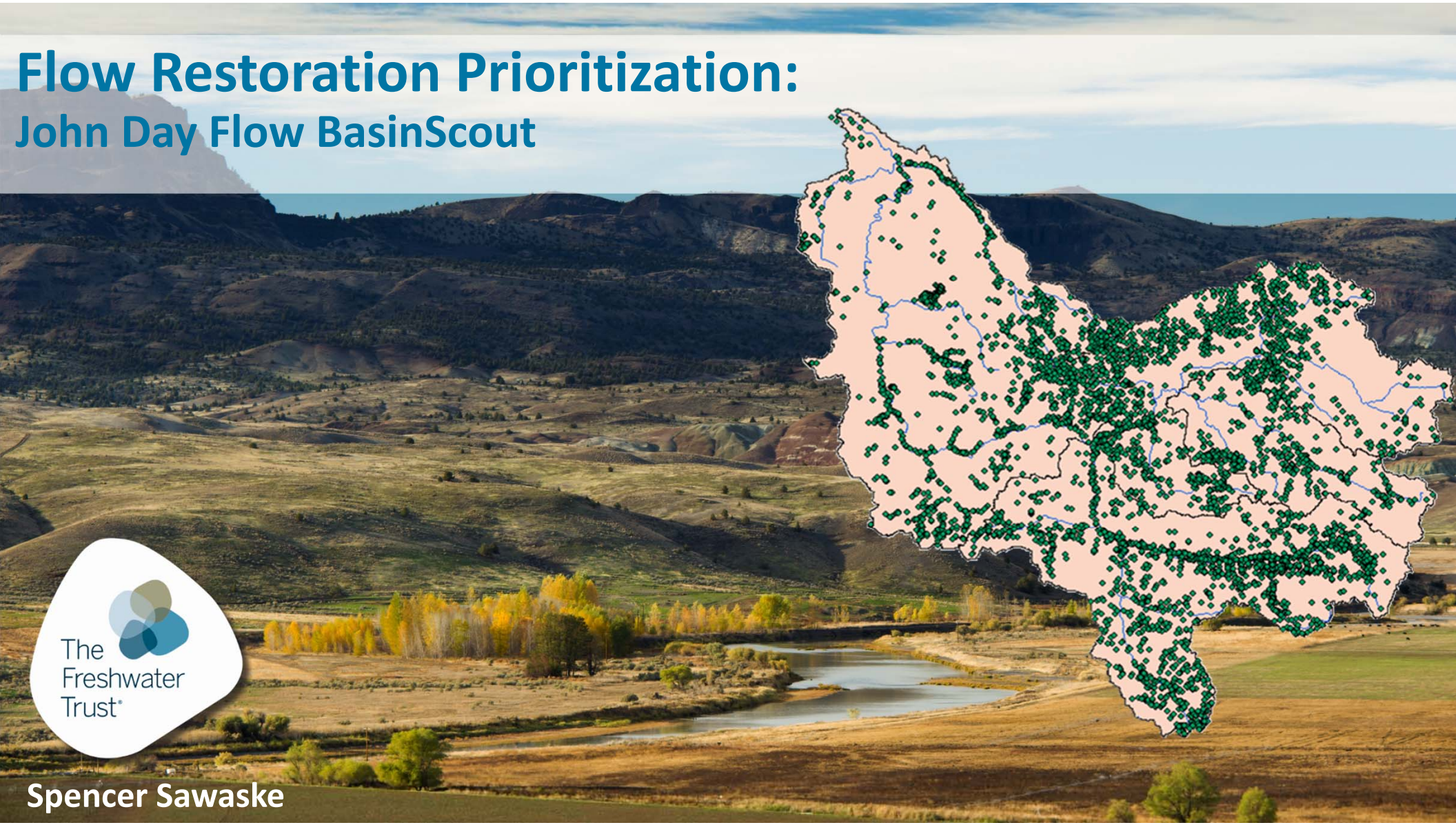
# Flow Restoration Prioritization:

## John Day Flow BasinScout



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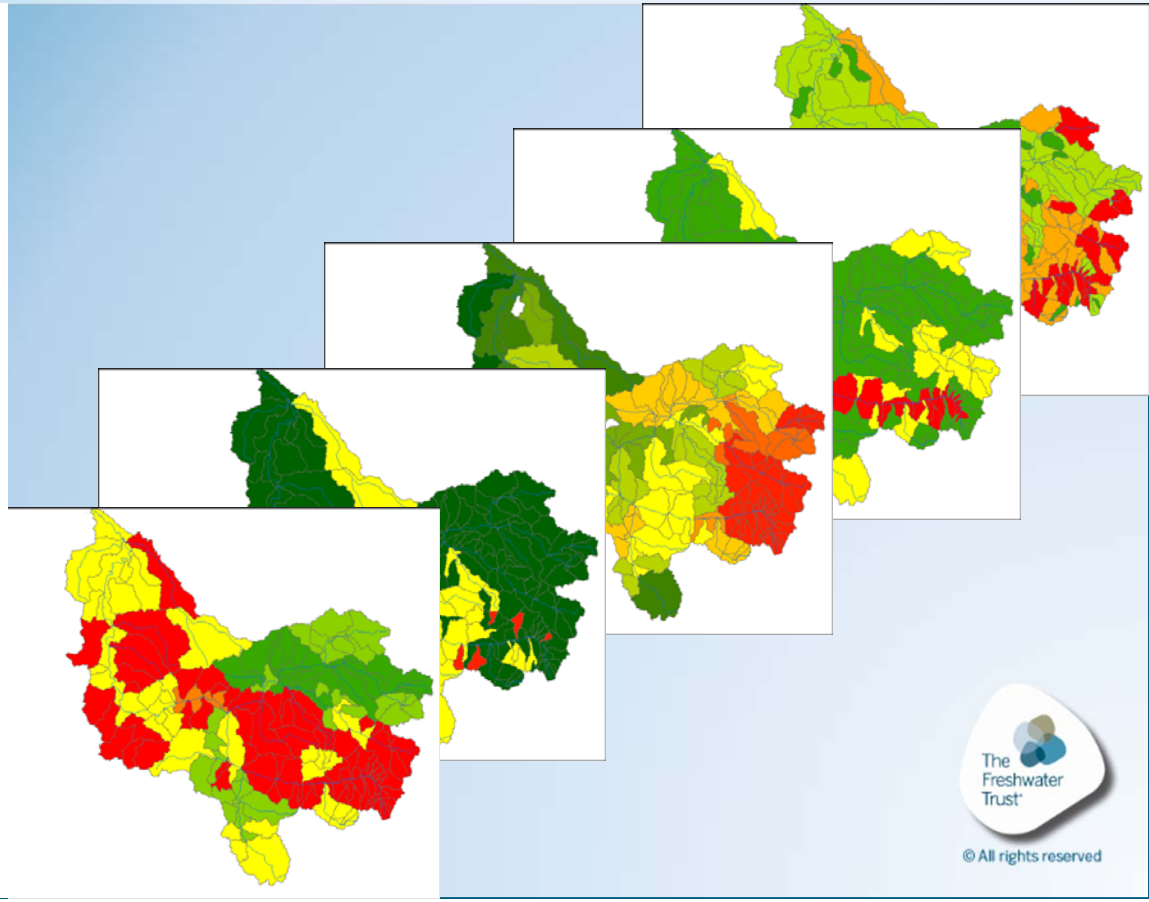
Spencer Sawaske

# Outline

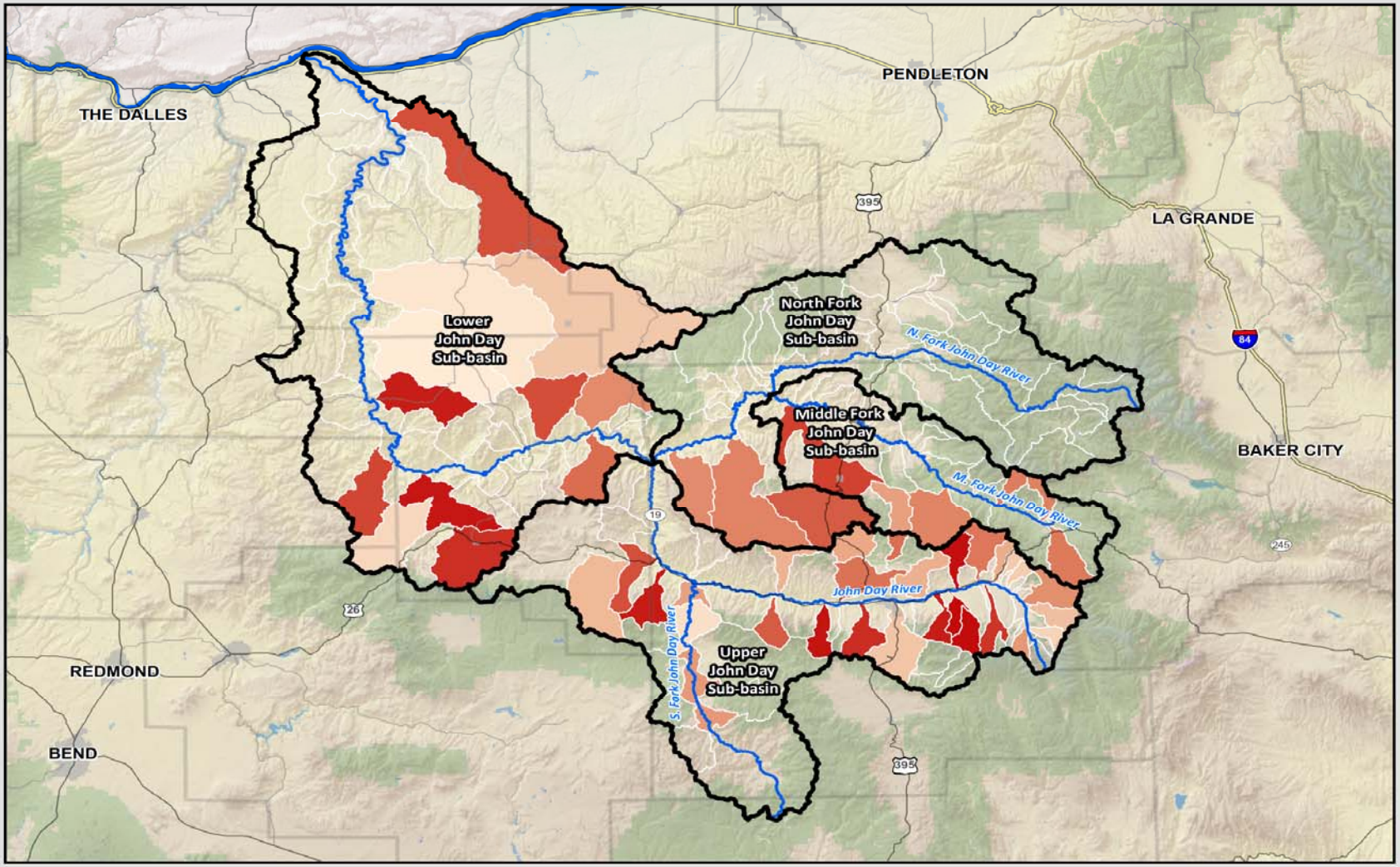
- Ecological/Watershed Prioritization
  - where to work
- Regulation Model
  - which water rights

# Watershed Prioritization

- Combination of 4 datasets
  - NWPC John Day Subbasin Plan
  - Oregon Plan for Salmon and Watersheds
  - NOAA/ODFW Mid-C Recovery Plan
  - CTWSRO Watershed Restoration Strategy
- Expert knowledge



# John Day BasinScout Overview

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Subbasin

River

County

Watershed Boundary

**Flow Restoration Biological Prioritization:**

Low Priority

High Priority

0 15 30

Miles

Projection: Lamber: Co
Datum: North American
Date:9/13/2016

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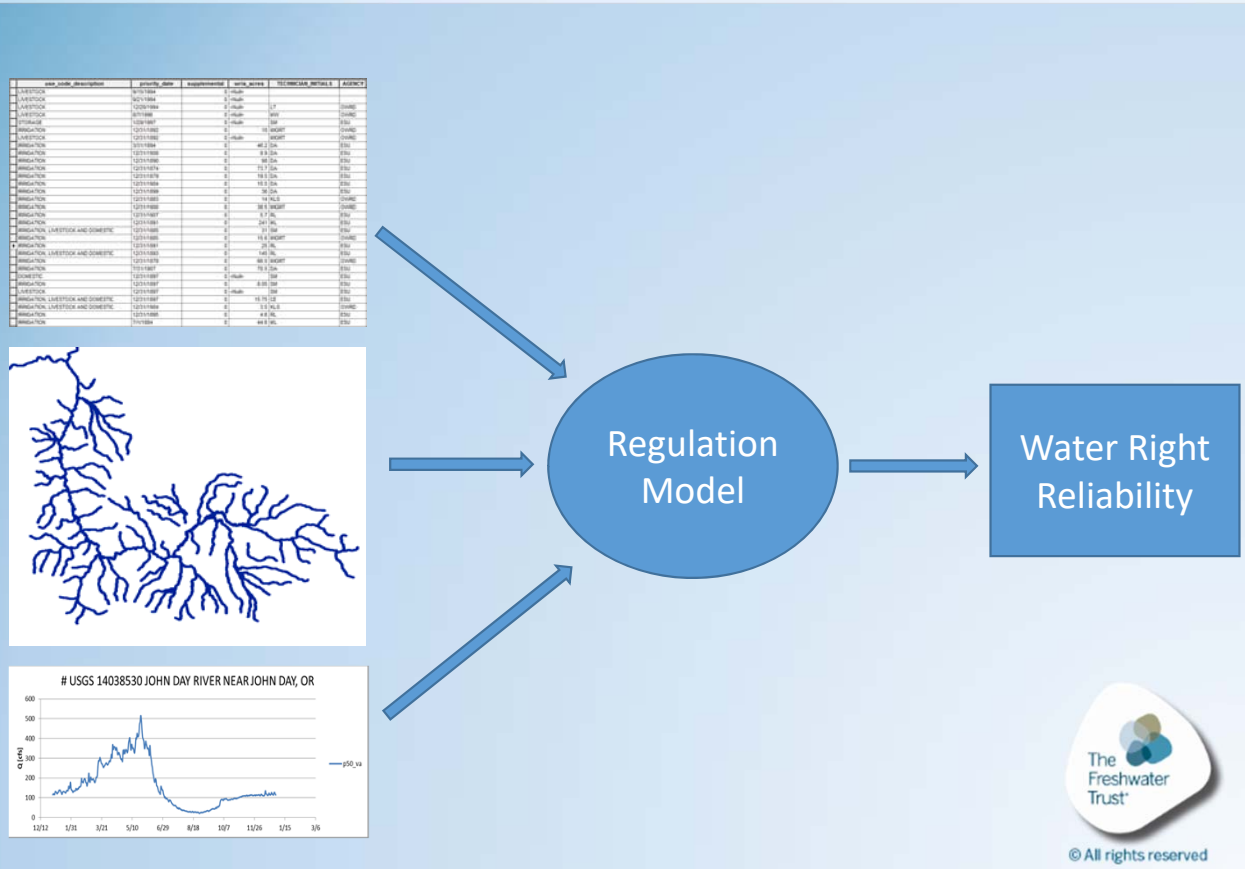
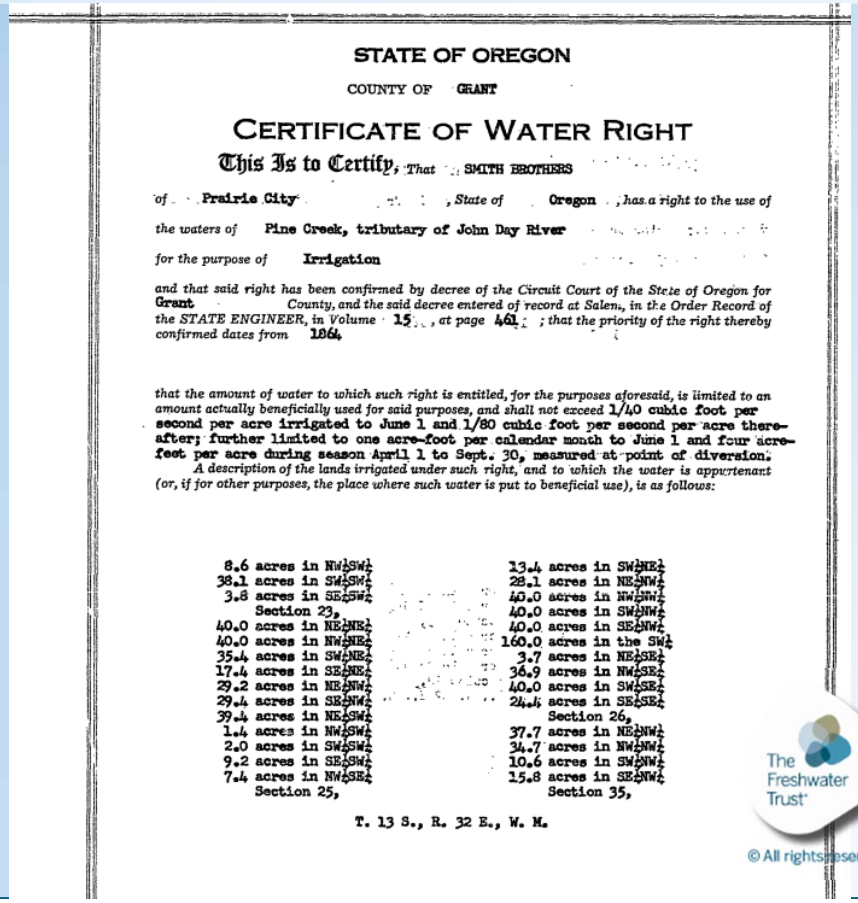
# Regulation Model

- Data: makes use of existing datasets
  - Water rights
  - Stream network- flow routing
  - Expected natural flow



# Oregon Water Rights

- Key Components
  - Priority Date
  - Source (stream, ground water, etc.)
  - Use (irrigation, domestic, livestock, etc.)
  - Place of use (acreage and description)
  - Duty (seasonal volume [acre-ft])
  - Rate (1/40th, 1/80th [cfs/acre])
  - Season of Use



STATE OF OREGON

COUNTY OF GRANT

CERTIFICATE OF WATER RIGHT

This Is to Certify, That SMITH BROTHERS

of Prairie City, State of Oregon, has a right to the use of the waters of Pine Creek, tributary of John Day River for the purpose of Irrigation and that said right has been confirmed by decree of the Circuit Court of the State of Oregon for Grant County, and the said decree entered of record at Salem, in the Order Record of the STATE ENGINEER, in Volume 15, at page 461; that the priority of the right thereby confirmed dates from 1864

that the amount of water to which such right is entitled, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 1/40 cubic foot per second per acre irrigated to June 1 and 1/80 cubic foot per second per acre thereafter; further limited to one acre-foot per calendar month to June 1 and four acre-feet per acre during season April 1 to Sept. 30, measured at point of diversion.

A description of the lands irrigated under such right, and to which the water is appurtenant (or, if for other purposes, the place where such water is put to beneficial use), is as follows:

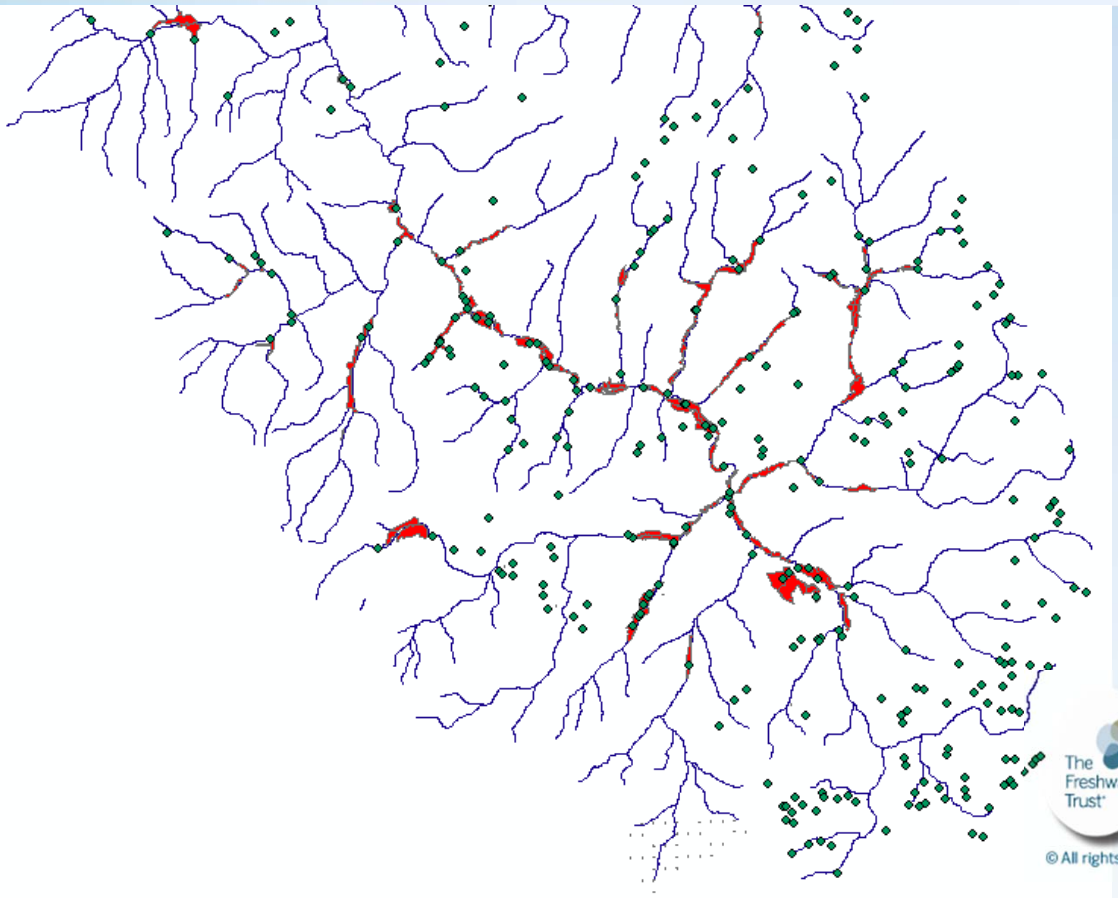
8.6 acres in NW¼SW¼
38.1 acres in SW¼SW¼
3.8 acres in SE¼SW¼
Section 23,
40.0 acres in NE¼NE¼
40.0 acres in NW¼NE¼
35.4 acres in SW¼NE¼
17.4 acres in SE¼NE¼
29.2 acres in NE¼NW¼
29.4 acres in SE¼NW¼
39.4 acres in NE¼SW¼
1.4 acres in NW¼SW¼
2.0 acres in SW¼SW¼
9.2 acres in SE¼SW¼
7.4 acres in NW¼SE¼
Section 25,

13.4 acres in SW¼NE¼
28.1 acres in NE¼NW¼
40.0 acres in NW¼NW¼
40.0 acres in SW¼NW¼
40.0 acres in SE¼NW¼
160.0 acres in the SW¼
3.7 acres in NE¼SE¼
36.9 acres in NW¼SE¼
40.0 acres in SW¼SE¼
24.4 acres in SE¼SE¼
Section 26,
37.7 acres in NE¼NW¼
34.7 acres in NW¼NW¼
10.6 acres in SW¼NW¼
15.8 acres in SE¼NW¼
Section 35,

T. 13 S., R. 32 E., W. M.

# Water Rights Datasets

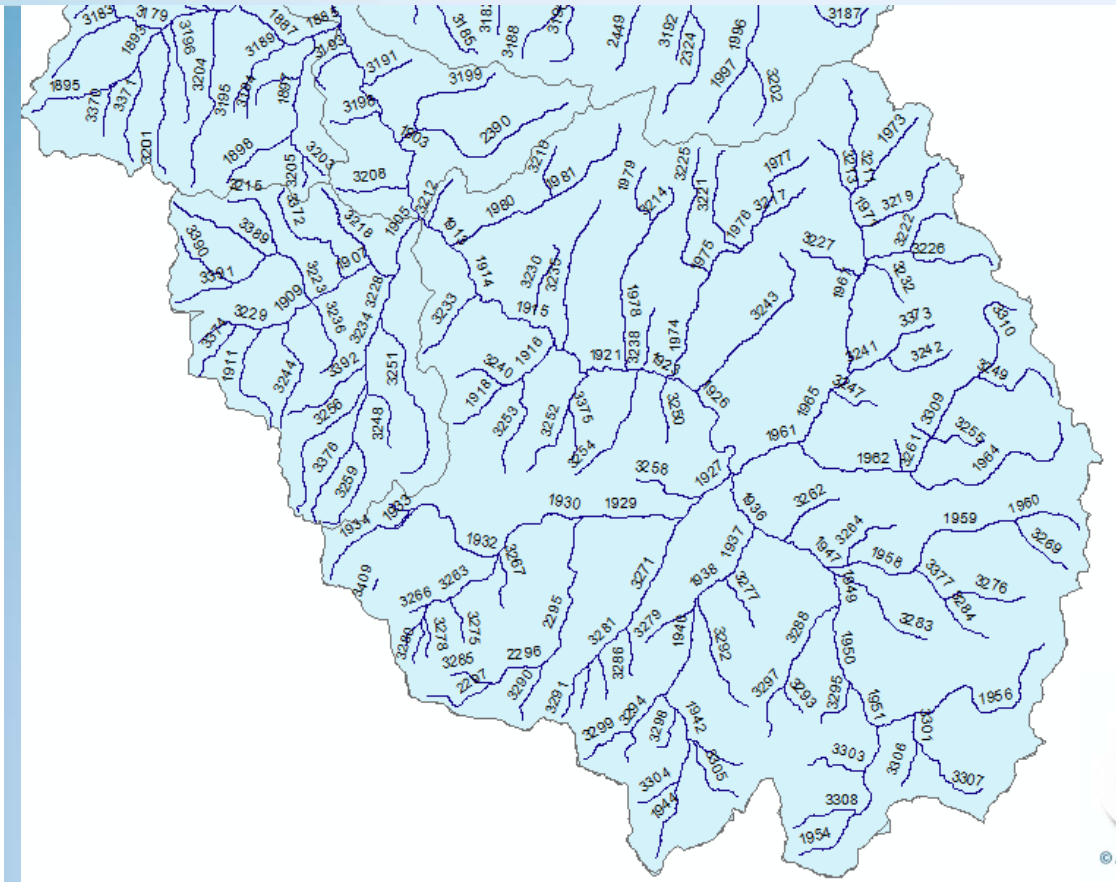
- OWRD database
- Manual verification
- POD and POU location, quantity and priority date
- Limited to irrigation water



# Stream Network

- NHDPlus dataset- EPA
- HydroID allows for flow routing
- Ttools for river mile

| HYDROID | FROM_NODE * | TO_NODE * | Shape_Length | FEATUREID | GridID | NextDownID * |
|---|---|---|---|---|---|---|
| 1743 | 1 | 2 | 1129.705627 | 1 | 1743 | -1 |
| 1744 | 3 | 1 | 2001.837662 | 2 | 1744 | 1743 |
| 1745 | 4 | 3 | 734.558441 | 3 | 1745 | 1744 |
| 1746 | 5 | 4 | 2046.396103 | 4 | 1746 | 1745 |
| 1747 | 6 | 5 | 4304.332697 | 5 | 1747 | 1746 |
| 1748 | 7 | 6 | 3732.200662 | 6 | 1748 | 1747 |
| 1749 | 8 | 7 | 639.214074 | 7 | 1749 | 1748 |
| 1750 | 9 | 8 | 3947.150667 | 8 | 1750 | 1749 |
| 1751 | 10 | 9 | 1716.00174 | 9 | 1751 | 1750 |
| 1752 | 11 | 10 | 60 | 10 | 1752 | 1751 |
| 1753 | 12 | 11 | 7159.056957 | 11 | 1753 | 1752 |
| 1754 | 13 | 1 | 1349.116882 | 12 | 1754 | 1743 |
| 1755 | 14 | 13 | 1001.346108 | 13 | 1755 | 1754 |
| 1756 | 15 | 14 | 1841.148927 | 14 | 1756 | 1755 |
| 1757 | 16 | 15 | 90 | 15 | 1757 | 1756 |
| 1758 | 17 | 16 | 1573.08378 | 16 | 1758 | 1757 |
| 1759 | 18 | 17 | 854.558441 | 17 | 1759 | 1758 |



# Expected Natural Flow

- OWRD database
  - 146 WABs(water availability basin)
  - mean monthly flow
  - scaled based on area $Q_{pod} = Q_{mouth}\left(A_{pod}/A_{mouth}\right)$

**Water Availability Calculation**

Monthly Streamflow in Cubic Feet per Second
Annual Volume at 50% Exceedance in Acre-Feet

| Month | Natural Stream Flow | Consumptive Uses and Storages | Expected Stream Flow | Reserved Stream Flow | Instream Flow Requirement | Net Water Available |
|---|---|---|---|---|---|---|
| JAN | 17.30 | 0.00 | 17.30 | 0.00 | 11.60 | 5.70 |
| FEB | 19.20 | 0.00 | 19.20 | 0.00 | 11.70 | 7.50 |
| MAR | 18.30 | 0.00 | 18.30 | 0.00 | 15.90 | 2.40 |
| APR | 19.20 | 0.97 | 18.20 | 0.00 | 18.00 | 0.23 |
| MAY | 27.50 | 2.12 | 25.40 | 0.00 | 18.00 | 7.38 |
| JUN | 21.50 | 2.82 | 18.70 | 0.00 | 15.00 | 3.68 |
| JUL | 17.40 | 4.22 | 13.20 | 0.00 | 12.00 | 1.18 |
| AUG | 16.70 | 3.24 | 13.50 | 0.00 | 7.62 | 5.84 |
| SEP | 16.50 | 2.12 | 14.40 | 0.00 | 8.18 | 6.20 |
| OCT | 16.10 | 0.83 | 15.30 | 0.00 | 5.00 | 10.30 |
| NOV | 17.70 | 0.00 | 17.70 | 0.00 | 5.00 | 12.70 |
| DEC | 17.60 | 0.00 | 17.60 | 0.00 | 11.50 | 6.10 |

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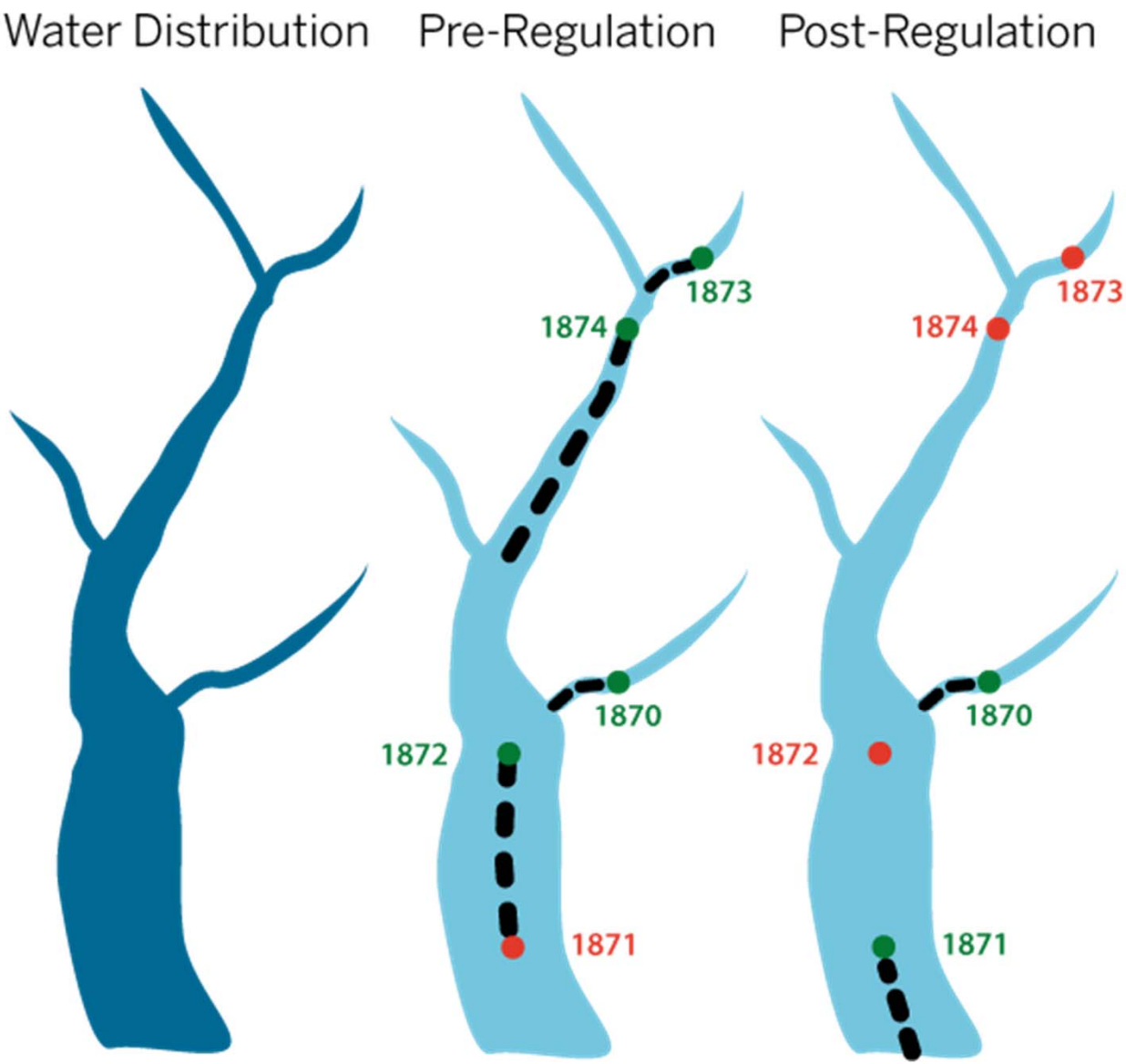
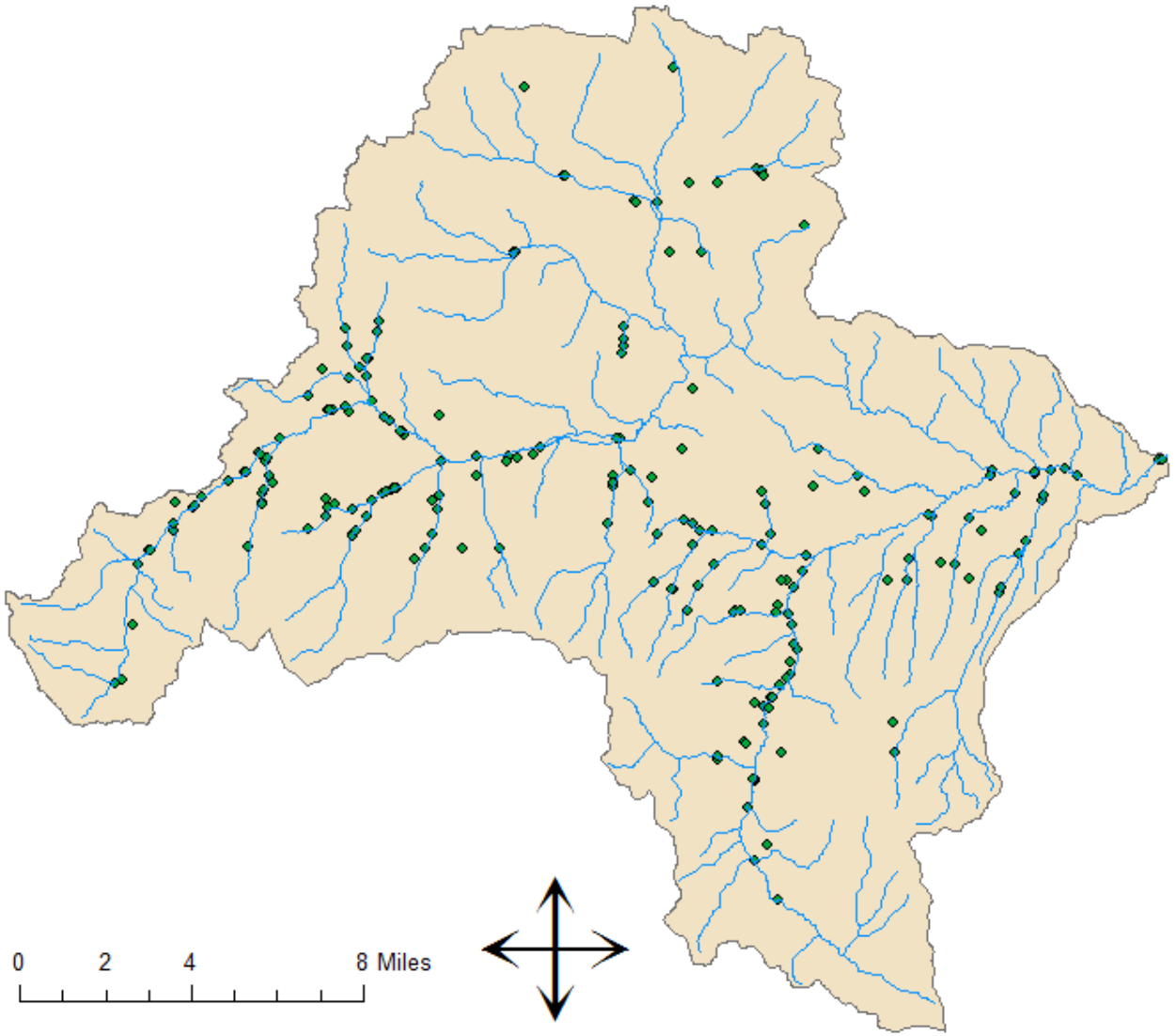
# Regulation

- Priority based
- Functions:
  1. Distribute natural flows
  2. Allocate water based on location
  3. Cycle senior to junior
     - search upstream
     - turn off junior users
     - ferry water downstream
- Nested WABs



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# Output Metrics

- WR monthly reliability during irrigation season (actual allocation/wr)
- Weighted metrics
  - reliability *distance*WR impact:
  - instream flow metric: $M_{inst} = R_{wr} l_{wr} \frac{Q_{wr}}{Q_{inst}}$
  - natural flow metric: $M_{nat} = R_{wr} l_{wr} \frac{Q_{wr}}{Q_{nat}}$

# Results

- Prioritized list of water rights based on impact metric
- Comparison of all WR
- Assess degree of over appropriation
- Combine with tax lot data

| Creek 67, April | | | | | | | |
|---|---|---|---|---|---|---|---|
| reachid | wr | current allocation | cert number | cumulative RM | priority date | natural flow metric | instream metric |
| 2090.00 | 0.20 | 0.00 | 7935 | 0.2 | 5/23/1927 | 0.00 | 0.00 |
| 2090.00 | 2.28 | 2.28 | 25312 | 0.2 | 11-Dec-1865 | 2.59 | 6.00 |
| 2090.01 | 0.13 | 0.00 | 8800 | 0.7 | 5/12/1927 | 0.00 | 0.00 |
| 2090.01 | 0.18 | 0.00 | 8802 | 0.7 | 5/23/1927 | 0.00 | 0.00 |
| 2090.01 | 0.42 | 0.00 | 56314 | 0.7 | 7/1/1983 | 0.00 | 0.00 |
| 2090.01 | 0.10 | 0.00 | 2096 | 0.8 | 8/6/1915 | 0.00 | 0.00 |
| 2090.02 | 0.08 | 0.00 | 7919 | 1.7 | 5/12/1927 | 0.00 | 0.00 |
| 2091.02 | 0.15 | 0.00 | 9060 | 2.5 | 6/30/1927 | 0.00 | 0.00 |
| 2091.03 | 1.17 | 1.05 | 24945 | 2.5 | 31-Dec-1875 | 15.62 | 29.66 |
| 2091.03 | 0.42 | 0.00 | 25118 | 2.5 | 12/31/1905 | 0.00 | 0.00 |
| 2091.03 | 0.79 | 0.79 | 25725 | 2.5 | 31-Dec-1875 | 11.64 | 25.35 |
| 2091.03 | 1.17 | 1.17 | 25749 | 2.5 | 31-Dec-1875 | 17.35 | 31.31 |
| 2091.03 | 0.95 | 0.00 | 49680 | 2.5 | 5/13/1910 | 0.00 | 0.00 |
| 2091.03 | 0.45 | 0.00 | 66816 | 2.5 | 4/25/1980 | 0.00 | 0.00 |
| 2091.03 | 0.06 | 0.00 | 17324 | 2.6 | 5/8/1946 | 0.00 | 0.00 |
| 2091.03 | 0.44 | 0.00 | 52551 | 2.8 | 3/28/1927 | 0.00 | 0.00 |
| 2092.00 | 0.00 | 0.00 | 0 | 3.5 | 1/1/4000 | 0.00 | 0.00 |
| 2093.00 | 0.07 | 0.00 | 2868 | 0.1 | 3/27/1917 | 0.00 | 0.00 |
| 2093.04 | 0.38 | 0.00 | 3275 | 4.0 | 3/11/1912 | 0.00 | 0.00 |
| 2093.04 | 0.09 | 0.00 | 3313 | 4.0 | 3/11/1912 | 0.00 | |
| 2920.00 | 0.06 | 0.00 | 3408 | 3.2 | 10/8/1918 | 0.00 | |

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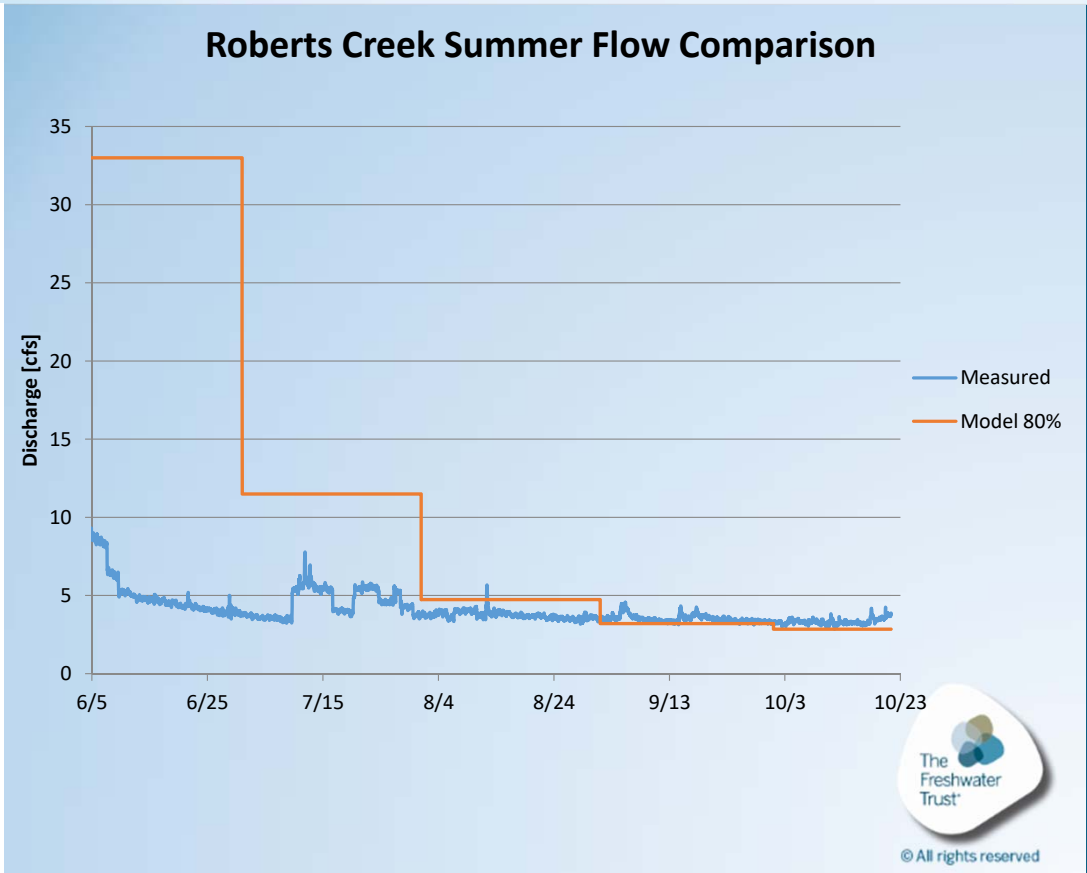
# Assumptions and Uncertainty

- WR data accuracy
  - includes all WR
  - users take exact paper water amount
- Modeled flow and area estimation
  - incorporate measured flow
- Use follows prior appropriation
  - cooperative agreements
  - single large landowners

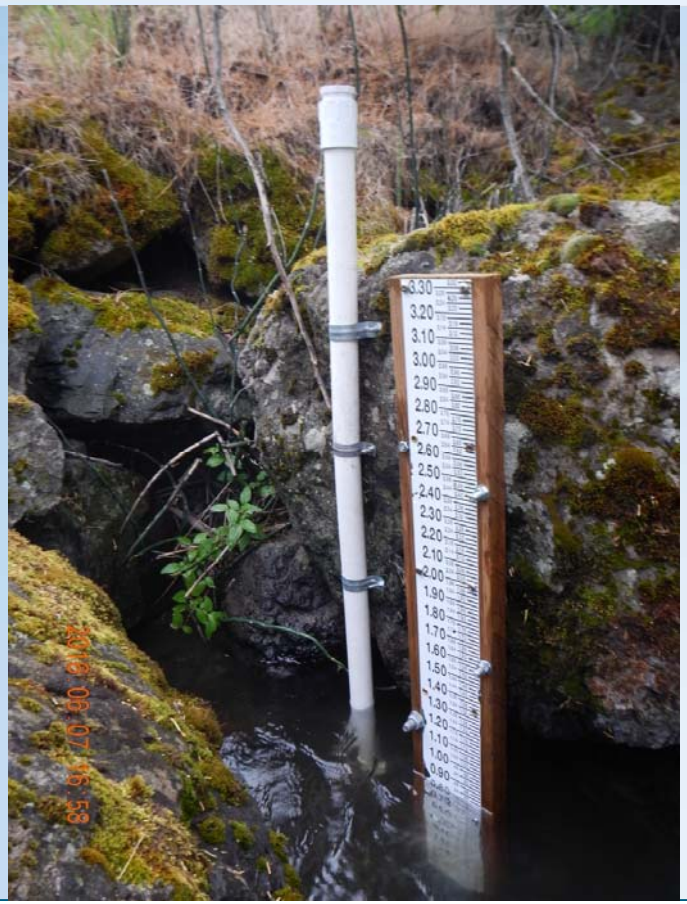


# Ground Truthing and Model Calibration

- Imagery
  - NAIP(annual 1m), Landsat(16 days 30m),Planet Labs(daily-monthly 3m)
- Watermaster input
- Measurement
- Time

# Conclusions and Next Steps

- Estimate of monthly instream transfer impact (location, reliability, magnitude)
- Applicable statewide
- Most appropriate in highly regulated, multi-user systems
- Incorporate return flow and seepage loss
- Collect more measured data



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# Questions?

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