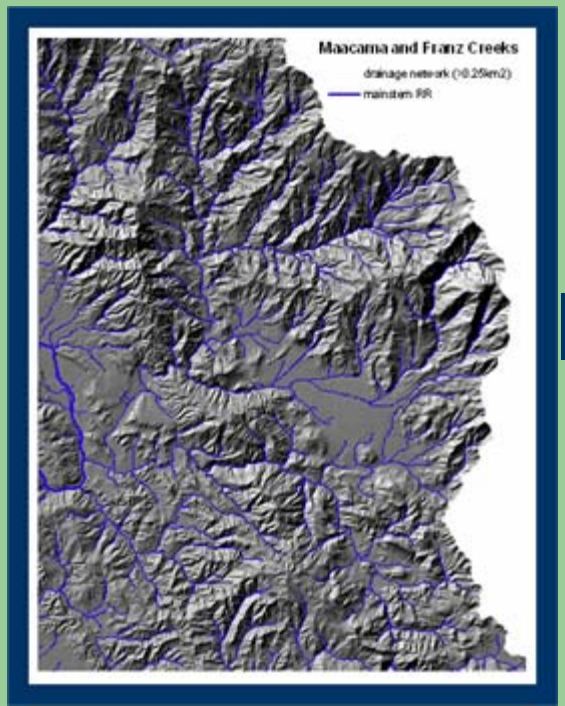
Decision-support for water allocation and environmental flow recovery



Hydrologic modeling of water diversions from North Coast streams

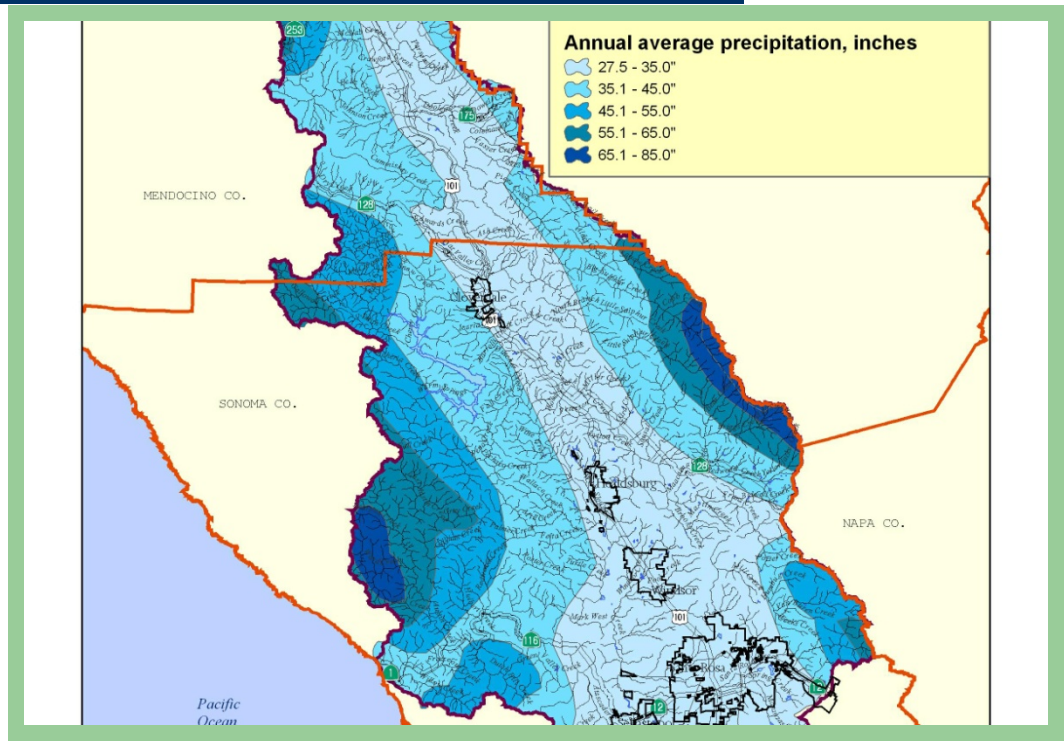
Adina Merenlender, PhD adina@nature.berkeley.edu
Matt Deitch, PhD
Shane Feirer
University of California Cooperative Extension/Berkeley
Hopland Research and Extension Center

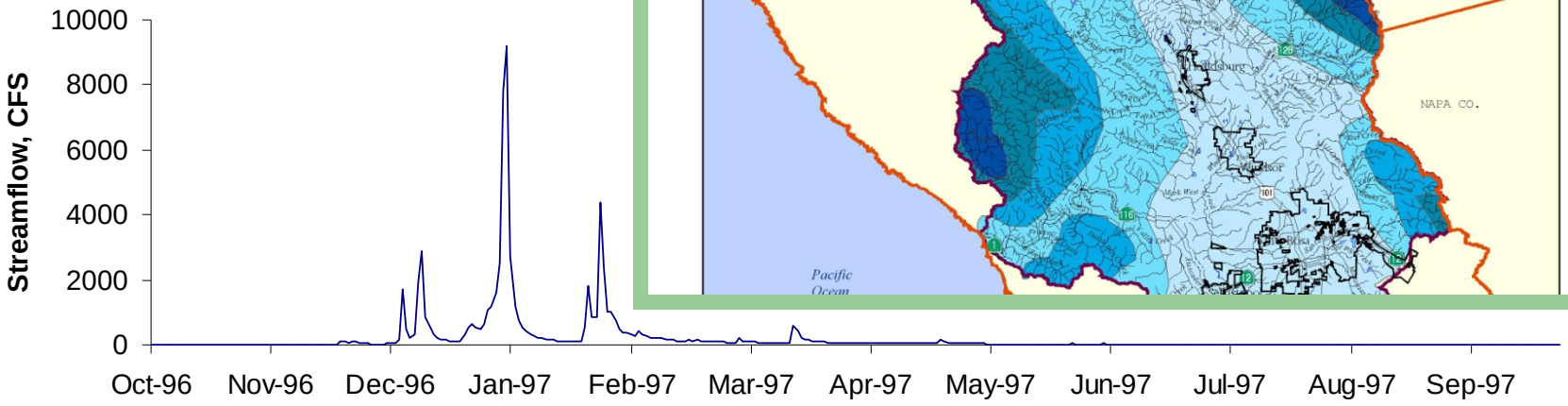
Today's presentation

- Background and justification for a spatial/temporal modeling approach
- A scientific decision-support system for…
  1) Water availability and allocation
     a) Cumulative impacts analysis
  2) Scenarios for policy
     a) Qmbf, Qmcd
  3) Watershed analysis
     a) Important for the Watershed Approach and restoration planning
- Questions

Scale matters especially in mediterranean-climate watersheds

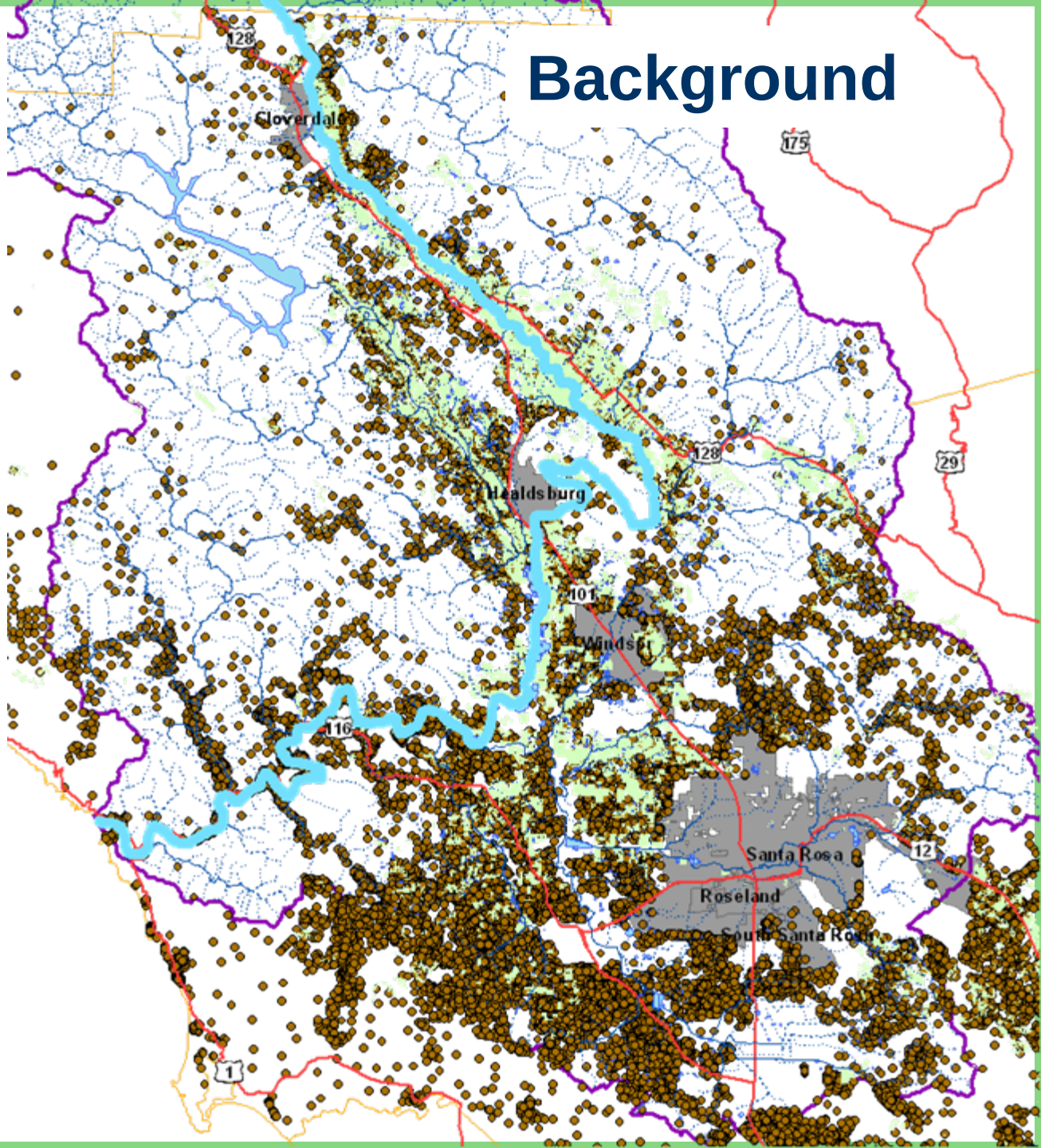
Inter- annual variation from 25-75” annual rainfall at Healdsburg 1950-2000.



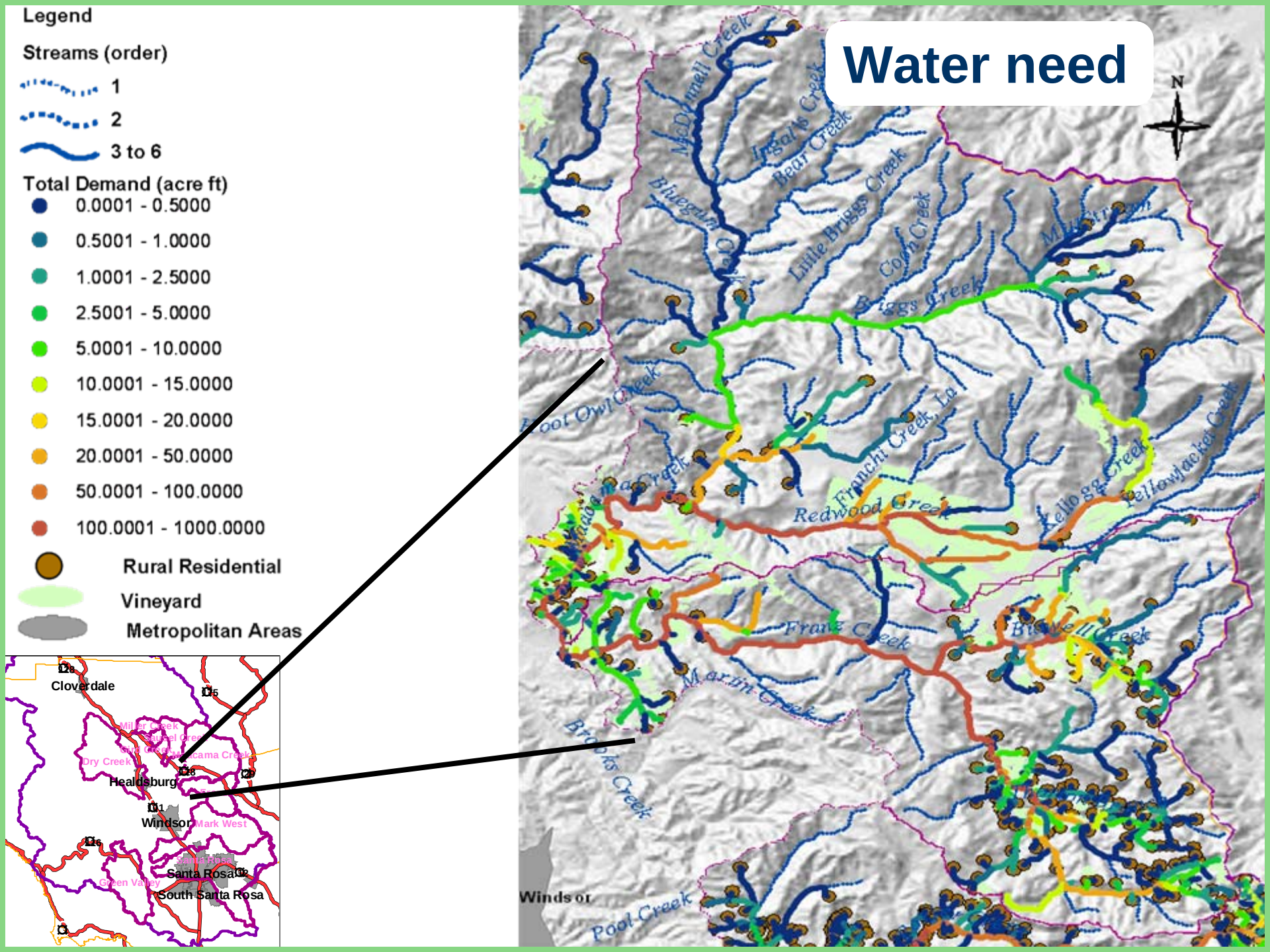


Background

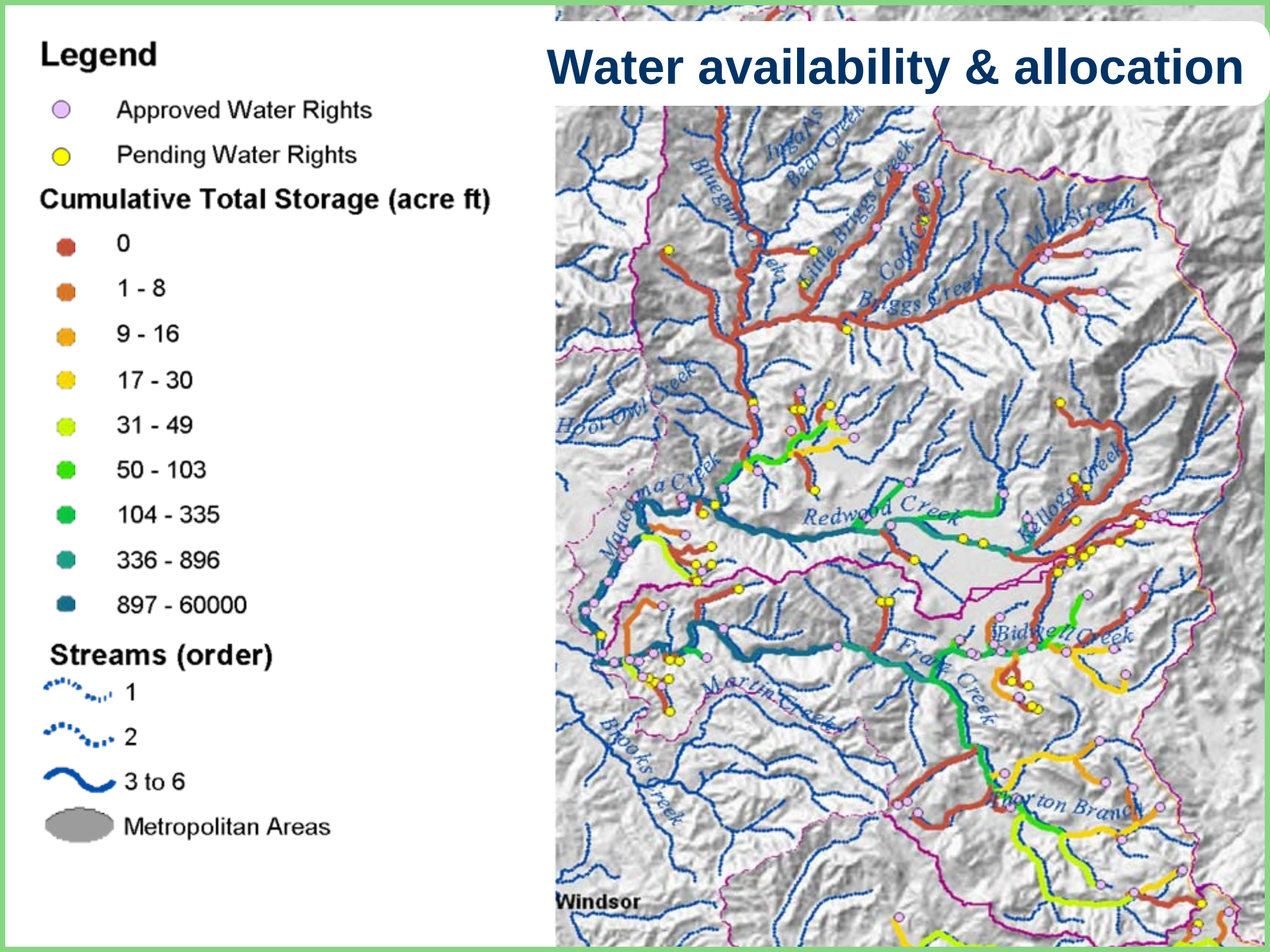
Water management is distributed throughout the watershed.



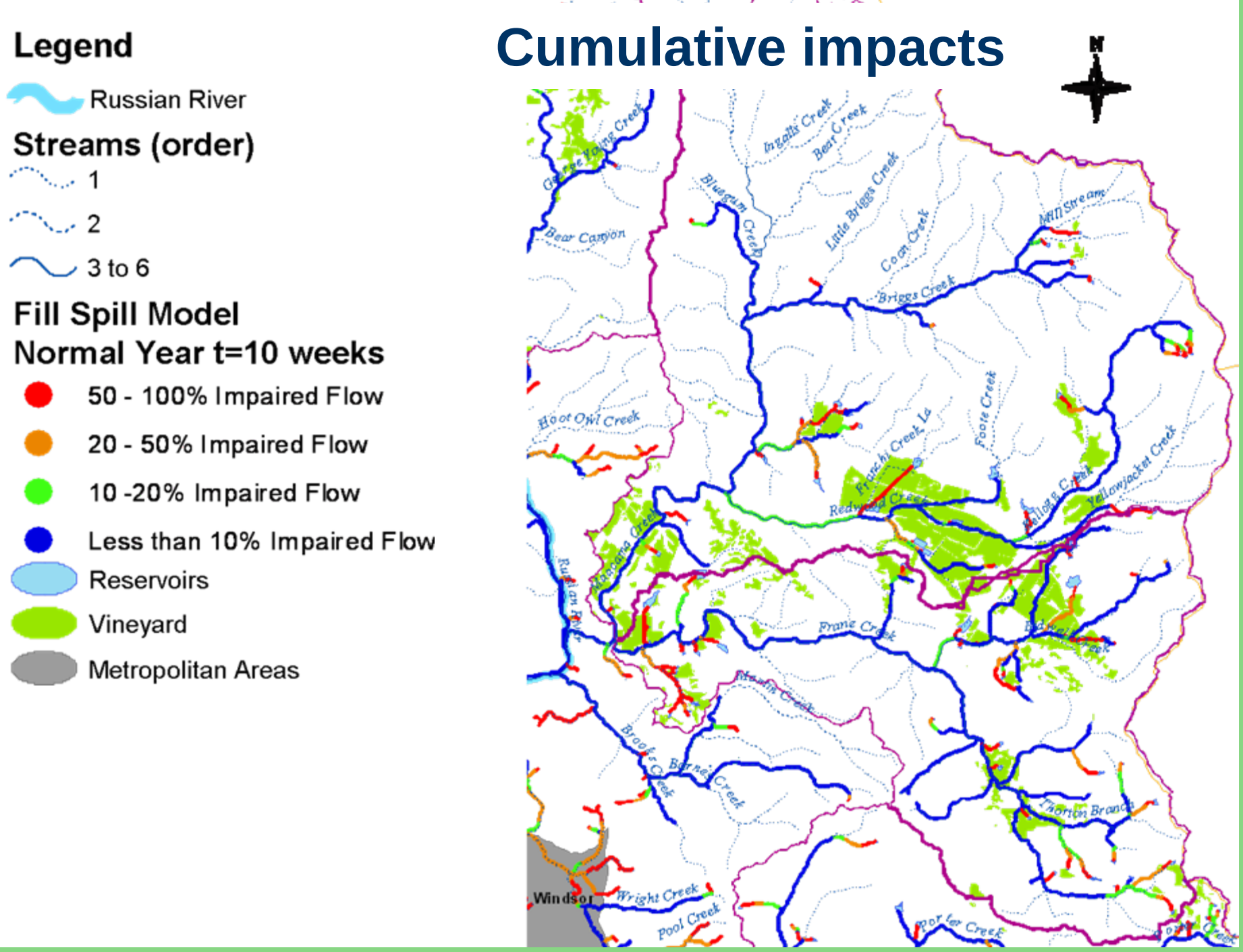
Water need


Legend
Streams (order)
1
2
3 to 6
Total Demand (acre ft)
0.0001 - 0.5000
0.5001 - 1.0000
1.0001 - 2.5000
2.5001 - 5.0000
5.0001 - 10.0000
10.0001 - 15.0000
15.0001 - 20.0000
20.0001 - 50.0000
50.0001 - 100.0000
100.0001 - 1000.0000
Rural Residential
Vineyard
Metropolitan Areas
N
McDonnell Creek
Bluegum Creek
Bear Creek
Little Briggs Creek
Corn Creek
Briggs Creek
Redwood Creek
Frank Creek
Marlin Creek
Pool Creek
Windsor
Cloverdale
Healdsburg
Santa Rosa
South Santa Rosa
Mark West
Dry Creek
Green Valley

Water availability & allocation

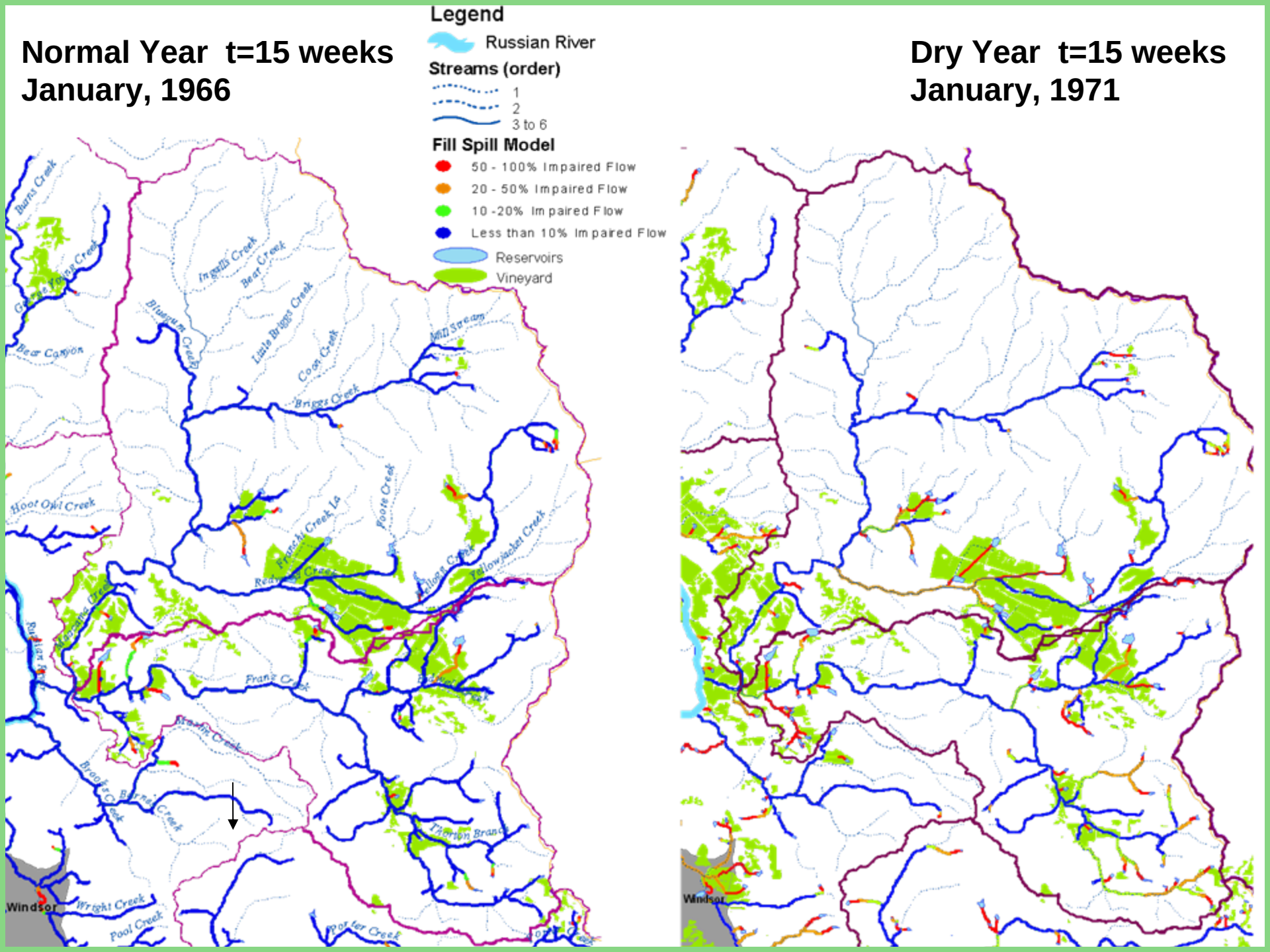


Cumulative impacts

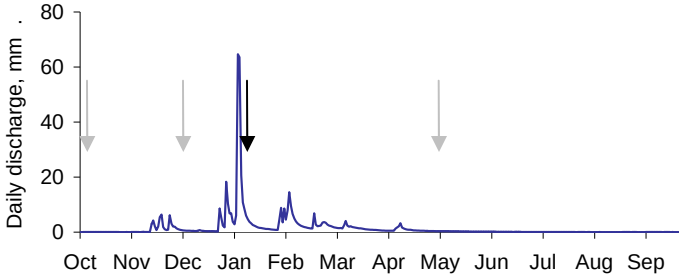


Normal Year t=15 weeks
January, 1966

Dry Year t=15 weeks
January, 1971



Time interval T15: January 13



Cumulative impacts

	Upstream catchment area: <1 km^2	1-10 km^2	10-40 km^2	40-100 km^2	>100 km^2
91% of impaired drainage	26%	36%	15%	8%	15%
4% of impaired drainage	64%	34%	2%	0%	0%
2% of impaired drainage	90%	10%	0%	0%	0%
4% of impaired drainage	95%	5%			

Utility for policy scenarios

- Bypass flow thresholds.
  - First day and number of days bypass flow (Qmbf) is exceeded.
- Maximum cumulative diversion (Qmcd).
- Total estimated amount of water that would be permitted to be diverted given Qmbf and Qmcd thresholds.
- Compare joint guidelines to proposed new policies (e.g. AB2121).

Policy scenarios

Estimated number of days Qmbf is exceeded

Legend

Russian River

# of Days Above Qmbf

0 - 1	24 - 25
2	26 - 27
3 - 4	28
5 - 6	29 - 30
7 - 8	31 - 33
9 - 10	34 - 35
11 - 12	36 - 37
13	38 - 39
14 - 17	40 - 41
18 - 19	42 - 43
20 - 21	44 - 47
22 - 23	48 - 49

Streams (order)

1

2

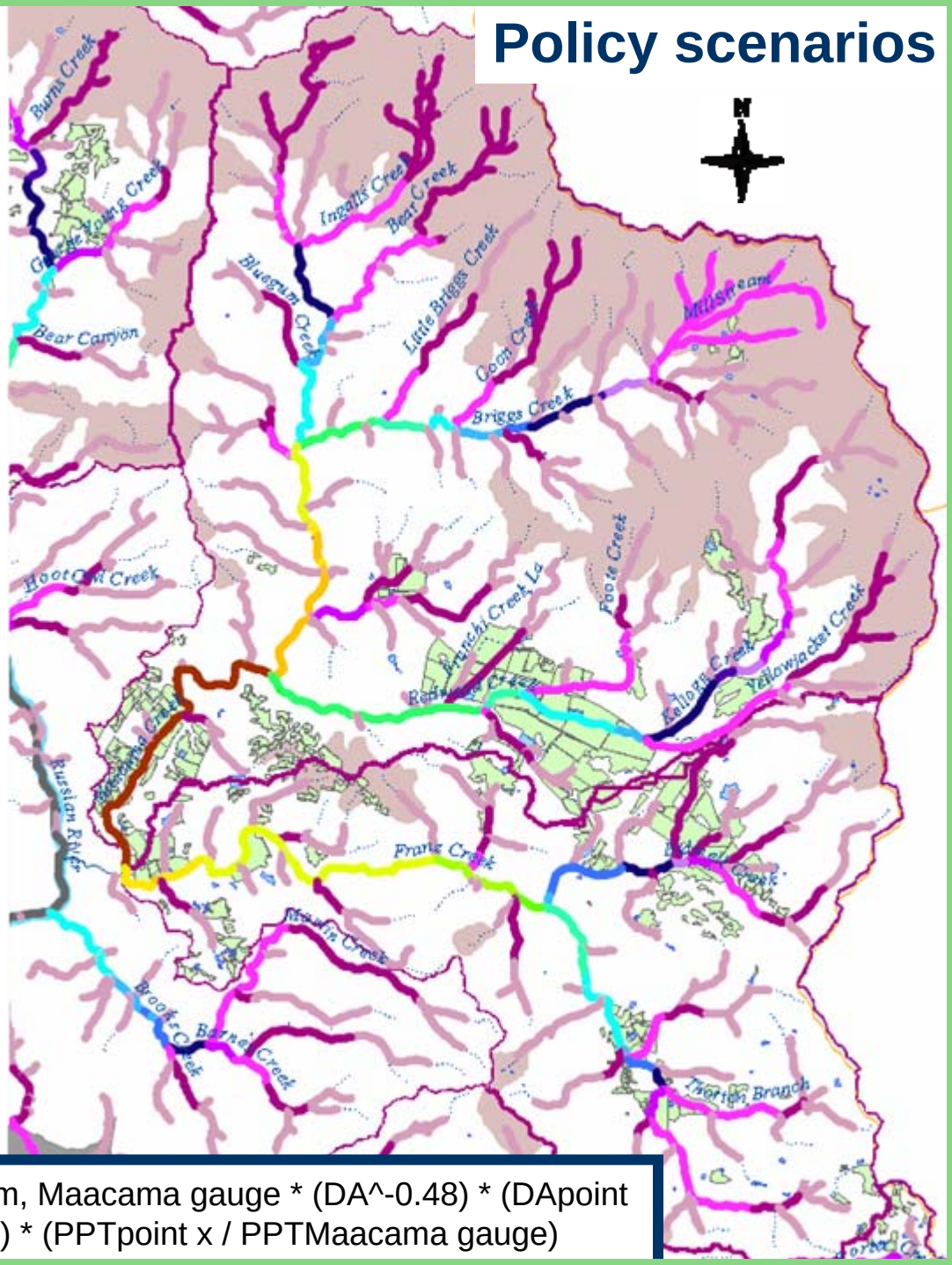
3 to 6

Reservoirs

Vineyard

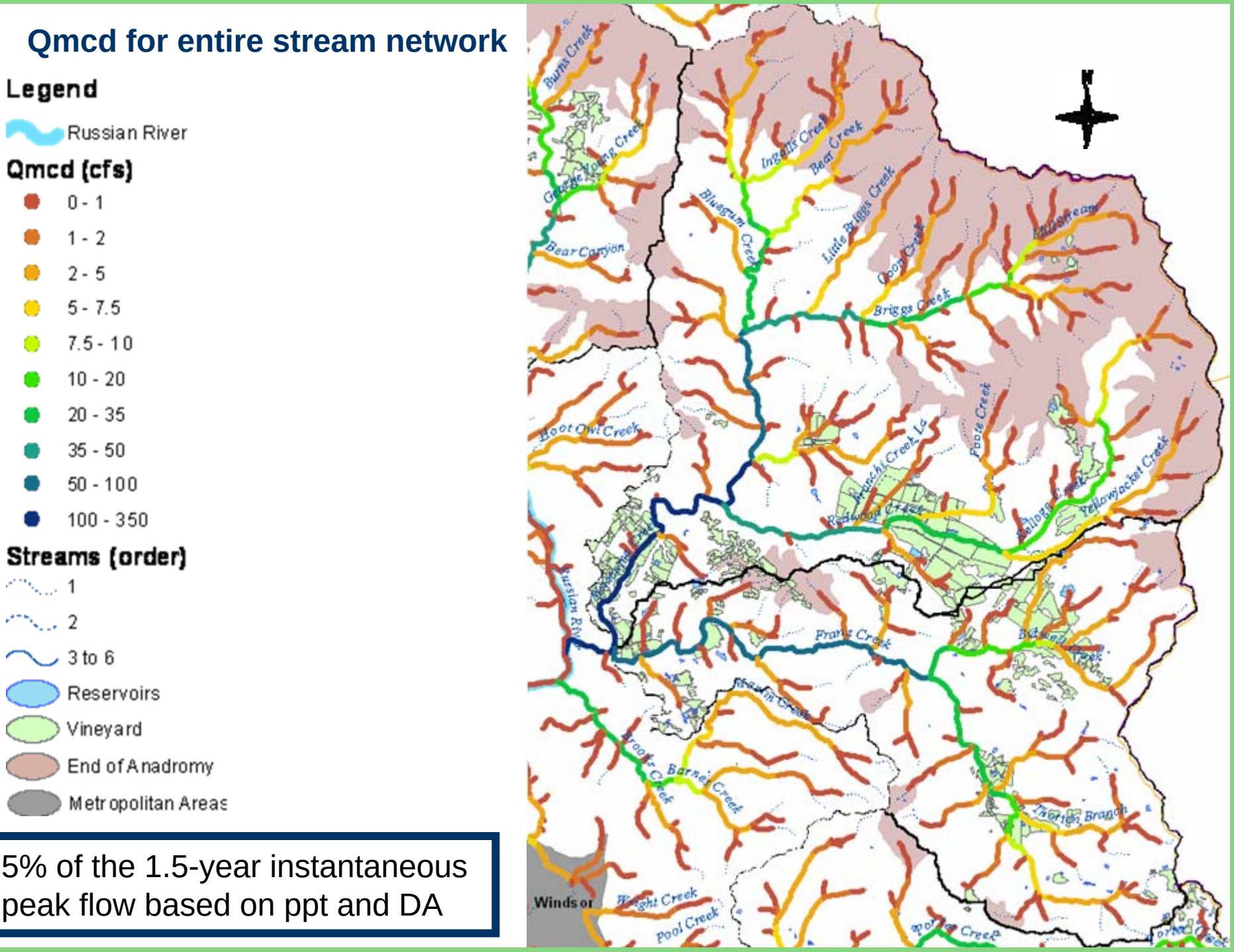
End of Anadromy

Metropolitan Areas



Qmbf, point x = 9.4* Qm, Maacama gauge * (DA^-0.48) * (DApoint x / DAMaacama gauge) * (PPTpoint x / PPTMaacama gauge)

Qmcd for entire stream network



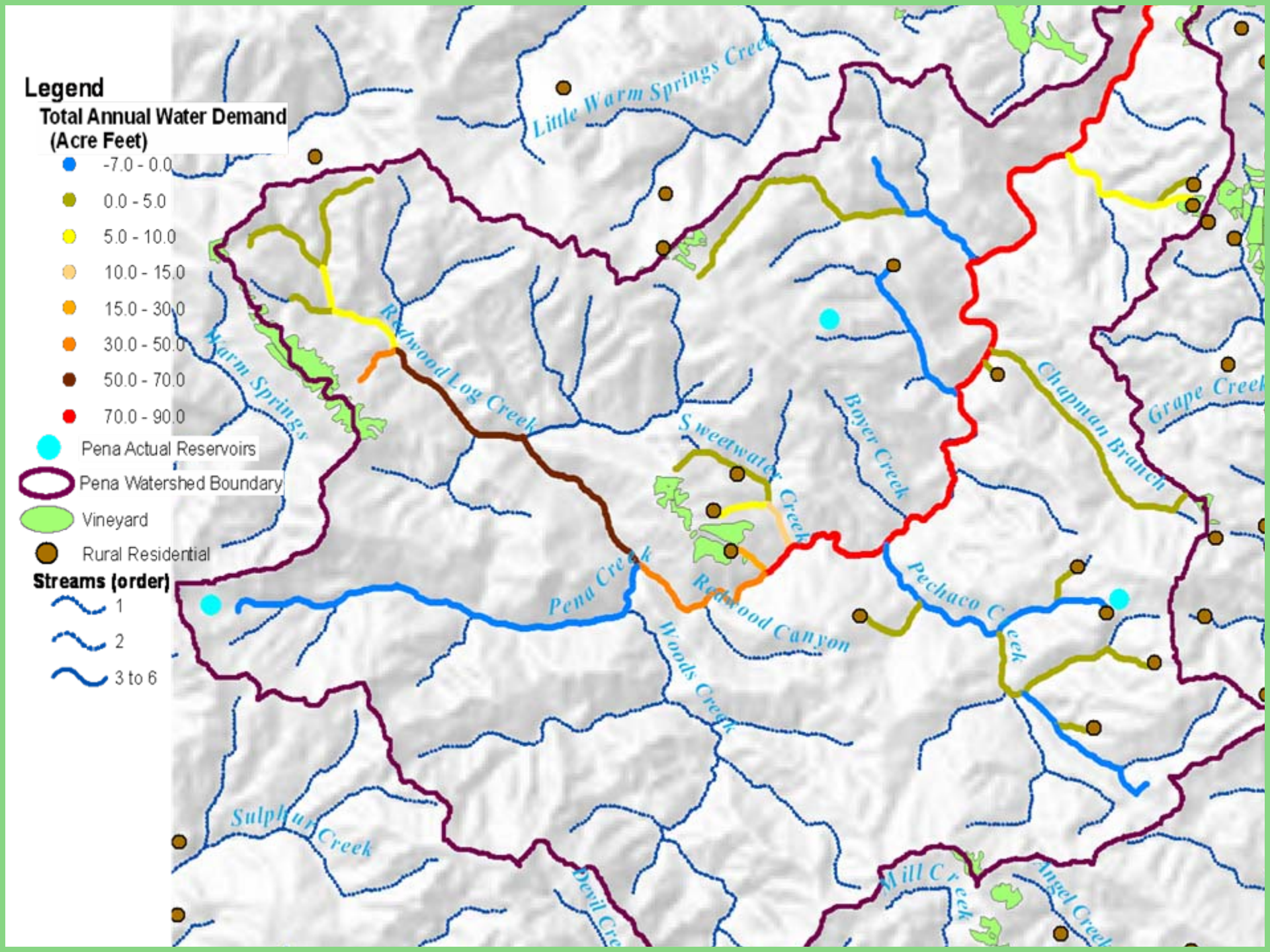
5% of the 1.5-year instantaneous peak flow based on ppt and DA

Comparisons of how much can be stored under different policy thresholds

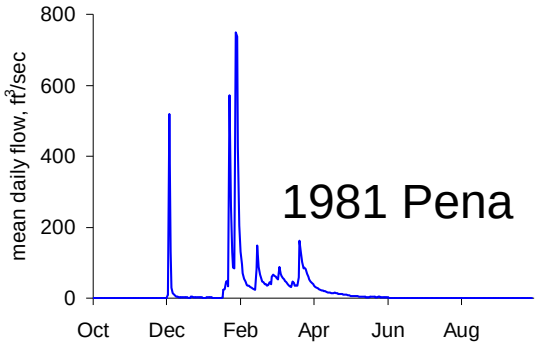
Watershed area	*Joint Guide*	*AB2121*
45 mi2	5180AF	8000AF
15 mi2	1835AF	2050AF
5 mi2	630AF	665AF
1 mi2	120AF	75AF
0.4 mi2	48AF	27AF

Watershed Analysis

- Evaluating tradeoffs for water management and stream flow recovery.
- Combining flow with other data to set restoration priorities.
- Helping those interested in the “watershed approach.”


Legend
Total Annual Water Demand (Acre Feet)
-7.0 - 0.0
0.0 - 5.0
5.0 - 10.0
10.0 - 15.0
15.0 - 30.0
30.0 - 50.0
50.0 - 70.0
70.0 - 90.0
Pena Actual Reservoirs
Pena Watershed Boundary
Vineyard
Rural Residential
Streams (order)
1
2
3 to 6
Little Warm Springs Creek
Warm Springs
Redwood Log Creek
Sweetwater Creek
Boyer Creek
Chapman Branch
Grape Creek
Pena Creek
Redwood Canyon
Pechaco Creek
Woods Creek
Sulphur Creek
Devil Cre
Mill Creek
Angel Creek

Watershed Analysis



Legend

- Pena Actual Reservoirs Only
- Pena Proposed Reservoirs

Streams (order)

- 1
- 2
- 3 to 6

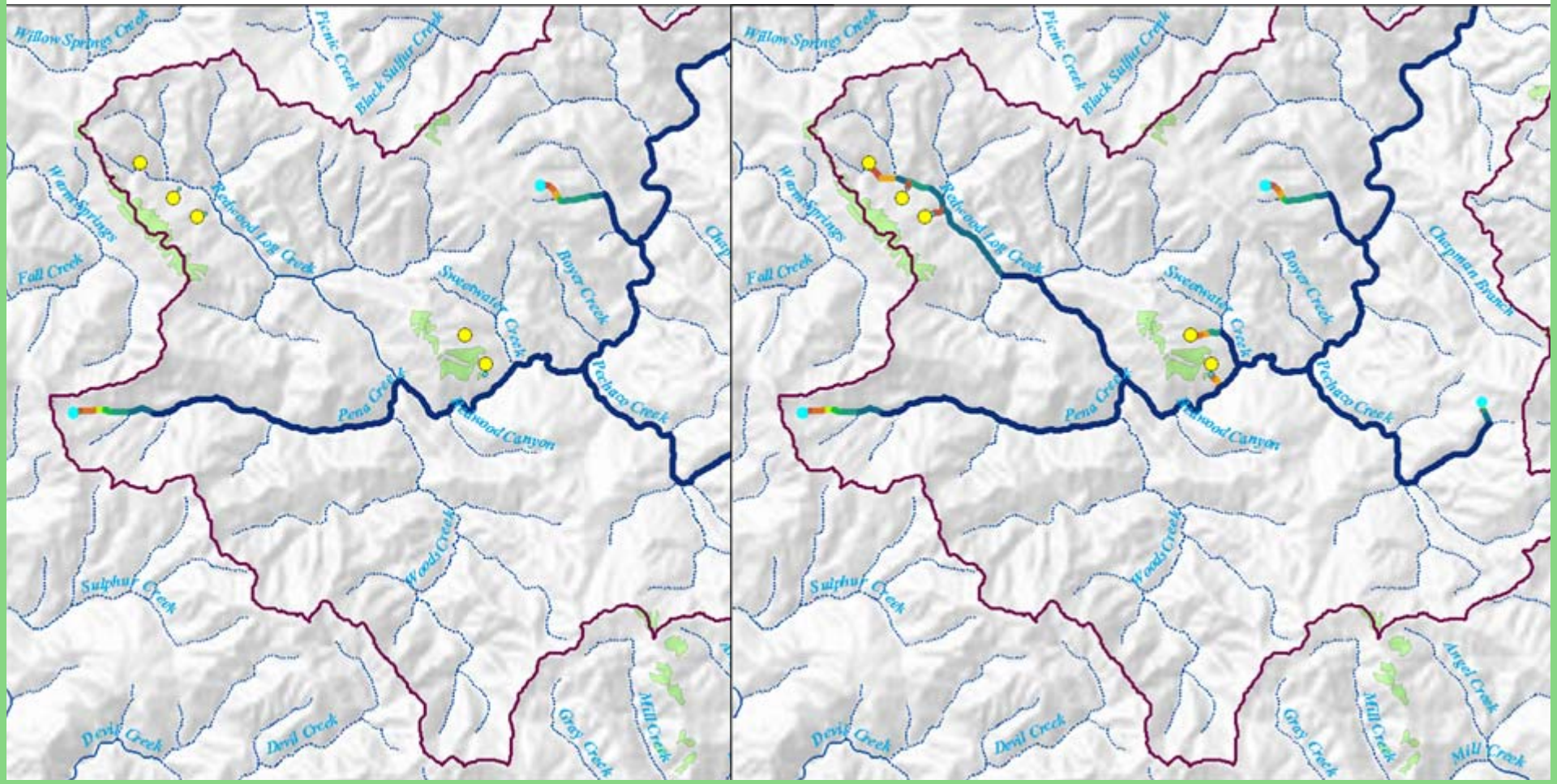
Fill Spill Model

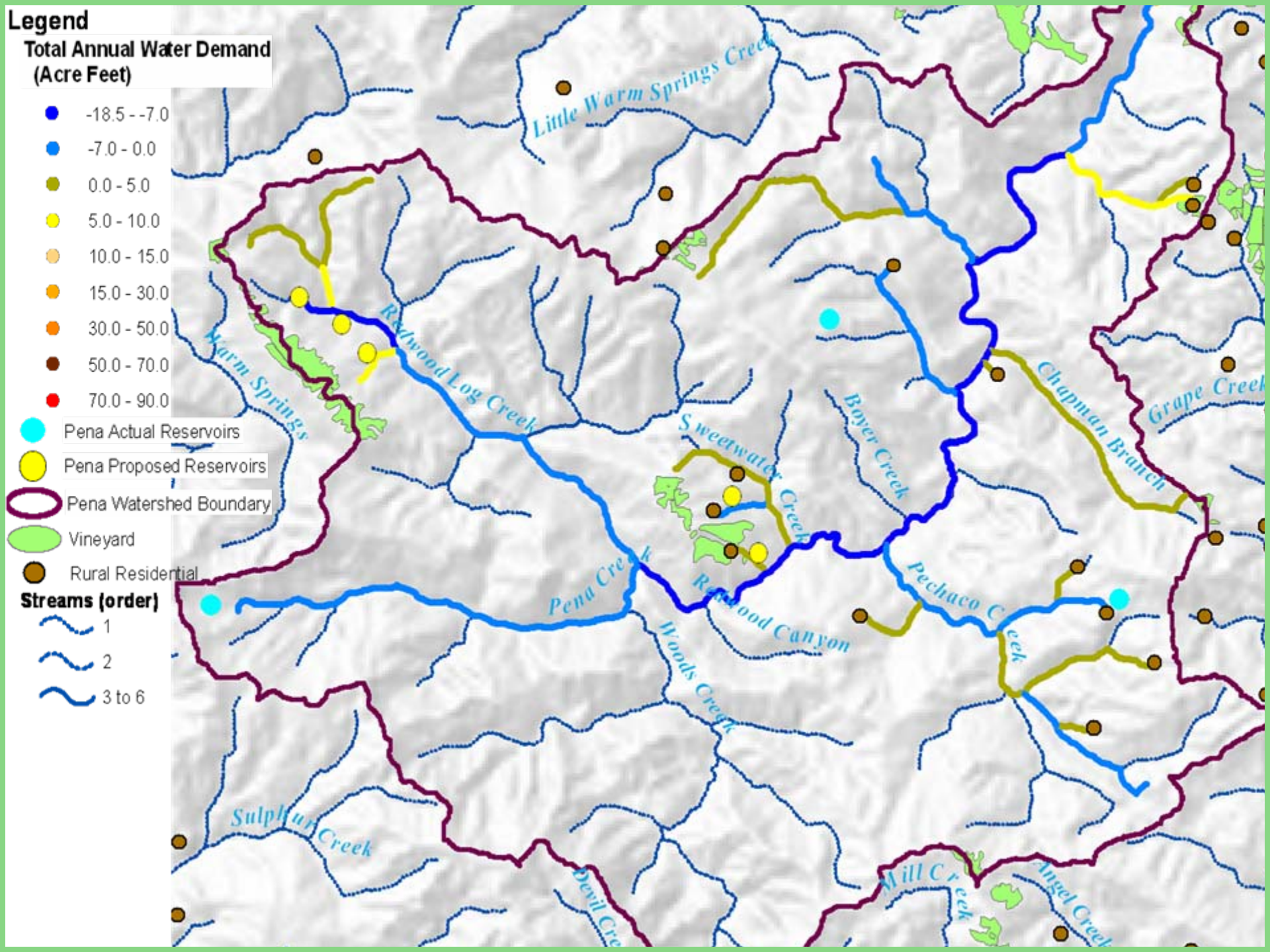
- 90 - 100% Impaired Flow
- 80 - 90% Impaired Flow
- 70 - 80% Impaired Flow
- 60 - 70% Impaired Flow
- 50 - 60% Impaired Flow
- 40 -50% Impaired Flow
- 30 - 40% Impaired Flow
- 20- 30% Impaired Flow
- 10 -20% Impaired Flow
- Less than 10% Impaired Flow

- Vineyards
- Pena Watershed Boundaries

Impacts Without Reservoirs

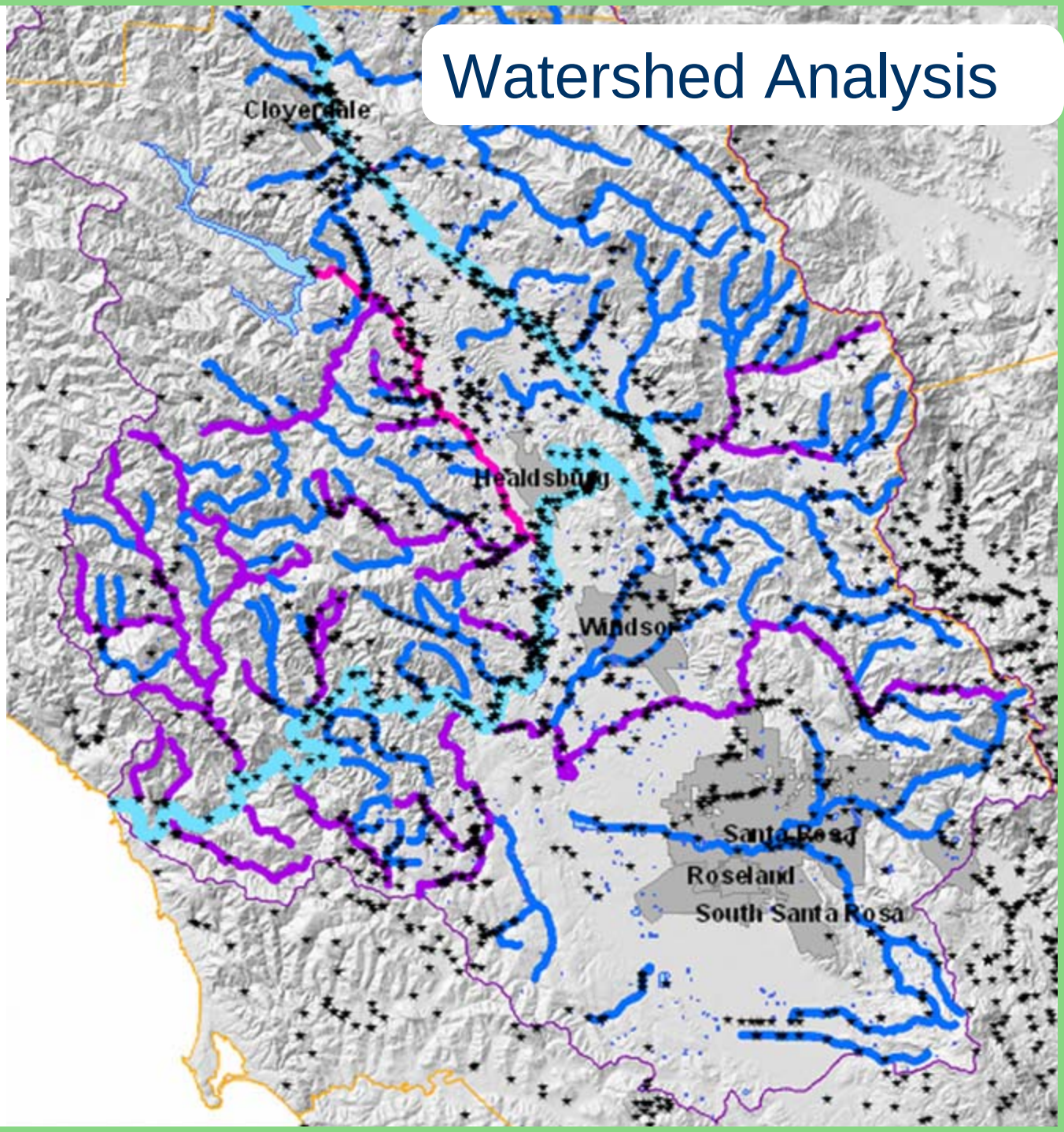
Impacts With Added Reservoirs




Legend
Total Annual Water Demand
(Acre Feet)
-18.5 - -7.0
-7.0 - 0.0
0.0 - 5.0
5.0 - 10.0
10.0 - 15.0
15.0 - 30.0
30.0 - 50.0
50.0 - 70.0
70.0 - 90.0
Pena Actual Reservoirs
Pena Proposed Reservoirs
Pena Watershed Boundary
Vineyard
Rural Residential
Streams (order)
1
2
3 to 6
Little Warm Springs Creek
Warm Springs
Redwood Log Creek
Sweetwater Creek
Boyer Creek
Chapman Branch
Grape Creek
Pena Creek
Redwood Canyon
Pechaco Creek
Woods Creek
Sulphur Creek
Devil Cre
Mill Creek
Angel Creek

Watershed Analysis

Combined with other mapped information to help prioritize flow recovery.



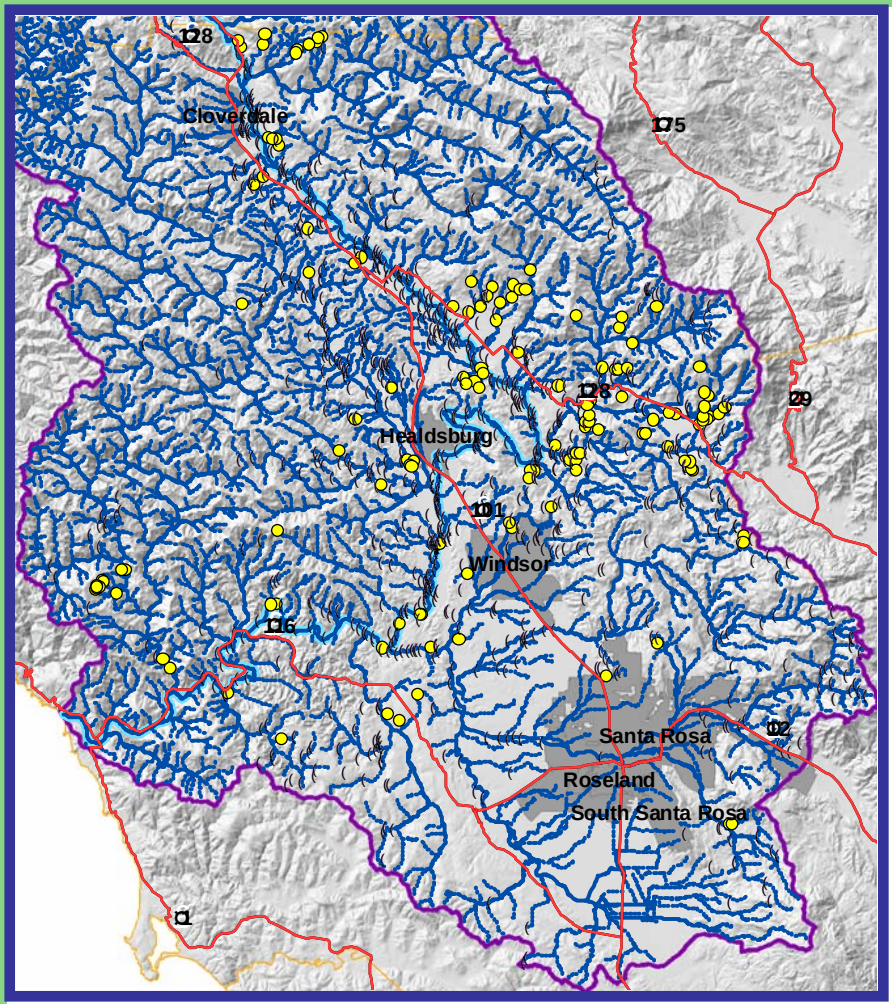
Legend

- Russian River

Historic Salmon Streams

- Chinook/Coho/Steelhead
- Coho/Steelhead
- Steelhead
- ^ Existing and Potential Barriers to Salmonid Migration
- Russian River Watershed
- County Boundaries
- Metropolitan Areas

Decision-support tool



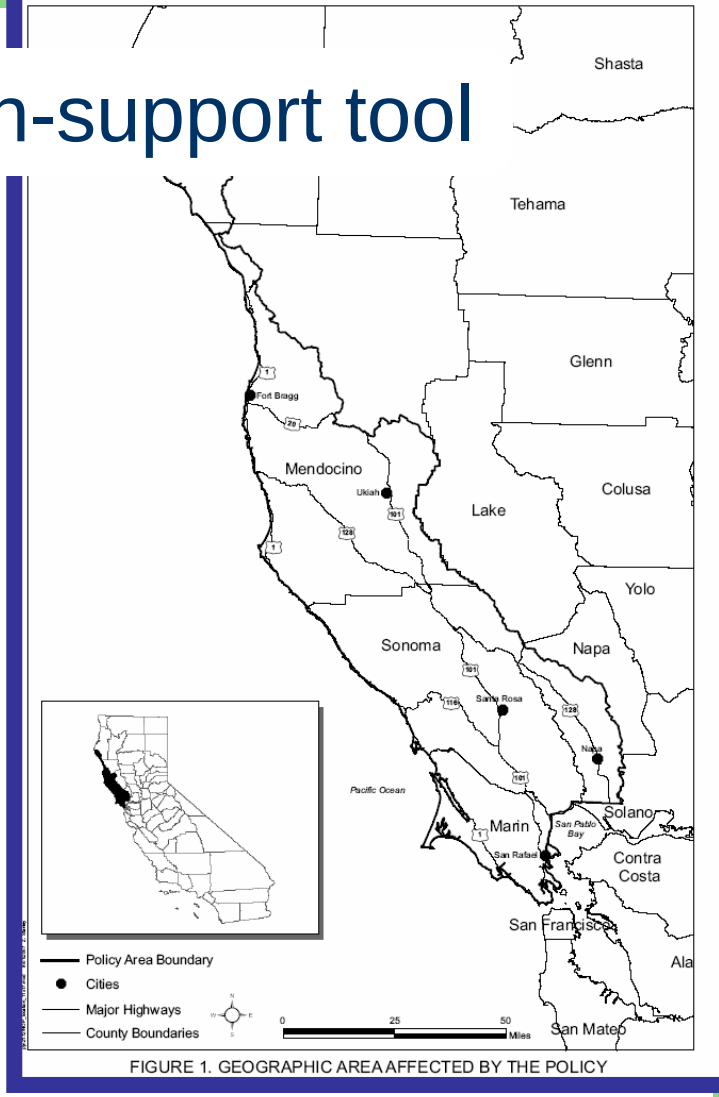


FIGURE 1. GEOGRAPHIC AREA AFFECTED BY THE POLICY

An interactive decision support system could:

- expand to the several coastal watersheds with many pending permits.
- run at a daily time scale.
- add proposed diversions and recalculate cumulative effects on environmental flows and for existing water right holders.

Next steps

- Implementation of these tools will save money and staff time.
- It will also “level the playing field” for those requesting water rights permits who are in need of large-scale analysis.
- Collaborate with SWRCB and resource agencies to ensure accuracy and maximize utility of this tool.
- Addition of a modest investment through SWRCB financial assistance branch?
- Work with stakeholders on tool development to support the Watershed Approach.