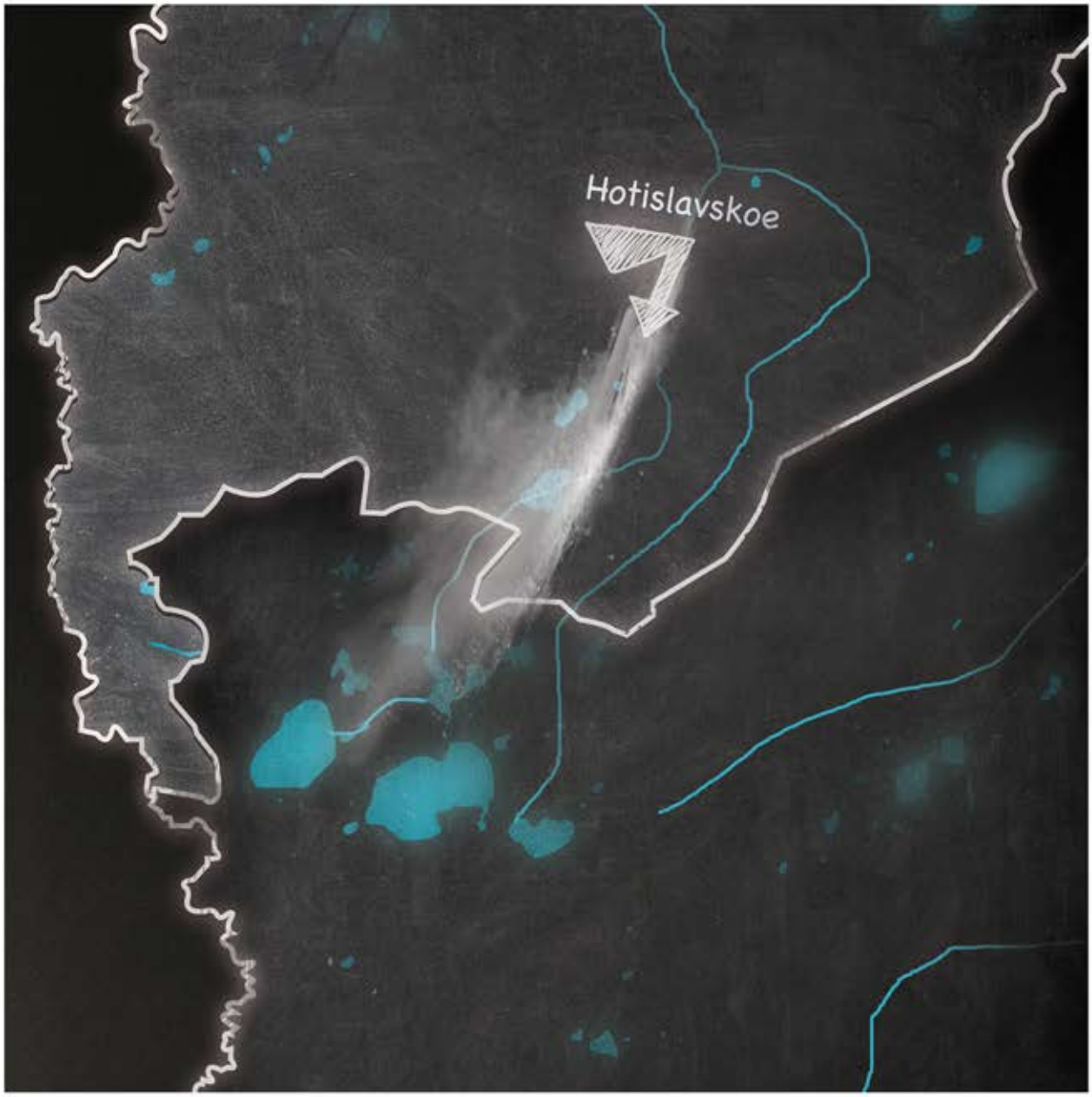
Report



Report by the bilateral working group for the environmental monitoring of the Khotislavskoye quarry

Pilot project in Belarus and Ukraine on post-project analysis of environmental impact in a transboundary context

April–December 2013

EaP GREEN PROGRAMME

The report was prepared by the bilateral working group for the environmental monitoring of the Khotislavskoye quarry, working under the general supervision of the United Nations Environment Programme in the framework of the project "Linking Environment and Security in Belarus" implemented through the Environment and Security Initiative (ENVSEC, www.envsec.org).

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CONTENT

INTRODUCTION

This report presents the results of the activities carried out by the bilateral monitoring group established by Belarus and Ukraine in the framework of the pilot project on post-project analysis (PPA) under the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention).

The pilot project is being executed as part of the project "Linking Environment and Security in Belarus" implemented through the "Environment and Security" Initiative (ENVSEC, www.envsec.org) by United Nations Economic Commission for Europe (UNECE), the United Nations Environmental Programme (UNEP) and the United Nations Development Programme (UNDP) in cooperation with the Ministry of Natural Resources and Environmental Protection of Belarus and Ministry of Ecology and Natural Recourses of Ukraine.

The project aims to promote environmental sustainability in Belarus taking into consideration the security aspect and having a particular focus on regional cooperation and application of regional environmental instruments (such as UN environmental conventions). The overall objective of the project is to build administrative capacity and enhance legal and institutional development for applying the transboundary environmental impact assessment (EIA) and strategic environmental assessment (SEA) procedures to projects and plans subject to environment and security challenges in Belarus and - where there is a transboundary context - Ukraine, and to foster stakeholder dialogue and access to information in relation to projects with transboundary environmental impacts and to plans. The UNECE Espoo Convention and its Protocol on Strategic Environmental Assessment are used as the main instruments to achieve this. [1] In addition to the pilot project on PPA, to which the results of the environmental monitoring and work of the bilateral working group presented in this report contribute to, the project activities include a legislative review on SEA and three local level workshops on SEA. The project also contributes to UNECE capacity building activities on SEA and EIA carried out in the framework of a regional programme "Towards Greener economies in the Eastern Partnership" (EAP-Green), implemented jointly by the Organisation for Economic Co-operation and Development (OECD), UNECE, UNEP and the United Nations Industrial Development Organization (UNIDO) and financed by the European Commission.

The specific objective of the pilot project is to establish practice in the post-project analysis of projects subject to a transboundary EIA procedure and to improve cross-border dialogue between Belarus and Ukraine in monitoring and mitigating transboundary impacts.

The project selected as the pilot case is the exploitation of the chalky deposits "Khotislavskoye" (2nd phase), which has recently been subject to a transboundary EIA procedure between Belarus and Ukraine. The aim of the PPA was to analyse both the activity as well as its potential adverse transboundary impacts, i.e. the impacts of the "Khotislavskoye" chalk deposit development on the environment of in the territory of Belarus as well as in the area of the Shatsky lakes in Ukraine. The "Khotislavskoye" chalk deposit is located in Belarus (Brestskaya Oblast, Maloritskiy raion) within 250 meters of the Belarus-Ukrainian border. On the Ukrainian side the border is close to the Shatsky

[1] More detailed information about the project could be found at:
http://www.unece.org/index.php?id=32778
http://www.unep.org/roe/Portals/139/documents/ENVSEC/ENVSEC_newsletter_jan-june2013.pdf

National Park, which is part of the trilateral Belarus-Polish-Ukrainian biosphere reserve “Polesiey” and Shatsky Lakes (Svyatoye and Turskoye Lakes).

In the beginning of the project, Ministry of Natural Resources and Environmental Protection of Belarus and Ministry of Ecology and Natural Recourses of Ukraine established of the bilateral working group for monitoring of the “Khotislavskoye” based on the previous agreements reached during the EIA and presented in the start-up workshop held in Brest 9-10 April 2013. The bilateral working group oversaw the conduct monitoring and evaluation of the ex-post environmental impacts of the mining activities at the “Khotislavskoye” chalk deposit site during the project, evaluated the results of the monitoring and the effectiveness applied mitigation measures and proposed recommendations for improvement of the EIA for consideration of the task force also set up for the pilot project.

The regular monitoring is conducted and the countries exchange monitoring data in order to assess the possible impact of the second stage development of the “Khotislavskoye” quarry on the state of water bodies and the environment as a whole. In the territory of Belarus, a monitoring network in the quarry development zone has been established in addition to the national network. In Ukraine a monitoring network for surface and ground waters, soils and forest plantations in the potential impact zone has been organized to determine the impact of “Khotislavskoye” on the environment. Within this project, the bilateral working group studied the documents on monitoring over the last years and conducted field work on monitoring in the focus area.

This report provides the results of the monitoring for the period of 2011-2013, and an analysis of the possible impact on the surface and ground water in the “Khotislavskoye” quarry zone. The report also describes the results of the activity of the Belarus-Ukrainian Working Group on monitoring within the pilot project (April-November 2013). Once the pilot project is over the countries are expected to continue the monitoring activities and annual data exchange based on the agreements reached by the countries in 2011.

ON "KHOTISLAVSKOYE" QUARRY

The deposit of construction raw materials "Khotislavskoye" is located in the Brestskaya Oblast in the southern part of the Mukhavetz River basin in the valley of its left tributary the river Rita. It is located slightly to the south of the town of Malorita.

Sands, which form the overburden of the Cretaceous rocks, are suitable for the production of construction materials, including concrete, mortar and dry mix, and can also be used in the metallurgical, glass and petrochemical industries. The quality of the chalk itself is such that first and second grades of lime can be produced, it can be used in the chemical, paint and coatings industries as well as in the medical industry, for soil deoxidation and the production of animal feed for agriculture.

From the geomorphological point of view, the area of the deposit is confined to the right hand side of the valley of the River Rita, a tributary of the Mukhavetz River. The river valley is weakly delineated in the landscape and is a gently sloping and marshy area of the territory of Ukraine. Peat occupies significant part of the deposit with its thickness ranging from 0,2 to 3,2 meters. Marshy depositions are underlain by upper quaternary fluviolacustrine fluorspar fine-grained sand. This sand has a productive horizon with a thickness of between 3,0 and 19,8 meters with the average being 15.0 meters. The ground water of marshy and alluvial deposits (subsoil water) is drained by trenches into two main canals, which then discharge into the River Rita. The catchment area of subsoil water coincides with the distribution zone and is primarily fed by atmospheric precipitation.

These deposits are all superimposed on rough and heavily eroded surface of loamy and chalky rocks of the upper cretaceous period. The upper cretaceous deposits consist of stratum of white chalk and loam exhibiting various degrees of fracture and porosity up to a depth of 60 meters after which these deposits become solid rock.

There is a confined aquifer, which is limited to the zone of loam and chalk fracture. This confined aquifer is separated from the subsoil water bearing horizon by a layer of thick chalk and gault clay, which are present in the overburden of chalk stratum together with moraine and loamy clays. The main catchment of the confined aquifer is located to the south of the study area within the Volyn Upland.

MONITORING

Environmental monitoring – a system of observations about the state of the environment to assess and forecast changes as a result of the impact of natural and anthropogenic factors. *Ground water monitoring* – a system of observations of hydrogeological and hydrochemical indicators on the state of ground water in order to identify negative processes, assess and predict their development, receive and provide trustworthy and timely information to state and legal bodies as well as citizens that is necessary for rational use and protection of ground water from depletion and pollution. *Local environmental monitoring* – a system of environmental observations about the state of the environment made in a specific area with administrative and other activity that has a negative impact on the environment, including environmentally hazardous activity. *Observation well* – a drill hole engineered to allow periodic observations of ground water levels and changes in quality to be made.

The Republic of Belarus

In 2011 the State enterprise "SPC on Geology" (since 2013 – the Scientific and Research Geology Prospecting Institute) developed and adopted "The Monitoring Programme for Surface and Ground Water on the Territory of the Republic of Belarus within the second stage of the "Khotislavskoye" deposit development". A preliminary monitoring programme was sent to the Ministry of Ecology and Natural Resources of Ukraine for consideration and reconcilement.

The main sections of the programme are:

- Goal and tasks of transboundary monitoring of surface and ground water;
- The structure of the observation monitoring network;
- The methodology of monitoring observations;
- Regulations on interaction and data exchange;
- Indicators of the ground water natural regime;
- Forms of the reporting documentation.

The ***monitoring system of ground water in the area of chalky deposit*** consists of 11 observation points including:

- 8 equipped observation wells to monitor subsoil water
- 2 equipped observation wells to monitor the water bearing strata of the upper cretaceous "basement"
- 1 observation well (a shaft well) in the Sushitnitza village.

The ***monitoring system of ground water under natural conditions*** outside of the zone subject to potential impact from the development of the chalky deposit:

- 2 hydrological posts (Masevischskiy and Velikoritskiy) located 30 km upstream of the underflow from the quarry in the territory of Maloritskiy rayon, Brestskaya Oblast;
- 6 wells including:
    - 4 equipped observation wells to monitor subsoil water (549, 543, 545, 550 – subsoil water);
    - 2 equipped observation wells to monitor confined groundwater water (quaternary and cretaceous deposits, N 546 and 547).

The monitoring system for surface waters in the deposit area:

- 3 hydrogeological posts, including:
- post № 1 – at the compensatory channel
- post № 2 – at the Rita River (control station, at the Rita River upstream of the quarry);
- post № 3 – at the Rita River (control station at the discharge of water drainage from the quarry).

Sampling of ground water quality in areas under natural conditions (without the impact of the development) is made **once** a year using **33** controlled macro and micro indicators.

Sampling for **ground water quality at the observation points in the deposit** is made **twice** a year: April-May, during the spring flood recession period, and July-August, the period of low summer runoff, on the basis of 23 controlled macro and micro indicators according to the approved programme.

Ground water leveling surveys in the observation wells situated in natural areas (hydrogeological posts) are made ***three times a month*** every ten days. The posts are equipped with automatic gauges.

Ground water leveling surveys in the observation wells in the deposit area are made on the 1st, 10th and 20th of each month in experimental network and once per month in regional network.

The level of surface water in the chalk deposit area is regularly measured at the Rita River and at the compensation channel (three times a month, every ten days).

Ukraine

In order to continuously monitor the changes in the environment during the construction and operation of the "Khotislavskoye" quarry, observation wells in areas adjacent to the future quarry were established in 1993. This was done in line with the scientific elaborations of the Hydrotechnics and Melioration Institute (now called – the Institute of Water Problems and Land Reclamation of the National Academy of Agrarian Sciences of Ukraine).

The monitoring network consists of:

- 2 wells near the Turskoye Lake, Tur village (wells №7 and №7a)
- 2 wells near Guta village (wells №15 and №15a) of the Volynskaya Oblast
- 11 individual wells (in Guta, Tur and Zabolotye village)
- Hydrological and melioration cross sections at the drain systems
- Hydrological post near urban settlement of Ratno
- Observation wells network in the Shatsky National Nature Park
- ***Water level measurements and water samples*** are made at the main lakes – Krymnoye, Svyatoye, Svityaz and Tur.

Measurements of ***subsoil and ground water levels*** are made ***three times*** a month (on the 10th, 20th and 30th of each month) at the wells№ 7, 7a, 15 and 15a. At other wells of the monitoring network such measurements are made **once** a month.

Hydrochemical analysis of water samples are made of:

- ground water – once a year
- surface water – once a quarter.

Observations of the state of water bodies have been conducted regularly since 1993, i.e. since the first attempt to develop the quarry. Monitoring of ground and surface water levels is undertaken by the Volynskaya Hydrogeological and Meliorative Party of the State Agency of Water Resources of Ukraine by order of the Institute of Water Issues and Land Reclamation of the NAAS.

In 2013, by order of the Volynskaya Oblast Administration, the Institute of Water Problems and Land Reclamation of the National Academy of Agrarian Sciences of Ukraine (Department of water bodies and reclaimed land ecology), Kiev, started implementation of the programme "The Current State of the Environment Assessment in the Potential Impact Area of "Khotislavlskoye" quarry in the Volynskya Oblast". The period of programme implementation is from May to December, 2013.

The main tasks of the programme:

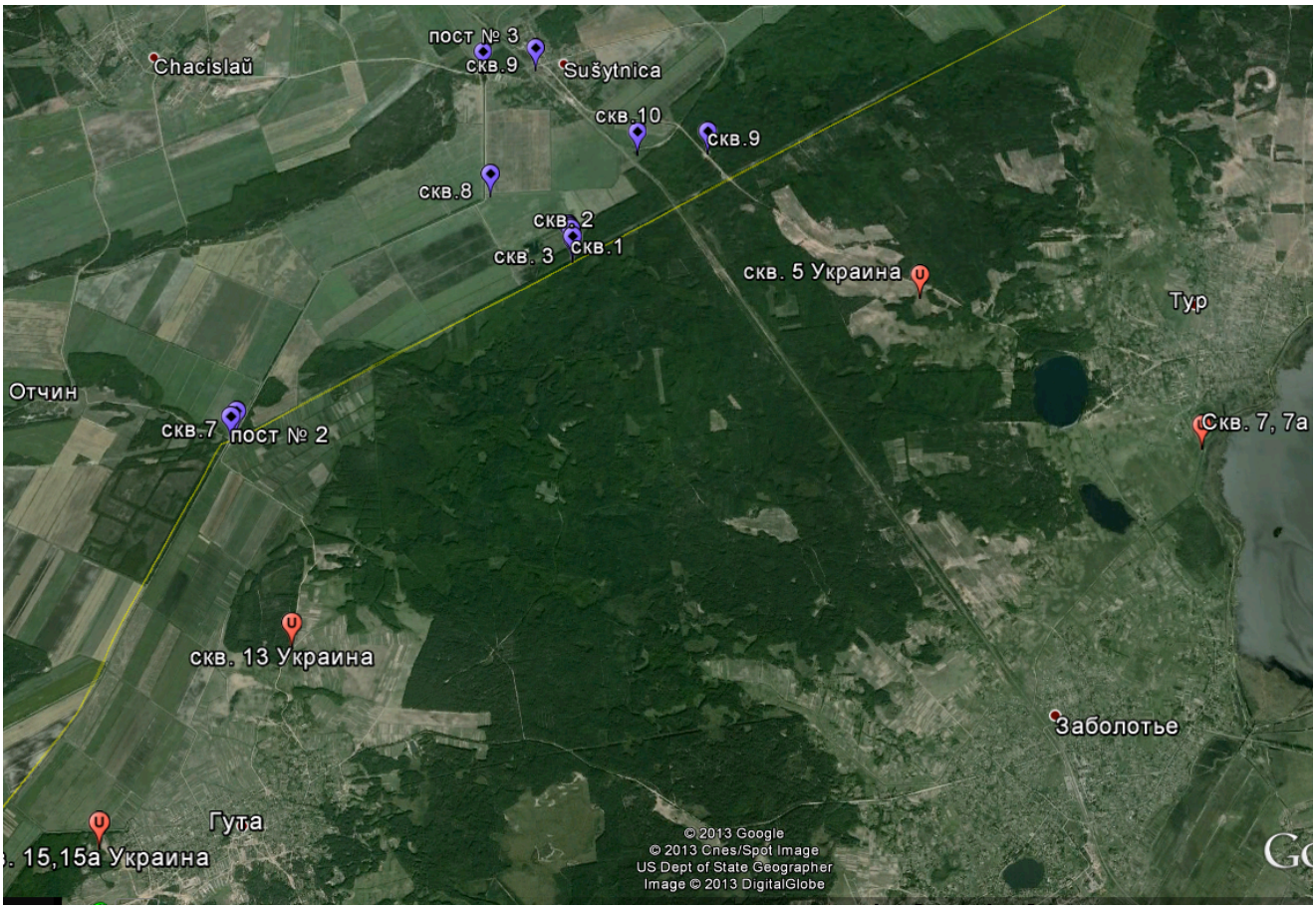
1. Renewal of the monitoring observation networks in the area of potential impact of the "Khotislavskoye" quarry on the Ukrainian side.
2. Establishment of hydrogeological posts on the Lakes Svyatoye, Krymno and Tur to monitor the hydrological regime.
3. Continued monitoring of hydrogeological, hydrological and hydrochemical indicators at wells, holes and lakes in the quarry impact zone.

4. Continued monitoring of ground water levels in the cross section near the urban settlement of Ratno, in Shatsky National Nature Park, and in the shaft wells in the settlements of Guta, Tur and Zabolotye.
5. Comparative analysis to identify changes in the hydrogeological and hydrochemical composition of ground and surface water for the whole period of observations (1993-2013).
6. Study of the soil cover, environmental quality and the state of reclaimed lands with the identification of their soil moisture index – as one of possible indicators for water regime changes.
7. Observations of vegetation at the sample points to obtain comparative data for the future development of forest, shrub and herbaceous vegetation and the state of forest litter.
8. Identification of background and critical indicators of the nature state adjacent to the quarry at the start of the chalk deposit development.
9. Generalization of accumulated materials of monitoring observations on the water regime of the territory before the development of chalk deposit started and making forecasts as to possible changes in the hydrological and hydrogeological regime in the course of further quarry development.

Expected results:

Once the works are completed, background and critical indicators of the state of nature complexes will be developed, the monitoring scheme for the initial phase of chalk deposit development will be optimized, and a forecast of potential negative changes during further development of chalk deposits at the "Khotislavskoye" quarry will be made.

The programme envisages an exchange of monitoring data with the Belarus party. Conclusions based on the data collected and in line with the joint observations of both parties will be made.



Scheme 1. Sketch map of the monitoring network of the studied area in Belarus and Ukraine.

RESULTS OF THE STUDIES IN AREA OF THE POTENTIAL IMPACT OF THE "KHOTISLAVSKOYE" QUARRY IN 2010-2013

The Republic of Belarus

Having analyzed the monitoring data of the Khotislavskiy area that were provided by the Belarus Party, it is possible to state the following.

Chemical composition of ground water under the natural conditions *as of* 2013:

- The concentration of **macro components** (temperature, pH, total hardness, carbonate hardness, dry residue, total mineral content, permanganate value Cl-, SO42-, CO32-, HCO3-, NO3-, NO2- , Na+, K+, Ca2+, Mg2+, NH4+, CO2, Fe total, SiO2) in ground water, complies with the approved sanitary regulations and standards (SanPiN 10-124 RB 99).
- **Single instances** of nitrate concentration exceeding MPC were determined in subsoil water. These appear to be related to anthropogenic pollution sources (agricultural pollution).
- There were no cases when the concentration for monitored parameters in the confined ground water exceeded MPC.
- The concentration of **micro components** in the water also complies with the requirements of SanPiN, however, subsoil and artesian water had a higher concentration of **iron** and **manganese**, but lower concentrations of **fluorine**. This is a characteristic of ground water in Belarus as it is determined by the impact of natural hydrogeological factors.

The ground water quality at observation points in the area of deposit as of 2013:

- The indicators monitored comply with the requirements of SanPiN 10-124 RB 99 with the exception of an increased concentration of iron and lower concentration of fluorine.
- In 2012, concentration of nitrates in the well at Sushitnitza was 35,8 mg/dm3. This does not exceed the MPC, but is higher than **background** value, which is determined by anthropogenic impacts. The well is located in the grounds of the farmhouse. The ground waters by their composition are calcium-sodium hydrocarbonate, by pH (6,3-8,9 unit of pH) are weak-acid and weakly alkaline, from low hardness to moderately hard (0,65–5,32 meq/dm3);
- An impact of the quarry on the composition and quality of ground water has not been identified.

Sampling of surface water quality at the observation points in the area of the deposit is made **twice** a year (April-May, during the spring flood recession period, and July-August, the period of summer runoff low) for the list of controlled macro and micro indicators according to the approved programme (**23** indicators). As of 2013:

- The chemical composition of the water is a calcium hydrocarbonate with an average mineral content of 105,74 – 320,75 mg/dm3. It is weakly alkaline with a pH-6,8-7,45 and of low hardness (with total hardness of 2,88-3,10 meq/dm3) There is a high concentration of organic substance (colour and turbidity).
- The concentration of biogenic compounds is **not high** and does not exceed MPC for ground water. All other parameters of chemical composition are also lower than established MPCs, except for **iron** concentration.
- In the compensation channel, the composition of macro components in the water is slightly different from the composition in the Rita River. The chemical composition is a calcium sulphate-hydrocarbonate and the average mineralization is insignificant (166,5-117,5 mg/dm3). It is weakly alkaline (pH = 6,8 -7,20) and the water is of very low hardness (total hardness of 1,14-1,2 meq/dm3).

- All chemical composition parameters are **below the established MPC** (except for iron and manganese).

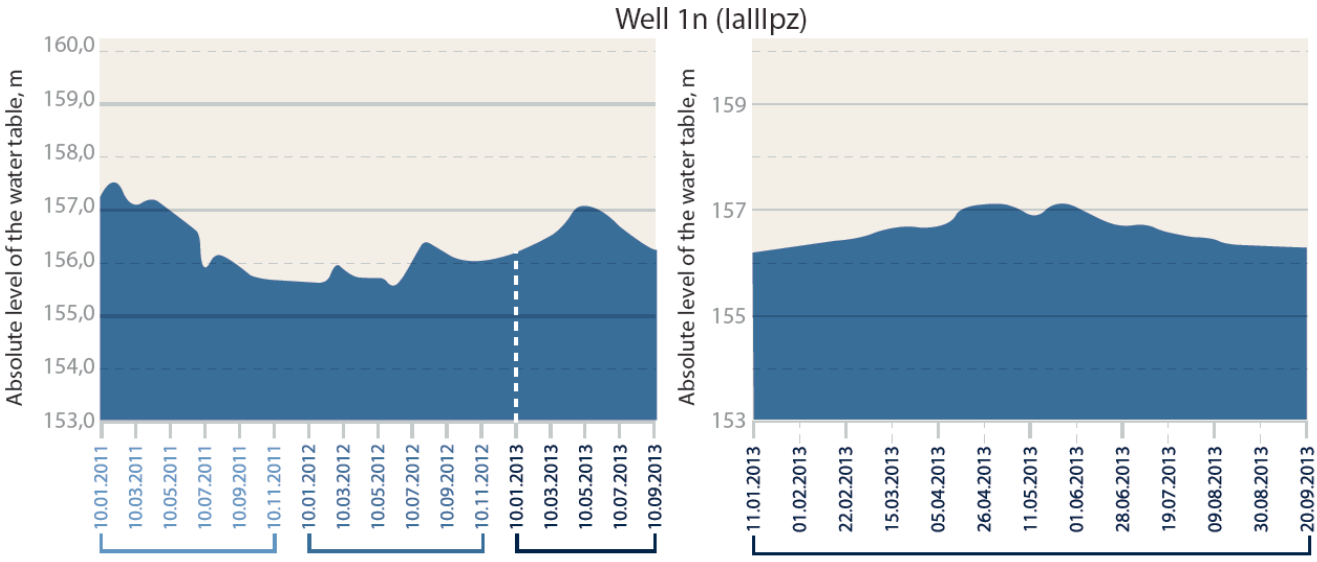
The ground water level regime in the observation wells under the natural conditions:

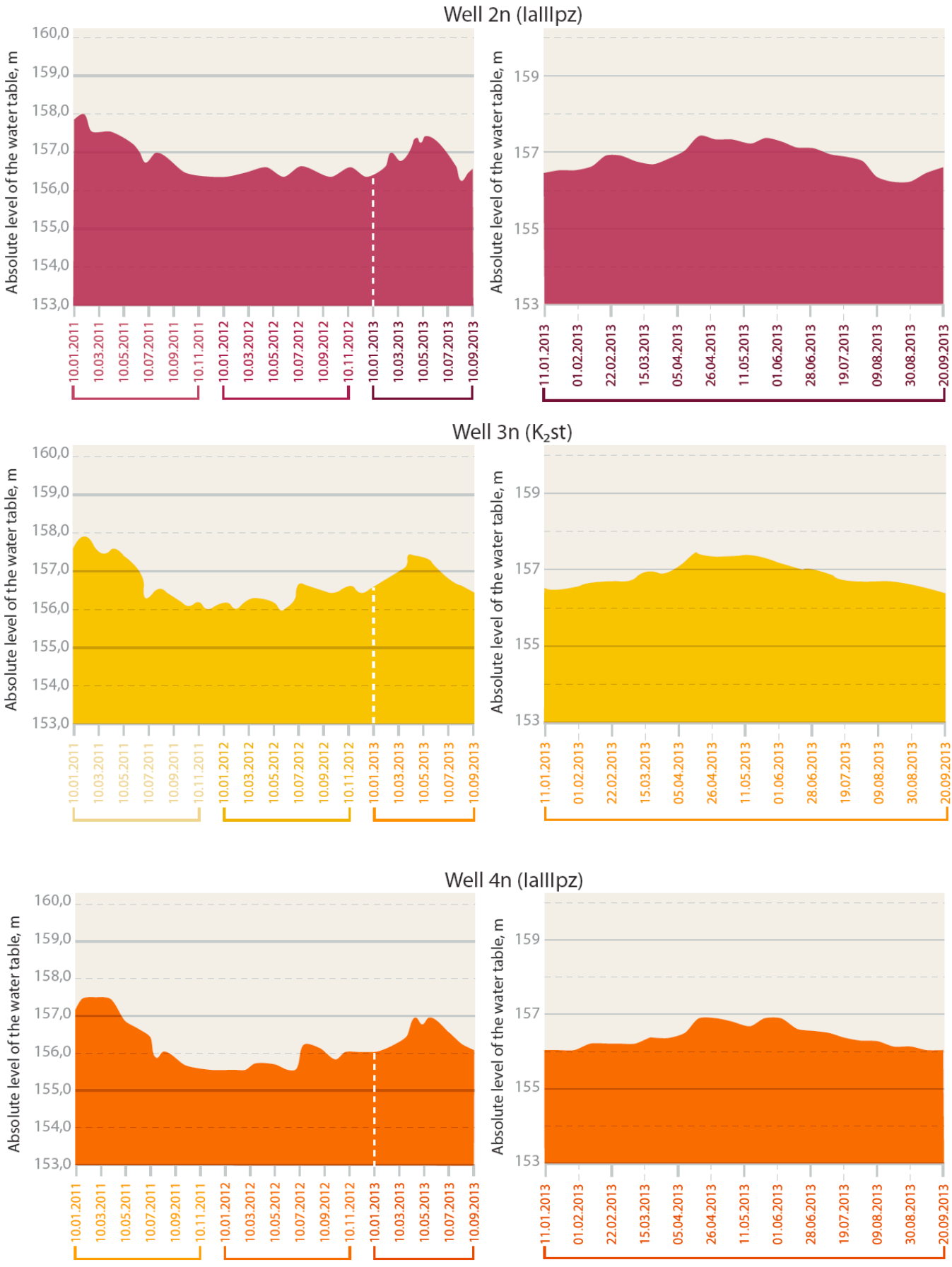
- During 2012 - the 3rd quarter of 2013 the ground water level tends to lower, which is primarily related to the annual climatic peculiarities of this region.
- The maximum annual depth for subsoil and artesian water was observed in January 2012 and at the beginning of March of the 1st quarter 2013. The minimum usually occurs in – in April (spring maximum).
- The minimum water level variation for subsoil and artesian water was 0,1 m and the maximum was 0,63 m for subsoil water and 0,68 m for artesian water.

The impact of the sand quarry on the hydrodynamic regime of ground water in the zone of monitored observation posts not identified.

The ground water level regime in the observation wells in the deposit area:

- The amplitudes of water level variation in 2012 and the 3rd quarter of 2013 were not significant. In the wells of the experimental network (wells 1n, 2n, 3n, 4n, 5n, 6n) they varied within the range of 0,01 to 0,61 meter;
- In the wells of the regional network (wells 7n, 8n, 9n, 10n and 11n) the amplitudes of water level variations is within the range of 0,01 to 0,9 meter;
- In **2011 and in the 3rd quarter of 2013** there was a **fall** in water level by 0,32 m on overage in the regional network and on average by 1.04m in the experimental network;
- In the **1st and 3rd quarters of 2013** there was a **rise** in water levels in wells 7,8,11 and a **fall** in wells 9,10 of the regional network. In the experimental network a **rise** was observed in wells 2, 4 and 6 and **fall** in wells 1 and 3.




Well 2n (IalIIpz)
Absolute level of the water table, m
160,0
159,0
158,0
157,0
156,0
155,0
154,0
153,0
10.01.2011
10.03.2011
10.05.2011
10.07.2011
10.09.2011
10.11.2011
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10.07.2013
10.09.2013
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11.01.2013
01.02.2013
22.02.2013
15.03.2013
05.04.2013
26.04.2013
11.05.2013
01.06.2013
28.06.2013
19.07.2013
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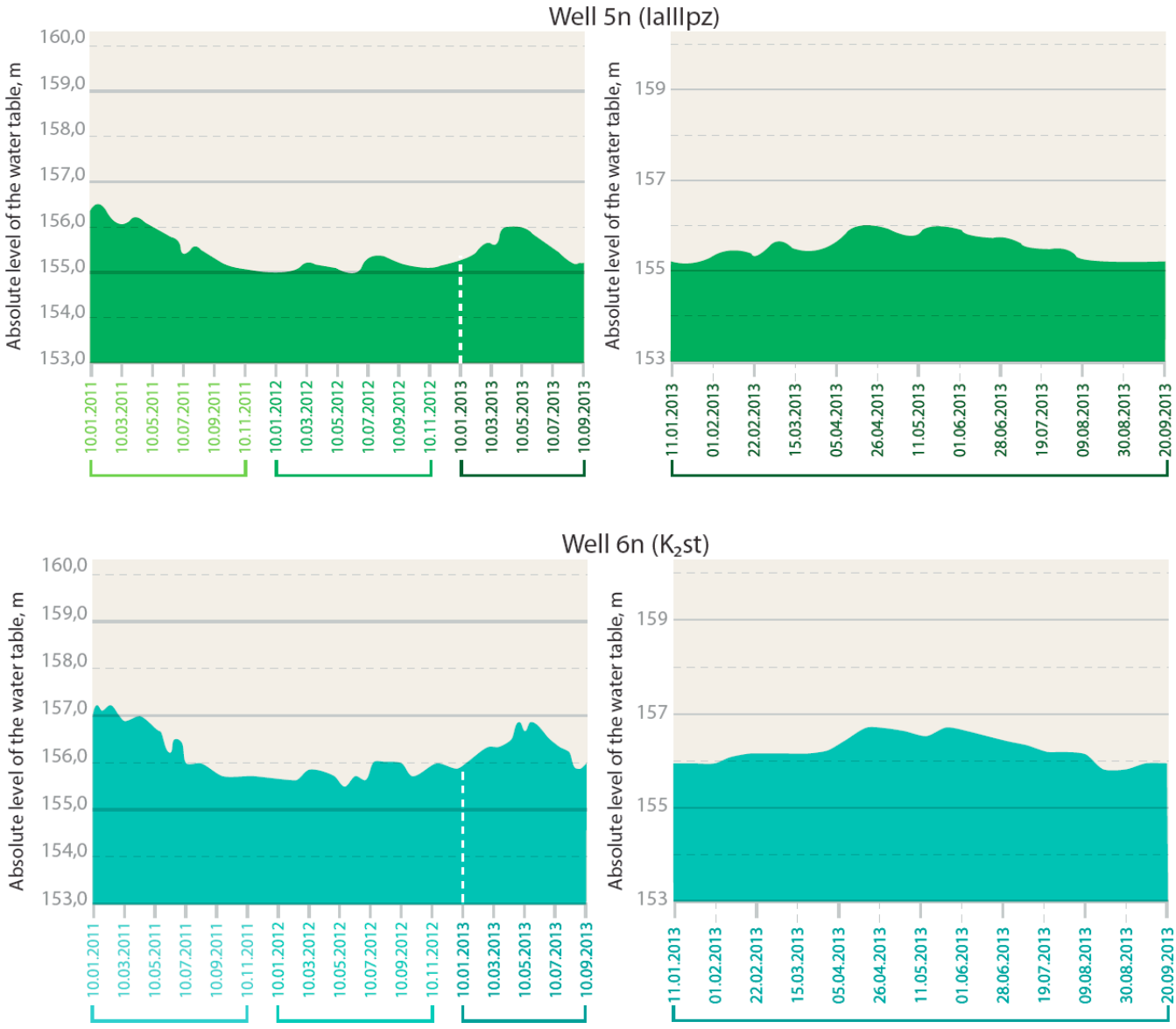
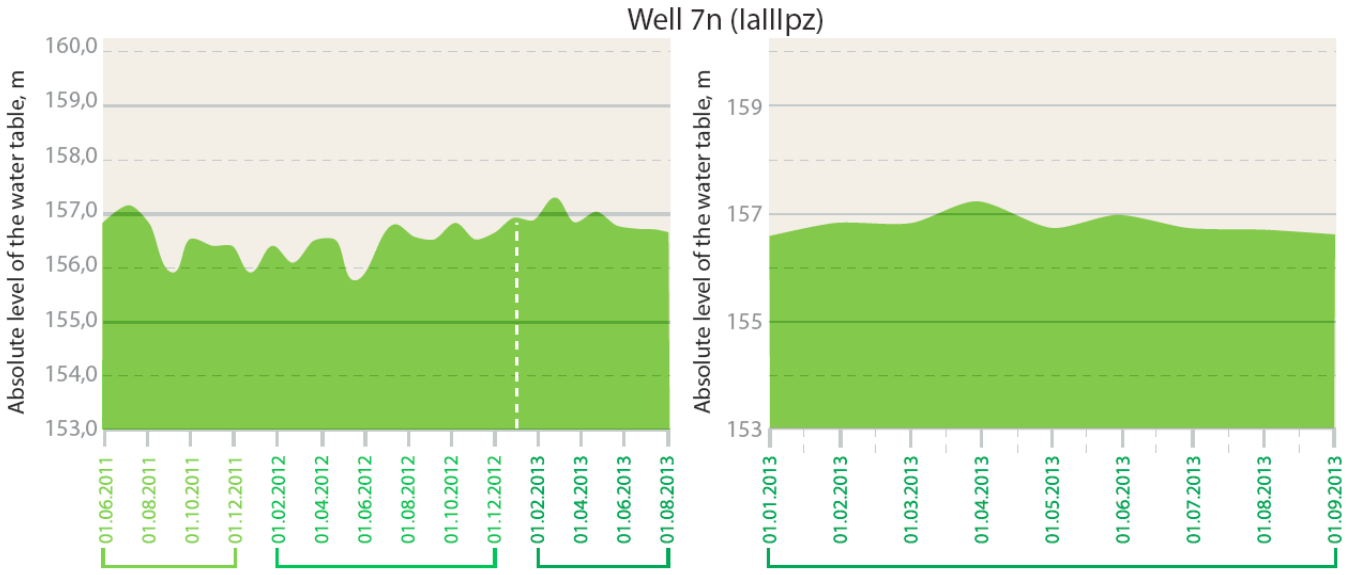
Well 3n (K2st)
Well 4n (IalIIpz)



Scheme 2. The ground water level regime at the observation points in the area of "Khotislavskoye" deposit (experimental network).


Well 7n (lalllpz)
Absolute level of the water table, m
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155,0
154,0
153,0
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Absolute level of the water table, m
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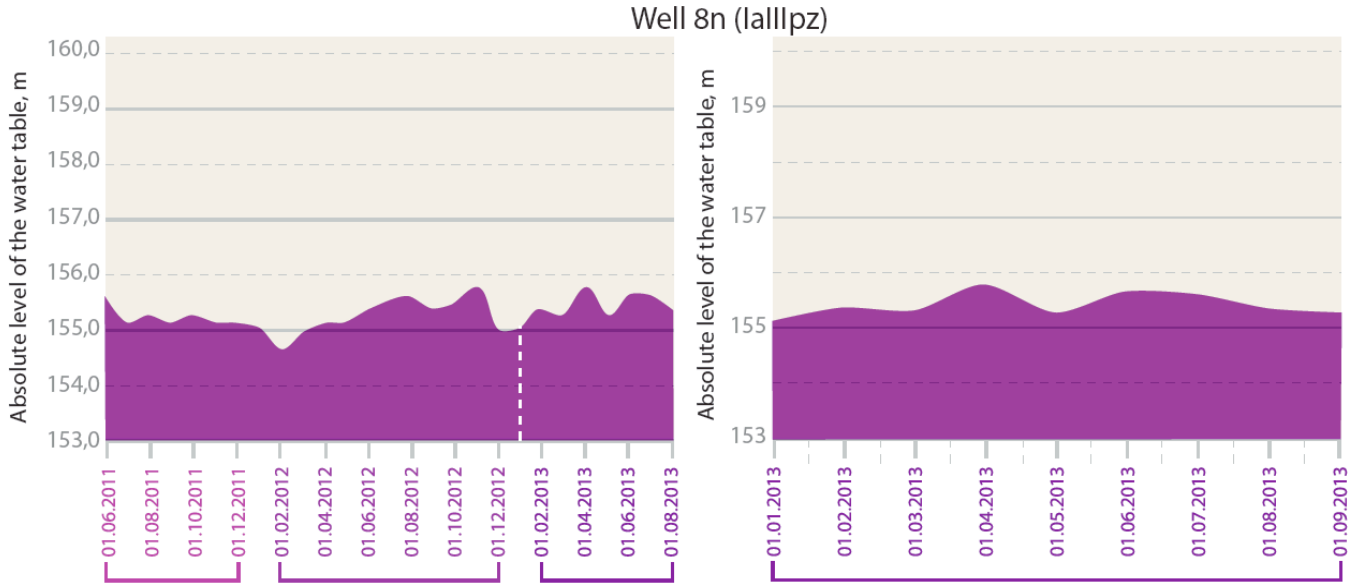
Well 8n (lalllpz)
Absolute level of the water table, m
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154,0
153,0
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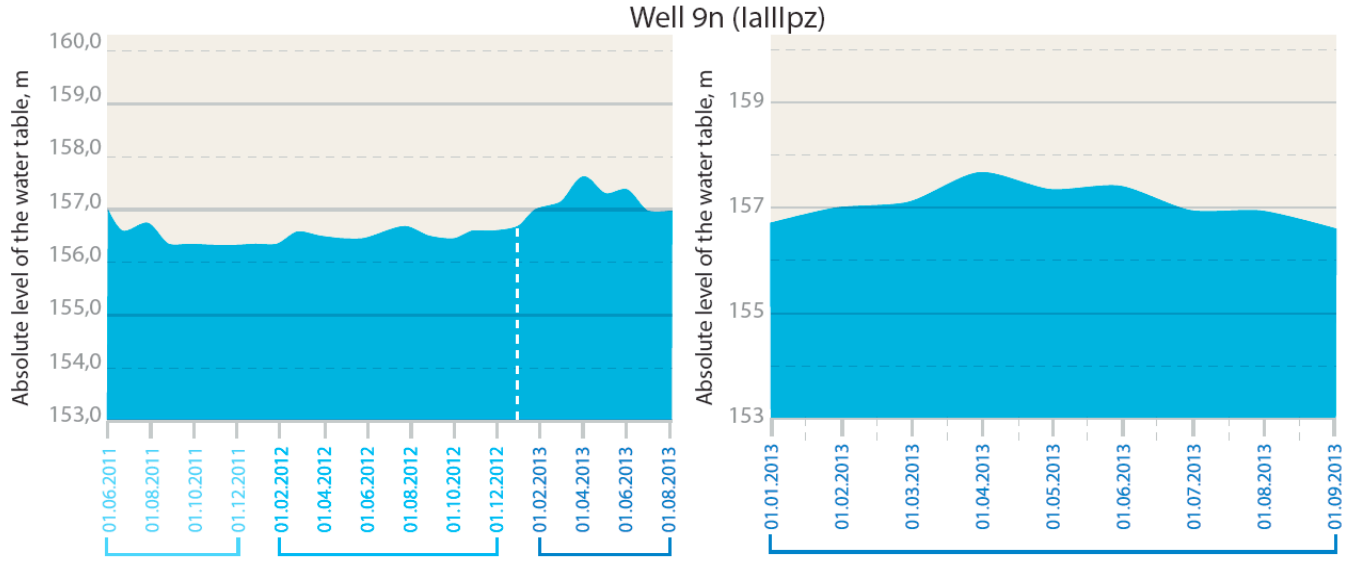
Well 9n (lalllpz)
Absolute level of the water table, m
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Absolute level of the water table, m
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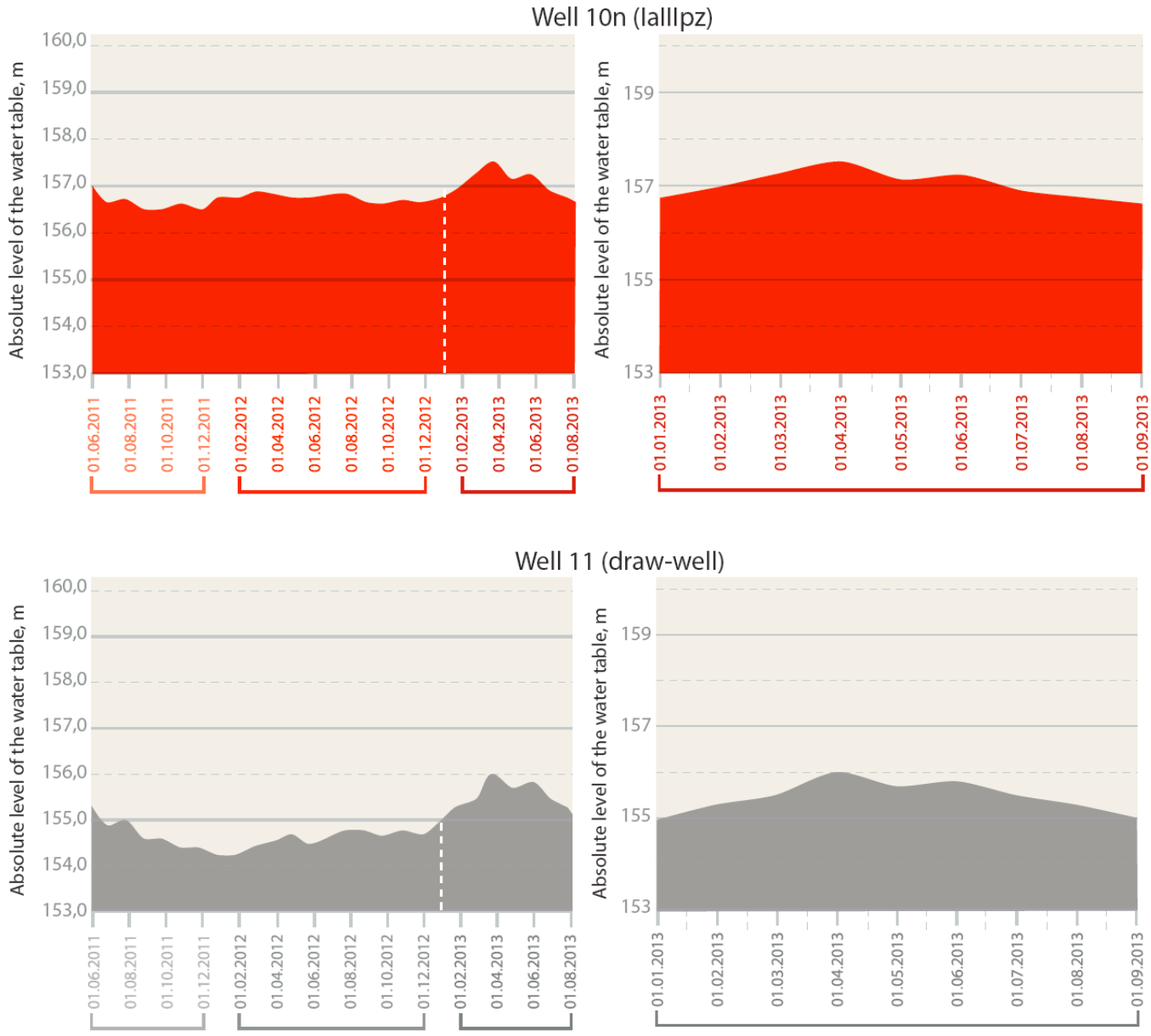


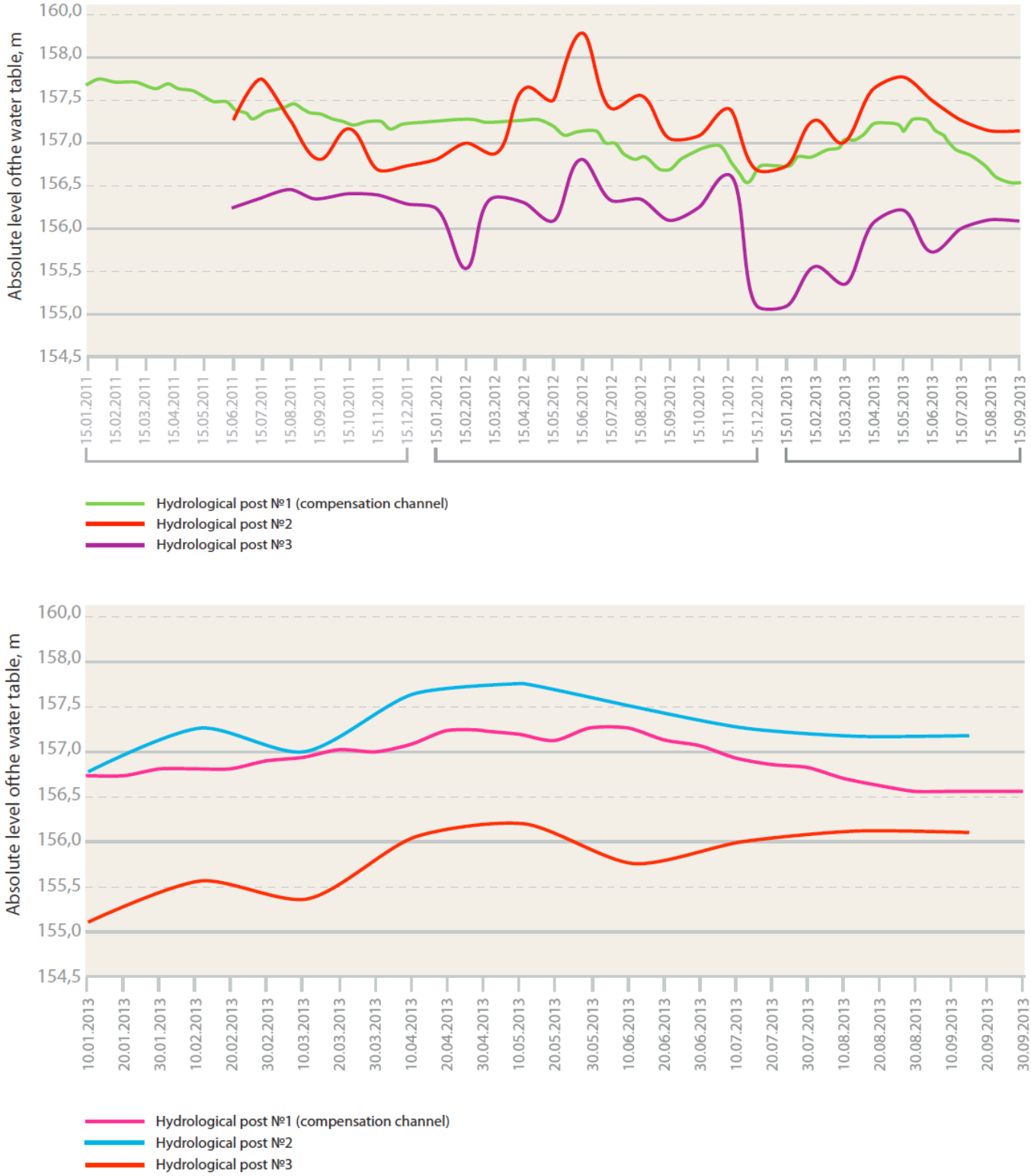
Scheme 3. The ground water level regime at the observation points in the area of "Khotislavskoye" deposit (regional network).

It is necessary to mention that the series of observations for the level regime of ground and surface water is not yet sufficient to make justified conclusions about the impact of the quarry on the hydrodynamic situation in the study area. It is important to continue monitoring with a continuous series of observations.

The surface water level regime in the area of chalk deposit

- In 2011 - the3rd quarter of 2013, the amplitudes of water level variations for the compensation channel were within the range of 0,05 m to 0,32 m. For the second hydrological post the range was from 0,02 to 0,85 meter and for the third hydrological post – from 0,01 to 1,5 meters.
- In general**, in 2011 and in the 3rd quarter of 2013** there was a **fall** of the water level for all hydrogeological posts by 0.45 meter on average.

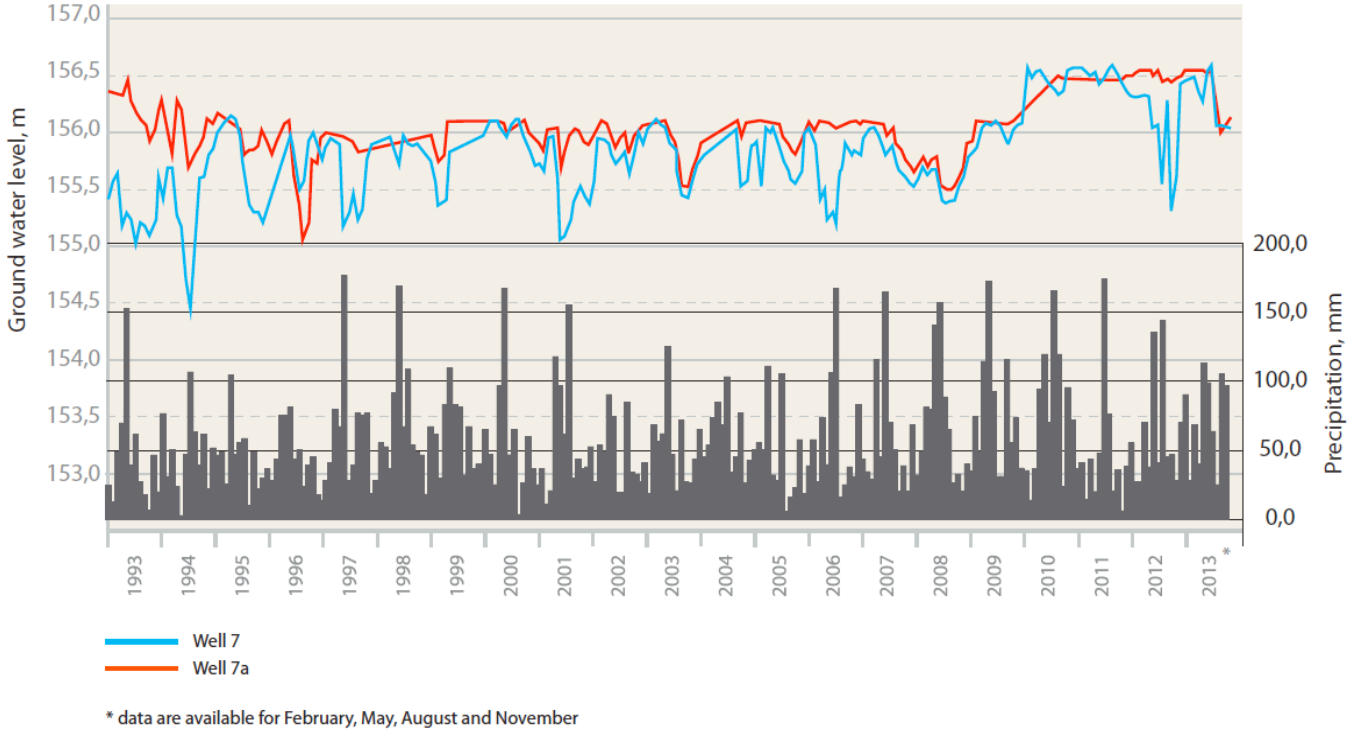
- In the **1st and 3rd quarters of 2013** there was a **tendency towards a fall** in the water level at the 1st hydrological post by 0,21 meter. At the 2nd and 3rd posts the level rose by 0,41 and 0,49 meters respectively.
- During the 3rd quarter of 2013 the amplitudes of variation were within the range of 0,01 to 0,71 meter.



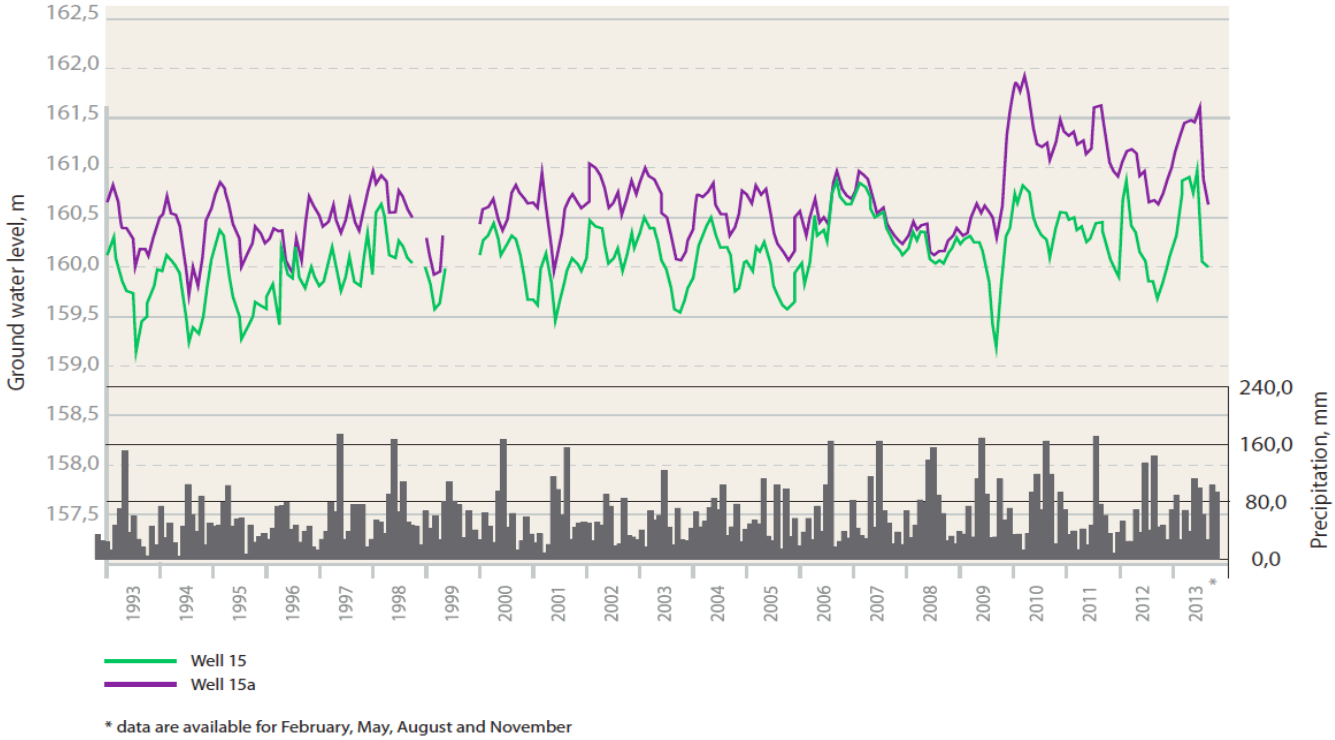
Scheme 4. The surface water level regime at the hydrogeological posts in the area of "Khotislavskoye" deposit

Ukraine

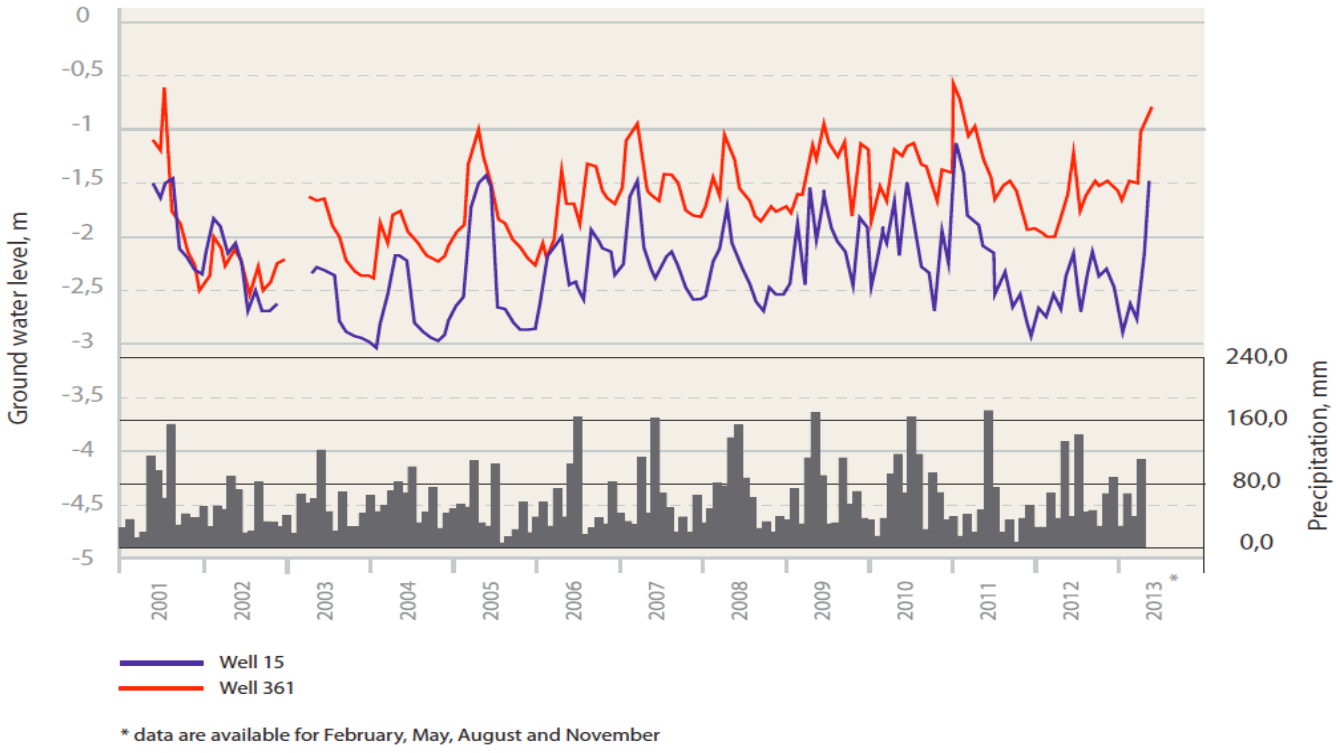
Average annual increase of the level of subsoil and ground water related to the increase in the average annual amount of atmospheric precipitation, is demonstrated by the analysis of the monitoring observations over the last years. The maximum levels were registered on **March 30, 2010** (well 7 – 0,07 m (156,04 m), well – 7a (+)0,05 m (156,16 m); well 15 – 1,27 m (160,81 m), well 15a – 0,16 m (161,9 m) respectively) and on **April, 20, 2013** (well 7 – 0,32 m (156,27 m), well 7a – (+) 0,05 m (156,16 m), well 15 – 1,19 m (160,89 m), well 15a – 0,59 m (161,47 m) respectively). The minimal level during low water – **September, 10, 2012 -** well 7 – 0,32 m (156,27 m), well 7a – (+) 0,05 m (156,16 m), well 15 – 1,19 m (160,89 m), well 15a – 0,59 m (161,47 m) respectively). Schemes 5-7 and table 1 provide the monitoring data. Also schemes 5-7 provide information on the amount of precipitation over the last years, for comparison - average annual amount of precipitation ranges within 538,0 to 821 mm).



Scheme 5. Variation of the water level in wells 7 (quaternary) and 7a (cretaceous) over the period of 1993-2013.



Scheme 6. Variation of the water level in wells 15 (quaternary) and 15a (cretaceous) over the period of 1993-2013.



Scheme 7. The subsoil water level regime for wells 15 and 361, cross section at the urban settlement Ratno

Well number	Sampling site	Ground water level, m		
		12.2010	07.2013	10.2013
1	Guta village, 11, Prilesnaya, Goloviy Nikolay Adamovich	0,45	1,20	1,3
2	Guta village, 19, Prilesnaya, Gluschuk German Mikhailovich	0,80	1,19	1,24
3	Tur village, 29, Zagrebelnaya Street, Goloviy N.S.	0,39	1,06	1,03
4	Tur village, at the church territory	5,40	4,40	4,57
5	Guta village, 6, Beloruskaya Street		1,42	1,65
6	Guta village, 46, Beloruskaya Street, Gluschuk N.V.	1,0	1,51	1,70
7	Zabolottya urban type settlement, 7, Sagaidachnogo Street, Yakovuk Elena Vasilievna	0,26	0,96	1,15
8	Zabolottya urban type settlement, 55, Sagaidachnogo Street	0,41	1,18	1,01
9	Zabolottya urban type settlement, 73, Sagaidachnogo Street,	0,51	0,94	1,15
10	Zabolottya urban type settlement, 223, Shevchenko Street	0,91	1,42	1,7
11	Tur village, 29, Zabrodivska Street Pampukha Ivan Semenovich		1,35	1,66

Table 1. The subsoil water levels at the observation wells

The minimum levels (Baltic Elevation System) were registered in the lakes:

- Svyatoye Lake – 158,42 m (September 2012), 158,59 m (January 2013);
- Dovgoye Lake – 156,18 m (October 2012); 156, 38 m (January, 2013).

The average monthly levels of the water table in the Svityaz Lake according to the data of observations in 2011 and 2013 are provided below.

		Water level, m, BES
2011	April	163,65
	May	163,63
	June	163,57
2013	January	163,36
	February	163,46
	March	163,52
	April	163,63
	May	163,69

Table 2. Water levels in the Svityaz Lake.

Currently, given the high water content of 2012, it is difficult to make an unequivocal assessment of the impact of the "Khotislavskoye" quarry development on the fall of the water levels in the lakes of Volyn located in the vicinity of the studied area.

According to the results of the instrumental and laboratory control, the chemical composition of water is stable, potassium hydrocarbonate.

The results of the latest measurements for the main hydrochemical indicators of the water qualitative composition in the lakes as of May 22nd, 2013 are provided below.

	Turskoye Lake	**Svyatoye Lake**
Dissolved oxygen	6,7	7,1
BOD 5	3,7	3,4
Ammonium	0,5	0,1
Nitrites	0,09	0,06
Nitrates	2,2	1,2
Sulphates	12,2	10,2
Phosphates	0,13	0,28
Total Ferrum	0,56	0,11

Table 3. Water quality in the lakes.

Date	BOD-5	COD	Hardness	Particulate matter	Residue on drying	Dissolved oxygen	Ph	Ammonium salts	Alkalinity	Calcium	Magnesium	Hydrocarbonates	Potassium	Sodium	Nitrites	Nitrates	Chlorides	Sulphates	Phosphates	Total iron
09.10.03	-	-	1,3	27,0	153	-	7,5	0,11	2,2	52,1	0	134,2	4,28	10,73	0,02	0,37	9,57	8,43	0,104	0,145
15.07.04	2,02	-	2,1	13,3	209	9,8	7,35	0,47	4,0	60,0	2,43	214	5,02	10,33	0,022	0,72	18,88	4,01	0,104	0,45
26.04.05	4,00	19,3	0,8	16,5	135	8,0	7,1	0,12	2,0	28,06	2,43	122	4,82	9,95	0,021	1,49	10,21	16,89	0,008	
18.10.05	4,60	19,26	1,1	15,1	142	9,1	7,75	0,13	2,2	36,07	4,86	134,2	0,72	3,94	0,024	1,1	11,91	15,73	0,014	
04.04.06	4,49	2,04	1,4	13,7	106	9,4	7,8	0,03	1,6	28,86	0	97,6	2,27	4,41	0,027	8,11	6,81	6,43	0,006	
18.10,06	5,15	13,76	3,2	13,75	177	8,85	8,15	0,23	2,4	62,12	1,22	146,4	4,84	8,52	0,004	8,48	11,7	6,74	0,056	0,24
13.07.07	3,06	17,57	1,2	8,5	132	7,57	7,5	0,15	2,2	28,04	3,65	134,2	3,82	9,35	0,046	0,14	13,62	6,43	0,07	0,12
10.10.07	3,85	15,52	1,5	10,0	118	10,62	7,3	0,13	2,0	28,06	1,22	122	2,45	6,0	0,002	0,41	11,91	6,87	0,024	
13.08.08	2,89	11,76	1,5	9,25	176	7,25	7,9	1,8	2,8	28,06	1,22	170,8	10,83	9,49	0,061	0,24	13,9	25,18	0,115	1,19
15.10.08	3,02	5,66	0,6	11,4	168	10,26	7,8	1,64	3,0	40,02	1,22	183	4,0	9,08	0,046	0,42	10,42	9,81	0,078	1,15
23.04.09	3,64	12,61	1,3	12,0	153	8,35	8,0	1,52	2,8	24,05	1,22	170,8	3,9	9,0	0,067	0,62	15,63	11,28	0,053	1,15
14.09.09	4,25	12,44	1,3	11,75	142	8,85	8,1	1,47	2,4	22,04	2,4	146,4	4,02	9,49	0,064	0,55	17,4	11,15	0,056	1,1
20.07.10	1,77	4,75	2,6	9,0	201	5,31	7,5	0,72	3,4	52,1	0	207,4	3,28	7,46	0,007	2,05	17,4	14,28	0,06	0,8
11.10.10	3,22	6,51	1,3	9,25	142	9,78	7,2	0,95	2,4	22,04	2,4	146,4	4,13	9,52	0,006	0,85	17,4	11,11	0,026	0,96
12.07.11	3,84	10,51	1,5	9,1	146	8,85	7,5	0,99	2,6	21,6	2,4	158,6	4,2	9,54	0,008	2,22	17,4	8,27	0,043	0,96
20.10.11	3,52	7,28	1,4	8,0	141	9,45	7,4	0,96	2,6	24,1	2,4	158,6	2,8	5,61	0,024	1,88	15,6	8,58	0,038	0,97
25.06.12	4,01	5,82	1,5	9,1	161	8,22	7,2	0,97	2,8	28,1	1,2	170,8	4,25	9,48	0,011	2,92	15,6	12,8	0,047	0,97
01.11.12	2,77	8,75	2,1	8,15	198	7,8	7,6	0,52	3,6	40,1	1,2	219,6	2,79	7,26	0,045	2,33	20,8	13,42	0,061	0,69
13.05.13	3,38	8,10	2,8	8,05	169	7,4	7,45	0,96	2,2	52,1	2,4	134,2	2,46	8,65	0,017	5,82	17,4	12,23	0,056	1,44
23.08.13								1,42							0,023	0,5				

Table 4. The results of the hydrochemical studies at the Krymnoye Lake in 2006-2013.

INFORMATION EXCHANGE

According to the "Monitoring Programme of Surface and Ground Waters on the Territory of the Republic of Belarus in the Area of the Second Stage of "Khotislavskoye" Chalk Deposit" (2011) the Parties are obliged to exchange research results once a year in the form of an information and analytical bulletin.

The results of the work of the joint bilateral monitoring working group undertaken within the pilot project will be posted on the websites of the Ministries of the Republic of Belarus and Ukraine. Information about the field work conducted by the working group was posted on the website of the Ministry of Ecology of Ukraine:
http://menr.gov.ua/index.php/press-center/news/123-news1/377-razrabotka-mestorozhdeniya-mela-khotislavskoe-sovremennoe-sostoyanie-i-analiz-vozdejstviya-na-okruzhayushchuyu-sredu-v-transgranichnom-kontekste

Also, the information was posted on the sites of:

- The Ukrainian Scientific Research Institute of Ecological Problems: http://www.niiep.kharkov.ua/news/razrabotka-mestorozhdeniya-mela-hotislavskoe-sovremennoe-sostoyanie-i-analiz-vozdeystviya-na
- National Joint Stock Company "Nadra Ukrayny" http://www.nadraukrayny.com.ua
- The Institute of Water Problems and Land Reclamation of the National Academy of Agrarian Sciences of Ukraine http://igim.org.ua/?p=736

BILATERAL WORKING GROUP FOR THE ENVIRONMENTAL MONITORING OF THE KHOTISLAVSKOYE QUARRY

Working Group members

On behalf of Belarus:

Olga Vasneva	State enterprise "SPC on Geology"
Viktro Muzykin	The Central Research Institute for Complex Use of Water Resources (CRICUWR)
Ruslan Novitzkiy	The State Scientific and Production Amalgamation "The Scientific and Practical Centre of the National Academy of Sciences of Belarus on Bioresources", the National Academy of Sciences of Belarus
Fedor Veras	JSC "Belgorkhimprom"

On behalf of Ukraine:

Alexander Vasenko	The Ukrainian Scientific Research Institute of Ecological Problems (USRIEP)
Leonid Turuchko	Volynskaya Hydrogeological Party
Alexander Bondar	The State Environmental Academy of Postgraduate Education

	and Management
Oleg Ulitzkiy	The National Joint Stock Company "Nadra Ukrayny"

External experts:

Viktor Khodin	Local Consultant
Roman Shakhmatenko	Local Consultant
Nina Stoyanova	UNECE Consultant
Lesya Nikolayeva	UNEP Consultant

Action plan of the bilateral monitoring within the project on post-project analysis (six-month period)

Task of the monitoring component (for a six-month period, April- October, 2013):

1. Analysis of the results of local and regional monitoring of surface and ground water in the area of the "Khotislavskoye" deposit (for 2010-2013).
2. Analysis of monitoring results of the state of water resources in Volynskaya Oblast (Ukraine), including the state of the aquatic and natural environment of the Shatsky lakes in Ukraine (for 2010-2013).
3. Identification of monitoring parameters and objects in the two countries.
4. Analysis of the field work results received.
5. Assessment of the efficiency of nature protection measures in the territory of Belarus.
6. Analysis of the research results of the observation points in the border areas developed according to the Aarhus Convention to provide the data to the public.
7. Development of the system to exchange information and monitoring data between the countries (execution of the task during the whole project period up to mid 2014).
8. Development of recommendations on the most effective implementation of the transboundary monitoring programme.

Work plan

Activity	Cross-section/observation point
Surface water	
Monitoring of the water level in the Rita River in Belarus (2 observation points that are located upstream and downstream of the deposit)	№2 №3
Monitoring of the water level in the compensation channel in the established cross-sections (Belarus Party)	№1
Monitoring of the water level in Shatsky lakes (Ukrainian party)	Shatsky lakes group
Collection of water samples in the Rita River for chemical analysis in the established cross-sections (Belarus Party)	№2 №3
Collection of water samples in the Krymnoye Lake in the head of the Rita River for chemical analysis in the established cross-sections (Ukrainian Party)	Krymnoye Lake, Rita River
Collection of water sample for chemical analysis in established cross-sections in the drainage channel of the quarry (Belarus Party)	№1

Ground water	
Monitoring of the ground water level (Belarus Party)	10 boreholes and the well
Monitoring of the ground water level (Ukrainian Party)	4 boreholes
Monitoring of the ground water quality (Belarus Party)	10 boreholes and the well
Monitoring of the ground water quality (Ukrainian Party)	4 boreholes

Over the project implementation period the experts of the working group exchanged information, collected and analysed research data for the preceding years and discussed the results received in the current year. The information collected and analysed by the Working Group over a six-month period, primarily covered the following tasks.

Conducting fieldwork (August 2013)

Joint field work by the Working Group experts in the area of study has become one of the important activities.

Activity	Measured Parameter	Point of Observation
Measurements of the ground and surface water level	Level	Rita River (Belarus) Compensation channel (Belarus) Rita River (Ukraine) Shatsky lakes Observation wells (Ukraine, Belarus)
Collection of ground and surface water samples for chemical analysis	Hydrogen ion concentration (pH), total mineral content, residue on drying, total hardness, permanganate value, hydrocarbonates, chlorides, nitrogen ammonia, nitrate nitrogen, nitrite nitrogen, sulphates, calcium, magnesium, sodium, colour, turbidity, potassium	Rita River (Belarus) Compensation channel (Belarus) Krymnoye Lake (Ukraine) Shatsky lakes

Meetings of the Working Group

The first meeting of the Working Group was conducted on the 10th of April, 2013 in the city of Brest, Belarus. The following issues were considered during the meeting:

- Membership and leadership of the WG;
- Development of the ToR for the WG
- A plan for the next meetings of the WG

The second meeting of the Working Group was conducted on the 27th of June, 2013, Kiev, Ukraine. The following issues were discussed at the meeting:

- Working plan of the bilateral monitoring programme within the project (for 6 months)
- Field work
- Exchange of information and publication of the monitoring results

The third meeting of the Working Group was conducted on the 24th of October 2013, Minsk, Belarus. The following issues were discussed at the meeting:

- Results of field work in the area of the “Khotislavskoye” quarry and Shatsky Lakes
- Draft report of the Working Group on monitoring within the project

- Draft recommendations of the Working Group on monitoring
- Draft recommendation on the post-project analysis

The minutes of all meetings and lists of participants are attached.

FIELD STUDIES

In order to implement the project field work on ground and surface water regime and the collection of samples for chemical analysis were conducted from the 19th to the 23d of August, 2013.

Complex hydrogeological works in the potential impact area of the "Khotislavskoye" quarry were undertaken by specialists of the joint Belarus-Ukrainian Working Group, who represent the following specialized organizations:

- State enterprise "SPC on Geology" (Belarus)
- The Ukrainian Scientific Research Institute of Ecological Problems of the Ministry of Ecology and Natural Resources (Ukraine)
- Institute of Water Problems and Land Reclamation of the National Academy of Agrarian Sciences of Ukraine (Ukraine)
- National joint stock company "Nadra Ukrayny"
- Volynskaya Hydrogeological and Ameliorative Party (Ukraine)

Field work schedule
(measurement of ground and surface water level and water sampling for chemical analysis)

Date	Number of the well	Depth of the well, m	Ground water level, m	Note
		The territory of Belarus		
19.08.2013	9	13,0	2,16	
	10	12,0	1,15	
	7	13,35	2,41	
	5	13,71	3,14	
	6	28,28	2,52	
	8	11,18	3,0	
20.08.2013	7	13,35	2,41	
	5	13,71	3,16	
	6	28,28	≈6,0	not recovered
	8	11,18	3,05	
	9	13,0	2,18	
	well in Sushitnitza		2,30	
	3		2,79	
	2		2,79	
	1		2,3	
	4		2,45	
		The territory of Ukraine		

21.08.2013	13	3,9	
	15a	1,24	
	15	1,86	not recovered
	7	0,95	
	7a	0,12	

Monitored indicators

During the fieldwork, the levels of surface and ground water were measured in the zone of potential impact and water samples collected for chemical analysis on the following indicators:

1. Hydrogen ion concentration (pH)
2. Total mineral content
3. Residue on drying
4. Total hardness
5. Permanganate value
6. Hydrocarbonates
7. Chlorides
8. Nitrogen ammonia
9. Nitrate nitrogen
10. Nitrite nitrogen
11. Sulphates
12. Calcium
13. Magnesium
14. Sodium
15. Colour
16. Turbidity
17. Potassium

Joint fieldwork provided the experts of the two countries with an opportunity to match observation approaches and methods and compare the results of laboratory studies.

Results of the work

Report on the results of fieldwork conducted between the 19th and the 23d of August on the territory of the chalky deposit "Khotislavskoye" (analysis made in the laboratory of the State enterprise "SPC on Geology" (Minsk).

Tests of the ground and surface water samples were made in the accredited Central Laboratory (registration number: BY/112 02.1.0.0252) of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus on August 22, 2013.

The MPC adopted according to SanPiN 10-12 RB 99 and MPC for fisheries were used to identify a degree to which the chemical composition of ground and surface water has changed.

As a result of laboratory tests it was determined that ground and surface water quality mainly complies with the established requirements, with the exception of the following indicators that had values exceeding MPC norms: turbidity, colour, pH, and permanganate. Wells 8 and 10 had increased values of nitrogen ammonia; the well (n the village) – had increased value of nitrate nitrogen, and the hydrological post near wells 5 and 6, high values for nitrite nitrogen.

Major anions – hydrocarbonates, major cations – calcium.

Agree with the Ukrainian side … "that monitoring observations should be continued to assess the impact of the "Khotislavskoye" quarry".

Results of laboratory tests on ground and surface water samples in the area of Shatsky lakes and the water of the Krymnoye Lake (tests made in the laboratory of the Ukrainian Scientific Research Institute of Ecological Problems (USRIEP), Kharkov.

Chemical analysis of ground and surface water samples collected to study the impact of the "Khotislavskoye" quarry was made by the laboratories of the Analytical Centre of the USRIEP certified to conduct such works (certificate as of July, 2010, 100-3714/2010 and valid until July, 2015). The quality of analytical work is controlled in line with the "Quality Guidelines" requirements that were developed with the consideration of DSTU ISO/TR 10013, DSTU ISO/IEC 17025-2001. Calibrating reference samples taken from certified state standard reference samples (DSZU) were used in measurements.

According to the research conducted by USRIEP, values exceeding the MPC were determined:

- In the Krymnoye Lake – the concentration of nitrogen ammonia was 1,7 times the MPC for fisheries, nitrites - 1,2 times the MPC for fisheries, phosphates - 1,26 times the MPC for fisheries, COD - 2,0 times of the fisheries norm.
- In the ground water of well 15, the concentration of phosphate was 2,7 times the MPC for drinking water. There was an increased value of COD in the following wells: 15 (2,7 times), 7a (1,3 times), and 7 (3 times).

Significant yellow and brown colouring of the water in the Krymnoye Lake was observed.

The salt content is within 250 – 300 mg/dm3. The major anions are – hydrocarbonates, and major cations – calcium.

Hydrogeological observations at these points of ground and surface water should be continued to determine the impact of the "Khotislavskoye" quarry.

Results of analytical research of ground, subsoil and surfacewater samples in the area of the "Khotislavskoye" deposit

Tests of ground, subsoil and surface water samples collected on the territory of Belarus and Ukraine in the area of the "Khotislavskoye" deposit were made by the water and soil monitoring laboratory of the Volynskaya Hydrogeological Ameliorative Party certified to conduct such works (registration 212 as of 11.06.2013). The statutory documents according to the "List of statutory documents and methodological documents that regulate identification of the composition and properties of environmental samples" approved by the order of the State Agency of Water Resources of Ukraine # 242 as of 19.11.2007 and calibrating reference samples made out of certified state standard reference samples (DSZU) were used in the analysis.

Results of chemical tests of ground, subsoil and surface water samples collected ***on the territory of Belarus***:

Analyzed water refers to the calcium hydrocarbonate type with low and average mineral content (100-500 mg/dm3). The water is neutral within the range of 6,75 to 7,4 pH. According to the hardness classification, the water of wells 2, 5, 6 and 9 refers to slightly hard, well 3 and the channel near the quarry – moderately hard, well 7 – hard. The surface water of the channel at well 7, the channel at Sushitnitsa village and well 11 –very hard.

In the well 5, nitrogen ammonia exceeds the MPC for drinking water for wells and spring tapping by 1,15 times, and in well 7 – by 1,7 times.

The water colour exceeds the norms in well 7, in the channel near well 7, and in the channel near the quarry of Sushitnitza village. The water is of yellow and brown colour.

All other parameters of water comply with the MPC norms.

Results of chemical tests of ground, subsoil and surface water samples collected ***on the territory of Ukraine***:

Analyzed water refers to calcium hydrocarbonate type with average mineral content (100-500 mg/dm3). The water is neutral within the range of 6,85 to 7,3 pH. According to the hardness classification, the water in the Krymnoye Lake is moderate hardness, and in the wells 15a, 15, 7a and 7 – hard.

Concentration of nitrogen ammonia in Krymnoye Lake exceeds the MPC for fisheries by 2,84 times. The water colour exceeds the norms by 10,6 times. The water is of yellow and brown colour, which is explained by the marshlands of the lakeside and iron presence in the water.

Analysis of the degree of pollution by the chemical composition of ground and surface water and possible impact of the “Khotislavskoye” quarry on the environment has been made using the MPC defined by the SanPiN 2.2.4-171-10 (drinking water), SOU 05.13-37-385:2006 (water of fisheries) and the total list of MPC for water of fisheries.

In general, according to the research results, the waters by their chemical composition comply with the established requirements, norms and rules. The increase is observed only for colour and nitrogen group (i.e. ammonium salts) which points to recent pollution, which might have a temporary character and may have been caused by agricultural activity, decay of albumen substance or is the result of life activity of microorganisms and fish in the lake.

Making conclusions as to the impact of the “Khotislavskoye” chalk deposit on the state of the environment in the territories of Belarus and Ukraine is quite difficult based on one-off studies. Further analysis of the impact of the “Khotislavskoye” quarry requires a continuation of the systematic field and laboratory studies at the same periods and at the same monitoring objects. The results of hydrochemical research conducted during the field work (August 19 -23, 2013) can be taken as background values that are used to analyse changes in the qualitative composition of surface and ground water and the level of regime in the area of “Khotislavskoye” deposit.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions:

- During the initial stage of the quarry development (up to 25 m depth), the efficiency of the water protection measures was quite high, as no tangible changes in the impact zone have been identified;
- As information on the current state of the hydrosphere in the area of potential impact of the "Khotislavskoye" quarry grows, it is necessary to forecast possible consequences of the business activity. The data required for such a forecast as the development of the quarry continues should be clarified.
- Comparative analysis of the monitoring data has demonstrated that the level of ground water in wells and boreholes has hardly changed as a result of the development of the quaternary deposits and the removal of the overburden at the quarry. The magnitude of groundwater variations is within 0,3-0,5 meters in the areas adjacent to the quarry and in the territory of the Shatsky National Park. These variations primarily depend upon atmospheric precipitation.
- In the wells with systematic active water exchange (flowing of wells 7 and 7a), the chemical composition of water, including its pH and nitrogen compounds, is the same in absolute values. Measureable changes have been recorded in wells with a lower water exchange. However they don't exceed the MPC for drinking water. There are various reasons for these changes and they require a more detailed analysis.
- No changes have been identified in vegetation and soil cover.

A study of the technical documentation for the second stage of the quarry development (up to 25 m depth) shows that project doesn't plan for any environmental protection (preventive) measures for the confined water horizon, but only for the subsoil layer. This is a cause of serious ***concern***, because :

- When the depth of the quarry will develop more than 25 m, the proposed protected measures may be insufficient and require more costly environmental measures.
- The installation of a hydraulic "curtain", which is proposed as a protection measure, can activate a karst-suffusion processes thus increasing the negative impact of the quarry drainage;
- Ukrainian experts suppose that under the natural conditions, the Turskoye Lake is fed by the subsoil water at a rate of 4921 m^3/day, and by confined water at a rate of 3219 m^3/day. If as a result of quarry drainage, the levels of ground water in the area of the lake fall by at least 0,5 m (as it is stated in the forecast by the project developers) the filtration will double and the level of the lake will possibly fall to household elevation. If its level falls 0,5 meters below the household level the lake will possibly turn into sapropelic marsh and the Turskaya drainage system that is based on soil moisture from Turskiy canal can turn into waterless overdrained territory of 9120 hectares.
- The natural environment of the Shatsky National Nature Park could be also under a threat. Some of lakes in the park have a common water system, for example, Lake Krymnoye is connected to the River Rita. Besides, karst is very much developed on the territory adjacent to the quarry. It is confined to an area of the ancient base level of runoff pradolina with the depth of river line over 60 meters, which is the stratum of

karstification. Under this scenario, the quarry may "pull" water via karst voids causing the disappearance of the karst lakes;

- Obviously a sudden disruption of the water regime and the creation of a negative water balance in this area will be followed by negative consequences for the whole ecosystem, including – reduced productivity of agricultural and forest lands. The impact of the quarry operation on the regime of the source wells, chemical composition of water as well as factors that can change the type of water are not yet known..
- In addition, the chalk processing plant operation will produce a huge amount of chalk dust. As a result of the prevailing wind pattern this dust will often reach the territory of Ukraine aggravating not only the living conditions in areas adjacent to the quarry, but the state of the soil cover, crop farming and cattle breeding. This group of factors points to the need to consider the consequences of the quarry and plant operation.

Based on the information presented above, it is necessary to reconcile the monitoring scheme between Ukraine and Belarus Parties and establish a single monitoring as it used to be in 1994. We suggest exchanging data, conducting joint discussions and research to assess the impact on the environment in the area of the "Khotislavskoye" quarry to prevent negative impact on the natural conditions caused by the operation of the quarry. Hence, continuation of the monitoring works is required.

Recommendations on monitoring:

- To establish a joint (agreed) system of monitoring in the area potentially impacted by the "Khotislavskoye" quarry covering areas both in Ukraine and Belarus land that are adjacent to the quarry;
- To reconcile the scheme and sequence of monitoring observations for ground and surface water monitoring by the Belarus scientists on the territory of Ukraine;
- To establish a system for the exchange of monitoring information;
- To conduct joint research of environmental changes in the area of impact of the "Khotislavskoye" quarry;
- To conduct joint discussions of the study results in order to assess possible negative consequences of the "Khotislavskoye" quarry operation with the Belarus party;
- To make joint decisions to prevent negative consequences caused by quarry development;
- The monitoring should be continued with the optimization of the observation network using environmental indicators.
- The issues of research funding should be solved.

Recommendations on post-project analysis:

1. To set clear stages and conditions for participation of the affected party in the EIA process held from the country of origin in order to insure equal rights to:
    - Be informed at each phase of the procedure and for further development of the assessed project;
    - Have opportunity for giving opinion about the EIA documentation, including proposals for mitigation measure and post project monitoring;
    - Have on disposal identity environmental information.
2. Establish a form of the EIA final document /decision/ with certain parts for conditions, mitigation measures and post project monitoring.
3. In each of the countries to develop system for:

- Periodic reporting by the investor on the project development and on the results from the self-monitoring which should be presented to the competent environmental authorities and/or
- Periodic control by the competent environmental authorities on the project development and application of the conditions, mitigation measures and monitoring.

4. Presenting the information gathered according to the point above to the affected country.
5. Assessment of the compliance and the effectiveness of the mitigation measures and verification of the past predictions. If there are reasonable grounds for concluding that there is a significant adverse transboundary impact or factors have been discovered which may result in such an impact the concerned Parties shall then consult on necessary measures to reduce or eliminate the impact.
6. To ensure public access to the following documents in both countries:
   - Final EIA document/decision;
   - Data from practical implementation of the mitigation measures;
   - Results from post project monitoring and adequacy of prescribed measures.
7. The public access /for both countries/ may be organized as appropriate and may include publishing of the information as follows:
   - On the web-pages of the Ministries of environment, their regional structures; National Environmental Agencies; Municipalities; Local governments and other state institutions;
   - Announcement in the newspapers – at national and local level;
   - On the information desks in the buildings of the concerned Municipalities, Local governments;
   - In the libraries of the concerned cities and villages;
   - In the offices of NGO's;
   - In the Aarhus centers;
   - In the offices of the developers.