MINNESOTA POLLUTION CONTROL AGENCY

4. Overview of Conceptual Drinking Water Supply Plan

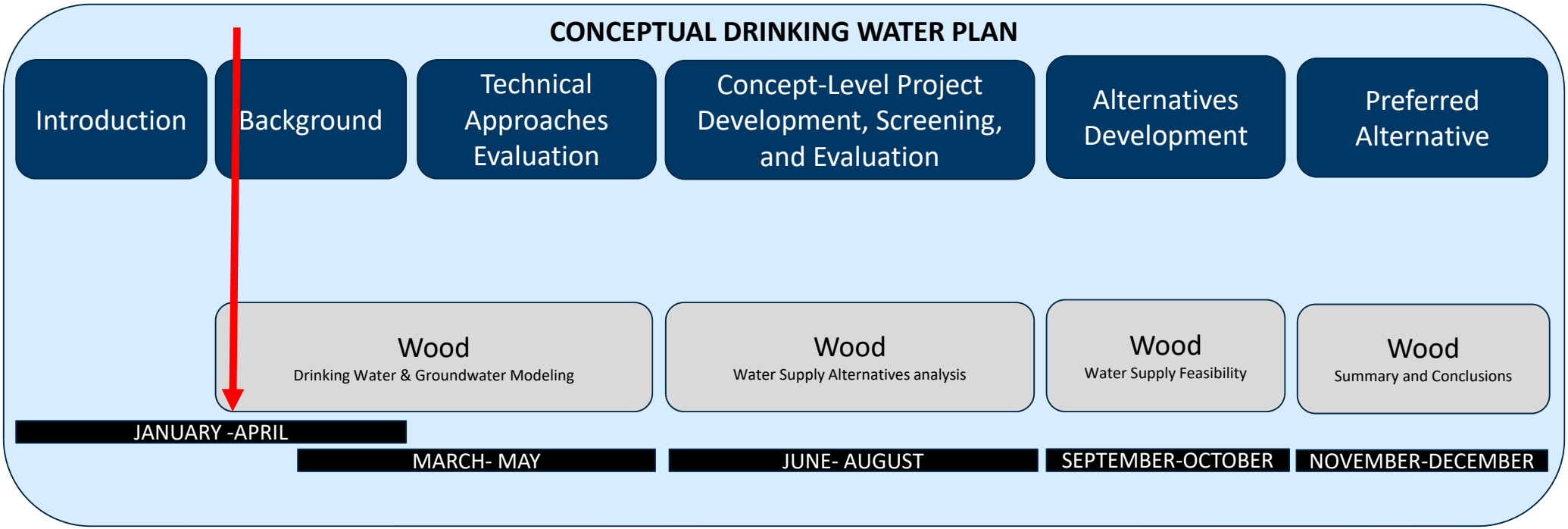
Hannah Albertus Benham and Shalene Thomas, Wood Environment & Infrastructure Solutions Inc.

April 3, 2019

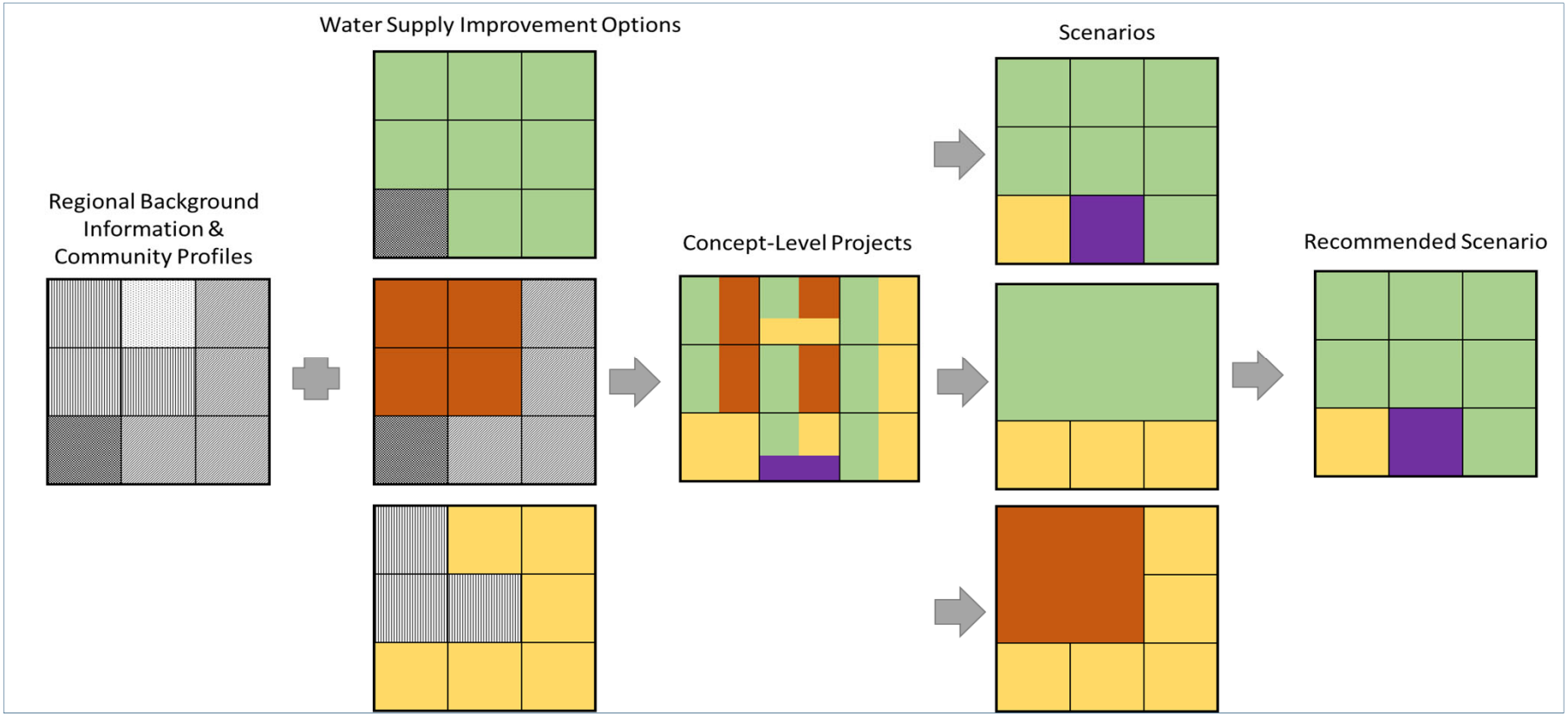
Overview of Scope and Work Flow Process

Goal for 2019

COMPLETION OF THE CONCEPTUAL DRINKING WATER PLAN



Overview of Approach



Plan Outline

1. **Introduction**
2. **Background**

✓Regional overview

- Contamination in groundwater across affected area (regional look)
- Summary of drinking water supply and use across affected area
- Other constraints on water use

✓Community profiles – brief summary of information collected

Plan Outline

3. Approach

- ✓Description of approach
- ✓Modeling

4. Model Development and Results

- ✓Community water system profiles and modeling
- ✓Groundwater modeling

Plan Outline

5. Evaluation of Water Supply Improvement Options

✓Water Supply Improvement Options

i. Drill new wells in optimized locations
ii. Connect subsets of communities to St. Paul Regional Water Services
iii. Create new surface water treatment plant for use of Mississippi or St. Croix River waters
iv. Create new regional water supply system(s) (with treatment)
v. Create new rural drinking water supply system(s) (with treatment)
vi. Move private well hookups to existing drinking water supply system(s) (where available)
vii. Provide drinking water treatment of existing water supply system(s)
viii. Provide point of use or point of entry treatment of drinking water
ix. Non-potable and potable reuse of treated 3M containment water
x. Minimize water well usage by reducing current potable demand

Plan Outline

6. Concept-Level Project Development, Screening, and Evaluation

- ✓Discussion of how project concepts were identified
- ✓Overview of project criteria
- ✓Treatment technology alternatives analysis for PFAS (up to 10 technologies evaluated)
- ✓Application of criteria
- ✓Hydrological analysis of concept-level projects that passed screening criteria

Plan Outline

7. Scenario Development and Evaluation

- ✓Proposed drinking water supply scenarios
- ✓Basis for scenario identification
- ✓For each scenario:
  - Map of projects that make up the scenario
  - Brief descriptions of each project
  - Approximate # of people served
  - Screening-level cost assessment (+/- 50%) of capital cost and operation/maintenance/replacement cost
  - Potential impacts of scenarios
- ✓Recommended scenario

8. Summary and Conclusions

MINNESOTA POLLUTION CONTROL AGENCY

9. Overview of New Regional Model

Hannah Albertus-Benham, Shalene Thomas, Jim Feild, PhD, Wood Environment & Infrastructure Solutions Inc.

April 3, 2019

Agenda

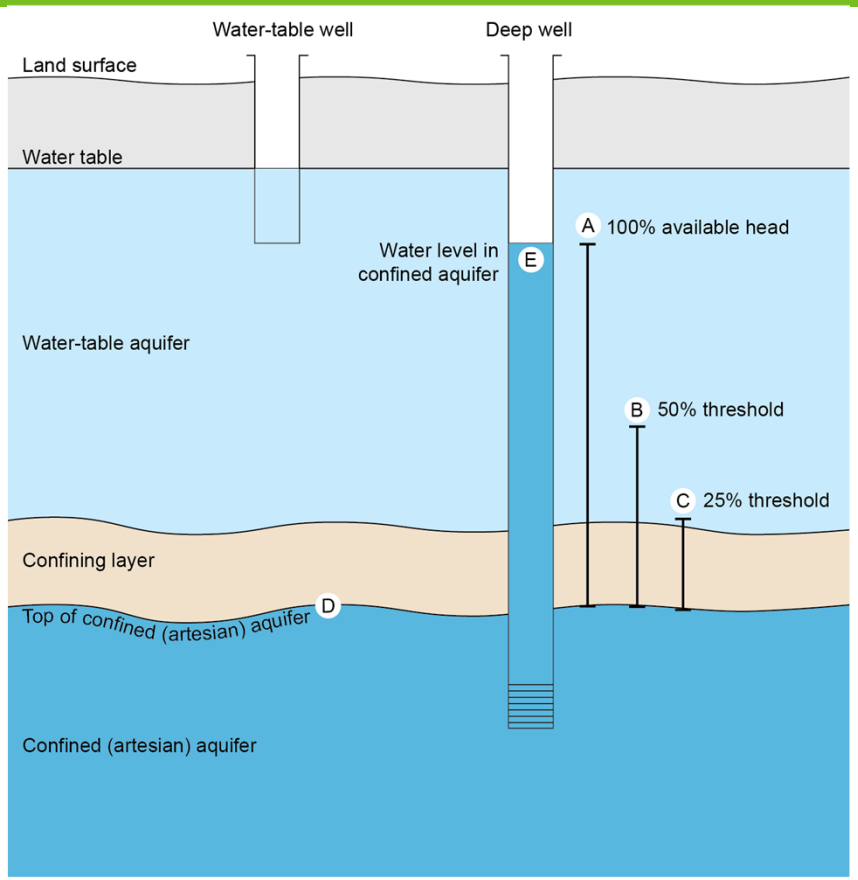
1. Purpose
   - What questions will modeling address?
   - How will questions be addressed?
2. Domain Extent
3. Methodology and Data Input
   - Development of Conceptual Site Model (CSM)
   - Numerical Model
4. Timeline for Completion

Purpose

Main Concerns based on discussions

- Mobilizing groundwater contamination from pumping activities that could adversely impact unaffected portions of the aquifer, particularly during transient peak demand periods;
- Avoiding negative surface water and wetland impacts;
- Aquifer safe yield.

Main Concerns



SAFE YIELD THRESHOLDS

Purpose

What questions will modeling address?

- A survey was developed and distributed to SubGroup-1 stakeholders
- The survey asked participants to rank what questions were most important to address
- Survey was divided into three sections
  - ✓ Water quantity
  - ✓ Water quality
  - ✓ Surface water implications

GW Modeling Objectives – Responses Received

Objectives	Overall AVERAGE	Overall RANGE
1) General:		
Combine all current models, data from the previous models, and new data (i.e., Washington County Geologic Atlas) to build a new regional model. This new regional model would then be the basis for an infinite series of sub-models that could be used for local issues in the future and aid in answering questions specific to each area.	**H**	**Unk-H**
2) Groundwater Quantity (Elevation) Concerns Accounting For:		
❖ All significant withdrawals currently within the model domain under multiple pumping scenarios (i.e., high pumping rates, average pumping rates, low pumping rates)	**H**	**H**
❖ Potential new water supply wells to meet growing demands on groundwater resources	**H**	**L-M-H**
❖ Droughts	**M-H**	**Unk-L-M-H**
❖ Seasonal changes in surface water levels within the model domain	**M**	**Unk-L-M-H**
❖ Assess aquifer safe yield	**H**	**M-H**
❖ Year-to-year and seasonal variability in water demands	**M-H**	**M-H**
❖ Climate change and recharge	**M**	**L-M-H**
❖ Others?		

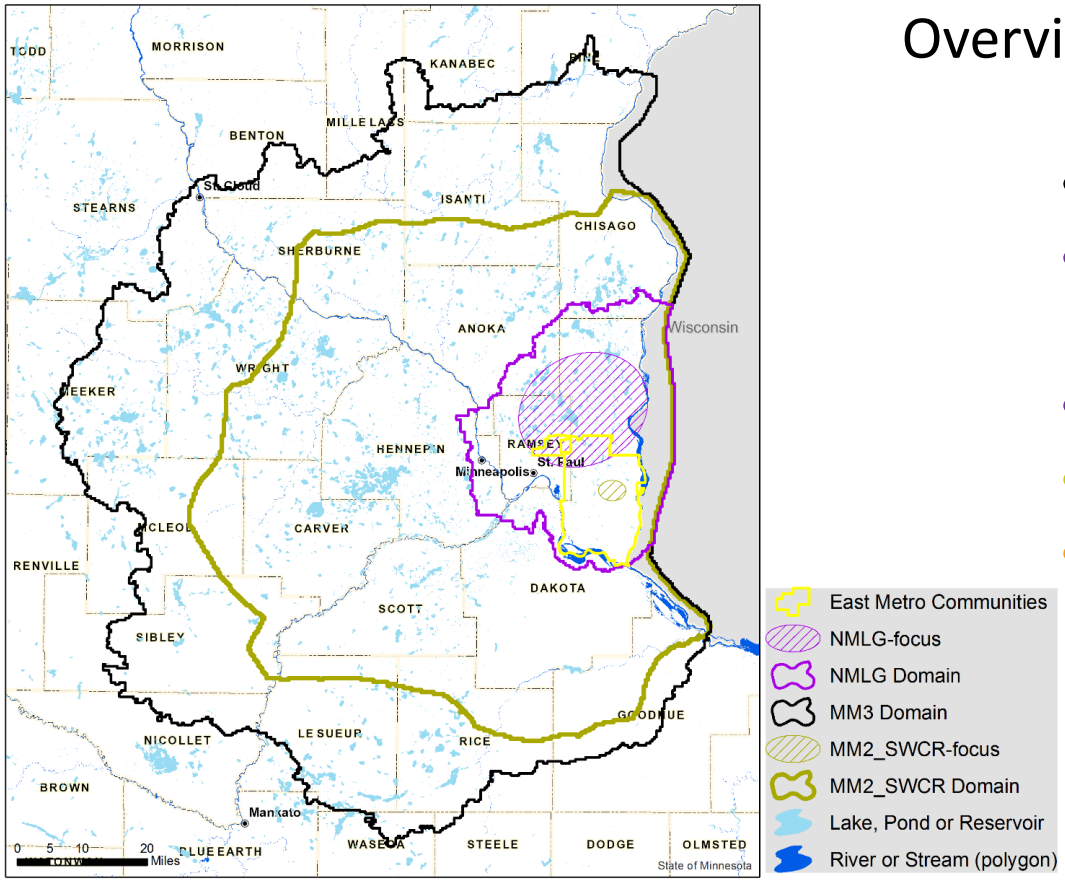
GW Modeling Objectives – Responses Received

Objectives	Overall AVERAGE	Overall RANGE
3) Groundwater Quality and Plumes:		
❖ Optimization of rates (lower or higher) for wellfields affected by contamination (PFAS or other contaminants). The optimized rate will be driven by the need to reduce or limit plume migration, or capture contamination as part of remedial options.	**H**	**M-H**
❖ Contaminant migration and groundwater flow paths to evaluate capture zones and see where the groundwater contamination affecting a well/wellfield or surface water body originated.	**M**	**L-M-H**
❖ Delineate changes in PFAS plume flow paths that may result in new or increased contamination of private and non-community drinking-water supply wells.	**H**	**L-H**
❖ Transport of actual contaminants.	**H**	**H**
❖ Evaluate how agricultural practices such as application of fertilizers could affect groundwater quality.	**M**	**L-M-H**
❖ Others?	**-**	**H**

GW Modeling Objectives – Responses Received

Objectives	Overall AVERAGE	Overall RANGE
4) Implications to Surface Water Bodies:		
❖ Identify which surface water bodies (lakes, rivers, streams, etc.) are affected the most by pumping conditions.	**M**	**L-M-H**
❖ Identifying how the baseflow of rivers and/or streams us affected.	**M**	**M-H**
❖ Identifying lake levels under normal seasonal conditions and how much they change during dry periods.	**M**	**M**
❖ Identifying if wetlands are affected (areal extent).	**M**	**L-M-H**
❖ Identifying which surface water bodies are most affected by contaminants and/or plume migration.	**M**	**M-H**
❖ Others?		

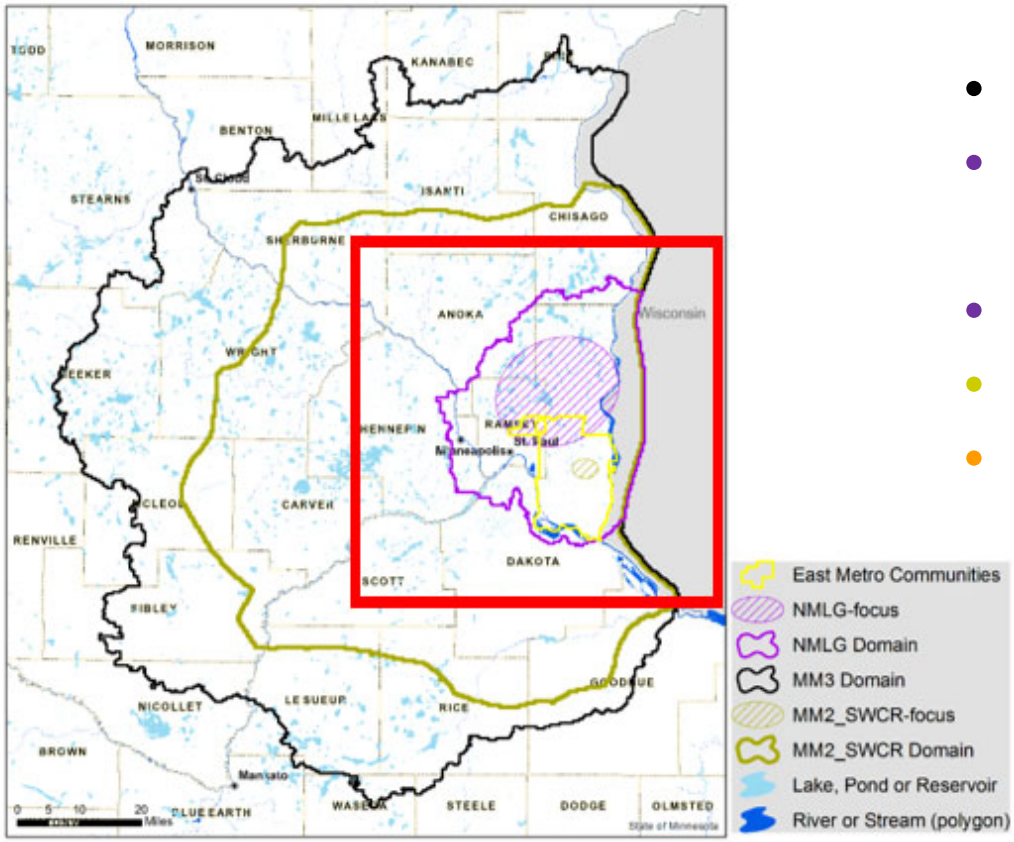
Domain Extent



Overview of Available Models

- Metro Model 3 (MM-3)
- DNR Northeast Metro Lake-Groundwater (NMLG) Model
- USGS NMLG Model
- South Washington County
- Wellhead Protection Areas (WHPA) delineations (various models and other approaches)

Approximate Area of Model Domain



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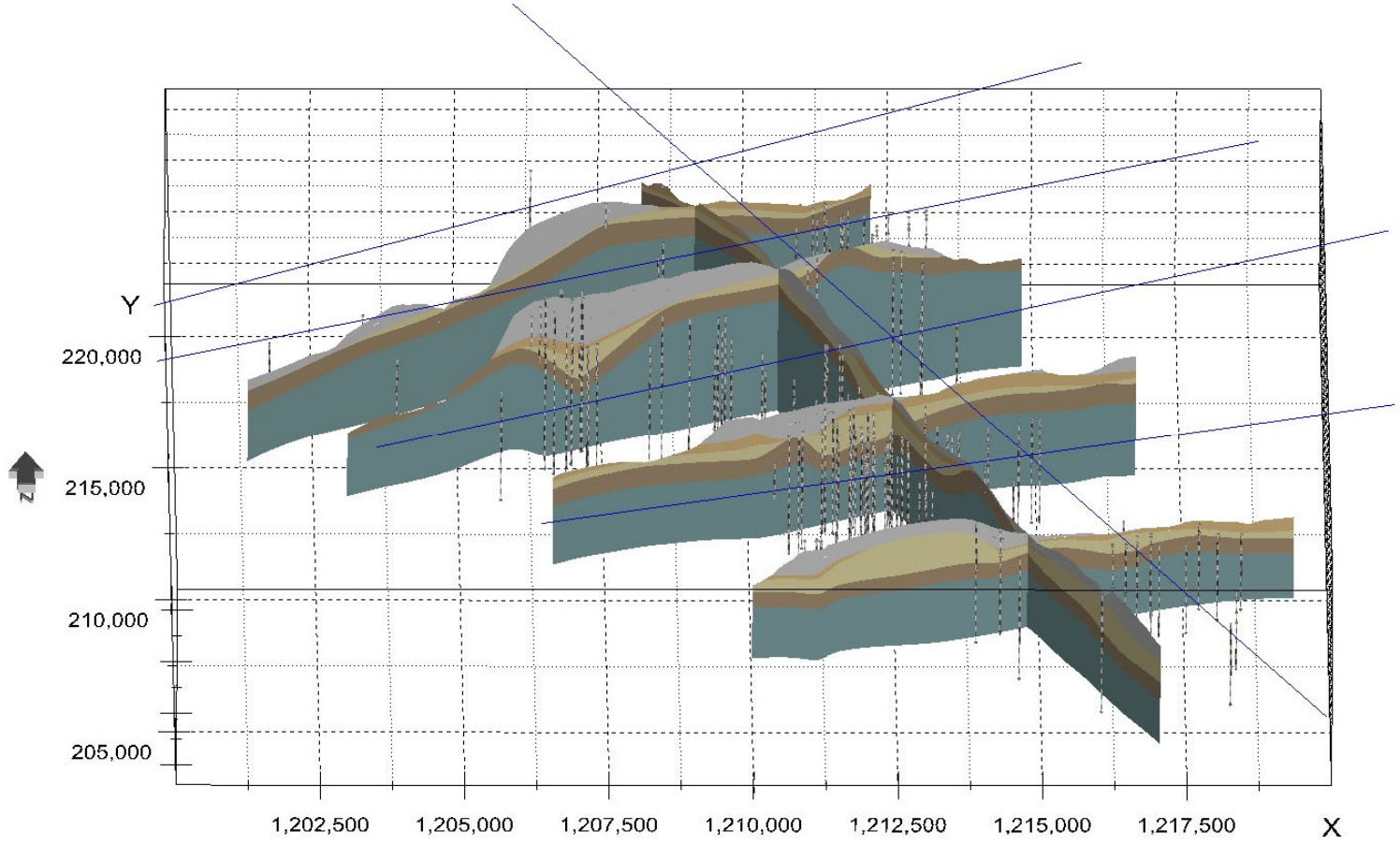
Methodology and Data Input

- ✓ **Development of a Conceptual Site Model (CSM)**
  - What is it?
  - What does a deliverable look like? (Memo and Model? Per SOW)
  - Needs from SG-1 members (Data? Review? Other?)

- ✓ **Development of a Numerical Model**

TS4
MM5

Example CSM– Fence Diagram

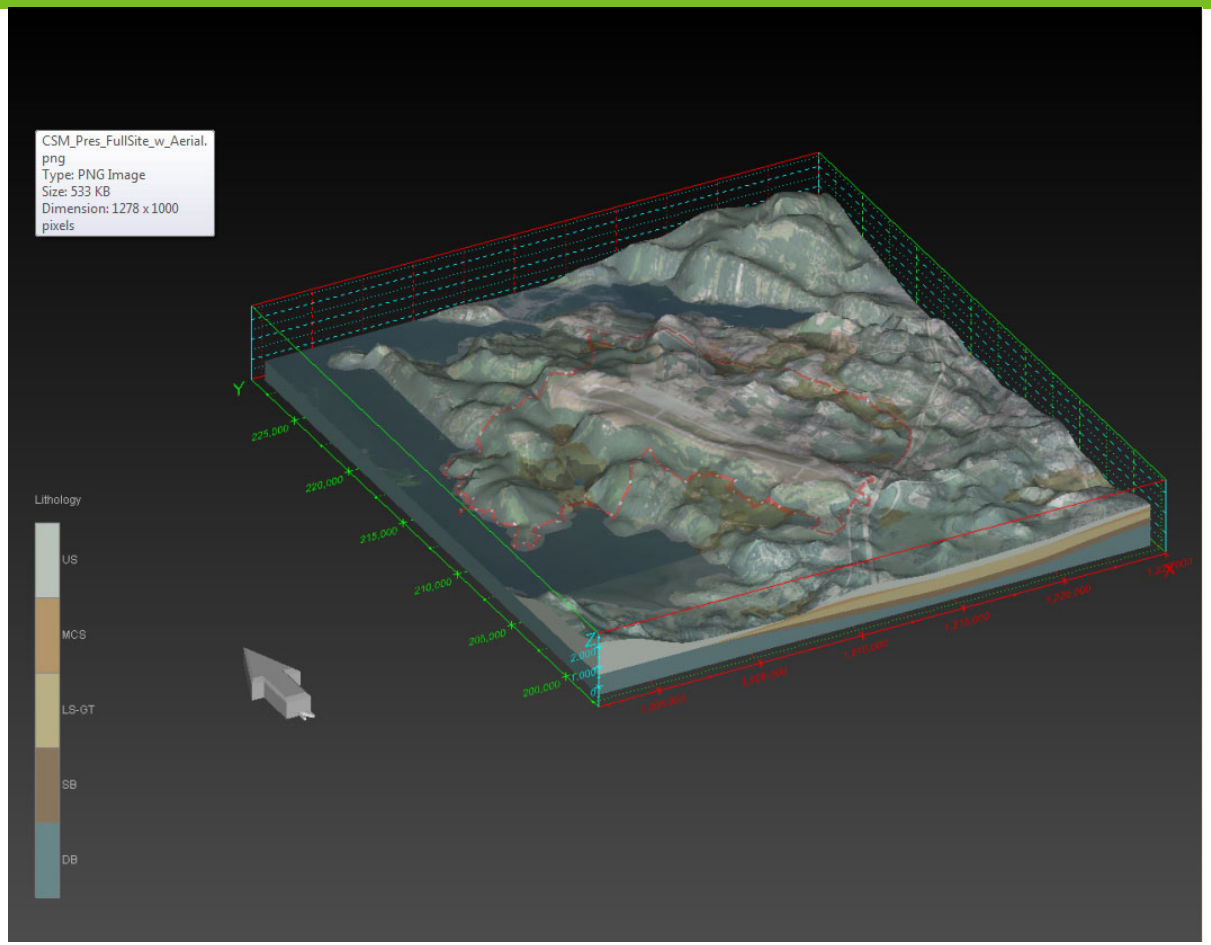


Slide 20

TS4 I am not sure if these next 4 slides are examples of what can be done but we should probably add a slide that explicitly provides expectations for next steps/meeting.
Thomas, Shalene, 3/18/2019

MM5 I think we deomonstrate that these are the types of products that can/will be produced as a result of this new model.
Michele Mabry, 3/19/2019

Example CSM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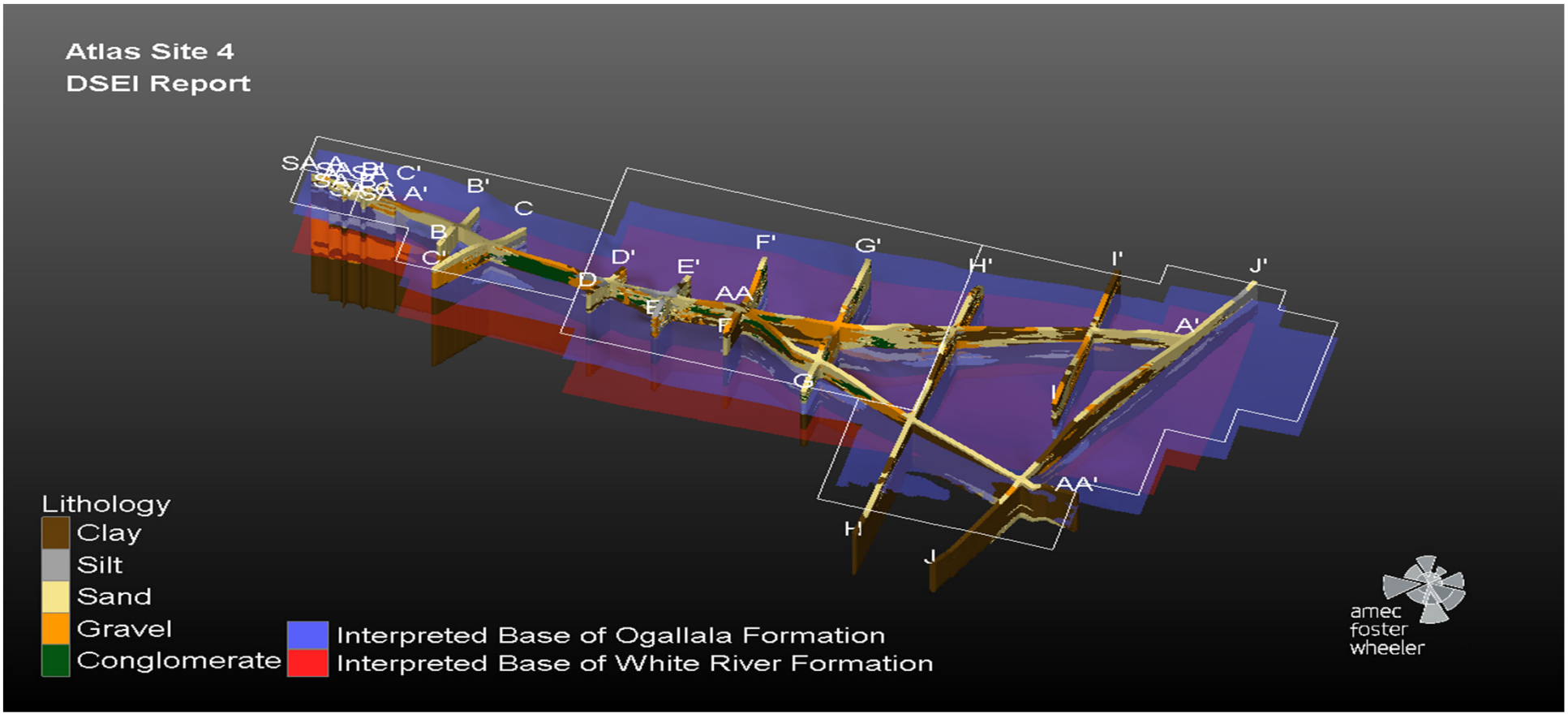
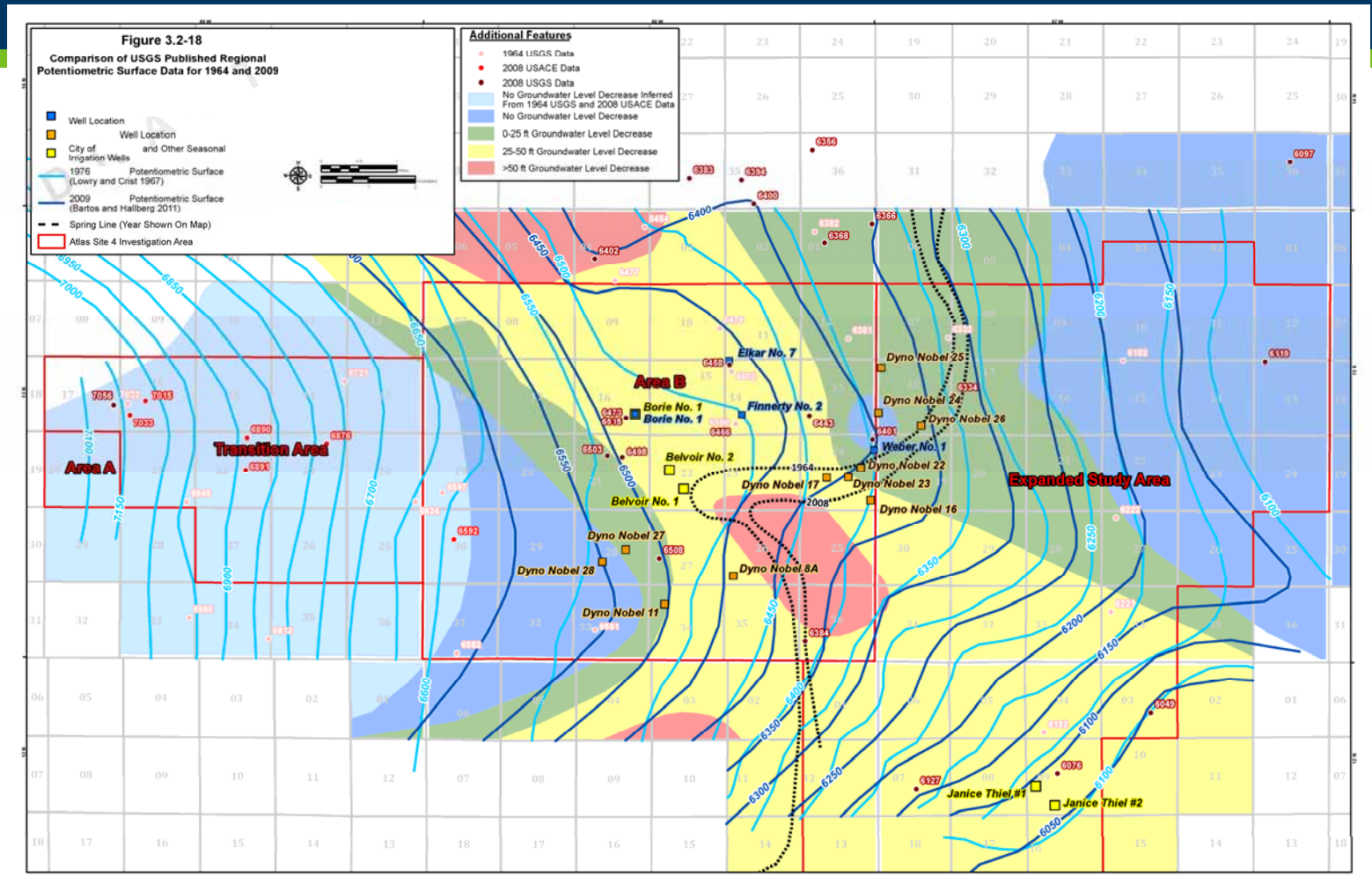
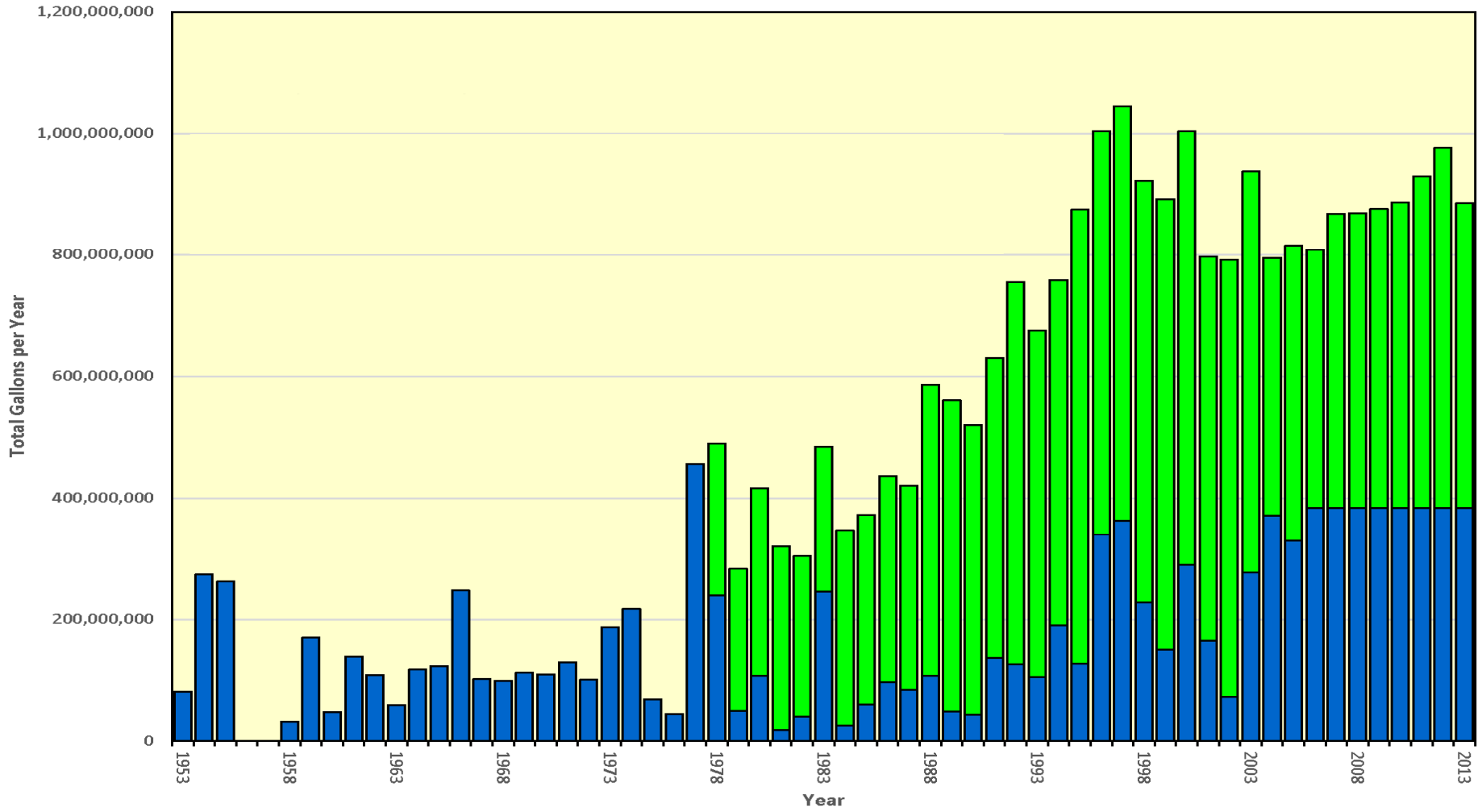
Geologic Data Evaluation & Interpretation
Example 3D CSM



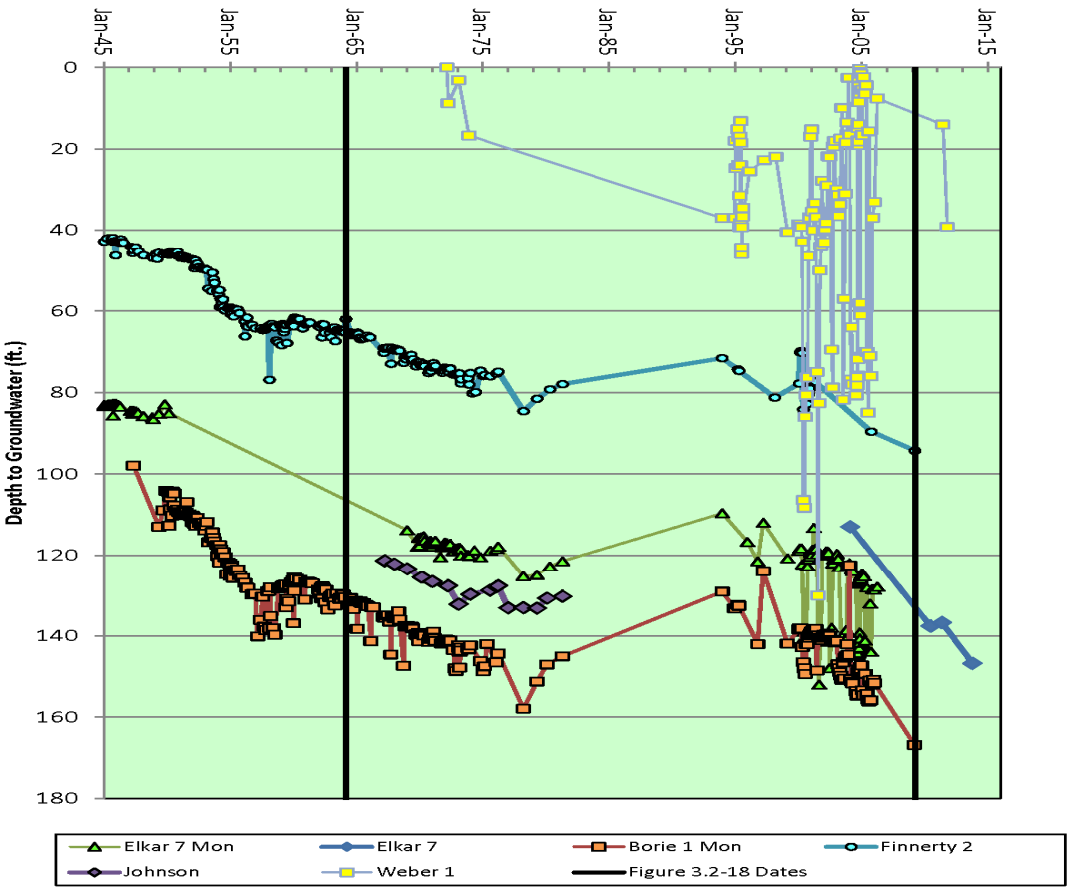
Responses to Groundwater Withdrawal



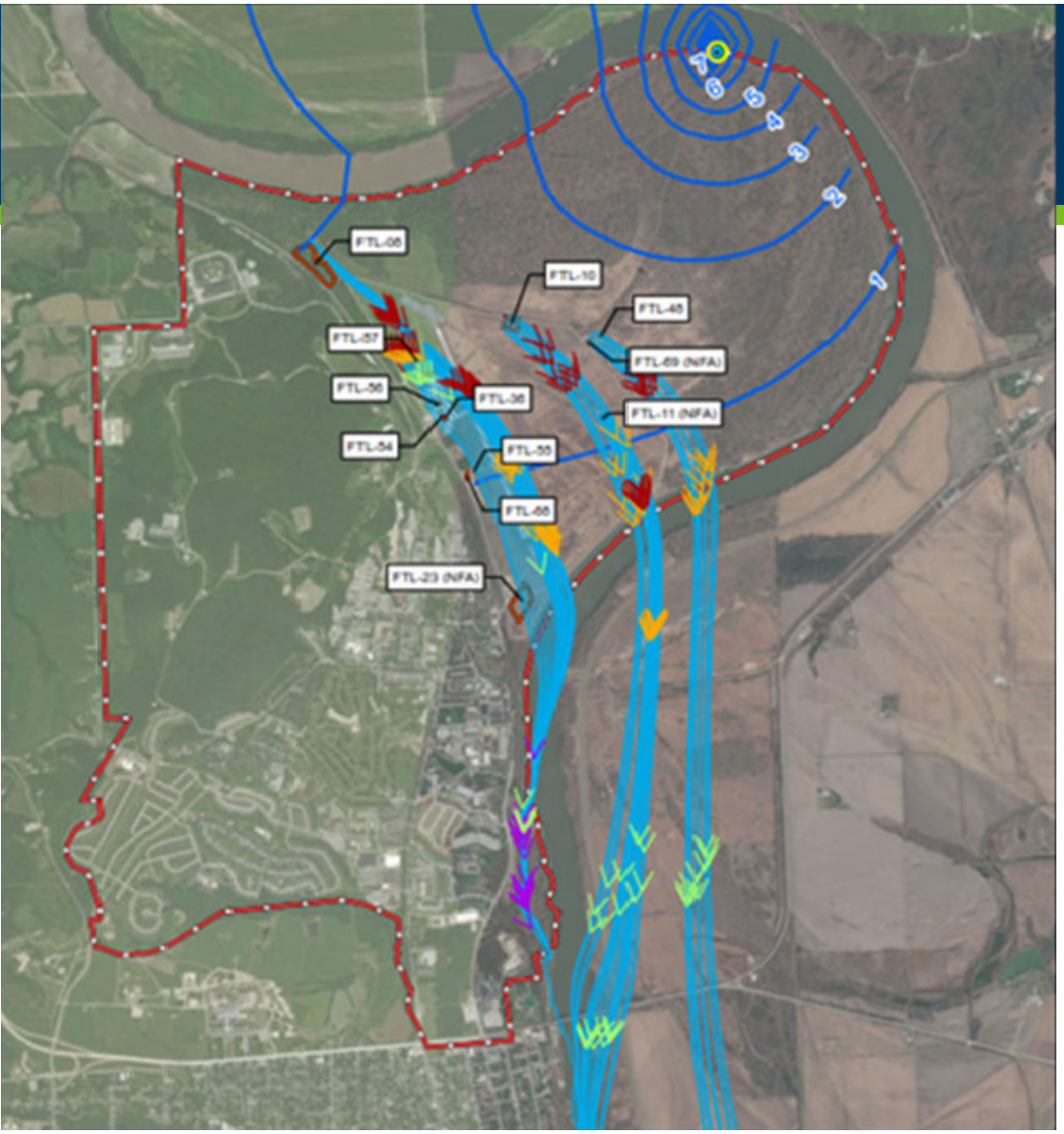
Groundwater Withdrawal



Groundwater Levels Area B



Numerical Modeling Particle Tracking – Forwards in time



Symbol Key

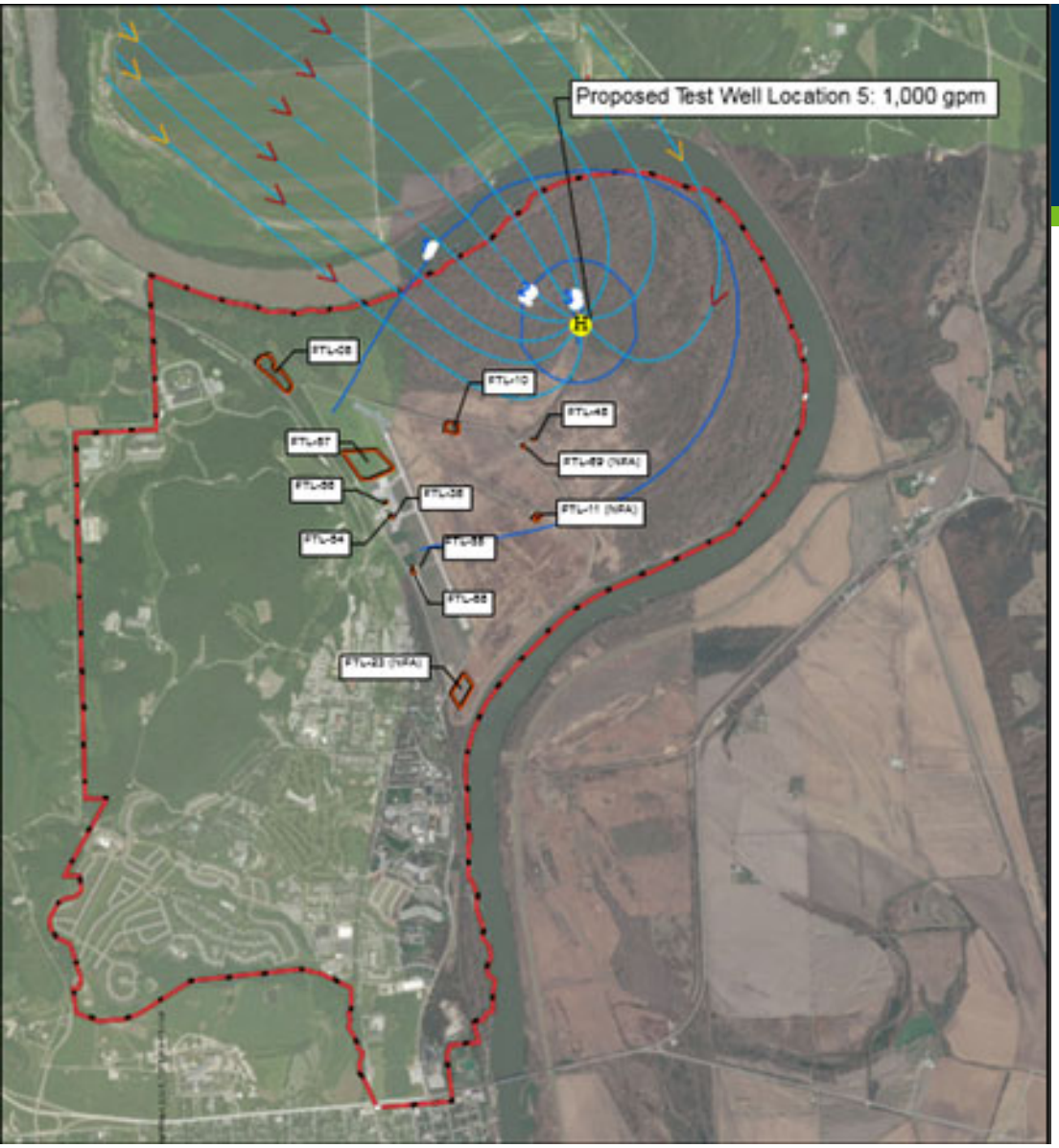
- Groundwater Flow Path
- Drawdown Contour
- SWMU Boundary
- Installation Boundary

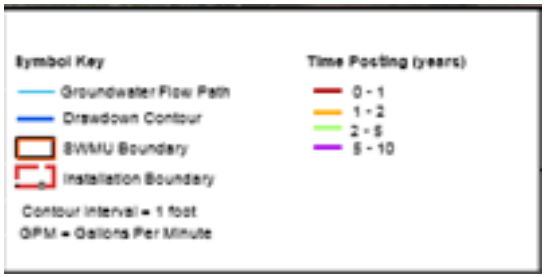
Contour Interval = 1 foot
GPM = Gallons Per Minute

Time Posting (years)

- 0 - 1
- 1 - 2
- 2 - 5
- 5 - 10

Numerical Modeling Particle Tracking – Backward in Time





Timeline for Completion

1. CSM Development – June 2019
2. Numerical Model- July 2019
3. Transport Model/Evaluation- September 2019

DRAFT REPORT- November 2019

FINAL REPORT (as part of CDWSP) – December 2019

Thank you!

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