An Update on Recharge Net Metering, with Distributed Stormwater Collection linked to Managed Aquifer Recharge (DSC-MAR)

A. T. Fisher[1], K. Camara[2] , E. McCarthy, and L. Lurie[2]
In collaboration with S. Beganskas[1,3], G. Gorski[1], A. Serrano[1], J. Pensky[1], V. Bautista[1], *and many others!*

[1] *Earth and Planetary Sciences Department University of California, Santa Cruz, CA*
[2] *Resource Conservation District – Santa Cruz County Santa Cruz, CA*
[3] *Temple University, Philadelphia PA*

UCSC Hydrogeology
"Endeavor to persevere..."

RESOURCE CONSERVATION DISTRICT OF SANTA CRUZ COUNTY

Community Water Dialog of the Pajaro Valley
Watsonville Civic Center
4 November 2019

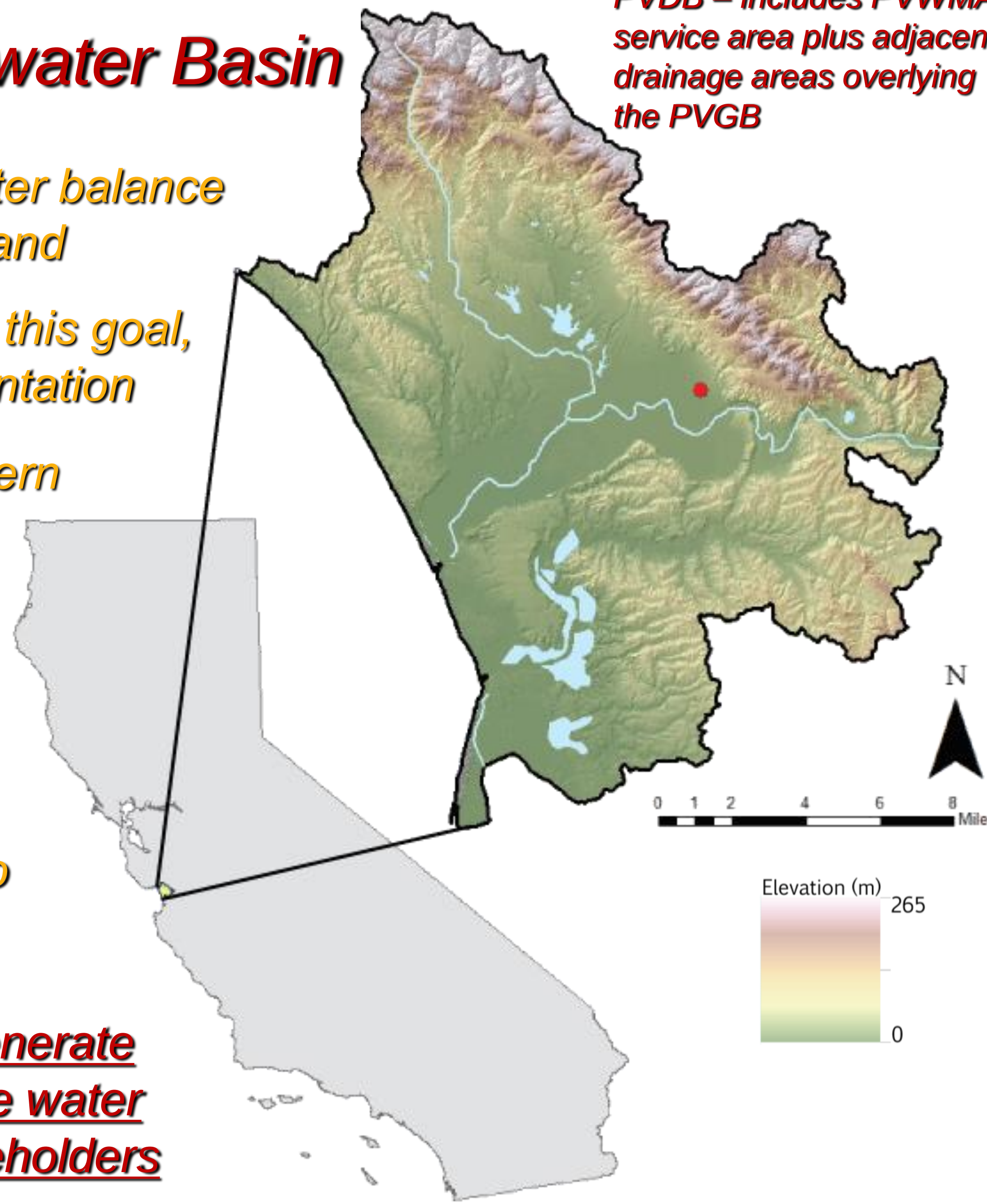
UC WATER Security and Sustainability Research Initiative

The Recharge Initiative
Replenish • Recover • Restore
www.rechargeinitiative.org

Pajaro Valley Groundwater Basin

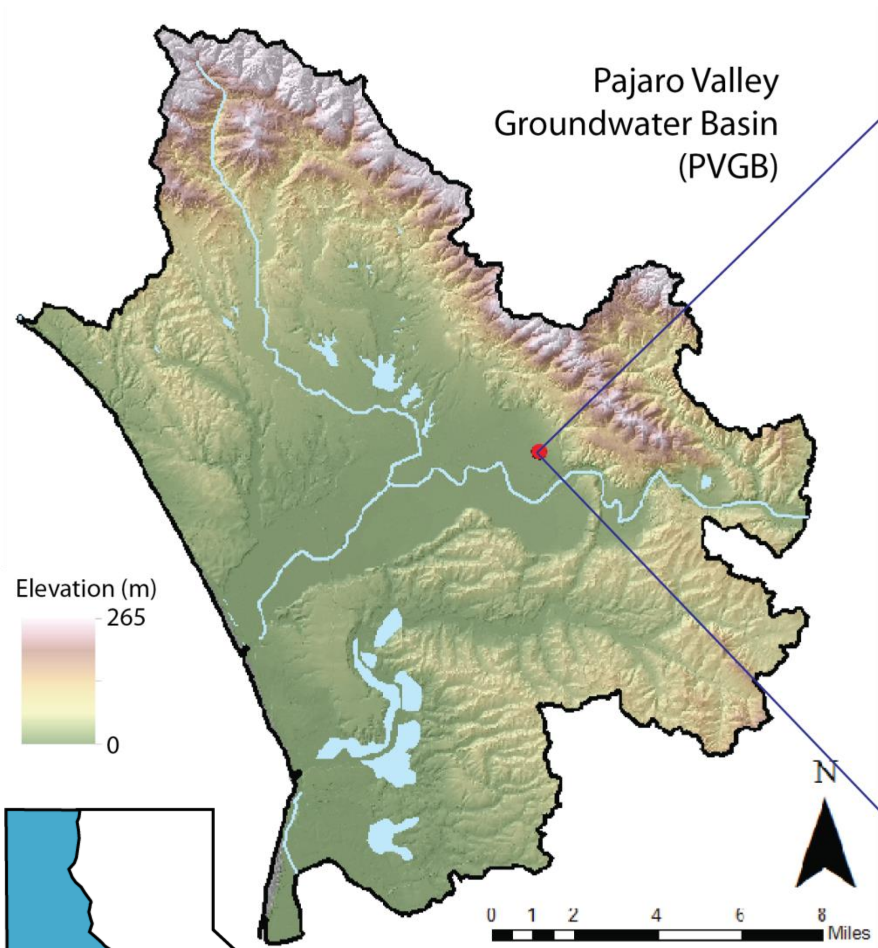
PVDB – includes PVWMA service area plus adjacent drainage areas overlying the PVGB

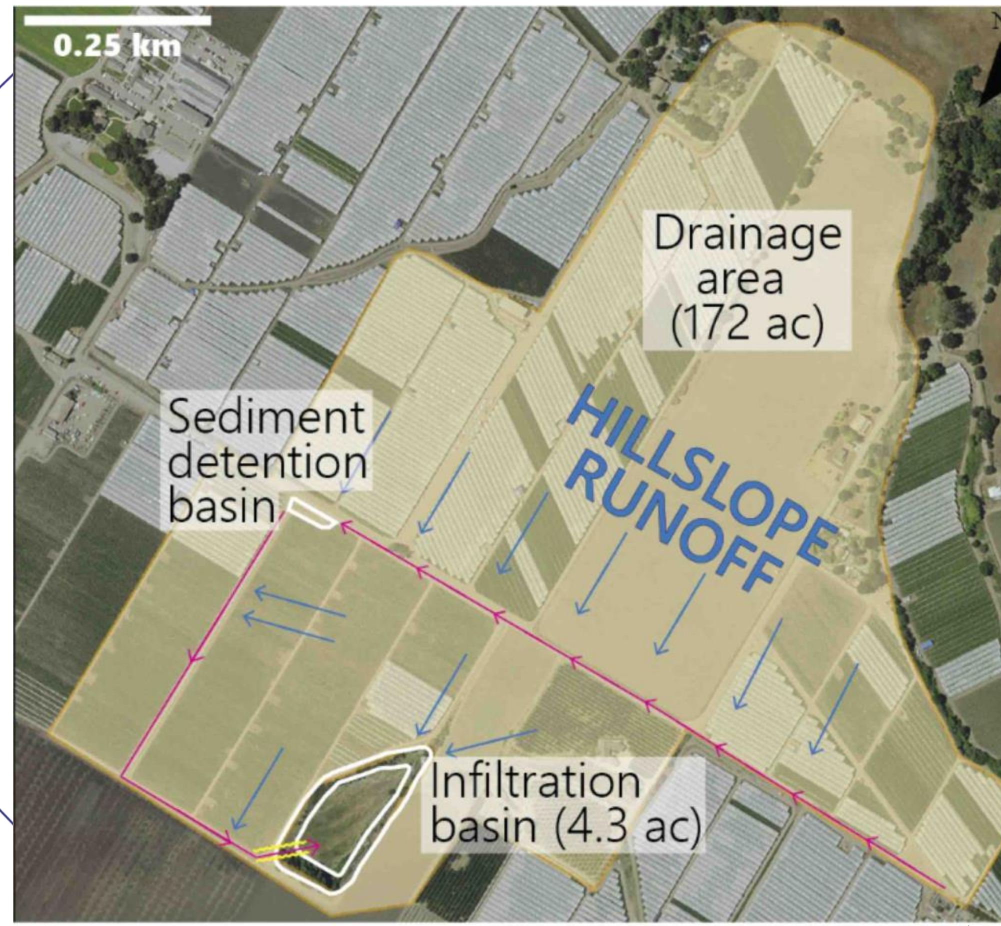
- PVWMA seeks to change water balance by ~12k af/yr: +supply, –demand
- PVWMA has BMP to achieve this goal, but will take time for implementation
- Water quality remains a concern throughout the basin
- Even if BMP is successful, PVGB still must deal with the legacy of overdraft
- Climate change and shifting land use will make it harder to balance basin



Would be beneficial to <u>generate additional supply</u>, <u>improve water quality</u>, and <u>engage stakeholders</u>

Distributed Stormwater Collection – Managed Aquifer Recharge (DSC-MAR)

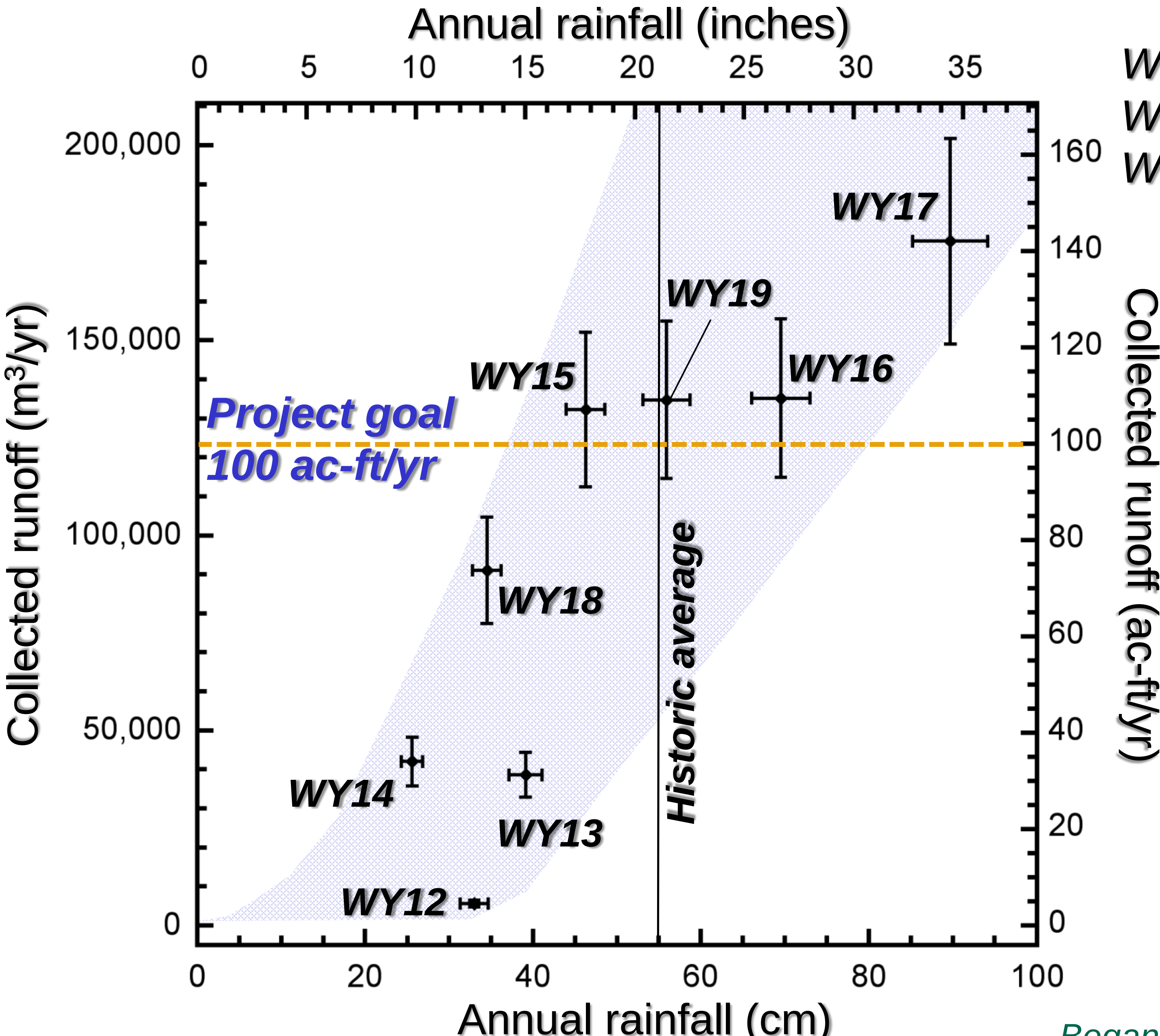




Bokariza-Drobac Ranch, *Project goal: ~100 ac-ft/yr*

modified from *Beganskas and Fisher (2017)*

Bokariza-Drobac Ranch: Performance WY12-19



WY12-15 = drought
WY16 = El Niño
WY17-19 = …?

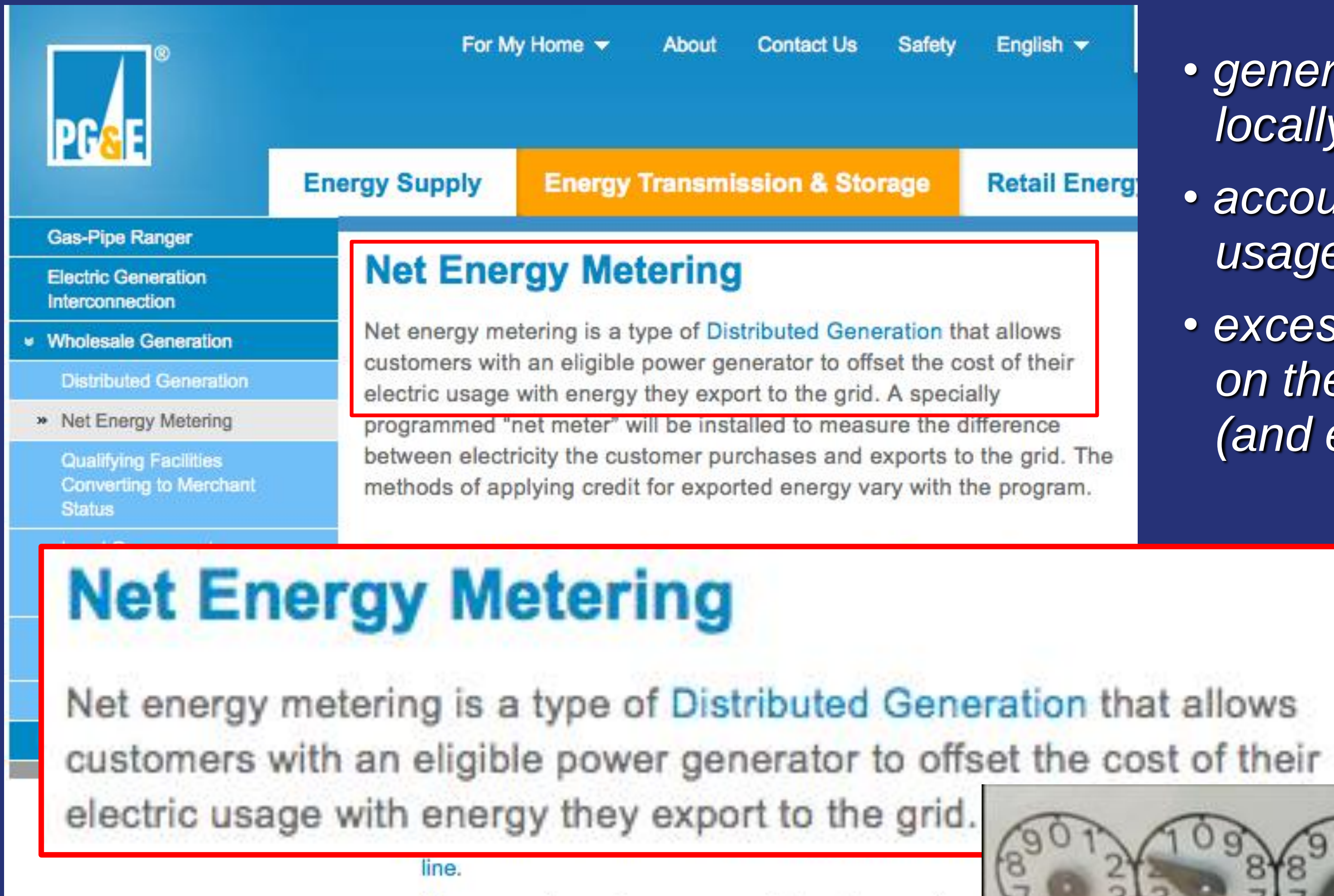
modified from
Beganskas and Fisher (2017)

Reduce Barriers that Limit Participation

- *Land taken from production, reduced access, crop impacts, liability*
- *Maintenance of infiltration systems (basins, dry wells, Flood-MAR fields)*

How can incentives be most effective?

There is a Workable Example: Net Energy Metering



- *generate energy locally*
- *account for net usage*
- *excess power goes on the grid for sale (and eventual use)*

- *Requires*
  - *reliable measurement and accounting*
  - *formula to calculate benefit/rebate*
  - *stakeholder and agency trust*

Example: Recharge Benefit Calculations

Irrigated area: 75 irrigated acres

Applied water: 2.5 ft

Annual precipitation: 1.5 ft (18 inches)

Runoff/precipitation = 0.4 (appropriate for intense events)

Options:

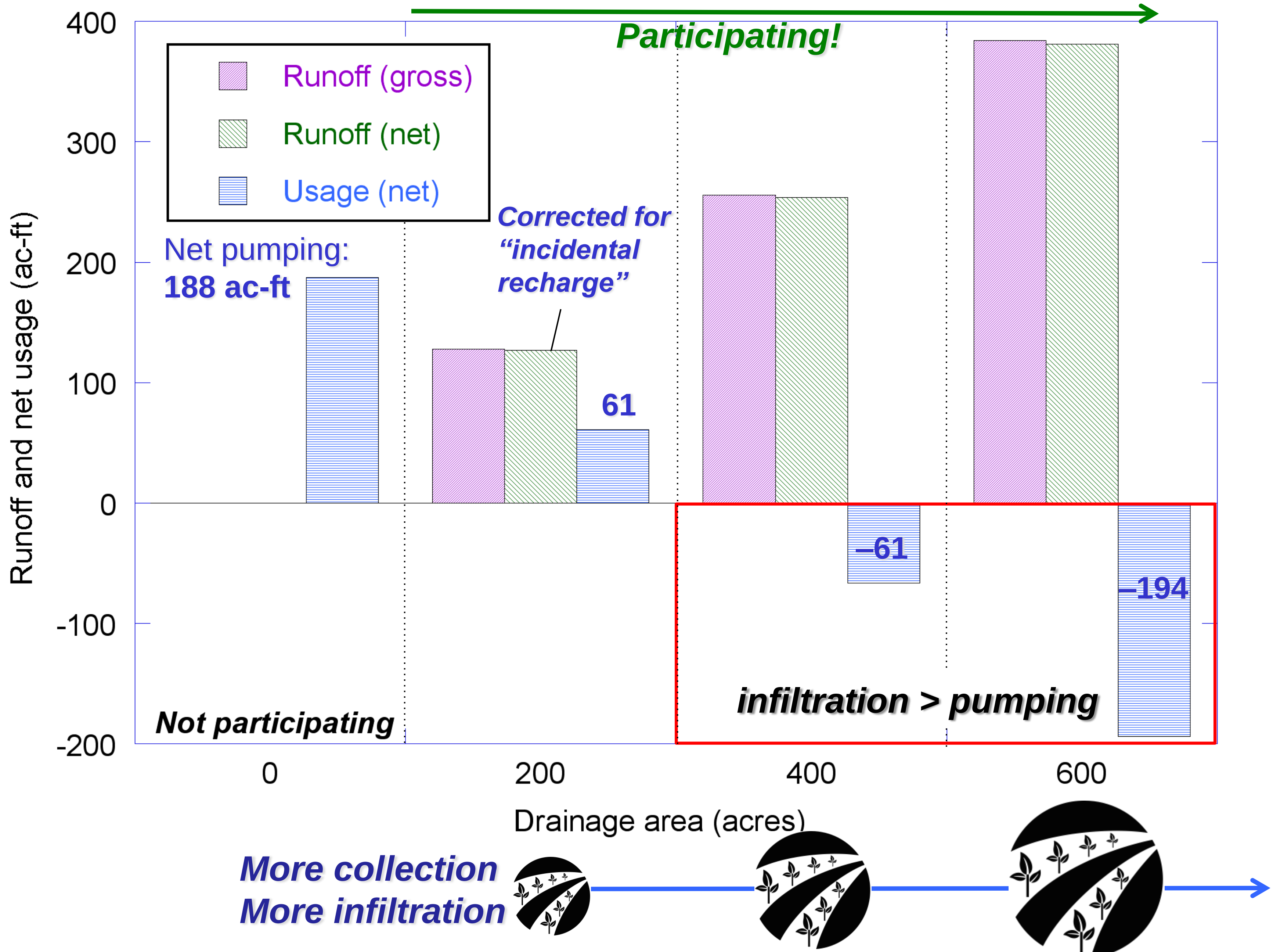
  

Drainage: 200 400 600 acres
Infiltration: 2 4 6 acres

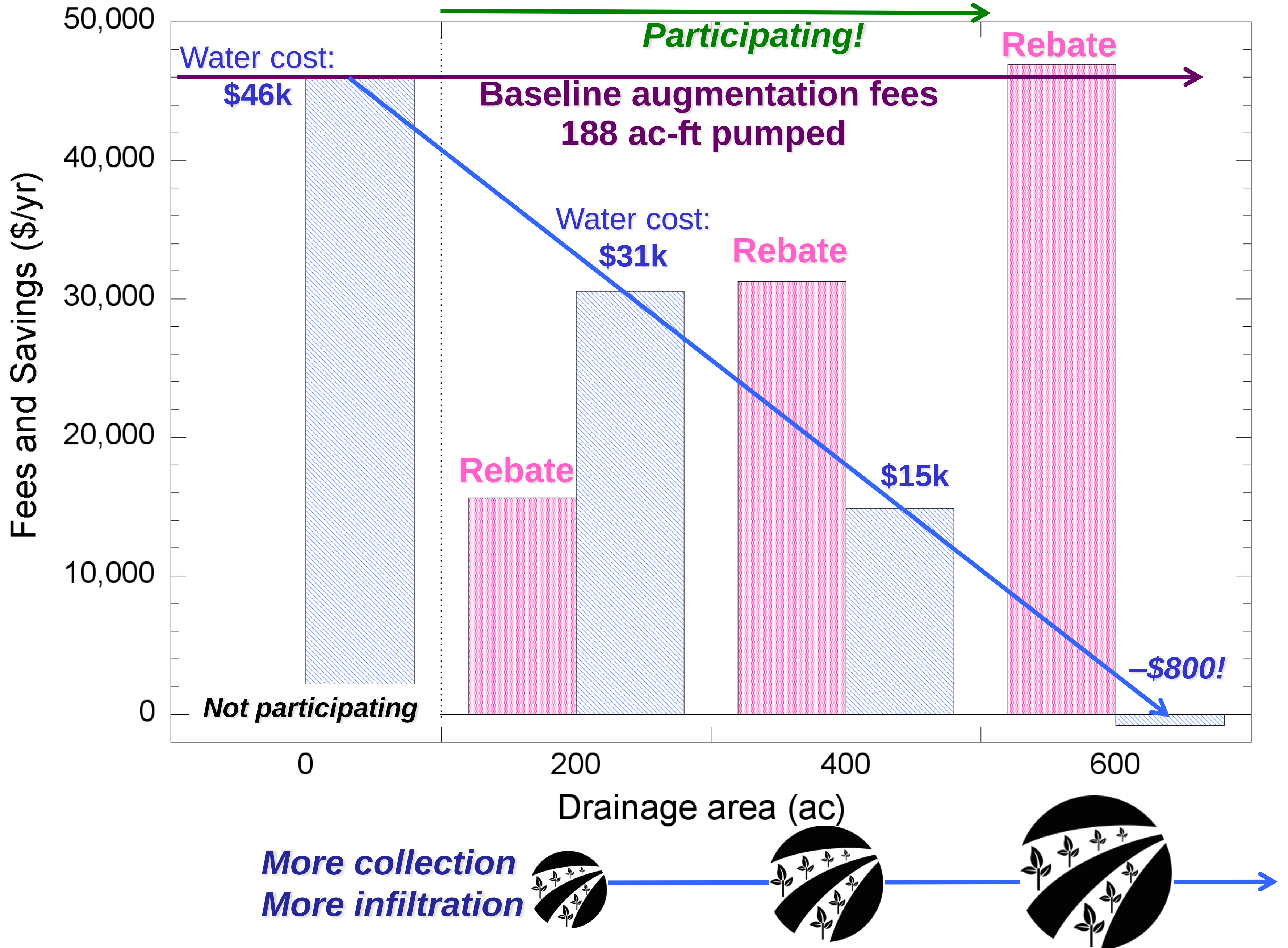
Augmentation fee = $246/ac-ft
(***outside*** of Delivered Water Zone, FY19-20)

Recharge Net Metering rebate: 50% of net infiltration

Example: Recharge Benefit Calculations



Example: Recharge Benefit Calculations



Recharge Net Metering (ReNeM) in the PVGB
(five-year pilot program, 10/2016-9/2021)

- ***"Began" in Fall 2016***
- ***Goal: ~1000 ac-ft/yr (≤10 field projects)***
- ***Third-party certifier (TPC=RCD+UCSC) identifies sites, raises capital, develops engineering, plans/builds for measurement***
- ***TPC works with landowners/tenants to validate, certifies performance, reports to agency***
- ***Agency applies formula to calculate rebate (= credit)***

<u>Program status</u>

→ One site operating, one more will begin operation in Winter 2019-20)

→ Two other projects constructed, but not part of program

→ More sites in the queue for investigation

Regional infiltration projects*

- Bokariza Ranch – infiltration basin, ***modified from existing***
  - *Infiltration measured since WY12*
  - *Operated/instrumented through WY20*
- Kelly-Thompson Ranch – infiltration basin, ***new***
  - *Funded, permitted, constructed!*
  - *Operating Winter WY20*
- Storrs Winery+ – infiltration basin, ***new***
  - *Installed Spring/Summer 2017*
  - *Operated/instrumented WY18-19*
- Watsonville Airport+ – drywell, ***new***
  - *Installed Fall/Winter 2017/18*
  - *Instrument/operated WY19*

**External funding secured, in operation or active preparation*

+Not operating as part of ReNeM program

ReNeM Pilot Funding: Three Kinds of Support

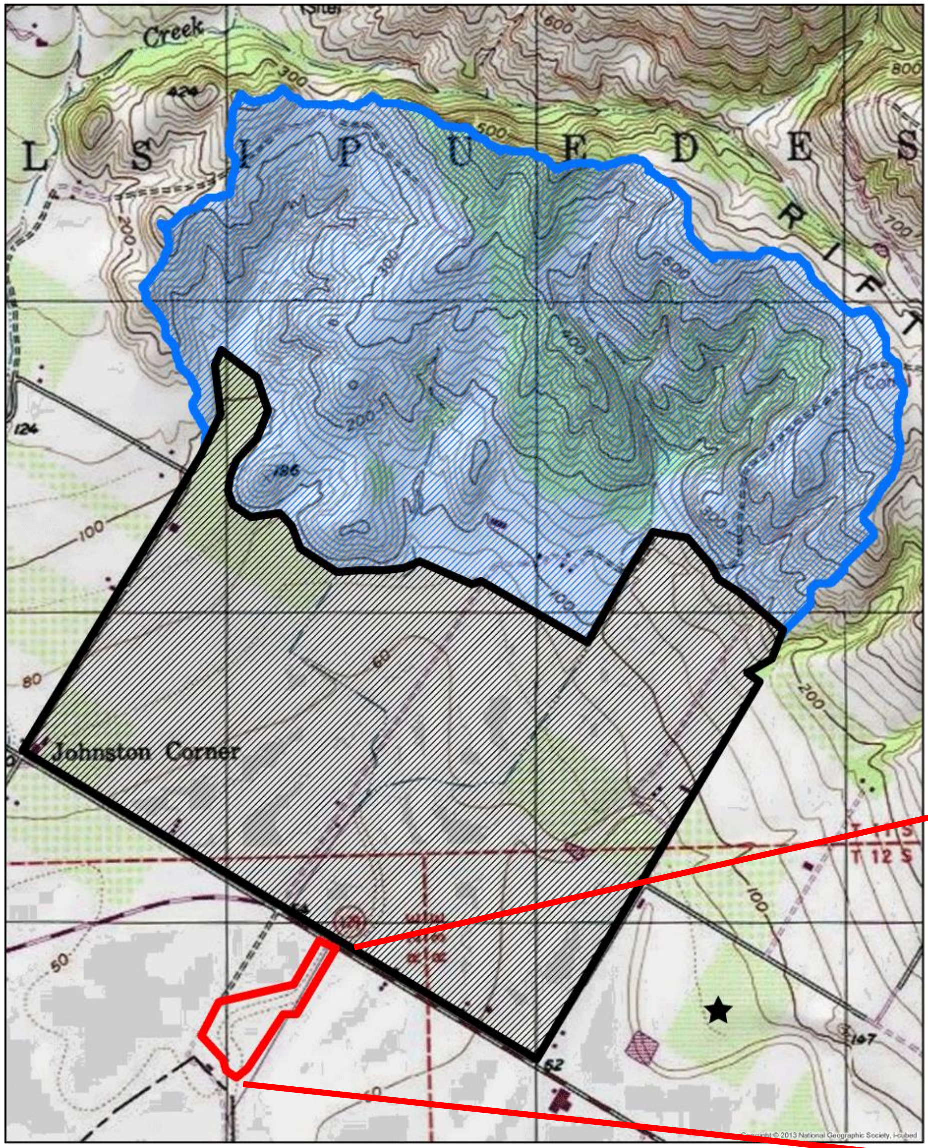
- ***Capital costs***
  site ID, design, engineering, installation
- ***Validation***
  measurements, sampling, certification
- ***Rebates (Incentives)***
  offset for operation and maintenance costs

In the PVGB:

Costs are competitive, program can be revenue positive

Kelly-Thompson Ranch

- Working ranch and rangeland
- >1300 acres draining into ~15 acres
- interest in improvement to water supply and water quality



Soil survey (drilling)

Locations and areas (approximate)

- Developed (620 acres)
- Undeveloped/less developed (700 acres)
- Potential infiltration area
- Nearby infiltration project

KT Project Concept and Timeline

√ *Secured land-owner agreement*

√ *Surveyed site, DP drilling*

- needed for grant applications

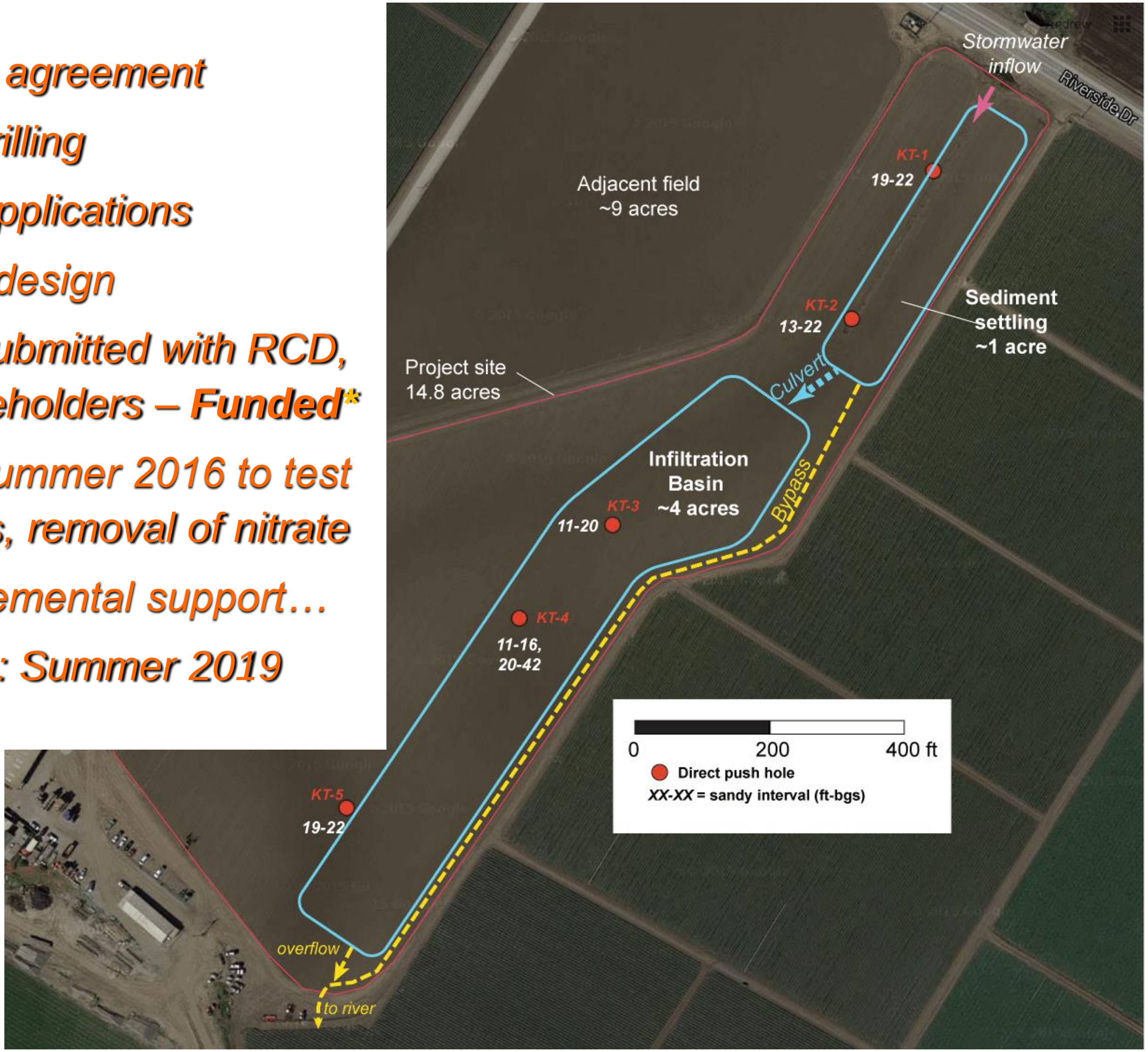
√ *Prelim. engineering design*

√ *Grant applications submitted with RCD, PVWMA, local stakeholders – **Funded****

√ *Field experiments Summer 2016 to test infiltration properties, removal of nitrate*

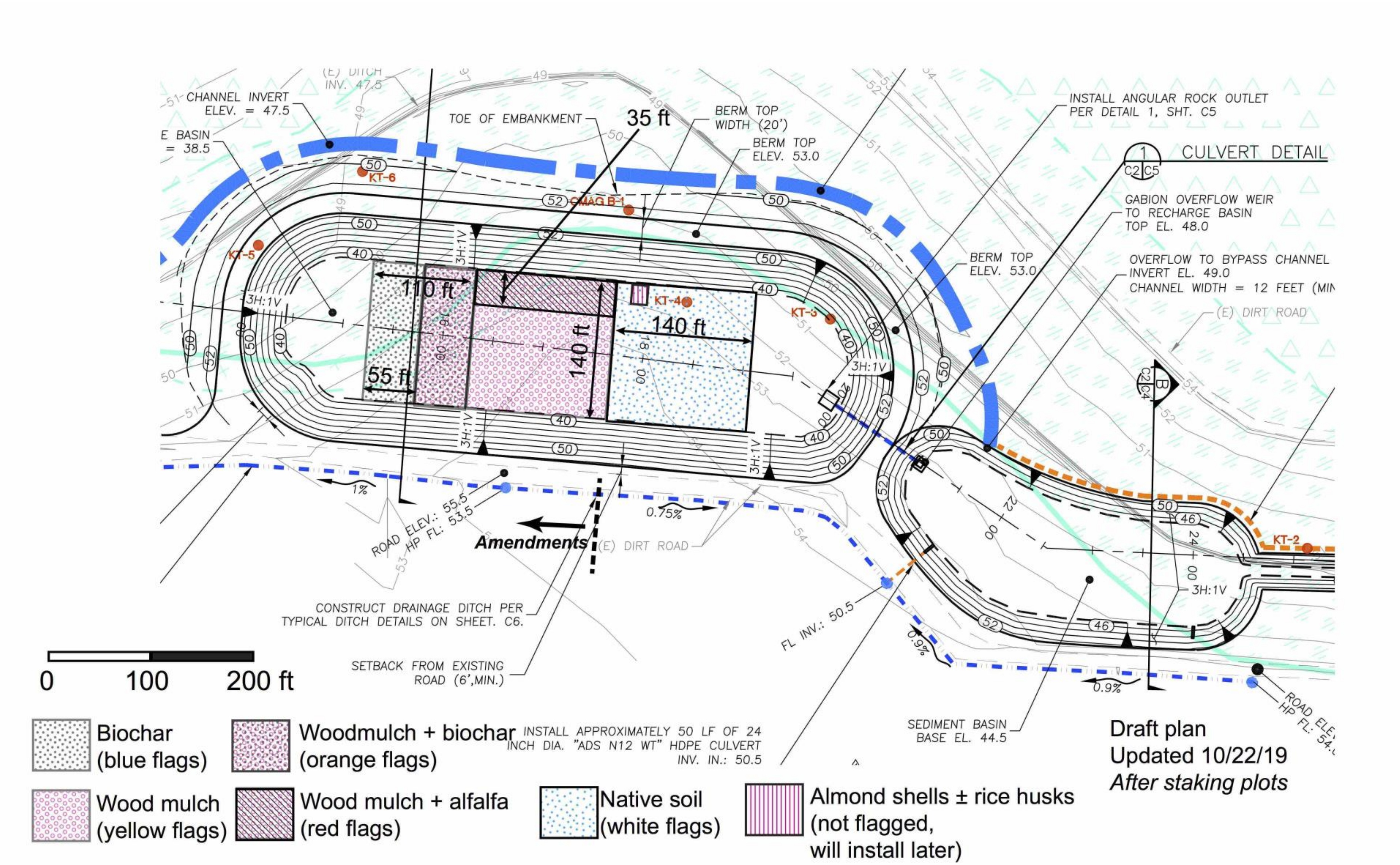
√ *Permits, bids, supplemental support…*

√ *System construction: Summer 2019*



**ReNeM helped to make this happen!*

KT Project Engineering



- *Test carbon-rich soil amendments*

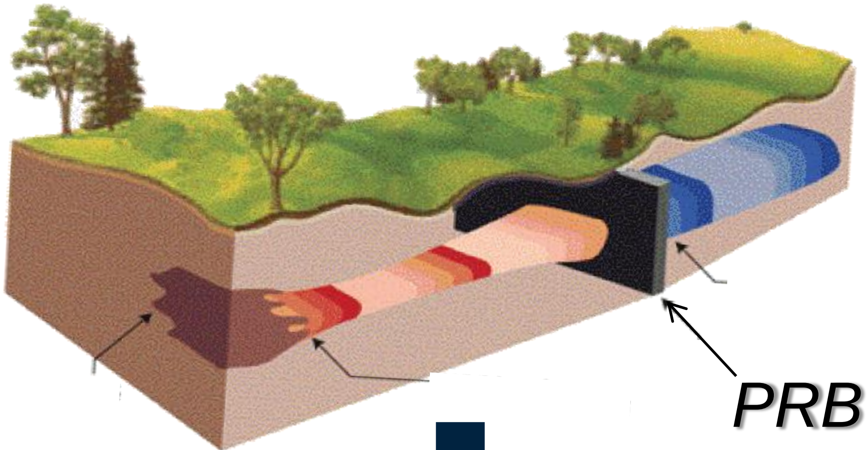
KT Ranch – Soil Amendments

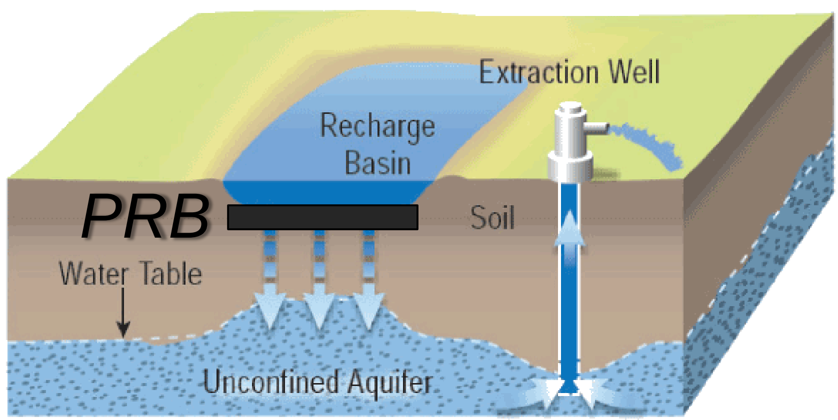
Friday 11/1/19

How to Improve Water Quality during DSC-MAR?

Field and laboratory studies:

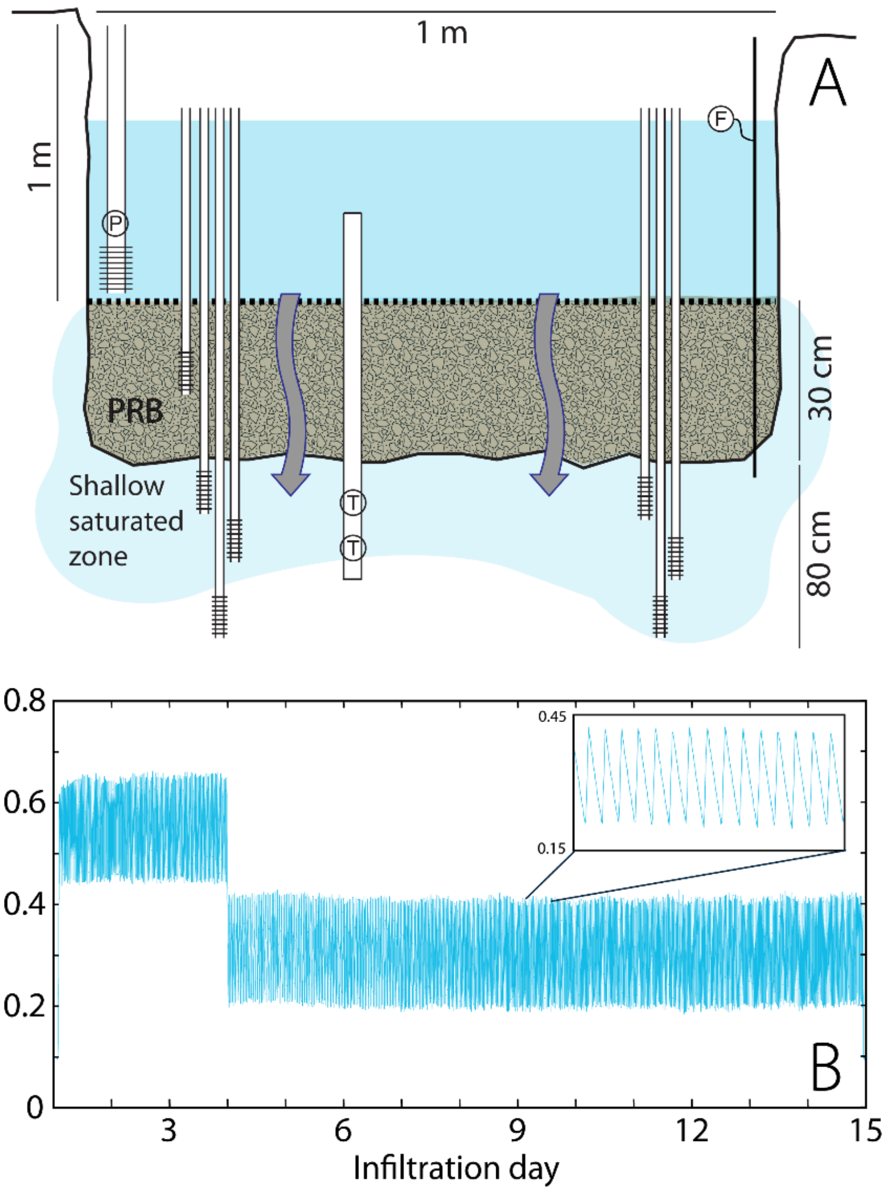
- *What are relations between infiltration rate, microbial activity, and nitrogen cycling?*
- *How can the use of a permeable reactive barrier (PRB) impact these relations?*
- *How can development and use of a low-cost PRB improve water quality during MAR?*





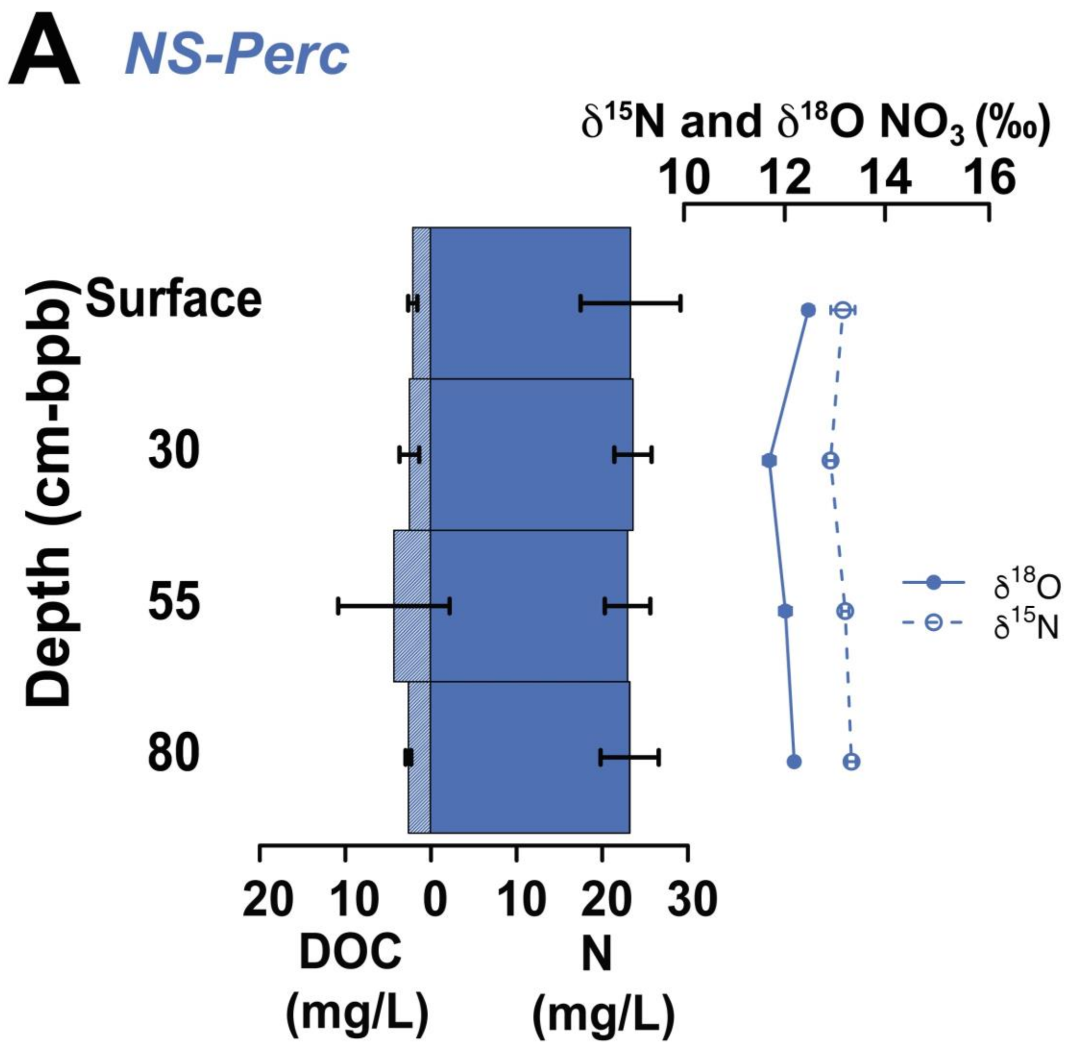
GORDON AND BETTY MOORE FOUNDATION

Experimental configuration



Beganskas et al. (2018)

Tests at Kelly-Thompson Ranch



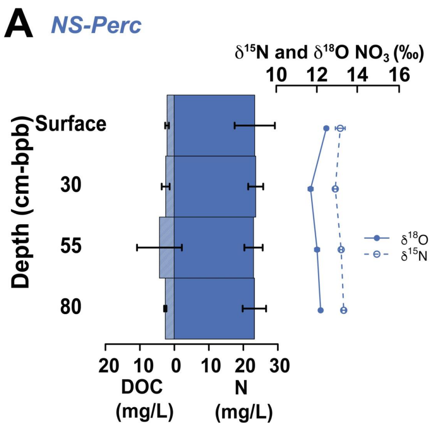
<u>Native soil (NS)</u>:

- little change in carbon or nitrate with depth

- Nitrate isotopes consistent

Gorski et al. (2019)

Tests at Kelly-Thompson Ranch



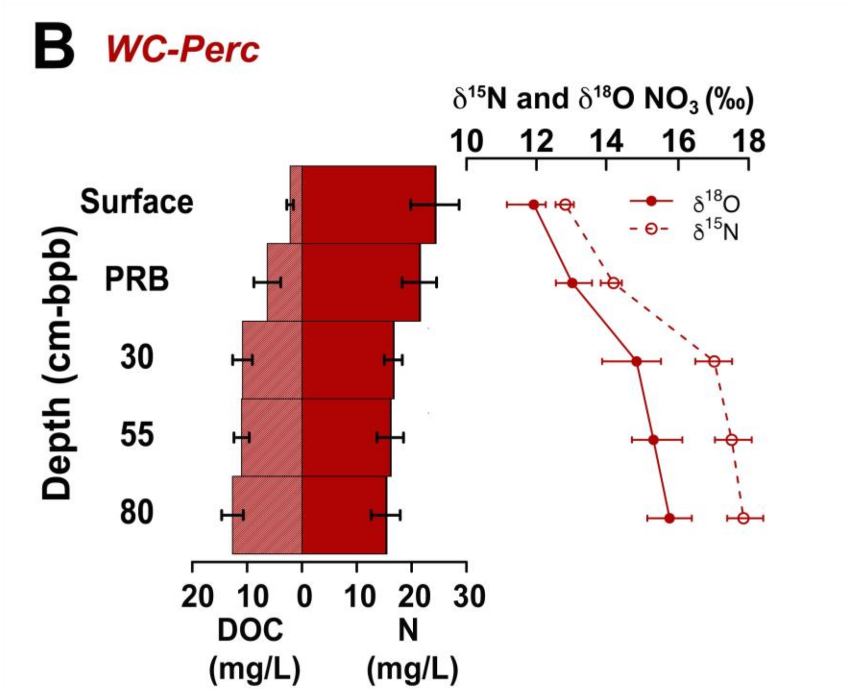
Wood chips (WC):

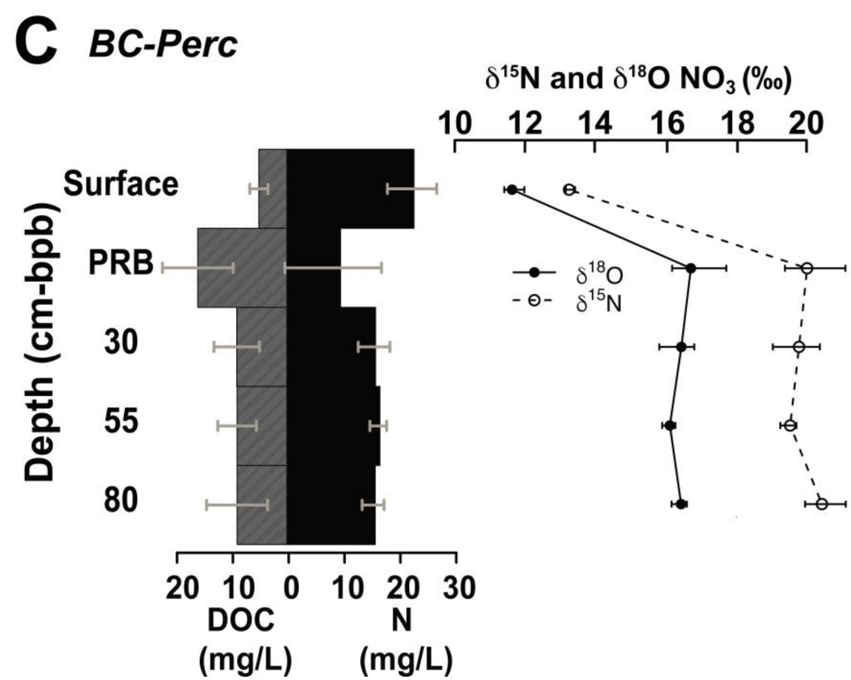
- Carbon increases, nitrate decreases with depth in soil

- Nitrate isotopic shift

Biochar (BC):

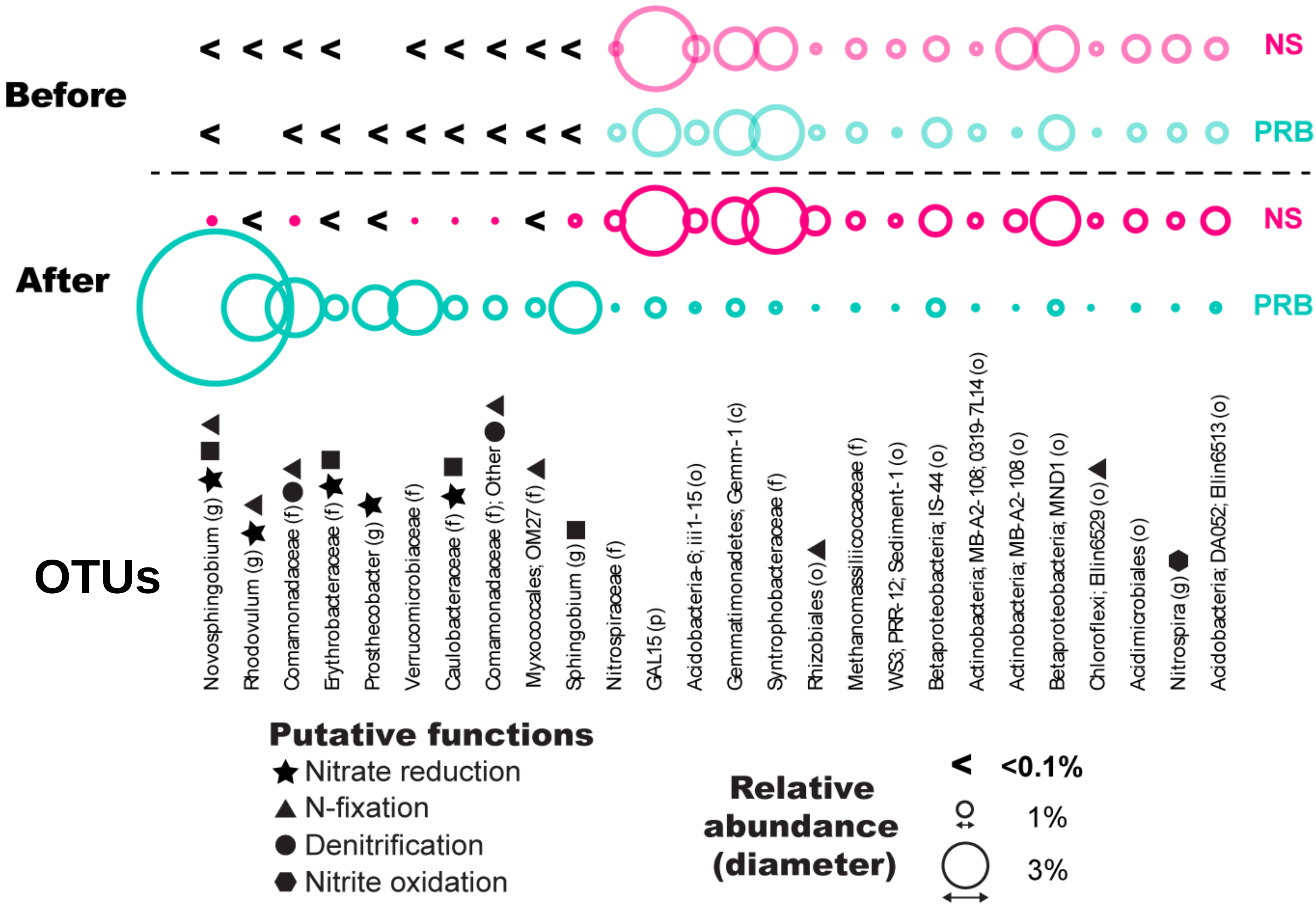
- Similar pattern, but more in the PRB than underlying soil





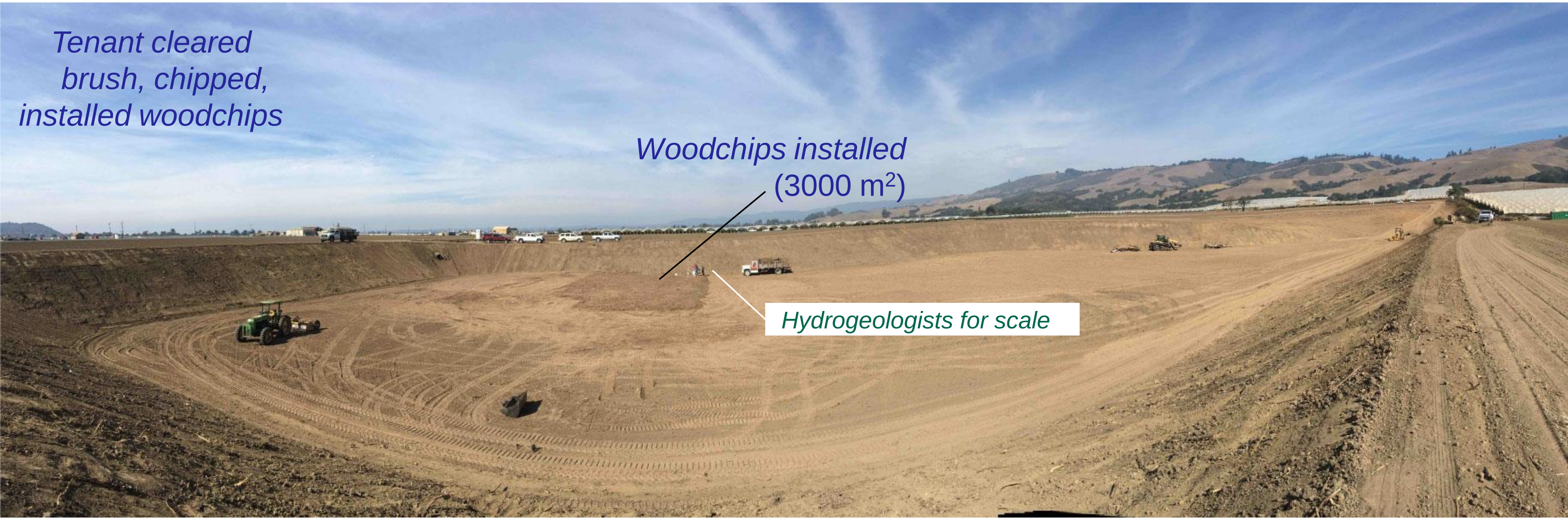
Gorski et al. (2019)

Shifts in microbial ecology with infiltration+PRB

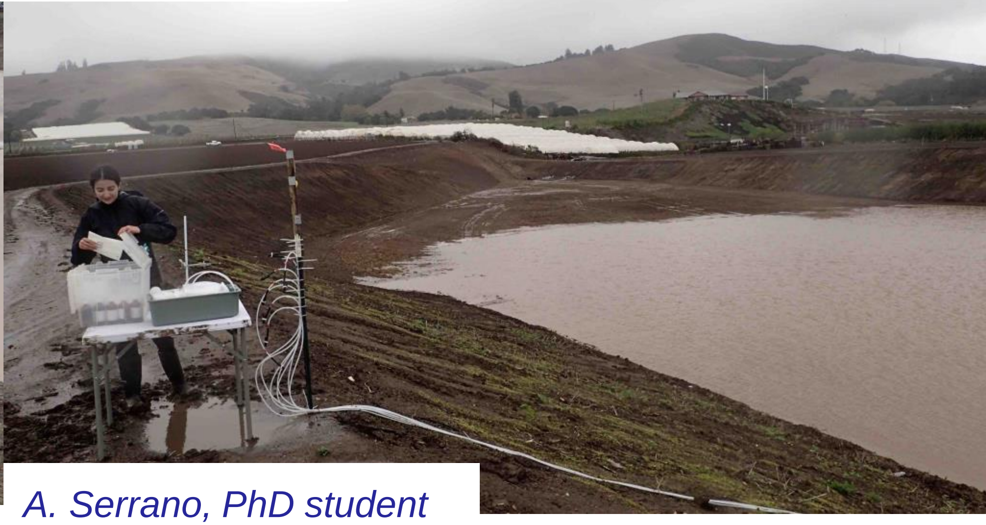


Beganskas et al. (2018)

Bokariza-Drobac: WY 19



Stormwater sampling, Winter 2018-19



A. Serrano, PhD student

Challenges and Bottlenecks

- ***Agreement on terms, requirements, liability, obligations.***

- ***Between UCSC, RCD, and participants (Phases 1/2, access)***
- ***Between water agency, participants (Phase 3, rebates)***
- ***One full package is complete***

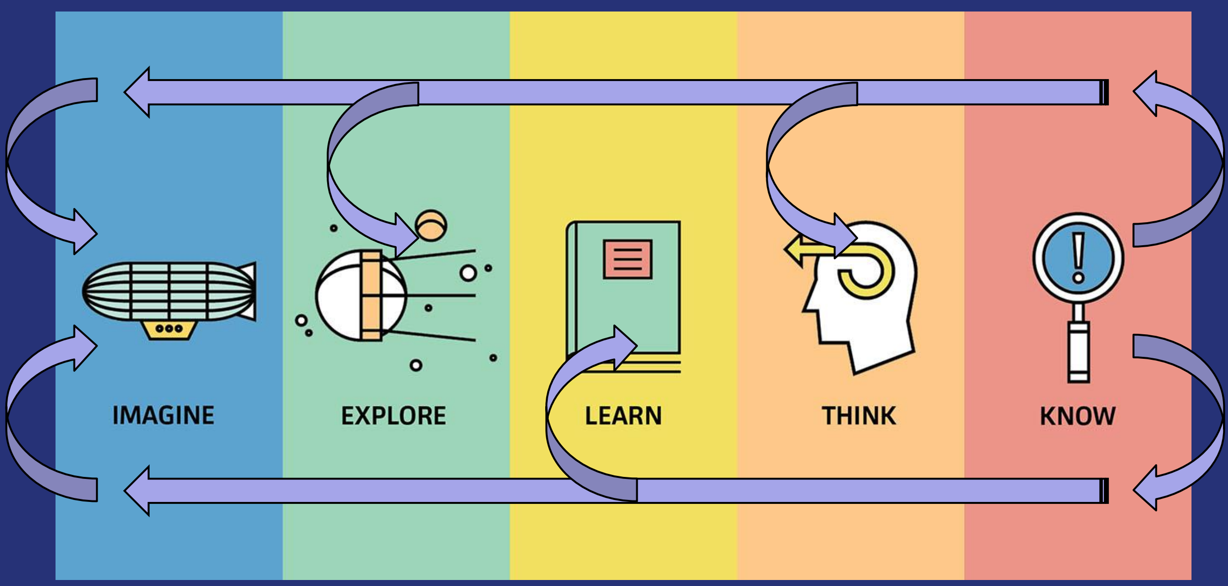
Challenges and Bottlenecks

- **Agreement on terms, requirements, liability, obligations.**
- ***Permits, "reasonable and beneficial," public benefit?***

Miller, K., N. G. Nylen, H. Doremus, D. Owen, and A. T. Fisher (2018), Issue brief: Groundwater recharge and beneficial use, Center for Law, Energy & the Environment, University of California at Berkeley, Berkeley, CA, 10.15779/J22D1H.

Challenges and Bottlenecks

- ***Agreement on terms, requirements, liability, obligations.***
- **Permits, "reasonable and beneficial," public benefit?**
- ***Establish and apply templates, best practices***

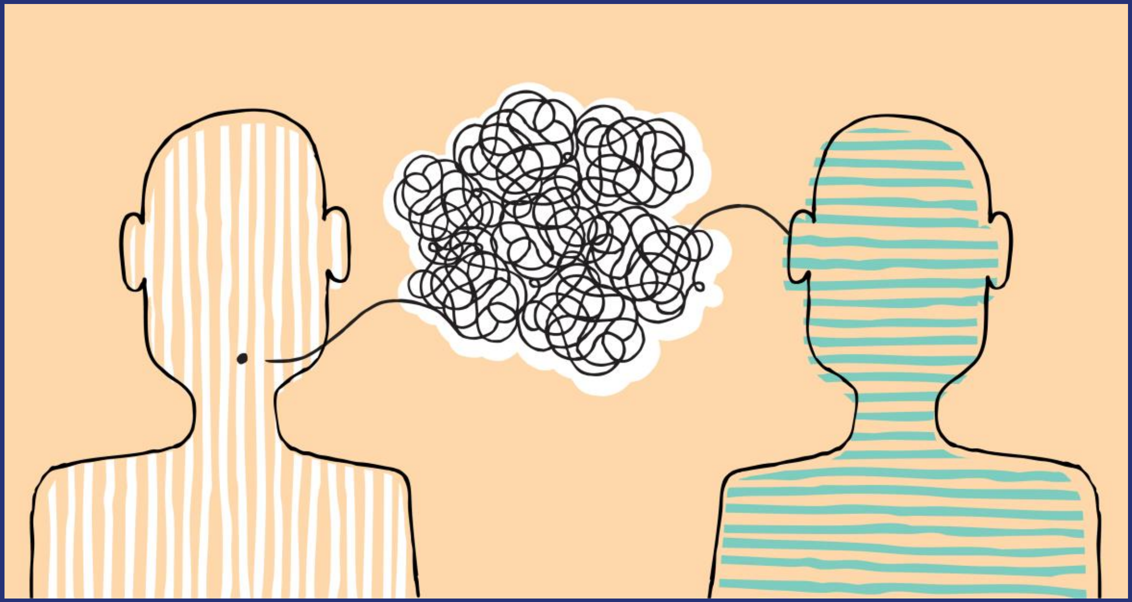


Develop tools/methods

Each site is different, requires careful design and operation

Challenges and Bottlenecks

- ***Agreement on terms, requirements, liability, obligations.***
- **Permits, "reasonable and beneficial," public benefit?**
- **Establish and apply templates, best practices**
- ***Misunderstandings***



- ***Recharge ≠ storage***
- ***Infiltration vs. recharge***
- ***FloodMAR***
- ***Stormwater***
- ***Biggest risk is not from "not recharging"***

ReNeM: Ongoing Work, Next Steps

- Encourage stakeholders to complete program paperwork
- Manage operating projects – maximize supply and quality benefits, maintain systems
- Collect water quality data from surrounding wells (in discussion with PVWMA staff, link to regional monitoring)
- Write annual reports for each project (once formally approved)
- Find new sites and partners
- Raise project funds: design, build, validate (repeat)
- Train personnel, make progress, address challenges.

- Avoid getting discouraged: ***giving up is not an option…***

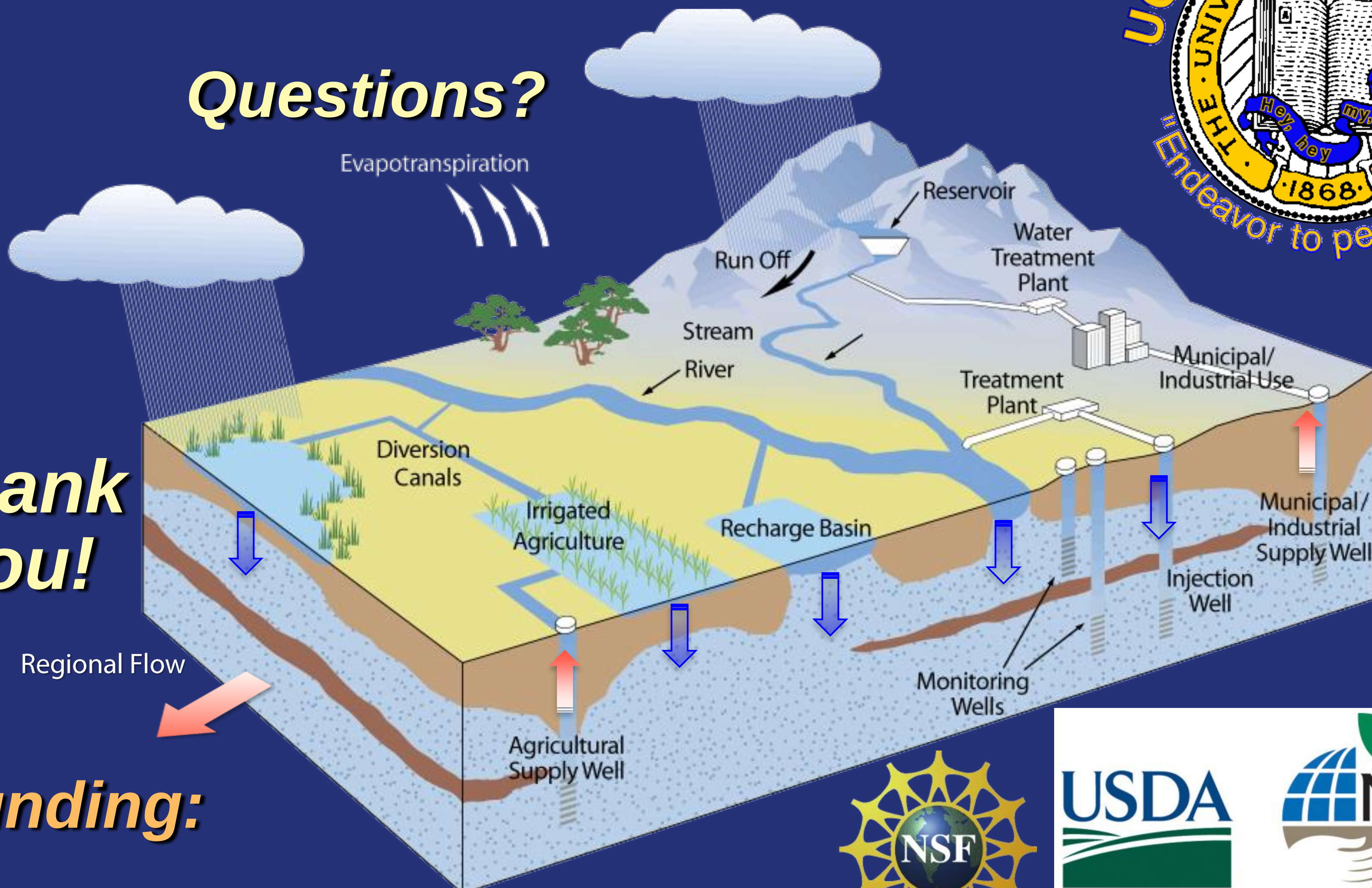
ReNeM: A Team Effort

Many partners, helpers, students, agencies, stakeholders, tenants, collaborators…

The Recharge Initiative
Replenish • Recover • Restore
www.rechargeinitiative.org

UCSC Hydrogeology
"Endeavor to persevere..."

Questions?



Thank you!

Funding:

NSF

USDA NIFA

UC WATER
Security and Sustainability Research Initiative

GORDON AND BETTY MOORE FOUNDATION

State of California Coastal Conservancy