POSTER GROUP 2

Role of Sequence Stratigraphy for Evaluating Topographic Pathways Impacting Distribution of PFAS

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INTRODUCTION

It is well established that surface water collection points accumulate released PFAS; however, the configuration of geologic depressions and their downgradient subsurface pathways are seldom understood or characterized. Further complicating geologic pathways is over pumping of aquifers in the American SW resulting in subsidence changing topography and in some cases earth fissures. Characterization of geology by using facies analysis and the principles of sequence stratigraphy can determine the interaction between surface water infiltration points and the downgradient subsurface hydrogeologic pathway heterogeneity.

OBJECTIVES

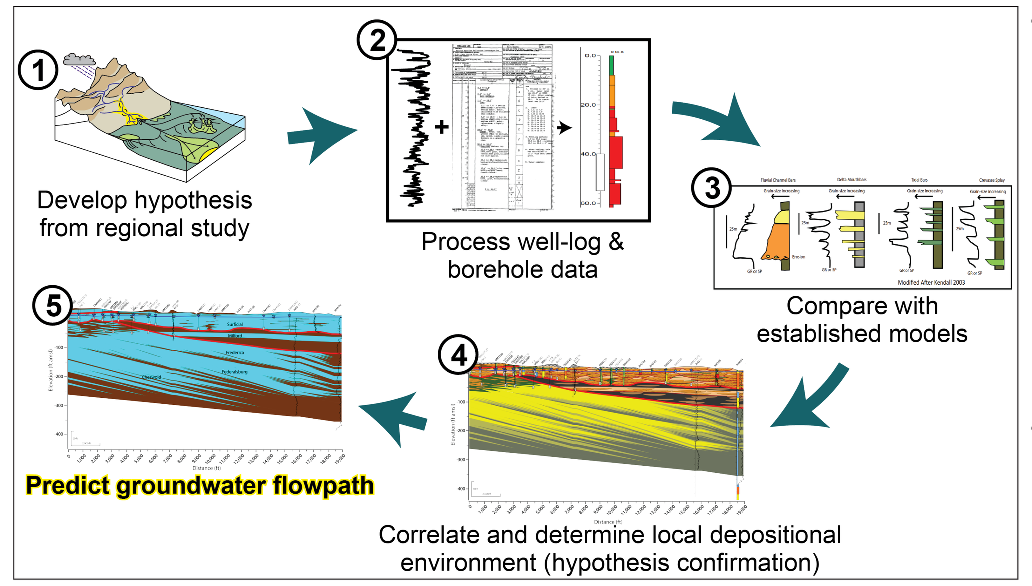
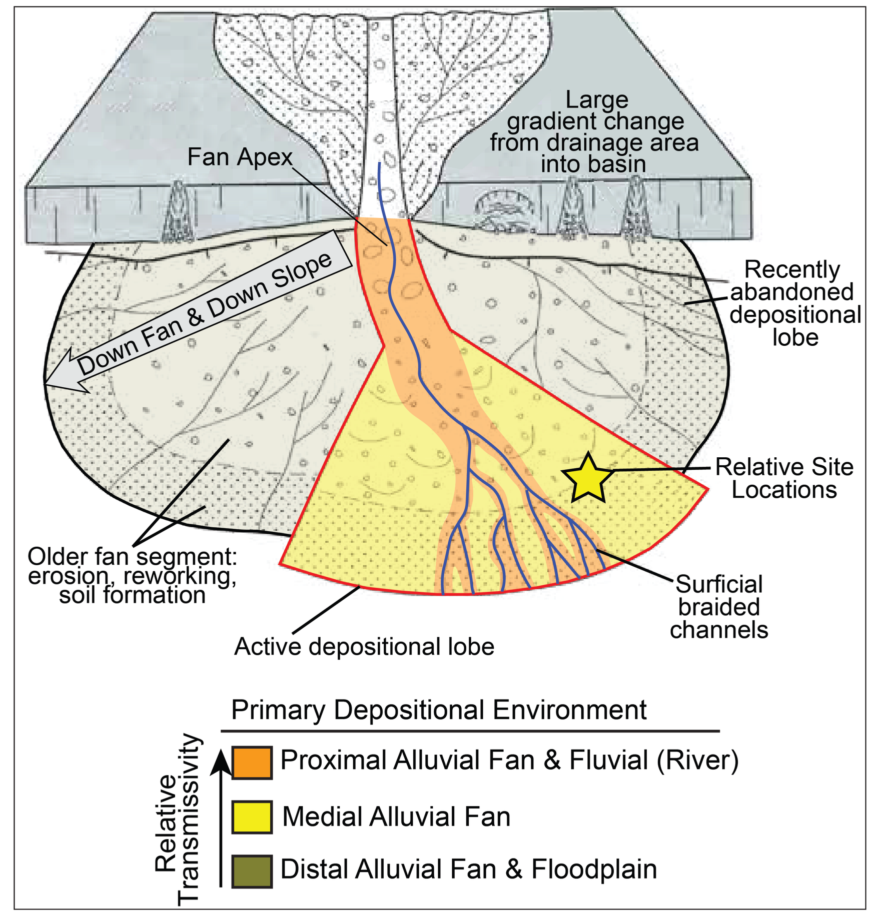


Figure 1. Predictive Integrated Stratigraphic Modeling (PRISM®)

- Generate a testable and predictive stratigraphic model to inform subsurface migration pathways from surface water recharge areas.
- Provide sequence stratigraphic hypothesis for natural surface depressions.

CONCEPTUAL MODELS

Figure 2. Alluvial Fan Depositional Block Diagram



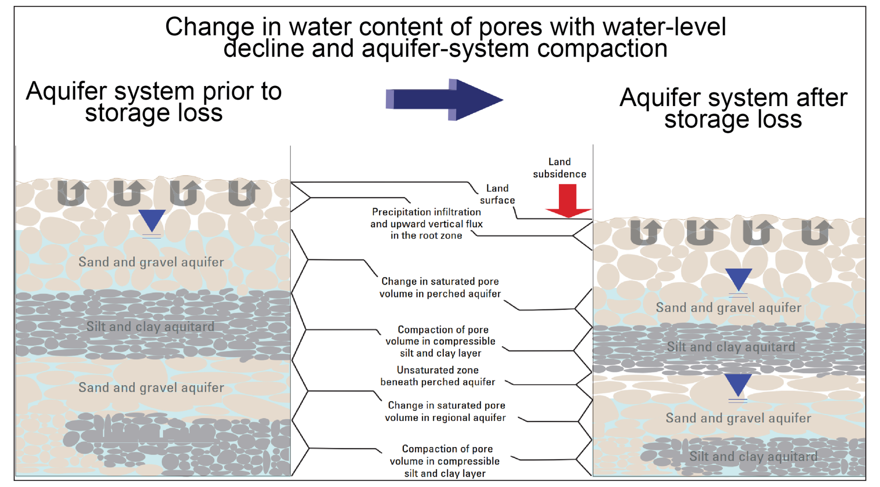


Figure 4. Aquifer Compaction

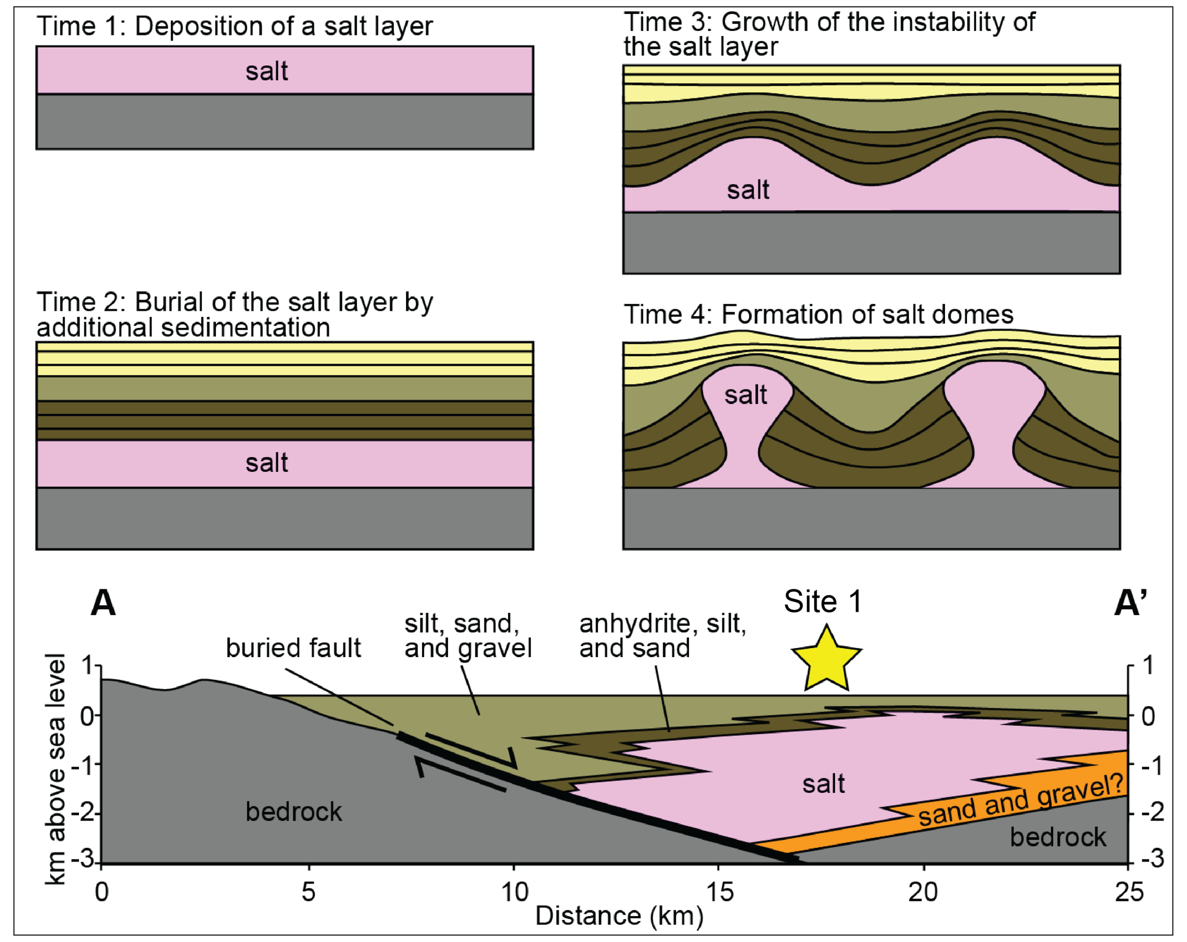
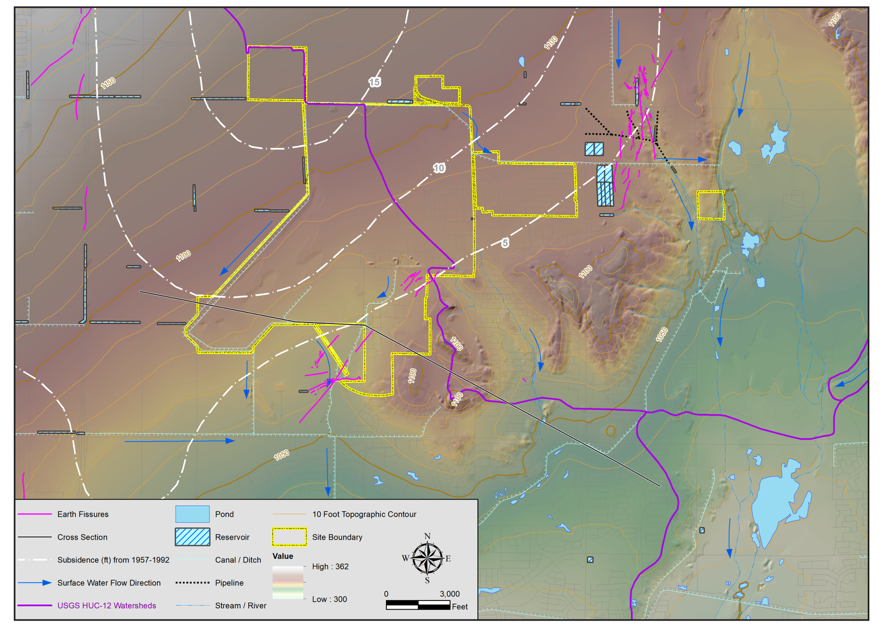


Figure 3. Salt Movement and Implications

Many models were used in generating the conceptual site model. An alluvial fan depositional model was used for the Sites to understand subsurface geologic heterogeneities. A post-deposition deformation model was also applied to Site 1 due to regional observations. Overprinting the geology, an aquifer compaction model was used to interpret subsidence related to over pumping.

SITE 1: SURFICIAL OBSERVATIONS

Figure 5. Site 1 Surface Features

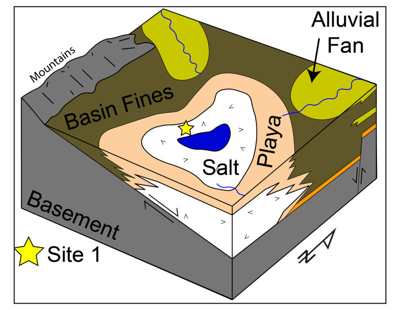


Regionally subsidence due to aquifer compaction has been greater than 15 feet. Subsidence due to over pumping is common in the American SW; however, earth fissures are an uncommon occurrence.

SITE 1: GEOLOGIC HISTORY

Site 1 geologic history is complex involving salt deposition, burial, and salt deformation following alluvial fan deposition. Spatial relationships can be seen between the salt high and alluvial fan deposition. The non-patterned areas of Fig. 7 are where the coarse-grained alluvial fan sediments are located. These are the water bearing units experiencing over pumping.

Figure 6. Salt Deposition Block Model



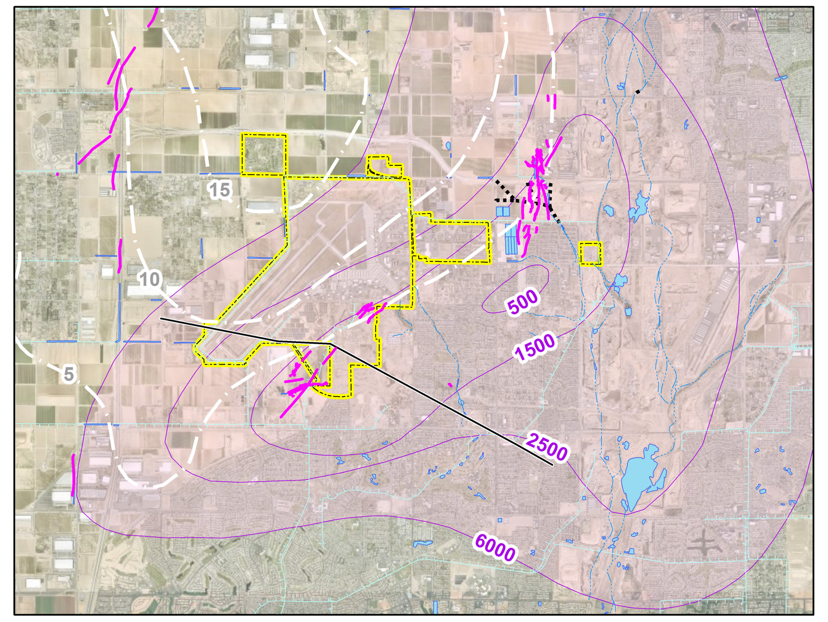


Figure 6. Site 1 Depth to Salt Map

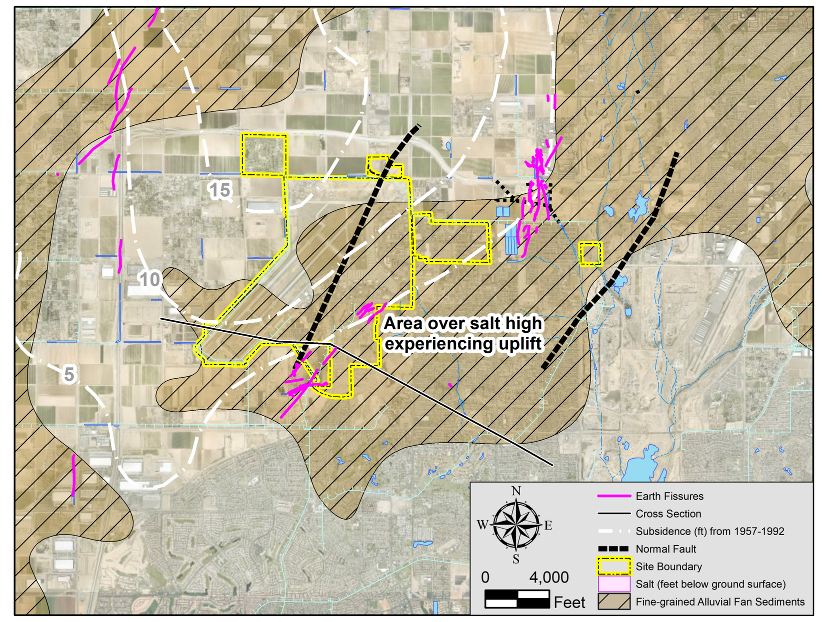
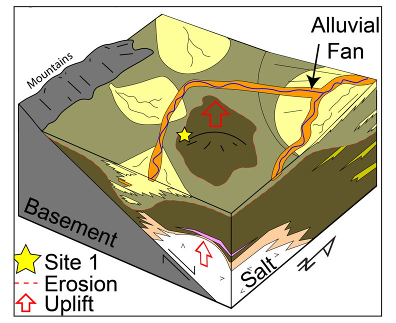


Figure 7. Site 1 Alluvial Fan Deposition

Figure 7. Fan Deposition Block Model



SITE 1: OCCURRENCE OF EARTH FISSURES

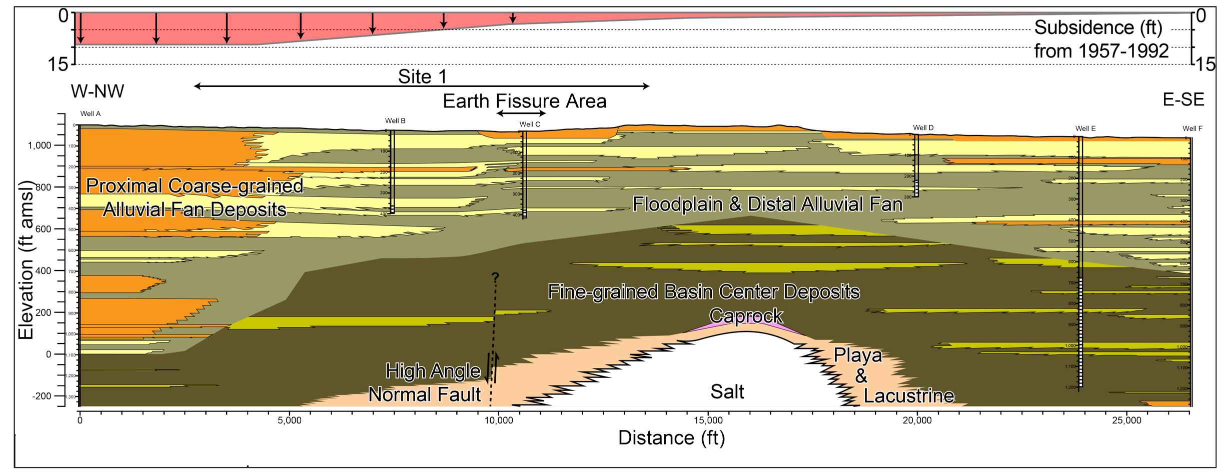


Figure 8. Site 1 Cross Section

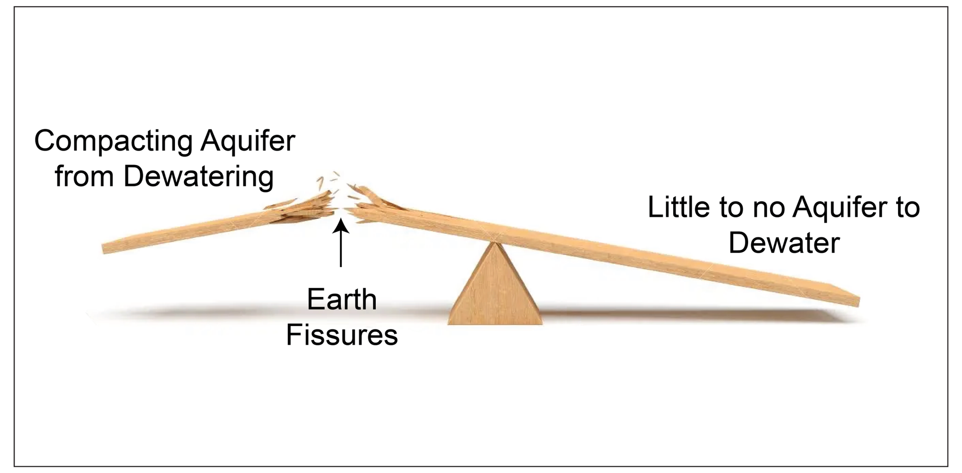


Figure 9. Breaking the Seesaw

Salt post-depositional movement influenced the location of the alluvial fan from uplift. Over pumping of the alluvial fan resulted in compaction leading to subsidence in select locations. The sharp contrast in aquifer subsidence resulted in a breaking point, the earth fissures. PFAS impacted ditches are intersected by fissures. The fissures delivered impacted waters to alluvial fan deposits who were defined by the stratigraphic analysis.

SITE 2: SURFICIAL OBSERVATIONS

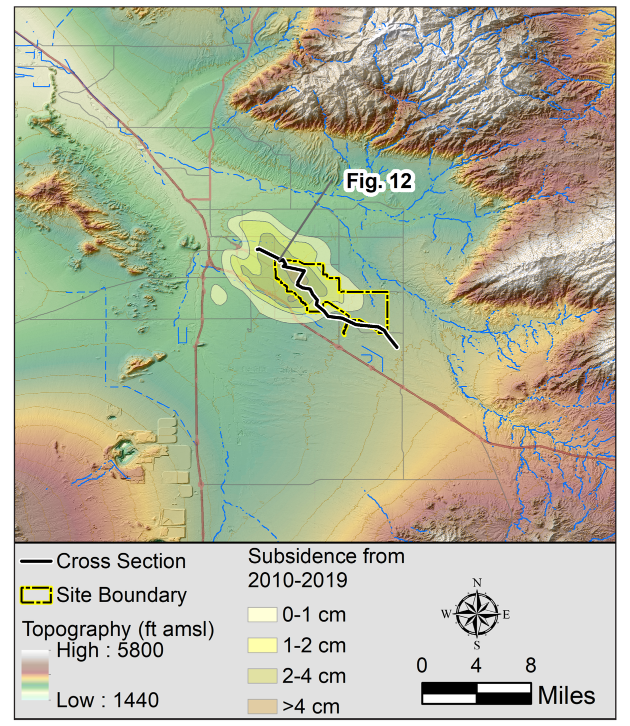


Figure 10. Site 2 Topography

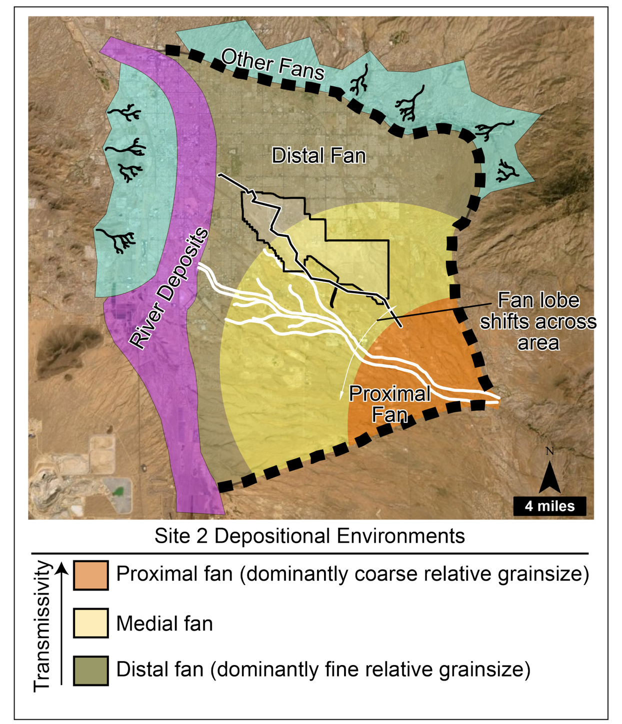


Figure 11. Site 2 Depositional Environments

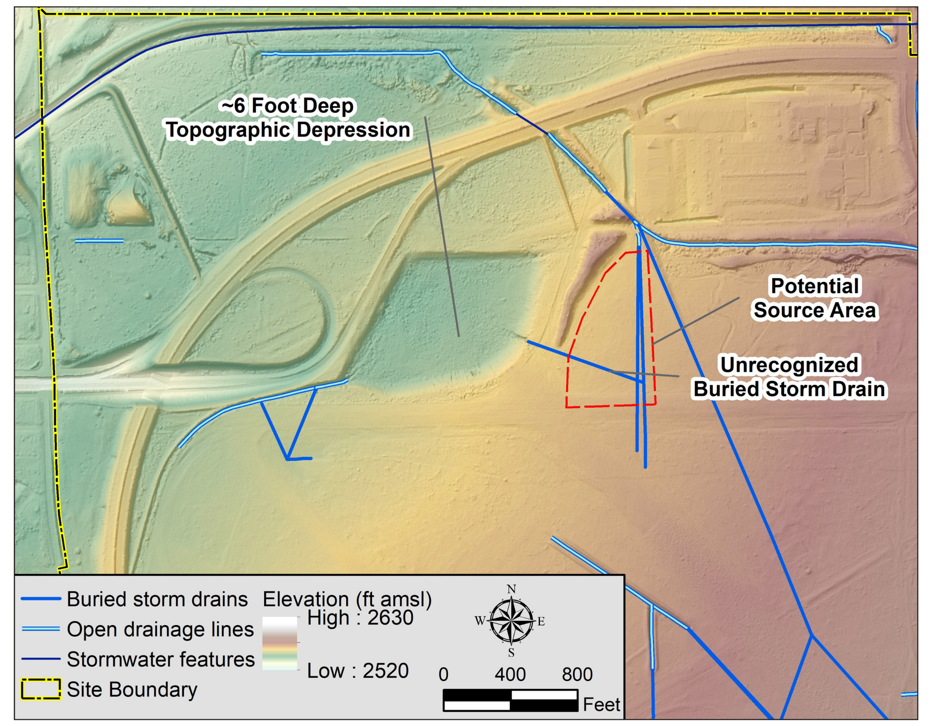
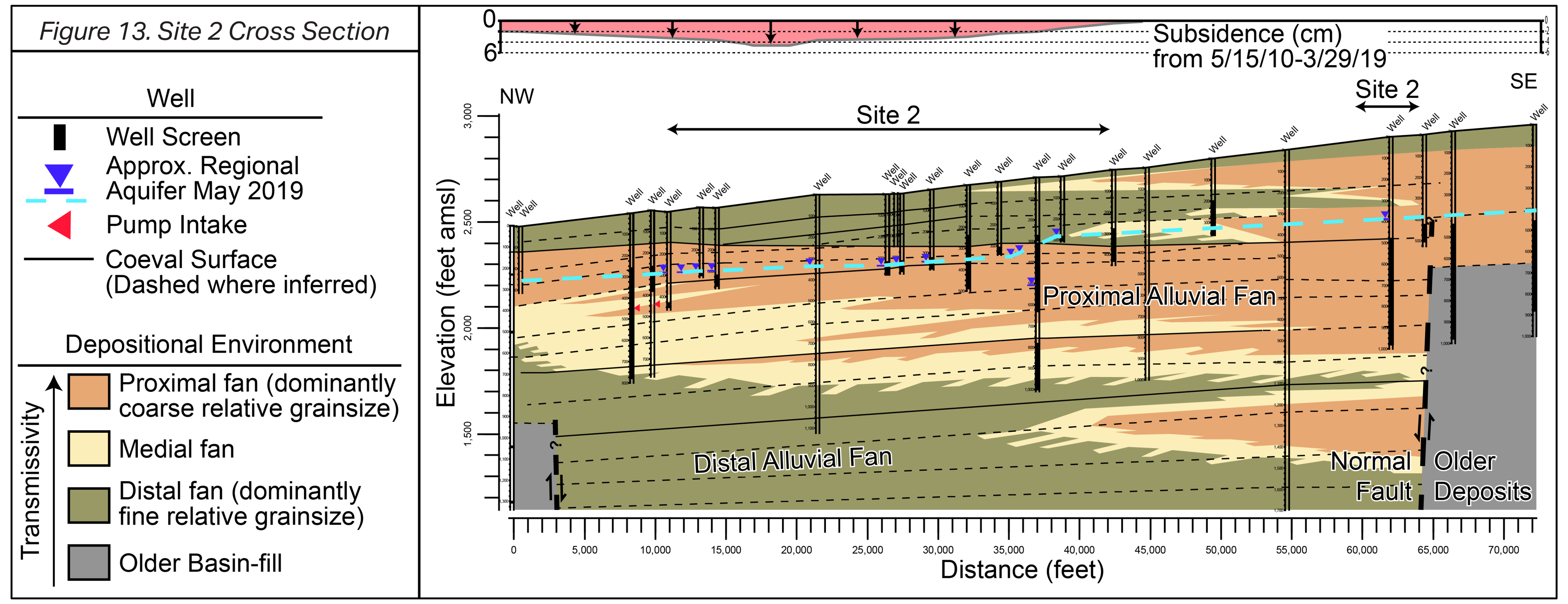


Figure 12. Site 2 Northwest Area

Site 2 sits within the basin center where alluvial fans have infilled over various stages during basin tectonism. The dominant surface water pathway at Site 2 is through manmade ditches and natural streams. Close inspection revealed a surface water collection area adjacent to a highly scrutinized canal.

SITE 2: CONSTRAINING GROUNDWATER PATHWAYS

Figure 13. Site 2 Cross Section



Surface waters within ditches delivered relatively little impacted water to the subsurface until reaching a source-distant unlined retention pond. Ephemeral surface waters drove the constituents vertically through the vadose zone to the groundwater table where a stratigraphic analysis showed that migration was focused within a single alluvial fan lobe. This review offered the client a targeted area of remediation for surficial soils and groundwater.

Learn more about the application of Sequence Stratigraphy

US EPA endorsed remediation best practice https://clu-in.org/conf/tio/DCHWS4/

Sadeque J. and Samuels R. (2023). 'The application of sequence stratigraphy to the investigation and remediation of LNAPL contaminated sites', in Lenhard R., Garcia-Rincon J., Atekwana E., Gatsios E., and Naidu R. (eds.) Advances in the Characterization and Remediation of Sites Contaminated with Petroleum Hydrocarbons. Springer Nature (in press).

PRISM Predictive Integrated Stratigraphic Modeling

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