

**BENEFICIARY
S.C. NISCO INVEST SRL**

**GEOTECHNICAL INVESTIGATION
FOUNDATION LAYING CONDITIONS
“MULTIFUNCTIONAL CENTRE” 3B+GF+5S
6 Haşdeu Str., CLUJ-NAPOCA**

**DRAWN UP BY
PROF. DR. ENG. AUGUSTIN POPA**

INVESTIGATION SHEET

DESIGNATION:
FOUNDATION LAYING CONDITIONS
“MULTIFUNCTIONAL CENTRE” 3B+GF+5S

BENEFICIARY: S.C. NISCO INVEST SRL

SITE: 6 Haşdeu Str. CLUJ-NAPOCA

DRAWN UP BY: PROF. DR. ENG. AUGUSTIN POPA

DATE: 16.10 2007

SIGNATURE LIST

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CLUJ-NAPOCA, ROMANIA]

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GEOTECHNICAL INVESTIGATION

“MULTIFUNCTIONAL CENTRE” 3B+GF+5S
6 Haşdeu Str. CLUJ-NAPOCA

1. GENERAL ASPECTS

a.1. Geomorphological aspects

The site is located south of the central area of Cluj-Napoca municipality, in the area of Clinics and Hospitals.

From a geomorphological standpoint, the land generally displays a prominent slope. This slope connects the 3rd terrace (Lucian Blaga Square) with the 4th terrace (the Clinics area).

The area is densely populated with buildings, which vary as far as the number of storeys and intended purpose are concerned, from private dwellings with ground floor only to multi-storeyed hotels and office spaces.

The site, up to its northern boundary, namely Clinicilor str., is populated with hospital-like premises and, more recently, with the UMF (University of Medicine and Pharmacy) administrative building. The area was initially populated with hospital-like premises (B (basement) + GF(ground floor) / B + GF + S(storey)). In order to reinforce the slope, numerous land management and consolidation works had been executed as far back as 1895. The existing drains were built in the same era as the clinics' premises, from 1895 to 1917, and are 6.00 - 10.00-m deep. Around 1923, over a 2-year period, new consolidation and repair works were carried out in the clinics area.

From 1956 to 1958 ample investigations, surveys and works were conducted in the area of the Anatomy, Dermatology and TBC Clinics, following land instability phenomena.

During the years 2000s, north of the site, the UMF building was erected, supported over its southern side by a wall made of large-diameter (Φ 600 mm) drilled piles, a wall which also supports the southern platform that houses a number of ground floor buildings. The current proposal is to extend the existing terrace in order to build amphitheatres. To that end, the existing terrace shall be extended across the Clinics area slope.

Between 1992 and 1994, a new investigation was conducted in regard to the drain network within the site, with the proposal to repair them and even increase their number. The work was not executed and the investigation stopped at the project phase.

From a structural standpoint, the site is part of the northern slope of Feleacului Hill. Feleacului Hill majestically extends from Lucian Blaga Square, located in the vicinity of the municipality central area, up to heights in excess of 800 m.

The northern slope features a sequence of flat areas, terraces and sloped areas. The flat areas also overlap the terrace benches, are generally extended and provide proper conditions for executing constructions.

a.2. Geological aspects. From a geological standpoint, the area features Sarmatian age soils, represented by sands, clays, freestones and marl clays. The sandy layers display intercalations of slabs or freestone knots. The spheroidal concretions are characteristic of this geological era. They are called “concretions”, are 0.5 - 0.6 m in size and were unearthed in certain places by torrents that used to flow across Feleacului slope.

The drillings executed in 2007 did not intercept any freestone concretions, however, during the 2006 drillings, their presence was recorded in the area of F3 and F4 drillings, around the 12.00 m depth and the 14.00 m depth, respectively (where such concretions were drilled through). It is difficult to estimate the frequency and level at which they might appear, even if they are not major obstacles in the execution of

the works, as they may exist individually and be pierced through by the drilling equipment. Nevertheless, the drilling works contractor needs to be warned on the matter.

a.3. Underground water. During the drillings carried out in June 2006, it emerged as underground water at variable depths: -4.00 m (F1) and -4.50 m (F3). During the July 07.2007 drillings, the depths that revealed underground water were: -7.00 m (F1); -6.50 m (F3); -9.00 m (F4). The two drillings that used piezometric equipment recorded the following measured values, in September 2007: -9.20 m (F1) – -10.80 m (F3).

The variation of underground water levels occurred due to low rainfall amounts throughout 2007, which caused a decrease by 1 – 2 m below the normal depths across the entire area of Cluj Napoca city.

The measurements to be further executed will be able to provide new data on the minimum depth of underground waters.

From a chemical standpoint, in accordance with STAS (Romanian standard) 3349/83, under water displays, in relation to concretes, very low carbon aggressiveness and low sulphate aggressiveness, elements that place soil-based chemical attack into XA2 exposure class (SR EN 206-1- 2002).

a.4. The climate is moderate continental, specific to hill regions. The maximum frost line is 0.80 m (STAS 6054/77).

a.5. The seismic hazard zone for design purposes is F (acc. to P100-1/2006), or a level 6 seismic hazard (acc. to SR 11100/93), for which the design terrain acceleration peak value is $a_g = 0.08$ g, with a corner seismic zone (corner period) $T_c = 0.7$ sec.

a.6. Land stability

The site has displayed certain slope instability phenomena, manifested as landfalls, which currently appear as stabilised landfalls. In order to stabilise the slope across the twinning area between Haşdeu str. terrace and Clinicilor str., draining works were carried out, but never updated since (see ch. a.1). Additionally, in order to protect the platform of UMF Administrative Office, an abutment wall, made of tangential drilled piles linked in the upper part with a stiffening girder, was built.

a.7. DETERMINING THE GEOTECHNICAL CATEGORY (NP 074-2007)

FACTORS	POINTS
- land conditions: difficult	6
- underground water – with normal dewatering works	4
- importance category – normal	3
- vicinities: featuring major risk	4
TOTAL POINTS	17

GEOTECHNICAL RISK: MAJOR

GEOTECHNICAL CATEGORY: 3

NOTE. The design of the works in “geotechnical category 3” relies on geotechnical data provided by laboratory and soil tests carried out by means of routine and special methodologies (SPT tests), as well as perfected calculation methods.

b. SUMMARY OF OBSERVATIONS MADE DURING THE FOUNDATION SOIL INVESTIGATION

The preliminary investigation of the foundation soil was conducted in (July) 2006 when, based on a 25-m deep drilling, two 15-m drillings and three dynamic cone probing tests (DPH) carried out up to a depth of 15 m, a preliminary geotechnical permit was drawn up. The results of the investigations conducted in 2006 do not differ from the results obtained throughout the current stage.

The phase of geotechnical investigation, elaborated as part of the geotechnical research for design purposes (2007), comprised 4 geotechnical drillings up to depths of 34.5 m (F1), 34.7 m (F2), 35.0 m (F3) and 34.4 m (F4) (DRILLING LAYOUT PLAN, drawing 1). The research depths of the foundation soil were adopted in compliance with SR EN 1997-1/2006.

The geotechnical drillings were executed as dry rotary drillings with an FS 2,5 machine boasting a 140-mm diameter. Between 13 and 17 undisturbed samples were collected, at a rate of - 1 sample / 2.00 m. Among these, there were also disturbed samples collected, at a rate of 1 sample / metre. Concurrently with the sample collecting procedure there were standard dynamic penetration tests (SPT) at all the depths from where undisturbed soil samples were collected (in cylindrical recipient). The obtained results are provided in the GEOTECHNICAL DRILLINGS SHEET, Annex 1.

The geotechnical research of the foundation soil was conducted by the company called SC GEOTECH SRL – Gheorgheni, which operates under the SRAC ISO 9001 and ISO 14001 certifications.

The foundation soil research works were conducted over the 20.07.2007 – 27.07.2007 period.

Two of the executed drillings benefitted from piezometric equipment (F1 and F3).

The laboratory tests were executed by the company called SC KONTROL INSERV Grup Baia Mare, having the Laboratory Clearance 2nd Degree/1180/ISC L01/2007. They were submitted to the beneficiary on 03.10.2007.

Laboratory tests were conducted on the resulted soil samples in order to determine geotechnical characteristics:

- grain-size analysis, including the determination of the granular fractions as per SR EN ISO 14688-1 and the classification of soils as per SR EN ISO 14688-2, including the uniformity coefficient (U);
- determination of density and weight of soil skeletons (γ_d) and in a natural humid state (γ);
- determination of humidity (w);
- determination of porosity (e);
- determination of plasticity indices (w_L ; w_p , I_p and I_c);
- determination of the internal measurement module ($M_{200-300}$),
- determination of free swelling (U_L);
- determination of the permeability coefficient (k);
- determination of organic substances and the carbonate content;
- determination of the shearing characteristics in a drained (ϕ' and C') and non-drained (ϕ_u and C_u) state.

The results of the laboratory tests are provided in the Laboratory Test Summary Table (Annex B).

In addition to drilling works, with the collection of samples, which are mandatory for the foundation soil investigation field, in accordance with normative P074/2007, it is recommended to opt for a surveying method. Standard penetration tests (SPT) were conducted, and their number of breakthrough hits over 30 cm (N_{30}) are mentioned in drawing no. 2. Based on these results, the geotechnical characteristics (e , φ' , E) were assessed.

The profile of the geotechnical drillings is provided in Drawing no. 3.

The characteristic values of the geotechnical parameters for various land formations, determined based on the laboratory tests and the SPT tests, are as follows:

- fine – medium – coarse sand, with clayey/silty binder and medium settlement:

$w = 7.77 - 16.98 \%$; $\gamma = 18 \text{ KN/mc}$; $\varphi = 33.6^\circ$ (25 hits).

$K = 1.98 - 7.7 \cdot 10^{-6} \text{ cm/s}$; $v = 0.30$;

- clayey marl / marl clay, with silt and fine sand, hard / of a hard-plastic consistency:

$\gamma = 19.39 \text{ KN/mc}$; $e = 0.5892$; $U_L = 109 + 160 \%$ (active – very active); $I_p = 40.35 + 66.08 \%$ (very high plasticity), $I_c = 0.90 + 1.41$ (of a hard-plastic consistency - hard); $M_{200-300} = 10642 \text{ KPa}$ (medium compressibility), $k = 1.45 + 4.29 \cdot 10^{-11} \text{ cm/s}$;

• Shearing characteristics in a drained state:

$\varphi' = 17.40^\circ$ (3 val.); $C' = 34.01 \text{ KPa}$ (3 val.)

• Shearing characteristics in a non-drained state:

$\varphi_u = 25.89^\circ$; $C_u = 67.47 \text{ KPa}$; $v = 0.42$

- fine sand with coarse shingle and silty binder, hard:

$\gamma = 19.03 \text{ KN/mc}$; $e = 0.495$ (settled); $U_L = 67.7$ (inactive); $I_p = 27.65 \%$ (medium plasticity); $I_c = 1.18$ (hard); $M_{200-300} = 17079 \text{ KPa}$ (medium compressibility); $\text{CaCO}_3 = 15.8 \%$; $v = 0.3$;

- fine sand / silt / clay - of a hard-plastic consistency - hard, settled: $\gamma = 20.77 \text{ KN/mc}$; $e = 0.498$; $I_p = 22.81 + 32.62 \%$; $I_c = 0.87 + 1.37$ (of a hard-plastic consistency - hard);

• Shearing characteristics in a drained state:

$\varphi' = 17.38^\circ$; $C' = 87.29 \text{ KPa}$; $v = 0.30$

- clayey silt with fine sand and fine shingle, hard:

$\gamma = 18.71 \text{ KN/mc}$; $e = 0.593$; $U_L = 161 \%$ (very active); $I_p = 31.34 \%$ (high plasticity); $I_c = 1.41$ (hard);

• Shearing characteristics in a drained state:

$\varphi' = 24^\circ$; $C' = 29.52 \text{ KPa}$; $v = 0.35$

The analysis of the data provided by the soil and laboratory works allows drawing the following conclusions:

• The foundation soil under investigation comprises three predominant soil packages:

- (i) one package with sand / silt / clay with a thickness between 0.70 m (F3) and 8.50 m in the F4 drillings, „settled”, consistency state: hard-plastic consistency – hard;
- (ii) one package with medium/fine/coarse sand; medium settlement and a thickness of 18.40m (F1) – 17.00m (F2) – 15.70m (F3) – 9.50m (F4). The layers extend up to a depth of 18.00 + 22.50 m from the natural ground level, representing the main formation (layer) encountered up to the level of the underground construction foundation plate bed;

This layer exists at the underground water level, at variable depths, the digging bottom being lower than the underground water level. The layer features a significant percentage of fine sand, thus entailing the risk of triggering a hydrodynamic movement of the fine particles.

Towards the base, the sand layer switches to a settled state,

- (iii) one package of marl clay / clayey marl, of a hard-plastic consistency in the upper part, which switches to a state of hard consistency across the entire site area. The layers feature high activity (significant swellings and contractions). Its position below the underground water level does not trigger the occurrence of contraction and swelling phenomena, while only influencing the behaviour of the piles.

The layers are characterised by medium compressibility.

This layer appears compact and impermeable across a significant thickness.

c. FOUNDATION LAYING CONDITIONS AND RECOMMENDATIONS

- Taking into account the characteristics of the main load bearing structure and the site particularities (the built-up area), in order to execute the building infrastructure, one shall adopt the solution of a premises on secant piles supported via the basement floors, which are to be successively concreted, top to bottom, as the excavation works advance (the “top-down” procedure);

- In the lower part, the trough shall be closed by a strengthening foundation plate (reinforced concrete), seated on the package with medium and coarse sand of medium settlement. The load bearing capacity to be adopted for the foundation soil shall be $p_{acc} = 300 \text{ KPa}$;

The inner poles shall be seated on the drilled piles at the foundation plate bed level. The depth of the piles shall be determined depending on the design load to be distributed from the poles to the piles. The design shall comply with the recommendations of SR EN 1997 ch. 7 and Annex A.

- In order to support the excavation walls, it is recommended to use walls made of drilled secant piles: concrete reinforced piles / non-reinforced piles. Considering the need to execute waterless diggings within a trough, it is necessary to embed the walls into the impermeable de marl clay / clayey marl layer. The embedding of the walls into the impermeable layer must also take into account the requirement to reduce the horizontal displacements of the walls during the final excavation phases;

- The vertical load bearing capacity of the piles shall be assessed only after the embedding depth of the piles into the bottom impermeable layers has been established, relying on the strength requirements, the normal operation limit state (displacements) and the premises waterproofing (at least 1,5 m of embedding depth):

- In order to maintain a low water level inside the premises, one shall use filter shafts designed to pump intermittently strictly those small amounts of water that might be able to infiltrate through the wall imperfections or the clayey layer;

- The maximum admissible horizontal displacement value for the wall shall be: $\Delta h/H \leq 0.1 \%$;
- Considering that a closed premises is being executed and the outside hydrostatic level remains unchanged, the danger that the surrounding soil might sink, as a cause for a subsiding underground water level (subsidence sinking) is removed;
- The selection of the materials to be used in the execution of reinforced concrete walls shall be made in line with the recommendations of SR EN 1992 – depending on the exposure class, as per SR EN 206-1-2002 – underground water falls into XA1 exposure class. There are no indications regarding the existence of gases within the soil structure;
- The calculation of the digging breast walls shall be made in accordance with the recommendations of normative NP 113-04 and SR EN 1992-1-2004. The verifications shall be conducted using the limit state method: structural (STR) and geotechnical (GEO), where the partial coefficients for actions, the soil parameters (calculation characteristics) and strength shall be set forth according to ANNEX - SREN - 1997 - 1 - 2004;
- The calculation of the breast walls shall adopt a traffic overload of 10 KN/sq m on the inside, and of 15 KN/ sq m (motor vehicle traffic) across the area in the vicinity of V. Babeş str.;
- In order to eliminate the effects of underpressure upon the water in the soil underneath the foundation plate bed, caused by possible settlements of the foundation plate, one shall fit floor drains dischargeable into the sewage network, which would operate only under overflow conditions, maintaining the underground water levels constant (the foundation plate bed);
- For the inner part of the box one shall execute a reinforced concrete partition wall (20 cm);
- The requirement regarding the premises imperviousness shall be met via the quality of the concrete in the reinforced concrete piles and its interior waterproofing by means of special mortars;
- In order to monitor the breast walls, the following solutions are required (SR EN 1997):
 - checking the cast wall for quality and inhomogeneity, by means of continuous-velocity logging, executed on all the walls within the premises. PVC tubes $\Phi 62$ (3 pcs.), fastened to the longitudinal reinforcement, shall be fitted;
 - the monitoring of displacements suffered by the walls made of secant piles shall be handled by 4 inclinometer columns, one for each side of the premises. The tubes shall descend together with the reinforcement cage, to which they shall be fastened using a rigid spiders. One shall secure the integrity and continuity of the 4 columns along the entire depth of the walls (bottom plug, rubber sleeves at the joints, water counter pressure),
 - one shall take steps to monitor the influence the displacements of the walls may have, during the excavation execution stages, upon the neighbouring buildings;
- The CBR value for a depth of 1.00 m is 4-5 %.

CLUJ-NAPOCA
08.10.2017

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FROM: Geo-Tech SRL Gheorghieni

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OCT. 09 2007 04

P1

ANNEX 1.1

S.C. GEO-TECH SRL GHEORGHIEI

EQUIPMENT:

FS 2,5

DRILLING METHOD:

DRY ROTARY SYSTEM

DATE OF EXECUTION: 20.07.2007

DIAMETER:

140mm

GEOTECHNICAL DRILLING F1 SHEET**CLUJ NAPOCA**

fitted with a piezometer, water at 7.00 m, on 02.02.2007

TBC hospital area, Haşdeu str., V. Babeş str.

SCALE 1:100

			LITHOLOGY		COLLECTION OF SAMPLES				SPT							
DEPTH	LAYER THICKNESS	UNDERGROUND WATER DEPTH	SYMBOL	DESCRIPTION	SAMPLE NO.	DEPTH		SAMPLE TYPE	RANGE		NO. OF HITS / 7.5 cm - ANCHORAGE NO. OF HITS / 10 cm - PENETRATION					
(m)	(m)	(m)				(m)			(m)		150 mm	300 mm				
1	2	3				from	to		between	and	illegible	1	2	3		
4	5	6	7	8	9	10	11	12	13	14	15	16				
0.60	0.60			Sol vegetal												
	1.70				Nivel cu prungi argilose galbur si bucati gresiate	B1	1.00	1.10	D							
2.30																
	15.30	NA 7.00				B2	3.00	3.10	D	4.00	4.30	2	4	4	4	3
						B3	6.50	5.70	D	6.50	6.30	4	3	4	5	4
						B4	8.50	8.10	D	8.30	8.50	6	7	5	5	7
					terp. conuşi, galben roscat, cu pietre mici, crescat până la 3 m de la 8 m					10.00	10.30	9	8	11	10	10
									12.00	12.30	8	11	12	14	17	
									14.00	14.30	9	9	11	18	18	
17.60									16.00	16.30	10	9	15	17	16	
	1.40			Pietr. cu mald. mar. belavani	B5	18.00	19.10	D	18.20	18.50	14	14	20	25	28	
19.00																
	1.60			Pietr. cu argile maro cenuşii	B6	19.50	19.70	D	20.00	20.30	18	22	24	21	37	
20.60																
		15.20			B7	22.00	22.10	D	22.20	22.30	12	15	18	13	24	
						B8	24.00	24.70	D	25.00	25.30	13	15	19	22	23
						B9	28.00	29.10	D	27.80	27.90	18	16	17	25	28
						B10	28.00	28.10	D	28.00	28.30	17	15	21	24	34
						B11	30.00	30.10	D	31.00	31.30	14	18	24	28	39
						B12	32.00	32.10	D	32.00	32.30	18	17	23	35	47
34.50					B13	34.50	34.60	D								

D DISTURBED SAMPLE - JAR

Drawn up by:

Eng. Geol. **illegible**

Signature: [illegible]

Geological assistance

illegible

Signature: [illegible]

Verified by

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TRADING COMPANY. ROMANIA]

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OCT. 09 2007 04:39 P2

ANNEX 1.2

S.C. GEO-TECH SRL GHEORGHIEI

EQUIPMENT:

FS 2,5

DRILLING METHOD:

DRY ROTARY SYSTEM

DATE OF EXECUTION: 20.07.2007

DIAMETER:

140mm

GEOTECHNICAL DRILLING F2 SHEET

CLUJ NAPOCA

TBC hospital area, Haşdeu str., V. Babeş str.

SCALE 1:100

			LITHOLOGY		COLLECTION OF SAMPLES				SPT							
DEPTH	LAYER THICKNESS	UNDERGROUND WATER DEPTH	SYMBOL	DESCRIPTION	SAMPLE NO.	DEPTH		SAMPLE TYPE	RANGE		NO. OF HITS / 7.5 cm - ANCHORAGE NO. OF HITS / 10 cm - PENETRATION					
(m)	(m)	(m)				(m)			(m)		150 mm	300 mm				
						from	to		between	and	illegible	1	2	3		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
3.20	3.20			Limestone	B1	2.00	2.10	O								
4.70	1.50			Pietris cu nisip galben mediu, indecat	B2	3.80	3.90	O	4.00	4.30	10	9	8	9	3	
	16.30			Pietris (fin, mediu, mare) galben cenuşiu cu pungi de argila cenuşie, indecat de la 9 m	B3	5.00	5.10	O	5.20	5.50	10	11	9	9	10	
					B4	8.20	8.30	O	8.20	8.50	9	12	8	10	11	
					B5	10.20	10.30	O	10.20	10.50	10	12	11	13	10	
					B6	12.00	12.10	O	12.30	12.60	9	14	10	13	15	
					B7	14.80	14.90	O	14.50	15.20	12	15	17	16	12	
					B8	17.00	17.10	O	17.20	17.50	10	16	18	24	30	
					B9	19.00	19.10	O	19.20	19.50	13	14	26	25	27	
21.00					B10	21.30	21.40	O								
21.80	0.80			Nisip cenuşiu mediu, indecat cu rar pietre												
24.00	2.20			Argila cenuşie tare cu intercalaţii fine de nisip cu pietre, bolovani	B11	23.00	23.10	O	23.00	23.30	21	16	20	42	-	
	12.00			Argila maroasă nisipoasă densă, tare	B12	25.30	25.40	O	25.50	25.80	11	12	12	19	24	
					B13	27.40	27.50	O	27.70	28.00	12	11	17	18	32	
					B14	30.00	30.10	O	30.30	30.60	14	15	22	21	31	
					B15	32.00	32.10	O	32.00	40.00	17	18	25	27		
38.00					B16	34.50	34.80	O	34.70	36.00	19	21	29	20		

D DISTURBED SAMPLE - JAR

Drawn up by:

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Signature: [illegible]

Geological assistance

illegible

Signature: [illegible]

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OCT. 09 2007 04:40 P3

ANNEX 1.3

S.C. GEO-TECH SRL GHEORGHIEI

EQUIPMENT:

FS 2,5

DRILLING METHOD:

DRY ROTARY SYSTEM

DATE OF EXECUTION: 20.07.2007

DIAMETER:

140mm

GEOTECHNICAL DRILLING F3 SHEET

CLUJ NAPOCA

fitted with a piezometer, water at 6.50 m, on 02.08.2007

TBC hospital area, Haşdeu str., V. Babeş str.

SCALE 1:100

DEPTH			SYMBOL	LITHOLOGY	DESCRIPTION	COLLECTION OF SAMPLES			SPT							
(m)	LAYER THICKNESS (m)	UNDERGROUND WATER DEPTH (m)				SAMPLE NO.	DEPTH		SAMPLE TYPE	RANGE		NO. OF HITS / 7.5 cm - ANCHORAGE NO. OF HITS / 10 cm - PENETRATION				
							(m)			(m)		150 mm	300 mm			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
0.70	0.70	6.50		Sol vegetal												
1.20	0.50			Argila maroasă cu prafuri nisipoase mici	B1	1.00	1.10	D								
	2.80			Nisip mediu fin galben cu puncte nisipoase medii îndesate	B2	2.00	2.10	D	2.80	2.90	5	6	4	5	6	
3.80					B3	3.20	3.30	D	4.20	4.30	5	7	5	5	7	
	2.70	NA 6.50		Argila grioasă nisipoasă cu extindere intermitentă plastică consistentă spre vârtosă, cu înclădituri omice de nisip	B4	4.00	4.10	D	5.00	5.30	5	7	6	7	7	
5.20					B5	5.50	5.80	D								
	8.20			Nisip galben deschis galben roscat cu puncte de argila rar plastică	B6	8.00	8.10	D	8.00	8.30	8	8	10	12	9	
15.70					B7	11.00	11.10	D	10.00	10.30	9	10	11	9	14	
16.40	0.70				B8	13.00	13.10	D	12.00	12.30	8	11	12	15	17	
17.90	1.20				Argila grioasă nisipoasă cu puncte plastică vârtosă, cu înclădituri de nisip	B9	16.00	16.10	D	16.00	16.30	8	7	10	12	11
					Pietri cu rar bolovanis	B10	17.60	17.70	D	17.20	17.50	20	20	26	34	
18.70	1.10				Pietri cu argila cavitare	B11	18.00	18.10	D	18.60	18.90	21	24	25	29	31
						B12	22.00	22.10	D	21.20	21.50	11	12	12	23	19
						B13	24.00	24.10	D	23.00	23.30	13	12	12	21	25
						B14	26.00	26.10	D	25.00	25.30	12	14	14	19	27
	17.30					B15	28.00	28.10	D	27.00	27.30	16	15	17	27	23
						B16	30.00	30.10	D	29.00	29.30	18	18	18	22	27
						B17	32.00	32.10	D	31.00	31.30	19	18	22	24	
					B18	34.50	34.60	D	33.00	33.30	18	20	20	26		
38.00									35.00	35.30	22	21	29	42		

D DISTURBED SAMPLE - JAR

Drawn up by:

Eng. Geol. **illegible**

Signature: [illegible]

Geological assistance

illegible

Signature: [illegible]

Verified by

illegibleStamp: [GEO-TECH SRL GHEORGHIEI
TRADING COMPANY. ROMANIA]

FROM: Geo-Tech SRL Gheorghieni

PHONE NO.: 0256365256

OCT. 09 2007 04:41 P4

ANNEX 1.4

S.C. GEO-TECH SRL GHEORGHIEI

EQUIPMENT:

FS 2,5

DRILLING METHOD:

DRY ROTARY SYSTEM

DATE OF EXECUTION: 20.07.2007

DIAMETER:

140mm

GEOTECHNICAL DRILLING F4 SHEET

CLUJ NAPOCA

TBC hospital area, Haşdeu str., V. Babeş str.

SCALE 1:100

DEPTH			SYMBOL	LITHOLOGY	DESCRIPTION	COLLECTION OF SAMPLES			SPT								
(m)	LAYER THICKNESS (m)	UNDERGROUND WATER DEPTH (m)				SAMPLE NO.	DEPTH		SAMPLE TYPE	RANGE		NO. OF HITS / 7.5 cm - ANCHORAGE NO. OF HITS / 10 cm - PENETRATION					
							(m)			(m)		150 mm		300 mm			
							from	to		between	and	illegible	1	2	3		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
1.60	1.60																
	5.10					B1	2.00	2.10	D	2.20	2.30	7	7	8	9	7	
						B2	3.00	3.10	D	3.20	3.30	6	6	7	8	9	
						B3	5.00	5.10	D	5.20	5.30	6	7	8	8	9	
3.70						B4	8.00	8.10	ND	8.50	8.60	8	8	9	9	11	
	11.30	NA 9.00				B5	8.30	8.30	D	8.40	8.70	8	7	8	7	9	
						B6	10.40	10.50	D	10.60	10.90	8	8	7	9	11	
						B7	13.00	13.10	D	13.20	13.30	9	9	9	10	12	
						B8	15.00	15.10	D	15.40	15.70	10	10	10	11	13	
19.20						B9	17.00	17.10	D	17.20	17.30	11	12	14	14	12	
	17.00					B10	19.00	19.10	D	19.30	19.60	8	7	16	12	19	
						B11	21.00	21.10	D	21.20	21.50	9	8	14	16	20	
						B12	23.00	23.10	D	23.20	23.50	8	11	13	18	19	
						B13	25.00	25.10	D	25.20	25.60	12	11	16	18	21	
						B14	27.00	27.10	D	27.20	27.50	14	12	21	26	21	
						B15	29.00	29.10	D	29.20	29.60	16	17	23	34	-	
						B16	31.00	31.10	D	31.20	31.50	17	19	23	37	-	
36.20						B17	34.00	34.10	D	34.20	34.50	19	22	26	40	-	

D DISTURBED SAMPLE - JAR

Drawn up by:

Eng. Geol. illegible

Signature: [illegible]

Geological assistance

illegible

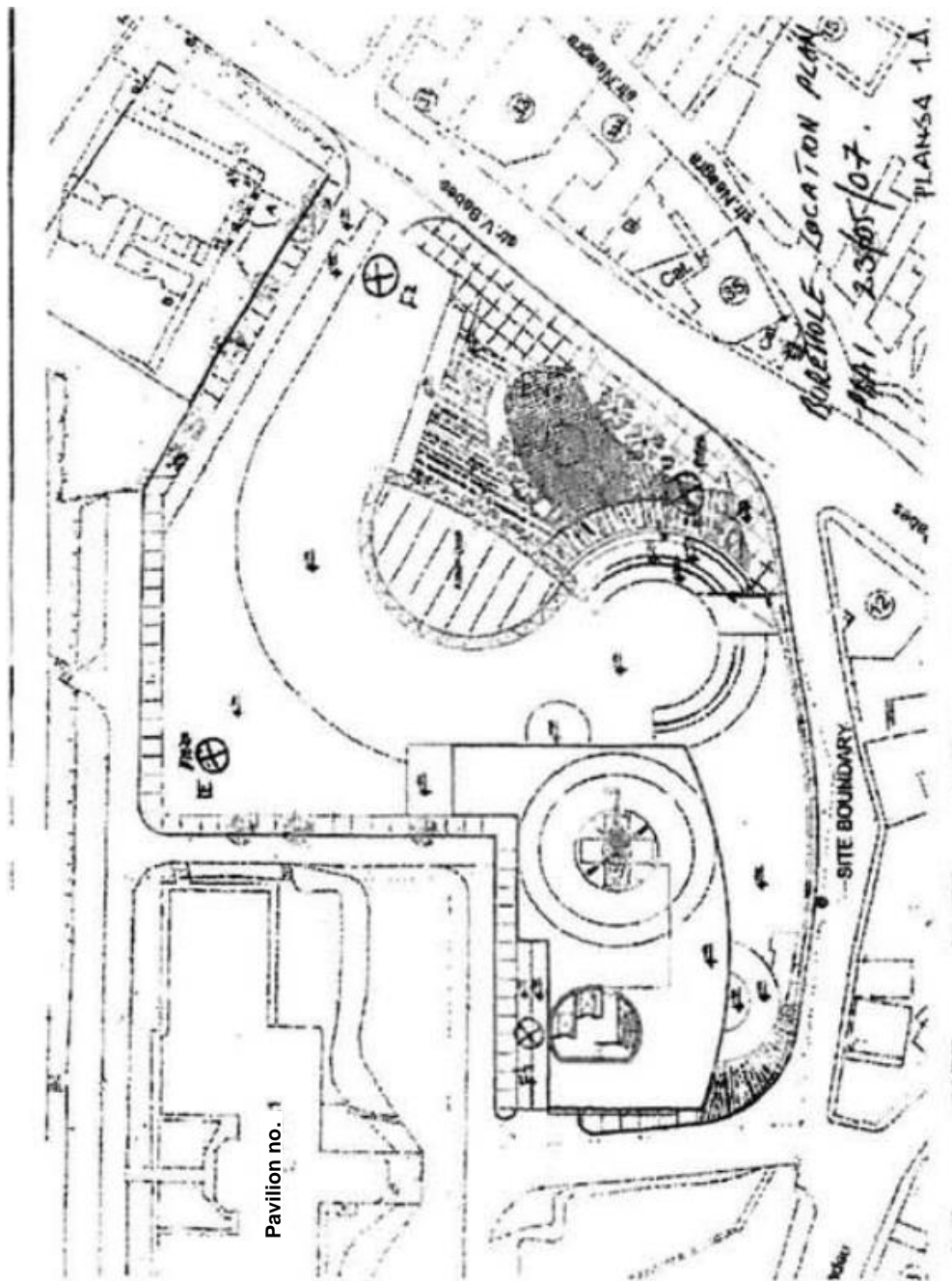
Signature: [illegible]

Verified by

illegible

Stamp: [GEO-TECH SRL GHEORGHIEI
TRADING COMPANY. ROMANIA]

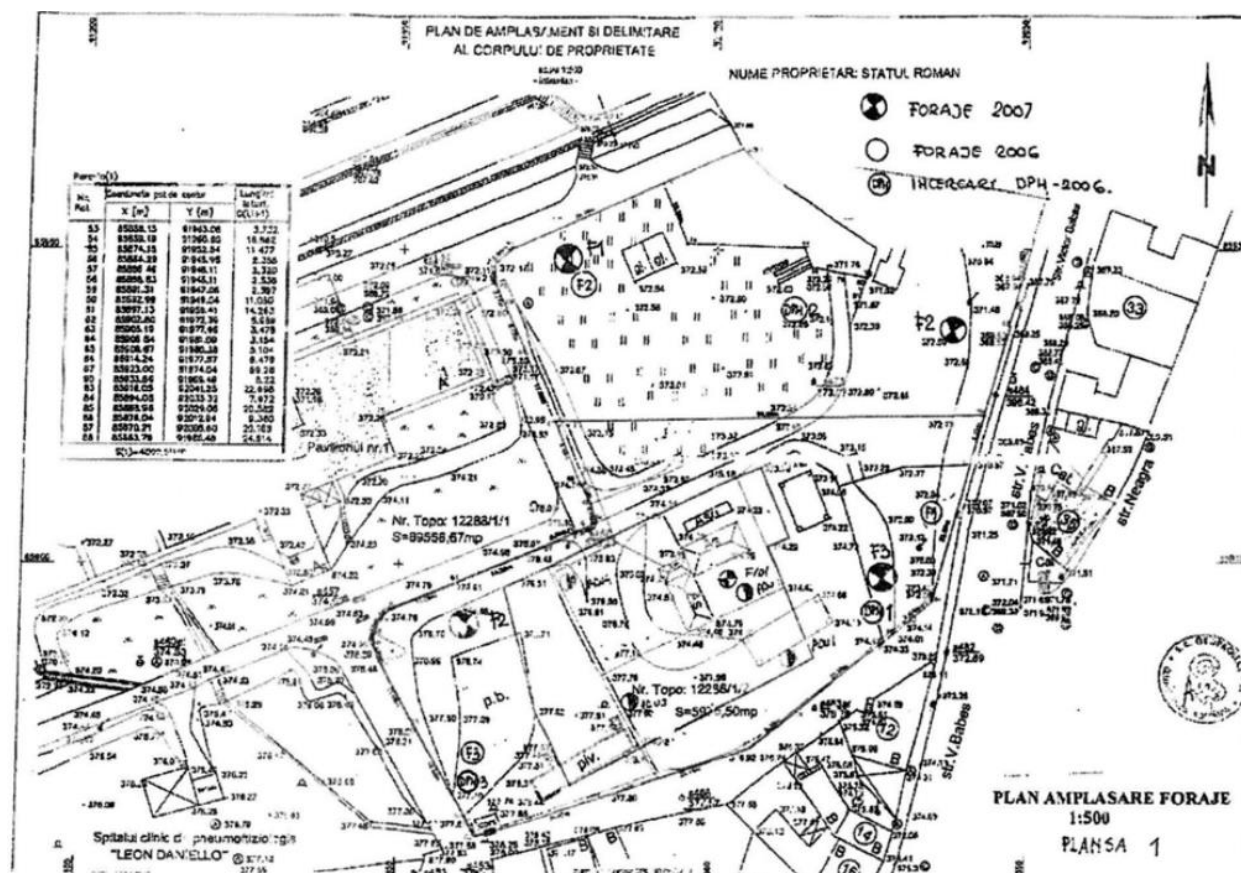
BOREHOLE LOCATION PLAN
PBAI 23/05/07
DRAWING 1.A



BOREHOLE LOCATION LAN

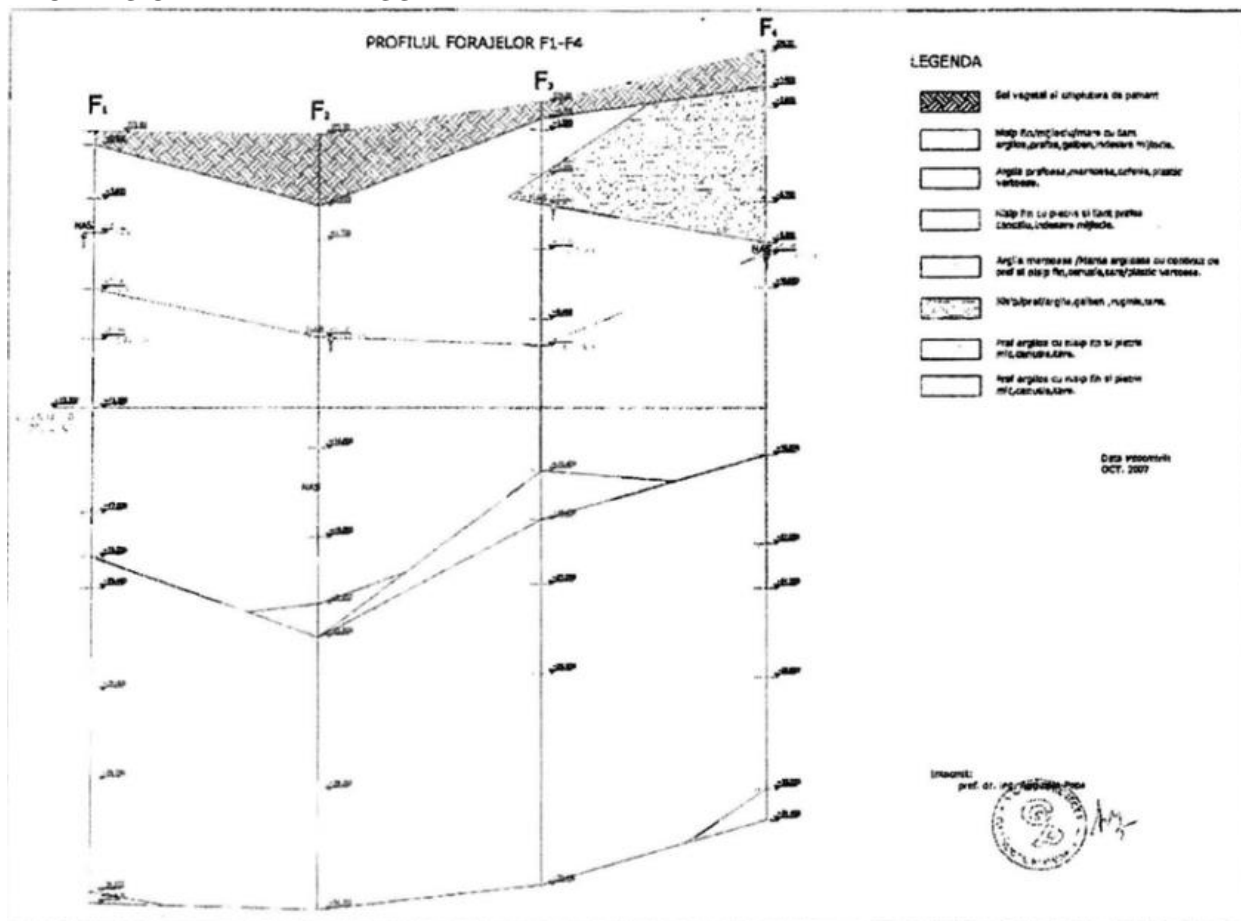
1:500

DRAWING 1

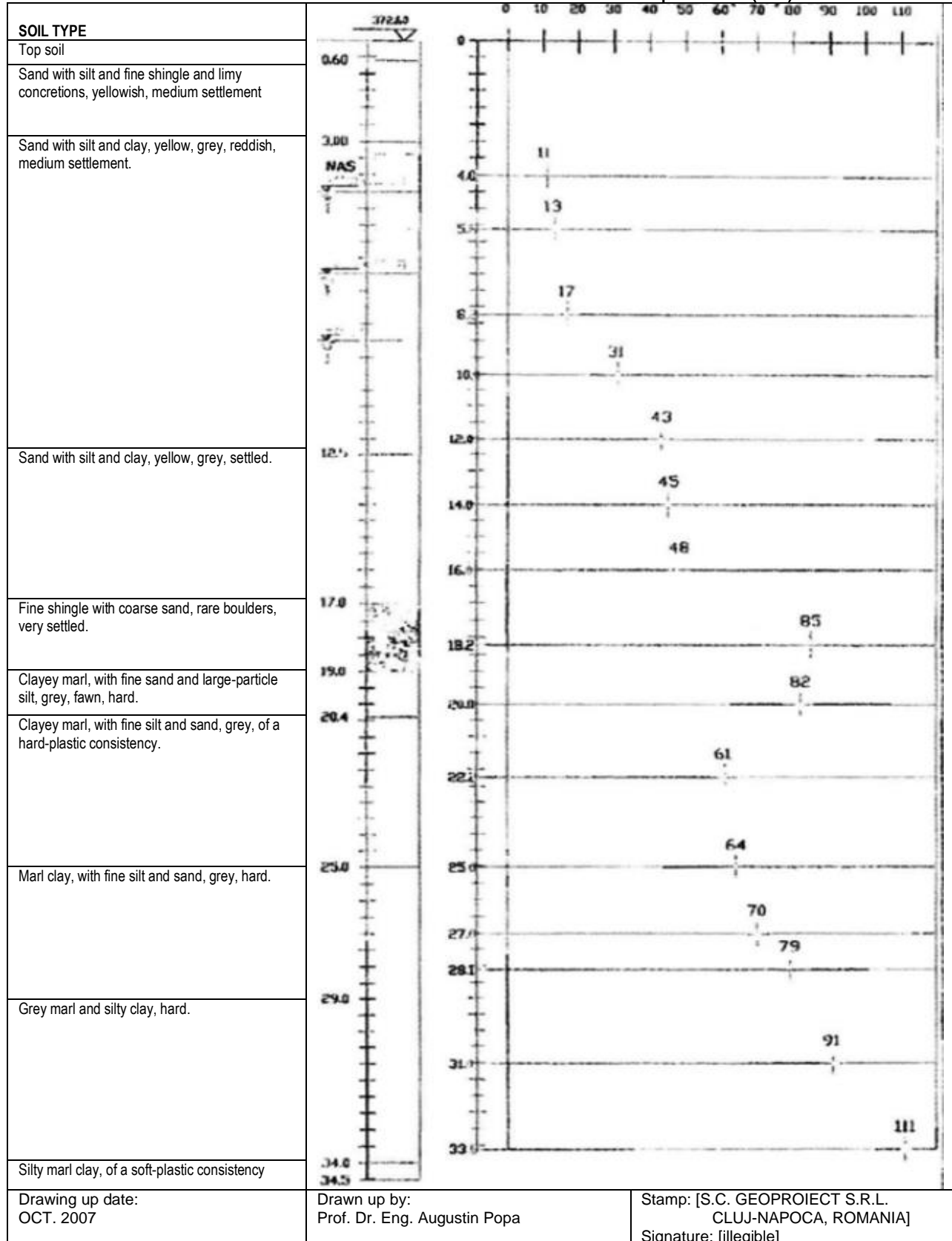


PLAN DE AMPLASAMENT SI DELIMITARE AL CORPULUI DE PROPRIETATE	PROPERTY UNIT LAYOUT AND DELIMITATION PLAN
NUME PROPRIETAR: STATUL ROMAN	OWNER'S NAME: THE ROMANIAN STATE
FORAJE	DRILLINGS/BOREHOLES
INCERCARE DPH	DPH TEST

PROFILES OF F1-F4 DRILLINGS



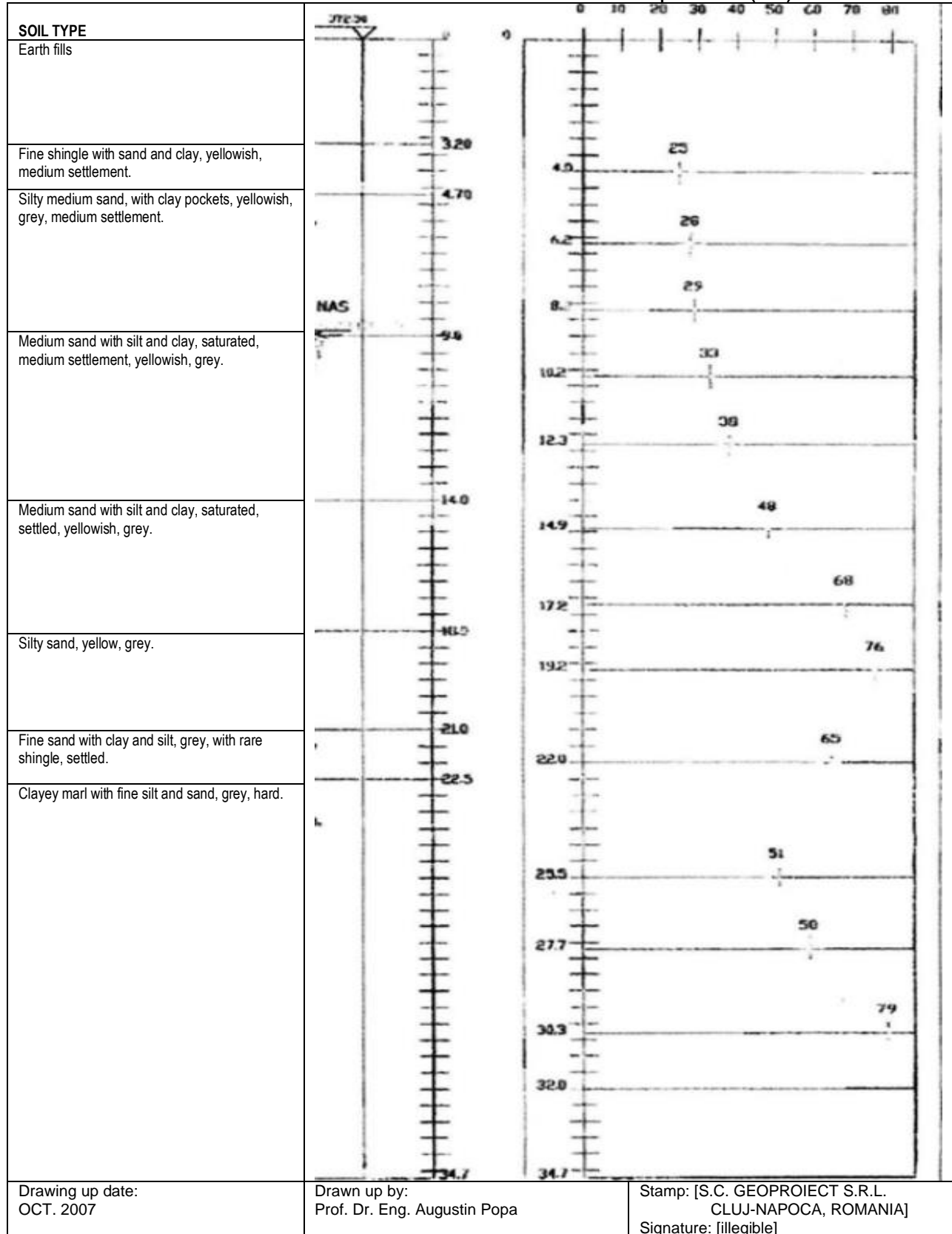
LEGENDA	CAPTION
	Top soil and earth fill
	Fine/medium/coarse sand with [... illegible ...], medium settlement.
	Silty, marl clay [... illegible ...], of a hard-plastic consistency.
	Fine sand with shingle and [... illegible ...], medium settlement.
	Marl clay/clayey marl [... illegible ...], of a hard-plastic consistency.
	[... illegible ...]/silt/clay, yellow, [... illegible ...]
	Clayey silt with fine sand and fine shingle, [... illegible ...]
	Clayey silt with fine sand and fine shingle, [... illegible ...]

F1 DRILLING PROFILE
Standard penetration (SPT) N 30


Drawing up date:
OCT. 2007

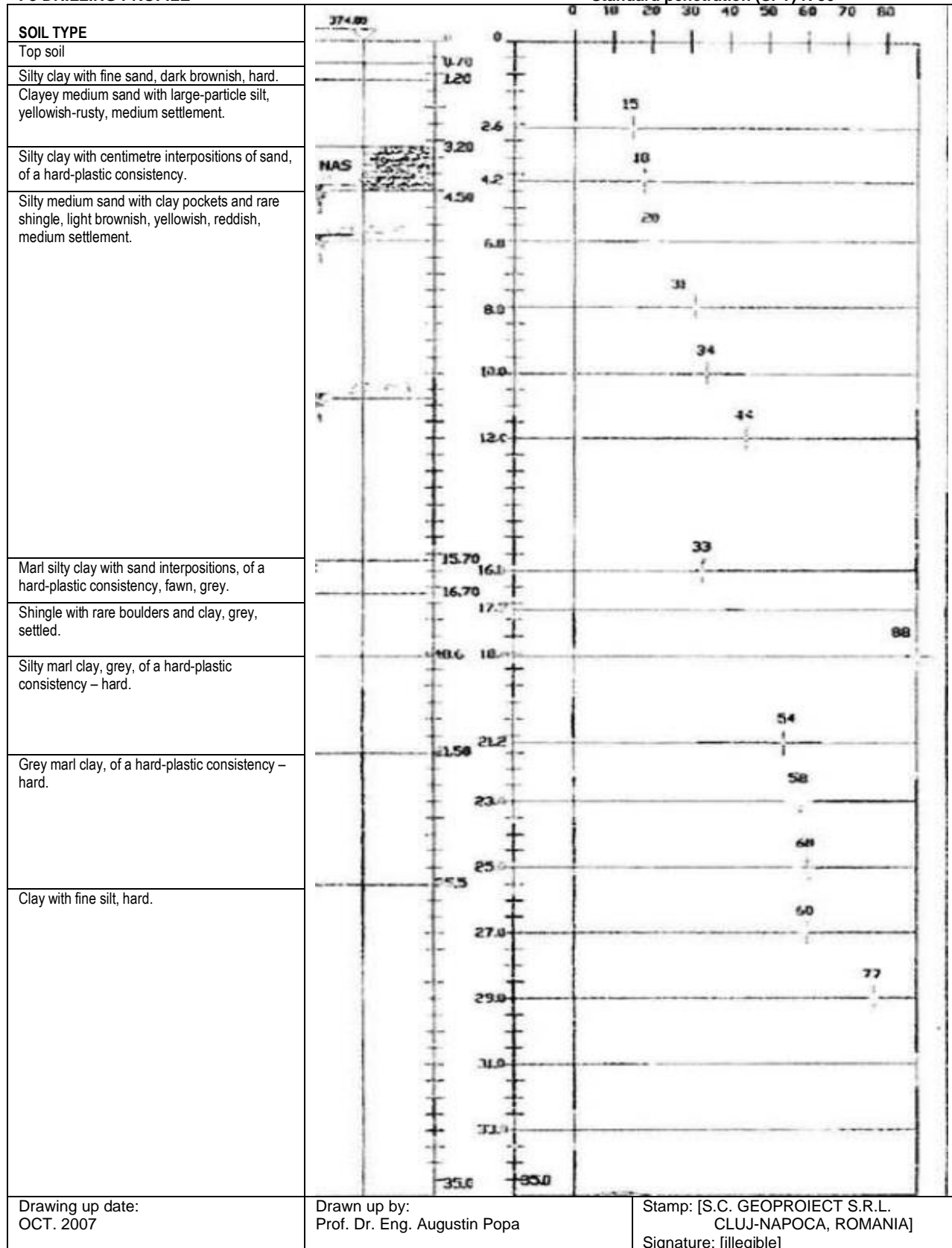
Drawn up by:
Prof. Dr. Eng. Augustin Popa

Stamp: [S.C. GEOPROIECT S.R.L.
CLUJ-NAPOCA, ROMANIA]
Signature: [illegible]

F2 DRILLING PROFILE
Standard penetration (SPT) N 30

 Drawing up date:
OCT. 2007

 Drawn up by:
Prof. Dr. Eng. Augustin Popa

 Stamp: [S.C. GEOPROIECT S.R.L.
CLUJ-NAPOCA, ROMANIA]
Signature: [illegible]

F3 DRILLING PROFILE
Standard penetration (SPT) N 30


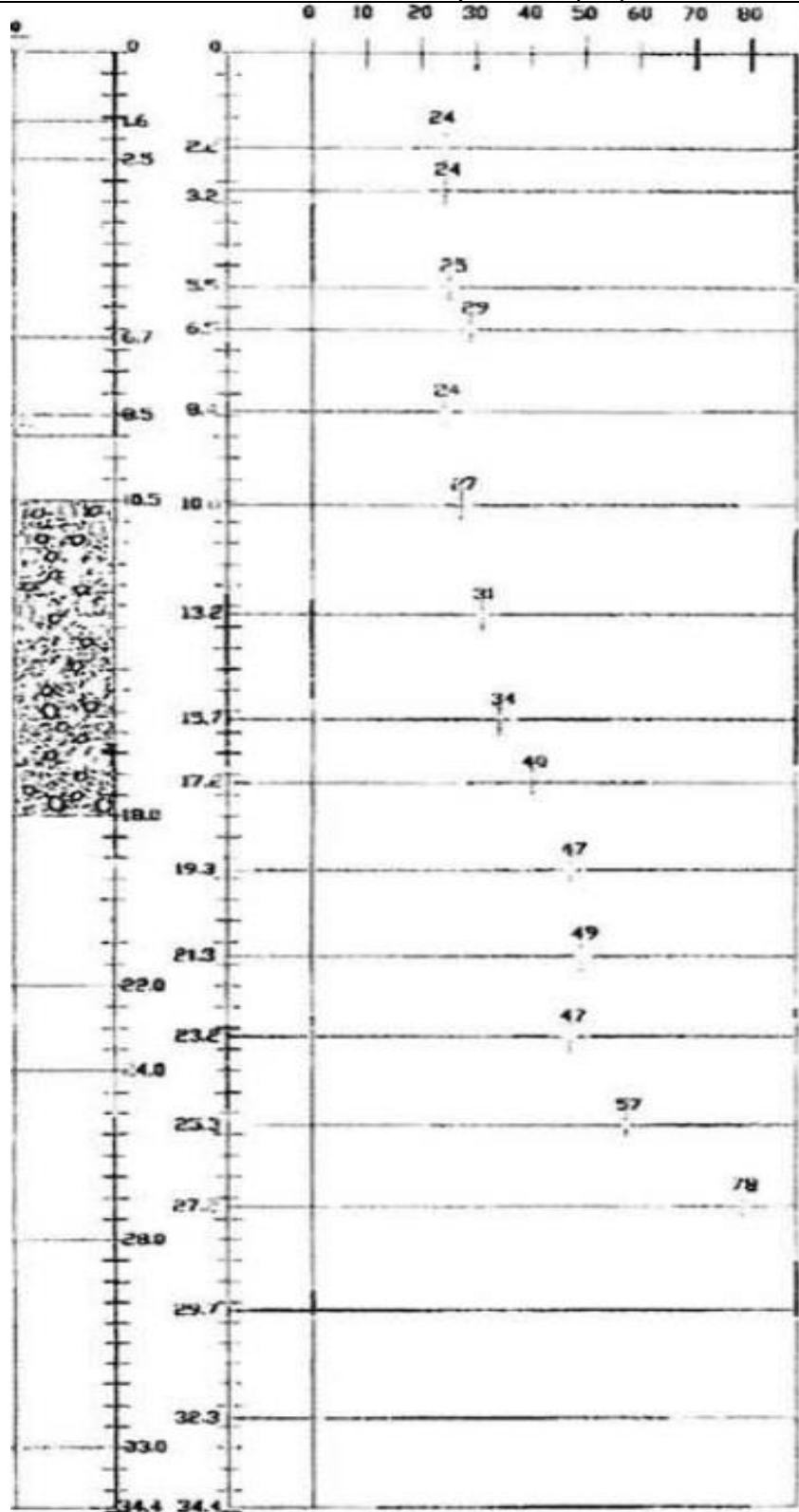
Drawing up date:
OCT. 2007

Drawn up by:
Prof. Dr. Eng. Augustin Popa

Stamp: [S.C. GEOPROIECT S.R.L.
CLUJ-NAPOCA, ROMANIA]
Signature: [illegible]

F4 DRILLING PROFILE
Standard penetration (SPT) N 30

SOIL TYPE		
Fill		
Silty, sandy clay, grey, hard		
Sand with silt and clay, light brownish, medium settlement.		
Silty clay, light brownish, of a hard-plastic consistency.		
Sand with clay and silt and fine shingle, fawn, rusty, grey, medium settlement.		
Medium sand with fine shingle, with freestone fragments, fawn, rusty, grey, medium settlement.		
Silty marl clay, grey, hard.		
Marl, grey, hard		
Silty marl clay, grey, hard		
Marl clay, grey, hard		
Clayey silt with fine sand and fine shingle, grey, hard.		
Drawing up date: OCT. 2007	Drawn up by: Prof. Dr. Eng. Augustin Popa	Stamp: [S.C. GEOPROIECT S.R.L. CLUJ-NAPOCA, ROMANIA] Signature: [illegible]



SUMMARY TABLE WITH RESULTS OF LABORATORY TESTS
Drilling no. 1

ANNEX B.1

No. ord.	Indicativ sondă	Cod probe	Tipul probelor, descriere sondaj	Fond nr.	Miner (m L)	γ_s (kN/m ³)	γ_d (kN/m ³)	T (kN/m ²)	w %	e	U_L %	w_p %	J_p %	I_p	k cmh	M_{50} MPa	E ₅₀ GPa	Subst. plastice %	Clasament %	q_{1d} MPa	q_{1d} MPa
	F181	076	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	1,0	20,70			10,11										0-1	30,8	
	F182	077	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	3,0										Report nr. 287						
	F183 (SPT)	088	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	4,0																
	F183	078	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	5,6	20,00			7,77		20,57										
	F184 (SPT)	080	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	6,0																
	F184	079	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	8,0										Report nr. 289						
	F185 (SPT)	081	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	8,2																
	F186 (SPT)	082	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	10,0				7,00												
	F185 (SPT)	083	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	12,0																
	F186 (SPT)	084	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	14,0				15,88												
	F187 (SPT)	085	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	16,0	20,54															
	F188	080	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	18,0				6,53												
	F189	081	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	18,8	25,89	17,17	20,24	18,89	0,508	204	78 25,58	83,42	1,10					1-2	29,7	29,58 76,68
	F189 (SPT)	080	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	20,0	25,70					100,67										
	F187	082	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	22,0	20,54			28,38		280,0	78,00 22,82	58,18	0,80					0-1	29,8	
	F187 (SPT)	087	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	22,2																
	F188	083	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	24,0																
	F1810 (SPT)	088	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	25,0																
	F189	084	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	26,0	20,889	17,31	20,31	18,39	0,624	870,0	68,00 26,07	42,80	1,10		10528	Report nr. 088	1-2	16		
	F1811 (SPT)	090	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	27,8																
	F1810	085	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	28,0																
	F1812 (SPT)	700	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	28,0																
	F1811	088	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	30,0	20,180	18,15	20,80	18,47	0,464	270	117,5 36,74	60,78	1,23		34647		1-2	17,4		
	F1813 (SPT)	701	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	31,0	28,78					183,33										
	F1812	087	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	32,0																
	F1814 (SPT)	702	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	33,0																
	F1818	089	Argila cu pietre de dimensiuni mici, nisipuri, carbonați	F1	34,5				15,40			28,00 7,23	15,77						1-2	21,61	

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CLUJ-NAPOCA, ROMANIA]

Signature: [illegible]
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Tests schedule

SUMMARY TABLE WITH RESULTS OF LABORATORY TESTS
Drilling no. 2

ANNEX B.2

Nr. crt.	Indicativ probe	Cod probe	Tipul pământului, descrierea succintă	Fonș nr.	Adâncime (m)	T ₁ (kN/m ²)	T ₂ (kN/m ²)	T ₃ (kN/m ²)	W (%)	e	U _L (%)	w _p (%)	I _p (%)	I _c	k (cm/s)	M _{sd} (kPa)	Edo (cmăciune)	Subst. organice	Carbonat (%)	q _{cl} (kPa)	q _{sc} (kPa)
	F201	703	Argilă neagră	F2	2,0																
	F202	704	Argilă neagră cu nisip și argilă	F2	3,8	25,065			0,30		30,67								0-1	15,4	
	F201/1 (SPT)	719	Argilă neagră cu nisip și argilă	F2	4,0																
	F203	705	Argilă neagră cu nisip	F2	6,0	25,957			18,86												
	F201/2 (SPT)	720	Argilă neagră cu nisip	F2	6,2																
	F204	706	Argilă neagră cu nisip	F2	8,0																
	F201/3 (SPT)	721	Argilă neagră cu nisip	F2	8,2																
	F205	707	Argilă neagră cu nisip și argilă plastică moale	F2	10,0	25,987			20,39												
	F201/4 (SPT)	722	Argilă neagră cu nisip și argilă plastică moale	F2	10,2																
	F206	708	Argilă neagră cu nisip și argilă plastică moale	F2	12,0																
	F201/5 (SPT)	723	Argilă neagră cu nisip și argilă plastică moale	F2	12,3																
	F207	709	Argilă neagră cu nisip și argilă plastică moale	F2	14,8																
	F201/6 (SPT)	724	Argilă neagră cu nisip și argilă plastică moale	F2	14,9																
	F208	710	Argilă neagră cu nisip și argilă plastică moale	F2	17,0																
	F201/7 (SPT)	725	Argilă neagră cu nisip și argilă plastică moale	F2	17,2																
	F209	711	Nisip grosier	F2	19,0	20,055			12,05												
	F201/8 (SPT)	726	Nisip grosier	F2	19,2																
	F2510	712	Nisip fin cu argilă și nisip	F2	21,5	28,104	17,46	19,03	15,40	0,406	67,67	48,00 29,35	27,05	1,18		17078			1-2	15,8	
	F201/9 (SPT)	727	Nisip fin cu argilă	F2	22,0																
	F2011	713	Mărmură argilaceă cu nisip și nisip fin	F2	23,0																
	F2012	714	Mărmură argilaceă cu nisip și nisip fin	F2	25,5																
	F201/10 (SPT)	728	Mărmură argilaceă cu nisip și nisip fin	F2	25,8																
	F2013	715	Mărmură argilaceă cu nisip și nisip fin	F2	27,4																
	F201/11 (SPT)	729	Mărmură argilaceă cu nisip și nisip fin	F2	27,7																
	F2014	716	Mărmură argilaceă cu nisip și nisip fin	F2	30,0																
	F201/12 (SPT)	730	Mărmură argilaceă cu nisip și nisip fin	F2	30,3																
	F2015	717	Mărmură argilaceă cu nisip și nisip fin	F2	32,0	26,040	17,58	20,24	15,17	0,527	126,00	51 19,12	31,88	1,12		14818			1-2	30,55	
	F201/13 (SPT)	731	Mărmură argilaceă cu nisip și nisip fin	F2	32,4																
	F2016	718	Mărmură argilaceă cu nisip și nisip fin	F2	34,5																
	F201/14 (SPT)	732	Mărmură argilaceă cu nisip și nisip fin	F2	34,7																

Stamp: [S.C. GEOPROIECT S.R.L.
CLUJ-NAPOCA, ROMANIA]
Signature: [illegible]

Tests schedule

Drilling no. 3

[illegible]

Stamp: [S.C. GEOPROIECT S.R.L.
CLUJ-NAPOCA, ROMANIA]
Signature: [illegible]

Tests schedule

SUMMARY TABLE WITH RESULTS OF LABORATORY TESTS
Drilling no. 4

ANNEX B.4

Nr. ser.	Indicativ (mă)	Cod profil	Tipul probelor, descriere asociată	Formă mă	Mădă (m)	T ₁ kN/m ²	T ₂ kN/m ²	T ₃ kN/m ²	W %	e	U ₁ %	U ₂ %	U ₃ %	U ₄ %	U ₅ %	M _{pr} kPa	Eda consolidare	Indus. ciment	Carbonat %	q _{pr} MPa	q _{pr} MPa
	F4B1	769	Argila prefecsa neprocesata	F4	2,0	25,000			13,30		80	21,70	20,21	1,20							
	F4P1 (SPT)	766	Argila prefecsa neprocesata	F4	2,2																
	F4B2	770	Argila prefecsa neprocesata	F4	3,0	25,104			13,17		108,67	41,8	21,89	22,81	1,37			1-2	2,78		
	F4P2 (SPT)	767	Argila prefecsa neprocesata	F4	3,2																
	F4B3	771	Argila prefecsa neprocesata	F4	5,0				16,18												
	F4P3 (SPT)	768	Argila prefecsa neprocesata	F4	5,2																
	F4S1	772	Argila prefecsa neprocesata	F4	6	25,697	17,30	20,77	15,67	0,400	85	41,00	18,32	24,00	1,13			1-2	0,3	17,30	87,29
	F4P4 (SPT)	769	Argila prefecsa neprocesata	F4	6,5																
	F4B4	773	Argila prefecsa neprocesata	F4	8,2	25,173			23,60		64	52,00	19,35	31,82	0,87			0-1	2,74		
	F4P5 (SPT)	770	Argila prefecsa neprocesata	F4	8,4																
	F4B5	774	Argila prefecsa neprocesata	F4	10,4	26,005			11,9												
	F4P6 (SPT)	761	Argila prefecsa neprocesata	F4	10,5																
	F4B6	775	Argila prefecsa neprocesata	F4	13,0	25,697			13,80												
	F4P7 (SPT)	762	Argila prefecsa neprocesata	F4	13,2																
	F4B7	778	Argila prefecsa neprocesata	F4	16,0				15,16												
	F4P8 (SPT)	763	Argila prefecsa neprocesata	F4	15,4				27,33												
	F4B8	777	Argila prefecsa neprocesata	F4	17,0				13,00												
	F4P9 (SPT)	764	Argila prefecsa neprocesata	F4	17,2																
	F4B9	778	Argila prefecsa neprocesata	F4	19,0	26,410	18,68	19,82	22	0,594	158,33	65,00	24,69	40,31	1,07		Raport nr. 665	1-2	16		
	F4P10 (SPT)	765	Argila prefecsa neprocesata	F4	19,3																
	F4B10	779	Argila prefecsa neprocesata	F4	21,0	26,410	18,629	19,483	0,647								Raport nr.				
	F4P11 (SPT)	766	Argila prefecsa neprocesata	F4	21,3																
	F4B11	780	Argila prefecsa neprocesata	F4	23,0				23,04		110,67	67,00	22,65	40,35	0,99			1-2	41		
	F4P12 (SPT)	767	Argila prefecsa neprocesata	F4	23,2																
	F4B12	781	Argila prefecsa neprocesata	F4	25,0	26,410	15,85	19,50	25,82	0,606	119,0	67,00	25,72	41,28	1,00	13394				25,82	67,47
	F4P13 (SPT)	768	Argila prefecsa neprocesata	F4	25,3																
	F4B13	782	Argila prefecsa neprocesata	F4	27,0																
	F4P14 (SPT)	769	Argila prefecsa neprocesata	F4	27,2																
	F4B14	783	Argila prefecsa neprocesata	F4	29,5																
	F4P15 (SPT)	800	Argila prefecsa neprocesata	F4	29,7																
	F4B15	784	Argila prefecsa neprocesata	F4	32,0																
	F4P16 (SPT)	801	Argila prefecsa neprocesata	F4	32,2																
	F4B16	785	Argila prefecsa neprocesata	F4	34,0	26,467	15,99	18,71	19,86	0,590	161	64,00	32,65	31,34	1,41			0-1		24,00	29,82
	F4P17 (SPT)	802	Argila prefecsa neprocesata	F4	34,4																

Stamp: [S.C. GEOPROIECT S.R.L.
CLUJ-NAPOCA, ROMANIA]
Signature: [illegible]

Tests schedule