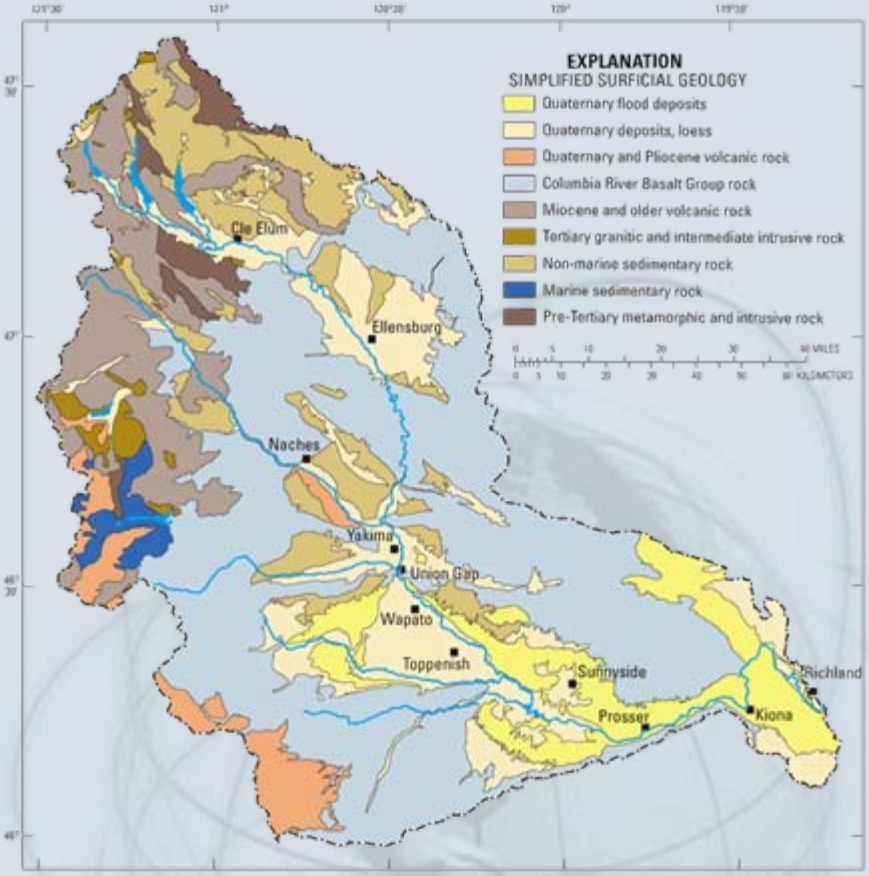
Groundwater Storage Assessments for the Yakima Basin

Golder Associates

Overview

- Draft EIS:
  - Surface recharge in alluvium
  - Municipal ASR in clastic formations
- Final EIS
  - Surface recharge in alluvium
  - Municipal ASR in clastic formations
  - Large scale ASR in Basalts



© Copyright 2007 Golder Associates Inc., All Rights Reserved

Aquifer Systems and Recharge Options

Alluvium

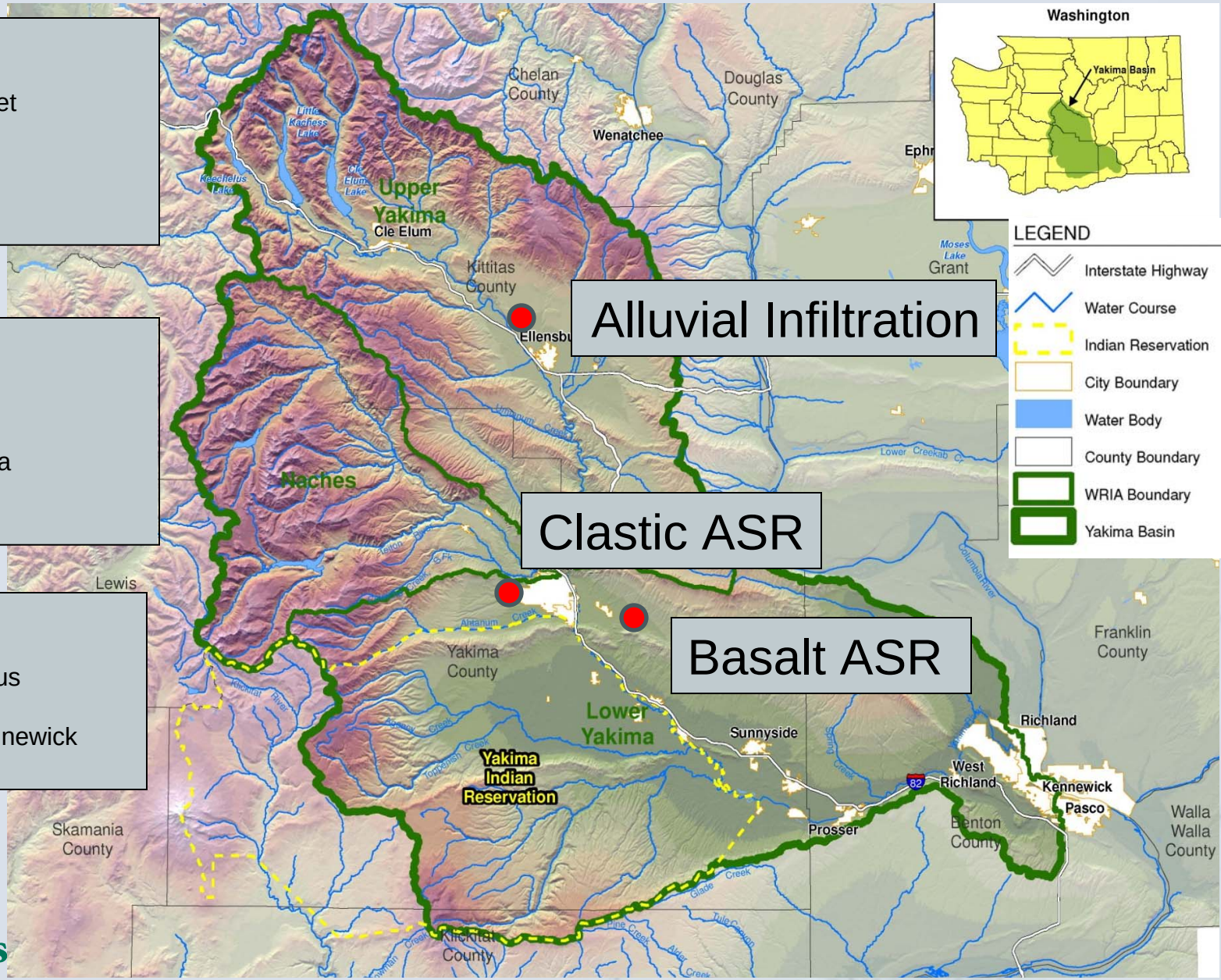
Surface infiltration Target
Upper River Focus;
- Ellensburg
- Toppenish

Clastics

Municipal ASR Target
Mid-River Focus
Ellensburg Fm. - Yakima

Basalt

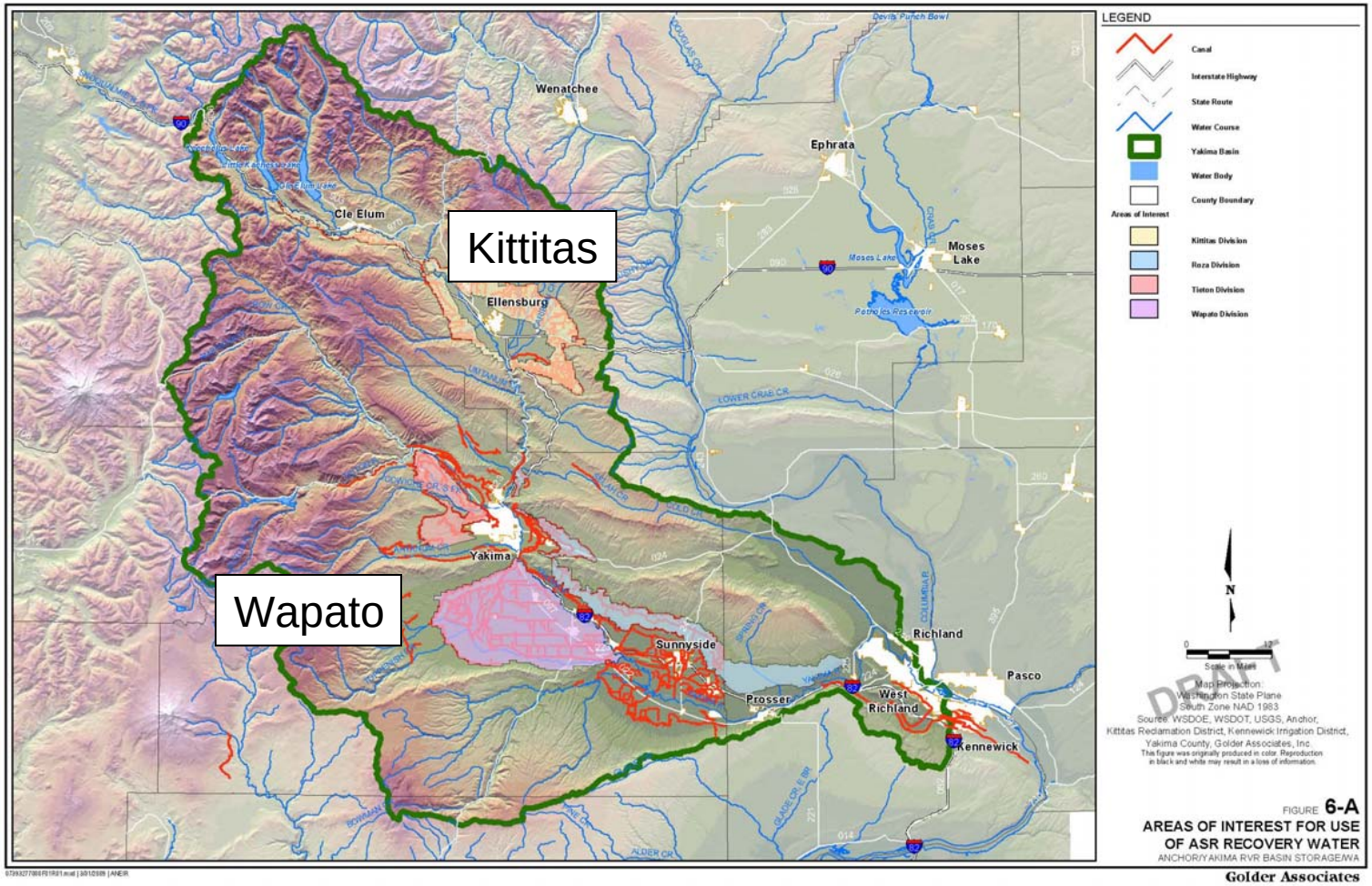
Mid to Lower River Focus
Ag ASR Target - Roza
Muni ASR Target – Kennewick
Grand Ronde Basalts



Golder Associates

Infiltration and Return Flow Target Areas

Objective : Passive return flow to streams

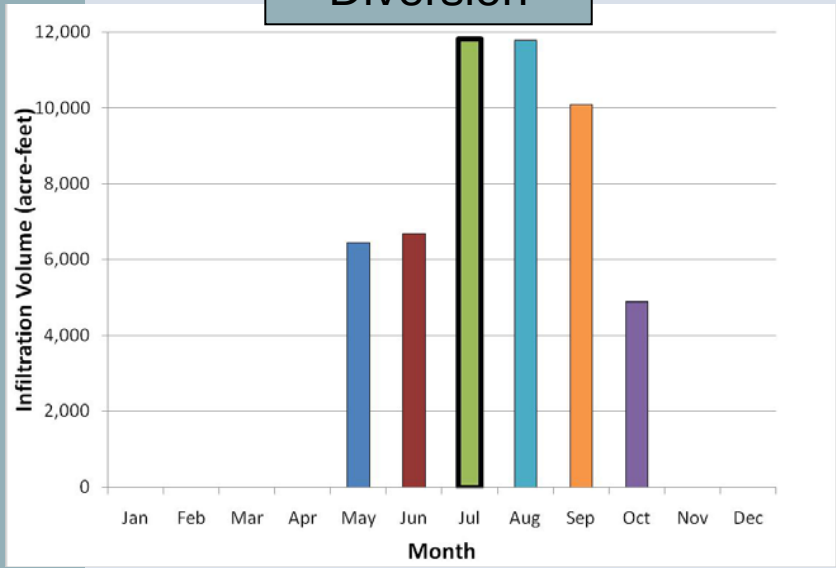


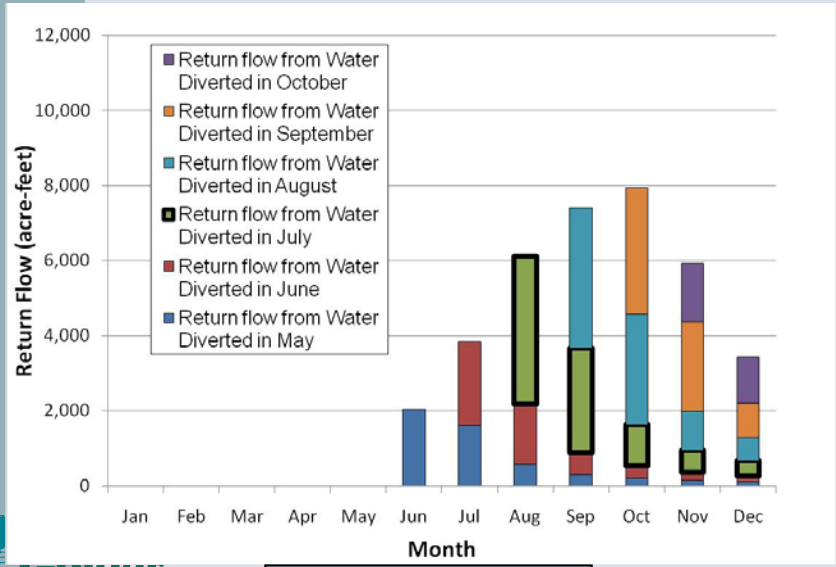
Golder Associates

© Copyright 2007 Golder Associates Inc., All Rights Reserved

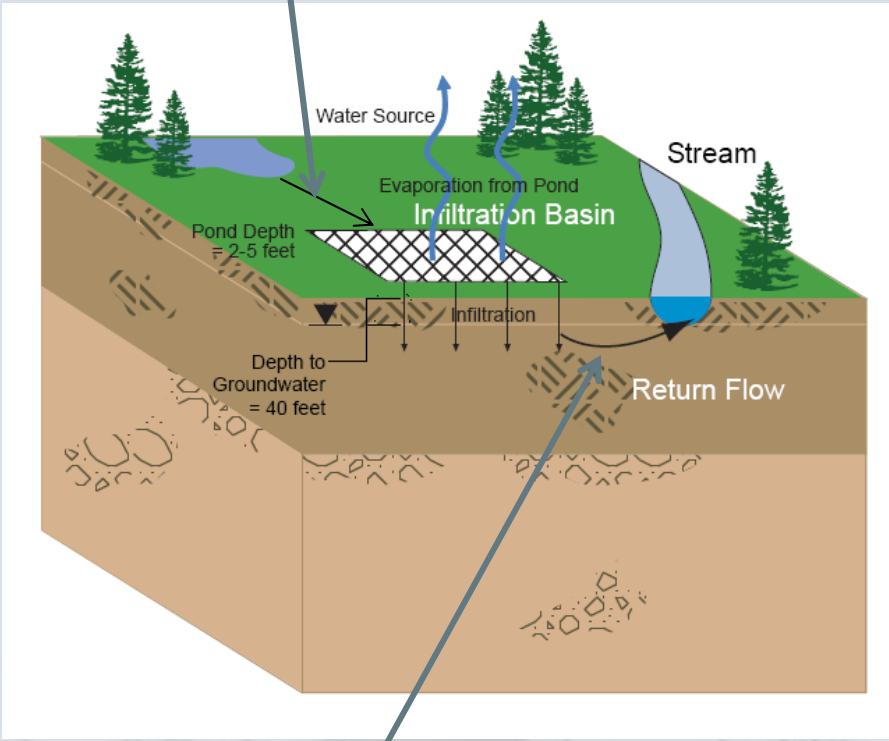
Alluvial Return Flow Profiles

Diversion





Return Flow



© Copyright 2007 Golder Associates Inc., All Rights Reserved

Surface Infiltration Evaluation

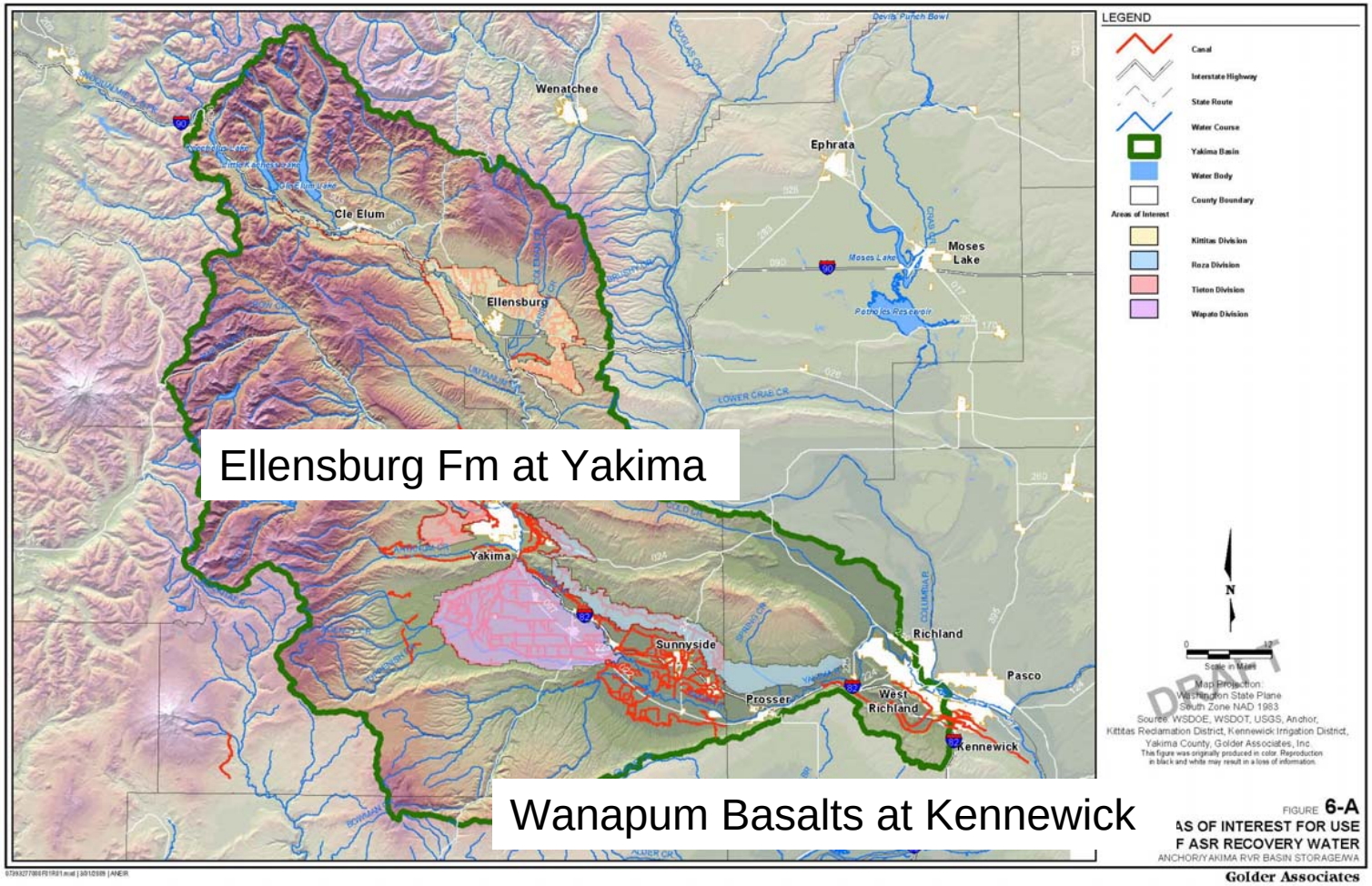
- SDF methodology – return flow timing and volume
  - 10,000 AF application (when “available”)
  - Typical alluvial characteristics
- Review land cover – area available
- Highest volume of passive return flow to streams
- Limited dry year return flow
- Large land requirements & operational issues

Golder Associates

© Copyright 2007 Golder Associates Inc., All Rights Reserved

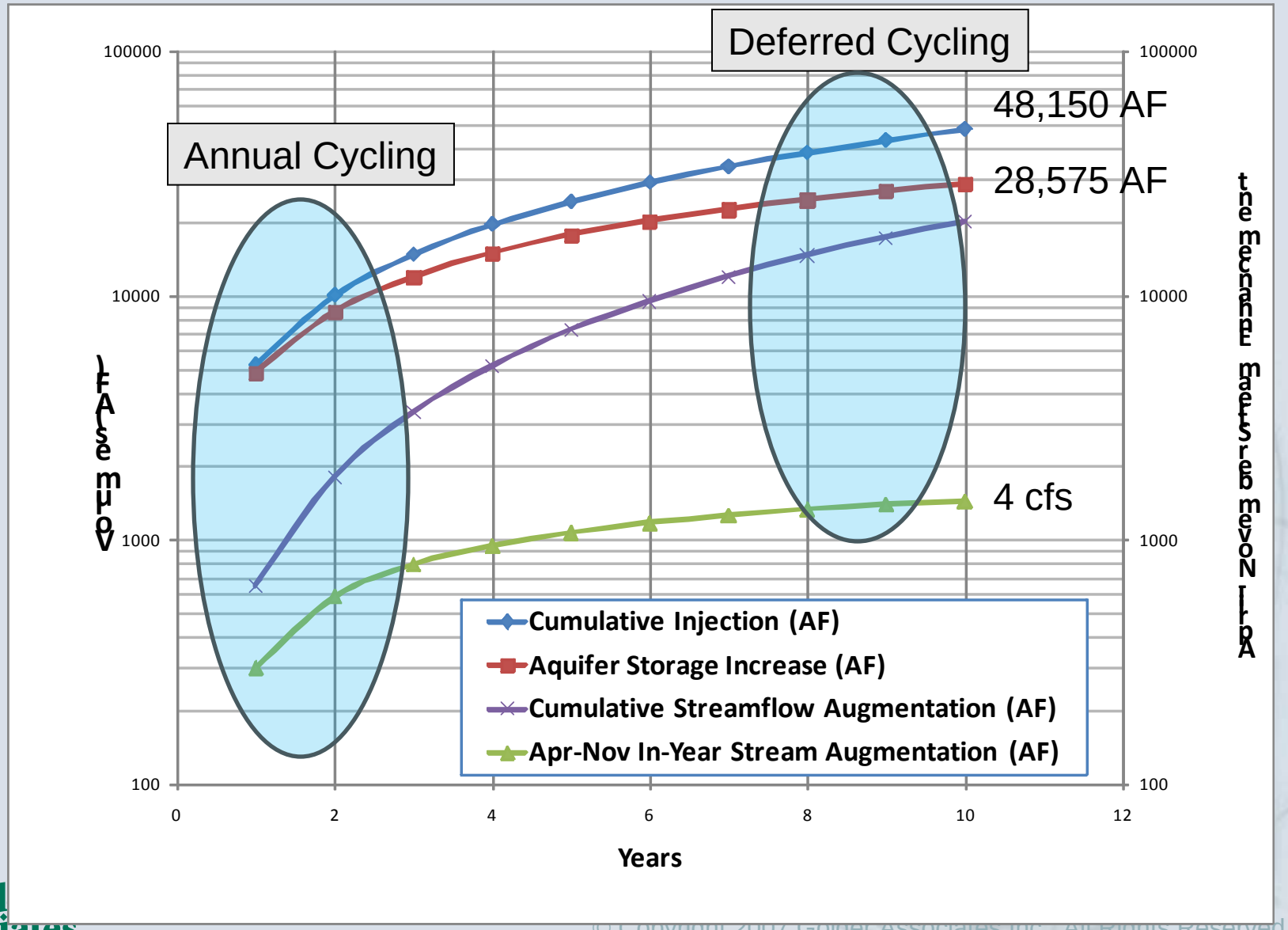
Municipal ASR Target Areas

Objective : Direct municipal supply



© Copyright 2007 Golder Associates Inc., All Rights Reserved

Yakima ASR



© Copyright 2007 Golder Associates Inc., All Rights Reserved

Contrasting Recovery Approaches

- Annual Recovery
  - Recovery efficiency is high and most of the previous years water can be recovered (92%)
  - Minor increases in Yakima River flows
- Deferred Recovery
  - Total recoverable amount of water is larger (good drought management tool), but at decreasing efficiency over time
  - Accumulated and “in-year” increases in Yakima River flows are higher (good stream mgmt tool)
  - 7-10 years to get to asymptotic portion of stream enhancement curve

Golder Associates

© Copyright 2007 Golder Associates Inc., All Rights Reserved

Municipal ASR

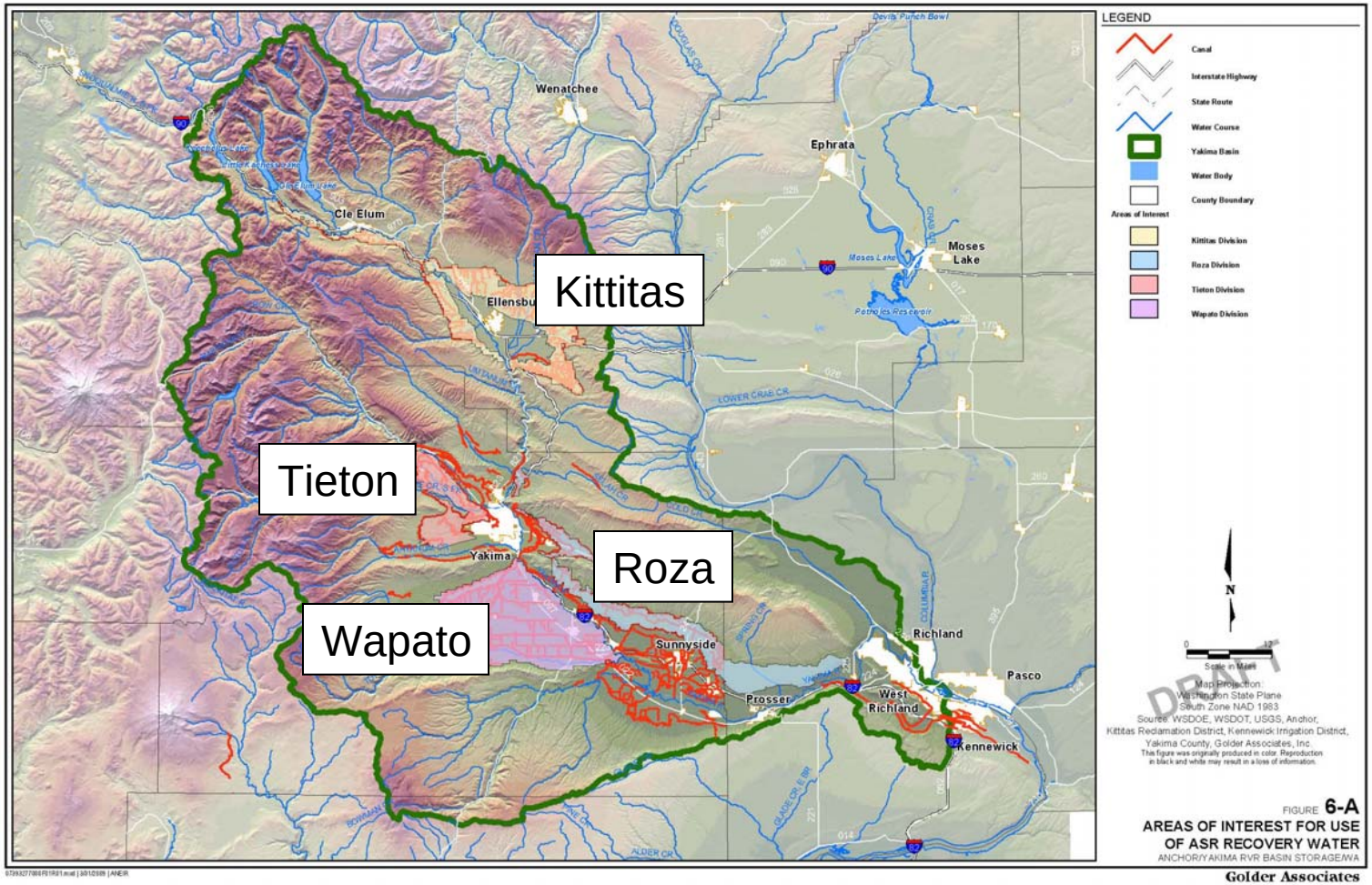
- Banking:
  - Approximately 2X storage volume
  - Increases flow augmentation (>10K cfs/10y)
  - Total recoverable amount of water is larger (good drought management tool), but at decreasing efficiency over time
  - 7-10 years to get to asymptotic portion of stream enhancement curve
- Annual Cycling:
  - Flow augmentation around (4 cfs/10y)
  - Recovery efficiency is high and most of the previous years water can be recovered (92%)

Golder Associates

© Copyright 2007 Golder Associates Inc., All Rights Reserved

Regional ASR Target Areas

Objective : Direct agricultural supply



© Copyright 2007 Golder Associates Inc., All Rights Reserved

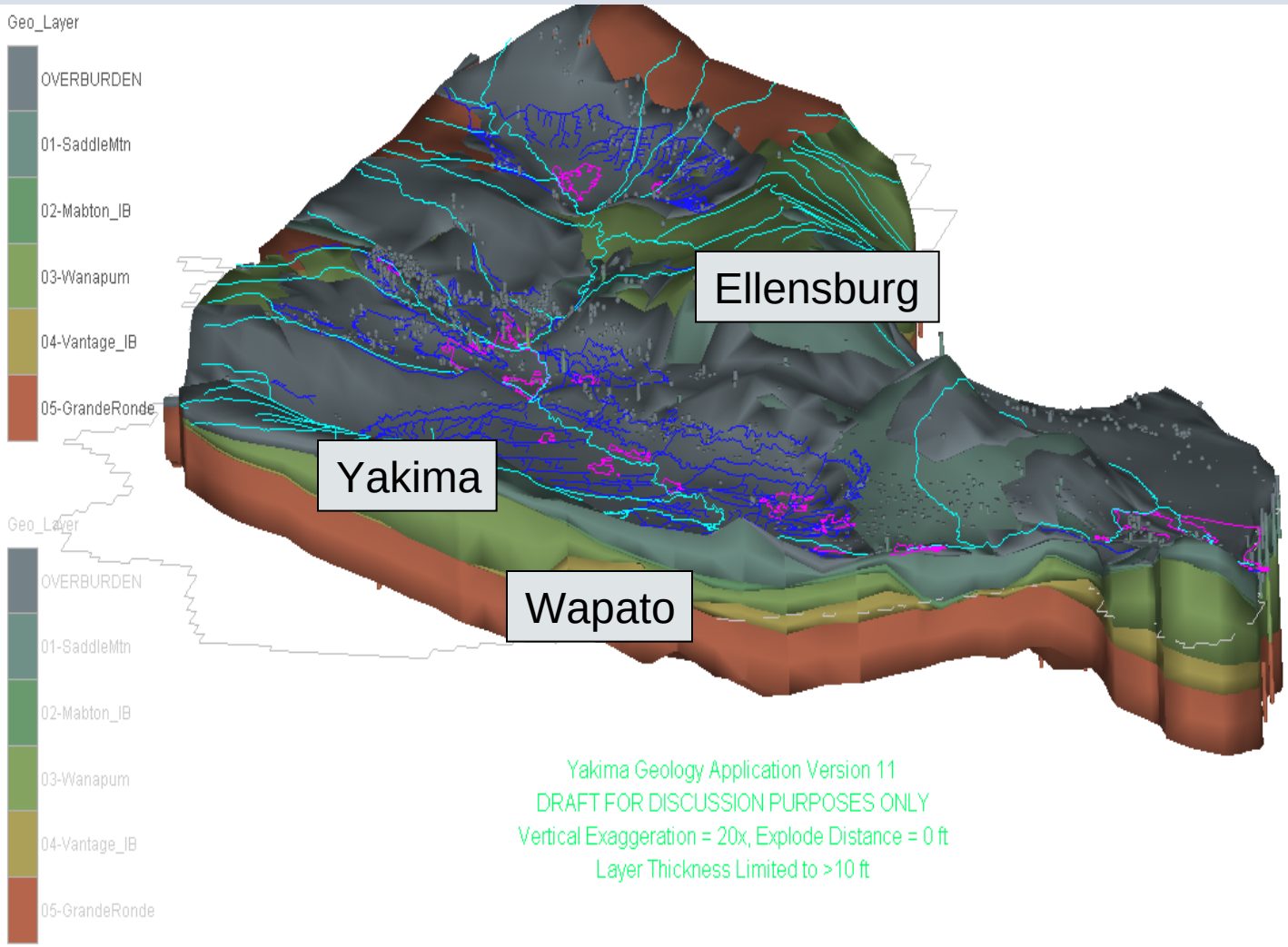
Regional ASR Issues

- Geologic Structure
- Well Capacity
- Aquifer Properties
- Wellfield Design and Interference
- Conveyance
- Treatment requirements
- Water Availability
- Water Quality

Golder Associates

© Copyright 2007 Golder Associates Inc., All Rights Reserved

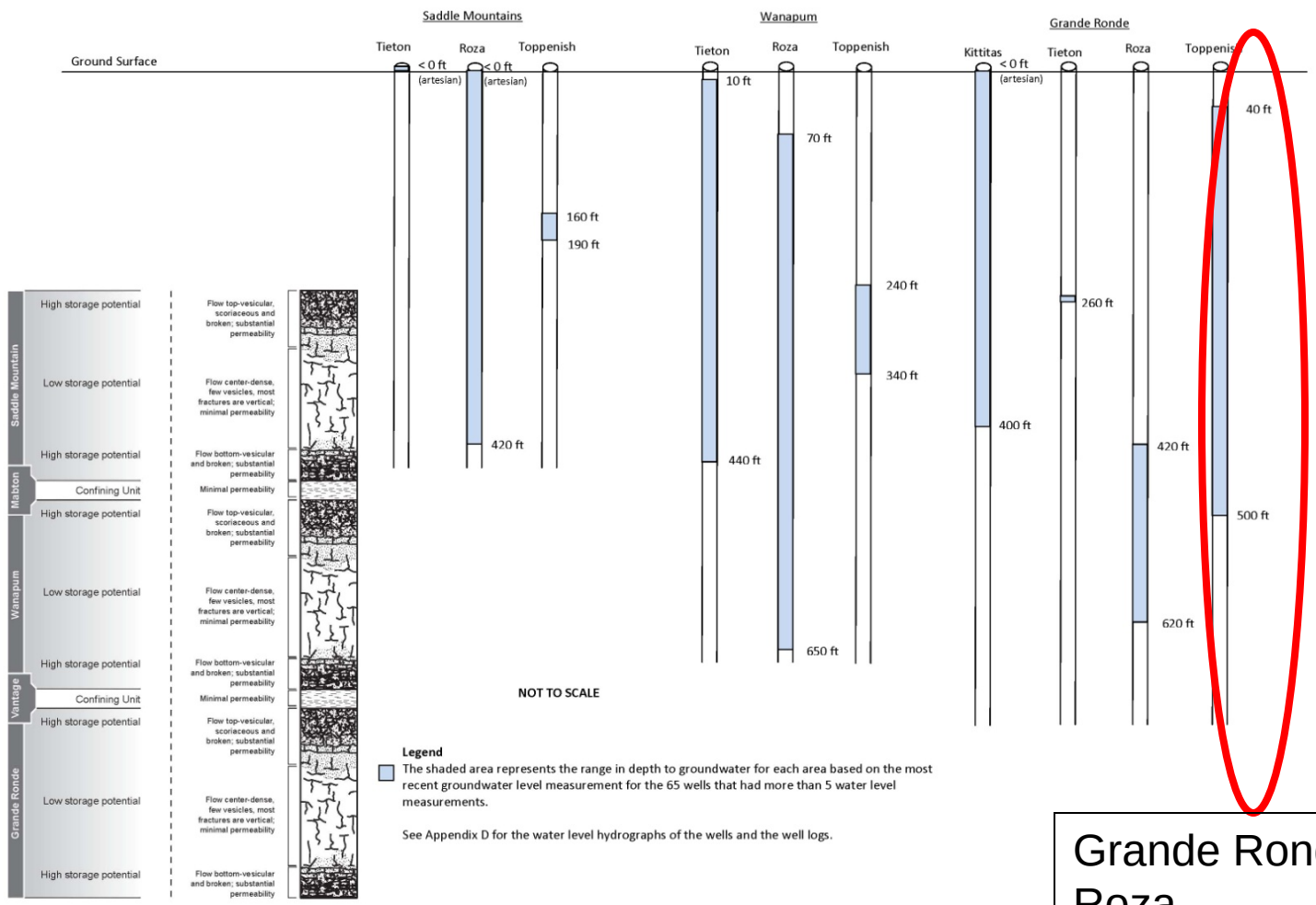
Yakima Basalt Geologic Structure



Golder Associates

© Copyright 2007 Golder Associates Inc., All Rights Reserved

Basalt Water-Levels



Grande Ronde
Roza

© Copyright 2007 Golder Associates Inc., All Rights Reserved

Well Capacity and Buildup

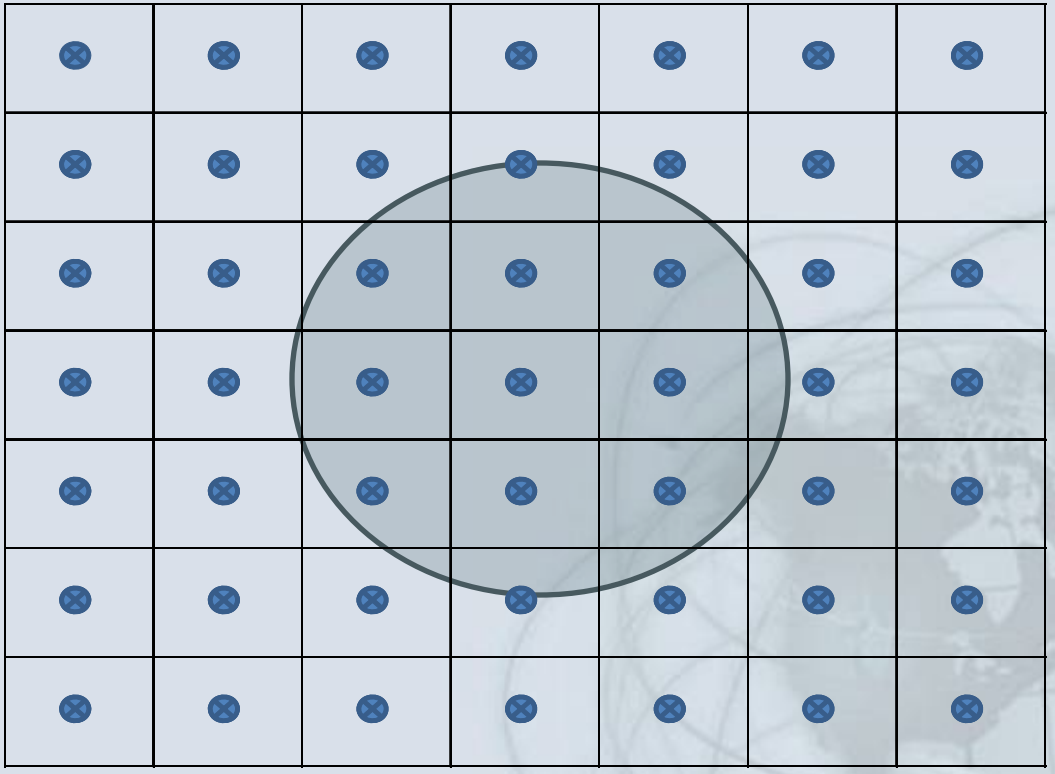
- Used USGS aquifer property measurements.
- Well capacity based on reported short term specific capacity tests on 36 wells.
- Predicted build-up using 2,500 gpm injection rate:
  - Maximum : >1,000 ft
  - Average : 473 ft
  - Median : 171 ft
  - Minimum : <20 ft

Golder Associates

© Copyright 2007 Golder Associates Inc., All Rights Reserved

Conceptual Wellfield Design

Wellfield

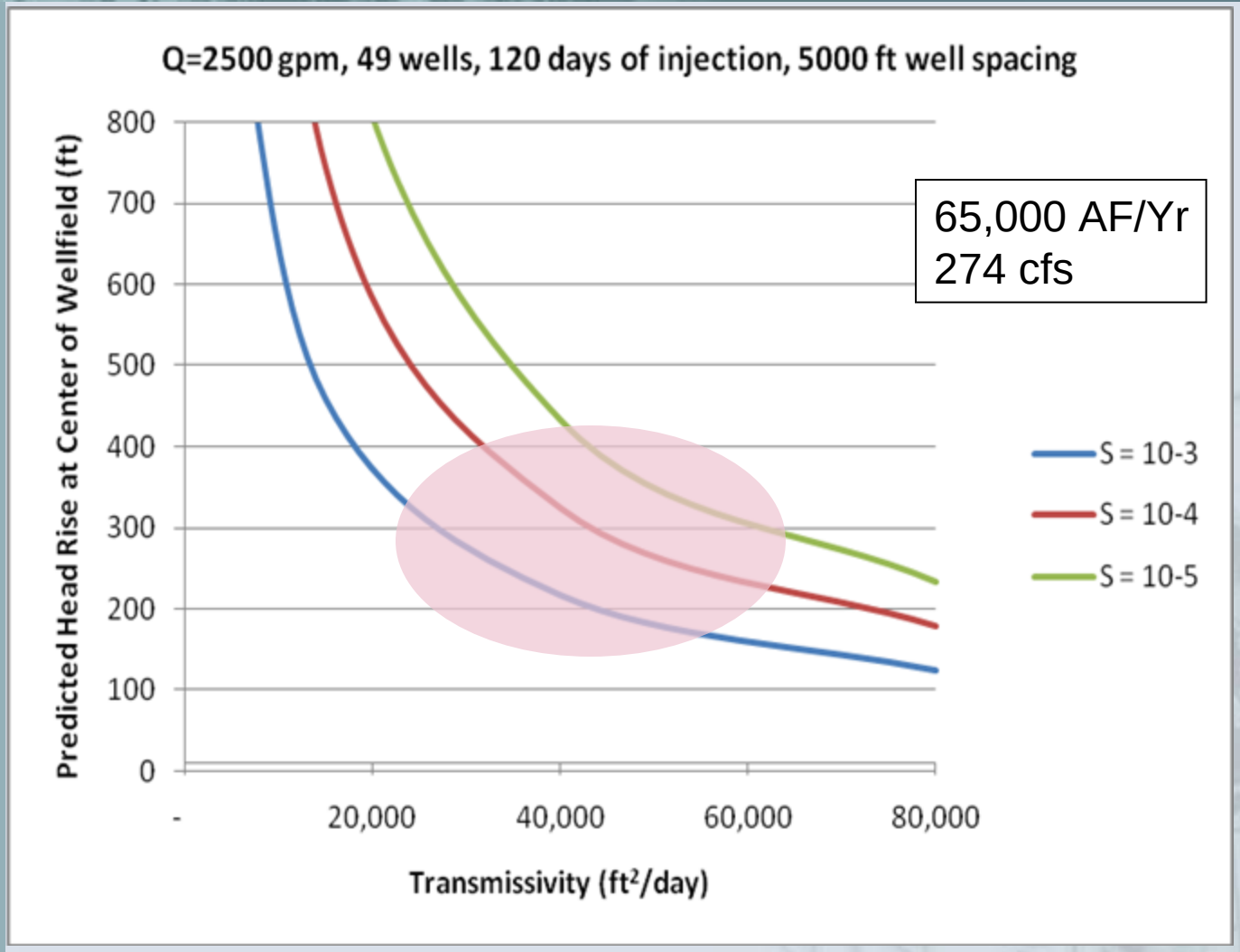


Over a range of aquifer parameters, a wellfield should see appx. 200 to 400 feet of buildup. 400 to 600 available at Roza.

Golder Associates

© Copyright 2007 Golder Associates Inc., All Rights Reserved

Conceptual Wellfield Design



Over a range of aquifer parameters, a wellfield should see appx. 200 to 400 feet of buildup. 400 to 600 available at Roza.

Golder Associates

© Copyright 2007 Golder Associates Inc., All Rights Reserved

Option Summary

- Surface Infiltration
  - 10,000 AF/Yr
  - Limited dry year return flow
  - Large land requirements & operational issues
- Municipal ASR
  - 6,000 AF/Yr
  - Indirect return flow & avoided diversions
  - Annual vs delayed use & WTP constraints
- Regional/Irrigation ASR
  - >60,000 AF/yr per well field
  - Replace/enhance agricultural diversions
  - Complex/costly infrastructure and operations

Golder Associates

© Copyright 2007 Golder Associates Inc., All Rights Reserved

Conclusions

- EIS Level Information is sufficient – a good foundation for further investigation
- More detailed feasibility testing is necessary for all alternatives
- Additional modeling of ASR alternatives may be beneficial

Golder Associates

© Copyright 2007 Golder Associates Inc., All Rights Reserved

Approach

- Identify one or more objectives, develop demonstration projects to address prioritized objectives:
  - Aquifers
  - Sources
  - Benefits

© Copyright 2007 Golder Associates Inc., All Rights Reserved

Alternative Objectives

- Optimizing Aquifers
  - Alluvial aquifer: direct return flow
  - Clastic aquifer: indirect leakage
  - Basalt aquifer: boundaries & porosity
- Optimizing Sources
  - Surface diversions: availability & conveyance
  - ASR capacity: WTP capacity, wellfields
  - Climate Change: hydrologic timing & magnitude
- Optimizing Benefits
  - In-stream
  - Out-of-stream agriculture
  - Out-of-stream municipal

Golder Associates

© Copyright 2007 Golder Associates Inc., All Rights Reserved

Thank You

Golder Associates

© Copyright 2007 Golder Associates Inc., All Rights Reserved