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D. I2.2.4. Site Specific Dataset for Geophysical Characterization Method on POMPEY site (FR)

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SUMMARY

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3 INTRODUCTION

The following report describes the site-specific datasets for investigation studies of Pompey , that will be used for: (1) the creation of the geophysical database needed to design the SMARTIX (WP T2- A4) and (2) the performance reports on the Geophysical Characterization Method (WP T3- A1).

Regarding the creation of the geophysical database needed in the SMARTIX, one of the goals of the software is to suggest a selection of geophysical methods that will be applied efficiently on site to characterize the volume of materials potentially revalorized. The validation of the tool will be done by processing built datasets from the different pilot and additional sites, including the results from Pompey.

Regarding the performance reports on the geophysical characterization method, the dataset on Pompey will help determine the pros and cons of each geophysical methods for the characterization of the volume of materials potentially revalorized (estimation of resources potential & existing pollution).

First, we introduce a decision tree composed of a series of questions, that have been used to develop this module. Then we present a geophysical dataset representative of the type of industrial waste and raw materials found here. In particular the latter dataset is composed of measurements of electrical resistivity tomography and induced polarization methods- which were the most suitable for the characterization.

3.1 THE STUDY AREA

Pompey is one of the three pilot sites of the NWE-REGENERATIS project. It is a former tailing pond owned by the EPFGE (Etablissement Public Foncier de Grand Est, Public Real-Estate Company of Grand Est region). The site has been chosen for two main reasons: (1) it hosted various activities for iron based alloys production; (2) it was just rehabilitated on surface, and historic documentation and investigations are done with respect of the French legislation and threshold values.

The Pompey site is a former tailing pond from the iron and steel complex of Pompey-Frouard-Custines, located 10 km North from Nancy (see deliverable DI2.1.1 and Huot, 2013). The depth of the deposits in the basin is estimated at around 10 m. The surface of the former pound is estimated to 26 000 m^2, for a total estimated volume of wastes equal to 260 000 m^3.

In order to improve the characterization of the deposits stored on the Pompey site, the BRGM and the university of Liège carried out 2D electrical resistivity and induced polarization tomographies, combined with: (1) seismic tomographies, (3) electromagnetic mapping and (4) mapping of the gradient of the Earth's magnetic field. The use of each of these methods in the post metallurgical site and deposits context in detailed in deliverable DT1.3.1 and in deliverable DI2.2.1.

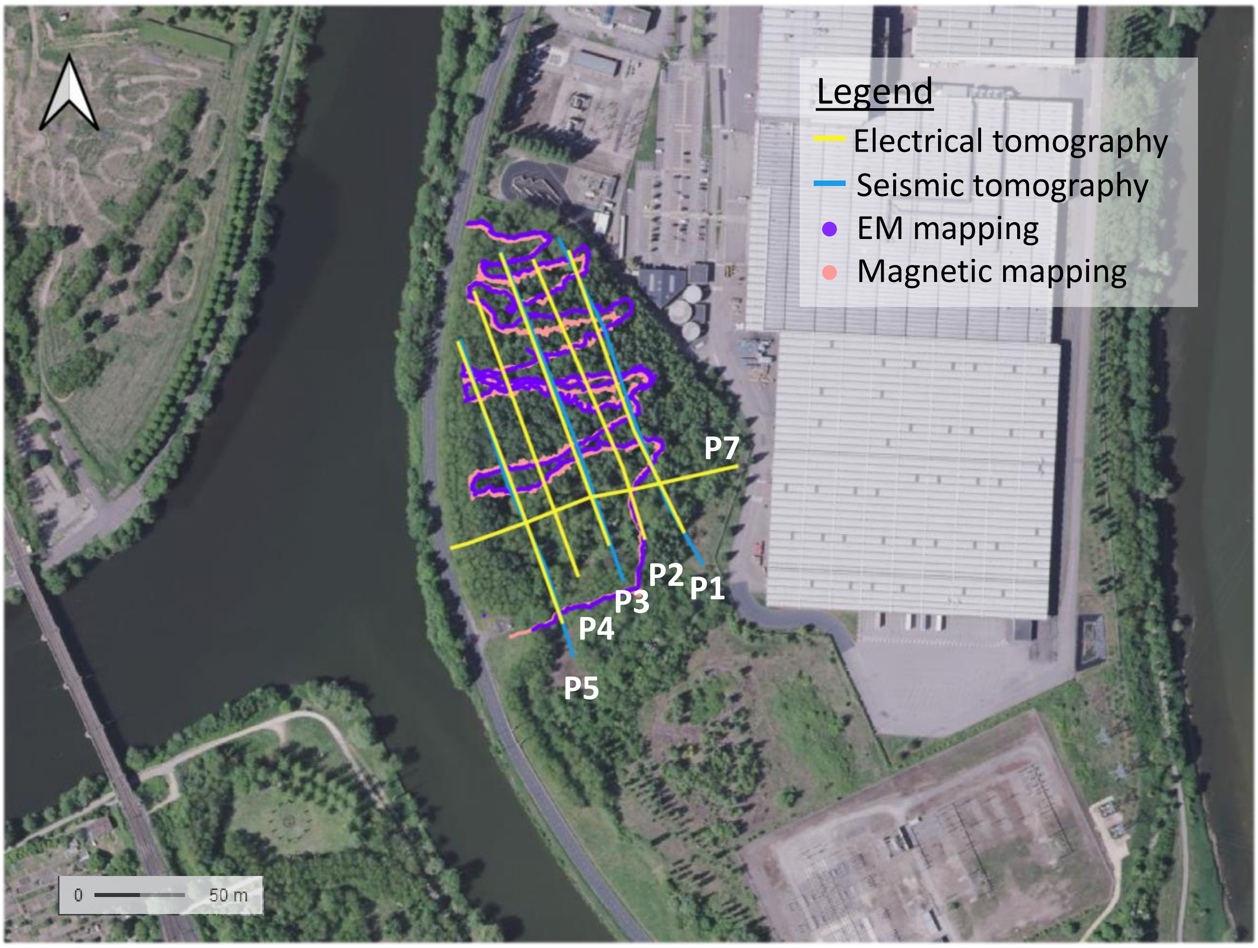

Figure 1: Location of the different geophysical profiling or mapping measurements. The profiles P1 to P7 are valide for both the electrical and seismic tomography.

4 DECISION TREE – GEOPHYSICAL CHARACTERIZATION MODULE

4.1 DESCRIPTION

This decision tree was built with U. of Liège (see Figure 2). More details regarding the description of the tree can be found in deliverable DI3.2.4.

The main objective of this decision tree is to define, set-up and carry out a geophysical survey in order to estimate the volume(s) of material(s) of interest.
Secondary objectives of the geophysical survey, that are not included in the decision tree, include the potential detection of water table(s), cavities and large concrete blocks. This information could be valuable for the definition of the recovery plan, and thus use as input of the related decision tree(s).

The inputs of the decision tree are the historical studies and available online data (e.g., remote sensing: aerial images) as well as the information obtained during site visits (i.e., current physical situation of the site: presence of vegetation, power lines at the vicinity, level of slopes…).

The header of the diagram defines:

- the different mapping (i.e. magnetic and electromagnetic induction methods) and profiling (i.e. ground penetrating radar, electrical resistivity tomography, induced polarization, seismic refraction tomography, multiple analysis of surface waves) geophysical methods that are considered in this decision tree for the field survey. A detailed description of each of these methods in the post metallurgical site and deposits context can be found in deliverable DT1.3.1.

- the Relevance (R) for each geophysical method: it defines the suitability of using a method according to available information. Its value ranges from 0% (non-informative method) to 100 % (volume estimation possible using this method). The initial Relevance is put to 100% *a priori* for all the methods. The detailed relevance rating of the output, splitted in 5 cathegories) is explained in Table 1.

The decision tree is composed of modules which are displayed in numerical order. Each module has a set of questions which are ordered continuously through all modules:

- **Module 1** is oriented to gather and organize information from historical studies and available online data of the site. Based on this, the Relevance of each method is updated.
- **Module 2** aims to update the method's Relevance after site visits where the current physical situation is considered.
- **Module 3**, based on Module 1 and 2, defines whether or not it is possible to estimate volume(s) of deposits of interest using geophysical characterization (used together with ground truth data from sampling).

The version of the decision tree presented below in Figure 2 has been updated from the initial version, based on the geophysical characterization results obtained for the pilote sites of La Louvière and Pompey, as well as the additional sites of Vieille Montagne, Nyrstar, STPI and La Campine. Indeed, the first version of the decision tree was too strict and would lower the score of the methods too drastically, when the methods actually were useful for the characterization of the PMSD.

Warning: For the sake of simplification, only basic questions, that can be applied to all the PMSD sites, have been kept in the decision tree. The results obtained are thus only indicative, and intended to help the site owner or the decision maker to target the most useful information in the available information, in order to discuss with the geophysicists. It cannot replace the expertise of a geophysicist, that is site-dependent.

Moreover, the decision tree only considers each method individually, when, in a lot of cases, it is the combination of several geophysical methods, combined with sampling characterization, that allow to extract the most qualitative (and quantitative) results. This will need to be considered in later versions of the decision tree and the SMARTIX tool.

Table 1: Final Relevance (R) rating in selected methods of the output

Method Relevance (R)		Description
0%	Non-informative	selected methods may be non-informative or non-applicable to the site
25%	Low interest	0< R≤ 25 % refers to methods of low interest
50%	Qualitative interpretation	if selected methods have a relevance of 25< R≤ 50 % a qualitative interpretation can be developed
75%	Quantitative interpretation	50< R≤ 75 % selected methods can be used to obtain a quantitative interpretation
100%	Volume(s) estimation	if 75< R≤ 100% an estimation of volume(s) is possible

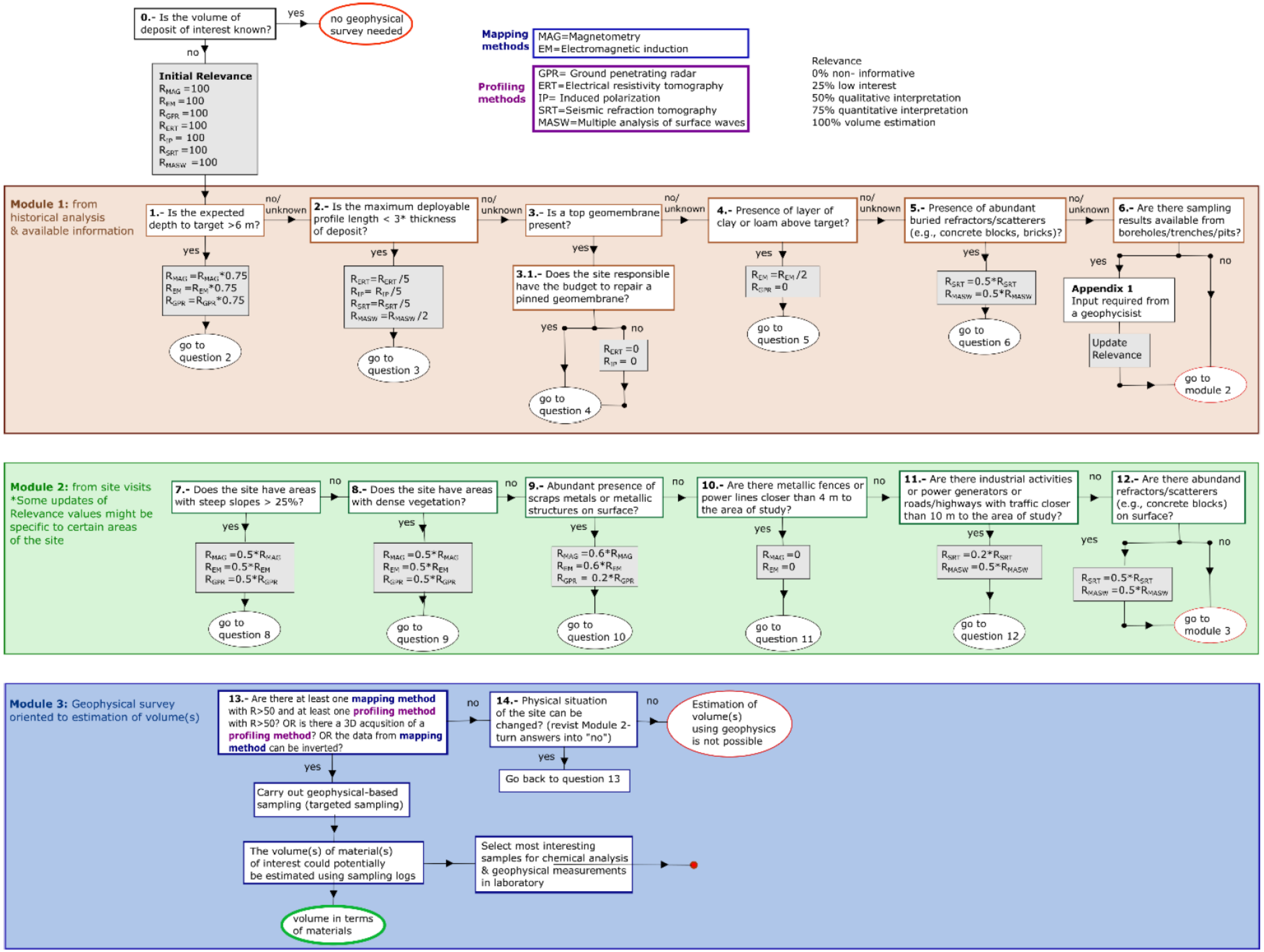

Figure 2: Decision tree for the Geophysical Characterization module

4.2 Input of the decision tree

In Table 2, we illustrate the information from Duferco site as input in the decision tree. The far right column indicates with 1's and 0's the answers "yes" and "no" respectively.

Table 2: Input of the decision tree for the Pompey pilote site

Questions			Description	Pompey
Module 1: from available information	Q1	Is the expected depth to target >6m?		**1**
	Q2	Is the max deployable profile length <3 * thickness of deposit?		**0**
	Q3	Is a top geomembrane present?		**0**
	Q4	Presence of layer of clay or loam above target?		**0**
	Q5	Presence of abundant buried refractors/scatterers?		**1**
	Q6	Are there sampling results available from boreholes/trenches/pits?		**1**
Module 2: from site visite	Q7	Does the site have areas with steep slopes >25%?	if yes, it might only be in certain areas and not the entire site	**0**
	Q8	Does the site have areas with dense vegetation?	if yes, it might only be in certain areas and not the entire site	**1**
	Q9	Abundant presence of scraps metals or metallic structures at the surface?		**0**
	Q10	Are there metallic fences or power lines closer than 4m to the area of study?		**0**
	Q11	Are there industrial activities or power generators or road with traffic closer than 10m to the area of study?		**0**
	Q12	Are there abundant refractors scatterers (e.g. concrete blocks) on the surface?		**1**

4.3 RELEVANCE PER METHOD

After answering questions Q1- Q12 the final Relevance obtained per method are presented in Table 3. According to the results of the decision tree,

- the seismic refraction tomography (SRT) and the multiple analysis of surface waves (MASW) represent only **low interest** to estimate the volume of the deposits
- the ground penetrating radar (GPR), the magnetic mapping (MAG) and the electromagnetic induction mapping (EM) allow only **qualitative interpretation** on the location of the deposits, both laterally and vertically
- the electrical methods (ERT and IP) are the most suited for **volume estimation** of the PMSD deposits to be revalorized.

In the field survey, carried out in March 2021 (see deliverable D I2.2.1), we used electrical tomography (both ERT and IP), seismic tomography (both SRT and MASW), EM and MAG mapping tools.

After data processing and interpretation of the methods used in the geophysical survey, we concluded that the most useful methods were ERT and IP. They allowed the detection of the interface between the natural geological layers and the settling pond. The IP data also allowed to identify areas within the deposit showing larger chargeability and metal factor signatures, potentially indicating areas with higher metallic content.

The MAG measurements were very noisy in the north and south area of the basin due to the presence of large metal (re)bars coming from all comers household and construction wastes that were probably deposited at the edge of the basin after the closure of the metallurgic industry. For the EM tool, the conductivity results were very coherent with the ERT data within the first 2 meters. Unfortunately, we used a CMD mini-explorer that has a very shallow penetration depth. We thus can not verify the good fit of the conductivity data with the ERT data deeper in the deposit. For both the MAG and the EM methods, the dense vegetation on site did not allow to get regularly spaced datapoints. No map could thus be built out of the data and the results are not covering a very large area of the site. The relevance R_{out} indicating only qualitative interpretation for these methods is relevant.

No GPR tool was used on site because of the dense vegetation and the thickness of the deposits estimated to 10 m. Maybe the score for the relevance of the GPR should be lower. However, no measurements were run, so the relevance is harder to evaluate.

Regarding the SRT results obtained on site, the data were noisy and the inversions were not usable. The relevance indicating only low interest for this method seems relevant.

Regarding the MASW results, the results are showing similar vertical lithology than ERT and IP results. The results were mostly used to validate the conclusions of the electrical measurements because only 3 profiles were acquired (compared to 6 electrical profiles). In this case, the relevance score indicating low interest might be underestimated.

Table 3: Relevance per method, updated for each question of the decision tree that gave a 'yes' result (see Table 2). The final relevance Rout is colored according to the rating in Table 1.

method	MAG	EM	GPR	ERT	IP	SRT	MASW
R_{ini} [%]	100	100	100	100	100	100	100
M1-Q1	75	75	75	100	100	100	100
M1-Q5	75	75	75	100	100	50	50
M1-Q6	75	75	75	100	100	50	50
M2-Q8	37.5	37.5	37.5	100	100	50	50
M2-Q12	37.5	37.5	37.5	100	100	25	25
R_{out} [%]	**37.5**	**37.5**	**37.5**	**100**	**100**	**25**	**25**

4.4 Output of the decision tree

Here we describe the main and secondary objectives that were or were not achieved for the Pompey site, based on the methods used in the geophysical survey (see Table 4). Most of the objectives were achieved using the ERT and IP data, validated by the MASW profiles for the vertical variations, and by the EM mapping tool in the first 2 meters for the lateral variations.

As the ERT and IP acquisitions were performed on 6 different 2D profiles, including one that was crossing the five others perpendicularly, it was possible to map the lateral and vertical variations of the electrical resistivity (ρ) and the chargeability (*M*) in the former settling pond. Therefore, together with the targeted sampling intended to calibrate the geophysical data with ground truth data, it was possible to develop a quantitative estimation of the targeted volumes. The estimations of volumes of materials of interest are not achieved yet on Pompey as the geophysical laboratory measurements on the samples are ongoing. They will allow to develop petrophysical relationships between the resistivity and chargeability measured and the concentrations of metallic elements (already analyzed).

Table 4: Output of objectives achieved and not achieved

Objectives	Achieved?	Description
Coverage of lateral variations	partially	The coverage of the mapping tools (MAG and EM) is low because of the dense vegetation cover. The 6 ERT/SIP profiles measured allow to detect partially the lateral variations. However, the lateral limits of the deposits and of the zones of interest are clearly visible using the electrical profiles results.
Coverage of vertical variations	yes	Layers detected by the 6 ERT and SIP 2D profiles and validated by the 3 MASW profiles for the entire volume investigated. Layers detected by EM mapping data for the 1st 2 meters only.
Qualitative interpretation of volumes	yes	Achieved using lateral and vertical variations coverage with ERT/IP data.
Quantitative estimation of volumes	yes	Achieved using lateral and vertical variations coverage with ERT/IP data, coupled with results of targeted sampling (chemical analysis)
Estimation of volume(s) of material(s) (per type(s))	not achieved yet	Ongoing measurements of both geophysical and geochemical data in the lab. Necessity to use petrophysical relationships and geostatistical analysis (also ongoing).
Identification of cavities	no	no existing cavities
Identification of water table(s)	no	the site is too heterogeneous to detect the water table

5 Site-specific geophysical dataset

In this section, we present the geophysical dataset that we obtained from the ERT and IP measurements, both in the field and in the laboratory for Pompey. As discussed in the previous section, ERT and IP are the most useful methods on this pilot site. They allow the detection of the interface between the natural geological layers and the settling pond. The IP data also allow to identify areas within the deposit showing larger chargeability and metal factor signatures, potentially indicating areas with higher metallic content. Four sampling points were chosen according to these interpretations (see Figure 3 and deliverable I2.2.2)

Figure 3: Map of the different sampling locations on the Pompey site. The geochemical and geophysical lab datasets are acquired on the 4 sampling points FP1-FP4.

In order to estimate volumes of materials interesting for revalorization, links need to be made between the geophysical field results and the nature of the deposits. To achieve this goal, geochemical analysis, coupled with geophysical measurements are performed on the samples collected. This step allows to understand the link between the IP signatures of the deposit and its chemical composition.

Three datasets are built to get the estimation of volumes of materials:

- **The field geophysical ERT and IP measurements**: extraction of the resistivity, chargeability and metal factor data at the location of the different sampling points at various depths
- **The lab geochemical characterization** using the NITON tool (X-ray fluorescence)
- **The lab geophysical measurements** on the same samples than the geochemical characterization

The first two datasets are presented in Table 5. The last dataset (geophysical laboratory measurements) is still in acquisition. The first results of the spectral induced polarization performed on 3 samples of FP2 sampling points are presented on Figure 4 as an example. The sample FP2 7.2m is taken below the PMSD deposits, within the natural alluvia. It's SIP signature shows a lower conductivity and no clear polarization peak, which is more typical of sand and gravel formations. On the other hand, the 2 samples within the PMSD deposits show higher real and imaginary conductivity, with a clear polarization peak for the sample FP2 5.8m, that could be linked with the presence of metallic particles in the sample. These first results need to be confirmed when the SIP dataset will be completed for all the sampling points.

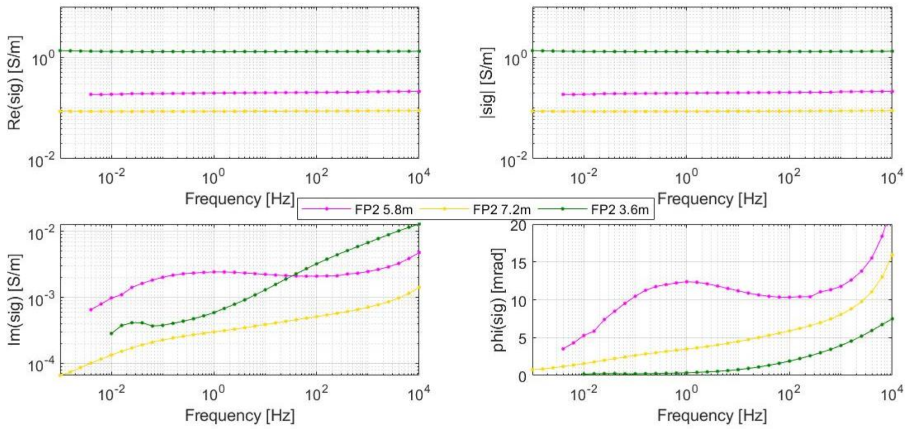

Figure 4: Examples of SIP spectra for 3 samples from the FP2 sampling points at three different depths. The real and imaginary parts of the conductivity are presented, as well its amplitude and phase shift. Sample FP2 7.2m is taken below the PMSD deposits (in the quaternary alluvium).

Table 5: Extracted geophysical field data and corresponding selected geochemical data

		Geophysical field data						Geochemical lab data									
Forage	**alt_mean [m]**	**Resistivity_median[Ohm.m]**	**Resistivity_std [Ohm.m]**	**M_median [mV/V]**	**M_std [mV/V]**	**MetalFactor_median [1/ohm.m]**	**MetalFactor_std [1/ohm.m]**	**Pb**	**Pb Error**	**Zn**	**Zn Error**	**Fe**	**Fe Error**	**Mn**	**Mn Error**	**Si**	**Si Error**
FP1	199.6	262.312	61.2652193	8.5493	0.64856938	65.1842	6.83218201	11910.13	145.96	20502.07	228.06	38222.23	411.33	56466.67	575	116891.07	1620.26
FP1	199.0	394.66	24.2587806	9.95037	0.65095328	50.425	7.35101484	2202.88	40.93	4039.9	69.42	58909.1	522.23	28323.29	368.81	171057.94	1900.38
FP1	198.0	286.487	19.0013361	10.7274	2.46610786	74.8893	18.2428342	20590.67	281.79	29043.21	368.24	18055.81	354.69	141787.53	1290.48	140525.94	1934.73
FP1	197.0	287.487	2.30E-13	16.2667	1.08E-14	113.165	1.44E-14	10827.18	160.44	16314.44	230.96	24022.68	398.66	196755.22	1624.17	148734.13	1953.72
FP1	196.0	100.754	58.9876654	114.848	31.9908949	2279.78	733.695478	26844.89	413	63876.69	822.67	44748.25	576.12	99505.62	1064.91	176684.3	1946.66
FP1	196.0	100.754	58.9876654	114.848	31.9908949	2279.78	733.695478	19684.07	341.18	48296.63	697.78	38543.46	588.2	77554.08	999.49	126356.26	1764.78
FP1	196.0	100.754	58.9876654	114.848	31.9908949	2279.78	733.695478	24518.89	377.24	60953.57	778.5	43100.34	552.52	89535.3	969.89	144133.86	1983.87
FP1	195.0	100.754	7.20E-14	114.848	1.44E-14	2279.78	9.21E-13	16864.16	243.7	35012.75	442.72	96761.14	938.86	47962.23	607.88	170887.2	1998.49
FP1	195.0	100.754	7.20E-14	114.848	1.44E-14	2279.78	9.21E-13	17309.08	251.97	36533.8	461.52	91024.3	894.03	50486.55	623.85	141732.47	1972.57
FP1	195.0	100.754	7.20E-14	114.848	1.44E-14	2279.78	9.21E-13	15909.29	233.45	33927.82	430.88	89750.41	882.06	43809.34	571.52	140467.72	1868.45
FP1	195.0	100.754	7.20E-14	114.848	1.44E-14	2279.78	9.21E-13	15462.1	217.55	32238.4	396.38	82548.84	806.94	49165.4	602.77	142984.81	1893.65
FP1	194.0	21.104	33.1486447	21.0307	39.0304188	1993.05	120.340661	17733.15	245.13	35488.33	426.84	73387.04	752.46	26230.18	423.89	180663.83	2012.32
FP1	194.0	21.104	33.1486447	21.0307	39.0304188	1993.05	120.340661	18504.01	251.49	37943.52	445.91	72871.08	734.14	25210.63	404.75	152505.69	1996.47
FP1	194.0	21.104	33.1486447	21.0307	39.0304188	1993.05	120.340661	16060.65	220.76	33729.59	399.98	70693.04	717.09	24541.58	401.88	149750.77	1886.34
FP1	194.0	21.104	33.1486447	21.0307	39.0304188	1993.05	120.340661	15443.44	206.54	31342.6	366.17	67746.98	680.86	25020.45	397.45	151660.75	1916.26
FP1	193.0	21.104	1.08E-14	21.0307	1.80E-14	1993.05	1.61E-12	19210.92	259.1	32571.87	391.74	48017.85	546.33	75329.54	794.7	121403.63	1720.88
FP1	192.0	21.104	1.08E-14	21.0307	1.80E-14	1993.05	1.61E-12	14529.12	196.89	25405.67	311.7	39329.95	477.66	91897.7	897.15	144199	1904.88
FP1	191.2	13.7979	1.82E-15	7.59992	9.11E-16	1101.61	2.33E-13	160.46	9.21	341.23	17.02	20556.18	235.38	1669.43	93.96	314620.59	1911.25
FP1	190.7	13.7979	1.82E-15	7.59992	9.11E-16	1101.61	2.33E-13	229.62	14.74	459.95	26.53	10370.41	229.47	1840.06	137.03	335865.44	2349.99
FP1	190.7	13.7979	1.82E-15	7.59992	9.11E-16	1101.61	2.33E-13	185.74	9.56	344.39	16.7	9902.06	159.71	1568.27	92.06	353025.31	1932.15
FP2	197.3	271.355	0	1.15284	0	8.49692	0	19594.32	225.37	10248.51	140.38	61635.07	592.07	29027.29	405.04	111532.91	1588.77
FP2	196.7	271.355	66.2480566	1.15284	0.40008064	8.49692	8.70354376	31813.68	461.61	28359.64	395.92	31404.38	480.29	121091.11	1258.65	138656.89	1956.89
FP2	195.8	82.6276	0	3.21189	0	77.7439	0	22543.36	325.94	42179.31	532.81	38937.12	506.93	121413.51	1164.12	171604.19	2074.5
FP2	194.8	27.1082	9.22095	5.17009	0.42787	381.44	96.0035	24407.75	360.53	51821.89	650.99	47745.17	578.28	93382.48	977.26	148530.14	1875.17
FP2	194.1	27.1082	0	5.17009	0	381.44	0	18566.92	254.34	31352.82	386.44	51653.23	574.04	94756.21	932.69	142673.38	1944.71
FP2	193.6	22.89635	0.26170022	4.61833	0.12189107	403.3775	6.03657059	24348.1	334.83	33986.36	426.39	64131.13	691.52	58402.92	696.61	136963.53	1907.92
FP2	192.5	22.7113	1.49459096	4.53214	0.28417234	399.109	45.1944203	4297.97	60.6	7421.07	98.22	40571.71	395.25	23831.54	329.56	186595.95	1793.23
FP2	191.5	36.1764		3.71905		205.606		374.31	13.21	635.72	21.97	18022.94	215.96	2380.31	104.98	306733.22	1890.63
FP2	190.8	47.5881	2.97085	3.86846	0.066205	162.581	6.5495	37.69	5.27	50.88	8.72	7424.22	135.19	121.02	57.15	373098.06	1969.27
FP2	189.8	53.5298	0	4.00087	0	149.482	0	63.32	6.32	115.61	11.08	10737.29	165.72	280.75	62.54	342083.59	1928.69
FP3	196.4	597.567	141.696813	11.05455	1.60249857	33.7804	11.0704977	2247.89	38.41	2226.26	46.27	41204.16	386.4	16778.05	266.98	224046.92	1885.92
FP3	195.8	475.703		15.3766		64.648		39475.09	546.34	18749.04	274.65	52309.68	640.88	90155.78	1000.27	141455.17	1895.09
FP3	195.1	294.2065	209.574106	19.57315	4.84575854	243.2155	206.191988	10982.73	168.46	18772.45	266.92	108937.05	1002.03	96956.16	952.29	132388.11	1852.68
FP3	194.1	102.93095	11.2918743	29.08835	6.14144802	580.256	182.988858	21429.01	310.93	44060.66	550.08	48038.11	573.04	89075.41	935.54	116939.18	1751.11
FP3	193.3	112.829	11.360579	96.4723	35.8334177	1710.06	560.798214	7168.88	96.36	14147.78	168.86	24024.77	323.95	63114.31	619.86	101786.62	1537.16
FP3	193.3	112.829	11.360579	96.4723	35.8334177	1710.06	560.798214	16326.13	231.87	27436.5	353.19	44861.01	536.43	104869.82	1026.36	140329.89	1954.82
FP3	192.8	112.829		96.4723		1710.06		25690.3	371.77	41675.74	537.25	98395.6	1002.32	27000.53	445.13	140660.8	1902.74
FP3	192.1	105.591	4.26275	89.66	22.0045	1698.25	527.975	18765.62	255.4	24809.98	319.36	59393	639.05	75974.59	811.53	146233.38	1880.21
FP3	191.1	97.0655	0	133.669	0	2754.2	0	100.14	7.54	167.34	12.67	17242.31	212.54	894.06	77.87	339061.25	1913.64
FP3	190.2	97.0655	0	133.669	0	2754.2	5.57E-13	66.79	6.44	84.6	10.16	13685.48	186.23	276	61.89	337315.38	1905.41
FP3	189.2	51.1491	20.0763575	30.0157	12.304456	1173.66	10.8896511	95.27	7.46	161.13	12.64	23029.06	247.78	763.11	74.56	328710.81	1937.9
FP3	188.2	51.1491	0	30.0157	0	1173.66	0	210.57	10.1	280.69	15.33	27295.66	266.51	1066.77	78.99	296687.03	1884.36
FP3	187.7	51.1491		30.0157		1173.66		227.3	10.5	311.77	16.11	13926.41	189.3	879.76	77.12	318903.72	1927.82
FP4	197.5	362.865	65.022003	9.21408	1.39291817	50.7852	1.04450812	12091.54	151.2	18924.32	220.35	58050.81	553.79	39408.04	475.38	130777.03	1679.28
FP4	196.9	258.086	29.5822395	10.3995	0.33467945	80.5891	8.41453065	10491.8	133.41	28483.3	296.65	33090.53	381.37	41986.72	488.49	164546.8	1869.71
FP4	196.2	43.1011	114.229428	10.3995	0.93272148	483.077	229.667997	9829.33	128.02	16086.4	195.3	17920.74	303.6	96072	849.31	138510.34	1756.82
FP4	195.7	33.4854	0	9.12643	0	545.099	0	25336.73	333.34	30184.67	364.61	29469.75	418.89	21826.92	397.48	175024.56	2002.47
FP4	195.1	33.4854	6.73098696	9.12643	1.81419637	545.099	2.02036421	29203.93	430.07	61242.63	738.56	18354.55	342.15	40982.26	594.05	139440.7	1840.48
FP4	195.1	33.4854	6.73098696	9.12643	1.81419637	545.099	2.02036421	29932.86	452.12	44740.47	603.97	96709.73	1009.67	61293.34	758.06	101926.16	1667.7
FP4	194.1	15.04	1.54517696	3.20855	0.70397944	426.67	37.1996386	22397.96	306.72	37642.03	454.86	65609.97	698.15	31210.82	471.05	125233.09	1766.83
FP4	193.1	13.4967	0.24401716	1.84129	0.21618279	272.85	24.3210775	18006.31	260.3	36186.47	458.47	127084.52	1183.17	10255.46	256.5	174803.58	1991.42
FP4	193.1	13.4967	0.24401716	1.84129	0.21618279	272.85	24.3210775	16842.75	245.95	34743.18	444.06	122092.31	1153.05	9535.99	244.74	145449.53	1918.26
FP4	193.1	13.4967	0.24401716	1.84129	0.21618279	272.85	24.3210775	16471.19	234.19	34153.16	424.78	119968.76	1110.96	9769.25	244.98	144857.34	1958.03
FP4	193.1	13.4967	0.24401716	1.84129	0.21618279	272.85	24.3210775	6624.09	86.54	11346.31	138.31	55868.56	506.23	29187.35	376.3	165049.44	1815.41
FP4	193.1	13.4967	0.24401716	1.84129	0.21618279	272.85	24.3210775	16707.05	241.34	34329.83	434.5	119868.38	1124.76	9273.55	242.47	141180.88	1892.03
FP4	192.1	13.4967	0.593963	1.84129	0.21478668	272.85	31.1122687	32254.15	521.77	46778.66	671.75	108921	1173.76	64694.79	823.25	129024.73	1823.94
FP4	192.1	13.4967	0.593963	1.84129	0.21478668	272.85	31.1122687	16831.47	222.19	27099.48	324.74	66313.61	652.34	41671.8	522.93	80660.82	1376.51
FP4	192.1	13.4967	0.593963	1.84129	0.21478668	272.85	31.1122687	31043.33	501.86	46685.88	669.46	102723.47	1120.81	64374.66	824.55	97216.24	1599.42
FP4	191.1	16.26	1.129727	1.28528	0.00614824	158.091	13.6786101	24319.65	326.51	33012.06	403.56	43799.28	536.31	50895.98	645.38	157561.3	1927.48
FP4	190.1	16.26	1.15485352	1.28528	0.03203095	158.091	11.9787978	20206.39	263.43	26518.48	323.57	35022.35	454	65823.23	736.75	161511.97	1932.78
FP4	189.4	20.5894	3.65E-15	1.1652	2.28E-16	113.184	0	279.78	11.61	416.02	18.27	23337.62	247.69	912.24	76.8	307788.34	1921.73
FP4	188.9	27.5477	2.85562607	1.13845	0.01097797	82.6527	12.5297811	2299.04	35.72	3767.26	57.05	18767.41	228.1	6349.57	160.68	272930.09	1866.02

6 CONCLUSIONS

In this report, we presented the different geophysical datasets that were built for the former settling pond investigated on the site of Pompey (FR).

First the two datasets that are used for the design of the SMARTIX and the performance report on the Geophysical Characterization Method are presented. The first one gives a value of relevance per method used on site, and the second one lists the objectives achieved (or not) in terms of volume estimations (qualitative and/or quantitative) and also cavity detection and water level estimations. They both depend on the geophysical decision tree tool. The results obtained as output of the decision tree are close to the field experience observed at the Pompey site, although some methods such as MASW and EM were ranked as "low interest" or only "qualitative interpretation", when in the end, better information could be extracted from these methods. The most useful geophysical methods at the Pompey site are the ERT and IP methods. They allow giving volume estimations of the materials to revalorize. The results we obtained with all the methods applied on the Pompey site were used as decision support tool to design the decision tree. Therefore this is not a fixed diagram and may be modified after the experience gained from the investigation on other PSMD sites.

As the geoelectric methods (ERT and IP) proved the most useful to investigate the Pompey site, site-specific datasets are developed around these results. In order to estimate quantitatively volumes of specific materials in the field, petrophysical relationships between the chemical composition of the deposits and their geophysical signature need to be developed. This can only be done by laboratory analysis. Based on the field geophysical campaign, four sampling point locations were chosen and 48 samples were extracted for geochemical and geophysical characterization in the lab. The field geophysical dataset is composed of extraction of the resistivity, chargeability and metal factor data from the 2D ERT/IP profiles at the location of the different sampling points at various depths. The lab geochemical dataset was built using the x-ray fluorescence measurements that were run on all the samples extracted. The lab geophysical dataset is built by measuring the spectral induced polarization signature of the same samples. This last dataset is still under construction. These three datasets are necessary to get quantitative volume estimations. The final results will be used in the performance reports on the Geophysical Characterization Method as well.