, the agency will focus internally on working through the data sharing process for one dataset, with complete metadata and mapping to SensorThings API data format.

Metric: At least one dataset per agency is available by public web service and agency has listed data on WDI data catalog by June 2022.

GOALS FOR THE WATER DATA INITIATIVE

Goal 1: Provide support or collaboration to help build directing agency resources to improve implementation and address the Act.

Action: Establish a task-group to meet periodically over a few months to evaluate options for funding to state agencies or collaborators for Water Data Act support.

Target: Agencies, through collaboration with each other, can explore and acquire grant funding to support agency staff and fulfillment of Water Data Act purposes.

Metric: At least one directing agency applies for new grant or other funding in support of the purposes of the Act in 2021–2022.

Goal 2: Build data literacy and understanding of how to work with data within directing agencies working with other local, regional, and national data providers.

Action: Set up a task-group for evaluating and providing the training needs for state agency data providers; identify and prioritize training needs to address purposes of the Act.

Target: Provide educational or learning opportunities to data providers to build “in-house” capacity to work with and share water data. Improve data management and data sharing practices in New Mexico agencies.

Metric: A summary list of training needs in priority order with cost estimates will be developed by June 2022.

Goal 3: Continue stakeholder engagement and working group activities in order to refine and identify data priorities and issues that data users need to access and use water data in New Mexico.

Action: Conduct a broadened data users’ survey based on 2019 Water Data Workshop results and 2020–2021 stakeholder engagement results to continue to learn about data needs, how to better meet these data needs, and what type of additional information, trainings, tools and data applications are needed. Survey working group members; water-interested public; state agency staff; and other local, regional, and federal agencies and report survey results.

Target: Capture 100+ statewide responses, including at least five non-New Mexico (external) perspectives, including tribal, local, and regional responses. Learn how stakeholders prefer to find, access, and use water data.

Metric: Completed survey process and summary of findings by May 1, 2022.

Roadmap

The roadmap to successfully enacting the Act requires commitment and participation from each of the directing agencies, and a full team of support to build and maintain the IT infrastructure. The WDI has successfully completed work on steps 1–4. Although, aspects of each will need to be maintained and updated going forward on the timeline. We continue now to work through steps 5–7, as we grow the data available within the planned IT infrastructure. Although we are working to demonstrate aspects of step 8, as more data become machine readable and accessible, data visualizations and usability will increase. In the coming years, steps 9–10 can be implemented.

Water Data Act Roadmap

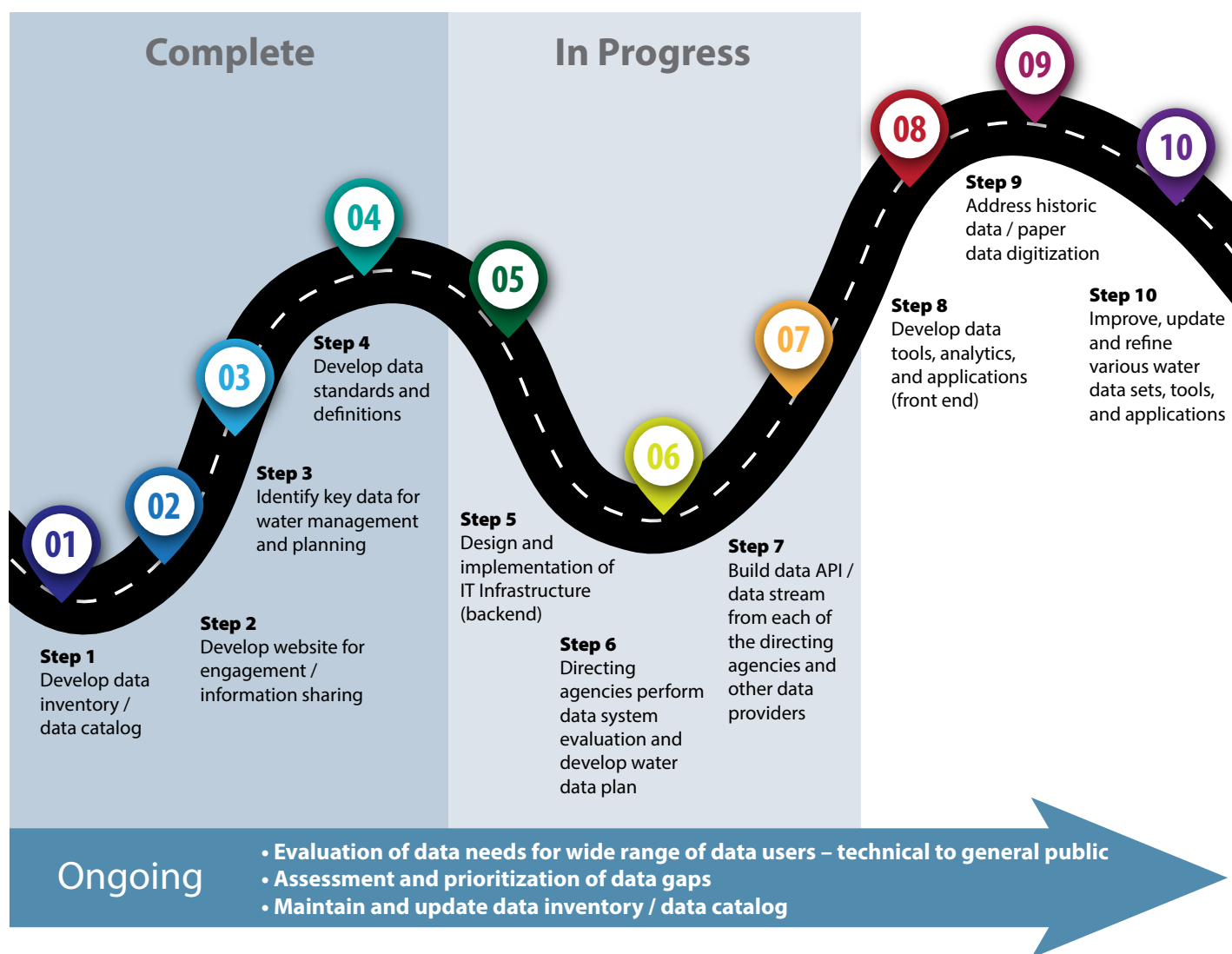


Figure 2. Roadmap and progress steps for the full implementation of the Water Data Act.

Budget Requirements

The current budget for the Act is only the annually recurring state funding at NMBGMR, for a total of approximately \$100,000. This fund is used to support part-time staff hours at NMBGMR, with some no- or low-cost software, and small contract services (i.e., data/software management, website design, and outreach). However, considering the urgency, the \$100,000 is insufficient to support the full intent of the Act, and the IT needs and support required to accomplish true, federated data integration service. The state funding is leveraged with a generous donation from the Healy Foundation (\$75,000, cumulative total since 2019) and also has been used as cost match to bring additional federal funds under the U.S. Bureau of Reclamation WaterSMART grant (Pecos Pilot Project, see below).

Based on work in the last two years of implementation of the Act, funding has largely been used to support two important tasks. First, the effort of convening the different working groups, and second, hosting the core

data infrastructure, which is built using low-cost open-source tools hosted on a secure cloud space.

Based on a budget analysis of the true needs of the project, we believe that this effort is a complex, multi-year project, estimated at approximately \$600,000 annually for at least the next 4 years (Table 3), and approximately half this cost after 4 years for maintaining the water data services. Currently the entire WDI project funding is managed under the New Mexico Institute of Mining and Technology (NM Tech), through the NMBGMR, as this agency was named as the convener of the Act.

The proposed WDI funding, at NM Tech/NMBGMR, would support building a robust IT system to support management of multiple water data sources, staffing and operational requirements with four full-time dedicated staff, providing technical support solutions to directing agencies and others for data sharing and integration, assisting with funding and grant writing,

Pecos Pilot Project

As part of a cooperative grant with the U.S. Bureau of Reclamation, under the applied science WaterSMART program, the WDI and Pecos Valley Artesian Conservancy District are collaborating on improved access to water data. For a 3-year project, which started in 2020, the WDI will facilitate providing better access to data in order to improve groundwater and surface water management and decision making. Ideally, the pilot project can be used as a model for regional data integration and tool

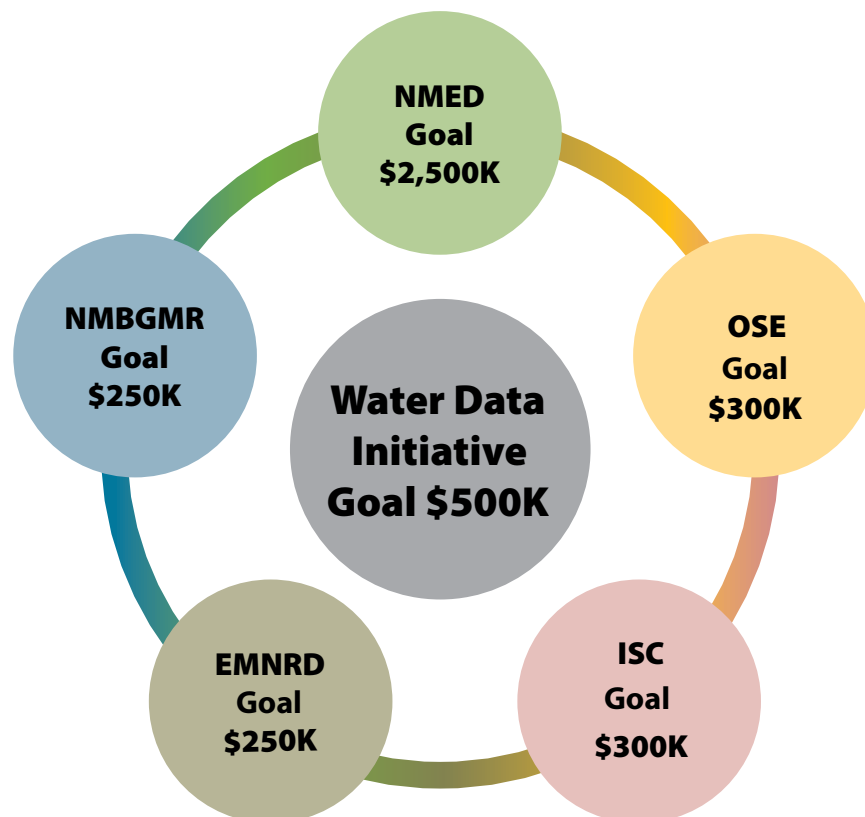
development for other regions of New Mexico and the West.

With a focus on the Pecos River corridor, in the Pecos Valley Artesian Conservancy District region, we will create more efficient data collection, data ingestion, data management, and re-usability of data for the regional and state water managers. We are working to integrate many datasets of interest for local stakeholders, such as water data from the OSE, ISC, U.S. Geological Survey, and U.S. Bureau of Reclamation.

Through new data integration, we will also work on improving new data visualization tools to address some of the most pressing water management challenges in this region. By having data more accessible, conflicts around water can be reduced. Using dashboards or data visualizations can help water managers, decision makers, and producers better understand the current status of water, and plan their water future.

Table 3. Budget estimate, currently administered at the NMBGMR, at NM Tech. This annual budget is expected to fully support the implementation through the WDI, supporting the Water Data Act over the next 3–4 years.

Estimate	Title	Responsibilities
\$115,000	Water Data Coordinator	Coordinate overall effort, implement plan, and direct communications and outreach
\$110,000	Data Architect	Full stack developer, build / maintain sustainable IT infrastructure
\$100,000	Technical Support	IT developer support, data integration and transformation
\$100,000	Water Data Liaison	Direct collaboration with data providers and stakeholders to evaluate data readiness and data needs
\$10,000	Web Master	Contract services for website maintenance
\$25,000	IT Services	Cloud-based services, site hosting, and software
\$50,000	Data Curator	Support for maintaining data catalog
\$40,000	Map Services	On-call development of water data maps
\$50,000	Application Developer	On-call development of tools or applications using water data
\$600,000	SUB TOTAL	
\$100,000	Water data fund already at NMBGMR	
\$500,000	FUNDING GOAL	



The overall budget estimate for the WDI, across all agencies is approximately \$4.1 million annually for at least the next 4 years.

convening different stakeholder and working groups, and guiding the overall direction of the WDI. To build a WDI IT support and operations team, the structure of the team and various contract services is estimated below. Note that costs are approximate, for estimation purposes, and intended to include fringe benefits in total cost.

The effort of building the data and information platform that integrates multiple agencies' water data in a robust, dynamic way is a large but critical project to undertake. This is a multiyear project that will require each participating agency to do tremendous improvements on how they manage water data. Unless it is properly funded, this process will progress at a slow pace. As New Mexico faces increasing water uncertainty—with numerous water-management

challenges, and ambitious goals for water planning—it is essential that the Act be fully funded in order to keep pace with current and future water challenges.

We must consider New Mexico's water and water data as part of the most basic, essential infrastructure we build, maintain, and periodically upgrade. Considering the investment our state and nation make and will be making toward numerous physical infrastructure improvements in the coming years, we must consider the relatively small investment required to build and improve our water data conditions. With input from each of the directing agencies, we estimate that with an initial one-time investment of approximately \$3.1 million (explained in Table 4), each agency will begin to dramatically change how water data are shared and managed. This must then be supported by annually

Table 4. Directing agencies one-time and recurring funding estimates.

Directing Agency	One-time Funding	Recurring Funding Need	Main Purpose for One-time and Recurring Funding Purpose
New Mexico Environment Department	\$1,500,000	\$2,500,000	<i>One time:</i> Contract services, IT support, new database acquisitions, cloud-hosting, and modifications to API management. <i>Recurring funding:</i> 4 to 6 FTEs, contract services, software licensing, digitizing service or equipment
New Mexico Office of the State Engineer	\$280,000	\$300,000	<i>One time:</i> Contract services, API creation <i>Recurring funding:</i> 3 FTEs for developer, data administrator, and water data liaison.
Interstate Stream Commission	\$500,000	\$300,000	<i>One time:</i> Contract services, including start of digitizing paper records and equipment <i>Recurring funding:</i> 3 FTEs with focus on water data and water planning, increased monitoring/data collection, and technical support
New Mexico Energy, Minerals and Natural Resources Department	\$500,000	\$250,000	<i>One time:</i> 2 technical and 2 IT staff (contractors, interns or temp staff) <i>Recurring funding:</i> 0.5 FTE technical support and 1.5 FTE IT
New Mexico Bureau of Geology and Mineral Resources*	\$300,000	\$250,000	<i>One time:</i> Data management system overhaul/ improvements supported by contractors and staff <i>Recurring funding:</i> 1 FTE data management and 1 FTE developer / web services
TOTAL DIRECTING AGENCY ESTIMATE	\$3,080,000	\$3,600,000	
GRAND TOTAL (INCLUDING SUPPORT FOR WDI, see Table 3)		\$4,100,000	

*Separate from funding /support to convene and implement WDI, shown in Table 3.

recurring agency budgets and support for the WDI, for a grand total annual budget of approximately \$4.1 million (such as for staffing, IT services, contractors, software licensing). It is expected that state agencies may request these funds in their annual budgeting process, and if funding is acquired, agencies will work with WDI to follow current best practices and data model.

One consideration in these budget estimates is that it does not include the cost of improving the current

water monitoring situation. Due to state and federal funding changes in recent years, long-standing data collection sites have been reduced in number, including groundwater monitoring, streamflow gauges, and climate stations. A known data gap recognized through the Act is that there are some regions where monitoring data are insufficient for management and planning purposes. This may be requested in future years, as we first review data coverage and explore creative funding solutions to fill data gaps.

Impact to New Mexico

One of the largest benefits to New Mexico, related to implementing the Act, is that by making steps to modernize our data management and improve how agencies share and utilize data, there will be huge improvements in the efficiency of state agencies, especially how they can respond to public inquiries. Fewer staff hours will be needed to fulfill data requests or to utilize the most current and robust data for modeling and management questions. This translates directly into cost savings for agencies, allowing them to support other priorities, and help meet the state's climate resiliency goals.

Enacting the Act is no small feat. By making several major changes in how our state data are managed and shared, we can provide water managers and water planners with tools to be nimble and resilient as we

face future water resource conditions increasingly impacted by climate change. This begins with making data accessible to computers (i.e., by API or web services), beyond just for human consumption. From these "computer accessible" or "machine readable" datasets, dynamic maps, applications, or dashboards can be built efficiently and directly supporting the decision-making process.

New Mexico is already proving to be a leader in water data. Fully investing in the New Mexicans working to achieve the goals of the Act, supporting the WDI, and funding the participation of state agencies will further New Mexico's strengths in water data, ensuring a data-driven approach to water management and water planning.



Appendix 1

Summary of Agency Responses



Each of the directing agencies were asked to complete a survey to describe how their agency will participate in the Water Data Act in the upcoming year, and provide estimates for budgetary requirements that would expedite the goals of the Act. This is provided for estimation and consideration of what the agency needs to meet the requirements of the Act, and should not be considered an official budget request.

All of the directing agencies reported the need to build agency resources for staff and IT support to address the Water Data Act.

The most consistent result of the survey is that all of the directing agencies reported the need to build agency resources for staff and IT support to address the Water Data Act.

New Mexico Environment Department

Major tasks:

- Inventory and evaluate available data / database applications.
- Acquire and implement new databases for the Ground Water Quality Bureau and Surface Water Quality Bureau.
- Provide additional IT Support for Safe Drinking Water Information System (SDWIS) and Drinking Water Watch.
- Continue to work on selecting water data features to share by API.
- Include new data features on current web mapping services.
- Initiate paper data digitization.
- New staff requirements in IT, Ground Water, and Surface Water.

Additionally, NMED has identified substantial information associated with water quality and quantity through monitoring well data from the Petroleum Storage Tank Bureau. The data come from investigations and mitigation activities at historic sites across the state.

One time funding estimate: \$1,500,000 (contract services, IT / database acquisitions and modifications to APIs). Includes costs to acquire and customize databases for Ground Water Quality Bureau, Surface Water Quality Bureau, Drinking Water Bureau, and Petroleum Storage Tank Bureau, as well as cloud hosting services.

Recurring funding estimate: \$2,500,000 (8 FTEs, contract services, software licenses, digitizing services, equipment)

SHARE OPPORTUNITY: NMED is currently developing an API management platform that can be shared with other state agencies.

New Mexico Office of the State Engineer

Major tasks:

- Build agency resources for staff and IT support to address Water Data Act.
- Provide Point of Diversion data to Water Data Act using FTP site.

One-time funding estimate: \$280,000 (contract services, such as data system review and API development)

Recurring funding estimate: \$300,000 (3 FTEs: developer, data administrator, and water data liaison)

New Mexico Interstate Stream Commission

Major tasks:

- Organize and document multiple datasets in different bureaus for improved data sharing including API development.
- Digitizing paper data, including historical records.
- Improvements of monitoring networks.
- Multiple staffing needs (water planning, monitoring, modeling, GIS/IT staff).

One-time funding estimate: \$500,000 (digitizing services, database with API development, software licensing, data collection equipment and installation)

Recurring annual estimate: \$300,000 (3 FTEs including a position to support the intersection of water data and water planning; increased monitoring, data collection, and technical support, such as GIS application developer to assist in water use models)

New Mexico Energy, Minerals and Natural Resources Department

Major tasks:

- Raise awareness and build funding for full participation in Water Data Act.
- By meeting internally a few times during the year, the agency will prepare a draft outline plan for implementing the Water Data Act in the agency, to include potentially updating Coal Mine water quality database and improve reporting data on water used for fracking.

One-time funding estimate: \$500,000 (contractors, interns, or temporary staff including 2 technical and 2 IT staff)

Recurring annual estimate: \$250,000 (0.5 FTE technical and 1.5 FTE IT staff)

New Mexico Bureau of Geology and Mineral Resources

Major tasks:

- Improve documentation of databases.
- Upgrade current databases.
- Fully automate API connection to databases.

One-time funding estimate: \$300,000 (data management system overhaul and improvements by contractors and staff)

Recurring annual estimate: \$250,000 (2 FTEs, as a data manager and full stack developer)