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Near Surface Geophysics Innovations, LLC

Bringing the Subsurface into View

Emergency Response - Using Electrical Resistivity to Locate an Uncontained Diesel Plume

Project: NSG Innovation's services were requested by an environmental consulting company in late 2017 and early 2018 to assist in locating a subsurface diesel plume resultant from a tanker truck spill adjacent to sandy alluvium of a river. After a few days, the diesel plume mobilized enough to make its way all the way to the river. The consultant in charge of the site called NSG to conduct an emergency geophysical survey to delineate the subsurface conditions that would indicate the location of the diesel plume in the sandy alluvial deposits.

Approach: NSG Innovations suggested running parallel (**Figure 1**) electrical resistivity (ER) survey lines between the road and the river. Establishing the ER lines parallel to the road was decided to be the best approach for intercepting potential subsurface migration diesel-plume pathways from the spill location (star) to the river. ER was the chosen methodology because such surveys detect a wide array of physical properties of materials and thus can be used to map a wide range of different materials. A variety of types of sediments and bedrock, the saturated zone, as well as signatures of the diesel plume could all be identified using ER.

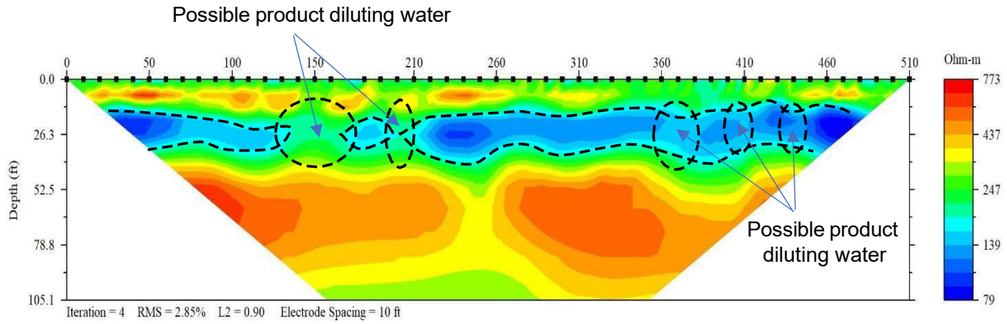

Figure 2. The above image is an example of an electrical resistivity cross section from the project. Such an ER survey permits characterization of subsurface features and designates possible locations of the diesel (product) spill plume.

Survey Results: Interpretations (Figure 2) for locating the diesel plume worked off two principles: 1) all hydrocarbons are non-polar molecules and thus they are resistive to electrical current and 2) diesel is an LNAPL and will be notably floating atop the saturated zone in the sandy river (fluvial) alluvial deposits. Based on these two principles, the expected observation would be a decrease in conductivity at or above the saturated zone. The dashed ellipses in the cross section above (**Figure 2**) indicate the expected signatures in this scenario and were picked as targets to be investigated with a direct-push technology boring program at the site.

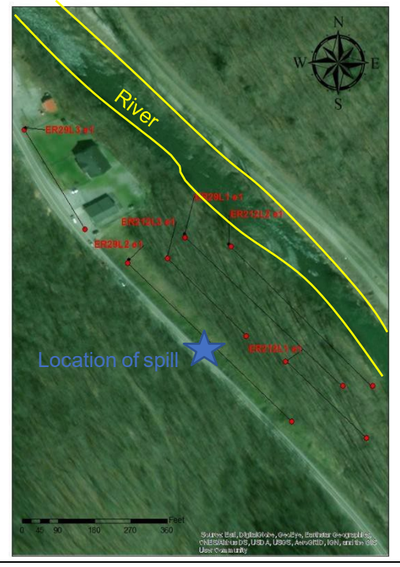

Figure 1. Map showing the layout of the ER surveys trending SE to NW. These types of maps are constructed, geolocated and projected using ArcGIS and sent to our clients. The blue star indicates the spill site and the river is outlined in yellow.

Figure 3. Image showing the site conditions as well as an ER line traversing from the top of the image to the right. Trees were felled to permit some access for geophysical surveys and heavy equipment operators for excavation.

Conclusion: Before conducting geophysical services, the consultant and emergency response company dug a series of trenches and test pits attempting to locate and recover the diesel plume. This field effort continued for one week after the spill occurred but with little success. With the diesel plume now reaching the nearby river, the state environmental cabinet recommended to the consultant that they dig a 500-foot trench along the river to intercept the diesel plume and prevent it from getting into the river. However, instead of allocating the time and resources to excavate a trench of this size through a heavily wooded area (**Figure 3**), the consultant decided to solicit a geophysical investigation. Within five hours of conducting the initial ER surveys, the bulk of the plume was discovered and a 50-foot long recovery trench along with five recovery wells were installed relying solely on the ER survey profiling and mapping,

The ER method not only saved the insurance company money, but saved time and resources for such a remote area with difficult accessibility. More importantly, the site was contained, and the emergency response company continued services to vacuum and monitor the recovery trench and wells on the site.

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