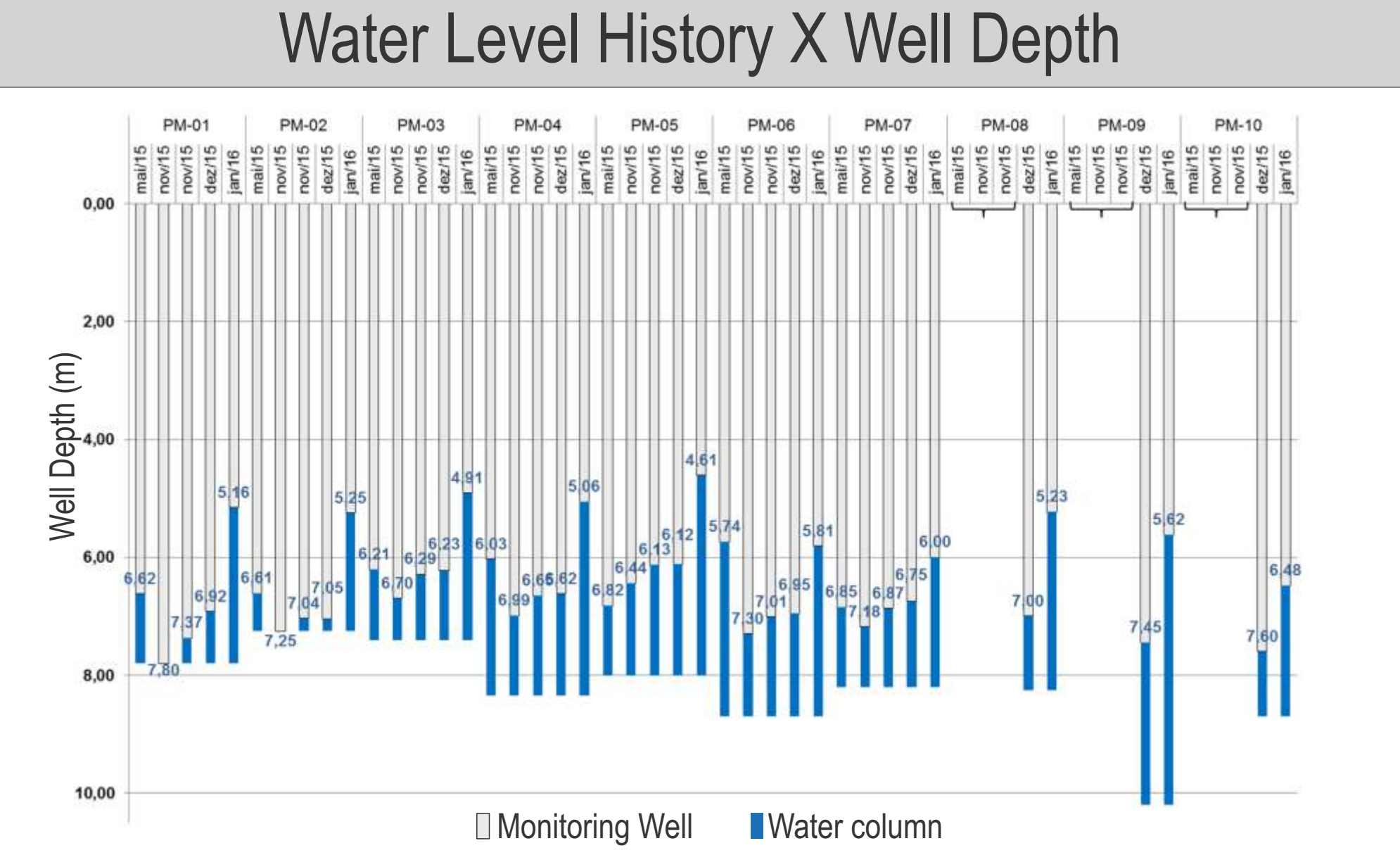
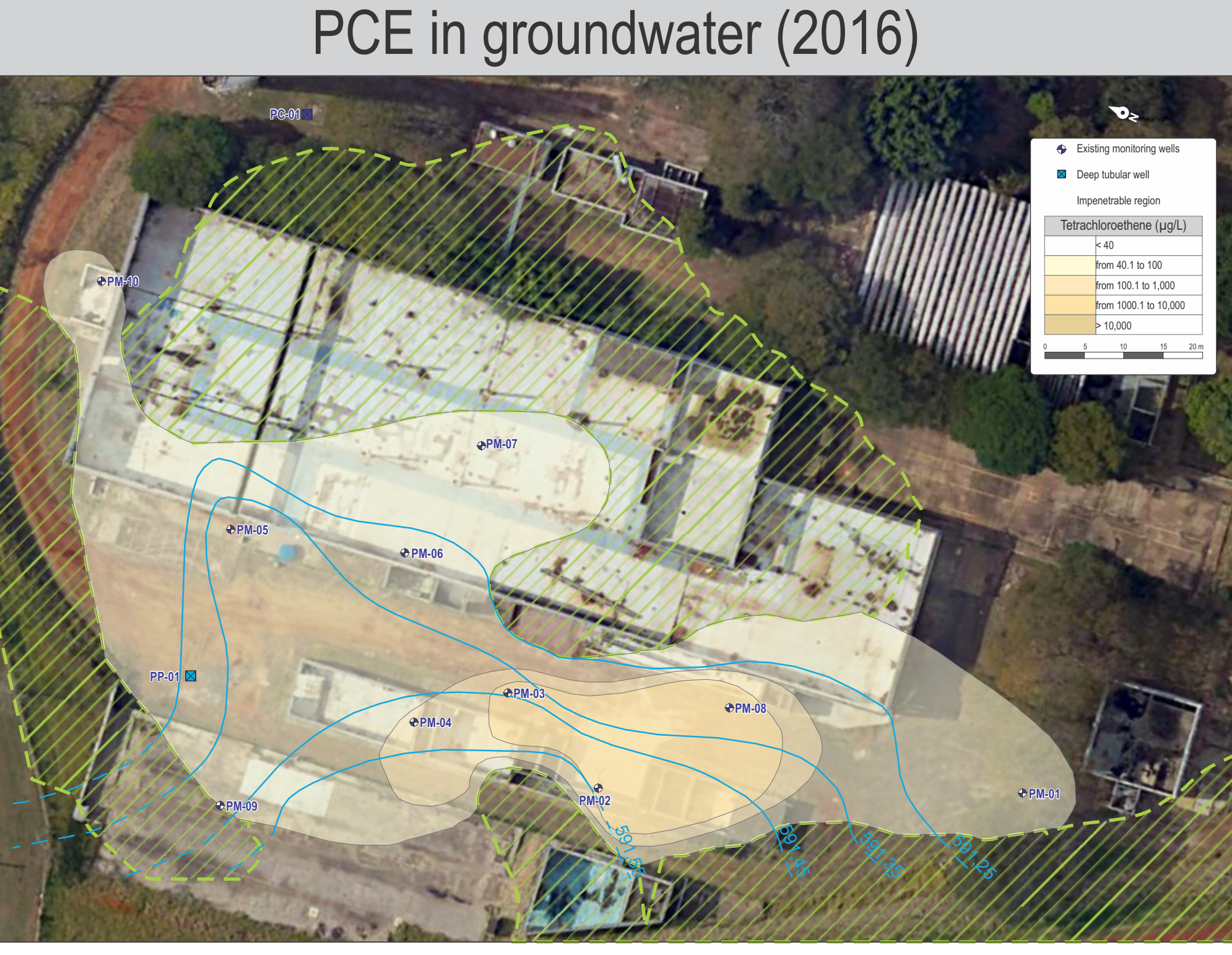
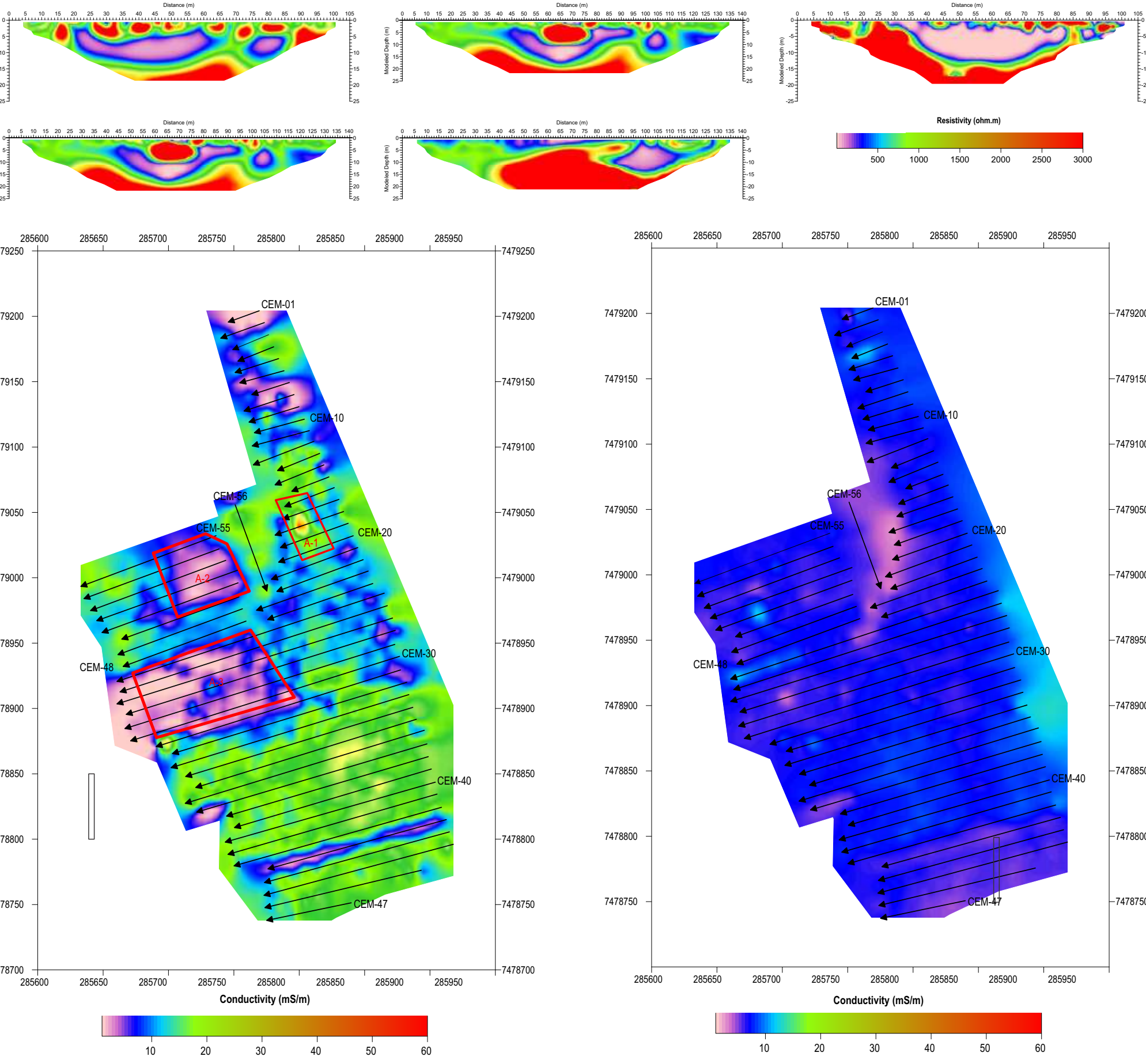
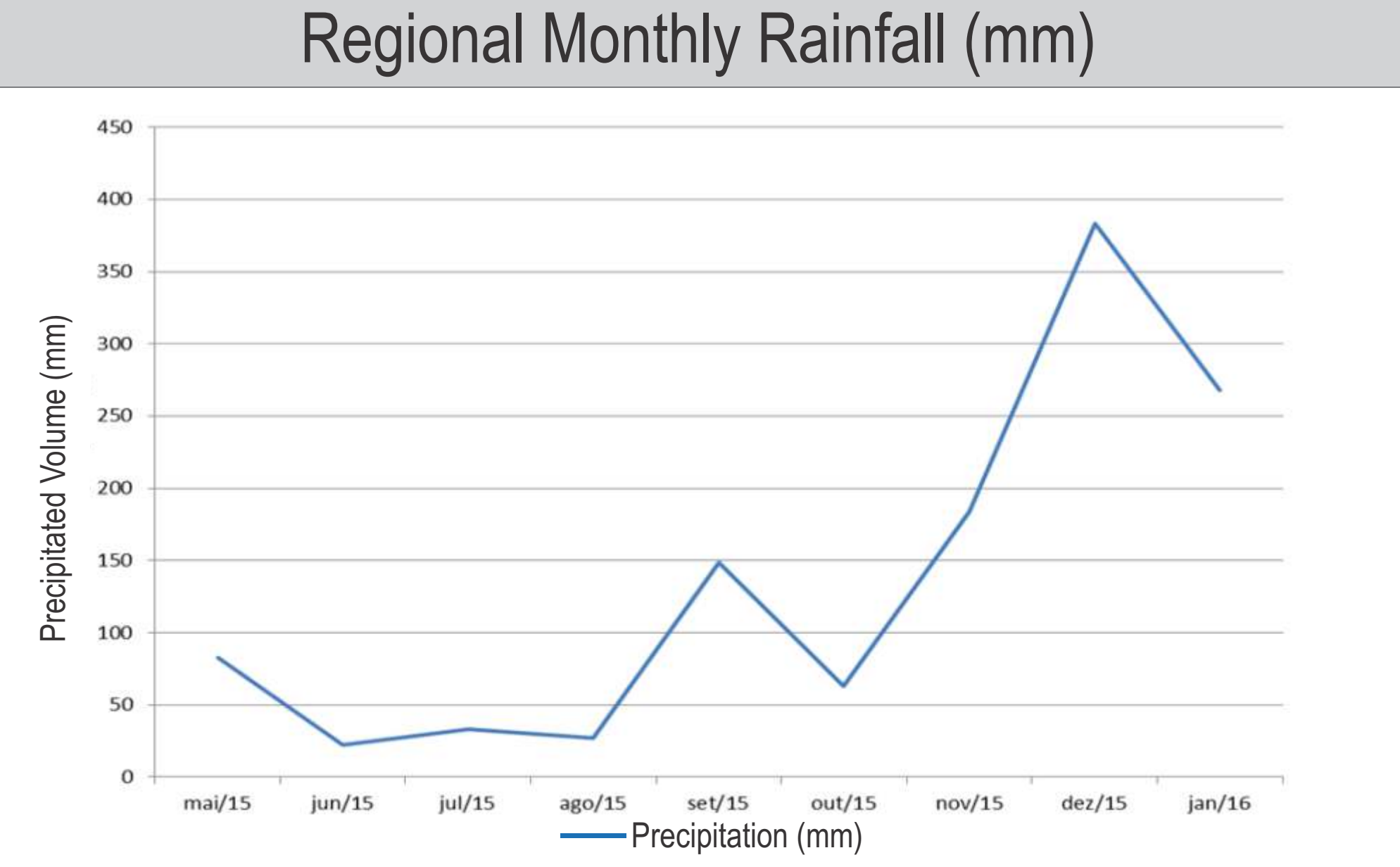


Understanding the Hydrogeological Conceptual Model to Define Remediation Approach: Bedrock Mapping in Site with Hydrocarbon and Chlorinated Compounds Contamination

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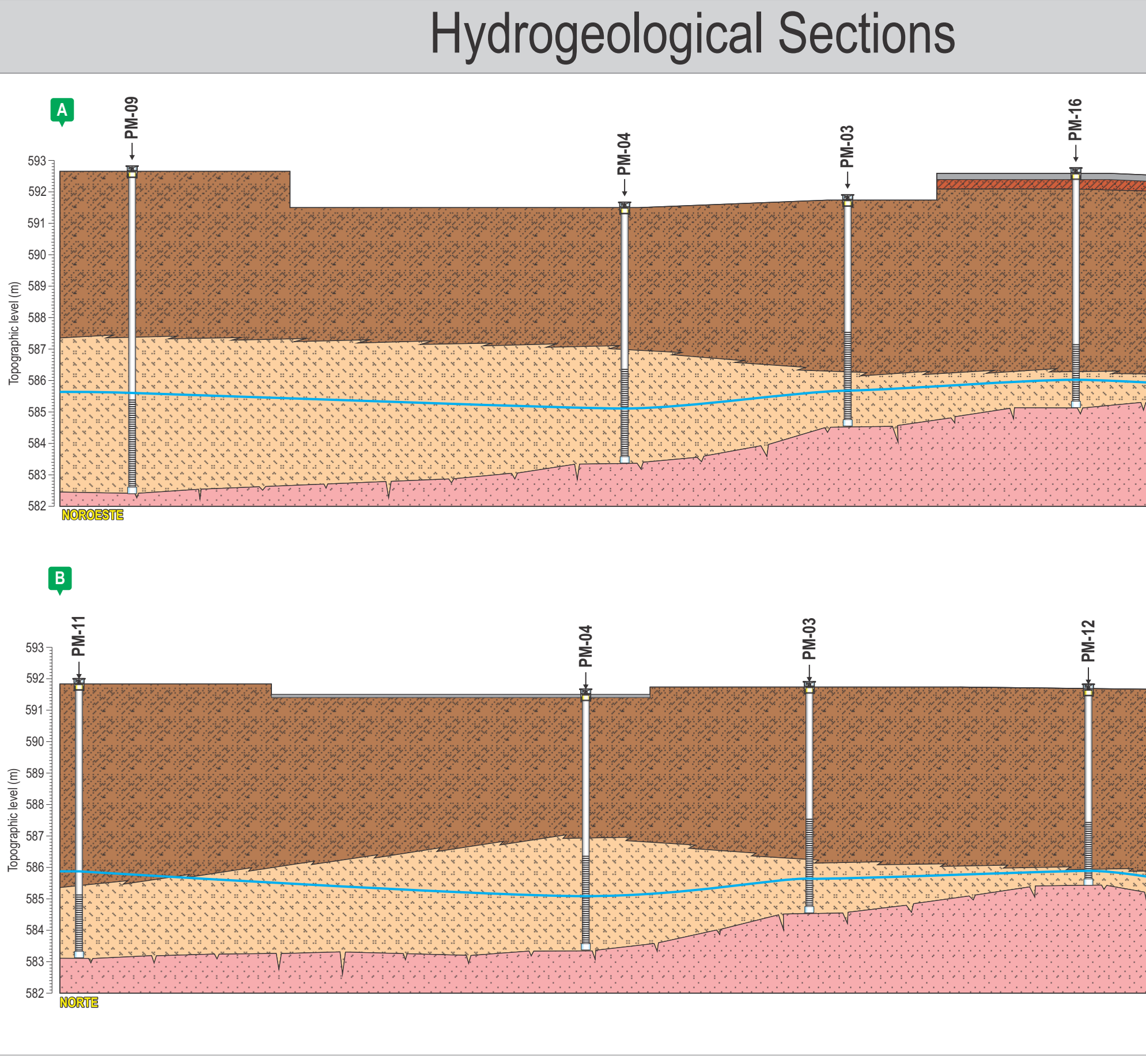
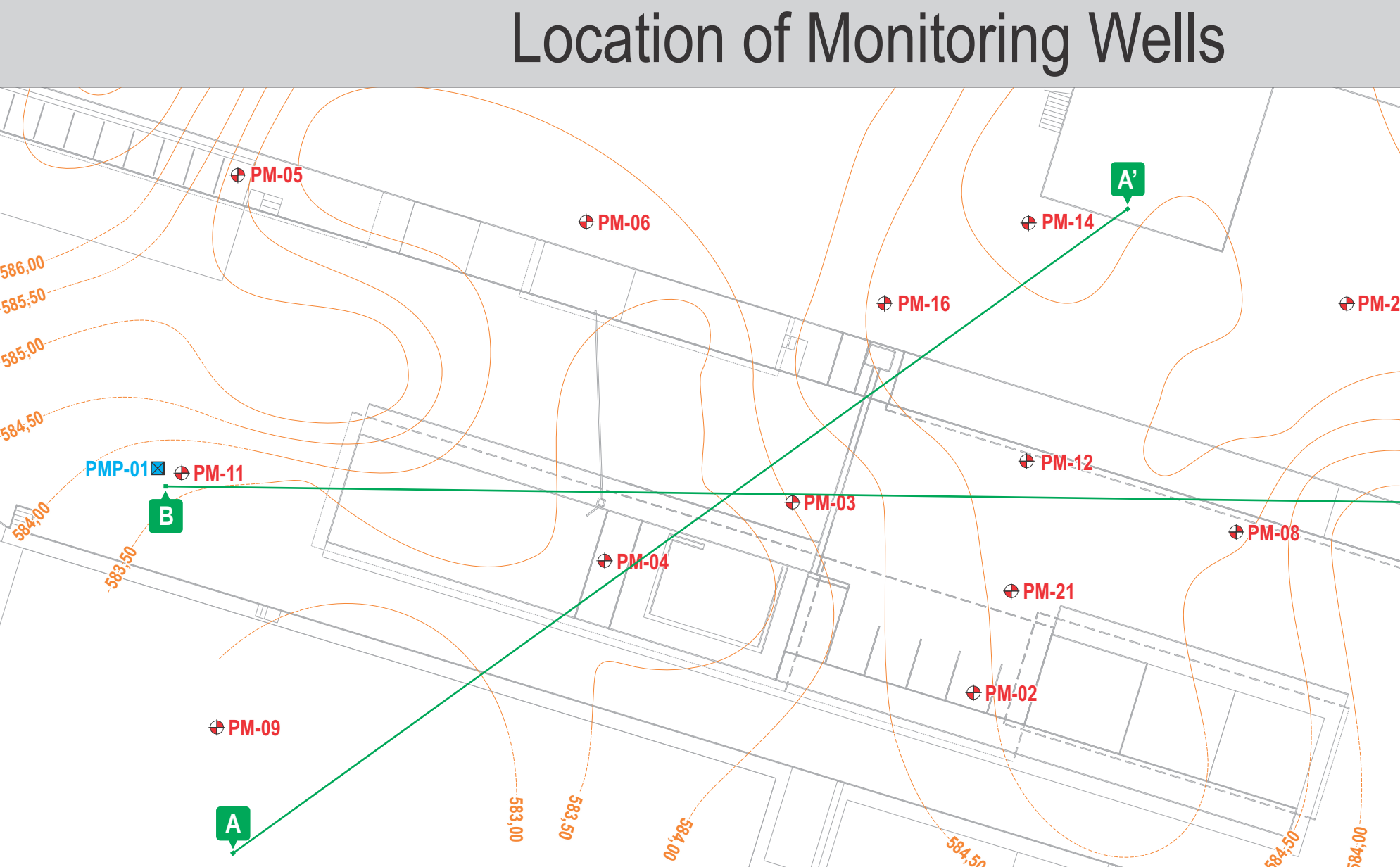
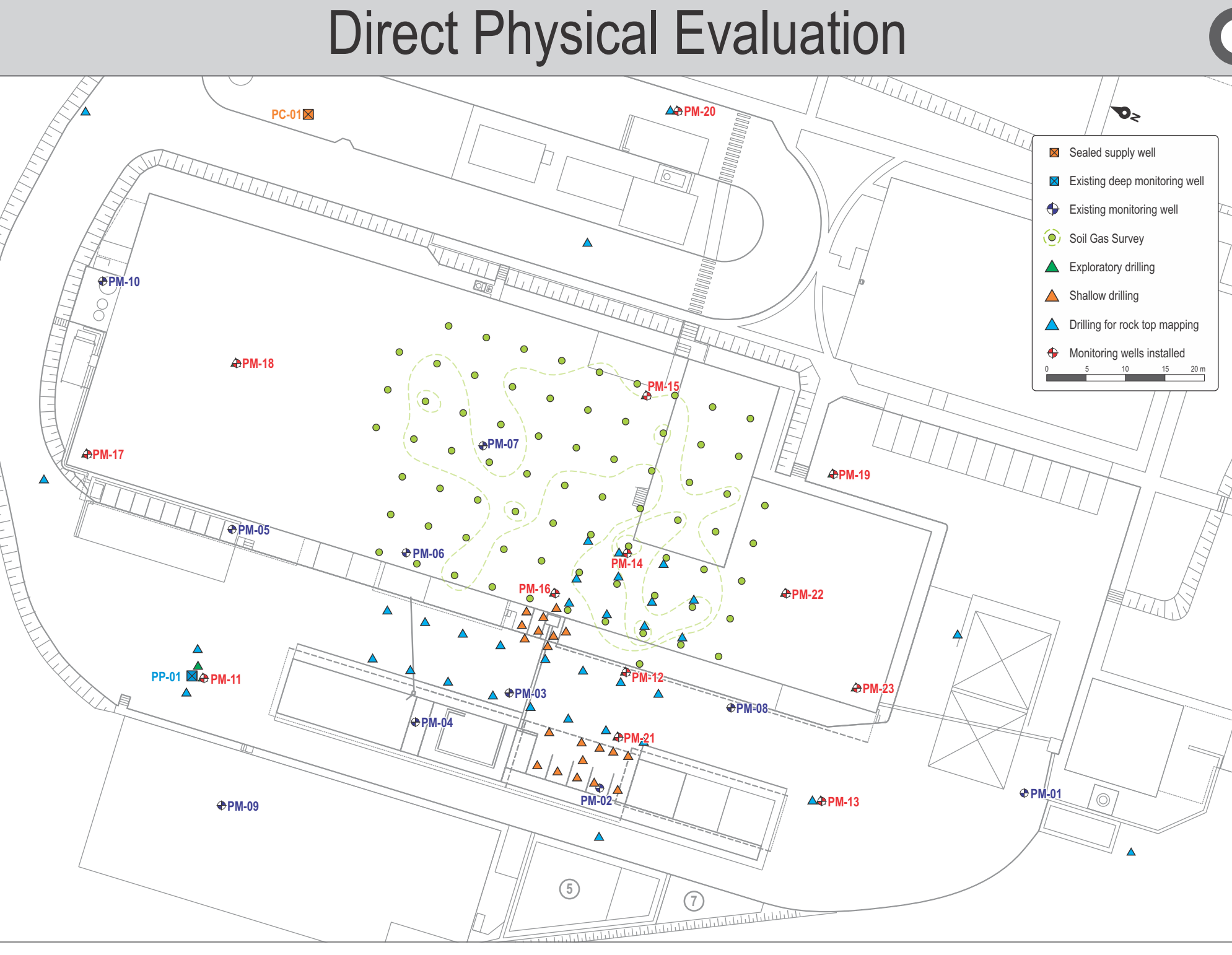
Background / Objectives

An industrial plant in Campinas, São Paulo, Brazil, operated between 1975 and 2013 manufacturing auto parts. An environmental investigation took place in **2011** and confirmed the **presence of chlorinated solvents and petroleum hydrocarbons contamination**, but the definition of primary **sources** and the **plume distribution was hampered by the seasonal water level variation: some wells had little or no water column** depending on the season.

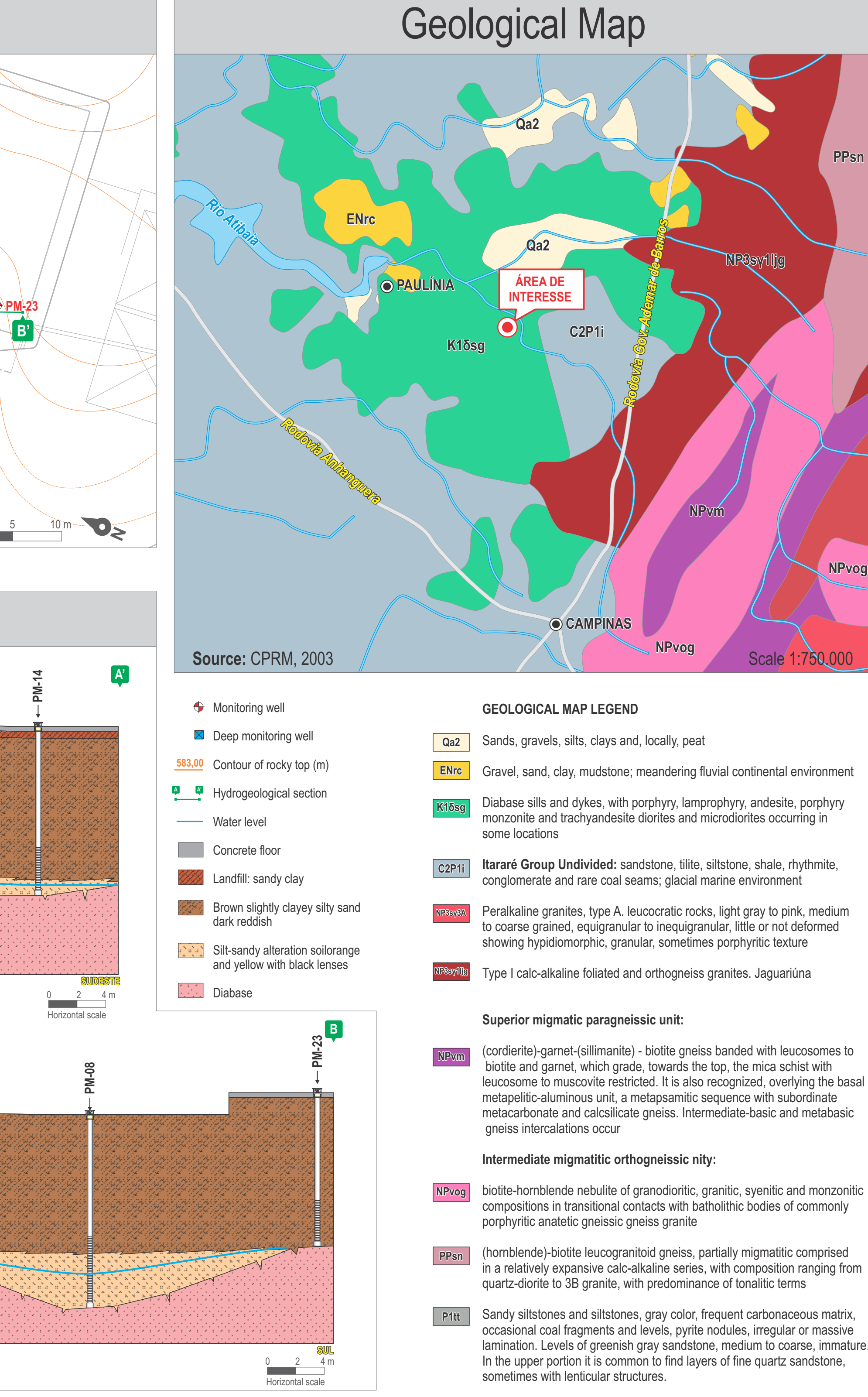


Based on the **hypothesis** that the locally **shallow bedrock exerted a direct influence** on the water regime and on the **distribution of contamination**, specific activities for **mapping the bedrock surface** began. The bedrock mapping started with the use of **geophysical methods of resistivity and electromagnetism**, which showed that the rock surface was quite irregular, **with the presence of “valleys” filled with water and dry “peaks”**. So, the **direct physical evaluation** of the bedrock surface was considered necessary.

Approach / Activities

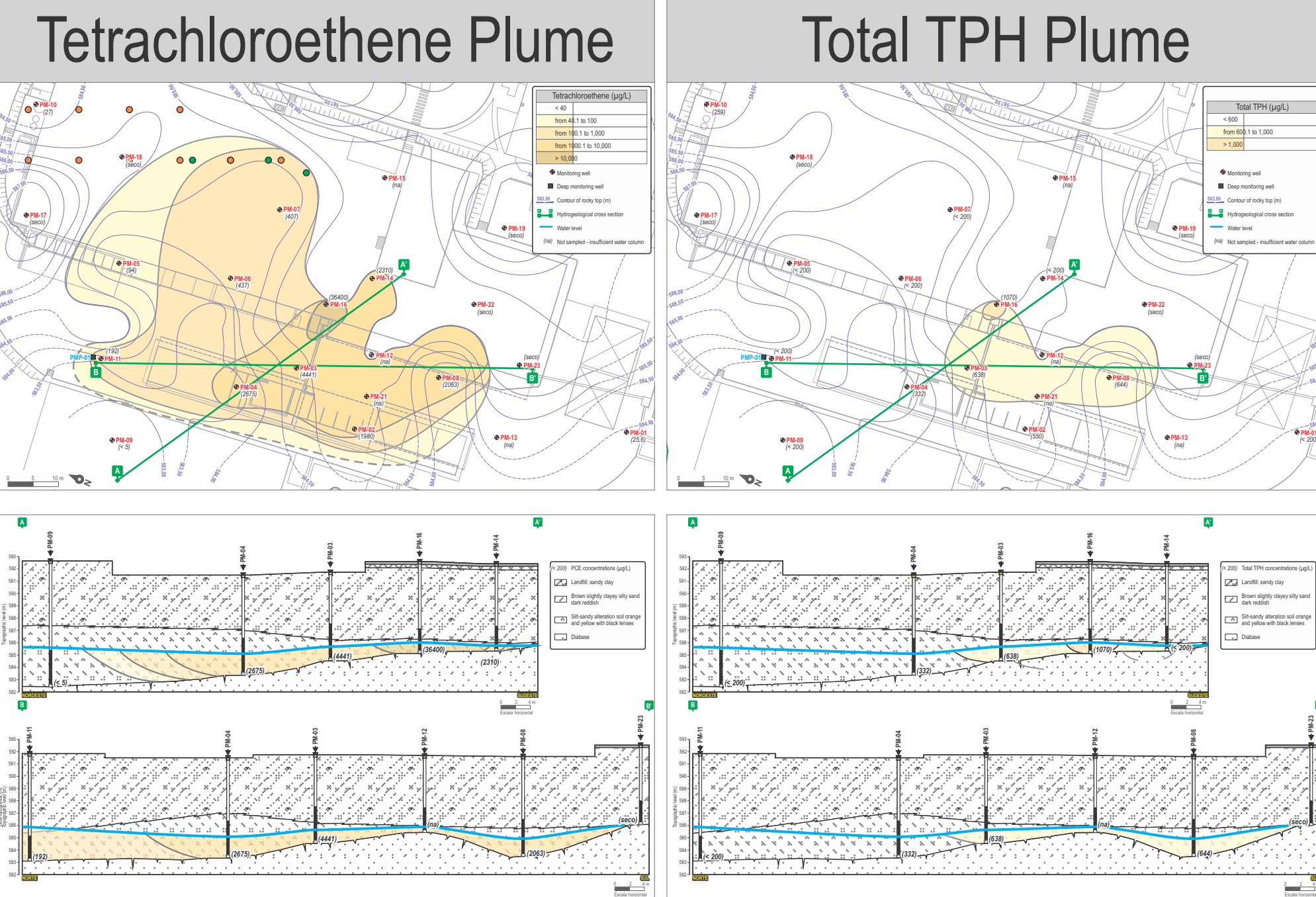
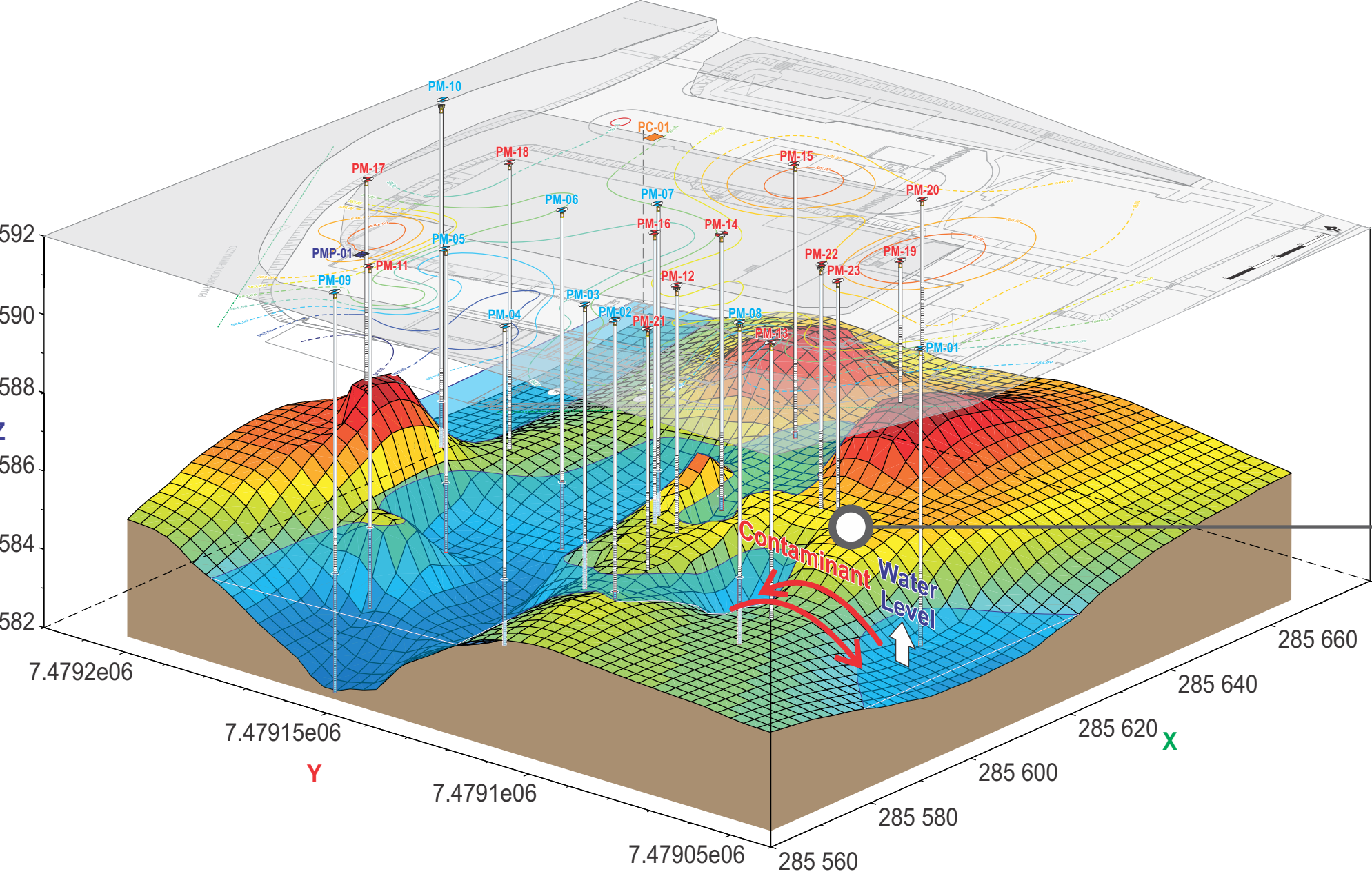


- Evaluation of organic vapors in topsoil
- Exploratory drillings for rock top mapping
- Drillings for installation of monitoring wells
- Shallow drillings to delimit oil and residues
- Sampling for soil characterization
- Sampling of installed and existing MWs
- Topographic survey
- Mathematical Modeling of Contaminant
- Update of the Human Health Risk



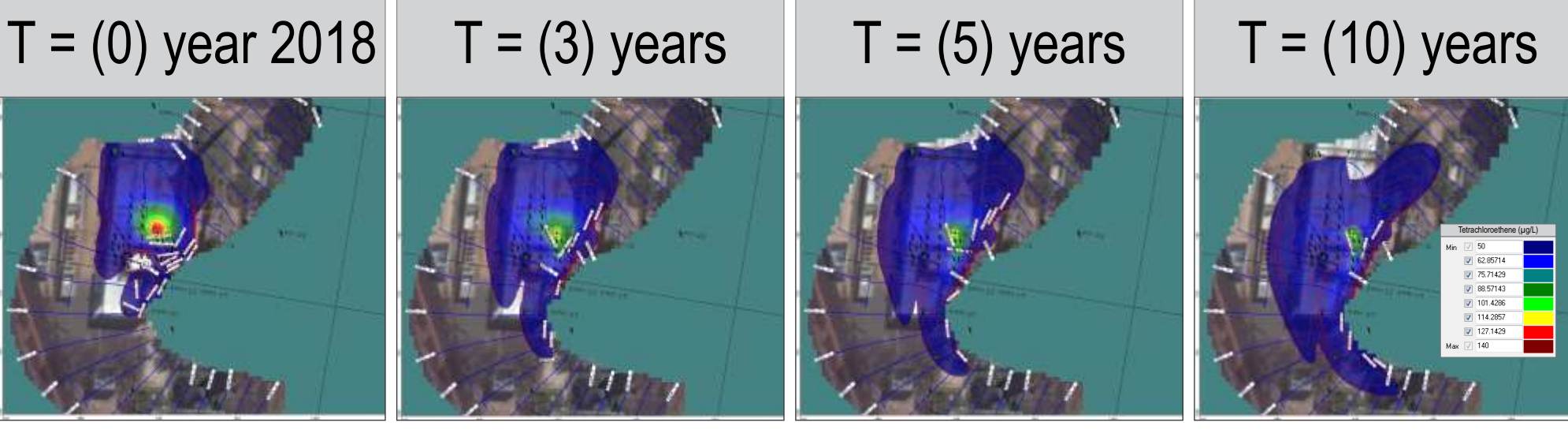
Results / Lessons Learned

A **detailed map of the bedrock surface** was obtained, which allowed defining the extent of the **aquifer at the site**, including portions with little or no water, but which, in periods of greater rainfall, **could connect portions that were initially isolated**.



It made possible to understand the **path taken by PCE from the old primary source to the hotspot well**. As **denser than water**, its transport is strongly influenced by the local geology, having **migrated through the rock surface**.

Regarding **hydrocarbons**, although the rock does not exert such a direct influence on its displacement, it was possible to observe the **spreading of the plume** according to the variation in water levels and extension of the aquifer, suggesting that it is a contamination **originated from a single source**. Modeling confirmed behavior of the aquifer and made predictions for migration of contaminants.



Understanding the distribution of contamination **goes beyond** identifying primary sources and concentration. The mechanisms of **percolation and transport** of substances is essential for defining a conceptual model for intervention actions.

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