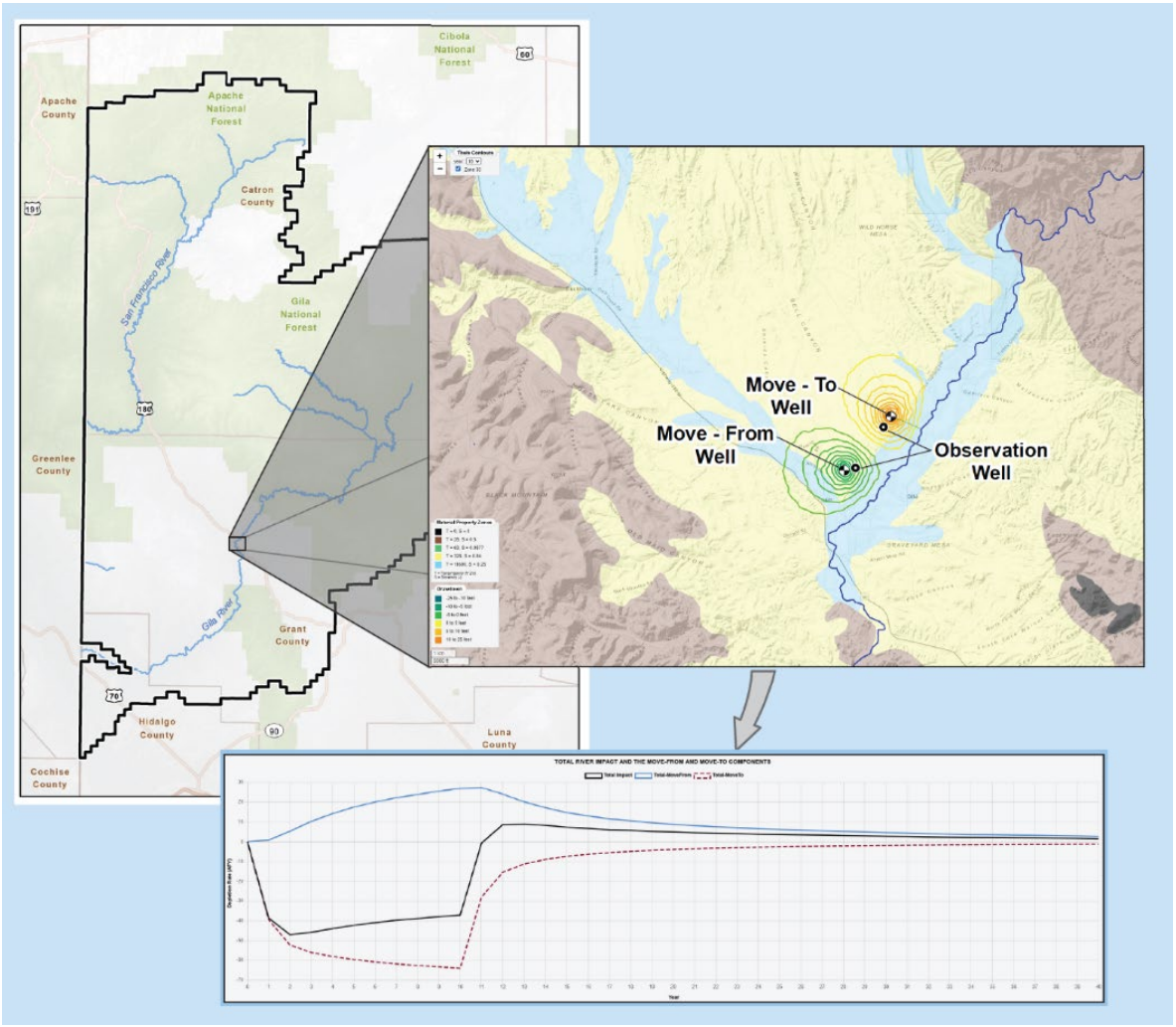
Developing a Map-based Analytical Interface (Ani) for Water Rights Administration in New Mexico

Submitted to: Department of the Interior Bureau of Reclamation WaterSMART Applied Sciences Program – Funding Opportunity No. R23AS00446



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LIST OF ACRONYMS

ACRONYM	DEFINITION
ADF	Analytical Depletion Function
AMP	Aquifer Mapping Program
Ani	Analytical Interface
CEJST	Climate and Economic Justice Screening Tool
GIS	Geographic Information Systems
GLHYMPS	Global Hydrogeology Maps
NMBGMR	New Mexico Bureau of Geology and Mineral Resources
NMISC	New Mexico Interstate Stream Commission
NMOSE	New Mexico Office of the State Engineer
NMWDI	Water Data Initiative
NOFO	Notice of Funding Opportunity
URGWOM	Upper Rio Grande Water Operations Model
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WDA	Water Data Act
WhAEM	Wellhead Analytic Element Model
WITF	Water Infrastructure Task Force
WRAP	Water Rights Allocation Program

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1. EXECUTIVE SUMMARY

The New Mexico Office of the State Engineer (NMOSE), headquartered in the City and County of Santa Fe, New Mexico, submits this proposal on October 16, 2023 to the Bureau of Reclamation's (BOR's) WaterSMART - Applied Science Grants under the Notice of Funding Opportunity (NOFO) No. R23AS00446. The project "Developing an Analytical Interface (Ani) for Water Rights Administration in New Mexico", will be directed by Dr. Katie Zemlick, with co-principal investigators Dr. Kamran Syed, Laura Hagan Petronis, and Dr. William Tintor.

The NMOSE is responsible for administration of the state's water resources which includes the supervision, measurement, appropriation, and distribution of all surface and groundwater in New Mexico. Current water management challenges posed by variable surface water supplies and declining groundwater levels will be further complicated by a changing climate. In addition, because most of the available water in the state is fully appropriated in an average year, increasing demands will require the ability to respond quickly to hydrologic changes to manage the resource and protect existing water rights.

To address these challenges, the NMOSE has invested in the development of Ani, a map-based analytical-model interface that predicts hydrologic changes associated with proposed water transfers. Those predictions help the NMOSE better understand potential impacts due to water management decisions. The proposed project will build upon the existing Ani framework by leveraging the work of the New Mexico Water Data Initiative to include mapped aquifers and their properties as well as data from existing models, including those from the United States Geological Survey (USGS). Not only will this tool improve water rights administration on behalf of the Agency, but it will also provide valuable information to planners and the public. The visualization of pumping effects will improve comprehension of potential hydrologic impacts on a system, and thus improve the public's ability to better understand their own water resources and limitations. It will also improve the ability of local water managers to evaluate options for their water systems, reducing the costs associated with hiring outside expertise. Conceptually and practically, the expansion of the Ani tool will significantly advance capabilities for both water managers and water users in the arid southwest and elsewhere.

The specific objectives and research efforts for the proposed project are: 1) compile a geodatabase containing mapped aquifers and their hydrogeologic characteristics, networks of perennial and ephemeral streams that interact with groundwater, and preexisting numerical groundwater models, 2) integrate this data into the existing Ani framework expanding its capabilities to represent most New Mexico basins which currently lack an administrative numerical groundwater model 3) demonstrate capabilities and limitations, including the impacts of boundary conditions and the spatial extent of predictions, 4) evaluate Ani predictions against benchmark configurations in order to document capabilities and limitations, 5) develop additional advanced capabilities in Ani, including user-defined river shapefiles, spatially weighted aquifer properties, refined drawdown integration techniques, and extended platform capabilities. These objectives are addressed in the research plan and will be completed within two years from the time of the award. Timelines provided in this proposal assume an award date of January 1st, 2024 which would result in completion before January 1st, 2026. Project efforts will not be performed at a federal facility. We are requesting a total of $249,743 federal funds and will contribute $259,936 of non-federal funding as cost share to complete this project.

This project will result in an improved water rights administration tool for New Mexico water managers, one that will assist in making informed decisions, aid in water planning and communication, and provide a tool with which communities can better understand their water

management challenges and opportunities. The proposed project directly addresses Reclamation's water management objectives including water rights administration, conjunctive use of surface and groundwater, and water supply reliability as listed in 2023 NOFO (R23AS004466). Moreover, this project will provide a readily adaptable framework which other states can utilize to expand upon their existing water management tools.

2. TECHNICAL PROJECT DESCRIPTION

2.1 Applicant Category

As the state agency responsible for water resources, the New Mexico Office of the State Engineer is a Category A applicant.

2.2 Background and Introduction

Groundwater is a critical component to New Mexico's limited water supplies. The state has long recognized the connection between surface water and groundwater, managing the resource conjunctively for over 60 years (City of Albuquerque vs. Reynolds, 1962). In the last decade, groundwater use has surpassed surface water use in the state, in part because of the oil and gas boom in southeastern New Mexico, but also due to applications to use groundwater to supplement surface water supplies. The latter activity has become increasingly challenging as surface water supplies become more variable, groundwater resources decline, and demands for water increase. In addition, because most surface waters of the State are considered fully appropriated, all groundwater has been included in a designated groundwater basin, and many of the groundwater basins have been closed to new appropriations, there are limited supplies of "new" water for future use. Therefore, understanding the hydrologic impacts of moving water around is of the utmost importance in managing these limited supplies.

Water management decisions are limited by available hydrologic data, and that which does exists often lacks the spatial and temporal detail necessary to develop regional numeric hydrologic models. To illustrate, of the thirty-nine declared groundwater basins in New Mexico, numerical models have been developed for fewer than half the declared basins and many of these have not been updated within the last decade (either due to limited staffing or budgetary restrictions). Thus, for a majority of New Mexico's groundwater basins, the State relies on analytical solutions to estimate hydrologic impacts, including depletions to surface water and drawdown in aquifers.

Analytical models have been used widely in the field of hydrology for more than a century and have advantages compared to numerical models. Unlike numerical models which require considerable time, effort, and data to develop, analytical models are easily implemented to evaluate potential hydrologic impacts and require limited data. Additionally, analytical models have a single solution, therefore results can be rapidly used by decision makers while also aiding in the development and verification of numerical models (Huang et al., 2018). For example, the Theis Equation was developed in New Mexico by C.V. Theis (1935) to provide an exact solution for the change in water levels of an ideal confined aquifer due to pumping from a nearby well. Further work by Hantush and Jacob (1955) and Neuman (1974) resulted in analytical models which solved for drawdown impacts due to pumping in leaky confined aquifers and unconfined aquifers, respectively.

The effects of groundwater pumping on surface water supplies have also been long simulated using analytical models, most importantly using the methodology described in the

"Glover-Balmer" solution of Glover and Balmer (1954). More recently, Zipper et al. (2018) developed an analytical depletion function (ADF) method by which stream depletion could be calculated at segmented reaches of a stream. Previous analytical models of surface water depletion (including Glover-Balmer) assumed surface features were infinitely linear for purposes of simpler computational requirement. This new approach improves depletion estimates based on more realistic stream geometries and scales these depletions by stream segment or reach (Zipper et al., 2019; Zipper et al., 2018). Given that analytical models often use similar aquifer properties (including but not limited to Storativity (S) and Transmissivity (T)) it is possible to simultaneously estimate both drawdown and stream depletion due to pumping a well at a specified rate over a specific period of time.

The NMOSE Water Resources Allocation Program (WRAP) has hundreds of applications pending state-wide at any given time and thus the queue for evaluation can be more than six months if the application is not protested. This project will improve the speed and consistency with which water rights are administered by the NMOSE. It will also support regional water planning by enabling communities to better understand their water management options prior to filing an application with the NMOSE. Last, this proposed project will provide a reproducible, technical framework with which other water management entities can build into their water management toolsets.

2.3 Project Goals

The overarching objective of this proposed project is to use existing methods to develop a tool, the Ani interface, that will allow water managers to quickly evaluate the hydrologic effects due to a proposed application to pump a well. To achieve this goal, we will combine existing hydrologic data on aquifers and the occurrence of surface water supplies as inputs to the Ani interface framework. This will help our estimations of hydrologic impacts in areas where a numerical model has not been developed. This tool will be useful not only to water managers, but to planners, consultants, and communities who want to better understand their water resources. In addition, the Ani interface framework will be useful to those outside of New Mexico who desire a tool to similarly manage this critical resource. The specific objectives for the proposed project are:

Objective 1: Conduct data collection and analysis pertaining to mapped aquifers and their hydrogeologic characteristics, networks of perennial and ephemeral streams that interact with groundwater, and data from existing non-NMOSE numerical models.

The New Mexico Water Data Initiative (NMWDI) is a collaborative group working to modernize New Mexico's water data as part of the Water Data Act. Organized by the New Mexico Bureau of Geology, this multiyear effort will provide access to data on water quality, quantity, and usage in an open data framework to provide information critical to the responsible and responsive management of water in New Mexico. The NMBGMR Aquifer Mapping Program (AMP) data products and USGS aquifer studies will be used to determine aquifer spatial extent. This project will also leverage the existing NMWDI data sets and improved data sets pertaining to aquifer tests and aquifer properties in a comprehensive geodatabase for use in developing Ani datasets and as a stand-alone reference for regional hydrology in the state. For areas in the state with limited aquifer studies, data from various global sources, such as GLobal HYdrogeology MaPS (GLHYMPS) (Gleeson et al., 2014) will be utilized.

Objective 2: Integrate this data into the existing Ani framework expanding its capabilities to represent most New Mexico basins not having an administrative numerical model.

Currently, two hydrologic basins are represented in the Ani prototype: Gila-San Francisco and Upper Pecos. Using data compiled in Objective 1, we will expand the integration first, to stream-connected groundwater basins in the state and second, to remaining closed or non-stream-connected groundwater basins for a total of up to 20 additional basins incorporated into the Ani framework.

For stream-connected groundwater basins, the ADF method (Zipper et al., 2019) will be implemented with the Glover-Balmer equation as well as proximity criteria and depletion apportionment. Proximity criteria calculates depletions for streams within a radius where the maximum annual depletion potential is at least 1% of the total pumping simulated. Depletion apportionment within the Ani interface employs the web squared method which divides stream segments into evenly spaced points (Zipper et al., 2019).

Objective 3: Develop advanced capabilities including user-defined river shapefiles, spatially weighted aquifer properties, depletion mapping, refined drawdown integration techniques, and extending platform capabilities.

The advanced capabilities objectives explicitly target extending Ani capabilities and are based on five features identified during Ani prototype development. Each of the five features extends Ani capability and significantly increases the tool's versatility. At the same time, the five features stem from established processes and methods. The underlying functionality, concepts, and science is well established. Details on advanced capabilities for the five features are summarized below.

1. Adding capability to include user-defined river shapefiles immediately expands Ani versatility, not only to refine or experiment with depletion of additional/different tributaries, but also taking Ani a significant step closer to unlimited application-location flexibility. This Ani advanced capability will allow users to specify other surface and groundwater characteristics by importing shapefiles, have the option to evaluate other geographic areas, and select options for river network representation. The user will provide the polyline river shapefile and some basic attribute mapping, and Ani will automatically process the shapefile into the format required for the ADF analysis. The processed shapefile will then be exported so that depletion calculations are transparent and reproducible.

2. Distance weighting of aquifer properties to provide harmonic mean values will significantly improve Ani's capability to represent simple heterogeneity. Implementation of harmonic-mean averaging is consistent with standard hydrogeologic practice, and Ani's map-based interface is conducive to extracting proportions and transmissivity values and then estimating impacts based on the spatially weighted aquifer properties. The option for the user to manually enter transmissivity and storativity values will be retained, so that a user's local knowledge on a specific well (i.e, a pump test) may be applied to Ani's calculations.

3. Depletion mapping will enhance visualization of estimated impacts, depicting both the spatial distribution and magnitude of the Ani results. By supplementing the existing

application-process required output, depletion maps allow the user insight to the predicted spatial extent of depletions by color coding river sections according to the magnitude of estimated depletion. Such insight will be valuable both in terms of verifying consistency of the estimate with the conceptual understanding of the physical system, and initiating, if necessary, the investigation of transfer alternatives and modifications.

4. The current Theis superposition approach faces challenges to evaluate multi-well drawdown in the vicinity of meandering rivers. Extending the depletion-integration method concepts (e.g., Zipper et al., 2019) to drawdown calculations will expand Ani drawdown-prediction versatility and provide better drawdown evaluations with less exceptions along meandering rivers.

5. Finally, extending the Ani desktop software to a web-based platform will allow the collected data (Objective 1) to be implemented through an update process, rather than requiring a new software release. Web-based Ani will also eliminate the need for IT oversite and installation issues on state of New Mexico hardware. Transition to a web-based platform will also facilitate the public release of Ani so that individuals outside of the NMOSE including planners, consultants, and communities, can have access to an accessible tool to better understand their water resources.

Objective 4: Evaluate Ani predictions against benchmark configurations in order to document impacts of boundary conditions, capabilities and limitations.

Ani depletion and drawdown predictions will be compared to a series of benchmarks, both analytical and numerical evaluations of hypothetical water transfers. The comparisons will allow detailed examination of capabilities for systems ranging from a basic straight-line river implementation to those with more complex, multiple-river geometries. As with any analytical approach, Ani estimates will be influenced by boundary conditions and the spatial relationship between pumping locations and areas of interest. Demonstration of those influences, as part of the Ani documentation and development process, will be critical for helping users properly interpret estimates as part of the water resources management decision process.

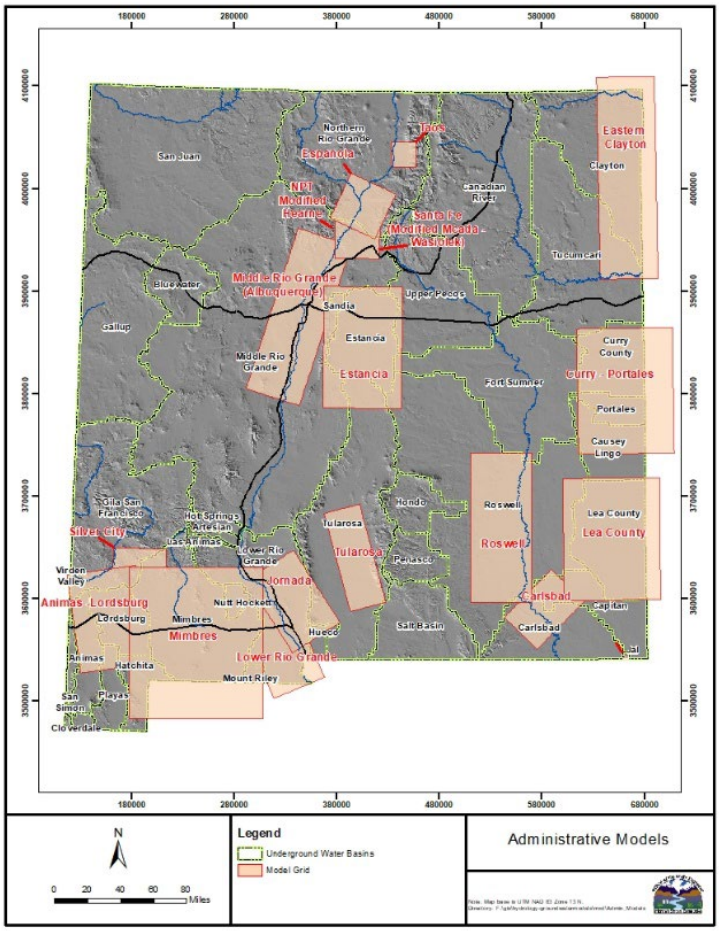
Comparison of Ani depletion and drawdown predictions to the basic Glover Balmer solution of stream-aquifer interaction will demonstrate proper implementation of solutions to the governing equations. This first step of benchmark configuration testing establishes a foundation: that for conditions consistent with assumptions of the Glover Balmer and Theis solutions of stream-aquifer interaction and drawdown, respectively, Ani predictions are consistent with the established solutions.

The second step of benchmarking characterizes Ani capabilities to incorporate stream geometry. Ani and numerical predictions will be evaluated for a hypothetical stream aquifer system consisting of a simple aquifer but including complex stream geometry and multiple streams. The evaluation will be used to demonstrate consistency between the numerical model and Ani predictions and provide insight as to conditions when prediction differences begin to occur. Results from this second benchmarking step will both demonstrate the basic consistency between Ani and numerical solutions for such systems and provide users insight into conditions when predictions may start to differ.

2.4 Project Location

Drought has been a recurrent and often severe challenge throughout the history of New Mexico. The region's arid and semi-arid climate, characterized by limited precipitation and high evaporation rates, makes it particularly susceptible to drought. The early 2000s witnessed a prolonged drought period that stressed water resources, impacted agriculture, and led to water use restrictions in some areas. This drought period was followed by intermittent droughts as well as the effects of climate change, which is predicted to increase the frequency and severity of drought events. Rising temperatures and altered precipitation patterns further complicate water management in the region. To address the ongoing issue of drought, New Mexico has adopted various water conservation measures, water planning initiatives, and drought response strategies. These efforts involve collaboration among government agencies, Native American tribes, water user associations, and other stakeholders to better manage and allocate water resources in the face of persistent water scarcity challenges.

All groundwater in the state of New Mexico is under the administration of the state engineer and delineated as thirty-nine individual groundwater basins (Figure 1). However, there are limited numerical models for water rights administration, many of which have not been updated recently. This means a significant portion of the state relies on analytical solutions, and the assumptions that are required for their use, for water management.



New Mexico has the third highest poverty rate in the U.S., with more than 16% of the population living below the poverty line. These communities are disproportionately affected by limited access to safe and reliable water supplies (ASU, 2021). In addition, New Mexico's diverse population of more than two million people includes 23 tribes and pueblos, more than 300 land grant communities, 10 irrigation districts, acequia communities, and municipalities all having different water management priorities. This tool will provide access to communities across the state to understand how their water management priorities will affect their local water resources and other water users.

2.5 Project Schedule

The project schedule and milestones are illustrated in Table 1. The project will be initiated with a kick-off meeting with the research team in the second month of the project timeline. The

important milestones of the projects are geodatabase development, Ani integration, incorporation of advanced capabilities, demonstration of capabilities and limitations, benchmarking, reporting and dissemination, quarterly progress reports, and final reports. The first progress report will include datasets and data sources that will be incorporated into the Ani framework. Progress of the subsequent Tasks, including Ani development, integration, testing, reporting, and dissemination will be summarized in the 2nd, 3rd, 4th, 5th, and 6th quarterly progress reports. The draft final report will summarize the overall progress throughout the project. Based on the feedback and

TABLE 1: PROJECT SCHEDULE AND MILESTONES

TASK	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Objective 1: Aquifer and Stream Property Collection								
Data Collection								
Data evaluation, review and characterization								
Documentation and metadata catalog development								
Objective 2: Data Assimilation								
Expand Ani capacity/capabilities								
Clean, test and integrate data sets within Ani								
Operator's manual appendix (metadata linking)								
Objective 3: Advanced Capabilties								
Spatial transmissivity weighting								
Depletion Mapping								
User defined river and hydraulic property files								
Refined drawdown methods								
Extending platform capabilities (web-based)								
Objective 4: Benchmarking and Documentation								
Analytical Baseline								
Numerical-Analytical direct comparison								
Guidance and summary documentation								

comments on the draft final report, we will submit the Final Report at the end of the project.

2.6 Anticipated Challenges

The number of existing numerical models in the state is an indicator that hydrologic data is not always robust. Therefore, the project team anticipates a number of challenges that are common occurrence in any data-driven modeling effort. These challenges may include: 1) uneven spatial distribution of aquifer test data in groundwater basins and variable quality in existing tests, 2) areas of great hydrostratigraphic complexity, for which the analytical solution may be inappropriate, and 3) limited stream gaging to determine the extent of potential hydrologic impacts to both perennial and ephemeral streams so that determining which surface water reaches should be included in the depletion evaluation may be challenging. Anticipating these challenges, we plan to incorporate a comparative data robustness indicator within the Ani interface where users can identify the number of data sets the analytical model is based upon as an indicator of confidence in the resulting model outputs. In addition, we will build in the capabilities for users to enter their own data as, for example, new aquifer tests are conducted.

3. DATA MANAGEMENT PRACTICES

This project is data-intensive and requires a robust data inventory. Any spatially explicit data or tools developed in the performance of an award made under this NOFO must be developed in industry standard formats that are compatible with Geographic Information System (GIS)

platforms. All other data collected in various formats will be catalogued and stored in spreadsheet format and will be available with the final Ani tool and documentation.

4. EVALUATION CRITERIA

4.1 Evaluation Criteria A – Benefits to Water Supply Reliability

4.1.1 Describe the water management challenge(s). Describe in detail the water management challenge(s) occurring within your project area. Describe the severity of the challenge to be addressed with supporting details.

This project will address a wide variety of complex water management challenges in New Mexico. Water supplies in the state of New Mexico are generally considered to be fully appropriated, meaning there are no "new" water supplies. In addition, the state has experienced both intermittent and extended periods of drought. In periods of shortage, junior users, typically non-irrigation water users like municipalities, may have shortfalls in supply. This may require them to attempt to supplement surface water supplies with groundwater. This process has historically been extremely time intensive, and thus not able to respond to rapid changes in water supply. In addition, because the evaluation of hydrologic impacts has been done on a regional basis, there has been a lack of consistency in determination of impacts. Lastly, the methodology behind determining impacts has largely been in the realm of administrators and consultants. As the State moves towards community-based water planning, tools such as this will enable communities and individuals to better understand their water supplies and plan for the future.

4.1.2 Describe the concerns or outcomes if this water management challenge is not addressed.

There is concern that tools available currently are insufficient to meet growing demands on limited water supplies. Without the proposed tool, backlog for analysis of hydrologic impacts will increase as will the time required to do so. This may result in prolonged periods where communities experience water supply uncertainty. In addition, as communities move ahead in their fifty-year water planning process, they will have limited tools with which to understand the impacts and thus, potential opportunities, for water management.

4.1.3 Explain how your project will address the water management issues identified in your response to the preceding bullets and provide support for your response.

This project will compile aquifer parameters and develop an analytical model for the **conjunctive use and associated water rights administration of water in New Mexico**. This will directly support water supply reliability by enabling stakeholders to understand the impacts of their proposed changes in water supply, aid in water marketing and drought management activities by enabling the evaluation of impacts due to moving water from one location to another.

This tool will improve our understanding of the complex interactions that occur due to the **conjunctive use of surface and groundwater** which is the foremost consideration of the NMOSE, to manage impacts to both the resource and to existing **water rights administration.** Furthermore, this tool will aid in communicating potential effects with water users so that administrative decisions are better understood, in the case of **drought management activities**. Lastly, this tool will provide more consistency and transparency in **water rights administration** by providing the source data as well as the methodology for determining hydrologic impacts.

4.2 Evaluation Criteria B – Need for Project and Applicability of Project Results

4.2.1 Describe how the need for the project was identified. Describe how the tool, method, or information will be applied and when it will be applied.

The need for improved water management tools in the West is evident as regional demands can often exceed existing supplies. In addition, the Water Infrastructure Task Force (WITF), authorized by New Mexico Governor Michelle Lujan Grisham, identified a key **need** in water resources management and planning to "Advance our scientific understanding of groundwater through measuring, monitoring, and models to protect the quantity and quality of groundwater resources."

The WITF is comprised of 29 members that include water and natural resources experts, state agency staff, and stakeholders from around New Mexico. They represented a diversity of geographies, water resources interests, and expertise. In addition, they defined one of five key areas in need of solution that "major gaps in our scientific understanding of New Mexico's water resources should be filled by hydrogeologic investigations and aquifer research." Given the state's emphasis on community-based planning into the future, there is a real need for tools that facilitate communication between decision-makers, planners, and the traditionally under-resourced communities in New Mexico.

This tool is expected to provide water managers and administrative staff with a tool that quickly and consistently evaluates hydrologic impacts due to proposed groundwater use within the state, particularly in areas where a numerical model has not been developed for water rights administration. This tool will play a significant role in improving NMOSE response to water rights applications, particularly in times of hydrologic uncertainty. In addition, the tool itself will provide a sound basis for communicating with the stakeholders impacted by these water management decisions while, at the same time, improving community capacity to plan for the future.

4.2.2 Describe how the tool, method, or information will be applied and when will it be applied. Will the tool or information be used immediately or will additional work need to be done before the tool will be used?

This tool will be used immediately by the NMOSE for water rights administration. First, during the development phase, results generated by the model will be compared to results using previous analytical methods and tools to establish reliability. During this period, the tool will be shared with stakeholders for testing and feedback. When completed, the tool is designed for use in water rights administration but can also be used to assist in planning by understanding regional hydrologic responses to various water management scenarios. In addition, this framework is designed to be iterative in nature, allowing for changes to model parameters. These changes may include addition or revision of data in the interface based on recent work or other technical feedback, or, by enabling users to re-define aquifer parameters in a given basin.

4.2.3 Who will use the tool or data developed under this proposal and how will they benefit from the project? Support could include but is not limited to letters from stakeholders expressing support for the project and how they will benefit.

In general, water users in the state of New Mexico will benefit from this project which will improve the speed and consistency with which water rights applications are reviewed by the NMOSE Water Rights Division.

This tool is designed to evaluate hydrologic effects in areas of the state for which no numerical model exists. However, the data and information required for the model will leverage the work of the USGS and NMBGMR within a seamless framework. This project also seeks to integrate data from numerical models in development by the USGS as they become available. This administrative tool will provide near real-time solutions in areas where existing models such as the Upper Rio Grande Water Operations Model (URGWOM) and the Middle Rio Grande Administrative (MRGA) Model are cumbersome and time-consuming to utilize.

4.3 Evaluation Criteria C – Project Implementation

4.3.1 Briefly describe and provide support for the approach and methodology that will be used to meet the objectives of the project.

Analytical models can provide accurate, consistent, and rapid solutions to hydrologic impacts and are particularly valuable in areas that are constrained by available data. These solutions are well established and widely accepted but are generally calculated separately from one another (e.g. Theis (1935) for drawdown and Glover-Balmer (1954) for surface water depletion). SSP&A has demonstrated the utility of applying analytical solutions to areas outside of the Carlsbad, NM area numerical model grid, enabling incorporation of hydrologic impacts in areas with limited hydrologic data. This effort improved upon the existing analytical solution by incorporating ADF for stream depletions at multiple stream segments. Following this effort, SSP&A worked with the NMOSE to develop the prototype Ani framework we propose to expand here. This demonstrated methodology will use existing data to simultaneously estimate both drawdown and stream depletion due to pumping a well at a specified rate over a specific period of time and provide consistent, easily interpretable results.

4.3.2 Describe the work plan for implementing the proposed scope of work. Such plans may include, but are not limited to:

A. ESTIMATED PROJECT SCHEDULE

The project schedule as shown in Table 1 reflects a combination of coordination, communication, and technical work. While some aspects need to be done sequentially (e.g., Benchmarking only after most of the advanced capabilities have been completed), other aspects can be addressed in parallel (e.g., Advanced Capabilities can be addressed while data is still be Assimilated).

b. milestones for each major task

Milestones and/or deliverables associated with each of the four objectives are summarized in the following list.

- Objective 1 Milestone/Deliverable: Completion of the aquifer and stream property catalog providing required inputs for the New Mexico basins of interest.
- Objective 2 Milestone: Completion of processing, formatting, and incorporating basin datasets within the expanded Ani framework.
- Objective 3 Milestone/Deliverable: Implementation of advanced Ani capabilities including loading user defined river and hydraulic property sets, distance weighting of hydraulic properties, depletion mapping, refined drawdown methods and transitioning to a web-based platform, resulting in an advanced capabilities Ani release.

- Objective 4 Milestone/Deliverable: Documentation of benchmark results and summary of Ani capabilities and limitations.

c. start and end dates for each task and milestones, and

Assuming a start date of January 1st, 2024, projective objectives will be achieved by the following dates

- Objective 1 (Aquifer and Stream Property Collection) will be completed by September 30th, 2024
- Objective 2 (Data Assimilation) will be completed by June 30th, 2025
- Objective 3 (Advanced Capabilities) will be completed by December 31st, 2025
- Objective 4 (Benchmarking and Documentation) will be completed by December 31st, 2025

d. costs for each task

Costs associated with each of the four proposed objectives are summarized in the table below.

Summary Cost Table

Objective	**Cost**
Objective 1 (Aquifer and Stream Property Collection)	$53,350
Objective 2 (Data Assimilation)	$226,686
Objective 3 (Advanced Capabilities)	$179,182
Objective 4 (Benchmarking and Documentation)	$50,461
Total	**$509,679**

4.3.2 Provide a summary description of the products that are anticipated to result from the project. These may include data, metadata, digital or electronic products, reports, and publications. Note: using a table to list anticipated products is suggested.

Anticipated Products Table

1	Hydrologic data inventory including aquifer tests, model aquifer properties, shapefiles of geology extents
2	A summary of the data inventory describing data sources and potential areas of need for which no data exists
3	An analytical modeling (Ani) tool for water rights administration
4	Report and appendices documenting model development and benchmarking
5	Ani user's manual

4.3.3 Who will be involved in the project as project partners? What will each partner or stakeholder's role in the project be? How will project partners and stakeholder be engaged in the project and at what stages? If you are a Category B applicant, be sure to explain how your Category A partners will be engaged in the project.

Data collection (Objective 1) will rely on information from the USGS, NMBGMR and the NMISC. Each of these agencies has hydraulic parameter and surface water network information, and technical expertise, that will be accessed and/or obtained as datasets for the Ani framework. During data assimilation information, and expertise, from those same three agencies will contribute to refinements. This may iterative efforts between contractors, the NMOSE and the three agencies as implementation within the Ani framework helps to potentially identify the need for any refinement of hydraulic or surface water datasets. Advanced capabilities development will

also draw upon NMISC expertise, in addition to NMOSE inputs, as new features are tested and evaluated. The fourth objective, Benchmarking, is the only objective requiring minimal partner input, in the form of editorial feedback on documentation. The first three objectives will, to varying degrees, rely on information from and communication with experts within the three partner agencies.

4.3.4 Identify staff with appropriate credentials and experience and describe their qualifications. Describe the process and criteria that will be used to select appropriate staff members for any positions that have not yet been filled. Describe any plans to request additional technical assistance from Reclamation or via a contract. Please answer the following:

a. Have the project team members accomplished projects similar in scope to the proposed project in the past either as a lead or team member?
Yes, the team members have accomplished similar projects (using both numerical and analytical models), serving in roles both as lead and team members.

b. Is the project team capable of proceeding with tasks within the proposed project immediately upon entering into a financial assistance agreement? If not, please explain the reason for any anticipated delay.
Yes, the project team is capable of proceeding with tasks within the proposed project immediately upon entering into a financial assistance agreement.

NMOSE Hydrology Bureau Staff:

- Dr. Katie Zemlick holds a Bachelor of Arts in environmental studies, a Master of Water Resources, and a Ph.D. in civil engineering from University of New Mexico (UNM). She has more than ten years of experience developing hydrologic models, particularly those that address interdisciplinary questions related to water for multiple stakeholders. Since joining the NMOSE in 2019, Dr. Zemlick has sought to improve hydrologic models and technical tools utilized by the agency by developing robust, in-house capabilities, collaborating with public and private sector water professionals, and providing updated technical training opportunities for water managers within and outside of the Agency, and to graduate students in Water Resources at UNM.
- Dr. Kamran Syed holds a Bachelor of Science in civil engineering and Master of Science and Ph.D. in hydrology & water resources from University of Arizona. He is a registered professional engineer in Colorado, Texas, and Washington states. Since completion of his Ph.D., he has worked for over 25 years in the fields of watershed modeling, global atmospheric research, and ecosystem/atmosphere greenhouse gas exchange processes. He has expertise in physically based deterministic watershed modeling and study of ecosystem-atmosphere interactions. He has extensive field experience in the collection of surface water and groundwater data and in analyzing and visualizing massive water quality data sets. Prior to joining Hydrology Bureau, Dr. Syed conducted research studies at various levels of watershed scale and complexity in a variety of experimental watersheds in the United States and Canada. Much of his work has been multi-disciplinary in nature involving links to hydrologic modeling, ecosystem physiology and use of global atmospheric remote-sensing data to study global climate change. He also taught civil engineering courses at major universities in Pakistan.
- Laura Hagan Petronis is a certified professional hydrologist (groundwater) with the American Institute of Hydrology. She received her Bachelor of Science degree from Bucknell University in

Geology (with a concentration in Environmental Geology) and a Master of Science degree from the University of New Mexico in Earth and Planetary Sciences. She worked for over six years at a water resources and environmental consulting firm and for the Hydrology Bureau of the NMOSE for the past 16 years. She has worked on variety of projects which have included preparing hydrologic analyses, developing, and reviewing hydrologic models in a collaborative environment for multiple stakeholders, and training and supervising technical staff.

- Dr. William Tintor holds a Bachelor of Science in Environmental Geosciences, a Master of Water Resources, and Ph.D in Geography from the University of Arizona. Prior to his Ph.D he worked as a hydrologist for the U.S. Fish and Wildlife Service in New Mexico where he conducted field measurements and developed management models. His doctoral research included the development of several tree-ring based paleohydrology reconstructions for the Southern Rocky Mountains of New Mexico and Colorado.

SSP&A Technical Staff:

- Dr. Gilbert Barth has performed expert hydrogeologic work for the state of New Mexico since 2003 in a variety of basins including the Lower and Middle Rio Grande, Pecos, Gila and Salt Basins. He has led SSP&A developing interfaces for New Mexico including the Carlsbad, Lea County, Mimbres, Estancia Basins and the Ani prototype. Dr. Barth provides quantitative assessments of water-resource and environmental conditions at the local-, basin- and watershed-scale to address questions associated with water planning, water rights, water-quality assessment, and remediation. He specializes in model development and calibration, with a focus on quantifying exchanges between surface-water and groundwater systems and the application of sensitivity analysis and parameter estimation. He has developed and applied groundwater simulation models to assist private and public clients throughout the Western United States.
- Dr. Jessica Rogers has performed expert hydrogeologic work for the state of New Mexico for the last 5 years. She has been the SSP&A technical lead developing interfaces for New Mexico including the Lea County, Mimbres, Estancia Basins and the Ani prototype. Dr. Rogers provides expertise in quantitative assessments of water resources and groundwater contaminant hydrology. She has experience in groundwater model development, calibration, and sensitivity analysis, and has applied groundwater simulations to address questions associated with water planning and water rights, including aquifer/stream-flow interactions. Dr. Rogers has developed programs allowing non-technical users to apply numerical and analytical methods for characterizing impacts from changes imposed on an aquifer/stream system. She has provided geochemical assessment in support of investigations of groundwater contamination in relation to upstream and midstream oil and gas production.
- Mr. Doug Hayes has performed expert coding for the state of New Mexico for the last several years. He has been the SSP&A programing lead, developing interfaces for New Mexico including the Carlsbad, Lea County, Mimbres, Estancia Basins and the Ani prototype. Mr. Hayes is an accomplished software developer who has extensive experience in several programming languages and platforms. He has the ability to execute both design and implementation of software applications.
- Mr. Neville directs the Waterloo, Ontario office of S.S. Papadopulos & Associates, Inc. His primary area of expertise is the quantitative analysis of groundwater flow and solute transport and specializes in the analytical solution of equations governing groundwater flow and transport. He has synthesized hydrogeologic data, evaluated groundwater resources, developed regional and

site-scale analyses of groundwater flow and solute transport, and analyzed and designed remedial measures. He has developed and documented large-scale three-dimensional numerical models for industrial, mining, and government clients.

4.4 Evaluation Criteria D – Dissemination of Results

4.4.1 Describe how the tools, frameworks, or analyses developed under the proposed scope of work will be disseminated, communicated, or made available to water resources managers who may be interested in the results.

The final products, including data and information compiled for the model will be shared with the project team for testing, feedback, and modification while the project is ongoing and upon completion. When complete, the model and supporting data and documentation will be shared on the NMOSE website for public use.

4.4.2 If the applicant is the primary beneficiary of the project, explain how the project results will be communicated internally, and to interested stakeholders and interested water resources managers in the area, if appropriate.

The NMOSE Water Rights Division is the primary beneficiary of the project as it will use Ani for water rights administration. During its development the Hydrology Bureau and SSP&A staff will work with WRD to evaluate the hydrologic properties included in Ani as well as the information included in the tool's output. NMOSE will work to communicate with stakeholders, including water managers and communities engaged in water planning, about the development of the tool and provide training in its use. These opportunities for outreach will include public meetings, technical conferences, and water workshops in New Mexico and the southwest region.

4.4.3 If the applicant is not the primary beneficiary of the project (e.g., universities or research institutes), describe how project results will be communicated to project partners and interested water resources managers in the area.

N/A

4.4.4 Describe how the project results will be shared with other water managers in the West that could use the information to support water management objectives.

This tool, as well as its documentation and user manual will be available to other western communities as an example framework for administering water transfers. In addition, the developers will present information on the development of Ani and its use at regional technical conferences and meetings with water managers.

4.5 Evaluation Criteria E – Presidential and Department of the Interior Priorities

4.5.1 If applicable, describe how the project addresses climate change and increases resiliency. For example, does the project help communities respond to or recover from drought or reduce flood risk?

This project will allow water managers to make decisions more efficiently and with greater consistency in response to changing hydrologic conditions. In addition, Ani and its user-friendly interface will enable communities to better understand their water resources and aid them in planning for the future in the face of uncertainty.

4.5.2 How will the project build long-term resilience to drought? How many years will the project continue to provide benefits? Please estimate the extent to which the project will build resilience to drought and provide support for your estimate.

The water supply gap in times of drought can be met with groundwater supplies, which are also limited. This project will allow water managers to evaluate the hydrologic impacts of drought mitigation strategies on the system and other water users. Communities can also use this tool to evaluate potential water management scenarios based on potential impacts. This tool is designed for use in decades to come based upon its open-source format and user-defined hydrologic properties. For example, local aquifer characteristics can be updated as new aquifer tests are conducted or hydrogeologic studies are completed.

4.5.3 Will the proposed project reduce greenhouse gas emissions by sequestering carbon in soils, grasses, trees, and other vegetation? Does the proposed project seek to reduce or mitigate climate pollutions such as air or water pollution? Does the proposed project contribute to climate change resiliency in other ways not described above?

Resiliency to climate change depends upon the ability to make management decisions. This project will aid both water managers and communities make decisions in response to both short term hydrologic variability and long-term hydrologic trends.

4.5.4 Describe how the project benefits those disadvantaged or underserved communities identified using the Council on Environmental Quality's interactive Climate and Economic Justice Screening Tool (CEJST).

New Mexico has the third highest poverty rate in the U.S. and more than half of the population lives in communities identified by CEJST as disadvantaged based upon marginalization, pollution, and access to infrastructure and basic services. Of these communities, 80% have multiple burdens in the eight categories to reflect EO 14008 where two or more categories indicate cumulative environmental justice issues exist.

4.5.5 Tribal Benefits

It is anticipated that Ani will provide benefits towards local water management decisions in many of the 23 Tribes and Pueblos in New Mexico. The flexible, user-friendly framework will enable water managers to incorporate local hydrologic information to aid in decision making.

5. PROJECT BUDGET

5.1 Funding Plan

The New Mexico Office of the State Engineer (NMOSE) will be the recipient of the Bureau of Reclamation funding. The total amount of funds requested from the BoR for the two year effort is $249,743. The total cost share provided by the recipient is $259,936. The funds will be available to the project when Reclamation announces the project start date. There are no other contingencies associated with the funding commitment. The amount of cost share accounts for 49% of the total project cost $509,679. A letter of official resolution from NMOSE regarding the cost share funding to the proposed project is attached in Attachment 1.

5.2 Budget Proposal

We have developed a detailed project budget in the suggested format as shown in Table 3. The proposed working period will be completed within two years from the time of award, or from approximately January 1, 2024 – December 31, 2025. The total amount of funds requested from Reclamation for the 2-year effort is $249,743. The total cost-sharing is $259,936. The breakdown of the budget such as quantity, type, and detailed budget for each category are described in the following sections of the Budget Narrative and Table 2.

5.3 Budget Narrative

This budget narrative follows the efforts outlined in prior sections, providing costs associated with each objective. Efforts towards the first objective focus on the acquisition of information from partner agencies, involving a $53,350 effort of communication, coordination, and review. Data assimilation, in the form of data review, processing to produce content compatible with the Ani framework, and testing amounts to a $226,686 effort culminating in robust, appropriate data sets for Ani-based water transfer evaluations. Advanced capabilities development, the bulk of which consists of algorithm and coding adaptations, and testing amounts to a $179,182 effort. Finally, the Benchmarking effort of $50,461 will be comprised primarily of quantitative hydrogeologic evaluations, with the balance of efforts towards documentation. The summary of budget funding sources is described in Table 2.

Table 2: Budget Sources

SOURCE	**AMOUNT**
Costs to be reimbursed with the request of Federal funding	$249,743
Costs to be paid by the applicant	$259,936
Value of third-party contributions	$0
TOTAL PROJECT COST	**$509,679**

6. ENVIRONMENTAL AND CULTURAL RESOURCES COMPLIANCE

There is no environmental compliance required for the proposed project.

7. REQUIRED PERMITS OR APPROVALS

No permits or approvals are required for the proposed project.

8. LETTERS OF PARTICIPATION AND SUPPORT

A letter of participation from S.S. Papadopulos and letters of support from the U.S. Geological Survey, New Mexico Interstate Stream Commission, and the New Mexico Bureau of Geology and the New Mexico Water Data Initiative are included in Attachment 2.

9. REFERENCES

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STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

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MIKE A. HAMMAN, P.E.
STATE ENGINEER

Mailing Address:
P.O. Box 25102
Santa Fe, NM 87504-5102

October 13, 2023

Mr. Nathan Moeller
Bureau of Reclamation
% Katie Zemlick
130 South Capitol Ave.
Santa Fe, New Mexico 87804

RE: WaterSMART Applied Science Grant for Fiscal Year 2023 (R23AS00446)
New Mexico Office of the State Engineer - *Developing a Map-based Analytical Interface (Ani) for Water Rights Administration in New Mexico* – OFFICIAL RESOLUTION

Dear Mr. Moeller,

The New Mexico Office of the State Engineer (NMOSE) is pleased to submit a proposal for a Bureau of Reclamation Applied Science Project Grant. Staff from the NMOSE Hydrology Bureau, within the Water Resources Allocation Program (WRAP), will be leading the effort to improve water management decisions by developing a map-based tool for water rights administration. This project, entitled "Developing a Map-based Analytical Interface (Ani) for Water Rights Administration in New Mexico" directly supports the purpose of the Applied Science Grants Program by "developing hydrologic information and improving modeling and forecasting abilities." This project is of particular value to New Mexico, where the challenges of managing variable supplies and increasing demands have been exacerbated by drought and climate change. In addition, this project will be useful to both water managers and communities engaged in regional water planning.

As the WRAP Director, I have the legal authority to enter into a cooperative financial assistance agreement with the Bureau of Reclamation, as indicated in this Official Resolution. Our agency has the capacity to provide matching funding to meet the project objectives we have proposed. The Hydrology Bureau will work with the Bureau of Reclamation to meet proposed deadlines required by entering into this cooperative financial agreement.

NMOSE has reviewed this application and supports this project because it will help water managers and additional stakeholders in New Mexico understand local and regional hydrology and aid in decision making in a manner that is protective of the resource and existing water rights. Thank you for your time and consideration.

Sincerely,

John T. Romero, P.E.
WRAP/WR Director
New Mexico Office of the State Engineer

Cc: Katie Zemlick, Hydrology Bureau Manager
Xavier Rodriguez, WRAP Program Manager

S.S. PAPADOPULOS & ASSOCIATES, INC.
ENVIRONMENTAL & WATER-RESOURCE CONSULTANTS

October 16th, 2023

Mr. Nathan Moeller
Bureau of Reclamation
% Katie Zemlick
130 South Capitol Ave.
Santa Fe, New Mexico 87804

Subject: WaterSMART Grant Program Letter of Participation for Water Data Initiative Applied Science Grant Proposal

Dear Mr. Moeller:

S.S. Papadopulos & Associates, Inc. (SSP&A) is an environmental and water resources consulting firm established in 1979 to provide professional services in groundwater and hydrogeology. We are best known for our work in modeling and have applied codes and techniques to over 300 investigations in groundwater flow and solute transport modeling. Our expertise allows us to develop state-of-the-art methods that address the water resources needs of our clients in a pragmatic and cost-effective approach.

SSP&A has worked with the New Mexico Office of the State Engineer (NMOSE) for more than thirty years in various capacities, including developing numerical hydrologic models and user interfaces and more recently, hybrid numerical-analytical model interfaces. These efforts have produced both a working relationship and operationally consistent interfaces that now have been adapted within New Mexico. SSP&A has also developed a more robust knowledge of the administrative needs of the agency by working with Hydrology Bureau staff to develop user-friendly and reproducible methods for implementing water transfer evaluations. The user-friendly nature of the interfaces makes them conducive to sharing with the general public.

I am writing to affirm our participation in the NMOSE WaterSMART Applied Science Grant under U. S. Bureau of Reclamation Notice of Funding Opportunity No. R23AS00446 entitled: "Developing a Map-based Analytical Interface (Ani) for Water Rights Administration in New Mexico." SSP&A began development of Ani in 2022 in coordination with NMOSE and two basins

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have been included: the Gila-San Fransisco and the Upper Pecos. The objective of this grant is to include twenty more basins within the Ani tool. The expertise of our staff and that of the Hydrology Bureau staff will provide an advanced tool for water rights administration that will benefit the NMOSE Water Rights Division in providing accurate and consistent results to make water management decisions. Furthermore, the user-friendly interface will aid local and regional communities in their 50-year water planning efforts.

If you have questions or comments, please feel free to contact me at your convenience.

Sincerely,

S. S. PAPADOPULOS & ASSOCIATES, INC.

Gilbert Barth, Ph.D.
Senior Associate, Boulder Office Manager
Direct line: 720-572-4670
gbarth@sspa.com

United States Department of the Interior
U.S. GEOLOGICAL SURVEY
New Mexico Water Science Center
DUNS 025287520
6700 Edith Blvd. NE Bldg. B
Albuquerque, NM 87113

Date: October 5, 2023

Dr. Katie Zemlick, PhD
Hydrology Bureau Chief, New Mexico Office of the State Engineer
Concha Ortiz y Pino Building
130 South Capitol Street
Santa Fe, NM 87504

Dear Dr. Zemlick,

The New Mexico Water Science Center, U.S. Geological Survey (USGS), has reviewed the proposed work of the Hydrology Bureau, New Mexico Office of the State Engineer on the WaterSMART Applied Science Grant under U. S. Bureau of Reclamation Notice of Funding Opportunity No. R23AS00446 entitled: "Developing a Map-based Analytical Interface (AnI) for Water Rights Administration in New Mexico". This proposed work will have a positive impact on science and the understanding of water resource management in the state of New Mexico as well as supporting the USGS mission. The proposed work will incorporate a wide variety of hydrologic and geologic data and models (including those developed by USGS) into a map-based analytical tool to enable technical assessments of water rights transactions statewide. This analytical framework will also be available to stakeholders for water management and planning. Existing and future data collection and interpretive studies of the state's water resources conducted by USGS New Mexico Water Science Center will contribute directly to this management tool, leading to identification of crucial data gaps, and ultimately to improved understanding and management of New Mexico's water resources.

Please be advised that this letter is not a commitment of Government resources but is written in support of the project's scientific and scholarly activities and mission relevance. Thank you for the opportunity to comment on this scientific effort.

Sincerely,

Peter Cinotto
USGS New Mexico Water Science Center, Acting Director

Cc: Michael Johnson, NMWSC Studies Section Chief
Jacob Gabel, NMWSC Administrative Officer

NEW MEXICO INTERSTATE STREAM COMMISSION

BATAAN MEMORIAL BUILDING
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October 13, 2023

Mr. Nathan Moeller
Bureau of Reclamation
% Katie Zemlick
130 South Capitol Ave.
Santa Fe, New Mexico 87504

RE: WaterSMART Grant Program Letter of Support for Water Data Initiative Applied Science Grant Proposal

Dear Mr. Moeller,

The New Mexico Interstate Stream Commission (NMISC) has broad powers to investigate, protect, conserve, and develop New Mexico's waters including both interstate and intrastate stream systems. New Mexico is a party to eight interstate stream compacts and the NMISC's authority includes supporting New Mexico in complying with the associated obligations under those compacts and working to settle interstate controversies related to water. NMISC staff analyze, review, and implement projects in New Mexico and analyze streamflow, reservoir, and other data on the stream systems. The NMISC is also authorized by statute to conduct work related to planning, conservation, protection and development of public waters.

It is anticipated that regional water planning will serve a critical role in our ability to manage limited water resources in the face of competing demands, drought, and climate change. In recognition of this need, the 2023 New Mexico Legislature unanimously passed a bill to revitalize regional water planning in New Mexico (the Water Security Planning Act or Senate Bill 337). The Act authorizes the NMISC to assist with the development and funding of water planning entities with outcomes that "consider public welfare values, balancing water uses and the needs of future generations of New Mexicans." However, there are critical gaps in both data and modeling tools that can assist communities with limited hydrologic expertise with water planning.

I am writing in support of the NMOSE WaterSMART Applied Science Grant under U. S. Bureau of Reclamation Notice of Funding Opportunity No. R23AS00446 entitled: "Developing a Map-based Analytical Interface (Ani) for Water Rights Administration in New Mexico". This proposed work will have a positive impact on science and the understanding of water resource management in the state of New Mexico as well as regional and community water planning efforts. The proposed work will incorporate a wide variety of hydrologic and geologic data and models in a seamless, map-based interface that will aid in collaborative planning and improved communication regarding water management issues and opportunities.

We would participate in activities described in their proposal by providing data and information, feedback on the tools in development, and facilitation with community and regional planning entities.

If you have questions or comments, please feel free to contact me at your convenience.

Sincerely,

Hannah Riseley-White
Director - NM Interstate Stream Commission

New Mexico Bureau of Geology & Mineral Resources
A DIVISION OF NEW MEXICO INSTITUTE OF MINING & TECHNOLOGY
801 Leroy Place
Socorro, NM 87801-4796

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October 16, 2023

Mr. Nathan Moeller
Bureau of Reclamation
℅ Katie Zemlick
130 South Capitol Ave.
Santa Fe, New Mexico 87804

RE: WaterSMART Grant Program Letter of Support for NMOSE Applied Science Grant Proposal

Dear Mr. Moeller,

The New Mexico Bureau of Geology & Mineral Resources (NMBGMR) is a non-regulatory, research and service division on New Mexico Institute of Mining and Technology (NM Tech). Our agency serves as the geological survey of the State of New Mexico and as the directing agency as part of the Water Data Act, as named as a directing agency in the legislation, 2019 NM House Bill 651.In this role, we develop geologic and hydrologic models, provide water resources data on our website, and coordinate water data standards in the State. In addition, we are working with other directing agencies, including the New Mexico Office of the State Engineer (NMOSE), to continue to develop and publish hydrologic data.

I am writing in support of the NMOSE WaterSMART Applied Science Grant under U. S. Bureau of Reclamation Notice of Funding Opportunity No. R23AS00446 entitled: "Developing a Map-based Analytical Interface (Ani) for Water Rights Administration in New Mexico". This proposed work will have a positive impact on science and the understanding of water resource management in the state of New Mexico as well as our Agency's role in the Water Data Act. The proposed work will incorporate a wide variety of hydrologic and geologic data and models, many of which have been developed by the NMBGMR. The proposed map-based analytical tool will aid in technical hydrologic evaluations, provide a streamlined interface for water management, and allow for incorporation of updated hydrologic data.

This project will improve access to hydrologic data for the region, which will in turn improve access to hydrologic data for water managers and users in the state. We would participate in activities described in their proposal by providing data and information, as well as feedback on the tools in development.

If you have questions or comments, please feel free to contact me at your convenience.

Sincerely,

Rachel Hobbs

Rachel Hobbs, Water Data Program Manager
New Mexico Bureau of Geology and Mineral Resources