

Meet Wanda: Wanda wonders about WHY pits and quarries are needed and HOW they operate.

Everything we eat, drink, work and play with comes from the earth. That includes the materials we use to build our communities. Did you know some of the most important materials for building our communities are stone, sand and gravel – aggregates – that come from the earth? The roads we drive on, the arenas we skate in and the schools we learn in are built from stone, sand and gravel all from the earth.

Pit

Sand and gravel left behind by glaciers provides some of what we need to build our communities. Glaciers used to cover most of the earth. A glacier is a river of ice. As it moves it pushes millions of tonnes of earth. The freezing, thawing and scraping of the glacier breaks up the earth underneath it. When it melts, glaciers leave behind 'deposits' of sand and gravel. It is this sand and gravel that is dug out in a pit and sold to construct our roads, bike paths, homes, swimming pools, and shopping malls.

Quarry

A quarry makes stone from the solid bedrock of the earth's crust. In a quarry, the glaciers have not done our work for us. Explosives are used to remove the solid rock.

A licence is required in order to establish a Pit or a Quarry. In order to get a licence:

- There must be stone, sand or gravel (resources) in the location.
- The resource must be good enough to use for construction.
- There must be a plan for how the resources will be removed and processed.
- Potential impacts to the water, habitats, vegetation, animals and people must be assessed.
- A plan to protect the water, habitats, vegetation and animals must be provided.
- Where necessary, a plan to monitor the water, habitats, vegetation and animals must be developed.
- A plan for the rehabilitation of the site must be provided.
- Technical experts review the information and decide whether it makes sense to issue the licence and approve the site plans.

The approved site plans instruct the pit or quarry owner how to operate. The quarry owners must monitor, check and inspect that they are operating as the site plan says. They also have to adapt their operations to protect the environment.

Steps involved in the operation of a Quarry

- | | |
|---------------|--------------------|
| 1. stripping | 7. washing |
| 2. drilling | 8. stockpiling |
| 3. blasting | 9. weighing |
| 4. hauling | 10. shipping |
| 5. processing | 11. rehabilitating |
| 6. screening | |

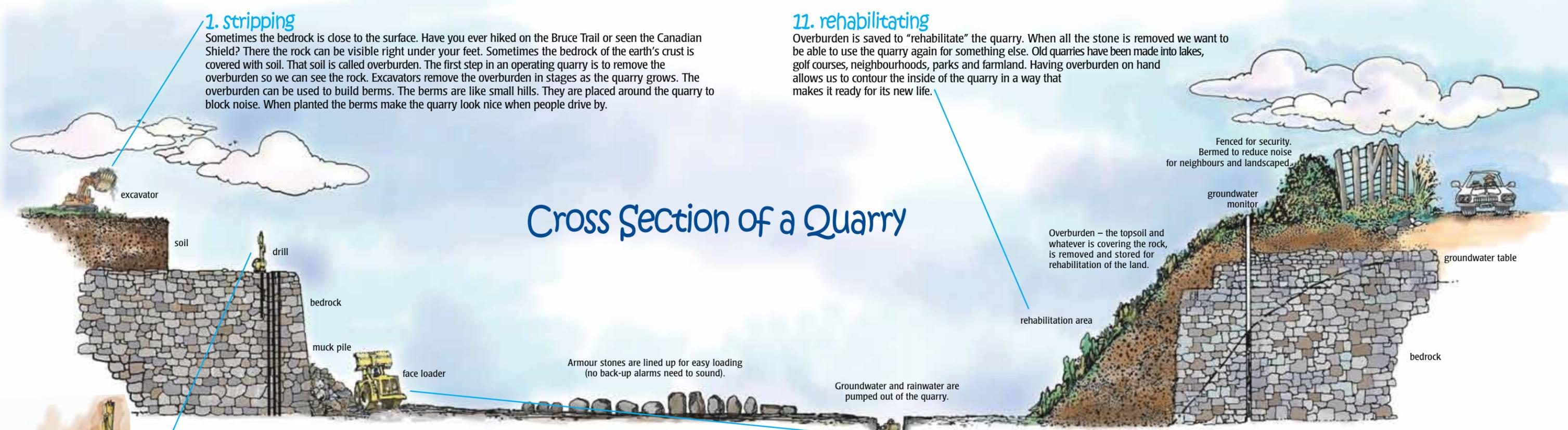
1. stripping

Sometimes the bedrock is close to the surface. Have you ever hiked on the Bruce Trail or seen the Canadian Shield? There the rock can be visible right under your feet. Sometimes the bedrock of the earth's crust is covered with soil. That soil is called overburden. The first step in an operating quarry is to remove the overburden so we can see the rock. Excavators remove the overburden in stages as the quarry grows. The overburden can be used to build berms. The berms are like small hills. They are placed around the quarry to block noise. When planted the berms make the quarry look nice when people drive by.

11. rehabilitating

Overburden is saved to "rehabilitate" the quarry. When all the stone is removed we want to be able to use the quarry again for something else. Old quarries have been made into lakes, golf courses, neighbourhoods, parks and farmland. Having overburden on hand allows us to contour the inside of the quarry in a way that makes it ready for its new life.

Cross Section of a Quarry



2. drilling

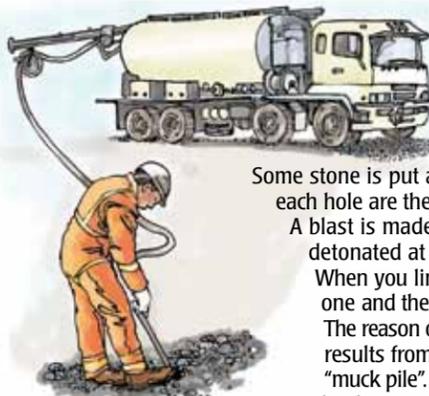
The drill – like a dentist drill but much bigger – drills long, thin holes in the rock. The holes are drilled in a pattern. The pattern is chosen to break the bedrock into the right sized pieces. The pattern of holes also affects how much noise and vibration happen from the blast.

The pattern of drill holes in the bedrock controls the blast.

3. blasting

Just like the glacier used energy to break up the rock as it moved, we use energy to break up the bedrock so we can use it. We blast in order to create the energy needed to break up the rock. A wire and an explosive mixture (known as an emulsion) are put into each long thin hole that was drilled.

Some stone is put at the top of the hole. That layer of stone is known as a "collar". The wires from each hole are then connected to a computer system. The computer is used to control the blast. A blast is made up of several small blasts. Each of the drilled holes is one blast. Each hole is detonated at a different time (milliseconds), one after the other. It is like the domino effect. When you line up dominoes and push one over, it knocks the next one over, then the next one and the next one. Only one domino falls at a time. The end result is all the dominoes fall. The reason only one hole is detonated at a time is to reduce the noise and vibration that results from the blast. The broken rocks then fall to the quarry floor into a pile called a "muck pile". Some of the large rocks – armour stone from the muck pile are put aside for landscapers and erosion control.



The explosives truck operator puts emulsion in the drill holes.

4. hauling

A face loader digs into the muck pile and loads very large dump trucks. A face loader has big teeth on its bucket. The teeth make it easier to pick up the rock. The dump trucks are called "haul trucks". They haul the large rocks from the face to the primary crusher.



Haul truck is filled by a face loader at the muck pile.



Commit • Create • participate

Steps involved in the operation of a Quarry Continued . . .

5. processing plant

The processing plant is made up of crushers, screens and conveyors. The crushers take big rocks and make smaller stones. Screens sort the stone into various sizes. Conveyors move the rock from crushers to screens and from screens to stockpiles. The first crusher in the processing plant is called the "primary crusher". It crushes the largest rocks. The jaw crusher chews up rock just like your jaw chews up food.



haul truck dumps into the enclosed primary crusher



screens with different sized holes separate the stones

6. screening

Screens are sieves with different sized holes in them. The top screen has larger holes and the size of the holes in the next screen are smaller and the next screen the holes are smaller again. This sorts the stones passing through the screens into different sizes. The screens are just like the strainer in your kitchen. The strainer lets you wash vegetables. The water passes through the holes but the vegetables stay in the strainer.



protective screens counteract dust

7. washing

Some stones need to have a shower to wash the dust off before they are used. Stones take their shower in the wash plant. Water sprays on the stone as it moves through the wash plant. The water from the wash plant goes to a pond where it sits still for awhile. Have you ever put muddy water in a jar before? If you shake it up the water turns grey. All the mud particles scatter in the water. When you let that jar sit over night the mud particles settle to the bottom of the jar. The water becomes clearer. That is what happens in the settling pond. The fine stone particles settle out and the water becomes clear. The clear water can be reused to wash more stone. The fine stone particles can be used to improve the soil on farm fields.

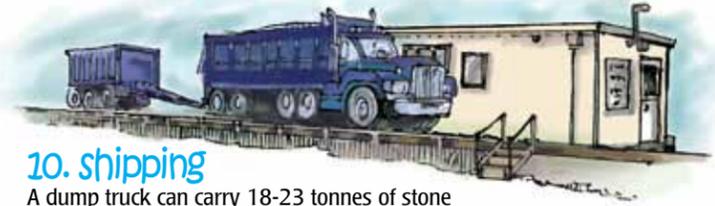
8. stockpiling

The stones that are sorted by the screens are put into different piles known as stockpiles. Dump trucks are used to transport stone to the customer. A yard loader is used to load the dump trucks. The yard loader has a flat blade on its bucket. The flat blade makes it easier to pick up the small stones.



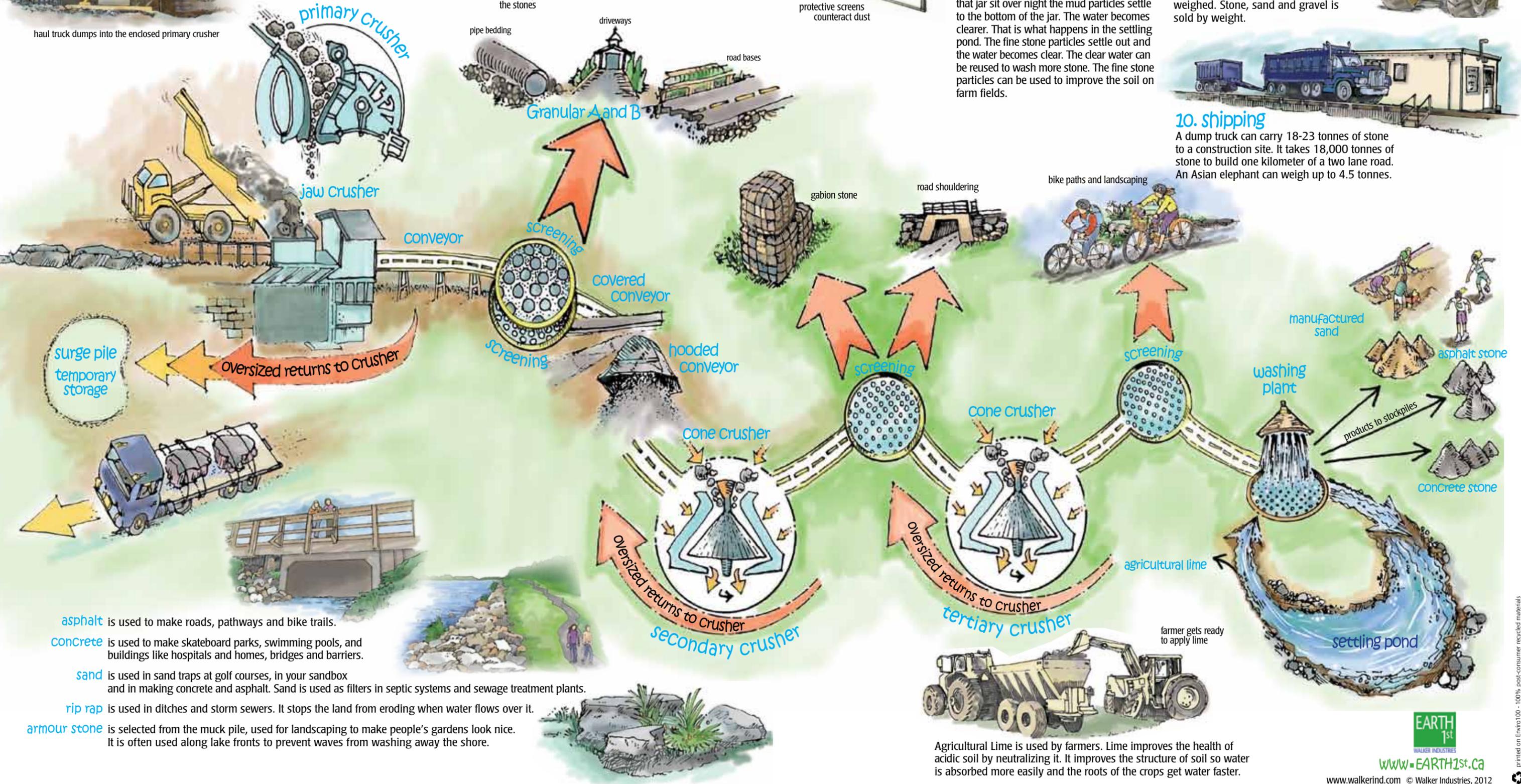
9. weighing

Once the trucks are loaded they are weighed. Stone, sand and gravel is sold by weight.



10. shipping

A dump truck can carry 18-23 tonnes of stone to a construction site. It takes 18,000 tonnes of stone to build one kilometer of a two lane road. An Asian elephant can weigh up to 4.5 tonnes.



asphalt is used to make roads, pathways and bike trails.

concrete is used to make skateboard parks, swimming pools, and buildings like hospitals and homes, bridges and barriers.

sand is used in sand traps at golf courses, in your sandbox and in making concrete and asphalt. Sand is used as filters in septic systems and sewage treatment plants.

rip rap is used in ditches and storm sewers. It stops the land from eroding when water flows over it.

armour stone is selected from the muck pile, used for landscaping to make people's gardens look nice. It is often used along lake fronts to prevent waves from washing away the shore.

Agricultural Lime is used by farmers. Lime improves the health of acidic soil by neutralizing it. It improves the structure of soil so water is absorbed more easily and the roots of the crops get water faster.



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