

# Evaluation of the Environmental Impact of the Activities Carried Out in the Area of Murighiol Channel Tulcea County

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**Abstract.** The Murighiol Channel area is a part of the Danube Delta Biosphere Reserve, a protected area in which economic activities of the type of tourism can have a negative significant impact if they are not carefully monitored. Thus, knowing the level of pollution in the area, and especially near the boarding house Blue Lagoon, helps us to pay a special attention to the fauna and flora by protecting the environment and giving nature enthusiasts a special area. For this, a series of measures have been taken in the preparation of samples taken from important places near the boarding house. Specific analysis for water, soil and noise were performed.

## 1. Introduction

In Europe, the first longest river is Volga and after beyond is Danube with 2860 km [1]. Danube river flows through 10 countries from where it collects discharges from industrial activities and urban activities and effluents [2]. The Danube, reached in Tulcea County, north of the Dobrogea area, dividing in two branches: Chilia (to the north) and Tulcea (to the south), which later separates into Sulina branche and Sfântu Gheorghe branche [3, 4]. On the world are several natural reservations but UNESCO classified Danube Delta on the third place with protected area due to his ecological importance. In this area are found over than 250 species of fauna and 300 of rare birds [5]. The Danube Delta is the largest humid ecological area from Europe with 5640 km<sup>2</sup>. This zone are very vulnerable to any change of the environment, human activities and especially to natural disasters (floods) [6]. In the area of Murighiol channel from Danube Delta, it is the most important and well protected area of biodiversity from Romania and one of the most important from Europe and the area of interest for this study. In this part of the Danube Delta no research has been done and that's way this research offer the opportunity to find out the current status of these places. Murighiol channel is a very often circulated channel by agreement boats, and also it is located in an economic area of Danube Delta and in this way it is done the connections between the dock from Murighiol village and the arm Sf. Gheorghe. On a distance of 150 – 200 m are placed two touristic locations, Pension „Laguna Albastră” and Puflene Resort, placed in an strategic way because of the facilities which are offered by the Murighiol channel for promoting touristic offers. Throughout time the number of tourists which visit the reservation or which are spending holidays in Danube Delta each year, is on an ascending curve, and this rising lead to supplementing the number of authorized tourist routes (2002) to meet their requirements, influencing in an indirect way the biodiversity [7].

The positive impact of tourism on environment occurs when the tourism and environment coexist in harmony and the environment benefits from tourism. Negative impact of tourism against environment is determined by the inappropriate use of the environment, in recreational way and in

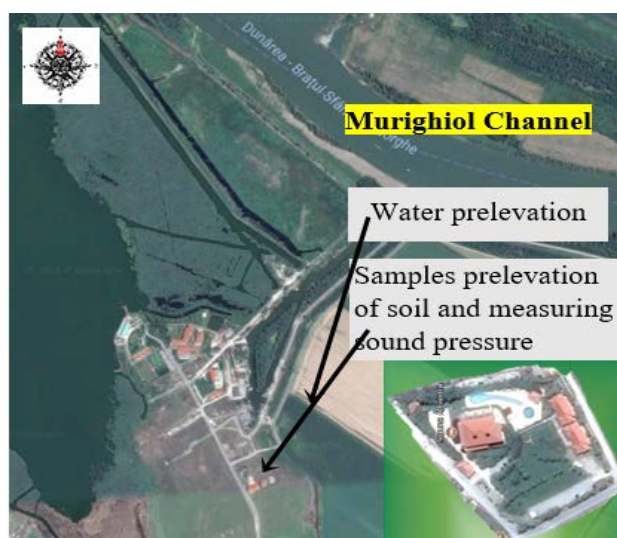


agreement and the big number of visitors arrived at destination is exceeded and environment quality, the diversity of flora and fauna are unavoidable affected [8].

Water and soil are most affected by the pollutants, heavy metals are considered ones of the most dangerous category of pollutants, because of the persistency and her tendency of being retained by the microorganisms from terrestrial and aquatic environment. The main problem caused by heavy metals in environment, is the tendency of toxicity to be accumulated in different types of tissues (plants, animals or human) even at low concentrations [9].

## 2. Materials and methods

For accomplishing this research we have used a series of methods in which we prelevated samples in places located in accord with Figure 1, for analysis of water, soils and also we have donned measurements of sound pressure.



**Figure 1.** Locations of prelevation of samples.

The analysis have been done by direct methods according to which the results are determined in a direct way by measured values with specific equipment.

### 2.1. Materials and method of prelevation for water

The samples of water have been prelevated from Murighiol channel and the analysis have been done in the laboratory of environment monitoring from the Department of Environment Engineering and Industry Safety using an multiparameter Hach with accessories, spectrophotometer DR5000 plus rapid tests LCK. Water samples were prelevated in accordance with standard procedure which implies that before to prelevate the sample the recipient was washed with distilled water and rinsed with water from prelevation area and analysis were made in the shorts time in the laboratory.

On establishing of the most important indicators (nutrients, salinity and specific pollutants) was started from the identification of the water quality status, polluting and dangerous substances for ecosystem and which of the determinate values are approaching the maximum admissible values. The resulted values obtained have been compared with those from the annexes of Environment Minister Order and Water Management no. 161 from 16 February 2006 [11]. This normative classifies the quality of surface waters in order to determine the ecological status of water bodies.

### 2.2. Materials and method of prelevation for soil

Soils samples have been prelevated from the perimeter of “Laguna Albastră” pension in five representative points and the necessity of soils evaluation was donned to know the actual status of

those from the point of view of humidity, natural radioactivity and chemical composition of presented soils and toxic elements (Cd, Pb, Zn, Cr, etc.) with significant negative impact against environment and local biodiversity. On the prelevation of soils samples was followed the method of five points or envelope method. Prelevation of samples was made in recipients from polyethylene, on a depth of 5 – 10 cm from the surface of soil. The probing device was cleaned after each prelevation in order to prevent the accidental contact of substances contained in samples which may denaturated the results of analysis. Chemical analysis have been made using the equipment of laboratory of environmental monitoring and the results of analysis are compared with values from Order no. 756/1997 Regulation regarding environmental pollution for types of sensible use of soils [12].

### 2.3. Method of measuring of noise

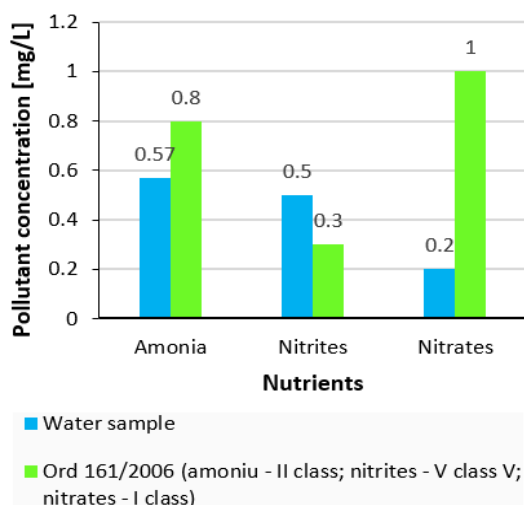
Measurements of sound pressure was made in the perimeter of pension “Laguna Albastră” having into consideration the evaluation of pressure levels and health risks or discomfort for population by reducing the noise. Measurements was done in twelve points in most agglomerated areas from pension perimeter with the help of an equipment PCE 222. The results of measurements are compared with levels of sound pressure specified in the Order no. 536/1997 regarding hygiene rules and recommendation regarding life environment of population [13].

The monitoring of sound pressure was done according HG no. 321/2005 [14] from 14 april 2005 regarding the evaluation and managing ambient noise between the hour 7:00 – 19:00 a.m., 19:00 – 23:00 p.m. and 23:00 – 7:00 p.m., in 15 and 16 july 2017 (when the flux of tourists have been high) with the purpose to evaluate the impact of noise from “Laguna Albastră” location and surrounding. Twelve points of measurements are in the near vicinity of pension and on and radius of approximately 1000 square meters. Measurements have shown values between 17.4 – 62.3 dB and possible sources of sound pressure are: naturals (birds, insects) and anthropic (cars, people, boats, etc.).

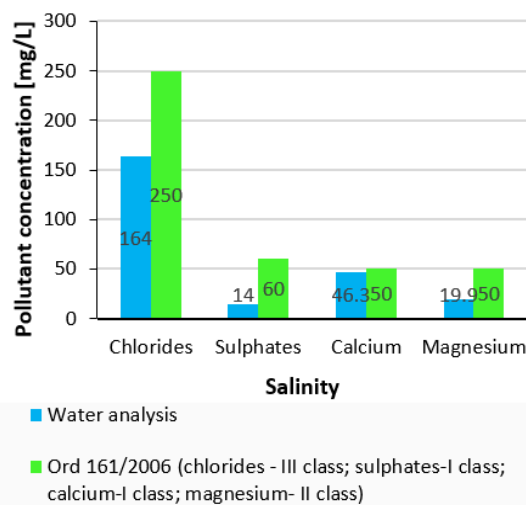
## 3. Results and discussion

### 3.1. Results for water

Parameters for the nutrients group (Figure 2) are ammonia, nitrites and nitrates and measurements shows that this are in the range of quality classes, with the exception of nitrites. Nitrites concentration above maximum level accepted 0.3 mg NO<sub>2</sub>/l determine the appearance of eutrophication process or “flowering” respectively of depletion of oxygen content from water by death and decomposition of zooplankton.

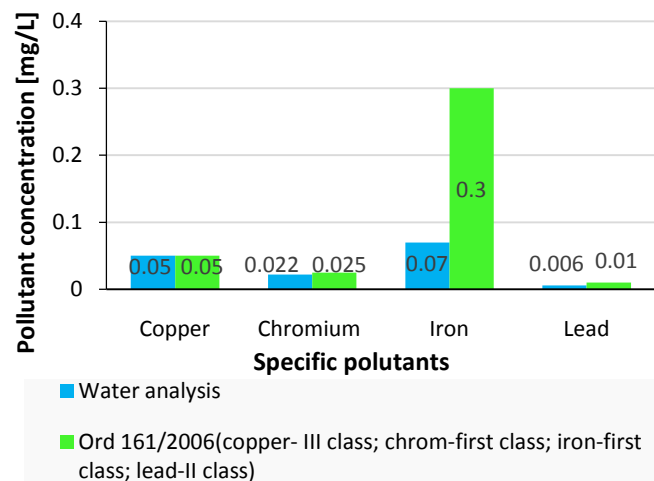


**Figure 2.** Nutrient analysis.



**Figure 3.** Salinity analysis.

Water salinity presented in Figure 3 is determined by measuring the parameters for chlorides, sulphates, calcium and magnesium. According to Order no. 161/2006 [15] parameters for water are classified in the following quality classes: chlorides – third class, sulphate – first class, calcium – first class, magnesium – second class and the results obtained have been compared with those and we may conclude that those have an very low impact against the aquatic life.

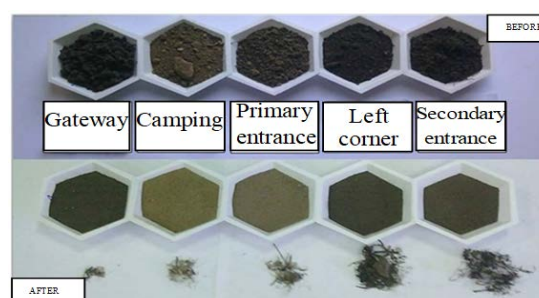


**Figure 4.** Specific pollutant analysis.

From the category for specific toxic of natural origin the parameters analyzed are copper, chromium, iron and lead. The results of analysis have determined framing of those parameters according to Order 161 from 16.02.2006 [15] in the following quality classes: copper – forth classes, hexavalent chromium – first class, iron – first class and lead – second class.

### 3.2. Results for soil

In order to obtain results for soils we have done a few preparatory steps of samples with the purpose of reducing measurements errors and this are presented in Figure 5. The measurements have been made after drying samples in dry oven in time of 48 hours on temperature of 50°C, removing organic and inorganic waste and shredding them.

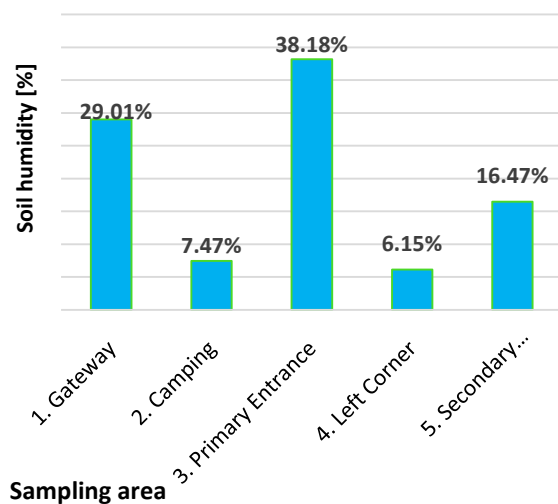


**Figure 5.** Preparing samples for analysis.

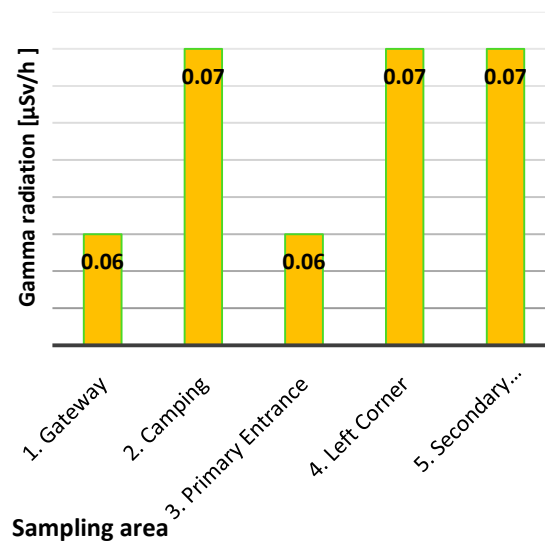
In Figure 6 it is graphically represented the variation of soil samples and values are between 6.15 – 38.8 % and minimum values was registered in point four from left corner (6.15 %) because this area of pension is very little frequented, the only sources of water for humidity vegetation is water from precipitations and groundwater. The maximum values was registered in point three “Poarta mare” (2)

because in this area the turf is watered frequently. Percentage differences of humidity are due to the existence of turf and trees, which are watered on very large surfaces from pension perimeter.

In Figure 7 is graphically represented the distribution of values of gamma dose registered in five samples of soil  $0.06 - 0.07 \mu\text{Sv/h}$  and these low values confirm the presence in very small quantities of radioactive elements. The soil does not represent any danger for the environment from the point of view of background radiation.

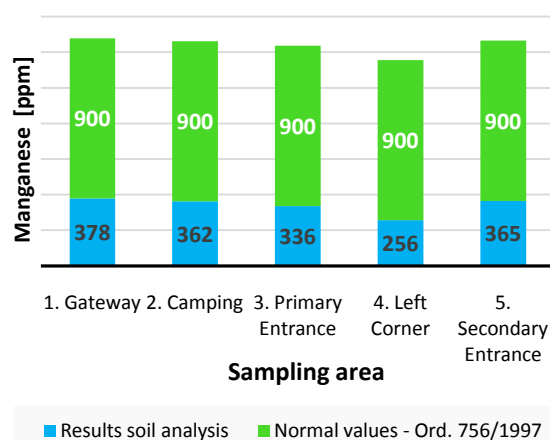


**Figure 6.** Humidity of soil samples.

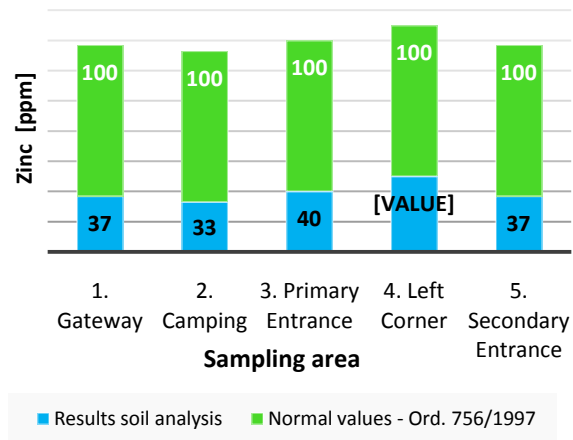


**Figure 7.** Measured gamma radiation.

According to Order no. 756/1997 Regulation regarding the evaluation of environment pollution [12], the types of soils according to the way of use are soils with *sensitive use* and *less sensitive use*. Knowing that the pension from where was prelevated samples of soils is located in economical area of reservation Danube Delta, the terrain is included in category of sensitive use, so the results of analysis are reported to values of type of soil with sensitive use (reference values: normal values – NV, alert threshold – AT, the intervention threshold – IT). In Figure 8 we show the manganese concentration variation present in five prelevation points, seeing values contained between 257- 378 ppm and these registered concentration are under normal level of 900 ppm for dry soil, and indicate the presence of element manganese in normal concentration and show a low impact against environment.

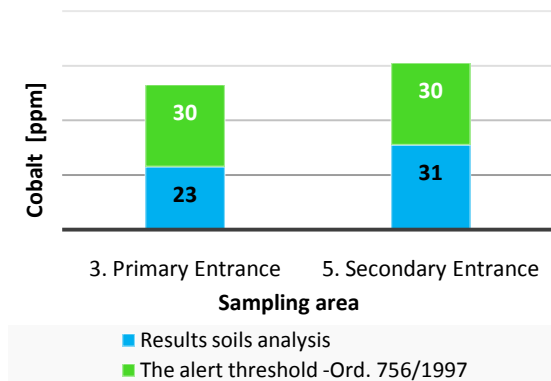


**Figure 8.** Variation of manganese.

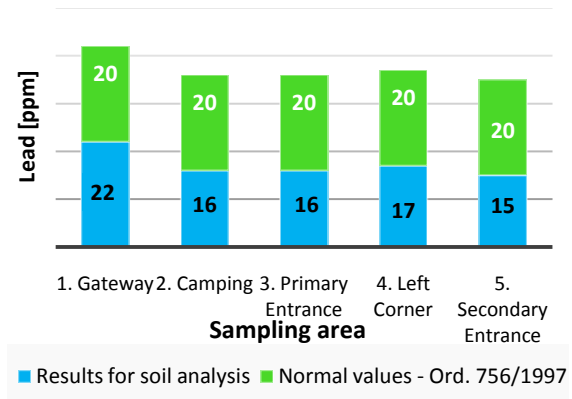


**Figure 9.** Variation of zinc concentration.

From graph analysis of Figure 9 we can conclude that the values of zinc do not exceed normal value threshold NV. The values are contained between 33 – 50 ppm and zinc is a microelement essential to grow and normal development of plants and the impact of the deficiency of this element on growth, development and productivity of plants is very large, having a negative impact against on the health of living creatures.



**Figure 10.** Variation of cobalt concentration.



**Figure 11.** Variation of lead concentration.

In soils, cobalt is found under different forms, in the crystalline network of some insoluble minerals, in hydrated oxides of iron and manganese, under the form of slightly soluble chelates especially in acidic and neutral soils, adsorbed on the surfaces of mineral organic colloids and soluble in soil solution [10]. In the five samples of analyzed soils, cobalt is found only in two samples respectively “Poarta mare” (2) – 23 ppm and “Poarta mică” – 31 ppm. In other three samples of soil the lack of cobalt may have an unwanted effect for human health such as the preventing the formation of red blood cells and not transmitting nerve impulses. From the graph presented in Figure 11 was observed that in four from five samples result values 15 – 17 ppm under normal values, showing an maximum value of 22 ppm on “Poarta mare” (1), and minimum value of 15 ppm on “Poarta mică”. Emphasizing that lead it is harmful to human health and this shows some significant negative impact on them.

### 3.3. Results for sound pressure

High sound pressure (noise pollution) generated by anthropogenic sources in a protected area implies potential significant environmental risks for the site. Thus, measurements were made at different times of the day around the pension in order to determine the level and to take measures to mitigate it if necessary. The average of the values measured over the two days was calculated by the relation (1) and the values are in the graph in Figure 12.

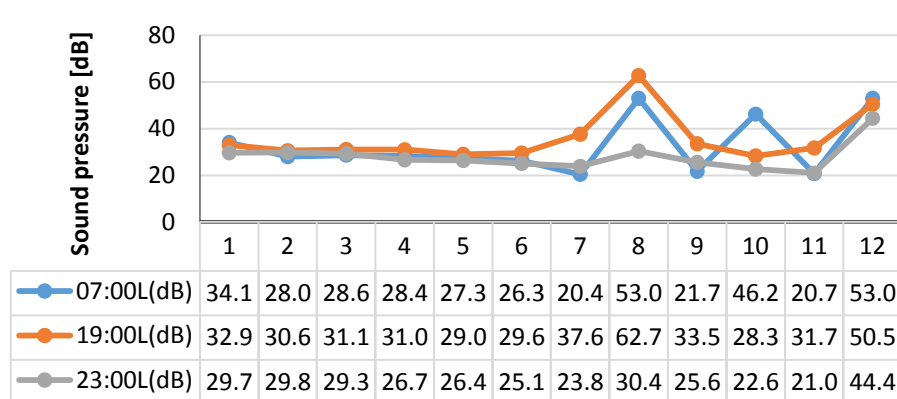
$$L_{dB} + L_{dB} = 10^{(L_{dB}/10)} + 10^{(L_{dB}/10)} = 10 * \log (10^{(L_{dB}/10)} + 10^{(L_{dB}/10)}) \quad (1)$$

In the graph from Figure 12 we represent the average values of sound pressure level from date 15 July and 16 July. The highest values were registered in the night interval in nearly the twelve measuring points, and in point 8 even was exceeded the maximum admittance level of 50 dB, in this point are multiple noise sources such as people, music, etc.

Values of equivalent permanent sound level  $L_{Aeq,24h}$  is represented in Figure 13.

$$L_{Aeq} = 10 * \log 1/24 (12 * 10^{(L_{day}/10)} + 4 * 10^{(L_{evening}/10)} + 8 * 10^{(L_{night}/10)}) \quad (2)$$



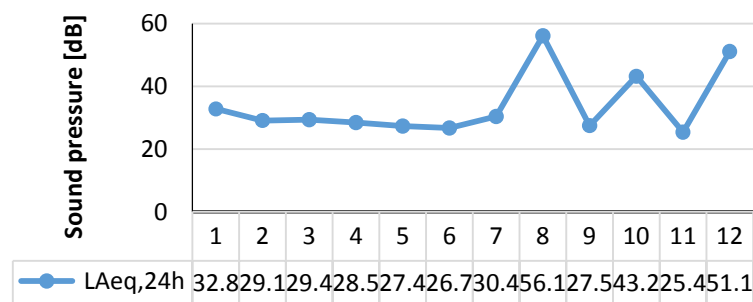


**Figure 12.** Average values from the date 15 and 16 july.



**Figure 13.** Equivalent permanent sound level  $L_{Aeq,24h}$ .

In the case of strong sound pressure variations, the "noisy" situation is characterized by the permanently equivalent sound indicator. By this indicator is understanding a calculable indicator of sound pressure, which corresponds to average value measured (calculated) in the time of sound energy action.



**Figure 14.** Variation of equivalent permanent noise level  $L_{Aeq,24h}$ .

The evaluation parameter (indicator) is equivalent noise level for 24 hour  $\leftrightarrow L_{Aeq,24h}$  is presented in Figure 14 and we can conclude that the domain of values are between 25 – 56 db acceptable values for the area.

#### 4. Conclusions

Environmental monitoring of the Danube Delta Murighiol aims to assess the impact of human activity on the conduct of environmental factors in the economic area of the reserve.

The main objective of declaring the Danube Delta as a biosphere reserve was and is the preservation of the diversity of species and habitats it hosts, the impact of people's activity on the reserve is low without negative repercussions. Thus, from the point of view of ecological status, the value of the elements pursued falls within the boundary between the good state and the moderate status of the biological quality of surface water.

Considering that the soil is the place where all the pollutants meet, airborne dust, toxic gases transformed by rain into the atmosphere, is most exposed to the negative effects of these substances, the soil samples (humidity, natural radioactivity, chemical composition) in the perimeter “Laguna Albastră” pension have not registered deviations from the level allowed in the legislation.

The relative soil moisture recorded large differences between the minimum value in the left corner peripheral area (6.15%) and the maximum value in the “Poarta mare” area (2) (38.18%).

The reason for these differences is justified by the maintaining and maintenance of landscape architectural objectives within the perimeter of the pension.

The results of the monitoring of the natural radioactivity of the soil samples confirmed in very small quantities the radioactive elements, the soil presenting no danger in terms of the radioactive background.

The elements present in their composition (Ti, Mn, Fe, Co, Zn, Pb, Rb, Sr, Zr) have been identified by analyzing the chemical composition of soil samples, among which there are heavy metals. The only element that has reached the alert threshold is cobalt. The threshold for intervention was not reached by any element found in the soil samples.

The activity carried out within the objective of the “Laguna Albastră” pension is not a source of noise pollution, the noise level being generated according to the measurements made within the limits set by the legislation, recommending the pension as a place of recreation and rest. In view of the overall reduced impact of the activities carried out on the site under consideration on the noise level of the area, no measures will be required to reduce the noise level at source.

The results obtained from the analyzes carried out in the Murighiol area of the Danube Delta confirm the status of the Danube Delta protected area, the anthropogenic activities have limited impact on the biodiversity of the reserve.

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