Pit & Quarry Rehabilitation

The State of the Art in Ontario

Ontario

Ministry of Natural Resources

Hon. Alan W. Pope
Minister

John R. Sloan
Deputy Minister

Current publications of the Ontario Ministry of Natural Resources, and price lists, are obtainable through the Ministry of Natural Resources Public Service Centre, Room 1640, Whitney Block, 99 Wellesley St. West, Toronto, Ontario M7A 1W3 (personal shopping and mail orders).

And:

Personal shopping: Ontario Government Bookstore, Main Floor, 880 Bay St., Toronto.

Mail orders: MGS Publications Services Section, 5th Floor, 880 Bay St., Toronto, Ontario M7A 1N8. Telephone 965-6015. Toll free long distance 1-800-268-7540, in Area Code 807 dial 0-Zenith 67200.

Cheques or money orders should be made payable to the Treasurer of Ontario, and payment must accompany order.

Pit & Quarry Rehabilitation
The State of the Art in Ontario

Printed in Ontario, Canada

Ontario
Ministry of Natural Resources

Hon. Alan W. Pope
Minister

John R. Sloan
Deputy Minister

"There is a basic conflict between the need for an adequate supply of essential construction aggregates, and the desire of many residents of the community that no extractive industry be established. The most moderate and equitable solution of the problem would seem to be stricter control of the siting, operation and *rehabilitation of pit and quarry sites*, and a fostering of the growing desire among the aggregate producers to improve their public image."

D.F. Hewitt and M.A. Vos, 1970

Introduction

Ontario residents enjoy one of the highest standards of living in the world. This is largely due to the province's abundance of natural resources such as trees, water, farmland and mineral deposits. Mineral aggregate (sand, gravel, and crushed stone) is one of the most important of these resources; supplying an essential material to Ontario's construction industry.

Mineral aggregate is the main component in concrete, mortar and asphalt pavement as well as the main source of foundation or fill materials for highways, buildings and structures such as dams and bridges. As everyone knows our towns and cities would not exist in their present state if these materials had not been available.

In 1981, alone, 92 million tonnes or 11 tonnes per person, of mineral aggregate were produced in this province. Half of this went into the construction, repair and maintenance of roads while most of the remainder went into the construction of buildings and structures of all kinds.

Supplying mineral aggregate to Ontarians requires the establishment and operation of pits and quarries to remove this material. Pits are excavations required for sand and gravel whereas quarries are excavations made into bedrock to obtain crushed stone. Pits and quarries are located as close to the marketplace as possible (i.e. next to cities and towns) so that the transportation costs to supply aggregate are as low as possible.

In recent years some people have expressed serious concerns that the presence of these excavations could negatively affect our quality of life through such means as noise, dust, truck traffic and disturbing the scenic beauty of the landscape. In fact, in certain high production areas, where insufficient regard was given to the environment in the past serious problems have occurred.

It is obvious, therefore, that the management of this non-renewable resource requires the understanding and cooperation of government at all levels, the aggregate industry and the public in general. Aggregate is vital to the province's economy but it must be developed with minimum physical, environmental and social disturbance. As will be discussed in the remainder of this booklet, rehabilitation is a process that is one of the basic methods of minimizing these disturbances and gaining public acceptance.

Aggregate operation in Uxbridge Township.

Rehabilitation

What is it?

Contrary to popular belief, a pit or quarry does not need to represent a loss of useful land to the community. If done responsibly, a pit or quarry need only be an interim use of land where valuable aggregate material is removed for the good of the province. Once the aggregate material is removed the land can be returned to a productive after use through rehabilitation.

Rehabilitation is the treatment of land from which aggregate has been excavated so that the use or condition of the land,

- is restored to its former use or condition, or
- is changed to another use or condition that is or will be compatible with the use of adjoining land.

The process of rehabilitation will, of course, vary from site to site in accordance with the special needs and characteristics of the particular pit or quarry, the surrounding land use and municipal land use planning controls. However, nearly all rehabilitation projects should include four essential steps.

- Storage of Topsoil, Subsoil and Overburden:
  Prior to commencing aggregate extraction, all the topsoil and sufficient amounts of subsoil and overburden material should be stockpiled for future rehabilitation needs. The topsoil should be stored separately from the subsoil and overburden.
- Grading:
  All steep slopes of a pit or quarry should be graded to gentle slopes.
- Topsoil:
  Topsoil that should have been stored in a separate stockpile prior to starting the excavation should be spread over the pit or quarry when grading is completed.
- Vegetation:
  The site should be revegetated as quickly as possible to prevent erosion and to hasten the establishment of an aesthetic vegetation cover.

The art of rehabilitation has already advanced to a high degree in Ontario. In fact, many sites are rehabilitated so well that they are scarcely recognizable as former pits or quarries. In addition, new approaches and techniques are steadily improving the aggregate industry's ability to carry out rehabilitation.

Progressive rehabilitation refers to rehabilitation done sequentially during the period that aggregate is being excavated. The Ontario government is actively encouraging the use of progressive rehabilitation for two reasons. Firstly, it keeps visual conflict with the surrounding landscape to an absolute minimum and secondly it reduces both the time and cost of rehabilitation. In comparison to the rehabilitation of a fully extracted site, the cost for progressive rehabilitation can be substantially less because of the ready availability of heavy equipment and because overburden and topsoil need not be moved as far or as often. In this way the actual area used for extraction is kept to a minimum. For progressive rehabilitation to be less expensive it is incumbent on other factors to be considered such as the location of the processing plant and truck routes on the site.

A special land use concept relating to rehabilitation is referred to as *sequential land use.* This is a practice in which mineral aggregate resources are removed immediately before an area is built over by incompatible uses such as a residential subdivision which would otherwise sterilize the aggregate resource. This concept can be put into practice most often in cases where an urban municipality is expanding into an urban fringe area having valuable aggregate resources.

Site being progressively rehabilitated to agriculture (TCG, Brantford).

Legislation

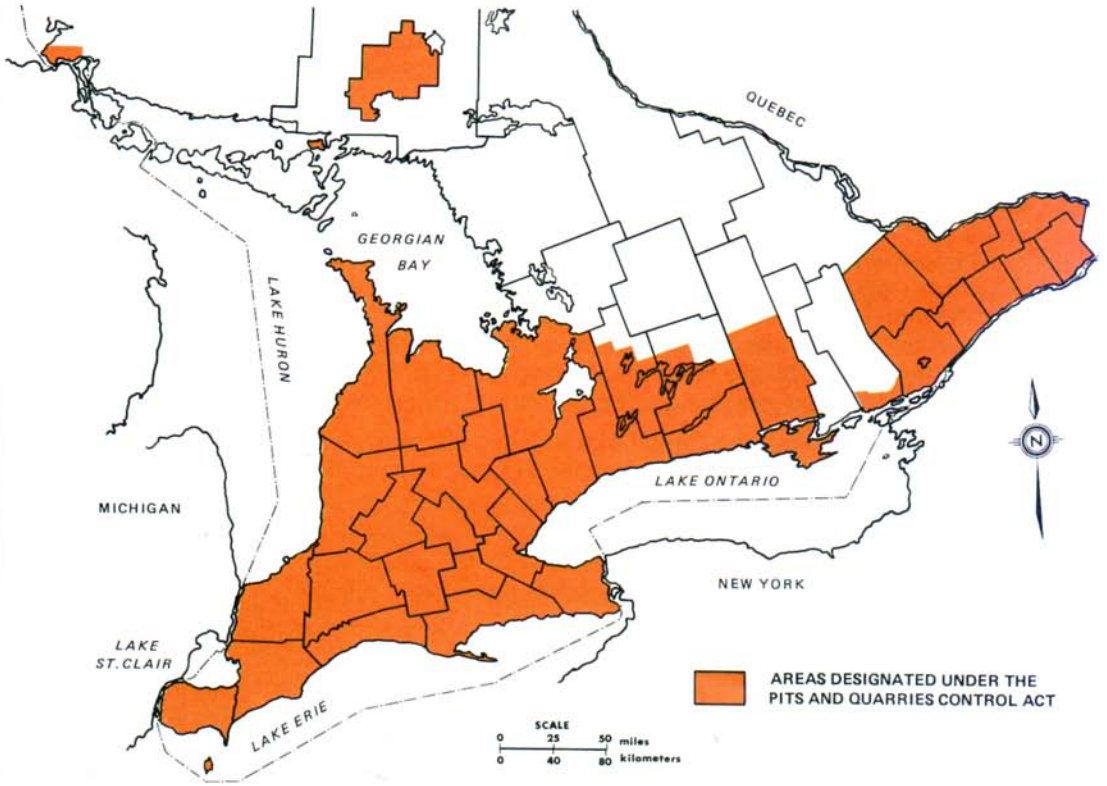
The Pits and Quarries Control Act was passed in 1971 by the Ontario Legislature. The intent of the Act was to regulate the operation of pits and quarries and provide for their rehabilitation. At present 404 geographic townships are designated as areas to which the Act applies. The municipalities are located in southern Ontario and parts of northern Ontario where both production and population are concentrated. Responsibility for the administration of The Pits and Quarries Control Act rests with the Ministry of Natural Resources.

All commercial aggregate operations require a licence to extract. The licence application must be accompanied by a site plan which shows proposed rehabilitation. Regulations under the Pits and Quarries Control Act require a security deposit equal to 8 cents per tonne of material removed from the property be paid to the Province. Payment into the fund must continue until such time as the licensee has a minimum of $1,000 on deposit per hectare of land requiring rehabilitation. Any surplus over and above the minimum amount required may then be claimed for expenses incurred in the rehabilitation of the site. If rehabilitation is not undertaken, payment must continue to a maximum of $3,000 per hectare requiring rehabilitation. Once rehabilitation is completed any surplus remaining in the security deposit is refunded to the producer.

Operations required on a short term basis for a specific municipal or provincial public project such as road construction are called wayside pits and quarries. A wayside permit rather than a licence is issued for these operations. In an attempt to minimize costs to the taxpayer for these smaller operations, rehabilitation requirements are less demanding and usually consist of sloping and revegetation.

Despite a number of excellent examples of rehabilitation occuring throughout Ontario, The Pits and Quarries Control Act has not been totally successful. Consequently, new, stricter legislation entitled The Aggregates Act is awaiting legislative approval. Among other things, the new legislation and its regulations will provide for an increase in the quality and quantity of rehabilitation, including the rehabilitation of abandoned pits and quarries. The Pits and Quarries Control Act has no provisions for dealing with such abandoned sites. However, under the new Act provision has been made for an abandoned pit and quarry rehabilitation fund. This money will come from the operators annual licence fees. It is believed that this fund will remedy the problem of abandoned pits and quarries in less than ten years.

* This section is written for general information purposes only. For complete information on provincial legislation reference should be made to the appropriate provincial statute.



Site Planning

The initial process in any rehabilitation program is site planning. This involves the planning and programming of extraction activities and after use design, in advance of any extraction. Under the licensing process of both The Pits and Quarries Control Act and the proposed new legislation, a site plan must be filed.

According to The Aggregates Act a site plan should be divided into three distinct parts:

- Existing Features
- Operational Plan
- Rehabilitation Plan

The value of a site plan is that it guides the direction and manner of excavation and rehabilitation so that the operator can plan the most efficient use of machinery and manpower. A lot of unnecessary work and expenses such as double handling of top-soil and overburden material can be avoided if a site plan is used.

With the definite plan of action provided by a site plan, an operator knows where to store topsoil and overburden so that it does not have to be moved again until required for rehabilitation. Also grading and filling can be achieved effectively in an aggregate depleted area of the pit or quarry, while extractive operations are carried out in another area.

By knowing the proposed plan for rehabilitation, the operator can carry out grading operations that will achieve the proposed after use, many years in advance of the actual final rehabilitation.

Choosing An After-Use

Perhaps one of the most difficult exercises in the rehabilitation process is choosing an after use.

The operator, however, can receive some guidance from the following considerations.

Characteristics of the Pit or Quarry

The characteristics of pits and quarries can vary a great deal in respect to such things as depth of excavation, amount and type of topsoil and overburden, presence of water, shape of aggregate deposits and amount of total area. Certain characteristics will suggest possibilities for certain types of after use activities and eliminate the possibilities of others. For example, if a pit or quarry is excavated below the water table, a land use requiring the presence of a lake or pond should be considered.

Surrounding Land Use Pattern

Since rehabilitation sites should blend in with the surrounding landscape, it is obvious that the surrounding land uses will have a significant bearing on what are the most appropriate types of after use. A pit or quarry immediately adjacent to a town, for example, is an ideal candidate for residential, commercial or industrial development whereas an operation surrounded by good farmland would be better suited for agricultural use.

Municipal Zoning

Any proposed after use must conform to municipal official plans and by-laws. It is paramount, therefore, to determine prior to choosing an after use that the proposal complies with municipal official plans and zoning by-laws or that municipal council is willing to amend their planning documents to permit the proposal.

It is often impossible to determine one specific after use where extracting operations may continue for ten or more years. However, with a site plan, it is possible to shape the land to accommodate a wide range of possible after uses.

The Steed and Evans site west of Fonthill has been progressively rehabilitated since 1970 to a golf course; fourteen holes have now been completed.

Site rehabilitated to agriculture in Whitchurch-Stoufville.

Regional Municipality of Waterloo pit rehabilitated to agriculture in North Dumfries Township: crop of alfalfa.

Agriculture

Good agricultural land is every bit as important to Ontario's economy as mineral aggregates. Therefore, where pits or quarries occur in good farmland, the aggregate producer has a special responsibility to see that his operation is returned to productive agricutural activities.

It has already been demonstrated in many parts of Ontario that valuable farmland does not have to be permanently lost to aggregate extraction. Wheat, barley, oats, soybeans, corn, alfalfa, clover and sour cherry tree orchards have all been successfully grown in Ontario on fields rehabilitated from pits and quarries. Cattle, sheep and horses presently graze on pasture lands that were once sites for aggregate extraction.

It has been proven that through careful rehabilitation agricultural lands can be returned to their original productivity. There are, however, several important rehabilitation techniques that apply particularly to agricultural rehabilitation:

- Topsoil should not be stockpiled any longer than necessary. After some time, stockpiled topsoil can begin to lose its structure and nutrient value. Progressive rehabilitation techniques should therefore be employed so that the time that any particular topsoil is stockpiled is kept to a minimum.
- Stockpiling practices should be carefully carried out to ensure that topsoil is stripped and stored separate from the remaining subsoil or overburden. In this way topsoil can be returned to the site uncontaminated by less fertile layers of the soil.
- For the first several years, crops introduced to a rehabilitated site should be of a type that are soil binding and nitrogen fixing. Legume species such as clover, alfalfa, birdsfoot trefoil and crownvetch have proven excellent in this respect. Corn is an especially undesirable initial crop species because it badly depletes nutrient content and as a row crop, it is susceptible to erosion.

In spite of past accomplishments, it is recognized that new research into this important type of rehabilitation is absolutely necessary. A study recently conducted at the University of Guelph evaluates past efforts in agricultural rehabilitation in Ontario, and details procedures and techniques for the successful rehabilitation of extracted sand and gravel lands to productive agriculture. Funded by the Ministry of Natural Resources, this study has been published in the form of a guidebook to assist operators interested in undertaking agricultural rehabilitation. Some aggregate producers are also conducting research in an attempt to find out what grasses and crops grow best on rehabilitated pits and quarries.

It is interesting to note that in certain areas of the farming community rehabilitation has actually improved the capability of the land for agriculture by sloping a site to more ideal conditions for drainage and use of farm machinery. Also since sand and gravel have low moisture retention characteristics, removal of this material down to a finer grained subsoil can improve the moisture holding capacity of the soil and improve its value for crop production.

The St. Mary's swimming pool is a former quarry situated within the town limits.

This rehabilitated pit is in Uxbridge Township, northeast of Toronto (Standard Aggregates).

Recreation

Rehabilitation to recreational land uses has historically been one of the most frequent and popular after uses.

This is especially true in sites where the extraction has gone below the water table and a lake or pond has been formed. In certain areas of southern Ontario where natural inland water based recreation facilities are otherwise lacking, the presence of a water filled pit or quarry has proven to be an invaluable resource to the community.

The important thing to keep in mind is that a site rehabilitated to recreation represents a facility that would not otherwise exist because it would be prohibitively expensive to produce without the economic returns provided by the aggregate material.

Golf courses are another very popular after use choice since they are in relatively high demand and the topographic possibilities provided by a pit or quarry can be used to produce attractive and challenging courses.

Recreation choices for rehabilitation are endless. Consider for example the large variety of recreation facilities that have been provided through rehabilitation such as conservation areas, parks, playgrounds and playing fields of all kinds.

Forestry

Rehabilitation to a forestry after use is proof positive that rehabilitation need not be an expensive or complex process. In many situations all that is required for forestry rehabilitation is to slope off pit faces and plant trees.

In cases where topsoil is at a premium or no longer available, reforestation may be the most suitable option using hardy tree and shrub species. For best results reference should be made to a recent publication based on research undertaken at the University of Guelph Arboretum and funded by the Ministry of Natural Resources. This report is entitled "Trees and Shrubs for the Improvement and Rehabilitation of Pits and Quarries in Ontario". This publication provides guidance on selecting the most appropriate tree and shrub species and also provides advice in proper care and maintenance practices.

An earlier and less detailed booklet entitled "Vegetation for the Rehabilitation of Pits and Quarries" is also a handy reference in that it also provides information on grasses and legumes.

By choosing the best suited species for a certain type of terrain and undertaking the appropriate care of them the survival rate of seedlings will be improved greatly.

In areas of sandy terrain unsuitable for agricultural production, rehabilitated sites can provide excellent opportunities for tree farming.

Wildlife flourishes in this nature area Paris, Ontario while extraction continues nearby (Standard Aggregates).

This subdivision in the hamlet of Mono Mills, east of Orangeville, was built without sterilizing valuable resources; the aggregate was extracted first.

Natural Areas

Rehabilitation to natural areas essentially constitutes providing habitat for wildlife.

The interesting thing about habitat rehabilitation is that habitats for wildlife can often be improved over what they were previous to excavation taking place.

This is especially true in wet extraction sites where formerly dry excavation sites are supplied with water once the pit or quarry intersects the water table. Biologists inform us that the presence of water not only enhances the habitat quality for existing species but encourages the arrival of new species of plants and animals.

In addition, during rehabilitation, shrubs can be introduced that provide valuable food sources for wildlife species at a faster rate and in greater numbers than natural reseeding could achieve.

Where a lake or pond was created by aggregate extraction, special care should be taken to ensure that the water body is designed for the maximum benefit of fish and wildlife. Creation of gentle slopes into the water body will promote the growth of aquatic vegetation required for the resting and feeding of fish and waterbirds. In deep ponds the backfilling of overburden may be necessary to achieve the desired slope. As well, deep holes should be provided in a pond for fish species to lie in through the hot summer months.

Housing

Rehabilitation to housing often occurs in areas adjacent to existing urban communities or in scenic areas of the countryside. Estate residential subdivisions have been established on former pits where creative and imaginative landscaping has created attractive homesites for country dwellers.

This form of rehabilitation is understandably quite popular because of its ability to provide high economic returns to the aggregate producer. Rehabilitation of this type should, however, be approached cautiously since the pressure of this type of development next to nearby mineral aggregate deposits could cause land use conflicts when an aggregate producer wants to extract the adjacent material.

Aggregate rich lands destined for housing development should not of course be built on until the valuable mineral aggregate has been extracted. This practice represents sequential land use.

Rehabilitation in Urban Areas

In highly urbanized areas rehabilitation usually takes place without the influence of legislation. This is presumably because of the high demand and potential of urban land for other uses.

Many of these sites are not even recognizable as former pits and quarries. A study prepared for the Ministry of Natural Resources (Yundt and Augaitis, 1979) revealed that sixty seven of some eighty two past extractive operations in Metropolitan Toronto have been completely rehabilitated. The rehabilitated uses represent a thorough cross section of typical land uses, found in Toronto with residential and recreation after uses predominating.

Similar analogies can likely be found in other urban areas.

Smythe Park in Toronto's west end received the 1977 Aggregate Producers' Association of Ontario Rehabilitation Award.

This booklet is not suggesting that rehabilitation is the answer to all of society's problems with pits and quarries. However, rehabilitation is an integral component in the overall management approach that must be adopted if we want to continue using pits and quarries and continue enjoying the positive economic benefits that mineral aggregate provides.

The establishment of pits and quarries without regard for rehabilitation represents little more than shortsightedness; showing little respect for the value of land, the residents of Ontario or the richness and bounty that nature has bestowed on this province.

References

Bauer, A.M. *A Guide to Site Development and Rehabilitation of Pits and Quarries*. Industrial Minerals Report 33. Ontario Department of Mines. Toronto, 1970 ($1.25).

Coates, W.E. and Scott, O.R. *A Study of Pit and Quarry Rehabilitation in Southern Ontario*. Ontario Geographical Survey. Miscellaneous Paper 83. Ministry of Natural Resources, 1979 ($2.00).

Hewitt, D.F. and Vos, M.A. *Urbanization and Rehabilitation of Pits and Quarries*. Industrial Minerals Report 34. Ontario Department of Mines. Toronto, 1970 ($0.50).

Lowe, S.B. *Trees and Shrubs for the Improvement and Rehabilitation of Pits and Quarries in Ontario*. Ministry of Natural Resources, Toronto, 1980 ($2.00).

Mackintosh, E.E. and Mozuraitis, E.J. *Agriculture and the Aggregate Industry: Rehabilitation of Extracted Sand and Gravel Lands to An Agricultural After-Use*. Ministry of Natural Resources, Toronto, April, 1982 ($2.00).

McLellan, A.G., Yundt, S.E. and Dorfman, M.L. *Abandoned Pits and Quarries in Ontario*. Ontario Geological Survey. Miscellaneous Paper 79. Ministry of Natural Resources, 1979 ($2.00).

Ministry of Natural Resources. *Vegetation for the Rehabilitation of Pits and Quarries*. Forest Management Branch. Division of Forests. Toronto, 1975 ($0.50).

Ontario Mineral Aggregate Working Party. *A Policy for Mineral Aggregate Resource Management in Ontario*. Ministry of Natural Resources. Toronto, 1977 ($3.00).

Yundt, S.E. and Augaitis, D.B. *From Pits to Playgrounds*. Aggregate Extraction and Pit Rehabilitation in Toronto — an Historical Review. Ministry of Natural Resources. April, 1979 ($2.00).

For further information, any of these publications may be obtained from:

Public Service Centre
Ministry of Natural Resources
Room 1640, Whitney Block
Toronto, Ontario
M7A 1W3

Please make cheque payable to Treasurer of Ontario

5830
(5 k P.R., 84 01 10)
Rev.
ISBN 0-7743-8937-0