

Performance Work Statement for
Eloy and Maricopa-Stanfield Basin Study
Groundwater Model Development

- I. INTRODUCTION: This Performance Work Statement (PWS) identifies requirements to develop a regional groundwater flow model for the Pinal Active Management Area (Pinal AMA) and work products that meet the planning needs of the Pinal Partnership, the Bureau of Reclamation (Reclamation), and other stakeholders and participants (collectively the “Study Participants”) for the Eloy and Maricopa-Stanfield Basin Study (Study). The goal of the groundwater flow modeling effort is to review, update, and recalibrate the Arizona Department of Water Resources (ADWR) Pinal AMA Regional Groundwater Flow Model (ADWR, 2014) to current groundwater conditions, use it as a tool to simulate future groundwater conditions under various scenarios of projected future water supply and demand, and prepare a final report. Results from the updated model projections will be used to support decisions on operations of existing and near-term projects and potential mitigations strategies in Pinal AMA. OBJECTIVES: Objectives of the groundwater modeling effort are:
- Data Compilation
 - Groundwater Model Development and Calibration
 - Scenario Development
 - Meetings
 - Deliverables

The contractor shall update the most recently available Arizona Department of Water Resources (ADWR) approved Pinal AMA groundwater model. ADWR is in the process of updating the Pinal AMA groundwater model, however all updates may not be available within the timeframe of the Study. The contractor will work with the Study Participants to use the most up to date model available, make additional updates and model calibrations as necessary, and develop potential predictive scenario runs for the updated Pinal AMA groundwater model.

The contractor will use a version of MODFLOW consistent to the version currently used by ADWR. Further, Groundwater Vistas (version 6 or higher) (brand name or equal) should be used as the pre- and post-processing software for the analysis. The data used in the model should be updated with the most currently available geology, aquifer properties, pumping, recharge, and any other stresses or boundary conditions when the project is initiated. The model will be calibrated to the available appropriate water level data. The resulting model will be the “base” model. Land subsidence is a key feature simulated in the existing ADWR Pinal AMA model, and it should be simulated in the updated model. The contractor will work with the Study Participants on selecting model calibration targets if the contractor will not use the same model calibration targets during model update. Vertical gradient is pronounced in Pinal AMA, the contractor will work with the Study Participants to identify specific locations for hydrographs showing vertical gradient and use these wells as model calibration targets.

All modeling tasks including documentation shall be conducted in accordance with industry accepted standards as well as all applicable American Society for Testing and Materials (ASTM) Standards.

The calibrated base models will be used to run eight (8) planning scenarios. Reclamation will provide climate change scenarios selected by the Study Participants. The climate change model will identify potential climate change impacts to surface water flows at the groundwater model boundaries. This information will be provided to the contractor to be used for the planning scenario runs. In addition, Reclamation and the Pinal Partnership will supply projected Colorado River/Central Arizona Project water availability.

The contractor will work with the Study Participants to design the planning scenarios and to determine the stress period length for the planning scenarios.

- III. PERFORMANCE PERIOD: The period of performance for the modeling work is 24 months after the receipt of award. Planning scenario results must be completed 15 months after contract award; and final reports will be due 18 months after contract award. A list of tasks and a refined schedule will be developed by the contractor, the Study Participants. Model and scenario development shall be worked on concurrently with the Study Participants. The work may be broken into two (2) phases to include the scenario modeling and the mitigation modeling.
- IV. DELIVERABLES: Deliverables include: Technical memorandum presenting recommendations for improvements of existing ADWR Pinal AMA model, adjustments to water budgets, hydraulic parameters, geology interpretations, model structure, model boundary conditions in the updated model, weekly email reports, draft report, final modeling report, predictive scenario evaluation report, and electronic model files as described in section 8(e). Deliverables shall meet all ASTM reporting requirements as applicable. Details for deliverables is found in section VII.

Government Acceptance Period:

The COR will have ten (10) workdays to review draft deliverables and make comments. The Contractor shall have five (5) workdays to make corrections. Upon receipt of the revised deliverables, the COR will have five (5) workdays for review prior to acceptance or providing documented reasons for non-acceptance. Should the Government fail to complete the review within the review period the deliverable will become acceptable by default, unless prior to the expiration of the ten (10) work days the Government notifies the Contractor in writing to the contrary.

V. TASKS:

A. Data Compilation

1. Supply: The Study Participants will supply specific well locations and current depth to groundwater if not included in ADWR GWSI; aquifer test data conducted at Study Participant wells; current and projected CAP and surface water deliveries; current long-term storage credits and projected groundwater recharge volumes; and any other projected supplies. Information that may be obtained from the ADWR databases such as the Groundwater Site Inventory (GWSI), the Registry of Grandfathered Rights (RoGR), and the Recharge database shall be obtained by the Contractor.
2. Demand: The Study Participants will supply projected demands (and the preferred sources to meet the demands) based on projected growth from current conditions to buildout.
3. The Contractor shall coordinate with CAP Staff on processing and conversion of CAP:SAM model output files to MODFLOW input files

4. The Contractor shall coordinate with USBR Technical Services on incorporation of climate information into projections of phreatophytic evapotranspiration, streambed and mountain front recharge
5. If necessary, the contractor shall compile additional data as requested by the Study Participants.
6. The Contractor shall prepare a Technical Memorandum summarizing all the data collected and submit to the Study Participants for review and approval prior to major changes to the groundwater model revisions.

B. Groundwater Model Development and Calibration

1. Review Existing ADWR Model

- a. Review the existing ADWR Pinal Model regarding geologic interpretations, hydraulic parameters, calibrations, and water budgets. Identify model deficiencies.
- b. Coordinate with ADWR regarding any updates that ADWR has made on the existing Pinal Model. Document any revisions to the existing ADWR Pinal Model geology and model parameters, including written justification and notation in appropriate electronic file format (e.g., file-based geodatabase, relational database, etc.)

2. Revisions to Existing ADWR Model

a. Geology:

- i. ADWR revised geology is preferable. If unavailable, contractor shall use existing data as a basis and update it with available new geology data; Reclamation, Pinal Partnership and Stakeholders will provide specific reports that are deemed useful, as available. No new fieldwork for data collection is envisioned.
- ii. The Study Participants will provide gravity measurements and seismic data to potentially improve the basin geometry.
- iii. Based on ADWR Well55 database, identify wells drilled after 2009 in Pinal AMA, especially in geology data gap areas shown on Figures 4, 7, and 11 of ADWR Modeling Report No. 26, analyze driller logs and supporting geophysical logs for revised geology interpretations for UAU, MSCU, and LCU layer contact elevations.

b. Hydraulic parameters:

- i. Collect and analyze additional aquifer test data that were performed after 2009 and used these data as primary information to update aquifer parameter distributions.
- ii. Investigate and potentially update values for vertical hydraulic conductivity.
- iii. The Study Participants will provide any additional aquifer test data that may be available.

- c. Pumping: Updated reports will be obtained from ADWR's RoGR database to update the model to current if needed. Actual measured monthly well pumping values from CAIDD and MSIDD shall be compared to the pumping values used in the ADWR model to make sure the model is using actual pumping rates. Future pumping will be provided by the Study Participants.
- d. Recharge (stream flow, agriculture, canal, mountain front, artificial, and underflow): the existing ADWR Pinal Model simulated recharge components up to 2009. The contractor shall review these recharge components simulated in the existing ADWR model and revise these estimates if needed. Update these model recharge components to current conditions. Future recharge from stream flow and canals will be updated based on climate modeling results. Future artificial recharge will be provided by the Study Participants. Revision of mountain front recharge due to climate change shall be evaluated by the contractor and revised if necessary. Lag time for agricultural recharge shall be evaluated and revised by contractor.
- e. Agricultural irrigation changes. The contractor shall devise a method or algorithm for converting agricultural use to municipal use as per growth projections.
- f. Evapotranspiration: The contractor will evaluate potential changes to riparian vegetation and revise as needed.
- g. The contractor will evaluate canal seepage and revise as necessary.
- h. Boundary conditions: surface water boundaries will be updated for planning scenarios using Reclamation climate change model results. All other boundary conditions shall be evaluated and changed as needed by the contractor to reflect projected future conditions.
- i. Based on GWSI, update model calibration targets (hydrographs) used in the model. There are a total of 89 wells are used as model calibration targets in the existing ADWR Pinal model. Since the vertical hydraulic gradient is significant in some of the study areas, the contractor should work with the Study Participants on selecting the wells used for calibration targets on vertical hydraulic gradients.
- j. Pick a year from 2009 to 2018 when most water level measurements are available, retrieve water level measurements at the selected year from ADWR GWSI database. Perform an analysis of these water level measurements and develop water level contour maps for UAU, MSCU and LAU, identify flow directions, and used these contour maps for model calibrations as well.
- k. Land subsidence is a key feature of the Pinal AMA model and the Contractor shall keep this model feature in the updated model. The land subsidence package is not supported by Groundwater Vistas, the Contractor shall prepare this subsidence package outside of the Groundwater Vistas. The Contractor also shall obtain additional land subsidence data since 2009 and update land subsidence targets for model calibrations
- l. Land subsidence shall be simulated in the model prediction scenarios. The Contractor shall provide maps of model predicted land subsidence for each planning scenario at selected years.

m. The updated Pinal model shall be recalibrated and the analysis of observed versus simulated heads for transient state shall be performed.

C. Modeling of Planning Scenarios: The contractor shall work with Study Participants to develop five (5) planning scenarios. Planning scenarios shall be run using the base (existing) model and the updated (future) model.

D. Modeling of Adaptation Strategies: The Study Participants will develop an array of adaptation and mitigation strategies to address issue identified in the planning scenario model runs. To investigate the effectiveness of the strategies, the Study Participants will select three strategies to be modeling using one of the existing planning scenarios for the total of three (3) adaptation strategy model runs.

VI. MEETINGS:

- A. Kick-off Meeting (1)
- B. Monthly Updates/Summaries
- C. Meeting to review technical results of updated model
- D. Quarterly Meetings or Stakeholder Meetings, as needed, up to 10 meetings (includes final results presentation)
- E. Scenario Development Workshop (1)
- F. Draft report presentation (1)
- G. Final report presentation (1)

VII. REPORTS:

- A. Technical memorandum summarizing the data collected in Task A: Data Compilation.
- B. Technical memorandum presenting recommendations for improvements of existing ADWR Pinal AMA model, adjustments to water budgets, hydraulic parameters, geology interpretations, model structure, model boundary conditions in the updated model, weekly email reports, draft report, final modeling report, predictive scenario evaluation report, and electronic model files shall be submitted to the Study Participants for review prior to full implementation of revised groundwater model
- C. Biweekly reports via email to summarize the progress to date and upcoming activities.
- D. Draft Report – three (3) copies will be distributed to Pinal Partnership members and Study stakeholders for review and comment.
 - 1. Creation of maps of depth to water and water level elevation through time and change in depth to water through time, along with pairwise comparison of scenarios for DTW & change in DTW
 - 2. Preparation of representative hydrographs
 - 3. Maps showing model predicted land subsidence in selected years
 - 4. All material suitable for printed report and PowerPoint presentation slides
 - 5. Detailed and summary water budgets, by sub-basin

- E. Final Report – up to three (3) copies will be distributed to Pinal Partnership members and Study stakeholders. The final report will include hard copies of figures and appendices
- F. Groundwater model and associated files – three (3) electronic format containing copies of geodatabases, GIS shape files, and model files will be distributed to Pinal Partnership members and Study stakeholders.

VIII. Quality Assurance Surveillance Plan (QASP): The Government intends to utilize a Quality Assurance Surveillance Plan (QASP) to monitor the quality of the Contractor's performance. The oversight provided for in the contract and in the QASP will help to ensure that service levels reach and maintain the required levels throughout the contract term. Further, the QASP provides the COR with a proactive way to avoid unacceptable or deficient performance. The QASP will be finalized immediately following award and a copy provided to the Contractor after award. The QASP is a living document and may be updated by the Government as necessary.

IX. PERFORMANCE REQUIREMENT SUMMARY.

Task No.	Task Description	Performance Indicator	Performance Standard	Acceptable Quality Level	Method of Surveillance
Paragraph V.A	Data Compilation	Technical memorandum delivered on time, complete and accurate.	Technical memorandum provided within established timeframes; Data is free of errors or clerical defects and is accurate and true.	Contractor works with the Pinal Partnership and Reclamation to compile Supply and Demand data and additional data as necessary.	COR reviews bi-weekly progress reports.
Paragraph V.B	Groundwater Model Development	Computer model delivered on time, complete and accurate.	Computer model provided within established timeframes and free of errors and is accurate and true.	Contractor develops and updates the groundwater model according to ASTM requirements within time frame stipulated in PWS.	COR reviews groundwater model development and updates.

Task No.	Task Description	Performance Indicator	Performance Standard	Acceptable Quality Level	Method of Surveillance
Paragraph V.C	Planning Scenarios	Computer models with planning scenarios delivered on time, complete and accurate.	Computer models with planning scenarios provided within established timeframes and free of errors and is accurate and true.	Contractor completes project within time frame stipulated in PWS.	COR monitors contractor's work.
Paragraph VI	Meetings	Conduct identified meetings at appropriate time in schedule.	Meetings should be held to provide appropriate feedback from partners and Reclamation.	Contractor schedules and facilitates meetings to provide status updates, develop scenarios and to present results.	COR monitors contractor's work.
Paragraph VII.B	Biweekly Reports	Reports delivered on time, complete, and accurate. (Time/Quality)	100% of reports accurately depict current status	98%	File reviews, periodic inspections, and random observations
Paragraph VII.D	Final Reports	Reports delivered on time, complete, and accurate. (Time/Quality)	Reports provided within established timeframes; Data is free of errors or clerical defects and is accurate and true.	100%	COR reviews all reports prior to acceptance. 100% Review