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THE PROCESS OF MINED LAND RECLAMATION IN NATURAL AGGREGATE QUARRIES EXEMPLIFIED BY THE SAND AND GRAVEL QUARRY DĘBINA ŁĘTOWSKA

1. Introduction

The opencast mining of natural aggregates, regardless of its extent, interferes with the natural environment. Relief is transformed, soil profile is disturbed, water relations may change and flora is badly affected. Very often after the mining operations carried out by irresponsible entrepreneurs, the landscape is decayed and consists of “holes in the ground” often used as illegal dump site, which is even more hazardous. Such behaviour mainly aims at avoiding reclamation costs and stems from the state authorities’ weakness in enforcing the obligation of post-industrial area reclamation. Another reason is the lack of rational planning and ongoing reclamation at the mining stage.

It’s worth noting, however, that post-mining forms, such as excavations, often filling with water, or heaps of overburden provide opportunities for them to be used in an interesting way, i.e. for recreational purposes. What’s necessary, however, is the need to plan the area’s future functions in agreement with the territorial authorities and the local community at a sufficiently early stage. In addition to mining, the commune’s land development, the needs of local people’s, the investment completion time, the costs and the division of obligations between the entrepreneur and the future land user all need to be taken into account.

2. The formal and legal grounds for mined land reclamation

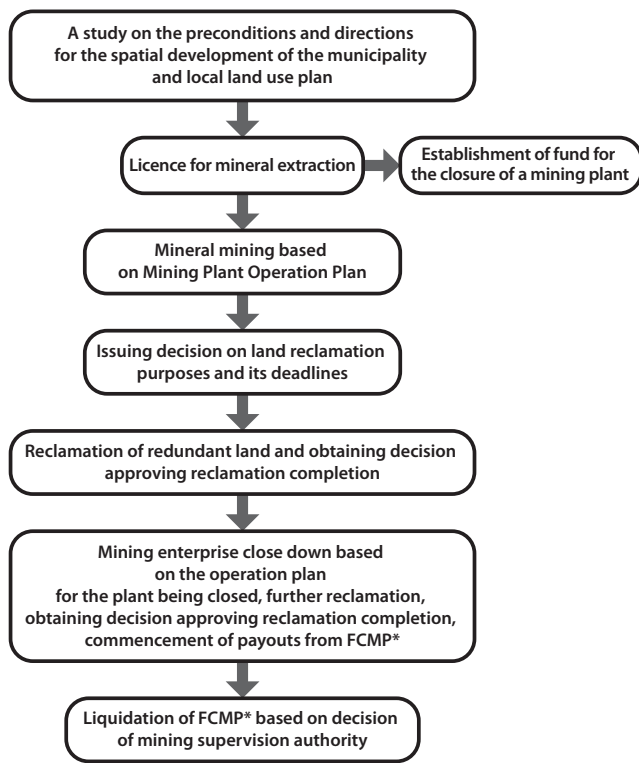
Pursuant to Article 129 of the Geological and Mining Law Act dated 9 June 2011 [5], the entrepreneur is required to reclaim the land pursuant to the Act on the Protection of Agricultural and Forest Land dated 3 February 1995 [4]. The said Act defines mined land reclamation as fol-

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lows: *creation or restoration of utility or natural value for degraded or devastated land through proper formation of the landscape, enhancements of physical and chemical properties, regulation of water conditions, and restoration of soil, reinforcement of scarps and reconstruction or construction of indispensable routes*. Article 20 of the said Act specifies that a person causing the loss or reduction of the land's useful value as is responsible for mined land reclamation [4]. Mined land reclamation ought to take place gradually while such land *is becoming redundant as regards the industrial activity — utterly or partly or for a definite period of time — and end within 5 years from its stopping*, and the process of mined land reclamation and land redevelopment ought to be planned at all stages of industrial activity [4]. The decision concerning mined land reclamation purposes and its deadlines are issued by the district governor (Starosta) after consulting the head of the circuit mining office in charge of that area, the head of the regional branch of the State Forests [Regionalna Dyrekcja Lasów Państwowych] or the head of the national park (for reclaimed land will suit forestry purposes) and the commune head (mayor or city president) [4]. The said Act does not specify whether a mined land reclamation project is to be drawn up at the decision-obtaining stage. As per practice, such a decision is issued based on different documents varying from district to district. The entrepreneur who has obtained the mining licence is required to establish a fund for the closure of a mining plant (Article 128 of the Geological and Mining Law Act [5]); the fund resources will be collected in a separate bank account and, in the case of opencast mining operations, will amount no less than the equivalent of 10% of the royalty. The financial resources may be released after the entrepreneur has obtained the decision approving the operation plan for the plant being closed. As for the bank account in question, it may be closed after the completion of the mining enterprise liquidation with the consent of a relevant mining supervision authority after consulting the commune head (city or town mayor). The approval of the closure plan operation for the plant, requires an agreement with the commune head (mayor or city president) as regards the conformity of the land's designation specified in the local land use plan. One has to bear in mind that only a mining enterprise whose resources are settled in the addendum in accordance with the geological documentation and the addendum to the deposit development plan may be close down. Having completed the mined land reclamation, the entrepreneur may apply to the district governor for a decision approving mined land reclamation completion, which is issued after consulting the head of the circuit mining office in charge of that area, the head of the regional branch of the State Forests [Regionalna Dyrekcja Lasów Państwowych] or the head of the national park (for land whose future reclamation will suit forestry purposes) and the commune head (mayor or city president) [4]. A simplified, formal scheme of the mined land reclamation process is presented in figure 1 below.

3. The planning, design, execution and costs of mined land reclamation

The planning of mining operations needs to include mined land reclamation activities or, more precisely, the target use of such areas. Consequently, land reclamation activities sho-



* Fund for the Closure of a Mining Plant

Fig. 1. Simplified formal scheme of the process of mined land reclamation (done individually)

uld be planned in accordance with a local land use plan, taking into consideration the needs of the local community as well as the demand for areas characterized by various utilization objectives, e.g. service provision, production, etc. The role of local authorities in the process of acquiring a decision concerning the forms of mined land reclamation is insignificant and limited to the presentation of opinions, which are not binding. It is only at this stage of the mine closure that local authorities participate in the planning of the operation plan for the plant being closed with respect to their compliance with the local land use plan.

In practice, well-prepared mined land reclamation activities facilitate their performance in a manner ensuring the fulfilment of all environmental protection standards and reducing their costs. In the process of natural aggregate mining, the main operating cost are deposit preparation costs, including the cost of the overburden movement. The further the distance of the soil mass movement or the greater its frequency, the higher the costs. In this context, it should be remembered that improper planning of opencast operations may result in the loss of the surface soil layer, which is indispensable for mined land reclamation. It may happen in the event of the absence of selective stripping, the mixing of the soil mass with other materials or its coverage with other materials on heaps. Such situations result in the necessity

to acquire the additional mass of a humus layer from other areas or to carry out additional and expensive fertilization operation at the reclamation stage. The process of planning and executing successive reclamation operations is also important in view of the necessity to pay considerable amounts of tax for the economic utilization of land from the time of such land's exclusion from agricultural or forestry activities until the completion of land reclamation. It can therefore be assumed that the best-case scenario would be to reclaim pieces of land systematically, allowing production operations only as much land as is necessary to maintain a proper lead in overburden stripping. In a situation like such as this the entrepreneur does not incur additional costs related to local taxes.

The documents connected with mining operations and specifying the manner of the reclamation of land transformed by mining operations include the following: geological documentation, a deposit development plan and an operation plan for the plant being closed. In such documents, the description of a method of land reclamation is most frequently very general and the shape of a final working is a derivative of the most beneficial method of resources management. There is usually a lack of coordination between the mining process and the process of successive land reclamation. This may lack of cooperation may sometimes result from the long period of time for which a deposit development plan is carried out or the validity of a mining licence. In order to avoid trend to the necessity to draw up addendums to deposit development plans, mining enterprises prepare such documents as generally as possible.

As far as mined land reclamation plans are concerned, there are no legal regulations providing any obligation to prepare such plans, describing the manner and procedure of their approval or specifying their features and scope. This causes situations in which considerable discretion is exercised in the process of acquiring decisions related to mined land reclamation. According to the Regulation on Mining Plant Operation Plan, planning and describing a land reclamation process does not require such documents, with the exception of an operation plan for the plant being closed. Such wording of the regulations causes a lack of planning activities and failures to fulfil the reclamation obligations properly. Entrepreneurs frequently make inadequate decisions concerning the forms of and deadlines for mined land reclamation which have been issued on the basis of expired land use plans and cover only a part of already existing workings.

The aforementioned deficiencies of the legal regulations do not favour proper utilization of the potential of post-mining areas. It is only the awareness of mining enterprises and their cooperation with local authorities that offer a chance for the mined land reclamation processes and a further utilization of post-mining areas to take a proper course.

4. Mined land reclamation at Lafarge

As per Lafarge's good practice, every mining enterprise has at its disposal an up-to-date decision on the mined land reclamation purposes along with deadlines, which is updated during the process of expanding the areas covered by mining operations (change of licence) and in connection with changes of environmental determinants, spatial planning as well as other factors. Thanks to this procedure one may, among others, define the mined land reclamation

progress for individual mining enterprises, update quarry reclamation financial reserves and continue improving the reclamation process.

The sand and gravel quarry Dębina Łętowska, located on the border of two communes, namely Wojnicz and Wierchosławice, may be used as an example (Fig. 2, 3). Kopalnie Odkrywkowe Surowców Drogowych w Rudawie S.A. (previous owner) had at its disposal the decision of the Wojnicz Commune Head under which the method of the mined land reclamation and redevelopment was said to suit the agricultural purposes — i.e. intensive fish farming — for a part of the post-mining area within the Wojnicz Commune. That Decision was issued in 1993 based on the mined land reclamation provisions contained in the deposit development project and concerned the part of the land located only in the Wojnicz commune, failing to include the land from the Wierchosławice commune. It is also worth mentioning that the two communes do not have current local land use plans.



Fig. 2. Dębina Łętowska: natural succession of flora (fot./photo: E. Nowak)



Fig. 3. Dębina Łętowska: natural succession of fauna (fot./photo: E. Nowak)

In 2011, Lafarge applied for a decision on the mined land reclamation purposes and drew up a mined land reclamation project for all workings. Initially, it was checked whether the agricultural purpose of the mined land reclamation, i.e. intensive fish farming, was attainable in a reservoir 8 to 10 metres deep [2]. J. Śliwiński PhD, Eng., a worker of the Department of Ichthyobiology and Fisheries [2] was asked to issue an opinion in this regard. In accordance with that opinion, it is not possible to carry out intensive fish farming in a reservoir of this depth, but such an area may be used for fishing purposes, including sport fishing, as an additional way of taking advantage of the reclaimed reservoir's fishing productivity potential. Given the water's low trophic level, it was suggested that the adjacent areas should be reclaimed for natural purposes. Based on those two premises, the agricultural purpose of the reclamation – with a water-based, economically useful specification – which was proposed for the post-mining working and a natural purpose for the adjacent areas [2]. In figure 4 one can see the original concept of reclaiming the post-mining reservoir for intensive fish farming purposes, carried out in two reservoirs.

At the stage of obtaining the decision on mined land reclamation purposes, the communes acceded to the purposes proposed, with the reservation that, based on the local community's needs, the reservoir would also be used for recreational purposes in the future [3].



Fig. 4. The map for the project of the “Dębina Łętowska I” deposit development plan providing for a set-up of two reservoirs 8 to 10 metres deep [1]

The commune’s another suggestion was to merge two workings into one reservoir and make it more shallow in order to set up a beach. Analyses were made to find out whether it was possible to make a gradual descent into the water as regards the existing reservoir, and how much the change of the place for filling up the water above the water table would affect the profitability and possibility of conducting mining operations [2].

Based on the observations of the 0–2 fraction material after dumping it into the reservoir it was concluded that although it is possible to make such shallownings by filling up a part of the existing reservoir, there is a real danger connected with the stability of such a dump. Shallownings can be made during mining operations by mining down to a level above the deposit

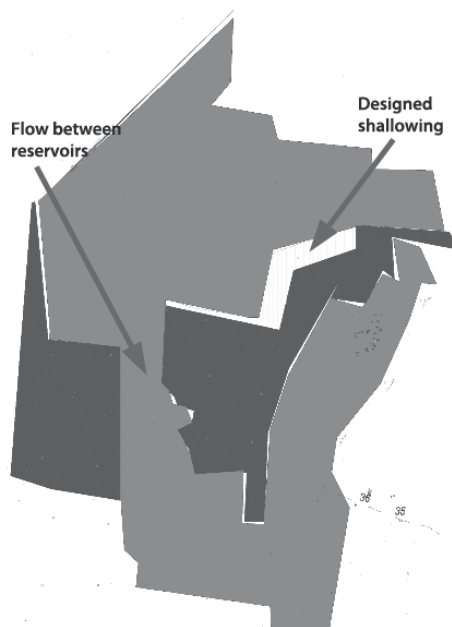


Fig. 5. Scheme of post-mining reservoir providing for making a shallowing with the possibility of a flow between the reservoirs [2]

floor, which, in turn, makes the utilisation of the mineral irrational. As a result of this, the communes were advised that the quarry would make the reservoir more shallow in the area adjacent to it, outside the borders of the documented deposit. Such a solution will facilitate the maximum use of the resources as well as guarantee that the gradual descents into the water, set up in that manner, would be safe. The use of sets of floating swimming pools and decks was also proposed in case the amount of the water turned out insufficient [2]. As for the possibility of changing the place for filling up the water above the water table, it came at the last moment for making such a change, given the planned discharge of the 0–0,063 fraction material in the place where the reservoirs were demarcated. The scheme for a post-mining reservoir allowing for a shallowing with the flow option between the post-mining reservoirs is presented in Figure 5. The solution has been accepted for implementation by the parties to the proceedings.

5. Summary

The analysis of the legal regulations as regards to mined land reclamation and the mined land reclamation example of the sand and gravel quarry, as presented above, indicate that the regulations are not consistent and fail to provide a uniform standard of planning and conducting mined land reclamation, which consequently entails additional work and costs. The example of the Dębina Łętowska quarry indicates that good practice in designing mining operations must take into account the future purposes of mined land reclamation and rede-

velopment, and verify regularly the decisions obtained and mined land reclamation projects. This would decrease the risk of not obtaining decisions deeming the mined land reclamation completed in the event of a change of the stance related to, for example, the purpose of the post-mining area redevelopment by any party to the proceedings, as well as reducing the costs related to land maintenance.

The example of the Dębina Łętowska quarry shows that plans related to the future functions of a mined land may also be changed and such change requires a detailed analysis focusing on the possibilities and profitability of these implementation.

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