Yakima River Basin Integrated Water Resource Management Plan

Update - Managed Recharge Groundwater Storage Element

June 8th, 2016

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* Modeling slides provided by Jennifer Johnson and Jonathan Rocha, Reclamation

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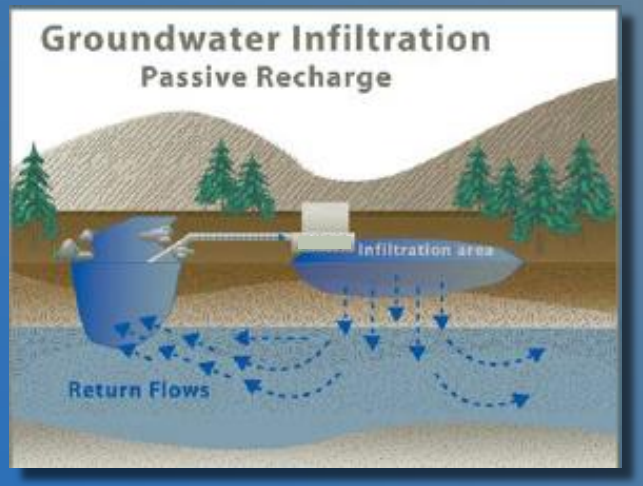
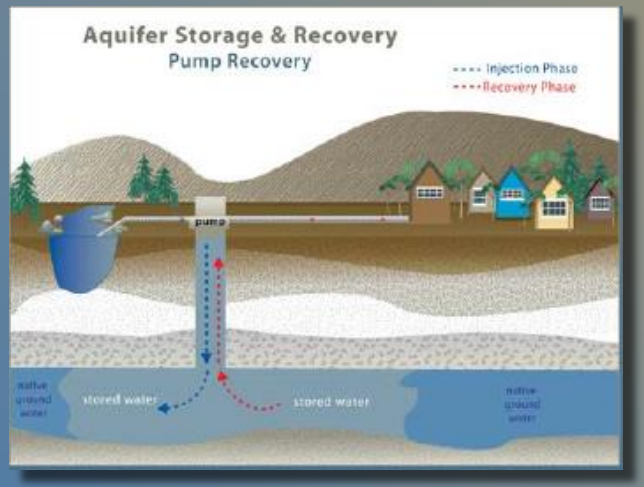
Groundwater Storage Element

Use surface water during periods of high runoff

Recharge aquifers for later withdrawal

Two distinct types





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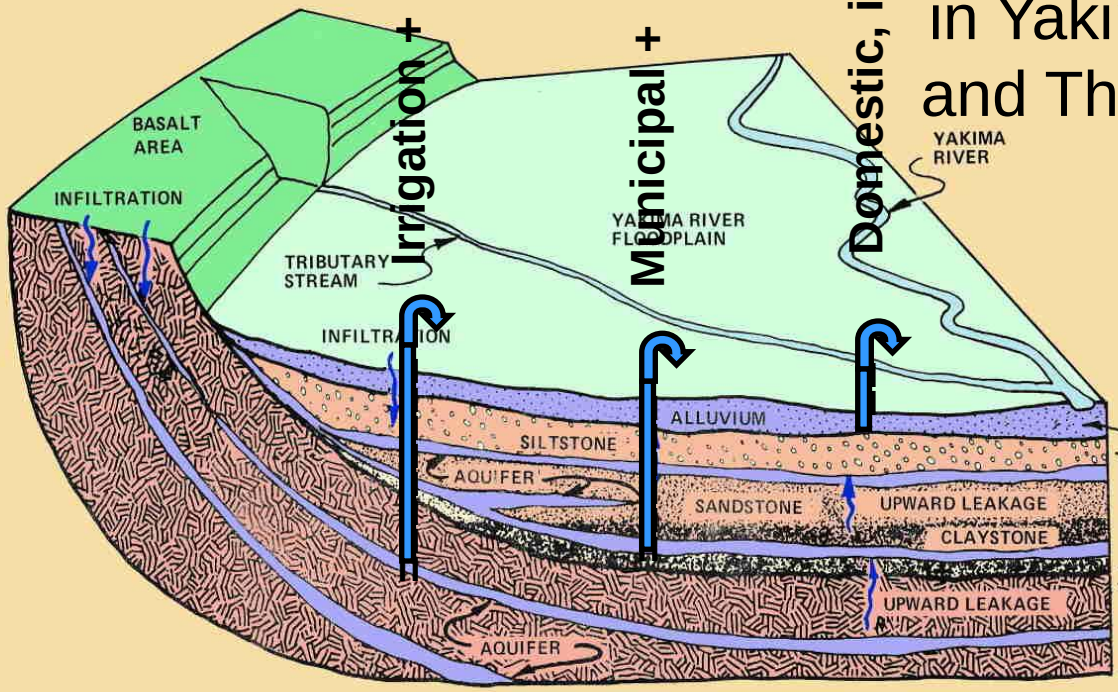
Synclinal Basin in Yakima Fold and Thrust belt



Not rivers, but leaky sheets of folded layer cake geology
In basalts, interflow zones most permeable
Alluvial aquifer water young like me, basalts old

Figure 3. The Three Principal Aquifer Systems in the Yakima River Basin

From U.S. Army Corps of Engineers, 1978,
Yakima Valley Regional Water Management Study

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Passive Recharge Concept

- Store water in aquifers pre-storage control
- Use water post-storage control in lieu of reservoir releases
- Benefit is increased carry-over storage
  - Hedges against drought following year
  - Optimizes
    - Juvenile passage from reservoirs
    - Spring outmigration conditions
  - Reduces unnaturally high summer flows
- Aquifer storage is same year (from pre- to post-storage control)
- Year to year storage is in the form of carryover storage in reservoirs

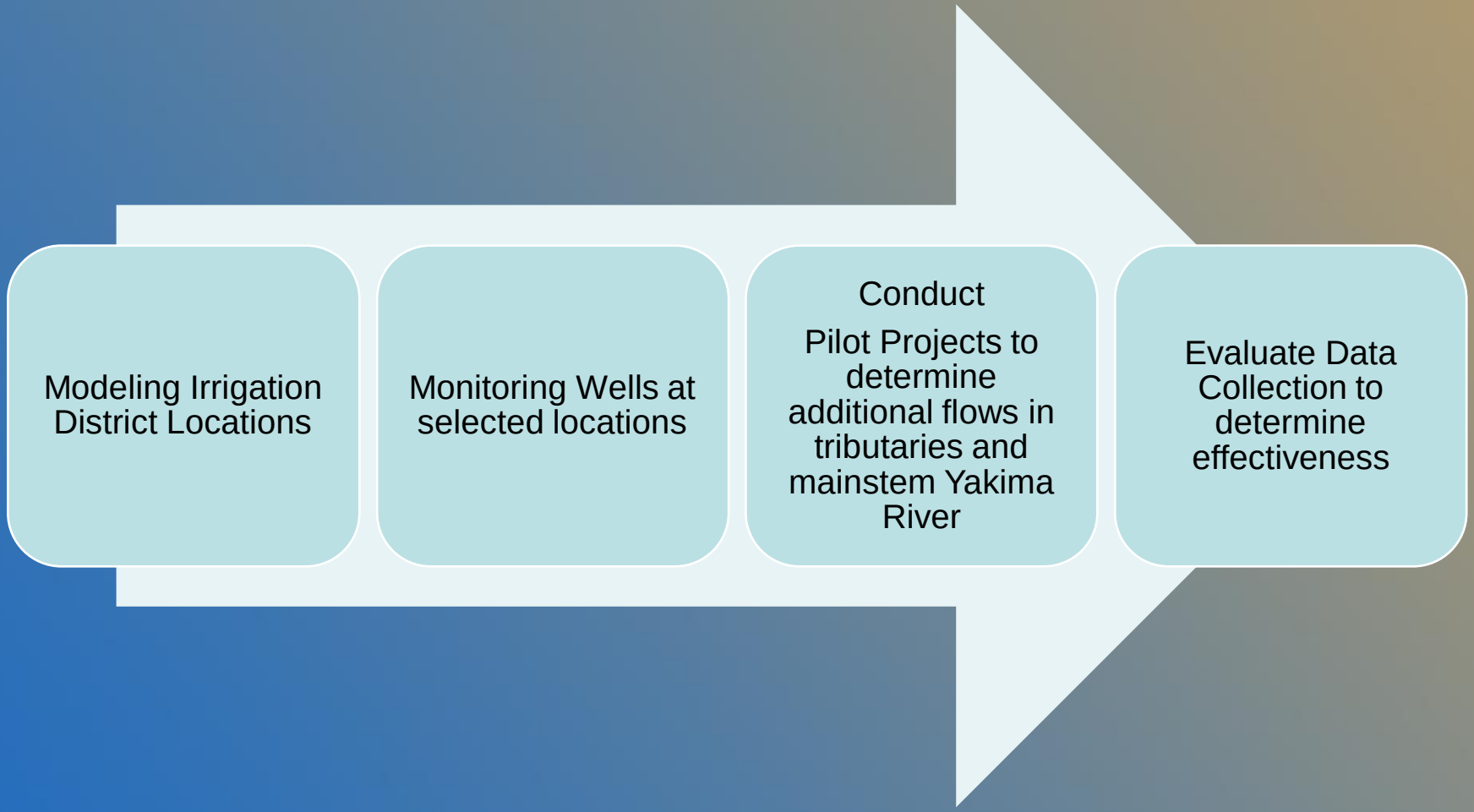
Recovery Concept

- Use water post-storage control in lieu of reservoir releases
- Recover by means of (as appropriate)
  - Wells
  - Drains
  - Passive recovery (let it discharge to streams)

Benefits

- Potential to increase carry-over storage
- Irrigation
  - Increased carry-over is hedge against drought the following year
- Aquatic resources:
  - Increased carry-over increases effectiveness of juvenile passage out of reservoirs and
  - Better spring outmigration conditions
  - Reduced high late summer flows
- Relatively low cost
  - Utilizes existing reservoir and conveyance facilities as much as possible

Managed Recharge Analysis Process



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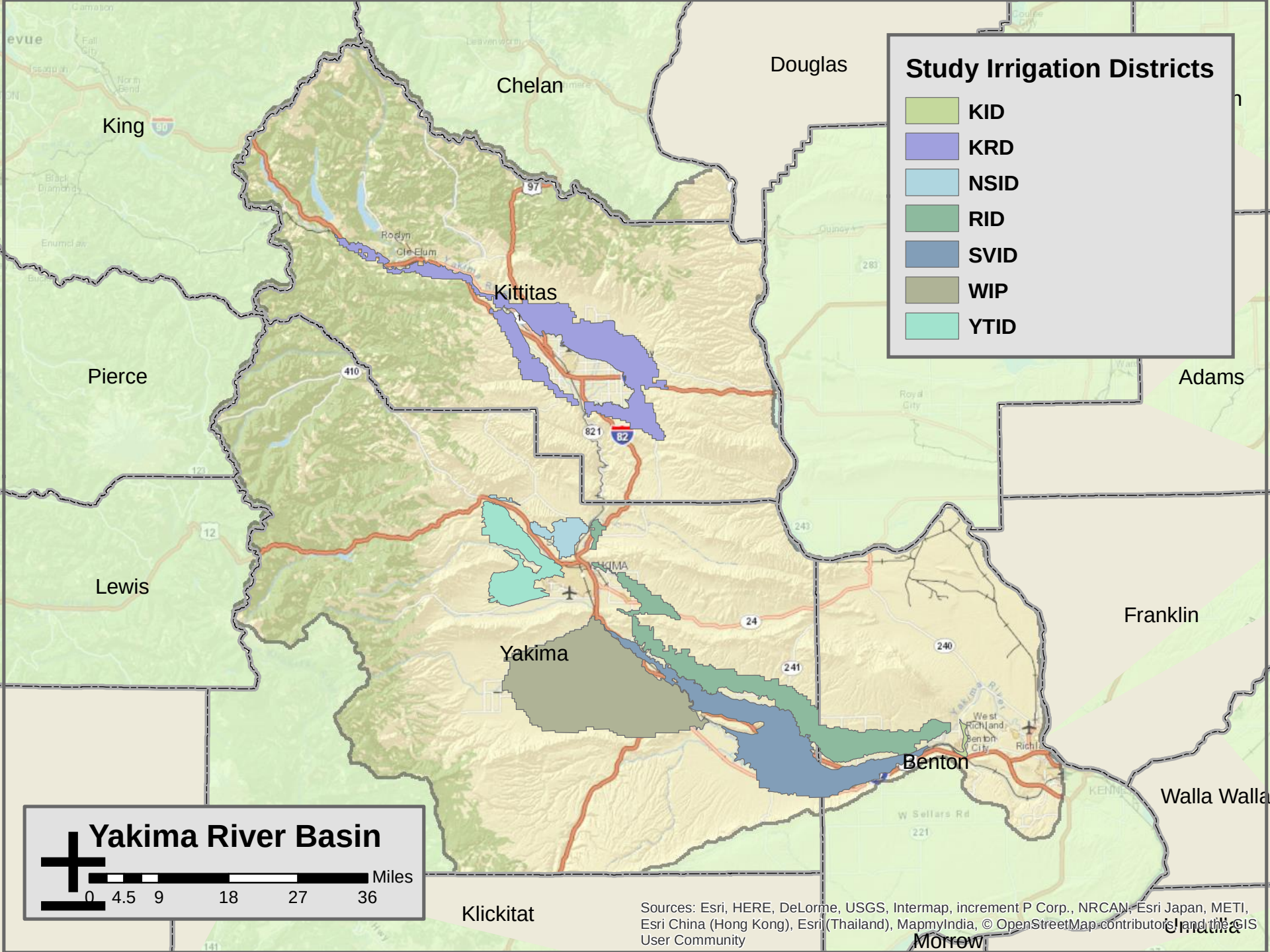
Background

Dates	Events
Jan 2014	Obtained USGS model – held training session with groundwater subcommittee
Apr 2014	Met with 7 Irrigation Districts
May-Jul 2014	Simulated selected sites using USGS model
Jun-Aug 2014	Presented results to districts and selected sites for additional monitoring
Sep 2014-Current	Installed instrumentation and collected monitoring data
Nov 2015	Finalized report describing modeling work to date

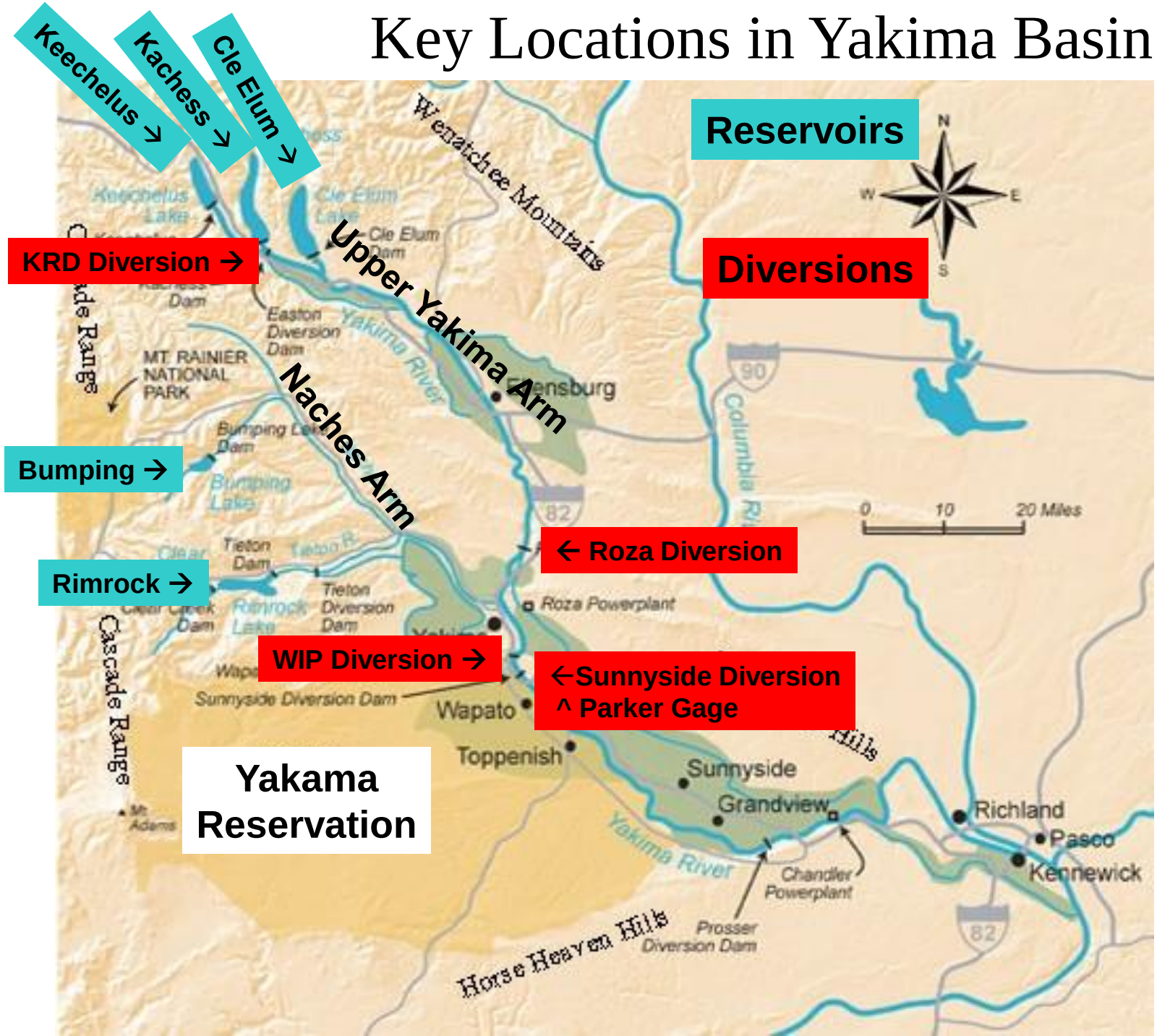

Study Irrigation Districts
KID
KRD
NSID
RID
SVID
WIP
YTID
Douglas
Chelan
King
Kittitas
Pierce
Adams
Lewis
Franklin
Yakima
Benton
Walla Walla
Klickitat
Morrow
Yakima River Basin
Miles
0 4.5 9 18 27 36
Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

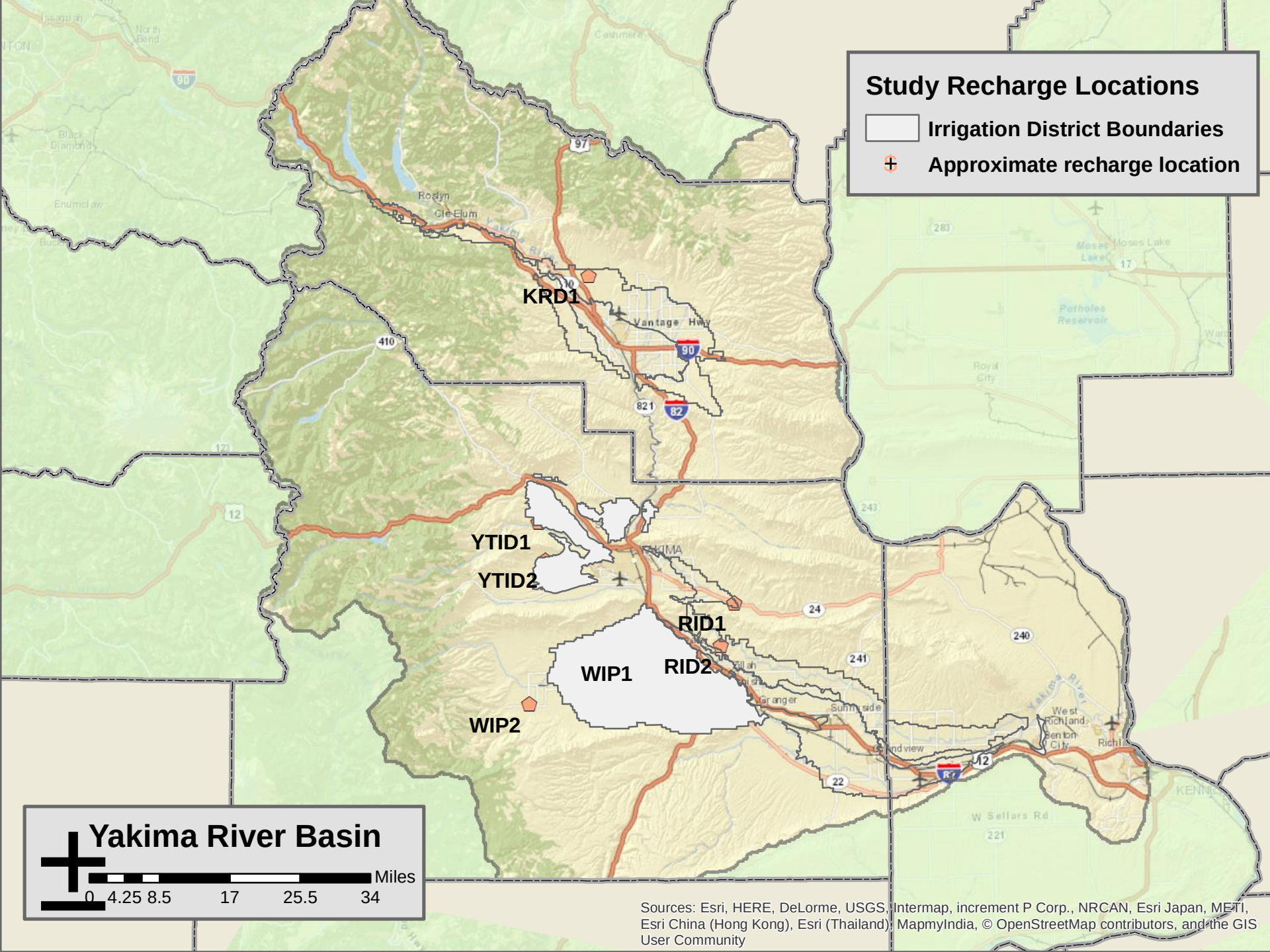
Modeling

- Objectives
  - Evaluate change in groundwater elevation near recharge location(s)
  - Evaluate increase or decrease in flow at the Parker gage

Caution: MODFLOW does not determine the amount of water that is able to infiltrate, so it assumes all of the water applied will infiltrate. These results are likely upper estimates of what is possible.

Key Locations in Yakima Basin




Study Recharge Locations
Irrigation District Boundaries
Approximate recharge location
KRD1
YTID1
YTID2
RID1
RID2
WIP1
WIP2
Yakima River Basin
Miles
0 4.25 8.5 17 25.5 34
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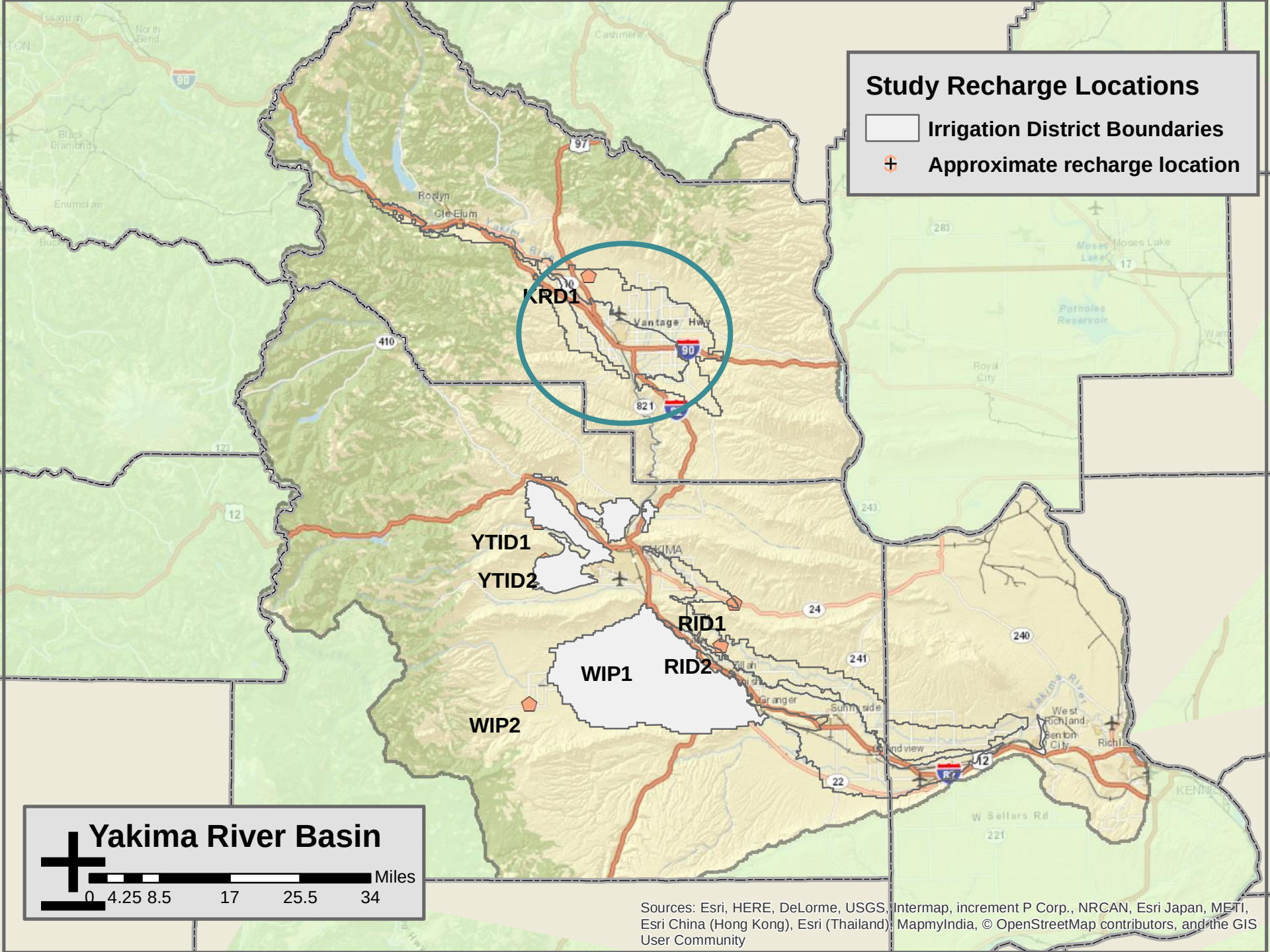
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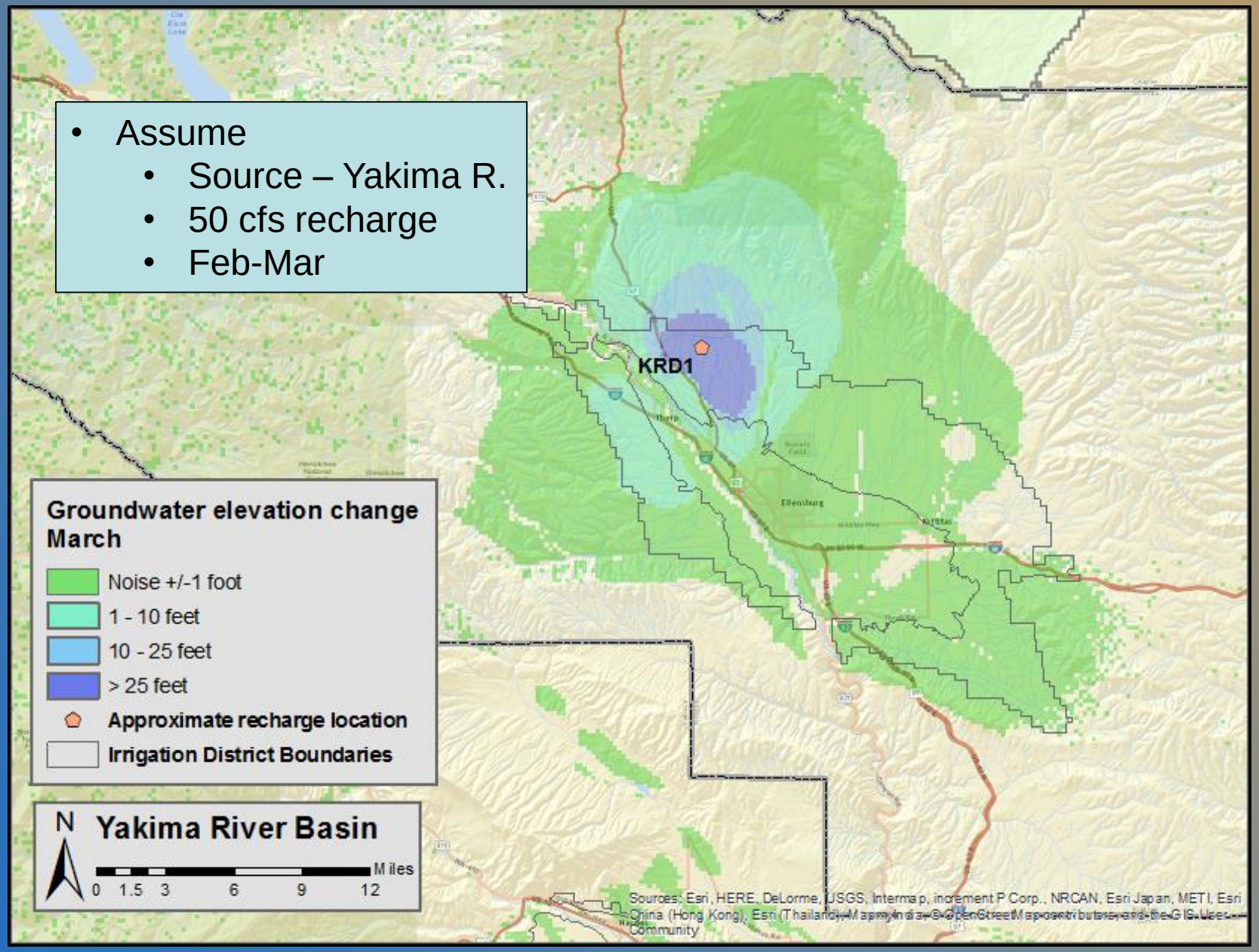

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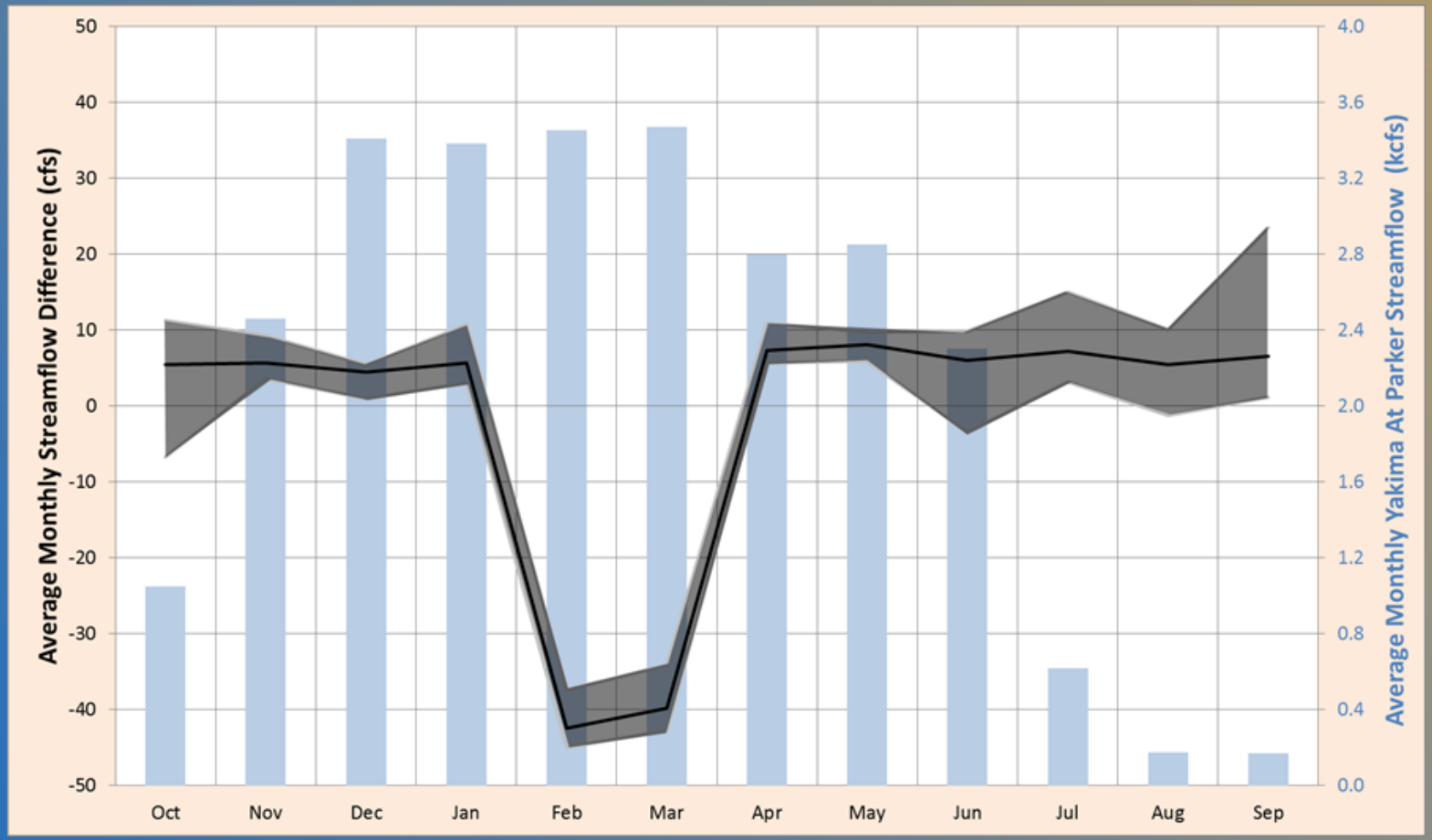

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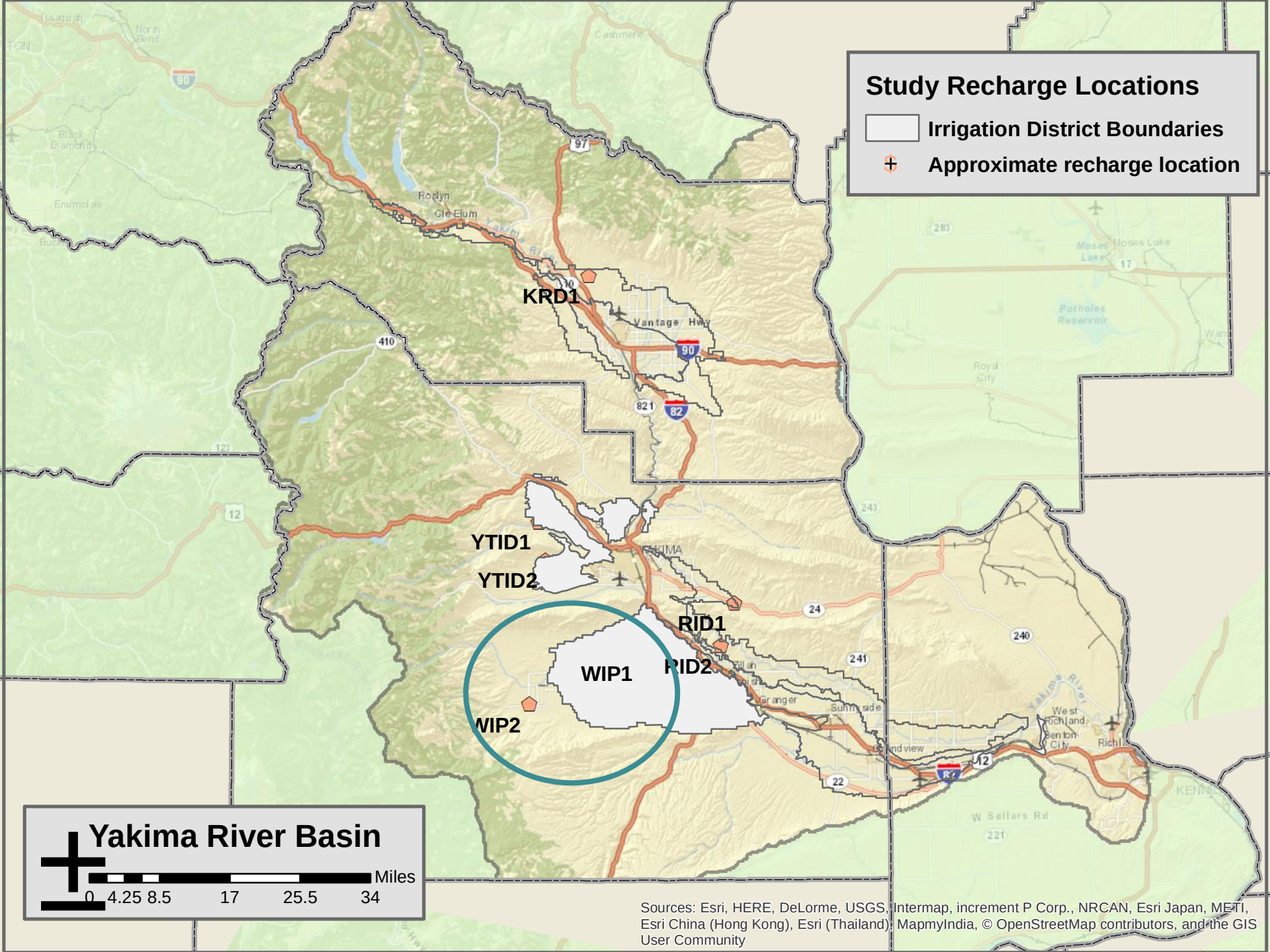
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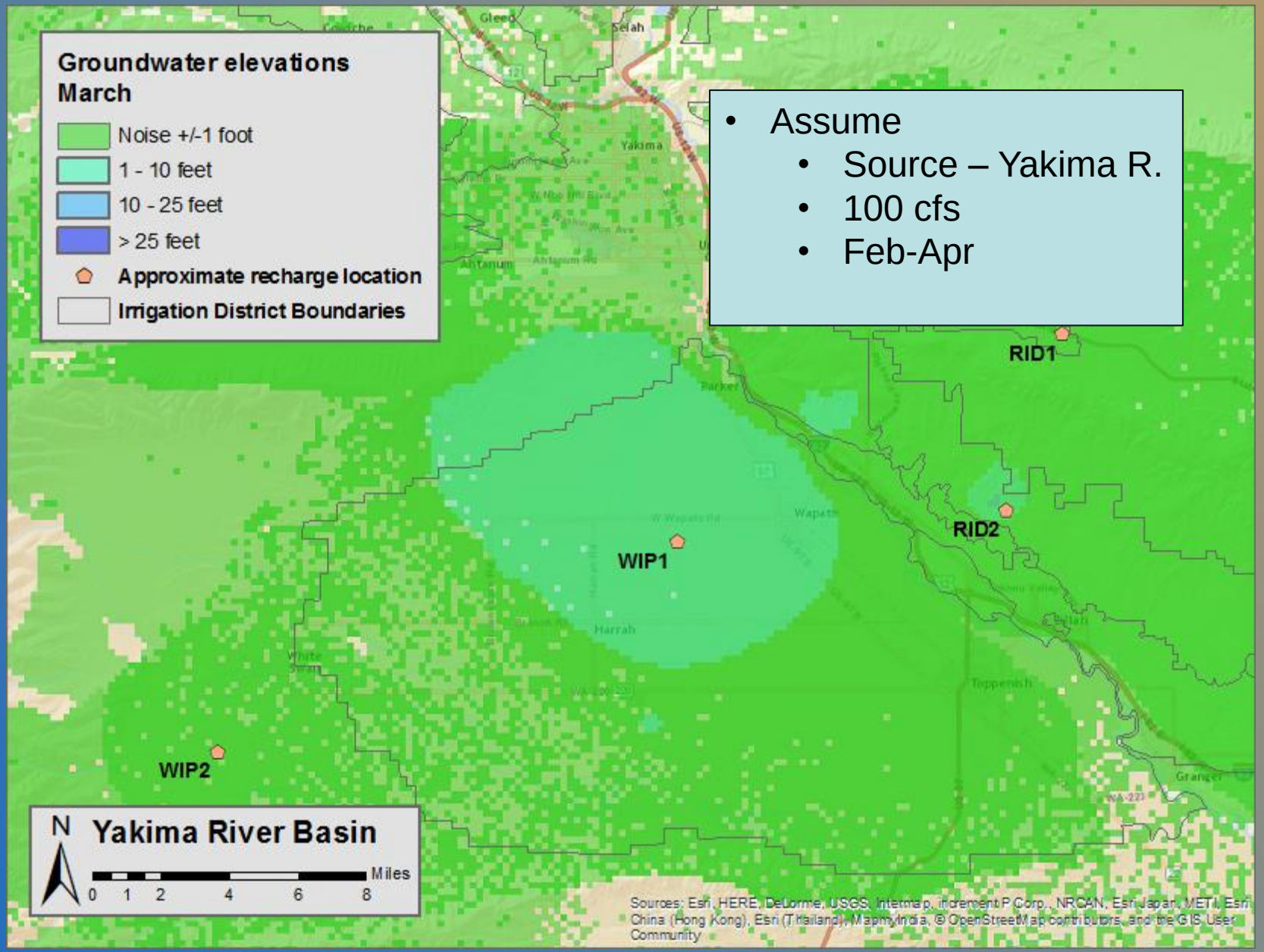

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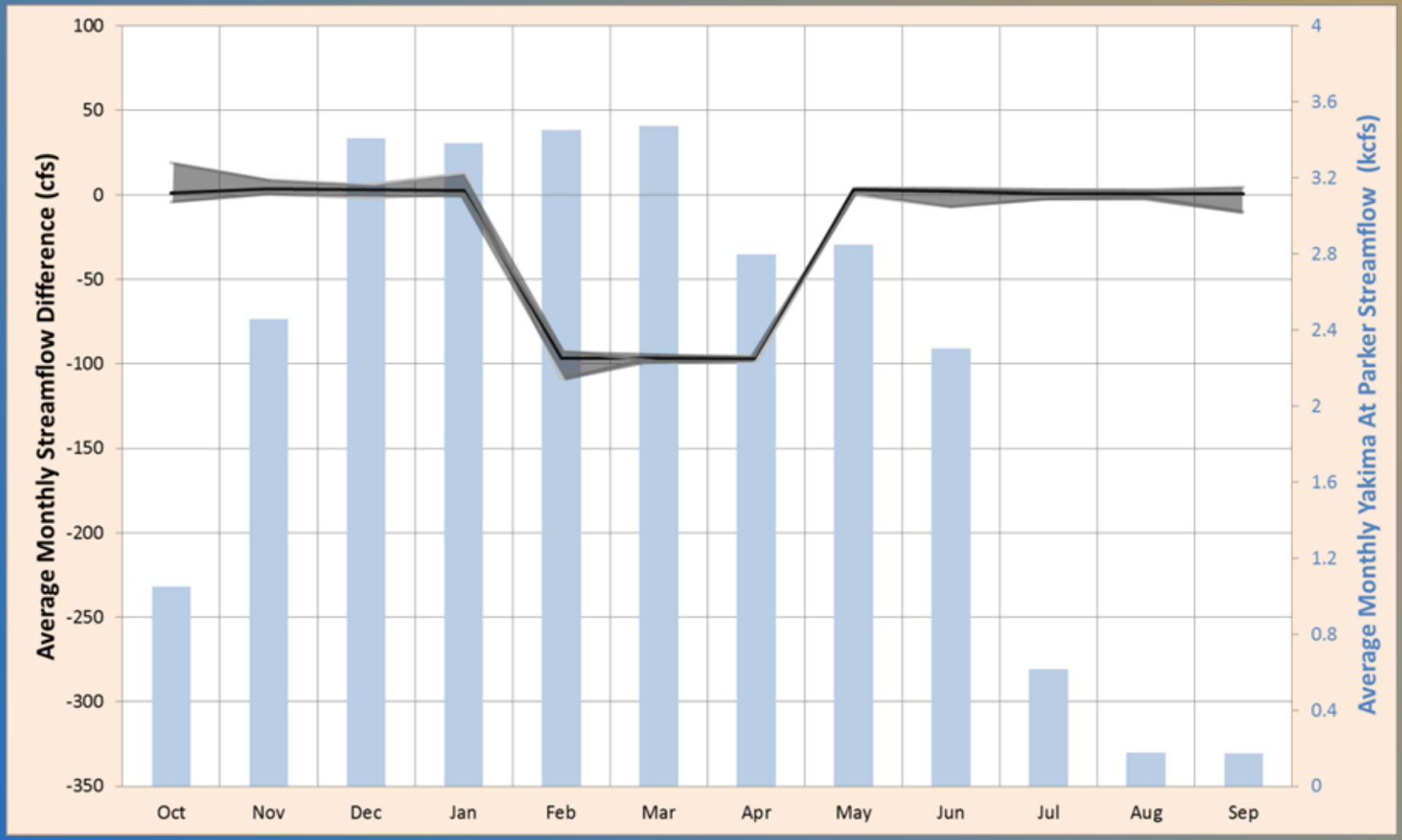

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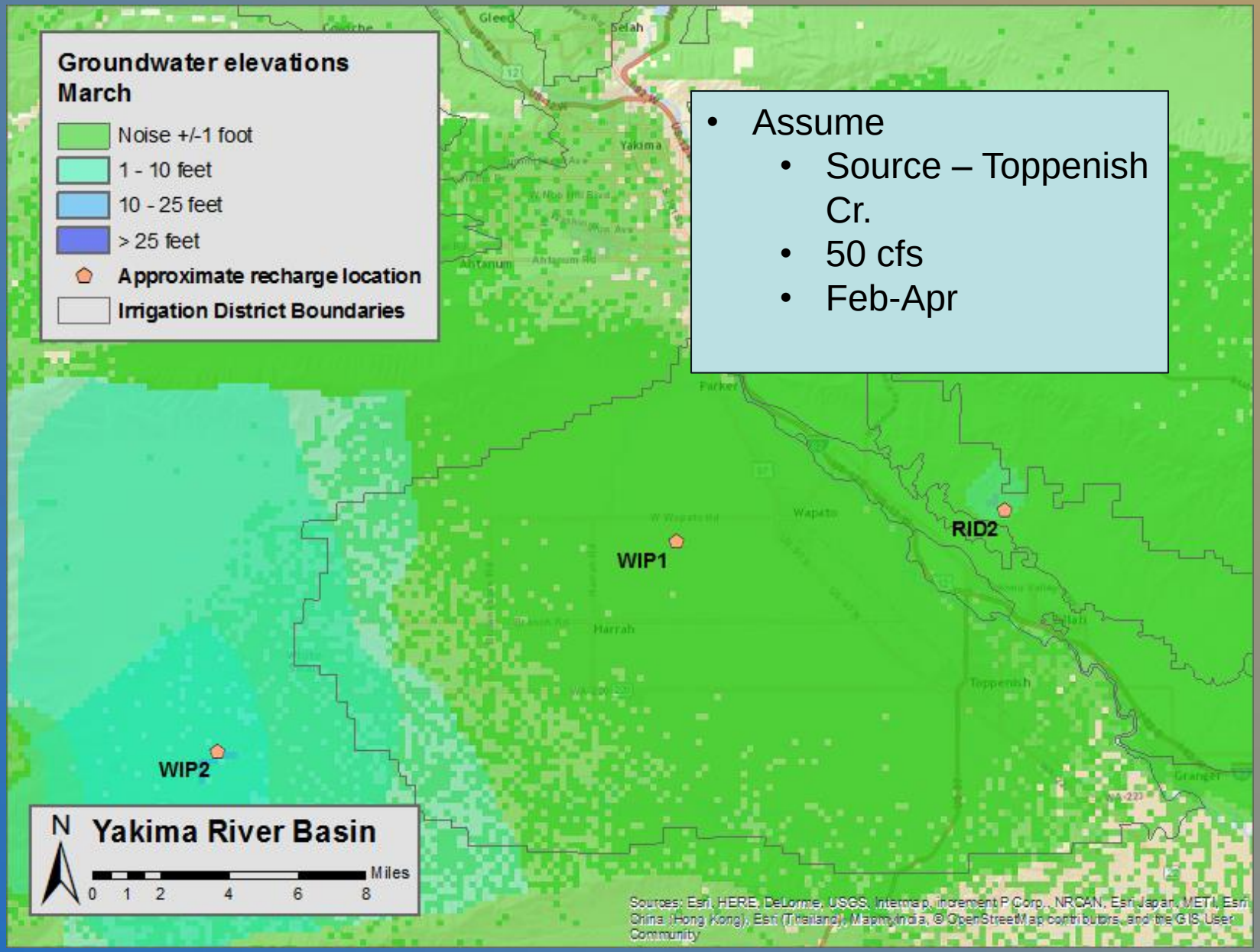

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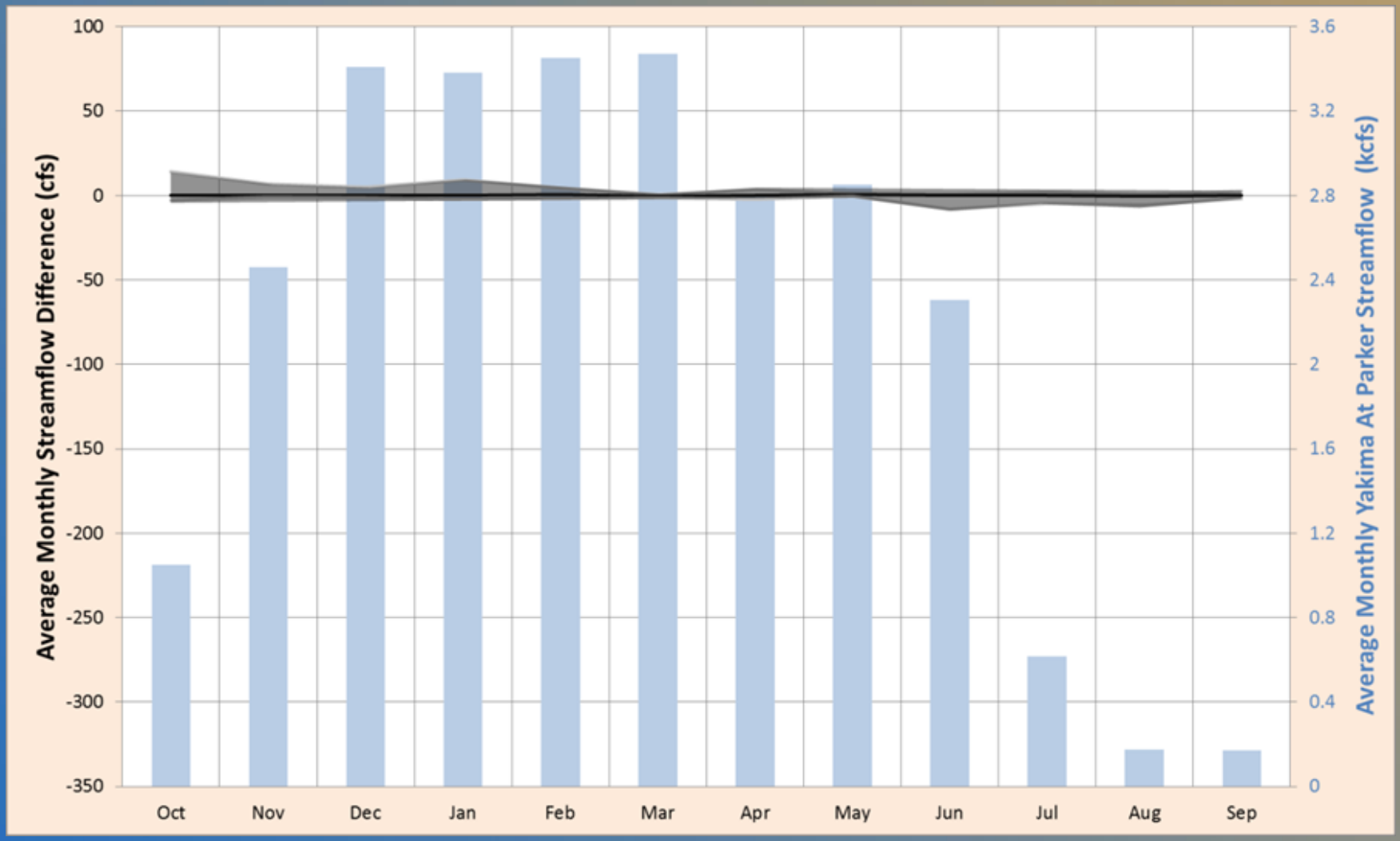

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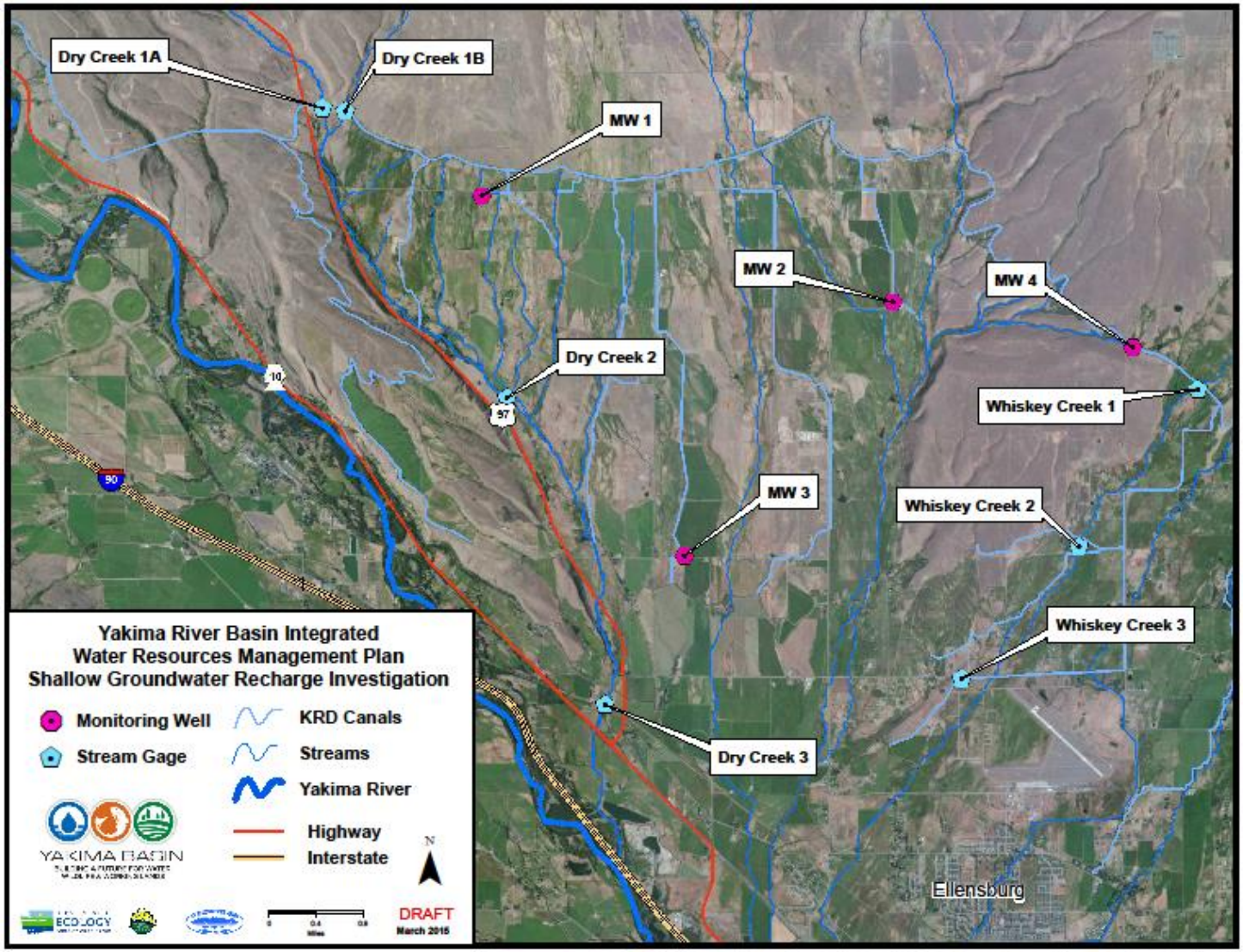
Monitoring

- Objectives
  - Confirm model results with field monitoring
  - Collect groundwater elevation data reflecting current operations
- Reclamation installed new monitoring wells in KRD
- Ecology installed monitoring equipment in new and existing wells in KRD and WIP

KRD – Monitoring locations



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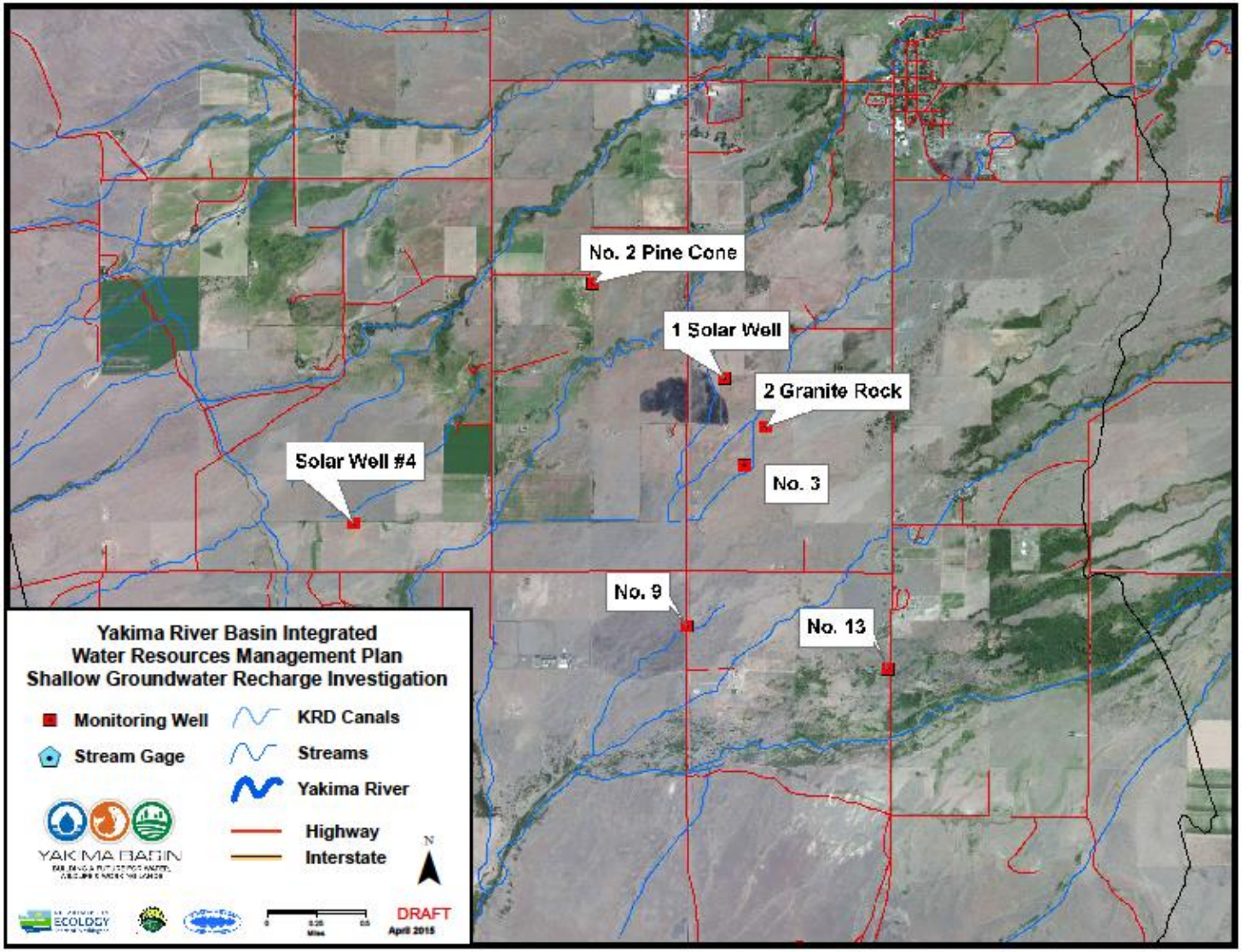
WIP – Monitoring locations



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Potential Next Steps

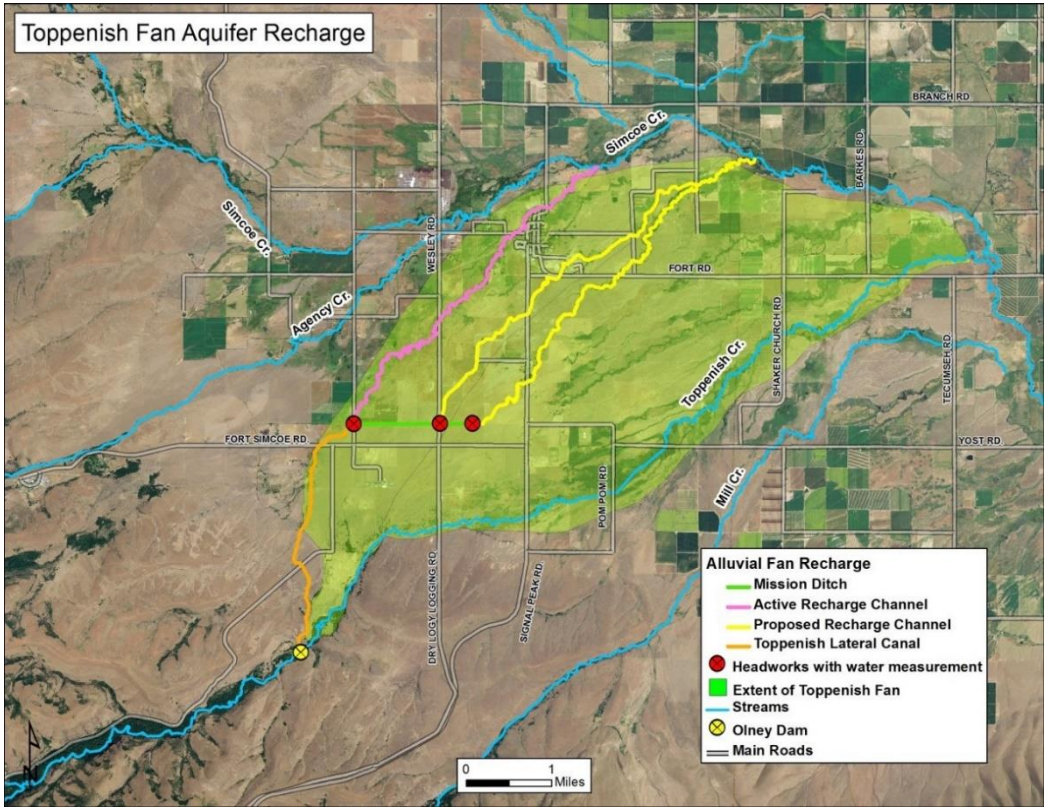
- Continue monitoring and data collection field work at KRD and WIP
- Drill additional wells at WIP
- Identify additional monitoring locations in YTID, NSID, RID, KID
- Evaluate possible pilot projects
- Review data collection, perform analysis, and reevaluate modeling results
  - Evaluate flow in tributaries
  - Evaluate impacts to river flow and carryover storage using RiverWare model

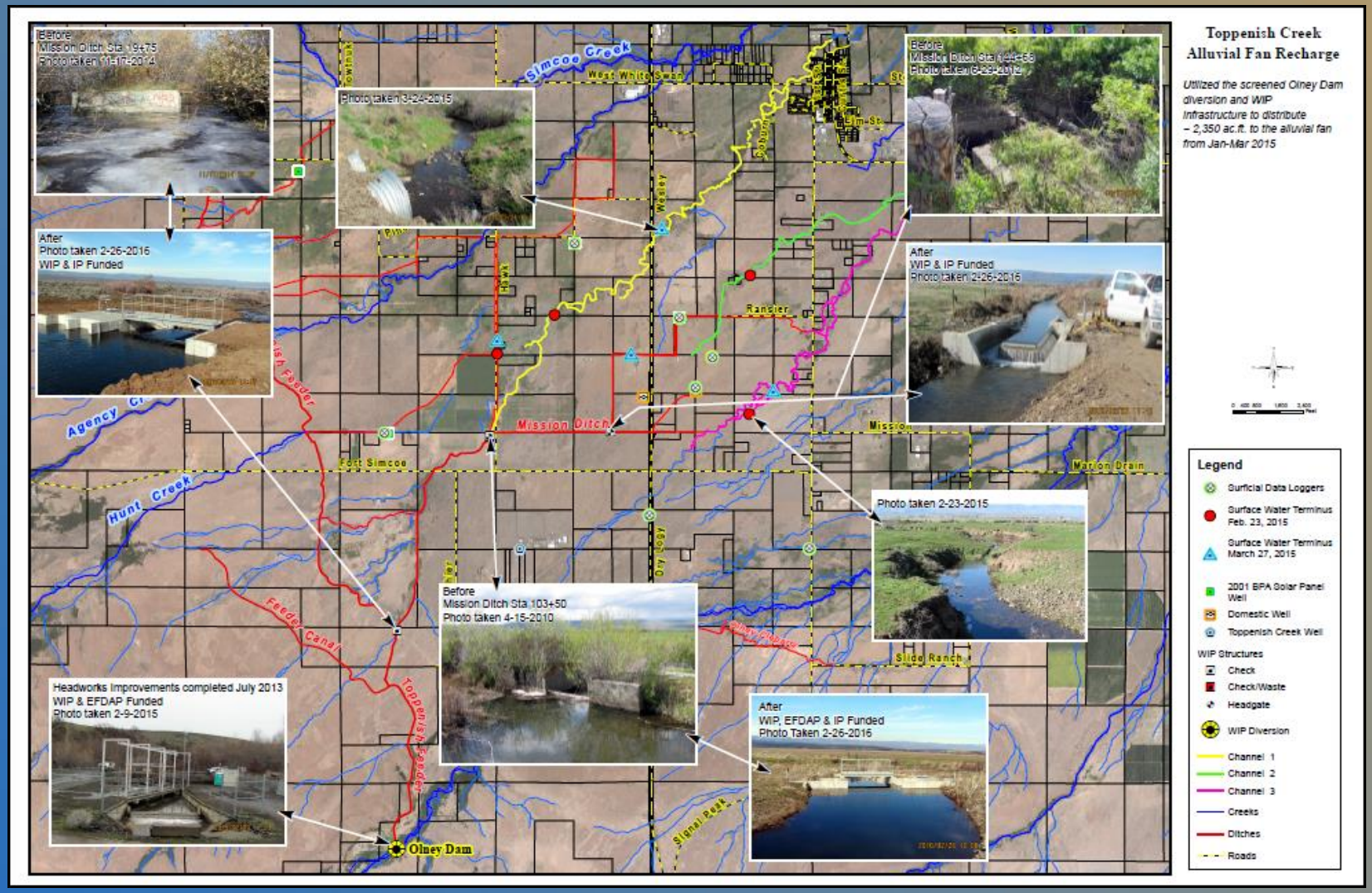
Toppenish Creek Alluvial Fan Aquifer Recharge

The area around White Swan has suffered degradation of water resources and native plants and animals for several decades.

This project is designed to start the process of restoring healthy, natural hydrology and ecology.

Using controlled and screened winter diversions of Toppenish Creek, the project will reestablish the Toppenish Fan's hydrologic cycle and the connectivity of its distributary channels.





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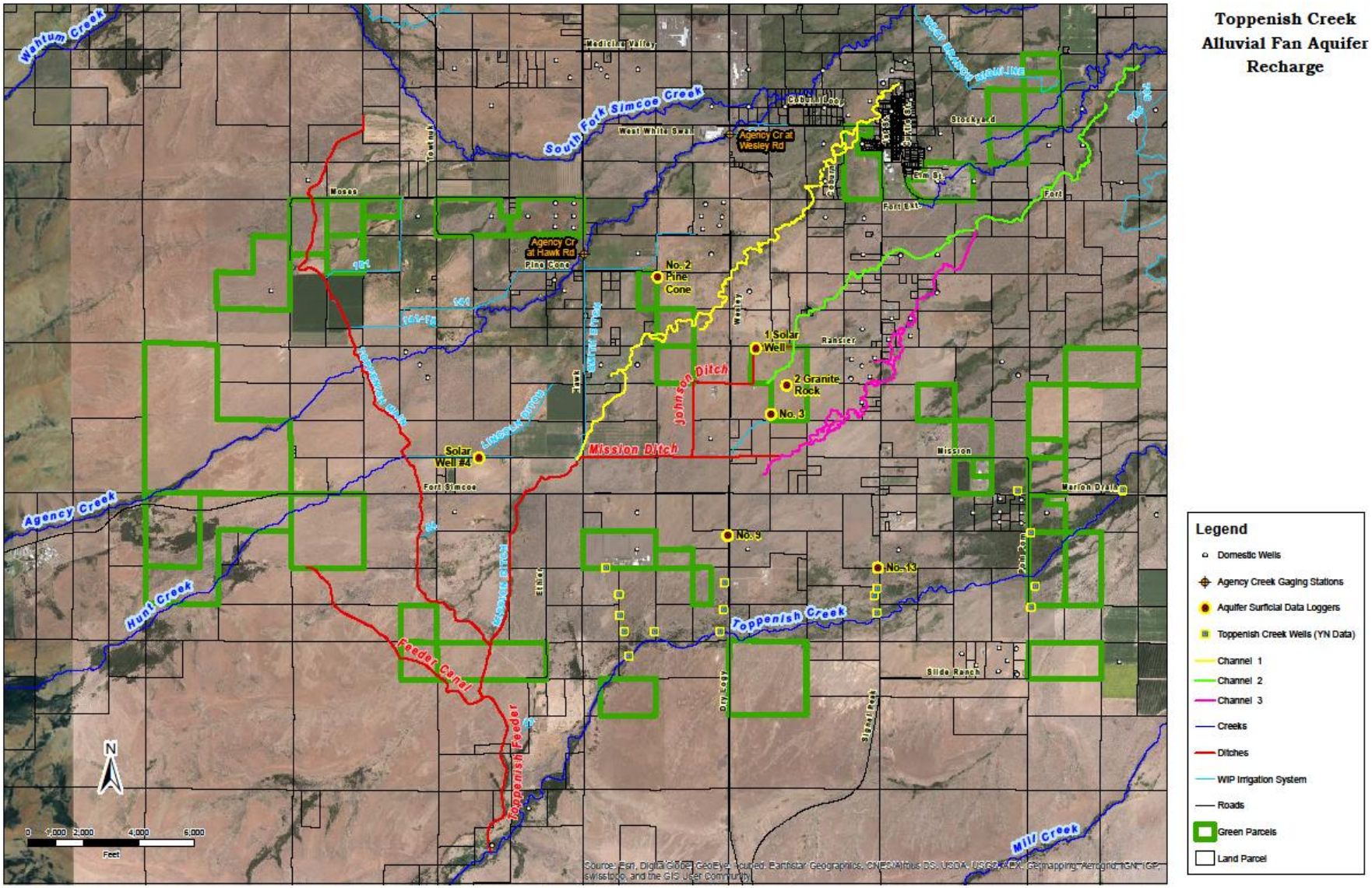
Toppenish Creek Fan Recharge Project 2016

- The following attachment illustrates improvements made on the Toppenish Unit.
- From mid-December 2015 through March 2016 approximately 2,500 ac-ft was diverted from Toppenish Creek through the fish screen and directed toward the fan. At the peak of our recharge season, we were diverting about 30cfs. Most of the water went to the distributary channels colored yellow and pink. We are still processing the data so the volume of water remains approximate for now.
- This year we seem to have elevated flow in lower Agency Creek relative to Simcoe Creek, which we are attributing to the recharge project.
- Just eyeballing the data at this point, and it needs a closer look.

WIP- Potential New Locations



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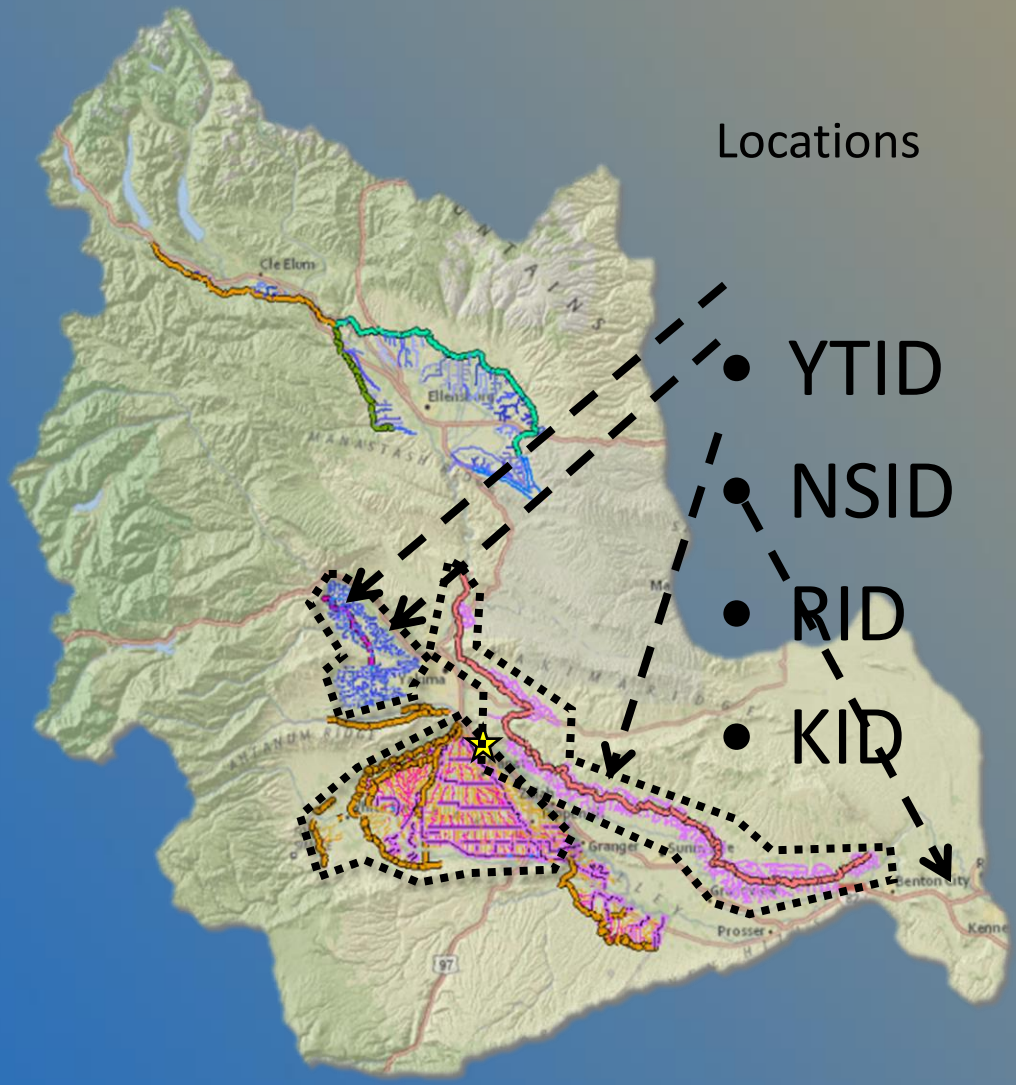
Potential Pilot Projects

Locations



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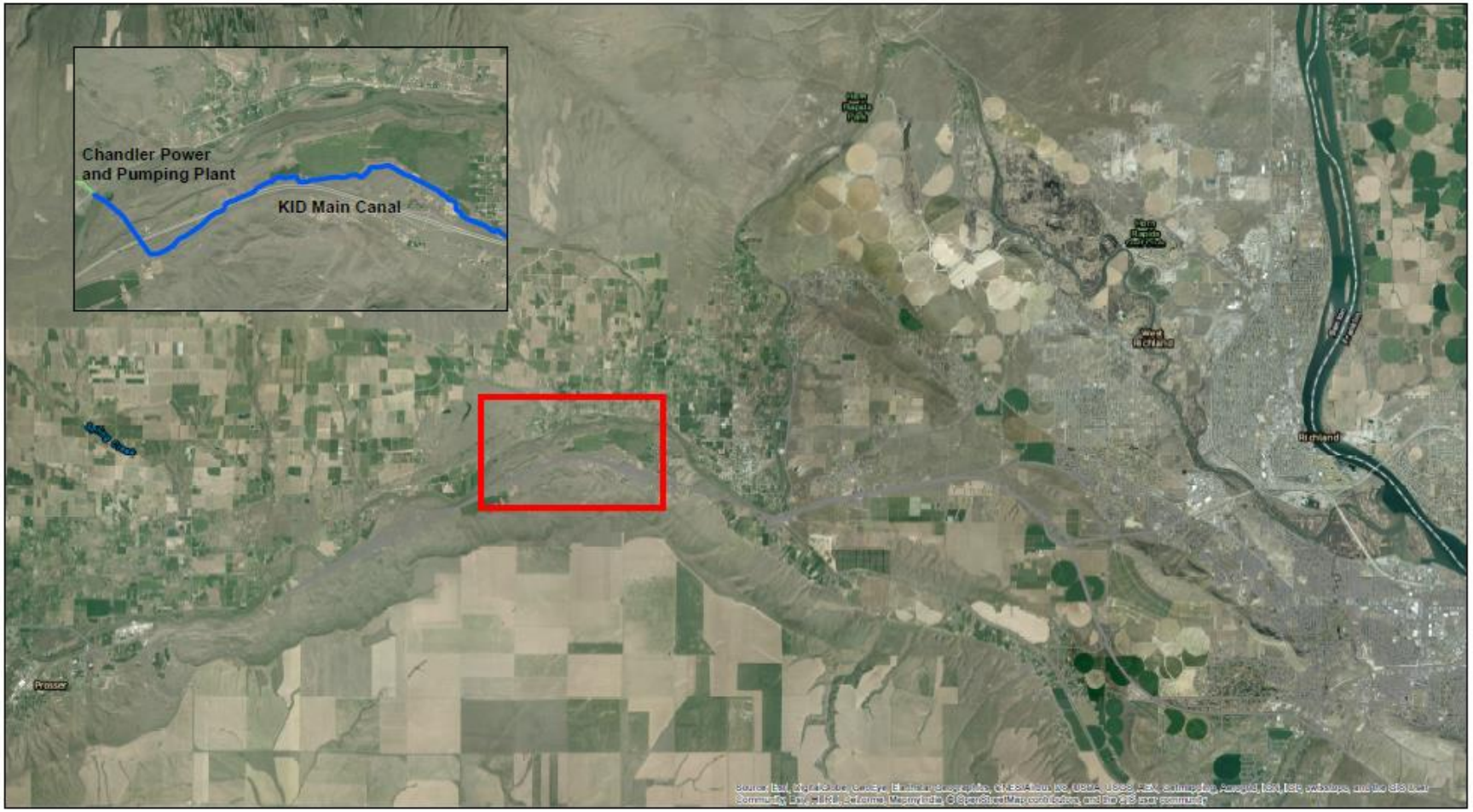

Cold Water Refuge Proposed Locations Near Chandler Power and Pumping Plant

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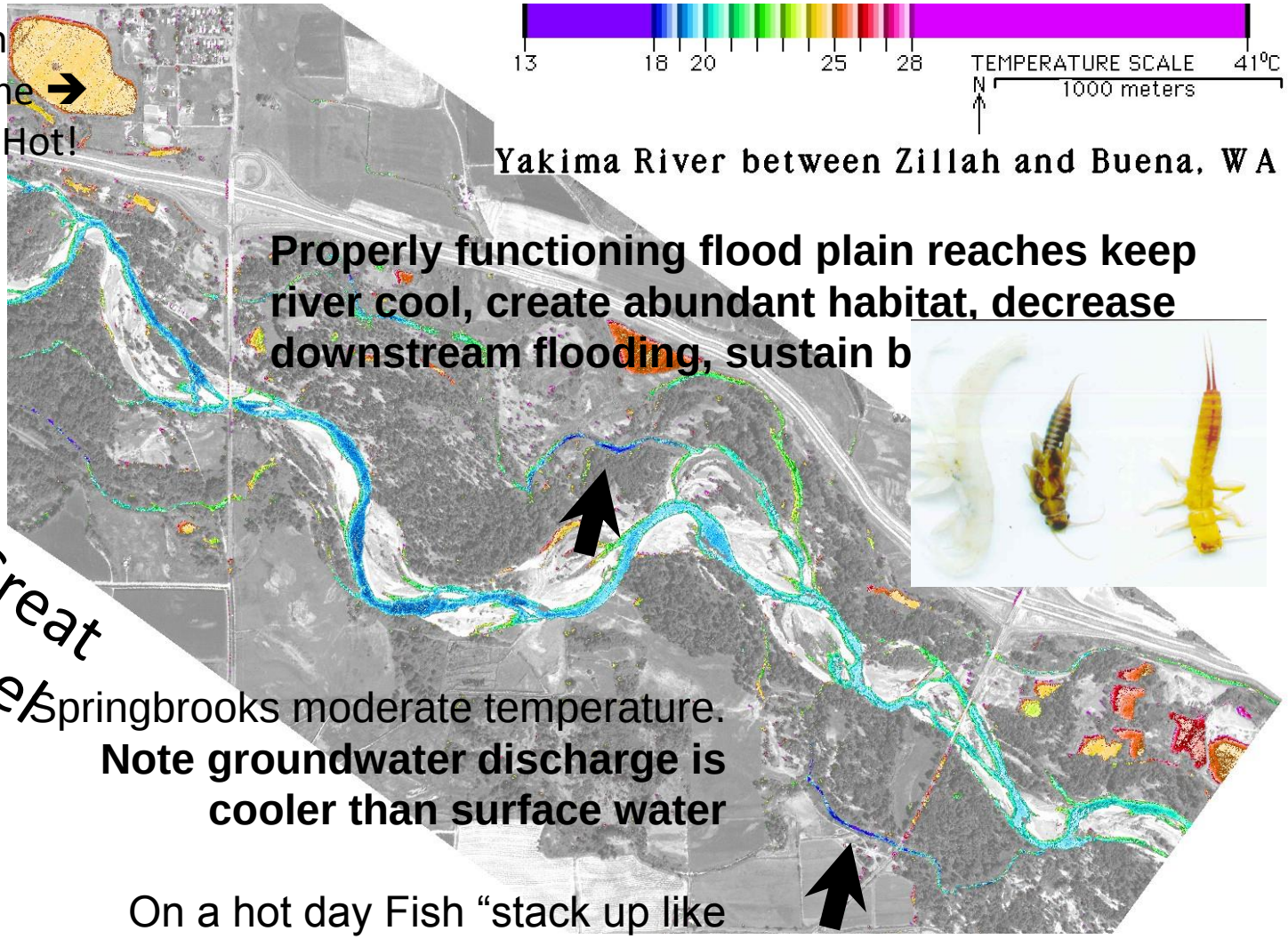
Floodplain
Gravel mine ➔
Hot! Hot! Hot!



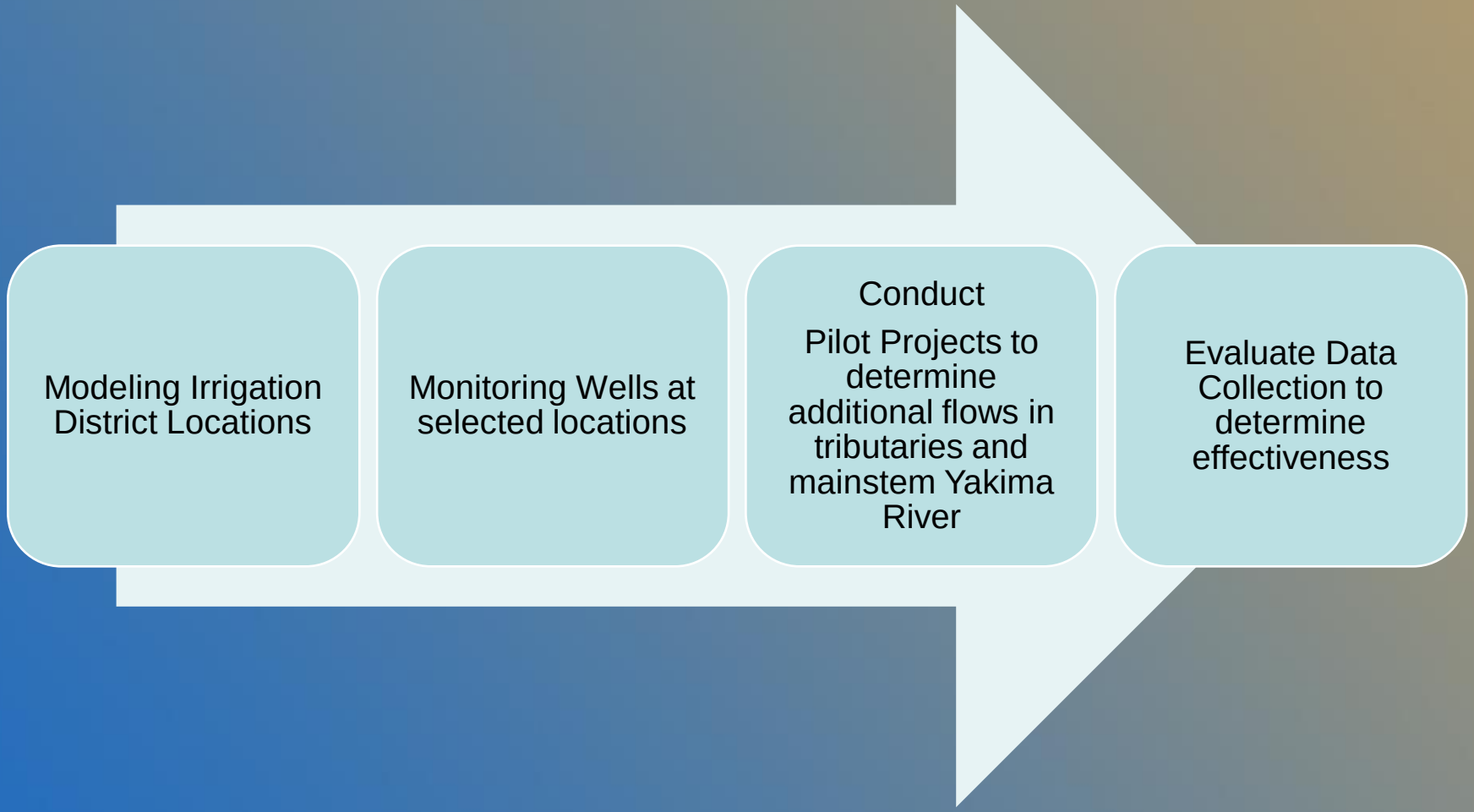
Properly functioning flood plain reaches keep river cool, create abundant habitat, decrease downstream flooding, sustain b

The Great Flywheel

Springbrooks moderate temperature.
Note groundwater discharge is cooler than surface water

On a hot day Fish “stack up like cordwood” on cool seeps

Managed Recharge Analysis Process



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