Brownfield Revitalization and Future Value Increase with a High-Resolution Site Characterization Approach

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Contaminated Sites Sustainable Management Strategies

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Case Study – São Paulo Metro Area - Brazil

- **BACKGROUND:**

  - 21,5 million inhabitants in with a growing rate of 1,6% per year;
  - High demand for land development.

Source: ISS

- **THE SITE:**
  - Former fuel distribution base;
  - Investigated since 2003 and under remediation work via Multi-Phase Extraction between 2004 and 2019;
  - Recurrent concentrations above legal standards for Groundwater and NAPL prevented any development or use of the area since then;
  - Environmental impact caused the loss of 45% of the value of the area;

Sustainable Management

- Was the management approach for this site sustainable?

- THREE PILARS OF SUSTAINABILITY:

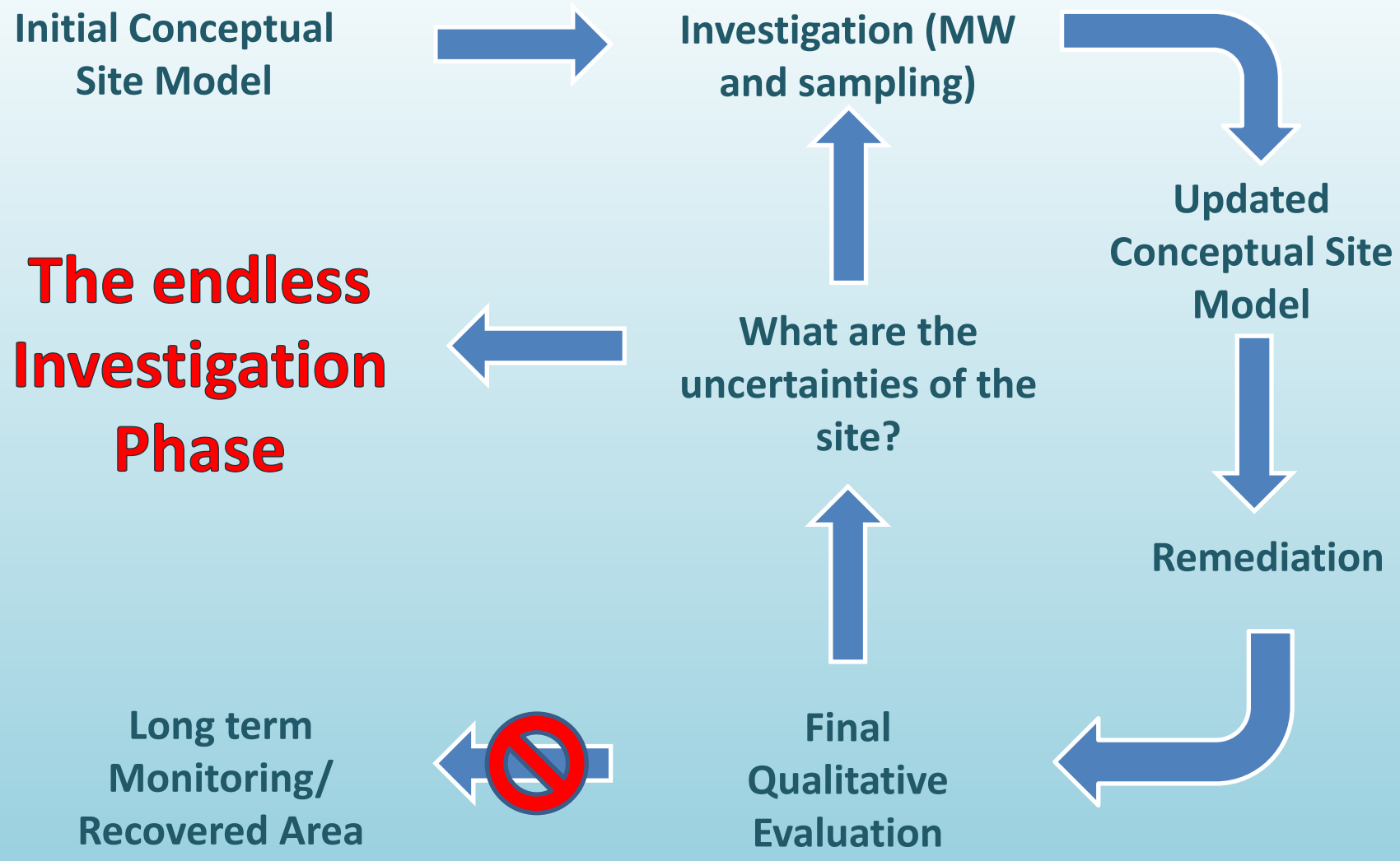
- Economic Development

- Social Development

- Environmental Protection

- CHARACTERIZATION UNCERTAINTY!

Management Lifecycle and Uncertainty



TRIAD Approach and High-Resolution Site Characterization (HRSC)

The TRIAD approach

Sistematic Project Planning

Dinamic Work Strategies

Real Time Measurement Tools

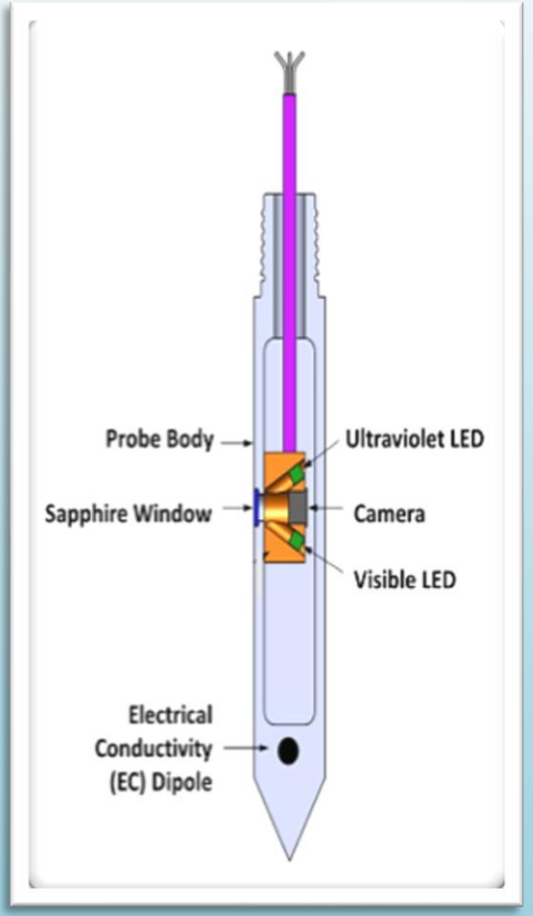
Source: Adapted from itrcweb.org

HRSC

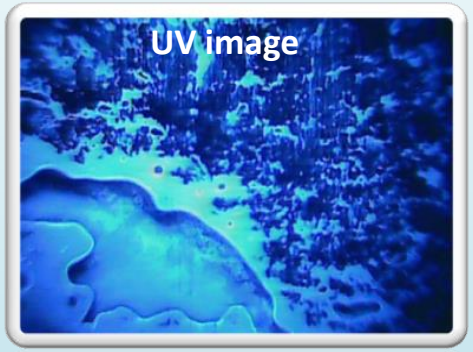
- Enhanced Details
- Reduced Uncertainty
- Applications to All Sites
- Best Management Practice

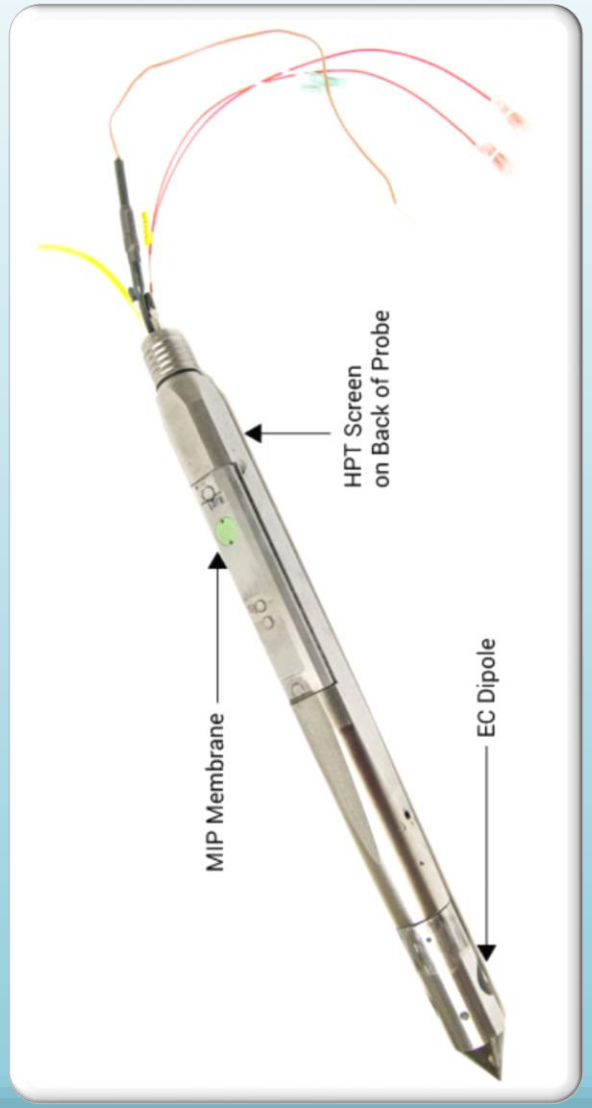
Source: clu-in.org

OIP – MIP- HPT - EC



Source: Geoprobe, 2020





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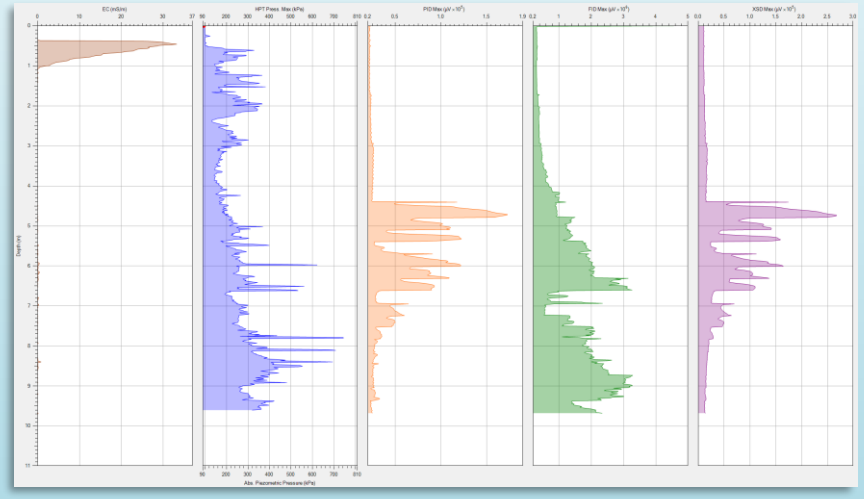


MiHPT Log

Investigation Overview

- Existing monitoring wells (blue and orange, 91 total) and extraction wells (green, 61 total):

Investigation Overview

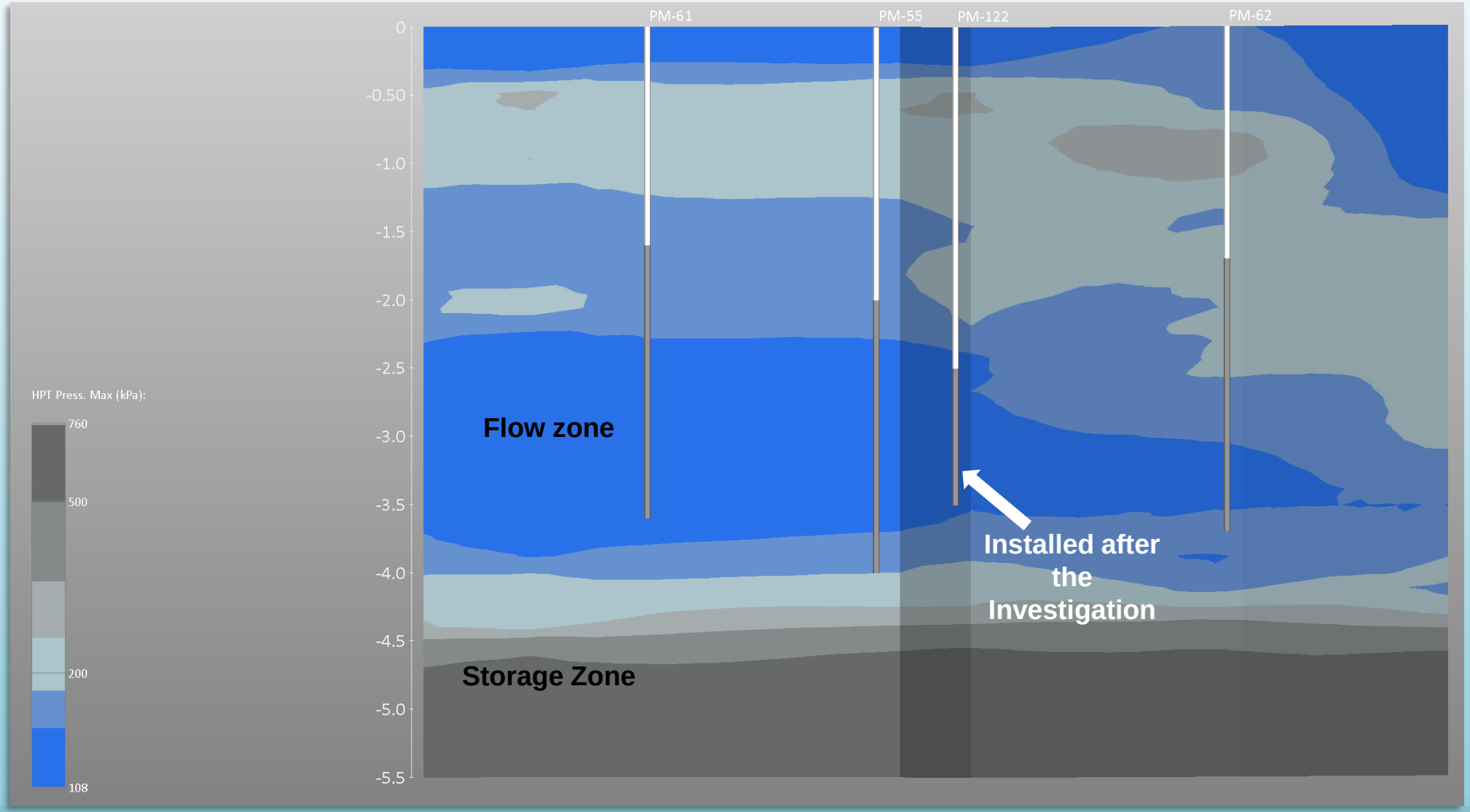
- **MiHPT and OIHPT log locations:**

Investigation Overview

- Target oriented monitoring wells (red):

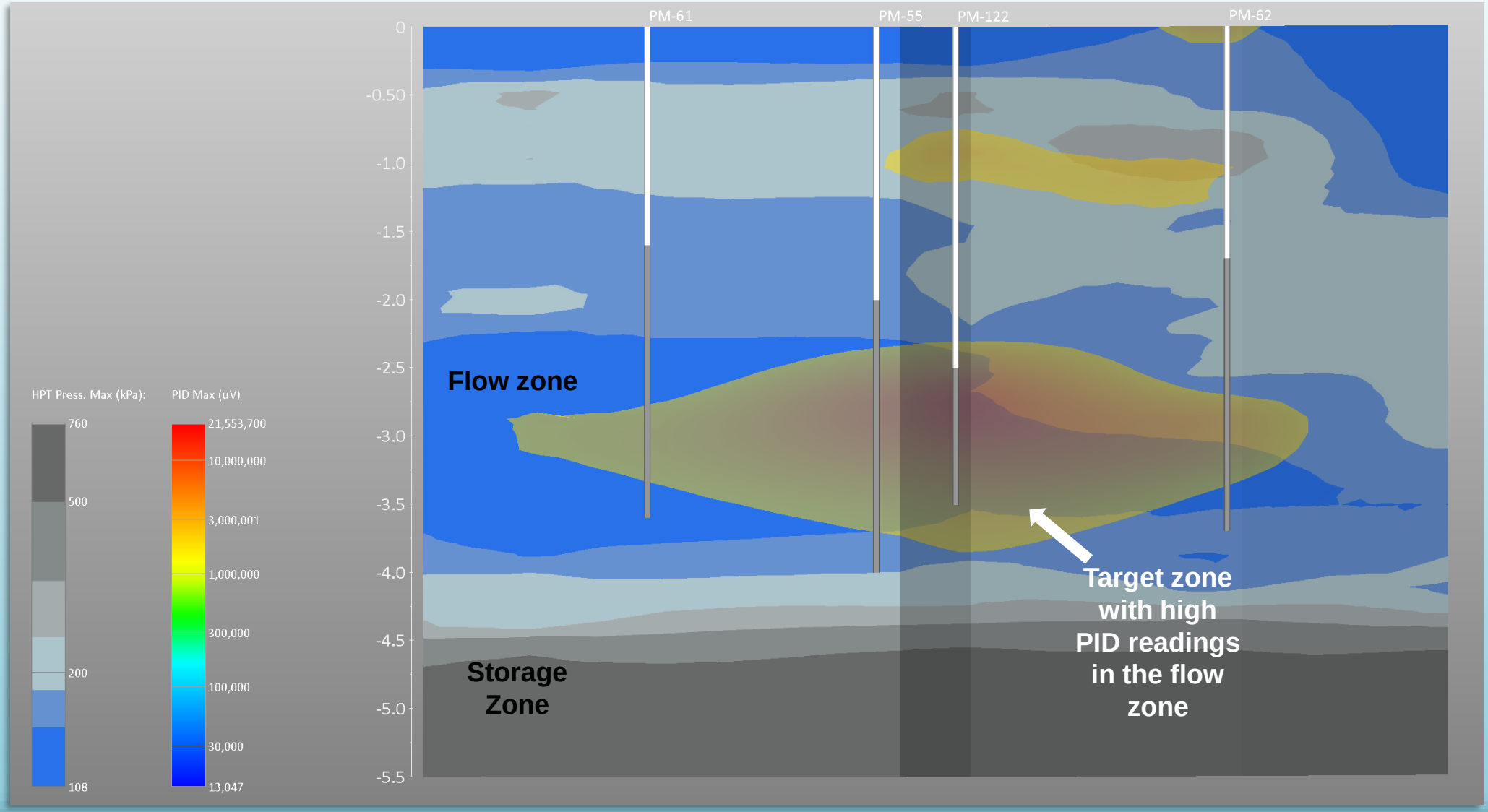
Investigation Overview

- **Cross Section with HRSC results:**



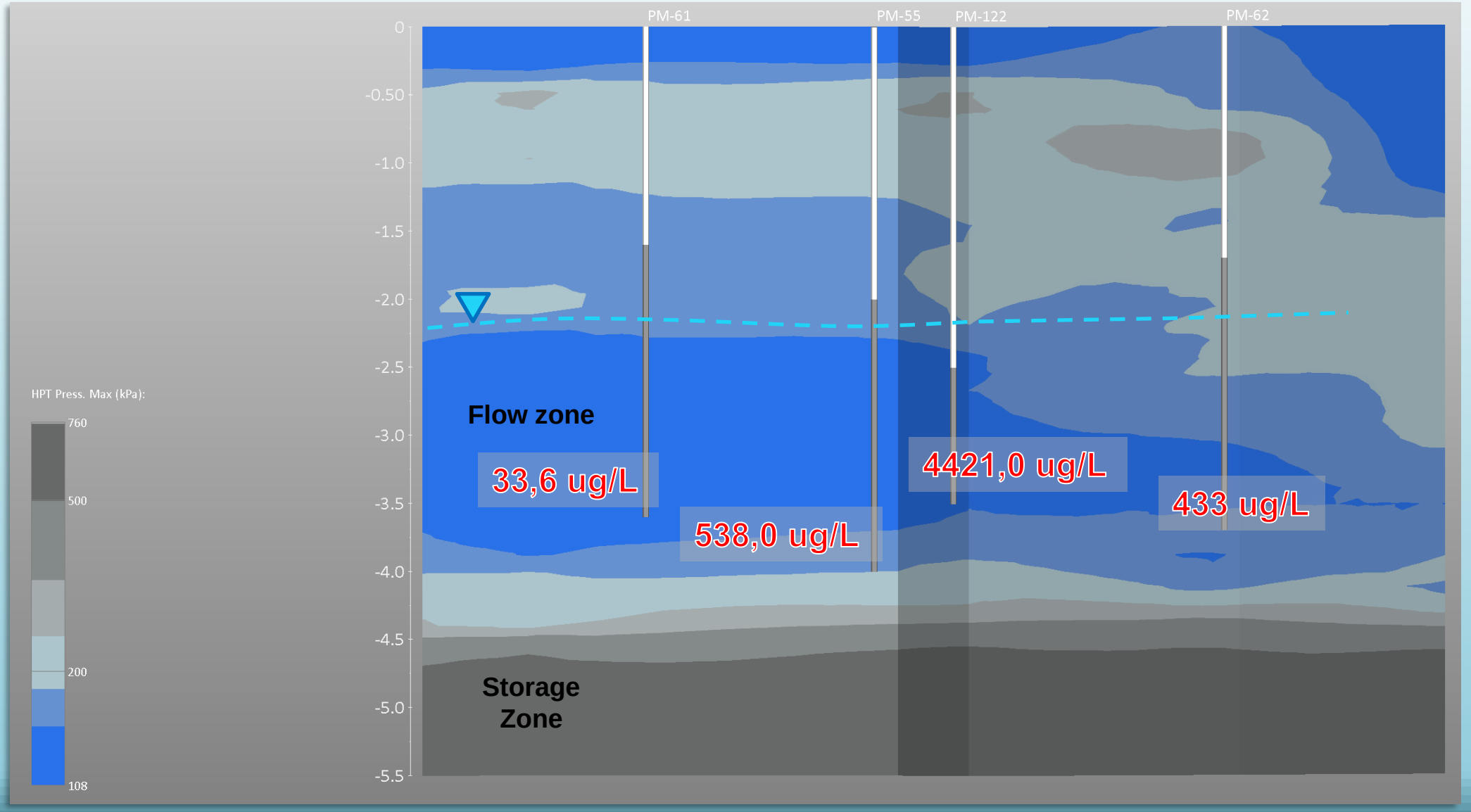
Investigation Overview

- **Cross Section with HRSC results:**

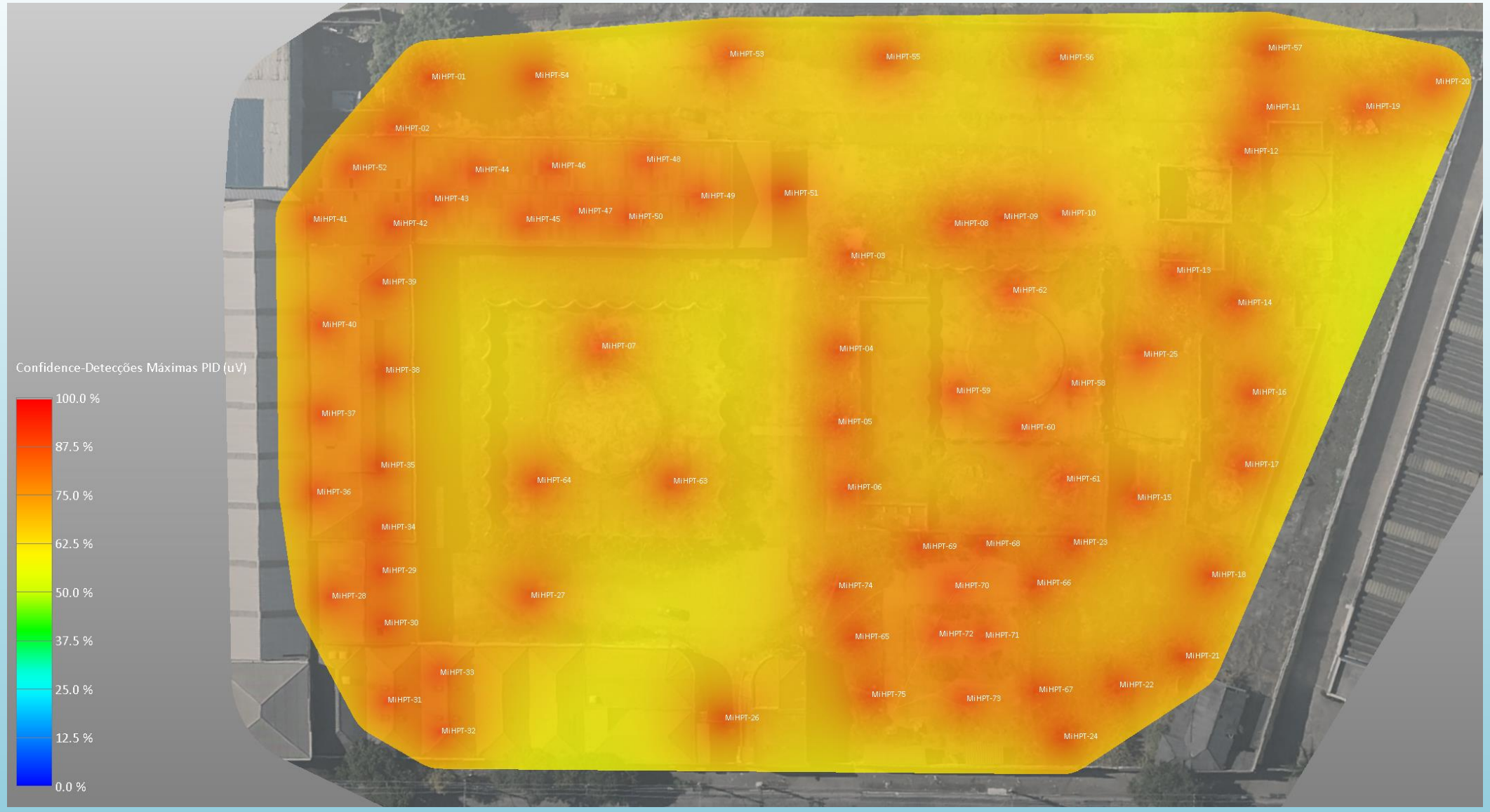


Investigation Overview

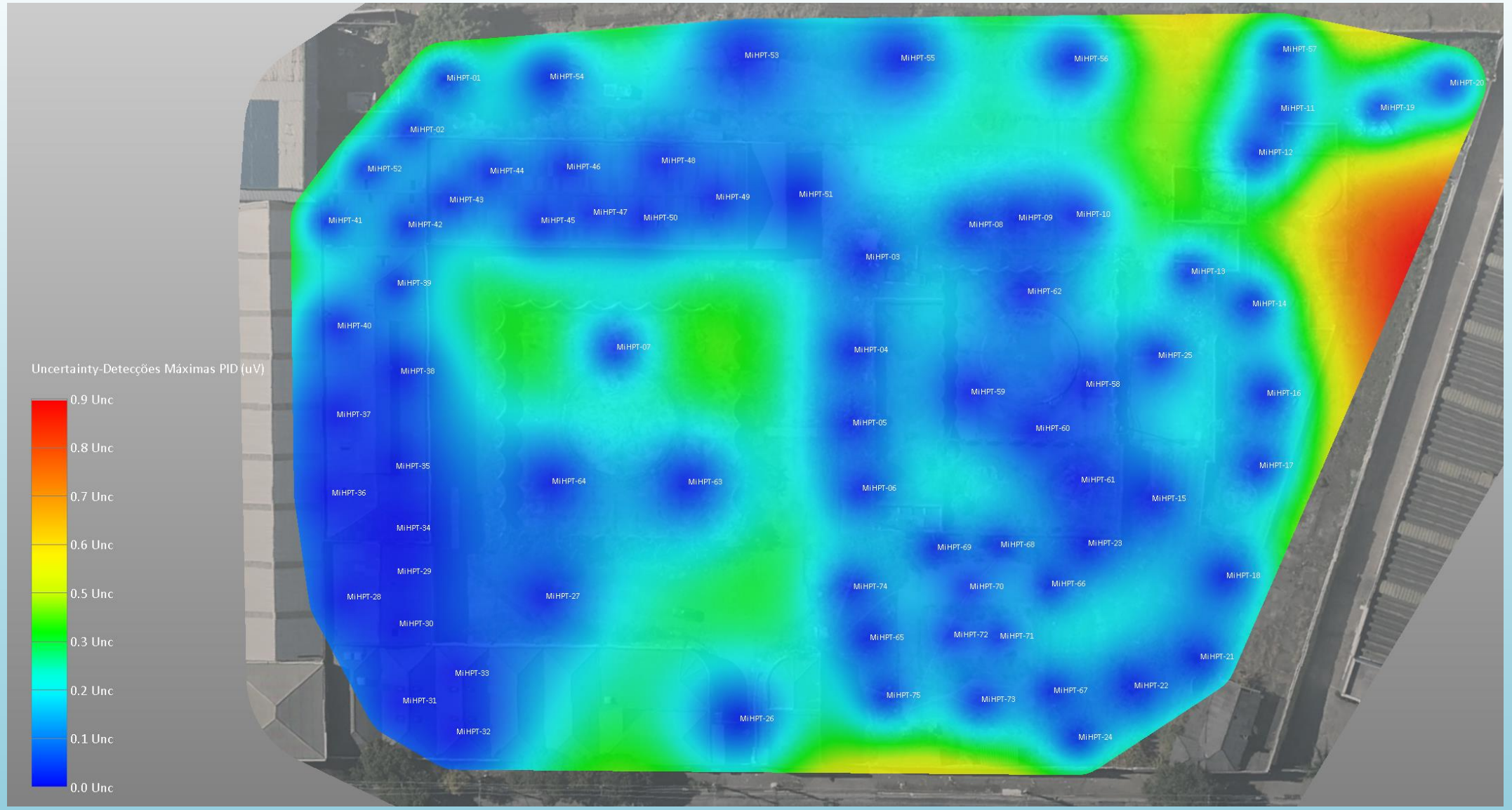
- **<u>Benzene</u> Levels in Groundwater (ug/L) (Standard = 5 ug/L):**



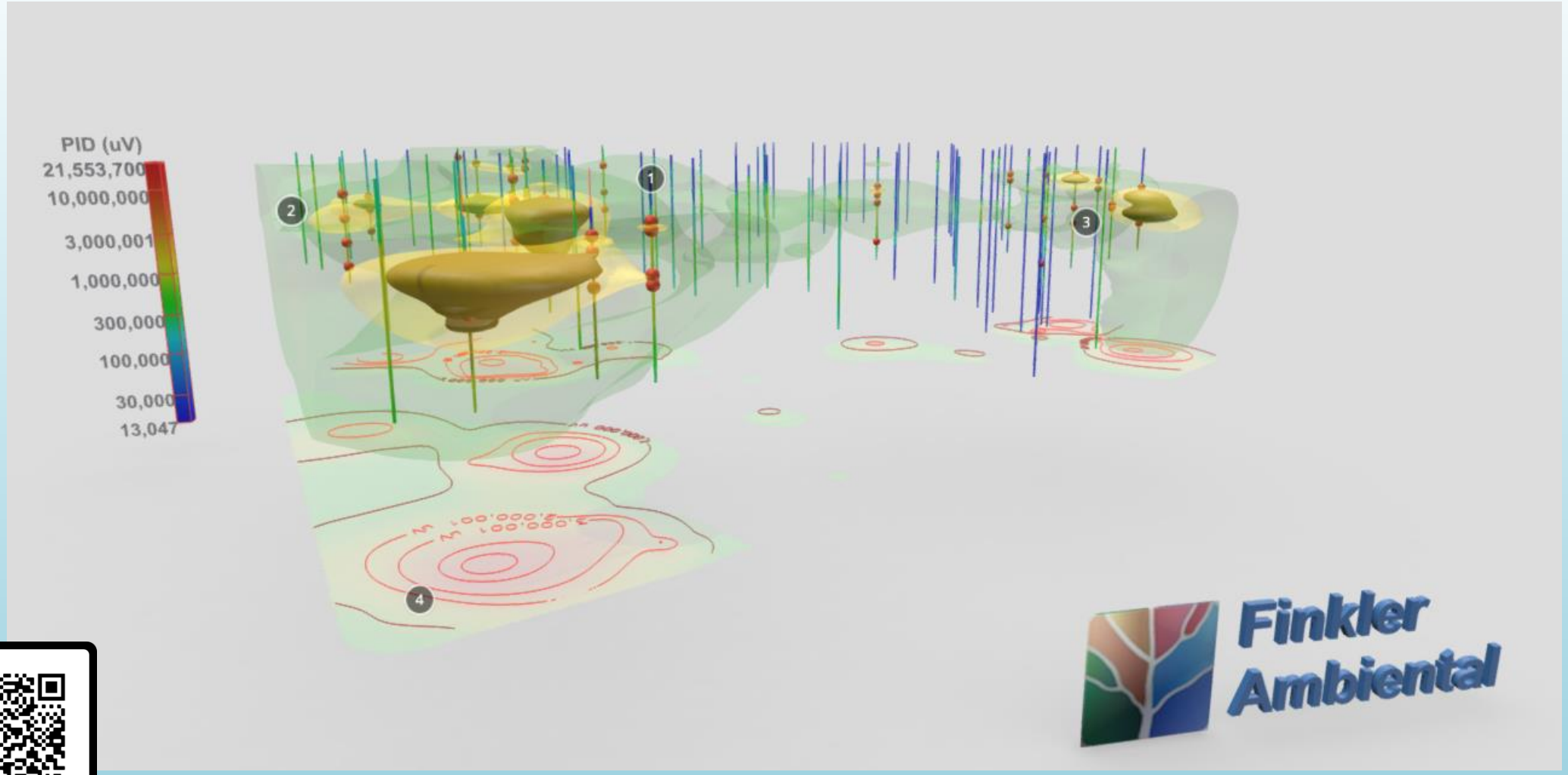
Statistical Confidence



Uncertainty Value



3D Models



SCAN ME

Points to Evaluate:

- ✓ 89 targeted soil samples were collected, 13 specific monitoring wells were installed, and 69 water samples were collected;
- ✓ **97,3%** of the mass is in the soil while only **2,7%** is in the water and just **0,01%** is due to vapor. Complete assessment of the remaining contamination;
- ✓ 15+ years of remediation focused solely on Groundwater and Vapor extraction (**91** monitoring wells and **61** extraction wells were installed during this period);
- ✓ Field work and data analysis took six months in total;
- ✓ HRSC Investigation costed about 458.000,00 BRL, compared to about 10 million BRL spent in previous investigation works and site maintenance since 2003.

TRIAD and HRSC

- ✓ Goal oriented, single, investigation campaign;
- ✓ Real Time decision making with all stakeholders involved, clear and transparent communication throughout the process;
- ✓ Reduced field time and workers exposition;
- ✓ Reliable data with measured uncertainty and statistical confidence levels;
- ✓ Assertive sampling campaigns to specific targeted zones;
- ✓ Replicable **strategies** to all sites;

Sustainable Management Key Points

- ✓ **What would the surrounding region of the area like if the site was used properly as a residential area?**

- ✓ The value of the site stands at its original price evaluation with a **detailed technical document** about the remaining contamination and human health risk;

- ✓ Impact to the regional groundwater is fully assessed with a dense data set which provides **technical and legal reliability**;

- ✓ **Legal and Technical Assurance** for stakeholder's decisions and future actions;

- ✓ Considering a 12% yearly interest rate, and 15 years of investment period, the 20 million BRL site value would have returned a profit of **89 million BRL** after taxes;

Sustainable Management of Contaminated Sites

✓**Sustainability** is achieved through **PRECISE, REAL TIME INVESTIGATION** and **TIMELY DECISION MAKING**. It is only possible to **SUSTAINABLY MANAGE** what **IS KNOWN!**

THANK YOU FOR THE ATTENTION,

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