

# Petaluma River Bacteria and Nutrients TMDL: Stakeholder Meeting



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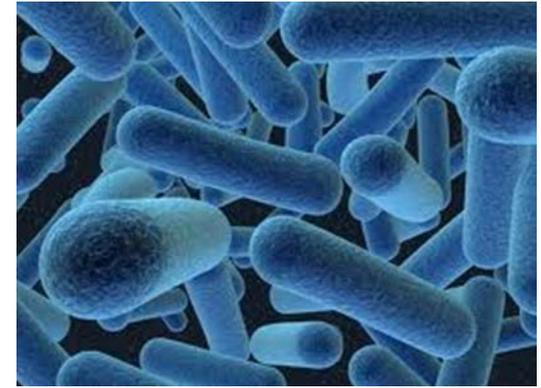
# Overview

- Problem Definition
- Solution (TMDL Plan)
- Project Scope
- Impairment Assessment (Bacteria, Nutrients)
- Identified Pollution Sources
- Public Engagement



# Problem: Excess Bacteria and Nutrients

- River is listed as “impaired” for:
  - bacteria (1976)
  - nutrients (1986)
- Does not meet water quality standards
- Beneficial uses (BUs) of River not protected → “Impairment”



\*This is not a photo of the Petaluma River

# Relevant Beneficial Uses of Petaluma River

## BU → Specific uses of water

- Water recreation
- Wildlife habitat
- Cold & warm freshwater habitat
- Fish spawning
- Estuarine habitat
- Rare & endangered species habitat



# Solution: Take Actions to Improve Water Quality

- TMDLs (“Total Maximum Daily Loads”):
  - Water quality improvement plans
  - **Evaluate impairment**
  - **Identify pollution sources**
  - Set maximum pollutant limit
  - Devise a plan of action to remedy the water quality impairment



# Petaluma River Bacteria and Nutrients TMDL Project Scope

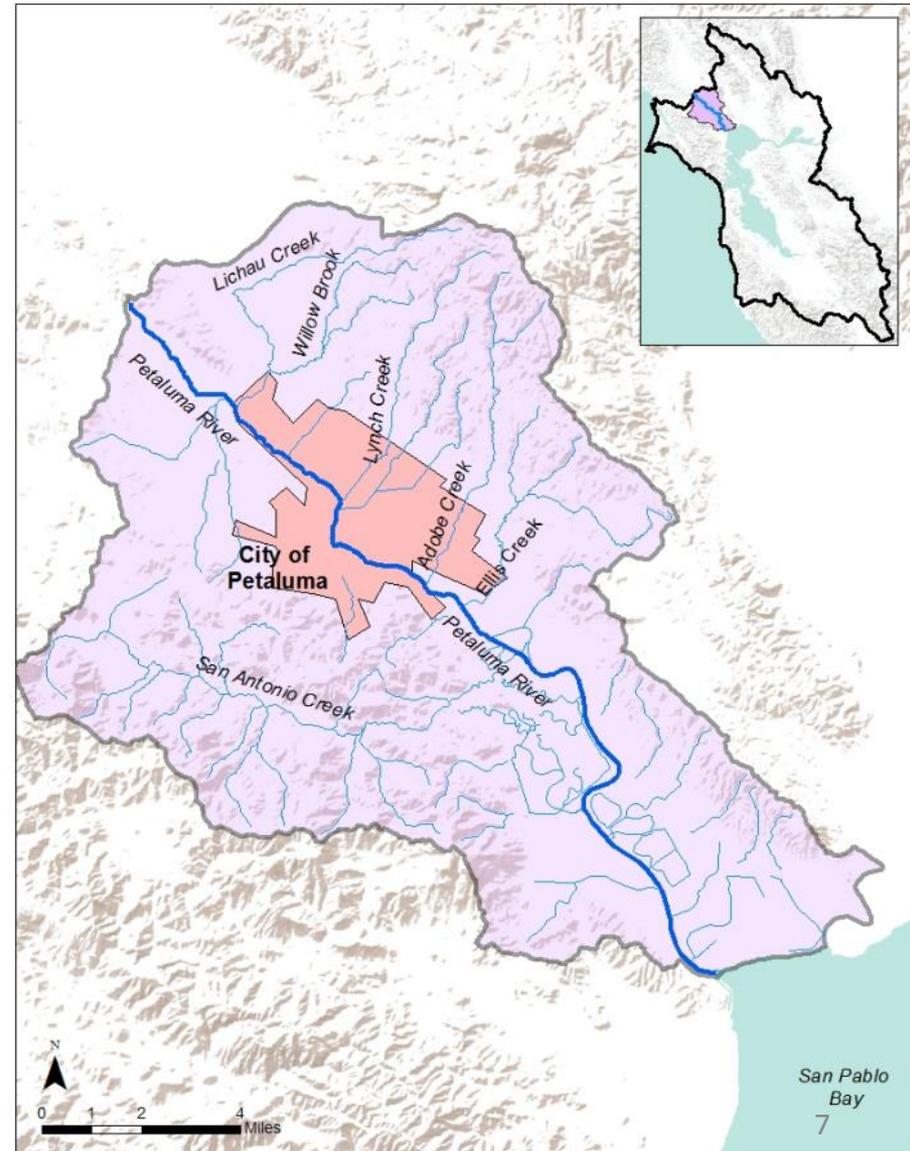
- Addresses bacteria & nutrients impairments

Petaluma River Impairments	Status
Bacteria	this project
Nutrients	this project
Diazinon	region-wide TMDL in place
Trash	stormwater permit
Sediment	later date
Nickel (at the mouth only)	later date

- Sources of bacteria and nutrients are similar

# Geographic Scope

- Project covers the entire Petaluma River watershed (150 square mile)
- Includes all tributaries, e.g., San Antonio Creek
- Tribs are connected to and discharge pollution into River



# Impairment Assessment: How is the water quality now?

- Need to evaluate **current** status of impairments
- **Recent** and adequate **data** are needed
- Started bacteria and nutrients monitoring (2015)



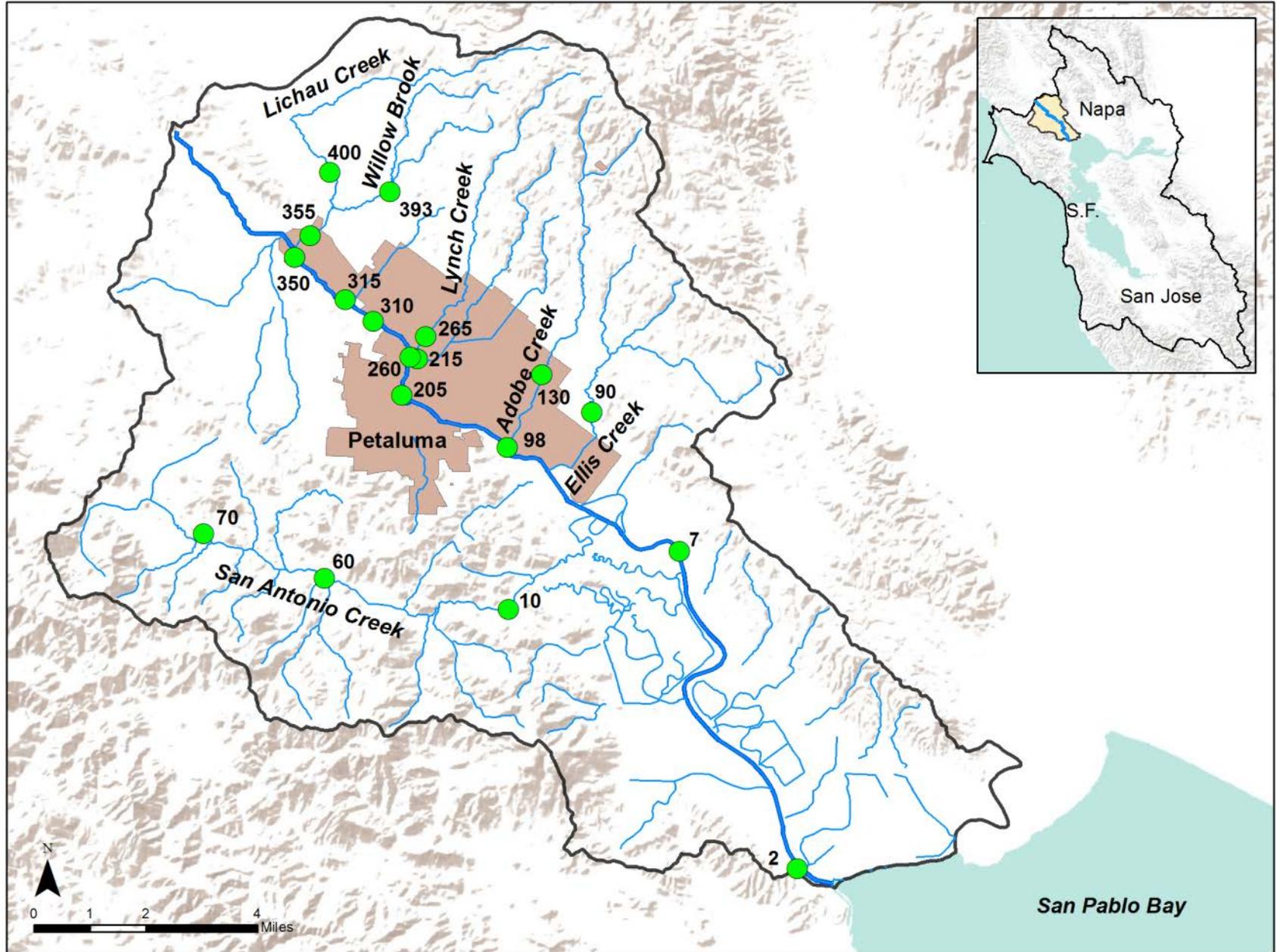
# Bacteria and Nutrients Monitoring

## Overview

- Sampling schedule:
  - Winter, spring and summer 2015 & 2016
  - Winter 2017
- Constituents:
  - Bacteria (5 times per season)
  - Nutrients (once per season)
  - Algae (Spring 2016)
  - DO & pH (Spring 2016)
- 18 sites:
  - Perennial and non-perennial streams
  - Tidal and non-tidal sections of the River

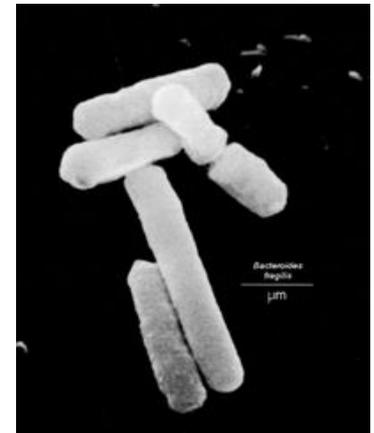
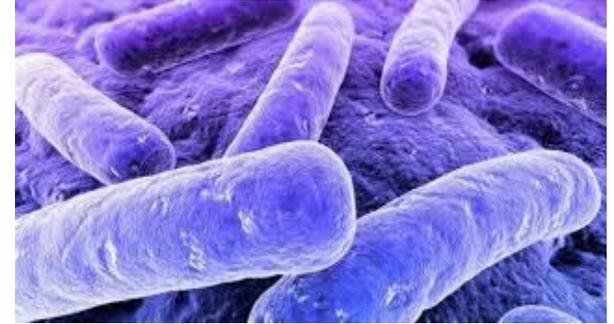


# Petaluma River Sample Sites



# Bacteria Impairment Assessment

- Fecal Indicator Bacteria (FIB)
  - Indicate presence of fecal pollution
  - Suggests potential presence of pathogenic organisms
  - *E. coli*, *Enterococcus*
- Source-Specific Fecal Bacteria
  - *Bacteroides* bacteria
  - “DNA fingerprinting”
  - Identifies specific source of pollution
  - human, horse, dog, ruminant (cow, deer, elk...)

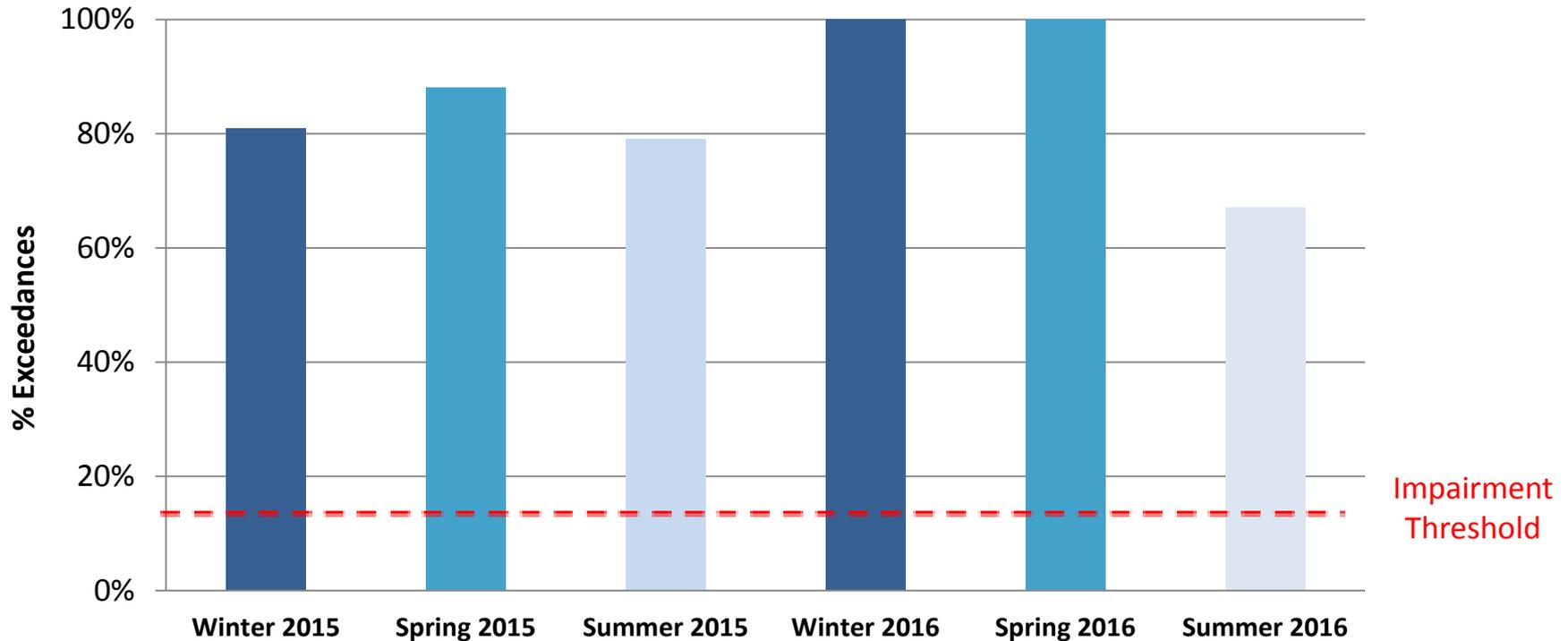


# Bacteria Water Quality Standards

Indicator	Standard	
	Geometric Mean (per 100 mL)	Single Sample Maximum (per 100 mL)
<i>Enterococcus</i> (estuarine & fresh water)	30	110
<i>E. coli</i> (fresh water only)	100	320

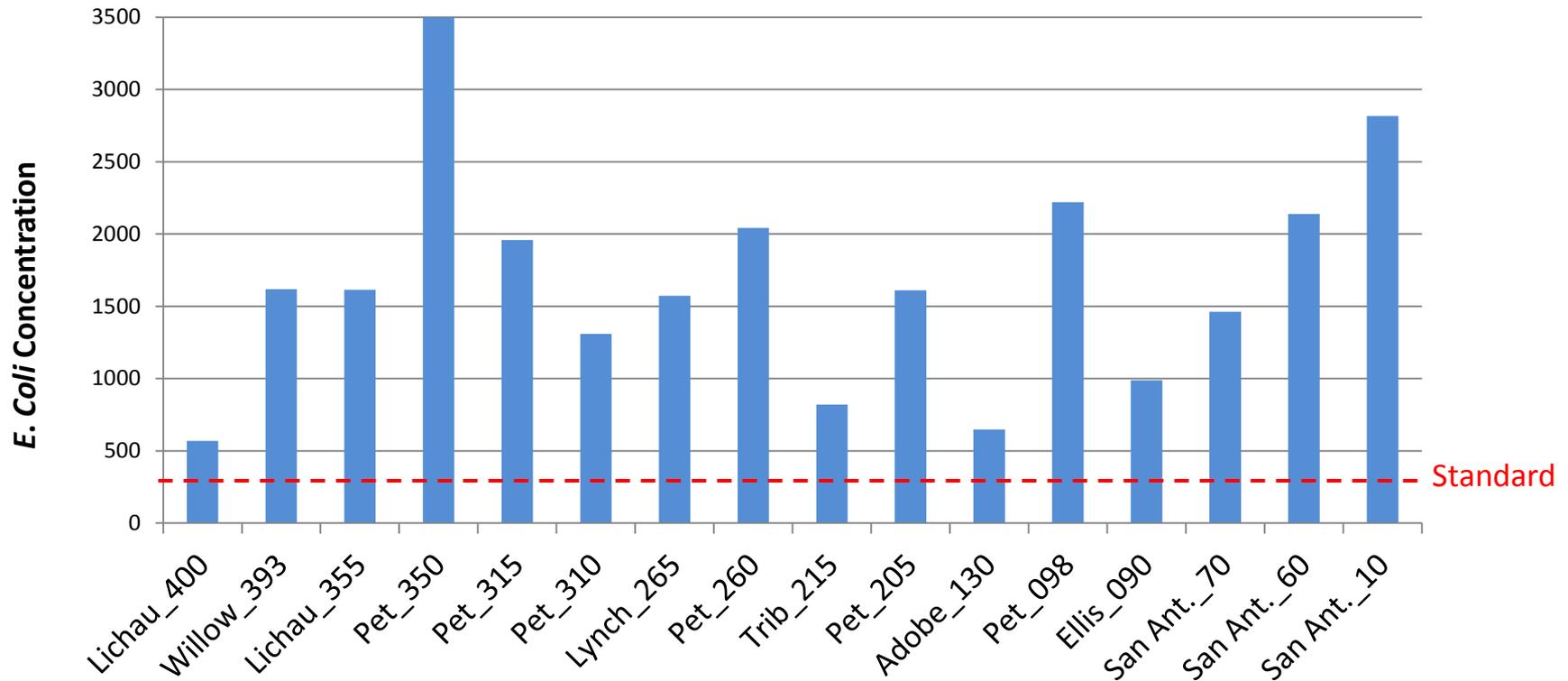
- Geometric mean: for five samples within a 30-day period
- Single sample maximum: for individual samples
- Impairment: >16% exceedance of these standards (California Listing Policy)

# Percent Exceedances of *E. coli* Geometric Mean Standard By Season



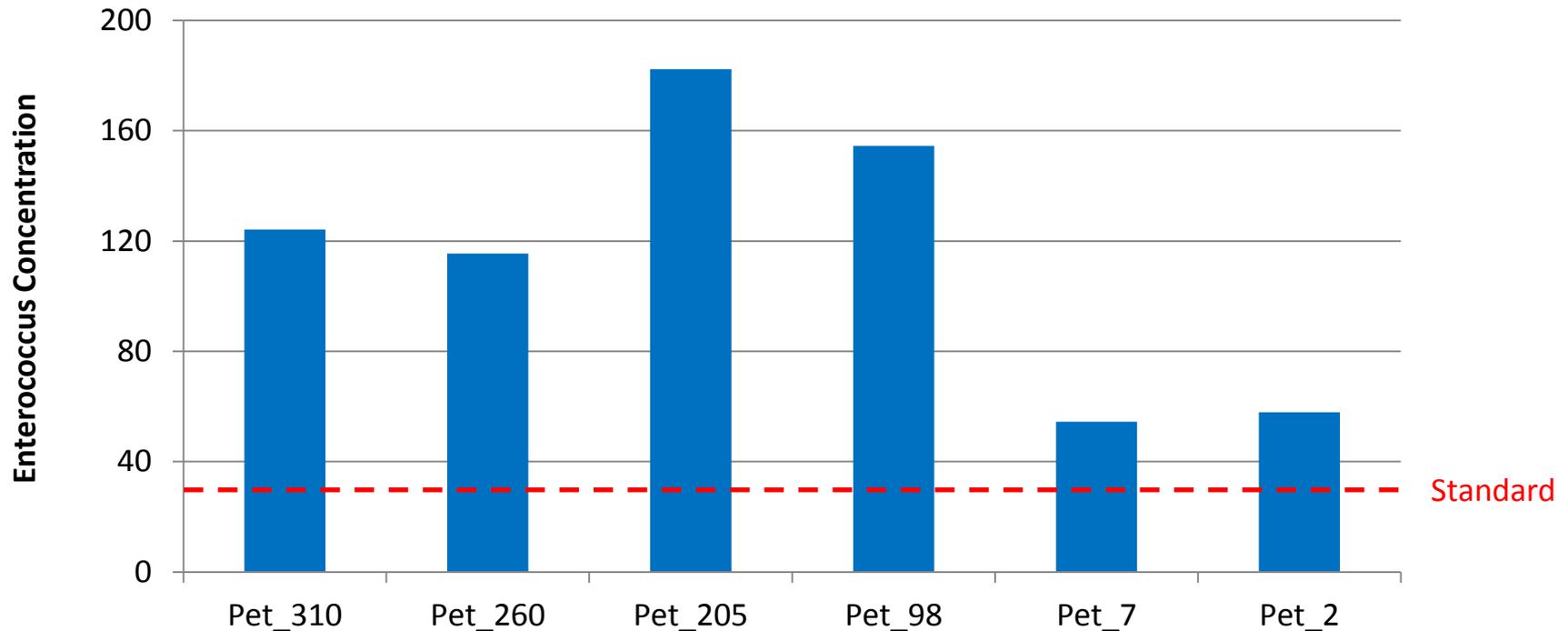
- Significant exceedances of geometric standard
- Higher in wet season than dry season (2016)

# Mean of *E. coli* Single Sample values By Sampling Station (2015-2016)



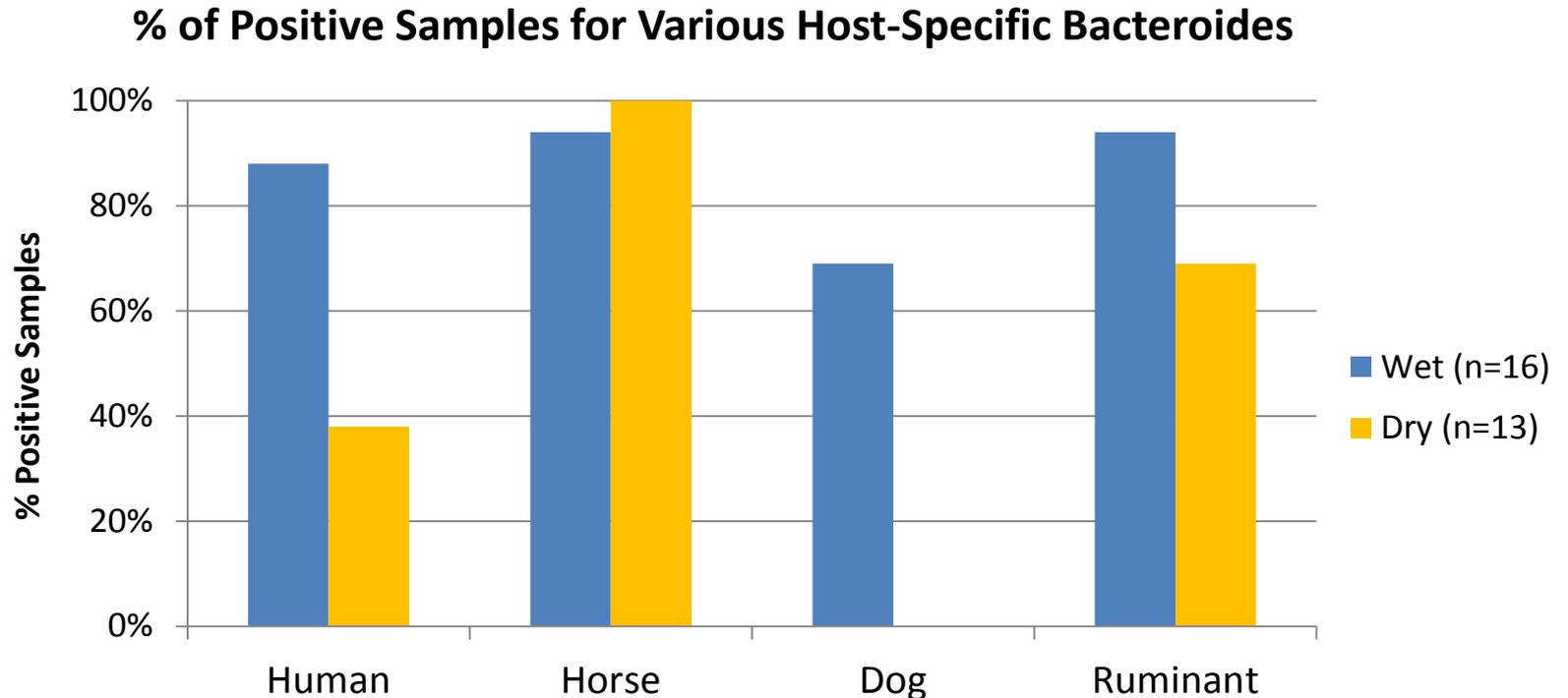
- All stations exceed standard
- Main stem and San Antonio Creek stations show higher levels

# *Enterococcus* Geometric Mean Values Winter 2017 (five events)



- *Enterococcus* sampling in tidal section of main stem
- All stations exceed standard, especially **Pet\_98** & **Pet\_205**
- Will monitor again in summer

# Bacteroides Results-2016



- Two rounds of sampling (February, June)
- **All four** Host-specific Bacteroides were **detected**
- **Higher wet season** “hits” than dry season hits

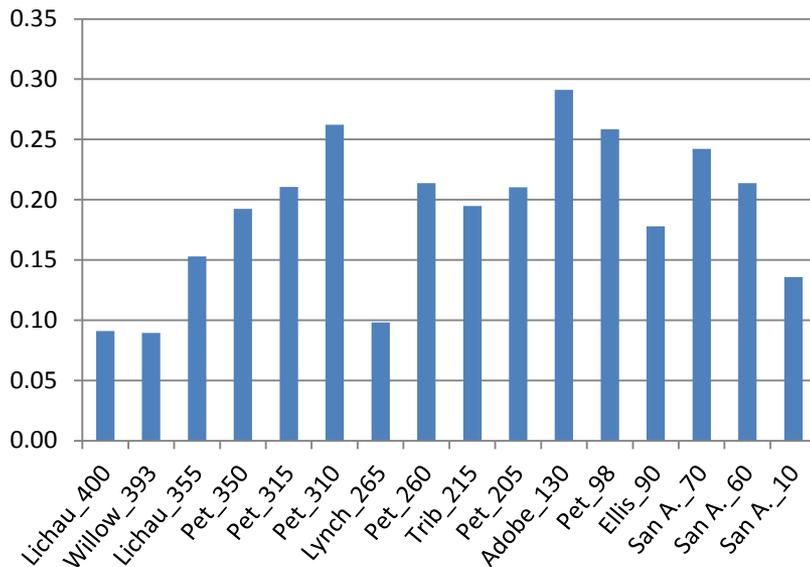
# Nutrients Impairment Assessment

- Two types of impacts:
  - Toxic effects
  - Eutrophication
- Toxicity due to high **ammonia** or **nitrate**
- Ammonia thresholds
  - Total ( $\text{NH}_3 + \text{NH}_4^+$ ) = **0.6-3.3 mg/L**
  - Unionized ( $\text{NH}_3$ ) = **0.025 mg/L annual median**
- Nitrate standard
  - **10 mg/L** (for drinking water)
- Eutrophication → lowers DO, can cause toxic algal blooms, impedes recreation

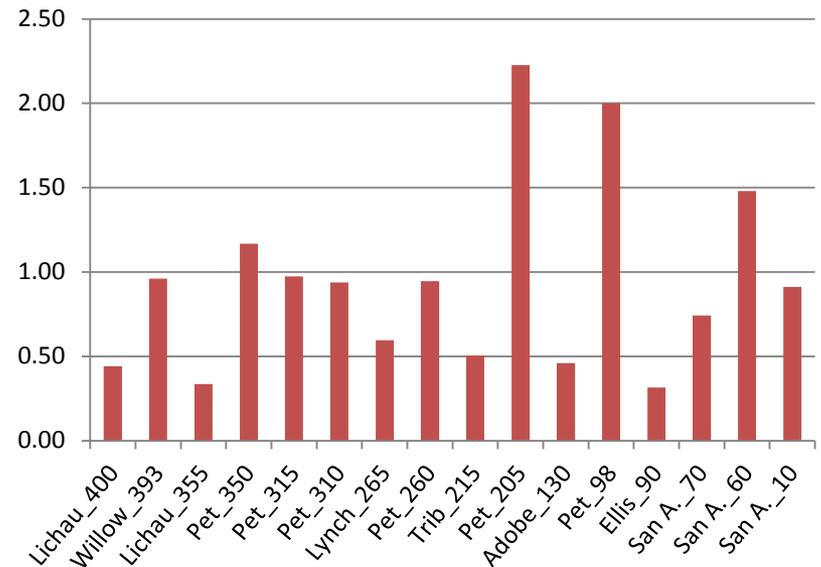


# Average Concentrations of Nitrate and Ammonia by Site (2015-2016)

Average of Total Ammonia as N (mg/L)



Average of Nitrate as N (mg/L)



- Ammonia and nitrate levels are well below established toxicity standards
- Petaluma mainstem (e.g., **Pet\_205**, **Pet\_98**) and **San Antonio** sites had highest nitrate levels

# Summary of Exceedances of Numeric Evaluation Guidelines for **Direct** Indicators of Eutrophication

Analyte	Numeric Evaluation Guideline	Number & Percent of Exceedances
Benthic algal chlorophyll a (COLD)	150 mg/m <sup>2</sup>	(0/9) = 0%
Percent macroalgae Cover	30%	(1/9) = 11%
Benthic algal biomass (AFDW) (COLD)	60 g/m <sup>2</sup>	(3/9) = 33%
Water column chlorophyll a	15 µg/L	(0/9) = 0%
Algae taxonomy indicators		Data forthcoming

- Algal sampling at 9 freshwater sites (spring 2016)
- **No** strong indication of **eutrophication**
- No toxic algae problem

# Summary of Exceedances of Numeric Evaluation Guidelines for **Indirect** Indicators of Eutrophication

Analyte	Numeric Evaluation Guideline	Number & Percent of Exceedances
pH-Instantaneous	6.5-8.5 units	(1/41,797) = 0.0%
Dissolved oxygen-Instantaneous (WARM)	5.0 mg/L	(30,254/41,797) = 72%
Dissolved oxygen-Instantaneous (COLD)	7.0 mg/L	(36,762/41,797) = 88%
Daily dissolved oxygen change	5 mg/L	(55/444) = 12%
Daily pH change	1 unit	(0/444) = 0%

- Continuous DO & pH readings at five sites (Spring-Summer 2016)
- **Chronically low DO** is observed but likely is not due to eutrophication
- Daily DO/pH fluctuations (**signals of eutrophication**) are low

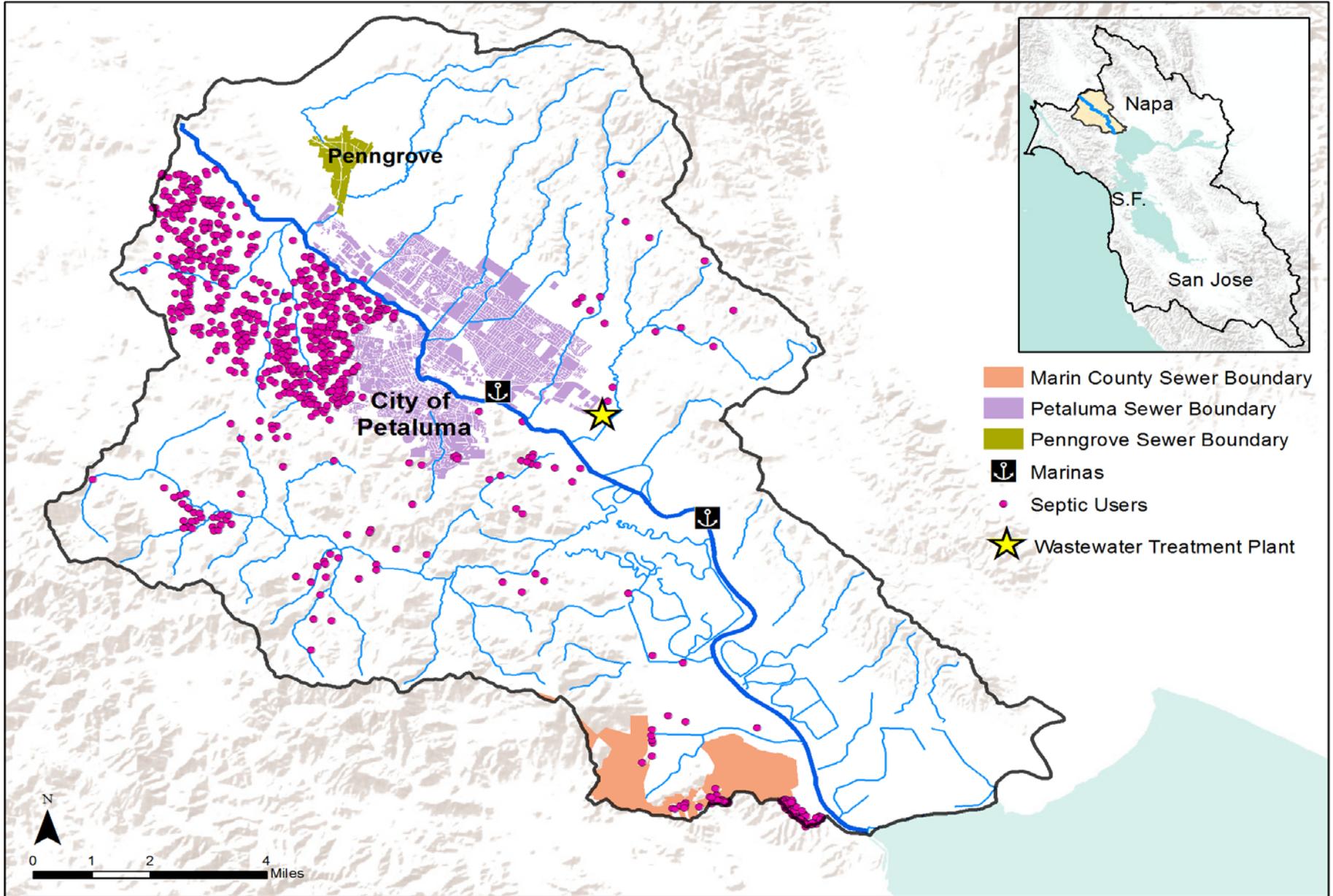
# Other Data

- SWAMP nutrients data (2003)
  - 7 sites (spring, summer, winter)
- CDFW historic ammonia data (1999-2001)
  - M. Rugg – San Antonia Creek; Ellis Creek
  - 108 samples
- Any other data sources we have missed?

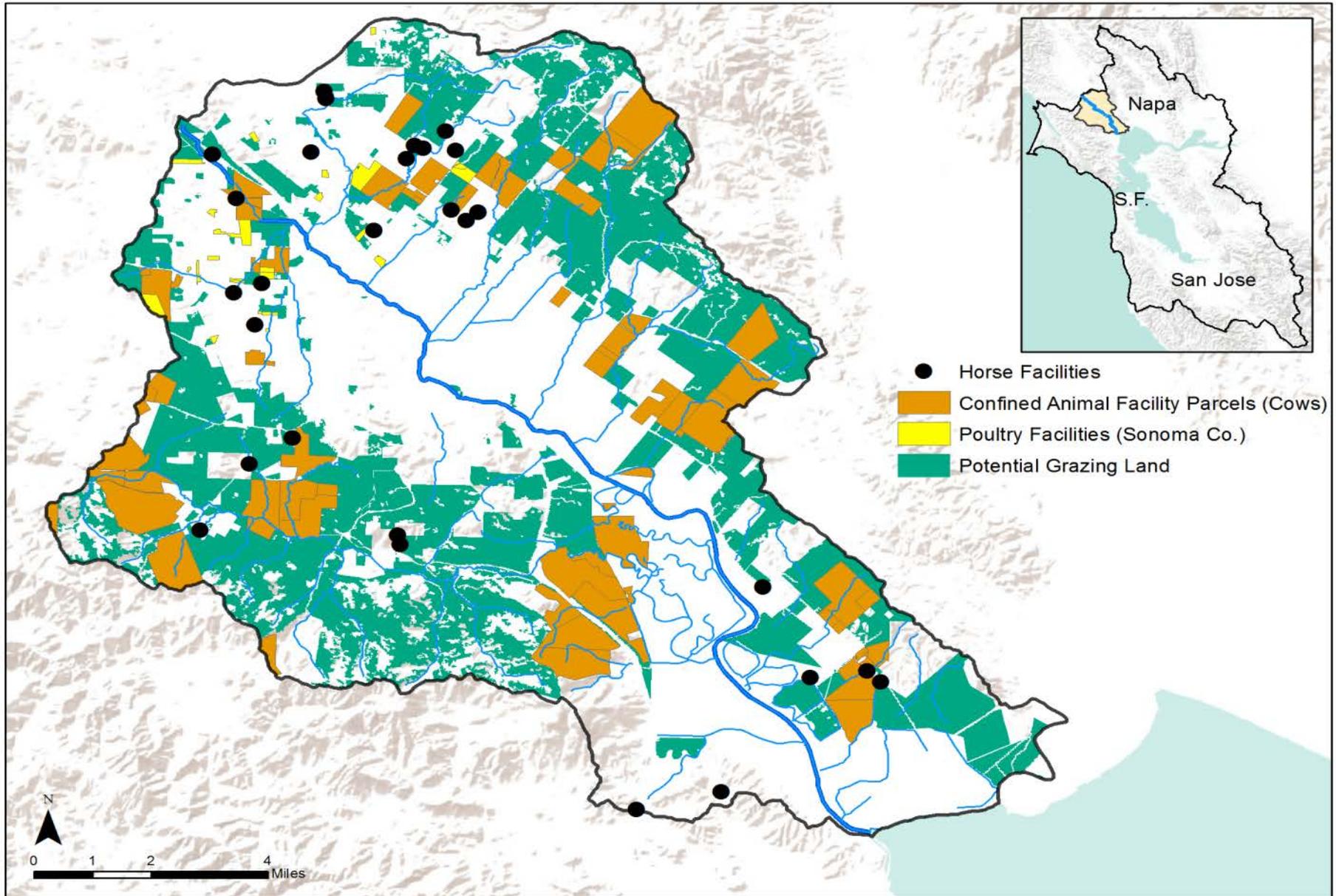
# Potential Sources

Source Category	Potential Sources	Bacteria Source	Nutrient Source
Human Waste	Wastewater treatment plant	X	X
	Sanitary sewer systems	X	X
	Private sewer laterals	X	X
	Septic systems	X	X
	Vessel marinas	X	X
Animal Waste	Livestock - Confined animal facilities	X	X
	Livestock - Grazing lands/operations	X	X
	Domestic pets	X	X
	Wildlife	X	X
Municipal Stormwater Runoff	Runoff from residential, commercial, industrial, and recreational areas	X	X

# Human Sources



# Animal Sources



# Conclusions

- River is impaired by bacteria
- River is likely not impaired by nutrients/  
eutrophication
- Control measures addressing bacteria  
discharges also address nutrient discharges

# Public Engagement Opportunities

- Project workshop & CEQA scoping meeting – **Fall 2017**
  - Public review of TMDL plan
  - Water Board adoption hearing
- } **2018**
- We are available to meet as requested
  - Are there other interested parties we should engage?

# Project Contacts

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Project Website:

[http://www.waterboards.ca.gov/sanfranciscobay/water\\_issues/programs/TMDLs/petalumabacterianutrienttmdl.shtml](http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/petalumabacterianutrienttmdl.shtml)