

**DRAFT Summary of Carrizo Aquifer
Outcrop DFC Simulations Conducted
for the Gonzales County UWCD**

**T. Neil Blandford, P.G.
Farag Botros, Ph.D., P.E.
January 18, 2024**

Presentation Outline

- Desired Future Conditions, focused on Carrizo-Wilcox Aquifer outcrop
- Groundwater Availability Models (GAMs)
- Recent and future (permitted) pumping in the Carrizo-Wilcox Aquifer in the Gonzales County UWCD
- Description of model simulations
- Simulation results at Carrizo Aquifer DFC wells

Desired Future Conditions (DFCs)

- A DFC is a desired, quantifiable condition applicable to groundwater resources at a specified time in the future, such as water levels or groundwater volumes.
- DFCs are set by the groundwater district representatives within a Groundwater Management Area (GMA). The Gonzales County UWCD is part of GMA 13.
- The amount of water that can be pumped without exceeding the DFC is determined by the TWDB using the GAM; this quantity of water is referred to as the Modeled Available Groundwater, or MAG.

Groundwater Availability Model (GAM)

- First GAM - Southern part of the Carrizo-Wilcox, Queen City and Sparta aquifers (Kelly and others, 2004)
- It was recognized by other experts during Joint Groundwater Planning that the first GAM simulated too much drawdown in the outcrop area relative to observed water levels
- The first GAM was recently updated (Panday and others, 2023). One of the features of the updated GAM is improved simulation of groundwater conditions in the Carrizo Aquifer outcrop.

Groundwater Availability Model (GAM) - Cont'd

- The model of Panday and others (2023) had some limitations based on input from stakeholders, including
 - Hydraulic conductivity/transmissivity values in some areas
 - Aquifer storage coefficient values in some areas
 - Pumping values in some areas
- The Panday and others (2023) model was updated by Hutchison (2024) on behalf of GMA 13 to address the above items
- The Hutchison (2024) model was accepted by GMA 13 on 9/20/24, and is currently undergoing approval by the TWDB to be used as the “official” GAM for water planning

GMA 13 DFCs

- The first DFC for the Carrizo-Wilcox, Queen City and Sparta aquifers in GMA 13 is that 75 percent of the saturated thickness in the outcrop at the end of 2012 remains in 2080.
- Due to limitations in the prior GAM, this first DFC could not be simulated.
- A secondary DFC for the Carrizo-Wilcox, Queen City and Sparta aquifers based on an average drawdown of 49 feet (+/- 5 feet) across all of GMA 13 has been simulated. This secondary DFC is not addressed in this presentation.

see <https://www.twdb.texas.gov/groundwater/dfc/2021jointplanning.asp> for details

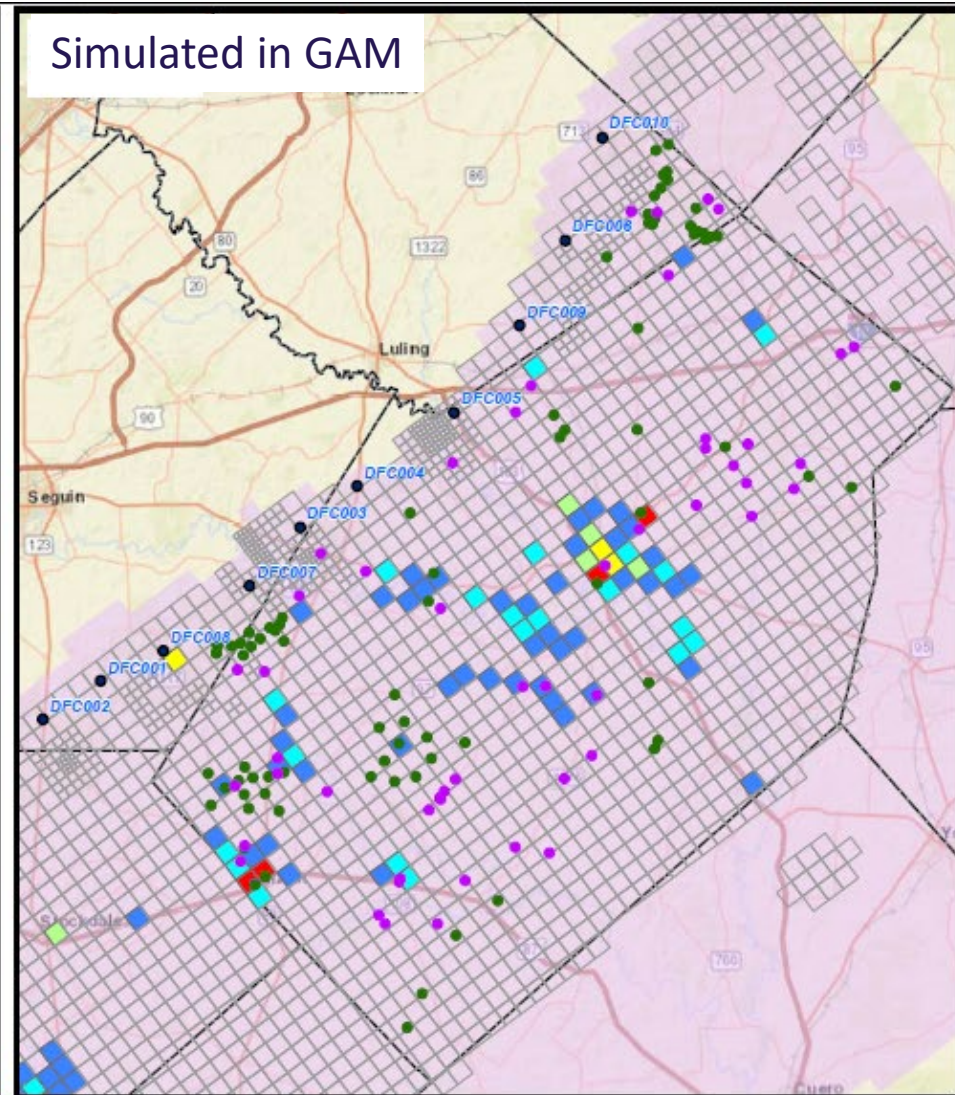
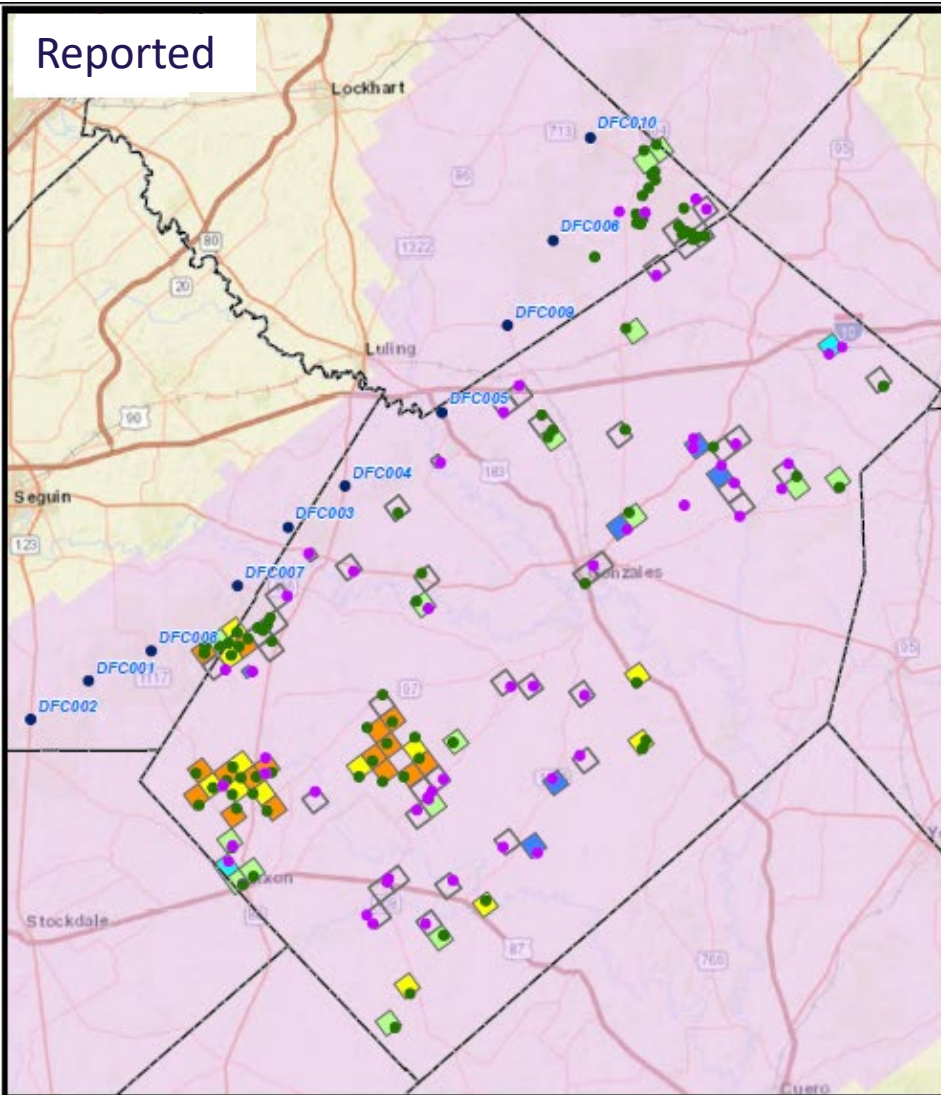
GMA 13 DFCs

- The Gonzales County UWCD asked DBS&A to conduct predictive simulations using the Hutchison (2024) model (the newest GAM) to evaluate future water levels at the 10 Carrizo outcrop DFC monitor wells
- The remainder of this presentation provides a summary of the simulation approach and results

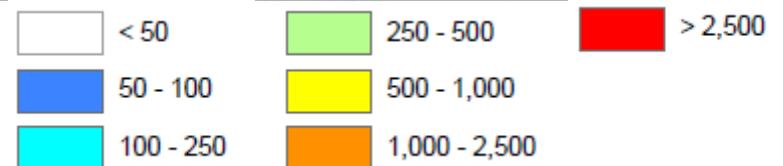
Predictive Simulations: 2018 through 2024

- GAM historical simulation extended
 - Used reported pumping for GCUWCD in Carrizo Aquifer (Model Layer 7) and for CRWA in Guadalupe County
 - For Nov/Dec 2024, used 2023 Nov/Dec values
 - Within GCUWCD for the Carrizo Aquifer
 - Reported pumping for GCUWCD applied
 - If a cell had pumping <50 afy in 2017, and there was no permitted well, the 2017 GAM pumping continued 2018-2080
 - If a cell had pumping >50 afy in 2017, and no permitted well, 50 ac-ft/yr pumping used from 2018 to 2080
 - All other regions, continued 2017 pumping
 - Assumed average groundwater recharge

2017 Reported and Simulated Pumping (ac-ft/yr)



- DFC well
- > 100 ac-ft/yr
- < 100 ac-ft/yr



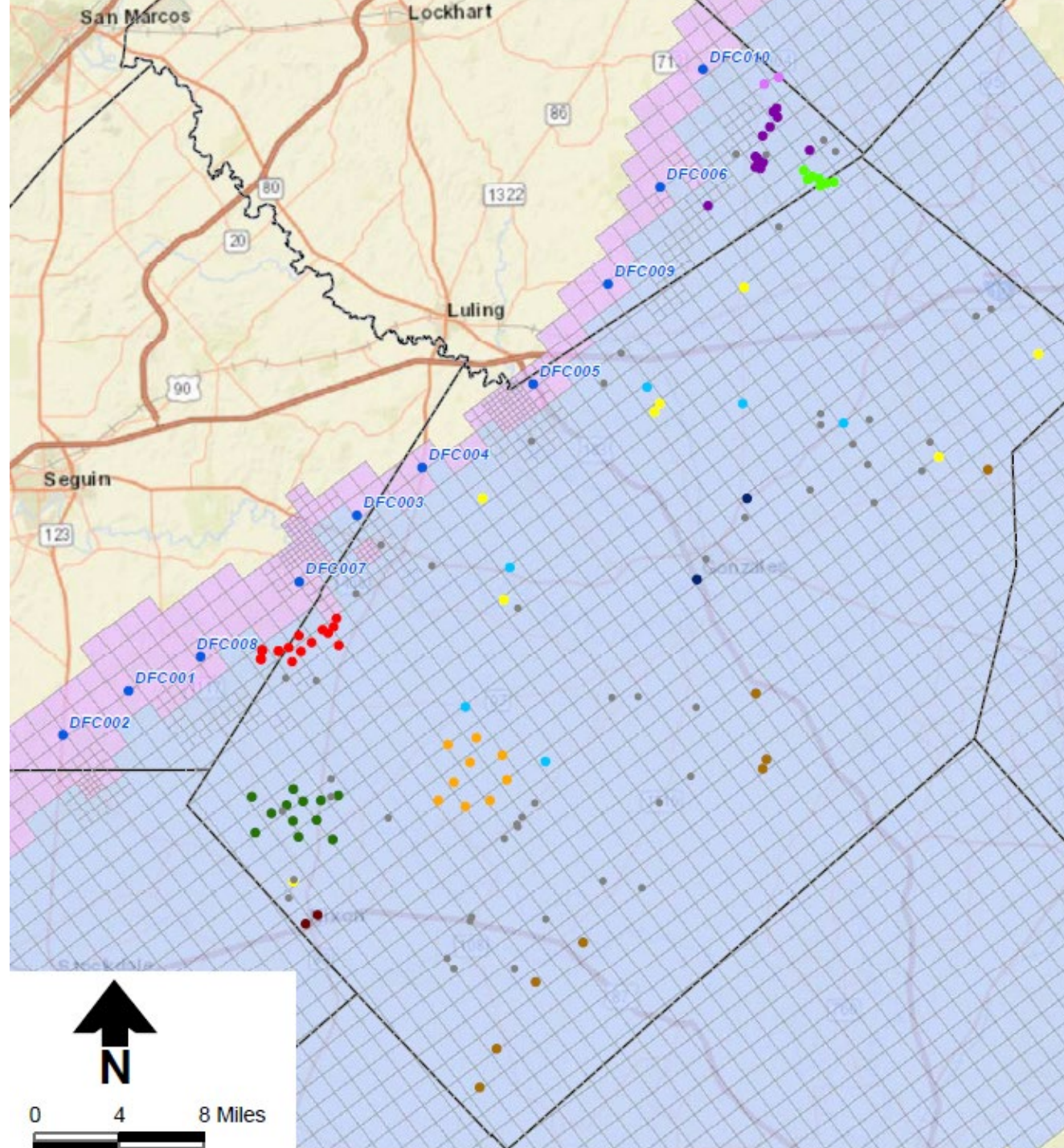
Predictive Simulations: 2025 through 2080

- Three predictive simulations
 - Scenario 1 (Base case) - continued 2024 pumping through 2080
 - Scenario 2 - Same as Scenario 1, plus full pumping by CRWA for currently permitted amount
 - Scenario 3 - Same as Scenario 1, plus full permitted pumping for all major permit holders

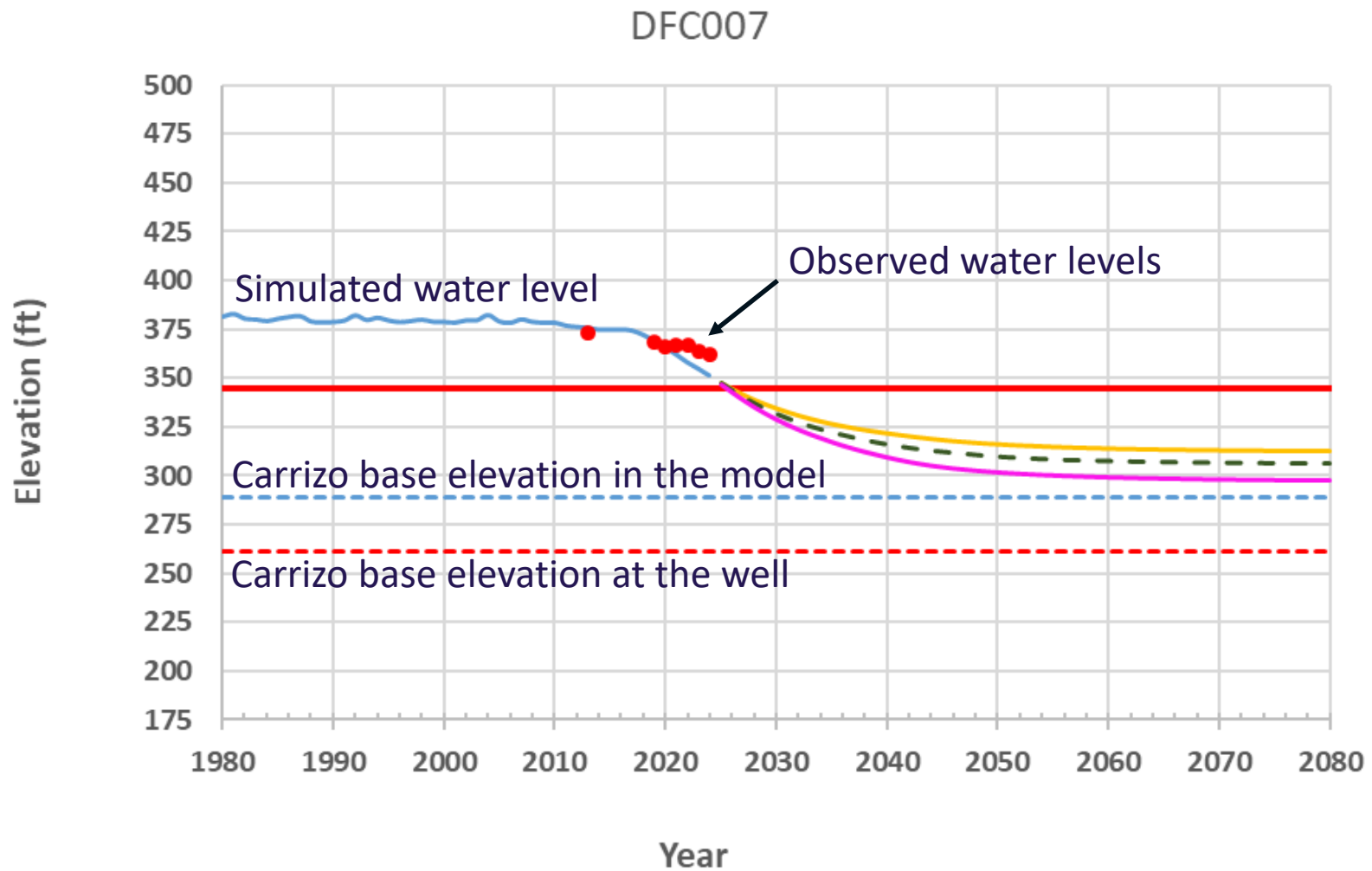
Carrizo Wells by Owner

- DFC well
- ARWA
- CRWA
- GBRA
- Aqua Water
- SAWS
- SSLGC
- GCWSC
- City of Gonzales
- City of Nixon
- EOG Resources
- Irrigation
- Other permitted well

- Outcrop
- Dwindip

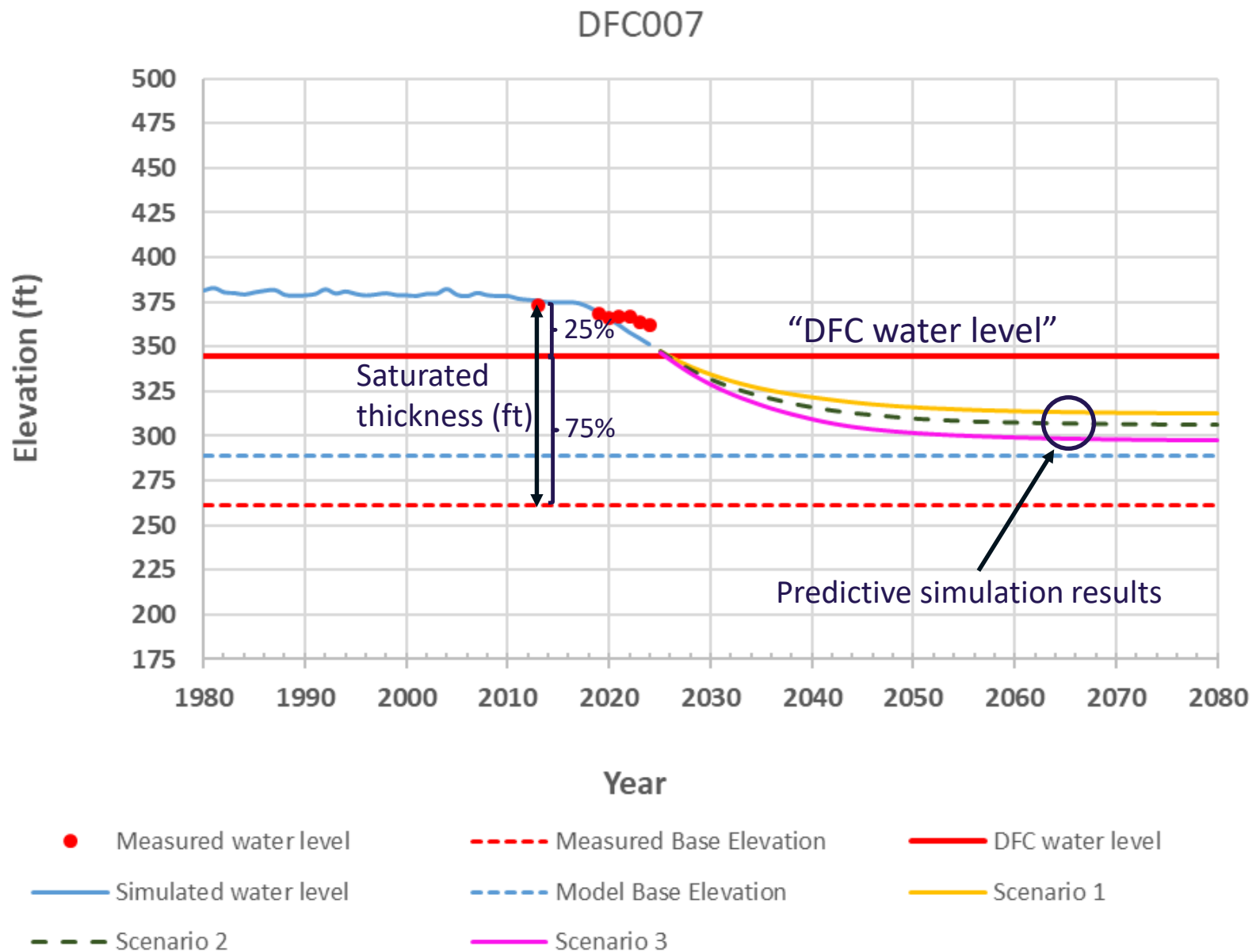


Example Plot Layout - Well MWCZ-7

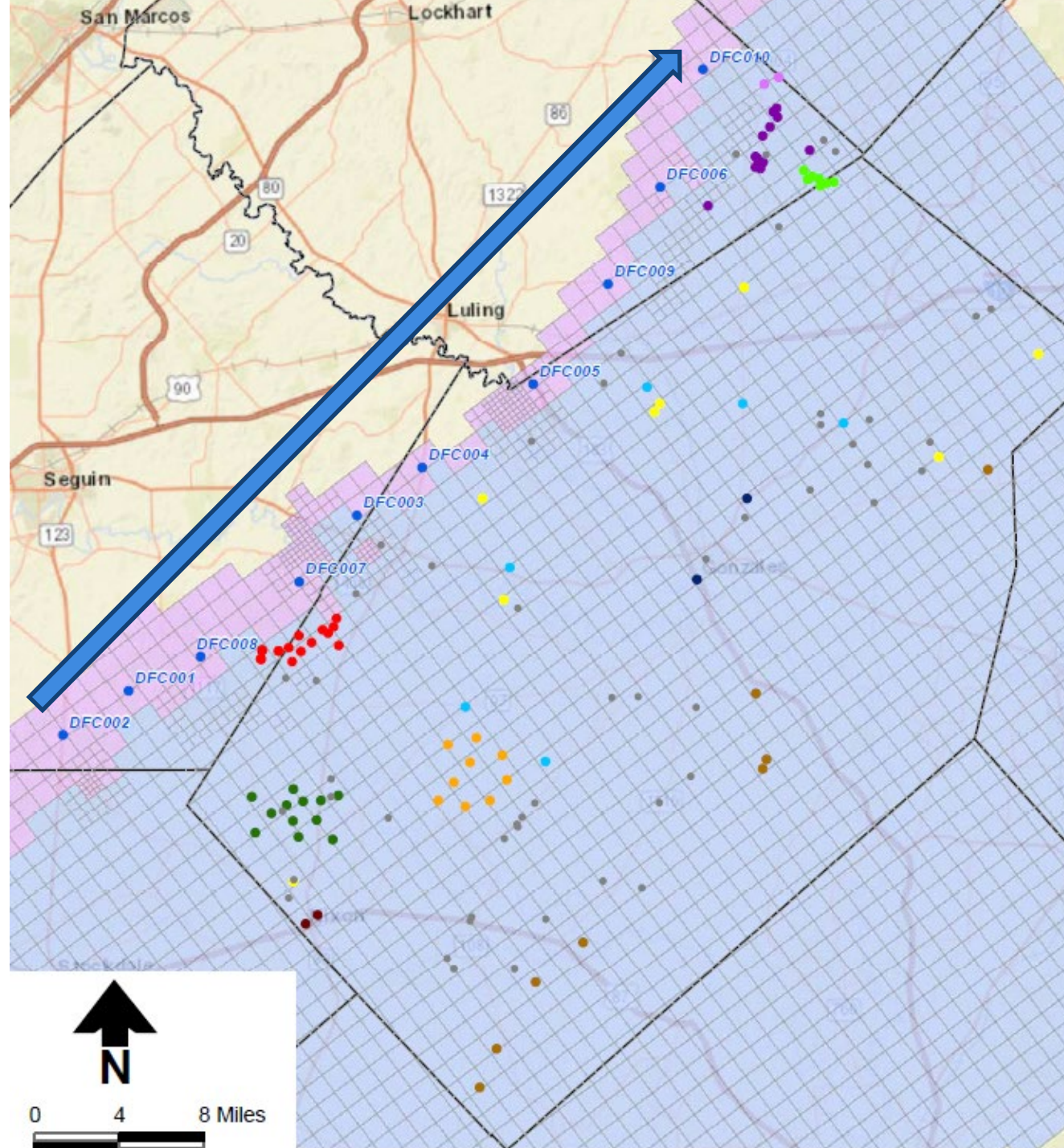


- Measured water level
- Simulated water level
- - - Scenario 2
- - - Measured Base Elevation
- - - Model Base Elevation
- - - Scenario 3
- DFC water level
- Scenario 1

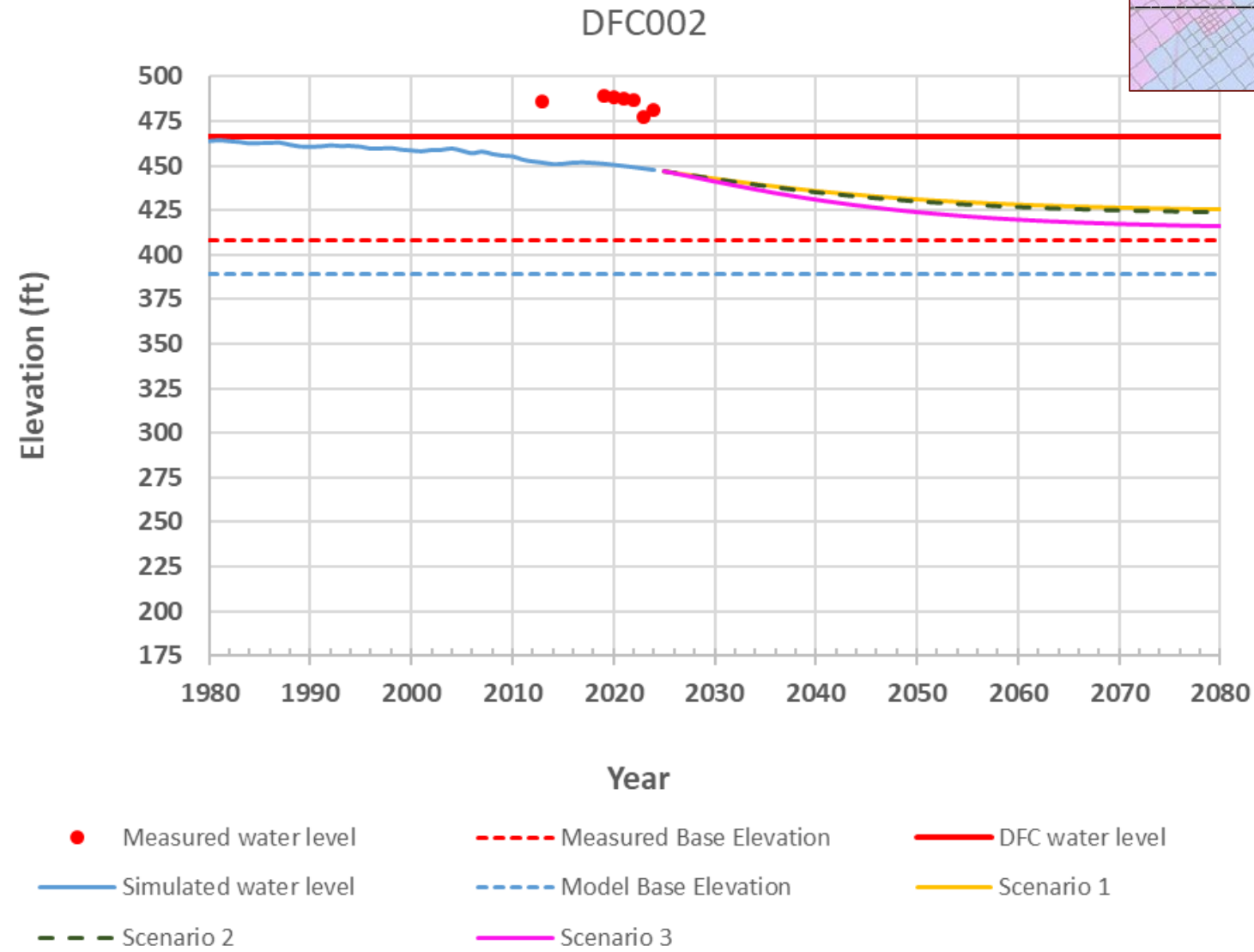
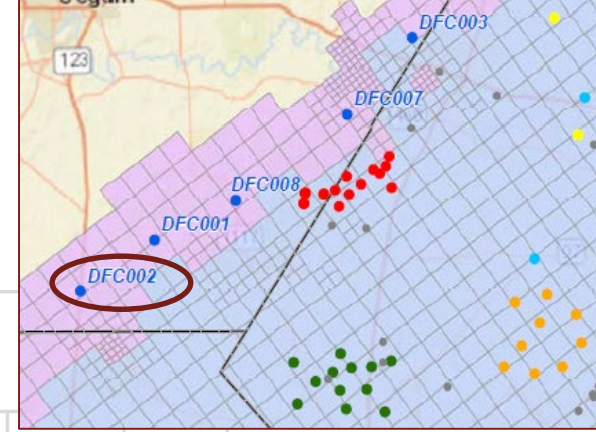
Example Plot Layout - Well MWCZ-7



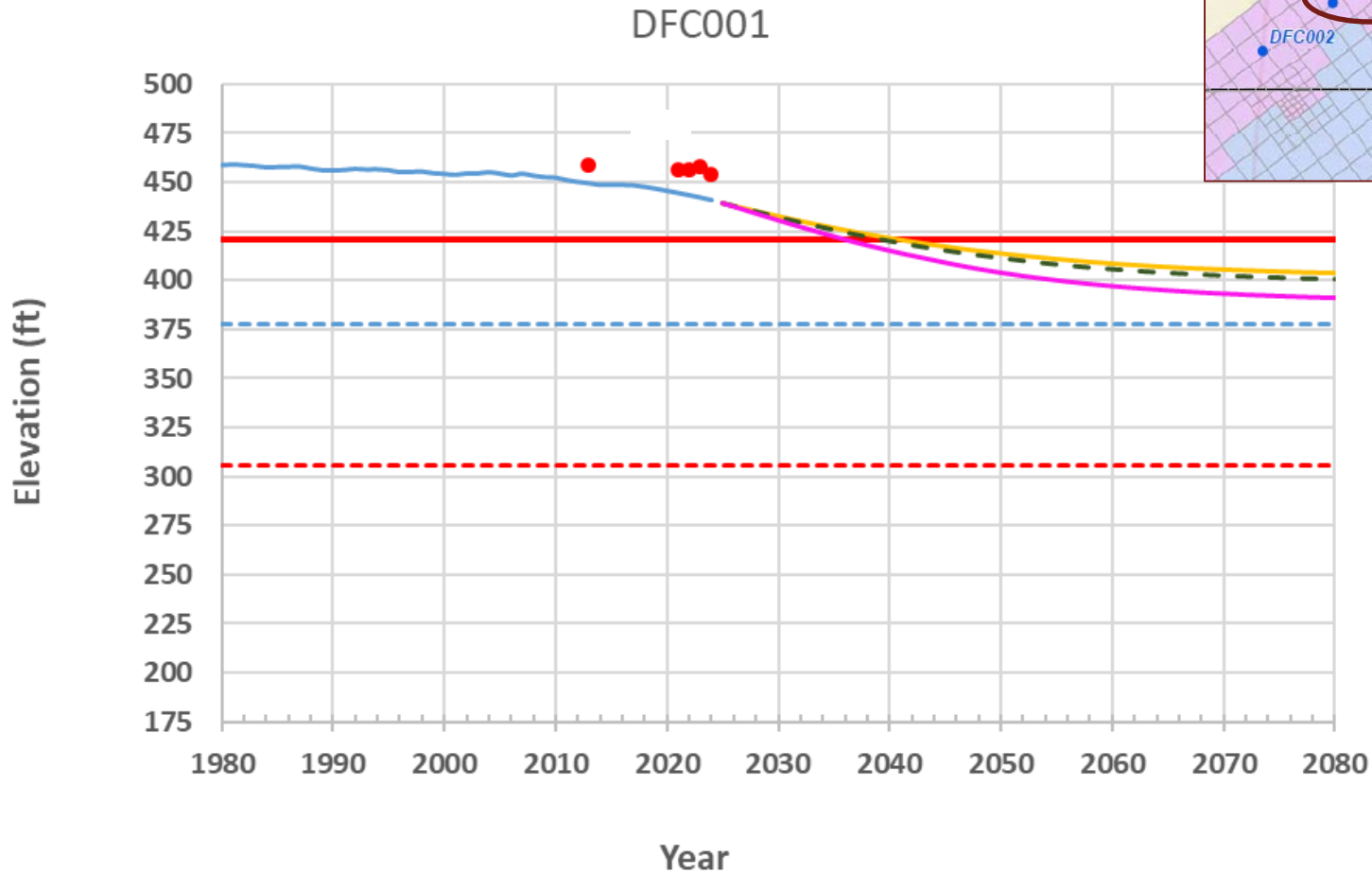
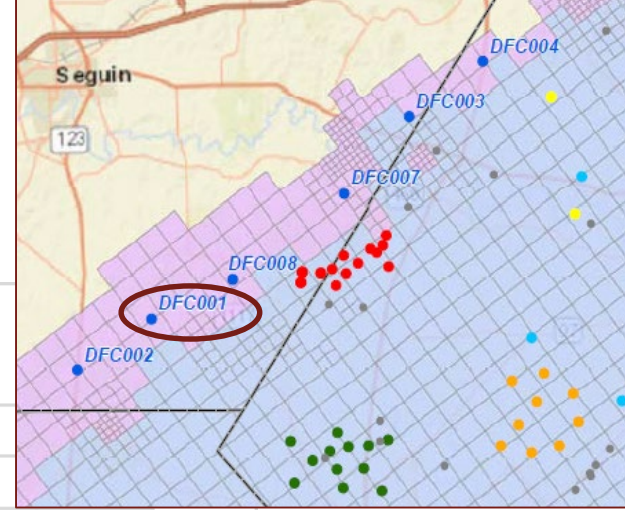
Results provided for each DFC well ordered from southwest to northeast



Well MWCZ-2

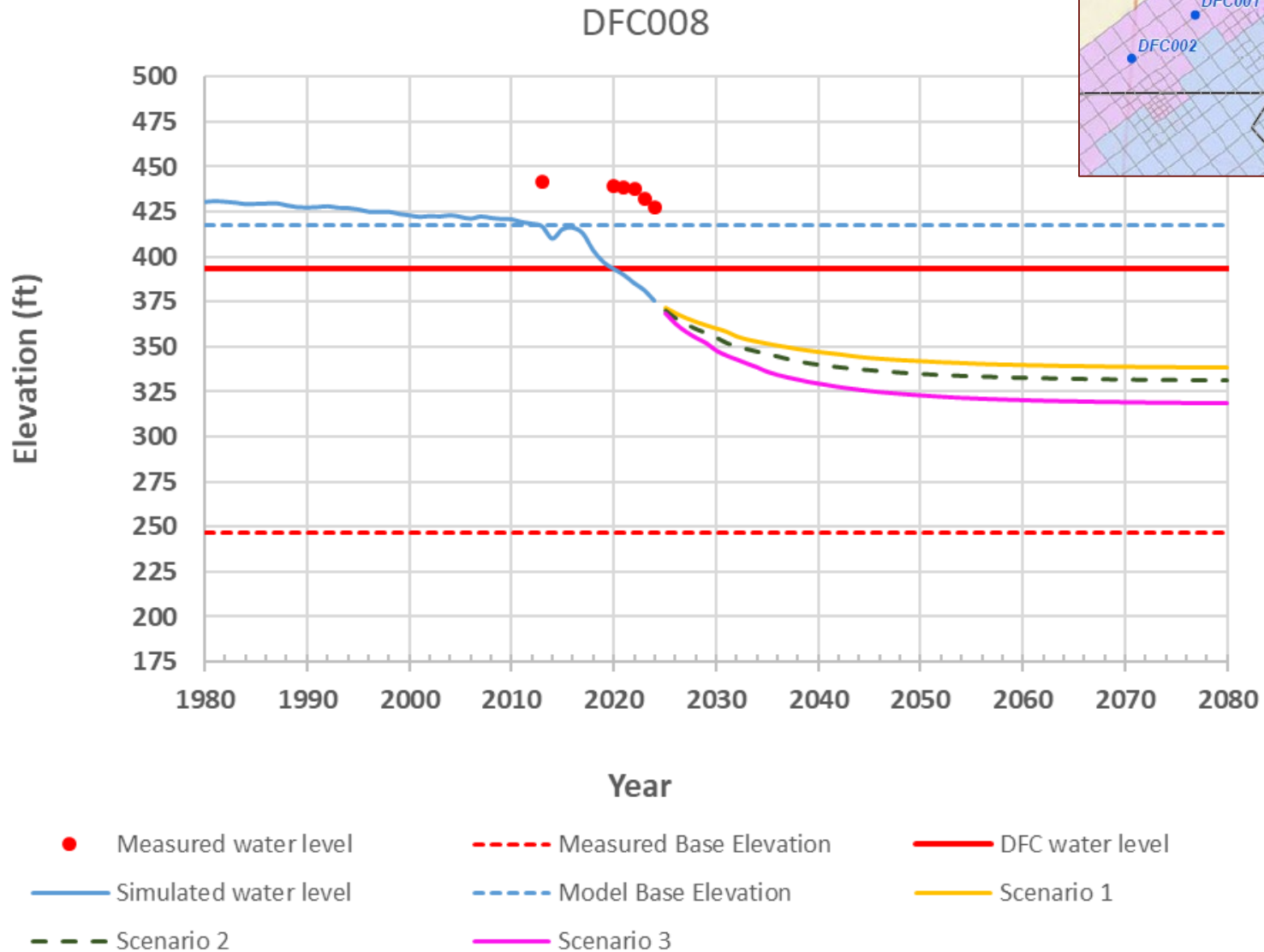
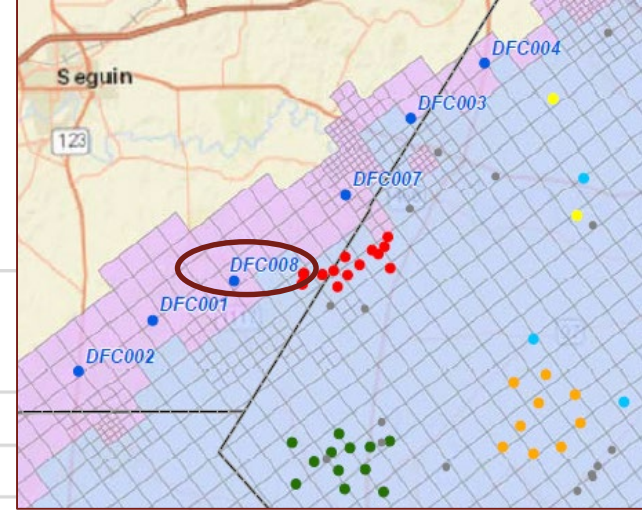


Well MWCZ-1B

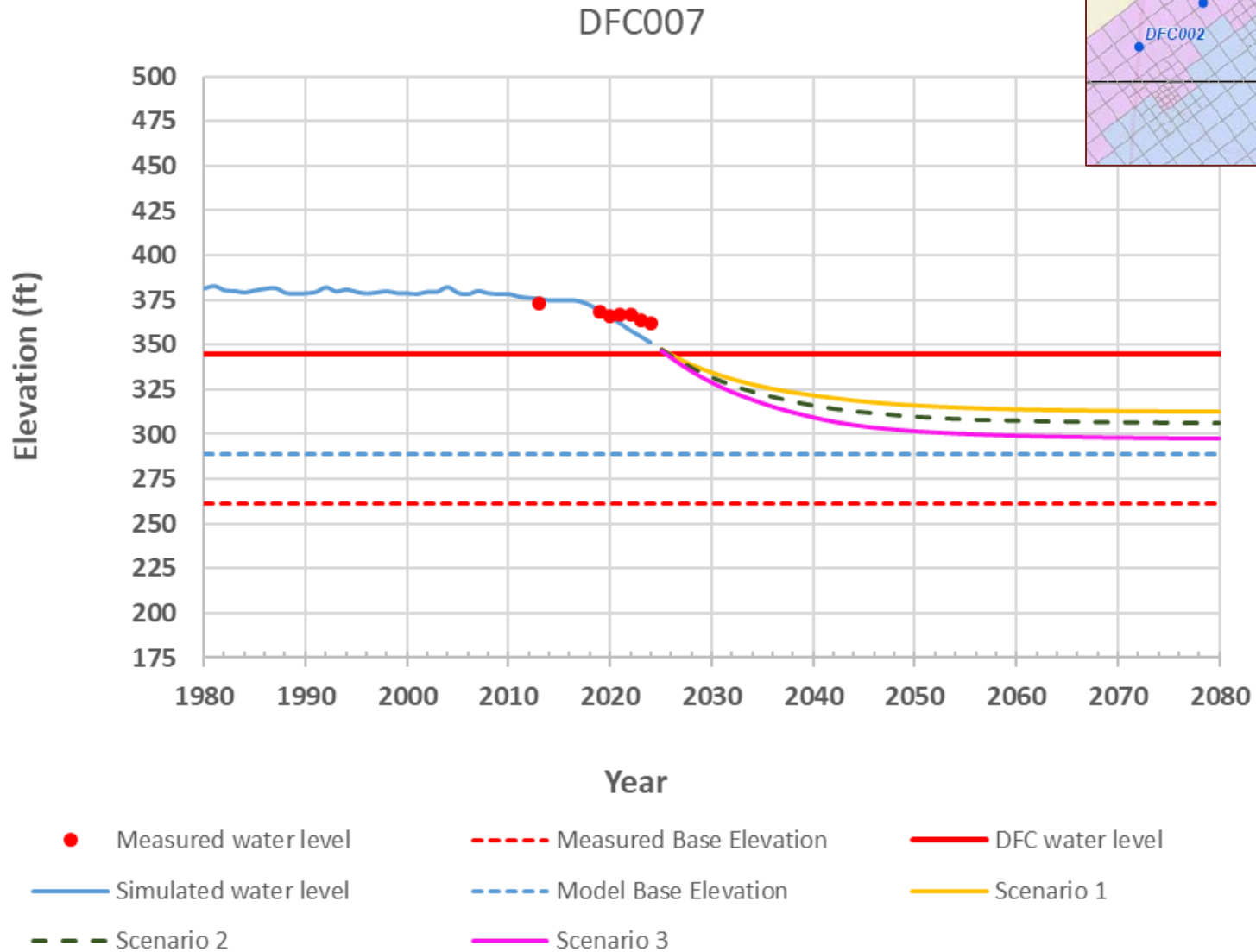
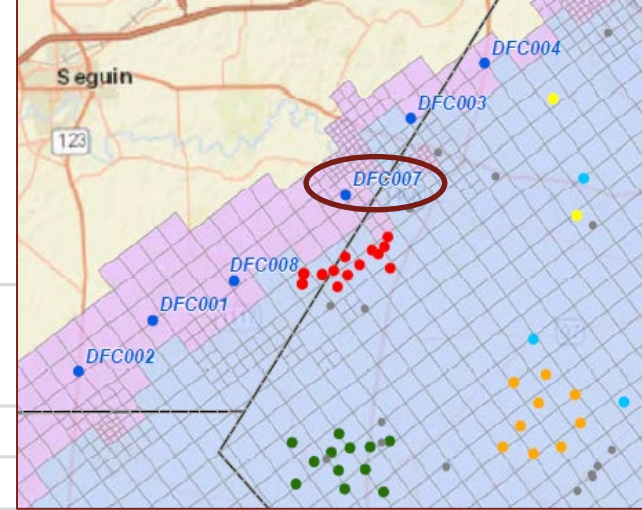


- Measured water level
- Simulated water level
- Scenario 2
- - - Measured Base Elevation
- - - Model Base Elevation
- Scenario 3
- DFC water level
- Scenario 1

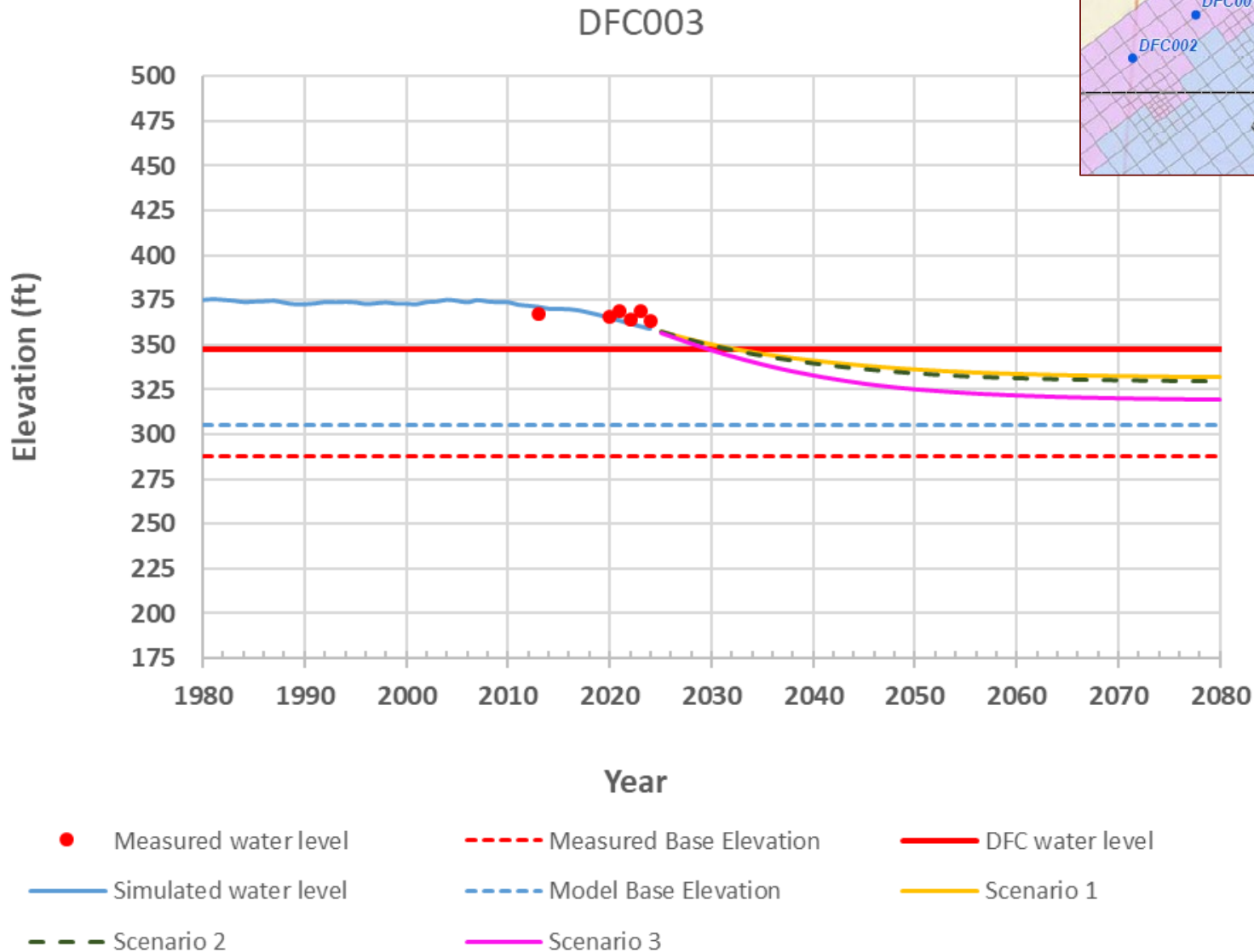
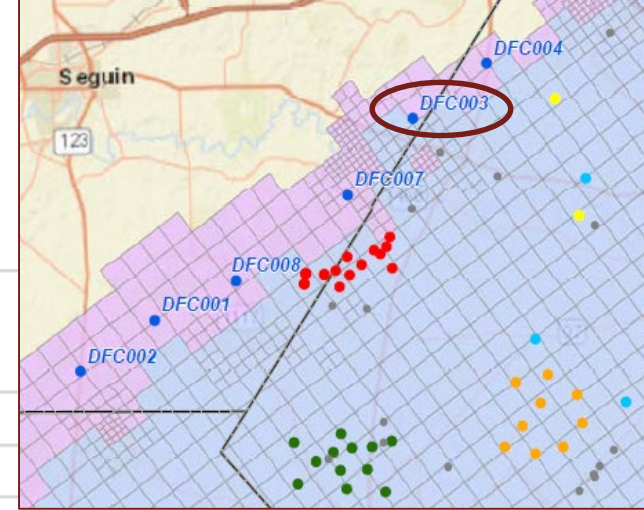
Well MWCZ-8



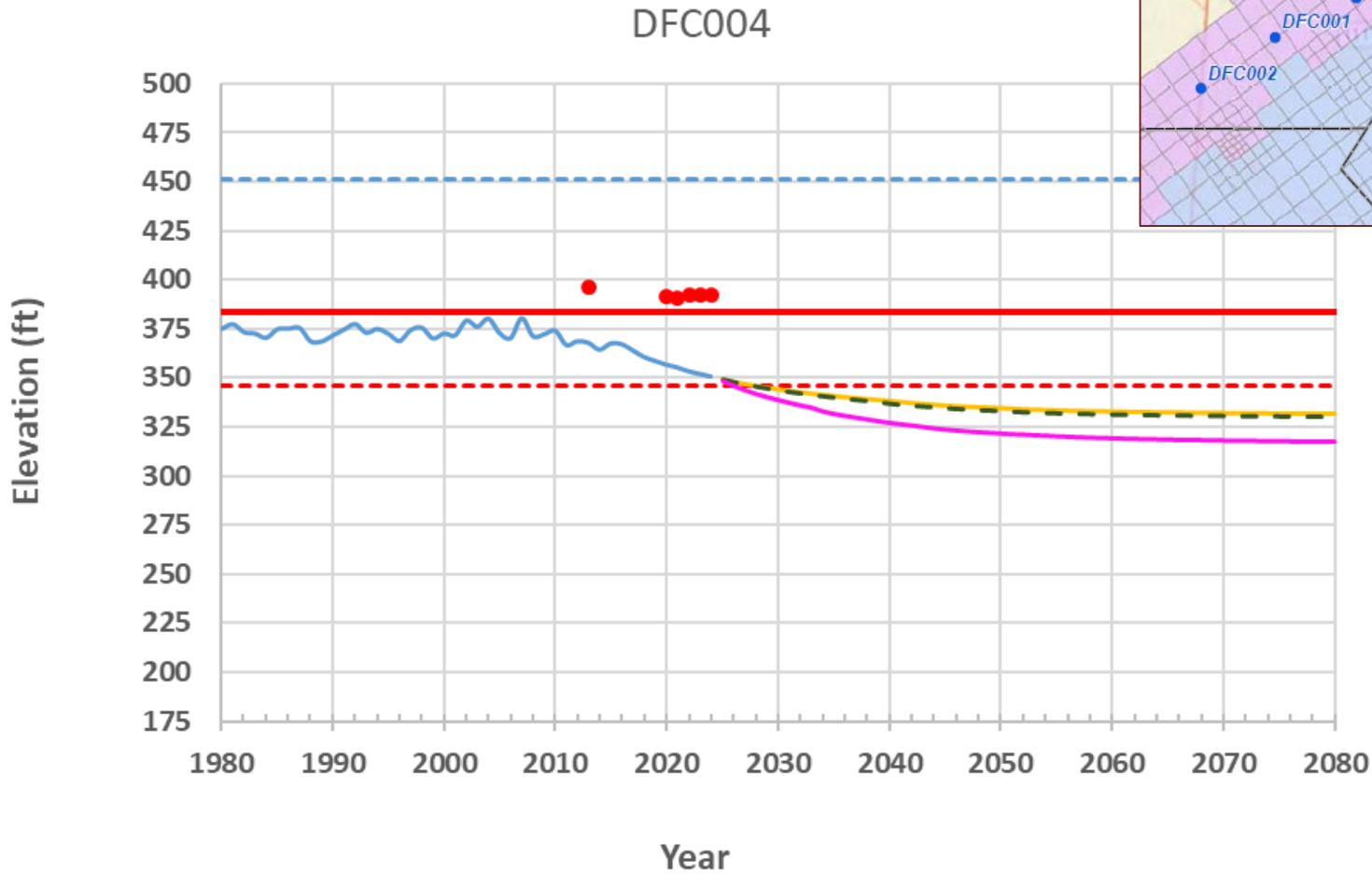
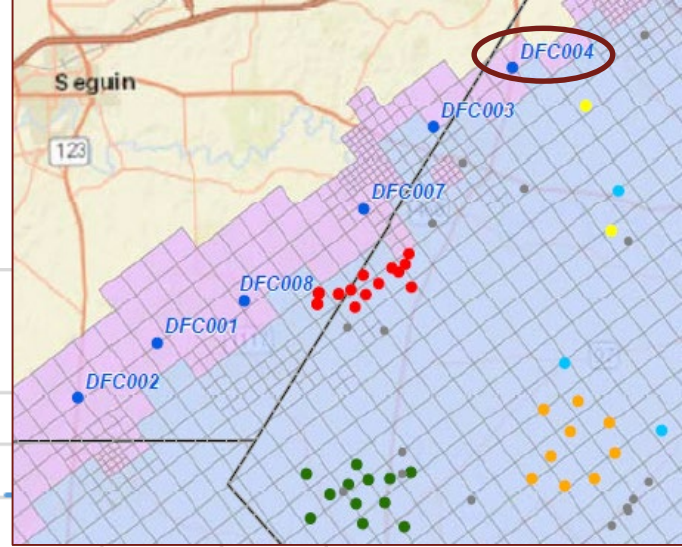
Well MWCZ-7



Well MWCZ-3

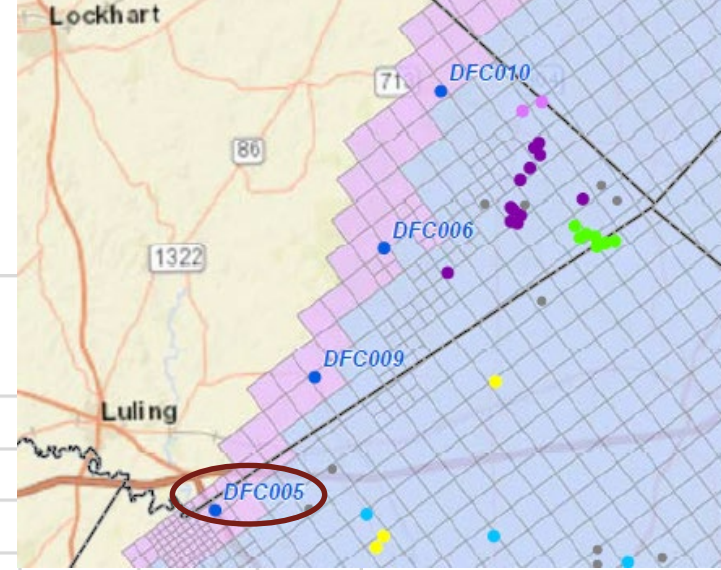


Well MWCZ-4

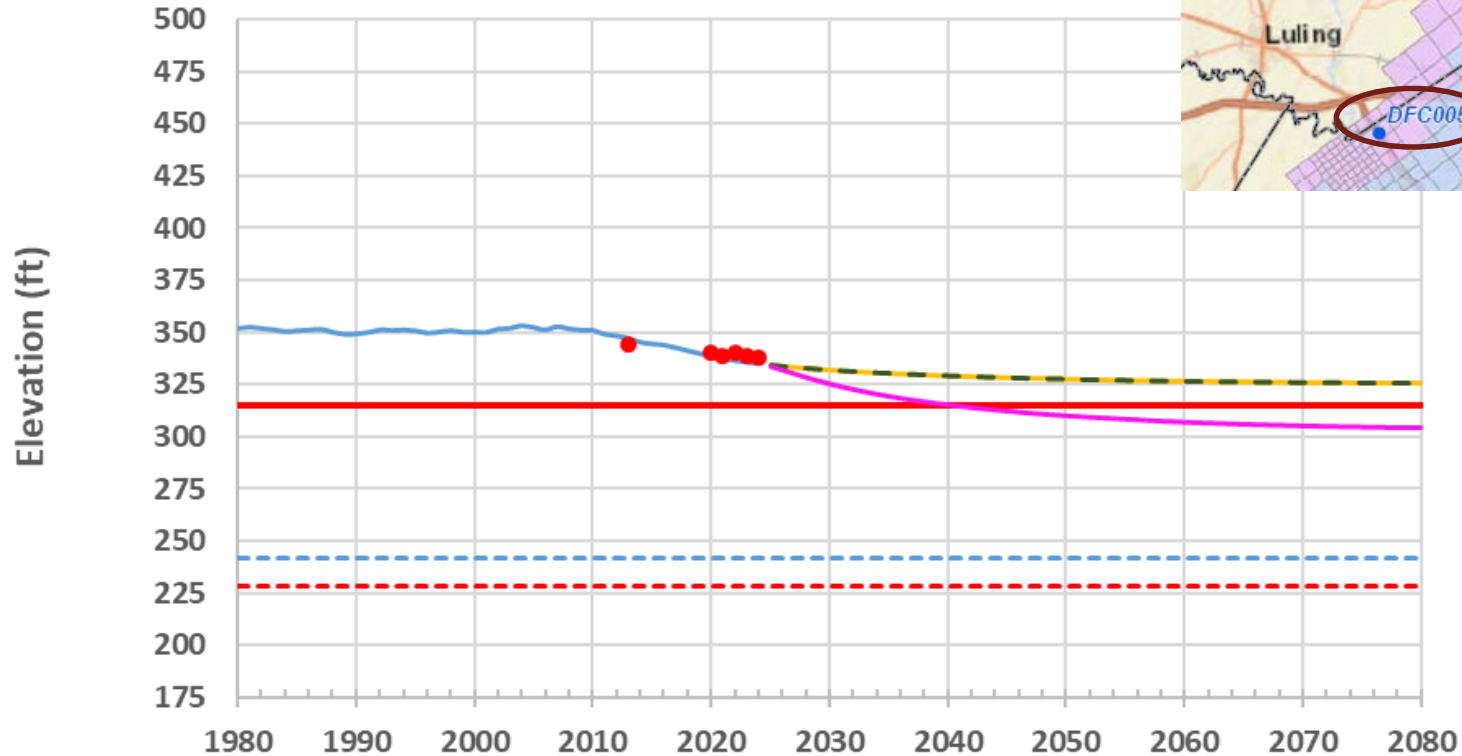


- Measured water level
- Simulated water level
- - - Scenario 2
- - - Measured Base Elevation
- - - Model Base Elevation
- Scenario 1
- DFC water level
- Scenario 3

Well MWCZ-5

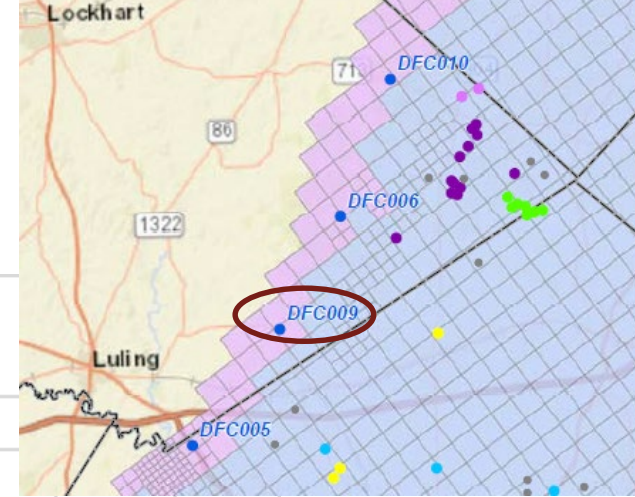


DFC005

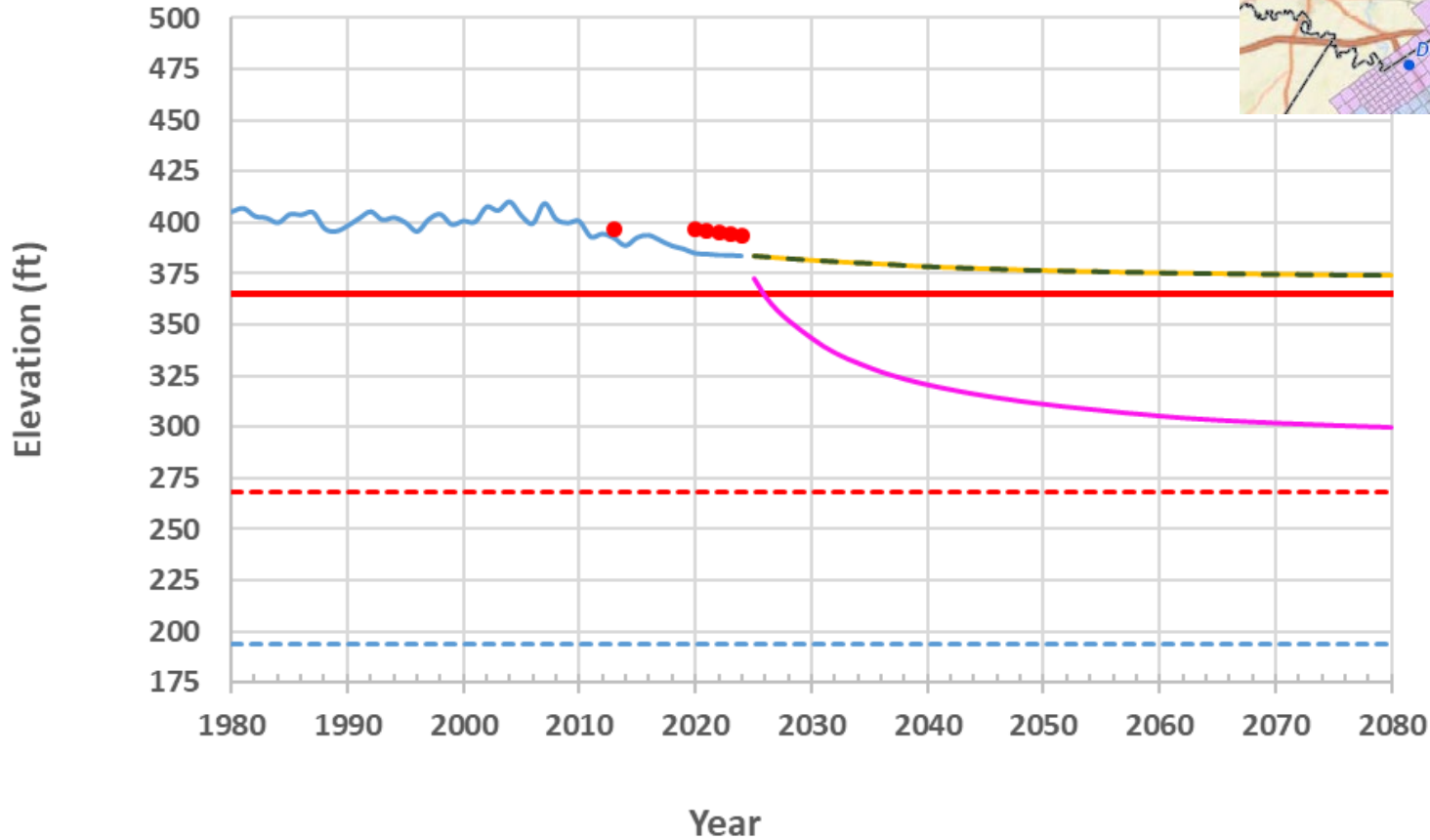


- Measured water level
- Simulated water level
- Scenario 2
- - - Measured Base Elevation
- - - Model Base Elevation
- Scenario 3
- DFC water level
- Scenario 1

Well MWCZ-9

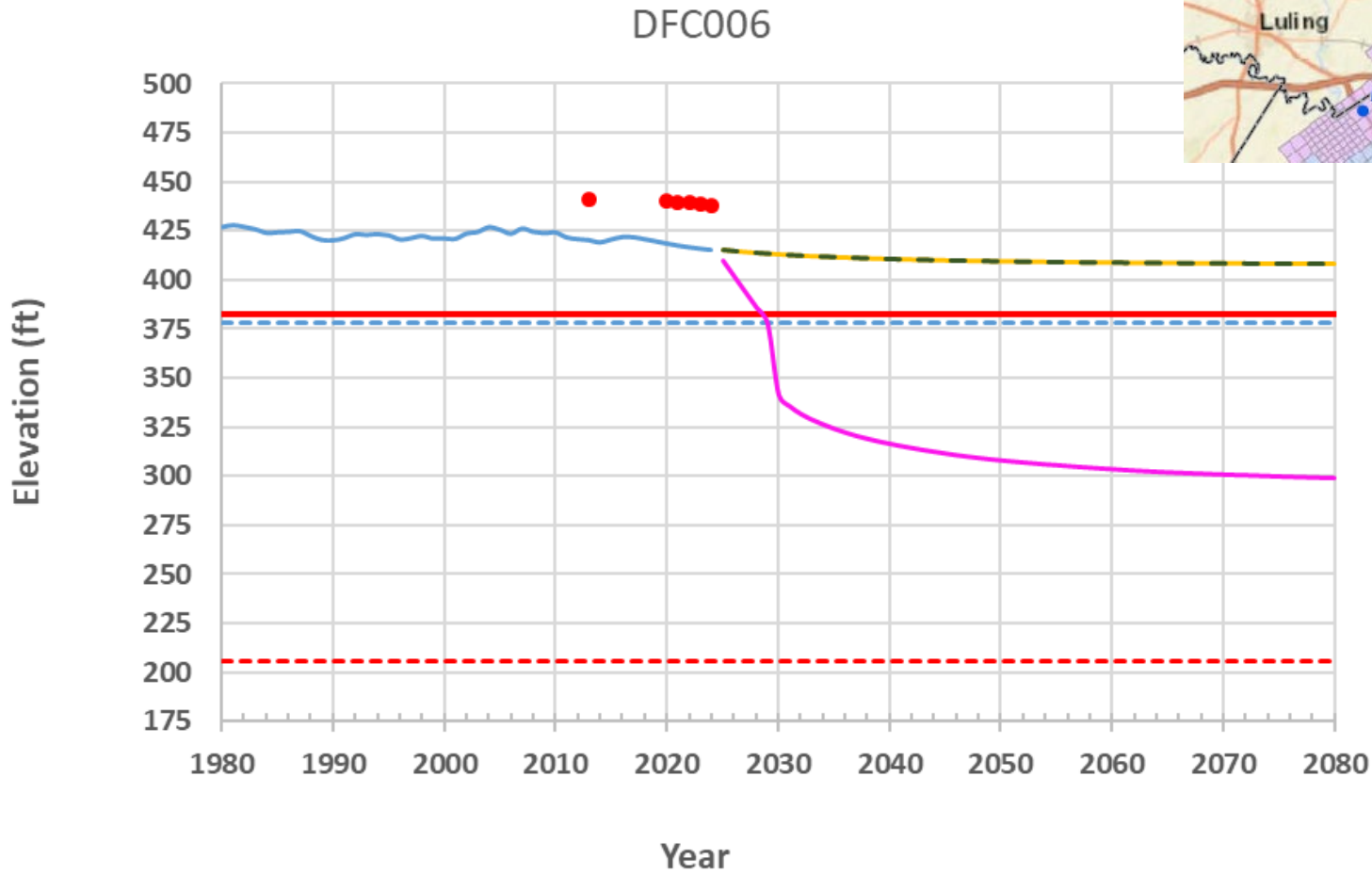
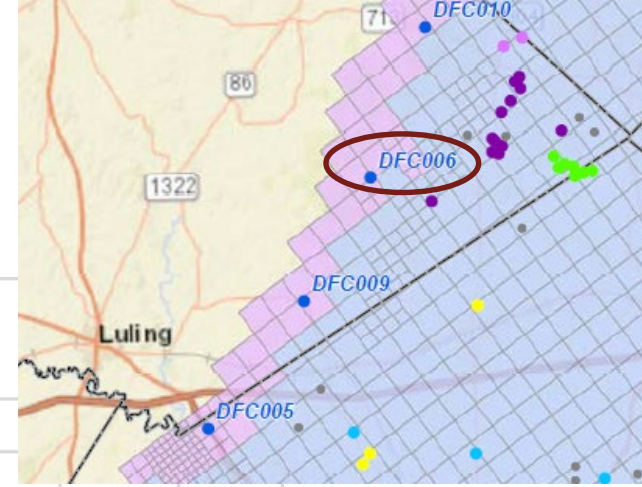


DFC009



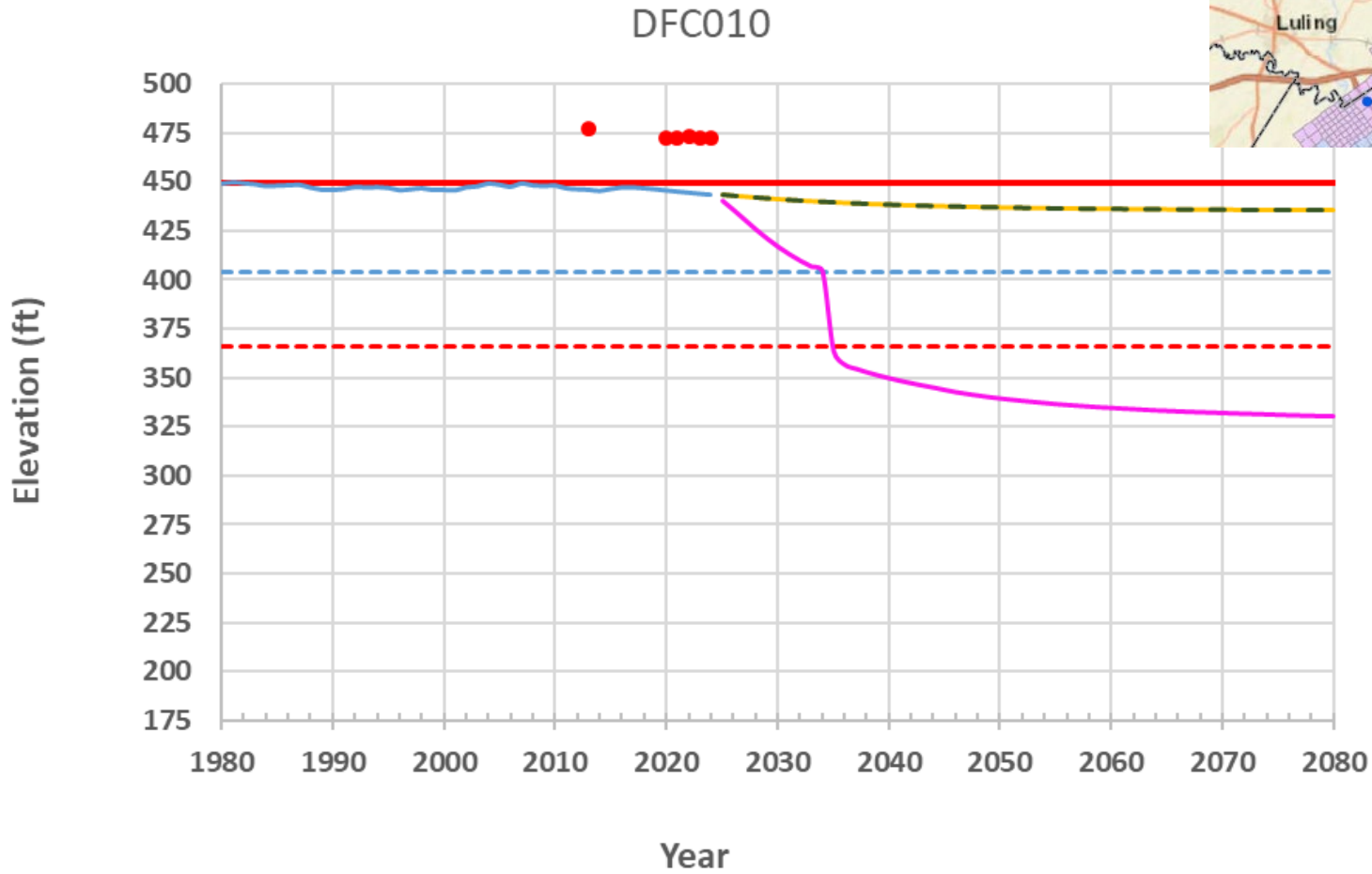
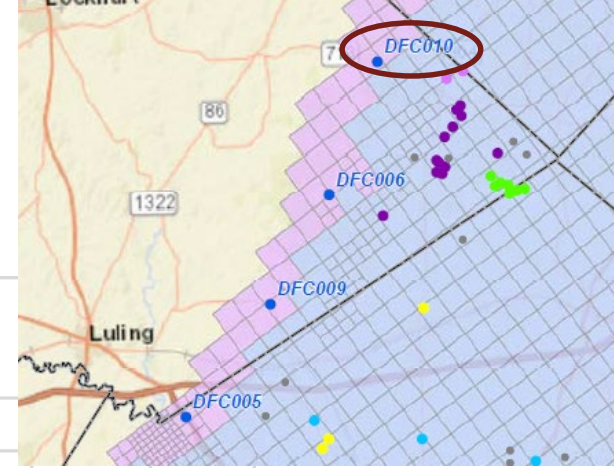
- Measured water level
- Simulated water level
- Scenario 2
- - - Measured Base Elevation
- - - Model Base Elevation
- Scenario 3
- DFC water level
- Scenario 1

Well MWCZ-6



- Measured water level
- Simulated water level
- Scenario 2
- - - Measured Base Elevation
- - - Model Base Elevation
- Scenario 3
- DFC water level
- Scenario 1

Well MWCZ-10



- Measured water level
- Simulated water level
- Scenario 2
- - - Measured Base Elevation
- - - Model Base Elevation
- Scenario 3
- DFC water level
- Scenario 1

Observations

- At DFC wells 1, 3, 5, 7, and 9, the GAM reasonably replicates observed water levels and water-level trends
- At DFC wells 2, 6, 8, and 10, the GAM simulates reasonable water-level trends, but the simulated water levels are consistently lower than observed values by a significant amount
- At DFC well 4, the simulated trend in water levels does not match the observed trend and the simulated water levels are consistently lower than observed values
- At all DFC wells the base of the Carrizo Aquifer is different from that reported for the DFC wells, but the differences are particularly large at wells 1, 4, 6, 8, and 9

Observations Cont'd

- At DFC wells 1, 2, 3, 4, 7, and 8, the simulated water level for predictive Scenarios 1 and 2 falls below the “DFC water level” prior to 2080
- For predictive Scenario 3 (full permitted pumping begins in 2025), the simulated water level falls below the “DFC water level” prior to 2080 at all DFC wells
- The current GAM is an improvement relative to prior GAMs, but simulation results and model inputs could be improved for some regions of the Carrizo outcrop area (e.g. DFC well 4)

References

Hutchison, W.R. 2024. *Documentation of GMA 13 Model: Update to Groundwater Availability Model for the Southern Portion of the Queen City, Sparta, and Carrizo-Wilcox Aquifers, Technical Memorandum 1, Draft 3*. Contract report prepared for Groundwater Management Area 13.

Kelley, V.A., N.E. Deeds, D.G. Fryar, and J.P. Nicot. 2004. *Groundwater availability models for the Queen City and Sparta aquifers*. Contract report to the Texas Water Development Board.

Panday, S., R. Wyckoff, G. Martell, S. Schorr, M. Zivic, W.R. Hutchison, and J. Rumbaugh. 2023. *Final numerical model report: update to the groundwater availability model for the southern portion of the Queen City, Sparta, and Carrizo-Wilcox aquifers*. Contract report to the Texas Water Development Board.

GMA 13 Web Sites

<https://www.twdb.texas.gov/groundwater/dfc/2021jointplanning.asp>

<https://www.gma13.org/>