Treasure Valley Modeling Technical Advisory Committee
Modeling Objectives

Presented by Sean Vincent
September 7, 2017

Overview

- What is a groundwater flow model?
- Why are we developing a groundwater flow model?
- Steps in applying a groundwater flow model
- Why do we need objectives?
- Potential objectives
- Discussion

What is a groundwater flow model?

- A model is a simplified representation of a physical system and a groundwater flow model represents an aquifer system
  - A conceptual model is the hydrogeologist's conceptual understanding of an aquifer system (layering, lateral extent, aquifer boundary conditions, etc.)
  - A numerical model represents an aquifer system with mathematical equations that are solved by a computer program

What is a groundwater flow model (cont'd)?

- MODFLOW is a computer program that solves the groundwater flow equation using the finite difference method

- The Enhanced Snake Plain Aquifer Model (ESPAM), the Wood River Valley Model, and the Treasure Valley Hydrologic Project Model are all MODFLOW-format numerical models

Why a groundwater flow model?

- Great way to integrate and make use of hydrologic and hydrogeologic data

- Tool for decision-making
  - Used to answer what if questions

HYDROLOGIC IMPLICATIONS OF CONTINUED DROUGHT AND POTENTIAL RECOVERY FROM DROUGHT

"Drought Scenario"

February 2005

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for the
Idaho Department of Water Resources

with guidance from the
Eastern Snake Hydrologic Modeling Committee

Design Document DDS-007

Idaho Water Resource Research Institute
Technical Report 05-004

Why a groundwater flow model?

- Great way to integrate and make use of hydrologic and hydrogeologic data

- Tool for decision-making
  - Used to answer what if questions
  - Used to quantify hydrologic impacts

EASTERN SNAKE PLAIN AQUIFER GROUND-WATER RIGHTS TRANSFER SPREADSHEET BASED ON ENHANCED SNAKE PLAIN AQUIFER MODEL

by

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Version 2.0

Why a groundwater flow model?

- Great way to compile and make use of available hydrologic and hydrogeologic data

- Tool for decision making
  - Used to answer what if questions
  - Used to quantify hydrologic impacts

- Legislative mandate

SCR #137 (signed on 3/22/2016)

"A CONCURRENT RESOLUTION STATING FINDINGS OF THE LEGISLATURE AND REQUESTING THAT THE IDAHO WATER RESOURCE BOARD ADDRESS STATEWIDE AQUIFER STALILIZATION AND SUSTAINABILITY STUDIES…"

"BE IT FURTHER RESOLVED that the Idaho Water Resource Board conduct aquifer recharge studies and develop a ground water model, with all necessary measurement networks, for the Treasure Valley Aquifer." (emphasis added)

Process for Applying a GW Flow Model (ASTM D5447)

- Define objectives
- Develop a conceptual model
- Select a computer code
- Construct a groundwater flow model
- Calibrate model and perform sensitivity/uncertainty analyses
- Make predictive simulations
- Document modeling study
- Perform postaudit
- Iterate (e.g., revise conceptual model and/or recalibrate)

Why do we need objectives?

- Aquifer models built for a variety of reasons
  - Delineation of wellhead protection areas
  - Evaluation of aquifer management alternatives
  - Hydrologic impact assessments
  - Contaminant fate and transport predictions
  - Design of mine and construction dewatering systems

- Need to consider scale of measurement when interpreting hydrologic data and scale of predictions when designing model

- Definition of objectives necessary to build the right tool for the job


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Wrong tool for the job
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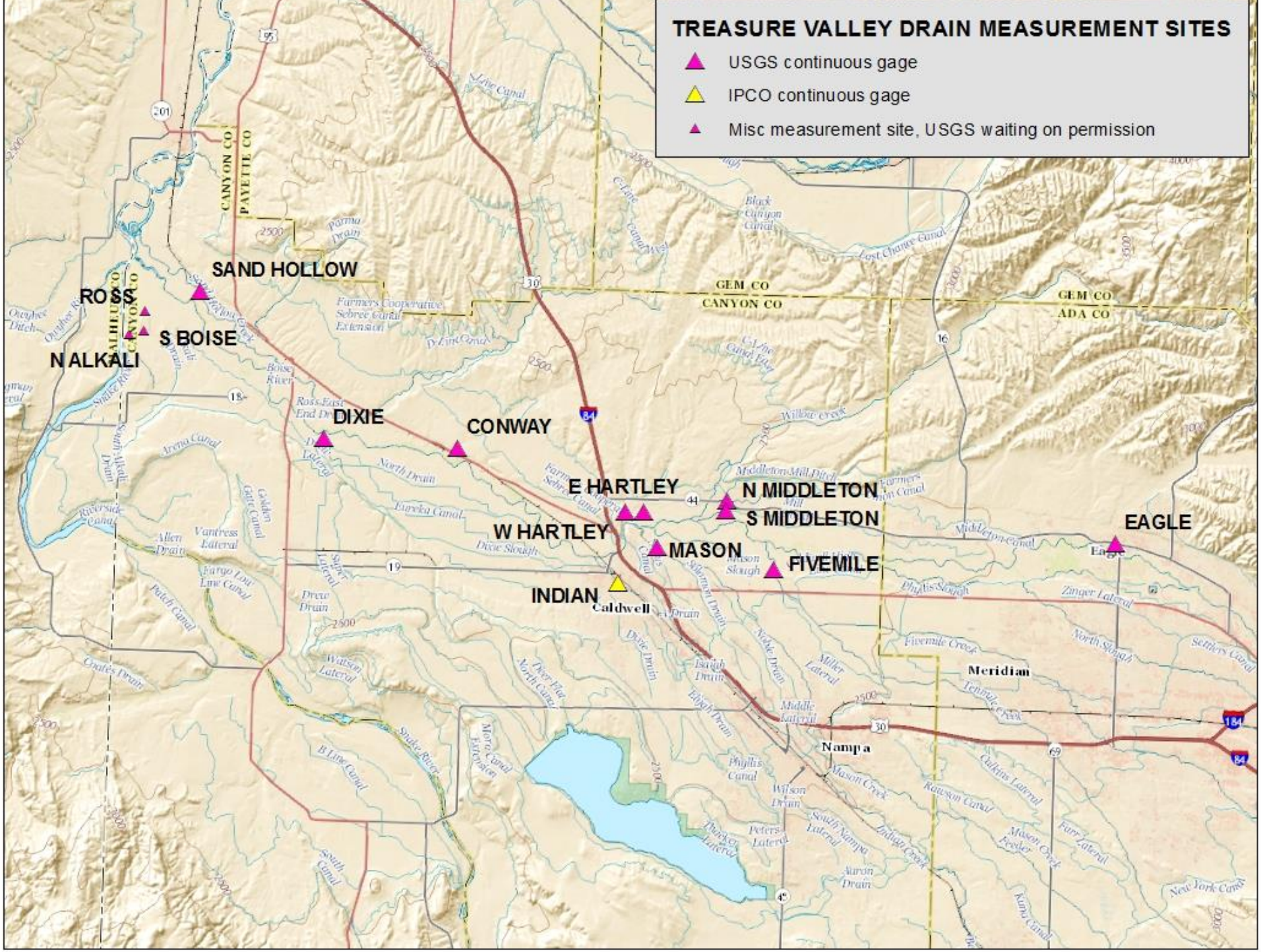
Potential Design Objectives

- Develop fully transient model
- Represent current understanding of aquifer system
- Improve understanding of aquifer system
- Identify data gaps


TREASURE VALLEY DRAIN MEASUREMENT SITES
USGS continuous gage
IPCO continuous gage
Misc measurement site, USGS waiting on permission
SAND HOLLOW
ROSS
S BOISE
N ALKALI
DIXIE
CONWAY
E HARTLEY
N MIDDLETON
S MIDDLETON
W HARTLEY
MASON
FIVEMILE
INDIAN
EAGLE
Caldwell
Meridian
Nampa
CANYON CO
PAYETTE CO
GEM CO
ADA CO

Potential Design Objectives (cont'd)

- Represent groundwater/surface water interaction on valley-wide scale
- Represent groundwater/surface water interaction on a local scale
- Facilitate evaluation/quantification of aquifer management options (e.g., managed recharge)

Incorporating Recharge Limitations into the Prioritization of Aquifer Recharge Sites Based on Hydrologic Benefits Using

ESPAM2.1

by

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Idaho Department of Water Resources

November 2015

Potential Design Objectives (cont'd)

- Facilitate assessments of water supply sufficiency (IDWR)

- Serve as tool for conjunctive administration (IDWR)
  - Curtailment analyses
  - Mitigation
  - Groundwater right transfers

- Serve as tool for long-term planning (IWRB)

Other Considerations

- Defensible in litigation
  - Commonly used, widely accepted modeling platform
  - Model development in collaboration w/ unbiased, 3rd party
  - Regular public meetings during model development

- Accessible and well documented
  - Public domain model and computer program
  - Peer review
  - Publication of interim work products
  - Data and documentation available via the Internet

Hydrologic Projects

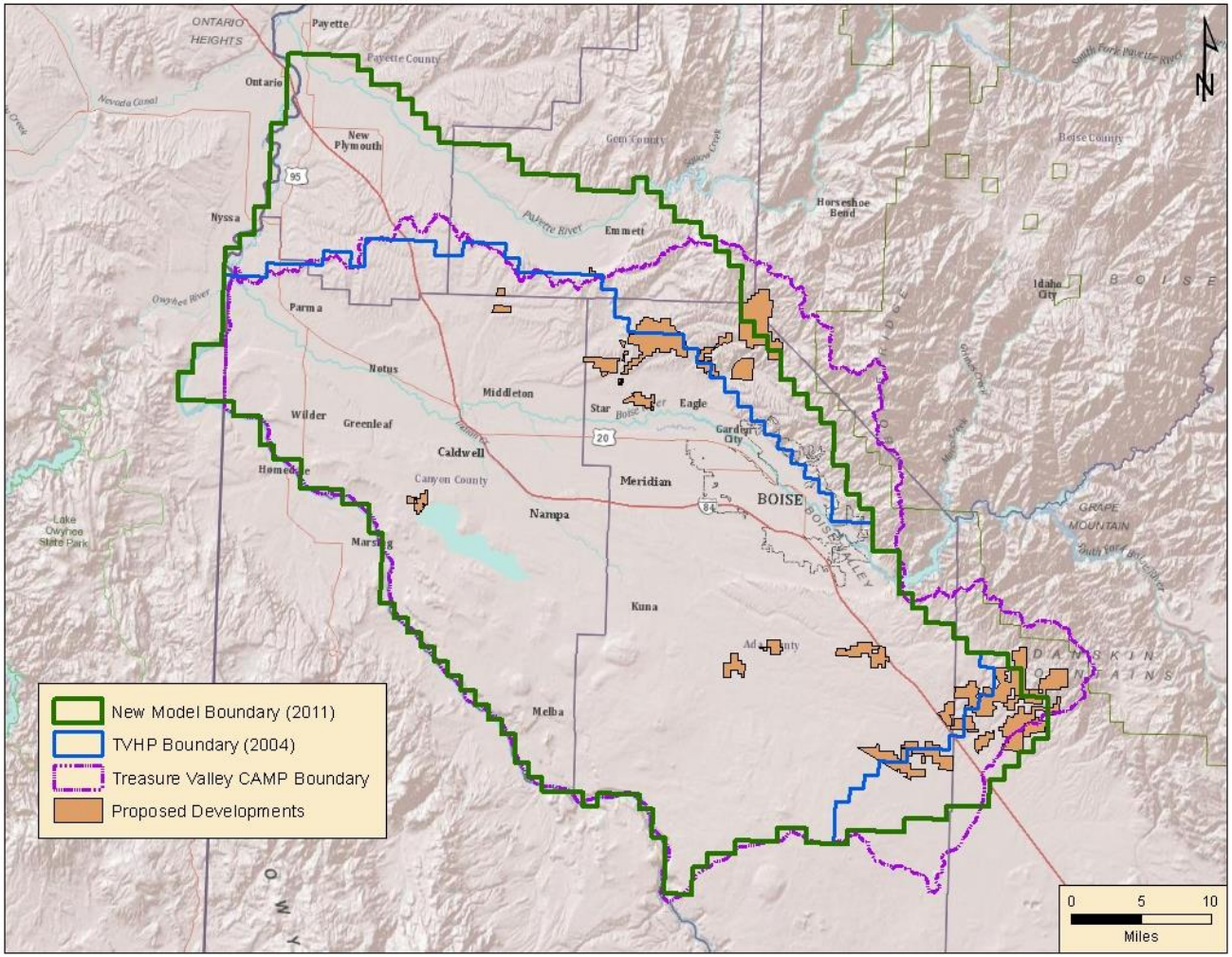
TREASURE VALLEY GROUNDWATER-FLOW MODEL

In 2016, the U.S. Geological Survey (USGS) in partnership with IDWR embarked on a five-year project to construct a numerical groundwater-flow model of the Treasure Valley and surrounding area. Resource managers will use the model for water-supply planning and management. As part of model construction, the hydrogeologic understanding of the aquifer system will be updated with information collected during the last two decades as well as new data collected for the study. Funding for the project is being provided by the USGS and by the Idaho Water Resource Board through a special appropriation from the Idaho Legislature for statewide aquifer stabilization and sustainability studies (see Senate Concurrent Resolution 137).

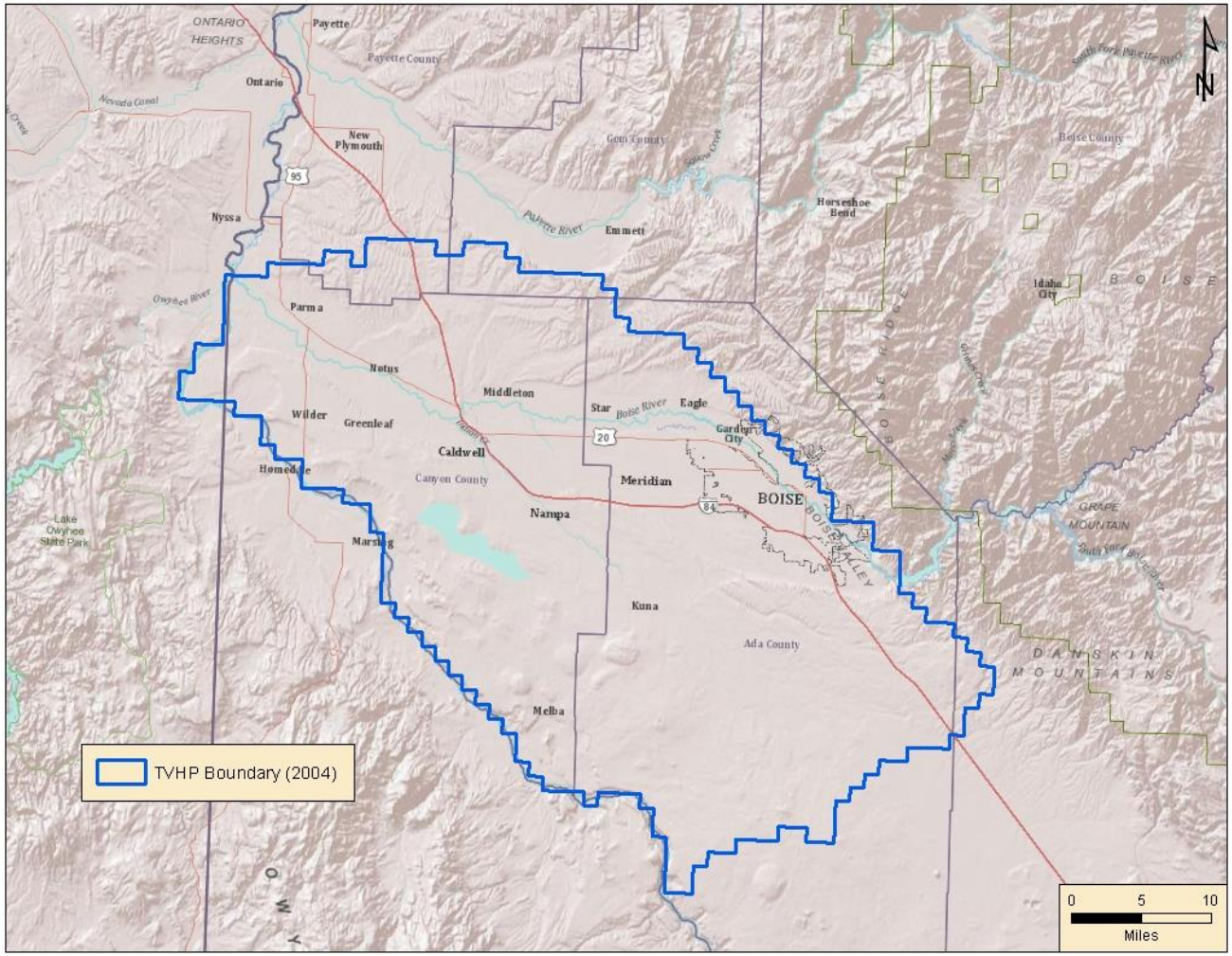
A technical advisory committee provides for transparency in model development and facilitates stakeholder input. Additional information describing the collaborative USGS-IDWR Treasure Valley groundwater flow model development project is provided in the project summary.

Discussion

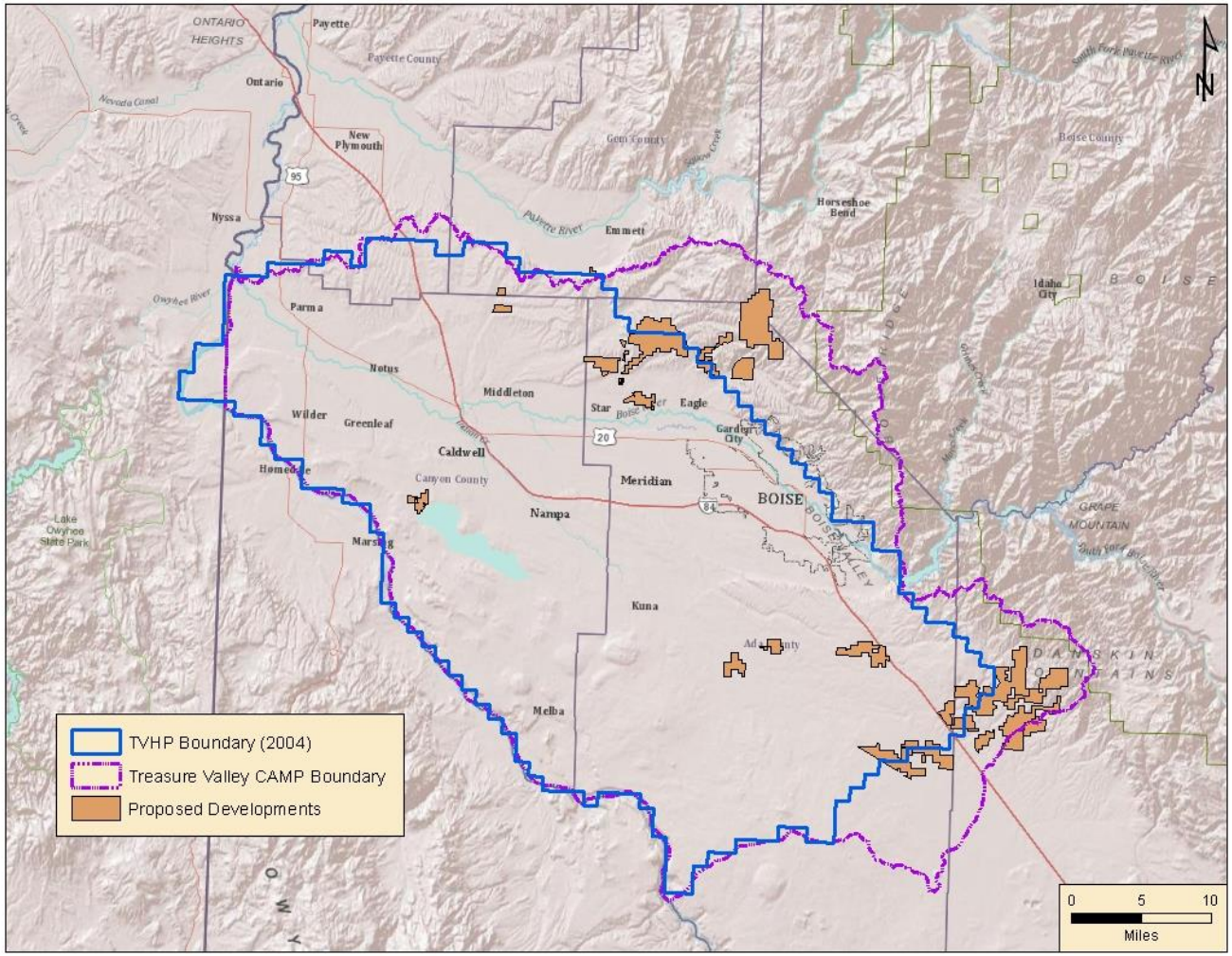
USBR Model Boundary



TVHP Model Boundary



TV CAMP Boundary



What is model role in a delivery call?

- Not used to determine injury

- Used to quantify gw user impacts on sw supply

1. Aquifer curtailment analyses
   - Determine priority date to make up for shortfall of calling party (iteratively estimate benefits to sw supply for different priorities)

2. Mitigation assessments
   - Determine benefits to calling party for various mitigation measures (CREP, recharge, conversions, etc.)
   - Account for residual benefits from previous years

3. Groundwater right transfers
   - Quantify distribution of hydrologic impacts & determine mitigation requirements (protect existing users)

Model role in a delivery call (cont'd)

- BWCC has threatened a delivery call on more than one occasion
- BWCC irrigation water is sourced from 4 different basins
- Wood River Valley model could have limited role in responding to a BWCC delivery call

Expectations

- If mandate approved, we will deliver new model
- Technical factors may hinder progress
  - Data gaps
    - Drain measurements (~50% of estimated aquifer discharge for Lower Boise + Lower Payette valleys)
    - Few water levels in deep aquifers (layers 3 and 4 in existing models)
    - METRIC ET processed for one year only (2000)
    - Need year-specific water budgets
  - TV aquifer system is complex
    - Lateral extent and continuity of aquifers uncertain
    - Recharge mechanisms to deep aquifers poorly understood
    - Faulting along basin margin w/ isolated/bounded aquifers
    - Wells allow commingling of water levels

Expectations (cont'd)

- Non-technical factors also may hinder progress
  - Uncertain modeling objectives
    - Inferred goal is a fully transient model to support planning and conjunctive administration
    - Other objectives?
  - Need to involve stakeholders in model development (MTAC)
    - Forum for stakeholder input
    - Transparency
    - Acceptance
  - TV will be IDWR's 4th actively maintained aquifer model

Star Bridge Moratorium

- A Moratorium Order was signed on May 3, 1995 for surface water on the Boise River upstream from the Star Bridge
- All surface water in the Boise River is fully appropriated in this reach
- Conjunctive management – Order includes non-domestic ground water right from wells less than 200 feet deep.

Southeast Boise GWMA

- Declared a GWMA on October 14, 1994 in response to significant water level declines
- Ground Water Management Plan approved on March 9, 2001
- Management efforts include conversion to surface water, reduced pumping, and recharge


Tool designed for a different scale than the problem