Approved July 18, 2013

TEXAS STATE SOIL AND WATER CONSERVATION BOARD

Policy on Brush Control Feasibility Studies for the Water Supply Enhancement Program

Being designated as the lead agency for administering a Water Supply Enhancement Program (WSEP) to increase available surface and ground water through selective control of brush species that are detrimental to water conservation (Texas Agriculture Code §§203.002 and 203.011), it is the policy of the Texas State Soil and Water Conservation Board (TSSWCB) to provide agency grant funds to perform watershed-specific assessments of the feasibility of conducting brush control for water supply enhancement (Texas Agriculture Code §203.057) in a manner consistent with agency rules (31 Texas Administrative Code Chapter 517, Subchapter B) and the following policy provisions.

This policy describes the requirements for computer modeling for water yield predictions in feasibility studies and the process to review applications for funding to conduct new feasibility studies. The requirements and process detailed in this policy are consistent with the *Policy on Allocation of Grant Funds for the WSEP* approved by the TSSWCB on March 6, 2013 and revised on July 18, 2013.

The TSSWCB has appointed a Science Advisory Committee to assist the agency in implementing statutory changes to the WSEP, particularly related to feasibility studies.

REQUIREMENTS FOR COMPUTER MODELING FOR WATER YIELD PREDICTIONS

These requirements provide detailed guidance for application of appropriate computer models for feasibility studies that predict water yield resulting from proposed brush control projects. For a proposed brush control project to be considered eligible for allocation of cost-share funds from TSSWCB, "the feasibility study must demonstrate increases in post-treatment water yield as compared to the pre-treatment conditions" (*Policy on Allocation of Grant Funds for the WSEP*). The projected water yield will be included in the WSEP proposal evaluation criteria and ranking system. These requirements provide the minimum criteria for the watershed description, model calibration and hydrologic data, and model simulations to accomplish this goal.

As required by Texas Agriculture Code §§203.053(b) and 203.057(a), the feasibility study, and more specifically the computer modeling, must be conducted and developed by "a person with expertise in hydrology, water resources, or another technical area pertinent to the evaluation of water supply."

To balance WSEP consistency and comparability between feasibility studies with the practical limitation on how strictly prescriptive these requirements should be, it is recommended that for all new feasibility studies the Soil and Water Assessment Tool (SWAT) (see http://swat.tamu.edu/) be used, or alternatively the Ecological DYnamics Simulation (EDYS) model (see http://www.tsswcb.texas.gov/files/docs/brush/EDYS_UsersGuide_ver5-1-0_201104.pdf). Justification for selecting a different model must be provided if either of the two recommended models is not utilized; in order to ensure that the selected model's capabilities are sufficient and that the model is employed properly, the adequacy of this justification will be reviewed by the Science Advisory Committee.

Watershed Description

The following list summarizes the input information necessary to characterize the watershed under consideration for brush control. All digital maps must be geo-referenced with sufficient metadata to allow overlays with other digital map layers.

- Watershed Delineation. The contributing drainage area that includes the treatment area should be identified using the United States Geological Survey (USGS) National Hydrography Dataset (NHD) and the USGS Watershed Boundary Dataset (12-digit hydrologic units), and confirmed with a digital elevation model (DEM).
- Topography. DEMs (10-meter) from the USGS National Elevation Dataset should be used and will likely require mosaic assembly to contain the watershed of interest.
- Hydrology. Appropriate data from the NHD and analysis of the DEM should confirm the locations of surface waterbodies, including stream and river channels, impoundments, and reservoirs within the watershed of interest, and other hydrologically sensitive areas critical to streamflow and aquifer recharge. Flood control dams (e.g., PL-566 floodwater retarding structures) must also be included in the hydrologic dataset.
- Soil Types and Distribution. The USDA Soil Survey Geographic database (SSURGO) provides polygon-type maps that demonstrate the variations in soil type and other physical parameters that impact runoff and infiltration across the watershed of interest. These maps must also be joined in a mosaic form.
- Vegetation and Land Use. The USGS National Land Cover Dataset (NLCD) 2006 provides different land cover classifications at 30-m resolution which should be analyzed. NLCD 2011 is scheduled for public release in December 2013. Additionally, the Ecological Mapping System of Texas dataset published by the Texas Parks and Wildlife Department should be utilized in the analysis. For more recent land use descriptions as well as vegetation descriptions, digital orthophoto quarter quadrangles can be obtained from the USDA and assembled as a mosaic to envelop the watershed of interest; 1-meter National Agriculture Imagery Program orthophotos from 2012 are available from the Texas Natural Resources Information System. Ground-truthing site visits are necessary to confirm vegetation types and locations.
- Roads and Highways. ESRI datasets include features such as streets, county roads, highways, freeways, and other transportation infrastructure that may affect local watershed behavior.

Model Calibration and Hydrologic Data

Model calibration determines the degree to which a model represents a real-world system and establishes the usefulness of the model for evaluating factors affecting water yield and predicting changes in the water yield from brush control scenarios. Calibration is a systematic procedure of testing and tuning model input parameters that result in model predictions that best match a set of observational data. Calibration is completed through use of graphical and statistical methods to evaluate the degree to which the model corresponds to reality.

For WSEP consistency and comparability between feasibility studies, the period for calibration for all new feasibility studies is defined as 1995-2010.

Such models require historical daily rainfall data within, or at least near, the watershed of interest. These datasets can be collected from the National Climatic Data Center. Data from the defined calibration period should be collected to represent both wet and dry conditions. Other periods can be considered and may also be included if the range of observed rainfall conditions can be justified as being more representative of future conditions.

The model will need appropriate parameters to account for the abstractions that prevent part of the rainfall from reaching the stream and river channels as runoff. The selection of simulation model and parameters must be based on an appropriate conceptual model that properly represents the conditions of the watershed. For example, the NRCS curve number method allows assignment of curve numbers based on soil type and condition, land use, and vegetation. The model's loss method must represent changes in runoff generation or streamflow caused by the removal of the target brush species. The parameter values must be supported by appropriate documentation, whether from field data collection, published values from the hydrologic literature, or the model's user guidance.

If the watershed of interest contains USGS streamflow gages, those flow data must be collected for comparison with the historical rainfall data and used in model calibration. Data from the defined calibration period should be sufficient to match the rainfall records. If the watershed of interest does not contain a USGS gage, data from either the nearest downstream gage or a gage in a neighboring watershed may be used to calibrate the model. The decision to use data from either a downstream gage or a gage in a neighboring watershed should be based on an analysis of the similarities in hydrology and land use to the watershed of interest.

The model should have a mathematical representation of spatially distributed infiltration losses. The model will also estimate evapotranspiration of water from the root zone. The combination of the infiltration and evapotranspiration amounts can be used as estimates of potential recharge to the shallowest aquifer in the watershed. These simulation methods must be clearly explained and their uncertainty estimated based on the model's user guidance and the hydrologic literature.

Optimally, rainfall and streamflow data from the complete defined calibration period will be available for calibration of the model over multiple seasonal variations. This situation would allow site-specific adjustment of the watershed parameters to best fit the observed rainfall-streamflow conditions. The calibrated model would represent pre-treatment conditions.

The modeler might have only local or nearby rainfall data for the defined calibration period and no observed streamflow data for calibration. In this situation, the most sensitive watershed characteristics must be identified, and ranges of reasonable values should be employed in multiple combinations to demonstrate a range of possible streamflow results with the pre-treatment conditions.

Model Simulations

After completion of the pre-treatment simulations, the model's watershed characterization input data must then be modified to represent the effects of brush control for water supply enhancement. The post-treatment simulations should employ the same rainfall data from the defined calibration period, and the post-treatment model results will demonstrate the impacts of brush control on surface water flows (and aquifer recharge) through comparison with observed or modeled pre-treatment flows. The primary indication of effectiveness on streamflow will be the total annual flow volume change per treated acre. The pre- and post-treatment losses to infiltration and evapotranspiration can also be compared as at least qualitative contributions to groundwater recharge in terms of volume per treated acre.

Treatment scenarios for brush control to be simulated with the model must at least include the removal of 100% of treatable brush within the watershed of interest. Treatable brush is unique to each watershed and varies based on factors such as slope, brush density, proximity to waterbodies, and endangered species habitat. Factors that define treatable brush for the watershed of interest must be clearly described in the feasibility study.

As described in Texas Agriculture Code §203.053(c), TSSWCB shall define a standard method of reporting the projected water yield of each proposed project as modeled in a feasibility study. As such, projected water yield for the treatment scenarios for each sub-basin shall be reported in a feasibility study as the 15-year average annual gallons of water yielded per treated acre of brush. The 15-year simulation period corresponds to the defined calibration period.

PROCESS TO REVIEW APPLICATIONS FOR FUNDING

Applications for TSSWCB grant funding to complete new feasibility studies of conducting brush control for water supply enhancement will be referred to the Science Advisory Committee for review. The Science Advisory Committee will review the applications and make recommendations to the TSSWCB on which new feasibility studies should be conducted with agency funds.

In reviewing the applications and formulating recommendations, the Science Advisory Committee will consider the science-oriented questions below. TSSWCB staff will consider the programmatic- and policy-oriented questions below.

1. Does the application indicate the proposed study will conform to the *Requirements for Computer Modeling for Water Yield Predictions in Feasibility Studies*? Does it appear that conformity can be reasonably achieved?
    - Does there appear to be sufficient streamflow and rainfall data for the watershed of the proposed project to satisfy the defined period for model calibration?
    - Will the proposed study utilize either of the recommended models, or does the application provide adequate justification for selecting a different model?
    - If the application indicates a modeler has already been selected by the applying entity, is the modeler a person with expertise in hydrology, water resources, or another technical area pertinent to the evaluation of water supply as required by Texas Agriculture Code §§203.053(b) and 203.057(a)?

2. Is there an apparent "conflict of interest" between the modeler (performing entity and/or person) who will be conducting the computer modeling for the proposed study (including any entity providing matching funds) and any potential beneficiaries of the proposed project (i.e., water user groups, water providers/sellers)?

3. Are matching funds being provided to conduct the proposed study?
    - Are the matching funds ≥75% of project costs?
    - Are the matching funds ≥50% of project costs?

4. Is the budget for conducting the proposed study accurate and reasonable? Are appropriate costs budgeted? Is the timeframe for completing the proposed study reasonably expeditious?

5. What is the capacity and ability of the performing entity to fulfill all commitments specified in the application? Past performance by entity on projects previously funded by TSSWCB is taken into account.

6. Is a need for conservation of water resources within the watershed of the proposed project documented in the *State Water Plan* (as adopted by the TWDB)?

7. Does the *State Water Plan* or a *Regional Water Plan* include a recommendation to conduct a feasibility study in the watershed of the proposed project?

8. What is the reliance per capita of the water user group on the public water supply expected to be benefited by the proposed project (utilize method for Ranking Index from cost-share applications; see *Policy on Allocation of Grant Funds for the WSEP*)?

9. Is the primary purpose of the proposed study an assessment of the feasibility of conducting brush control for water supply enhancement in a particular watershed?

10. Does the application include a statement of the anticipated impact on water resources as required by Texas Agriculture Code §203.057(c)?

11. Is the application's statement of the anticipated impact on water resources supported by published science that suggests the proposed project may yield water in Texas?
    - Was the published science conducted in the watershed of the proposed project?
    - Was the published science conducted in a similar watershed in Texas?
    - Was the published science conducted in a similar watershed outside of Texas?

12. Will the proposed study examine brush species identified as detrimental to water conservation in the *State Water Supply Enhancement Plan*?

13. Is the watershed of the proposed study identified in the *State Water Supply Enhancement Plan* as a priority for conducting a new feasibility study?
    - If not identified as a priority, was a feasibility study previously published for the watershed of the proposed study but for a different species of brush?
    - As a factor of holistic and synergistic watershed management, are other watershed planning and management activities ongoing in the watershed of the proposed study?

Once applications are considered, the Science Advisory Committee will direct applying entities to an appropriate modeler [per Texas Agriculture Code §203.057(a)] to conduct the new feasibility study.