Outline

• Introduction
• Calibration Targets
• Adjustable Parameters
• Process
Calibration Targets

• River gains
  – Big Wood River
  – Silver Creek
  – Willow Creek

• Water levels in wells

• Underflow out of the model
River gains

- Continuous stations
  - Big Wood nr Ketchum
    - 4/2011 – present
  - Big Wood River at Hailey
    - 7/1915 – present
  - Big Wood River at Stanton Crossing
    - 9/1996 – present
  - Silver Cr at Sportsman Access
    - 10/2007 – present
  - Willow Cr
    - 6/2006 - present

- Seepage runs
  - August 2012
  - October 2012
  - March 2013

Daily average discharge, Big Wood River near Ketchum (cfs)

Daily average discharge, Big Wood River at Hailey (cfs)

\[ y = 0.3475x + 0.1845 \]

\[ R^2 = 0.9612 \]
Nr Ketchum to Hailey reach gain (includes runoff from smaller tributaries)

- Monthly average gain (cfs)
- Jan-95 to Jan-13

Graph showing monthly average gain from Jan-95 to Jan-13.
Hailey to Stanton Crossing (includes smaller tributaries)
Flow in Big Wood River

• With the stream flow routing package flow in the river can be used as a calibration target

• Possible additional targets could include making sure that the river is dry in the appropriate places at the appropriate times
  – Dry is not a continuous function
  – More on this later
Water levels in wells

- Most wells don’t have many measurements during the calibration period
Adjustable Parameters

- **Aquifer properties**
  - Hydraulic conductivity
    - Pilot points
  - Specific yield
    - Pilot points
  - Riverbed conductance
  - Drain conductance

- **Components of water budget**
  - ET
    - By irrigation entity
  - Tributary inflow
    - By tributary valley
  - Canal seepage
    - By irrigation entity
Pilot Points

- Estimate hydraulic conductivity (K) or specific yield (SY) at pilot points
- Interpolate values between pilot points
Pilot Points
Riverbed Conductance (RBC)

- Assign RBC by reach
Evapotranspiration (ET)

• Assign ET adjustment factors by entity
  – \(\frac{(\text{model-start})}{\text{start}}\)
Tributary valley inflow (TRB)

- Assign TRB adjustment tributary valley
Canal Seepage (CNL)

- Assign CNL adjustment factors by entity
PEST

- Parameter ESTimation software (PEST) ‘http://www.pesthomepage.org/’
- PEST is the industry standard software package for parameter estimation and uncertainty analysis of complex environmental and other computer models.
- PEST does not have a Graphical User Interface (GUI), it works from the command line.
PEST

- Simple 2 parameter model
- Populate jacobian matrix
  - Adjust each parameter record impact of adjustment on every observation
- Calculate upgrade vector
- Move down upgrade vector comparing model output with field observations
- When match stops improving, stop and repopulate jacobian matrix
- etc
PEST

– Jacobian matrix
  • Change between model output and field observations with respect to change in model parameters

– Best if model output is continuous
  • i.e. decrease non-irrigated recharge results in lower water levels at well X
  • What if well goes dry?
    – Results in non-continuous output?
    – Wells actually go dry
    – What value do we hand to PEST?
PEST

- **Jacobian matrix**
  - Change between model output and field observations with respect to change in model parameters

- **Best if function is continuous**
  - i.e. decrease non-irrigated recharge results in lower water levels at well X
  - What if well goes dry?
    - Results in non-continuous output?
    - Wells actually go dry
    - What value do we hand to PEST?
PEST

- Populate jacobian matrix using fixed transmissivity model
  - Wells can not go dry
- Calculate upgrade vector using jacobian populated with fixed transmissivity model
- Evaluate upgrade vector using variable transmissivity model
  - Wells can go dry
Conclusions

• Calibration Targets
  – River gains and losses
    • Flow in river
  – Water levels in wells
  – Outflow from model

• Adjustable Parameters
  – Hydraulic conductivity (K)
  – Specific yield (Sy)
  – Riverbed conductance (RBC)
  – Drain conductance (DC)
  – Evapotranspiration adjustment factor (ET)
  – Tributary inflow adjustment factor (TRB)
  – Canal seepage factor (CNL)