Appendix E Leak Detection Report

Technical Assistance
Leak Detection

California
Rural Water Association

Date

7/10/2018-7/13/2018

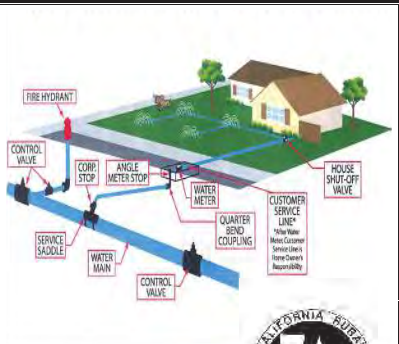
Abel Silva
Leak Detection Specialist I / Resource Development Unit
California Rural Water Association

Water System

Sheep Creek Water Company
4200 Sunnyslope Rd Phelen, CA
Chris Cummings
760-868-3755
sheepcreek@verizon.net

Quality On Tap!
Our Commitment Our Profession

Water System Resources



Water Loss %	18-20%
System PSI	60-180
Pressure Zones	7
MHI (< $51,026)	43,000
Population Served	3,300
Connections	1,188
Year Est.	1914
Flat/Tiered Rates	Tiered
Maps/As-builts/GIS	Yes
Dirt/Paved Roads	Both
Sewer/Septic	Septic
System Operator	Chris Cummings D3/T3

Wells	Qty.	Avg. Depth	Surface Water		Treatment Plant	
	5	500				

Main Pipe	Size	Miles	Asbestos	Ductile Iron	Steel	Cast Iron	PVC (C-900)	CMLC
	4"-12"	48	✓		✓		✓	

Service	Size	Poly	Copper	Galvanized	HDPE	PVC	Driscoll	Other
	3/4"-2"	✓		✓				

Valve	Size	Qty.	Gate	Butterfly	Globe	Check	Ball	Plug
	2"-12"	750	✓	✓				

Hydrant	Size	Qty.	Wharf-Head	Blow-Off	Commercial	Residential	Meter
	4" - 6"	290		✓		✓	

Meter	Size	Qty.	AMR/AMI	P/D	Smart	Turbine	Compound	Mag
	3/4" - 1"	1,088		✓				

Air Relief &Vacuum	Size	Qty.	Booster Pump & Hydro Pneumatic	Qty.	Storage Tanks	Qty.
	1"					7

Backflow Valve	Size	Qty.	Pressure Reducing Valve	Size	Qty.
	1" - 4"	88		2" - 8"	90

Recommendations:

1. Replacing old P/D meters with Preferred Provider Program Kamstrup Smart Meters.
2. Infrastructure Replacement Distribution pipes, and Valves are old and past life expectancy.
3. Full System Survey.

Water System Age

Typical Equipment		Life Expectancy Years
Source of supply		
Intake Structures		35 – 45
Wells and Springs	1993	25 – 35
Transmission mains	1971	35 – 40
Pumping Plants		
Pumping Equipment	2001	10 – 15
Treatment Plants		
Structures		30 - 60
Equipment		10 – 15
Chlorination Equipment		10 – 15
Distribution		
Reservoirs and Tanks	1979	30 – 60
Distribution Pipes	1956	35 – 40
Services	1956	30 – 50
Valves	1956	35 – 40
Backflow Prevention	1990	35 – 40
Blow-off valves	1980s	35 – 40
Meters	1970s	10 – 15
Hydrants	1950s	40 – 60

Leak Report

Date:	7/10/2018-7/11/2018-7/13/2018
System:	Sheep Creek Water Company
Leak Detection members:	Abel Silva
Equipment Used:	FCS Correlator and FCS Acoustic Ground Mic
Map Reference:	Amigo Collect/GIS Map

Street and/or Block Numbers:

Monte Vista, Nielson, Serra St, Campanula, Yucca Terrace, Alta Mesa, Smoke Tree, Johnson.

Leak Number	Address of Suspected Leak	Utility or Customer (U or C)	Leak Pinpointed (Y or N)	Leak to be Rechecked (Y or N)	Leak Repaired (Y or N)	Not a Leak? (Date)
1	Serra St	U	Y		Y	
2	Yucca Terrace	U	N			

	Meters / Curb Stop	Hydrants	Valves	Test Rods	Other
Indicate Number of Manual Listening Points Used	9	10	6		
Indicate Number of Leak Noise Loggers Listening Points Used					

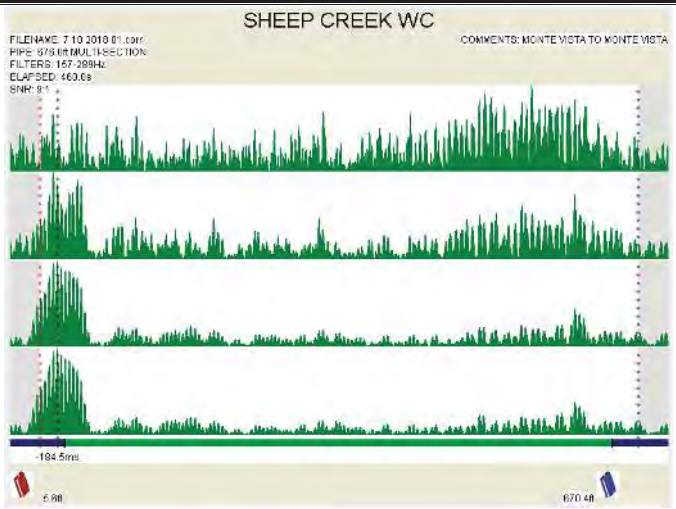
Miles of Mains Surveyed:	1.753	Survey Time: (Hours)	19
Number of Leaks Suspected:	2	Rechecked: (Numbers)	
Number of Leaks Pinpointed:	1	Pinpointing Time: (Hours)	

Remarks:

Leak was found Pinpointed and repaired at address 9372 Serra St. Meter at address 9372 Serra St was found not registering advised District to replace bad Meter. Possible leak 16' from Intersection of Yucca Terrace / Monte Vista.

Leak Detection Survey Results

Survey #1



Survey Graph

The Correlator program allows for a "***Snapshot Option***". When the snapshot button is pressed during a correlation, the snapshot feature effectively enables the operator to compare noise levels at different points during the correlation process. When a leak is detected, the graph will have a peak in the same spot and will be located in the same spot on all snapshots. This will indicate the presence of a leak.

The correlation has detected a "Leak(s)".

✓

The Correlator displays a peak in all snapshots graphs in the same spot but is not leak due too:

✓ Water passing through a meter.	Running pumps.	Pressure Reducing Valve.
Electrical (Transformer).	Illegal service.	Underground Sewer, Power, Cable lines.
		Gas Service

The correlation has detected "No leak(s)".

The Correlator program snapshots are all differ in graph peaks, this indicates flow due to pumping, pressure surges or momentary use of water through meter(s).

The correlation has detected "No leak(s)".

The Correlator program displays a "***Center Correlation***". The graph peak is in the center of the screen with equal footage on each side indicates the program sensor at a 50/50 point hears no sounds.

The correlation has detected "No leaks".

Remarks:

No leaks were found at time of survey.

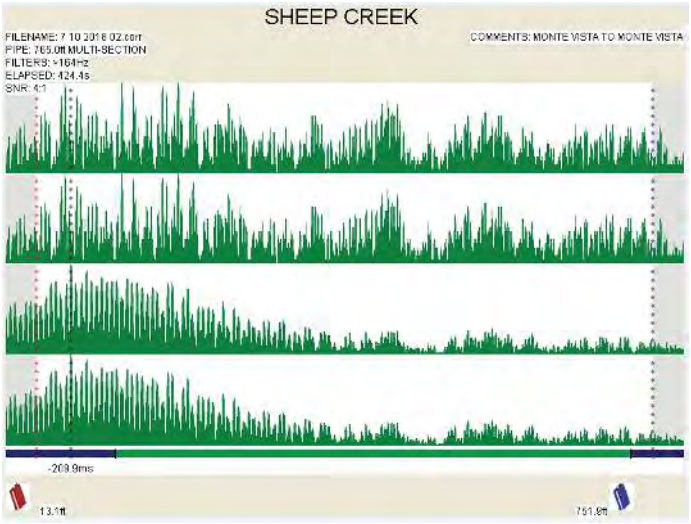
Location:

4717 Monte Vista to 9554 Monte Vista.

Hydrant	*System Valve*	*Curb Stop*	*Diameter*	*Material*	*Length*
		2	8"	Steel	676Ft

Leak Detection Survey Results

Survey #2



Survey Graph

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Electrical (Transformer).	Illegal service.	Underground Sewer, Power, Cable lines.
		Gas Service

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The correlation has detected "No leak(s)".

The Correlator program displays a "***Center Correlation***". The graph peak is in the center of the screen with equal footage on each side indicates the program sensor at a 50/50 point hears no sounds.

The correlation has detected "No leaks".

Remarks:

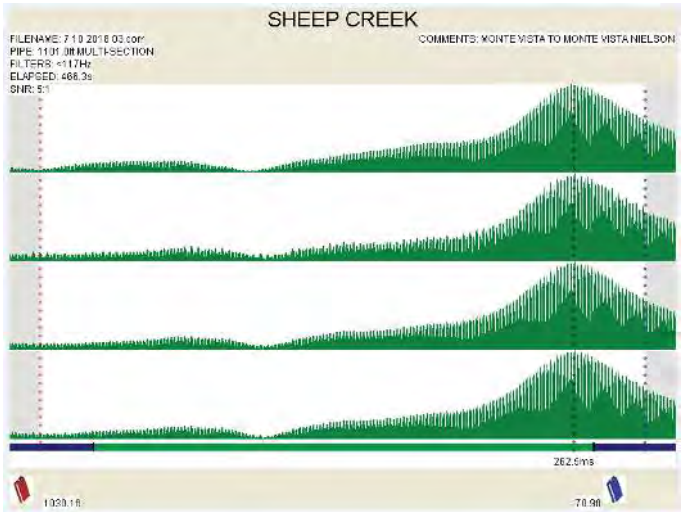
No leaks were found at time of survey.

9554 Monte Vista to 9474 Monte Vista.

Hydrant	*System Valve*	*Curb stop*	*Diameter*	*Material*	*Length*
		2	8"	Steel	765Ft

Leak Detection Survey Results

Survey #3



Survey Graph

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Electrical (Transformer).	Illegal service.	Underground Sewer, Power, Cable lines.
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The Correlator program displays a "***Center Correlation***". The graph peak is in the center of the screen with equal footage on each side indicates the program sensor at a 50/50 point hears no sounds.

The correlation has detected "No leaks".

Remarks:

No leaks were found at time of survey.

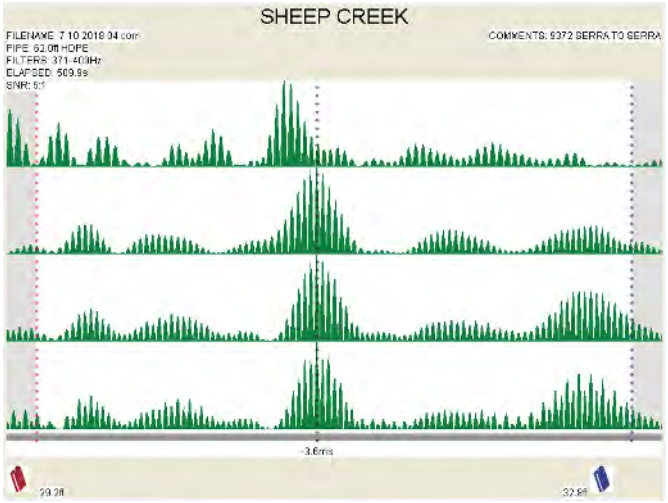
Location:

9474 Monte Vista to 4560 Nielson

Hydrant	*System Valve*	*Curb Stop*	*Diameter*	*Material*	*Length*
		2	8"	Steel	1101

Leak Detection Survey Results

Survey #4



Survey Graph

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Water passing through a meter.	Running pumps.	Pressure Reducing Valve.
Electrical (Transformer).	Illegal service.	Underground Sewer, Power, Cable lines.
		Gas Service

The correlation has detected "No leak(s)".

The Correlator program snapshots all differ in graph peaks, this indicates flow due to pumping, pressure surges or momentary use of water through meter(s).

The correlation has detected "No leak(s)".

The Correlator program displays a "***Center Correlation***". The graph peak is in the center of the screen with equal footage on each side indicates the program sensor at a 50/50 point hears no sounds.

The correlation has detected "No leaks".

Remarks:

Leak located on Service Line Utility side.

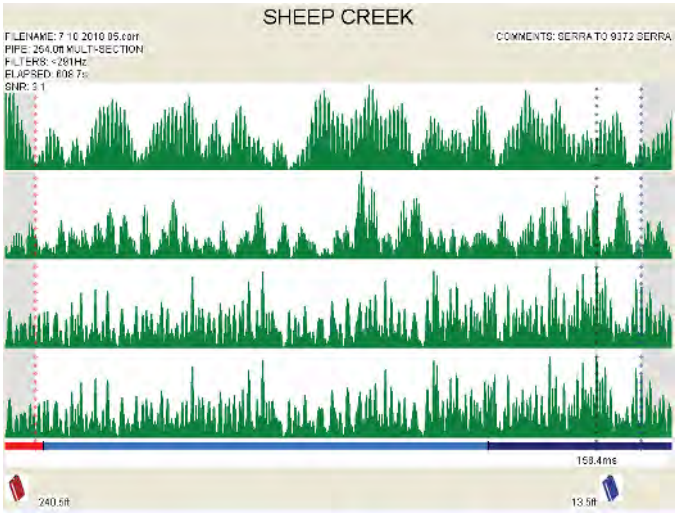
Location:

Pothole to 9372 Serra

Hydrant	*System Valve*	*Curb Stop*	*Diameter*	*Material*	*Length*
		1	1"	Poly	63Ft

Leak Detection Survey Results

Survey #5



Survey Graph

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Electrical (Transformer).	Illegal service.	Underground Sewer, Power, Cable lines.
		Gas Service

The correlation has detected "No leak(s)".

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The correlation has detected "No leak(s)".

The Correlator program displays a "***Center Correlation***". The graph peak is in the center of the screen with equal footage on each side indicates the program sensor at a 50/50 point hears no sounds.

The correlation has detected "No leaks".

Remarks:

No leaks were found at time of survey.

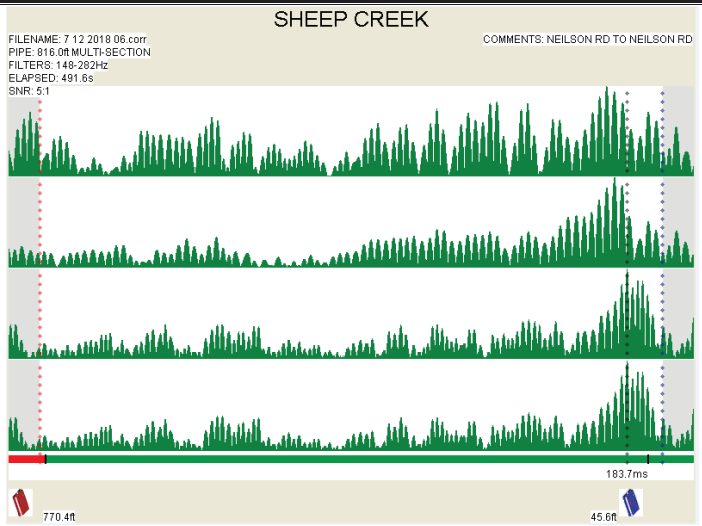
Location:

Serra St to 9372 Serra St

Hydrant	*System Valve*	*Curb Stop*	*Diameter*	*Material*	*Length*
1		1	8"	PVC	254Ft

Leak Detection Survey Results

Survey #6



Survey Graph

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The correlation has detected a "Leak(s)".

The Correlator displays a peak in all snapshots graphs in the same spot but is not leak due too:

Water passing through a meter.	Running pumps.	Pressure Reducing Valve.
Electrical (Transformer).	Illegal service.	Underground Sewer, Power, Cable lines.
		Gas Service

The correlation has detected "No leak(s)".

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The Correlator program displays a "***Center Correlation***". The graph peak is in the center of the screen with equal footage on each side indicates the program sensor at a 50/50 point hears no sounds.

The correlation has detected "No leaks".

Remarks:

No leaks were found at time of survey.

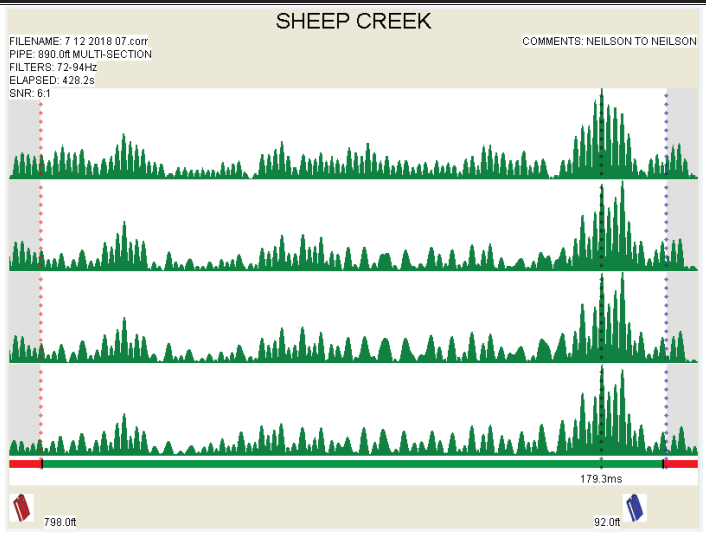
Location:

Nielson to Nielson

Hydrant	*System Valve*	*Curb Stop*	*Diameter*	*Material*	*Length*
2			4"	Steel	816"

Leak Detection Survey Results

Survey #7



Survey Graph

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The correlation has detected a "Leak(s)".

✓

The Correlator displays a peak in all snapshots graphs in the same spot but is not leak due too:

Water passing through a meter.	Running pumps.	✓ Pressure reducing Valve.
Electrical (Transformer).	Illegal service.	Underground Sewer, Power, Cable Lines.
		Gas Service

The correlation has detected "No leak(s)".

The Correlator program snapshots all differ in graph peaks, this indicates flow due to pumping, pressure surges or momentary use of water through meter(s).

The correlation has detected "No leak(s)".

The Correlator program displays a "***Center Correlation***". The graph peak is in the center of the screen with equal footage on each side indicates the program sensor at a 50/50 point hears no sounds.

The correlation has detected "No leaks".

Remarks:

No leaks were found at time of survey.

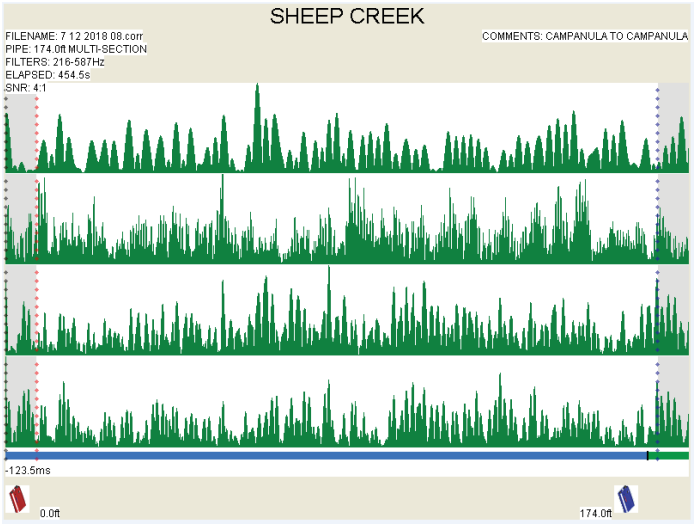
Location:

Nielson to Nielson

Hydrant	*System Valve*	*Curb Stop*	*Diameter*	*Material*	*Length*
2			6"	Steel	890Ft

Leak Detection Survey Results

Survey #8



Survey Graph

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Water passing through a meter.	Running pumps.	Pressure Reducing Valve.
Electrical (Transformer).	Illegal service.	Underground Sewer, Power, Cable lines.
		Gas Service

The correlation has detected "No leak(s)".

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The correlation has detected "No leak(s)".

The Correlator program displays a "***Center Correlation***". The graph peak is in the center of the screen with equal footage on each side indicates the program sensor at a 50/50 point hears no sounds.

The correlation has detected "No leaks".

Remarks:

No leaks were found at time of survey.

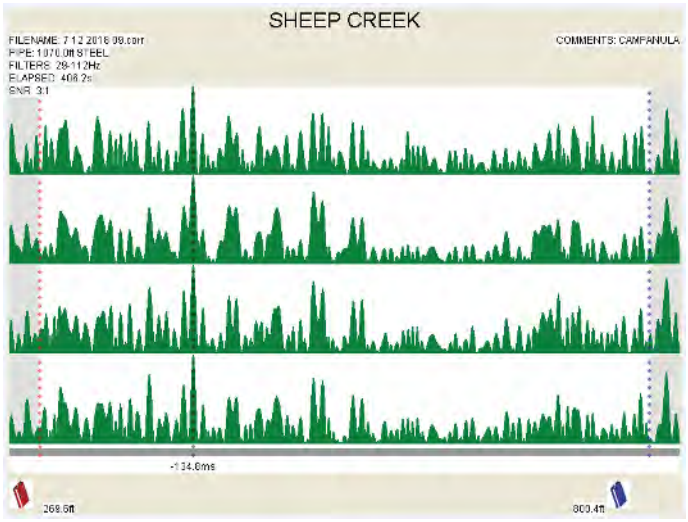
Location:

Campanula to Campanula

Hydrant	*System Valve*	*Curb Stop*	*Diameter*	*Material*	*Length*
1	1		4"	Steel	174Ft

Leak Detection Survey Results

Survey #9



Survey Graph

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Water passing through a meter.	Running pumps.	Pressure Reducing Valve.
Electrical (Transformer).	Illegal service.	Underground Sewer, Power, Cable lines.
		Gas Service

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The correlation has detected "No leak(s)".

The Correlator program displays a "***Center Correlation***". The graph peak is in the center of the screen with equal footage on each side indicates the program sensor at a 50/50 point hears no sounds.

The correlation has detected "No leaks".

Remarks:

No leaks were found at time of survey.

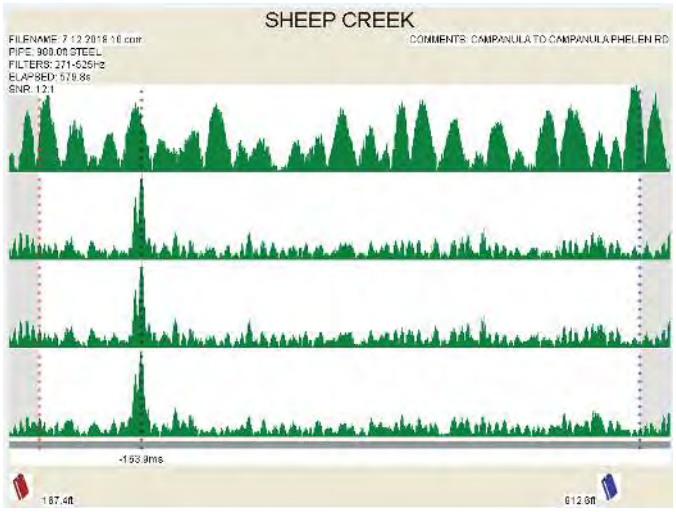
Location:

Campanula to Campanula

Hydrant	*System Valve*	*Curb Stop*	*Diameter*	*Material*	*Length*
	2		6"	Steel	1070Ft

Leak Detection Survey Results

Survey #10



Survey Graph

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The correlation has detected a "Leak(s)".

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✓ Water passing through a meter.	Running pumps.	Pressure Reducing Valve
Electrical (Transformer).	Illegal service.	Underground Sewer, Power, Cable lines.
		Gas Service

The correlation has detected "No leak(s)".

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The correlation has detected "No leak(s)".

The Correlator program displays a "***Center Correlation***". The graph peak is in the center of the screen with equal footage on each side indicates the program sensor at a 50/50 point hears no sounds.

The correlation has detected "No leaks".

Remarks:

No leaks were found at time of survey.

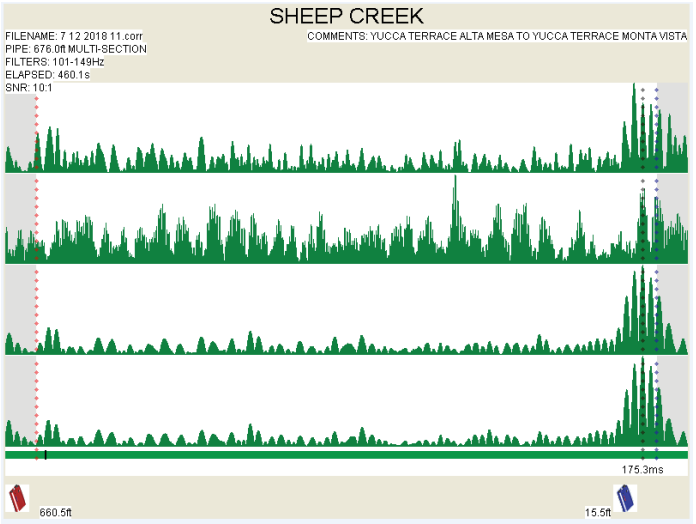
Location:

Campanula to Campanula / Phelan Rd

Hydrant	*System Valve*	*Curb Stop*	*Diameter*	*Material*	*Length*
	2		6"	Steel	980Ft

Leak Detection Survey Results

Survey #11



Survey Graph

✓

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The correlation has detected a "Leak(s)".

The Correlator displays a peak in all snapshots graphs in the same spot but is not leak due too:

Water passing through a meter. Running pumps. Pressure Reducing Valve

Electrical (Transformer). Illegal service. Underground Sewer, Power, Cable lines.

Gas Service

The correlation has detected "No leak(s)".

The Correlator program snapshots all differ in graph peaks, this indicates flow due to pumping, pressure surges or momentary use of water through meter(s).

The correlation has detected "No leak(s)".

The Correlator program displays a "***Center Correlation***". The graph peak is in the center of the screen with equal footage on each side indicates the program sensor at a 50/50 point hears no sounds.

The correlation has detected "No leaks".

Remarks:

Possible leak 16' from intersection of Yucca Terrace / Monte Vista.

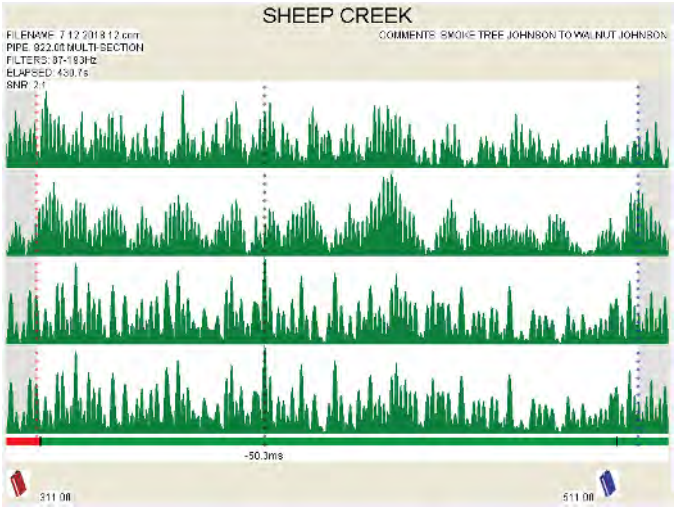
Location:

Yucca Terrace / Alta Vista to Yucca Terrace / Monte Vista.

Hydrant	*System Valve*	*Curb stop*	*Diameter*	*Material*	*Length*
1	1		8"	Steel	676Ft

Leak Detection Survey Results

Survey #12



Survey Graph

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The correlation has detected a "Leak(s)".

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Water passing through a meter.	Running pumps.	Pressure Reducing Valve.
Electrical (Transformer).	Illegal service.	Underground Sewer, Power, Cable lines.
		Gas Service

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The correlation has detected "No leak(s)".

The Correlator program displays a "***Center Correlation***". The graph peak is in the center of the screen with equal footage on each side indicates the program sensor at a 50/50 point hears no sounds.

The correlation has detected "No leaks".

Remarks:

No leaks were found at time of survey.

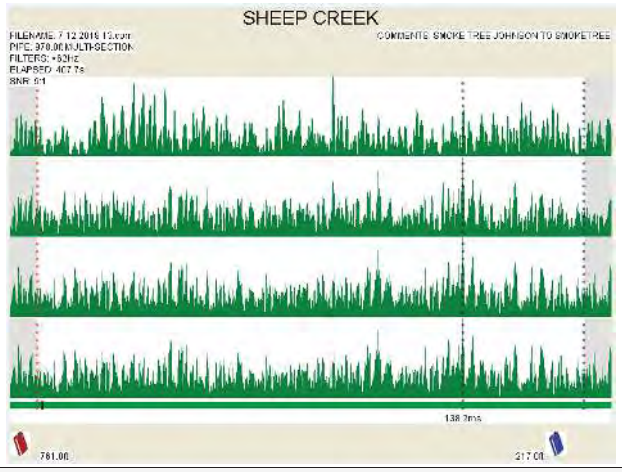
Location:

Smoke Tree / Johnson to Walnut / Johnson

Hydrant	*System Valve*	*Curb Stop*	*Diameter*	*Material*	*Length*
1		1	4"	Steel	822Ft

Leak Detection Survey Results

Survey #13



Survey Graph

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The correlation has detected a "Leak(s)".

The Correlator displays a peak in all snapshots graphs in the same spot but is not leak due too:

Water passing through a meter.	Running pumps.	Pressure reducing Valve.
Electrical (Transformer).	Illegal service.	Underground Sewer, Power, Cable lines.
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The Correlator program displays a "***Center Correlation***". The graph peak is in the center of the screen with equal footage on each side indicates the program sensor at a 50/50 point hears no sounds.

The correlation has detected "No leaks".

Remarks:

No leaks were found at time of survey.

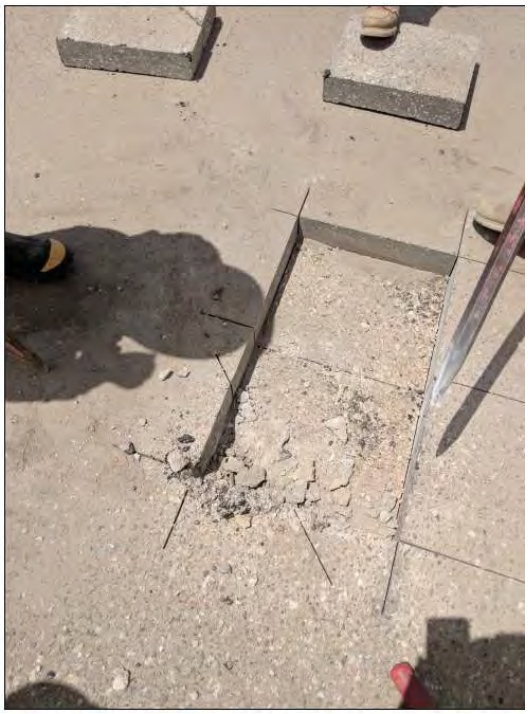
Location:

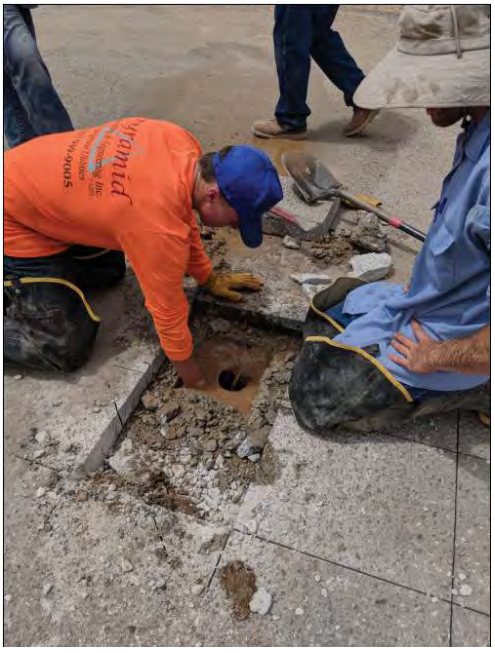
Smoke Tree / Johnson to Smoke Tree

Hydrant	*System Valve*	*Curb Stop*	*Diameter*	*Material*	*Length*
2			4"	Steel	979Ft

Water System Map

Water System Pictures





Water System Pictures

Appendix F – Tank Inspection Report

TANK INSPECTION REPORT

FOR

SHEEP CREEK WATER COMPANY

INSPECTIONS AND REPORT BY:

LARRY WOMBLES, PRESIDENT AND CEO,

ASSOCIATED CONSTRUCTION AND ENGINEERING

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OCTOBER 17, 2018

On 10-17-18 a cursory inspection was completed for Sheep Creek Water Company in Phelan, CA. The description of each of seven tanks is below. I was asked to inspect each tank for coating issues. While I have comments with photos for each tank below, I also make suggestions to bring tank(s) to current AWWA seismic, OSHA, and working order for each tank in below description. For each tank I walked around the perimeter(s) and took notes and photos of each area of concern. Only two tanks had interior ladders to decent into tank interior and inspect interior coatings. Please note that all tanks were in-service and I was only able to inspect visually within 20-30LF of tank roof hatch(es). Below interior assessment is based upon visual inspection from the roof hatch; 30 years tank inspection experience; and visual signs of leakage at exterior of the bolted tanks.

TANK 2

- 55' diameter x 24' shell height with 23' high water elevation (HWL).
- Type Tank: Bolted flange water tank
- Built in 1979
- Tank Manufacturer – Tri-State

EXTERIOR

- Exterior coatings appear to be in fair condition on shell and roof.
- Tank exterior grade band that retains the gravel bed under the tank is exhibiting fresh vegetation around ¼ of tank perimeter at 6-10" tall. This tells me that the tanks has some periodic leaks under the tanks. Tank grade band is fairly secured into earthen grade and not showing any signs of failure.
- Tank overflow is at roof line. This tank does not meet AWWA standards for 'freeboard' and risks roof failure in event of minor-moderate earthquake. No air-gap on overflow line per DOSH requirements.
- Tank appears to have (1) drain line; (1) inlet line; and (1) outlet line. Both inlet and outlet are direct connects to tank shell with no reinforcement nozzles and rigid connections to shell. Tank at risk of fracturing inlet and/or outlet lines in event of seismic event at or near site.
- Three visual signs of leakage at tank vertical seam. This is due to either insecure nut/bolt; deteriorated gasket; or severe corrosion from interior of tank.
- No center roof vent to determine corrosion at center dollar plate and rafters. Tank roof hatch is designed as roof vent and hatch at estimated 18" diameter.

    - Tank appears to have barely enough venting per current AWWA standards vs. tank overflow, Inlet, and outlet nozzles.
- Tank roof does not have any roof hand railing and is not OSHA compliant
- Exterior ladder anti-climb is not OSHA compliant.
- Tank Liquid Level indicator malfunctioning.
- Tank exterior shell showing signs of fatigue via 'bellying' 12-20" above tank chime at about ¼" to ½" out of plane.

INTERIOR

- No interior ladder present on tank.
- Tank staves (shell plates) are bolted together via backing bar which is exhibiting signs of moderate to start of severe corrosion.
- Top sides of rafters and all bolted connections are showing signs of moderate corrosion.

SUGGESTIONS:

- Take tank out of service for period of 03 months.
- Install Seismic flexible coupling on inlet and outlet lines. Estimated cost $36,000 to remove existing, open trenching back estimated 10-15lf and install new flex-couplings onto existing shell nozzles.
- Install Roof hand railing to 8LF each side of exterior ladder opening at roof line and 8LF toward center of tank (32LF total) at cost of $3,800
- Remove and replace liquid level indicator complete at cost of $4,200
- Engineer tank for sloshing wave and reduce overflow elevation and install air-gap at exterior overflow line at estimated cost of $17,000
- Install FRP interior ladder on tank at cost of $6,900
- Sweep blast interior coatings to SSPC-SP7 (remove all loose materials and create a profile); and paint interior with 15-20MDFT 100% solids epoxy. Pay special attention to avoid direct blasting at shell interior horizontal and vertical seams so not to destroy gasket materials. After coatings, apply even layer of mastic sealant that is NSF61 approved to all interior bolts and seams to seal tank. Cost of interior coatings is $67,700.00
- Should you require the exterior of tank be pressure washed and exterior coatings, PRT could perform at the cost of $21,350.00

- Note that there is the possibility of creating more damage to bolted tank gaskets. An alternative approach would be to replace the tank in its entirety with newer bolted or welded tank.
    - Flat Panel Bolted tank per AWWA D103 standards with all new ladders, reinforced nozzles, sloshing-wave considerations, venting, and LLI would be estimated $325,000 utilizing existing foundation. Please note that I have not performed seismic evaluation to determine if this tank requires anchorage or not. Tank may need concrete ringwall with anchorage at cost of estimated $75,000.
    - A similar welded tank with same capacity would cost $458,000 utilizing existing foundation. Please note that I have not performed seismic evaluation to determine if this tank requires anchorage or not. Tank may need concrete ringwall with anchorage at cost of estimated $75,000.
        - PRT can perform the seismic analysis for each tank against current AWWA standards for cost of $8,500 each tank. This would include new tank design for both foundation and tank as well as tank drawings.

Bolted tanks were originally intended for temporary storage with expected life expectancy of 25-30 years. This tank was erected in 1979 and is currently 39 years old. It has lived its anticipated life cycle. You can repair it per the suggestions above and get another anticipated 10-15 years of life from this tank in my opinion. If you are looking for permanent storage, I recommend dismantling both tank 2 and 4 from this site and erecting a 1.5MG (estimated cost $1.05M for ringwall and tank) in its place next to the existing welded tank on site. This will afford you the opportunity to have similar storage in the future maintenance interruptions while still maintaining capacity for your end users.

TANK 3

- 47’ diameter x 16’ shell height with 15’ high water elevation (HWL).
- Type Tank: Bolted flange water tank
- Built in 1983
- Tank Manufacturer – Unknown

EXTERIOR

- Exterior coatings appear to be in fair condition on shell and roof.
- Tank exterior grade band that retains the gravel bed under the tank and I did not see much fresh vegetation around perimeter.
- Tank grade-band is twisted and bowing around perimeter which is allowing tank sub-grade (gravel) to fall from under tank to exterior of grade-band.
- Tank overflow is at roof line. This tank does not meet AWWA standards for ‘freeboard’ and risks roof failure in event of minor-moderate earthquake. No air-gap on overflow line per DOSH requirements.
- Tank appears to have (1) drain line; (1) inlet line; and (1) outlet line. Both inlet and outlet are direct connects to tank shell with no reinforcement nozzles and rigid connections to shell. Tank at risk of fracturing inlet and/or outlet lines in event of seismic event at or near site.
- Many visual signs of leakage all around tank. This is due to either insecure nut/bolt; deteriorated gasket; or severe corrosion from interior of tank.
- No center roof vent to determine corrosion at center dollar plate and rafters. Tank roof hatch is designed as roof vent and hatch at estimated 18” diameter.
    - Tank appears to have barely enough venting per current AWWA standards vs. tank overflow, Inlet, and outlet nozzles.
- Tank roof does not have any roof hand railing and is not OSHA compliant
- Exterior ladder anti-climb is not OSHA compliant.
- Tank Liquid Level indicator malfunctioning and in need of replacement.

INTERIOR

- Perimeter roof vent too small and not per OSHA standard to allow access to tank interior. Should be considered vent only and not roof access hatch.
- No interior ladder present on tank.

- Severe to moderate corrosion at tank perimeter roof hatch and visual areas from roof to interior.
- Top sides of rafters and all bolted connections are showing signs of moderate corrosion.

SUGGESTIONS:

- Take tank out of service for period of 03 months.
- Install Seismic flexible coupling on inlet and outlet lines. Estimated cost $36,000 to remove existing, open trenching back estimated 10-15lf and install new flex-couplings onto existing shell nozzles.
- Install Roof hand railing to 8LF each side of exterior ladder opening at roof line and 8LF toward center of tank (32LF total) at cost of $3,800
- Remove and replace liquid level indicator complete at cost of $4,200
- Engineer tank for sloshing wave and reduce overflow elevation and install air-gap at exterior overflow line at estimated cost of $17,000
- Install FRP interior ladder on tank at cost of $6,900
- Sweep blast interior coatings to SSPC-SP7 (remove all loose materials and create a profile); and paint interior with 15-20MDFT 100% solids epoxy. Pay special attention to avoid direct blasting at shell interior horizontal and vertical seams so not to destroy gasket materials. After coatings, apply even layer of mastic sealant that is NSF61 approved to all interior bolts and seams to seal tank. Cost of interior coatings is $61,900.00
- Should you require the exterior of tank be pressure washed and exterior coatings, PRT could perform at the cost of $18,425.00
    - Note that there is the possibility of creating more damage to bolted tank gaskets. An alternative approach would be to replace the tank in its entirety with newer bolted or welded tank.
        - Flat Panel Bolted tank per AWWA D103 standards with all new ladders, reinforced nozzles, sloshing-wave considerations, venting, and LLI would be estimated $275,000 for new grade-band/gravel foundation and tank.
        - A similar welded tank with same capacity would cost $360,000 for gravel-band foundation and new tank.
            - PRT can perform the seismic analysis for each tank against current AWWA standards for cost of $8,500 each tank. This would include new tank design for both foundation and tank as well as tank drawings.

Bolted tanks were originally intended for temporary storage with expected life expectancy of 25-30 years. This tank was erected in 1983 and is currently 35 years old. It has lived its anticipated life cycle. You can repair it per the suggestions above and get another anticipated 10-15 years of life from this tank in my opinion.

TANK 4

- 55’ diameter x 24’ shell height with 23’ high water elevation (HWL).
- Type Tank: Bolted flange water tank
- Built in 1984
- Tank Manufacturer – unknown

EXTERIOR

- Exterior shell coatings appear to be in fair condition. Exterior roof coatings have sporadic ultraviolet damage and roof coatings are down to bare steel which is starting to exhibit flash rusting which will continue to get worse and eventually start to corrode the steel plate.
- Tank exterior grade band that retains the gravel bed under the tank is exhibiting fresh vegetation around ¼ of tank perimeter at 6-10” tall. This tells me that the tanks has some periodic leaks under the tanks. Tank grade band is failing in three areas where gravel is being lost to surrounding site and coming out from under tank. With time, this will create unbalanced tank pad and tank will shift with unlively surface.
- Tank overflow is at roof line. This tank does not meet AWWA standards for ‘freeboard’ and risks roof failure in event of minor-moderate earthquake. No air-gap on overflow line per DOSH requirements.
- Tank appears to have (1) drain line; (1) inlet line; and (1) outlet line. Both inlet and outlet are direct connects to tank shell with no reinforcement nozzles and rigid connections to shell. Tank at risk of fracturing inlet and/or outlet lines in event of seismic event at or near site.
- I did not see any visual signs of exterior leaking at the tank walls. I was told by Chris that this tanks leaks periodically.
- Center roof vent was removed to inspect center dollar plate and rafters. Upon inspection, I witnessed the entire dollar plate delaminated from coatings (all cracked and falling off). Lower connection bolts have moderate to severe corrosion and need replacing. Rafters to underside of the roof have minimal spot corrosion and appears to be in fair condition.
- Tank roof hatch is designed as roof vent and hatch.
- Tank roof does not have any roof hand railing and is not OSHA compliant
- Exterior ladder anti-climb is not OSHA compliant.

- Tank Liquid Level indicator malfunctioning.
- I did not witness any tank 'bellying' on this tank.
- Extruding exterior gaskets appear to be dry rotting and in need of replacement; however, I did not notice any visible leaks as mentioned above.

INTERIOR

- No interior ladder present on tank.
- Tank staves (shell plates) are bolted together with no backing bars and have encapsulated bolt heads.
- Interior roof and shell appear to be in fair to good condition.

SUGGESTIONS:

- Take tank out of service for period of 03 months.
- Install Seismic flexible coupling on inlet and outlet lines. Estimated cost $36,000 to remove existing, open trenching back estimated 10-15lf and install new flex-couplings onto existing shell nozzles.
- Install Roof hand railing to 8LF each side of exterior ladder opening at roof line and 8LF toward center of tank (32LF total) at cost of $3,800
- Remove and replace liquid level indicator complete at cost of $4,200
- Engineer tank for sloshing wave and reduce overflow elevation and install air-gap at exterior overflow line at estimated cost of $17,000
- Install FRP interior ladder on tank at cost of $6,900
- Access interior for more detailed inspection. I recommend spot repair of this tank interior.
- Should you require the exterior of tank be pressure washed and exterior coatings, PRT could perform at the cost of $21,350.00

Bolted tanks were originally intended for temporary storage with expected life expectancy of 25-30 years. This tank was erected in 1983 and is currently 35 years old. It has lived its anticipated life cycle. You can repair it per the suggestions above and get another anticipated 10-15 years of life from this tank in my opinion. If you are looking for permanent storage, I recommend dismantling both tank 2 and 4 from this site and erecting a 1.5MG (estimated cost $1.05M for ringwall and tank) in its place next to the existing welded tank on site. This will afford you the opportunity to have similar storage in the future maintenance interruptions while still maintaining capacity for your end users.

TANK 5

- 39’ diameter x 16’ shell height with 15’ high water elevation (HWL).
- Type Tank: Bolted flange water tank
- Built in 1985
- Tank Manufacturer – Unknown

EXTERIOR

- Exterior coatings appear to be all worn down to prime coat due to UV damage on tank and tank exterior piping.
- Tank gravel band twisted and losing tank base (aggregate).
- Tank overflow is at roof line. This tank does not meet AWWA standards for ‘freeboard’ and risks roof failure in event of minor-moderate earthquake. No air-gap on overflow line per DOSH requirements.
- Tank appears to have (1) drain line; (1) inlet line; and (1) outlet line. Both inlet and outlet are direct connects to tank shell with no reinforcement nozzles and rigid connections to shell. Tank at risk of fracturing inlet and/or outlet lines in event of seismic event at or near site.
- Many visual signs of leakage at tank vertical seam. This is due to either insecure nut/bolt; deteriorated gasket; or severe corrosion from interior of tank.
  Tank roof does not have any roof hand railing and is not OSHA compliant
- Exterior ladder anti-climb is not OSHA compliant.
- Tank Liquid Level indicator malfunctioning.
- Tank exterior shell showing signs of fatigue via ‘bellying’ 12-20” above tank chime at about ¼” to ½” out of plane.

INTERIOR

- No interior ladder present on tank.
- No backing bar at vertical seam. Bolts are starting to show signed of corrosion around all edges. Rafter clips are delaminating between coatings and steel. Underside of roof appears to be in ok condition.
- Top sides of rafters and all bolted connections are showing signs of moderate corrosion.
- Liquid level indicators missing guide wires and not working.

- This tank has a center vent. Center Dollar plate (supports rafters at center) is delaminating and starting to severely corrode under coatings. 20-25% of rafter at dollar plate starting to corrode at connection points to dollar plate.

SUGGESTIONS:

- Take tank out of service for period of 03 months.
- Install Seismic flexible coupling on inlet and outlet lines. Estimated cost $36,000 to remove existing, open trenching back estimated 10-15lf and install new flex-couplings onto existing shell nozzles.
- Install Roof hand railing to 8LF each side of exterior ladder opening at roof line and 8LF toward center of tank (32LF total) at cost of $3,800
- Remove and replace liquid level indicator complete at cost of $4,200
- Engineer tank for sloshing wave and reduce overflow elevation and install air-gap at exterior overflow line at estimated cost of $17,000
- Install FRP interior ladder on tank at cost of $6,900
- Sweep blast interior coatings to SSPC-SP7 (remove all loose materials and create a profile); and paint interior with 15-20MDFT 100% solids epoxy. Pay special attention to avoid direct blasting at shell interior horizontal and vertical seams so not to destroy gasket materials. After coatings, apply even layer of mastic sealant that is NSF61 approved to all interior bolts and seams to seal tank. Cost of interior coatings is $58,700.00
- Should you require the exterior of tank be pressure washed and exterior coatings, PRT could perform at the cost of $17,350.00
    - Note that there is the possibility of creating more damage to bolted tank gaskets. An alternative approach would be to replace the tank in its entirety with newer bolted or welded tank.
        - Flat Panel Bolted tank per AWWA D103 standards with all new ladders, reinforced nozzles, sloshing-wave considerations, venting, and LLI would be estimated $250,000 (tank grade-band gravel foundation and tank).
        - A similar welded tank with same capacity would cost $295,000 utilizing existing foundation. Please note that I have not performed seismic evaluation to determine if this tank requires anchorage or not. Tank may need concrete ringwall with anchorage at cost of estimated $50,000.

- PRT can perform the seismic analysis for each tank against current AWWA standards for cost of $8,500 each tank. This would include new tank design for both foundation and tank as well as tank drawings.

Bolted tanks were originally intended for temporary storage with expected life expectancy of 25-30 years. This tank was erected in 1985 and is currently 33 years old. It has lived its anticipated life cycle. You can repair it per the suggestions above and get another anticipated 10-15 years of life from this tank in my opinion.

TANK 6

- 80’ diameter x 24’ shell height with 23.17’ high water elevation (HWL).
- Type Tank: Bolted flange water tank
- Built in 1989
- Tank Manufacturer – Unknown

EXTERIOR

- Exterior coatings appear to be in fair condition on shell. Roof has moderate to severe UV damage and in need of coatings.
- Tank exterior grade band that retains the gravel bed under the tank and I did not see much fresh vegetation around perimeter. Grade-band is failing and in need of replacement due to being too narrow and setting on top of finish grade instead of buried 6” with retaining stakes to prevent twisting and loss of tank base material.
- Tank overflow is at roof line. This tank does not meet AWWA standards for ‘freeboard’ and risks roof failure in event of minor-moderate earthquake. No air-gap on overflow line per DOSH requirements.
- Tank inlet/outlet lines appear to be entering under the tank. I was not able to inspect interior to determine if the inlet/outlet lines are far enough away from shell to withstand seismic uplift and not tear from bottom in event of earthquake per AWWA standards,
- Many visual signs of leakage all around tank. This is due to either insecure nut/bolt; deteriorated gasket; or severe corrosion from interior of tank.
- No center roof vent to determine corrosion at center dollar plate and rafters. Tank roof hatch is designed as roof vent and hatch at estimated 18” diameter (two vents present).
- Tank roof does not have any roof hand railing and is not OSHA compliant
- Exterior ladder anti-climb is not OSHA compliant. Exterior ladder has anti-climb door which is not OSHA complaint and dangerous to accessing employees. Tank exterior ladder lines up on roof vent/access hatch and is tripping hazard to those accessing roof from ladder. Exterior ladder is est. 96” from grade and illegal to climb without designed temporary ladder. Entire exterior caged ladder should be replaced.
- Tank Liquid Level indicator malfunctioning and in need of replacement.

INTERIOR

- Perimeter roof vent too small and not per OSHA standard to allow access to tank interior. Should be considered vent only and not roof access hatch.

- No interior ladder present on tank.
- Severe to moderate corrosion at tank perimeter roof hatch and visual areas from roof to interior.
- Underside of roof appears to be in good to moderate condition.
- Perimeter shell is showing signed of severe delamination and in need of coatings repair.

SUGGESTIONS:

- Take tank out of service for period of 04 months.
- Install Seismic flexible coupling on inlet and outlet lines. Estimated cost $36,000 to remove existing, open trenching back estimated 10-15lf and install new flex-couplings onto existing shell nozzles.
- Install Roof hand railing to 8LF each side of exterior ladder opening at roof line and 8LF toward center of tank (32LF total) at cost of $3,800
- Remove and replace liquid level indicator complete at cost of $4,200
- Engineer tank for sloshing wave and reduce overflow elevation and install air-gap at exterior overflow line at estimated cost of $17,000
- Install FRP interior ladder on tank at cost of $6,900
- Sweep blast interior coatings to SSPC-SP7 (remove all loose materials and create a profile); and paint interior with 15-20MDFT 100% solids epoxy. Pay special attention to avoid direct blasting at shell interior horizontal and vertical seams so not to destroy gasket materials. After coatings, apply even layer of mastic sealant that is NSF61 approved to all interior bolts and seams to seal tank. Cost of interior coatings is $79,200.00
- Should you require the exterior of tank be pressure washed and exterior coatings, PRT could perform at the cost of $30,005.00
    - Note that there is the possibility of creating more damage to bolted tank gaskets. An alternative approach would be to replace the tank in its entirety with newer bolted or welded tank.
        - Flat Panel Bolted tank per AWWA D103 standards with all new ladders, reinforced nozzles, sloshing-wave considerations, venting, and LLI would be estimated $388,000 for new grade-band/gravel foundation and tank.
        - A similar welded tank with same capacity would cost $475,000 for gravel-band foundation and new tank.

- PRT can perform the seismic analysis for each tank against current AWWA standards for cost of $8,500 each tank. This would include new tank design for both foundation and tank as well as tank drawings.

Bolted tanks were originally intended for temporary storage with expected life expectancy of 25-30 years. This tank was erected in 1989 and is currently 29 years old. It is at the end of its original designed life cycle. You can repair it per the suggestions above and get another anticipated 10-15 years of life from this tank in my opinion.

TANK 7

- 103’ diameter x 16’ shell height cone roof water tank with 15’-1” high water elevation (HWL).
- Type Tank: AWWA D100 welded tank
- Built in 1993
- Tank Manufacturer – Pittsburg Demoine Steel (PDM)

EXTERIOR

- Exterior shell appeared to be in fair condition on exterior shell. Signs of UV chalking and coatings are doing their job on shell.
- Roof has severe UV damage and finish coatings appear to have dissipated to prime coat.
- Tank gradeband and gravel appear to be in excellent condition
- Tank exterior ladder is not OSHA compliant.
- Overflow is too high and tank has zero freeboard. The bottom of the roof girders have been submerged in water.

INTERIOR

- Tank interior coatings fair condition below the HWL. Above the HWL, there is a black staining and pitch material that appears to be foreign to the tank. Spot rusting to be expected and minimal at this point.

SUGGESTIONS:

- It does not appear that this tank has ever been inspected and the coatings have held up quite well. I recommend taking this tank out of service for 04 months to power wash interior, hand tool clean rusted surfaces, and apply total (existing and new) of 12-15MDFT coatings over damaged area.
- I cannot provide definitive price on spot repair as I could not access total foreign material or perimeter rust damage. I anticipate that it would cost estimated $65,000 to pressure wash and spot repair within 03 weeks and place tank back into service for next five years prior to re-inpection.
- Cost to remove all coatings and recoat interior of tank would be $150,500.00.
- Exterior coatings on shell and roof should be pressure washed and top coated with 2-3MDFT polyurethane at cost of $49,200.00

- After above work is completed, I recommend visual inspection every twelve months and full out of service inspection every five years.

Welded tanks will last indefinitely with the proper maintenance and repair. I suggest placing this tank and remainder of tanks on maintenance cycle for visual inspection every 12 months and complete out of service inspection every five years. You do this and all your welded tanks will last indefinitely. Unlike bolted tanks, the welded tanks do not have any gaskets that will dry rot/deteriorate and have costly repairs. Welded tanks that are coated by a SSPC QP1 contractor will provide you tank coatings that should last 30-35 years with between coatings. This tank is 25 years old and is aging very well. I do not expect you will have any issues with coatings on this tank once you make the suggested repairs. The coatings should last 30+ years prior to needing to be removed and reapplied.

TANK 8

- 150’ diameter x 24’ shell height plus 3’ knuckle with 23’ high water elevation (HWL).
- Type Tank: AWWA D100 welded tank
- Built in 2009
- Tank Manufacturer – Crosno Construction

EXTERIOR

- Exterior shell appeared to be in excellent condition with exception of two flanges that are exhibiting flash rusting.
- Tank chime needs to be sealed with sealant.
- Concrete ringwall foundation appears to be in excellent condition.
- Tank Roof coatings is delaminating between finish coat and prime coat around the entire perimeter at the weld seams.
- Tank roof handrailing has one 12” area of flash rusting that needs to be repaired.

INTERIOR

- Tank interior coatings appear to be in good to excellent condition.
- Area of concern is the ends of rafters to knuckle braces all have spot rusting and need to be addressed before it becomes larger problem.

SUGGESTIONS:

- Take tank out of service for three weeks and spot repair all the rafter ends. Estimated cost for this work is $22,000.00. While tank is out of service, inspect remainder of interior and spot repair with Aquadapoxy.
- Spot repair roof delamination’s (workmanship) at estimated cost of $17,000.
- After above work is completed, I recommend visual inspection every twelve months and full out of service inspection every five years.

Welded tanks will last indefinitely with the proper maintenance and repair. I suggest placing this tank and remainder of tanks on maintenance cycle for visual inspection every 12 months and complete out of service inspection every five years. You do this and all your welded tanks will last indefinitely. Unlike bolted tanks, the welded tanks do not have any gaskets that will dry rot/deteriorate and have costly repairs. Welded tanks that are coated by a SSPC QP1 contractor will provide you a tank coatings that should last 30-35 years with between coatings. This tank is 09 years old and is aging very well. I do not expect you will have any issues with coatings on this tank once you make the suggested repairs. The coatings should last 30+ years prior to needing to be removed and reapplied.

Cost of Maintenance Contract

Tank ID	Annual	5-yr agreement	10-yr agreement	15-yr agreement
2	$ 7,500	$ 33,750	$ 67,500	$ 101,250
3	$ 7,100	$ 31,950	$ 63,900	$ 95,850
4	$ 7,500	$ 33,750	$ 67,500	$ 101,250
5	$ 7,000	$ 31,500	$ 63,000	$ 94,500
6	$ 11,000	$ 49,500	$ 99,000	$ 148,500
7	$ 14,000	$ 56,000	$ 112,000	$ 168,000
8	$ 18,000	$ 72,000	$ 144,000	$ 216,000

Clarifications:

- All inspections are based upon 5-year agreement minimum.
- 5 – 10 – 15 year plans all include annual tank inspection set up by our Project Manager to notify you 30 days in advance of each tank inspection. PRT can work around your schedule to meet you scheduling needs.
- Above plans are based upon all tanks being brought up to current AWWA, OSHA, DOSH, and acceptable coating standards.
- All tanks must have minimum OSHA openings to access tank interiors.
- All tanks will require initial tank cleaning to remove all sediment and debris from tank bottoms.
- Annual inspection includes the following:
  - Dry dive each tank with OSHA required three-man dive team
  - All dives include disinfection and safe entry practices as those mentioned in AWWA C652 standard.
  - Tank bottom will be cleaned every 5 years via underwater vacuum removal of sediment
  - Reports will be in both video and picture format with complementing written report of each tank.
  - Should any coating failures be detected during inspection, PRT will clean and apply underwater Aquadpoxy to damaged area. Damage is limited to 6” x 6” area. Area’s larger will be required to be repaired via dry method.
  - We anticipate being able to dive 1-2 tanks per eight (08) hour day.
  - Inspection of roof rafter areas may require that you fill tank to capacity and PRT float tank interior with rubber rafter to access rafters.
  - For Bolted tanks, divers will adjust nuts and bolts where possible to reduce/eliminate leaks.

- All tanks are to be lockout/tag out by our staff for the duration of their work on said tank(s).

- Payments are 1/12 of amounts shown above paid by the 15th of each month for duration of contract.
- All suggested repairs can be completed on T&M or lump sum amount as agreed upon by Owner. No additional work is to commence without Owner written approval.

Appendix G Hydrogeological Investigation of Swarthout Canyon, Sheep Creek Area and Mojave Basins

Preliminary Well Siting Study
Sheep Creek Water Company
October, 2018

Background

The Sheep Creek Water Company (SCWC) boundary is located on the northern side of the San Gabriel Mountains just northeast of where Sheep Creek exits Swarthout Canyon (Figures 1 and 2). SCWC is mainly located within the Alto Sub-Basin, although some of the western and southwestern portions of the District overlap into the Oeste Sub-Basin. Geologically, the District area is mostly underlain by older alluvial fan sediments of the Victorville Fan (Upper Mojave River Watershed), with the western part of the District underlain by younger alluvial fan sediments of the Sheep Creek Fan (El Mirage Watershed). See Figure __ for boundaries of the Oeste and Alto Sub-Basins.

SCWC is surrounded by the Phelan Pinion Hills Community Services District (PPHCSD), which operates water supply wells within the Oeste Sub-Basin and the Alto Sub-Basin, as well as water supply wells outside of the adjudicated basins managed by the Mojave Water Agency Water Master.

Geology

Geologic descriptions in this section are mainly derived from *Geologic Map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California* (2006) and *Oeste Hydrologic Sub-Area Hydrogeologic Report* (2009). See references for full citations.

Bedrock within the El Mirage Valley area is predominantly granitic. Basement rock in the southern portion of the basin is composed of two distinct rock sequences divided by the San Andreas Fault. South of the fault (Swarthout Valley), rocks are predominantly composed of Pelona Schist, a gray to green chlorite-actinolite and muscovite schist. North of the San Andreas Fault are the basement rocks of Table Mountain. These include Mesozoic granites and gneisses and marbles of Pre-Mesozoic age.

El Mirage Valley is formed between the Shadow Mountains on the northeast and Adobe Mountain on the northwest. Contour lines on gravity data from a regional study indicate that the basement may deepen in a broad subsurface valley southeastward from El Mirage (dry) Lake towards the east-west elongate depression shown about 6 miles north of Cajon Pass. West of the Oeste Hydrologic Sub-area, a narrow basement trough deepens southeastward from the Lovejoy Buttes subsurface ridge and south of Black Butte. This depression most likely controls deep groundwater movement and may be the location of a fault that is shown on a regional gravity survey.

The geomorphology and depositional history of El Mirage Valley is the result of the interaction between the Transverse Ranges, namely the San Gabriel Mountains to the south and a desert semi-bolson to the north. El Mirage Valley is the semi-bolson formed between the Adobe and Shadow Mountains. Very young alluvial deposits comprise the Sheep Creek fan and the fan consists mostly of Pelona Schist debris. Eolian sand is also widespread on the fan. Underlying these younger sediments are deposits exposed in the in-facing bluffs and San Gabriel Mountains that have been described as, from oldest to youngest respectively: the Phelan Peak Formation, the Harold Formation, the Shoemaker Gravel and the Older Alluvium. The area geologic map and cross sections are shown in Figures __ and __, which also include a short cross-section across the narrow channel of Sheep Creek to illustrate the loose stream alluvium and groundwater elevations in the recharge area of the basin.

Faulting

Main faults that dissect the groundwater basin are located north of Mirage Valley (Mirage Valley fault) and near Wrightwood within Swarthout Valley (San Andreas fault). The Llano fault is a seven km long northwest trending reverse fault near the San Gabriel mountain front west of the Oeste Sub-area. The San Andreas Fault is an active strike-slip fault. A more northerly oriented and isolated structure has been proposed, which is corroborated with gravity linear lows from regional gravity surveys. The structure extends from near Lovejoy Buttes to just north of the mouth of Sheep Creek.

Geologic Formations Underlying the SCWC Service Area

Phelan Peak Formation

The lithology of the older Phelan Peak Formation deposits consists of Pliocene aged arkosic sandstone with thin beds of clayey and silty sandstone and feldspathic conglomerate [Foster, 1980; Weldon 1984]. The younger Phelan Peak (QTpp3) consists of claystone and siltstone containing lesser sandy zones in which sand is either disseminated or restricted to beds. Phelan Peak also includes argillic paleosols and carbonate-cemented layers. The clasts, which include, granitic, volcanic, and a variety of metamorphic rocks, are derived from the contains no rock fragments of Pelona Schist. The age significance of this is that debris forming these deposits was being derived 3 to 4 Ma from the area of Table Mountain and not the Hinterland mountains south of the San Andreas Fault where Pelona Schist is abundantly exposed today.

Harold Formation

The Harold Formation lies unconformably above the Phelan Peak Formation and grades upward into the Shoemaker Gravel. The Harold Formation is composed of arkosic conglomeratic sandstone and arkosic sandstone, with discontinuous carbonate cemented layers. The clasts are composed of Pelona Schist and other metamorphic rocks that are sub-rounded to moderately rounded. The Harold Formation is Pleistocene in age and is about 490 ft thick at the mountain front where Sheep Creek debouches into the El Mirage Valley and Sheep Creek Fan.

Shoemaker Gravel

The Shoemaker Gravel is composed of conglomerate, lithic arkosic conglomerate and lithic arkosic sandstone. The clasts range in size from pebbles to meter sized boulders, and are typically rounded to sub-rounded. Clast composition includes a large variety of granitic rocks including Lowe granodiorite, gneiss, and Pelona Schist. The Shoemaker Gravel is unconformably overlain by very old Quaternary fanglomerate deposits. Mappers suggest that the Harold Formation and Shoemaker Gravel formed as an upward coarsening alluvial fan reflecting the initial Pleistocene uplift of the San Gabriel Mountains.

Very old alluvial fan deposits

Middle to early Pleistocene alluvial fan deposits are comprised of moderately to well consolidated deposits of silt, sand, and gravel. These deposits were named for exposures above the Shoemaker Gravel along the trace of the mountain front in the Pearland and Valyermo areas. Grain size is mostly medium- to very-coarse sand and ranges from sparsely to highly conglomeratic. These deposits also contain an abundance of Pelona Schist clasts.

Old Alluvial Fan deposits

The late to middle Pleistocene (Qof) fans consist of massive to poorly bedded, sand to boulder alluvium. In the distal fan region, approximately 4.5 to 5 mi (7 to 8 km) north of the San Gabriel Mountain front, the deposits become primarily clays as observed in well 5N/7W-24D2. Within this well, clay is present from a depth of 260 ft (80 m) to the bottom of the well at 700 ft (213 m). These fans are moderately consolidated and highly dissected where exposed. This older alluvium underlies much of the SCWC service area. No significant clay zones are present in this area based on the log of SCWC Well #11.

Young Alluvial Fan Deposits

Young unconsolidated alluvium derived from the San Gabriel Mountains overlies all older deposits to a depth of several hundred feet in a wedge that thickens towards El Mirage (dry) Lake. Intermixed with the young alluvial fan deposits derived from the San Gabriel Mountains are other alluvial fan deposits that were derived contemporaneously from the Shadow Mountains, Adobe Mountain, Gray Mountain, and Black Mountain. However, within this overall sequence of coarse alluvial deposits is a thick section of brown sandy clay that extends in the subsurface over an area of approximately 35 mi2 (90 km2). These clay deposits reportedly underlie a large area in the vicinity of El Mirage (dry) Lake and act as an aquiclude separating a perched groundwater aquifer from a deep groundwater. The clay zone is thickest southwards from the eastern portion of El Mirage (dry) Lake in a westward turning arc that ends about 3.7 mi (6 km) south of El Mirage (dry) Lake near Black Mountain. It is continuous from about 100 ft (30 m) depth to 300 ft (90 m), though in places the clay will be separated by sand and gravel lenses that range from 10 to 16 ft (3 to 5 m) thick. North of Black Mountain in the western portion of El Mirage Valley and south of El Mirage (dry) Lake, the clay is mostly confined to shallower depths. Here groundwater wells are shallower and the clay occurs from the surface to a depth of no more than about 115 ft (35 m). Farther northwest, particularly north of Gray Mountain and along the west perimeter of El Mirage (dry) Lake, there are many groundwater wells with no clay mentioned in the well records. This thick subsurface clay

sequence extends southward about 2 mi (3 km) to well 5N/7W-04M01 and is not mentioned in records from wells located further south. This thick clay mainly appears to be associated with the El Mirage Lake basin and the Sheep Creek Fan.

Hydrogeology

Hydrogeologic descriptions in this section are mainly derived from the *Oeste Hydrologic Sub-Area Hydrogeologic Report* (2009). See references for the full citation.

El Mirage Valley Groundwater Basin (Oeste Sub-Basin)

The El Mirage Valley groundwater basin has two principle groundwater aquifers. A lower regional aquifer extends from the southern portion of Sheep Creek to El Mirage (dry) Lake in the north. This aquifer extends from the Los Angeles county line in the west to the community of Phelan in the east. The lower, regional aquifer is primarily being used by the larger water consumers in the north and is the primary aquifer for several municipal groups [Sheep Creek Water Company and the County of San Bernardino]. The upper perched aquifer is isolated near the dry lake area and is typically less then 250 ft in depth. However, in several places, the depth of the perched layer may be deeper and is interbedded with sands, silts, and gravels. The upper perched aquifer is principally used by single family dwellings and small businesses. DWR reports well yields averaging 230 gallons/minute (gpm) and a high of 1,000 (gpm). It is not clear in the DWR report if these yields are derived from the perched (less than 250 ft) or regional aquifer, although the regional aquifer seems more likely.

Upper Mojave River Valley Groundwater Basin (Alto Sub-Basin)

Most of the SCWC service area is located in the southwestern portion of the Alto Sub-Basin in what is considered to be the Upper Mojave River Valley Groundwater Basin.

Generally, in this portion of the Alto Sub-Basin, water is produced from a deeper aquifer which appears to be an easterly extension of the deeper aquifer system in the Oeste Sub-Basin. This deeper aquifer is located within the older alluvium of the Victorville Fan. The geology consists mainly of typical alluvial fan deposits with interbedded sand, silt and clay, along with minor gravel zones. Limited information on yields indicate wells on the order of 250 to 350 gallons per minute from the deeper aquifer, which is present at about 950 feet below grade in this portion of the Alto-Sub-Basin

Water Master records for the Alto Sub-Basin indicate that PPHCSD produced 237 acre-feet in the 2016-2017 water year. This compared to an overall production out of the Alto Sub-Basin in the 2016-2017 water year of 71,400 acre-feet. The only other significant producer in the southwestern portion of the Alto Sub-Basin is Hesperia Water District with a single well that produces in the range of 201-400 acre-feet per year.

Groundwater Flow Out of Sheep Creek

Groundwater flow out of Sheep Creek wash is the primary source of drinking water for the communities of Phelan and Adelanto. Sheep Creek Water Company, on average, pumps 500 + acre-ft/yr of groundwater near the mouth of Sheep Creek wash. Groundwater flow from Sheep Creek originates from the San Gabriel Mountains, in the southern portion of the El Mirage Valley watershed extending into the Wrightwood area. Based on average rainfall within this portion of the watershed, approximately 7,147 acre-ft/yr of recoverable water exists as subsurface flow. This is significantly higher than the previous estimate of DWR of 3,300 acre-ft/yr.

Groundwater Recharge to Southwestern Alto Sub-Basin

A simplified flow analysis from Sheep Creek wash to the El Mirage Valley groundwater basin was also conducted for this report. Utilizing several sources of information [Sheep Creek Water Company data; DWR, 1967; Horne, 1989; GeoConsultants, 2005], a generalized cross-section was constructed (Plate 3c: Generalized Geology Cross-section D-D', E-E', Insert A and Insert B). Aquifer hydraulic conductivities coupled with the cross-sectional area were used to calculate ranges of subsurface flow from the Sheep Creek wash. Based on these simplified calculations, flow values from Sheep Creek wash range from a low of 1,340 (acre-ft/yr) to a high of 24,000 (acre-ft/yr) (Table 6: Range of Yearly Discharge Values acre-ft/year). The high seems unreasonable based on the hydrographs used for this study and the lack of large changes in storage. The more reasonable range is 1,340 – 8,000 acre-ft/year [DWR, 1967; Horne, 1989].

Water Budget

Based on a review of available water budget data prepared by others, it appears that the majority of researchers conclude that the annual average water supply to the Oeste Sub-area is most likely between 1,000 to 3,000 acre-ft/yr. The best contemporary estimates of water being removed from the system [Stamos, et. al., 2001 and the Mojave Basin Area Watermaster], estimate an annual budget deficit of approximately 1,600 acre-ft/yr. These estimates appear reasonable when compared to water levels in the region which show a gradual downward trend. More work is needed to establish an actual basin safe yield for the sub-area although based on current water budget estimates, annual volumes groundwater that can be totally consumptively used in the Oeste sub-area without mining the basin will most like fall somewhere in the lower portion of the range of 1,500 to 3,000 acre-ft/yr.

No data was readily available on the water budget for the southwestern potion of the Alto Sub-Basin., which receives most of its recharge from the San Gabriel Mountains in this potion of the Sub-Basin. See the precipitation map in Figure __ for annual rainfall available for groundwater recharge.

Water Quality

Based on data compilation completed for the *Oeste Hydrologic Atlas* (2009), water quality in the northern portion of the SCWC service area is generally good, with some elevated carbonate and bicarbonate documented in new Well #11, along with a positive Langelier Saturation Index (LSI). The carbonate, bicarbonate and LSI indicate a higher potential for mineral incrustations than average. In addition, the positive LSI may indicate a higher than average potential for

corrosion, which may have implications for well design. In the southern portion of the SCWC service area, data from the *Oeste Hydrologic Atlas* (2009) indicates increased potential for elevated calcium, magnesium and nitrates. Water quality generally appears to get worse to the southeast and east with the Oeste Sub-Basin generally containing poorer quality water than the Alto Sub-Basin, within the SCWC service area.

Existing Wells

There are a limited number of municipal wells within the portion of the Oeste or Alto Sub-Basins within or surrounding SCWC. PPHCSD wells are mostly located to the north and northwest of the SCWC service boundaries, either farther north within the Oeste Sub-Basin or farther to the west outside of the Oeste Sub-Basin.

Describe nearby PPHCSD wells and production characteristics. The only PPHCSD well located within the Alto Sub-Basin is Well 9B, constructed in 1989. This well produces in the range of 250 gallons per minute and is generally run at full capacity. Details of well construction are not available at the time of this report.

Describe SCWC well #11 and pumping test results. SCWC Well #11, constructed in 2018, is located within the Alto Sub-Basin at 4406 Walnut Road in Phelan, California, near the north-central portion of the SCWC service area. Well #11 was drilled to 1500 feet below grade and completed to 1480 feet below grade. The well is screened from 870 to 1020 feet, 1080 to 1340 feet and 1380 to 1460 feet. Static water level was reported at 936 feet and a 7.5 hour pumping tests yield 251 gallons per minute under steady state conditions. Although the drillers log indicated a significant clay thickness from 940 to 1000 feet, an analysis of the elog indicates sandy zones within this logged clay zone. No other significant clay zones which could qualify as aquitards appear to be present at this location based on the elog.

Based on limited yield data from deeper municipal wells in the southern Alto Sub-Basin Expected, yields from new wells constructed similarly to SCWC Well #11 and PPHCSD Well #94 in this area are expected to be in 200-400 gpm range. Based on the needs of SCWC, it is likely that three to four new wells will be required to meet maximum daily demand for the district, based on expected yields.

Proposed Test Well Locations

CRWA has identified six preliminary locations for test wells, dependent on property availability. All test well locations are within the Alto Sub-Basin and are situated to minimize the potential for well interference with existing and planned wells. In addition, SCWC has suggested three additional locations based on existing district infrastructure, one of which overlaps with a CRWA location. Figure __ shows the location of the preliminary test well locations, with CRWA recommendations in blue and SCWC recommendations in yellow.

Estimated depth to water at these locations is estimated to be on the order of 950-980 feet below grade, based on groundwater elevation contours reported in the *Oeste Hydrologic Atlas*

(2009). This water level data correlates well with the static water level reported in SCWC Well #11.

Based on the estimated water levels and the limited subsurface geologic data, the depth of test wells is estimated to be on the order of 1200 to 1500 feet below grade. Actual well construction design would be developed based on geologic logs, elog data and zone testing in the test wells.

The test well locations are based on being located outside the Sheep Creek Fan and the Oeste Sub-Basin due to potential water quality issues. They are also located far enough north to avoid possible elevated nitrate concentrations present in groundwater closer to the entrance to Swarthout Canyon, where Sheep Creek exits the canyon and flows onto the Sheep Creek Fan. Locations take into account enough separation distance to avoid potential well interference. Locations are also focused on areas where there are vacant lots and potentially acquirable land for well construction purposes.

The southern well locations recommended by SCWC may run the risk of encountering elevated nitrate concentrations based on data reported in the *Oeste Hydrologic Atlas* (2009), although these are favorable locations based on proximity to existing district infrastructure.

Based on limited geologic and hydrogeologic data, it is likely that any of the six identified test well locations would encounter sufficient water within the expected 200-400 gpm range. Location D is likely to be highest priority based on proximity to SCWC infrastructure. Location A is also a priority also based on similar proximity of infrastructure. The other four locations were selected based on open property and considerations of potential well interference. These last four locations could potentially be shifted based on the needs of SCWC and any constraints that become apparent during detailed analysis and ranking of the test well locations.

Final selection and prioritization of test well locations would include ranking based on environmental screening, property availability, costs to tie into the existing SCWC system and water rights availability within the adjudicated Alto Sub-Basin.

Test Well Process

The MCUSD seeks to construct an additional water supply well to provide a reliable secondary water source free from elevated iron and manganese concentrations and without detectable levels of arsenic. To determine the suitability of the preferred location, a test well will be drilled at Alternative Location B. The test well will be used to confirm water quality and quantity for a future production well.

The scope of this project includes test well activities from planning and design through Final Test Well Report. After preparing the plans and specs, CRWA will select the drilling contractor, coordinate with the drilling contractor, and mange drilling the test well. Subsequently,

hydrogeological logging, oversight and interpretation of an E-log of the test hole, oversight of zone testing, water quality sampling, and a Final Test Well Report will take place. Test well activities will begin after approval of this Test Well Plan by Division of Drinking Water (DDW) and the DFA Grant Manager. The test well activities are defined by five phases described below.

Test Well Preliminary Actions

Driller Selection

Plans, specifications, and construction bid documents will be prepared for DFA's approval. The plans and specifications will define requirements to construct the test well, log and sample the test hole, conduct zone testing in the test well, and temporarily fill the bore for safe keeping during final design and procurement. The Bid documents will include the bid solicitation, contract agreement, and bid items for the work. Following DFA approval of the plans, specifications and construction bid documents, bids will be obtained and evaluated, and a driller will be selected based on price, qualifications, responsiveness, and availability. Prior to bid request issuance, drillers will be pre-screened for their ability to drill and construct wells to the anticipated depths.

Permit Requirements

Mariposa County requires a drilling permit to construct a test well for a public water supply. The permit application will be filed by CRWA on behalf of SCWC.

Environmental Considerations

It is anticipated that test well drilling and testing can be covered under a CEQA Exemption. This will require completing and filing the appropriate documentation with the Regional Water Quality Control Board.

Schedule

The test wells are planned to be drilled as soon as funding approval is complete and all other pre-drilling considerations are addressed. Based on the depth, it is expected that the test well drilling will require 20-30 days and testing activities will require one to two weeks from mobilization to final cleanup, based on the following assumptions:

- Drilling of each test well will require 20-25 days.
- Bailing and development of the test well will require five to seven days.
- Zone testing in three separate zones. Each zone will require one day.
- Decommissioning the well, if necessary, will require five days.

Well Boring Plan

Due to the depth of the proposed test well, drilling will be conducted using mud rotary drilling methods. The driller will propose detailed drilling methods and equipment for review and acceptance prior to starting the project. The driller will be required to collect and keep samples of cuttings and maintain a log detailing progress and geological formations encountered. Drilling fluid will be contained on-site and disposed of by the driller. Water from the boring and

development will be discharged to a sediment trap and allowed to infiltrate on site. If water quality or quantity test results from this test boring indicate that a viable long-term groundwater source is not available, the test well will be decommissioned in accordance with DWR and AWWA Water Well Standards. However, if the test results indicate a viable well, the construction of a production well will proceed, including design specifications based on geologic logging, geophysical logging, and zone testing of the test well.

Geophysical Survey

The E-log is expected to be completed after reaching total depth. The geophysical survey will consist of gamma, spontaneous potential, resistivity (SN and LN), caliper, deviation log, and temperature, with optional borehole flow meter logging.

Test Well Project Management and Oversight

Throughout the process, CRWA will provide oversight of the drilling contractor and subcontractor(s). A representative of CRWA will be on site during drilling to monitor progress and take independent samples and observations. CRWA's hydrogeologist will also provide oversight and provide interpretation of the borehole geophysical survey. A CRWA representative will monitor the test well process through development and zone testing including selection and evaluation of zones, calculating specific capacity, collecting water quality samples, and managing the construction day to day.

Test Well Development Plan

The test well will be developed in accordance with the requirements of AWWA A100-15.

Methods

The test well will be developed using a variable speed submersible pump with a minimum capacity of 150 gpm. Preliminary development to clear sand and drilling fluid may be done with air lifting, flushing, pumping, or another method selected by the driller in consultation with CRWA personnel. Development pumping data including that related to the step test and constant rate will be recorded by the driller and monitored by CRWA personnel.

Pump tests will proceed without interruption once they begin. In accordance with AWWA A100 – 15, well development will continue until the following conditions are met:

- Sand content is below 5 mg/L for 2 hours or longer over 4 - 5 samples.
- Turbidity is less than 5 NTU.
- The specific capacity of the well increases by less than 10 percent over a 2 hour period.

Step draw down tests will be used to determine the pumping rate for constant rate tests. Step draw down pumping will be for two hours at each pumping rate. The pumping rate will increase for each consecutive step test. Step test results will be used to calculate constant rate test pumping rate. Constant rate tests will be used to determine well specific capacity. Nearby wells (including domestic wells), if any, may be monitored for water level changes during pump

testing. Constant rate testing will continue for a minimum of 8 hours and at least 2 hours after steady state conditions are established.

Zone Testing

Zone testing will be performed to determine the relative quantity of water available from each zone identified during drilling. It is anticipated that a minimum of three zones, identified from the geologic and geophysical logs of the test boring, will be tested. Inflatable packers or an equivalent method will be used to isolate each zone for testing. A variable speed submersible pump with a pressure transducer will be used to evaluate production capacity. Water levels in the test well and nearby wells will be monitored during zone testing. Zone testing equipment specifications will be submitted by the subcontractor for review and acceptance by CRWA prior to proceeding with zone testing.

Water Quality Testing Plan

Water quality testing will be conducted to evaluate the water from the test boring with respect to safe drinking water standards for potable water supply.

One set of water quality samples will be collected and analyzed for each producing zone tested. Zone test samples will be subject to a select group of analytes based on the results of the first test well water quality tests. It is anticipated that water quality samples collected during zone will be analyzed for the following parameters, using appropriate USEPA drinking water standards:

- Nitrate, as NO_3
- Hexavalent Chromium
- Flouride
- Total Iron
- Total Manganese
- Sulfate
- Total Dissolved Solids
- pH

This list may be modified based on the detailed environmental review of the test well locations.

An overall water sample will be collected from the well near the completion of constant rate testing and will be tested for a more complete list of analytes. Analyses will generally be consistent with CCR Title 22 regulations:

- inorganic chemicals per §64431 (Table 64431-A)
- radionuclides per §64442 (Table 64442)
- organic chemicals per §64444 (Table 64444-A)

Due to the nature of test well drilling, coliform samples will not be collected until final well construction and disinfection are complete.

Field test kits may be employed to spot test at discrete depths for nitrates, hexavalent chromium and other constituents of concern in the general area during drilling, development or zone testing, as appropriate.

Test Well Decommissioning

Should the test well be determined not to be viable for a production well, the test well will be decommissioned in accordance with AWWA A100-15 guidelines to protect the local ground water from surface contamination or inter-fracture transmission. Sealing volume, depth, and procedures will be noted and included in the test well report.

Test Well Report

A Final Test Well Report summarizing the findings of the test well construction and testing will be prepared by CRWA and submitted to DDW and DFA for approval. The Report will document the results of the test hole drilling and logging, borehole geophysical survey, development, zone testing, and water quality testing to determine if a production well is viable at the selected location. The report will include background data, as well as a description of the test well, including field notes, a detailed boring log, as-built schematic of the test well, a recommendation on using the test well location to develop a production well, along with preliminary design for a production well, if determined to be viable.

Well Rehabilitation of Existing SCWC Wells

Based on production characteristics and well videos, current SCWC wells 2A, 3A and 4A appear to be experiencing screen and gravel pack clogging from mineral incrustations and possible biomass. Well 2A in particular shows a production response when compared to other wells in the Sheep Creek well field, which indicates it is experiencing severe clogging issues. CRWA recommends a program of well rehabilitation for at least wells 2A, 3A and 4A to address clogging issues, optimize production, minimize drawdown and extend the life of the wells to the extent possible. Prior to contracting for well rehabilitation, CRWA recommends testing the water in these wells for a suite of diagnostic biological and chemical parameters to allow design of the most effective rehabilitation treatment.

The recommended procedure for well rehabilitation in these wells is as follows:

1. Brush the well to remove as much of the mineral incrustations and biomass as possible to expose the screens for further treatment to open the screens and gravel pack.
2. Airlift debris from the bottom of the well.

3. Apply acid treatment to help remove incrustations. The best bet to treat both carbonate and iron/manganese incrustations would be a phosphoric or oxalic acid. If biofilm is present as well, then oxalic acid would be the best choice to address all three issues without having to apply different rounds of chemicals.
4. Use dual surge block to work acid solution into formation.
5. Allow well to sit for 24-48 hours.
6. Remove and neutralize acid solution; verify pH; pump to waste.
7. Dual surge block to loosen mineral incrustations in screen and gravel pack.
8. Video well to determine progress.
9. Vibratory acoustic shock or jetting to address filter pack, if necessary.
10. Dual surge block.
11. Airlift debris from bottom of well.
12. Video log well to confirm well rehabilitation.
13. Upon completion of the well rehabilitation, a pumping step test should be conducted to determine optimal pumping rate, with 4-5 steps of approximately 1 hour each. Specific capacity should be measured during this testing

During the final part of well rehabilitation, pH, turbidity and sand should be monitored.

The recommended process above may need to be modified based on any diagnostic water chemistry or other data which may be available.

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Morton, D. M., and Miller, F.K. (2006). *Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California*, United States Geological Survey Open File Report 2006-1217.

W. Richard Laton, W.R., Foster, J., Blazevic, M., Velarde, J. and Cruikshank, M., 2009, *Oeste Hydrologic Sub-Area Hydrogeologic Report*, prepared for Mojave Water Agency by California State University, Fullerton, Department of Geological Sciences.

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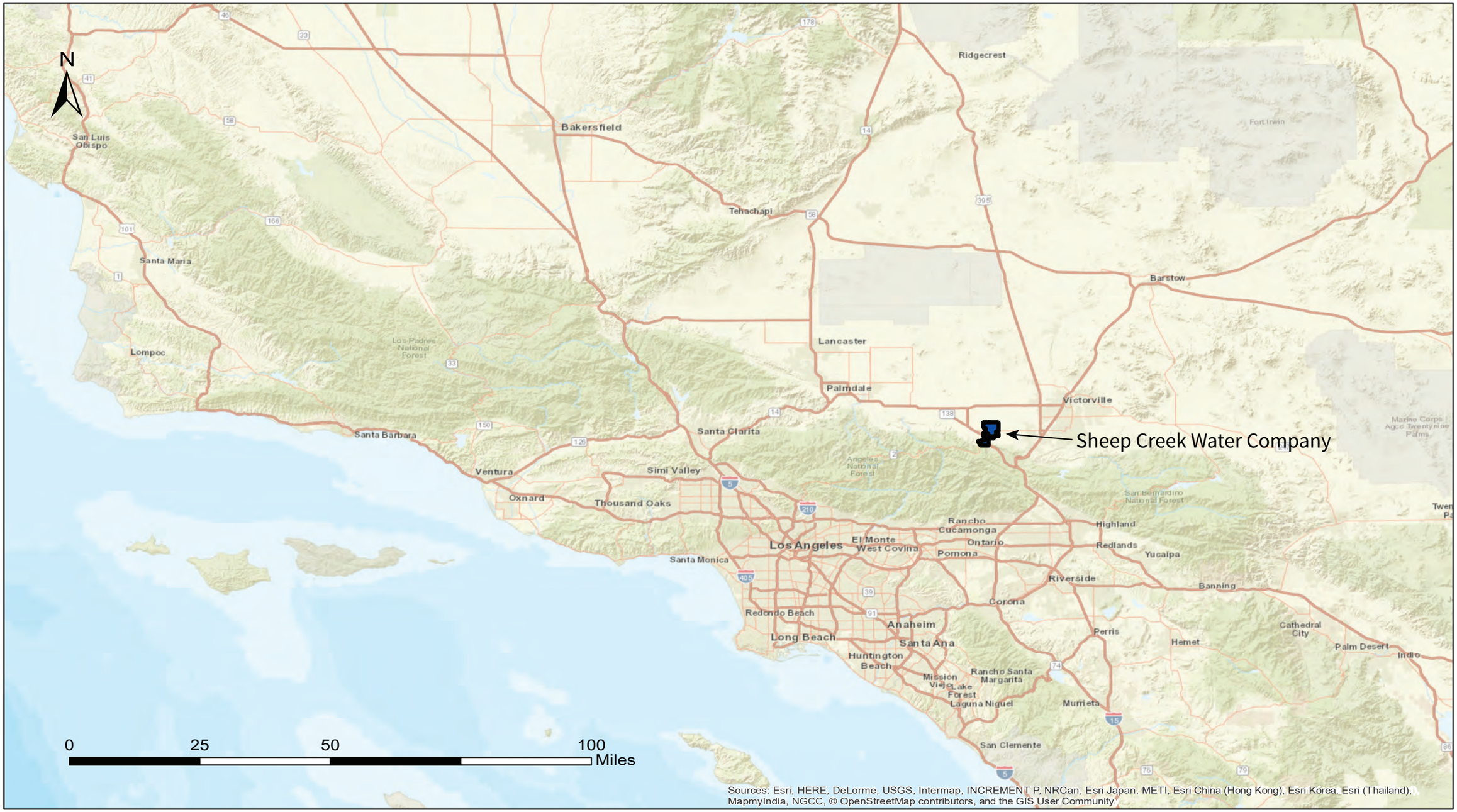
United States Geological Survey's (USGS) National Water Information System (NWIS) Access at http://waterdata.usgs.gov/nwis.



California Rural Water Association

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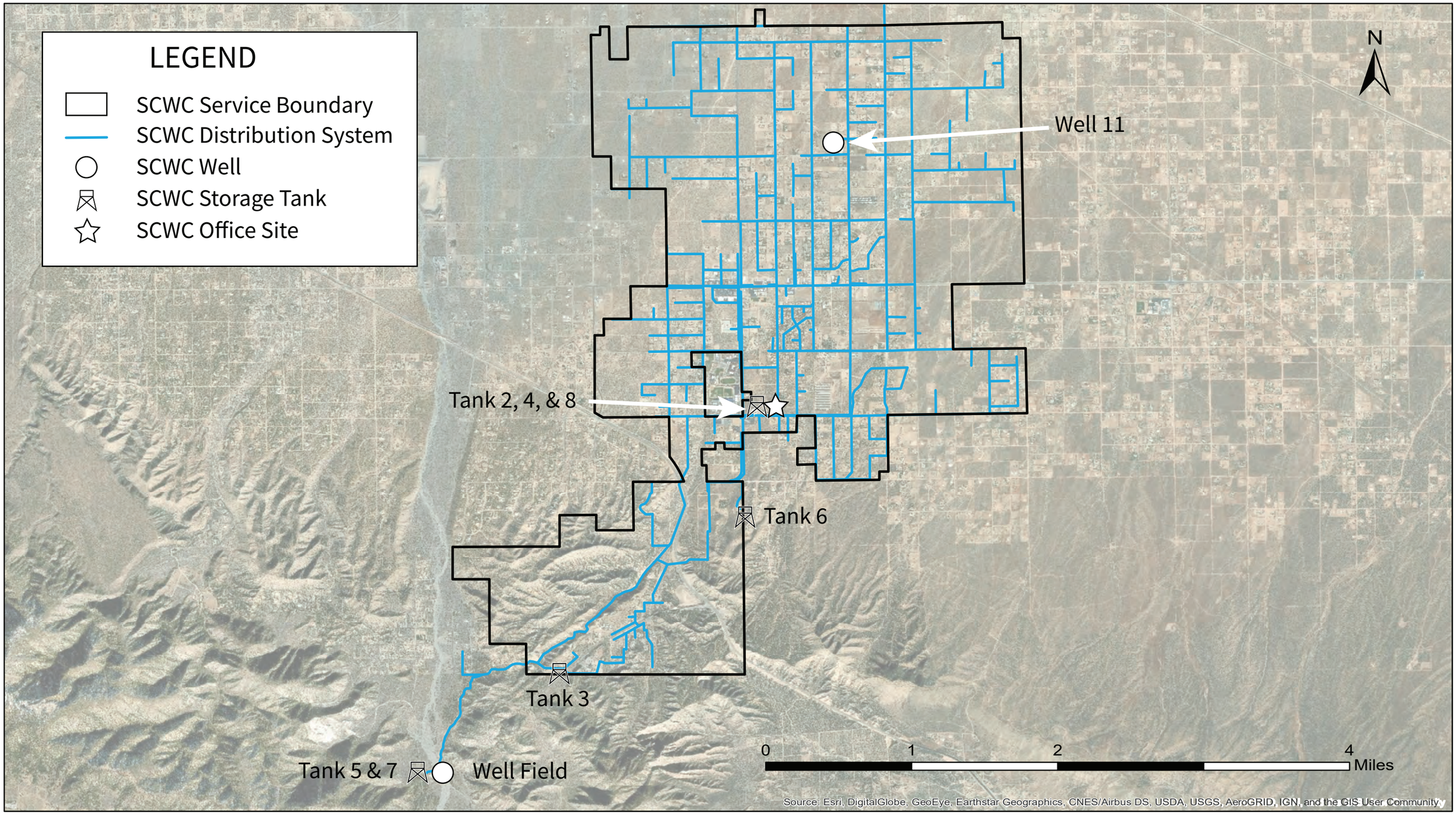
SHEEP CREEK WATER COMPANY LOCATION MAP

FIGURE 1



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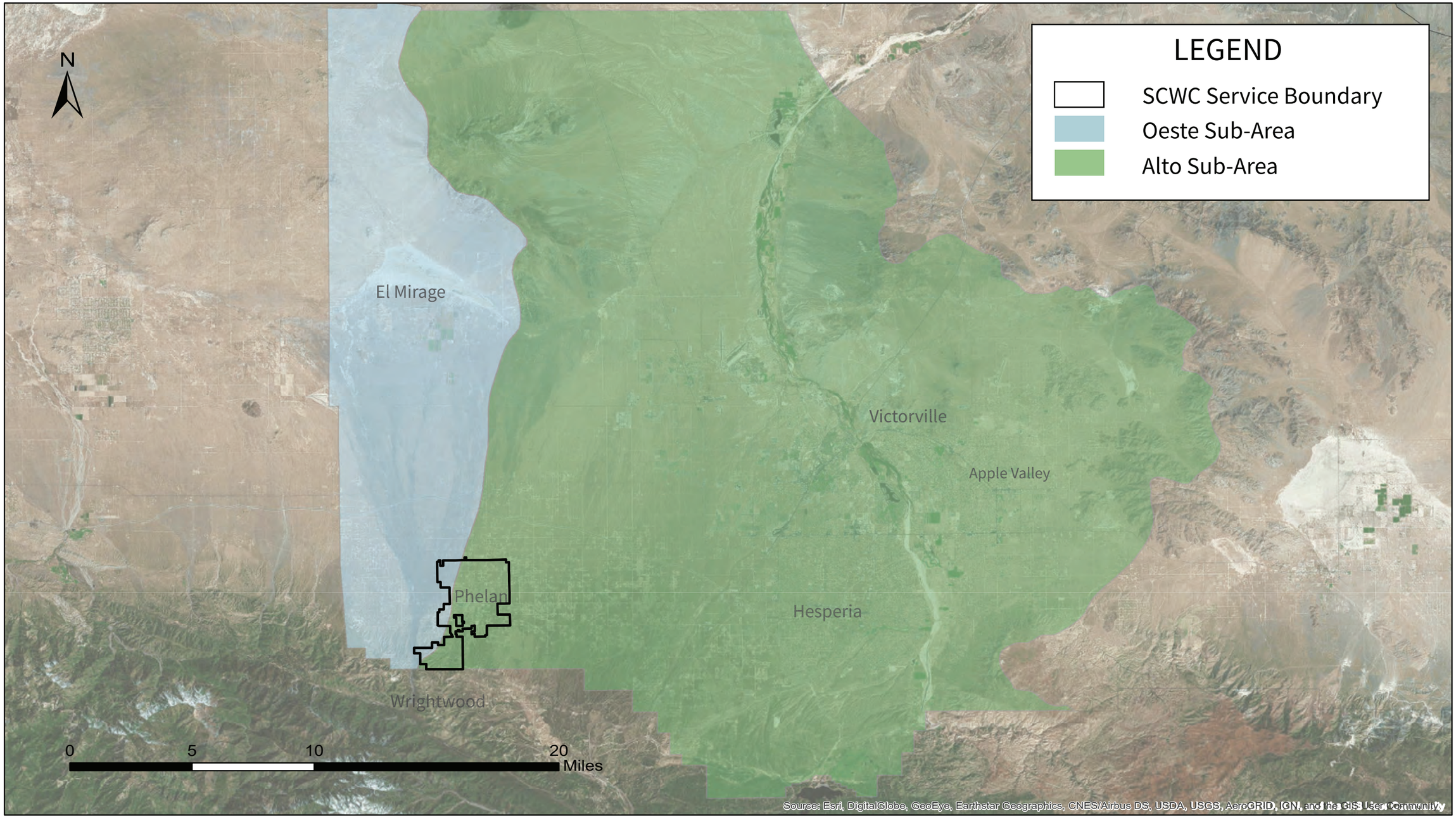
SHEEP CREEK WATER COMPANY SERVICE AREA

FIGURE 2



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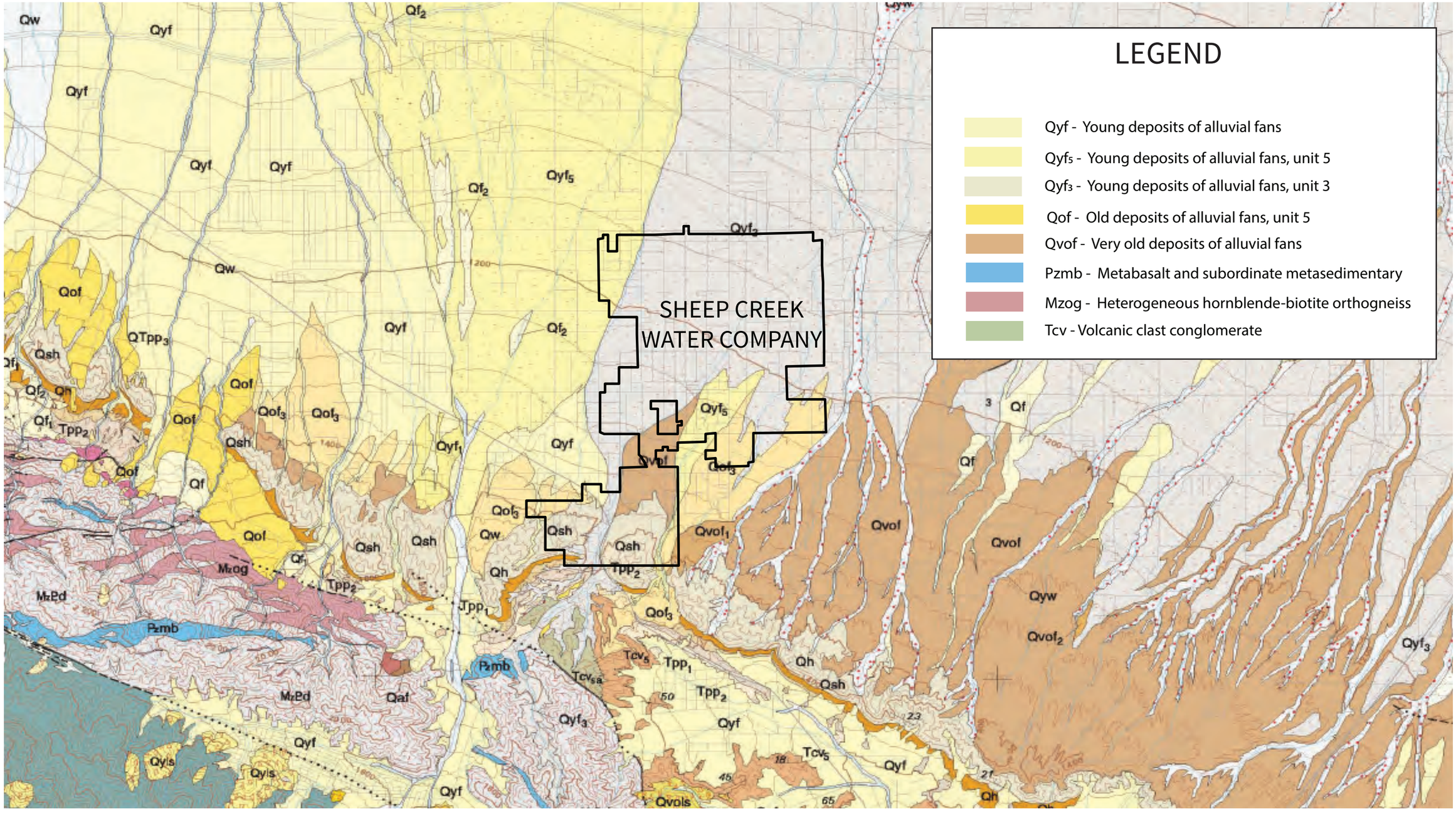
RELIABILITY | RESTORATION | RESILIENCE

OESTE AND ALTO SUB-AREA

*W. Richard Laton, W.R., Foster, J., Blazevic, M., Velarde, J. and Cruikshank, M., 2009, Oeste Hydrologic Sub-Area Hydrogeologic Report, prepared for Mojave Water Agency by California State University, Fullerton, Department of Geological Sciences.

FIGURE
3



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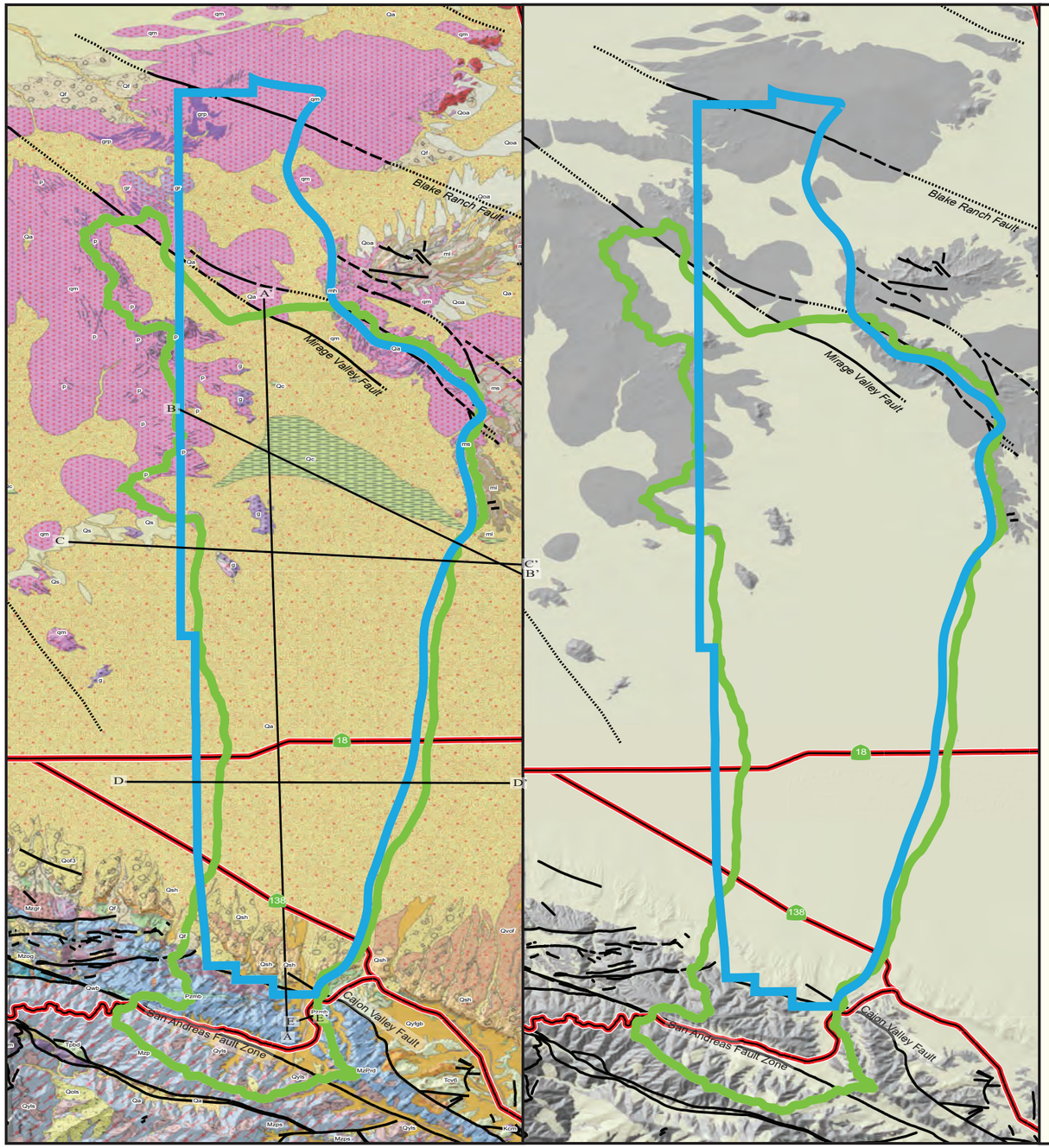
WATER BOND 2014
RELIABILITY | RESTORATION | RESILIENCE

USGS GEOLOGIC MAP

*Morton, D. M., and Miller, F.K. (2006). Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California, United States Geological Survey Open File Report 2006-1217.

FIGURE
4A



QUATERNARY DEPOSITS

- Qdg — Disturbed ground
- Qaf — Artificial fill
- Qw — Very young wash deposits
- Qa — Alluvial gravel and sand
- Qc — Playa clay
- Qcs — Playa clay and windblown sand
- Qf — Fanglomerate
- Qs — Windblown sand
- Qsb — Wave-deposited bars
- Qls — Very young talus deposits
- Qls — Very young landslide deposits
- Ql — Very young lacustrine deposits
- Qyw — Young wash deposits
- Qyt — Young talus deposits
- Qyls — Young landslide deposits
- Qys — Young surficial deposits
- Qyf — Young alluvial-fan deposits
- Qof — Old alluvial-fan deposits
- Qoa — Older Alluvial Sediments
- Qols — Old landslide deposits
- Qvof — Very old alluvial-fan deposits
- Qvols — Very old landslide deposits
- Qvos — Very old surficial deposits
- Qsh — Shoemaker Gravel
- Qh — Harold Formation
- QTpp — Phelan Peak deposits,
- QTfz — QTfz Crushed rock in fault zones

TERTIARY DEPOSITS

- Ttus — Sandstone
- Tv — Vaqueros Formation
- Ttuc — Chert
- Ttug — Granitic Breccia
- Ttrb — Red Buttes quartz basalt of Tropico group
- Tb — Olivine basalt
- Tls — Clay shale
- Tls — Limestone and (or) dolomite and shale
- Tts — Sandstone
- Ttlt — Ryolitic tuff
- Tb — Bissell Formation limestone and (or) dolomite
- Ttgh — Gem Hill Formation ryolitic tuff
- Tdv — Dacite vitrophyre of Tropico group
- Td — Dacite
- Tpbd — Diorite-clast unit
- Tpp — Phelan Peak deposits of Weldon (1984)
- Tcv — Cajon Valley Formation
- Tg — Granodiorite of Telegraph Peak
- Tsf — San Francisquito Formation

MESOZOIC PLUTONIC ROCKS

- ql — Quartz Latite
- gr — Granite
- grp — Granite pegmatite-aplite
- g — Granite
- p — Pegmatite and aplite dikes
- qm — Quartz monzonite
- hd — Hornblende diorite
- hg — Hornblende granite
- Kpg — Monzogranite of Punchbowl Fault area
- Ksa — Quartz diorite of Mount San Antonio
- Kgdc — Biotite granodiorite, Cajon area
- Kcm — Tonalite of Circle Mountain
- KPm — Mylonitic orthogneiss related to Vincent Thrust Fault
- hl — Mount Lowe Intrusive Suite
- g p — Pelona Schist, undifferentiated
- g ps — Pelona Schist, muscovite schist unit
- g pr — Gneiss of Pinyon Ridge
- gb b — Mixed metamorphic and granitic rocks of Big Dalton Canyon
- g gr — Biotite monzogranite of Big John Peak
- g gd — Gneissic granodiorite of Holcomb Ridge
- g og — Heterogeneous hornblende-biotite orthogneiss
- gc m — Mixed granitic and metasedimentary rocks
- gb d — Gneiss of Devil Canyon
- mhs — Hornblende schist
- ml — Crystalline limestone and dolomite
- mh — Lime silicate hornfels
- ms — Hornfels schist
- mq — Quartzite
- bc — Biotite schist
- hs — Hornblende schist or gneiss
- gs — Greenstone
- gt — Garnet tactite

PALEOZOIC METAMORPHIC ROCKS

- c mg — Marble, San Gabriel Mountains
- c mb — Marble, San Bernardino Mountains

PROTEROZOIC METAMORPHIC ROCKS

- b gn — Layered gneiss, undifferentiated
- bgc — Coarse-grained biotite granite-augen gneiss

Explanation

- Major Highways
- Oeste Hydrologic Sub-area Boundary
- El Mirage Watershed
- Fault - Solid where known, dashed where approximate, dotted where inferred

0 2 4 8 Kilometers
0 1 2 4 Miles

Descriptions modified from T.W. Dibblee, Jr. geologic map quadangles: Roger and Kramer, 1960; Shadow Mountains, 1960. San Bernardino 100,1000 Quadrangle (Morton and Miller, 2003).

Plate 2. Oeste Hydrologic Sub-area Generalized Geology and Bedrock Alluvium Map.

California Rural Water Association

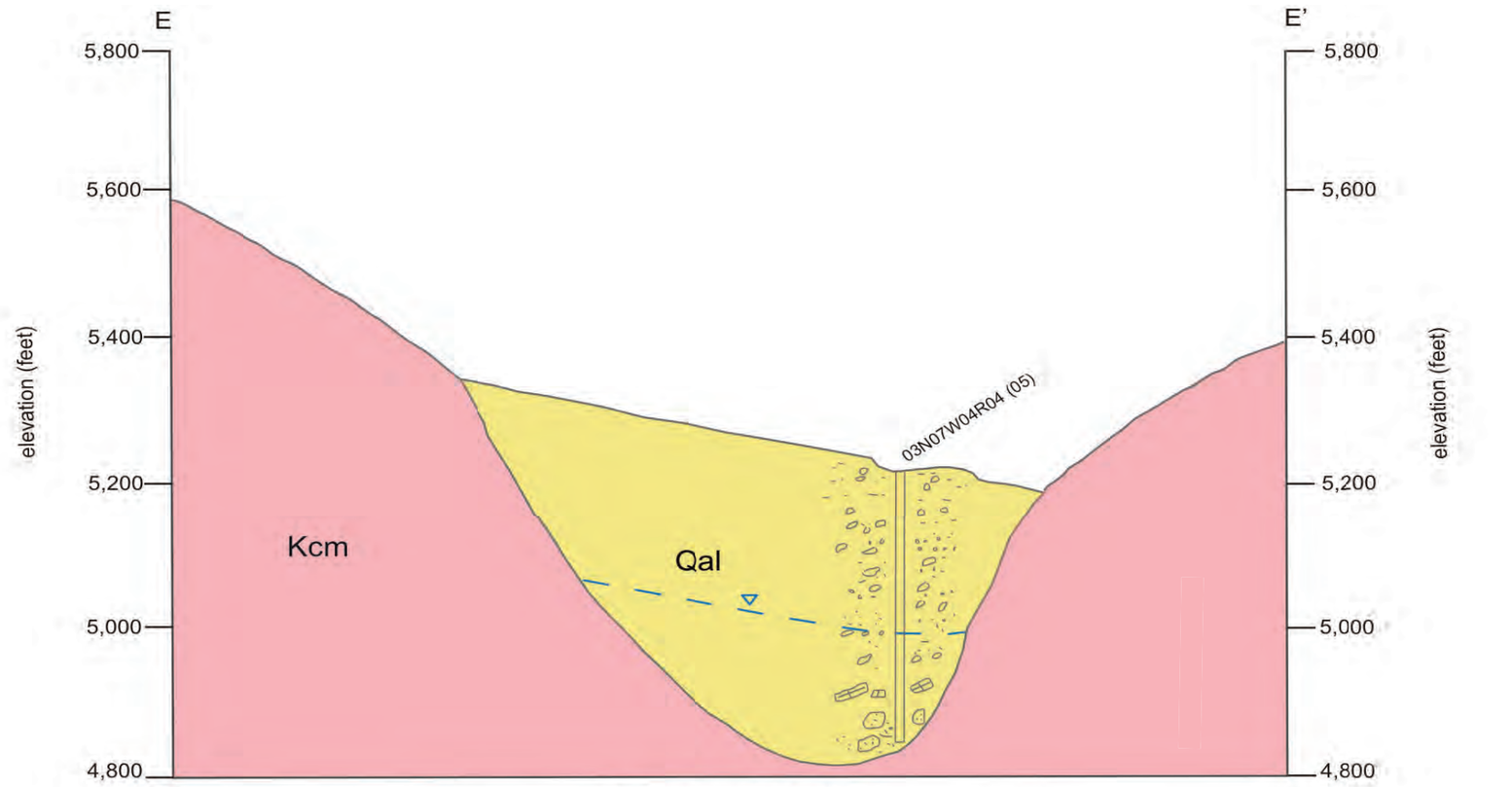
PROP 1 GOVERNOR EDMUND G. BROWN, JR. WATER BOND 2014 RELIABILITY | RESTORATION | RESILIENCE

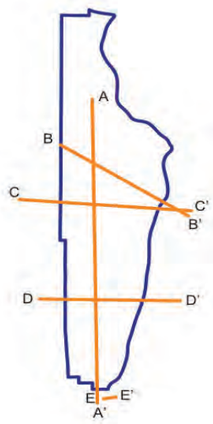
OESTE SUB-AREA GENERALIZED GEOLOGY

*W. Richard Laton, W.R., Foster, J., Blazevic, M., Velarde, J. and Cruikshank, M., 2009, Oeste Hydrologic Sub-Area Hydrogeologic Report, prepared for Mojave Water Agency by California State University, Fullerton, Department of Geological Sciences.

FIGURE 4B

Oeste Hydrologic Sub-area Geologic Cross Section E-E'





Explanation

Qal — Alluvial Deposits
Unconsolidated boulders, sand, clay with limestone and abundant pelona schist fragments

Kcm — Tonalite of Circle Mountain
Mixed Tonalite and gneiss

Groundwater Table 2006

Scale

0 400 800 1,200 1,600 Feet

V.E. = 2X

California Rural Water Association

PROP 1 GOVERNOR EDMUND G. BROWN, JR. WATER BOND 2014 RELIABILITY | RESTORATION | RESILIENCE

SHEEP CREEK CROSS SECTION

*W. Richard Laton, W.R., Foster, J., Blazevic, M., Velarde, J. and Cruikshank, M., 2009, Oeste Hydrologic Sub-Area Hydrogeologic Report, prepared for Mojave Water Agency by California State University, Fullerton, Department of Geological Sciences.

FIGURE
5

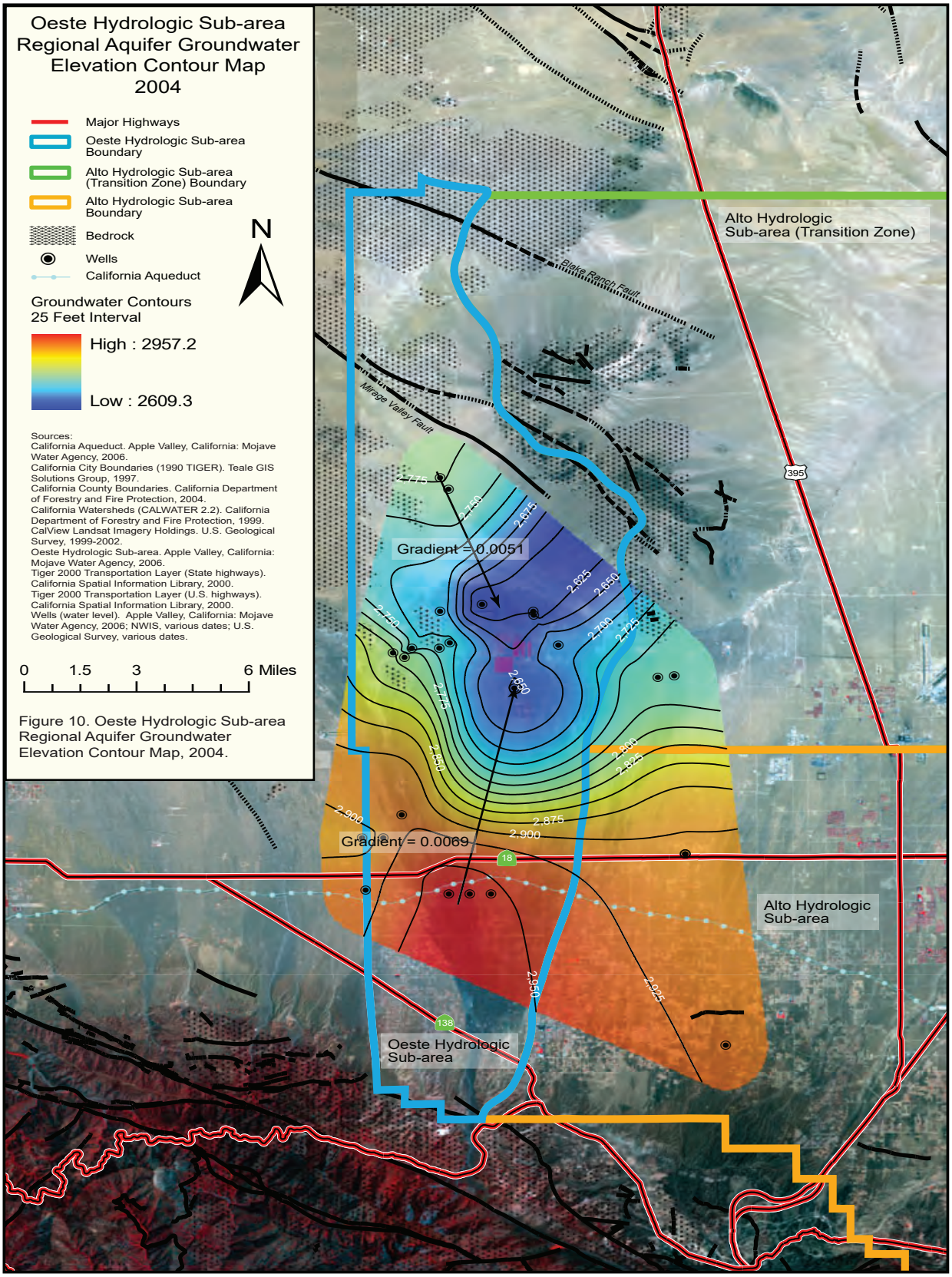


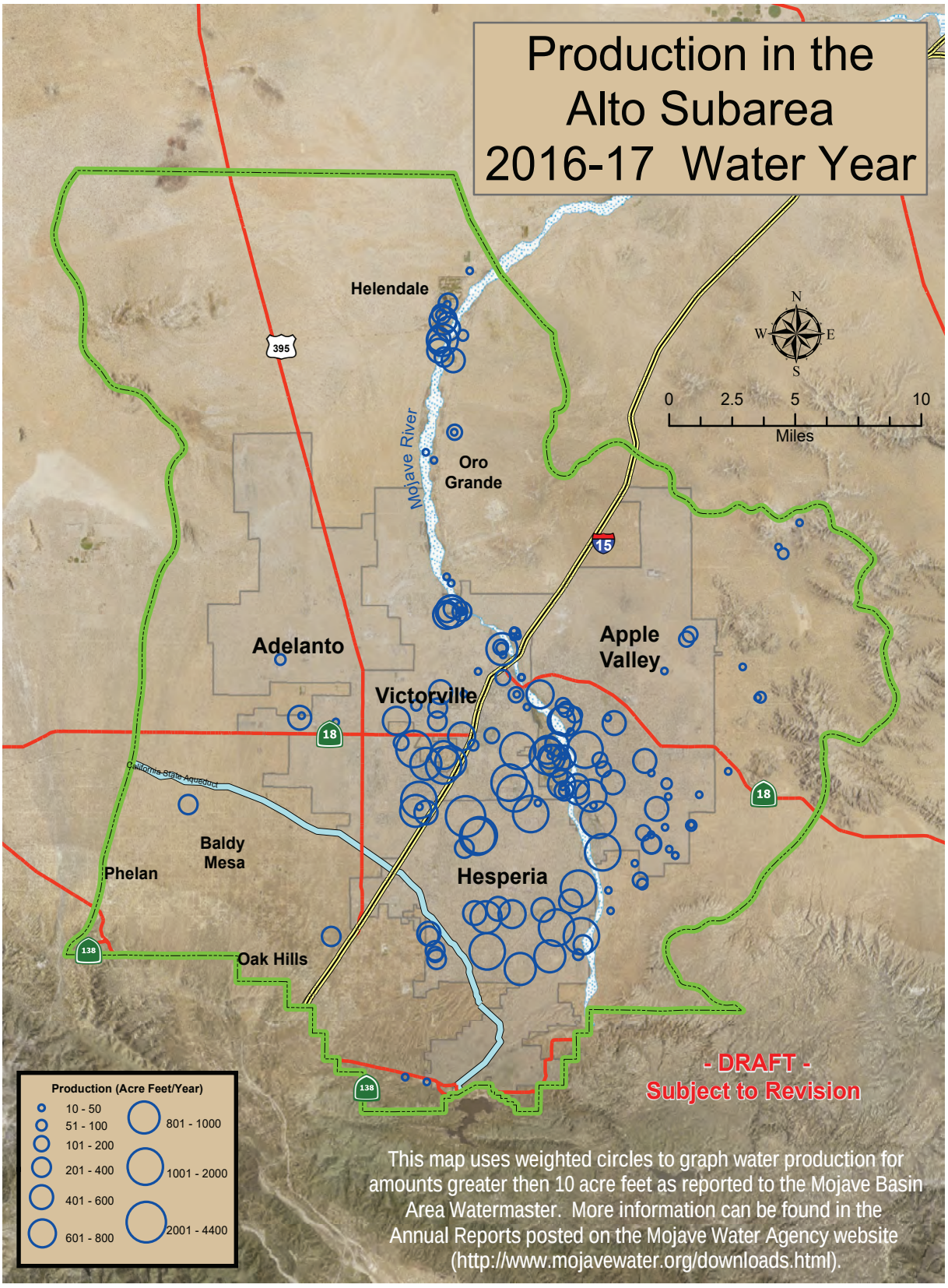
Figure 10. Oeste Hydrologic Sub-area Regional Aquifer Groundwater Elevation Contour Map, 2004.

*W. Richard Laton, W.R., Foster, J., Blazevic, M., Velarde, J. and Cruikshank, M., 2009, Oeste Hydrologic Sub-Area Hydrogeologic Report, prepared for Mojave Water Agency by California State University, Fullerton, Department of Geological Sciences.

California Rural Water Association

OESTE SUB-AREA
GROUNDWATER CONTOURS

FIGURE
6

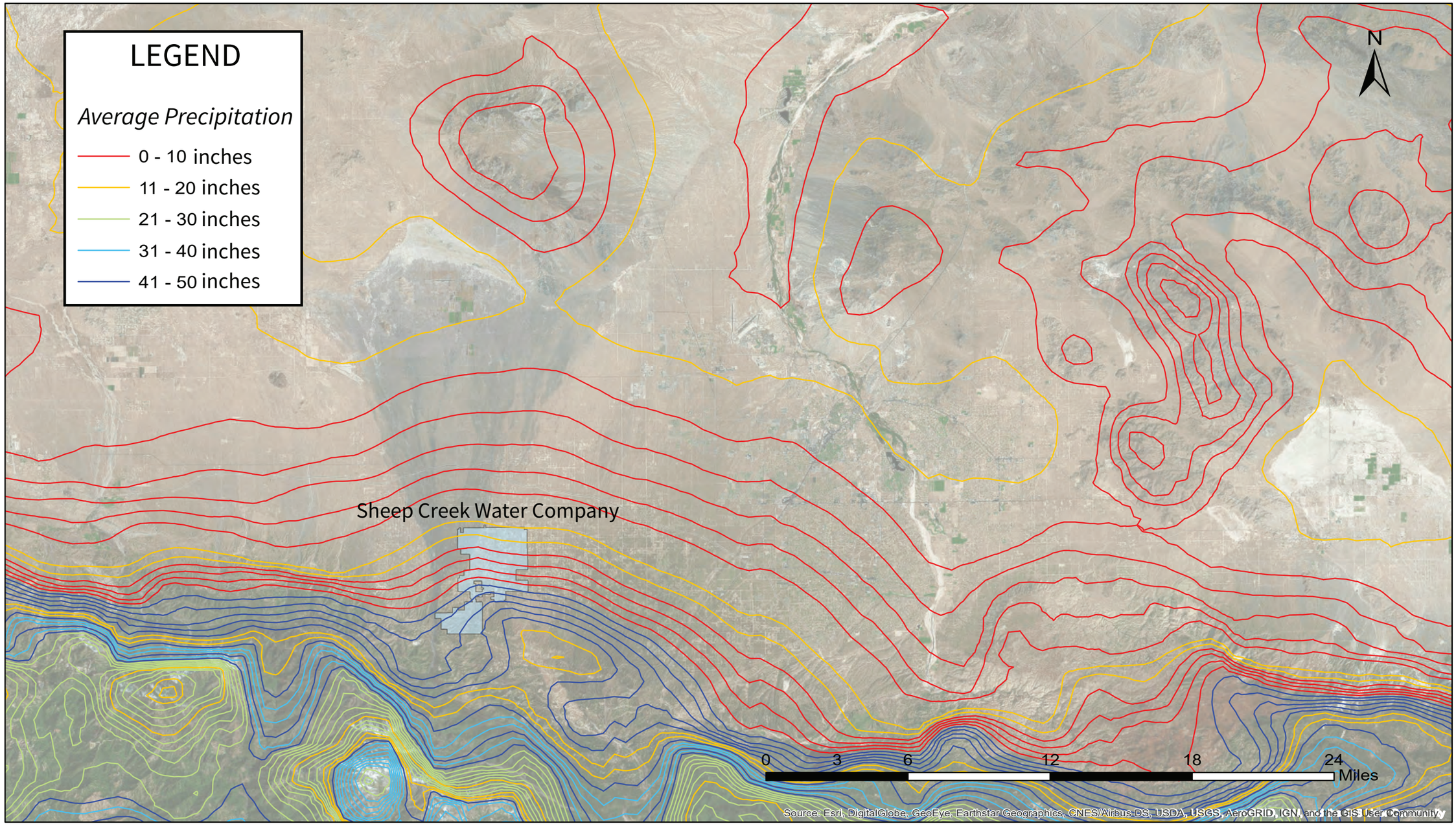


*Mojave Basin Area Watermaster, 2018, Twenty-Fourth Annual Report of the Mojave Basin Area Watermaster for the Water Year 2016-17, Mojave Basin Area Watermaster.

California Rural Water Association

ALTO SUB-AREA PRODUCTION

FIGURE 7



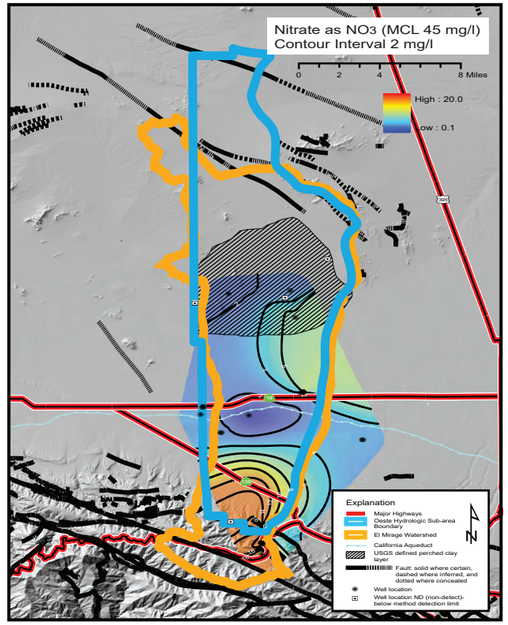
California
Rural Water Association

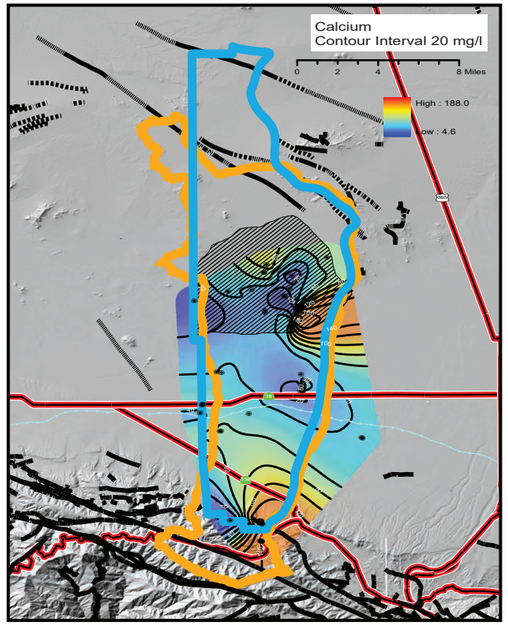
PROP 1
GOVERNOR EDMUND G. BROWN, JR.
WATER BOND 2014
RELIABILITY | RESTORATION | RESILIENCE

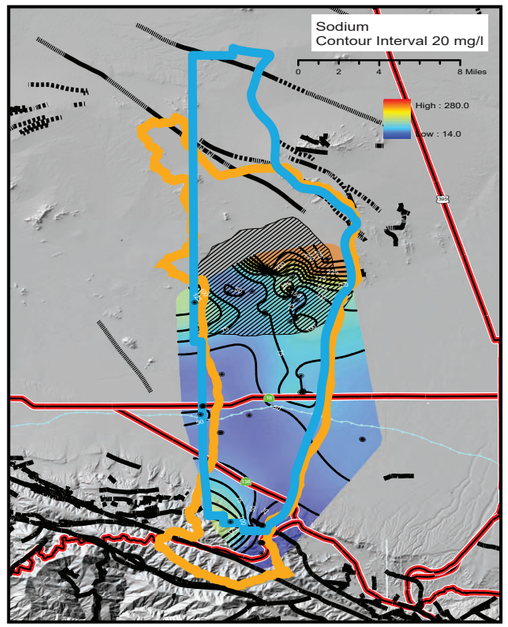
SHEEP CREEK AREA PRECIPITATION DATA

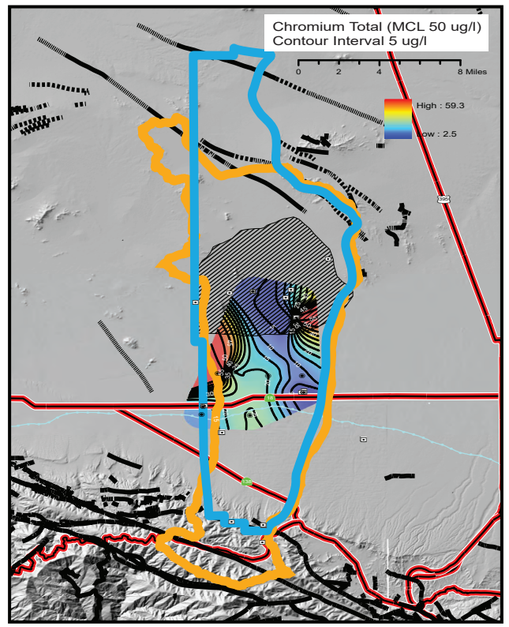
*W. Richard Laton, W.R., Foster, J., Blazevic, M., Velarde, J. and Cruikshank, M., 2009, Oeste Hydrologic Sub-Area Hydrogeologic Report, prepared for Mojave Water Agency by California State University, Fullerton, Department of Geological Sciences.

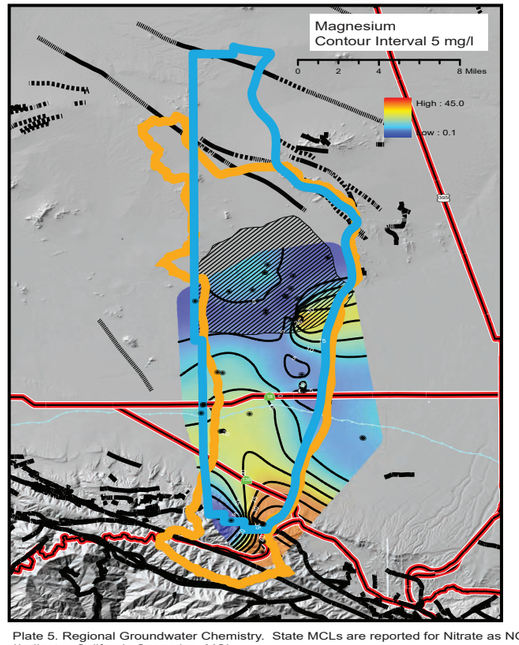
FIGURE
8

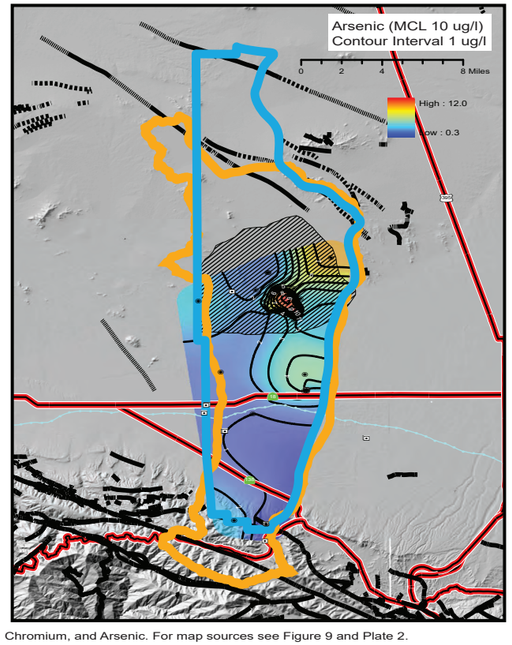


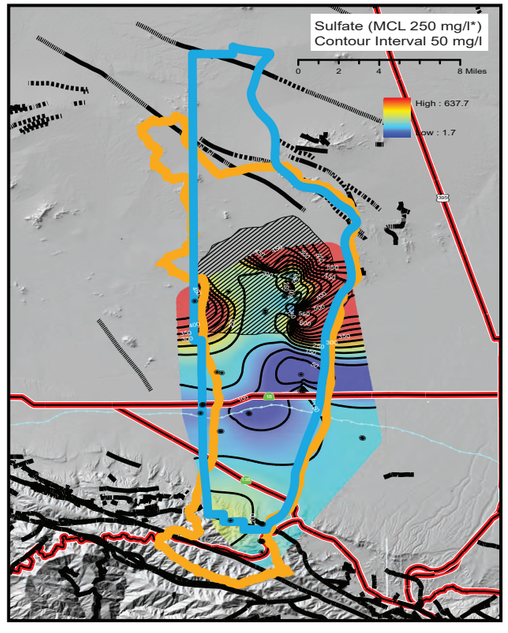












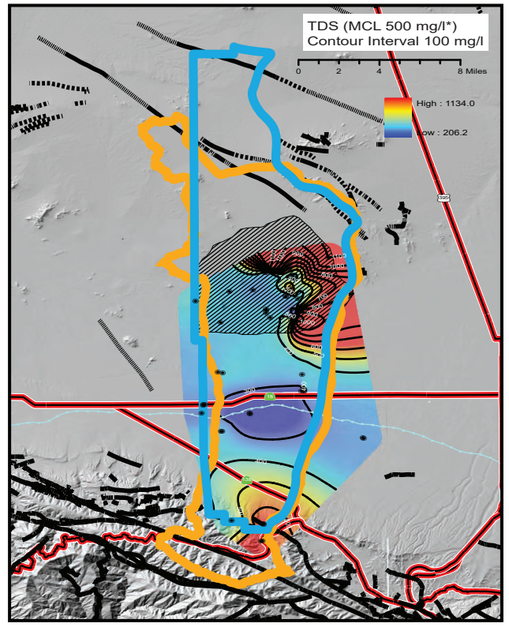


Plate 5. Regional Groundwater Chemistry. State MCLs are reported for Nitrate as NO_3, Chromium, and Arsenic. For map sources see Figure 9 and Plate 2.
*Indicates California Secondary MCL.

California Rural Water Association

PROP 1 GOVERNOR EDMUND G. BROWN, JR. WATER BOND 2014 RELIABILITY | RESTORATION | RESILIENCE

OESTE SUB-AREA GROUNDWATER QUALITY

*W. Richard Laton, W.R., Foster, J., Blazevic, M., Velarde, J. and Cruikshank, M., 2009, Oeste Hydrologic Sub-Area Hydrogeologic Report, prepared for Mojave Water Agency by California State University, Fullerton, Department of Geological Sciences.

FIGURE
9

Appendix H Vendor Quote for New Water Meters

iFLOW ENERGY SOLUTIONS
2109-C South Wright St.
Santa Ana, CA 92705
T: 1-888-651-1130 F: 1-888-250-8281
www.iflowinc.com

Company: Cal Rural
Attn: Archana Jindal
Phone: 562-773-9134
Cell:
Email: ajindal@calruralwater.org

Quotation# 03-66961
Date: 10/8/2018
Project: Cal Rural

ITEM	QTY	BUDGETARY PROPOSAL	PRICE	
1	1345	**1" Model 3101 Kamstrup Ultrasonic Water Meter with Integral Radio**	$302.86	ea
		Body: Stainless Steel		
		P/N# 03U-57-C02-8UP		
2	41	**2" Model 3101 Kamstrup Ultrasonic Meter with Integral Radio**	$772.00	ea
		Body: Stainless Steel with Flanged Connection, 17" lay length		
		P/N: 03U-57-C08-8UP		
3	1	**4" Mag 8000 Magnetic Flow Meter**	$4,033.85	ea
		Flow rate: 10 to 2000 gpm		
		grounding rings, 6 year battery,READy MTU		
		P/N: 6584434-MTU		
3	1	**Kamstrup Ready Smartphone Remote Reading Kit: advanced (hardware)**	$1,800.00	ea
		Remote reading via Android smartphone or tablet (device not included)		
		Includes:		
		Mapping capabilities - maps requires input of geo points		
		2 ReadySuite Bluetooth converter, whip antennas, wall and car charger and usb cables		
		2 external antennas and case		
		Ethernet communication: *Android operating system of 6.0 or higher is required for tablet		
		P/N# 6696200020		
4	1	**Hosted Ready Management Software and Ready App (one-time charge)**	$3,060.00	ea
		PC Software for handling up to 1600 meters and reading data		
		Remote reading via Android smartphone or Tablet (device not included)		
		Read Suite app for android devices		
		Mapping capabilities - maps requires input of geo points		
		Meters are encrypted only allowing a utility to read meters via RF signal		
		P/N: 6696054		
5	1	**Hosted Ready Hosting Subscription Agreement (annual charge) After First Year**	$1,531.00	ea
		Yearly software license and hosting agreement,first year included		
		Billed directly by Kamstrup.		
		P/N:6696054FH		
		Optional:		
6	1	**Ready Bluetooth Optical Head (data logger) (hardware)**	$780.00	ea
		Enables user to read the logged data in meter via Android device		
7	1	**Samsung Galaxy Tab A**	$295.00	ea
		Android operating system 6.0 or higher, 9 inch screen		
		P/N: 969485		
8	1	**Billing interface file:**	$500.00	
		Ready to interface with existing billing system, flat file or fixed width format		
9	1	**Onsite Setup and Training by Iflow**	$0.00	
		Subtotal:	$449,423.55	
		Sales Tax@ %:	$0.00	
		Shipping (Prepaid & add)	$0.00	
		Total:	$449,423.55	
	Notes:	**A restock fee of 25% applies if orders are cancelled once product has shipped. Price quote is good for 30 days from date of quote. Orders totaling over $25,000 qualify for free shipping**		
	Net 30 Days	F.O.B.	Salesman Email:	
	OAC	**Santa Ana, CA**	o.figueroa@iflowinc.com	

Appendix I Vendor Quote for New Tank Mixers

Main Office & Service Center
1-866-437-8076 | medoraco.com
3225 Highway 22, Dickinson, ND 58601

Medora Corporation

GridBee® SolarBee®

Purchase Quotation: Potable Water Circulation Equipment for the San Bernardino County Tanks

Date: September 25, 2018

Project #: 10624

To: Archana Jindal, P.E.
California Rural Water Association
AJindal@calruralwater.org • 916-553-4900

From: Harvey Hibl, Medora Corporation West U.S. Manager, Offices in: AZ, CO, OR
harvey.hibl@medoraco.com • 303-887-5323

Melisa L. Olheiser, Medora Corporation Engineered Sales Dept., Dickinson, ND
melisa.olheiser@medoraco.com • 866-437-8076

PROJECT DESCRIPTION

1. Tank Name, Location and Description

Tank 2: Dia - 55, Height - 24 feet, Volume 428,000
Tank 3: Dia - 47, Height - 16 feet, Volume 210,000
Tank 4: Dia - 55, Height - 24 feet, Volume 428,000
Tank 5: Dia - 39, Height - 16 feet, Volume 141,000
Tank 6: Dia - 80, Height - 24 feet, Volume 912,000
Tank 7: Dia -103, Height - 16 feet, Volume 1MG
Tank 8: Dia - 145 feet, Height - 24 feet, Volume 3MG

2. Customer Objectives

The objective is to provide thorough mixing of the tanks to reduce water age, stagnation, stratification, and short circuiting. Thorough mixing not only improves water quality, it also allows for representative sampling of the tank water, and disinfectant boosting if ever needed.

3. Medora Co. Recommendation/System Design for this Project

We have two styles of mixers that will meet the above objectives; Electric Powered or Solar Powered. The below are our recommendations per tank.

Tank 2: GS-9 Electric or SB500PWc Solar
Tank 3: GS-9 Electric or SB500PWc Solar
Tank 4: GS-9 Electric or SB500PWc Solar
Tank 5: GS-9 Electric or SB500PWc Solar
Tank 6: GS-9 Electric or SB500PWc Solar
Tank 7: GS-9 Electric or SB500PWc Solar
Tank 8: GS-12 Electric or SB1250PWc Solar

Equipment Notes:

- The minimum hatch size for GS Series placements is 12" diameter. Unit(s) require 120 vAC power; which is to be provided by the customer/contractor.
- The minimum hatch size for the SB500PWc placement is 18" diameter with unobstructed clearance.
- The minimum hatch size for the SB1250PWc placement is 24" diameter with unobstructed clearance.

Performance Guarantee: These mixers will completely mix the subject tank. In continuous operation, (1) at least once per 24 hours all water temperatures within the tank shall converge to within 0.8 degrees C, and (2) at least once per 72 hours all chlorine concentrations within the tank shall converge to within 0.18 mg/l.

PRICING

4. Equipment Cost - GS Series Electric Mixers

Quantity	Equipment Description	Cost Each	Equipment Total
6	GS-9-120v Submersible Electric Mixer:	$6,880	$41,280
1	GS-12-120v Submersible Electric Mixer:	$9,580	$9,580
7	GS Series Control Box with SCADA Monitoring:	$1,090	$7,630
		Equipment Subtotal:	$58,490
		Applicable Taxes:	-to be determined -

Choose Only One (1) of the Following:	Project Total
Option #1: FOB Destination, cost for Freight Prepay & Add: $580	**$59,070**
Option #2: *Discounted Factory Delivery and Placement with On-Site Training (Startup if customer supplied power is available): $60,099	**$118,589**

Note: Placement of the GS Series Electric mixers are well within the scope of work most cities or contractors can perform. An owners manual is provided with all machines and an 11 minute placement video may be viewed at the following link: http://www.medoraco.com/GSSeries1802. Power source for the mixer and control box to be supplied by the customer/contractor.

4.1 Equipment Cost - SB Series Solar Mixers

Quantity	Equipment Description	Cost Each	Equipment Total
6	SB500PWc v20 Solar-Powered Mixer:	$19,725	$118,350
1	SB1250PWc v20 Solar-Powered Mixer:	$27,440	$27,440
		Equipment Subtotal:	$145,790
		Applicable Taxes:	-to be determined -
		*Discounted Factory Delivery and Placement with On-Site Training:	$60,099
		Equipment, Delivery and Placement with On-Site Training Total:	**$205,889**

***The above Multi Unit Factory Delivery and Placement discount presumes all tanks would be completed during the same site visit. Please request a new quote if doing less machines in a single trip.**

POTABLE WATER OPTIONS

Options for GS Series Electric Mixers		
Interior Chemical Injection Line	100 ft. long x 1/2" ID injection hose setup to connect to the mixer and hang loose below the hatch, does not include the tank penetration thru fitting for metals tanks.	$230 per 100'
Motor Control Panel SCADA not included	Control Panel: 8" X 6" X 4" Carlon NEMA 4X enclosure, UL listed, 2-position On/Off switch, contactor for mixer control, run indicator light, timer, grounding lug, 120v/1ph male molded plug, and locking latch for security. SCADA not included. Timer: Programmable timer for scheduling run times and duty cycles to prolong motor life. The GS-9/GS-12 mixer is rated for continuous duty, using the timer is not typically recommended.	$695 per mixer
Mix-Guard Replacement Program	*Equipment Protection Program for GS Series Mixers:* Covers beyond the warranty, it replaces the mixer for Acts of God, lightning, vandalism, power problems, handling damage or any other issue. Annual Cost: While in 5 year warranty: GS-12 $450, GS-9 $350 Annual Cost: When beyond the 5 year warranty: GS-12 $850, GS-9 $690 Additional details available at: https://www.medoraco.com/gs-mix-guard-beekeeper	

Options for SB Series Solar Mixers		
SCADA Outputs	All SB v20 models come standard with a SCADA brain-board with six outputs. *(For on-site communication options please request accessories list.)*	
LED RPM Indicator	*Recommended when SCADA is not available.* An electronic pulsing monitor is added to the digital controller and a flashing green LED beacon is located outside of the tank. The LED indicates the SolarBee impeller rotational speed, and the beacon can be directionally targeted for ground level viewing.	$985 per mixer.

Options for all Mixers		
Chemical Injection Thru Fitting	Tank penetration thru fitting for metal tanks to seal around the chemical injection hose when hose is run to the outside of the tank.	$445 per fitting
Exterior Chemical Injection Hose	3/8" Stainless Steel Sheated Exterior Chemical Injection hose with quick connect valve box (minimum 50 feet required).	$7.20 per foot
Portable Disinfectant Boost System	*Consider when occasional on-site boosting is desired.* Portable Disinfectant Boost System (designed to be installed in the back of a pickup), safe, durable chemical transfer system to boost disinfectant in potable water reservoirs. Boosting rate up to 4 gpm, one system can treat multiple tanks, approximate dimensions: 20" W x 52" L x 20" H. Air compressor (4 cfm @ 60 psi) is required to operate the air-powered diaphragm pump; air compressor not included. Brochure available upon request.	$8,720
ResidualHQ Disinfectant Control System	Designed for continuous monitoring and management of disinfectant residual levels. Limited maintenance, simple single-point calibration. Water Quality Monitoring includes continuous monitoring and logging of Total and Free Chlorine residual concentrations utilizing two reagent-free, low- maintenance, amperometric membrane sensors. Feed Capabilities include feed rates for bulk disinfectant chemicals. Unit produces and delivers chlorine, ammonia, and chloramine containing solutions. Adjustable concentrations and ratios. Automated and manual feed operations. Redundant flow verification. Configurable volume and frequency limits. SCADA includes control system accessed via 7" color touch- screen and tactile buttons, or remotely through Modbus protocols (RTU or TCP/IP). Digital outputs available for additional status monitoring. Data logs for various historical actions and parameters. Details available at: https://www.medoraco.com/residualHQ	
THM Removal System	Effective and economical spray nozzle system that works in conjunction with a GridBee / SolarBee mixer to strip TTHM from potable water storage tanks and clearwells. Detail available at: https://www.medoraco.com/THM-VOC-reduction	
Beekeeper Service Program	The Beekeeper is a program that utilizes Factory Crews to service and maintain proprietary designed equipment. Details available at: https://www.medoraco.com/beekeeper	

TERMS

5. General Provisions

A. Material Supplier only. This quotation is to supply materials only. No contracting or construction work of any type is being offered or will be performed by Medora Corporation (Medora) at the jobsite or at any Medora location or factory.

1) To order the materials in this quotation, the purchaser should use the same type of purchase order as would be used to order other materials; for example, a desk or a forklift. Please do not attempt to order the equipment quoted here with a "contractor" or "subcontractor" agreement of any sort, because Medora is strictly a material supplier, not a contractor, and would have to reject that type of agreement.

2) The US Department of Labor clearly defines a Material Supplier, such as Medora, and its allowable activities. All activities by Medora factory personnel to transport, place and start up the Medora equipment are incidental to Medora being a Material Supplier, and Medora will not perform contracting or construction work of any type for any project. Also, no local, state, or federal laws regarding contractors or construction projects, or Davis Bacon or similar reporting requirements, are applicable to this quotation because Medora is not a contractor and does not perform any construction activities.

3) It is the responsibility of the purchaser of Medora's equipment to determine in advance whether there are any contracting or construction activities required in order for Medora's equipment to be made operational. Usually there aren't any such activities; but if there are, it is the purchaser's sole responsibility, at its sole cost, to perform all of those activities in advance of Medora's equipment arriving at the jobsite.

B. Assumptions: This quotation may be based on worksheets, calculations or other information that has been provided by the City. The City should bring to Medora's attention any discrepancies, errors in data, or false assumption that Medora may have made while preparing this quotation.

C. Expiration: This quotation expires in 90 days, or on the date of any new quotation for this project, whichever is sooner.

D. Delivery Time: Delivery time varies, for Equipment Only it is usually within 2-3 weeks from order date and for Factory Placement it is usually within 6-8 weeks from order date.

E. Payment Terms: For a federal, state, or local government purchaser with a good credit rating, full payment is due in US dollars 30 days after invoice date, which is generally the date when the goods leave the Medora factory. For a non-government purchaser, full payment must be made by credit card or cashier's check before the goods leave the Medora factory though, in some cases, based on availability of a payment bonding or a bank Letter of Credit, 30 day credit terms may be extended upon special request by the purchaser. If there are any issues with these payment terms, please do not rely on this quotation until the issues have been resolved with Medora.

F. Add for Taxes and Any Governmental Fees: Except as indicated above, no taxes, tariffs or other governmental fees are included in the quote shown above, nor are there any costs added for special insurance coverage the customer may require. It is the customer's responsibility to pay all local, state, and federal taxes, including, sales and use taxes, business privilege taxes, and fees of all types relating to this sale, whether they are imposed on either Medora or the customer, or whether these taxes and fees are learned about after the customer orders the equipment. The customer's purchase order should indicate any taxes or fees due on equipment and/or services, and whether the customer will pay them directly to the governing body or include the tax payment with the purchase for Medora to submit them to the governing body.

G. Add for Special Insurance Requirements: Medora Corporation maintains adequate liability and workman's compensation insurance to generally comply with its requirements for doing business in all fifty U.S. states, and will provide at no charge certificates of insurance when requested. However, if additional insurance or endorsements beyond the company's standard policy are required by the customer, then the costs of those additional provisions and/or endorsements will be invoiced to the customer after the costs become known.

H. Add for Special Training, Safety, Signage, or Other Requirements: Medora has a very strong safety training program for its employees. If any special training classes for Medora personnel are required by the customer, please notify Medora well in advance. The cost of this training will be added to this quotation or invoiced to the customer separately. The same applies to any other special requirements the customer may have, including providing of project signage or any other requirement.

I. Safe and Accessible Tank Condition Required. This quotation is based on the best information made available to us by the above date. If this equipment is ordered, Medora's engineering team will need detail information and photographs to plan the equipment placement. If the detail information changes the scope significantly, Medora reserves the right to withdraw or alter this quotation, even if the equipment has already been ordered. To avoid surprises, the City should supply detailed tank information and photos as soon as possible. To ensure the safety of Medora's crews, it is the City's responsibility to make sure that all antennas (radio, cell phone, other) located at or near the tank site are inactivated during the placement of this equipment.

J. Customer to Follow Medora's Maintenance and Safety Guidelines: The customer agrees to follow proper maintenance, operating, and safety instructions regarding the equipment as contained in the safety manual that accompanies the equipment or is sent to the customer's address.

K. Regulatory Compliance. The customer must comply with all applicable Federal and State governmental regulations. It is the customer's sole responsibility to inquire about governmental regulations and ensure that GridBee and SolarBee equipment is deployed and maintained so as to remain in compliance with these regulations and guidelines, and to hold Medora harmless from any liability caused by non-compliance with these regulations and guidelines.

L. Warranty. Medora Corporation has the best parts and labor warranties that we are aware of in the industry. The details of the Warranty which applies to this project are either attached to this document or are available at: https://www.medoraco.com/resources/warranty-information.

6. To Accept This Quotation

To order the equipment, please issue a purchase order to Medora Corporation, 3225 Hwy. 22, Dickinson, ND 58601. The purchase order can be mailed to the address above, faxed to 866-662-5052, or emailed to the home office at orderprocessing@medoraco.com. The purchase order should refer to the date of this quotation, and will be assumed to include this entire quotation by reference.

If purchase orders are not utilized, please sign and date below, provide billing information, and fax to 866-662-5052 or email to orderprocessing@medoraco.com.

Signing below acknowledges acceptance of this quotation. Please indicate which of the following options have been chosen.

Proposal Date: September 25, 2018

Project #: 10624

- ☐ GS Series Mixer & Control Box Purchase - Option #1: Shipping Cost Prepaid & Add
- ☐ GS Series Mixer & Control Box Purchase - Option #2: Factory Delivery and Placement with On-Site Training:
- ☐ Solar Mixer Purchase with Factory Delivery and Placement with On-Site Training:
- ☐ Additional Equipment Options Added: _____

Signature	Date
Printed Name	Title

Appendix J Vendor Quote for New SCADA SYSTEM

XiO Cloud SCADA® Water Control System for Sheep Creek Water Company Water System

Nick Liles
XiO, Inc. | www.xiowatersystems.com | 415-900-4503
October 4, 2018

The XiO Cloud SCADA® Control System

XiO is dedicated to providing controls to water system operators and managers. Our experienced staff is committed to delivering practical, effective solutions to the problems facing the industry today.

Enhanced Connection
The intuitive XiO portal allows users to monitor all operations and make secure changes from anywhere via smartphone, tablet or computer. Real time text and e-mail alerts prompt immediate action before a minor problem becomes a major out-of-water event.

Built-in Security
XiO works tirelessly to stay ahead of the curve and implement the latest security protocols. 3rd party verification and testing ensure all XiO systems are secure.

Powerful Cloud Analytics
Unlimited data storage and powerful cloud servers enable XiO systems to collect, store, and analyze more information than ever before. Cloud analytics and advanced scheduling save users up to 25% on their energy bill.

Reliable Local Control
All XiO systems arrive pre-configured and ready to install. Field devices operate autonomously from the Cloud, ensuring that data is kept safe.

Reimagined for Maximum ROI
Smarter maintenance through analytics combined with labor-reducing features and intelligent pumping strategies combine to save utilities money and reduce operational errors.

24/7 Technical Support & Lifetime Warranty
Trained support engineers are available 24/7 to assist with installation and system operation at no additional cost. All systems come with a lifetime warranty on critical control hardware included in monthly service.

XiO Cloud SCADA® Control System

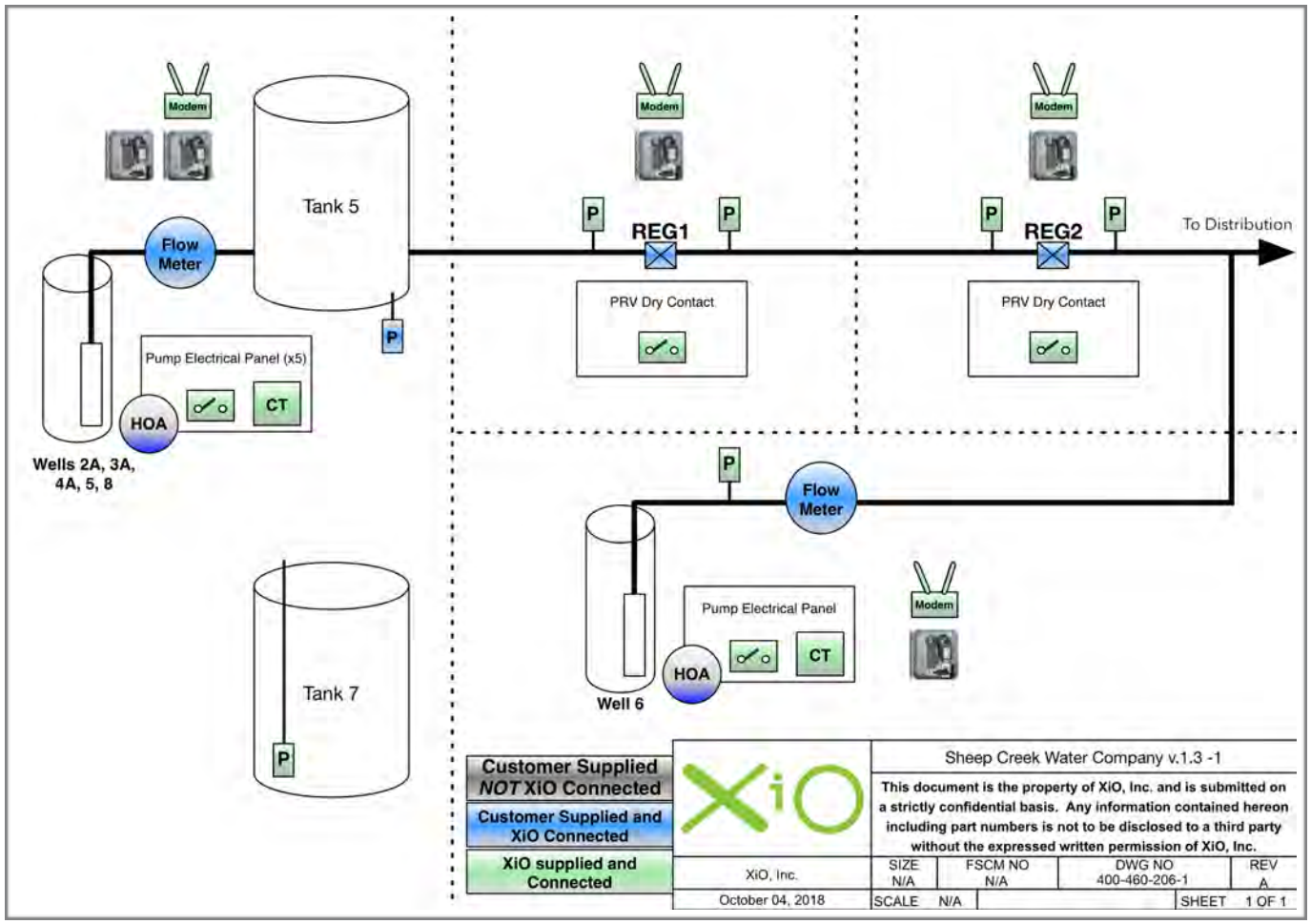
This document serves as a preliminary scope of work estimation. This is not an official proposal or agreement.

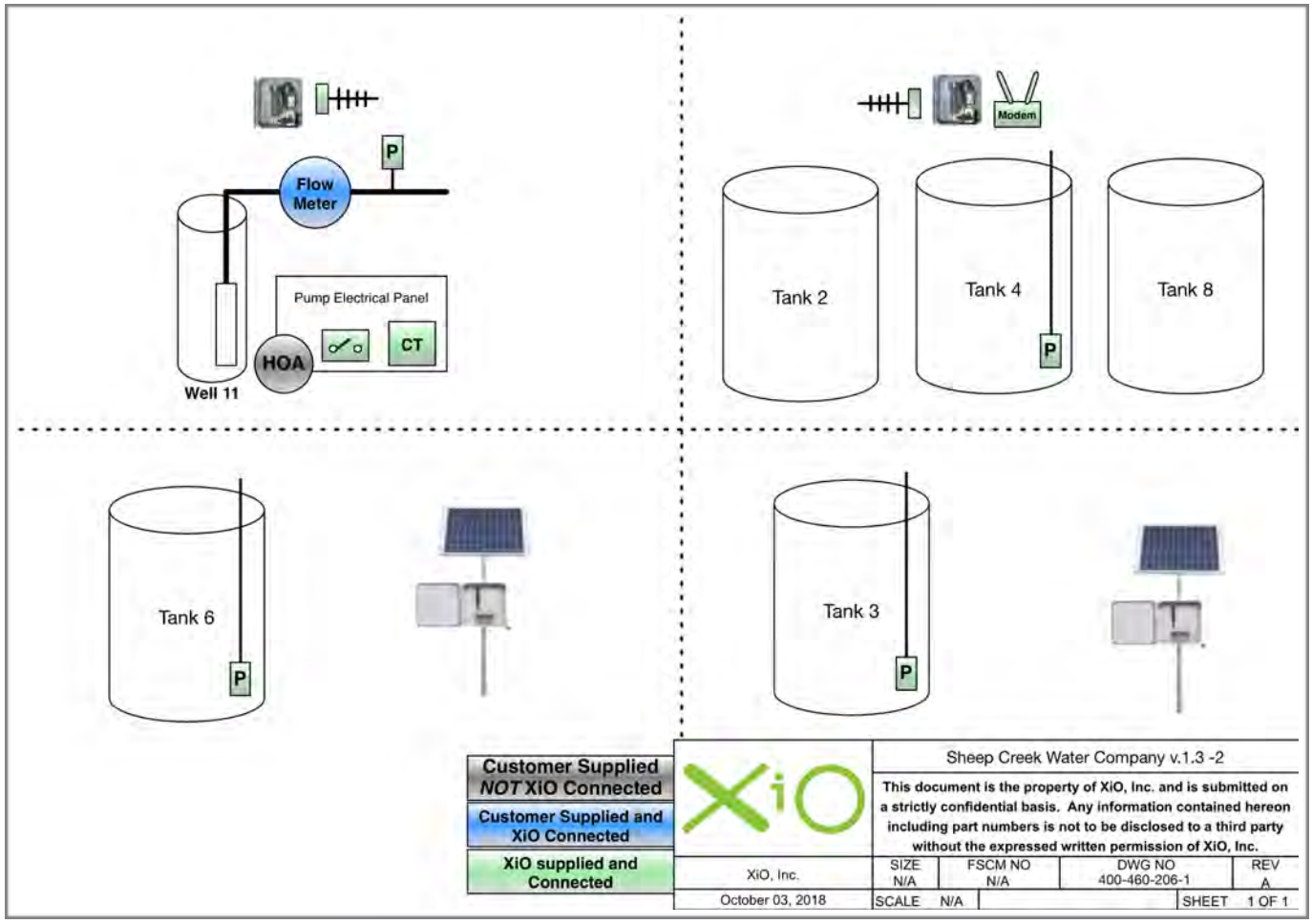
System Overview

The Sheep Creek Water Company Water System consists of eight locations with five identical wells that pump to a tanks for drinking water storage. Two pressure reducing valves will be monitored, as well as the intake and discharge on each pressure reducing valve. Well 6 is at it's own site and pumps directly into the distribution system. Well 11 pumps directly to distribution, and is connected to the office location via Yagi Radio link. Tanks 3 and 6 will use a solar powered Field Monitoring Unit with integrated cellular modem to connect to the XiO Cloud.

Each location will use an XiO-provided cellular modem to communicate with the XiO cloud servers.

System Diagram




P
Flow Meter
Pump Electrical Panel
CT
HOA
Well 11
Modem
Tank 2
Tank 4
P
Tank 8
Tank 6
P
Tank 3
P
Customer Supplied NOT XiO Connected
Customer Supplied and XiO Connected
XiO supplied and Connected
Sheep Creek Water Company v.1.3 -2
This document is the property of XiO, Inc. and is submitted on a strictly confidential basis. Any information contained hereon including part numbers is not to be disclosed to a third party without the expressed written permission of XiO, Inc.
XiO, Inc.
SIZE N/A
FSCM NO N/A
DWG NO 400-460-206-1
REV A
October 03, 2018
SCALE N/A
SHEET 1 OF 1

XiO Cloud SCADA® Solution

The solution provided by XiO will serve to provide authorized operators the ability to remotely monitor all plant operations and equipment status. This will allow authorized users to primarily monitor the following values:

Wells 2A, 3A, 4A, 5, 8, and Storage Tanks 5 and 7

- Monitor and control each of the five well pumps based on a user defined level in Tank 5.
- Monitor and report the electrical energy used by each of the five well pumps.
- Monitor and report the flow rate and total flow through the system utilizing one existing flow meter. This requires that the meter be equipped with a pulse output.
- Provide signal isolation to monitor and report the Tank 5 level utilizing a customer-supplied external water level management sensor.
- Monitor and report the Tank7 level utilizing an XiO-Supplied water level management sensor.

Pressure Reducing Valve 1 (REG 1)

- Monitor and report the intake pressure of REG 1 utilizing an XiO-supplied external water pressure sensor.
- Monitor and report the discharge pressure of REG 1 utilizing an XiO-supplied external water pressure sensor.
- Monitor and report the REG 1 position utilizing a dry contact .

Pressure Reducing Valve 2 (REG 2)

- Monitor and report the intake pressure of REG 2 utilizing an XiO-supplied external water pressure sensor.
- Monitor and report the discharge pressure of REG 2 utilizing an XiO-supplied external water pressure sensor.
- Monitor and report the REG 2 position utilizing a dry contact .

Well 6

- Monitor and control the well6 pump based on a user defined system pressure.
- Monitor and report the electrical energy used by well 6 pump.
- Monitor and report the flow rate and total flow through the system utilizing an existing flow meter. This requires that the meter be equipped with a pulse output.
- Monitor and report system pressure utilizing an XiO-supplied external system pressure sensor.

Well 11

- Monitor and control the Well 11 pump based on a user defined system pressure.
- Monitor and report the electrical energy used by the Well 11 pump.
- Monitor and report the flow rate and total flow through the system utilizing an existing flow meter. This requires that the meter be equipped with a pulse output.
- Monitor and report system pressure utilizing an XiO-supplied external system pressure sensor.

Tanks 2, 4, and 8

- Monitor and report the level of the tanks utilizing an XiO-supplied submersible water level sensor.

Tanks 3 and 6

- Monitor and report the level of Tank 3 every ten minutes utilizing an XiO-supplied submersible water level sensor.
- Monitor and report the level of Tank 6 every ten minutes utilizing an XiO-supplied submersible water level sensor.

Features to be Delivered

Qty	Item	Description
		Wells 2A, 3A, 4A, 5, 8 and Tanks 5 and 7
2	**Pump Controller**	Pump Controller provides up-to-the-minute views of pump operation. Monitors and controls two pumps. Contactor relays are provided to operate the pumps. Provides reports on electrical energy used by well pump, water production reports and pump efficiency reports. Advanced correlation alarms notify users of low flows and pump failures. Historical pump runtimes are included in the package. Pricing includes: • One FIU • Two contactor relays • Two RMS electrical current sensor each with 10 feet of shielded 600V cable, approved for use inside electrical enclosures. • Inputs to monitor a water meter
1	**Pump Monitoring and Control**	Pump Monitoring and Control provides the ability to monitor and control one pump. Provides reports on pump run times and electrical energy used. Pricing includes: • RMS electrical current sensor with 10 feet of shielded 600V cable, approved for use inside electrical enclosures. • Inputs to monitor a water meter.
1	**Analog Signal Isolation**	Isolated inputs provide galvanic isolation to monitor any externally powered signal or signals that are shared with another device or system. The XiO Cloud SCADA® Control System provides up-to-the-minute views of isolated inputs monitored. Pricing includes: • Galvanic Signal Isolation Module to Isolate non-loop powered 4-20mA signals.

1	**Virtual Water Meter™**	The Virtual Water Meter™ is an advanced algorithm that uses a number of values from the water system as a whole to determine flow rates instead of using a physical meter. The Virtual Water Meter™ enables a the XiO Cloud SCADA® system to monitor and report flow rates and total flow from a tank without additional hardware. This substantially lowers the costs of hardware, installation, calibration, labor, and maintenance required with a physical meter.
1	**Tank Monitoring with Submersible Pressure Sensor**	Tank Monitoring provides up-to-the-minute views of an additional tank level. Provides the XiO Cloud SCADA® system with the ability to adjust well operation based on tank levels. Alarms notify users of a high and low levels. Pricing includes: • Submersible Water Level Management Sensor with 50 feet of water-tight, connectorized, low-loss, shielded cable for easy installation.
1	**Cloud-Link Cellular Modem Package**	Provides secure access to the XiO Cloud SCADA® servers. Housed in a NEMA-4X enclosure.
	REG 1 and 2	
2	**Custom Controller**	The custom controller is pre-configured for up to a total of 12 inputs and outputs. All inputs and outputs provided by the custom controller are managed on the secure cloud server and provide up-to-the-minute-views of system operation. Pricing includes: • Pre-configured FIU
4	**System Pressure Monitoring**	Monitors system pressure. Provides the XiO Cloud SCADA® system with the ability to monitor system pressure and notifies users of low pressure. Pricing includes: • Pressure Sensor with 20 feet of water-tight, connectorized, low-loss, shielded cable for easy installation.
2	**Dry Contact Monitoring**	Monitors the status of a dry contact and will allow for alarms assigned to specific values.
2	**Cloud-Link Cellular Modem Package**	Provides secure access to the XiO Cloud SCADA® servers. Housed in a NEMA-4X enclosure.

	Well 6	
1	**Well Controller without Submersible Water Level Sensor**	Well Controller provides up-to-the-minute views of well operation. Monitors well pump. Provides reports on electrical energy used by well pump, water production reports and pump efficiency reports. Advanced correlation alarms notify users of low flows and pump failures. Historical pump runtimes are included in the package. Provides flow rates and total flow from the well. *water production reports and flow require a water meter to be connected. Pricing includes: • One FIU • RMS electrical current sensor with 10 feet of shielded 600V cable, approved for use inside electrical enclosures. • Inputs to monitor a water meter
1	**System Pressure Monitoring**	Monitors system pressure. Provides the XiO Cloud SCADA® system with the ability to monitor system pressure and notifies users of low pressure. Pricing includes: • Pressure Sensor with 20 feet of water-tight, connectorized, low-loss, shielded cable for easy installation.
1	**Cloud-Link Cellular Modem Package**	Provides secure access to the XiO Cloud SCADA® servers. Housed in a NEMA-4X enclosure.
	Well 11	
1	**Well Controller without Submersible Water Level Sensor**	Well Controller provides up-to-the-minute views of well operation. Monitors well pump. Provides reports on electrical energy used by well pump, water production reports and pump efficiency reports. Advanced correlation alarms notify users of low flows and pump failures. Historical pump runtimes are included in the package. Provides flow rates and total flow from the well. *water production reports and flow require a water meter to be connected. Pricing includes: • One FIU • RMS electrical current sensor with 10 feet of shielded 600V cable, approved for use inside electrical enclosures. • Inputs to monitor a water meter

1	**System Pressure Monitoring**	Monitors system pressure. Provides the XiO Cloud SCADA® system with the ability to monitor system pressure and notifies users of low pressure. Pricing includes: • Pressure Sensor with 20 feet of water-tight, connectorized, low-loss, shielded cable for easy installation.
1	**PtP-Link IP Radio with Yagi Antenna**	Provides communication between sites. Includes 50 feet of shielded ethernet cable for easy installation.
	Tanks 2, 4, and 8	
1	**Tank Controller with Submersible Water Level Sensor**	Tank Controller provides up-to-the-minute views of tank levels. Provides the XiO Cloud SCADA® system with the ability to adjust well operation based on tank levels. Alarms notify users of a high and low tank levels. Pricing includes: • One FIU • Submersible Water Level Management Sensor with 50 feet of water-tight, connectorized, low-loss, shielded cable for easy installation. • Inputs to monitor a water meter
1	**PtP-Link IP Radio with Yagi Antenna**	Provides communication between sites. Includes 50 feet of shielded ethernet cable for easy installation.
1	**Cloud-Link Cellular Modem Package**	Provides secure access to the XiO Cloud SCADA® servers. Housed in a NEMA-4X enclosure.
	Tanks 3 and 6	
2	**Field Monitoring Unit with Solar Power Package**	Field Monitoring Unit provides near real-time views of up to four monitored inputs. Includes complete solar kit for the FMU. Perfect for remote sites without AC Power. Pricing includes: • FMU housed in a NEMA-4X enclosure • Cellular Modem to provide secure access to the XiO Cloud SCADA® servers • 30W Solar Panel • Solar Panel Mounting Bracket and Hardware • 18Ah Replaceable Battery with NEMA-4X Enclosure

2	**Tank Monitoring with Submersible Pressure Sensor**	Tank Monitoring provides up-to-the-minute views of an additional tank level. Provides the XiO Cloud SCADA® system with the ability to adjust well operation based on tank levels. Alarms notify users of a high and low levels. Pricing includes: • Submersible Water Level Management Sensor with 50 feet of water-tight, connectorized, low-loss, shielded cable for easy installation.

XiO Pricing Model
XiO's pricing model reflects our core values. We maintain an ongoing relationship through excellent service, predicable cost, and ensuring the overall health of your water system.

Hardware Price
There is a one- time, low cost for the hardware.
- *Payment plans are available upon qualification.*

XiO Hardware Estimate for Sheep Creek Water Company Water System **$73,312**
*Estimate subject to change pending confirmation call with XiO Engineer.**

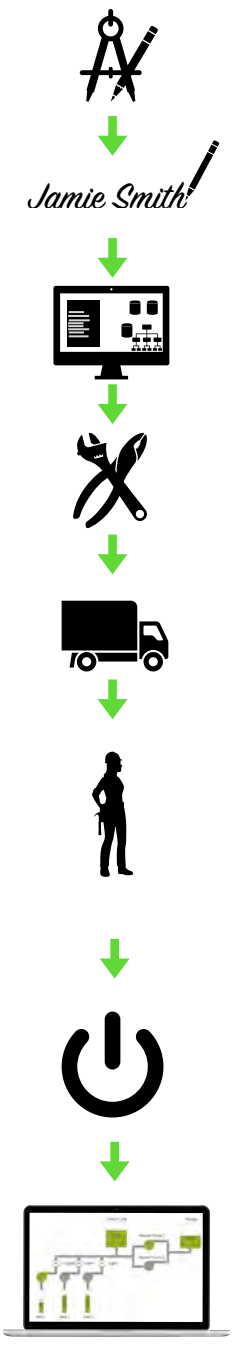
Cloud Service
XiO is the first company to offer SCADA as an ongoing service. Our customers know exactly what their ongoing service costs will be for their XiO SCADA system. Cloud Service may be billed monthly or annually. **There is no minimum contract or commitment to use this service.**

Pricing:
$39/mo. Per Controller (FIU)
$35/mo. Per Modem
$41/mo. Per Field Monitoring Unit (FMU)

XiO Cloud Service Estimate for Sheep Creek Water Company Water System: **$530/ month**
*Estimate subject to change pending confirmation call with XiO Engineer.**

Includes:
- Full-Featured Cloud Application (Browser Based)
- Extended Warranty on Hardware.
- Unlimited Historical Data Storage
- Continuous Data Backups
- Continuous Software/ Feature Upgrades
- 24/7 No-Cost Remote Support
- Unlimited Users
- Custom Reporting
- Constant Security Updates

Next Steps



Design
An XiO engineer covers specific details about your water system (make/model of equipment, operational schemes, etc.).

Confirm
XiO provides a detailed proposal including price and estimated delivery timeline. Signing this document begins the building process.

Configure
XiO configures the Field Installable Unit(s) to the specifications in the design documents.

Build & Test
XiO builds and tests your system at our facility in California. A project manager will contact you with questions as they go through the process.

Ship
All systems ship UPS Ground. The project manager calls to notify you of estimated delivery date and schedule remote installation support.

Install
Installation is done by any licensed electrician. XiO does not install but will be available for remote support. It is best to have your electrician reach out to the project manager prior to installation day. Contact your XiO representative for assistance in finding an electrician if you do not have one already.

Startup
An XiO support professional guides the operators and installers through the startup procedure. This procedure tests all sensors, operational functions, and alarms. You may also schedule a cloud portal orientation.

Manage
You're now up and running with your XiO Cloud SCADA® Control System! You'll have access to unlimited data and continuous software updates will always keep your system up-to-date. We may reach out periodically to see how things are going.

Nick Liles
XiO, Inc. | www.xiowatersystems.com | 415-900-4503

Appendix K – Consolidation Evaluation – Sheep Creek Water Company

Consolidation Evaluation
Sheep Creek Water Company

Prepared for:

State Water Resources Control Board
Division of Financial Assistance

Proposition 1
Technical Assistance
Program

Grant Agreement No. D16-12810

April 2018

California
Rural Water Association

Table of Contents

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A. Introduction

Sheep Creek Water Company (Sheep Creek) is a private, share-holder owned water utility that is located in the incorporated community of Phelan, in western San Bernardino County. Sheep Creek applied to the State Water Resources Control Board (SWRCB) to participate in the Proposition 1 Technical Assistance (TA) Program. The Sheep Creek TA Work Plan consists of seven tasks:

Task 1. Needs Assessment and Work Plan
Task 2. Income Survey
Task 3. Consolidation Evaluation (Conceptual Evaluation of Potential Consolidation Opportunities)
Task 4. Preliminary Engineering Report
Task 5. Environmental Compliance
Task 6. DWSRF Finding Application
Task 7. Post-Application Support

This current document is Task 3 - “Conceptual Evaluation of Potential Consolidation Opportunities”. This report focuses on the opportunities for an entity to resolve its operational issues through partnering with one or more neighboring districts. The results of this investigation do not draw a conclusion as to consolidating or creating a new entity. The State Water Resources Control Board (SWRCB) has identified three potential opportunities for one entity to partner with one or more additional entities. These are:

A - Local Resource Sharing: As the name suggests, this involves sharing of such resources between the partnering agencies such as operational staff, specialized equipment, minor construction activities, meter reading, book keeping, chemical and material supply purchases, system monitoring and reporting, or any other specialized activity and associated costs. One of the most common sharing of local resources is a mutual aid agreement which enables emergency responders to lend assistance across jurisdictional boundaries. It can also involve sharing water during an emergency. Two or more agencies can also decide to have an ‘extension of service’, which is a water service agreement wherein one entity purchases water from the other but is responsible for operating and maintaining its own infrastructure within its boundaries.

B - Water System Consolidation: Two or more entities would physically connect their individual water supply, distribution, treatment or storage systems (or portions thereof). These joined water system (Restructured Water System) would be responsible for operating and maintaining the entire distribution system. A water service agreement would be written to transfer legal rights and liabilities of the infrastructure and related operational assets to the Restructured Water System. For a mutual water company, since each customer has individual

deeded ownership of the company, a different water service agreement would be required between each owner and the Restructured Water System.

C - Regionalization: This type of consolidation is the merger of three or more water systems, often resulting in the formation of a much bigger public water supply entity. The physical proximity of cooperating agencies must allow a cost-effective merger for this kind of partnering. Although initial cost for this exercise can be high, it benefits all communities in the long term.

B. Background and System Description

Sheep Creek is a stock holder – owned, private water company serving a portion of the community of Phelan, which is located on the southwest side of San Bernardino County south of Highway 18. As can be seen in Figure 1, below, Sheep Creek is mostly surrounded by the Phelan-Pinion Hills Community Services District (PPHCSD). As also can be seen, there is a small portion of Sheep Creek that includes Wrightwood, a residential area where five wells, a tunnel and several storage tanks are located.

Hydro-geologically, Sheep Creek overlays two adjacent groundwater basins – Mojave Basin on the east and Antelope Valley Basin on the west. The Sheep Creek Water Company was established on December 5, 1913 with the use of water from Swarthout Canyon as the primary water source for the community.

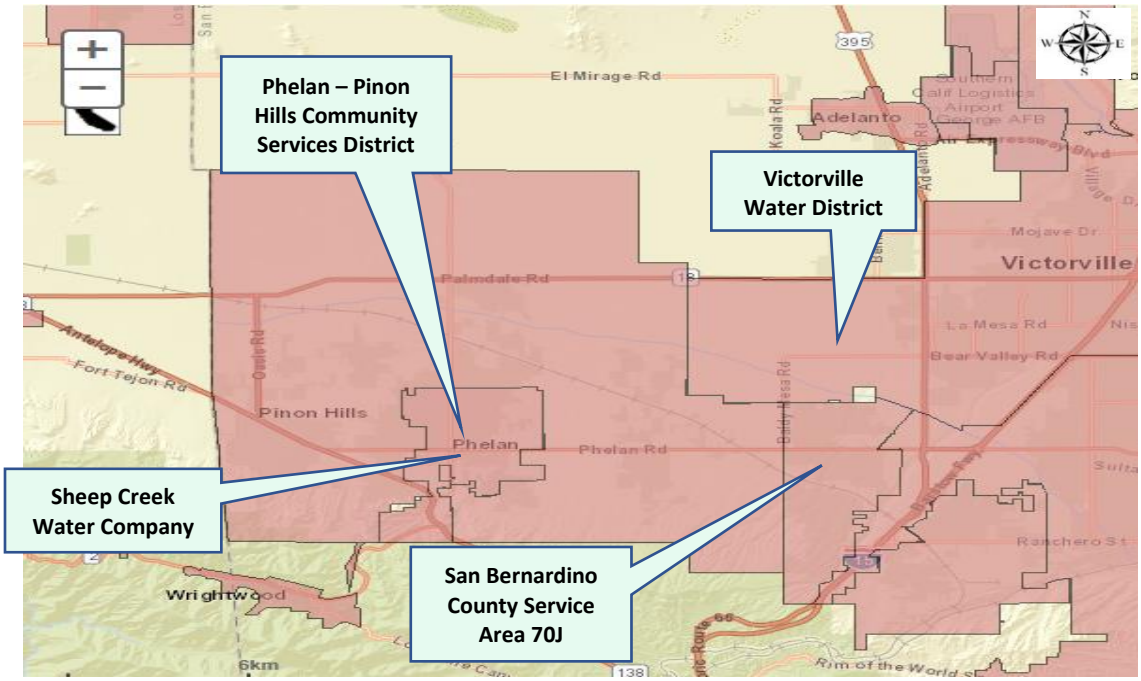

Figure 1: Location Map of Sheep Creek Water Company

This groundwater water supply is largely dependent on snowpack in the mountainous area above Swarthout Canyon. During the 1920's and 1930's Sheep Creek received a water right for 3,000 acre-feet per year for this water source. Over the years a tunnel and pipeline were built to supply water to the Sheep Creek system. Later, five groundwater wells were drilled in the canyon to serve the needs of the growing community.

The distribution system consists of approximately 45 miles of water pipelines serving about 1170 connections in eight pressure zones. The majority of the connections are residential. There are seven storage reservoirs, two of which are welded steel and the remaining 5 tanks are of bolted steel construction. In all, the total storage capacity available is 6.1 MG. Groundwater is chlorinated at the well site and subsequently stored in the reservoirs before being gravity fed into the distribution system.

C. System Deficiencies and Scope of Technical Assistance

The following paragraphs provides a brief overview of deficiencies identified in the Sheep Creek water system.

Water Supply: The most significant issue faced by Sheep Creek in recent years is the decline in static water levels in the wells in Swarthout Canyon. Sheep Creek relies solely on the water produced from groundwater in Swarthout Canyon, and production rates from the wells have been significantly reduced in recent years. During the ten-year period between 2007 and 2017 the production rate dropped from 1,102.02 Acre Feet (AF) to 686.61 AF.

Monthly groundwater levels show a seasonal variation between wet season recovery and dry season usage. The wet season recovery was not as large in 2013 as in 2007, but the summer draw-down of water levels in the wells has not been as great, possibly due to water conservation measures by Sheep Creek.

Responding to the dropping groundwater levels and declining production, the Sheep Creek Board of Directors began implementing water allotment reductions. Each share owned by a stock-holder of the company is assigned a monthly water allocation. In the summer of 2016, allocation for the first share was temporarily cut to only 500 ccf per share. In May, 2017 the Board of Directors approved an allotment of 1,000 ccf (100 cubic feet) of water for first-shares, and 350 ccf for all remaining shares held by an account, which was further cut back to 250 ccf for remaining shares in April, 2018. Water allotments are calculated based on 8,000 available shares and billed monthly.

Consumption has also dropped between 2007 and 2017 – dropping from 809 AF (2007) to 558.38 AF (2017). This reduction can be attributed to two events; the state mandated drought restrictions as well as water allotment cuts by Sheep Creek.

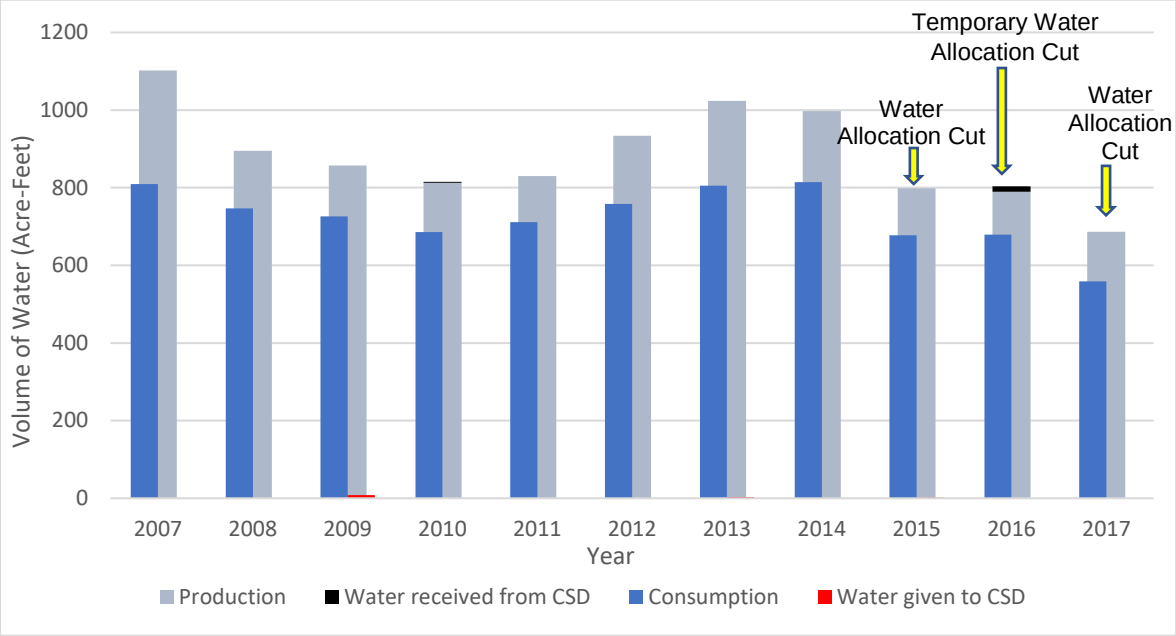

Figure 2: Production vs. Consumption Data

Over the past ten years improvements have been made to the system to increase supply and reliability. The improvements include:

- Construction of Well 8
- Construction of Well 2A
- Rehabilitation of Well 5
- Installation of variable frequency motor drives to control well pumping speeds
- Construction of a 3 million-gallon welded steel storage tank

Sheep Creek is drilling a new well (Well 11) in 2018 to secure a new source of water to increase water supply and redundancy for the community. The new well will be located roughly in the center of the Sheep Creek service area, on a property in the vicinity of Smoke Tree and Monte Vista roads. Because the location of the new well is in the Alto subarea of the Mojave Basin, Sheep Creek requested and became a stipulating party to the Mojave Basin Area Adjudication for the water produced from the well. If the well produces water, Sheep Creek will not have a water allotment, but instead be required to pay the Mojave Water Agency for the water. The adequacies of the supply and the water quality are not known at this time.

D. Consolidation Viability

The only viable candidate for resource sharing is between Sheep Creek and the Phelan-Pinon Hills Community Services District (PPHCSD). Consolidation with the Victorville Water District would not be practical because PPHCSD surrounds Sheep Creek separating it from the Victorville Water District.

D.1 – Phelan-Piñon Hills Community Services District

The Phelan-Piñon Hills Community Services District is a retail water provider that serves the unincorporated communities of Phelan and Piñon Hills in San Bernardino County and is a part of the Mojave Water Agency. It was established in 2008 by consolidation of three special districts in the area, encompassing a total area of 128 square miles. It is the largest community services district in San Bernardino County and provides water treatment and supply, park and recreation, solid waste and recycling, and street lighting services to a population of about 20,000 people. The total water demand is about 2,800 AFY.

PPHCSD has nine groundwater wells located within the Oeste subarea of Mojave basin. Two wells, one well in the Alto sub-basin and one in the Antelope Valley basin, currently provide all of the drinking water supply for the PPHCSD. It owns pumping rights to about 5,035 acre-foot/year (AFY) of water from the Mojave basin and 1,200 AFY from the recently adjudicated Antelope Valley basin. The PPHCSD has established two-way interconnections with Sheep Creek in the south, Victorville Water District on the north-east and San Bernardino County Special District 70-J in the south-east. These interties improve reliability of the system and its ability to provide safe and reliable drinking water supply in case of emergencies such as natural disasters, water shortages, fire flow, etc.

D.2 – Consolidation Interest

As a part of the technical assistance work plan, CRWA engineers met with the General Managers from both Sheep Creek and the PPHCSD to evaluate the feasibility of consolidating the two systems.

D.3 – Sheep Creek Water Company

Chris Cummings, General Manager of Sheep Creek, expressed that the Sheep Creek Board of Directors is not in favor of partnering or consolidation. This position was confirmed by Board members at the Sheep Creek Board meeting on April 5, 2018. Board members shared that: a) they have no interest in consolidating with PPHCSD, b) the shareholders have invested significant amounts of money in the water company and are concerned about return on these investments, and c) the Board of Directors want to maintain the small rural water system status for the company with low and affordable water rates.

D.4 – Phelan – Piñon Hills CSD

CRWA representatives met with Don Bartz, General Manager, Phelan-Piñon Hills Community Services District in February 2018. Mr. Bartz confirmed that PPHCSD is aware of the supply challenges faced by Sheep Creek and are willing to supply them with additional water in periods of peak demand in the coming summer months. The PPHCSD has added booster pumps within their distribution system to facilitate that transfer. Mr. Bartz indicated that the PPHCSD has sufficient water pumping rights to meet the needs of Sheep Creek's customers if partnering or consolidation happens.

E. Recommendations and Future Steps

Maintaining local control is an important factor for the Sheep Creek Water Company. Many of the common reasons for pursuing a consolidation of water systems; deteriorated physical infrastructure, lack of access to capital, limited customer and rate base, lack of economies of scale, and limited technical and managerial capabilities are not present in this case. The Sheep Creek Board of Directors is actively pursuing additional source capacity to provide an adequate water supply. However, failure to acquire or develop additional source capacity may force some level of consolidation between PPHCSD and Sheep Creek. At the time of writing this report, Sheep Creek is in the process of installing casing, screens and pump testing the new well (Well #11) mentioned earlier in this report.

Currently, there is a 12-inch intertie with PPHCSD that can be used as a source of emergency water for Sheep Creek. In the summer of 2016, Sheep Creek received 4.6 MG of water from the PPHCSD through the intertie. This was a water-for-water type agreement between the two agencies, meaning that the receiving agency simply returns an equal amount of water back to the loaning party. Sheep Creek must return or pay for 2 – 2.4 MG of water. However, Sheep Creek anticipates future transfers to cost more because of adjudication costs. There are efforts to develop an agreement to allow PPHCSD to provide water to Sheep Creek during peak summer months again in 2018.

A request for Technical Assistance was submitted to the SWRCB for assistance in securing additional water sources to address the decline in water levels, and system water losses. CRWA is preparing an Engineering Report to quantify the water supply challenges, assess the condition and capacity of existing facilities, and develop source capacity and system improvement recommendations.

The recommendations developed in the Engineering Report and the outcome of Sheep Creek's efforts to secure additional source capacity will affect future partnering and consolidation options. It is recommended that consideration of future partnering or consolidation options be deferred until the Engineering report has been completed and the viability of source capacity is known.

Appendix M – DFA Comments to Preliminary Engineering Report

CRWA received the following comments on the Preliminary Engineering Report submitted to DFA and DDW on November 19, 2018. The comments are addressed in this final report within appropriate sections, as mentioned below.

1. The **Engineering Report** must provide a cost breakdown of all alternatives and compare estimated capital costs and O&M Costs over the projected term of the financing agreement or over a 20-year period, or whichever is longer. Potential rate structures should be provided to ensure that the residents can afford the rates under each scenario.

CRWA Response: Agreed. A revenue requirements and breakdown of costs will be provided in the Final Engineering Report.

2. For the Consolidation Project, not all of the improvements listed in Alternative 2 are necessary. Phelan has already purchased three new wells on the north side of their system that they could run a pipeline to their system instead of drilling three new sources. This could result in cost savings, plus avoiding any potential detects of hex chrome that we have to deal with later.

CRWA Response: Phelan-Piñon Hills Community Services District (PPHCSD) has acquired three new wells in the northern part of their distribution system as a part of their Chromium-6 Mitigation Project. The project includes $17M worth of capital improvements to rehabilitate these wells, connect them to the existing infrastructure as well as other necessary upgrades required to blend and mitigate hexavalent chromium issues in the existing wells. However, this project is currently on hold pending new hexavalent chromium regulations. A timeline for the proposed new regulations is not known at this time.

As discussed in the Preliminary Engineering Report (PER), consolidation between SCWC and PPHCSD would likely be a protracted process due to complexities of the issues involved, including resolution of ownership structure of SCWC and the presence of hexavalent chromium in PPHCSD water. SCWC is in urgent need of additional water sources to fulfil demand during summer months, and expedited action is required to fulfil the requirements of the citation issued to the system by Division of Drinking Water (DDW). Hence, construction of new wells is recommended. Should consolidation happen, this additional source capacity will support future demand for the consolidated system.

3. Tank maintenance is not critical as both Phelan and Sheep Creek have adequate storage in both of their systems. Is a tank needed at the transfer area for the booster feed?

CRWA Response: Tank rehabilitation is prioritized as third in the list of recommended upgrades. Since

it is not critical to short term operation of the SCWC system, the cost of tank rehabilitation will be removed from the total project cost in the Final Engineering Report.
However, tank improvements are required to ensure long term sustainability of the system. Hence, the Capital Improvement Plan (CIP) should include a budget for tank upgrades and/or replacement as required.
Preliminary hydraulic analysis of SCWC system around Tank 6 shows that a booster pump station should be sufficient to meet the average daily demand of the surrounding area. However, at the time of consolidation, a detailed hydraulic analysis of the combined system should be performed to make sure that storage is adequate to meet diurnal patterns as well as fire flow in the area.

4. The limit for construction funding is **$5 million** dollars and the recommended Alternative 2 is at **$12,221,290**. The project should focus on improvements to address the main issue of Inadequate Source Capacity to reduce Alternative 3 – Consolidation.
CRWA Response: Inadequate source capacity is the most critical issue for SCWC. Three new wells are needed to secure additional source capacity, which can be accomplished using the construction funding of $5 million. Additionally, it is recommended that SCWC develop a CIP to appropriately plan and fund the remaining system upgrades.