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LETTER REGARDING DIFFERENTIAL LEVELS TO SELECTED GROUNDWATER OBSERVATION WELLS NSB KINGS BAY GA
6/21/1993
U S DEPARTMENT OF THE INTERIOR

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
Peachtree Business Center, Suite 130
3039 Amwiler Road
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TAKE PRIDE IN AMERICA

June 21, 1993

Mr. Ed Lohr
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive, P.O. Box 190010
North Charleston, SC 29419-9010

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16.01.00.0005

Dear Ed:

On June 10 and 11, Welby Stayton of our Savannah Field Office and I visited Kings Bay Submarine Base to become more familiar with the area and run differential levels to selected ground-water observation wells. When water-level gradients are slight, as they appear to be at the base, relatively small errors in water-level elevations can cause inaccurate contouring. Therefore, the leveling work was done to help ensure the accuracy of the water-level data collected and used by ABB Consultants to prepare contour maps of the ground-water table and interpret flow at the Base.

Levels were run from reference marks of known elevation to wells at sites 5 and 11, as planned. However, levels were not run to wells at site 16 because site 16 is a high-security area and time constraints prevented arrangements needed to obtain access on this trip. Our findings and suggestions/recommendations are discussed briefly in the succeeding paragraph and in greater detail in the attached summary.

The ABB elevation data (actually obtained by an ABB subcontractor) listed for wells at sites 5 and 11 in Technical Memorandum Number 1 (TM1) are within 0.07 foot of values obtained by the USGS, except for three wells. The apparent differences, if substantiated, are large enough at two wells (5-1 and 11-2) to require a reinterpretation of the water-table contours shown in TM1. If ABB elevation data are found to be incorrect at the three wells in question, arrangements will be made to run levels to wells at site 16 on the next trip to Kings Bay.

On the matter of the ABB reply to the USGS review of ABB slug tests, I believe their interpretation that drainage of about 1 foot of sand pack in 0.3-0.6 seconds gives an unreasonably fast drainage, and that their interpretation results in a hydraulic conductivity of the sand pack rather than of the aquifer. Moreover, they have not corrected for water contributed from the sand pack (by effectively increasing casing diameter), as we discussed on the phone. If you would like, I will discuss this with ABB at our next meeting.

I presently am conducting a second review of the water-quality section of TM1. A letter summarizing my findings will be sent to you within about two weeks. Following transmission of that letter, I will review the two reports of site 11 that you sent me.

Sincerely,

Bud Zehner

Bud Zehner
Hydrologist

Enclosure

SUMMARY OF LEVELING PERFORMED BY USGS PERSONNEL
AT KINGS BAY SUBMARINE BASE ON JUNE 10 AND 11, 1993

Levels were run from two Navy elevation markers, which are referenced to Mean Low Water (MLW). Traverses were closed with less than 0.02-foot differences from starting elevations, but maximum error is estimated to be slightly more, at about +-0.04 foot. A closed traverse of about 0.6 mile was made from marker PCM 11 to nine wells at site 11 and back to PCM11, and closure was less than 0.01 foot. The approximately 1.3-mile-long traverse from marker PCM 14 to seven wells at site 5 was not closed back to PCM 14 because of insufficient time to complete the return leg, and because most USGS elevations at the wells were within 0.05 foot of ABB values. However, closure was made of the local traverse around the site 5 area, back to the starting well, and was +0.01 foot.

All well casings were inside steel well protectors with locked covers. The covers could be lifted sufficiently, without removal of the locks, to see the casing tops. Casing tops were near the tops of the outside lock brackets. Therefore, levels were shot to the tops of the lock brackets. A ruler was inserted under the cover to measure the distance from the lock bracket to the top of the casing. Maximum error of this measurement, due to the angle of the ruler after insertion below the cover, is estimated as about 0.04 foot. A ground-level measurement was made by a leveling shot with the stadia set on the concrete pad directly below the lock bracket.

Level data are given in the enclosed table, which includes USGS values for the top of the lock bracket, top of the casing, ground level, and computed height of the casing above ground. The elevation of the pond (given at the bottom of the table) may prove useful for future comparison to water-level data from wells. Also shown are ABB values for top of casing, and the difference of USGS minus ABB values. The ABB elevations were taken from appendix A of Technical Memorandum Number 1 (TM1). No elevation is given in TM1 for well 11-8. Differences between USGS and ABB top-of-casing elevations for the 15 wells which were compared were within 0.07 foot, except for differences of 3.00 feet at well 5-1, -0.19 feet at well 5-2, and 1.06 feet at well 11-2.

The larger differences at wells 5-1, 5-2, and 11-2 were checked for possible USGS measurement error. Checking was done by relevaling. A new instrument setup was made at each site near a well which had small USGS-ABB difference (well 5-3 at site 5 and well 11-1 at site

11) to obtain a new instrument height, then the level was turned for a shot to the nearby well with large elevation difference. The larger differences were verified by the checking, and were within 0.02 foot of the first USGS measurements.

If the difference of 1.06 feet at well 11-2 actually represents an error in the ABB elevation data, a correction to the potentiometric-surface map of site 11 (figure 4-12 in TM1) would show somewhat different local flow. The flow on the west side of the site 11 would more to the north, and the water-table gradient would be less between wells 11-1 and 11-2.

A correction for the -0.19-foot difference at well 5-2 would make little change in interpretation of flow. A correction for the 3.0-foot difference at well 5-1 would make a large change in interpretation of flow, however, and such a change would not even seem to fit the flow pattern at site 5. The ABB value for top of casing at well 5-1 is exactly the same as the USGS value for ground level at 5-1 (see table). Perhaps the ABB value in TM1 is incorrectly labeled as top of casing, and is actually supposed to be ground level.

The USGS-ABB elevation differences at wells 5-1, 5-2, and 11-2 do not necessarily mean that the ABB elevations are wrong. Other explanations are possible. For example, additional lengths of casing could have been added to the wells after the initial ABB leveling to previous tops of casings, or the values in TM1 could be typo errors, or the values in TM1 could be mislabeled as discussed in the previous paragraph for well 5-1. Also, the water-level elevations for the wells in question could have been referenced to measuring points other than the tops of the casings. Those other measuring points could be accurate, and thus the water-level values shown on the potentiometric-surface maps for the wells in question could be accurate.

Statements are made on pages 2-11 and 2-12 in TM1 that data obtained in elevation surveys at wells were for both top of casing and ground level. Only the values for top of casing are given in TM1, however, and the data are evidently printed by plotting pens (some difficult to read) at top of borings logs in appendix A. Presentation of ABB data for both top of casing and ground level, and the measuring point used for water-level measurements shown on potentiometric-surface maps, would be helpful for report review.

In order to complete accuracy checks of ABB casing and ground-level elevations and potentiometric-surface maps, it would be helpful to obtain from ABB: (1) elevation data for well 11-8, (2) elevations of casing tops, if different than in the TMI report, (3) elevations of ground level (or cement pad) at the wells, (4) measuring points for water-level data shown on potentiometric-surface maps, and (5) distance of water-level measuring point to a point of measured elevation, if these points are different.

Well	ABB,top casing	USGS, bracket	USGS,top casing	USGS-ABB diff. top casing	USGS,grd level	USGS,height cas'gabovgrd
5-1	19.08	22.29	22.08	3.00	19.08	3.00
5-2	19.83	19.89	19.64	-0.19	17.25	2.39
5-3	20.99	21.02	20.99	0.00	18.13	2.86
5-4	21.72	21.81	21.76	0.04	18.84	2.92
5-5	21.02	21.10	21.07	0.05	18.25	2.82
5-6	22.85	22.92	22.89	0.04	19.59	3.30
5-7	20.50	20.61	20.54	0.04	17.66	2.88
11-1	36.60	36.75	36.60	0.00	33.72	2.84
11-2	34.92	36.10	35.98	1.06	33.14	2.84
11-3	34.59	34.63	34.60	0.01	31.70	2.90
11-4	35.12	35.19	35.16	0.04	32.33	2.83
11-5	36.01	36.09	36.06	0.05	33.05	3.01
11-6	37.39	37.46	37.43	0.04	34.39	3.04
11-7	37.25	37.44	37.32	0.07	34.22	3.10
11-8	---	38.33	38.21	---	35.49	2.72
11-9	34.59	34.70	34.63	0.04	30.80	3.83

Surface of pond approx 40 feet north of well 5-5, USGS elev = 13.61.
ABB elevations are from TMI - none given for well 11-8.
All elevations originate from Navy markers referenced to MLW: USGS site 5 measurements are from marker PCM 14, and USGS site 11 measurements are from marker PCM 11.