

**BUFFALO RIVER WATERSHED ALLIANCE  
ARKANSAS CANOE CLUB  
NATIONAL PARKS CONSERVATION ASSOCIATION  
OZARK SOCIETY**

January 29, 2016

**Via Email**

C&H Hog Farms EA  
c/o Cardno, Inc.  
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**Re: Comments on FSA and SBA Final Environmental Assessment and Draft  
Finding of No Significant Impact, C&H Hog Farms**

Dear Administrator Dolcini and Administrator Contreras-Sweet,

The Buffalo River Watershed Alliance, Arkansas Canoe Club, National Parks Conservation Association, and Ozark Society (collectively, “the Coalition”) respectfully submit these comments on the Final Environmental Assessment (“EA”) and Draft Finding of No Significant Impact (“FONSI”) prepared by the U.S. Department of Agriculture Farm Service Agency and the Small Business Administration (jointly, “the Agencies”). The Draft FONSI and Final EA were made available for public comment pursuant to NEPA regulation, 40 C.F.R. § 1501.4(e)(2), and the order of the District Court of the Eastern District of Arkansas in *Buffalo River Watershed Alliance v. Department of Agriculture*, No. 4:13-cv-450-DPM, 2014 WL 6837005 (Dec. 2, 2014).<sup>1</sup> As explained below, the Draft FONSI and Final EA are unsupportable. The Coalition urges the Agencies to comply with the National Environmental Policy Act (“NEPA”) and make the necessary finding pursuant to NEPA that the C&H facility may have significant adverse impacts on the human environment.<sup>2</sup>

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<sup>1</sup> The Court found that the C&H concentrated animal feeding operation (“CAFO”) for which the Agencies had guaranteed millions in federal loans was unprecedented, necessitating public review of the draft FONSI for thirty days in accordance with 40 C.F.R. § 1501.4(e)(2). *Buffalo River Watershed Alliance*, 2014 WL 6837005 at \*4.

<sup>2</sup> These comments are supplemental to and wholly incorporate by reference the Coalition’s September 4, 2015 comments on the Agencies’ Draft EA, including attached exhibits. The Coalition directs the Agencies to those comments without repeating each of the many issues already raised before the Agencies, nearly all of which have been inadequately considered in the Agencies’ Final EA. Here, the Coalition merely highlights several of the key problems with the Agencies’ environmental review and identifies additional problems with the Draft FONSI and Final EA.

The EA and FONSI as drafted fail to comply with NEPA, which requires federal agencies to prepare an Environmental Impact Statement (“EIS”) for federal actions “significantly affecting the quality of the human environment.” 42 U.S.C. 4332(2)(C). Importantly, NEPA regulations define “affecting” to mean “will or *may have* an effect on.” 40 C.F.R. § 1508.3 (emphasis added). The facts and science show that the unprecedented 6,500-swine C&H operation located in the watershed of the Buffalo National River indeed may have a significant adverse impact on the environment. The Agencies’ conclusion to the contrary is unsupported by the science and will not withstand judicial scrutiny.

## **I. THE KARST SYSTEM AND ITS IMPLICATIONS FOR C&H’S IMPACTS ON WATER RESOURCES**

NEPA is an “environmental full disclosure law,” *Monroe Cnty. Conservation Council, Inc. v. Volpe*, 472 F.2d 693, 697 (2d Cir. 1972) (internal citation and quotation marks omitted). It ensures “that environmental information is available to public officials and citizens.” 40 C.F.R. § 1500.1(b). An agency cannot comply with its obligations under NEPA by providing incorrect or inaccurate information. Rather, NEPA requires the disclosed information to be “high quality” because “[a]ccurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA.” *Id.* Agencies are obligated to “insure the professional integrity, *including scientific integrity*, of the discussions and analyses” in their NEPA review. *Id.* § 1502.24 (emphasis added).

The Agencies’ Draft FONSI and Final EA provide inaccurate scientific information and analysis. The glaring inaccuracy that permeates the Agencies’ review and discredits all related findings is the Agencies’ continued insistence that C&H is not located in a karst system. *See generally* Final EA at 3-10 to 3-13; *see, e.g., id.* at 3-11 (“[T]he C&H Hog Farms site and vicinity do not exhibit strongly developed karst landforms . . .”). The Final EA repeats the claim that soil borings conducted as part of C&H’s permit application were indicative of an absence of karst beneath C&H,” *id.* at 3-10—a claim that has been thoroughly discredited by experts in the field<sup>3</sup> and the National Park Service.<sup>4</sup> The conclusion that C&H is not located on

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<sup>3</sup> *See, e.g.,* Testimony of Tom Aley, A Technical Assessment of the Adequacy and Accuracy of the Draft Environmental Assessment for C&H Hog Farms, Newton County, Arkansas at 12 (Aug. 27, 2015), <http://buffaloriveralliance.org/Resources/Documents/Tom%20Aley%20hog%20farm%20assessment.pdf> (“Aley comments”) (noting that the three test borings were “done to characterize the sediments encountered and their possible utility for a compacted soil liner” and are “not indicative of an adequate subsurface hydrogeologic investigation”); Katarina Kotic et al., *Proposals for Integrating Karst Aquifer Evaluation Methodologies into National Environmental Legislations*, 1 Sustainable Water Resources Mgmt. 363, 370 (2015), <http://link.springer.com/article/10.1007/s40899-015-0032-5/fulltext.html> (“Kotic”) (attached as Exhibit 1) (noting that “the subsurface investigation . . . conducted as part of the permitting process prior to construction” was “very limited”).

karst, and hence that groundwater and surface water contamination via seepage and underground conduits are not a potentially significant impact, flies in the face of the overwhelming consensus of the scientific community.

It is undisputed by scientists that C&H is located in a region dominated by karst.<sup>5</sup> But the Agencies make no mention of the comments submitted by Thomas Aley, a preeminent geologist and hydrogeologist with special expertise in karst, and arbitrarily dismiss the research conducted by University of Arkansas Professor Emeritus and U.S. Geological Survey (“USGS”) Research Hydrologist Emeritus John Van Brahana. *See, e.g.*, Final EA at 3-12. Turning a blind eye to the expertise volunteered to the Agencies by established and credible scientists is the antithesis of ensuring the scientific integrity of its analysis. *See* 40 C.F.R. § 1502.24. Indeed, two sister federal agencies—the National Park Service (“NPS”) and USGS, both of which have more direct and relevant expertise than the Farm Service Agency and the Small Business Administration on the geology and hydrogeology of the region—concur with the statements of these experts that C&H is located in a karst system dominated by closely interconnected groundwater and surface water flow.

In its comments on the Draft EA, NPS states that “[t]he EA does not take into account the fragile nature of the karst system on Surface Water or Ground Water, which are intimately connected throughout the Buffalo River watershed.”<sup>6</sup> NPS accepts as a fact that C&H’s waste storage ponds “are built upon karst mantled with the insoluble residue from limestone decomposition” and that it is therefore “reasonable to believe that much if not all of th[e ponds’] leakage is finding its way into the karst groundwater system.”<sup>7</sup> Pointing to the Electrical Resistivity Imaging (“ERI”) study conducted by Oklahoma State University and its finding of a sinkhole in Field 12, NPS reiterates that “it is reasonable to believe that the facility may be directly discharging contaminants into the Buffalo River and surface streams flowing directly

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<sup>4</sup> *See* Letter from Kevin G. Cheri, Superintendent, Buffalo National River, to C&H Hog Farms EA at 23 (Sept. 4, 2015), <http://buffaloriveralliance.org/Resources/Documents/BNR%20Comments%20on%20draft%20EA.pdf> (“NPS comments”) (“The geotechnical investigations did not indicate there were ‘no karst features or topography’ in the area of the buildings and waste storage ponds.”).

<sup>5</sup> *See* Aley comments; *see also* John Van Brahana, Comments of Professor John Van Brahana on Draft Environmental Assessment for C&H Hog Farm (attached as Exhibit 1 to the Coalition’s September 4, 2015 comments and also available at <http://buffaloriveralliance.org/Resources/Documents/Ex%201%20-%20FINAL%20Brahana%20statement%20with%20CV.pdf>) (“Brahana comments on Draft EA”). These comments also incorporate by reference the comments submitted by Professor Brahana on the Final EA. *See* Letter from John Van Brahana, Professor Emeritus, Univ. of Ark., to U.S. Farm Service Agency and U.S. Small Business Agency (Jan. 27, 2016), [http://buffaloriverwatershedalliance.wildapricot.org/resources/Documents/Van Brahana re Final EA.v8.pdf](http://buffaloriverwatershedalliance.wildapricot.org/resources/Documents/Van%20Brahana%20re%20Final%20EA.v8.pdf) (“Brahana comments on Final EA”).

<sup>6</sup> NPS comments at 18-19.

<sup>7</sup> *Id.* at 10.

into the Buffalo River.”<sup>8</sup> NPS cites the work of Dr. Brahana in describing “recent groundwater tracing in the area [that] indicates groundwater in the vicinity of spreading field 15 moves directly to the Buffalo River through the karst aquifer system, and comes out in a distributary pattern into the river,” and admonishes the Agencies for failing to consider “the data Dr. Brahana has collected over the past two years.”<sup>9</sup>

USGS too has corroborated the credibility of Dr. Brahana’s findings. Dr. Brahana and his colleagues on the Karst Hydrogeology of the Buffalo National River (“KHBNR”) team presented a study and an abstract at the USGS Survey Karst Interest Group Proceedings held from April 29 to May 2, 2014.<sup>10</sup> Notably, the abstract was authored jointly with USGS geoscientist and ground water specialist Dr. Phillip Hays, who is also a member of the Big Creek Research and Extension Team (“BCRET”) so frequently referenced in the EA. In the abstract, the authors, including Dr. Brahana and Dr. Hays, note that the C&H CAFO is located in a “region [that] has a *mature karst landscape*, which provides rapid recharge to groundwater” and that “[g]roundwater and surface-water interaction within the Big Creek watershed is *extensive*.”<sup>11</sup>

The Final EA thus entirely misses a central point. The key question is not *whether* the swine waste stored in C&H’s two storage ponds and the swine waste spread on fields might eventually enter the karst groundwater system, but where that waste and contaminated water will travel. In a document obtained in response to a Freedom of Information Act request, NPS, in commenting on its water resources concerns related to C&H, notes that “[d]ue to the underlying karst geology and heterogeneous and flashy nature of groundwater flow, contamination may be rapidly transported in the subsurface to Big Creek.”<sup>12</sup> NPS also noted that “[a] USGS-approved dye tracing study for the pond and barn area would help define subsurface hydrology, including groundwater flow direction, transit rates offsite, and areas of groundwater discharge.”<sup>13</sup> In fact,

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<sup>8</sup> *Id.* at 12.

<sup>9</sup> *Id.* at 11, 21.

<sup>10</sup> See Nat’l Cave & Karst Res. Inst., USGS, Scientific Investigations Report 2014-5035, U.S. Geological Survey Karst Interest Group Proceedings, Carlsbad, New Mexico, April 29-May 2, 2014 at 4, 6 (Eve L. Kuniandy & Lawrence E. Spangler eds., 2014), <http://pubs.usgs.gov/sir/2014/5035/sir2014-5035.pdf>; Van Brahana et al., CAFOs on Karst—Meaningful Data Collection to Adequately Define Environmental Risk, with a Specific Application from the Southern Ozarks of Northern Arkansas 87, *in* Nat’l Cave & Karst Res. Inst., U.S. Geological Survey Karst Interest Group Proceeding (“CAFOs on Karst”); Victor L. Roland II et al., An Initial Investigation of Hydrogeology and Water Quality of Big Creek in the Buffalo River Watershed near a Major Concentrated Animal Feeding Operation—Abstract 97, *in* Nat’l Cave & Karst Res. Inst., U.S. Geological Survey Karst Interest Group Proceedings (“Hydrogeology Investigation”).

<sup>11</sup> *Id.* at 97 (emphasis added).

<sup>12</sup> NPS, Mitigation and pollutant minimization proposals for C&H Hog Farm, Inc. 2 (preliminary draft, May 9, 2013) (attached as Exhibit 2).

<sup>13</sup> *Id.*

USGS already has funded a study undertaken by Dr. Brahana, USGS's Dr. Hays, and others, which accepts as a known fact that C&H is sited on karst and that the CAFO poses "a potential threat to groundwater and surface-water quality in the Mt. Judea area."<sup>14</sup> The study examines the hydrogeologic connections between groundwater and surface-water in the karst region and seeks to calculate diffuse groundwater flow and quick conduit flow in karst and the contribution of groundwater in the Buffalo River and Big Creek.<sup>15</sup>

In a similar vein, the two authors of the Oklahoma State University electrical resistivity imaging ("ERI") study of three C&H fields presented their findings, entitled "Resistivity imaging of Swine Waste in Mantled Karst," at the Midwest Ground Water Conference.<sup>16</sup> The title of the presentation indicates the undisputed conclusion that C&H is located on karst. The presentation notes that the ERI was conducted not to assess *whether* there was karst underlying the facility and its fields but rather to "[c]haracterize potential groundwater flowpaths in a complex mantled karst."<sup>17</sup> The presentation states that the bedrock underlying the soil and epikarst zones of the three imaged fields showed "[e]vidence for possible flowpaths."<sup>18</sup> In an email among members of the BCRET team about the presentation, USGS water quality specialist Timothy Kresse noted that he spoke with Professor Todd Halihan:

I did chat with Todd [Halihan] and Jon [Fields] some about the pond results . . . . In short, it would be nice to put a well on the west side in the vicinity of where Todd believed he saw *a major fracture and movement of waste. This could be critical to resolving the interpretation of the*

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<sup>14</sup> State Water Resources Research Institute Program (WRRI), USGS, Hydrogeology and Biogeochemical Evolution of Groundwater in Big Creek and Buffalo River Basins and Implications for Concentrated Animal-Feeding Operations (Abstract), <http://water.usgs.gov/wrri/grant-details.php?ProjectID=2014AR355B&Year=2014> (last visited Jan. 28, 2016).

<sup>15</sup> *Id.*

<sup>16</sup> The Final EA references an electrical resistivity imaging analysis of three C&H fields conducted by Oklahoma State University's School of Geology, *see* Final EA at 3-12, which was attached as Exhibit 6 to Coalition's September 4, 2015 Comments and are also available at <http://buffaloriveralliance.org/Resources/Documents/Ex.%206%20-%20OSU%20ER%20Report%202015.pdf>. The Agencies note that "a second field effort was conducted in May 2015" but claim that "[t]he results of the May surveys are not yet available." Final EA at 3-12. However, the two authors of the ERI study, Professor Todd Halihan and student Jon Fields, presented their findings on C&H as recently as October 2015 at the Midwest Ground Water Conference. *See* 60<sup>th</sup> Annual Midwest Groundwater Conference, Conference Program at 9 (2015), <http://www.irwp.org/assets/PDF/2015-Midwest-Groundwater-ConferenceProgramFINALweb.pdf>; *see also* Jon Fields & Todd Halihan, Okla. State Univ., Resistivity Imaging of Swine Waste in Mantled Karst (Powerpoint presentation) (attached as Exhibit 3).

<sup>17</sup> Exhibit 3 at slide 2.

<sup>18</sup> *Id.* at slide 18.

*resistivity data . . . . I believe it is a critical component.* Todd is fairly confident of his interpretation.<sup>19</sup>

The overwhelming scientific consensus is thus that C&H is located on karst. The Final EA inexcusably misses this significant point entirely. The facts and science ignored by the Agencies rationally lead to a conclusion that, particularly in a karst system, with its closely interconnected groundwater and surface water flow, C&H may have significant impacts on water resources. The Agencies' failure to ensure the scientific integrity of its analysis concerning karst and the related water impacts is a fatal flaw and discredits most of the findings in the EA and FONSI—such as impacts on protected species, on public health, and on the Buffalo National River—which are predicated on the erroneous conclusion that C&H will have no adverse impacts on water resources.

## **II. ADDITIONAL ERRORS AND FLAWS IN THE FINAL EA**

These comments incorporate by reference the comments and attached exhibits submitted by the Coalition on September 4, 2015, with the following additional points:

### **Karst and Impacts on Water Resources**

- The Final EA claims that “the C&H Hog Farms site and vicinity do not exhibit strongly developed karst landforms as demonstrated by a review of the Mt. Judea USGS 7.5 minute topographic quadrangle map and online aerial photograph information.” Final EA at 3-11. As Dr. Brahana notes in his comments on the Final EA, however, reviewing the USGS 7.5 minute topographic quadrangle map and online aerial photographs is an insufficient method for determining the presence of karst.<sup>20</sup> Likewise, the NPS has noted that hundreds of sinkholes identified through Light Detection and Ranging (“LiDAR”) do not appear on USGS topographic maps.<sup>21</sup>
- The Final EA discounts Dr. Brahana’s groundwater characterization, karst inventory, and fluorescent dye tracing study because “no published data or results are available.” Final EA at 3-12. In fact, though, Dr. Brahana’s research on the impacts of C&H in the Big Creek and Buffalo River watersheds has been published<sup>22</sup> and presented.<sup>23</sup> In one peer-reviewed publication, Dr. Brahana and his team note that “based

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<sup>19</sup> Email from Timothy Kresse, USGS, to Andrew N. Sharpley, Univ. of Ark. (Oct. 16, 2015) (attached as Exhibit 4). Thus, the Agencies’ conclusion from the ERI study that the underlying epikarst might actually “be a beneficial condition to the use of spray application,” Final EA, App. B at 23, has no support in the science and directly contradicts the concerns raised by USGS scientists and the authors of the ERI study.

<sup>20</sup> See Brahana comments on Final EA at 1-3.

<sup>21</sup> NPS comments at 16.

<sup>22</sup> See Kasic (Ex. 1).

<sup>23</sup> See CAFOs on Karst; Hydrogeology Investigation.

on the indicated groundwater connections, and known physical and operational site characteristics, contaminant migration may already be occurring, presenting a significant risk for surrounding groundwater bodies, surface waters and natural heritage.”<sup>24</sup> The Final EA’s failure to acknowledge and consider this credible scientific finding is arbitrary and capricious.

The Final EA also discounts Dr. Brahana’s data because the collected water quality data are “not available through the USGS or EPA water quality databases.” Final EA at 3-12. The Agencies provide no rationale why availability through the USGS or EPA water quality databases is a necessary condition for the Agencies’ consideration of data. Moreover, the Agencies’ inconsistent approach of relying heavily on data collected by the BCRET team, which also is not available through the USGS or EPA water quality databases,<sup>25</sup> is further evidence of their arbitrary and capricious approach.

- The premise of the BCRET’s comparison of upstream and downstream water quality data is fundamentally flawed, as the Coalition noted in its September 4, 2015 comments on the draft EA and as Mr. Aley noted in his comments.<sup>26</sup> NPS too has flatly stated that the Agencies “appear to lack any understanding of the dynamics of groundwater flow in a karst dominated watershed”<sup>27</sup>:

They believe that the study Big Creek Research and Extension Team (BCRET) is conducting will determine if there are impacts to water quality as they are taking samples immediately above and below the spreading fields in Big Creek. They have failed to take into account the diverse flow possible in karst, and the long distance transport of groundwater, and contaminants. . . .

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. . . Because of the fact that the water from this valley is flowing through the karst aquifers, it is not reasonable to assume that measuring the nutrient levels and bacteria just downstream of the CAFO is an accurate method to determine pollution potential.<sup>28</sup>

Yet, hand in hand with a myopic refusal to acknowledge the karst system, the Final EA continues to rely almost exclusively on the BCRET upstream and downstream data to conclude that C&H will not have adverse impacts on water quality. This “analysis” is scientifically indefensible.

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<sup>24</sup> Kasic at 370 (Ex. 1).

<sup>25</sup> See Brahana comments on Final EA at 8.

<sup>26</sup> See Aley comments at 4, 6 (noting that monitoring upstream and downstream of C&H will not accurately capture the facility’s impacts “since the majority of the water containing contaminants derived from the manure will move downward into the karst groundwater system rather than overland to Big Creek”).

<sup>27</sup> NPS comments at 14.

<sup>28</sup> *Id.* at 14, 21.

Dr. Brahana's peer-reviewed and published research shows that dye injected in a dug well in close proximity to three C&H fields was detected upstream of BCRET's "upstream" site,<sup>29</sup> invalidating any interpretation of the BCRET data that higher upstream than downstream values indicate contamination from sources other than C&H. Dr. Brahana's findings call into question the basis for much of the EA that references the BCRET upstream versus downstream data.<sup>30</sup>

- Even setting aside the fundamental flaw that characterizes BCRET's upstream versus downstream approach for assessing water quality impacts, the Agencies' nearly exclusive reliance on the BCRET study indicates a failure to insure the scientific integrity of the Final EA, *see* 40 C.F.R. § 1502.24, because the BCRET study to date does not accurately assess the impacts of C&H. The BCRET has noted of its own study:

This information will be a short-term assessment . . . . Additional funds would be needed for sample collection and labor to continue monitoring for a minimum of five years. *This time frame is recognized by NRCS [Natural Resources Conservation Services], EPA [Environmental Protection Agency], and general scientific community to be the minimum required to accurately assess any impacts and overcome annual weather fluctuations.*<sup>31</sup>

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<sup>29</sup> *See* Brahana comments on Final EA at 4; Kasic at 369 (Ex. 1).

<sup>30</sup> In any event, BCRET's quarterly report covering July 1 to September 30, 2015 states that "Nitrate-N concentration in Big Creek below the C&H Farm continue to be greater than those measured at the upstream site" and that "[c]oncentrations of nitrate-N and bacteria collected from the house well, which is . . . adjacent to the manure holding ponds have periodic high values." BCRET, Quarterly Report – July 1 to Sept. 30, 2015, Monitoring the Sustainable Management of Nutrients on C&H Farm in Big Creek Watershed at 2, [http://www.bigcreekresearch.org/project\\_reports/docs/UofA%20BCRET%20Quarterly%20Report%20April%20-%20Sept%202015.pdf](http://www.bigcreekresearch.org/project_reports/docs/UofA%20BCRET%20Quarterly%20Report%20April%20-%20Sept%202015.pdf). This quarterly report also indicated the continued presence of *E. coli* and total coliform in an ephemeral stream and in the monitoring trenches constructed below the two waste storage ponds specifically to detect pond leakage. *Id.* at 39-44. The trend of higher downstream than upstream Nitrate-N concentrations continues in the most recent BCRET quarterly report covering October 1, 2015 to December 31, 2015. BCRET, Quarterly Report – Oct. 1 to Dec. 31, 2015, Monitoring the Sustainable Management of Nutrients on C&H Farm in Big Creek Watershed at 41-43, [http://www.bigcreekresearch.org/project\\_reports/Quarterly%20Report%20Oct%20-%20Dec%202015.pdf](http://www.bigcreekresearch.org/project_reports/Quarterly%20Report%20Oct%20-%20Dec%202015.pdf). The most recent report also shows the continued presence of *E. coli* and total coliform in the ephemeral stream and monitoring trenches. *Id.* at 44-49. The Final EA does not consider this data.

<sup>31</sup> BCRET, Quarterly Report – Oct. 2013 to Dec. 2013, Demonstrating and Monitoring the Sustainable Management of Nutrients on C&H Farm in Big Creek Watershed at 10, [http://www.bigcreekresearch.org/project\\_reports/docs/CH%20Quarterly%20Report%20Oct%20-%20Dec%202013%20Sharpley.pdf](http://www.bigcreekresearch.org/project_reports/docs/CH%20Quarterly%20Report%20Oct%20-%20Dec%202013%20Sharpley.pdf).



The BCRET study has now been ongoing for just over two years, and therefore, by its authors' own admissions, its data does not accurately assess the impacts of C&H.

The BCRET team plainly is still in an early stage of understanding the quality, reliability, and meaning of the data it is collecting. In an email exchange between members of the BCRET team that was obtained pursuant to the Freedom of Information Act, for instance, a USGS scientist noted:

There [are] some analyses that don't make sense from several ways of looking at the data. . . . For example, there was one event where TN was 2.2 (upstream; 9/24/13), with NH<sub>4</sub> and NO<sub>3</sub> concentrations of only 0.03 and 0.44 respectively, and an organic N (which should supply the remainder) of 0. Doesn't add up. . . . There are others like these, which I'll simply highlight so we can discuss them at a later date. I don't want to get into too much minutiae on this point, but we'll want to decide if there is data that should be flagged and not used in further interpretation (hate to throw out data, but if not supported, then we'll at least want to discuss further). It would be nice to isolate these sooner, so the lab could re-run or check some of this older data . . . . Just wanted to give a flavor for what we are seeing, both positive and negative.<sup>32</sup>

The Final EA's assertion that the BCRET data are "considered sufficient to conclude that if the farm's operation over the last 18 months was contributing measureable concentrations of nutrients or bacteria then it would be apparent in the water quality monitoring data collected to date, or be observed in emerging trends," Final EA at 3-23, thus plainly has no support even from the scientists who have collected the data.

- The Final EA notes that a pending application by EC Farms proposes to spread C&H's swine waste on approximately 558 acres of land elsewhere in Newton County, Arkansas. Final EA at 4-3. The EA's facile conclusion that "[t]he addition of these fields for land application of C&H Hog Farms manure would allow for greater flexibility" fails to grasp the magnitude of this reasonably foreseeable change in circumstance on the impacts of C&H. *Id.*

In July 2015, ADEQ received a request from EC Farms to land apply waste from C&H.<sup>33</sup> The requested permit is pending. EC Farms proposes to take the swine waste from C&H and land apply it on 33 land parcels located in 4 different townships (T13N-R20W, T14N-R21W, T15N-R20W, and T15N-R21W) in Newton County.<sup>34</sup> The vast majority of the 558 acres are located in the watersheds of the Little Buffalo River and

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<sup>32</sup> Email from Timothy Kresse, USGS, to Andrew N. Sharpley, Univ. of Ark. (Jan. 21, 2015) (attached as Exhibit 5).

<sup>33</sup> Letter from Monica Hancock, Certified Planner, ANRC, to Ark. Dep't of Env'tl. Qual., Water Div., Permits Branch (July 27, 2015), [https://www.adeg.state.ar.us/downloads/WebDatabases/PermitsOnline/NPDES/PermitInformation/3540-WR-7\\_Application%20Packet\\_20150727.pdf](https://www.adeg.state.ar.us/downloads/WebDatabases/PermitsOnline/NPDES/PermitInformation/3540-WR-7_Application%20Packet_20150727.pdf).

<sup>34</sup> *Id.* at 28-29.

Left Fork of Big Creek, which are within the Buffalo River watershed. More than one-third of this acreage is located on karst,<sup>35</sup> which can allow the waste to rapidly infiltrate into groundwater and flow unabated into streams, rivers, springs, and wells. The Final EA must consider these impacts<sup>36</sup> and also must consider that if the EC Farms permit is approved and waste from C&H is spread on additional fields in the Buffalo River watershed, the BCRET study that the EA relies upon so heavily, which focuses only on the area immediately surrounding C&H, will be made further unreliable in capturing the true impacts of the facility.

- The Final EA repeatedly references C&H’s voluntary proposal to install liners in its two waste storage ponds and claims that this modification “would address concerns about potential seepage of wastes into groundwater, would control odor, and would convert methane into carbon dioxide.” Final EA at 2-6. Setting aside the accuracy of these claims, the Final EA fails to note the distinct possibility that C&H actually will not implement this modification. In an email to Arkansas Department of Environmental Quality (“ADEQ”), Jason Henson of C&H asks ADEQ whether in the event that “ADEQ’s final decision allow[s] for the installation of Pond liners/cover, C&H Hog Farms may choose not to move forward with the actual installation of said liners/cover and may rather opt to continue utilizing the existing clay liners.”<sup>37</sup>
- In light of the inaccurate scientific analyses that pervade the Final EA, it is worth noting that the preparers of the Final EA, identified as consultants to the Agencies, *see* Final EA at 5-1, do not have academic or professional backgrounds that reflect any particular expertise in karst systems or hydrogeology. Their failure to consult with and incorporate the findings of Dr. Brahana and Thomas Aley, both preeminent scientists known as experts in their respective fields, speaks volumes about the Agencies’ failure to insure the scientific integrity of their analyses.

### **Impacts on Other Resources**

- The Final EA does not sufficiently consider impacts to threatened and endangered bat species. White nose syndrome (“WNS”) caused by the fungus *Pseudogymnoascus*

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<sup>35</sup> Letter from Kevin G. Cheri, Superintendent, Buffalo Nat’l River, to Katherine McWilliams, Ark. Dep’t of Env’tl. Qual. (Sept. 18, 2015), <http://buffaloriverwatershedalliance.wildapricot.org/resources/Documents/BNR%20EC%20Hearing%20Request.pdf>.

<sup>36</sup> Notably, while the Final EA describes C&H’s proposed pond liner in a “Proposed Modifications” section, the Agencies inconsistently omit in this section any references to the proposed modification that would result in C&H’s swine waste being spread over an even greater area in the Buffalo River watershed. *See* Final EA at 2-6.

<sup>37</sup> Email from Jason Henson, C&H Hog Farms, Inc., to Water Permit Application, ADEQ (Sept. 29, 2015), [https://www.adeg.state.ar.us/downloads/WebDatabases/PermitsOnline/NPDES/PermitInformation/ARG590001\\_Pond%20Liner%20Application%20Inquiry\\_20150929.pdf](https://www.adeg.state.ar.us/downloads/WebDatabases/PermitsOnline/NPDES/PermitInformation/ARG590001_Pond%20Liner%20Application%20Inquiry_20150929.pdf).

*destructans* was confirmed to be present in Arkansas in 2014<sup>38</sup> and according to NPS staff, was discovered in two caves in the Buffalo National River, Newton County, in 2015—including Fitton Cave, which is habitat to the federally protected Indiana Bat (*Myotis sodalis*), Gray Bat (*Myotis grisescens*), and Northern Long-Eared Bat (*Myotis septentrionali*), all of which have been shown to forage in and around C&H and on the Left Fork of Big Creek. WNS primarily affects hibernating bats. In affected hibernacula, 78 to 100 percent of bat populations—more than 5.7 million bats in northeastern North America—have died.<sup>39</sup> States where WNS has been present for several years have experienced severe declines in bat populations. Since the introduction of WNS, bat populations in Georgia have declined 82%, for instance, and in New Jersey they have declined 90%.<sup>40</sup> In a published study of WNS invasion dynamics in Midwestern states, researchers found that the first year of WNS invasion caused only small to moderate population declines.<sup>41</sup> In the second year, WNS resulted in “high population declines.”<sup>42</sup> In Newton County, the second year of WNS infestation will begin in 2016.

As noted in the Final EA, “the primary threats to gray bat are human disturbance, deforestation, chemical contamination from pesticides, and white-nose syndrome (WNS).” Final EA at 3-38. Yet, in a serious oversight, the Agencies do not indicate that WNS is present in Arkansas nor in caves in Newton County, and do not analyze the impacts of C&H in the context of WNS on the three federally protected bat species in the proximity of C&H. In a failure to “use the best scientific and commercial data available,” 16 U.S.C. § 1536(a)(2), the Agencies failed to request data from Dr. Brahana, which would have revealed that dye under high flow conditions traveled from a location near C&H manure spreading fields to John Eddings Cave, a major hibernaculum for gray bats.<sup>43</sup> The special requirements and selectivity of gray bat roosting areas translates to only 5% of available caves being suitable for this endangered species. Final EA at 3-39. Because of the gray bats’ unique roosting requirements and the connectivity of C&H land application fields to John Eddings Cave, further investigation is required to better understand the impacts of C&H on John Eddings Cave and on the endangered Gray bat.

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<sup>38</sup> Blake Sasse, Arkansas Game and Fish Commission, Arkansas Bat Monitoring Report October 1, 2014 – September 30, 2015 (Nov. 23, 2015).

<sup>39</sup> U.S. Fish and Wildlife Servs., Regional Issue: White-Nose Syndrome, <http://www.fws.gov/northeast/ecologicalservices/ecissues/wns.html> (last updated July 20, 2015).

<sup>40</sup> *Fungus Kills 90 Percent of N.J. Bat Population, Scientists Say*, Associated Press, Apr. 30, 20110, [http://www.nj.com/news/index.ssf/2010/04/fungus\\_kills\\_90\\_percent\\_of\\_nj.html](http://www.nj.com/news/index.ssf/2010/04/fungus_kills_90_percent_of_nj.html); Grant Blankenship, *Researchers Explore Declining Bat Population in North America*, National Public Radio (Aug. 19, 2015), <http://www.npr.org/2015/08/19/432910265/researchers-explore-declining-bat-population-in-north-america>.

<sup>41</sup> Kate E. Langwig et al., *Invasion Dynamics of White-Nose Syndrome Fungus, Midwestern United States, 2012-2014*, 21 *Emerging Infectious Diseases* 1023, 1024 (2015), <http://wwwnc.cdc.gov/eid/article/21/6/pdfs/15-0123.pdf>.

<sup>42</sup> *Id.* at 1023.

<sup>43</sup> See Brahana comments on Final EA at 8.

The Final EA acknowledges that macroinvertebrate populations could be adversely affected by nutrient runoff and contamination that affect bats by reducing prey availability. *See id.* at 3-31. Over the long term, if water quality is reduced, significant alteration of the prey community could change the aquatic invertebrate ecology.<sup>44</sup> Gray bats forage over large areas up to a 60 km range primarily over water (creeks, rivers, and ponds), requiring management strategies to include waterways and riparian areas beyond roost sites.<sup>45</sup> Given the anticipated impact to bats from WNS, any alteration to prey availability to the local ecosystem could further impact the survivability of these endangered species in Arkansas and must be further examined.

- The Final EA downplays C&H's contribution to odor impacts by noting that agriculture is already common in Newton County, highlighting the existence of four other swine CAFOs. Final EA at 3-44, 3-45. But this analysis fails to consider that the scope of C&H's swine operations is "unprecedented" in the area. *Buffalo River Watershed Alliance*, 2014 WL 6837005, at \*4. C&H concentrates into one facility twice as many swine as all other swine CAFOs in Newton County combined. *See Coalition's September 4, 2015 Comments at 28.*
- EPA and the Department of the Interior have determined, under the Clean Air Act, that the Upper Buffalo Wilderness Area is a mandatory Class I federal area where visibility is an important value. 40 C.F.R. § 81.404. Thus, while the Final EA notes that the Northwest Arkansas Intrastate Air Quality Control region is in attainment for all criteria air pollutants, Final EA at 3-2, it should also recognize that the Upper Buffalo, in particular, receives the highest level of visibility protection under the Clean Air Act.
- Tourism is the lifeblood of Newton County and the surrounding area: over 1.3 million people visited the Buffalo National River in 2014 and contributed \$65 million to the local economy. *See Coalition's September 4, 2015 Comments at 32.* The Buffalo National River relies on clear waters and a pristine environment to attract tourists to enjoy recreational activities such as swimming, kayaking, and fishing. Notably, the Buffalo River is a blue-ribbon smallmouth bass stream.

But the Final EA improperly relies on the fact that visitation to the Buffalo National River did not decrease in 2013 or 2014 to dismiss concerns about C&H's potential impacts on the tourism industry. Final EA, App. B at 28-29. Visits to the National Park System overall increased from 2012 to 2014, so increased visitation to the Buffalo National River may simply be reflective of this nationwide trend. In addition, C&H's land application did not begin until late December 2013, Final EA at 2, so

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<sup>44</sup> Erin N. McKinney, *Relative Contribution of Water Quality and Habitat to Macroinvertebrate Community Composition in Streams Influenced by Agricultural Land Use in the Cedar Creek Watershed, Indiana* at 26 (May 2012) (unpublished Master's thesis, Indiana Univ. – Purdue Univ. Ft. Wayne), [http://opus.ipfw.edu/masters\\_theses/12](http://opus.ipfw.edu/masters_theses/12).

<sup>45</sup> Patrick Moore et al., *Home Range and Habitat Use of Foraging Myotis grisescens from Five Maternity Sites in Northern Arkansas Using Aerial Tracking—Abstract*, North American Society for Bat Research at 63 (2015), [https://www.nasbr.org/pdfs/2015\\_Abstracts.pdf](https://www.nasbr.org/pdfs/2015_Abstracts.pdf).

tourism data cited in the Final EA reflect only one year of C&H's waste management operations. "Both short- and long-term effects are relevant" to a NEPA analysis, 40 C.F.R. § 1508.27(a), and the full extent of the land application's impacts on the Buffalo River's environment and reputation as a tourist destination cannot be reflected in one year of data.

## Alternatives

- The Final EA persists in an alternatives "analysis" that offers no actual consideration of alternatives in comparative form that, as required, "sharply defin[es] the issues and provid[es] a clear basis for choice among options by the decisionmaker and the public." 40 C.F.R. § 1502.14. Instead, the Agencies essentially analyze a single alternative: the operation of the C&H facility. Their rationale—that C&H and the lender "are free to continue their financial relationship without Federal guarantees," Final EA at 1-4, and that C&H "provided substantial collateral to secure the loans, including cash and property, which could be lost in the case of default," Final EA at 2-1—ignores relevant facts and disregards the very intent of the NEPA review, at the "heart" of which is the analysis of alternatives, 40 C.F.R. § 1502.14.

First, in assuming that C&H will simply continue to repay its loans and that the facility's relationship with the lender will remain unchanged by the vacatur of the federal loan guarantees, the Agencies overlook the critical fact that C&H was unqualified to receive any credit without the federal loan guarantees. The Agencies' guarantees thus provided a level of insurance to the lender unmet by C&H's collateral. Moreover, the extent to which C&H is able to continue repaying its loan depends in large part on C&H's ability to retain its contract with Cargill, now JBS Pork—the sole consumer of C&H's product. The record before the agencies indicate that C&H's contract with Cargill is term-limited and also that the "demand" and "sales activity trend" in the relevant market is "below average."<sup>46</sup> The Appraisal Report for C&H noted that "[t]he demand for swine units is weak at the present time due to Tyson Foods shutting down their swine operation and cancelling contracts leaving only one swine integrator (Cargill Inc.) and one swine independent integrator (Coastal Plains Pork Cooperative) in the area. (Coastal Plains filed Bankruptcy 9-09)."<sup>47</sup> Thus, the continued viability of C&H and its ability to fulfill the terms of its loan repayment are not nearly as certain as the Agencies baselessly assume in the Final EA. A proper analysis of the no action alternative must therefore consider the impacts of a scenario in which C&H is not in operation in the Buffalo River watershed.

The Agencies' failure to consider the impacts of a scenario in which C&H is not operating in the Buffalo River watershed also flies in the face of NEPA. The Final EA quotes from the Council on Environmental Quality (CEQ)'s Forty Most Asked Questions to justify its failure to assess more than a single alternative, *see* Final EA at 1-5, but in doing so, omits relevant language in that CEQ document stating that:

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<sup>46</sup> Jim B. Wiedeman, Uniform Agricultural Appraisal Report at P553-P554 (Farm Credit Servs. of W. Ark. 2012) (excerpt attached as Exhibit 6).

<sup>47</sup> *Id.* at 4.

[T]he [NEPA] regulations require the analysis of the no action alternative even if the agency is under a court order or legislative command to act. This analysis provides a benchmark, enabling decisionmakers to compare the magnitude of environmental effects of the action alternatives. It is also an example of a reasonable alternative outside the jurisdiction of the agency which must be analyzed . . . . Inclusion of such an analysis in the EIS is necessary to inform the Congress, the public, and the President as intended by NEPA.<sup>48</sup>

Contrary to NEPA, the Agencies have not provided an analysis of the no action alternative that actually “provides a benchmark” for comparison of environmental effects.

### **Cumulative Impacts**

- The Final EA’s cumulative impacts analysis is inadequate. For all resource areas, the Final EA lists stressors that are negatively affecting the area’s environment, but in all instances the Final EA conclusorily states that the Proposed Action will result in “no significant negative cumulative impacts” Final EA at 4-6 to 4-8. The Final EA provides no explanation why the cumulative effect of the many listed negative impacts are considered by the Agencies to be insignificant. Such “conclusory or unsupported suppositions” will not withstand judicial review. *See McDonnell Douglas Corp. v. U.S. Dep’t of Air Force*, 375 F.3d 1182, 1187 (D.C. Cir. 2004).
- In particular, the Final EA’s assessment of cumulative impacts on water resources is striking in its lack of substance. The Final EA provides a list of purported activities with vague and unsupported suppositions about the activities’ impacts. *See* Final EA at 4-6. For instance, the EA speculates that “[c]hanges to agricultural practices and continued downward trends in animal production could result in positive cumulative effects to water quality,” *Id.* at 4-6, without identifying these “changes” or providing any evidence of downward trends, much less that these changes and trends are having a positive cumulative impact on water quality in the area. The string of vague and unsubstantiated assertions that constitute the cumulative impact analysis falls far short of a hard look.
- In fact, the Agencies omit a key fact that is highly relevant to an analysis of cumulative impacts. On October 6, 2015, NPS notified ADEQ that three tributaries to the Buffalo River, including Big Creek, should be listed as “impaired” pursuant to Section 303(d) of the Clean Water Act.<sup>49</sup> The letter from NPS documents NPS and

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<sup>48</sup> Memorandum from Nicholas C. Yost, General Counsel, CEQ, to Federal, State, and Local Officials and Other Persons Involved in the NEPA Process at 4 (Mar. 16, 1981), <http://energy.gov/sites/prod/files/G-CEQ-40Questions.pdf>.

<sup>49</sup> Letter from Kevin G. Cheri, Superintendent, Buffalo National River, to Becky Keogh, Dir., ADEQ (Oct. 6, 2015), [http://buffaloriveralliance.org/resources/Documents/NPS%20303\(d\)%20Letter.pdf](http://buffaloriveralliance.org/resources/Documents/NPS%20303(d)%20Letter.pdf).

USGS data showing that Big Creek has minimum dissolved oxygen values well below water quality standards. The low dissolved oxygen recorded by the federal agencies in Big Creek is consistent with the eutrophication and thick algal mats that residents and local community members have observed in Big Creek increasingly in recent years. The photo below of the thick algae in Big Creek was taken by a member of Buffalo River Watershed Alliance in September 2015.



Dr. Brahana’s comments appropriately note that the NPS and USGS data, together with water quality data collected by the KHBNR team, show that “Big Creek and its ecosystem are being stressed” and that “[i]mpaired water is flowing directly into the Buffalo National River”<sup>50</sup>—facts that must be, but are not, considered in the Final EA.

### **Mitigation**

- In its response to public comments, the Agencies note that “[e]ffectively, the operating requirements [in C&H’s NPDES permit] are mitigation measures built in to the Proposed Action.” Final EA, App. B at 7. To the extent the Agencies rely on these mitigation measures to reach a FONSI determination, they are required to “sufficiently demonstrate that the mitigation measures adequately address and remediate the adverse impacts so that they will not significantly affect the environment.” *O’Reilly v. U.S. Army Corps of Eng’rs*, 477 F.3d 225, 234 (5th Cir. 2007).

As the Coalition already pointed out in its September 4, 2015 comments, the Agencies have failed to meet this burden—not least because the NPDES permit is issued pursuant to the Clean Water Act and focuses on ascertaining land application rates

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<sup>50</sup> Brahana comments on Draft EA at 10.

pursuant to Arkansas' Phosphorus Index. The NPDES permit does not, by its own terms, address all of the impacts of the CAFO. For instance, the NPDES permit requires a buffer zone in the vicinity of sinkholes, but while “buffers may reduce the suspended load reaching streams and will biologically strip some nutrients,” they “will have little effect on pathogenic organisms.”<sup>51</sup> It is not clear, moreover, that the NPDES permit would have any mitigative impact on any pharmaceuticals, feed additives, and pesticides used to treat the swine and fields as part of the C&H operations.<sup>52</sup>

### **III. TO COMPLY WITH NEPA'S MANDATE, THE AGENCIES MUST MAKE A FINDING OF POTENTIAL SIGNIFICANT IMPACTS AND PREPARE AN EIS**

“An agency's decision not to prepare an EIS will be considered unreasonable if the agency failed to supply a convincing statement of reasons why potential effects are insignificant.” *Choate v. U.S. Army Corps of Eng'rs*, No. 4:07-CV01170-WRW, 2008 WL 4833113, at \*6 (E.D. Ark. Nov. 5, 2008) (quoting *Save the Yaak Comm. v. Block*, 840 F.2d 714, 717 (9th Cir. 1988)). Here, the FONSI, based as it is on a deeply flawed and scientifically inaccurate EA, does not provide the convincing statement of reasons required to meet NEPA's standard.

Significance under NEPA “requires considerations of both context and intensity.” 40 C.F.R. § 1508.27. Context reflects the fact that “[s]ignificance varies with the setting of the proposed action,” and NEPA regulations note that “[b]oth short- and long-term effects are relevant.” *Id.* § 1508.27(a). “Intensity” reflects “the severity of impact,” and the NEPA regulations identify ten factors that are to be considered in evaluating intensity. In this case, the context—the unprecedented siting of the C&H CAFO in the watershed of the Buffalo National River, which is a national park unit, a beloved state treasure, and a significant driving force behind the local economy—weighs in favor of a finding of significance. When the “intensity” factors are considered in these contexts, it is clear that a finding of potentially significant impacts is warranted and that an EIS must be prepared.

Each of the twelve points in the FONSI, which loosely maps to the intensity factors set forth in the NEPA regulations, are refuted by the Coalition's September 4, 2015 comments and the additional comments above. Numerous intensity factors ignored or wrongly assessed by the Agencies warrant a finding of significant impacts. First, the “[u]nique characteristics of the geographic area,” *Id.* § C.F.R. 1508.27(b)(3), including C&H's proximity to a national park unit and a river listed in NPS's Nationwide Rivers Inventory of rivers that potentially qualify as wild, scenic, or recreational river areas,<sup>53</sup> weigh in favor of a finding of significance.

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<sup>51</sup> Kasic at 370 (Ex. 1)

<sup>52</sup> See NPS at 2 (Ex. 2) (NPS document proposing a Big Creek monitoring regime that would test for the presence of these chemicals and “provide an early warning system for primary contact and help determine effects on aquatic organisms”).

<sup>53</sup> NPS, Conservation and Outdoor Recreation, Nationwide Rivers Inventory, Arkansas Segments, <http://www.nps.gov/nrcr/programs/rtca/nri/states/ar.html> (last modified Nov. 23, 2004).



Additionally, the highly controversial nature of C&H and the federal government's financial assistance to this CAFO weigh in favor of a finding of significance. *See id.* § 1508.27(b)(4). A federal action is controversial if “a substantial dispute exists as to [its] size, nature or effect.” *LaFlamme v. Fed Energy Regulatory Comm’n*, 852 F.2d 389, 401-402 (9th Cir. 1988) (internal citations and marks omitted) (emphasis in original). A substantial dispute exists, as here, “when evidence, raised prior to the preparation of an EIS or FONSI, casts serious doubt upon the reasonableness of an agency’s conclusions.” *Nat’l Parks & Conservation Ass’n v. Babbitt*, 241 F.3d 722, 736 (9th Cir. 2001) (internal citation omitted). Expert evidence introduced during the public comment period—including statements presented by hydrogeologist Thomas Aley, President of the Ozark Underground Laboratory; Dr. John Van Brahana, Ph.D., Professor Emeritus of Geosciences at University of Arkansas; Dr. JoAnn Burkholder, Ph.D., William Newal Reynolds Distinguished Professor and Director of Center for Applied Aquatic Ecology at North Carolina State University; Dr. Michael Smolen, Ph.D., retired Professor of Biosystems and Agricultural Engineering at Oklahoma State University; and Dr. Steve Wing, Ph.D., Associate Professor of Epidemiology at University of North Carolina Gillings School of Global Public Health—all seriously call into question the reasonableness of the Agencies’ FONSI. Notably, NPS also has identified “[s]ignificant factual errors” and “[m]isrepresentation of data and facts” in the Agencies’ analysis.<sup>54</sup> Disagreement by other agencies, together with “responses from conservationists, biologists, and other knowledgeable individuals, all highly critical of the EA and all disputing the EA’s conclusion” is “precisely the type of ‘controversial’ action for which an EIS must be prepared.” *Found. for N. Am. Wild Sheep v. U.S. Dep’t of Agric.*, 681 F.2d 1172, 1182 (9th Cir. 1982). Because the Agencies have “apparently ignored the conflicting views of other agencies having pertinent expertise,” a court “may properly be skeptical as to whether [the EA’s] conclusions have a substantial basis . . . .” *Sierra Club v. U.S. Army Corps of Eng’rs*, 701 F.2d 1011, 1030 (2d Cir. 1983).

Further, the degree to which C&H’s possible effects on the human environment “involve unique or unknown risks” weighs in favor of a finding of significance. 40 C.F.R. § 1508.27(b)(5). Although it is well-known that C&H is sited in a karst system and Dr. Brahana’s dye tracing research has shown that groundwater from an area near three of C&H’s fields travel to various caves, springs, and streams, including to the Left Fork of Big Creek,<sup>55</sup> the precise delineation of underground water flow in and around the C&H site have not yet been ascertained. Thus, while the “indicated groundwater connections, and known physical and operational site characteristics” indicate that “contaminant migration may already be occurring, presenting a significant risk for surrounding groundwater bodies [and] surface waters,” “[o]nly through additional evaluation such as a determination of groundwater discharges, and a more complete delineation of groundwater divides can the real hazards to private water sources, and the [Buffalo National River] be determined.”<sup>56</sup> USGS scientist Timothy Kresse on the BCRET team corroborates this assessment, noting that “Van [Brahana] shows different directions of groundwater flow (bringing into question changes in baseflow between measuring points)” and

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<sup>54</sup> Cover letter transmitting NPS comments.

<sup>55</sup> Koscic. at 369-70 (Ex. 1); Brahana Comments on Final EA at 8.

<sup>56</sup> Koscic at 370 (Ex. 1).

that “we don’t have perfect delineations of the watershed.”<sup>57</sup> NPS too has called for a “dye tracing study for the pond and barn area would help define subsurface hydrology, including groundwater flow direction, transit rates offsite, and areas of groundwater discharge.”<sup>58</sup> Mr. Aley concurs, noting that apart from the research undertaken by Dr. Brahana, “no groundwater tracing has been done to determine which local and/or regional springs will receive water and contaminants from the C&H Hog Farm operation. This is basic data essential for an adequate environmental assessment.”<sup>59</sup> Where uncertainty such as that about the precise delineation of the subsurface hydrological boundaries “may be resolved by further collection of data, . . . or where the collection of such data may prevent speculation on potential . . . effects,” an agency must prepare an EIS. *Nat’l Parks & Conservation Ass’n*, 241 F.3d at 732–33 (internal quotation marks and citations omitted).

In addition, the precedent-setting nature of a decision to provide financial support for a large CAFO in the watershed of an Extraordinary Resource Water and national park unit weighs in favor of a finding of significance. 40 C.F.R. § 1508.27(b)(5). The District Court unequivocally found that the C&H CAFO is “unprecedented.” *Buffalo River Watershed Alliance*, 2014 WL 6837005 at \*4. It would seem to follow necessarily that the federal government’s financial support enabling the construction and operation of this unprecedented facility will set a precedent for future such CAFOs and future such federal financial support. The FONSI, which conclusorily asserts that “[t]he proposed action does not set precedent for FSA or SBA,” provides no evidence to the contrary.

Finally, the potentially cumulatively significant impacts of C&H; the degree to which it might affect public health through the infiltration of untreated swine waste into surface waters in which people swim, fish, and paddle, and well water that they drink; and the degree to which C&H may adversely affect endangered or threatened species also favor the preparation of an EIS. See 40 C.F.R. §§ 1508.27(b)(2), (7), (9). Consideration of each of these three intensity factors turns largely on C&H’s impacts on water quality. Here, it is simply worth reiterating that the conclusion that C&H will not have an adverse impact on water quality squarely contradicts the overwhelming scientific consensus. The Agencies have irrationally disregarded credible and highly-regarded scientific experts who have voiced their expert opinion to the Agencies that C&H—sited as it is on karst and spreading swine waste on fields adjacent to a tributary to the Buffalo River—will or may have significant adverse impacts on water quality. If the Agencies issue a FONSI based on the Final EA as drafted, they will have “entirely failed to consider an important aspect of the problem,” in violation of their legal obligations. *Motor Vehicle Mfrs. Ass’n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983).

On remand, the Agencies have undertaken a new assessment, but NEPA requires more than just a larger word count and more pages in an environmental review. It requires an actual hard look at environmental impacts. *Friends of Boundary Waters Wilderness v. Dombeck*, 164

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<sup>57</sup> Email from Timothy Kresse, USGS, to Andrew Sharpley, Univ. of Ark. (Oct. 9, 2015) (attached as Exhibit 7).

<sup>58</sup> Ex. 2 at 2.

<sup>59</sup> Aley comments at 6.

F.3d 1115, 1128 (8th Cir. 1999). The Agencies' determination must be "founded on a reasoned evaluation of the relevant factors." *Marsh v. Or. Natural Res. Council*, 490 U.S. 360, 378 (1989) (internal quotation marks omitted). For all the reasons set forth by the Coalition in this letter and its earlier comments and attached exhibits, the Agencies have failed to meet their obligations under the law. The Coalition urges the Agencies to re-assess its FONSI and to determine, as the facts and science show, that C&H may have significant impacts warranting an EIS.

Sincerely,



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*On behalf of:*  
Buffalo River Watershed Alliance  
Arkansas Canoe Club  
National Parks Conservation Association  
Ozark Society

# **Exhibit 1**

*Proposals for integrating karst aquifer  
evaluation methodologies into national  
environmental legislations*

**Katarina Kosič, Carol L. Bitting, John  
Van Brahana & Charles J. Bitting**

**Sustainable Water Resources  
Management**

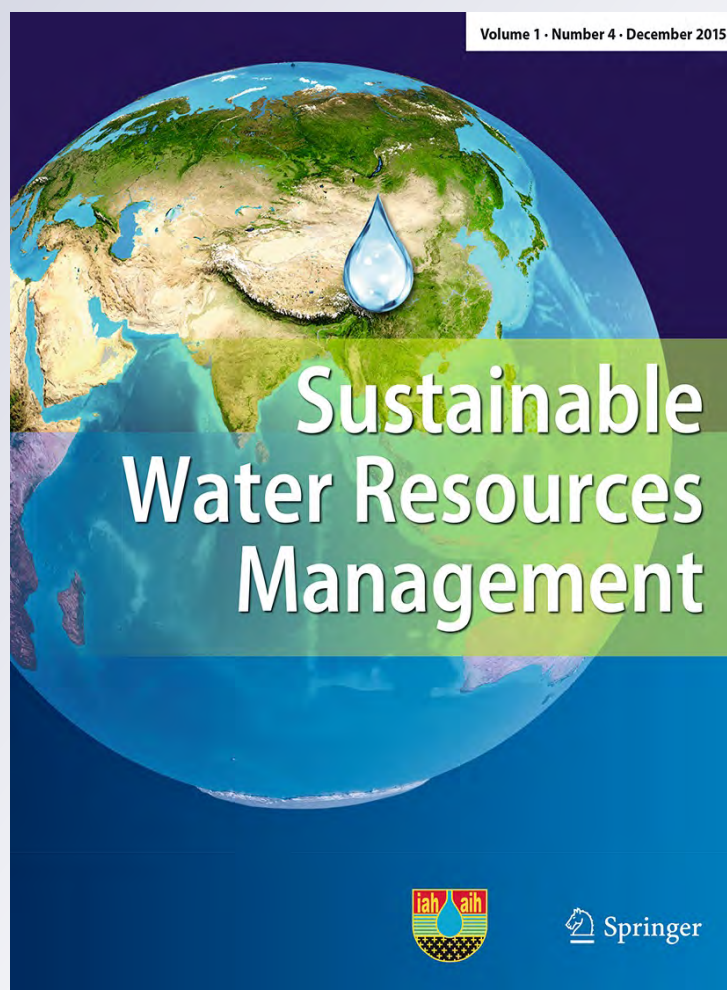
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# Proposals for integrating karst aquifer evaluation methodologies into national environmental legislations

## Case study of a concentrated animal feeding operation in Big Creek Basin and Buffalo National River Watershed, Arkansas, USA

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**Abstract** Characterization of karst aquifers in order to reduce the impacts of human activities on these vital groundwater resources poses a significant challenge for scientists, land managers and policy makers. Methods and criteria for improvement of karst management have been suggested by the scientific community in order to assure the preservation of karst groundwater resources. However, these methods are rarely integrated into national groundwater protection policies. A case-based study of a swine confined animal feeding operation sited on mantled karst terrain in the southern Ozark Highlands in the State of Arkansas, United States of America helped illustrate why karst-specific evaluation methods should be implemented in national legislation. Through the review of the area's geomorphology and hydrogeology, dye tracer test results, and existing state and federal legislation and permitting

processes for confined animal feeding operations, proposed improvements to existing legislation for confined animal feeding operations were developed. The study provides an example of how integrating science into policy-making can enhance protection of valuable groundwater resources.

**Keywords** Karst aquifers · Vulnerability · Groundwater protection · Legislation · CAFO

### Introduction

Karst aquifers are unique, complex and sensitive groundwater bodies that are extremely susceptible to contamination and human impacts (see, for example, Ford and Williams 2007; Kačaroğlu 1999; Goldscheider and Drew 2007; Chapman et al. 2015). Considering that karst aquifers provide 25 % of the world's drinking water (van Beynen 2011), their characterization, and an understanding of the contamination processes in karst groundwaters is of extreme importance.

Numerous science-supported methodologies have been developed in order to assure coherent and thorough characterization of karst aquifers, drawing on event-based sampling strategies, artificial and natural tracing methods, water-quality mapping, water-budget assessment, and karst field mapping (Goldscheider and Drew 2007; Ravbar and Goldscheider 2007). Additionally, criteria have been discussed and suggested, for the proper management of karst, and comprehensive protection of karst groundwaters (see, for example, van Beynen 2011; Ravbar and Šebela 2015).

Nevertheless, little has been done to actually implement these karst-specific methods in national legislation. To do so requires close cooperation between the scientific and policy-making spheres. However, opinions regarding the

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combining of science and policy vary among experts of different fields. For example, some consider scientific studies expensive, and potentially contributing to increased uncertainties due to the accumulation of information (Rayner 2006). On the other hand, some point out the failure of science to solve day-to-day issues faced by environmental decision makers due to lack of sufficient data (Robertson and Hull 2003). Although these might be valid concerns in some areas of environmental policy-making, the implementation of karst-specific scientific methods into groundwater protection policies is vital for assuring preservation of karst groundwater resources.

In an effort to illustrate the importance of integrating scientific evaluation techniques into policy-making process, the authors performed a case-based study of a confined animal feeding operation (CAFO) located on a karst terrain.

The studied CAFO is located in the Ozark Highlands of the United States (USA) State of Arkansas. It is situated in close proximity to the Buffalo National River (BNR) Park, within the Big Creek drainage Basin. Permitting and construction of the studied CAFO was conducted with few karst-specific evaluation methodologies.

Through a review of the geomorphology and hydrogeology of the studied area, tracer test results, and existing state and federal legislation, the study sought to describe: (1) shortcomings of existing preliminary geological investigations for siting of CAFOs on karst terrain, and suggestions to improve these preliminary investigations; (2) shortcomings in the legislative system that can lead to deterioration of important groundwater resources and water resources of protected areas, e.g., National Parks; (3) the importance of using site-specific evaluation methodologies and proper site-specific protection measures while siting hazardous operations on karst terrain; (4) how the scientific approach can help improve the protection of important surface and groundwater resources on karst terrains while still allowing the agricultural development of the area.

Additionally, proposals for (1) implementing karst-specific evaluation methods into CAFO regulations and (2) improvements to national legislation were developed.

### **General description of cafos and associated hazards for karst terrain**

A CAFO may be loosely defined as a factory-farm operation in which a very large number of farm animals are kept in a relatively small area. The USA Environmental Protection Agency (EPA) considers a CAFO as a point source, as defined by the Clean Water Act (CWA) [§ 502(14)] (Field 2011).

All swine CAFOs utilize open waste lagoons which store liquefied animal manures; these manures are sprayed on approved spray fields. Spraying accomplishes two objectives: (1) it prevents over-storage of manure in the waste lagoons; and (2) the liquid manure serves as a nutrient for grass and hay crops, which are used to feed livestock.

Multiple studies of CAFOs have shown that both waste lagoons and spray fields present significant environmental threats to karst terrains and underlying groundwater (Field 2011; Brahana et al. 2014; Chapman et al. 2015; Ham 2002; Kelly et al. 2009).

Groundwater contamination from CAFOs can occur from various sources, such as: leaking lagoons, breaches in piping or barn infrastructure, and land application of liquid and solid wastes (Hutchins et al. 2012). Such leakage has been associated with increased levels of nitrates, phosphates, pathogen bacteria, steroid hormones, heavy metals, antibiotics, and other pharmaceuticals in groundwater bodies and soil (Hong et al. 2013; Mallin and Cahoon 2003; Lapworth et al. 2012). The nitrate form of N is especially mobile in soils and can pass readily through soils to contaminate groundwater (Mallin and Cahoon 2003).

The central issue regarding these types of micropollutants and CAFOs is that they may readily be released in large quantities from a CAFO without any form of treatment (Field 2011) since microbes generated by CAFOs are not exposed to secondary treatment or chlorination to disinfect the material (Mallin and Cahoon 2003). This latter concern is particularly important in karst terrains where rapid and direct groundwater migration often occurs, and where low groundwater temperatures may slow microbial die-off (Davis et al. 2000).

CAFO manure lagoons are typically excavated into the soil and lined with clay; even when properly constructed, such lagoons tend to leak. Slow leakage can release large amounts of contaminants over time. Calculations have shown that nitrogen losses from a lagoon of approximately 2.5 ha could exceed 230,000 kg over a period of 25 years (Ham 2002). Lagoon leakage can be increased due to environmental factors (e.g., drying, wetting, and freezing) that may cause additional cracks in their structures. Since their performance is dependent on site-specific factors (e.g., soil type, chemistry of waste, climate), scientists have proposed a logical framework for determining the optimal lagoon design. It is based on evaluation of site-specific conditions through geological assessment, vadose-zone soil analysis, and depth to the water table (Ham and De Sutter 2000). However this proposed framework has not been universally implemented.



## Study area

### Geological, geomorphological and hydrological settings

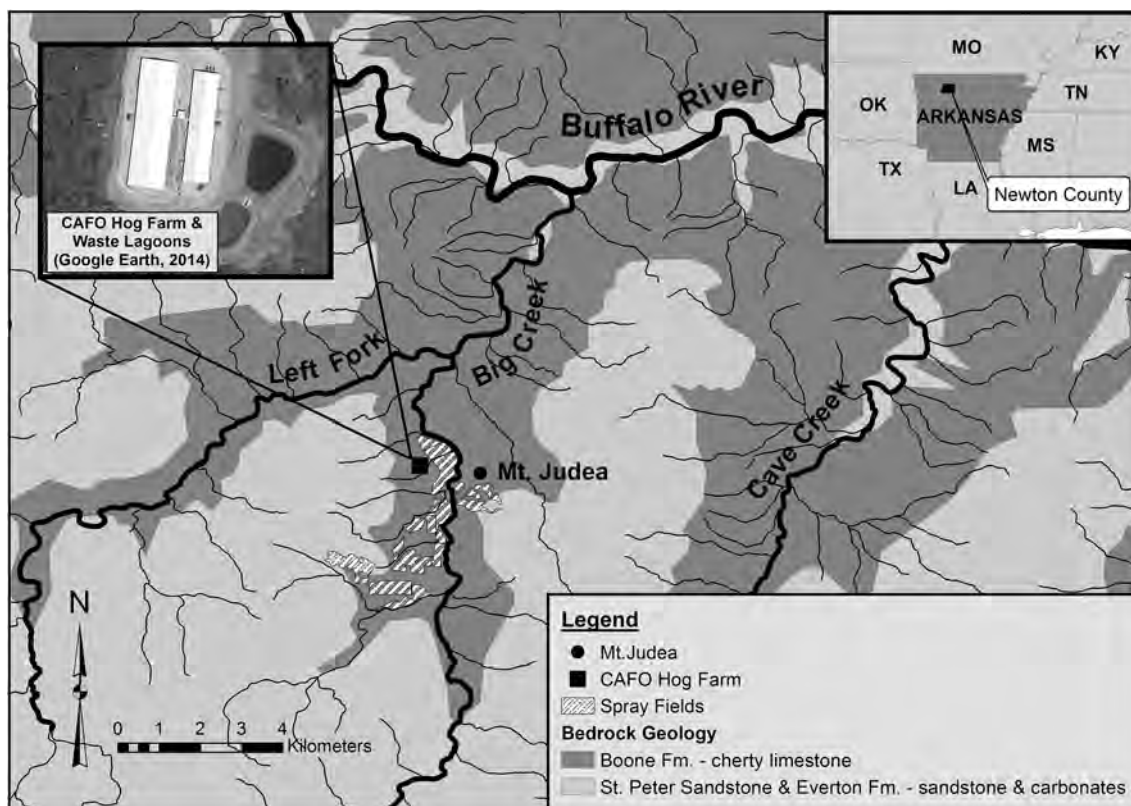
In 2012, a 6500 head swine CAFO was approved by the Arkansas Department of Environmental Quality (ADEQ) (ADEQ 2012) to be situated on a karst area in Big Creek Basin near the town of Mount Judea in Newton County, Arkansas (Fig. 1). The location is approximately 110 m up-gradient from Big Creek and less than 10 km from the confluence of Big Creek with the BNR (Fig. 1).

Geomorphologically the area consists of the Buffalo River Valley (approximately 200 m asl) and the valleys of its tributaries intersected by hills that can reach elevations of just over 672 m asl. Based on the geologic map of the Mt. Judea quadrangle (Braden et al. 2003), the geology of the study area is characterized by relatively flat-lying sedimentary rocks of Ordovician through Upper Carboniferous (Pennsylvanian) age. The ridges typically consist of Pennsylvanian age sandstones, shale and siltstones. The lower elevation foothills and valleys are formed on the underlying Mississippian of Lower Carboniferous (Boone Formation on Fig. 1) and Ordovician rocks (St. Peter

Sandstone and Everton Formation on Fig. 1), dominantly impure limestone, sandstone and dolomite.

The main strata of interest in this study are the Boone Formation (Fig. 2), which consists of about 7 m of relatively pure limestone in its upper reaches, underlined by 80–90 m of thin, cherty limestone. The Boone Formation directly underlies the studied CAFO as well as part of the spray fields downstream from the CAFO (Fig. 1). The lowest reaches of Big Creek and much of the BNR valley are formed in the Ordovician aged carbonates of the Ferndale, Plattin, and Everton Formations, and the St. Peter Sandstone (Fig. 1). All of the latter except the St. Peter Sandstone are karstified. The valley of Big Creek is typically covered in non-indurated sediments, primarily chert gravel, and terrigenous sediments overlying the Boone Formation. The alluvium in tributary valleys varies in thickness from a feather-edge to about 8 m. Outcrops of the Boone Formation are common in the streambed through the entire study area. They tend to develop obvious karst features, including sinkholes, sinking and dry streams, swallow holes and caves on exposed bedrock surfaces (Fig. 2).

Big Creek is the fifth largest tributary to the BNR and encompasses approximately 8 % of the total drainage of the BNR drainage area (Mott and Luraas 2004). During



**Fig. 1** Generalized geological and hydrological settings [including major surface drainages, the CAFO and its spray fields (Google Earth 2014)]



**Fig. 2** Typical karst feature in Boone Formation, Left Fork of Big Creek, AR

heavy rains, the steeper slopes and shale bedrock of the headwater areas result in fast-rising floods on the BNR and other Ozark streams (Mott and Luraas 2004).

The study area is typified by karst drainage, but owing to the high concentration of chert and clay that weathers from the Boone Formation, karst landforms are typically mantled and not usually obvious in that portion of Big Creek (Brahana et al. 2014). However, karst hydrogeology is present throughout both Big Creek and BNR valleys, with extensive surface-water and groundwater interaction and numerous springs. Upper reaches of most creeks are dry during late summer months.

Springs are common along the entire reach of Big Creek, ranging from relatively small discharges in the tens of liters per minute range, to large discharges in the tens of liters per second. These larger discharges resurge from relatively pure limestone lithology (Brahana et al. 2014).

The climate of the BNR basin is characterized by long, hot summers and relatively short, mild winters. Annual rainfall totals vary from 760 to 2030 mm, with an average of 1170 mm (Mott and Luraas 2004). The greatest amounts of precipitation typically occur in winter and spring with approximately 100–120 mm per month. Average winter snowfall is 30 cm (Mott and Luraas 2004). Minimum precipitation amounts typically occur between July and October, when average monthly precipitation is approximately 80 mm. In spite of the fairly uniform precipitation, runoff varies widely by season, with dry river sections commonly occurring in late summer and fall. Large storms are most likely to occur during spring months (Mott and

Luraas 2004), if occurring after the dry season they can cause excessive flooding of streams and rivers.

### Subsurface characteristics

Ground Penetrating Radar (GPR) surveys were performed after siting of the CAFO by the Department of Agriculture from the University of Arkansas. Survey results of three spray fields identified several subsurface features that were wavy in nature and resemble the dissolution features that are manifested in cutter and pinnacle karst (Cochran 2013), these features appeared to be present at depths ranging from 0.5 to 1.5 m. Excavation to positively identify these subsurface features was not feasible due to rocky conditions (Cochran 2013).

### Economic activities and natural resources

Prevailing economic activities in the area are cattle farming and tourism (fishing, floating, swimming, hiking and climbing). Tourism occurs primarily in the BNR Park which is managed by the National Park Service (NPS). The Buffalo River has been designated as an Extraordinary Resource Water (ERW) and Natural and Scenic Waterway by the Arkansas Pollution Control and Ecology Commission (APC&EC). These designations identify high-quality waters that constitute an outstanding state or national resource and should therefore be protected by (1) water quality controls, (2) maintenance of natural flow regime, (3) protection of instream habitat, and (4) encouragement of land management practices protective of the watershed (APC&EC Reg. 2.203, 2014a). However, this regulation does not have the authority over private property.

Since water flowing in the Buffalo River during its base flow stage is supplied by groundwater recharge, threats to the groundwater supply also mean threats to the water quality of the Buffalo (Mott and Luraas 2004).

### Waste handling at the studied CAFO

The waste lagoons of the studied CAFO (Fig. 1) were excavated in the clay soil and lined with a fat, high plasticity clay. No additional synthetic or concrete liners to prevent leakage of liquid waste into the subsurface were used. As stated in the National Pollutant Discharge Elimination System (NPDES) permit application, the leakage from the lagoons, with a combined area of approximately 0.85 ha is limited to approximately 7659 liters/ha/day as required by ADEQ (ADEQ 2012).

There are 17 spray fields covering approximately 243 ha, ranging from 4 to 33 ha in size. Spray fields are predominantly located in areas underlain by the Boone

Formation and Big Creek alluvium both of which drain to springs along Big Creek and Left Fork (Fig. 1).

### Methodologies used

#### Legislation analysis

In order to assess the legislative and regulatory processes associated with CAFOs and environmental protection, various State and Federal policies and programs were reviewed. These reviews enabled an assessment of the CAFO permitting process and related groundwater protective measures. They also provided a framework within which proposed improvements to existing policies have been formulated.

As part of this review the following Federal acts and regulations were analyzed: the CWA, which is the primary act protecting USA waters, also referred to as Federal Water Pollution Control Act; the Resource Conservation and Recovery Act (RCRA); EPA's CAFO regulations from Title 40 of the Code of Federal Regulations (40 CFR), published in the Federal Register (FR). Additionally, the following State regulations from APC&EC were analyzed: Regulation No. 2, Establishing Water Quality Standards for Surface Waters of the State of Arkansas; Regulation No. 5, Liquid Animal Waste Management Systems; and Regulation No. 6, Regulations for State Administrations of the National Pollutant Discharge Elimination System (NPDES).

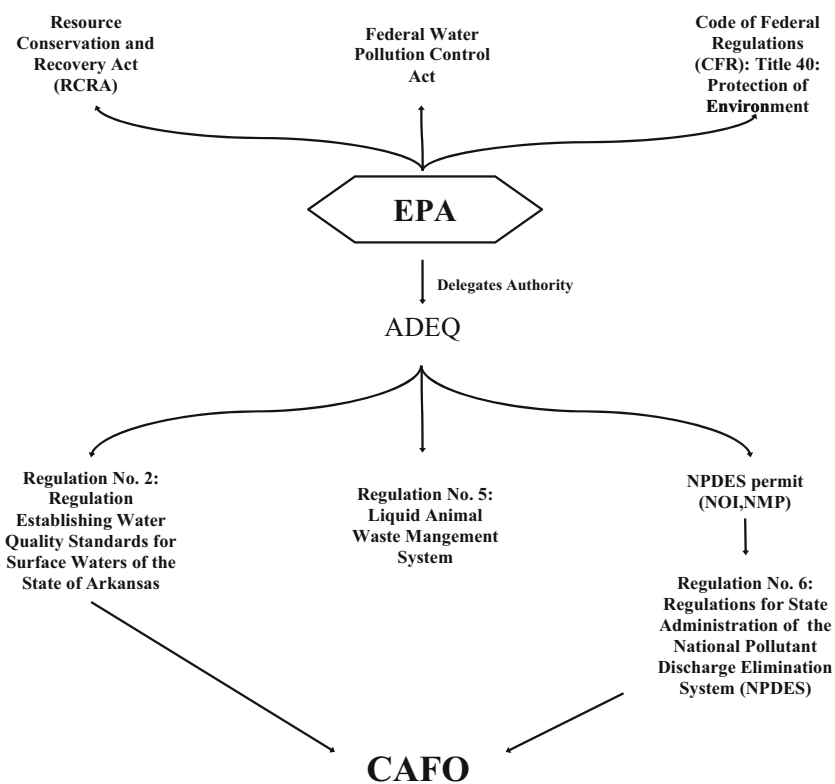
Acts in the USA present approved laws and are published in the U.S. Code, while the USA regulations explain the technical, operational, and legal details necessary to implement these laws. Regulations are mandatory requirements that can apply to individuals, businesses, state or local governments, non-profit institutions, or others (EPA 2014). They are typically written by governmental agencies, which are designated as the Regulatory Entities for the subject matter involved, and when approved, are published in the CFR. For example, EPA is one of the Regulatory Entities for the Protection of the Environment that is published under the 40 CFR. Every state then has separate regulations that must comply with federal laws but can include more stringent requirements.

The EPA has ten regional offices across the USA, responsible for a subset of states, territories or special environmental programs. The State of Arkansas is included in Region 6, and therefore implements rules and regulations from the Region 6 Office.

The environmental policy-making body for Arkansas is the APC&EC. With guidance from the Governor, the Legislature, the EPA and others, the Commission determines the environmental policy for the state (ADEQ 2013). The ADEQ is designated to implement those policies.

Figure 3 illustrates relationships relevant to this study, between the State and Federal regulators, their policies, and the subject CAFO.

**Fig. 3** Flowchart of legislations and regulatory entities for CAFOs on Federal and State level



## Tracer test

After the construction of the studied CAFO, a pro-bono private interest group of scientists and volunteers, including several of the authors, performed a dye tracer test for the purpose of characterizing possible groundwater and surface water connections in the area of the CAFO, Big Creek Basin, and the BNR.

Eosin dye was injected in a private well located between spray fields (Fig. 4). This dye injection point was chosen based on the hydrogeological setting of the area, direct accessibility to the aquifer, and proximity to the CAFO and its spray fields.

Dye receptors were placed at 140 monitoring points in private or NPS springs, wells and caves. Several monitoring points were also located in the stream beds of Big Creek and BNR. The sampling utilized active charcoal dye receptors which enabled the time-integrated monitoring of a large number of locations (Goldscheider and Drew 2007).

Three kg of Eosin, previously diluted with 5 l of water, were injected on May 12, 2014 and flushed with 20 l of water. Two days thereafter a rain event of 89 mm precipitation occurred. Dye receptors were collected periodically over a period of four months, with a sample frequency of days to weeks depending

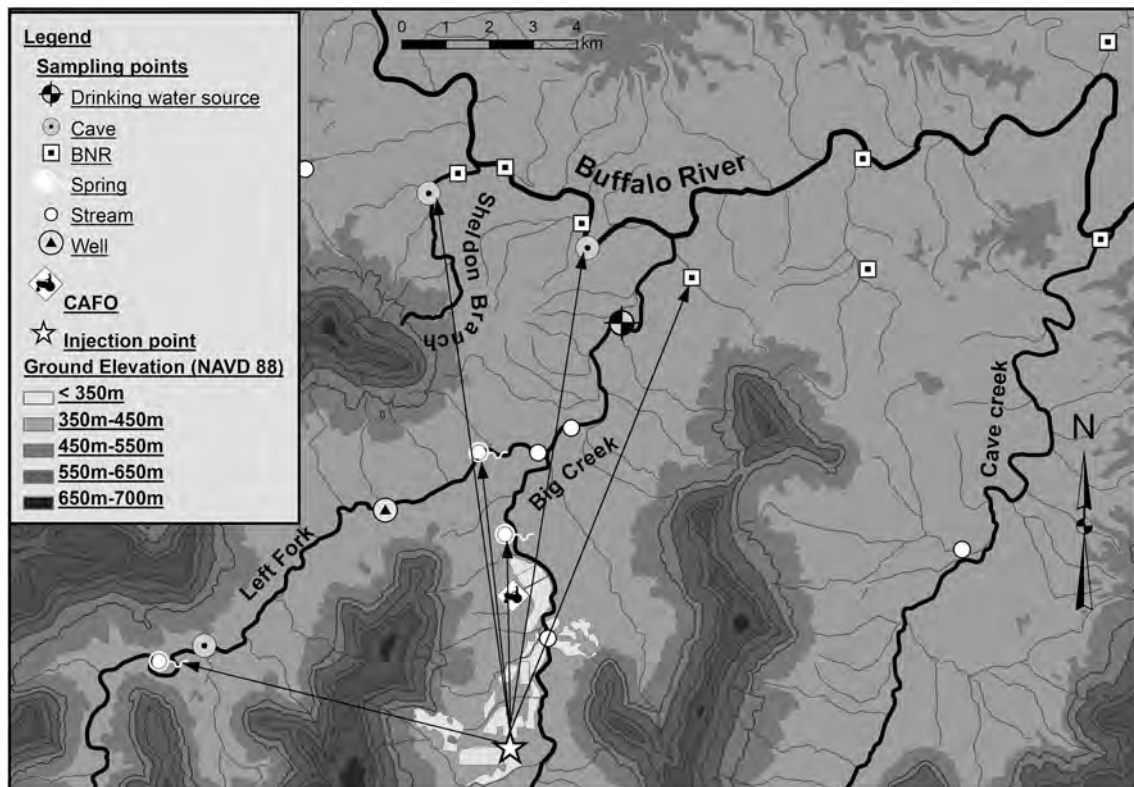
on hydrological conditions. Receptors were cleaned, dried and eluted with a mixture of 70 % of isopropanol and 5 % potassium hydroxide (Aley 2002). The resulting eluent was analyzed after 5 h, using a scanning Shimadzu spectrophotofluorimeter at the University of Arkansas.

## Results

### Legislation analysis

The CWA defines a point source as any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, CAFO, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural stormwater discharges and return flows from irrigated agriculture (§502(14), 2011).

Nonpoint sources of contamination are defined as agricultural and silvicultural activities, including runoff from fields, and crop and forest lands (CWA §304 (f) (A), 2011) and the disposal of pollutants in wells or in subsurface excavations (CWA §304 (f) (D), 2011).



**Fig. 4** Tracer test results (showing selected eosin positive detections, groundwater connections and elevations for the area)

All CAFOs that propose to discharge manure, litter or processed wastewater into waters of the USA must obtain NPDES permits under the 40 CFR § 122.23. Usually the permit is issued by EPA, however states can also implement their own NPDES programs and issue NPDES permits if approved or authorized by EPA under 40 CFR Part 123 (40 CFR § 122.23, 2015). The State of Arkansas has been authorized by the EPA to administer the NPDES Program in Arkansas, including the issuance of general permits to categories of dischargers under the provisions of 40 CFR § 122.28, as adopted by reference in APC&EC Reg. 6.104 (2014b). Under this authority, ADEQ may issue a single general permit to a category of point sources located within the same geographic area, whose discharges warrant similar pollution control measures or if they, in the opinion of the Director of ADEQ, are more appropriately controlled under general permit than under individual (Arkansas Department of Environmental Quality 2011a, b). These ADEQ NPDES programs must comply with the CWA and those federal regulations incorporated in Regulation No. 6 from APC&EC (2014b). ADEQ is also the responsible department for verifying if all the NPDES procedures are properly performed. In order to obtain an NPDES permit, a proposed operation needs to submit an NPDES Permit Application, a Notice of Intent (NOI) and a Nutrient Management Plan (NMP) to ADEQ.

CAFOs in Arkansas, operating under the NPDES general or individual permits, are excluded from Regulation No. 5 (Fig. 3). Regulation No. 5 addresses those CAFOs not otherwise required to obtain an NPDES permit, and establishes the minimum qualifications, standards and procedures for issuance of permits for CAFOs using liquid animal waste management systems within the State of Arkansas, and for the issuance of land application sites within the state (APC&EC Reg. 5.102, 2012). The requirements from regulation No. 5 and those issued as part of the NPDES General Permit are generally consistent with each other, however some differences do exist. For example, both suggest a minimum 30 m setback distance for application of manure, litter, and process wastewater to any down-gradient surface waters, open tile line intake structures, sinkholes, agricultural well heads, or other conduits to surface waters and 90 m from ERW. However, Regulation No. 5 also applies buffer zones of 30 m to intermittent streams, springs, rocky outcrops, etc. (APC&EC Reg. 5.406(D), 2012), while the NPDES general permit does not. Additionally, the NPDES permit allows a CAFO to substitute the 30 m setback with a 11 m wide vegetated buffer, or to demonstrate that neither of them is necessary if implementation of alternative

conservation practices or field-specific conditions will provide equivalent or better pollutant reduction (ADEQ 2011a, b).

There is a liner requirement for CAFO lagoons in EPA Region 6 which requires a permittee to document that no direct hydrologic connection through groundwater exists between the contained wastewater and surface waters of the United States. Where the permit cannot document that no direct hydrologic connection through groundwater exists, the ponds, lagoons and basins of the containment facilities must have a liner which will prevent the potential contamination of surface waters (EPA 2011). However, this requirement does not apply to the State of Arkansas because of the authorization to implement their own NPDES programs (EPA 2015).

EPA also implements RCRA, the goals of which are (1) to protect human health and the environment from the potential hazards of waste disposal, (2) to conserve energy and natural resources, (3) to reduce the amount of waste generated, and (4) to ensure that wastes are managed in an environmentally sound manner. RCRA regulates the management of solid waste (e.g., garbage), hazardous waste, and underground storage tanks holding petroleum products or certain chemicals (EPA 2013). Currently, agricultural wastes are largely exempted from regulation under RCRA (40 CFR §261.4(b), 2015).

The RCRA program assumes that all lagoons and landfills will leak. Therefore, it requires that all hazardous waste disposal sites on land be lined with double liners and have both leak detection and leak collection systems installed (Field 2011).

### Tracer test

Based to the data available to the authors, fifty-nine positive detections were identified in the tracer test, some of which were located in different surface-drainage basins. Forty-four detections were located in various springs and streams, 26 of which are privately owned. Fourteen of the detections were located in caves or springs managed by the BNR, and three of these detections were located in the BNR itself. One of the positive detections occurred in a private well that is used for extraction of potable water. The groundwater straight-line flow directions are oriented west, north, northwest and northeast. For illustration purposes, only 21 selected positive detections (including streams, springs, caves and wells) are presented on Fig. 4. The arrows on this figure illustrate the assumed straight-line groundwater flow directions between injection point and the sampled springs and caves (excluding streams and wells).

## Discussion

Based on the information reviewed as part of this study, site evaluation conducted prior to issuance of the NPDES permit for the studied CAFO did not incorporate adequate karst-specific evaluation methods to address potential hazards to nearby groundwater and surface water resources.

The GPR surveys conducted at the analyzed CAFO spray fields suggest that shallow karst features may be present beneath the spray fields (Cochran 2013). The underlying Boone Formation is characterized by karst dissolution features and secondary porosity (e.g., caves, conduits) presenting an increased risk of infiltration and migration of potential hog farm wastes (e.g., liquefied manure). However, because these features were not further evaluated, the true potential vulnerability of the aquifer associated with rapid infiltration of contaminants remains unknown. In the absence of more detailed investigations to characterize the potential risks, contamination of groundwater through rapid infiltration may go unnoticed until detected at offsite locations, at which point remediation would be made more complex and expensive.

The presence of the Boone Formation beneath the waste lagoons presents a similar potential contamination risk, with the added hazard associated with the potential formation of sinkholes and subsurface voids leading to increased leakage of contaminants into the subsurface. Some multiparameter studies of the vadose zone have shown that the localized source of pollution with higher concentration of nitrates, chlorides, phosphates and sulfates such as leakage waters from landfills, foster increased dissolution of limestone (Kogovšek in Knez et al. 2011). A subsurface investigation utilizing soil borings was conducted as part of the permitting process prior to construction of the waste lagoons. However the scope (number of borings and total depth) was very limited, and such investigations may not be well suited to evaluating karst areas due to the potential for solution features to go undetected (see, for example, Hoover 2003; van Beynen 2011; Goldscheider and Drew 2007). Therefore more comprehensive karst-specific investigation prior to siting of the waste lagoons should have been performed, and alternative site-specific construction practices (e.g., the addition of a synthetic liner) should have been considered.

The tracer test performed in the area indicates a linkage between groundwater bodies surrounding the area of the studied CAFO, the spray fields, several private springs, wells, and the BNR. These results, while indicating that possible connections exist, do not provide information regarding the rate and volume of groundwater migration.

Therefore, an accurate prediction of the magnitude of contamination risk posed by infiltration of agricultural wastes cannot be made. Only through additional evaluation such as a determination of groundwater discharges, and a more complete delineation of groundwater divides can the real hazards to private water sources, and the BNR be determined. However, based on the indicated groundwater connections, and known physical and operational site characteristics, contaminant migration may already be occurring, presenting a significant risk for surrounding groundwater bodies, surface waters and natural heritage. It should also be recognized that slight changes in groundwater chemistry, while not immediately and dramatically evident, may become so over a longer time frame (Urich 2002). Conducting comprehensive tracer tests prior to the siting of potentially hazardous activities on karst terrain would help minimize these uncertainties and potential risks through accurate delineation of the aquifer.

The NPDES permit for this CAFO requires a buffer zone of 30 m or alternatively, an 11 m vegetated buffer in the vicinity of sinkholes; however it does not include buffers for caves, sinking streams and other existing karst features. Such buffers may reduce the suspended load reaching streams and will biologically strip some nutrients, but will have little effect on pathogenic organisms (Ford and Williams 2007). Various processes act on inorganic, organic and particulate contaminants, but the effectiveness of these processes depends, firstly, upon the properties of the substrate layers through which the contaminants are transmitted and, secondly, on the physical and chemical properties of the contaminants (Ford and Williams 2007). Therefore, in order to properly determine appropriate buffer widths and locations, a more complete evaluation of both surface and subsurface characteristics should be conducted.

Due to karst aquifer heterogeneity, contaminants in groundwater may travel for several km before reaching a spring (see, for example, Knez et al. 2011; Imes and Emmet 1994). Therefore the delineation of karst aquifers is extremely important in order to define potential areas that may be impacted in the event of groundwater contamination.

If the preservation of important water resources e.g., BNR and private potable water sources is to be considered a priority, then more rigorous siting and permitting evaluations should be conducted prior to construction and operation of CAFOs and similar facilities. Doing so not only protects these valuable natural resources, but it enables the agricultural operations to operate undisturbed by additional limitations, and protects neighboring private landowners from unwanted impacts to their groundwaters.

### Proposals for implementig karst-specific evaluation methodologies and improving groundwater protective policies

Some scientists suggest CAFO facilities or the application of animal waste from a CAFO on croplands should not be allowed within karst areas (Kelly et al. 2009). Such a restriction could have significant negative socio-economic impacts to local communities. Therefore the following steps were developed with respect to CAFO permitting which would enhance karst groundwater protection while simultaneously allowing for an appropriate level of agricultural activity.

In addition to their current status as point-sources, CAFOs should additionally be regulated as potential non-point sources for contaminants considering that spreading of large volumes of manure on fields and leakage from waste lagoons can cause diffuse discharge of contaminants to the subsurface.

An additional step would be to minimize the probability of CAFO waste lagoon leakage by implementing more strict requirements for site-specific lagoon liners, regardless of whether the NPDES permits are issued by the EPA directly or by the state. Here it should be emphasized that by assigning the EPA as the sole regulatory entity for NPDES programs, the inconsistencies in implementing NPDES permits between states might be avoided (Fig. 5).

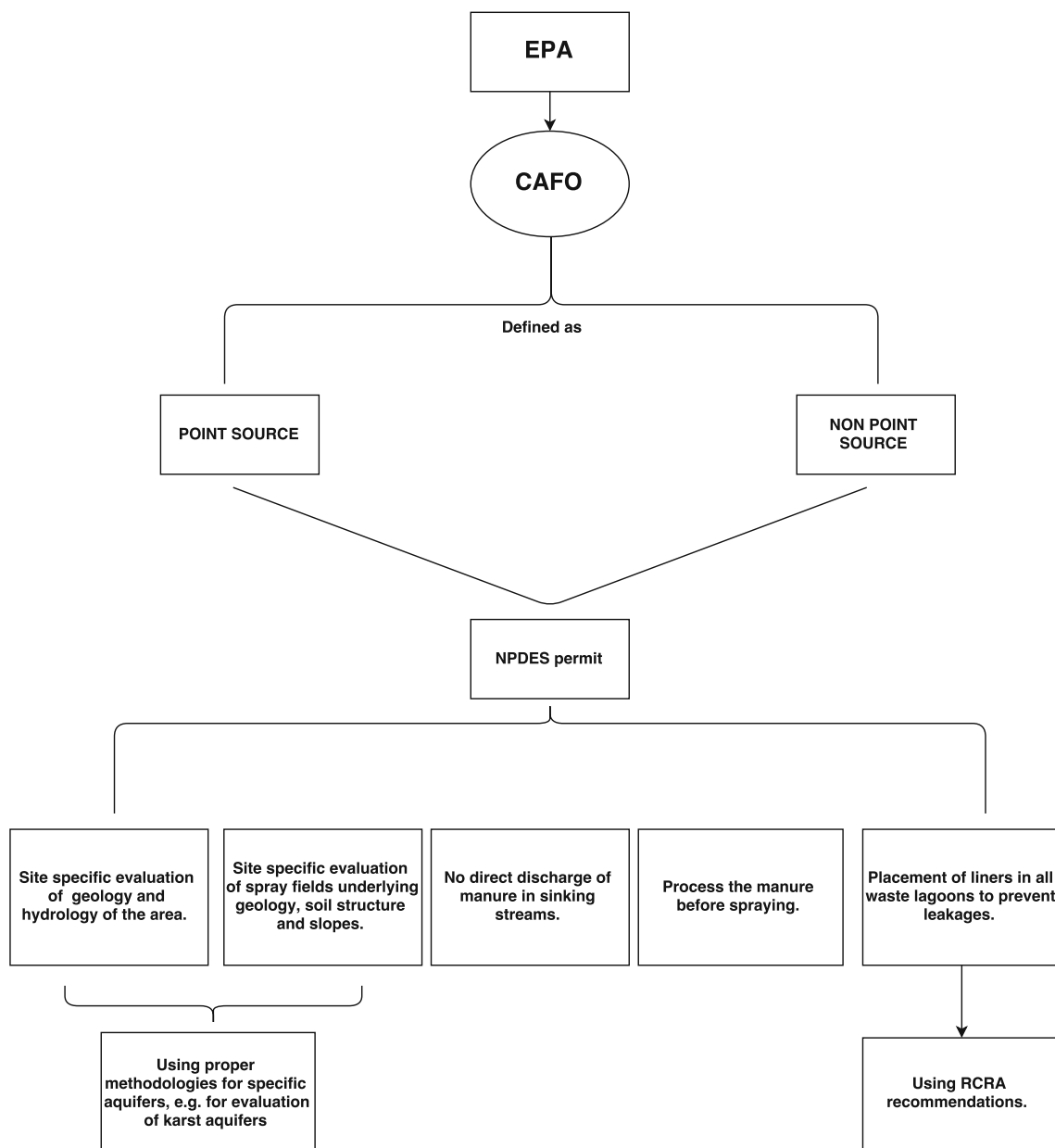


Fig. 5 Flowchart with proposal for improved groundwater protective legislation

Manure lagoons should be constructed or lined in a way that prevents leakage to the soil, groundwater and/or surface water. The liner should be resistant to: physical contact with the waste, pressure gradients, climatic conditions, etc. (Field 2011). The type of liners should be chosen based on the geological, hydrological and soil characteristics of the site (Ham 2002). Stronger, thicker, or multiple liners should be required for vulnerable areas e.g., karst, in order to assure that no leakage will occur. Requirements similar to those used in RCRA could be adopted for waste lagoons and included in the NPDES permit. Alternatively, a better solution might be to regulate CAFOs as part of RCRA since these operations typically generate large volumes of waste, comparable to those generated by industrial facilities currently regulated by RCRA.

Manure could be exposed to secondary treatment or chlorination in order to disinfect the material prior to spreading on spray fields.

Spreading of manure should be strictly prohibited on fields that are underlain by karst features without the express written permission of all landowners that share the delineated aquifer. Failure to do so could be considered a nuisance or even trespassing, since the contaminants may migrate with groundwater onto all properties sharing the aquifer. Also, the possibility of contaminating protected areas (e.g., National Parks) should be more rigorously considered.

Buffer distances from karst features, e.g., caves, sink-holes, swallow holes, sinking streams, should be determined on a site-specific basis.

Most of the proposed steps listed above rely on rigorous characterization of karst features, therefore the following methods of investigation should be considered in the NPDES permit and implemented before siting and construction of waste lagoons and spray fields on karst terrains:

- Aerial photo analyses;
- Geologic analyses;
- Geophysical evaluation;
- Airborne light distancing and ranging (LiDAR) surveys;
- Detailed soil surveys and analysis of site-specific qualities;
- Karst inventory and mapping;
- Hydrological analyses (e.g., precipitation monitoring, recharge monitoring, discharge measurement, tracing analyses, hydraulic conductivity measurements, delineation of aquifers);
- Test boring investigation (only if performed based on the prior geological and geophysical evaluation and possible speleological investigations);
- Preliminary and compliance groundwater quality monitoring, incorporating event-based sampling strategies

in order to define possible impacts on groundwater quality;

- Vulnerability mapping and contamination risk mapping (developed for karst areas).

## Conclusions

Karst groundwater protection policies are still inchoate, which contributes to daily deterioration of these valuable water resources. As presented in this study, integrating scientific methods in policy-making can enhance the preservation of valuable karst groundwater resources, and the protection of highly valued areas such as State and National Parks, all while simultaneously allowing for an appropriate level of agricultural activity. Therefore combining the scientific and political knowledge is a crucial element in the process of achieving protection of karst groundwaters.

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## **Exhibit 2**

PRELIMINARY DRAFT – May 9, 2013

Mitigation and pollutant minimization proposals for C&H Hog Farm, Inc.

The National Park Service (NPS) has identified water-resource concerns related to the development of the C&H Hog Farm, Inc. concentrated animal feeding operation along Big Creek. In order to minimize water pollution threats to Big Creek and the Buffalo National River, the NPS proposes implementation of the following actions.

**Corrective Actions:**

**Annual nutrient management plan assessment.** An independent contractor could be used to test ~~receiving-application~~ field soils, and evaluate and revise the nutrient management plan as necessary to ensure on-site nutrient retention.

**Line waste storage pits.** Well-maintained storage pit linings would reduce the potential for leakage into groundwater and may prevent failure due to subsurface saturation and catastrophic sinkhole collapse.

**Delineate riparian buffers.** To prevent applying waste too close to streams, sinkholes and other karst features (as specified in permits), one hundred foot (100') field buffer boundaries could be solidly delineated, e.g. with vegetation or secure posts.

**Manure application to fields using soil injection.** Ammonia, hydrogen sulfide, and particulate matter can be injurious to organism health. ~~Methane is an explosion hazard and may be an asphyxiate at high concentrations.~~ Soil injection is the preferred soil application method when soil depth and depth to groundwater are appropriate. Soil injection should drastically reduce odors, and reduce the potential for stream contamination from runoff. The application area could be assessed for soil injection as a treatment method and adopted if deemed appropriate.

**Early spill notification.** Contacting the Arkansas Department of Environmental Quality, Arkansas Department of Health, and the National Park Service within 24 hours of any unplanned discharge of wastes on the hog farm would provide these agencies the opportunity to minimize impacts.

**Non-floodplain field alternatives.** Fields that minimize the potential for stream contamination due to stormwater runoff and subsurface flowpaths, e.g. through karst, are preferred for manure applications. A site analysis would help identify most appropriate application areas.

**Inventories and Monitoring:**

**US Geological Survey monitoring.** Establishment of a USGS monitoring station on Big Creek would provide baseline and ongoing data to demonstrate that water quality is not impacted by hog farm operations, such monitoring needs to be initiated prior to any application so that original conditions can be established.

**Escherichia coli (E. coli) monitoring.** E. coli monitoring for Buffalo National River at Carver and Big Creek would ensure primary contact waters remain safe for swimming and other recreation.

**Comment [KTM1]:** I believe there are more stringent liner requirements that were implemented for the Ozarks years ago. Is that not correct? These were some concerns voiced during our early studies.

**Comment [KTM2]:** I'd delete this one. Methane explosive and asphyxiation threats are only important in homes and confined situations. The odor issues and reducing potential for runoff are far more important, and shallow injection does reduce these and other problems.

**Comment [p3]:** Assessment of application field soils—soil thickness, clay content, permeability, preferential flow, etc—should be included as part of this measure to ensure that soil injection will work well without rapid introduction to the epikarst. Outcome of soil injection could be worse in karst than the runoff effect in unsuitable soils.

**Comment [KTM4]:** This is good because although Reg 2 addresses contamination from releases there is no language for contacting the department (unless this has been re-written in recent years).

**Comment [KTM5]:** I'm confused on this one. Already have something about buffers, injection, etc. They can't have in floodplain anyway, and have requirements on slopes, etc., so a little confused on topic title and text. If just wanting a better review of application sites, can put sentence under you buffers topic, or at least move this before spill notification to keep topic of application-related text together.

**Aquatic ecology inventory.** A mussel and macroinvertebrate inventory for Big Creek and Buffalo River would establish a baseline ecological condition. Future assessments would demonstrate aquatic populations have not been impacted.

**Monitoring wells.** Due to the underlying karst geology and heterogeneous and flashy nature of groundwater flow, contamination may be rapidly transported in the subsurface to Big Creek. An early warning well network could be installed downslope of the waste storage pits to demonstrate contamination is not occurring ensure protection of groundwater and receiving streams serving as groundwater discharge areas. Such monitoring alert operators to unseen contamination very early after break out, resulting in tremendous cost savings for any contaminant remediation; monitoring wells have proven to be very cost-effective in this regard.

**Dye tracing study.** A USGS-USGS-approved dye tracing study for the pond and barn area would help define subsurface hydrology, including groundwater flow direction, transit rates offsite, and areas of groundwater discharge. These analyses would assist with wastewater permit determinations for concentrated animal feeding operations, and manure application on karst terrain, and optimum monitoring areas for assessing potential impacts to receiving streams.

**Monitor for potential endocrine disruptors.** A Big Creek monitoring regime that tests water for the presence of pharmaceuticals, feed additives, and pesticides used to treat swine and fields as part of the C&H Hog Farm, Inc. operations would provide an early warning system for primary contact and help determine effects on aquatic organisms.

Not sure how to title, but work we were all involved in from the DOI on the Landscape karst study which showed a significant increases in nitrates in GW where the density of sinkholes increased, i.e. where karst development was greater, relative to areas void of mapped sinkholes. As such, I would include under 'Dye tracing study' an inventory of sinkholes and bedrock exposure, that to reveal determine areas of increased karst vulnerability (sensitivity) to an waste-application land use.

**Comment [KTM6]:** This is a very important and inexpensive alternative that protects both the facility and water resources. Groundwater remediation cost are in the millions of dollars – early detection prevents such costs to the facility. We fought for monitoring wells (3 would be sufficient) for years to no avail. There are facilities in Arkansas that suffered under massive cleanup costs because of leaky treatment ponds. Additionally, surface water mitigation can be done in much shorter timeframes, but discharge of contaminated GW takes years to remediate and serves as constant source of contamination to receiving streams. Ugh, don't know how to put all this down, but this is one of the most cost-effective early warning systems in the entire process.

**Comment [p7]:** I don't think that 3 monitor wells would be sufficient in this setting. Wells will need to target regolith zone, epikarst, and karst zones

**Comment [KTM8]:** Not sure what "...wastewater permit determinations ..." are in reference to CAFOs. Is this application rate? Need some specifics. I'm not sure what the benefits of dye tracing are besides defining GW flow directions.

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# **Exhibit 3**

# Resistivity Imaging of Swine Waste in Mantled Karst

Jon Fields

Todd Halihan, Ph.D., P.Gp.

*Oklahoma State University*



# Objectives

- ▶ For this experiment, electrical imaging was conducted to:
  - ▶ Evaluate rock properties.
  - ▶ Characterize potential groundwater flowpaths in a complex mantled karst.
  - ▶ Evaluate potential electrical signals of applied swine waste.



# Electrical Resistivity

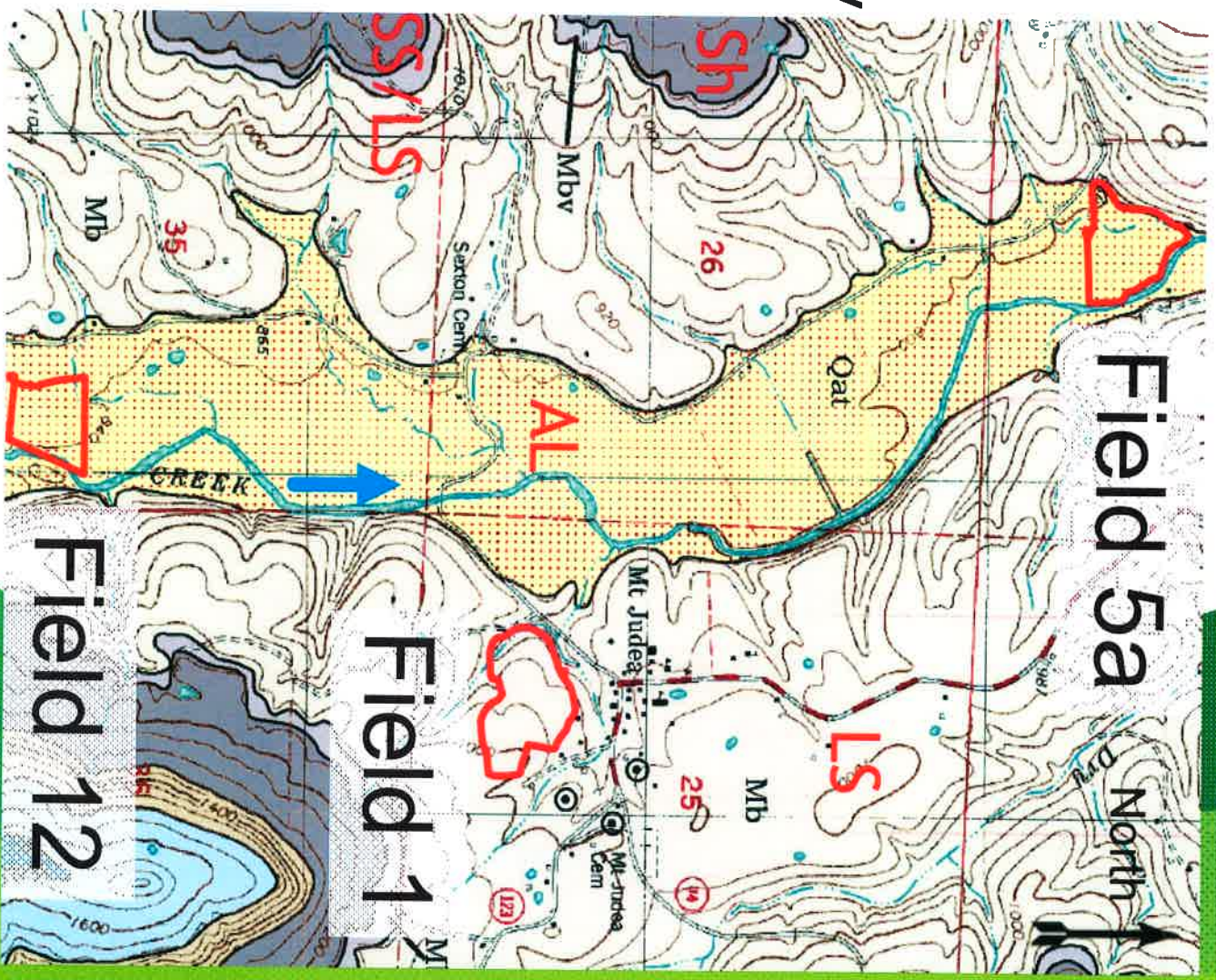
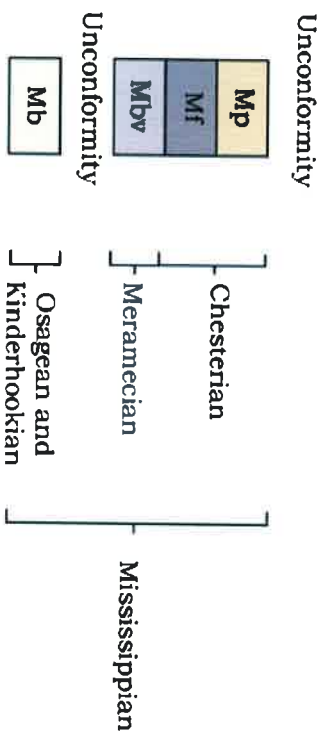
## Imaging

- ▶ One of the oldest geophysical methods; significant improvements in last 20 years
- ▶ 56 electrodes connected to an energy source and an instrument that measure the differences in apparent resistivity and generates a 2D dataset



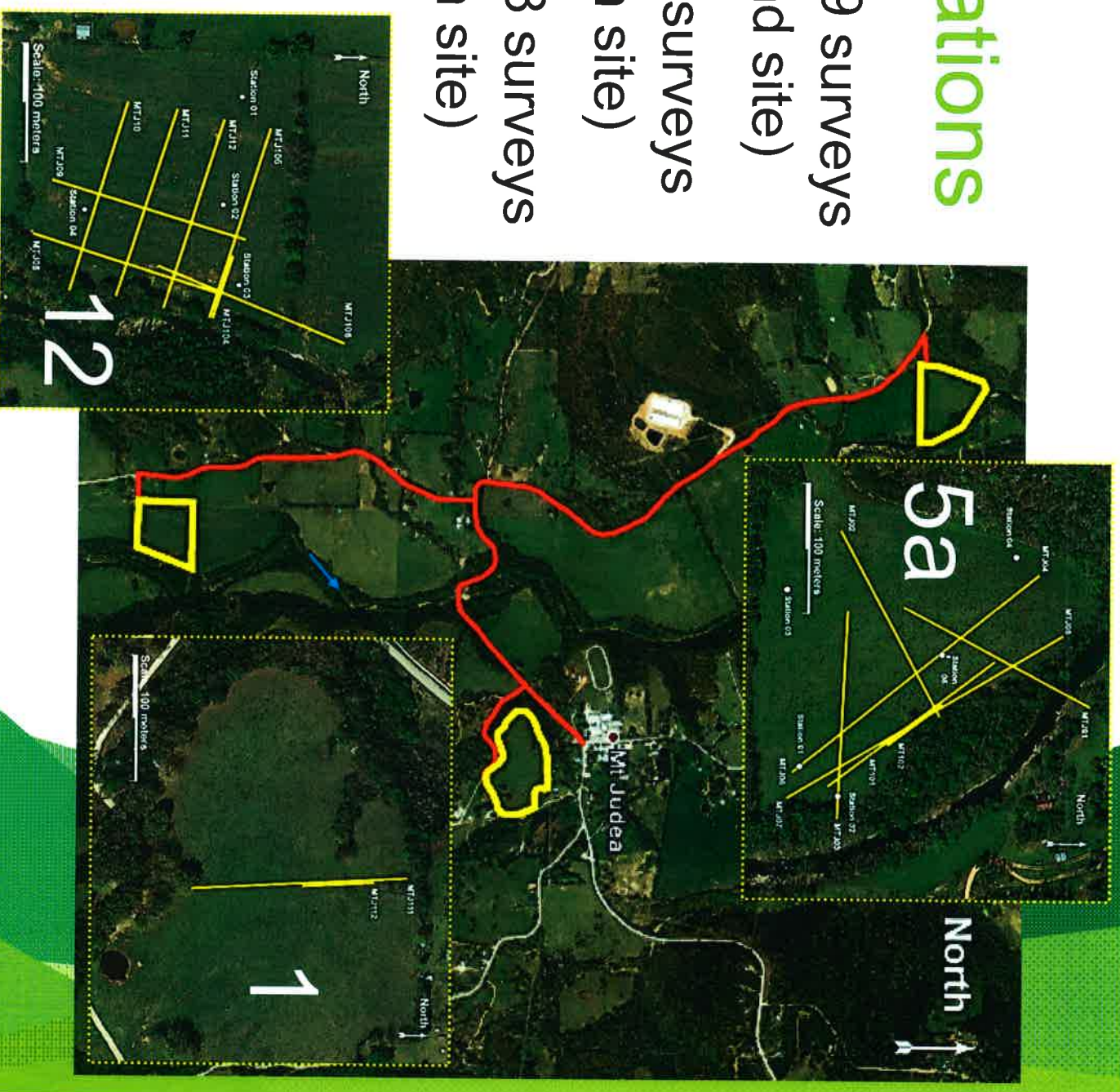
# Geology

- Fayetteville Shale (Sh) – **Mf**
- Batesville Formation (SS/LS) – **Mbv**
- Hindsville Limestone Member
- Boone Formation (LS) – **Mb**



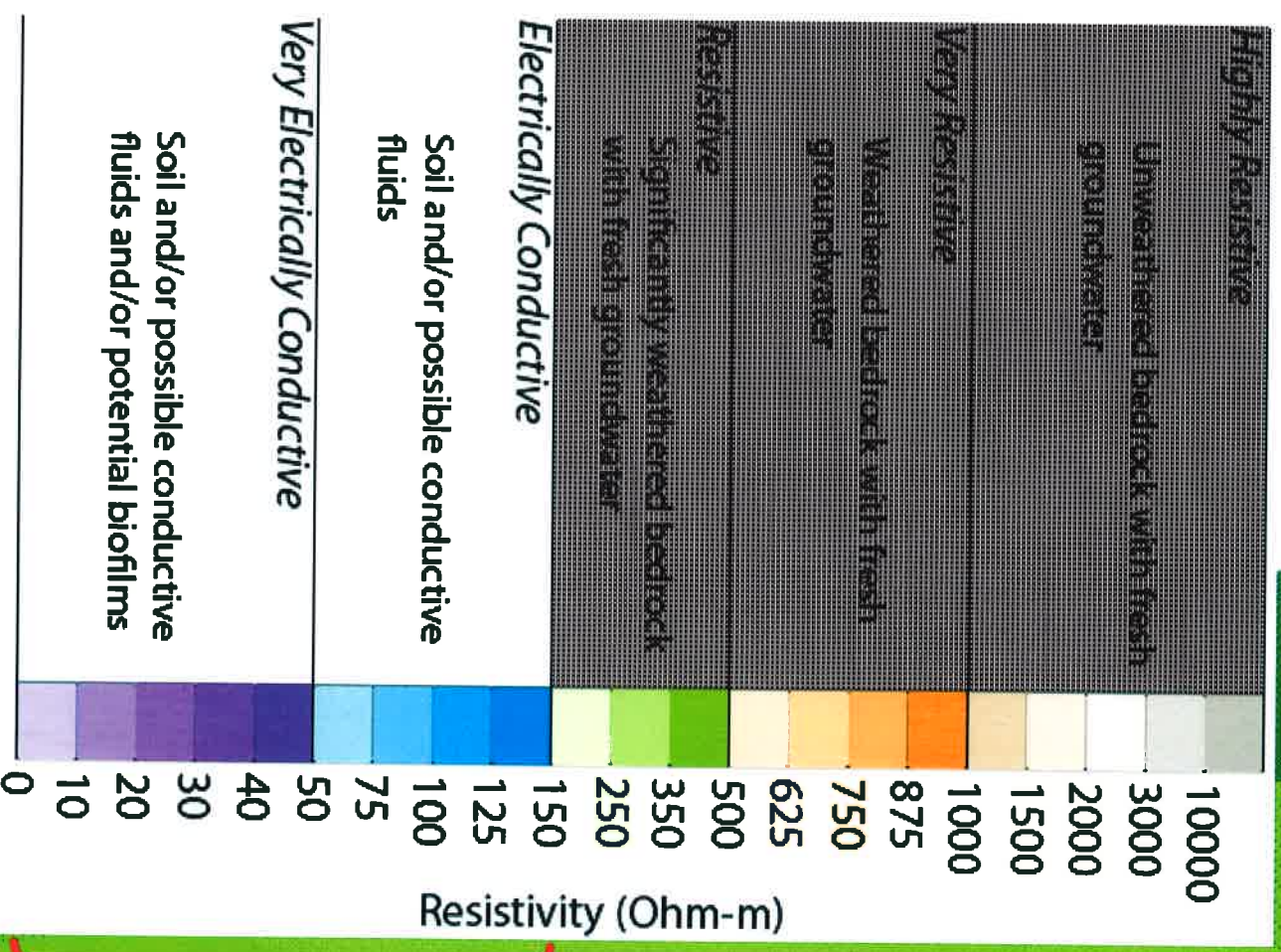
# Site Locations

- ▶ *Field 5a* – 9 surveys  
(background site)
- ▶ *Field 1* – 2 surveys  
(application site)
- ▶ *Field 12* – 8 surveys  
(application site)



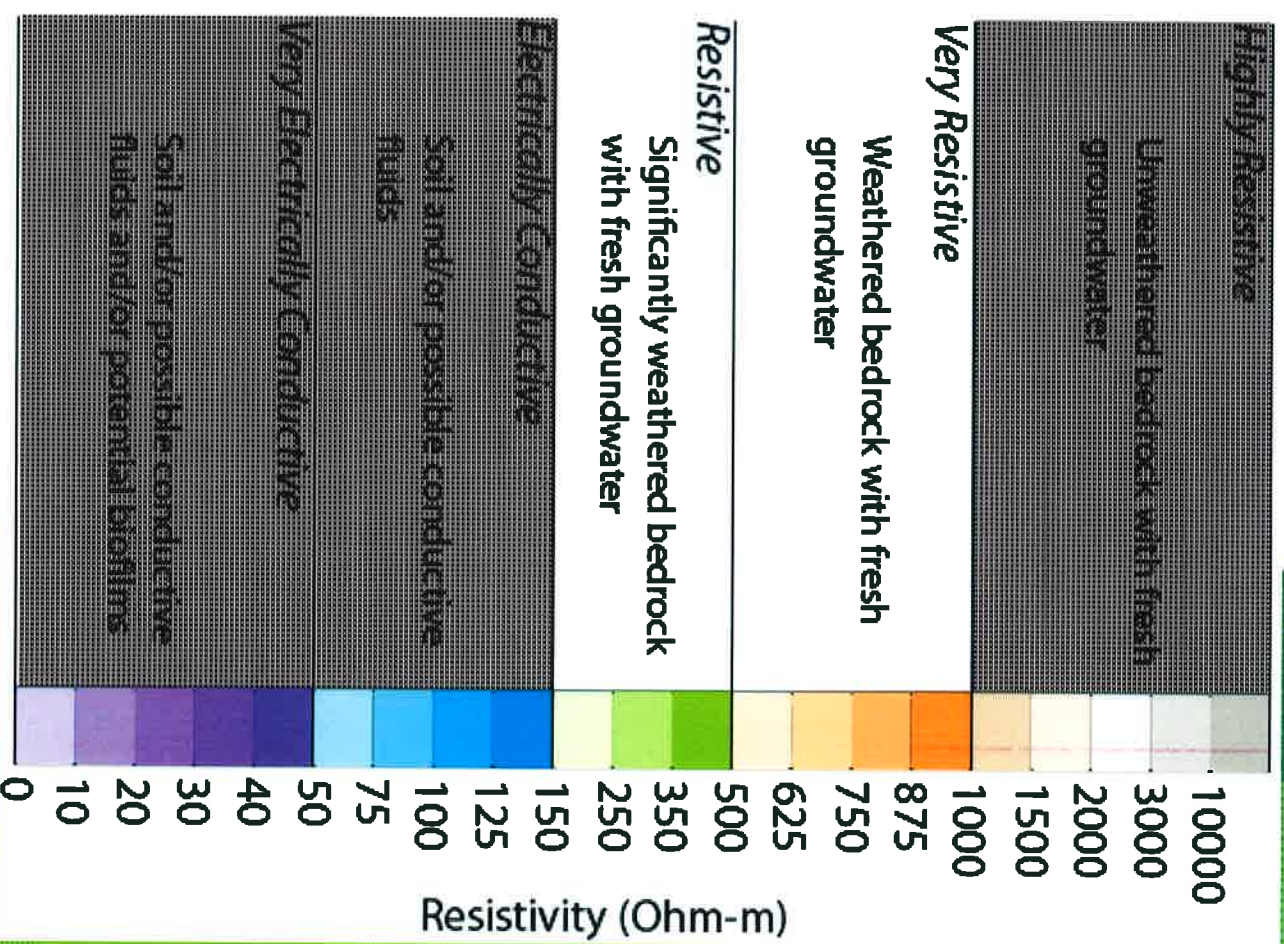
# Soil Zone

- ▶ The electrically conductive zone between ground surface and the epikarst.
- ▶ Determined through hand coring to refusal



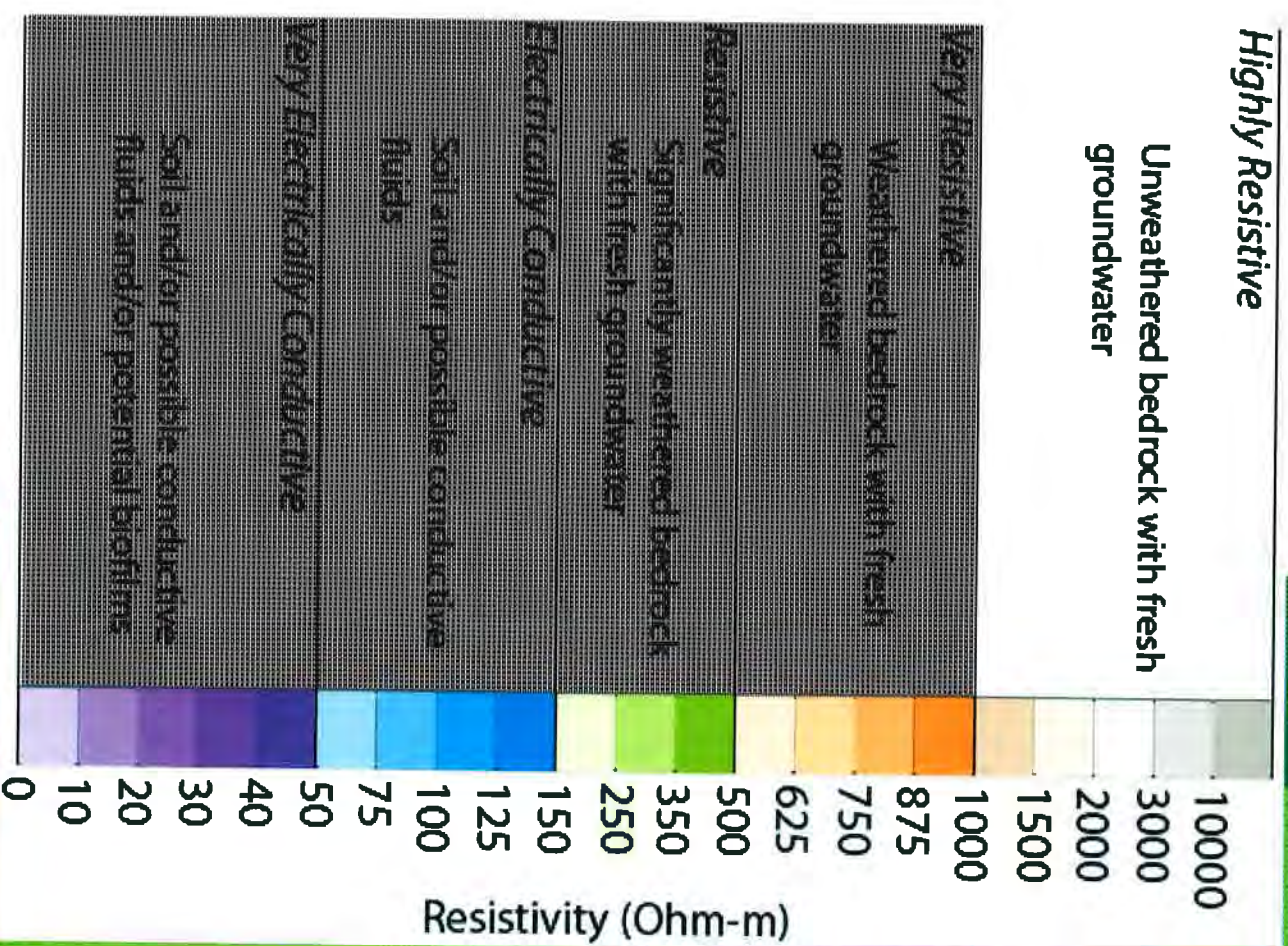
# Epikarst Zone

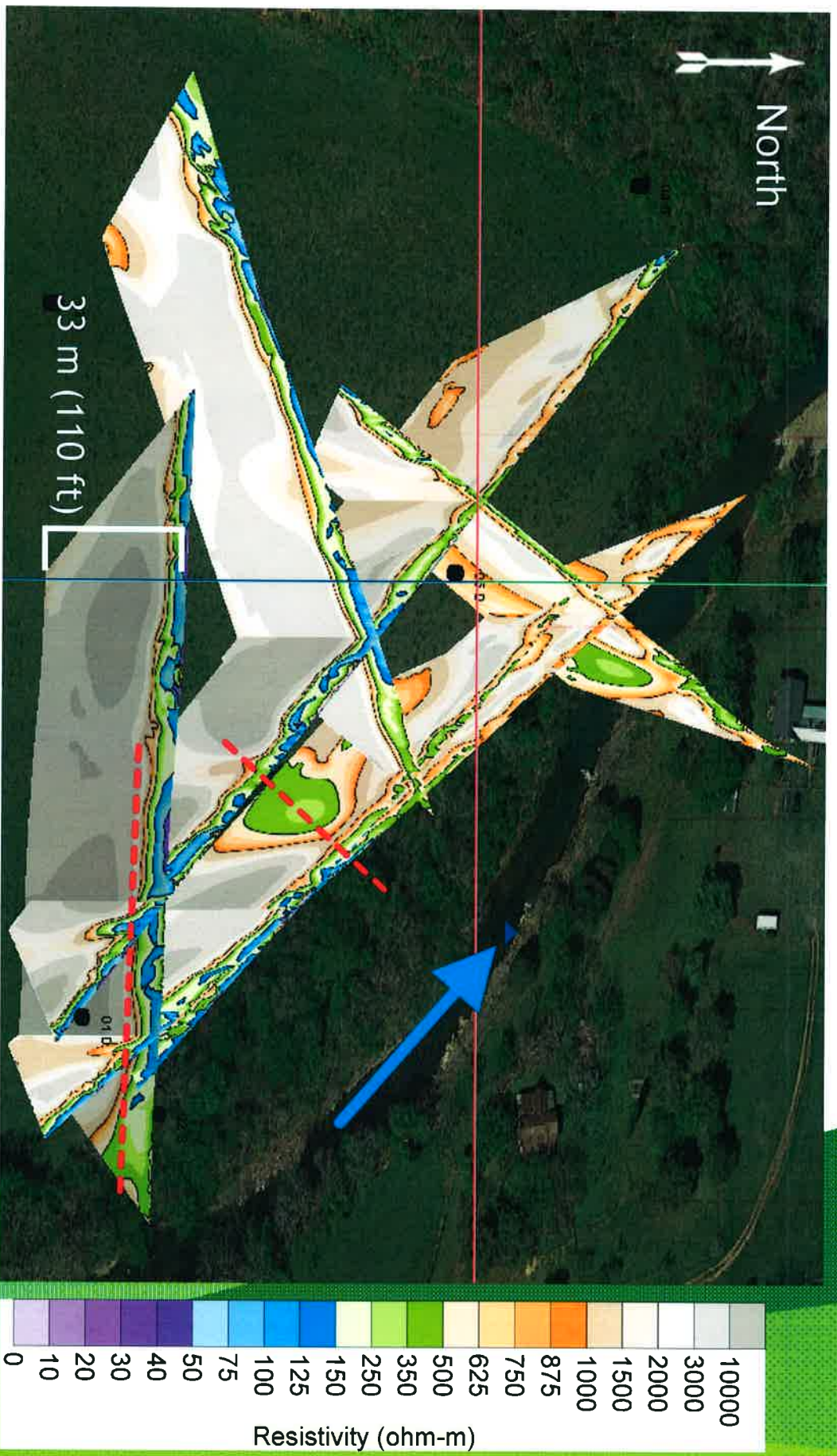
- ▶ Zone extending from the base of the soil zone to the surface of the competent bedrock  
*Klimchouk 2004*
- ▶ Determined from soil coring and vertical electrical gradients



# Bedrock

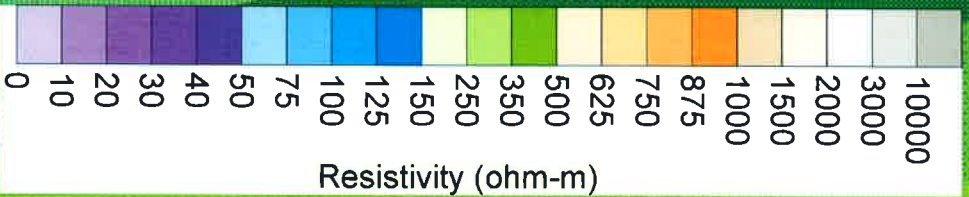
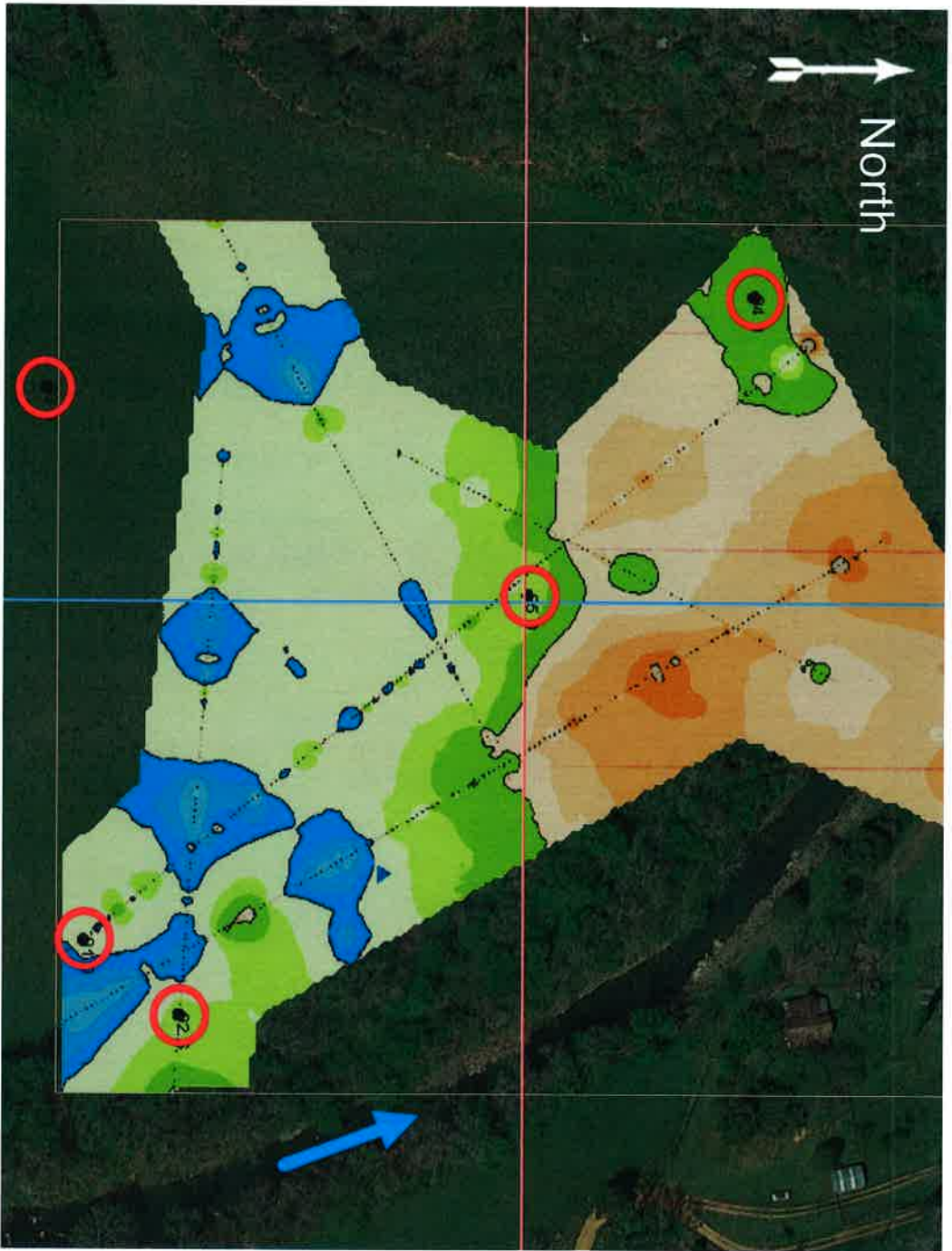
- ▶ Zone of competent rock beneath epikarst
- ▶ Generally highly resistive zone at depth





# Results – Overview

Field 5a (background site)

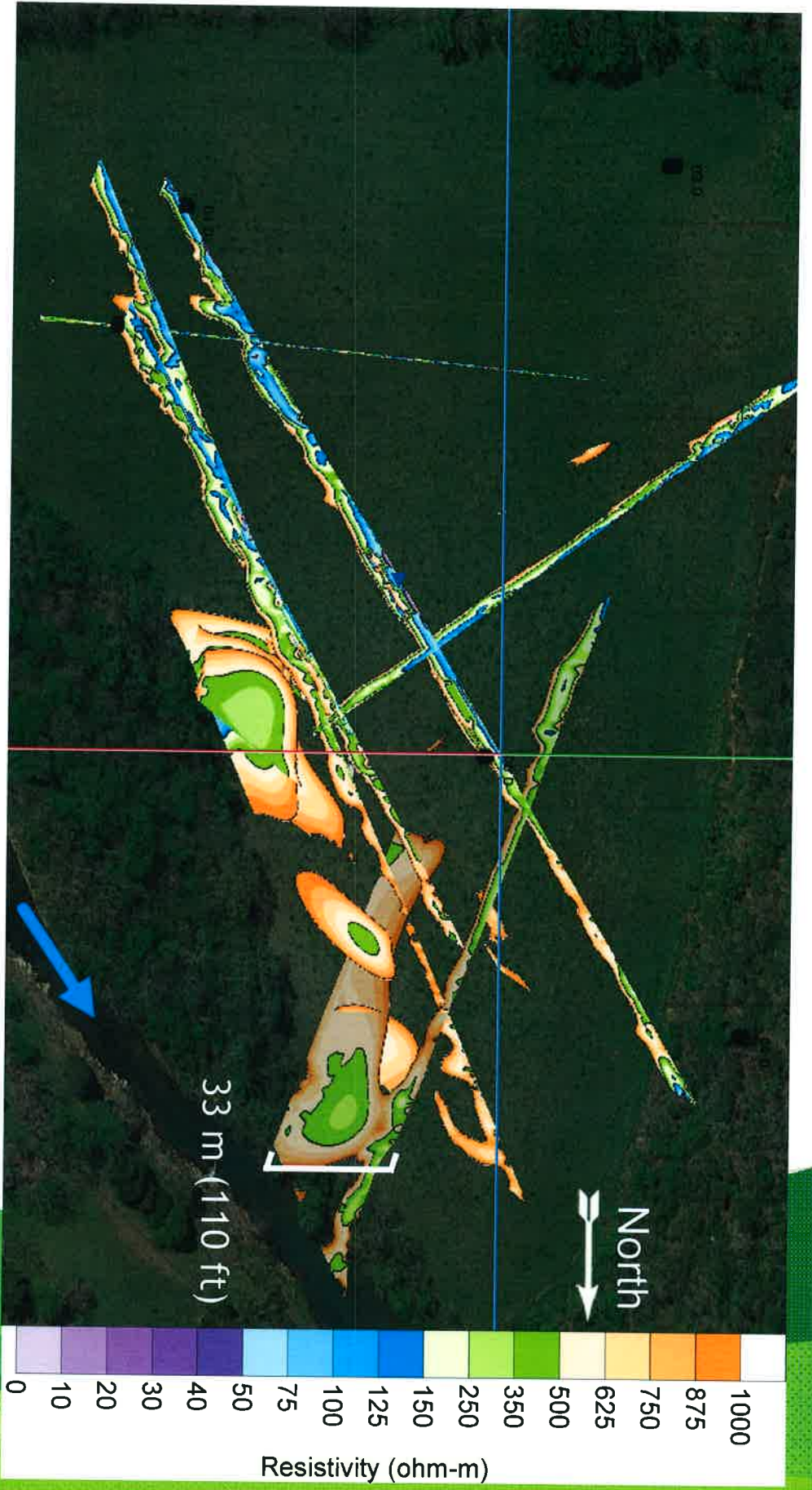


# Soil Zone

Field 5a (background site)

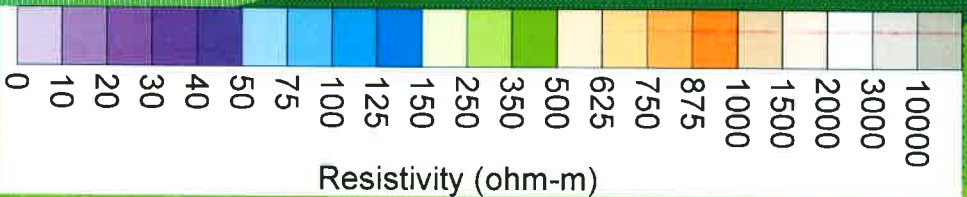
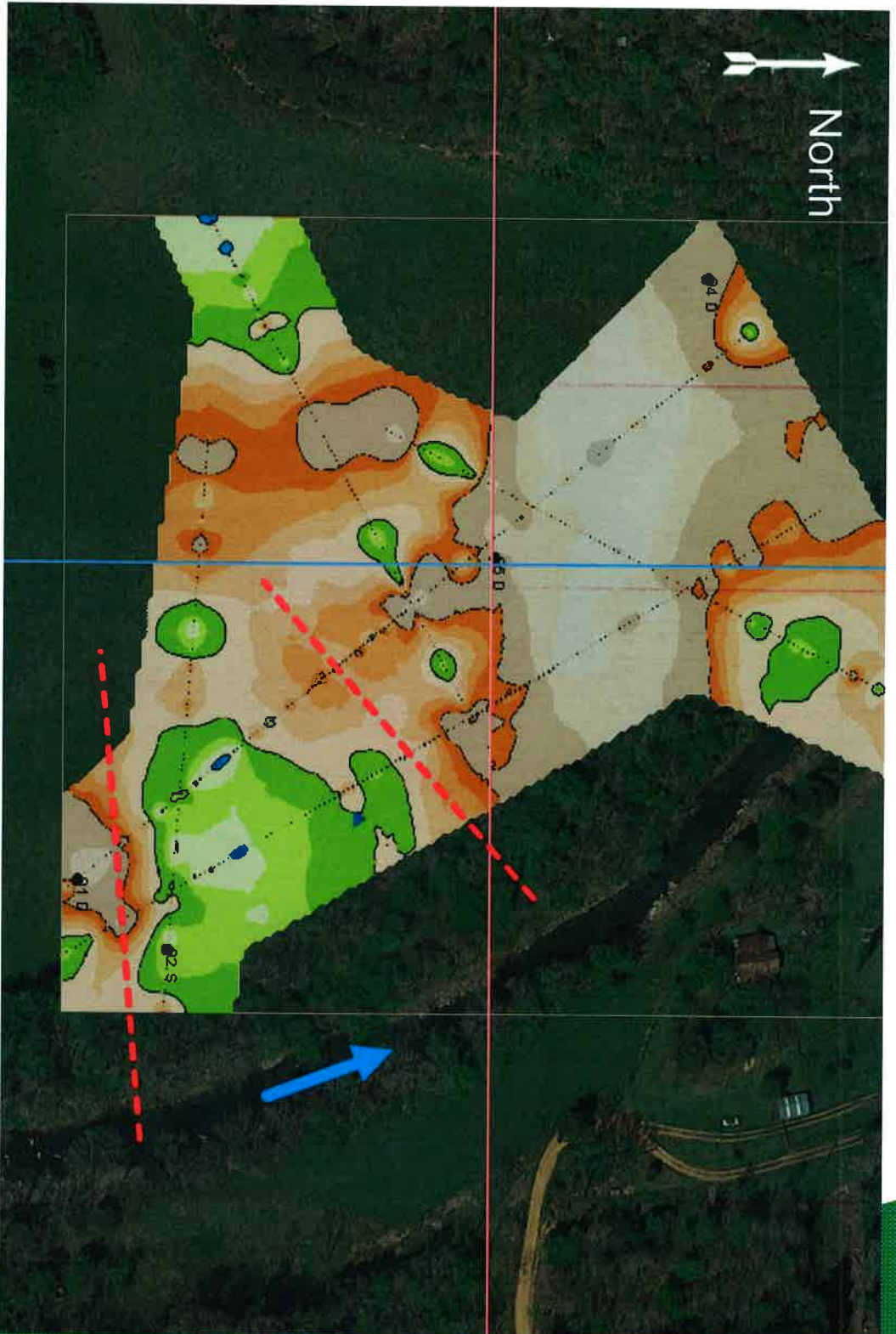
Horizontal Slice at  
-1.5 m (-5.0 ft)





# Soil / Epikarst Zones

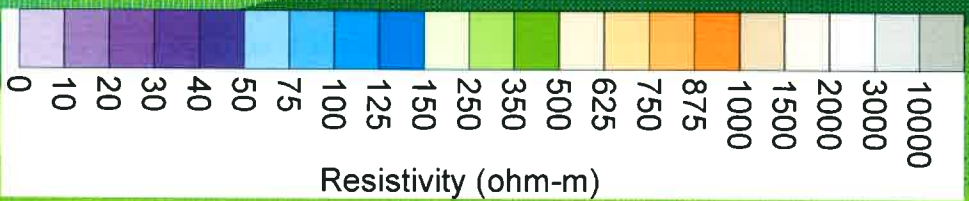
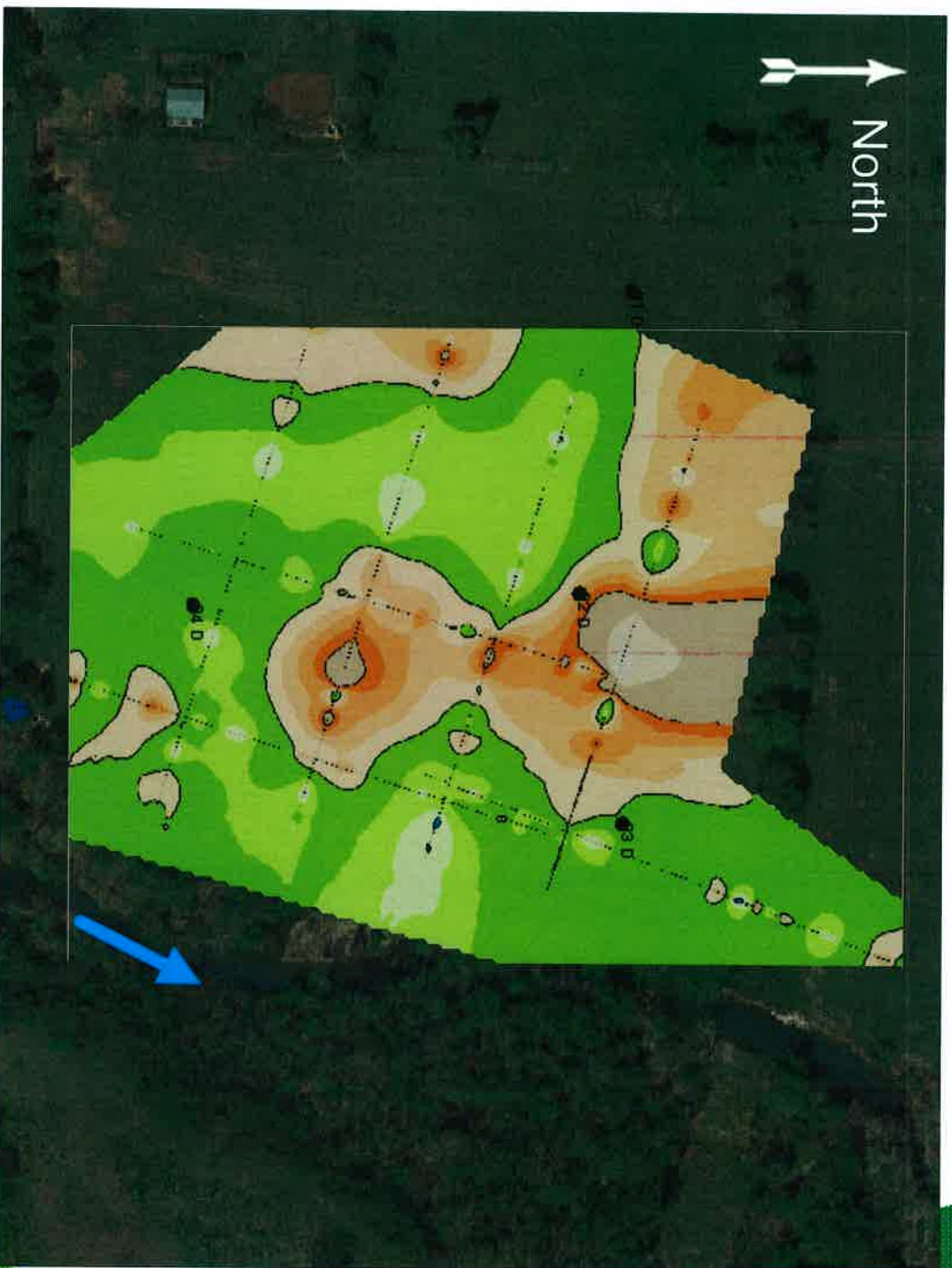
Field 5a (background site)



# Epikarst Zone

Field 5a (background site)

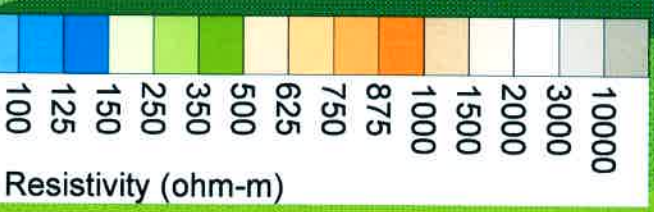
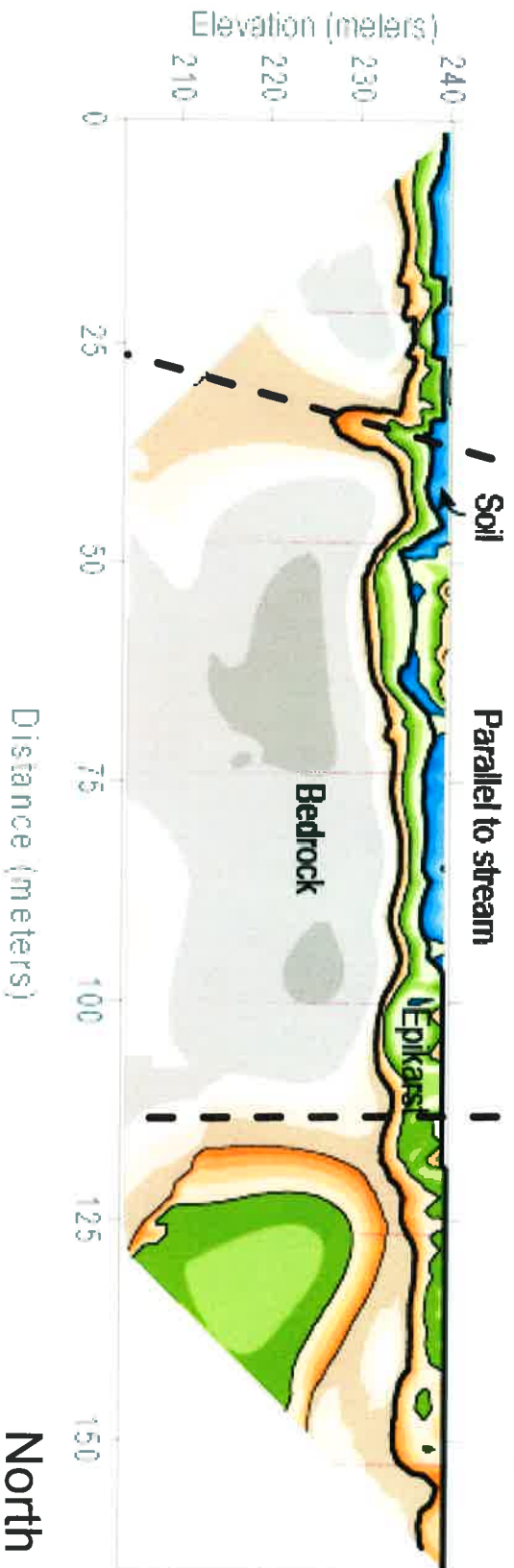
Horizontal Slice at  
-4.5 m (-15.0 ft)



# Epikarst Zone

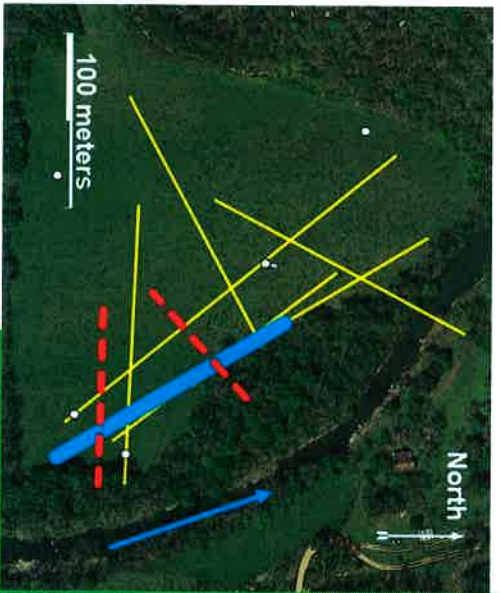
Field 12 (application site)

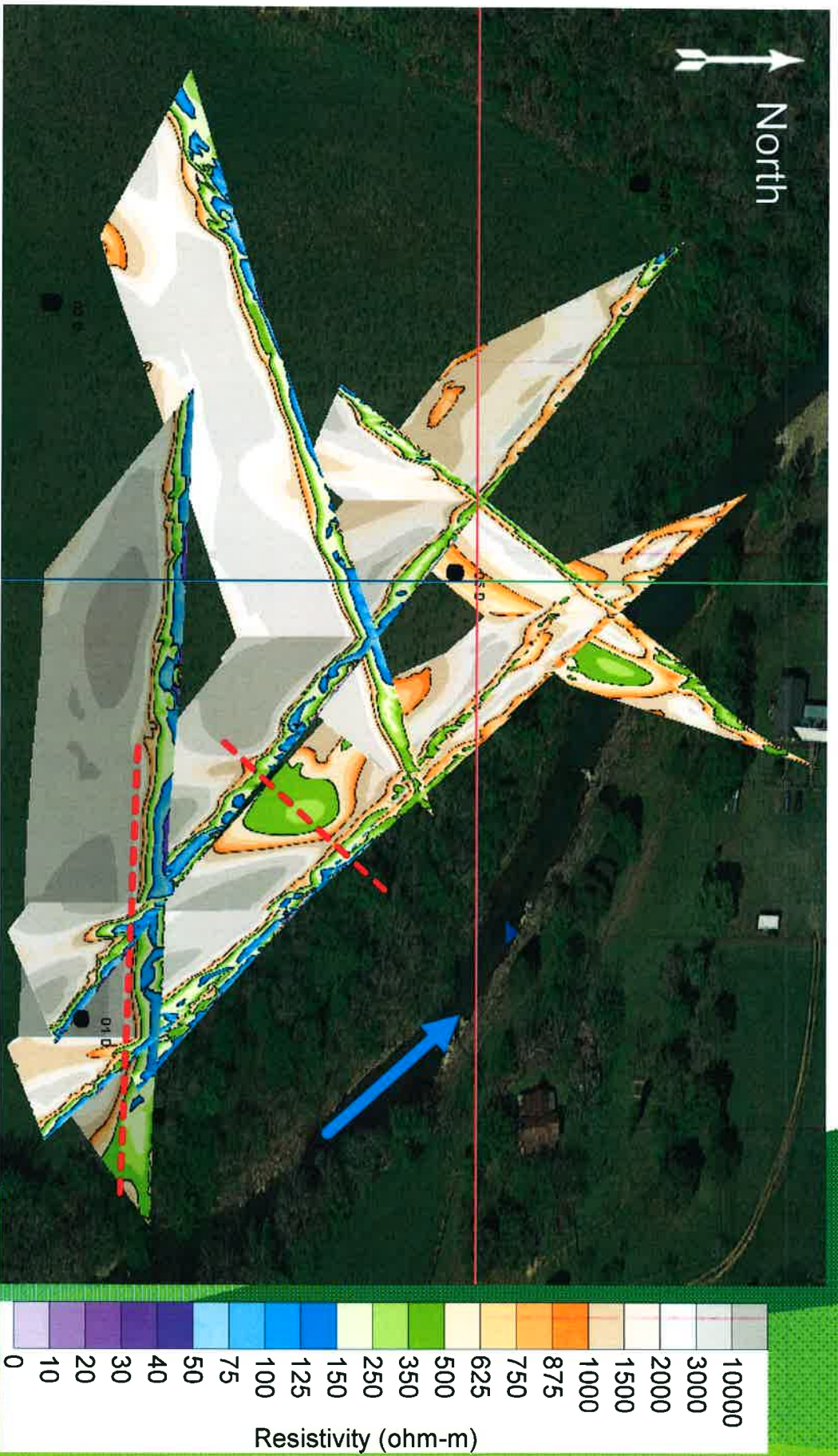
Horizontal Slice at  
-6.0 m (-20.0 ft)



# Bedrock

Field 5a (background site)



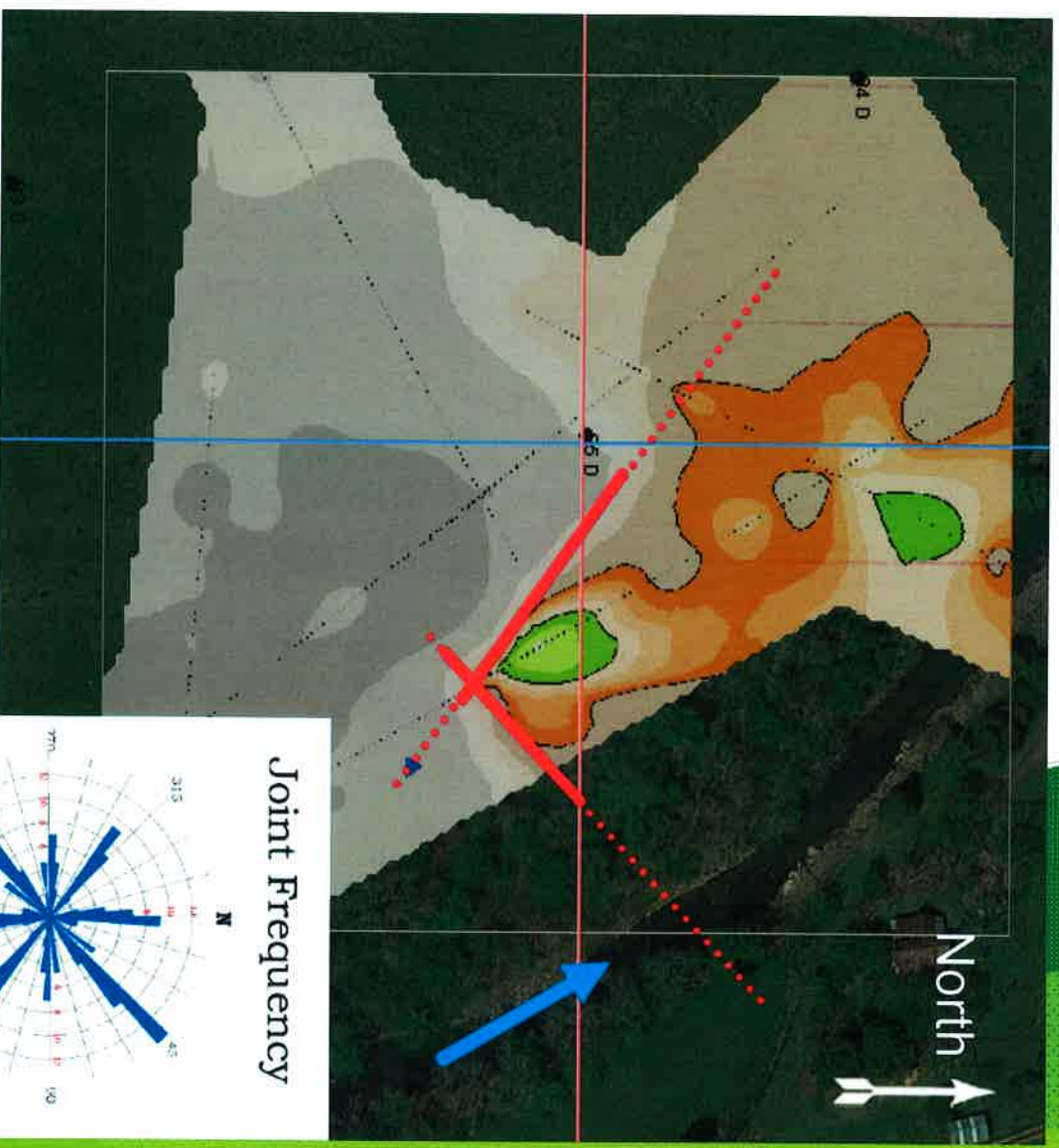


# Bedrock

Field 5a (background site)

# Bedrock

- ▶ Field 5a
- ▶ Faulting / Regional Trends
- ▶ NE and NW
- ▶ Electrically Conductive Flowpaths

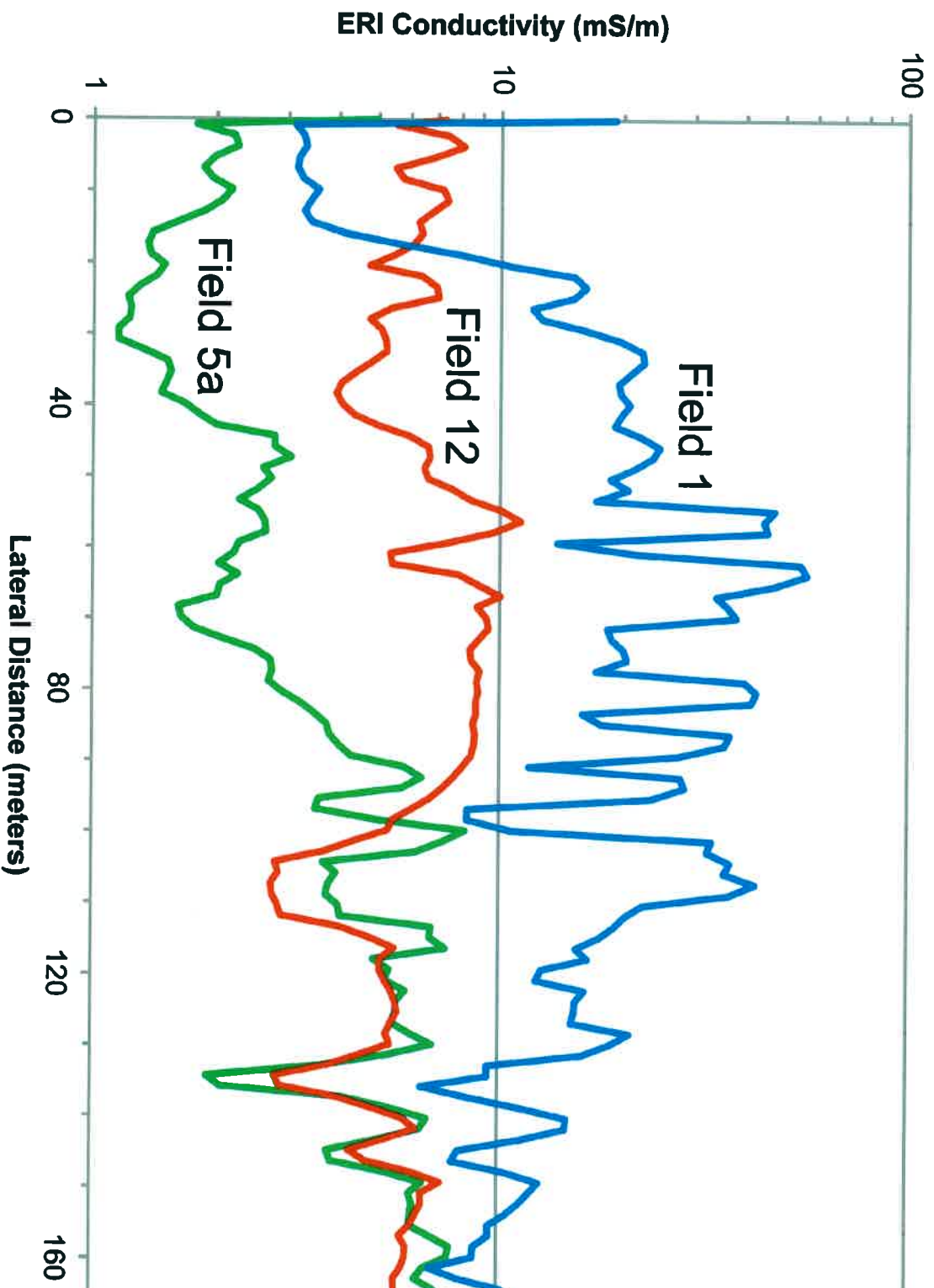


*Horizontal Slice*  
at -33 m (-110 ft)

Rose diagram of strike frequencies of joints recorded within the Mt. Judea Quadrangle.

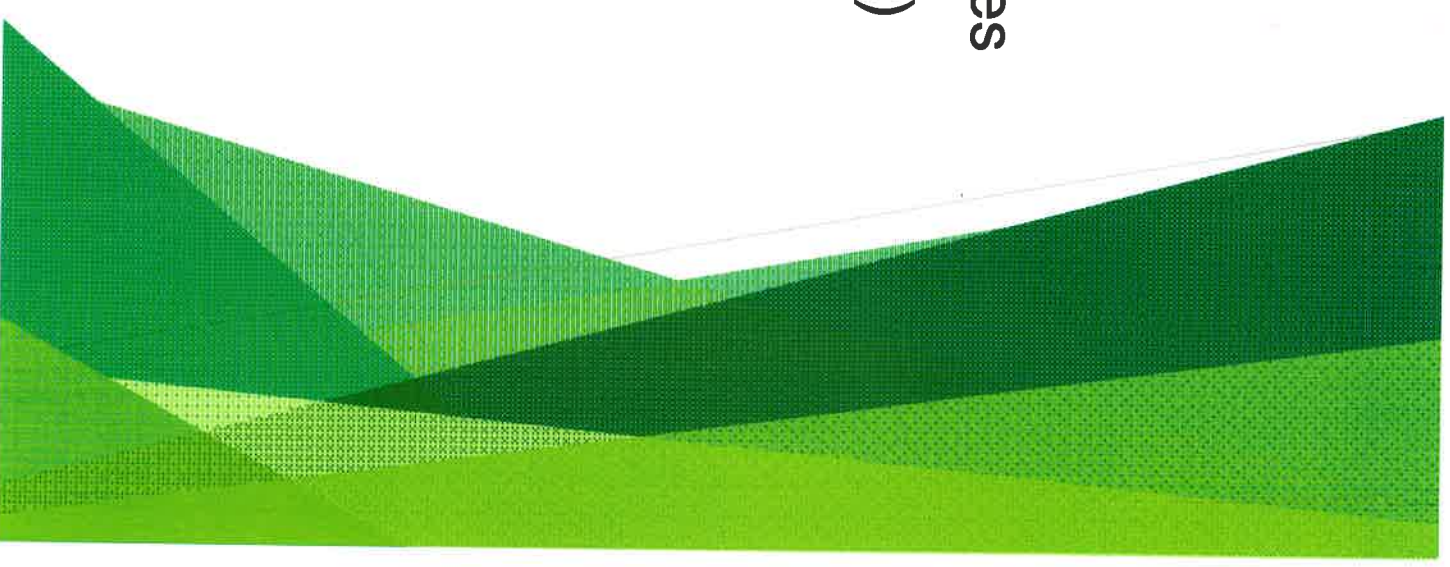
**N = 43**

# Shallow Soil Signatures



# Summary

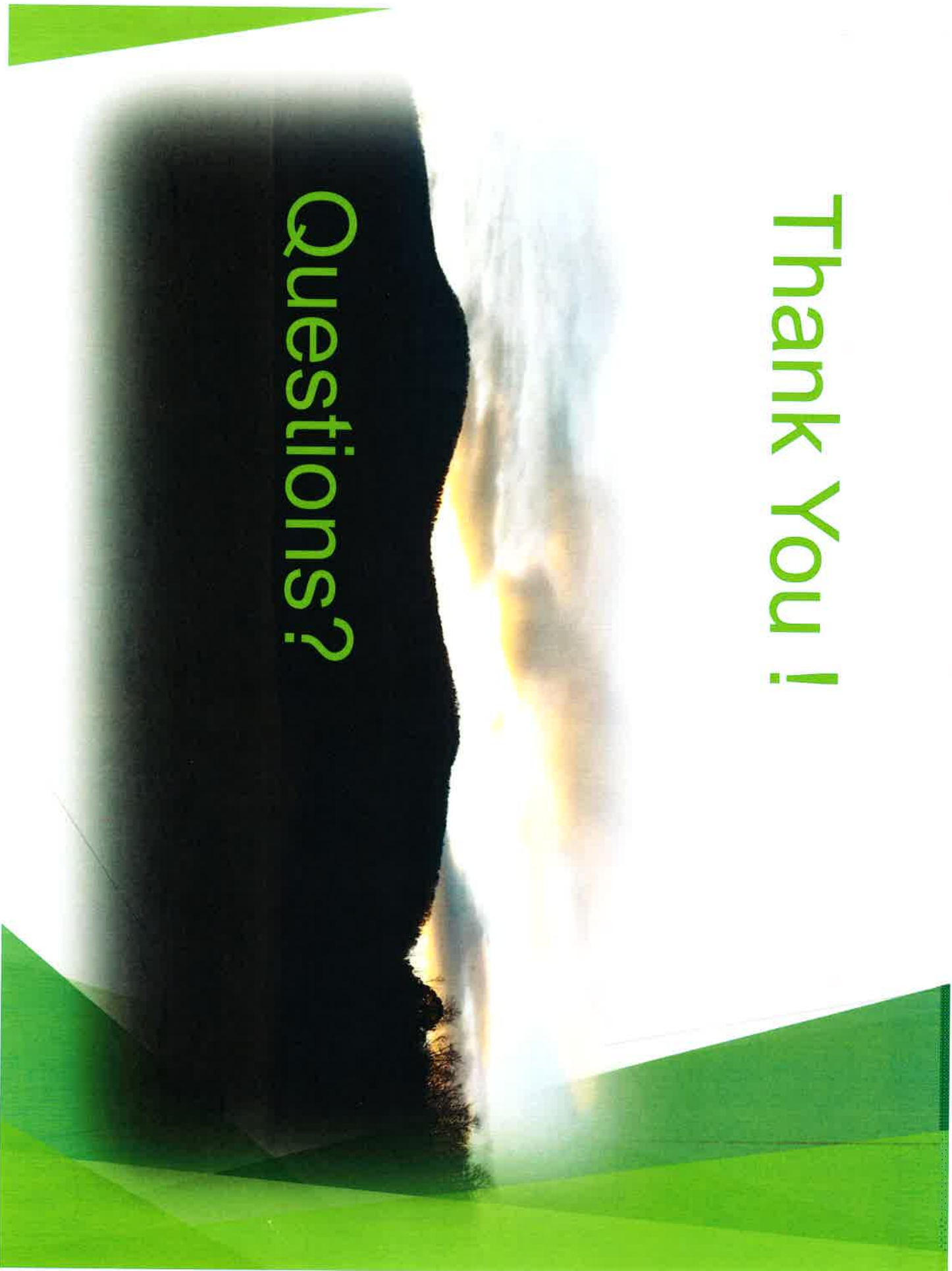
- ▶ Soil Zone
  - ▶ Electrically conductive shallow features
  - ▶ Average thickness 0–3.5 m (0–11.5 ft)
- ▶ Epikarst Zone
  - ▶ More resistive features
  - ▶ Average thickness 4–7 m (13–23 ft)
- ▶ Bedrock
  - ▶ Highly resistive features
  - ▶ Evidence for possible flowpaths





Thank You !

Questions?



# **Exhibit 4**

## Pat Walters

---

**From:** Andrew N. Sharpley <sharpley@uark.edu>  
**Sent:** Friday, October 16, 2015 10:44 AM  
**To:** Kresse, Timothy  
**Cc:** Mike Daniels; Karl VanDevender; Phillip Hays  
**Subject:** RE: FW: 2015\_Fields-Halihan\_MTJ Presentation for 60thMGWC\_Bentonville, AR

Good. I am glad the presentation went well.

**From:** Kresse, Timothy [<mailto:tkresse@usgs.gov>]  
**Sent:** Friday, October 16, 2015 9:38 AM  
**To:** Andrew N. Sharpley <sharpley@uark.edu>  
**Cc:** Mike Daniels <[mdaniels@uaex.edu](mailto:mdaniels@uaex.edu)>; Karl VanDevender ([kvandevender@uaex.edu](mailto:kvandevender@uaex.edu)) <[kvandevender@uaex.edu](mailto:kvandevender@uaex.edu)>; Phillip Hays <[pdhays@usgs.gov](mailto:pdhays@usgs.gov)>  
**Subject:** Re: FW: 2015\_Fields-Halihan\_MTJ Presentation for 60thMGWC\_Bentonville, AR

I saw the presentation. There were no difficulties at all and it was a good presentation. I did chat with Todd and Jon some about the pond results, and Phil joined in on the second half of that conversation. We can chat about that sometime. In short, it would be nice to put a well on the west side in the vicinity of where Todd believed he saw a major fracture and movement of waste. This could be critical to resolving the interpretation of the resistivity data. Todd would be willing to assist on getting the drilling done for free. I just don't know the amount of grief or worry this would cause, in lieu of all the activity at the farm, but again I believe it is a critical component. Todd is fairly confident of his interpretation. Thoughts?

On Wed, Oct 14, 2015 at 10:27 AM, Andrew N. Sharpley <[sharpley@uark.edu](mailto:sharpley@uark.edu)> wrote:

Just for you information, attached is Jon's presentation at the upcoming Groundwater meeting at Crystal Bridges tomorrow.

I didn't see any "major difficulties." But am not privy to the dialogue that will go with it.

Andrew

**From:** Halihan, Todd [<mailto:todd.halihan@okstate.edu>]  
**Sent:** Tuesday, October 13, 2015 9:05 PM  
**To:** Andrew N. Sharpley <[sharpley@uark.edu](mailto:sharpley@uark.edu)>  
**Subject:** FW: 2015\_Fields-Halihan\_MTJ Presentation for 60thMGWC\_Bentonville, AR

Andrew,

Let us know if you see any major difficulties with Jon's presentation for Thurs.

# **Exhibit 5**

**Subject:** RE: Follow-up on data interpretation  
**From:** "Andrew N. Sharpley" <sharpley@uark.edu>  
**Date:** 1/21/2015 2:58 PM  
**To:** "Kresse, Timothy" <tkresse@usgs.gov>  
**CC:** Phillip Hays <pdhays@usgs.gov>

Tim

Thank you very much. This is great stuff. I am particularly impressed with the particulate P versus suspended sediment relationship, which is close to my heart of course and which we have seen over and over again in agricultural surface runoff. But it is good to see it at this larger scale. I assume these relationships cover the range of flows we have taken samples under, which I suppose influences both variables by a similar mechanism.

We are building a really good data set here that will foster many publication, I feel in the short and long term.

Thank you for doing this, exciting us, adding fuel to the fire, and giving us more evidence of the depth and breadth of work the legislature have invested in.

Andrew

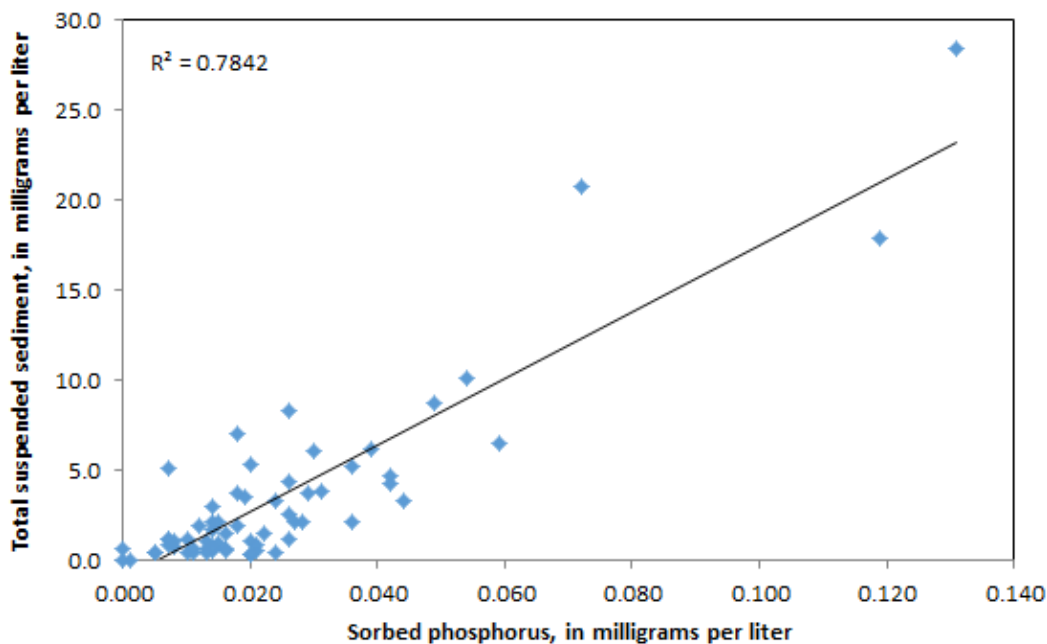
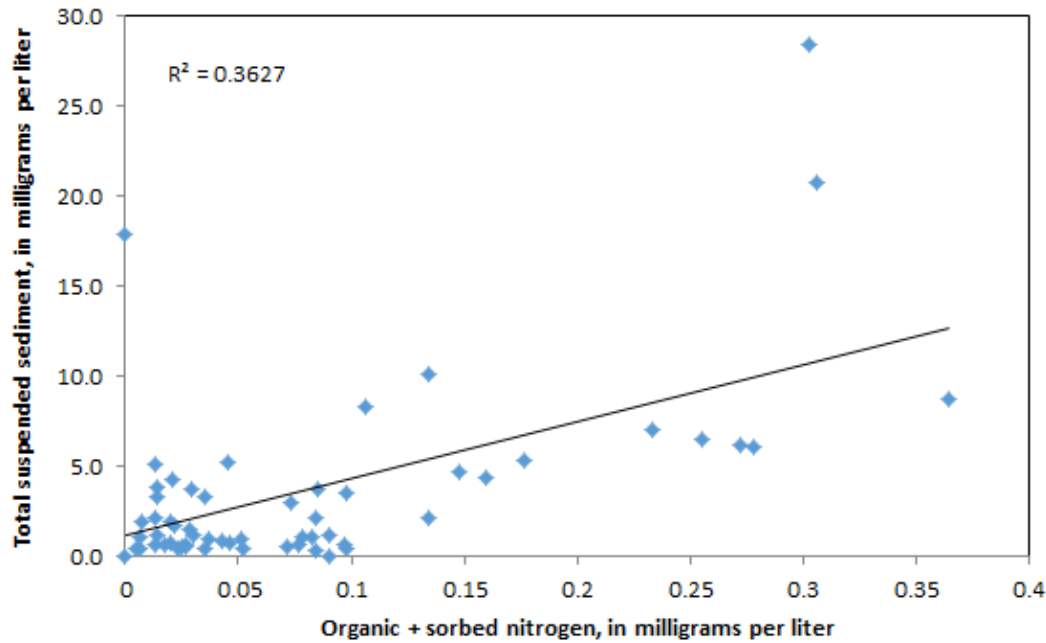
Office: (479) 575-5721  
Cell (479) 871-6703

Email: [sharpley@uark.edu](mailto:sharpley@uark.edu)

**From:** Kresse, Timothy [mailto:tkresse@usgs.gov]  
**Sent:** Wednesday, January 21, 2015 12:25 PM  
**To:** Andrew N. Sharpley  
**Cc:** Phillip Hays  
**Subject:** Followup on data interpretation

Andrew, this is just to show a few relations, which I believe reflect the underlying processes controlling the fate and transport of many of the constituents we are monitoring. Of course, we have many sampling sites, and the relationships change a little for each, as each is unique with respect to one another. Just in short, and until we get more data, here are some of the more interesting things popping up, which may have further implications for calculating loads, isolating outliers that may reflect poor data or simply an outlier for whatever reason, and basically to add to our knowledge of what is occurring where in the system. I'll send you the entire excel file, so you can peruse some of this at your leisure, when I've completed more of the analysis:

1) I've calculated, for loss of a better term, the sorbed/organic phase by subtracting the soluble components of N and P from the total. Both of these calculated values track better with TSS than total or (obviously) dissolved. Here are some examples from the upstream site;



Without showing you numerous graphs until such a point this exercise is completed, other observations are as follows:

2) DOC has an inverse relation with the sorbed species, and virtually no relation with TSS. If we had TOC we might see something, but until some processing occurs to transfer much of the organic matter into more labile dissolved forms, I somewhat understand this relation (if you guys can buy into this).

3) I've never seen good relations with bacteria, but we do see an overall increasing trend with both total coliform and E.coli with increasing TSS. However, there can be many instances of low counts, even where TSS is elevated; therefore, obviously there is no significant trends.

4) There is some analyses that don't make sense from several ways of looking at the data. Some of this was borne out by the relations, but others in simply reviewing the raw data. For example, there was one event

where TN was 2.2 (upstream; 9/24/13), with NH<sub>4</sub> and NO<sub>3</sub> concentrations of only 0.03 and 0.44 respectively, and an organic N (which should supply the remainder) of 0. Doesn't add up. In another instance when plotting TSS and sorbed P, there was a high P value with a very low TSS value (see upstream; 4/22/14). The total was very high (0.888) - one of the highest measured, but virtually no TSS. I would have wanted the lab to review this and possibly drop in from the interpretation. There are others like these, which I'll simply highlight so we can discuss them at a later date. I don't want to get into too much minutiae on this point, but we'll want to decide if there is data that should be flagged and not used in further interpretation (hate to throw out data, but if not supported, then we'll at least want to discuss further). It would be nice to isolate these sooner, so the lab could re-run or check some of this older data (they could find simple problem somewhere in system).

Ok, that's it for now. Just wanted to give a flavor for what we are seeing, both positive and negative. We'll obviously use faster and more sophisticated ways of analyzing the data (I fully realize this), but such analysis as this hopefully helps to fine tune what we are wanting to do and to try to do some QA/QC as we are collecting it. So, for what it's worth, I thought I'd share some of this with you and Phil, just to get us thinking of the data as we go forward. All the best,

Tim

--

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# **Exhibit 6**



# Uniform Agricultural Appraisal Report

This report does contain a hypothetical condition.

Summary Appraisal Report  
C & H Farms (Campbell and Henson)  
259.93 Acres Swine, More or Less  
Newton County, Arkansas

**Prepared For:**

Farm Credit Services of Western Arkansas  
3115 W. 2nd Court  
Russellville, AR 72801

**Intended User:**

Farm Credit Services of Western Arkansas  
3115 W. 2nd Court  
Russellville, AR 72801

**Prepared By:**

Jim B. Wiedeman  
Regional Appraiser  
CG 2649  
3115 W. 2nd Ct., Russellville, Arkansas 72801

**Date Prepared:**

05/22/12

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**Property Identification**

Owner/Occupant: C & H Farms (Campbell and Henson) Total Deeded Acres: 259.93  
 Property Address: Near Mount Judea, AR Effective Unit Size: 259.93  
 State/County: Arkansas / Newton Zip Code: \_\_\_\_\_  
 Property Location: 0-3 Miles from Mt. Judea, AR Paved and Gravel Property Code #: \_\_\_\_\_  
 Highest & Best Use: Agri-Pasture "As If" Vacant FAMC Comd'ty Gp: \_\_\_\_\_  
Agri-Swine "As Improved" Primary Land Type: Pasture  
 Zoning: None Primary Commodity: Hogs  
 Unit Type:  Economic Sized Unit  Supplemental/Add-On Unit  
 FEMA Community # See Memo FEMA Map # See Memo FEMA Zone/Date: See Memo  
 Legal Description: \_\_\_\_\_ SEC \_\_\_\_\_ TWP \_\_\_\_\_ RNG \_\_\_\_\_ Attached   
 Purpose of Report: To Obtain Mortgage Financing  
 Use/Intended User(s): Estimate Market Value  
 Rights Appraised: Surface Rights  
 Value Definition: \_\_\_\_\_ Attached   
 Assignment: Field Inspected \ In-House Appraisal Report Type: Summary  
 Extent of Process/Scope of Work: The appraisal was performed under the uniform standards of professional appraisal practice (USPAP). The appraiser assumes that the user of this report (employees of Farm Credit Services of Western Arkansas) are highly informed persons with a through knowledge of the national swine industry and current conditions. The report was prepared as directed by the user (Farm Credit Services of Western Arkansas) with association guidelines and procedures followed, including but limited to the needs of management, credit staff, support staff or loan officers. The appraiser also has considered any special conditions the user has requested by (See Comments Section)

**Appraisal Report Summary**

Date of Inspection: 01/30/12 Effective Date of Appraisal: 01/30/12  
**Value Indication**  
 - Cost Approach: \_\_\_\_\_ \$  
 - Income Approach: \_\_\_\_\_ \$  
 - Sales Comparison Approach: \_\_\_\_\_ \$  
**Opinion of Value:** (Estimated Marketing Time 12-24 months) \_\_\_\_\_ \$  
 Cost of Repairs: \$ \_\_\_\_\_ Cost of Additions: \$ \_\_\_\_\_  
**Allocation:**  
 Land: \$ \_\_\_\_\_ / Acre ( \_\_\_\_\_ %)  
 Land Improvements: \$ \_\_\_\_\_ / Acre ( 0 %)  
 Structural Improvement Contribution: \$ \_\_\_\_\_ / Acre ( \_\_\_\_\_ %)  
 Non-Realty Items: \$ \_\_\_\_\_ / ( 0 %)  
 Leased Fee Value (Remaining term of encumbrance \_\_\_\_\_) \$ \_\_\_\_\_ / ( 0 %)  
 Leasehold Value: \$ \_\_\_\_\_ / ( 0 %)  
 Overall Value: \$ \_\_\_\_\_ / Acre ( 100 %)  
**Income and Other Data Summary:**  Cash Rent  Share  Owner/Operator  FAMC Suppl. Attached  
 Income Multiplier \_\_\_\_\_ ( ) Income Estimate: \$ \_\_\_\_\_ / \_\_\_\_\_ (unit)  
 Expense Ratio \_\_\_\_\_ % Expense Estimate: \$ \_\_\_\_\_ / \_\_\_\_\_ (unit)  
 Overall Cap Rate: \_\_\_\_\_ % Net Property Income: \$ \_\_\_\_\_ / \_\_\_\_\_ (unit)

**Area-Regional-Market Area Data and Trends:**

	Above Avg.	Avg.	Below Avg.	N/A
Value Trend	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sales Activity Trend	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Property Compatability	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effective Purchase Power	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Demand	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Development Potential	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Desirability	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Subject Property Rating:**

	Above Avg.	Avg.	Below Avg.	N/A
Location	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Soil Quality/Productivity	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improvement Rating	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Compatibility	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rentability	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Market Appeal	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Overall Property Rating	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Area-Regional Description

**Area-Regional Boundary:** Market influence for a swine operation is slightly outside the boundaries of the swine integrators who contract which is typically within 40 to 50 miles from their feed mill. Subject is 62 miles from the feed mill at London, AR.

**Major Commodities:** Poultry, Hogs, and Cattle

Off Property Employment:	Above Avg. <input type="checkbox"/>	Avg. <input checked="" type="checkbox"/>	Below Avg. <input type="checkbox"/>	N/A <input type="checkbox"/>
Change in Economic Base:	Unlikely <input checked="" type="checkbox"/>	Likely <input type="checkbox"/>	Taking Place <input type="checkbox"/>	
From				
To				

**On and Off Property:**

	Up	Stable	Down
Value Trend:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Sales Activity Trend:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Population Trend:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Employment Trend:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

**Market Availability:**

	Under Supply	Balanced	Over Supply	No Influence
Cropland Units:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Livestock Units:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Recreational Tracts:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Forces of Value:** *(Discuss social, economic, governmental, and environmental forces.)*  
 A continued stable demand for cattle, swine, and poultry products is critical for real estate values in this area. Off farm employment opportunities must be maintained and the taxes are assumed to continue at their present relatively low levels. The demand for swine units is weak at the present time due to Tyson Foods shutting down their swine operation and cancelling contracts leaving only one swine integrator (Cargill Inc.) and one swine independent integrator (Coastal Plains Pork Cooperative) in the area. (Coastal Plains filed Bankruptcy 9-09). Cargill sent out a letter in 4-2004 stating that farms under 100 miles from the feed mill would be considered a more desirable location from a competitive standpoint long-term. Subject is located approximately 62 miles from the feed mill at London, AR.

**Exposure Time:** 12-24 months. *(See attached definition and discussion)*

**Specific Market Area Boundaries:** Area served by swine contract.

Market Area Description

<b>Market Area:</b>	Rural	Suburb	Urban
Type	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Up	Stable	Down
Value Trend	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Sales Activity Trend	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Population Trend	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Development Trend	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

<b>Market Area:</b>	Above Avg.	Avg.	Below Avg.	N/A
Property Compatability	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effective Purchase Power	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Demand	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Development Potential	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Desirability	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Analysis/Comments:** *(Discuss positive and negative aspects of market area.)*  
 Farms such as subject are limited in this area and not commonly found. Demand is low with an limited supply of units for sale at the present time. Financing is available with agricultural lenders. Local property owners are the main purchasers with some non-resident buyers causing limited demand influence in this market. The low demand is due to Tyson Foods shutting down its swine operation in fall 2002 and cancelling contracts leaving only Cargill Inc. and Coastal Plains Pork Cooperative (Coastal Plains filed Bankruptcy 9-09) offering contracts.

**Property Description:** (Location, use and physical characteristics) The subject has approximately 259.93 ac in several tracts owned by three individuals that are going together to build a 2500 head Cargill Farrow to Wean unit. The tracts are located in close proximity to each other thus are being appraised in one report at the request of the user of this report. The pastureland acres are felt to be average and the wood land is a mixture of native hardwood and cedar. Jason has approx. 118.50 ac located at Mt. Judea on a paved county road with a nice modern dwelling. Richard has approx. 71 acres located about 3 miles west of Mt. Judea on a county gravel road. Improvements consist of a dwelling, shed and outbuildings. Phillip has approx. 47 ac located a few feet from Richards farm just off the county gravel road. Improvements consist of a dwelling, shed and pole barn.

The improvements or proposed improvements do not appear to be in a flood zone but a flood determination should be obtained. Comments continued on next page:

Subject Land Description

Land Use	Deeded Acres	Unit Type	Unit Size	Subject Description:			
				Above Avg.	Avg.	Below Avg.	N/A
Pasture	95.00		( 36.5%)		X		
Pasture B	0.00		( 0.0%)		X		
Cropland B	0.00		( 0.0%)		X		
Woods	155.00		( 59.6%)		X		
Site	8.00		( 3.1%)		X		
Roads/waste	1.93		( 0.7%)		X		
			( 0.0%)		X		
			( 0.0%)		X		
			( 0.0%)		X		
			( 0.0%)		X		
			( 0.0%)		X		
<b>Total Deeded Acres</b>	<b>259.93</b>	<b>Total Units</b>	<b>( 100 %)</b>	FEMA Zone/Date <b>See Memo</b>			

Comments Subject land classes values in this report for pasture, woods, cropland, site and waste are established by ratio analysis from sales of other similar properties in the Western Arkansas area.

Land Improvements:	Above Avg.	Avg.	Below Avg.	N/A
	Domestic Water		X	
Livestock Water		X		
Interior Roads		X		
Drainage		X		

**Water Rights:**  No  Yes  Supplement Attached  
**Mineral Rights:**  No  Yes  Supplement Attached  
 Comments: Water rights is not a factor in this market. Mineral rights are not valued as is beyond the scope of this report.

Topography:	Level	Un-dulating	Rolling	Stopping
Pasture B				
Cropland B				
Woods				
Site	X			
Roads/waste		X		
<b>Overall Topography</b>		X		

**Soils Description:** Upland and bottomland clay to gravelly loam soils, average fertility. (see plat and aerial photo.)

Soil Quality/Production:  Above Avg.  Avg.  Below Avg.  N/A  Supplement Attached

**Climatic:** \* Annual Precipitation \_\_\_\_\_ ' to \_\_\_\_\_ ' Elevation \_\_\_\_\_ Frost-Free Days \_\_\_\_\_  
**Utilities:** Well Water Public Electric Lagoon Sewer LP Gas Public Telephone  
**Distance To:** 6 Schools 6 Hospital 6 Markets 2 Major Hwy. 13 Service Center  
**Easements/Encroachments:** (Conservation, Utility, Preservation, etc.) None noted that would impact value.

**Hazards and Detriments:** Subject is in the 100 year flood plain.

### Additional Comments

It is proposed to purchase a 23.43 ac tract at a reported cost of \$ [REDACTED] located about .75 mile NW of Mt. Judea on a county gravel road & to construct a 2,500 head farrow to wean Cargill Sow unit at a reported cost of \$ [REDACTED] including the site. See bids and specifications in the addenda of this report. Cargill will reportedly offer a 12 year contract with \$ [REDACTED] pig base pay and \$ [REDACTED] pig bonus. Cargill is the only swine integrator that offers a contract for hogs in the area since Tyson pulled out of the hog business as an integrator in early 2003 and Coastal Plains Pork filed bankruptcy 9-09. The farm is located approximately 62 miles from Cargill's feed mill in London. All permits are reportedly in compliance. All of the farms are reportedly on rural public water although a well will be drilled for the proposed swine operation.

This report is being amended to reflect a change in proposed swine unit location. A new inspection was not completed on the acres owned but a new inspection was done on the 23.43 acres to be purchase. The effective date of the appraisal will still be 1-30-12 but the date of completion of the report will be 5-22-12.

# **Exhibit 7**

## Pat Walters

---

**From:** Andrew Sharpley  
**Sent:** Friday, October 09, 2015 10:24 AM  
**To:** Kresse, Timothy  
**Subject:** RE: Stage only site

Thanks, Tim,

I am pretty sure that we can rustle up the necessary \$6000 for this site. It's a sorry state of affairs if we can't!!

I will get back to you next week, so we can proceed post haste.

Andrew

**From:** Kresse, Timothy [<mailto:tkresse@usgs.gov>]  
**Sent:** Friday, October 09, 2015 8:18 AM  
**To:** Andrew N. Sharpley <[sharples@uark.edu](mailto:sharples@uark.edu)>  
**Subject:** Re: Stage only site

Ok, that sounds good. My feelings are that all of us have limited funds and want to spend our money wisely. I'm always trying to think of ways to get information at the best bang for the buck. My first thought, as you know, was a simple subtraction, but we don't have perfect delineations of the watershed, Van shows different directions of groundwater flow (bringing into question changes in baseflow between measuring points), and other considerations. Similar to comparisons of continuous nitrate to lab analysis of nitrate samples, I do think one year of stage compared to variation in flow between the 2 sites will yield some good information. I would pay for it out of my account, if I hadn't been told (rather strongly) that I'm already overextended. Let me know if you can scrape it together, and we'll get things moving on this end. All the best,

Tim

On Wed, Oct 7, 2015 at 5:24 PM, Andrew N. Sharpley <[sharples@uark.edu](mailto:sharples@uark.edu)> wrote:

Tim

Given the visibility of our program and scrutiny our finding attract, I think I should try to find the \$6,000 to enable you (USGS) to monitor stage at Left Fork for one year at least. As you note this would afford us a more reliable relationship to determine flow than by subtraction.

I'll let you know what I can find out as soon as possible.

Thank you,