1.D.2.1 Attachments to Comments of AquAlliance

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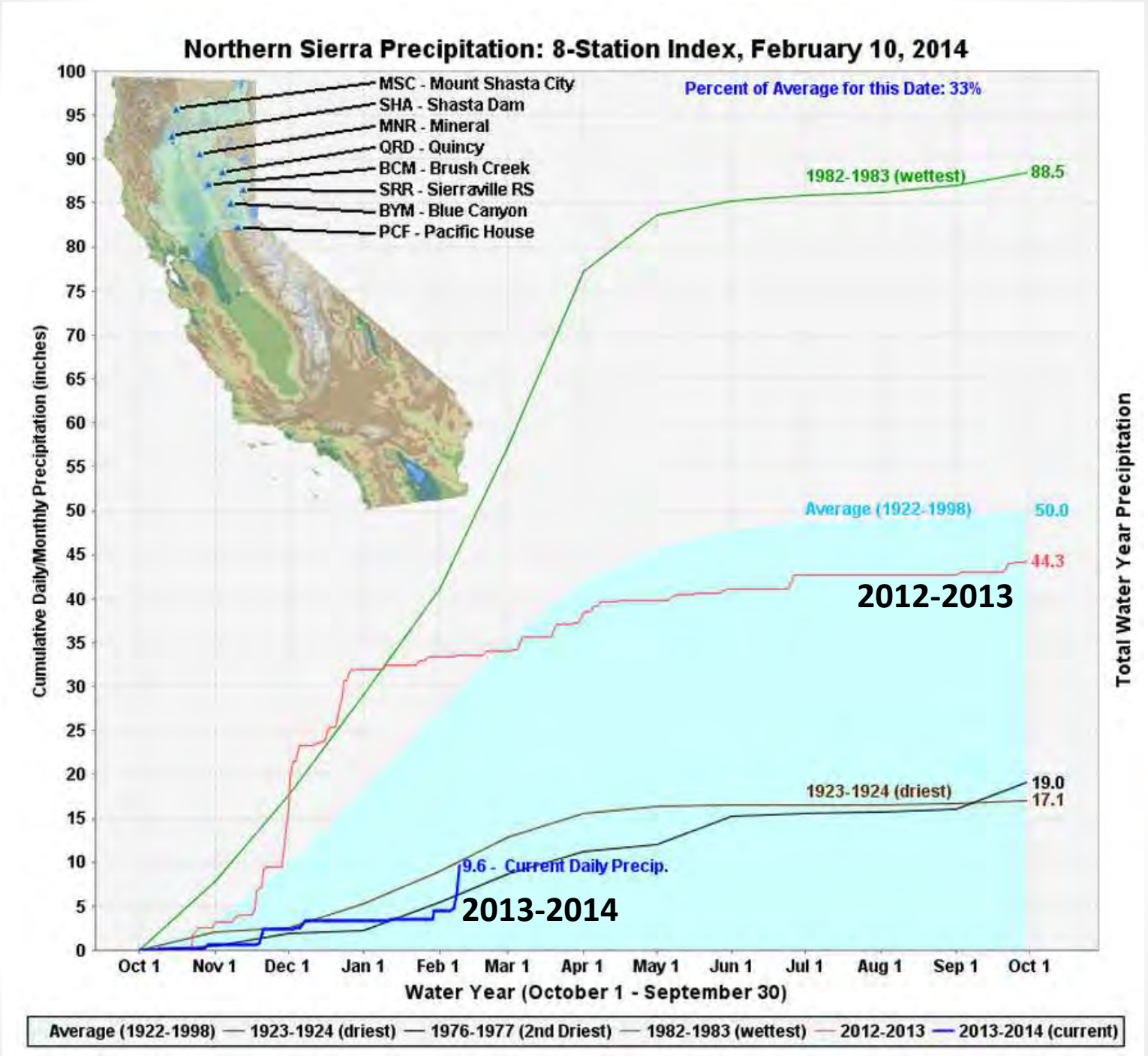
Groundwater Conditions in Butte County

Christina Buck, PhD
Water Resources Scientist
Dept. of Water & Resource Conservation

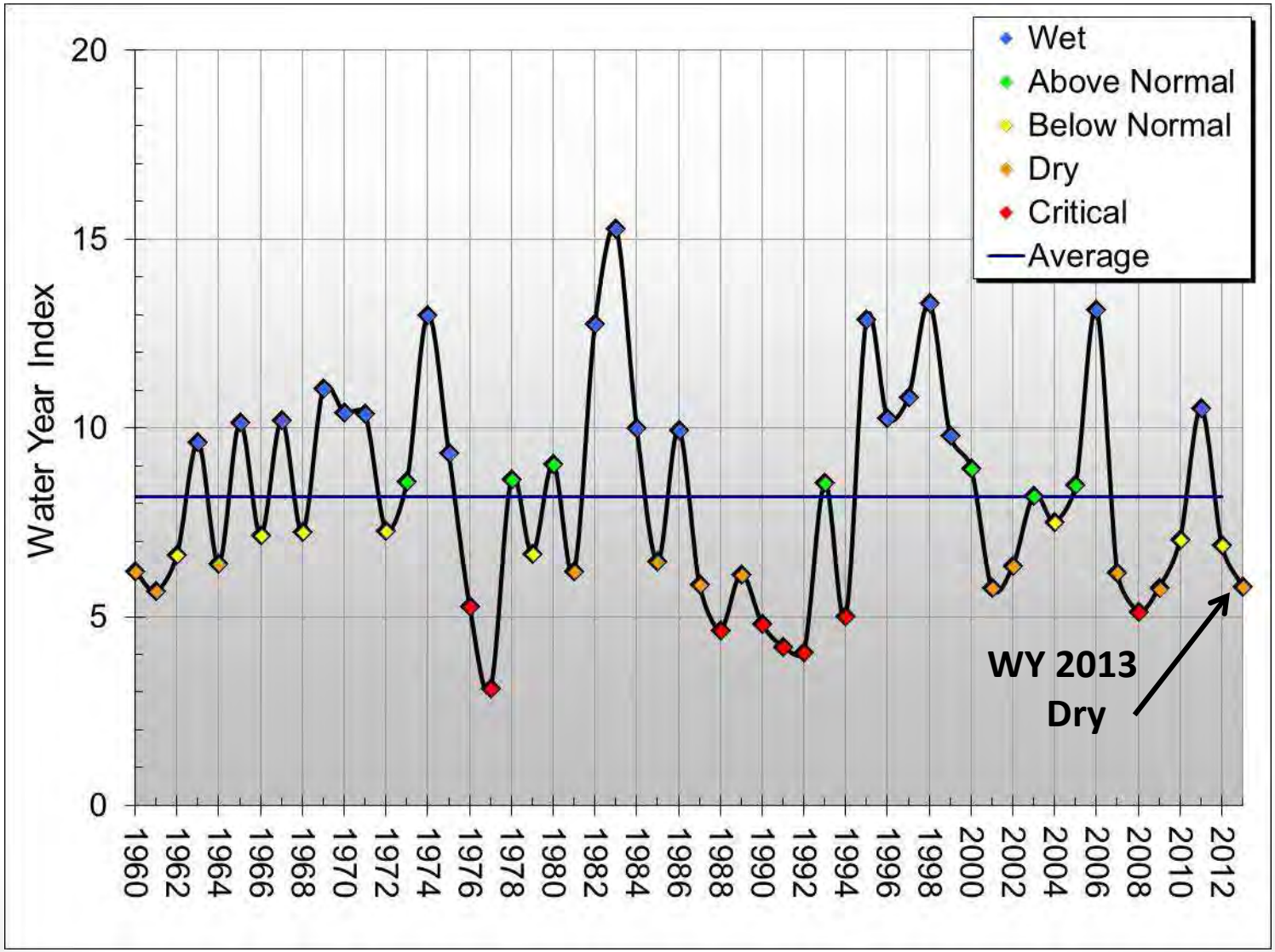
Durham Groundwater Meeting
February 10, 2014

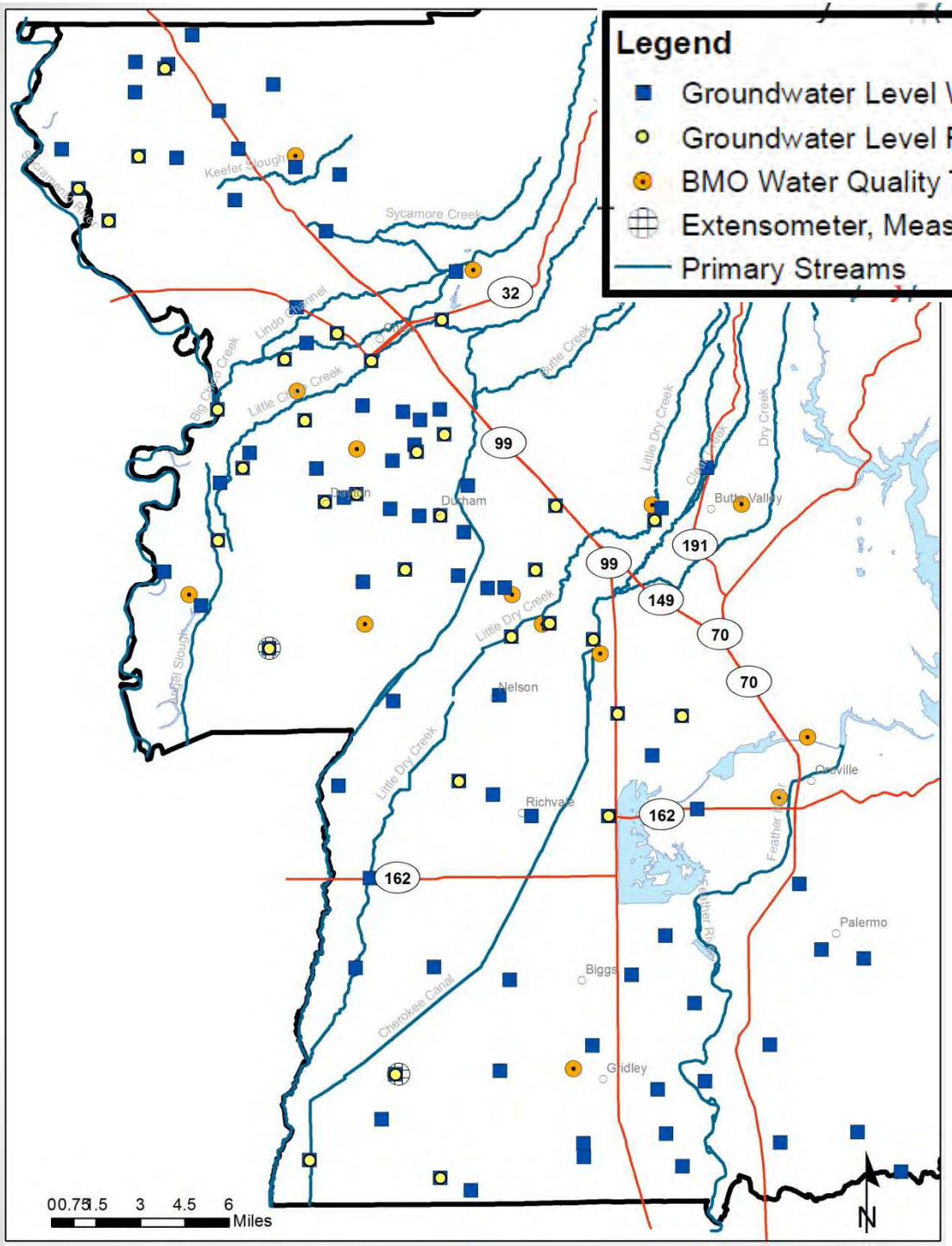
Understanding the Basin

- Ongoing monitoring of groundwater levels tracks the result of hydrologic variability and groundwater use
- Research and modeling helps identify the inputs (hydrology, demands, geology, basin dynamics, etc.)


Northern Sierra Precipitation: 8-Station Index, February 10, 2014
MSC - Mount Shasta City
SHA - Shasta Dam
MNR - Mineral
QRD - Quincy
BCM - Brush Creek
SRR - Sierraville RS
BYM - Blue Canyon
PCF - Pacific House
Percent of Average for this Date: 33%
1982-1983 (wettest)
88.5
Average (1922-1998)
50.0
44.3
2012-2013
1923-1924 (driest)
19.0
17.1
9.6 - Current Daily Precip.
2013-2014
Cumulative Daily/Monthly Precipitation (inches)
Total Water Year Precipitation
Water Year (October 1 - September 30)
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Aug 1
Sep 1
Oct 1
Average (1922-1998) — 1923-1924 (driest) — 1976-1977 (2nd Driest) — 1982-1983 (wettest) — 2012-2013 — 2013-2014 (current)

Sacramento Valley Water Year Type Index





Monitoring Network

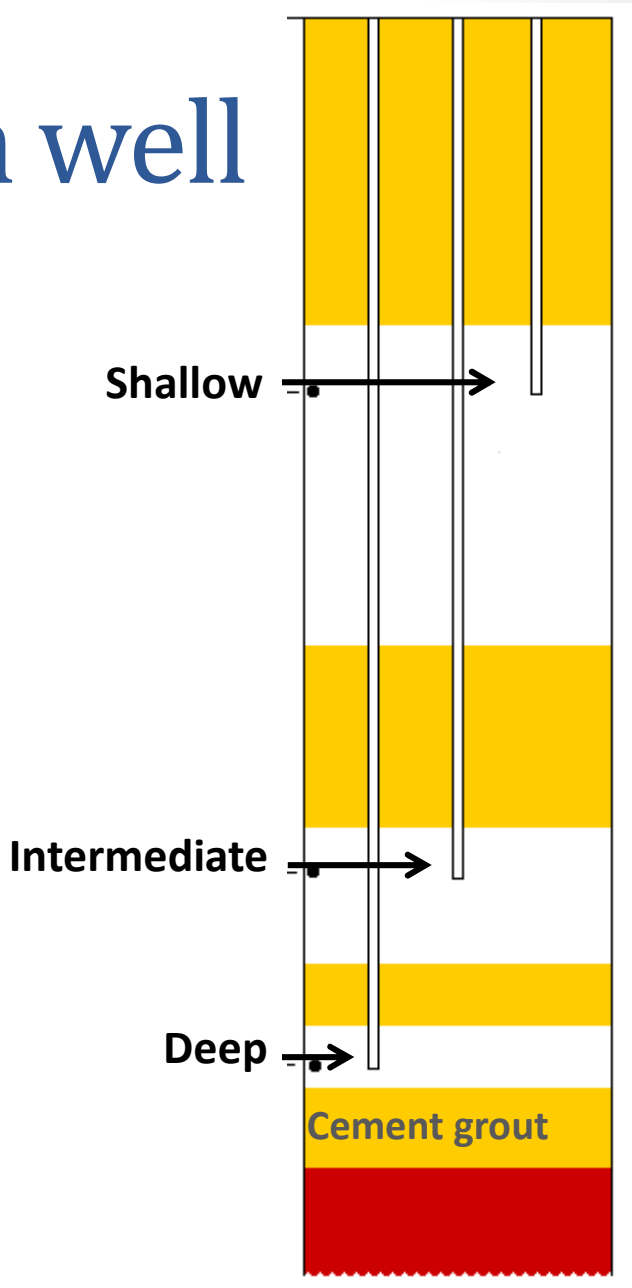
- 125 BMO wells
- 59 equipped with a data logger
- 77 assigned spring/fall alert levels
- 69 additional wells since 2000
- Data online (CASGEM and Water Data Library)

Domestic well

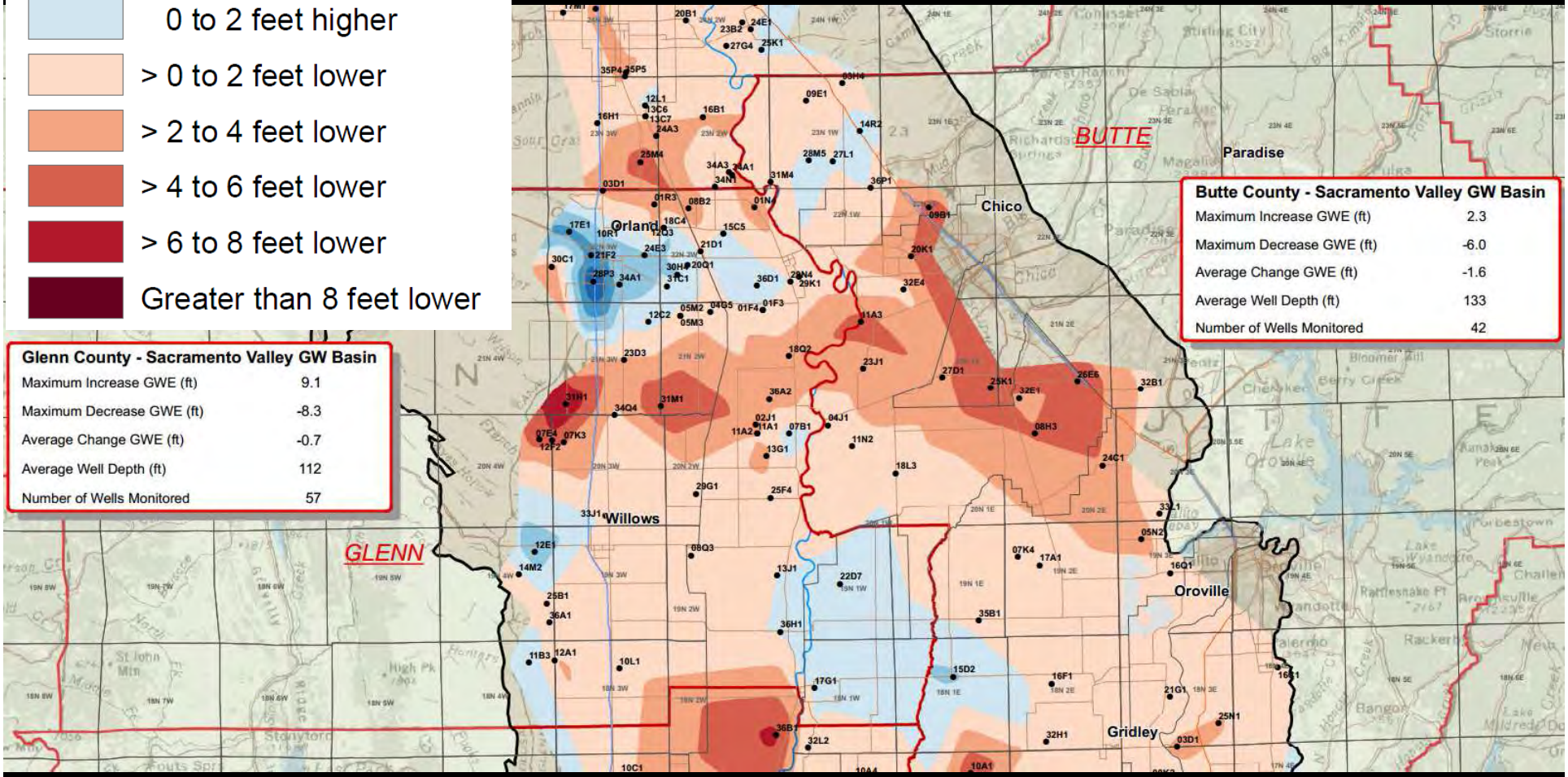
Irrigation well

Multi-completion well

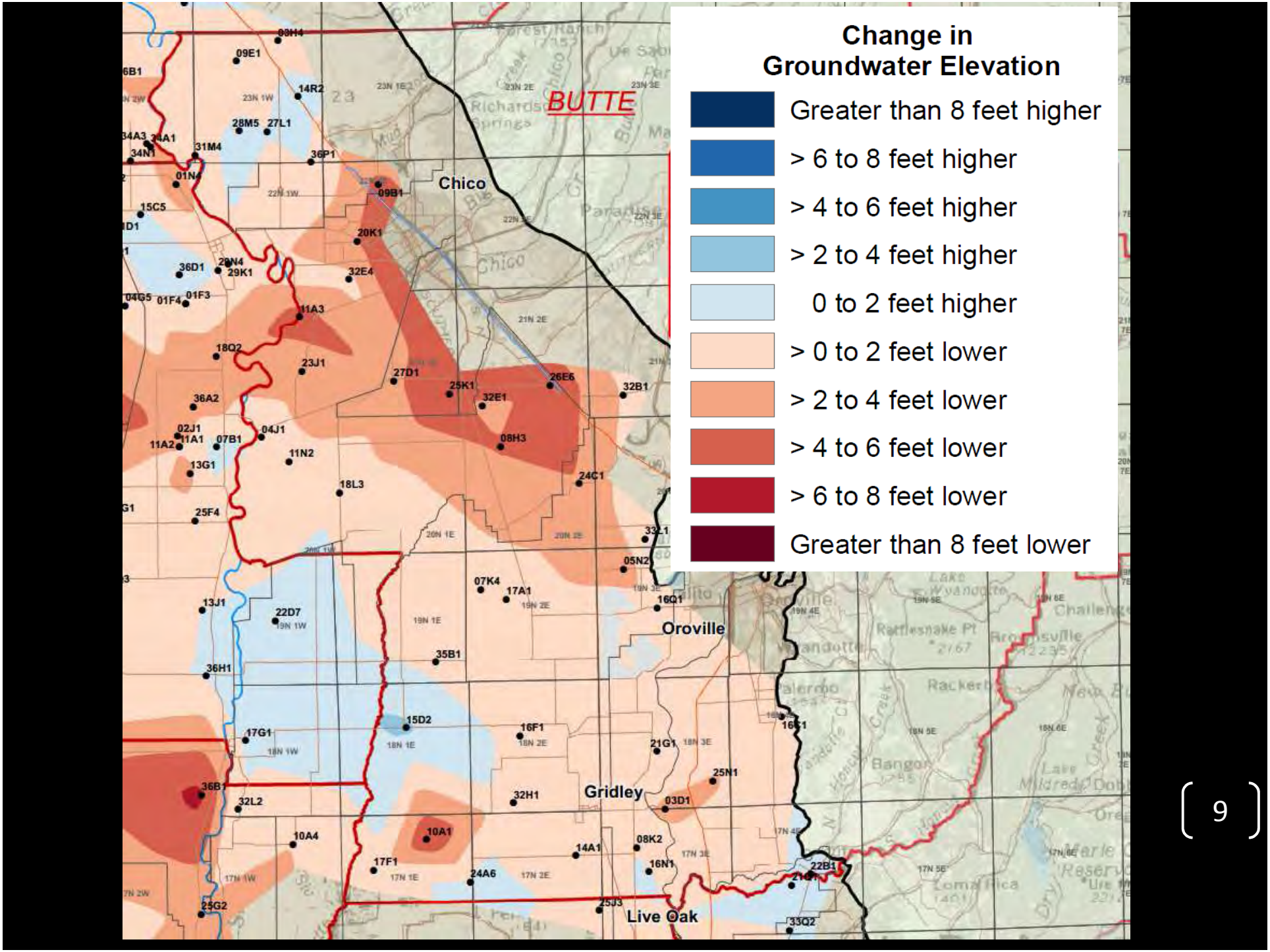
Multi-completion well



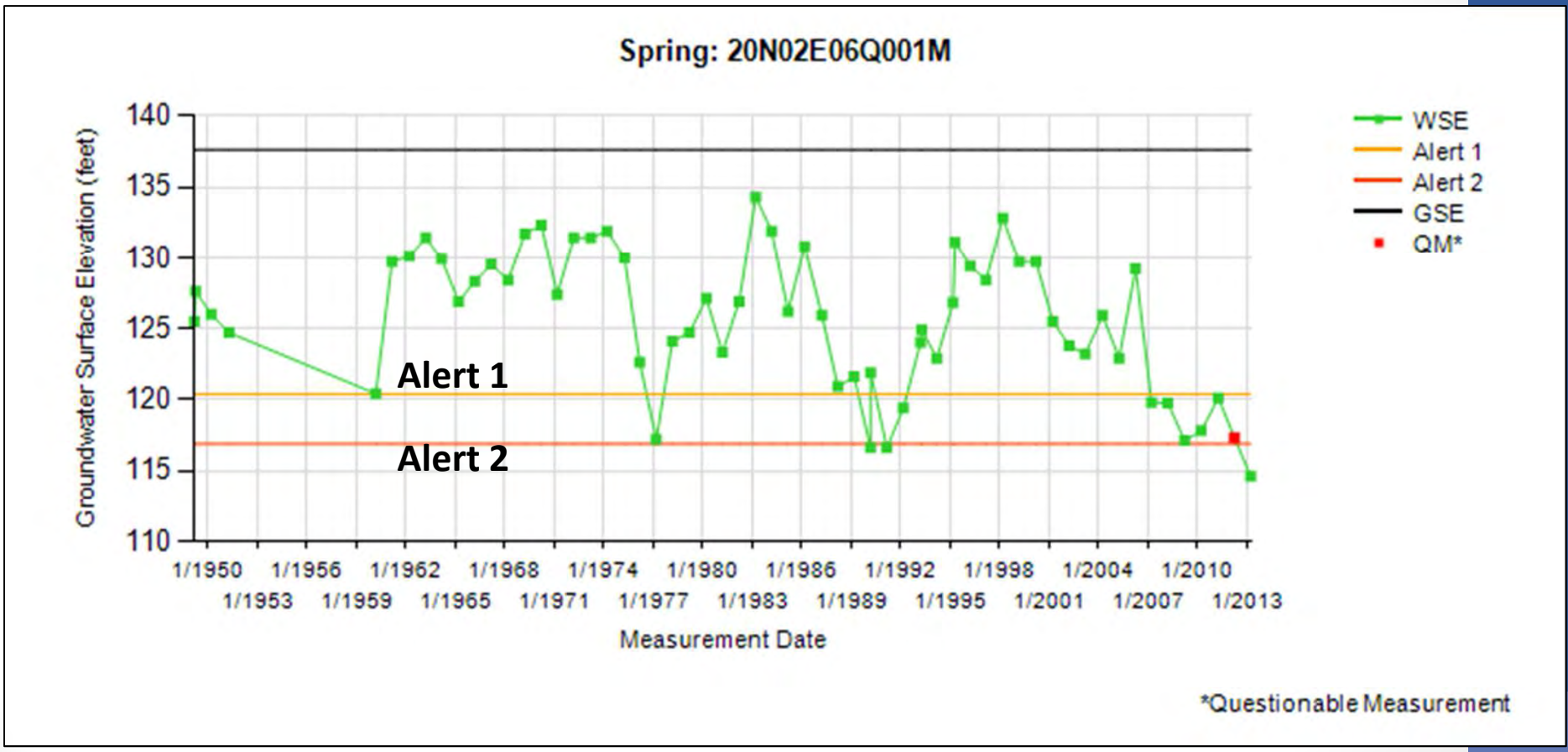
Change in Groundwater Elevation Map Spring 2012 to Spring 2013 Shallow Aquifer Zone (<200 ft.)



Produced by Department of Water Resources Northern Region Office


Change in
Groundwater Elevation
Greater than 8 feet higher
> 6 to 8 feet higher
> 4 to 6 feet higher
> 2 to 4 feet higher
0 to 2 feet higher
> 0 to 2 feet lower
> 2 to 4 feet lower
> 4 to 6 feet lower
> 6 to 8 feet lower
Greater than 8 feet lower
BUTTE
Chico
Oroville
Gridley
Live Oak

Water Level Graphs & Alert Levels



Well in Durham/Dayton Sub-inventory Unit

BMO Alert Stage Frequency

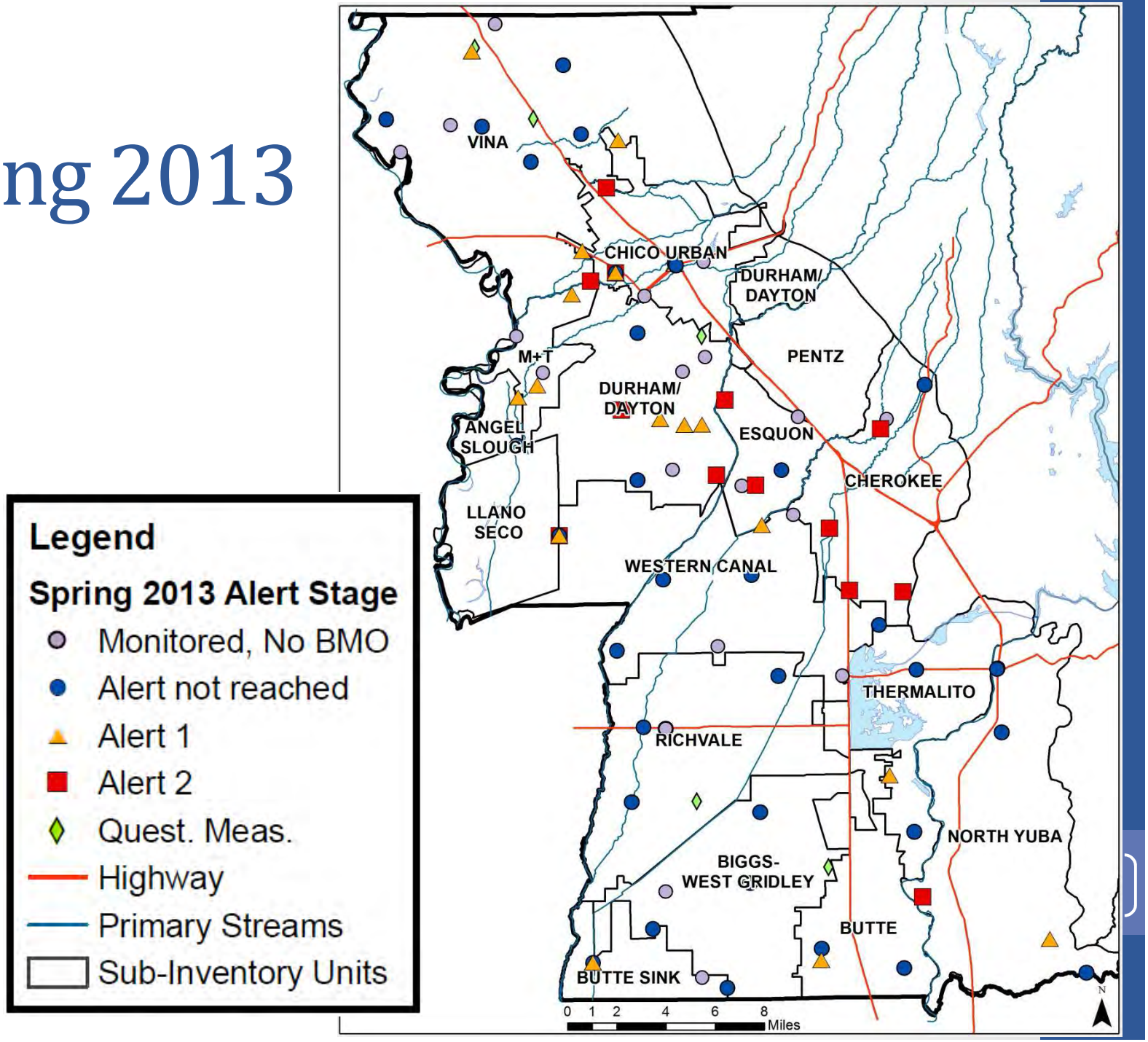
Spring: March 2013

	2008	2009	2010	2011	2012	2013
Alert 1	26	31	25	24	25	20
Alert 2	0	6	3	0	4	15

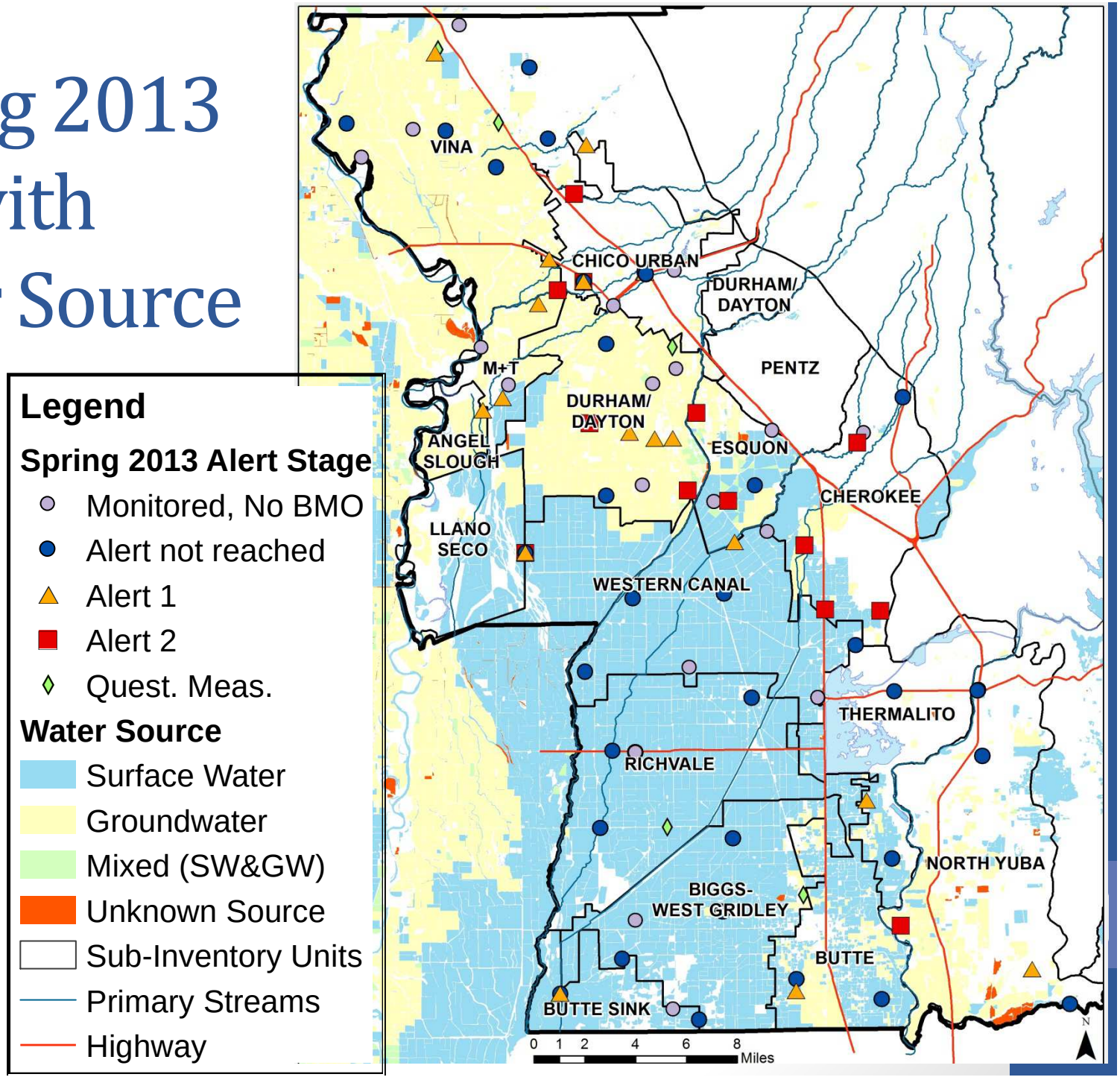
Fall: October 2013

	2008	2009	2010	2011	2012	2013
Alert 1	27	29	24	7	26	23
Alert 2	2	1	2	2	6	16

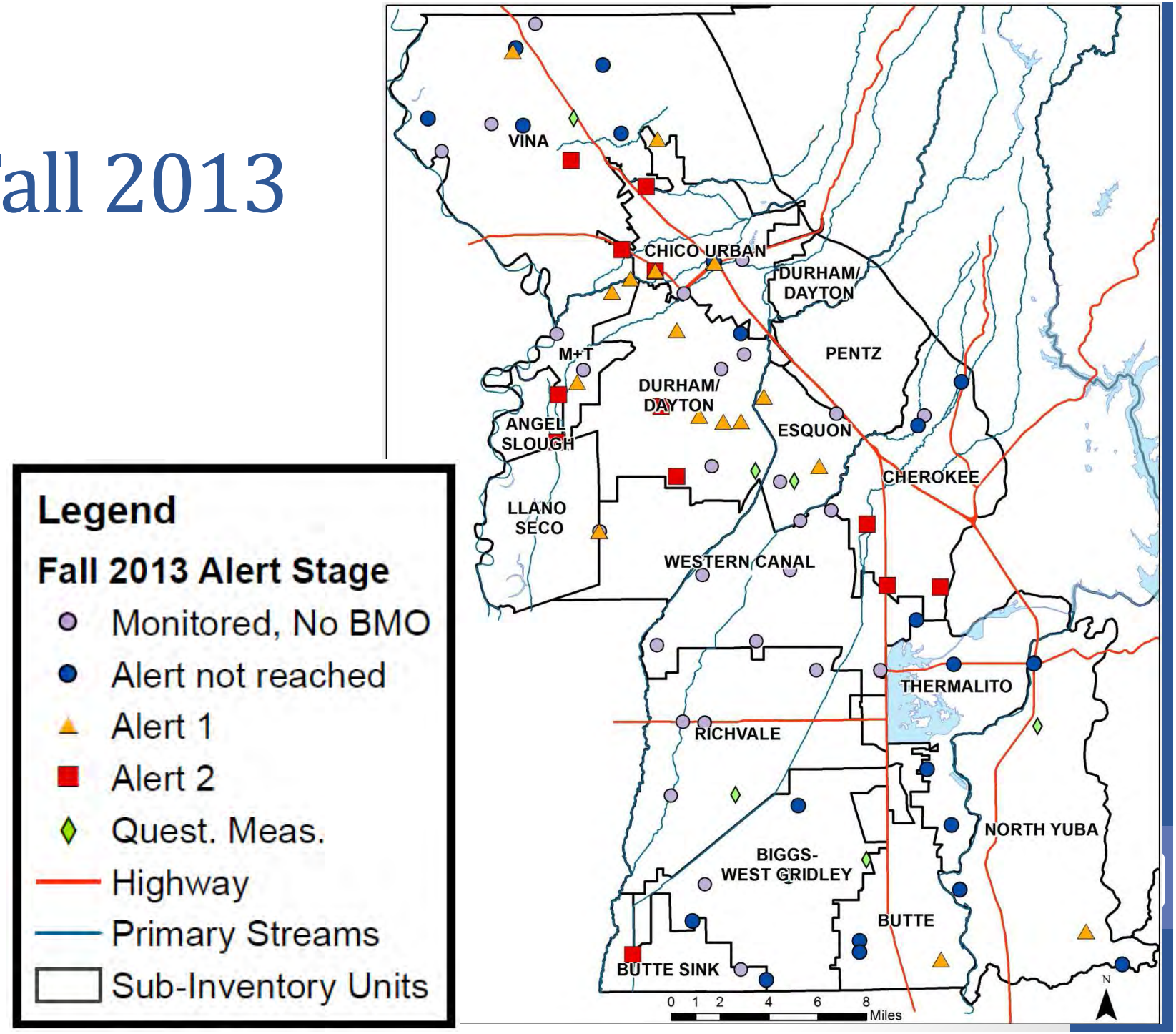
Spring 2013


VINA
CHICO URBAN
DURHAM/
DAYTON
PENTZ
M+T
DURHAM/
DAYTON
ANGEL
SLOUGH
ESQUON
CHEROKEE
LLANO
SECO
WESTERN CANAL
THERMALITO
RICHVALE
NORTH YUBA
BIGGS-
WEST GRIDLEY
BUTTE
BUTTE SINK
0 1 2 4 6 8
Miles
N
Legend
Spring 2013 Alert Stage
Monitored, No BMO
Alert not reached
Alert 1
Alert 2
Quest. Meas.
Highway
Primary Streams
Sub-Inventory Units

Spring 2013 with Water Source

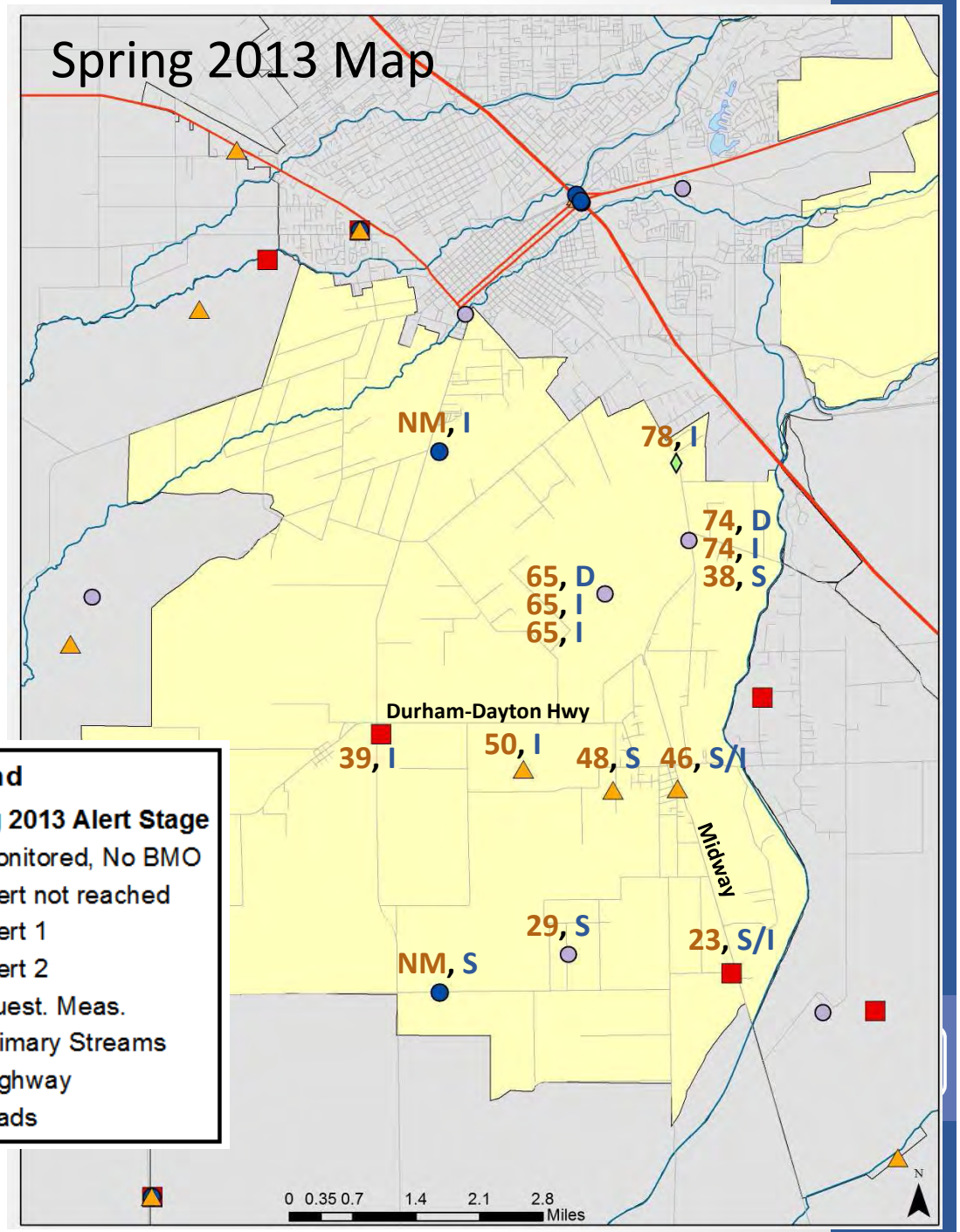


Fall 2013


VINA
CHICO URBAN
DURHAM/
DAYTON
M+T
PENTZ
DURHAM/
DAYTON
ANGEL
SLOUGH
ESQUON
CHEROKEE
LLANO
SECO
WESTERN CANAL
THERMALITO
RICHVALE
NORTH YUBA
BIGGS-
WEST GRIDLEY
BUTTE
BUTTE SINK
0 1 2 4 6 8
Miles
N
Legend
Fall 2013 Alert Stage
Monitored, No BMO
Alert not reached
Alert 1
Alert 2
Quest. Meas.
Highway
Primary Streams
Sub-Inventory Units

Durham Dayton Area

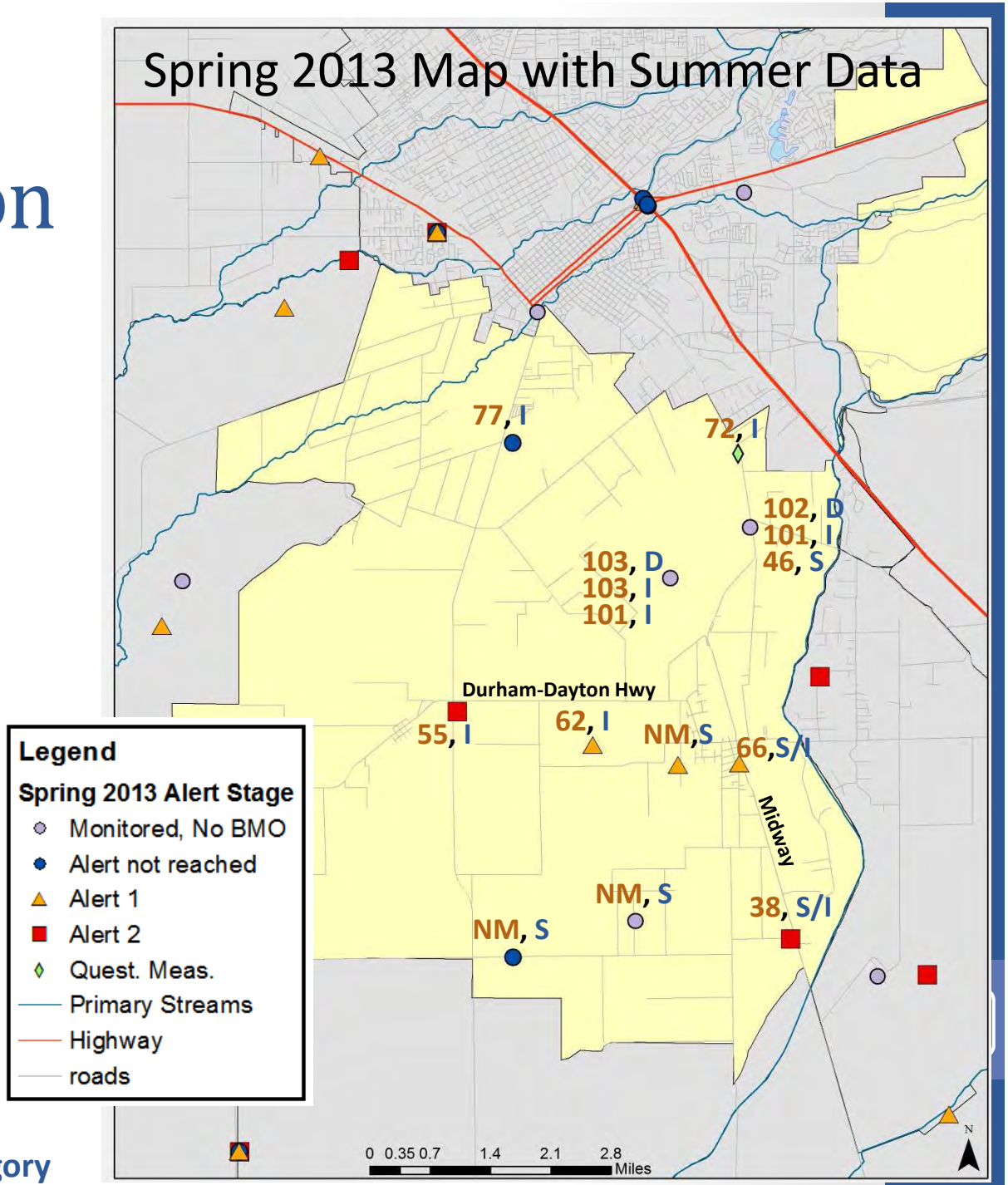
- 15 monitoring wells
  - 2 multi-completion wells
  - 8 wells with data loggers
  - 7 added since 2000, no alert stage set
- Spring 2013
  - 3 Alert 1; 2 Alert 2
- Fall 2013
  - 4 Alert 1; 2 Alert 2



Spring 2013 data
Depth to Water (ft), Well Depth Category

Durham Dayton Area

- 2013 Summer Depth to Water (feet)

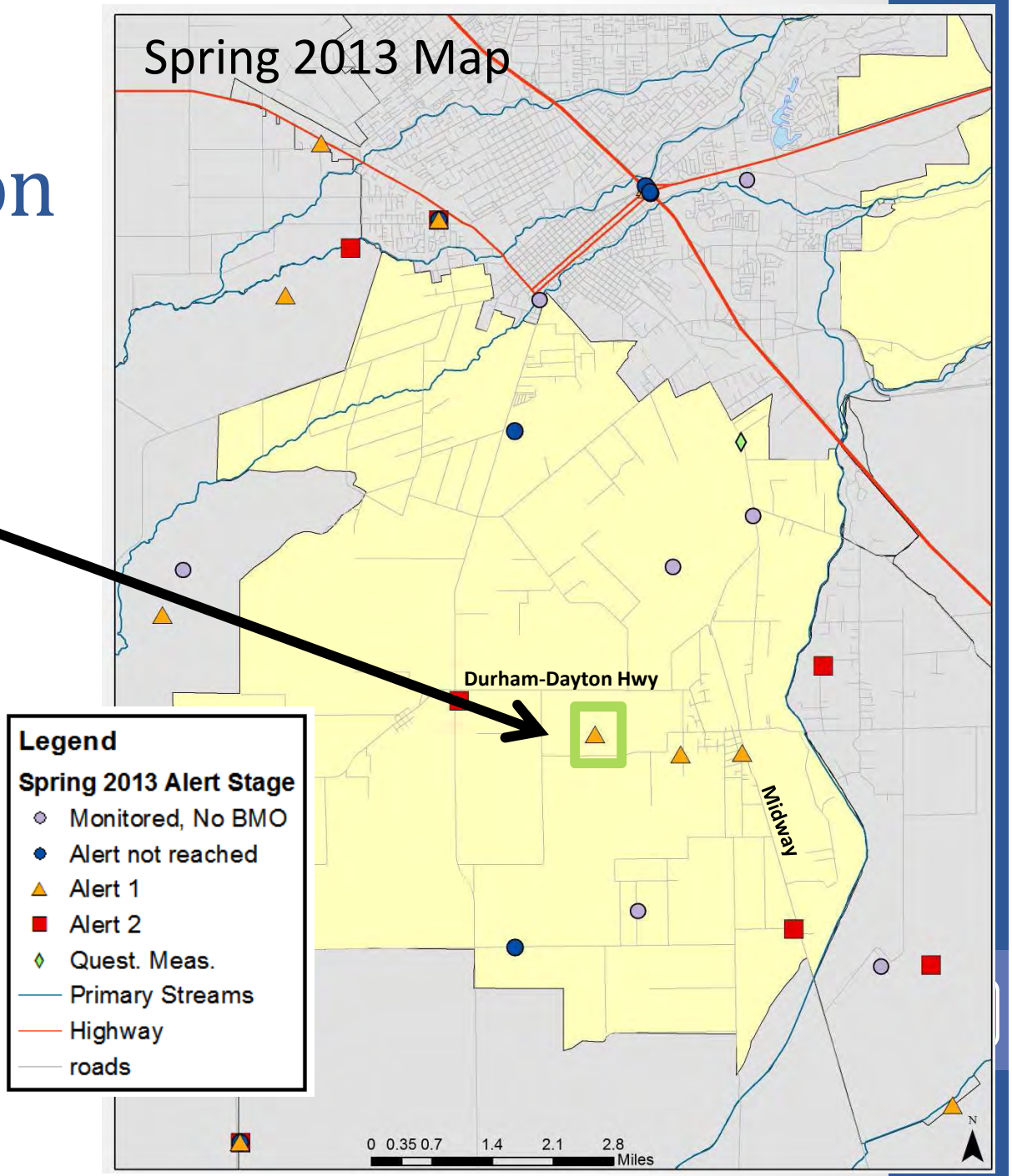


SUMMER 2013 data

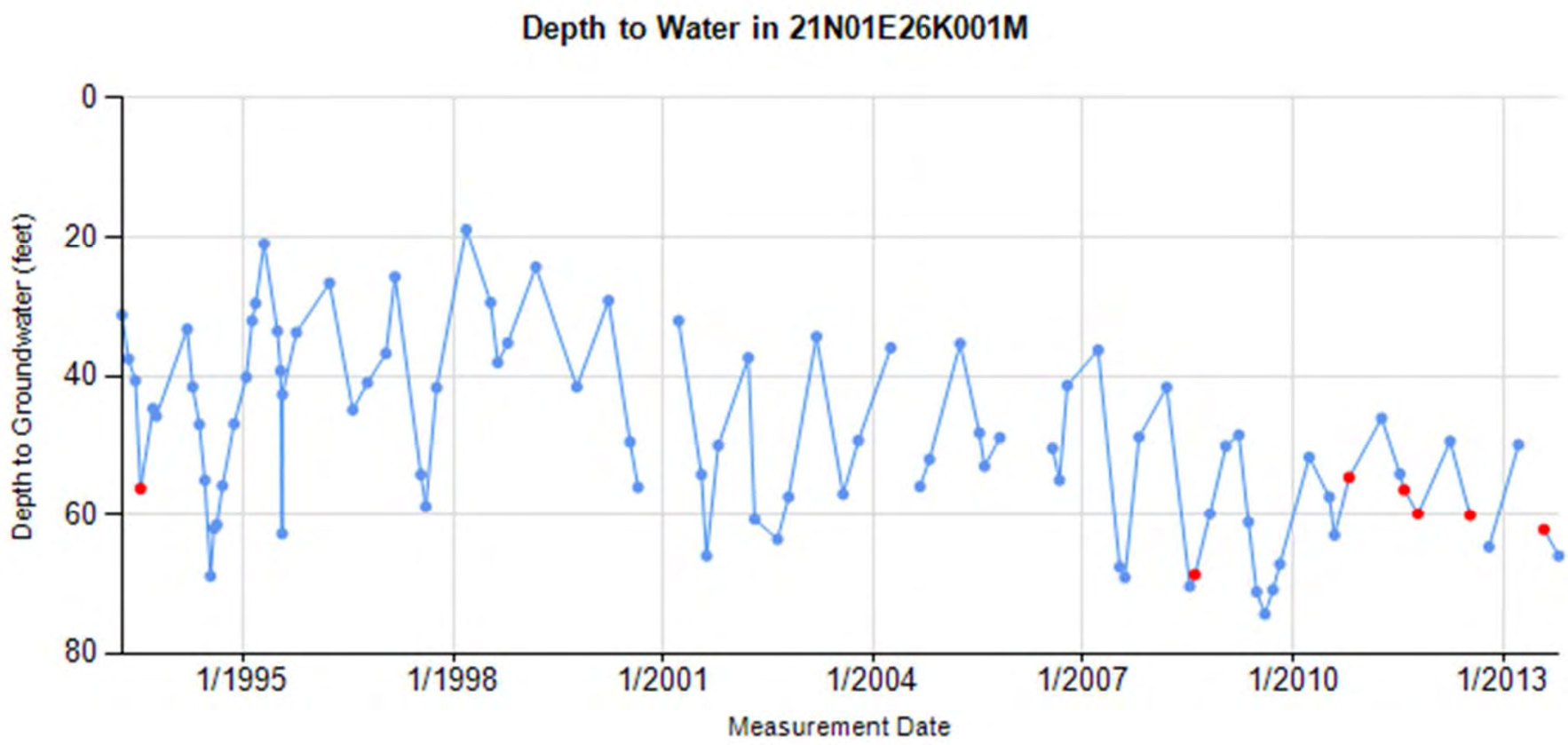
Depth to Water (ft), Well Depth Category

Durham Dayton Area

- A peek at the data….



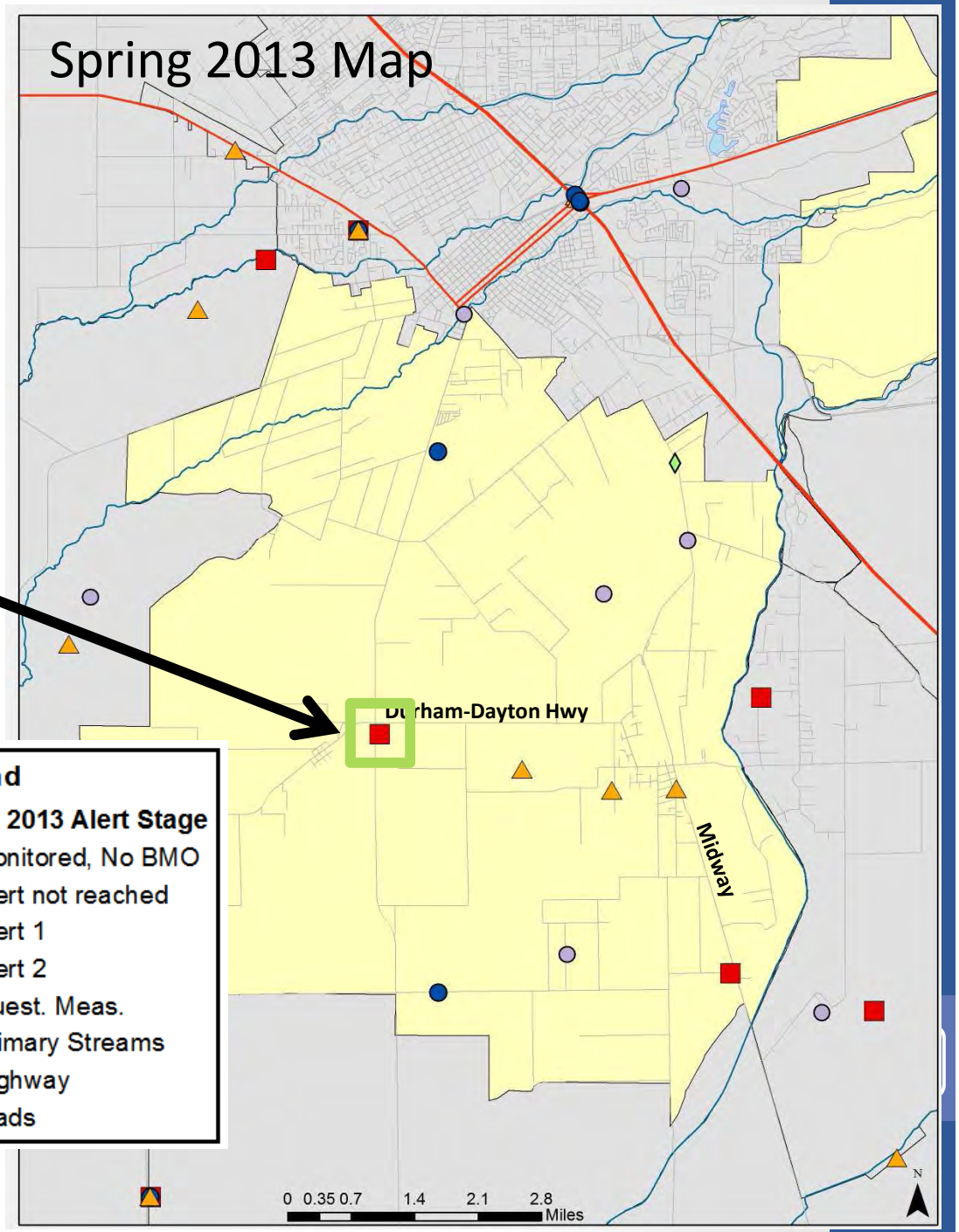
Groundwater Level Trends



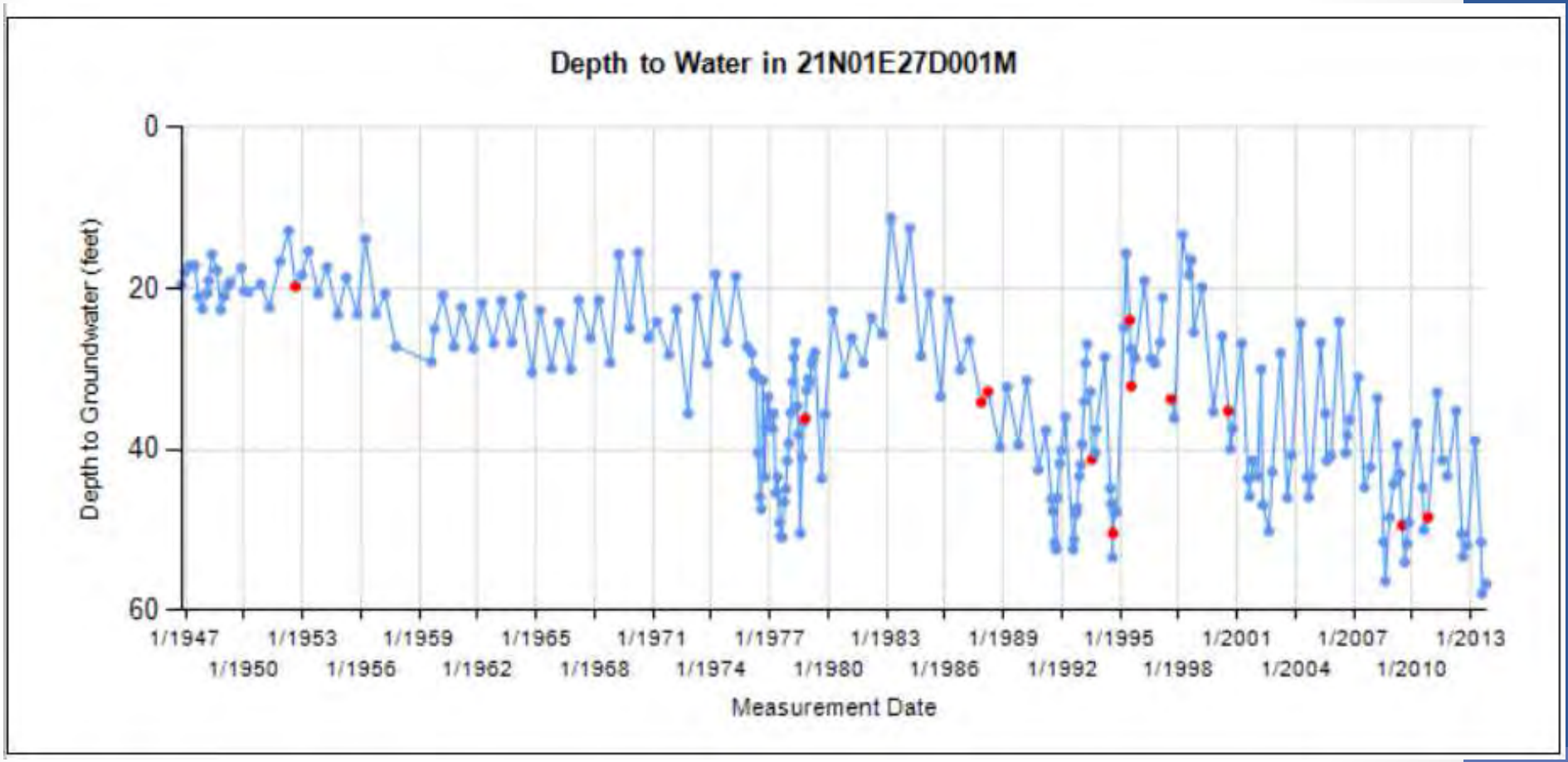
Irrigation, Intermediate (200-600 ft.) well in Upper Tuscan Formation.
Record begins in 1993
Spring and Fall Alert 1

Durham Dayton Area

- A peek at the data….



Groundwater Level Trends



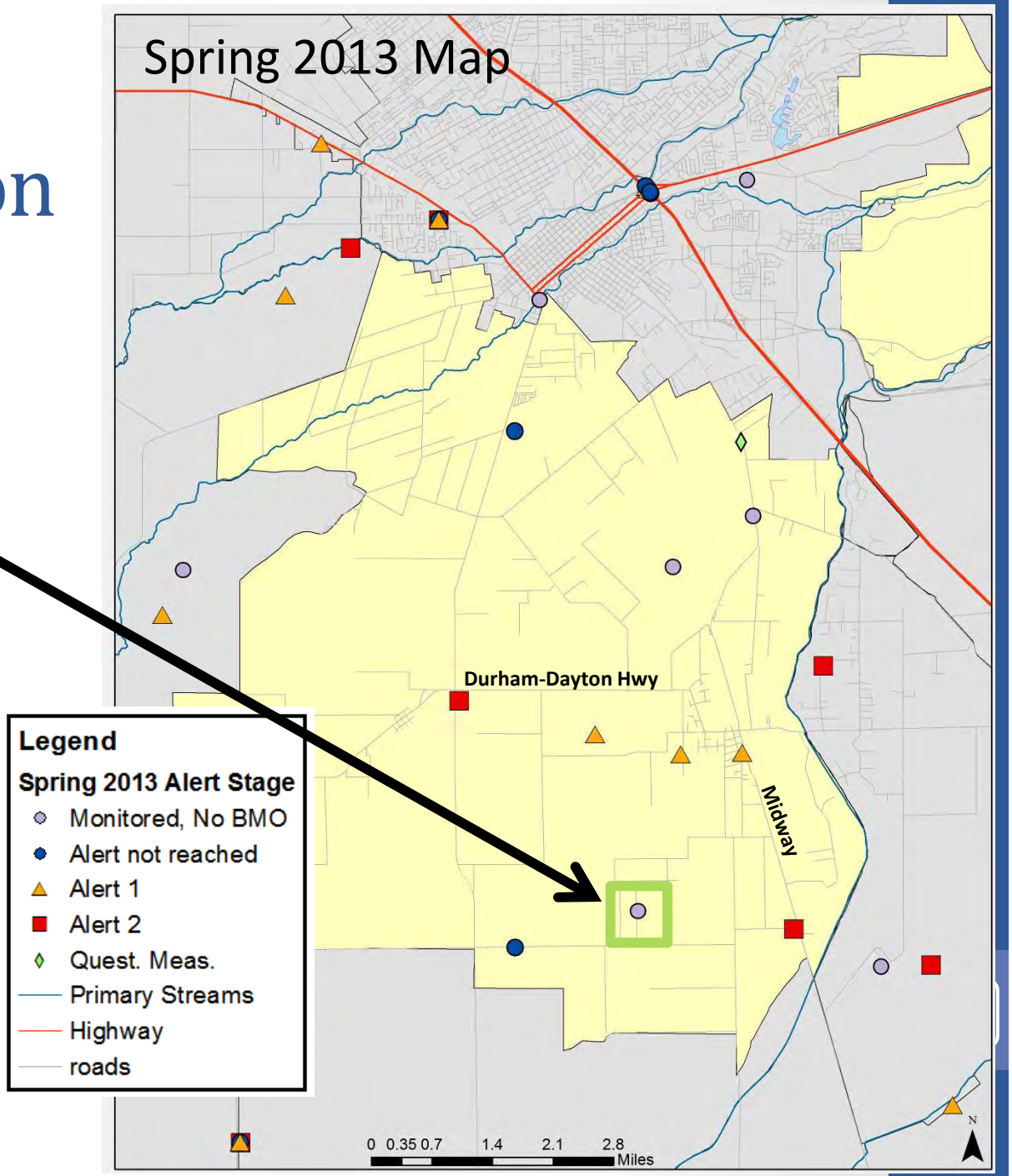
Domestic, shallow (<200 ft.) well in Modesto Formation.

Record begins in 1947

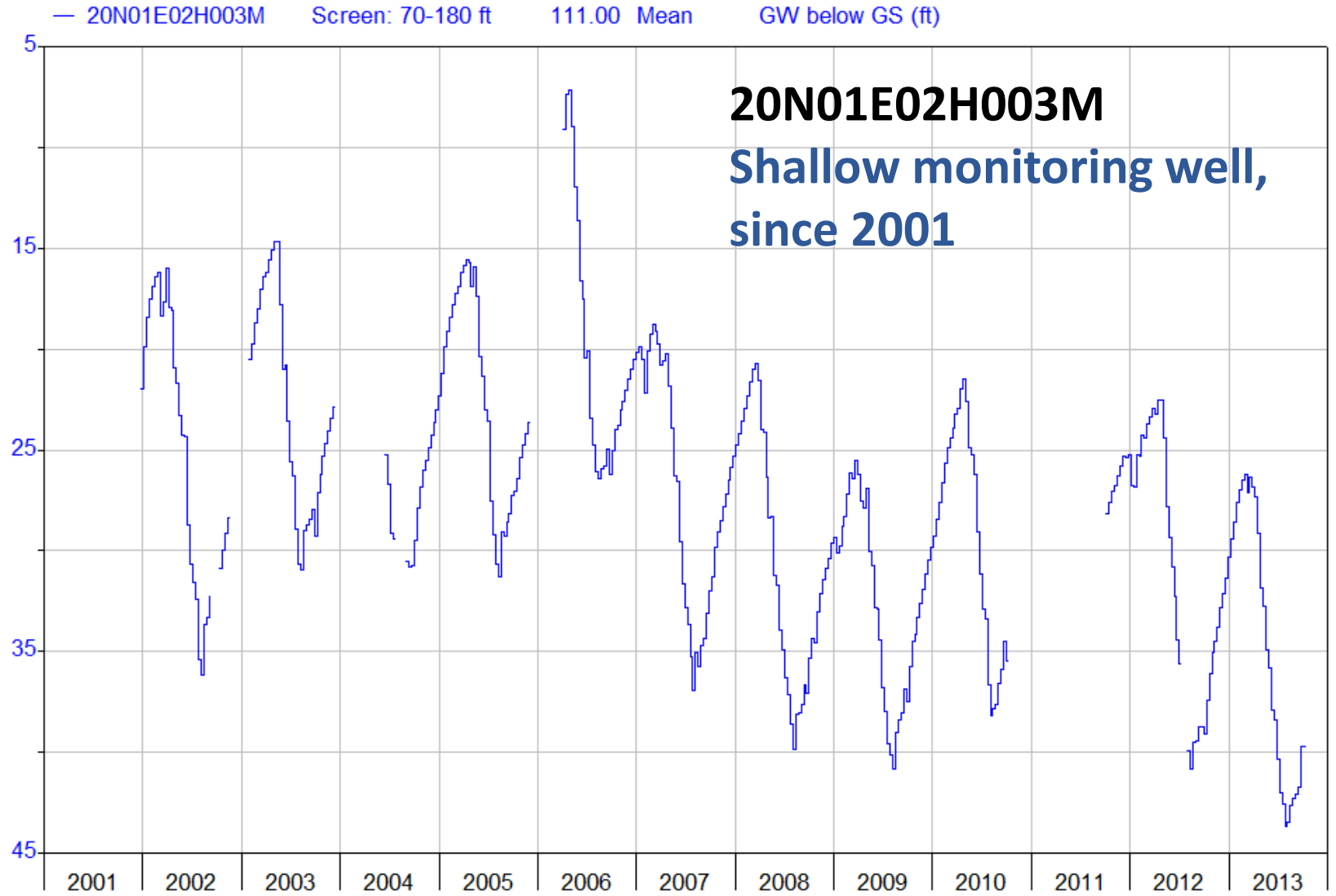
Spring and Fall Alert 2

Durham Dayton Area

- A peek at the data….

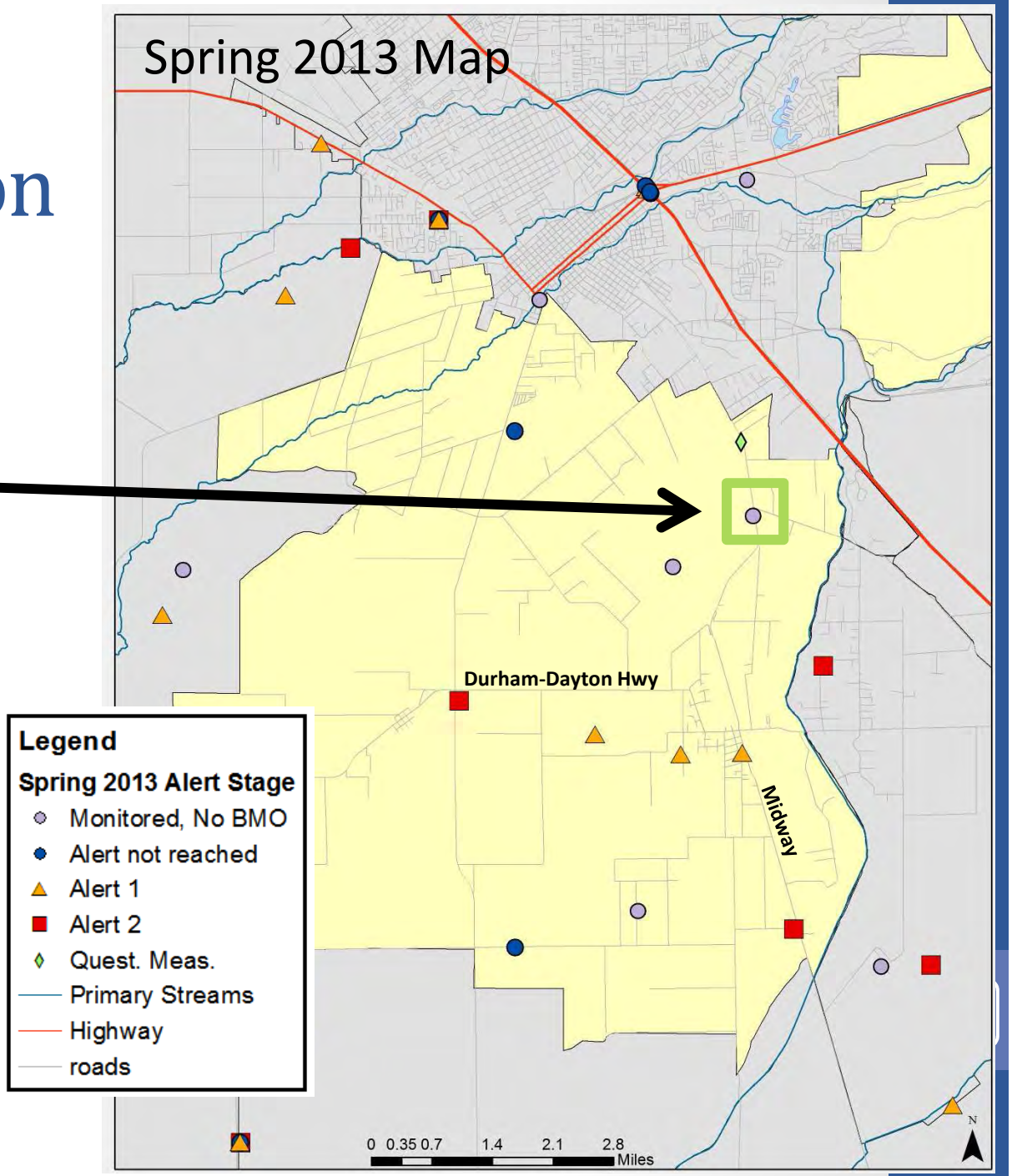


Logger Data


— 20N01E02H003M Screen: 70-180 ft 111.00 Mean GW below GS (ft)
5
15
25
35
45
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
20N01E02H003M
Shallow monitoring well, since 2001

Durham Dayton Area

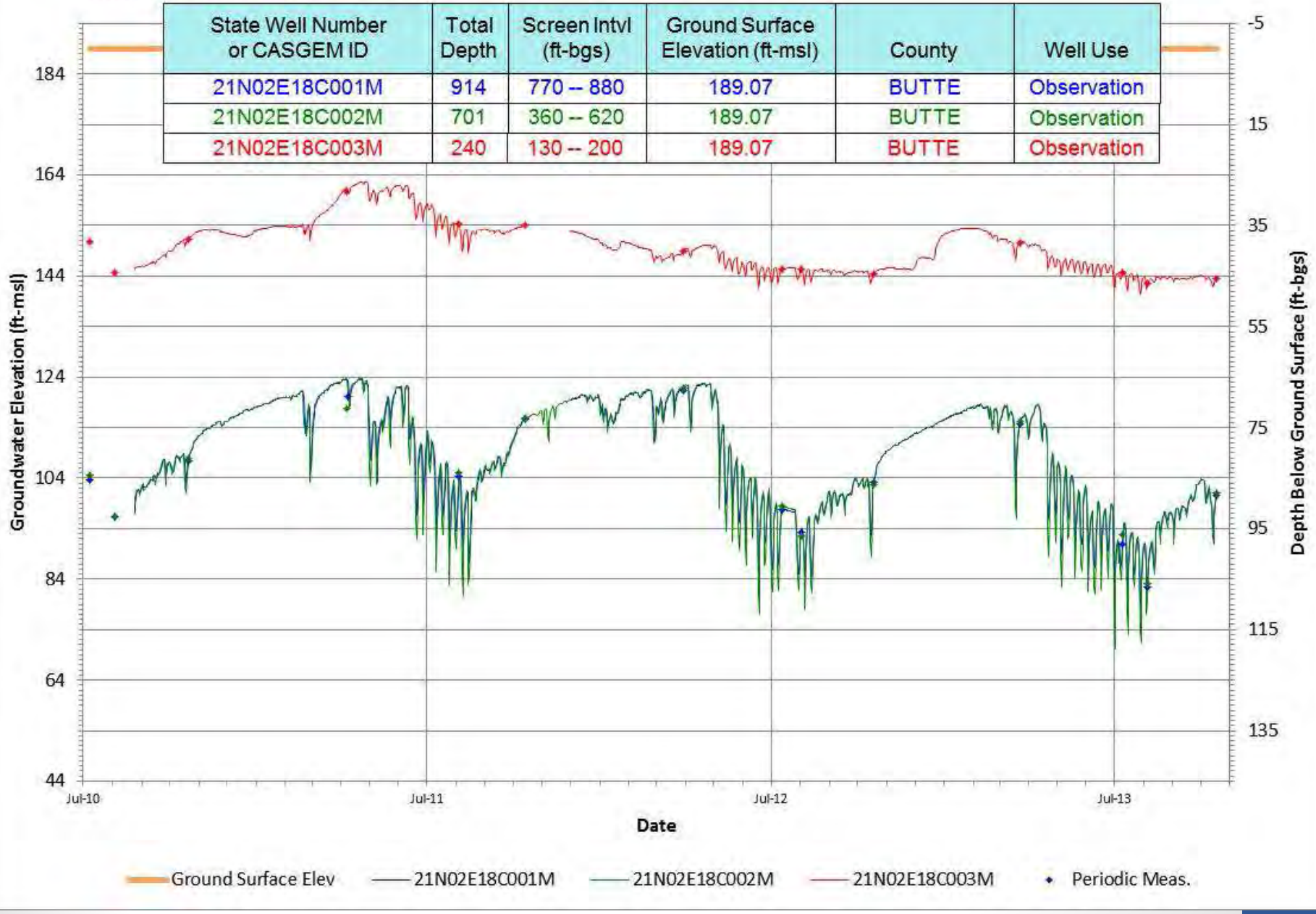
- A peek at the data….



Clustered Well Hydrograph

Period Of Record: 07/08/2010 to 10/17/2013

State Well Number or CASGEM ID	Total Depth	Screen Intvl (ft-bgs)	Ground Surface Elevation (ft-msl)	County	Well Use
21N02E18C001M	914	770 -- 880	189.07	BUTTE	Observation
21N02E18C002M	701	360 -- 620	189.07	BUTTE	Observation
21N02E18C003M	240	130 -- 200	189.07	BUTTE	Observation



Issued Well Permits

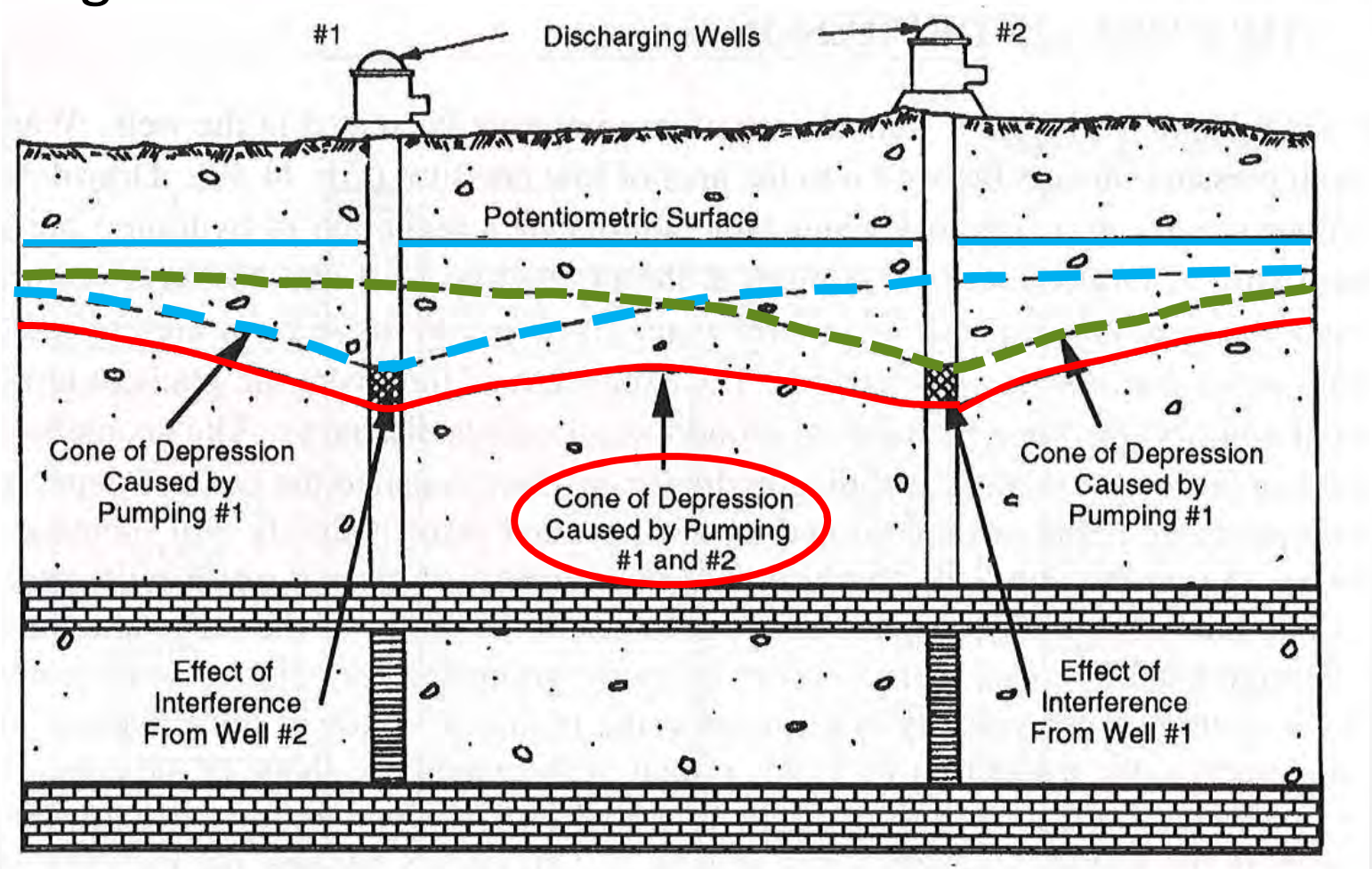
Well Type	2009	2010	2011	2012	2013
Small Diameter	97	82	53	63	125
Large Diameter	28	6	15	19	29
Well Deepening	16	8	5	12	8

- Number of well permits issued by Butte County Environmental Health, not necessarily wells actually drilled.
- Over 14,000 wells exist in the county
- 2009 was the last year of the last 3 year drought

Given the conditions….
What can I do?

What can I do?

1. Coordinate agricultural pumping with your neighbors



Credit: Kasenow 2010

What can I do?

2. Well Owners, Be Prepared
    - Have your well log on hand (a.k.a. well completion report). Available from Butte County Dept. of Environmental Health
    - Have a licensed well driller give your system an annual check up
    - **Wellowner.org** for basic groundwater information and well maintenance
        - Also has contractor locator tool

What can I do?

3. Be aware of groundwater conditions near you
    - Online Water Data Library for monitoring data
    - Come check out our table in the back
    - Know information about your well's construction (total depth, screening intervals, depth of pump)

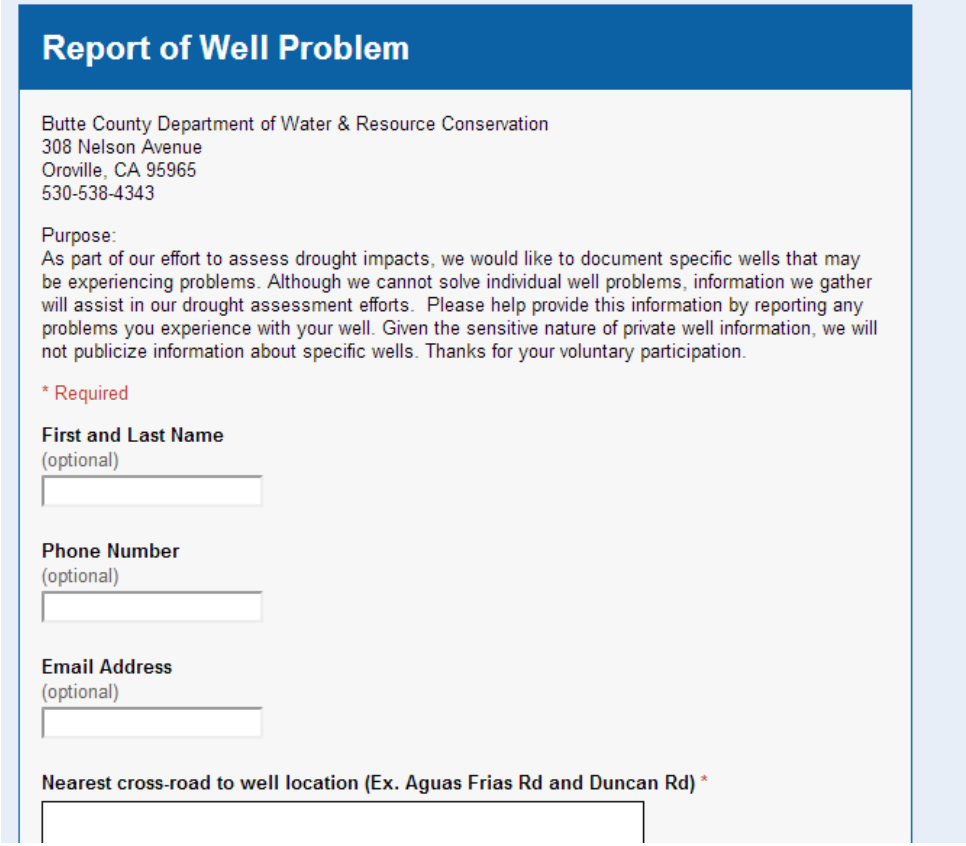
What can I do?

4. Use Water Wisely!
    - **SaveOurH2O.org**
    - Ways to save water Indoors and Outdoors

If you do run into trouble…

Help us document the impacts of the drought!

Fill out the online form. This will help us keep track of where and what the problems are.



Report of Well Problem

Butte County Department of Water & Resource Conservation
308 Nelson Avenue
Oroville, CA 95965
530-538-4343

Purpose:
As part of our effort to assess drought impacts, we would like to document specific wells that may be experiencing problems. Although we cannot solve individual well problems, information we gather will assist in our drought assessment efforts. Please help provide this information by reporting any problems you experience with your well. Given the sensitive nature of private well information, we will not publicize information about specific wells. Thanks for your voluntary participation.

* Required

First and Last Name
(optional)

Phone Number
(optional)

Email Address
(optional)

Nearest cross-road to well location (Ex. Aguas Frias Rd and Duncan Rd) *

Recap

- 2013 was a dry year in the Sacramento Valley and Statewide. Off to a very dry start for 2014.
- Groundwater levels generally declined over last several years, especially in groundwater dependent areas where they are at or near historical lows in many monitoring wells
- For local conditions, see spring/fall hydrographs in BMO reports or on Water Data Library
- Be prepared! Have your well log on hand and use water wisely

Questions?

Christina Buck
Water Resources Scientist
Butte County
Dept. of Water & Resource Conservation
cbuck@buttecounty.net
538-6265

State of California
State Water Resources Control Board
DIVISION OF WATER RIGHTS
P.O. BOX 2000, Sacramento, Ca. 95812-2000
Info: (916) 341-5300, FAX: (916) 341-5400, Web: http://www.waterrights.ca.gov
Rich.Satkowski@waterboards.ca.gov

PROTEST – (Petitions)
OBJECTION
PETITION FOR RECONSIDERATION
PETITION FOR HEARING

BASED ON ENVIRONMENTAL OR PUBLIC INTEREST CONSIDERATIONS

Temporary Urgency Change Petition and Responding Order for Permits 16478, 16479, 16481, 16482 and 16483 (Applications 5630, 14443, 14445A, 17512 and 17514A, respectively) of the Department of Water Resources for the State Water Project and License 1986 and Permits 11315, 11316, 11885, 11886, 11887, 11967, 11968, 11969, 11970, 11971, 11972, 11973, 12364, 12721, 12722, 12723, 12725, 12726, 12727, 12860, 15735, 16597, 20245, and 16600 (Applications 23, 234, 1465, 5638, 13370, 13371, 5628, 15374, 15375, 15376, 16767, 16768, 17374, 17376, 5626, 9363, 9364, 9366, 9367, 9368, 15764, 22316, 14858A, 14858B, and 19304, respectively) of the United States Bureau of Reclamation for the Central Valley Project.

We, Chris Shutes, Water Rights Advocate, California Sportfishing Protection Alliance (CSPA), 1608 Francisco St., Berkeley, CA 94703, blancapaloma@msn.com, (510) 421-2405; Bill Jennings, Executive Director, CSPA, 3536 Rainier Ave, Stockton CA 95204, deltakeep@me.com, (209) 464-5067; Barbara Vlamis, Executive Director, AquAlliance, P.O. Box 4024, Chico, CA 95927, barbarav@aqualliance.net, (530) 895-9420; Carolee Krieger, Executive Director, California Water Impact Network, 808 Romero Canyon Rd., Santa Barbara, CA 93108, caroleekrieger7@gmail.com, (805) 969-0824; and Michael Jackson, counsel to CSPA, CWIN and AquAlliance, P.O. Box 207, 429 W. Main St., Quincy, CA 95971, mjatty@sbcglobal.net (Protestants)

have read carefully a notice relative to a petition for Temporary Urgency Change (TUCP) of the Department of Water Resources (DWR) and the Bureau of Reclamation (Bureau), dated January 23, 2015. The Executive Director issued an Order granting this petition in part and denying it in part on February 3, 2015 entitled ***Order Approving in Part and Denying in Part a Petition for Temporary Urgency Changes in License and Permit Terms and Conditions Requiring Compliance with Delta Water Quality Objectives in Response to Drought Conditions*** (TUCO or "Order").

The proposed petition for water and Order will:

(1) not be within the State Water Resources Control Board's (SWRCB) jurisdiction
(2) not best serve the public interest

(3) be contrary to law
(4) have an adverse environmental impact

(All of the above)

We object to the TUCP and petition for reconsideration of the proposed Order for the reasons described below.

State Facts, which support the foregoing allegations:

Summary

The State and Federal water projects have again petitioned the State Water Board to relax Bay-Delta standards in February and March so that more water can be exported from the Delta during what appears to be a fourth consecutive year of drought. After twenty years of acquiescing to the water interests, consistently leaving Delta standards unenforced in dry years, Board staff has issued an Order that would reduce Delta outflow requirements, allow additional operation of the Delta Cross Channel gates, and reduce Vernalis flows with no mitigation, but would not allow the requested higher exports when D-1641 standards are not being met, despite acquiescence of the fisheries agencies to what these agencies appear to have assumed was a foregone conclusion. However, the Order leaves open the option for the Board to change its mind on the request in the future, and will discuss the matter with those involved at a February 18, 2015 public workshop.

Recognizing the failure of the fisheries agencies to address the appropriate legal standard (whether the requested actions will have unreasonable effects on fish and wildlife), Board staff at least refuses in the Order the request of DWR and the Bureau to weaken export requirements even more than last year.[1] In what we would like to think is responsive to our comments last September,[2] the Order cites to objective evidence and highlights key biological considerations.[3] The discussion portion of the Order describes how it is necessary to consider the condition of affected fisheries over the past several years and over the past few months. However, despite the acknowledgment of such required analysis, the Order incredibly draws exactly the same conclusions and requires the same weakened Delta outflow and export conditions that similar

[1] See Order, p. 17:

> It should be noted that while the fisheries agencies indicated that the changes proposed in the TUCP could be made in compliance with ESA and CESA requirements, those letters did not determine whether the potential impacts of the changes would unreasonably affect fish and wildlife. The ESA and CESA standard of avoiding jeopardy to the continued existence of a threatened or endangered species is a minimal standard, and as such may differ from the Water Code requirement that the changes must not unreasonably affect fish and wildlife, especially when many species have already experienced extreme impacts from the drought for several years.

[2] See CSPA et al Comments on *Draft Order Denying Petitions for Reconsideration and Addressing Objections regarding the Temporary Urgency Change Petitions and Orders for the operation of the Central Valley Project and the State Water Project,* September 16, 2014, p. 2: "Rather than citing objective evidence, the Board has relied on concurrence from the fisheries agencies to support its decisions."

[3] See Order, Section 2.6.

orders required last year. These are the conditions that led, as CSPA predicted in 2014, to all-time lows in Delta smelt abundance and the population collapse of winter-run Chinook salmon.

The Order recognizes that the main beneficiaries of water held in storage rather than released to meet D-1641 outflow and salinity requirements are water users. In light of the failure of 2014's efforts to maintain temperature control, and the loss of ~95% of the 2014 winter-run cohort and the loss of virtually all of the 2014 spring-run cohort (of fish that spawn in the Sacramento River), the statement is indisputable. The solution in 2015 is to require lower deliveries to CVP Settlement Contractors north of Delta and/or lower deliveries of CVP Settlement Contractors' water in the form of transfers south of Delta. With 75% of deliveries in 2014 allowed to CVP Settlement Contractors north of Delta, and likely identical deliveries in 2015, this represents real water, far greater than the savings achievable by starving Delta outflow and water quality requirements. The glib statement in the TUCP cover letter that requested "… changes would allow management of reservoir releases on a pattern that conserves upstream storage for fish and wildlife protection" offers no assurance that such management will occur or will be effective.[4] This year, the Board should exercise strict independent oversight of efforts to manage water temperature in the Sacramento River downstream of Keswick, using its water rights authority to limit north of Delta CVP deliveries if necessary, and not rely on the irresolute federal fisheries agencies who failed in 2014. This option should be considered in the water temperature modeling that is required under Order ¶6(b), alterative (c).

The Order appears to make an improvement over last year's orders in that it does not allow transfers of water from SWP and CVP contractors north of Delta to SWP and CVP contractors south of Delta unless D-1641 requirements are being met. This appears to respond affirmatively to our criticism in our September 16, 2014 comments: "the transferred water [in 2014] was largely sourced from Project reservoirs, sold by settlement contractors who in water year 2014 got most of the available water."[5] One does not conserve project water in storage for any purposes by allowing it to be called on from Lake Shasta by Settlement Contractors and then transferred south of Delta.

However, the Order continues to exempt from limitations transfers of water that are made where the transferred water is sold by an entity with non-project water rights.[6] It makes no difference to fish if the increased risk of entrainment or other causes of mortality in the central and south Delta is caused by export of transferred water rather than export of project water. The Board should not only disallow transfers of *any* water through project facilities when D-1641 standards are not being met, it should require the same import-export mitigations it requires of the projects. What is unreasonable for project water is no less unreasonable for anyone else's water.

Storage conditions in the San Joaquin tributary reservoirs are particularly severe. However, the Order does nothing to reduce the severe risks to lower San Joaquin River and San Joaquin tributary fisheries. The Board should order the Bureau of Reclamation to immediately develop and, as soon as practicable, implement a plan in conjunction with the Department of Fish and Wildlife to capture Stanislaus River salmonid outmigrants at the fish weir on the Stanislaus River

[4] See TUCP cover letter, p. 1 of TUCP.
[5] CSPA et al September 16, 2014 comments, op cit, p. 5.
[6] See Order at ¶1(e), p. 22.

and transport them to barges at the upstream-most point this is reasonably feasible, for barge transport to Suisun or San Pablo Bay. In addition, the Bureau should capture and transport juvenile salmon migrants from the San Joaquin River downstream of Friant Dam to the same barges, rather than dumping them at the confluence of the lower San Joaquin River with the Merced River, as the Bureau did in 2014. In the absence of such a program, allowing exports at D-1641 levels under flow conditions in the lower San Joaquin River will have severe impacts on San Joaquin River and tributary salmon and steelhead, to a level that will have unreasonable effects to fish and wildlife.[7]

In sum, the TUCO, if adopted, would allow measures that would have unreasonable effects on fish and wildlife. The protective measures in the TUCO should be retained. The variances requested in the TUCP should be denied, especially considering that rainfall in the Sacramento Valley has been near or above normal and Shasta and Oroville have almost a million acre-feet more water in storage than this time last year. In addition, we recommend adding protections and a strong array of mitigation actions rather than relaxing standards. In the long run it makes no sense to destroy public trust fishery resources for a minute augmentation of water supply.

TUCP Proposed Changes

The Temporary Urgent Change Petition (TUCP) requests temporary modification of requirements included in Water Board's Decision 1641 (D-1641) to meet water quality objectives in the Water Quality Control Plan (Plan) for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary. Specifically, the TUCP requests modifications to water right requirements to meet the Delta outflow, San Joaquin River flow, Delta Cross Channel (DCC) Gate closure, and Delta export limits objectives. Reclamation and DWR are requesting these temporary modifications in February and March in order to respond to unprecedented critically dry hydrological conditions as California enters its fourth straight year of below average rainfall and snowmelt runoff. The TUCP also identifies possible future requests for further modifications to operating standards for the period from April to September.

The following are the proposed changes in standards:

1. The Delta Standard for the minimum net daily Delta outflow index (NDOI) during February through June is 7,100 cfs calculated as a 3-day running average. This requirement may also be met by achieving either a daily average or 14-day running average EC at the confluence of the Sacramento and San Joaquin Rivers of less than or equal to 2.64 millimhos per centimeter (mmhos/cm) (Collinsville station C2). **Proposed Change:** reduce minimum to 4000 cfs in February and March.
2. The San Joaquin River Delta inflow requirement for February and March is 710 or 1,140 cfs. **Proposed Change:** reduce to 500 cfs in February and March.
3. X2 Days at Port Chicago (days EC is to be 2.64 millimhos per centimeter at Port Chicago - station C2 – 9 days according to Table 4 D-1641. **Proposed Change:** no requirement.
4. The Delta Cross Channel (DCC) is to remain closed in winter. **Proposed Change:** Opening DCC as necessary to protect water quality.

[7] Of the juvenile salmon transported from the San Joaquin River downstream of Friant to confluence of San Joaquin and Merced rivers, 2 were captured in the Mossdale trawl and none were detected at Chipps Island.

5. Delta Exports are not to exceed 1500 cfs when NDOI is less than 7100 cfs or 45% of Delta Inflow. **Proposed Change:** Allow exports when NDOI is less than 7100 cfs up to 45% of Delta Inflow.

Possible Future Change Requests

According to the TUCP, potential future requests to modify D-1641 requirements include: (1) additional requests to modify Delta outflows to balance upstream storage and fish protection, (2) requests to move the compliance point for the Western Delta agriculture salinity objective from Emmaton to Three-Mile Slough, (3) additional requests to modify San Joaquin flows at Vernalis, and (4) requests to modify Rio Vista flow requirements. Additionally, the Petitioners may request flexibility provided in D-1641 to adjust the export limits to modify required averaging periods for sporadic storm events. There will also likely be a request to place salinity barriers in the Delta to minimize salt water intrusion into the Delta (so that the "last drop" of freshwater can be exported). Other water project funded actions may include preferential pumping at one or the other SWP and CVP export facilities in the South Delta to reduce fisheries impacts (which serves to mask true fish losses) and increasing hatchery production to mitigate for drought impacts.

These potential future requests, while not presently under consideration, will individually and collectively result in serious biological harm to beleaguered pelagic and salmon fishery populations that are already at or near historically low abundance levels. The parties filing this Object and Petition for Reconsideration will provide comprehensive comments on the consequences of these potential actions when DWR and the Bureau formally request them.

Order in Response to TUCP

The Order in response to the TUCP would make the following temporary modifications to D-1641 requirements during February and March:

- Modify minimum monthly Delta outflows to 4,000 cfs;
- Modifies minimum monthly San Joaquin River flows at Vernalis to 500 cfs;
- Allow the DCC Gates to be opened consistent with triggers to protect fish species;
- Adds export constraints to allow exports of 1,500 cfs when Delta outflows are below 7,100 cfs regardless of DCC Gate status and allows exports up to D-1641 limits when Delta outflows are above 7,100 cfs and the DCC Gates are closed. (Note this is not consistent with the TUCP, which requests higher exports.)
- The Order appears to drop the requirements for D-1641 Table 4 minimum X2 requirements, though it leaves open the option of a flow pulse for the estuary.

The Order also includes additional requirements to assure that the changes: do not impact other legal users of water, do not have unreasonable impacts of fish and wildlife and other beneficial uses; and are in the public interest. The Order also provides for a higher pulse flow to be scheduled to benefit fish species (possibly to satisfy Table 4 requirements in D-1641). The magnitude, timing, and duration of this pulse flow will be determined through the upcoming consultation process.

The Order would allow the DCC gates to be opened during February and March as needed to reduce upstream releases to maintain salinity conditions in the interior Delta. To ensure that gate opening avoids impacts to fish, the Order would require the gates to be operated in compliance with the DCC Gate Triggers Matrix in the April 2014 Drought Operations Plan and Operational Forecast. The opening would only occur when exports are less than 1500 cfs.

The Order does not approve the requested interim export level of 3,500 cfs when NDOI is at least 5,500 cfs. This request may be allowed in subsequent orders.

The Order would reserve the Executive Director's authority to require modifications to the Order to protect fish and wildlife or other uses of water based on additional information, including information that may be presented during the State Water Board workshop on February 18, 2015, concerning the Order and the Drought Contingency Plan.

Given the present condition of fisheries, the Order's modification of D-1641 standards developed and implemented through extensive evidentiary proceedings will unreasonably affect fish and wildlife. The standards themselves have proven to be seriously inadequate and fishery populations have continued to decline. To further weaken these inadequate standards will cause grievous irrevocable harm and potential extinction.

Status of the Fish Populations

The populations of fish species that depend on the Delta including Chinook salmon, steelhead, sturgeon, American and threadfin shad, striped bass, and delta and longfin smelt have all declined over the past eight years that included six years of drought (2007-09; 2012-14). The latest indicators show near historic or historic low levels of abundance for all of the Delta's pelagic species. All indications are that the populations that depend on the Delta are at extreme risk of added mortality under the present winter 2015 conditions. According to the Order most of the limited production of wild winter run salmon smolts moved into the Delta during the December storms and have yet to leave to the Bay and Ocean. In addition, the spawning runs of adult delta and longfin smelt moved upstream from the Bay into the Delta during the December flow events. They have begun spawning in areas where hatched larvae are highly vulnerable to South Delta exports.

If we have learned anything from decades of relentlessly declining fisheries, it is that the present D-1641 standards, as well as the current biological opinions, are not protective of listed species or the Bay-Delta ecosystem. Given this irrefutable fact, species that are hovering on the precipice of extinction should not have to assume an additional burden of further sacrifices to benefit water exports and deliveries. Any "balancing" of the public trust or beneficial uses must take the present jeopardy of these fisheries into consideration.

Over the last several years, CSPA has appeared before the State Water Board on a number of occasions and described the consequences of weakening already inadequate standards protecting fisheries and water quality. Unfortunately, our predictions came true. In August 2013, we prepared a report that documented the adverse impacts to Delta smelt from the Board's relaxation of standards (Attachment 1, *Summer of 2013*). Again, in October 2014, we prepared a

report chronicling the impacts from the relaxation of standards on Delta smelt (Attachment 2, *Summer of 2014*). As we predicted, the population abundance of Delta smelt, as well as all pelagic species, again declined (Attachment 3, Fall Midwater Trawl 2014 Annual Fish Abundance Summary). In January 2015, the California Department of Fish and Wildlife's initial Spring Kodiak Trawl revealed that abundance of spawning Delta smelt had declined 84% from the last year's abysmal low.[8] With Delta smelt abundances at a historical low, the State Water Board inexplicably proposes to again relax critical standards established to protect these species in drought conditions. We further advised the Board in 2014 that efforts to reserve cold water in Shasta Reservoir to protect fisheries would come to naught if the reservoir was drained to provide water to CVP contractors. That too came to pass, as deliveries to Sacramento River contractors depleted the reservoir leaving insufficient water to maintain temperatures and protect spawning beds (Attachment 4, Demise of Winter Run in Summer 2014). Consequently, Winter-run salmon losses approached 95%.

Winter 2015 Risk Factors

Following a respite from drought in a wet December, there was record low January precipitation that brought back drought conditions to the Central Valley and the Bay-Delta. With limited restrictions in the Delta Standards for January[9], moderate exports brought salvage events at the south Delta fish facilities of winter run Chinook salmon smolts and adult delta smelt. Surveys indicate that most of the 2014-year class of winter-run salmon have yet to move out of the Delta on their emigration from the Sacramento River to the Bay and Ocean. Early warning trawl surveys in January indicate the presence of adult longfin and delta smelt in the lower San Joaquin River near Jersey Point and Prisoners Point, a sign that the smelt may likely spawn in the Central and South Delta where newly hatched larvae will be highly vulnerable to South Delta exports. The January Larval Smelt Survey indicates recently hatched longfin smelt larvae are concentrating in the low salinity zone in the Western Delta[10]. Gages measuring salinity indicate that as Delta outflow has fallen in January, the low salinity zone has moved upstream into the central Delta. With each high tide, large amounts of the low salinity zone water are "pumped" into Franks Tract and Old River where water and planktonic fish like the smelt are likely to be entrained into the flow to the south Delta export pumps. Little remains of the fresh water in the Delta left over from the December storms. This pool of fresh water has been diverted from the Delta by high January exports. Any benefits to Delta conditions accruing from the February storms will likely dissipate if not followed by subsequent rain events. No one really believed the Delta needed protection in January when D-1641 standards were originally being developed in 1995. What has happened this January is already a demonstration that this lack of concern was a grave mistake.

The Smelt Working Group has met weekly in January and has carefully documented these risks and what may be in store for the fish[11]. Each week, it indicates that "some of its members" are worried, but the conclusion is often "*distribution information does not indicate advice is*

[8] http://www.dfg.ca.gov/delta/projects.asp?ProjectID=SKT
[9] 4500 cfs minimum Delta outflow; export allowed up to 65% of Delta inflow.
[10] http://www.dfg.ca.gov/delta/data/sls/CPUE_Map.asp
[11] http://www.fws.gov/sfbaydelta/cvp-swp/smelt_working_group.cfm

warranted". We believe the level of concern is greater than expressed, and recommend that the Board hear from individual members of the Smelt Working Group at the upcoming workshop.

In early February of this year, 600,000 hatchery winter-run Chinook juveniles were released from the Livingston Stone fish hatchery into the Sacramento River near Redding. Although flows downstream at Bend Bridge reached 50,000 cfs on February 7 and was as high as 20,000 cfs two days later, the pulse downstream of Keswick was less than 5000 cfs, and was back to a the minimum release of just of 3000 in two days. Salmon and steelhead immediately downstream of valley rim dams, the major spawning areas on regulated rivers, receive no direct flow benefit from storms when reservoirs are storing all inflow possible. The absence of designed flow releases from Sacramento Valley rim dams timed to take advantage of the natural flow increases due to accretion further downstream leaves salmonids without benefit from natural events. In the Sacramento system, this can be partially mitigated by trucking hatchery fish downstream to points where tributary inflow is substantial.

In the San Joaquin system, there is little significant tributary inflow downstream of rim dams; peak flow at Vernalis increased to just over 1260 cfs after on February 10 while flows at in the Sacramento were over 30,000 cfs. More extensive transport of salmon juveniles from the Merced River Fish Hatchery and the upper San Joaquin program to Suisun or San Pablo bays may be needed this year, and capture of wild fish may need to be considered.[12] Delta pumping during outmigration of the remaining San Joaquin system salmon will be particularly harmful this year, particularly if pulses are exported, as they were in 2014.

In fact, exporting storm-fed pulse flows have already been permitted twice this winter, once in early December and once in early February, to the detriment of Delta smelt and Winter-run and Spring-run salmon. Each of these events had major consequences to the Delta and its low salinity zone. The two storm events brought considerable freshwater inflow to the West Delta at Jersey Point. However, the salinity response at Jersey Point lagged and salinity actually increased slightly on he ascending limb of the flow pulse. The reason is that, on the ascending limb of the flow pulse, a precipitous increase in exports drew water from the West and Central Delta. The low salinity zone, which had been located between Antioch and Jersey Point on the lower San Joaquin River was drawn eastward (upstream) into Old River. Flow across the Northern to the Central Delta is limited because the Delta Cross Channel is closed during winter to protect Sacramento River salmon from being diverted into the Central Delta. There was a lag in salinity response to the increased freshwater flows. The expected EC response at Collinsville didn't show up until 10 February, several days after the storm pulse reached Freeport. Unfortunately, Delta exports were allowed to increase prior to the flushing of the low salinity zone west of the Delta. Increases in Delta exports following storm events should not be allowed until storm pulses have pushed the low salinity zone into the West Delta.

D-1641 Delta Outflow Standards Do Not Comport With Actual Measured Outflow

The Net Delta Outflow Index (NDOI) relied upon by the State Water Board in establishing outflow standards protecting fish is based upon flawed calculations and is significantly different that the measured outflow at United States Geological Survey (USGS) gages that record

[12] Escapement to the Merced and Tuolumne rivers in 2014 was in the hundreds; to the Stanislaus less than 3000.

cumulative Delta outflow (Attachment 4, *Delta Smelt on the Scaffold*, pp. 3-7). At times, particularly during periods of low flow, this discrepancy is substantial. For example, during May 2014, the NDOI calculated Delta outflow at 3,805 cfs while the measured outflow as a minus 45 cfs. The agencies have long known that the NDOI does not reflect actual outflow.[13] Relaxing standards and reducing Delta outflow requirements to levels that are likely to result in negative outflow will lead to unreasonable and potentially irreversible affects upon fisheries and cannot serve the public interest. The State Water Board must develop Delta outflow standards that accurately reflect actual Delta outflow.

Continuing Violations of Interior Delta Salinity Standards are Ignored in the Order

The Order is strangely silent regarding the chronic violations of D-1641 interior Delta salinity standards. For example, between 13 January and 11 February 2015, salinity continually exceeded the salinity standard of 1.0 mmhos/cm at Brandt Bridge and Old River Near Tracy. There were frequent violations of standards at Vernalis and Old River Near Middle River. DWR and the Bureau are under a Cease & Desist Order issued by the State Water Board that requires notification of exceedences and a description of measures that are being taken to alleviate violations. However, the relaxation of flow requirements requested in the TUCP and provided in the Order will only exacerbate salinity levels and increase violations. As the temporary increase in streamflow from recent rains subsides, salinity concentrations are likely to significantly increase. Salinity standards protect numerous beneficial uses including agriculture and aquatic life, and simply ignoring these long-established standards is contrary to law, cannot be in the public interest, and represents an unreasonable adverse impact to fisheries and Delta agriculture.

Chronic Relaxation of Promulgated Standards Because Water Agencies Refuse to Pursue Reasonable Measures to Address Drought Emergencies that Occur 40% of the Time Cannot be in the Public Interest

The State Water Board has now relaxed Bay-Delta standards established to protect fisheries and water quality in each of he last three years. In March 2014, CSPA chronicled the habitual pattern of mismanagement by the state and federal water project operators at a Board workshop (Attachment 4, *CSPA Presentation*). We pointed out that California experiences drought conditions 40% of the time, yet the state and federal projects continue to operate and deliver water as if there is no tomorrow. The projects draw down reservoir storage under the assumption that the coming year will be wet, providing little reserve storage in the event the following year is dry. In the event of another dry year, they endeavor to maximize deliveries in the hope that it will rain next year. This pattern has repeated itself for decades, most recently during the 2007-2000 and 2013-2015 droughts. Project operators have refused to adjust to the state's Mediterranean climate and over-subscribed water delivery system. They count on the Board to bail them out by relaxing standards and reducing water flows crucial to healthy and reproducible fisheries. And the Board has obliged the projects by relaxing standards thereby encouraging them to continue to operate on the edge of crisis while fisheries, hanging on the lip of extinction, pay the price.

[13] http://www.water.ca.gov/dayflow/docs/2014_comments.pdf

The Bay-Delta ecosystem is a national treasure similar to the Everglades, Chesapeake Bay, Great Lakes or Puget Sound. It is a public trust resource – a property right - owned by all of the citizens of the state and nation. Since the State Water Project became operational, population abundances of the estuary's native pelagic and salmonid fisheries and associated lower trophic orders have declined by one to two magnitude. Listed Delta smelt abundance has plunged to historic lows each of the last two years. The continuing collapse of fisheries is a continuing indictment of the Board and fishery agencies to fulfill their public trust mandates. Yet, the State Water Board has again relaxed minimal standards developed for drought conditions even as Sacramento Valley rainfall is near or above normal and Sacramento Valley Reservoirs contain more than a million acre-feet more water than they did last year.

It cannot serve the public interest to sacrifice species that evolved over millennia in one of the great natural ecosystems on the planet simply to provide a marginal increase in water delivery to projects that have repeatedly refused to adjust an over-subscribed water delivery system to the reality of available water supply. It cannot serve the public interest to continue to encourage water project operators to take reckless risks under the assumption that the Board can be counted upon to waive standards and bail them out from the consequences of their mismanagement. It cannot serve the public interest to choose almonds over salmon and exports to junior water rights holders over sustainable Delta agriculture.

The TUCP and the Responding Order are Contrary to Law

While the State Water Board has been granted water quality permitting authority pursuant to the federal Clean Water Act, establishment and modification of water quality criteria must be approved the U.S. EPA. The Board has said on several occasions that it does not necessarily agree with this requirement but petitioners believe the Board to be in error and a failure to seek approval for the present waiver of standards would represent a serious violation of the Clean Water Act. In any case, the Order violates the federally promulgated Estuarine Habitat Criteria for the Bay/Delta estuary at CFR 131.37.[14] This federal criteria requires that salinity shall not exceed 2640 micromhos/cm specific conductance at 25 degrees Centigrade (measured as a 14-day moving average) at the confluence of the Sacramento and San Joaquin Rivers at specific locations near Roe and Chipps Islands for a specified number of days each month between 1 February and 20 June depending on the 8-River Index. Specifically, for February, the 2650 micromhos/cm standard at Chipps Island must be maintained throughout the month under all historical 8-River Index values for January. Other federal criteria include Stripped Bass spawning criteria between 1 April and 31 May and Suisun marsh criteria. The Board has consistently ignored these federally issued criteria and we believe failure to enforce these criteria has contributed to plummeting fish populations.

For all of the reasons herein, we believe the evidence would show that the proposed TUCP, and the Order to the degree that it grants the measures requested in the TUCP, violate state and federal laws, including but not limited to:

The California public trust case law;

[14] http://www.ecfr.gov/cgi-bin/text-idx?node=pt40.22.131&rgn=div5#se40.22.131_137

Article 10, Section 2 of the California Constitution;
The California Water Code;
SWRCB D-1641;
SWRCB D-990;
The California Endangered Species Act;
Section 5937 of the California Fish and Game Code;
Section 7 of the Federal Endangered Species Act;
The Federal Clean Water Act;
The Federal CVPIA doubling standard for salmon and steelhead; and
The Governor's 2014 Declaration of Drought Emergency.

As the Board knows from previous drought proceedings, petitioners believe the overwhelming evidence of violation of these statutes by the Bureau and DWR is arbitrary and capricious, and the Board's refusal to hold evidentiary hearings violates our due process rights under both the state and federal constitutions.

Specific Comments on the Responding Order

We present below a point-by-point response to sections of the Order Approving in Part and Denying in Part DWR and the Bureau's January 23, 2015 Temporary Urgency Change Petition.

The allowance of continued exports of 1,500 cfs when outflows are below 7,100 cfs and exports up to D-1641 limits when outflows of 7,100 cfs are maintained (but not additional Table 4 requirements) was made to mitigate to some extent the significant water supply reductions to municipal, industrial, and agricultural water users that are likely to occur due to the drought. The water supply considerations discussed above are considered urgent due to the significant impacts to water supplies that occurred last year and the associated severe economic impacts in some communities, especially given that foregone opportunities to conserve storage for later use cannot be regained. (Order, p. 16)

Comment: We recognize the urgency, but the urgency for the fish is just as important and needs to be discussed on an equal level by the Board. The water that would be delivered or temporarily stored pursuant to TUCP, while needed for other beneficial uses, but it is absolutely essential for the survival of fish and other Bay-Delta public trust resources.

As discussed above, dry conditions during this winter are expected to adversely affect spawning and rearing conditions for delta smelt and longfin smelt, and migration conditions for winter-run Chinook salmon, spring-run Chinook salmon, steelhead trout, and North American green sturgeon. While maintaining the D-1641 Delta outflows and San Joaquin River flow requirements would provide some short term benefits to these species, the overriding effects of the drought would persist. (Order, p. 17)

Comment: We disagree that the benefits of maintaining standards are "short term benefits;" failure to survive is not a short-term issue. Relaxing standards would add further to the burden on fish by taking away what little is left of the freshwater essential to the Bay-Delta Estuary. The effects of drought were greatly exacerbated in January when the Low Salinity Zone was

pulled upstream into the Delta because of a combination of high volume January exports and inflow diminishing to very low levels.[15] This already created a prolonged period of high mortality. The augmented exports requested in the TUCP (though so far denied in the Order) would allow a repeat of these conditions, which are not allowed in February and March under D-1641.

With respect to the DCC Gates, the Petitioners propose to open the gates as necessary to reduce intrusion of high salinity water into the Delta while preserving limited storage in upstream reservoirs and reducing impacts to migrating Chinook salmon through use of the DCC Gate triggers and consultation with the RTDOMT. The principal benefit of opening the DCC Gates in February and March is to move more fresh water to the interior Delta, using less storage releases than would be needed to achieve the same salinity with the gates closed. This freshening of the Delta will maintain water quality at the CVP and SWP export pumps and the intakes of Contra Costa Water District that are needed for the protection of public health and safety. (Order, p.18)

Comment: The reality is that opening the DCC gates as requested would not save reservoir storage, but would be required to enable higher exports without at the same time pulling saltwater into the West Delta. Higher storage releases would be necessary to control salinity intrusion with the higher exports requested in the TUCP. Maintaining minimum exports will alleviate the need to open the DCC.

With the DCC Gates open, there is potential for decreased survival of Sacramento River-origin species as they move through the central Delta. Potential hazards include increased entrainment, predation, and salvage. These impacts will be reduced by implementing the DCC Gate closure criteria proposed in the TUCP. Further, the tradeoff with maintaining upstream storage will also reduce impacts to other uses as discussed above. The State Water Board concludes that the potential for impairment to instream beneficial uses from this temporary change is not unreasonable considering the potential impacts to agricultural and municipal water supplies and potentially fish and wildlife that could occur if the temporary change is not approved. (Order, p. 18)

Comment: The impacts of DCC gate opening will not be mitigated by implementing gate closure criteria (e.g., temporary gate openings and the following closures). Fish that have already moved through the gates will be trapped in the interior Delta. Monitoring is insufficient to assess any real risks to the populations from DCC openings. Sudden opening and closure of the gates causes large scale shifts in Delta hydrodynamics that affect fish survival and migration success.

With respect to the export limits, as stated in the TUCP and discussed above, unlike Water Year 2014, winter-run Chinook salmon and delta smelt are currently at an elevated risk of entrainment impacts due to their spatial distribution, abundance, and productivity, as well as

[15] Standards for February and March call for the LSZ to be centered around Collinsville in eastern Suisun Bay and not upstream in the Delta.
http://cdec.water.ca.gov/jspplot/jspPlotServlet.jsp?sensor_no=8873&end=02%2F09%2F2015+10%3A52&geom=huge&interval=120&cookies=cdec01

predicted storm events later in the week. Spring-run Chinook and steelhead are also predicted to have an increased risk of entrainment in the south Delta as their migration increases through February and March. Given this heightened concern, this Order does not approve the requested interim pumping level of 3,500 cfs when NDOI is at least 5,500 cfs. This Order does allow for exports of 1,500 cfs when NDOI is at least 4,000 cfs, regardless of whether the DCC Gates are open. This Order also allows for exports of natural and abandoned flows above Flow and salinity objectives in the Bay-Delta Plan and D-1641 were developed based on historic hydrologic conditions. Provisions for the extreme dry conditions currently being experienced were therefore not considered in either the Bay-Delta Plan or D-1641. (Order, p. 18)

Comment: The situations for fish are surprisingly similar between winters 2014 and 2015. We appreciate the Board's greater awareness of these conditions following what happened in 2014. We are astounded that the fisheries agencies do not appear to share the Board's "heightened concern." Despite last year's lessons, NMFS appears to believe that the TUCP will conserve Shasta storage. The 2014-year class of winter-run and spring-run was lost because of storage releases for water supply and not for releases to maintain Delta standards. A real benefit to winter-run would accrue from keeping exports to a minimum and not dropping outflow to 4000 cfs; thus enabling more winter-run to the Bay and Ocean. Finally, there is nothing in any record that supports the contention by Executive Director Howard, made in a workshop last year and now repeated in the Order, that provisions for extreme conditions were not considered in the Bay-Delta Plan or D-1641.

These approvals are consistent with export levels approved in 2014, which balanced water supply needs with the need to protect of fish and wildlife. While there may be impacts to fish and wildlife from entrainment and associated effects associated with the approved export levels, these changes are reasonable given the extremely limited water supply conditions that water supply contractors and wildlife refuges are likely to face this year and the prolonged depletions of groundwater resources that have occurred associated with the drought. (Order, p. 19)

Comment: The "approvals" and "changes" are not balanced. They are one-sided, even when unchanged from 2014 or D-1641. The fish and the Bay-Delta ecosystem are again being asked to bear the burden of drought with little consideration or benefit in order to add a very small increment of water for water supply (less than the amount of added water stored in Shasta in one day from the recent storms). These changes are not "reasonable." Allocating some of the added Shasta storage for fish would be reasonable**.**

With respect to the interim export level, there is not currently adequate information to indicate that this export level is reasonable given the current status of species and their distribution in the Delta and the potential additional risk of entrainment from the interim pumping level on various species, especially given the precipitation events that are projected this week, which may increase turbidity and associated entrainment risks as discussed above and in the Biological Reviews. While the TUCP and Biological Reviews state that additional monitoring will be conducted to evaluate this issue, it is not clear if that monitoring would be adequate to avoid entrainment impacts given the concerns with the accuracy of entrainment estimates due to the extensive amount of water hyacinth in the vicinity of the export facilities, especially for eggs and larvae. Further, the water supply tradeoffs are not clear given the unknown water contract

allocations that will occur this year. This matter will be further discussed at the Board's workshop on February 18, 2015. If adequate information is developed to determine that the interim pumping level could be allowed in a way that would not have unreasonable impacts on fish and wildlife, this Order may be amended to allow for the interim pumping level. (Order, p. 19)

Comment: The export levels of 2500-3500 cfs to date in February and the export of 4000-6000 cfs in January were entirely "unreasonable" given current conditions. Not only is monitoring "unclear" but it is also after–the-fact. As to "adequate information," we present what we believe is adequate in our attachments to these comments. We fear that the Board will receive a chorus of arguments and counter-arguments at the workshop on subjects that have been argued in many forums over the past several decades to no avail. There is no "adequate information" that will change the consequences of last year's actions and the fisheries disasters of the last twenty years: the listed species and many other species are at record lows even under full D-1641 protections. Now is not the time to reduce even these minimal protections.

Based on the above, the State Water Board concludes that the potential for impairment to instream beneficial uses from the approved temporary changes is not unreasonable considering the impacts to agricultural, municipal and wildlife refuge supplies or fish and wildlife that could occur if the temporary changes are not approved. (Order, p. 19).

Comment: We disagree with the conclusion that the approved changes are "not unreasonable". The impacts to fish of reduced outflow and opening the DCC gates is not a reasonable burden to place on the fish populations and the Bay-Delta ecosystem. On the contrary, further actions are necessary to protect these public trust resources.

The population of delta smelt, which is listed as threatened under both ESA and CESA, has reached record low numbers, as measured by the Fall Midwater Trawl (FMWT), which began in 1967, and the first survey of the Spring Kodiak Trawl (SKT). (Order, p. 9)

Comment: The Board recognizes that the FMWT 2014 index of delta smelt is at a record low, as is the catch level in the January 2015 SKT survey. Equally relevant are the record low index from 2014 Summer Townet Survey and previous record low indices from these surveys from the 2007-2009 and 2012-2013 drought years.

Further, according to the Biological Reviews submitted with the TUCP, monitoring has not detected any delta smelt in the Cache Slough and Liberty Island complex, a location that in previous years has been considered a spatial refuge for delta smelt, especially from the effects of entrainment and the Project pumping facilities. According to the Biological Reviews, this has shifted the centroid of the delta smelt population distribution south and closer to the Project export facilities, making the condition of and risks to the delta smelt in the lower Sacramento River and San Joaquin River of greater importance to the overall status of the species. (Order, p. 9)

Comment: Adult delta smelt were found in the north Delta in the Ship Channel. Since the January SKT survey, "early warning monitoring" with Kodiak trawls has only occurred in the

Lower San Joaquin River from Jersey Point and Prisoners Point, with adult delta smelt collected at both locations, thus indicating the potential for substantial smelt spawning in the Central and South Delta. Regardless, larval smelt spawned in north Delta remain vulnerable to south Delta exports via Three Mile Slough and False River.

Storm events in December are thought to have stimulated a pre-spawning migration of delta smelt that has expanded the population west and east of its centroid, which led to increased entrainment at Project facilities this water year that was not observed last water year. Further, delta smelt captured in trawl surveys during 2014 were reported to have been in relatively poor condition and of smaller size than in previous years, which indicates a potential for lower fecundity and survival of offspring in 2015. (Order, p. 9)

Comment: Spawning in the central Delta, subsequent poor condition, and smaller size are just some of the risk factors facing the fish during drought conditions. Contributing to such risk by reducing outflow and allowing exports is not reasonable.

Because of elevated water temperatures from the drought and the pre-spawn migration that has occurred, an early spawning event is expected this year, which will expose both adult delta smelt and eggs to the changes considered under the TUCP. (Order, p. 9)

Comment: This is equally true for larval and juvenile smelt.

The Smelt Working Group (SWG) expects that delta smelt will remain in the central and south Delta in preparation for spawning as long as conditions remain turbid during February and March (SWG notes, January 5, 2015). (Order, p. 9)

Comment: Adult smelt will spawn upstream of the Low Salinity Zone in freshwater. Exports (pulling freshwater from the north Delta toward the south Delta export pumps), opening the DCC, and the salinity barriers under consideration will if allowed freshen the central and south Delta, stimulating spawning in these extremely dangerous locations.

Continued minimal reservoir releases proposed in the TUCP are expected to cause the centroid of the delta smelt population to shift inland, exposing a greater proportion of the population to entrainment if the distribution does not shift back into the Sacramento River in response to lower outflow and higher water transparency. Potential impacts from entrainment are expected to be higher in February than March because more delta smelt will be spawning in February than in March. (Order, p. 9)

Comment: January and February exports, not minimal reservoir releases, have moved the Low Salinity Zone upstream into the Delta. The pool of freshwater from the December storms has been removed by exports. It will take time for the new storm water to flush the Delta again, although increased exports will now limit such flushing[16], because exports are allowed based on

[16] Exports as of February 11, 2015 are greater than 6000 cfs. http://cdec.water.ca.gov/jspplot/jspPlotServlet.jsp?sensor_no=8873&end=02%2F09%2F2015+10%3A52&geom=huge&interval=120&cookies=cdec01

inflow, not on real outflow, X2, or EC at Collinsville, Emmaton, or Jersey Point. Entrainment risks to delta smelt will be high into the summer.

According to the Biological Reviews, with the DCC Gates closed it is expected that adult delta smelt entrainment will be low if NDOI is between 4,000 cfs and 5,500 cfs and pumping remains at 1500 cfs. However, under turbid conditions, if pumping increases on the ascending limb of the hydrograph in response to increased NDOI between 5,500 and 7,100 cfs, model results indicate that if delta smelt are east of Franks Tract, upward of 70 percent of adults are at risk of entrainment. **(**Order, p. 10)

Comment: Any adult or juvenile smelt unlucky enough to find itself in Frank's Tract or other areas of the central and south Delta will likely not survive.

However, according to the Biological Reviews, the December and January SKT surveys showed that the majority of Delta smelt were distributed around Decker Island and the confluence of the Sacramento and San Joaquin Rivers. (Order, p. 10)

Comment: Delta outflow was near 15,000 cfs or higher during these surveys. Saltwater subsequently intruded upstream of these areas as outflows fell to 5000 cfs or below by mid–January, when adult smelt were detected at Prisoners Point well upstream in the central Delta.

As such the Biological Reviews conclude that adult delta smelt would only be expected to shift their distribution towards the south Delta if another rain event occurs and turbidity is dispersed again into the southern Delta. The Biological Reviews conclude that as long as the proposed operations do not draw delta smelt into the San Joaquin River in the vicinity of Prisoner's Point, it is unlikely that delta smelt distribution will change in a way that increases their entrainment risk. The Biological Reviews call for continued monitoring and evaluation to inform real-time operations. As discussed above, rain events are expected later this week that may increase turbidity in the Delta. (Order, p. 10)

Comment: With outflow at 7000 cfs and exports at 2500 cfs, any increase in Delta inflow unless very substantial would be exported, since the limit is 45% of Delta inflow. If inflow increases to 15,000 cfs from the present 10,000 cfs, exports would increase to 6750 cfs, while outflow would increase to only 8250 cfs. Such conditions in February would be dire for delta smelt, longfin smelt, and Chinook salmon, as they were in December and early January. A strengthening of D-1641 standards is needed to protect fish; relaxation of the existing protections will make things worse.

Longfin smelt, which is listed as threatened under CESA and is a candidate for listing as threatened or endangered under ESA, experienced its second lowest FMWT index in 2014. According to the Biological Reviews, reductions in flows associated with the TUCP are expected to shift the centroid of the longfin smelt population inland, which will expose a greater proportion of the adult population to entrainment at the Project facilities. The primary concern for entrainment however is for larval and juvenile longfin smelt. Based on the current longfin smelt distributions, a reduction in outflows is expected to result in an elevated risk of entrainment of larvals and juveniles during February and March.

Comment: The same risks occur for delta smelt larvae and juveniles in February and March, but were not mentioned in the section of the Order that discusses delta smelt.

The strong and consistent relationship between outflows and survival of juvenile to age-1 longfin smelt, also supports the conclusion that reductions in outflows this year will reduce the survival of these fish (Jassby et al. 1995, Kimmerer 2002, McNally et al. 2010). However, detection of larval longfin smelt in the Cache Slough Complex and the current distribution of adults indicate that the larval population is likely to be widely dispersed during February and March. (Order, p. 10)

Comment: the first Larval Smelt Survey (early January) shows larval longfin smelt were concentrated in the Low Salinity Zone in the west Delta. Subsequent reductions of outflow have moved this zone into the central Delta, where longfin larvae are at high risk of entrainment due to export operations.

Therefore, operations are not expected to affect the species population as heavily as may be the case with delta smelt unless a greater percentage of the population migrates into the lower San Joaquin River. (Order, p. 10)

Comment: Significant numbers of longfin smelt larvae were already identified in the January Larval Smelt Survey in the Lower San Joaquin River portion of the western Delta.

The Biological Reviews conclude that entrainment risk of adult longfin smelt is likely to be low unless their distribution narrows and shifts further into the interior and south Delta, which may occur as a result of the expected precipitation. (Order, p. 10)

Comment: This risk factor was already apparent in late January and early February. Expected precipitation and associated higher exports will only worsen the risk.

The endangered winter-run Chinook salmon is of particular concern during dry years. Winter-run inhabit the upper reaches of the Sacramento River below Keswick Dam and are entirely dependent on adequate temperature and flow conditions below the dam for their survival. Despite temperature modeling that indicated that temperatures could be maintained below 56 degrees throughout the 2014 temperature control season immediately below the dam under the conditions that existed last year, temperature control was lost several weeks before the end of the egg incubation life stage last year. As a result, the 2014 winter-run brood year (BY) is estimated to have experienced 95 percent mortality. This is of particular concern given winter-run's endangered status and extremely limited distribution, reducing the resilience of this species to withstand impacts, especially during a prolonged drought. **(**Order, p. 10)

Comment: Absent substantial increase in storage levels at Lake Shasta and/or dedication of adequate storage to instream uses, conditions and risks will be no different this year.

According to the Biological Reviews, it is currently estimated that 95 percent of the surviving winter-run are in the Delta and rearing extensively in the lower Sacramento River and Delta with some fish in the south Delta waterways.

Comment: If 95% of the year class already perished, and 95% of the remaining 5% is now in the Delta, what is the possible justification for cutting outflow, opening the DCC, and (as requested) increasing exports?

The 2014 spawning run of spring-run Chinook salmon returning to the upper Sacramento River also experienced significant impacts due to drought conditions as well as from sedimentation resulting from rain events in late October through December that covered eggs leading to mortality. According to the Biological Reviews, the run was lower in four of seven locations compared to the 2013 escapement,8 with considerably lower escapement observed in the Butte Creek and Feather River Hatchery. Spring-run eggs in the Sacramento River underwent significant, and potentially complete, mortality due to high water temperature downstream of Keswick Dam starting in early September when water temperatures exceeded 56 degrees Fahrenheit. Extremely few juvenile spring-run Chinook salmon have been observed this year migrating downstream on the Sacramento River during high winter flows, when spring-run originating from the upper Sacramento River, Clear Creek, and other northern tributaries are typically observed, which presents a significant concern for the population. Based on the currently available data, the majority (80-90 percent) of yearling spring-run are estimated to be in the Delta, while less than 5 percent remain upstream of Knights Landing on the upper Sacramento River and less than 15 percent have already exited the Delta. Up to half (25-50 percent) of young of the year spring-run are estimated to be in the Delta, while 50-75 percent remain upstream, and less than 5 percent are estimated to have already exited the Delta. **(**Order, p. 11)

Comment: The Delta is an important rearing area. If many salmon move with the storm flows into the Delta under conditions of higher exports and negative flows at cross Delta sloughs, they will die at the pumps or on their way to the pumps. The excellent pool of fresh and low salinity water provided by the December storms is now gone. If anything, some young salmon have likely moved upstream from Suisun Bay into the Delta during January. If 100% of the Sacramento River year class of spring-run have already perished, and 50-75% of the surviving juveniles from the few remaining tributaries are now in the Delta, what is the possible justification for cutting outflow, opening the DCC, and (as requested) increasing exports?

Steelhead and green sturgeon have also likely been affected by the drought, but given the difficulty in sampling for these fish it is problematic to determine exactly how the species have been affected. Impacts to other species, including commercially important fall-run are also expected to be realized as a result of the drought. If these impacts are severe enough they could result in significant impacts to the commercial and recreational fishing industry." (Order, p. 11)

Comment: Adult and juvenile abundance of these listed species is monitored. Runs are down. Hatchery returns of steelhead are very low this year. Budgets for the hatchery programs have been decimated. Funds are needed to continue trucking hatchery fall-run smolts to the Bay; otherwise hatchery production will simply be dumped into the rivers to experience low drought

flow to and through the Delta. The prognosis for commercial and sport fishing for salmon, steelhead, sturgeon, shad, striped bass, and other Central Valley fish is indeed poor.

According to the Biological Reviews, both positive and negative effects of the TUCP are expected on salmonids and green sturgeon during February and March. The TUCP changes are expected to affect the abundance and spatial distribution of juvenile winter-run and spring-run Chinook salmon, steelhead, and green sturgeon. The modifications to outflows and DCC Gate operations may affect the spatial distribution and abundance of adult winter-run Chinook salmon and green sturgeon. Life history diversity of steelhead may be affected due to reduced survival through the San Joaquin River migration corridor. The modification of outflow, exports, and Vernalis flows may reduce survival of juvenile listed salmonids, steelhead and green sturgeon, and may modify their designated critical habitat. The modification of juvenile winter-run and spring-run Chinook salmon and steelhead survival due to changes in outflow would occur primarily in migratory corridors in the north Delta due to increased entrainment into the interior Delta. Steelhead survival may also be reduced along the mainstem of the San Joaquin River downstream of the Stanislaus River leading to increased entrainment of steelhead toward the Project pumping facilities. (Order, p. 11)

Comment: The Order correctly notes that the conservation of water in storage is essentially a water supply benefit. We see no "positive effects" to fish of the variances allowed in the Order. The lower San Joaquin River flows (from 700 cfs to 500 cfs) will cause lower tributary flows and lower survival to and through the Delta for San Joaquin salmon and steelhead.

There may be impacts from opening the DCC Gates on Sacramento River origin salmonids from straying and entrainment. However, the Biological Reviews conclude that those effects will be minimized due to compliance with the DCC Gate operations matrix which limits opening of the DCC when migrating ESA-listed salmonids are present in the lower Sacramento River region. Further, during the period the gates are open, exports are proposed to be limited to 1,500 cfs. This export limit along with the implementation of the DCC Gate Triggers Matrix is expected to minimize entrainment of existing rearing fish in the interior and south Delta. (Order, p. 12)

Comment: The Delta is a significant rearing habitat under low inflow/outflow and low exports. Opening the DCC will move more young salmon into the interior Delta to rear. They will be more likely to survive if exports are kept low. However, if the projects subsequently close the DCC and increase exports when inflows increase (usually at Freeport on the Sacramento River), the fish rearing in the interior Delta will not survive in the absence of a positive QWEST (positive San Joaquin River outflow). USFWS studies have shown very poor survival of salmon rearing in the interior Delta following closure of the DCC.

While there may be impacts from modifications to outflows, San Joaquin River flows and opening of the DCC on salmonids and other species, the Biological Reviews conclude that these effects would be offset by increased storage in Project reservoirs which will help to maintain water temperatures necessary for Chinook salmon, steelhead, and green sturgeon over the summer and fall of 2015. (Order, p. 12)

Comment: There is need for storage releases only to meet the requested higher exports that the Order does not allow. Storage releases are and can remain at the minimums required by tailwater requirements, which include spring-summer water temperature maintenance in the Sacramento River. Low storage last summer was a direct consequence of downstream export/diversion requirements for water supply, not water released to meet Delta standards. Increased storage must come from limiting exports, transfers of stored water and in-basin diversions. Trading between one and the other doesn't help. For example, last year summer water transfers via south Delta exports were exempt from Delta standards. Water released from Shasta to maintain water temperature in the Sacramento River for salmon went eventually to water contractors not the Bay. The only way to save the cold water pool in Shasta is to reduce allocations for exports to water contractors. Reducing requirements for Delta outflow provides little water, saves little or none of the coldwater pool in Shasta, and causes severe stresses to the Bay-Delta ecosystem and all the listed fish species.

The Biological Reviews conclude that without the changes to outflows, the low reservoir storage conditions are likely to result in extremely high egg mortality or even complete failure of natural BY 2015 spring-run Chinook and winter-run Chinook below Keswick Dam due to high water temperatures. Relaxation of Delta outflow requirements and San Joaquin River flow requirements, while still continuing to meet required tributary releases from Oroville, Folsom, and New Melones, is projected to enhance the opportunities for summertime cold water management across Project reservoirs in 2015." (Order, p. 12)

Comment: The D-1641 standards allow for relaxation of Delta outflow standard of 7100 cfs for February and March to conserve reservoir storage. Reducing this outflow standard in February and March will not improve Shasta reservoir storage absent subsequent reductions in water supply deliveries. So far in February, no added reservoir releases have been necessary to meet this outflow standard. However, allowing the full 45% export limit under the standard could require additional reservoir releases, which would affect Shasta storage. .

With respect to the proposed modifications to exports, the Biological Reviews find that unmeasured mortality of salmonids in the south Delta region may increase as a result of increased entrainment towards the Project facilities under the proposed intermediate export rate of 3,500 cfs when NDOI is between 5,500 and 7,100 cfs. (Order, p. 12)

Comment: The Water Board concedes that operations since mid-January of 5000 cfs exports with only 5000 cfs outflow resulted in unnecessary increased mortality of juvenile salmonids that had moved into the Delta during the December storms. Given present salmonid population levels, increased though not precisely quantifiable mortality provides ample justification to conclude that higher exports and reduced outflow results in unreasonable effects to salmon and smelt.

The Biological Reviews also find that mortality may increase due to long transit times on the San Joaquin River where exposure to degraded habitat and predaceous species is constant. The Biological Reviews conclude that under exports of 1,500 cfs with NDOI of 5,500 or less, reduced entrainment and salvage of listed species at the Project fish collection facilities adjacent to the

South Delta export facilities would be expected due to increased positive flows in the south and central Delta. (Order, pp. 12-13)

Comment: Exports of 1500 cfs would lead to "reduced entrainment and salvage" as compared to greater exports, but to increased entrainment and salvage as compared to D-1641 required outflow, because flows in the south and central Delta would continue to be negative, not "increased positive". Exports of 1500 cfs and with outflow of 4000 cfs would continue to put salmonids and other fish populations at risk in the Delta.

In determining whether the impact of the proposed changes on fish and wildlife is reasonable, the short-term impact to fish and wildlife must be weighed against the long-term impact to all beneficial uses of water, including irrigated agriculture, municipal and industrial use, use by wildlife refuges, salinity control in the Delta, and other fish and wildlife uses, if the changes are not approved. Further, the effects that have occurred to the species over several years must be considered." (Order, p. 17)

Comment: The key question that the State Water Board must address is whether the Order is reasonable. The fisheries agencies submitted concurrence letters on January 29 (NOAA) and January 30 (USFWS and DFW) indicating that the changes proposed in the TUCP are in compliance with ESA and CESA requirements; however, as the Order states, these concurrences did not address the question of whether impacts to fish and wildlife would be unreasonable. In addition, the fisheries agencies concurred with the TUCP based on the unfounded assumption that the following statement from the TUCP was true: "*While maintaining flows consistent with unmodified D-1641 outflow requirements would provide some short-term support for these species, the reduced storage concomitant with these outflows would lead to substantially worse impacts later in the year. Conversely, while a modified D-1641 which reduces outflows may decrease Delta survival of the salmonids during winter, it will conserve reservoir storage which will lead to increased cold water pool available later in the year to provide upstream fishery benefits*." (Attachment 1 of TUCP, p. 10). In 2014, D-1641 flows were reduced, but the assumed benefits of increased storage were undermined by exports and deliveries to settlement contractors. The resulting insufficient storage in Lake Shasta led to a 95% population loss of endangered winter-run salmon and a historic low for Delta smelt. Given the present population levels of both pelagic and anadromous species, increased reservoir storage must come from reduced exports and water deliveries, and not at the expense of eliminating fundamental biological requirements for fish.

Specific Comments on the January 23, 2015 TUCP

The following are CSPA's comments on details of the proposed changes and supporting rationale presented in Attachment 1 of DWR and the Bureau's January 23, 2015 Temporary Urgency Change Petition.

Comments on Proposed Changes:

1. DWR and Reclamation request a Delta outflow of 4,000 cubic feet per

second (cfs),

Comment: February and March Delta outflow requirements are provided to protect many aspects of the Delta environment not the least winter run Chinook passage through the Delta, upstream adult winter and spring run Chinook on their spawning runs, steelhead smolt emigration through the Delta, adult steelhead spawning runs, and longfin and delta smelt spawning and early rearing. One critically important function of outflow is estuary productivity including the pelagic organism food web concentrated in the Low Salinity Zone (LSZ). An outflow of 4000 cfs greatly reduces estuary productivity from San Francisco Bay into the Delta. With proposed moderate exports the LSZ will be subject to direct exports from the South Delta and general degradation by high inflows of reservoir water needed to meet the export demands. The proposed outflow of 4000 cfs is to be measured by the standard NDOI, a notoriously poor predictor of true Delta outflow, particularly at low outflow levels. Such a low and unpredictable outflow will put Delta and longfin smelt at added risk of extinction by greatly increasing their vulnerability to south Delta exports and degrading their pelagic habitat within the Delta. Such low outflows and proposed exports may cause more smelt to spawn in the central and south Delta, essentially sacrificing this production to the south Delta exports (Smelt Working Group discussions[17]). Both species are already at record low levels from three years of drought and previous TUCs. Adding this new and unprecedented combination of changes would put these species at extreme risk of extinction. Winter-run Chinook have been devastated by these same three years of drought, causing Interior to raise and release more hatchery smolts at Redding to replace lost production. Reducing smolt survival through the Delta will put the population at further unnecessary risk Last year, deliveries to water contractors diminished critically needed outflow and at the same time depleted the Shasta cold-water pool. The State Board should require that Shasta water releases first meet outflow and achievable temperature requirements and meet water delivery requirements as a benefit of meeting temperature requirements; not the other way around. Providing winter storage releases to provide higher survival for downstream migrating young winter run may be, on balance, just as important as maintaining summer water temperatures. Regardless, given the state of fisheries, both of these needs should have priority over demands for water contractors from Shasta in spring and summer.

2. *San Joaquin River at Airport Way Bridge, Vernalis river flow of 500 cfs*

Comment: Reducing the winter flow requirement of the San Joaquin from an already low level of 700 cfs to 500 cfs will simply further burden the San Joaquin salmon and steelhead populations by reducing tributary flows needed for spawning and rearing, as well as survival of smolts through the Delta. All the efforts toward salmon recovery in the San Joaquin system will simply go for naught if winter flows continue to be reduced.

3. *Modify the closure requirement of the Delta Cross Channel gates (DCC) to address Delta water quality concerns consistent with fish protections necessary as determined by the RTDOT,*

Comment: Allowing the opening of the DCC during February and March to reduce salinity levels in the South Delta will simply allow higher export levels while increasing the probability

[17] http://www.fws.gov/sfbaydelta/cvp-swp/smelt_working_group.cfm

that emigrating winter and spring run Chinook salmon and steelhead will be diverted into the Central and South Delta to die. These fish will not be able to complete their emigration as they will succumb to the many forms of mortality in the Delta including loss to the export pumps. The closure of the DCC in winter has long been a key element of the salmon and steelhead recovery plans as well as being an essential element of the historic 1995 Delta Agreement and D-1641 Standards.

4. *Allow higher export rate that reflects an appropriate balance between competing beneficial needs in light of the drought.*

Comment: The existing requirement that no more than 35% of Delta inflow may be exported from the Delta in February and March is a key provision of D-1641. A January limit of 65% has devastated the Delta in many dry years, showing clearly that not including January in the 35% criteria was a mistake. D-1641 already allows the standard to be increased to 45% in droughts. Allowing the exports to reach 50% or higher of total Delta inflow puts all the listed species at further increased risk and would further degrade the pelagic organism habitat of the LSZ and other zones of the estuary. Not only does it encourage higher exports, but it also releases of what little reservoir storage that remains upstream, because higher allowed exports would increase demands on Shasta reservoir storage by water contractors south of the Delta.

Comments on Supporting Rationale

"These changes will allow management of reservoir releases on a pattern that will conserve upstream storage for fish and wildlife protection and Delta salinity control while allowing for critical water supply needs exports." (Attachment 1, p. 1)

Comment: The proposed changes will increase Central Valley reservoir releases and Delta exports, while devastating already stressed Central Valley and Bay-Delta ecosystems and populations of listed fish species.

"As set forth in the 2015 DCP, critical operational considerations for these and other changes includes providing essential human health and safety needs to CVP and SWP service areas throughout 2015 and 2016 if drought conditions continue, reducing critical economic losses to agriculture, municipal and industrial uses, maintaining protections for endangered species and other fish and wildlife resources, providing water for state, federal and privately managed wetlands, and maximizing operational flexibility within existing law and regulations. These critical operational considerations are detailed further in the 2015 DCP." (Attachment 1, p. 2)

Comment: Early last year the Board determined that "essential health and safety needs" could be met by exports less than 1500 cfs. The TUCP levels would be well above these levels to provide more water for water contractors during the present drought. Continuing such higher exports will put the future availability of water for health and safety exports at risk. The proposed changes will not maintain protections for endangered species and other fish and wildlife resources. Higher exports and demands on reservoir storage will put all of the Central Valley fish and wildlife at greater risk.

"Upstream Reservoirs: Upstream reservoirs will be operated through the winter and spring to preserve and build storage. Upstream reservoir storage, while improved from end of September 2014 storage, remains extremely low in the early part of WY 2015. Reclamation and DWR will be trying to develop cold water resources in the winter and spring in those reservoirs where temperature management is needed later in the year. This may include working with the Sacramento River Settlement Contractors to shift early spring demand later into the year to conserve water in Shasta Reservoir, if warranted." (Attachment 1, p. 5)

Comment: The TUCP changes will increase demands on reservoirs, reducing "cold water resources" in Shasta and Folsom reservoirs. Shifting demands of Settlement Contractors will make more water available for planned summer water transfers that increase risks to smelt as well as winter run salmon in summer.

Water Supply: Throughout dry conditions, CVP and SWP systems will be operated to lessen critical economic losses to agricultural, municipal, and industrial uses due to water shortages through project water deliveries and by facilitating voluntary water transfers and exchanges to the extent possible, while balancing the needs of upstream storage, fishery and wildlife resource protection, and operational flexibility. A key to minimizing water supply shortages for economic purposes will be to take advantage of opportunities to export natural or abandoned flow in the winter and spring while maintaining Delta water quality and minimizing adverse effects to listed fish. Release of stored water in summer and fall will be managed to concurrently benefit in-stream temperature objectives, wildlife objectives, meet Sacramento Valley in-basin needs, and preserve carry over storage to meet objectives in WY 2016. (Attachment 1, p. 5)

Comment: The existing standards have already "balanced" needs while providing far from needed resource protections over the past 20 years. The TUCP asks to remove what little protections exist. Taking advantage of "opportunities to export natural or abandoned flow" is an ominous statement of the true intent of the TUCP. There are no natural or abandoned flows into, through and out of the Delta, only those that have been painstakingly negotiated over the past several decades. These conditions are termed "in balance". Removing these protections will permanently setback recovery of Delta and Central Valley river systems and their protected resources.

D-1641 Related Actions: Reclamation and DWR may seek adjustments under D-1641, including: (1) triggers for modified X2 criteria to balance upstream storage and fish protection, (2) triggers for moving Western Delta Ag compliance point (i.e., Emmaton to Three-Mile Slough), (3) San Joaquin flows at Vernalis, (4) Rio Vista flow requirements, and (5) Net Delta Outflow requirements. Additionally, Reclamation and DWR may exercise the flexibility provided in D-1641 to adjust the E/I ratio's averaging period for sporadic storm events (similar to 2014). (Attachment 1, p. 6)

Comment: This is an ominous statement suggesting the further removal of limited protections from D-1641 in upcoming TUCPs. We will specifically address any such requests when they are formally proposed.

Preferential Pumping: The projects will consider a facility shift in exports in April and

May so that minimal pumping will occur at the SWP's Banks Pumping Plant and the majority will occur at the CVP's Jones Pumping Plant. This export shift will increase survival of salmonids through these facilities, since fewer fish will enter the SWP, where loss is higher due to substantial pre-screen mortality associated with Clifton Court Forebay. Combined exports would remain the same. The amount of shifted pumping from Banks to Jones would be made available to the SWP. (Attachment 1, p. 6)

Comment: In January the projects did the opposite: they shifted exports to Banks to reduce the salvage count of smelt as it approached its federal BO take limit. Banks "takes" less smelt because smelt do not make it through Clifton Court Forebay to be salvaged and counted as take. Exports from Banks are far worse because water is taken directly from the north and west Delta via the central Delta, thus having greater probability of involving salmon and smelt and the LSZ. Loss of salmon and smelt in Clifton Court Forebay prior to the fish salvage facilities is 70-90% or higher. Therefore, focusing exports at Banks not only limits the total take count, but also has a greater effect on smelt and their critical habitat. However, there is considerable evidence that "take" at the federal facility is underreported, and this should also be addressed.

Temporary Emergency Drought Barriers: If hydrologic forecasts show there will be insufficient water in upstream reservoirs to repel the saltwater and meet health and safety and other critical needs, then installation of Emergency Drought Barriers will be considered to lessen water quality impacts. Excessive salinity increases in the Delta could render the water undrinkable for 25 million Californians and unusable by farms reliant upon this source. Temporary rock (rip-rap) Emergency Drought Barriers may be installed at up to three locations in the Delta during drought conditions in 2015, or in a subsequent year if necessary, to manage salinity in the Delta when there is not enough water in upstream reservoirs to release to rivers to repel the saltwater. Consultation on installation and operation of the barriers will be conducted on the barriers prior to installation and may require additional adjustments to D-1641. (Attachment 1, p. 6)

Comment: Again, an ominous statement for the future, which bears some immediate response. Drought barriers on Sutter and Steamboat Slough would degrade over 30 miles of designated critical habitat for endangered species (salmon, smelt, sturgeon, and steelhead) in Sutter, Steamboat, Cache, and Miners sloughs by making the sloughs "dead-end" with little or no flow, more invasive aquatic plants, warmer water temperatures, and lower concentrations of dissolved oxygen. At present, the sloughs pass over 20 percent of the Sacramento River inflow to the Delta, more than 1000 cfs in each channel. Blocking these channels will force this flow down the main Sacramento channel into the interior Delta. With the DCC open (as proposed in the TUCP), more of the inflow will flow into the central Delta and be available for exports. Higher exports could then be achieved without higher inflows (reservoir releases). Simply put, the projects would export more water than presently available for the same reservoir releases. That water will come from reduced Delta outflow (also proposed in TUCP). In addition, less fresh water would enter the 30+ miles of sloughs and mixes into the critical habitats of the lower Yolo Bypass (Cache Slough, Liberty Island, and Ship Channel). The third barrier on False River would do the same: higher exports could be achieved with the same Delta inflow, because salinity from False River would no longer enter Old River and the south Delta on incoming tides.

Hatchery Operations: Livingston Stone National Fish Hatchery (LSNFH) managers will coordinate with Delta Operations for Salmonids and Sturgeon (DOSS) to time the hatchery release of winter-run Chinook salmon to coincide with favorable hydrologic conditions, and to track their movement down the Sacramento River into and through the Delta utilizing acoustically-tagged winter-run Chinook salmon released at approximately the same time and real-time acoustic receivers deployed in the Sacramento River and Delta at various locations. DOSS will review the real-time acoustic tag data to determine the likely migration timing and distribution of the hatchery winter-run in the Sacramento River and into the Delta, and advise NMFS and Water Operations Management Team (WOMT) of potential risks to hatchery winter-run salmon. (Attachment 1, p. 6)

Comment: With the DCC opening, higher exports, and lower Delta outflow, significant numbers of winter-run Chinook salmon are unlikely to survive transit to and through the Delta to the Bay and Ocean. There will be no "favorable hydrologic conditions" under the TUCP. Hatchery winter-run should be trucked and barged to the Bay. Reclamation should fund this provision. These winter- run hatchery smolts will have as little chance of survival as the 60,000 spring run Chinook hatchery smolts released in 2014 in the San Joaquin River (few if any survived).

Transfers and Exchanges: Reclamation and DWR will continue to facilitate water transfers and exchanges. If these transfers or exchanges are conveyed through the Delta outside the transfer window described in the 2008 and 2009 BiOps (July-September), Reclamation and DWR will consult with USFWS and NMFS prior to conveyance of the transfer water and DWR will request a consistency determination from CDFW. (Attachment 1, p. 7)

Comment: Transfers within and outside the "transfer window" will occur under the TUCPs to move water through the Delta from the north to the south. Transfers are exempt from rules and allow substantial added exports as well as reservoir releases in drought years. Transfers are devastating to the delta smelt in the summer of drought years. Any transfers involving storage releases are devastating to all listed fish species as well as future water supplies. Transfers outside the "summer window" could be devastating to other species such as winter-run and spring-run Chinook. To date, all transfer requests have been approved with little environmental review or affects assessment.

Throughout dry conditions, CVP and SWP systems will be operated to lessen critical economic losses to agricultural, municipal, and industrial uses due to water shortages through project water deliveries and by facilitating voluntary water transfers and exchanges to the extent possible, while balancing the needs of upstream storage, fishery and wildlife resource protection, and operational flexibility. (Attachment 1, p. 5)

Comment: To date, no formal "balancing" has occurred.

The proposed export limits are intended to provide additional water deliveries while not exceeding proportional regulatory standards regarding exports (e.g. E/I). The proposed DCC gate operations balance risks to both water quality and outmigrating anadromous fish during February and March, in the event of the extreme low Delta inflows. Hence, this proposal seeks to

balance the short-term and long-term habitat needs of some of the covered anadromous and pelagic species during the entirety of WY2015. (Attachment 1, p. 10)

Comment: The proposed changes are not "proportional". The present constraints are minimal at best at protecting the listed species. Opening the DCC in winter will kill listed salmon and steelhead. Reductions in outflow will kill listed pelagic species. The "take" will not be observable except in future population counts and in sport and commercial fisheries. The TUCP provides no "balancing." It simply takes more of what little is left.

Unlike WY2014, winter-run Chinook salmon and Delta Smelt are currently at an elevated risk of entrainment impacts, due to their spatial distribution, abundance, and productivity. (Attachment 1, p. 11)

Comment: With its drought conditions, TUCP changes, and summer water transfers, WY2014 was a great debacle leading to devastation of winter run and delta smelt: Delta smelt had record low indices (see Order, p. 9). Because of the 2014 orders, the species are already at elevated risk and exposure, which will hinder future potential recovery of their populations. Adding to these conditions, as proposed in the TUCP, would have huge environmental and economic consequences far beyond what is considered in the TUCP or the Temporary Barriers EIS/EIR.

Spring-run Chinook and steelhead are predicted to have an increased risk of entrainment in the South Delta as their migration increases through February and March. Green sturgeon are typically exposed to a broad spectrum of flows and exports over the course of the year, and thus not likely to have increased risk of entrainment due to changes in flows. Increased monitoring and coordination, extending from the interagency drought response efforts in WY2014, is intended to support management of key entrainment risk indicators in the Interior and South Delta as part of the proposed operations. The evidence for the risk of entrainment for each species of concern will be considered as part of the biological review being conducted to support the Endangered Species Act consultation process." (Attachment 1, p11)

Comment: Fisheries already have an increased risk during the February-March migration period. The TUCP proposes to increase that risk by adding higher exports, lower outflows and DCC openings. These are "the key entrainment risk indicators." Adult delta smelt were being collected in January and February at all the key indicator stations, and little was done to protect them. The Smelt Working Group appeared confused and was not unanimous in its review, warnings, or recommendations. Apparently, there was little concern that the LSZ was moving into the Delta with its population of larval longfin smelt. The absence of January fishery protections was devastating to fish populations and their critical habitats. The TUCP seeks to remove the slightly stronger but limited February-March D-1641 protections. The primary purpose is to preserve reservoir storage for higher exports and contractor deliveries and not to provide storage that benefits the Bay-Delta ecosystem and its listed fish species.

Specific comments on the USFWS Concurrence Letter[18]

[18] http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/docs/tucp/2015/fws2usbr_pitts013015.pdf

"*Reclamation has determined that the proposed drought actions will result in no additional adverse effects on Delta Smelt or its critical habitat for the months of February and March 2015 beyond those previous analyzed in the 2008 BiOp. The Service accepts Reclamation's determination*." (Letter.)

Comment: It is incredible that the Service would state that 1) 4000 cfs outflow with 1500 cfs exports, and 2) 5500 cfs outflow and 3500 cfs exports would not cause adverse effects on Delta Smelt or its critical habitats. It is particularly vexing given their subsequent statements on the positive relationship between population abundance and winter-spring Delta outflow.

"The smelt supporting information document includes an analysis of the effects of the actions on larval Delta Smelt production using the recently published new information in the Interagency Ecological Program (IEP) Management, Analysis, and Synthesis Team's (MAST) An Updated Conceptual Model of Delta Smelt Biology technical report. The MAST report may provide valid new information that spring outflow has a positive impact on the relative abundance of Delta Smelt surviving to the early juvenile phase of their life cycle." (Letter)

Comment: It is further incredible that the Service acknowledges that science points to a positive relationship between outflow and smelt abundance, but treats it as "new science" worthy of consideration in future assessments of the effects of TUCPs. Yet they are fine with lower outflow and higher exports, and concur with the TUCP changes.

Comments On The NMFS Concurrence Letter[19]

"As mentioned above, winter-run eggs and juveniles in broodyear 2014 experienced approximately 95% temperature related mortality of the egg and fry life history stages last year. NMFS included this high mortality rate in its JPE, and estimated that approximately 124,521 wild juvenile winter-run from brood year 2014 are expected to enter the Delta. Based on discussions at the Delta Operations for Salmonids and Sturgeon Technical Work Group, >95% of young-of-year winter-run are currently rearing in the Delta, and <5% have exited the Delta (past Chipps Island)." (Letter, p. 5)

Comment: NMFS shows concern for summer river temperature conditions (need to maintain storage and cold-water pool), but recognizes that most of the 2014 wild smolt production is already in the Delta and subject to the harmful consequences of the TUCP's proposed changes.

"*In addition, Livingston Stone National Fish Hatchery increased its winter-run broodstock collection in 2014 by three-fold, and is currently rearing approximately three times (current estimate is 610,000) the typical hatchery production of juvenile winter-run, awaiting release into the upper Sacramento River in February. The hatchery winter-run are an important component of broodyear 2014, and therefore, are important to track as they migrate down the Sacramento River, and enter and exit the Delta*." (Letter, p. 5)

[19] http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/docs/tucp/2015/nmfs_stelle012915.pdf

Comment: NMFS shows concern for these hatchery smolts that have yet to pass through the Delta but appears to be less concerned that these smolts will be adversely impacted by the TUCP's proposed increased exports, reductions in outflow and opening of DCC.

"Inherent in the interim contingency plan is the objective to meet multiple needs with limited water resources. Most of the adverse effects to species identified in the Biological Review (e.g. , the potential for reduced survival of outmigrating salmonids from the Sacramento Basin due to modifications to outflow criteria in D-1641) are the consequences of actions intended to result in conditions (e.g., greater Shasta Reservoir storage and a greater cold water pool) that will preempt more severe adverse effects to species (e.g., potentially running out of cold water in Shasta Reservoir to meet the needs of winter-run and spring-run egg incubation throughout the temperature management season). Some adverse effects to species identified in the Biological Review (e.g., the potential for increased entrainment of salmonids in the South Delta region due to modifications to export limits that allow above-minimum exports when outflow is at least 5,500 cfs, but less than the requirement in footnote 10 of Table 3 of D-1641) are the consequences of actions intended to result in conditions (e.g., greater south-of-delta storage) that will pre-empt adverse effects to non-fish-and-wildlife beneficial uses of CVP and SWP project water (e.g., municipal and agricultural purposes)." (Letter, p. 6)

Comment: NMFS assumes that the TUCP actions will save upstream storage when in fact the minimal conserved storage will largely benefit of exports and water deliveries. Maintaining 7000 cfs outflow with 1500 cfs exports is clearly preferable to 5500 outflow and 3500 cfs exports under the same minimum allowed reservoir releases.

"In conclusion, NMFS concurs that Reclamation's Project Description is consistent with Action 1.2.3.C and meets the specified criteria for an interim contingency plan. We are making this finding based on both the Biological Review attached to Reclamation's letter, which describes the additional adverse effects of the drought and drought operations, and our conclusion that the potential effects of the types of operations proposed in the interim contingency plan were considered in the underlying analysis of the CVP/SWP Opinion, which considered that droughts would occur and concluded that implementation of the RPA, including Action I.2.3.C, is <u>not likely to jeopardize the continued existence</u> of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley steelhead, the Southern Distinct Population Segment of North American green sturgeon, and the Southern Resident killer whales, and <u>will not result in the destruction or adverse modification of their designated critical habitats</u>. Furthermore, the best available scientific and commercial data indicate that implementation of the interim contingency plan will not exceed levels of take anticipated for implementation of the RPA specified in the CVP/SWP Opinion." (Letter, p. 7)

Comment: We disagree that lower outflows and higher exports in February and March are not likely to further jeopardize the listed salmonids or negatively affect their designated critical habitats. Lower outflow in February and March from the present 7000 cfs to 4000 cfs would have adverse effects to winter-run and spring-run salmon survival to and through the Delta. Exports of 3500 cfs at relaxed outflow (5500 cfs outflow) would have adverse effects on salmon and their designated critical habitats in the Delta. Opening the DCC when exports are below 1500 cfs will result in increased take. Because these changes would have little or no benefit to

preserving the storage or cold-water pools in upstream reservoirs, there are no beneficial tradeoffs.

Under what conditions may this Objection and Petition for Reconsideration be disregarded and dismissed?

The TUCP should be denied and the Order rescinded.

In its place, the Board should order the following short-term measures to protect fish and wildlife:

1. Allow only minimum exports when EC Collinsville >2.64 mmhos or when outflow is less than 7100 cfs as determined by daily average Delta outflow from the USGS gages at Rio Vista, Three Mile Slough, Jersey Point, and Dutch Slough. Minimum exports are 1500 cfs or lower if less is needed for Health and Safety. We recommend this action be taken to preserve the listed species and their critical habitat in the Delta. The action is consistent with the original intent of D-1641 to protect public trust resources in the Bay and Low Salinity Zone, because the location of X2 (2.64 EC) was found to and continues to be related to the success of many Bay-Delta fishes and the quality of many Bay-Delta estuary habitat features.
2. If inflow increases from storms and unbalanced Delta conditions occur, then exports should only be allowed up to the D-1641 35% of Delta inflow, provided the conditions in #1 above are met. All existing OMR restrictions per the OCAP BOs must apply. During the ascending and descending limbs of storm derived high outflows, exports should be ramped up and down, respectively to (1) preserve habitat integrity (e.g., habitat gradients of salinity and temperature) within the interior Delta most influenced by exports, and (2) to reduce risks to any localized concentrations of special status fish species.
3. Hatchery programs should be enhanced to ensure maximum production and survival to the ocean during the drought. Hatchery operators should truck or, preferably, barge hatchery produced salmon and steelhead to the Bay to ensure maximum survival. If possible, such transport should occur before April 1. Winter-run and spring-run hatchery Chinook smolts should be trucked to the lower Sacramento River near Knights Landing and then barged to the Bay. This would greatly enhance survival and minimize straying. This approach is already being developed by East Bay MUD with fall-run on the Mokelumne. A similar approach should be adopted at the Feather and American hatcheries for the respective runs of salmon raised at these facilities, as well as any planned releases of San Joaquin River spring-run salmon. The Bureau and DWR should be required to fund any added costs associated with these enhanced hatchery practices.
4. The Board should require management of delta hydrology through EC and gauged outflow, not NDOI. EC recorders and USGS gauges located throughout the river, Delta, and Bay provide a better management tool than the estimated NDOI.
5. The Bureau and DWR should install the Head of Old River Barrier to increase migration success of San Joaquin salmon young.
6. The projects should release 200 cfs into the Yolo Bypass through the Fremont Weir, Colusa Basin Drain, and Sacramento Ship Channel to minimize poor habitat conditions in the Cache Slough lower bypass region of the north Delta. This would alleviate the

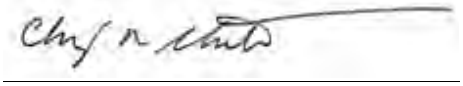
negative net flows occurring in the area from local diversion demands that threaten rearing salmon and smelt.

7. DWR should use the Montezuma Slough salinity control weir to sustain Low Salinity Zone habitat in Montezuma that would be present under proposed conditions (#1 above).
8. The Board should require the RTDOMT to operate the Delta Cross Channel gates in real time to minimize export losses of smelt and San Joaquin salmonids during periods of high Delta inflows to minimize negative OMR and improve positive QWEST flows.
9. The Board should require the DWR and the Bureau to adjust exports to the natural monthly tidal cycle to minimize negative effects on Delta hydrology and fish habitat and entrainment risk conditions.
10. The Board should require DWR and the Bureau to shift exports to Tracy facility to minimize effects of exports. Per unit of export, Banks impacts appear to be greater than Tracy impacts.
11. The Board should require pulse flow releases timed to coincide with storms to stimulate outmigration of fish directly below rim dams and to improve and sustain benefits of natural high flow events.
12. The Board should require the projects to reduce exports during higher flows (if any) from San Joaquin. The Board should not allow exports greater than 1500 cfs exports during San Joaquin pulses. The Board should not allow export of San Joaquin pulses as is currently allowed under D-1641 Critically Dry year standards and as was allowed regardless of Delta outflow last year.
13. At no time in the December-March period should OMR flows exceed the -5,000 cfs limit. At no time should they exceed -2,000 cfs when EC at Jersey Point exceeds a daily average of 500.
14. The Board must hold an evidentiary hearing on the requested TUCP and on necessary measures to protect gravely threatened fish species during current drought and depleted storage conditions.

A true copy of this protest has been served upon the petitioners by e-mail (see below).

Date: February 13, 2015

Chris Shutes, Water Rights Advocate
California Sportfishing Protection Alliance



Bill Jennings, Executive Director
California Sportfishing Protection Alliance

Barbara Vlamis, Executive Director
AquAlliance

Carolee Krieger, Executive Director
California Water Impact Network

Michael Jackson
Counsel to California Sportfishing Protection Alliance,
AquAlliance, and
California Water Impact Network

/s/ Michael Jackson

Attachments:
Att. 1, Summer 2013
Att. 2, Summer 2014
Att. 3, 2014 FMWT
Att. 4, Demise of Winter-run 2014
Att. 5, Delta Smelt on the Scaffold
Att. 6, CSPA Presentation 2014

Pursuant to the January 27, 2015 Notice of Temporary Urgency Change Petition, we have filed this protest, objection, petition for reconsideration and petition for hearing, on 13 February, via e-mail to: Rich.Satkowski@waterboards.ca.gov

Also pursuant to the January 27, 2015 Notice of Temporary Urgency Change Petition, we have served this protest, objection, petition for reconsideration, and petitions for hearing, on 13 February, via e-mail to the following:

Department of Water Resources, c/o James Mizell: P.O. Box 942836; Sacramento, CA 94236-0001; James.Mizell@water.ca.gov

Regional Solicitor's Office, c/o Amy Aufdemberge: Room E-1712; Cottage Way; Sacramento, CA 95825; Amy.Aufdemberge@sol.doi.gov

Addendum to the

Environmental Water Account

Environmental Impact Statement/Environmental Impact Report

http://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=107

Re: 2009 Drought Water Bank Transfers

State Clearinghouse #1996032083

Prepared by the State of California

The Resources Agency

Department of Water Resources

March 04, 2009

March 04, 2009

Addendum to the

Environmental Water Account

Environmental Impact Statement/Environmental Impact Report

http://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=107

State Clearinghouse #1996032083

Prepared by the State of California

The Resources Agency

Department of Water Resources

Introduction

This Addendum has been prepared as part of the Environmental Impact Statement/Environmental Impact Report (EIS/EIR) (2004) and Supplement (2008) for the Environmental Water Account (EWA). The Addendum notes and discusses three minor changes to the EWA project as analyzed. The EWA EIS/EIR includes the Department of Water Resources (DWR) as the lead State agency for the California Environmental Quality Act (CEQA) and the Bureau of Reclamation (Reclamation) the lead Federal agency for the National Environmental Policy Act (NEPA). *CEQA Guidelines Section 15164* provides guidelines for preparation of an Addendum to an EIR.

The EWA is an existing and ongoing CalFED program that seeks to increase protection to the fish resources of the Bay-Delta estuary. These protections go beyond those afforded by the regulatory baseline identified in the 2000 Record of Decision for the CalFED program through operational curtailments of the State Water Project (SWP) and Central Valley Project (CVP; collectively Project) operations at no net cost to Project deliveries and supply. The regulatory baseline was determined by the standards in the

1994 Bay-Delta Accord, as incorporated into Project operations and in the Project descriptions included in No Jeopardy Biological Opinions promulgated in 1995 under the federal Endangered Species Act (ESA) for Project operations. EWA operational curtailments include reductions in pumping, increases in flow through the Delta, and changes in the flow regime within Delta channels. The primary means for compensating for delivery reductions in Project water to the Project contractors on account of the curtailments is through transfers of up to 600,000 acre-feet per year of non-Project water.

Thus, two key features of the EWA are:

(1) Reductions in water deliveries resulting from Project operation curtailments beyond the water costs of the regulatory baseline; and
(2) Replacement of water supplies lost to the Project on account of these curtailments from non-Project sources through the acquisition and transfer of non-Project supplies.

The EWA originally provided that curtailments for additional fish protection beyond the regulatory baseline would be determined by the three Management Agencies (US Fish and Wildlife Service, National Marine Fisheries Service, and Department of Fish and Game). However, such curtailments have recently been pre-empted and imposed on the Project by the Federal District Court as an injunctive remedy under the federal ESA, with no provision, however, for the replacement of lost water supplies. Along with this asymmetrical, uncompensated application of curtailments beyond the regulatory baseline, two years of statewide drought and the prospect of a third year, were addressed in the summer of 2008 in an Executive Order issued by the Governor and in a subsequent Governor's Proclamation of Drought Emergency for the Central Valley. In these documents, the Governor called for increased water transfers and in particular the establishment of a Drought Water Bank for 2009 to alleviate the reduction in deliveries and water shortages.

The 2009 Drought Water Bank (DWB) thus will be the mechanism for acquiring and transferring water to replace Project supplies lost and that will be lost due to the judicially mandated operational curtailments, aggravated by the conditions of drought. These transfers will not come close to making up the mandated losses below the regulatory baseline. Nor will they be at no cost to Project contractors. This source of water must be paid for by its recipients, and no offset or credit is planned to be given for losses due to the imposed curtailments.

In addition, the DWB acquisitions will be available to users others than SWP and CVP contractors. In this sense, the purpose of the EWA transfers is being generalized on account of the dry conditions to all water users suffering curtailments, not just Project contractors; but the essential purpose of the transfers program remains the same: the need to replace reductions in accustomed water deliveries and supplies by water transfers. Although the DWB is not restricted to SWP and CVP contractors, the fact that Project facilities will be used in securing or delivering the water under the DWB means that the great majority will go the SWP and the CVP service areas; as does the fact that Project contractors represent the vast majority of the state's population.

The EWA originally looked to selected areas in the Central Valley for transfer water supplies, but only because at the time they represented the location of willing sellers. There is nothing in the EWA that intended to preclude looking to sellers in other similar areas of the Central Valley, and one purpose of this Addendum is to assess those other areas that appear to be available for transfers in 2009 that were previously unavailable. As the EWA's exclusive mechanism in 2009 for securing replacement water for curtailed operations through transfers, the DWB is limited to the maximum 600,000 acre-feet analyzed in the EIS/EIR for the program.

There are three changes and additions proposed by the DWR in the DWB that differ from the Flexible Purchase Alternative project described in the EWA EIS/EIR. DWR, acting as Lead Agency, has determined that none of these changes involves new

significant environmental effects, a substantial increase in the severity of previously identified significant effects, or substantial changes in the circumstances under which the project will be implemented. For these reasons, DWR has elected to prepare this Addendum to the EWA EIS/EIR.

The three changes that are discussed in this Addendum are as follows:

1. Change in giant garter snake mitigation in response to the Draft US Fish and Wildlife Service (USFWS) Biological Opinion
2. Change in the areas from which water may be purchased
3. Change in the areas to which water may be delivered

Following are explanations of each of these changes and the rationale for the determination that they constitute only minor technical changes and additions that involve no new significant environmental effects or substantial increases in severity of previously identified significant effects.

1. Change in Giant Garter Snake Mitigation

As part of the DWB, DWR will implement a series of conservation measures to offset the potential effects of rice crop idling and crop substitution water transfers on Sacramento Valley populations of giant garter snakes. These measures can be found in conditions in a Draft Biological Opinion issued by USFWS on November 18, 2008. This Draft Biological Opinion includes the following protections for the giant garter snake: 1) exclusion areas from rice crop idling that are known giant garter snake core habitats and habitat corridors, 2) description of rice land best management practices for the giant garter snake, 3) and idled rice crop land limitations of no more than 320 continuous acres, using a checkerboard pattern as the preferred layout.

DWR has prepared a Giant Garter Snake Baseline Monitoring and Research Strategy.

The implementation of this Strategy will provide significant contributions towards the development of a Giant Garter Snake Conservation Strategy for the Sacramento Valley. The Strategy has been reviewed and endorsed by State and Federal agencies and two giant garter snake experts, Eric Hansen and Glenn Wylie. Monitoring and research will be the primary tools to gather information on giant garter snake distribution, life history, and ecology. Monitoring will be designed to assess population structure, distribution, and movement within the Sacramento Valley and determine the existing (baseline) population of study sites. The duration of the monitoring and research study designs will incorporate the goal of including wet, dry, and normal hydrologic years.

Broad monitoring and research goals include:

a. Developing and implementing a monitoring plan for giant garter snake populations in the Sacramento Valley,
b. Monitoring giant garter snake populations for a minimum of ten years (subject to appropriations) using multiple survey methods (e.g., trapping, hand captures, and mark-recapture),
c. Using radio-telemetry and mark-recapture to study habitat use and selection, mortality rates, response to crop idling, and use of rice lands for a minimum of five years, and
d. Gathering enough data to make recommendations to minimize the effects of crop idling practices on the giant garter snake and make general conservation recommendations to the California Rice Industry Association to update their 1995 publication *Managing Ricelands for Giant Garter Snakes*. Conservation recommendations may include actions that rice farmers could implement to reduce potential impacts to the giant garter snake from rice farming, or actions a rice farmer could implement to increase the habitat value for the giant garter snake.

Specific research goals include:

a. Developing and implementing a radio-telemetry study for a minimum of five years (subject to appropriations),
b. Quantifying and evaluating the response (*e.g.*, movement patterns and survival) of giant garter snakes to changes in habitat conditions and landscape cropping patterns,
c. Quantifying and evaluating the response of giant garter snakes to crop idling including a specific experimental design to evaluate different block sizes and landscape patterns,
d. Examining the relationship of giant garter snake habitat use in relation to habitat availability and surrounding land use using GIS technologies,
e. Quantifying giant garter snake survival and population fecundity (*e.g.*, number of immature to adults) in relation to changing environmental and habitat conditions and identify variables that may be important correlates of survival and fecundity,
f. Quantifying minimum size of buffer zone between idled rice fields and suitable habitat, and
g. Providing recommendations for adaptive management of giant garter snakes with respect to water transfers.

In light of new scientific information, there are two modifications to the conservation measures contained in the 2003 EWA EIS/EIR. Both are based on the recognition of new data and changed circumstances since 2003. 1) A change in the idled block size from 160 to 320 acres, and 2) the locations from which water transfers can occur.

The expansion of the block size from 160 acres (1/2 mile on each side of a square) to 320 acres (approximately 3/4 mile on each side of a square) would change the distance a giant garter snake would travel through an idled block by approximately 1/4 mile or 1,320 feet. The original 160 acre block size was largely based on estimates of median home range size. Although the median is a useful number, the home range size of an

animal is affected by many variables and may be a misleading indicator of the distance an animal can successfully travel between habitats. Estimates of maximum home range sizes and distances traveled suggest that a 320 acre block is a navigable size for a giant garter snake.

It is important to consider that when a giant garter snake emerges from aestivation in March or April, not all rice fields are flooded, and during that time, rice fields may not provide a habitat component that is significantly different from idled fields. Hansen (1986) found that giant garter snakes in the Sacramento Valley avoided large bodies of shallow open water (rice fields are generally over 100 acres in size and flooded to a depth of 3-5 inches). In general, rice fields do not provide high quality habitat for the giant garter snake until the rice plants emerge in the flooded rice field and reduce the amount of open water, typically in June. Before this time, permanent wetlands, flooded ditches, and flooded canals are important habitats. The seller will be required to maintain baseline water in major irrigation and drainage canals to serve as movement corridors and habitat for giant garter snakes during this period.

The expansion of the block size has the potential to expose giant garter snakes to more adverse habitat conditions and potentially increase their exposure to predators if a snake chooses to cross an idled block. However, telemetry studies suggest that a giant garter snake is unlikely to leave suitable habitat to cross large areas of upland (Wylie et. al 2003, Wylie and Amarello 2008). The probability that a snake enters a large block of upland is not likely to be significantly different based on whether an upland block size is 160 or 320 acres. External factors such as habitat disturbance and the surrounding landscape are likely more significant factors affecting long movements (Wylie et. al 1997, Wylie 1998, Wylie et. al 2002). Constraining idled parcels to a checkerboard pattern in which idled parcels may not completely share a common boundary, maintaining water in main ditches and canals, and excluding core habitats and corridors is expected to help reduce any potential impacts of increasing the crop idled block size on the giant garter snake population.

A part of the Giant Garter Snake Baseline Monitoring and Research Strategy will include implementation of a radio-telemetry study to evaluate and quantify the response of the giant garter snake to riceland idling, thereby providing additional data on giant garter snake behavior and ecology. Furthermore, ongoing studies funded through the Ecosystem Restoration Program will also provide data on giant garter snake response to cropland idling and habitat restoration.

The EWA Biological Opinion excluded Yolo County east of Highway 113 from crop idling and substitution actions. Yolo County is known to support the giant garter snake, yet very little data is available on the population size, or distribution within this area. Surveys in 2005-2007, documented snakes at the Yolo Wildlife Area, Conaway Ranch, and Davis Wetlands (Hansen 2008). A giant garter snake Conservation Bank has been established south of Interstate 80 inside the Yolo Bypass and habitat has been created for the giant garter snake within the Yolo Wildlife Area. The area of Yolo County east of Highway 113 will be included in the DWB.

Existing protected habitats within the area and the conservation measures outlined in the DWB, should reduce any potential impacts to the giant garter snake population by including this area in the DWB.

At the request of the USFWS, the Natomas Basin is excluded from the DWB. This area is currently implementing a Habitat Conservation Plan that includes impacts to the giant garter snake.

In summary, DWR is initiating a number of conservation measures to reduce the effect of crop idling and crop substitution actions on the giant garter snake. These actions include requiring rice farmers to follow Best Management Practices as described in the Draft Giant Garter Snake Recovery Plan (USFWS 1999), requiring baseline water in main canals and ditches, minimizing the size of idled parcels, idling parcels using a

checkerboard pattern as the preferred layout, and excluding lands adjacent to habitat corridors and lands with known populations. Together, these actions are expected to reduce any impacts to the giant garter snake population to less than significant.

2. Change in the areas from which water may be purchased

The Supplemental EWA EIS/EIR study area includes areas of California that might receive benefits from EWA actions or areas potentially affected by EWA because they serve as a site for EWA water asset acquisition, conveyance, or storage. The EWA study area comprises the land and tributaries upstream from the Delta, the Delta, and the CVP and SWP Export Service Area. This is roughly the same study area that will be a part of the DWB. The CVP and SWP Export Service Area is defined as those lands that receive SWP and CVP water via the south Delta pumping plants, as well as reservoirs that are used for EWA asset management.

The overall EWA study area includes areas that may be directly or indirectly affected by potential EWA acquisitions. These areas include the same areas found as part of the DWB. Those areas that may participate in the DWB, but are not specifically described in the EWA documentation are located adjacent to those areas that are described and include the same ecosystem features, and the same species composition. Thus the analysis and conclusions done as part of the EWA document would be the same as any analysis and conclusions that would be done for those areas that are not specifically described as part of the EWA but may be a part of the DWB.

As done in the EWA document, the effects analysis done on fisheries and water quality in the Delta does not depend on the location of the water seller, but on the total amount of water to be transferred via a particular tributary and receiving water body. Thus, fisheries and water quality effects were evaluated based on the largest amount of water that EWA agencies could manage in the Delta for fish actions (approximately 600,000 acre-feet, per the analyses in the EWA EIS/EIR), regardless of whether the specific water sellers could be identified. Therefore, the effects analysis represents a “worst-

case scenario" based on the maximum amount of water that may be purchased by the EWA agencies. The circumstances mentioned above will be exactly the same for the DWB.

The EWA document evaluated impacts by regions and does not analyze impacts as a complete list of specific areas. Some of the regions described in the EWA EIS/EIR include the following:

a. Agricultural lands in the Sacramento Valley (Butte, Colusa, Glenn, Placer, Sutter, and Yolo counties) and the San Joaquin Valley (Kings, Fresno, Kern, and Tulare counties) in which farmers participate in crop idling and/or crop substitution; and

b. Groundwater basins that participate in acquisition of EWA water via groundwater substitution, stored groundwater purchase, or groundwater storage.

c. Areas upstream of the Delta include the Sacramento Valley, the Sacramento River, and its tributary rivers: Feather, Yuba, and American rivers. Because the San Joaquin River also flows into the Delta upstream from the Delta pumps, the portions of the San Joaquin Valley that are drained by the San Joaquin River are also considered to be "upstream" from the Delta. The Merced River, a San Joaquin River tributary, is also part of the Upstream from the Delta region.

The areas described above are the same or similar in nature to the areas that are a part of the DWB. Table 1 lists agencies (those that are covered in the EWA documentation and those that are not) that may be willing to sell water to the DWB along with a maximum amount of potentially available water volumes. DWR would only make purchases from willing sellers. The numbers presented in Table 1 are estimates and do not necessarily reflect the amount of water that would be available in 2009. Generally, these estimates reflect the potential upper limit of available water in order to include the maximum extent of potential transfers in the environmental analysis. Actual purchases would depend on the year type, DWB funding (interested buyers), and the amounts that sellers would ultimately be willing to transfer in 2009. The potential transfers identified

in Table 1 may not all occur. All of the potential transfers are in regions identified and analyzed in the EWA documentation.

Table 1. Potential Sellers (Upper Limits, in Acre Feet)

Water Agency (County)	*Stored Reservoir Water*	*Groundwater Substitution*	*Crop Idling Substitution*	*Method TBD*
Upstream from the Delta Region				
Sacramento River Area of Analysis				
*Amaral Ranch (Sutter)	-	2,000	2,000	
*Carter MWC (Colusa)	-	650	0	
*+Conaway Preservation Group (Yolo)	-	0	25,000	
+Glenn-Colusa ID (Glenn and Colusa)	-	0	50,000	
*Lewis Ranch (Colusa)	-	2,000	0	
*Maxwell ID (Colusa)	-	1,200	2,500	
*+Meridian Farms (Sutter)	-	1,000	2,000	
+Natomas Central MWC (Sutter and Sacramento)	-	10,000	0	
*Orland Unit Water User's Association (Glenn)	10,000	-	-	
*Parrott Investment Company (Butte)	-	0	1,500	
*+Pelger MWC (Sutter)	-	1,500	2,000	
*Pinnacle Land Ventures, LLC (Broomieside Farms) (Sutter)	-	10,000	0	
*+Pleasant Grove-Verona MWC (Sutter)	-	6,000	4,000	
*+Princeton-Codora-Glenn ID (Glenn and Colusa)	-			3,000
*+Provident ID (Glenn and Colusa)	-			3,000
*+River Garden Farms (Yolo)	-	3,500	0	
+Reclamation District 108 (Colusa and Yolo)	-	4,000	20,000	
*+Reclamation District 1004 (Colusa)	-	50,000	10,000	
*Sacramento River Ranch (Yolo)	-	1,000	1,275	
*+Sutter MWC (Sutter)	-	0	10,000	
*Sycamore MWC (Colusa)	-	2,400	6,360	
*Upper Swanston Ranch (Yolo)	-	8,500	0	
Subtotal	-	103,750	136,635	6,000
Feather River Area of Analysis				
*Browns Valley ID	5,000	0	0	
Butte WD (Butte and Sutter)	-	10,000	10,000	
Garden Highway MWC (Sutter)		2,000	0	
*Goose Club Farms (Sutter)	-	0	3,500	
Richvale ID (Butte)		0	10,000	
South Sutter WD(Sutter and Placer)		-	-	10,000
Sutter Extension WD (Sutter)		11,000	14,000	
*Plumas MWC		2,800	1,750	
Western Canal Water District (Butte and Glenn)	-	0	20,000	
Yuba County Water Agency		110,000		
Subtotal	5,000	135,800	59,250	10,000

Table 1 cont. Potential Sellers (Upper Limits, in Acre Feet)				
American River Area of Analysis				
+Placer County WA (Placer)	20,000			
Sacramento Suburban WD		17,000		
+City of Sacramento (Sacramento)		5,000		
Subtotal	20,000	23,000		
Merced/San Joaquin River Area of Analysis				
Merced ID(Merced)				25,000*
	-	-	-	-
Total	35,000	261,550	195,885	41,000
Grand Total	**533,435**			
GW: Groundwater		WA: Water Agency		
ID: Irrigation District		WD: Water District		
MWC: Mutual Water Company		TBD: To be Determined		

Note: Those agencies/project components with an * are not specifically identified in the EWA EIS/EIR

Note: Those agencies with a + will require Bureau of Reclamation approval

3. Change in the areas to which water may be delivered

The State Legislature has established legal principles that must be satisfied if the DWB and its participating buyers are to be involved in the purchase or conveyance of water. These legal principles require the buyers to be concerned about the impacts of its water purchases on the water source areas. This concern about possible local area impacts of water transfer makes the buyers an “enlightened consumer” as it enters the water market.

As defined by the EWA documents, the export service area is defined as the area that receives, stores, and uses CVP and SWP water pumped from the Delta. It includes the San Joaquin Valley and CVP/SWP customers in the Bay Area, south central California Coast, and southern California. These areas are similar in nature to those that are a part of the DWB. Any analysis and conclusions done as part of the EWA EIS/EIR will be the same if done for the DWB.

Table 2 identifies potential buyers (those that are covered in the EWA documentation and those that are not) who have indicated interest in participating in the DWB. Not all of these potential buyers may end up actually purchasing water from the DWB in 2009.

Table 2 ***Potential Buyers (Upper Limits in Acre Feet)***		
Water Agency		***Amount Requested***
Downstream from the Delta		
Alameda County Water District		20,000
Antelope Valley East Kern Water Agency		28,212
Central Cost Water Authority		15,000
Castaic Lake Water Agency		10,000
*Contra Costa Water District		20,000
Desert Water Agency		10,000
Dudley Ridge Water District		7,500
Kern County Water Agency		123,333
Metropolitan Water District of Southern California		300,000
Mojave Water Agency		1,000
Oak Flat Water District		1,000
Palmdale Water District		8,000
San Bernardino Valley Municipal Water District		20,000
San Diego County Water Authority		10,000
San Luis & Delta Mendota Water Authority, which includes:		150,000
Byron Bethany Irrigation District	Oro Loma Water District	
Del Puerto Water District	Pacheco Water District	
Eagle Field Water District	Panoche Water District	
James Irrigation District	Patterson Irrigation District	
Laguna Water District	Reclamation District 1606	
Mercy Springs Water District	San Benito County Water District	
Tranquility Irrigation District	Banta Carbona Irrigation District	
West Side Irrigation District	City of Coalinga	

Table 2 ***Potential Buyers (Continued)***	
Water Agency	***Amount Requested***
San Luis & Delta Mendota Water Authority (continued):	
West Stanislaus Irrigation District — City of Huron	
Westlands Water District — City of Avenal	
Broadview Water District — Avenal State Prison	
Santa Clara Valley Water District	30,000
Tulare Lake Basin Water Storage District	20,000
Upstream from the Delta	
*Bella Vista Water District	2,000
*Dunnigan Water District	2,000
City of Yuba City	2,000
Napa County Flood Control and Water Conservation District	13,860
*Tehama Colusa Canal Authority	25,000

Note: Those agencies with an * are not specifically Identified in EWA EIS/EIR

Currently, there are four potential buyers of DWB water that are outside of those identified in the EWA EIS/EIR; 1) Bella Vista Water District, 2) Dunnigan Water District, 3) Contra Costa Water District, and 4) the Tehama Colusa Canal Authority. All four buyers will not be using the purchased water for any new users or contribute to any level of use above their baseline usage.

The Bella Vista Water District is located in Shasta County and provides water to approximately 5,700 municipal users in the northeast portion the City of Redding and 300 agricultural users (primarily, irrigated pasture). They have a contract with the Bureau of Reclamation for 24,578 acre-feet of water. Over the last five years, annual water consumption averaged 20,645 acre-feet.

The Contra Costa Water District (CCWD) provides water to primarily industrial and municipal users in Contra Costa County. Over the last five years, annual water consumption has averaged 120,000 acre-feet. CCWD provides less than 100 acre-feet a year to agricultural users.

The Dunnigan Water District is located in northern Yolo County and uses contracted water from the CVP delivered from the Tehama Colusa Canal. Over the last five years, annual water consumption has average 16,000 acre-feet. The majority of water, approximately 98 percent, goes to agricultural users and the remaining 2 percent to landscaping. The variety of crops within the district includes permanent orchards and vineyards.

The Tehama-Colusa Canal Authority (TCCA) is a Joint Powers Authority comprised of 17 CVP water contractors. The service area spans four counties (Tehama, Glenn, Colusa, and Yolo) along the west side of the Sacramento Valley, providing irrigation water to farmers growing a variety of permanent and annual crops. TCCA operates and maintains the 140 mile Tehama-Colusa and Corning canals irrigation water supply system. The service area is approximately 150,000 acres.

Conclusion

The use of an addendum to the Supplemental EWA EIS/EIR for the DWB is consistent with CEQA guidelines. The DWB comprises no substantial changes to the analysis done in the Supplemental EWA EIS/EIR. The actions for the DWB are the same as described in the EWA document.

The sellers and buyers as part of the DWB will have asset acquisition amounts that are the same or less than that described in the EWA document. Therefore, any analysis will be the same and any resource impacts will be the same or less. All DWB water transfer actions have been described and analyzed in the EWA documents.

For further clarification on the environmental factors potentially affected by the DWB, a copy of the checklist found in Appendix G of the CEQA Guidelines can be found after the bibliography. Any environmental issues found below in the checklist are explained as part of the addendum.

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Environmental Checklist Form

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

Symbols ☑ ☐	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant**	**No Impact**
1. AESTHETICS – Would the project:				
a. Have a substantial adverse effect on a scenic vista?	☐	☐	☑	☐
b. Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☑
c. Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☐	☑
d. Create a new source of substantial light or glare that would adversely affect day or nighttime views in the area?	☐	☐	☐	☑

Symbols ☑ ☐	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact

2. AGRICULTURE RESOURCES: In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. Would the project:

a. Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☑
b. Conflict with existing zoning for agricultural use or a Williamson Act contract?	☐	☐	☐	☑
c. Involve other changes in the existing environment which, due to their location or nature, could result in conversion of farmland to non-agricultural use?	☐	☐	☑	☐

Symbols ☑ ☐	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
3. AIR QUALITY--Where available, the significant criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a. Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☑
b. Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☑	☐
c. Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or State ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors)?	☐	☑	☐	☐
d. Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☑
e. Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☑

The following text (in italics) is excerpted from the EWA DEIS/DEIR, July 2003, pp. 8-16 and if:

The potential effects on air quality due to groundwater substitution, stored groundwater purchase, and crop idling would not differ by county. Therefore, the effects of the EWA actions are evaluated for the Upstream from the Delta Region as a whole.

Groundwater substitution would require use of groundwater pumps to retrieve groundwater. Groundwater substitution would take place in Glenn, Colusa, Yolo, Butte, Sutter, Sacramento, Shasta, and Yuba Counties. Agricultural users would use groundwater instead of surface water for their water supply. The use of groundwater would require pumps to lift the groundwater to the surface. Groundwater pumps can be driven by many different means. Table 8-4 shows the estimated NOx and PM10

emissions for a 115 hp pump with electric, propane, and diesel motors, operating under the assumptions described in Section 8.2.1.1. NOx and PM10 emissions are presented because several counties are in nonattainment for ozone and PM10 and NOx is considered an ozone precursor. This information is for comparison purposes, but actual pollutants emitted depend on how the pump is powered, the size of the pump, the efficiency of the well, the length of time the pump is running, and the depth to groundwater.

Table 8-4

Groundwater Pump Emissions by Motor Type

Motor Type	*NOx (lbs/year)*	*PM10 (lbs/year)*
"Dirty" Diesel	*2,544*	*236*
"Clean" Diesel	*2,007*	*236*
Electric	*84*	*5.6*
Propane	*562*	*66*

Source: California Farm Bureau Federation 1999.

These calculations assume that the pump would operate 2,000 hours in an average year. Electric pumps do not emit pollutants at the pump; the source of pollutants can be traced to emissions from the powerplant. Powerplants are given permits based on their maximum operating potential. Although the electricity required to power the groundwater pumps would not be needed under the Baseline Condition, the additional electricity would not cause any powerplant to exceed operating capacity. A majority of power is derived from fossil fuel combusted at powerplants to generate electricity required to run the groundwater pumps. CO2 is the primary pollutant emitted as a result of the oxidation of the carbon in the fuel. NOx and PM10 are also emitted. As mentioned previously, these pollutants are noteworthy because many of the counties in the Upstream from the Delta Region are nonattainment areas for ozone and PM10.

Diesel pump engines emit air pollutants through the exhaust. The primary pollutants from the pumps are NOx, TOC, CO, and particulates (including visible and nonvisible

emissions). Pumps that run on propane burn much cleaner than diesel, but still contribute NOx, CO2, VOCs, and trace amounts of SO2 and particulate matter.[6]

The pumps that would be used for groundwater substitution are existing pumps; no new pumps would be installed as a result of this alternative. The pumps have most likely been used in the past and will be used in the future; thus, the pumps are not a new source of emissions. However, groundwater substitution activities would result in use of the pumps at times when they would otherwise not be used.

According to CARB surveys, approximately 74.7 percent of groundwater pump emissions occur between April and September. The project-related emissions, both NOx and PM10, in Sacramento, Yolo, Sutter, Glenn, and Colusa Counties have been accounted for within CARB's inventory as is demonstrated by the fact that the annual average EWA project emissions produced from groundwater pumping would fall below the diesel-fueled groundwater pump emission inventory. (see Table 8-5, pg. 8-18, EWA DEIS/DEIS, 2003) *However, because the project-related emissions would be produced in a nonattainment area, the project would contribute to an existing air quality violation, which is a significant impact. Butte, Shasta, and Yuba Counties exceed CARB's inventory, also producing a significant impact. The mitigation measures listed in Section 8.2.7 would lower emissions to a negligible amount; therefore, these significant impacts would be reduced to a less-than-significant level.*

[6] *NOx = Nitrogen oxides, TOC = Total organic carbon, CO = Carbon monoxide, CO2 = Carbon dioxide, VOCs = Volatile organic compounds, SO2 = Sulfur dioxide.*

The mitigation measures specified in the EWA DEIS/DEIR for groundwater substitution water transfers are as follows:

8.2.7.1 Groundwater Substitution

If the EWA agencies obtain water from groundwater substitution, increased groundwater pumping would increase NOx emissions. The EWA agencies and willing sellers would work together to implement one, or a combination, of the following mitigation measures that is appropriate to reduce impacts to a less-than-significant level. The mitigation measures will be implemented within the willing seller's air district.

EWA agencies will require willing sellers to use only electric pumps.

EWA agencies will require willing sellers to use electric or propane-fueled pumps. For each propane-fueled pump, a diesel engine within the district that is not a part of the EWA must be replaced with a propane or electric pump to 'offset' the emissions from the project-related pump.

EWA agencies will require the willing sellers to purchase offsets to compensate for producing project-related emissions.

The 2009 DWB intends to implement the last mitigation measure listed above in the following manner. Actual NOx emissions from diesel groundwater pumps will be calculated using actual anticipated operating conditions (i.e., fuel type) and scheduled hours of operation. Emissions of NOx that would have been emitted by farm equipment that would have been used on lands fallowed for water transfers for the 2009 DWB will also be calculated, and these foregone emissions will be used to offset NOx emissions from groundwater pumping. As long as emissions generated by groundwater substitution pumping do not exceed NOx emissions foregone due to land fallowing as part of the 2009 DWB, this impact will be reduced to a less than significant level.

Symbols ☑ ☐	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
4. BIOLOGICAL RESOURCES -- Would the project:				
a. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or the U.S. Fish and Wildlife Service?	☐	☑	☐	☐
b. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Game or the U.S. Fish and Wildlife Service?	☐	☐	☑	☐
c. Have a substantial adverse effect on federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) or other wetlands through direct removal, filling, hydrological interruption, or other means?	☐	☐	☑	☐
d. Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☑	☐	☐
e. Conflict with any local applicable policies or ordinances protecting biological resources?	☐	☐	☐	☑
f. Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other applicable habitat conservation plan?	☐	☐	☐	☑

Symbols ☑ ☐	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
5. CULTURAL RESOURCES -- Would the project:				
a. Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5 of the California Code of Regulations (CCR)?	☐	☐	☐	☑
b. Cause a substantial adverse change in the significance of an archaeological resource pursuant to CCR §15064.5?	☐	☐	☐	☑
c. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☑
d. Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☑
e. Exceed an applicable Land Resource Development Plan (LRDP) or Program EIR standard of significance?	☐	☐	☐	☑

Symbols ☑ ☐	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
6. GEOLOGY AND SOILS – Would the project:				
a. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☑
Ii. Strong seismic ground shaking?	☐	☐	☐	☑
Iii. Seismic-related ground failure, including liquefaction?	☐	☐	☐	☑
iv. Landslides?	☐	☐	☐	☑
b. Result in substantial soil erosion or the loss of topsoil?	☐	☐	☐	☑
c. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☐	☐	☑
d. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☑
e. Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☐	☐	☑

Symbols ☑ ☐	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
7. HAZARDS AND HAZARDOUS MATERIALS – Would the project:				
a. Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☑
b. Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☑
c. Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☑
d. Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5, and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☑
e. Result in a safety hazard for people residing or working in the project area for a project located within an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport?	☐	☐	☐	☑
f. Result in a safety hazard for people residing or working in the project area for a project within the vicinity of a private airstrip?	☐	☐	☐	☑
g. Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☑

Symbols ☑ ☐	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
h. Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☑
8. HYDROLOGY AND WATER QUALITY – Would the project:				
a. Violate any water quality standards or WDRs?	☐	☐	☐	☑
b. Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☑	☐
c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☐	☐	☑
d. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner, which would result in flooding on- or off-site?	☐	☐	☐	☑
e. Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☑

Symbols ☑ ☐	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
f. Otherwise substantially degrade water quality?	☐	☐	☐	☑
g. Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☑
h. Place structures within 100-year flood hazard area, which would impede or redirect flood flows?	☐	☐	☐	☑
i. Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☑
j. Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☑
9. LAND USE AND PLANNING - Would the project:				
a. Physically divide an established community?	☐	☐	☐	☑
b. Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the LRDP, general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☑
c. Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☑
10. MINERAL RESOURCES -- Would the project:				
a. Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State?	☐	☐	☐	☑

b. Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☑

Symbols ☑ ☐	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant**	**No Impact**
11. NOISE – Would the project result in:				
a. Exposure of persons to or generation of noise levels in excess of standards established in the local plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☐	☑
b. Exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels?	☐	☐	☐	☑
c. A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☑
d. A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☑
e. Exposure of people residing or working in the project area to excessive noise levels for a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport?	☐	☐	☐	☑
f. Exposure of people residing or working in the project area to excessive noise levels for a project within the vicinity of a private airstrip?	☐	☐	☐	☑

Symbols ☑ ☐	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
12. POPULATION AND HOUSING – Would the project:				
a. Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☑
b. Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☑
c. Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☑
13. PUBLIC SERVICES				
Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities and the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☐	☑
Police protection?	☐	☐	☐	☑
Schools?	☐	☐	☐	☑
Parks?	☐	☐	☐	☑
Other public facilities?	☐	☐	☐	☑

Symbols ☑ ☐	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
14. RECREATION				
a. Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☑
b. Does the project include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?	☐	☐	☐	☑
15. TRANSPORTATION/TRAFFIC – Would the project:				
a. Cause an increase in traffic, which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	☐	☐	☐	☑
b. Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☐	☐	☐	☑
c. Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☑
d. Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☑
e. Result in inadequate emergency access?	☐	☐	☐	☑

Symbols ☑ ☐	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
f. Result in inadequate parking capacity?	☐	☐	☐	☑
g. Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☐	☑

Symbols ☑ ☐	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
16. UTILITIES AND SERVICE SYSTEMS – Would the project:				
a. Exceed wastewater treatment requirements of the applicable Regional Board?	☐	☐	☐	☑
b. Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☑
c. Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☑
d. Have sufficient water supplies available to serve the project from existing entitlements and resources or are there new or expanded entitlements needed?	☐	☐	☐	☑
e. Result in a determination by the wastewater treatment provider, which serves or may serve the project, that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☑
f. Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☑
g. Comply with applicable federal, State, and local statutes and regulations related to solid waste?	☐	☐	☐	☑

Symbols ☑ ☐	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
17. MANDATORY FINDINGS OF SIGNIFICANCE --				
a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	☐	☑	☐	☐
b. Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☑	☐	☐
c. Does the project have environmental effects, which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☑

ENVIRONMENTAL AND PUBLIC INTEREST CONSIDERATIONS REGARDING THE BAY INSTITUTE'S PROTEST OF THE JANUARY 23, 2015, PETITION TO THE STATE WATER RESOURCES CONTROL BOARD FOR TEMPORARY URGENCY CHANGES TO LICENSE AND PERMIT TERMS AND CONDITIONS REQUIRING COMPLIANCE WITH DELTA WATER QUALITY OBJECTIVES IN RESPONSE TO DROUGHT CONDITIONS AND OBJECTIONS TO THE FEBRUARY 3, 2015, SWRCB EXECUTIVE DIRECTOR'S ORDER APPROVING IN PART AND DENYING IN PART THE PETITION

The Bay Institute's protest of the January 23, 2015 petition and objections to the February 3, 2015 order are based on the following environmental and public interest considerations:

1. Reducing Delta outflows required under D-1641 in February and March will exacerbate extremely adverse habitat conditions for pelagic fish species of the San Francisco Bay-Delta estuary that are at extremely high risk of extinction. In addition, reducing required Delta outflows in combination with the proposed relaxation of the Vernalis flow objective will also decrease river flows into the Delta (to the extent that those are controlled by reservoir releases) and degrade habitat conditions for migratory fish species. The benefits afforded to imperiled populations from D-1641 objectives for March – required by February runoff well in excess of the triggers for relaxing these objectives – would be completely eliminated, and one of the few chances to ameliorate the effects of the drought on the estuary lost.

2. Part of the stated basis for relaxing Delta outflow requirements is to preserve storage to provide adequate upstream habitat conditions for salmonids, but there is little assurance or likelihood that such storage can or will be used to provide for the needs of salmonids spawning in 2015 and migrating downstream in subsequent years. Failure to protect either 2014 outmigrating salmonids or the 2015 year class throughout the freshwater stages of their life history could very well result in the extinction of winter-run Chinook salmon and severe impacts to other runs. Maintaining required outflows, on the other hand, will reduce extinction risk for both imperiled pelagic species and migratory species by minimizing the degradation of habitat conditions in the Delta.

3. Increasing Delta exports, especially when flows into and out of the Delta are low and OMR restrictions have also been relaxed, risks major population losses to both pelagic species and migratory salmonids, and the February 3 order rightly denies this part of the petition.

These considerations are addressed in greater detail below.

Reducing Delta outflows required under D-1641 in February and March will exacerbate adverse habitat conditions for pelagic fish species of the San Francisco Bay-Delta estuary at extremely high risk of extinction. In addition, reducing required Delta outflows in combination with the proposed relaxation of the Vernalis flow objective will also decrease river flows into the Delta (to the extent that those are controlled by reservoir releases) will degrade habitat conditions for migratory fish species. The benefits afforded to imperiled populations from D-1641 objectives for March – required by February runoff well in excess of the triggers for relaxing these objectives – would be completely eliminated, and one of the few chances to ameliorate the effects of the drought on the estuary lost.

The population viability of many aquatic organisms in the Bay-Delta estuary is strongly and significantly correlated to Delta outflow (Figure 1), and for these organisms viability increases as outflow increases. The vast and overwhelming evidence for the critical importance of these flow-viability relationships is well documented, and described in detail in the SWRCB's 2010 "Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem" report and the record of the 2012 workshops pertaining to Phase 2 of the SWRCB's update of the Bay-Delta Water Quality Control Plan. The Interagency Ecological Program's January 2015 "Delta Smelt MAST Synthesis Report" updates available information regarding flow effects on this once common, now extremely rare species.

Flow-dependent estuarine species include American shad, Delta smelt, longfin smelt, Sacramento splittail, starry flounder, striped bass, and *Crangon* shrimp. Some of these species are at high risk of extinction and most are experiencing record or near-record low population levels (Figure 2; Figure 4). The 2014 Fall Mid-Water Trawl survey found that Delta smelt abundance is the lowest level ever recorded, and longfin abundance is at the second lowest level on record[1]. Populations of American shad, striped bass, and threadfin shad are also at near-record low levels, clearly indicating that estuarine habitat conditions are grossly inadequate to support fish and wildlife beneficial uses.

[1] In presentations to the SWRCB in the last several years, the Metropolitan Water District of Southern California has suggested that the tremendous decline in the FMWT index of longfin smelt was due to changing environmental conditions and/or changing efficiency of the sampling gear. However, two other data sets, which sample the entire pelagic extent of the estuary with different gear (the Bay Study's midwater trawl and otter trawl) have also detected statistically significant and very large declines in longfin smelt. Preliminary analysis of longfin smelt catches in these other surveys in 2014 indicate that longfin smelt abundance was either the third lowest on record, as measured by the Bay Study Otter Trawl, or the fourth lowest on record, as measured by the Bay Study Midwater Trawl respectively (Figure 4). This should lay to rest the suggestion that the decline (of more than 99%) in longfin smelt abundance is attributable to the particulars of any one sampling program or region of the estuary.

Due to long-term water management (and occasional natural droughts), these species have experienced catastrophically low outflow conditions for half of the past 45 years (Figure 3). The long-term decline in populations caused by persistently inadequate flows has been exacerbated by the current drought. In addition, migratory species, including Chinook salmon, steelhead, green sturgeon, and Sacramento splittail, benefit from higher river inflows to the Delta. As a result of human water management practices and habitat degradation, two Sacramento River Chinook salmon runs (winter and spring), Central Valley steelhead, and green sturgeon are listed as threatened or endangered, and the fall run of Chinook salmon has suffered very large population impacts. Reducing river inflows this year (both as a result of reduced Delta outflow requirements and as a direct modification to the San Joaquin flow standard at Vernalis) will add severe impacts to these populations as their juveniles migrate to and through the Delta. Similar impacts were noted last year when fresh water flows into, through, and out of the Delta were reduced as part of a temporary urgency change (USFWS. 2014. Contingency Release Strategies for Coleman National Fish Hatchery Juvenile Fall Chinook Salmon due to Severe Drought Conditions in 2014).

For many of these species, there is no margin of error. Causing additional impacts on top of those created by the natural drought risks the loss of imperiled populations forever. In particular, species with short life spans that spawn only one time (semelparous species such as Delta smelt, longfin smelt, and Chinook salmon) are extremely vulnerable to the negative conditions contemplated by the proposed changes to fresh water flow and water quality; they simply cannot wait out bad years and spawn when wetter conditions return. The extremely depressed population levels that these species now are experiencing therefore make them highly vulnerable to acute reductions in outflow. Relaxing Delta outflow requirements (and associated levels of flow into and through the Delta) during the critical February through June period in 2015 could result in the extinction of these species; at best, reduced Delta outflows will continue to cause their populations to contract.

Denying the petition's request to relax Delta outflows will not result in recovery of these species to viable population levels. Only timely action by the SWRCB to adopt and implement water quality objectives and other requirements to fully protect estuarine habitat and other fish and wildlife beneficial uses will accomplish that goal. But ensuring that the minimal Delta outflows and San Joaquin River inflows required by D-1641 actually occur will significantly reduce the very real risk of extinction for several pelagic and migratory species.

Indeed, projected March outflows under D-1641 could contribute significantly to population increases for many of these species. The current estimated February 8-River index is 2.511 MAF, which would trigger 31 days of compliance with the Chipps Island outflow objective in March. Far from reducing outflows from 7,100 cfs to 4,000 cfs, the proposed relaxation would decrease outflows by over two thirds of the required 11,400 cfs outflow under D-1641. To reduce outflows so drastically from the existing requirements is neither justified by current hydrological conditions nor responsible in the face of the severe and perhaps irreversible consequences likely to ensue for populations at record or near-record lows.

Part of the stated basis for relaxing Delta outflow requirements is to preserve storage to provide adequate upstream habitat conditions for salmonids, but there is little assurance or likelihood that such storage can or will be used to provide for the needs of salmonids spawning in 2015 and migrating downstream in subsequent years. Failure to protect either 2014 outmigrating salmonids or the 2015 year class throughout the freshwater stages of their life history could very well result in the extinction of winter-run Chinook salmon and severe impacts to other runs. Maintaining required outflows (and river inflows), on the other hand, would reduce extinction risk for both imperiled pelagic species and migratory species by minimizing the degradation of habitat conditions in the Delta.

There are rational arguments to be made that relaxing Delta outflow requirements during extreme drought conditions may be prudent. Such actions might allow the Central Valley Project and the State Water Project to store cold water in their upstream facilities in order to release water to maintain downstream spawning habitat conditions for salmonids later in the year. The question for the SWRCB to consider in evaluating this particular petition is whether relaxing outflows is likely to result in increased protection of this year's salmonid year class during its incubation phase ***and*** when those fish hatch and begin their journey downstream to the ocean. The evidence is that approving the petition will not.

The SWRCB approved a previous petition by the CVP and SWP in 2014 based on a similar rationale. As a result, very poor estuarine habitat conditions in 2014 were further degraded, and estuarine fish population indices fell to record or near-record lows. In addition, salmonid juveniles that were migrating into and through the Delta during 2014 (fish that spawned during 2013) experienced elevated mortality resulting from reduced fresh water flow rates[2]. The proposed benefits for salmonids spawning in 2014 that justified the relaxation were not realized, however. CVP and SWP operations failed to protect either the outmigration of the 2013 salmonid year class nor the egg stage of the 2014 year class; only 5% of the 2014 year class of winter-run salmon is estimated to have survived to-date, and these fish must still transit the Delta.

Now, petitioners propose to reduce the flow into and through the Delta needed to aid the remnants of the 2014 year class as it struggles to reach the ocean as a tradeoff for "protecting" the 2015 spawning class. Maintaining the minimum Delta outflow requirements in 2015 is the only way to protect the remaining 5% of the 2014 winter-run Chinook salmon year class. If the drought continues, the ability of the projects to maintain sufficient storage to protect ***both*** the egg stage and the outmigration of the 2015 year class is extremely doubtful (protection of only a

[2] For example, in 2014, USFWS wrote: "Decreased flows in the Sacramento River lead to significantly reduced survival of juvenile salmon because of reduced travel times exposing the fish to increased predation and increased risk of diversion into the interior Delta where survival is significantly reduced." [p. 2-3 in USFWS 2014, cited above]

fraction of the life cycle, at the expense of protections in the remainder of the life cycle simply does not make sense). If the proposal to reduce fresh water flows needed by the 2014 year class to complete their freshwater journey is implemented, the 2014 year class will be lost – and the 2013 year class was sacrificed to protect the 2014 year class. The best chance to avoid the potential destruction of the 2014 year class of all runs of Chinook salmon and steelhead and at the same time prevent extinction of estuarine pelagic species at risk and of the winter Chinook salmon run and to ameliorate the effects of the continuing drought on the public trust values of the Bay-Delta ecosystem is to maintain the minimal Delta outflow requirements in 2015.

Increasing Delta exports, especially when flows into and out of the Delta are low and OMR restrictions have also been relaxed, risks major population losses to both pelagic species and migratory salmonids, and the February 3 order rightly denies this part of the petition.

Both estuarine fish species and migrating salmonids are highly vulnerable to entrainment mortality and other effects of Delta export pumping. The impact of export pumping to these populations is greatest when flows through and out of the Delta are low. Allowing elevated exports when Delta outflows are lower than the level set in D-1641 represents a very grave risk that the projects will entrain and kill a disproportionately large fraction of one or more imperiled populations.

The best available scientific evidence indicates that up to 40% of the delta smelt population and 15% of outmigrating Chinook salmon are lost to entrainment when Delta exports occur at high levels relative to Delta outflows[3]. These figures do not factor in the indirect effects of entrainment on survival of these species.

Longfin smelt are particularly susceptible to entrainment impacts (as indexed by salvage at the CVP/SWP fish screening facilities) during years with low outflow (Figure 5). This is hypothesized to be because the location of longfin spawning and early rearing is focused upstream of the salinity field – as the salinity field moves to the east during January through April (the longfin spawning period), the fish move closer to the export facilities[4]. In addition, the rate of longfin entrainment accelerates rapidly as OMR flows become more negative[5]. Thus, allowing decreased freshwater flows out of the Delta puts the already severely imperiled longfin population in harm's way and increasing exports and reducing San Joaquin inflow to the Delta

[3] See: Kimmerer, W.J. 2008. Losses of Sacramento River Chinook Salmon and Delta Smelt to Entrainment in Water Diversions in the Sacramento-San Joaquin Delta. San Francisco Estuary and Watershed Science, 6(2).

[4] See: Rosenfield, J.A. 2010. Conceptual life-history model for longfin smelt (Spirinchus thaleichthys) in the San Francisco Estuary. California Department of Fish and Game, Sacramento, CA.

[5] See: Grimaldo, L. F., T. Sommer, N. Van Ark, G. Jones, E. Holland, P. B. Moyle, B. Herbold, and P. Smith. 2009. Factors Affecting Fish Entrainment into Massive Water Diversions in a Tidal Freshwater Estuary: Can Fish Losses be Managed? North American Journal of Fisheries Management 29:1253-1270.

(both of which lead to increasingly negative OMR flows) is a recipe for entraining and killing a very large fraction of the longfin spawning and larval rearing populations.

In conclusion, the D-1641 objectives for Delta outflow and Vernalis inflows should not be relaxed, and the D-1641 export criteria maintained per the February 3 order, in order to:

- Avoid the very real prospect of causing the extinction of one or more pelagic estuarine or migratory salmonid populations.

- Avoid repeating the mistakes of 2014, when Delta outflows were relaxed for the ostensible purpose in part of protecting migratory salmonids, and as a result both pelagic estuarine and migratory salmonid populations were devastated.

- Avoid the likelihood of catastrophic effects on imperiled populations from the combined effects of relaxing outflow and export criteria in tandem.

- Ameliorate the effects of the drought on the Bay-Delta estuary ecosystem by providing the benefit of improved conditions as required under D-1641 – a long-awaited opportunity to ease the pressure on an ecosystem and species at risk.

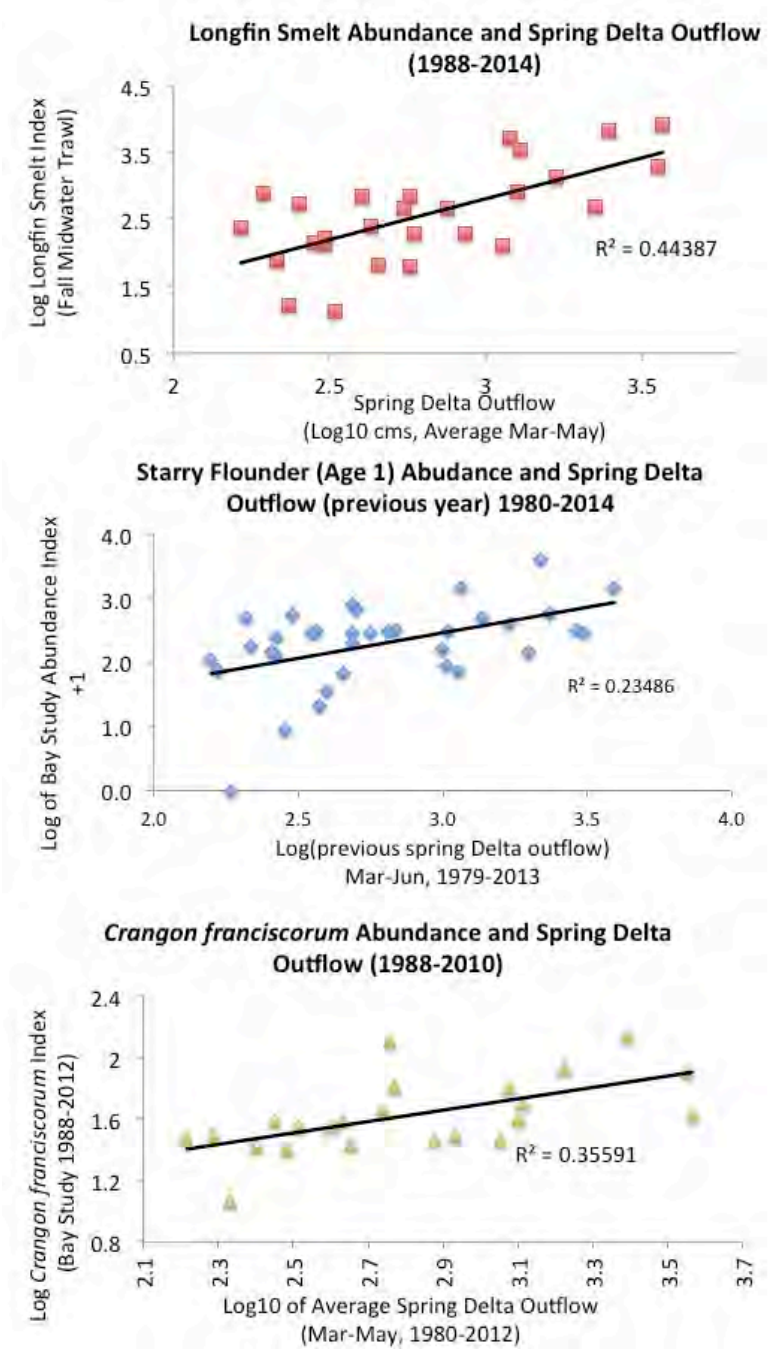


Figure 1: Long term relationship of Delta outflow and abundance indices for three estuarine species. These species display a range of trophic levels, behaviors, and ecological tolerances. They are also representative of a broader suite of species that show similar long-term positive relationships between abundance and winter-spring Delta outflow. Starry flounder and *Crangon* shrimp data courtesy of CDFW's San Francisco Bay Study and the Interagency Ecological Program for the San Francisco Estuary.

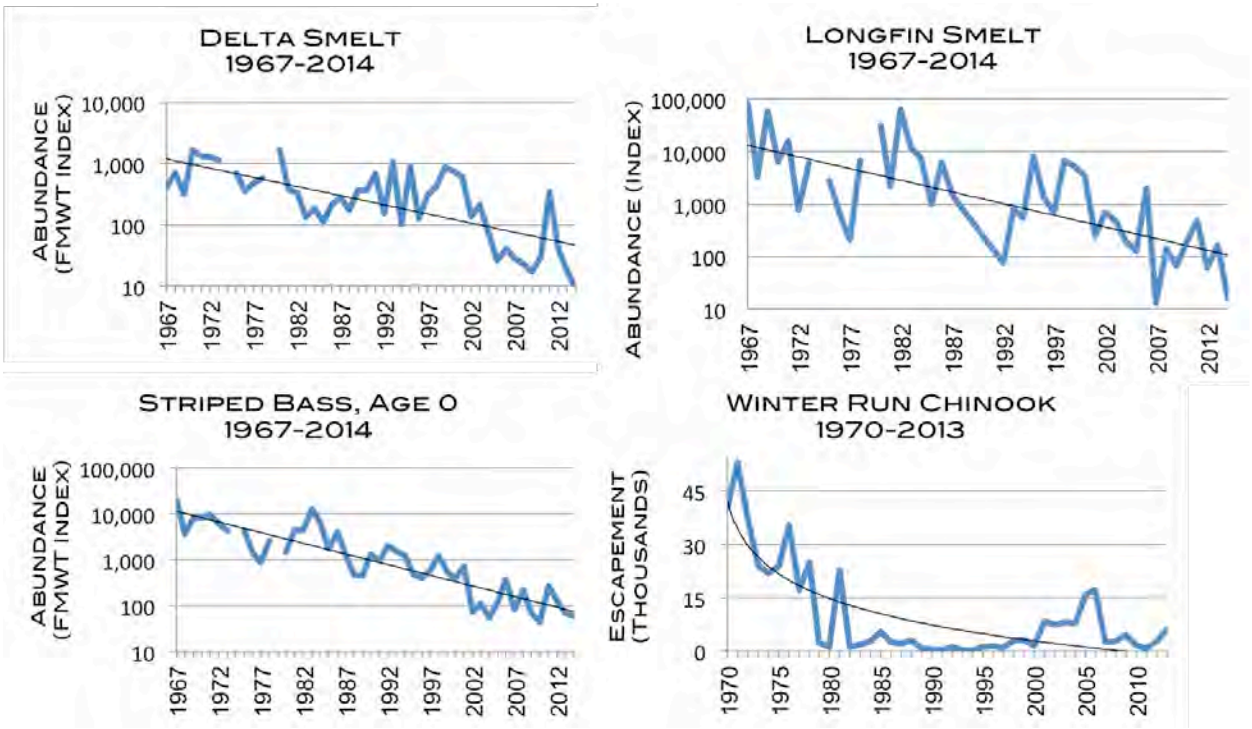


Figure 2: Long-term decline of four fish species of the San Francisco Bay-Delta estuary. The pelagic species have declined by at least 99% over the period of record. Note that the y-axis for Delta smelt, longfin smelt, and Age-0 striped bass is a log-scale; each scale value is 10x the scale value immediately below. The y-axis for the winter-run Chinook salmon is linear.

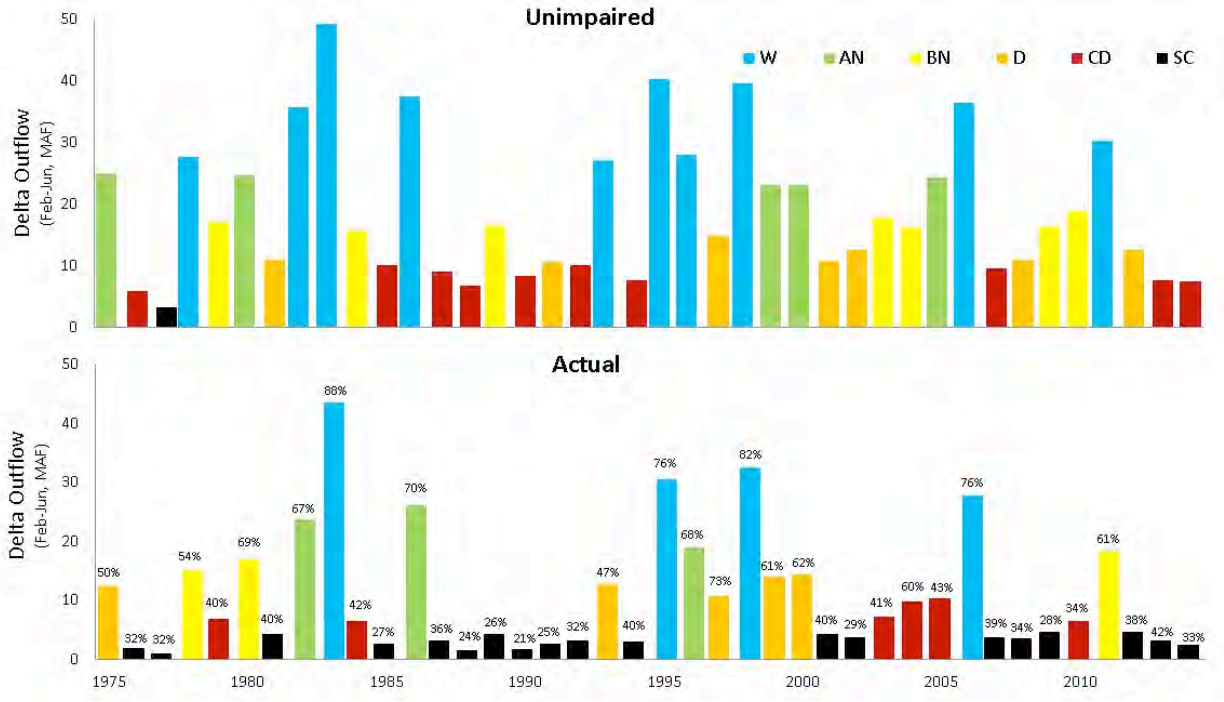


Figure 3: Persistent, man-made drought experienced by the San Francisco Bay-Delta estuary ecosystem. Bars represent the volume of Delta fresh water outflows that would be expected under current landscape conditions without storage or diversion (upper panel; unimpaired) and those that actually occurred (lower panel; actual). Colors represent water year types (W=wet, AN=Above Normal, BN = Below Normal, etc.). Black bars represent Super-critically Dry (SC) runoff conditions that occur naturally in <3% of years (e.g., 1977 in the upper panel). Actual outflows have been equal to or less than the Super-critical threshold in 19 of 40 years since 1975 (47.5% of years). Since 1995, Wet years and Above Normal years have occurred naturally 40% of the time, but the estuary has only experienced those conditions in 20% of years. Since 1995, Super-critically Dry conditions have occurred in the estuary in twice as many years as Wet + Above Normal conditions.

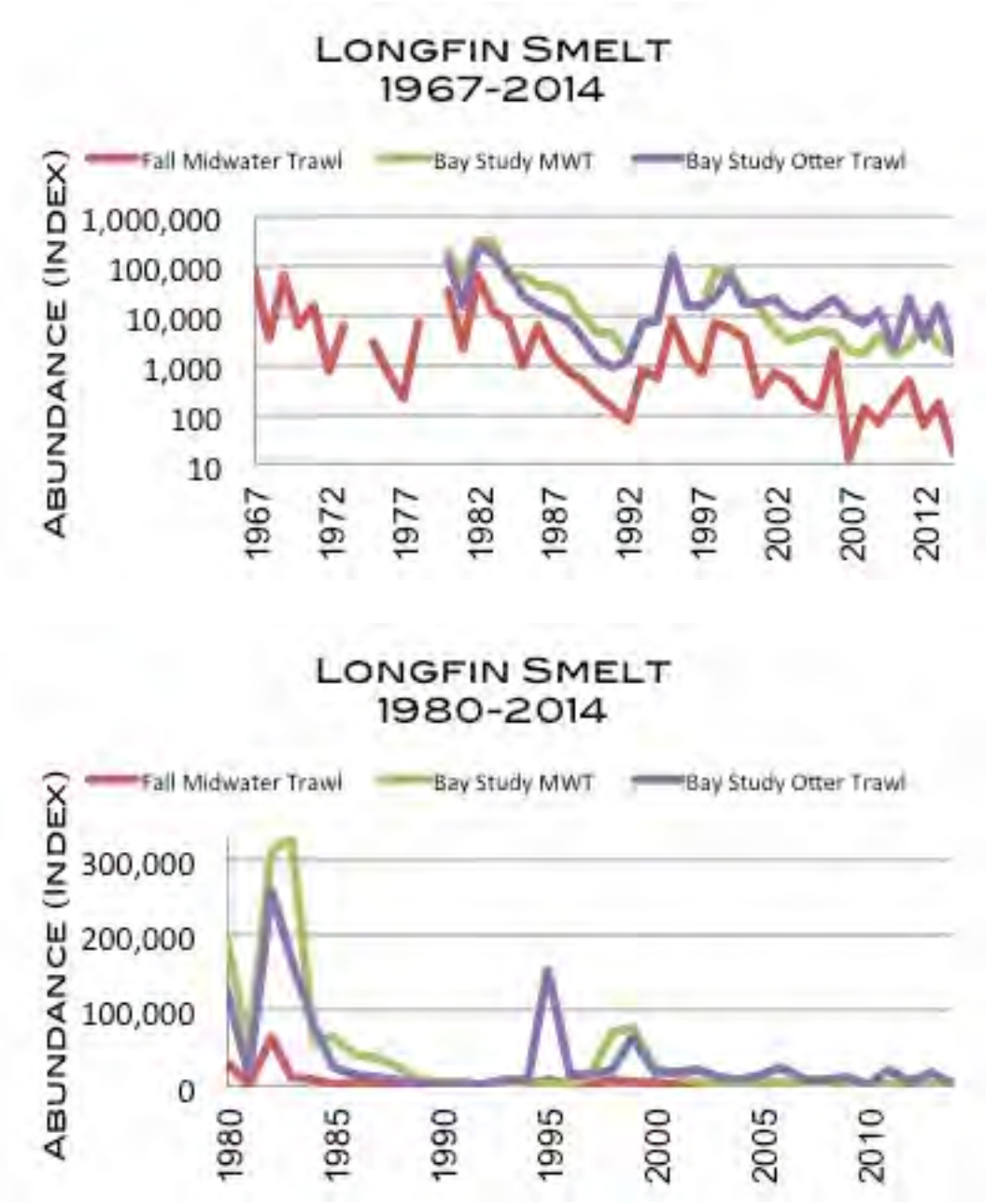


Figure 4: Decline in longfin smelt abundance indices from three different sampling programs in the San Francisco Bay Estuary. For each sampling program the decline from the largest index on record to the most recent (2014) index is greater than 99%. The y-axis in the top panel displays index values on a $\log_{10}$-scale; this allows for visualization of the orders of magnitude changes in all three indices over time. The y-axis in the bottom panel shows index value on a normal linear y-axis – the x-axis here begins in 1980 to show only the period when all three sampling programs were active.

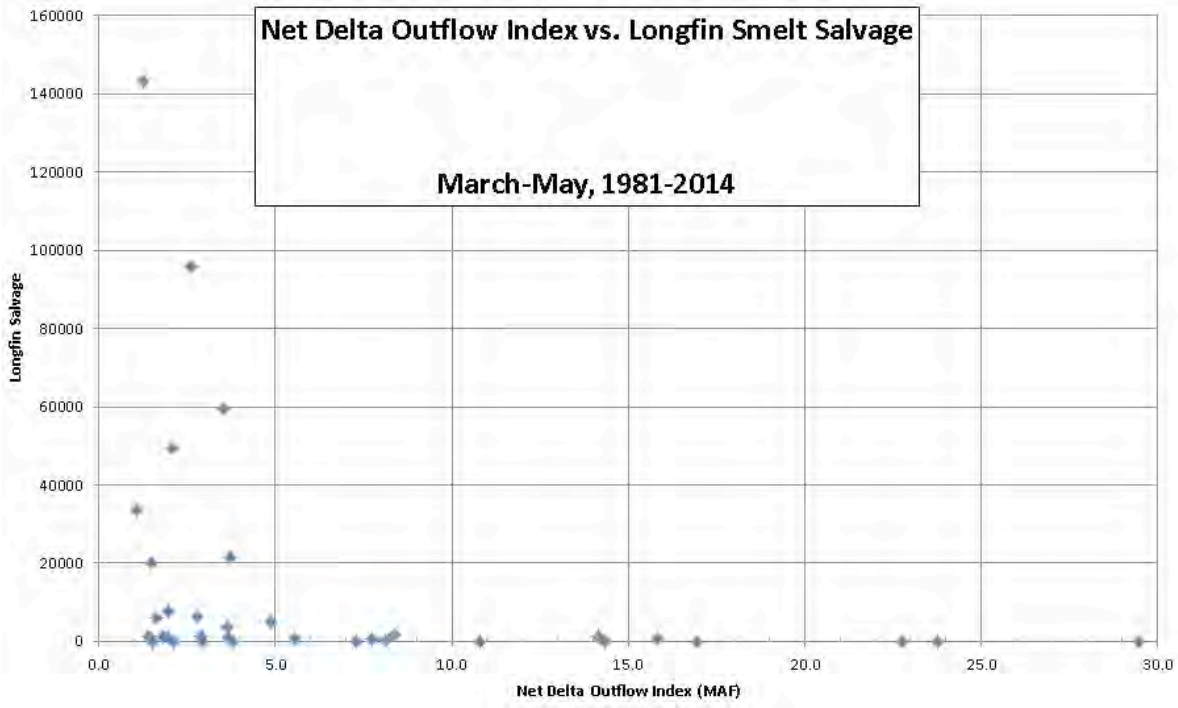
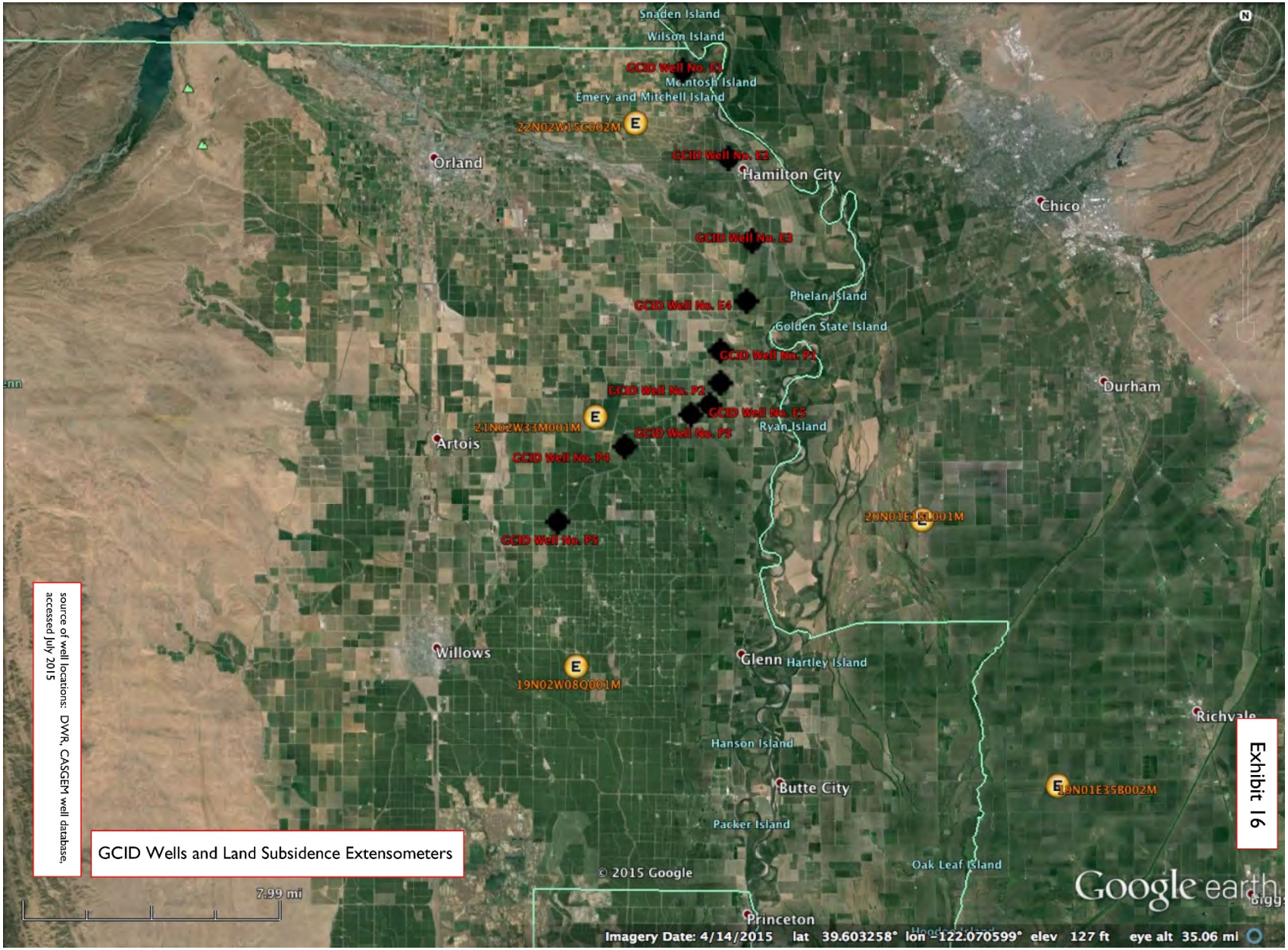


Figure 5: Historical salvage of longfin smelt at SWP and CVP salvage facilities, as a function of Delta outflow. Most salvage occurs when Delta outflows are low in the winter and spring, probably because longfin smelt focus spawning east of the salinity field and, as the salinity field moves further east, spawning adults, larval, and juvenile longfin aggregate closer to the export facilities. This effect, combined with the strong correlation between salvage and OMR flows or exports, suggests that longfin smelt entrainment risk is highest when outflows are low and exports are high.


Snaden Island
Wilson Island
GCID Well No. E1
Mc.ntosh Island
Emery and Mitchell Island
22N02W15C002M
Orland
GCID Well No. E2
Hamilton City
Chico
GCID Well No. E3
Phelan Island
GCID Well No. E4
Golden State Island
GCID Well No. P1
Durham
GCID Well No. P2
GCID Well No. E5
21N02W33M001M
Ryan Island
GCID Well No. P3
Artois
GCID Well No. P4
20N01E18L001M
GCID Well No. P5
Willows
Glenn
Hartley Island
19N02W08Q001M
Richvale
Hanson Island
Butte City
19N01E35B002M
Packer Island
Oak Leaf Island
© 2015 Google
Princeton
Google earth
Imagery Date: 4/14/2015 lat 39.603258° lon -122.070599° elev 127 ft eye alt 35.06 mi
7.99 mi
source of well locations: DWR, CASGEM well database, accessed July 2015
GCID Wells and Land Subsidence Extensometers
Exhibit 16

California Department of Water Resources

HYPLOT V133 Output 07/04/2015

Period 11 Year Plot Start 00:00_01/01/2005

Interval 6 Day Plot End 00:00_01/01/2016

Extensometer 21N02W33M001M, Glenn County

2005-16

— 21N02W33M001M Screen: 869-890 ft 115.00 Mean GS Displacement (ft)

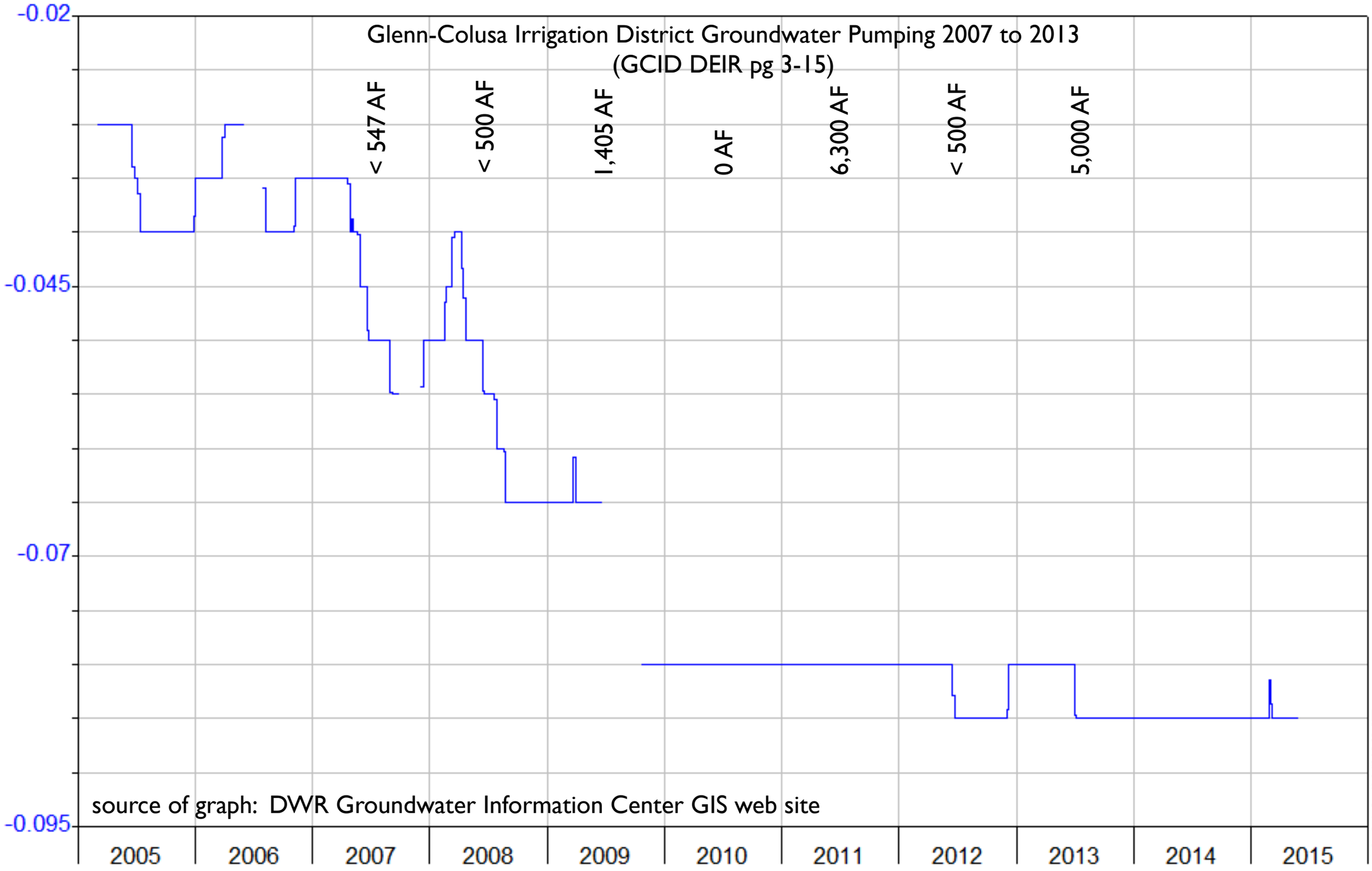


Exhibit 17A

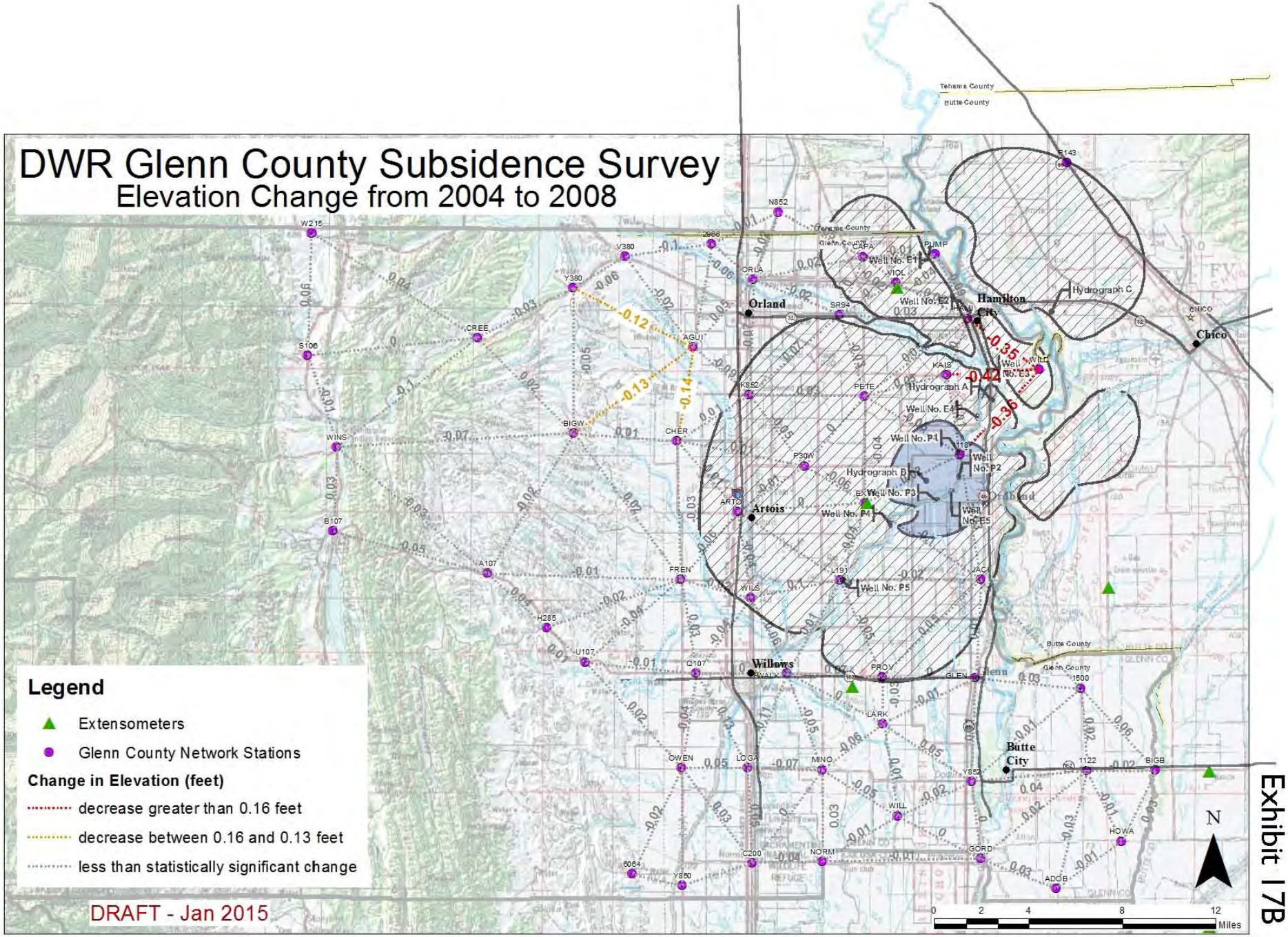
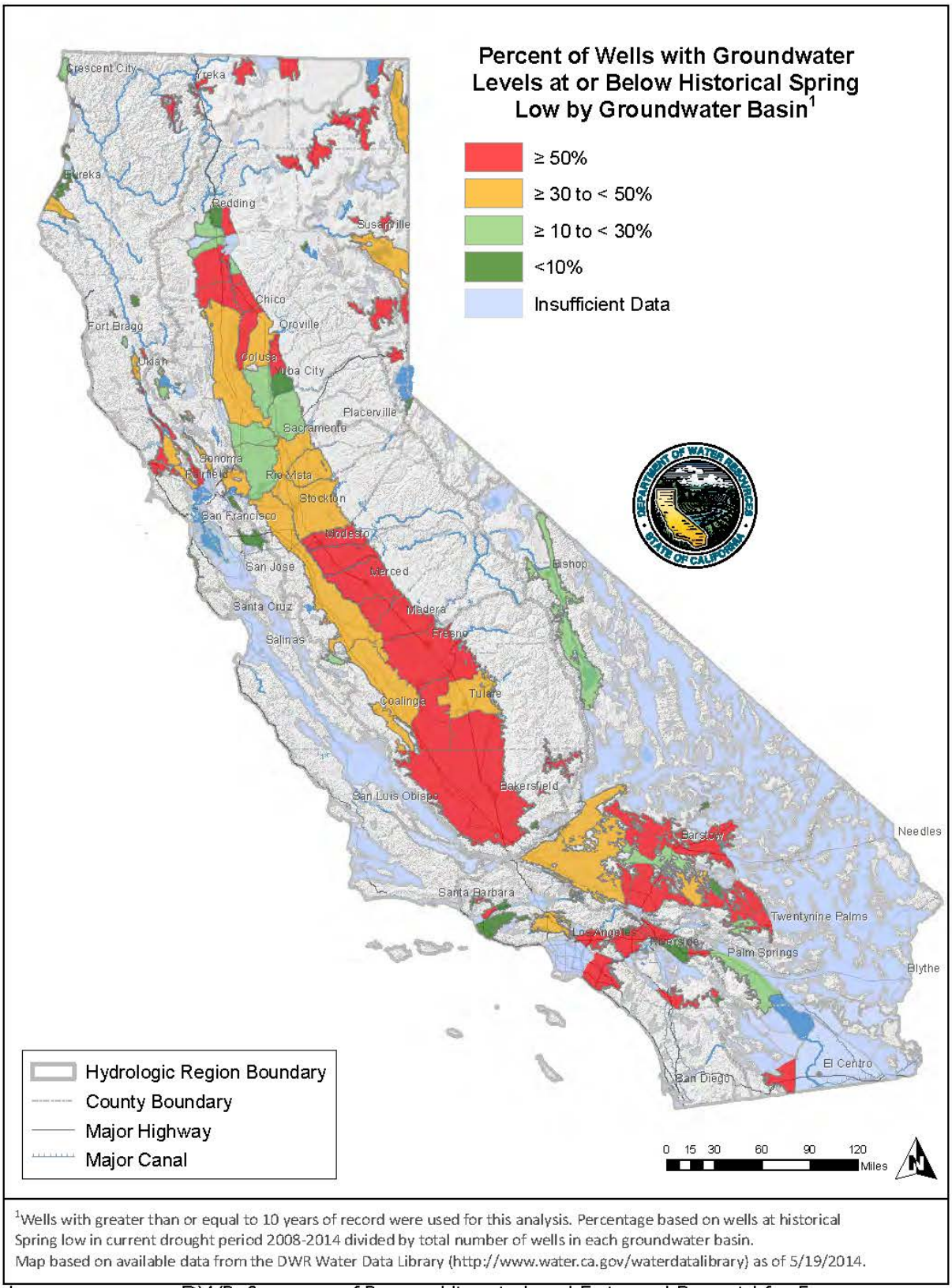


Exhibit 17B

base map source: DWR, Letter from Bill Ehorn to Glenn Co. Supervisors and Water Advisory Committee, Spring 2008 Subsidence GPS survey results, dated February 3, 2015

FIGURE 2

Percent of Wells with Groundwater Levels at or Below Historical Spring Low by Groundwater Basin



[1]Wells with greater than or equal to 10 years of record were used for this analysis. Percentage based on wells at historical Spring low in current drought period 2008-2014 divided by total number of wells in each groundwater basin.
Map based on available data from the DWR Water Data Library (http://www.water.ca.gov/waterdatalibrary) as of 5/19/2014.

base map source: DWR, Summary of Recent, Historical, and Estimated Potential for Future Land Subsidence in California, 2014

Exhibit 19

Glenn Colusa Irrigation District Sub-Areas 8, 9 & 11 BMO Monitoring Wells

Map ID Number	Latitude	Longitude	Name	BMO	Description	Start Date	End Date
S8-1	39.6971	-121.9893	21N01W04N001M	4	Irrigation	8/24/59	6/2/15
S8-2	39.7687	-122.0547	22N02W11Q001M	4	Irrigation	8/8/73	6/2/15
S8-3	39.7301	-122.0022	22N01W29K001M	4	Irrigation	12/13/73	6/2/15
S9-1	39.7090	-122.0542	21N02W02B002M	1	Residential	3/9/60	6/3/15
S9-2	39.6869	-122.0130	21N02W09M002M	1	Irrigation	6/19/63	6/3/15
S9-3	39.6628	-122.0553	21N02W23G001M	1	Irrigation	1/20/65	6/3/15
S11-1	39.4661	-122.1076	19N02W29Q001M	3	Residential	9/13/41	7/15/15
S11-2	39.4665	-122.1670	19N03W26P001M	3	Residential	2/6/74	6/1/15
S11-3	39.6159	-122.0471	20N02W02J001M	3	Residential	12/22/41	7/15/15
S11-4	39.6237	-122.1016	20N02W05A001M	3	Irrigation	8/26/59	10/12/06
S11-5	39.6087	-122.0456	20N02W11A001M	3	Observation 70-90'	11/17/76	6/1/15
S11-6	39.6087	-122.0456	20N02W11A002M	3	Observation 140-180'	11/16/76	6/1/15
S11-7	39.6087	-122.0456	20N02W11A003M	3	Observation 490-510'	11/17/76	6/1/15
S11-8	39.5913	-122.0367	20N02W13G001M	3	Residential	8/26/59	7/15/15
S11-9	39.5632	-122.1069	20N02W29G001M	3	Residential	12/20/41	6/1/15

Foster Island
Lower Foster Island
Snodgrass Island
Wilson Island
GCID Well No. P1
McIntosh Island
Emery and Mitchell Island
22N02W11Q001M
Orland
GCID Well No. P2
Hamilton City
22N01W29K001M
Chico
21N02W02B002M
21N02W04N001M
21N02W09M002M
Phelan Island
GCID Well No. P3
Golden State Island
21N02W23G001M
GCID Well No. P4
GCID Well No. P7
GCID Well No. P6
Durham
Artois
20N02W05A001M
GCID Well No. P5
Ryan Island
20N02W02J001M
GCID Well No. P8
20N02W11A002M
20N02W13F001M
GCID Well No. P5
20N02W29G001M
Willows
Glenn
Hartley Island
Richvale
Hanson Island
© 2015 Google
19N03W26P001M
19N02W29Q001M
Butte City
8.09 mi
Packer Island
Imagery Date: 4/14/2015 lat 39.646244° lon -122.006146° elev 120 ft eye alt 35.01 mi
Google earth

source of well locations: DWR, CASGEM well database, accessed July 2015

GCGWMP Key Wells Sub-Areas 8, 9, & 10

Exhibit 20

Summary

The Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report Public Draft (henceforth referred to as the "EIR/EIS") articulates an ambitious plan to transfer water within the state of California. But this ambition is not matched by a similar degree of technical merit, as the modeling components of the EIR/EIS are potentially inadequate, inaccurate, and insufficient to the task. Because of this shortcoming, the EIR/EIS fails to demonstrate that environmental impacts of these transfers will be acceptably small. In particular, the groundwater substitution components of the proposed water transfers are based on modeling assumptions that likely limit their practical accuracy, and on computational simulation techniques that cannot be trusted for their intended use without additional work.

The EIR/EIS as written fails to make a technically-persuasive case for these water transfers, and therefore the proposed transfers should be rejected until the various water transfer stakeholders can advocate more effectively for these transfers by using sound scientific principles instead of mere assertions of negligible impact on the environment.

Critique Overview

This critique concentrates on the groundwater modeling portions of the EIR/EIS, as those portions of the EIR/EIS provide the least technical information relative to the importance of this particular part of the transfer plans. Groundwater resources are seldom seen directly, but their influence is present throughout the hydrological cycle. When the water table sinks, streams dry up and fish die. And when that phreatic surface drops below the level available to domestic water-supply wells, families lose their water supply. Groundwater mining is an all-too-common source of environmental woes, including irreversible loss of aquifer capacity and subsidence observable at the surface of the ground. So accurate groundwater modeling is an essential component of any trustworthy assessment of potential negative environmental effects.

This critique focuses on four particular aspects of the groundwater modeling efforts outlined in the EIR/EIS, namely:

- the lack of a defensible technical basis for the use of the SacFEM2013 groundwater model in assessing man-made hazards due to groundwater substitution activities,
- the inherent assumptions and potential inaccuracies present in the SacFEM2013 model, including an exposition of how better groundwater modeling techniques could have been deployed to engender more trust in the computed results,
- the lack of any formal characterization of uncertainty in the model that might be used to assess the impact of those SacFEM2013 model inaccuracies, and
- some general comments on the EIR/EIS's all-too-often inadequate technical treatment of aquifer mechanics.

Sins of omission and commission are thus found in the EIR/EIS, and this critique will attempt to guide the reader through a discussion of each, towards the goal of more accurate and technically-defensible modeling that would be required to support the proposed water transfers.

Professional Background

My professional experience has long been concentrated in the development and deployment of large-scale computational models for engineered and natural systems. I have worked in this professional field for well over thirty years, and have published refereed journal publications on subsurface mechanics and computational simulation of geological processes, as well as texts and related educational works on computational modeling in solid and fluid mechanics. I have served as a regular faculty member on the Civil Engineering faculties of two major U.S. research universities (the University of California, Davis, and the University of Oklahoma), as well as in leading-edge technical and administrative capacities at federal national laboratories. With my academic colleagues and graduate students, I have published journal articles and technical reports on aquifer mechanics, computational geomechanics, fluid-solid interaction, high-performance computing, and on the inherent limits to accuracy of computational modeling for complex systems in the presence of inherent uncertainties. I have an earned M.S. and Ph.D. in Civil Engineering and a B.S. in Mathematics, all from the University of California, Davis. I have lived in Northern California for more than one-half of my adult life, and have long provided *pro bono* technical assistance on science and engineering topics of import to the quality of life for residents of California. My current work involves simulation of complex man-made and natural systems using some of the largest computers in the world, and so I am well-equipped to describe the state-of-the-art in predictive modeling for large-scale water transfers in California.

Overview of Technical Concerns

This review focuses primarily on the groundwater substitution aspects of the EIR/EIS, because those aspects are where my own expertise is deepest. The groundwater model utilized in the EIR/EIS has enough shortcomings to call into question the trustworthiness of the entire EIR/EIS, and until these shortcomings are remedied, such groundwater transfers should not be permitted. Some representative problems with the SACFEM2013 model are presented below.

Fundamental Technical Problems with the SacFEM2013 Model

In simplest terms, the EIR/EIS fails to make a compelling case for the use of the SacFEM2013 groundwater model in assessing man-made hazards due to groundwater substitution activities.

For example Appendix D of the EIR is provided to document the SacFEM2013 model, but this section of the EIR/EIS raises more questions than answers about the suitability of the model. Some of the assertions made in Appendix D are incorrect, while others are irrelevant to the purpose of the EIR/EIS. And the most fundamental problem with the information presented on the SacFEM2013 model is that Appendix D fails to provide enough technical context to justify the use of SacFEM2013. A technically-informed citizen interested in providing accurate public commentary on the EIR/EIS must search the literature and other open-source documents to find relevant information about the suitability of the SacFEM2013 model. Unfortunately, these searches prove fruitless, because there simply is not enough information provided in the EIR/EIS to perform a technically-defensible characterization of the suitability of SacFEM2013. Because of this, some of the my comments include qualifiers such as “appears to be” or “apparently”. These qualifiers do not imply any insufficiency in my own understanding: they are explicit reminders that the EIR/EIS fails to provide an adequate technical basis for use of SacFEM2013.

One example of incorrect modeling assertions in the EIR/EIS is the characterization[1] of SacFEM2013 and its parent code MicroFEM as "three-dimensional" and "high-resolution". In fact, the SacFEM2013 model provides only a linked set of two-dimensional analyses[2], and would more charitably be described as "two-and-a-half dimensional" instead of possessing a fully-3D modeling capability. This limitation is not an unimportant detail, as a general-purpose 3D groundwater model could be used to predict many important physical responses, e.g., the location of the phreatic surface within an unconfined aquifer. For the SacFEM2013 model, this prediction is part of the data instead of part of the computed solution, and hence SacFEM2013 apparently has no predictive capability for this all-important aquifer response. Here is the relevant EIR/EIS content on this topic[3]:

> The uppermost boundary of the SACFEM2013 model is defined at the water table. To develop a total saturated aquifer thickness distribution and, therefore, a total model thickness distribution, it was necessary to construct a groundwater elevation contour map and then subtract the depth to the base of freshwater from that groundwater elevation contour map. Average calendar year groundwater elevation measurements were obtained from the DWR Water Data Library. These measurements were primarily collected biannually, during the spring and fall periods; and these values were averaged at each well location to compute an average water level for each location. These values were then contoured, considering streambed elevations for the gaining reaches of the major streams included in the model, to develop a target groundwater elevation contour map for the year 2000.

Note that, in order to begin a SacFEM2013 analysis, the phreatic surface must be specified instead of predicted, and that this specification is based on past records of water table location instead of on verifiable accurate predictions of future groundwater resources. Since California is currently in an unprecedented drought, and because the assessment of similarly-unprecedented future large-scale groundwater transfers is the whole point of the EIR/EIS, it is technically inappropriate to use an averaged historical basis to locate the water table surface simply because the SacFEM2013 is unable to predict that important parameter from first principles!

A good example of an irrelevant assertion in the EIR/EIS is the list of reasons given[4] why MicroFEM was chosen as the modeling platform. The first reason is true of *any* finite-element code used to model groundwater response, and the second and third arise from the existence of a graphical user interface for the model input and output data. Any modern computational tool (e.g., the word-processing application I'm using to write this critique) possesses such a user interface, so all three reasons apply equally well to any well-designed finite element application, yet they are used to motivate the choice of only one such application. Why this specific choice of MicroFEM was made is never developed in the EIR/EIS, but it should be, as with the choice of computational model comes a set of model constraints that can limit the model's utility.

> ***Technical sidebar:*** *finite element models are particularly easy to develop and deploy graphical user interfaces for, because the interpolation scheme used to generate the finite element results provides uniquely-defined and easy-to-compute results for every point in the spatial domain. In addition to this readily-accessible supply of spatial data available for visual interpretation of results, these models also can produce results at regular time*

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[1] *EIR/EIS, Appendix D, Page 1*
[2] *S.A. Leake and P.A. Mock, "Dimensionality of Ground Water Flow Models", Ground Water, Volume 35, Number 6, Page 930, 1997*
[3] *EIR/EIS, Appendix D, Page 4*
[4] *EIR/EIS, Appendix D, Page 1*

intervals (e.g., monthly) that make it easy to generate animations of the spatial data. So the presence of a graphical user interface is a poor reason to choose a particular finite element application, as custom visualization tools are readily developed at low cost to support the use of the model, or public-domain visualization tools can be utilized instead.

Unfortunately for the results presented in the EIR/EIS, MicroFEM is a poor choice for such large-scale modeling. It is an old code that apparently utilizes only the simplest (and least accurate) techniques for finite-element modeling of aquifer mechanics, and MicroFEM (and hence SacFEM2013) embed serious limitations into the model that compromise the accuracy of the computed results. These limitations include, but are not limited to, the following:

- The model places a remarkably-low upper limit on problem resolution, i.e., 250,000 surface nodes are available to the modeler, but no more. This limit would appear to the technically-oriented reader to indicate that the advanced age of the MicroFEM program has constrained its software architecture so that high-resolution and high-fidelity models are beyond its capabilities. In particular, its MS/DOS origins might indicate an inability to address sufficient computer memory to support a higher-resolution model, or that its solver routines do not scale to support the multiple-processor capabilities available on virtually all current computers. If this is the case, then this problem should be explicitly noted in the EIR/EIS as a model limitation. If it is not the case, then some justification for this upper limit should be provided to aid in the impartial evaluation of the SacFEM2013 model.
- As mentioned above, the SacFEM2013 model is only partially predictive, in that some aquifer responses are entered as input data instead of being computed as predictive quantities. The most serious of these is the lack of ability to predict the location of the phreatic surface in the aquifer. This location is a natural candidate as the single the most important predicted quantity available for understanding near-surface environmental effects of groundwater motion, yet it is apparently not computed by SacFEM2013, which instead relies on its location via the a priori data-entry process quoted above.
- As mentioned earlier, the model is not a three-dimensional model, but instead estimates groundwater response via approximations involving a suite of two-dimensional layers with uniform horizontal permeabilities coupled via estimated leakage parameters that represent the actual three-dimensional flow fields of groundwater resources. The limitations of this self-induced model constraint are outlined in more detail below, but the summary is simple enough: the real-world complexities of California's groundwater aquifers are over-simplified by the SacFEM2013 model into no more than 25 available two-dimensional layers of uniform composition, and hence the model results are at best computational simplifications not necessarily representative of actual groundwater responses to pumping.

In addition to the model not being a true 3D model of the actual geometric nature of the state's groundwater resources, some other problems with the model include the following:

- The model requires considerable data manipulation to be used, and these manipulations are necessarily subject to interpretation. This fact implies that the model results depend on the choices made by the analyst, and are hence not necessarily reproducible. In other words, adjusting of the results (by accident or by design) is an inherent characteristic of the model, and that characteristic alone erodes trust in the model. There are technically-defensible ways to provide accurate assessments of how such adjustments might affect output results used in

decision-making (e.g., sensitivity analyses for these parameters), but these means for evaluating trust in the model are not mentioned in the EIR/EIS, and one can only conclude that they have never been performed.

- The model description in the EIR/EIS presents no validation results that can be used to provide basic quality-assurance for the analyses used in the EIR/EIS. The reader can seek information on the parent code MicroFEM, but precious little data is available on that code's capabilities, so the question of "can the results of this model be trusted?" is not answered by the EIR/EIS. An expert reviewing the EIR/EIS might seek to examine the MicroFEM code directly, but the underlying source code is not available, and the MicroFEM tool can only be purchased for a substantial fee ($1500), so it is infeasible to gain informed public comment on the suitability of MicroFEM or SacFEM2013 without paying a substantial price.
- The model is not predictive in some aquifer responses (as mentioned above), so its results are a reflection of past data (e.g., streamflows, phreatic surface location, etc.) instead of providing a predictive capability for future events. Since accurate prediction of future environmental effects is the whole point of the EIR/EIS, the SacFEM2013 model is arguably not even suitable for use in the EIR/EIS, much less in real-world hydrological practice.

The problem of data manipulation mentioned in the first bullet above represents a serious limitation of the SacFEM2013 model. Model quality can be measured by standard quality-assurance processes utilized for software development, such as the CMM model[5] widely used in software practice. The five stages of increasing quality in the CMM model are termed ad hoc (or chaotic), repeatable, defined, managed, and optimized, and the repeatable stage is generally accepted as the minimal level of quality appropriate for any critical analysis methodology. Since analyst intervention in data preparation creates an obvious risk of analyst dependencies in the output data used to set policy, the current SacFEM2013 workflow is likely only at the "ad hoc/chaotic" state of quality assurance for a model. This is simply not appropriate for critical analyses that are used in decision-making on such important resources as water in California.

A typical example of analyst intervention in data preparation can be found in Appendix D of the EIR/EIS[6]:

> After a transmissivity estimate was computed for each location, the transmissivity value was then divided by the screen length of the production well to yield an estimate of the aquifer horizontal hydraulic conductivity (Kh). The final step in the process was to smooth the Kh field to provide regional- scale information. Individual well tests produce aquifer productivity estimates that are local in nature, and might reflect small-scale aquifer heterogeneity that is not necessarily representative of the basin as a whole. To average these smaller scale variations present in the data set, a FORTRAN program was developed that evaluated each independent Kh estimate in terms of the available surrounding estimates. When this program is executed, each Kh value is considered in conjunction with all others present within a user-specified critical radius, and the geometric mean of the available Kh values is calculated. This geometric mean value is then assigned as the representative regional hydraulic conductivity value for that location. The critical radius used in this analysis was 10,000 meters, or about six miles. The point values obtained by this process were then gridded using the kriging algorithm to develop a Kh distribution across the model domain. The aquifer transmissivity at each model node within each model layer was then computed using the geometric mean Kh values at that node times the thickness of the model layer. Insufficient data were available to attempt to

[5] *M.C. Paulk, C.V. Weber, B. Curtis, M.B. Chrissis, "Capability Maturity Model for Software (Version 1.1)". Technical Report, Software Engineering Institute, Carnegie Mellon University, 1993*

[6] *EIR/EIS, Appendix D, Page 13*

> subdivide the data set into depth-varying Kh distributions, and it was, therefore, assumed that the computed mean Kh values were representative of the major aquifer units in all model layers. The distribution of K used throughout most of the SACFEM2013 model layers is shown in Figure D-4. During model calibration, minor adjustments were made to the Kh of model layer one east of Dunnigan Hills and in model layers six and seven in the northern Sacramento Valley based on qualitative assessment of Lower Tuscan aquifer test data in this area.

Note the presence of terms such as "adjustments", "assumed", "insufficient data", and "representative". What is being described in this paragraph is a potentially non-repeatable process that converts the three-dimensional permeability tensor into a homogenized number Kh that is then used to estimate conductivity in a plane parallel to the ground surface. Permeability is a local tensorial property of the aquifer (i.e., it varies from point to point in the 3D subsurface domain), but the resulting Kh is smeared across the domain to convert this tensor with six independent spatially-dependent components into a single number that is applied over a huge geographical area instead. And this conversion is subject to the judgment of each analyst, so the results depend on the skill (or lack thereof) of the particular analyst doing the modeling.

> ***Technical sidebar:*** *it is remarkably straightforward to perform accurate and technically-defensible computational analyses to assess the ultimate effect of these data adjustments. One of the most easily-deployed of these techniques is the use of a sensitivity analysis that measures how computed output results depend on adjustments to input parameters. Sensitivity analyses are readily grafted onto nearly any computational model, and while these computations require more effort than not using them, most of the additional effort can readily be offloaded to the computer, so that undue levels of human efforts are not required for their application. Formal sensitivity analyses can also be used to aid in the assessment of model uncertainty (see discussion below), so their omission in the EIR/EIS is a mystery to the technically-informed impartial reviewer of the EIR/EIS.*

And that's only the tip of the larger iceberg of problems with these ad hoc techniques. It is actually quite easy to avoid all these adjustments and oversimplifications entirely, and treat the aquifer as it is, namely as a true three-dimensional physical body of large extent, with a time-varying location of the water table, and with accurate treatment of the complex hydraulic conductivity inherent to the subsurface conditions of California. It's also remarkably simple to include poromechanical effects (see discussion below) in such a 3D model so that accurate local and regional estimates of environmental impacts such as subsidence and loss of aquifer capacity can be predicted and validated. All of this technology has been available for decades, but it is not utilized in the SacFEM2013 model. *The citizens of California clearly deserve a better model for decision-making involving one of their most precious resources!*

Regarding The Need to Characterize Uncertainty in Engineered and Natural Systems

Some discussion is warranted at this point on the difference between a natural and an engineered system, towards the goal of appreciating why characterizing uncertainty in any proposed water-transfer strategy is an essential goal of a well-considered EIR/EIS. An engineered system is designed entirely by humans, so each component of that system is reasonably well-understood *a priori*, and the uncertainties that are inherent in any system (natural or man-made) are limited to defined uncertainties such as materials chosen, geometric specifications, and conditions of construction and use. So an engineered system such as an automobile (or a groundwater-pumping facility) is uncertain in many aspects, but that uncertainty can in theory be constrained

by quality-control efforts or similar means of repeatability. Constraining these uncertainties comes at a price, of course: that is a large part of what we mean when we refer to *quality* in an engineered system such as in cars or consumer electronics.

A natural system has a much higher threshold for uncertainty, as we often do not even know of all the components of the system, much less their precise characterization (e.g., in a water-bearing aquifer, the materials that entrain the water are by definition unavailable for characterization, and the mere act of digging some of them up for laboratory inspection often changes their physical behaviors so that the tests we perform in the laboratory may not be entirely relevant to the response of the actual subsurface system). So when studying a natural system, a scientist or engineer must exercise due diligence in the examination and characterization of the system's response to stresses of operational use, and must consistently provide means to determine the presence and effect of these inherent uncertainties. To do otherwise is to risk visitation by Murphy's Law, i.e, "anything that can happen, will happen."

Thus one of the most obvious metrics for evaluating the quality of any environmental plan is to examine the plan's use of terms such as "uncertainty", as well its technical relatives that include "validation" (testing of models via physical processes such as laboratory experiments), "verification" (testing of models via comparison with other generally-accepted models), and "calibration" (tuning a model using a given set of physical data that will be used as initial conditions for subsequent verification, validation, and uncertainty characterization). These basic operations are fundamental characteristics of any computational model, and are used in everyday life for everything from weather prediction (where uncertainty dominates and limits the best efforts at forecasting) to the simple requirement that important components of infrastructure such as highway bridges be modeled using multiple independent analyses to provide verification of design quality before construction can begin.

Unfortunately, the EIR/EIS does not contain a formal characterization of model uncertainty, either for the SacFEM2013 application itself, or for the underlying data gathered to support the SacFEM2013 analyses. As described in previous sections, both the model and the input data contain simplifications that potentially compromise the model's ability to provide accurate estimates of real-world responses of water resources, and these idealizations create *more* need for uncertainty characterization, not less. And the all-important technical terms "validation" and "verification" do not appear the EIR/EIS. The term "calibration" occurs twice[7] with regard to groundwater models, but only in the context of ad-hoc "adjustments" of the model data.

Lack of Trust in the SacFEM2013 Model

In addition to generally-poor modeling assumptions inherent in the SacFEM2013 model, the all-important task of characterizing uncertainty in the model's implementation and data is neglected in the EIR/EIS. On page 19 of Appendix B, the reader is promised that model uncertainty will be described in Appendix D, but that promise is never delivered: the only mention of this essential modeling component occurs merely as an adjunct to discussion of deep percolation uncertainty.

[7] *EIR/EIS, Appendix D, Pages 10 and 13*

This lack of any formal measure of uncertainty is not an unimportant detail, as it is impossible to provide accurate estimates of margin of error without some formal treatment of uncertainty. Many such formal approaches exist, but apparently none were deployed for the EIR/EIS modeling efforts. In simple terms, this lack of uncertainty characterization removes the basis for trust in the model results, and hence the entire groundwater substitution analysis presented in the EIR/EIS is not technically defensible. Until this omission is remedied, the EIR/EIS simply proposes that water interests in California trust a model that is arguably not worthy of their trust.

And it's even worse than this, as while the model is asserted to be "high-resolution", in fact the SacFEM2013 model is quite the opposite. The actual spatial resolution of the model is given in Appendix D as ranging from 125 meters for regions of interest, up to 1000 meters for areas remote from the transfer effects. Nodal spacing along flood bypasses and streams is given as 500 meters. No mention is made in the EIR/EIS of exactly what this means in terms of trust in the model, but in accepted computational modeling practice, this is not a particularly high resolution.

In fact, there are formal methods for characterizing the ability of a discretized model such as SacFEM2013 to resolve physical responses of interest. These methods are based on elementary aspects of information theory (e.g., the Nyquist-Shannon sampling theorem), and their practical result is that a discrete analog (i.e., a computer model) of a continuous system (i.e., the actual subsurface geological deposits that entrain the groundwater) cannot resolve any feature that is less than a multiple of the size of the discretization spacing. For regular periodic features (e.g., the waveforms that make radio transmission possible), that multiple can be a small as two, but for transient phenomena (e.g., the response of an aquifer), established practice in computational simulation has demonstrated that a factor of five or ten is the practical limit on resolution.

Thus the practical limit of the SacFEM2013 model to "see" (i.e., to resolve) any physical response is measured in kilometers! The model can compute results smaller than this scale, but those results cannot be implicitly trusted: they are potentially the computational equivalent of an optical illusion. For this reason alone, the SacFEM2013 model cannot be trusted without substantial follow-on work that the EIR/EIS gives no indication of ever having been performed. And thus any physical response asserted by the model's results has a margin of error of 100% if that response involves spatial scales smaller than a kilometer or more, i.e., there is little or no predictive power in the model for those length scales.

The additional verification effort required to gain some measure of trust in the model (i.e., refining the nodal spacing by a factor of two and four to create more refined models, and then comparing these higher-resolution results to gain assurance that no computational artifacts exist in the original model, i.e., no optical illusions are being used to set water transfer policy) is quite straightforward and is also standard practice in verifying the utility of a computational model. It is something of a mystery why this standard modeling quality-assurance technique is not presented in the EIR/EIS, but this omission provides yet-another sound technical reason to reject the results of the EIR/EIS until better modeling efforts are provided.

> ***Technical sidebar:*** *one important side benefit of performing verification studies by refining the finite element mesh in the spatial and temporal domains is that this extra effort provides important information as to whether the resolution of the model is sufficient. In practice, improving the resolution of a computer model is only a means to*

> *the desired end of gaining higher fidelity, i.e., a closer approximation to reality. So what we really desire from a computer model is not resolution, but fidelity, and while it is notoriously difficult to assess measures of fidelity, verification techniques based on refining the finite element mesh do provide some measure of trust in model results. One particularly simple verification measure involves plotting the computed results for a quantity of interest (e.g., groundwater flux at some point in the aquifer) as a function of model resolution (e.g., a metric indicating the number of the elements in the model, or a representative spatial scale used) for successive refinements of the finite-element mesh. Such plots help the analyst estimate whether the results at any given resolution yield an asymptotically-accurate estimate of the best results the model can provide given its inherent modeling assumptions. When combined with validation data (e.g., model predictions compared to real-world measured data), these verification-and-validation techniques provide a more sound basis for trust in the model than the minimal motivations found in the EIR/EIS.*

It is likely that the SacFEM2013 model may be incapable of performing these more refined higher-resolution analyses because of its underlying assumptions (e.g., idealizing the three-dimensional subsurface domain as a set of coupled two-dimensional layers), and if that is the case, then the underlying groundwater model is simply not up to the requirements of accurate regional water transfer modeling. The underlying MicroFEM model is an old simulation tool, originally written for the MS/DOS platform, and it appears to be near the practical limit of its resolution at the stated size[8] of 153,812 nodes (compared to the maximum nodal resolution in MicroFEM of 250,000 nodes cited above). But the current generation of desktop computers can easily handle many millions of nodes for such simulations, and enterprise computers well within the budgets of government agencies are routinely utilized to model systems with hundreds of millions of nodes, so if the SacFEM2013 model is already at its limit of resolution, then it's clear that a newer, better computational model should be used to replace it.

Inadequacy of Basic Aquifer Mechanics Principles in the EIR/EIS

In addition to all the fundamental problems inherent in the SacFEM2013 model, the EIR/EIS presents a biased view of basic principles of aquifer mechanics, and this bias serves to understate the risks of serious environmental problems that have long been a bane of water policy in California. In particular, the EIR/EIS simply understates the risk of these environmental effects, beginning with its executive summary and continuing throughout the rest of the document. Here's a representative sample of the problem at its first occurrence[9]:

> Groundwater substitution would temporarily decrease levels in groundwater basins near the participating wells. Water produced from wells initially comes from groundwater storage. Groundwater storage would refill (or "recharge") over time, which affects surface water sources. Groundwater pumping captures some groundwater that would otherwise discharge to streams as baseflow and can also induce recharge from streams. Once pumping ceases, this stream depletion continues, replacing the pumped groundwater slowly over time until the depleted storage fully recharges.

[8] *EIR/EIS, Appendix D, Page 3*
[9] *EIR/EIS, Executive Summary, Page 10*

The use of the adverb "fully" implies that the original storage is entirely recovered, but this is not necessarily the case. The science of poromechanics demonstrates that irreversible loss of aquifer capacity can occur with groundwater extraction, and while this physical phenomenon is explained elsewhere in the EIS/EIR, it is apparently ignored by the SacFEM2013 model, and hence it is not predicted with any degree of accuracy for use in estimating this important environmental effect. California has seen many examples of the accumulation of this environmental risk, as the readily-observable phenomenon known as subsidence is the surface expression of this loss of aquifer capacity. The small strains induced in the aquifer skeleton by groundwater extraction accumulate over the depth of the aquifer, and are expressed by the slow downward movement of the ground surface. The EIR/EIS makes little connection between groundwater extraction process modeled by SacFEM2013 and the all-too-real potential for surface subsidence, and the attendant irreversible loss of aquifer capacity. It is remarkably simple to model these coupled fluid- and solid-mechanical effects using modern computers, and it is thus a fatal shortcoming of the EIR/EIS that such a rational science-based approach to estimating these environmental risks has not been undertaken.

The problem is especially important during drought years, when groundwater substitution is most likely to occur. In a drought, the aquifer already entrains less groundwater than normal, so that additional stresses due to pumping are visited upon the aquifer skeleton. This is exactly the conditions required to cause loss of capacity and the risk of subsidence. Yet the EIR/EIS makes scant mention of these all-too-real problems, and no serious modeling effort is presented in the EIR/EIS to assess the risk of such environmental degradation.

Taken together with the other problems catalogued above, it is clear that the EIR/EIS does not accurately estimate potential environmental risks due to groundwater extraction. And since this component of the water transfer process is only one aspect of how water might be moved within the state, the interested reader of the EIR/EIS can only wonder what other important environmental effects have not been accurately assessed in the EIR/EIS.

Conclusions

The current draft version of the EIR/EIS fails to accurately estimate environmental effects likely to occur during water transfers. The model used to predict groundwater resources is flawed by being based on old technology that is apparently not up to the task of accurate large-scale modeling as combined with requisite validation measures and uncertainty characterization efforts needed to justify the use of the model. The reasons given for the use of this model do not stand up even to the most rudimentary examination, and the model neglects important environmental effects that have long been observed in California. The proposed transfers should be rejected until a more sound scientific basis can be established for prediction of all substantial environmental effects, and established practices in the use of computational models are developed and deployed in all aspects of computational prediction of those effects.