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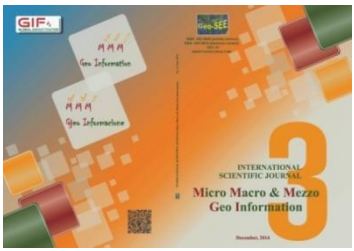
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GROUND DISPLACEMENTS DETECTION IN TRIFON ZAREZAN LANDSLIDE BASED ON GNSS AND SAR DATA

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UDC: 551.311.24:[528.8:629.783(497.2)

ABSTRACT

The Trifon Zarezan landslide is one of the well-studied areas north of Varna. It has been registered in 1998 and monitored since then, but due to expansion of construction activities and lack of sewerage facilities in 2005 it exhibited strong activation seriously damaging the panoramic coastal road remaining closed up to nowadays. One important issue in mitigating the effect of this phenomenon is its continuous monitoring and one promising solution of this problem is the usage of differential Synthetic Aperture Radar interferometry In the framework of this study two sources of data have been used – three geodetic surveys and SAR data from C-SAR instrument onboard Sentinel-1. The main research objective was to combine the advantages offered by both data sources in order to produce regularly updated information about the whole site. The GNSS data are precise, but does not originate from dense geodetic network, while SAR data cover the whole area, but they lack of high spatial resolution which is disadvantage in case of exploring small areas such as this one. Based on the results achieved it can be concluded that both sources of data provide complementary information confirming the overall behavior of the studied phenomena for the time period analyzed.

Key words: landslide, GPS data, DInSAR

1. INTRODUCTION

The Trifon Zarezan landslide is one of the well-studied natural occurrences located north of Varna city with initially recorded area of 3ha, but has grown to 6ha and continues to increase. This is one of the 88 objects prone to natural

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hazards in the area of the region. First movements of the landmasses has been registered in 1998 and monitored since then by the competent national authorities (MRRB, 2017). Due to expansion of the construction activities in its vicinity and lack of sewerage facilities in 2005 it exhibited strong activation seriously damaging the panoramic coastal road remaining closed up to nowadays. The monitoring of this landslide revealed the following facts – direction of movement is eastward, total horizontal displacement for almost 20 years to be 11m and on some places of the landslide the subsidence was found to be more than one meter.

2. MOTIVATION

From the geology surveys carried out in mentioned region it resulted that the geology settings are highly favorable for landslides formation and in addition it was established that the abrasion process is the most important factor for triggering of such phenomena. All those negative geodynamic processes and phenomena have been studied since 60-ties of the last century especially along the road Varna – Golden Sands resort. For this reason the region has been included in list of Europe's towns prone to ground instability geohazard (Pangeo'2017).

Figure 1: Cracks and subsidence in the area of Trifon Zarezan landslide.

As pointed out above the human activities, more specifically construction ones, have intensified during the last decades contributing to natural factors. The consequences resulted in serious damages to the private properties, roads, water mains, power lines and other facilities.

The reasons stated above motivated the authors to initiate this research for monitoring the landslide movement by SAR data complemented by GNSS measurements. The focus was set on this single object located 20km north of the town of Varna since it affects directly human lives. The slope of the terrain is between 18 and 24 degrees and the elevations vary from 0m to 37m ASL. The manifestation of the landslide started in 1998 by forming a circle affecting five plots, then in 2001 expanded again. In 2005 new activation was registered (see Fig.1) and the process continues up to nowadays evidenced even by satellite images available in Google Earth (Fig.2).

Figure 2: Landslides region of Google Earth 2018

3. METHOD AND DATA

One important issue in mitigating the effect of the landslide phenomenon is the regular monitoring of the area of the landslide and its surroundings at short intervals. One reliable source of information in resolving this task lies in using the satellite differential Synthetic Aperture Radar interferometry (DInSAR) – a widely adopted technique which is able to create map of ground surface deformations delivering sub-centimeter accuracy. Serious advantage of the proposed approach is the possibility to obtain data at six days intervals regardless of the weather conditions owing to the SAR data freely provided by ESAs' Sentinel-1 mission. The created interferometric maps can be complemented by conventional geodetic field surveys as well thus benefiting

from the advantages offered by both methods in updating the existing landslide map.

3.1 DATA

In order to carry out the tasks foreseen in the framework of this research two sources of data have been used – GNSS measurements from three geodetic surveys in made in two consecutive years and SAR data from C-SAR instrument onboard Sentinel-1 constellation. To reach the main objective set it was essential to exploit at full scale the advantages offered by both sources in order to produce regularly updated information about the whole site. The GNSS data are precise, but because creation of dedicated geodetic network was a must and additional human effort for frequent measurements was required, information could be obtained for several points only. On the other hand the SAR data cover the large area, but they lack of high spatial resolution which is serious drawback when exploring small areas such as of this landslide.

a b

Figure 3: Picture of landslides region and GNNS network (a) and sampling network for SAR data (b).

3.1.1 GEODETIC SURVEYS

In case exploration of a landslide has to be done by GNSS measurements one must establish a network by fixing two types of points – ones on geologically stable terrain and others that are to be monitored inside the investigated area. The main advantage of such measurements is that no direct visibility between points is required, but for every point of the network it is essential to have the

GNSS receiver set for certain amount of time. For this specific study three cycles of GNSS measurements have been performed on a purposely built geodetic network. This network consists of 8 points representing all the typical features of the investigated terrain and their position is presented on Fig.3a. It needs to be emphasized that two landslides are located closely in the studied area and most probably both contribute to ongoing land deformation processes.

3.1.2 SAR DATA

The SAR data used in this research are acquired by SAR instrument onboard the Sentinel-1 mission which entered its operational phase in November 2014. Those data are freely provided by ESA and have been downloaded from its official repository (https://scihub.copernicus.eu/). In order to obtain reliable information about the ground displacements the authors set the following requirements:

1. The satellite orbit should be ascending – this is because the radar is right looking this way the foreshortening effect shall be minimized since most of the slopes are eastward facing;
2. Time of the SAR acquisitions – to be as close as possible to dates of field campaigns;
3. Minimum vegetation cover – due to lack of obvious persistent scatterers in the area we had to rely on constant properties of the ground objects to mitigate the temporal decorrelation;
4. Small perpendicular baseline (PB) – the images selected for processing to have as short PB as possible and high modelled coherence (MC).

For interferometric image creation selected were two SLC images satisfying the above criteria namely one from Nov 26th 2014 and the other from April 7th 2015. From them an interferometric pair (IfP) having PB=21.95m and MC=0.83 was formed. This IfP coincided with the period between in-situ GNSS measurement cycles 2 and 3. The final interferometric image representing the displacements was produced within SNAP software following the methodology implemented in (Veci, 2016). The DEM used during the processing was the SRTM with 1arcsec spatial resolution while for better overlaying the SAR pixels were multilooked thus obtaining square pixels. At next stage the phase of the processed complex SAR signal was unwrapped in order to convert it to metric units and finally the whole image was image geocoded as it has to be used as raster layer for visualization in Google Earth.

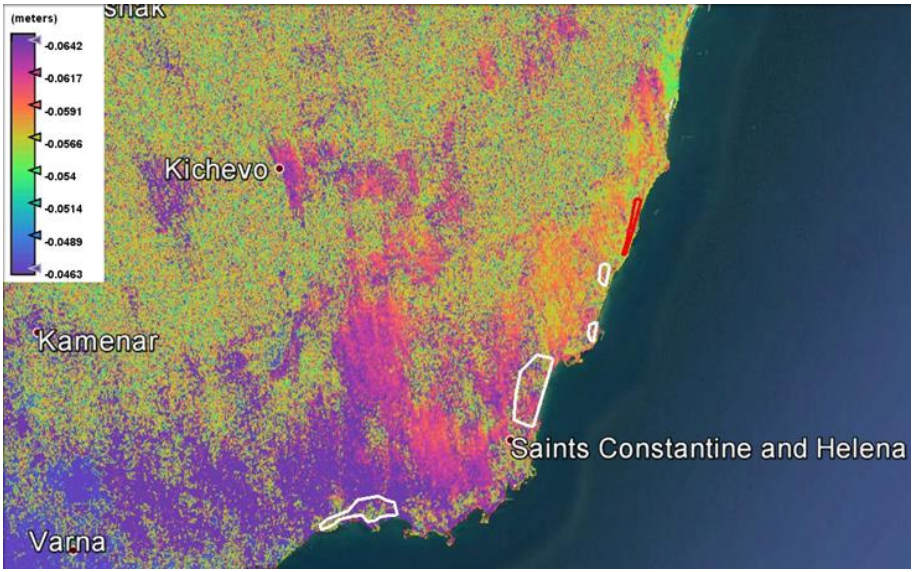

Figure 4: Excerpt from results from the DInSAR (from Nov 26th 2014 to April 7th 2015) over study area (white polygons are as reported to Pangeo Project).

In order to evidence the deformations after year 2015 one additional IfP was created covering the period 2015-2018, but unfortunately for this period some of the points of the geodetic network were already destroyed because of new activations of the landslide. For this reason here we report results based only on information from SAR data. This new IfP used for interferometric processing consisted of two SLC images covering the period from March 1st 2015 to February 25th 2018 from a descending track 36 of Sentinel-1A acquired in IW swath mode. Based on those images an IfP having PB=41.80m was created and processed the same manner as described in the previous paragraph.

4. RESULTS

The image on Figure 4 represents a part from the interferometric image which corresponds to the displacements for larger area including the site investigated (denoted by the red polygon). As it can be seen their magnitude is in the range from 4 to 6 centimeters subsidence.

In order to calculate the horizontal and vertical displacements for the points located inside the studied area of the landslide by direct geodetic measurements two stable points situated outside the zone of deformation were selected (see Fig. 3a points 101, 102) and all results reported are relative to

them. In Table 1 presented are the horizontal displacements in the two perpendicular directions X and Y (Nikolov,2016).

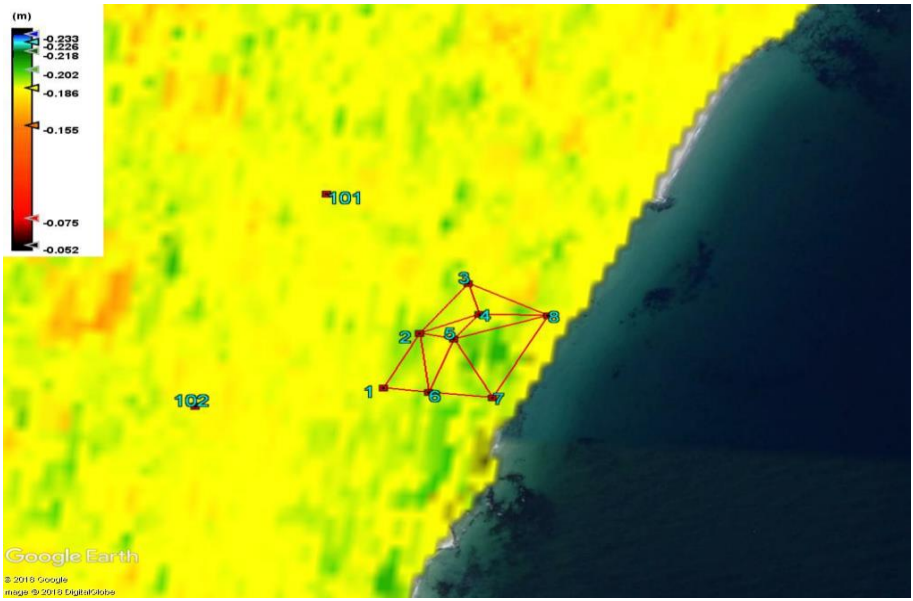

Figure 5: Excerpt from the interferometric image covering the study area (SAR images are dated March 1st 2015 and February 25th 2018).

On the other hand the vertical displacements reported in Table 1 are those displacements of the studied area in vertical plane for every point. This displacement can be subsidence or lifting relative to the height of the same point as measured during the previous cycle.

Table 1: Horizontal and vertical displacements as calculated from GNNS measurements.

	I-st - 10.08.2014			II-nd - 08.11.2014		II-nd - 08.11.2014			III-rd - 21.03.2015	
	∂X/m/	∂Y/m/	∂S/m/	α/g/	∂H/m/	∂X/m/	∂Y/m/	∂S/m/	α/g/	∂H/m/
1	-0.059	-0.028	0.065	228.2088	-0.003	0.053	0.069	0.087	58.3017	-0.017
2	-0.098	-0.053	0.111	231.5614	-0.016	0.098	0.094	0.136	48.6739	-0.01
3	-0.003	-0.06	0.06	296.8195	-0.014	0.001	0.092	0.092	99.308	-0.019
4	0	-0.093	0.093	300.00	-0.067	0.002	0.248	0.248	99.4866	-0.074
5	-0.046	-0.052	0.069	253.8928	-0.027	-0.009	0.225	0.225	102.5451	-0.156
6	-0.063	-0.032	0.071	229.9196	-0.07	0.033	0.279	0.281	92.5049	-0.172
7	-0.114	0.062	0.13	168.2889	0.015	0.068	0.266	0.275	84.0667	-0.045
8	-0.061	0.003	0.061	196.8716	-0.034	-0.011	0.259	0.259	102.7022	-0.037

101	0.002	-0.002	0.003	350	-0.007	0.002	-0.003	0.004	338.4359	-0.01
102	0.001	0.002	0.002	70.4833	0.002	0.003	0.005	0.006	65.5958	0.006

At the final stage of IfP processing obtained were the displacements for every pixel from the interferometric image located inside the polygon formed by the corner points of the GNSS network. The quality of these results was assessed by means of the coherence calculated for the same element. It was assumed that if its value is below 0.3 those data can't be considered reliable. This is why from the 235 points forming the point vector layer of the sampling grid (see Fig.3b) only 93 have been accepted as correctly reflecting the real ground movements. As final step from the interferometric raster images containing the computed displacements extracted in a new vector layer were only the mentioned 93 points and they were subsequently imported into GoogleEarth for visualization.

Table 2: Comparison between the vertical displacements calculated from GNSS and those obtained from SAR data.

	X	Y	∂H/m/	displ_VV 2014/2015	displ_VV 2015/2018
1	28.03604295	43.26730233	-0.0170	-0.0289	-0.17225
2	28.03639275	43.26803072	-0.0100	-0.0301	-0.18107
3	28.03690931	43.26871200	-0.0190	-0.0244	-0.17132
4	28.03711245	43.26833259	-0.0740	-0.0310	-0.16925
5	28.03683690	43.26799073	-0.1560	-0.0239	-0.16341
6	28.03662526	43.26728444	-0.1720	-0.0323	-0.17312
7	28.03746616	43.26726091	-0.0450	-0.0277	-0.16449
8	28.03802484	43.26838694	-0.0370	-0.0340	-0.16216

In Table 2 a comparison is made between values for the vertical movements as calculated from GNNS data and those derived from the interferometric images. The values presented in the last two columns in the same table are the calculated displacements based on the values of the unwrapped phase.

5. CONCLUSIONS

Based on the results reported above it can be concluded that both sources of data provide comparable results (being in the range of centimeters) confirming the overall behavior of the phenomenon studied. The differences between them could be contributed to large number of external factors affecting the SAR data used such as vegetation cover and temporal decorrelation. One more

thing needs to be taken into account when comparing the results from GNSS measurements and those from the SAR data is that the values of the latter correspond to displacements of a much larger area (15m by 15m) than those retrieved from GNNS where the size of the point can be a centimeter. Nevertheless the results obtained encourage the authors to continue their research in improving this method for investigation landslides with SAR data since for most of them no data from GNSS surveys are present and this is only possibility to register their expansion.

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APPLICATION OF GIS IN NTEGRATED RIVER BASIN MANAGEMENT, CASE STUDY OF THE BLINAJA RIVER BASIN, KOSOVO

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UDC: 004.6:528.47]:556.53(497.115)

ABSTRACT

Water is one of the most underlying resources in our life, for human life and for a sustainable development. Integrated managing of water resources asks for a wide base of date concerned with water. The neccesary information to evaluate the water resources is comprised of all variables that close the balance of water that is collected in the reservoir. The managing of a river basin (WFD 2000/60 EC) is admitted as a mechanism that responds to the requirements of the community as far as the river pond is concerned. In many cases the existing crises of water resources comprises in itself a crises which is concerned with managing process of water resources as well as lack of proper information which is related to exploitation of water. The management of water resources in real time as well as the implementation of GIS technology the most demanding challenges that the respective authorities which are obliged to cope with. This paper aims to reveal and demonstrate how GIS facilitates the process of planning and managing the water resources in the river basin of Blinaja. GIS serves as a tool which provides opportunities for carrying out the systemization, analysis and managing of collected data which are related to planning the water resources in the respective basin. The results of this paper witnessed how the implementation of GIS technology has succeed to provide rapid assessments, visualizing oppotunities aiming to assist the planning, exploitation and well-administering until the decision-making process in the river basin of Blinaja.

Key words: *Water, River basin, Management, GIS, Data, Information.*

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INTRODUCTION

Water is vital for human survival, health and dignity. It is also a fundamental resource for human development. Nowadays the quantity of potabel water on earth is limited and its availability per capita is reducing day by day due to increase in global population and ruining of environment (Gowda & Doddaswamy, 2011). The integrated management of water resources requires a broadly data base and information directly to water. The necessary information to evaluate water resources consist in all kinds of variables that are required to close up the water balance amidst different degrees. According to WFD, the river basin is considered as the main unit for integrated water management. The first step of Integrated Water Resources Management is to scan the overall area under consideration, to identify sub-areas with water quality problems, and rank these sub-areas according to the level of problem intensity in order to decide where to start with water management measures. To carry out this initial step in the case study Blinajë river basin, there was elaborated a methodological concept which was based on the application of GIS technology. GIS is a very powerful tool for the development of the watershed area with all natural and socio-economic facets for better planning, execution and monitoring of the project. Advanced technologies and approaches, such as geographical information systems (GIS), offer a unique opportunity to tackle spatial problems traditionally associated with more efficient and effective data collection, analysis, and taking into consideration all the possible alternatives

STUDY AREA

The study area is located in the central part of Republic of Kosovo (fig.1.), between the geographical coordinates 20º 57′30″, 21º 04′00″ and 42º 28′20″, 42º 33′50″. The chachment area is 31.19 km^2 (Çadraku H., et.al. 2016), they are devided into two morphological units. The climate of the river basin Blinaja is continental (Pllana R., 2015), the average annual rainfall are 660 mm (2001-2011), the largest amount of rainfall 66.7 mm in November, while the lowest in February 31.1 mm (KHI quoted by Bublaku S. 2015). Air temperature referring to the meteorological station of Prishtina, in 2013 the average annual temperatures ranged from 0ºC (December) up to 23.4ºC (August).

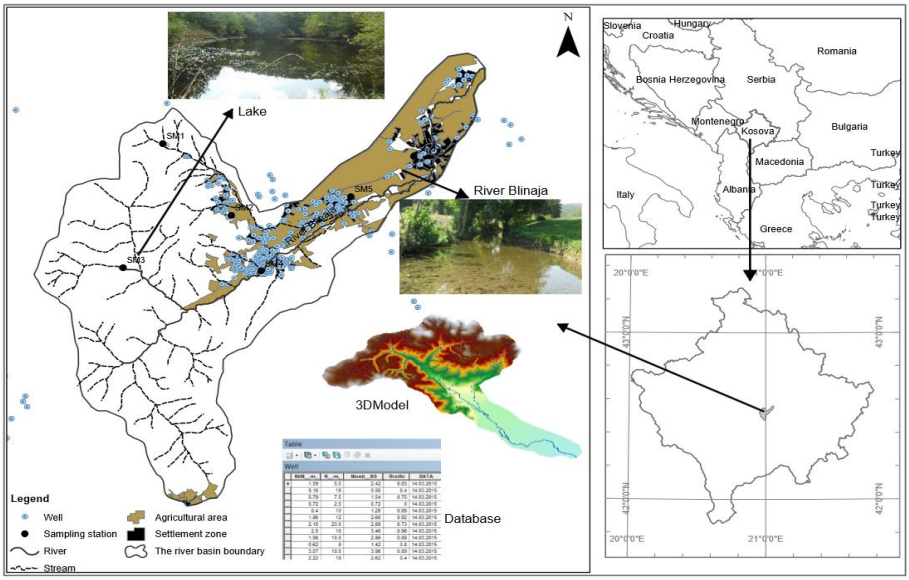

Fig. 1. The position of the river basin Blinaja

METHODOLOGY

There has been applied and implemented a working methodology, which represents in itself a systematic labor which is mainly relies on research and that are carried out in pratice. The scope of research which has been implemented in this paper is closely related to the subject called gathering of scientific data. (Jakupi A., 2005). GIS database was created using different cartographic documents at the scales 1:25 000, 1:50 000, 1:200 000. most of the thematic layers have been taken from this classical mapping support. The physical structure of the system is shown in fig.2. The maps were scanned and converted in digital formats, whereas the images which were imbibed from the air were geo-referencing. Due to fact there have been created and designed digital maps concerned with hydrographic network, water resources, wells, sub-basin, inhabited areas, road network, agricultural land and land coverage.

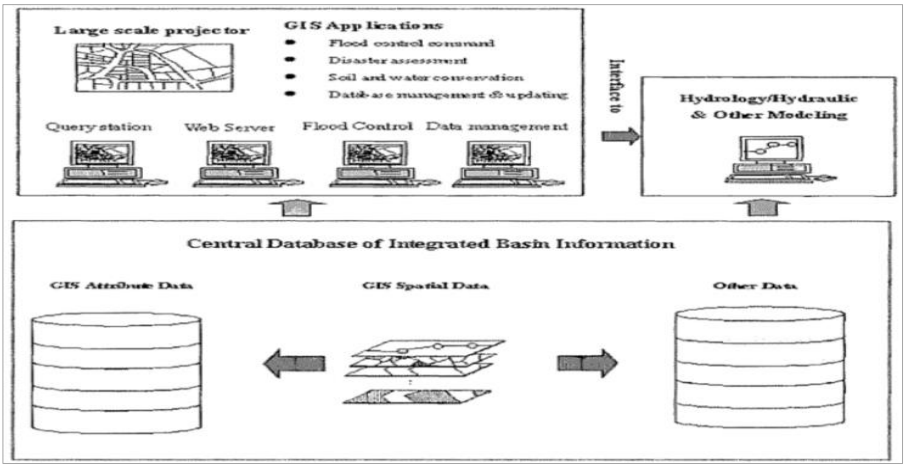

Fig.2. Sistem structure (according to: Wu Chaojun., et.al., 2004)

RESULTS AND DISCUSSION

The determined of underlying objectives concerning the river basin management in other words emphasizes the importance between the coexistence between human and water. The implementation of GIS resulted in a multifaceted conclusion that determined the repective coverage of each area. Consequently, the catchment are is covered by: 64.86% forests, 17.37% agriculture land, 9.21, mountain pastures 5.02% inhabited area, 2.32% meadows, 0.86% road infrastructure and 0.14 water area. To conclude GIS facilitates the process which is related with the delination of water bodies and the codification system. In this case study there was also managed to create a broad data base for parameters which are neccesary for integrated managing of water resources. There was also enabled to create a 3D model for the Blinaja river basin. These data which have been imbibed by GIS in this case study may be up-to-dated and are of significant importance for planning, administering and decision-making.

CONCLUSIONS

Many real-world spatially related problems, including river-basin planning and management, give rise to geographical information system based on decision making bodies. Owing to fact that the incorporation of spatial policy alternatives is traditional and it is often represented by thematic maps, digital maps and their underlying data base are well suited for water resources

planning. Therefore it is possible to geo-reference them indirectly. In this way we reach the unification of the format of the information as well as georeferencing the visualization of data. The date which have been depicted from GIS in our case study, might have a crucial importance and strong impact on service delivery and local policy implementation.

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CONTACT LOCATIONS OF THE PUBLIC-PRIVATE RELATIONSHIP IN THE GEODETIC AND CADASTRE FILDS

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UDC: 347.235:349.418]:[334.7:528.44(497.7)

ABSTRACT

Geodetic activity in the Republic of Macedonia is covered in several normative acts, depending on the field of interest. The most important is the Law on Real Estate Cadastre, which, for the most part, regulates the geodetic activity in our country, that is, with the changes in the old law from the year 2005 and with two new laws from the years 2008 and 2013. These laws regulate, inter alia, the work of the private geodetic companies, acquiring the necessary licenses and authorizations, organizing and executing the works, functioning of the geodetic-cadastre activity as a whole, as well as association in the chamber. Such rapid changes and the implementation of the three laws, with many changes and additions, for a relatively short period of time, create legal uncertainty and inability to follow the rules of the "game". An aggravating circumstance is the tendency with every new law and with every change of law to reduce the credentials and the scope of work, for something that has previously been granted as a competence of the private geodetic activity. In order to overcome these conditions, a greater interaction between the Agency for Real Estate Cadastre and the Chamber of Private Geodetic Companies is needed in the future in order to establish long-term and sustainable mutual professional relations. All this is possible if a stable public-private partnership, expansion of competencies and authorizations is established with a clear, unambiguous and permanent division of competences and with establishment of an effective concept of professional association in a chamber.

Key words: Law on Real Estate Cadastre, Private Geodetic Activity, Private Geodetic Companies, Public - Private, Real Estate Cadastre Agency (AREC), Chamber

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INTRODUCTION

Today the private geodetic business activity is a serious stakeholder in the overall economic life in the Republic of Macedonia, besides the challenges which has been following it from the beginning to the present days. The evident growth and positive trend can be illustrated (Zhivkovska at al., 2013, p. 184) with a graph per years in relation to the number of authorized geodetic engineers and registered geodetic companies(Figure 1).

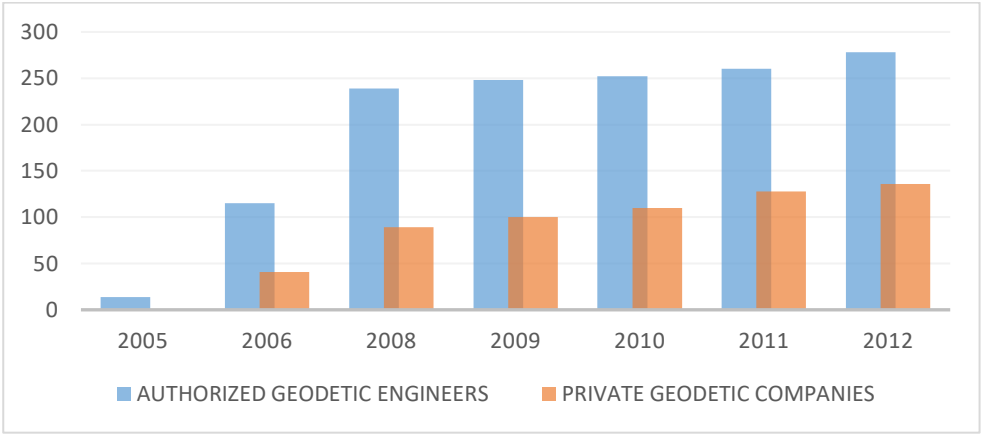

Figure 1: *Relation of authorized geodetic engineers and private geodetic companies per years (based on Zhivkovska at al., 2013)*

At the end of the year 2005 there were 14 registered private geodetic companies and today, according to the directory of registered companies managed by the Chamber of sole proprietors and trade companies for geodetic activities, their number is 144.

All the above mentioned, represents an indication of the fact that this social activity has justified and even exceeded the expectations. There are 126 authorized geodetic engineers in total on the list of authorized geodetic engineers, available on the AREC web site. The biggest part of them have been employed in the private sector, part of them work in the AREC, state enterprises and the building & construction sector, while a small portion of them are still unemployed. The accurate number out of the total number of employed in the private geodetic companies is not known, however, if we take an average of three employees in every company, we get the number of about 350 employed persons, who have found their existence and the existence of their families withim the frames of this business activity.

LEGAL FRAME FOR THE PRIVATE GEODETIC PRACTICE

The existence of the private geodetic business remains on in the Law on Amending and Supplementing the Law on Survey, Cadastre and Registration of real estate rights, Official Gazette of the Republic of Macedonia No. 84/05 (October, 2005).With these amendments, creation of a private geodetic practice was provided and in this a way, the field activities became exceptionally an authorization of the registered legal subjects, with transferred public authorizations, for execution of the field geodetic activities, in which there is authorized geodetic engineer employed. These amendments enabled the prescription of conditions under which the geodetic engineers can acquire an authorization for an authorized geodetic engineer, as a physical person authorization. The legal entities, i.e. sole proprietors-authorized geodetic engineers or a trade company for geodetic activities were obliged to be registered in the directory of sole proprietors –geodetic engineers or trade companies for geodetic activities in the Chamber of authorized architects and engineers. The supervision over the activities of the registered legal entities was supposed to be executed by the AREC predecessor, the State Authority for geodetic activities. There was a prohibition for the employees in the State Authority, in whatever form, in the same time, to be included in the functioning of the private geodetic companies.

A time period of 2 (two) years was set as a transition period from the date of entering into force of these amendments in the Law, in which period the State Authority for geodetic activities could execute the operative field activities until certain preconditions for complete taking over of these activities by the private sector were fulfilled.

In accordance with the above established legal principles, one can easily conclude that with this division of competences, in a public-private relationship, legal and technical preconditions for the initial development of the private initiative were created, which was a good novelty after the social changes in the 90s of the last century.

Recognizing the newly created conditions, a large number of geodetic engineers acquired the authorizations, in accordance with the then positive legal provisions, and started registering the legal entities that established the private geodetic practice in the Republic of Macedonia.

Laws for Real Estate Cadastre from the year 2008

The next conceptual step forward occurred in the year 2008 with the adoption of the Law on Real Estate Cadastre (Official Gazette of the Republic of Macedonia No. 40/08). First of all, we will note that this Law establishes the Agency for Real Estate Cadastre of the Republic of Macedonia (AREC), with

which the State Authority for Geodetic Works of the Republic of Macedonia ceased to exist. Within the framework of the law, the legislator created conditions for conducting real estate survey by AREC, prescribed by Article 8, paragraph 1, line 3.

With this provision, the process of undertaking a part of the works and competences that were previously assigned to the private geodetic companies is opened. This means that the activity that started under certain conditions has now changed , but in an opposite direction. The registered legal entities with private capital, which decided to deal with a private geodetic activity, with previously established criteria for division of works, now faced with changes that limited their field of activity. In the same Article, in line 6 of paragraph 1, the Agency for Real Estate Cadastre was assigned to perform the geodetic works for special purposes of importance for the Republic of Macedonia, determined by the Government of the Republic of Macedonia.

As novelties, which are related to this law and apply to private companies, it is that they are now registered in the trade register, with the main activity described as geodetic works, and they should have a license for work issued by AREC. The authorized geodetic engineer is defined as a person allowed to perform surveying, field geodetic works that refer to basic geodetic works and topographic maps, as well as geodetic works for special purposes.

Following the entering into force of the Law in the year 2008, in the period from the year 2010 to the year 2012, four amendments to the law were followed. These changes were, for the most part, related to the working conditions of sole proprietors and trade companies for geodetic works, for the obligations of the authorized geodetic engineers and the penal provisions.

Laws for Real Estate Cadastre from the year 2013

In the year 2013, a new Law on Real Estate Cadastre was adopted (Official Gazette of the Republic of Macedonia No.55 / 13), after the existing law was amended several times. In this Law in Article 8, paragraph 1, line 3, the right was reserved for the Agency to conduct real estate surveying, while in line 5, AREC retained the right to perform the geodetic works for special purposes of importance for the Republic of Macedonia, determined by the Government of the Republic of Macedonia. With the amendments to the Law on Real Estate Cadastre (Official Gazette No. 115/14), the Agency shall extend the powers so that paragraph 2 of Article 8 is completely changed. This paragraph is completely redefined, where AREC is authorized to Register the rights to real estate owned by the Republic of Macedonia, update the real estate data ex officio, office geodetic works for special purposes, survey in the function of preparation of topographic maps, geodetic reports for special purposes for persons receiving social and permanent financial assistance, as well as other

tasks prescribed by other laws. In the year 2015, it was intervened in Article 8, paragraph 2 of the Law on Real Estate Cadastre once again (Official Gazette of the Republic of Macedonia No. 116/15). The same one is changed again and the Agency's competences are renewed again. With the amendments, the legislator awarded AREC with the development of updated geodetic platforms in the function of spatial planning, registration of the rights for the facilities that were built with the construction technical documentation issued before the entering into force of the Real Estate Cadastre for the specified municipality and office geodetic works for special purposes .

In the same time, with this Law, the Agency for Real Estate Cadastre acquired the exclusive right in the preparation of geodetic reports for special purposes - numerical data for the realization of urban plans and urban planning documentation, given in the amendments to Article 88 of the Law on Real Estate Cadastre (Official Gazette of the Republic of Macedonia No.55 / 13).

As a novelty, related to the work of sole proprietors and trade companies for geodetic works, the obligation is to have a license for work issued to a legal entity, described in Article 104, paragraph 1, line 4 of the Law on Real Estate Cadastre (Official Gazette of the Republic of Macedonia No. 55 / 13). Also, with this law, the licensing of legal entities is conditioned by the basic demographic standards of the statistical regions. According to the nomenclature of the territorial units for statistics (NTES), the standard for one license is 10,000 inhabitants.

Regarding the competencies of AREC-Chamber, the new Law on Real Estate Cadastre from the year 2013 conceptually changed the roles. With the Law, instead of the Chamber, the acquisition and the withdrawal of authorization for a licensed geodetic engineer are transferred to the Agency for Real Estate Cadastre, while the issuance and revocation of the license for the work of the legal entities is taken over by the Management Board of the Chamber.

ASSOCIATION IN A CHAMBER

From the very beginning of the private geodetic practice in the Republic of Macedonia, attempts were made to establish a certain form of professional association, which would connect the participants in this business. A qualitative step was made with the establishment of the Association of Certified Geodetic Engineers of the Republic of Macedonia, on 01/02/2007 in Skopje (Monograph, 2017, Real Estate Cadastre Agency, Skopje). This association was, in a way, a precursor for creating a higher level of organization - association in a chamber. The Law on Real Estate Cadastre (Official Gazette of the Republic of Macedonia No. 40/08), enabled the establishment of a Chamber of authorized geodetic engineers, which enabled

the authorized geodetic engineers to obtain an appropriate status within the scope of the activity and the profession, and, of course, in the society as a whole. Following the newly created legal preconditions, after the organized Initiative Assembly on 10th and 11th of May 2008, conditions for founding Assembly were created and the Chamber of authorized geodetic engineers was established on 20/06/2008.

Analyzing the legal solutions in the part of the chamber association, it is impossible not to be noted, that the legislator, in this case, did not fail to impose control over the work of the Chamber. This conclusion is reflected in the fact that in the Management Board of the Chamber, which has a total of seven members, together with the President, there are two members proposed by the director of AREC from among the employees in the agency. Among other competencies, the chamber had the authority to conduct the exams for authorized geodetic engineers and to keep a register of authorized geodetic engineers, as well as to organize the compulsory educational training intended for the authorized geodetic engineers. The new Law on Real Estate Cadastre from the year 2013 conceptually changed the placement of the Chamber. First, it granted a new non-functional title: Chamber of sole proprietors-authorized geodetic engineers and trade companies for geodetic works. Apart from the change in the name, the membership structure changed, with the members of the Chamber becoming business owners. By doing so, the authorized geodetic engineers remained outside the system, without any institutional protection. Conceptually, a change of competences was made, whereby the operating licenses of the companies have now been transferred to the Chamber, while the taking and running of the register of authorized geodetic engineers, as well as the implementation of the obligatory educational training intended for the authorized geodetic engineers, has passed into the hands of the agency. Following the tendency for maximum control and influence on private business, the legislator in the new code increased the number of members in the Management Board delegated by the director of AREC. This means that now there are three members of AREC, out of seven, including the president of the Chamber, in the Management Board.

Such a procedure is completely vague and illogical if one takes into account that the Chamber is an association of holders of capital. The change imposes the dilemma: How members of the Management Board of AREC would take care of the development and promotion of the private initiative?

This is especially true when considering the fact that the activities, goals and tasks of the Chamber include, inter alia, the promotion of a free business initiative and competitiveness. This arrangement is not a practice in other professional associations of the same or related character.

ANALYSIS OF THE CONDITION IN THE CORRELATION PUBLIC - PRIVATE

Analyzing the chronological review of the legislation in the period from the year 2005 to the present, it can be easily concluded that it has undergone many changes, additions, and completely new solutions. Certainly, the occurrence of certain changes is an inevitable process in the development of a certain activity. However, it should be kept in mind that, in this short period, from the beginning of the private practice to the present day, we are working according to three laws that regulate the field of the cadastre. All of these laws together had a total of 14 amendments, decrees and decisions by the Constitutional Court. This undoubtedly points to the conclusion that permanent monitoring and adaptation to the changes is an aggravating circumstance for the proper functioning of the business. Such a rapid change in the rules of "play" creates uncertainty, and sends a negative signal to all who are currently dealing with private geodetic practice, as well as those who intend to start entrepreneurship in this sphere.

Initially, the concept of establishing a public-private partnership was conceived with a clear distinction between competencies between the private geodetic sector, on the one hand, and SAGW (today AREC) on the other. However, over time, this concept began to evolve retrograde , with the withdrawal of previously granted authorizations and the competence of the private sector, and their return to the "homeowner", i.e. AREC. This is another location in which the notions of business conceptions are collided, publicly vs. privately, which violates the concept of healthy competition.

A third segment, which can generally be characterized as a low-pass location, is a competition that is imposed in the public-private relationship. I consider that private practice, as a service activity for citizens, in terms of resolving issues related to the cadastre, should be a complement to the service offered by AREC. This system of services should be based on the principle of synergy, and not on the principle of competition. This means that it is of great interest for AREC to have a well-developed, stable, reliable and advanced private service, which can, at any moment, respond quickly, professionally, with quality and under market conditions to the citizens' requests. This implies that some mutual misunderstandings that occur during the operation between the private sector and AREC need to be overcome together. On the other hand, this means continuous need to improve the services delivered to the end users, which are: the citizens, the legal entities, the private sector, the local self-government and the public institutions.

AREC CONTRIBUTION IN THE DEVELOPMENT OF THE PRIVATE GEODETIC PRACTICE

From the present perspective, the contribution and the role of the Agency for Real Estate Cadastre of the Republic of Macedonia is undisputable in the development and affirmation of the private geodetic business. Namely, AREC in the past period, with a series of reforms and implementation of new and modern technical, software and IT solutions, contributed to stable and high quality business relations that need to be upgraded and promoted. There are significant benefits from the establishment of the real estate cadastre and infrastructure objects, the adaptation of the analogue plans to the guiding format and the alignment of the alphanumeric bases of the cadastre system, the introduction of the MAKPOS system, which enables precise geospatial location in real time, the improvement of the counter operation through the system E-cat counter and electronic connection of private geodetic engineers, notaries, enforcement agents, municipalities, etc., the OSSP portal, as well as the introduction of several types of registers and other innovations that facilitate daily activities. Since the new time brings new challenges, it is expected that AREC will continue to improve its services in the future, monitoring the modern trends in this area and, of course, building a mutual and fair relationship with the private geodetic practice.

CONCLUSION

Such a conceived concept for private geodetic activity can respond to certain activities and contemporary social challenges, but in general, in certain way, it limits the development component. The idea that is in the announcement, which refers to essential changes and the adoption of a new set of laws that will affect the geodetic activity, construction and construction land, may, in large part, improve the situation in this area. I think that it is necessary first to create assumptions for permanent establishment of mutual partnership relationship between AREC and the private geodetic sector, which will create conditions for two-way interaction, in order to improve the services, which will bring benefits for the end users. This implies, once and for all, separation and division, of competencies between AREC and the private sector. This should be mostly reflected in the domain of adoption of the legal and by-law regulations, whereby the practical experience of the authorized geodetic engineers should be used to establish professional and legal assumptions that are sustainable in the long run. When adopting laws and by-laws, it is natural for the legislator to insist on maintaining certain degree of indirect and direct

control over the operation and functioning of the geodetic companies. This should only refer to the part of the activity related to geodetic-cadastre activities, which have expressive public character. For this reason, the profession should be raised to a higher level and in the performance of certain tasks, the authorized geodetic engineers should be given a "higher degree" of public authorizations.

On the contrary, certain areas of private sector operation, which are mostly related to construction, urbanism and engineering as a whole, should be liberalized and the principles of a market economy and healthy competition, without side effects in operation, should be applied.

In this context, it is necessary to mention the Chamber, to find a more efficient and effective way of association in order to unite the parties and protect the interests of all participants in this sphere.

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TECHNOLOGY OF TREATMENT AND DISPOSAL OF ANIMAL BY-PRODUCT WASTE AND ENVIRONMENTAL PROTECTION

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ABSTRACT

The purpose of this paper is to identify and analyse the environmental impact and the necessary measures to protect the environment and public health regarding the location where animal waste and animal by-product waste will be treated.
The plant for animal by-product waste treatment is very important for Kosovo, based on data regarding this waste and its treatment.
In this paper, analysis have also been made regarding the current state of the environment and technical characteristics of the works which will be undertaken to build and operate this treatment plant.
For all the activities that will happen in this plant, there is a need to do an environmental impact assessment, which will define all relevant impacts that may occur in the plant – environment relationship, not overlooking the impact in the surrounding area.

Key words: Animal waste, Environment, Treatment plant

1. INTRODUCTION

This study is a very important step in supporting the Agency of Food and Veterinary (AFV), in developing the laws and regulations to create a system supported by the EU for the collection and disposal of animal by-products,

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including building a new treatment and disposal plant. (Kosovo, Government of, 2015)
Considering this goal and the methodology of creating an environmental impact assessment rapport, this paper will help in defining the measures to be undertaken in order to protect the environment from negative impacts.
The study has been done in a location opposite the industrial park in Sankoc, KK.Gllogoc.
Environmental impact assessment and measures to decrease negative impacts on the environment will be our purpose during both the construction of the main building and also the other facilities. The treatment and disposal of waste will be according to the laws of the Republic of Kosovo. (Government of Kosovo, 2012)

2. LOCATION CHARACTERISTICS AND THE ENVIRONMENT

To define the main location characteristics and the ecological potential, one must consider several natural factors such as: soil, water, air, landscape, flora and fauna.
Each one of the ecological potentials has certain functions which essentially relate all too environmental protection (Government of Kosovo, 2009).
The location where the plant will be built is close to the main Prishtinë – Pejë road and is connected into the entire Kosovo road network as seen of Figure 1 and 2. (Government of Kosovo, European Union Office in Kosovo)

Figure 1 & 2 – Location of the plant in the orthographic map

Regarding the climate conditions, the air temperature regime is expressed either daily monthly or yearly with certain values as seen in Figure 3. Through the climate studies, all average yearly values, minimal and maximal monthly temperatures, and the daily frequency with temperatures higher than 25, 30 and 35^0 C, and the possible frost with over 5 cm of soil have all been defined.

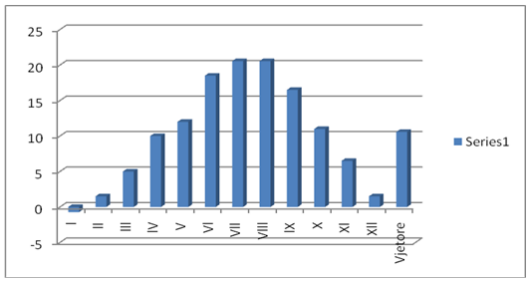

Figure 1 – Temperature variation graph

Average wind speed has been shown in the variation graph for each season as measured by the Fushë Kosovo meteorological station for the time period of 1954-2003 and can be seen in Figure 4.

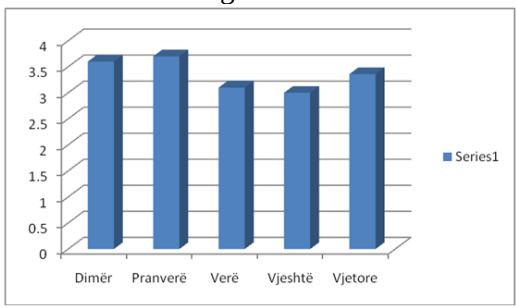

Figure 2 – Yearly average wind speed

Regarding the geological, hydrogeological and geo-mechanical aspects, the location is from diluvia deposits very heterogeneous and with layers both horizontally and vertically. These deposits in this micro-location are products of erosion (sand, gravel) and are thought to be a very appropriate location for such activities.

3. PROJECT AND TECHNOLOGICAL PROCESS DESCRIPTION

The urban plan where the plant is to be built consists mostly of:

- Administration building
- Industrial halls for the treatment and disposal of animal product waste
- Wastewater treatment plant

As can be seen in Figure 6.
The purpose of this project is to convert the animal by-product waste that is not destined for human consumption into energy production or animal feed.

Figure 6 – View of the treatment plant

The plant will be divided into sectors, and each sector will be responsible for a part of the technological process. The internal division of the plant into sectors and the placement of equipment can be seen in Figure 7.

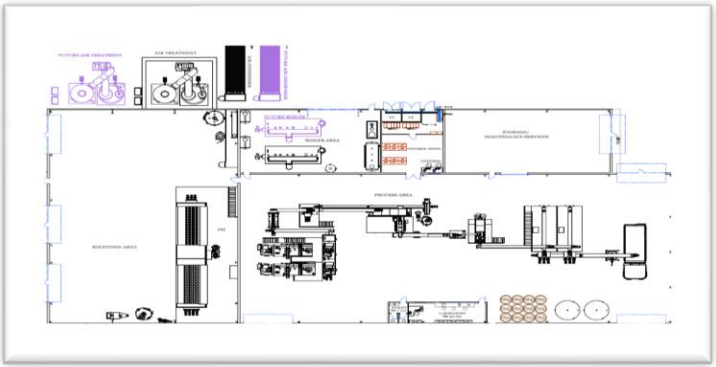

Figure 7 – Schematics of the equipment placement

In order to draft a rapport with a safe nominal capacity and assuming a 240 day/year timetable, the plant will need to treat around 84 t/day of material. For the plant's optimal performance, main components are:

- *The influent sector*

The part that gets all the waste will have 2 x **100 m^3** barrels, specifically designed for animal waste.

- *The blood collecting sector*

This space will have a reservoir to collect and store the blood with a capacity of **10 m^3**, and it from the blood that comes from butchers' which needs to be filtered so that all bones and other objects that are transported with the blood can be removed.

- *Oven sector*

The oven sector will have two ovens with a capacity of **6.500 kg,** specifically designed for meat treatment and all other solid waste such as feathers and also blood.

- *The pressure sector*

This sector will have steel plates for 2 presses with a capacity of 2500 – 3000 kg/h for the waste it gets from the boiling reservoir.

- *Grease and fat sector*

This sector will have a filter for all grease removal and a centrifugal pump, and also a reservoir for fat and grease storage with a capacity of **2.5 m^3**

- *Food sector*

Food sector will have feeding troughs and hammers with a capacity of storage **1 m^3** and hammering capacity of **2-4 t/h**

- *The air and vapour treatment sector*

This sector will have bio filters, and the pollutant values should be as low as possible. The cooling troughs for condensation with a capacity of **7,200 kg/h** and room temperature of **15 ° C.**

- *Boiler room*

To heat the plant with hot water and steam, a boiler room system will be installed which will work with electricity. However, the water will also be heated with the energy exchange from the condensed vapours. The boiler room will also have a hot water reservoir so that there will be water at all times, which is needed for industrial purposes and washing the trucks. The necessary hot water quantity is **10 m^3/day** with a temperature of **35ºC.**
In the figure below, you can see the flow of the process itself.

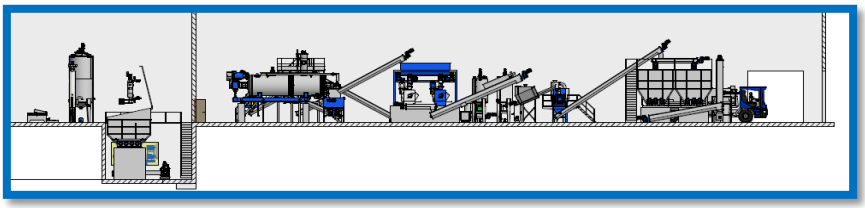

Figure 8 – Process illustration

4. ANIMAL BY-PRODUCTS

With "animal by-products" we mean the entire body or animal body parts that are not destined for human consumption. Animal by-products are categorized into 3 groups according to their hazard level:

4.1. Highly hazardous materials:

CSE risk, (waste from treatments will illegal chemicals and environmental polluters)

Material from the first category, as seen in figure 10, are highly hazardous regarding contagious spongiform encephalopathy (CSE), materials with specific risks (MSR) – these parts of animals are most likely to carry diseases such as cattle spine or likely to carry illegal chemicals. This type of waste should be completely incinerated or deposited in a landfill only after heat treatment.

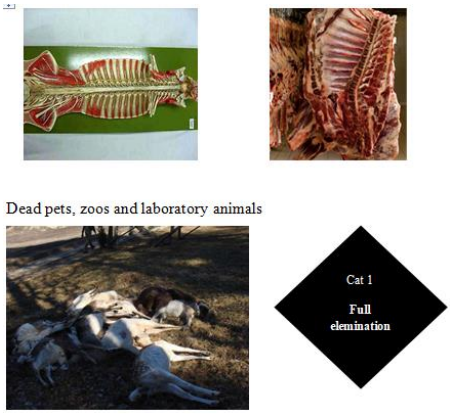

Figure 9 – Category 1 waste

4.2. Microbiological risks, veterinary medicinal waste

This is the second category, as seen in Figure 11, slightly less hazardous (mostly animals who died in the farm after some disease caught them), and the biggest problems are medicine, digestive track contents, fertilizer, and wastewater from butcheries. They can be recycled for other uses except food, such as biogas, compost, grease products.

Figure 10 – Category 2 waste

4.3. By-products from healthy animals, kitchen waste

Third category materials (products from healthy animals for human consumption, fresh fish, and milk from healthy animals), as seen in figure 12, can be used as animal food.

Figure 11 – Category 3 waste

4.4. Gathering and transporting waste

Animal and by-product waste should be gathered and transported in new packaging, in covered containers, as seen below, or transportation that does not leak. The **operators** gather, identify and transport the animal by-products **as soon as possible** in conditions that **prevent human and animal health risks.**


Figure 12 – Animal waste containers

4.5. Environmental impact assessment

Assessing the potential environmental impacts which result from technological processes in the plant, can be done with a fully encompassing analysis and is not the same in all project stages, so all the impacts are divided into 3 categories:

- Plant construction phase
- Technological process phase
- Post-plant activity phase

➢ ***Impact on air***

During the activities in the plant, air pollution happens from:

- Dust from construction
- Gas from transport vehicles
- During the process of waste incineration
- From the equipment at work

➢ ***Impact on soil***

During the activities in the plant, soil pollution happens from:

- Depositing base material for the technological process
- Solid waste generated from maintenance
- Organic and inorganic waste from employees
- Liquid waste from grease and fat

➢ ***Impact on water***

During the activities in the plant, water pollution happens from:

- Leaking of liquids
- Washing the equipment
- Washing the operational spaces and areas
- Grease and oil leakage from equipment maintenance
- Wastewater leakage from the kitchen with oil and detergents, toilet water, road washing water etc.

- ***Impact on the flora and fauna***

According to the analysis conducted so far, if there is pollution on water, air and soil, it may impact the flora and fauna. However due to the location chosen, there is not much vegetation lost except the one where construction will happen.

- ***Impact on the population***

Building this plant on a location that is economically under - developed, will very much help the population because a large number of them will be employed.

- ***Impact from noise***

During the activities in the plant, noise pollution happens from:

- Activities during the technological process
- From the transportation vehicles during loading and unloading
- From the equipment

Usage of the equipment will guarantee level of noise at the source under 90 dB. For populated areas, the noise will not go past the standard value of 50 dB, as shown in detail below in the table.

Table 1 – Equipment noise level and the distance it is felt in

Noise	Distance (m)			
	10	50	100	500
90db – modern equipment noise level	59	45	39	25

4.6. Measures to prevent or minimize negative impact on the environment

To prevent or minimize negative environmental impacts as in water (Government of Kosovo, 2013), soil, air and human health, measures must be taken both during the process at the plant and after.

5. CONCLUSION

After this Environmental Impact Assessment rapport regarding the animal by-product waste treatment plant, we can conclude that the plant does not pose a significant risk to human health, or the soil, water, air and landscape.

After identifying and implementing all recommended safety and protection measures, we firmly believe that all negative impacts can be sufficiently minimized or completely eliminated during the rehabilitation phase.
The construction of this plant will be according to all lawful standards. The impact on air, soil and water can be controlled. These impacts need to be monitored and a rapport made at the end of each year or as requested.
This plant will have a very positive socio – economic impact from employing the people of that location.
We believe that this data is enough and can aid the competent people or organizations in giving a positive go-ahead for the construction of this plant for the disposal and treatment of animal by-product waste in the location opposite the Industrial Park in Sankoc, Municipality of Drenas (Gllogoc).

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