

# February 2017 Increased Flows

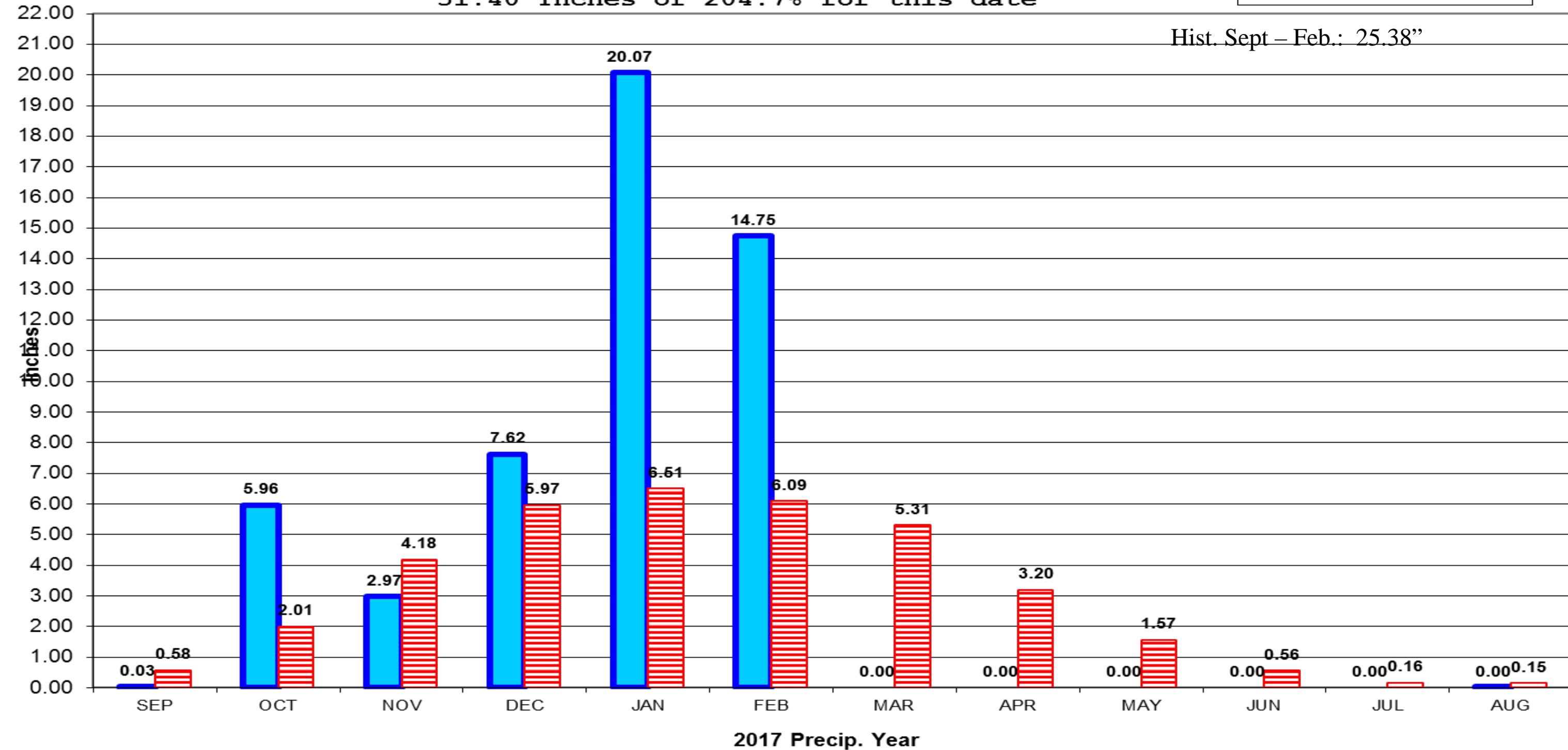


## Watershed Monthly Accumulation of Precipitation

51.40 Inches or 204.7% for this date

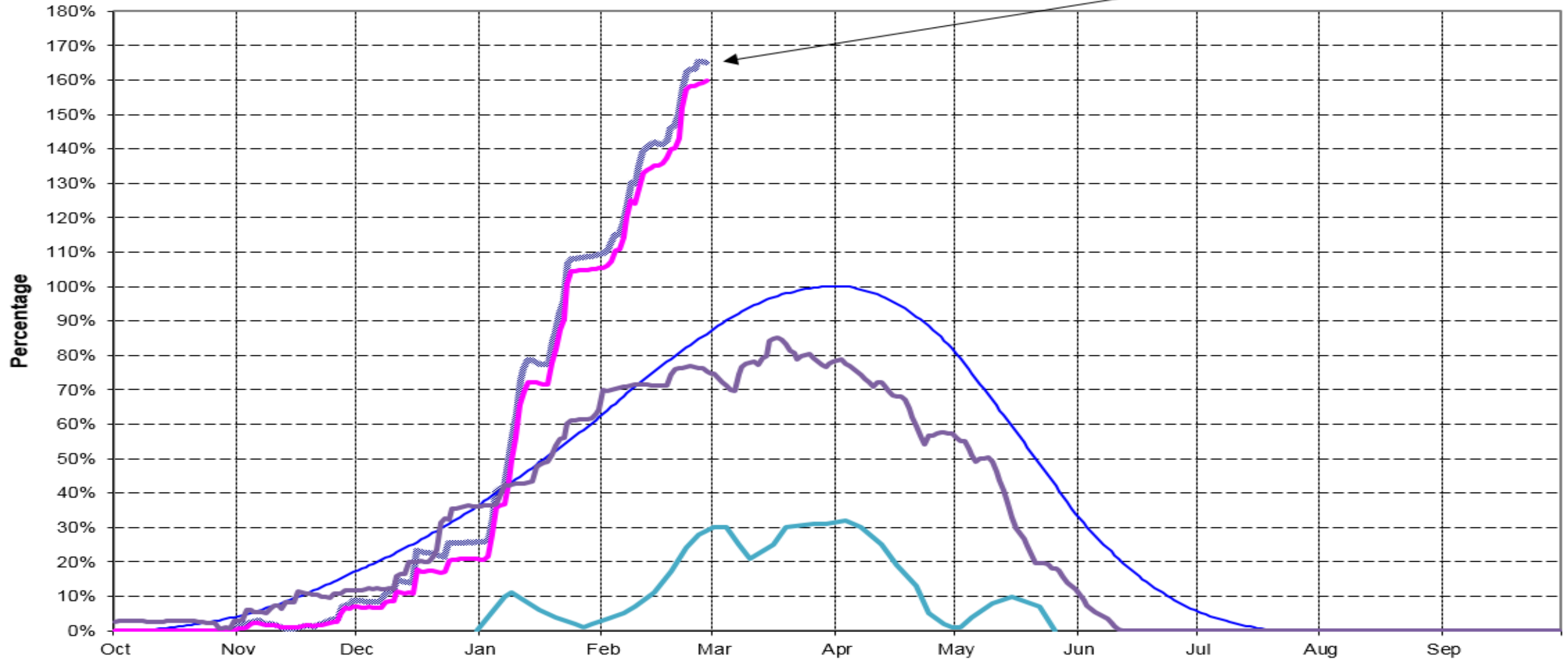
2016 - 2017 AVERAGE

Hist. Sept – Feb.: 25.38"



## Snow Sensors Used in Tuolumne River Forecast

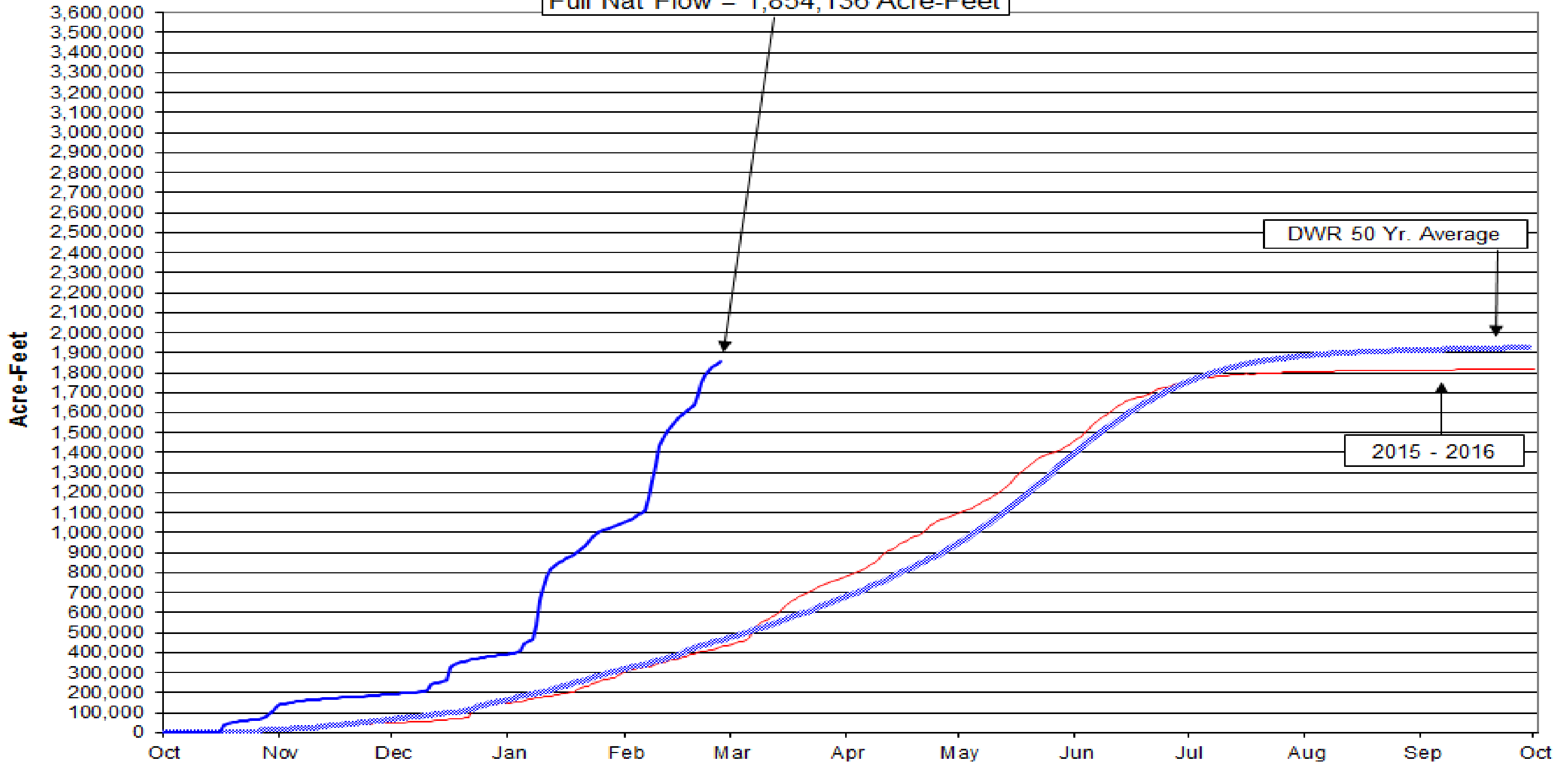
165.2% Average of Apr. 1 or  
191.7% Average for Date



# Hydrology

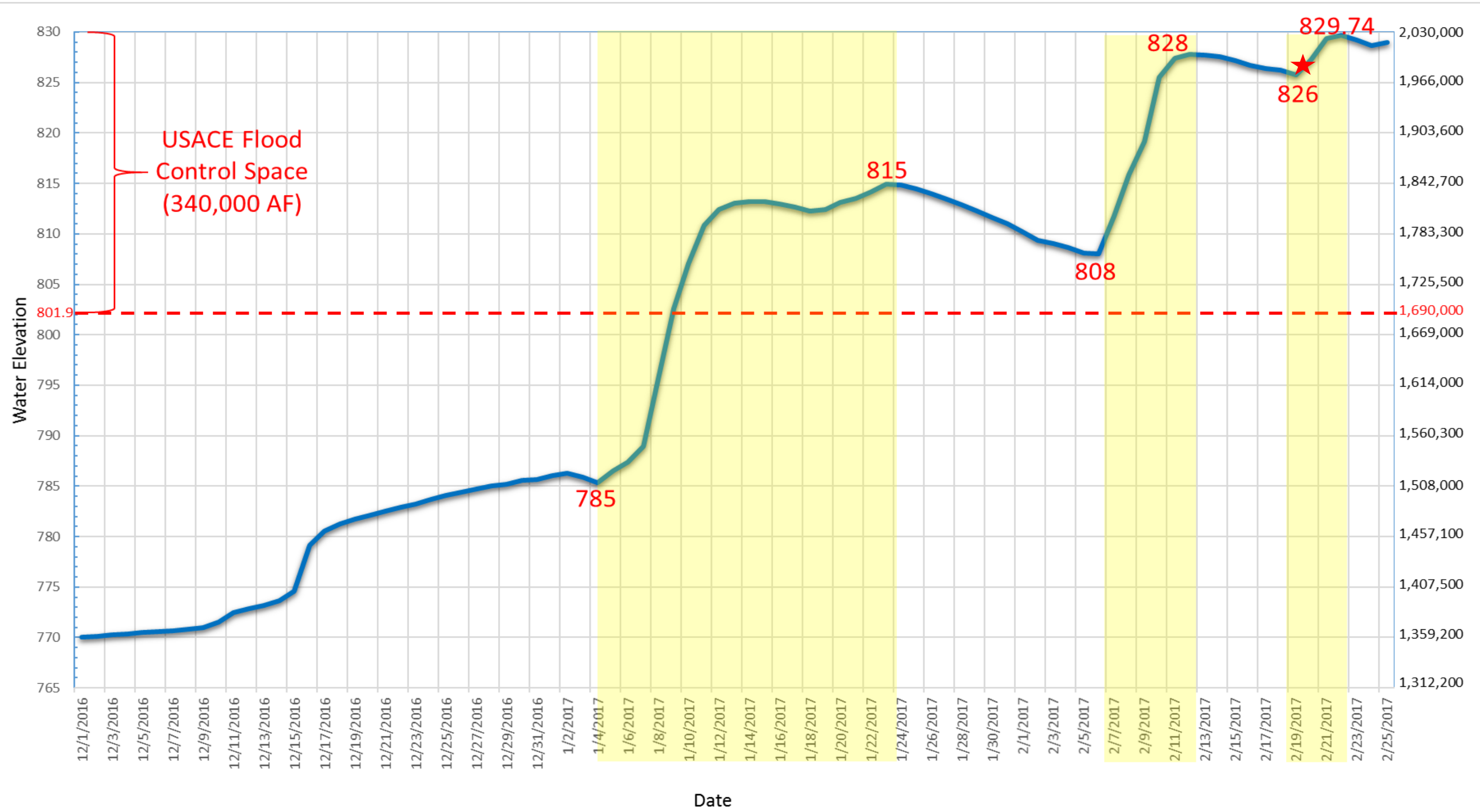
## Full Natural Flow

Full Nat Flow = 1,854,136 Acre-Feet



September - February				
Year	Amount	Ranking	Year	Amount
<b>2017</b>	<b>51.40</b>	<b>1</b>	<b>2017</b>	<b>51.40</b>
2016	27.72	2	1983	48.97
2015	14.03	3	1969	47.80
2014	11.01	4	<b>1997</b>	<b>45.22</b>
2013	19.62	5	1956	43.89
2012	12.24	6	1980	41.10
2011	37.59	7	1951	39.14
2010	24.35	8	1998	38.69

# Don Pedro Reservoir



# Preparations & Coordination

- TID prepared
- Don Pedro watershed modeling by Hydrocomp
- District Operations Center
  - Manage operations, planning, communications, & logistics
  - Level 1 on 2/13/17, Level 2 on 2/19/17, Level 3 on 2/20/17
- Spillway Operations
  - Spillway Operations Manager
  - Spillway gate
  - Power Plant
- Multi-agency coordination
  - MID, Tuolumne, Merced, and Stanislaus OES

# Water Releases

- Tuolumne River
  - Target 9,000 cfs – 1/2/17
  - Target river elevation 55.0' at 9<sup>th</sup> Street – 2/10/17
  - Target river elevation 55.5' at 9<sup>th</sup> Street – 2/17/17
- Turlock Lake – utilized as buffer
- TID canal system – 2/6/17
- MID canal system – 2/15/17



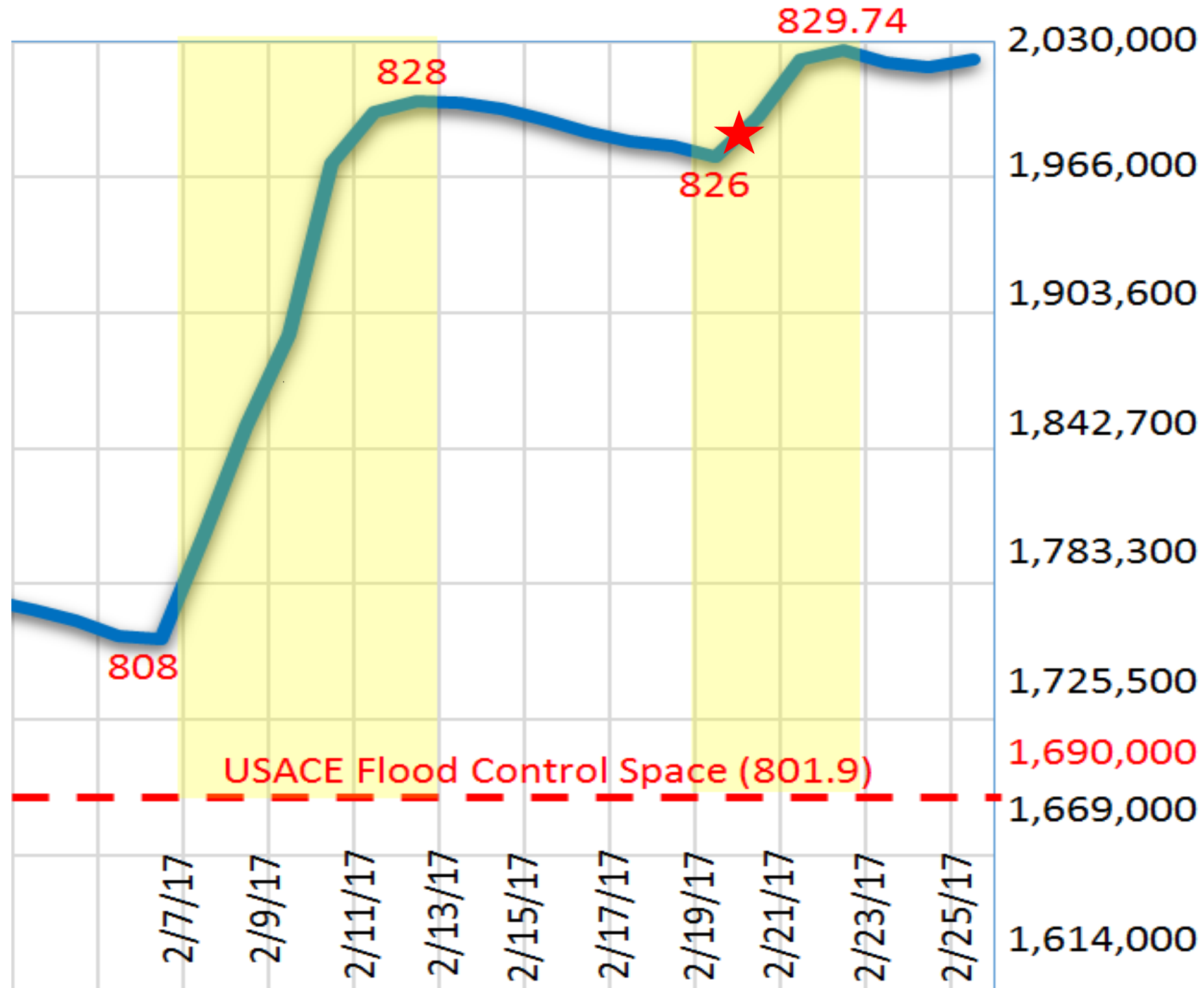
# The Executive Order

- Water models converge, projecting Don Pedro to spill – 2/19/17
- Executive Order – 10:25AM on 2/20/17
  - Demolition of Bonds Flat Road
  - De-energize electric customers along river
  - Make preparations to open spillway gate
    - Target combined river release of 18,000 cfs
- Center spillway gate opened @ 3:00PM on 2/20/17

# Spillway Gate Opened



# Objectives



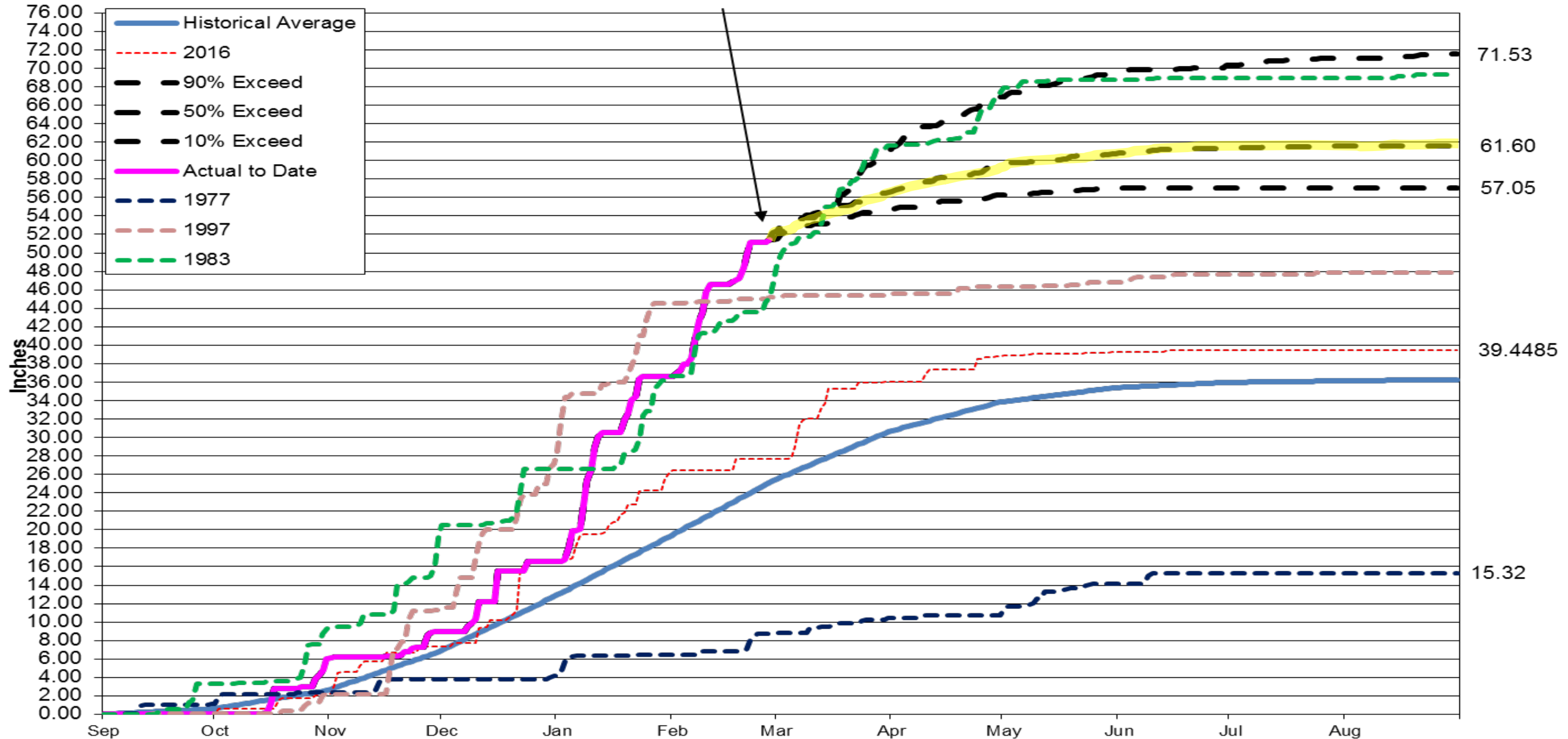
# Spillway Gate Closed

- Spillway gate closed
  - 2/27/17 at 4:57AM
  - Reservoir elevation 828.67'

# What to Expect Going Forward

## Watershed Accumulated Precipitation

51.40 Inches or 204.7% for this date



71.53

61.60

57.05

39.4485

15.32

# What to Expect Going Forward

- Continue releases maintaining elev. 55.0' @ 9<sup>th</sup> Street
  - Objective to vacate flood control space
- Continue to monitor hydrology
- Continue to prepare for dynamic situations
  - DOC/Operations staff on standby
  - Communicate regularly with MID, OES partners and public stakeholders
- Stand ready to react



## **Definitions**

**Milk products plant** means any place in which a person engages in the business of handling, receiving, manufacturing, freezing, processing, or packaging milk, or any product of milk, or engages in the business of manufacturing, freezing, or processing imitation ice cream or imitation ice milk.

**Single Service Containers** shall mean any container having milk or milk product—contact surface and used in the packaging, handling or storage of Grade "A" milk and /or milk products which is intended for one (1) use only.

### **9.16.010 Milk inspection department created.**

A milk inspection department of the county is created which shall conduct an approved milk inspection service in the county within an area, the boundaries of which are fixed by, and which is designated and assigned for that purpose by the Director of Agriculture of the state. The health officer of county, or his authorized agents or deputies, shall be in charge of the milk inspection department created in this section. Whenever the term "health officer" is used in this chapter, it refers to and means the health officer of the county. (Prior code §3-200).

### **9.16.020 Grading standards.**

It is unlawful for any person, firm or corporation to sell, offer for sale, distribute or have in possession for sale or distribution, any milk, cream or fluid derivatives of milk for human consumption, unless such products conform to the highest standards of grading, and ~~to the~~ requirements for the production of milk, cream and fluid derivatives of milk, established by (A) the provisions of the Agricultural Code of the state, (B) the rules and regulations of the State Department of Agriculture, and (C) the most current edition of the United States Public Health Service Grade A Pasteurized Milk Ordinance (D) or such higher standards of grading and requirements as are provided by this chapter. The standards of grading and requirements established by this section are as follows:

A. ~~Pasteurization.~~ Grade A milk for pasteurization ~~shall contain not more than fifty thousand bacteria per milliliter before pasteurization, and not over fifteen thousand bacteria per milliliter at the time of delivery to the consumer, and~~ Grade A Market Milk shall conform to the strictest Bacteriological Standards. of the CA Food & AG Code

B. Cream. Grade A pasteurized cream shall contain not more ~~than seventy five thousand bacteria per milliliter before pasteurization, and not more~~ than twenty ~~five~~ thousand bacteria per milliliter at the time of delivery to the consumer. Unless pasteurization is commenced immediately after separation, Grade A cream for pasteurization shall be cooled to ~~fifty~~ forty degrees ~~five degrees~~ Fahrenheit, or below, immediately after separation, and so maintained until the process of pasteurization begins.

C. Skim Milk. Skim milk intended for human consumption in fluid form shall be derived from Grade A pasteurized milk, and may be pasteurized before or after separation.

D. Chocolate Milk. Chocolate milk shall be made from Grade A milk. Chocolate dairy drink and similar chocolate drinks shall be made from Grade A milk, or skim milk derived from Grade A milk. Said products shall contain not more than ~~twenty five thousand bacteria per milliliter~~ 15,000 bacteria per milliliter or more than 10 coliform bacteria per milliliter at the time of delivery to the consumer, and shall be pasteurized after all ingredients have been added. (Prior code §3-201).



### **9.16.030 Permit—Required.**

It is unlawful for any person, firm or corporation to engage in the production, processing or distribution of milk, cream or fluid derivatives of milk, to produce for sale, offer for sale, distribute or have in charge or possession for sale, any milk, cream or fluid derivatives of milk without first having obtained a permit from the health officer. Permits issued by the health officer pursuant to this section shall be valid for one year, and shall expire on ~~the anniversary date thereof.~~ June 30 of every year (Prior code §3-202).

A. All production, processing or distribution regulated under this section shall be subject to compliance with all applicable county zoning regulations prior to issuance of a permit from the health officer.

### **9.16.040 Permit—Revocation.**

Permits issued under this chapter may be revoked by the health officer upon violation of any provisions of this chapter, the most current edition of the United States Public Health Service Grade A Pasteurized Milk Ordinance or the Agricultural Code of California. Permits issued under this chapter also may be revoked in any emergency when, in the judgment of the health officer, the milk or cream supply in question has become a menace to the public health. Before revocation of any permit issued the holder of such permit first shall be given a hearing before the health officer, after at least twenty-four hours' notice in writing to appear at the time and place specified in said notice to show cause why such permit should not be revoked. (Prior code §3-202).

### **9.16.050 Sanitation requirements.**

It is unlawful for any person, firm or corporation engaged in the production of milk, cream or fluid derivatives of milk to fail to observe and comply with the following regulations:

A. Suitable equipment shall be provided for properly washing and sterilizing all dairy equipment. All milk handling equipment must be of a type and construction approved by the health officer.

B. Hooded milk buckets with small openings shall be used at all times.

C. Milking stools shall be made of metal, or other impervious materials, and shall be kept in a clean and sanitary condition.

D. Feed racks, water troughs, lanes and corrals shall be so constructed and made of such materials as to keep cows out of mud and manure during winter months.

E. Cows' udders, flanks and hind legs shall be washed until clean before each milking. (Prior code §3-203).

F. If milk products (Pasteurized or Unpasteurized) are sold or otherwise distributed to consumers on the farm, then any and all such operations, (including single service containers) shall be inspected by the California Department of Food and Agriculture, installed and operated in the same provisions of a milk products plant, and located in a place and manner acceptable to the California Department of Food & Agriculture, and shall meet the specifications of the United States Public Health Service Grade A Pasteurized Milk Ordinance, and be in compliance with county zoning ordinances.

#### **9.16.055 Raw Milk Warnings.**

No person, partnership, firm, cooperative or corporation acting directly or through their agents, servants or employees shall offer or expose for sale or sell any raw milk products without first posting a warning sign as provided for in this section. The warning sign shall be posted immediately adjacent to any raw milk product offered or exposed for sale and shall be clearly visible to the patron at the point of sale. Such sign shall be not less than eight inches by eleven inches in size and shall be printed on a contrasting background and in a legible manner, conveying the following warning:

“WARNING: Raw milk products are not pasteurized and may contain organisms that cause human disease. They therefore should not be consumed by the very young ; the very old; persons with illnesses which alter, or who take drugs which affect the immune systems; and persons with severe chronic medical problems.”

The word “Warning” shall be in a print of eighty-four point height and Helvetica type and the remainder of the text in a print of twenty-four point height and in Helvetica medium-face, Futura medium-face or Universe 65 type.

#### **9.16.060 Storage temperature.**

It is unlawful for any person, firm or corporation operating any store, restaurant, bakery or other establishment which handles milk or milk products to fail, refuse or neglect to keep all such milk and milk products in a clean, well-drained cooler or refrigerator, which shall be maintained at a maximum temperature of ~~fifty~~ forty five degrees Fahrenheit, or below, at all times. (Prior code §3-204).

For Dairy Farms. Market milk shall be cooled as indicated by a recording thermometer to fifty degrees Fahrenheit or less within four hours of the commencement of the first milking and to forty five degrees Fahrenheit or less within two hours of the completion of milking. The blend temperature after the first milking and subsequent milking's, or milk in transit on bulk milk tankers, shall not exceed fifty degrees Fahrenheit. CA Food & Ag Code

#### **9.16.070 Inspection fees.**

Every milk plant within the area described in Section 9.16.010 shall pay to the health department of the county a fee of ninety dollars each month, plus an amount equal to seven dollars per month for each milk producer supplying milk to the milk plants. Every milk plant not within the area shall pay the health department of the county a fee of seven dollars per month for each dairy farm within he area from which market milk is received; provided, however, that where any such dairy farm deliver to more than one milk plant, the fee shall be apportioned on an equitable basis. A county that maintains an approved milk inspection service may levy and collect an inspection fee or fees from producers of milk that is produced at dairy farms within the county. For ~~other~~ hooved mammals (goats, sheep, etc.) other than cows, the fees collected shall be a flat fee. For cow dairies the fee is based on the number of gallons produced during the quarter of the year preceding the date the inspection fee becomes due and payable. The inspection fees are due and payable on or before the twentieth day of each the month, following the quarter (January, April, July, and October), and . If if not paid ~~within thirty days from~~ by the date due, there shall accrue and be added to the fee a penalty of ~~five~~ ten percent of the unpaid amount of the fee ~~for each month or~~

~~fraction thereof~~ until the entire fee and penalty are paid. The milk inspection fee shall be adjusted from time to time by the health officer ~~or the~~ Director of Environmental with Resources with approval of the ~~chief executive officer~~ Board of Supervisors of the county, so that the revenues from the fees shall not exceed the cost of the inspection service as defined and described in ~~Section 490 of~~ the Agricultural Code. Delinquency or nonpayment of any inspection fees and penalties shall constitute cause for suspension or revocation of any permit issued under the provisions of this chapter. (Prior code §3-205).

#### **9.16.080 Exceptions.**

Persons, firms and corporations engaged in the production, processing or distribution of milk, cream or fluid derivatives of milk in the county who have been issued permits to engage in such activities and are regularly inspected by the State Department of Agriculture or by the health officer of the city and county of San Francisco are excepted from the operation and requirements hereof. (Prior code §3-206).

#### **9.16.090 Penalties**

~~A person who violates this Division is subject to a civil penalty of at least one hundred dollars (\$100.00) but not more than one thousand dollars (\$1,000.00) for each violation, or by imprisonment in the county jail not less than ten days nor more than ninety days or both. Each day that a violation continues shall constitute a new violation.~~

# Can We Use Almond Orchards for Groundwater Recharge?

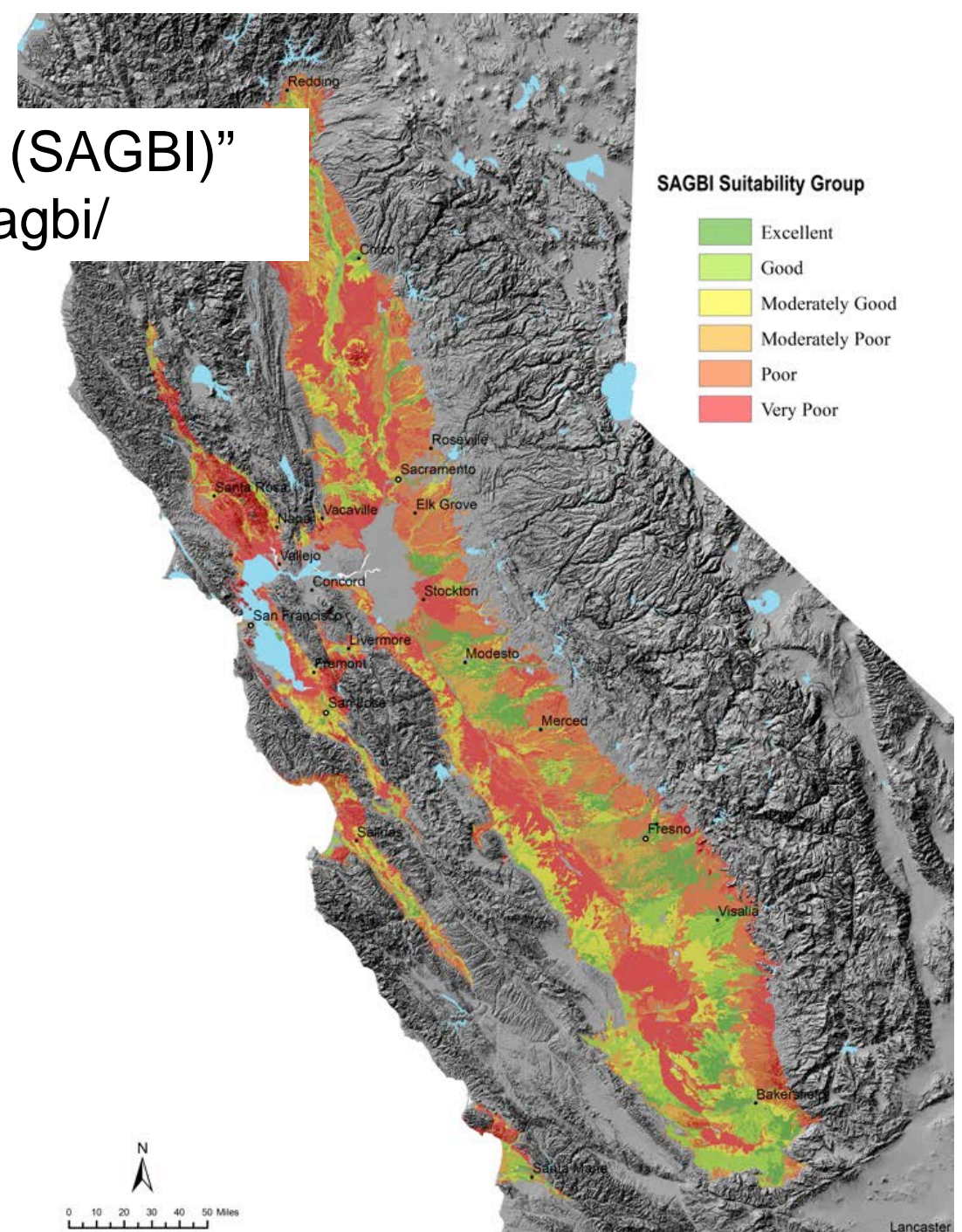
- Ken Shackel, Helen Dahlke, Astrid Volder, Roger Duncan, David Doll, Bruce Lampinen.
- Nick Blom, Modesto Irrigation District
- Lawrence Berkeley Lab
- Maciej Zwieniecki
- Almond Board of CA



“Soil Agricultural Groundwater banking index (SAGBI)”  
<http://casoilresource.lawr.ucdavis.edu/sagbi/>

Soil characteristics that determine suitability:

- Hydraulic conductivity
- Occurrence of water restrictive layers,
- Topographic Limitations (slope),
- Chemical Limitations (EC),
- Surface Condition (e.g. erodibility)



Saturated conditions: generally BAD

Questions:

1. Is it OK for Almonds if the trees are dormant (Dec/Jan)?
2. What happens to root and tree health over the long run?
3. What about leaching of N, pesticides, salts, etc.?
4. What happens to the water?
5. Is it OK with the water lords?
6. Etc, Etc...



# Using Orchards for Winter Recharge

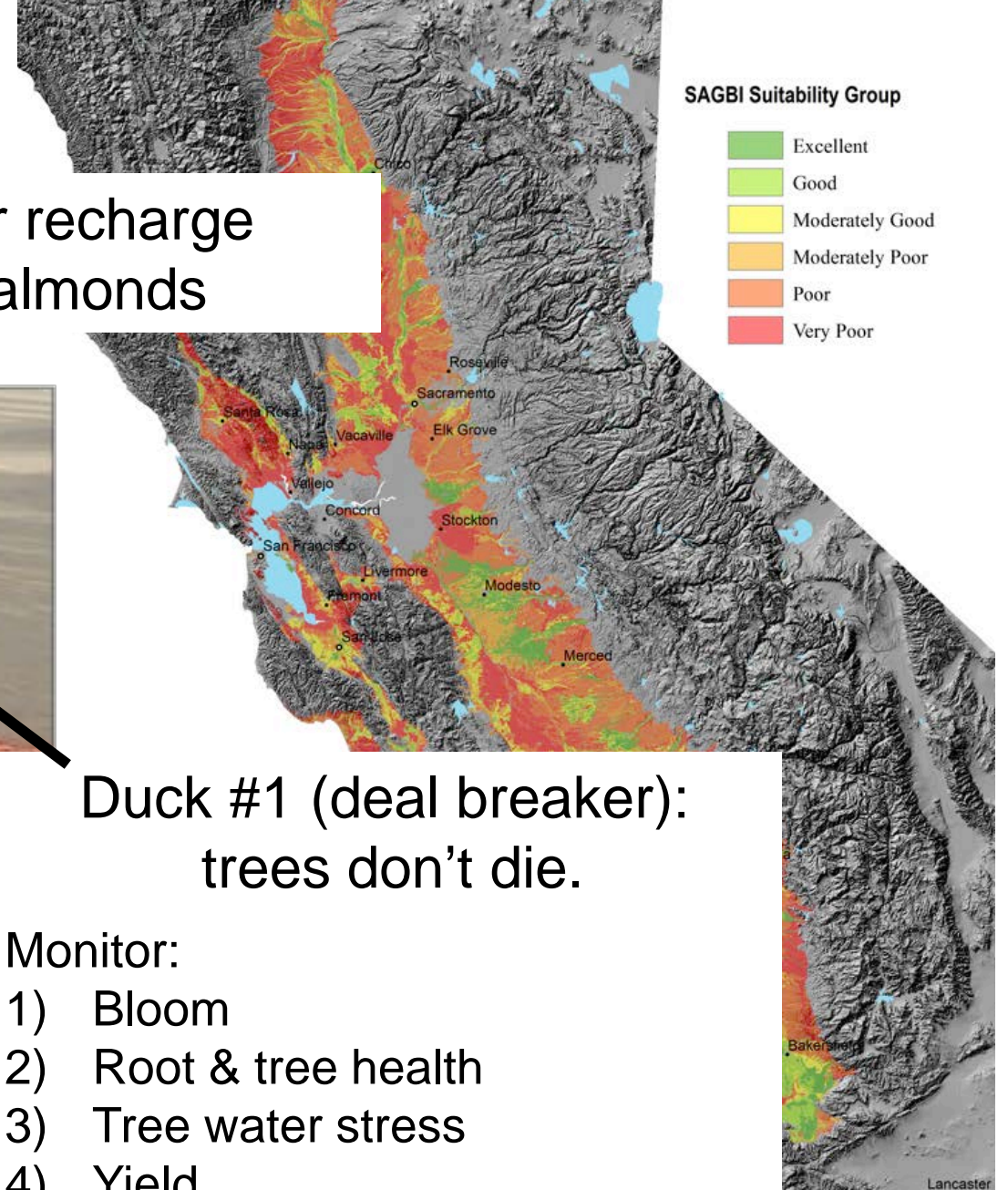
Many ducks need to be in a row for winter recharge flooding to be a sustainable strategy in almonds



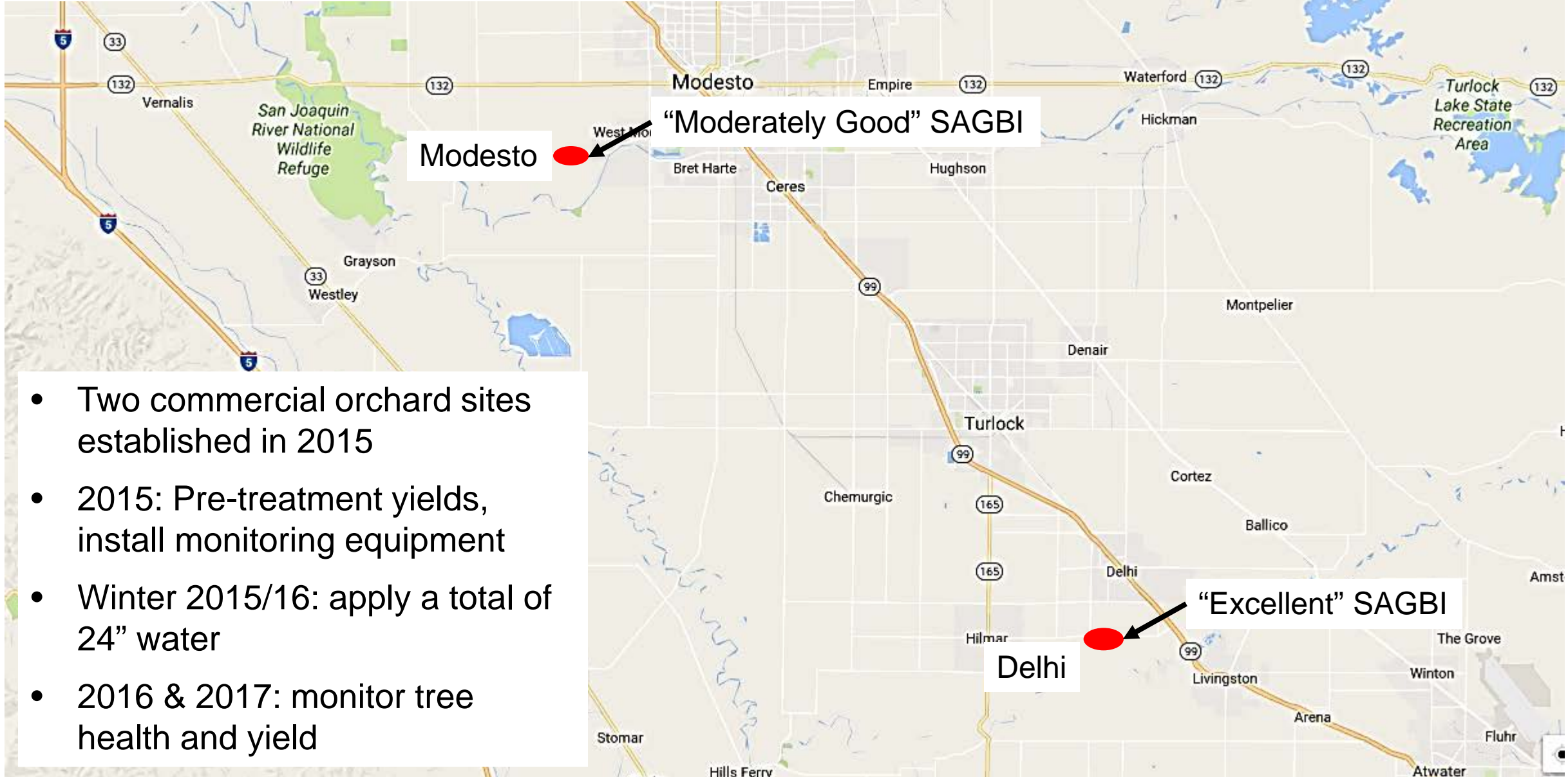
Duck #1 (deal breaker):  
trees don't die.

Monitor:

- 1) Bloom
- 2) Root & tree health
- 3) Tree water stress
- 4) Yield
- 5) Etc....



# Two Initial Pilot Studies, Nonreplicated







# Modesto Irrigation District Captured Storm Runoff



Six inches of water applied for four consecutive weeks in January



Compared against adjacent section with no winter irrigation

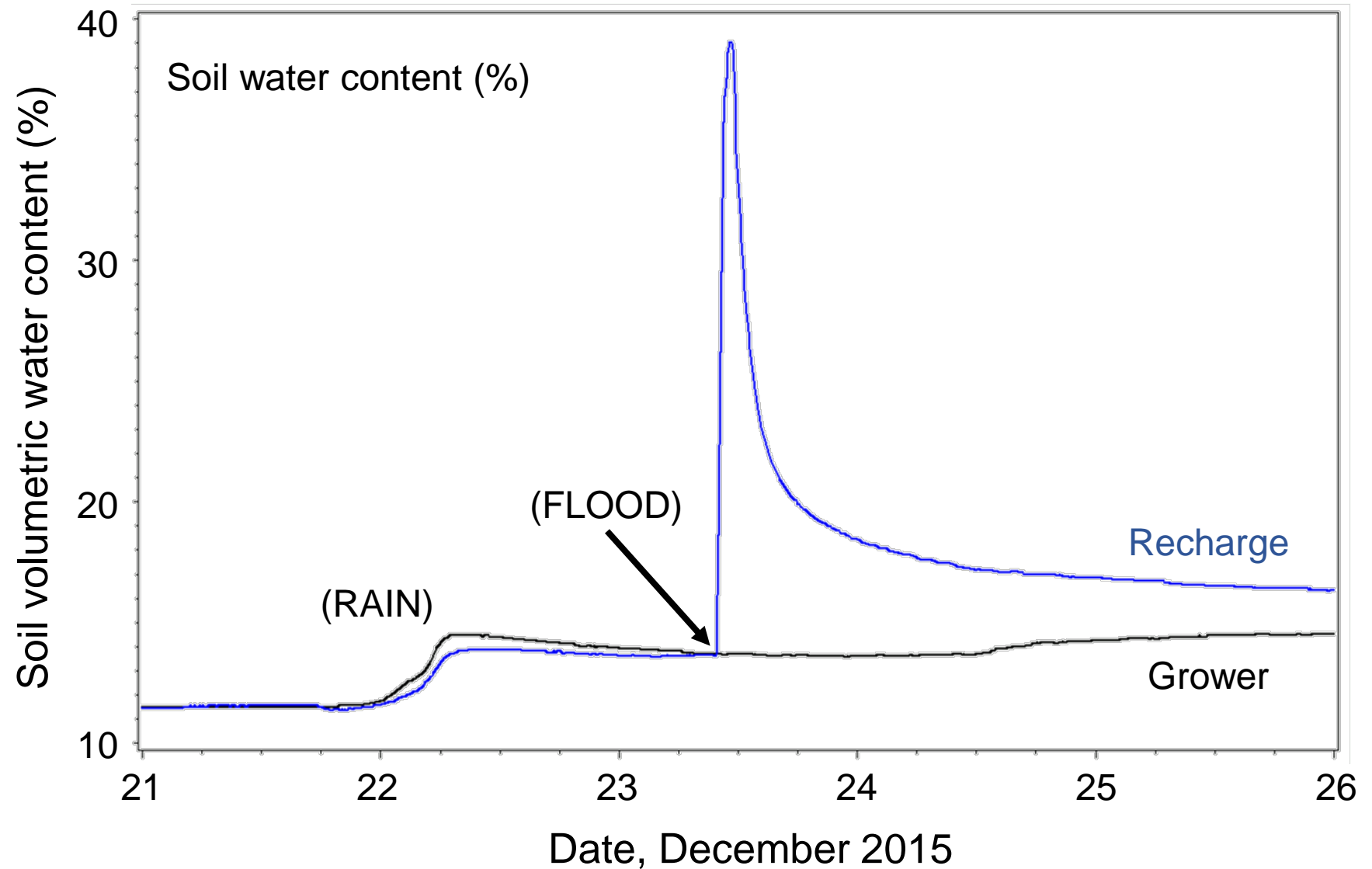


A suite of hydrologic measurements, including water infiltration rate, temperature,  $\text{NO}_3$ , EC, contaminants, etc.



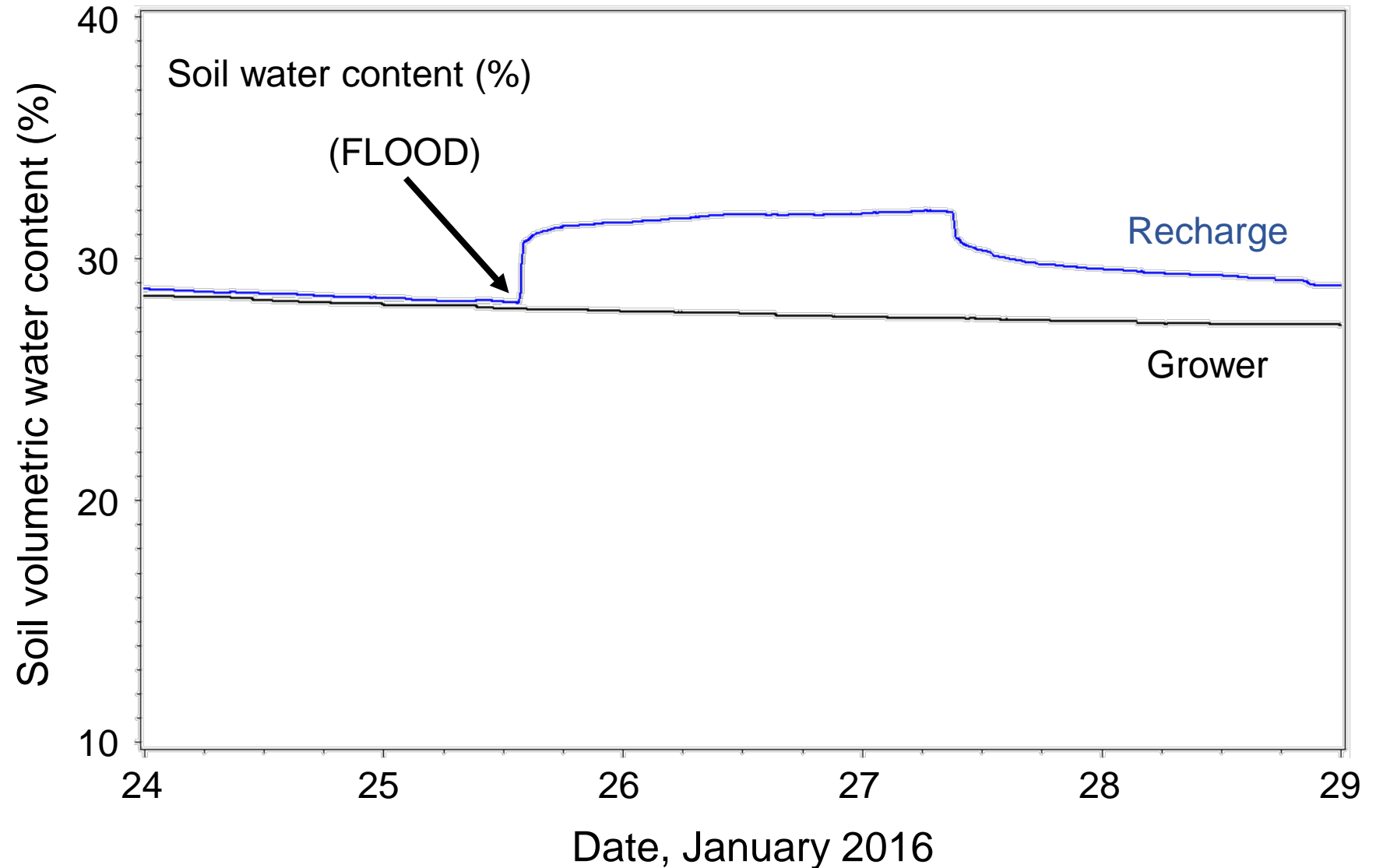
# Example 5 day soil moisture pattern during a recharge event at the Delhi site (soil: 'Sand')

Large increase in soil moisture, rapid drop (drainage) within about **12h**.

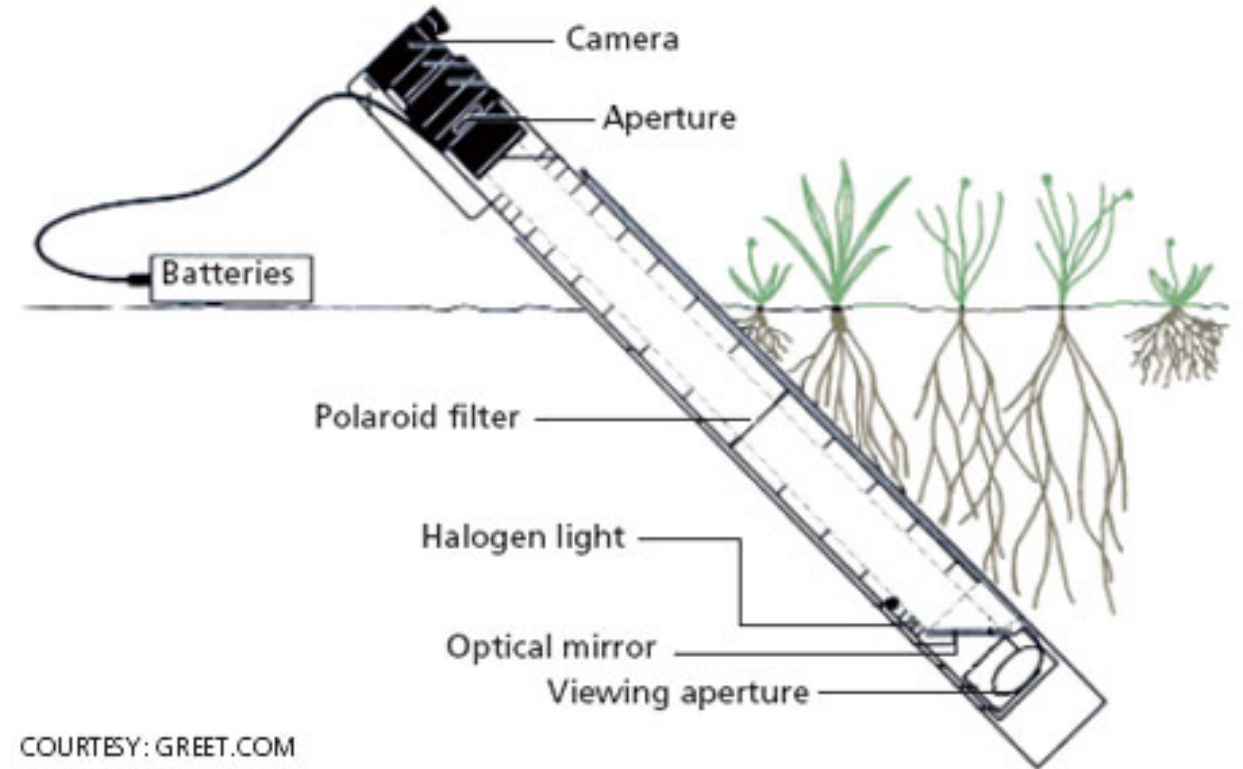


# Example 5 day soil moisture pattern during a recharge event at the Modesto site (soil: 'Fine Sandy Loam')

Small increase in soil moisture, about **2 days** required to see soil 'drain' from saturated conditions.



# 'Mini-rhizotron' method to observe root growth and 'health'







# Root observations: Modesto



11 Jan 16



1 Feb 16



29 Feb 16



28 Mar 16



18 April 16



9 May 16



28 May 16

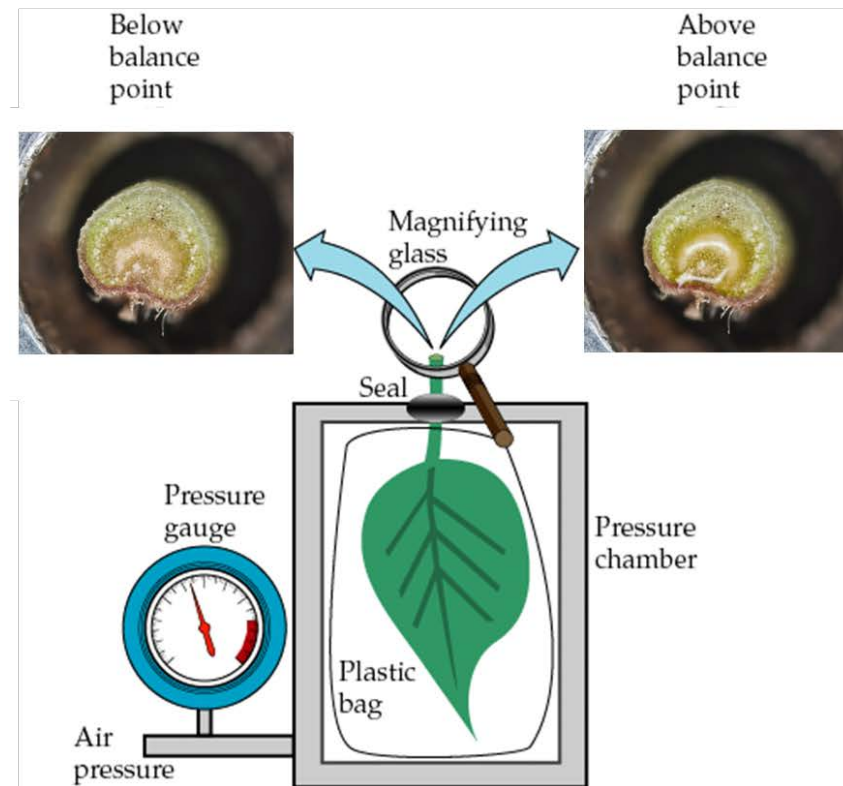


20 June 16

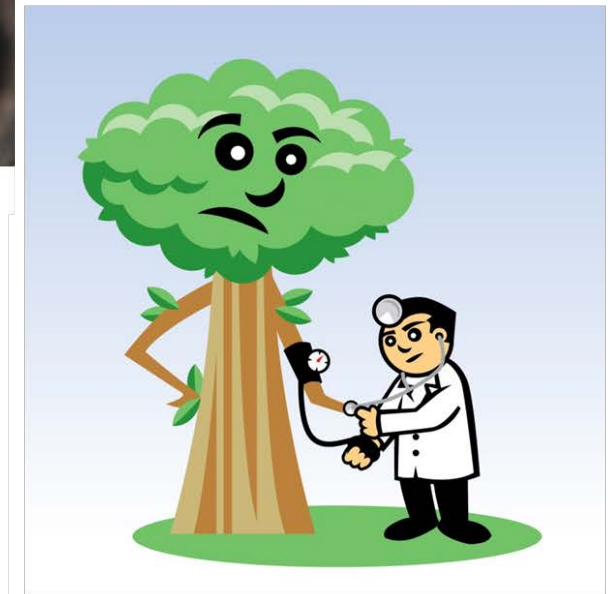
Observation Date

# Checking root health by testing for tree water stress: Are roots able to supply the water that the tree needs?

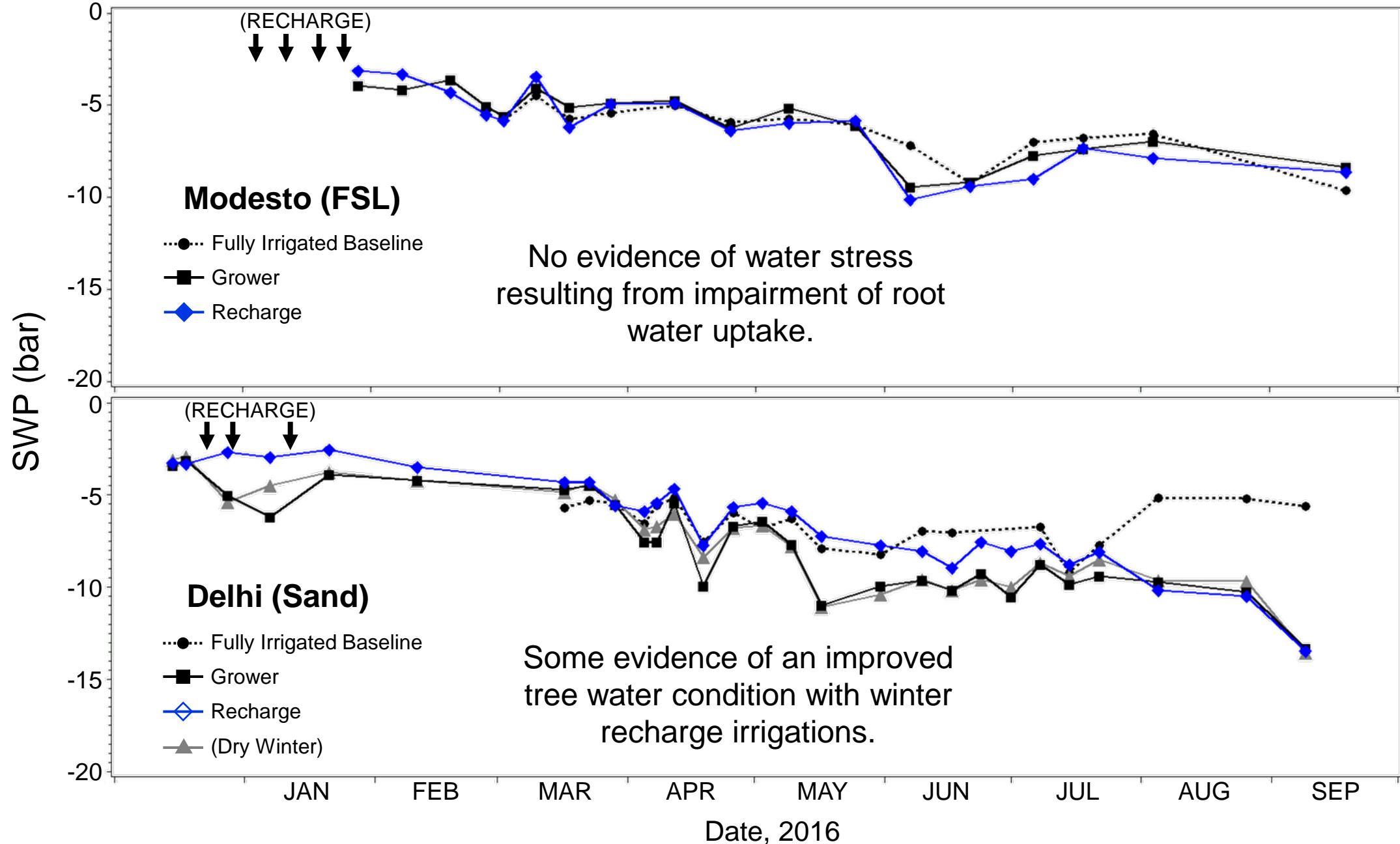
Pressure chamber method for measuring the level of water suction in the plant: midday stem water potential (SWP)



Like measuring the “blood pressure” of the plant



# Testing for water stress during the growing season



# Yields this far: no indication of any positive or negative treatment effect

		Year	
Site	Treatment	2015 (pre-treatment)	2016
Modesto	No water	3220	3090
	Recharge	3430	3130
	(Dry Winter)	3360	3290
Delhi	No water	1230	1250
	Recharge	1410	1200
	(Dry Winter)	1190	1140



## Summary:

- 1) Using orchards to sustainably manage groundwater will involve consideration of many issues, any one of which could be a 'deal breaker.'
- 2) Initial measurements do not indicate an obvious problem from the tree perspective.
- 3) Multiple treatment years (3-4) will be required to evaluate the potential long term yield effects in almond.
- 4) Need to expand and replicate field trials before recommending practice.
- 5) Leaching of N or pesticides could be an issue; may require changes in farming practices



# Media Captivated by Project



It will take a few more years and lots of data before we feel confident to recommend using almond orchards to recharge groundwater.

