niesú tu:
- tabuľky v originál. texte
- mapy situácie
- grafy
- prílohy - tabuľky laborat. testov

v texte je to označené ako „chart"

GEOKONZULT, a.s., KOŠICE

ENGINEERING GEOLOGY, HYDROGEOLOGY, ECOLOGY, SPECIAL BUILDING WORKS

FINAL REPORT

ANGLICKÝ PREKLAD
ČASTI SPRÁVY

Title of the task	: Košice – USS – oxygen apparatus no. 9
Number	: 2001-317
Procurement	: US STEEL s.r.o. Košice
Task solved by	: Mgr. J. Ondrejka – engineering geology : Ing. A. Höger – geotechnics : Ing. V. Pramuk – chemistry of the soil types : Ing. A. Szabová – chemistry of water
Date	: December, 2001

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1.0 INTRODUCTION

In accordance with order No. AG21Z210259 of 27 November, 2001 the company U.S. Steel, s.r.o., Košice ordered engineering-geological and hydro-geological research for "US Steel, s.r.o., Košice objects – oxygen apparatus No. 9".

Scope and specification of the geological-survey works have been worked out in project of geological-research works, that US Steel, s.r.o., Košice has accepted in full amount. Economical relations have been concluded by signing the contract on the work No. 2001-317.

2.0 PURPOSE OF THE GEOLOGICAL WORKS

The purpose of the geological-research works rested in:

- finding out geological relations of the concerned territory
- finding out physical and descriptive characteristic of the soil
- finding out the ground water level
- assessment of the ground water from the aspect of its aggressiveness on concrete and iron
- assessment of the foundation conditions
- definition of the classes of workability
- finding out the current state of the pollution of the mineral environment of the aeration zone and ground water in the concerned area

3.0 USED DOCUMENTS

- Elaborated price offer of 13 November, 2001
- Situation on the territory in ratio M 1:1000 and 1: 3000
- Kaličiak Michal et al. (1996): Regional Geology Maps of Slovakia, ratio M= 1:50 000; Geologická mapa Slanských vrchov a Košickej kotliny (Geology Map of Slanec Hills and Košice-basin) – the southern part with appropriate commentaries : GÚDŠ Bratislava – Land survey Institute.

4.0 NATURAL CONDITIONS OF THE LARGER SURROUNDING AREA

4.1 Geo-morphological relations

According to the geographic relief of Slovakia (Mazúr, Lukniš) the concerned territory belongs to the Lučenec-Košice lowland region and to the complex of the Košice-basin, division of Medzev hills.

The surface of the territory is plain with relatively small height differences. It is significantly marked by building and industrial activities – adaptation of the terrain near premises and building up a scrap yard.

4.2 Geological relations

The concerned territory consists of Neogene and Quarter sediments.

Neogene - made up of clay and silts with components of gravel sand of so called Sečov strata. From place to place there are components of tuffs and tuffits.

Quarter – is represented by sediments of fluvial cone created by stream Ida. Quarter sediments are represented by fine-grained soil, 1-2 m thick on the surface (or anthropogenic sediments - made up grounds). Under sluiced soils there are gravel components from fluvial cone. The thickness of the proluvial sediments in the concerned territory exceeds 9 m.

4.3. Hydro-geological relations

Hydro-geological relations of the territory are conditioned by the geological structure, the flow of ground waters is affected by building up VSŽ – steel works. The ground waters are supported by infiltration of atmospheric water or by transfers from higher situated locations. The water collector represents a complex of fluvial and proluvial gravel sand with variable content of fine-grained fraction. The ground water level is mildly under pressure in the concerned area.

5.0 METHODOLOGY AND SCOPE OF RESEARCH WORKS

For achievement of the target of the geological works the following activities have been carried out:

- Boreholes – 5 boring, three of them have been supplied as surveying probes with filtration part, made from PVC.
- Sample-collecting works – taking samples from soil and ground water
- Dynamic penetration probes
- Laboratory works – physical-descriptive characteristics of the soil, physical-chemical characteristics of the ground water, analysis of the extractions of soil samples
- Measuring works

While stating the places of carrying out the surveying probes, we took into consideration the planned location of the buildings and the preconditions of the most vulnerable locations from the aspect of the possible pollution. The scope of the sample taking and laboratory works has been defined regarding the information on quantitative and qualitative parameters of the potential contaminants in mineral environment of the aeration zone and in ground water.

Geological works have been carried out by company Geokonzult, a.s. Košice, by its own employees, measuring works and hydro-chemical analyses of water and soil extractions have been ensured through sub-contracting.

Research works – bore holes and penetration probes have been carried out at presence of Ing. Vertala. The situation of researched objects is included in Annex No. 2.

5.1 Boring and sample collecting works

In order to find out the geological and hydro-geological conditions of the territory, 5 core samples: V-1 – V-5 have been made. All of them have been bored in depth up to 10 m. The whole amount made 50 bm. The bore works have been carried out by the staff of drilling foreman, Mr. Andrejčák by machine drilling rig UGB-50M in November, 2001. During the boring documentation, samples of soil had been taken which were discarded after geological documentation. The written documentation on boring works is included in Annex No. 3.

From the boreholes soil samples have been taken that have been processed in laboratory on mechanics of soil. All together 12 disturbed samples of gravel and 4 disturbed samples of fine-grained soil with saved humidity have been taken into paper bags. The data on depth under surface, the samples have been taken from, and their numbers are put down in engineering-geological sections – Annex 6/1-6/2.

From boreholes V-1, V-2, V-4 and V-5 samples have been taken in order to define the content of potential contaminants, found in the mineral environment of the aeration zone as a result of the anthropogenic activity. Following from lithological attributes of the minerals, their relatively unfavorable structure from the aspect of transfer and migration of the pollution from the concerned surface, we have taken samples especially from the levels, situated immediately under surface (from relatively pervious sub-surface zone sediments, resulted by human activities). – 0,5 m u.t. (= under terrain) and 1,0 m u.t.; subsequently samples have been taken from 1,5 m u.t., 2,0 m u.t. 2,5 m u.t. and 3,0 m u.t. Because of presence of organic smell in bore hole V-1, we removed soil sample from stratum 3,5 m u.t. The different depths and numbers of samples are depicted in engineering–geologic profiles in Annex 6/1 and 6/2.

Soil samples, designated for definition of the content of the possible contaminating materials, had been put to paper bags, which were immediately after delivered to the chemical laboratory in labeled and imperviously closed packages.

On the basis of the works, directed to taking samples and the subsequent laboratory–tests, while respecting the available date on the location, we orientated our activities mainly to find out information on the most supposed present contaminant i.e. hydrocarbons. Besides this, considering the type of activities in the concerned location (scrap yard) and the previously known results, we have taken samples of soils for stating the trace-metal level in the terrain – TOX, BTX, PAU, PCB.

Altogether 20 samples have been taken from the boreholes, i.e. 5 samples from each of them.

Ground water samples for assessment have been taken directly to sample containers. We have taken samples of water from bore holes V-3 and V-5 for basic physical-chemical analysis and for stating the presence of NEL, PAU, phenols, cyanides, tenzides and certain trace metals; from bore holes V-1 and V-3 we have taken samples of water in order to assess the ground waters from aspect of their aggressiveness on concrete and iron.

The results of the laboratory analyses of the samples of ground water and soil are shown in Annex No. 7.

5.2 Penetration tests

In order to find out the geo-technical characteristics of the Quarter soil in-situ, on the concerned territory we performed 5 dynamic penetration probes, marked DP-1 – DP-5. The depth of the dynamic penetration probes was between 3,20 – 5,80 m, their whole volume was 19,80 bm.

The penetration probes serve to find out some characteristics in-situ. The test is founded on the ability of the soils to resist to tip of the instrument (by driving in piles of 50 kg, falling from height 50 cm).

Dynamic penetration probes have been carried out by heavy dynamic penetration test device, made by firm BORROS. By dynamic penetration probe the number of strikes, needed to drive the pile-tip into standard depth 20cm (value N_{20}), is recorded. This value is corrected by friction of the earth with the testing rods. The corrected value N_{20} is re-calculated under empirical formulae to measured dynamic resistance q_{dyn} (MPa). The values of measured dynamic resistance q_{dyn} are initial date for stating some attributes according to verified correlation.

Dynamic penetration probes have been carried out by the group, specialized for terrain tests from Geokonzult a.s. Košice in November 2001. The results of these dynamic penetration probes are shown in Annex No. 4.

5.3. Laboratory works

Taken samples of soil have been processed in laboratory of mechanics of soils within Geokonzult a.s., Košice. From the total number of 16 samples after macroscopic assessment all 16 have been designed for laboratory evaluation. The selected samples have been tested in regard of their grain structure, plasticity and humidity.

The results of laboratory tests of the soil, the number of different tests and their brief methodology is shown in Annex 5.

The water samples and extractions of the soil have been analysed in hydro-chemical laboratory EKOLAB, s.r.o., Košice, the results of the hydro-chemical analyses with evaluation are included into Annex 7. The analytical works have been performed in accordance with the valid standards and methodology.

5.4. Measurements

After finishing surveys in terrain (boring holes, penetration probes) the boreholes were surveyed from the aspect of planimetry and altitude by surveyor group from US STEEL, s.r.o. Košice, division - Implementation of projects Košice, lead by Ing. Bartka.

Planimetric co-ordinates are shown in local co-ordinate system - U.S. STEEL Košice, altitude co-ordinates are shown in system Jadran. The location of the boreholes is descripted in Annex No. 2.

In the following chart it is shown the list of the co-ordinates and heights of surveying probes:

(chart)

6.0 RESULTS OF THE RESEARCH WORKS

6.1 Engineering-geological relations

The surveyed territory's surface is plain. In the past the surface was affected from building works.

Engineering geological-relations of the territory were observed by boreholes V-1 – V-5 and penetration probes DP-1 – DP-5. On the base of these probes were later constructed the engineering-geological sections I-I in M=1:500/100 and II – II′ in M= 1:200/100 (Annex 6/1 – 6/2) On the basis of these sections have been assigned the following characteristic strata in the surveyed territory:

1. Made up Ground

The most upper situated position on the surveyed territory consists of made up ground with cross cut and backward fillings near the foundation of objects and along the underground mains installation. The made up ground consists of mainly form fine-grained soil of rich grained structure and plasticity with variable content of rough fraction – gravel boulders and fragments of building work waste with switches into gravel soils. The average size of the made up ground is between 1,00-2,00 m, in some places they are absent. We studied the maximal size of the made up ground in the place of dynamic penetration probe DP-3, the verified size of the made up ground is 3,6 m. It has been a backward filling, made by building the sewerage system.

In accordance with STN 73 1001 (standard system) it is a special soil – tipped earth material, marked by symbol GCY, CGY, SPY and GPY. Taking into consideration the little depth of the made up ground we are not going to analyse it in details.

To give complex information we are giving the limit values of the geo-technical attributes of the made up grounds with fine-grained soil and gravel, studied by penetration tests:

(chart)

2 Fine grained fluvial sediments

It is a discontinuous stratum with limited territorial extent. In the most of the territory they are absent, have been found within bore holes V-1 and V-3 in depth 1,30-1,80 and 0,30 – 1,00 m u.t.

From macroscopic aspect the fluvial sediments have been evaluated as clays of different plasticity and variably grainy structure. They are of grey and brown colour having stiff, stiff-solid and solid consistency. On the basis of the laboratory test results and analyses we can characterize them with the following values of humidity, plasticity and consistency: Wn=22,0%, W_L = 38,5% W_P = 19,2%, I_C = 38,5%.

In accordance with STN 73 1001 we can classify these soils into group F – fine–grained soil types, class F6 – clay with medium and low plasticity. Regarding their limited impact in depth and the area, we are not going to discuss them in details.

3 Gravels from the fluvial cone

They have been found under fluvial sediments and under the made up ground in depth under 1,0 – 2,0 m u.t. We did not check the whole size of the gravels with borings into 10,00 m depth. The amount of the gravel we have checked has been stated between 8,0-9,6 m. We suppose that their thickness is more than 10-12 m.

From macroscopic aspect they have been evaluated as grey and brownish grey gravels, containing fine-rained soil. The size of the boulders makes 5-7 cm, some of them have 10-15 cm. The boulders are medium shaped. The lower part of the gravels under 5,50 –7,00 m u.t. we evaluated as gravelly clays.

According to the results of the granularity analysis the gravel stratum consists of gravels with fine grained soil as additional agents – symbol G-F, class G3, lower strata gravelly clays – symbol GC, class G5.

From place to place in the gravel we have found strata of fine-grained soils of variable granularity and plasticity (Boring V-2 3,00 – 3,20 m u.t.; V-3 7,50-7,80 m u.t.; V-5 5,30-5,60 m u.t.). On the basis of the laboratory examinations and analyses we characterise them with the following limit values of humidity and plasticity and consistency: Wn=12,0-22,2%, W_L = 25,5 -33,0% W_P = 16,3 – 21,3%, I_C = 0,90 – 1,49%. The thickness of the fine-grained soil strata is between 0,20 – 0,30 m. According to the results of the granularity analysis there are sand-clays and gravelly clays.

On the basis of laboratory test results and analyses we can classify fine–grained soil strata in gravel in accordance with STN 73 1001 into group F – fine grained soils class F4 and F2 – (sand clays and gravel clay).

In accordance with STN 73 1001 – soils representing proluvial gravel belong to group G3 – (gravel with fine-grained soil as additional agents-GC) and class G5 (clayey gravel – G-F).

We did not check the entire thickness of the gravels with penetration probes taking into consideration their settlement and capacity of the penetration device. **Their most upper situated loamy and medium compact position** we checked with the following probes in the shown depth: probe DP – 1 in 0,80-2,2 m u.t. deep; probe DP – 4 in 2,20-3,0 m u.t. deep and probe DP – 5 in 0,60-2,0 m u.t.

On the basis of the penetration probe results we can characterise this position of gravel through the following limit values derived from geo-technical characteristics:

(chart)

The position of compact gravels we investigated in depth 0,80-2,20 m u.t., within probe DP-3 under made up ground under 3,6 m u.t. – we checked them only up to 1,2-2,4 m under the surface. On the basis of the penetration test results we can characterise the compact gravel positions as following:

(chart)

For the purpose of geo-technical calculations in case of **compact gravel of class G3 and G5** we recommend to consider under STN 73 1001 (Foundation ground under surface foundations) the following attributes

(chart)

The positions of fine-grained soil we can characterise through the following standard values under STN 73 1001.

(chart)

6.2. Hydro-geological relations

In the time of carrying out the survey (November 2001) the ground water level was struck by all borings in depth 6,0 – 6,7 m u.t., after the strikes the water level raised by 0,60 – 0,70 m up to level 5,20 – 6,00 m u.t.

The ground water is bound to positions of gravel and its level varies depending on atmospheric precipitation. We consider the ground water level average. At the time of higher precipitation it is necessary to take into account the raise of ground water level by another 1,5 – 2 m.

On the basis of the hydro-chemical analyses the water is about medium mineralised. Under S. Gazda´s classification the ground water, coming from bore hole V-3 belongs to basic type $Ca\text{-}So_4$ and water from bore hole V-5 disposes with mixed chemism with prevailing $S2(SO_4)$ component.

Through surface foundation laying the foundation structures would not contact the ground water level. Through deep foundation, built on piles, it is necessary to calculate with the raised aggressiveness in relation to iron materials, however the ground water is not aggressive to concrete materials. The detailed description of chemism with the analysis lists is included into Annex 7.

6.3 Relations of the foundation

According to the engineering-geological survey we can state that the geological structure of the observed territory is relatively simple. On the surface there is a layer of made up ground and cross cut, reaching to depth 1,00-2,00 m u.t., in some places up to 3,80 m u.t. Under the made up ground on some places there is a layer of fluvial fine grained sediments of size 0,50 – 0,70 m.

In the subsoil of the made up ground and the fine-grained fluvial sediments there is a layer of proluvial gravel – gravel with additional fine grained soil and clayey gravel with positions of clay up to 0,10 – 0,20 m. We checked the gravel component as deep as 10,00 m u.t.

Ground water has been found in all bore holes in depth 6,0-6,7 m u.t. After striking, its level has raised by amount of 0,60-0,70 m as high as 5,20-6,00 m u.t. Ground water is bound to positions of gravel and its level depends on the precipitation.

Under standard STN 73 1215 "Classification of aggressive environment" – we can evaluate the water as non-aggressive on concrete materials. Under standard STN 03 8375 "Protection of metal pipes, put down to ground or water" the water can be evaluated as having raised aggressiveness in relation to iron materials.

Carrying capacity

By surface foundation laying we recommend to avoid foundation, made on non-homogeneous made up ground and we would prefer **settled gravel – soil of class G3,** with depth of laying down D=1,0 m u.t.. for different foundation width we can take into consideration the following values of carrying capacity:

(chart)

By different depth it is necessary to adapt the shown data in accordance with the influence of the used depth of foundation under 1st comment of Annex 6 – standard STN 73 1001.

Settlement

From the aspect of compressibility the gravel soils represent a very little compressible foundation ground. The settlement process will be weak and most of it will take place during the building works and its unsteadiness would not exceed the permitted values.

The foundation pit/ditch

By machine excavation of the ditch, its last layer over the level of foundation of size 20-30 cm, we recommend to excavate manually in order not to disturb the natural settlement of the soil.

Temporary gradient of slope of the ditch in the made up ground and fine-grained soil up to 2 m u.t. can be chosen in ratio 1:1. In the case of gravel with additional fine grained soil in gradient 1:1,25.

6.4 Classes of the workability of the minerals

Under standard STN 73 3050 the minerals, that will be affected by earth works we classify to following classes of workability:

- made up ground, fluvial fine-grained minerals 3rd- 4th class
- gravels with additional fine grained minerals, settled 3rd- 4th class
- clayey gravels 3rd- 4th class

The classes of workability have to be precised according to the circumstances during the earth works.

6.5. Evaluation of the laboratory-works results - ground water and minerals

6.5.1. Evaluation of the chemical structure of the ground water from boreholes V-1, V-2 and V-4

Water, originating from bore hole V-1 is neutral (pH=7,06), quite mineralised with mineralisation 0,83 $g.l^{-1}$.

The entire mineralisation is resulted especially by ions SO_4^{2-} and HCO_3^-, before Cl^- and NO_3^-, from cations there are Ca^{2+} and Na^+ that define the chemical type of the water. According to Gazda´s classification the water shows mixed type with prevailing component S_2 (SO_4), it is mildly under-saturated with low content of aggressive CO_2.

Water, originating from bore hole V-2 is slightly alcalic (pH=7,3), quite mineralised with mineralisation 0,52 $g.l^{-1}$. The entire mineralisation is made especially from ions SO_4^{2-} and HCO_3^-, from cations there are Ca^{2+}, Na and Mg^{2+}. According to Gazda´s classification the water shows mixed type with prevailing component $S_2(SO_4)$, it is mildly under saturated with content of aggressive CO_2.

In the water we found increased content of organic materials, defined as chemical consumption of O_2 by manganese and NEL.

Water originating from bore hole V-4 is alcalic (pH=11,27), quite mineralised with mineralisation 0,82 $g.l^{-1}$. The water mineralisation is made especially from ions SO_4^{2-} and Cl^-.

High pH of the water causes the presence of CO_3^{-2} and OH^- ions. According to Gazda´s classification the water shows mixed type with prevailing component $S_2(SO_4)$. The chemical structure of the water is significantly affected secondarily. Besides the increased concentration of organic materials (SO_4^{2-}, Cl^-, Cr, CN^-, NH_4^+, NO_2^-, Mn) there are increased organic materials stated as chemical consumption of O_2 by manganese, but in the form of non-polar extractable materials (NEL).

Basic chemical parameters of the water, originating from boreholes V-1, V-2 and V-4, and their comparison respecting the criteria, laid down in the

Directive of the Ministry of the Administration and Privatization of the National Property of the Slovak Republic and the Ministry of the Environmental Affairs of the Slovak Republic of 15 December, 1997 No. 1617/97 min (Further: Directive) and respecting the standard STN 75 7111 "Drinking Water" - is included in Chart No. 1.

6.5.2. Evaluation of the quality of the ground water in relation to the Directive of MAP SR and MEA SR) of 15 December, 1997, No. 1617/97 min

The ground water, originating from borehole V-4 contains increased amount of NEL, phenols and Pb. The concentration of NEL (1,07 mg $.l^{-1}$) exceeds by 0,07 mg $.l^{-1}$ the limit value of C category and that indicates strong influence of polluting oil carbohydrates on the ground water.

Content of Pb (0,094 mg $.l^{-1}$) is within category B that shows the influence on hydro-sphere, caused by this contaminating stuff. The phenol content of V-4 sample in the ground water (3,9 $mg.l^{-1}$) oversteps category C too. Probably, the increased content of phenols is related directly to increased content of carbo-hydrates as products of their degradation. The water contains increased amount of NH_4^+, CN^-, and Cd which overstep the limit values of B category of the Directive, Cu and Cr exceed the C category values, stated in the Directive.

In other boreholes and analysed samples (V-1, V-2) the presence of increased amount of crude oil carbohydrates has been shown too, however, their extent is much less.

Water from boring V-1 showed increased content of NEL in extent of B category (0,23 mg $.l^{-1}$), in water from V-2 it was within A category (0,13 mg $.l^{-1}$).

Water from V-2 has increased concentration of NEL NH_4^+, CN^-, exceeding limit values of B category of the cited Directive.

6.5.3. Evaluation of the quality of the ground water in relation to STN 75 7111 (Slovak Standard System) „Drinking water"

Water from bore hole V-1 has increased content of Mn, Al, Fe, Hg, NO_2^-, SO_4^{2-}, NEL and CHSK-Mn which overstep the limit values of the set standard for drinking water.

Ground water from V-4 is intensively polluted from the aspect of the cited standard. Elements, exceeding limit values of the standard are: NEL, Pb, Cd, Fe, Mn, NH_4^+, Cl^- , CN^-, NO_2^- SO_4^{2-} , CHSK-Mn and Cr. The found concentration of the last element is very high in this water (152,86 mg $.l^{-1}$ Cr). There has been increased the pH value and conductivity of this water too.

Water from V-2 has a high amount of organic materials, defined as chemical consumption of O_2 by manganese and NEL.

Mn, Fe, NH_4^+, CN- and NO_2^- have exceeded the limit values, defined for drinking water from inorganic components.

Chart 1

6.5.4. Evaluation of the quality of the mineral environment in relation to requests of the Directive of MAP SR and MEA SR No. 1617/97 min

Within the present task we have taken samples from the soil, originating from V-1, V-2, V-4 and V-5. The samples have been removed from depth 0,5, 1,0, 1,5, 2,0, 2,5, 3,0 and 3,5 m u.t.

The implemented chemical analyses were directed on defining the inorganic and organic components, recommended by Directive of MAP SR and MEA SR of 15 December, 1997, No. 1617/97 min. The survey aimed to study those elements that were supposed to occur there, regarding the type of antrophogene activities in the concerned territory.

From tabular evaluation of the observed results (Chart 2) and their comparison with the criteria of categories B and C of the Directive, it follows that the soil samples from boreholes contain increased concentration of polluting organic materials, namely non-polar extractable elements (NEL) and benzene in different levels of the boring V-1, V-2 and V-4. NEL is increased especially in V-1 where in depth up to 2,5 m u.t. they exceed limit values of B category. Samples taken 1,0 m u.t. overstep even limits of C category NEL, defined in UV-spectrum (1265 mg $.kg^{-1}$ solids).

In deep level of aeration zone 3,5 m u.t. in V-1 the NEL content values are again deeply under B category in both parts of the spectrum (86 mg $.kg^{-1}$ solids in IR, 268 mg $.kg^{-1}$ solids in UV spectrum). Respecting the found lithological characteristics we can state increased NEL content in soil as a result of penetration and cumulation of the pollution in relatively permeable environment of anthropogene made up grounds.

Similar situation appeared in borehole V-2 where NEL polluted is just the sub-surface stratum in zone 0-0,5 m u.t. (571 mg $.kg^{-1}$ solids in IR and 3614 mg $.kg^{-1}$ solids), while higher amounts, defined in UV part of the spectrum indicate relatively new pollution.

From the defined inorganic materials concentration of Ba has been increased in V-1 and V-2 which exceeded the limit value of B category of the Directive. The increased content was a result of anthropogene made up grounds again.

The other organic and inorganic elements values did not exceed the limit values of A category. The laboratory works results, aimed at defining the content of polluting materials in the soils is shown in Chart No 2.

Chart 2

7 CONCLUSIONS

On the basis o the performed engineering- geological survey we can observe the following:

The foundation conditions at the building site are simple, consistent with Article 20 of standard STN 73 1001
the surface level of the territory 1,0-2,4 m thick, in some places up to 3,6 m consists of discontinuous stratum of made up grounds and cross cut and in some places fine-grained soil, coming from fluvial cone.
deeper there is a stratum of medium settled and settled gravel; we checked it up to 10 m u.t.
the ground water level is between 6,0-6,70 m u.t., it is mildly under pressure, stable in depth 5,20-6,00 m u.t.
Under standard STN 73 1215 "Classification of aggressive environment" – the water is non-aggressive on concrete materials. Under standard STN 03 8375 "Protection of metal pipes, put down to ground or water" the water disposes with raised aggressiveness in relation to iron materials.
we recommend to make foundation of objects in the level of bearing gravels. Objects, founded this way, will be settling down minimally.
pollution of the mineral environment: in the observed samples during the boring works we have found in part of the samples increased concentration of organic polluting materials, namely they were non-polar extractable materials (NEL) and benzene.
Following the defined lithological characteristic we can state increased NEL content in the soil as a result of penetration and cumulation of the pollution in relatively permeable environment of anthropogene made up grounds.
The other values of organic and inorganic materials in the soil did not exceed the A-category limit values.

pollution of the ground water: in the ground water there are increased contents of NEL. Content of NEL falls to B category (in bore hole V-4 they exceed C category), it indicates the influence of these contaminants on the underground hydrosphere. Besides this in the ground water there is an increased amount of : CN^-, NH_4^+, Cd , Cu, Hg that exceed the limit values of B category; Cr oversteps category C.
These inorganic contaminants in the mineral environment of the aeration zone are not found in amounts, exceeding the limits values. We can exclude secondary pollution of the ground water by infiltration of harmful materials from the settled sediments by influence of vertical migration. It is more likely to expect the effect of water, originating from the surrounding area.