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From: Fran Alexander <fran@deane-alexander.com>
Sent: Friday, December 09, 2016 3:33 PM
To: drillingstudyquestions
Subject: 20161209-Fran-Alexander

~~~~Please send reply indicating this email has been received~~~~thanks.

**Misc. Questions:**

1. After 2 1/2 months since the drilling took place, why was the public given only 9 days to examine a 542 page document, which needs extensive examination by a variety of people with different expertise?
2. Can you extend this comment period?
3. If not, why not?
4. Considering the extremely negative reaction the public has had in regard to transparency and the modest notification of various aspects in the permitting and development of this hog farm, would continued public relations be helped or hampered if inadequate examination time of drilling findings was provided?
5. Why were citizens told that the drilling results would be provided at a meeting in Little Rock and after many traveled there——on their own time and at their expense—— were they denied the opportunity to ask questions for the record of Harbor or ADEQ?
6. Does ADEQ have a written policy definition of “transparency” and “public participation?” If so, would you please provide?

Other questions (below in blue) I have are in regard to the selection of the bore hole location and the decision to drill only one hole.

In my examination of the documents provided online (and many would not open for some reason), I have tried to trace and piece together the path ADEQ followed to pick the bore hole location and the reasoning in limiting drilling to one bore hole for this testing. Please inform me, if there is a gap of misunderstanding cited in other documents not available in this path that I’m missing.

**From the: Comments Summary Aug. 26, 2016**

*Project Scope*

A number of questions were raised regarding the scope of this project. ADEQ undertook this investigation as part of its regulatory authority in response to citizen concerns regarding the findings of the Electrical Resistivity Imaging (ERI) study conducted by Dr. Todd Halihan under a contract with the University

of Arkansas Big Creek Research and Extension Team (BCRET). These concerns were based on a statement made by a member of the BCRET team in an email recounting a discussion with Dr. Halihan and others. The email stated: *“In Short, it would be nice to put a well on the west side in the vicinity of where Todd (Dr. Halihan) believed he saw a major fracture and movement of waste. This could be critical to resolving the interpretation of the resistivity data . . .”* The purpose of the drilling is to follow up on that summation (i.e. to investigate the anomaly as a possible fracture and movement of waste). The scope of this study is intended to resolve questions regarding subsurface conditions at the point of interest identified by the ERI study.

#### Questions:

1. The bore hole location “to put a well on the west side in the vicinity . . . . .believed . . .a major fracture and movement of waste. . . . .” does not delineate on the west side of what. The buildings? The ponds? The eastward slope? Big Creek? The road?
2. What is the surface description of where this fracture is suspected and the rationale for drilling only one hole to locate it?
3. Is this single bore hole uphill from the ponds? The aerial photo has no compass points on it to determine east from west or topographic lines to indicate if the hole is uphill from the ponds or level with them or below the ponds (which seems unlikely).

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## From: ADEQ MANAGEMENT PLAN—C&H FARMS INVESTIGATION

### 1. Introduction and Purpose

This investigation is in response to interpreted results from a 2015 electrical resistivity imaging (ERI) survey commissioned by the Big Creek Research and Extension Team (BCRET) that suggested possible **vertical** leakage from the waste storage ponds and possible fracturing within limestone bedrock ***below the site***. Potential concerns raised by a citizens group regarding the ERI survey included the rapid transport of contaminants in ***groundwater through weathered limestone pathways and subsidence or collapse of the ponds due to karst terrain***. The citizen’s group recommended a subsurface investigation prior to installation of synthetic liners within the ponds.

***Given the concerns, this investigation is being conducted by ADEQ to evaluate the lithology/geology below the site and assess potential subsurface impact from the waste storage ponds.*** As part of this process, Harbor prepared the Drilling Study Work Plan (DSWP) to describe the methods and procedures to be utilized in the collection and analysis of soil, rock, and groundwater samples at the C&H Hog Farms facility.

#### Questions:

4. If “this investigation is in response. . . . .[to the] suggested possible **vertical** leakage from the waste storage ponds and possible fracturing within limestone bedrock **below the site**,” why was the one and only bore hole apparently up-slope from the area “below the site,” if the “site” is defined as the ponds? It was expressly stated that the concerns have to do with “pathways and subsidence or collapse of the **PONDS** due to karst terrain.”
5. If “this investigation is being conducted by ADEQ to evaluate the lithology/geology **BELOW THE SITE** and assess potential subsurface impact from the waste storage ponds,” why was the single bore hole not below the ponds, but instead seemingly uphill from them?

## From: DRILLING STUDY WORK PLAN --HARBOR Aug. 20161.3 Project Goals

To accomplish these project goals, a boring expected to be approximately 120-feet in depth will be drilled in the vicinity of the waste storage ponds to evaluate the subsurface and collect soil and groundwater samples for analysis of potential contaminants. *The location of the boring was chosen by ADEQ based on the ERI data (35.92279, -93.073269).*

6. Question: If this was to be an independent study, why did ADEQ choose the bore site? The independent consultants' judgment of where the bore hole should be drilled would have truly made the study "independent."

### 2.2 Physical Setting

#### 2.2.1 Physiography

The C&H Hog Farms facility *slopes slightly to the east* toward Big Creek, located roughly 2,500 feet east of the site. The site elevation ranges from approximately 895 to 920 feet above National Geodetic Vertical Datum (NGVD). No water bodies exist on the site other than the two waste storage ponds. *Storm water runoff from the site exists primarily as sheet flow and is conveyed eastward, eventually entering an intermittent drainageway that traverses an agricultural field and discharges into Big Creek.* Big Creek flows generally northward and receives runoff from Left Fork Creek prior to discharging into the Buffalo River at a point roughly 4.5 miles northeast of the hog farm near the Carver community.

*The planned 120-foot boring will be placed between the waste storage ponds and the farrowing barn, as directed by ADEQ.* The boring location, shown on Figure 2 of the DSWP, is in the vicinity of the MTJ108 transect line established during the 2015 ERI study. Coordinates for the boring are 35.922779, -93.073269. An Arkansas-registered surveyor will be used to establish the boring location and elevation in the field prior to drilling activities.

#### Questions:

7. Were benchmarks placed at the bore hole and below the lowest pond on the east slope in order to determine the drop in feet between those two points?
8. If so, how many feet are there between those two points?
9. If the purpose of the drill test was to determine possible leaking underneath and/or below the ponds, why would the bore hole be placed above the ponds near the barn?
10. If the karst substructure underneath the ponds is a maze of pathways, would any of those geologic paths enable any drainage from these ponds to wick uphill or to the west, or is it generally accepted that water in the karst would flow downhill, eventually making its way through the karst?

### 3.0 Field Activities and Sampling Methodology

#### 3.1 Boring Location

From: Quality Assurance Project Plan

### 1.3 Summary of Drilling Study Activities

*Results of a 2015 electrical resistivity imaging (ERI) study suggested vertical leakage from the waste storage ponds and possible fracturing within limestone bedrock below the site.* A 120-foot boring will be completed in the vicinity of the waste storage ponds to evaluate the subsurface and collect soil and groundwater samples for analysis of potential analytes of interest (AOIs). The coordinates for the boring are 35.922779, -93.073269. Downhole geophysical logging will be conducted within the borehole to further characterize subsurface conditions.

### 2.0 Data Quality Objectives and Criteria

*In general, the primary Data Quality Objective (DOO) for the Drilling Study is to collect data of sufficient quality for use in assessing migration of contaminants from the waste storage ponds to the subsurface and evaluating the existence of potential migration pathways (e.g., fracturing or dissolutional features) in limestone bedrock below the site.* Quality criteria are set herein to assure suitability for intended use of the data.

#### Question:

11. Again, these statements speak of “below the site.” Where is the “below the site” location — underneath the ponds or downhill from them?

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#### C&H Hog Farms Drilling Study Work Plan

##### 2.2.4 Hydrogeology

Groundwater below the site is contained within the Ozark Plateaus aquifer system, which consists of three distinct water bearing zones separated by two distinct confining units. The uppermost aquifer is the Springfield Plateau aquifer, which is contained in the Boone Formation and the St. Joe Member of the Boone Formation (Renken, 1998). *Depth to the uppermost water-bearing zone below the C&H Hog Farms facility is unknown. As discussed above, saturated conditions were not encountered within 18.5 feet bls during the 2012 geotechnical investigation at the site.* The well log from the onsite water well (Appendix A) indicates saturation within the residuum zone, but does not indicate depth to groundwater. A saturated zone is commonly present at the interface of residuum and competent bedrock.

#### Question:

12. “Saturated conditions were not encountered within 18.5 feet bls during the 2012 geotechnical investigation of the site.” Were the ponds in place and filled at that time or was this a “before” analysis of the site before ponds were installed and filled?

The onsite water well was completed to a total depth of 325 feet bls, and surface casing was installed to a depth of 74 feet bls. Static groundwater was measured at a depth of 138 feet bls. The occurrence of groundwater within limestone is typically related to secondary porosity (fractures or dissolution features) that developed after rock formation. The anticipated groundwater flow direction in the vicinity of the site would generally be eastward, similar to surface topography; however, the movement of groundwater within limestone is highly dependent upon the interconnection of fractures or other secondary features. *It should be noted that groundwater flow direction will not be evaluated as part of the Drilling Study.*

Question:

13. Would not groundwater flow direction be the most important key to understanding if, where, and why there might be a contamination leak from the waste ponds?
14. Why was groundwater flow not evaluated as part of this study, especially using a dye testing method considering the known karst subsurface?

### 2.3 Historical Summary of Regulatory and Site Activities

On March 14, 2015, BCRET conducted an ERI at the C&H Hog Farms facility. ERI is a geophysical technique for imaging subsurface characteristics, such as geologic structure, moisture content, or presence of conductive fluids, from electrical resistivity measurements made at the surface. ERI datasets were collected from four separate transects placed in the vicinity of the waste holding ponds. Professor Todd Halihan, working for BCRET, concluded that the ERI results along Transect MTJ108, located west of the waste storage ponds, suggested leakage from the waste storage ponds and possible fracturing within limestone bedrock below the site. Dr. Halihan recommended drilling to evaluate subsurface contamination and fracturing below the pond area.

### 1.2 Previous Investigations

The BCRET team has been monitoring water quality of the farm and the Big Creek watershed since late 2013. Additionally, electrical resistivity imaging (ERI) was conducted in 2015 around the waste ponds to evaluate subsurface conditions. The results of the ERI survey showed an area of low resistivity at depth between the two ponds.

Questions:

15. Was Professor Halihan's logic that if there were fractures west of the ponds then test drilling below the pond area would indicate that moisture flow was traveling from the fractured area on the west to the substructure under and on the east of the ponds?
16. Once again, was the recommendation for beneath the ponds or below them on the eastward underground slope?
17. "The results of the ERI survey showed an area of low resistivity at depth between the two ponds." What was the depth?
18. Why were more bore holes not drilled to be certain that all the fractures and dissolution features, etc underground were not distorting the water flow situation below and beneath that can not be seen?

Thank you,  
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