MINUTES

Owens Valley Groundwater Authority

Board Members:

INDIAN CREEK-WESTRIDGE CSD	Luis Elias	BIG PINE CSD	BryAnna Vaughan
COUNTY OF MONO	Fred Stump	LONE PINE PAIUTE SHOSHONE TRIBE	Mel Joseph
CITY OF BISHOP	Chris Costello	OWENS VALLEY COMMITTEE	Mary Roper
COUNTY OF INYO	Dan Totheroh		

October 8, 2020

The Owens Valley Groundwater Authority meeting was called to order at 2:01 p.m. via videoconference.

1. Pledge of allegiance

The Chairman led the pledge of allegiance.

2. Public Comment

Sally Manning stated the Ad Hoc Committee for sustainable criteria is not on the agenda and she thought that was the purpose of today's meeting. Dr. Steinwand stated he would be discussing that in item #9.

3. Introductions

The Board introduced themselves with no alternates in attendance, one absence, BryAnna Vaughan, Big Pine CSD.

4. Approval of minutes from the September 10, 2020 OVGA Board meeting

The Chairperson requested a motion to approve the minutes of the September 10, 2020 meeting. Mary Roper requested a correction to item #10, roll call votes, and item #8 "staffed" to "staff". Motion to approve the minutes as amended by Dan Totheroh, seconded by Chris Costello. The Chairperson requested a roll call vote; Luis Elias – Y, Fred Stump - Y Chris Costello – Y Dan Totheroh - Y , Mel Joseph - Y, Mary Roper - Y . Motion passed 6 Yes, 1 absent.

5. Board Member Reports

The Chairperson stated Mono County/Sierra Club have filed their briefs with the court in Alameda County; DWP has a period of time to respond; the first hearing is set for January 2021; any questions please send to Stacey Simons with Mono County Council. He stated he was invited to participate as a local government tribal panel member with the Public Utilities Commission regarding the bankruptcy of Frontier; they are attempting to change their surface area into two distinct offerings of service as part of their reorganization; and for detailed information you may contact him.

6. OVGA staff reports

a. Financial Report
b. Report on website development

Laura Piper, Inyo County Water Department provided the financial report and stated the OVGA cash balance is $468,010.91, with no revenue or expenses since last meeting. She stated the OVGA grant manager at DWR was expediting the April-June 2020 reimbursement of approximately $137,000 which should be received in the next 4- 6 weeks. She provided the update on the website development and stated the selected consultant was undergoing a name change and the contract should be finalized in the next few weeks.

7. Action item: Approval of draft Communications and Engagement Plan

Mel Joseph stated under the basin overview he has mentioned the designation may get changed again in the future and that was not included; under essential communication strategies it was discussed to provide the link to the interactive groundwater map under 3d,

under 3e to make sure that social media interface didn't have more information than the main website, he felt this is misunderstood in that there is no way the social media site can have all the same information the website provides, but that the social media doesn't have more current information than the main website; under 4b it should be stated the agenda should be posted "at least" 72 hours prior, he said although it's what the Brown Act says, he stated he doesn't feel the public should have to know the brown act details; key messages #10, he feels that shouldn't be stated in the documents, the compatibility with the Water Agreement hasn't been agreed to by the Board and the GSP should be written as needed and not restrained as a compromise agreement. He stated the GSP is the best opportunity to improve practices to make the basin sustainable especially in southern Inyo. Dr. Steinwand stated the changes will be made, the document will be revised as needed with substantive changes and he recommends approving the plan as revised. Mary Roper asked for one page in all of the documents that define the acronyms. Dr. Steinwand wanted to reiterate that this plan will not be regulating LADWP or a replacement for the Water Agreement. Stacy Simon recommended called it the Communications and Engagement Plan and not draft even though there will be ongoing updates. Chris Costello asked if it would be available in Spanish as well. Motion by Chris Costello to approve the document with ongoing modifications and version numbers, seconded by Luis Elias. The Chairperson requested a roll call vote; Luis Elias – Y, Fred Stump - Y , Chris Costello - Y , Dan Totheroh - Y , Mel Joseph - Y , Mary Roper - Y . Motion passed 6 Yes, 1 absent.

8. Presentation from Daniel B. Stephens and Associates on elements of the Groundwater Sustainability Plan.

Tony Morgan provided a power point presentation and provided a GSP update. He stated the LADWP groundwater model files have not been received; they have modified their request to LADWP for data; reviewed the timeline details; data gap evaluations; admin draft of GSP by February 2022; public review draft in May 2022: adjusted document based on comments to Board in October, then consideration of adoption. Shey Rajagopal of DBS&A provided an in depth and detailed presentation on the recharge estimate for Owens basin water budget which is mandated under SGMA be included in the GSP; the various components of the water balance and methods; BCM models; and management areas. The Board and staff discussed this in detail. Sally Manning asked if the models include pumping. Shey stated no. Lynn Boulton inquired about specific recharge estimates from the BCM; April Zrelak asked if this model isn't going to account for the outflow, will this model be refined to actually get real data on the water budget for each management area. Shey stated they are using USGS data; Tony Morgan stated every 5 years the GSP will need to be updated. He stated at this time there is no way to collect new real time data so they have to use best available data at this time which has been the USGS data. She stated would refining the model include export; Aaron stated it is part of the basin calculation but not what this model is designed to do. She inquired why the ET so variable; Shey stated it is based on precipitation and temperature.

The Chairperson called a break at 3:53 pm and reconvened the meeting at 4:00 pm.

Lynn Boulton submitted a question and Shey Rajagopal addressed. Dr Rajogopal returned to his presentation and stated the management areas are proposed and can be changed. The Board and staff discussed this item in detail. April Zrelak asked if the water that DWP uses for in valley mitigation counted in the pumping for export numbers. Dr. Steinwand stated mitigation uses are combination of surface water and groundwater. Christian Braudrick of Still Water Sciences gave a power point presentation on the Owens Valley groundwater dependent ecosystems (GDEs). Sally Manning stated this valley was a hot spot for GDE's and its LADWP dewatering that has taken it away. She also asked questions regarding difference in specific vegetation which was answered by Bruce Orr of Stillwater and asked about the removal of vegetation from the map by the Water Department.

9. Discussion regarding schedule for future meetings and agenda items

Dr. Steinwand stated staff removed the request to set up an Ad Hoc Committee based on concerns raised at the last meeting and discussions with County Council. He stated that staff will concentrate on the public engagement process instead of establishing Ad Hoc committees.

10. Set next meeting

The next meeting was scheduled for November 12, 2020 via videoconference.

11. Adjourn

The Chairperson adjourned the meeting at 5:00 pm.

SORT ORDER: OBJECT within BUDUNIT

SELECT BUDGET UNIT: 621601

Lg	BUDGET UNIT	Primary Ref	Transaction Description	SS	Ref Date	Job No	Debit	Credit	NET
GL	621601-1000	YEAREND	3. Balance Forward 2019/2020	JE	07/01/20	02771175	257,728.58	0.00	257,728.58
GL	621601-1000	JE37035	AutoID: JS20722C Job: 2728031	JE	07/22/20	02728031	75,513.66	0.00	333,242.24
GL	621601-1000	TTLCR	AutoID: CS20722A Job: 2728577	CR	07/22/20	02728577	52,859.66	0.00	386,101.90
GL	621601-1000	JE37069	AutoID: JS20729D Job: 2733834	JE	07/29/20	02733834	22,654.00	0.00	408,755.90
GL	621601-1000	TTLOH	AutoID:WD19721A Job:2734188	OH	07/29/20	02734188	0.00	165.40	408,590.50
GL	621601-1000	TTLOH	AutoID:WD19721B Job:2734188	OH	07/29/20	02734188	0.00	66.24	408,524.26
GL	621601-1000	INTRCBL	AutoID: JA20806A Job: 2740435	JE	08/04/20	02740435	1,371.90	0.00	409,896.16
GL	621601-1000	TTLCR	AutoID: CR20805A Job: 2739981	CR	08/05/20	02739981	22,654.00	0.00	432,550.16
GL	621601-1000	TTLOH	AutoID:WD19805A Job:2747387	OH	08/17/20	02747387	0.00	2,174.85	430,375.31
GL	621601-1000	TTLCR	AutoID: CI20818A Job: 2749131	CR	08/18/20	02749131	75,513.66	0.00	505,888.97
GL	621601-1000	TTLOH	AutoID:WD19811A Job:2749832	OH	08/19/20	02749832	0.00	1,438.50	504,450.47
GL	621601-1000	TTLOH	AutoID:OW20827C Job:2758428	OH	08/31/20	02758428	0.00	33,944.66	470,505.81
GL	621601-1000	TTLOH	AutoID:WD19825A Job:2760763	OH	09/02/20	02760763	0.00	2,494.90	468,010.91
******Total *OBJT 1000			CLAIM ON CASH			DR	508,295.46	40,284.55	468,010.91
GL	621601-1160	YEAREND	3. Balance Forward 2019/2020	JE	07/01/20	02771175	1,371.90	0.00	1,371.90
GL	621601-1160	INTRCBL	4th QTR INTEREST RVRS	JE	08/04/20	02740435	0.00	1,371.90	0.00
******Total *OBJT 1160			INTEREST RECEIVABLE			DR	1,371.90	1,371.90	0.00
GL	621601-2000	YEAREND	4. Balance forward 2019/2020	JE	07/01/20	02771175	0.00	37,624.25	37,624.25
GL	621601-2000	TTLOH	AutoID:WD19721A Job:2733181	OH	07/28/20	02733181	0.00	165.40	37,789.65
GL	621601-2000	TTLOH	AutoID:WD19721A Job:2734188	OH	07/29/20	02734188	165.40	0.00	37,624.25
GL	621601-2000	TTLOH	AutoID:WD19721B Job:2734188	OH	07/29/20	02734188	66.24	0.00	37,558.01
GL	621601-2000	TTLOH	AutoID:WD19805A Job:2747387	OH	08/17/20	02747387	2,174.85	0.00	35,383.16
GL	621601-2000	TTLOH	AutoID:WD19811A Job:2749832	OH	08/19/20	02749832	1,438.50	0.00	33,944.66
GL	621601-2000	TTLOH	AutoID:OW20827C Job:2758428	OH	08/31/20	02758428	33,944.66	0.00	0.00
GL	621601-2000	TTLOH	AutoID:WD19825A Job:2759412	OH	09/01/20	02759412	0.00	2,494.90	2,494.90
GL	621601-2000	TTLOH	AutoID:WD19825A Job:2760763	OH	09/02/20	02760763	2,494.90	0.00	0.00
******Total *OBJT 2000			ACCOUNTS PAYABLE			CR	40,284.55	40,284.55	0.00
GL	621601-3000	YEAREND	1. Balance Forward 2019/2020	JE	07/01/20	02771175	0.00	59,494.71	59,494.71
GL	621601-3000	YEAREND	2. Balance Forward 2019/2020	JE	07/01/20	02771175	0.00	161,981.52	221,476.23
******Total *OBJT 3000			FUND BALANCE AVAILABLE			CR	0.00	221,476.23	221,476.23
GL	621601-4599	JE37035	20/21 INYO OVGA CONTRIBUTION	JE	07/22/20	02728031	0.00	75,513.66	75,513.66
GL	621601-4599	CR119092	I#3 OVGA GSP CONTRIBUTION	CR	07/22/20	02728577	0.00	52,859.66	128,373.32
GL	621601-4599	JE37069	I#3 OVGA GSP DEVELOPMENT	JE	07/29/20	02733834	0.00	22,654.00	151,027.32
GL	621601-4599	CR119368	I#3 WESTRIDGE/INDIAN CREEK	CR	08/05/20	02739981	0.00	22,654.00	173,681.32
GL	621601-4599	CR119566	I#3 20/21 OVGA-MONO CO 2020-21	CR	08/18/20	02749131	0.00	75,513.66	249,194.98
******Total *OBJT 4599			OTHER AGENCIES			CR	0.00	249,194.98	249,194.98
GL	621601-5155	GS200710060	GOLDEN STATE RI ACCT#OWENVAL	OH	09/01/20	02759412	2,494.90	0.00	2,494.90
******Total *OBJT 5155			PUBLIC LIABILITY INSURANCE			DR	2,494.90	0.00	2,494.90
GL	621601-5263	70243	INYO REGISTER, CUST#01110862	OH	07/28/20	02733181	165.40	0.00	165.40
******Total *OBJT 5263			ADVERTISING			DR	165.40	0.00	165.40
******Total *BUDG 621601			OVGA-OWENS VALLEY GROUNDWATER			DR-CR	552,612.21	552,612.21	0.00

SORT ORDER: OBJECT within BUDUNIT

SELECT BUDGET UNIT: 621601

Lg	BUDGET UNIT	Primary Ref	Transaction Description	SS	Ref Date	Job No	Debit	Credit	NET
			** G R A N D T O T A L **			DR-CR	552,612.21	552,612.21	0.00

COUNTY OF INYO

Budget to Actuals with Encumbrances by Key/Obj

Ledger: GL

As Of 11/5/2020

Object	Description	Budget	Actual	Encumbrance	Balance	%
Key: 621601 - OVGA-OWENS VALLEY GROUNDWATER						
Revenue						
4301	INTEREST FROM TREASURY	4,000.00	0.00	0.00	4,000.00	0.00
4498	STATE GRANTS	311,284.00	0.00	0.00	311,284.00	0.00
4599	OTHER AGENCIES	249,195.00	249,194.98	0.00	0.02	100.00
	Revenue Total:	564,479.00	249,194.98	0.00	315,284.02	44.14
Expenditure						
5129	INTERNAL COPY CHARGES (NON-IS)	1,500.00	0.00	0.00	1,500.00	0.00
5155	PUBLIC LIABILITY INSURANCE	2,500.00	2,494.90	0.00	5.10	99.79
5263	ADVERTISING	2,000.00	165.40	0.00	1,834.60	8.27
5265	PROFESSIONAL & SPECIAL SERVICE	319,534.00	2,275.00	13,425.00	303,834.00	4.91
5291	OFFICE, SPACE & SITE RENTAL	1,500.00	0.00	0.00	1,500.00	0.00
5311	GENERAL OPERATING EXPENSE	500.00	0.00	0.00	500.00	0.00
5539	OTHER AGENCY CONTRIBUTIONS	104,470.00	8,673.75	0.00	95,796.25	8.30
5901	CONTINGENCIES	13,290.00	0.00	0.00	13,290.00	0.00
	Expenditure Total:	445,294.00	13,609.05	13,425.00	418,259.95	6.07
621601	**Key Total:**	119,185.00	235,585.93	(13,425.00)	(102,975.93)	

COUNTY OF INYO
UNDESIGNATED FUND BALANCES

AS OF 11/05/2020

		Claim on Cash 1000	Accounts Receivable 1100,1105,1160	Loans Receivable 1140	Prepaid Expenses 1200	Accounts Payable 2000	Loans Payable 2140	Deferred Revenue 2200	Computed Fund Balance	Encumbrances	Fund Balance Undesignated
WDIR	**- WATER**										
6272	OVGA-OWENS VALLEY	457,062							457,062	13,425	443,637
WDIR	**Totals**	457,062							457,062	13,425	443,637
	Grand Totals	**457,062**							**457,062**	**13,425**	**443,637**

Owens Valley GSP Update

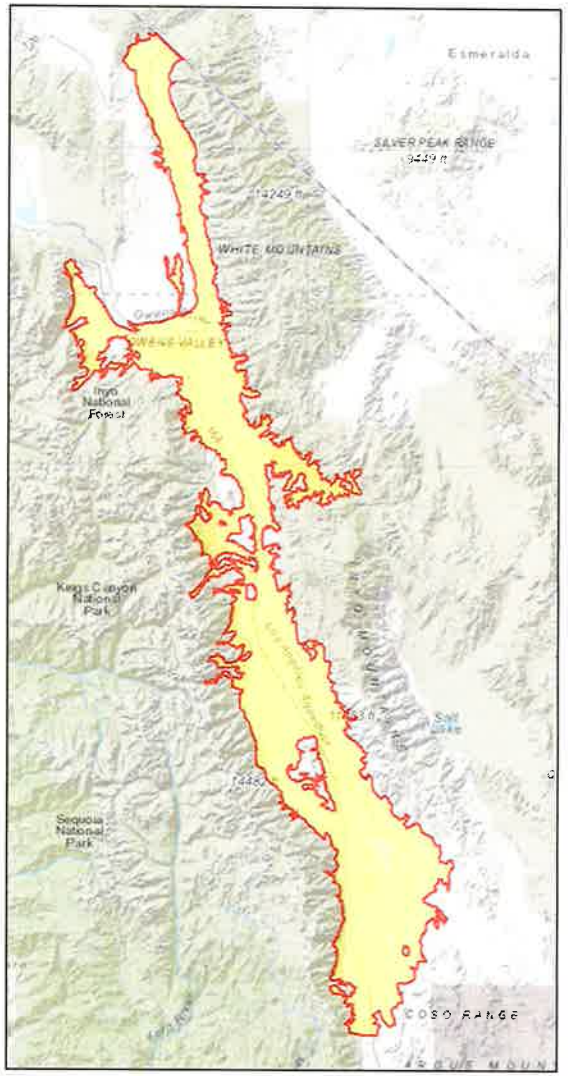
November 12, 2020

Questions from October Meeting?

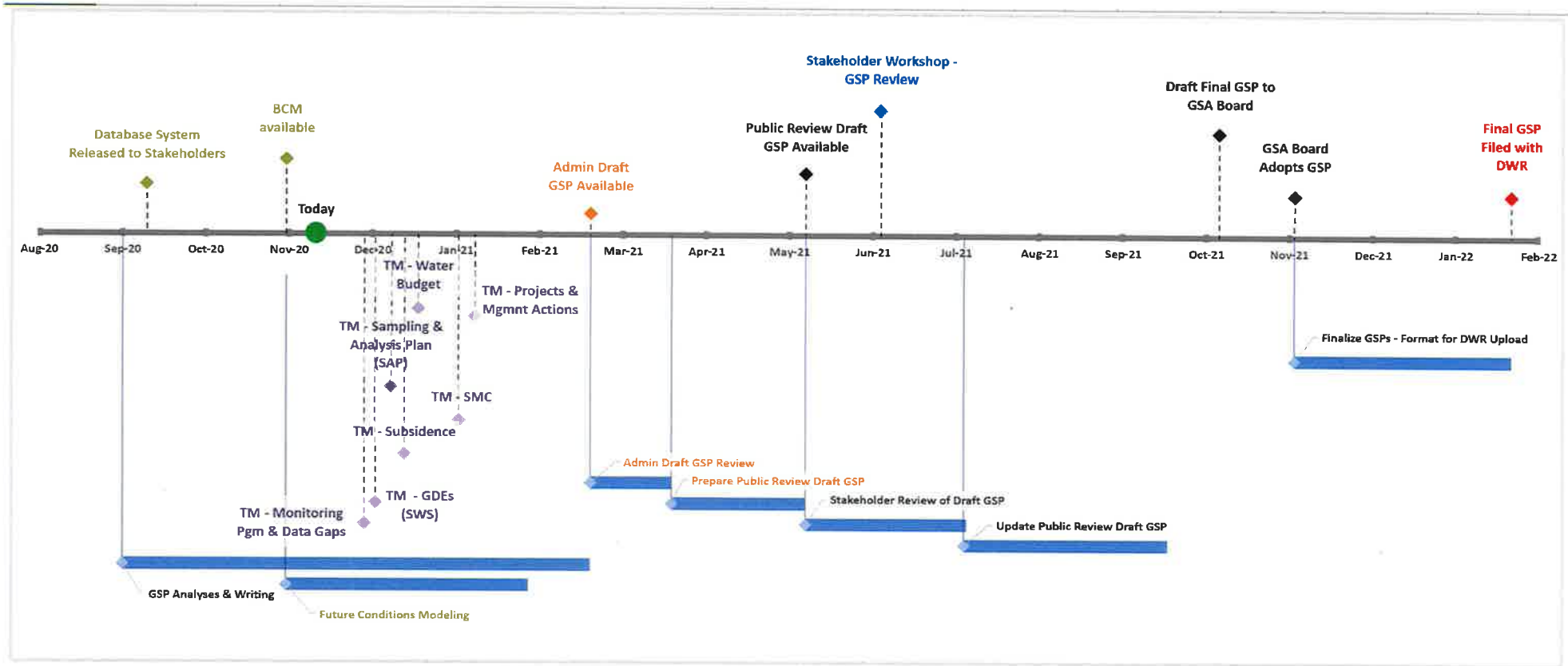
- Topics covered:
  - ✓Groundwater Dependent Ecosystems (GDEs)
  - ✓Land Surface Water Budgets
    - ✓Basin Characterization Model (BCM)

Today's Topics...

- General GSP Status Update
- Groundwater Dependent Ecosystems
- Projected Future Water Budgets
- Monitoring Plan and Data Gaps Analysis Tech Memo Summary



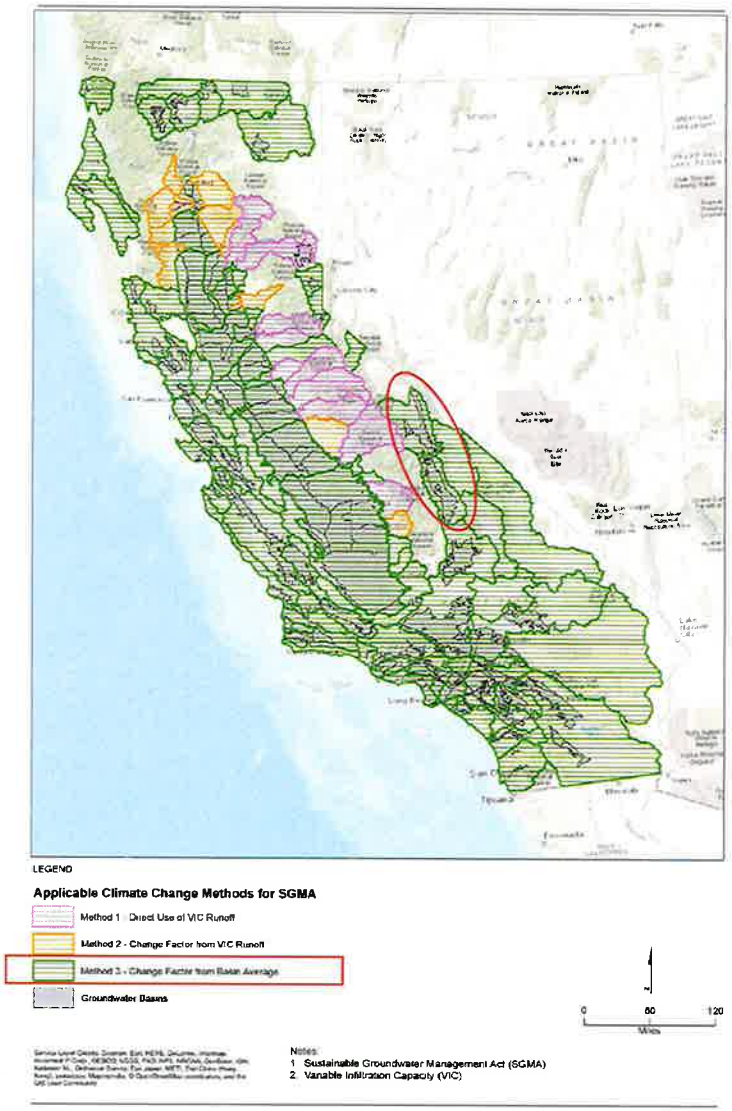
General GSP Status Update



Owens Watershed
Future Water Budget Development

Future Conditions

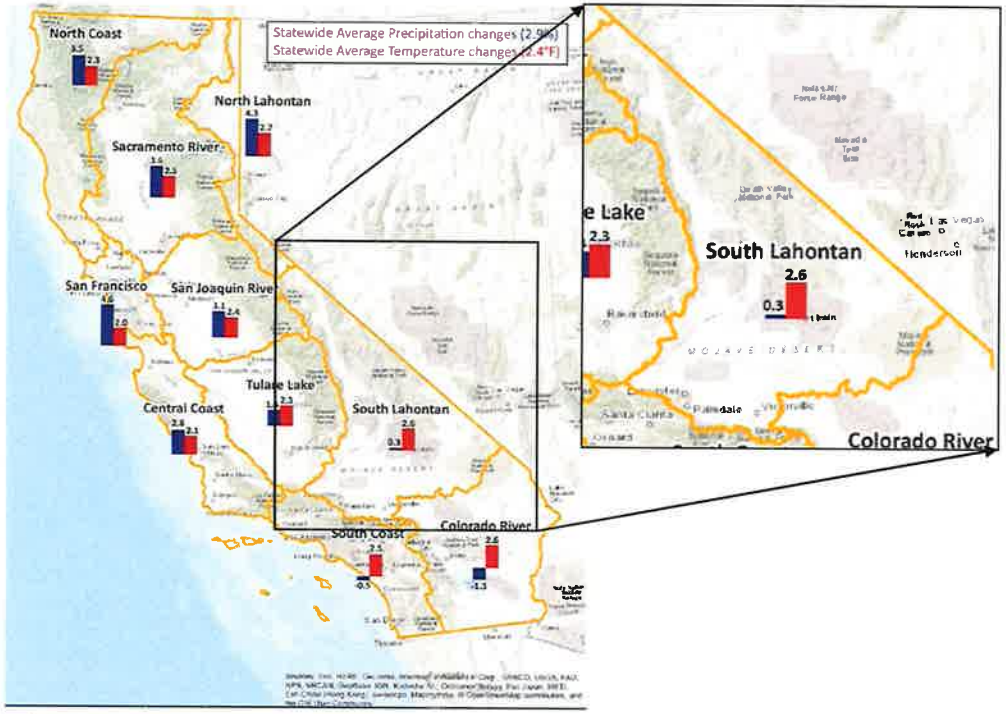
- SGMA guidance for climate change data recommends
  - Using a change factor from basin average for Owens Basin
- Climate simulation approach
  - Two future climate periods
    - Mid century (2016-2045)
    - End of century (2056-2085)
- Evaluated the mid-century future scenario and it's impact on recharge



Source: SGMA climate change guidance

Future Conditions

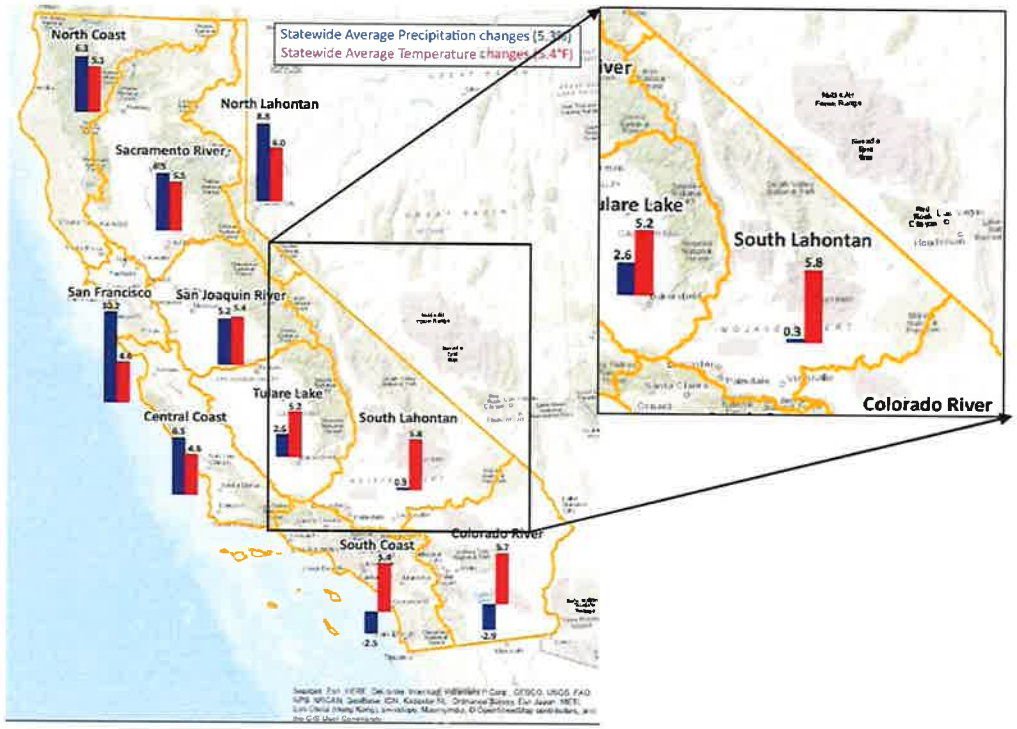
Mid-century



Average Precipitation Change (%)
Average Temperature Change (°F)
Hydrologic Region
HTD: Historical Temperature Detrended
Reference: Water Storage and Investment Program Technical Reference, California Water Commission, 2016.

Figure A-13. Projected Changes in Climate Conditions for 2050
Source: California Water Commission, 2016

End-century

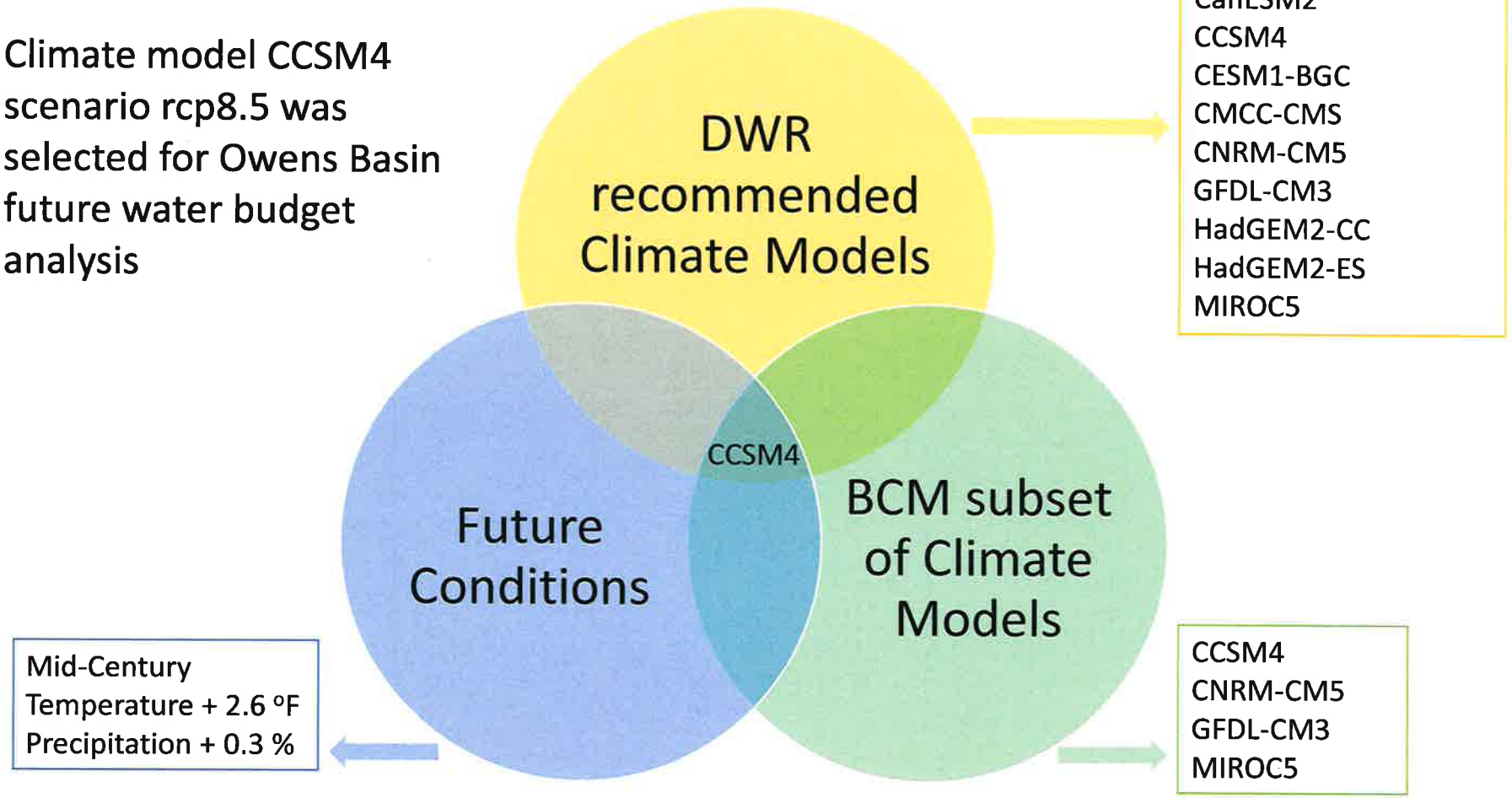


Average Precipitation Change (%)
Average Temperature Change (°F)
Hydrologic Region
HTD: Historical Temperature Detrended
Reference: Water Storage and Investment Program Technical Reference, California Water Commission, 2016.

Figure A-14. Projected Changes in Climate Conditions for 2070
Source: California Water Commission, 2016

Climate Model Selection

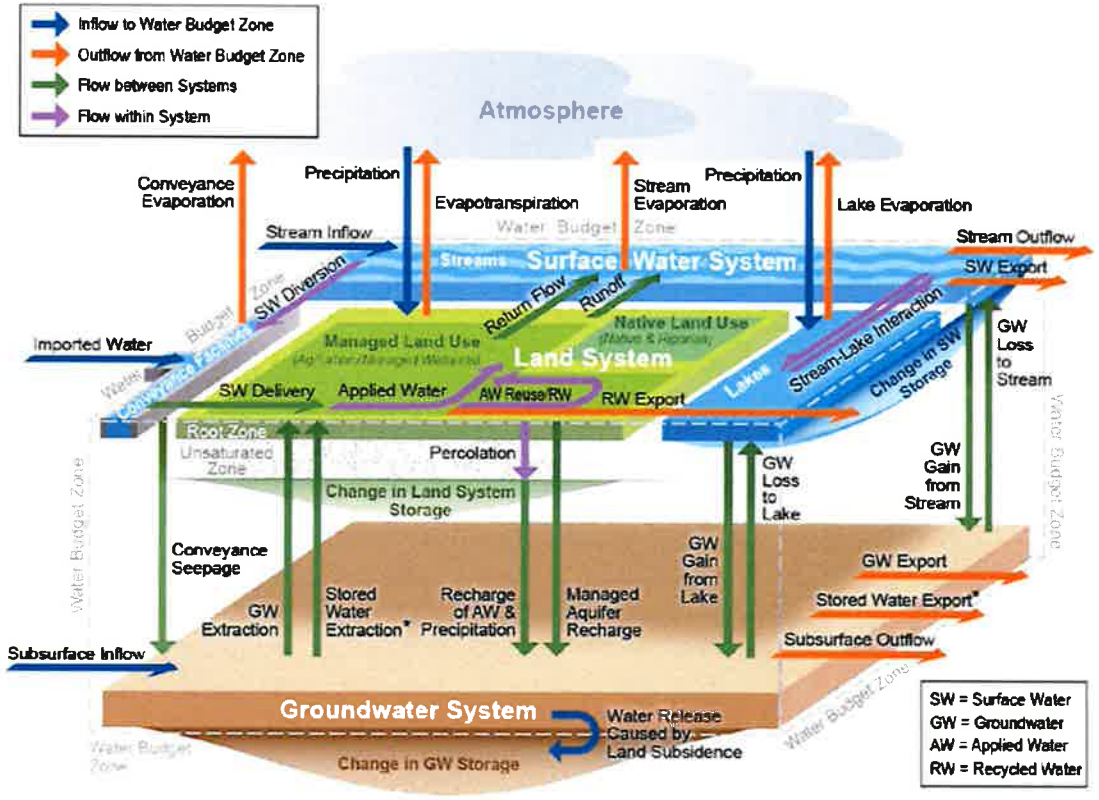
Climate model CCSM4 scenario rcp8.5 was selected for Owens Basin future water budget analysis



Water Budget Schematic

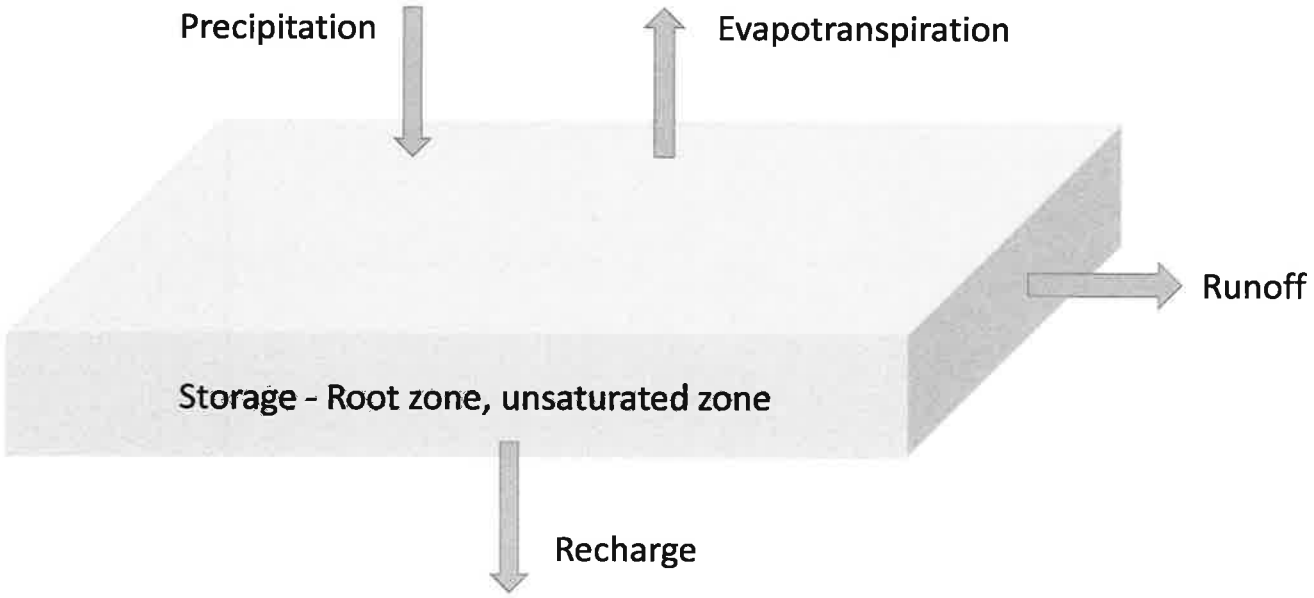
- Total water budget includes the budget for the land system and the groundwater system
- Basin Characterization Model used for the land system
- LADWP models for groundwater system?

Figure 1-1 Total Water Budget Schematic



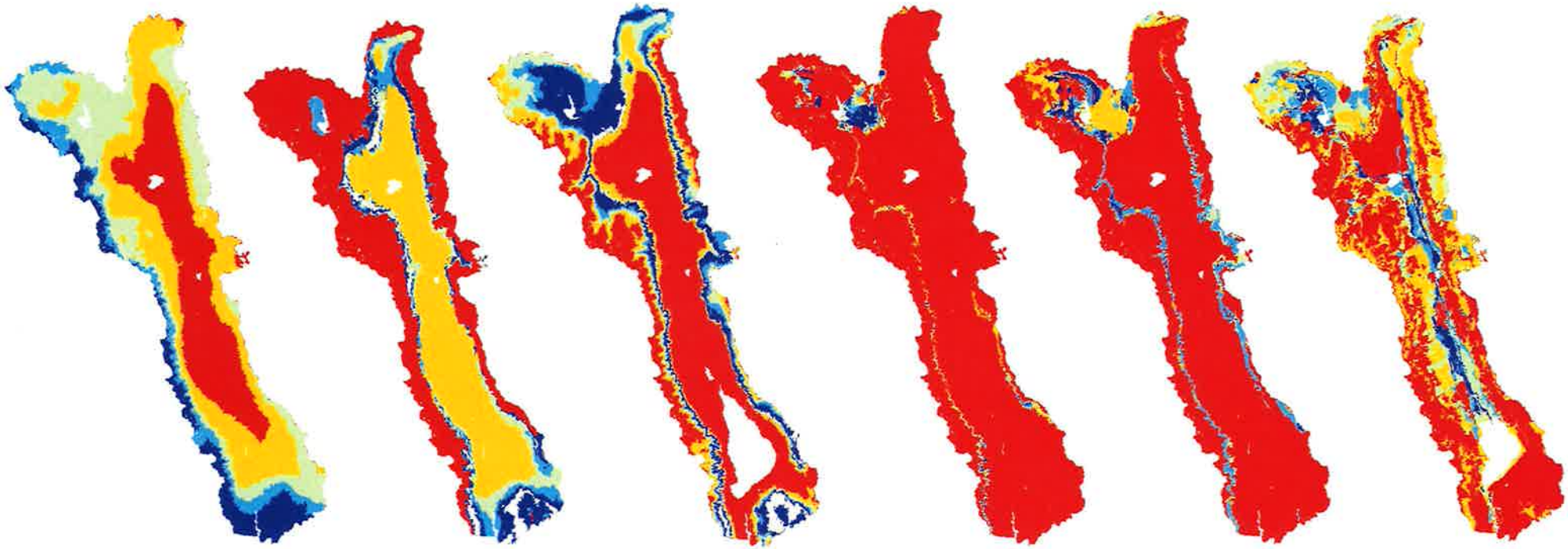
*For clarification, see Table 1-1.

Simplified Land System Water Budget Schematic

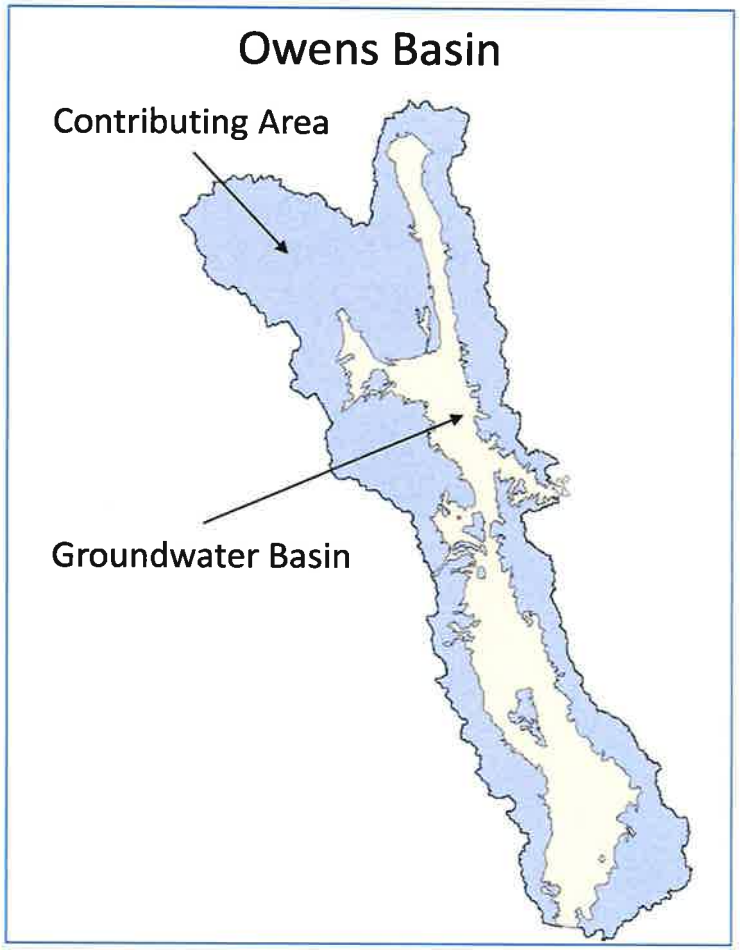


Water Budget - Methods

precipitation – evapotranspiration – sublimation – runoff – recharge – delta soil storage = 0

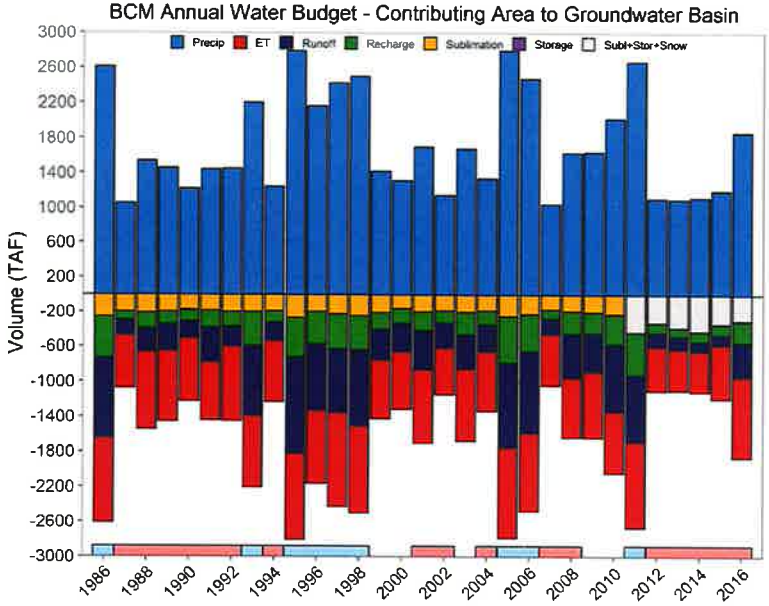


Water Budget - Methods

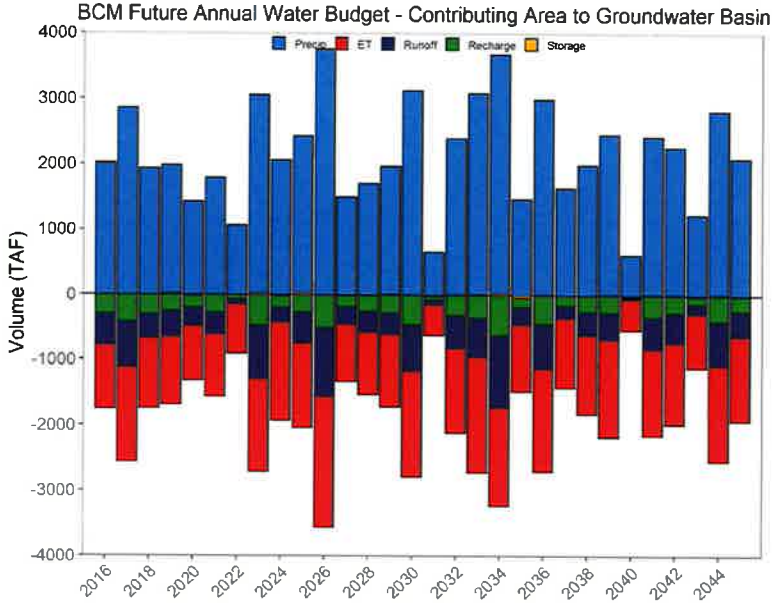


Contributing Area to Groundwater Basin

Historical



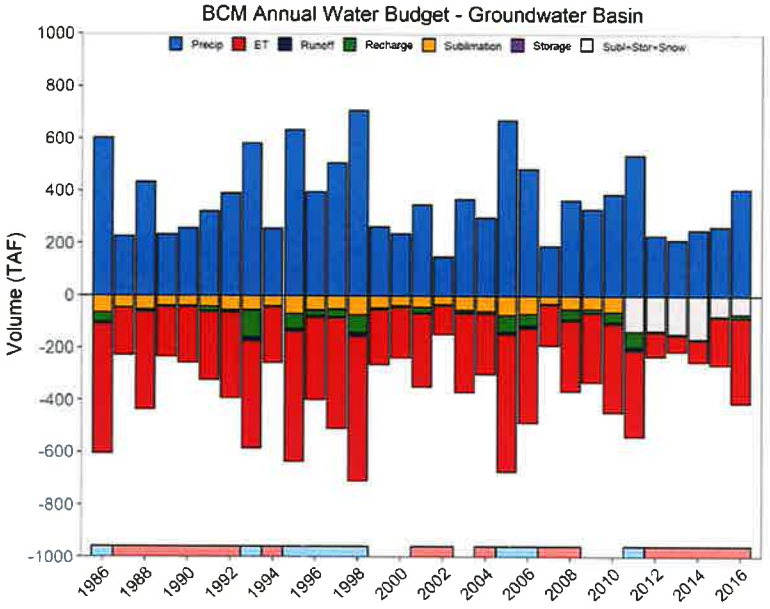
Future Mid Century



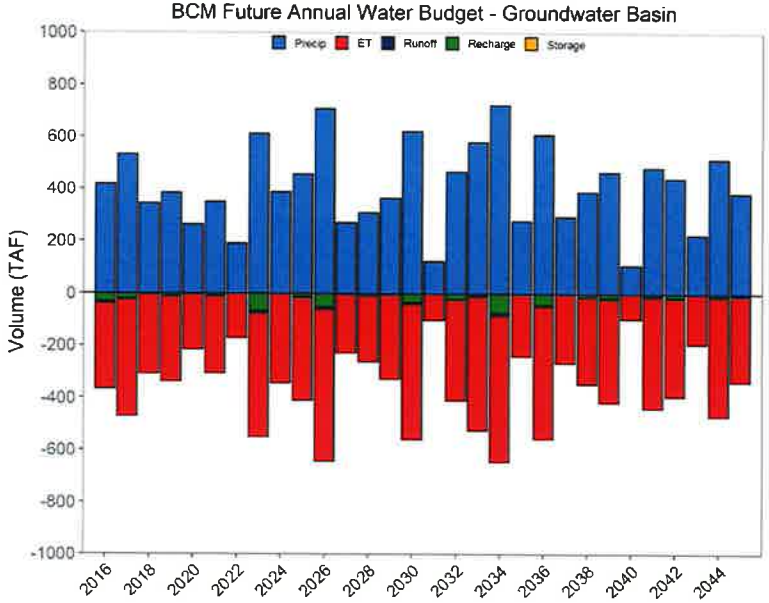
Average	Precip	ET	Runoff	Recharge
Historical (TAF)	1719	765	469	252
Future (TAF)	1804	904	443	266
Change (%)	5	18	-6	6

Groundwater Basin

Historical



Future Mid Century



Average	Precip	ET	Runoff	Recharge
Historical (TAF)	372	282	4	23
Future (TAF)	410	346	3	16
Change (%)	10	23	-25	-30

Providing Context

Only recharge from the land system model is comparable to the recharge used by the groundwater system

	Harrington (2016)	BCM
Inflow (Recharge)	220-271 (TAF)	275 (TAF)

A 5% increase in precipitation and a 2.4 deg F increase in temperature causes a 2.5% increase in recharge

	Recharge
Historical (TAF)	275
Future (TAF)	282
Change (%)	2.5

Summary

- The future mid-century land system budget shows a minor (2.5%) increase in recharge compared to historical average.

- Even though the precipitation increased by 5% most of that excess water is lost to evapotranspiration due to increased temperatures.

- The values of recharge estimated by the BCM model compare well to past reports.

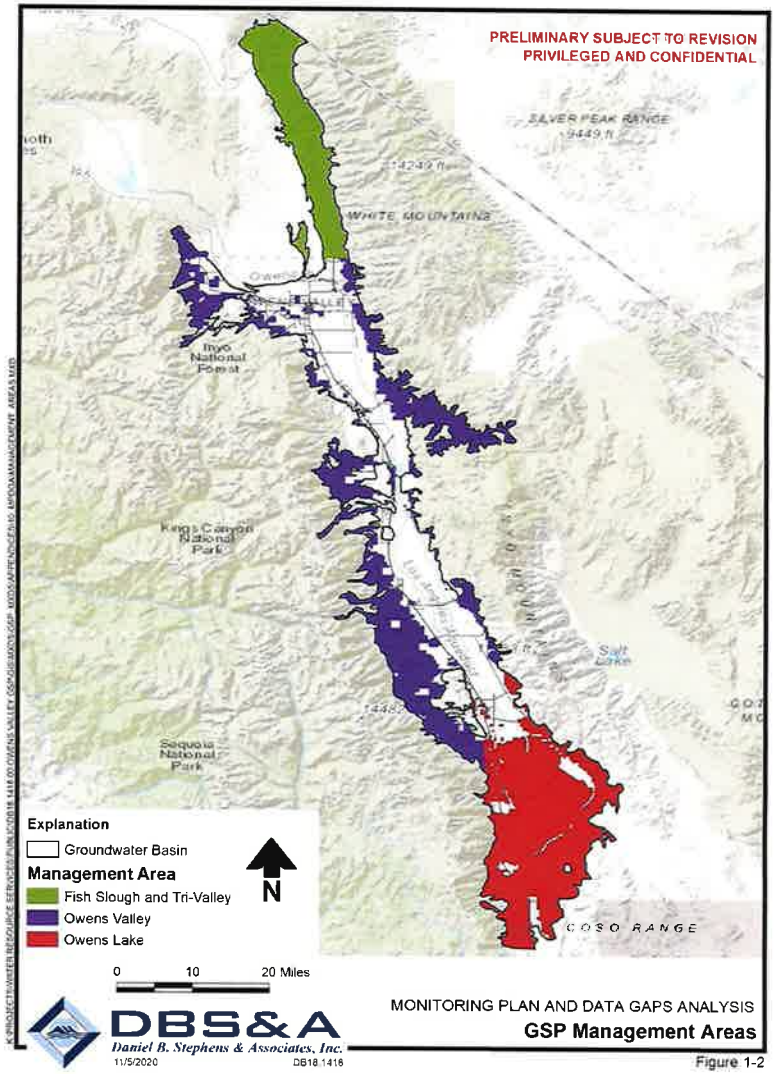
Monitoring Plan and Data Gaps Analysis Tech Memo Summary

Monitoring Plan and Data Gaps Analysis

- Where and when do we have data?
  - -Well construction
  - -Water levels
  - -Water quality
  - -Flows (spring, wells, surface-water)

- Are current data sufficient for developing sustainable management criteria?
  - -Evaluation of current monitoring networks
  - -Trend analysis
  - -Future conditions

- Where and when should new data be collected?
  - -Modification of sampling intervals
  - -Prioritization of new data collection



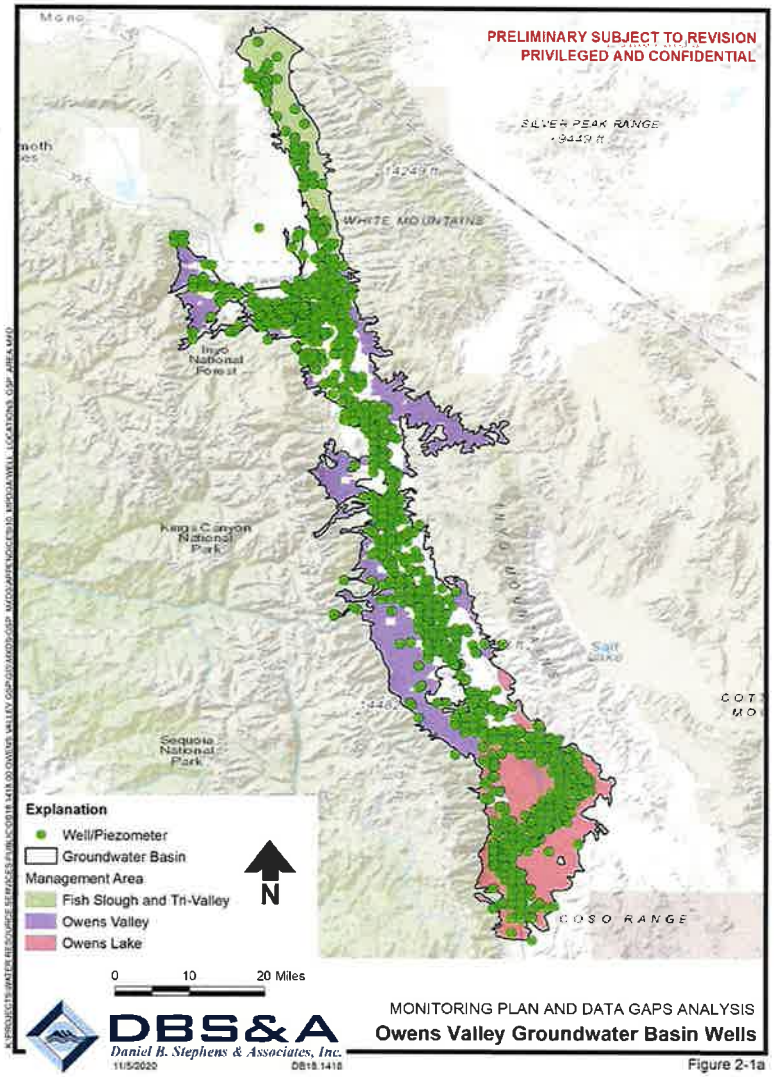


Figure 2-1a

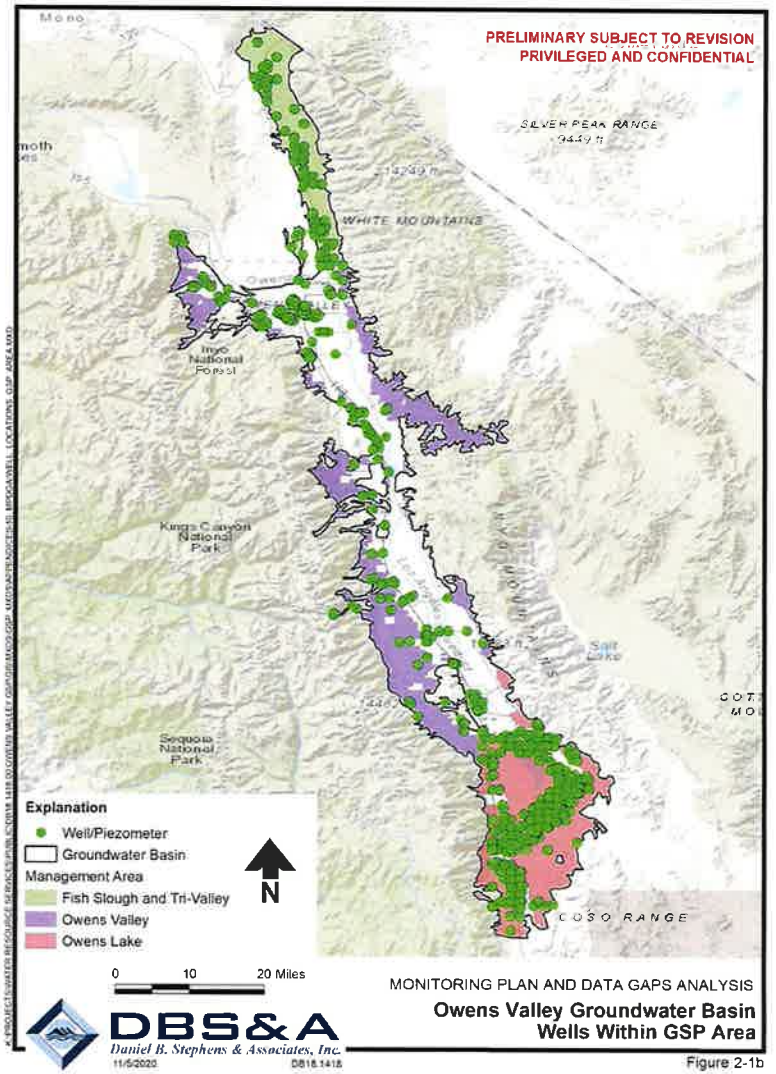


Figure 2-1b

Table 2-1. Well data summary.

	Groundwater Basin	GSP Area	Fish Slough and Tri-Valley Management Area	Owens Valley Management Area	Owens Lake Management Area [a]
Wells	4929	-	-	-	-
Wells with coordinates	4481	1903	287	935	681
Wells with accurate coordiantes [1]	2422	936	72	465	399
Wells with screen depth information [1,2]	1095	522	18	206	298
Wells with recent water level data [1,3]	874	123	20	62	41
Wells with recent pumping data [1,3]	179	15	0	15	0
Wells with recent water qualiy data [1,3,4]	117	83	12	62	9

1. Coordiantes do not correspond with centriod of section
2. Top of screen depth reported
3. Measurement collected since January 1, 2010
4. Limited to wells sampled for arsenic, chloride, sodium, nitrate, or total dissolved solids (TDS)

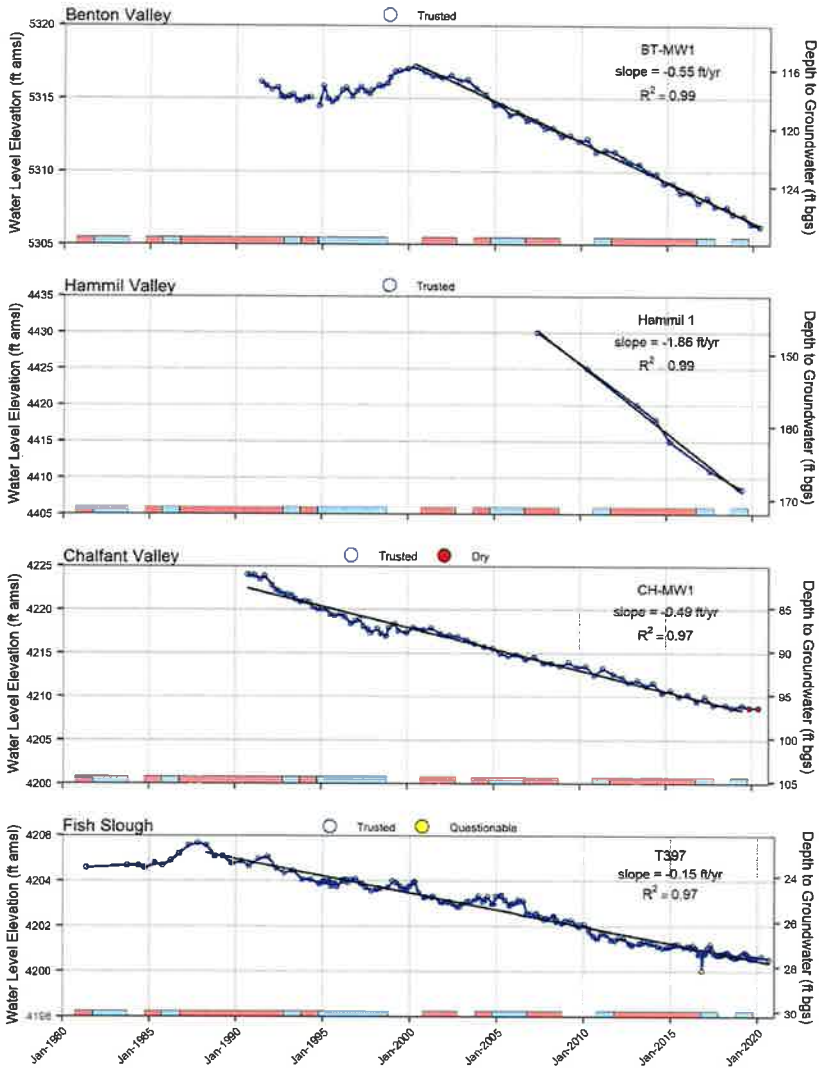
a. Includes piezometeres

Table 2-2. Well use summary.

Well Use	Groundwater Basin	GSP Area	Fish Slough and Tri-Valley Management Area	Owens Valley Management Area	Owens Lake Management Area
Agricultural	113	57	36	5	16
Domestic	1412	686	185	347	154
Flowing Artesian	77	8	0	0	8
Groundwater Monitoring	1627	577	24	234	319
Municipal and Industrial	516	208	22	140	46
Other[1]	280	63	4	44	15
Unknown	903	304	16	165	123

1. Exploratory borings, contaminant extraction wells, heat exchange wells, toes drains, vapor extraction wells, and toe drains

Water Level and Spring Flow Trends


Benton Valley
Trusted
BT-MW1
slope = -0.55 ft/yr
R² = 0.99
Water Level Elevation (ft amsl)
Depth to Groundwater (ft bgs)
Hammil Valley
Trusted
Hammil 1
slope = -1.86 ft/yr
R² = 0.99
Chalfant Valley
Trusted
Dry
CH-MW1
slope = -0.49 ft/yr
R² = 0.97
Fish Slough
Trusted
Questionable
T397
slope = -0.15 ft/yr
R² = 0.97
Jan-1980
Jan-1985
Jan-1990
Jan-1995
Jan-2000
Jan-2005
Jan-2010
Jan-2015
Jan-2020

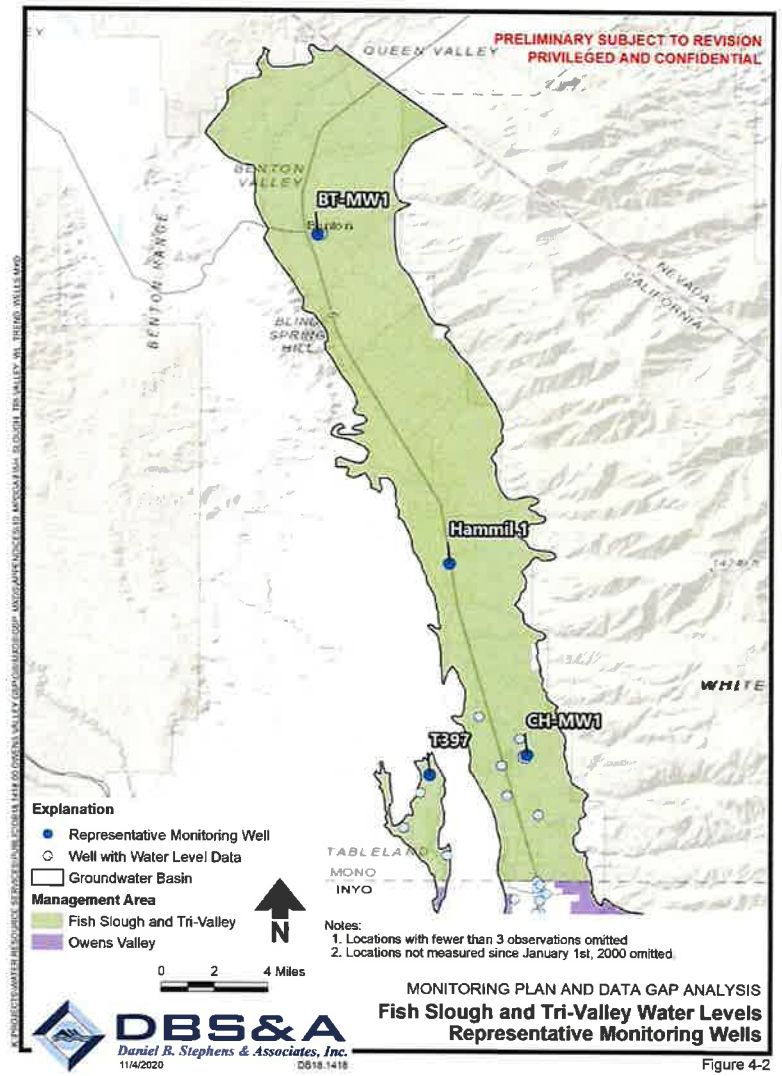
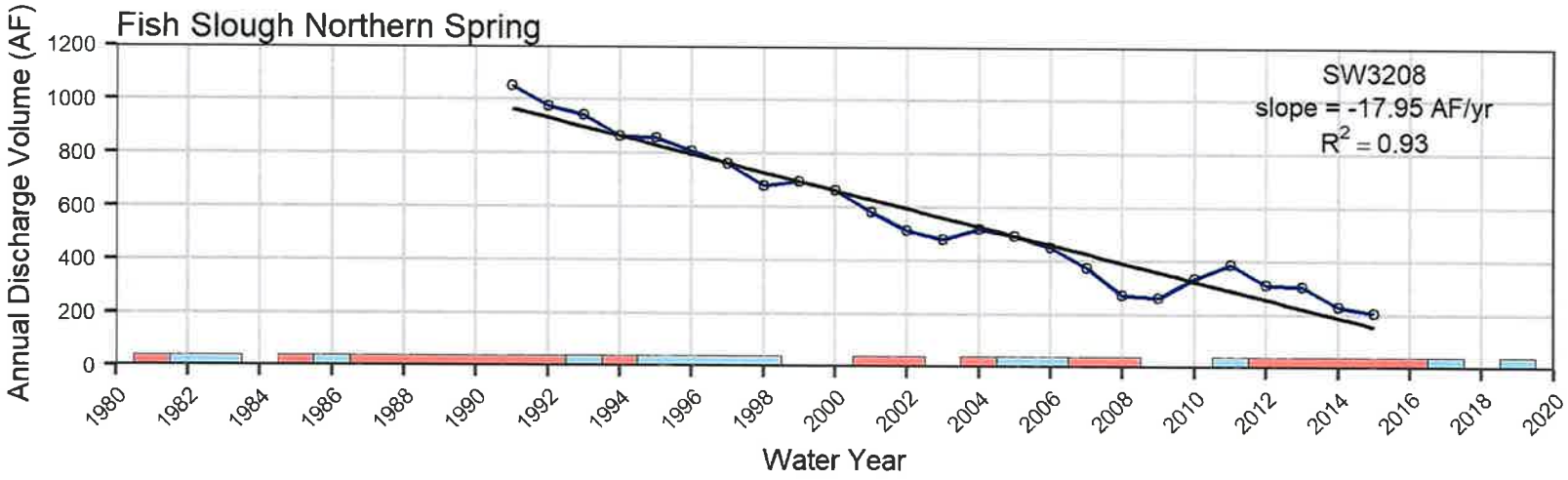
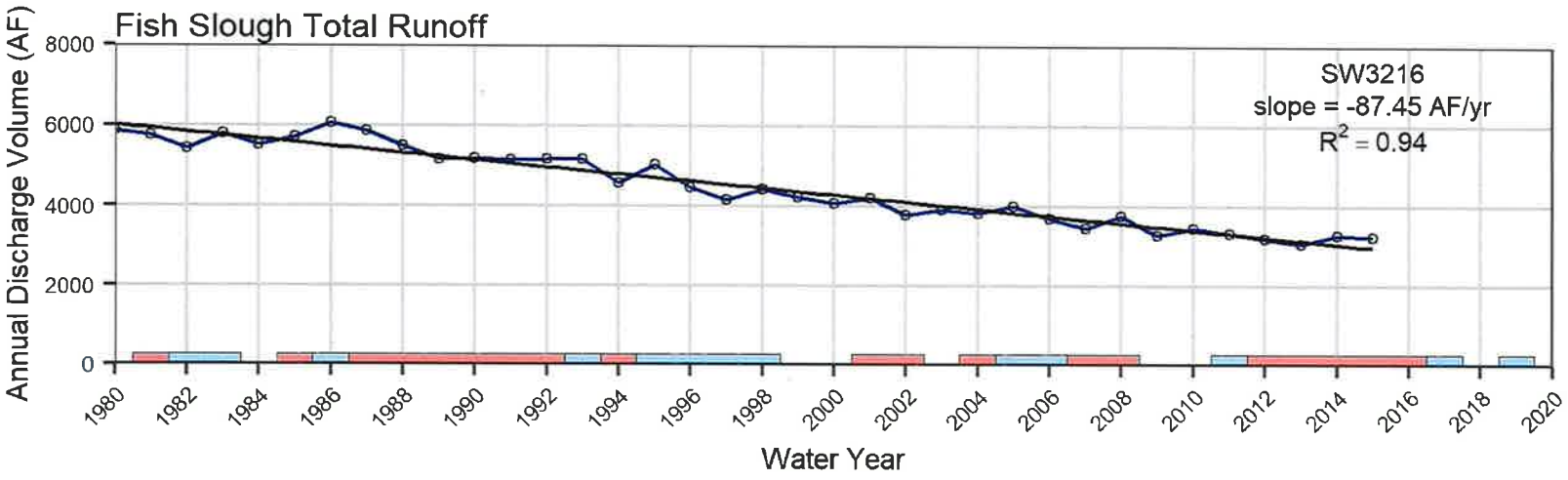
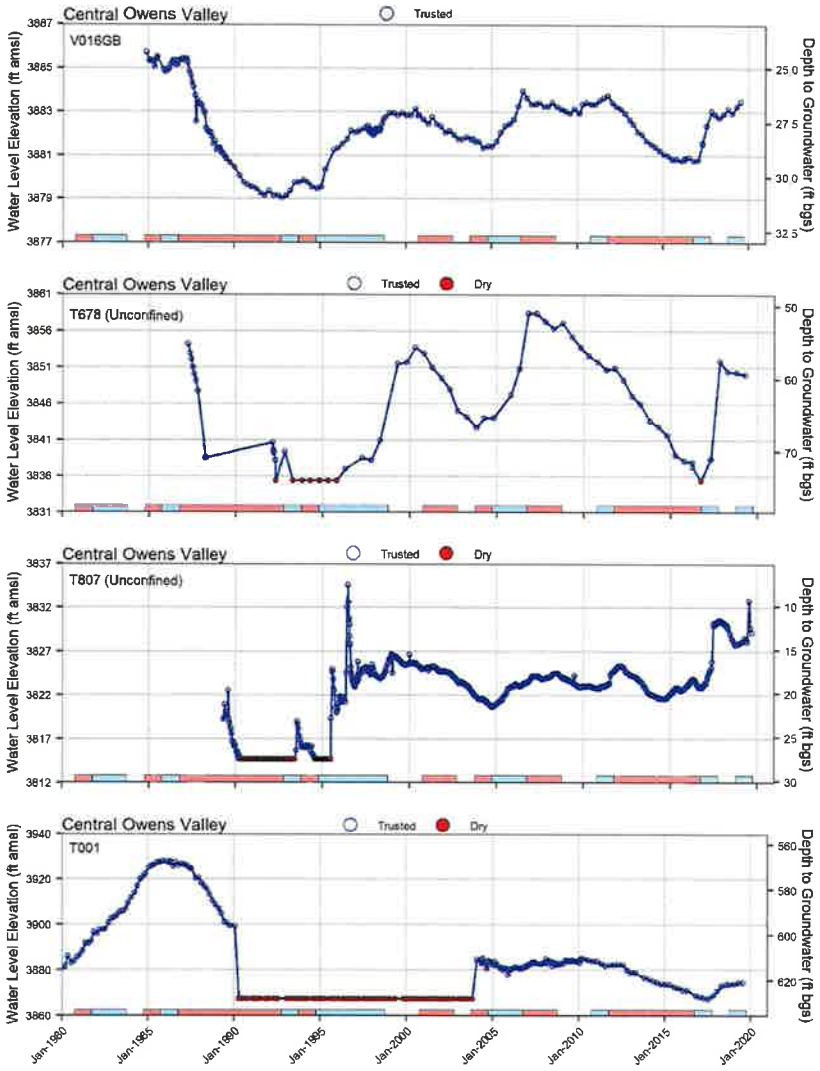

PRELIMINARY SUBJECT TO REVISION
PRIVILEGED AND CONFIDENTIAL
QUEEN VALLEY
BENTON VALLEY
BENTON RANGE
BLIND SPRING HILL
NEVADA
CALIFORNIA
BT-MW1
Hammil 1
CH-MW1
T397
WHITE
TABLELAND
MONO
INYO
Explanation
Representative Monitoring Well
Well with Water Level Data
Groundwater Basin
Management Area
Fish Slough and Tri-Valley
Owens Valley
N
0 2 4 Miles
Notes:
1. Locations with fewer than 3 observations omitted
2. Locations not measured since January 1st, 2000 omitted.
DBS&A
Daniel B. Stephens & Associates, Inc.
11/4/2020
D518.1418
MONITORING PLAN AND DATA GAP ANALYSIS
Fish Slough and Tri-Valley Water Levels
Representative Monitoring Wells

Figure 4-2


Fish Slough Northern Spring
Annual Discharge Volume (AF)
1200
1000
800
600
400
200
0
SW3208
slope = -17.95 AF/yr
R2 = 0.93
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Water Year


Fish Slough Total Runoff
Annual Discharge Volume (AF)
8000
6000
4000
2000
0
SW3216
slope = -87.45 AF/yr
R2 = 0.94
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Water Year


Central Owens Valley
Trusted
V016GB
Water Level Elevation (ft amsl)
Depth to Groundwater (ft bgs)
Central Owens Valley
Trusted
Dry
T678 (Unconfined)
Central Owens Valley
Trusted
Dry
T807 (Unconfined)
Central Owens Valley
Trusted
Dry
T001
Jan-1980
Jan-1985
Jan-1990
Jan-1995
Jan-2000
Jan-2005
Jan-2010
Jan-2015
Jan-2020

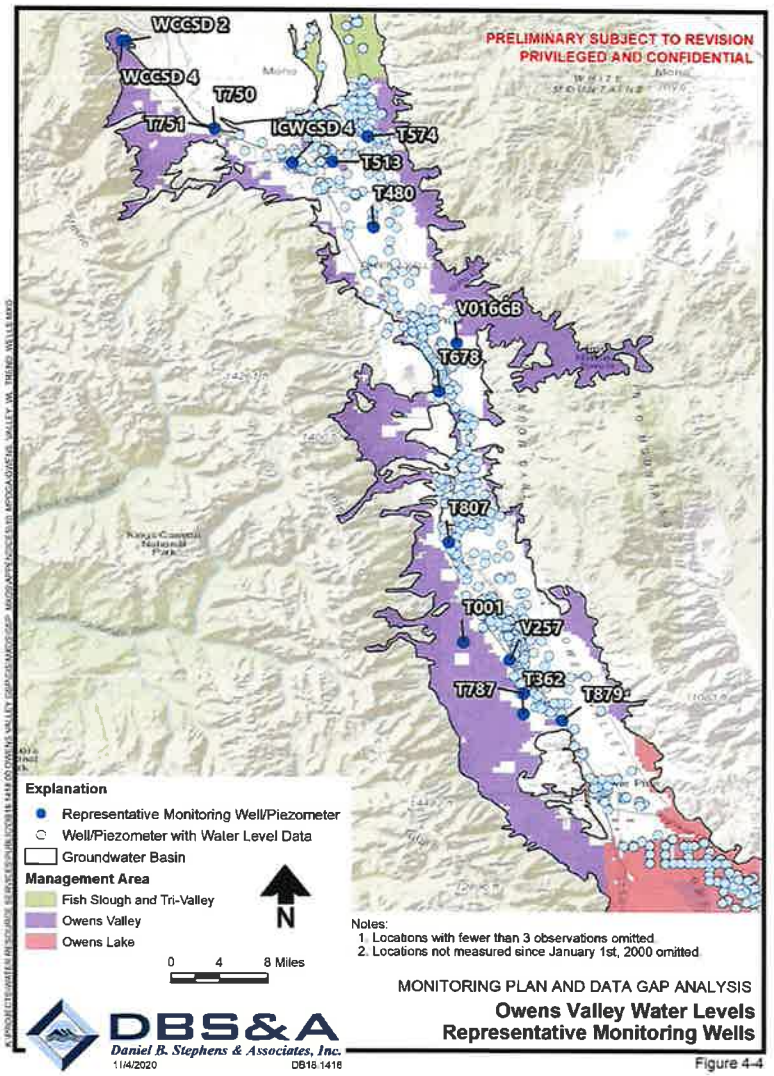
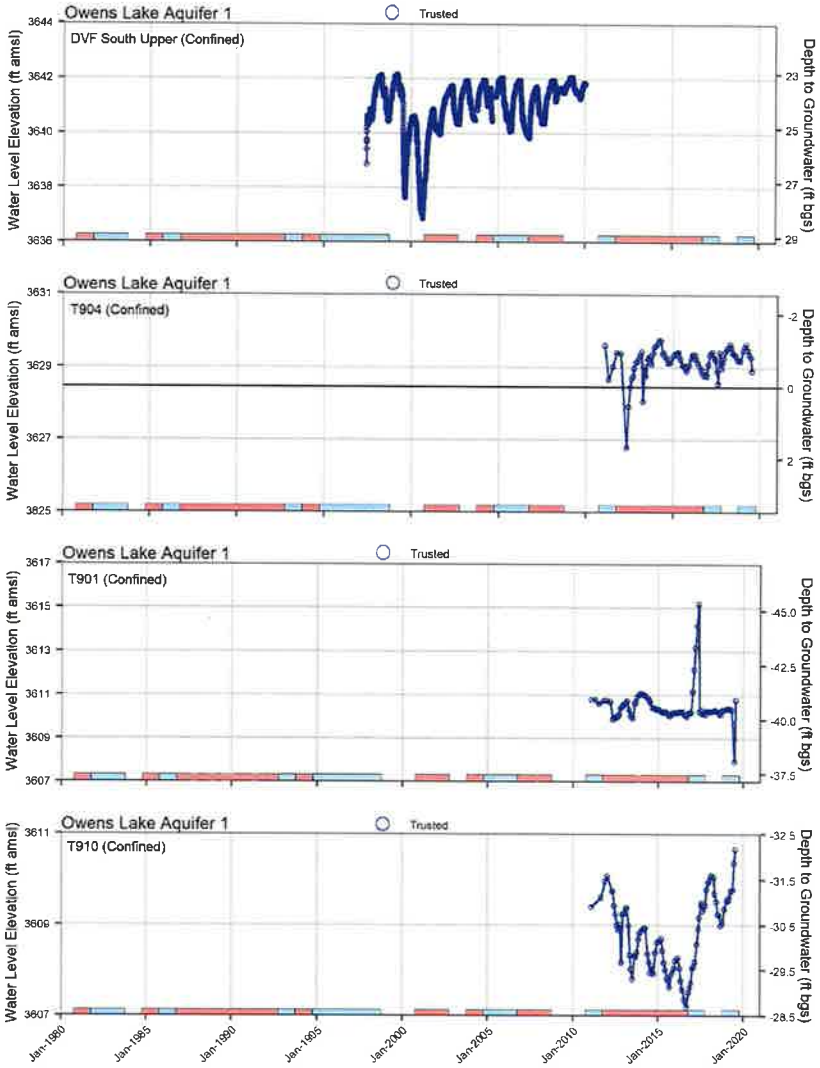
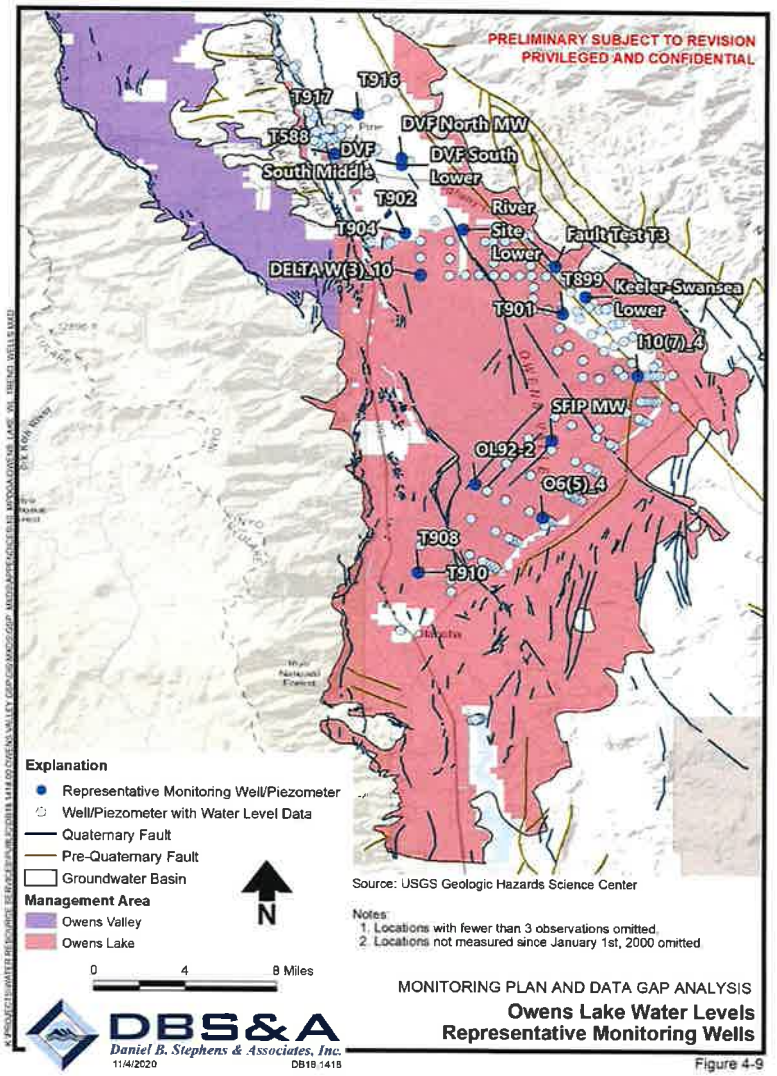

PRELIMINARY SUBJECT TO REVISION
PRIVILEGED AND CONFIDENTIAL
WCCSD 2
WCCSD 4
T750
T751
IGWCSD 4
T574
T513
T480
V016GB
T678
T807
T001
V257
T362
T787
T879
Explanation
Representative Monitoring Well/Piezometer
Well/Piezometer with Water Level Data
Groundwater Basin
Management Area
Fish Slough and Tri-Valley
Owens Valley
Owens Lake
N
0 4 8 Miles
Notes:
1. Locations with fewer than 3 observations omitted.
2. Locations not measured since January 1st, 2000 omitted.
DBS&A
Daniel B. Stephens & Associates, Inc.
11/4/2020
DB18.1418
MONITORING PLAN AND DATA GAP ANALYSIS
Owens Valley Water Levels
Representative Monitoring Wells

Figure 4-4


Owens Lake Aquifer 1
Trusted
DVF South Upper (Confined)
Water Level Elevation (ft amsl)
Depth to Groundwater (ft bgs)
3644
3642
3640
3638
3636
23
25
27
29
Owens Lake Aquifer 1
Trusted
T904 (Confined)
Water Level Elevation (ft amsl)
Depth to Groundwater (ft bgs)
3631
3629
3627
3625
-2
0
2
Owens Lake Aquifer 1
Trusted
T901 (Confined)
Water Level Elevation (ft amsl)
Depth to Groundwater (ft bgs)
3617
3615
3613
3611
3609
3607
-45.0
-42.5
-40.0
-37.5
Owens Lake Aquifer 1
Trusted
T910 (Confined)
Water Level Elevation (ft amsl)
Depth to Groundwater (ft bgs)
3611
3609
3607
-32.5
-31.5
-30.5
-29.5
-28.5
Jan-1980
Jan-1985
Jan-1990
Jan-1995
Jan-2000
Jan-2005
Jan-2010
Jan-2015
Jan-2020


PRELIMINARY SUBJECT TO REVISION
PRIVILEGED AND CONFIDENTIAL
T916
T917
DVF North MW
T588
DVF
DVF South
South Middle
Lower
T902
River
T904
Site
Fault Test T3
Lower
DELTA W(3)_10
T899
Keeler-Swansea
T901
Lower
I10(7)_4
SFIP MW
OL92-2
O6(5)_4
T908
T910
Explanation
Representative Monitoring Well/Piezometer
Well/Piezometer with Water Level Data
Quaternary Fault
Pre-Quaternary Fault
Groundwater Basin
Management Area
Owens Valley
Owens Lake
N
0
4
8 Miles
Source: USGS Geologic Hazards Science Center
Notes:
1. Locations with fewer than 3 observations omitted.
2. Locations not measured since January 1st, 2000 omitted.
DBS&A
Daniel B. Stephens & Associates, Inc.
11/4/2020
DB18.1418
MONITORING PLAN AND DATA GAP ANALYSIS
Owens Lake Water Levels
Representative Monitoring Wells
Figure 4-9

Water Quality Trends

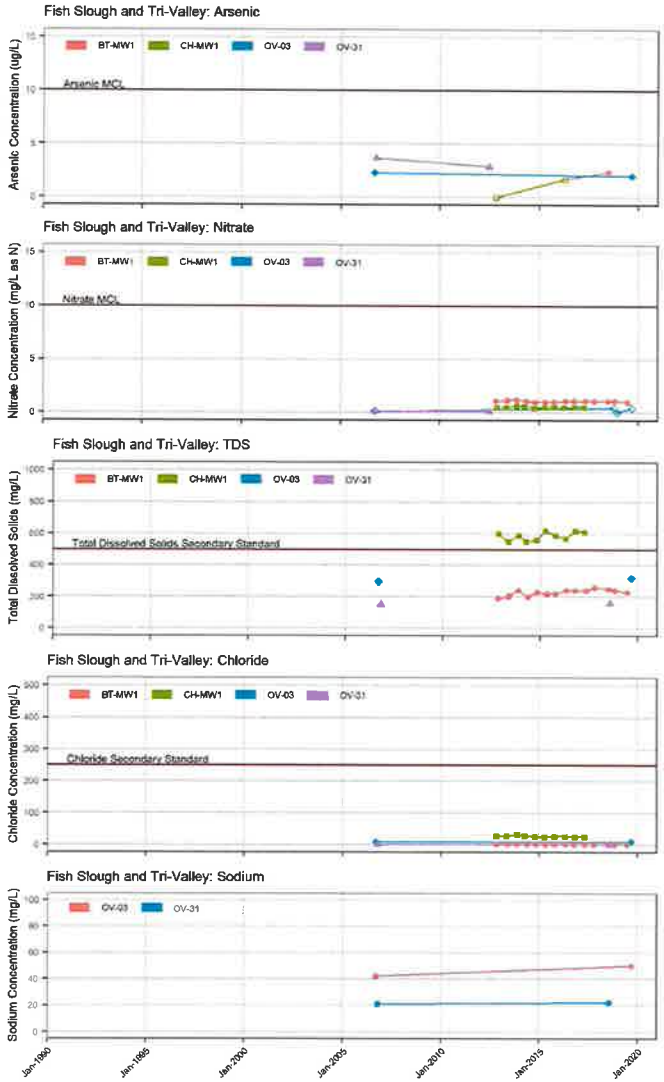
Arsenic

Nitrate

TDS

Chloride

Sodium



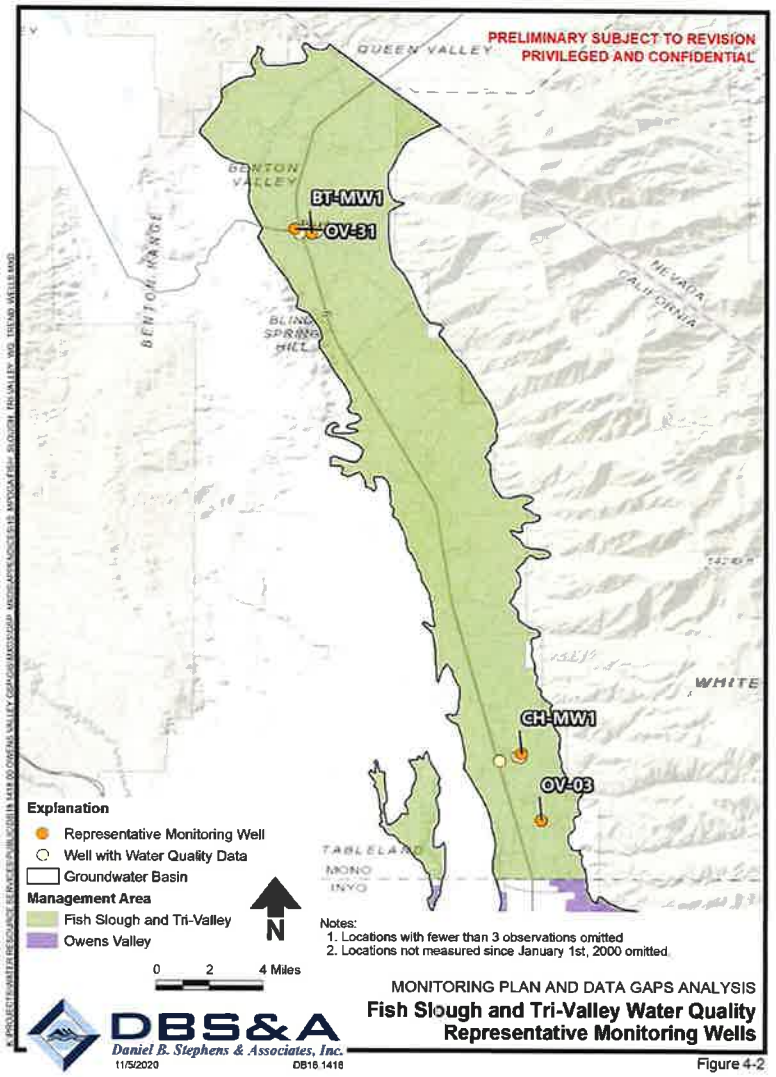


Figure 4-2

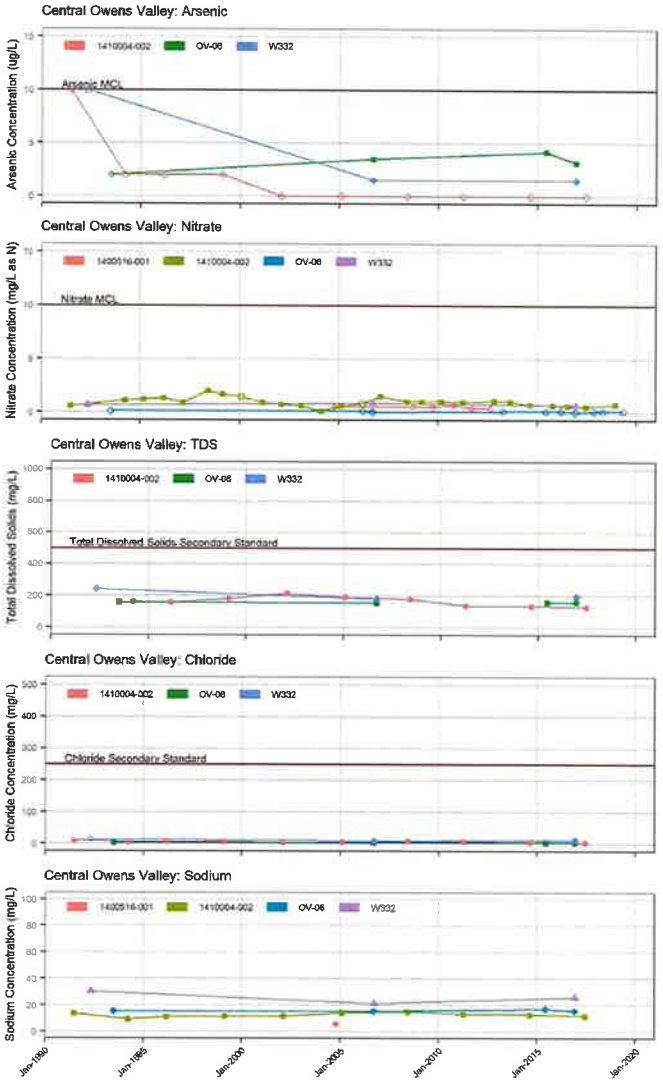
Arsenic

Nitrate

TDS

Chloride

Sodium



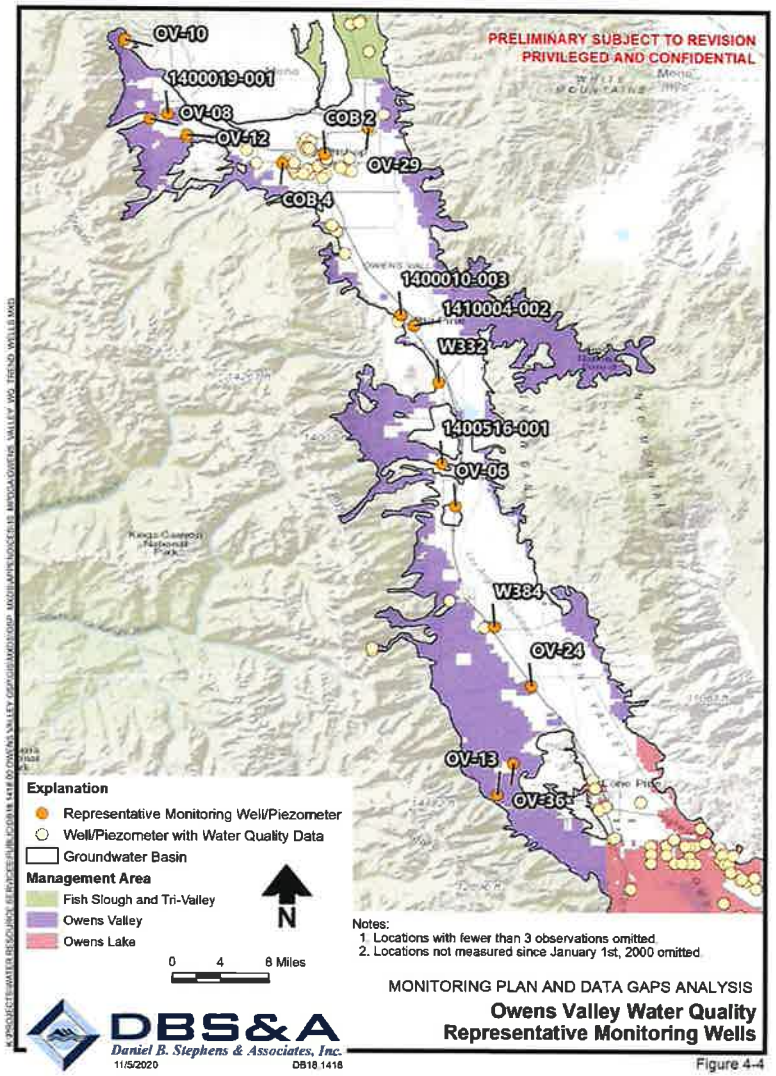


Figure 4-4

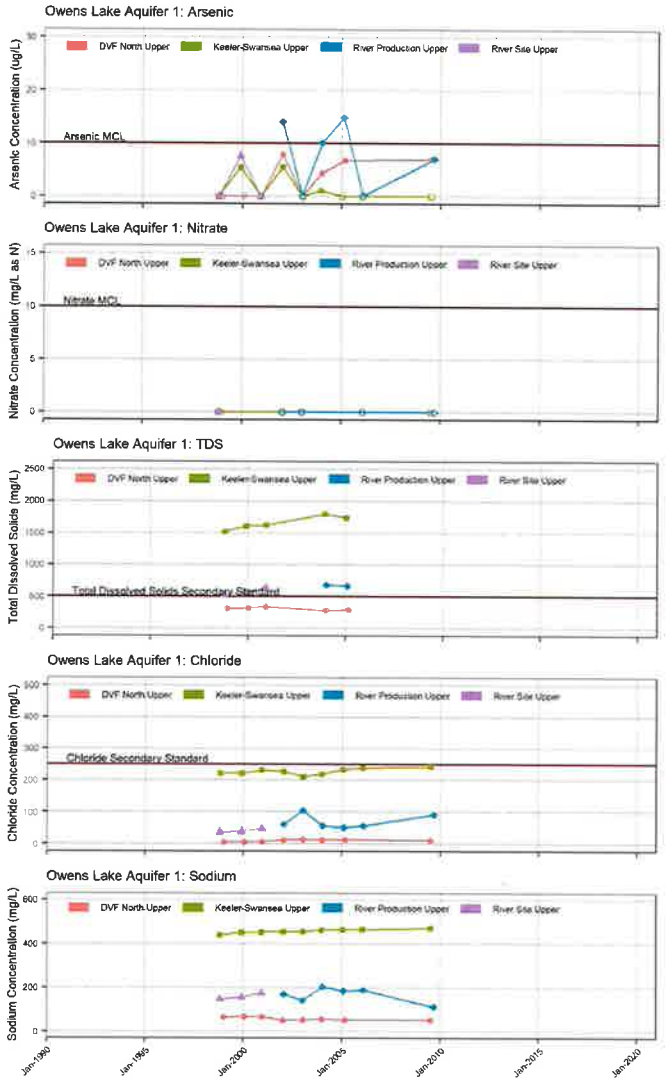
Arsenic

Nitrate

TDS

Chloride

Sodium



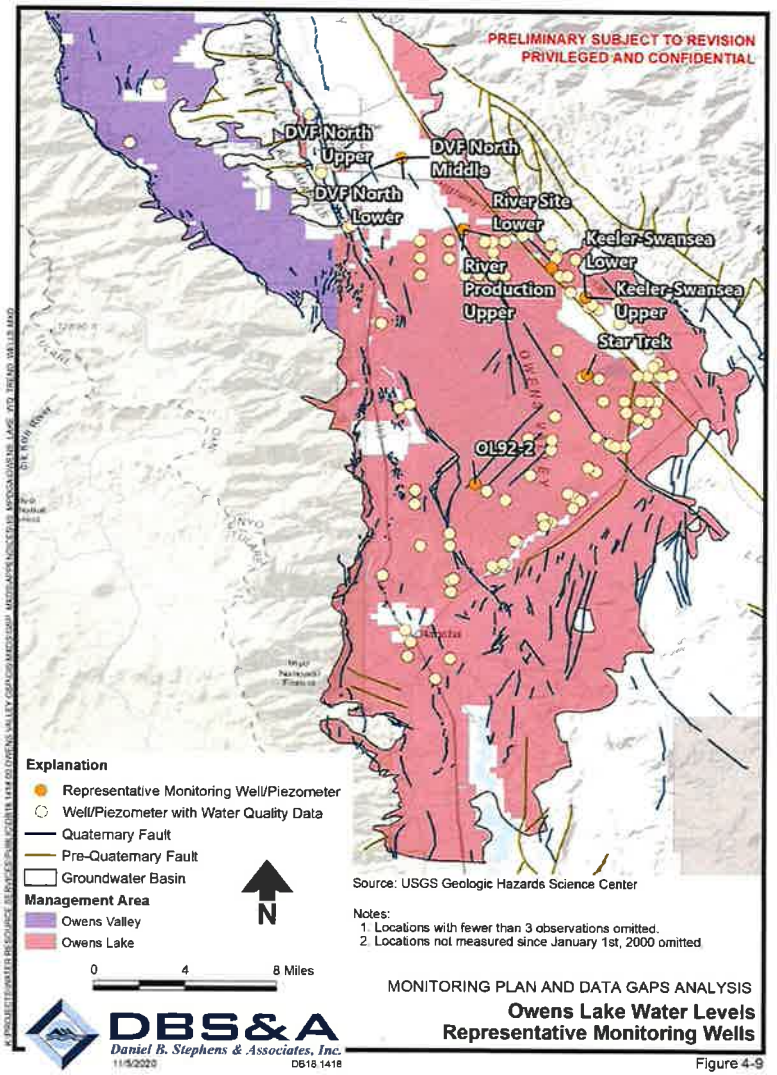


Figure 4-9

Data Gaps Summary

-Relatively few wells located with GSP area

-Limited well location and construction information

-Limited pumping data within GSP Area

-Sporadic water level data for some portions

-Sporadic water quality data

Table 2-1. Well data summary.

	Groundwater Basin	GSP Area	Fish Slough and Tri-Valley Management Area	Owens Valley Management Area	Owens Lake Management Area [a]
Wells	4929	-	-	-	-
Wells with coordinates	4481	1903	287	935	681
Wells with accurate coordiantes [1]	2422	936	72	465	399
Wells with screen depth information [1,2]	1095	522	18	206	298
Wells with recent water level data [1,3]	874	123	20	62	41
Wells with recent pumping data [1,3]	179	15	0	15	0
Wells with recent water qualiy data [1,3,4]	117	83	12	62	9

1. Coordiantes do not correspond with centriod of section
2. Top of screen depth reported
3. Measurement collected since January 1, 2010
4. Limited to wells sampled for arsenic, chloride, sodium, nitrate, or total dissolved solids (TDS)

a. Includes piezometeres

Proposed Additional Data Collection Prioritization

High Priority

Add wells to monitoring network in Fish Slough and Tri-Valley management area

Identify most common well screen intervals for each valley to better understand domestic well vulnerability

More accurate determination of well locations

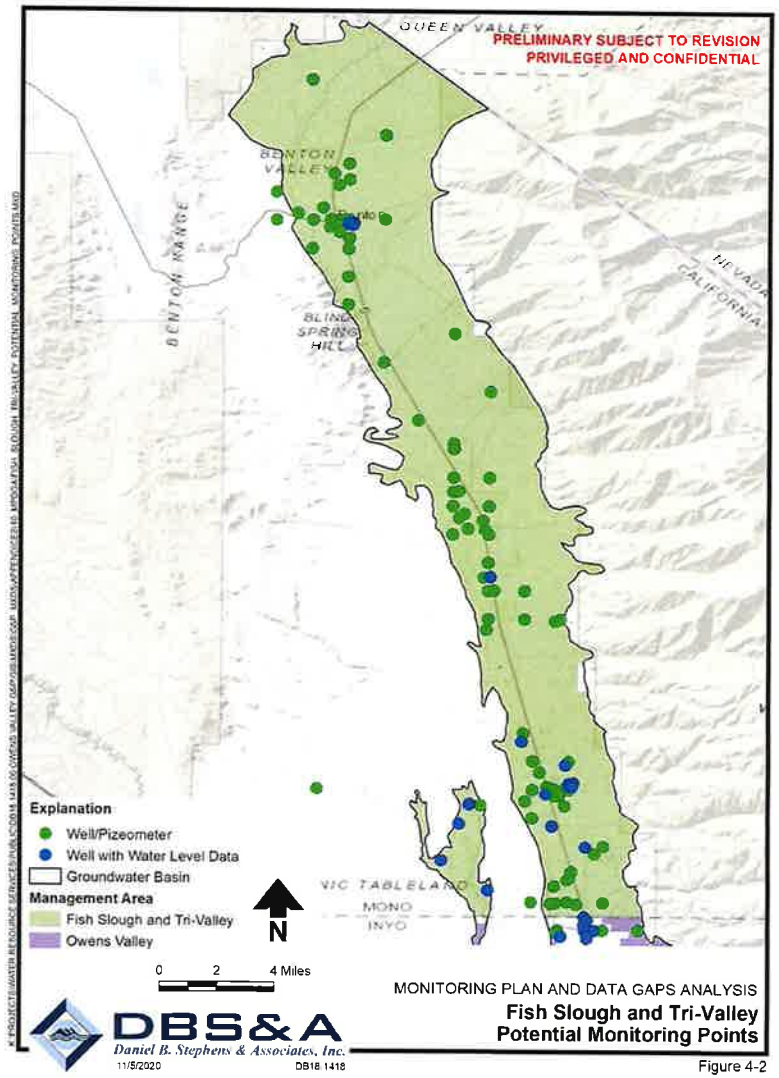
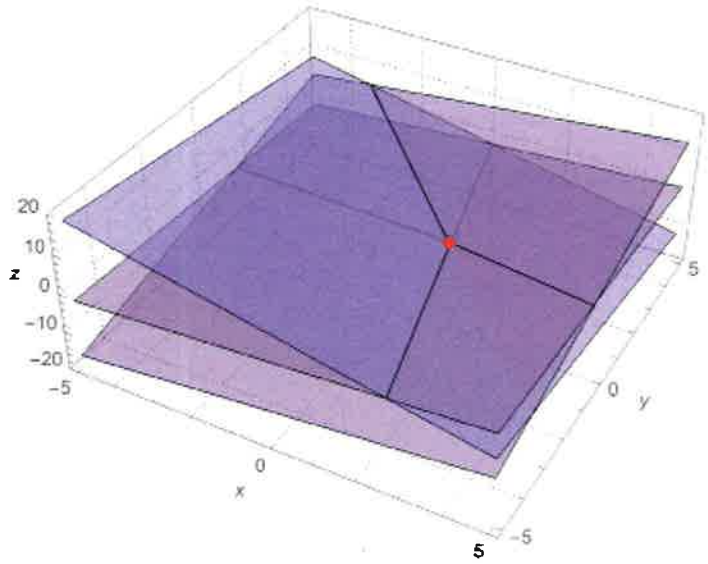
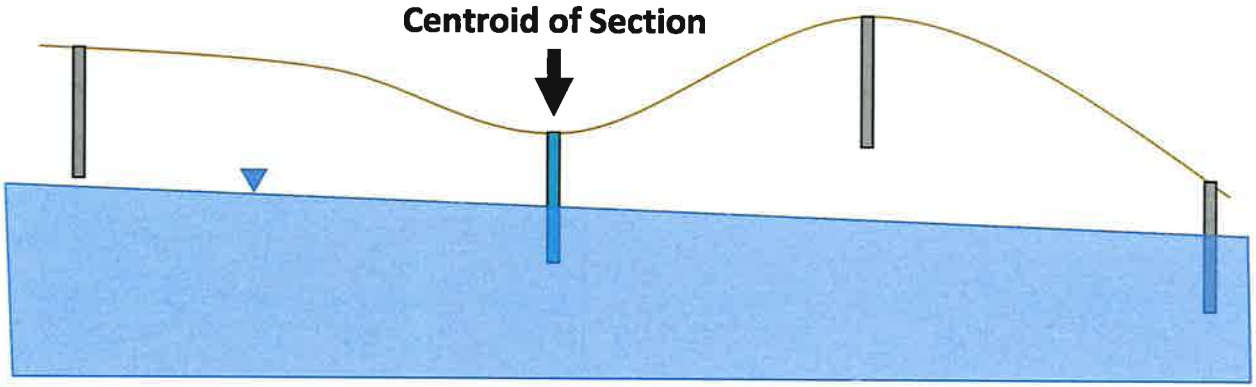


Figure 4-2



It is impossible to represent a unique 3D surface with only a single point...



Inaccurate well location + topographic effects result in poor predictions of well vulnerability

Proposed Additional Data Collection Prioritization

Medium Priority

Add wells to monitoring network located within Owens Valley management area

Identify most common well screen intervals to better understand domestic well vulnerability

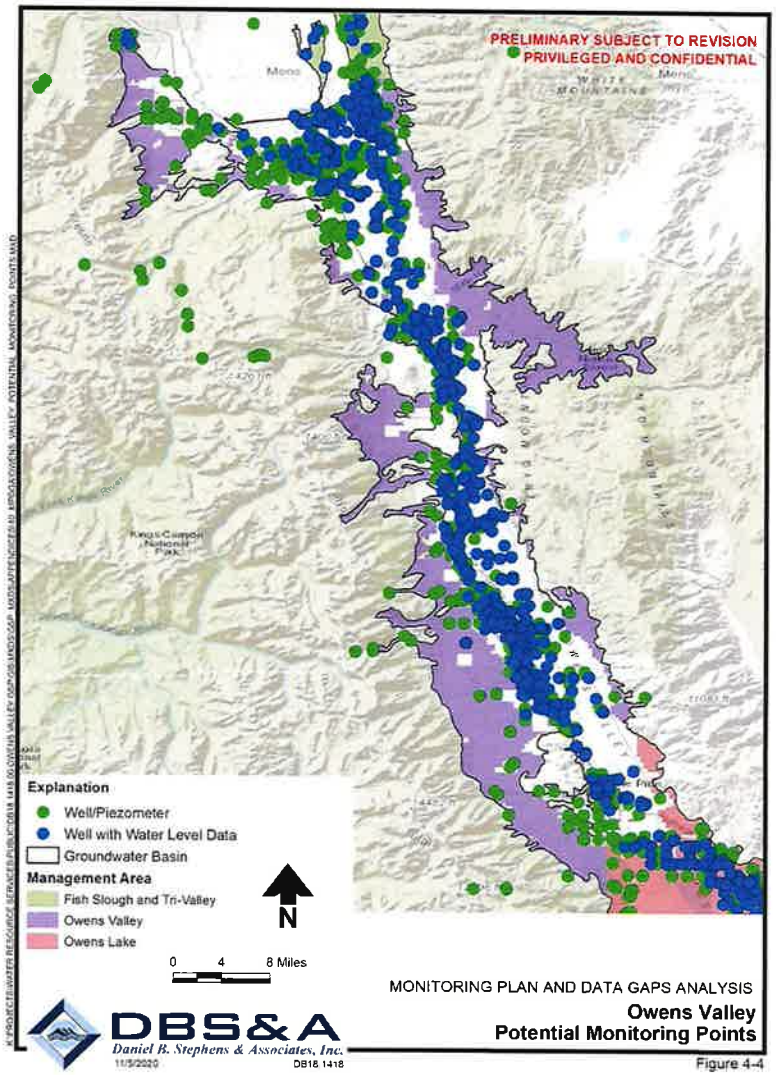


Figure 4-4

Proposed Additional Data Collection Prioritization

Low Priority

Add monitoring well(s) to eastern side of Owens Valley management area

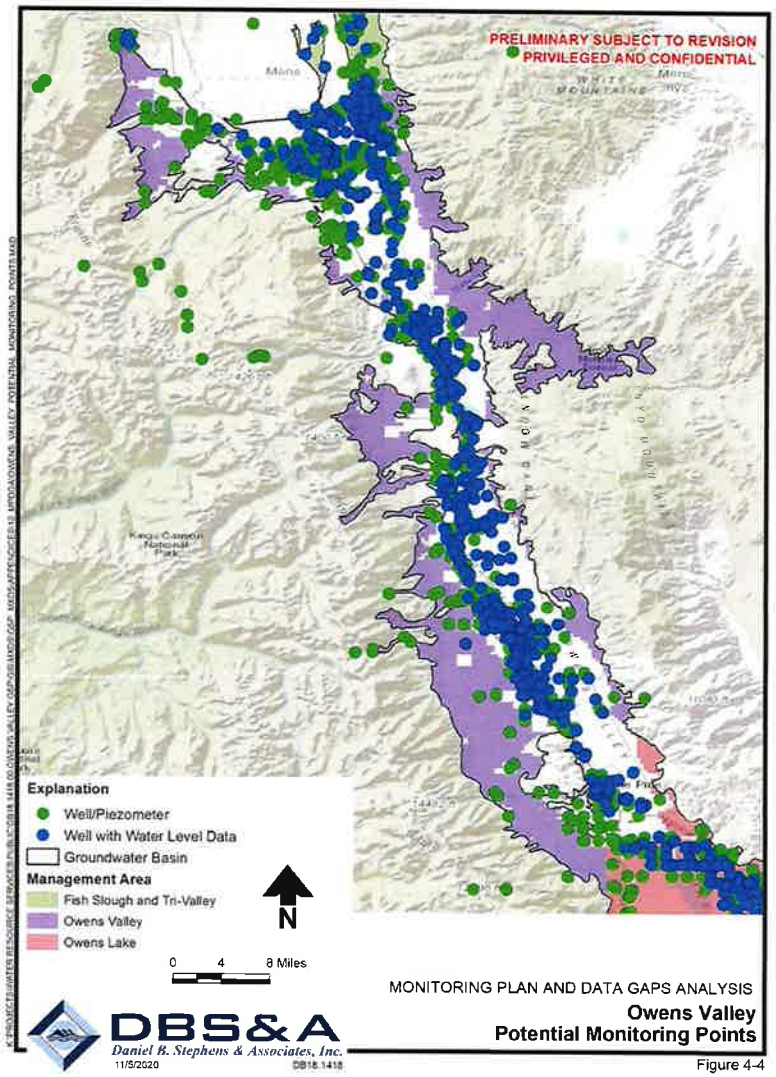
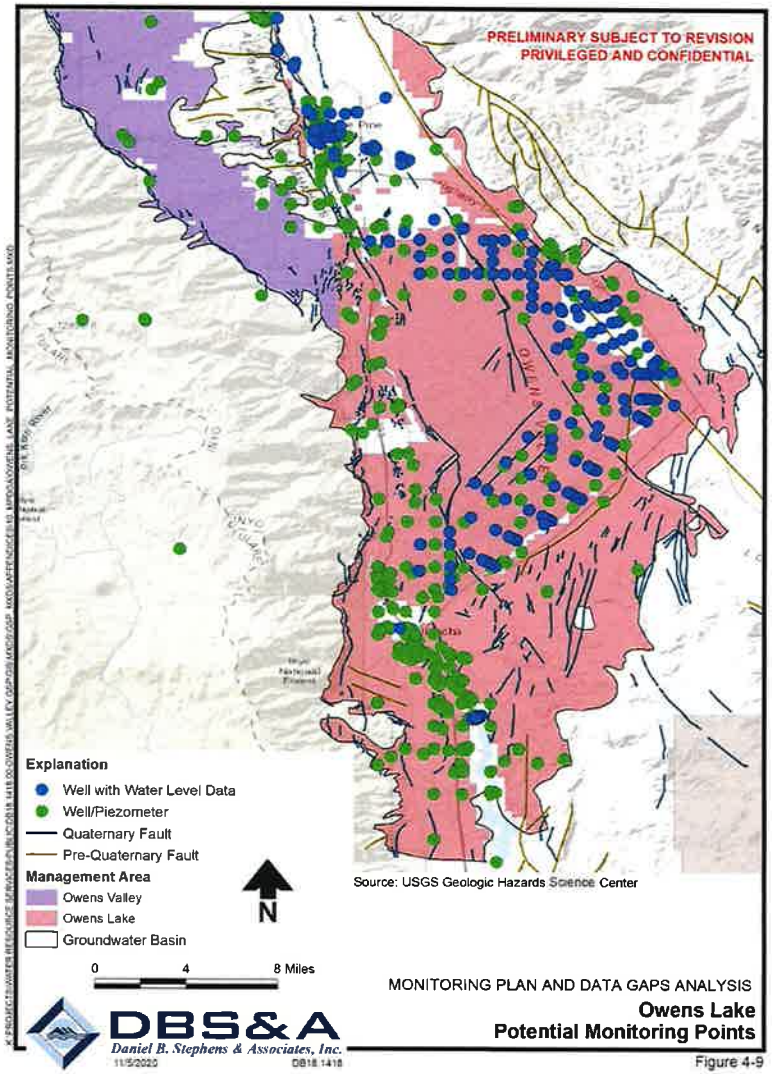


Figure 4-4

Proposed Additional Data Collection Prioritization

Low Priority

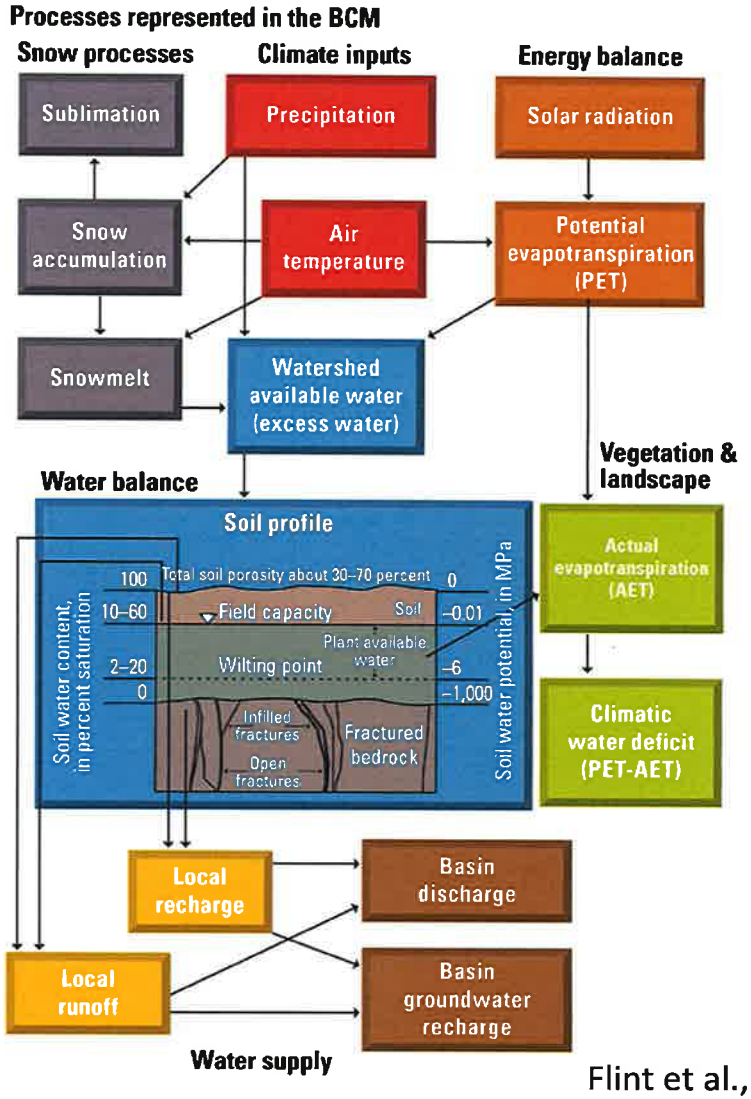
Additional monitoring in Owens Lake management area



DBS&A
Daniel B. Stephens & Associates, Inc.

Water Budget - Methods

- USGS Basin Characterization Model (BCM) is a regional water balance model (Flint et al., 2013)
- BCM mechanistically models the transformation of precipitation into evapotranspiration, infiltration into soils, runoff, or percolation below the root zone.
- Department of Water Resources handbook for Water Budget Development recommends using BCM for basins with no existing models.



Flint et al., 2013

Water Budget - Methods

- BCM model inputs and outputs are shown in Table
- Not all outputs are archived for the historical period
- For the GSP water years 1986-2016 is the historical period
- Water year 2006-2016 is the current
- Recharge is amount of water that penetrates below the root zone. BCM calls this potential recharge.

Variable	Code	Creation Method	Units	Equation/model	Description
Maximum air temperature	tmx	downscaled	degree C	Model input	The maximum monthly temperature averaged annually
Minimum air temperature	tmn	downscaled	degree C	Model input	The minimum monthly temperature averaged annually
Precipitation	ppt	downscaled	mm	Model input	Total monthly precipitation (rain or snow) summed annually
Potential evapotranspiration	pet	Modeled/ pre-processing input for BCM	mm	Modeled* on an hourly basis from solar radiation that is modeled using topographic shading, corrected for cloudiness, and partitioned on the basis of vegetation cover to represent bare-soil evaporation and evapotranspiration due to vegetation	Total amount of water that can evaporate from the ground surface or be transpired by plants summed annually
Runoff	run	BCM	mm	Amount of water that exceeds total soil storage + rejected recharge	Amount of water that becomes stream flow, summed annually
Recharge	rch	BCM	mm	Amount of water exceeding field capacity that enters bedrock, occurs at a rate determined by the hydraulic conductivity of the underlying materials, excess water (rejected recharge) is added to runoff	Amount of water that penetrates below the root zone, summed annually
Climatic water deficit	cwd	BCM	mm	pet-aet	Annual evaporative demand that exceeds available water, summed annually
Actual evapotranspiration	aet	BCM	mm	pet calculated* when soil water content is above wilting point	Amount of water that evaporates from the surface and is transpired by plants if the total amount of water is not limited, summed annually
Sublimation	sbl	BCM	mm	Calculated*, applied to pck	Amount of snow lost to sublimation (snow to water vapor) summed annually
Soil water storage	str	BCM	mm	ppt + melt – aet – rch - run	Average amount of water stored in the soil annually
Snowfall	Snw	BCM	mm	precipitation if air temperature below 1.5 degrees C (calibrated)	Amount of snow that fell summed annually
Snowpack	Pck	BCM	mm	Prior month pck + snow – subl - melt	Amount of snow as a water equivalent that is accumulated per month summed annually (if divided by 12 would be average monthly snowpack)
Snowmelt	mlt	BCM	mm	Calculated*, applied to pck	Amount of snow that melted summed annually (snow to liquid water)
Excess water	Exc	BCM	mm	ppt – pet	Amount of water that remains in the system, assuming evapotranspiration consumes the maximum possible amount of water, summed annually for positive months only

Owens Valley GSP Groundwater Dependent Ecosystems

Christian Braudrick and Bruce Orr

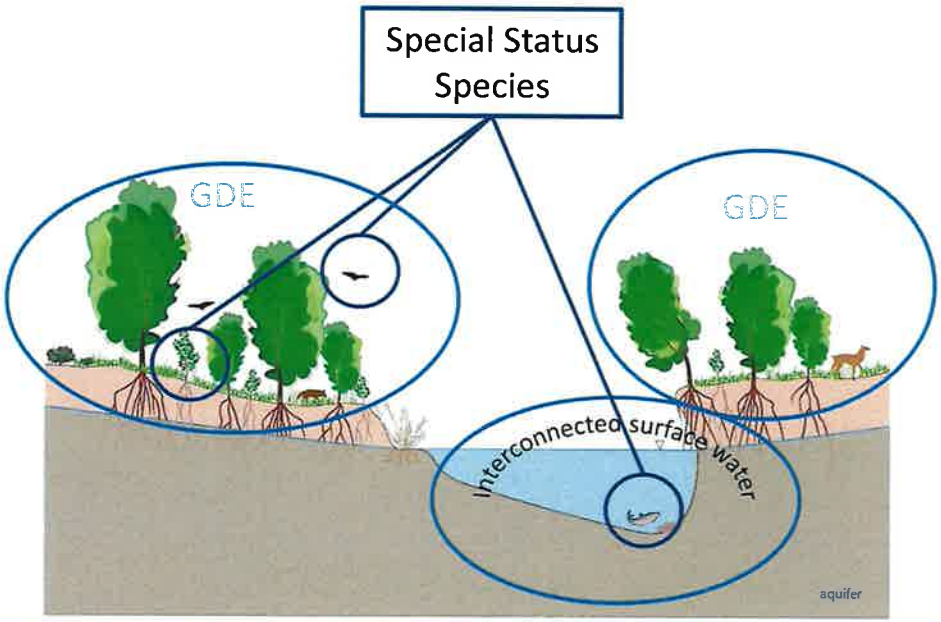
Stillwater Sciences

Outline

- Review GDE mapping
- New source Map!!
- Preliminary GDE units
- Future monitoring of GDE health
- Assess ICWD GDE assessment

Groundwater Dependent Ecosystems (GDEs)

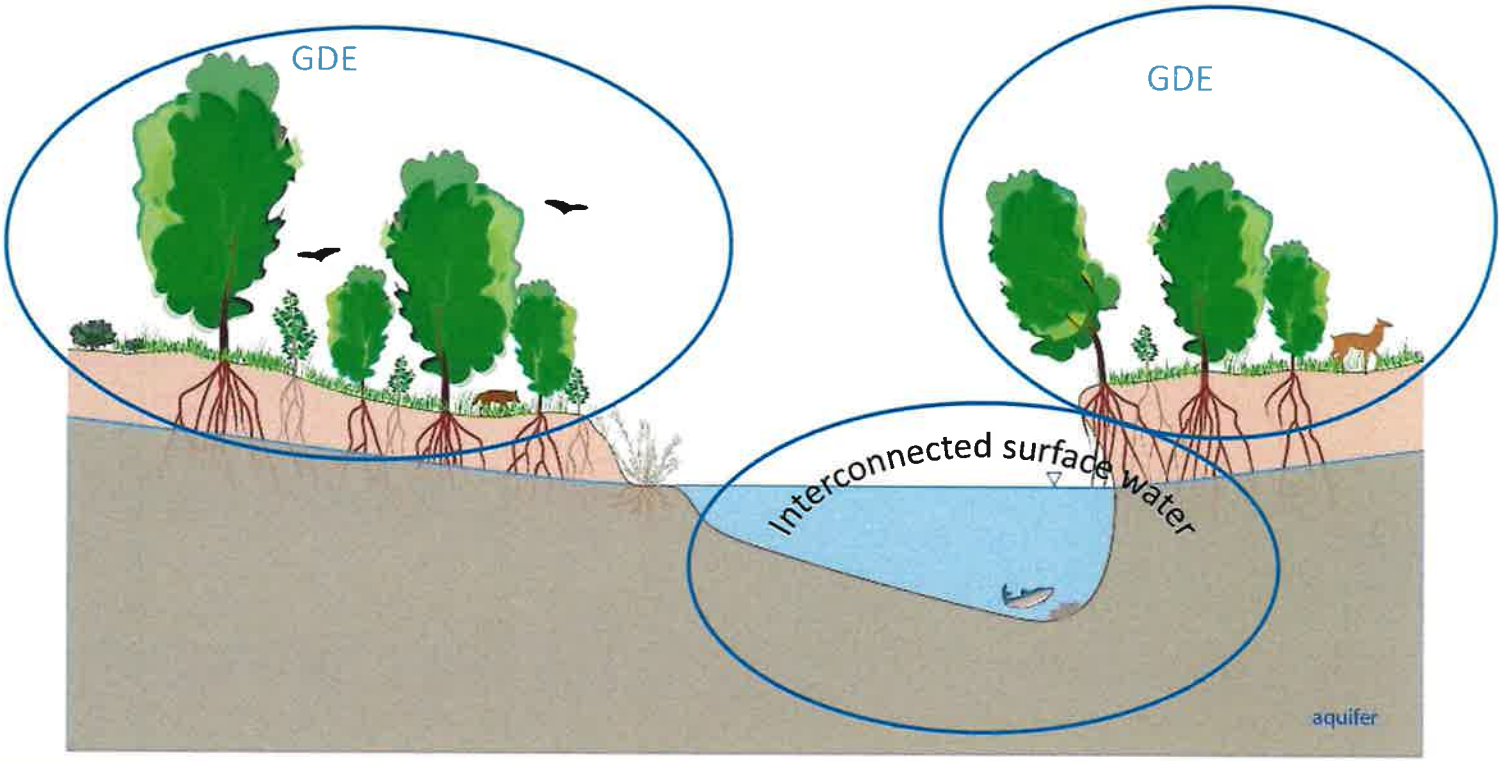
DWR defines GDEs as ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface.



Braudrick et al., 2018 (figure by K. Rodriguez and A. Merrill)

GDEs occur in a variety of different environments ranging from seeps and springs, to groundwater-dependent wetlands, to aquatic and riparian ecosystems associated with rivers that partially or entirely rely on groundwater.

Part 1. GDE Mapping

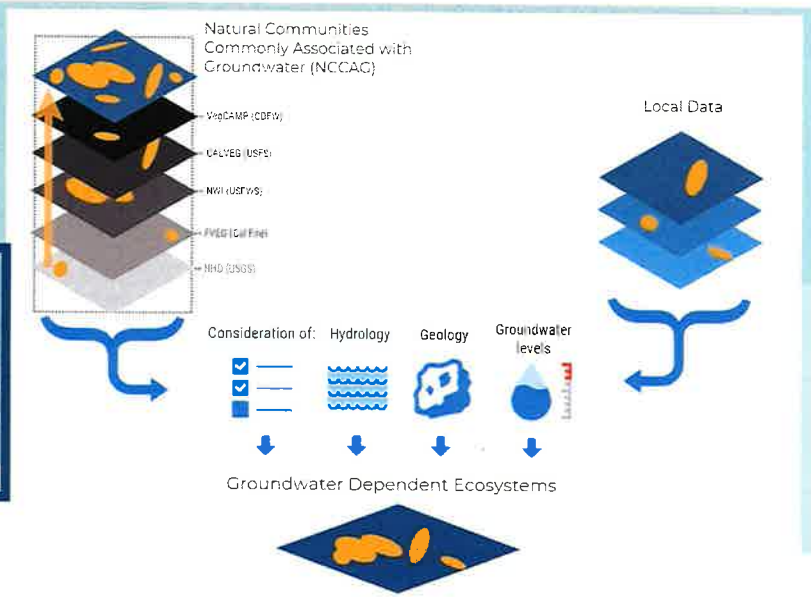


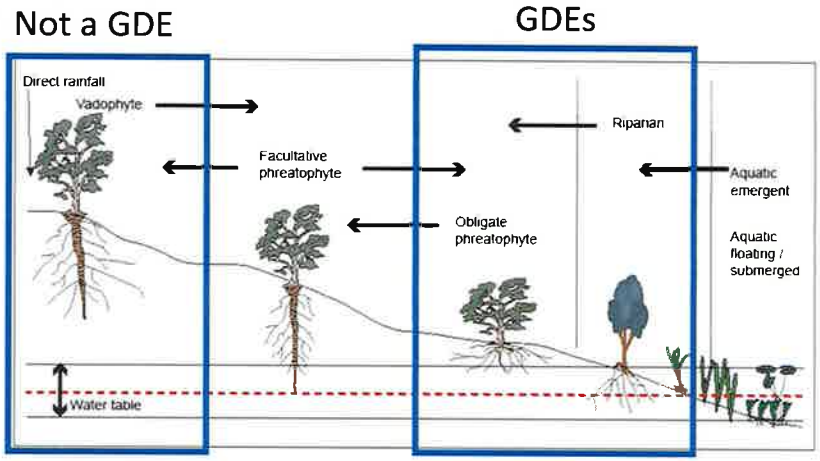
Braudrick et al., 2018 (figure by K. Rodriguez and A. Merrill)

Mapping GDEs

DWR NCCAG Database

1. Overlay statewide vegetation maps (VEGCAMP, CalVeg, National Wetland Inventory, FRAP) based on map quality and age
2. Assess ***potential GDEs*** based on mapped vegetation type (e.g., phreatophytes)
3. Add local vegetation data not in DWR database and assess ***potential GDEs*** based on mapped vegetation type (e.g., phreatophytes)
4. Assess groundwater dependence of Potential GDEs based on
   - Species present (if known)
   - Measurements of depth to groundwater (if known)
   - Local geology, presence of springs, seeps
5. Create a single map of GDEs





OVGA complications

1. The basin is very large and has a broad range of map quality and map age

   Address with consistent method, prioritize newer, more detailed mapping and monitor for uncertainties

2. Species details are poor in many of the maps (particularly FRAP and CalVeg) making it hard to assess groundwater dependance

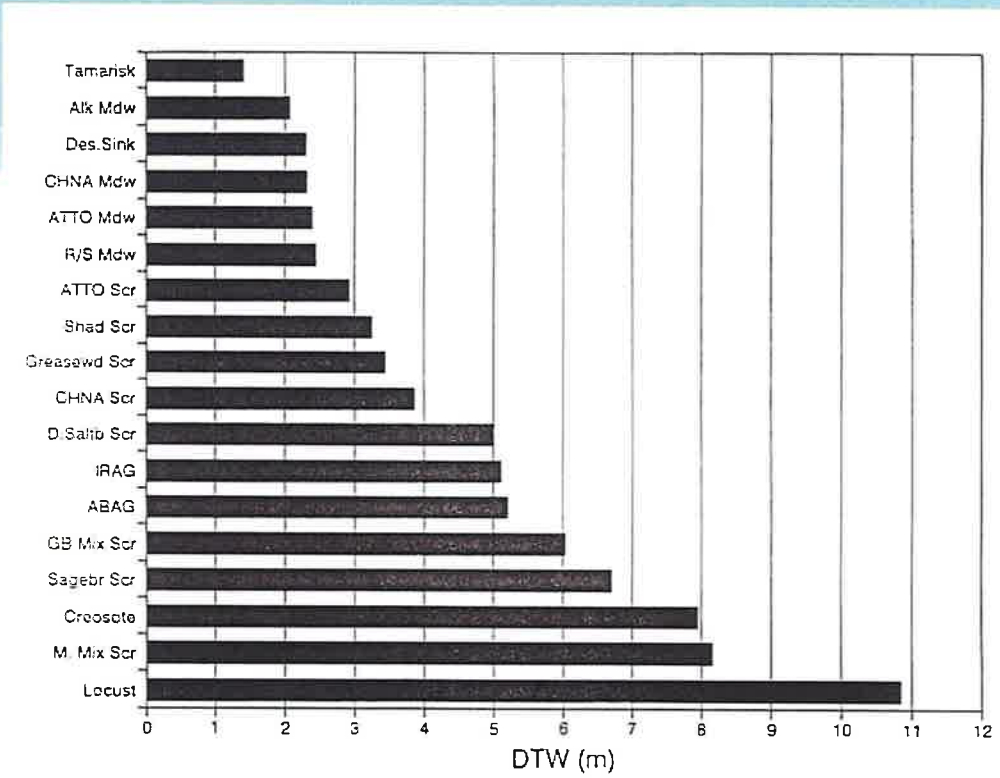
   ICWD botanists have provided input on the preliminary maps based on the presence of groundwater dependent species

3. Groundwater measurements are sparse outside of the Adjudicated Area and Owens Lake

   Assume potential GDEs after Steps 1 and 2 are GDEs and monitor to assess the degree to which this is true

ICWD Assessment

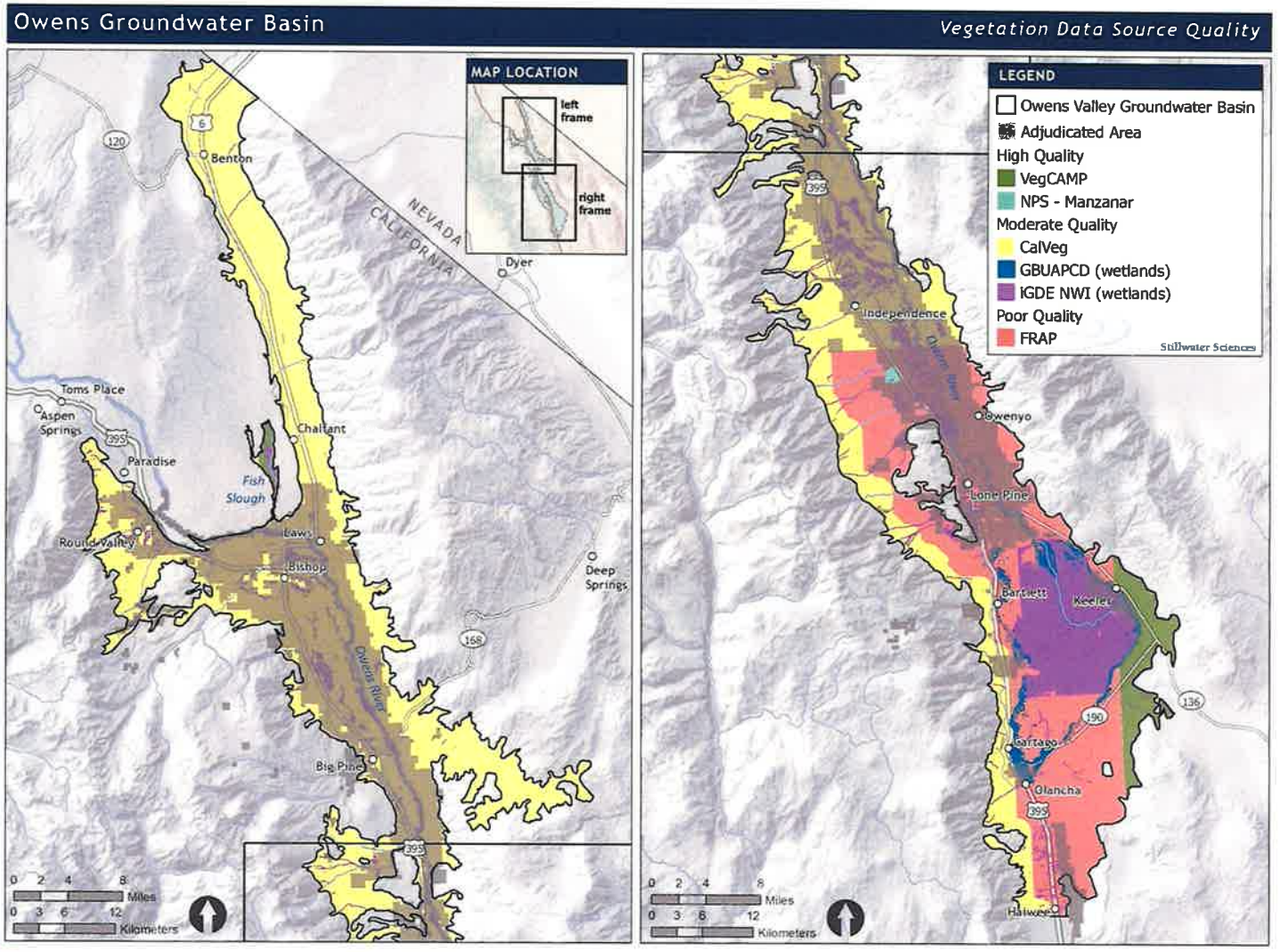
- ICWD has been tracking GDEs in the adjudicated area since the 1980s and has extensive studies of groundwater depth of different plant communities
- Studies include measurement of transpiration and ET and comparison with ET and rainfall to define phreatophytes (phreatophyte units can have ET>precipitation due to groundwater)
- Parcels in the vegetation map were kept or removed based on whether they contained plants known or likely to be GDE indicators



Manning, 1999

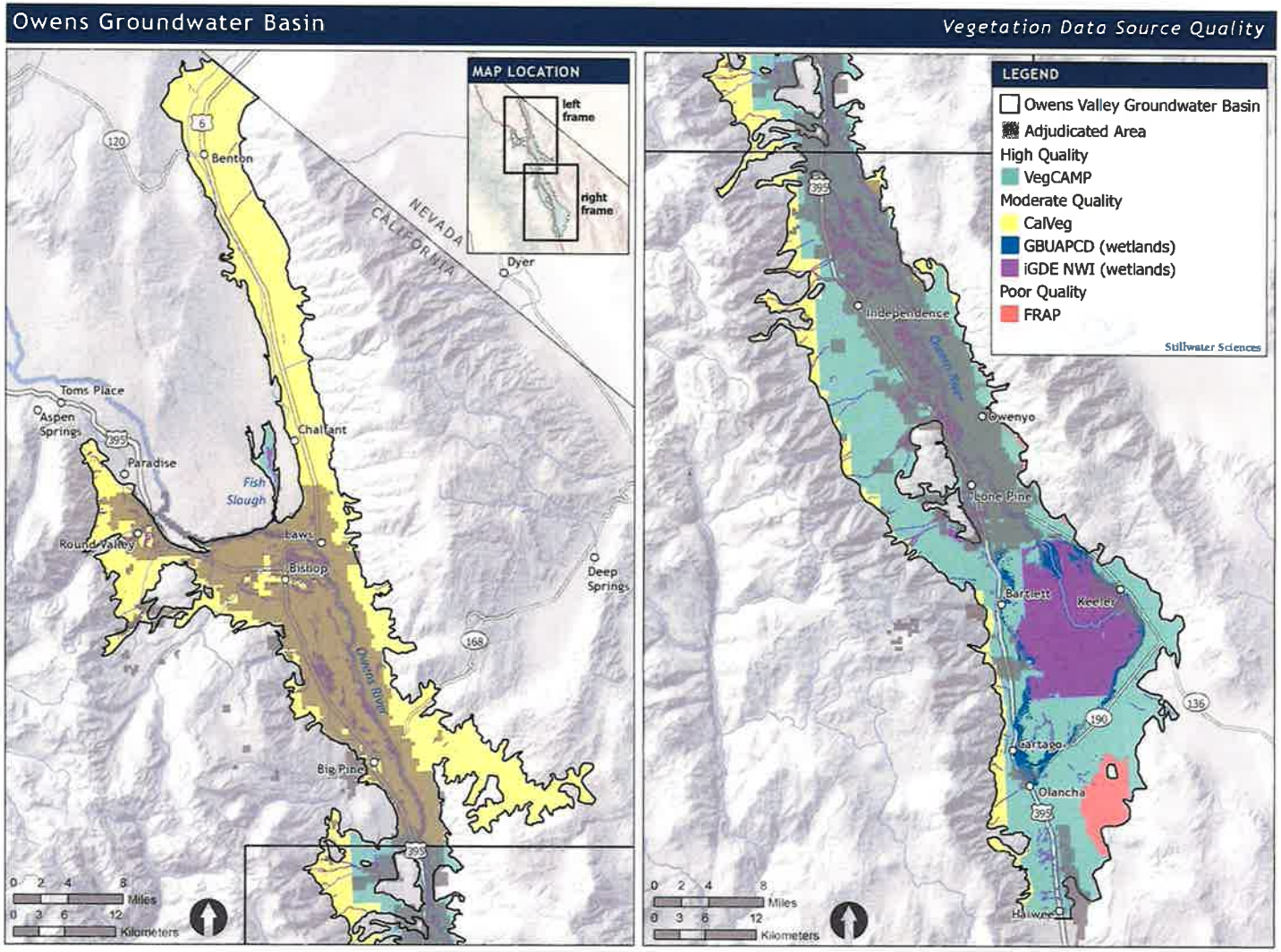
Source Data

- Vegetation map integrates 6 data sources.
- ICWD helped identify potential GDEs



Source Data

- New VegCamp map covers the southern half of the OVGA basin
- Data processing is still in progress



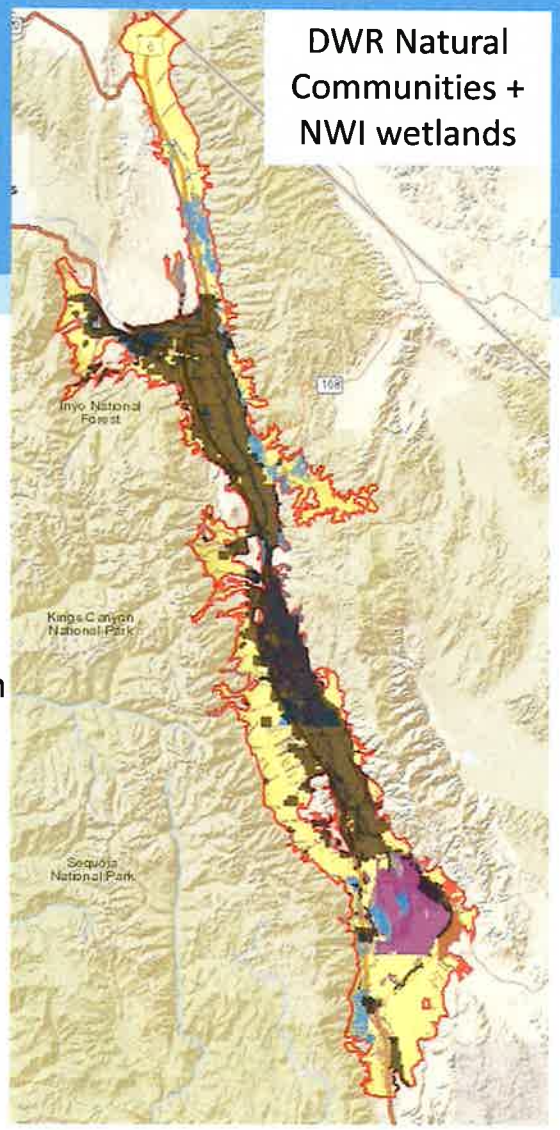
Potential GDE extent (in progress)

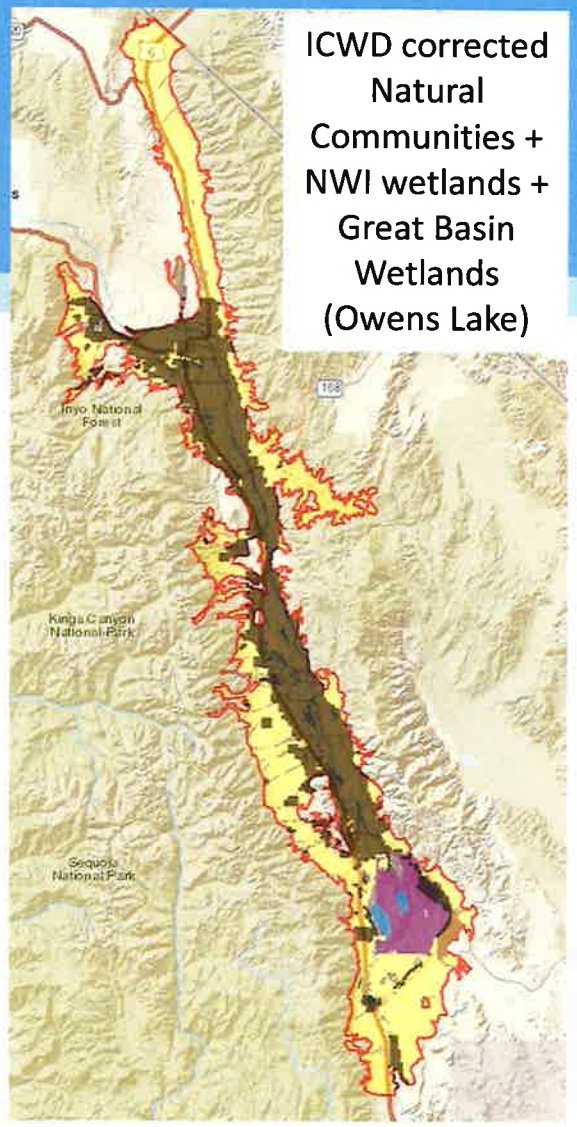
From OVGA database (in development)

Owens Basin

Still need to:

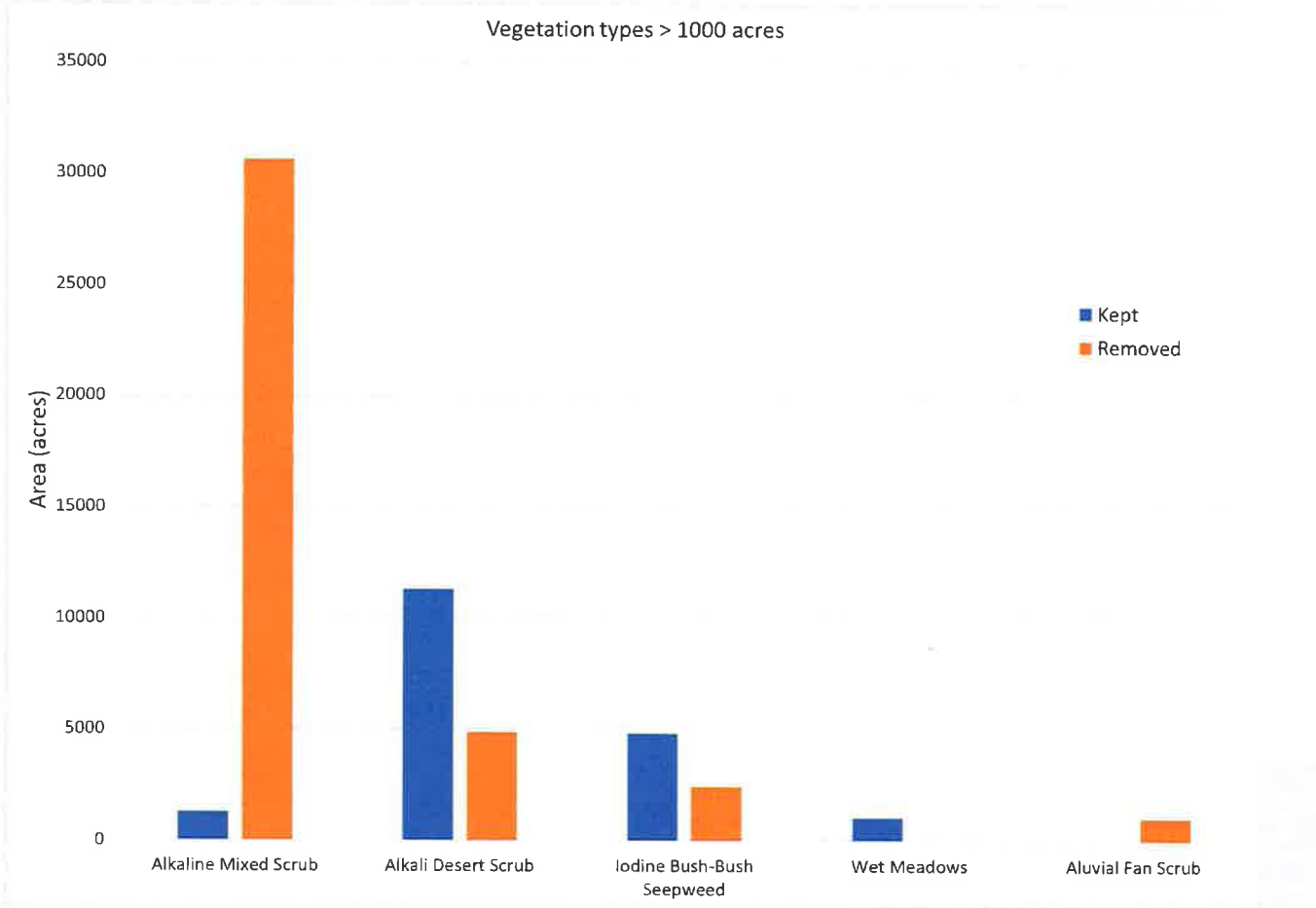
- Incorporate new map for southern portion of the basin (Owens Lake) Assess interconnected surface water and aquatic species





GDEs Removed

- 90% of total area removed was Alkaline Mixed Scrub (CalVeg) and Alkali Desert Scrub (FRAP)
- Other notable removals include: Mid-elevation wash, Xeric scrub



Preliminary GDE Units (subject to change)

1. Owens Valley (Owens Valley Management Unit)

   Most GDEs are along riparian zones on western tributaries and at springs

2. Owens Lake (Owens Lake Management Unit)

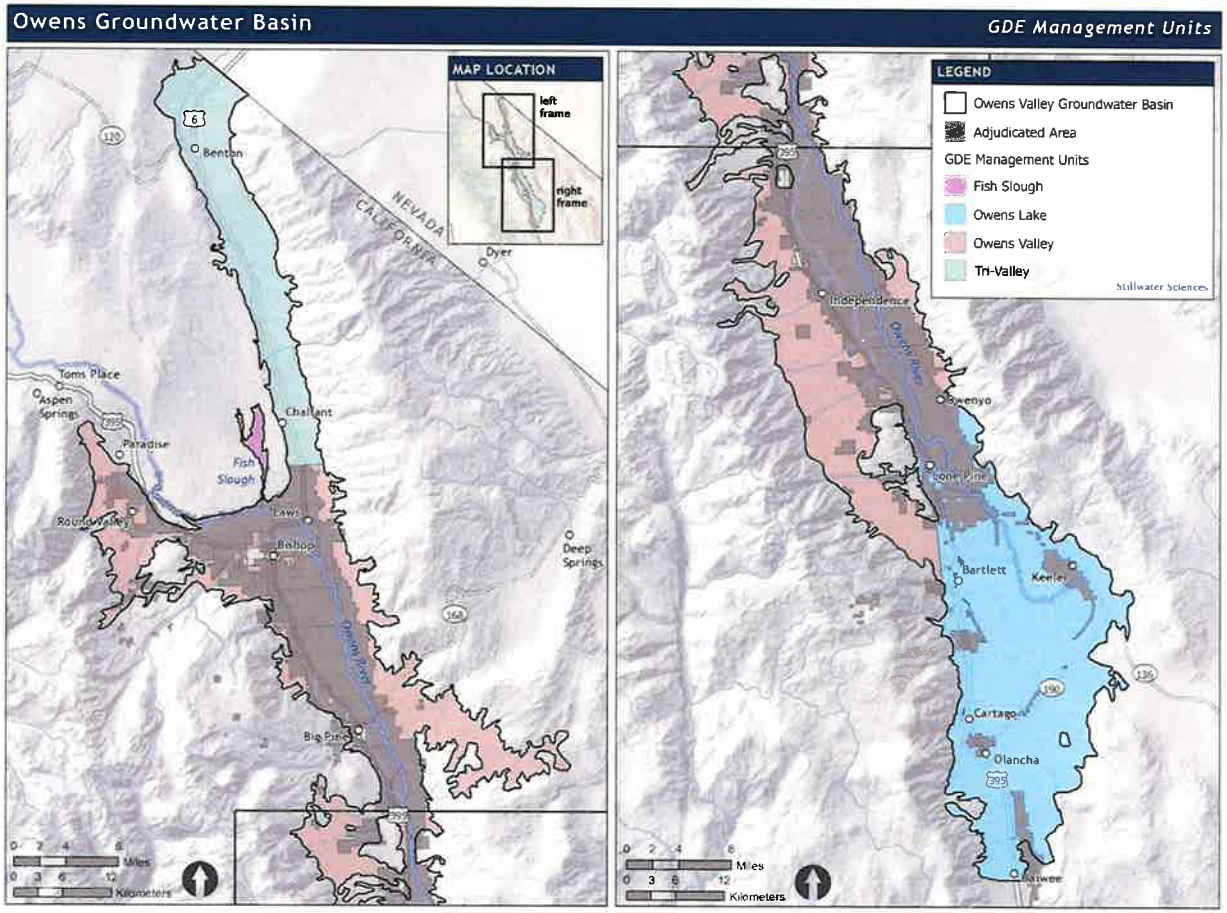
   Unique substrate and groundwater conditions

3. Tri-Valley (Tri-Valley and Fish Slough Management Unit)

   Similar to Owens Valley, somewhat drier

4. Fish Slough (Tri-Valley and Fish Slough Management Unit)

   Springs and interconnected surface water differentiate this GDE from Owens Valley and the Tri-Valley area.



Monitoring GDE health

Problem:

How will the OVGA evaluate changes in vegetation once the plan is adopted?

Often sustainable management criteria are tied to groundwater levels, but for outside of the adjudicated area, groundwater data is sparse and given the large size of the basin installing monitoring wells would be very expensive.

Proposal:

Monitor the health of GDEs in the OVGA using NDVI/NDMI. Historical values of NDVI/NDMI will be used to evaluate GDE health through time.

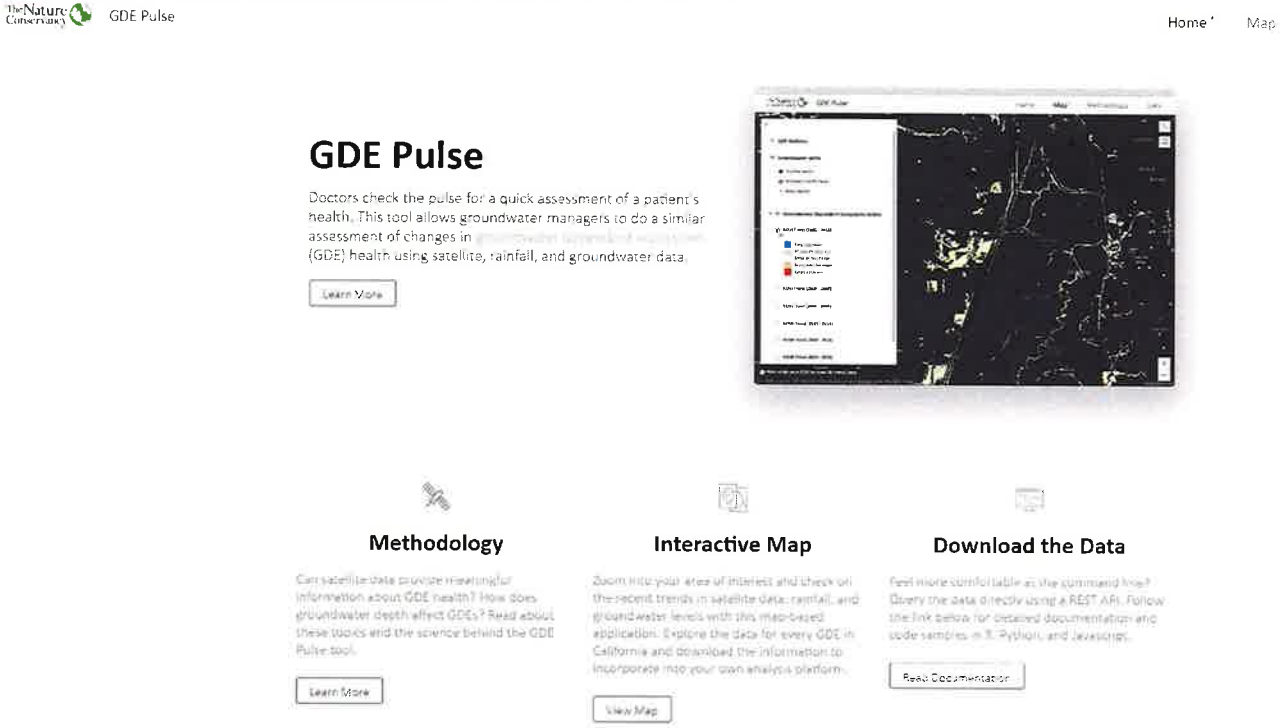
We still need to evaluate how to assess interconnected surface water changes

Next Steps: Vegetation Map

- Integrate new VegCAMP map, assess groundwater dependance of these units (based on species)
- Where the new VegCAMP map overlaps with Inyo County keep/remove assessment, see if the findings agree.
- Create a cross reference table to align similar vegetation types from different sources.

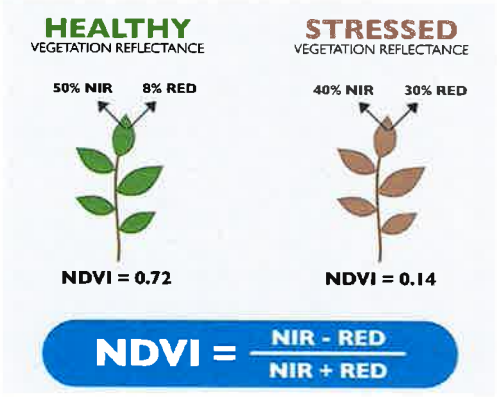
Tracking Changes Through Time (GDE Pulse)

https://gde.codefornature.org/#/home



Source: Klausmeyer et al., 2019

NDVI (Normalized Differential Vegetation Index) and NDMI (Normalized Differential Moisture Index)



Vegetation Reflectance

Source: https://www.agricolus.com/en/indici-vegetazione-ndvi-ndmi-istruzioni-luso/

$$NDMI = \frac{NIR - SWIR}{SWIR + NIR}$$

NDMI=Normalized Differential Moisture Index
(measures water stress)
NIR=Near infrared
SWIR=Short-wave infrared

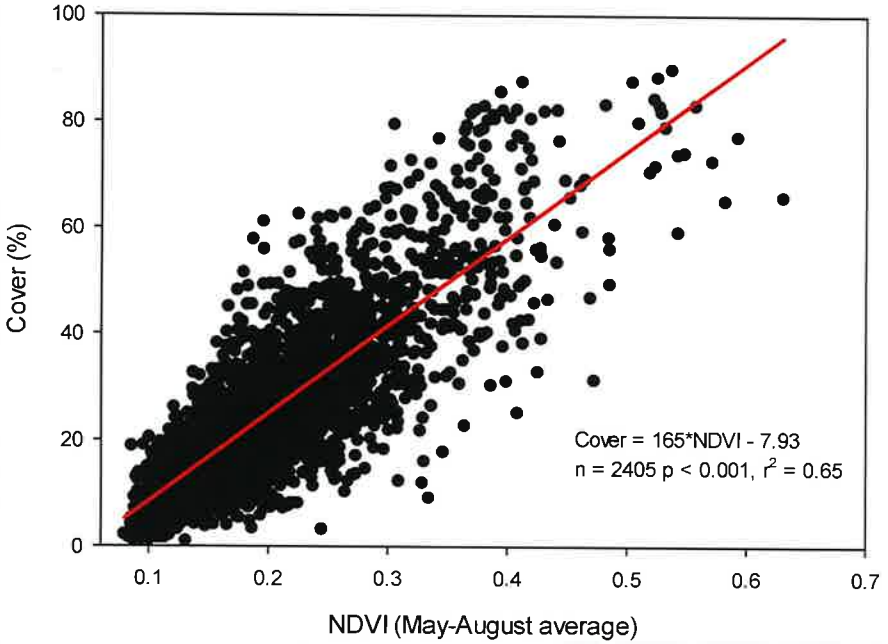
NDVI (Normalized Differential Vegetation Index) and NDMI (Normalized Differential Moisture Index)

NDVI changes 2009-2018 (GDE Pulse)

Map ° Methodc

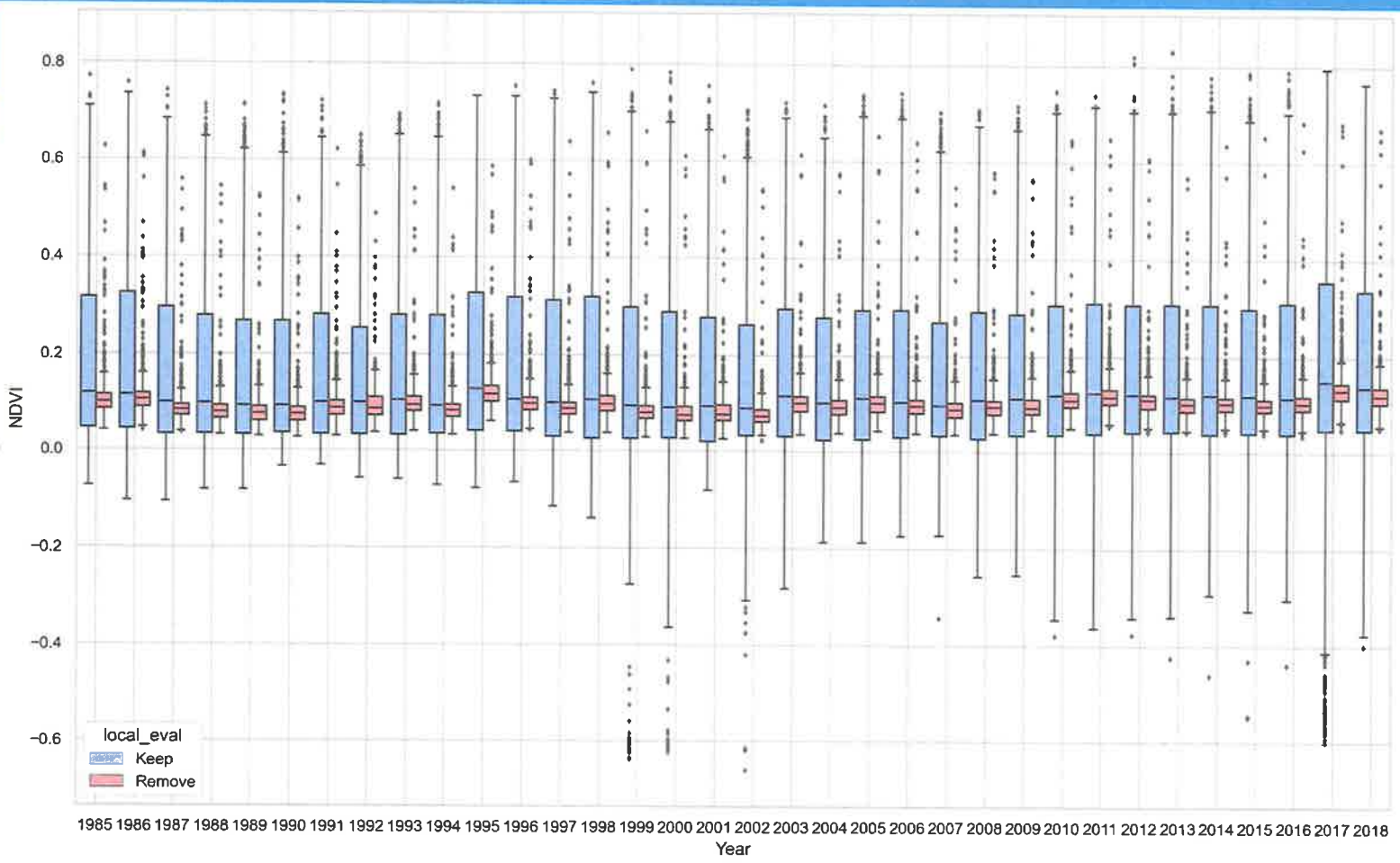
Go to GDE pulse Tool
https://gde.codefornature.org/#/map

NDVI versus cover in the Adjudicated Area



Courtesy Zach Nelson, ICWD

All GDEs changes through time



Summary

- GDE mapping is still in progress (New Map!) and will be finishing soon
- IGDE dataset adjusted with the help of ICWD mostly removing the alkali mixed scrub (CalVeg) and alkali desert scrub (FRAP) along the margin of the valley and in the Tri-Valley area.
- We've preliminarily identified 4 potential GDE units, Owens Valley, Owens Lake, the Tri-Valleys, and Fish Slough
- We propose that groundwater-dependent vegetation could be monitored using NDVI.

Thanks