



MEMO

To: Kristopher Byrd, Well Construction and Compliance Section Manager
From: Joel Jeffery, Well Construction Program Coordinator
Subject: Review of Limited License Applications LL-1726 1728
Date: August 30, 2018

The attached application was forwarded to the Well Construction and Compliance Section by Water Rights. Darrick Boschmann reviewed the application. Please see Darrick's Groundwater Review and the Well Information Reports.

Applicant's Well SVE #1 (LAKE 52530): The only reports that exist for this well are a Department generated information report and an oil or gas well lithographic description. A Water Supply Well Report does not exist. Because there is no water supply well report certified by a licensed well constructor for this well, the Department is not able to determine if the construction of the well meets minimum well construction standards. (See OAR 690 Division 210).

My recommendation is that the Department **not issue** a permit for Applicant's Well SVE #1 (LAKE 52530) unless it is brought into compliance with current minimum well construction standards or information is provided showing that it is in compliance with current minimum well construction standards.

Applicant's Well SVE #2 (LAKE 52529): The only reports that exist for this well are a Department generated information report and an oil or gas well lithographic description. A Water Supply Well Report does not exist. Because there is no water supply well report certified by a licensed well constructor for this well, the Department is not able to determine if the construction of the well meets minimum well construction standards. (See OAR 690 Division 210).

My recommendation is that the Department **not issue** a permit for Applicant's Well SVE #2 (LAKE 52529) unless it is brought into compliance with current minimum well construction standards or information is provided showing that it is in compliance with current minimum well construction standards.

Applicant's Well SVE #3 (LAKE 52812): The only reports that exist for this well are a Department generated information report, an oil or gas well lithographic description, and an oil or gas well summary report. A Water Supply Well Report does not exist. Because there is no water supply well report certified by a licensed well constructor for this well, the Department is not able to determine if the construction of the well meets minimum well construction standards. (See OAR 690 Division 210).

My recommendation is that the Department **not issue** a permit for Applicant's Well SVE #3 (LAKE 52812) unless it is brought into compliance with current minimum well construction standards or information is provided showing that it is in compliance with current minimum well construction standards.

Bringing Applicant's Wells SVE #1, SVE #2 and SVE #3 into compliance with minimum well construction standards may not satisfy hydraulic connection issues.

LAKE 52530

WELL I.D. # L _____

(1) LAND OWNER Well Number SVE #1
 Name Colahan Enterprises
 Address P.O. Box 300
 City Paisley State OR Zip 97636

(2) TYPE OF WORK
 New Well Deepening Alteration (repair/recondition) Abandonment

(3) DRILL METHOD:
 Rotary Air Rotary Mud Cable Auger
 Other _____

(4) PROPOSED USE:
 Domestic Community Industrial Irrigation
 Thermal Injection Livestock Other _____

(5) BORE HOLE CONSTRUCTION:
 Special Construction approval Yes No Depth of Completed Well 1360 ft.
 Explosives used Yes No Type _____ Amount _____

HOLE				SEAL		
Diameter	From	To	Material	From	To	Sacks or pounds
	0	1360		0	900	

How was seal placed: Method A B C D E
 Other _____

Backfill placed from _____ ft. to _____ ft. Material _____
 Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	<u>13 3/8"</u>	0	900		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Liner:					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Drive Shoe used Inside Outside None
 Final location of shoe(s) _____

(7) PERFORATIONS/SCREENS:

From		To		Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
								<input type="checkbox"/>	<input type="checkbox"/>

(8) WELL TESTS: Minimum testing time is 1 hour

Yield gal/min	Drawdown	Drill stem at	Time 1 hr.
<u>~1,000</u>			

Temperature of water _____ Depth Artesian Flow Found _____
 Was a water analysis done? Yes By whom _____
 Did any strata contain water not suitable for intended use? Too little
 Salty Muddy Odor Colored Other _____
 Depth of strata: _____

(9) LOCATION OF WELL by legal description:
 County LAKE Latitude _____ Longitude _____
 Township 33 S N or S Range 18 E E or W. WM.
 Section 23 1/4 _____ 1/4 _____
 Tax Lot _____ Lot _____ Block _____ Subdivision _____
 Street Address of Well (or nearest address) 2,050 ft N & 1,370 ft E
from SW corner of section 23

(10) STATIC WATER LEVEL:
 _____ ft. below land surface. Date _____
 Artesian pressure _____ lb. per square inch Date _____

(11) WATER BEARING ZONES:

Depth at which water was first found _____

From	To	Estimated Flow Rate	SWL

(12) WELL LOG:

Ground Elevation _____

Material	From	To	SWL
<u>See attached</u>			

Date started _____ Completed _____

SOURCE OF DATA/INFO
File T-11860
File LL-1450

COMPILED BY: Gerald Grendin
OWRD Groundwater Section

DATE: 22 July 2014

LAKE 52530

LITHOGRAPHIC DESCRIPTION OF OIL OR GAS WELL

(Not required if a mud log is submitted)

STATE OF OREGON • DEPT OF GEOLOGY & MINERAL INDUSTRIES • 229 BROADALBIN ST SW • ALBANY OR 97321

(In compliance with rules and regulations pursuant to ORS 520.)

(1) Permittee Information

Name	Surprise Valley Electrification Corp.
Mailing Address	516 US Hwy 395 E
City/State/Zip	Alturas, CA 96101
Telephone	530.233.3511
Fax	530.233.2190
Email	lynnsvec@frontier.com
Prepared by	Lynn Culp, Silvio Pezzopane, Roy Mink, Kyle Makovsky

(2) Well Information

Well No.	SVE #1
DOGAMI ID No.	36-037-90009 Lake 448

General Manager

5/29/2012

Signature

Title

Date

(3) Well Cuttings

Depth		Description
From	To	
0	40	Brown clay soil and gravelly sand
40	75	Brownish-grey rounded mixed volcanic (basalt, rhyolite, andesite, tuff, pumice) gravel, qtz-rich sand
75	105	Grey quartz-rich sand, with thin brown and grey clay beds, Water Bearing (WB)
105	150	Greyish-brown mixed volcanic gravel, qtz-sand, and clay, WB
150	165	Brown mixed volcanic (basalt, rhyolite, andesite) gravel, rounded sand and clay
165	175	Brown clayey sand and mixed gravels
175	225	Blackish grey basalt gravel, w/ sand and clay beds, WB
225	240	Blackish grey to brown basalt and andesite gravel, and sand
240	305	Varicolored mixed volcanic (basalt, rhyolite, andesite, tuff) gravel and sand, w/ brown clay beds
305	360	Brown gravelly sand and brown clay beds
360	390	Varicolored (grey, brown, black, red, green) basalt, rhyolite, andesite gravel, sand, and brown clay, WB
390	415	Brownish grey and red volcanic gravel, sand, and clay, WB
415	435	Varicolored mixed volcanic gravel (basalt, rhyolite, andesite, tuff), rounded, reddish brown sand and clay
435	490	Varicolored coarse volcanic gravel, rounded, red to brown sand, brown sticky clay beds
490	530	Varicolored volcanic pebble gravel, rounded, w/ sand and reddish brown sticky clay
530	540	White calcite, black and grey basalt andesite, red rhyolite, red and grey tuff w/ brownish red sticky clay
540	575	Red sticky clay ash, vesicular and fibrous pumice clasts, minor sand, grey pebbles
575	640	Red and grey tuffs w/ altered vesicles, minor grey to greenish to black basalt, andesite, rhyolite, WB?
640	675	Red rhyolite tuff and grey andesite w/ altered vesicles, greenish basalt, blades of calcite
675	715	Light grey basalt, reddish brown and green alteration stains, altered vesicles, pyrite, euhedral calcite and quartz
715	715	Light greyish green rhyolite, reddish brown to dark purple basalt?, altered vesicles, pyrite, calcite and quartz
715	795	Dark greenish grey andesite?, dark purplish brown basalt, minor light red and white tuff, rare euhedral quartz
795	870	Dark grey to brown basalt w/ white pumice chunks, rare red and white tuff cinders, rare euhedral quartz
870	905	Dark greenish grey to dark purplish brown basalt, few pumice, rare euhedral and calcite quartz
905	920	Grey to white calcite flakes, possible fracture zone? no rock data - lost circulation, samples floated up during trip out
920	950	Brown sticky slick clay ash, large (<2 cm dia.) euhedral calcite chunks, red cinders and pumice, dries hard
950	1000	Purple, grey, and brown lithic tuff, poorly-welded?, soft waxy, sticky ashy clay, small calcite and quartz crystals
1000	1050	Green, grey, and brown andesite, alteration stains, red lithic tuff, cinders?, large euhedral calcite and quartz crystals
1050	1080	Dark greenish grey andesite, reddish purple stains, hard, fine-grained, large euhedral calcite flakes (fractures?)
1080	1100	no data - no returns
1100	1100	Red, grey, white, and brown lithic tuff or volcaniclastic sediment (depth uncertain, samples floated up during cleaning)
1100	1120	no data - no returns - lost circulation
1120	1120	Dark greenish grey andesite, reddish purple clay? stains, hard, fine-grained, red lithic tuff w/ euhedral quartz crystals, (depth uncertain, sample picked out of the drill collar)
1120	1133	no data - no returns
1133	1133	Reddish brown, lithic tuff, poorly-welded?, sticky clay, dries hard, small calcite and quartz crystals (depth uncertain, sample stuck to the drill bit face)
1133	1235	no data - no returns
1235	1315	Dark greenish grey andesite, red lithic tuff, euhedral quartz crystals, (depth uncertain, sample stuck to the bailer)
1315	1360	no data - no returns
	1360	- Total Depth

LAKE 52530



Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem Oregon 97301
(503) 986-0900
www.wrd.state.or.us

Application for
Well ID Number

RECEIVED BY OWRD

Do not complete if the well already has a Well Identification Number.

NOV 03 2014

SALEM, OR

I. OWNER INFORMATION

Current Owner Name (please print): Suprise Valley Electrification Corp. (SVEC); Attn: Lynn Culp
Mailing Address: 516 US Highway 395 E
City, State, Zip: Alturas, CA, 96101
Mail Well ID Tag to: [X] SAME AS ABOVE [] In Care Of (C/O)
Name & Address:
City, State, Zip:

II. WELL LOCATION INFORMATION (Please fill out as completely as possible)

Township: 33S (North / South) Range: 18E (East / West) Section: 23
Tax Lot: 1300 County Lake NE 1/4 of the SW 1/4
GPS Coordinates: already assigned a OWRD well Log number: LAKE 52530 - but does not have ID number
Street Address of Well, City:
If the property had a different street address in the past:

III. GENERAL WELL INFORMATION (Please fill out as completely as possible)

Use of Well (domestic, irrigation, commercial, industrial, monitoring): industrial/geothermal & irrigation
Date Well Constructed (or property built): August 2012 Total Well Depth: 1360 Casing Diameter: 13 3/8 "
Owner at time the well was constructed (if known): SVEC is well owner - Colahan's own the property
Other Information: Well name: SVE-1

SUBMITTED BY (please print): Lynn Culp
PHONE: (530) 233-3511 EMAIL &/or FAX: lynnsvec@frontier.com

Send application to: Oregon Water Resources Department 725 Summer St NE, Suite A, Salem, Oregon 97301; or fax to (503) 986-0902. Applications are processed in the order they are received, and Well ID Numbers are mailed within 4-5 business days.

For Official Use Only by the Oregon Water Resources Department.
Received Date: 11-3-14
Well Log Number: LAKE 52530
Well Identification #: L-117043

LAKE 52529

LITHOGRAPHIC DESCRIPTION OF OIL OR GAS WELL

(Not required if a mud log is submitted)

STATE OF OREGON • DEPT OF GEOLOGY & MINERAL INDUSTRIES • 229 BROADALBIN ST SW • ALBANY OR 97321

(In compliance with rules and regulations pursuant to ORS 520.)

(1) Permittee Information

Name	Surprise Valley Electrification Corp.
Mailing Address	516 US Hwy 395 E.
City/State/Zip	Alturas, CA 96101
Telephone	530.233.3511
Fax	530.233.2190
Email	lynnsvec@frontier.com
Prepared by	Lynn Culp, Kyle Makovsky, Roy Mink, Silvio Pezzopane

(2) Well Information

Well No.	SVE #2
DOGAMI ID No.	36-037-90027 Lake 1628

General Manager

5/29/2012

Signature

Title

Date

(3) Well Cuttings

Depth		Description
From	To	
0	40	Brown clay soil and gravelly sand
40	60	Light brown ash fragments, reddish rhyolite, black basalt, minor calcite/quartz
60	80	Light brown/grey ash, red rhyolite, black basalt, cinders, rounded grains, black and red cuttings magnetic
80	105	Light grey/brown ash, red rhyolite, black basalt, rounded grains, chert and obsidian magnetic
105	125	Light grey/brown ash, red rhyolite, black basalt, rounded grains, purple, orange alteration, green stone
125	155	Grey/brown ash, red rhyolite, black basalt, rounded grains, black and grey chips magnetic, light tan pumice fragments
155	185	Grey/brown ash, red rhyolite, black basalt, magnetic, white/grey pumice green stone, minor alteration stains
185	210	Grey/brown rhyolite, red rhyolite with alteration, black basalt, white/grey pumice
210	245	Grey/brown rhyolite, red rhyolite, black basalt, light brown pumice
245	300	Grey/brown rhyolite, red and brown rhyolite, black basalt, pumice, rounded grains
300	340	Brown/grey rhyolite, rounded w/ some alteration, light grey tuff, black basalt/rhyolite; light grey tuff, feldspar chips
340	360	Grey/light brown rhyolite, dark grey/black rhyolite, light red/yellow altered rhyolite, some chips rounded
360	410	Grey/brown rhyolite, dark grey/black basalt, light red/yellow altered rhyolite, grey/white pumice, rounded pebbles
410	420	Black basalt, light brown rhyolite, some alteration
425	430	no data - no returns
435	460	Black basalt, light brown/grey rhyolite, red altered rhyolite
460	465	Fine sand of light brown/grey rhyolite, black basalt/rhyolite; light brown/red altered rhyolite
465	475	Light brown/grey rhyolite, black basalt/rhyolite, yellow/red altered rhyolite
475	490	Large amount fine sand, smaller cuttings are same as above with white alteration/pumice
490	510	Altered tuff, light grey to reddish brown to dark brown, waxy texture, amorphous silica present
510	530	no data - no returns
530	565	Dark to light gray basalt, andesite, white and green alteration minerals
565	620	Porphyritic basalt and andesite, pink/dark green/white alteration, opaline quartz, amorphous silica, calcite rhombs
620	695	Dark gray, green, purple, and red basalt, amorphous silica, euhedral quartz, and calcite in vesicles
695	710	Porphyritic andesite, opaline quartz
710	790	Gray green and red basalt, altered, fibrous banded white mineral, calcite rhombs, crystalline and opaline quartz
790	800	Olivine rich basalt, little alteration
800	815	Porphyritic andesite and basalt rock, highly altered, clear crystalline quartz, banded alteration
815	845	Amygdaloidal basalt, amygdules are green, white banded, botryoidal texture, calcite grains
845	890	Gray basalt, little to no alteration
890	905	Vesicular/amygdaloidal basalt, high amount of crystalline quartz filling vesicles
905	920	Basalt with pyrite mineralization
920	930	Gray basaltic andesite
930	960	Gray/red/purple basalt, calcite rhombs, some amygdaloidal calcite
960	1010	Dark gray and green basalt, calcite rhombs
1010	1070	Highly altered vesicular/amygdaloidal basalt, pyrite mineralization, dark green/white/pink alteration minerals
1070	1260	no data - no returns
	1260	- Total Depth

LAKE 52529



Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem Oregon 97301
(503) 986-0900
www.wrd.state.or.us

Application for
Well ID Number

RECEIVED BY OWRD

Do not complete if the well already has a Well Identification Number.

NOV 03 2014

SALEM, OR

I. OWNER INFORMATION

Current Owner Name (please print): Surprise Valley Electrification Corp. (SVEC); Attn: Lynn Culp
Mailing Address: 516 US Highway 395 E
City, State, Zip: Alturas, CA, 96101
Mail Well ID Tag to: [X] SAME AS ABOVE [] In Care Of (C/O)
Name & Address:
City, State, Zip:

II. WELL LOCATION INFORMATION (Please fill out as completely as possible)

Township: 33S (North / South) Range: 18E (East / West) Section: 23
Tax Lot: 1300 County Lake SW 1/4 of the NE 1/4
GPS Coordinates: already assigned a OWRD well Log number: LAKE 52529 - but does not have ID number
Street Address of Well, City:
If the property had a different street address in the past:

III. GENERAL WELL INFORMATION (Please fill out as completely as possible)

Use of Well (domestic, irrigation, commercial, industrial, monitoring): industrial/geothermal & irrigation
Date Well Constructed (or property built): Feb 2012 Total Well Depth: 1260 Casing Diameter: 13 3/8"
Owner at time the well was constructed (if known): SVEC is well owner - Colahan's own the property
Other Information: Well Name: SVE-2

SUBMITTED BY (please print): Lynn Culp
PHONE: (530) 233-3511 EMAIL &/or FAX: lynnsvec@frontier.com

Send application to: Oregon Water Resources Department 725 Summer St NE, Suite A, Salem, Oregon 97301; or fax to (503) 986-0902. Applications are processed in the order they are received, and Well ID Numbers are mailed within 4-5 business days.

For Official Use Only by the Oregon Water Resources Department.
Received Date: 11-3-14
Well Log Number: LAKE 52529
Well Identification #: L-117044

LAKE 52812

WELL I.D. # L

(1) LAND OWNER Well Number SVE #3
Name: Surprise Valley Electrification Corp.
Address: 516 US HWY 395 E
City: Alturas **State:** CA **Zip:** 96101

(2) TYPE OF WORK
 New Well Deepening Alteration (repair/recondition) Abandonment

(3) DRILL METHOD:
 Rotary Air Rotary Mud Cable Auger
 Other _____

(4) PROPOSED USE:
 Domestic Community Industrial Irrigation
 Thermal Injection Livestock Other _____

(5) BORE HOLE CONSTRUCTION:
 Special Construction approval Yes No Depth of Completed Well 2705 ft.
 Explosives used Yes No Type _____ Amount _____

HOLE		SEAL				Sacks or pounds
Diameter	From	To	Material	From	To	
SEE ATTACHED						

How was seal placed: Method A B C D E
 Other _____

Backfill placed from _____ ft. to _____ ft. Material _____
 Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

Casing:	Diameter	From	To	Gauge	Material			
					Steel	Plastic	Welded	Threaded
SEE ATTACHED					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Liner:	Diameter	From	To	Gauge	Material			
					Steel	Plastic	Welded	Threaded
					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Drive Shoe used Inside Outside None
 Final location of shoe(s) _____

(7) PERFORATIONS/SCREENS:

Perforations		Screens		Material			
From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
SEE ATTACHED						<input type="checkbox"/>	<input type="checkbox"/>

(8) WELL TESTS: Minimum testing time is 1 hour

Yield gal/min	Drawdown	Drill stem at	Time 1 hr.	Flowing	
				<input type="checkbox"/> Pump	<input type="checkbox"/> Artesian
				<input type="checkbox"/> Bailer	<input type="checkbox"/> Air

Temperature of water _____ Depth Artesian Flow Found _____
 Was a water analysis done? Yes By whom _____
 Did any strata contain water not suitable for intended use? Too little
 Salty Muddy Odor Colored Other _____
 Depth of strata: _____

(9) LOCATION OF WELL by legal description:
 County LAKE Latitude 42.697929 Longitude -120.548951
 Township 33 S N or S Range 18 E E or W. WM.
 Section 24 SW 1/4 NW 1/4
 Tax Lot _____ Lot _____ Block _____ Subdivision _____
 Street Address of Well (or nearest address) _____

(10) STATIC WATER LEVEL:
 _____ ft. below land surface. Date _____
 Artesian pressure _____ lb. per square inch Date _____

(11) WATER BEARING ZONES:
 Depth at which water was first found _____

From	To	Estimated Flow Rate	SWL

(12) WELL LOG:
 Ground Elevation _____

Material	From	To	SWL
SEE ATTACHED			

Date started 7/25/2012 Completed 8/17/2012

SOURCE OF DATA/INFO
APPLICATION MATERIALS LL-1726; LL-1127; LL-1128
DOGAMI FILES

COMPILED BY: D. BOSCHMANN
OWRD GROUNDWATER SECTION

DATE: 01/10/2018

WELL INFORMATION REPORT

11/16/2000

LAKE 52812

LITHOGRAPHIC DESCRIPTION OF OIL OR GAS WELL

(Not required if a mud log is submitted)

STATE OF OREGON • DEPT OF GEOLOGY & MINERAL INDUSTRIES • 229 BROADALBIN ST SW • ALBANY OR 97321

(In compliance with rules and regulations pursuant to ORS 520.)

(1) Permittee Information

Name	Surprise Valley Electric
Mailing Address	516 U.S. Hwy. 395E
City/State/Zip	Alturas, California 96101
Telephone	866-843-2667 530-233-3511
Fax	
Email	
Prepared by	Lynn Culp, Roy Mink, Silvio Pezzopane

(2) Well Information

Well No.	SVE-3
DOGAMI ID No.	

RECEIVED BY OWRD

RECEIVED

DEC 04 2017

JAN 02 2018

SALEM, OR

OWRD

Signature

Title

Date

(3) Well Cuttings

Depth		Description
From	To	
0	10	Brown sandy soil and gravelly sand; mix of volcanic lithologies (basalt, rhyolite, andesite, tuff, pumice)
10	40	Brownish-gray rounded fine gravel; mixed volcanic (basalt, rhyolite, andesite, obsidian, tuff, pumice), qtz-rich sand
40	100	Brownish-gray rounded medium to coarse (cobble) gravel; mixed volcanic (as above)
100	180	Dark brownish-gray rounded sand and gravel; mixed volcanic (as above)
180	230	Light-dark brownish-gray rounded medium (pebble) gravel; mixed volcanic (as above)
230	310	Brownish-gray rounded sand and coarse gravel; mixed volcanic (as above), qtz and detrital sand, brown silt and clay
310	440	Dark brownish gray rounded basalt gravel; olivine? phenocrysts rusty yellowish green, minor varicolored tuff and cinders
440	460	Brownish-gray rounded sand and medium gravel; mixed volcanic (as above), qtz and detrital sand, brown clay
460	490	Light-dark brownish gray rounded basalt gravel; phenocrysts rusty yellowish green, minor varicolored tuff and cinders
490	560	Brownish-gray rounded medium (pebble) gravel; mixed volcanic lithologies (as above), sand, brown clay
560	600	Brown sticky clay ash; dark brownish gray basalt gravel; weakly cemented qtz sand and ash fragments
600	660	Brownish-gray rounded pebble gravel; mixed volcanic lithologies, sand, brown clay
660	720	Reddish brown sticky clay ash; lithics of varicolored tuff; rounded pebble gravel, white, red, and black cinders, qtz sand
720	820	Grayish brown clay ash; soft red, olive gray to brown tuff; rounded basalt pebble gravel, w/pumicite and obsidian
820	860	Light olive brown clay ash; chunks soft red and brown non-welded tuff; rounded basalt pebble gravel
860	880	Reddish brown clay ash; chunks olive, red, and brown non-welded tuff; rounded pebble gravel, olive green clay coatings
880	920	Light olive to grayish brown clay ash; waxy red, white, and brown tuff and ash fragments; rounded basalt pebble gravel
920	970	Reddish brown clay ash; waxy olive, red, and brown tuff; weakly cemented qtz sand and ash fragments
970	1040	Brown clay ash; white pumicite, qtz sand, rounded olive and red welded tuff granules, cinders and ash fragments
1040	1140	Reddish brown clay ash; chunks of waxy olive, red, and light gray tuff; weakly cemented qtz sand and ash fragments
1140	1240	Red sticky clay ash; lithics of cinders and qtz ash fragments; whitish, red and gray tuff, rounded obsidian/basalt pebbles
1240	1290	Dark olive brown clay ash; red and olive gray non-welded tuff; rounded qtz, obsidian grains
1290	1350	Dark gray clay and ash; red and gray tuff; rounded basalt pebbles; calcite/qtz (chalcedony?) coatings/fillings
1350	1490	Dark olive gray to black, partially-welded vitric lithic tuff; red and gray tuff; clay, calcite/qtz fillings/cement?
1490	1540	Dark olive gray to black, moderately-welded vitric tuff; varicolored tuff lithics; calcite/qtz fillings/cement
1540	1630	Black partially-welded lithic tuff (50%); brown clay ash (20%), varicolored tuff (30%); calcite/qtz blades/fillings/cement
1630	1730	Reddish brown clay ash (60%); black to olive and varicolored tuffs (40%); calcite/qtz euhedral, blades/coatings
1730	1840	Black to dark olive partially-welded lithic tuff (60%); brown and gray tuff (40%); calcite/qtz in blades/fillings/cement
1840	1910	Black to dark olive partially-welded lithic tuff (50%); brown and gray tuff (50%); calcite/qtz in blades/fillings/cement
1910	1920	Reddish brown clay ash (60%); olive to black, and varicolored tuff (30%); calcite/qtz blades, rounded pebbles
1920	1990	Dark gray to black partially-welded tuff (60%); brown and gray ash tuff (40%); calcite/qtz fillings/cement
1990	2090	Olive gray to black moderately-welded vitric tuff (80%); white, red and gray ash tuff (<20%); chalcedony, FeO stains?
2090	2210	Light gray to white ash tuff (90-20%); black to olive gray tuff (20-70%), brown, red, and gray tuff (2-15%); qtz
2210	2370	Dark reddish brown lithic non-welded (ash) tuff (70-90%); red, white, black, and olive gray tuff (10-30%); calcite/qtz
2370	2410	Light bluish to greenish gray ash tuff (90-20%); brown, red, black, white, olive tuff (20-70%); calcite/euhedral qtz
2410	2430	Dark reddish brown lithic ash tuff (50-70%); greenish gray tuff (20-30%), red, gray, and black tuff (10-20%); calcite/qtz
2430	2460	Light bluish to greenish gray ash tuff (90-20%); brown, black, and red lithic tuff (20-70%); euhedral calcite blades/qtz
2460	2580	Dark reddish brown lithic ash tuff (40-50%); greenish gray ash tuff (20-30%), varicolored tuff (10-30%); calcite
2580	2610	Reddish brown tuff (30-40%); olive gray moderately-welded tuff (20-30%); varicolored lithics (20-30%), calcite blades
2610	2630	Reddish brown tuff (30-40%); olive gray densely-welded tuff (20-30%); varicolored lithics (20-30%), calcite blades
2630	2660	Reddish brown tuff (40-50%); olive gray partially-welded tuff (20-30%); varicolored lithics (10-20%), calcite/qtz crystals
2660	2705	no returns - no data
	2705	- Total Vertical Depth (before cleaning)

LAKE 52812

PROPOSED WELL DIAGRAM
for
Surprise Valley Electric
Pasley #3

HOLE Information

CONDUCTOR
26 in to 40 ft

SURFACE HOLE
17-1/2 in to 102 ft

PRODUCTION HOLE 1
12-1/4 in to 2500 ft

spec. hole
12-1/4 in to 2745'

7" Perf. liner 2580'-2692'

CASING Information

CONDUCTOR PIPE
20 in

Top of 12-5/8" Production Liner 102 ft

SURFACE CASING
13-0 in 68 ppi J-5 Seal-offs

PRODUCTION LINER 1
9-5/8 in 40 ppi K55, BTC Co. 3mil, ss

 CAPUANO
ENGINEERING
CONSULTANTS

RECEIVED

JAN 02 2018

OWRD

RECEIVED BY OWRD

DEC 04 2017

SALEM, OR

8/2014 Cleared hole 2657-2710'
set 7" perf. liner with
bull nose and hole @
2692ft.

LAKE 52812

SUMMARY REPORT - OIL OR GAS WELL
STATE OF OREGON • DEPT OF GEOLOGY & MINERAL INDUSTRIES • 229 BROADALBIN ST SW • ALBANY OR 97321

(In compliance with rules and regulations pursuant to ORS 520.)

(1) Permittee Information

Name	Surprise Valley Electrification Corp.
Mailing Address	516 US Hwy 395 E
City/State/Zip	Alturas, CA. 96101
Telephone	530.233.3511
Fax	530.233.2190
Email	lynnsvec@frontier.com
Prepared by	Lynn Culp/George Scheid

(2) Well Information

Well No.	SVE Well #3
DOGAMI ID No.	36-037-90032
Drilling Commenced	July 25, 2012
Drilling Completed	August 17, 2012
Date P & A	July 9, 2012
Total Depth	2705ft
Redrill Depth	
Logs Run	

Signed E. Lynn Culp

Member Service Manager

November 9, 2012

Signature

Title

Date

(3) Casing Record

Size of Hole	Size of Casing	Weight (pounds per foot)	Grade/Type	Depth	Type and Amount of Cement	
26"	20"	104.05	30XS	40'	Type II	159 sx
17 1/2"	13 3/8"	68#	K-55	602'	89.1	bbls.
12 1/4"	9 5/8"	40#	K-55	2580'	N/A	bbls.
						bbls.

(4) Plugs & Junk

Plugs / Junk	Geological Marker	Depth

(5) Perforations or Liner

Size of Casing	From	To	Shots/ft.	Method of Perforating		
				Jet	Bullet	Slotted Liner
9 5/8"	490'	2580'				

(6) Initial Production

Date	Clean Oil (bbl/day)	Gravity	Percent Water	FTP	FCP	SITP	SICP

RECEIVED

RECEIVED BY OWRD

JAN 02 2018

DEC 04 2017

OWRD

SALEM, OR

Groundwater Application Review Summary Form

Application # G- LL-1726/1728

GW Reviewer D. BOSCHMANN Date Review Completed: 8/28/2018

Summary of GW Availability and Injury Review:

Groundwater for the proposed use is either over appropriated, will not likely be available in the amounts requested without injury to prior water rights, OR will not likely be available within the capacity of the groundwater resource per Section B of the attached review form.

Summary of Potential for Substantial Interference Review:

There is the potential for substantial interference per Section C of the attached review form.

Summary of Well Construction Assessment:

The well does not appear to meet current well construction standards per Section D of the attached review form. Route through Well Construction and Compliance Section.

is 8/29/18

This is only a summary. Documentation is attached and should be read thoroughly to understand the basis for determinations and for conditions that may be necessary for a permit (if one is issued).

PUBLIC INTEREST REVIEW FOR GROUNDWATER APPLICATIONS

TO: Water Rights Section Date 08/28/2018
 FROM: Groundwater Section Darrick E. Boschmann
Reviewer's Name
 SUBJECT: Application LL1726/LL1728 Supersedes review of N.A.
Date of Review(s)

PUBLIC INTEREST PRESUMPTION; GROUNDWATER

OAR 690-310-130 (1) *The Department shall presume that a proposed groundwater use will ensure the preservation of the public welfare, safety and health as described in ORS 537.525.* Department staff review groundwater applications under OAR 690-310-140 to determine whether the presumption is established. OAR 690-310-140 allows the proposed use be modified or conditioned to meet the presumption criteria. **This review is based upon available information and agency policies in place at the time of evaluation.**

A. GENERAL INFORMATION: Applicant's Name: Surprise Valley Electrification Corp County: Lake

A1. Applicant(s) seek(s) 6.68 cfs from 2 well(s) in the Goose & Summer Lakes Basin,
Summer Lake/Lake Abert subbasin

A2. Proposed use: 6.68cfs (3000gpm)* INDUSTRIAL/POWER DEVELOPMENT FROM GEOTHERMAL FLUID
 Seasonality: year round

A3. Well and aquifer data (**attach and number logs for existing wells; mark proposed wells as such under logid**):

Well	Logid	Applicant's Well #	Proposed Aquifer*	Proposed Rate(cfs)	Location (T/R-S QQ-Q)	Location, metes and bounds, e.g. 2250' N, 1200' E fr NW cor S 36
1	LAKE 52530 (production well)	SVE#1	Volcanic rock aquifer unit	2.67 (1200gpm)**	33.00S-18.00E-23-NW SW	2090 FT N AND 1275 FT E FROM SW CORNER OF SECTION 23
2	LAKE 52529 (production well)	SVE#2	Volcanic rock aquifer unit	5.12 (2300gpm)**	33.00S-18.00E-23-SW NE	2665 FT N AND 1725 FT W FROM SE CORNER OF SECTION 23
3	LAKE 52812 (injection well)	SVE#3	Volcanic rock aquifer unit	-6.68(3000gpm)***	33.00S-18.00E-24-SW NW	2220 FT S AND 1190 FT E FROM NW CORNER OF SECTION 24
4						
5						

* Alluvium, CRB, Bedrock

Well	Well Elev ft msl	First Water ft bls	SWL ft bls	SWL Date	Well Depth (ft)	Seal Interval (ft)	Casing Intervals (ft)	Liner Intervals (ft)	Perforations Or Screens (ft)	Well Yield (gpm)	Draw Down (ft)	Test Type
****1	4490	75-105	140	?	1360	0-900	0-900	806-1310	806-1310	1300	?	?
****2	4472	?	131	?	1260	0-495	0-495	445-1210	445-1210	2500	?	?
****3	4417	?	106	?	2705	0-602	0-602	490-2692	2580-2692	2200	?	?

Use data from application for proposed wells.

A4. **Comments:** _____

Note: This review considers both the production and re-injection of low temperature geothermal fluids as proposed in original applications LL-1726 and LL-1728.

This application proposes to produce low-temperature geothermal fluids (bottom hole temperature <250°F) from two wells in the Goose and Summer Lakes Basin. The application states that all fluids produced from the two proposed wells (4838 acre feet annually) will be supplied to a binary cycle geothermal power plant by way of pipelines from the well to the plant, and after passing through the plant will be delivered by way of pipelines to an injection well and returned to the same source aquifer from which they were produced, resulting in an open-loop non-consumptive cycle.

The proposed wells are located in Lake County just outside the city of Paisely along the Chewaucan River. The area immediately underlying the wells was mapped by Walker (1963) as QTs (sedimentary deposits) which are described as lacustrine, fluvialite, and aeolian sedimentary rocks, interstratified tuff, ashy diatomite, and unconsolidated clay, sand, silt, and gravel. Proposed production well SVE#1 is located very near the contact with the underlying unit TvB (basalt flows). Also mapped in the vicinity of the wells underlying the QTs unit are Ttf (tuff of rhyolitic and dacitic composition, tuffaceous sedimentary rocks, and aerially restricted rhyodacitic and andesitic rocks), and Taf (tuff, tuff, breccia, tuffaceous sedimentary rocks, gray and reddish claystones, hornblende andesite flows and less abundant altered basalt flows). Walker's

1963 map explanation indicates that the stratigraphic relation between unit Tvb and the Ttf/Taf units cannot be implied by stratigraphic position; therefore their relative stratigraphic relation is unknown.

The two production wells are located within the Summer Lake Hot Springs Known Geothermal Resource Area (KGRA) (Muffler, 1979) and the injection well just outside of the KGRA boundary. The geothermal system discharges to the surface at several natural hot springs and has an estimated mean reservoir temperature of 118±6°C (~245°F) (Muffler, 1979). The geologic and structural setting of the area strongly suggests the geothermal system here is analogous to other structurally-controlled geothermal systems of the Great Basin, wherein upwelling of geothermal fluids in most systems is not related to upper crustal magmatic heat sources, but is instead related to crustal extension, faulting, and high heat flow (e.g. Coolbaugh, 2005; Faulds, 2015).

SVE#1: Formation descriptions for proposed production well SVE#1 (LAKE 52530) depict an interval from 0 to 530 comprised of predominantly unconsolidated gravels, sands, and clay which is likely correlative with Walker's QTs unit. This interval is underlain from 530 to 1360 (TD) by a series of altered/mineralized volcanic deposits including basalt, andesite, rhyolite, tuff, ash, pumice, and cinders, which is likely correlative with Walker's Ttf/Taf and/or Tvb unit. Note that the interval from 1080 to 1360 (TD) was a lost circulation zone with intermittent sample recovery from uncertain depths, however all samples recovered through this interval are volcanic. The well is continuously cased and continuously sealed through the QTs sedimentary unit into the underlying volcanic rock aquifer unit.

Proposed production well SVE#1 (LAKE 52530) has a reported bottom-hole temperature of 239.2°F.

SVE#2: Formation descriptions for proposed production well SVE#2 (LAKE 52529) depict an interval from 0 to 410 feet comprised of predominantly volcanic rocks and rounded volcanic sediments herein interpreted as unconsolidated sedimentary deposits on the basis of mapped stratigraphy and comparison with nearby well logs (LAKE 52506; LAKE 52683; LAKE 1628/LAKE 1626), which is likely correlative with Walker's QTs unit. This interval is underlain from 410 to 1070 by a series of altered/mineralized volcanic deposits including basalt, andesite, rhyolite, and tuff, with minor sand which is likely correlative with Walker's Ttf/Taf and/or Tvb unit. Note that the interval from 530 to 1070 is described entirely as basalt and/or andesite. Note also that the interval from 1070 to 1260 was a lost circulation zone with no samples recovered. Based on mapped stratigraphy and intermittent sample recovery from the lost circulation zone in LAKE 52530 it is reasonable to assume that this interval is a continuation of the Ttf/Taf and/or Tvb unit. The well is continuously cased and continuously sealed through the QTs sedimentary unit into the underlying volcanic rock aquifer unit.

Proposed production well SVE#2 (LAKE 52529) has a reported bottom-hole temperature of 225.4°F.

SVE#3: Formation descriptions for proposed injection well SVE#3 (LAKE 52812) depict an interval from 0 to 560 feet comprised of predominantly unconsolidated gravels, sands, silt and clay which is likely correlative with Walker's QTs unit. This interval is underlain from 560 to 1350 feet by a sequence of tuffaceous sedimentary rocks dominated by clay, ash and tuff with subordinate gravel, sand and cinders, which is likely correlative with Walker's Ttf/Taf unit. Below this from 1350-2705 (TD) is a sequence dominated by a variety of tuffaceous rocks described as tuff; lithic tuff; ash tuff; vitric tuff and partially welded tuff, which is also likely correlative with Walker's Ttf/Taf unit. The interval from 1660 to 2705 (TD) was a zone of lost circulation. The well is continuously cased and continuously sealed through the QTs sedimentary unit into the underlying volcanic rock aquifer unit.

Proposed injection well SVE#3 (LAKE 52812) has a reported bottom-hole temperature of 225°F.

*The application states that all fluids produced from the two proposed production wells will be supplied to a binary cycle geothermal power plant by way of pipelines from the well to the plant, and after passing through the plant will be delivered by way of pipelines to an injection well and returned to the same source aquifer from which they were produced, resulting in an open-loop non-consumptive cycle.

**Total combined rate from both production wells not to exceed 6.68 cfs (3000gpm).

***Proposed well 3 LAKE 52812 (SVE#3) is the intended injection well. The rate listed here is the proposed reinjection rate.

****All information from application materials and available DOGAMI permit files.

Note that all proposed wells are currently authorized under the DOGAMI geothermal permitting process (LAKE 52530/SVE#1 under DOGAMI API# 36-037-90009; LAKE 52529/SVE#2 under DOGAMI API# 36-037-90032; LAKE 52812/SVE#3 under DOGAMI API# 36-037-9032).

Note: proposed production wells LAKE 52530 and LAKE 52529 currently serve as authorized POD 2 and POD 3, respectively, under transfer T-11894. As such, some portion of the groundwater produced from these wells may be diverted

for supplemental irrigation of up to 400 acres during the irrigation season. Any use authorized under this limited license must be coordinated with the water right holder for T-11894. See section B3.

A5. **Provisions of the** Goose & Summer Lake Basin rules relative to the development, classification and/or management of groundwater hydraulically connected to surface water **are**, or **are not**, activated by this application. (Not all basin rules contain such provisions.)

Comments: _____

A6. **Well(s) #** _____, _____, _____, _____, _____, tap(s) an aquifer limited by an administrative restriction. Name of administrative area: _____

Comments: Currently no administrative area.

B. GROUNDWATER AVAILABILITY CONSIDERATIONS, OAR 690-310-130, 400-010, 410-0070

B1. **Based upon available data**, I have determined that groundwater* for the proposed use:

- a. is over appropriated, is not over appropriated, or **cannot be determined to be** over appropriated during any period of the proposed use. * This finding is limited to the groundwater portion of the over-appropriation determination as prescribed in OAR 690-310-130;
- b. **will not** or **will** likely be available in the amounts requested without injury to prior water rights. * This finding is limited to the groundwater portion of the injury determination as prescribed in OAR 690-310-130;
- c. **will not** or **will** likely to be available within the capacity of the groundwater resource; or
- d. **will, if properly conditioned**, avoid injury to existing groundwater rights or to the groundwater resource:
 - i. The permit should contain condition #(s) _;
 - ii. The permit should be conditioned as indicated in item 2 below.
 - iii. The permit should contain special condition(s) as indicated in item 3 below;

- B2. a. **Condition** to allow groundwater production from no deeper than _____ ft. below land surface;
- b. **Condition** to allow groundwater production from no shallower than _____ ft. below land surface;
- c. **Condition** to allow groundwater production only from the _____ groundwater reservoir between approximately _____ ft. and _____ ft. below land surface;
- d. **Well reconstruction** is necessary to accomplish one or more of the above conditions. The problems that are likely to occur with this use and without reconstructing are cited below. Without reconstruction, I recommend withholding issuance of the permit until evidence of well reconstruction is filed with the Department and approved by the Groundwater Section.

Describe injury –as related to water availability– that is likely to occur without well reconstruction (interference w/ senior water rights, not within the capacity of the resource, etc): _____

B3. **Groundwater availability remarks:** _____

The proposed production wells produce groundwater from the predominantly volcanic rock unit underlying the predominantly basin fill sediment unit. As proposed the injection well is intended to inject 100% of the produced fluids back into the predominantly volcanic unit underlying the predominantly basin fill sediment unit resulting in an open-loop non-consumptive cycle. The proposed injection well is located within one mile of both proposed production wells.

The nearest state observation well to the proposed location is State Observation Well 374 (LAKE 1633) located ~1.5 miles to the northeast which has a period of record from 1963 to 2017. The long term annual groundwater level trend in this well indicates an overall year-year water level decline of about 19 feet from 1980 to 2017, or roughly 0.5 feet per year since 1980. Formation descriptions on the well log for LAKE 1633 indicate the well is completed in the basin fill sediments.

Observation well LAKE 52683 (permit condition obs well under permit G-17434; 380ft TD/115°F) located within the project area has a period of record from 2015 to 2018. No long term annual groundwater level trend can be identified in this well due to the short period of record; however there are no immediate signs of water level decline. Formation descriptions on the well log for LAKE 52683 indicate the well is completed in the basin fill sediments.

March static water levels reported to the department under the permit condition program for LAKE 1628 (“Little Hot Well”; 432 ft TD/175°F) indicate a 73 foot water level decline over the period 3/2015 – 30/2017. March static water levels reported to the department under the permit condition program for LAKE 52506 (“SVE#4” industrial use/cooling water; 378 ft

TD/118°F indicate a 20 foot water level decline over the period 3/2015 – 3/2016. These reported records suggest significant rates of decline in the immediate vicinity of proposed production well LAKE 52529 (see following paragraphs).

Miscellaneous water level data made available to this reviewer by the applicant supplement the data available from the OWRD GWIS database. Review of these data presents an alternate interpretation from that made based on the permit condition program data alone for LAKE 1628 and LAKE 52506.

It is clear from the supplemental data that the “static” water level reported to the department for 03/01/2016 and 03/22/2017 for LAKE 1628 was affected by a recent period of pumping either in that well, or in LAKE 52506, or possibly both, and that the water level reported represents a pumping or recovery/rising level, rather than a true static water level which could be directly compared to the March level from the previous year. Due to the year-round pumping/recovery cycles at this well it is difficult to determine whether or not any year-to-year water level declines are occurring, however since regular pumping began in 2015 the well has never fully recovered to its pre-2015 static water levels, and the full record does seem to indicate that declines may be occurring.

It is clear from the supplemental data that the “static” water level reported to the department for 03/01/2016 for LAKE 52506 was affected by a recent period of pumping in that well; and that the water level reported represents a pumping or recovery/rising level, rather than a true static water level which could be directly compared to the March level from the previous year. The period of record for LAKE 52506 provided in the supplemental data covers 05/12/2014 – 01/16/2018. Due to the year-round pumping/recovery cycles at this well it is difficult to determine whether or not any year-to-year water level declines are occurring; although from October 2014 to October 2017 (two periods for which there appears to be no direct pumping influence), the record does indicate approximately 7-8 feet of overall decline; or approximately 2.5 ft/yr.

The supplemental water level data made available to this reviewer by the applicant also includes the two proposed production wells and several other nearby wells:

Proposed production well LAKE 52530 (SVE#1) has a period of record from 6/6/2014 to 1/16/2018. Due to the year-round pumping/recovery cycles at this well it is difficult to determine whether or not any year-to-year water level declines are occurring, however there are no apparent signs of significant water level declines.

Proposed production well LAKE 52529 (SVE#2) has a period of record from 6/17/2014 to 1/16/2018. Due to the year-round pumping/recovery cycles at this well it is difficult to determine whether or not any year-to-year water level declines are occurring, however there are no apparent signs of significant water level declines.

LAKE 1638 (“Mud Well”; unused irrigation well/livestock?; 775 ft TD/120°F) has a period of record from 3/28/2014 to 5/2/2017. The hydrograph for this reportedly unused irrigation well shows a clear and consistent decline trend from 2014 through spring of 2017 of approximately 6-10 feet over the period of record; or approximately 2 – 3.3 ft/yr. Formation descriptions on the well log for LAKE 1638 indicate the well is completed in the basin fill sediments.

LAKE 1625 (“Corky’s”; unused irrigation well; 610 ft TD/175°F) has a period of record from 3/28/2014 to 5/2/2017. The hydrograph for this reportedly unused irrigation well shows a clear and consistent decline trend from 2014 through spring of 2017 of approximately 6-7 feet over the period of record; or approximately 2 ft/yr. Formation descriptions on the well log for LAKE 1625 indicate the well is completed in the basin fill sediments.

LAKE 1637 (“Trailer Court”; livestock; 153 ft TD/~75°F) has a period of record from 3/28/2014 to 5/2/2017. Due to the year-round pumping/recovery cycles at this well it is difficult to determine whether or not any year-to-year water level declines are occurring. Formation descriptions on the well log for LAKE 1637 indicate the well is completed in the volcanic rock unit.

LAKE 4278 (“Paisley”; unused; 515 ft TD/115°F) has a period of record from 3/28/2014 to 1/16/2018. The hydrograph for this well does not indicate any apparent signs of significant water level declines. Formation descriptions on the well log for LAKE 4278 indicate the well is completed in the volcanic rock unit.

LAKE 51059 (“ZX”; unused; 1412 ft TD/78°F) has a period of record from 3/28/2014 to 1/16/2018. The hydrograph for this well indicates a decline trend from spring of 2014 through spring of 2017 of approximately 3.25 feet over the period of record; or approximately 1 ft/yr. Formation descriptions on the well log for LAKE 51059 indicate the well is completed in the volcanic rock unit.

Although all produced fluids are intended to be reinjected in an open-loop, non-consumptive cycle (no net groundwater use), local interference with existing nearby wells may occur as a result of pumping from the production wells. Nearby wells with

elevated temperatures are presumably hydraulically connected to the deep geothermal reservoir. Additionally, public comment received by the department asserts that direct interference between the SVE production wells and existing authorized irrigation wells is occurring.

Firstly, proposed production wells LAKE 52530 and LAKE 52529 currently serve as authorized POD 2 and POD 3, respectively, under transfer T-11894. As such, some portion of the groundwater produced from these wells may be diverted for supplemental irrigation of up to 400 acres during the irrigation season. Any use authorized under this limited license must be coordinated with the water right holder for T-11894.

Proposed production well LAKE 52530 is located ~445 feet north of POD 1 under transfer T-11894 (**LAKE 1627 “Hot Well”**). LAKE 1627 (reconditioning log LAKE 4448) has a reported water temperature of 212 degrees F. The potential increase in interference at LAKE 1627 was calculated using the Theis equation (see attachment). The values for the calculation are conservative and appropriate until better values become available. The calculations use an intermediate storage coefficient (0.001). The transmissivity used in the calculation (5,050 ft²/day [1ft²/day ≈0.37 darcy-ft]) is the transmissivity of the deep geothermal aquifer derived from the Geologica multi-well interference test (report dated 04/19/2018). At the maximum proposed pumping rate for LAKE 52530 (2.67 cfs), the results show an increase in drawdown of ~36 feet after 365* days.

Some degree of relief will be provided by reinjection of produced fluids into LAKE 52812, which is located 5,310 feet northeast of LAKE 1627. The potential decrease in interference at LAKE 1627 resulting from reinjection of fluids produced from LAKE 52530 was calculated using the Theis equation (see attachment). The values for the calculation are conservative and appropriate until better values become available. The calculations use an intermediate storage coefficient (0.001). The transmissivity used in the calculation (5,050 ft²/day [1ft²/day ≈0.37 darcy-ft]) is the transmissivity of the deep geothermal aquifer derived from the Geologica multi-well interference test (report dated 04/19/2018). At the maximum proposed pumping rate for LAKE 52530 (2.67 cfs – reinjected into LAKE 52812), the results show a decrease in drawdown of ~18 feet after 365* days, for a net drawdown of 18 feet, which begins to approach the 25 foot interference limit imposed by condition 7N. See notes below.

*Note: interference will continue to increase after the 365 day calculated value for this proposed year-round use.

*Note: the interference resulting from a combined pumping rate of 3,000 gpm from both production wells will increase the magnitude of interference at these wells.

If this permit is approved the following conditions are recommended:

7A:Monitoring Plan: The water user shall develop a plan to monitor and report the impact of water use under this permit. The plan shall be submitted to the Department before water use begins under this permit and shall be subject to the approval of the Department.

7I Injection Well Condition: Prior to use of water under this permit, the permit holder must register the injection activity with the Oregon Department of Environmental Quality's Underground Injection Control Program, which can be contacted at 2020 SW 4th Ave, Ste 400, Portland OR 97201, or 503-229-5263.

7P: Well Tag Condition

Flow meter condition: Apply the “Large” water use reporting condition to all production and injection wells to monitor and report both the total volume produced and total volume reinjected at each well. An additional flow meter is required at any diversion points that supply groundwater for irrigation authorized under any other water right, or any other consumptive use authorized from these wells under LL-11727 or any other water right.

As well as the following special conditions:

Special condition for no net groundwater use under this permit: This permit is valid if and only if 100 percent of the groundwater extracted from the production wells for use under this permit (that is not diverted under another previously authorized groundwater right), is reinjected back into the authorized injection well in a manner that can be confirmed by the reported flow meter data. Any volume of groundwater diverted from these wells for use under any other water right must be measured with a dedicated flowmeter at the point where diversion takes place. If this condition is not met the use is invalid and subject to regulation, including possible immediate cancellation of the permit.

Conduct a mechanical integrity test at least once every five years on all injection wells to determine that there is no leak in the casing, and no fluid movement into an underground source of water other than that from which the fluid was produced, unless otherwise approved by the Department. The Department may require surveys to detect movement of fluid in adjacent rock formations, cement bond logs, special wellhead equipment, or other methods employed by industry to monitor re-injection operations.

C. GROUNDWATER/SURFACE WATER CONSIDERATIONS, OAR 690-09-040

C1. 690-09-040 (1): Evaluation of aquifer confinement:

Well	Aquifer or Proposed Aquifer	Confined	Unconfined
1	Volcanic Rock Aquifer Unit	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Volcanic Rock Aquifer Unit	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Volcanic Rock Aquifer Unit	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>

Basis for aquifer confinement evaluation: _____

No detailed studies of the groundwater system in this part of the Summer Lake Subbasin have been reported, but numerous studies within the broader Goose and Summer Lakes Basin serve as analogues for understanding the general characteristics of the groundwater flow system regionally. Reports across the Goose and Summer Lakes Basin indicate that groundwater generally occurs in a basin fill sediment unit overlying a predominantly volcanic/volcaniclastic rock unit under both confined and unconfined conditions (e.g. Brown, 1957 – upper Summer Lake subbasin; Hampton, 1964 – Fort Rock Basin; Miller, 1986 – Fort Rock Basin; Morgan, 1988 – Goose Lake Basin; McFarland, 1991 – Fort Rock Basin). In the Ana Springs area in the northern Summer Lake Basin Brown (1957) describes the occurrence of groundwater under both confined and unconfined conditions, and describes flowing wells producing groundwater from the volcanic rock aquifer unit. In the Fort Rock Basin Miller (1986) indicates that the Quaternary unconsolidated deposits constitute an upper groundwater reservoir reflecting a somewhat higher head system with lower transmissivities than the underlying main ground water reservoir. In the Goose Lake Basin Morgan (1988) found that regionally the volcanic units and basin fill deposits together comprise a single groundwater flow system; unconfined groundwater commonly occurs within the upper 10-20 feet of saturated sediments; confined conditions prevail with increasing depth; and that 100 feet below the water table, groundwater is confined nearly everywhere in the basin fill deposits. Hampton (1964), Miller (1986), and McFarland (1991) all describe natural discharge of groundwater from the volcanic unit to surface water at the northern end of the Summer Lake Subbasin at Ana Springs. Hampton (1964), Morgan (1988) and McFarland (1991) all indicate that given the lithology and depositional environment within both the basin fill and the underlying volcanic section, a high degree of anisotropy is characteristic of the groundwater flow system - vertical hydraulic conductivity is less than horizontal hydraulic conductivity. Within the volcanic section Morgan argues for a ratio of vertical to horizontal hydraulic conductivity of 1:1000; and suggests ratios from 1:2 up to 1:170 within the basin fill.

Several thermal springs occur approximately 5 miles to the northwest of the proposed location. Additionally, numerous wells in the vicinity of the proposed location with elevated temperatures (>80°F) range in depth from 130 to 983 feet, suggesting groundwater from the deep thermal reservoir has some degree of vertical connection with the shallower parts of the groundwater flow system in this area, possibly to some degree by way of sub-vertical faults behaving as conduits for vertical fluid migration.

A 10-day, multi-well interference test completed by the applicant involved pumping ~1300 gpm from production well SVE#1 (LAKE 52530) while simultaneously reinjecting the produced fluids into injection well SVE#3 (LAKE 52812). Aquifer response was monitored during the test by measuring water levels in SVE#2 (LAKE 52529) as well as 4 shallower wells nearby (“Mud Well” – LAKE 1638; “Corky’s” – LAKE 1625; “ZX” – LAKE 51059; “City Well” – unknown well log). Production well SVE#2 (LAKE 52529) exhibited a clear pressure response both to pumping from production well SVE#1 (LAKE 52530) and to injection into SVE#3(LAKE 52812). The four shallower wells did not exhibit any significant pressure response.

Given the above considerations, the deep thermal reservoir appears to exist under confined to semi-confined conditions, resulting from both the vertical heterogeneity of aquifer materials, and the anisotropy of hydraulic conductivity within the various geologic materials comprising the aquifer system; some degree of vertical hydraulic connection between the deeper and shallower parts of the system is apparent as described above, possibly to some degree by way of sub-vertical faults behaving as conduits for vertical fluid migration.

C2. **690-09-040 (2) (3):** Evaluation of distance to, and hydraulic connection with, surface water sources. All wells located a horizontal distance less than ¼ mile from a surface water source that produce water from an unconfined aquifer shall be assumed to be hydraulically connected to the surface water source. Include in this table any streams located beyond one mile that are evaluated for PSI.

Well	SW #	Surface Water Name	GW Elev ft msl	SW Elev ft msl	Distance (ft)	Hydraulically Connected?			Potential for Subst. Interfer. Assumed?	
						YES	NO	ASSUMED	YES	NO
1	1	Chewaucan River	4,350	*4,350	*7,500	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	1	Chewaucan River	4,340	*4,340	*7,000	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Basis for aquifer hydraulic connection evaluation: _____

The application states that all fluids produced from the two proposed wells will be supplied to a binary cycle geothermal power plant by way of pipelines from the well to the plant, and after passing through the plant will be delivered by way of pipelines to an injection well and returned to the same source aquifer from which they were produced, resulting in an open-loop non-consumptive cycle. The special condition for no net groundwater use requires that 100 percent of the groundwater extracted from the production wells (that is not diverted under another previously authorized groundwater right) is reinjected back into the authorized injection well. As such the potential for substantial interference with surface water is expected to be fully mitigated.

The reach of the Chewaucan River closest to proposed well HARN 52530 (SVE#1) is about 2,020 feet away at an elevation of about 4,415 feet. The reach of the Chewaucan River closest to proposed well HARN 52529 (SVE#2) is about 995 feet away at an elevation of about 4,395 feet.

*At these closest reaches the river appears to be above the static groundwater level in these wells; however the river quickly drops in elevation downstream to the elevation of the static groundwater level. The 4,350 river elevation is about 7,500 feet away from HARN 52530. The 4,340 river elevation is about 7,000 feet away from HARN 52529. The reaches at these distances are presumed to be where hydraulic connection with the Chewaucan River begins, and as such are the distances used in the table above.

Water Availability Basin the well(s) are located within: CHEWAUCAN R > L ABERT - AT MOUTH

C3a. **690-09-040 (4):** Evaluation of stream impacts for each well that has been determined or assumed to be **hydraulically connected and less than 1 mile** from a surface water source. Limit evaluation to instream rights and minimum stream flows that are pertinent to that surface water source, and not lower SW sources to which the stream under evaluation is tributary. Compare the requested rate against the 1% of 80% *natural* flow for the pertinent Water Availability Basin (WAB). If Q is not distributed by well, use full rate for each well. Any checked box indicates the well is assumed to have the potential to cause PSI.

Well	SW #	Well < ¼ mile?	Qw > 5 cfs?	Instream Water Right ID	Instream Water Right Q (cfs)	Qw > 1% ISWR?	80% Natural Flow (cfs)	Qw > 1% of 80% Natural Flow?	Interference @ 30 days (%)	Potential for Subst. Interfer. Assumed?
		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>

C3b. **690-09-040 (4):** Evaluation of stream impacts by total appropriation for all wells determined or assumed to be **hydraulically connected and less than 1 mile** from a surface water source. **Complete only if Q is distributed among wells.** Otherwise same evaluation and limitations apply as in C3a above.

	SW #		Qw > 5 cfs?	Instream Water Right ID	Instream Water Right Q (cfs)	Qw > 1% ISWR?	80% Natural Flow (cfs)	Qw > 1% of 80% Natural Flow?	Interference @ 30 days (%)	Potential for Subst. Interfer. Assumed?
			<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
			<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
			<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
			<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>

Comments: _____

 This section does not apply. See comment in C2 above.

C4a. **690-09-040 (5):** Estimated impacts on **hydraulically connected surface water sources greater than one mile** as a percentage of the proposed pumping rate. Limit evaluation to the effects that will occur up to one year after pumping begins. This table encompasses the considerations required by 09-040 (5)(a), (b), (c) and (d), which are not included on this form. Use additional sheets if calculated flows from more than one WAB are required.

Non-Distributed Wells													
Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
Distributed Wells													
Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
(A) = Total Interf.													
(B) = 80 % Nat. Q													
(C) = 1 % Nat. Q													
(D) = (A) > (C)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
(E) = (A / B) x 100		%	%	%	%	%	%	%	%	%	%	%	%

(A) = total interference as CFS; (B) = WAB calculated natural flow at 80% exceed. as CFS; (C) = 1% of calculated natural flow at 80% exceed. as CFS; (D) = highlight the checkmark for each month where (A) is greater than (C); (E) = total interference divided by 80% flow as percentage.

Basis for impact evaluation: _____

 This section does not apply. See comment in C2 above.

C4b. **690-09-040 (5) (b) The potential to impair or detrimentally affect the public interest is to be determined by the Water Rights Section.**

- C5. **If properly conditioned**, the surface water source(s) can be adequately protected from interference, and/or groundwater use under this permit can be regulated if it is found to substantially interfere with surface water:
- i. The permit should contain condition #(s) 7I, 7N, 7P, Water Use Reporting-Large, special conditions.;
 - ii. The permit should contain special condition(s) as indicated in "Remarks" below;

C6. **SW / GW Remarks and Conditions:** _____

If this permit is approved the following conditions are recommended:

7A:Monitoring Plan: The water user shall develop a plan to monitor and report the impact of water use under this permit. The plan shall be submitted to the Department before water use begins under this permit and shall be subject to the approval of the Department.

7I Injection Well Condition: Prior to use of water under this permit, the permit holder must register the injection activity with the Oregon Department of Environmental Quality's Underground Injection Control Program, which can be contacted at 2020 SW 4th Ave, Ste 400, Portland OR 97201, or 503-229-5263.

7P: Well Tag Condition

Flow meter condition: Apply the "Large" water use reporting condition to all production and injection wells to monitor and report both the total volume produced and total volume reinjected at each well. An additional flow meter is required at any diversion points that supply groundwater for irrigation authorized under any other water right, or any other consumptive use authorized from these wells under LL-11727 or any other water right.

As well as the following special conditions:

Special condition for no net groundwater use under this permit: This permit is valid if and only if 100 percent of the groundwater extracted from the production wells for use under this permit (that is not diverted under another previously authorized groundwater right), is reinjected back into the authorized injection well in a manner that can be confirmed by the reported flow meter data. Any volume of groundwater diverted from these wells for use under any other water right must be measured with a dedicated flowmeter at the point where diversion takes place. If this condition is not met the use is invalid and subject to regulation, including possible immediate cancellation of the permit.

Conduct a mechanical integrity test at least once every five years on all injection wells to determine that there is no leak in the casing, and no fluid movement into an underground source of water other than that from which the fluid was produced, unless otherwise approved by the Department. The Department may require surveys to detect movement of fluid in adjacent rock formations, cement bond logs, special wellhead equipment, or other methods employed by industry to monitor re-injection operations.

References Used: _____

Walker, G.W., 1963, Reconnaissance geologic map of the eastern half of the Klamath Falls (AMS) quadrangle, Lake and Klamath Counties, Oregon. U.S. Geological Survey Mineral Investigations Field studies Map MF-260, 1:250000.

Davis, L., et al., 2013. Multi-well interference test of the Paisley geothermal reservoir. Industry report.

Brown, S.G., 1957. Occurrence of ground water near Ana Springs, Summer Lake basin, Lake County, Oregon: US Geol. Survey open-file report.

Miller, D.W., 1986. Ground Water Conditions in Fort Rock Basin, Northern Lake County, Oregon. State of Oregon, Water Resources Department.

Morgan, D.S., 1988. Geohydrology and numerical model analysis of ground-water flow in the Goose Lake Basin, Oregon and California (Vol. 87, No. 4058). US Department of the Interior, US Geological Survey.

Muffler, L. J. P., 1979. Assessment of geothermal resources of the United States, 1978 (No. USGS-CIRC-790). Geological Survey, Reston, VA (USA). Geologic Div.

Faulds, J.E. and Hinz, N.H., 2015, April. Favorable tectonic and structural settings of geothermal systems in the Great Basin region, western USA: Proxies for discovering blind geothermal systems. In Proceedings of the World Geothermal Congress, Melbourne, Australia (pp. 19-25).

Coolbaugh, M. F., Arehart, G. B., Faulds, J. E., Garside, L. J., Rhoden, H. N., Steininger, R. C., & Vikre, P. G. (2005). Geothermal systems in the Great Basin, western United States: Modern analogues to the roles of magmatism, structure, and regional tectonics in the formation of gold deposits. In Geological Society of Nevada Symposium (pp. 1063-1081).

OWRD water well reports, water level data, and/or hydrographs.

Oregon Administrative Rules.

DOGAMI permit files.

Supplemental data provided by the applicant.

D. WELL CONSTRUCTION, OAR 690-200

D1. Well #: 1-3 Logid: LAKE 52530; LAKE 52529; LAKE 52812

D2. **THE WELL does not appear to meet current well construction standards based upon:**
a. review of the well log;
b. field inspection by _____;
c. report of CWRE _____;
d. other: (specify) _____

D3. **THE WELL construction deficiency or other comment is described as follows:** _____

D4. **Route to the Well Construction and Compliance Section for a review of existing well construction.**

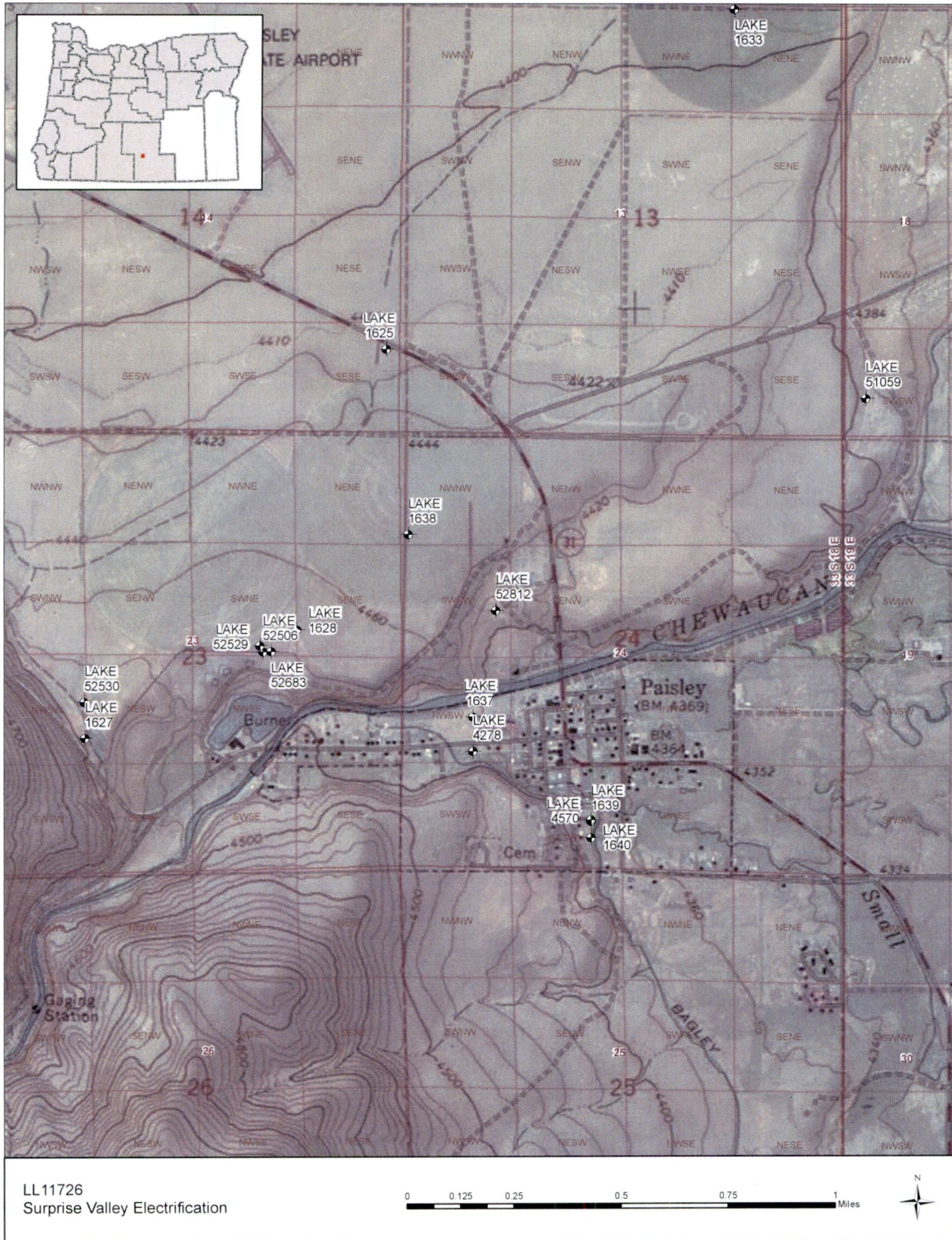


Figure 1: Location map.

Water-Level Trends in Nearby Wells

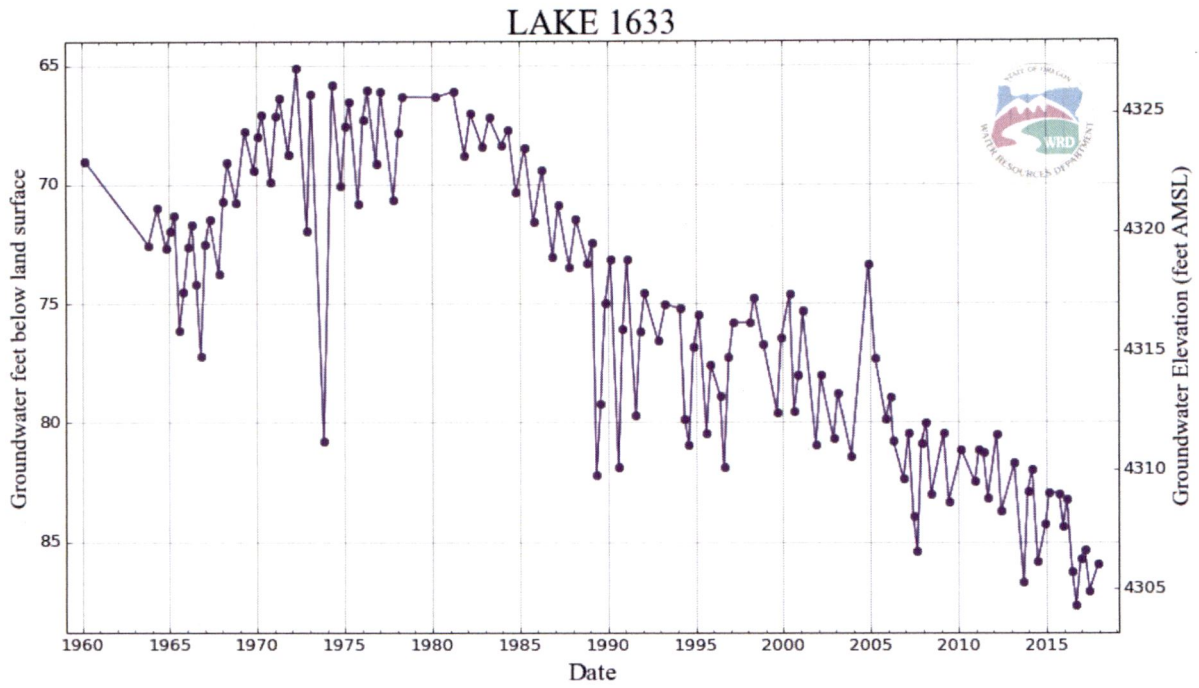


Figure 2: Hydrograph for LAKE 1633.

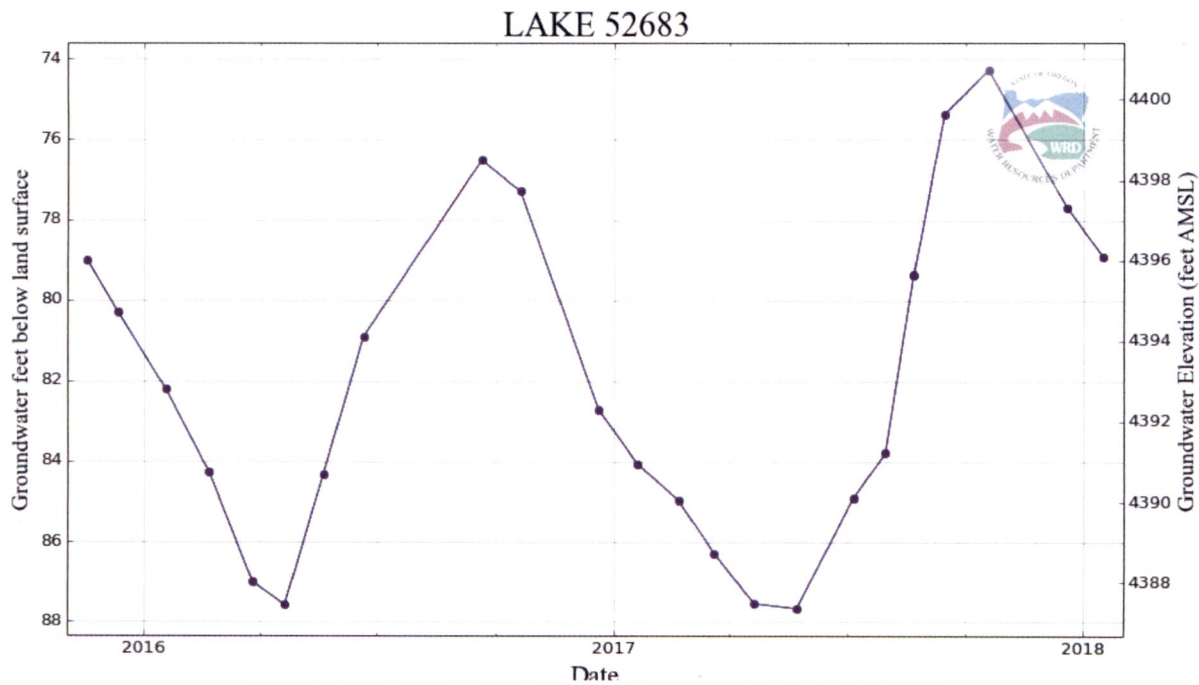


Figure 3: Reported permit condition water level data for LAKE 52683.

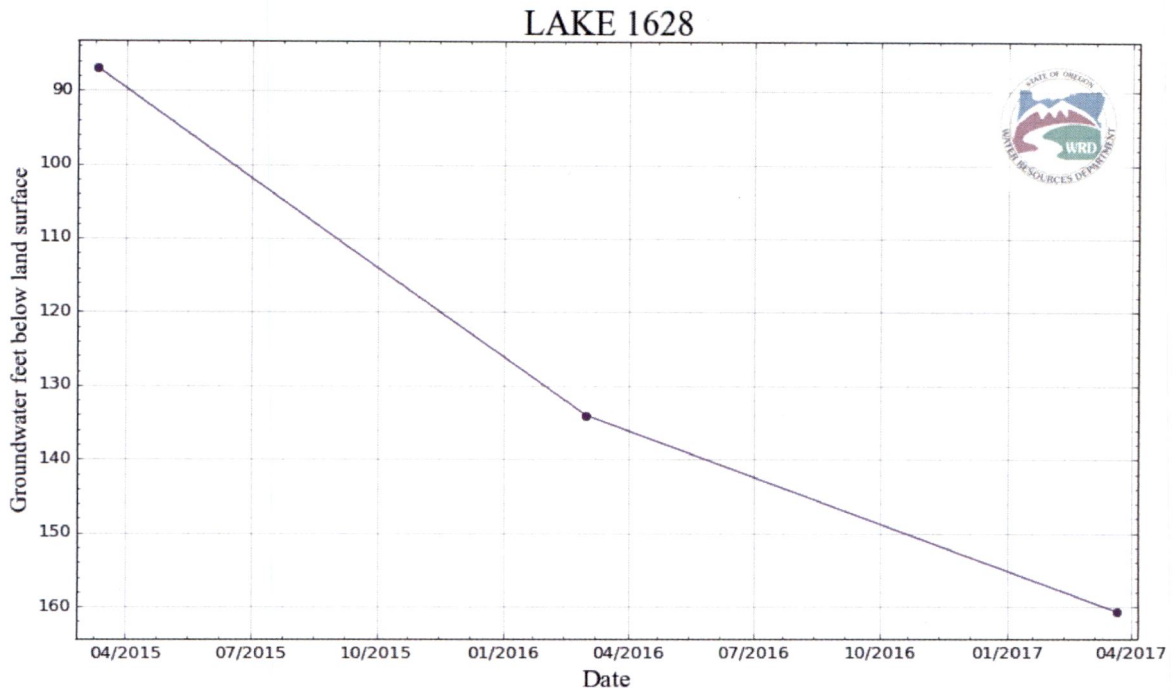


Figure 4: Reported permit condition water level data for LAKE 1628.

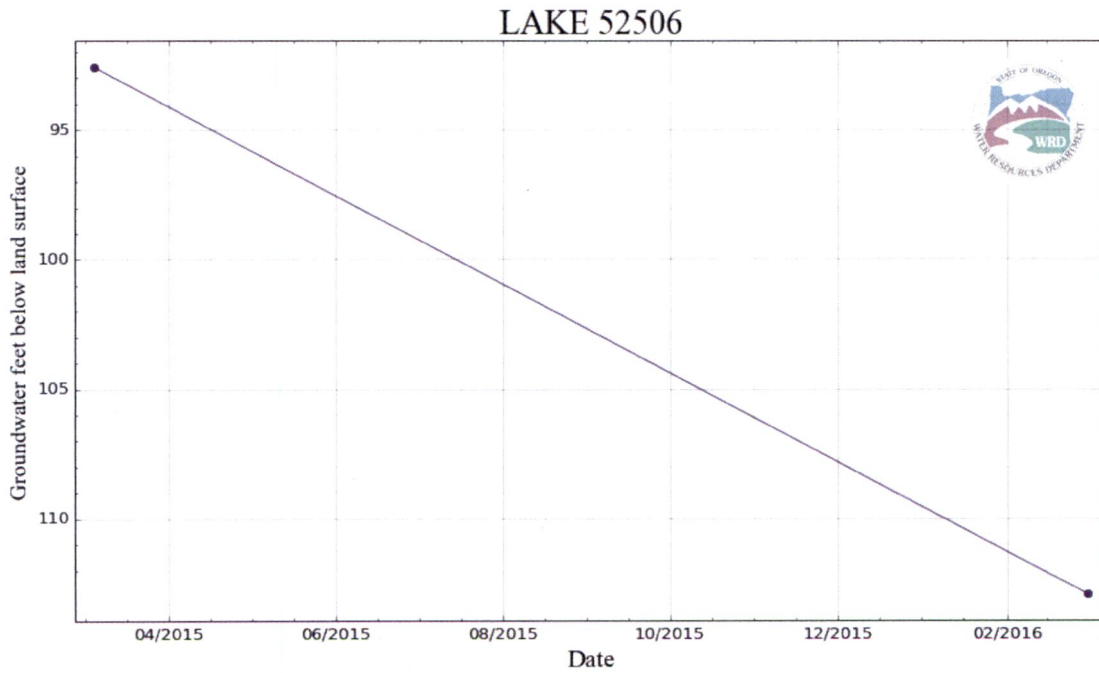


Figure 5: Reported permit condition water level data for LAKE 52506.

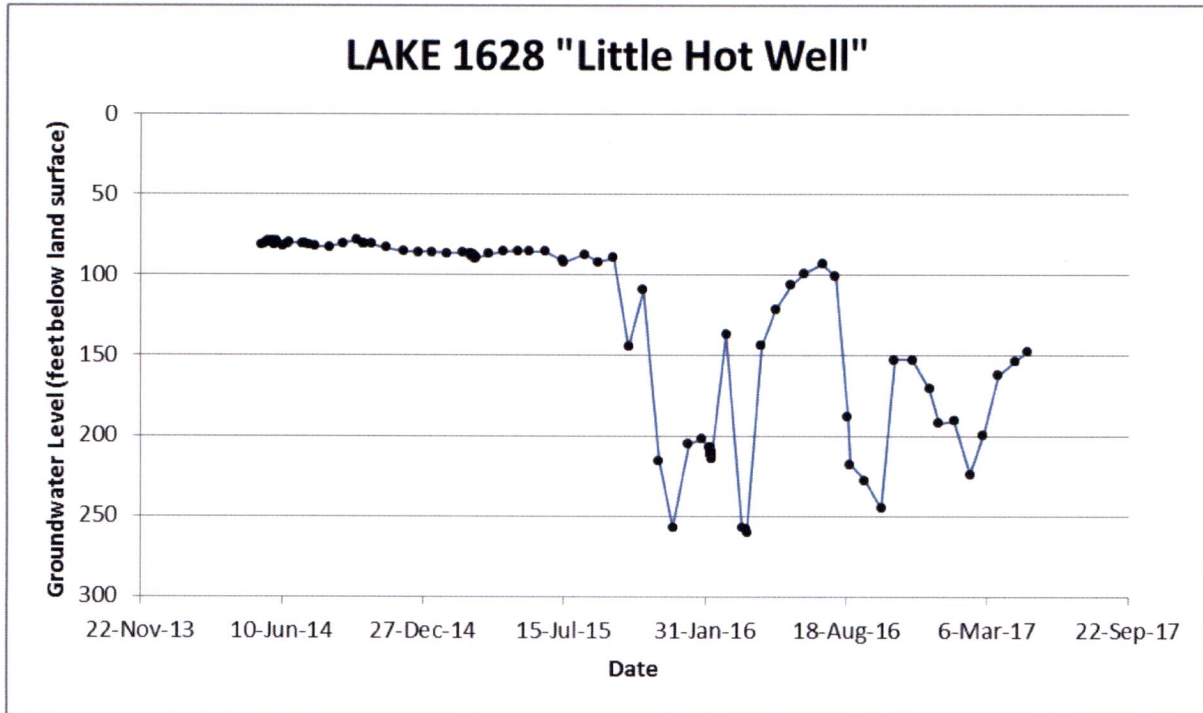


Figure 6: Supplemental data provided by the applicant - LAKE 1628.

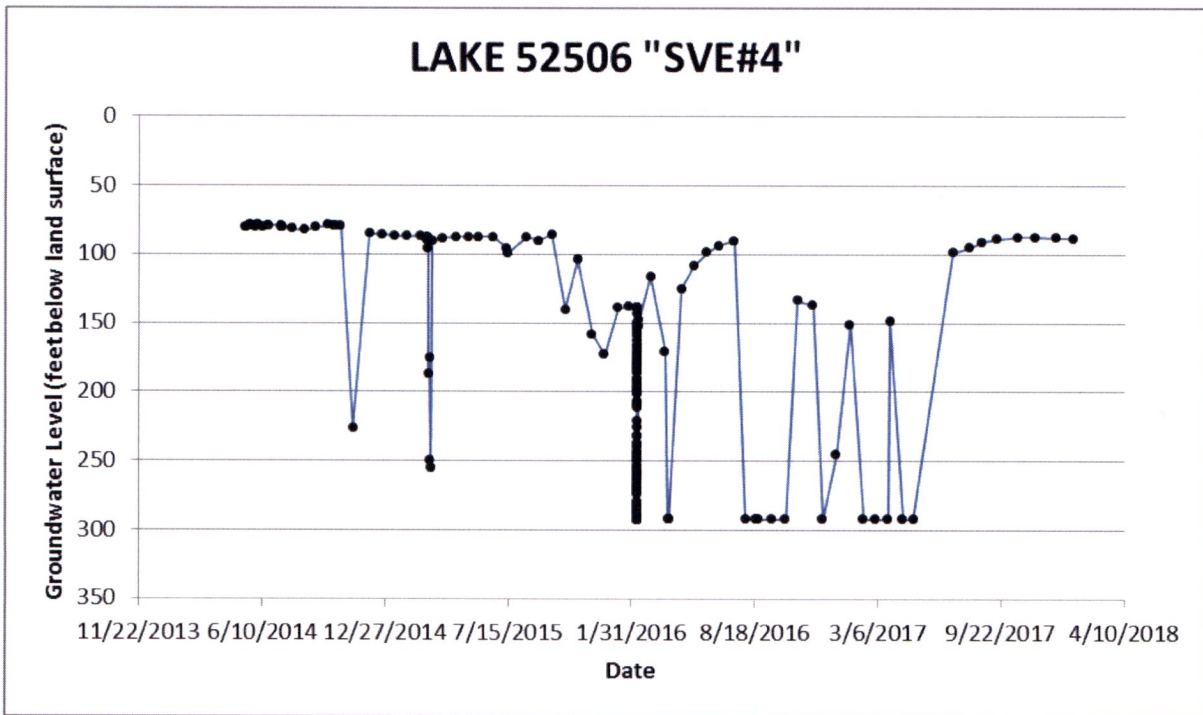


Figure 7: Supplemental data provided by the applicant - LAKE 52506.

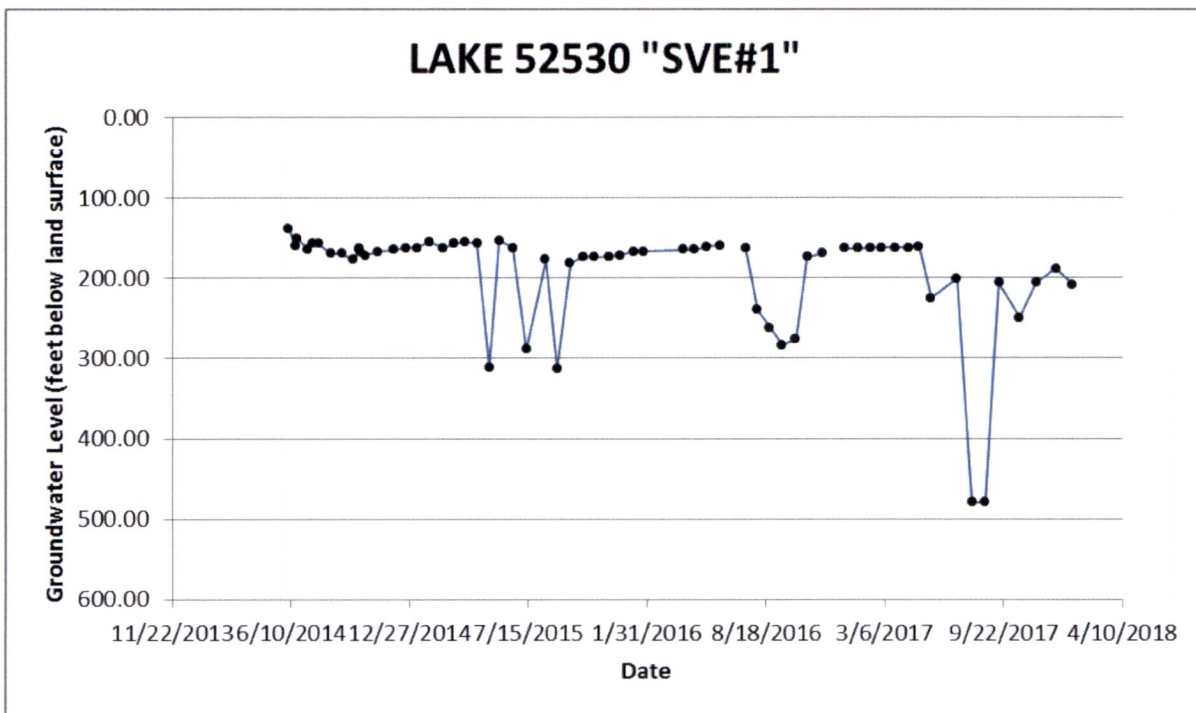


Figure 8: Supplemental data provided by the applicant - LAKE 52530.

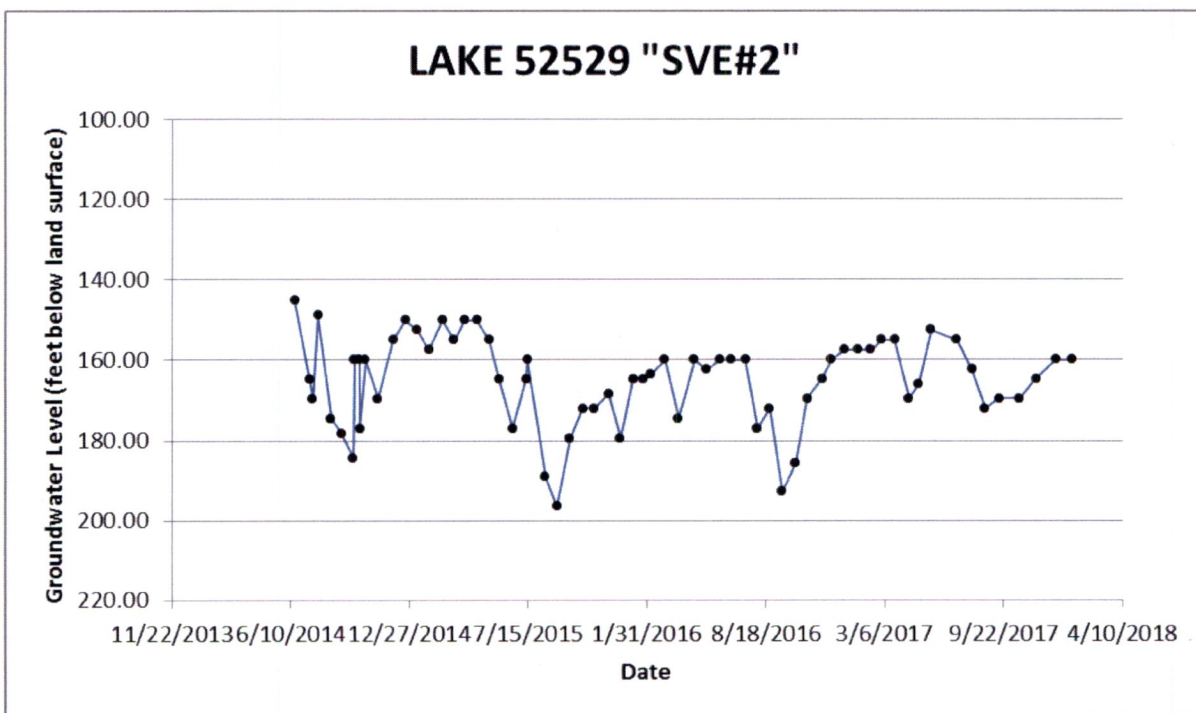


Figure 9: Supplemental data provided by the applicant - LAKE 52529.

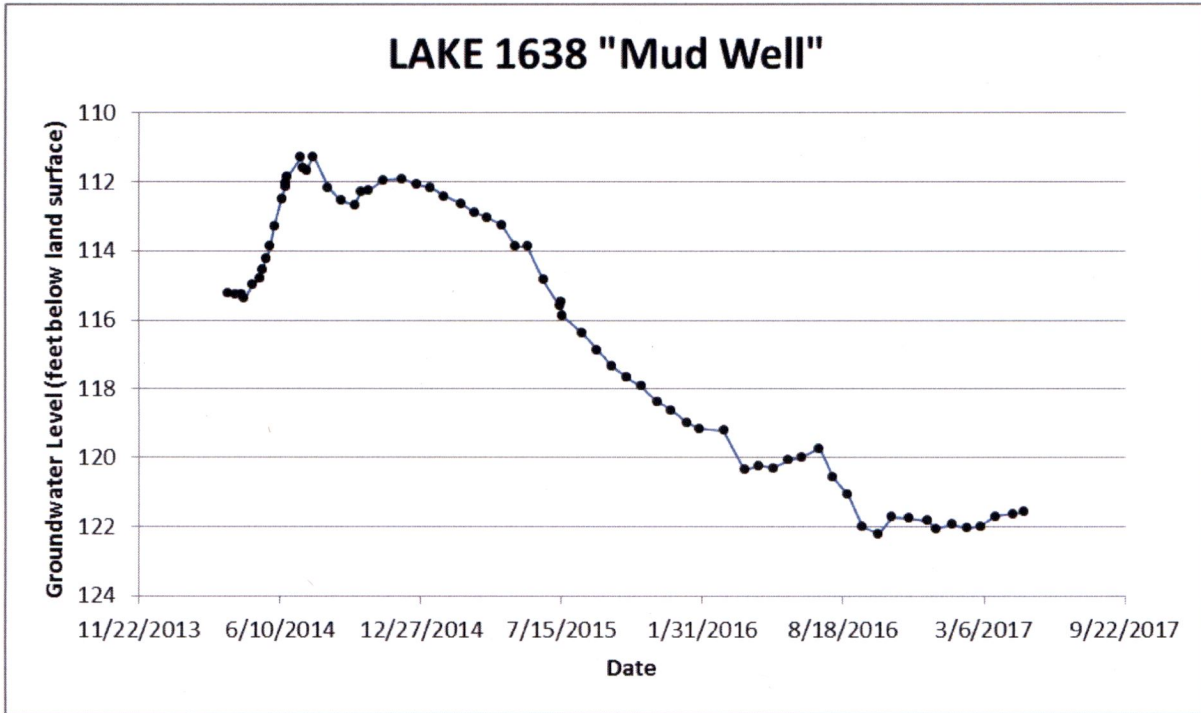


Figure 10: Supplemental data provided by the applicant - LAKE 1638.

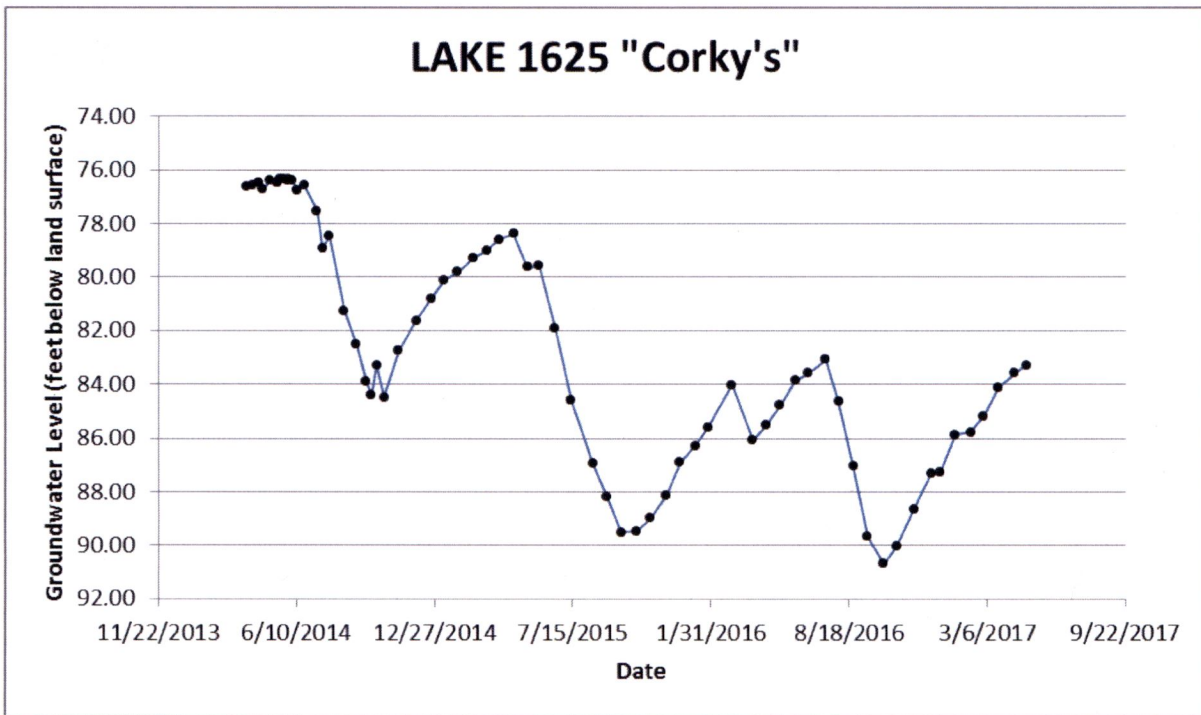


Figure 11: Supplemental data provided by the applicant - LAKE 1625.

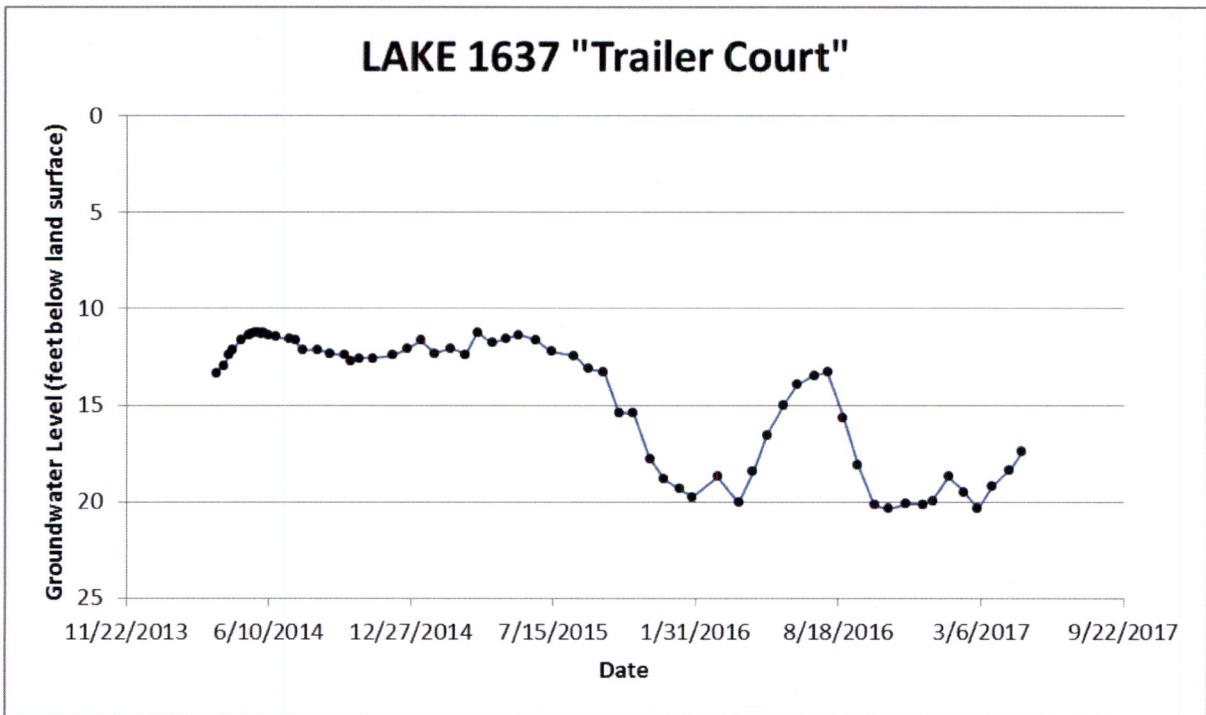


Figure 12: Supplemental data provided by the applicant - LAKE 1637.

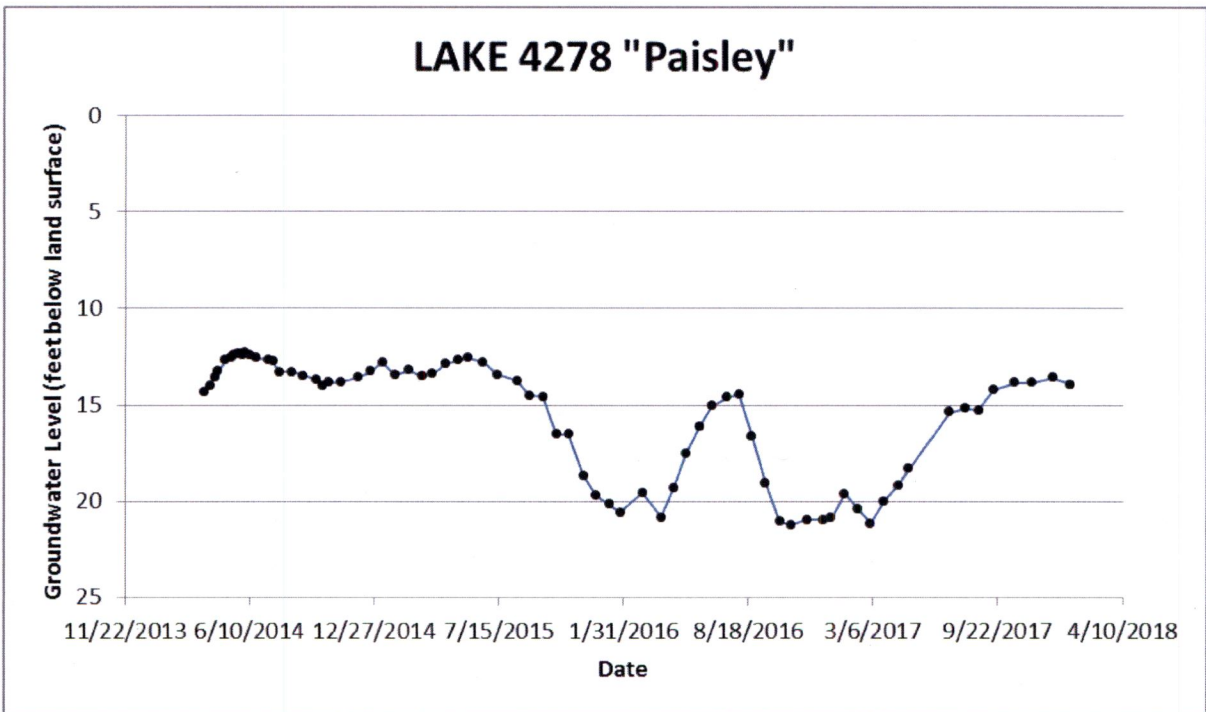


Figure 13: Supplemental data provided by the applicant - LAKE 4278.

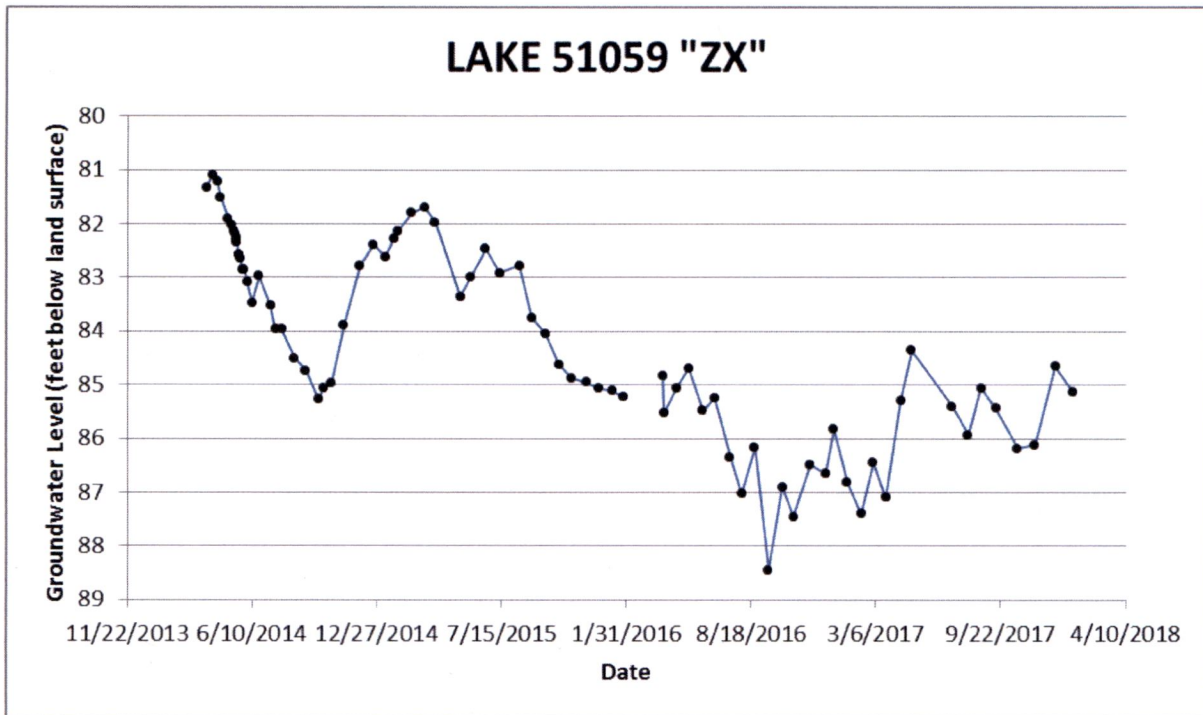


Figure 14: Supplemental data provided by the applicant - LAKE 51059.

Thisis Time-Drawdown Worksheet v.3.00
 Calculates Thisis nonequilibrium drawdown and recovery at any arbitrary radial distance, r, from a pumping well for 3 different T values and radial distance, r, from a pumping well for 3 different T values and 2 different S values.
 Written by Karl C. Wozniak September 1992. Last modified December 30, 2014

Input Data:	Var Name	Scenario 1	Scenario 2	Scenario 3	Units
Total pumping time	t		365		d
Radial distance from pumped well:	r		445.00		ft
Pumping rate	Q		2.7		cfs
					Q conversions
					1,198.30 gpm
Hydraulic conductivity	K	51	51	51	ft/day
					2.67 cfs
Aquifer thickness	b		100		ft
					160.20 cfm
Storativity	S_1	0.00100	0.00100	0.00100	
	S_2				230,688.00 cfd
					5.30 afd
Transmissivity Conversions	T_ftpd	5.050	5.050	5.050	ft ² /day
	T_ft2pm	3.5069	3.5069	3.5069	ft ² /min
	T_gpdft	37.774	37.774	37.774	gpd/ft

Recalculate Use the Recalculate button if recalculation is set to manual

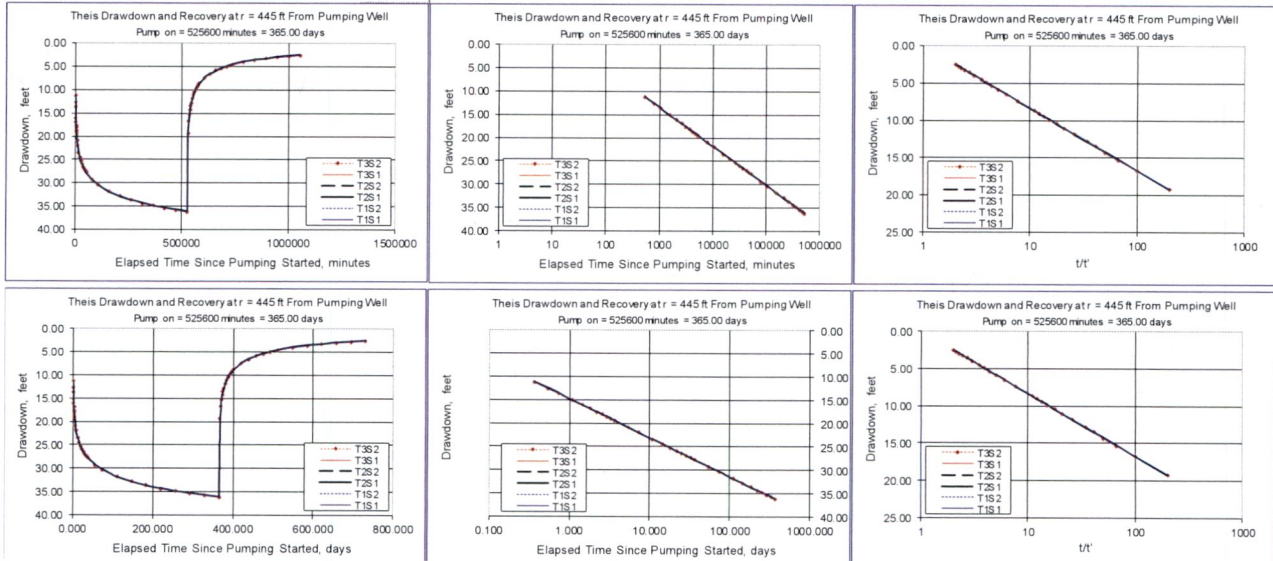


Figure 15: Interference calculation: LAKE 52530-LAKE 1627 (pumping).

Thisis Time-Drawdown Worksheet v.3.00
 Calculates Thisis nonequilibrium drawdown and recovery at any arbitrary radial distance, r, from a pumping well for 3 different T values and radial distance, r, from a pumping well for 3 different T values and 2 different S values.
 Written by Karl C. Wozniak September 1992. Last modified December 30, 2014

Input Data:	Var Name	Scenario 1	Scenario 2	Scenario 3	Units
Total pumping time	t		365		d
Radial distance from pumped well:	r		5310.00		ft
Pumping rate	Q		-2.7		cfs
					Q conversions
					-1,198.30 gpm
Hydraulic conductivity	K	51	51	51	ft/day
					-2.67 cfs
Aquifer thickness	b		100		ft
					-160.20 cfm
Storativity	S_1	0.00100	0.00100	0.00100	
	S_2				-230,688.00 cfd
					-5.30 afd
Transmissivity Conversions	T_ftpd	5.050	5.050	5.050	ft ² /day
	T_ft2pm	3.5069	3.5069	3.5069	ft ² /min
	T_gpdft	37.774	37.774	37.774	gpd/ft

Recalculate Use the Recalculate button if recalculation is set to manual

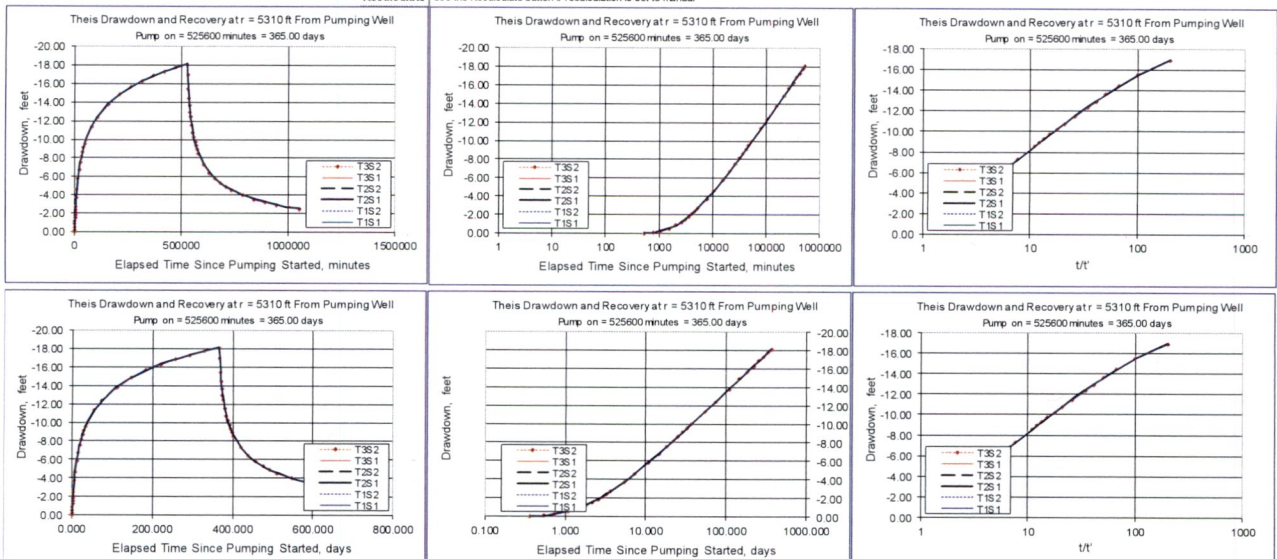


Figure 16: Interference Calculation: LAKE 52529-LAKE 1627 (injection).