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# EastMed Pipeline Project


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## External cooperation

This document was drafted with the cooperation of:

- INTERGEO, Environmental Technology Ltd

# ANNEX 8A.1 SOIL AND GROUNDWATER CHARACTERISTICS

# REPORT FOR ATHERINOLAKKOS COMPRESSOR STATIONS

### 8A.1.1 SUMMARY

INTERGEO Environmental Technology Ltd was assigned to perform an Environmental Site Investigation at the plot where the future Natural Gas Compression Stations CS2/MS2-CS2/MS2N will be constructed in Lasithi, Crete

This site investigation was performed in order to obtain a representative overview of the type and extent of potential contamination that might be present at the site and included the collection of fourteen (14) surface soil samples and one (1) groundwater sample well located in the adjacent area of the plot, within the same river basin.

The plot is located approximately 1.5 km east from the village Goudouras, 37 km east of Ierapetra and 73km southeast of Agios Nikolaos.

All the fieldwork activities took place on 02/06/2021.

The collected samples were analyzed in order to evaluate concentration of organic, inorganic and microbiological parameters.

According to the overall evaluation of the investigation results, no significant inorganic, organic and microbiological concentrations were detected in the surface soil and the groundwater of the investigated area.

The environmental sensitivity of the investigated plot area in Lasithi should be defined generally as low to moderate.

This arises from to the hydrogeological map of Crete as the main aquifer in the broader area of investigation characterized as an extended and low yield aquifer. The depth of the aquifer within the investigated plot is estimated approximately greater than 100m below ground surface (sea level). No groundwater wells and water streams were detected within or in the immediate vicinity of the investigated plot, during the on-site visit. . Furthermore hydrogeologically, the site is underlain by geological layers with varying permeability at the shallow depth that generally does not allow the easy downward migration of potential contaminants to the groundwater table and to sea level.

Both current environmental sensitivity of the study area and absence of any contamination load in the surface soil render the plot suitable for the implementation of any future industrial use.

Finally, considering that no groundwater wells were detected within or in the immediate vicinity of the investigated plot, at this time, no any future periodic monitoring of groundwater quality is recommended.

## 8A.1.2 PRELIMINARY INVESTIGATION

### 8A.1.2.1 Site Location

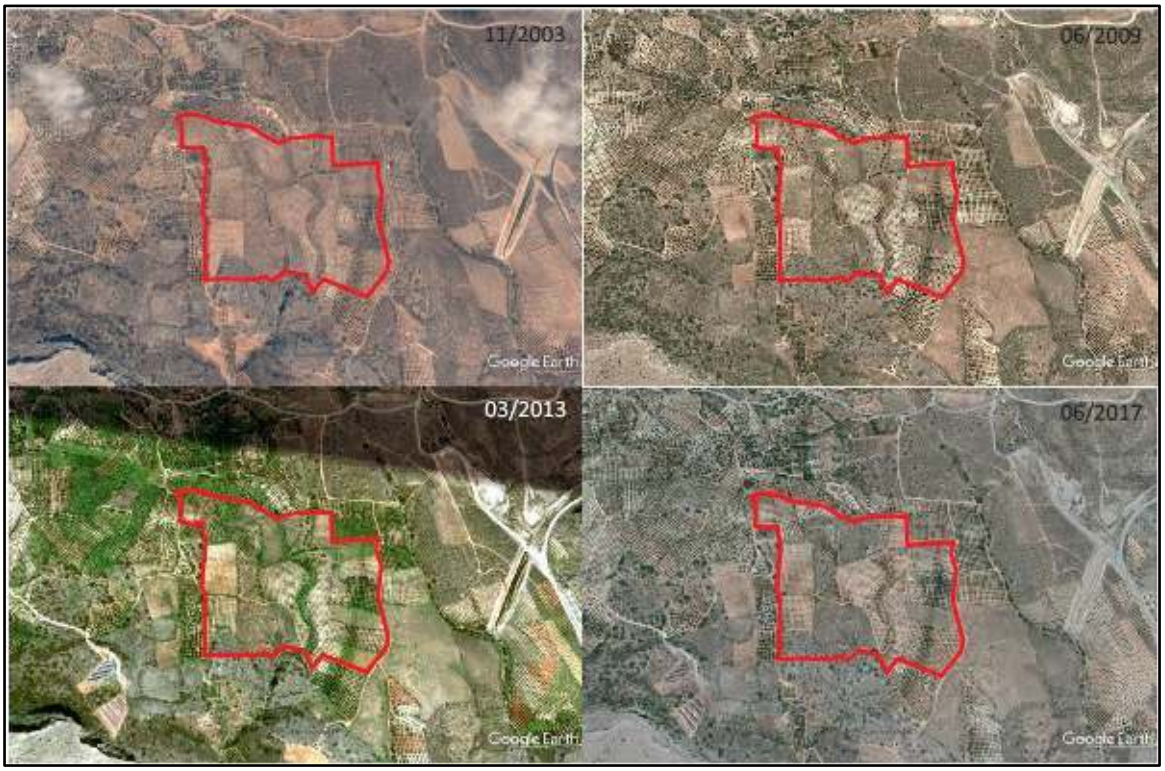
The plot is located approximately 1.5 km east from the village Goudouras, 37 km east of Ierapetra and 73km southeast of Agios Nikolaos. In addition, the area of investigation is located at approximately 700 m west from the Atherinolakos Power Plant of the Public Power Corporation. Moreover, the south Cretan sea is located at a distance of approximately 0.5 km from the plot.

The total area of the investigated plot is approximately 167,450 $m^2$. The geographic location and a satellite view of the investigated plot are shown in the attached Figures 1, 2 (Appendix 1 - FIGURE).

### 8A.1.2.2 Site previous and current land use

Based on available relevant past satellite photographs (see Figure A1- 1) at the investigated plot not any previous industrial activities took place. Past and current use of the plot is mainly for agricultural purposes (olive groves and sparsely vegetated uses).

Furthermore, not any hazardous or debris materials were encountered at the plot during the walkover survey that took place during the field work (02/06/2021).




Prepared by: INTERGEO on behalf ASPROFOS, 2022.

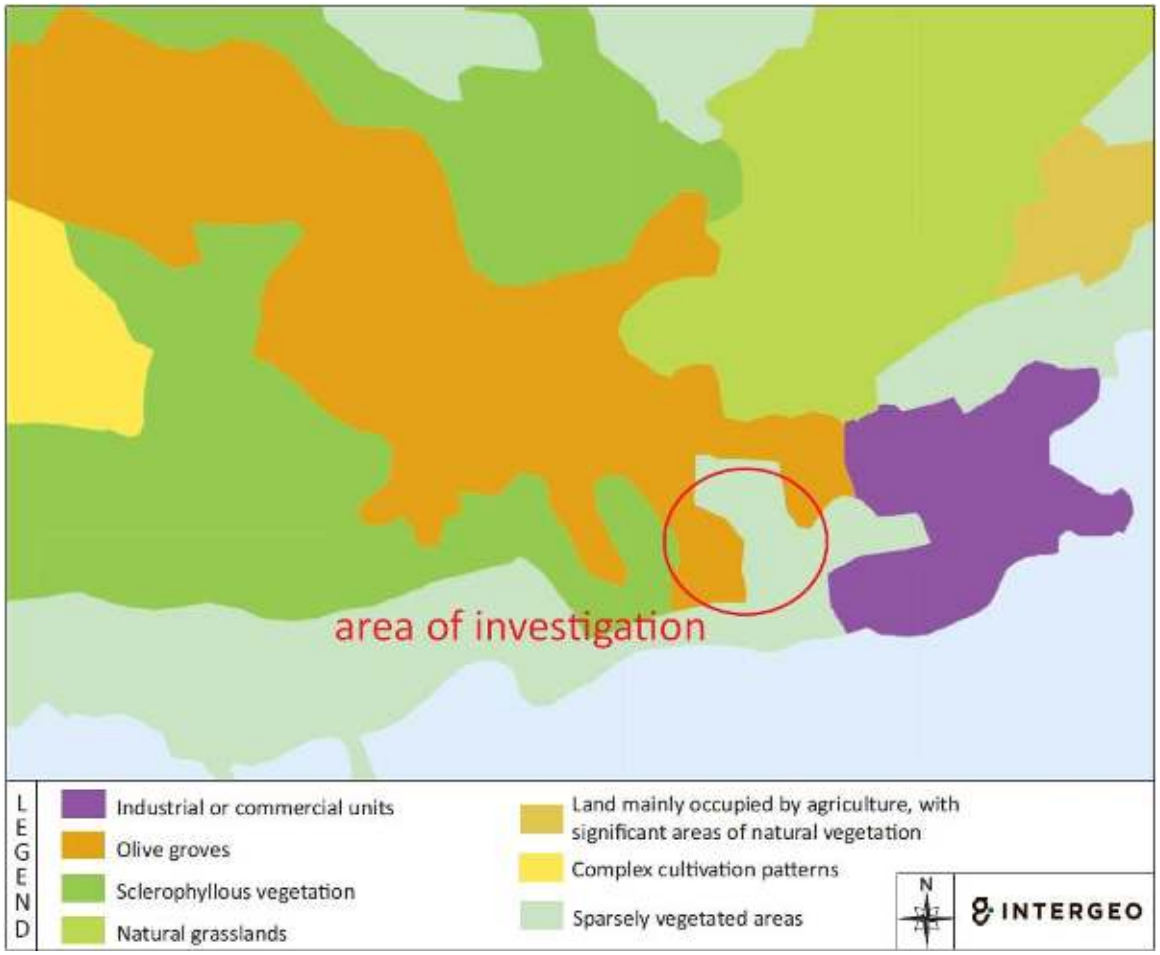
Figure A1- 1 Investigated plot past satellite photographs (source Google Earth)

### 8A.1.2.3 Land cover

Land cover of the broader area of investigation in 2018, according to the European Union CORINE program, is presented in the following Figure A1- 2.

Broader area of investigation is mainly covered by Agricultural land (Olive groves and sparsely vegetated areas) as well as semi-forest natural areas (Sclerophyllous vegetation and natural grasslands). Moreover, in the vicinity of the investigated plot an industrial unit is located (Public Power Corporation Atherinolakos Power Plant).

In a radius of 5 Km distance from the investigated plot, no Natura 2000 as well as other national network of protected or/and ecologically sensitive area is located.




Prepared by: INTERGEO on behalf ASPROFOS, 2022.:Data from Oikoskopio.gr (2021)

Figure A1- 2 Land cover of the broader area of investigation in 2018, according to the European Union CORINE program

## 8A.1.2.4 Environmental settings

### *8A.1.2.4.1 Topography*

The plot is located at a short distance (500 m) from the coastline. Near the coastline there is a steep relief however at the area of the investigated plot the relief is milder. The elevation within the plot fluctuates between 100-109 m and 110-123 m above sea level in its southern and northern boundaries, respectively. Figure A1- 3, below, illustrates the morphology of the territory, in the study area.


Prepared by: INTERGEO on behalf ASPROFOS, 2022. Data from: Oikoskopio.gr (2021)

Figure A1- 3 Morphology of the territory, in the broader area of the investigated plot

#### *8A.1.2.4.2 Hydrology*

The plot is located at a short distance (500 m) from the south Cretan sea. No water streams are located in the vicinity of the investigated area (see Figure A1- 4).

Considering the water basin, both the area of investigation and the groundwater well, where the groundwater sampling took place, are located within the same drainage basin (Eastern Crete streams) (see Figure A1- 4).


Prepared by: INTERGEO on behalf ASPROFOS, 2022. Data From: Oikoskopio.gr (2021)

Figure A1- 4 Hydrology in the broader area of the investigated plot (source: Oikoskopio.gr)

### *8A.1.2.4.3 Regional Geology/Hydrogeology*

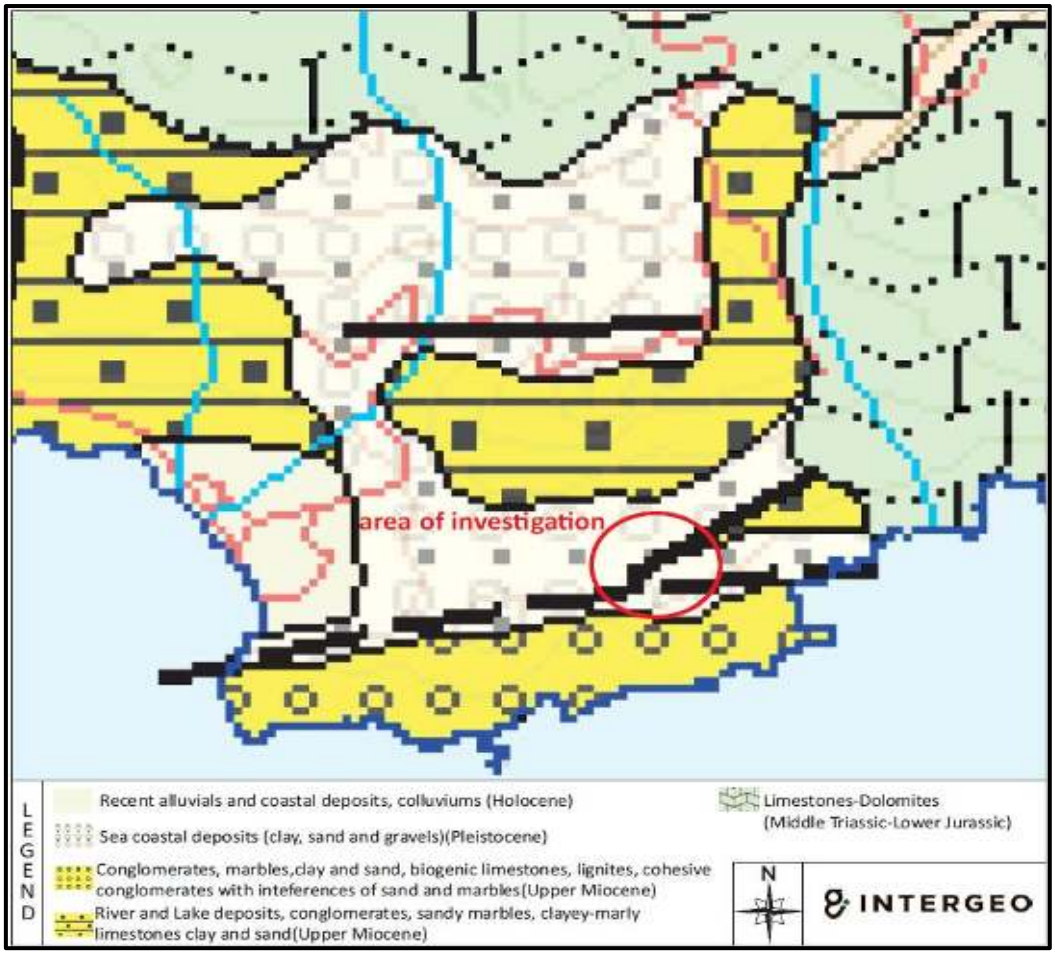
The geological substratum of the broader area of investigation is consisted of formations of the geotectonic zones of Tripoli-Maggasa and more specifically of a thick sequence of limestones and dolomites covered by flysch deposits consisted of clay, marbles, sandstones, ilyoliths and conglomerates.

Limestones appear north and east of the investigated plot at the areas of the village Agia triada and Livari.

Tripoli zone flysch appear north and east of Goudoura village, in the Platani area as well as northeast of the Atherinolakkos bay north of Livari area.

Limestones of the Maggasa geotectonic zone are white colored and twisted and they appear eastern of Handras village.

A geological map of the broader area of investigation is presented in the following Figure A1- 5.



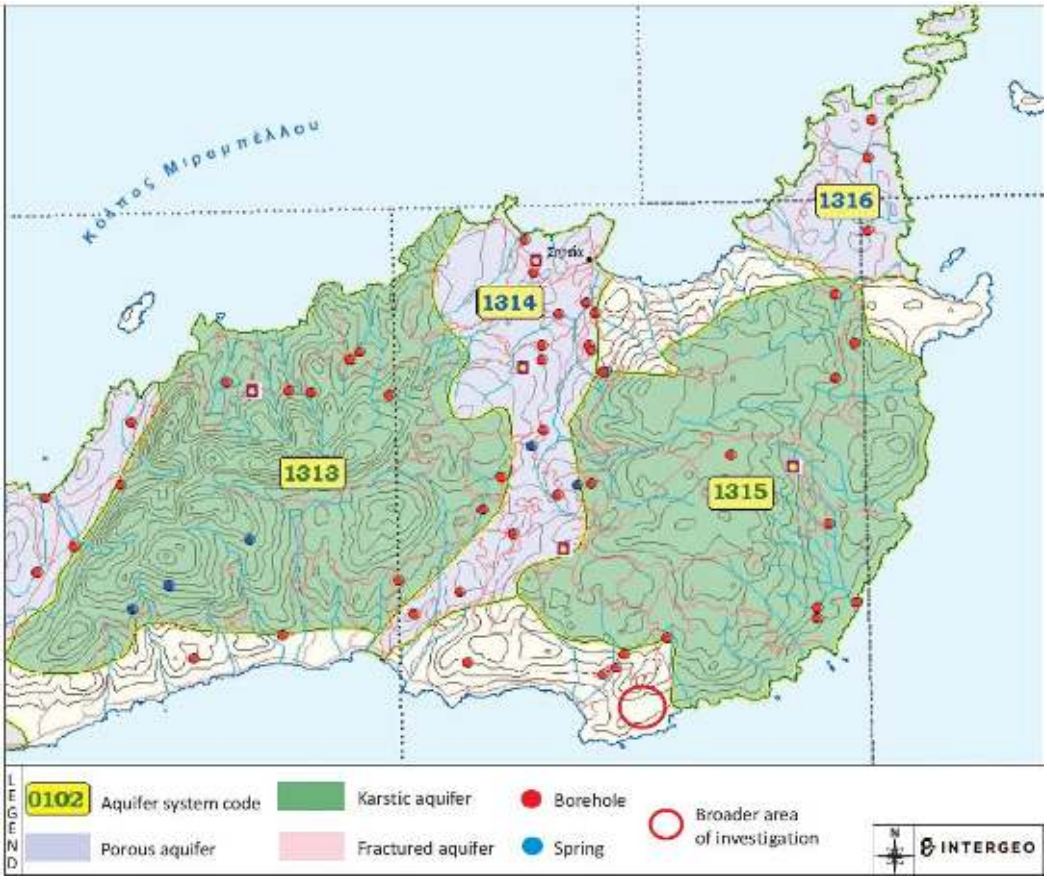

Prepared by: INTERGEO on behalf ASPROFOS 2022. Data from: Geological map of the River Basin district of Crete, Institute of Geology and Mineral Exploration (IGME) (2000)

Figure A1- 5 Simplified geological map of the area under investigation

In the investigated plot the following geological formations are expected:

- An upper soil layer consisted of sea coastal deposits (clay, sand and gravels).
- Below the upper soil layer flysch deposits consisted of conglomerates, clay, marbles, sandstones, and biogenic limestones.

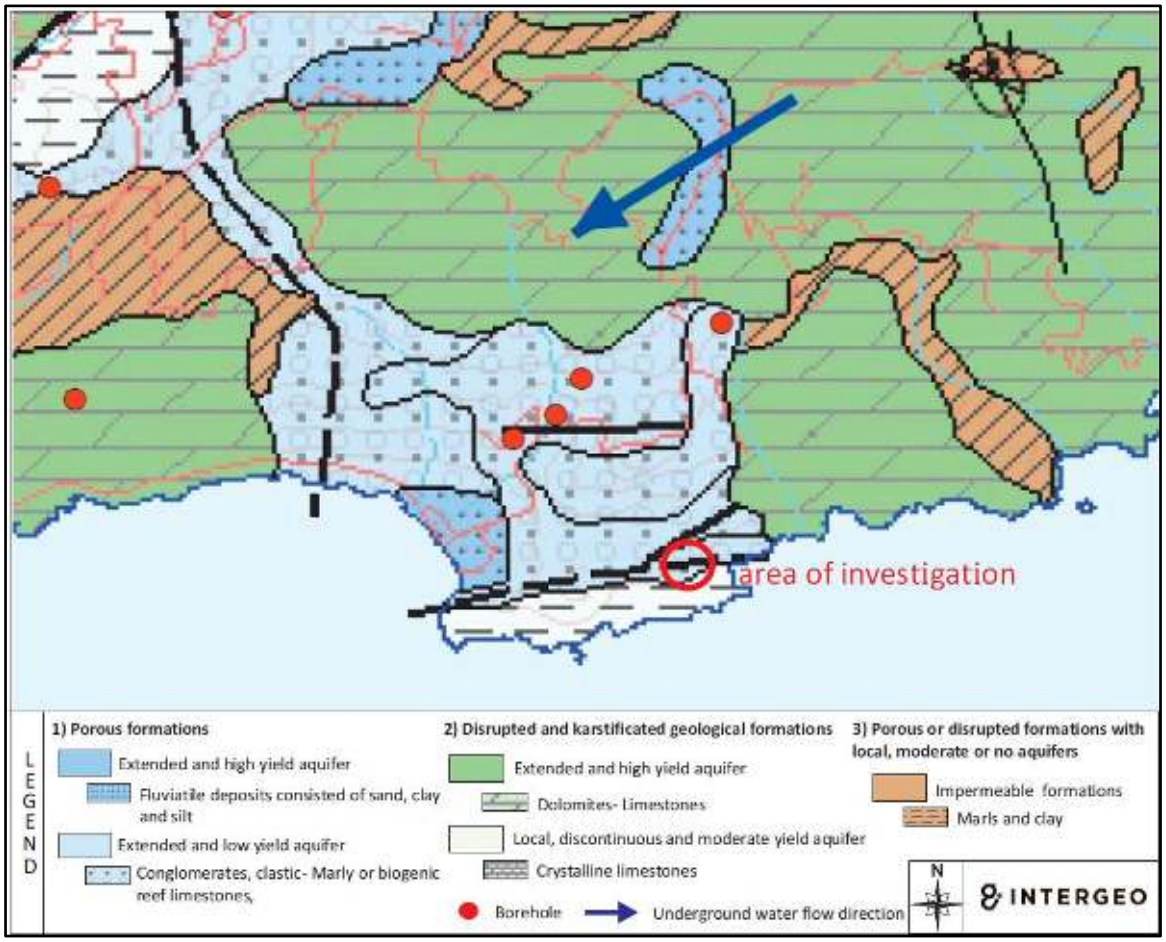
As far as hydrogeology is concerned, the broader area of investigation is not located within any of the 15 designated Groundwater bodies (GWB) of the groundwater system of Crete (GR13) (see Figure A1- 6).




Prepared by: INTERGEO on behalf ASPROFOS, 2022. Data from: Groundwater aquifer systems, Water District of Crete, Institute of Geology and Mineral Exploration (IGME) (Scale 1:250000)

Figure A1- 6 Groundwater aquifer systems in the broader area of investigation

According to the hydrogeological map of Crete (Source: Institute of Geology and Mineral Exploration (IGME) 2006), the main aquifer in the broader area of investigation is consisted of conglomerates and clastic-Marly or biogenic reef limestones characterized as an extended and low yield aquifer (see Figure A1- 7). No groundwater wells were detected within or in the immediate vicinity of the investigated plot, during the on-site visit. The depth of the aquifer within the investigated plot is estimated approximately > 100m below ground surface (sea level).




Prepared by: INTERGEO on behalf ASPROFOS, 2022. Data from: Hydrogeological map of the Water District of Crete, Institute of Geology and Mineral Exploration (IGME) (Scale 1:250000),2006

Figure A1- 7 Simplified hydrogeological map of the area under investigation

## 8A.1.3 INVESTIGATION METHODS

### 8A.1.3.1 Surface soil sampling

A total number of fourteen (14) sampling points for surface soil analyses were performed in specific locations in order to properly cover all the surface of the area to be investigated and achieve a representative framework of the quality of the surface soil.

All surface soil samples were carried out manually from the depth 0-0,3m, below ground surface.

The location of all sampling points is indicated in the attached Figure 4 (Appendix 1 - FIGURE). The coordinates (WGS84) of all surface soil sampling points are illustrated in the following Table A1- 1

Table A1- 1 Coordinates of all surface soil sampling points (WGS84)

| No | Coordinates | | Altitude in m (a.s.l*) |
|---|---|---|---|
| | Longitude | Latitude | |
| SS1 | 26° 7' 38.0"N | 35° 0' 20.4"E | 105.5 |
| SS2 | 26° 7' 38.0"N | 35° 0' 22.0"E | 110.8 |
| SS3 | 26° 7' 36.9"N | 35° 0' 22.9"E | 111.2 |
| SS4 | 26° 7' 34.7"N | 35° 0' 21.1"E | 109.8 |
| SS5 | 26° 7' 33.1"N | 35° 0' 22.6"E | 107.6 |
| SS6 | 26° 7' 32.1"N | 35° 0' 24.8"E | 107.9 |
| SS7 | 26° 7' 29.6"N | 35° 0' 25.4"E | 109.6 |
| SS8 | 26° 7' 24.9"N | 35° 0' 25.4"E | 119.1 |
| SS9 | 26° 7' 26.6"N | 35° 0' 22.7"E | 120.5 |
| SS10 | 26° 7' 29.4"N | 35° 0' 22.3"E | 113.6 |
| SS11 | 26° 7' 27.9"N | 35° 0' 21.2"E | 117.3 |
| SS12 | 26° 7' 29.6"N | 35° 0' 18.1"E | 115.8 |
| SS13 | 26° 7' 37.9"N | 35° 0' 17.5"E | 101.2 |
| SS14 | 26° 7' 33.7"N | 35° 0' 16.8"E | 101.8 |

Prepared by: INTERGEO on behalf ASPROFOS 2022. *Above sea level

All collected soil samples were stored in cool condition. After the completion of field work the obtained surface soil samples were delivered in accredited laboratories, certified by EN ISO 17025, for the performance of chemical analyses including the following parameters: Residue at 105° C, Fraction sieved 2mm dry basis at 105° C , Heavy Metals (Sb, As, Be, Cd, Co, Cr, CrIV, Hg, Ni, Pb, Cu, Se, Sn, Tl, V, Zn), TPH index, PCBs and PAHs (Total PAH).

All chemical analyses results are presented in Appendix 2 - TABLE OF CHEMICAL ANALYSES.

Table A1- 2 Parameters tested in the obtained soil samples (residue and fraction 2 mm)

| Number of samples | Parameter |
|---|---|
| 14 | Heavy metals (Sb, As, Be, Cd, Co, Cr, CrIV, Hg, Ni, Pb, Cu, Se, Sn, Tl, V, Zn) according to EN ISO 11885, DIN EN ISO 12846, DIN EN 15192 and DIN EN ISO 17294-2 (E 29) |
| 14 | Total Petroleum Hydrocarbons (TPH) according to EN ISO 16573 |

| Number of samples | Parameter |
|---|---|
| 14 | Polycyclic Aromatic Hydrocarbons (PAH's) according to DIN ISO 18287 : 2006-05 |
| 14 | PCB's according to DIN EN 15308 |

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In addition, all collected surface soil samples were submitted to a fraction sieve analysis. A sieve analysis (or gradation test) is a procedure commonly used in civil engineering and it serve to assess the particle size distribution (also called gradation) of a granular material by allowing the material to pass through a series of sieves of progressively smaller mesh size and weighing the amount of material that is stopped by each sieve as a fraction of the whole mass.

The size distribution is often of critical importance to the way the material performs in use. A sieve analysis can be performed on any type of non-organic or organic granular materials including sands, crushed rock, clays, granite, feldspars, coal, soil, a wide range of manufactured powders, grain and seeds, down to a minimum size depending on the exact method. Being such a simple technique of particle sizing, it is probably the most common.

During sieving, the sample is subjected to horizontal or vertical movement in accordance with the chosen method, this causes a relative movement between the particles and the sieve. Depending on their size, the individual particles either pass through the sieve mesh or are retained on the sieve surface. The likelihood of a particle passing through the sieve mesh is determined by the ratio of the particle size to the sieve openings, the orientation of the particle and the number of encounters between the particle and the mesh openings.

#### 8A.1.3.2 Groundwater sampling- On site measurements

During the field work (02/06/2021) one (1) groundwater sample was collected from a private well in order to indicate groundwater current environmental condition. Both well and investigated plot are located within the same river basin (Eastern Crete streams whereupon groundwater sampling is representative.

The distance of the well from the boundaries of the investigated plot is approximately 1,780 m. The approximate geographic location of the well is shown in the attached Figure 3 (Appendix 1 - FIGURE).

The coordinates of the well are 26° 6' 33.4"N (Longitude) and 35° 1' 11.9"E (Latitude).

The sample was collected at ground level by a valve. The sampling was performed during the pumping of groundwater through a submersible electric pump that was installed inside the well casing.

The collection, conservation, storage and transportation of the collected groundwater sample took place according to specifications of the relevant standard EN ISO 5667-3 (General Information for Sample Recovery and Preservation).

The performance of on-site groundwater piezometric measurements was not possible due to sealed casing of the head of the well. However, according to data from the Special Secretariat for Water, groundwater piezometric level at the specific well is estimated >150m above sea level. Nevertheless, on-site physicochemical measurements on the collected groundwater sample took place

After the completion of field work the collected groundwater sample was submitted to a series of chemical analyses, presented in the Table A1- 3, below.

Table A1- 3 Parameters analysed in the groundwater sample collected from the private well

| Number of samples | Parameter |
|---|---|
| 1 | Heavy metals (Al, As, Be, , Cd, Co, Cr, CrIV, Cu,F, Fe, Li, Mn, Mo, Ni, Pb, , Se,V, Tl, Zn, Sb ,B, Hg) according to, DIN EN ISO 12846 and DIN EN ISO 17294-2 (E 29) |
| 1 | Total oil (TPH + TOG) according to EN ISO 9377-2 and DIN 38409-H56 |
| 1 | Polycyclic Aromatic Hydrocarbons (PAH's) according to DIN 38407-39 |
| 1 | Total coliforms according to(J.M.D. 1811/2011 and M.D 67322/2017 ) |
| 1 | BOD5, COD, according to ΕΛΟΤ EN ISO 15705 and BOD Sensor |
| 1 | TDS, according to ΕΛΟΤ EN 15216 |
| 1 | Sum TCE+PCE according to DIN EN ISO 10301 |
| 1 | TOC according to DIN EN 1484 |
| 1 | Anions according to EPA 325.1, EPA 375.4, DIN 38405 D9, EPA 340.3 and EN 1189 |

Prepared by: INTERGEO on behalf ASPROFOS, 2022.

### 8A.1.3.3 Soil and Groundwater legislation and standards

Currently, in Greece, there is no integrated legal framework setting up threshold values regarding soil or groundwater pollution. In the future the competent authorities will set up quality standards and

threshold values for a variety of parameters in the soil or the groundwater across a range of land uses.

A variety of provincial regulations exist within the European Union, setting limits for contaminants in soil and groundwater. In Germany, for example, each province has its own list for the tolerable concentration of various contaminants.

Currently, when the local environmental Authorities are involved in case of a contamination site, they generally refer to international accepted standards for the soil and groundwater. These are for example the New Dutch list standards[2] that are preferred by the local authorities due to the absence of relevant regulatory list in Greece.

According to the New Dutch List, the regulatory list, which is also valid in many European countries, two different values are given for the concentration of each pollutant as follows.

*Target value:* determines the average concentration (applicable only for groundwater)

*Intervention value:* determines the concentration above which the application of decontamination measures is compulsory (applicable for both soil and groundwater)

Recently, Greek Authorities adopted the limit concentrations regarding several organic or inorganic parameters, that are mentioned in the European Community decision 2003/33 (Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills pursuant to article 16 of Annex II of the Directive 1999/31/EC) and indicate the characterization of inert material/waste. The threshold limit concentration of TPH in the soil is 500 mg/Kg.

According to the New Dutch List, intervention values of metal contaminants, TPH, PAH's and PCB's in the soil are given in the following Table A1- 4.

Table A1- 4 Intervention values (New Dutch List) for metal contaminants in the soil

| Contaminant | Intervention Value (mg/kg) |
|---|---|
| Heavy metals | |
| Arsenic (As) | 76 |
| Cadmium (Cd) | 13 |
| Total Chromium (Cr) | 258 |
| Hexavalent Chromium (CrIV) | --- |
| Copper (Cu) | 190 |

[2] Ministerie van Volkshuisvesting (2013). Soil Remediation Circular 2013, version of 1st July 2013.

| Contaminant | Intervention Value (mg/kg) |
|---|---|
| Mercury (Hg) | 36 |
| Nickel (Ni) | 100 |
| Lead (Pb) | 530 |
| Zink (Zn) | 720 |
| Beryllium (Be) | 30 |
| Selenium (Se) | 100 |
| Vanadium (V) | 250 |
| Cobalt (Co) | 190 |
| Thallium (Tl) | 15 |
| Antimony (Sb) | 22 |
| Tin (Sn) | 900 |
| Total Petroleum Hydrocarbons (TPH) | 5000 |
| Sum PAHs | 40 |
| Sum 6 PCBs | 1 |

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In addition, it has to be noted that, for groundwater pollution the current Greek legal framework (J.M.D 1811/22-12-2011) sets up threshold limits for a variety of organic or inorganic parameters (see Table A1- 5).

Table A1- 5 Quality standards and threshold limits of contaminants in the groundwater according to J.M.D 1811/2011

| PART A | |
|---|---|
| Contaminant | Quality standards for Groundwater |
| Nitrates (NO3-) | 50 mg/l |
| Pesticides active substances | 0,1 μg/l<br>0,5 μg/l (total) |
| PART B | |
| Parameter | Threshold limit |
| pH | 6.50 – 9.50 |
| Electrical Conductivity (EC) | 2,500 μS/cm |
| Arsenic (As) | 10 μg/l |

| | |
|---|---|
| Cadmium (Cd) | 5 µg/l |
| Lead (Pb) | 25 µg/l |
| Mercury (Hg) | 1.0 µg/l |
| Nickel (Ni) | 20 µg/l |
| Chromium total (Cr) | 50 µg/l |
| Aluminum (Al) | 200 µg/l |
| Ammonium ($NH_4^+$) | 0.50 mg/l |
| Nitrite ($NO_2^-$) | 0.50 mg/l |
| Chloride ($Cl^-$) | 250 mg/l |
| Sulfates ($SO_4^{2-}$) | 250 mg/l |
| Sum of Trichloroethylene and Tetrachloroethylene | 10 µg/l |

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Moreover, current active legislation (M.D. 67322/2017) concerning the quality of water for Human consumption (Irrigation, water supply, industrial use, etc.) sets up threshold limits for a variety of organic or inorganic parameters (see Table A1- 6).

Table A1- 6 Threshold limits in Human consumption water according to M.D 67322/2017

| Parameter | Threshold limit |
|---|---|
| Iron (Fe) | 200 µg/l |
| Manganese (Mn) | 50 µg/l |
| Antimony (Sb) | 5 µg/l |
| Boron (B) | 1.0 mg/l |
| Copper (Cu) | 2.0 mg/l |
| Arsenic (As) | 10 µg/l |
| Selenium (Se) | 10 µg/l |
| Cadmium (Cd) | 5 µg/l |
| Lead (Pb) | 10 µg/l |
| Mercury (Hg) | 1.0 µg/l |
| Nickel (Ni) | 20 µg/l |
| Chromium total (Cr) | 50 µg/l |
| Aluminum (Al) | 200 µg/l |
| Chloride ($Cl^-$) | 250 mg/l |

| Parameter | Threshold limit |
|---|---|
| Sulfates ($SO_4^{2-}$) | 250 mg/l |
| Nitrate ($NO_3^-$) | 50 mg/l |
| Dissolved Hydrocarbons – Oil grease | 10 μg/l |
| PAHs | 0.1 μg/l |
| Sum of Trichloroethylene and Tetrachloroethylene | 10 μg/l |
| pH | 6.50 – 9.50 |
| Electrical Conductivity (EC) | 2,500 μS/cm |
| Escherichia coli (E. coli) | 0/100 ml |
| Coliform bacteria | 0/100 ml |

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New Dutch List value limits (Target and Intervention values) regarding a variety of organic or inorganic parameters are shown in following Tables (Table A1- 7- Table A1- 10)

Table A1- 7 Limit Values (New Dutch List) of heavy metals in the groundwater

| Parameter | Target Value (μg/l) | Intervention Value (μg/l) |
|---|---|---|
| Arsenic (As) | 10 | 60 |
| Cadmium (Ca) | 0.4 | 6 |
| Copper (Cu) | 15 | 75 |
| Chromium (Cr) | 1 | 30 |
| Mercury (Hg) | 0.05 | 0,3 |
| Nickel (Ni) | 15 | 75 |
| Lead (Pb) | 15 | 75 |
| Zinc (Zn) | 65 | 800 |
| Barium (Ba) | 50 | 625 |
| Molybdenum (Mo) | 5 | 300 |
| Vanadium (V) | 1.2 | 70 |

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Table A1- 8 Limit Values (New Dutch List) of Total Petroleum Hydrocarbons in the groundwater

| Parameter | Target Value (μg/l) | Intervention Value (μg/l) |
|---|---|---|
| TPH | 0.05 | 0.6 |

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Table A1- 9 Limit Values (New Dutch List) of Polycyclic Aromatic Hydrocarbons (PAHs) concentration in the groundwater

| PAH | Target Value (µg/l) | Intervention Value (µg/l) |
|---|---|---|
| Naphthalene | 0.1 | 70 |
| Acenaphthylene | -- | -- |
| Acenaphthene | -- | -- |
| Fluorene | -- | -- |
| Phenanthrene | 0.03 | 5 |
| Anthracene | 0.02 | 5 |
| Fluoranthene | -- | -- |
| Pyrene | -- | -- |
| Benzo(a)anthracene | 0.002 | 0.5 |
| Chrysene | 0.002 | 0.05 |
| Benzo(b)fluoranthene | -- | -- |
| Benzo(k)fluoranthene | 0.001 | 0.05 |
| Benzo(a)pyrene | 0.001 | 0.5 |
| Dibenzo(ghi)perylene | -- | -- |
| Benzo(ghi)perylene | 0.0002 | 0.05 |
| Indeno(1,2,3-cd)pyrene | 0.0004 | 0.05 |

Prepared by: INTERGEO on behalf ASPROFOS, 2022.

Table A1- 10 Limit Values (New Dutch List) of Volatile Organic Compounds (VOCs) in the groundwater

| VOC | Target Value (µg/l) | Intervention Value (µg/l) |
|---|---|---|
| Benzene | 0.2 | 30 |
| Ethylbenzene | 0.2 | 150 |
| Toluene | 0.2 | 1000 |
| Xylene | 0.2 | 70 |
| Vinil cloride | -- | 0.7 |
| Dichloromethane | 0.001 | 1000 |
| Dichoroethene, trans | 0.01 | 20 |
| Dichoroethene, cis | 0.01 | 20 |

| | | |
|---|---|---|
| 1,2 Dichoroethane | 0.01 | 400 |
| Trichloromethane | 0.01 | 400 |
| 1,1,1-Trichloroethane | 0.01 | 40 |
| Trichloroethene | 0.01 | 500 |
| Tetrachloromethane | 0.01 | 10 |
| Tetrachloroethane | 0.01 | 40 |

Prepared by: INTERGEO on behalf ASPROFOS, 2022.

### 8A.1.4 CHEMICAL ANALYSES RESULTS

After the completion of field work the collected surface soil and groundwater samples were delivered in accredited laboratories, certified by EN ISO 17025, for the performance of a series of chemical analyses.

#### 8A.1.4.1 Surface soil samples

##### *8A.1.4.1.1 Heavy metals*

Fourteen (14) surface soil samples were tested according to EN ISO 11885, DIN EN ISO 12846, DIN EN ISO 15192 and DIN EN ISO 17294-2 (E 29) Standard Methods to define their concentration in selected Heavy Metals (Sb, As, Be, Cd, Co, Cr, $Cr^{IV}$, Hg, Ni, Pb, Cu, Se, Sn, Tl, V, Zn). The Standard Methods applied for the determination of each metal are shown in the table of chemical analysis results in Appendix 2- TABLE OF CHEMICAL ANALYSES

Not significant heavy metals concentration was recorded in the examined surface soil samples compared to the New Dutch List intervention values. The concentration of 15 Heavy metals parameters and more specifically of Antimony (Sb), Arsenic (As), Cadmium (Cd), Beryllium (Be), Lead (Pb), Total Chromium (Cr), Nickel (Ni), Vanadium (V), Cobalt (Co), Copper (Cu), Zink (Zn), Thallium (Tl), Cobalt (Co), Tin (Sn) and Selenium (Se) in all of the examined surface soil samples was below the intervention value of the New Dutch List. Regarding Hexavalent Chromium ($Cr^{IV}$) the concentrations ranged between non detectable values (<0,1 mg/Kg) and 0,8 mg/Kg. Currently, in the New Dutch List is not mentioned any intervention value regarding Hexavalent Chromium ($Cr^{IV}$).

Table A1- 11 shows the range of the recorded concentrations of heavy metals in the examined soil samples:

Table A1- 11 Range of the recorded concentrations of heavy metals in the examined surface soil samples

| Heavy metal parameter | Number of examined samples | Intervention Value (mg/kg) | Detection limit (mg/l) | Minimum concentration (mg/kg) | Maximum concentration (mg/kg) | Number of samples exceeding intervention value of NDL |
|---|---|---|---|---|---|---|
| Arsenic (As) | 14 | 76 | 0.8 | 4.5 | 6.2 | -- |
| Cadmium(Cd) | 14 | 13 | 0.2 | n.d. | 0.3 | -- |
| Chromium(Cr) | 14 | 258 | 1.0 | 23 | 59 | -- |
| Copper (Cu) | 14 | 190 | 1.0 | 6 | 16 | -- |
| Mercury (Hg) | 14 | 36 | 0.05 | 0.06 | 0.11 | -- |
| Nickel (Ni) | 14 | 100 | 1.0 | 26 | 67 | -- |
| Lead (Pb) | 14 | 530 | 2.0 | 7 | 13 | -- |
| Zink (Zn) | 14 | 720 | 2.0 | 22 | 42 | -- |
| Beryllium (Be) | 14 | 30 | 1.0 | n.d. | n.d. | -- |
| Selenium (Se) | 14 | 100 | 2.0 | n.d. | n.d. | -- |
| Vanadium (V) | 14 | 250 | 3.0 | 22 | 46 | -- |
| Cobalt (Co) | 14 | 190 | 3.0 | 5.6 | 13 | -- |
| Thallium (Tl) | 14 | 15 | 2.0 | n.d. | 0.2 | -- |
| Antimony (Sb) | 14 | 22 | 2.0 | n.d. | n.d. | -- |
| Tin (Sn) | 14 | 900 | 1.0 | n.d. | n.d. | -- |

Prepared by: INTERGEO on behalf ASPROFOS, 2022. n.d.: not detected NDL: New Dutch List

All heavy metals analyses results are presented in Appendix 2 - TABLE OF CHEMICAL ANALYSES

#### *8A.1.4.1.2 Total Petroleum Hydrocarbons (TPH) and Polycyclic Aromatic Hydrocarbons (PAHs)*

Fourteen (14) collected soil surface samples were tested to define the concentration of TPH and PAHs according to EN ISO 16703 and DIN ISO 18287 Standard Methods, respectively.

According to the New Dutch List, intervention values regarding Total Petroleum Hydrocarbons and sum PAHs concentration in the soil are set to 5000 mg/Kg and 40 mg/Kg, respectively.

Furthermore, a variety of provincial regulations exist within the European Union, setting limits for contaminants in the soil. In Germany, for example, each province has its own list for the tolerable

concentration of (total) mineral oil hydrocarbons. The limit concentration for TPH varies between 300 and 1,000 mg/kg, with a dominantly accepted maximum tolerable concentration of 500 mg/kg. Moreover, according to the European Community decision 2003/33, (Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC) the threshold limit concentration of TPH in the soil is 500 mg/Kg.

The range of concentrations in the collected surface soil samples for the parameters of TPH and sum PAH's are presented in the following Table A1- 12

Table A1- 12 Range of concentrations in the collected surface soil samples for the parameters of TPH and PAHs

| Parameter | New Dutch list | European Community decision 2003/33 limit values | Detection limit (mg/Kg) | Range of concentrations (mg/Kg) |
|---|---|---|---|---|
| | Intervention Value (mg/Kg) | Threshold limit (mg/Kg) | | |
| Sum PAHs | 40 | - | 0.05 | n.d. |
| TPH | 5,000 | 500 | 50 | n.d.-88 |

Prepared by: INTERGEO on behalf ASPROFOS, 2022. n.d.: not detected

According to the chemical analysis results, both threshold limit of 500 mg/Kg (European Community decision 2003/33) and NDL intervention value of 5.000 mg/Kg were not exceeded in all analyzed surface soil samples (see Appendix 2- TABLE OF CHEMICAL ANALYSES).

Moreover, in all analyzed surface soil samples the concentration of PAH's was found in non-detectable levels (see Appendix 2- TABLE OF CHEMICAL ANALYSES).

#### *8A.1.4.1.3 PCBs*

All collected surface soil samples (14) were analyzed for their concentration in six (6) PCBs and more specifically PCB (28), PCB (52), PCB (101), PCB (118), PCB (138), PCB (153) and PCB (180) according to DIN EN 15308 standard method.

According to the New Dutch List, the intervention value regarding sum of PCBs contaminants in the soil is given in the following Table A1- 13.

Table A1- 13 Limit Values (New Dutch List) for sum PCBs in the soil

| Parameter | Detection limit(mg/kg) | Intervention Value (mg/kg) |
|---|---|---|
| Sum 6 PCBs | 0.01 | 1 |

Prepared by INTERGEO on behalf ASPROFOS, 2022.

The results of the performed analyses did not show any contamination of PCBs in the examined surface soil samples. All concentrations remained in not detectable level. The analyses results are presented in Appendix 2- TABLE OF CHEMICAL ANALYSES

#### *8A.1.4.1.4 Fraction sieve analysis*

Sieve analyses results in the collected surface soil samples are presented in the following Table A1-14

Table A1- 14 Sieve analysis in the collected surface soil samples

| Surface sample No | Cobles (%) | Sand (%) | Silt-Clay (%) | Clay (%) |
|---|---|---|---|---|
| Ss1 | 2 | 20 | 74 | 4 |
| Ss2 | -- | 16 | 73 | 6 |
| Ss3 | -- | 22 | 75 | 3 |
| Ss4 | -- | 17 | 78 | 5 |
| Ss5 | 4 | 19 | 70 | 7 |
| Ss6 | -- | 21 | 79 | -- |
| Ss7 | -- | 23 | 72 | 5 |
| Ss8 | 6 | 20 | 70 | 4 |
| Ss9 | -- | 14 | 82 | 4 |
| Ss10 | -- | 25 | 68 | 7 |
| Ss11 | 5 | 19 | 70 | 6 |
| Ss12 | 4 | 18 | 74 | 4 |
| Ss13 | 5 | 22 | 70 | 3 |
| Ss14 | -- | 18 | 80 | 2 |

Prepared by INTERGEO on behalf ASPROFOS, 2022.

### 8A.1.4.2 Groundwater sample

After the completion of field work the collected groundwater sample was analysed in order to evaluate concentrations for the following parameters: Anions (Cl, PO4, Nitrate, Sulfate), Metals (Al, As, Be, Cd, Co, Cr, $Cr^{IV}$, Cu, F, Fe, Li, Mn, Mo, Ni, Pb, Se, V, Tl, Zn, Sb, B, Hg), Total oil (TPH and animal and vegetable oil and fat), PAHs (Total PAH), Total coliforms, BOD5, total COD, TDS, TOC, Sum of Trichloroethylene and Tetrachloroethylene.

The results of the performed chemical analyses in the collected groundwater sample as well as an evaluation of its quality in comparison with the above mentioned relevant limit values are presented in the following paragraphs.

#### *8A.1.4.2.1 Heavy metals*

The regulatory limit values of the New Dutch List and the relevant Greek legislation (J.M.D. 1811/2011) regarding groundwater quality were compared to the findings of the conducted chemical analyses in order to evaluate possible impacted by heavy metals. One (1) groundwater sample was tested according to DIN EN ISO 17294-2 (E-29) and EN ISO 12846 Standard Methods in order to define the concentration of the following heavy metals: Al, As, Be, Cd, Co, Cr, $Cr^{IV}$, Cu, Fe, Li, Mn, Mo, Ni, Pb, Se, V, Tl, Zn, Sb, Hg).

Following Table A1- 15 shows the limit values of New Dutch List and relevant Greek legislation (J.M.D. 1811/2011) regarding tested heavy metals as well as range of recorded concentrations in the obtained groundwater sample.

Table A1- 15 Limit Values (New Dutch List and Greek Legislation) of heavy metals in the groundwater and range of recorded concentrations

| Heavy metal | Target Value (NDL) (µg/L) - Shallow | Intervention Value (NDL) (µg/L) | Greek legislation (M.D. 1811/2011) limit Values (µg/L) | Limit of quantification (µg/L) | Private Well (µg/L) |
|---|---|---|---|---|---|
| Aluminium (Al) | - | - | 200 | 20 | n.d. |
| Arsenic (As) | 10 | 60 | 10 | 1 | n.d. |
| Antimony (Sb) | - | 20 | - | 0.5 | n.d. |
| Beryllium (Be) | - | 15 | - | 5 | n.d. |
| Lead (Pb) | 15 | 75 | 25 | 1 | n.d. |

| Heavy metal | Target Value (NDL) (µg/L) - Shallow | Intervention Value (NDL) (µg/L) | Greek legislation (M.D. 1811/2011) limit Values (µg/L) | Limit of quantification (µg/L) | Private Well (µg/L) |
|---|---|---|---|---|---|
| Cadmium (Cd) | 0.4 | 6 | 5 | 0.1 | n.d. |
| Chromium (Cr) | 1 | 30 | 50 | 1 | 3 |
| Hexavalent Cr (IVCR) | - | - | - | 0.1 | n.d. |
| Iron (Fe) | - | - | - | 10 | n.d. |
| Cobalt (Co) | 20 | 100 | - | 5 | n.d. |
| Copper (Cu) | 15 | 75 | - | 5 | n.d. |
| Lithium (Li) | - | - | - | 5 | n.d. |
| Manganese (Mn) | - | - | - | 5 | n.d. |
| Molybdenum (Mo) | 5 | 300 | | 5 | n.d. |
| Nickel (Ni) | 15 | 75 | 20 | 5 | n.d. |
| Mercury (Hg) | - | - | 1 | 0.1 | n.d. |
| Selenium (Se) | - | 160 | - | 1 | n.d. |
| Thalium (Tl) | - | 70 | - | 0.2 | n.d. |
| Vanadium (V) | - | 70 | - | 4 | n.d. |
| Zinc (Zn) | 65 | 800 | - | 10 | 10 |

Prepared by INTERGEO on behalf ASPROFOS, 2022.

Based on the heavy metal analyses results, the concentrations ranged between low and non-detectable levels remaining below the target and intervention values of New Dutch List as well as limit values of the relevant Greek legislation (J.M.D. 1811/2011). Consequentially, not any inorganic contamination by heavy metals was recorded in the collected groundwater sample of the study area.

#### *8A.1.4.2.2 Total Petroleum Hydrocarbons (TPH)*

As part of the performed investigation, one (1) groundwater sample was analyzed according to EN ISO 9377-2 standard method in order to define its Total Petroleum Hydrocarbons (TPH)

concentration. The limit values of the New Dutch List regarding groundwater quality (0.05 and 0.1 µg/l for target and intervention value, respectively) were compared to the findings of the conducted chemical analysis in order to evaluate possible organic impacted by TPH.

According to the chemical analysis results, the parameter of TPH in the collected groundwater sample was found in non-detectable concentrations (<0.1 mg/l). Consequently, no organic groundwater contamination by Total Petroleum Hydrocarbons (TPH) was recorded in the collected groundwater sample of the study area.

The analysis result is presented in Appendix 2- TABLE OF CHEMICAL ANALYSES

#### *8A.1.4.2.3 Polycyclic Aromatic Hydrocarbons (PAHs)*

The collected groundwater sample was analysed according to DIN 38407-39 Standard Method for its concentration in Polycyclic Aromatic Hydrocarbons (PAHs).

Table A1- 16, below, show the limit values of New Dutch List concerning Polycyclic Aromatic Hydrocarbons (PAHs) in the groundwater as well as the range of recorded concentrations in the obtained groundwater sample.

Table A1- 16 Limit Values (New Dutch List) of Polycyclic Aromatic Hydrocarbons (PAHs) in the groundwater and range of recorded concentrations

| Parameter | New Dutch List Target value (NDL) (µg/l) | New Dutch List Intervention value (NDL) (µg/l) | Private well (µg/l) |
|---|---|---|---|
| Naphthalene | 0.1 | 70 | n.d. |
| Acenaphthylene | -- | - | n.d. |
| Acenaphthene | -- | - | n.d. |
| Fluorene | -- | - | n.d. |
| Phenanthrene | 0.03 | 5 | n.d. |
| Anthracene | 0.02 | 5 | n.d. |
| Fluoranthene | -- | 1 | n.d. |
| Pyrene | -- | - | n.d. |
| Benz(a)anthracene | 0.002 | 0.5 | n.d. |
| Chrysene | 0.002 | 0.2 | n.d. |

| | | | |
|---|---|---|---|
| Benzo(b)fluoranthene | -- | - | n.d. |
| Benzo(k)fluoranthene | 0.001 | 0.05 | n.d. |
| Benzo(a)pyrene | 0.001 | - | n.d. |
| Dibenzo(a,h)anthracene | -- | - | n.d. |
| Benzo(g,h,i)perylene | 0.0002 | 0.05 | n.d. |
| Indeno(1,2,3-cd)pyrene | 0.0004 | 0.05 | n.d. |
| Sum PAH (16 EPA) | - | - | n.q. |

Prepared by INTERGEO on behalf ASPROFOS, 2022. n.d.: not detected / n.q.: not quantified

According to the chemical analyses results the concentration of PAHs remained at non- detectable levels. Hence, no organic groundwater contamination by Polycyclic Aromatic Hydrocarbons (PAHs) was recorded in the collected groundwater sample of the study area.

All PAHs chemical analyses results are presented in Appendix 2- TABLE OF CHEMICAL ANALYSES

#### *8A.1.4.2.4 Volatile Organic Compounds (VOCs) – Sum TCE and PCE*

The collected groundwater sample was analyzed according to DIN 38407-39 Standard Method for its concentration in Volatile Organic Compounds (VOCs) and more specifically for the parameters of Trichloroethene (TCE) and Tetrachloroethylene (PCE).

Table A1- 17, below, show the limit values of New Dutch List and relevant Greek legislation (M.D. 1811/2011) for Trichloroethene (TCE) and Tetrachloroethylene (PCE) in the groundwater as well as the range of recorded concentrations in the obtained groundwater sample.

Table A1- 17 Limit Values (New Dutch List and Greek Legislation) of specific Volatile Organic Compounds (VOCs) in the groundwater and range of recorded concentrations

| Parameter | Greek legislation (M.D. 1811/2011) limit Values (µg/L) | New Dutch List Target value (NDL) (µg/L) | New Dutch List Intervention value (NDL) (µg/L) | Private well (µg/L) |
|---|---|---|---|---|
| Trichloroethene (TCE) | - | 24 | 500 | n.d. |
| Tetrachloroethene (PCE) | - | 0.01 | 40 | 1.4 |
| Sum TCE + PCE | 10 | - | - | 1.4 |

Prepared by INTERGEO on behalf ASPROFOS, 2022. n.d.: not detected

Based on the results of the chemical analyses regarding the concentration on TCE and PCE, no organic groundwater contamination, by Volatile Organic Compounds (VOC's) was recorded in the collected groundwater sample of the study area.

All concentrations were lower than the intervention value of New Dutch List as well as the limit value of the relevant Greek legislation. All VOCs chemical analyses results are presented in Appendix 2-TABLE OF CHEMICAL ANALYSES

#### *8A.1.4.2.5 Oil and Grease*

The collected groundwater sample was analysed according to DIN 38409-56 Standard Method for its concentration in Oil and Grease.

Table A1- 18, below, show the limit values of relevant Greek legislation (M.D. 67322/2017) for Oil and Grease as well as recorded concentration in the obtained groundwater sample.

Table A1- 18 Threshold limit of relevant Greek legislation (M.D. 67322/2017) and recorded concentration for Oil and Grease in the analyzed groundwater sample

| Parameter | Threshold limit (M.D 67322/2017 ) | Private well |
|---|---|---|
| Oil and Grease | 10 μg/l | <10 |

Prepared by INTERGEO on behalf ASPROFOS, 2022.

According to chemical analyses results Oil and Grease was found in non-detectable concentrations (<10 mg/l) remaining below the threshold limit regarding quality of water for human consumption referred in M.D. 67322/2017.

#### *8A.1.4.2.6 Anions-Microbiological*

Based on the results of the chemical analyses regarding anions parameters, all concentrations, remained in the normal range values according to relevant local legal framework (J.M.D. 1811/2011 and M.D. 67322/2017).

Table A1- 19, below, show the limit values of the relevant Greek legislations (J.M.D. 1811/2011 and M.D 67322/2017) for anions and microbiological parameters in the groundwater as well as the range of recorded concentrations in the obtained groundwater sample.

Table A1- 19 Limit values (Greek Legislation) of specific Volatile Organic Compounds (VOCs) in the groundwater and range of recorded concentrations

| Parameter | Threshold Limit (J.M.D. 1811/2011 and M.D 67322/2017 ) | Private well |
|---|---|---|
| Chloride ($Cl^-$) | 250 mg/l | 230 mg/l |
| Sulfates ($SO_4^{2-}$) | 250 mg/l | 46 mg/l |
| Nitrate ($NO_3^-$) | 50 mg/l | 6.6 mg/l |
| Total Coliforms | 0 cfu/100ml | n.d. |
| Escherichia coli (E. coli) | 0 cfu/100ml | n.d. |

Prepared by INTERGEO on behalf ASPROFOS, 2022.

As far as microbiological analyses results are concerned the coliform bacteria and Escherichia coli were found in non-detectable concentrations remaining below the threshold limits regarding quality of water for human consumption referred in M.D. 67322/2017.

#### *8A.1.4.2.7 Water quality parameters*

The recorded concentrations regarding water quality parameters (COD, BOD, TOC and TDS) in the collected groundwater sample are presented in the following Table A1- 20

Table A1- 20 Recorded concentrations of quality parameters in groundwater

| Parameter | Private well (mg/l) |
|---|---|
| Chemical Oxygen Demand (COD) | n.d. |
| Biochemical Oxygen Demand ($BOD_5$) | n.d. |
| Total Dissolved Solids (TDS) | 600 |
| Total Organic Carbon (TOC) | 33 |

Prepared by INTERGEO on behalf ASPROFOS, 2022.

#### *8A.1.4.2.8 On site measurements*

The results of the on-site physicochemical measurements that took place on the collected groundwater sample are presented in the following Table A1- 21.

Table A1- 21 Physicochemical measurements on the collected groundwater sample (02/06/2021)

| No | Electrical Conductivity (µS/cm) | Temperature ($^0$C) | pH | Dissolved $O_2$ (mg/l) | Organoleptical observation |
|---|---|---|---|---|---|
| Well | 1.280 | 19.0 | 8.1 | 8.2 | No smell |

Prepared by INTERGEO on behalf ASPROFOS, 2022.

Concerning the performed on-site measurements the following conclusion can be drown:

Regarding the measurement of pH, the collected groundwater sample value of 8.1 was found within the usual range values for the groundwater (6.5-9.5). The value of 8.2 mg/l for the dissolved oxygen was found within the expected range values considering the oxygen solubility in water at various temperatures. In addition, the value of Electrical Conductivity of the groundwater sample was found relatively low (1.280 µS/cm), showing low concentrations of inorganic salts, below the threshold limit value of 2500 µS/cm referred in relevant legislation regarding groundwater quality (J.M.D 1811/22-12-2011).Temperature was found in normal range expected at the specific time period. Moreover, according to organoleptic observation, no smell of any organic volatile pollutant was recorded in the obtained groundwater sample.

### 8A.1.5 INTERPRETATION OF THE RESULTS

The objective of the proposed soil sampling program was to investigate the area of interest in order to initially detect any potential surface (0-0.3m depth) soil contamination and, if this is the case, to obtain an overall indication of its type and vertical extent.

In addition, one (1) groundwater sample was collected from a private well located within the same river basin in order to indicate groundwater current environmental condition.

Based on the results of the environmental assessment, the following synoptic conclusions could be drawn:

Surface soil

Based on the performed chemical analyses results the condition of surface soil in the investigated plot is considered as satisfactory. No organic or inorganic contamination was recorded in all analysed

surface soil samples. Concentration of all tested parameters remained below the intervention value of the New Dutch List.

More specifically, regarding heavy metals, not any significant concentration was recorded. Concentrations of 15 Heavy metals parameters (Sb, As, Be, Cd, Co, Cr, Hg, Ni, Pb, Cu, Se, Sn, Tl, V, Zn) in all of the examined surface soil samples remained below the intervention value of the New Dutch List. Regarding Hexavalent Chromium ($Cr^{IV}$) the concentrations ranged between non detectable values (<0.1 mg/Kg) and 0,8 mg/Kg. Currently, in the New Dutch List is not mentioned any intervention value regarding Hexavalent Chromium ($Cr^{IV}$).

In addition, concerning TPH concentration, both threshold limit of 500 mg/Kg (European Community decision 2003/33) and NDL intervention value of 5.000 mg/Kg were not exceeded in all analysed surface soil samples.

Finally, in all analysed surface soil samples the concentration of PAHs and PCBs was found in non-detectable levels (see Appendix 2- TABLE OF CHEMICAL ANALYSES)

## Groundwater

Based on the performed chemical analyses results, **no organic or inorganic contamination was recorded** in the collected groundwater sample of the study area.

More specifically, based on the heavy metal analyses results, the concentrations ranged between low and non-detectable levels remaining below the target and intervention values of New Dutch List as well as the limit values of the relevant Greek legislation (M.D. 1811/2011).

In addition, both TPH and PAHs concentrations were found in non-detectable levels. Moreover, regarding tested VOCs parameters (TCE and PCE), detected concentrations remained lower than the intervention value of New Dutch List as well as the limit value of the relevant Greek legislation.

Based on the results of the chemical analyses regarding anions parameters, all concentrations, remained in the normal range values according to relevant local legal framework (M.D. 1811/2011 and M.D. 67322/2017).

Moreover, according to chemical analyses results, Oil and Grease was found in non-detectable concentrations (<10 mg/l) remaining below the threshold limit regarding quality of water for human consumption referred in M.D. 67322/2017.

Finally, the coliform bacteria and Escherichia coli were found in non-detectable concentrations remaining below the threshold limits regarding quality of water for human consumption referred in M.D. 67322/2017.

### 8A.1.6 SUGGESTED FURTHER ACTIONS

Taking under consideration that:

- Coastline is located at a distance of approximately 0.5 km from the plot;
- no previous industrial activities took place within the investigated plot;
- the broader area of investigation is mainly covered by Agricultural land (Olive groves and sparsely vegetated areas) as well as semi-forest natural areas (Sclerophyllous vegetation and natural grasslands);
- in a radius of 5 Km distance from the investigated plot, no Natura 2000 as well as other national network of protected or/and ecologically sensitive area is located;
- no water streams are located in the vicinity of the investigated area;
- main aquifer in the broader area of investigation is consisted of conglomerates and clastic-Marly or biogenic reef limestones characterized as an extended and low yield aquifer;
- No groundwater wells were detected within or in the immediate vicinity of the investigated plot, during the on-site visit;
- The depth of the aquifer within the investigated plot is estimated approximately > 100m below ground surface (sea level),

the environmental sensitivity of the study area is estimated as low to moderate.

Both current environmental sensitivity of the study area and absence of any contamination load in the surface soil render the plot suitable for the implementation of any future industrial use.

Finally, considering that no groundwater wells were detected within or in the immediate vicinity of the investigated plot, at this time, not any future periodic monitoring of groundwater quality is recommended.

**I.N T E R G E O**

**Environmental Technology**

**Kostantinos Gantzidis** **Dr. Christos Vatseris**

# Appendix 1 FIGURES


Figure 1 Geographic location of the investigated plot at Lasithi, Crete


Figure 2 Satelite view of the investigated plot at Lasithi, Crete


Figure 3 Approximate geographic location of the existing private well at Lasithi Crete

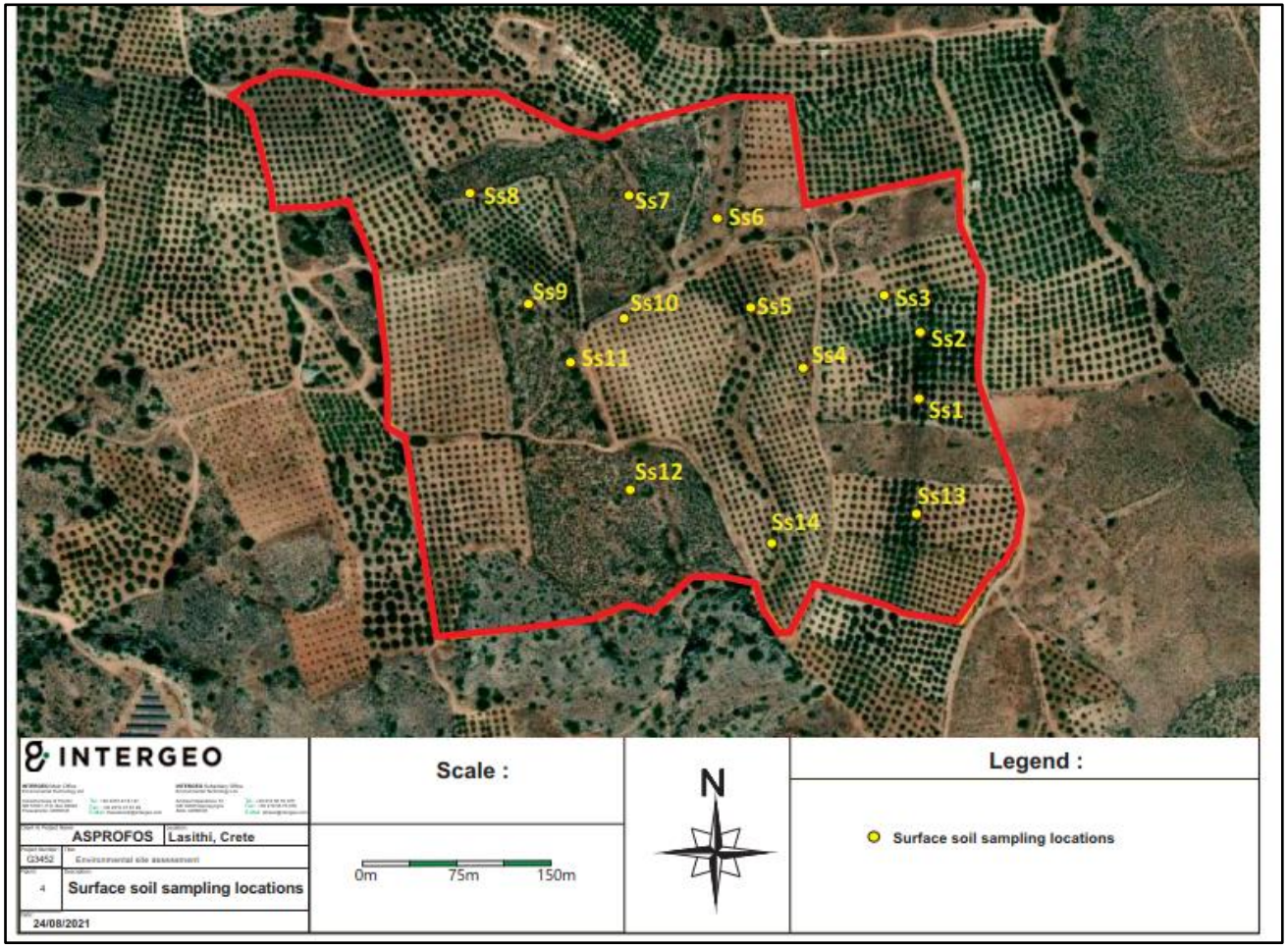


Figure 4 Surface soi sampling locations at the investigated plot in Lasithi, Crete

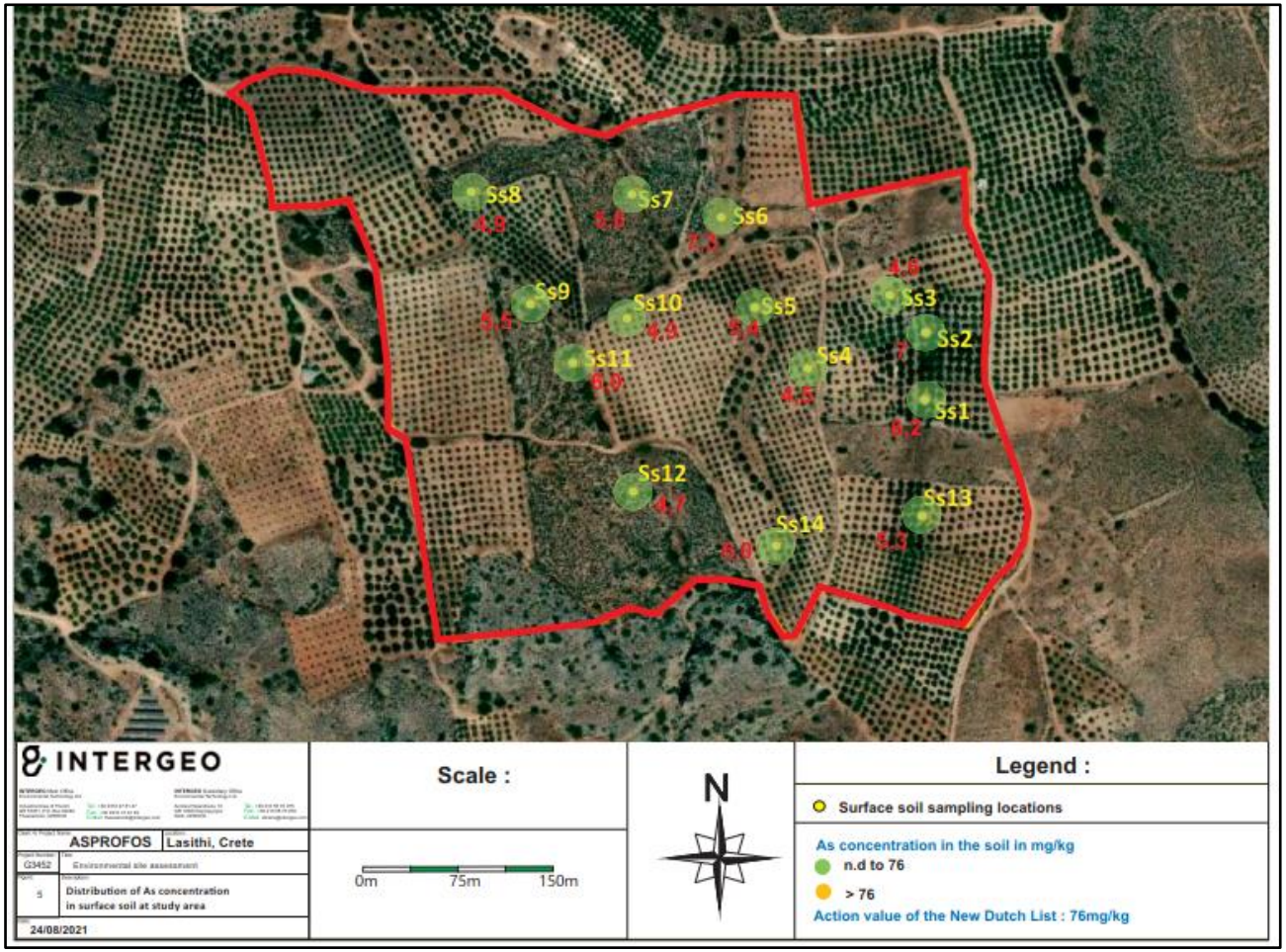


Figure 5 Distribution of As concentration in surface soil at the investigated plot at Lasithi, Crete

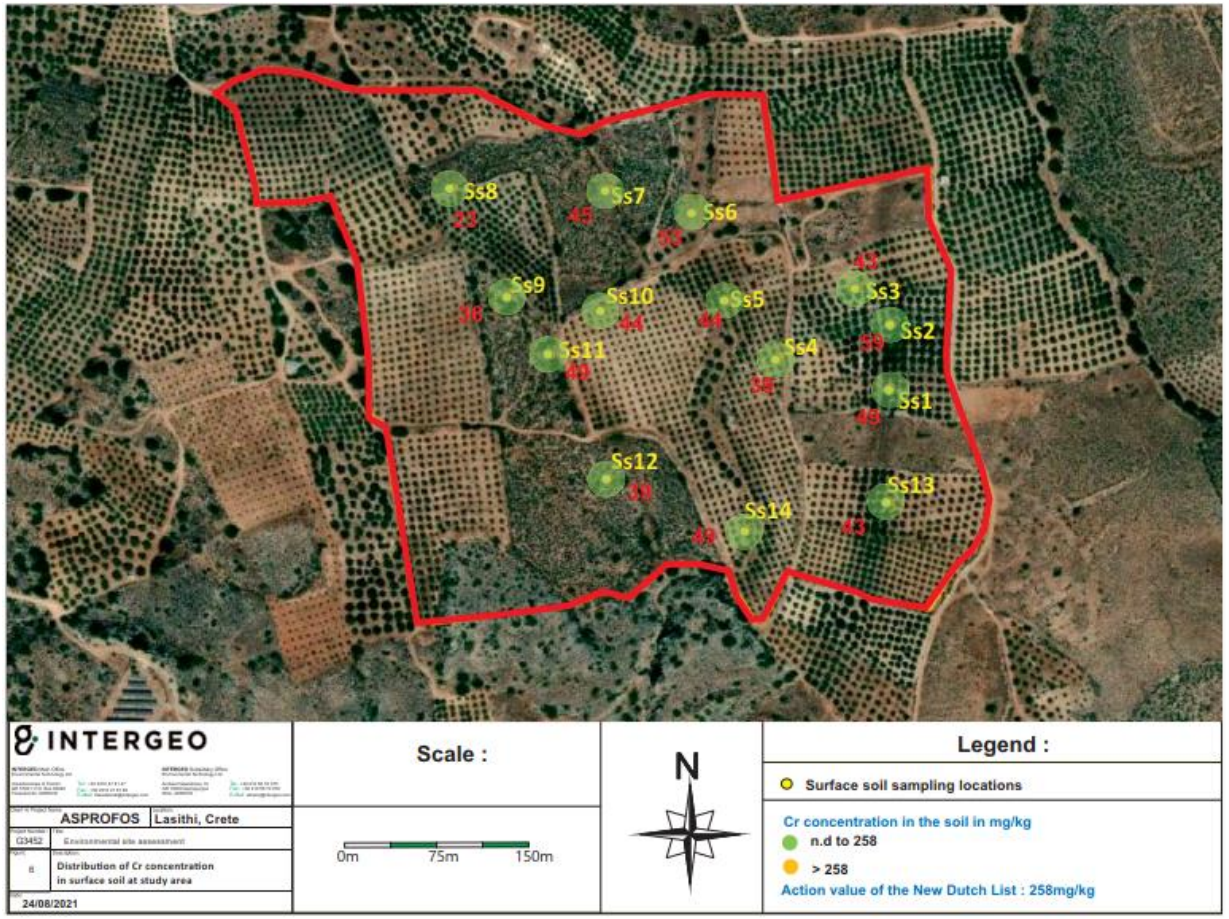


Figure 6 Distribution of Cr concentration in surface soil at the investigated plot at Lasithi, Crete

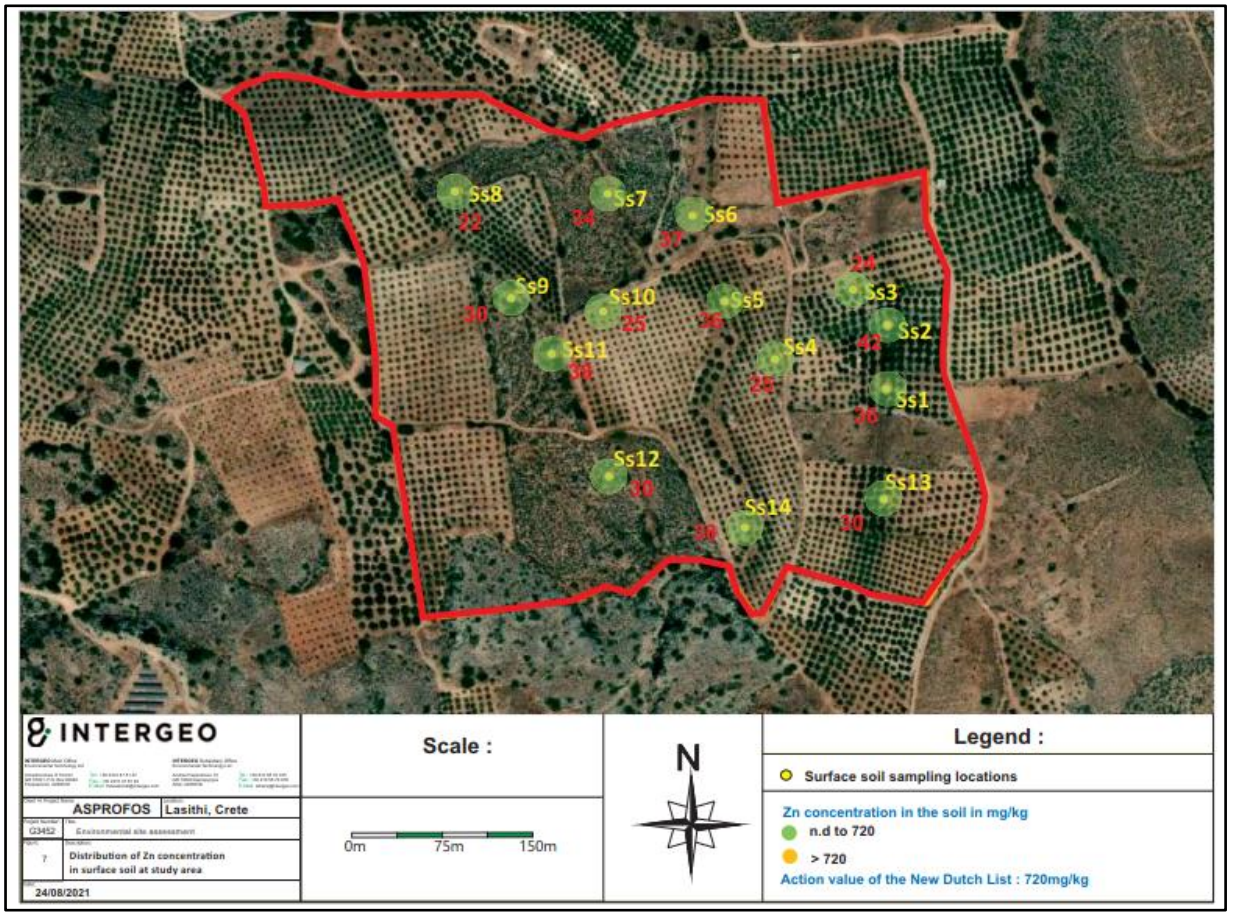


Figure 7 Distribution of Zn concentration in surface soil at the investigated plot at Lasithi, Crete

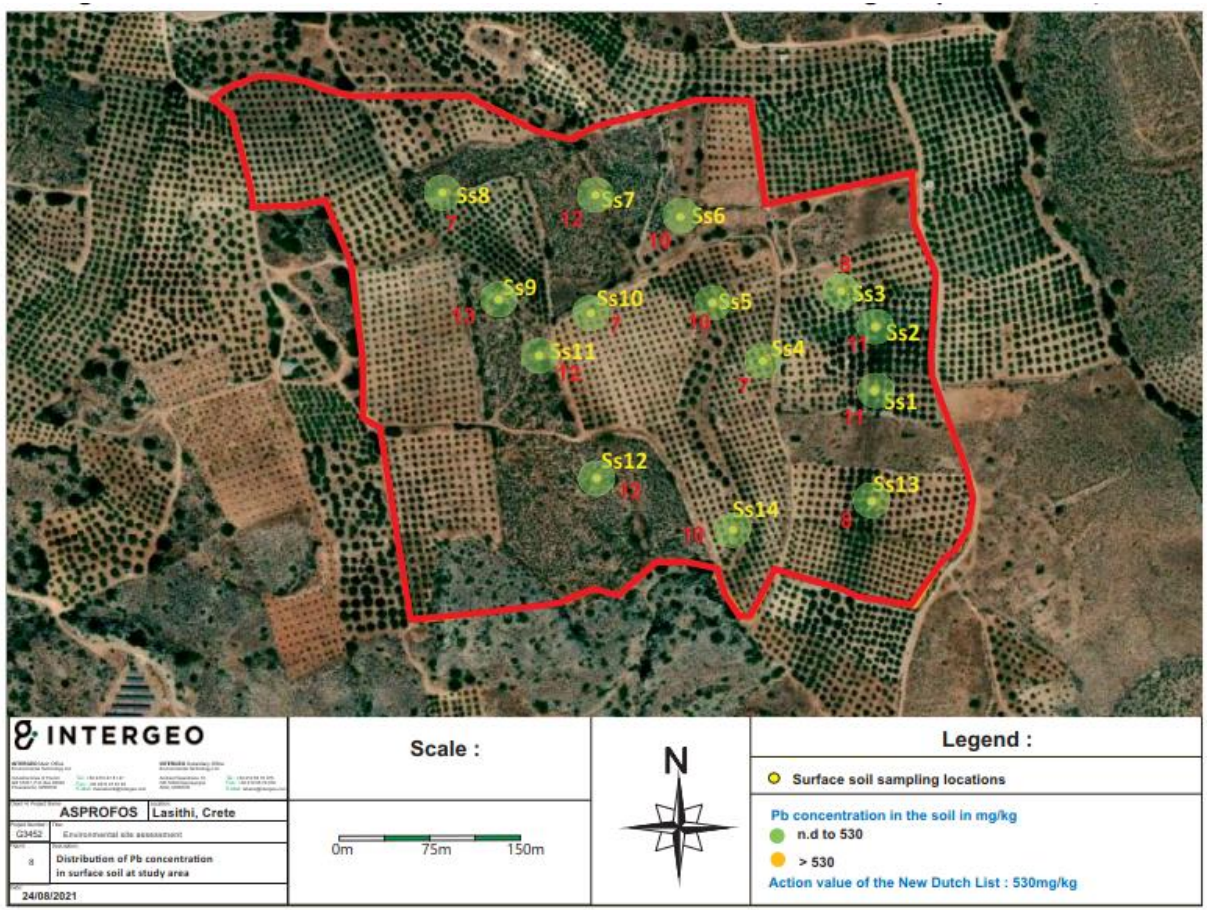


Figure 8 Distribution of Pb concentration in surface soil at the investigated plot at Lasithi, Crete

# Appendix 2 TABLE OF CHEMICAL ANALYSES

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| | |
|---|---|
| PROJECT CODE: | G3452 |
| OWNER OF PROJECT: | ASPROFOS S.A |
| AREA: | LASITHI, CRETE |
| TITLE OF PROJECT: | SOIL&GW INVESTIGATION |
| SAMPLING DATE: | 02.06.2021 |
| SAMPLE: | 14 surface soil samples |

| A/A | PARAMETER | METHOD OF ANALYSIS | UNIT | DETECTION LIMIT | Ss1 | Ss2 | Ss3 | Ss4 | Ss5 | Ss6 | Ss7 | Ss8 | Ss9 | Ss10 | Ss11 | Ss12 | Ss13 | Ss14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Antimony (Sb) | DIN EN ISO 17294-2 : 2017-01 | mg/Kg | 2,0 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| 2 | Arsenic (As) | DIN EN ISO 17294-2 : 2017-01 | mg/Kg | 0,8 | 6,2 | 7,0 | 4,6 | 4,5 | 5,4 | 7,3 | 5,6 | 4,9 | 5,5 | 4,9 | 6,0 | 4,7 | 6,0 | 5,3 |
| 3 | Beryllium (Be) | DIN EN ISO 11885 : 2009-09 | mg/Kg | 1,0 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 4 | Lead (Pb) | DIN EN ISO 17294-2 : 2017-01 | mg/Kg | 2,0 | 11 | 11 | 8 | 7 | 10 | 10 | 12 | 7 | 13 | 7 | 12 | 12 | 10 | 8 |
| 5 | Cadmium (Cd) | DIN EN ISO 17294-2 : 2017-01 | mg/Kg | 0,2 | 0,2 | 0,2 | <0,2 | <0,2 | 0,3 | 0,3 | 0,3 | 0,3 | 0,2 | <0,2 | 0,3 | 0,2 | 0,3 | 0,2 |
| 6 | Chromium (Cr) | DIN EN ISO 17294-2 : 2017-01 | mg/Kg | 1,0 | 49 | 59 | 43 | 39 | 44 | 53 | 45 | 23 | 36 | 44 | 49 | 39 | 49 | 43 |
| 7 | Hexavalent Chromium (IV Cr) | DIN EN 15192 : 2007-02 | mg/Kg | 0,1 | 0,80 | 0,80 | 0,15 | 0,43 | 0,24 | <0,10 | 0,54 | 0,38 | 0,59 | 0,43 | 0,71 | 0,10 | <0,10 | 0,70 |
| 8 | Cobalt (Co) | DIN EN ISO 11885 | mg/Kg | 3,0 | 11 | 13 | 7,5 | 7,5 | 9,5 | 12 | 9,3 | 5,6 | 8,2 | 8,3 | 10 | 8,3 | 10 | 8,6 |
| 9 | Copper (Cu) | DIN EN ISO 11885 : 2009-09 | mg/Kg | 1,0 | 13 | 16 | 8 | 8 | 13 | 13 | 11 | 6 | 10 | 8 | 12 | 9 | 12 | 10 |
| 10 | Nickel (Ni) | DIN EN ISO 17294-2 : 2017-01 | mg/Kg | 1,0 | 56 | 67 | 52 | 47 | 49 | 62 | 51 | 26 | 35 | 51 | 51 | 46 | 55 | 51 |
| 11 | Mercury (Hg) | DIN EN ISO 17294-2 : 2017-01 | mg/Kg | 0,05 | 0,06 | 0,11 | 0,09 | 0,08 | 0,06 | 0,09 | 0,10 | 0,09 | 0,08 | 0,08 | 0,08 | 0,07 | 0,07 | 0,06 |
| 12 | Selenium (Se) | DIN EN ISO 12846 : 2012-08 | mg/Kg | 2,0 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| 13 | Thallium (Tl) | DIN EN ISO 17294-2 : 2017-01 | mg/Kg | 0,1 | 0,2 | 0,2 | <0,1 | <0,1 | 0,1 | 0,1 | 0,1 | <0,1 | 0,1 | <0,1 | 0,1 | 0,1 | 0,2 | <0,1 |
| 14 | Vanadium (V) | DIN EN ISO 17294-2 : 2017-01 | mg/Kg | 3,0 | 37 | 46 | 23 | 23 | 32 | 38 | 32 | 22 | 30 | 26 | 38 | 27 | 37 | 29 |
| 15 | Zinc (Zn) | DIN EN ISO 11885 : 2009-09 | mg/Kg | 2,0 | 36 | 42 | 24 | 25 | 36 | 37 | 34 | 22 | 30 | 25 | 38 | 30 | 36 | 30 |
| 16 | Tin (Sn) | DIN EN ISO 17294-2 : 2017-01 | mg/Kg | 1,0 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 17 | **TPH Index** | ISO 16703 | mg/Kg | 50,0 | <50 | <50 | 59 | <50 | <50 | <50 | <50 | 65 | <50 | <50 | <50 | 88 | <50 | <50 |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | | | | | | | | | | | | |
| 18 | Naphthalene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 19 | Acenaphthylene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 20 | Acenaphthene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 21 | Fluorene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 22 | Phenanthrene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 23 | Anthracene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 24 | Fluoranthene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 25 | Pyrene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 26 | Benzo(a)anthracene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 27 | Chrysene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 28 | Benzo(b)fluoranthene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 29 | Benzo(k)fluoranthene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 30 | Benzo(a)pyrene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 31 | Dibenzo(a,h)anthracene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 32 | Benzo(ghi)perylene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 33 | Indeno(1,2,3-cd)pyrene | DIN EN ISO 18287 | mg/Kg | 0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 | <0,05 |
| 34 | **sum PAHs (EPA)** | DIN EN ISO 18287 | mg/Kg | | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. |

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| | |
|---|---|
| PROJECT CODE: | G3452 |
| OWNER OF PROJECT: | ASPROFOS S.A |
| AREA: | LASITHI, CRETE |
| TITLE OF PROJECT: | SOIL&GW INVESTIGATION |
| SAMPLING DATE: | 02.06.2021 |
| SAMPLE: | 14 surface soil samples |

| A/A | PARAMETER | METHOD OF ANALYSIS | UNIT | DETECTION LIMIT | Ss1 | Ss2 | Ss3 | Ss4 | Ss5 | Ss6 | Ss7 | Ss8 | Ss9 | Ss10 | Ss11 | Ss12 | Ss13 | Ss14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PCB | | | | | | | | | | | | | | | | | | |
| 35 | PCB (28) | DIN EN 15308 | mg/Kg | 0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 |
| 36 | PCB (52) | DIN EN 15308 | mg/Kg | 0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 |
| 37 | PCB (101) | DIN EN 15308 | mg/Kg | 0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 |
| 38 | PCB (118) | DIN EN 15308 | mg/Kg | 0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 |
| 39 | PCB (138) | DIN EN 15308 | mg/Kg | 0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 |
| 40 | PCB (153) | DIN EN 15308 | mg/Kg | 0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 |
| 41 | PCB (180) | DIN EN 15308 | mg/Kg | 0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 | <0,01 |
| 42 | Sum 6 PCB (STI-table) | DIN EN 15308 | mg/Kg | | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. | n.q. |
| 43 | Dry mater | DIN EN 14346 | % | 0,1 | 96,9 | 96,0 | 93,7 | 99,1 | 97,7 | 98,7 | 98,9 | 99,3 | 99,2 | 98,8 | 98,8 | 66,9 | 96,4 | 99,3 |

n.q: non quantified

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| | |
|---|---|
| **PROJECT CODE:** | **G3452** |
| **OWNER OF PROJECT:** | **ASPROFOS S.A** |
| **AREA:** | **LASITHI, CRETE** |
| **TITLE OF PROJECT:** | **SOIL&GW INVESTIGATION** |
| **SAMPLING DATE:** | **02.06.2021** |
| **SAMPLE:** | **1 groundwater sample** |

| A/A | PARAMETER | METHOD OF ANALYSIS | UNIT | DETECTION LIMIT | PRIVATE WELL |
|---|---|---|---|---|---|
| 1 | pH | St. Met. 4500-pH Value B | | | 8,1 |
| 2 | Conductivity(EC) | St. Met. 2510 B | μS/cm | | 1280 |
| 3 | Dissoved oxygen (DO) | DIN 38406-G21 | mg/l | 0,1 | 8,2 |
| 4 | Total Petroleum Hydrocarbons (TPH index) | EN ISO 9377-2 | mg/l | 0,1 | n.d. |
| 5 | Cloride ($Cl^-$) | EPA 325.1 | mg/l | 5 | 230 |
| 6 | Sulfate ($SO_4^{2-}$) | EPA 375.4 | mg/l | 5 | 46 |
| 7 | Nitrate ($NO_3^-$) | DIN38405 D9 | mg/l | 0,5 | 6,6 |
| 8 | COD | ΕΛΟΤ EN ISO 15705 | mg/l | 10 | n.d. |
| 9 | $BOD_5$ | BOD SENSOR | mg/l | 2 | n.d. |
| 10 | TDS | ΕΛΟΤ EN1S216 | mg/l | 10 | 600 |
| 10 | Phosphates ($PO_4$) | EN 1189 | mg/l | 0,05 | n.d. |
| 11 | Total Organic Carbon | DIN EN 1484 | mg/l | 0,5 | 33 |
| 12 | TPH | DIN EN ISO 9377-2 | mg/l | 0,1 | n.d. |
| 13 | Oil and grease | DIN 38409-56 | mg/l | 10 | n.d. |
| 14 | total coliforms | ISO 9308-1:2014 & Amd1:2016 | cfu/100ml | 10 | n.d. |
| 15 | E.coli | ISO 9308-1:2014 & Amd1:2016 | cfu/100ml | 10 | n.d. |
| **PAH** | | | | | |
| 1 | Naphthalene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 2 | Acenaphthylene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 3 | Acenaphthene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 4 | Fluorene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 5 | Phenanthrene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 6 | Anthracene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 7 | Fluoranthene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 8 | Pyrene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 9 | Benzo(a)anthracene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 10 | Chrysene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 11 | Benzo(b)fluoranthene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 12 | Benzo(k)fluoranthene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 13 | Benzo(a)pyrene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 14 | Dibenzo(ah)anthracen | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 15 | Benzo(ghi)perylene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 16 | Indeno(1,2,3-cd)pyrene | DIN 38407-39 | μg/l | 0,01 | n.d. |
| 17 | Sum PAH | | μg/l | 0,01 | n.q. |

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| | |
|---|---|
| PROJECT CODE: | G3452 |
| OWNER OF PROJECT: | ASPROFOS S.A |
| AREA: | LASITHI, CRETE |
| TITLE OF PROJECT: | SOIL&GW INVESTIGATION |
| SAMPLING DATE: | 02.06.2021 |
| SAMPLE: | 1 groundwater sample |

| A/A | PARAMETER | METHOD OF ANALYSIS | UNIT | DETECTION LIMIT | PRIVATE WELL |
|---|---|---|---|---|---|
| **METALS** | | | | | |
| 1 | Aluminium (Al) | EN ISO 17294-2 | µg/l | 20 | n.d. |
| 2 | Arsenic (As) | EN ISO 17294-2 | µg/l | 1 | n.d. |
| 3 | Antimony (Sb) | EN ISO 17294-2 | µg/l | 0,5 | n.d. |
| 4 | Beryllium (Be) | EN ISO 17294-2 | µg/l | 5 | n.d. |
| 5 | Lead (Pb) | EN ISO 17294-2 | µg/l | 1 | n.d. |
| 6 | Cadmium (Cd) | EN ISO 17294-2 | µg/l | 0,1 | n.d. |
| 7 | Total Chromium (Cr) | EN ISO 17294-2 | µg/l | 1 | 3 |
| 8 | Chromium (Cr+6) | EN ISO 15293-1 | µg/l | 0,1 | n.d. |
| 9 | Iron (Fe) | EN ISO 17294-2 | µg/l | 10 | n.d. |
| 10 | Cobalt (Co) | EN ISO 17294-2 | µg/l | 5 | n.d. |
| 11 | Copper (Cu) | EN ISO 17294-2 | µg/l | 5 | n.d. |
| 12 | Lithium (Li) | EN ISO 17294-2 | µg/l | 5 | n.d. |
| 13 | Manganese (Mn) | EN ISO 17294-2 | µg/l | 5 | n.d. |
| 14 | Molybdenum (Mo) | EN ISO 17294-2 | µg/l | 5 | n.d. |
| 15 | Nickel (Ni) | EN ISO 12846 | µg/l | 5 | n.d. |
| 16 | Mercury (Hg) | EN ISO 17294-2 | µg/l | 0,1 | n.d. |
| 17 | Selenium (Se) | EN ISO 17294-2 | µg/l | 1 | n.d. |
| 18 | Thalium (Tl) | EN ISO 17294-2 | µg/l | 0,2 | n.d. |
| 19 | Vanadium (V) | EN ISO 17294-2 | µg/l | 4 | n.d. |
| 20 | Zinc (Zn) | EN ISO 17294-2 | µg/l | 10 | 10 |
| **VOC** | | | | | |
| 1 | Vinyl chloride | EN ISO 10301 | µg/l | 0,5 | n.d. |
| 2 | 1,1 - Dichloroethene | EN ISO 10301 | µg/l | 0,5 | n.d. |
| 3 | 1,1 - Dichloroethane | EN ISO 10302 | µg/l | 0,5 | n.d. |
| 4 | Dichloromethane | EN ISO 10301 | µg/l | 0,5 | n.d. |
| 5 | 1,2-Dichloroethane | EN ISO 10301 | µg/l | 0,5 | n.d. |
| 6 | cis-1,2-Dichloroethene | EN ISO 10301 | µg/l | 0,5 | n.d. |
| 7 | trans-1,2-Dichloroethene | EN ISO 10301 | µg/l | 0,5 | n.d. |
| 8 | Trichloromethane | EN ISO 10301 | µg/l | 0,5 | n.d. |
| 9 | Tetrachloromethane | EN ISO 10301 | µg/l | 0,5 | n.d. |
| 10 | 1,1,1-Trichloroethane | EN ISO 10301 | µg/l | 0,5 | n.d. |
| 11 | Trichloroethene | EN ISO 10301 | µg/l | 0,5 | n.d. |
| 12 | Tetrachloroethene | EN ISO 10301 | µg/l | 0,5 | 1,4 |
| 13 | Volatile Halogenated Hydrocarbons total | | µg/l | 0,5 | n.q. |

n.d.: non detected/ n.q.: not quantified