

Exhibit A Scope of Work

TASK 1. Description of Region

The objective of this task is to update the description of the region in the 2006 Panhandle Water Plan. It will require updating the text to describe changed conditions and new studies completed since the 2006 Water Plan.

This task will include the following:

- Revise text to reflect changed conditions in the Panhandle Region. This will include discussions of the recent growth in the dairy industries, increased irrigated agriculture due to increases in commodity prices and demands for ethanol, increases in wind power generation and other changes identified during the planning process.
 - Update historical and projected water use by major use category, as needed.
 - Update descriptions of wholesale water providers, historical water use and service connections, as needed.
 - Review and update threatened and endangered species in the Panhandle Planning Area
 - Update the descriptions of studies and plans completed since the 2006 water plan.
- Update current preparation for drought conditions.
- Add information compiled by the TWDB from water loss audits performed by retail public utilities pursuant to 31 TAC §358.6.

Deliverable: Updated Chapter 1 of the 2011 Panhandle Area Water Plan.

TASK 2. Review and Revision of Population and Water Demand Projections

The focus of this task is to update projected populations and water demands based on changed conditions. The Texas Water Development Board will not be developing new population or water demand projections for the 2011 Region A water plan with the exception of steam electric power demands.

2a: Steam-Electric and Wholesale Water Provider Demands

- Review newly developed steam electric power demands
 - Revise tables and figures with new demands
 - Request revisions to demands as needed
- Review and update demands on wholesale water providers, including new and changed contracts, including updating TWDB database as needed.

Deliverable: Updated Chapter 2 per above changes.

2b: Irrigation and Livestock Demand Revisions

- Develop new irrigation and livestock demands for all counties in the Panhandle Planning Area using the TAMA irrigation and livestock model.
 - Review prior agricultural water use estimates for eight major irrigated crop categories. Add new crop sectors that have emerged within the region since the prior estimates.
 - Update acreages, irrigation application data by producers and the latest average ET demand data to update water use estimates.
 - Document model assumptions on updated producer adoption rates and aquifer water availability. Develop technical memorandum with supporting data.
 - Collect recent data on livestock production and develop anticipated livestock trends. Update livestock water use by industry type.
 - Report updated irrigation and livestock water use by county and river basin.
- Submit revisions to demands to TWDB with required documentation.
- Revise text, tables and figures in Chapter 2 with new demands.
- Review updated TWDB database.

Deliverable: Updated Chapter 2 with updated irrigation and livestock demands.

2c: Municipal Demand Revisions

- Survey municipal water user groups with 2007 populations greater than projected in the 2006 plan and solicit input on population and water demands. Develop revised projections if needed.
- Submit revisions to demands to TWDB with required documentation.
- Revise text, tables and figures in Chapter 2 with new demands.
- Review TWDB database, as needed.

Deliverable: Updated Chapter 2 with updated population and municipal demands.

2d: Mining Demand Revisions

- Review Groundwater Conservation Districts’ records and available data from the Railroad Commission on mining water use and update mining demands, as needed.
- Submit revisions to demands to TWDB with required documentation.
- Revise text, tables and figures in Chapter 2 with new demands.
- Review TWDB database, as needed.

Deliverable: Updated Chapter 2 with updated mining demands.

Table 1: List of entities with anticipated demand review and/or revisions:

Steam electric power demands:	All counties
Wholesale water providers:	CRMWA, Amarillo, Greenbelt M&IWA, Borger, Cactus and Dumas
Irrigation	All counties
Livestock	All counties
Municipal water users	Amarillo, Perryton, Cactus, Dalhart
Mining water users	All counties

TASK 3. WATER SUPPLY ANALYSIS

This task focuses on updating water supplies in the Panhandle Planning Area based on changed conditions and requirements for the 2011 regional water plans. For the 2011 plans, surface water supplies must include reporting of firm yield. Allocations of supply can be limited to safe yield supply, operational yield or other factors. Groundwater supplies must comply with Managed Available Groundwater (MAG) values as determined by the TWDB and Groundwater Management Areas if this information is available.

TASK 3a: Update Water Supplies

- Update supplies available to water user groups based on changes in contracts and/or connections to new supplies (see Table 2).
- Update supplies available to wholesale water providers based on changes in contracts and/or connections to new supplies (see Table 2).
- Update TWDB database as needed.

- Describe findings from the 1st biennium study on aquifer recharge. This will include a synopsis of the recharge study in the 2011 plan with recommendations for modifications to the Ogallala GAM.

Deliverable: Updated Chapter 3 with minimal to no changes to source supplies or distribution of supplies.

TASK 3b. Refine Ogallala GAM demands and allocations to users

- Redistribute Ogallala groundwater to users.
- Develop updated demand inputs for GAM. Using data collected under task 2 and other available data from the Groundwater Conservation Districts, develop historical (1998 to 2007) and future demand projections on the Ogallala aquifer.

Deliverable: Updated distribution of Ogallala water supplies to users and update water use data for input to Northern Ogallala GAM.

TASK 3c. Incorporate MAGs

Incorporate MAGs into redistribution under TASK 3b. (above) if available. Develop water availability for the Ogallala Aquifer by county and basin based on Managed Available Groundwater (MAGs) values provided by the TWDB and GMA 1. [Note: GMA 1 and TWDB will develop MAGs based on current Northern Ogallala GAM.] Assign water to users considering geographical constraints, infrastructure, contracts and other constraints as appropriate.

Deliverable: Updated distribution of Ogallala water supplies to users based on MAGs and input into to Northern Ogallala GAM.

TASK 3d. Refine Ogallala GAM and Recast Water Use Projections for GAM input

- Assign the historical and future groundwater demand to be met from the Ogallala aquifer to locations. Municipal, Industrial, Mining, and some Livestock water use can be allocated to specific wells. Special effort will be focused on using new information to allocate pumping to specific wells. Residential (non-urban) water demand will be allocated on the basis of census data. Using a cutoff of minimum population density is needed to avoid assigning negligible pumping rates to many model cells. Irrigation demand will be allocated on the basis of GIS data sets, also following TWDB protocols.
- Once groundwater withdrawal has been allocated to model cells representing the Ogallala aquifer, the information will be translated into input for the wells package of Modflow.

- c. Incorporate irrigation return flows as appropriate. [Note: Irrigation return flow calculations can be made using various assumptions. Dutton and others (2000) added return flow estimates to the input for recharge rate. They had found that uncertainty in return flow estimates was the same as the uncertainty in model calibration without considering return flow. If the downward flow rate of return flow is less than the rate at which the water table drops in a given area, no return flow recharges the aquifer. It is possible, therefore, that omitting return flow might be a reasonable simplification.]
- d. Run Ogallala GAM with updated inputs.
- e. Conduct sensitivity analyses with new data. This will include varying the assumptions about pumping rates. Increasing and decreasing pumping rates by some percentage and rerunning the Modflow model will show how that uncertainty impacts model predictions. This is needed in identifying areas that might have shortages in water. Adjust model calibration if needed.
- f. Incorporate any recommended revisions to the recharge values in the GAM based on the 1st biennium recharge study.
- g. Run GAM and review model results to historical water levels. Re-calibrate model if needed.
- h. Collect additional geologic data from new well data. Incorporate new geologic information into the Northern Ogallala GAM to refine the aquifer bottom layer. Run GAM and compare results to historical measurements. Refine calibration, if needed.
- i. Compare storage in updated Northern Ogallala GAM to storage in current Northern Ogallala GAM. If significant differences in storage are identified, present data to GMA 1 for consideration of developing new MAGs. With GMA 1 and TWDB input, consider refining water availability with updated availability values. Note differences in the regional water plan.
- j. Submit refined Northern Ogallala GAM to TWDB with required documentation.
- k. Groundwater consultant attends up to 3 Panhandle Water Planning Group meetings.

Deliverable: Updated Northern Ogallala GAM and updated available supply from the Ogallala.

TASK 3e. Update Chapter 3 with revisions

- a. Revise text, tables and figures in Chapter 3 with new supplies.
- b. Update TWDB database.

Deliverable: Updated Chapter 3 with changes to Ogallala supplies and distribution of supplies to water users.

TASK 3f: Surface Water Study – Evaluate Lake Meredith

- a. Collect historical data on precipitation, rainfall intensities, temperature, stream flows, land use practices, acreages of brush and salt cedar, spring flow, Soil Conservation Service (SCS) impoundment, other surface impoundments, groundwater levels and other data determined relevant. Data should include the Texas Panhandle and surrounding areas in the Lake Meredith watershed below the Logan gauges (USGS 07227000 and 07227100).
- b. Obtain available studies on brush control, precipitation, and other relevant studies.
- c. Analyze trends of average annual and seasonal values of rainfall, temperature, and streamflows. Analyze trends in rainfall intensity, spring flows, small impoundments, groundwater levels and other relevant data. To the extent that data are available, analyze historical trends in land use practices and brush infestation.
- d. Develop historical estimates of rainfall amounts over the contributing watershed between the Logan gauges and the Amarillo gauge (USGS 07227500) and between the Amarillo gauge and Lake Meredith. Calculate historical precipitation to runoff ratio and analyze trends of this ratio.
- e. Examine collected data for correlations between historical trends in rainfall to runoff ratio and other historical data collected above. Identify trends within the Lake Meredith watershed. Identify areas that may merit further study to help quantify impacts on future water supplies in the Panhandle Region.
- f. Prepare a draft report including methodology, results and conclusion. Submit draft report to the planning group and TWDB for review. Address comments by the planning group and TWDB and submit a final report.

Deliverable: Study report to be incorporated in the 2011 Panhandle Area Water Plan.

Table 2: List of entities with anticipated water supply review and/or revisions:

Entity	Anticipated Change
Steam electric power	All counties due to changes in demands
Amarillo	New groundwater development
Wholesale water providers and customers	All WWP's due to potential changes in contract agreements and supplies
Livestock	All counties due to revised demands and updated groundwater supplies
Municipal water users	WUGs with changed demands and/or supplies
Irrigation	All counties due to revised demands and updated groundwater supplies
CRMWA	Changes in available supply from Lake Meredith and new groundwater wells

TASK 4. Identification, Evaluation and Selection of Water Management Strategies

The objective of this task is to update water management strategies in the 2006 Panhandle Water Plan and evaluate new strategies that may be identified for the 2011 water plan. As part of the 2011 plan, the Panhandle Water Planning Group will be able to identify alternative water management strategies. All alternative strategies will be evaluated to the same level as recommended strategies. Also, capital and annual cost estimates for all strategies must be updated to 2008 dollars.

Because of the potential changes to demands and water supplies, there is a high probability that new needs will be identified and new water management strategies will need to be developed. All water user groups and wholesale water providers will be contacted to verify the recommended strategies in the 2006 regional water plan are still applicable and identify potential new strategies that the entity may be considering.

4a: Update Water Needs and Water Management Strategies

- Update water needs analysis for water user groups with changed demands and/or supplies
 - Steam electric power
 - Others identified in Chapter 3 due to changes in supplies and/or contracts
 - Others due to changed conditions identified by the RWPG or public
- Update water needs analysis for wholesale water providers with changed demands and/or supplies
 - Changed contracts as identified in Chapter 2
 - Changed supplies
- Survey all water user groups and wholesale water providers to confirm need analysis and recommended water management strategies.
- Update text, tables and figures in Chapter 4 of the water plan.
- Update TWDB database as needed.
- Reevaluate all retained water management strategies used to meet needs as required by Exhibit B Section 4.0. Revise as needed.
- Update strategies for steam electric power.
- Update capital costs for retained water management strategies to 2008 dollars. Develop costs for new strategies. Calculate annual costs as required for database entry.

Deliverable: Updated Chapter 4 based on minimal changes to demands and current supplies as required per above subtasks.

4b: Update Needs Analysis

- Update water needs analysis for water user groups with changed demands and/or supplies
 - Irrigation
 - Livestock
 - Municipal user groups (if demands are revised)
 - All users of Ogallala Aquifer groundwater based on revised availabilities
- Update water needs analysis for wholesale water providers with changed demands and/or supplies
 - Changed supplies as determined from refined GAM and changes to surface water supplies

4c: Update Water Management Strategies

- Update irrigation conservation strategies based on updated historical irrigation use, projected demands, and changing sector analysis, as necessary. Develop new strategies if appropriate. Evaluate the updated water savings and economics impact of conversion to the respective identified strategies.
- Develop new water management strategies or refine existing strategies based on revised needs analysis. Update capital costs for refined strategies and develop costs for new strategies to 2008 dollars. Calculate annual costs as required for database entry.
- Evaluate all new and revised water management strategies as required by Exhibit B Section 4.0.
- Review water quality of strategies in light of changed conditions
 - Consider updated water quality data of groundwater sources
 - Consider impacts of drought on water quality of surface water

4d: Update Chapter text and database

- Update text, tables and figures in Chapter 4 of the water plan.
- Update TWDB database.

Deliverable: Updated Chapter 4 incorporating changes to demands and current supplies as the result of completing task 2.

Table 3: List of entities with anticipated water management strategy review and/or revisions:

Subtask	Entity	Anticipated Change
Update needs analysis	All WUGs and WWPs with changes to demands and/or supplies	Changes to demands and/or supplies
Update capital and annual costs to 2008 dollars	All WUGs and WWPs	Required revision
Update and/or develop new strategies	All steam electric power demands:	All counties due to anticipated changes in demands
Update and/or develop new strategies	CRMWA	Reduced supply from Lake Meredith

Table 4: List of entities with anticipated water management strategy review and/or revisions:

Update weather modification strategies	Irrigation water user groups	Some areas have discontinued precipitation enhancements
Replacement well	All municipal groundwater users	Add strategy if anticipated but not already recommended
Update irrigation conservation strategies	All counties with irrigation	New demands and other information from the Irrigation Study under Chapter 2
New or revised strategies	All WUGs and WWPs that use Ogallala	MAGS and updated GAM
New or revised strategies	All livestock WUGs Some municipal WUGs	New demands

TASK 5. Impacts of Water Management Strategies on Key Parameters of Water Quality and Impacts of Moving Water from Rural and Agricultural Areas

The objective of this task is to update the 2006 plan to incorporate changed conditions and new water management strategies.

Work will include the following:

- Review and update impacts as needed, considering new water management strategies and changed conditions.
- Revise text as needed.

Deliverable: Updated Chapter 5 for the 2011 Panhandle Area Water Plan.

TASK 6. Water Conservation and Drought Management Recommendations

This task will update the water conservation and drought management recommendations for the 2011 water plan.

Work will include the following:

- Review assumptions for conservation in new steam electric power demands. Update discussions as needed.
- Review and update model conservation and drought contingency plans for any changes required by the TCEQ for these plans.
- Review and update drought trigger conditions based on updated drought contingency plans.
- Update discussions on irrigation conservation based on revised strategies developed under Task 4.

Deliverable: Updated Chapter 6 for the 2011 Panhandle Area Water Plan with an updated discussion of irrigation conservation strategies in Chapter 6.

TASK 7. Description of How the Regional Water Plan is Consistent with Long-Term Protection of the State's Water Resources, Agricultural Resources and Natural Resources

Work will include the following:

- Update descriptions considering updated and new water management strategies.

Deliverable: Updated Chapter 7 for the 2011 Panhandle Area Water Plan.

TASK 8. Unique Stream Segments/ Reservoir Sites/ Legislative Recommendations

The focus of this task will be on reviewing and updating legislative recommendations based on changed conditions, new legislation and other factors.

Work will include the following:

- Review and consider new and updated policy and legislative recommendations.
- Update Chapter 8 with new recommendations.

Deliverable: Updated Chapter 8 for the 2011 Panhandle Area Water Plan..

TASK 9. Infrastructure Financing Recommendations

The objective of this task is to update the assessment of funding needs and preferred funding vehicles for entities in the Panhandle region.

Work will include the following:

- Send infrastructure financing surveys developed by TWDB to each water user group with a recommended strategy to update consensus of recommendations and obtain information on plans for financing strategies.
- Update information on available sources of funding.
- Update findings and recommendations.

Deliverable: Updated IFR survey and Chapter 9 for the 2011 Panhandle Area Water Plan.

TASK 10. ADOPTION OF PLAN

This task provides for public participation, eligible administrative costs, planning member travel costs and other activities deemed eligible by the TWDB.

Work will include the following:

TASK 10a. Adoption of Plan

- Assist with public participation activities
- Assist with plan adoption activities
- Attend one Panhandle Planning Group meeting and one public hearing on the Initially Prepared Plan
- Respond to comments on Initially Prepared Plan and incorporate in final plan
- Prepare 100 copies of the Initially Prepared Plan and Final Plan

TASK 10b. Administrative Costs (Panhandle Regional Planning Commission)

- Eligible administrative costs, including but not limited to: member travel, printing, issuing notices, mailing costs, facility rentals
- Assist with public participation activities
- Assist with plan adoption activities

Deliverable: Updated 2011 Panhandle Area Water Plan.

TASK 10c. Scope of work development

Development of planning grant application.