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Please respond to our Meredith Office

August 11, 2023

VIA EMAIL TO Andrew.T.Koff@des.nh.gov
AND REGULAR MAIL
Andrew Koff, P.G.
Drinking Water and Groundwater Bureau
New Hampshire Department of Environmental Services
29 Hazen Drive
P.O. Box 95
Concord, NH 03302-0095

Re: Koss Construction LLC (**"the Developer"**) (Tax Map Lots 140-16 & 170-12) Bean Road (**"the Project"**)
CWS Moultonborough: Harbor Landing: PWS ID: New System
Proposed BRW1 and BRW2; NHEDS#DR006013

Good Afternoon Mr. Koff:

On behalf of the Center Harbor Board of Selectmen (**"the Selectmen"**), I am sending this letter to you in follow up to the Selectmen's letters of February 23, 2022, and March 8, 2023, as well as your letter of April 21, 2022 (which indicated that the proposed wells were not able to be approved as new community water supply wells).

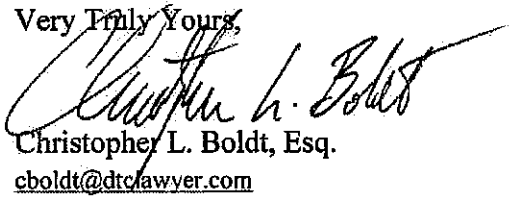
First, I am tendering the attached Letter Report with exhibits from Richard S. Vandenberg and Peter Thompson of Credere Associates, LLC dated August 11, 2023 (**"the Credere Report"**) listing their professional opinions in light of the Edgewater Strategies report dated July 8, 2023. As the Credere Report indicates, the Developer's proposed wells have a "high probability of capture and eventual transport" of known contaminants in the immediate area, including but not limited to PFAS. The Credere Report also states that the Developer's requested waivers "are inappropriate under these circumstances".

Second, I join in the detailed concerns and objections to these wells and waivers as raised in Attorney Rouvalis' letter to you dated August 9, 2023.

On behalf of the Selectmen, we respectfully request that the Developer's request for waivers and for approval of the proposed wells for this Project be denied outright.

If you have any questions, please do not hesitate to call or email me.

Very Truly Yours,



Christopher L. Boldt, Esq.
cboldt@dtclawyer.com

cc: Center Harbor Board of Selectmen (via email to selectmen@centerharbornh.org)
Jarred Swinotek, P.G., DES Hazardous Waste Remediation Bureau (via email to jarred.swinotek@des.nh.gov)
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CREDERE ASSOCIATES, LLC
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August 11, 2023

Christopher L. Boldt, Esq.
Donahue, Tucker & Ciandella, PLLC
164 NH Route 25
The Towle House, Unit 2
Meredith, New Hampshire 03253

SUBJECT: Letter Report and Opinion on Well Impacts
Bean Road Development Site Review
Center Harbor, New Hampshire

Dear Mr. Boldt:

At your request, we have reviewed the report prepared by Edgewater Strategies (Edgewater) dated July 8, 2023, and titled *Small Community Preliminary Well Siting Application Form, Supplemental Information Submittal for Harbor Landing, Moultonborough, NH for Proposed BRW1 and BRW2* including its associated attachments concerning per-and polyfluoroalkyl substances (PFAS) contamination in bedrock wells located to the west of the proposed development. We also reviewed the document described as 2021 Koss Well Docs which contains the initial pumping test data and report for the preliminary pumping test of bedrock wells BR1 and BR2 conducted on January 24, 2021. You requested our opinion on the potential impacts, if any, of the proposed use of BR1 and BR2 considering the contaminants on nearby properties. We have considered those impacts, especially at the applicant's proposed pumping rate [17.5 gallons per minute (gpm)] and if such pumping would pose a risk of capturing and pulling PFAS or other contamination toward the proposed wells or would otherwise affect the current distribution of PFAS and other contaminants in bedrock wells at the site. Our opinions and conclusions are based on data contained in the documents referenced above and as described in the remainder of this letter.

It is our opinion that pumping the proposed bedrock wells poses an unreasonable risk of impacting the current distribution of PFAS and causing eventual migration of PFAS impacted groundwater toward the proposed wells BR1 and BR2, and the surrounding residential wells. It is customary for pumping test data to be evaluated to develop an estimate of aquifer hydraulic properties which was not done by Edgewater or the Developer in this application. Despite the lack of this information, we used the pump test data to calculate aquifer hydraulic properties, which informed our opinion.

Technical Basis, Analytical Approach, and Opinions

We converted the pump test data from PDF files in our possession to Microsoft Excel ™ and have evaluated the pumping test results to derive aquifer parameters. Those parameters were then used to calculate estimated groundwater distance-drawdown projections from the proposed pumping wells to ascertain if the wells could potentially capture bedrock groundwater impacted by PFAS or other contaminants to the west. **Figure 1** presents a contoured interpretation of the cone of depression that would likely result from a combined pumping rate of 17.5 gpm at BR1 and BR2. To simplify the analysis, we treated these closely spaced wells as one well. The calculated area of groundwater drawdown extends into the region of PFAS impacted bedrock groundwater shown in the Edgewater report.

Exhibits 1-A through D present supporting technical analysis and opinions developed by Credere to assess the potential for future impact of BR1 and BR2 on nearby PFAS in bedrock groundwater. Each exhibit, and its purpose, is discussed below:

Exbibit 1-A presents a plot of the combined drawdown of BR1 and BR2 during the Edgewater pumping test as developed by Credere. BR1 was pumped at an average rate of 34.60 gpm and one hour later BR2 was turned on and pumped at an average rate of 33.65 gpm. The combined average was 68.26 gpm. Each well was pumped for 5 hours. Please note that the groundwater drawdowns in BR2 and BR1 are nearly identical when only BR1 was pumping (Pumping Step 1). When both wells were pumped (Pumping Step 2), water levels in both wells were also nearly identical. This illustrates that the wells and aquifer are well connected and can be treated mathematically as one well. The combined average maximum drawdown was 26.29 feet. When BR1 was turned off, both wells recovered approximately halfway. When BR2 was turned off both wells recovered to within 98 percent of static. Edgewater reported specific capacities of each well at approximately 1.3 gpm/foot of drawdown (gpm/ft). This is incorrect. This was computed as the pumping rate at each well divided by the total drawdown. The drawdown was the result of the combined pumping because the wells were pumped together so the individual pumping rates should not have been used. The corrected specific capacity is the total pumping rate divided by the total drawdown or 2.6 gpm/ft. Because the pumping test combined two wells rather than pumping BR1 for 5 hours, shutting it down, and after reaching static pumping BR2 for 5 hours, analysis of the pumping test results can be treated as a step test for "one combined" well where BR1 is the first step and the combined BR1 and BR2 rate is the second step. It is possible to estimate the drawdown of BR-1 based on the graph (see dashed line).

Exhibit 1-B shows the results of an analysis of the pumping test results which was conducted using publicly available pumping test analysis tools presented in the US Geological Survey Open File Report 02-197. In this manner our assumptions and conclusions can be independently validated or refuted. Specifically, this included the step drawdown method which is analogous to the Cooper-Jacob method at higher pumping rates. **Exhibit 1-B** presents the curve match for the shallow bedrock or Step Test 1 (hours 0-1) for BR1. Although the

analysis required extrapolation of the drawdown slope due to the early nature of the data, the results of the curve matching are acceptable and indicate a transmissivity (T) of 1,030 ft^2/day and a hydraulic conductivity (K) of 4.29 ft/s and with a storativity (S) of 0.0095. These values are slightly higher than the later data which affected deeper bedrock at a higher pumping rate (Step 2) which is consistent with a conceptual model that the shallow bedrock is more weathered, has more and larger fracture apertures, and therefore has slightly higher T and S values.

Exhibit 1-C shows the analysis of the later (1-5 hours) data based on the second step with the combined pumping rate of BR1 and BR2 which averaged 68.26 gpm with a maximum drawdown of 26.29 feet averaged between the wells. The best curve match for this bedrock with deeper drawdown indicates a lower transmissivity of 775 ft^2/day with a K of 3.22 ft/d and a storativity of 0.00015. This suggests the deeper bedrock has lower transmissivity and storativity than the shallow bedrock which is consistent with accepted bedrock conceptual models in New England, where weathering and glacial stresses resulted in more transmissive shallow bedrock.

Exhibit 1-D presents the results of calculations of the distance drawdown for pumping the combined BR1 and BR2 at the design discharge rate of 17.5 gpm (8.75 gpm per well). The method used is the Theis solution for confined aquifers. This analysis uses the more fully developed aquifer parameters from Exhibit 1-C and is simplified by the assumption that pumping of the two closely spaced wells is approximated by pumping one well at the combined rate of 17.5 gpm. This assumption is justified by the data presented in Exhibit 1-A. The exhibit presents a screen shot of the calculation input sheet and results followed by a compilation of the calculated distance drawdown data for time frames of 24, 48 and 96 hours of pumping. The 96-hour values are used in the interpretation in **Figure 1**. The aquifer parameters used for these calculations include a K of 3.22 ft/d and S of 0.00015. The effective aquifer thickness (b) was adjusted to 213 feet (versus 240 feet) so that the calculated drawdown (at five hours) adjacent to the pumping well (R=0.25 feet) matched the drawdown in the pump test at five hours when BR1 and BR2 were pumped at a combined rate of 68 gpm.

Conclusions

Figure 1 and Exhibit 1-D indicate that hydrologically significant drawdown (>1 foot) can be expected at least 1,600 feet from the proposed pumping wells after several (4) days of pumping. This will result in a high probability of capture and eventual transport of PFAS impacted bedrock groundwater, and other contaminants, by the proposed pumping wells. The time frame for detecting changes in solute concentrations is likely to be on the order of months to years due to other transport considerations that retard transport rates such as advection, dispersion, diffusion in microfractures, and solute sorption to iron oxide mineral surfaces on fractures. Chemical changes are not expected to occur within the limited timeframe of the proposed pumping test (several days) as suggested by Edgewater. That expectation does not appear to be well informed considering the time it takes for transport of a groundwater plume in a bedrock regime.

Based on these considerations we do not concur with Edgewater that operation of these wells can occur without high probability of long-term adverse effects. As such, it is our opinion that pumping the proposed bedrock wells poses an unreasonable risk of impacting the current distribution of PFAS and causing eventual migration of PFAS impacted groundwater toward the proposed wells BR1 and BR2. Accordingly, the requested waivers are inappropriate under these circumstances.

Please let us know if you have questions concerning the aforementioned information and conclusions. It has been our pleasure reviewing this data on your behalf.

Sincerely,
Credere Associates, LLC

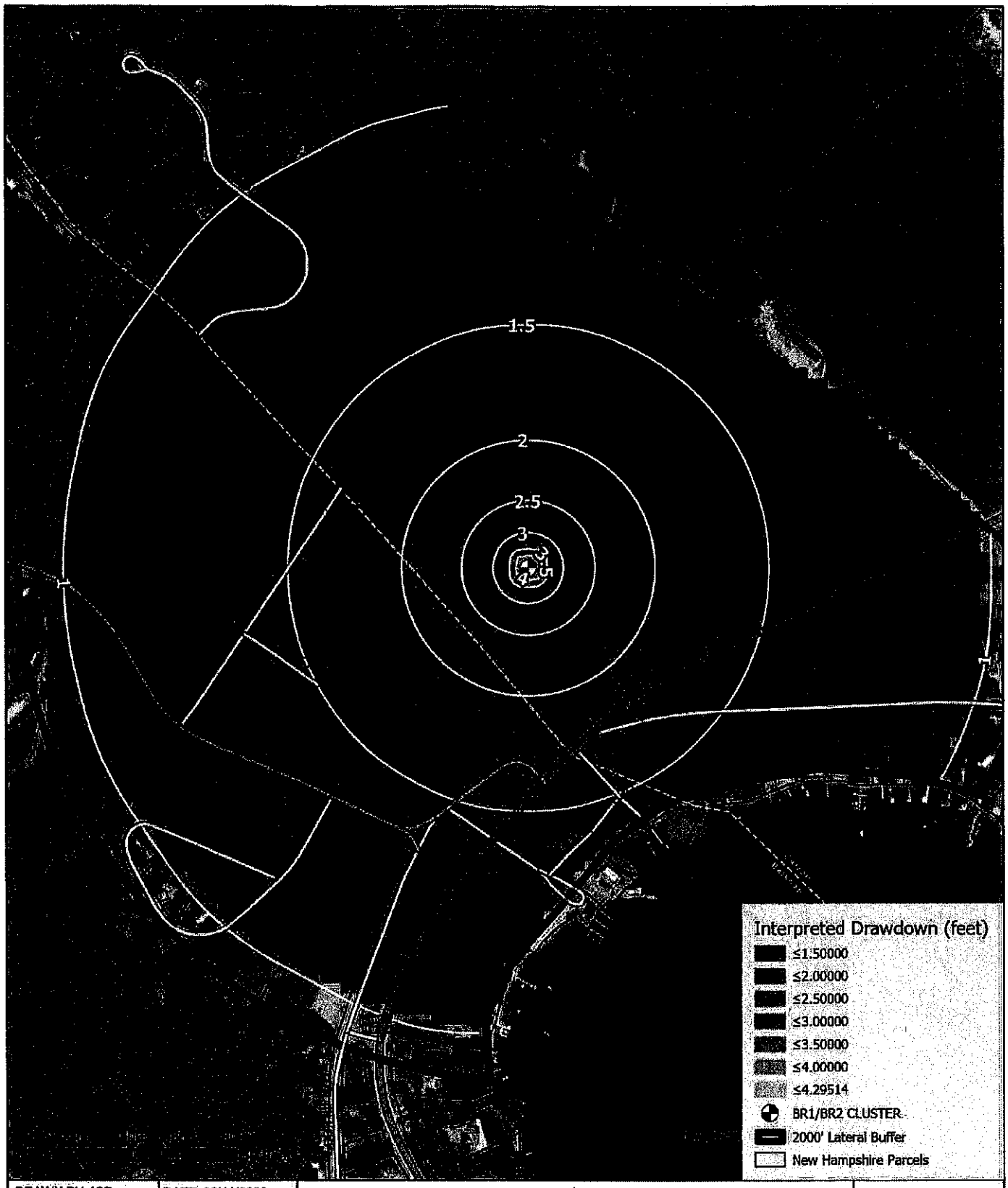
Richard S. Vandenberg, LG, PG
Senior Hydrogeologist/QC Manager/VP of Operations

Peter Thompson
Senior Project Manager, Senior Hydrogeologist

Attachments:

Figure 1: Estimated Pumping Cone of Depression BR1 and BR2
Exhibits 1A - D: Technical Basis of Opinion

Figure 1
Estimated Pumping Cone of Depression BR1 and BR2



DRAWN BY: ICD	DATE: 08/11/2023
CHECKED BY: PHT	PROJECT: 23001786

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WESTBROOK, MAINE
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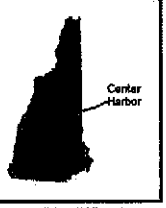
FIGURE 1
Interpreted Pumping Cone of Depression at 96 hours
BR1 and BR2 Pumping at 17.5 GPM

Harbor Landing
MOULTONBOROUGH, NEW HAMPSHIRE



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Exhibits 1A - 1D
Technical Basis of Opinion

EXHIBIT 1-A
Pumping Test Drawdown Summary

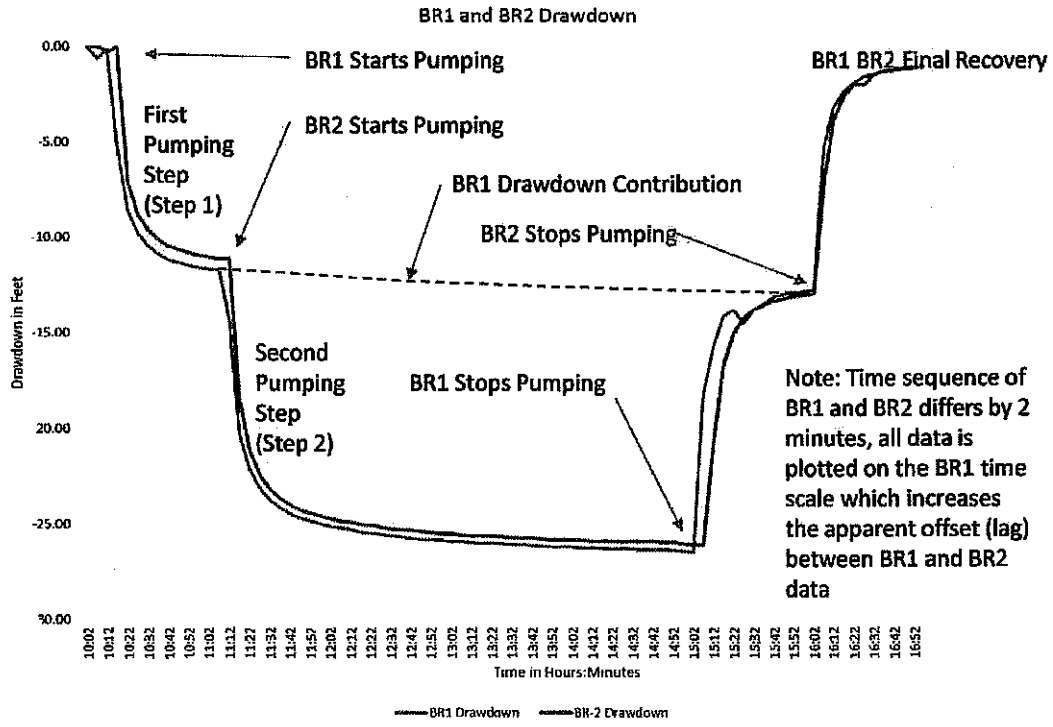
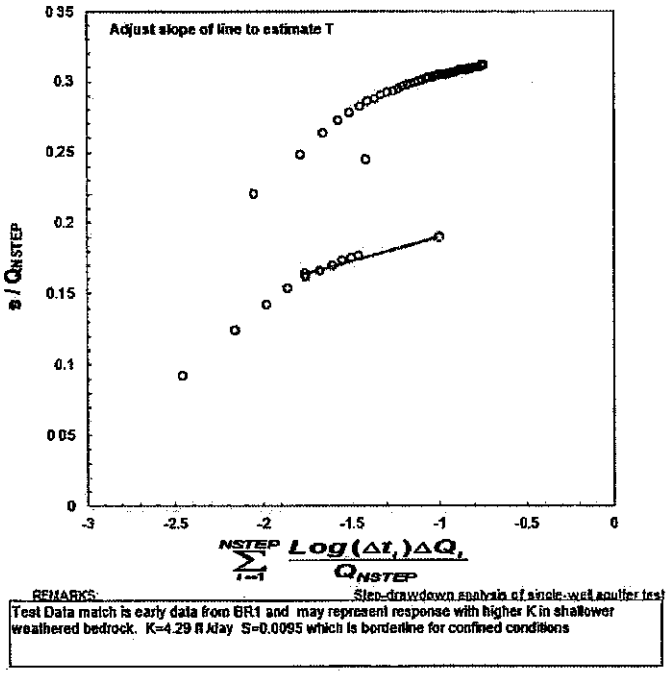


EXHIBIT 1-B
Shallow Bedrock Step 1 Test Curve Match BR1 Pumping



REMARKS: Step-drawdown analysis of single-well aquifer test

Test Data match is early data from BR1 and may represent response with higher K in shallower weathered bedrock. K=4.29 ft/day S=0.0095 which is bordertine for confined conditions

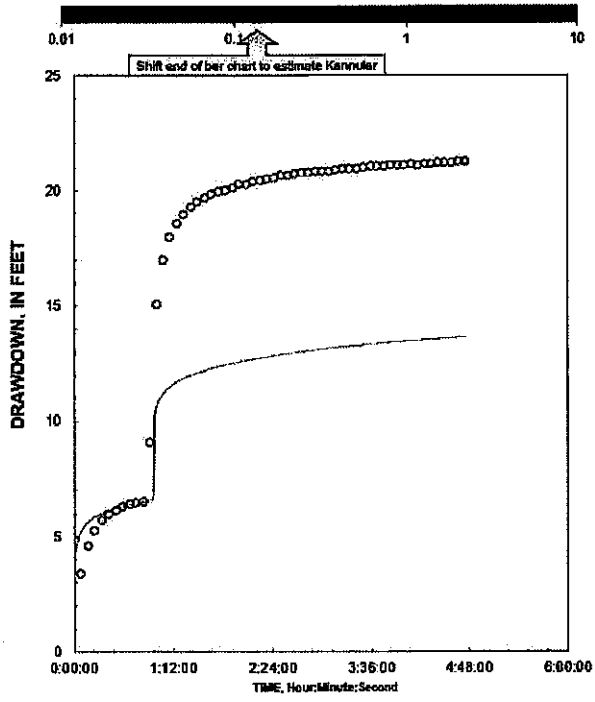


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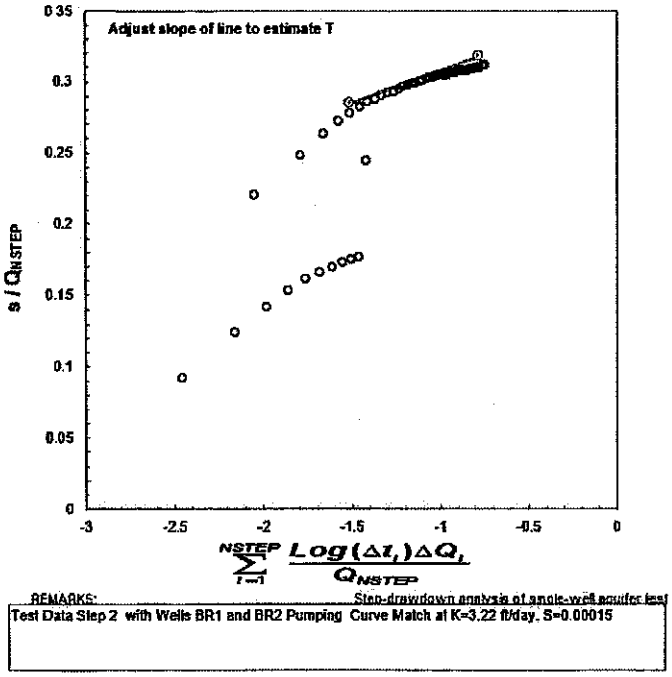
EXHIBIT 1-C
Deeper Bedrock Step 2 Test Curve Match BR1 and BR2 Pumping



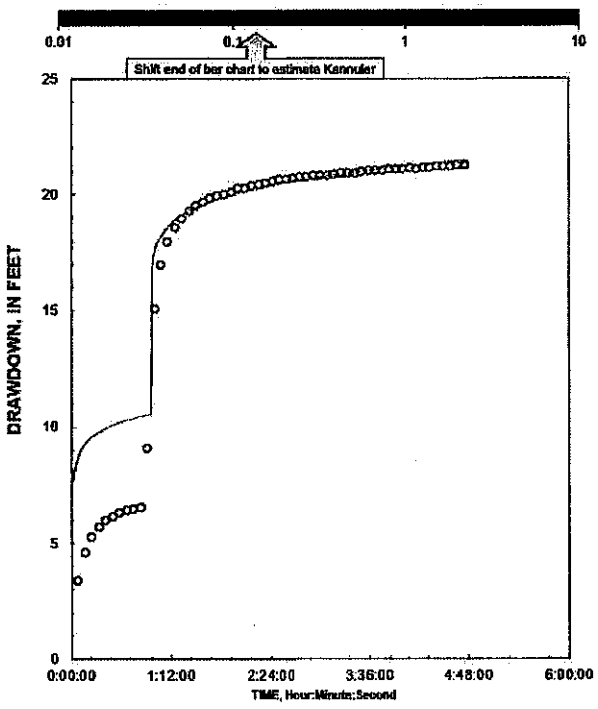


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EXHIBIT 1-D
Theis Distance Drawdown Calculation for Confined Aquifers Input Screen

Drawdown Prediction for Confined Aquifers, Theis(1935)

Input Data for prediction of drawdown

Hydraulic conductivity, K, ft/day	3.22
Aquifer Thickness, b, ft	213
Storage Coefficient, S	0.00015
Pumping Rate, GPM	17.5
Distance from well, ft	100

K: 0.01 | 0.1 | 1 | 10 | 100 | 1000

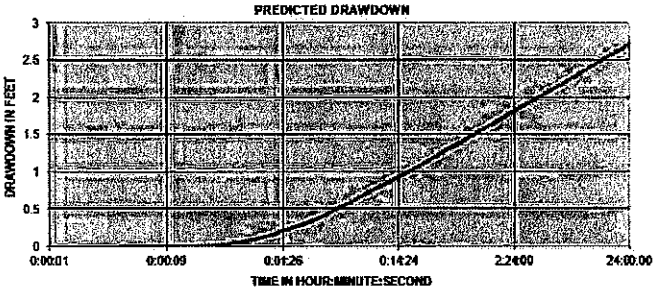
S: 0.000001 | 0.00001 | 0.0001 | 0.001 | 0.01 | 0.1 | 1

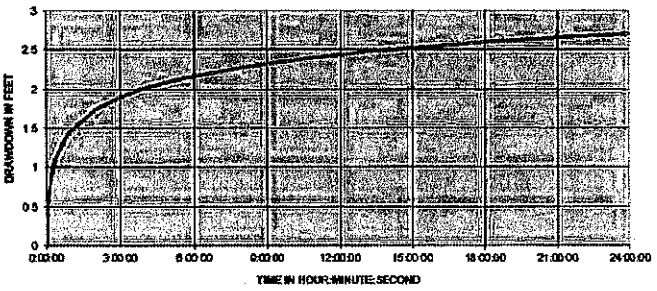
Equation used in prediction

$$s = \frac{Q(W(u))}{4\pi T} \qquad u = \frac{r^2 S}{4Tt}$$

s is drawdown, W(u) is the well

PREDICTED DRAWDOWN





Calculation Notes

1. Step Test Averaged 68 gpm for BR1 and BR2 Combined Pumping
   Aquifer depth 380 feet, Cased to 60 feet. Available Aquifer 240 feet for computation of T&S
   S=0.00015 best fit
   K = 3.22 ft/d
2. Pumping Test Drawdown was 26.29 at 5 hours
   At 68 GPM at 5 hours this solution 26.35
3. Calculation is reasonable for Estimates of Time /Distance Drawdown
4. Computation sheet has been expanded to 48 and 96 hours
5. Sectific capacity 2.5864 gpm/ft

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EXHIBIT 1-D
Theis Distance Drawdown for Confined Aquifers Calculation Results

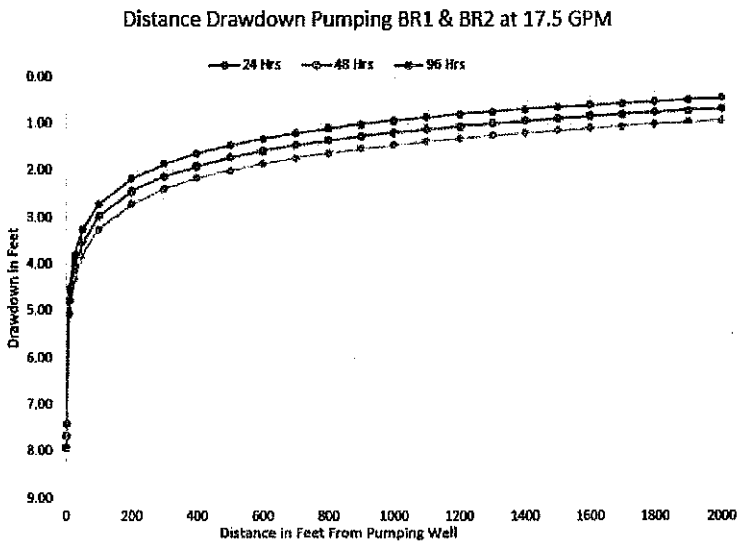
Storativity	0.00015	unitless
Aquifer Thickness	213	ft
K=	3.22	ft/day
Q=	17.5	gpm

Solution

Distance (ft)	24 Hrs	48 Hrs	96 Hrs
100	2.71	2.98	3.25

Copy Results Below For data Plot

Distance from Pumping Well (feet)	Drawdown in Feet		
Elapsed Time	24 Hrs	48 Hrs	96 Hrs
0	7.39	7.67	7.94
10	4.51	4.78	5.05
25	3.79	4.07	4.34
50	3.25	3.52	3.79
100	2.71	2.98	3.25
200	2.17	2.44	2.71
300	1.85	2.12	2.39
400	1.63	1.90	2.17
500	1.46	1.73	2.00
600	1.32	1.58	1.85
700	1.20	1.47	1.73
800	1.10	1.36	1.63
900	1.01	1.27	1.54
1000	0.93	1.19	1.46
1100	0.86	1.12	1.38
1200	0.80	1.05	1.32
1300	0.74	0.99	1.26
1400	0.69	0.94	1.20
1500	0.64	0.89	1.15
1600	0.60	0.84	1.10
1700	0.56	0.80	1.05
1800	0.52	0.76	1.01
1900	0.48	0.72	0.97
2000	0.45	0.68	0.93



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