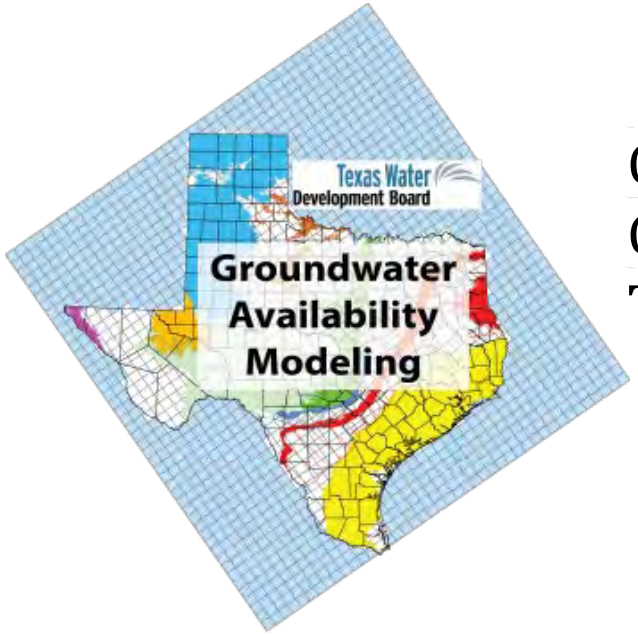
Texas Water Development Board (TWDB) Groundwater Availability Modeling (GAM) Program



Cindy Ridgeway (Manager)
Groundwater Availability Modeling Program
Texas Water Development Board

What is the Texas Water Development Board?

Not regulatory agency like Texas Commission on Environmental Quality.

Science: Groundwater, surface water, innovative water technology, conservation, education, flooding.

Planning: Assist with regional planning and state planning (drought and flood plans)

Funding: We assist with implementing water projects with funding

Groundwater Availability Modeling (GAM) Program

Aim: Develop groundwater flow models for the major and minor aquifers of Texas.

Purpose: Tools that can be used to aid in groundwater resources management by stakeholders.

Public process: Stakeholder involvement during model development process.

Models: Freely available, standardized, thoroughly documented. Reports, data, models are available for download from TWDB download page for models.

Living tools: Periodically updated.

Why Stakeholder Advisory Forums?

Keep stakeholders updated about progress of the modeling project

Inform how the groundwater model can, should, and should not be used

Provide stakeholders with the opportunity to provide input and data to assist with model development

Contact Information

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Web information:
https://www.twdb.texas.gov/groundwater/models/gam/mrtn/mrtn.asp

Texas Water Development Board

Marathon Aquifer Conceptual Model

Stakeholder Advisory Forum #1

December 3-4, 2020

Marathon, Texas

DBS&A Daniel B. Stephens & Associates, Inc. a Geo-Logic Company

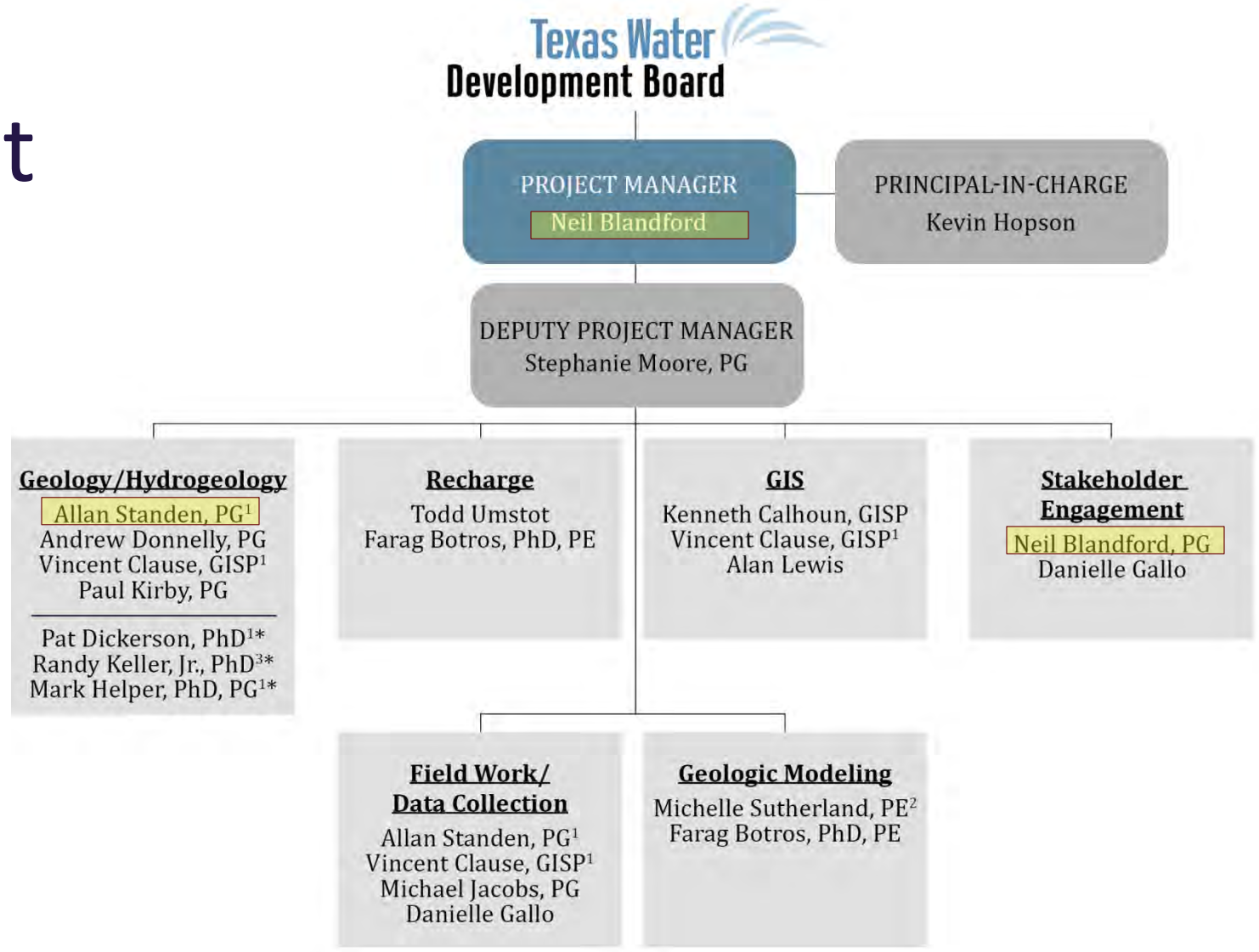
Allan R. Standen LLC Groundwater & Natural Resource Consulting

MICHELLE A. SUTHERLAND Groundwater Resource Consulting

Agenda

1. Introduction to Project Team
2. Marathon Aquifer Overview
3. Project Objectives
4. Approach
5. Project Schedule
6. Request for Data
7. Stakeholder Input and Questions

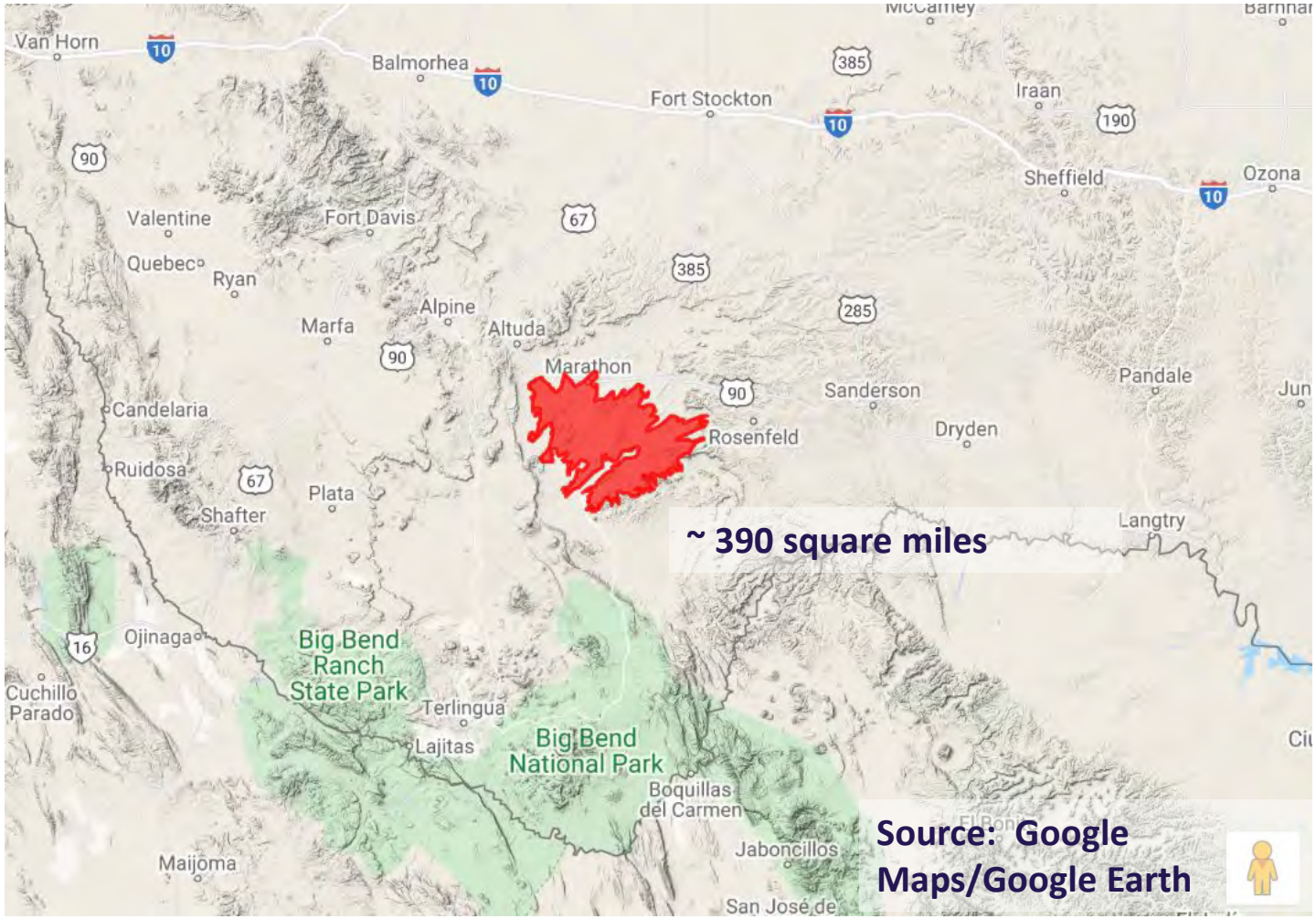
Project Team



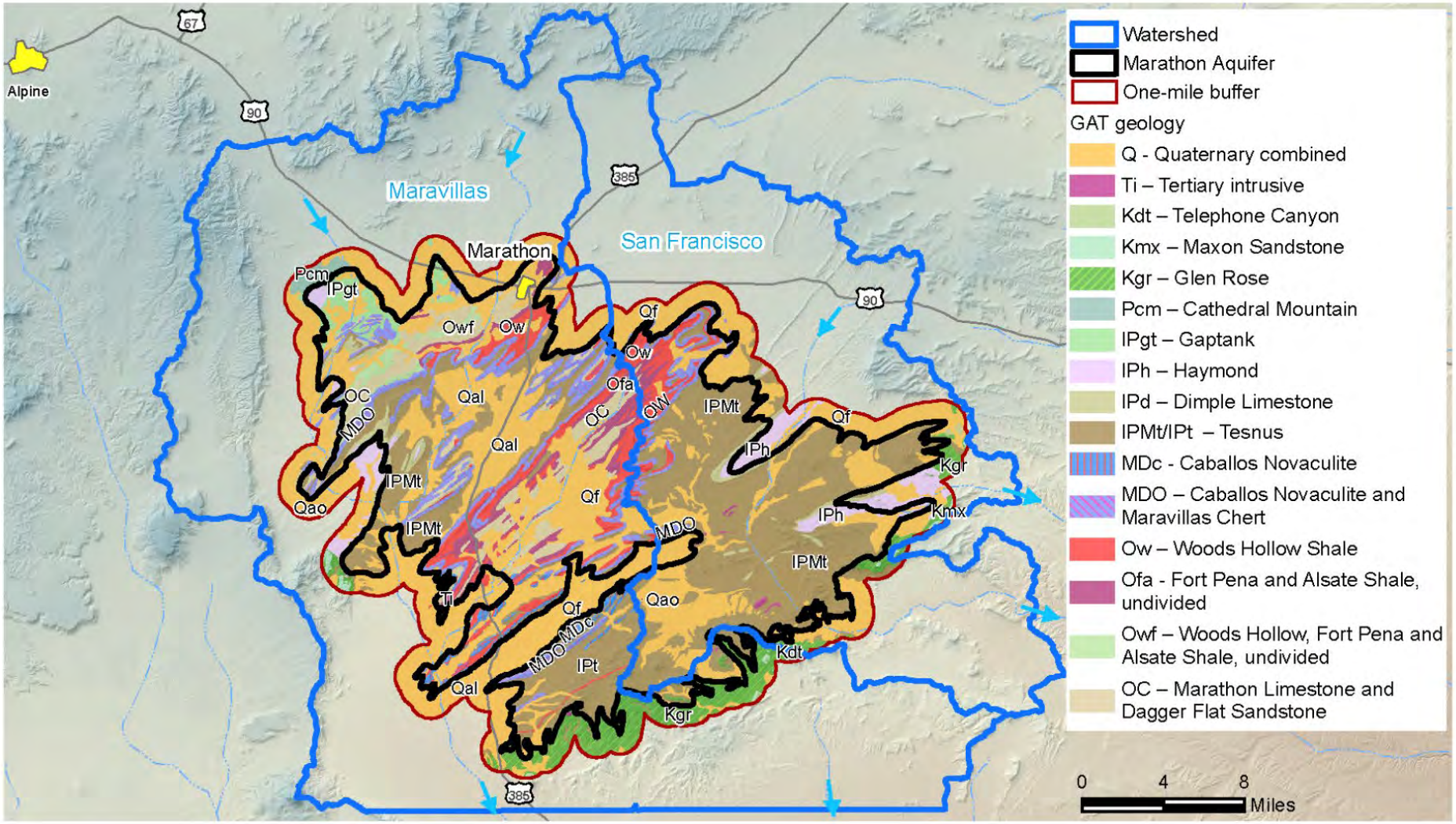
Additional Staff Support Available Companywide

53 Hydrologists/Hydrogeologists	13 Environmental Scientists	57 Engineers
38 Geologists	14 GIS/CADD/Database	2 Biologists
	39 Laboratory and Field Technicians	

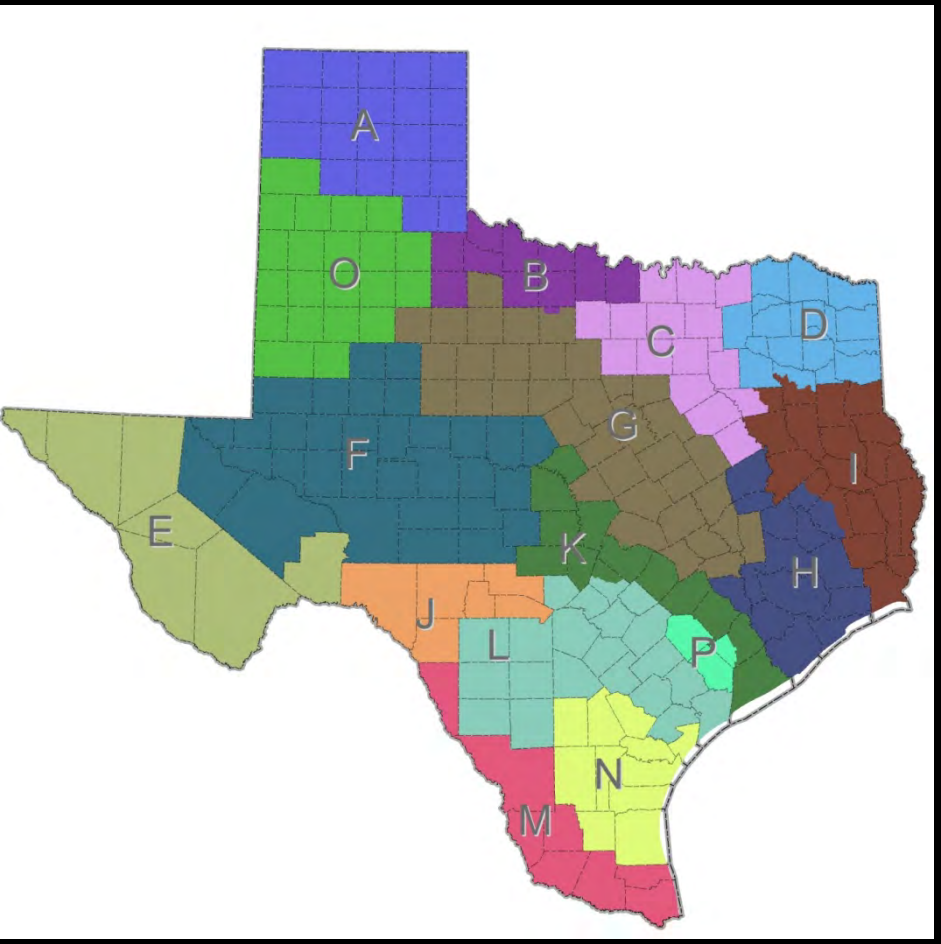
Marathon Aquifer



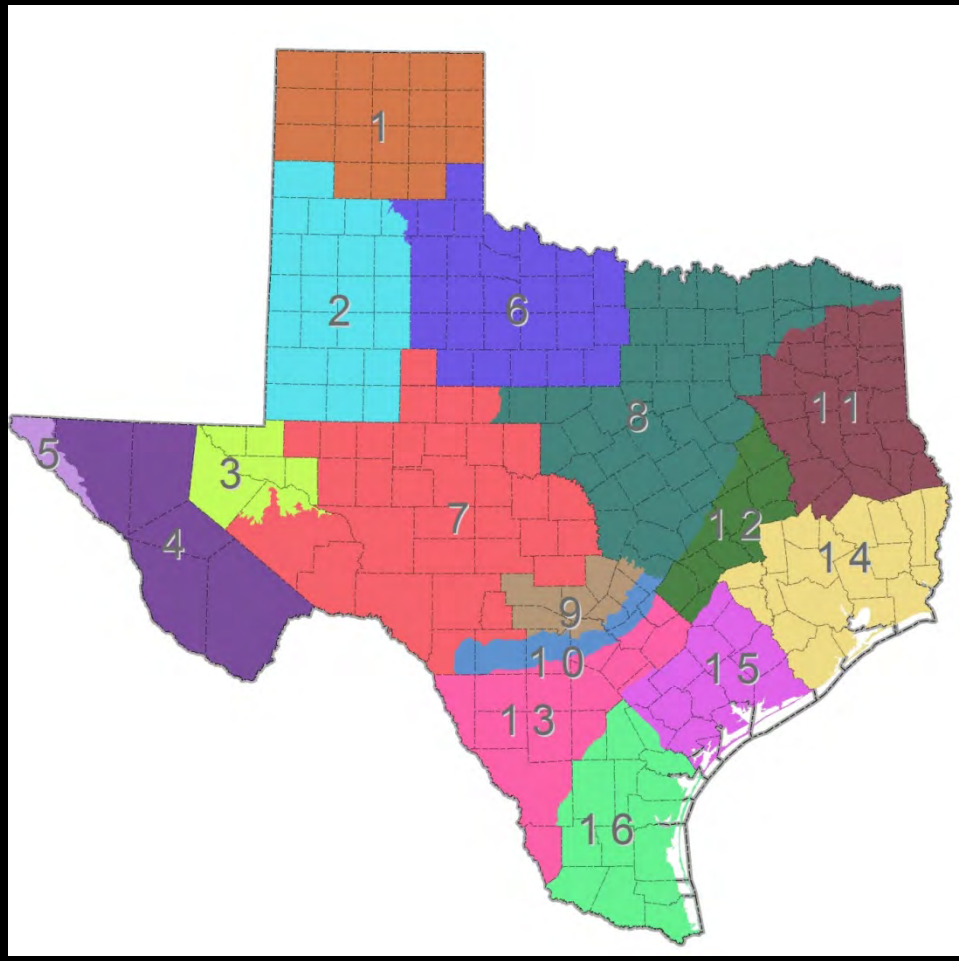
Study Area and Surface Geology



Regional Water Planning Areas



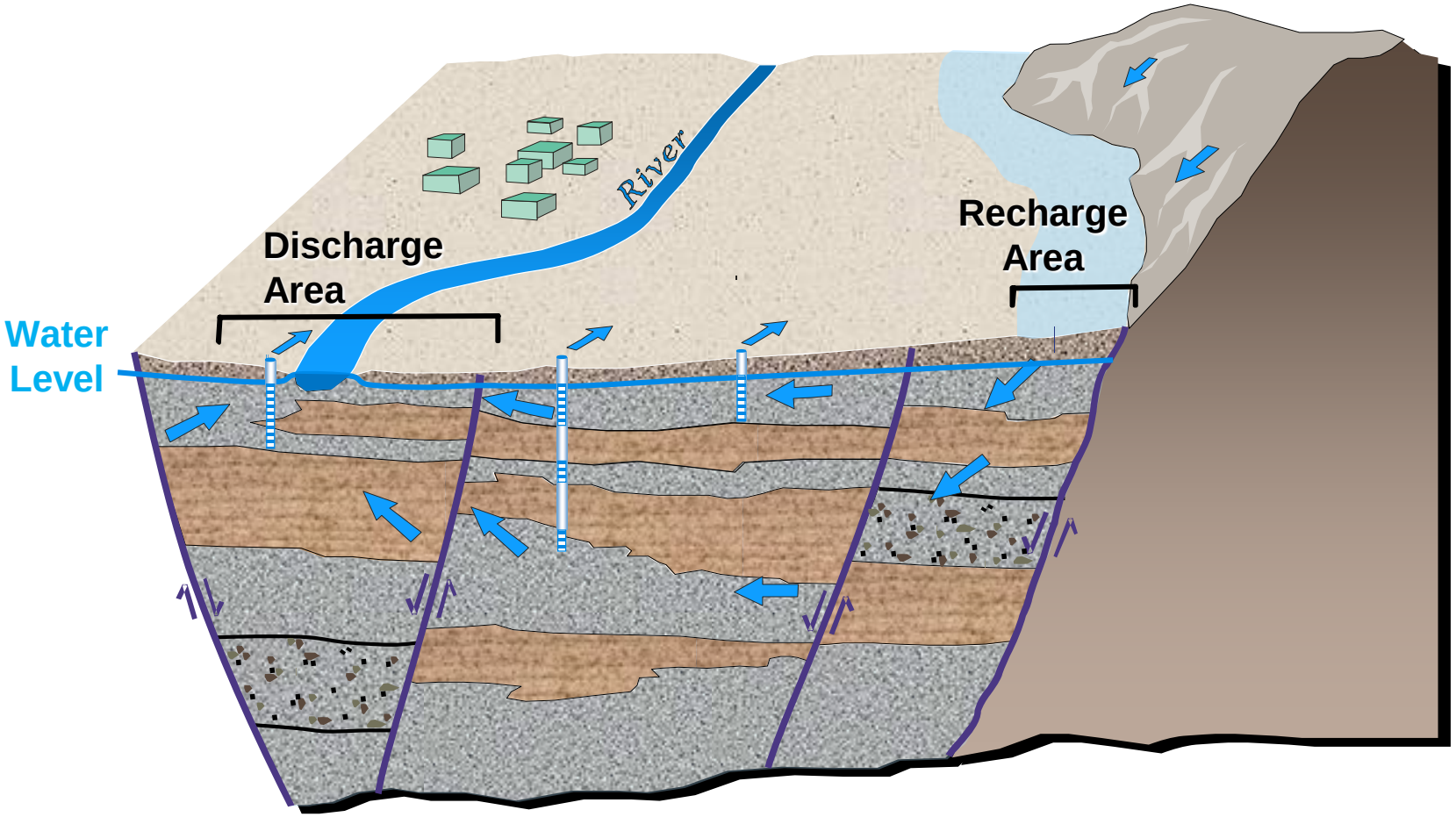
Groundwater Management Areas



Project Objectives

- Develop a conceptual model of the Marathon Aquifer
  - Describe the best understanding of how groundwater moves through the aquifer system
- Future Goal: Develop numerical groundwater flow model (GAM) of the Marathon Aquifer

Conceptual Model



Components of Conceptual Model

1. Physiography and climate
2. Geology
3. Hydrostratigraphy
4. Hydrostratigraphic framework
5. Water levels and regional groundwater flow
6. Recharge
7. Rivers, streams, springs and other surface water features
8. Hydraulic properties
9. ~~Subsidence~~
10. Discharge
11. Water quality

Previous Studies

- Geology - Over 30 publications used in our proposal
- Hydrogeology
  - Brune (2002) - Springs of Texas
  - DeCook (1961) - Reconnaissance of Groundwater Resources in the Marathon Area
  - Muse (1966) - Water level data for Brewster and adjoining counties
  - Smith (2001) - Hydrogeology of the Marathon Basin

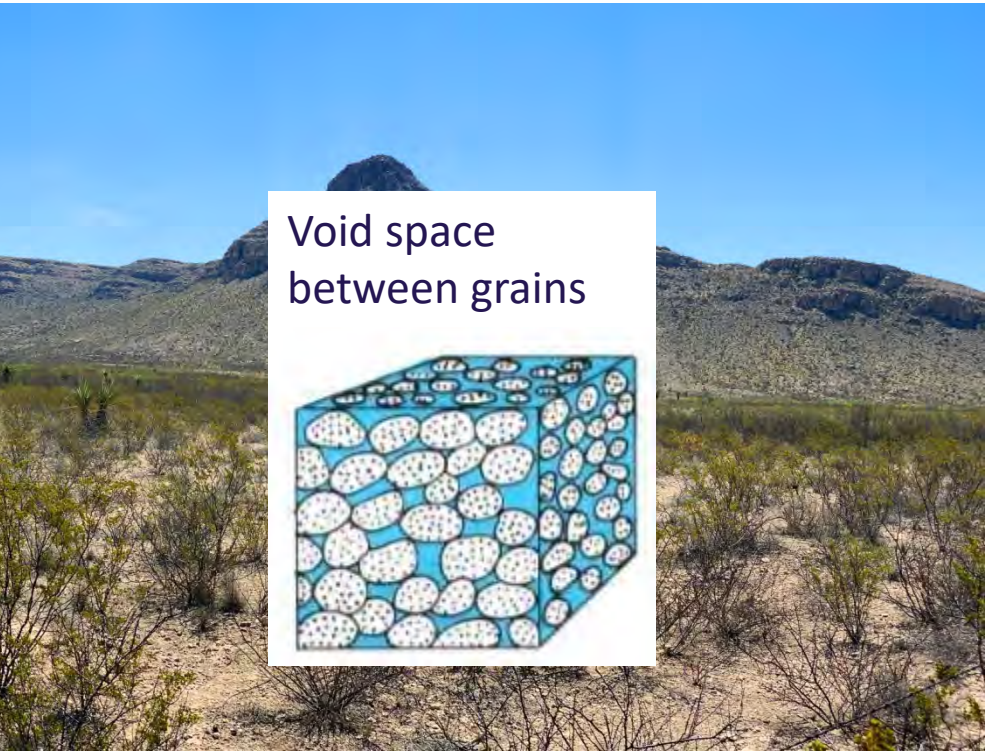
Approach: Geology

- Utilize results of prior studies
  - Georeference and digitize selected plates from King (1937), King (1980), Flawn (1956) and possibly others
- Geophysical log search (add up to 20)
- Supplemental strike and dip measurements
- GIS hill shade/fracture analysis to identify highly faulted/fractured areas

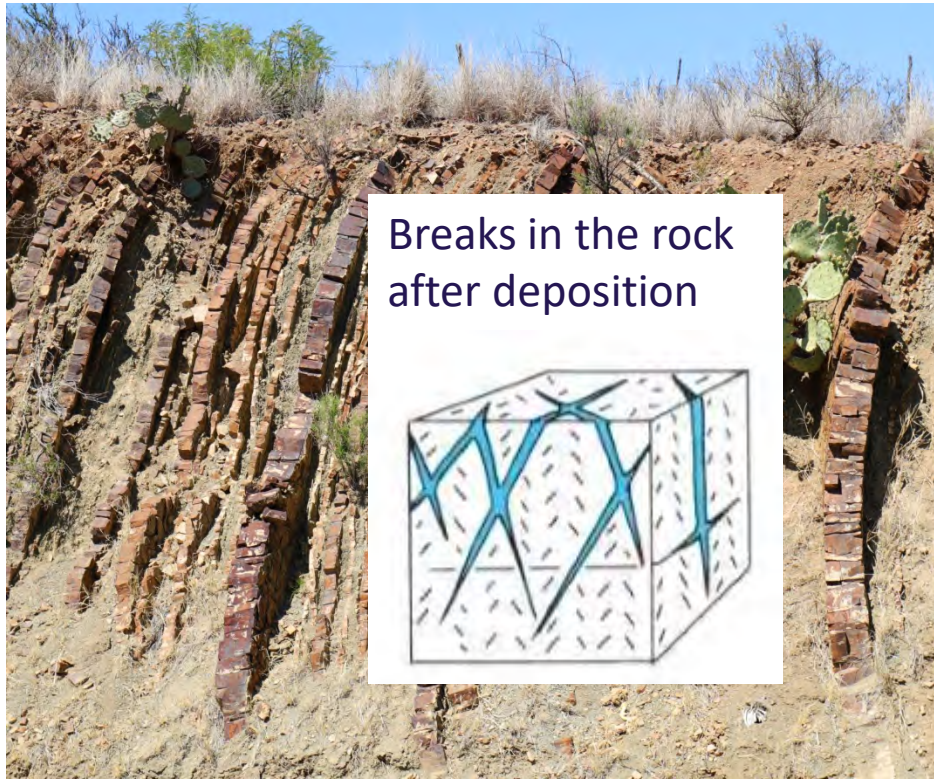
Geologic Column and Preliminary Hydrostratigraphic Designations

Age	Formations	Predominant Lithology	Hydrostratigraphic Designation
Quaternary	Alluvium, fan, landslide, playa and eolian deposits	Gravel, sand, silt, clay	Aquifer
Tertiary	Volcanic rocks, multiple formations	Rhyolite, tuff, basalt flows	Not significant sources of groundwater
Cretaceous	Glen Rose Formation; Telephone Canyon	Limestone	Aquifer (?)
Permian	Skinner Ranch Formation; Hess Limestone; Lenox Hills Formation	Dolomite, Limestone (calcarenite), shale, conglomerate	Aquitard
Upper Pennsylvanian	Gaptank Formation; Haymond Formation	Limestone, sandstone, shale	
Lower Pennsylvanian	Dimple Limestone; Tesnus Formation	Limestone, shale sandstone, quartzite	Aquifer, except where Tesnus is predominately shale
Devonian-Upper Ordovician	Caballos Novaculite; Maravillas Chert; Woods Hollow Shale; Fort Pena Formation; Alsate Shale	Novaculite, chert, limestone, shale	Aquitard
Lower Ordovician-Upper Cambrian	Marathon Limestone; Dagger Flat Sandstone	Limestone and Sandstone	Aquifer

Aquifer Types

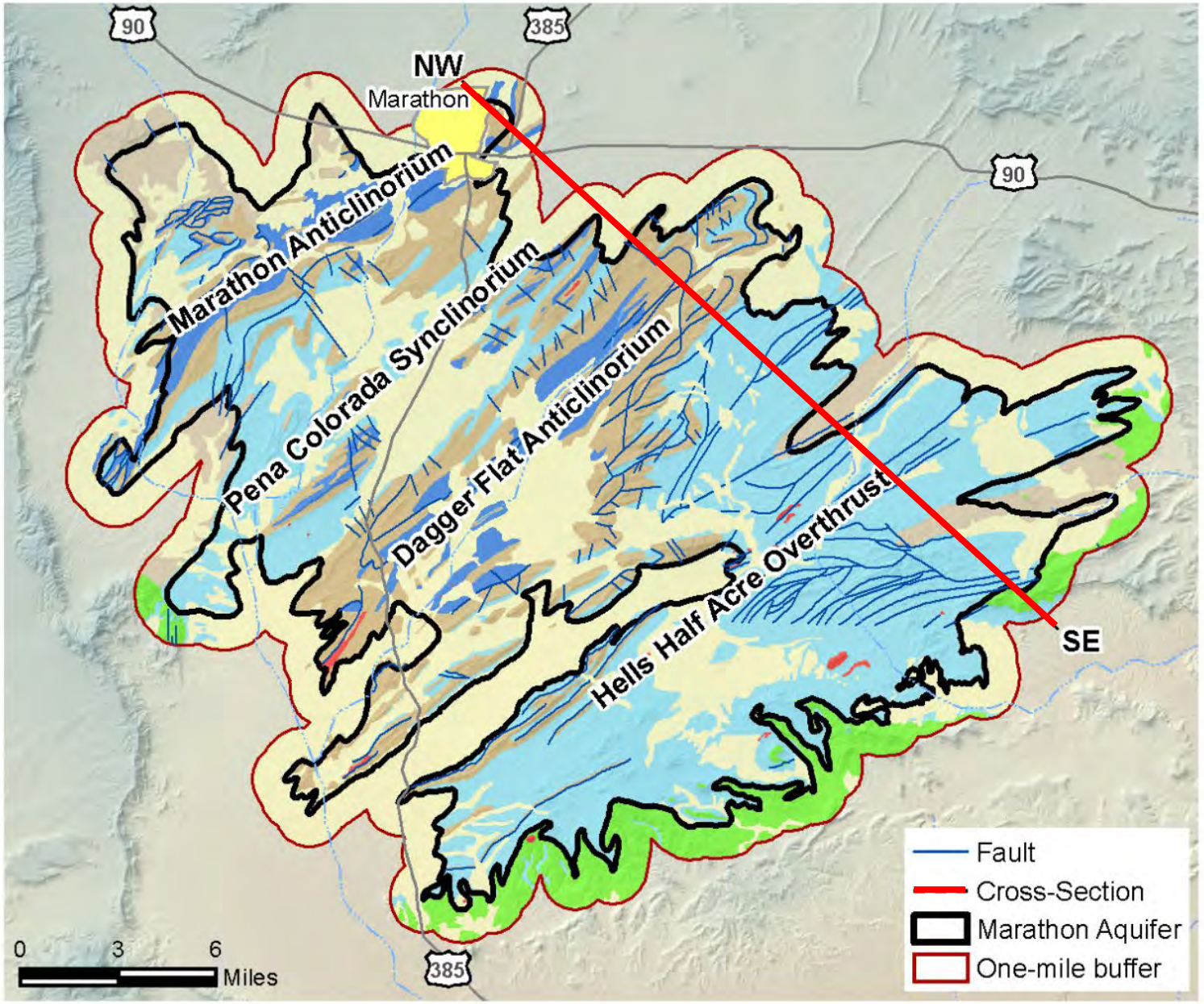


Primary Porosity



Secondary Porosity

Hydrostratigraphic Framework



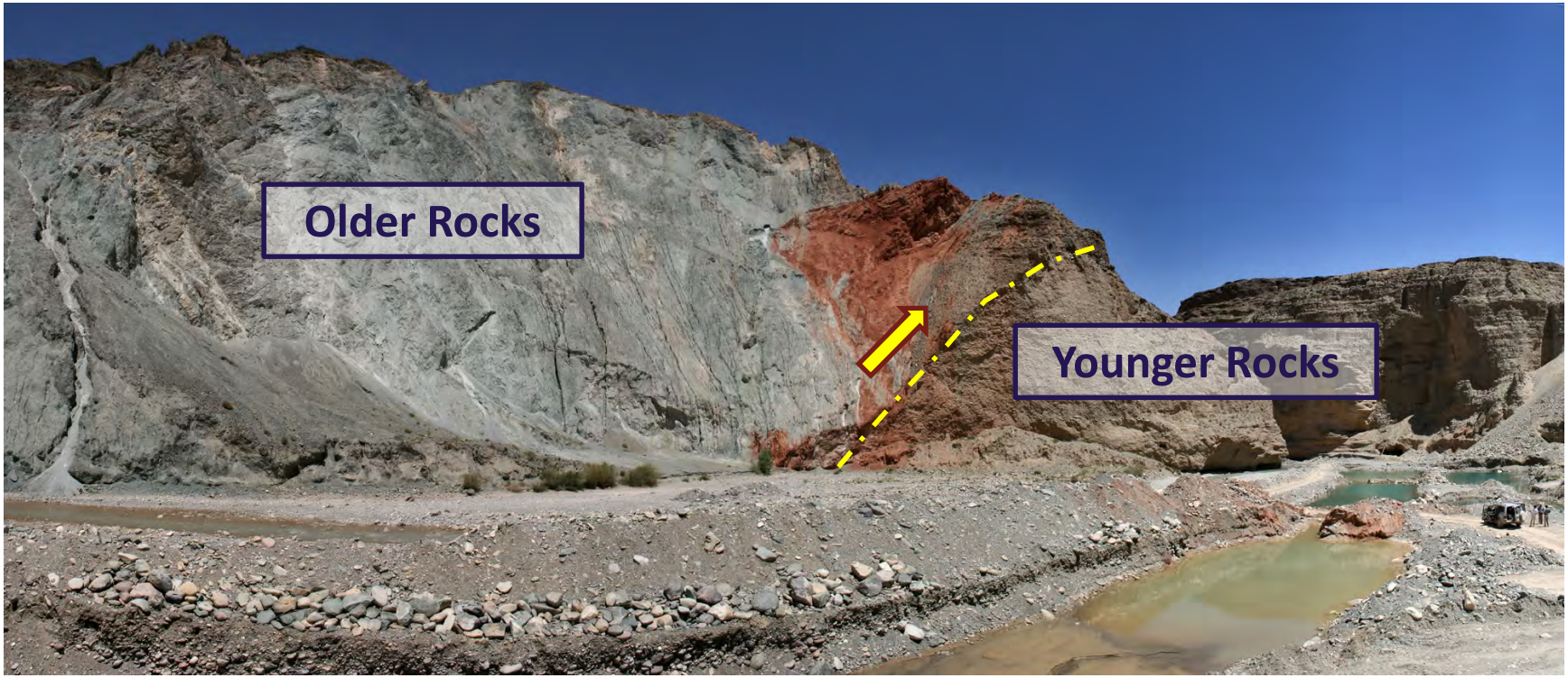
Anticline

photo by Neil Blandford

Syncline

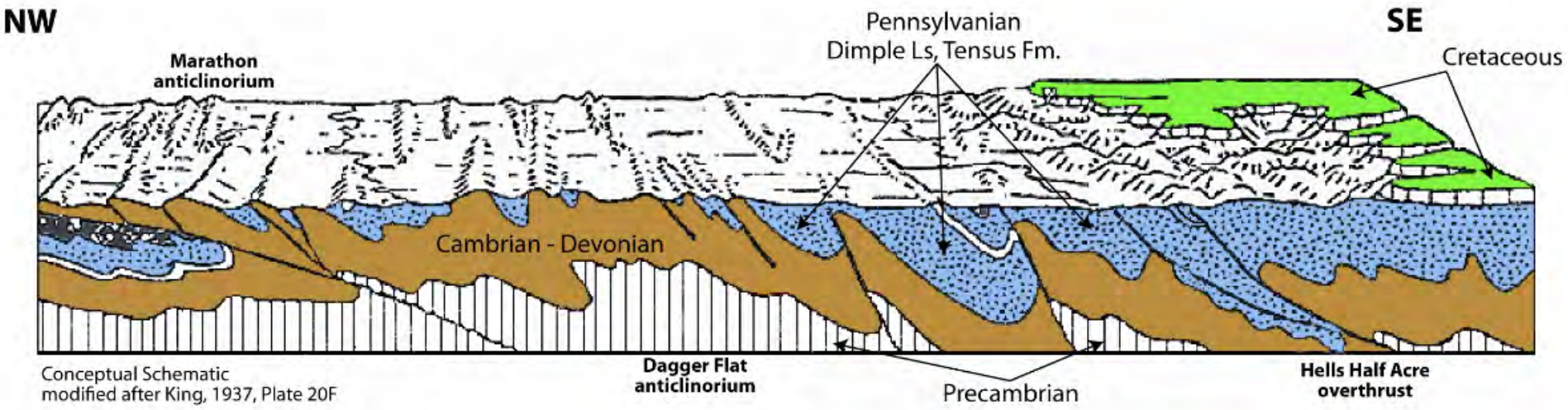
photo by Neil Blandford

Overthrust Fault



Source: https://en.wikipedia.org/wiki/Thrust_fault

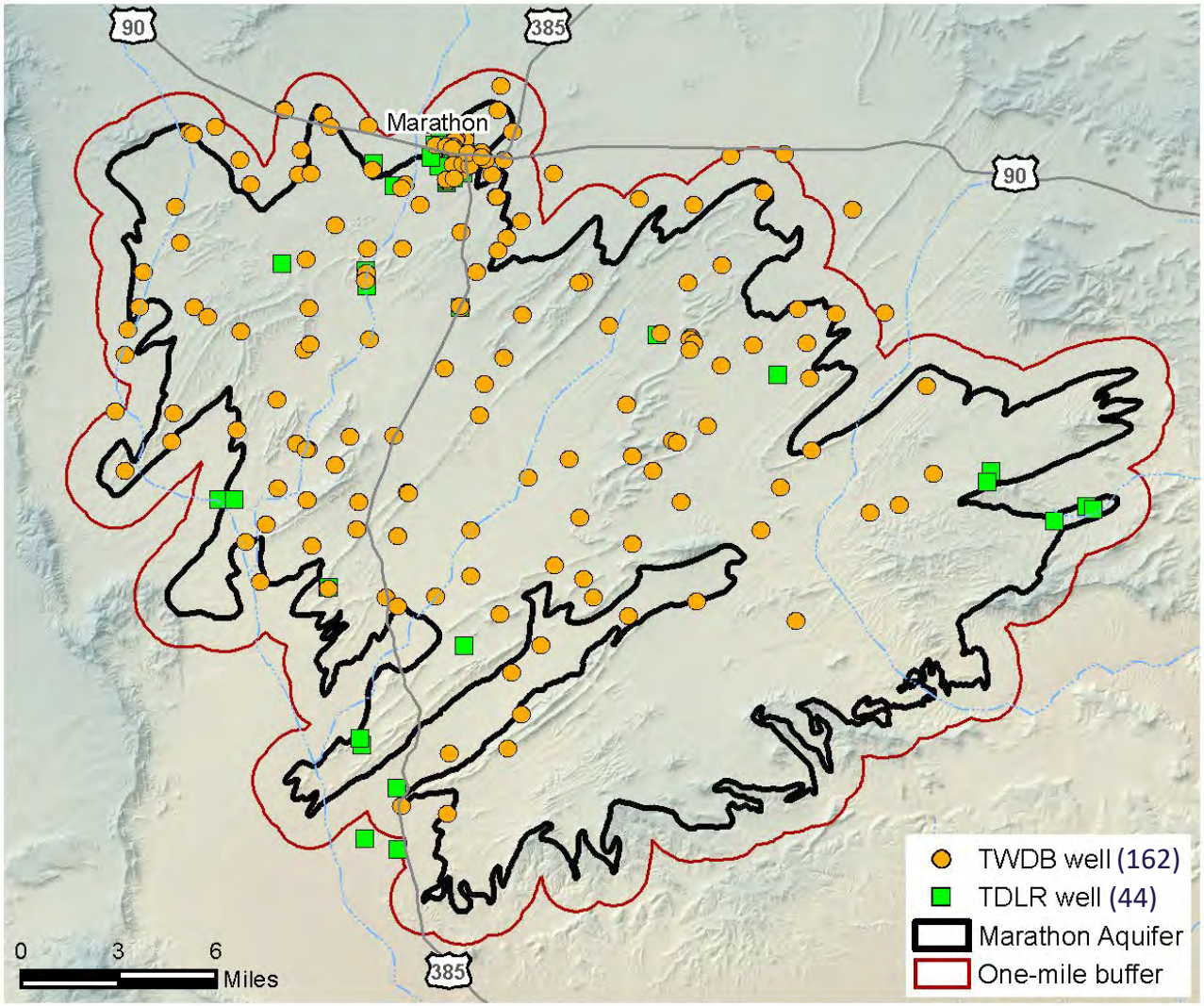
Hydrostratigraphic Framework - Cont'd



Blue areas to a depth of 1,000 feet are potential aquifers that will be evaluated to identify areas with high density fractures

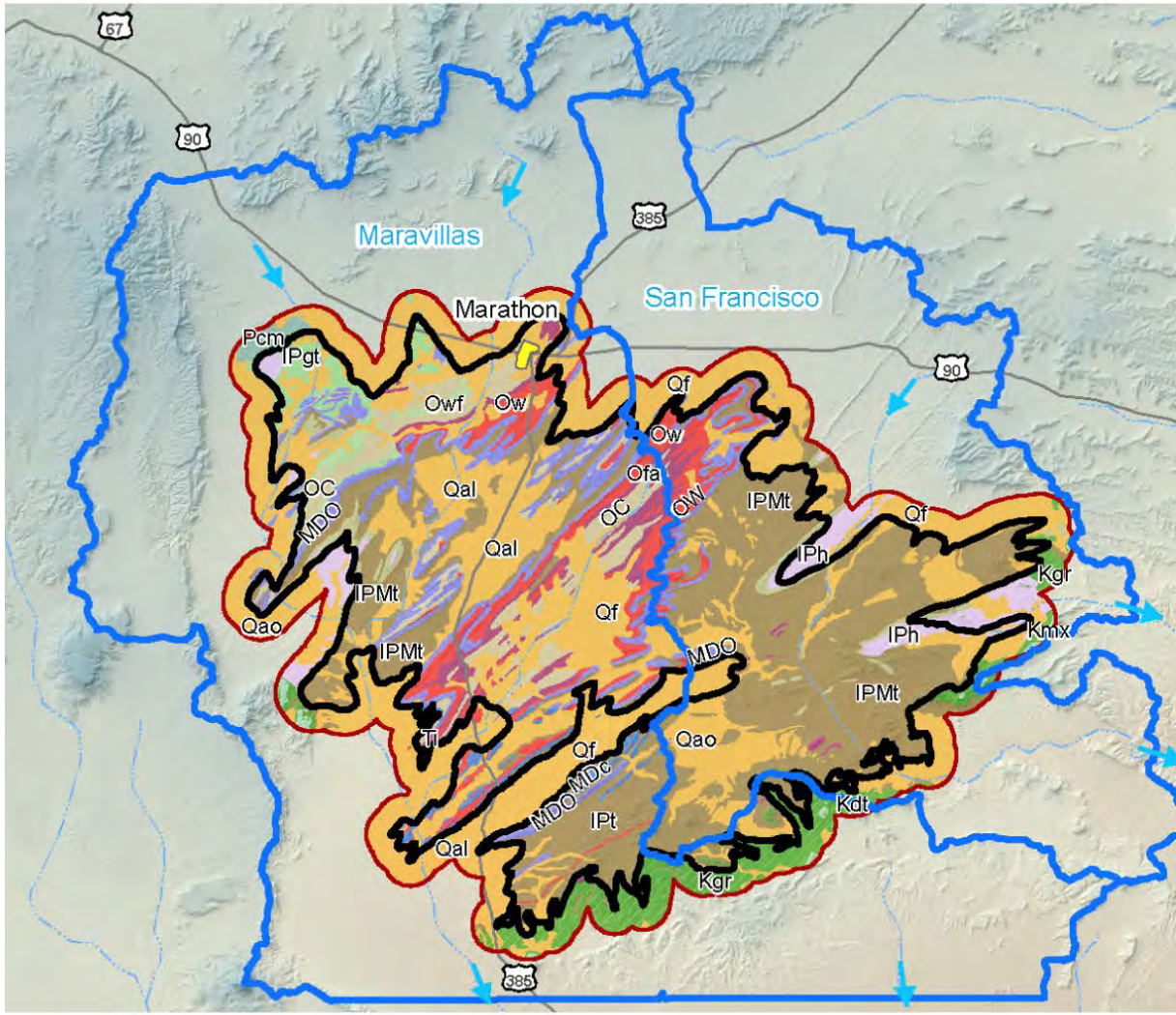
Approach: Water Levels and Regional Groundwater Flow

- Compile, analyze, summarize available data
- Confirm that water levels from early studies are included in the database
- Collect up to 15 current water levels



Approach: Groundwater Recharge

- Use Distributed Parameter Watershed Model (DPWM) to estimate recharge
  - Soil water-balance
  - Site-specific climate, topography, geology, soils and vegetation
  - Daily time step, aggregate into annual values and long-term averages

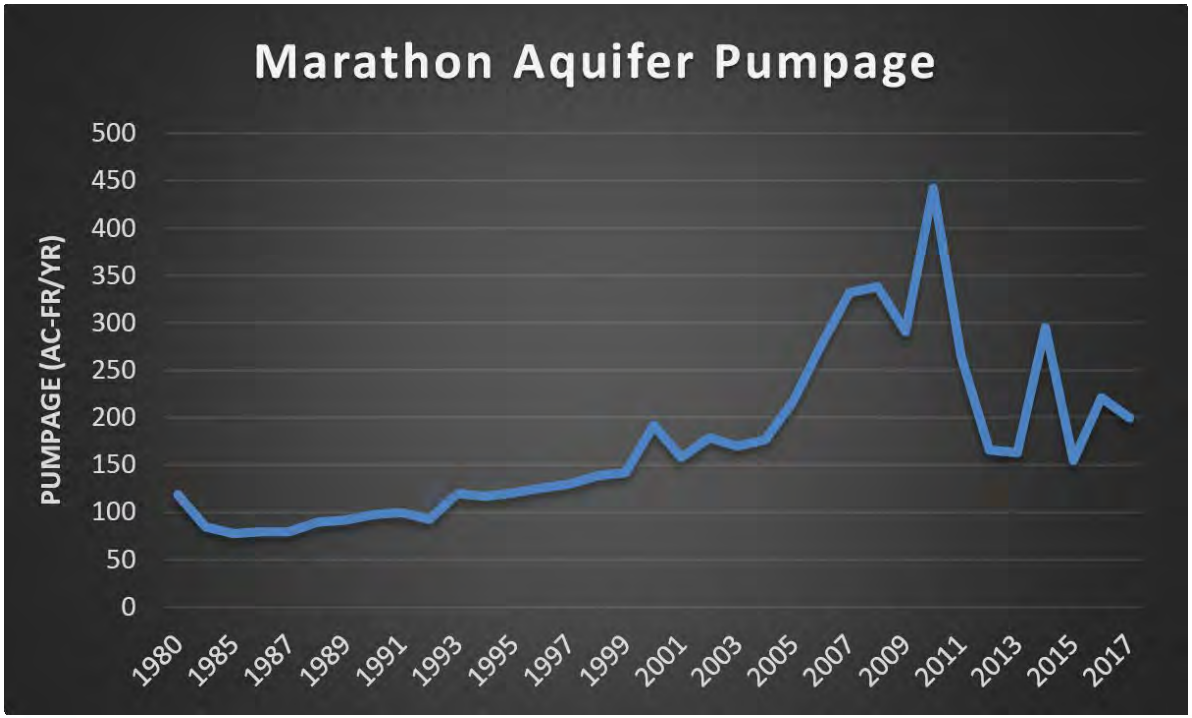


Approach: Hydraulic Properties

- Compile available data from prior reports, TWDB and TDLR well logs
- Estimate aquifer transmissivity where data is available
- Field work - conduct several short-term aquifer tests where existing pumping configuration allows and landowner approval is obtained
- Storage coefficients will be estimated based on aquifer rock type

Approach: Groundwater Discharge

- Compile, analyze, summarize available data
- Discharge to springs and evapotranspiration
- Groundwater pumping - TWDB data and Brewster County GCD



Approach: Water Quality

- Compile, analyze, summarize all available data
- About 28 wells with basic water quality data
- Field parameters (electrical conductivity, pH) for wells that can be pumped or are pumping in the field

Project Schedule

- October 1, 2020 - Start date
- December 3-4, 2020 - SAF 1
- Field work - January, February 2021
    - Strike and dip, water levels, pumping tests
- July 30, 2021 - Interim Deliverable
- March 31, 2022 - Study Completion Date
- April 2022 - SAF 2 (approximate)

Data Requests

- Well locations and construction information
- Water level data
- Production data (water use information)
- Aquifer test data
- Spring locations
- Property access?

Contact Info

https://www.twdb.texas.gov/groundwater/ models/gam/mrtn/mrtn.asp

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Thank you!

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