Going from Desired Future Conditions to Modeled Available Groundwater

Overview

- These guidelines apply when a groundwater availability model is used to estimate modeled available groundwater from desired future conditions.
- A groundwater availability model is a regional groundwater flow model based on the U.S. Geological survey MODFLOW code(s) that has been accepted by the Texas Water Development Board (TWDB) for joint groundwater planning purposes.
- Desired future conditions, such as specified drawdowns, saturated aquifer thickness, or spring flow, are criteria adopted by district representatives in a groundwater management area during joint planning.
- Modeled available groundwater is the amount of groundwater pumping that will achieve the desired future condition(s).
- Modeled available groundwater values are provided to each groundwater conservation district and regional water planning group in a groundwater management area.
- Regional water planning groups express their planning efforts in 10-year increments, extending 50 years into the future.
- The next regional water plans will be complete in 2021. The next state water plan is the 2022 State Water Plan. These have a 50-year planning horizon from 2030 to 2080.
- Groundwater pumping, simulated using the MODFLOW well package, is saved in the MODFLOW volumetric budget file. Because the well package and the cell-by-cell budget file may contain different values, the budget file is used in conjunction with the well file to estimate modeled available groundwater.
- The Groundwater Availability Modeling team at the TWDB will use the U.S. Geological Survey software ZONEBUDGET Version 3.01 to process the cell-by-cell budget file.

Desired Future Conditions

Administrative Review

- Once a desired future condition submittal is received by the TWDB, staff reviews the submitted information to determine whether it is administratively complete.
- The review also includes a verification that all technical work has been sealed by a licensed Texas Professional Geoscientist or Engineer.
- The TWDB notifies the groundwater management area if the desired future condition submittal is complete or incomplete.

- After the TWDB receives all required data, TWDB staff determines whether the desired future condition is achievable. The TWDB will notify the groundwater management area if the desired future condition is NOT achievable.
- Once the desired future condition is determined to be achievable, TWDB staff estimates modeled available groundwater.

Well package assumptions

- Modeled available groundwater calculations are associated with a specific MODFLOW input file (WEL), which contains aquifer pumping data.
- It is preferred that desired future condition submittals include the MODFLOW WEL file which achieves the desired future condition.
- If no WEL file is submitted TWDB staff develops the WEL file.
- If the submitted WEL file does not achieve the desired future condition TWDB groundwater availability modeling staff revises the submitted WEL file.
- A TWDB groundwater management area liaison communicates through the groundwater management area technical coordinator to discuss assumptions for revising the WEL file.

Aquifer extent vs. model extent

- Unless stated otherwise in the desired future condition submittal, TWDB staff calculates averages based on the footprint of the official aquifer boundaries if the desired future condition is average drawdown or aquifer thickness. For example, if the desired future condition is stated as an average drawdown over a groundwater management area, TWDB staff calculates the average drawdown for all model cells within the groundwater management area only within the official aquifer boundary, even if the groundwater availability model extends beyond the official aquifer boundary.
- GIS data of official aquifer boundaries can be found here: www.twdb.texas.gov/mapping/gisdata.asp.
- For other desired future conditions such as water levels at a specific monitoring well or specified spring flow, the TWDB evaluates the conditions consistent with the desired future condition description.

Average Drawdown Calculation

Reference (baseline) year and target (ending) year

- For each model cell, drawdown is calculated as the difference between water levels at a reference year and water levels at a target year.

- The desired future condition submittal or supporting documentation needs to specify which model stress periods correspond with the reference and desired future condition target years.
- The reference year must be sometime in the past and should not be the current year or sometime in the future.
- If a reference year or the desired future condition target year is not specified in the submittal, the submittal is considered incomplete and the TWDB groundwater management area liaison will contact the groundwater management area technical coordinator for the additional information.

Model cells

- The drawdown values for all active official aquifer cells in a specified area is summed and divided by the number of active official aquifer cells in that area.
- Model cells with a simulated head below the cell bottom at the reference year and initially dry cells that rewet during a predictive run are excluded from calculations, unless otherwise specified.
- Please see the document: Dry Cells_May 2020.pdf for additional details on the treatment of dry cells in the desired future condition and modeled available groundwater calculations.
- The specified area is the area stated in the desired future condition such as county, groundwater conservation district, or the entire groundwater management area. It may be for an individual aquifer unit or model layer or for all layers or even parts of an aquifer.

Model Grids

- Each groundwater availability model has a GIS grid with attributes for various geographic designations, such as county, groundwater management area, groundwater conservation district, and active or inactive cells. These grids can be found at www.twdb.texas.gov/groundwater/models.
- The grid file also includes aquifer boundary or layering information in fields with the header *AQ_Active*. There is an *AQ_Active* field for each model layer. Integer values have been assigned to model cells to identify whether the cells are active or inactive, within or outside an official aquifer boundary, or some other hydrostratigraphic designations.
- In general, an *AQ_Active* value of *0* indicates a model cell is inactive, a value of *1* indicates the model cell is active and within the official aquifer boundary and a value of *2* indicates the model cell is active but represents something other than the official aquifer.

- Other *AQ_Active* values may be assigned depending on how various hydrostratigraphic units are represented in the model.
- Each model grid includes detailed documentation of *AQ_Active* values and what they represent.
- It should be noted that for the Gulf Coast Aquifer, model areas located under bays are also excluded even though they are active model cells within the official aquifer boundaries.

ZONEBUDGET

- The U.S. Geological Survey program ZONEBUDGET extracts MODFLOW cell-by-cell flows based on a zone file. The zone file may contain different zones represented by integers at model cells. The program calculates flows within and between zones.
- TWDB staff uses the model grids to construct zone files for the program ZONEBUDGET to extract the well flow from the MODFLOW volumetric budget file for all model cells.
- For modeled available groundwater values, the TWDB delineates the zones based on county, river basin, regional water planning area, groundwater conservation district, groundwater management area splits, and any other specified areas in the desired future condition resolution. Thus, modeled available groundwater values are provided under different categories to meet different planning purposes.
- The model GIS grid files discussed above include geographic locations for each model grid cell based on the location of the model grid cell centroid.
- Unless otherwise stated in the desired future condition submittal, modeled available groundwater values (groundwater pumping values) are only extracted from the model within the official aquifer boundaries.

For questions, contact:

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