Lake County Irrigated Agriculture

State Water Board, Irrigated Lands Regulatory Program and Water Quality Monitoring in Lake County

Regional Board TMDL Meeting July 2018

Presentation Outline

- Lake County Irrigated Agriculture Overview
- Irrigated Lands Regulatory Program
- Lake County Grading Ordinance
- Sustainability Programs/Stewardship
- Estimating Phosphorus Load Reductions
    - Amber Knolls example

Public Concerns around Ag and the Lake:

- Erosion = phosphorus loading to Lake
- Unregulated or poorly-regulated development
- Unregulated or poorly-regulated maintenance
- Lack of accountability/program to ensure management practices are being followed.
- Other inputs to lake: pesticides, phosphorus fertilizer etc.

About Lake Sub-Watershed Group

- Third Party Coalition that facilitates ILRP enrollment and promote compliance/sustainability within the watershed.


STATE WATER RESOURCES CONTROL BOARD
9 REGIONAL BOARDS
REGION 5 – CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD
THIRD PARTY COALITION
Sacramento Valley Water Quality Coalition
Lake Subwatershed Group
Lake County Grower

Irrigated Ag in Lake County

Lake County - 849,766 acres total (includes public lands, private lands, water bodies, municipalities and ag lands)

Clear Lake - 44,000 acres when full

Upper Cache Creek Watershed - 271,360 acres

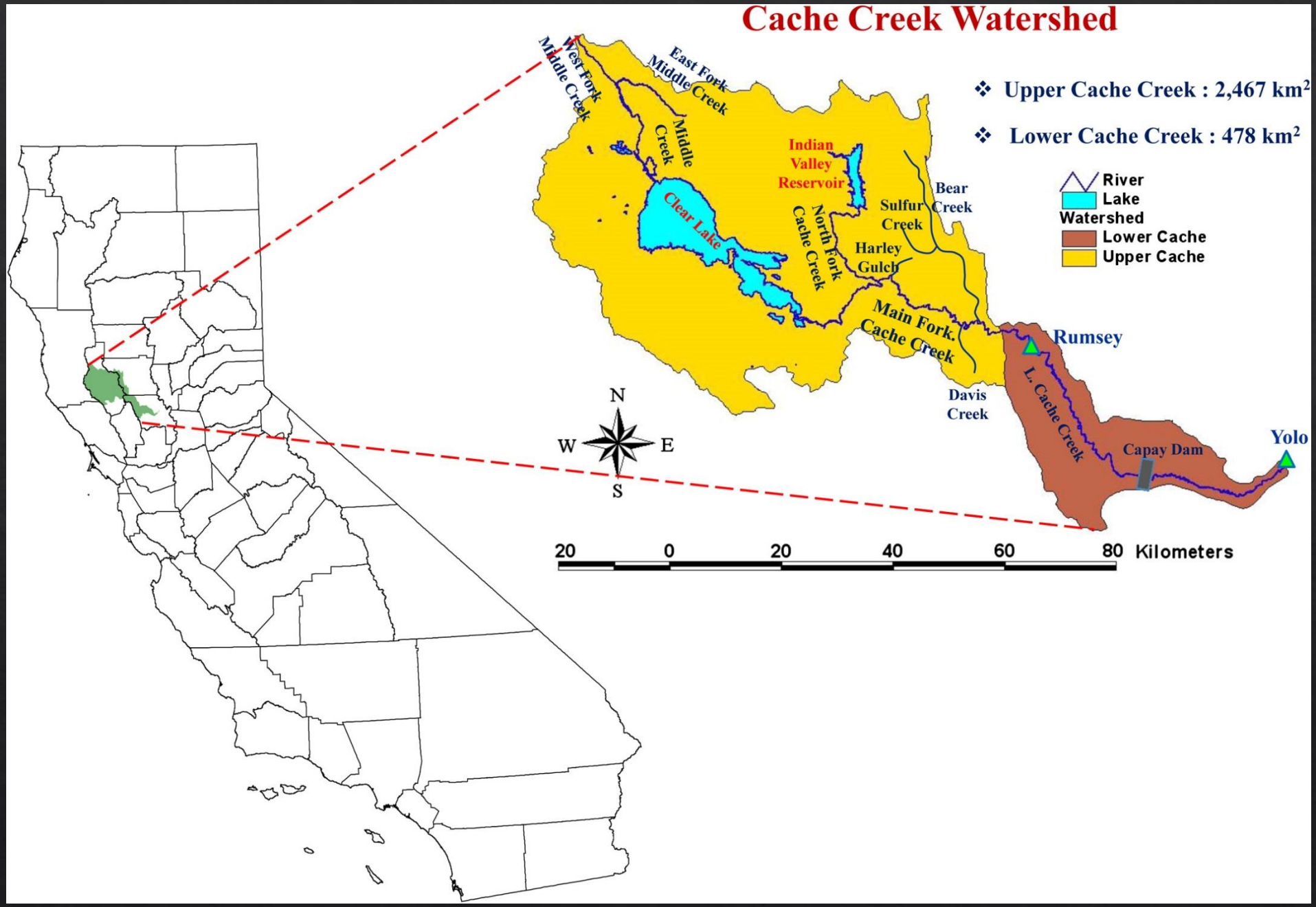
Total Farm Land – 17,456 acres *(2016 Crop Report—Vineyard, Orchard, Hay and Irrigated Pasture)*

2% of land in Lake County, 6.4% of land in Upper Cache Creek Watershed

Irrigated land enrolled in program - 13,500 acres

4.9% of land in Upper Cache Creek Watershed

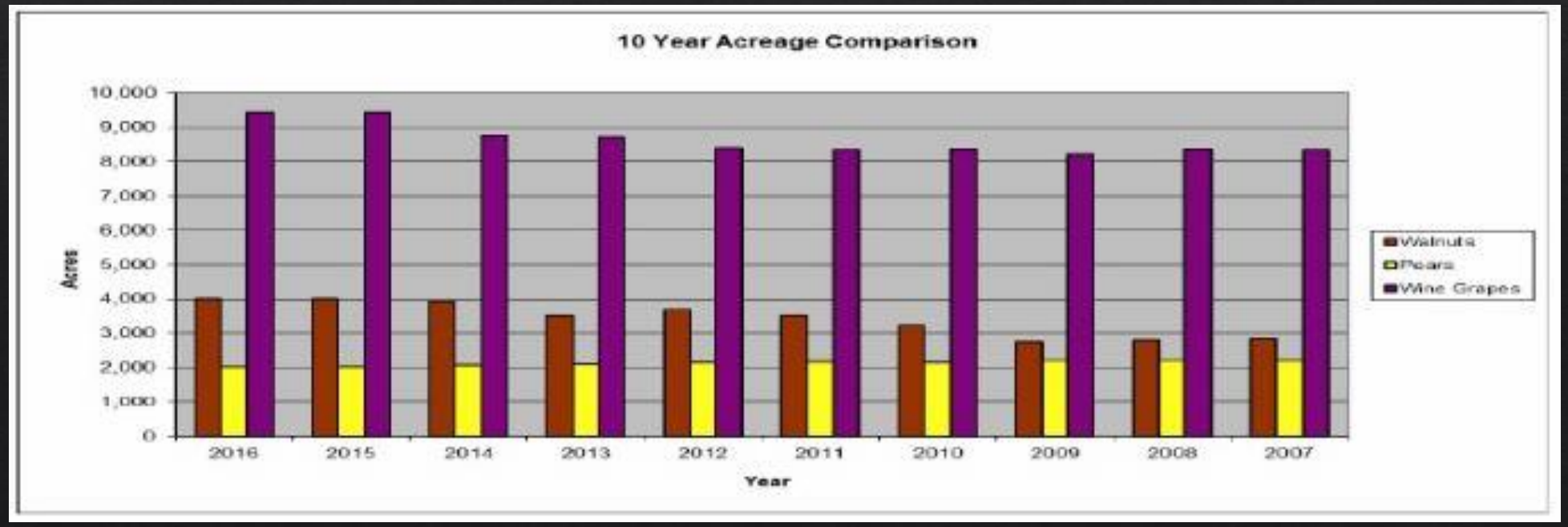
**Colusa Glenn Subwatershed irrigated acreage represents approximately 40% of total acreage


Cache Creek Watershed
Upper Cache Creek : 2,467 km²
Lower Cache Creek : 478 km²
River
Lake
Watershed
Lower Cache
Upper Cache
West Fork Middle Creek
East Fork Middle Creek
Middle Creek
Clear Lake
Indian Valley Reservoir
North Fork Cache Creek
Bear Creek
Sulfur Creek
Harley Gulch
Main Fork. Cache Creek
Davis Creek
Rumsey
L. Cache Creek
Capay Dam
Yolo
N
W
E
S
20 0 20 40 60 80 Kilometers

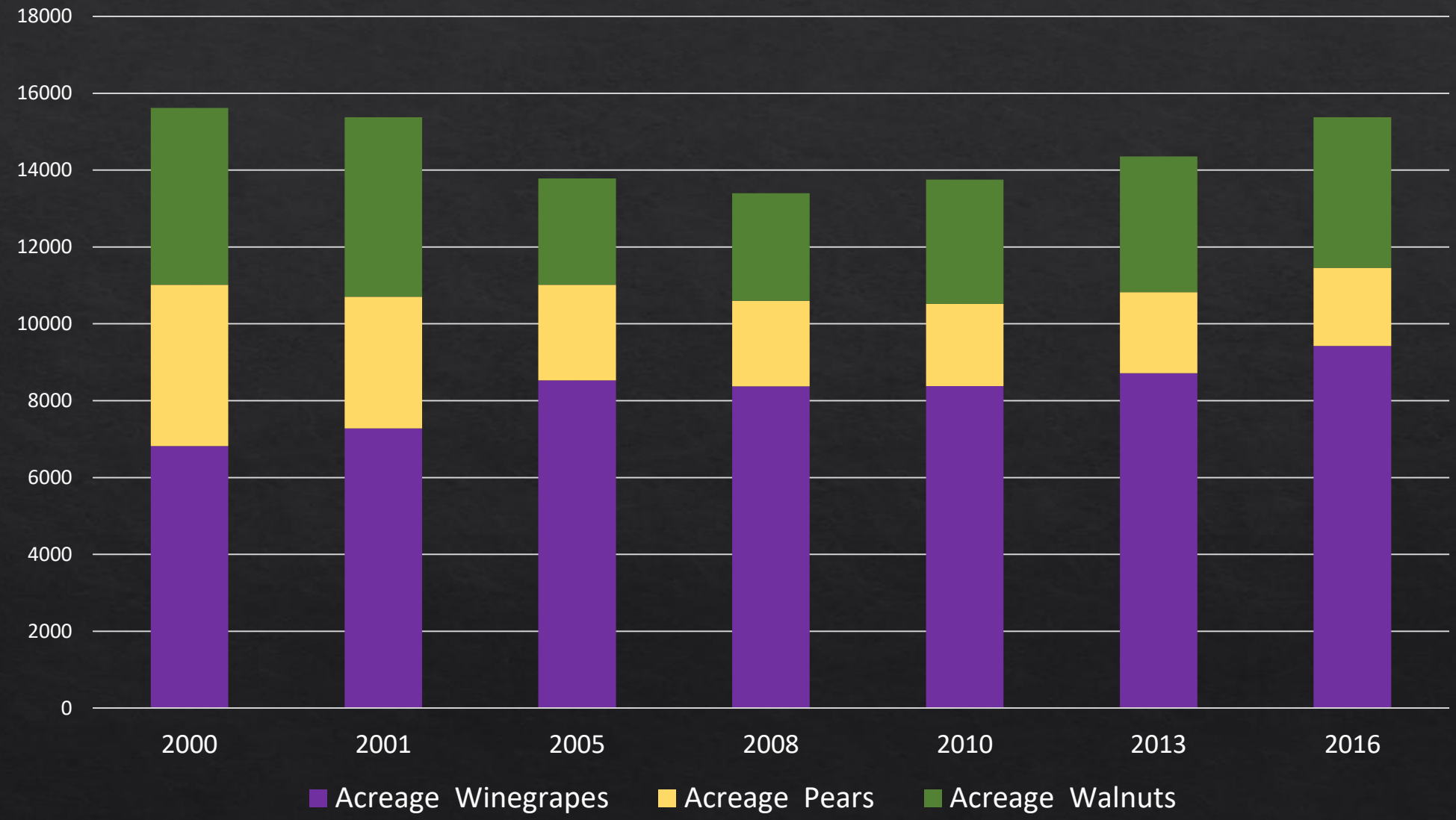
Current Ag in Lake County

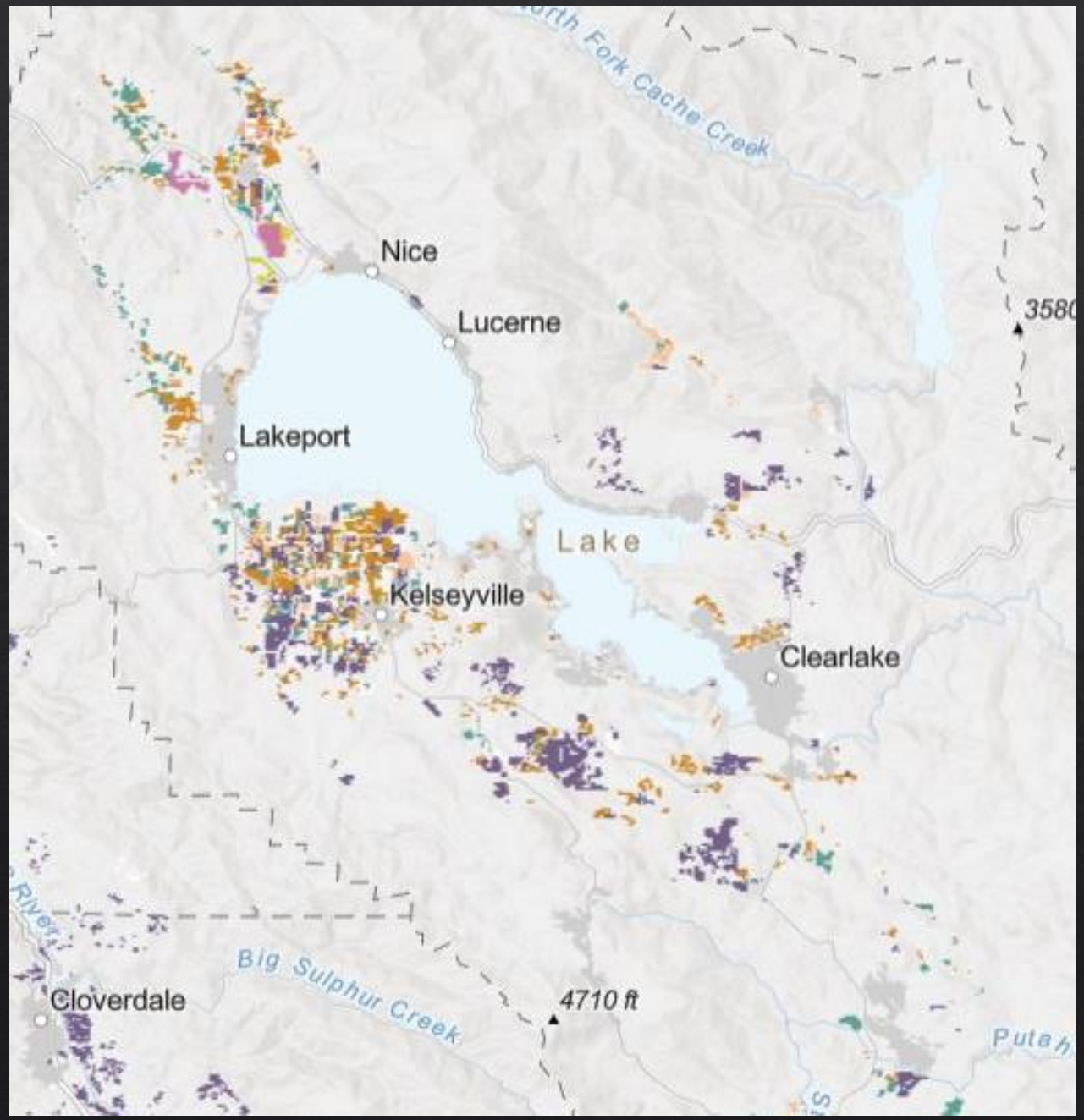
Winegrape Acres: 8225 acres + 1195 non-productive acres
Pear Acres: 2011 acres + 23 non-productive
Walnuts Acres: 3650 acres (about ½ are unirrigated)
Hay Crops (unirrigated): 2450 acres
Irrigated Pasture: 600 acres

(Source: 2016 Lake County Crop Report)



Lake County Crop Acreage 2000-2016



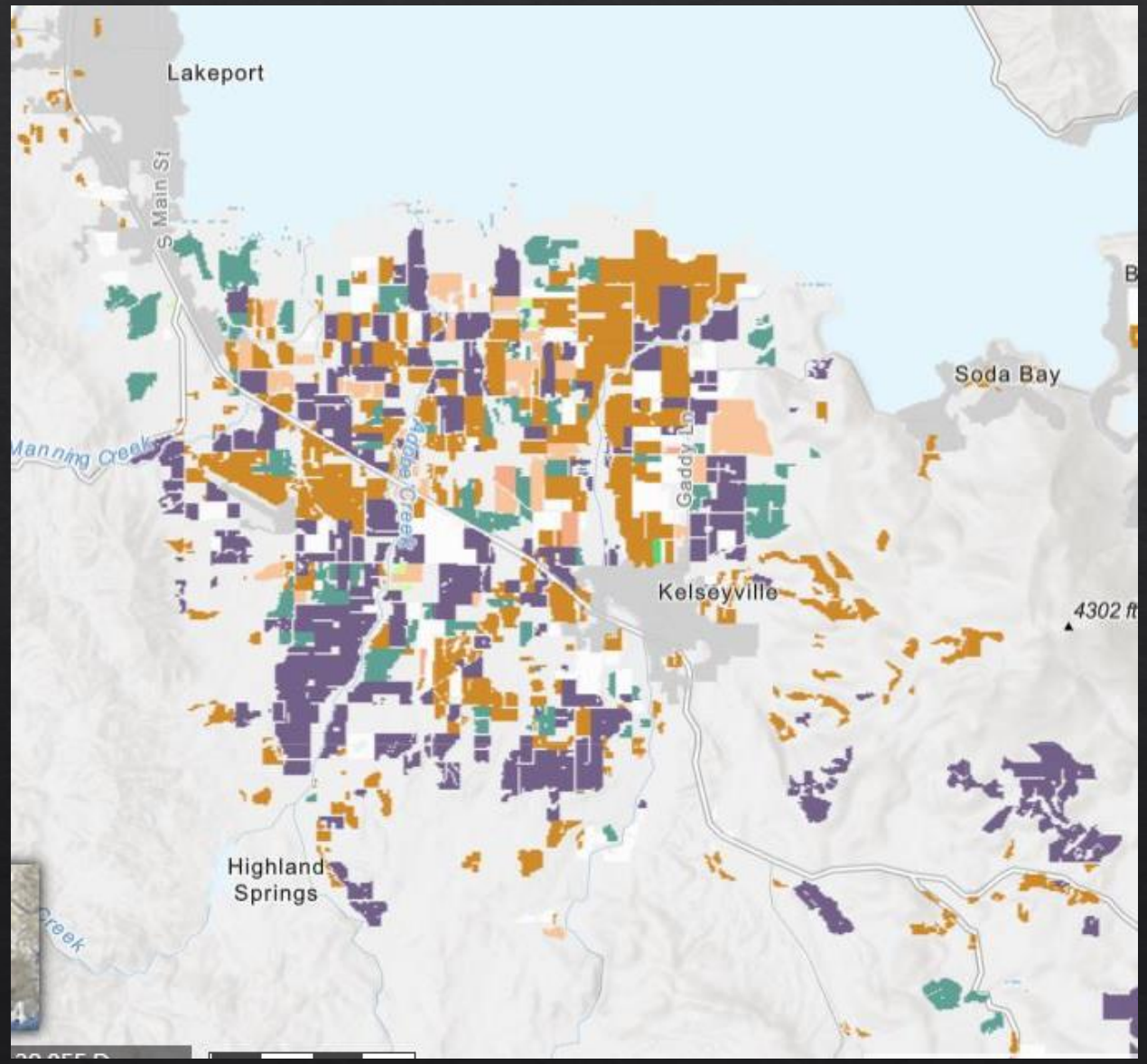


Statewide Crop Mapping 2014

- R | RICE
- P | PASTURE
- G | GRAIN AND HAY CROPS
- T | TRUCK NURSERY AND BERRY CROPS
- F | FIELD CROPS
- C | CITRUS AND SUBTROPICAL
- D | DECIDUOUS FRUITS AND NUTS
- V | VINEYARD
- Y | YOUNG PERENNIAL
- I | IDLE
- NR | RIPARIAN VEGETATION
- U | URBAN

(Following slides source: DWR Statewide Crop Mapping 2014)

Big Valley



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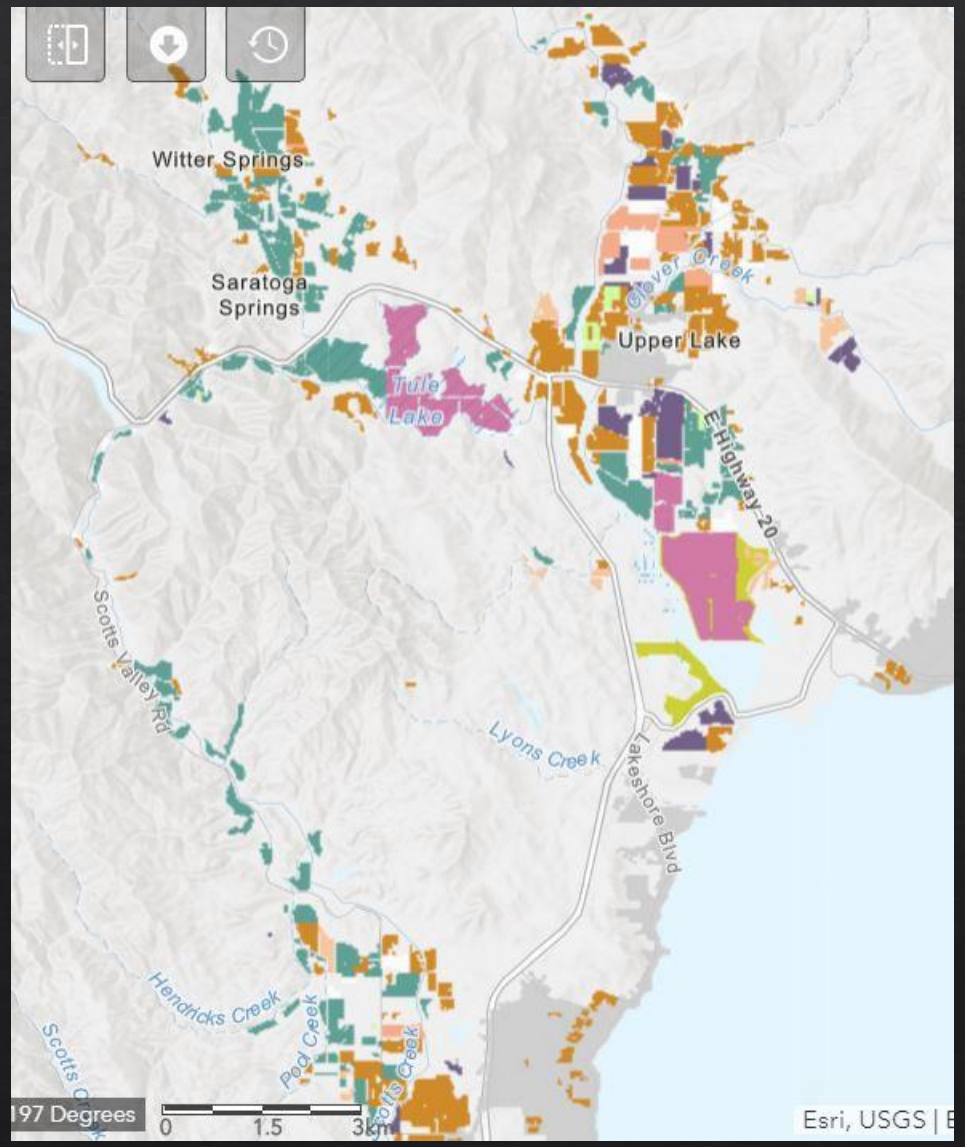
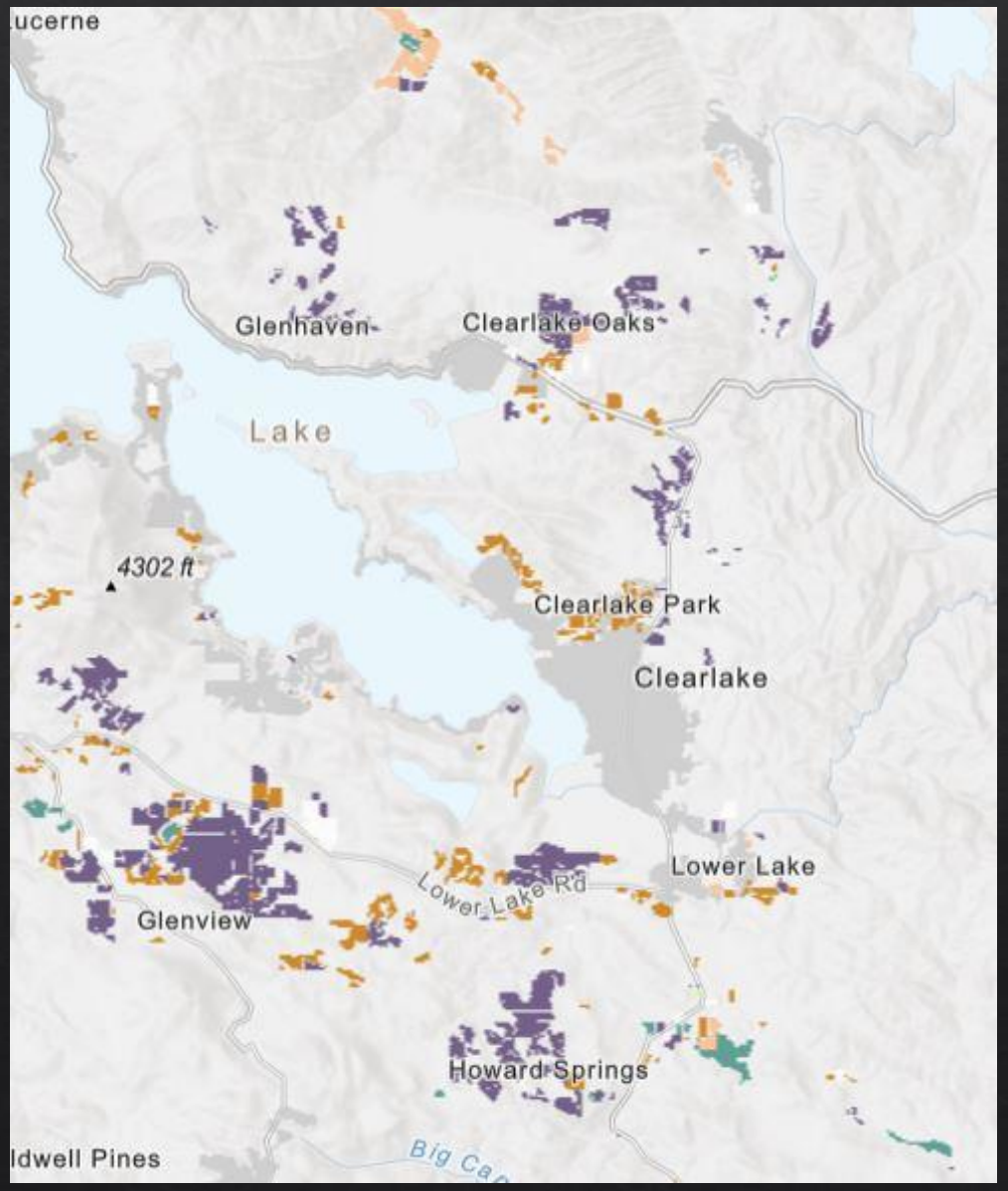
Upper Lake/Middle Creek Watershed



Red Hills, Clearlake and South County

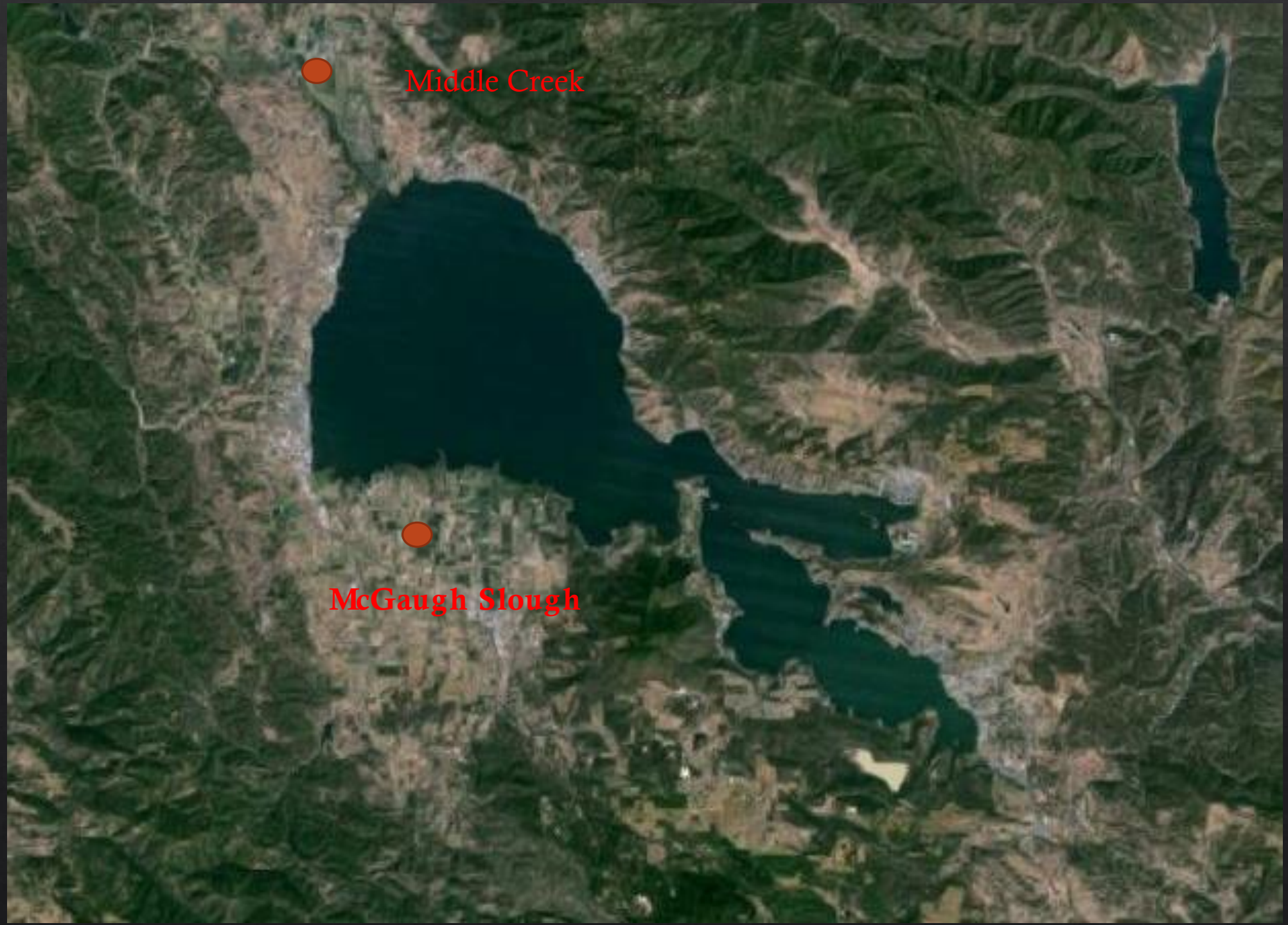


Irrigated Lands Regulatory Program

- The ILRP is responsible for regulating ALL discharges (real or potential) off irrigated agricultural lands.
- Central Valley farmers **pay** for the program through acreage, state and administration fees.
- **These fees pay for the following <u>mandatory</u> regulatory elements that all farmers must comply with:**
  - Grower Farm Evaluations – *identifying practices on farm*
  - Nitrogen Management – *managing groundwater quality*
  - Surface Water Quality Monitoring – *monitoring discharges*
  - Sediment Erosion and Control – *preventing discharges*
  - Groundwater Assessment Reports/CV SALTS/RUSLE Model – *research*
  - Inspections – *confirming program compliance*
  - Clean-up/Abatement Orders – *addressing issues on an individual scale*
  - Water Quality Management Plans – *addressing issues on watershed scale*
  - Outreach Meetings – *Grower Education*

Lake County Water Quality Monitoring

- Surface water quality monitored throughout the year at representative monitoring sites McGaugh Slough and Middle Creek
- Historically wet and dry (stagnant) conditions
- Suite of parameters evaluated
- Second exceedance triggers Management Plan. Extra monitoring, point-source determination, grower outreach in watershed above exceedance point, increased program costs for growers
- Management Plan is deemed complete after two years of zero exceedances otherwise Management Plan continues.
- Lake County Water Quality Monitoring began in 2005.


Middle Creek
McGaugh Slough

General Physical Parameters	**Pathogen Indicators**	**Trace Elements**
Flow	*E. coli* bacteria	Arsenic
pH		Boron
Conductivity	**Nutrients**	Cadmium
Dissolved Oxygen	Total Kjeldahl Nitrogen	Copper
Temperature	Nitrate + Nitrite as N	Lead
Hardness, as CaCO3	Ammonia as N	Molybdenum
Turbidity	Phosphorus, total	Nickel
Total Suspended Solids	Soluble Orthophosphate	Selenium
Total Organic Carbon		Zinc
Registered Pesticides	**Organochlorine pesticides**	**Group-A organochlorine pesticides**
Chlorothalonil (Bravo)	Dicofol	Aldrin
Oxyfluorfen (Goal)	DDD(p,p')	a-, b-, c-, and g-BHC
Chlorpyrifos (Lorsban)	DDE(p,p')	**Chlordane** and g-chlordane
Diazinon	**DDT(p,p')**	Endosulfan I, II and Sulfate
Malathion	Dieldrin	Heptachlor and Heptachlor epoxide
Simazine	Endrin	**Toxaphene**
	Methoxychlor	

Lake County Water Quality Monitoring Data since 2005

- In 12 years of monitoring, Lake County has never had management plan triggered for agricultural-specific parameters.
- Low history of exceedances across watershed
- Parameters from stagnant conditions (DO, conductivity, pH)
- E coli?
- Zero Exceedances in Phosphorus, Nitrate or Nitrite.
- 1 exceedance Nitrate + Nitrite as N. Specific exceedance from a sample taken in stagnant pool in middle of summer

- 2 pesticide Exceedances.

- Malathion in 2012
- DDT in 2010

Per Lake County Pesticide Use Reports:
In 2012, 20 lbs malathion applied on walnuts, 112 lbs structural pest control
No registered uses of DDT. Legacy pesticide; illegal use?

Appendix B: Lake County Surface Water Monitoring Data 2005-2015

PARAMETERS	Unit	Middle Creek U/S Hwy 20		McGaugh Slough Finley Rd		Total # Analyses	Total # Exceedance	Minimum Result	Maximum Result
		Dry	Wet	Dry	Wet				
GENERAL									
Alkalinity	mg/L			2	2	4		36	354
Color	CU	1	2	2	2	7		4	150
Dissolved Oxygen	mg/L	35	26	12	10	83	19	2.32	13.5
Electrical Conductivity	µS/cm	35	26	12	10	83	9	93	1329
Hardness as CaCO3	mg/L	5	3	2	2	12		36	462
pH	-log[H+]	35	26	12	9	82	2	6.12	8.57
Total Dissolved Solids	mg/L	5	6	2	2	15	1	90	630
Dissolved Organic Carbon	mg/L			1	1	2		4.4	13
Total Organic Carbon	mg/L	32	24	2	2	60		0.49	15
Total Suspended Solids	mg/L	32	26	2	2	62		<4.2	260
Turbidity	NTU	32	26	2	2	62		<0.03	110
Ultraviolet Absorption (254nm)	ABS/cm			1	1	2		0.13	0.47
PATHOGENS									
E. coli	MPN/100mL	32	26	2	3	63	9	5.2	2419.6
Fecal Coliforms	MPN/100mL	3	1			4		30	240
WATER COLUMN TOXICITY									
Ceriodaphnia Survival	% of control	6	5	2	2	15	1	6.7	105.6
Pimephales Survival	% of control	5	2	2	2	11		94.7	102.6
Selenastrum Growth	% of control	11	8	2	1	22		131.6	436.3
PESTICIDES									
Aldicarb	µg/L	1	2	1		4		<0.2	<0.2
Aldrin	µg/L	6	5	1	1	13		<0.001	<0.009
Allethrin	µg/L			2	1	3		<0.005	<0.005
Ametryn	µg/L	2	3	1	1	7		<0.005	<0.005
Aminocarb	µg/L	1	2	1		4		<0.2	<0.2
Atraton	µg/L	2	3	1	1	7		<0.005	<0.005
Atrazine	µg/L	2	3	1	1	7		<0.005	<0.005
Azinphos methyl	µg/L	4	3	2	2	11		<0.01	<0.05
Barban	µg/L	1	2	1		4		<1.75	<1.75
Benomyl/Carbendazim	µg/L	1	2	1		4		<0.2	<0.2
Bifenthrin	µg/L			2	1	3		<0.005	<0.005
Bromacil	µg/L	1	2	1		4		<0.2	<0.2
Carbaryl	µg/L	1	2	1		4		<0.05	<0.05
Carbofuran	µg/L	1	2	1		4		<0.05	<0.05
Chlordane, cis	µg/L	6	5	1	1	13		<0.001	<0.007
Chlordane, trans	µg/L	6	5	1	1	13		<0.001	<0.006
Chlorothalonil	µg/L	2	1			3		<0.1	<0.1
Chloroxuron	µg/L	1	2	1		4		<0.2	<0.2
Chlorpropham	µg/L	1	2	1		4		<0.4	<1.75
Chlorpyrifos	µg/L	8	5	2	2	17		<0.005	0.0016

Cyanazine	µg/L	2	3	1		6		<0.005	<0.005
Cyfluthrin	µg/L			2	1	3		<0.005	<0.005
Cypermethrin	µg/L			2	1	3		<0.005	<0.005
Dacthal	µg/L	5	4	1		10		<0.005	<0.008
DDD(o,p)	µg/L	6	5	1	1	13		<0.001	<0.005
DDD(p,p)	µg/L	6	5	1	1	13		<0.001	<0.003
DDE(o,p)	µg/L	6	5	1	1	13		<0.001	<0.005
DDE(p,p)	µg/L	6	5	1	1	13		<0.001	<0.004
DDT(o,p)	µg/L	6	5	1	1	13		<0.001	<0.003
DDT(p,p)	µg/L	6	5	1	1	13	1	<0.007	0.0095
Deltamethrin	µg/L			2	1	3		<0.005	<0.005
Demeton	µg/L	6	4	2	2	14		<0.001	<0.01
Diazinon	µg/L	8	5	2	2	17		<0.005	<0.005
Dichlorvos	µg/L	8	5	2	2	17		<0.003	<0.02
Dicofol	µg/L	5	4	1		10		<0.01	<0.05
Dieldrin	µg/L	6	5	1	1	13		<0.001	<0.005
Dimethoate	µg/L	6	3	2	2	13		<0.003	<0.005
Disulfoton	µg/L	6	4	2	2	14		<0.001	<0.01
Diuron	µg/L	1	2	1		4		<0.2	<0.2
Endosulfan I	µg/L	6	5	1	1	13		<0.001	<0.005
Endosulfan II	µg/L	6	5	1	1	13		<0.001	<0.004
Endosulfan sulfate	µg/L	6	5	1	1	13		<0.001	<0.005
Endrin	µg/L	6	5	1	1	13		<0.001	<0.007
Endrin Aldehyde	µg/L	6	5			11		<0.001	<0.009
Endrin Ketone	µg/L	6	5	1	1	13		<0.001	<0.006
Esfenvalerate/Fenvalerate	µg/L			1		1		<0.005	<0.005
Ethoprop	µg/L	6	4	2	2	14		<0.001	<0.01
Fenchlorphos	µg/L	6	4	2	2	14		<0.002	<0.01
Fenitrothion	µg/L	1	1			2		<0.01	<0.01
Fenpropathrin	µg/L			2	1	3		<0.005	<0.005
Fensulfothion	µg/L	6	4	2	2	14		<0.001	<0.01
Fenthion	µg/L	6	4	2	2	14		<0.002	<0.01
Fenuron	µg/L	1	2	1		4		<0.2	<0.2
Fluometuron	µg/L	1	2	1		4		<0.2	<0.2
Glyphosate	µg/L	1	3			4		<4.0	<4.0
HCH, alpha	µg/L	6	5	1	1	13		<0.001	<0.005
HCH, beta	µg/L	6	5	1	1	13		<0.001	<0.008
HCH, delta	µg/L	6	5	1	1	13		<0.001	<0.005
HCH, gamma	µg/L	6	5	1	1	13		<0.001	<0.005
Heptachlor	µg/L	6	5	1	1	13		<0.001	<0.008
Heptachlor epoxide	µg/L	6	5	1	1	13		<0.001	<0.007
Hexachlorobenzene	µg/L	1	1			2		<0.001	<0.001
Hexazinone	µg/L	2	1			3		<0.1	<0.1
L-Cyhalothrin	µg/L			1	1	2		<0.005	<0.005
Linuron	µg/L	1	2	1		4		<0.2	<0.2
Malathion	µg/L	8	5	2	2	17	1	<0.03	0.0115
Merphos	µg/L	2	3	2	2	9		<0.001	<0.01

Methamidophos	µg/L	2	2	2	1	7		<0.05	<0.05
Methidathion	µg/L	6	2	2	2	12		<0.005	<0.01
Methiocarb	µg/L	1	2	1		4		<0.2	<0.2
Methomyl	µg/L	1	2	1		4		<0.05	<0.05
Methoxychlor	µg/L	6	5	1	1	13		<0.001	<0.008
Metolachlor	µg/L	2	2			4		<0.005	<0.26
Mevinphos	µg/L	6	4	2	2	14		<0.005	<0.01
Mexacarbate	µg/L	1	2	1		4		<0.4	<0.4
Mirex	µg/L	3	4	1	1	9		<0.001	<0.001
Molinate	µg/L		1			1		<0.05	<0.05
Monuron	µg/L	1	2	1		4		<0.2	<0.2
Naled	µg/L	2	1			3		<0.2	<0.2
Neburon	µg/L	1	2	1		4		<0.2	<0.2
Nonachlor, cis-	µg/L	3	4	1	1	9		<0.001	<0.001
Nonachlor, trans-	µg/L	3	4	1	1	9		<0.001	<0.001
Oryzalin	µg/L	1	2	1		4		<0.2	<0.2
Oxamyl	µg/L	1	2	1		4		<0.2	<0.2
Oxychlordane	µg/L	3	4	1	1	9		<0.001	<0.001
Oxyfluorfen	µg/L	12	8			20		<0.05	0.0086
Paraquat	µg/L	1	3			4		<0.2	<0.25
Parathion, Ethyl	µg/L	2	2	2	2	8		<0.01	<0.01
Parathion, Methyl	µg/L	6	4	2	2	14		<0.001	<0.01
Pendimethalin	µg/L		1			1		<0.05	<0.05
Permethrin	µg/L			2	1	3		<0.005	<0.005
Perthane	µg/L	3	4			7		<0.005	<0.005
Phorate	µg/L	6	4	2	2	14		<0.005	<0.01
Phosmet	µg/L	6	2	2	2	12		<0.005	<0.05
Prallethrin	µg/L			2	1	3		<0.005	<0.005
Prometon	µg/L	2	3	1	1	7		<0.005	<0.005
Prometryn	µg/L	2	3	1	1	7		<0.005	<0.005
Propachlor	µg/L	1	2	1		4		<0.2	<1.75
Propargite	µg/L		1			1		<0.05	<0.05
Propazine	µg/L	2	3	1	1	7		<0.005	<0.005
Propham	µg/L	1	2	1		4		<0.4	<1.75
Propoxur	µg/L	1	2	1		4		<0.2	<0.2
Secbumeton	µg/L	2	3	1	1	7		<0.005	<0.005
Siduron	µg/L	1	2	1		4		<0.2	<0.2
Simazine	µg/L	4	4	1	1	10		<0.12	0.224
Simetryn	µg/L	2	3	1	1	7		<0.005	<0.005
Sulprofos	µg/L	6	4	2	2	14		<0.002	<0.01
Tebuthiuron	µg/L	1	2	1		4		<0.2	<0.2
Terbuthylazine	µg/L	2	3	1	1	7		<0.005	<0.005
Terbutryn	µg/L	2	3	1	1	7		<0.005	<0.005
Tetrachlorvinphos	µg/L	6	4	2	2	14		<0.002	<0.01
Thiobencarb	µg/L		4			4		<0.05	<0.05
Tokuthion	µg/L	6	4	2	2	14		<0.003	<0.01
Toxaphene	µg/L	2	4	1	1	8		<0.01	<0.01

Lake County Reduced Monitoring Management Practices Alternative

Trichloronate	µg/L	6	4	2	2	14		<0.001	<0.01
Trifluralin	µg/L		1			1		<0.001	<0.001
METALS									
Antimony - Dissolved	µg/L	1			1	2		<0.3	0.1
Antimony - Total	µg/L	1			1	2		<0.1	<0.3
Arsenic - Dissolved	µg/L	2	3	2	1	8		0.2	1.3
Arsenic - Total	µg/L	2	3	2	1	8		0.2	2
Beryllium - Dissolved	µg/L	1			1	2		<0.7	<0.12
Beryllium - Total	µg/L	1			1	2		<0.7	<0.12
Boron - Dissolved	µg/L	1	2	1	1	5		24	170
Boron - Total	µg/L	1	3	1	1	6		26	180
Cadmium - Dissolved	µg/L	2	3	2	1	8		<0.04	0.04
Cadmium - Total	µg/L	2	3	2	1	8		<0.04	0.04
Chromium - Dissolved	µg/L	1			1	2		1.7	3.6
Chromium - Total	µg/L	1			1	2		1	5.9
Copper - Dissolved	µg/L	5	3	2	1	11		0.12	2
Copper - Total	µg/L	5	3	2	1	11		0.21	13
Lead - Dissolved	µg/L	2	3	2	1	8		<0.1	0.16
Lead - Total	µg/L	2	3	2	1	8		<0.1	3
Molybdenum - Total	µg/L	3	3			6		0.17	0.31
Nickel - Dissolved	µg/L	2	3	2	1	8		0.8	15
Nickel - Total	µg/L	2	3	2	1	8		1.3	47
Selenium - Dissolved	µg/L	2		2	1	5		<0.98	2
Selenium - Total	µg/L	2		2	1	5		<0.90	0.42
Silver - Dissolved	µg/L	1			1	2		<0.02	<0.02
Silver - Total	µg/L	1			1	2		<0.02	<0.02
Thalium - Dissolved	µg/L	1			1	2		<0.006	<0.01
Thalium - Total	µg/L	1			1	2		<0.01	0.01
Zinc - Dissolved	µg/L	2	3	2	1	8		1	3
Zinc - Total	µg/L	2	3	2	1	8		2	28
NUTRIENTS									
Ammonia, Total as N	mg/L	18	16	3	3	40		<1.0	0.24
Nitrate as N	mg/L	2	4			6		<0.01	0.52
Nitrate+Nitrite, as N	mg/L	30	22	9	7	68	1	<0.02	11
Nitrite as N	mg/L	2	4			6		<0.004	0.012
Orthophosphate, as P - Dissolved	mg/L	18	16	1	1	36		<0.01	0.34
Phosphorus as P, Total	mg/L	32	24	10	7	73		<0.007	1.9
Total Kjeldahl Nitrogen	mg/L	9	9	2	1	21		<0.08	1.1

Farm Evaluations 2015

- Grower Assessments collected Spring 2015
- Update required by ILRP in 2020.
- 94% of irrigated acreage represented in FE data (9,375 acres of 10,073 irrigated acres enrolled in 2015)
- Focus on Sediment and Erosion Control Management Practices:
    - 7270 acres use cover crop (77% of acreage)
    - 7052 acres (75%) incorporate minimum tillage
    - 6376 acres (68%) use drip or micro-irrigation to eliminate drainage
    - The following erosion control practices incorporated in at least 2200 acres: Vegetated buffer strips, vegetated ditches, stabilized banks and sub-surface pipelines.
    - The following erosion control practices incorporated in at least 1500 acres: Sediment catchment ponds, berms to catch sediment at the low end of the field.
    - 90% of vineyard acreage maintaining an annual or winter cover crop.

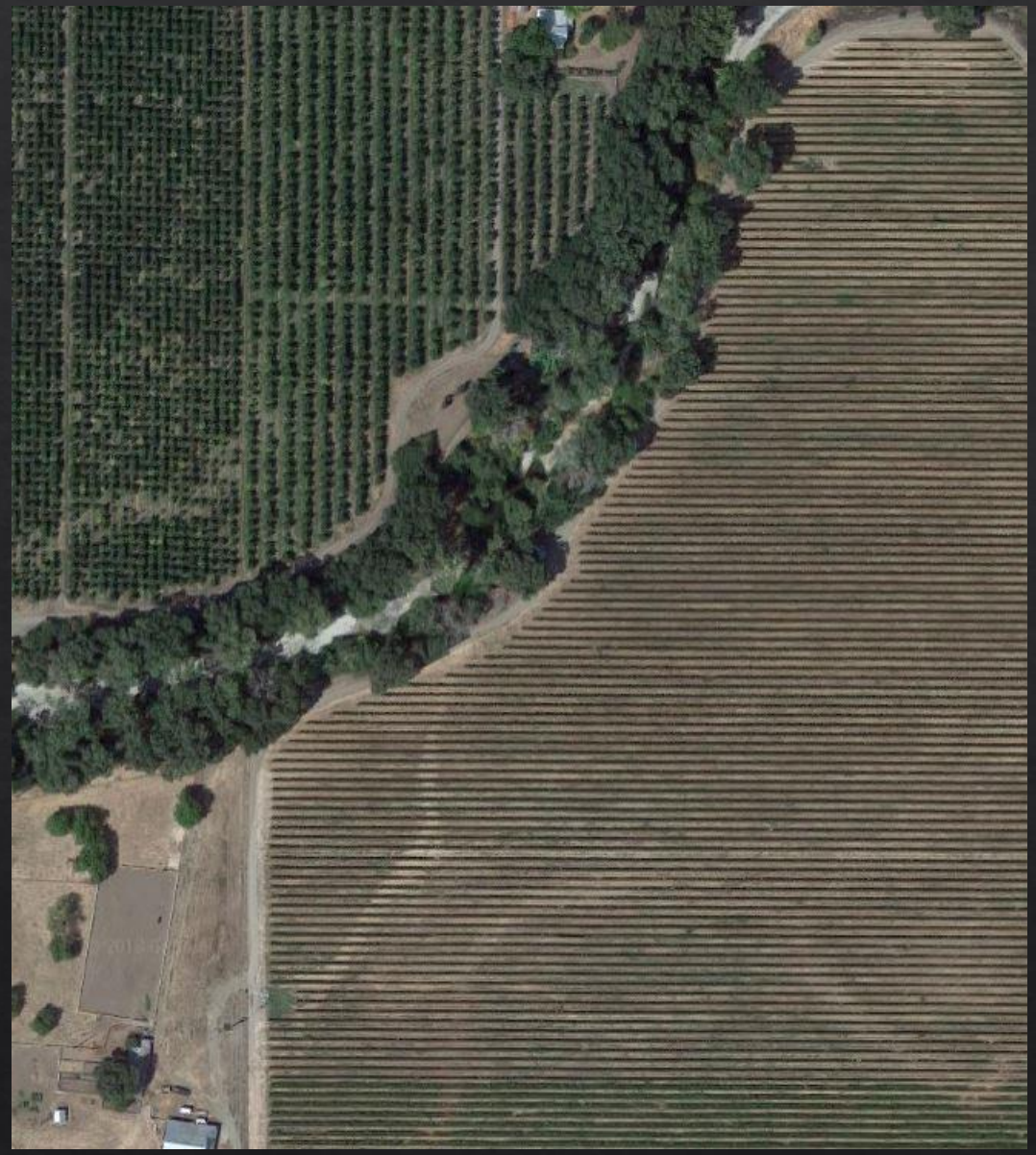


Figure 18: Orchard grass used as a cover crop in Big Valley.

Figure 19: Straw is laid down in a new vineyard development in the Red Hills.

Figure 20: Wattles are used on slopes and in the avenues as standard practice.

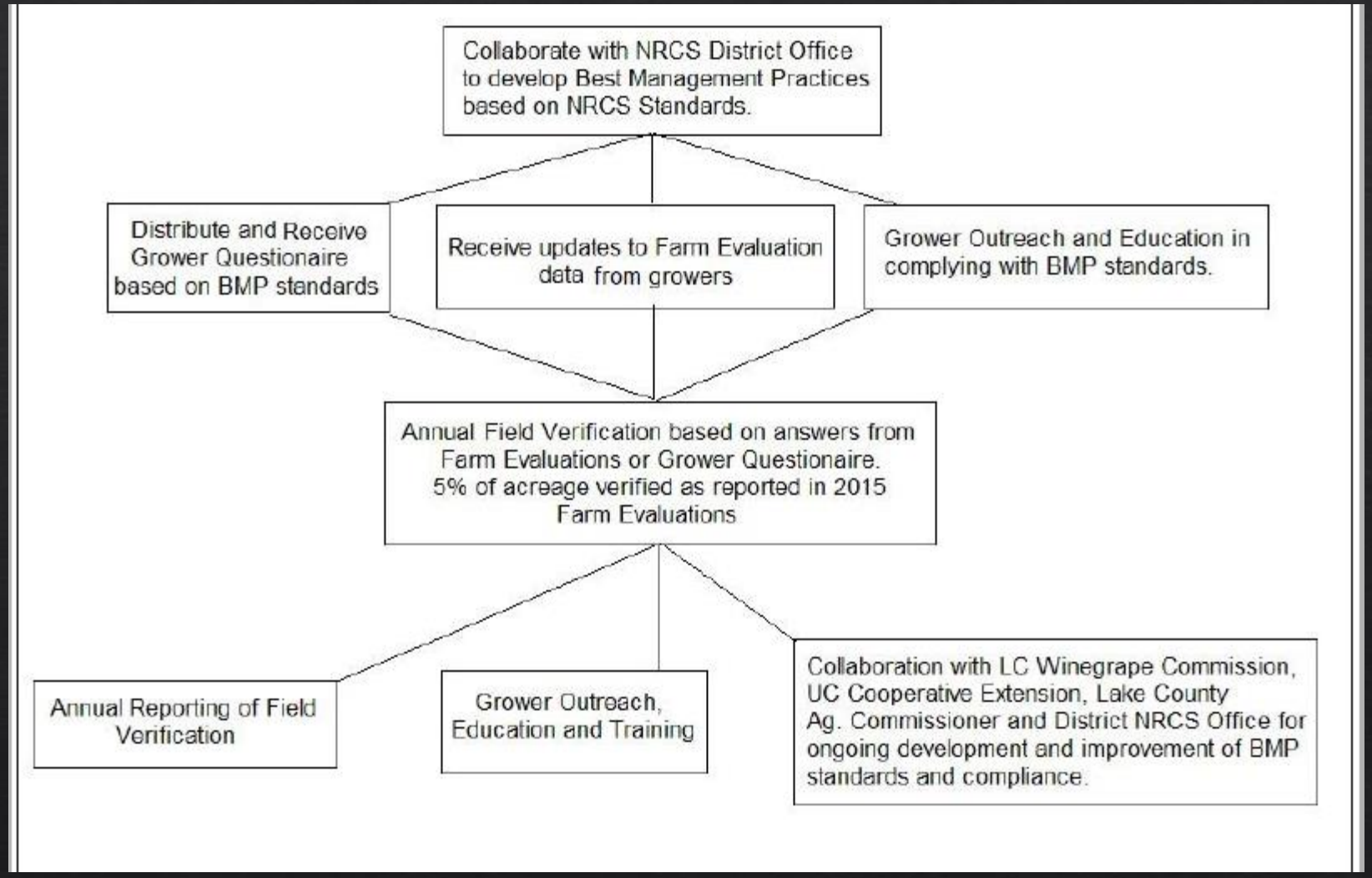
Management Practice Verification

At last public TMDL meeting, comments centered on verifying that BMPs are being followed

Lake County is in its third year of Management Practice Verification

Staff must verify that 5% of acreage annually employing management practices claimed in Farm Evaluation

Flow Chart for Lake County Management Practice Verification Developed in 2016



Lake County Farm Bureau Education Corporation

Management Practice Field Verification

2016 Growing year

Member ID: _____ Verified Acreage: _____

- ☐ FE Completed
- ☐ NMP Completed
- ☐ Sediment Erosion and Control Plan self-certification signed

FE/NMP Consultation Date _____

Date of Field Visit: _____

Field Visit Verification:

Management Practice	Identified on FE	Verified in Field	Notes
Pesticide Application Practices			
County Permit Followed			
Follow label instructions			
Sensitive Areas Mapped			
Attend Trainings			
End of Row Shutoff when spraying			
Avoid Surface Water when spraying			
Reapply Rinsate to treated field			
Target Sensing Sprayer Used			
Use Drift Control Agents			
Monitor Wind Conditions			
Use Appropriate Buffer Zones			
Use Vegetated Drain Ditches			
Monitor Rain Forecasts			
Use PCA Recommendations			
Chemigation			
No Pesticides Applied			
Who develops Nutrient Plan?			
Does Farm have potential to discharge sediment:			

Irrigation Practices (Primary and Secondary)			
Drip			
Micro-sprinkler			
Furrow			
Sprinkler			
Border Strip			
Flood			
Irrigation Efficiency Practices			
Laser levelling			
Use of Et in scheduling irrigation			
Water application scheduled to need			
Use of Moisture probe			
Soil Moisture Neutron Probe			
Pressure Bomb			
Other			
Nitrogen Management Practices			
Cover Crops			
Split Fertilizer Applications			
Soil Testing			
Tissue/Petiole Testing			
Variable Rate Applications using GPS			
Foliar N Application			
Irrigation Water N Testing			
Fertigation			
No not apply N			
Irrigation Well Practices			
Cement Pad			
Ground Sloped Away from Wellhead			
No Standing Water around Wellhead			
No Debris or Refuse around Wellhead			
Air Gap			
Backflow Valve			
Abandoned Well Practices			
Wellhead capped or destroyed?			
Sediment Erosion and Control Practices			
In-furrow dams			
Time between pesticide application/irrigation			
Short irrigation runs			
PAM used in furrow			
Drip or micro-irrigation			
Flow dissipaters			
Tailwater Return System			
Catchment Basin			

No Irrigation Drainage due to field conditions			
Field borders			
Vegetated Ditches			
Hedgerows or Trees			
Soil Penetration methods used			
Crop rows graded and banked			
Creek banks stabilized			
Subsurface pipelines used			
Berms constructed at low points			
Minimum tillage			
Field is lower than surrounding terrain			
No storm drainage due to field conditions			
Roads and Site			
Pesticides stored in contained, covered location			
No discharge at Mixing/Loading sites			
Service Roads are armored			
Service Roads are strawed in winter			
Service Roads are closed in winter			

Additional management practices/paperwork verified:

_____

_____

_____

_____

_____

Notes:

_____

_____

_____

_____

_____

_____

Verifier Signature:

_____, _____. _____

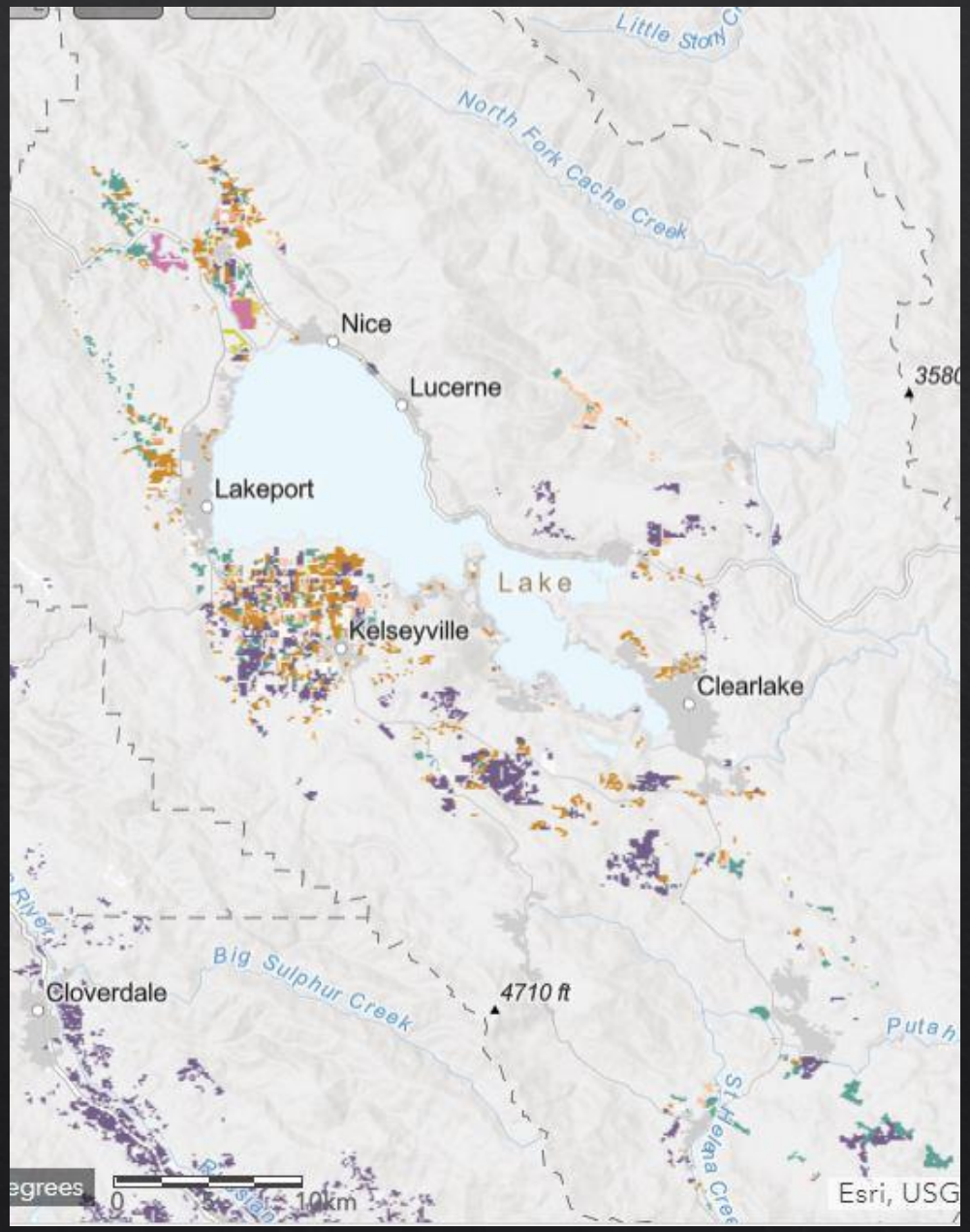
Name Title Date

Management Practice Verification cont'd

Regional Board staff has inspected growers the past 2 winters in Lake County.

Mostly focused on vineyards on steep slopes during and after heavy rain events

And pear and vineyard acreage in valley topography in the winter.


Little Stony C
North Fork Cache Creek
Nice
Lucerne
3580
Lakeport
Lake
Kelseyville
Clearlake
Big Sulphur Creek
Cloverdale
4710 ft
Putah
St Helena Cree
egrees
0
10km
Esri, USG

Lake County Grading Ordinance, adopted July 2007

- Implementation of BMP's is required for new agricultural development (native vegetation to agriculture) and conversions of deep rooted crops (orchard to vineyard) on soils with a moderate to severe hazard rating or slope.

- Restrictions to grading on certain soil types, proximities to waterways or riparian habitats and required mitigation practices for revegetation and dust control.

- Ordinance exemption only for for crop conversions not expanding current footprint; not within thirty feet of the top of bank of a water body; do not remove stable woody root systems extending at least twelve inches below the soil surface; do not occur on soils with a moderate or severe erosion hazard rating; do not occur during winter period and do not cut or fill slope with a 2:1 or greater ratio.

- Outlines restrictions and mitigations on roadways and infrastructure to reduce erosion hazard on access roads.

Additional Sustainability Programs

- Sustainability Programs in California vineyards quickly becoming industry standard. Wineries demanding grapes grown under sustainability program.
- First implemented in 2005 under guidance of Lake County Winegrape Commission
- **5100 acres (63% of LC vineyard acreage)** enrolled in either California Sustainable Winegrowing Alliance (CSWA), Fish Friendly Farming, Lodi Rules or Sustainable in Practice (SIP). More acreage expected following July 2018 audits.
- Independent third-party auditor reviews work, conducts onsite visits, evaluates and validates practices and helps draft a continuous improvement plan for the coming year.
- Sustainability programs differ slightly but requirements are similar.

Additional Sustainability Programs: CSWA

- 58 prerequisite vineyard practices for certification in Year 1. Requirements range from erosion control/soil management to IPM practices, water use, materials used and ecosystems management.
- Must demonstrate continuous improvement for Year 2 certification.
- Soil Management Requirement examples *(Source: CSWA SWP Workbook)*
    - Temporary drainage structures such as hay bales or shoveled diversion ditches utilized during the winter.
    - Action(s) taken to eliminate obvious sources of erosion (e.g., out-sloped or vegetated roads, vegetated or hardened ditches, incorporated riprap into culvert outflows)
    - Irrigation practices and/or property location or design causes no rills or gullies to form due to concentrated flows from rainfall or applied water
    - Preventive techniques (e.g., cover crops, vegetated, rocked, or solid surfaced ditches) in place to reduce rainfall runoff, minimizing off-site movement of silt, pesticides, and/or fertilizers
    - If applicable, engineered drainage systems (culverts, drop inlets, diversions) in place for hillside or terraced sites to minimize off-site movement of silt, pesticides, and/or fertilizers.
- There are 140 Management Practices for winegrape growing in the SWP Workbook

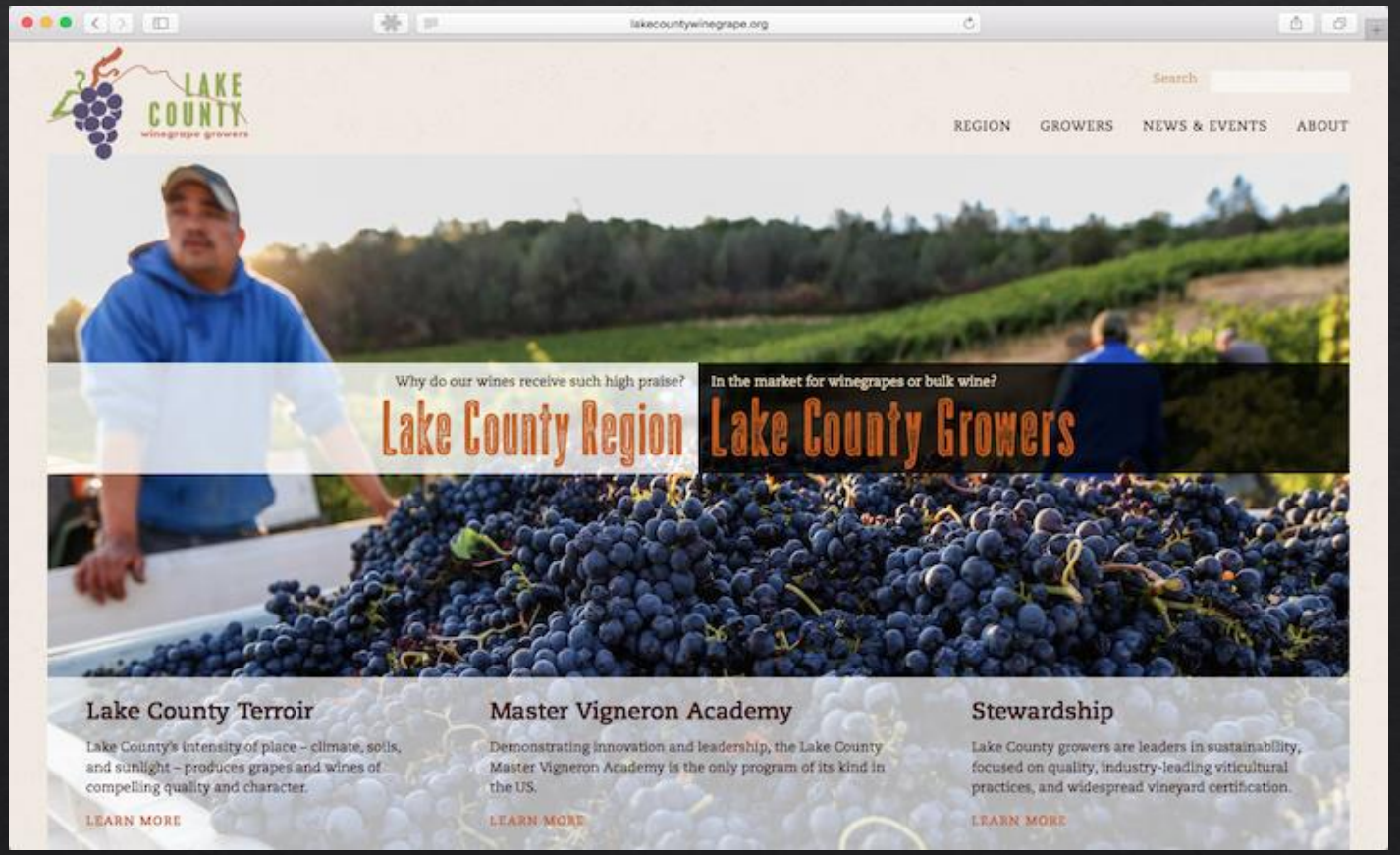
Lake County Winegrape Commission

- Promotion of Sustainable Winegrowing Program:
- LCWC employs a Vineyard Certification Coach to assist growers with the certification process.
- LCWC works closely with the local CSWA auditor to facilitate third-party certification.
- LCWC shares the cost of certification – i.e., 50/50 of auditor & application fees. Pilot Program through CSWA to help small vineyards with the cost of certification.
- LCWC works with a range of vineyard sizes and growers.

- LCWC reports that over 70% of Lake County winegrape growers have completed the Code of Sustainable Winegrape Practices Self-Assessment Workbook.
- Next step: 3rd party certification.

Lake County Winegrape Commission Website

https://www.lakecountywinegrape.org/



Calculating Phosphorus Load Reductions in Ag since 2001

- **Assumption 1**: Most phosphorus load from agriculture comes from sediment erosion.
    - Lake County soil is high in naturally-occurring phosphorus.
    - Phosphorus as fertilizer just not applied widely in Lake County agriculture. Rarely in Big Valley, minimal in hill topography vineyards. *(Source: Local Certified Crop Advisors).*

- **Assumption 2:** Acres developed under Grading Ordinance, Irrigated Lands Program and maintained under Sustainability Programs will reduce more sediment loading through implementation of BMPs.

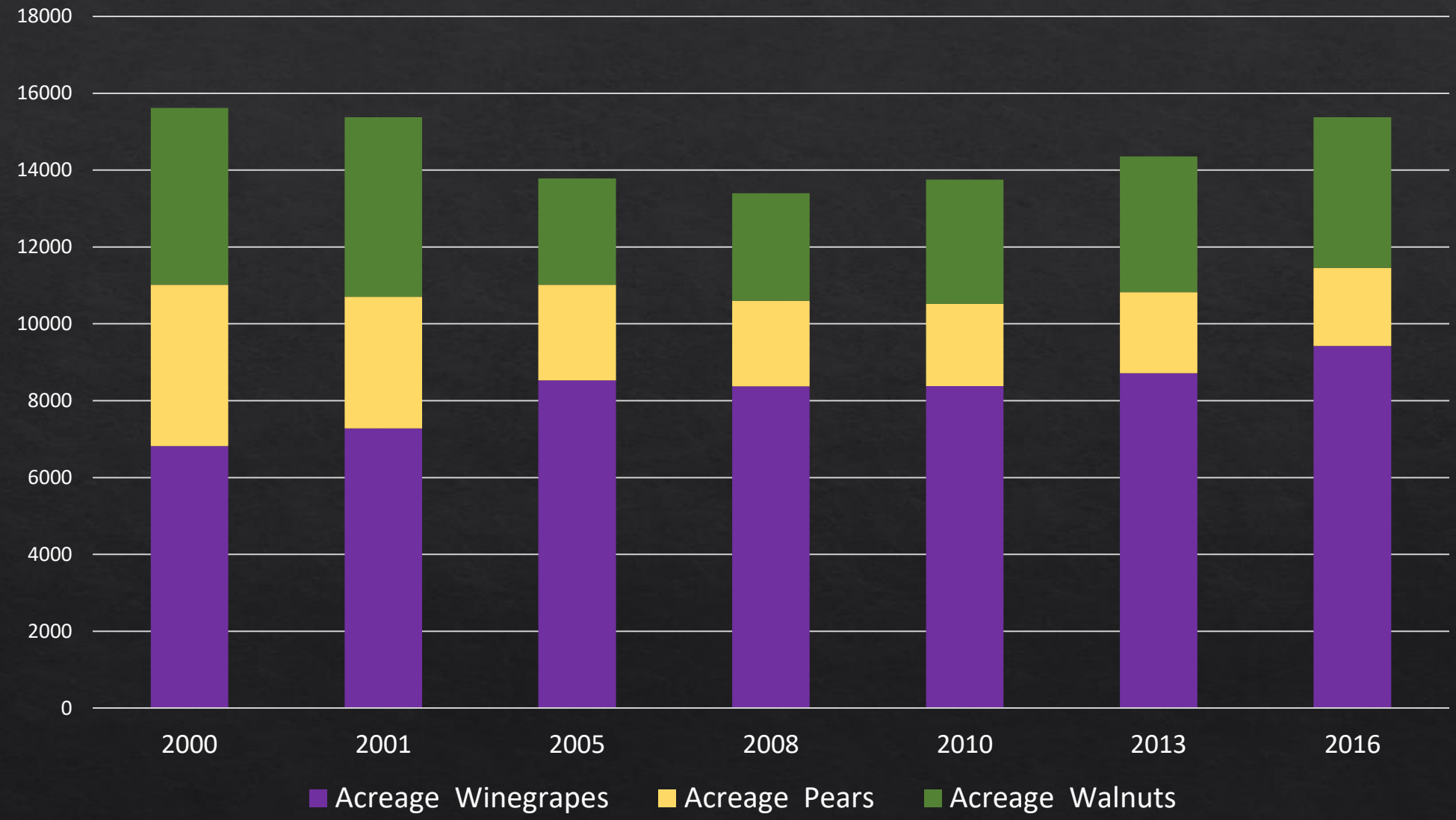
- **Assumption 3:** NRCS Soil Loss Calculations and RUSLE 2 model is best available science at this point.

- **Assumption 4:** Exact acreage conversions are unknown. Reasonable estimate

Ag Acreage input considerations

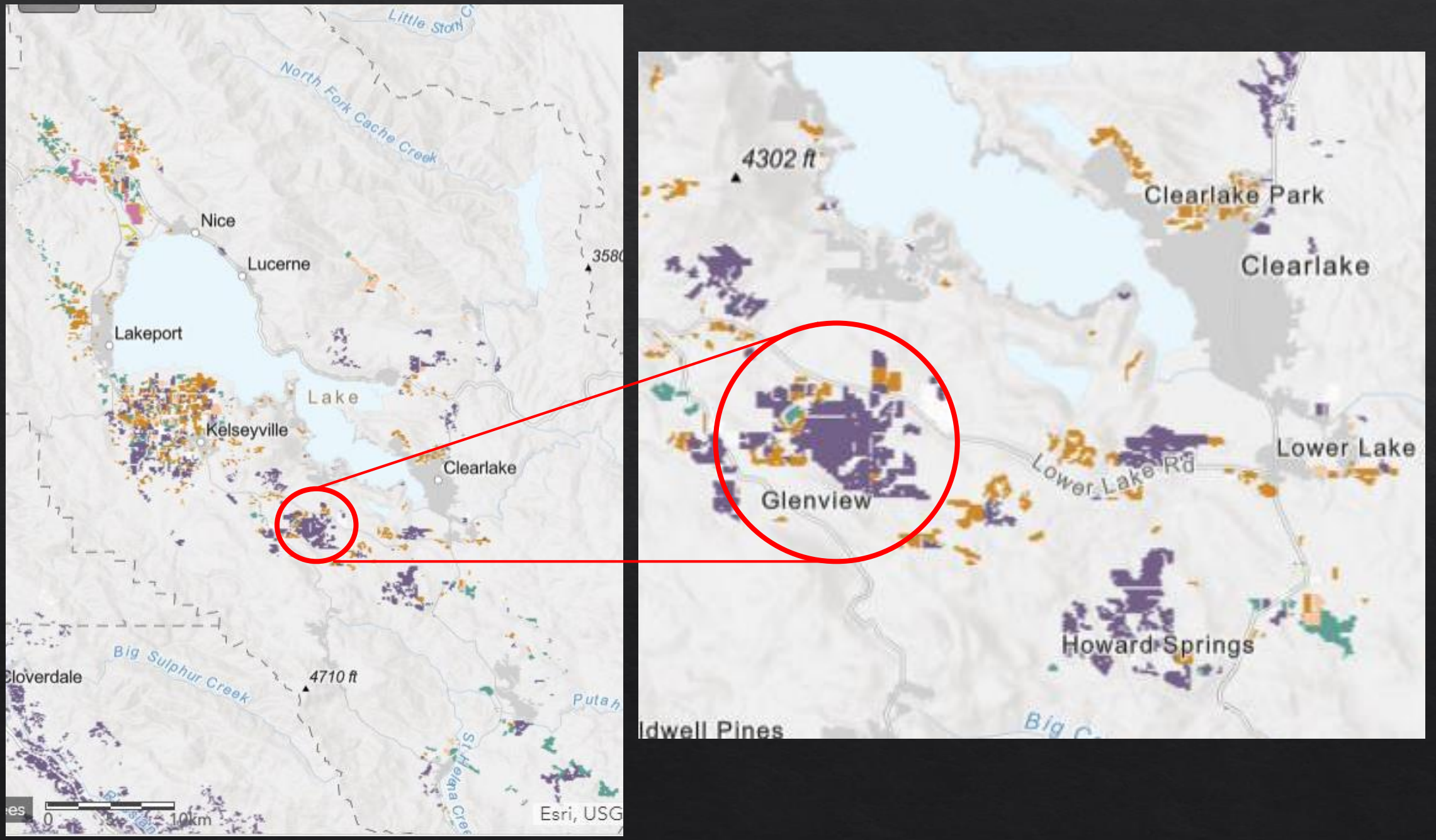
- Irrigated Lands Program implemented in 2005.
- Management Practices established in Farm Evaluations in 2015.
- 5100 Acres enrolled in Sustainability Programs starting in 2005 with big push in 2010. Continuing enrollment.
- 1842 acres developed under Lake County Grading Ordinance, developed 2007
- How many acres have implemented management practices through NRCS EQIP program and assistance
- 400-600 Acres developed in Red Hills from till-style walnuts to vineyard with cover crops in 2001.

Lake County Crop Acreage 2000-2016



Small-Scale Example: “Amber Knolls”

- Prior to 2000, “Amber Knolls’ area of Red Hills was a dry-farmed Walnut Orchard.
    - Orchards dated back to 1930s and 1940s
    - Standard practice: till once or twice a year
    - Tilling and grading orchard before harvest for ease of hand-picking.
    - At first rain, tilled soil easily transported off hillside
- Crop conversion from orchard to vineyard from 2000-2001, vineyard established 2001.
- Vineyard BMPs:
    - No till practices
    - Seeded cover crops
    - Low-impact irrigation methods (drip)
    - Sediment catchment pond for farm roads ‘avenues’
    - Improved avenue surfaces
- Using NRCS Universal Soil Loss Equation (RUSLE II model): some percentage of erosion minimized in that area. Timeline?


Little Stony C
North Fork Cache Creek
Nice
Lucerne
3580
Lakeport
Lake
Kelseyville
Clearlake
Big Sulphur Creek
Cloverdale
4710 ft
Putah
St Helena Cre
0
10km
Esri, USG
4302 ft
Clearlake Park
Clearlake
Lower Lake
Lower Lake Rd
Glenview
Howard Springs
ldwell Pines
Big C

Of note about Walnuts:

- Most of the ‘steep slope’ walnut orchards on erosive soil were converted to vineyard in the early 2000s.
- Majority of productive walnut orchards now can be found in the valleys.
- Many irrigated orchards now employing cover crops and mowing for harvest instead of tilling.
- Example: irrigated walnut orchard on Thomas Drive, Big Valley. Lake spring and post-harvest

Calculation cont'd

- To get county-wide load reductions, similar Universal Soil Loss calculations based on crop conversions must be made on different slopes and soil types then extrapolated using relative crop acreage data, and management practice implementation in Farm Evaluation and Sustainability Program data.

- How to incorporate acres developed under Grading Ordinance?

Conclusions

- Crop type changes and management practice development have likely reduced sediment load to Clear Lake since 2001.
- Need for quantitative data to back up this assertion.
- Difficulty of capturing definitive numbers in non-point source. (Inspection example).
- Moving forward: Arrive at reasonable calculation.
- Possibility to refine NRCS calculations and track management practice improvements in future for more refined data?
- Also possible to update NRCS RSULE 2 calculations with management practice improvements & track changes. 2015 FE data vs. 2020 FE data?

Questions?