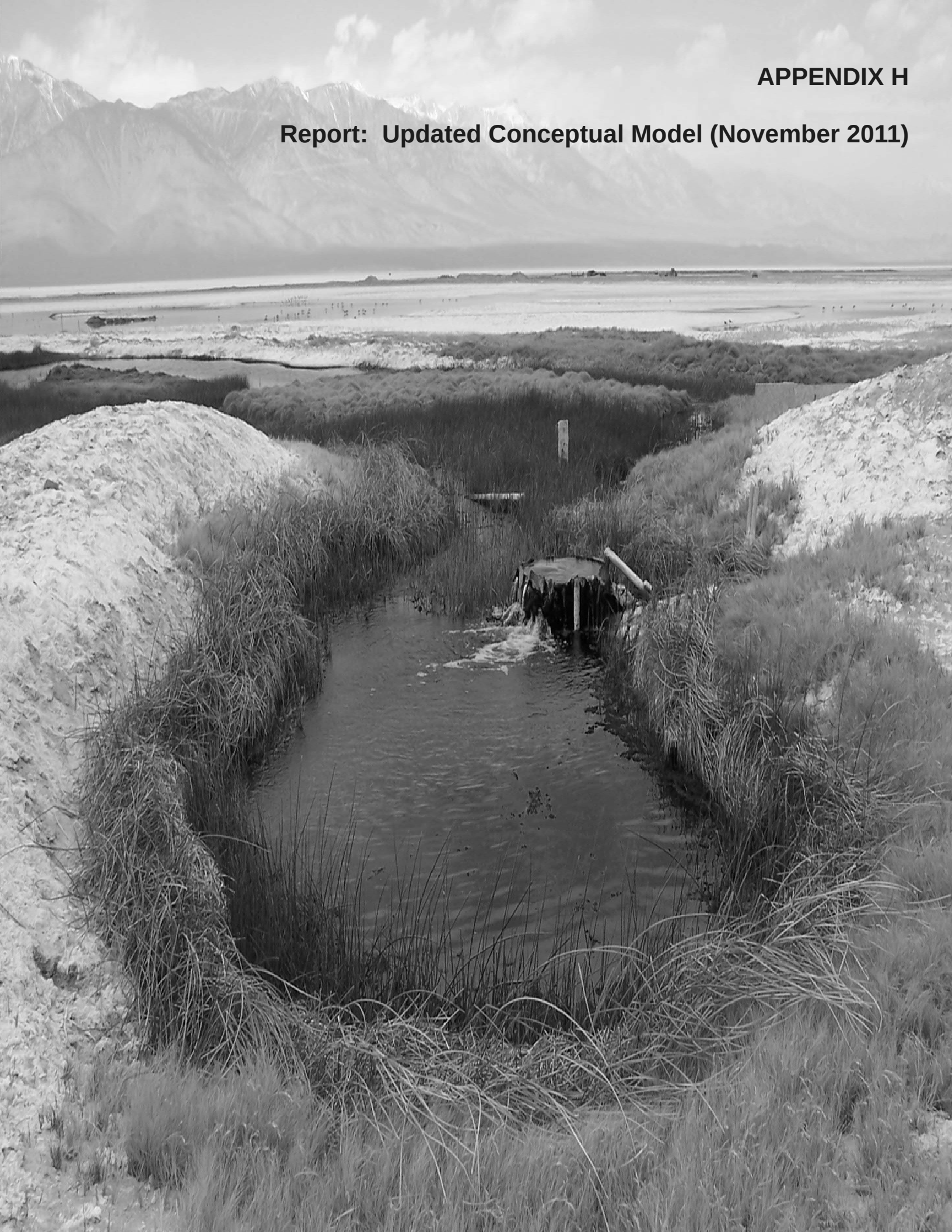
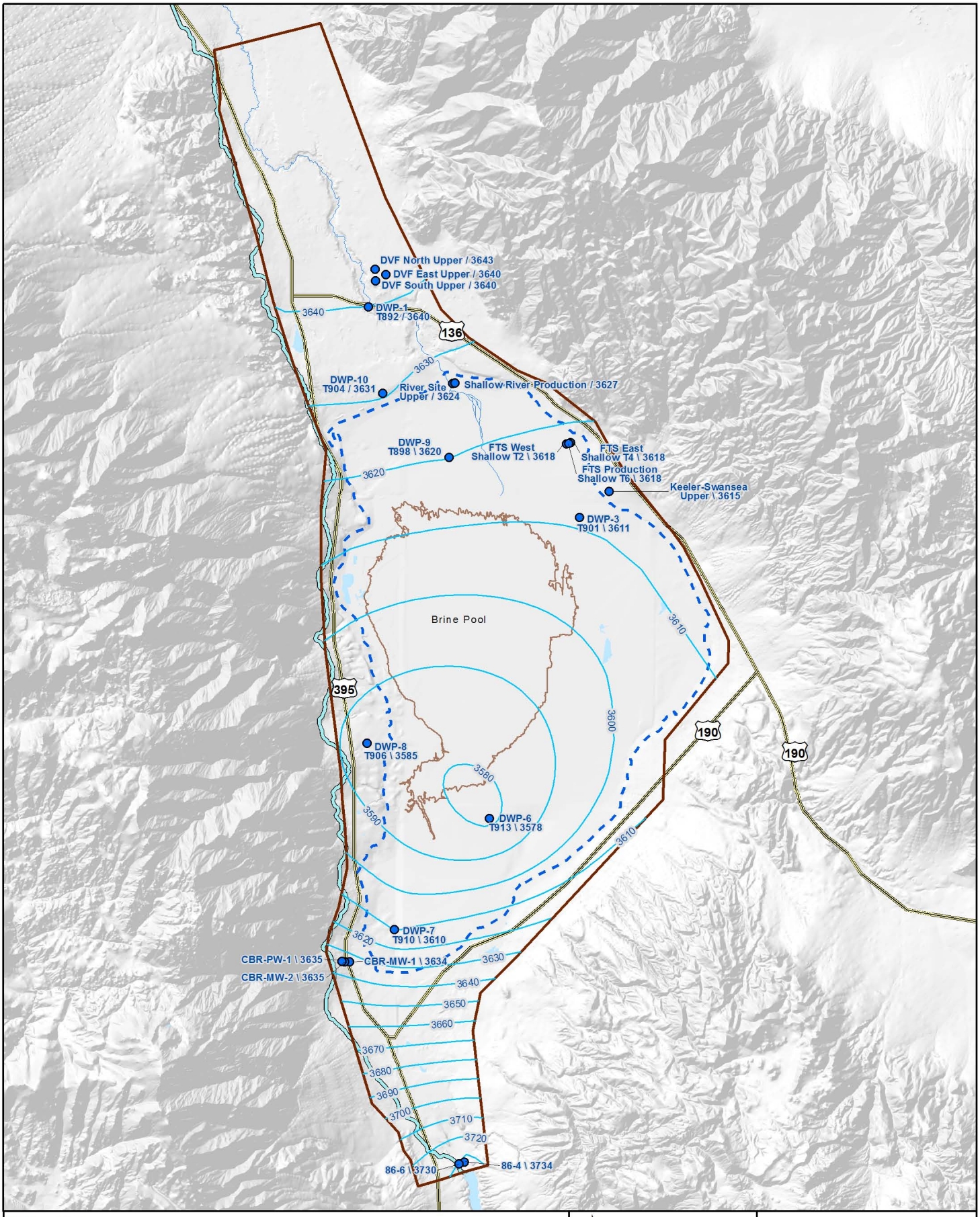


APPENDIX H

Report: Updated Conceptual Model (November 2011)

APPENDIX A

Groundwater Contour Maps for Aquifer Units 1 - 5



Key to Features

- Data Point Used for Contouring
- DWP-1 T892 \ 3640 — Well Name \ Water Elevation (feet AMSL)
- Water Level Elevation Contour interval = 10 feet
- Highways
- Los Angeles Aqueduct
- Owens River
- OLGEP Study Area
- Other Water Bodies
- Owens Lake (Historic Shoreline)

N

0 1.5 3 Miles

Document: \\Uspas1s01\muni\Clients\Los Angeles Water&Power\Owens Valley Data\Owens Valley GIS \Projects\OLGEP\ConceptModel0711\ RevDomainCntrs.mxd

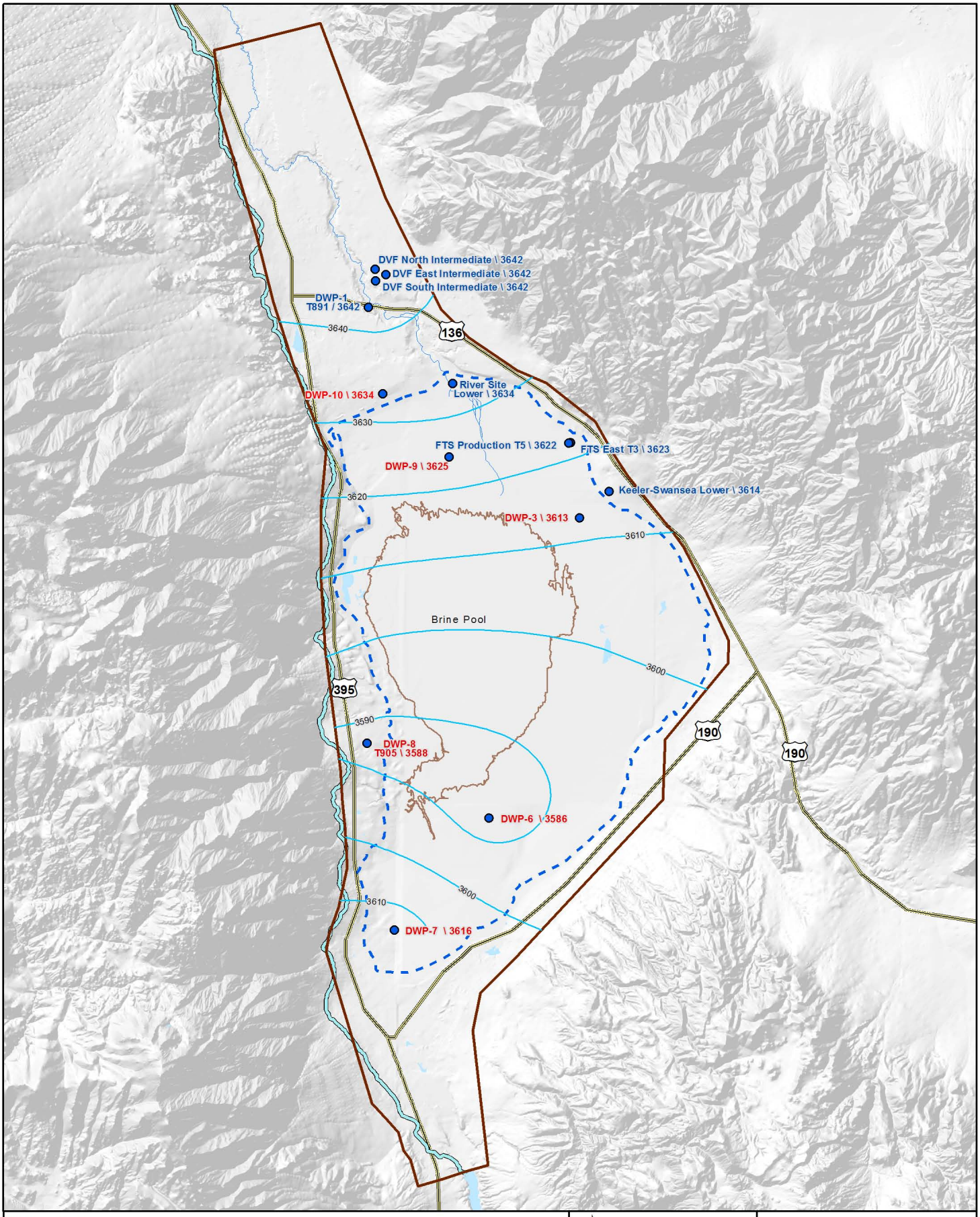
Conceptual Model for Owens Lake Groundwater Evaluation Project

Water Level Contours Aquifer 1

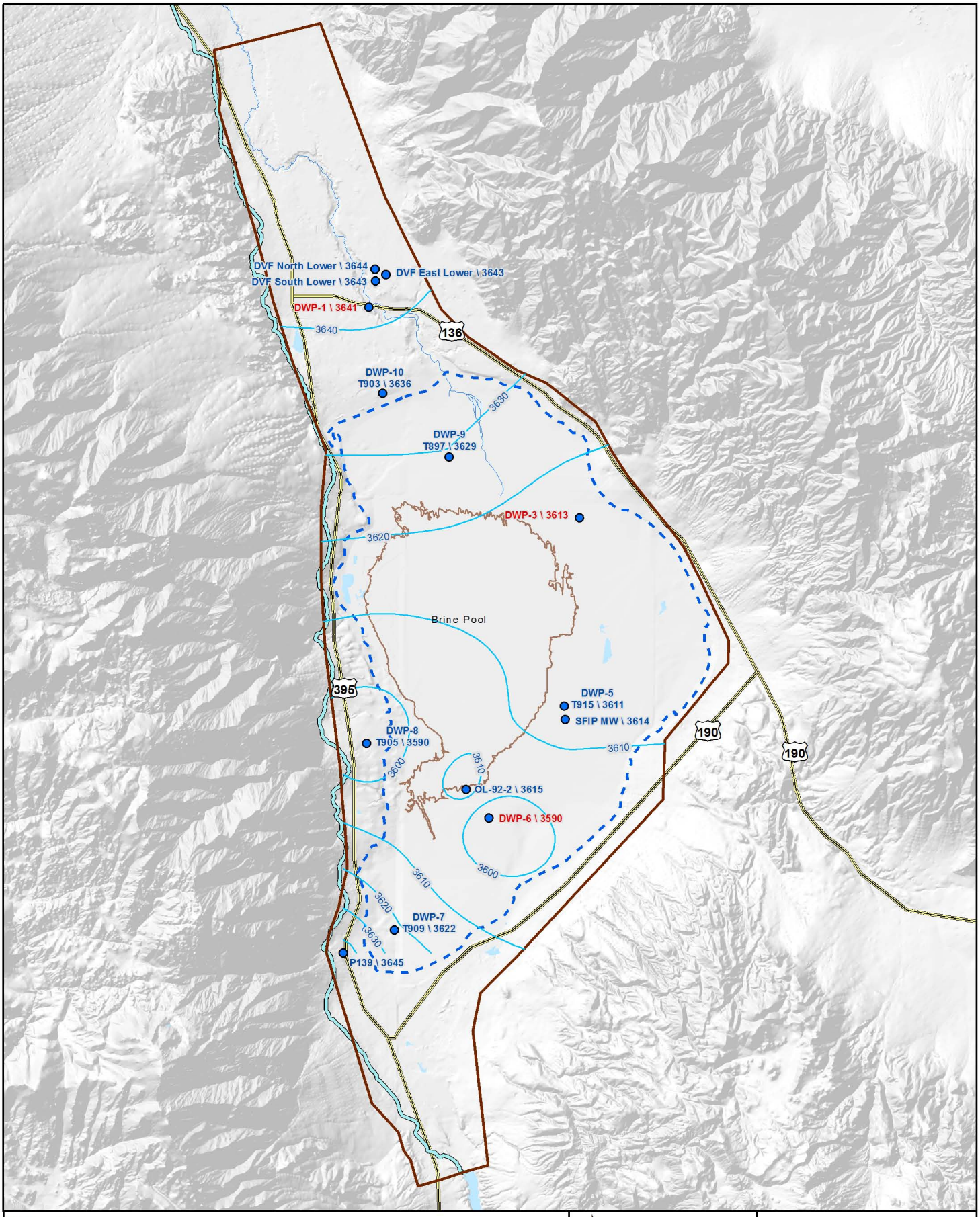
Los Angeles Department of Water & Power

MWH

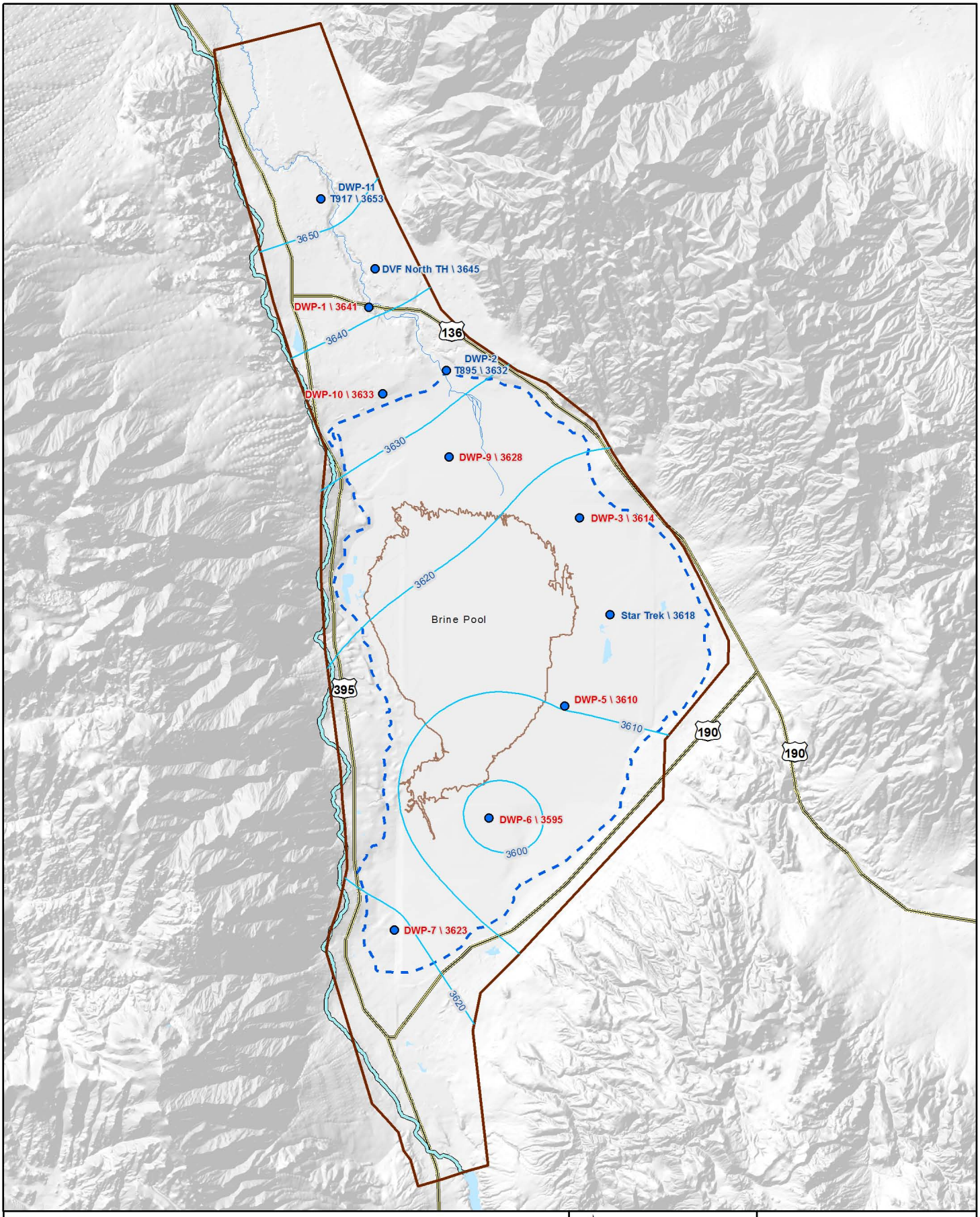
This map has been designed to print 8.5" x 11".



This map has been designed to print 8.5" x 11''.



This map has been designed to print 8.5" x 11".



Key to Features

- Data Point Used for Contouring
- Star Trek \ 3618 — Well Name \ Water Elevation (feet AMSL)
- DWP-1 \ 3641 — Well Name \ Averaged Water Elevation (feet AMSL)
- Water Level Elevation Contour interval = 10 feet
- Highways
- Los Angeles Aqueduct
- Owens River
- OLGEP Study Area
- Other Water Bodies
- Owens Lake (Historic Shoreline)

N

0 1.5 3 Miles

Document: \\Uspas1s01\muni\Clients\Los Angeles Water&Power\Owens Valley Data\Owens Valley GIS \Projects\OLGEP\ConceptModel0711\ RevDomainCntrs.mxd

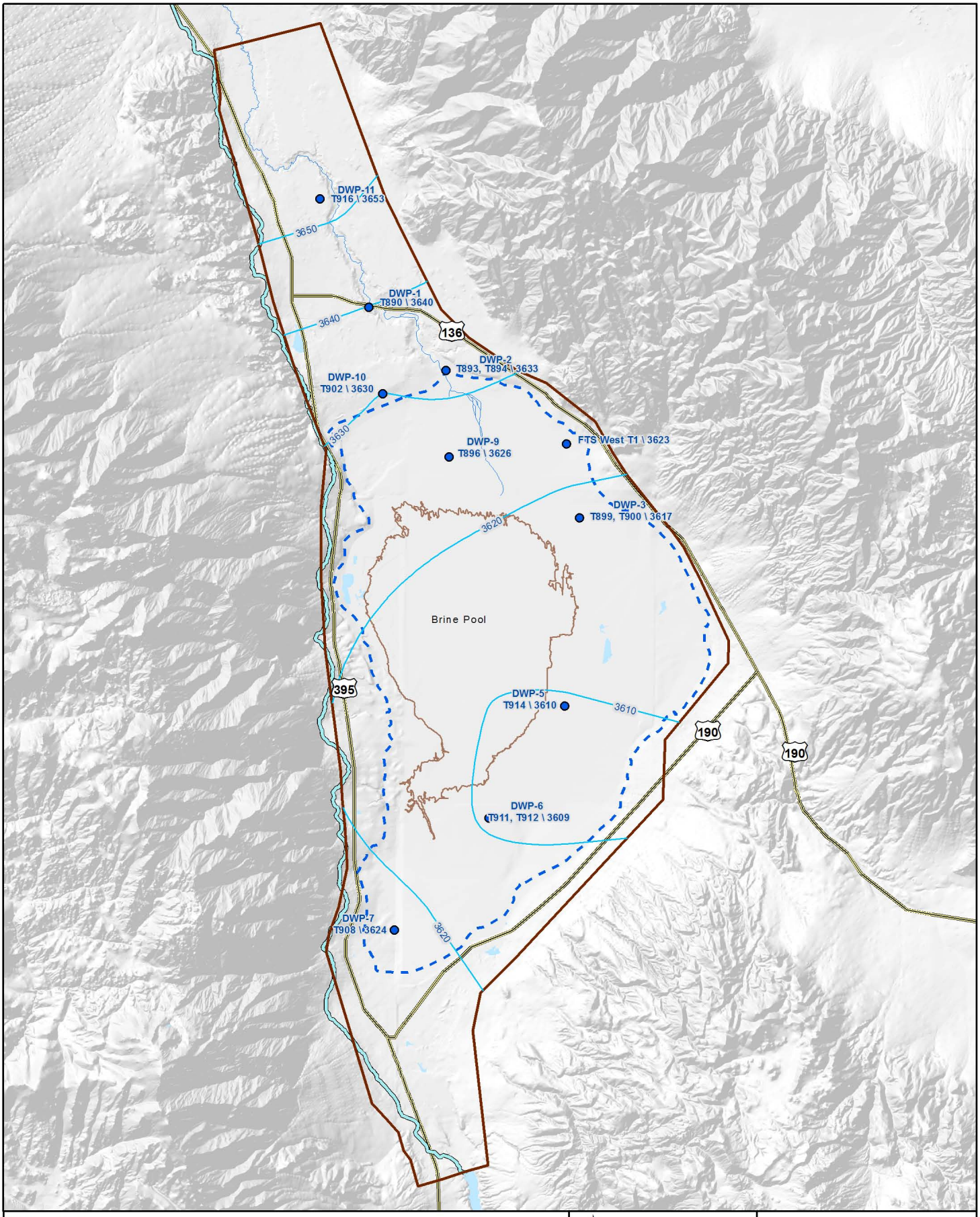
Conceptual Model for Owens Lake Groundwater Evaluation Project

Water Level Contours Aquifer 4

Los Angeles Department of Water & Power

MWH

This map has been designed to print 8.5" x 11".



Key to Features

- Data Point Used for Contouring
  FTS West T1 \ 3623 Well Name \ Water Elevation (feet AMSL)
- Water Level Elevation Contour interval = 10 feet
- Highways
- Los Angeles Aqueduct
- Owens River
- OLGEP Study Area
- Other Water Bodies
- Owens Lake (Historic Shoreline)

N 0 1.5 3 Miles

Document: \\Uspas1s01\muni\Clients\Los Angeles Water&Power\Owens Valley Data\Owens Valley GIS \Projects\OLGEP\ConceptModel0711\ RevDomainCntrs.mxd

Conceptual Model for Owens Lake Groundwater Evaluation Project

Water Level Contours Aquifer 5

Los Angeles Department of Water & Power

MWH

This map has been designed to print 8.5" x 11".

Water Level Elevations Corrected for Density and Temperature

Well Site	Well ID	Water Quality		Specific Gravity[1] (kg/m^3)	Depth to Aquifer (ft)	Calculated Water Level[3] (ft amsl)	Observed Water Level (ft amsl)	Water Level Difference (ft)	Aquifer Unit (1-5)
		Temp (˚C)	TDS (mg/L)						
DWP-1	T890	27	1,200	997.447	1,150	3639.89	3640.8	-0.91	5
	T891	21	650	998.518	480	3642.43	3642.29	0.14	2
	T892	19	330	998.688	290	3640.05	3639.92	0.13	1
DWP-2	T893	23	1,200	998.478	1,430	3634.84	3634.49	0.35	5
	T894	24	700	997.857	1,170	3630.28	3630.72	-0.44	5
	T895	23	1,200	998.478	860	3632.28	3632.07	0.21	4
DWP-3	T899	27	1,000	997.296	920	3617.12	3617.98	-0.86	5
	T900	24	750	997.895	660	3617.73	3617.95	-0.22	5
	T901	18	1,900	1,000.081	150	3611.15	3610.87	0.28	1
DWP-5	T914	37	2,820	995.448	1,360	3609.55	3613.34	-3.79	5
	T915	29	4,816	999.574	760	3611.32	3610.3	1.02	3
DWP-6	T911	42	6,490	996.239	1,420	3606.61	3609.44	-2.83	5
	T912	34	4,208	997.526	1,020	3610.70	3611.42	-0.72	5
	T913	22	20,983	1,013.633	260	3577.51	3573.51	4.00	1
DWP-7	T908	35	1,007	994.813	1,360	3624.25	3628.9	-4.65	5
	T909	28	420	996.580	740	3621.69	3622.91	-1.22	3
	T910	20	222	998.404	200	3609.53	3609.5	0.03	1
DWP-8	T905	29	5,600	1,000.157	1,200	3590.41	3588.1	2.31	3
	T906	22	1,700	999.091	450	3584.99	3584.6	0.39	1
	T907	19	1,700	999.734	250	3583.46	3583.08	0.38	1
DWP-9	T896	21	1,370	999.065	1,280	3626.16	3625.1	1.06	5
	T897	24	1,142	998.191	780	3629.36	3629.39	-0.03	3
	T898	22	726	998.353	240	3620.25	3620.22	0.03	1
DWP-10	T902	26	1,400	997.869	1,290	3629.82	3630.29	-0.47	5
	T903	23	1,000	998.327	720	3636.37	3636.3	0.07	3
	T904	21	480	998.388	300	3630.77	3630.72	0.05	1
DWP-11	T916	25	1,058	997.874	1,220	3652.76	3653.2	-0.44	5
	T917	24	1,266	998.284	930	3652.65	3652.6	0.05	4
DVFT North Pad	Upper	18.7	298	998.722	212	3642.81	3642.71	0.10	1
	Middle	19.5	728	998.892	512	3641.66	3641.32	0.34	2
	Lower	20.1	1,119	999.067	662	3643.66	3643.11	0.55	3
	Test Hole	19.6	1,164	999.205	938	3645.20	3644.29	0.91	4
DVFT East Pad	Upper	18.7	298	998.722	189	3640.07	3639.98	0.09	1
	Middle	19.5	728	998.892	497	3642.19	3641.86	0.33	2
	Lower	20.1	1,119	999.067	643	3642.92	3642.38	0.54	3
DVFT South Pad	Upper	18.7	298	998.722	205	3640.49	3640.39	0.10	1
	Middle	19.5	728	998.892	518	3642.43	3642.09	0.34	2
	Lower	20.1	1,119	999.067	659	3642.76	3642.21	0.55	3
River Site (RS)	Upper	17.1	830	999.425	170	3624.40	3624.2	0.20	1
	Lower	20.6	790	998.711	485	3634.00	3633.77	0.23	2
RS Production	Shallow	17.1	549	999.210	155	3627.15	3627	0.15	1
FTS West Pad	T1	21.9	858	998.481	555	3623.23	3623.09	0.14	5
	T2	19.1	1,781	999.771	64	3618.17	3618.07	0.10	1
FTS East Pad	T3	20.5	1,385	999.185	264	3622.45	3622.2	0.25	2
	T4	19.1	1,508	999.563	66	3617.98	3617.89	0.09	1
FTS Production	T5	20.5	1,391	999.189	277	3622.10	3621.84	0.26	2
	T6	19.1	1,508	999.563	73	3617.98	3617.88	0.10	1
Keeler Swansea	Upper	20.1	2,201	999.890	100	3614.53	3614.36	0.17	1
	Lower	21.6	2,344	999.670	220	3614.03	3613.71	0.32	2
Star Trek		28.4	3,103	998.473	644	3618.39	3618.24	0.15	4
SFIP	MW	31.1	7,937	1,001.243	700	3613.92	3611.81	2.11	3
OL-92-2		24.1	17,101	1,010.152	750	3615.14	3606.2	8.94	3
Olancha	86-4	20.0	370	998.517	20	3734.43	3734.42	0.01	1
	86-6	20.0	370	998.517	150	3730.43	3730.39	0.04	1
Cabin Bar Ranch	MW-1	20.0	130	998.333	150	3633.69	3633.68	0.01	1
	MW-2	20.0	130	998.333	165	3634.85	3634.83	0.02	1
	PW-1	20.0	130	998.333	200	3635.09	3635.07	0.02	1
P139						3644.80	3644.8	0.00	3

Note:

1. Density is calculated as a function of both temperature and salinity using method from University of Michigan and NOAA (http://www.csgnetwork.com/h2odens

2. Density of pure water at 20^oC = 998.234 kg/m^3

3. Head correction is based on $H_c=H_{obs}$ + d X (ρ-998.234)/1000, where H_{obs} is observed head, d is depth to the aquifer and ρ is specific gravity.

Estimated Water Levels from Measurements in Adjacent Aquifers

Well Site	Estimated Water Level (ft amsl)	Aquifer Unit (1-5)	Estimation Method
DWP-1	3641.16	4	Averaged between measurements in Aquifer 2 (T891) and 5 (T890).
	3641.16	3	
DWP-2	3632.56	5	Averaged between measurements in T893 and T894 in Aquifer 5.
DWP-3	3617.43	5	Averaged between measurements in T899 and T900 in Aquifer 5.
	3614.11	4	Linear interpolated between the averaged value in Aquifer 5 and measured value in Aquifer 1 (T901).
	3613.35	3	
	3612.61	2	
DWP-5	3610.44	4	Averaged between measurements in Aquifer 3 (T915) and 5 (T914).
DWP-6	3608.66	5	Averaged between measurements in T911 and T912 in Aquifer 5.
	3595.05	4	Linear interpolated between the averaged value in Aquifer 5 and measured value in Aquifer 1 (T913).
	3589.92	3	
	3585.96	2	
DWP-7	3622.97	4	Averaged between measurements in Aquifer 3 (T909) and 5 (T908).
	3615.61	2	Averaged between measurements in Aquifer 3 (T910) and 5 (T909).
DWP-8	3587.7	2	Averaged between measurements in Aquifer 1 (T906) and 3 (T905).
DWP-9	3627.76	4	Averaged between measurements in Aquifer 3 (T897) and 5 (T896).
	3624.81	2	Averaged between measurements in Aquifer 1 (T898) and 3 (T897).
DWP-10	3633.1	4	Averaged between measurements in Aquifer 3 (T903) and 5 (T902).
	3633.57	2	Averaged between measurements in Aquifer 1 (T904) and 3 (T903).

ft amsl = feet above mean sea level

APPENDIX B

Application of Crippen Method to the Study Area for Calculation of Interfluve/Fan Recharge

The procedure for applying the Crippen method to the study area included:

1. Zones of altitude were established using topographic maps, and the area of each zone was calculated using ArcView® software GIS measuring tools.
2. The long-term mean annual precipitation, *P*, for each altitude zone was determined using estimated isohyets developed by Danskin (1998; see Figure 7).
3. In combination, these values were used to derive the contribution of the various interfluve zones surrounding Owens Lake, as well as the zone containing the greater Owens Lake playa.

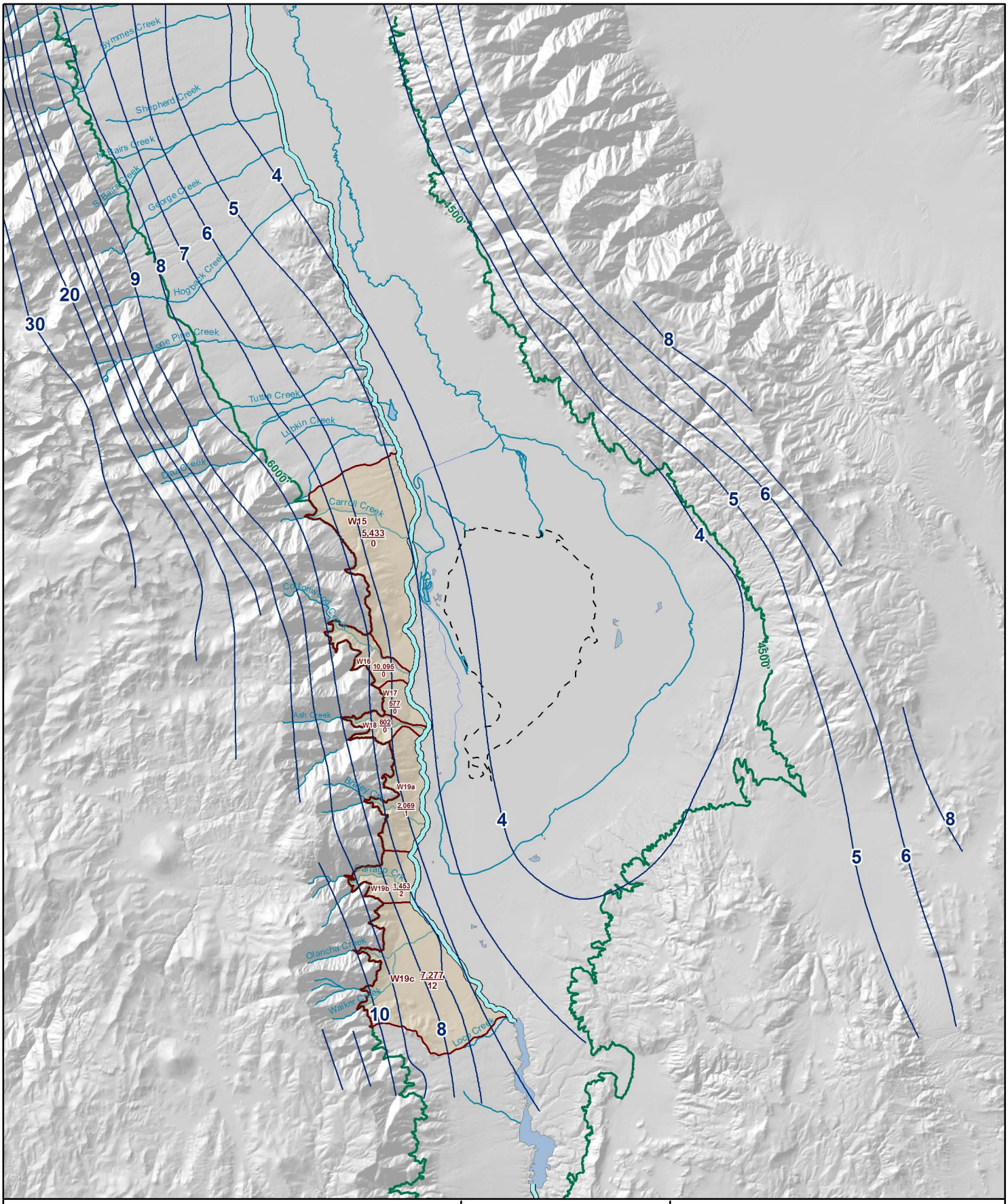
The attached figure identifies the various interfluve zones (outside of the Southern Model/OLGEP overlap area) along with the isohyet zones of precipitation developed by Danskin (1998). Also represented, next to the area labels, are the total precipitation values (top) and total recharge values calculated using the Crippen method for each zone(bottom).

Along the Sierra Nevada mountain front, areas W15 through W19 represent the portion of interfluve areas, occurring between 6,000 fmsl and the Los Angeles Aqueduct, for each respective drainage. The interfluve area between these elevations is dominated by alluvial fans, and all precipitation outside of the stream channels is assumed to evaporate or infiltrate.

Along the Inyo and Coso mountains, the mountainous bedrock/alluvial fan boundary occurs at a lower elevation of approximately 4,500 fmsl. As a result, interfluve recharge for the balance of the study area (outside of the Southern Model/OLGEP area overlap) was grouped into a single unit, identified as the Lake Basin in the table below.

The estimates of interfluve/fan recharge for each of these zones using Crippen are listed in the following table. Total interfuve/fan recharge for the area outside of the Southern Model/OLGEP overlap is estimated at approximately 15 acre-feet per year.

OLGEP Interfluve Zones			
Area ID	**Area (acre)**	**Precipitation (acre-feet)**	**Recharge (acre-feet)**
W15	11,293	5,433	0
W16	1,891	10,095	0
W17	1,175	577	0
W18	1,106	602	0
W19a	17,201	2,069	1
W19b		1463	2
W19c		7277	12
Lake Basin	164,319	58,386	0
TOTAL	**196,985**	**85,902**	**15**



Key to Features

- 8 — Isohyets (Inches)
- Los Angeles Aqueduct
- Rivers and Streams
- Elevation Contour (in feet)
- Brine Pool
- Watershed — Total Precipitation (AFY) / Estimated Recharge (AFY)

Recharge estimation is based on the methods of Crippen (1965) and Maxey-Eakin (1949). Isohyets after Danskin (1998).

N

0 1.5 3 Miles

Document: \\uspas1netapp1\MUNI\Clients\Los Angeles Water&Power LADWP\Owens Valley Data\Owens Valley GIS\Projects\OLGEP\Watershed\OLGEPWatersheds070811.mxd

Date: July 2011

Watersheds and Estimate of Recharge in Interfluve

Los Angeles Department of Water & Power

MWH

APPENDIX C

Centennial Flats Area Well Log Information

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e053494

Page 1 of 1

Owner's Well Number Centennial Flats

Date Work Began 03/14/2007 Date Work Ended 3/25/2007

Local Permit Agency

Permit Number Permit Date

DWR Use Only – Do Not Fill In

State Well Number/Site Number: 19S39E11D01M

Latitude N Longitude W

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
0	35	Gravelly Sand; M-VC sand w/ gravels , 14mm dia.
35	42	Sand- M-VC, w/ gravels < 10 mm, high dolomite content
42	141	Gravelly Sand; M-VC sand w/ gravels , 10mm dia.
141	148	Silty Sand; VF-F sand w/ silt, 10YR 5/3
148	165	Gravelly Sand; M-VC sand w/ granules
165	205	Innerbedded- Silty Sands and Sandy Gravels
205	236	Gravelly Sand; M-VC sand w/ gravels , 6mm dia.
236	324	Gravelly Silty Sand; M-VC sand w/ VF-silt and granules
324	330	Sand; Clean M-VC sand
330	380	Gravelly Silty Sand; M-VC sand w/ VF-silt and granules
380	408	Silty Sand
408	510	Clay, White 10YR 8/1
510	545	Sandy Silt; Silt w/ VF-M sand 2.5Y 5/2
545	595	Gravelly Sandy Silt/Clay; Silt/clay w/ VF-VC sand & gran 2.5Y 6/4
595	612	Gravelly Sandy Silt/Clay; Silt/clay w/ VF-VC sand & gran, 10Y 3/1
612	668	Sandy Clayey Silt; Silt w/ clay and VF-M sand, 2.5Y 5/2
668	708	Sandy Clayey Silt; Silt w/ clay and VF-M sand, N 4/1
708	755	Silty Clay; 10GY 6/1
755	770	Slightly Sandy Silty Clay; 10GY 6/1
770	915	Silty Clay; 10GY 4/1
915	1,100	Silty Clay; 10GY 5/1

Total Depth of Boring 1100 Feet

Total Depth of Completed Well 1080 Feet

Well Owner

Name Bureau of Indian Affairs, Central California Agency

Mailing Address 650 Capitol Mall Suite 8-500

City Sacramento State CA Zip 95814

Well Location

Address unnamed dirt road on BLM land in Centennial Flats

City closest to Darwin, CA County Inyo

Latitude 36 Deg. 18 Min. 7 Sec. N Longitude 117 Deg. 43 Min. 27 Sec. W

Datum NAD83 Decimal Lat. .85 Decimal Long. .70

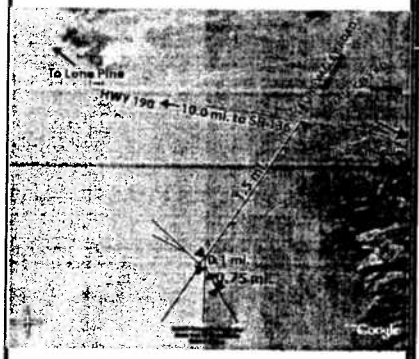
APN Book Page Parcel

Township 19S Range 39E Section 11D

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North



South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete

Activity

◉ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply
☐ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
◉ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water 900 (Feet below surface)

Depth to Static Water Level 900 (Feet) Date Measured 03/26/2007

Estimated Yield * 0.08 (GPM) Test Type

Test Length 15.0 (Hours) Total Drawdown (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
760	780	9.875	Screen	Low Carbon Steel	.25	4.5	Milled Slots	0.020
820	840	9.875	Screen	Low Carbon Steel	.25	4.5	Milled Slots	0.020
920	940	9.875	Screen	Low Carbon Steel	.25	4.5	Milled Slots	0.020
1,020	1,040	9.875	Screen	Low Carbon Steel	.25	4.5	Milled Slots	0.020
1,060	1,080	9.875	Screen	Low Carbon Steel	.25	4.5	Milled Slots	0.020
All other depths		9.875	Blank	Low Carbon Steel	.25	4.5		

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	708	Bentonite	Grout @ 30% solid
708	1,100	Filter Pack	RMC #3 Sand

Attachments

☑ Geologic Log
☑ Well Construction Diagram
☑ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☑ Other On file @ USGS- San Diego

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Rhett Everett, Hydrologist, U.S. Geological Survey
Person, Firm or Corporation

4165 Spruance Road Suite 200 San Diego CA 92101
Address City State Zip

Signed Rhett R Everett 4/10/2007
C-57 Licensed Water Well Contractor Date Signed

federal government
C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

CENTENNIAL FLATS

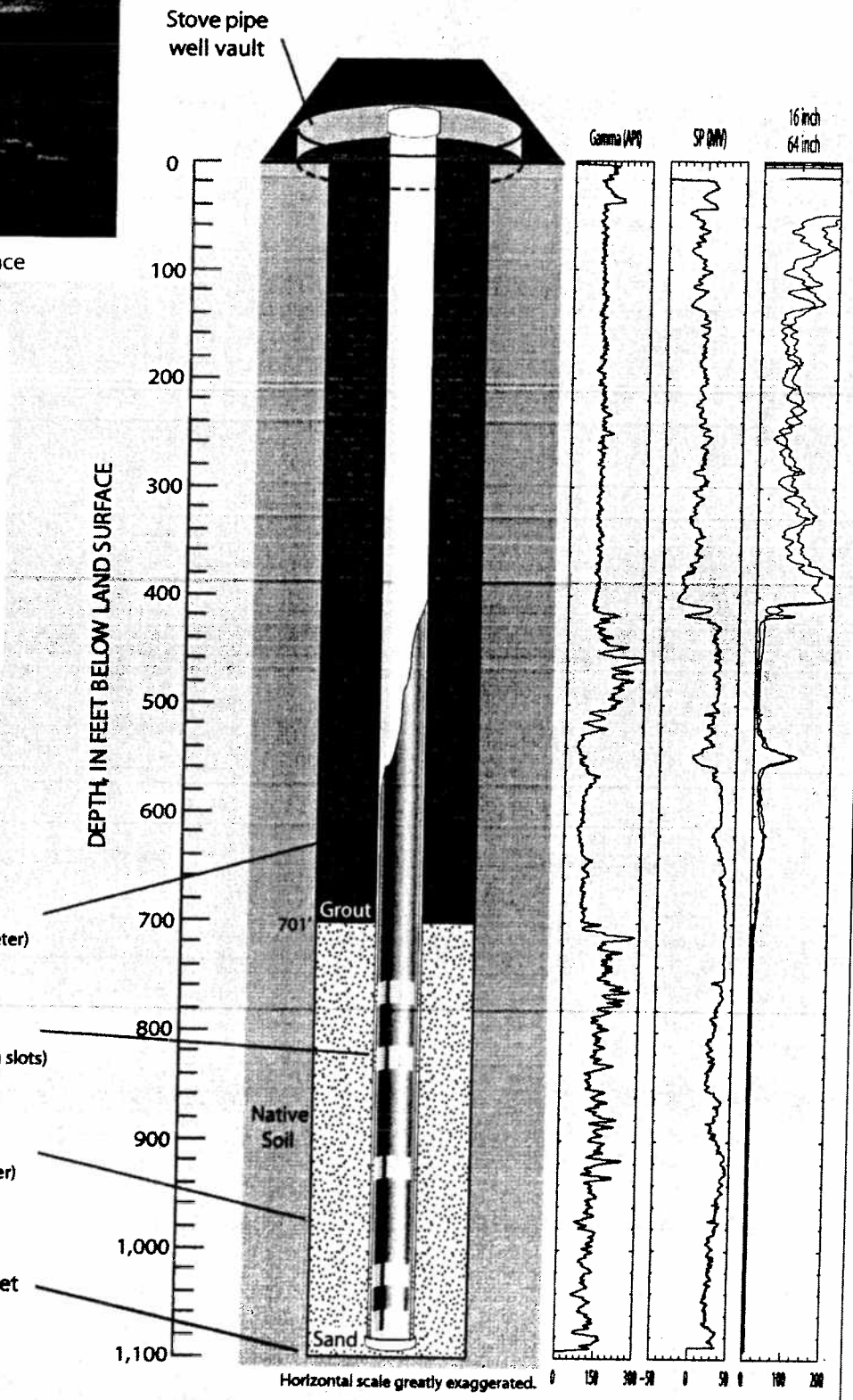
T19S/R39E-11D 001m

36°18'07.85" 117°43'27.70"

Well vault as it appears on surface

Well vault as it appears on surface

Drill method: hydraulic mud rotary



Peak Streamflow for the Nation

USGS 10285780 OWENS LK TRIB NR KEELER CA

Available data for this site: Surface-water: Peak streamflow | GO

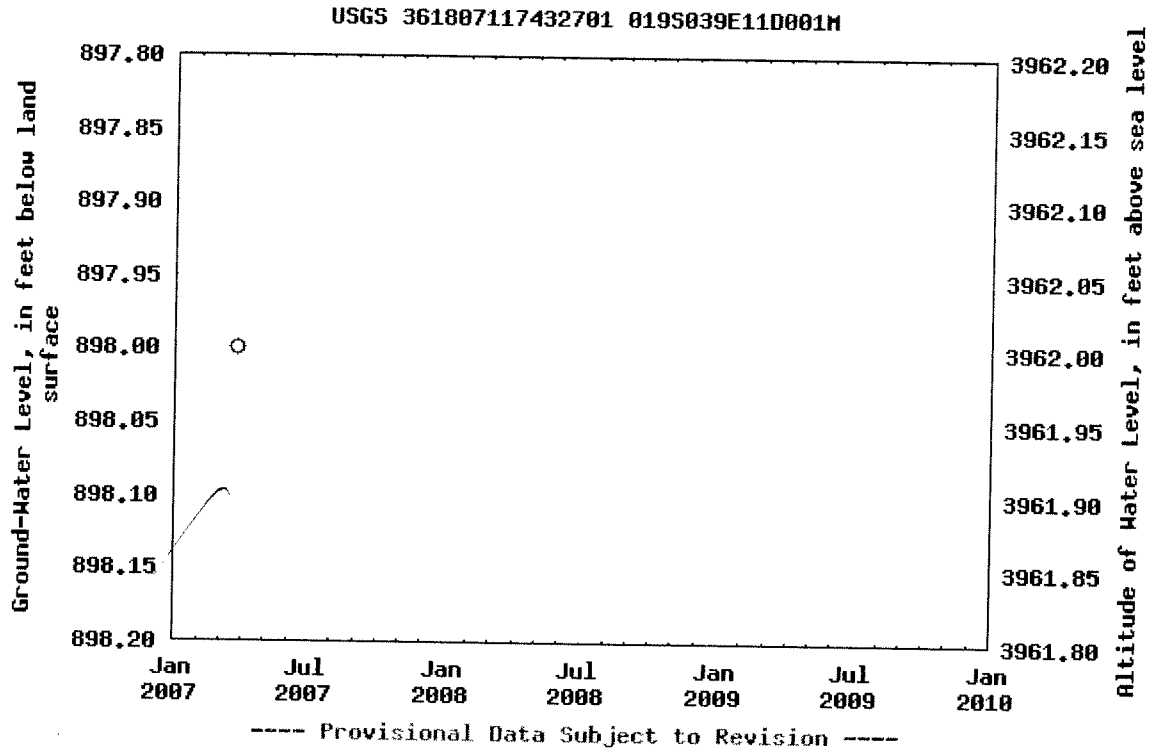
Inyo County, California
Hydrologic Unit Code 18090103
Latitude 36°23'30", Longitude 117° 48'23" NAD27
Drainage area 3.83 square miles
Gage datum 4,270 feet above sea level NGVD29

Output formats

- Table
- Graph
- Tab-separated file
- peakfq (watstore) format
- Reselect output format

Annual Peak

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1965	Aug. 16, 1965	4.42	14.0
1966	Aug. 15, 1966	4.71	18.0
1967	Sep. 04, 1967	9.20	68.0
1968	Aug. 07, 1968	5.67	31.0
1969	1969		0.00
1970	1970		0.00
1971	1971		0.00
1972	1972		0.00
1973	Nov. 14, 1972	3.97	8.80



Breaks in the plot represent a gap of at least one year between field measurements.

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U.S. Department of the Interior | U.S. Geological Survey
Title: Ground water for USA: Water Levels
URL: http://waterdata.usgs.gov/nwis/gwlevels?

Page Contact Information: NWISWeb Support Team
Page Last Modified: 2009-07-28 14:50:59 EDT
1.93 1.89 nadww01

898.0' bgs on 3/26/2007
772.6' bgs on 8/27/2007

USGS Home
Contact USGS
Search USGS

National Water Information System: Web Interface

USGS Water Resources

Data Category: Ground Water | Geographic Area: United States | GO

News New Mapper ! - updated July 2009

Ground-water levels for the Nation

Search Results -- 1 sites found

Search Criteria

Agency code = usgs
site_no list = • 361907117433001
Minimum number of levels = 1

Save file of selected sites to local disk for future upload

USGS 361907117433001 018S039E35N001M

Available data for this site: Ground-water: Field measurements | GO

Inyo County, California
Hydrologic Unit Code
Latitude 36°19'07.96", Longitude 117°43'30.30"
NAD83
Land-surface elevation 4,764.1 feet above sea level
NGVD29
The depth of the well is 702.5 feet below land surface.
The depth of the hole is 1,000 feet below land surface.

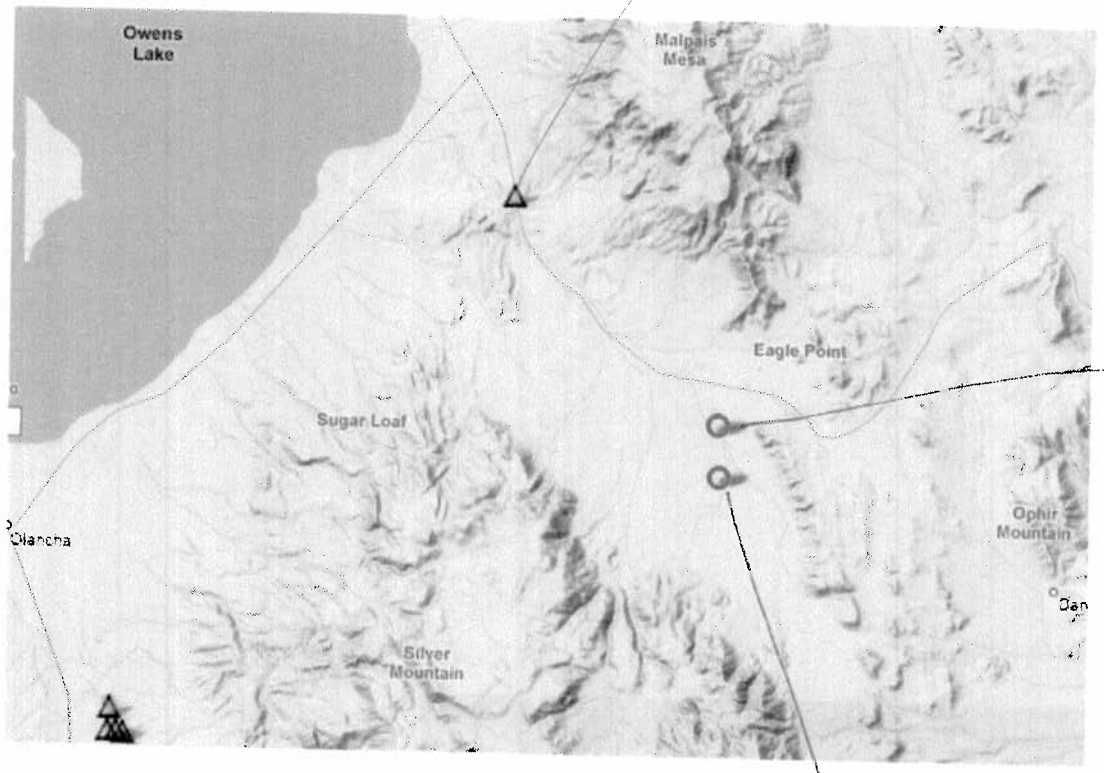
Output formats

- Table of data
- Tab-separated data
- Graph of data
- Reselect period

Dry well

Gage datum 4270

Drainage area 3.83 square miles



18S 39E 35N 001M

WL <4061.6 ON 12/12/20

19S 39E 11D 001M

WL = 3962 ON 3/26/2007

APPENDIX D

Summary of Annual Stream Flow Diverted to the Los Angeles Aqueduct for Carroll, Cottonwood, Ash, and Braley Creeks

Annual Streamflow Diverted into the Los Angeles Aqueduct

Year	Carroll Creek (AF)	Cottonwood Creek (AF)	Ash Creek (AF)	Braley Creek (AF)
2010-11	62	15,364	2,326	887
2009-10	0	7,135	825	655
2008-09	106	9,319	1,345	801
2007-08	0	3,378	223	801
2006-07	325	21,537	3,366	1,279
2005-06	1,103	27,020	4,417	1,807
2004-05	0	8,365	1,675	1,020
2003-04	20	9,571	1,431	656
2002-03	0	4,849	428	584
2001-02	236	13,174	1,726	630
2000-01	0	7,210	875	725
1999-00	19	8,812	1,489	914
1998-99	648	29,117	6,867	1,674
1997-98	110	19,302	3,264	1,097
1996-97	135	18,968	4,290	1,367
1995-96	290	31,481	6,180	1,383
1994-95	0	7,036	1,062	675
1993-94	178	18,243	4,221	798
1992-93	57	10,872	2,032	644
1991-92	0	--	908	413
1990-91	0	--	332	445
1989-90	0	--	1,603	678
1988-89	0	--	616	721
1987-88	0	--	790	883
1986-87	0	--	5,505	1,949
1985-86	186	--	3,625	1,583
1984-85	0	--	2,360	1,334
1983-84	0	--	3,397	2,519
1982-83	2	--	4,724	1,453
1981-82	0	--	1,549	895
1980-81	0	--	6,760	1,845
1979-80	53	--	3,126	1,366
1978-79	226	--	8,180	2,072
1977-78	4	--	1,354	836
1976-77	78	--	910	706
1975-76	166	--	1,743	756
1974-75	194	--	2,474	803
1973-74	356	--	3,716	968
1972-73	0	--	552	545
1971-72	0	--	1,102	697
1970-71	0	--	1,292	980
1969-70	222	--	4,123	2,149
1968-69	0	--	2,229	1,072

Annual Streamflow Diverted into the Los Angeles Aqueduct

Year	Carroll Creek (AF)	Cottonwood Creek (AF)	Ash Creek (AF)	Braley Creek (AF)
1967-68	562	--	5,493	762
1966-67	135	--	2,050	729
1965-66	85	--	2,131	641
1964-65	0	--	628	347
1963-64	154	--	2,852	472
1962-63	348	--	3,610	750
1961-62	0	--	271	460
1960-61	0	--	418	497
1959-60	0	--	750	680
1958-59	607	--	4,924	1,266
1957-58	109	--	2,398	726
1956-57	76	--	2,301	588
1955-56	0	--	995	706
1954-55	0	--	1,875	668
1953-54	0	--	1,333	783
1952-53	953	--	6,521	1,244
1951-52	0	--	1,015	493
1950-51	0	--	1,242	566
1949-50	9	--	854	546
1948-49	0	--	571	678
1947-48	63	--	1,926	964
1946-47	144	--	3,056	1,220
1945-46	128	--	4,218	1,330

APPENDIX E

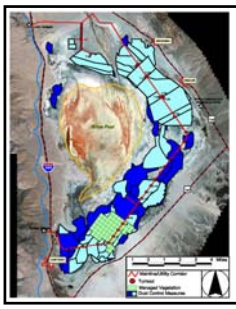
Dust Control Phases Through Time
(provided by Jason Olin of LADWP)

Owens Lake Phase Maps

Courtesy of LADWP, 2011

SSS Phase 2

2003 – Operation began



Phase 7

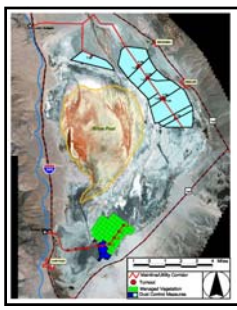
2010 – Operation began

NSS Phase 1

2002 – Operation began

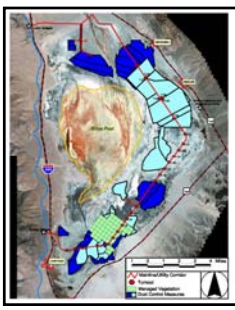
Phase IV

2005 – Operation began



SSS Phase 1

2002 – Operation began



Phase V

2007 – Operation began

APPENDIX F

GBUAPCD's Shallow Hydrology Monitoring Network
(from GBUAPCD, 2009)

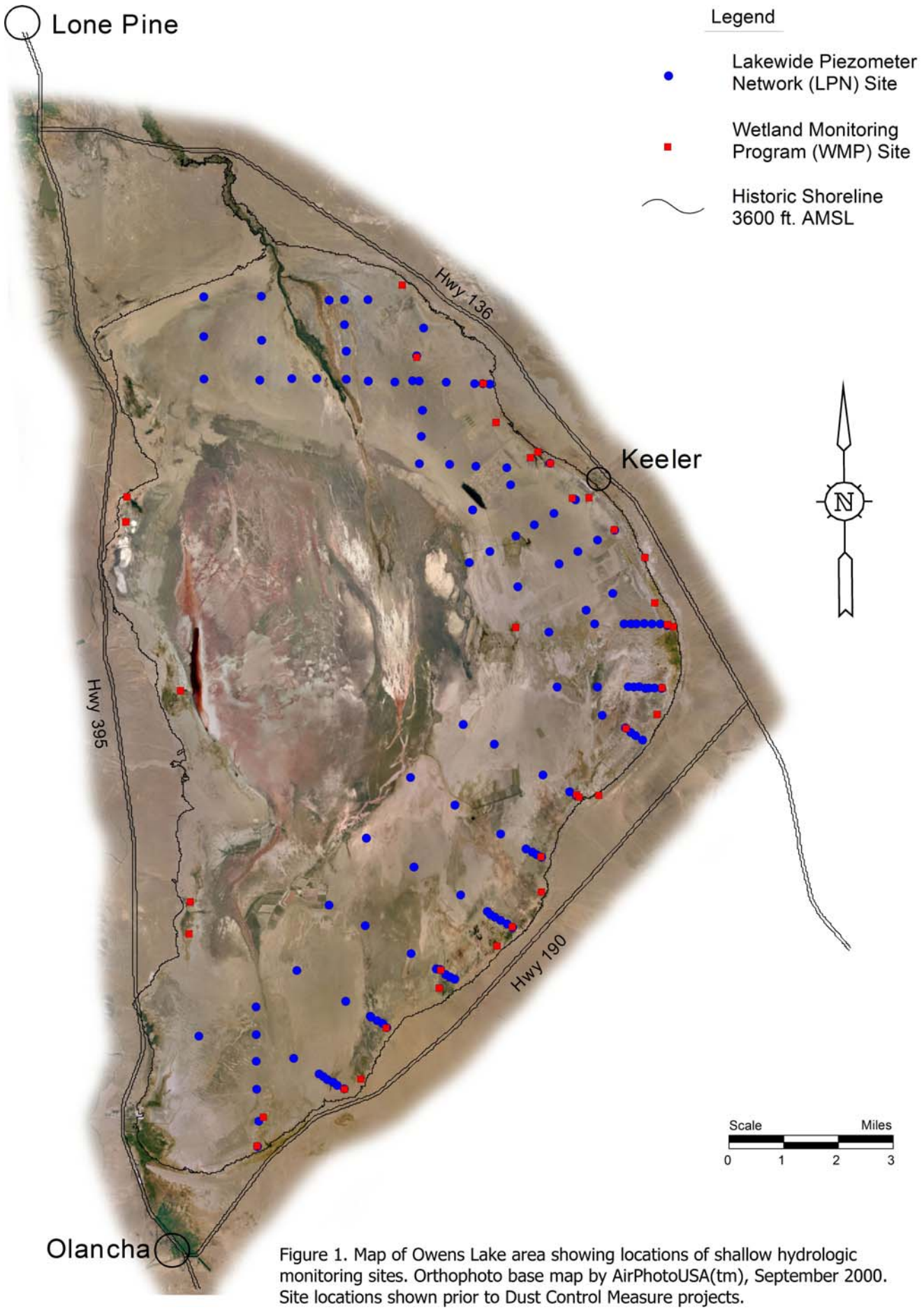


Figure 1. Map of Owens Lake area showing locations of shallow hydrologic monitoring sites. Orthophoto base map by AirPhotoUSA(tm), September 2000. Site locations shown prior to Dust Control Measure projects.

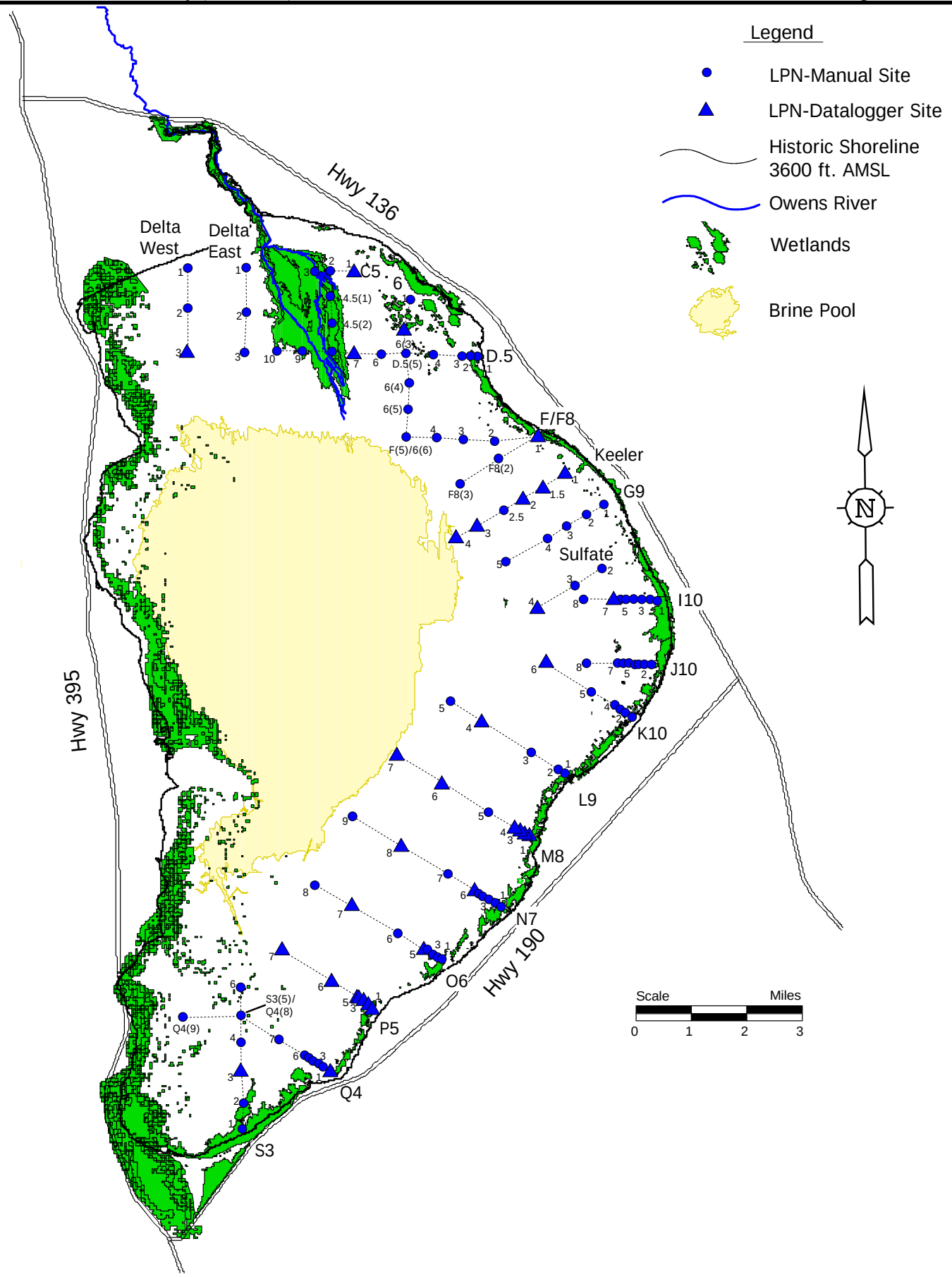


Figure 2. Location of Lakewide Piezometer Network (LPN) sites and transects. Locations shown prior to Dust Control Measure (DCM) projects. Manual data exists for all sites. Datalogger sites have instrumentation for hourly water level measurement.

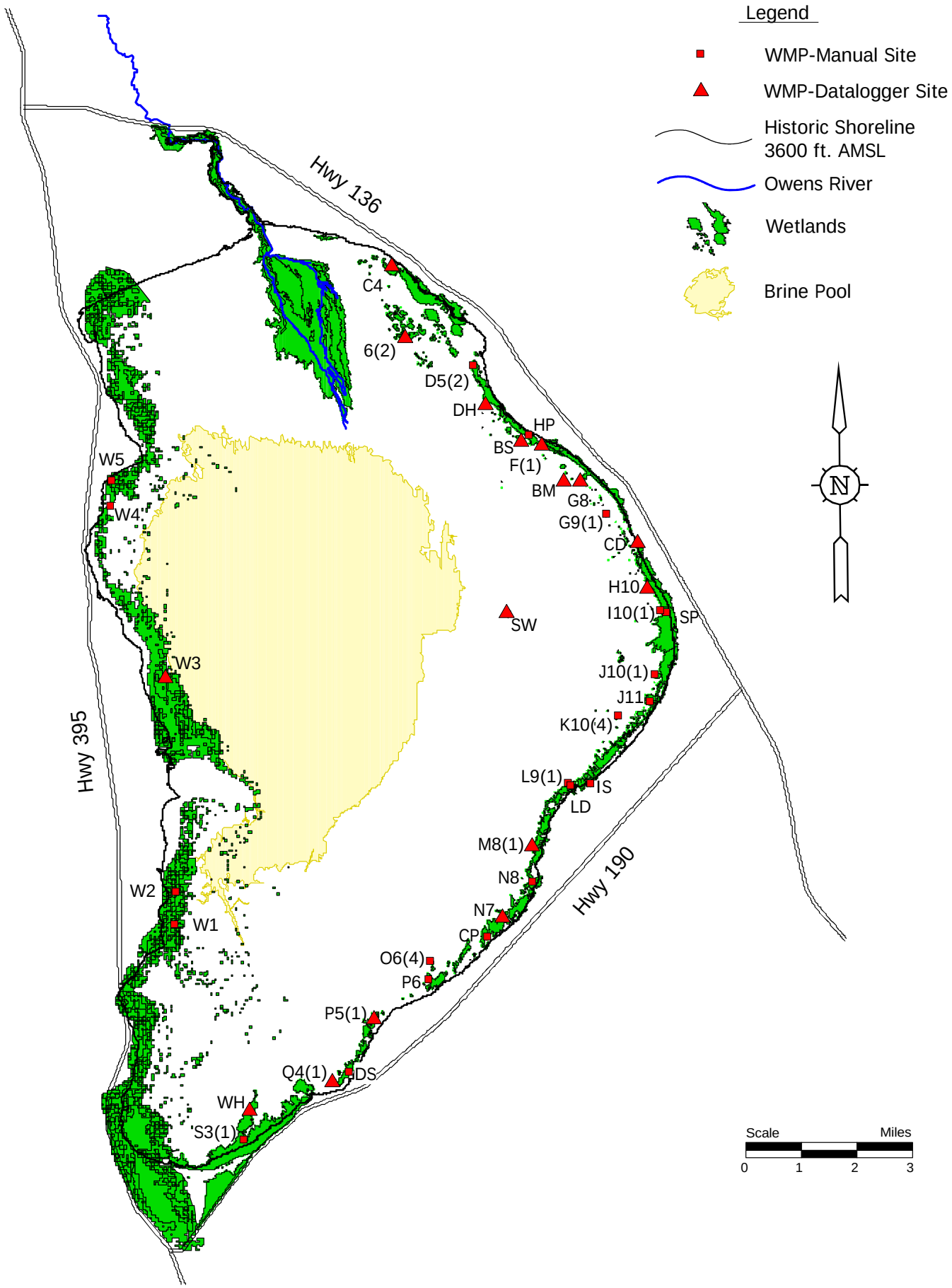


Figure 3. Location of Wetland Monitoring Program (WMP) sites. Manually collected data exists for all sites. Datalogger sites have instrumentation for hourly water level and/or flow rate measurements.

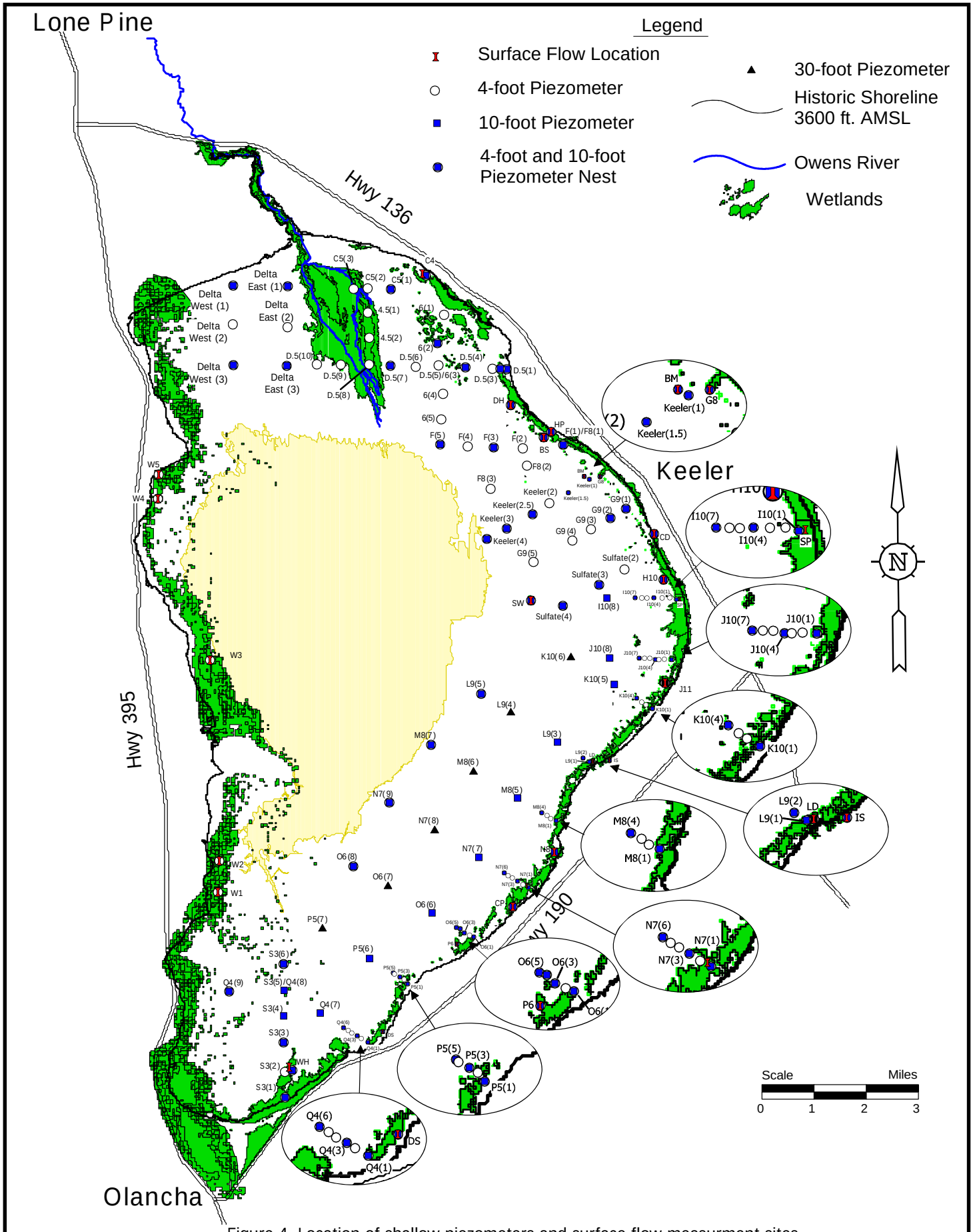
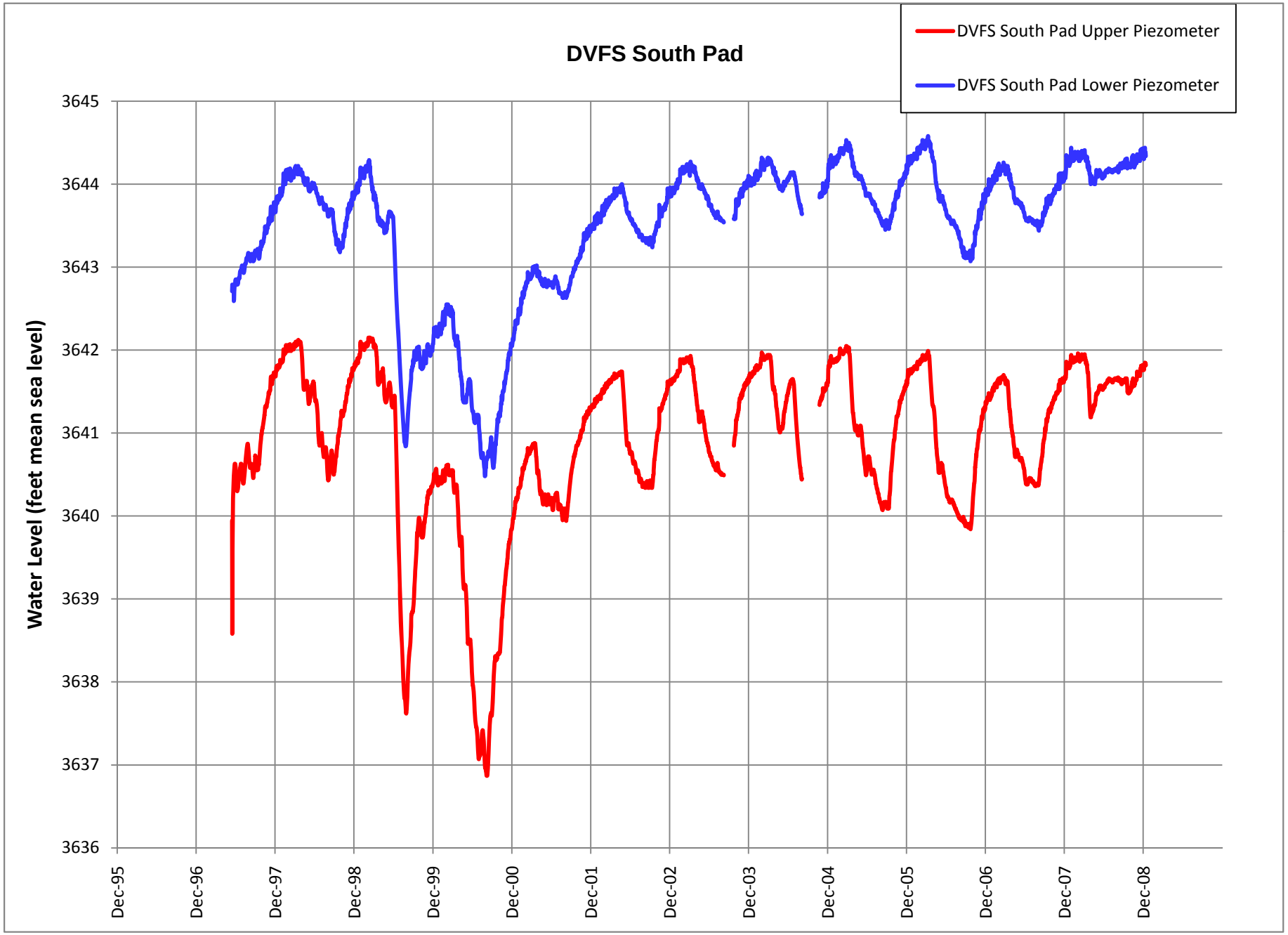
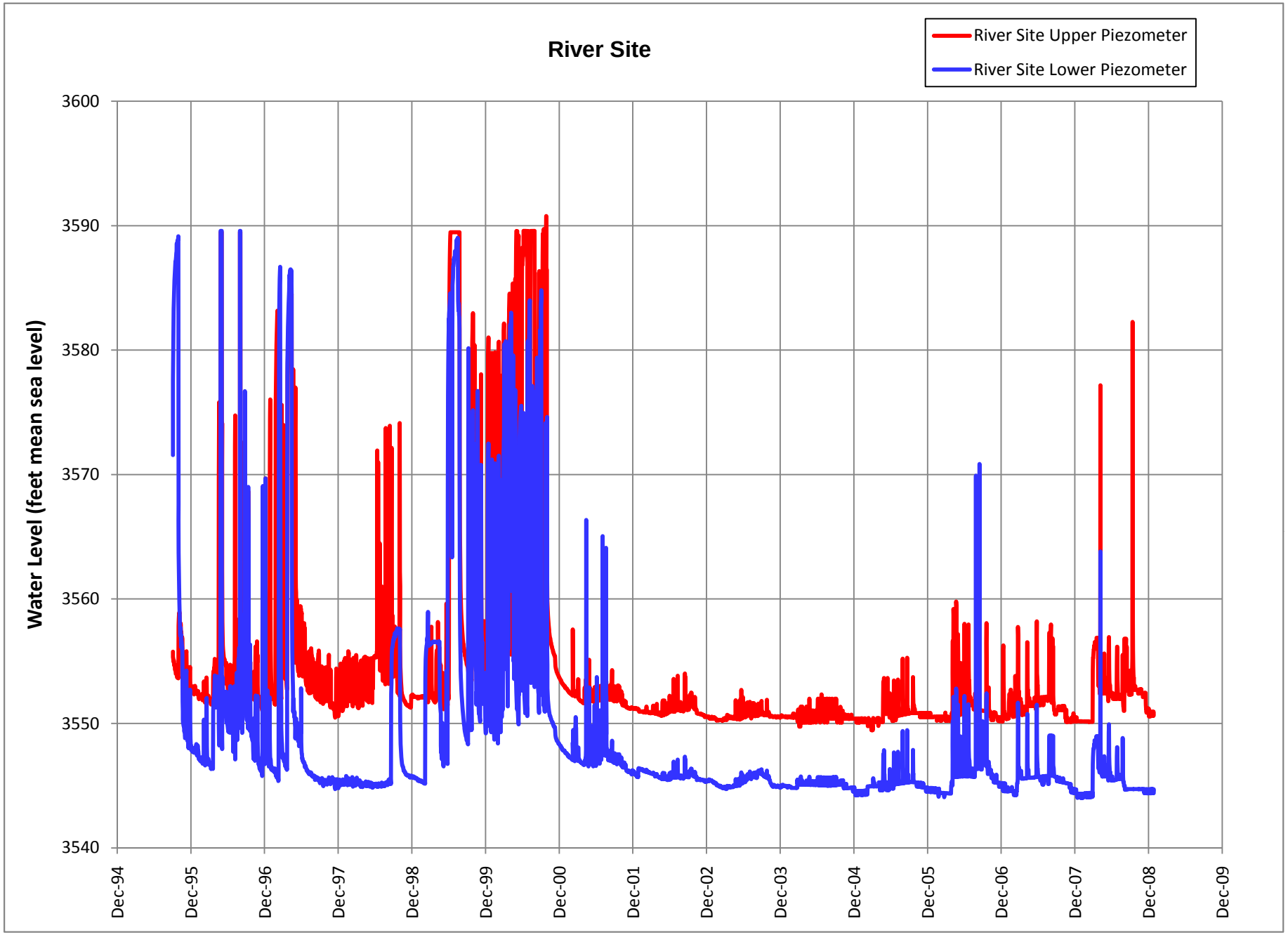


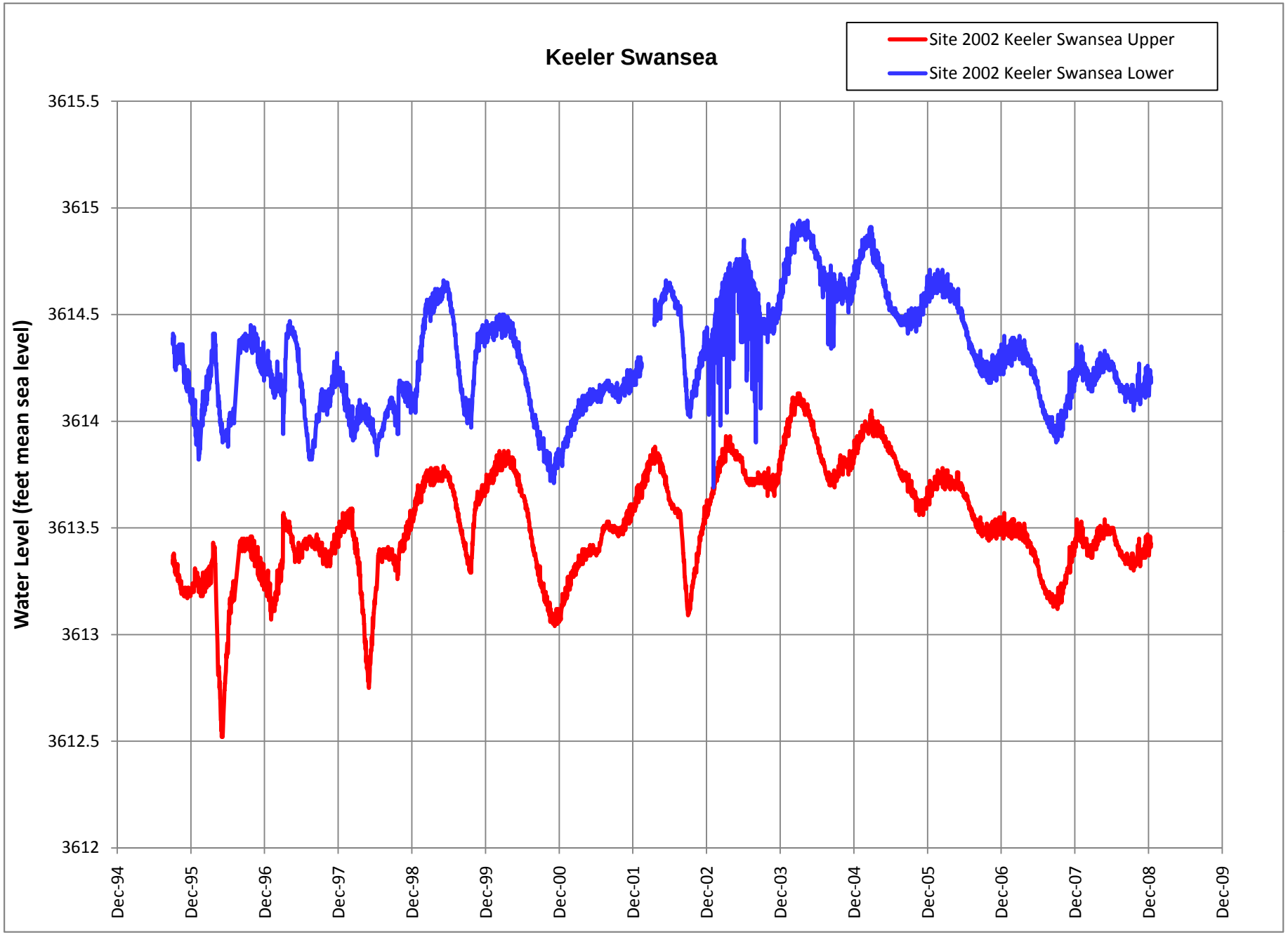
Figure 4. Location of shallow piezometers and surface flow measurment sites. Locations shown prior to Dust Control Measure (DCM) projects.

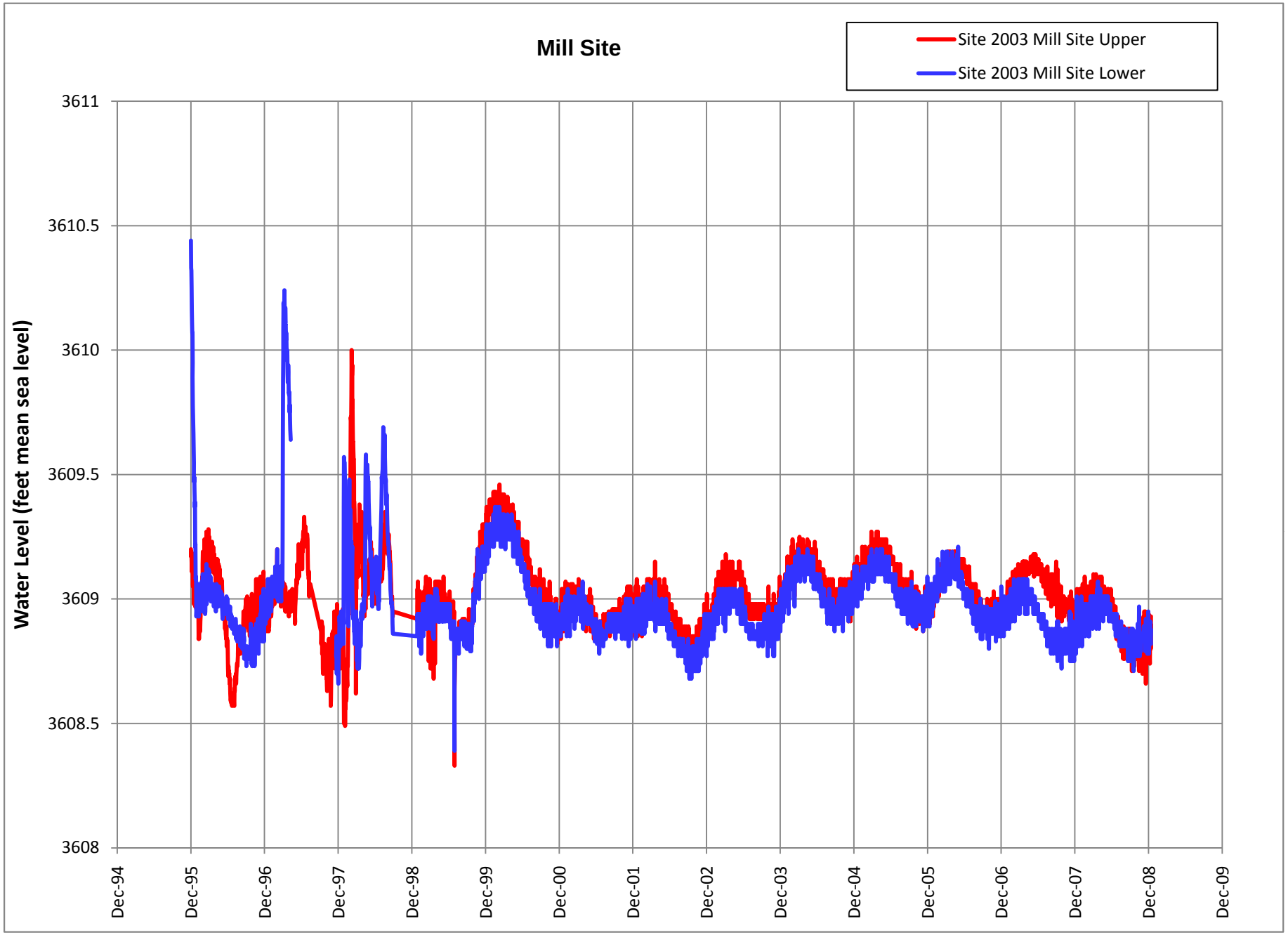
APPENDIX G

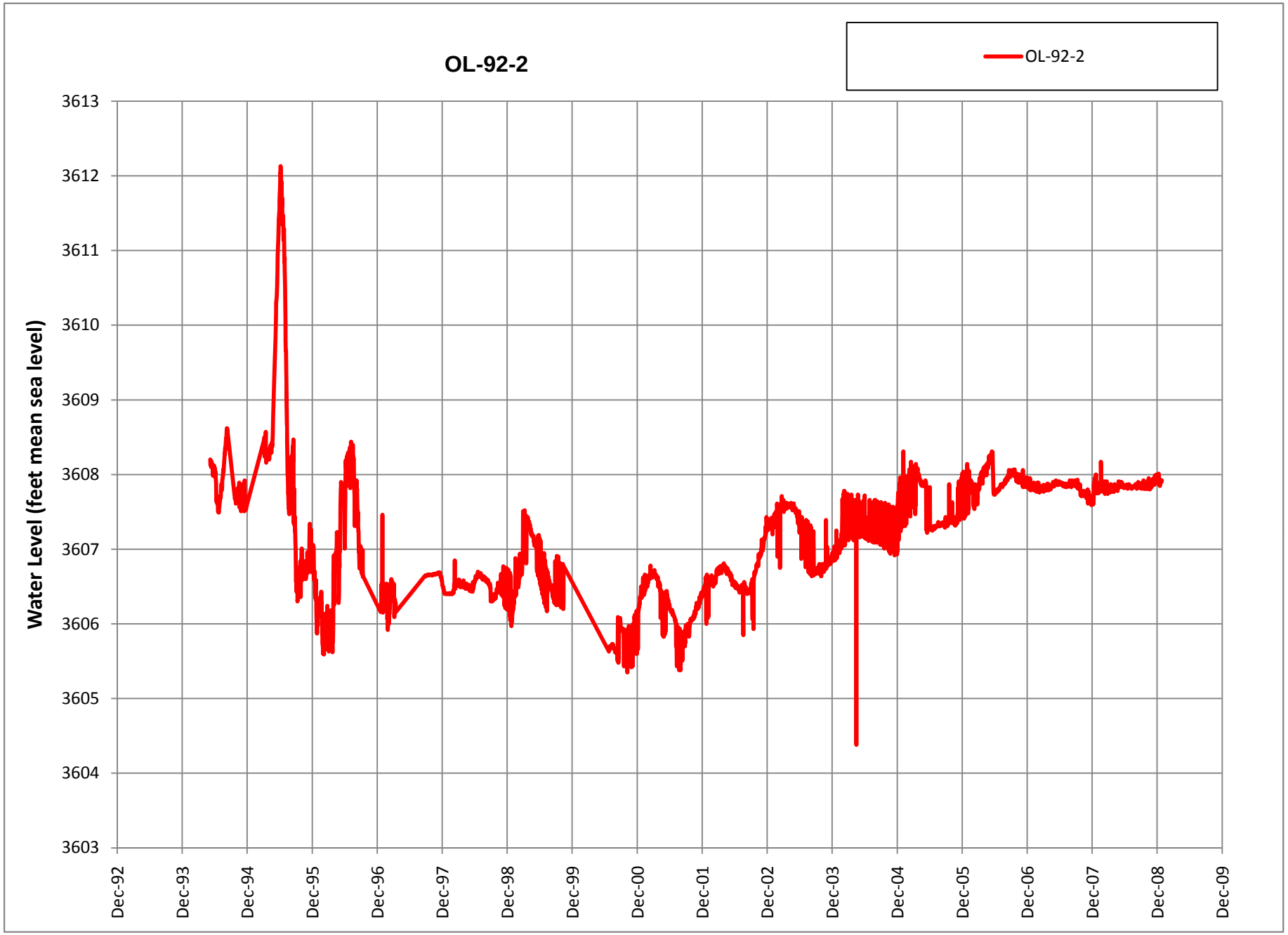
Hydrographs Used for the Evaluation of Dust Control Measures

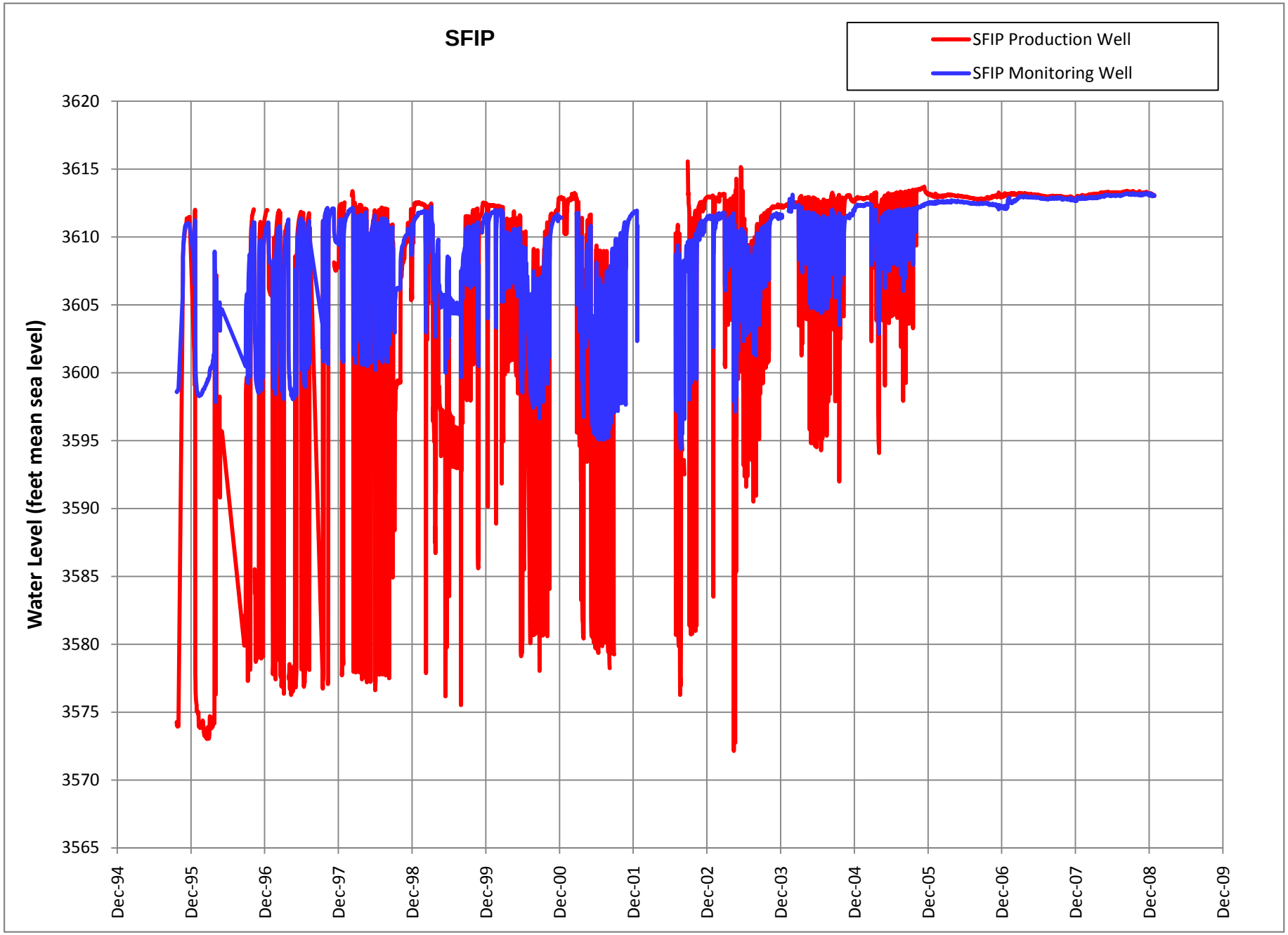

DVFS South Pad
DVFS South Pad Upper Piezometer
DVFS South Pad Lower Piezometer
Water Level (feet mean sea level)
3645
3644
3643
3642
3641
3640
3639
3638
3637
3636
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

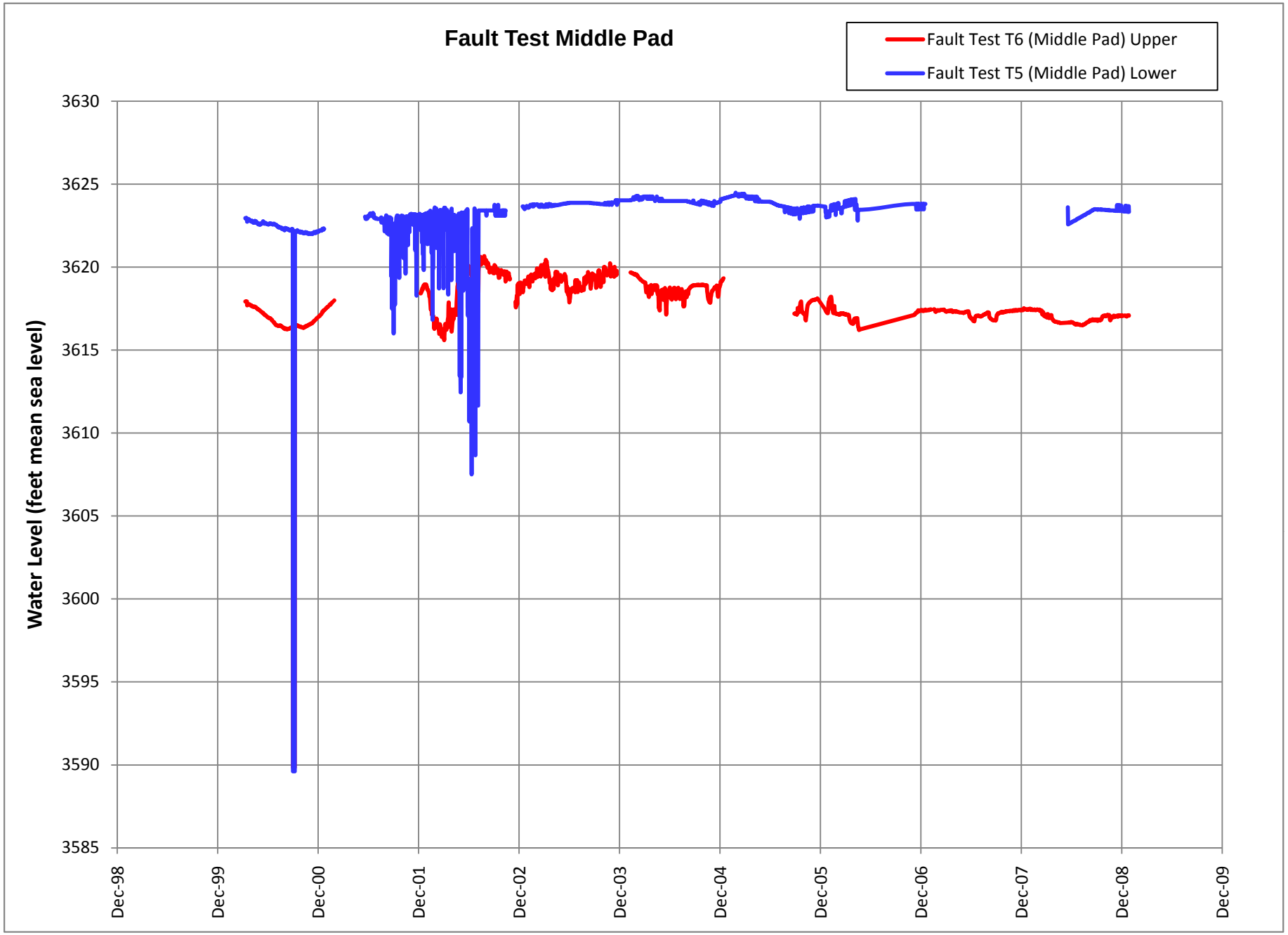

River Site
River Site Upper Piezometer
River Site Lower Piezometer
Water Level (feet mean sea level)
3600
3590
3580
3570
3560
3550
3540
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

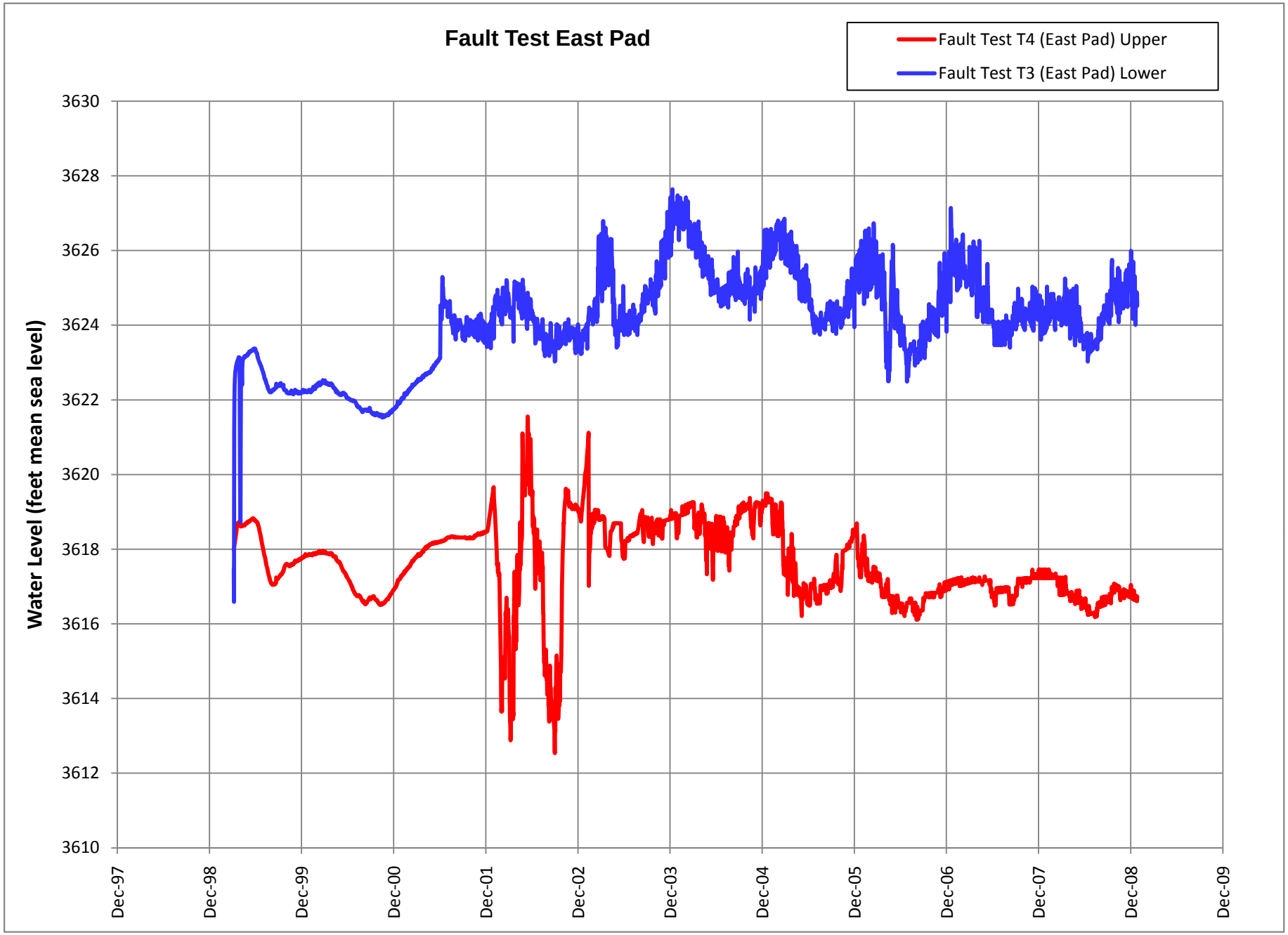

Keeler Swansea
Site 2002 Keeler Swansea Upper
Site 2002 Keeler Swansea Lower
Water Level (feet mean sea level)
3615.5
3615
3614.5
3614
3613.5
3613
3612.5
3612
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

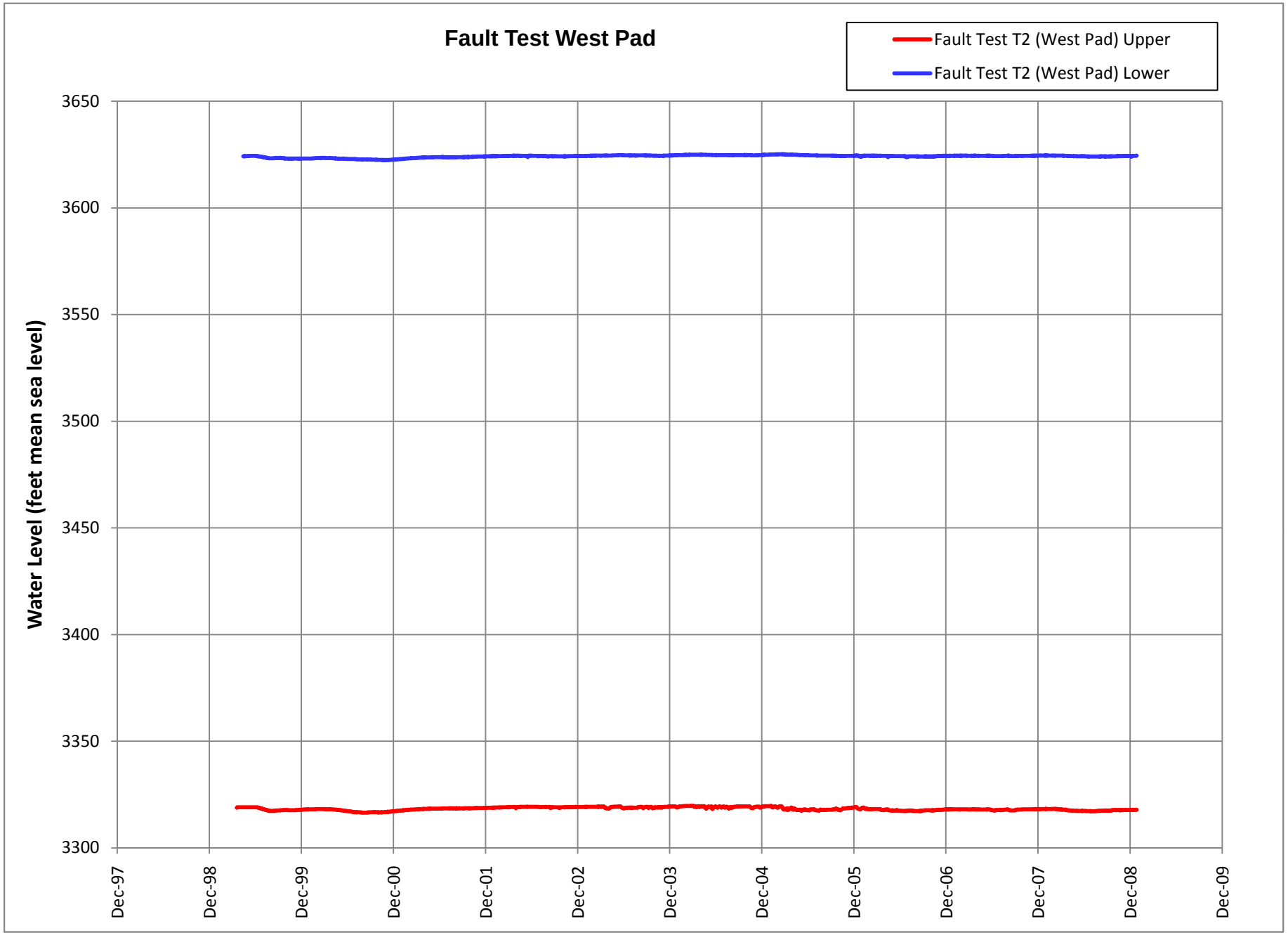

Mill Site
Site 2003 Mill Site Upper
Site 2003 Mill Site Lower
Water Level (feet mean sea level)
3611
3610.5
3610
3609.5
3609
3608.5
3608
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

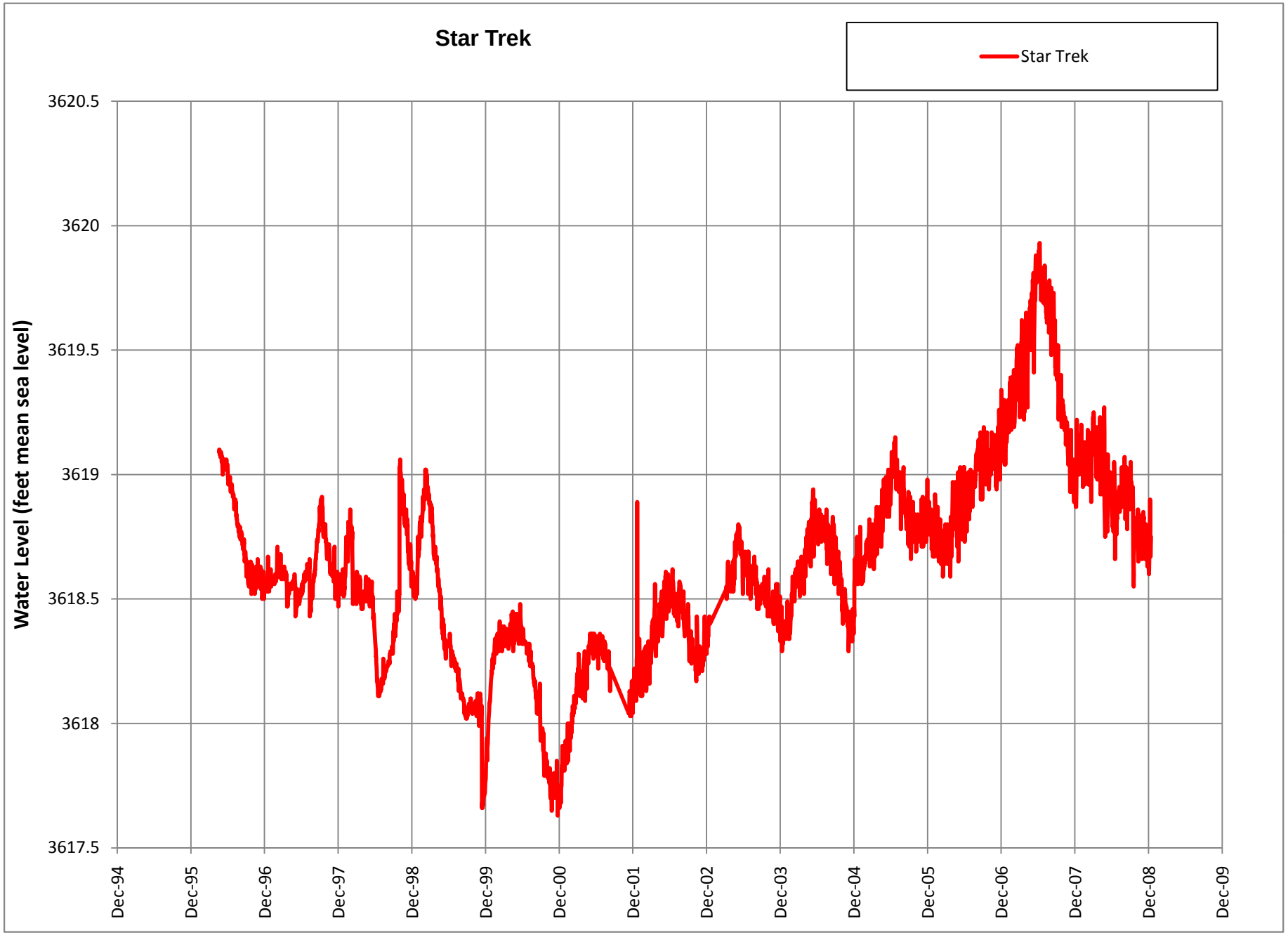

OL-92-2
OL-92-2
Water Level (feet mean sea level)
3613
3612
3611
3610
3609
3608
3607
3606
3605
3604
3603
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

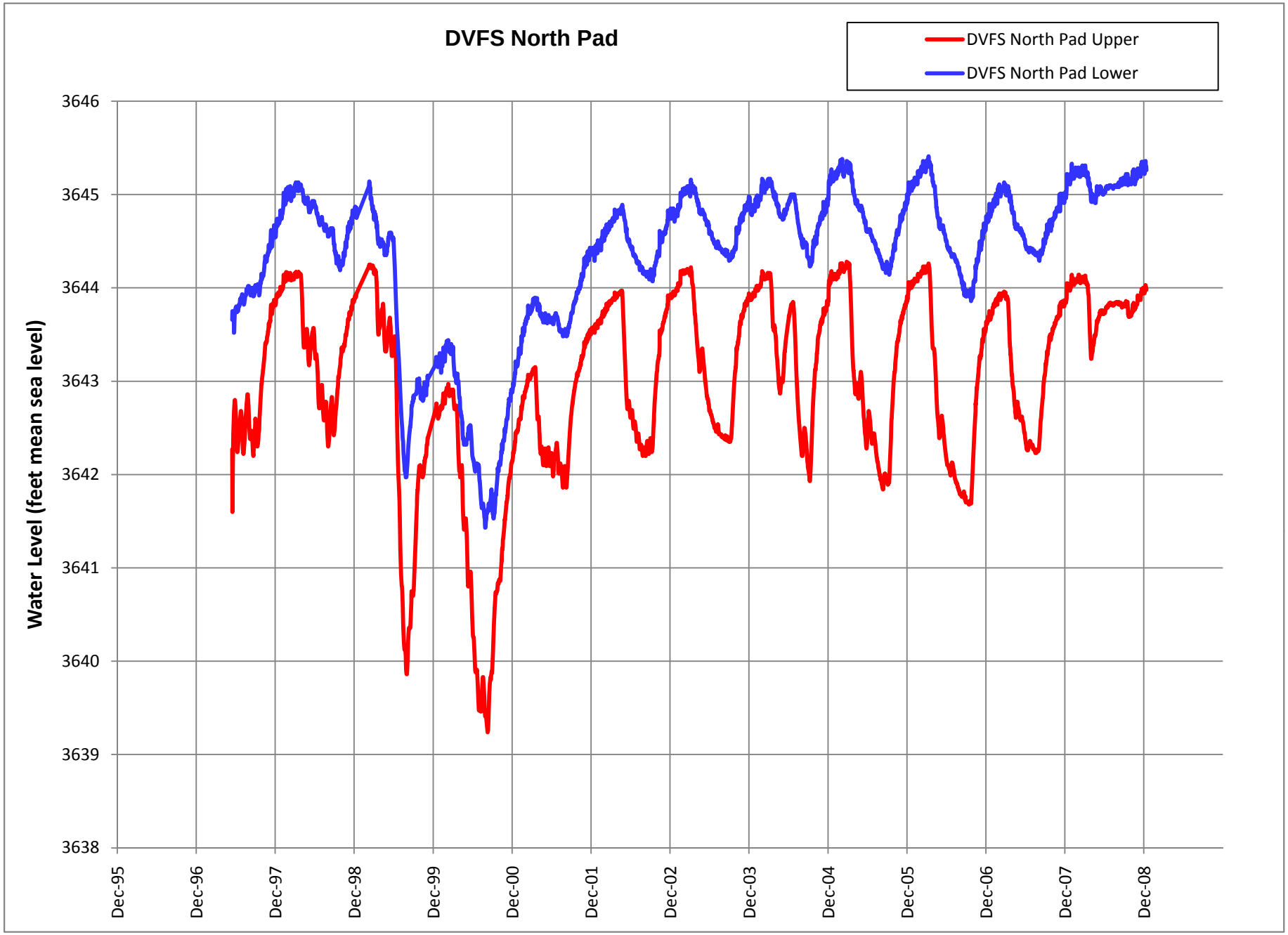

SFIP
SFIP Production Well
SFIP Monitoring Well
Water Level (feet mean sea level)
3620
3615
3610
3605
3600
3595
3590
3585
3580
3575
3570
3565
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

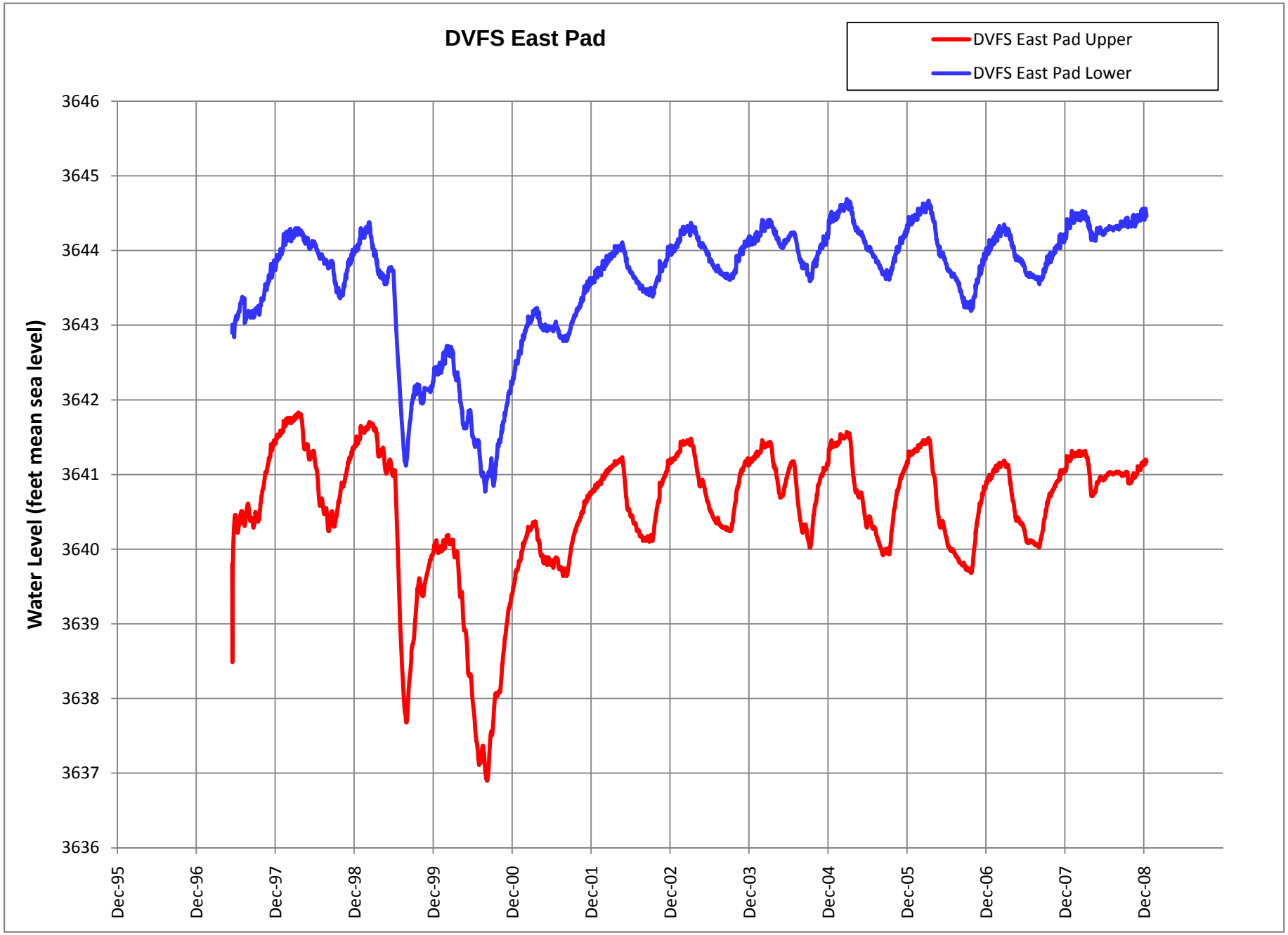

Fault Test Middle Pad
Fault Test T6 (Middle Pad) Upper
Fault Test T5 (Middle Pad) Lower
Water Level (feet mean sea level)
3630
3625
3620
3615
3610
3605
3600
3595
3590
3585
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

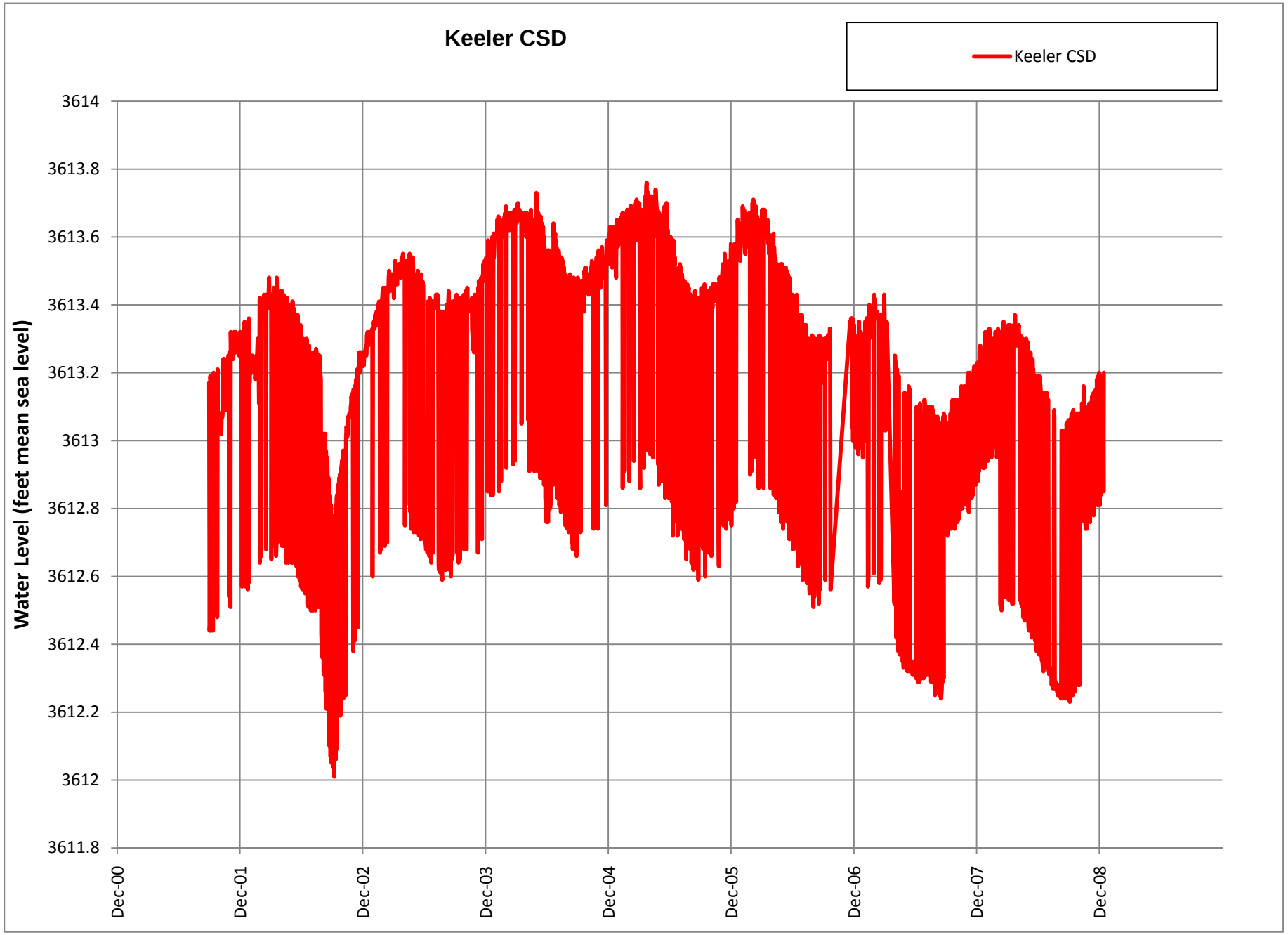

Fault Test East Pad
Fault Test T4 (East Pad) Upper
Fault Test T3 (East Pad) Lower
Water Level (feet mean sea level)
3630
3628
3626
3624
3622
3620
3618
3616
3614
3612
3610
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

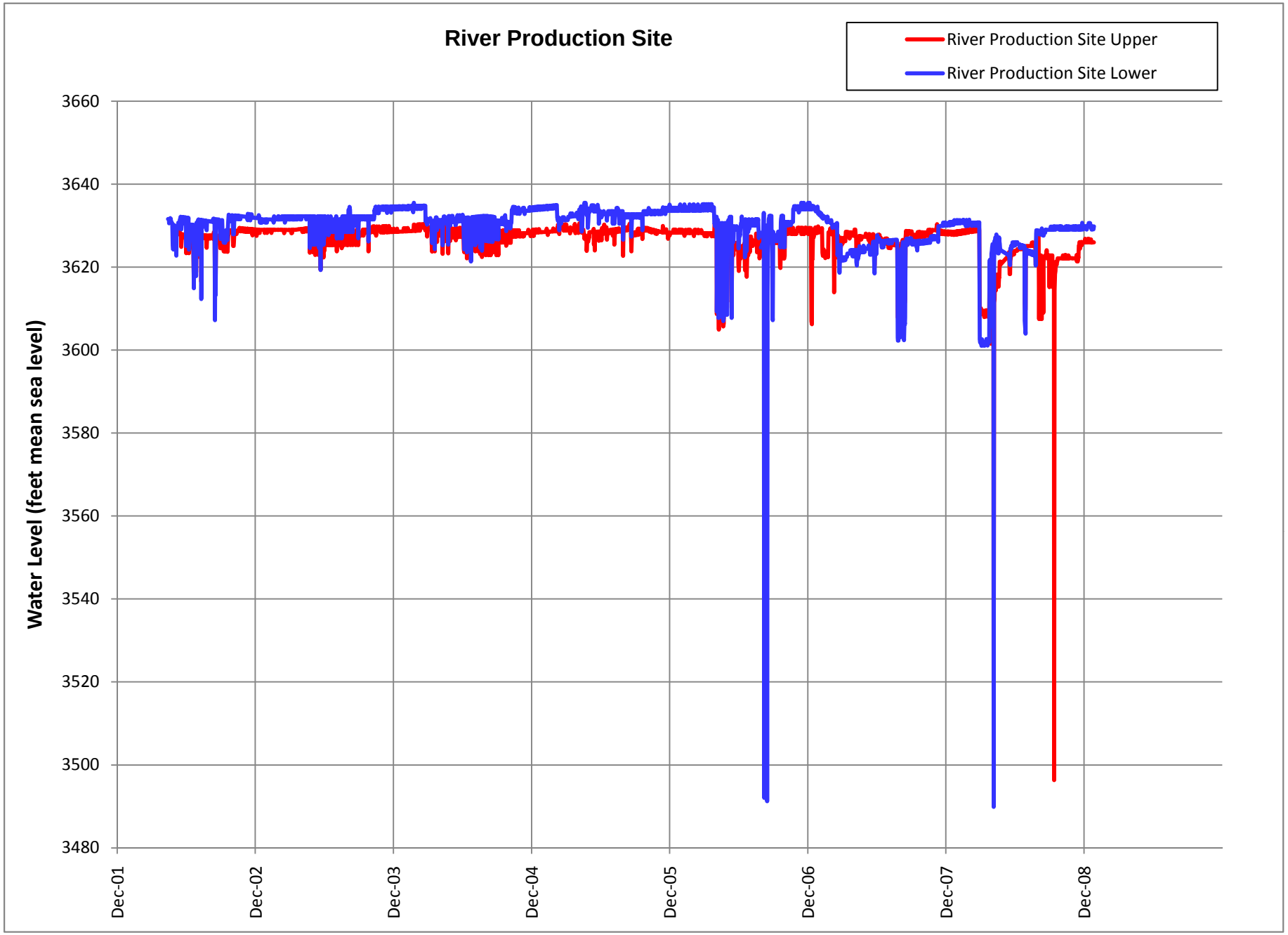

Fault Test West Pad
Fault Test T2 (West Pad) Upper
Fault Test T2 (West Pad) Lower
Water Level (feet mean sea level)
3650
3600
3550
3500
3450
3400
3350
3300
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

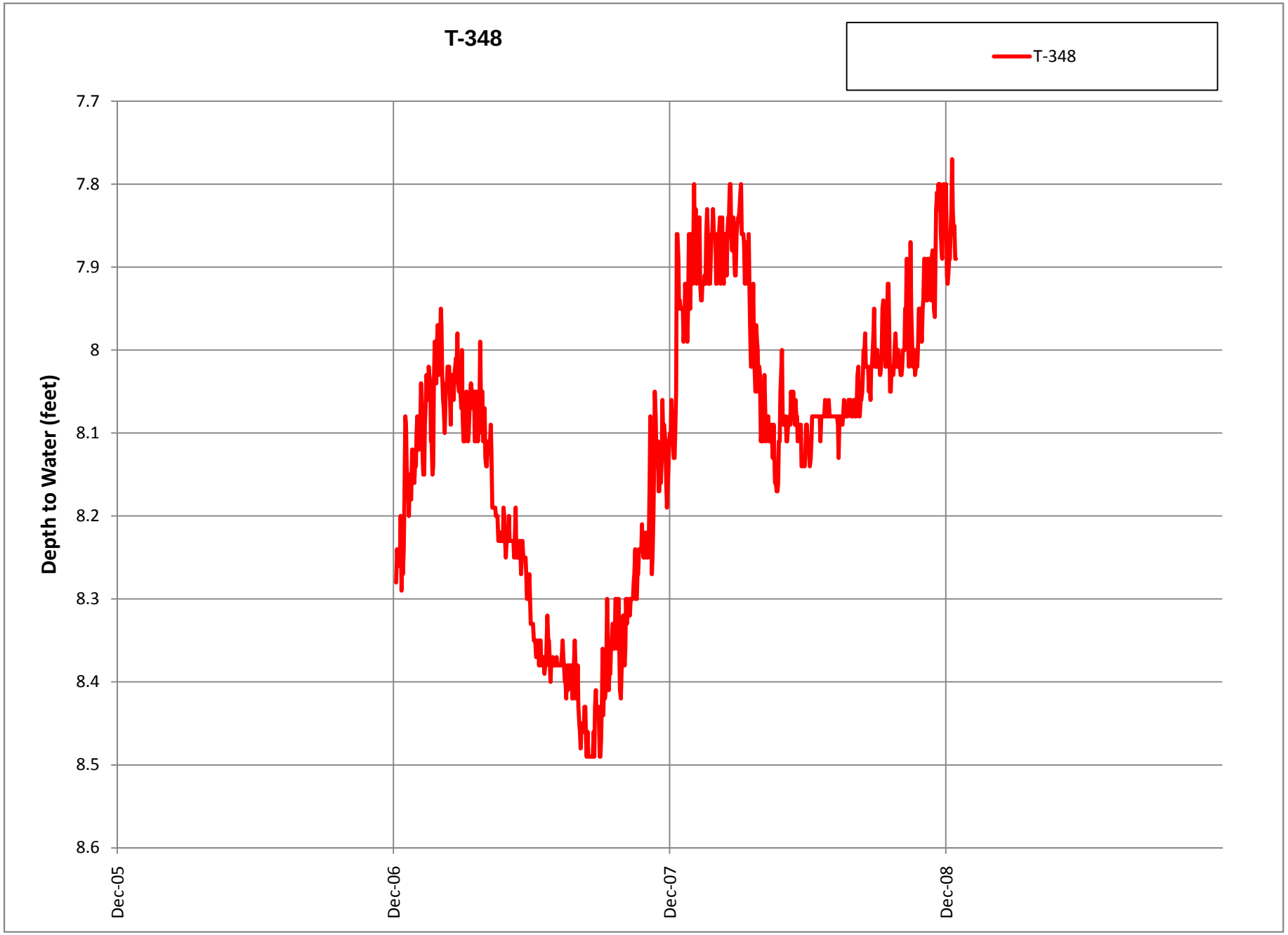

Star Trek
Star Trek
Water Level (feet mean sea level)
3620.5
3620
3619.5
3619
3618.5
3618
3617.5
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

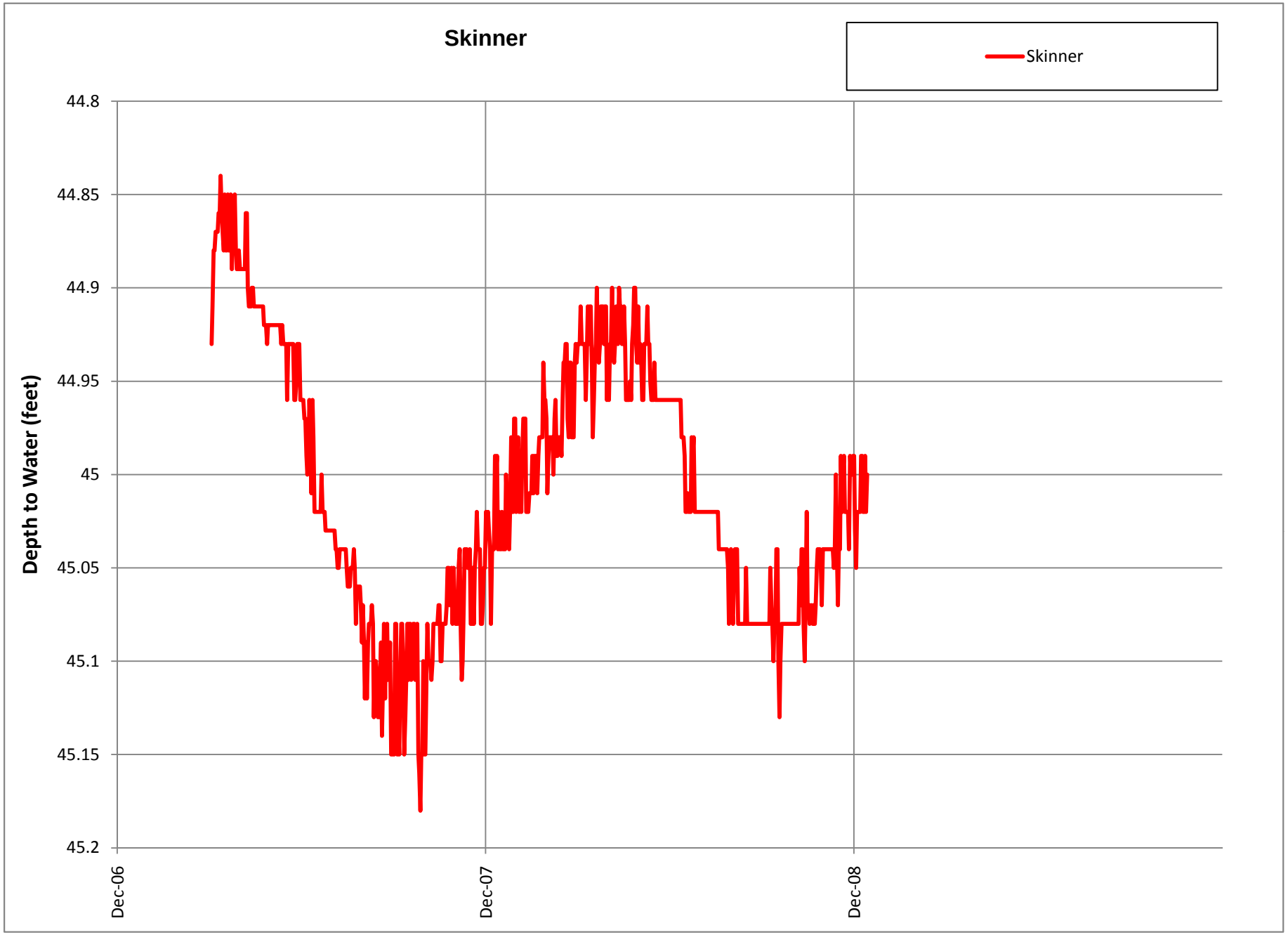

DVFS North Pad
DVFS North Pad Upper
DVFS North Pad Lower
Water Level (feet mean sea level)
3646
3645
3644
3643
3642
3641
3640
3639
3638
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

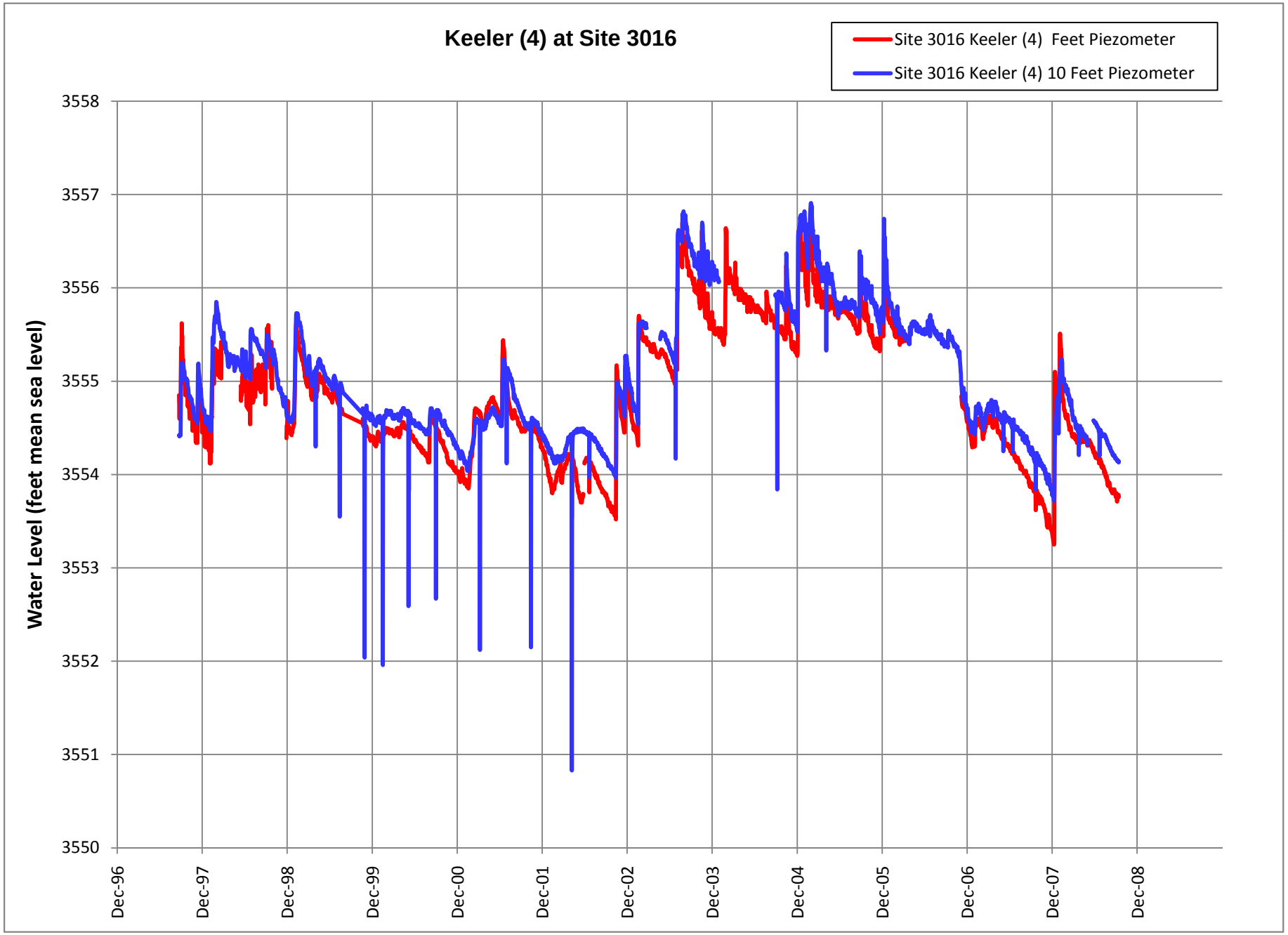

DVFS East Pad
DVFS East Pad Upper
DVFS East Pad Lower
Water Level (feet mean sea level)
3646
3645
3644
3643
3642
3641
3640
3639
3638
3637
3636
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

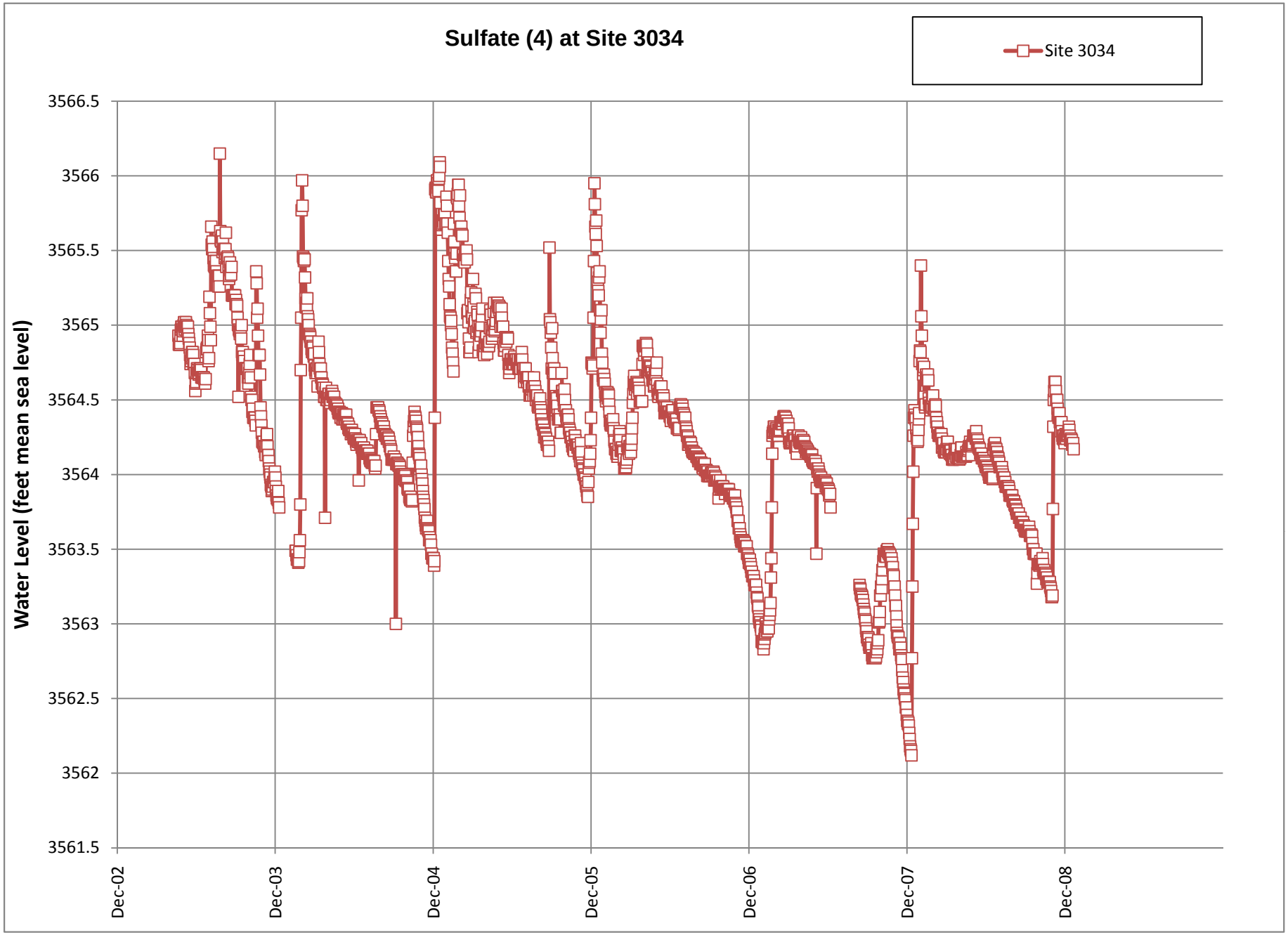

Keeler CSD
Keeler CSD
Water Level (feet mean sea level)
3614
3613.8
3613.6
3613.4
3613.2
3613
3612.8
3612.6
3612.4
3612.2
3612
3611.8
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

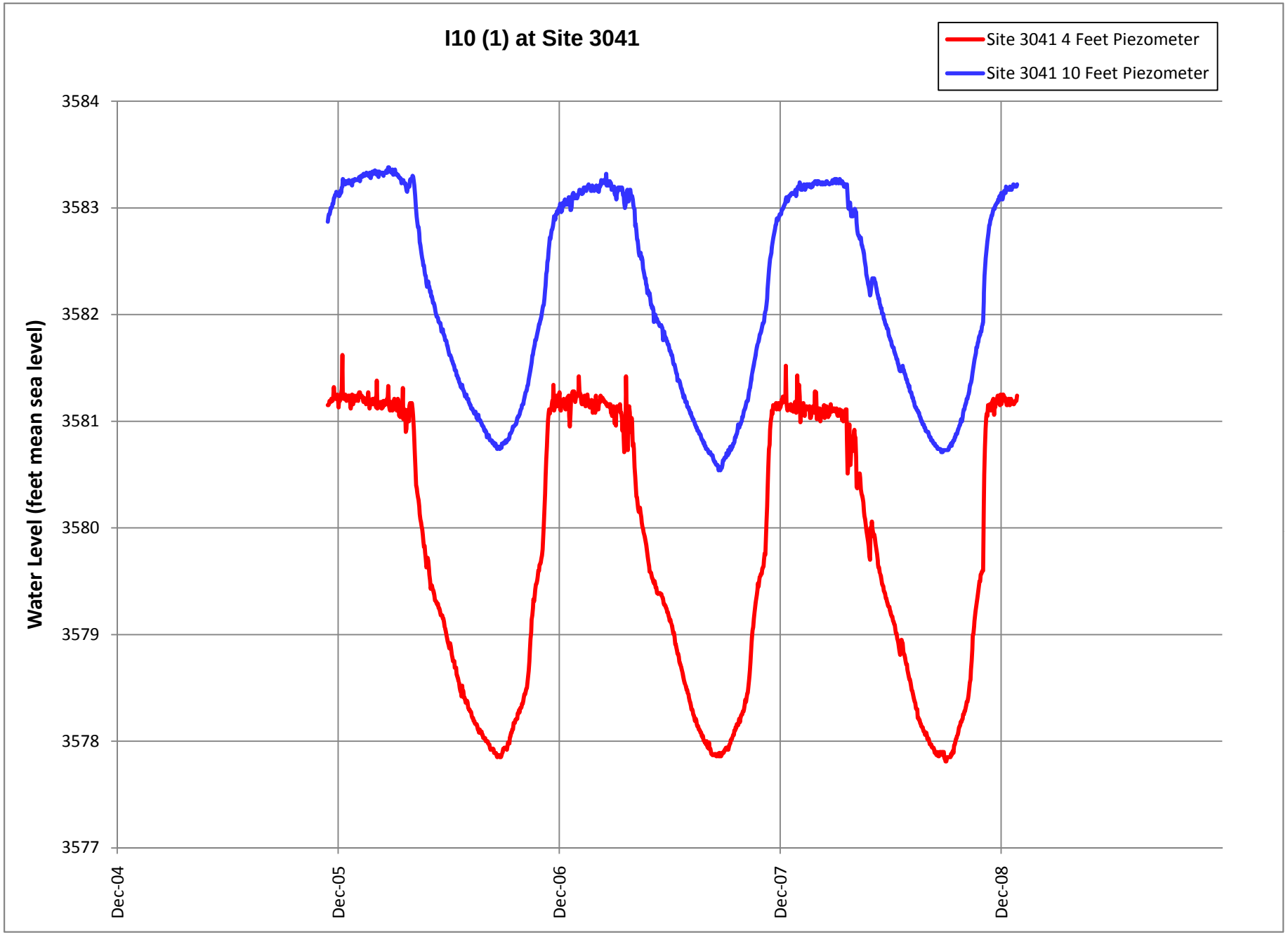

River Production Site
River Production Site Upper
River Production Site Lower
Water Level (feet mean sea level)
3660
3640
3620
3600
3580
3560
3540
3520
3500
3480
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

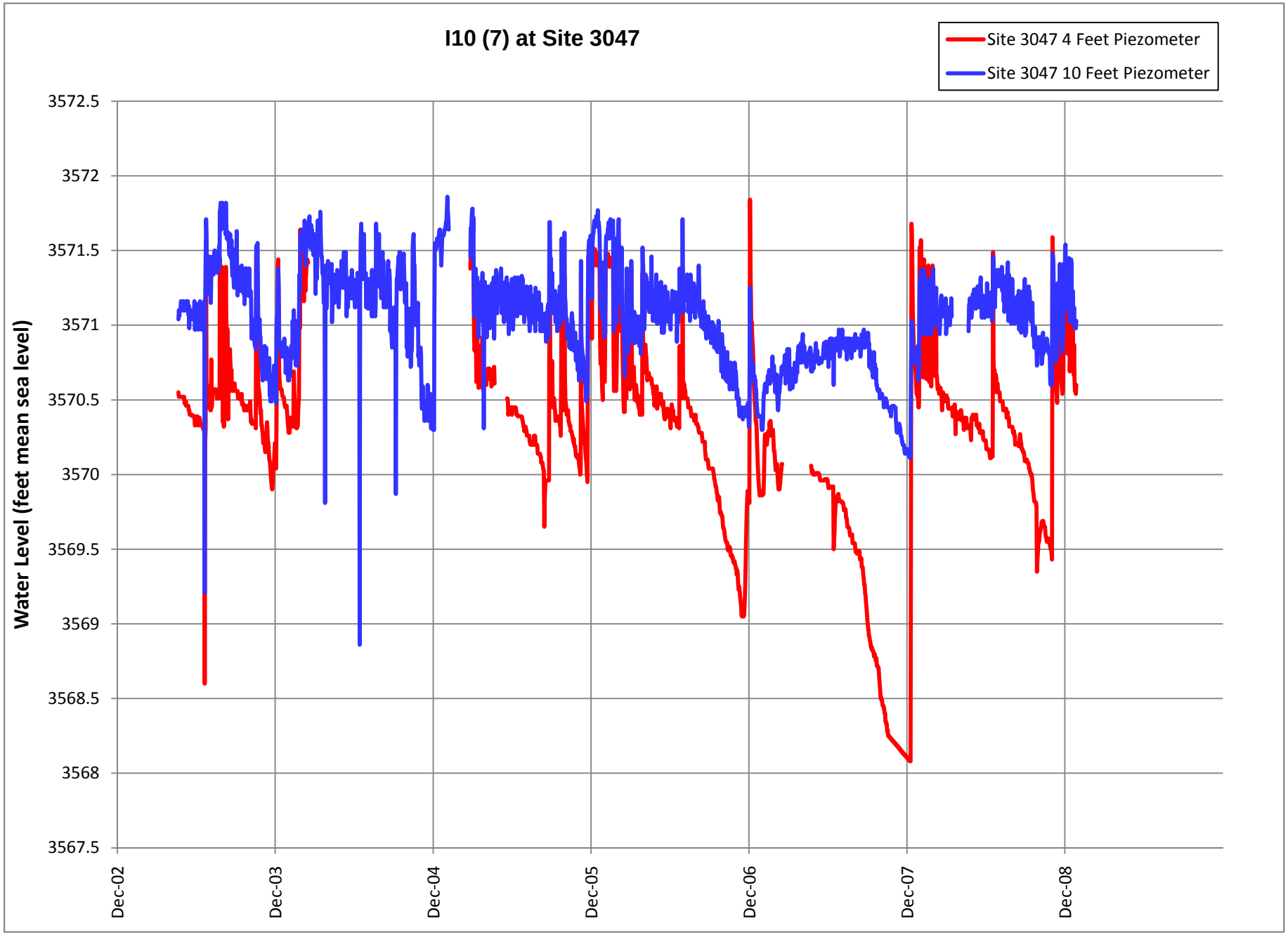

T-348
T-348
Depth to Water (feet)
7.7
7.8
7.9
8
8.1
8.2
8.3
8.4
8.5
8.6
Dec-05
Dec-06
Dec-07
Dec-08

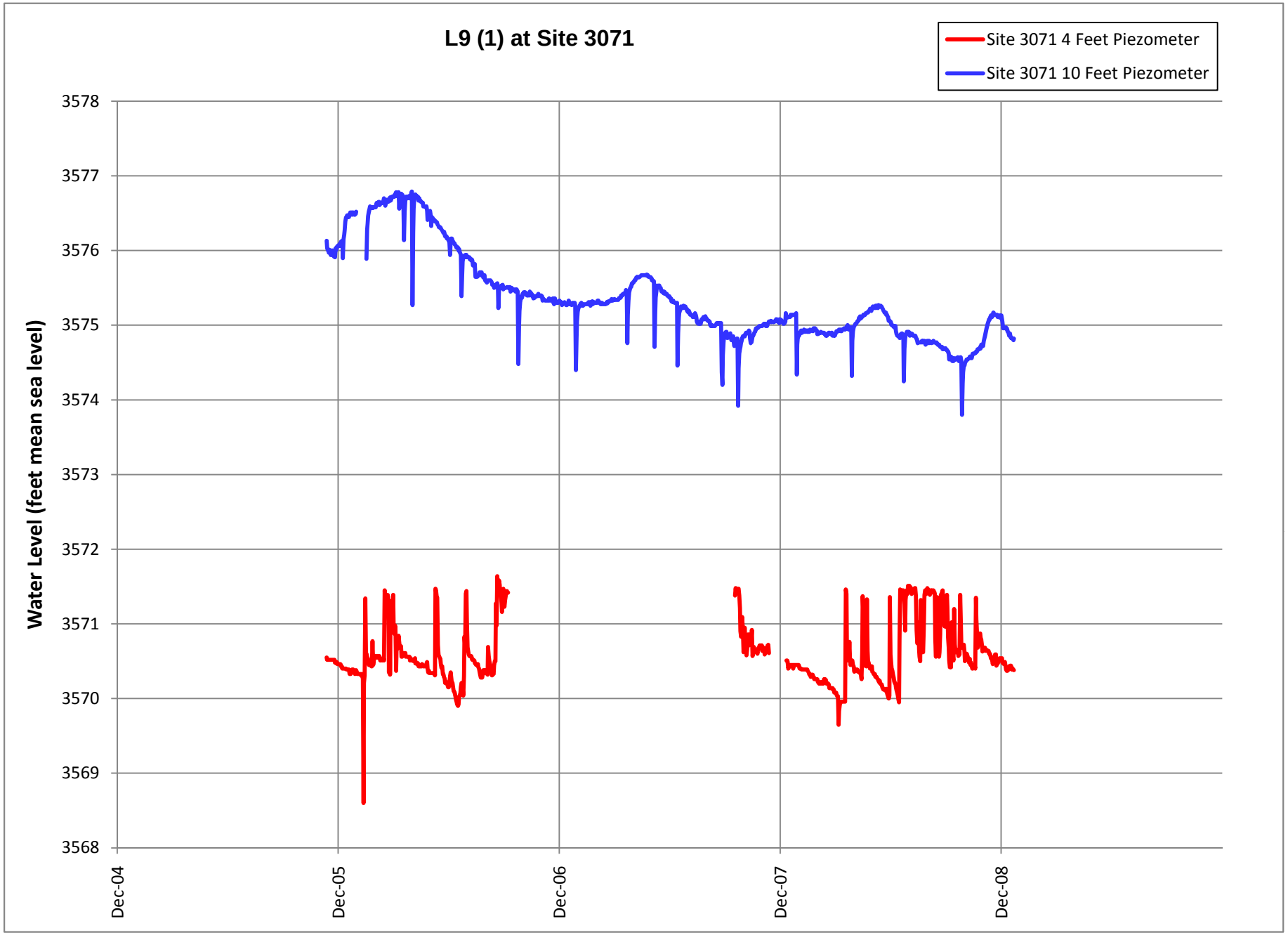

Skinner
Skinner
Depth to Water (feet)
44.8
44.85
44.9
44.95
45
45.05
45.1
45.15
45.2
Dec-06
Dec-07
Dec-08

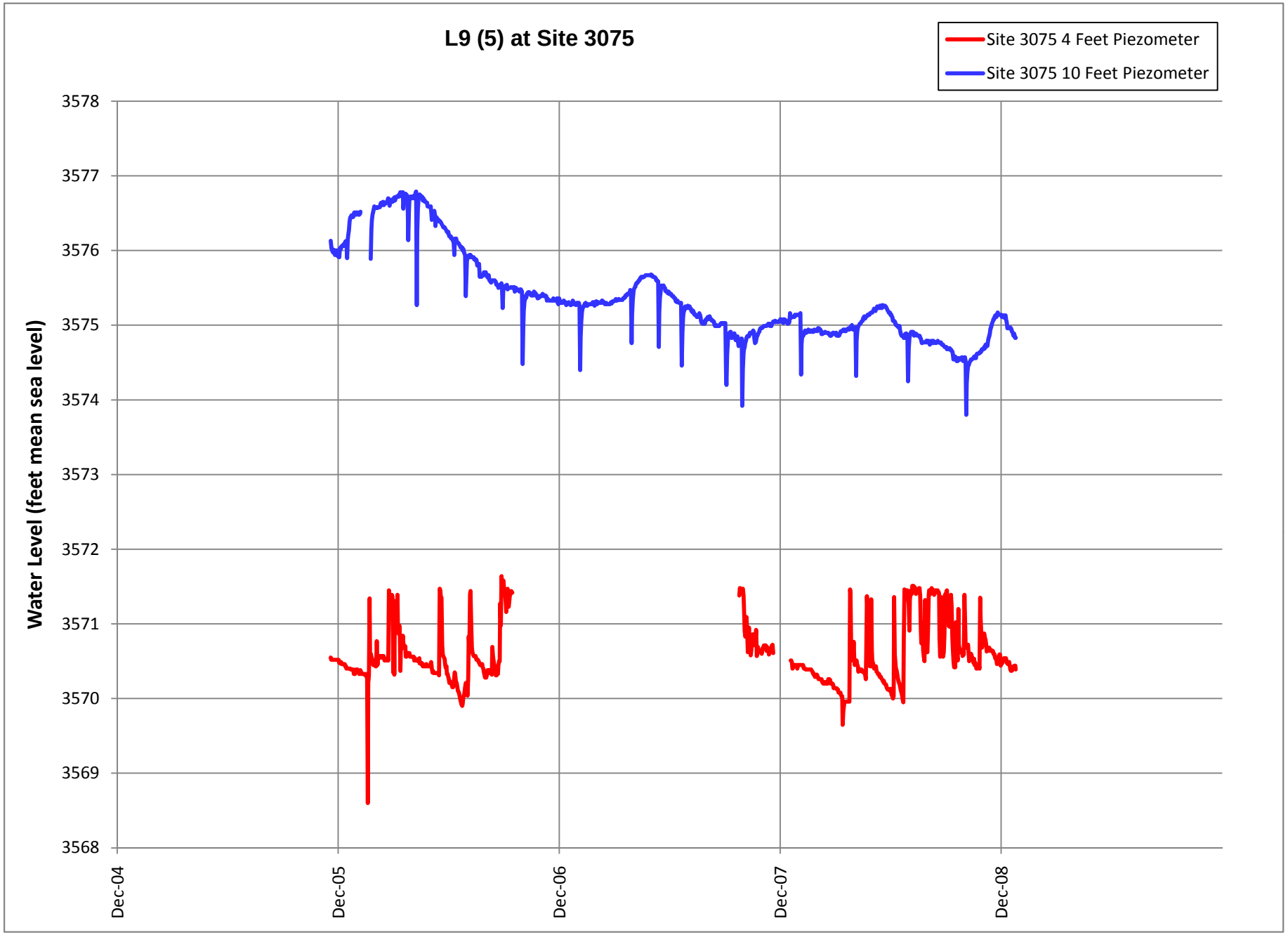

Keeler (4) at Site 3016
Site 3016 Keeler (4) Feet Piezometer
Site 3016 Keeler (4) 10 Feet Piezometer
Water Level (feet mean sea level)
3558
3557
3556
3555
3554
3553
3552
3551
3550
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

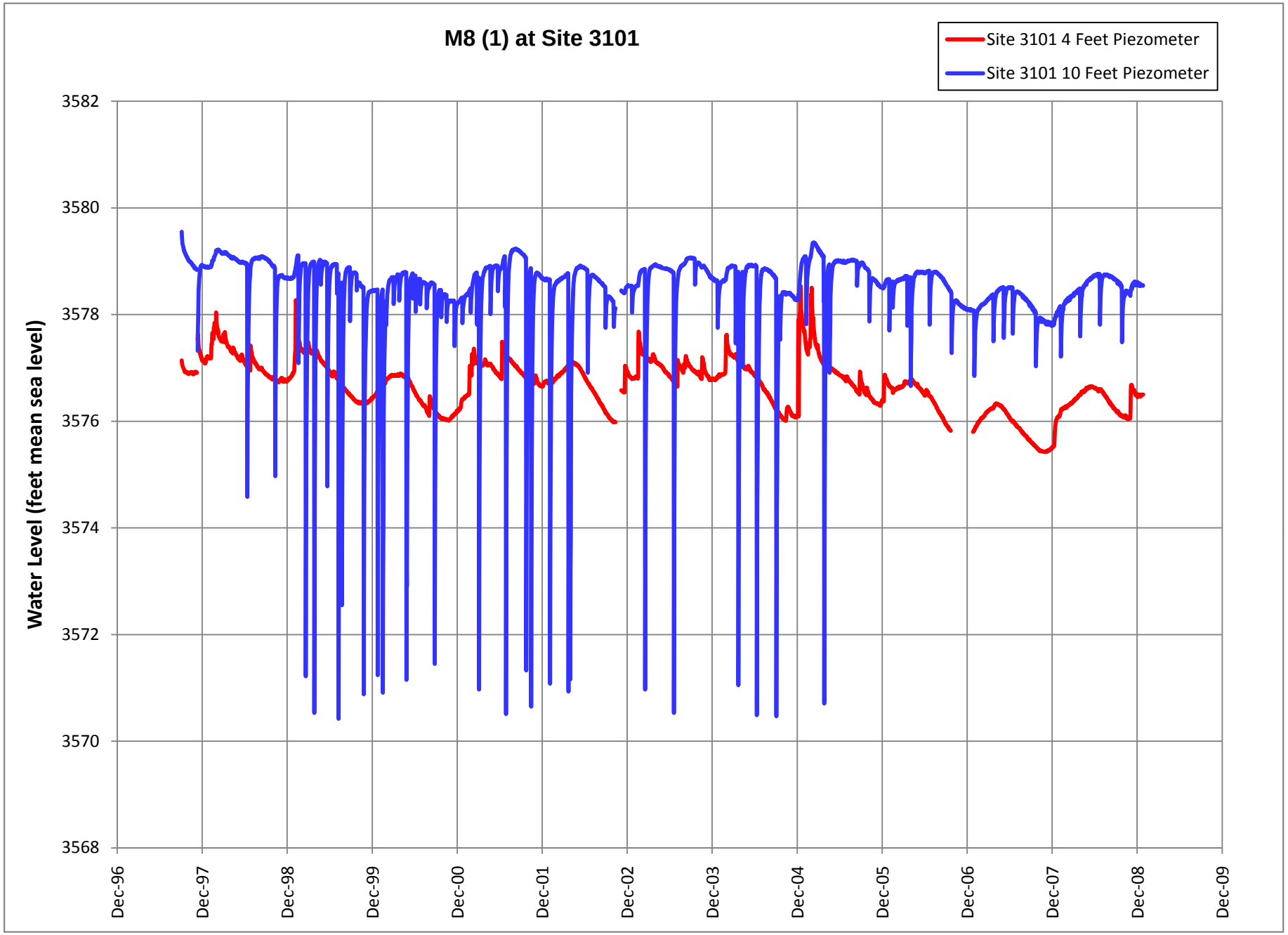

Sulfate (4) at Site 3034
Site 3034
Water Level (feet mean sea level)
3566.5
3566
3565.5
3565
3564.5
3564
3563.5
3563
3562.5
3562
3561.5
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

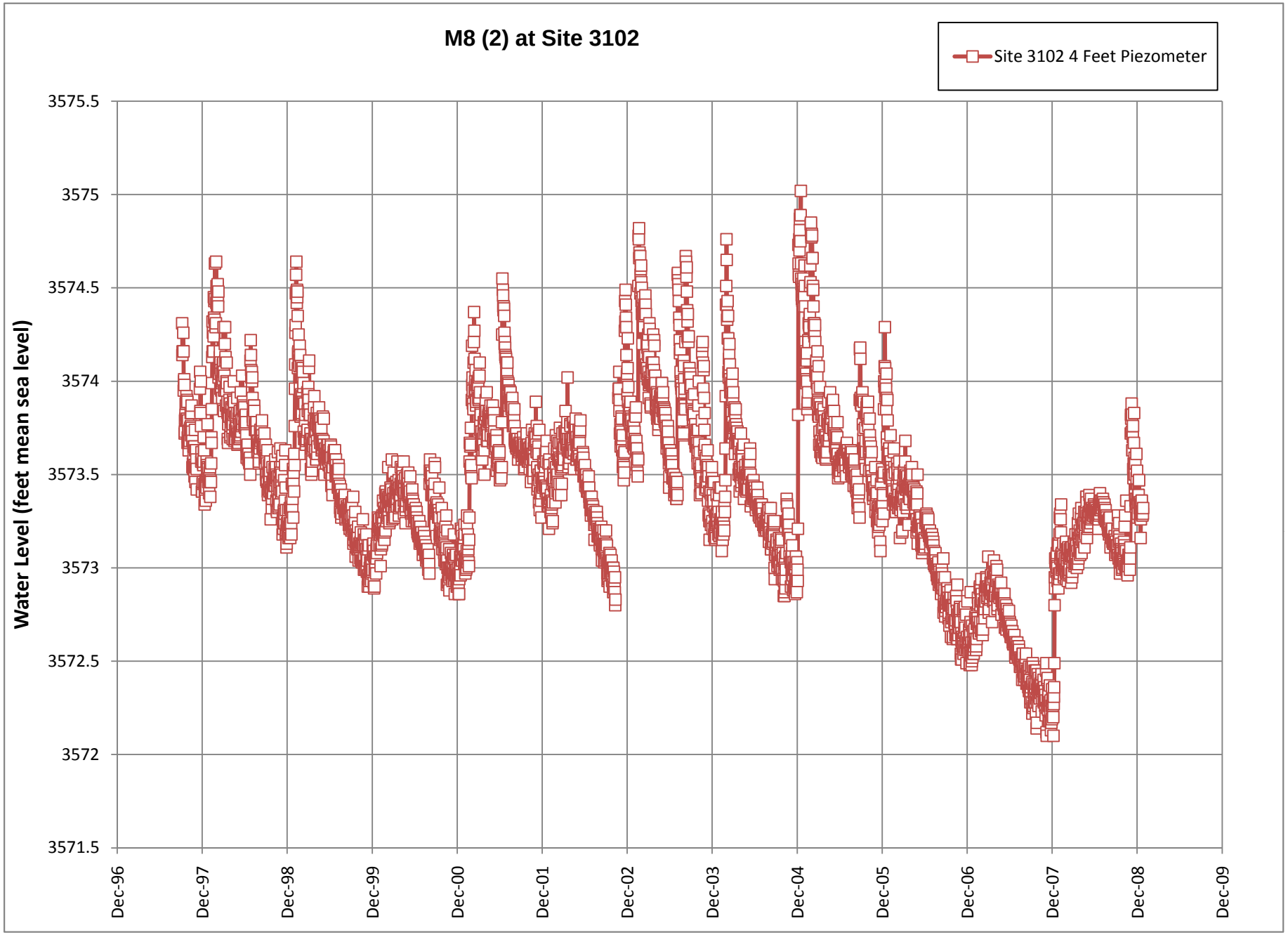

I10 (1) at Site 3041
Site 3041 4 Feet Piezometer
Site 3041 10 Feet Piezometer
Water Level (feet mean sea level)
3584
3583
3582
3581
3580
3579
3578
3577
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

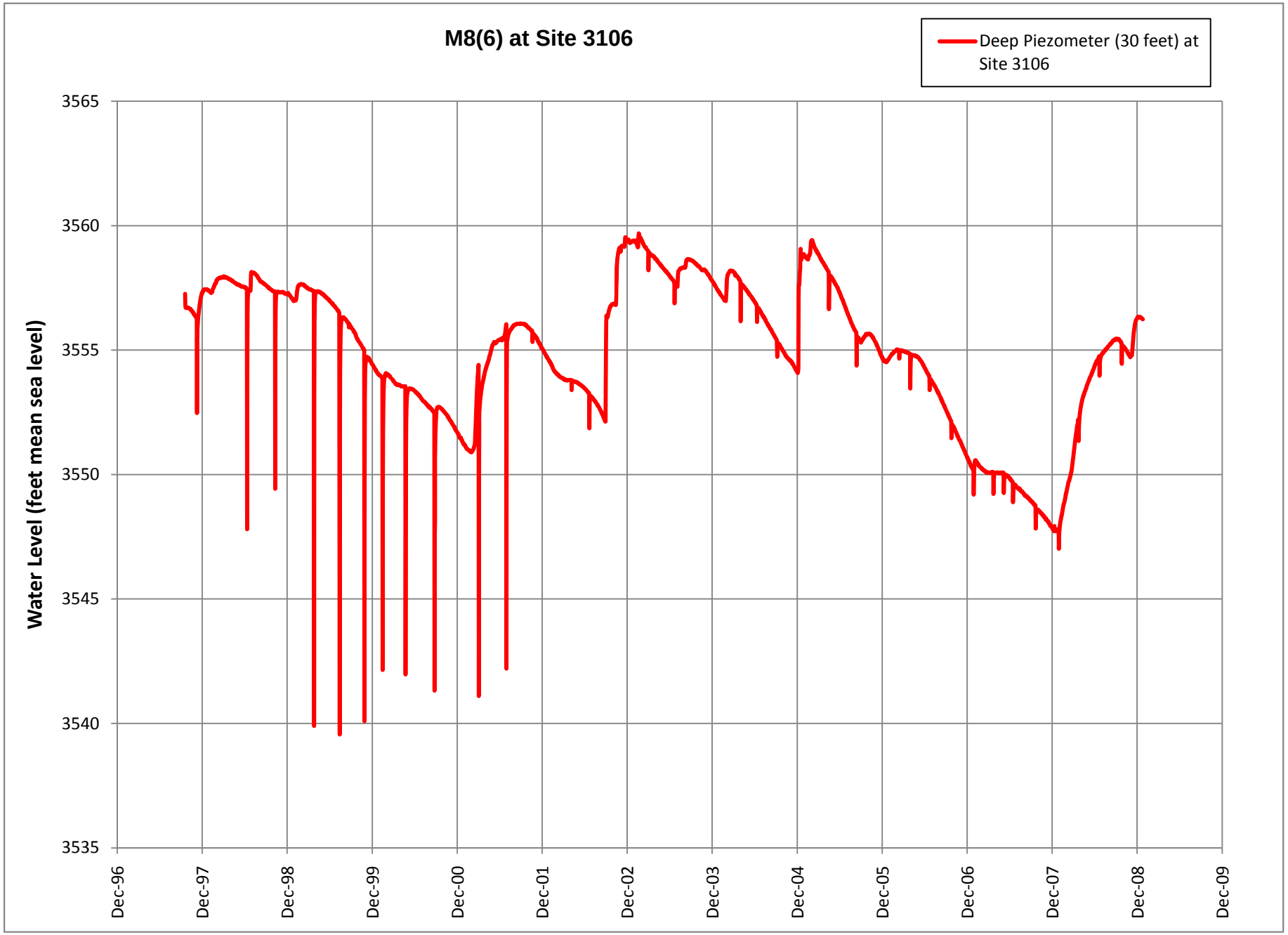

I10 (7) at Site 3047
Site 3047 4 Feet Piezometer
Site 3047 10 Feet Piezometer
Water Level (feet mean sea level)
3572.5
3572
3571.5
3571
3570.5
3570
3569.5
3569
3568.5
3568
3567.5
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

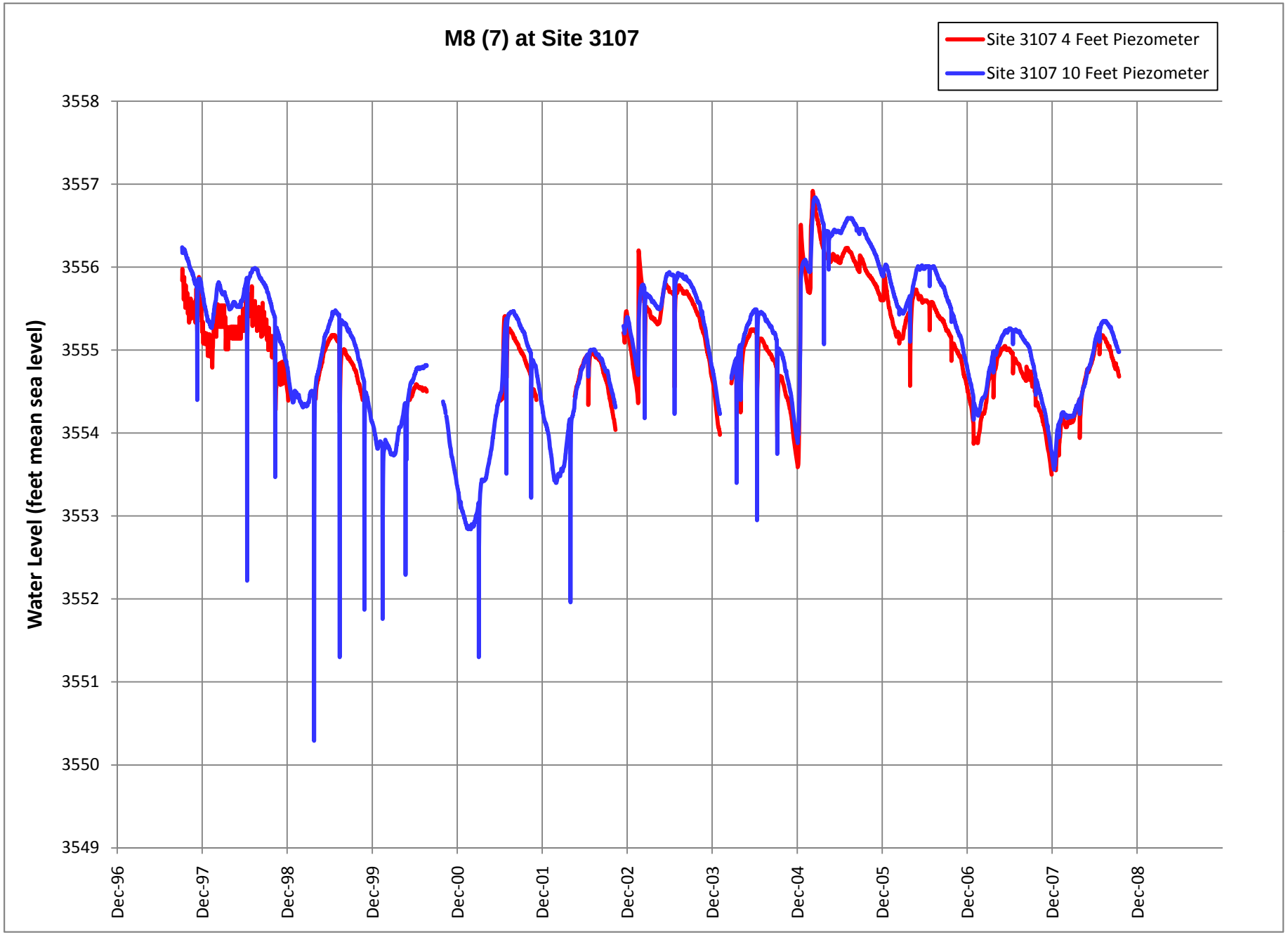

L9 (1) at Site 3071
Site 3071 4 Feet Piezometer
Site 3071 10 Feet Piezometer
Water Level (feet mean sea level)
3578
3577
3576
3575
3574
3573
3572
3571
3570
3569
3568
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

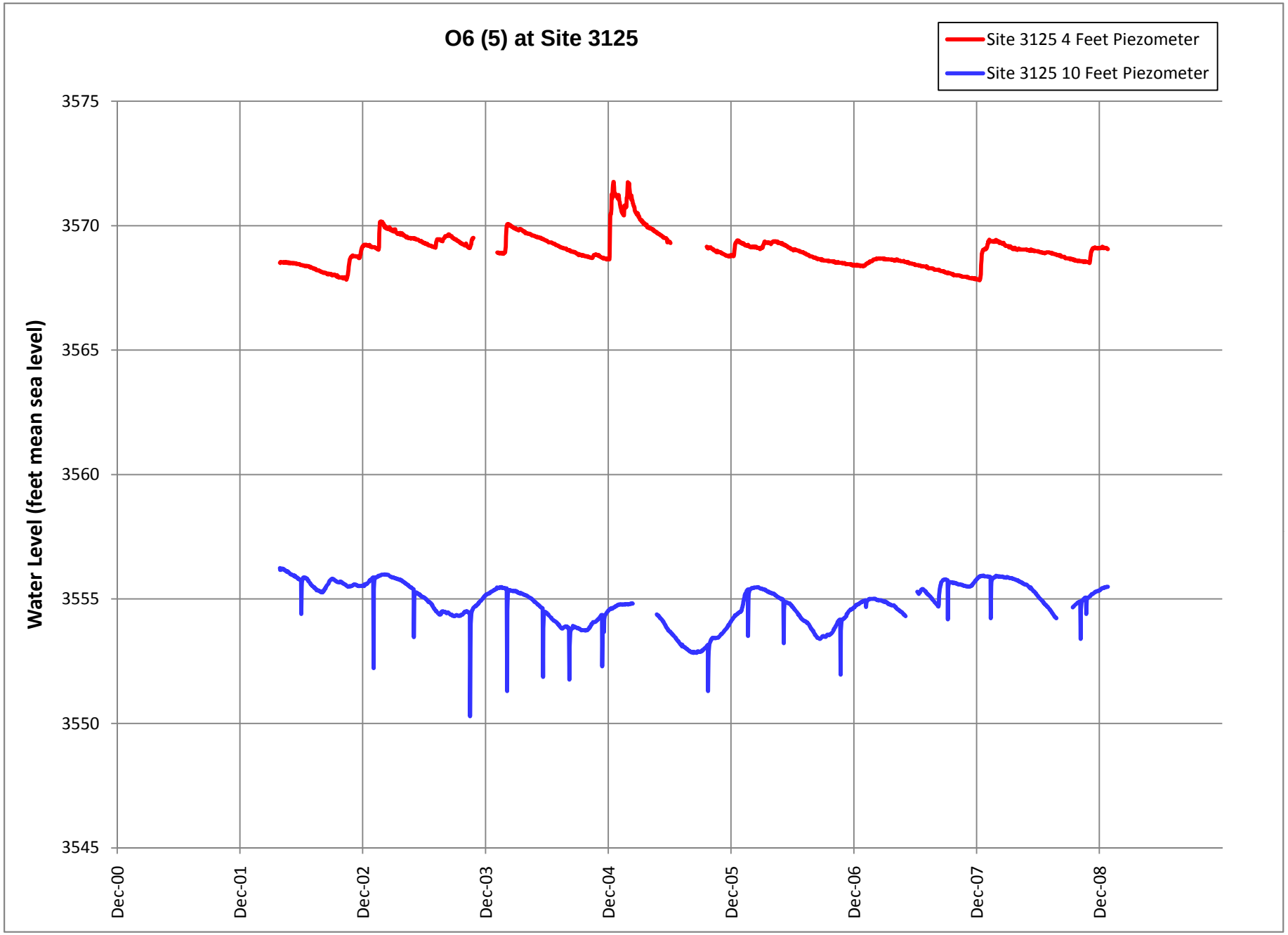

L9 (5) at Site 3075
Site 3075 4 Feet Piezometer
Site 3075 10 Feet Piezometer
Water Level (feet mean sea level)
3578
3577
3576
3575
3574
3573
3572
3571
3570
3569
3568
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

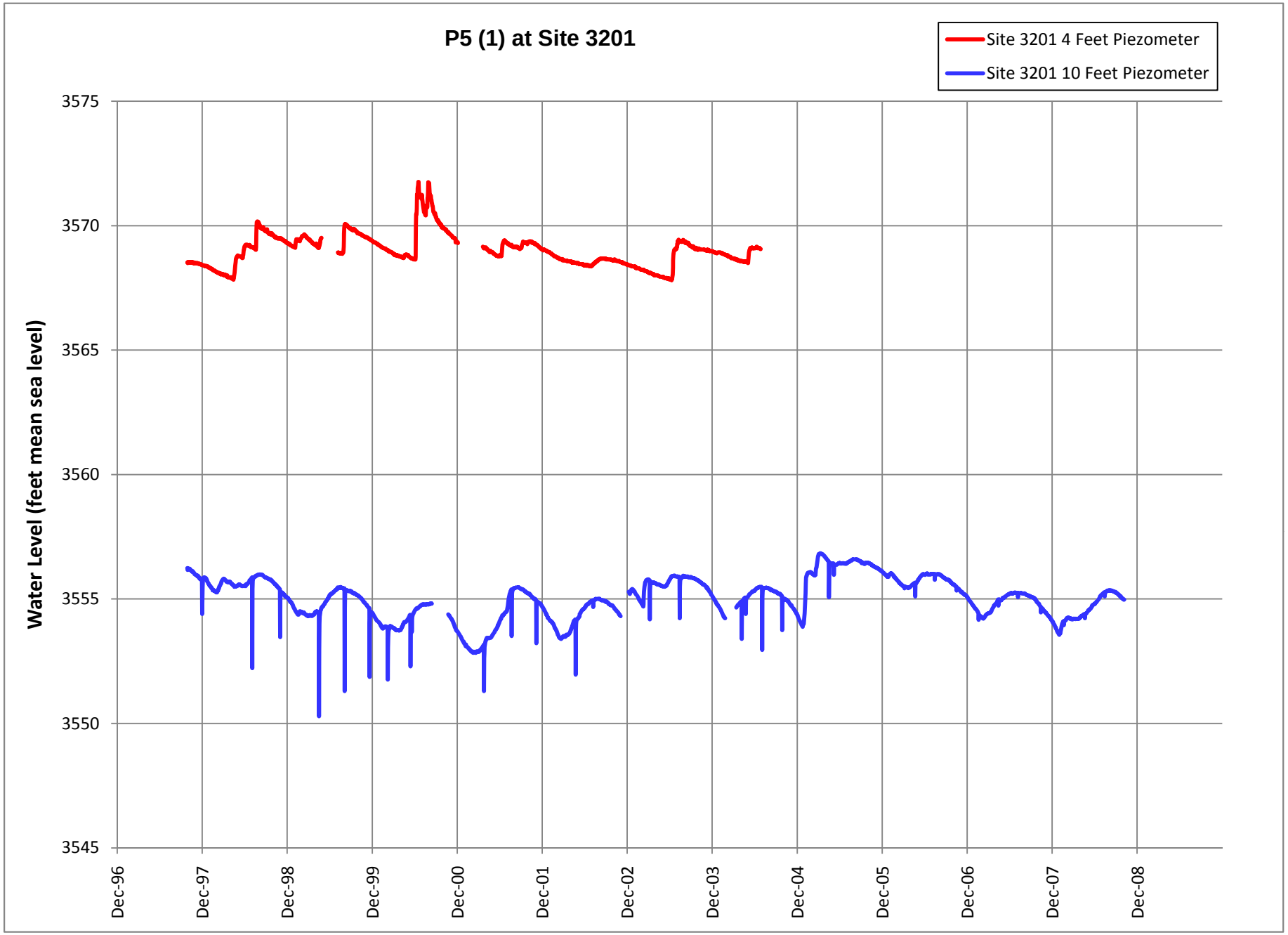

M8 (1) at Site 3101
Site 3101 4 Feet Piezometer
Site 3101 10 Feet Piezometer
Water Level (feet mean sea level)
3582
3580
3578
3576
3574
3572
3570
3568
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

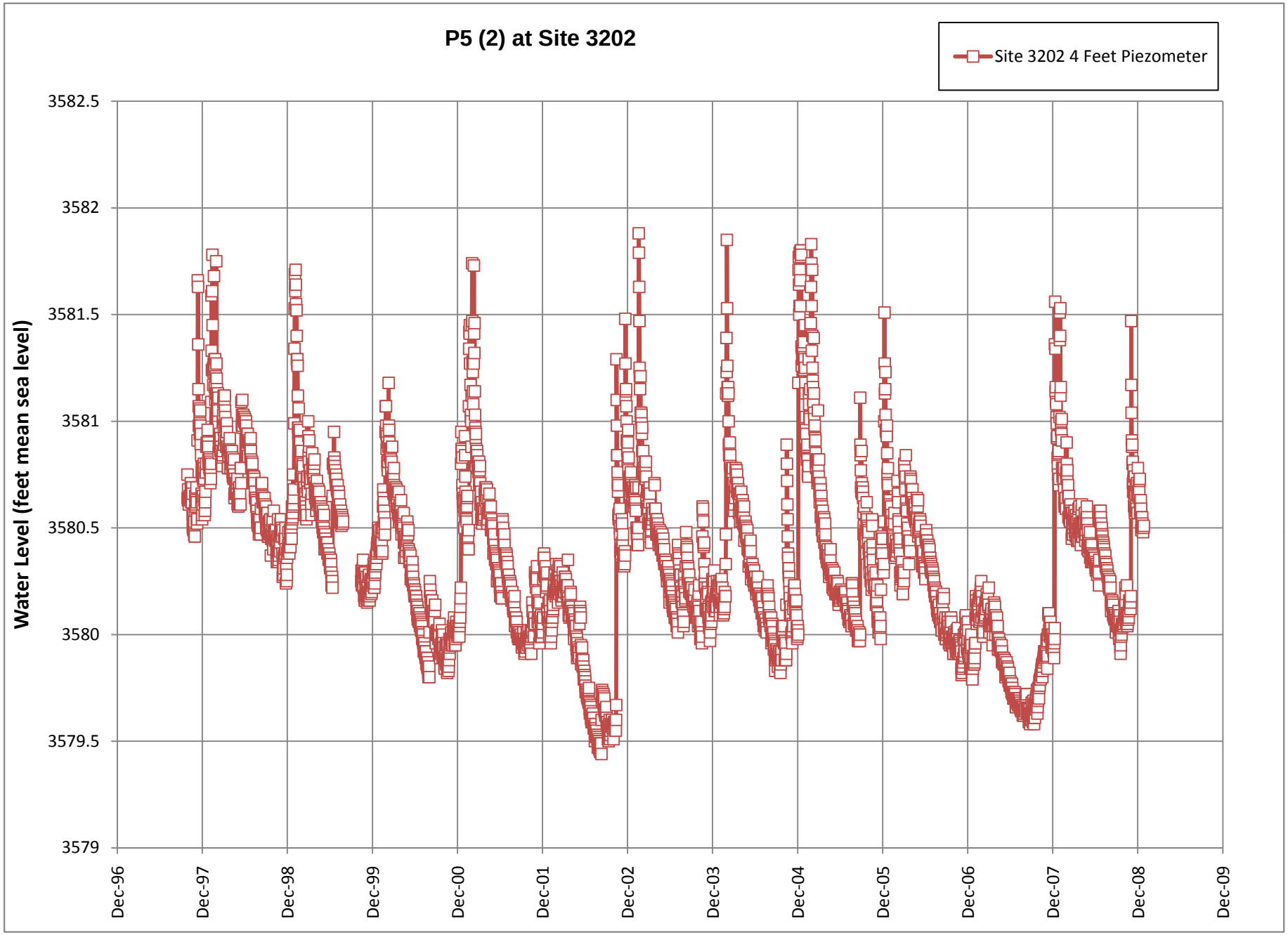

M8 (2) at Site 3102
Site 3102 4 Feet Piezometer
Water Level (feet mean sea level)
3575.5
3575
3574.5
3574
3573.5
3573
3572.5
3572
3571.5
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

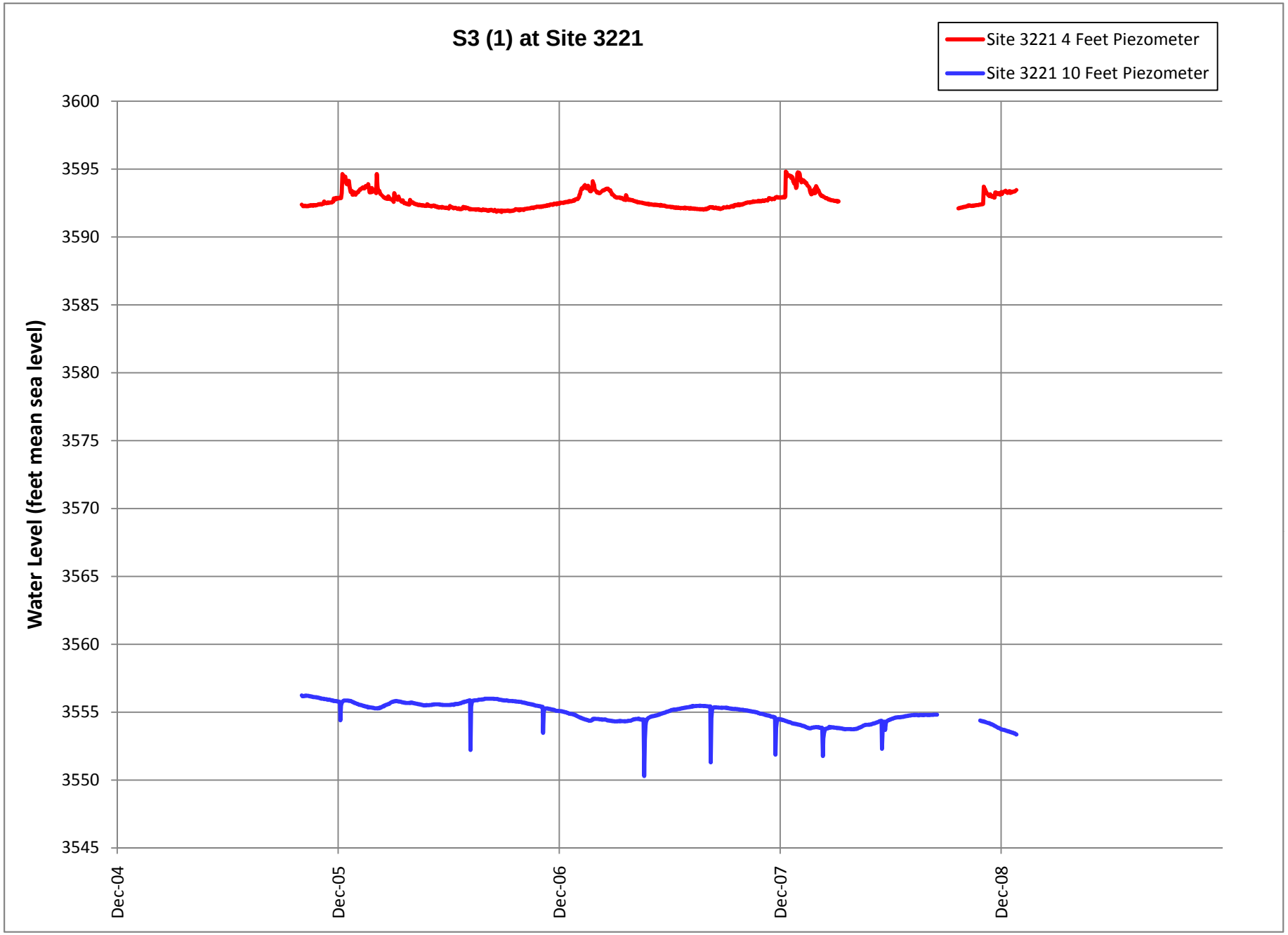

M8(6) at Site 3106
Deep Piezometer (30 feet) at Site 3106
Water Level (feet mean sea level)
3565
3560
3555
3550
3545
3540
3535
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

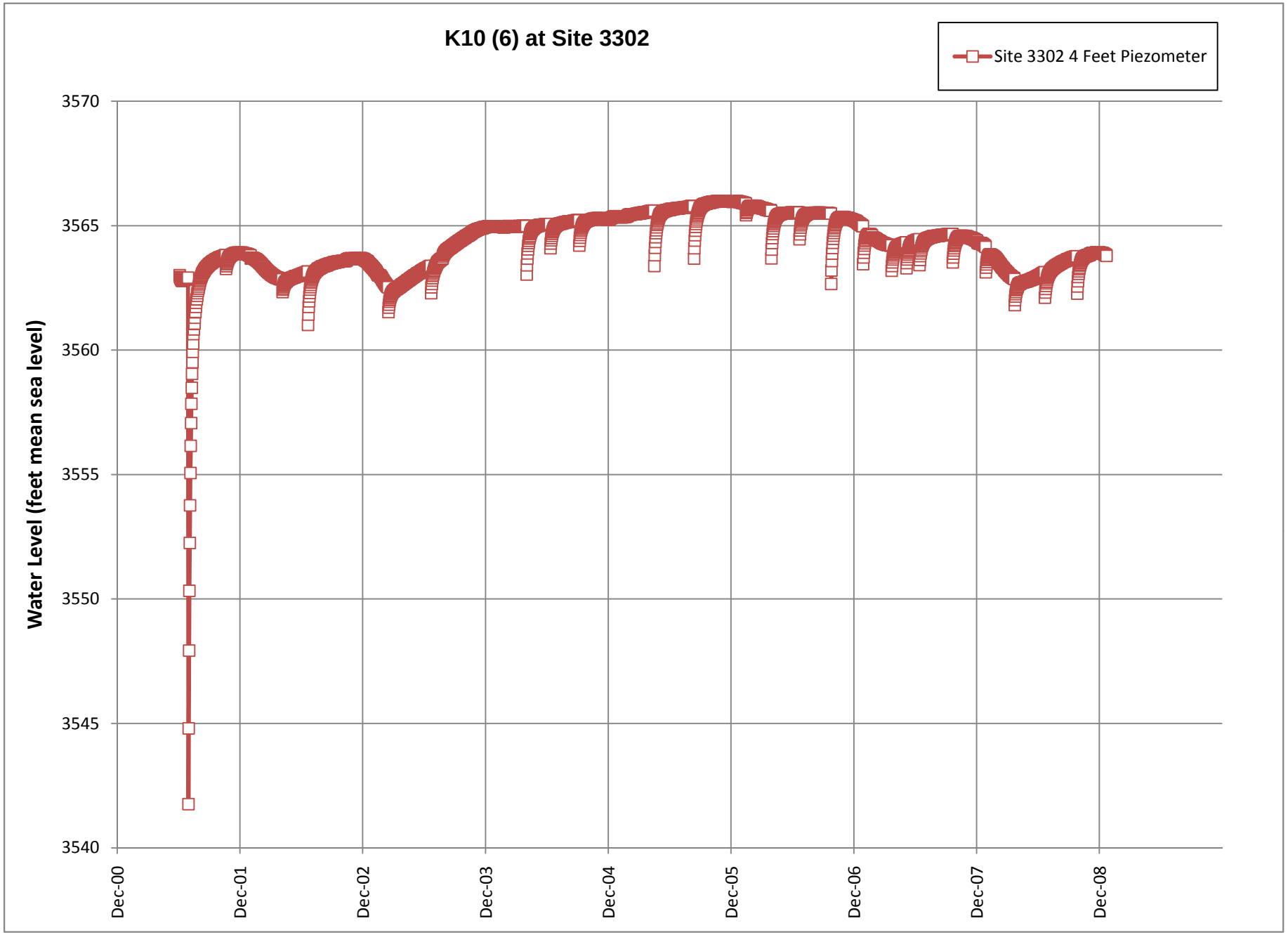

M8 (7) at Site 3107
Site 3107 4 Feet Piezometer
Site 3107 10 Feet Piezometer
Water Level (feet mean sea level)
3558
3557
3556
3555
3554
3553
3552
3551
3550
3549
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

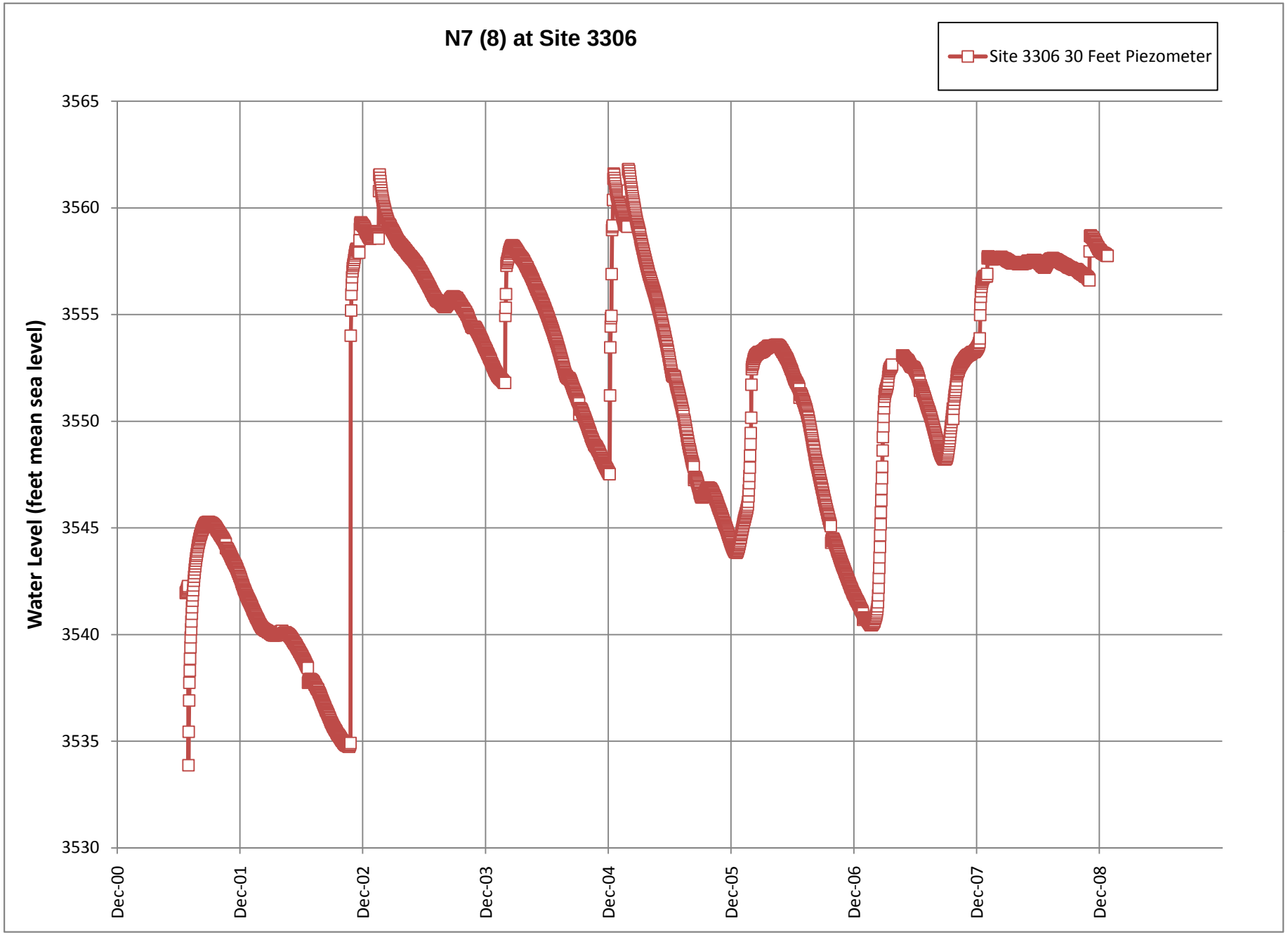

O6 (5) at Site 3125
Site 3125 4 Feet Piezometer
Site 3125 10 Feet Piezometer
Water Level (feet mean sea level)
3575
3570
3565
3560
3555
3550
3545
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

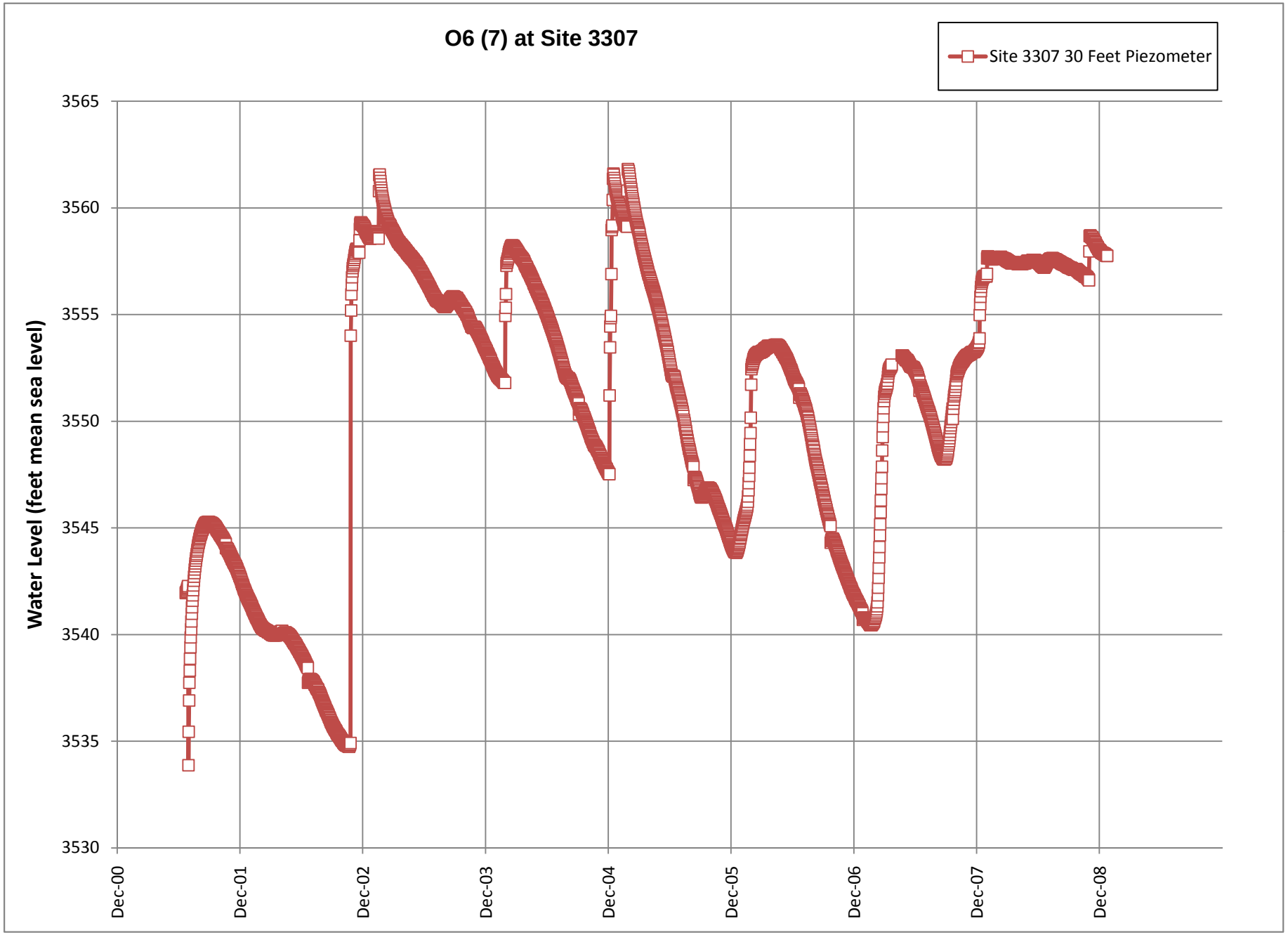

P5 (1) at Site 3201
Site 3201 4 Feet Piezometer
Site 3201 10 Feet Piezometer
Water Level (feet mean sea level)
3575
3570
3565
3560
3555
3550
3545
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

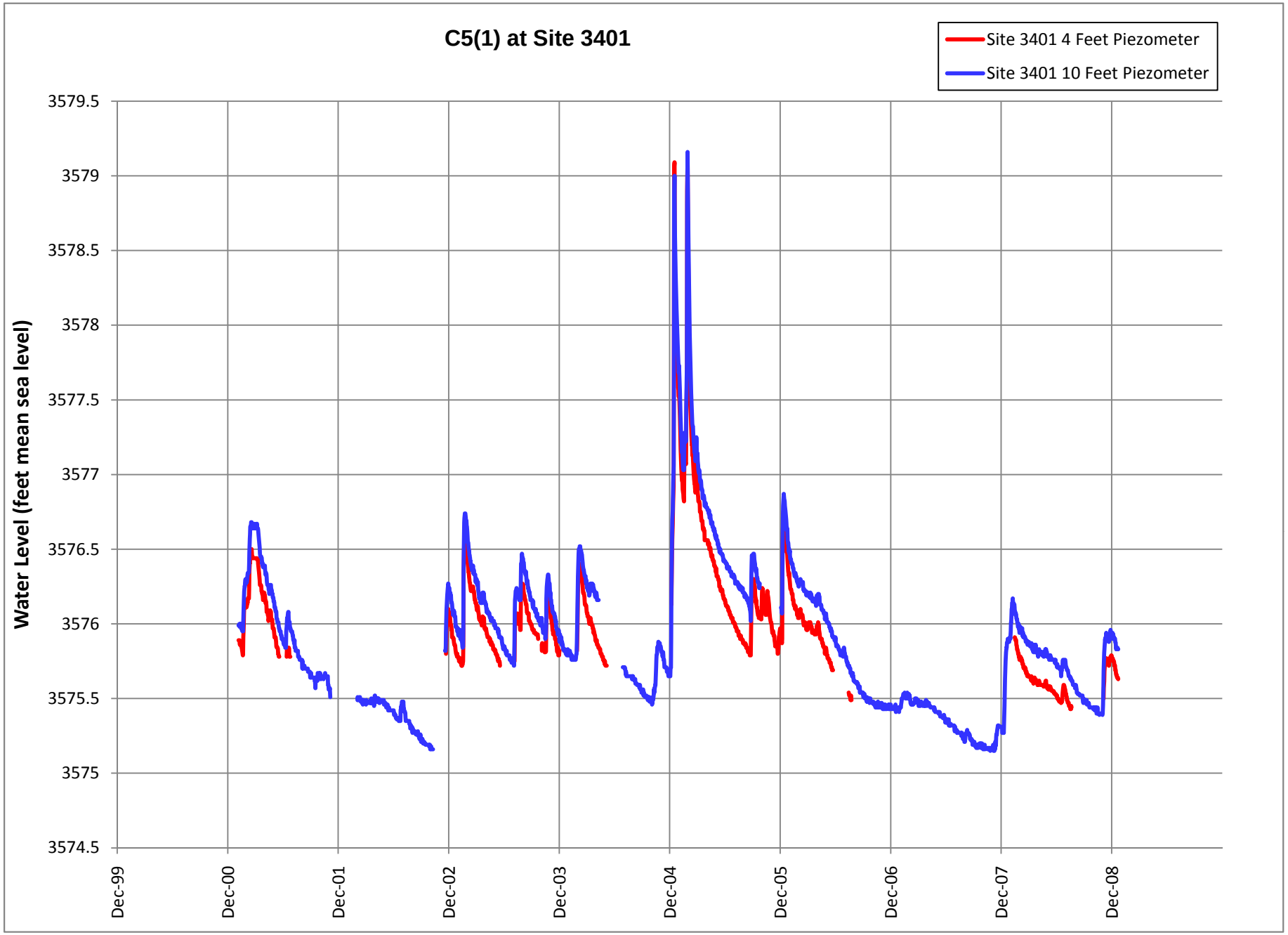

P5 (2) at Site 3202
Site 3202 4 Feet Piezometer
Water Level (feet mean sea level)
3582.5
3582
3581.5
3581
3580.5
3580
3579.5
3579
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

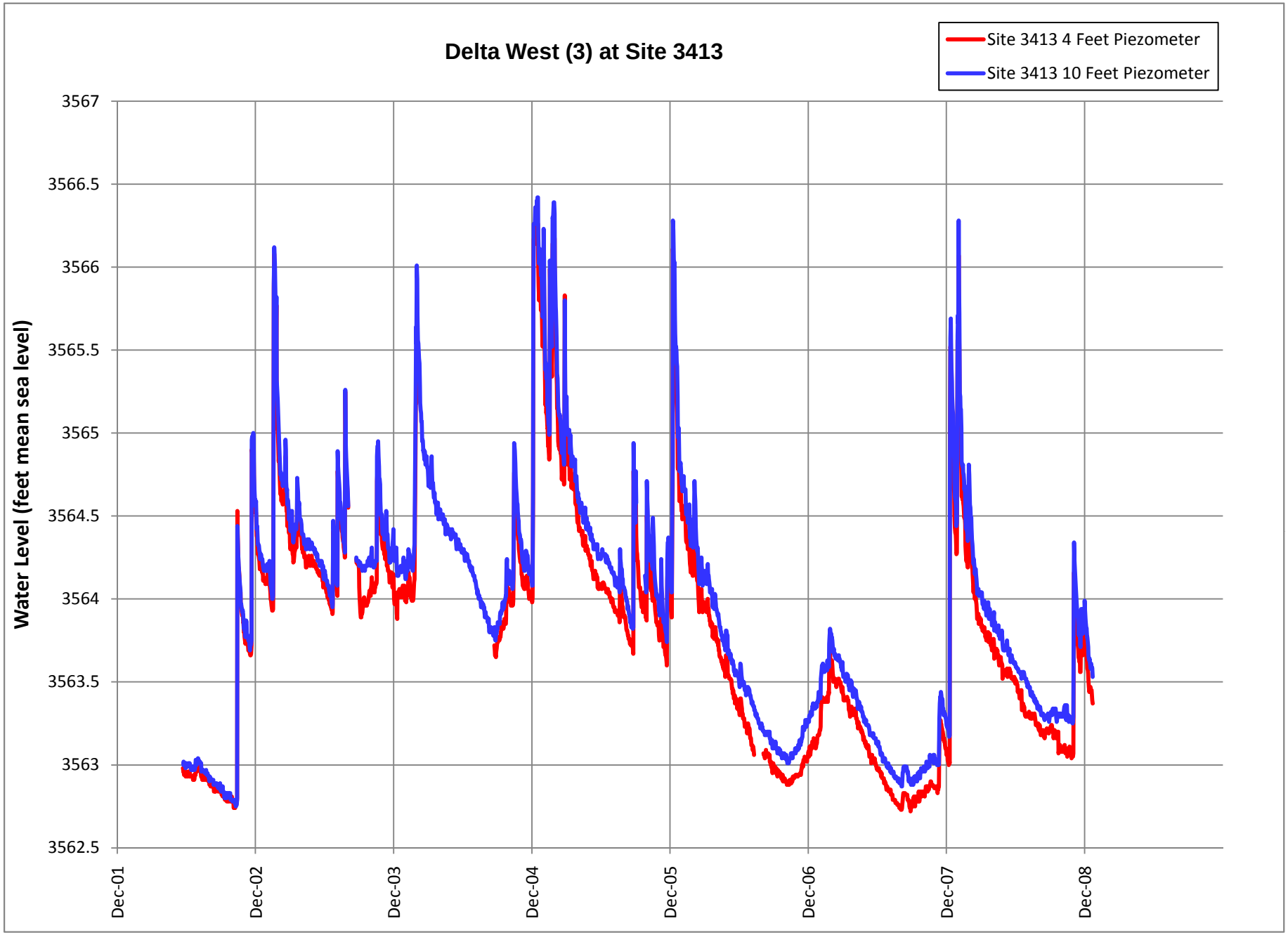

S3 (1) at Site 3221
Site 3221 4 Feet Piezometer
Site 3221 10 Feet Piezometer
Water Level (feet mean sea level)
3600
3595
3590
3585
3580
3575
3570
3565
3560
3555
3550
3545
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

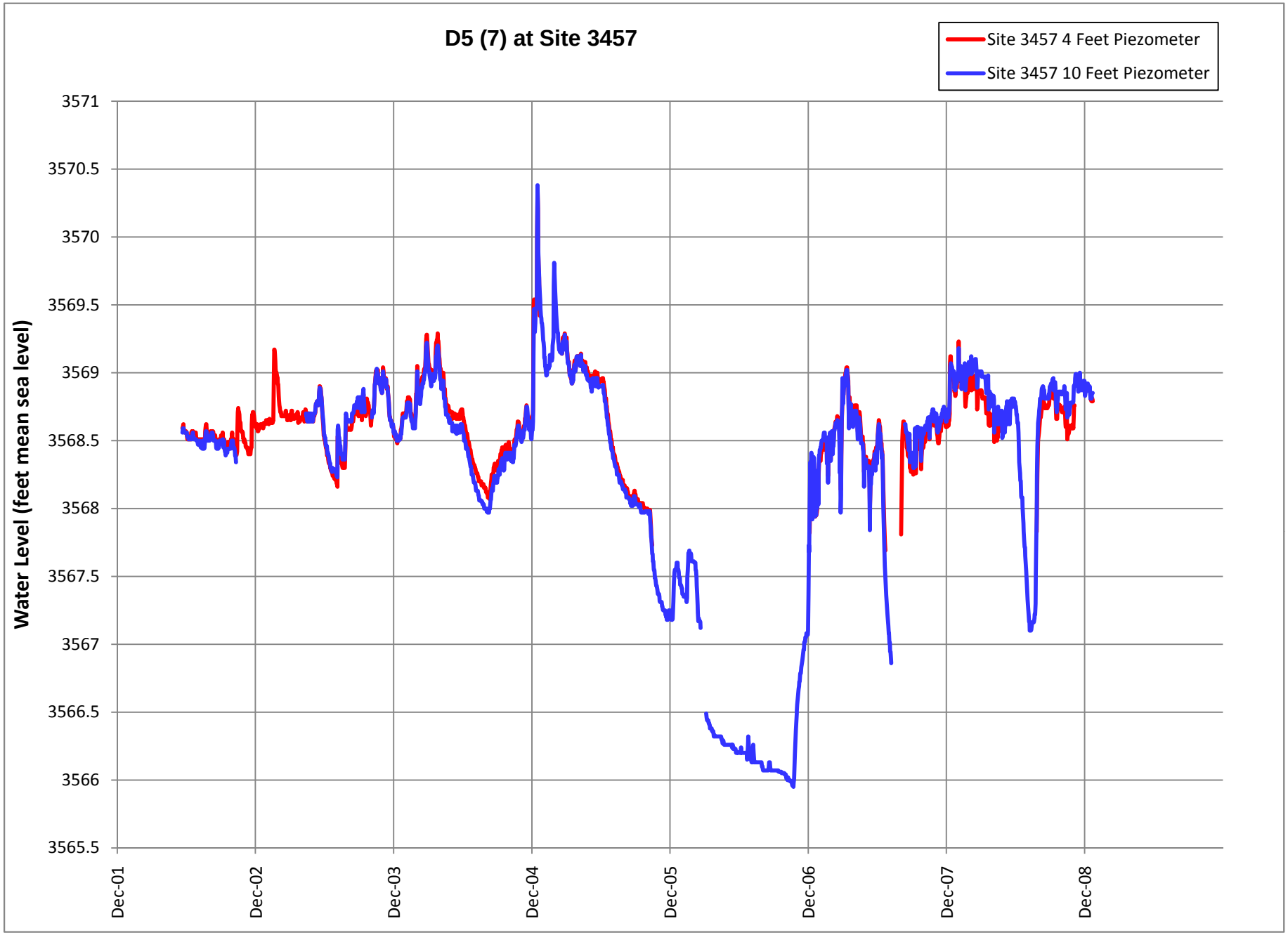

K10 (6) at Site 3302
Site 3302 4 Feet Piezometer
Water Level (feet mean sea level)
3570
3565
3560
3555
3550
3545
3540
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

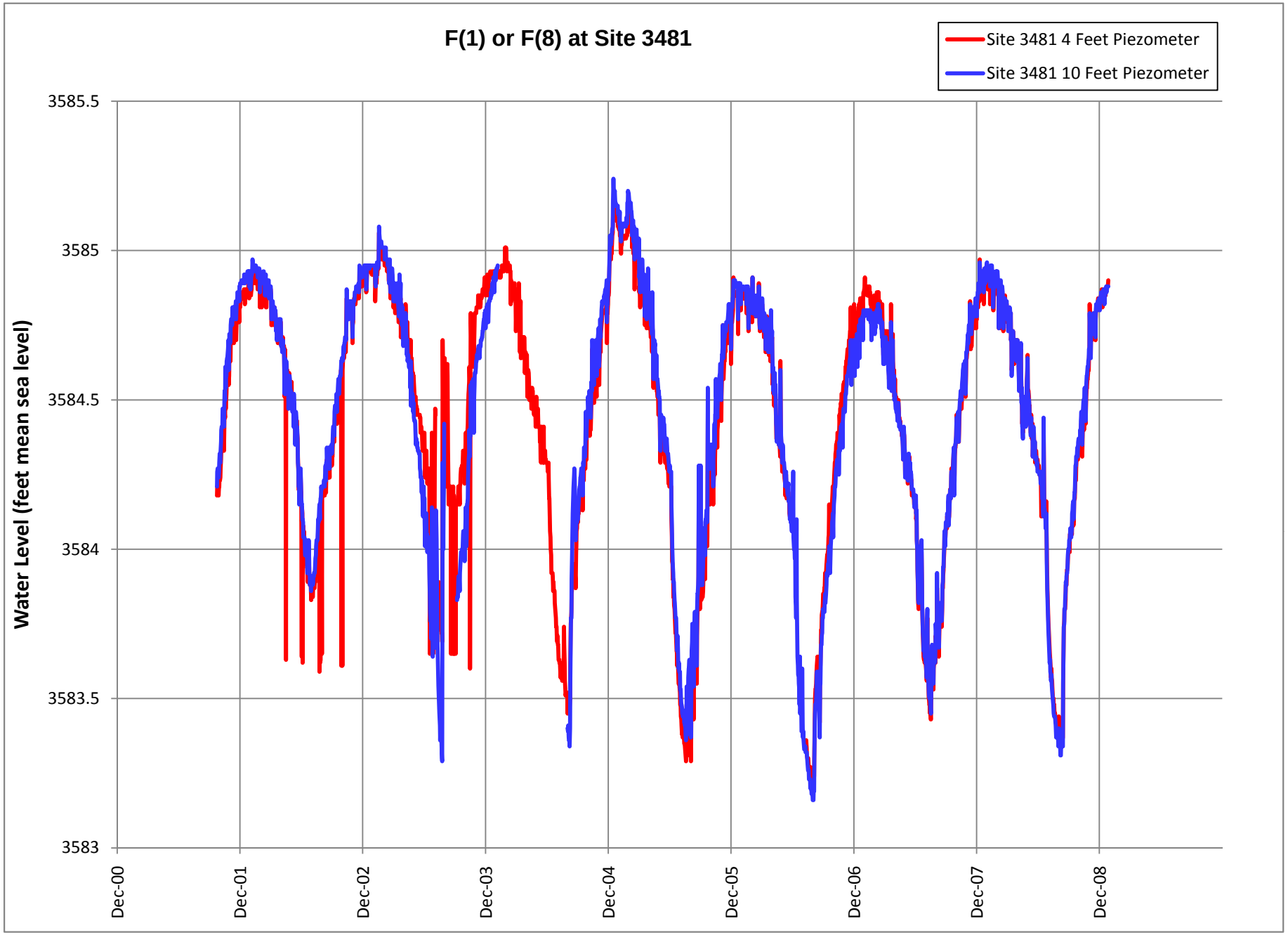

N7 (8) at Site 3306
Site 3306 30 Feet Piezometer
Water Level (feet mean sea level)
3565
3560
3555
3550
3545
3540
3535
3530
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

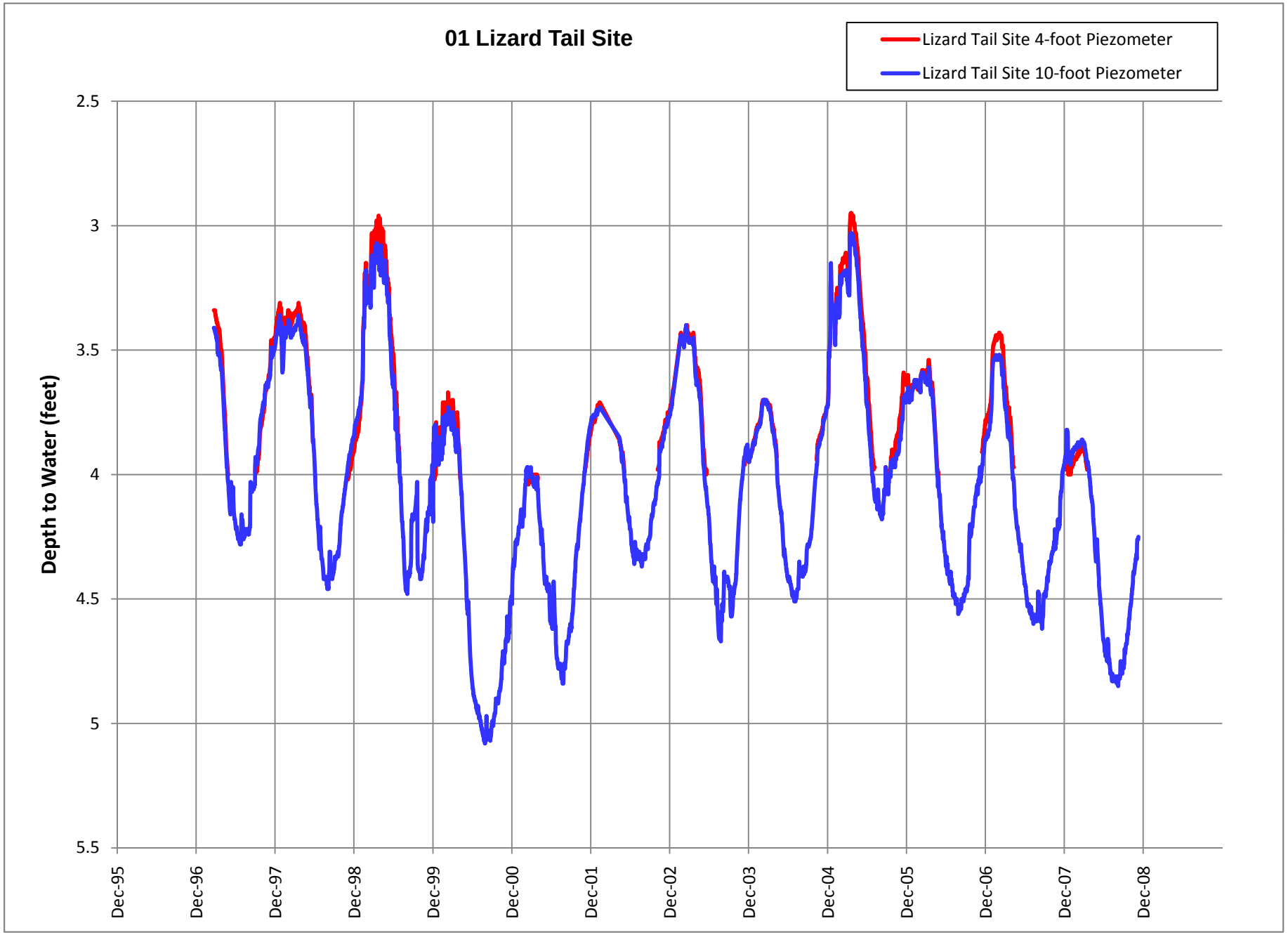

O6 (7) at Site 3307
Site 3307 30 Feet Piezometer
Water Level (feet mean sea level)
3565
3560
3555
3550
3545
3540
3535
3530
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

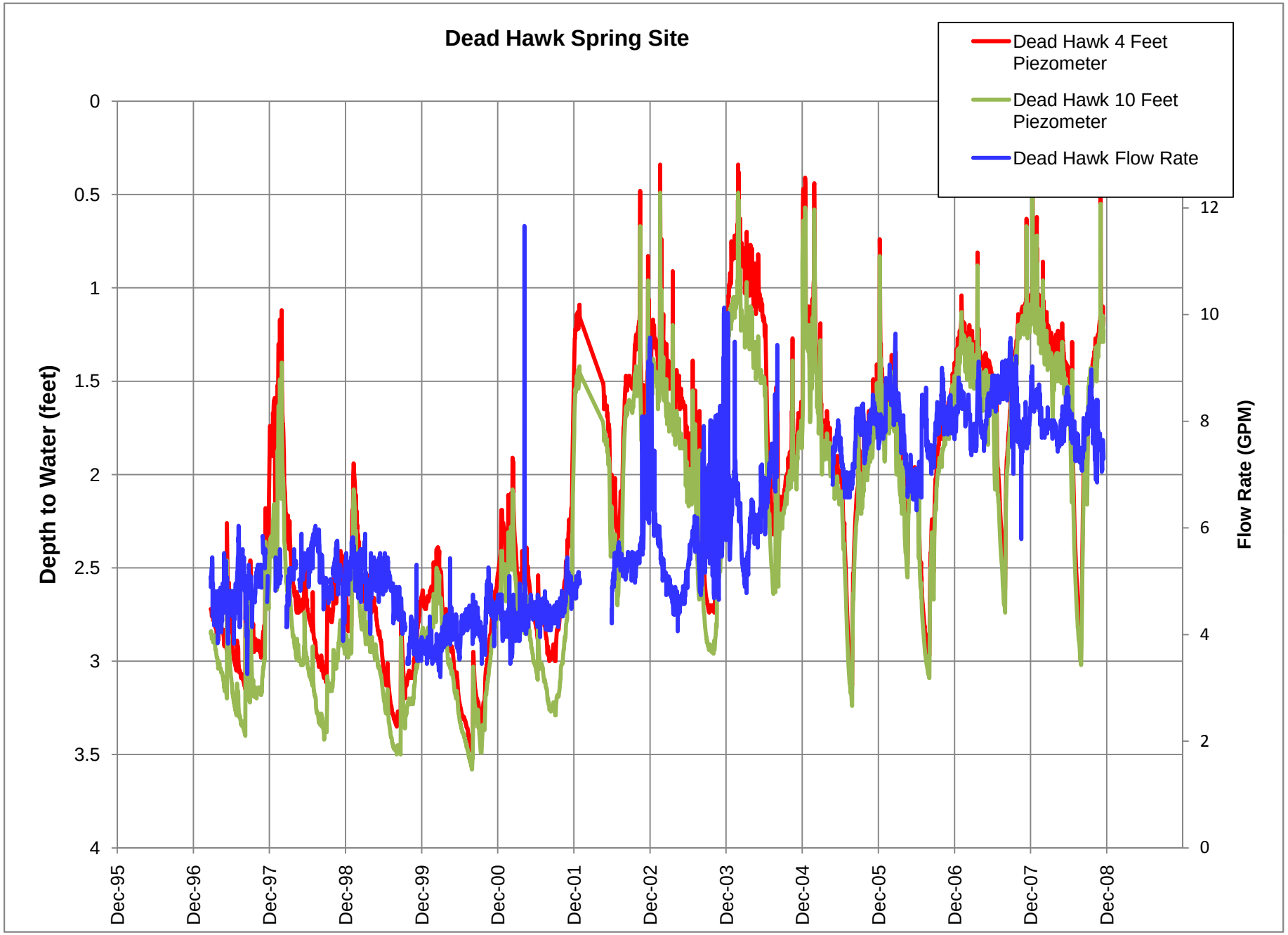

C5(1) at Site 3401
Site 3401 4 Feet Piezometer
Site 3401 10 Feet Piezometer
Water Level (feet mean sea level)
3579.5
3579
3578.5
3578
3577.5
3577
3576.5
3576
3575.5
3575
3574.5
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

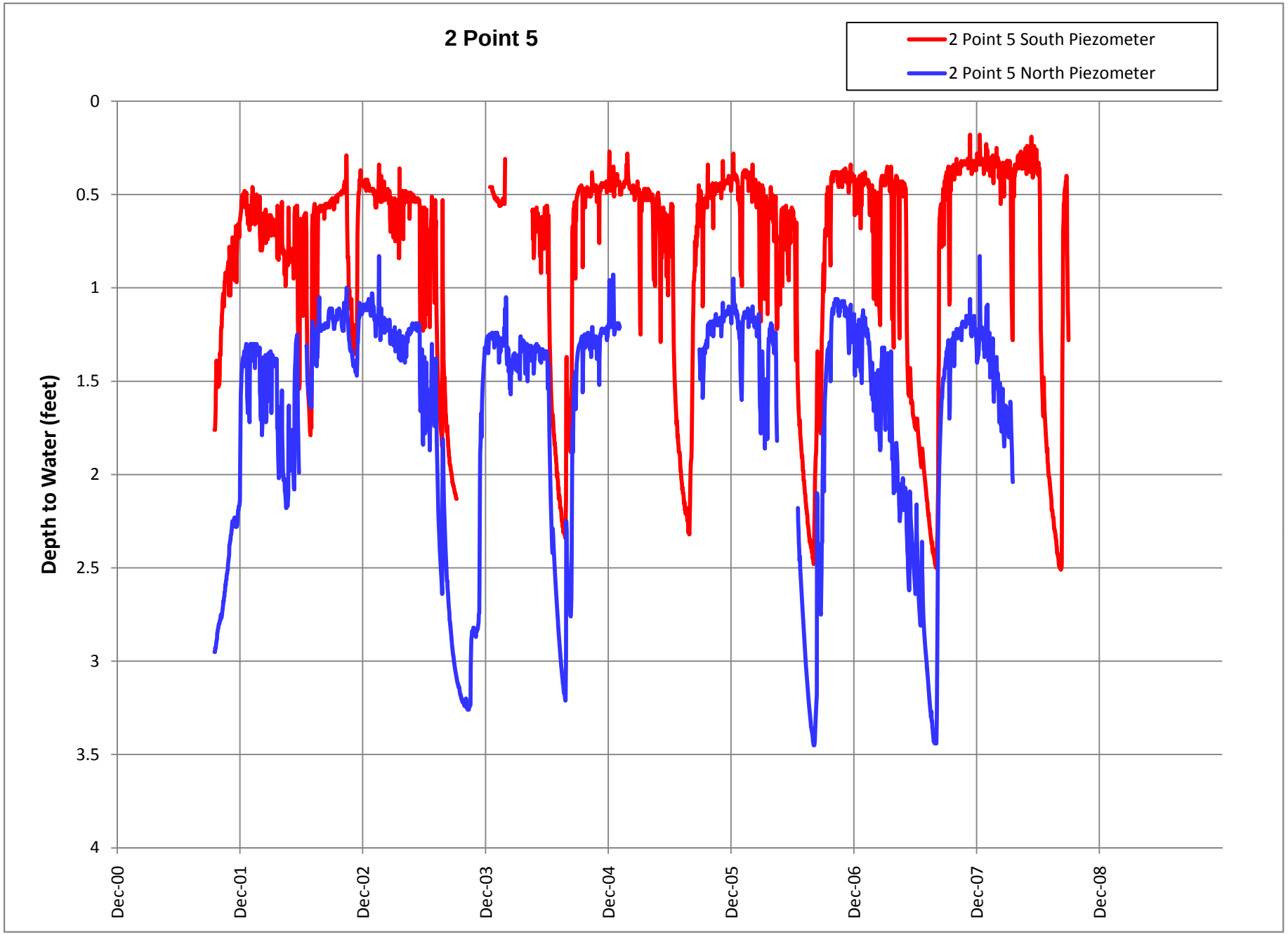

Delta West (3) at Site 3413
Site 3413 4 Feet Piezometer
Site 3413 10 Feet Piezometer
Water Level (feet mean sea level)
3567
3566.5
3566
3565.5
3565
3564.5
3564
3563.5
3563
3562.5
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

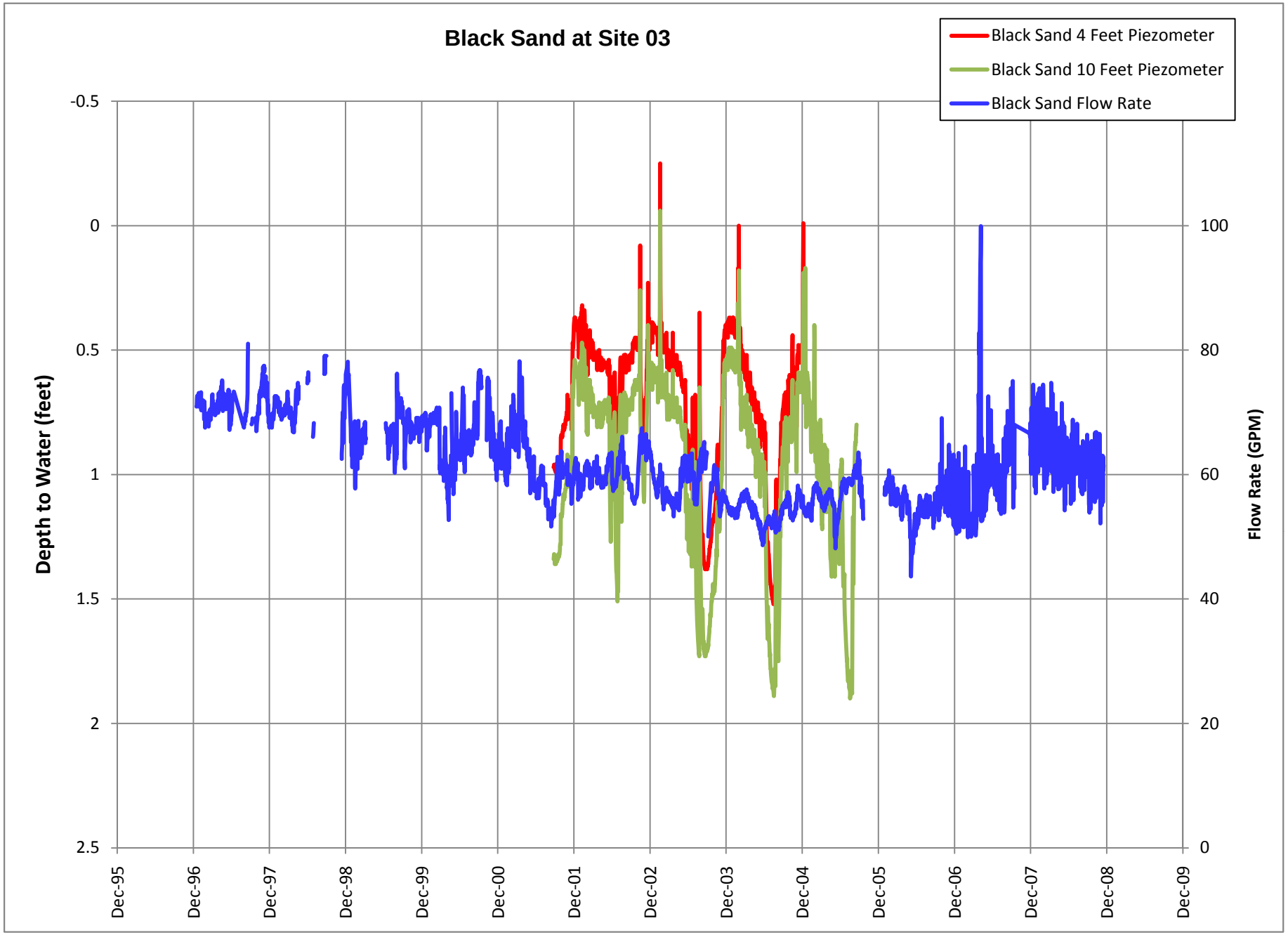

D5 (7) at Site 3457
Site 3457 4 Feet Piezometer
Site 3457 10 Feet Piezometer
Water Level (feet mean sea level)
3571
3570.5
3570
3569.5
3569
3568.5
3568
3567.5
3567
3566.5
3566
3565.5
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

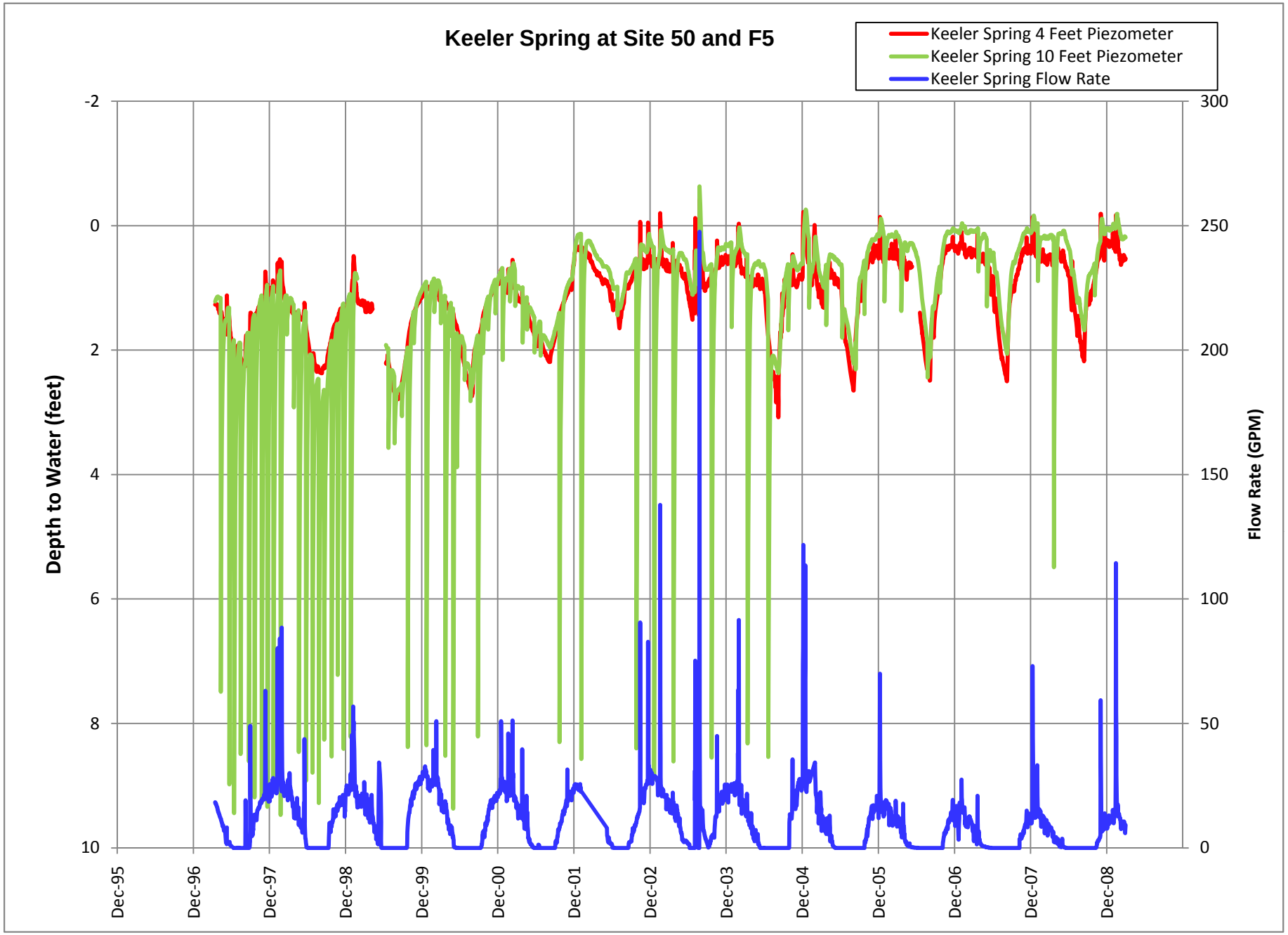

F(1) or F(8) at Site 3481
Site 3481 4 Feet Piezometer
Site 3481 10 Feet Piezometer
Water Level (feet mean sea level)
3585.5
3585
3584.5
3584
3583.5
3583
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

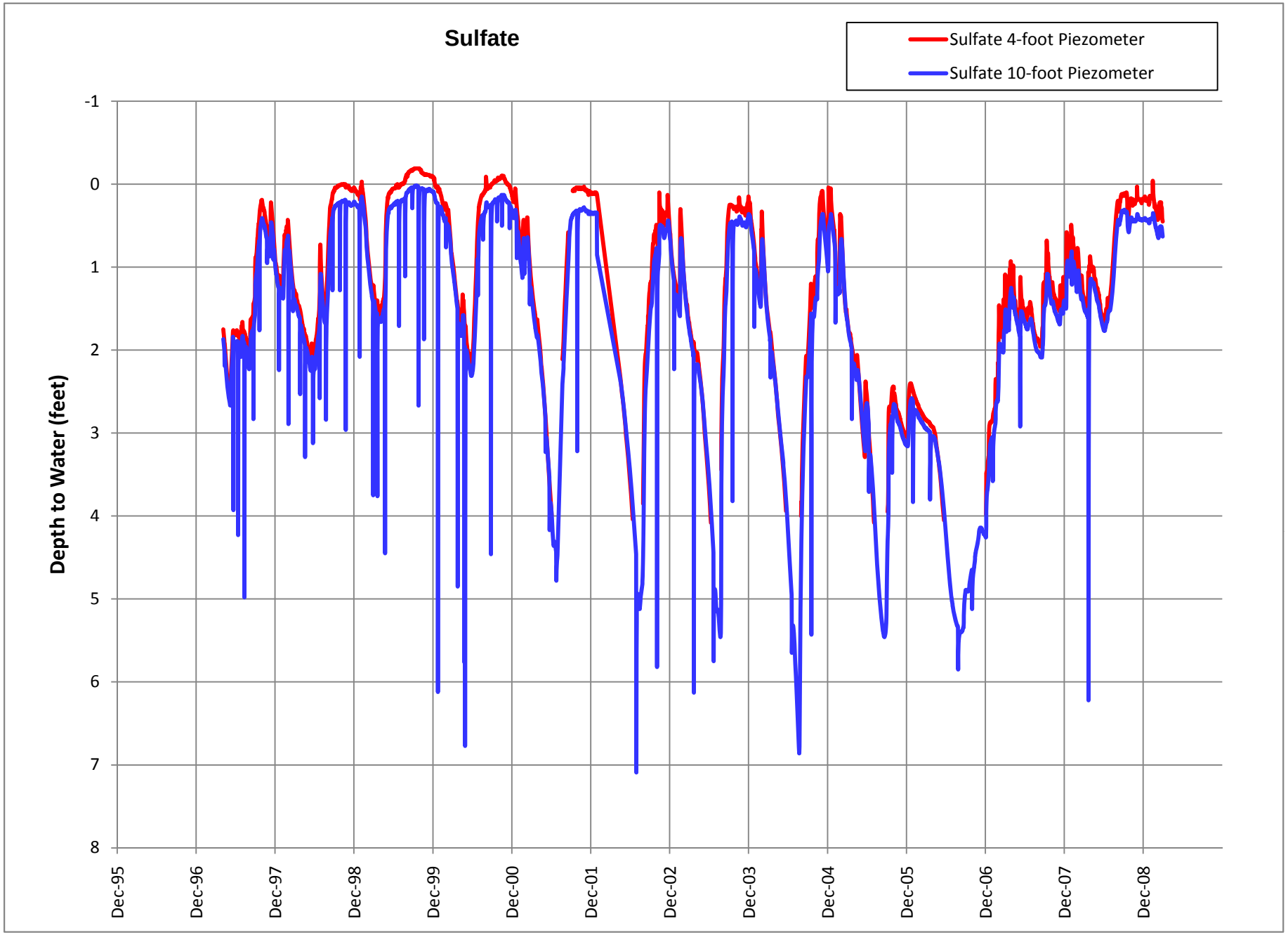

01 Lizard Tail Site
Lizard Tail Site 4-foot Piezometer
Lizard Tail Site 10-foot Piezometer
Depth to Water (feet)
2.5
3
3.5
4
4.5
5
5.5
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

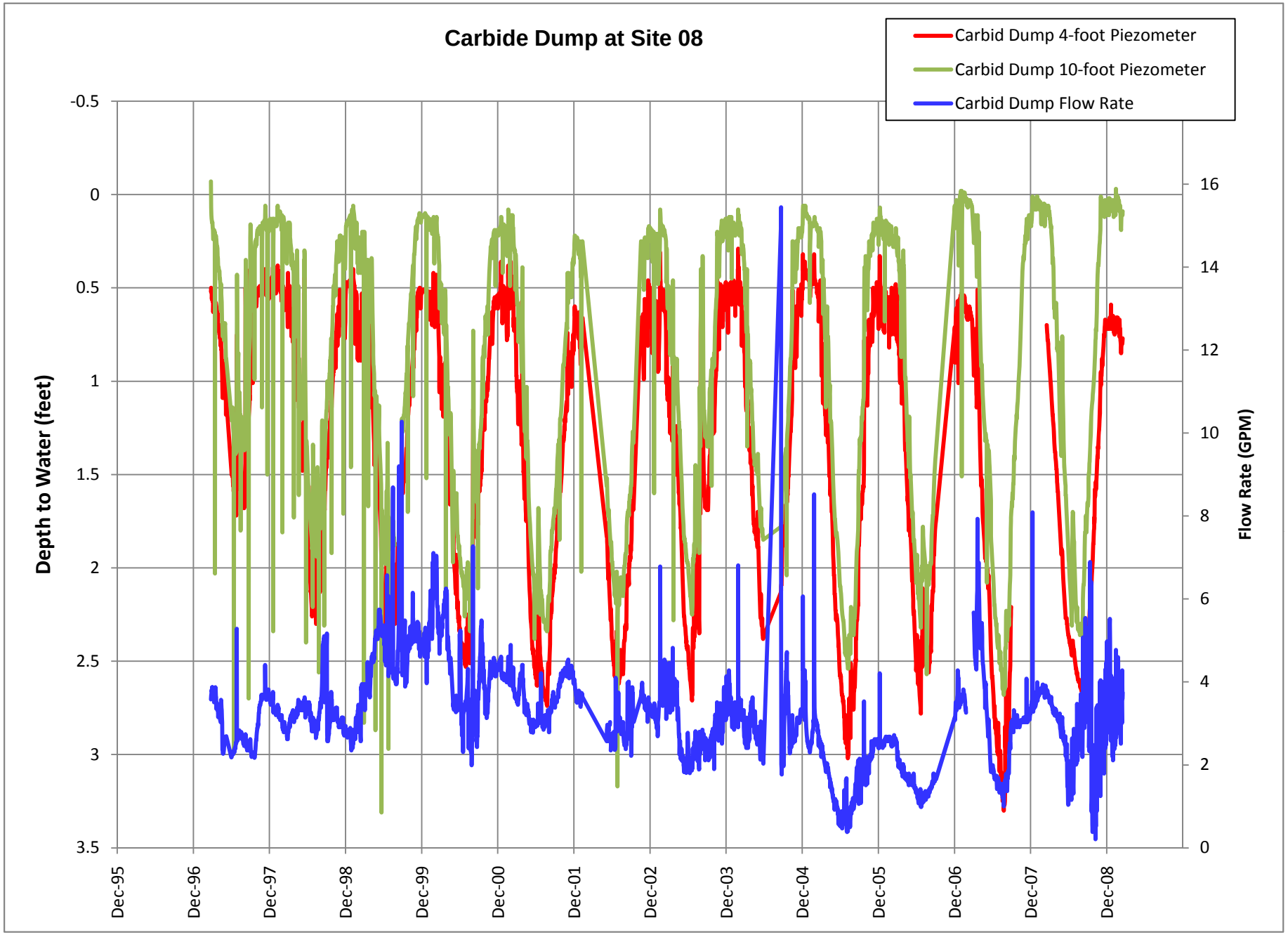

Dead Hawk Spring Site
Dead Hawk 4 Feet Piezometer
Dead Hawk 10 Feet Piezometer
Dead Hawk Flow Rate
Depth to Water (feet)
Flow Rate (GPM)
0
0.5
1
1.5
2
2.5
3
3.5
4
12
10
8
6
4
2
0
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

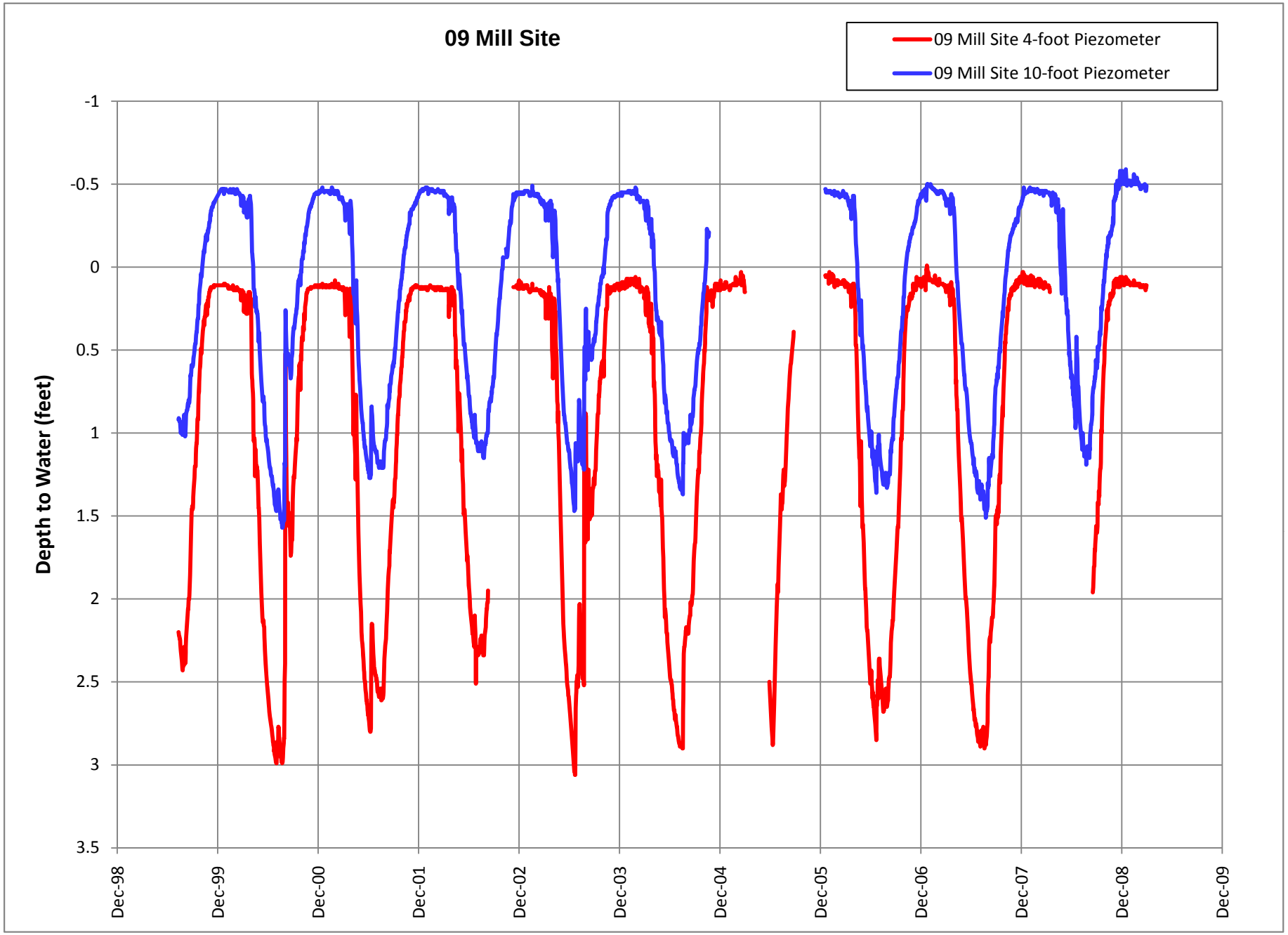

2 Point 5
2 Point 5 South Piezometer
2 Point 5 North Piezometer
Depth to Water (feet)
0
0.5
1
1.5
2
2.5
3
3.5
4
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

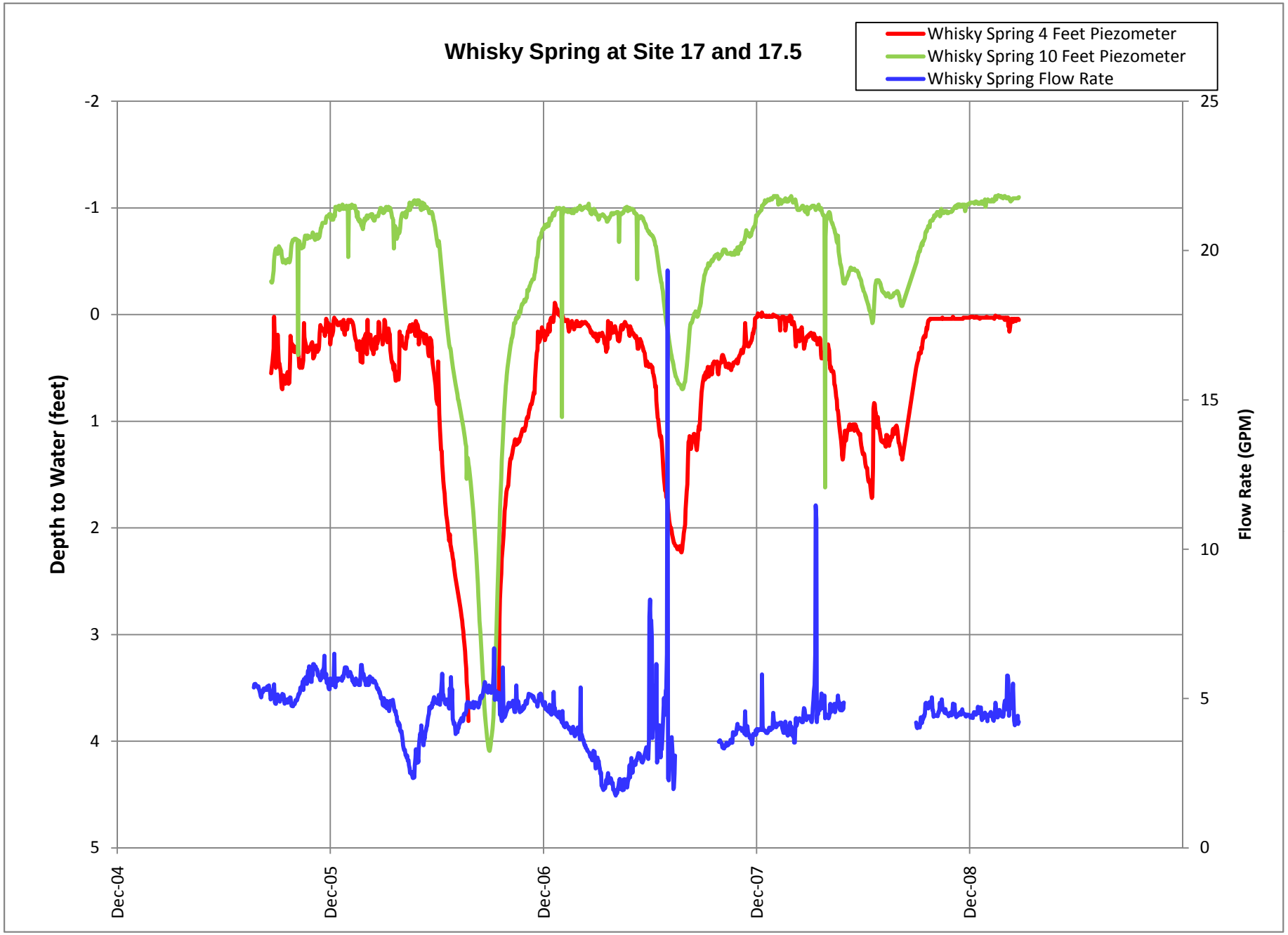

Black Sand at Site 03
Black Sand 4 Feet Piezometer
Black Sand 10 Feet Piezometer
Black Sand Flow Rate
Depth to Water (feet)
Flow Rate (GPM)
-0.5
0
0.5
1
1.5
2
2.5
100
80
60
40
20
0
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09

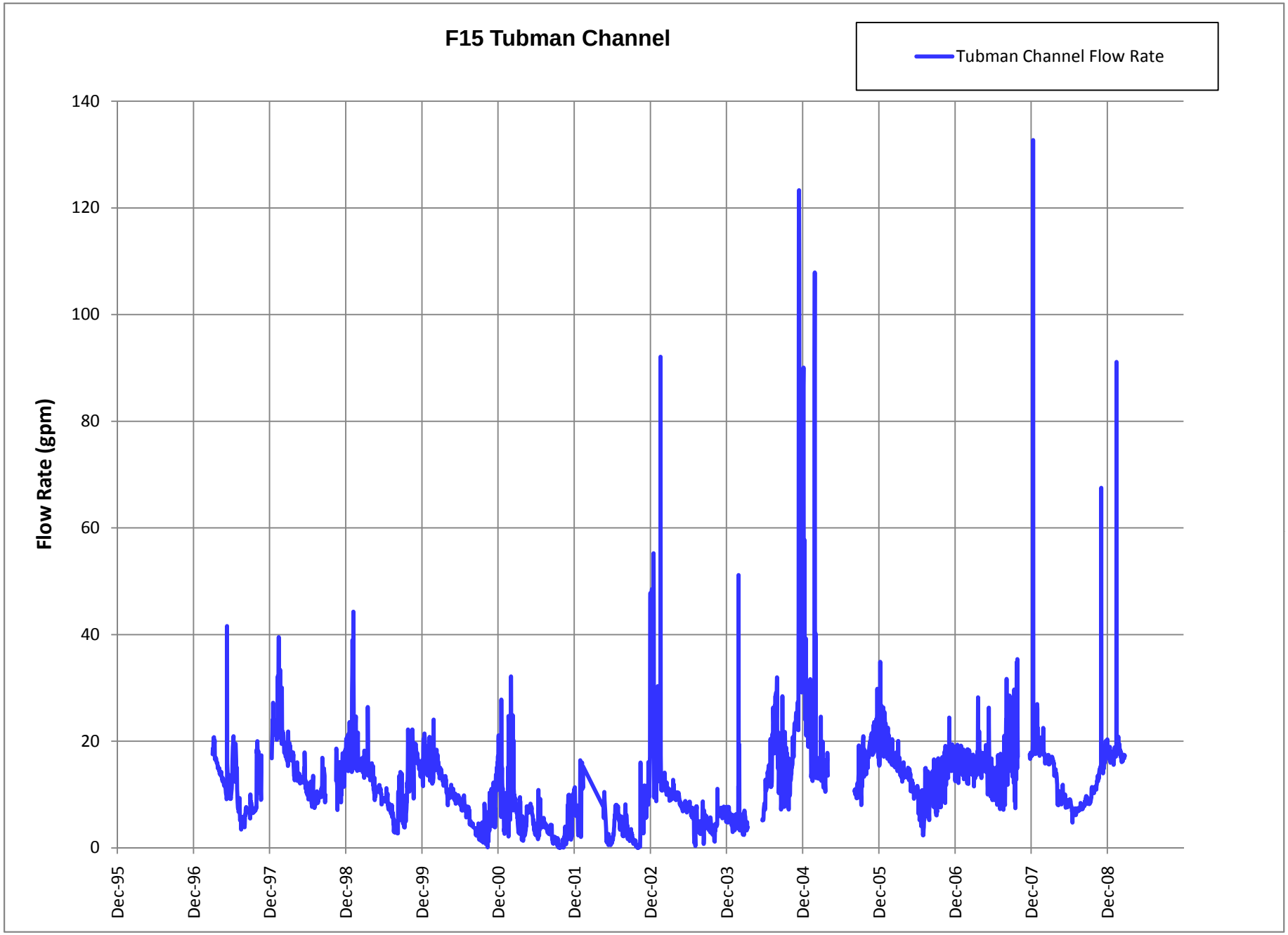

Keeler Spring at Site 50 and F5
Keeler Spring 4 Feet Piezometer
Keeler Spring 10 Feet Piezometer
Keeler Spring Flow Rate
Depth to Water (feet)
Flow Rate (GPM)
-2
0
2
4
6
8
10
300
250
200
150
100
50
0
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

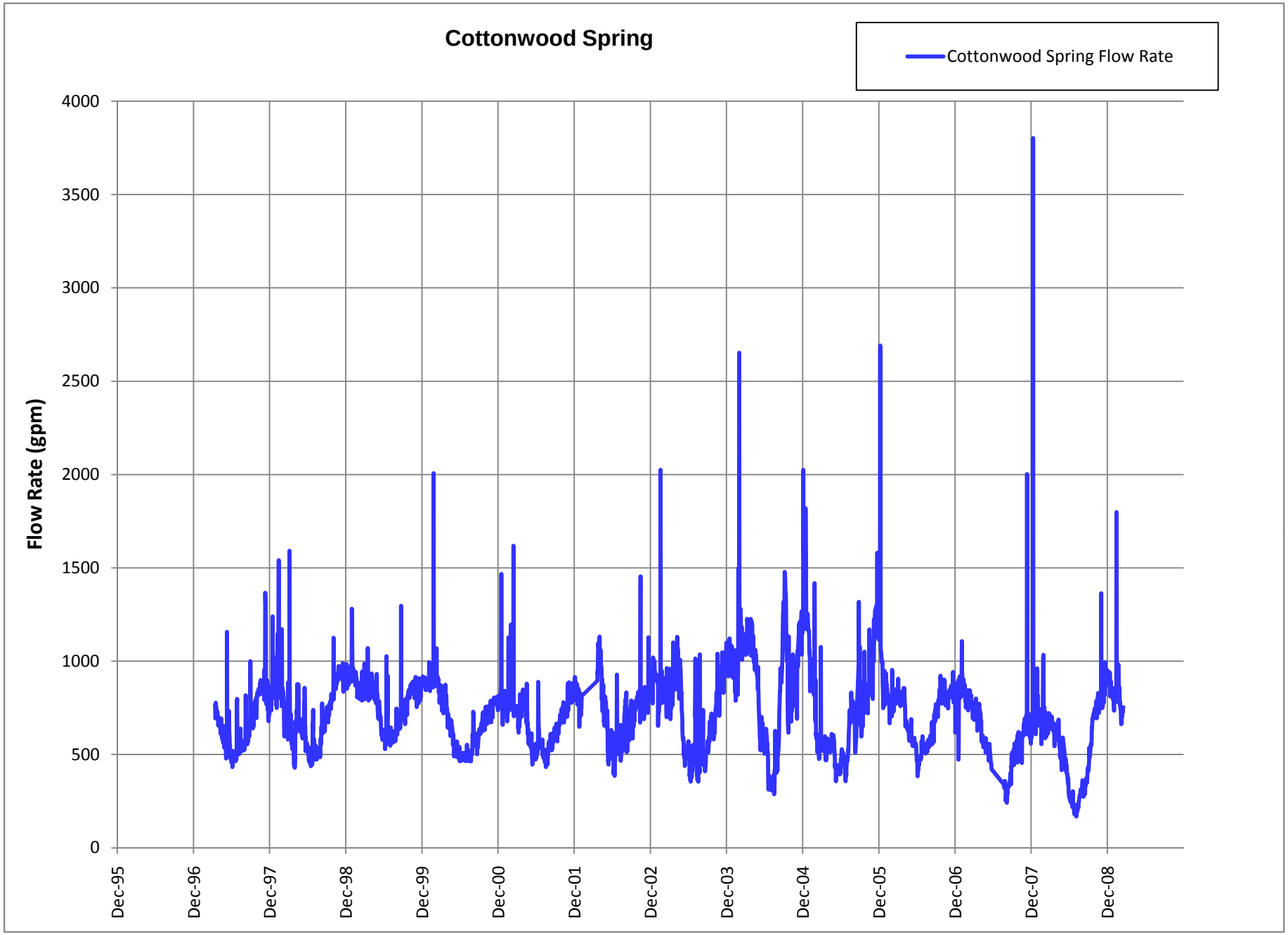

Sulfate
Sulfate 4-foot Piezometer
Sulfate 10-foot Piezometer
Depth to Water (feet)
-1
0
1
2
3
4
5
6
7
8
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08


Carbide Dump at Site 08
Carbid Dump 4-foot Piezometer
Carbid Dump 10-foot Piezometer
Carbid Dump Flow Rate
Depth to Water (feet)
Flow Rate (GPM)
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
16
14
12
10
8
6
4
2
0
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

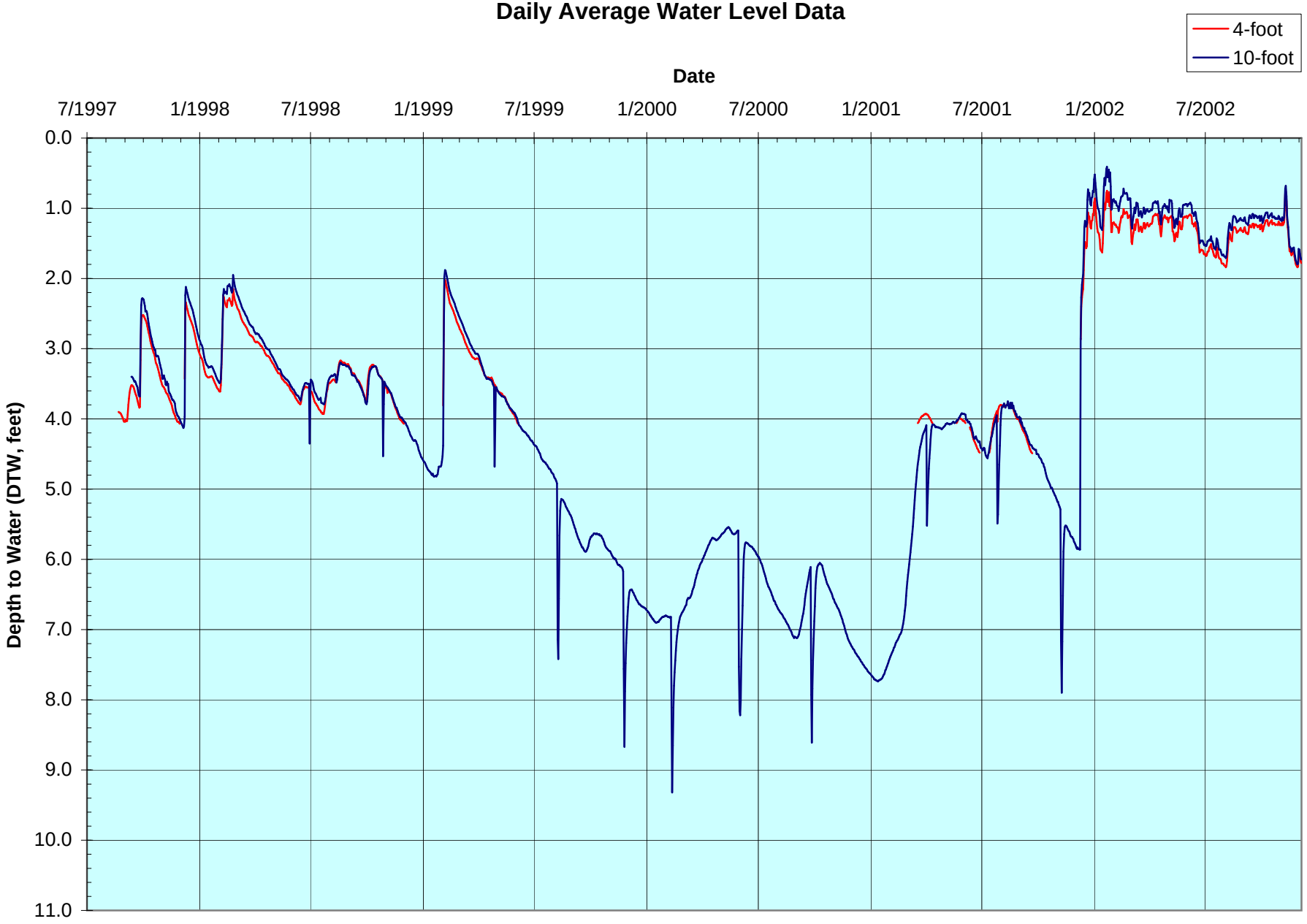

09 Mill Site
09 Mill Site 4-foot Piezometer
09 Mill Site 10-foot Piezometer
Depth to Water (feet)
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09


Whisky Spring at Site 17 and 17.5
Whisky Spring 4 Feet Piezometer
Whisky Spring 10 Feet Piezometer
Whisky Spring Flow Rate
Depth to Water (feet)
Flow Rate (GPM)
-2
-1
0
1
2
3
4
5
25
20
15
10
5
0
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08


F15 Tubman Channel
Tubman Channel Flow Rate
Flow Rate (gpm)
140
120
100
80
60
40
20
0
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08


Cottonwood Spring
Cottonwood Spring Flow Rate
Flow Rate (gpm)
4000
3500
3000
2500
2000
1500
1000
500
0
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08

Appendix G-4
Monitoring Site 3015, Keeler(3)
Daily Average Water Level Data



APPENDIX H

Geotechnical Laboratory Reports for Soil Samples

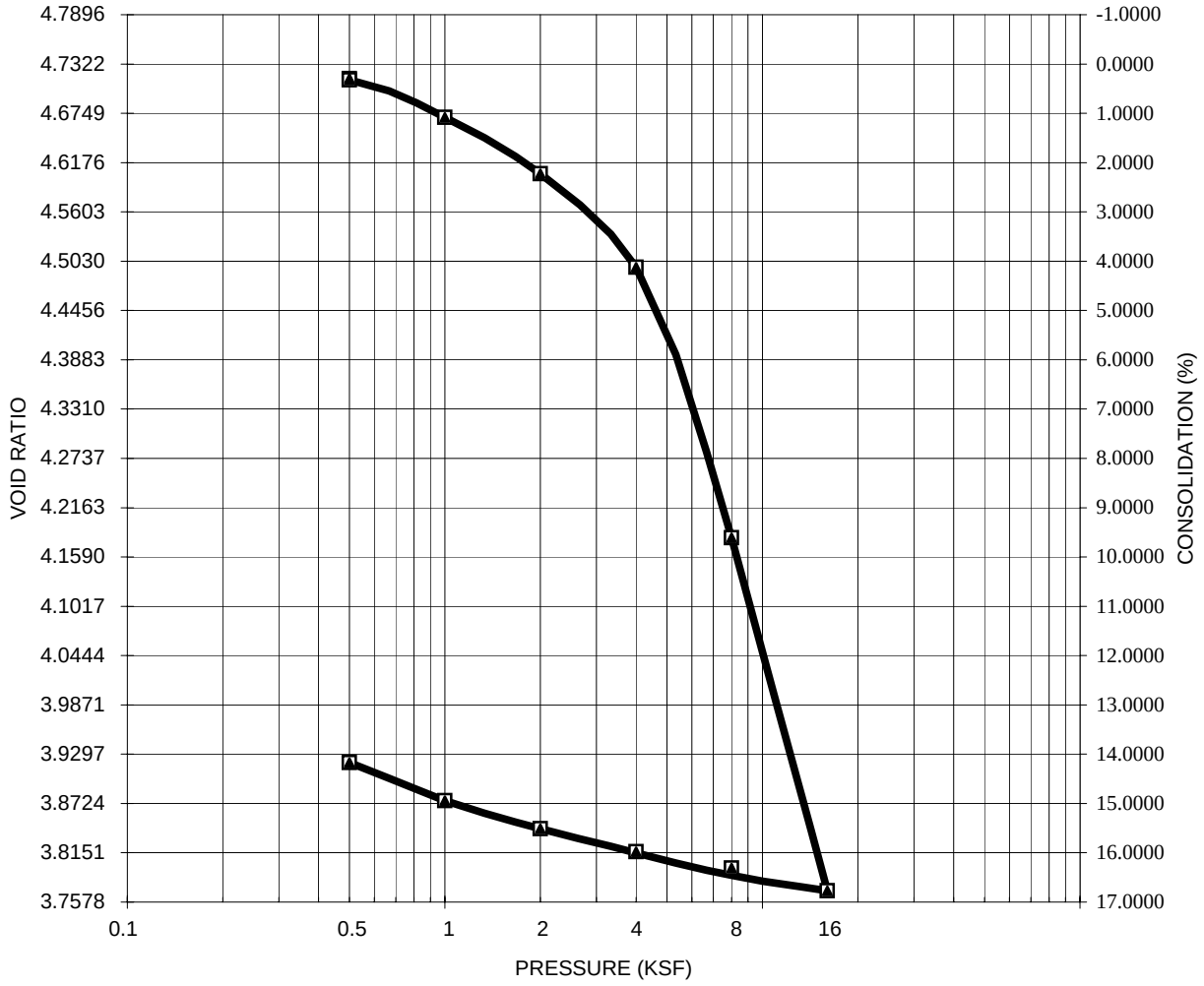
LOS ANGELES DEPARTMENT OF WATER AND POWER
WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

ASTM D 2435-04 - ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS.

JOB:	OWENS LAKE GROUNDWATER EVALUATION
SAMPLE:	T898 @126'
DATE:	7/12/2010
TEST BY:	JML
DESCRIPTION:	N/A
SPECIFIC GRAVITY:	2.46
NOTE:	UNDISTURBED SAMPLE

SAMPLE PROPERTIES:

	PLACING	REMOVAL
WATER CONTENT (%)	188.5	135.3
DRY UNIT WEIGHT (PCF)	26.8	31.2
SATURATION (%)	98.0	84.9
VOID RATIO	4.7322	3.9199



LOS ANGELES DEPARTMENT OF WATER AND POWER
WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

HYDRAULIC CONDUCTIVITY USING A FLEXIBLE WALL PERMEATER
ASTM D5084, METHOD A - CONSTANT HEAD TEST

JOB	OWENS LAKE GROUNDWATER EVALUATION
LOCATION:	T898
CLASSIFICATION	N/A
DATE:	7/8/2010
PERMEANT:	DISTILLED WATER
SG:	2.46
TEMP:	24.2 ºC
DIAMETER:	2.403 in.
HEIGHT	3.392 in.
DRY UNIT WEIGHT:	29.9 pcf
CONFINING PRESSURE:	104.167 psi
HYDRAULIC GRADIENT:	8
CONDUCTIVITY DIRECTION TESTED:	VERTICAL
SAMPLE PREPARATION:	UNDISTURBED

HYDRAULIC CONDUCTIVITY, k:	7.88E-08	cm/s	2.59E-09	ft/s
HYDRAULIC CONDUCTIVITY, $k_{20^{o}C}$:	7.14E-08	cm/s	2.34E-09	ft/s

LOS ANGELES DEPARTMENT OF WATER AND POWER
WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

OWENS LAKE GROUNDWATER EVALUATION PROJECT
SOIL CLASSIFICATION (ASTM D2487-06)

Sample Type[1]	Location	Depth (ft.)	Classification of Soils for Engineering Purposes (Unified Soil Classification System)													
			Maximum Particle Size (US Sieve)[2]	Sieve Analysis-Percent Passing (%) (US Standard Sieve Size)								Coefficients[3]		Atterberg Limits		Soil Classification
				1 1/2 in.	3/4 in.	3/8 in.	No. 4	No. 10	No. 40	No. 100	No. 200	Uniformity (Cu)	Curvature (Cc)	Liquid Limit (LL)	Plasticity Index (PI)	
CA	T909	350	No. 40	100.0	100.0	100.0	100.0	100.0	99.5	94.1	84.4	ND	ND	60	32	CH, FAT CLAY W/SAND

NOTES:

1. S = SHELBY TUBE, SPT = STANDARD PENETRATION TEST, BB = BULK BAG, CA = CALIFORNIA MODIFIED 2.416" I.D.
2. MAXIMUM NOMINAL PARTICLE SIZE RETAINED ON THE INDICATED US STANDARD SIEVE .
3. ND = NOT DETERMINED. COEFFICIENTS DO NOT HAVE TO BE DETERMINED WHEN MORE THAN 12% OF THE TEST SPECIMEN PASSES THE NO. 200 SIEVE.

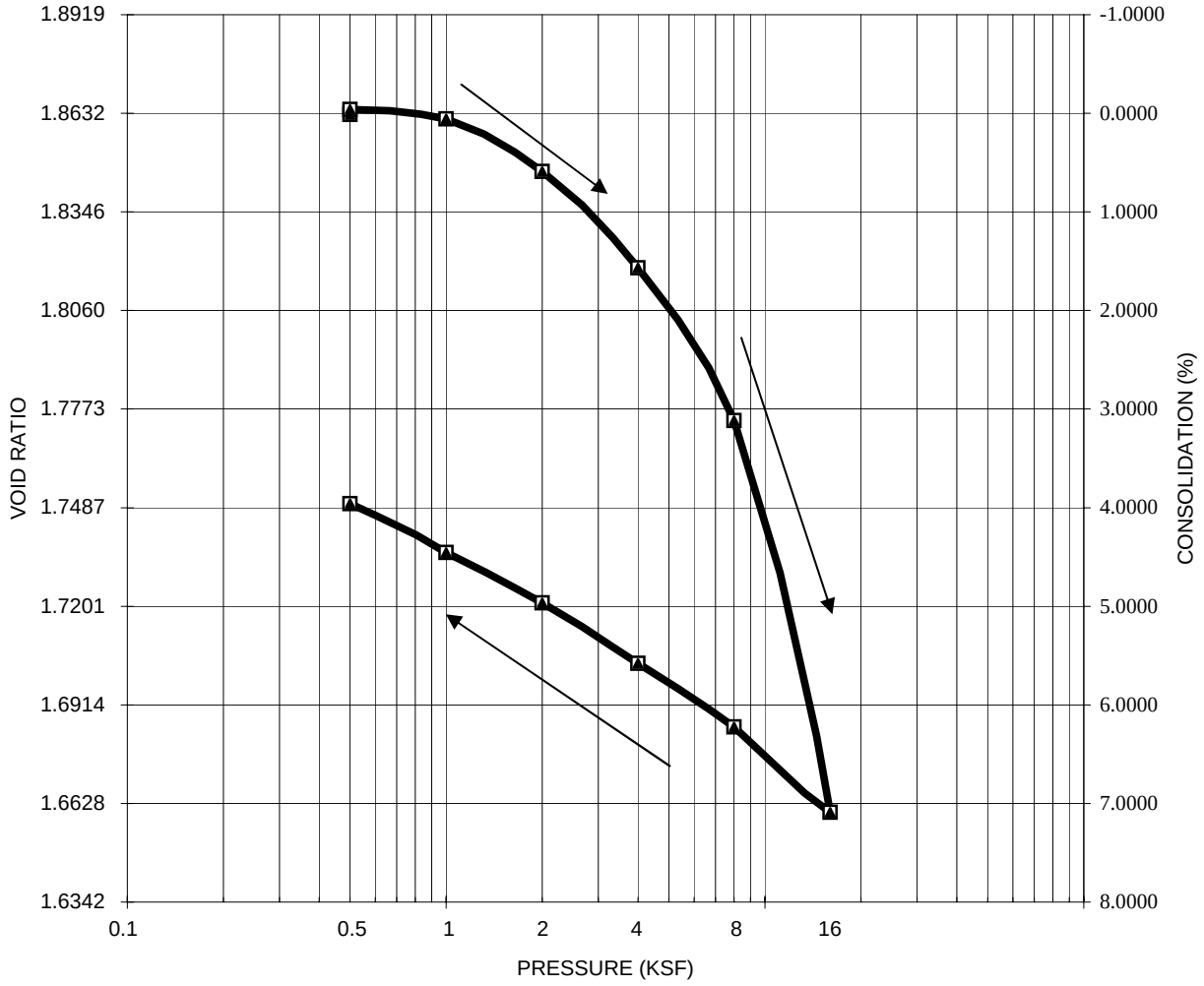
LOS ANGELES DEPARTMENT OF WATER AND POWER
WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

ASTM D 2435-04 - ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS.

JOB:	OWENS LAKE GROUNDWATER EVALUATION
SAMPLE:	T909 @ 350'
DATE:	2/16/2011
TEST BY:	JML
DESCRIPTION:	CH, FAT CLAY W/ SAND
SPECIFIC GRAVITY:	2.69
NOTE:	UNDISTURBED SAMPLE

SAMPLE PROPERTIES:

	PLACING	REMOVAL
WATER CONTENT (%)	67.2	64.6
DRY UNIT WEIGHT (PCF)	58.7	61.1
SATURATION (%)	97.0	99.3
VOID RATIO	1.8632	1.7498



LOS ANGELES DEPARTMENT OF WATER AND POWER
WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

HYDRAULIC CONDUCTIVITY USING A FLEXIBLE WALL PERMEATER
ASTM D5084, METHOD A - CONSTANT HEAD TEST

JOB	OWENS LAKE GROUNDWATER EVALUATION PROJECT
LOCATION:	T909 @ 350'
CLASSIFICATION	CH, FAT CLAY W/ SAND
DATE:	2/23/2011
PERMEANT:	DISTILLED WATER
SG:	2.69
TEMP:	24 ºC
DIAMETER:	2.432 in.
HEIGHT	4.472 in.
DRY UNIT WEIGHT:	51.9 pcf
CONFINING PRESSURE:	69.444 psi (10 ksf)
HYDRAULIC GRADIENT:	15
CONDUCTIVITY DIRECTION TESTED:	VERTICAL
SAMPLE PREPARATION:	UNDISTURBED

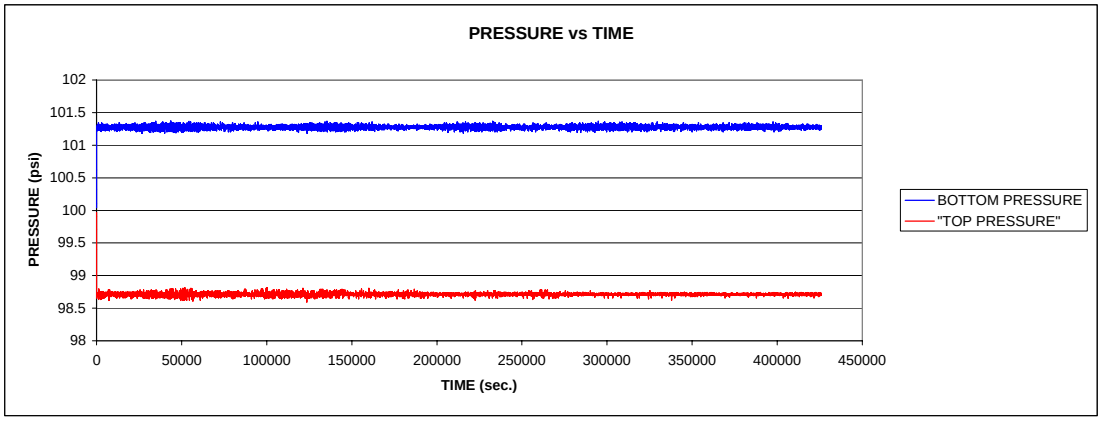
HYDRAULIC CONDUCTIVITY, k:	N/A	cm/s	N/A	ft/s
HYDRAULIC CONDUCTIVITY, $k_{20^{o}C}$:	N/A	cm/s	N/A	ft/s

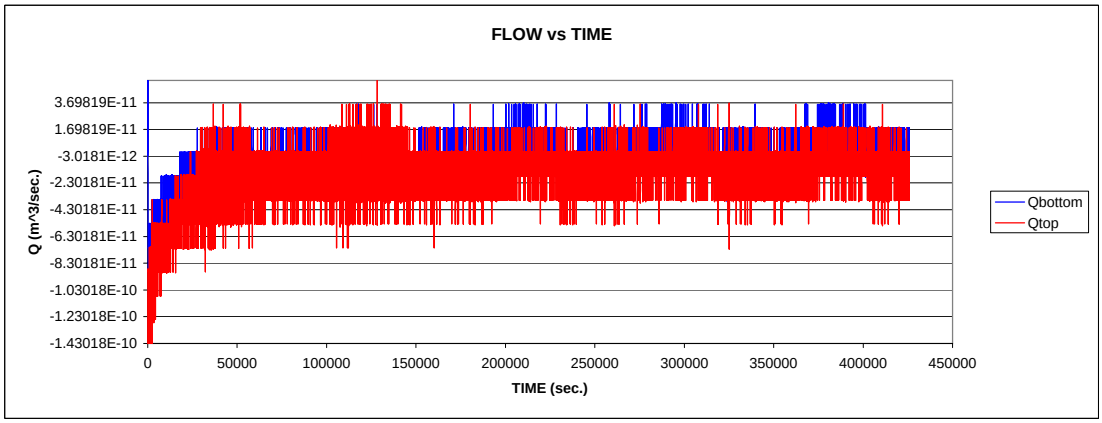
NOTE: N/A = NOT AVAILABLE

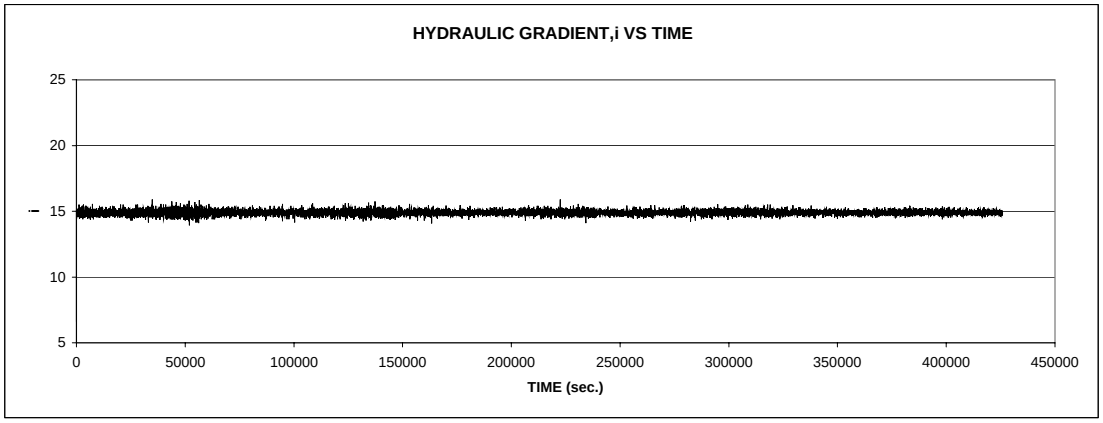
LOS ANGELES DEPARTMENT OF WATER AND POWER
WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

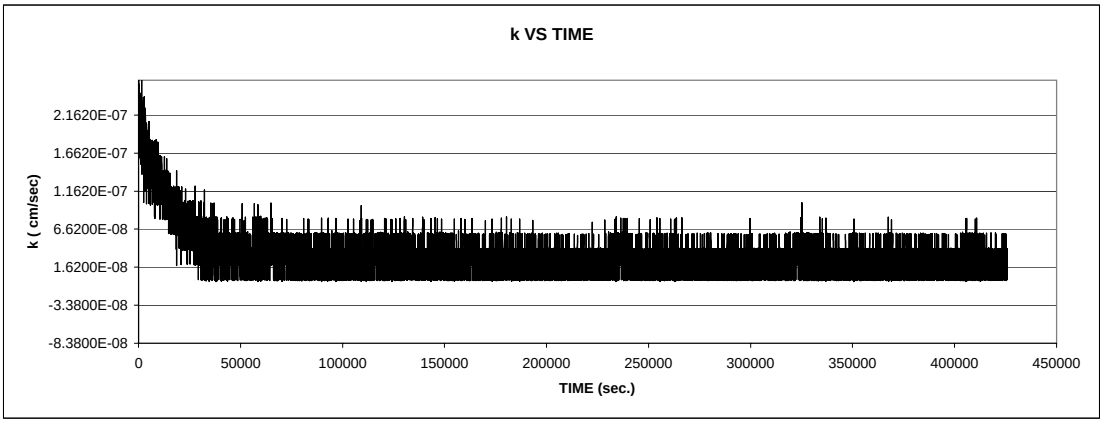
HYDRAULIC CONDUCTIVITY USING A FLEXIBLE WALL PERMEATER
ASTM D5084, METHOD A - CONSTANT HEAD TEST

JOB OWENS LAKE GROUNDWATER EVALUATION PROJECT
LOCATION: T909 @ 350'
CLASSIFICATION CH, FAT CLAY W/ SAND









LOS ANGELES DEPARTMENT OF WATER AND POWER
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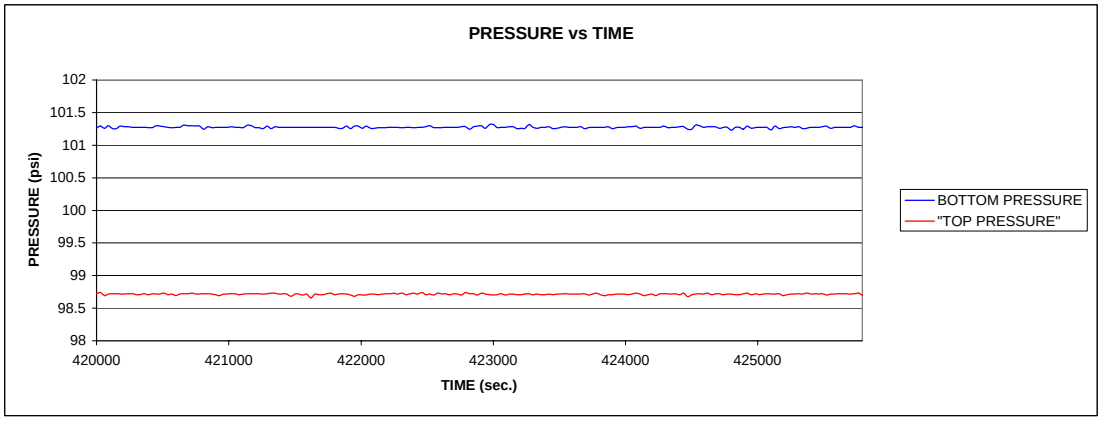
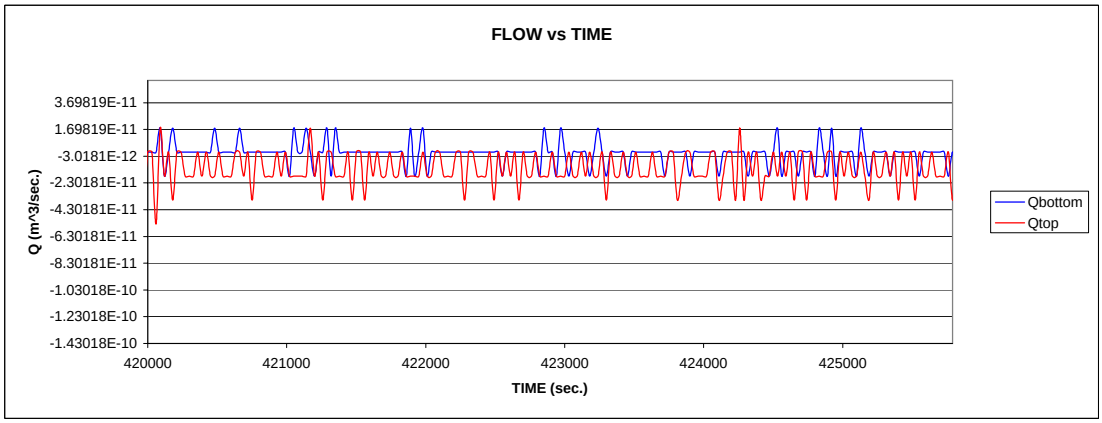
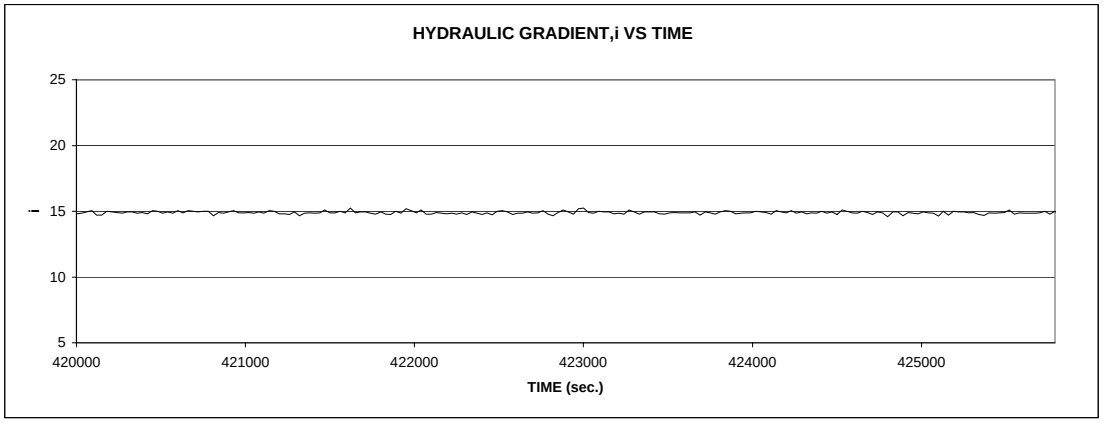
SOILS AND MATERIALS TESTING SQUAD

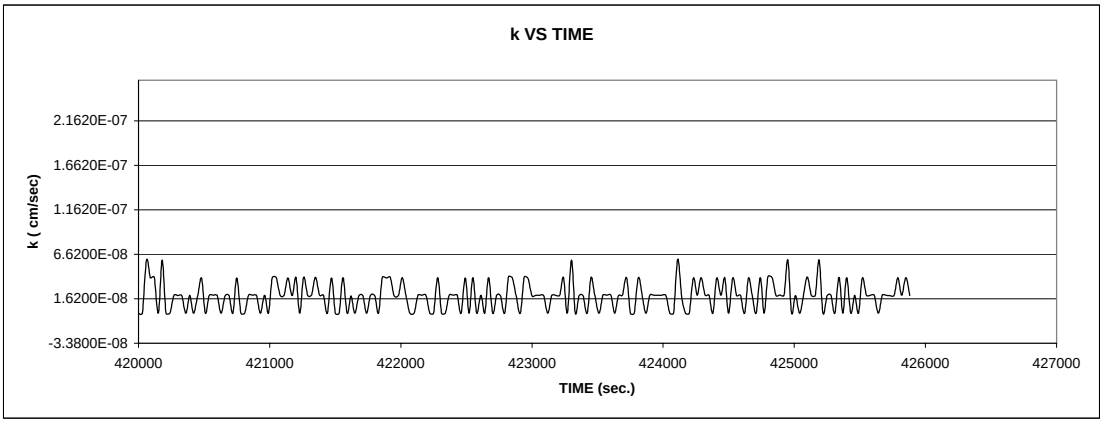
HYDRAULIC CONDUCTIVITY USING A FLEXIBLE WALL PERMEATER
ASTM D5084, METHOD A - CONSTANT HEAD TEST

JOB OWENS LAKE GROUNDWATER EVALUATION PROJECT
LOCATION: T909 @ 350'
CLASSIFICATION CH, FAT CLAY W/ SAND









LOS ANGELES DEPARTMENT OF WATER AND POWER
WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

OWENS LAKE GROUNDWATER EVALUATION PROJECT
SOIL CLASSIFICATION (ASTM D2487-06)

Sample Type[1]	Location	Depth (ft.)	Classification of Soils for Engineering Purposes (Unified Soil Classification System)												
			Maximum Particle Size (US Sieve)[2]	Sieve Analysis-Percent Passing (%) (US Standard Sieve Size)								Coefficients[3]		Atterberg Limits		Soil Classification
				1 1/2 in.	3/4 in.	3/8 in.	No. 4	No. 10	No. 40	No. 100	No. 200	Uniformity (Cu)	Curvature (Cc)	Liquid Limit (LL)	Plasticity Index (PI)	
CA	T912		No. 40	100.0	100.0	100.0	100.0	100.0	99.9	99.5	99.0	ND	ND	52	25	CH, FAT CLAY

NOTES:

1. CA = CALIFORNIA MODIFIED 2.416" I.D.
2. MAXIMUM NOMINAL PARTICLE SIZE RETAINED ON THE INDICATED US STANDARD SIEVE .
3. ND = NOT DETERMINED. COEFFICIENTS DO NOT HAVE TO BE DETERMINED WHEN MORE THAN 12% OF THE TEST SPECIMEN PASSES THE NO. 200 SIEVE.

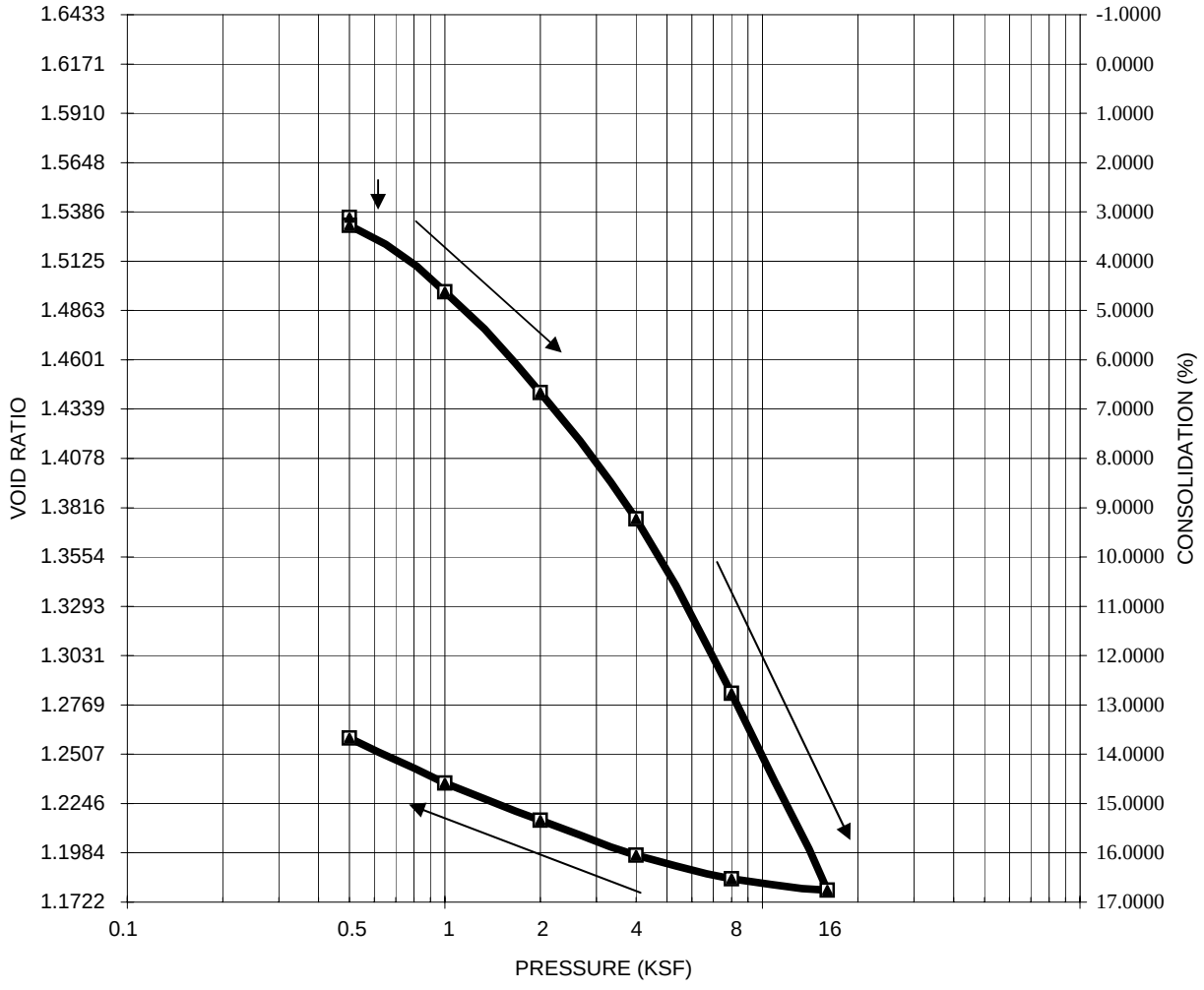
LOS ANGELES DEPARTMENT OF WATER AND POWER
WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

ASTM D 2435-04 - ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS.

JOB:	OWENS LAKE GROUNDWATER EVALUATION
SAMPLE:	T912
DATE:	3/29/2011
TEST BY:	JML
DESCRIPTION:	CH, FAT CLAY
SPECIFIC GRAVITY:	2.78
NOTE:	UNDISTURBED SAMPLE

SAMPLE PROPERTIES:

	PLACING	REMOVAL
WATER CONTENT (%)	58.0	45.3
DRY UNIT WEIGHT (PCF)	66.3	76.8
SATURATION (%)	99.8	100.0
VOID RATIO	1.6171	1.2594



LOS ANGELES DEPARTMENT OF WATER AND POWER
WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

HYDRAULIC CONDUCTIVITY USING A FLEXIBLE WALL PERMEATER
ASTM D5084, METHOD A - CONSTANT HEAD TEST

JOB	OWENS LAKE GROUNDWATER EVALUATION PROJECT
LOCATION:	T912
CLASSIFICATION	CH, FAT CLAY
DATE:	3/29/2011
PERMEANT:	DISTILLED WATER
SG:	2.78
TEMP:	27 ºC
DIAMETER:	2.405 in.
HEIGHT	3.959 in.
DRY UNIT WEIGHT:	64.4 pcf
CONFINING PRESSURE:	83.333 psi (12 ksf)
HYDRAULIC GRADIENT:	15
CONDUCTIVITY DIRECTION TESTED:	VERTICAL
SAMPLE PREPARATION:	UNDISTURBED

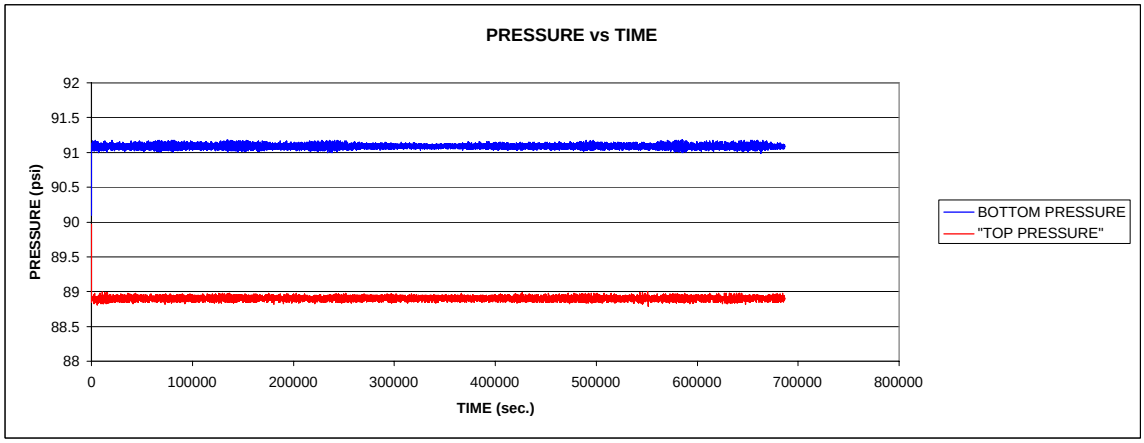
HYDRAULIC CONDUCTIVITY, k:	N/A	cm/s	N/A	ft/s
HYDRAULIC CONDUCTIVITY, $k_{20^{o}C}$:	N/A	cm/s	N/A	ft/s

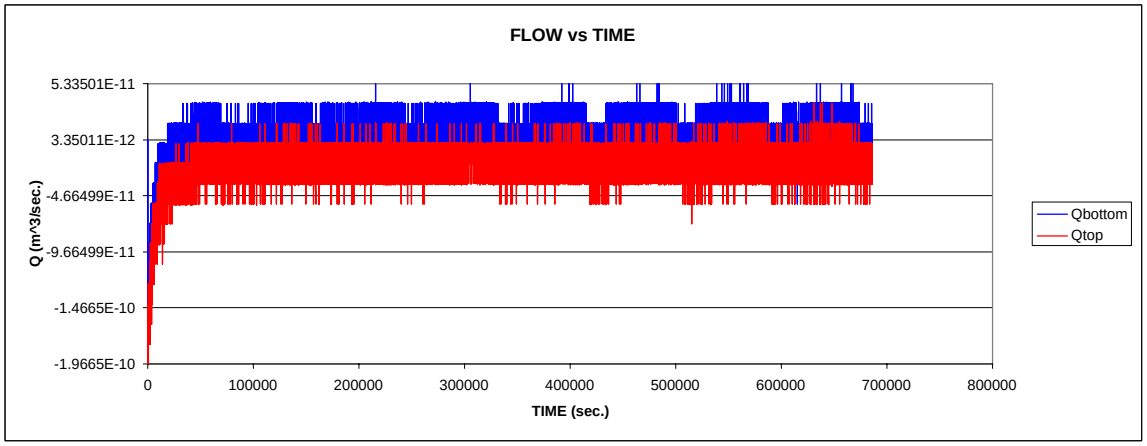
NOTE: N/A = NOT AVAILABLE

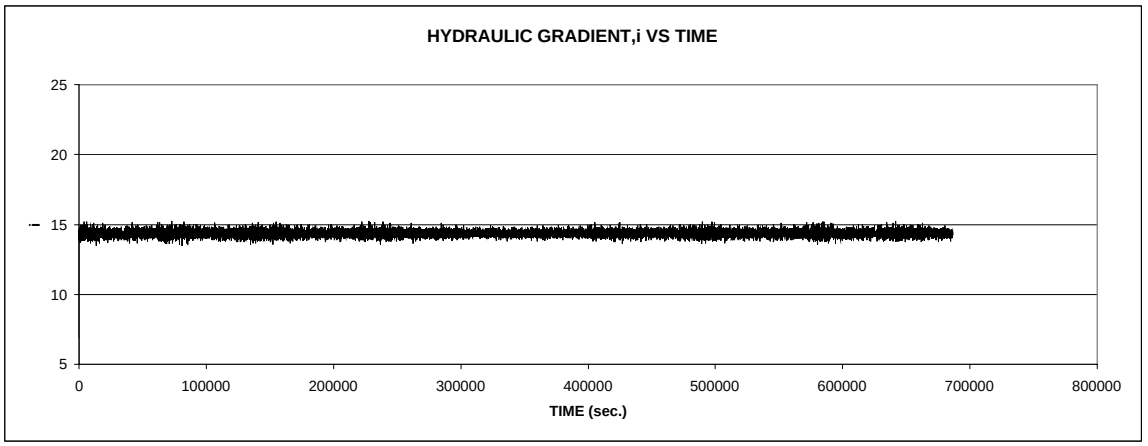
LOS ANGELES DEPARTMENT OF WATER AND POWER
WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

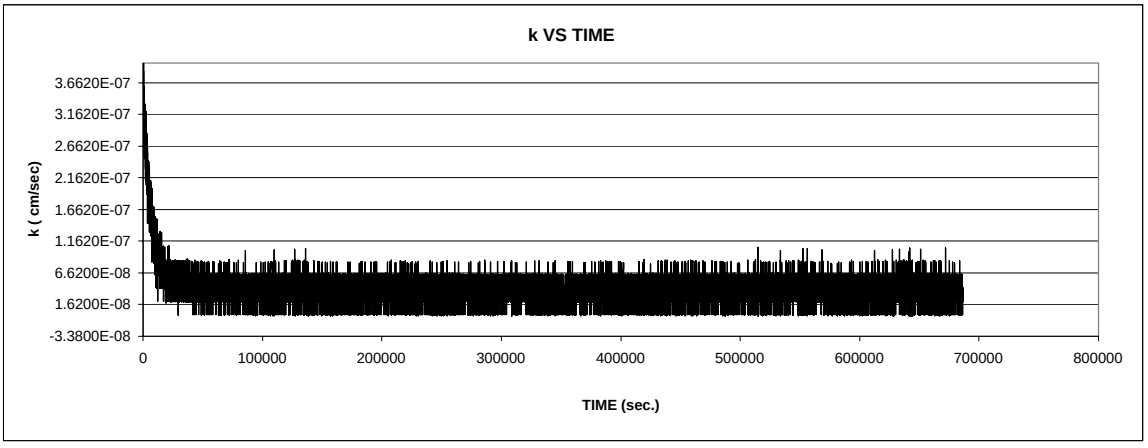
HYDRAULIC CONDUCTIVITY USING A FLEXIBLE WALL PERMEATER
ASTM D5084, METHOD A - CONSTANT HEAD TEST

JOB OWENS LAKE GROUNDWATER EVALUATION PROJECT
LOCATION: T912
CLASSIFICATION CH, FAT CLAY





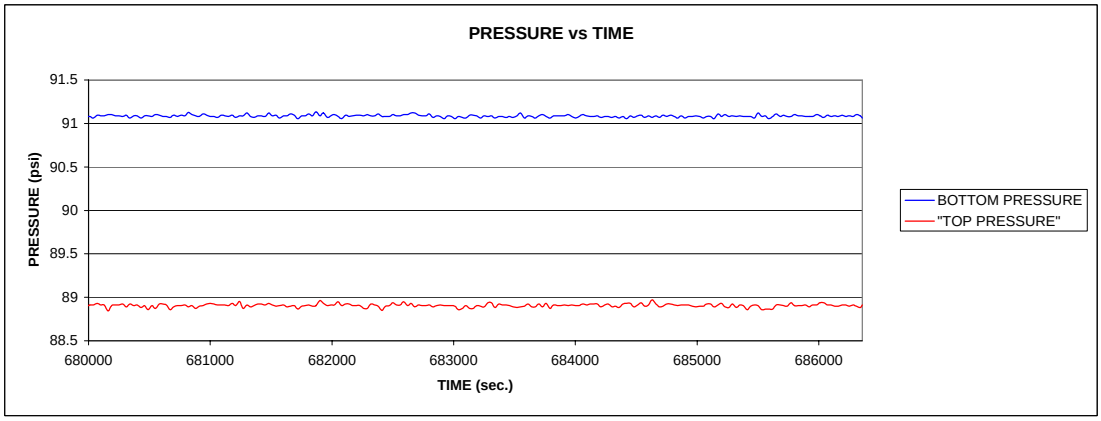


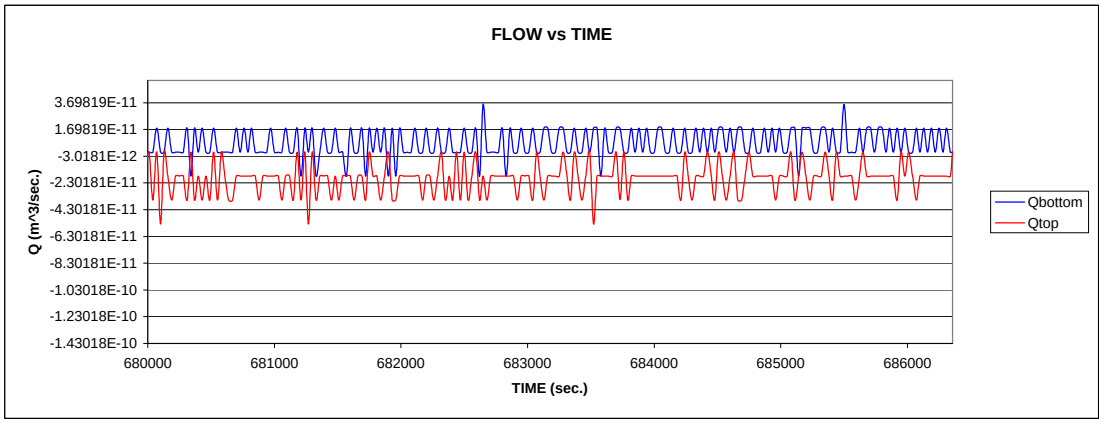


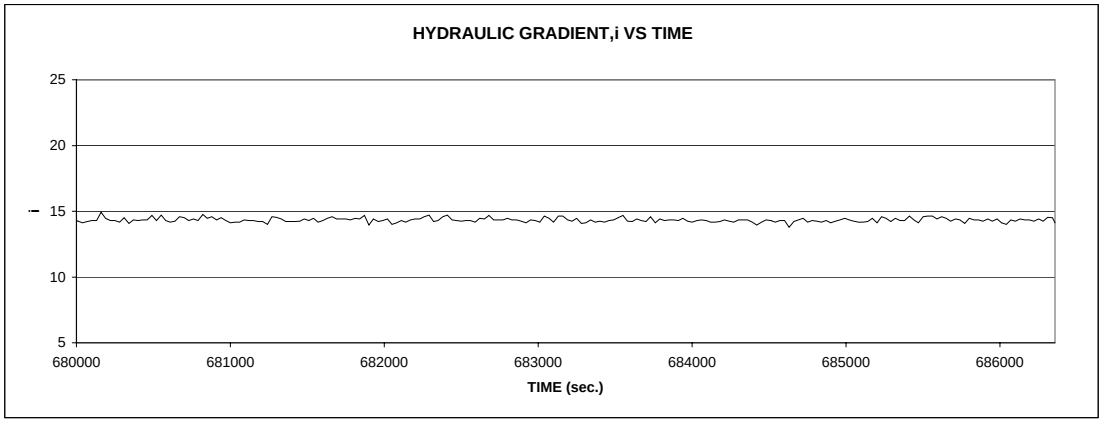
LOS ANGELES DEPARTMENT OF WATER AND POWER
WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

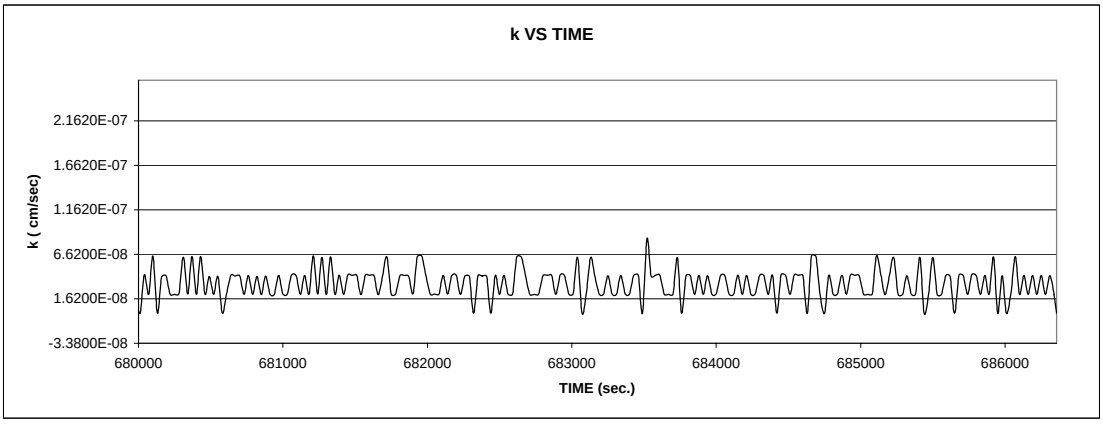
HYDRAULIC CONDUCTIVITY USING A FLEXIBLE WALL PERMEATER
ASTM D5084, METHOD A - CONSTANT HEAD TEST

JOB OWENS LAKE GROUNDWATER EVALUATION PROJECT
LOCATION: T912
CLASSIFICATION CH, FAT CLAY









LOS ANGELES DEPARTMENT OF WATER AND POWER
WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

OWENS LAKE GROUNDWATER EVALUATION
SOIL CLASSIFICATION (ASTM D2487-06)

Sample Type[1]	Location	Depth (ft.)	Classification of Soils for Engineering Purposes (Unified Soil Classification System)													
			Maximum Particle Size (US Sieve)[2]	Sieve Analysis-Percent Passing (%) (US Standard Sieve Size)								Coefficients[3]		Atterberg Limits		Soil Classification
				1 1/2 in.	3/4 in.	3/8 in.	No. 4	No. 10	No. 40	No. 100	No. 200	Uniformity (Cu)	Curvature (Cc)	Liquid Limit (LL)	Plasticity Index (PI)	
CA	T914		No. 10	100.0	100.0	100.0	100.0	99.9	99.1	98.7	98.2	ND	ND	59	29	CH, FAT CLAY

NOTES:

1. CA = CALIFORNIA MODIFIED2.416 IN. DIA.
2. MAXIMUM NOMINAL PARTICLE SIZE RETAINED ON THE INDICATED US STANDARD SIEVE .
3. ND = NOT DETERMINED. COEFFICIENTS DO NOT HAVE TO BE DETERMINED WHEN MORE THAN 12% OF THE TEST SPECIMEN PASSES THE NO. 200 SIEVE.

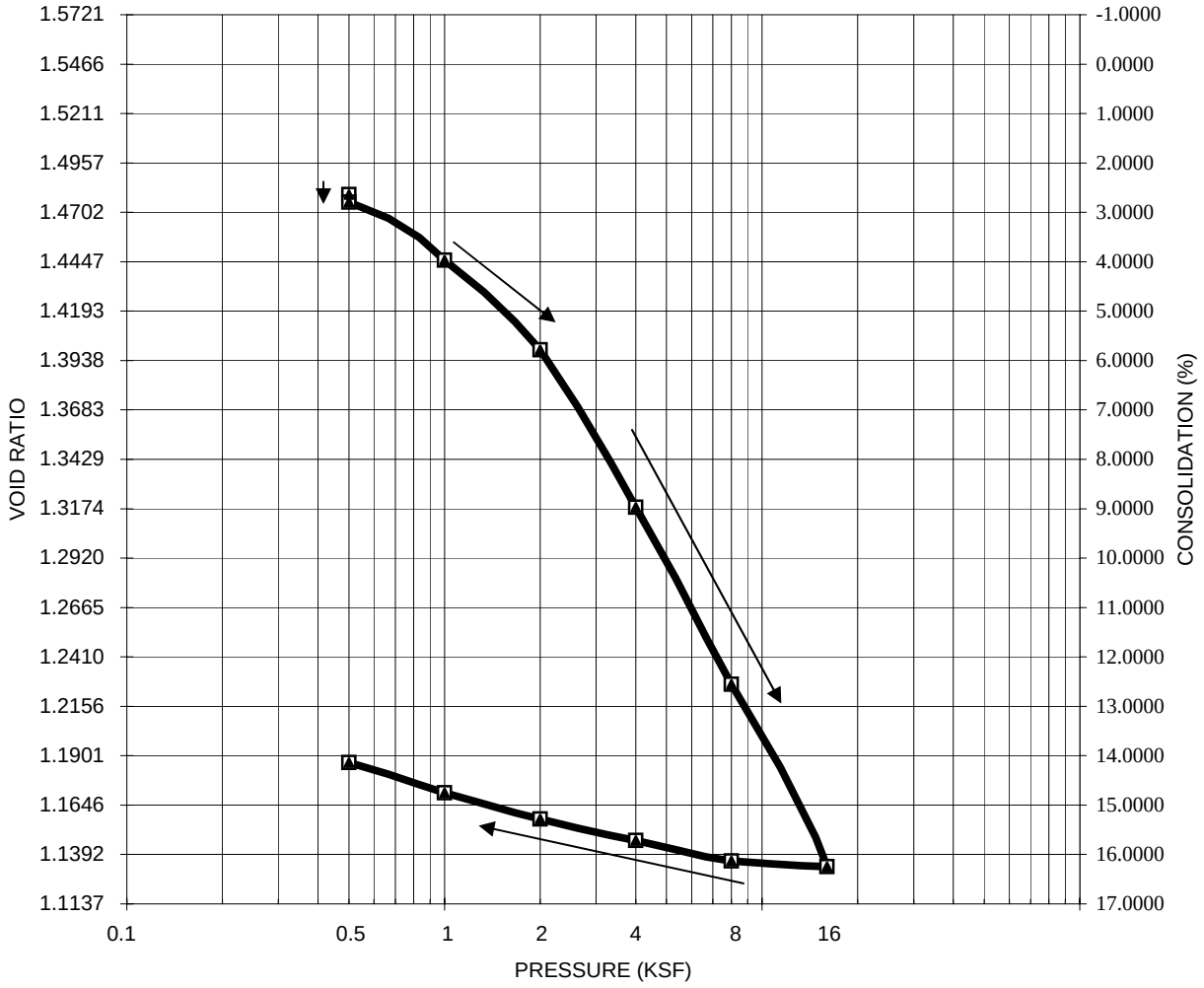
LOS ANGELES DEPARTMENT OF WATER AND POWER
WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

ASTM D 2435-04 - ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS.

JOB:	OWENS LAKE GROUNDWATER EVALUATION
SAMPLE:	T914
DATE:	6/27/2011
TEST BY:	JML
DESCRIPTION:	CH, FAT CLAY
SPECIFIC GRAVITY:	2.78
NOTE:	UNDISTURBED SAMPLE

SAMPLE PROPERTIES:

	PLACING	REMOVAL
WATER CONTENT (%)	54.7	42.7
DRY UNIT WEIGHT (PCF)	68.2	79.4
SATURATION (%)	98.3	100.1
VOID RATIO	1.5466	1.1865



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WATER ENGINEERING AND TECHNICAL SERVICES DIVISION
SOILS AND MATERIALS TESTING SQUAD

HYDRAULIC CONDUCTIVITY USING A FLEXIBLE WALL PERMEATER
ASTM D5084, METHOD A - CONSTANT HEAD TEST

JOB	OWENS LAKE GROUNDWATER EVALUATION PROJECT
LOCATION:	T914
CLASSIFICATION	CH, FAT CLAY W/ SAND
DATE:	5/20/2011
PERMEANT:	DISTILLED WATER
SG:	2.78
TEMP:	23 ºC
DIAMETER:	2.43 in.
HEIGHT	3.601 in.
DRY UNIT WEIGHT:	63.3 pcf
CONFINING PRESSURE:	69.444 psi (10 ksf)
HYDRAULIC GRADIENT:	15
CONDUCTIVITY DIRECTION TESTED:	VERTICAL
SAMPLE PREPARATION:	UNDISTURBED

HYDRAULIC CONDUCTIVITY, k:	N/A	cm/s	N/A	ft/s
HYDRAULIC CONDUCTIVITY, $k_{20^{o}C}$:	N/A	cm/s	N/A	ft/s

NOTE: N/A = NOT AVAILABLE

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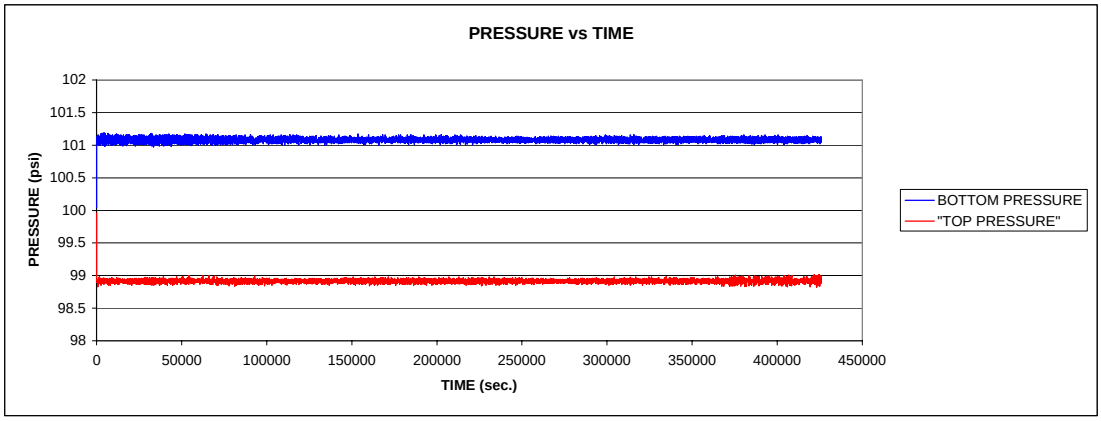
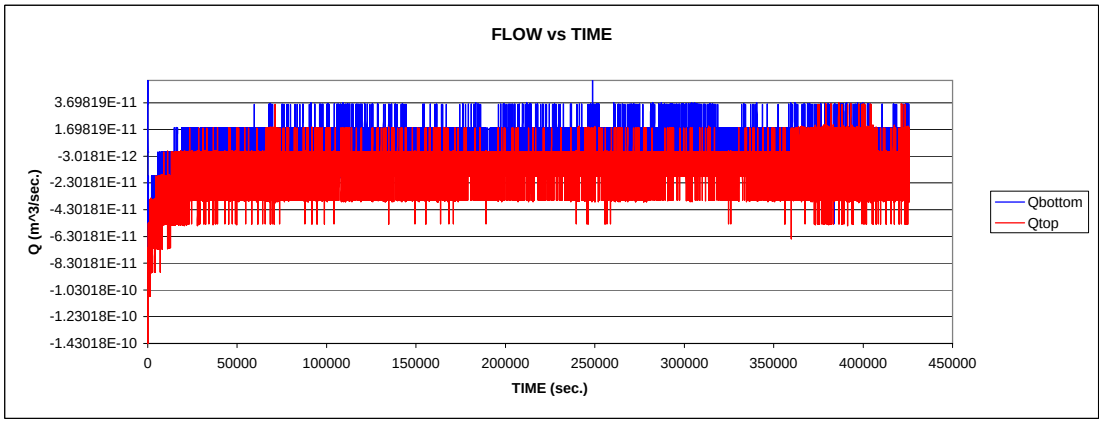
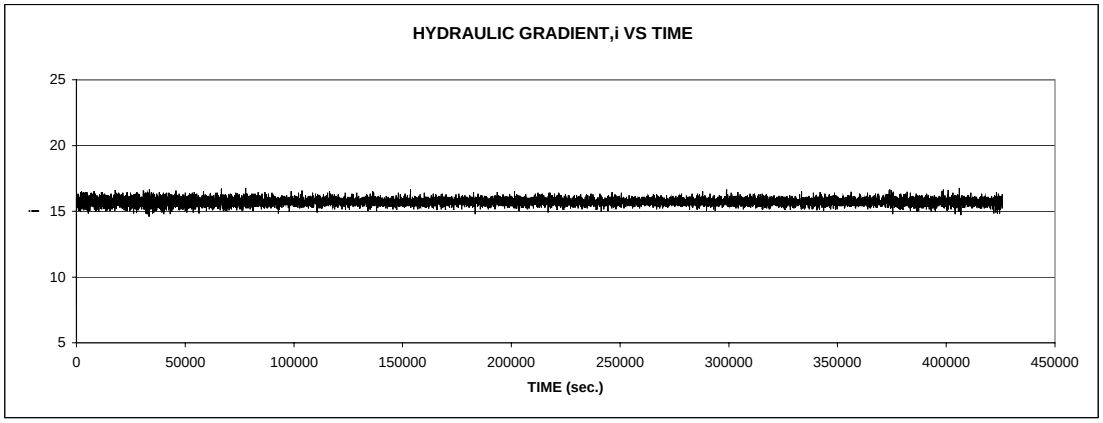
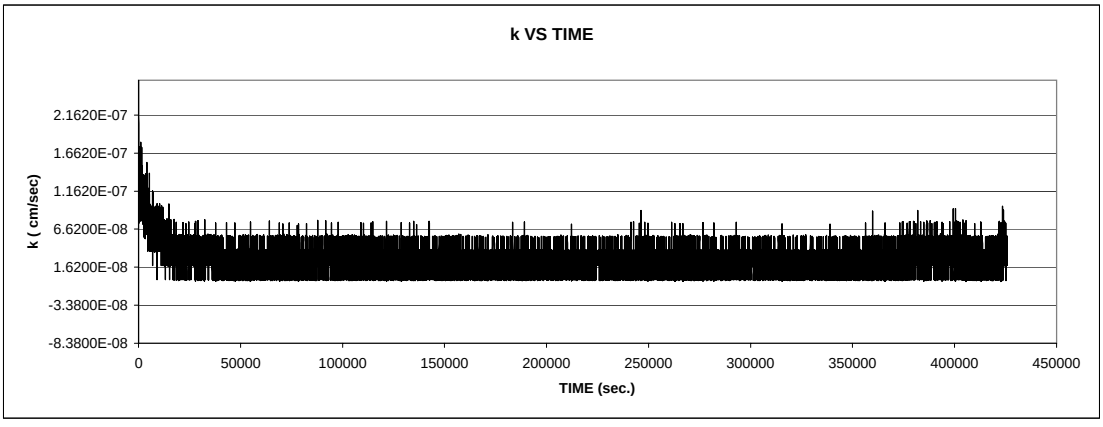
HYDRAULIC CONDUCTIVITY USING A FLEXIBLE WALL PERMEATER
ASTM D5084, METHOD A - CONSTANT HEAD TEST

JOB OWENS LAKE GROUNDWATER EVALUATION PROJECT
LOCATION: T914
CLASSIFICATION CH, FAT CLAY W/ SAND









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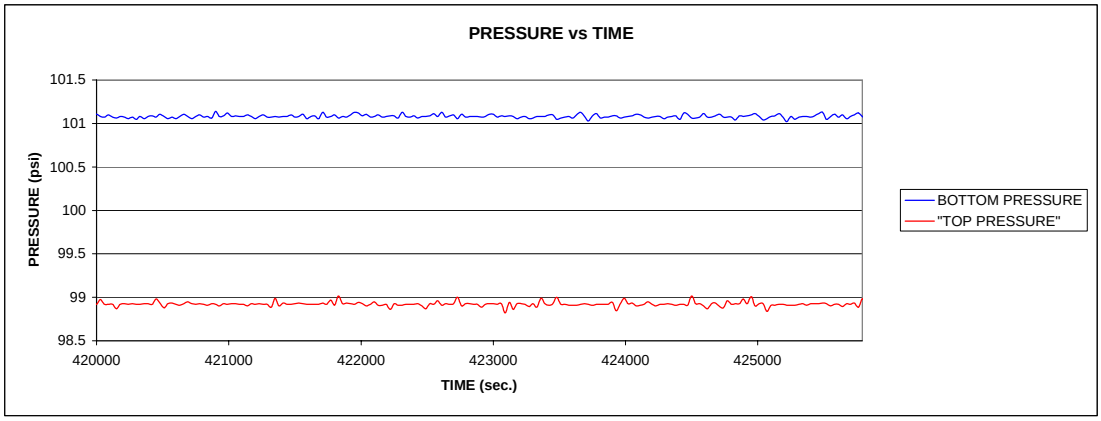
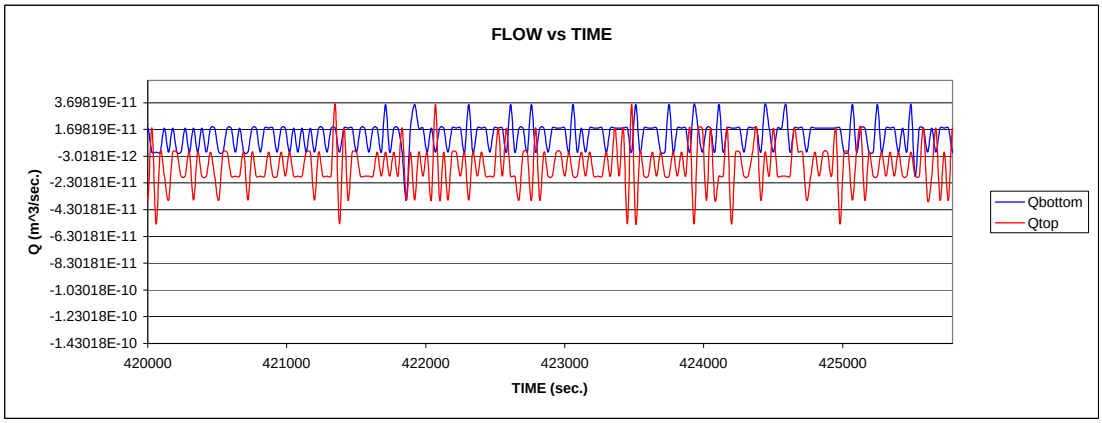
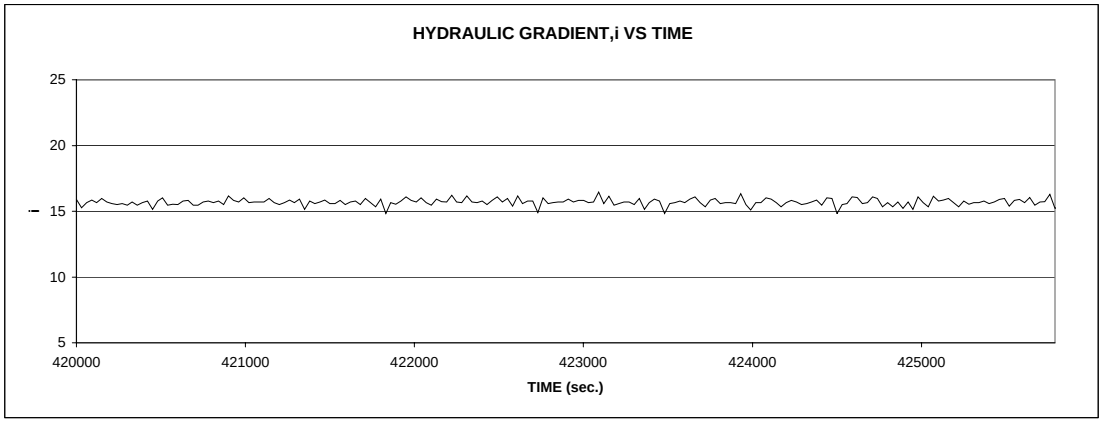
SOILS AND MATERIALS TESTING SQUAD

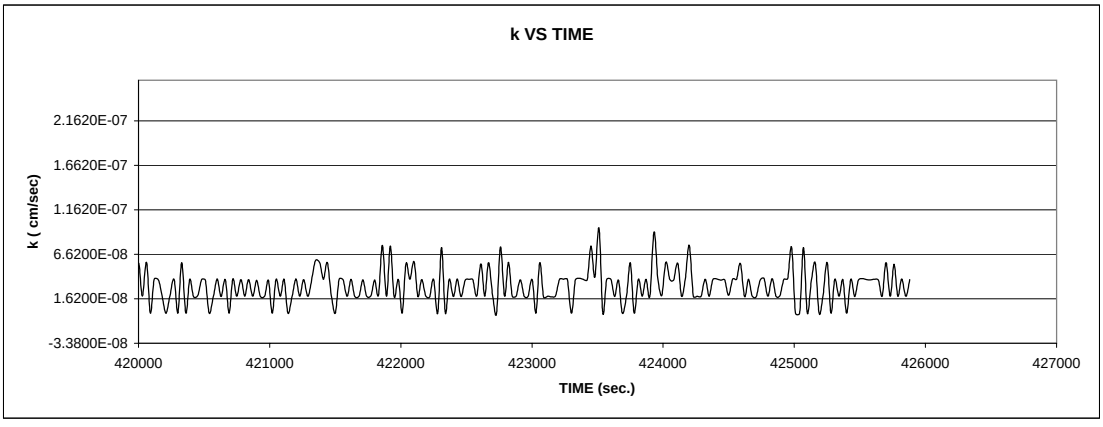
HYDRAULIC CONDUCTIVITY USING A FLEXIBLE WALL PERMEATER
ASTM D5084, METHOD A - CONSTANT HEAD TEST

JOB OWENS LAKE GROUNDWATER EVALUATION PROJECT
LOCATION: T914
CLASSIFICATION CH, FAT CLAY W/ SAND









APPENDIX I

Master Spring Table for OLGEP Area Springs

Name	Alternate Name	Alternate Name used by GBUAPCD	Location					Fault Correlation (Y/N/I)	Surface Expression	Flow Info											Water Quality																		
												Range									Temperature (°C)				EC (mS/cm)				pH				O_2					H_2S (mg/l)		
			UTM - X	UTM - Y	Elevation (fmsl)	City Land (Y/N)	East or West Side Spring (E/W)			Flow Info Availability (Y/N)	Period of Record	Average POR[1] (gpm)	Avg. High[2] (gpm)	Avg. Low[3] (gpm)	Min (gpm)	Max (gpm)	Flow Type[4]	Seasonality[5] (Y/N)	Runoff Correlation[12] (Y/N)	Precip. Correlation[6] (Y/N/I)	Avg.	Min	Max	Temp. Variability[7]	Avg.	Min	Max	Estimated TDS[8] (ppm)	Avg.	Min	Max	pH Variability[9]	Avg. (ppm)	Min (ppm)	Max (ppm)	O_2 Concentration[10]	O_2 Concentration Variance[11]	Avg.	Min	Max
Lizard Tail Spring	---	1	416,042.69	4,044,143.88	3,598		E	Y	Point	Y	1997-2011	1.2	2.05	0.88	0	2.8	I	N	N	N	19.9	16.0	22.0	C	1.2	0.64	1.4	804.00	7.5	6.61	7.94	V	3.83	1.66	5.21	High	V	0	0	0
Dead Hawk Spring	---	2	418,735.75	4,040,159.47	3,599	Y	E	Y	Point	Y	1997-2011	6.3	7.96	5.08	4	7.2	P	N	N	N	18.7	18.0	20.0	C	2.72	1.92	3.39	1,822.40	8.8	8.35	9.25	C	2.72	1.92	3.39	Low	C	5.62	3.95	8.26
Bonsai Mound	---	6	421,006.47	4,037,932.28	3,580	Y	E	Y	Point	N	1997-2011						P				18.1	14.0	24.1	V	3.1	2.29	3.73	2,077.00	8.29	7.89	8.95	V	1.84	0.17	7.6	Med	V	0.2	0	0.5
Carbide Dump	U40	8	423,151.41	4,036,186.32	3,599	Y	E	Y	Point	Y	1997-2011	3.1	5.5	1.7	0.6	7.5	P	Y	Y/I	N	19.2	17.0	22.0	C	1.66	1.39	1.94	1,112.20	8.7	7.8	9.21	V	1.82	0.26	5.1	Med	V	0.23	0	0.6
Mill Site	U41	9	423,408.34	4,034,863.69	3,593	Y	E	Y	Diffuse	Y	1997-2011	1.4	3.53	0	0	5.2	I	Y	Y	N	20.5	10.0	30.0	V	4.15	3.07	5.69	2,780.50	8.14	7.39	9.33	V	3.11	0.37	7.7	High	V	0.42	0	2.9
Swedes Pasture	U42, U43, U44 Complex	10	423,940.09	4,034,145.08	3,591	Y	E	Y	Multiple Points	Y	1997-2011	1.4	2.22	0.79	0.5	3.4	P	N	N	N	22.9	17.0	31.0	V	3.13	2.13	4.24	2,097.10	8.71	7.66	9.48	V	0.31	0.04	1.04	Low	C	0.74	0	1.5
Mambo	U46	11	423,511.41	4,031,599.61	3,594	Y	E	Y	Point	Y	1997-2011	0.2	0.36	0	0	1.5	I	Y	Y	N	19.7	15.0	29.0	V	2.32	1.77	3.32	1,554.40	7.9	6.58	8.65	V	0.35	0.08	1.17	Low	C	1.14	0	5.1
L9 Ditch Seep	---	13	421,224.66	4,029,169.47	3,587	Y	E	Y	Diffuse	Y	1997-2011	0.1	0.68	0	0	0.9	I	Y	Y	N	16.7	1.7	33.0	V	19.67	11.6	35.7	13,178.90	9.25	8.81	9.95	V	8.61	5.97	16.5	High	V	0	0	0
Indian Creek Seep	---	12	421,779.81	4,029,203.79	3,600		E	Y	Diffuse	Y	1997-2011	0.3	0.71	0	0	0.9	I	Y	Y	N	17.7	0.0	32.0	V	8.05	4.94	11.92	5,393.50	8.92	8.41	9.56	V	8.42	4.5	16.8	High	V	0	0	0
Truckstricker Seep	U32	14	420,093.97	4,026,379.62	3,597		E	I	Diffuse	Y	1997-2011	0.3	0.88	0	0	1.3	I	Y	Y	N	15.0	8.0	30.0	V	20.17	11.88	39.7	13,513.90	8.6	8.05	9.39	V	3.81	2.01	7.9	High	V	0.1	0	0.4

Name	Alternate Name	Alternate Name used by GBUAPCD	Location					Fault Correlation (Y/N/I)	Surface Expression	Flow Info											Water Quality																		
												Range									Temperature (°C)				EC (mS/cm)				pH				O_2					H_2S (mg/l)		
			UTM - X	UTM - Y	Elevation (fmsl)	City Land (Y/N)	East or West Side Spring (E/W)			Flow Info Availability (Y/N)	Period of Record	Average POR[1] (gpm)	Avg. High[2] (gpm)	Avg. Low[3] (gpm)	Min (gpm)	Max (gpm)	Flow Type[4]	Seasonality[5] (Y/N)	Runoff Correlation[12] (Y/N)	Precip. Correlation[6] (Y/N/I)	Avg.	Min	Max	Temp. Variability[7]	Avg.	Min	Max	Estimated TDS[8] (ppm)	Avg.	Min	Max	pH Variability[9]	Avg. (ppm)	Min (ppm)	Max (ppm)	O_2 Concentration[10]	O_2 Concentration Variance[11]	Avg.	Min	Max
Tubman Springs	U19	15	419,257.59	4,025,346.76	3,581		E	I	Multiple Points	Y	1997-2011	12.3	21.2	5.7	1.3	35	P	Y	Y	N	19.8	15.0	24.0	C	6.29	2.96	9.34	4,214.30	7.05	6.69	8.44	V	0.99	0.08	12.9	Low	V	3.12	0	6.9
Cement Pond	U20	16	418,778.81	4,024,798.13	3,594		E	Y	Point	Y	1997-2011	5.9	7.9	4.1	2.5	8.8	P	N	N/I	N/I	22.3	17.6	25.0	C	7.2	6.49	8.61	4,824.00	6.78	6.37	7.69	V	0.34	0.09	1.4	Low	C	0.01	0	0.1
Whiskey Springs	U21, U22 Complex	17	417,126.94	4,023,570.03	3,588		E	I	Point	Y	1997-2011	4.6	7.9	3.9	2.9	10.8	P	N	N	N	19.8	16.0	23.0	C	8.26	7.54	9.34	5,534.20	7.06	6.61	7.66	C	1.05	0.26	3.5	Med	V	1.25	0	2.9
Wahoo	U24	19	411,951.19	4,019,797.07	3,587		E	I	Point	Y	1997-2011	1.5	2	0.8	0	4.2	P	N	N	N	17.3	7.0	25.0	V	0.42	0.25	0.53	281.40	7.75	6.7	9.16	V	2.52	1.17	5	High	V	0.06	0	0.9
Georgia O'Keefe	U1	20	409,764.38	4,025,151.36	3,569		W	Y	Multiple Points	Y	1997-2011	20.4	30.7	9.5	0.9	42.8	P	Y	Y/I	N	20.7	4.0	35.0	V	5.01	4.45	6.42	3,356.70	8.14	7.3	9	V	9.88	6.6	16.1	High	V	0	0	0
Northwest Seep	---						W			N																													
Kaiser Permanente	U1	21	409,764.38	4,025,151.36	3,569		W	Y	Point	Y	1997-2011	18.7	25	15.4	8.9	36.4	P	N	N	N	19.2	13.0	24.0	V	2.78	2.51	3.15	1,862.60	8.03	7.23	8.56	V	1.36	0.3	4.54	Med	V	0.06	0	0.2
Cottonwood Springs	DWP2	22	409,525.91	4,032,261.49	3,563		W	Y	Multiple Points	Y	1997-2011	730	1000	410	431.6	1157	P	Y	Y	Y	17.1	5.0	27.4	V	1.85	1.39	3.09	1,239.50	8.17	7	8.88	V	7.54	3.52	10.3	High	V	0	0	0
Cartago Springs Wildlife Area	---						W	I		N																													
Cabin Bar Ranch Springs	---					N	W	I	Multiple Points	N																													

Name	Miscellaneous Notes	Site Description *[per GBUAPCD Shallow Hydrology Report (2009) Appendix B]*	Source Characterization	Notes on Conclusion
Lizard Tail Spring		This site is the farthest north of all the spring monitoring sites and consists of a distinct mound in a dune area along the northeastern shoreline of the lake. The mound is composed of sandy soil and is fairly tall and narrow, similar to other spring mounds found on the North Sand Sheet. The mound is named Lizard Tail because of a healthy stand of *Anemopsis californica* it supports. Other vegetation present includes cattails, sedges and saltgrass. Surface flow from the mound is colorless and odorless. Water samples for chemical analysis and temperature measurement are collected from where the flow daylights on the northeast side of the mound. Measurements of the spring flow are made using a portable velocity meter (PVM) in a small channel on the side of the mound. Water samples are collected at the intake of the PVM channel. This site has a piezometer nest located at the base of the mound east of the spring that is instrumented with water level data logging equipment.	Indeterminate	Exhibits Characteristics of both shallow and deep aquifer sourcing. Deep - no seasonality, precipitation, or runoff correlation, constant temp., distinct single point mounding surface expression. Shallow - high and variable dissolved oxygen concentration and intermittent flow.
Dead Hawk Spring		This site is located on the North Sand Sheet, on a mound composed of sandy soil with a typical North Sand Sheet spring mound structure; tall and narrow with a shallow pool in the middle. Saltgrass grows on the mound. The surface water flow is perennial and the water has an odor and is colored light brown. The flow is low volume but sufficient such that it can be measured with a flume. The flume is installed within a few feet of the source of the spring near the top of the mound. Samples for chemical analysis and temperature measurement are collected from the central pool at the top of the mound. A piezometer nest is present at the eastern base of the mound. The water level of the shallow groundwater and the spring flow rate has been electronically logged on an hourly basis since March 1997.	Deep	No seasonal, precipitation, or runoff correlation with flow patterns, constant temperatures and O_2 concentrations, low average O_2 concentration, single point mounding surface expression.
Bonsai Mound		This site receives its name from a salt-cedar tree that grew for many years in a wire basket buried in the mound such that the site resembled a Bonsai garden. The site is located on the North Sand Sheet approximately 0.5 mile west of Keeler and has a typical North Sand Sheet spring mound shape (tall and narrow). The mound consists of sandy soil. This site is different than all others in the monitoring program in that channelized surface flow has never been observed, so no flow measurements are made. There is a small perennial pool of water in a depression at the top of the mound about a foot in diameter and varying from 1 to 4 inches in depth. The mound itself is about 1-meter high. The water has an odor and is colorless. The site has a piezometer nest installed just to the west of the mound, and hourly data were recorded electronically from October 2001 to July 2005.	Indeterminate	Lack of flow data. Shallow characteristics include variable temp and O2 concentrations, higher dissolved O_2. Deep characteristics include surface expression and perennial flow.
Carbide Dump	Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	This site derives its name from its proximity to the old Union Carbide dump site along the eastern portion of the lake bed. It is located about 50 yards south of the Sulfate Road and about 0.5 mile east of the former Union Carbide dump site. The wetland is above the playa along the historic shoreline. Vegetation present at the site includes *Distículus spicata, Scirpus sp.* , and *Anemopsis californica.* The spring origin is at the edge of an old mill site and the spring flow may be due to an old well. The only visual evidence of a man-made structure is a wooden frame built around a hole above the spring; however, the water does not flow out of this frame. Samples for chemical analysis are collected from the pool, where water can be seen bubbling up out of the ground. The water runs down the hill in a channel that parallels the Sulfate Road, and the flume is located about 50 to 75 feet from the spring origin. The water is odorless and colorless. A piezometer nest is located about 15 feet to the south of the flume within the wetland meadow. The flume and piezometer nest are instrumented with electronic equipment for hourly measurements.	Indeterminate	Spring exhibits characteristics of both shallow and deep aquifer influence. Deep - no seasonal influence on flow, relatively constant temp, single point surface expression. Shallow - flow patterns may show influence of precipitation and runoff, varying temp and dissolved oxygen levels, avg. dissolved oxygen levels higher than other suspected deep source springs. Location at base of alluvial deposits might indicate shallower sourcing.
Mill Site	Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	This site is located on the playa about 1/4 mile west of the Mill Site well and about one mile southeast of the Carbide Dump Site. The site consists of a large flat mound typical of the mounds located in clay soils. These mounds are typically much larger in diameter with less height than the North Sand Sheet mounds and often have a less obvious point where the water exits the ground. They frequently exhibit a "bulls-eye" pattern in vegetation with sedges in the wet center and ringed by saltgrass on the dryer outer edges. The piezometer nest, located on the northern edge of the site, was instrumented with electronic water level recording equipment in August 1999. The soil is mostly clay from two to 10-feet below the surface with an upper two-foot thick layer of sand and sandy clay. This site displays strong seasonal trends and the playa edge, where the saltgrass meets the clay pan, is a seep area with flowing water in the winter and spring. The surface flow typically dries up in the summer. Water flow measurements are taken in the same location as Feeney-Hall (1996). Samples for chemical analysis and temperature measurement are collected from the wet center of the mound where the sedges grows. There is standing water year round in the center of the mound but there is no distinct point of origin.	Shallow	Diffuse surface expression. Flow patterns show seasonal and runoff related influence. Variable temp and dissolved oxygen levels.
Swedes Pasture	LADWP Grazing lease; extensive wetland area	The site is located in a pasture above the playa along the historic shoreline. There are numerous springs in this complex with a corresponding abundance of vegetation that includes *Distículus spicata, Scirpus sp.* , and *Anemopsis californica* as well as other species. The monitored site consists of a small spring with a shallow pond about 13-feet in diameter in the northeastern portion of the Swedes meadow complex. A standard piezometer nest is installed at this monitoring site near the spring origin and the 10-foot piezometer generally has flowing artesian conditions. Horses and cattle crop and trample vegetation regularly, which may be the reason there is a pond instead of a thick stand of *Scirpus.* The PVM channel for flow measurements is located at the western edge of the pond where the water begins to run westward toward the playa. Temperature measurements and samples for chemistry are taken in the pond where the water bubbles up out of the ground in a distinct point of origin. The spring water has a slight odor and is clear.	Indeterminate	Multiple point surface expression. Flow patterns show no seasonality, or influence from precip or runoff. Variable temperatures. Spring flow does exhibit lower and more constant dissolved oxygen levels, which tend to be more indicative of deeper sourced springs.
Mambo	Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	Mambo is a spring with a circular surface expression and very little relief. It is located above the playa within a thick saltgrass meadow along the historic shoreline. Vegetation present in the center of the mound includes *Scirpus sp.* and *Typha sp.* (cattail), and can get over 9-feet tall when not grazed. There is also a stand of healthy *Triplex lentiformis* adjacent to the site. There is a distinct point near the edge of the mound where water exits the ground that is usually hidden by the heavy vegetation cover but can be seen when grazed. Temperature measurement and water samples for chemical analysis are taken from this point. A standard piezometer nest is located along the northern edge of the mound. The soil at the site is sandy to a depth of 5 feet below the surface with clay from 5 to 10 feet below the surface. There may be more water here than can be measured as surface flow because of immediate losses to infiltration. Flow measurements are taken about 15 feet from the center of the mound in a natural channel using the PVM or volume/time method. The water has an odor and is colorless.	Shallow	Flow patterns are seasonal and show runoff related influence. Variable temperatures. Higher and more variable dissolved oxygen. Location along boundary between the playa and alluvial deposits might be more indicative of shallower sourcing.
L9 Ditch Seep		This site is located in a small (3 to 4 feet deep) clay channel similar to Indian Creek in that flow daylights from fractures in the clay dispersed along the bottom and sides of the channel. The flow rate is very low and does not support vegetation in the upper portion of the channel. *Distículus spicata* grows in the lower channel. Samples for chemical analyses are taken at the top of the channel where water is first visible. The PVM location is located in the channel about 100 feet downstream of this area. Surface water flow is seasonal and the water is colorless and odorless. Because of the diffuse and low volume outflow, temperature measurements tend to be strongly influenced by ambient air temperature. A standard piezometer nest is installed at this site just east of the upper portion of the channel.	Shallow	Diffuse surface expression. Seasonal flow patterns show runoff related influence. Variable temp and dissolved oxygen levels.
Indian Creek Seep	Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	The Indian Creek site is located in an 8-10 foot deep channel cut by flash flooding along the southeastern portion of the lake bed. Above and southeast of the channel is a clay pan behind an old beach ridge. Surface water drains through the channel from the clay pan and onto the playa during large precipitation events and subsequent overland runoff (flash flooding). Subsurface water supports vegetation year round in the channel, but surface flow is seasonal. Vegetation present includes *Typha sp.* and *Tamarisk sp.* (salt cedar) in the upper channel and *Distículus spicata* in the lower channel. A standard piezometer nest is installed in the upper portion of the channel. The piezometer site is about 100 feet upstream of the location where surface flow is measured. At the piezometer site location, the soil consists of sand to a depth of 2 feet and then clay from 2 to 10 feet below the surface. Down channel from the piezometers the soil turns to fractured clay and water seeps along the bottom and sides of the channel for a distance of several hundred feet. The PVM channel location was sited in what appears to be the area of maximum flow. Temperature measurements are taken and water samples are collected for chemical analysis from where the water flows out of a set of large fractures. The surface water is clear and odorless. Because of the diffuse and low volume outflow, temperature measurements tend to be strongly influenced by the ambient air temperature.	Shallow	Diffuse surface expression. Seasonal flow patterns show runoff related influence. Variable and high dissolved oxygen levels. Variable temperature patterns.
Truckstícker Seep	Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	Truckstícker gets its name from the 2-foot deep vehicle ruts near the site. It is located in the northeastern portion of the Tubman complex. A standard piezometer nest is installed at the site. The soil consists of 10-feet of heavy clay. This site is similar to L9 and Indian Creek in the way the water seeps out of the ground through fractures, but the nature of the channel differs. Water seeps into a shallow (6-12 inches in depth), short channel filled with saltgrass, and outflow runs onto the playa. Surface flow is seasonal, and the water is odorless and colorless. The temperature is measured and the samples for chemical analysis are collected from where there is enough ponded water for a sample. The PVM channel is located about 20 feet downstream of the sample collection point.	Shallow	Diffuse surface expression. Seasonal flow patterns show runoff related influence. Variable temp and dissolved oxygen levels.

Name	Miscellaneous Notes	Site Description *[per GBUAPCD Shallow Hydrology Report (2009) Appendix B]*	Source Characterization	Notes on Conclusion
Tubman Springs	Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	Tubman is a large broad spring complex with multiple source areas. Numerous small springs and seeps are present across the complex and flow into several channels and then out on the playa. Vegetation present includes *Disticulus spicata* and *Scirpus sp.*. The main part of the spring complex has low relief with little elevation drop causing the water to spread on the surface and making the siting of a flume location difficult. Chemistry samples are collected and temperature measurements are taken from a specified spring located nearest the flume where the water is visibly discharging from the ground. The water has an odor and is colorless. A standard piezometer nest is installed at this site about 50 feet southeast of the flume.	Shallow	Multiple point surface expression. Seasonal flow patterns with runoff related influence. Spring flow does exhibit lower dissolved oxygen levels and more constant temperatures, which tend to be more indicative of deeper sourced springs.
Cement Pond	Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	This site is located in the southwestern portion of the Tubman complex. The spring consists of a pond, about 10 feet in diameter, surrounded by rocks that are cemented together by tufa. Although the pond is naturally occurring, the initial impression gives the appearance of artificial construction. Vegetation present includes *Scirpus sp.* in the pond and in the channel area and *Disticulus spicata* in the drier areas. There are several locations in the pond where the water bubbles up out of the ground. The chemistry samples and temperature measurements are taken in one of these points. Surface water flow is measured with the PVM about 20 feet downstream from the pond where the channel naturally narrows. The water is clear and odorless. A standard piezometer nest is located at this wetland adjacent to the pond.	Deep	Single point surface expression. No seasonal flow patterns and no runoff or precipitation influence. Constant temperatures. Lower and more constant dissolved oxygen levels.
Whiskey Springs	Owens Valley Vole Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	This spring is located on a distinct mound on the edge of the playa and along the northern edge of a shoreline meadow. The initial flow direction of this mound is to the southeast toward the historic shoreline and away from the playa, probably because of a buildup of windblown soil deposits on its lake-ward (northwest) edge. Vegetation includes *Scirpus sp., Sarcobatus vermiculatus,* and *Disticulus spicata* . Temperature measurements are made and samples for chemical analysis are collected at the center of the mound where the water is visibly flowing out of the ground. Surface flow rate was formerly measured with the PVM and is currently measured with a flume. The flow measurement point is about 15 feet from the spring origin. The water is colorless with an odor. A standard piezometer nest is installed at this site along the northern side of the mound near the playa edge about 50 to 75 feet from the flume. The piezometer nest was instrumented with equipment for recording of hourly water levels in August 2005. Hourly flow rate measurements started in September 2005.	Deep	Single point surface expression. No seasonal flow patterns and no runoff or precipitation influence. Constant temperatures. Spring does exhibit medium and more variable dissolved oxygen levels, which could be indicative of shallow sourcing.
Wahoo	Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	Wahoo is the largest mound present in a north-south trending linear array of spring mounds on the southern portion of the playa. *Tamarisk sp.* and a few willow and *Baccharis sp.* trees are present on the mound. Vegetation also includes *Disticulus spicata* , *Chrysothamnus nauseosus* (rabbit brush), *Typha sp.* and *Nitrophila occendentalis* (inkweed). The surface water flow path on the mound has changed over time. Former flow paths are evident as dry channels marked with lines of *Tamarisk sp.* plants extending down the hill. There is a prominent channel full of *Typha sp.*, *Tamarisk sp.* and willow starting at the top of the mound extending to the north. Flow and temperature measurements and water sampling used to be conducted at the top of this channel but are now done in a smaller channel on the south side of the mound. The change was made when the original main channel became dry in 2003 and the surface water began to daylight from a new location. The spring water is odorless and colorless. A standard piezometer nest is installed on the northern portion of the mound near the base of the original channel and was instrumented from March 1997 until September 2005. The 4-foot piezometer is frequently dry due to low groundwater levels on the northern portion of the mound following the change in location of the spring. The soil is sandy to a depth of nine feet and then clay to a depth of ten feet below the surface.	Deep	No seasonal flow patterns and no runoff or precipitation related influence. Single point, mounding surface expression. Spring does exhibit temp and dissolved Oxygen variability, which may be the result of sampling location.
Georgia O'Keefe	Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	The Georgia O'Keefe Meadow is located at the base of an alluvial fan on the western side of the lake bed, approximately 2 miles north of the Lake Minerals (US Borax/Rio Tinto) gate on Highway 395 and 0.5 miles southeast of the Kaiser Permanente ruins. A 4-foot piezometer is present near the flow measurement point, and the soil is composed of coarse sand and fine gravel from 0.5 to 4 feet in depth below the surface. A six-inch thick layer of clay is present at the top of the soil profile. The soil is very wet throughout the profile. It was not possible to core below six feet because the sides of the borehole kept sloughing. A line of springs below the shoreline bluff support several acres of wetland meadows that extend eastward to the playa edge. Where the water comes out of the ground there are tall stands of *Scirpus sp.* Possibly mixed with *Typha sp.* The water runs towards the playa in a small creek. Water sampling, temperature measurement and flow rate measurements are all conducted about 100 yards downstream from where the water daylights on a section of creek that is naturally narrow. Measurements and water samples are not taken at the source of the spring because of unreliable access throughout the year.	Shallow	Diffuse surface expression. Seasonal flow patterns with possible runoff related influence. Variable temp and dissolved oxygen levels. Siting near boundary of alluvial and lacustrine deposits indicates likely structural control.
Northwest Seep	Spring Snails (P. wongii)			
Kaiser Permanente	Spring Snails (P. wongii) Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	This wetland site is located less than 0.5 mile north of the Georgia O'Keefe site and east of the Kaiser Permanente ruins along the upper edge of an extensive wetland complex on the west side of the lake bed. The soil is composed of coarse sands, fine gravel, and silts and is saturated at a depth of six inches. Due to sloughing it was not possible to core below six feet at this site so only a four-foot piezometer was installed. This spring originates in a small hollow: this is the location for acquiring samples for chemical analysis and where temperature measurements are taken. The water flows eastward down slope without significant ponding and the PVM channel is installed about 20 feet downstream of the source.	Indeterminate	Spring flow does not exhibit seasonal patterns or show influence of runoff or precipitation. Variable temps and oxygen levels.
Cottonwood Springs	Spring Snails, Western Toad and Pacific Tree frog breeding area; Well known birding area . Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	Cottonwood Springs consists of a large complex of ponds and springs on the western side of the lake about four miles north of Kaiser Permanente and four miles south of Bartlett Point. The monitoring site is located along the eastern side of the spring complex where the bulk of the surface water drains through a cement flume and into a small creek that flow directly into the brine pool. The soil near the flume consists of coarse sand and fine gravel and is saturated at one foot in depth. This site has a four-foot piezometer. The vegetation in the wetlands above the flume and along the creek is lush and includes *Scirpus sp., Typha sp., Disticulus spicata,* and cottonwood trees. This site has the highest surface flow rates currently measured on the lake bed generally ranging from 500 to 1500 gallons per minute (gpm). The concrete flume and stilling well at the site were used to measure surface flow since before inclusion in the WMP/SMP. A datalogger and pressure transducer were installed when the previous flow recorder failed; the District has collected hourly records of the flow rate through the flume since April 1997. Since the spring complex at this site is widespread and contains multiple discharge sources, the water sample for chemical analysis is taken about 10 feet upstream of the flume and represents a composite sample from the main spring area. Temperature is also measured at this point, and is influenced by the ambient air temperature. The spring water is fresh.	Shallow	Multiple point surface expression. Seasonal flow patterns showing influence of precip and runoff. Variable and high dissolved oxygen levels.
Cartago Springs Wildlife Area	Significant shorebird and waterfowl use, Western Toad and Pacific Tree frog breeding area, State Wildlife Area			
Cabin Bar Ranch Springs	Series of springs and seeps located along the boundary of alluvial deposits and the historic shoreline of Owens Lake			

1. Average flow rate for entire period of record

2. Average of all high flows in each year

3. Average of all low flows in each year

4. **P**=Perennial, **I** = Seasonal or Intermittent, **F** = Flowing Well

5. **Y**=clear seasonal pattern, **N**=no clear seasonal pattern.
6. **Y**=clear pattern of precipitation influence, **N**=no clear pattern of precipitation influence, **I**=Indeterminate precipitation correlation. Utilized Keeler precip data for eastside wells and Cottonwood Power Plant for westside wells.

7. **C**=Temp variance less than 10 degrees, **V**=Temp variance greater than 10 degrees

8. Estimated utilizing standard conversion factor of 0.67

9. **C**=Std. deviation less than 0.2, **V**=Std. deviation greater than 0.2
10. **Low**=O_2 concentration less than 1.0 ppm, **Med**=O_2 concentration from 1.0 - 2.0 ppm, **High**=O_2 concentration greater than 2.0 ppm

11. **C**=O_2 variance less than 1.0 ppm, **V**=O_2 variance greater than 1.0 ppm
12. **Y** = clear pattern of runoff influence, **N** = no clear patter of runoff influence, Correlated utilizing Cottonwood Creek runoff data.

Sources Used:

GBUAPCD Shallow Hydrology Report

MWH OLGEP Conceptual Model TM (January 2011)

MWH/LADWP Task A.2.10.1.16 December 2010 Workshop Documentation and Appendices

Master Table for OLGEP Area Flowing Wells

Name	Alternate Name	Alternate Name used by GBUAPCD	Location					Fault Correlation (Y/N/I)	Surface Expression	Flow Info										Temperature (°C)				EC (mS/cm)			
												Range																
			UTM - X	UTM - Y	Elevation (fmsl)	City Land (Y/N)	East or West Side Spring (E/W)			Flow Info Availability (Y/N)	Period of Record	Average POR[1] (gpm)	Avg. High[2] (gpm)	Avg. Low[3] (gpm)	Min (gpm)	Max (gpm)	Flow Type[4]	Seasonality[5] (Y/N)	Precip. Correlation[6] (Y/N/I)	Avg.	Min	Max	Temp. Variability[7]	Avg.	Min	Max	Estimated TDS[8] (ppm)
Dirty Socks	DWP1	18	414,801.03	##########	3,595		E		Well	Y	1997-2011	151.3	197.8	118.4	110	280	F	N	N	31.0	25.0	35.0	V	8.85	6.96	9.88	5,929.50
Horse Pasture	U25, U26, U27, U28, U29 Complex	4	419,995.19	##########	3,594	Y	E	Y	Well	Y	1997-2011	444	451	440	429	460.2	F	N	N	21.5	21.0	23.0	C	2.85	2.42	3.43	1,909.50
Black Sands	U29	3	419,777.69	##########	3,588	Y	E	Y	Well	Y	1997-2011	62.4	67.7	55.3	99.91	43.64	F	N	N	21.3	18.0	23.0	C	3.64	2.18	4.56	2,438.80
Sulfate Well	---	7	419,383.53	##########	3,562		E	Y	Well	Y	1997-2011	382	401	361	345	526.6	F	N	N	26.1	25.0	28.0	C	3.35	2.58	3.81	2,244.50
PPG Well	---	23	407,928.59	##########	3,581		W	Y	Well	Y	1997-2011	25.9	34.6	19.9	13.8	45.8	F	Y	N	20.0	19.0	21.0	C	4.17	3.81	4.63	2,793.90
Bartlett Well	---	24	407,968.00	##########	3,587		W	Y	Well	Y	1997-2011	104.3	155.8	81.7	49	217.9	F	N	I	22.0	21.0	25.0	C	0.39	0.29	0.48	261.30
Keeler Spring	U31	5	421,493.78	##########	3,589	Y	E	Y	Multiple Points	Y	1997-2011	10.5	23.8	0	0	61.2	I	Y	Y	N/I	16.4	5.0	23.0	V	1.74	1.37	2.29	

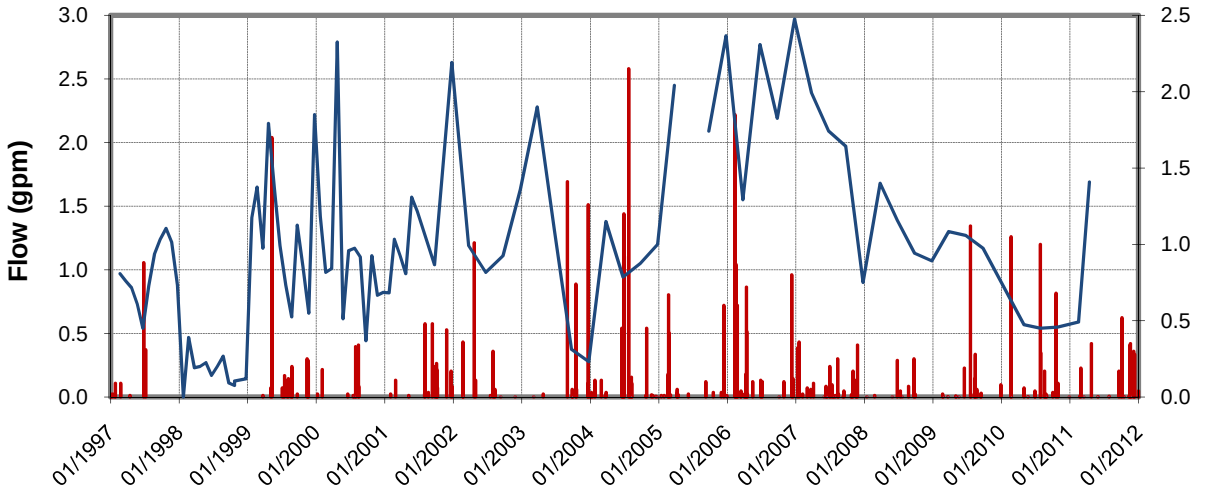
Master Table for OLGEP Area Flowing Wells

Name	Water Quality												Miscellaneous Notes	Site Description [per GBUAPCD Shallow Hydrology Report (2009) Appendix B]	Source Characterization	Notes on Conclusion
	pH				O_2					H_2S (mg/l)						
	Avg.	Min	Max	pH Variability[9]	Avg. (ppm)	Min (ppm)	Max (ppm)	O_2 Concentration[10]	O_2 Concentration Variance[11]	Avg.	Min	Max				
Dirty Socks	6.91	6.59	7.48	C	3.69	1.13	8.3	High	V	0	0	0	Shorebird use; popular recreation and birding area; Owens Valley Vole	This site is located along the southeastern portion of the historic shoreline and consists of an uncontrolled abandoned flowing artesian well surrounded by a concrete swimming pool. The pool is about 30 feet in diameter and 3 feet deep and is still used occasionally for swimming. The swimming pool was constructed around the wellhead and is filled with water flow from the well. Once the pool is full it overflows into a channel on the northern edge of the pool and then into a duck pond about 200 feet in diameter. Overflow from the pond extends northward onto the playa. There is *Distichlus spicata* and *Sarcobatus sp.* around the swimming pool and *Distichlus spicata* and *Scirpus sp.* around the duck pond and in the wetland below the pool. It is not practical to sample directly from the well head on a regular basis, so samples for chemical analysis are collected from the edge of the pool. Due to concerns of vandalism, a permanent PVM channel is not installed. Previous to May 1997, the channel was measured before each PVM run for flow calculation. In May 1997 an 8-inch metal culvert was installed at the outflow of the swimming pool, and all water now flows through the culvert. Flow measurements are now measured in the culvert. The water from the well is colorless and has an obvious odor. A standard piezometer nest is installed north of and down slope of the developed cement pad surrounding the swimming pool. The soil at the piezometer location consists of sandy clay to a depth of about 4 feet below which there is heavy clay to a depth of 10 feet below the surface.	Deep	Uncontrolled flowing artesian well. Flow patterns with no seasonal or precipitation influence. Low temperature variability. Lower and more constant dissolved oxygen levels.
Horse Pasture	7.51	7.09	7.81	C	0.22	0.11	0.36	Low	C	0	0	0		The Horse Pasture site consists of an uncontrolled flowing artesian well with a 13-inch casing. The flow from the well supports a lush pasture and pond approximately one mile north of the community of Keeler along the historic shoreline. The soil is sandy to a depth of about 4 feet and then clay from a depth of 4 to 10 feet below the surface. Vegetation present includes sedges (*Scirpus sp.*) , saltgrass (*Disticulus spicata*), *Nitrophila sp.*, and *Sueda sp.*. Measurements of flow rate from the well are made with the portable velocity meter (PVM) directly in the well casing and are generally about 440 gpm, making this the highest measured flow rate on the east side of the lake bed. The water has a slight odor and is clear. Water sample collection for chemical analysis and temperature measurements are done at the top of the well casing. A piezometer nest is present in the Horse Pasture meadow about 20 feet north of the well head.	Deep	Uncontrolled flowing artesian well. No seasonal or precipitation influence on flow patterns. Constant temp. and O_2 concentration.
Black Sands	8.37	8.08	8.9	C	0.71	0.23	2.91	Low	V	0.39	0	0.8		The site is located on the playa near the eastern end of a former abandoned wooden pipeline north of Keeler, and less than 1/4 mile west of the Horse Pasture well (Site #04). Although this spring is believed to be the result of flow from an abandoned uncontrolled artesian well, no well casing is visible. The mound is thought to have formed over the top of the abandoned well head by deposits of windblown sand. The soil is sandy to a depth of ten feet below the surface. A low broad mound has formed around the discharge point. Saltgrass is present on the mound and plant cover has increased over time since implementation and operation of the Shallow Flooding dust control project. The water from the site daylights at the top of the mound in a circular pool about 10 feet in diameter. A flume is installed on the perimeter of the pool and spring flow rates have been electronically recorded since 1997. The flow rate from the spring typically averages 65 gallons per minute (gpm). Water samples for chemical analysis and temperature measurement are collected from the central pool as close to the discharge point as possible. The water has a modest odor and light brown color. A 4-foot and 10-foot piezometer nest is installed to the west of the spring near the top of the mound. Water levels were electronically recorded from September 2001 to September 2005.	Deep	Uncontrolled flowing artesian well. No seasonal or precipitation influence on flow patterns. Constant temp. and O_2 concentration.
Sulfate Well	8.4	8.05	8.89	C	0.14	0.06	0.3	Low	C	0.28	0	0.4	Significant shorebird use, Owens Valley Vole	This site consists of an uncontrolled abandoned artesian well with a high flow rate of about 390 gpm. Flow from the well supports a substantial wetland often used by shorebirds. The vegetation within the wetland includes *Disticulus spicata* and *Scirpus sp.*. The site is isolated on the playa at a distance of 1.25 miles from the nearest naturally occurring spring and approximately three miles from the historic shoreline. Flow rate and temperature are measured directly in the well casing. Samples for chemical analysis are collected from water at the top of the wellhead. The soil at the site consists of heavy clays to a depth of 10-feet below the surface. The water from the well has an odor and is colorless. Piezometer water levels have been recorded hourly since April 1997.	Deep	Uncontrolled flowing artesian well. Flow patterns with no seasonal or precipitation influence. Low temperature variability. Lower and more constant dissolved oxygen levels.
PPG Well	9.06	8.62	9.48	C	0.49	0.38	3.12	Low	C	0.51	0	1	Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	The Pittsburgh Plate Glass (PPG) site is located at an uncontrolled abandoned flowing artesian well that is covered with a flat iron plate around which the flow discharges onto the surface. The site is located at the foot of the bluff below (east) the old PPG plant and is surrounded by slag heaps, berms and piles of material as well as other artifacts. A 4-foot piezometer is installed about 10 feet from the wellhead. The soil is mostly clay, in contrast to the W1, W2, and W3 sites which are dominated by sand and fine gravels. The site supports only a small amount of vegetation that includes *Scirpus sp.* , *Disticulus spicata* , and *Anemopsis californica.* The water samples for chemical analysis and temperature measurement are taken directly at the well head and the PVM channel is located approximately five feet downstream. Below the PVM channel the surface water flows eastward into a large pool behind an old mining berm. During high flows, the water flows out of the pool and out onto the playa below the berms.	Deep	Uncontrolled flowing artesian well. Flow patterns with no seasonal or precipitation influence. Low temperature variability. Lower and more constant dissolved oxygen levels.
Bartlett Well	8.48	7.4	8.98	V	3.43	3.12	3.73	High	C	0	0	0		This site consists of an uncontrolled abandoned artesian well that supplied drinking water to the former town of Bartlett. The well had an old pump on it until the spring of 2008 around which there was significant water flow and leakage around the base. In the spring of 2008, the pump was removed and a metal plate was installed over the top of the well around which the artesian flow now discharges. The flow from the well flow supports a large wetland on the lake bed that includes *Tamarisk chinensis* , *Disticulus spicata* , *Scirpus sp.* , *Baccharis sp.* trees, willows, watercress, and other species. A 4-foot piezometer is installed about 50 feet east of the well head. The soil here is sandy to a depth of about three feet and then clay from 3 to 4 feet below the surface. Samples for chemical analysis are collected and temperature is measured from where the water comes out of the well head. The surface flow is sampled about 15 feet away from the well head in a location where the water narrows into a channel. The well head was surrounded by a chain link enclosure until the spring of 2008. The edges of the enclosure had a lot of vegetation that restricted the flow out of the well and caused the water to pond inside the enclosure to a depth of about one foot. The majority of the water flowed out of the open gate of the enclosure and to the south into the channel where flow measurements were taken, but a small amount seeped out to the west and supported some plant growth.	Deep	Uncontrolled flowing artesian well. Flow patterns with no seasonal or precipitation influence. Low temperature variability. Lower and more constant dissolved oxygen levels.
Keeler Spring	1,165.80	8.03	7.3	8.56	V	4.78	0.37	8.3	High	V	0.01	0.1	Monitoring point is located at some distance from source; therefore, water quality parameters likely are affected by surface flow.	The Keeler Spring site consists of a spring complex along the eastern shoreline of the lake originating behind (west) the old swimming pool in the community of Keeler. Vegetation present in the spring complex includes *Scirpus sp.*, *Anemopsis californica* and *Disticulus spicata*. The piezometers and flume are located approximately 0.2 miles west of the swimming pool along the western edge of the spring complex. The soil profile is sand-dominated to a depth of 10 feet below the surface at the piezometer nest. A flume is installed on the south side of a small pond where the water runs through a small channel and out onto the playa. The flume was sited in the same location as previous flow measurements by Feeney-Hall (1996). There is a large wet area directly behind the swimming pool house in Keeler where the water daylights and this is where the samples for chemical analysis are collected and temperature is measured. The spring water is odorless and colorless. There is no obvious distinct single origin point for the spring, therefore, temperature measurements are strongly affected by ambient air temperature. There are no visual signs of whether this spring is man-made or natural but its proximity to the old swimming pool suggests that it may be man-made or that the pool was constructed there due to the presence of the spring. Water flow through the flume is seasonal with flows generally ceasing during the summer months. However, the pond is perennial and the spring supports a significant amount of vegetation in the surrounding meadow. A piezometer nest is located at the site about 50 feet west of the lower pond within the saltgrass meadow. Piezometer water levels and flume flow have been recorded hourly on a datalogger since April 1997.	Deep	Information from GBUAPCD indicates that this is a flowing well.

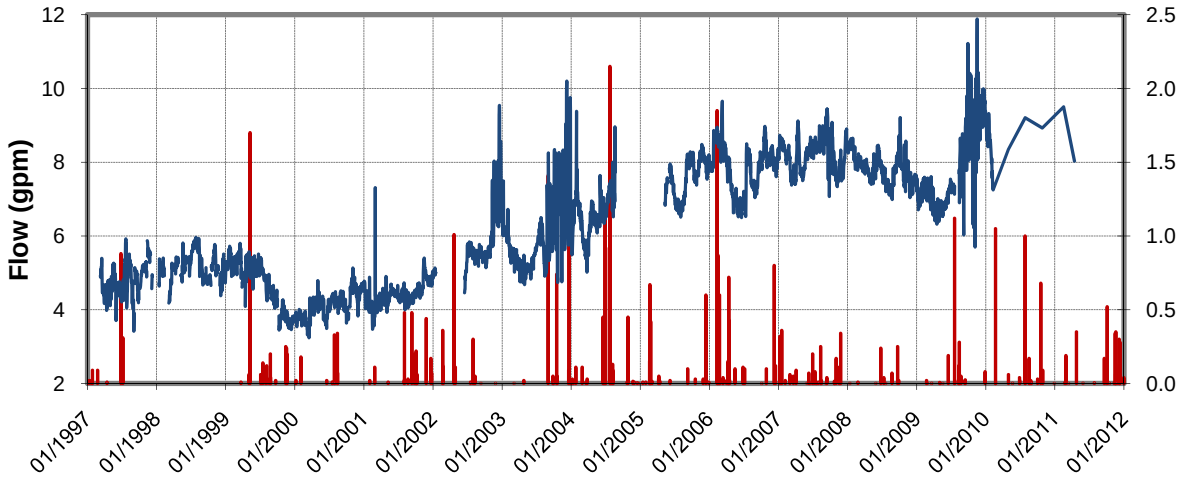
APPENDIX J

Hydrographs Showing Spring Flow versus Runoff and Precipitation

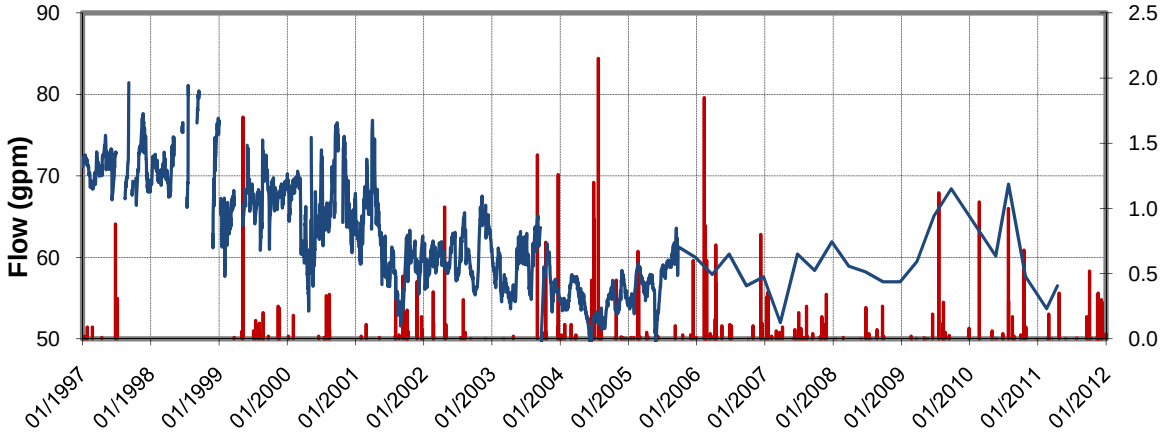
Lizard Tail Spring



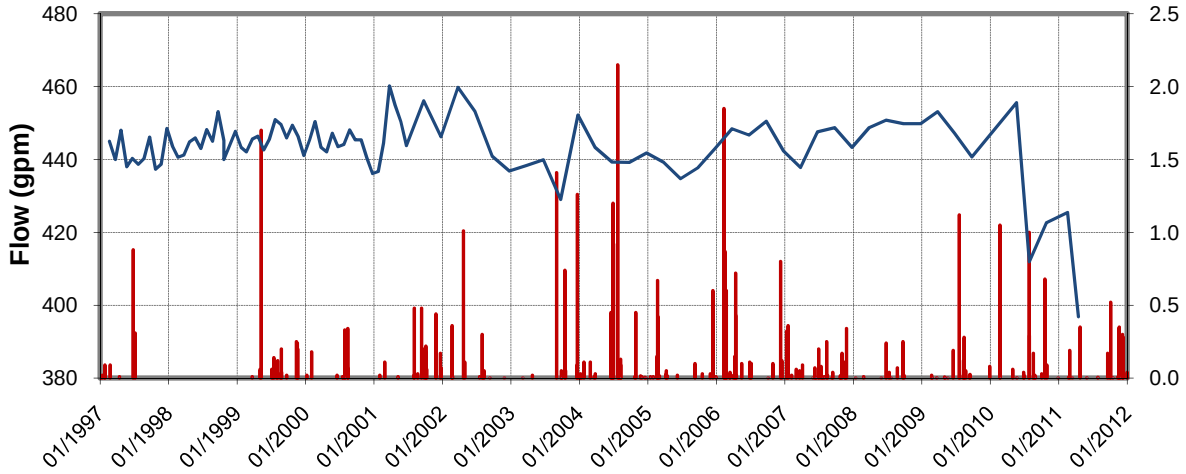
Dead Hawk Spring



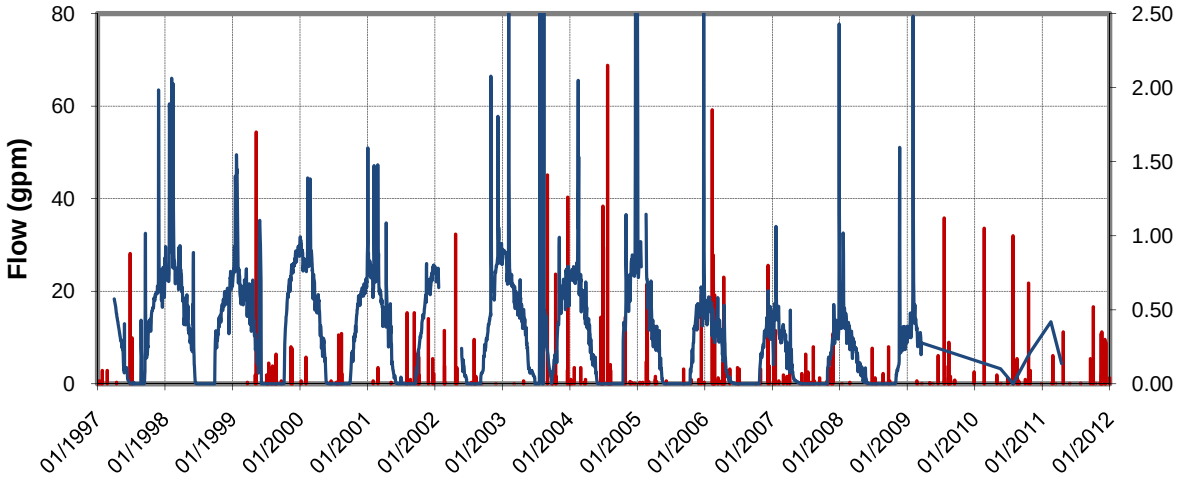
Black Sand Spring
(03)



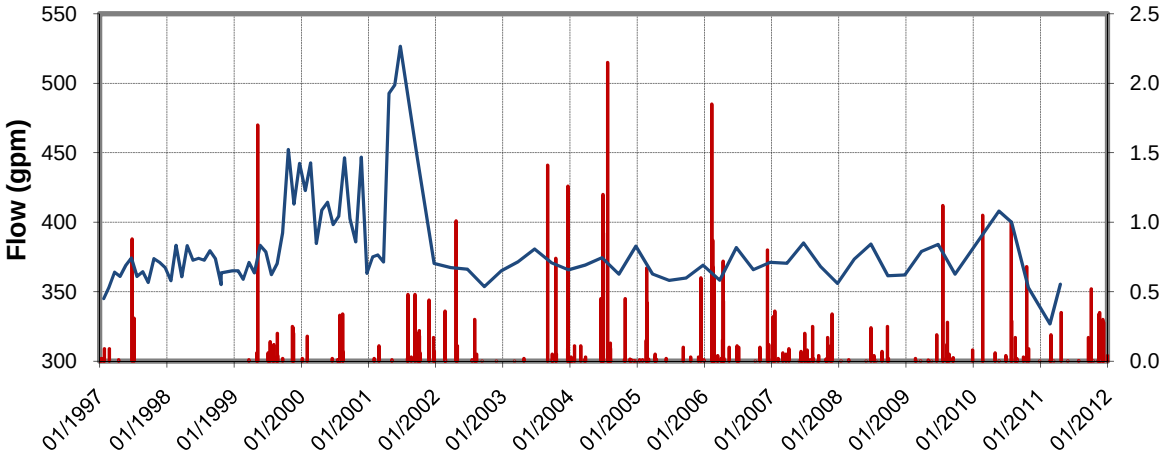
Horse Pasture Spring



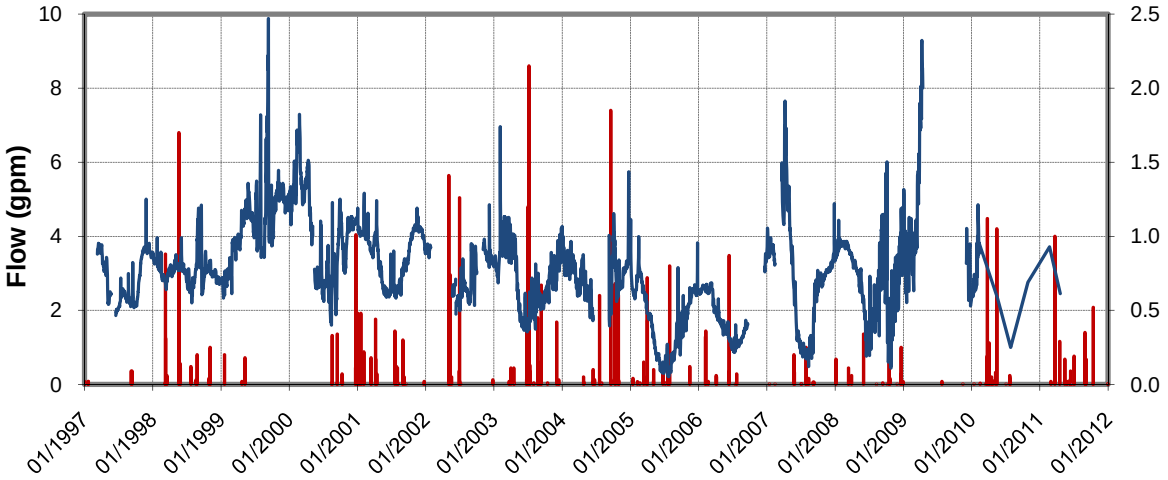
Keeler Spring



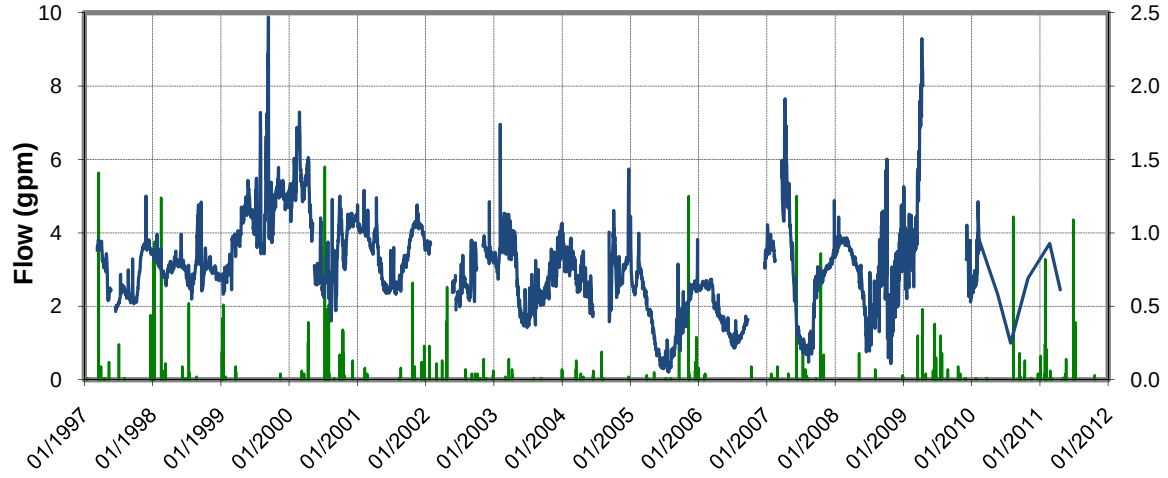
Sulfate Flowing Well

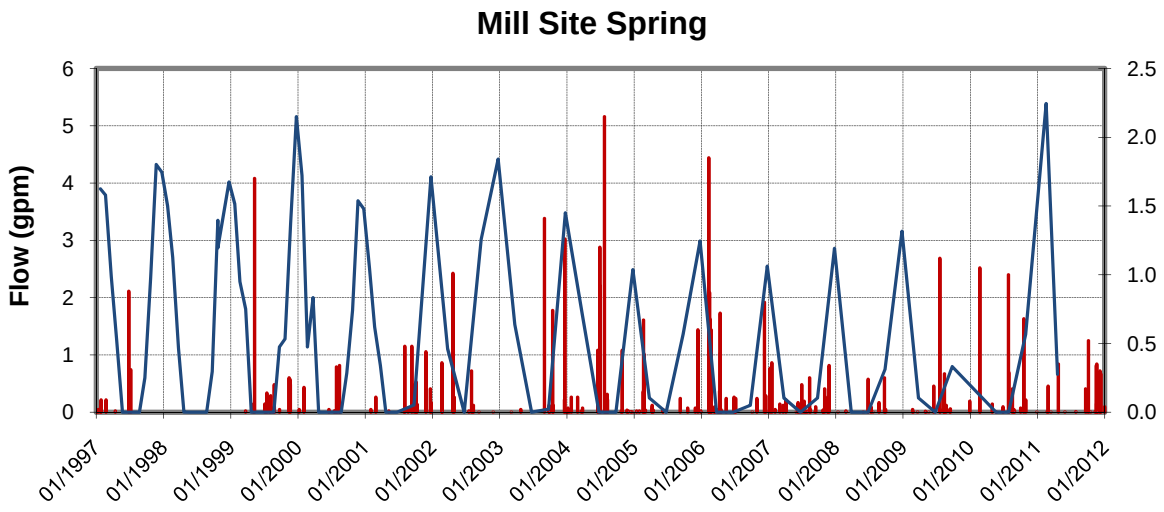


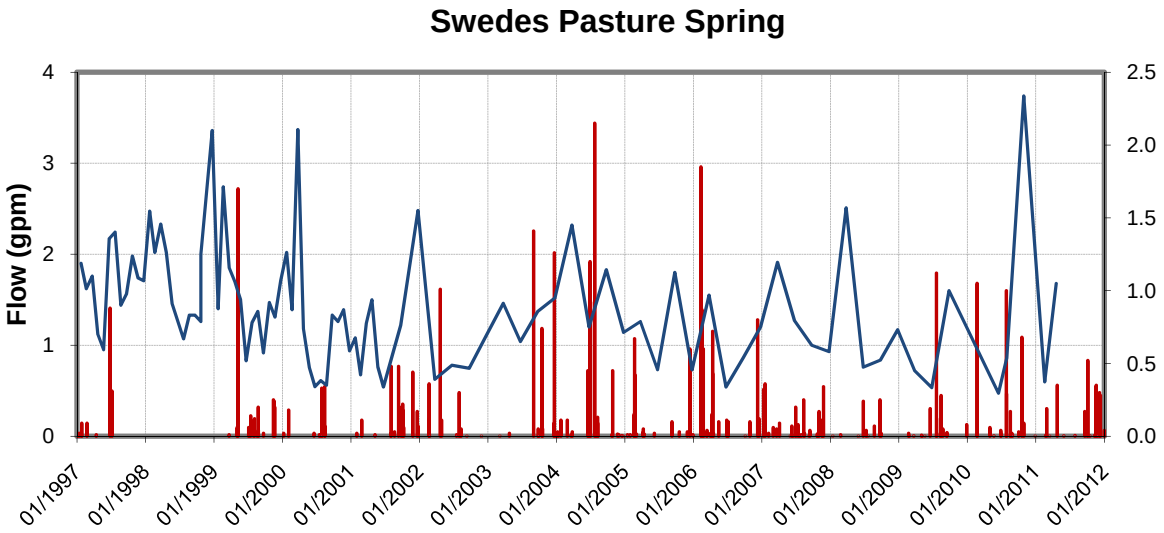
Carbide Dump Spring



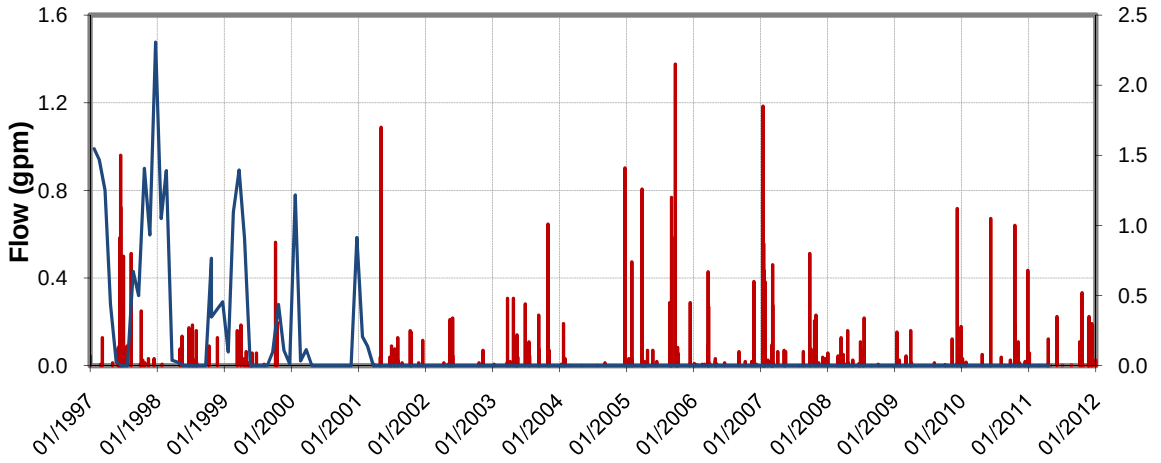
Carbide Dump Spring
W/ SIMIS precip data



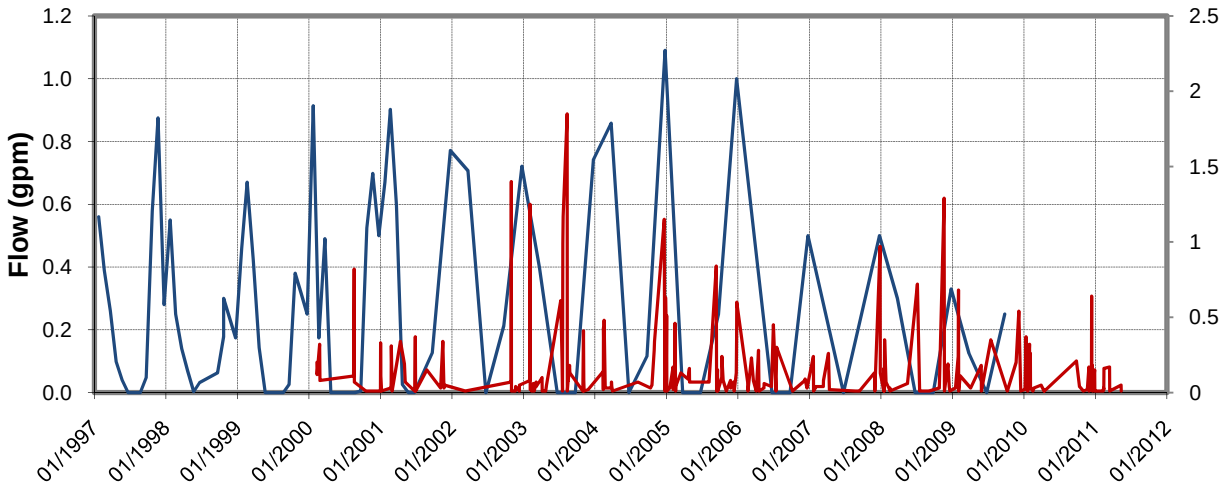

Mill Site Spring
Flow (gpm)
6
5
4
3
2
1
0
2.5
2.0
1.5
1.0
0.5
0.0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007
01/2008
01/2009
01/2010
01/2011
01/2012


Swedes Pasture Spring
Flow (gpm)
4
3
2
1
0
2.5
2.0
1.5
1.0
0.5
0.0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007
01/2008
01/2009
01/2010
01/2011
01/2012

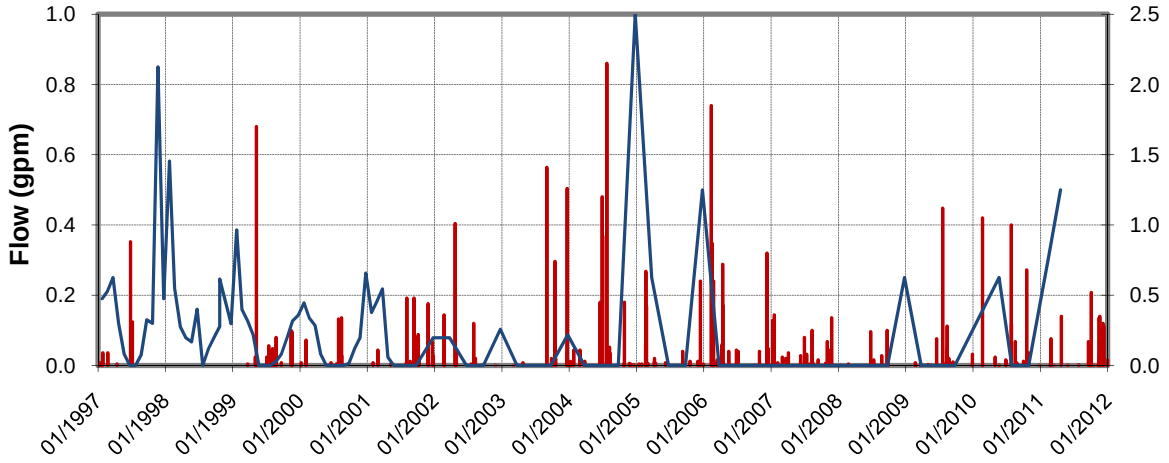
Mambo Spring



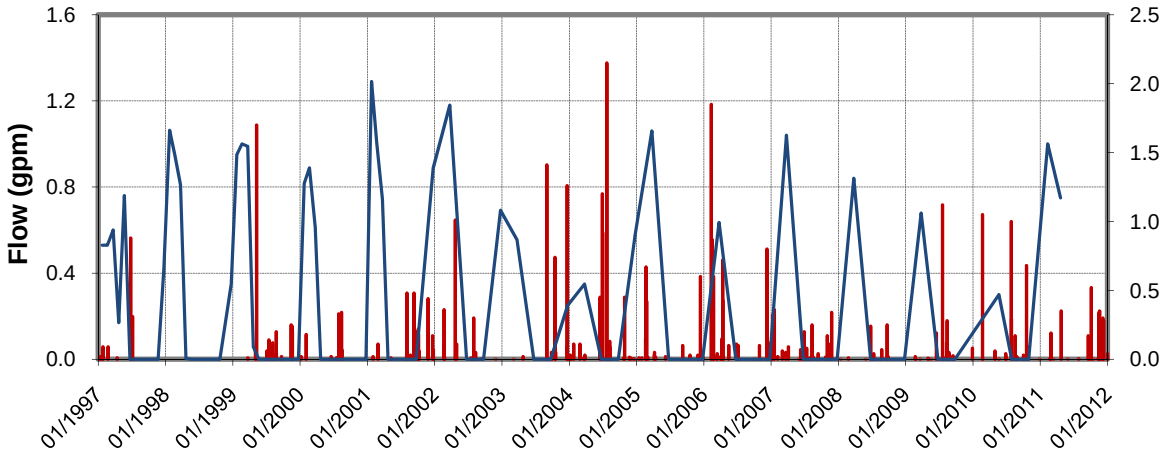
Indian Creek Seep



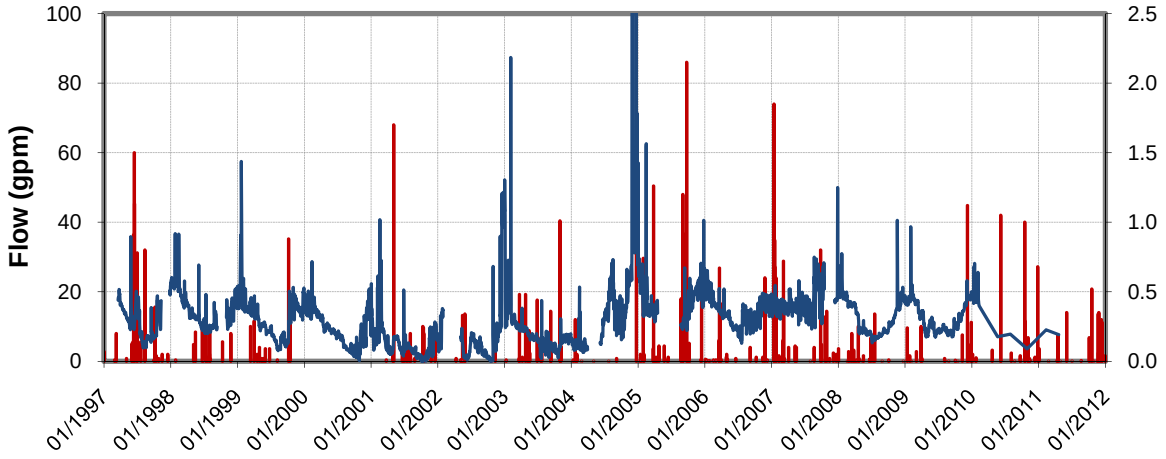
L9 Ditch Seep



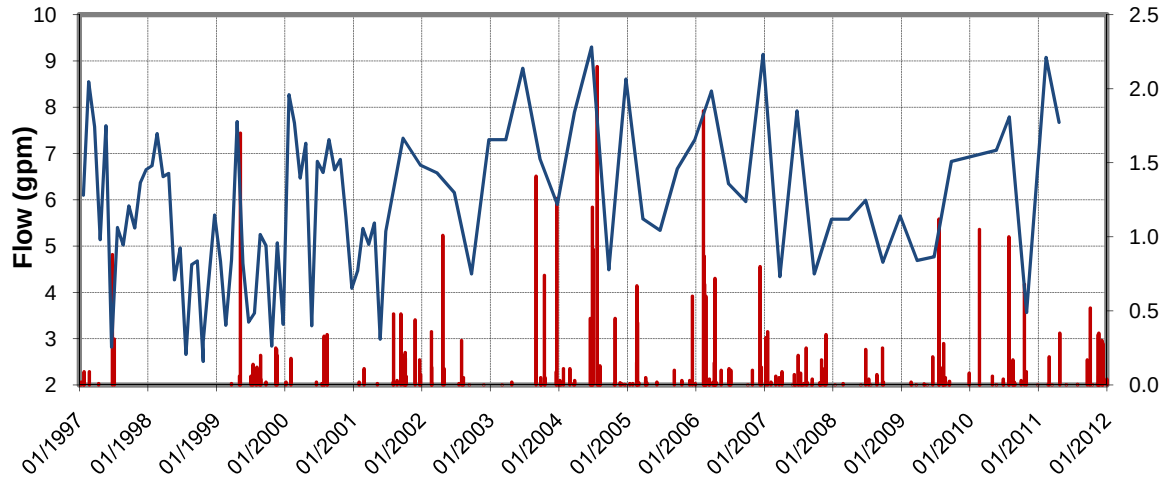
Trucksticker Seep



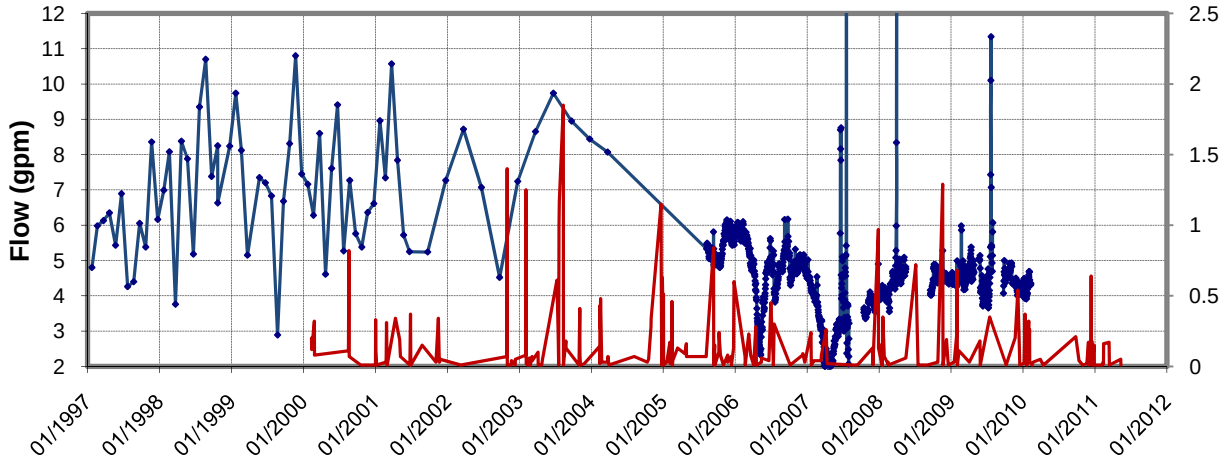
Tubman Channel Spring



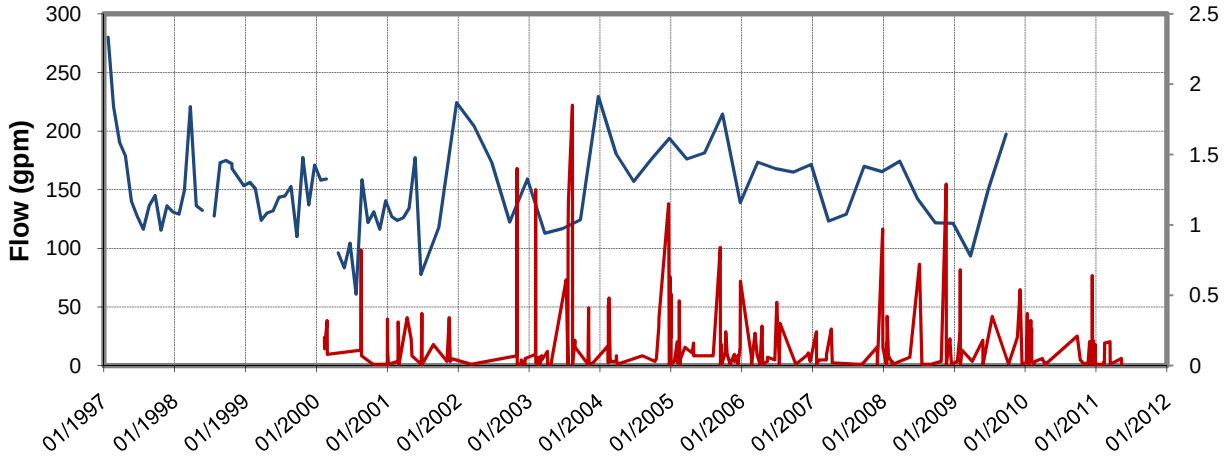
Cement Pond Spring

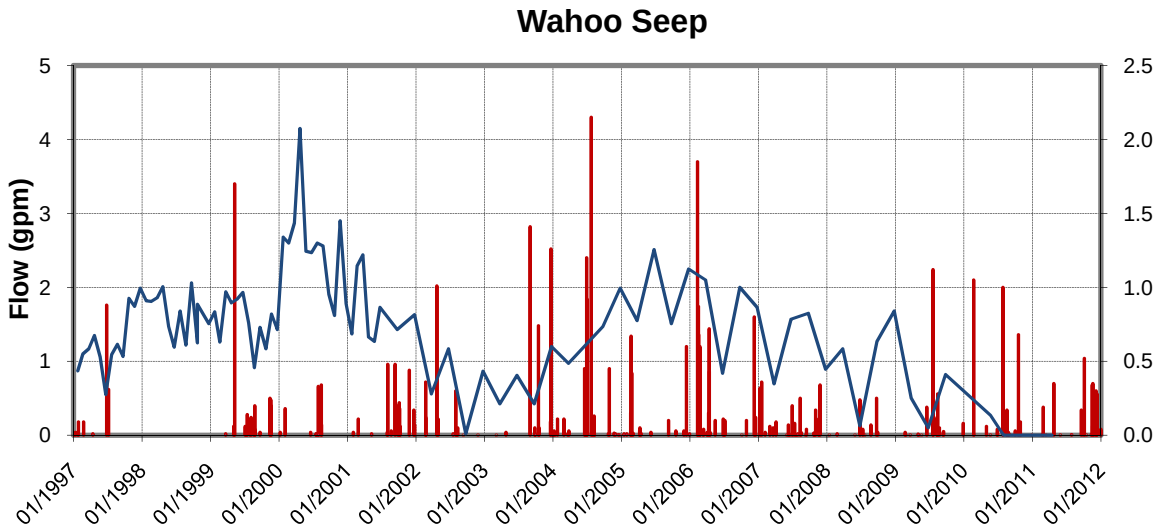


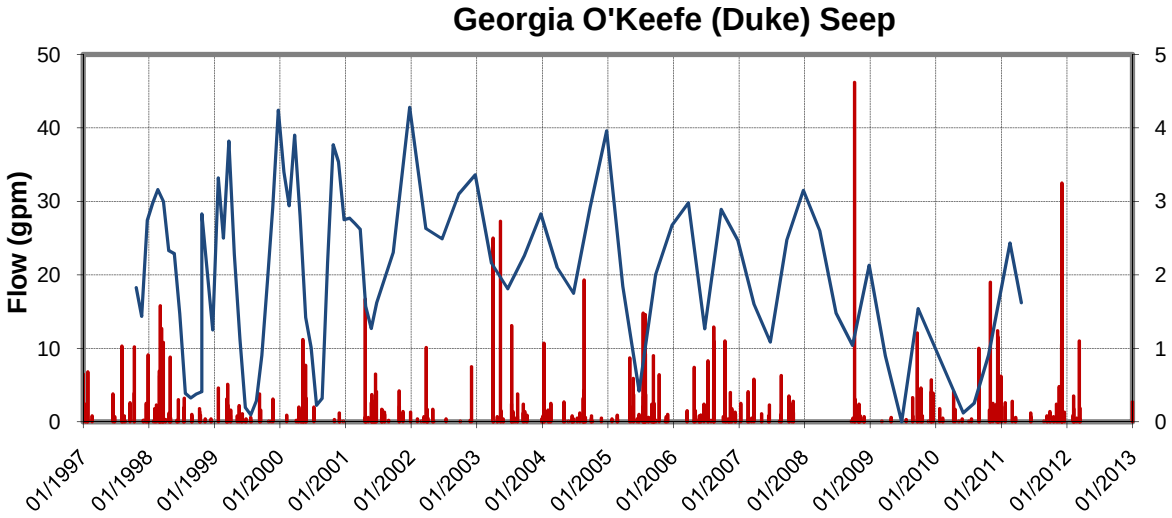
Whiskey Spring



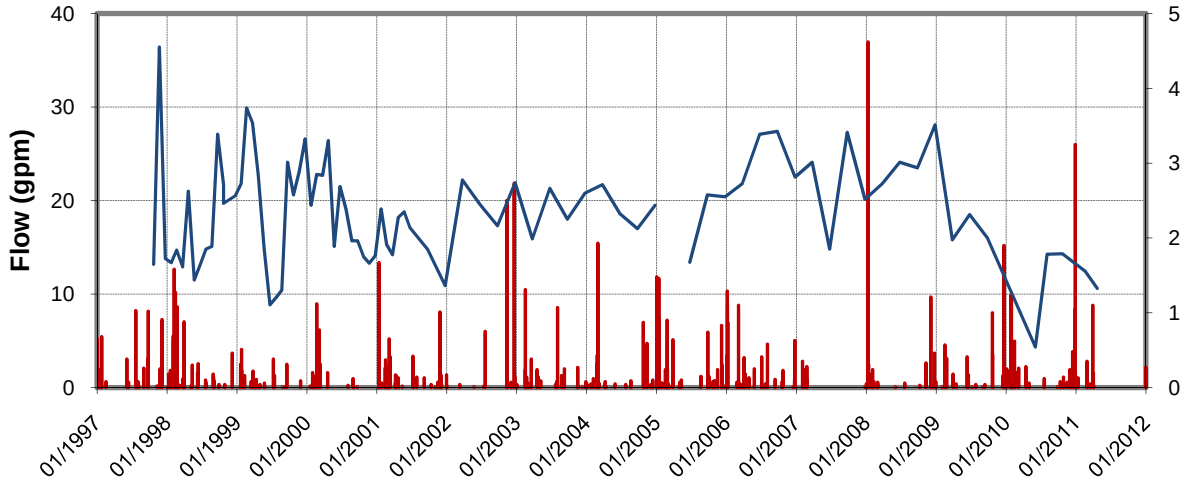
Dirty Socks Flowing Well



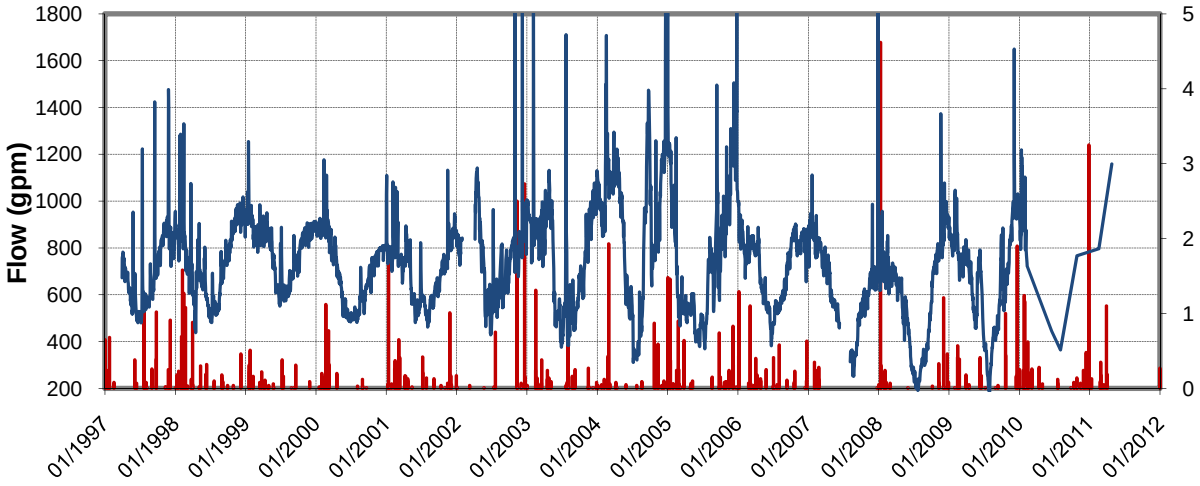

Wahoo Seep
Flow (gpm)
5
4
3
2
1
0
2.5
2.0
1.5
1.0
0.5
0.0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007
01/2008
01/2009
01/2010
01/2011
01/2012

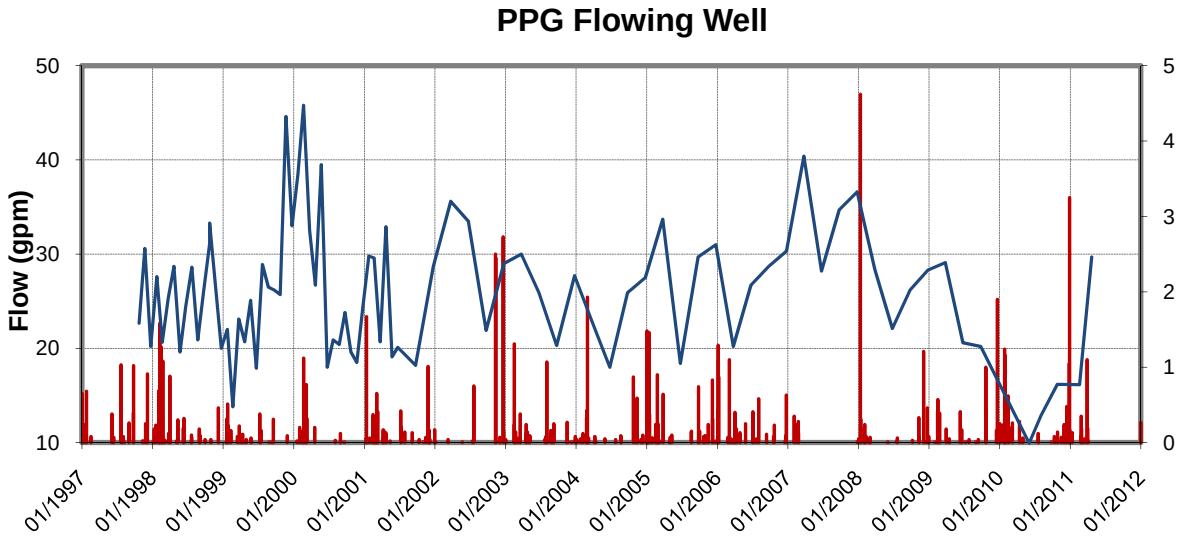

Georgia O'Keefe (Duke) Seep
Flow (gpm)
50
40
30
20
10
0
5
4
3
2
1
0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007
01/2008
01/2009
01/2010
01/2011
01/2012
01/2013

Kaiser Permanente Seep



Cottonwood Spring




PPG Flowing Well
Flow (gpm)
50
40
30
20
10
5
4
3
2
1
0
01/1997
01/1998
01/1999
01/2000
01/2001
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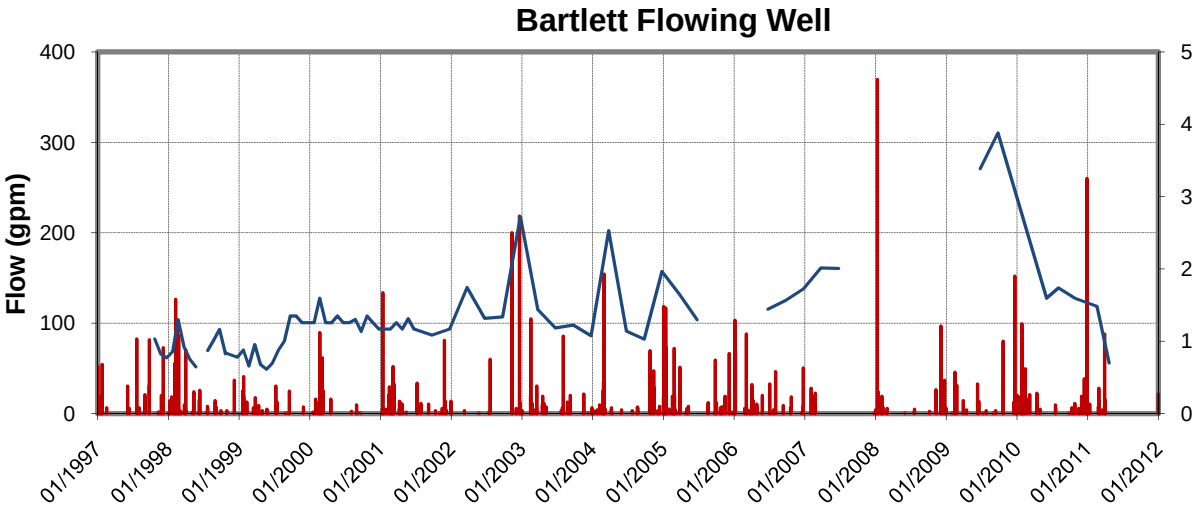
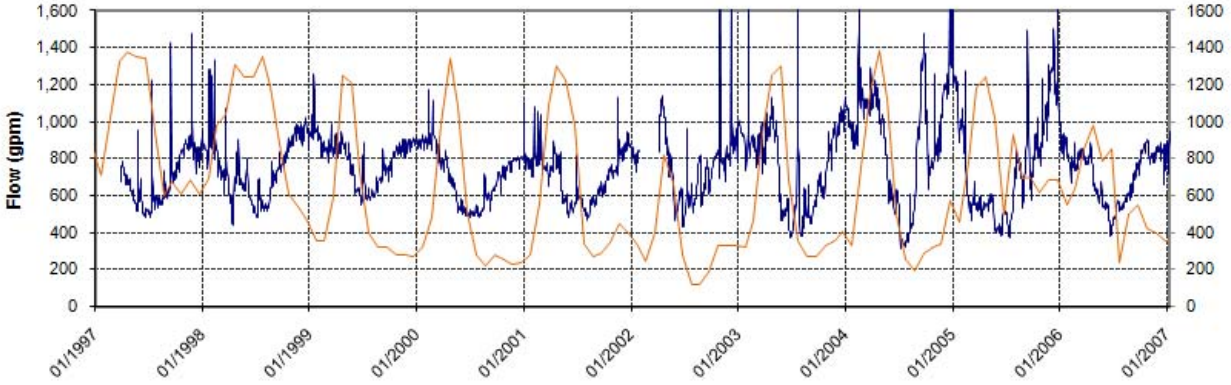
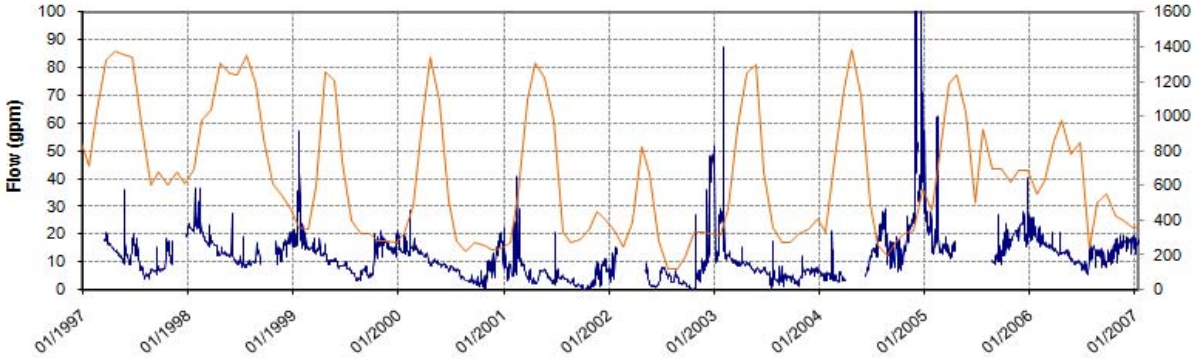
01/2007
01/2008
01/2009
01/2010
01/2011
01/2012


Bartlett Flowing Well
Flow (gpm)
400
300
200
100
0
5
4
3
2
1
0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007
01/2008
01/2009
01/2010
01/2011
01/2012

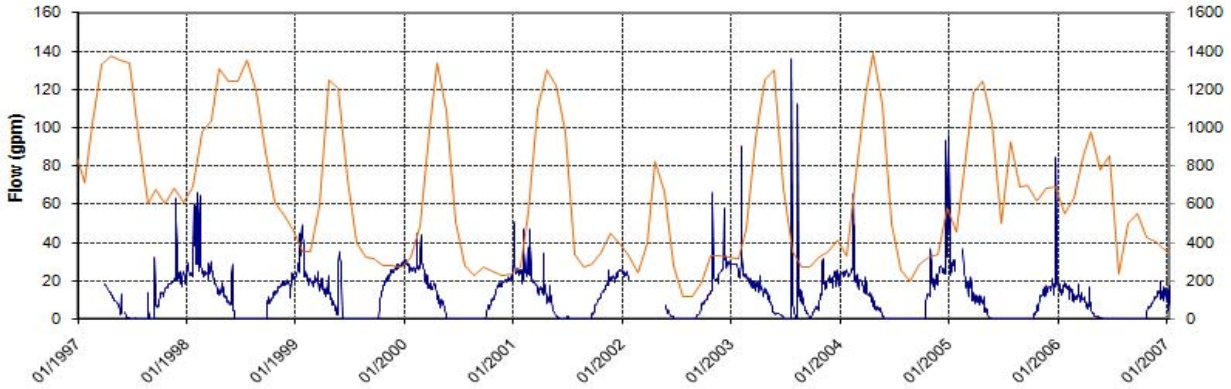
Cottonwood Spring



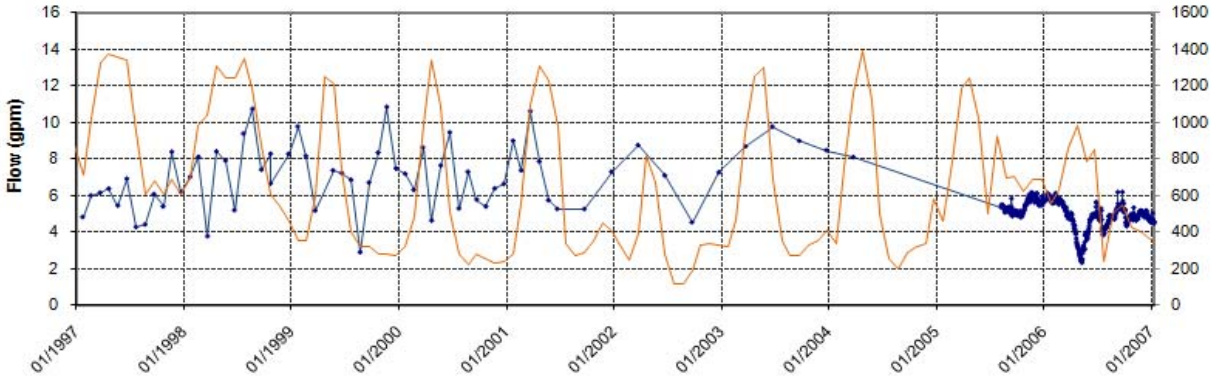
Tubman Channel Spring

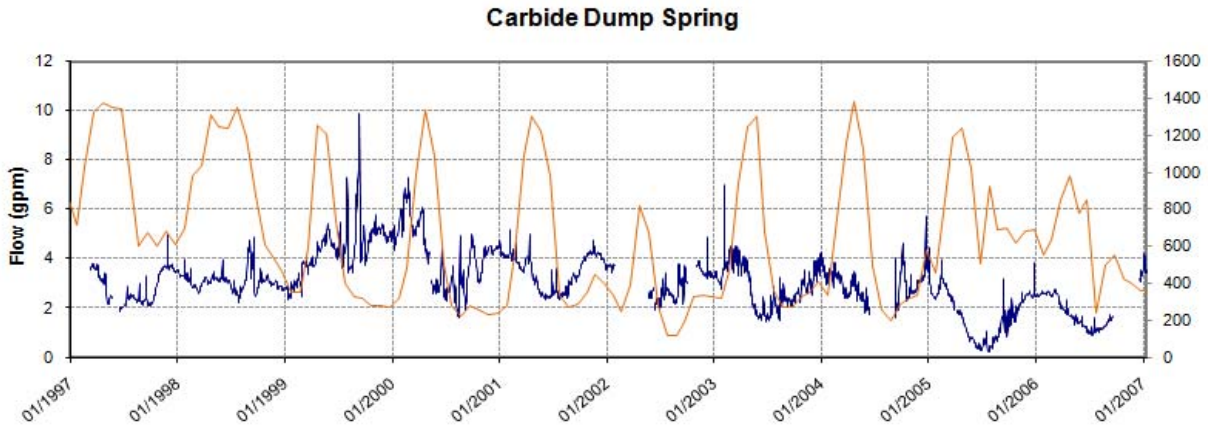


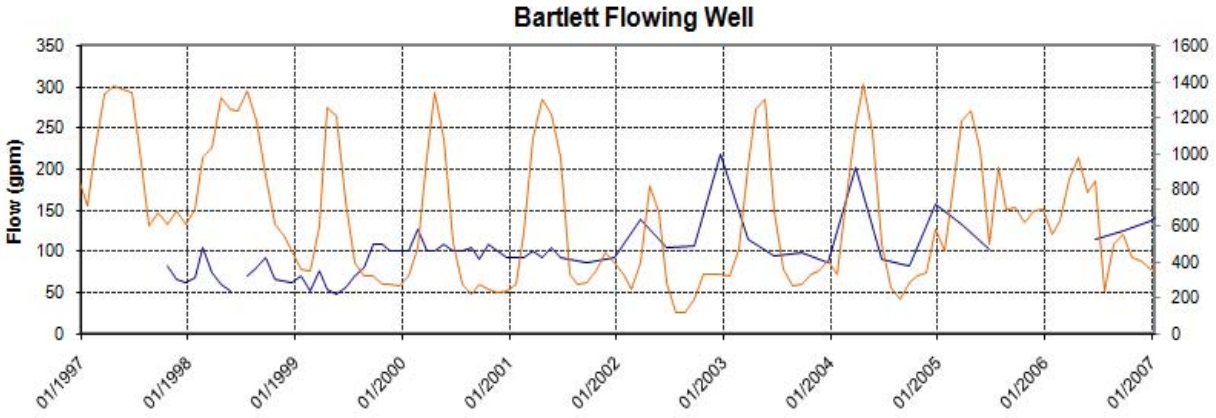
Keeler Spring



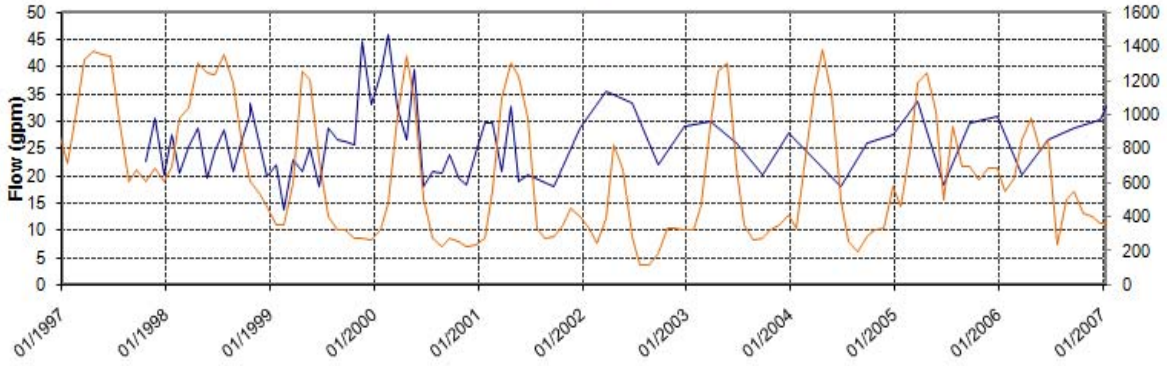
Whiskey Spring



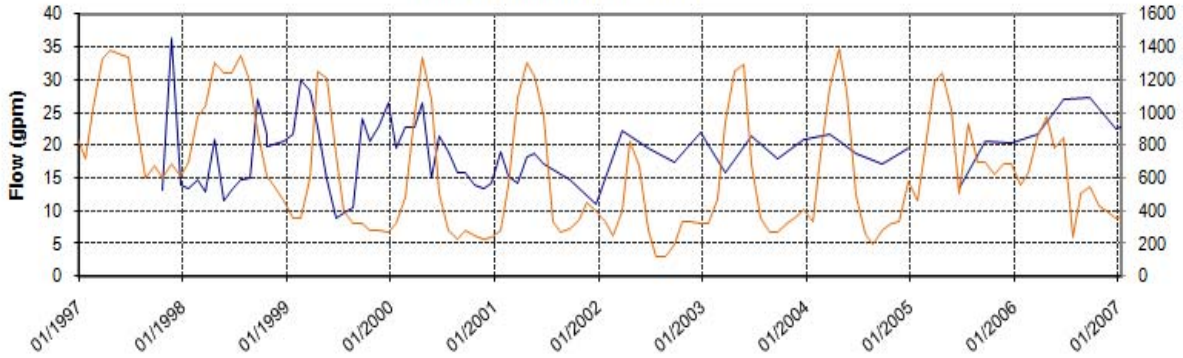

Carbide Dump Spring
Flow (gpm)
0
2
4
6
8
10
12
0
200
400
600
800
1000
1200
1400
1600
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007

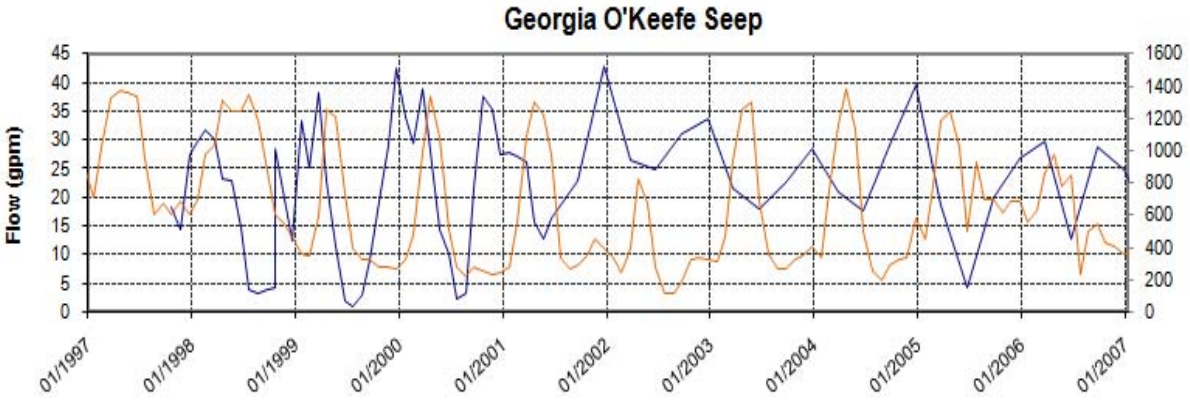

Bartlett Flowing Well
Flow (gpm)
0
50
100
150
200
250
300
350
0
200
400
600
800
1000
1200
1400
1600
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007

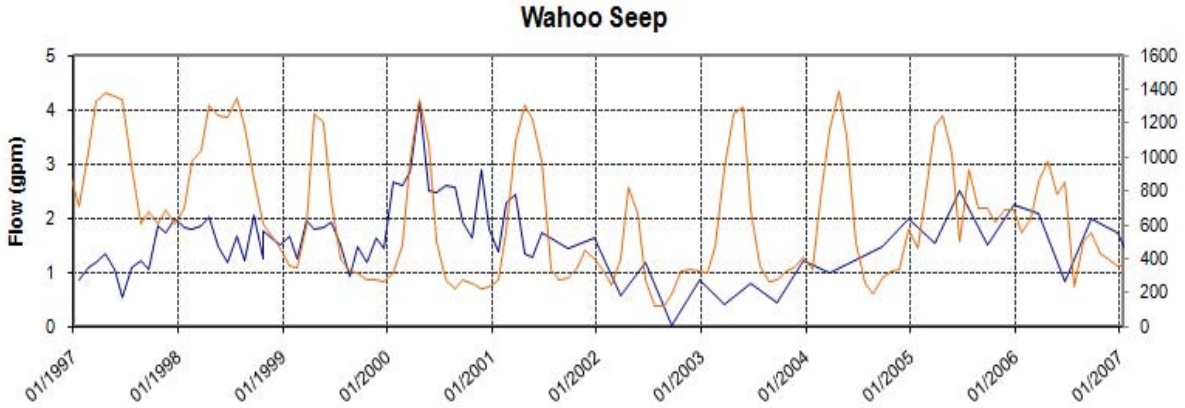
PPG Flowing Well



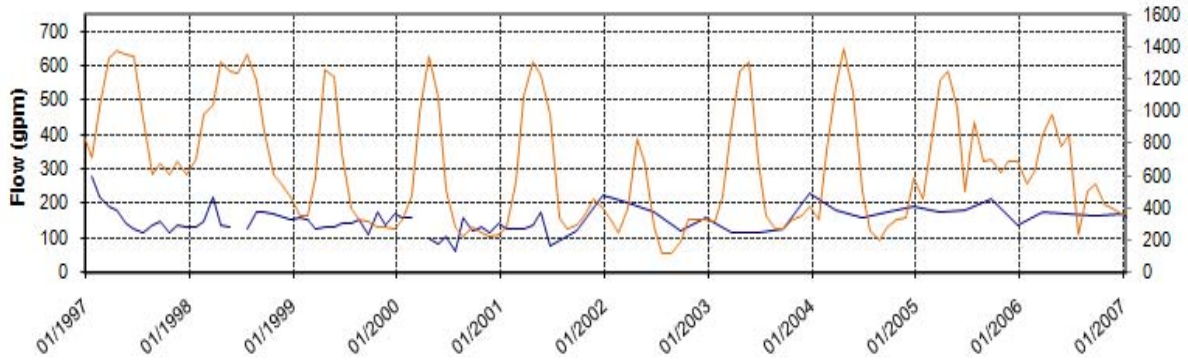
Kaiser Permenente Seep



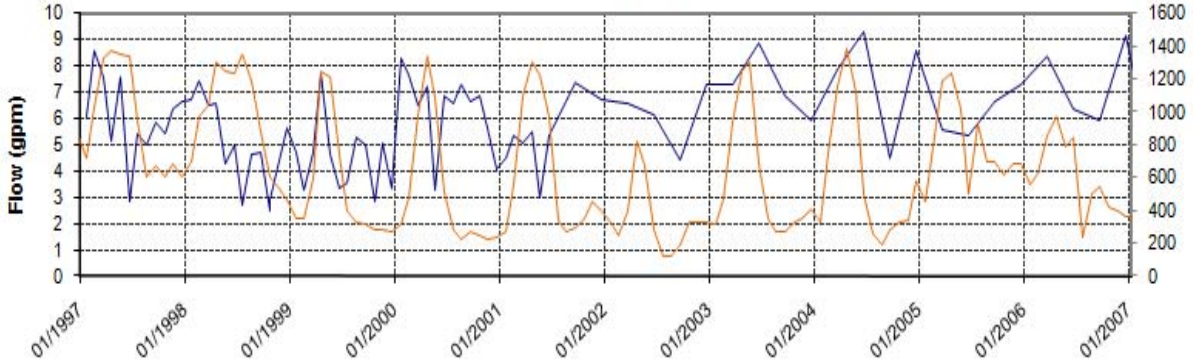

Georgia O'Keefe Seep
Flow (gpm)
45
40
35
30
25
20
15
10
5
0
1600
1400
1200
1000
800
600
400
200
0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007


Wahoo Seep
Flow (gpm)
5
4
3
2
1
0
1600
1400
1200
1000
800
600
400
200
0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007

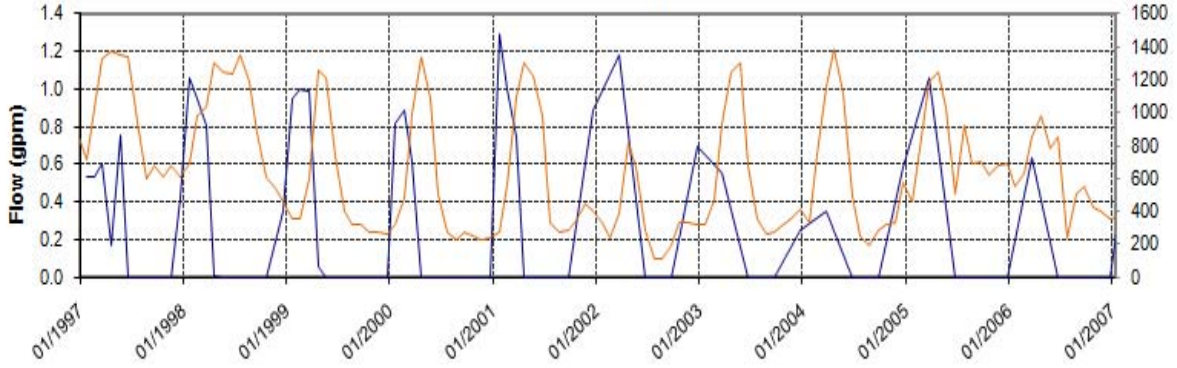
Dirty Socks Flowing Well



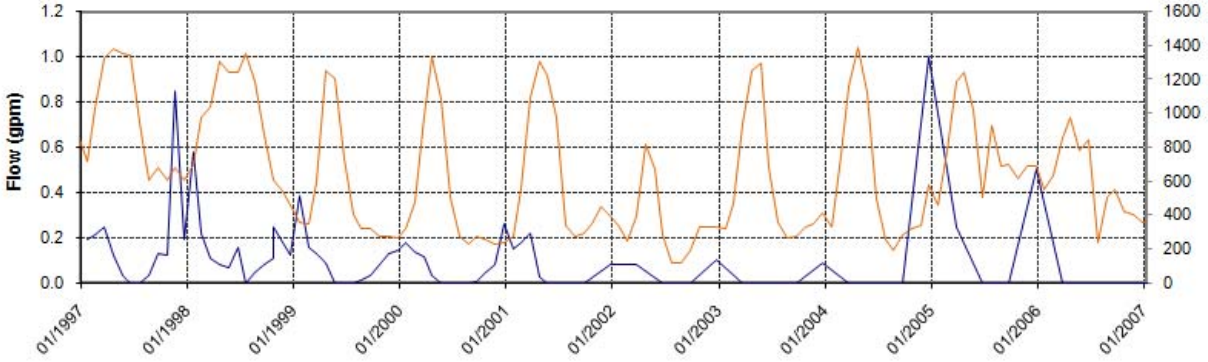
Cement Pond Spring

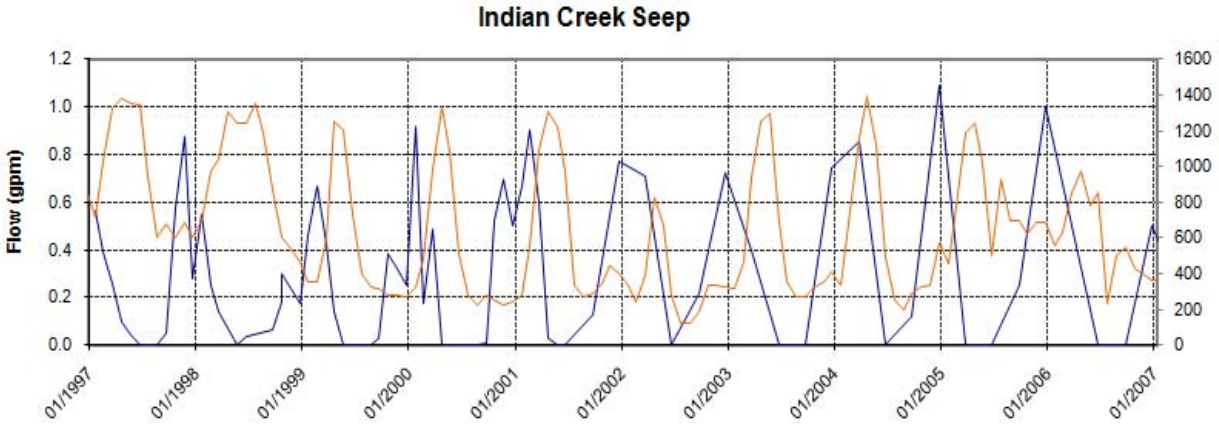


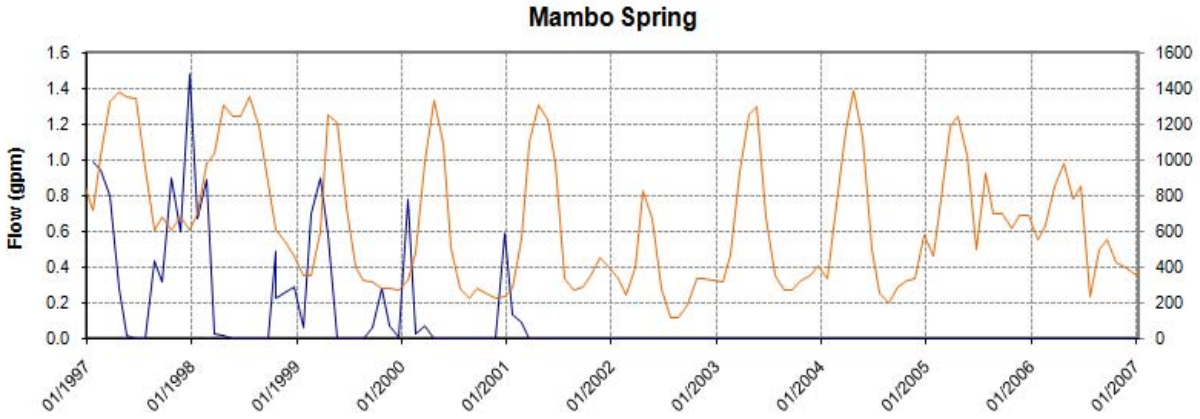
Trucksticker Seep

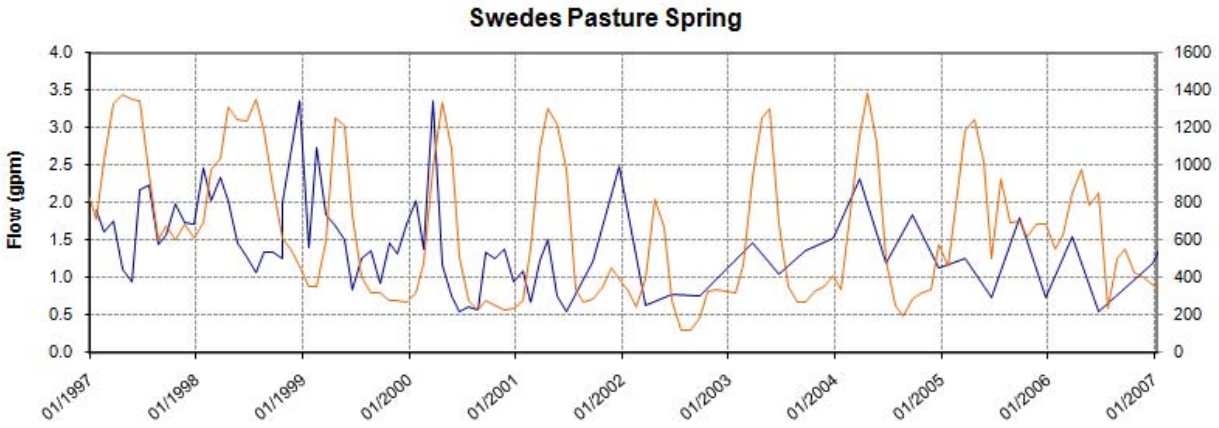


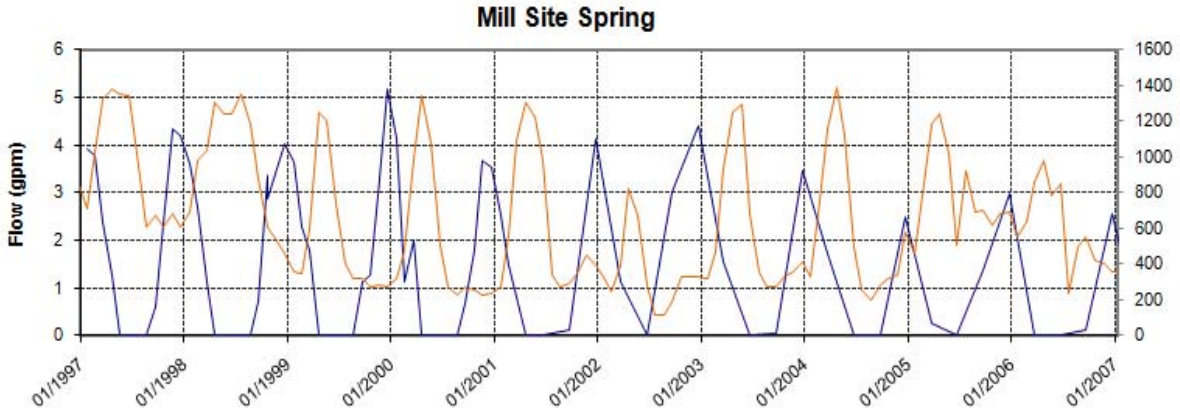
L9 Ditch Seep

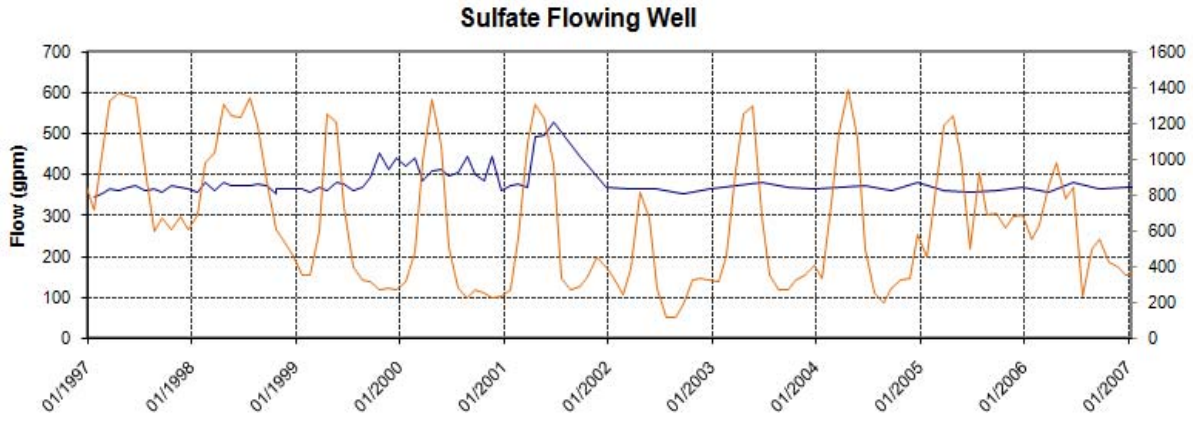


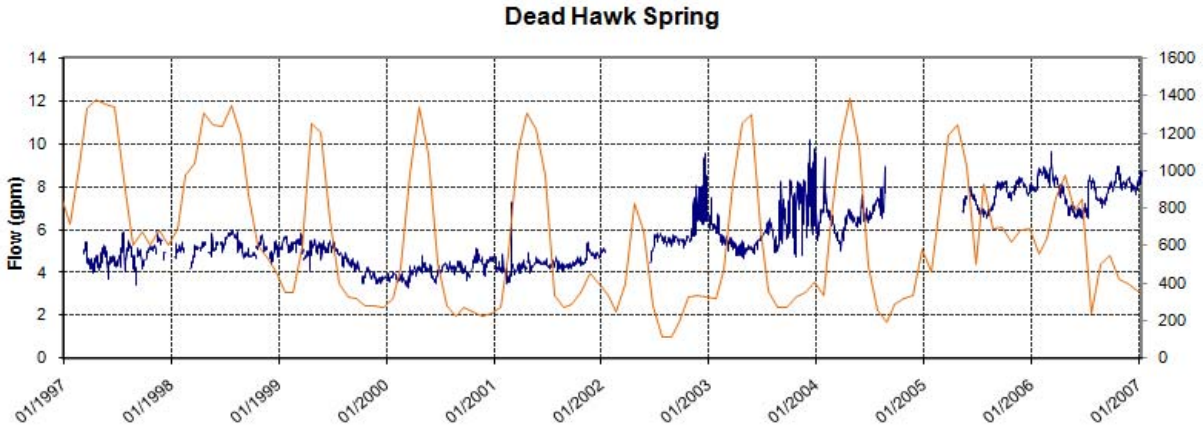

Indian Creek Seep
Flow (gpm)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1600
1400
1200
1000
800
600
400
200
0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007

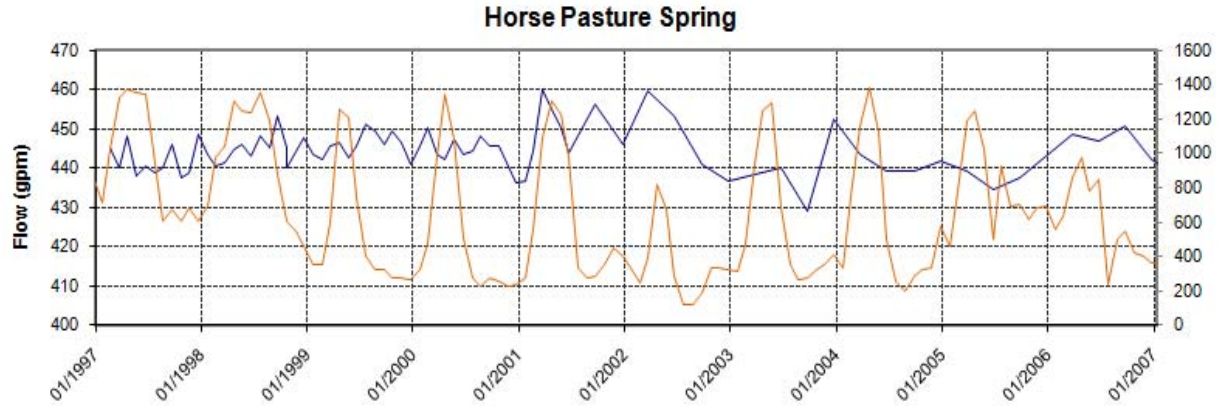

Mambo Spring
Flow (gpm)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1600
1400
1200
1000
800
600
400
200
0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007

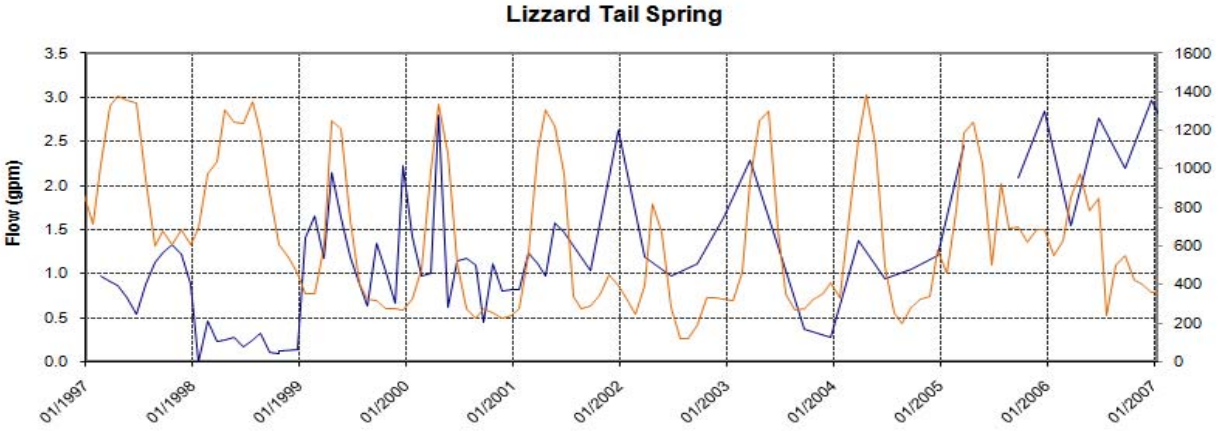

Swedes Pasture Spring
Flow (gpm)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1600
1400
1200
1000
800
600
400
200
0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007


Mill Site Spring
Flow (gpm)
6
5
4
3
2
1
0
1600
1400
1200
1000
800
600
400
200
0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007


Sulfate Flowing Well
Flow (gpm)
700
600
500
400
300
200
100
0
1600
1400
1200
1000
800
600
400
200
0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007

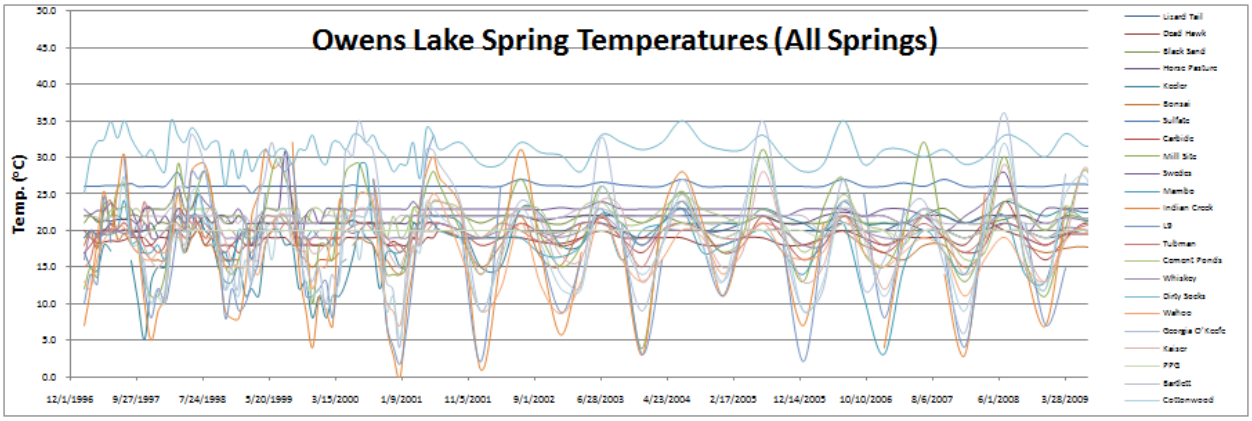

Dead Hawk Spring
Flow (gpm)
14
12
10
8
6
4
2
0
1600
1400
1200
1000
800
600
400
200
0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007

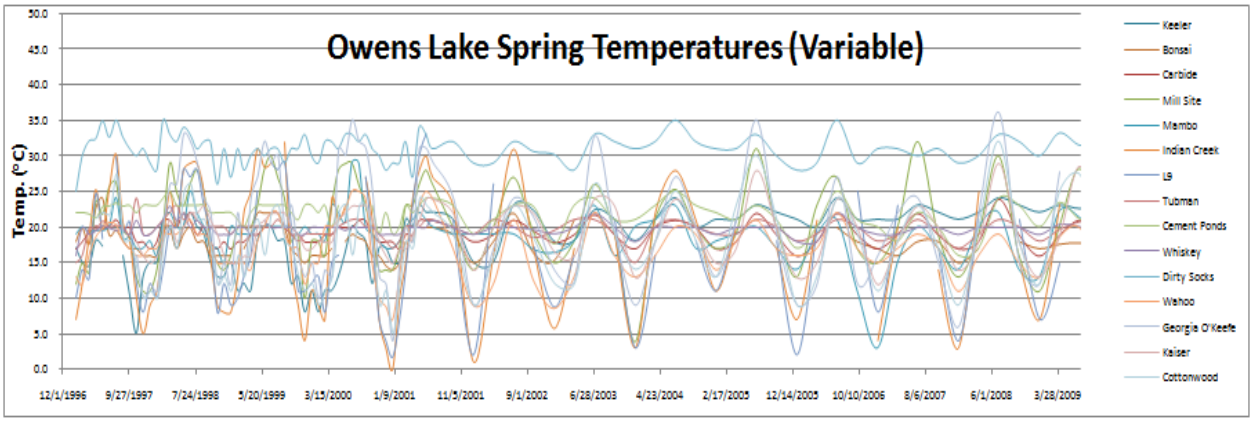

Horse Pasture Spring
Flow (gpm)
470
460
450
440
430
420
410
400
1600
1400
1200
1000
800
600
400
200
0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007

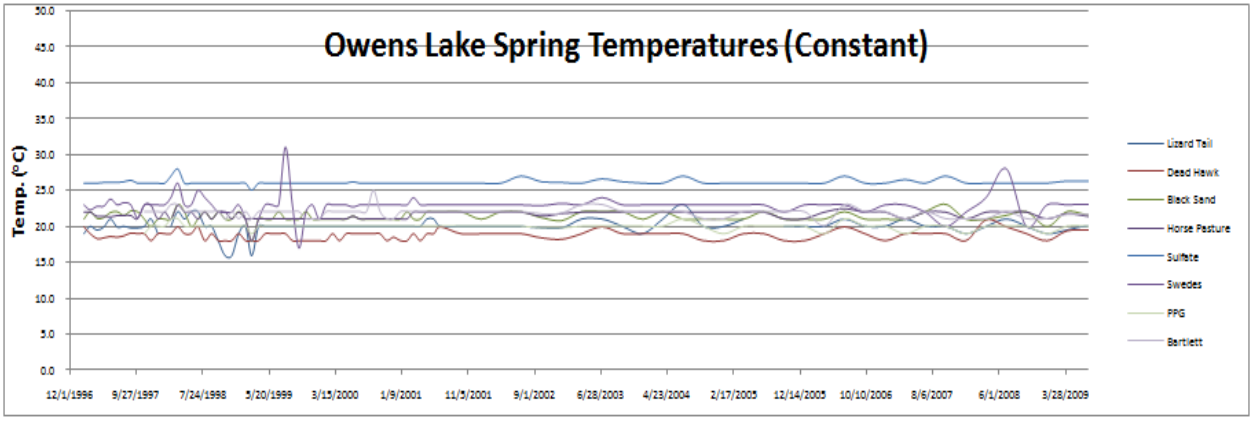

Lizzard Tail Spring
Flow (gpm)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1600
1400
1200
1000
800
600
400
200
0
01/1997
01/1998
01/1999
01/2000
01/2001
01/2002
01/2003
01/2004
01/2005
01/2006
01/2007

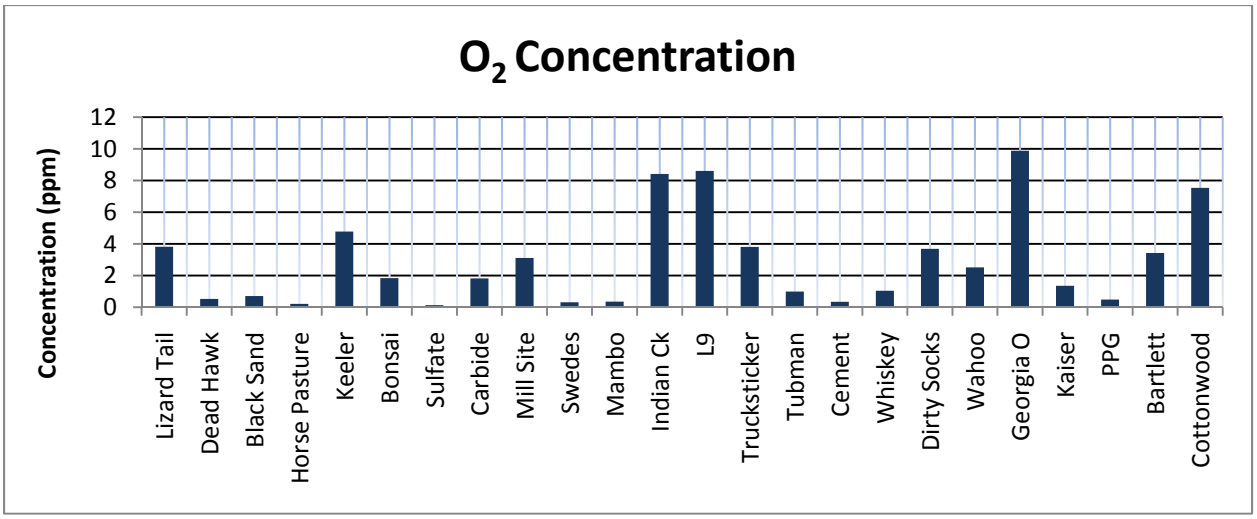
APPENDIX K

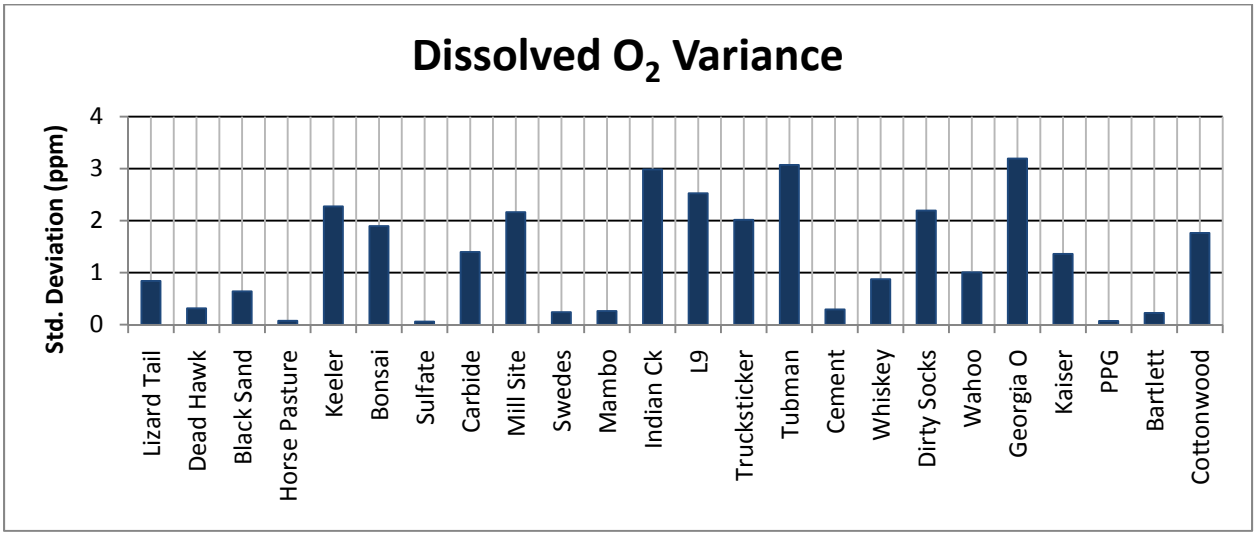
Water Quality Plots for Analysis of Springs

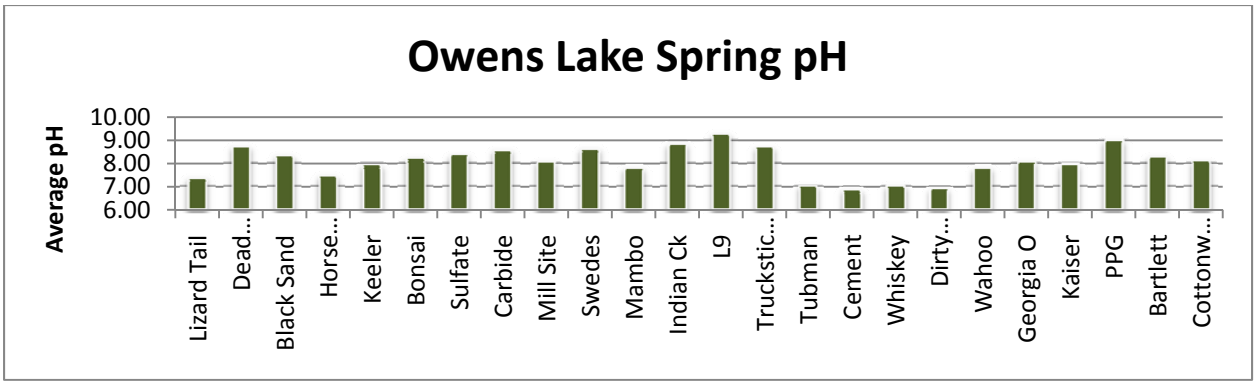

Owens Lake Spring Temperatures (All Springs)
Temp. (°C)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
12/1/1996
9/27/1997
7/24/1998
5/20/1999
3/15/2000
1/9/2001
11/5/2001
9/1/2002
6/28/2003
4/23/2004
2/17/2005
12/14/2005
10/10/2006
8/6/2007
6/1/2008
3/28/2009
Lizard Tail
Dead Hawk
Black Sand
Horse Pasture
Keeler
Bonsai
Sulfate
Carbide
Mill Site
Swedes
Mambo
Indian Creek
L9
Tubman
Cement Ponds
Whiskey
Dirty Socks
Wahoo
Georgia O'Keefe
Kaiser
PPG
Bartlett
Cottonwood

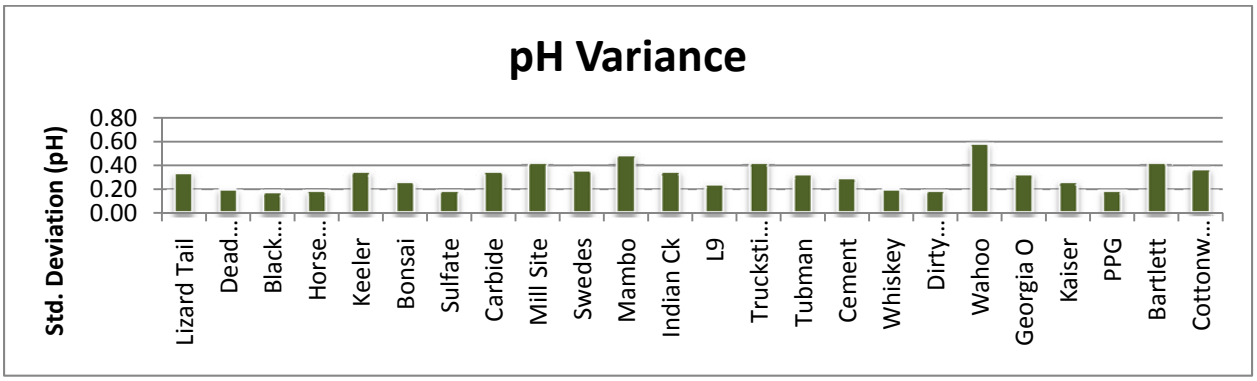

Owens Lake Spring Temperatures (Variable)
Temp. (°C)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
12/1/1996
9/27/1997
7/24/1998
5/20/1999
3/15/2000
1/9/2001
11/5/2001
9/1/2002
6/28/2003
4/23/2004
2/17/2005
12/14/2005
10/10/2006
8/6/2007
6/1/2008
3/28/2009
Keeler
Bonsai
Carbide
Mill Site
Mambo
Indian Creek
L9
Tubman
Cement Ponds
Whiskey
Dirty Socks
Wahoo
Georgia O'Keefe
Kaiser
Cottonwood


Owens Lake Spring Temperatures (Constant)
Temp. (°C)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
12/1/1996
9/27/1997
7/24/1998
5/20/1999
3/15/2000
1/9/2001
11/5/2001
9/1/2002
6/28/2003
4/23/2004
2/17/2005
12/14/2005
10/10/2006
8/6/2007
6/1/2008
3/28/2009
Lizard Tail
Dead Hawk
Black Sand
Horse Pasture
Sulfate
Swedes
PPG
Bartlett


O_2 Concentration
Concentration (ppm)
12
10
8
6
4
2
0
Lizard Tail
Dead Hawk
Black Sand
Horse Pasture
Keeler
Bonsai
Sulfate
Carbide
Mill Site
Swedes
Mambo
Indian Ck
L9
Truckstricker
Tubman
Cement
Whiskey
Dirty Socks
Wahoo
Georgia O
Kaiser
PPG
Bartlett
Cottonwood


Dissolved O_2 Variance
Std. Deviation (ppm)
4
3
2
1
0
Lizard Tail
Dead Hawk
Black Sand
Horse Pasture
Keeler
Bonsai
Sulfate
Carbide
Mill Site
Swedes
Mambo
Indian Ck
L9
Truckstricker
Tubman
Cement
Whiskey
Dirty Socks
Wahoo
Georgia O
Kaiser
PPG
Bartlett
Cottonwood


Owens Lake Spring pH
Average pH
10.00
9.00
8.00
7.00
6.00
Lizard Tail
Dead...
Black Sand
Horse...
Keeler
Bonsai
Sulfate
Carbide
Mill Site
Swedes
Mambo
Indian Ck
L9
Truckstic...
Tubman
Cement
Whiskey
Dirty...
Wahoo
Georgia O
Kaiser
PPG
Bartlett
Cottonw...


pH Variance
Std. Deviation (pH)
0.80
0.60
0.40
0.20
0.00
Lizard Tail
Dead...
Black...
Horse...
Keeler
Bonsai
Sulfate
Carbide
Mill Site
Swedes
Mambo
Indian Ck
L9
Truckstic...
Tubman
Cement
Whiskey
Dirty...
Wahoo
Georgia O
Kaiser
PPG
Bartlett
Cottonw...

APPENDIX L

LADWP Maps and Photographs for Selected Springs Showing the Source Location and Monitoring Points

N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

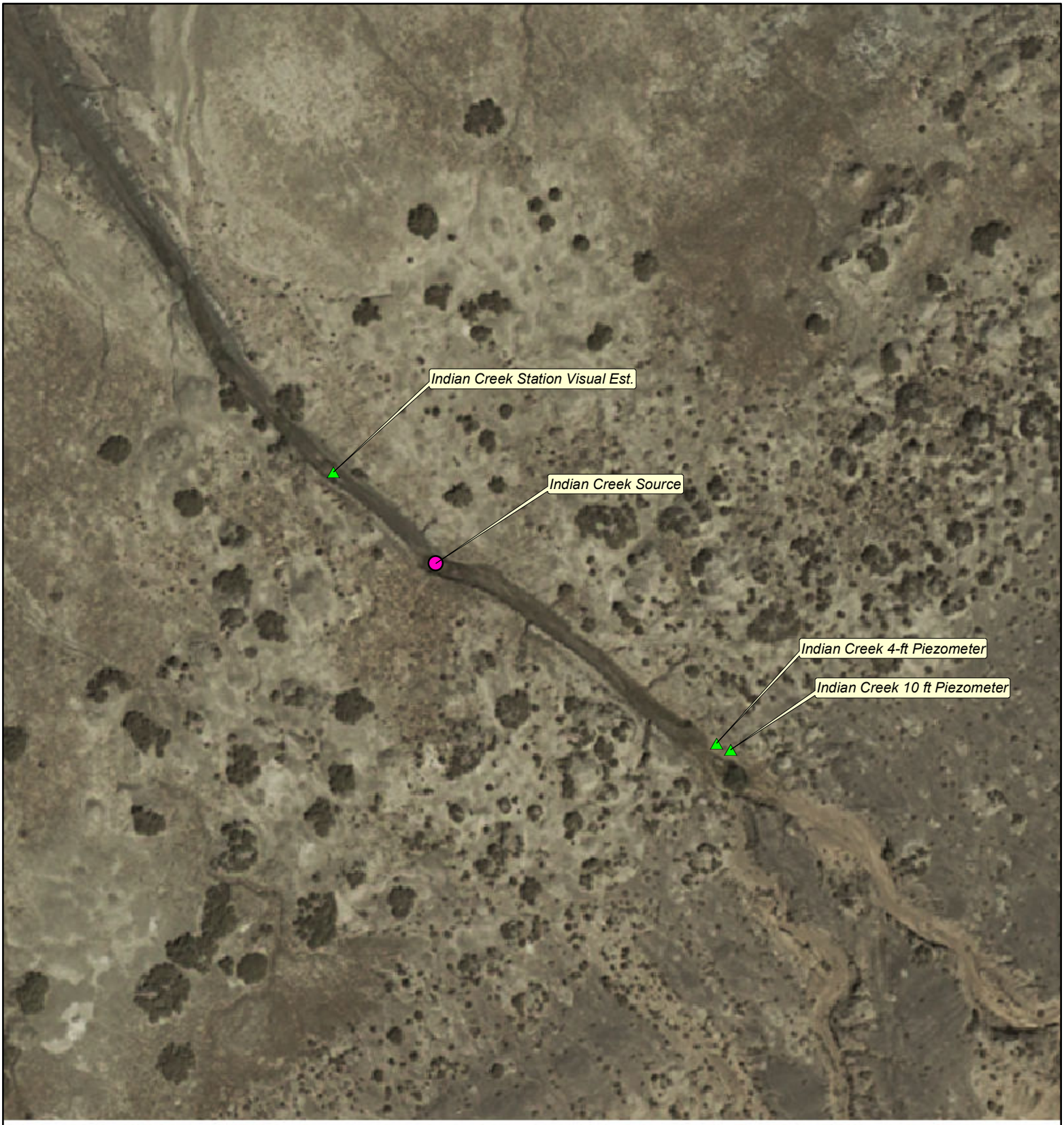
Feet

Legend

Source

Station

Owens Lake Flowing Well



N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

N

100 0 100

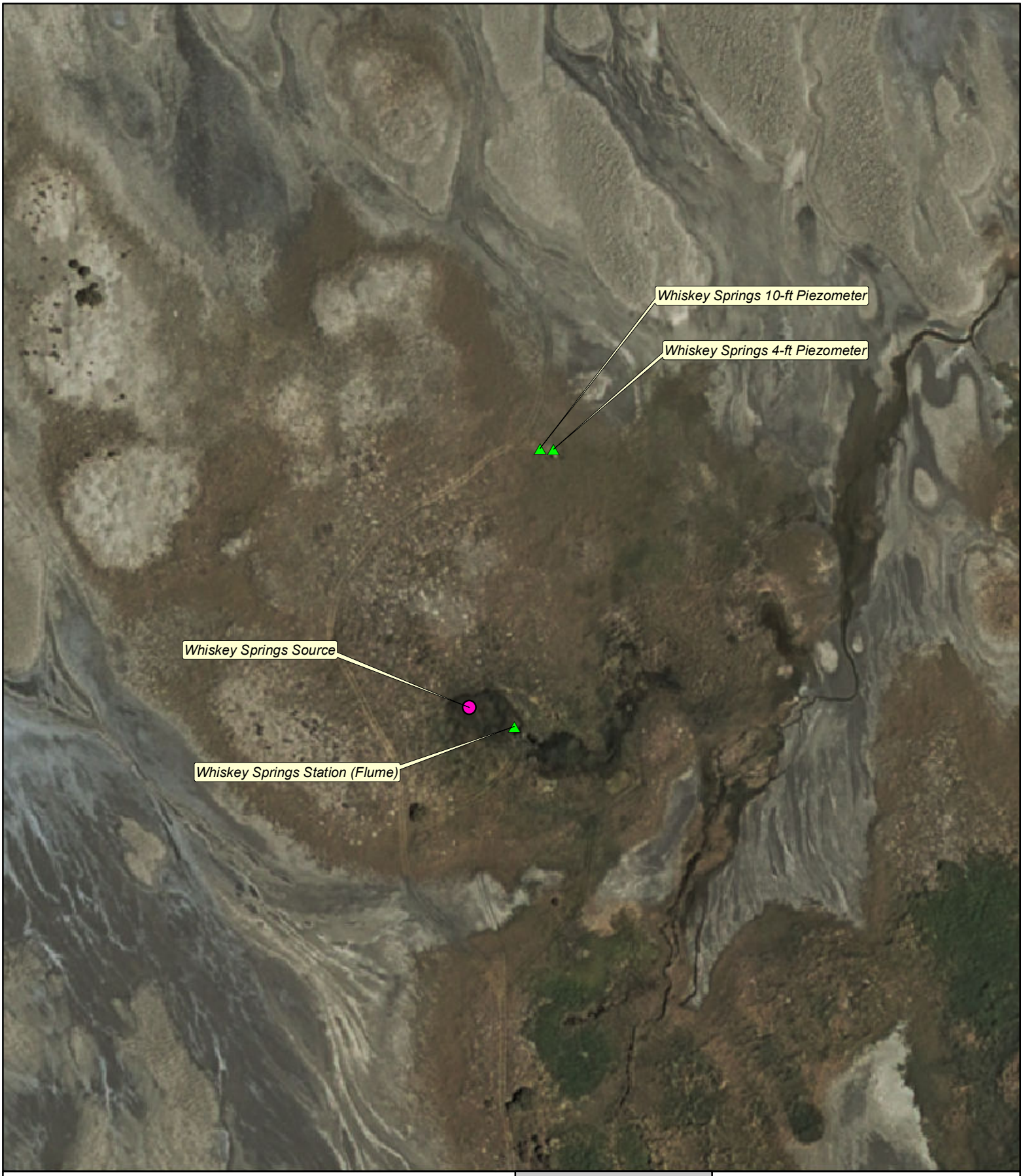
Feet

Legend

Source

Station

Owens Lake Flowing Well



N

100 0 100

Feet

Legend

Source

Station

Owens Lake Flowing Well

Question: Spring Sites that have vegetation upstream of where flow is measured (between spring source and measuring place).

Dirty Socks: Flow measured at round tub. No vegetation upstream.

Wahoo: Flume is at east channel "new" spring location. Flume has been dry. Flume is in middle of tamarisk approximately 10 meters downstream of spring source. Tamarisk may affect flow.

S3: No surface flow measured? [No GPS data on where flow measured. Perhaps not monitored because it is now private property]?

Georgia O'Keefe: Extensive SAM upstream of flow measuring site (flume). Photo looking uphill towards Sierra Nevada.

Kaiser Permanente: Small SAM (much less than Georgia O'Keefe) upstream of flow measuring site (flume). Photos looking uphill towards Sierra Nevada. 24 meters of vegetation from spring source to measuring site.


07/11/2011 09:06


07/11/2011 09:06

Cottonwood: Extensive SAM above flume. About 200 meters from spring source to flow measuring site. Photo looking uphill toward Sierra Nevada.

PPG: Small SAM above flume. Flow measuring site 10 meters downstream of spring source. Photo looking uphill towards Sierra Nevada.

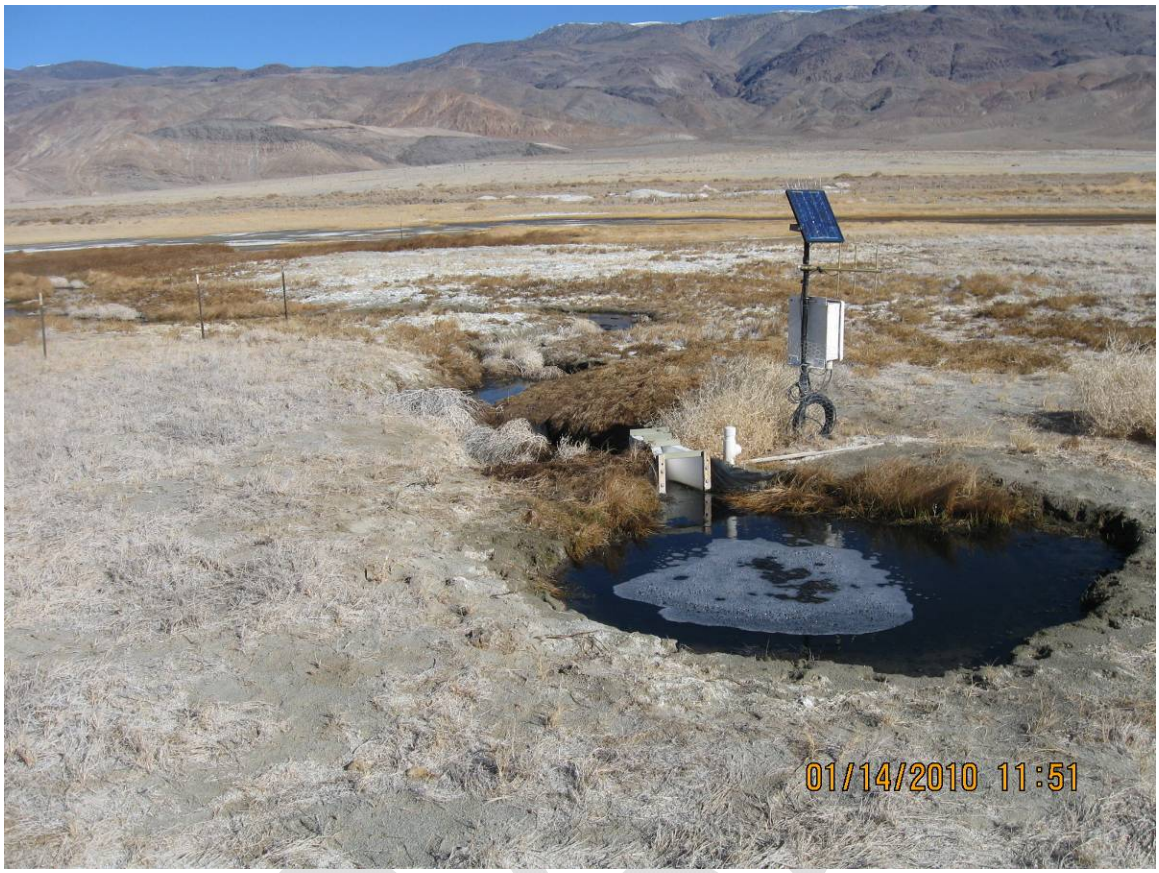
Bartlett: No vegetation before flow measuring location. Flow measured inside wellhead.

C4 Lizard Tail: No surface flow measuring site.

Dead Hawk: No vegetation upstream of where flow measured.

Horse Pasture: No vegetation above flume. No surface flow measuring site.

Black Sands: No vegetation before flume.



F8: No surface flow monitoring site.

Bonsai Mound: No surface flow monitoring.

Keeler Spring: Vegetation before where flow is measured. About 500 meters of vegetation from source to flow measuring site.

Sulfate Well: Flow measured at source. No vegetation between source and where flow is measured.

Carbide Dump: Extensive SAM above where flow is measured (flume is located at green dot on Grace's pdf- F2 question). There is 50 meters of vegetation between spring source and flow measuring site.

Mill Site: Small amount of vegetation above piezometers. About 100 meters between Mill Site spring source and station where flow is measured.

Swedes Pasture: Vegetation (SAM) immediately above flume. However, Swedes Pasture spring source and measuring station are recorded as same location.

I10: No surface flow measured.

J10: No surface flow measured.

J11 Mambo: Extensive SAM above flume. About 50 meters between Mambo spring source and where flow is measured. However, flume was dry in July 2011.

K10: No surface flow measured.

Indian Creek: There is about 24 meters between the Indian Creek source and where flow is visually estimated. Both the source and where flow is visually estimated are below the piezometers. There is some DISP and TYDO between the source and where flow is estimated.

L9: No surface flow measured.

L9 Ditch: The L9 source is at the site where a visual estimate is done.

M8: No surface flow measured.

Truckstricker N8: From spring source to where flow is measured is 35 meters. Some vegetation (DISP). Flume dry July 2011.

Tubman Channel N7: There is 150 meters between the spring source and the monitoring station. There is some vegetation between the spring source and monitoring station (SAM).

Tubman Cement Pond: About 32 meters from spring source to surface flow measuring site. Vegetation above flume.

O6: No surface flow measured.

Whiskey Springs: Approximately 10 meters between spring source and surface measuring station. Extensive SAM above flume.