A Review On Land Reclamation In The Aspect Of Mining.

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Abstract

Mining sectors are playing a vital role to shape the modern world. By the sphere of time, Mining techniques include strip mining, mountaintop removal mining, and open-pit mining have created a tremendous velocity on the world mining revenue but at the same time, open-pit mining went as opposed to agriculture, foresty, fisheries sector by burring millions of hectors land for unorganized mineral extraction. Luckily, Under the voice of environmentalists, and sustainable thinking to reutilize the mined area, the land reclamation process after mining has taken appears to create a new tagline to the Revegetation process. It is one of the best actions to reduce the threat against the Ecosystem even in the Environment.

This review aims to discuss land reclamation and its effective process to refill the mined area for ensuring land fertility to recover agricultural losses after mining.

Keyword: *Agriculture sector; Mine reclamation; Mining sector; Open-pit mining*

Introduction

Mining may strongly have been the following of human kinds. The most pioneering endeavors granted that agriculture was the first. Those two areas take a lift together as the primary or basic industries of primitive civilization [1]. Little has changed in the importance of these industries since the beginning of civilization.

As it is well noted, Mining is the biggest contributor to a developed country. Only coal is one of the main primary energy sources in China. In China, coal production shows a rapid growth rate. In 2001, for example, production amounted to 2960 million tons, while yields rose to 1381 million tons in 2009, with an annual average growth rate of 175 million tons [2]. The rapid growth of the supply of coal satisfies the social and economic development criteria and forms a significant base for national economic development [3]. In the energy generation and usage structure in 2008, it accounted for about 75.6 percent and 68.7 percent, respectively. For almost 50 years, the main role of coal remained unchanged. Coal plays special important roles in the process of industrialization, urbanization, and modernization in the world. However, the mining, transportation, and utilization of minerals bring up a series of environmental problems, as is the trouble we have to confront and solve in building a well-off society and achieving good ecological mining areas [4]. All the mining activities will lead to subside, exert an effluence on surface structures and environments such as the reduction in farmland output, flatlands ponding, road crack,

and house collapse[5]. According to statistics, there were 1060 thousand hectares of woodland broken directly by mining, 263 thousand hectares of ruined grassland [6]. The region of failure due to the mining industry has hit 5000-6000 thousand mu (a Chinese unit of area, equivalent to 1/15 or about 0.066 hectares.)

, including 1300 thousand mu (a Chinese unit of area, equivalent to 1/15 or about 0.066 hectares.), around 40 cities of farmland. All the towns suffered from mine subsidence and 25 of their towns were heavily affected. The losses due to mining subsidies have reached more than 400 million last year. In short, the damage caused by the subsidence in mining is more extreme than the earthquake[7]. Recently, the idea of green mining and the mining industry was proposed in succession and got widely recognized. The achievement of "green mining" was one of the basic beliefs of the "friendly mining industries"[8]. The goal of the connotation of green mining was to adopt the concept of the green industry in the economy, producing "low mining-high use-low emissions" technology for production[9]. The key argument of this method focuses on the empirical and rational regulation of coal mining subsidence. The resulting unfair mining of the coal district would contribute to a variety of environmental concerns. **(1)** The mine subsidence of the coalfield seriously affected the ecosystem of the mining district, resulting in building cracking, ponding of agricultural property, road breaks, drying up of the swamp, and so on. All the harm makes a major difference to everyday life and development and losses. It is particularly hard to recover from the loss of the ground cape. **(2)** The subsidence has caused destruction to houses, highways, trains, bridges, tunnel tube networks and urban infrastructure, resulting in the diversion of railroads and roads, the rehabilitation of buildings and enormous economic damages. **(3)** Subsidence has destroyed groundwater and flood levels, creating low-lying areas and pools, and even wetlands. The destroyed land neither can be used for planting nor breeding turning into a wasteland in the end. The destruction of the underground water system and the runoff of the underground water are unrecoverable. **(4)** Natural forests, grasslands, vegetation, and massifs are impacted by subsidence, disrupting ecological balance[10]. **(5)** Subsidence can also impact the relationship between agriculture and social stability in the field, exacerbating the contradiction between enterprises and local regions and exacerbating social instability.Based on the above problems, this paper conducted a study about the utilization methodl of mine land reclamation.

Method of Land Reclamation

Agriculture, forestry, fishing, building and entertainment are primarily included in the usage of mine land reclamation[11].

In the 20th century, in all the world's large mining districts, massive advances and advancements in technology and equipment used in the mining industry transformed the entire face of landscape alteration. The rise in water surface area and acid mine runoff, resulting in extreme site conditions, are typical problems in such post-mining areas. Therefore, site-specific factors related to prior mining operations should be taken into consideration before any reclamation study, and proposals for sustainable habitat growth should be planned accordingly. In addition, for the successful development of terrestrial habitats at post-mining sites[12], plant succession and site-specific biocoenosis processes should be extensively explored.

Reclamation for Agriculture: According to the Land Administrative Rules, land reclaimed can be used for agriculture on a priority basis. In different contexts, agricultural reclamation may follow various management methods. Due to the difficult areas in the mountainous regions, the shallow slope can be used directly for reclamation with a little right adjustment[13]. The shallow subsides that have been produced can be found in plain areas.

According to the water table[14], they are turned into dry land or paddy fields, respectively. As for the deep fall, we should take the methods of filling and overlying transition with a low water

table. Finally, we have to do the full treatment concerning the extensive, deep, and low water table collapse. In general, before reclamation, we took the method of drilling, filling, and filling the rimland.

The Reclamation for Forestry: the reclaim of sunken land for forestry is determined by the land and property of the soil[15]. In general, for the garden, the asperous land in hill and mountain regions and the erratic reclaimed land is acceptable. In these gardens, cash crops may be planted or forested. The dry, high, and steep land should be reclaimed into forest or meadowland[16]. They are fit for planting forages or trees for the fall of low mountains and hills or overlying land after strip mining[17].

Fishery reclamation: Fishing reclamation is cheaper and quicker. Normally, the land that sunk in the plain can be turned into a fish farm with ponding at 2 meters or deeper. Fish farming can take place at the depth of subsidence in the water-accumulated region during the year[18]. The subsidence areas that excavate coal are already failing, so we can adapt to fish-duck polyculture the robust reclamation method.

Reclamation for Construction: For development, the leveled mining area in the subsidence zone can be used. Residential houses and manufacturing structures may be built using the areas after base care. On the one hand, this step will relax our country's land to be expanded to a degree, and on the other hand, it can provide a nearby place for returning to the countryside, moving about again, relieving the relationship between industry and agriculture, saving loss compensation and the expense of relocating[19].

Reclamation for Tourist: It is important to smartly arrange the complete collapse. We can set ornamentally attractive tourist attractions, plant trees, and flowering straws, and develop ponticulus and lakes for fish and sightseeing[20]. The collapse can create an underwater park or amusement center with a wide water surface, deep water, and good water quality.

Reclamation for Headwaters: Under rational growth and utilization, the subsidence basin should be able to contain and block water as far as possible. The water from the deposit will supply underground water or aquaculture or irrigate the land. This method is a very effective planning technique for the water supply for the north, which needs water. It is possible to expand the collapsed areas with high-quality water into a new Waterhead field. In these regions, we can also create waterworks. To alleviate the shortage of water in urban, residential areas, and industry, the purification treated hydrops are converted into drinking water.

The technical specifications of the method of land reclamation are shown in Table 1.

Table:1 Requirements of the land reclamation.[28]

Reclamation method	Application	Technical requirements
Agriculture	Plantation, garden	Land leveling spread topsoil. For the food crops, the topsoil should not be less than 0.5 meters, of which the humus layer should not be less than 0.2-0.3 meters. The filling material should not contain harmful elements, if any the

		isolation layer is needed and the thickness should not be less than 0.4 meters. The hydraulic condition should be good. The demand for topsoil: the soil mass density should not be more than 1.5 g/cm3.Theproportionofclayand sand is 1 : 3or1: 2. The porosity is no less than 40%–50%. The content of the soluble sodium sulfate and magnesium sulfate is no more than 5%. Sodium oxide is no more than 0.01% and the pH value should be 6–8.
Forestry	Planting trees, orchard	The terrain may have an appropriate grade and the topsoil is needed. For planting trees, the topsoil is no less than 0.3 meters and the plant pit needs more than 1 meter. The isolated layer is needed if the filling material contains harmful elements. The thickness of the filling material is no less than 0.4 meter and filling material should be punning.
Forestry	Reservoir, fish-farming	The gradient of the shoreside should not be too steep. The area of the water should not be too large. The quality of the water should meet the water quality standard for fisheries.
Construction	Civilian, industry	The land needs to be punned well and the houses need anti-deformation measures.
Tourist	Stadium, park, swimming pool	The land needs to be punned well and the houses need anti-deformation measures.
Headwaters	Irrigation, drinking	The land needs to be punned well. The isolated layer is needed and its thickness is no less than 0.5 meter. Besides, cement to harden the surface is needed if necessary.

Technology for Land Reclamation

In a good mining culture in the mine area, reclamation technologies, including geese filling, ash filling, and deep drilling, have been active since the starting of the green mining concept. The majority of coal mines also obtained good experience in the formation of land, irrigation, immersion reduction, and reclamation of environmental engineering[21]. Technological insights such as salt marsh administration, waste heap reclaim for forestation, collapse pit for open mine, and development reclaims [22] were gained by the other coal mines. For instance, the Huaibei coal mine comprehensive treatment system process analysis of subsidence reclaim, the Tongshan County mine land reclaim study, and the Hegang mining area waste heap reclaim study. It can be said that the acquiring of all the above expertise and accomplishment can set the style for our nation's mine land reclamation, making a groundbreaking contribution.

Land Formation and Gradient Technology: This technology is perfect for low-water table mining areas or medium-high-water irrigation areas and reduction of disposal actions[23]. In the implementation of this method, the following should be noted: the stripping and preservation of the topsoil, the determination of elevation after land leveling, the determination of elements in the terrace portion, the combination of irrigation-drainage methods, and so on. The hand of the hydropowerless collapse areas.

The fall of the pond and collapse of hills, land-forming, and transformation reclamation approaches into terrace or greenbelt, are all appropriate. Figure 1 displays the pitch-to-terrace portion view. The additional gradient created by mining subsidies is generally limited. After land leveling, the collapsed land with the slope gradient is used for planting.

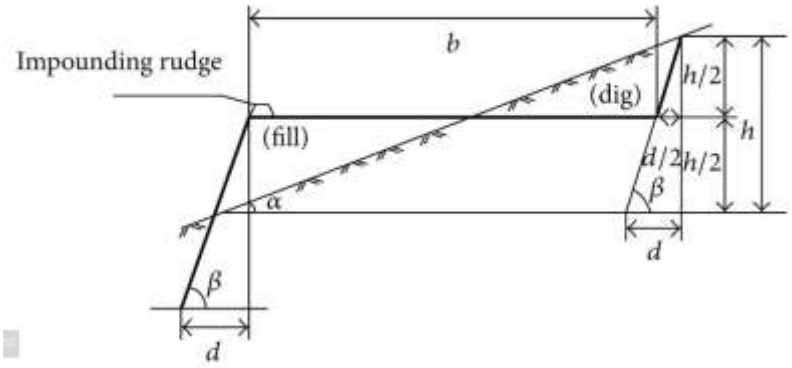

Figure 1: Slope-to-terrace sectional view.[28]

Depending on the topographic contour, the collapsed ground with the slope gradient between 2-6 can be transformed into a terrace and it should be cambered inwards to dam water for soil moisture. The use of the mode of contour ploughing in farming favors the conservation of land and water.

Elevating Land-Reclamation Technology: Gangue, fly ash, hydraulic clay, domestic refuse, commercial refuse, and outsole backfill are the key stuffing in elevating reclaim. Using mud in the pond, lake, and canal, agricultural waste, out-soil, and so on is the best option of raising reclamation. Steps to avoid secondary emissions should be taken where ganglion, fly ash and agricultural refuse have been used[24].

Gangue Filling Reclamation Technology: The gangue-filling reclamation technology solution is ideal for all types of mining areas[25]. Not only can the gangue serve as the filling substance to renew the destructive soil, but it can also reduce the gangue's covering and emissions. For farming as well as building property, the restored land may be used.

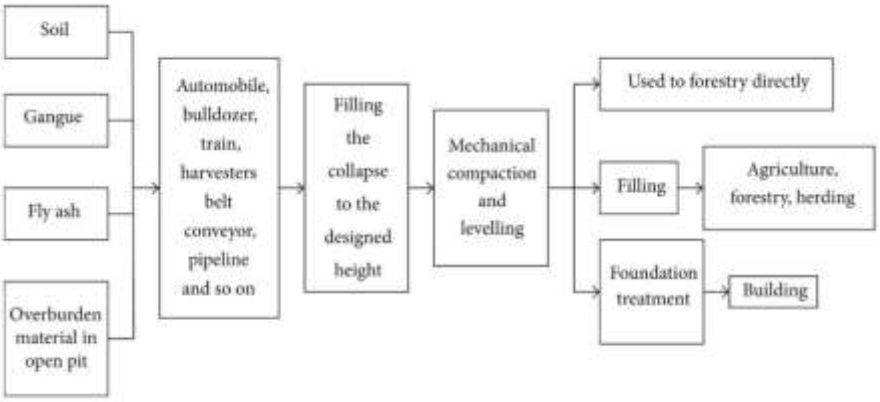

Figure 2: The industrial and mining area filling the reclamation process flow diagram.[28]

Gangue reclamation phases are as follows:

In the stable subsidence areas at first can be peeled and piled around the shallow mellow dirt, and then the gangue is filled. The mellow soil on the gangue should be covered, serving as a plowing sheet, until the filled gangue reaches horizontal. If the ganglion is toxic and dangerous, isolation therapy is needed in the reclamation. In other words, to stop the drainage of the toxic and dangerous substance in the gangue, lay the waterproof sheet of clay in the collapse trap. If the collapse does not take form or take shape, the gangue should be set directly in the collapse for reclamation.

That is, forecast the places to submerge and take out the topsoil to pile up around, and then set the gangue as per the projected subsidence depth and scope in advance by the dumping equipment. Finally, when the gangue is full to the expected level, cover the topsoil, which is piled all over on the gangue layer to backfill. For the land retrieved by the gangue and is used for cultivation,

At the foot, the filled gangue should be thick and lose the upper portion in order to retain soil moisture and nutrients to promote plant growth. The handling should be done in compliance with the demand for the gangue reclaimed land which is used for development. The application, groundwater elevation, and flood elevation should decide the elevation of the land reclaimed in collapse. The recovered height of the construction land should usually be higher than the local flood elevation or the original elevation restored. The recovered elevation of agriculture and forestry is often lower than the original elevation to promote the retention of soil moisture, water and fertilizer, as well as the growth of crops, with an eye on the degradation of the surface and the water table after harvest. The reclaimed elevation of farmland and forests in the reclamation area is then determined by the water table. If the reclaimed surface approaches the water table elevation, the water logging resistance of the crops should be verified.

The technical method of reclamation for industrial and mining area filling is seen in Figure 2.

Drainage Reclamation Technology: The ground surface subsidence is often followed by ponding or undischarged water in the diggings that are plain or have a higher water table, hindering cultivation. As follows, surface ponding can be split into two examples.

(1) The flood level of the outer channel is greater than the elevation of the soil and, thus, the water in the failure cannot immediately flow out. To remold the areas for planting, filling reclamation, or exhausting the ponding in the collapse can be added.

(2) The flood level of the outer channel is smaller than the elevation of the soil and, thus, water will flow naturally after the failure. In order to automatically discharge the pond in the failure, an adequate drain system is now needed. Furthermore, if the groundwater table is overtopped, a drainage canal is needed to lower the underwater level in order to maintain normal crop growth.

The architecture of the drainage scheme is the secret to drainage reclamation. Because of the integrality of the water, in the configuration of the drainage system, the condition of the whole mine or even the whole digging should be taken into account to form a full drainage system. We should, therefore, with a global concept, develop the drainage scheme. The drainage system usually consists of a drainage ditch and an impounding unit, a drainage receiver outside the drainage field, and a drainage center. Similar to the extent and effect of the discharge, the fixed drainage ditch channel is broken into four levels. The pool, swag, reservoir, and so on can be impounding facilities, and the drainage ditch can also be used for impounding water. The Science World Journal 5 drainage receiver is the so-called outer river. The drainage center, efficient drainage station, and so on are referred to as the drain valve.

Water Surface and Eco-Engineering Technology: High groundwater mining areas are more likely to have hydrops, so industrial and productive recovery technologies for these regions are planned to integrate water surface usage with environmental engineering. On the one hand, the importance of this technology manifested in that we do not need to spend a large amount of money in removing stagnant water, and on the other hand, in preserving the ecological equilibrium of mining fields, the reserved water surface has tremendous ecological benefit. For starters, for irrigation, the collapse pit may be used for flood storage. The ornamental importance of the water park is ornamental and the scientific use of the water surface is capable of acquiring high economic benefits, and so on[26]. In applying this technology, it should be remembered that ecological engineering technology should be used as much as possible to improve the production of marine animals and plants, thus improving the production potential of the oceans and the productivity of the reclaimed land.

Technology for Complex Pre-reclamation in Industrial and Mining Regions. This technology is primarily used to address reclamation issues in vulnerable areas of collapse[27]. When the fall is not complete and the hydrops has not formed, it is carried out. This technology, designed according to its size, reach, and purpose, consists of two phases:

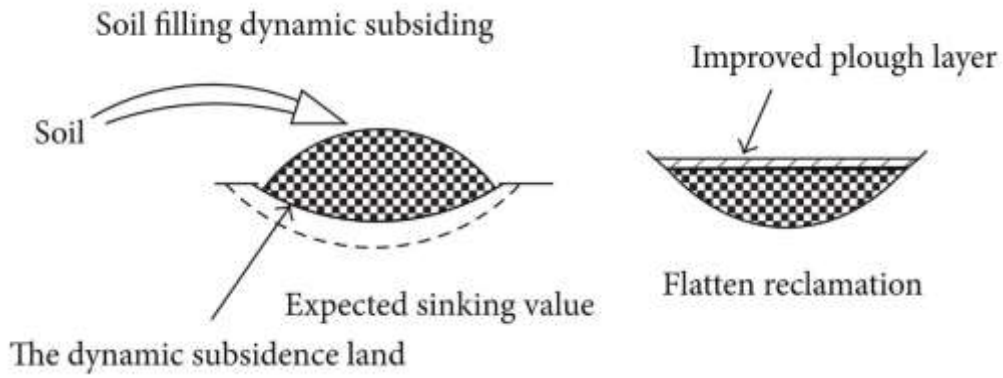

Figure 3: The dynamic pre-reclamation schematic diagram of soil backfilled collapse.[28]

The engineering specification estimate and engineering execution. The engineering design calculation involves the measurement of the predicted deflection, the division of the building area, and the construction parameter determination.

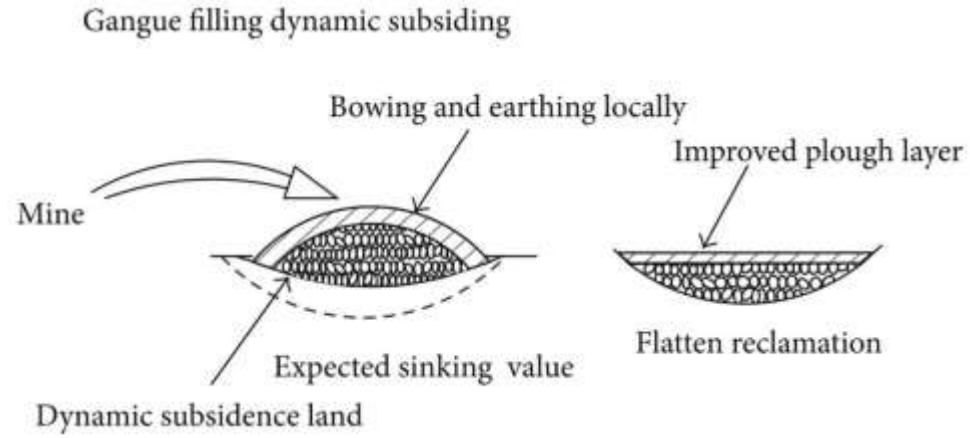

Figure 4: The dynamic pre-reclamation schematic diagram of gangue backfilled collapse.[28]

This technique has the following benefits relative to the widely used technology "destruction first, the government later,": the dynamic pre-reclamation achieves the effective combination of mining and reclamation, minimizing the reclamation supply, shortening the reclamation time, increasing the reclamation gain, encouraging the productive usage of land resources in mining areas. As seen in Figures 3 and 4, the complex pre-reclamation drawing is.

Combing Reclamation Measures with Mineral Engineering: Combining the reclamation measure and mineral engineering will take the following forms: the area with poor conditions for the occurrence of coal seam and the consistency of coal can take the local mining to mitigate the harm to productive farmland. To transport gangue directly to the collapse, create a reasonable method of discharging gangue. In order to minimize the loss on the floor, underground mining should make a successful mining project (such as the mining sequence and mining area partition) to reduce the loss on the floor. In order to reduce the dumping coating and to allow agricultural recovery, the open cast process can optimize the mining technology by casting mining. For coal mine capital building, the mining wasteland can be used as soon as possible.

Usage of post-reclamation technology: The primary mission of biological reclamation is to improve the reclaimed soil and optimize land use. The types and physicochemical properties of the reclaimed soil, material, and technical conditions in diggings should be taken into account in the methodology of improving the reclaimed soil. In addition, the approaches can be paired with planting tactics, too. The land-using technology not only involves the primary determination of land use, but also includes the planting strategy and farming techniques in the soil productivity recovery era.

Conclusion

One of the human footprints that cause drastic changes in the environment is mining. Although it has a significant contribution to the world economy and an indisputable social influence on the life of communities, its devastating negative impacts on the environment cannot be disregarded. In particular, opencast mining operations dramatically change the topography and physical environments of the atmosphere and have an inverse impact on plant life, soil conditions, wildlife ecosystems, and water supplies in the mining area and its immediate surroundings. As a result of the above-mentioned factors, post-mining landscapes lose their previous aesthetic, ecological and socioeconomic values. Unless successful mitigating steps to mitigate detrimental environmental effects are taken, environmental damage can be permanently attributable to opencast mining operations. As addressed within the chapter, the ultimate goal of reclamation is two-fold: i) to sustainably establish the aesthetic and ecological conditions of the post-mining landscape so that it becomes As compliant as it is with undisturbed adjacent lands, and ii) Recovering or improving the land's productive potential and prosperity in order to contribute more effectively to the economic and social welfare of the society. Due to rapid industrialization and economic growth, the size and the content of the problems arising from the negative impacts of mining activities have been changed and become more complicated than ever. Therefore, a multidisciplinary methodology enriched by the latest technical means is strongly needed in order to produce good outcomes in reclamation studies. Of course, there is no “unique” and “magical” reclamation plan that can be directly applied on all post-mining areas, since major determinants in each reclamation study highly differ and depend on the specific characteristics of the site. Additionally, the collaborative and creative involvement of all concerned parties (i.e., state and company officials,local authorities and non-governmental organizations, scientists, engineers and specialists, environmental groups etc.) is crucial for the development of landscape use and reclamation plans that are indefinitely stable. It should also be emphasized that reclamation studies should start at the earliest stages of project growth, begin through extraction, and continue after completion of the process.The role of landscape architects in such studies has recently gone far beyond the “classical” borders of the profession. They also partake in large-scale complex reclamation and reconstruction projects instead of repetitive beautification and site preparation activities, and they even serve as the project team leader by taking advantage of their training and realistic experiences, allowing them to establish more creativity, consolidated, and detailed approaches to the ultimate solution. Legislative challenges in mining and recovery studies are primarily based on the opinions of the governments. However, in order to encourage the productivity and preservation of post-

mining ecosystems and to protect our precious natural resources, in our increasingly developing environment, much more rigorous global standardization of legal measures is needed. Our future relies on what we are doing now and how we connect with nature. Therefore, by extensive and collaborative planning that takes into account all main factors, it is important to sustainably reclaim mine-disturbed lands. Since we borrow from the future, the nature of which we exist.

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