MINNESOTA POLLUTION CONTROL AGENCY

Overview of Groundwater Modeling

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1. Discuss Value of Groundwater Modeling
   - What questions can modeling address?
   - How are questions addressed?

2. Overview of Available Models/Information
   - Metro Model 3 (MM-3)
   - DNR transient Northeast Metro Lakes-Groundwater (NMLG) model
   - USGS NMLG model
   - South Washington County model

3. Next Steps
   - Development of Conceptual Site Model (CSM)
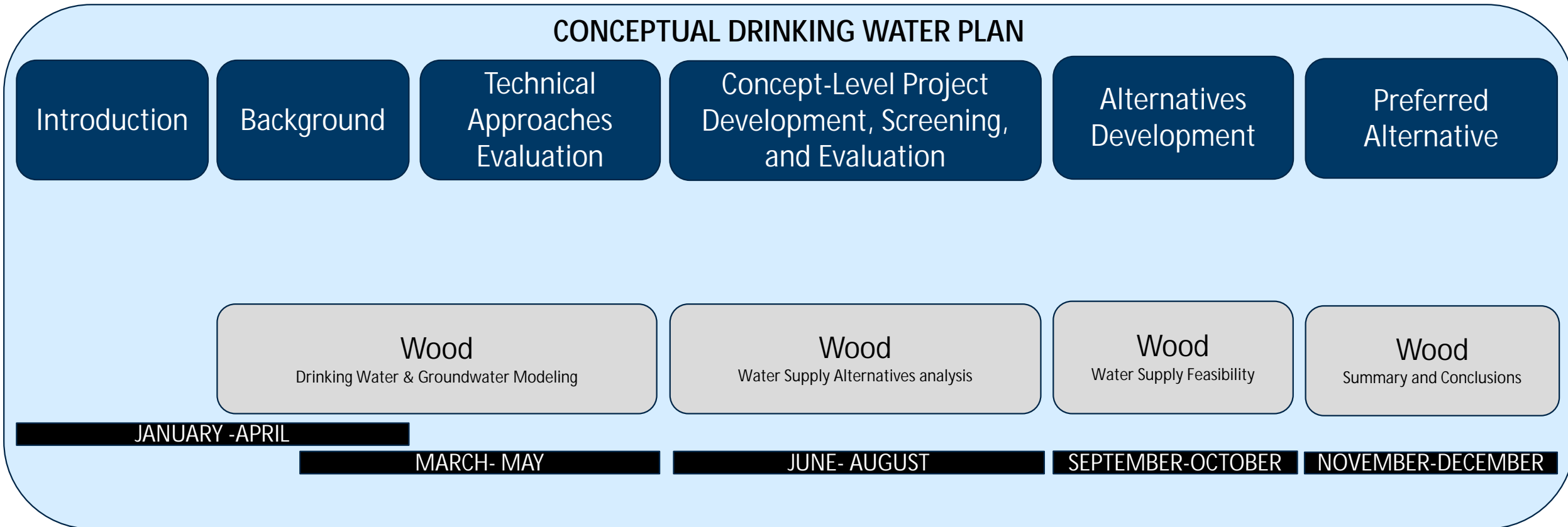
- Mobilizing groundwater contamination from pumping activities that could adversely impact unaffected portions of the aquifer, particularly during transient peak demand periods;

- Avoiding negative surface water and wetland impacts;

- Aquifer safe yield.
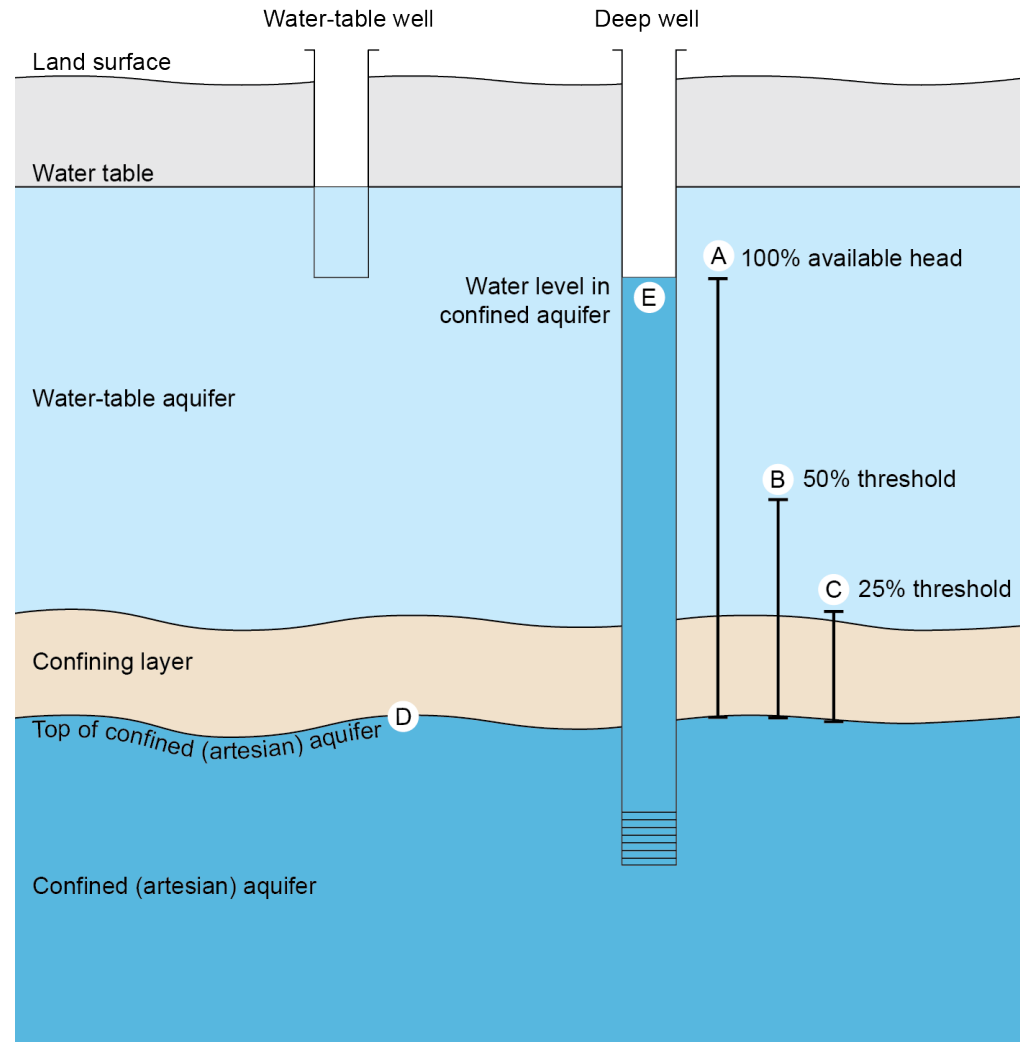
SAFE YIELD THRESHOLDS

Value of Groundwater Modelling

üGroundwater models are effective tools for:

- Understanding the dynamics of the groundwater flow system;
- Gaining insight to key parameters controlling the groundwater flow system;
- Evaluating and managing groundwater resources (Over allocation, Safe Yield);
- Supporting decisions regarding remedial actions for contaminated groundwater; and,
- Predicting groundwater response to hydrologic changes applied to the groundwater system (such as pumping, injection/recharge, agricultural practices, etc.)

ü What questions can be asked?
- What is the sustainable yield of an aquifer?
- How can pumping rates in a wellfield be optimized?
- What are the capture areas of a municipal wellfield?
- What is the amount and distribution of recharge to an aquifer?
- What amount of groundwater discharges to surface water bodies?
- How does the change in surface water elevations affect groundwater elevations in an adjacent aquifer?
- What are pathways and travel times of contaminants in groundwater?
- How can long term stresses impact future trends of groundwater elevations?

Value of Groundwater Modelling

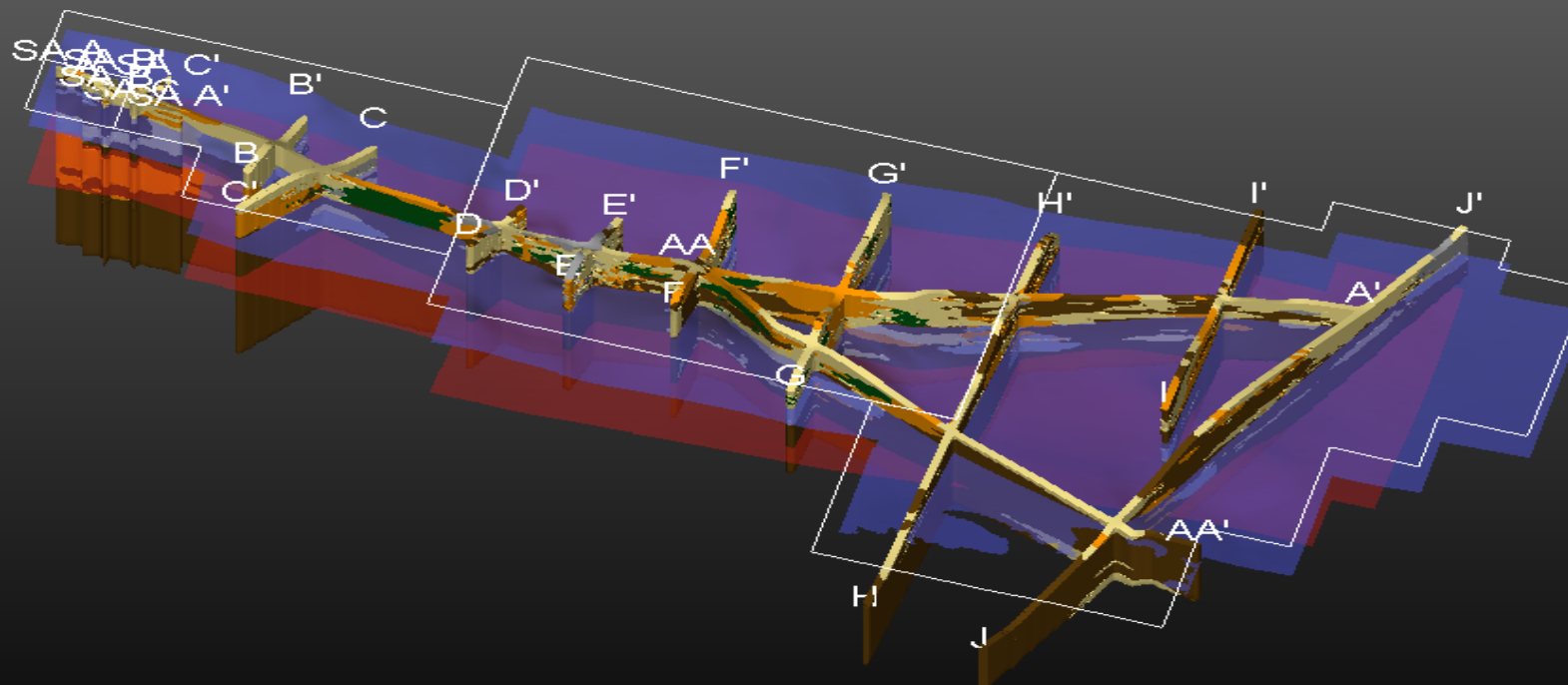ü How are questions addressed? A calibrated groundwater model can:

- Predict/compute steady-state and transient groundwater elevations for determining horizontal and vertical directions of groundwater flow;
- Predict/simulate pumping of an aquifer to determine drawdown and capture zones of pumping wells;
- Assess the impacts of the variability of recharge to groundwater and leakance to and from surface water bodies;
- Compute groundwater travel times and flow paths;
- Simulate transport processes for evaluating current and future contaminant migration; and,
- Simulate changes in pumping, surface water levels and groundwater recharge over time for predicting future groundwater elevations.

- Development of a Conceptual Site Model (CSM)

  - What is it?
  - What does a deliverable look like? (Memo and Model? Per SOW)
  - Next steps once CSM developed
  - Needs from SG-1 members (Data? Review? Other?)

Groundwater Withdrawal

Figure 3.2-18 Comparison of USGS Published Regional Potentiometric Surface Data for 1964 and 2009
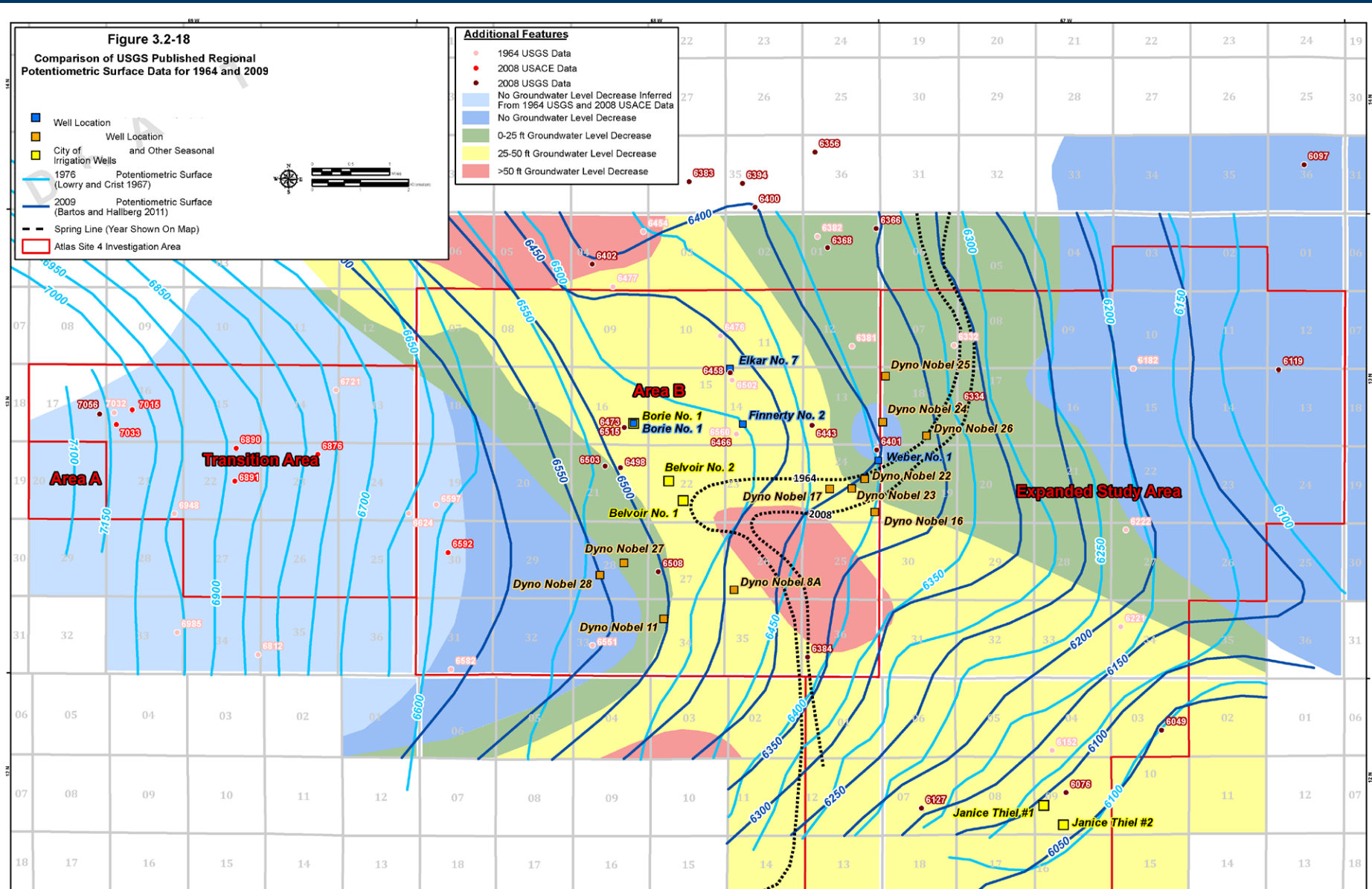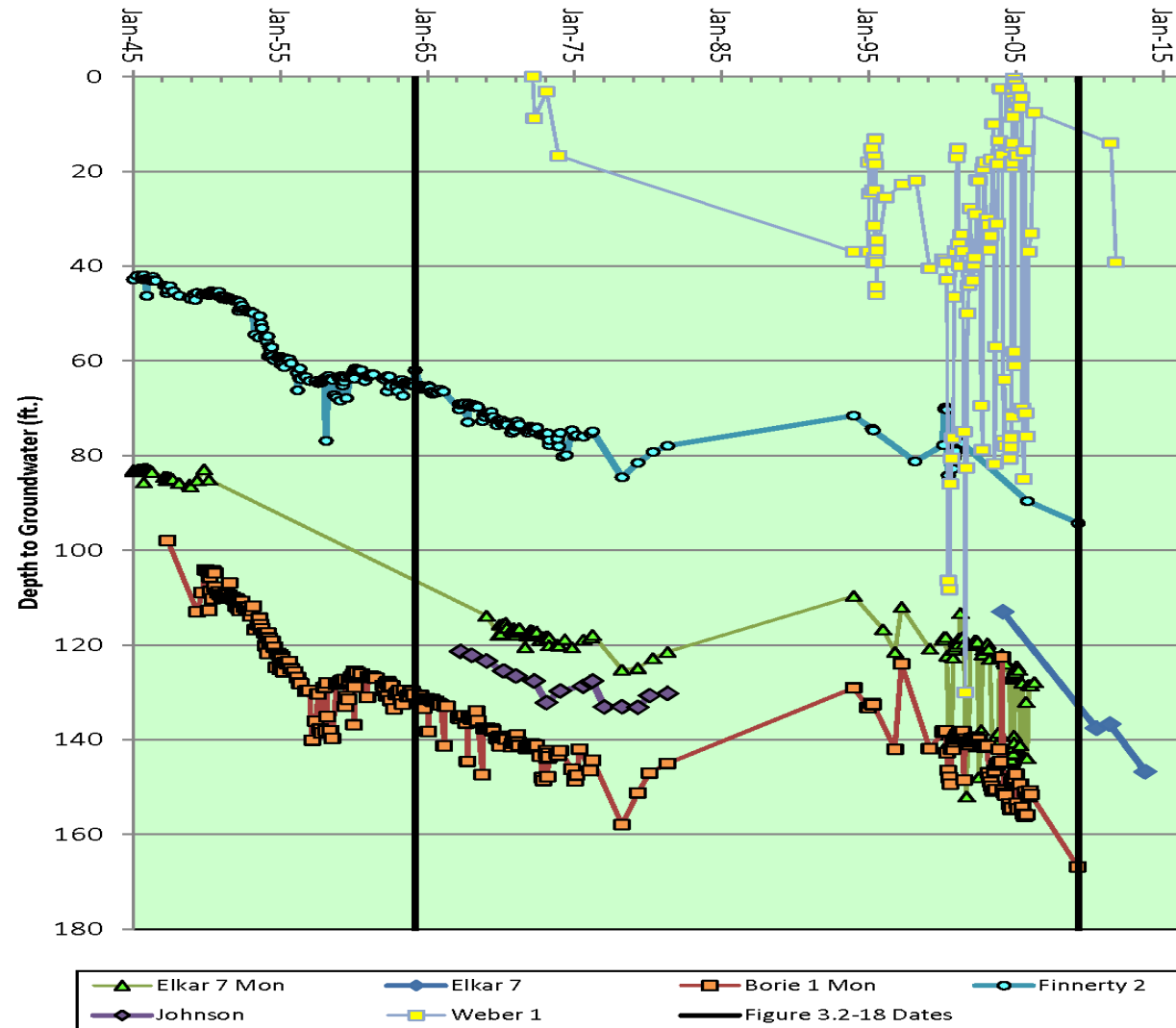
- Metro Model 3 (MM-3)
- DNR Northeast Metro Lake-Groundwater (NMLG) Model
- USGS NMLG Model
- South Washington County
- Wellhead Protection Areas (WHPA) delineations (various models and other approaches)

14
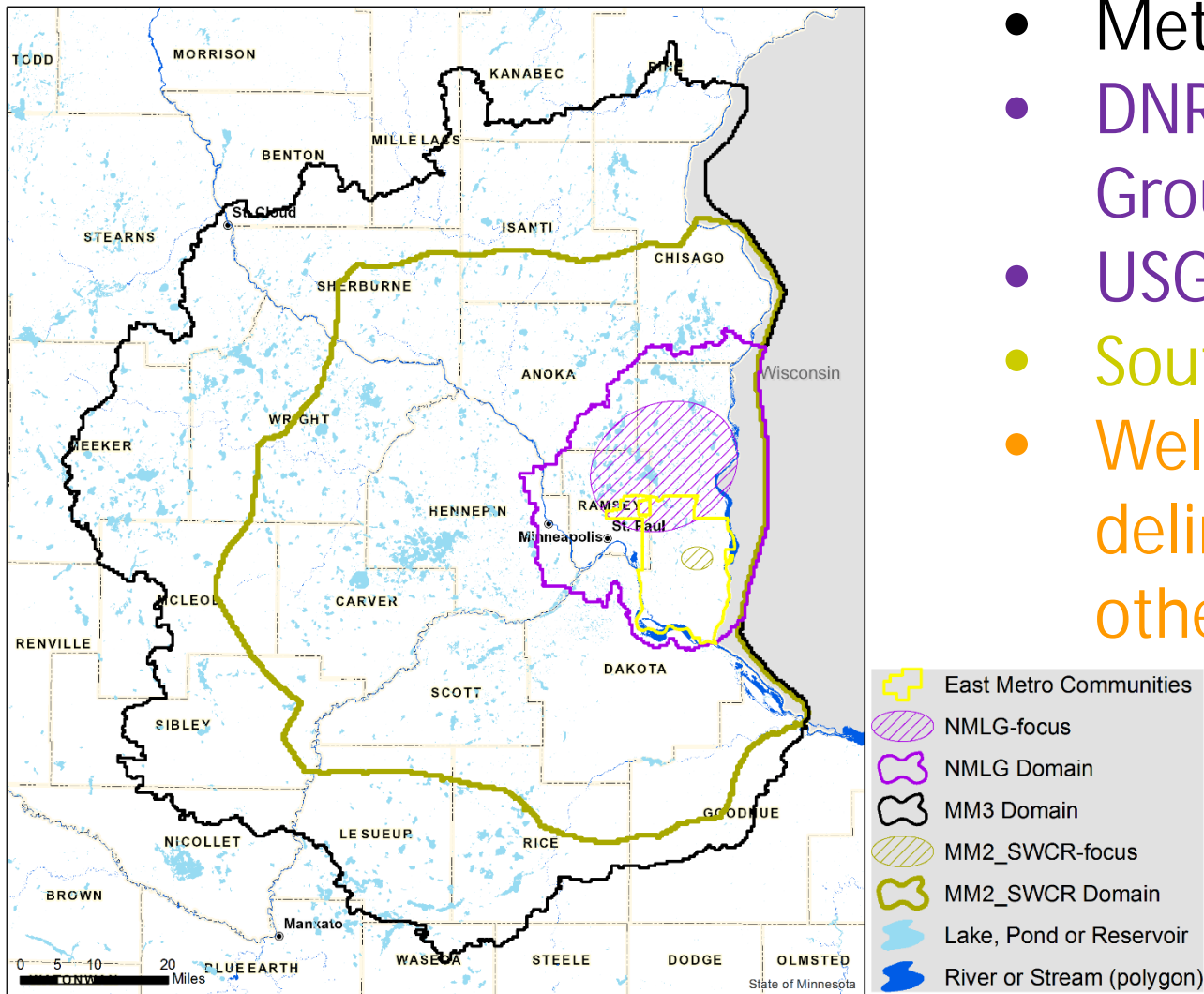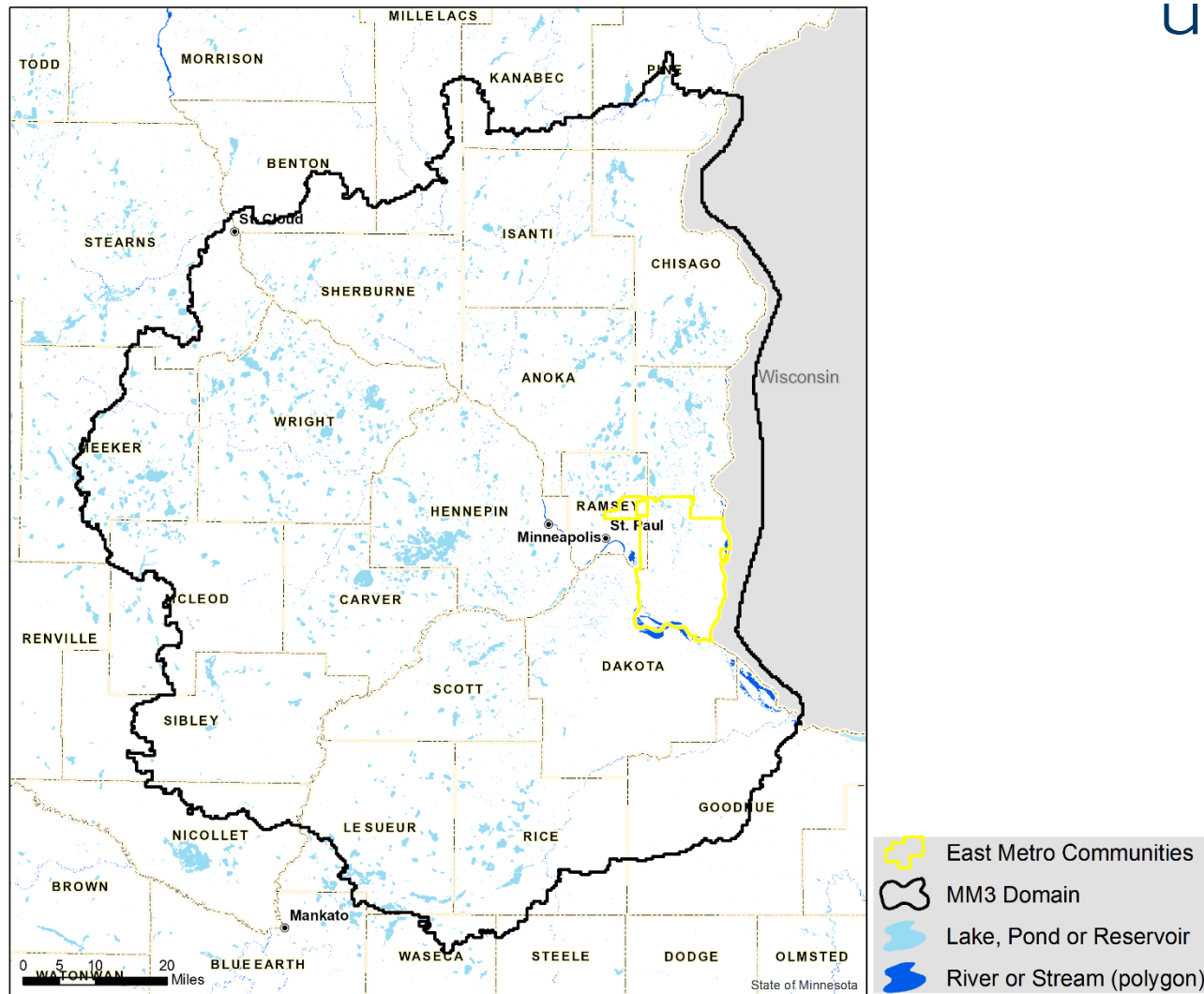
üMetro Model 3 (MM-3)

- Regional scale applications with a focus on potential drawdown in the bedrock aquifers

- Enhancements to previous regional models

- Basis for some locally refined models

- Coarse lateral and vertical grid and simple representation of lakes and wetlands as external boundaries

- Not based on most recent geological mapping in Washington Co.

Legend:
- East Metro Communities
- MM3 Domain
- Lake, Pond or Reservoir
- River or Stream (polygon)

15
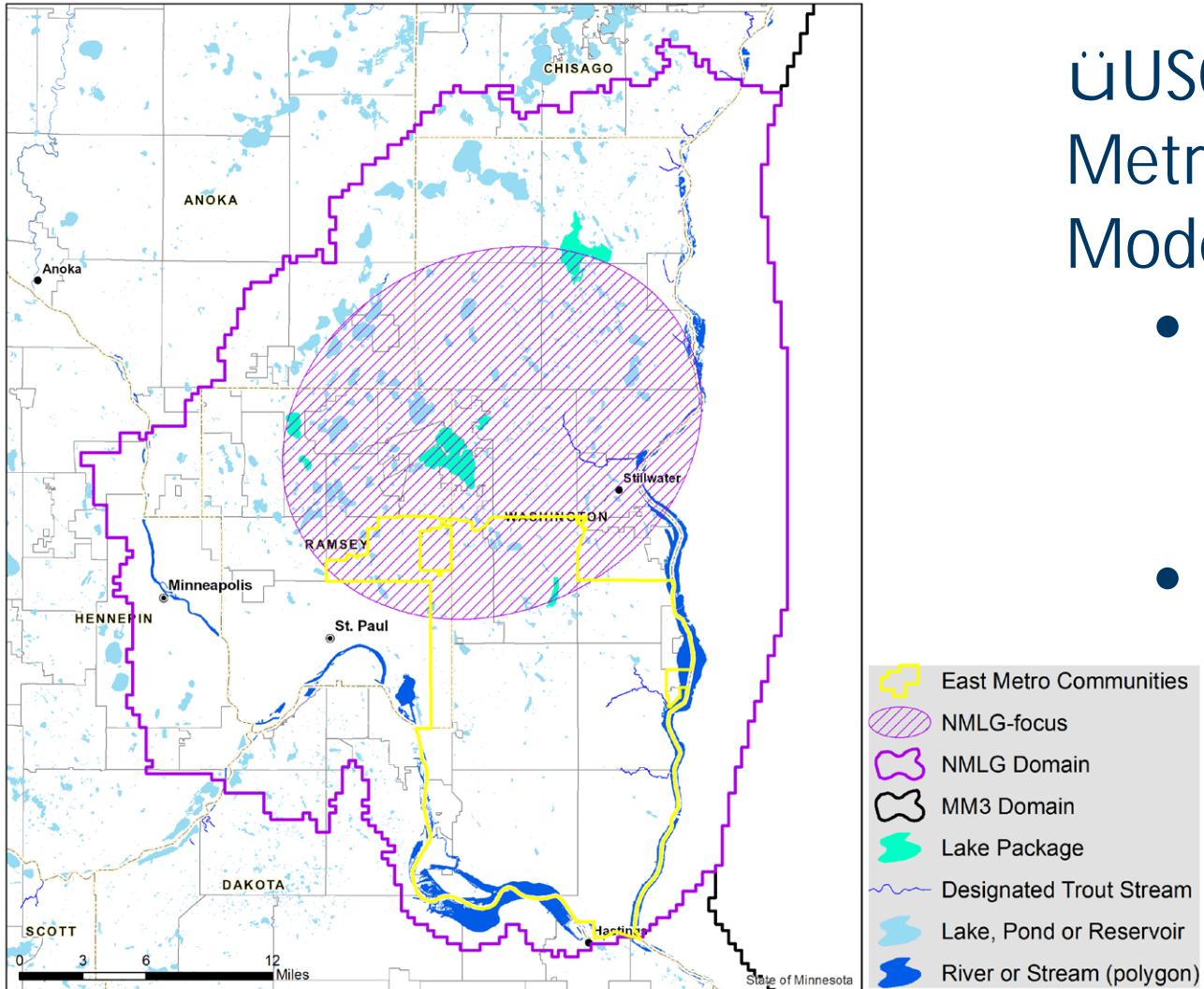
ü USGS and DNR modified Northeast Metro Lake-Groundwater (NMLG) Models

- Borrow much from MM3 with finer grid, added layers, and input and parameter differences
- Water budget/levels for several lakes (Lake Package)
  - Initial focus of transient DNR version on White Bear Lake

Legend:
- East Metro Communities
- NMLG-focus
- NMLG Domain
- MM3 Domain
- Lake Package
- Designated Trout Stream
- Lake, Pond or Reservoir
- River or Stream (polygon)

16
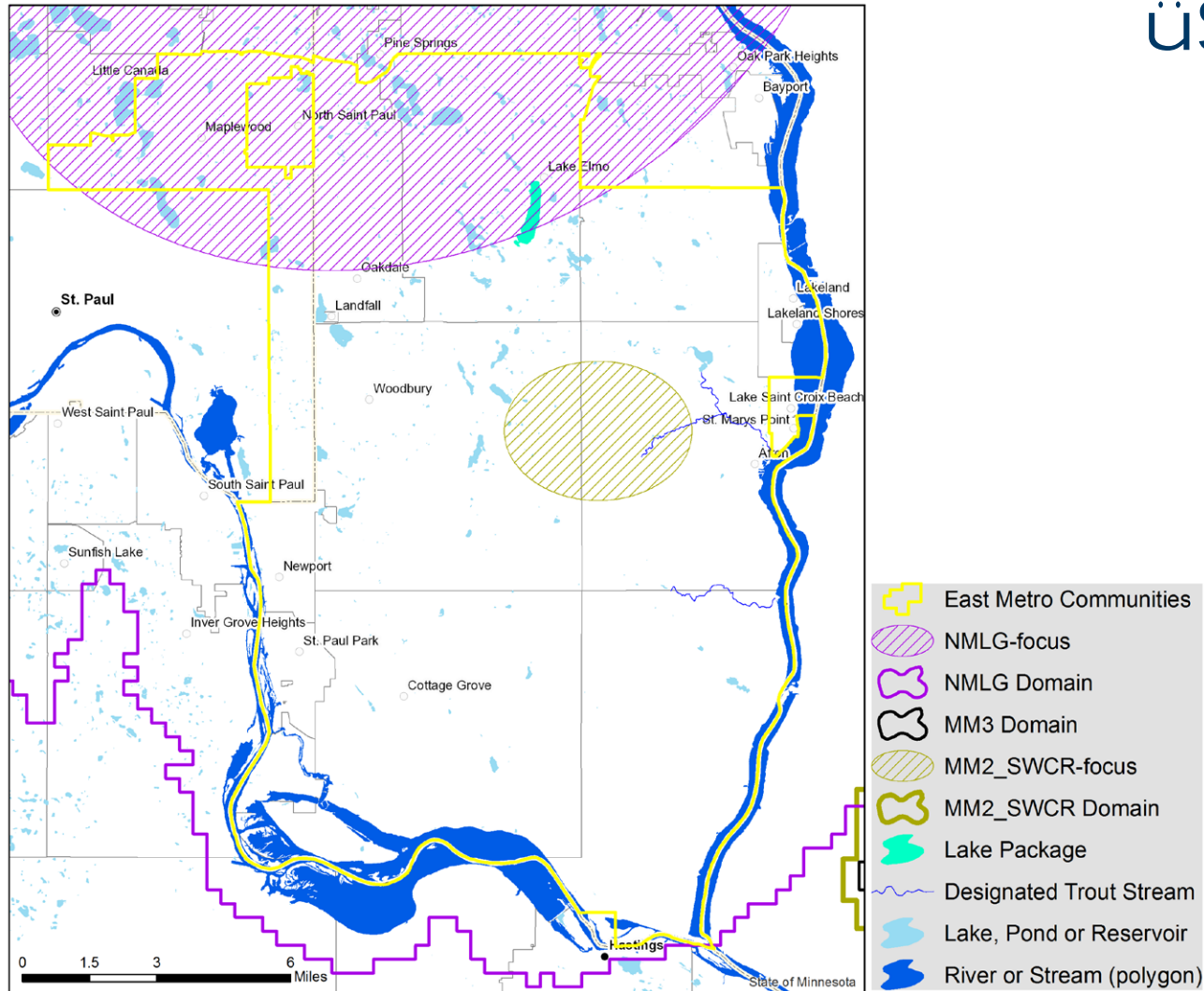
üSouth Washington County Model
- Last version was a local refinement of Metro Model 2 with transient pumping capability
- Built to evaluate potential impact of Woodbury's East well field on base flow in Valley Creek
- Parameter estimation to match a long-term pumping test

Legend:
- East Metro Communities
- NMLG-focus
- NMLG Domain
- MM3 Domain
- MM2_SWCR-focus
- MM2_SWCR Domain
- Lake Package
- Designated Trout Stream
- Lake, Pond or Reservoir
- River or Stream (polygon)
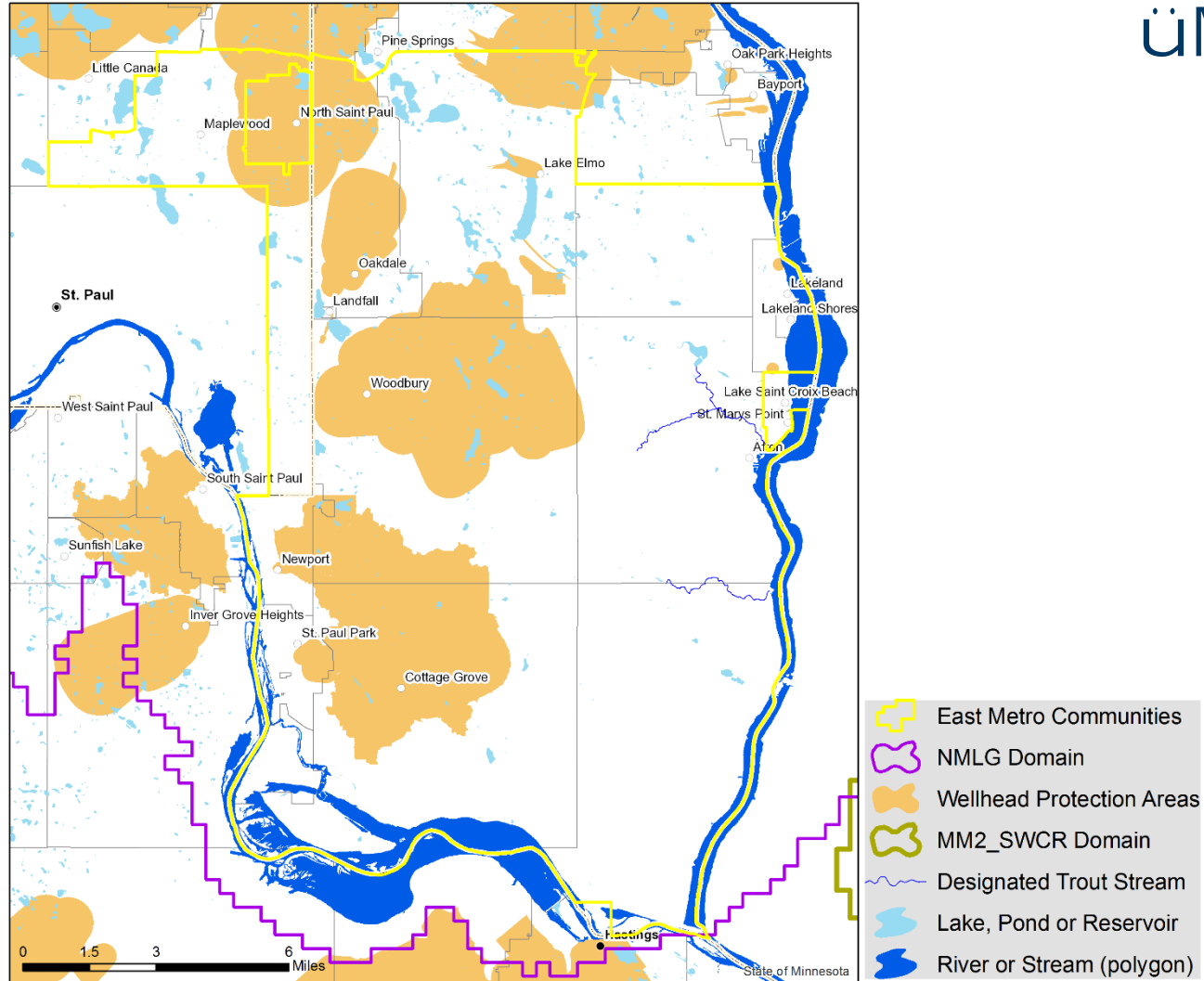
üMDH Wellhead Protection Areas

- Delineation of 10-year capture zones within pumped aquifer systems; some include surface drainage areas to vulnerable capture zones
- Extents of some WHPAs defined by simple volume mapping technique for fractured aquifers
- Local refinements of MM3 or other models
- Pros and cons vary

Legend:
- East Metro Communities
- NMLG Domain
- Wellhead Protection Areas
- MM2_SWCR Domain
- Designated Trout Stream
- Lake, Pond or Reservoir
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18

ü Summary thoughts on existing models

- Existing models could have some utility for looking at questions about large-scale plume impacts and sustainability criteria.
- May be most useful for helping to identify specific modeling objectives and locations that would benefit from model refinements and/or new data.
- The models have limitations due to scale, intended purpose, data inputs, and what is achievable at each scale.
- None of them incorporate all of the latest geological mapping/interpretations.
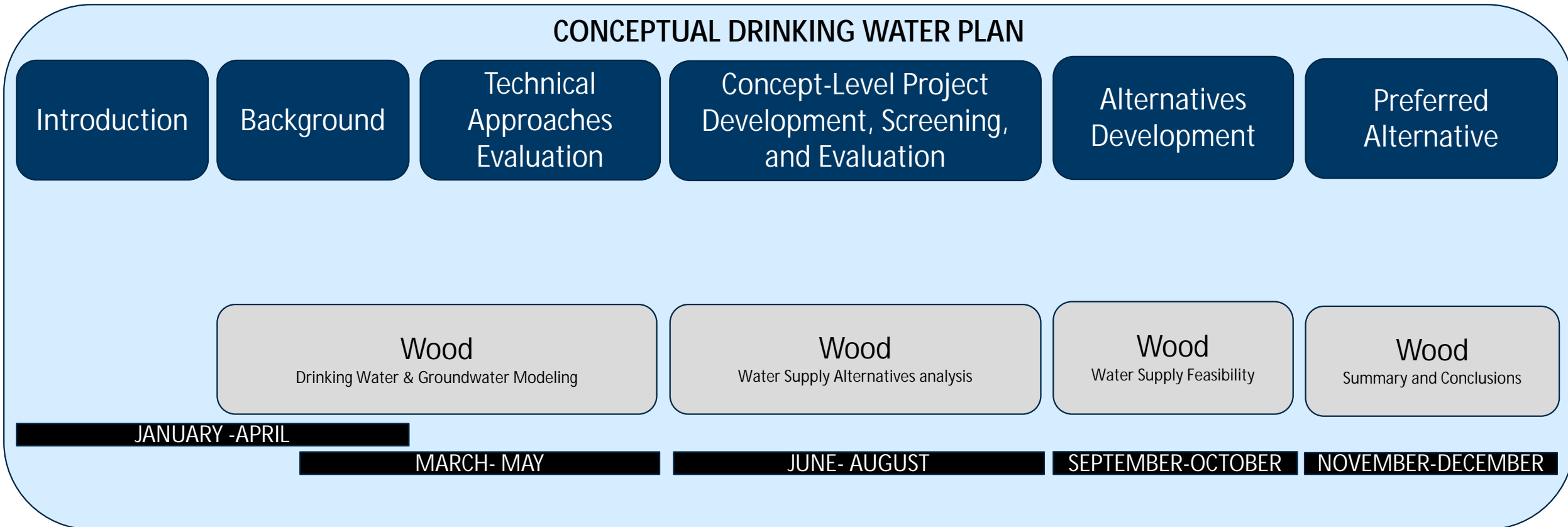
Why is this relevant?

- Growing demand for groundwater; population growth, industrial growth;

- Future predictions taking into account changes in pumping rates, recharge & plume dynamics;

- Evaluate production well alternatives/scenarios;

- Reduce the uncertainty regarding the issues of over-allocation and/or sustainability; and

- Data Gaps identification and analysis.

Overview of Scope and Work Flow Process

Scope Review- Goal for 2019
COMPLETION OF THE CONCEPTUAL DRINKING WATER PLAN

CONCEPTUAL DRINKING WATER PLAN

| Introduction | Background | Technical Approaches Evaluation | Concept-Level Project Development, Screening, and Evaluation | Alternatives Development | Preferred Alternative |

Wood
Drinking Water & Groundwater Modeling

Wood
Water Supply Alternatives analysis

Wood
Water Supply Feasibility

Wood
Summary and Conclusions

JANUARY -APRIL

MARCH- MAY

JUNE- AUGUST

SEPTEMBER-OCTOBER

NOVEMBER-DECEMBER

Thank you!

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