

Gvirgvini Ltd.

The Results of Engineering and Geological Study in Bakuriani, on Didveli Area Ordered by
Mountain Resorts Development Ltd.

Engineering and Geological Conclusion

The Director of
Gvirgvini Ltd.

/Ramaz Chikovani/

Tbilisi
2014

Content

1.	Introduction	
2.	Brief description of natural conditions on the site of works	
3.	Methodology and volume of conducted works	
4.	Engineering and geological conditions on the study area	
5.	Conclusion and recommendations	
6.	Reference list	

Annexes

1.	Graphical Annexes	
1.1.	The plan of the study area with mining waste and section lines SF 1:1000 . .	1 pg.
1.2.	. Engineering and geological sections I-I ^I	1 pg.
1.3.	Engineering and geological sections II-II ^I	1 pg.
1.4.	Conventional references.	1 pg.
1.5.	Engineering and geological sections of the wells, №1-6	12 pg.
1.6.	Engineering and geological sections of the pares №1÷5	5 pg.

2.	Textual Annexes	
2.1.	Technical order	1 pg.
2.2.	Reporting indicators of physical and mechanical indicators of the soil	1 pg.
2.3.	Results of laboratory study of the soil samples – the conclusion of LEPL Levan Samkharauli National Forensic Bureau	10 pg.
2.4.	Results of laboratory study of the soil samples – The results of the laboratory study performed by GeoEngineering.	11 pg.
2.5.	Results of laboratory study of filtration properties of the soil.	1 pg.
2.6.	The results of statistical processing of the laboratory study materials regarding the quake characteristics	1 pg.

1. Introduction

Engineering and geological studies were conducted in December and January of 2014-2015 in order to study the nearby territory of lower Bakuriani, on the area of Didveli, on the basis of the agreement concluded by “Mountain Resorts Development” Ltd. and “Gvirgvini” Ltd.

The works were conducted in accordance with the technical order given by the customer (see annex 2.1).

Under the agreement the contractor shall ensure expertise of the documents of engineering and geological studies (the Engineering and Geological Conclusion) by LEPL Levan Samkharauli National Forensic Bureau and it is emphasized that the purpose of the expertise is to determine compliance of the conducted works with the technical order.

The engineering and geological studies included field, laboratory studies and cameralistic processing stages.

The director of “Gvirgvini” Ltd. - Ramaz Chikovani, his deputy M. Kipiani, Engineer-Geologists: A. Lobjanidze, E. Katsadze, T. Jajanidze, V. Ivanov and L. Kobesashvili carried out the works.

2. Brief description of natural conditions on the site of works

The study area is located within the north slope of Adjara-Trialeti mountain ridge. The climate is transitional from moderately humid to continental climate; winters are cold and snowy, the thickness of snow is approximately 64 cm. Snow is maintained stable from the early December to the end of March. Summer is quite long. Average temperature in January is -7.2° , in August - 15° . Average annual precipitation is 734 mm.

The hydrographic network of the territory consists of Gujareti Water from the north and River Ktsia from the south, which flow in the opposite longitudinal directions with their small and medium tributaries.

According to geomorphology, the area belongs to the South Georgia volcanic mountainous zone and peripheral longitudinal mountain ridge zones of the Tori-Gujareti volcanic area of Trialeti Ridge region, which includes the cave between the volcanic flows of Tsikhisjvari (main) and Gvirgvini Ridge. These two flows (ridges) of the most recent volcanism join each other at the mountain Jamjama.

River Gujaretistskali flows in longitudinal direction, while Borjomula flows in meridian direction.

General nature of relief is technogenic and erosion which is complicated with lava flows, plateaus and other volcanic forms.

Geologically, the territory consists of upper cretaceous porphyrite and quartz-porphyrite, albitophyre and their tuffs and tuff-breccia and tuff-sandstones, lava flow layers of Paleogenic andesite, tuff-sandstones, coarse grained andesite tuffs and dislocated mudstone.

Tectonics of the region is the result of its location within the Lesser Caucasus mega-anticlinorium region, which is the precondition for high seismic activity.

According to the hydrological zoning map, the studied area belongs to the crevice water area of Akhaltsikhe artesian basin within Adjara-Trialeti channelling system region.

According to the engineering and geological zoning map, the studied area is located within the area of cretaceous and Paleogenic volcanogenic sediments, rocky and partially-rocky soil of the Adjara-Trialeti folded system region.

It should be noted, that many types of geo-dynamic processes are widely characteristic to this area, which must be taken into consideration when designing projects of specific engineering constructions.

3. Methodology and volume of conducted works

According to the technical order, 6 wells must have been bored at the site, with the depth of 30 linear meters each, or totally 180.0 linear meters, by taking the samples and pares with the depth of approximately 5.0-6.0 meters or up to basic soil layers, must have been made and the samples taken.

Physical and mechanical properties of the soil (of dispersive layers) must have been studied at the laboratory in accordance with the international standard requirements; the following must have been determined: 1) granulometric content, 2) humidity, 3) porosity, 4) filtration, 5) compression, 6) direct cutting and 7) Atterberg limits. Amount of each definition must have been 5.

The technical order was accomplished as follows: complete core and soil samples were taken by mechanical-linear method. 6 wells were bored with the diameter of 127 mm-76 mm, with the depth of 30.0 meters each and 20 samples of soil were taken.

Five pares were made with the depth of 5.0 linear meters each, and in total with the depth of 25.0 linear meters and 11 samples of the disturbed structure of soil were taken. Due to high content of coarse debris insertions the samples of monolithic rocky stratum were not taken from the pares.

As the upper part of the studied section is directly connected to the project of engineering construction, main part of the laboratory studies were conducted on the samples taken from the pares (see annex 2.3). This was also caused by the fact, that applied western method allows to put the samples, with disturbed structure, into their natural load conditions and based on them to determine the values of physical properties and of section parameters.

This type of experiments requires significant amount of samples to the extent which is allowed by the pares, while in case of wells it was not possible to conduct such experiments. (See annex 2.4).

The laboratory of “GeoEngineering” has established the density of mineral part of the soil on the basis of the percentage correlation of loamy soil and coarse debris insertions, using the existing fund materials, which amounted to 2.69 linear cm³ and 2.70 linear cm³ (see annexes 2.2, EGE 2 and EGE 3).

Filtration properties were studied at the laboratory of JSC “Saktskalproekti”.

The results of field and laboratory studies were processed in accordance with current standards and normative requirements and Engineering and Geological Elements (EGE) were distinguished.

Numbers were assigned according to the consistency and the increase in the amount of coarse debris insertions.

In all, 8 Engineering and Geological Elements were distinguished.

On the basis of laboratory determinations 3 EGEs were distinguished: 2, 3 and 7 and the quake properties of EGE 7 were described. The other layers were distinguished according to the field description and the values of mechanical properties were determined in accordance with the current normative recommendations. Only in one case (EGE 7) it was possible to determine the values of quake properties as a result of processing laboratory study materials by a statistical method (see annexes 2.2 and 2.6).

Also, it is notable that as the structure of clay filler is low in the process of experiment on disturbed structure samples, the results of this method must be slightly lower than actual. We assume that due to the above, the values given in brackets for quake properties of EGE 7 are slightly lower than those, recommended by technical normative standards.

Study of underground waters for engineering and geological purposes was not considered by the technical order.

4. Engineering and geological conditions on the study area

The study area is located between lower Bakuriani, Tskhratskaro Ridge and the River Ktsia and it is a hill with a slope and it has almost quadrangular shape in the bottom, at the plain territory; the total area of the site is 3.5 hectares (see annex 1.1). The surface landmarks range between 2099-2140 meters; the inclination goes from south-west to north-east and

achieves its maximum at the central part of the slope (20-25°), while the north and north-east end is a plain territory (see annexes 1.1, 1.2 and 1.3).

The surface is covered by the soil layer of 0.25-0.4 meters thickness.

As a result of cameralistic processing of field and laboratory study materials 8 EGEs were distinguished up to the depth of 30.0 meters according to current normative standard requirements (see annex 2.2): (1) the soil layer edQ_{IV} - brown loam, with high plasticity, with grit and gravel content of up to 15% and with the plant roots of up to 35%; (2) brown loam, semi-solid, with grit and gravel content of up to 40%; (3) greenish loam, solid, with grit and gravel content of up to 35%; (4) greyish-brown loam, semi-solid, with grit and gravel content of up to 50%; (5) brownish-grey loam, semi-solid, with grit and gravel insertions of up to 40% and 0.2÷0.5 m thick middle-layers (percentage correlation in the section - 75%-25%); (6) light and dark brown, semi-solid, the sequence of the loam with grit insertions of up to 40% (0.1÷0.9) and 0.1÷0.2 meters thick grit layers (percentage correlation in the section - 60%-40%); (7) gravel ground with hard loam filler of up to 30%; (8) gravel ground.

Within the scope of the study area, mined up to 30.0 m. depth, the descending section is as follows: the whole territory is covered with 0.25-0.4 m. thick soil layer (EGE 1), under which the gravel layers of 3.75÷4.6 m. capacity and with solid loam filler of up to 30% are situated (EGE 7). Their capacity is slightly increasing to the bottom of the slope and they are also detected in the well №2, within the depth interval of 9.1-14.0 meters. They have the following properties: density value of 1.83 t/m³, porosity coefficient - 0.631, reported resistance of the ground - $4.5 \cdot 10^5$ Pa.

Grit soils (EGE 8) are spread under the EGE 7, in the higher part of the slope (well №6). Here the total capacity of its layers is 6.25 m. It may also be observed in the centre of the studied territory (well №4) directly under the soil layer, where it has lenses with 0.7 m. capacity. In other cases they participate in the sequence of layers, where they occupy various parts of the layers (EGE 5 and EGE 6). The value of reported resistance of the soil is $6.0 \cdot 10^5$ Pa in this case.

The following layer of the territory is EGE 6 – the sequence of the layers with fillers of loam with semi-solid coarse debris insertions and with loam fillers (similar to the layers of EGE 2 and EGE 8), percentage correlation in the section is up to 60%-40%. These layers are

situated at 4.9-12.7 meters intervals in the form of layers with 1.6-3.7 meters capacity and at the depth of up to 22.2-27.5 m. in well №5.

The value of reported resistance for these layers is $3.2 \cdot 10^5$ Pa.

In the upper part of the studied area under EGE 6, 4 layers of EGE 2 (brown loam, semi-solid, with the grit and gravel content) with up to 1.0-1.5 m. capacity are situated within various depth interval of 12.7-30.0 m. depth. They are mostly spread in the lower, plain part of the territory, where their capacity is within the range of 3.0-9.6 m. (see annexes 1.2 and 1.3). The density of these layers is 1.99 l/cm^3 , their porosity coefficient is 0.620 and the reported resistance of the soil is $2.4 \cdot 10^5$ Pa.

EGE 5 (brownish-grey loam, semi-solid, with grit and gravel insertions of up to 40% and with gravel middle-layers with loam fillers of up to 30% (the percentage correlation in the section is 75%-25%)) is dominant in the section of the higher part of the territory.

The value of reported resistance of the soil is $2.9 \cdot 10^5$ Pa.

Three layers of EGE 4 (greyish-brown loam, semi-solid, with grit and gravel content of up to 50%) with the capacity of 1.8-3.4 m. are situated in the central part of the studied area (well №4) at the depth of up to 19.1-30.0 m. These layers are more dominated in the lower part of the territory (see annexes 1.2 and 1.3).

The value of their reported resistance of the soil is $2.8 \cdot 10^5$ Pa.

The 30.0 m. deep section is ended with the EGE 3 soils layers (dark greenish loam, solid, with grit and gravel content of up 35%), which are situated from the depth of 17.0-24.2 meters;

Their properties are as follows: the value of density - 2.03 l/cm^3 , the porosity coefficient is 0.519 and the reported resistance of the soil is $2.7 \cdot 10^5$ Pa.

It is notable, that due to the amount of laboratory determinations strictly required by the technical order, it was not possible to determine physical and mechanical values for all layers, while it was possible to apply a statistical method only in one case during determining quake properties of the EGE 7 (see annex 2.6).

The values of properties of layers 4, 5, 6 and 8 were determined on the basis of description of the core taken from the wells.

The underground waters were opened in the lower, plain area of the territory within the depth interval of 13.0-15.0 m. Their chemical composition was not studied; according to the fund materials the aggression of underground waters is not detected.

It is notable, that the studied area is completely located within the hills of deluvial-proluvial genesis.

It is observed, that the strong mudflow coming from the region of Oshora and Bakurianistskali sources has filled the negative forms of relatively lower areas of the relief situated below it, including the lake located near the bottom of the hill slope of the studied territory, which is identified by the loamy soils containing gallic and organic signs characteristic from the depth of 14.3-24.2 m. in wells №1, 2 and 3 (see annexes 1.1, 1.2 and 1.3).

In the part of the south slope of the Trialeti Ridge, within which the discussed area is located, middle-Eocene lava flow layers are open; due to this this is the zone of intensive physical erosion area and the basic zone of collection of inert coarse debris materials, which signals possible danger of mudflow event.

As the studied territory is located within the deluvial-proluvial body, it has achieved the natural balance relevant to its current condition as a result of geo-dynamic processes, and is characterized with stability.

Unforeseen technogeneious interruption may result in activation of geo-dynamic processes, which will put the construction project, as well as the facilities located below the object, in danger.

5. Conclusions and Recommendations

1. According to the engineering and geological zoning map the study area is located within area of cretaceous and Paleogenic volcanogenic sediments, rocky and partially-rocky soil of the Adjara-Trialeti folded system region.
2. According to complexity of engineering and geological conditions (BNR 1.02.07-87) the study area belongs to the second, middle category.
3. On the basis of cameralistic processing of conducted field and laboratory study materials 8 Engineering Geological Elements (EGE) were distinguished in compliance with current standards and requirements (see annex 2.2).
4. The numbers were assigned to the EGEs according to their consistency and the increase in the amount of coarse debris insertions.
5. All Engineering Geological Elements (EGE) are of deluvial-proluvial genesis and except for the one (EGE 8, gravel ground) they represent the mixture of loamy mass and coarse debris insertions with various percentages (see annex 2.2).
6. The value of reported resistance of the soil fluctuates for the above mentioned layers within the range of $2.4-4.5 \cdot 10^5$ Pa, while it amounts to $6.0 \cdot 10^5$ Pa for the EGE 8 (see annex 2.2).

Also, it must be noted that under the technical order, due to the volume of laboratory studies (in 5 complexes of determinations) laboratory study of physical-mechanical properties of all the layers were not possible to conduct.

7. Under the above-stated loads (see annex 2.2), the sustainability of the construction project would be ensured by the EGEs according to high probability discussed by us, however two factors must be taken into consideration: the type of the construction and the genesis of the study area.
8. The necessary requirement under the current normative regulations during designing hydro-technical construction projects is to study physical-mechanical properties in the conditions of complete water-saturation of the soil, and to conduct field-experimental works in order to study filtration properties.

9. The studied area is a part of the hill of deluvial-proluvial genesis, which is in the condition of natural balance relevant to the type and dimensions of its geological composition as a result of geo-dynamic and erosion processes.
10. The above is the basis for its stable condition and without comprehensively substantiated technogenic interruption negative geo-dynamic processes, such as erosion and landslide, may develop.
11. The studied area is located in valley of the trapezoidal, mudflow nature and mudflow processes are likely to develop in the future from the north-west side.
12. Due to all the above-mentioned, it is advisable to conduct quantitative evaluation of sustainability of the study hill slope, as well as to evaluate possible impact of the geo-dynamic dangers, existing in the region, to the construction project.
13. During the works the underground waters were detected at the bottom of the studied hill within the interval of the depth of $13.0 \div 15.0$ m; according to the data from the fund materials aggression of underground waters is not detected in the study area.
14. According to the seismic zoning map of Georgia the study territory belongs to the zone of 8 ball seismic hazard (PN 01.01-09).

Engineer-Geologists:

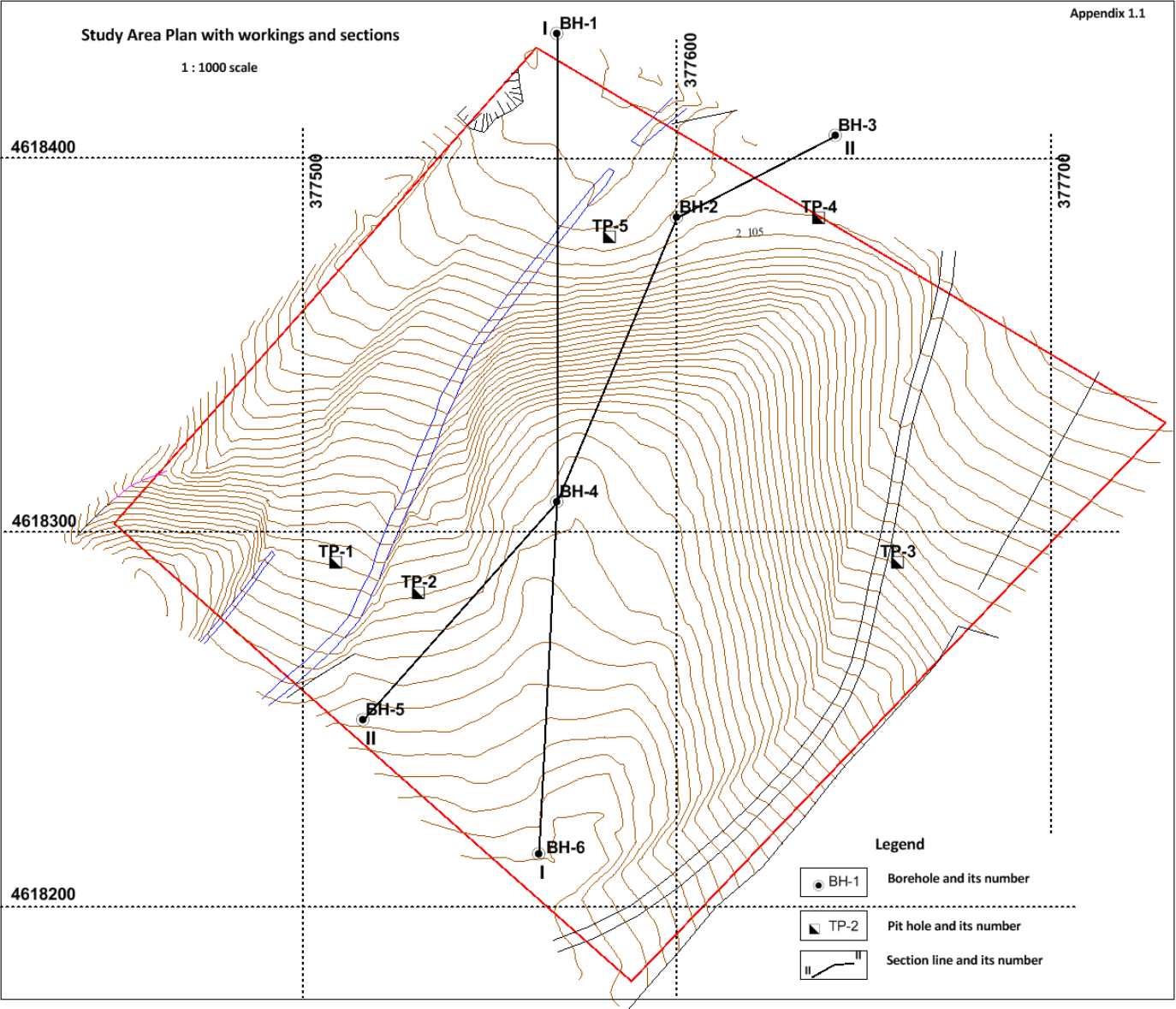
E. Katsadze
R. Chikovani
A. Lobjanidze

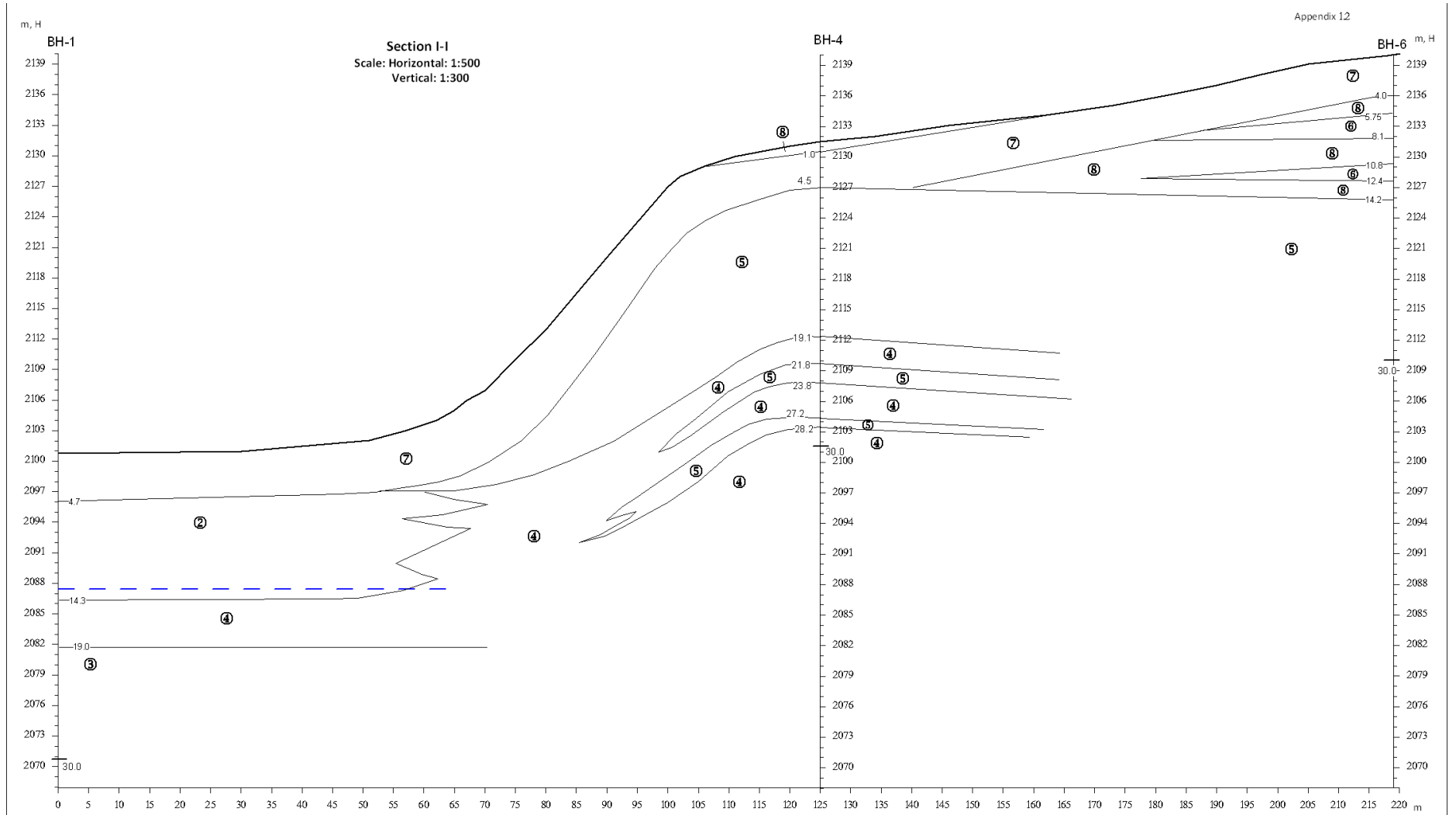
6. Reference List:

1. BS 1377 Part 2 1990:3.2;
2. BS 1377 Part 2 1990:4.3/S;
3. BS 1377 Part 2 1990:9.3;
4. BS 1377 Part 7: Clause 5 (procedure 5 5 5);
5. GOST 25100-82 - Soil Classification;
6. Building Norms and Regulations (BNR) 1.02.07-87 "Engineering Studies for Construction Works";
7. BNR 2.02.01-83 "Foundation of Buildings and Constructions";
8. "Manual for the Design of Foundations of Buildings and Constructions" (BNR 2.02.01-83);
9. "Method of Evaluating Strength and Compression of Round-clastic soil with Silty and Clay Compressor and of Silty and Clay Soils with Round-clastic Insertions" M. 1989;
10. BNR 01.01.-09 "Seismic Resistant Construction";
11. I. M. Buachidze "Hydrogeology of the Soviet Union", T. X-M 1970;
12. I. M. Buachidze, K. I. Janjghava, M. V. Turchinov – "Engineering Geology of the Soviet Union" T-VIII, M.1978.

Appendix

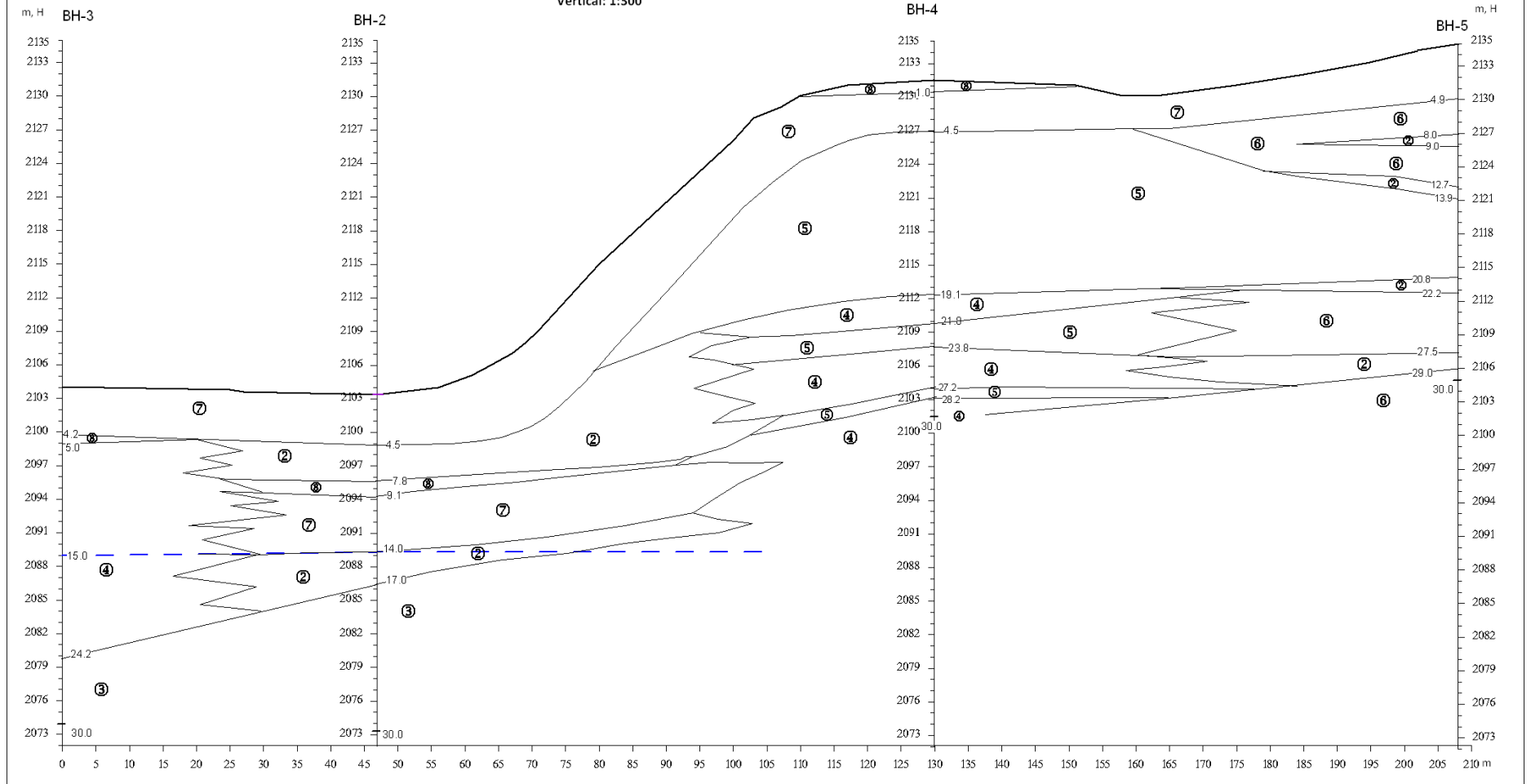
1. Graphical appendix



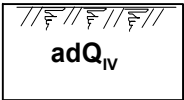
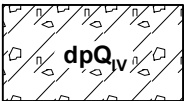
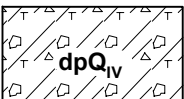

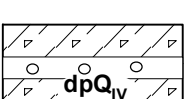
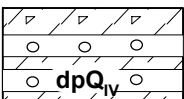
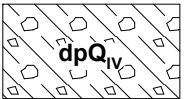
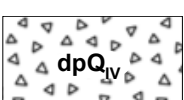
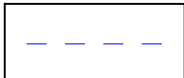



Section II-II
Scale: Horizontal: 1:500
Vertical: 1:300

Appendix 13



Legend

- | | | |
|----|---|--|
| 1 |  | EGE - ① — Soil layer - clay soil brown, with gravel content up to 15% and plant roots up to 35 %. |
| 2 |  | EGE- ② — Clay soil brown, semisolid, crushed stone and gravel content up to 40 %; |
| 3 |  | sge- ③ — Clay soil dark greenish, solid, crushed stone and gravel content up to 35 %; |
| 4 |  | EGE- ④ — Clay soil grayish - brownish, semisolid, crushed stone and gravel content up to 50 %; |
| 5 |  | EGE- ⑤ — Clay soil brownish-grayish, semisolid, gravel content up to 40 % and 0.2-0.5m thickness gravel interlayers with clay soil I filler (percentage correlation in section 75 % - 25%); |
| 6 |  | EGE- ⑥ — Alteration of light and dark brown, semisolid clays (0.1-0.9m) with gravel inclusions up to 40 % and 0.1-0.2 m thickness gravel layers (percentage correlation in section 60% - 40%); |
| 7 |  | EGE- ⑦ — Crushed stone soil, solid clay with fillers up to 30 %; |
| 8 |  | EGE- ⑧ — Crushed stone. |
| 9 |  | Ground water level |
| 10 |  | Borehole, Pit hole and their number |

ობიექტი: ბაკურიანი-დიდველი
Object: Bakuriani-Didveli

ჭაბურღილი №1
Borehole No

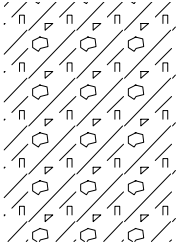
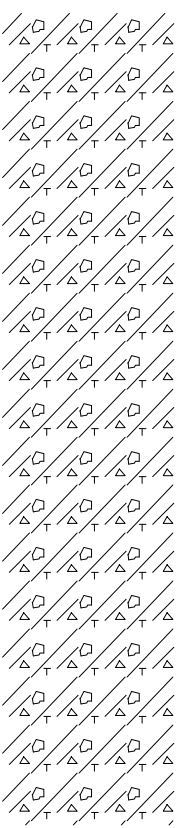
დანართი 1.5-1
Appendix 1.5-1

დაწყების თარიღი: 09.12.2014
Initial Date: 09.12.2014
დამთავრების თარიღი: 10.12.2014
Final Date: 10.12.2014

x=377568
Y=4618433
d=90mm _ 0.0-4.9m
d=76mm _ 4.9-30.0m

გამონამუშევრის პირის ნიშნული – მ
Excavation Level _ m
გრუნტის წყლის დონე: გამოჩენა –13.5მ
დამყარება – 13.0მ
Ground water Level: _ Flow level- 13.5 m
Stable level - 13.0 m

№	სახის-გეოლოგიური ელემენტი (სვე) Engineering Geological Elements	ღრმის საფუძვლის სიღრმე, (მ) Depth of Basement Layer (m)	ღრმის სიმძლავრე, (მ) Layer Thick (m)	გეოლოგიური ინდექსი Geological Index	გამონამუშევრის ლითო-ლოგოური ჭრილი Lithological Section of Excavation	ნიმუშის აღება Sampling			გრუნტის აღწერა Description of Soil
						ნიმუშის ნომერი Sample Number	ნიმუშის სახეობა Sample Type	ნიმუშის აღების ინტერვალი, (მ) Sampling Depth (m)	
1	①	0.4	0.4	adQ _{IV}					Soil layer – clay soil brown, with gravel content up to 15% and plant roots up to 35 %.
2	⑦	4.7	1	dpQ _{IV}					Crushed stone soil, solid clay with fillers up to 30 %;
			2						
			3						
			4						
3	②	14.3	5	dpQ _{IV}		1	m	11.4-11.6	Clay soil brown, semisolid, crushed stone and gravel content up to 40 %;
			6						
			7						
			8						
			9						
			10						
			11						
			12						
			13						
			14						
4	④	19.0	15	dpQ _{IV}		2	m	15.5-15.7	Clay soil grayish – brownish, semisolid, crushed stone and gravel content up to 50 %;
			16						
			17						
			18						
4		19.0	19						

4	④	16 17 18 19.0	4.7	dpQ _{IV}		2	m	15.5-15.7	gravel content up to 50 %;
5	③	20 21 22 23 24 25 26 27 28 29 30.0	11.0	dpQ _{IV}		3	m	22.2-22.4	Clay soil dark greenish, solid, crushed stone and gravel content up to 35 %;

ობიექტი: ბაკურიანი-დიდველი
Object: Bakuriani-Didveli

ჭაბურღილი №2
Borehole No 2

დანართი 1.5-2
Appendix 1.5-2

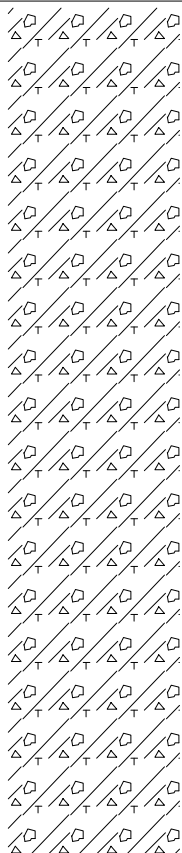
დაწყების თარიღი:
Initial Date: 10.12.2014
დამთავრების თარიღი:
Final Date: 12.12.2014

x=377600
Y=4618384
d=127mm _ 0.0-4.0m
d=108mm _ 4.0-12.0m
d=90mm _ 12.0-30.0m

გამონამუშევრის პირის ნიშნული –
Excavation Level_ 2103.2m

გრუნტის წყლის დონე: გამონა –14.0 მ
დამყარება – 14.0მ
Ground water Level: _ Flow level- 14.0m
Stable level - 14.0m

№	საინჟინრო-გეოლოგიური ელემენტები (სგე) Engineering Geological Elements	შრის საყრდენის სიღრმე, (მ) Depth of Basement Layer (m)	შრის სიმძლავრე, (მ) Layer Thick (m)	გეოლოგიური ინდექსი Geological Index	გამონამუშევრის ლითონო-ლოგოური ჭრილი Lithological Section of Excavation	ნიმუშის აღება Sampling			გრუნტის აღწერა Description of Soil
						ნიმუშის ნომერი Sample Number	ნიმუშის სახეობა Sample Type	ნიმუშის აღების ინტერვალი, (მ) Sampling Depth (m)	
1	①	0.4	0.4	adQ _{IV}					Soil layer – clay soil brown, with gravel content up to 15% and plant roots up to 35 %.
2	⑦	4.5	4.1	dpQ _{IV}					Crushed stone soil, solid clay with fillers up to 30 %;
3	②	7.8	3.3	dpQ _{IV}					Clay soil brown, semisolid, crushed stone and gravel content up to 40 %;
4	⑧	9.1	1.3	dpQ _{IV}					Crushed stone
5	⑦	14.0	4.9	dpQ _{IV}					Crushed stone soil, solid clay with fillers up to 30 %;
6	②	17.0	3.0	dpQ _{IV}		1	m	16.0-16.5	Clay soil brown, semisolid, crushed stone and gravel content up to 40 %;
						2	m	19.0-19.5	Clay soil dark greenish, solid, crushed stone and gravel content up to 35 %;

6		17.0	3.0						
③		17		dpQ _{IV}		2	m	19.0-19.5	Clay soil dark greenish, solid, crushed stone and gravel content up to 35 %;
		18							
		19							
		20							
		21							
		22							
		23							
		24							
		25							
		26							
		27							
		28							
		29							
7		30.0	13.0			3	m	28.5-29.0	

ობიექტი: ბაკურიანი-დიდველი
Object: Bakuriani-Didveli

დანართი 1.5-3
Appendix 1.5-3

ჭაბურღილი №3
Borehole No 3

დაწყების თარიღი:
Initial Date: 10.12.2014
დამთავრების თარიღი: 11.12.2014
Final Date: 11.12.2014

x=377642.2
Y=4618405.8

d=90mm _ 0.0-3.0m
d=76mm _ 3.0-30.0m

გამონამუშევრის პირის ნიშნული – მ
Excavation Level_ m
გრუნტის წყლის დონე: გამოჩენა –15.3 მ
დამყარება – 15.0მ
Ground water Level: _ Flow level- 15.3m
Stable level - 15.0m

№	საინჟინრო-გეოლოგიური ელემენტი (სვე) Engineering Geological Elements	ღრმის საფუძვლის სიღრმე, (მ) Depth of Basement Layer (m)	ღრმის სიმაღლე, (მ) Layer Thick (m)	გეოლოგიური ინდექსი Geological Index	გამონამუშევრის ლითო- ლოგიური ჭრილი Lithological Section of Excavation	ნიმუშის აღება Sampling			გრუნტის აღწერა Description of Soil
						ნიმუშის ნომერი Sample Number	ნიმუშის სახეობა Sample Type	ნიმუშის აღების ინტერვალი, (მ) Sampling Depth (m)	
1	①	0.3	0.3	adQ _{IV}					Soil layer – clay soil brown, with gravel content up to 15% and plant roots up to 35 %.
2	⑦	4.2	3.9	dpQ _{IV}					Crushed stone soil, solid clay with fillers up to 30 %;
3	⑧	5.0	0.8	dpQ _{IV}					Crushed stone
	④			dpQ _{IV}		1	m	9.6-9.8	Clay soil grayish – brownish, semisolid, crushed stone and gravel content up to 50 %;

			17					
			18					
			19					
			20			2	m	20.0-20.2
			21					
			22					
			23					
4		24.2	24	19.2				
			25					
			26					
	③		27	dpQ _{IV}				
			28		3	m	27.2-27.4	Clay soil dark greenish, solid, crushed stone and gravel content up to 35 %;
			29					
5		30.0	30	10.8				

ობიექტი: ბაკურიანი-დიდველი
Object: Bakuriani-Didveli

დანართი 1.5-4
Appendix 1.5-4

ჭაბურღილი №4
Borehole No 4

დაწყების თარიღი:
Initial Date: 13.12.2014
დასრულების თარიღი:
Final Date: 14.12.2014

x=377568
Y=4618308

გამონამუშევრის პირის ნიშნული –2131.4 მ
Excavation Level_ 2131.4m
გრუნტის წყლის დონე: გამოჩენა –
დამყარება –
Ground water Level: _ Flow level -
Stable level -

d=90mm _ 0.0-3.0m
d=76mm _ 3.0-30.0m

№	საინჟინრო-გეოლოგიური ელემენტი (სვე) Engineering Geological Elements	ღრმის საფუძვლის სიღრმე, (მ) Depth of Basement Layer (m)	ღრმის სიმაღლე, (მ) Layer Thick (m)	გეოლოგიური ინდექსი Geological Index	გამონამუშევრის ლითო- ლოგიური ქირილი Lithological Section of Excavation	ნიმუშის აღება Sampling			გრუნტის აღწერა Description of Soil
						ნიმუშის ნომერი Sample Number	ნიმუშის სახეობა Sample Type	ნიმუშის აღების ინტერვალი, (მ) Sampling Depth (m)	
1	①	0.3	0.3	adQ _{IV}					Soil layer – clay soil brown, with gravel content up to 15% and plant roots up to 35 %.
2	⑧	1.0	0.7	dpQ _{IV}					Crushed stone
3	⑦	4.5	2	dpQ _{IV}					Crushed stone soil, solid clay with fillers up to 30 %;
			3						
			4						
4	⑤	19.1	5	dpQ _{IV}		1	m	11.1-11.3	Clay soil brownish-grayish, semi-solid, gravel content up to 40 % and 0.2-0.5m thickness gravel interlayers with clay soil I filler (percentage correlation in section 75 % - 25%);
			6						
			7						
			8						
			9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						
			17						
			18						
4		19.1	19			2	m	19.5-19.7	Clay soil gravish – brownish

4		17 18 19.1	14.6						
5	④	20 21 21.8	2.7	dpQ _{IV}		2	m	19.5-19.7	Clay soil grayish – brownish, semisolid, crushed stone and gravel content up to 50 %;
6	⑤	22 23 23.8	2.0	dpQ _{IV}					Clay soil brownish-grayish, semisolid, gravel content up to 40 % and 0.2-0.5m thickness gravel interlayers with clay soil I filler (percentage correlation in section 75 % - 25%);
7	④	24 25 26 27.227	3.4	dpQ _{IV}		3	m	25.6-25.8	Clay soil grayish – brownish, semisolid, crushed stone and gravel content up to 50 %;
8	⑤	28.228	1.0	dpQ _{IV}		4	m	27.5-27.7	Clay soil brownish-grayish, semisolid, gravel content up to 40 % and 0.2-0.5m thickness gravel interlayers with clay soil I filler (percentage correlation in section 75 % - 25%);
9	④	29 30.030	1.8	dpQ _{IV}					Clay soil grayish – brownish, semisolid, crushed stone and gravel content up to 50 %;

ობიექტი: ბაკურიანი-დიდველი
Object: Bakuriani-Didveli

ჭაბურღილი №5
Borehole No 5

დანართი 1.5-5
Appendix 1.5-5

დაწყების თარიღი:
Initial Date: 14.12.2014
დამთავრების თარიღი:
Final Date: 15.12.2014

x=377516
Y=4618250

d=90mm _ 0.0-3.0m
d=76mm _ 3.0-30.0m

გამონამუშევრის პირის ნიშნული -2134.8მ
Excavation Level_ 2134.8m
გრუნტის წყლის დონე: გამოჩენა -
დამყარება -
Ground water Level: _ Flow level -
Stable level -

№	საინჟინრო-გეოლოგიური ელემენტი (ს.ე.) Engineering Geological Elements	შრის საფუძის განლაგების სიღრმე, (მ) Depth of Basement Layer (m)	შრის სიმძლავრე, (მ) Layer Thick (m)	გეოლოგიური ინდექსი Geological Index	გამონამუშევრის ლითონ-ლოგური ჭრილი Lithological Section of Excavation	ნიმუშის აღება Sampling			გრუნტის აღწერა Description of Soil
						ნიმუშის ნომერი Sample Number	ნიმუშის სახეობა Sample Type	ნიმუშის აღების სიღრმე, (მ) Sampling Depth (m)	
1	①	0.3	0.3	adQ _{IV}					Soil layer – clay soil brown, with gravel content up to 15% and plant roots up to 35 %.
2	⑦	1.0 2 3 4 4.9	0.7 4.6	dpQ _{IV}					Crushed stone soil, solid clay with fillers up to 30 %;
3	⑥	5 6 7 8.0	 3.1	dpQ _{IV}		1	m	6.0-6.2	Alteration of light and dark brown, semisolid clays (0.1-0.9m) with gravel inclusions up to 40 % and 0.1-0.2 m thickness gravel layers (percentage correlation in section 60% - 40%);
4	②	9.0	1.0	dpQ _{IV}		2	m	8.1-8.3	Clay soil brown, semisolid, crushed stone and gravel content up to 40 %;
5	⑥	10 11 12 12.7	 3.7	dpQ _{IV}					Alteration of light and dark brown, semisolid clays (0.1-0.9m) with gravel inclusions up to 40 % and 0.1-0.2 m thickness gravel layers (percentage correlation in section 60% - 40%);
6	②	13 13.9	 1.2	dpQ _{IV}					Clay soil brown, semisolid, crushed stone and gravel content up to 40 %;
	⑤	14 15 16 17 18 19	 	dpQ _{IV}		3	m	15.1-15.3	Clay soil brownish-grayish, semi-solid, gravel content up to 40 % and 0.2-0.5m thickness gravel interlayers with clay soil I filler (percentage correlation in section 75 % - 25%);

7	⑤	17 18 19 20	20.8	6.9					
8	②	21 22	22.222	1.4	dpQ _{IV}				Clay soil brown, semisolid, crushed stone and gravel content up to 40 %;
9	⑥	23 24 25 26 27	27.5	5.3	dpQ _{IV}				Alteration of light and dark brown, semisolid clays (0.1-0.9m) with gravel inclusions up to 40 % and 0.1-0.2 m thickness gravel layers (percentage correlation in section 60% - 40%);
10	②	28 29	29.0	1.5	dpQ _{IV}	4	m	28.0-28.2	Clay soil brown, semisolid, crushed stone and gravel content up to 40 %;
11	⑥	30	30.0	1.0	dpQ _{IV}				Alteration of light and dark brown, semisolid clays (0.1-0.9m) with gravel inclusions up to 40 % and 0.1-0.2 m thickness gravel layers (percentage correlation in section 60% - 40%);

ობიექტი: ბაკურიანი-დიდველი
Object: Bakuriani-Didveli

ჭაბურღილი №5
Borehole No 5

დანართი 1.5-5
Appendix 1.5-5

დაწყების თარიღი:
Initial Date: 14.12.2014
დამთავრების თარიღი:
Final Date: 15.12.2014

x=377516
Y=4618250
d=90mm _ 0.0-3.0m
d=76mm _ 3.0-30.0m

გამონამუშევრის პირის ნიშნული -2134.8მ
Excavation Level_ 2134.8m
გრუნტის წყლის დონე: გამოჩენა -
დამყარება -
Ground water Level: _ Flow level -
Stable level -

№	საინჟინრო-გეოლოგიური ელემენტი (ს.გ.) Engineering Geological Elements	შრის საფუძის განლაგების სიღრმე, (მ) Depth of Basement Layer (m)	შრის სიმძლავრე, (მ) Layer Thick (m)	გეოლოგიური ინდექსი Geological Index	გამონამუშევრის ლითონ-ლოგური ჭრილი Lithological Section of Excavation	ნიმუშის აღება Sampling			გრუნტის აღწერა Description of Soil
						ნიმუშის ნომერი Sample Number	ნიმუშის სახეობა Sample Type	ნიმუშის აღების სიღრმე, (მ) Sampling Depth (m)	
1	①	0.3	0.3	adQ _{IV}					Soil layer – clay soil brown, with gravel content up to 15% and plant roots up to 35 %.
2	⑦	1.0 2 3 4 4.9	0.7 4.6	dpQ _{IV}					Crushed stone soil, solid clay with fillers up to 30 %;
3	⑥	5 6 7 8.0	 3.1	dpQ _{IV}		1	m	6.0-6.2	Alteration of light and dark brown, semisolid clays (0.1-0.9m) with gravel inclusions up to 40 % and 0.1-0.2 m thickness gravel layers (percentage correlation in section 60% - 40%);
4	②	9.0	1.0	dpQ _{IV}		2	m	8.1-8.3	Clay soil brown, semisolid, crushed stone and gravel content up to 40 %;
5	⑥	10 11 12 12.7	 3.7	dpQ _{IV}					Alteration of light and dark brown, semisolid clays (0.1-0.9m) with gravel inclusions up to 40 % and 0.1-0.2 m thickness gravel layers (percentage correlation in section 60% - 40%);
6	②	13 13.9	 1.2	dpQ _{IV}					Clay soil brown, semisolid, crushed stone and gravel content up to 40 %;
	⑤	14 15 16 17 18 19	 	dpQ _{IV}		3	m	15.1-15.3	Clay soil brownish-grayish, semi-solid, gravel content up to 40 % and 0.2-0.5m thickness gravel interlayers with clay soil I filler (percentage correlation in section 75 % - 25%);

7	⑤	17 18 19 20	20.8	6.9					
8	②	21 22	22.222	1.4	dpQ _{IV}				Clay soil brown, semisolid, crushed stone and gravel content up to 40 %;
9	⑥	23 24 25 26 27	27.5	5.3	dpQ _{IV}				Alteration of light and dark brown, semisolid clays (0.1-0.9m) with gravel inclusions up to 40 % and 0.1-0.2 m thickness gravel layers (percentage correlation in section 60% - 40%);
10	②	28 29	29.0	1.5	dpQ _{IV}	4	m	28.0-28.2	Clay soil brown, semisolid, crushed stone and gravel content up to 40 %;
11	⑥	30	30.0	1.0	dpQ _{IV}				Alteration of light and dark brown, semisolid clays (0.1-0.9m) with gravel inclusions up to 40 % and 0.1-0.2 m thickness gravel layers (percentage correlation in section 60% - 40%);

ობიექტი: ბაკურიანი-დიდველი
Object: Bakuriani-Didveli


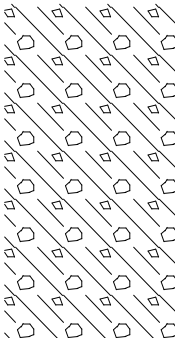
შურფი №1
TP No1

დაწყების თარიღი:
Initial Date:
დასრულების თარიღი:
Final Date:

X=377509
Y=4618292

გამონამუშევრის პირის ნიშნული –
Excavation Level – 2125.8m

გრუნტის წყლის დონე: გამოჩენა – მ
დაძვარება – მ
Ground water Level: –

№	საინჟინრო-გეოლოგიური ელემენტი (სგე) Engineering Geological Elements	შრის საფუძვლის განლაგების სიღრმე, (მ) Depth of Basement Layer (m)	შრის სიმძლავრე, (მ) Layer Thick (m)	გეოლოგიური ინდექსი Geological Index	გამონამუშევრის ლითო- ლოგური ჭრილი Lithological Section of Excavation	ნიმუშის აღება Sampling			გრუნტის აღწერა Description of Soil
						ნიმუშის ნომერი Sample Number	ნიმუშის სახეობა Sample Type	ნიმუშის აღების ინტერვალი, (მ) Sampling Depth (m)	
1	①	0.3	0.3						Soil layer - clay soil brown, with gravel content up to 15% and plant roots up to 35 %.
2	⑦	1				1		1.0-1.5	Crushed stone soil, solid clay with fillers up to 30 %;
		2				2		2.0-2.5	
		3							
		4							
		5.0	4.7			3		4.5-5.0	

შურფი №2
TP No 2

ობიექტი:
Object: Bakuriani-Didveli

დაწყების თარიღი:
დამთავრების თარიღი:
Initial Date:
Final Date:

X=377531
Y=4618284

გამონამუშევრის პირის ნიშნული –
Excavation Level – 2128.8 m

გრუნტის წყლის დონე: გამოჩენა – მ
დამყარება – მ
Ground water Level: –

№	საინჟინრო-გეოლოგიური ელემენტი (სვე) Engineering Geological Elements	შრის საგებობის განლაგების სიღრმე, (მ) Depth of Basement Layer (m)	შრის სიმისი (მ) Layer Thick (m)	გეოლოგიური ინდექსი Geological Index	გამონამუშევრის ლითო- ლოგიური ქრონი Lithological Section of Excavation	ნიმუშის აღება Sampling			გრუნტის აღწერა Description of Soil
						ნიმუშის ნომერი Sample Number	ნიმუშის სახეობა Sample Type	ნიმუშის აღების ინტერვალი, (მ) Sampling Depth (m)	
1	①	0.4	0.4						Soil layer - clay soil brown, with gravel content up to 15% and plant roots up to 35 %.
2	⑦	1	4.6			4		1.0-1.5	Crushed stone soil, solid clay with fillers up to 30 %;
		2							
		3							
		4				5		3.0-3.5	
2		5.0							

ობიექტი: ბაკურიანი-დიდველი
Object: Bakuriani-Didveli

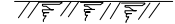
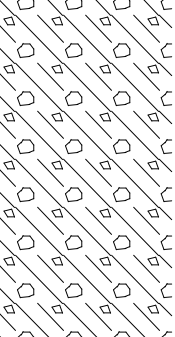
შურფი №3
TP No 3

დაწყების თარიღი:
დამთავრების თარიღი:
Initial Date:
Final Date:

X=377659
Y=4618292

გამონამუშევრის პირის ნიშნული –
Excavation Level – 2112m

გრუნტის წყლის დონე: გამოჩენა – მ
დამყარება – მ
Ground water Level: –

№		შურფის საფუძვლის განლაგების სიღრმე, (მ) Depth of Basement Layer (m)	შურფის სიმაღლე, (მ) Layer Thick (m)	გეოლოგიური ინდექსი Geological Index	გამონამუშევრის ლითო-ლოგოური კვეთი Lithological Section of Excavation	ნიმუშის აღება Sampling			გრუნტის აღწერა Description of Soil
№	საინჟინრო-გეოლოგიური ელემენტი (სვე) Engineering Geological Elements					ნიმუშის ნომერი Sample Number	ნიმუშის სახეობა Sample Type	ნიმუშის აღების ინტერვალი, (მ) Sampling Depth (m)	
1	①	0.4	0.4						Soil layer - clay soil brown, with gravel content up to 15% and plant roots up to 35 %.
2	⑦	1	4.6			6		1.0-1.5	Crushed stone soil, solid clay with fillers up to 30 %;
		2							
		3							
		4				7		3.0-3.5	
		5							
		5.0							

შურფი №4
TP No 4

ობიექტი: ბაკურიანი-დიდველი
Object: Bakuriani-Didveli

დაწყების თარიღი:
დამთავრების თარიღი:
Initial Date:
Final Date:

X=377638
Y=4618384

გამონამუშევრის პირის ნიშნული –
Excavation Level – 2104m

გრუნტის წყლის დონე: გამოჩენა – მ
დამყარება – მ
Ground water Level: –

№	საინჟინრო-გეოლოგიური ელემენტები (სგე) Engineering Geological Elements	ღრმის საფუძვლის განლაგების სიღრმე, (მ) Depth of Basement Layer (m)	ღრმის სიმძლავრე, (მ) Layer Thick (m)	გეოლოგიური ინდექსი Geological Index	გამონამუშევრის ლითონ- ლოგური ჭრილი Lithological Section of Excavation	ნიმუშის აღება Sampling			გრუნტის აღწერა Description of Soil
						ნიმუშის ნომერი Sample Number	ნიმუშის სახეობა Sample Type	ნიმუშის აღების ინტერვალი, (მ) Sampling Depth (m)	
1	①	0.4	0.4						Soil layer - clay soil brown, with gravel content up to 15% and plant roots up to 35 %.
2	⑦	1				8		1.0-1.5	Crushed stone soil, solid clay with fillers up to 30 %;
		2							
		3				9		3.0-3.5	
		4							
		5.0	4.6						

შურფი №5
TP No 5

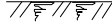
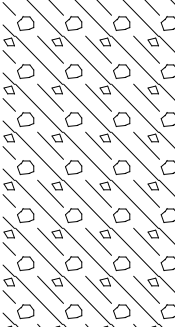
ობიექტი: ბაკურიანი-დიდველი
Object: Bakuriani-Didveli

დაწყების თარიღი:
დამთავრების თარიღი:
Initial Date:
Final Date:

X=377582
Y=4618379

გამონამუშევრის პირის ნიშნული –
Excavation Level – 2102.4m

გრუნტის წყლის დონე: გამოჩენა – მ
დამყარება – მ
Ground water Level: –

№		შურფის სიღრმის განლაგების სიღრმე, (მ) Depth of Basement Layer (m)	შურფის სიმაღლე, (მ) Layer Thick (m)	გეოლოგიური ინდექსი Geological Index	გამონამუშევრის ლითო- ლოგური ჭრილი Lithological Section of Excavation	ნიმუშის აღება Sampling			გრუნტის აღწერა Description of Soil
№	საინჟინრო-გეოლოგიური ელემენტი (სვე) Engineering Geological Elements					ნიმუშის ნომერი Sample Number	ნიმუშის სახეობა Sample Type	ნიმუშის აღების ინტერვალი, (მ) Sampling Depth (m)	
1		0.4	0.4						ნიდაგის ფენა-თიხნარი ქავისფერი, ხრეშითა და ხვინჭით 15%-მდე და მცენარეთა ფესვებით 35%-მდე ღორღნარი, მაგარი თიხნარი შემავესებით 30%-მდე
2	⑦	1				10		1.0-1.5	
		2							
		3				11		3.0-3.5	
		4							
		5.0	4.6						

2. Text Appendix

გრუნტების ფიზიკურ-მექანიკური თვისებების მაჩვენებლების საანგარიშო
Table. Values of the Physicomechanical Characteristics of

№N ^რ რიგზე / Serial No	სგე № / SGE No	გეოლოგიური ინდექსი Geological Index	პირობითი აღნიშვნები / Legend	გრუნტების დახასიათება Soil Description	მაჩვენებლები დამუშავებისათვის Indices for Processing									გრანულომეტრული შემადგენლობა, % / Granulometric Composition, %				პლასტიკური Plasticity		
					მექანიზმებით СНП-IV-5-82			ბურღვა-აფეთქებით СНП-IV-2-82			ფერდობის დრო- ებითი კანონი ქვაბულის ჩაღრმავებისას/ Temporary Gradient			გრუნტების კატეგორია სისმუერი თვისებების მიხედვით, პნ 01.01-09 შეისმიც ცატეგორე სოილს	თიხა / Clay	მტვერი / Dust	ქვიშა / Sand			ხრეში (ხვინჭა) Gravel
					სიმკვრივე/Density	დამუშავების ჯგუფი Processing Class	კატეგორია Category	სიმკვრივე/Density	დამუშავების ჯგუფი Processing Class	კატეგორია Category	3 მ-ღვ / up to 3 m	5 მ-ღვ / up to 5 m	ფრაქციათა ზომები, მმ / Dimensions of Fractions, mm							
													<0.002		0.002-0.0063	0.0063-2.0	2.0-60.0			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1	①	adQ _{IV}		Soil layer – clay soil brown, with gravel content up to 15% and plant roots up to 35 %.	1400	9 ^B	I	1400	8 ^B	II	–	–	–	–	–	–	–	–	–	–
2	②	dpQ _{IV}		Clay soil brown, semisolid, crushed stone and gravel content up to 40 %;	1950	33 ^F	III	1950	33 ^F	III	1:0.75	1:1	II	12.4	29.2	22.1	36.3	0.462	0.335	
3	③	dpQ _{IV}		Clay soil dark greenish, solid, crushed stone and gravel content up to 35 %;	1950	33 ^F	III	1950	33 ^F	III	1:0.75	1:1	II	9.7	22.9	26.8	40.6	0.388	0.264	
4	④	dpQ _{IV}		Clay soil grayish – brownish, semisolid, crushed stone and gravel content up to 50 %;	1950	33 ^F	III	1950	33 ^F	III	1:0.75	1:1	II	–	–	–	–	–	–	–
5	⑤	dpQ _{IV}		Clay soil brownish-grayish, semisolid, gravel content up to 40 % and 0.2-0.5m thickness gravel interlayers with clay soil I filler (percentage correlation in section 75 % - 25%);	<u>1950</u> 1950	<u>33^F</u> 39 ^δ	<u>III</u> III	<u>1950</u> 1950	<u>33^F</u> 39 ^δ	<u>III</u> III	1:1	1:1	II	–	–	–	–	–	–	–
6	⑥	dpQ _{IV}		Alteration of light and dark brown, semisolid clays (0.1-0.9m) with gravel inclusions up to 40 % and 0.1-0.2 m thickness gravel layers (percentage correlation in section 60% - 40%);	<u>1950</u> 1950	<u>33^F</u> 39 ^δ	<u>III</u> III	<u>1950</u> 1950	<u>33^F</u> 39 ^δ	<u>III</u> III	1:1	1:1	II	–	–	–	–	–	–	–
7	⑦	dpQ _{IV}		Crushed stone soil, solid clay with fillers up to 30 %;	1950	39 ^δ	II	1950	39 ^δ	III	1:1	1:1	II	3.5	9.7	16.6	70.2	0.339	0.239	
8	⑧	dpQ _{IV}		Crushed stone.	1950	39 ^δ	II	1950	39 ^δ	III	1:1	1:1	I	–	–	–	–	–	–	–

ფიზიკური თვისებები Physical Characteristics										ფილტრაციის კოეფიციენტი, K _f Filtration Ratio, K _f	მექანიკური თვისებები Mechanical Characteristics						შენიშვნა / Note
ზბა	სიმკვრივე, გ/სმ ³ Density, g/cm ³			ტენიანობა, W Moisture, W	ფორიანობა, n Void, n	ფორიანობის კოეფიციენტი, e Void Ratio, e	სრული ტენიანობა, W _{sat} Moisture Capacity, W _{sat}	ტენიანობის ხარისხი, S _r Moisture Degree, S _r	დეფორმაციის მაჩვენებელი, I _L Yield Indices, I _L		საერთო დეფორმაციის მოდული Modulus of Total Deformation, E _o	სიმტკიცე Strength					
პლასტიკურობის რიცხვი, I _p Plasticity Number, I _p	გრუნტის ნაწილაკების, ρ _s Granule, ρ _s	ბუნებრივი მდგომარეობის გრუნტის, ρ / Natural Soil, ρ	გრუნტის ჩონჩხის, ρ _h Soil Skeleton, ρ _d									შინაგანი ხახუნის კუთხე, φ Angle of Internal Friction, φ	შეჭიდულობა / Friction, C	გრუნტის საანგარიშო წინააღმდეგობა, R ₀	წინააღმდეგობა ერთღერძა კუმშვაზე, R _c	დაბრუნების კოეფიციენტი, K _{sof} Softening Ratio, K _{sof}	
%	g/cm ³	g/cm ³	g/cm ³	—	—	—	—	—	—	m/day	10 ⁵ pa	grad.	10 ⁵ pa	10 ⁵ pa	10 ⁵ pa	—	
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1. Outcomes of laboratorial researches and recommendation of special literature were used in order to determine normative and calculation values of engineering-geological elements physical-mechanical characteristics. 2. Values of characteristics given in fraction correspond in denominator – normative values and in numerator – calculation values; 3. Laboratorial researches were carried out to determine shift characteristics values for EGE 7 and their values are given in brackets. Calculation values are determined during reliability probability P =0.95. 4. Values in moisture column for Engineering-Geological Elements 2 and 3 are given in fraction: the numerator shows the common ground moisture value and denominator exhibits <2 fraction value according to which floating value was determined. 5. Values of mechanical properties for engineering-geological elements 4- 6 are accepted in accordance to their description, through calculation of average weighted values.
12.7	2.69	1.99	1.66	$\frac{0.202}{0.362}$	0.383	0.620	0.231	0.87	0.21	0.027	210	$\frac{20.6}{23.7}$	$\frac{0.19}{0.29}$	2.4	—	—	
12.4	2.70	2.03	1.71	$\frac{0.189}{0.257}$	0.367	0.579	0.214	0.88	-0.06	0.018	240	$\frac{21.6}{24.8}$	$\frac{0.24}{0.36}$	2.7	—	—	
—	—	—	—	—	—	—	—	—	—	0.045	270	$\frac{28.7}{33.0}$	$\frac{0.15}{0.22}$	2.8	—	—	
—	—	—	—	—	—	—	—	—	—	0.06-0.20	280	$\frac{24.8}{28.6}$	$\frac{0.18}{0.27}$	2.9	—	—	
—	—	—	—	—	—	—	—	—	—	0.5-1.5	310	$\frac{27.3}{31.4}$	$\frac{0.17}{0.25}$	3.2	—	—	
10.0	2.61	1.83	1.6	0.144	0.387	0.631	0.242	0.60	-0.95	15.0-20.0 (0.054-0.13)	460	$\frac{39.1}{(33.2)} \frac{430}{(35.6)}$	$\frac{0.13}{(0.04)} \frac{0.19}{(0.17)}$	4.5	—	—	
—	—	—	—	—	—	—	—	—	—	80-100	570	$\frac{41.8}{46}$	$\frac{0.06}{0.09}$	6	—	—	

Table for outcomes of laboratorial researches of soils filtration characteristics

Object description: BAKURIANI

№ №	Sample Taking Places		Laboratorial №	PH	Granulometric composition, % (Fraction size in mm)										Plasticity		
	Pit – hole	Depth m,			>10	10-5	5-2	2-1	1-0.5	0.5-0.25	0.25-0.10	0.10-0.05	0.05-0.010	0.010-0.005	<0.005	Upper limit W _L	Lower limit W _p
1	1	1.0-1.5	166														
2	1	2.0-2.5	167		Each sample is dark gray clay soils with gravel and crushed stones inclusions												
3	1	4.0-4.5	168														
4	2	16.0-16.5	169														
5	2	19.0-19.5	170														

Table continuation

№ №	Natural Moisture W ₁ One Part	Soil Density of			Porosity, n, %	Porosity ration One part	Consistency Index I _L One Part	Complete Moisture Capacity W _n One Part	Water saturation ration G, One part	Filtration coefficient K ₁₀ m/24 h	Reduction, %		Soaking, %		Organic admixtures I _{om} One Part	Soaking rate
		Mineral. Part ρ _s	Natural Soil ρ	Skeleton ρ _d							Water reducing value	Water reduction limit moisture	Water soaking value	Maximum soaking moisture		
1	0.198	2.71	1.79	1.49	45.02	0.818		0.302	0.65	0.054						
2	0.198	2.71	1.79	1.49	45.02	0.818		0.302	0.65	0.054						
3	0.277	2.71	1.75	1.37	49.45	0.978		0.361	0.77	0.11						
4	0.296	2.71	1.76	1.36	49.82	0.993		0.366	0.81	0.13						
5	0.231	2.69	2.04	1.66	38.30	0.620		0.231	1.0	0.027						
	0.214	2.70	2.14	1.71	36.70	0.579		0.214	1.0	0.018						

Statistical Interpretation of Mechanical Data.

##	Mechanical Characteristics		Unit	No. of Samples		Average Square Deviation s_{n-1}	Coefficient of Variation, v	Reference Value, A^n	Calculated Value		
				Initial	Final				a=0.85	a=0.95	a=0.99
1	Cohesion, C	Natural Moisture Content	10^5 Pa	9	9	0.068	0.400	0.17	0.09	0.04	-0.03
2	Internal friction angle, φ	Natural Moisture Content	Degree	9	9	0.031	0.044	35.56	34.21	33.25	31.84