Lesson 4: Aggregates and Fill

Overview

Of the many geological resources outlined in the first two lessons of this Module, aggregates (sand and gravel) and ordinary fill are most often of interest and value to woodland owners.

If you are interested in aggregate resources, there are some questions that you should consider answering, including:

- Are these resources present on your land?
- If they are present, do you require these materials for your own use, or do you wish to sell them?

Local contractors who have experience developing and extracting aggregate resources could help you determine your options. In addition, the Department of Natural Resources, Geoscience and Mines Branch, can assist you in understanding local geology and resources. You could also hire a geologist to visit your property and provide you with advice.

Prior to initiating an aggregate extraction operation, some background information can prove useful. You should think about:

- The potential value of the resource you are extracting; and
- Which provincial regulations are applicable and which best practices you or a contractor should follow to protect the environment? Are the resources of an adequate quality for intended purpose?
- If a **quarry or pit** will be greater than four hectares, you must complete an environmental assessment and consult with the local community as part of the permitting process. Reclamation plans (restoration of the site) following closure of a quarry must also be discussed. Community members will also have opportunities to comment on proposed projects during the environmental assessment phase.

Figure 39. Community meeting.

Similar to any woodland activity, planning is a critical component of quarry development. It is essential to adequately consider all stages of a proposed operation to avoid unintended consequences.

Developing an Aggregate or Fill Operation

How to prepare for an aggregate operation on your land depends on the geology of the site. If deposits of sand, gravel or fill are at or near the surface, extraction may be straightforward. If high quality bedrock is present for quarrying,

you may need to use explosives, which initiates a distinct series of regulations. As an example, the setback or distance from the blast and quarry face must be at minimum of 800 metres from the nearest structure, such as a house, cottage or school. The setback can be reduced if the owners of structures within 800 metres give written consent for blasting. See the Nova Scotia Pit and Quarry Guidelines for more information on blasting: **novascotia.ca/nse/dept/docs.policy/Guidelines-Pit-and-Quarry.pdf**

Seek advice if you have no experience in the aggregate quarrying industry. All quarries must be approved by Nova Scotia Environment. Quarries and pits larger than four hectares must go through an environmental assessment process to receive approval.

Geology consultants may be able to assist you with obtaining permits and starting the quarrying process, or an existing company might be interested in the resources on your land. Companies will sometimes pay the landowner for access to resources, depending on location and demand; they may also test your land for aggregate quality.

Figure 40. Quarry and equipment.

Sand and gravel deposits or ordinary fill are usually easier to develop because they are frequently accessible at the surface. Operations less than two hectares in area do not require government approval. In addition, they often require less processing equipment and excavation activities are less regulated. On the other hand, while sand, gravel and fill excavation might be relatively simple, the size of deposits is often limited and an operation may have a shorter lifespan than a bedrock quarry.

Bedrock quarries less than two hectares in area still require approval and compliance with the Pit and Quarry Guidelines. The Guidelines provide direction on criteria such as acceptable noise and dust levels, setbacks from watercourses and liquid discharge from the site.

Best management practices (BMPs) are guidelines recommended for safe and efficient operations. BMPs protect the environment and help promote the social and economic factors of an operation. Seek advice when you need assistance in understanding operational procedures.

When in doubt, seek advice from a professional geologist or engineer!

Following Best Management Practices

Best management practices will help you protect the environment, your neighbours, your land and your investment. Controlling dust, noise, soil erosion and stream siltation while protecting groundwater resources can be challenging during excavation operations.

Sensitive sites and habitats, such as riparian zones, species-at-risk habitat and rare landforms, should be identified during the planning stages and avoided during operations. A NSDNR Regional Biologist can provide you with more information, and other lists are available which can assist you in identifying these areas.

Figure 41. Bedrock quarry and equipment.

EROSION CONTROL

Removal of topsoil to access other resources can result in wind and water erosion of both the topsoil and exposed sub-soil. Where watercourses are nearby, sediment may enter the water and make it unsuitable for aquatic life.

Because topsoil is valuable and contains the richest layer of living organisms in the soil, it is important to protect it from erosion and degradation. Cover topsoil as soon as possible after removal and when operations are finished. Treat it like the living blanket it is.

Protecting sub-soil from erosion and moving off-site can be challenging. Both sheet-plastic barriers and straw bales can be placed downhill from exposed sub-soil to intercept runoff. Sediment pits and crushed aggregate barriers can be constructed in drainage ditches to trap sediment.

SURFACE WATER PROTECTION

Settling ponds can be used to collect surface water before it moves off the site. These ponds can also be used to capture sediment-laden water from aggregate screening or washing activities. Avoid disturbing natural runoff channels: these are often the best conduits for moving water; blocking or diverting them could create problems.

It is essential to prevent sediment entering watercourses, both during an operation and afterwards. Damage can occur even after an operation is finished and equipment has been removed. Heavy rain events can easily overwhelm barriers and move straw bales from their original locations. For this reason, erosion barriers should be inspected on a regular basis, and checked more frequently during unstable weather.

Diversion of natural occurring watercourses and filling in wetland is illegal without a permit from Nova Scotia Environment. It is required to stay at least 30 metres from any watercourse when operating. A setback of 100 metres is a good practice in building woodland roads, and is a good policy for any operation when bare mineral soil will be exposed.

Figure 42. Proper road construction is essential in controlling erosion.

Re-establishing vegetation as soon as possible will help reduce erosion in the long-term. Generously scattering hay on exposed soil often helps, but hydro-seeding with highway mix or other seed combination is an even better approach.

More information about controlling runoff and soil erosion can be found in *NSDNR Home Study Module 11 - Roads and Trails: Planning it Right from the Start.*

Figure 43. Erosion and dust can be reduced by placing straw in critical areas.

DUST CONTROL

Dust from mining and excavation operations can travel significant distances. It can be generated as wind passes over exposed and stockpiled soil. Dust is created when loading trucks or screening aggregate, and when heavy equipment is moving around a site.

Dust control should be a practice in every mining and excavation operation. Best practices include lowering truck speeds, covering lose material with straw and planting grass seed where possible, using dust covers or water sprinklers while screening or transferring loose material, maintaining treed buffer zones around the perimeter of an operation will assist in preventing dust from leaving your property. Trees are both visually appealing and help maintain the health of ecosystems.

Figure 44. Hydro-seeding exposed soil and subsoil can reduce dust and soil erosion.

NOISE CONTROL

Heavy equipment such as excavators, loaders, trucks and processing equipment create noise, which can generate issues in a community and with the owners of neighbouring properties.

Noise often travels farther when operations are situated on higher ground. Noise can be reduced by leaving treed buffers and by constructing earth barriers, or berms. In some rural areas, background noise from roads and highways may help mask noise from a sand and gravel or fill operation. Close proximity to residential areas may require greater efforts in noise suppression.

GROUNDWATER PROTECTION

Extra care should be used to prevent groundwater contamination. Gravelly and sandy areas are particularly susceptible to water contamination from fuel or oil spills.

The groundwater table in much of Nova Scotia is often close to the surface. It is likely that the water table will be reached during excavation for resources. Equipment operators must be diligent in preventing fuel and fluid leaks.

Best practices specify that

- excavation equipment is in good repair and that regular checks are maintained on hydraulic lines and other potential sources of fluid; and
- the construction and maintenance of a concrete or clay-lined pad to refuel and repair equipment.

SITE RECLAMATION

The restoration of a mining or excavation site to productive land use should be a primary consideration of every landowner. Before excavation begins, planning should commence for site reclamation. In particular, exposed mineral soil can be challenging to manage once wind and water erosion has begun, so it is prudent to plan for weather events and erosion well in advance of them.

Once a site has been worked to its capacity, reclamation activities can be initiated. Water management is a primary consideration of reclamation.

Operators often excavate close to the water table and then outwards to avoid coping with water issues. This practice could be problematic during site reclamation. If the landowner plans to create a pond or small lake, sufficient water is required to support such an ecosystem. While deep pits can provide ponds with good fish habitat, shallow excavations may create seasonal ponds.

Reclaiming an excavated site to woodland requires extensive planning and preparation. Planting trees and establishing ground vegetation is a long-term endeavour which demands commitment and resolve.

A reclaimed site must contain enough soil to support the growth of newly planted trees. Topsoil removed during the initial stages of the excavation should be replaced as soon as possible. This will conserve beneficial fungi and other organisms in the soil, and assist in re-establishing a healthy soil organic layer.

Other uses for reclaimed pits and excavations include:

- Pond for aquatic habitat and/or fire pond, where design, area and depth are key considerations;
- Habitat for upland bird species, which require digestive grit and dusting areas;
- Recreational site, used for hiking trails, birding, fishing or mountain biking.

Figure 45. Urban park in a reclaimed sand and gravel pit, Truro, N.S.

Consideration should also be given to reclaiming a pit as it grows in area. This is called progressive reclamation, and there are several reasons why you should consider this management practice. The primary advantage is the area of disturbance is limited. This will assist in:

- reducing compaction by limiting equipment traffic;
- limiting exposure to the elements;
- promoting the establishment of new vegetation, which will stabilize the site and improve aesthetics;
- reducing the cost of follow-up remediation. Less exposure to the elements means that dust, water drainage and erosion are easier to control. In addition, the cost of site reclamation is spread out over the life of the pit operations, avoiding a large single cost when your operation ends.

Getting Started in Aggregate and Fill Operations

1. Visit the Department of Natural Resources in person or go to its website to review bedrock and surficial geology maps to learn about potential resources in the area at: **novascotia.ca/natr/meb/geoscience-online/maps-gallery.asp**. A good next step is to contact the Department to speak with a geologist or contacting a consulting geologist with knowledge about aggregates, fill and regulations to learn more about a specific area.
2. Walk the property and take note of the land surface and materials on the land. A geologist can provide on-site advice and help determine if there are resources that can be developed. Things to think about:
   - Is the land fairly smooth or rough?
   - Are there wet areas?
   - Does the land seem to be covered with soil and other surface deposits or are there lots of boulders and/or rock at the surface?
   - Are there road cuts where it is possible to see the surface materials and how thick these materials might be?
   - Are the surface deposits sandy or clay-like?
   - Are there aggregate or fill operations in the area already?
3. Talk to people in the area that are involved with road construction, well drilling and excavation – they may have valuable information about depth to bedrock and conditions in the area.
4. Visit Nova Scotia Environment in person or by website to review the Nova Scotia Pit and Quarry Guidelines at: **novascotia.ca/nse/ea/docs/ea.guide-registrationdocumentation-pitquarry.pdf**. The guidelines cover minimum distances needed from property boundaries, highways and neighbours (setbacks). They also provide guidance on noise levels, dust and liquid discharge. Setbacks are critical to consider during the planning stage because they help to determine if a property is large enough to support a pit or quarry operation. The following points provide general guidance on the initial stages of an operation; it is not a complete list, does not cover every situation and is not provided for legal advice. Each operation is different, and Nova Scotia Environment should be contacted for assistance in understanding the guidelines which apply to a specific situation.

continued on next page...

continued from previous page...

Getting Started in Aggregate and Fill Operations cont...

The *active area or working face* of a pit or quarry must be at least 30 metres away from the bank of any watercourse or ordinary high water mark.

- The *active area or working face* of a pit or quarry must be at least 30 metres away from the boundary of a public or common highway (unless written permission is granted by the Department of Transportation and Infrastructure Renewal.
- The *active area or working face* of a pit or quarry must be at least 30 metres from the property boundary.
- The *active area or working face* of a pit must be at least 90 metres away from the foundation or base of a structure (house, cottage, school, etc.) located off site (unless written consent is granted by all individuals owning structures within 90 metres).
- In a quarry operation, blasting must be at least 800 metres away from the nearest foundation or base of a structure (house, cottage, school, etc.) located off site (unless written consent is granted by all individuals owning structures within 800 metres).

5 Once the initial research is done, a decision must be made regarding what type of operation is suitable for the property, based on geology and location. Following is a general summary of the environmental permit requirements:

- A sand and gravel, ordinary fill or slate pit (no blasting) that is less than 2 hectares in size does not need an approval but the Pit and Quarry Guidelines must be followed.
- A sand and gravel, ordinary fill or slate pit (no blasting) that is greater than 2 hectares in size but less than 4 hectares requires an Industrial Approval from Nova Scotia Environment.
- A sand and gravel, ordinary fill or slate pit (no blasting) that is greater than 4 hectares requires an Environmental Assessment and subsequent Industrial Approval from Nova Scotia Environment.
- A topsoil operation less than 1 hectare does not require an approval but an operation greater than 1 hectare requires an Industrial Approval. The Pit and Quarry Guidelines must be followed.
- Quarries less than 4 hectares require an Industrial Approval.
- Quarries greater than 4 hectares require an Environmental Assessment and an Industrial Approval.

Quiz 4

1 All rock quarries require approval from Nova Scotia Environment. ☐ **True** ☐ **False**

2 Any bedrock source of aggregate is suitable for making concrete. ☐ **True** ☐ **False**

3 Nova Scotia aggregate is only used for local road building and concrete production. ☐ **True** ☐ **False**

4 Sand and gravel operations larger than 2 hectares are regulated under the Mineral Resources Act. ☐ **True** ☐ **False**

5 Provincial approval is not required to remove fill as long as the size of the pit is less than 2 hectares. ☐ **True** ☐ **False**

6 The Nova Scotia Pit and Quarry Guidelines only apply to pits more than 2 hectares in area. ☐ **True** ☐ **False**

7 Placing straw on exposed soil helps to prevent soil erosion. ☐ **True** ☐ **False**

8 A silt collection pond is the only way to protect streams and rivers from siltation. ☐ **True** ☐ **False**

9 Leaving vegetation buffers helps reduce dust leaving your pit operation. ☐ **True** ☐ **False**

10 It is best to delay site reclamation until a sand and gravel operation is ready to close. ☐ **True** ☐ **False**

Case Study – Part 3

When Mattie told Thomas about the company's call, Thomas was skeptical. "Why should we allow some company to walk all over our property? What if they found something? Could we lose control of everything?" Mattie wasn't certain, but Sam said no exploration would be started without their permission.

Mattie was divided. On one hand, she enjoyed the fact that Thomas had taken an interest in the property, and that he was keen to develop a sustainable supply of wood products from the woodland. One the other hand she wondered if the prospect of finding a mine on their land could benefit them in the future.

True to his word Sam returned – this time with maps of the area, indicating where many of the old diggings were located. "My father was a prospector in those days," he indicated to Mattie and Thomas, rolling the maps on the kitchen table. "He was convinced all the conditions were ideal for a gold deposit in this area, but could never find it. With the price of gold these days, many companies are looking at old gold discoveries to see if they can be developed," Sam added ruefully.

Thomas was intrigued. Talk about gold was sharpening his interest in all things geological. He studied forest soils and the material beneath them but had not seriously considered there may be more value in the woodland than what was growing on the surface. Near the end of the meeting with Sam, he explained in some detail what types of exploration surveys North Star was planning. "We will walk the streams, the woodlot and roads taking rock and soil samples to be analyzed for gold and other elements. If the results are interesting, we will then conduct drilling to further assess the property. He also explained that the sampling activities would have no effect on their land as no machinery is used other than trucks or ATVs to access the property. Sam said that "if drilling was proposed they would create an agreement to address any impacts to their land, measures to fix any issues and possible compensation.

Those white quartz rocks he had steered the old tractor around now seemed much more interesting. But he still wished he had a proper woodland road.