Stantec Consulting Services Inc.
3437 Empresa Drive, Suite A
San Luis Obispo CA 93401-7355
Tel: (805) 546-0455
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September 6, 2016

Mr. Mark Crisp
PC Inc.
P.O. Box 2116
Nipomo, California 93444

Dear Mr. Crisp,

SUBJECT: Results of Groundwater Resources Evaluation for Proposed Greenville Estates Subdivision, Stagecoach Road and El Sueno Way, Arroyo Grande Area San Luis Obispo County, California

Introduction

On behalf of PC Inc., Stantec Consulting Services has completed a review of potential groundwater resources to provide future water supply to above referenced development. The scope of work for this project has included a review of the currently proposed single-family residential development, estimation of future water demand associated with the project, and a review of previous hydrogeological data and reports for the project site. The purpose of this work was to evaluate water demand of the project, available groundwater resources to support the proposed project, and the water supply development needs for the property.

Site Location and Description

The subject property consists of an approximately 36.7 acre parcel (APN 047-181-001) located at the northern terminus of Stagecoach Road in the Arroyo Grande area of unincorporated San Luis Obispo County (Figure 1). The parcel is rectangular is shape with surface elevations ranging from approximately 275 feet above mean sea level (msl) near the southeastern corner of the property to approximately 450 feet msl on the western portion of the property (Figure 2). Surface topography at the property is characterized as hilly with a shallow canyon trending northeast/southwesterly across the central portion of the property. The property is currently undeveloped and vegetated with coastal live oak, chaparral, and grasses. Surrounding properties consist of a combination of undeveloped land and rural residential developments.

Hydrogeologic Setting

The Property is located in the Southern Coast Ranges geomorphic province of California. The Coast Ranges extend to the San Francisco Bay to the north and to the Santa Ynez River to the south. The Coast Ranges are characterized by northwest-southeast trending mountain ranges and intervening valleys which are generally separated by faults.

The Property is further located in the coastal hills northeast of the Village of Arroyo Grande, situated on a ridge between the Arroyo Grande Creek Valley to the east and Corbett Canyon to the west. The creek valleys are underlain by unconsolidated alluvial sediments of Quaternary age. This alluvium is in turn underlain by weakly consolidated sand, gravel and conglomerate deposits of the Pliocene/Pleistocene age Paso Robles Formation. Beneath the Paso Robles

Formation are marine sedimentary strata of the Pliocene age Pismo Formation. The Pismo Formation is typically underlain by marine siltstone and shale of the Miocene age Monterey Formation.

Shallow groundwater is generally present in an unconfined condition within the unconsolidated alluvium deposited along local creeks such as the Arroyo Grande Creek. Deeper groundwater is present within the underlying sedimentary deposits of the Pismo Formation. Geologic maps of the area indicate that the property is underlain by the upper members of the Pismo Formation known as the Squire and Edna members. These units consist of fine to coarse grained sandstone containing minor fractions of gravel and silt. Locally, private wells tap the Pismo Formation and are used for domestic and livestock supply. Depth to uppermost groundwater within the Pismo Formation depends upon local topography but typically occurs at depths greater than 200 feet bgs in the elevated hilly areas, such as the subject property location.

Current Development Plans

Stantec reviewed a tentative tract map for the Greenville Estates subdivision prepared for the property by Omni Design Group. The map depicts a total of 21 residential lots ranging in size from 1.00 to 3.16 acres (gross). A single proposed road leading from the north end of Stagecoach Road to the east-central portion of the property would provide primary access to the 21 proposed residential lots.

Water Demand Analysis

Stantec estimated the future water demand for the proposed Greenville Estates development using water demand (water duty) factors obtained from the following sources:

- California Department of Water Resources, *Methodologies for Calculating Baseline and Compliance Urban per Capita Water Use*, February 2011;
- California Department of Water Resources, *Model Water Efficient Landscape Ordinance*, 2009;
- US Department of Energy, *Guidelines for Estimating Unmetered Landscaping Water Use*, July 2010;
- County of San Luis Obispo, Department of Planning and Building, *Laetitia Agricultural Cluster Subdivision Tentative Tract Map and Conditional Use Permit, Recirculated Draft Environmental Impact Report*, April 2012;
- City of Arroyo Grande, *Urban Water Management Plan, 2010 Update*, January 2012.

<u>Indoor Use</u>:

US EPA and California DWR indoor water use estimates range from 0.20 to 0.29 acre feet per year (AFY) per residential unit. Assuming the new residences would be occupied year round by four residents on average and be constructed with low flow water conserving fixtures and appliances, an indoor water duty factor of 0.29 AFY was selected for the project.

Because the size of the lots for the proposed Greenville Estates development are sufficient to accommodate a secondary residential unit such as a guesthouse, a water duty factor of 0.16 AFY was assigned to a secondary residential unit, which is characteristic of typical residential water demand for an apartment unit.

Outdoor Use:

The California DWR and US Department of Energy methods provide estimates of 0.069 to 0.072 AFY/unit for outdoor water use. Assuming that the residential building sites would be landscaped with minimal turf (lawn) and primarily with drought tolerant landscaping on drip irrigation, an outdoor water duty factor of 0.070 AFY/unit was used. The estimated outdoor water demand does not include landscaping of the subdivision common areas (entrance, sidewalk areas, berms, etc.) which is assumed by Stantec to be minimal.

Total Water Demand:

A combined indoor and outdoor water duty factor of 0.36 AFY/unit was used for each residence in the proposed subdivision. This residential water demand factor is comparable to the 2010 single-family use of 0.349 reported in the Arroyo Grande UWMP and with the 2015 projection of 0.378 AFY per single-family residence within the City. However, to accommodate the potential for secondary guesthouse units, an additional water demand of 0.16 AFY was conservatively added to each lot, to reflect the eventual build out scenario of a secondary residential unit on each lot within the development. Accordingly, the total water duty factor assigned to each of the 21 lots was 0.52 AFY.

Using the water duty factor of 0.52 AFY/lot, the calculated total project water demand is 10.92 AFY for 21 new residences (and guesthouses) on the property. For the purposes of this evaluation, it was assumed that the water demand for the proposed development would be met wholly by groundwater resources available beneath the subject property. It was also assumed that the residences would be connected to private septic systems.

Groundwater Resources

One existing water supply well (Well No. 1) is located on the northern portion of the property (Figure 2). The well boring was drilled to a total depth of 600 feet below ground surface (bgs) in January 2013 and geophysical (electric) logging of the borehole was performed. The well was completed to a total depth of 460 feet bgs and constructed with 5-inch diameter PVC casing. The perforated interval of the casing extends from 200 to 460 feet bgs, for a well screen length of 260 vertical feet. A copy of the geophysical log and the California DWR Well Completion Report are included as an attachment.

Short Term Pumping Test

In January 2014, the well driller, Filiponi & Thompson Drilling Inc., conducted a 4-hour pumping test of the well using a submersible pump. The static depth to groundwater prior to pumping was measured at 230.9 feet bgs. The test was initiated at a pumping rate of 68 gallons per minute (gpm) but was reduced to 50 gpm after the first hour and remained steady for the remainder of the test. At the end of the four hours or pumping, the water level was measured at 337.7 feet bgs, indicating 106.8 feet of drawdown. After pumping, water level recovery was gauged for a period of one hour. The water level in the well had recovered to 241.4 feet bgs after 60 minutes, indicating a recovery to within 10.5 feet of the pre-pumping static water level.

This short duration pump test suggests that Well No. 1 is likely capable of a sustained yield of at least 40 gpm or 57,600 gallons per day (also equivalent to 64.5 AFY).

Constant Rate Pump Test

Stantec reviewed a report dated May 2015 by Cleath-Harris Geologists, Inc. that described the results of a 72-hour constant rate pump test conducted at the property in March 2015. As part of the aquifer test, four surrounding private domestic wells were utilized for water level monitoring. The domestic wells ranged in distance from 330 feet to 910 feet from the pumping well (Well No. 1). A pressure transducer was installed in Well No.1 to continuously record water level during pumping, whereas the four nearby domestic wells were gauged manually. The average pumping rate in Well No. 1 was 41 gpm which resulted in a drawdown of 85.69 vertical feet at the end of the 72-hour pumping test. Recharge in Well No. 1 was monitored every 2 to 5 minutes for the first hour following the end of pumping, and intermittently afterward. After one hour of recharge monitoring, the water level in the well remained 14.24 feet below the pre-pumping static water level.

Cleath-Harris used the drawdown measurements obtained from the four nearby domestic wells to create a distance-drawdown plot in order to calculate aquifer characteristics including Transmissivity (T) and Storage Coefficient (S). Drawdown in the domestic observation wells near the end of the pumping phase ranged from 3.72 feet of drawdown in the nearest well (330 feet from Well No. 1) to 0.18 feet in the farthest well located 910 from Well No. 1. Values of 3,732 gallons per day per foot (gpd/ft) for T and 0.0033 for S (dimensionless) were calculated from the distance-drawdown plot. Using the trasmissivity value of 3,732 gpd/ft and the total drawdown of 85.69feet, the empirical effective radius of the well is 1,000 feet.

Using the aquifer properties calculated from the pumping test data, Cleath-Harris modeled estimated water level interference that could occur in surrounding domestic wells created by pumping Well No. 1 for a period of one year. The methodology used assumes that groundwater level declines (cone of depression) will expand uniformly around the pumping well (Well No. 1) and that no recharge (rain percolation, septic system infiltration, irrigation water return) to the aquifer occurs. The calculated water level interference (drawdown) within the aquifer ranged from 2.8 feet at 500 feet from Well No. 1 to 2.1 feet at 1,000 feet away to 1.5 feet of drawdown at 2,000 feet from the pumping well. However, for the water level interference modeling, Cleath-Harris used a water demand factor (23 AFY) approximately two times higher than the project demand (10.92 AFY) estimated by Stantec herein. Accordingly, the water level interference within the aquifer would be significantly less at the current water demand estimated for the Greenville Estates development.

Aquifer testing data compiled by Cleath-Harris are included in the attachments.

Water Supply Development

In addition to the domestic water needs of the 21 proposed residential lots, fire protection supply and backup supply will also be needed for the development. Accordingly, Stantec assumes that at least one, and possibly two, additional supply wells will be completed on the property and incorporated into the project. Although the additional wells would likely be completed at depths similar to Well No. 1, they could be constructed with larger diameter casing to increase the efficiency of the wells. It is also assumed that one or more storage tanks will be included in the final water system design for the project, to provide for the necessary fire protection volume and backup domestic supply.

Summary and Conclusions

Based on the development plan for the proposed Greenville Estates reviewed by Stantec, the total water demand for the subdivision was estimated at 10.92 acre feet per year (AFY) at total

project build out. The single existing water supply well on the property was demonstrated to have a sustainable yield of 41 gallons per minute (gpm) during a 72-hour aquifer test conducted by others in 2015. At the end of the pump test, water level drawdown in the well was 85.7 feet, leaving 140 vertical feet of water column remaining in the well. Using the aquifer characteristics calculated from the distance-drawdown data from the pump test, simulated water level interference created by the project well on surrounding private domestic wells was evaluated. The water level interference values calculated were made using a water demand of 23 AFY for the project, or approximately twice the demand calculated by Stantec. Accordingly, actual water level interference created by groundwater extraction at the project site would be significantly less, and within acceptable ranges. No surface water bodies, riparian areas, or wetlands are present at the project site or in the immediately surrounding area that could be impacted by groundwater supply development at the site.

In summary, the sandstone aquifer within the Tertiary age Pismo Formation beneath the subject site is capable of yielding sufficient groundwater supply for the proposed project. The existing supply well could readily provide for the entire water demand of the development, but would be supplemented with an additional well(s) and storage capacity to meet the necessary backup supplies required for the development.

Limitations

The conclusions and opinions expressed herein are based on a review of work performed by others and independent estimates made by Stantec. All work has been conducted in accordance with generally accepted practices in the fields of environmental engineering, geology, and hydrogeology. No other warranty, either expressed or implied, is made.

Thank you for this opportunity to provide environmental services. Should you have any questions regarding the information presented herein, please do not hesitate to contact this office at (805) 546-0455.

Sincerely,

Stantec Consulting Services Inc.

REGISTERED GEOLOGIST
STEPHEN W. LITTLE
No 4945
STATE OF CALIFORNIA

Steve Little, PG, CHG
Senior Geologist

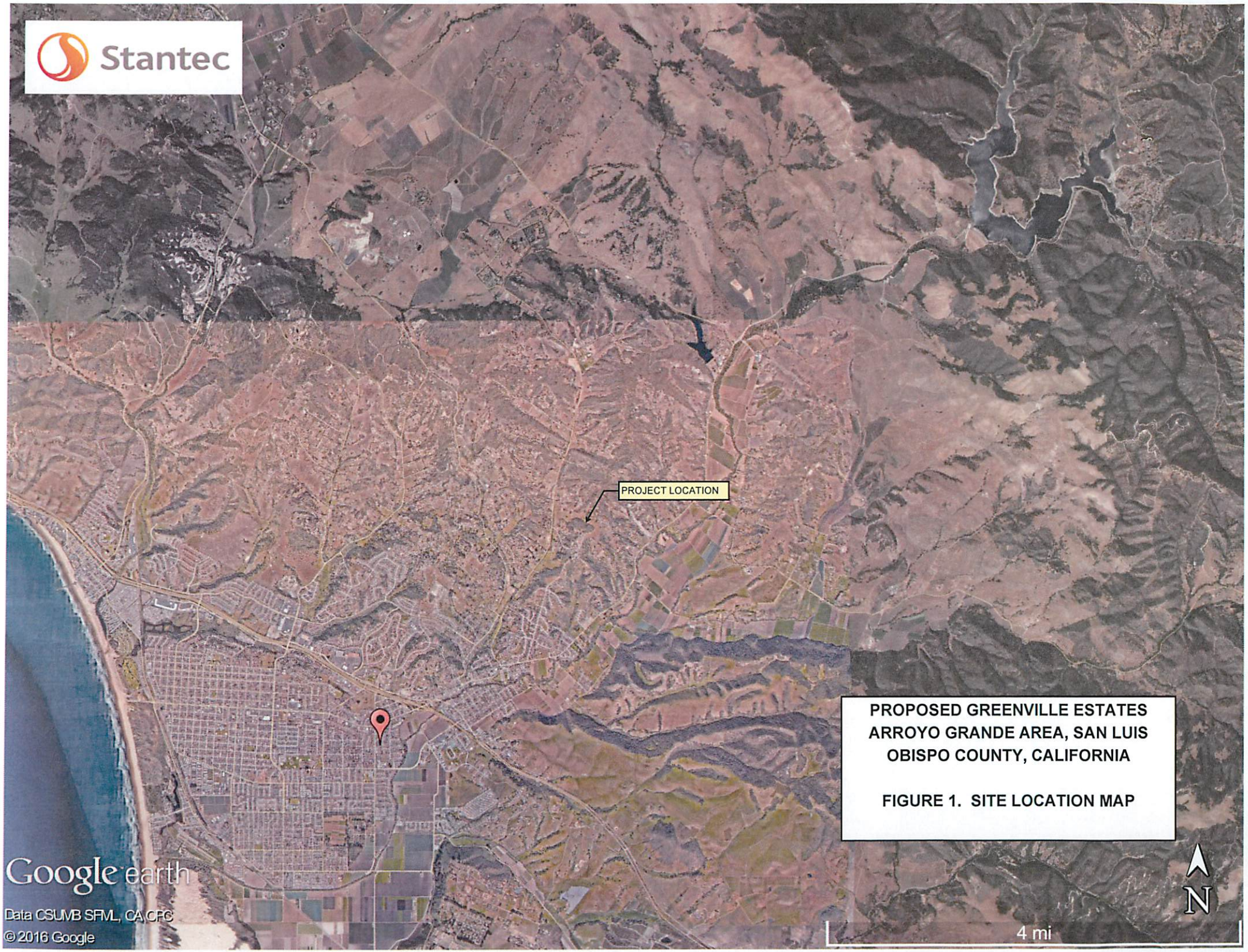
Steve Strait, PG, CEG, CHG
Principal Hydrogeologist

CERTIFIED HYDROGEOLOGIST
STEVEN STRAIT
No. HG123
Exp. 2/16
STATE OF CALIFORNIA

Attachments: Figure 1. Site Location Map
Figure 2. Site Map
Pumping Test Data

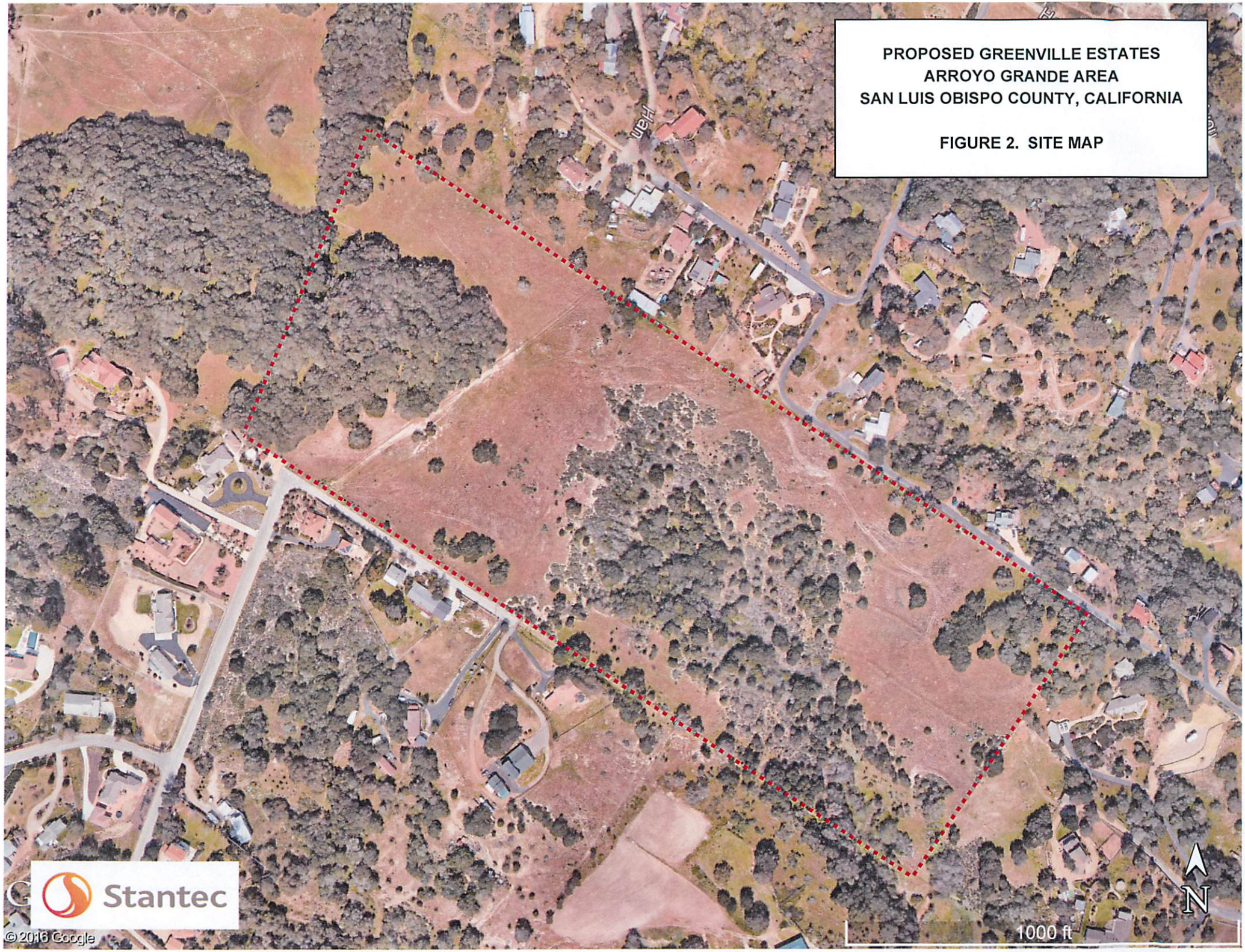
P:\Regional Projects\Greenville Estates Water Supply Development

ATTACHMENTS



PROPOSED GREENVILLE ESTATES
ARROYO GRANDE AREA, SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE 1. SITE LOCATION MAP


PROPOSED GREENVILLE ESTATES
ARROYO GRANDE AREA
SAN LUIS OBISPO COUNTY, CALIFORNIA
FIGURE 2. SITE MAP
Stantec
© 2016 Google
1000 ft
N

Filipponi & Thompson Drilling Inc.

State License No. C57 432680
P.O. BOX 845
ATASCADERO, CA 93423
805-466-1271

Name	MARK CRISP	Date	1/22/2014
Mailing Address	MACSON3262@AOL.COM	Phone	441-1963
Job Location	STAGECOACH & EL SUENO - ARROYO GRANDE	Fax	
Well Size	5" PVC — Depth 465'	Duration	4 HOUR + RECOVERY
Tested by	C. HALL & B. SOUZA — Rate of Flow (gpm) 68 - 50	Static Level	230.9'

Well Test Report

Date	Time	Water Level (FT)	G.P.M.
1/15/2014	11:00AM	230.9	68
	11:05	296.7	68
	11:10	312.3	68
	11:15	322.5	55
	11:20	326.6	55
	11:30	330.7	53
	11:45	333.0	53
	12:00PM	330.5	50
	12:15	231.9	50
	12:30	332.2	50
	12:45	332.9	50
	1:00	334.0	50
	1:15	334.4	50
	1:30	335.1	50
	1:45	335.3	50
	2:00	336.0	50
	2:15	336.5	50
	2:30	337.1	50
	2:45	337.3	50
	3:00	337.7	50

Recovery

Date	Time	Water Level (FT)
1/15/2014	3:00PM	337.7
	3:05	253.7
	3:10	251.0
	3:15	248.8
	3:20	247.1
	3:30	244.9
	3:45	242.7
	4:00	241.4

Additional Comments:
PUMP WAS SET @ 440'

Thank you,

Ned M. Thompson

Ned M. Thompson

*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. e0167406

Page 1 of 1

Owner's Well Number

Date Work Began 01/15/2013 Date Work Ended 1/17/2013

Local Permit Agency SAN LUIS OBIPSO COUNTY

Permit Number 2012-269 Permit Date 1/3/13

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N W

Latitude Longitude

APN/TRS/Other

Geologic Log

Orientation ⦿ Vertical ○ Horizontal ○ Angle Specify

Drilling Method ROTARY Drilling Fluid BENTONITE

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
0	3	TOP SOIL
3	42	SANDY BROWN CLAY & SAND STRINGERS
42	48	SAND & GRAVEL
48	56	SANDY LT BROWN CLAY & SAND LAYERS
56	65	COURSE & FINE SANDS
65	178	LT BROWN CLAY & SAND STRINGERS
178	213	GRAY CLAY
213	220	COURSE SANDS & GRAVEL
220	232	SANDY BROWN CLAY
232	246	COURSE & FINE SANDS, SMALL GRANUELS
246	275	CHATTERING GREY CLAY
275	291	COURSE & FINE GREY SANDS
291	312	SANDY GREY CLAY
312	316	COURSE & FINE SANDS
316	402	SANDY GREY CLAY
402	417	GREY SANDS
417	461	GREY SANDY CLAY, MOSTLY SANDS
461	503	CHATTERING SANDY GREY CLAY
503	600	TIGHT GREY SAND, SOME CLAY
		THE AIR LIFT TEST IS ONLY APPROXIMATE.
		A TEST PUMP IS RECOMENDED FOR AN
		ACCURATE ACCOUNT.
		(GM)

Total Depth of Boring 600 Feet

Total Depth of Completed Well 460 Feet

Well Owner

Name PATRICK SULLIVAN

Mailing Address 874 TEMPUS CIRCLE

City ARROYO GRANDE State CA Zip 93420

Well Location

Address STAGECOACH ROAD & EL SUENO WAY

City ARROYO GRANDE County San Luis Obispo

Latitude 35 Deg. 8 Min. 48.5 Sec. N Longitude 120 Deg. 33 Min. 11.4 Sec. W

Datum Decimal Lat. Decimal Long.

APN Book 047 Page 181 Parcel 001

Township 32S Range 13E Section 14

Location Sketch

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

North

West East

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 (Feet below surface)

Depth to Static Water Level 180 (Feet) Date Measured 01/17/2013

Estimated Yield * 12 (GPM) Test Type Air Lift

Test Length 4.0 (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)
0	200	10		PVC	SDR-21	5		
200	460	10		PVC	SDR-21	5		0.040

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	50	Cement	
50	600	Fill	8X12 SAND

Attachments

☐ Geologic Log

☐ Well Construction Diagram

☐ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☐ Other

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 FILIPPONI & THOMPSON DRILLING, INC.
Person, Firm or Corporation

P.O. Box 845 Atascadero CA 93423
Address City State Zip

Signed
C-57 Licensed Water Well Contractor

1/21/2013 432680
Date Signed C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

boredata

ELECTRIC LOG

11011 Villa Monterey Dr., Bakersfield CA 93311 · Phone: 888.908.5226 Fax: 661.505.6561 · Web: www.boredata.com Email: ccorbell@boredata.com

FILING NO.

COMPANY Filipponi and Thompson

WELL Patrick Sullivan

FIELD Arroyo Grande

STATE CA COUNTY San Luis Obispo

LOCATION:

Approx .2 Mi. N.E. of the corner of Stagecoach Rd. and El Sueno Wy.

OTHER SERVICES:

JOB NO. 1033

SEC: ____ TWP: ____ RGE: ____ LAT.: 35.1468 LONG.: 120.5529

Permanent Datum: Ground Level, Elev. ____ Ft. Elev.: K.B. ____ Ft.

Log Measured From: Ground Level, 0 Ft. Above Perm. Datum D.F. ____ Ft.

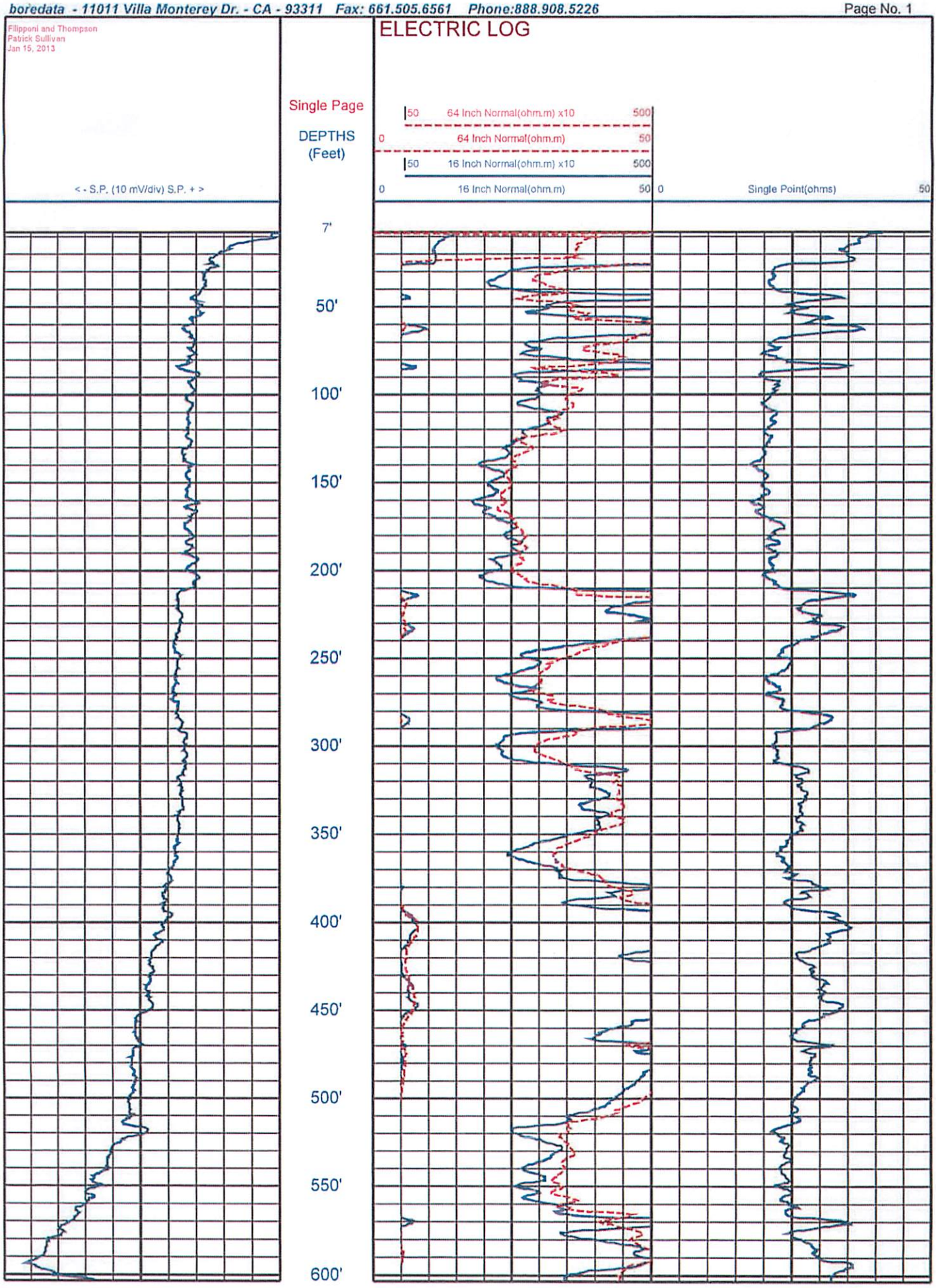
Drilling Measured From: Ground Level G.L. ____ Ft.

Run	One			
Date	Jan 15, 2013			
Depth-Driller	600 Ft	Ft	Ft	Ft
Depth-Logger	602 Ft	Ft	Ft	Ft
Top Logged Interval	7 Ft	Ft	Ft	Ft
Btm. Logged Interval	602 Ft	Ft	Ft	Ft
Casing-Driller	N/A In @ Ft	In @ Ft	In @ Ft	In @ Ft
Casing-Logger	In @ Ft	In @ Ft	In @ Ft	In @ Ft
Bit Size	9.875 In	In	In	In
Time On Bottom	16:37			
Type Fluid In Hole	Bentonite			
Density / Viscosity				
pH / Fluid Loss	ml	ml	ml	ml
Source of Sample	Circ			
Rm @ Measured Temp.	17.5 @ 75 °F	@ °F	@ °F	@ °F
Rmf @ Measured Temp.	15.9 @ 75 °F	@ °F	@ °F	@ °F
Rmc @ Measured Temp.	@ °F	@ °F	@ °F	@ °F
Source Rmf / Rmc	Meas			
Rm @ BHT	@ °F	@ °F	@ °F	@ °F
Time Since Circulation	.5 Hr	Hr	Hr	Hr
Max. Rec. Temp.	N/A °F	°F	°F	°F
Van No. / Location	BD-1			
Recorded By	Craig Corbell			
Witnessed By				

This Heading Conforms To API RP 31A—-Eagle Plot

Filipponi and Thompson
Patrick Sullivan
Jan 15, 2013

ELECTRIC LOG



Well 1

Pumping Test (72-hour), Greenview Estates

Cleath-Harris Geologists

Day	Time	Elapsed Time	Depth to Water	Drawdown	Recorded Pumping Rate
Mo./Day/Yr	hr:min	minutes	feet	feet	gallons per minute
3/19/15	10:30	0	233.54	0.00	Start
	10:31	1	254.60	21.06	278506
	10:32	2	258.90	25.36	
	10:33	3	271.20	37.66	
	10:34	4	278.32	44.78	
	10:35	5	282.55	49.01	
	10:36	6	285.35	51.81	
	10:38	8	288.70	55.16	278837
	10:40	10	290.80	57.26	
	10:42	12	292.52	58.98	
	10:45	15	294.55	61.01	279126
	10:50	20	296.86	63.32	
	10:55	25	298.63	65.09	279580
	11:00	30	299.70	66.16	
	11:10	40	301.12	67.58	280155
	11:20	50	302.37	68.83	280567
	11:30	60	303.27	69.73	280977
	11:45	75	304.47	70.93	281633
	12:00	90	305.17	71.63	282204
	12:15	105	305.96	72.42	282817
	12:30	120			
	12:35	125	307.00	73.46	283633
	13:02	152	308.50	74.96	
	14:09	219	309.40	75.86	287517
	17:29	419	312.08	78.54	295720
3/20/15	6:59	1229	316.52	82.98	328280
	12:00	1530	317.55	84.01	344110
	16:05	1775	317.97	84.43	350520
3/21/15	8:42	2772	318.35	84.81	390190
	14:40	3130	319.08	85.54	405290
	16:50	3260	319.09	85.55	410550
3/22/15	9:01	4231	319.20	85.66	450160
	10:38	4328	319.23	85.69	
	10:50	4340			454391
				Average GPM	**41**

Recovery Test (30-min manual), Greenview Estates

Day	Time	Elapsed Time	Depth to Water	Elapsed Time	Recovery Time Ratio
Mo./Day/Yr	hr:min	minutes	feet	minutes	
		Since pumping started	s	Since pumping stopped	t/t(0)
3/22/15	10:51	4341	287.83	1	4341.0
	10:52	4342	275.56	2	2171.0
	10:53	4343	269.43	3	1447.7
	10:54	4344	266.02	4	1086.0
	10:55	4345	263.27	5	869.0
	10:56	4346	261.61	6	724.3
	10:58	4348	259.23	8	543.5
	11:00	4350	257.63	10	435.0
	11:02	4352	256.44	12	362.7
	11:05	4355	255.14	15	290.3
	11:08	4358	254.01	18	242.1
	11:10	4360	253.41	20	218.0
	11:12	4362	252.87	22	198.3
	11:15	4365	252.21	25	174.6
	11:18	4368	251.63	28	156.0
	11:20	4370	251.27	30	145.7
	11:25	4375	250.48	35	125.0
	11:30	4380	249.78	40	109.5
	11:35	4385	249.21	45	97.4
	11:40	4390	248.68	50	87.8
	11:50	4400	247.78	60	73.3
	17:30	4740	238.51	400	11.9
3/23/15	7:40	5590	235.19	1250	4.5
3/24/15	15:40	7510	233.85	3170	2.4

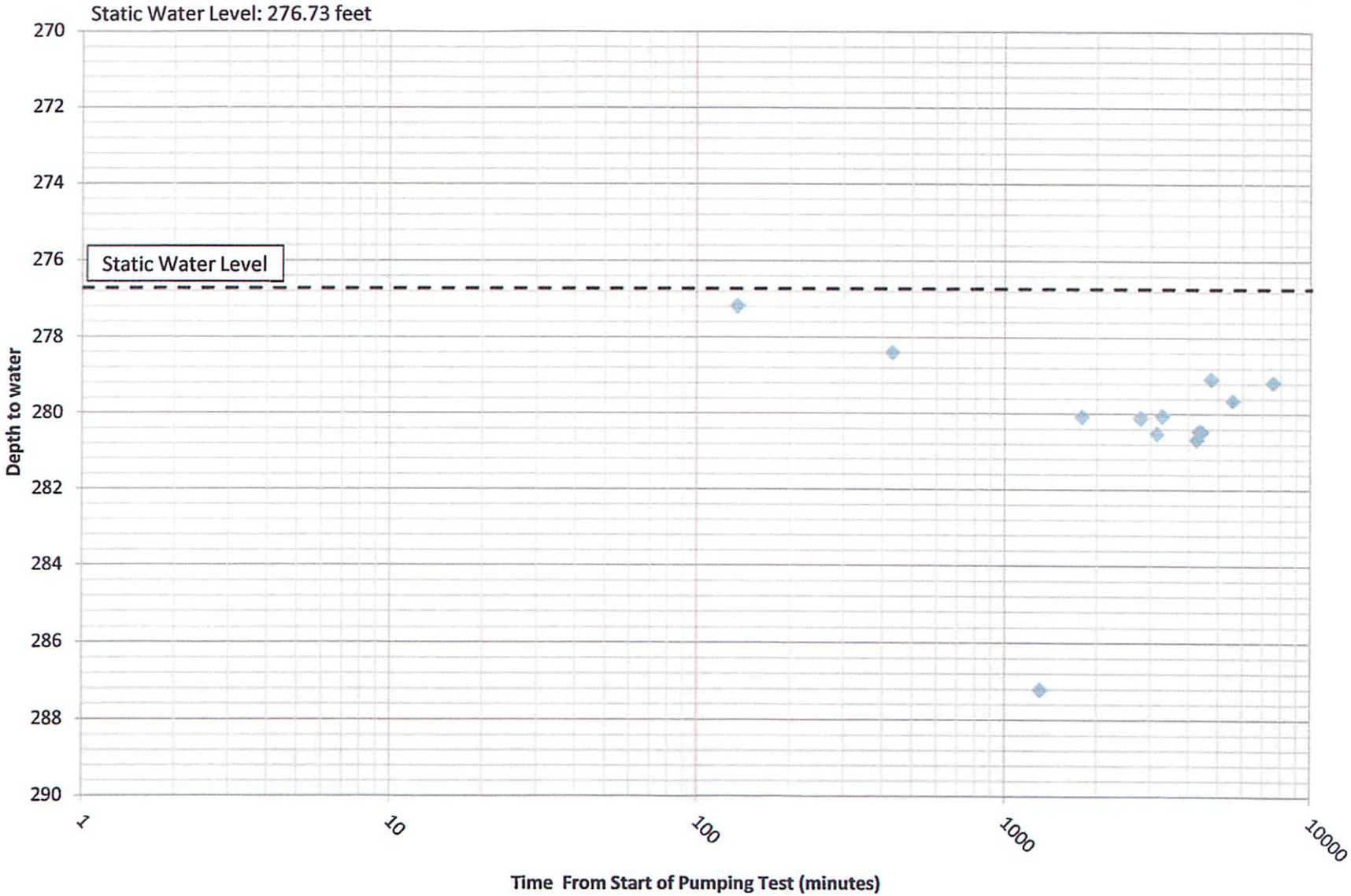
Water Level Data Sheet for Monitored Wells

Date	Well A				Well B			
	Time	date/time	Test time	Depth to Water (feet)	Time	date/time	Test time	Depth to Water (feet)
3/11/15	10:15 AM	3/11/15 10:15 AM		277.58	10:20 AM	3/11/15 10:20 AM		292.82
3/18/15	5:30 PM	3/18/15 5:30 PM		276.73	5:38 AM	3/18/15 5:38 AM		292.44
3/19/15	9:55 AM	3/19/15 9:55 AM		285.80	10:10 AM	3/19/15 10:10 AM		292.93
3/19/15	10:15 AM	3/19/15 10:15 AM		280.70				
3/19/15	12:45 PM	3/19/15 12:45 PM	135	277.17	12:50 PM	3/19/15 12:50 PM	140	292.27
3/19/15	5:40 PM	3/19/15 5:40 PM	430	278.39	5:49 PM	3/19/15 5:49 PM	439	291.88
3/20/15	8:15 AM	3/20/15 8:15 AM	1305	287.21	7:33 AM	3/20/15 7:33 AM	1263	295.33
3/20/15	12:50 PM	3/20/15 12:50 PM	1580	307.10	12:55 PM	3/20/15 12:55 PM	1585	294.61
3/20/15	4:15 PM	3/20/15 4:15 PM	1785	280.07	4:28 PM	3/20/15 4:28 PM	1798	293.51
3/21/15	8:50 AM	3/21/15 8:50 AM	2780	280.10	8:55 AM	3/21/15 8:55 AM	2785	301.33
3/21/15	2:45 PM	3/21/15 2:45 PM	3135	280.50	2:50 PM	3/21/15 2:50 PM	3140	299.75
3/21/15	4:55 PM	3/21/15 4:55 PM	3265	280.05	5:04 PM	3/21/15 5:04 PM	3274	295.83
3/22/15	9:11 AM	3/22/15 9:11 AM	4241	280.67	9:15 AM	3/22/15 9:15 AM	4245	294.01
3/22/15	10:30 AM	3/22/15 10:30 AM	4320	280.45				
3/22/15	11:55 AM	3/22/15 11:55 AM	4405	280.46	11:58 AM	3/22/15 11:58 AM	4408	293.79
3/22/15	5:21 PM	3/22/15 5:21 PM	4731	279.08	5:26 PM	3/22/15 5:26 PM	4736	295.06
3/23/15	7:20 AM	3/23/15 7:20 AM	5570	279.65				
3/24/15	4:03 PM	3/24/15 4:03 PM	7533	279.17	4:17 PM	3/24/15 4:17 PM	7547	292.78
3/24/15								

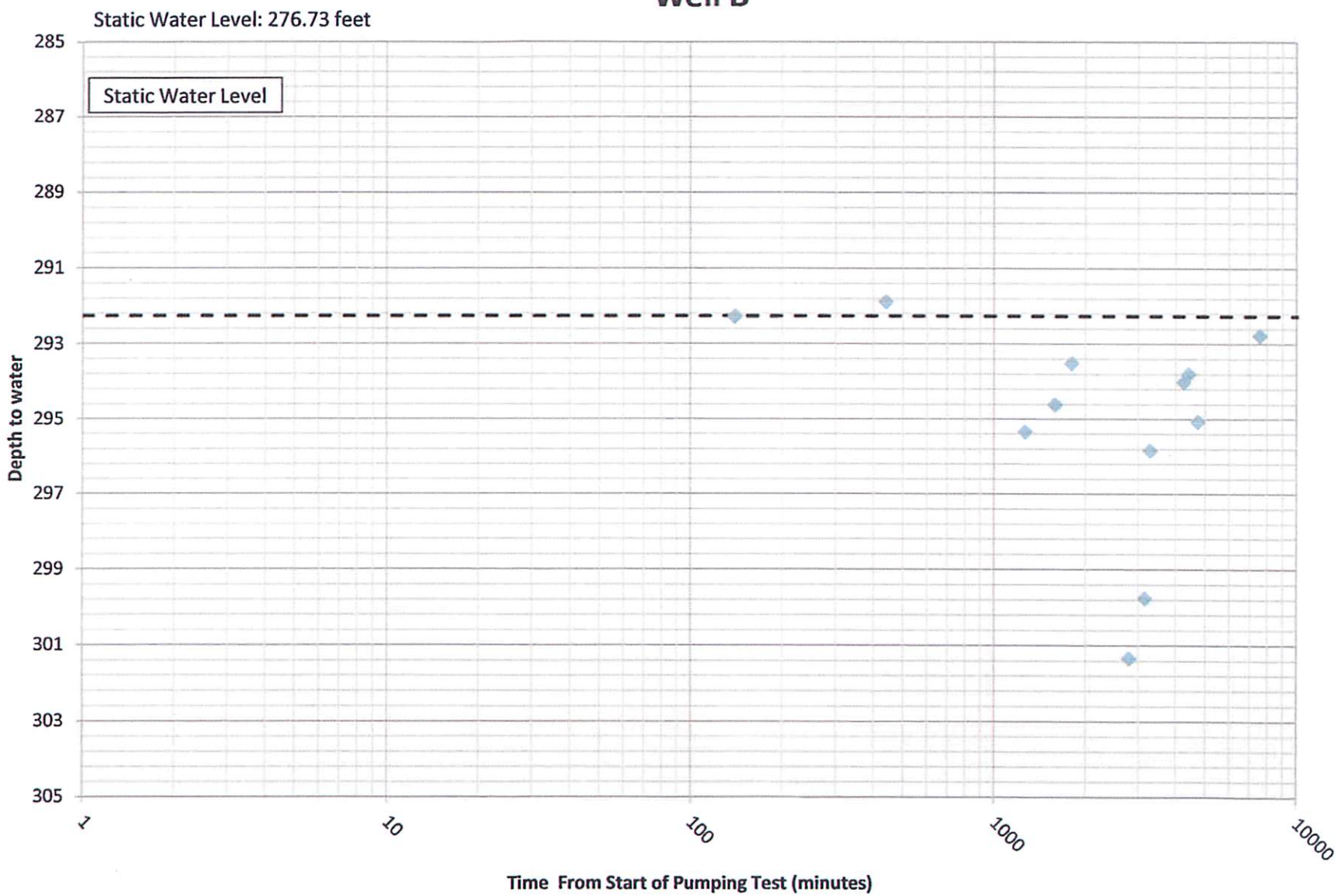
Water Level Data Sheet for Monitored Wells

Date	Well C				Well D			
	Time	date/time	Test time	Depth to Water (feet)	Time	date/time	Test time	Depth to Water (feet)
3/11/15								
3/18/15					5:54 PM	3/18/15 5:54 PM		203.00
3/19/15					9:27 AM	3/19/15 9:27 AM		297.00
3/19/15								
3/19/15	1:30 PM	3/19/15 1:30 PM	180	205.21	1:45 PM	3/19/15 1:45 PM	195	207.70
3/19/15	6:08 PM	3/19/15 6:08 PM	458	205.10	6:01 PM	3/19/15 6:01 PM	451	203.01
3/20/15								
3/20/15	1:20 PM	3/20/15 1:20 PM	1610	205.80	1:25 PM	3/20/15 1:25 PM	1615	204.30
3/20/15								
3/21/15	9:41 AM	3/21/15 9:41 AM	2831	205.70	9:12 AM	3/21/15 9:12 AM	2802	203.21
3/21/15	2:12 PM	3/21/15 2:12 PM	3102	206.30	2:16 PM	3/21/15 2:16 PM	3106	204.15
3/21/15	5:15 PM	3/21/15 5:15 PM	3285	206.26	5:20 PM	3/21/15 5:20 PM	3290	204.71
3/22/15	8:50 AM	3/22/15 8:50 AM	4220	205.77	8:40 AM	3/22/15 8:40 AM	4210	203.10
3/22/15								
3/22/15								
3/22/15	5:43 PM	3/22/15 5:43 PM	4753	205.96	6:00 PM	3/22/15 6:00 PM	4770	213.50
3/23/15	7:55 AM	3/23/15 7:55 AM	5605	205.97	7:53 AM	3/23/15 7:53 AM	5603	
3/24/15	3:35 PM	3/24/15 3:35 PM	7505	205.51	3:30 PM	3/24/15 3:30 PM	7500	203.89
3/24/15	4:50 PM	3/24/15 4:50 PM	7580	205.48	4:45 PM	3/24/15 4:45 PM	7575	203.45

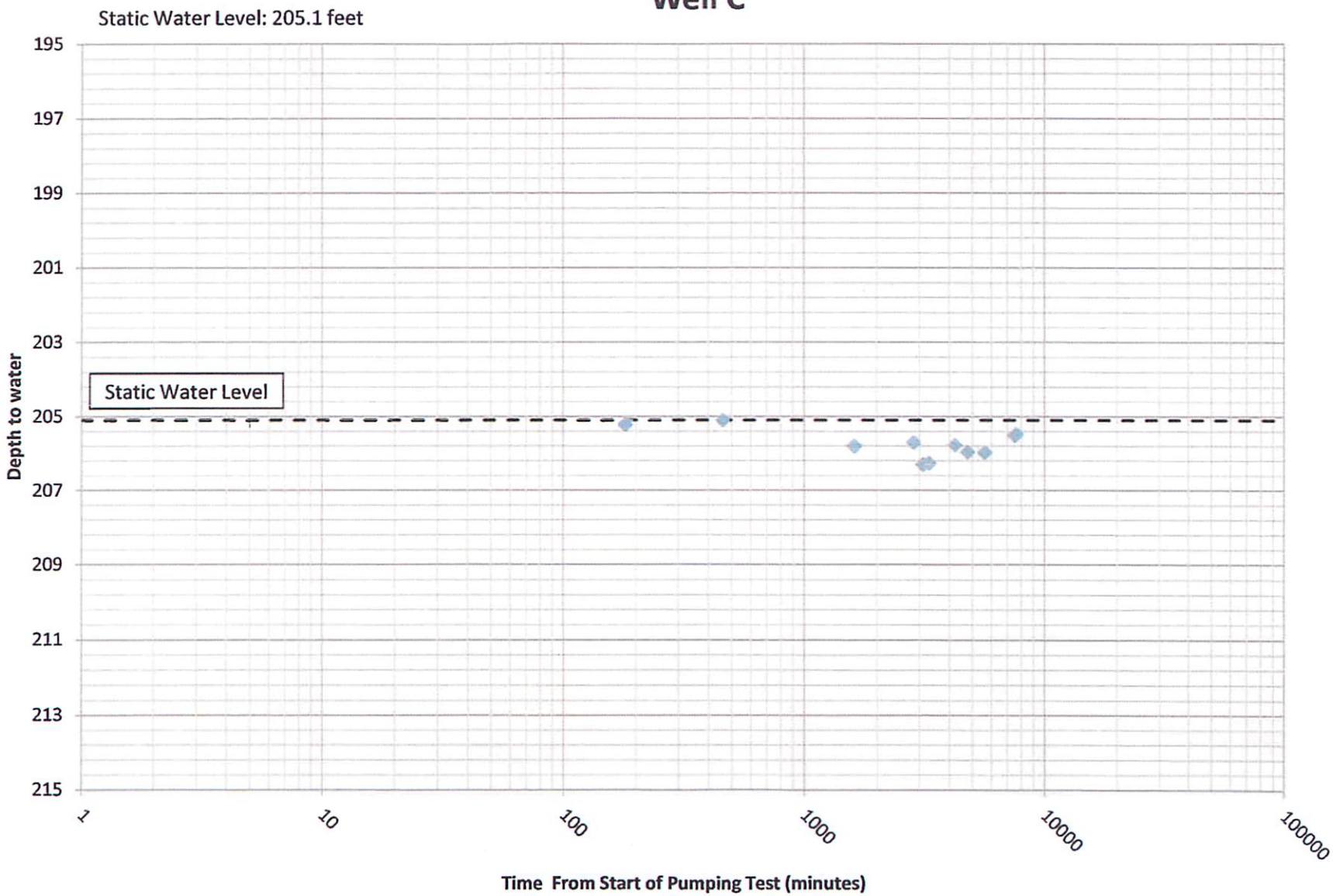
Groundwater Level
Well A

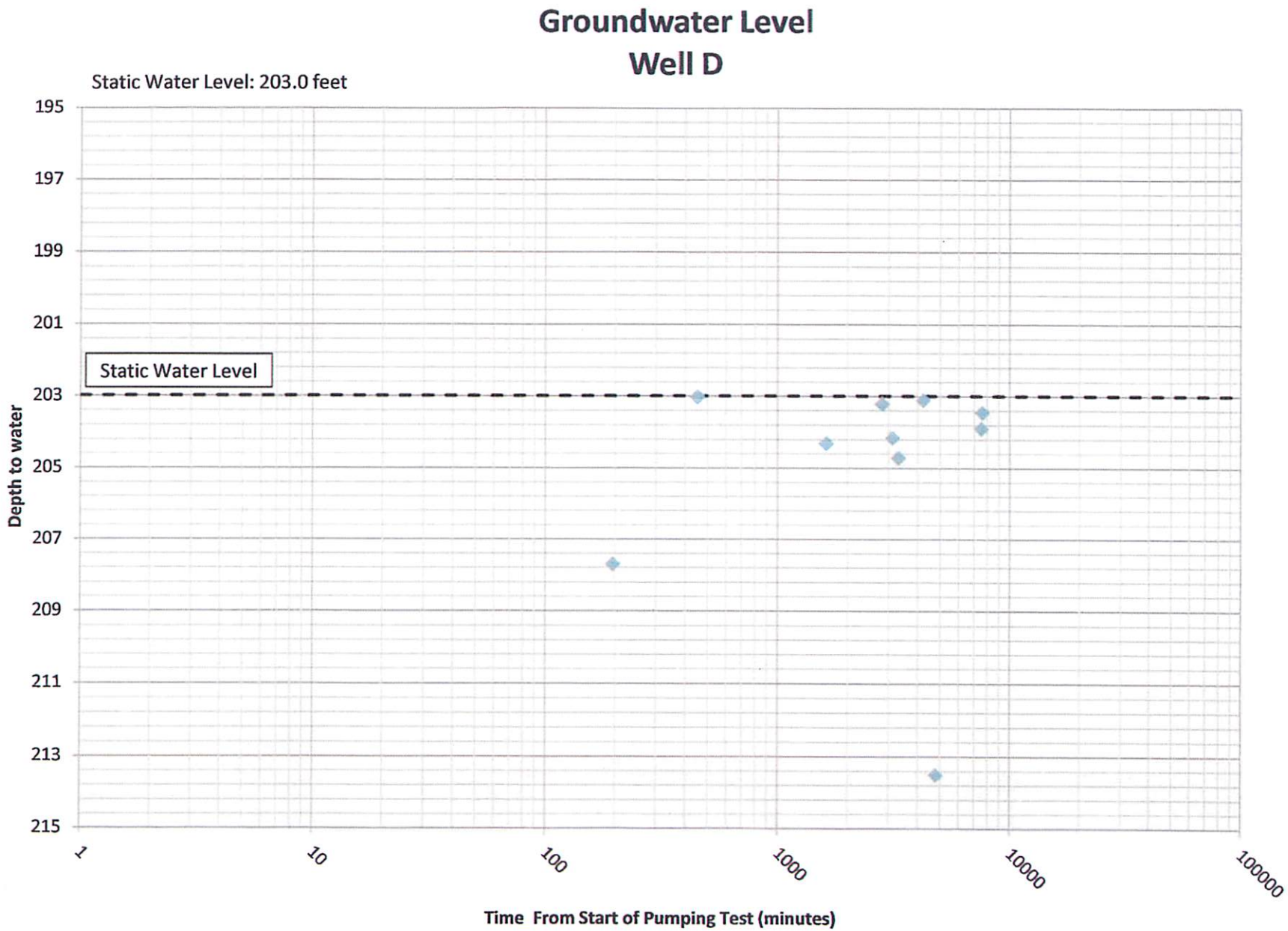


Groundwater Level
Well B



Groundwater Level
Well C




Groundwater Level
Well D
Static Water Level: 203.0 feet
Static Water Level
Depth to water
195
197
199
201
203
205
207
209
211
213
215
1
10
100
1000
10000
100000
Time From Start of Pumping Test (minutes)

Interference Calculation
Greenview Estates Subdivision 36 Lots, 36 Dwellings

Greenview Well 1
Calibration - Distance Drawdown Crisp Well 1 pumping test

S	0.0033
T	3732 gpd/ft
Q	41 gpm
t	1 and 3 days

r	r^2	S	(1.87)*(r^2S)	T	t	Tt	u=1.87r^2S/Tt	W(u)	Q	114.6Q	T	114.6Q/T	s=Q/4pT*W(u) (calculated interference (ft))	actual inter. (ft)
350	122500	0.0033	755.9475	3732	1	3732	0.20255828	1.2076004	41	4698.6	3732	1.259003	1.52	3.37
350	122500	0.0033	755.9475	3732	3	11196	0.067519427	2.1791883	41	4698.6	3732	1.259003	2.74	3.72

Interference Calculation - constant flow component
Greenview Estates Subdivision
It's assumed the distance drawdown calculations are representative of the flow between wells in the aquifer.

S	0.0033	
T	3732 gpd/ft	
Q	14.27 gpm	23 afy
t	365 days	

r	r^2	S	(1.87)*(r^2S)	T	t	Tt	u=1.87r^2S/Tt	W(u)	Q	114.6Q	T	114.6Q/T	s=Q/4pT*W(u) (calculated interference (ft))
350	122500	0.0033	755.9475	3732	365	1362180	0.000554954	6.9199645	14.27	1635.342	3732	0.438195	3.03
400	160000	0.0033	987.36	3732	365	1362180	0.000724838	6.6530714	14.27	1635.342	3732	0.438195	2.92
500	250000	0.0033	1542.75	3732	365	1362180	0.00113256	6.2071913	14.27	1635.342	3732	0.438195	2.72
600	360000	0.0033	2221.56	3732	365	1362180	0.001630886	5.8430464	14.27	1635.342	3732	0.438195	2.56
700	490000	0.0033	3023.79	3732	365	1362180	0.002219817	5.5353334	14.27	1635.342	3732	0.438195	2.43
800	640000	0.0033	3949.44	3732	365	1362180	0.002899353	5.2689493	14.27	1635.342	3732	0.438195	2.31
900	810000	0.0033	4998.51	3732	365	1362180	0.003669493	5.0341522	14.27	1635.342	3732	0.438195	2.21
1000	1000000	0.0033	6171	3732	365	1362180	0.004530238	4.8242902	14.27	1635.342	3732	0.438195	2.11
1500	2250000	0.0033	13884.75	3732	365	1362180	0.010193036	4.019002	14.27	1635.342	3732	0.438195	1.76
2000	4000000	0.0033	24684	3732	365	1362180	0.018120953	3.4515099	14.27	1635.342	3732	0.438195	1.51
2500	6250000	0.0033	38568.75	3732	365	1362180	0.028313989	3.0152984	14.27	1635.342	3732	0.438195	1.32
3000	9000000	0.0033	55539	3732	365	1362180	0.040772145	2.6629008	14.27	1635.342	3732	0.438195	1.17
3500	12250000	0.0033	75594.75	3732	365	1362180	0.055495419	2.368974	14.27	1635.342	3732	0.438195	1.04
4000	16000000	0.0033	98736	3732	365	1362180	0.072483813	2.1183676	14.27	1635.342	3732	0.438195	0.93
4500	20250000	0.0033	124962.75	3732	365	1362180	0.091737325	1.9012858	14.27	1635.342	3732	0.438195	0.83
5000	25000000	0.0033	154275	3732	365	1362180	0.113255957	1.7110175	14.27	1635.342	3732	0.438195	0.75

Interference Calculation
Greenview Estates Subdivision 36 Lots, 36 Dwellings

Intermittent pumping adjustment

S	0.0033	
T	3732	gpd/ft
Q	26.73	gpm
t	0.2	days

calculated interference (ft)

r	r^2	S	(1.87)*(r^2S)	T	t	Tt	u=1.87r^2S/Tt	W(u)	Q	114.6Q	T	114.6Q/T	s=Q/4pT*W(u)
350	122500	0.0033	755.9475	3732	0.2	746.4	1.012791399	0.2147378	26.73	3063.258	3732	0.820809	0.18
400	160000	0.0033	987.36	3732	0.2	746.4	1.322829582	0.1307601	26.73	3063.258	3732	0.820809	0.11
500	250000	0.0033	1542.75	3732	0.2	746.4	2.066921222	0.0445912	26.73	3063.258	3732	0.820809	0.04
600	360000	0.0033	2221.56	3732	0.2	746.4	2.976366559	0.0134468	26.73	3063.258	3732	0.820809	0.01
700	490000	0.0033	3023.79	3732	0.2	746.4	4.051165595	0.0035524	26.73	3063.258	3732	0.820809	0.00
800	640000	0.0033	3949.44	3732	0.2	746.4	5.291318328	0.0008168	26.73	3063.258	3732	0.820809	0.00
900	810000	0.0033	4998.51	3732	0.2	746.4	6.696824759	0.0001627	26.73	3063.258	3732	0.820809	0.00
1000	1000000	0.0033	6171	3732	0.2	746.4	8.267684887		26.73	3063.258	3732	0.820809	0.00
1500	2250000	0.0033	13884.75	3732	0.2	746.4	18.602291		26.73	3063.258	3732	0.820809	0.00
2000	4000000	0.0033	24684	3732	0.2	746.4	33.07073955		26.73	3063.258	3732	0.820809	0.00
2500	6250000	0.0033	38568.75	3732	0.2	746.4	51.67303055		26.73	3063.258	3732	0.820809	0.00
3000	9000000	0.0033	55539	3732	0.2	746.4	74.40916399		26.73	3063.258	3732	0.820809	0.00
3500	12250000	0.0033	75594.75	3732	0.2	746.4	101.2791399		26.73	3063.258	3732	0.820809	0.00
4000	16000000	0.0033	98736	3732	0.2	746.4	132.2829582		26.73	3063.258	3732	0.820809	0.00
4500	20250000	0.0033	124962.75	3732	0.2	746.4	167.420619		26.73	3063.258	3732	0.820809	0.00

Cumulative Interference

distance	interference (ft)
r	s
350	3.2
400	3.0
500	2.8
600	2.6
700	2.4
800	2.3
900	2.2
1000	2.1
1500	1.8
2000	1.5
2500	1.3
3000	1.2
3500	1.0
4000	0.9
4500	0.8
5000	0.8

Interference Calculation
Greenview Estates Subdivision 36 Lots, 36 Dwellings

Assumptions:
T = transmissivity, estimated based on pumping test of nearby well
S = storativity, estimated based on pumping test of nearby well
Q = 23 acre-feet per year (14.27 gpm) and one 4.8 hour cycle at difference between assumed pumping rate (41 gpm) and average rate (14.27 gpm).
t = 365 days continuous pumping
r = distance from pumping well to off-site well

1. The water bearing formation is uniform in all directions and infinite in areal extent
2. The formation receives no recharge for one year
3. Wells are fully penetrating and 100 percent efficient

REFERENCES:
Driscoll, F.G., 1986, Groundwater and Wells, Johnson Filtrations Systems, Inc.
Theis, C.V., 1935, The relationsip between the lowering of the peizometric surfaces and the rate and duration of discharge of a well using groundwater storage, Transactions, American Geophysical Union, Washington D.C., pp 518-524.

Interference Calculation
Greenview Estates Subdivision 36 Lots, 72 total Dwellings
(36 primary Dwellings and 36 secondary Dwellings)

Greenview Well 1
Calibration - Distance Drawdown Crisp Well 1 pumping test

S	0.0033
T	3732 gpd/ft
Q	41 gpm
t	1 and 3 days

r	r^2	S	(1.87)*(r^2S)	T	t	Tt	u=1.87r^2S/Tt	W(u)	Q	114.6Q	T	114.6Q/T	s=Q/4pT*W(u) (calculated interference (ft))	actual inter. (ft)
350	122500	0.0033	755.9475	3732	1	3732	0.20255828	1.2076004	41	4698.6	3732	1.259003	1.52	3.37
350	122500	0.0033	755.9475	3732	3	11196	0.067519427	2.1791883	41	4698.6	3732	1.259003	2.74	3.72

Interference Calculation - constant flow component
Greenview Estates Subdivision
It's assumed the distance drawdown calculations are representative of the flow between wells in the aquifer.

S	0.0033	
T	3732 gpd/ft	
Q	22.32 gpm	36 afy
t	365 days	

r	r^2	S	(1.87)*(r^2S)	T	t	Tt	u=1.87r^2S/Tt	W(u)	Q	114.6Q	T	114.6Q/T	s=Q/4pT*W(u) (calculated interference (ft))
350	122500	0.0033	755.9475	3732	365	1362180	0.000554954	6.9199645	22.32	2557.872	3732	0.685389	4.74
400	160000	0.0033	987.36	3732	365	1362180	0.000724838	6.6530714	22.32	2557.872	3732	0.685389	4.56
500	250000	0.0033	1542.75	3732	365	1362180	0.00113256	6.2071913	22.32	2557.872	3732	0.685389	4.25
600	360000	0.0033	2221.56	3732	365	1362180	0.001630886	5.8430464	22.32	2557.872	3732	0.685389	4.00
700	490000	0.0033	3023.79	3732	365	1362180	0.002219817	5.5353334	22.32	2557.872	3732	0.685389	3.79
800	640000	0.0033	3949.44	3732	365	1362180	0.002899353	5.2689493	22.32	2557.872	3732	0.685389	3.61
900	810000	0.0033	4998.51	3732	365	1362180	0.003669493	5.0341522	22.32	2557.872	3732	0.685389	3.45
1000	1000000	0.0033	6171	3732	365	1362180	0.004530238	4.8242902	22.32	2557.872	3732	0.685389	3.31
1500	2250000	0.0033	13884.75	3732	365	1362180	0.010193036	4.019002	22.32	2557.872	3732	0.685389	2.75
2000	4000000	0.0033	24684	3732	365	1362180	0.018120953	3.4515099	22.32	2557.872	3732	0.685389	2.37
2500	6250000	0.0033	38568.75	3732	365	1362180	0.028313989	3.0152984	22.32	2557.872	3732	0.685389	2.07
3000	9000000	0.0033	55539	3732	365	1362180	0.040772145	2.6629008	22.32	2557.872	3732	0.685389	1.83
3500	12250000	0.0033	75594.75	3732	365	1362180	0.055495419	2.368974	22.32	2557.872	3732	0.685389	1.62
4000	16000000	0.0033	98736	3732	365	1362180	0.072483813	2.1183676	22.32	2557.872	3732	0.685389	1.45
4500	20250000	0.0033	124962.75	3732	365	1362180	0.091737325	1.9012858	22.32	2557.872	3732	0.685389	1.30
5000	25000000	0.0033	154275	3732	365	1362180	0.113255957	1.7110175	22.32	2557.872	3732	0.685389	1.17

Interference Calculation
Greenview Estates Subdivision 36 Lots, 72 total Dwellings

Intermittent pumping adjustment

S	0.0033	
T	3732	gpd/ft
Q	18.68	gpm
t	0.2	days

calculated interference (ft)

r	r^2	S	(1.87)*(r^2S)	T	t	Tt	u=1.87r^2S/Tt	W(u)	Q	114.6Q	T	114.6Q/T	s=Q/4pT*W(u)
350	122500	0.0033	755.9475	3732	0.2	746.4	1.012791399	0.2147378	18.68	2140.728	3732	0.573614	0.12
400	160000	0.0033	987.36	3732	0.2	746.4	1.322829582	0.1307601	18.68	2140.728	3732	0.573614	0.08
500	250000	0.0033	1542.75	3732	0.2	746.4	2.066921222	0.0445912	18.68	2140.728	3732	0.573614	0.03
600	360000	0.0033	2221.56	3732	0.2	746.4	2.976366559	0.0134468	18.68	2140.728	3732	0.573614	0.01
700	490000	0.0033	3023.79	3732	0.2	746.4	4.051165595	0.0035524	18.68	2140.728	3732	0.573614	0.00
800	640000	0.0033	3949.44	3732	0.2	746.4	5.291318328	0.0008168	18.68	2140.728	3732	0.573614	0.00
900	810000	0.0033	4998.51	3732	0.2	746.4	6.696824759	0.0001627	18.68	2140.728	3732	0.573614	0.00
1000	1000000	0.0033	6171	3732	0.2	746.4	8.267684887		18.68	2140.728	3732	0.573614	0.00
1500	2250000	0.0033	13884.75	3732	0.2	746.4	18.602291		18.68	2140.728	3732	0.573614	0.00
2000	4000000	0.0033	24684	3732	0.2	746.4	33.07073955		18.68	2140.728	3732	0.573614	0.00
2500	6250000	0.0033	38568.75	3732	0.2	746.4	51.67303055		18.68	2140.728	3732	0.573614	0.00
3000	9000000	0.0033	55539	3732	0.2	746.4	74.40916399		18.68	2140.728	3732	0.573614	0.00
3500	12250000	0.0033	75594.75	3732	0.2	746.4	101.2791399		18.68	2140.728	3732	0.573614	0.00
4000	16000000	0.0033	98736	3732	0.2	746.4	132.2829582		18.68	2140.728	3732	0.573614	0.00
4500	20250000	0.0033	124962.75	3732	0.2	746.4	167.420619		18.68	2140.728	3732	0.573614	0.00

Cumulative Interference

distance	interference (ft)
r	s
350	4.9
400	4.6
500	4.3
600	4.0
700	3.8
800	3.6
900	3.5
1000	3.3
1500	2.8
2000	2.4
2500	2.1
3000	1.8
3500	1.6
4000	1.5
4500	1.3
5000	1.2

Interference Calculation
Greenview Estates Subdivision 36 Lots, 72 total Dwellings

Assumptions:
T = transmissivity, estimated based on pumping test of nearby well
S = storativity, estimated based on pumping test of nearby well
Q = 36 acre-feet per year (22.32 gpm) and one 4.8 hour cycle at difference between assumed pumping rate (41 gpm) and average rate (22.32 gpm).
t = 365 days continuous pumping
r = distance from pumping well to off-site well

1. The water bearing formation is uniform in all directions and infinite in areal extent
2. The formation receives no recharge for one year
3. Wells are fully penetrating and 100 percent efficient

REFERENCES:
Driscoll, F.G., 1986, Groundwater and Wells, Johnson Filtrations Systems, Inc.
Theis, C.V., 1935, The relationsip between the lowering of the peizometric surfaces and the rate and duration of discharge of a well using groundwater storage, Transactions, American Geophysical Union, Washington D.C., pp 518-524.