Groundwater Infiltration Assessment
Yakima River Basin Study

CELEBRATING 50 YEARS in 2010

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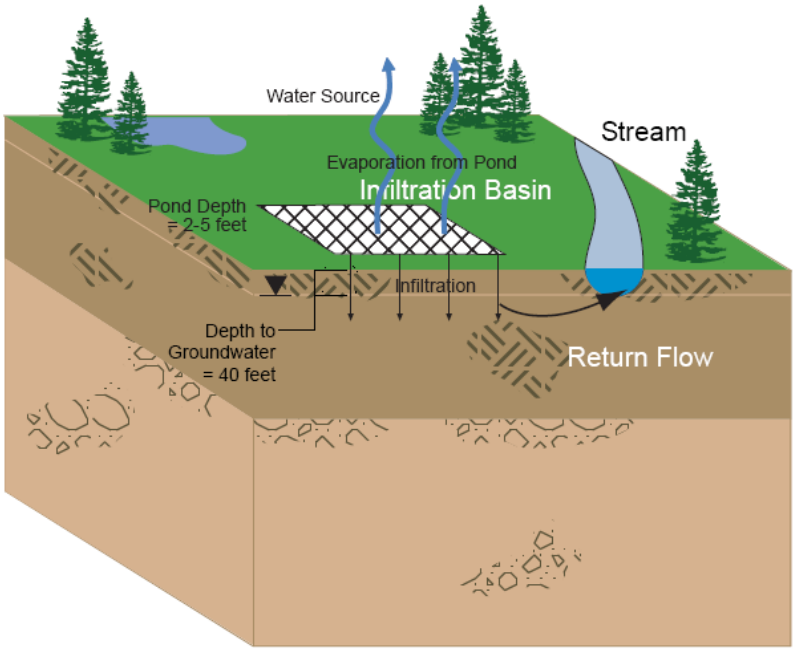
Infiltration Concept (2009)

- Focused on return flows directly to the Yakima River
- Objective was to “re-time” return flows from an infiltration basin to environmental and irrigation benefit.
- The results indicated re-timing was possible, the distance between any infiltration area and the river was a critical (and potentially limiting) constraint.



Infiltration Concept (2010)

- Infiltration is focused prior to storage control in uplands
- Withdrawal and use is focused after storage control in-lieu of reservoir releases
- Benefits are measured thru modified reservoir operations, especially carry-over storage and higher outmigration flows
- Re-timing is focused on the reservoirs and not the Yakima River.
- Management model is more complex
  - Water balance/RiverWare
  - “Bucket” concepts

Study Areas

- Kittitas Reclamation District (KRD)
  - Potential Thorp Pump Station concept, which would deliver piped water to the uppermost canals of the KRD North Branch, continuing through Badger Pocket and toward Wymer Reservoir.
  - Sub-basin is “enclosed” (like a bucket) from a groundwater perspective such that all groundwater infiltration would (eventually) discharge to the Yakima River at Umptanum.

- The Wapato Irrigation District (WIP)
  - Magnitude of allowable water deliveries to the WIP system (130,000 AF) and laterals that likely affect shallow groundwater flows
  - Sub-basin is open and groundwater spreads toward Toppenish and Yakima Rivers . Irrigation system has shifted the groundwater hydrograph regime from its natural condition. Potential to restore more natural groundwater hydrograph

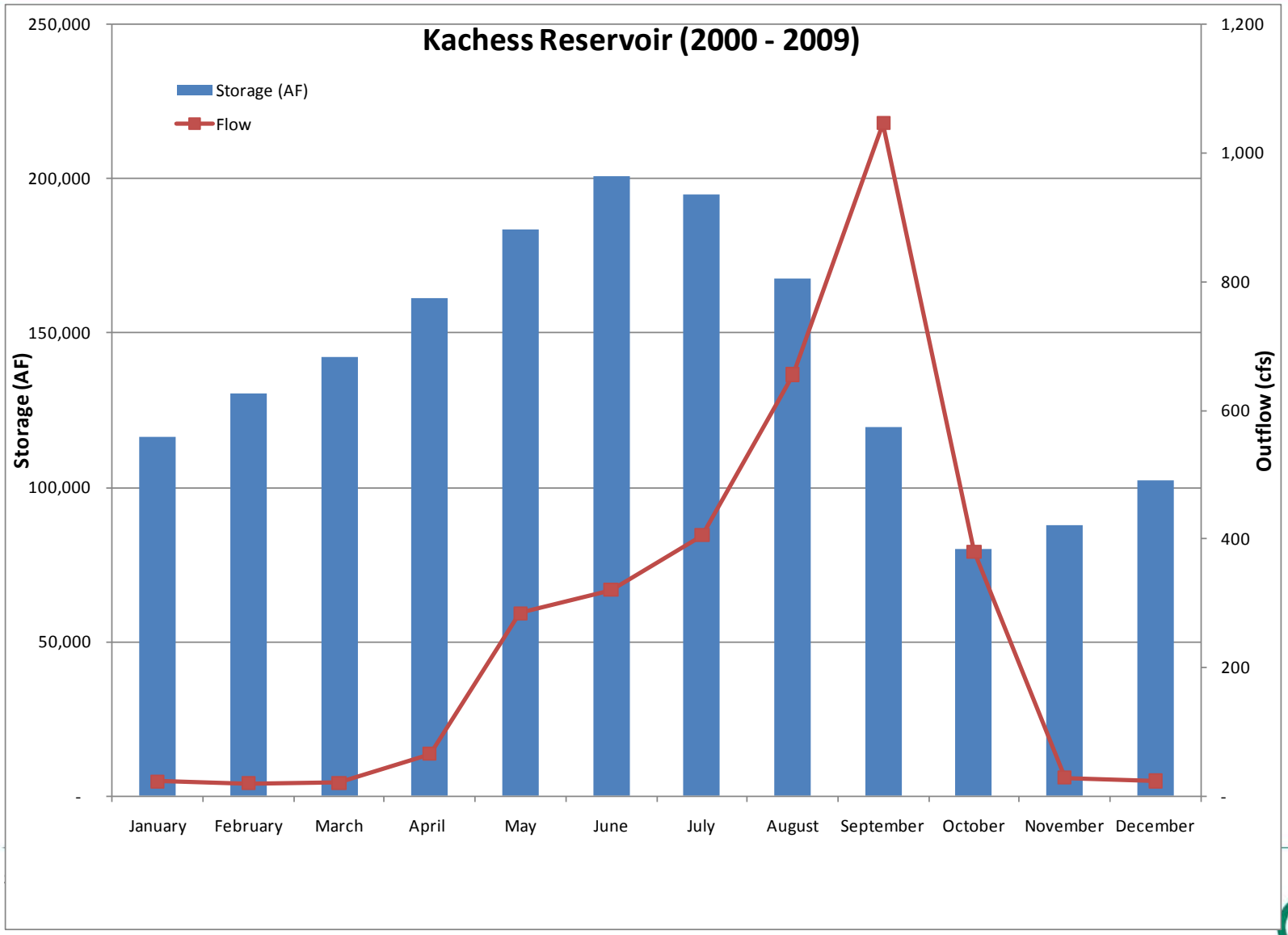
Four Questions….

1. How much can be infiltrated?
2. Where does the water go?
3. How much can be withdrawn and how?
4. What happens to TWSA?

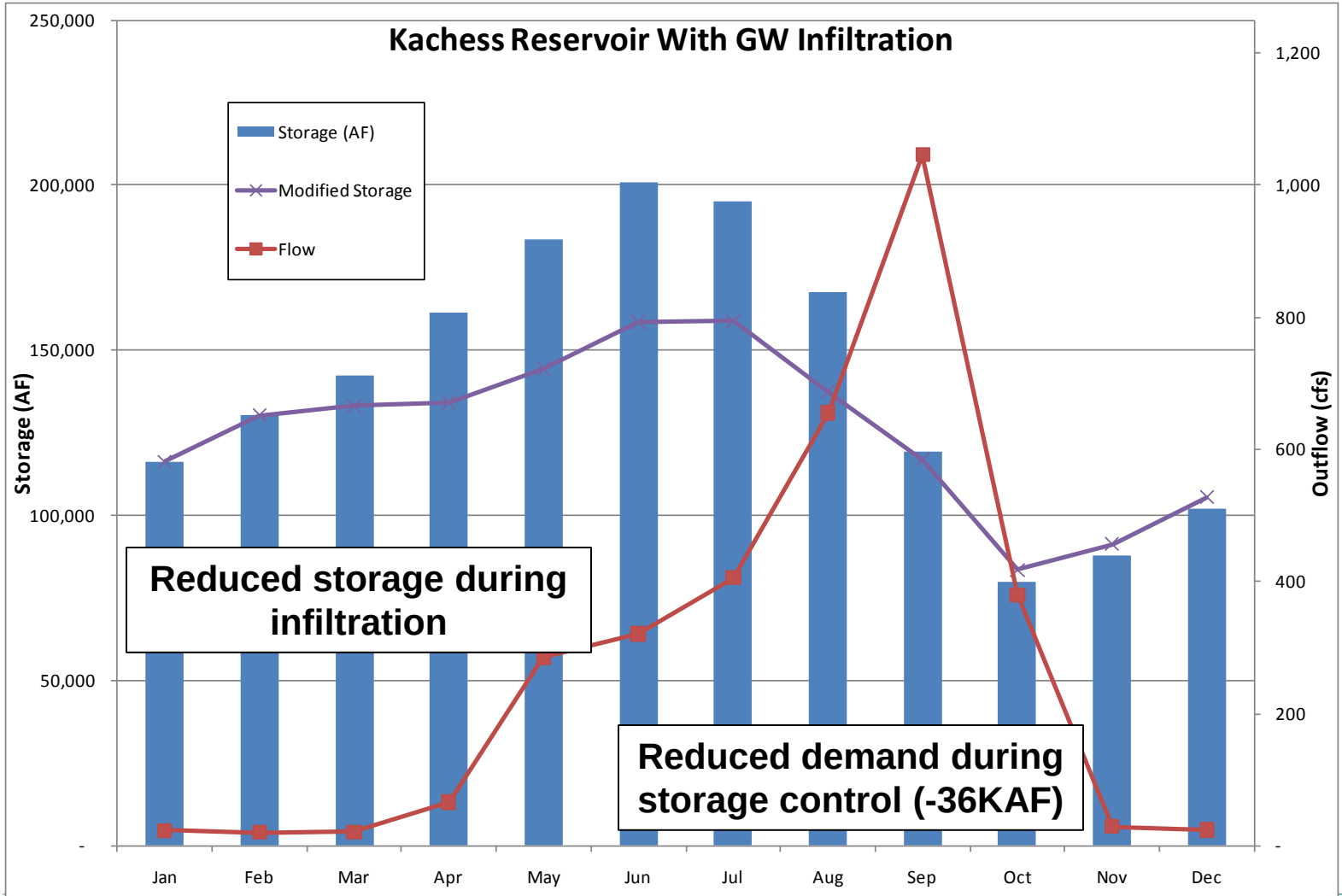
What happens to TWSA?

- Concept for Reservoir Response

Kachess Reservoir - Baseline



Storage Profile with 50KAF GW Infiltration



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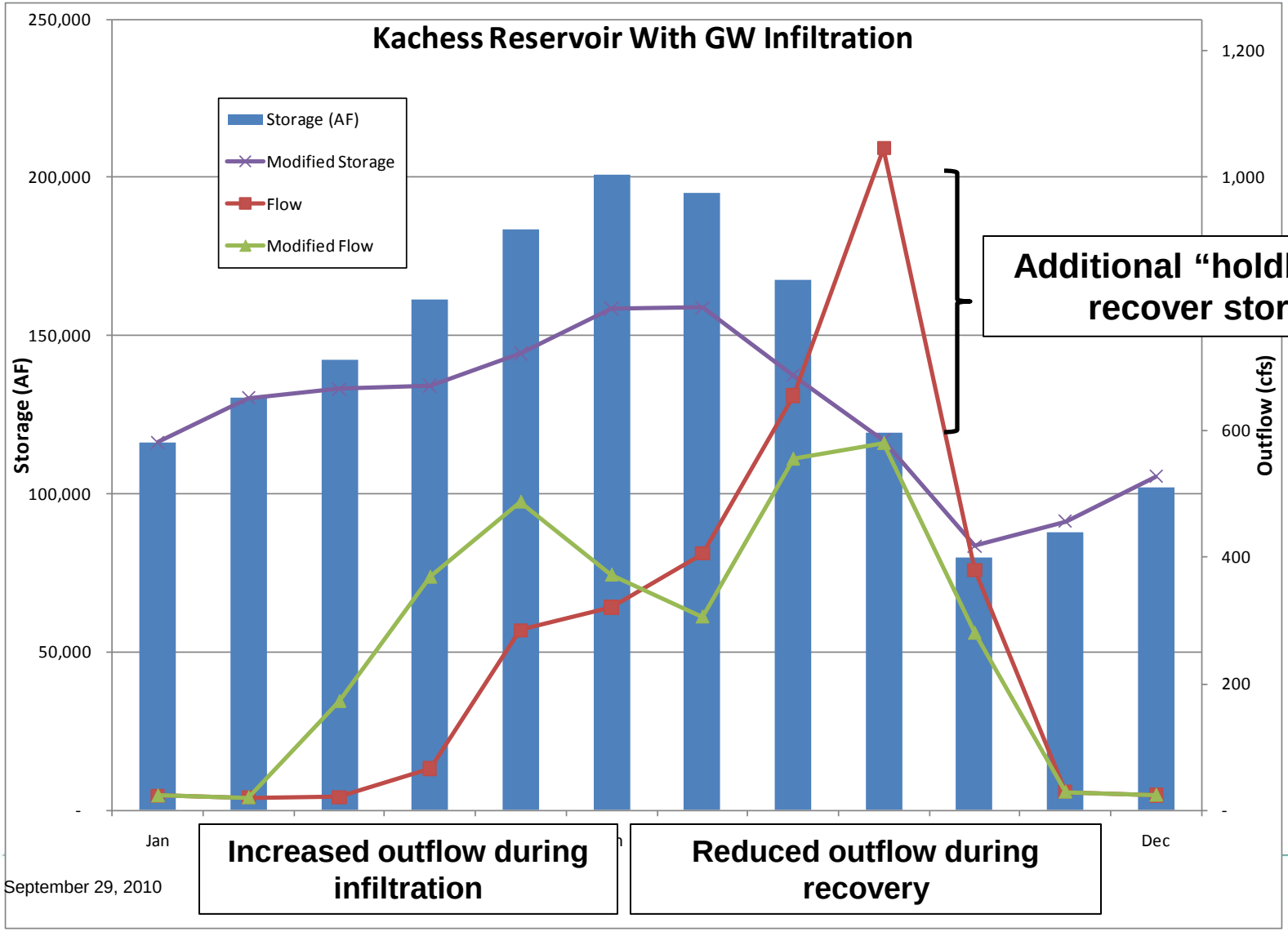
Outflow With 50KAF GW Infiltration



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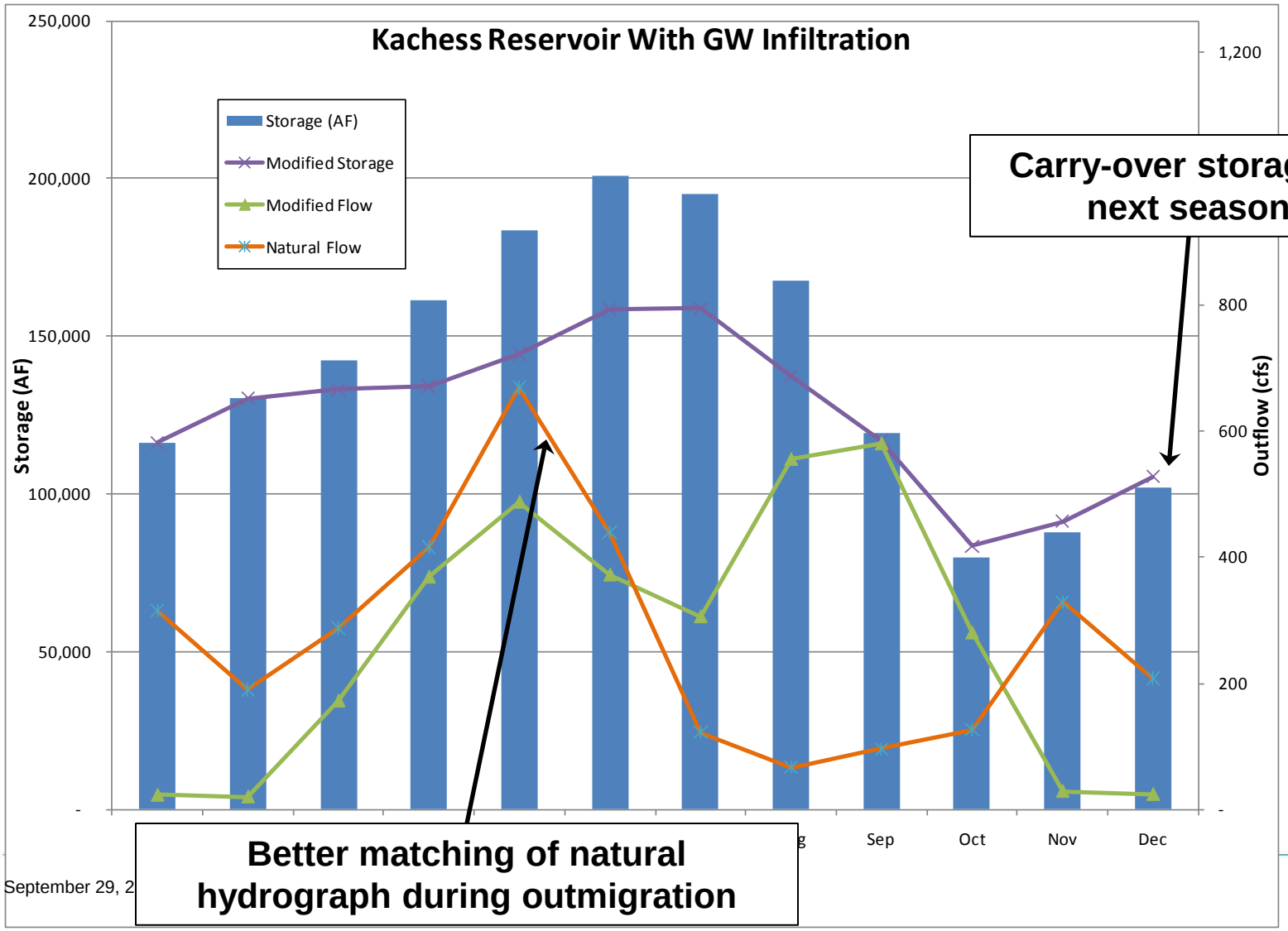
Natural Flow Matching



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Where does the water go?

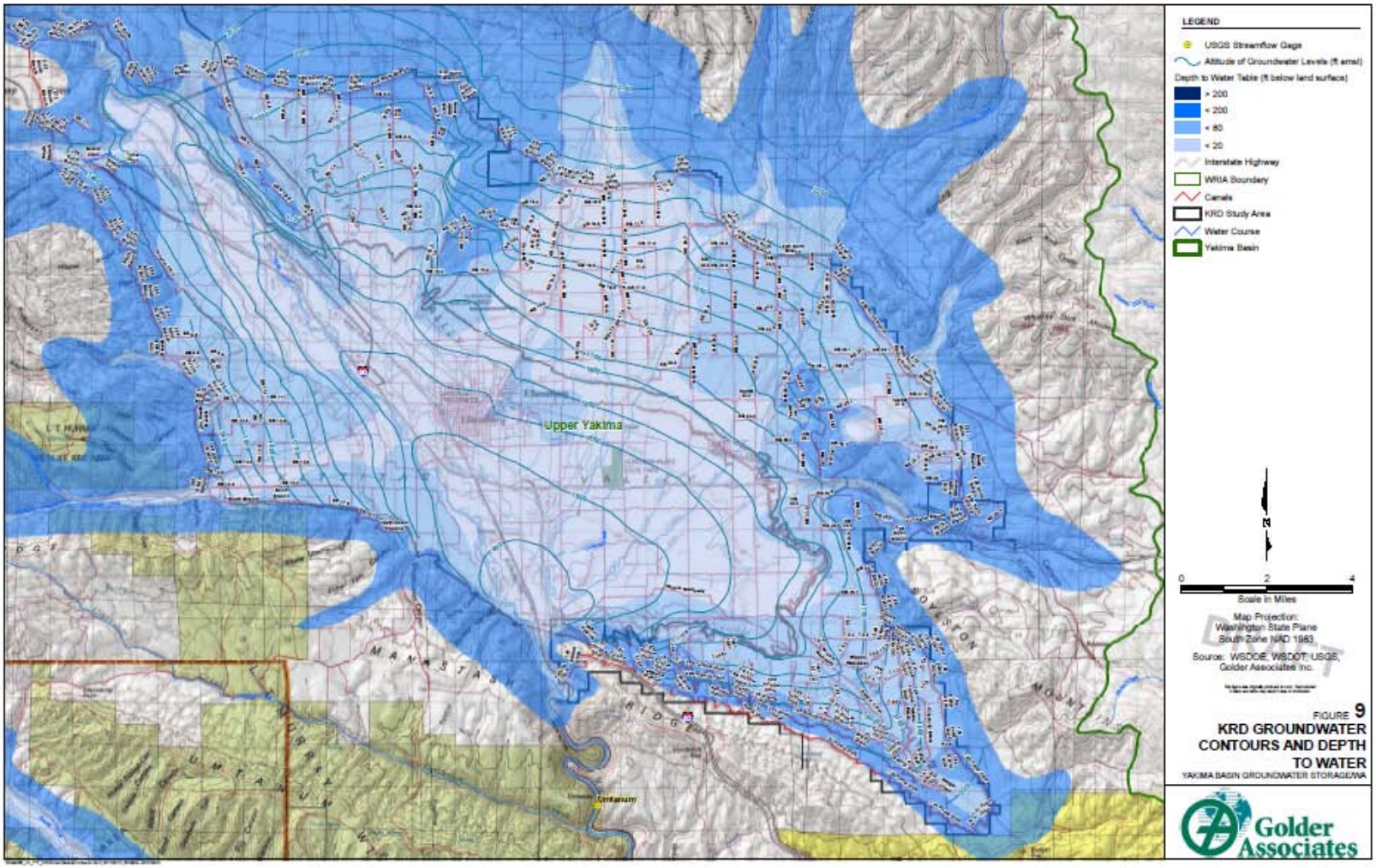
Storage and Flowpaths	Methods & Data

2. Storage
   A. Groundwater flow
   B. Aquifer Storage

- Hydrogeologic maps
- Geologic cross-sections
- Professional judgment

- Topographic maps
- Ecology Well logs
- USGS, 2009

Kittitas Groundwater Map (USGS, 2009)



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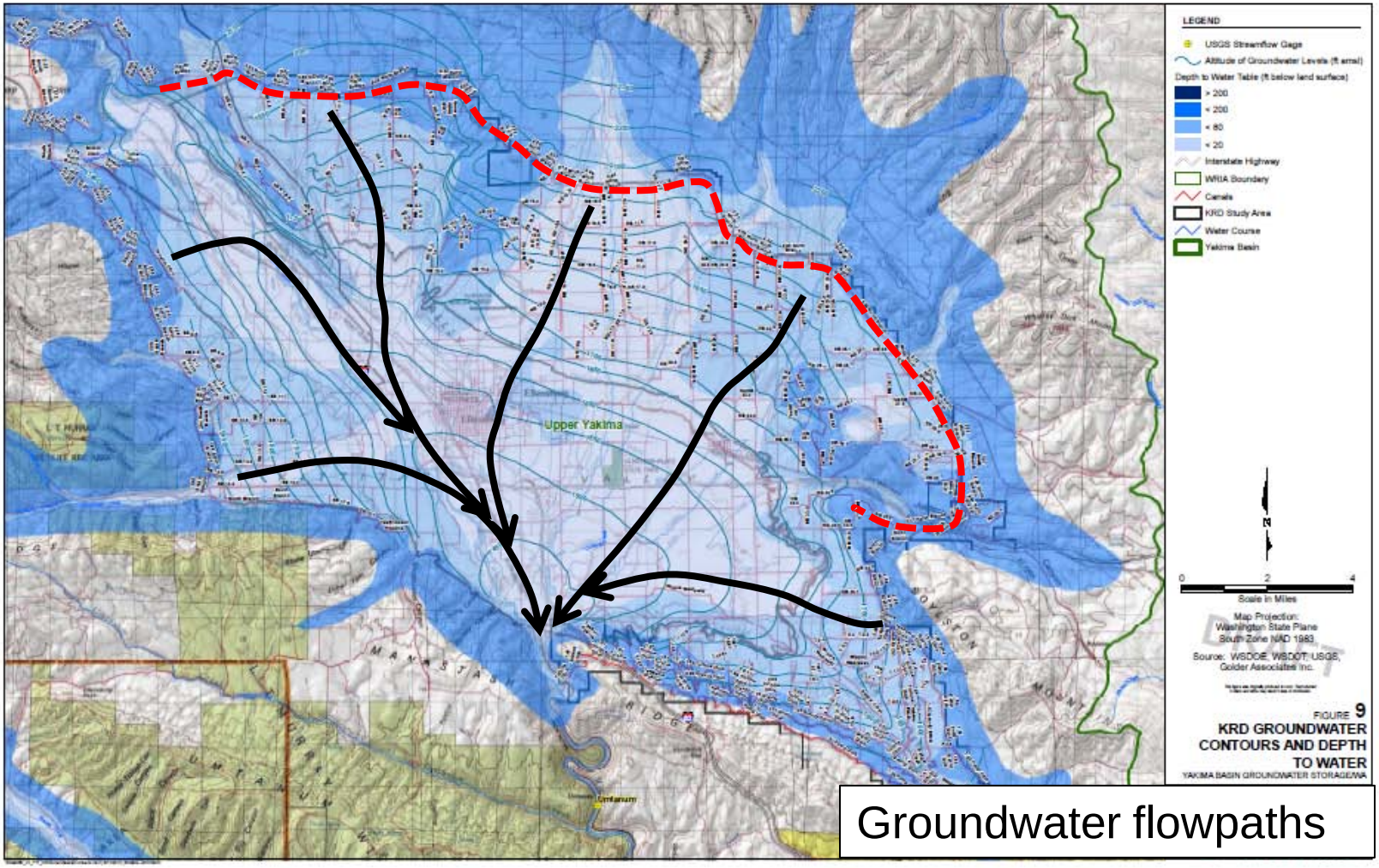
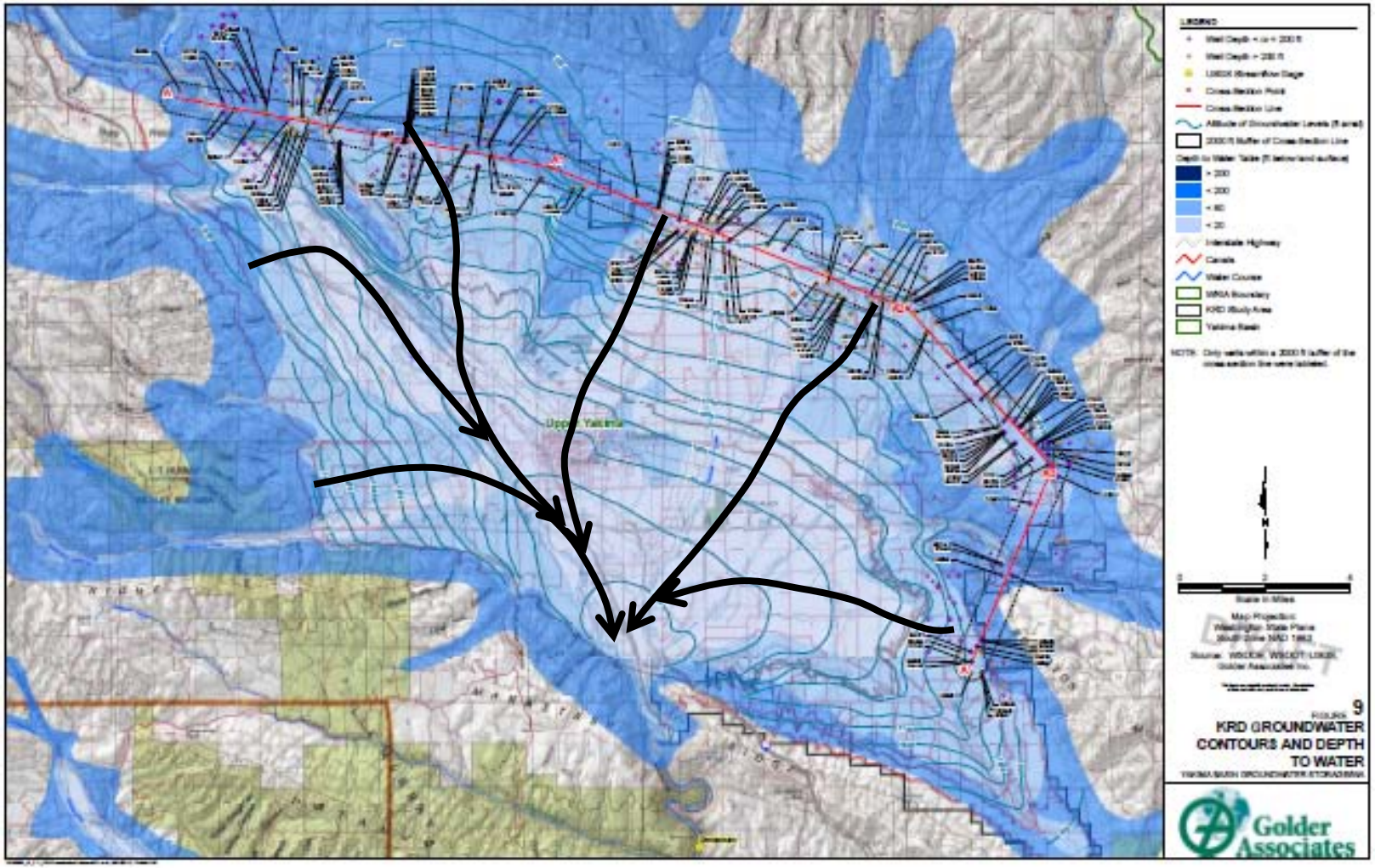
KRD Groundwater Flowpaths



KRD Well Logs



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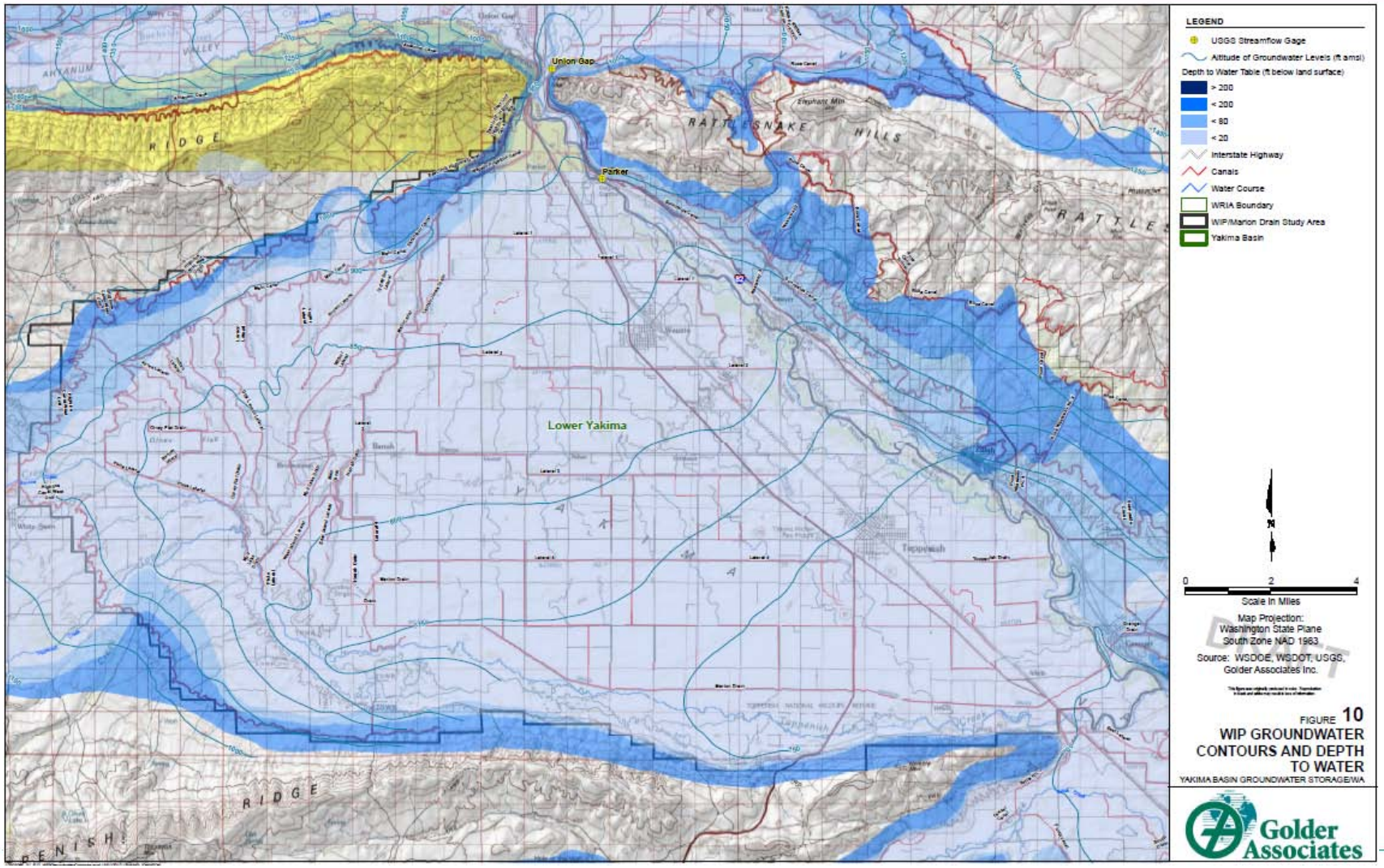
WIP Groundwater Map (USGS, 2009)



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WIP Groundwater Flowpaths

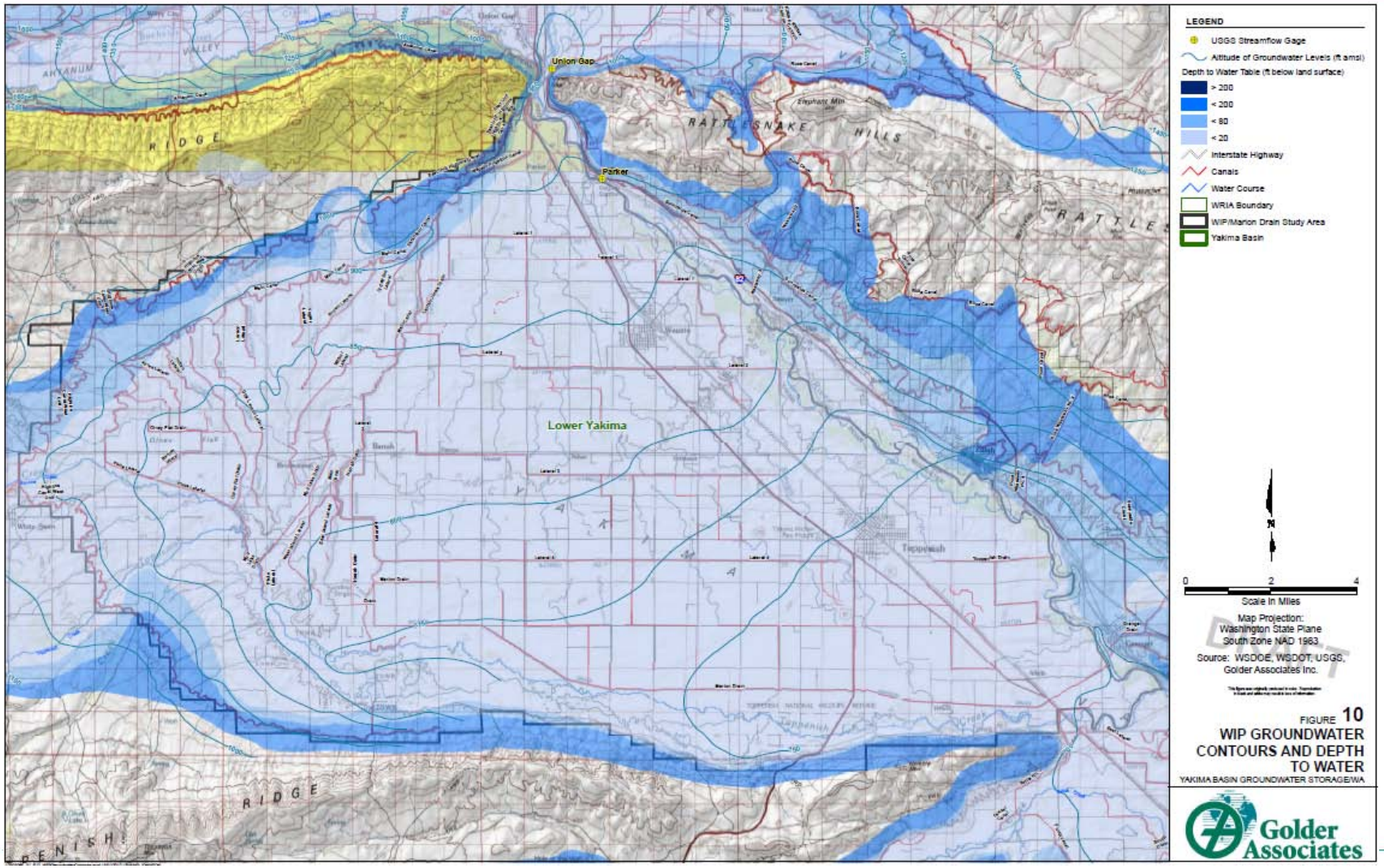

FIGURE 10
WIP GROUNDWATER CONTOURS AND DEPTH TO WATER
YAKIMA BASIN GROUNDWATER STORAGE/WA

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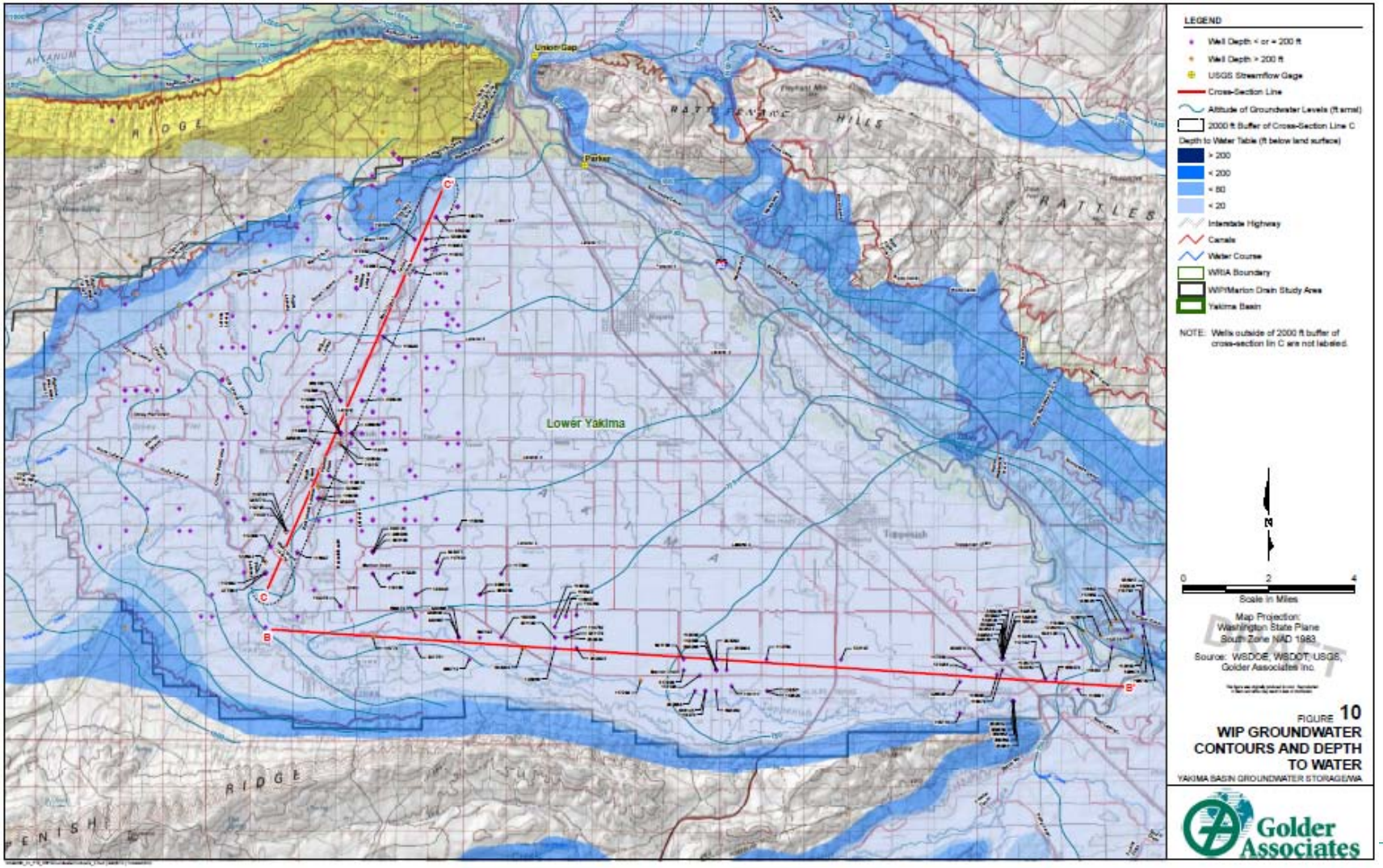
WIP Groundwater Flowpaths



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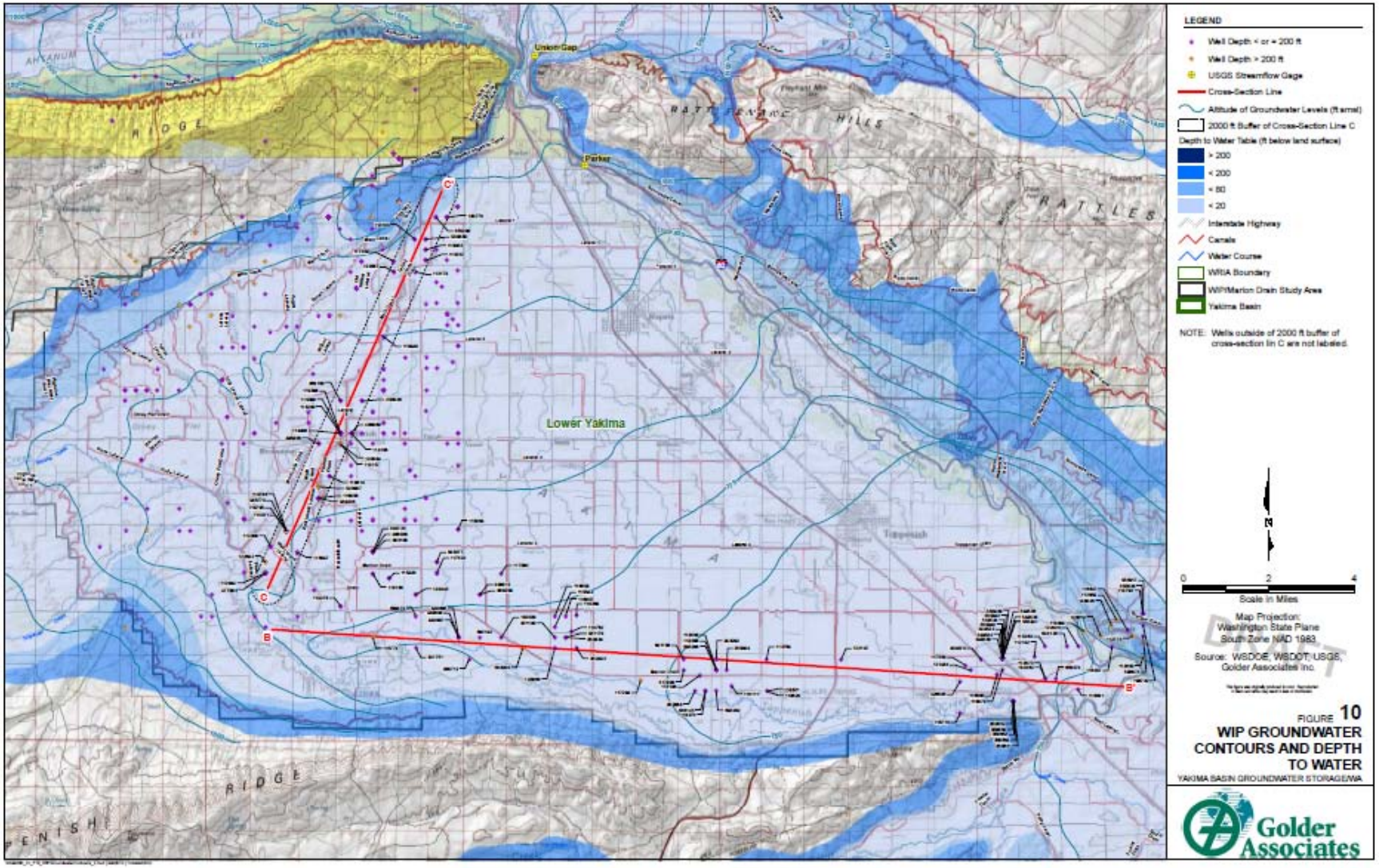
WIP Groundwater Flowpaths



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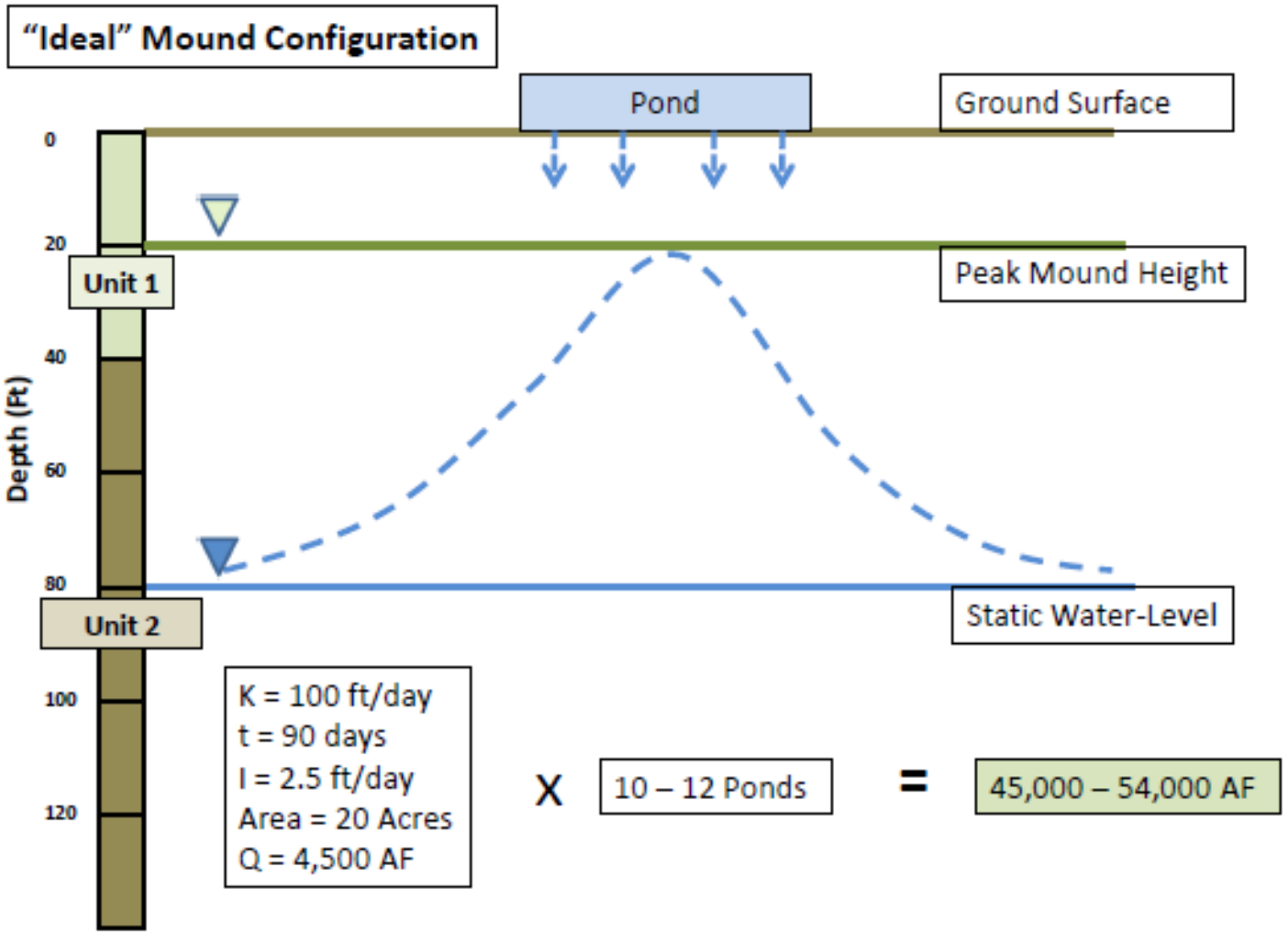
Where and How Much to Withdraw?

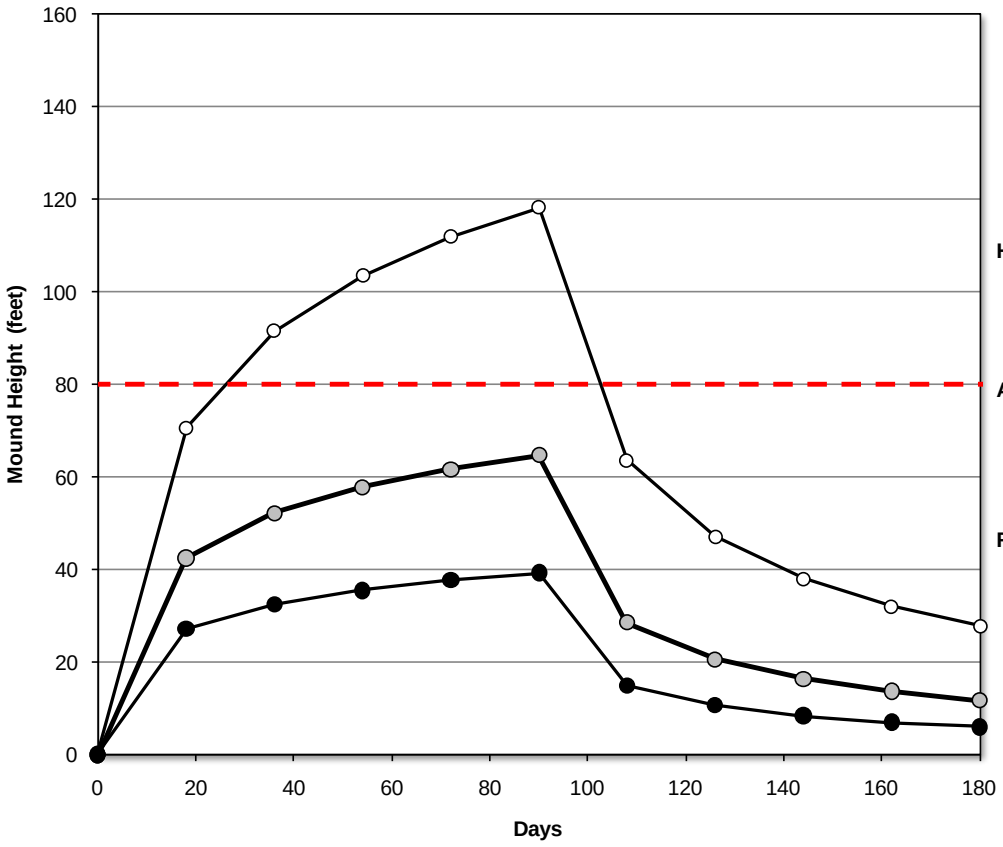
3. Mound Withdrawal
   A. Active (wells)
   B. Passive (canals)
   C. Downstream capture

- Management model is complex
  - Water balance and RiverWare
  - “Bucket” concepts

Groundwater Mounding – “Head on”



Groundwater mounding – versus time



Legend

- LOW
- MODERATE
- HIGH
- Maximum Height Allowed

Hydraulic Conductivities:
LOW = 20 ft/d
MODERATE = 50 ft/d
HIGH = 100 ft/d

Aquifer Properties:
Hydraulic Conductivity, K (see above)
Specific Yield, S_y = 0.30
Depth to Water = 80 feet
Initial Saturated Thickness, $h_{(0)}$ = 200 ft

Recharge Area Properties:
Infiltration Rate = 2.5 ft/d
Simulation Time, t = 180 days
Recharge Duration, $t_{(0)}$ = 90 days
Length in x direction: 600 ft
Length in y direction: 360 ft
Total area: 20 ACRES

Golder Associates	Title: Mounding Results for 20-Acre Pond with 200 feet Saturated Thickness		Drawn: DH
	Project Name: Yakima Infiltration	Project No.: 103-93060	Checked:
	Client Name:	Date: September 22, 2010	Reviewed:
			FIGURE 6

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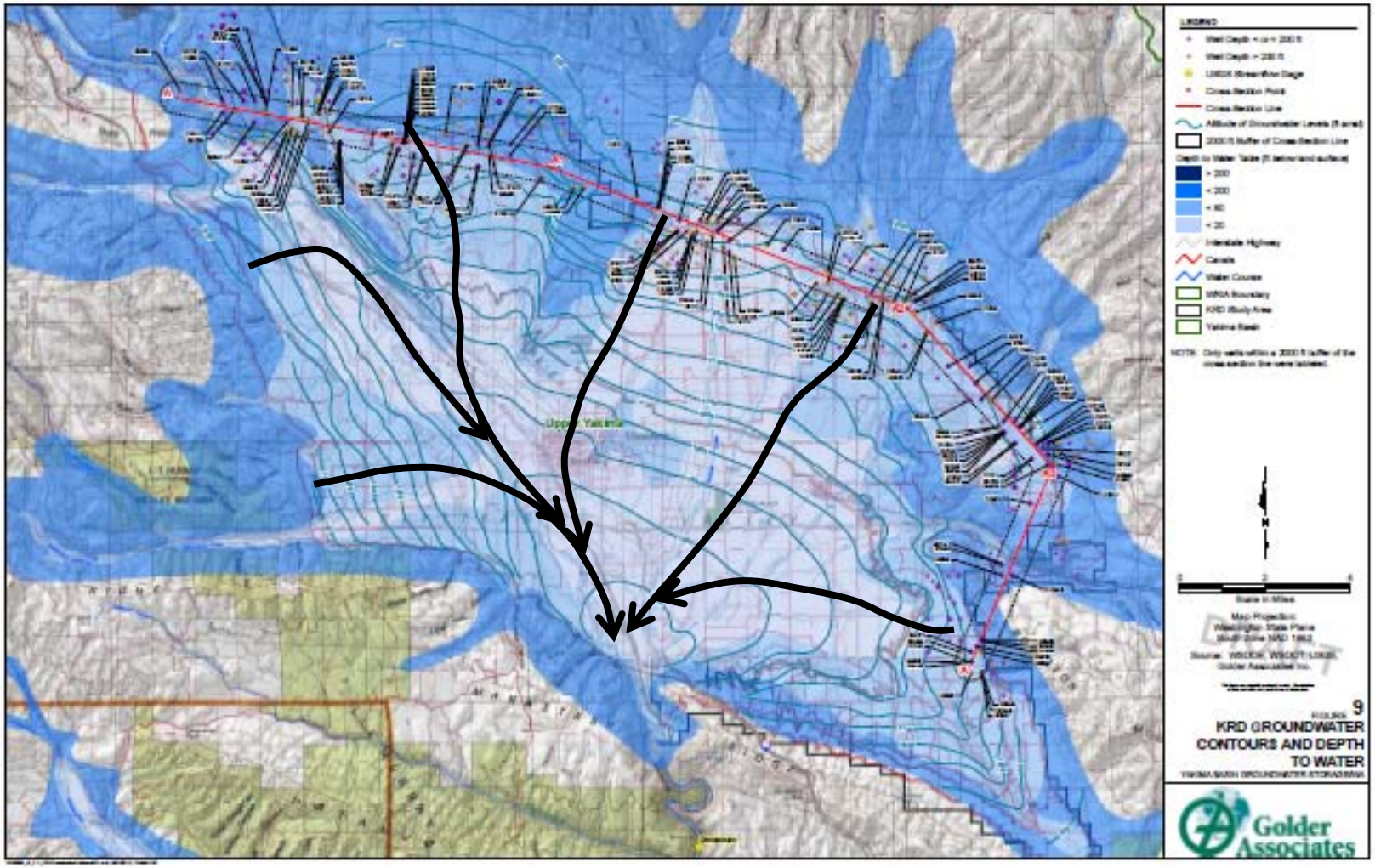
Flow lines……



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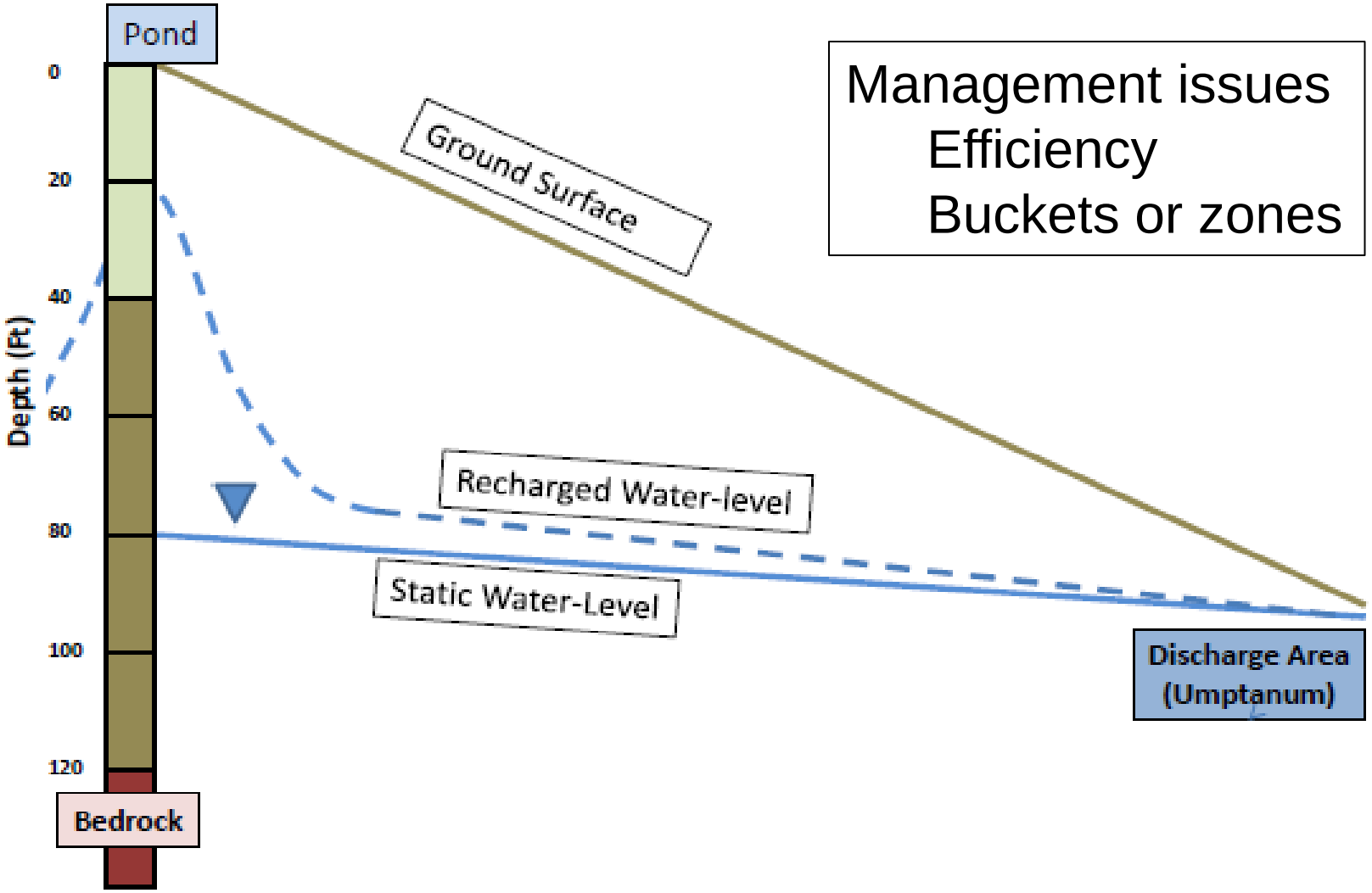
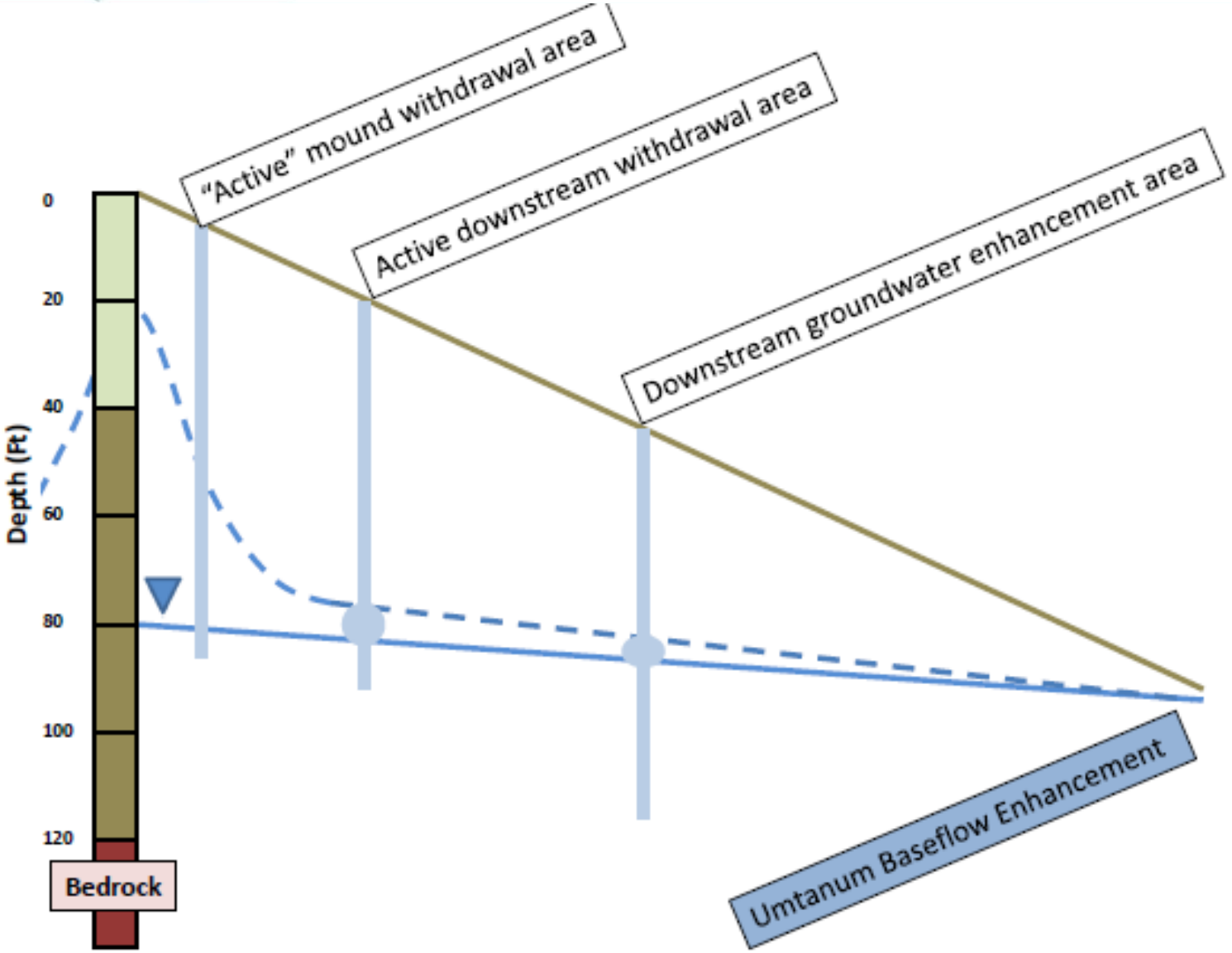
Groundwater mounding – along flowpath



Management issues
- Efficiency
- Buckets or zones

Recovery Areas



Pilot Test Program

- KRD - Gravels
  - Geologic and hydraulic testing of gravels
    - Testing of existing wells
    - Installation of new wells
  - Field test of infiltration & mounding
    - 2 sites of at least 1 acre each (land agreements)
      - Naneum creek, Badger pocket
  - Modeling (USGS model and analytical flowpath)
    - Mound build-up/decay & flow paths (multi-year)
    - Extraction scenarios
  - Develop and test management model

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Pilot Test Program

- KRD – Basalt interbeds
  - Geologic characteristics and hydraulics
    - Field mapping and testing of existing wells
  - Flowpath characterization
    - Basalt – Gravel connections
    - Regional basalt flowpaths (to lower basin areas)
  - Benefits assessment
    - TWSA
    - Regional flow

Pilot Test Issues

- WIP
  - Geologic and hydraulic testing
    - Testing of existing wells
    - Installation of new wells
  - Field test of infiltration & mounding
    - 2 sites of at least 1 acre each (land agreements)
    - “hourglass” area
  - Modeling (USGS model and analytical flowpath)
    - Mound build-up/decay & flow paths (multi-year)
    - Extraction scenarios
  - Develop and test management model

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Next Steps

- Draft Tech Memo (including costs)
- RiverWare Simulations
- Pilot Test Plan
- Cost Analysis

Questions