Pelton, Jason M (DEC)

From: Stumm, Frederick <fstumm@usgs.gov>
Sent: Monday, December 11, 2017 9:19 PM
To: Lehtinen, Michael D.
Cc: Como, Michael; Christopher Schubert; Englert, Scott G.; Pelton, Jason M (DEC); Hesler, Donald (DEC); St Germain, Daniel; Masterson, John; Walter, Donald; Frederick Stumm; John Williams
Subject: Re: NYSDEC Grumman Drilling Program
Attachments: DECVPB2_usgs_finalv.pdf

All,

We completed the relogging of the test borehole DEC-VPB-2 today. The following logs were collected gamma, single-point resistance, short and long normal resistivity, and electromagnetic (EM) conductivity. Due to the large amount of time between the first half of the rods being removed before the weekend some narrowing of the borehole was observed at the clay horizons resulting in difficulty in getting the geophysical probes to the bottom of the borehole. After several attempts the gamma/electric probe was able to pass through the Raritan Clay and encountered the Lloyd sand below. However, the conductivity probe which is lighter weight could not advance below 620 ft BLS and the original conductivity log was plotted. The logging operation took about 5 hours. We collected portions of the split-spoon cores to use for our research and to aid in the interpretation of the geophysical results.

Please consider this as a preliminary analysis and not an official report. There was a surface casing of steel pipe from land surface to about 55 ft BLS which prevented the collection of single-point resistance, resistivity, and EM conductivity logs. The gamma log responded well to the different hydrogeologic formations and the presence and thickness of clays. I would estimate the contact between the Upper Glacial aquifer and the Magothy aquifer was at around 55 feet below land surface (BLS). The Magothy aquifer displayed a general upward fining sequence with distinct clay units interspersed within the aquifer. The lowest portion of the aquifer contained more fines than is typical indicated by the increased gamma and decreased resistivity response below 800 ft BLS. The gamma, resistivity, and EM conductivity logs indicate the Raritan Clay unit below 960 ft BLS but this will need further examination of the core samples. Solid Raritan Clay was encountered from 996 ft to 1,072 ft BLS based upon gamma and electric log response and preliminary core sample examination. Below 1,072 ft BLS the reduction in gamma response and increase in resistivity indicates the Raritan Sand unit or Lloyd aquifer was encountered to the bottom of the borehole at 1,085 ft BLS. A Raritan formation contact is difficult to determine above 996 ft BLS due the limited core samples available. It may be that the Raritan formation in this part of Nassau County has a more complex structure which can be better defined with higher intervals of core samples which would require a more detailed examination before a formational contact could be estimated. The geophysical log response can only indicate the presence of fines and sand since the sand related to the Magothy formation and the sandy portions of the Raritan formation would show similar geophysical responses. The first major clay at depth was at 964 ft BLS a second clay unit was encountered at 999 ft BLS since no core was obtained at 964 ft it is hard to determine which formation the clay is associated with at this time. A spike in the EM conductivity log at 355 to 358 ft appears to be above a clay unit at 358 to 368 ft BLS which may suggest a conductive water quality change. Another spike in the EM log at 960 to 964 ft was also above a clay unit at 964 to 975 ft BLS also suggests a possible conductive water quality change.

Both the resistivity and EM logs correlated well with each other. The resistivity log is very sensitive to small changes in formation composition related to fines and small water quality changes related to specific

conductance in the groundwater. As the dissolved solids in the groundwater increases the resistivity log loses the ability to show these changes as it becomes essentially a flat line. The EM conductivity log displays these increases in dissolved solids very well and is very useful in quantifying large water quality changes.

The resistivity logs appear to be suppressed from 55 to about 530 ft BLS. This lowering of the resistivity and increasing of the EM conductivity logs is interpreted as possibly due to dissolved constituents in the groundwater or a formational feature. If we compare two sections of the Magothy aquifer, one at 220 ft BLS and the second, at 660 ft BLS they indicate similar gamma log responses suggesting similar aquifer materials. Resistivity log response at 220 ft BLS is nearly one quarter of that measured at 660 ft BLS. This suggests a groundwater water quality related cause for the suppression of the resistivity log. The EM conductivity log also indicated an increase above 530 ft BLS. The resistivity slowly decreases and the EM conductivity log increases in the upper parts of the Magothy.

I appreciate the sharing of the core samples. I think the relogging of the borehole was worth the time and effort based upon the strong log response and critical depth core samples collected. Given the large variation in the Raritan Clay seen in this part of Nassau County I feel drilling through the Raritan Clay and into the Lloyd sand, increasing core sampling near the base of Magothy into the Lloyd, and collecting a suite of borehole geophysical logs is the best course of action to delineate the formation changes and their impact on contaminant migration. Let me know if you need anything else.

Sincerely,
Fred Stumm

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On Mon, Dec 11, 2017 at 8:30 AM, Lehtinen, Michael D. <Michael.Lehtinen@hdrinc.com> wrote:

The driller said the rods should be all out of the hole between 11am and noon. Are you coming out to log the hole this afternoon.

Scott Englert is our geologist on-site and his cell is – 845-641-3245.

Thanks

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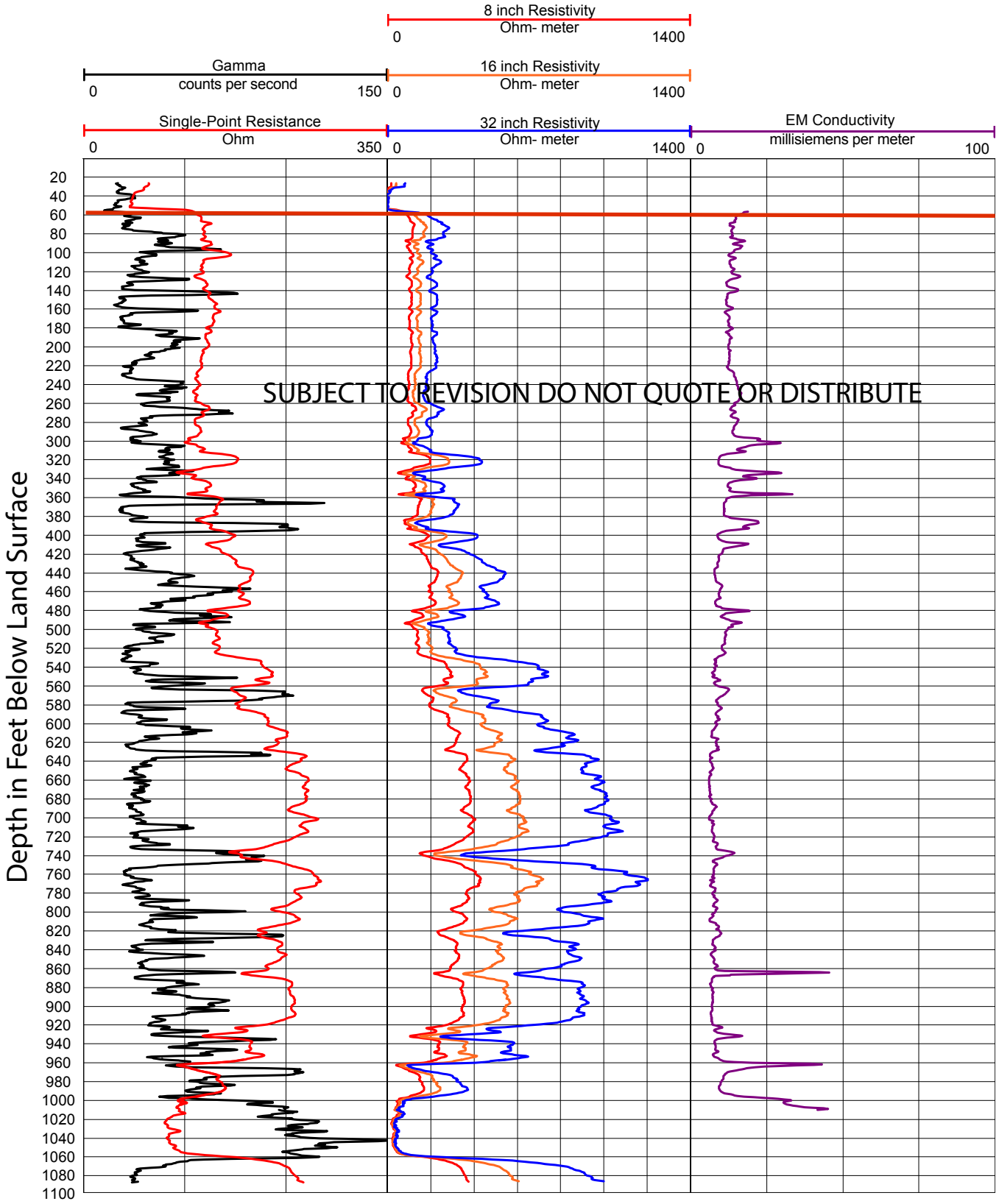
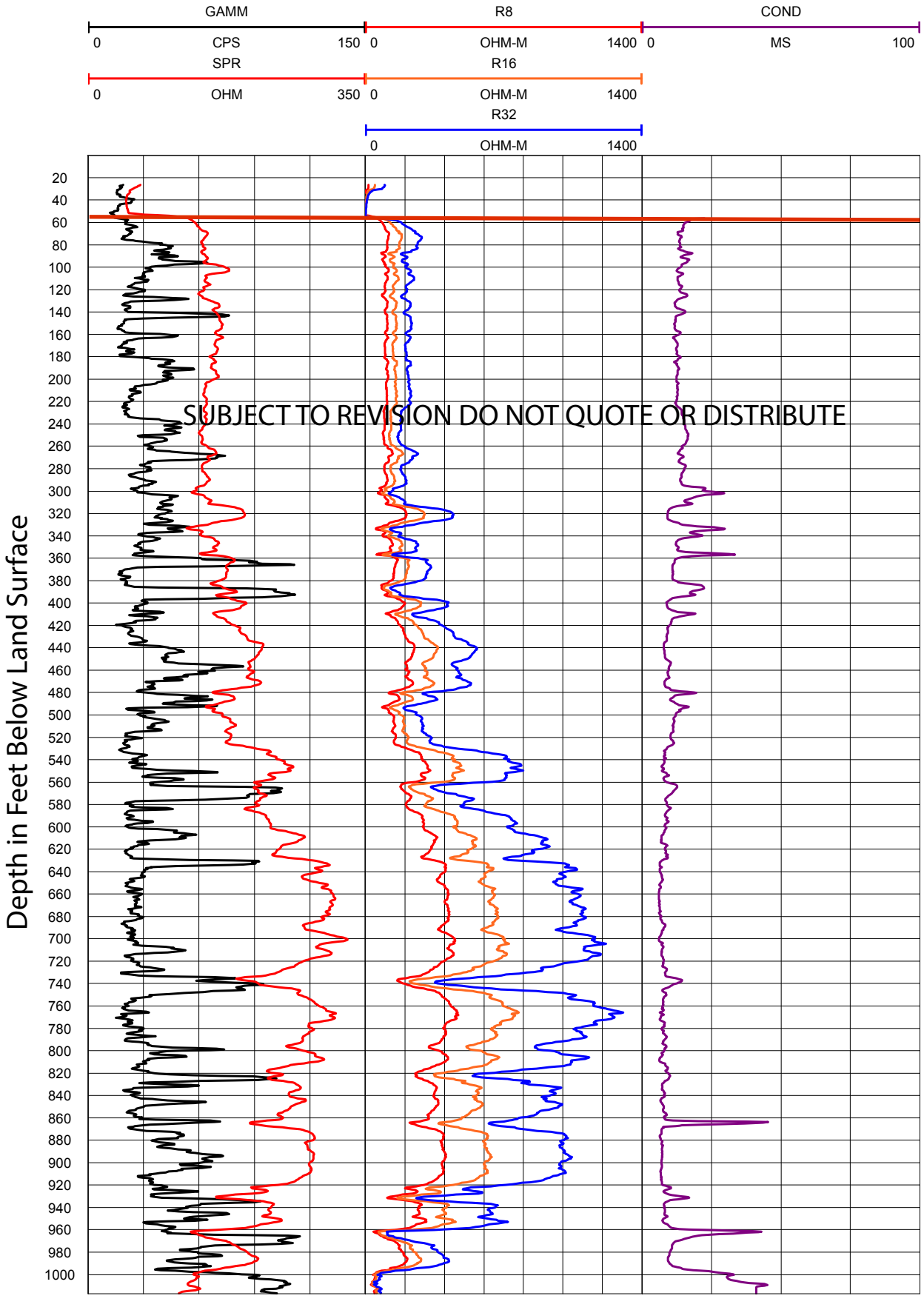
DEC-VPB-2
Test Borehole (Deepened)
12/11/17



Geophysical log suite of DEC-VPB-2 after borehole was drilled deeper.

DEC-VPB-2
Test Borehole
11/28/17



Geophysical log suite of DEC-VPB-2