

Chronological Overview of Management of Raw Minerals in Varaždin County

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Abstract: Mining is the branch of the economy which is most represented in the Varaždin County. The usable value of mineral raw materials is constantly changing, depending on the needs, and it is the job of the profession to continually assess its value. Mineral raw materials are usually defined as natural aggregates of minerals and/or natural compounds that can be used for different economic needs and are primarily considered from the point of view of the possibility of being put into function or through possible exploitation. The aim of this paper is to present the actual situation in the area related to the exploration and exploitation of mineral resources in the period from the preparation of the first Study of the potential and basis of mineral resources management in the Varaždin County to the present day through the analysis of the current spatial plans of cities and municipalities.

Key words: area of research; exploitation fields; mineral raw materials; Varaždin county

1 INTRODUCTION

Mining is one of the oldest branches of the economy engaged in the exploration and exploitation of mineral resources. Ores are a national treasure representing a natural resource of interest to the Republic of Croatia under its special protection and can be used exclusively under the conditions and in the manner prescribed by the Mining Act [1] and by-laws. Mineral raw materials (ores) in the Varaždin County are obtained (mined, extracted and exploited) by surface, underground, underwater ways, and are refined (processed) by various methods at mining facilities [2].

Mineral resources (ores) of the Republic of Croatia, including the Varaždin County, enable the exploitation and processing of mineral resources in the oil, chemical, glass, ceramic, cement, refractory, brick and architectural and building stone industries, and in particular in the construction industry [3]. The possibilities, that is, restrictions on the exploitation of mineral resources depend on geological, genetic, technical-exploitation, regional, market and socio-economic factors. Any agglomeration of rocks is considered as a reservoir of mineral raw material only if it is determined that there is the technology to extract minerals or energy from it, to have it in sufficient quantities for economical exploitation, and that the reservoir conditions are economical, i.e. enable the exploitation of mineral resources [4].

However, intensive industrial development, with the increasing needs for exploitation of mineral resources, especially energy, has recently caused a number of environmental problems (climate change, ozone depletion, droughts, forest destruction, threats to the conservation of biological species and others). Addressing these issues imposes a whole new approach in all industries, including mining, which involves the direct inclusion of environmental protection and conservation in development plans [5].

Therefore, the future use of the area related to the exploration and exploitation of mineral resources will be determined by the State Spatial Development Plan of the Republic of Croatia (currently being prepared), and in the process of its preparation it is proposed to rationally identify the areas in which day-to-day development of

these activities is possible, respecting environmental laws and regulations.

2 PLANNING DOCUMENTS FOR MINERAL RESOURCES MANAGEMENT IN THE VARAŽDIN COUNTY

The Mineral Resources Management Strategy of the Republic of Croatia is the basic document that defines the management of mineral resources and plans the mining activities at the state level [6].

According to the Mining Act, the counties are obliged to prepare mining-geological studies for their areas that cover the existing and potential mineral deposits and which must be in accordance with the Strategy, and submit them to the ministries responsible for mining, spatial planning and nature and environment protection.

A new Mining and Geological Study of the Varaždin County (June 2016) is the starting point for activities in the planning and approval of exploration and exploitation of mineral resources in the County, rehabilitation of abandoned and closed mines [7]. In accordance with the applicable regulations in the field of spatial planning, planning of exploration areas and mineral exploitation fields will be the topic of spatial development, which will be covered by the future Spatial Development Plan of the Republic of Croatia.

Until the adoption of the National Spatial Development Plan of the Republic of Croatia, the Mining and Geological Survey of the Varaždin County shall be used in the procedures of drawing up the spatial plans and their amendments and supplements at the County level. In all these procedures, the Study's recommendations and guidelines are respected in such a way that the requirements for the exploration and exploitation of mineral resources are aligned with the requirements of environmental protection [8], nature and cultural and historical heritage, with the highest priority being the protection of drinking water beds [9].

Determining the locations for future exploration and exploitation of mineral resources cannot be ensured everywhere in the area, as there are prohibitions, restrictions and special conditions that affect the selection of potential sites and their size. Priorities in selection are given in the areas of higher geological potentiality, although the data indicating geological potentiality in

convenience zones determined by distances from construction sites, infrastructure and other spatial features should be taken into account. Therefore, the provisions for the implementation of spatial plans define the conditions of space limitations according to their use and purpose. Pursuant to the Physical Planning Act [10], spatial plans have the force and legal nature of the by-law.

Spatial plans treat the exploitation of mineral resources as a transitional period (irrespective of the long-term exploitation) and in these documents, as a rule, the final use of space according to the Rulebook on content, map scales, mandatory spatial indicators and compulsory attachments to spatial plans is determined [11]. Mostly, these are sports and recreational purposes in the areas of exploitation of gravel and sand, economic purposes - production zones in the areas of exploitation of stone, clay, etc., possibly tourism purposes, etc., and where it is not realistic or purposeful the recultivation or natural succession is defined [12].

Management of natural resources in accordance with the concept of sustainable development - geological information provides an estimate of the quantities and availability of renewable natural resources and enables their exploitation in an economically cost-effective way that is environmentally friendly [20].

3 ANALYSIS OF THE SITUATION IN THE MINERAL RESOURCES MANAGEMENT IN THE PERIOD FROM 2006 TO 2010 IN THE AREA OF THE VARAŽDIN COUNTY

Due to the great interest in the exploitation of mineral resources in the Varaždin County, especially gravel and sand, the County has developed and adopted the Study on

the potential and basis of mineral resources management in the Varaždin County. The County Assembly accepted the Study and in such a way the County determined itself with respect to resolving the request for mineral exploration and ensuring the conditions for it through the spatial planning documentation. A particularly significant result of the Study was the mapping: "Limited potentialities of mineral resources in the Varaždin County", [13]. These areas of limited potential were appropriately incorporated into the spatial plans of municipalities and cities as they were amended (Fig. 1).

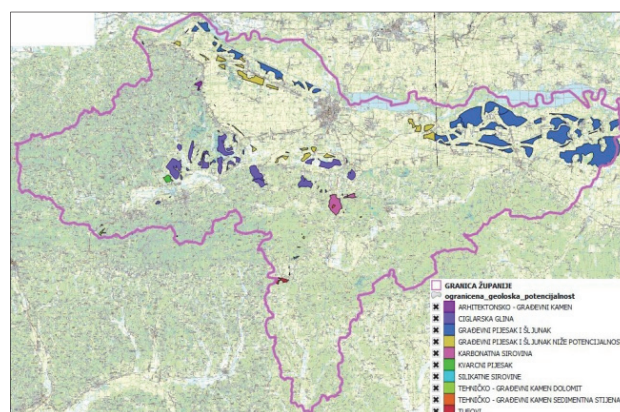


Figure 1 Limited potentialities of mineral resources in the Varaždin County

In the Varaždin County, during those years, mineral raw materials with exclusive use in construction were exploited: exploitation and processing of technical building stone (Tab. 1), construction sand and gravel (Tab. 2), brick clay (Tab. 3) and other (Tab. 4). The use of mineral resources depended on the needs of the market, and production depended on the natural potential.

Table 1 Exploitation fields and exploration areas of technical building stone

No.	Exploitation field	Area in ha	JLS	Date of decision	Investor
1.	Hruškovec (diabase)	54.29	Municipality Ljubešćica [28]	1975(1989)	Kaming d.d. Ljubešćica
2.	Pečina (vinicit)	0.18	Municipality Vinica [37]	08/06/1977	Jedinstvo - Kamen d.o.o.
3.	Očura (dolomite)	20.3	Town Lepoglava [22]	12/06/1985	IGM Kamenolom Očura
4.	Belski dol (limestone)	3.9	Town N. Marof [18]	19/07/1987	Vodogradnja d.d.
5.	Jazvina – Hruškovec IV	15.7	Municipality Ljubešćica [28]	05/08/1988	Kaming d.d. Ljubešćica
6.	Špica (limestone)	46.8	Municipality Ljubešćica [28]	09/01/1993	Kaming d.d. Ljubešćica
7.	Podevčevo (dolomite)	6.1	Town N. Marof [18]	10/05/1995	Vlado Puškadija, Remet
8.	Marčan (tor. limestone)	2.23	Municipality Vinica [37]	30/10/1995	Zagorje - Kamen d.o.o.
9.	Čanjevo (limestone breccia)	6.9	Municipality Visoko [19]	05/03/1998	Cesta - Varaždin d.d.
10.	Očura II (dolomite)	17.2	Town Lepoglava [22]	10/05/2000	IGM Kamenolom Očura
11.	Črlena zemlja (diabase)	1.3	Municipality B. Hum [25]	13/12/2004	Raport d.o.o. Radešić
12.	Žulinec		Municipality Ljubešćica [28]		Prema PPUO Ljubešćica
13.	Belski dol Gornji	7.6	Town N. Marof [18]	05/10/199x	GTP Sudovec d.o.o.
14.	Očura III	11.23	Town Lepoglava [22]	11/06/2008	Holcim d.o.o.

Table 2 Exploitation fields and exploration areas of building sand and gravel

No.	Exploitation field	Area in ha	JLS	Date of decision	Investor
1.	Motičnjak	55.5	Municipality T. Bartolovečki [35]	15/11/1978	Cesta - Mineral d.o.o., Varaždin
2.	Trstika	32.9	Municipality Veliki Bukovec	27/10/2000	Obrt Smontara, Veliki Bukovec
3.	Jamičak	42.9	Municipality Sveti Đurd [34]	27/03/2001	Obrt Bagerkop - Rauš, N. Marof
4.	Turnišće	10.5	Municipality Sračinec [33]	12/12/2001	Meteor grupa
5.	Hrastovljan	47.9	Municipality D. Martijanec [30]	03/09/2002	Cesta - Mineral d.o.o., Varaždin
6.	Lešće	19.8	Municipality Sveti Đurd [34]	10/02/2003	Cesta - Mineral d.o.o., Varaždin
7.	Prudnica	14.9	Municipality Mali Bukovec [29]	19/07/2004	Obrt Josip Šerbetar, M. Bukovec
8.	Molve	24.0	Municipality Petrijanec [32]	04/02/2005	Obrt Niskogradnja Hudek Petrij.
9.	Krtinje	18.2	Municipality Mali Bukovec [29]	21/12/2004	Baliža d.o.o. N. Selo Podravsko
No.	Exploration area	Area in ha	JLS	Date of decision	Investor
10.	Škareški lug	15.9	Municipality Veliki Bukovec [36]	06/06/2005	Obrt Transporti Lilek, Kapela P.
11.	Brezine	5.9	Municipality Cestica [26]	27/06/2005	Cesta - Mineral d.o.o.

Table 3 Exploitation fields and exploration area of brick clay

No.	Exploitation field	Area in ha	JLS	Date of decision	Investor
1.	Čret	27.1	Town Lepoglava [22]	24/01/1980	IGM Lepoglava
2.	Cerje Tužno	54.4	Municipality Maruševac [31]	04/05/1981	IGM Brickyard Cerje Tužno
3.	Cukavec	13.2	Municipality G. Knežinec [27]	25/08/1988	Brickyard Dubravka d.o.o.
5.	Lukavec	32.8	Town Ivanec [21]	28/02/2002	IGM Brickyard Cerje Tužno
6.	Cukavec II	7.4	Municipality G. Knežinec [27]	17/03/2005	Brickyard Dubravka d.o.o.
7.	Ludbreški vinogradi				Prema PPUG Ludbrega
No.	Exploitation area	Area in ha	JLS	Date of decision	Investor
8.	Cerje Tužno II		Municipality Maruševac [31]		IGM Brickyard Cerje Tužno

Table 4 Exploitation fields of quartz sand and geothermal wells

No.	Exploitation field	Area in ha	JLS	Investor / Concessionaire
1.	Jerovec	21.1	Town Ivanec [21]	IGM Pješčara Jerovec 17.11.1975.
2.	Varaždinske Toplice		Town V. Toplice [24]	Special Hospital for Medical Rehabilitation Varaždinske Toplice
3.	Lunjkovec		Municipality Mali Bukovec [29]	INA d.d. Zagreb
4.	Topličica		Town Novi Marof [18]	

The study of the potential and basis of mineral resources management in the Varaždin County also indicates the existence of geothermal water sources in Podvčevu (town of Novi Marof) on the east side of Remetinec - Podevčevu road, but there is no data to indicate significant exploration and use of geothermal water from these sources [13].

According to the data of the Ministry of Labour and Entrepreneurship of the Republic of Croatia for 2006, the Mining Directorate, in the territory of the Varaždin County, the potential area for the exploitation of mineral resources is about 65 km², or 5% of the total area of the County (of which 47.2 km² is suitable for exploitation of sand and gravel, and 13 km² for the exploitation of brick clay).

Generally, the County Spatial Plan defines the procedure for exploration and exploitation of mineral resources, which means that only the locations of significance for the County were entered into the graphic part of the plan at the time of the development of the Spatial Plan of the Varaždin County, while the implementing provisions enabled the formation and opening of newly created exploitation fields under certain conditions [12].

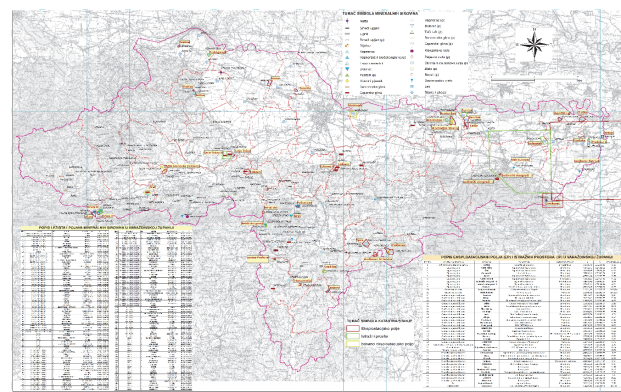
In order to harmonize the management of mineral resources with environmental and nature protection conditions [16], natural heritage, agricultural land, as well as with new regulations on mining, the Varaždin County has initiated the initiative to revise/develop a new Study on the potential and basics of mineral resources management in the area of the Varaždin County.

4 STATE OF EXPLORATION AND EXPLOITATION OF MINERAL RESOURCES IN THE VARAŽDIN COUNTY

According to the Mining Act [1], data on existing exploitation fields and exploration areas were kept in the Register of approved exploration areas and the Register of identified exploitation fields of mineral resources, in the State Administration Offices in counties (for mineral raw materials for the production of building materials: technical-building stone, construction sand and gravel and brick clay) while the Ministry is responsible for energy mineral raw materials, mineral raw materials for industrial processing, architectural stone and metal mineral raw materials.

At the end of 2017, under the Mining Act, the Ministry of Economy, Entrepreneurship and Crafts took over from

the State Administration Office all competencies related to the management of mineral resources in the existing exploration areas and exploitation fields.

**Figure 2** Overview of the exploration areas and exploitation fields of mineral resources in the Varaždin County

Up to 2017, the registers kept by the State Administration Office in the Varaždin County recorded a total of 17 active exploitation fields (7 technical-construction stone, 7 construction sand and gravel and 3 brick clay), as well as 5 exploration areas of construction gravel, and sand [17]. For some of the exploitation fields and exploration areas, the licensees have been deprived of the right of exploitation/exploration of mineral resources, and the competent authority considers such fields passive (Fig. 2).

According to the data of the Institute for Physical Planning of the Varaždin County (based on the data obtained from the State Administration Office in the Varaždin County, the Department of Economy and data of the Ministry of Economy, Energy and Mining Directorate), mineral resources are being explored and exploited in the County within the following exploration areas (IP), that is, exploitation fields (EP), as described below by types of mineral resources.

4.1 Technical Building Stone

According to the Register of Exploitation Fields kept by the State Administration Office in the Varaždin County, the Department of Economy until 2017 operated the following exploitation fields of technical building stone:

According to the data in Tab. 5, the total area (maximum) of all exploitation fields of technical construction stone in the area of the Varaždin County is 162,815 ha, and the total area of active exploitation fields is 126,745 ha [17].

In the area of the Varaždin County (City of Lepoglava) there is a very small part of the exploitation field "Lovno - Lovno 2" (0.49 ha), on which the technical-building dolomite stone is exploited, and which is mostly located in the area of the Krapina-Zagorje County, in the Municipality of Novi Golubovec (total area of 31.00 ha) [17].

Limestone and dolomitized limestone were exploited in Belski dol, and because of the wells and established

water protection zones, this exploitation ceased. With the PPUG of Novi Marof, this exploitation field is no longer planned, that is, the existing field that is within the sanitary zones of Belski dol well protection is planned to be closed and rehabilitated [18].

Until 2003 the exploitation field of the technical-building stone - limestone breccia "Čanjevo" in the municipality of Visoko was also in operation, but the exploitation was suspended on the basis of the decision of the Ministry of Economy in 2003 and the ruling of the Administrative Court of 2007 and at the initiative of the Ministry of Culture for the Protection of the cultural property of the Čanjevo Fort [19].

Table 5 Technical - building stone

No.	Exploitation field	Mineral raw material	Area / ha	JLS	Authorised person
1.	Očura	Technical - building stone - dolomite	20.34	Town Lepoglava [22]	IGM Quarry Očura d.o.o. Lepoglava
2.	Očura II	Technical - building stone - dolomite	17.23	Town Lepoglava [22]	Holcim mineralni agregati d.o.o. Očura
3.	Hruškovec	Technical - building stone - diabase	54.29	Municipality Ljubešćica [28]	Kaming d.d. Ljubešćica
4.	Hruškovec IV-Jazvina	Technical - building stone - diabase	15.7	Municipality Ljubešćica [28]	Kaming d.d. Ljubešćica
5.	Belski dol	Technical - building stone - limestone	6.06	Town Novi Marof [18]	Vodogradnja d.d. Varaždin
6.	Špica	Technical - building stone - limestone	46.0	Municipality Ljubešćica [28]	Kaming d.d. Ljubešćica
7.	Podevčevo	Technical - building stone - dolomite	6.3	Town Novi Marof [18]	"Graditelj" Vlado Puškadija, Novi Marof
8.	Črlena zemlja	Technical - building stone - diabase	1.22	Municipality Breznički Hum [25]	Mežnar d.o.o. Karlovac
No.	Exploration area	Mineral raw material	Area / ha	JLS	Authorised person
1.	Očura III	Technical - building stone	11.23	Town Lepoglava [22]	Holcim mineralni agregati d.o.o.

4.2 Building Sand and Gravel

There are significant amounts of building sand and gravel in the Varaždin County area associated with the Drava River alluvium. The thickness of the gravelly-sandy horizon increases from west to east, and at Otok Virje it is

8 m, at Varaždin it is 60 m, and at Hrastovljan it is over 100 m [12]. Approved exploitation fields, according to the Register of exploitation fields kept by the State Administration Office in the Varaždin County, the Department of Economy until 2017 were as follows.

Table 6 Building sand and gravel

No.	Exploitation field	Mineral raw material	Area / ha	JLS	Authorised person
1.	Trstika	Building sand and gravel	32.9	Municipality Veliki Bukovec	Gravel pit transport "Smontara" Veliki Bukovec
2.	Jamičak	Building sand and gravel	42.9	Municipality Sveti Đurđ [34]	Bagerkop-Roberto d.o.o. Novi Marof
3.	Turnišće	Building sand and gravel	8,61	Municipality Sračinec [33]	Gravel pit Turnišće d.o.o. Varaždin
4.	Škareški lug	Building sand and gravel	16,0	Municipality Veliki Bukovec	LTK d.o.o. Kapela Podravska
5.	Hrastovljan	Building sand and gravel	46.4	Municipality Martijanec [30]	Colas Mineral d.o.o. Varaždin
6.	Lešće	Building sand and gravel	19.78	Municipality Sveti Đurđ [34]	Cesta-Mineral d.o.o. Varaždin
7.	Prudnica	Building sand and gravel	14,99	Municipality Mali Bukovec [29]	Gravel pit and transportation "JOLE" Mali Bukovec
8.	Molve	Building sand and gravel	24.0	Municipality Petrijanec [32]	Obrt Niskogradnja Huček Petrijanec
9.	Krtinje	Building sand and gravel	9.5	Municipality Mali Bukovec [29]	Balija d.o.o. Novo Selo Podravsko
10.	Brezine	Building sand and gravel	4.5	Municipality Veliki Bukovec	Cesta Mineral d.o.o. Varaždin
No.	Exploration area	Mineral raw material	Area (ha)	JLS	Authorised person
1.	Prudnica 2	Building sand and gravel	8.3	Municipality Mali Bukovec [29]	Gravel pit and transportation "JOLE" Mali Bukovec
2.	Černjak	Building sand and gravel	38.3278	Municipality Sveti Đurđ [34]	Trgograd d.o.o. Varaždin
3.	Dolenščak	Building sand and gravel	50.4	Municipality Sveti Đurđ [34]	Smontara d.o.o. V. Bukovec
4.	Peski gornji	Building sand and gravel	10.4	Municipality Cestica [26]	Sirik Beton j.d.o.o. Gornje Vratno
5.	Hrastovljan I	Building sand and gravel	23.56	Municipality Martijanec [30]	Colas Mineral d.o.o. Varaždin

According to the data in Tab. 6, it is evident that the total (maximum) area of all exploitation fields of building sand and gravel in the area of the Varaždin County is 221.02 ha, and the total area of active exploitation fields is 187.16 ha. The total area of exploration areas of this mineral resource in the County is 130.9878 ha [17].

Until 2013 the exploitation field of building sand and gravel "Motičnjak" in the municipality of Trnovec

Bartolovečki was also in operation, at which the exploitation was completed and it was deleted from the Register of exploitation fields [35].

4.3 Brick Clay

Brick clay is exploited at several locations in the Varaždin County, where there are certain capacities and

potentials, but the quality of the raw material varies and the quantities are limited.

It is estimated that only the brick mill in Cerje Tužno has sufficient raw materials for longer exploitation. According to the Register of Exploitation Fields kept by the State Administration Office in the Varaždin County, the Department of Economy until 2017 the following brick clay exploitation fields were in operation.

Exploitation fields of brick clay in the area of the Varaždin County is 116.46 ha, and the total area of active exploitation fields is 70.65 ha [17].

The Ludbreg PPUG established that no further exploitation was carried out on the exploitation field next to the existing brickyard (EP Ludbreški Vinogradi - north), and it was no longer planned as an exploitation field but a construction area of the settlement [23].

Table 7 Brick clay

No.	Exploitation field	Mineral raw material	Area / ha	JLS	Authorised person
1.	Cerje Tužno	Brick clay	54.5	Municipality Maruševac [31]	Brickyard Cerje Tužno d.o.o. Cerje Nebojse
3.	Cukavec	Brick clay	12.96	Municipality Gornji Kneginec [27]	Leier-Leitl d.o.o., Turčin
4.	Cukavec II	Brick clay	7.4	Municipality Gornji Kneginec [27]	Leier-Leitl d.o.o., Turčin
5.	Lukavec	Brick clay	32.85	Town Ivanec [21]	IGM Brickyard Cerje Tužno d.o.o. Lepoglava
6.	Ludbreški Vinogradi - north	Brick clay	1.95	Town Ludbreg [23]	Brickyard Kovačić d.o.o. Ludbreg
7.	Ludbreški Vinogradi - south	Brick clay	6.8	Town Ludbreg [23]	Brickyard Kovačić d.o.o. Ludbreg

4.4 Geothermal Water

Until 2012 the exploitation field of the Čret brick clay in the town of Lepoglava was also in operation, at which the exploitation was completed and it was deleted from the Register of exploitation fields [22]. In the Varaždin

County, energy mineral resources (hydrocarbons/oil and fossil fuels/geothermal water) and mineral resources for industrial processing (sand) under the jurisdiction of the Ministry of Economy are also explored and exploited (Tab. 8).

Table 8 Geothermal water

No.	Exploitation field	Mineral raw material	Area / ha	JLS	Authorised person
1.	Varaždinske Toplice	Thermomineral water	- point source - well	Town Varaždinske Toplice [24]	/
2.	Lunjkovec-Kutnjak	Geothermal water	10.000,00	Municipality Mali Bukovec [29]	MB GEOTHERMAL d.o.o. Zagreb
3.	Topličica	Geothermal water	- point source	Town Novi Marof [18]	/
No.	Exploration area	Mineral raw material	Area / ha	JLS	Authorised person
1.	Mali Bukovec	Geothermal water	5. 248.00*	Municipality Mali Bukovec [29]	Vis Viridix d.o.o. Zagreb

4.5 Sand

In the Varaždin County, mineral resources for industrial processing (quartz sand) are explored and

exploited under the jurisdiction of the Ministry of Economy. In the Varaždin County there is only one active field of mineral raw material - quartz sand (Tab. 9).

Table 9 Sand

No.	Exploitation field	Mineral raw material	Area / ha	JLS	Date of decision	Authorised person
1.	Tiglin - Horvacka (Jerovec)	Quartz sand	19.75	-	-	IGM Pješčara Jerovec d.o.o. Ivanec
No.	Exploration area	Mineral raw material	Area / ha	JLS	Date of decision	Authorised person
1.	Jarek	Dolomite sand	1.72	Town Novi Marof [18]	-	Constructor Vlado Puškadija, Novi Marof

4.6 Oil/Hydrocarbons

According to the information provided by the Institute for Physical Planning of the Varaždin County, an oil exploration procedure was initiated in the territory of the Petrijanec municipality, and connected to this there is only a mark on the copy of the cadastral plan (cadastral municipality Družbinec) entered with a symbol and indicating the approximate location of the exploration well (Strmec Podravski I) [32].

Exploitation fields and exploration areas are defined in the spatial plans as the existing economic purpose - areas

for exploration and exploitation of mineral resources, and the total area of this purpose in the spatial plans of the LSG is approximately 660.44 ha (existing stone exploitation fields 161.24 ha, clay 148.43 ha, gravel and sand 244.25 ha and quartz sand 19.21 ha, and planned spaces for the exploitation of stone 12.98 ha, clay 44.99 ha and gravel and sand 29.34 ha) [17].

It is extremely important that after the exploitation is completed or after a particular phase of exploitation, the area is rehabilitated and the final planned purpose of the area is realized.

Table 10 Hydrocarbons

No.	Exploitation field	Mineral raw material	Area / ha	JLS	Authorised person
1.	Cvetkovec	Hydrocarbons	423.00	Town Ludbreg and Municipality Rasinja	INA - Industrija nafte d.d. Zagreb

5 CONCLUSION

The overall analysis and assessment of the situation in the management of mineral resources of the Varaždin County from 2006 to 2010, when the County Assembly adopted the Study of the potential and basis of mineral resources management in the Varaždin County in relation to the period when the new Mining Geological Study of Varaždin County was adopted (June, 2016), and according to the available data, which until 2017 were kept by the State Administration Offices (Economy Department), the Institute for Physical Planning of the Varaždin County and the Ministry of Economy, Directorate for Energy and Mining, and the applicable spatial planning documents. shows that the number of exploration areas and exploitation fields in the area of the Varaždin County for all mineral resources has increased.

Both Studies have analyzed the needs and potential of mineral resources through sustainable management of mineral resources both in economic and spatial planning field.

However, it is important to emphasize that the management of mineral resources of the Varaždin County (according to data from the current Mining and Geological Survey of the County of Varaždin, and related to data from the Ministry of Economy (MINGO), shows that the existing mineral reserves of construction sand and gravel, technical and construction stone are sufficient by 2045, and brick clay by 2053. Consequently, there are currently sufficient quantities of mineral raw materials available for building materials for the construction of large infrastructure facilities and the manufacturing industry.

Through this analysis and assessment of the state of exploration and exploitation of mineral resources in the Varaždin County, all these years, there are certain problems, especially in relation to the environment (occupation of space, changes of landscapes, air pollution, water, impacts on flora, fauna, transport infrastructure) given the specificity of these activities. Namely, the exploitation of mineral resources inevitably means the degradation of space compared to its original state, since the image of space is permanently changing. Although areas are being rehabilitated after the cessation of mineral exploration activities (or planned to be rehabilitated according to a remediation project that is part of the documentation for the exploitation of the exploitation field), the possibilities of using the space after the exploitation are often limited, especially after the exploitation of gravel and sand (due to the presence of groundwater) and stone.

It is important to emphasize and conclude that the Varaždin County needs to determine the real possibilities for exploration and exploitation of mineral resources in accordance with the needs of the community and economic development, given that there are available quantities of mineral resources for the construction of larger infrastructure facilities. But it should also be emphasized that all relevant experts, miners, geologists, biologists, landscape architects should be actively involved in spatial planning in such a way as to identify potential sites of activation, so that decisions on the priorities for purpose, remediation or conservation can be made to ensure the protection of mineral deposits for

future generations and to achieve development that promotes humane, sustainable, economical and environmentally friendly production.

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