GEOLOGICAL SURVEY OF CANADA
OPEN FILE 5560

GeoTour guide for the Hazeltons, British Columbia

R.J.W. Turner, B. Van Heek, and S. Dodd

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GEOTOUR GUIDE

FOR THE HAZELTONS, BRITISH COLUMBIA

OUR LAND THAT SUSTAINS US: GEOLOGY, LANDSCAPES, AND EARTH RESOURCES

Figure 1. *Hazelton sits on the floodplain and adjacent benches along the Skeena River. The river has carved into the floor of a broad, glacier-sculpted valley filled with thick deposits of Ice Age glacier debris. On the skyline are the high mountains of the Roche de Boule range.*

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BRITISH COLUMBIA Ministry of Energy, Mines and Petroleum Resources

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THE HAZELTONS – A MEETING OF WATERS

We live at the junction of two great rivers – the Bulkley draining from the east and south, and the Skeena flowing from the north and northeast. Each river flows in a broad forested valley that join together below the steep face of Stegyawden mountain, part of the Roche de Boule range that form the southern wall to the Skeena River valley along its downstream course to Terrace. To the north, the Kispiox River joins the Skeena, draining a broad lowland shared with the Nass River. The Skeena Mountains rise to the north, and the Kispiox Range to the northwest. Gitsan and Wet'suwet'en peoples have lived along the rivers in these valleys for thousands of years, harvesting the rich salmon runs and wildlife, as they do today. Traders, prospectors, and settlers came only recently, traveling first by river and horse, then rail, and finally road. Today, the major highway and rail connections between the central BC Interior and the Coast follow the Bulkley and Skeena River valleys, making this a vital transportation route.

This guide tells its story about the landscape of the Hazeltons area by taking you on a tour through the local area. These locations will be familiar to many, but the guide may inspire a new look with "landscape eyes".

Figure 2. *Our community lives on and lives from the land. Our local lands provide essential resources such as water and sand and gravel for roads, asphalt, and concrete. Lands further away provide energy resources such as petroleum and natural gas, as well as metals and minerals. Our local lands also receive our wastes: garbage goes to landfills and waste water is treated and returned to the land.*

HOW OUR LAND CAME TO BE.
A QUICK TOUR THROUGH GEOLOGIC TIME

Figure 3*. A cartoon cut-away showing the earth below the region surrounding the Hazeltons.*

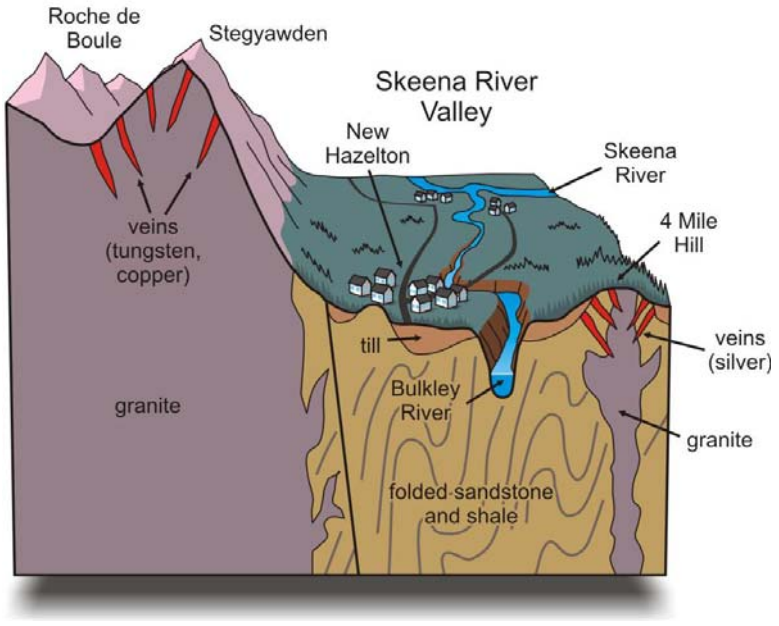
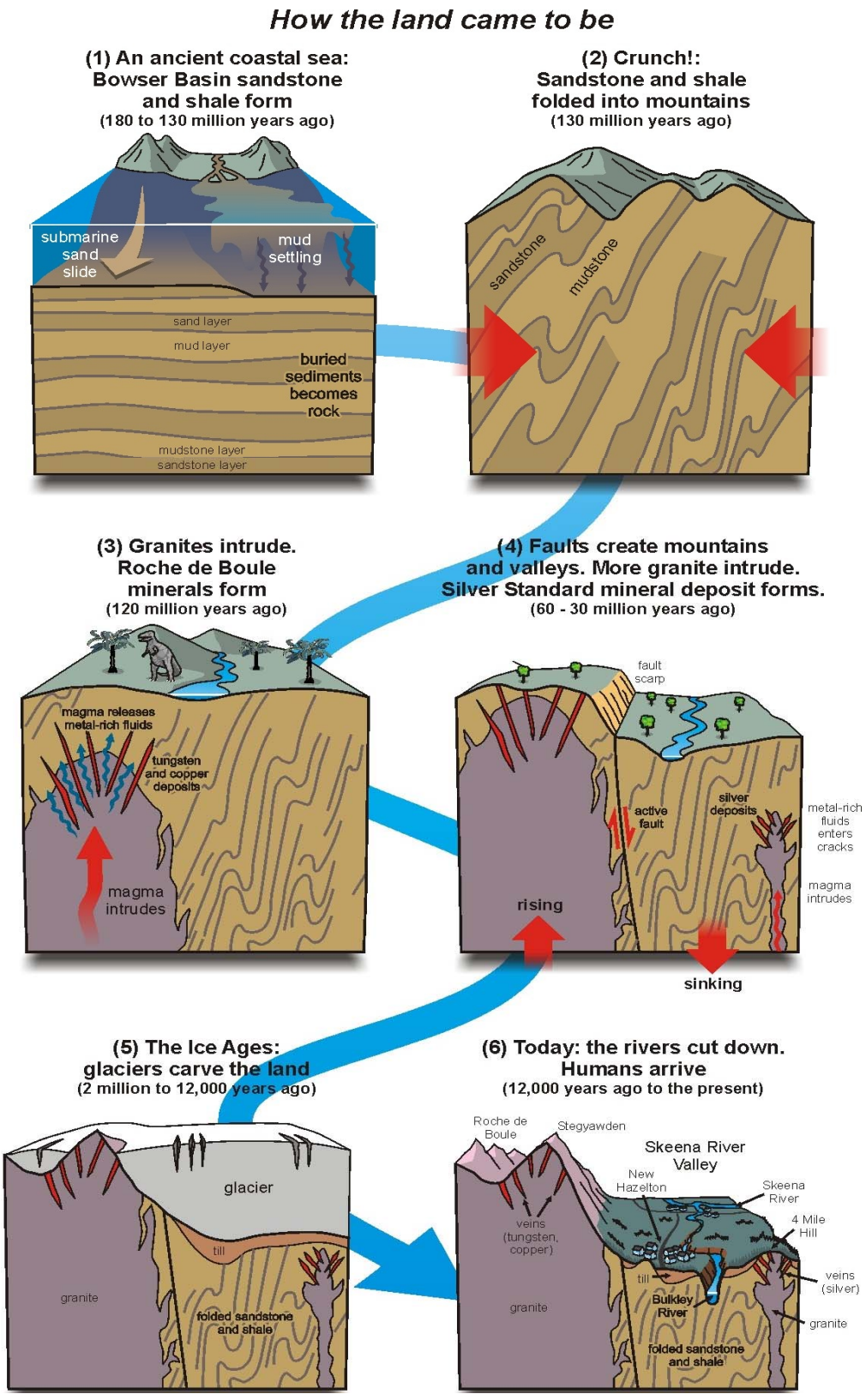


Figure 4*. The geological history of the Earth in the Hazeltons region.*



First Nations peoples have lived for thousands of years near the junction of the Bulkley and Skeena rivers. But the land itself is much, much, much older. Geologists will tell you that the granitic rocks of Stegyawden mountain are 120 million years old while the sandstone under the Skeena River valley and mountains to the north are older still! What follows is a brief summary of the history that geologists have pieced together.

(1) ANCIENT SEAFLOOR: SAND AND MUD

The oldest rocks in the Hazeltons area are layered sandstone and shale that underlie the Skeena River valley and the Hazeltons area, and are exposed in the canyons of the Bulkley and Skeena Rivers, and on the peaks of the Kispiox Range, 9 Mile Mountain, and Skeena Mountains to the north. These sandstone and shale rocks underlie a large area of northwest B.C. from Terrace and Smithers in the south, to the Stikine River. These rocks formed in an ancient shallow sea and adjacent coastal plain or "basin" about 180 to 130 million years ago. Rivers flowed into the sea from the east, bringing sand, mud, and gravel. Dinosaurs roamed coastal swamps, leaving their footprints. Today, geologists refer to these widespread sandstone and mudstone rocks as the "Bowser Basin", and are exploring these rocks for natural gas, coal-bed methane, and coal deposits. These rocks, now tilted, underlie the Hazelton area and form the walls of the Bulkley River including Hagwilget Canyon.

(2) CRUNCH! SANDSTONE AND SHALE ARE FOLDED INTO MOUNTAINS

A volcanic island chain, the "Wrangellia terrane", collides with the western margin of North America, adding the land west to the Queen Charlotte Islands. The collision folds and faults the Bowser Basin rocks, creating a mountain belt. The tilting of the sandstone layers we see today in Hagwilget Canyon occurred at this time.

(3) GRANITES INTRUDE. ROCHE DE BOULE MINERAL DEPOSITS FORM

After the great collision, granitic magma (melted rock) intruded the deeply-buried folded sedimentary rocks. The magma crystallized to form the granitic rock. Today this granite forms the high peaks of Stegyawden and the Seven Sisters. As the granite magma crystallized, it released waters rich in dissolved tungsten, copper, gold, and silver into fractures in surrounding rocks, to form metal deposits that later would be the Red Rose and Roche de Boule mines.

(4) FAULTS, GRANITE, SILVER AND GOLD

About 60 million years ago, the lands of British Columbia started to pull apart. The land broke into fault blocks, and the great Bulkley and Kispiox valleys formed during this period. Rocks under the valleys sank while the flanking mountains rose. An ancient Skeena River further carved the valleys. Granite magma once again intruded upwards, releasing metal rich waters to form metal deposits of silver, gold, lead, and zinc. Much later, miners would dig these precious rocks at the Silver Standard mine north of Hazelton.

(5) THE BIG FREEZE

Two million years ago, great glaciers formed across northern North America. Ice Ages came and went. The last great Ice Age reached its maximum about 25,000 years ago when the ice sheet was two kilometers thick over Hazelton and most parts of British Columbia. The slow-moving glaciers flowed down the Kispiox, Skeena, and Bulkley valleys towards the sea. Glaciers overtopped all but the highest peaks, and scoured the valleys, leaving behind scratched bedrock, and thick deposits of mixed stones, clay, and silt, that geologists call "glacial till".

(6) SINCE THE ICE AGE

For the past 11,000 years, the Skeena and Bulkley rivers have cut down through the thick glacial till bedrock. Where the river encountered soft glacial deposits, the river migrated back and forth and carved a wide river plain. Where the river encountered rock, erosion was slow, and the river was held to a narrow canyon.

As the Ice Age waned, coastal people migrated from Asia down the BC Coast. A major cluster of villages, Dimlahamid, was centered near the rich salmon fishing sites near the junction of the Skeena and Bulkley rivers. About 3500 years ago, a major exodus occurred to the coast, creating the Nisga'a and Tsimshian peoples of the lower Skeena and Nass river valleys. The Gitxsan people continued to inhabit the area, as they have to this day. In the mid 1800's, immigrants settled the valley, first for mining and agriculture, later for forestry. Sternwheeler ships could travel upstream as far as the Bulkley Canyon, so Hazelton became the transfer point for goods heading overland to the Omineca goldfields and along the Babine Trail. Later the railway, then Highway 16 followed the Bulkley and Skeena valleys as a route connecting the BC Interior with the coast at Prince Rupert and Kitimat.

(SITE 1) FOUR MILE HILL: THE "BIG PICTURE" OF HOME.

So, with our geological history in mind, let's head out and take a look. Our first stop is the lookout on Four Mile Hill. Drive east through community of Two Mile, head north up Four Mile Hill on a jeep track, and then take the trail to the rock bluff where a panoramic view of the valley awaits. The Hazelton region lies at the junction of three major valleys – the Bulkley to the East, the Kispiox and Skeena to the north, and the Skeena to the west. These valleys separate the Kispiox Range to the northwest, the Skeena Mountains to the north, and the Roche de Boule range to the south.

HOW THICK WAS THE GLACIER DURING THE LAST ICE AGE?

You can answer this question by observing the shape of the mountains across the valley from the lookout. The lower and mid slopes of all the mountains are worn smooth by glacier ice that flowed over them. Only the mountain tops are craggy, indicating they poked up above the flowing glacier. So as you look at the view, imagine the valleys filled with glacier ice up to the highest peaks!

Figure 5*. View of Stegyawden mountain and the Roche de Boule range, and the Bulkley River valley. Ice Age glaciers left behind thick deposits of glacial debris (till), gravel, and sand that form the valley floor. The Bulkley River lies in a canyon it has cut into the valley floor. Parts of the villages of New Hazelton (left) and Hagwilget (right) are visible on the old glacial valley floor.*

WHAT AM I STANDING ON?

Granite! The rock at the lookout is a pale grey colour. If you get down on your hands and knees you will see that it has a salt-and-pepper texture with black specks in a pale grey matrix. The black specks are crystals of dark-coloured minerals (biotite, hornblende) surrounded by intergrown crystals of light-coloured minerals such as feldspar and quartz.

(SITE 2) GITANMAAX : STEGYAWDEN AND THE MOUNTAINS ABOVE

Head back to Gitanmaax and go to John Field Elementary School. Walk across the main road to the view of the Bulkley River and mountains beyond.

Figure 6. *Stegyawden peak and the Roche de Boule Range rise above the Bulkley Valley. Thick Ice Age deposits of glacial debris (till), gravel, and sand underlie the forested valley floor. The distinct curving line down the lower forested slope to the left of Stegyawden marks the path of debris flows descending the mountain. The Bulkley River has carved down through the glacial sediments, creating the flat river plain at Anderson Flats across the river. The Flats are now the site of pasture, forest, and the Hazeltons wastewater treatment plant (out of the picture to the left).*

GRANITE COUNTRY

The high peak of Stegyawdin is made of hard granitic rock**.** This is one reason why Stegyawdin rises so steeply above the valley. Granitic rock usually contains few fractures and resists erosion. As a result, granitic rock forms most of the highest peaks in the Hazeltons area such as Stegyawdin, the Seven Sisters, and Mount Thomlinson northeast of Kispiox. More easily eroded sandstone and shale form the lower slopes of these mountains and underlie the valleys. Granite also the forms nearby 4 Mile and 9 Mile mountains. Granite has a salt-and-pepper texture of intergrown light (feldspar, quartz) and dark minerals (hornblende, mica) that crystallized from a rock melt (magma).

DEBRIS FLOW!

The north face of Stegyawdin mountain rises very steeply nearly 2000 metres above the Skeena River valley. Various types of landslides have occurred on its slopes, hence the French name “roche de boule” meaning “rolling rock”. The narrow line on the lower forested slope east of Stegyawden was formed by a flow of mud and rock debris that crashed down the mountain some time in the recent past. A Provincial geologist described a debris flow down Chicago Creek west of Stegwayden in July 1946 that occurred during an intense rainstorm and created a great noise that lasted 4 hours. The rock debris traveled down a steep avalanche chute and then cleared a great swath through the forest. There is evidence for a massive debris flow down Chicago Creek about 3500 years ago that has been investigated by geologists and may link to the Gitxsan saga of the Medeek, the ferocious spirit that attacked Dimlahamid from a creek draining Stegyawden.

(SITE 3) HAZELTON SECONDARY SCHOOL SANDSTONE OUTCROP: OUR ROCK FOUNDATIONS

Figure 7. *Pale-coloured sandstone outcrop near Hazelton Secondary School.*

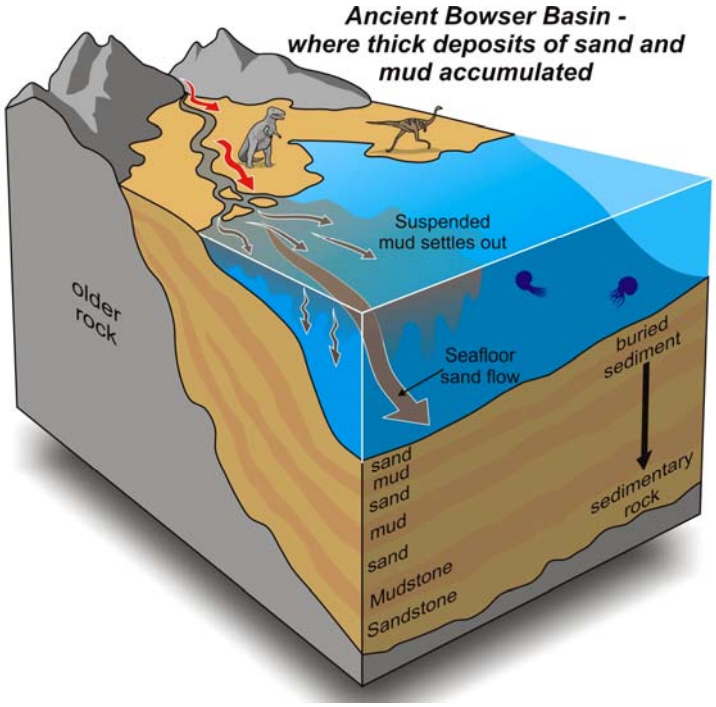
Across the road from Hazelton Secondary School, is a sandstone rock with an interesting story to tell. Many rock exposures are coated with lichen or mineral stains that hide the features contained in a rock. However, the rock was recently washed clean so many rock features are visible.

SO, HOW CAN I TELL IT IS SANDSTONE?

If you get down on your hands and knees and take a close look you will see the rock is made up of sand-sized grains. A magnifying glass makes the grains more obvious. The easiest grains to spot are pebbles within the sandstone. Geologists interpret that this sandstone formed along the coast of an ancient sea near the mouth of a large river, about 180 to 130 million years ago. Geologists refer to this ancient sea and the sandstone, shale, and conglomerate that formed in it as the "Bowser Basin". Sand deposited on the seafloor at the river mouth, collapsed as underwater landslides and spread out across the ocean floor. As the sand slid across the muddy seafloor, it ripped up fragments of seafloor mud. These wispy fragments of mud, now shale, are visible within the sandstone.

Figure 8*. Close-up view of ancient fragments of sea floor mud (shale) within the sandstone .*

Figure 9. *A geologist's view of what Bowser Basin looked like 150 million years ago.*



This sandstone outcrop near the school is similar to the sandstone layers exposed in the Bulkley and Skeena river canyons. Hagwilget Canyon and in the Skeena River canyon at the Kispiox Road bridge are good places to look. Layered sandstone and shale underlie the Skeena River valley and a large region of northwestern BC. Cobbles of this sandstone are common on the bars of the Bulkley River and Skeena rivers. Some deeply buried layered sandstones in the Bowser Basin may be reservoirs for natural gas accumulations. Geologists are currently trying to determine this potential.

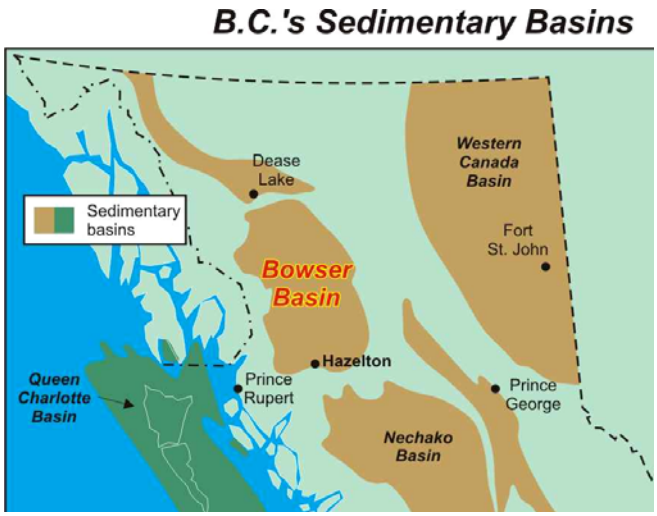
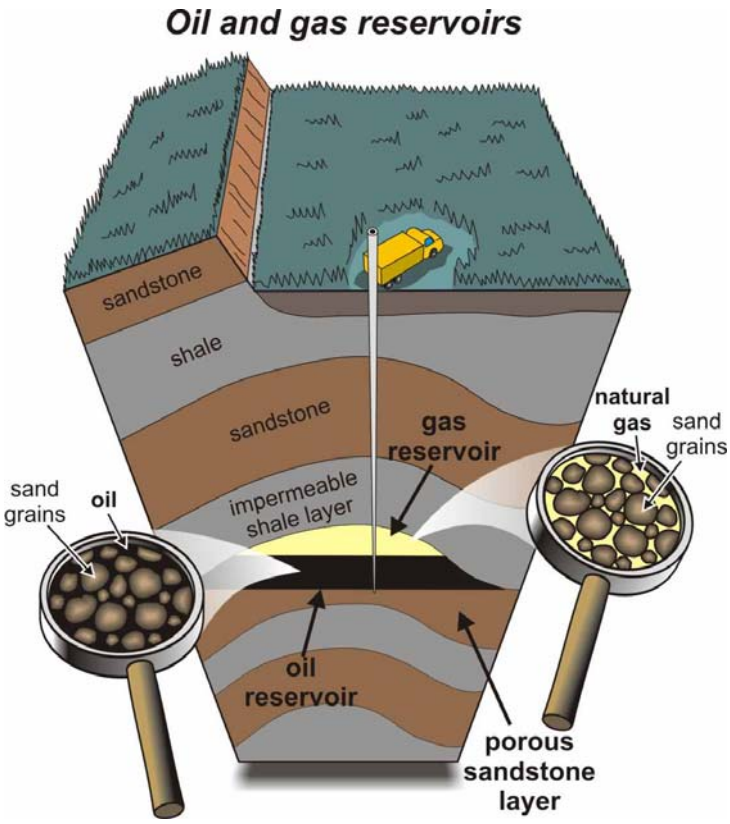


Figure 10. *A map of the Bowser Basin and other sedimentary basins in northern BC.*

Figure 11. *Oil and natural gas reservoirs may occur if deeply- buried porous sandstone layers are overlain by an impermeable shale layer.*



Something else to look for is not "in" the rock, but, "on" the rock. These are scratches left by the glaciers. You have to be careful, because there are also scratches made by machines when they were clearing the soil that buried this rock. The glacier scratches are narrow and oriented to the south. Stones embedded in the base of the moving glacier scoured the sandstone, leaving geologists evidence as to which way the glaciers flowed. As you look at these scratches, imagine 2 kilometres of glacier ice over your head!

Figure 12. *Glacial scratches on the surface of the sandstone.*

(SITE 4) HAGWILGET CANYON AT HAGWILGET: THE RIVER CUTS THROUGH SANDSTONE LAYERS OF THE BOWSER BASIN

Our next stop is the bridge at Hagwilget Canyon. This is a great place to look at the rocks that underlie the valley. In most places the rock is buried below thick layers of glacial sediments. But at the bridge, the Bulkley River has cut down through the glacial sediment to expose the underlying rock.

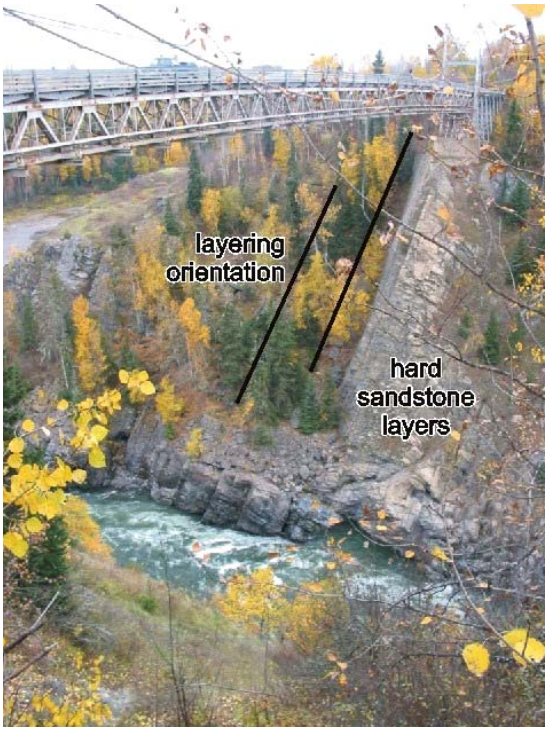


Figure 13. *(left) View looking east across Hagwilget Canyon at the bridge. Layers of hard sandstone, tilted steeply, make up the canyon walls of the Bulkley River. A very hard, thick sandstone layer resistant to erosion, protrudes as a rib into both sides of the canyon and provides the foundation for the bridge on both sides of the canyon. That is a good example of engineers taking advantage of geology. ". These sandstones are interlayered with shale layers and are a part of the "Bowser Basin", an extensive geological region in northwestern BC.*

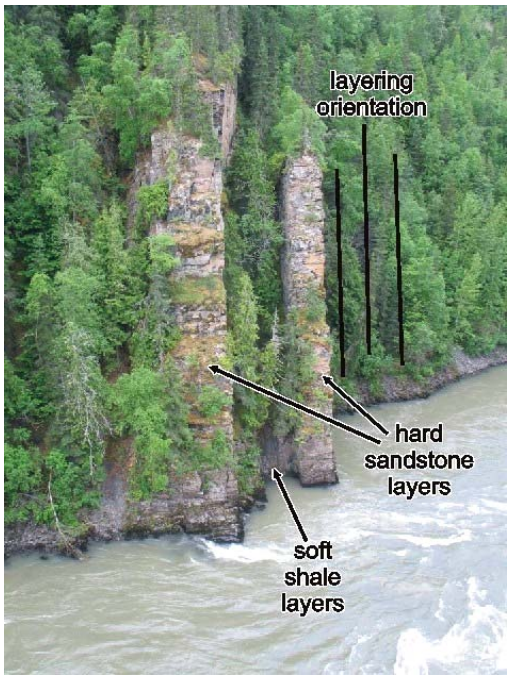


Figure 14. *(Right) Further upstream at "the Gate" north of Ross Lake, the Bulkley River cuts through more layered sandstone and shale, tilted to vertical. Thick, resistant layers of sandstone protrude into the river to form "the Gate*

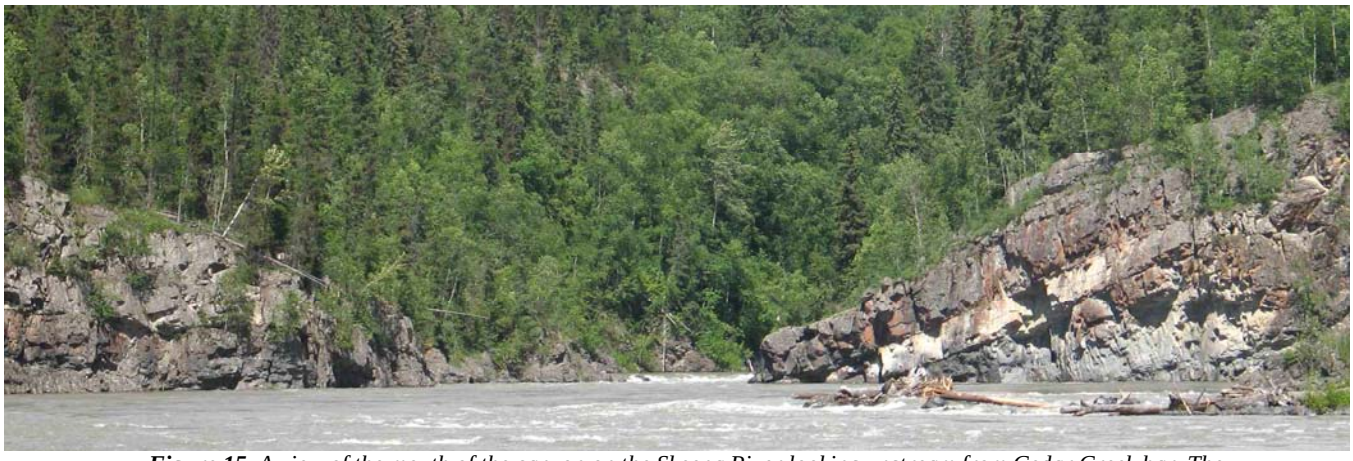


Figure 15*. A view of the mouth of the canyon on the Skeena River looking upstream from Cedar Creek bar. The canyon rocks are composed of gently tilted layers of sandstone. A dark sandstone layer overlying a pale sandstone layer is visible on the right wall of the canyon*

(SITE 5) NEW HAZELTON: AN ANCIENT LANDSCAPE SCULPTED BY GLACIERS

So let's head over to New Hazelton. New Hazelton is built on glacier debris left behind during the Ice Ages. This debris of mud and stones is called "glacial till". Most of the Skeena and Bulkley river valleys is underlain by a thick layer of glacial till. At New Hazelton, this till has been sculpted into streamlined hills by the glacier as it moved westwards down the valley. Geologists call such a sculpted hill a "drumlin". New Hazelton is built on several such drumlins. So is the village of Hagwilget.

Figure 16. *A view of a "drumlin" hill near the intersection of Highway 16 and Laurier Street in New Hazelton. The hill has been smoothed by the glacier that once flowed over this area.*

Figure 17. (Left) *A close-up of the glacial debris of mud and stones called glacial till that forms the drumlin hill. This exposure is on Laurier Street in New Hazelton.*

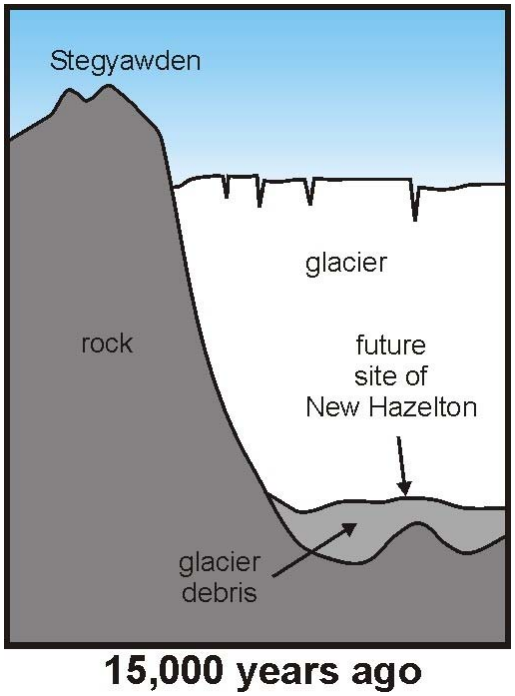


Figure 18. (Right) *Fifteen thousand years ago New Hazelton and the Bulkley and Skeena River valleys were covered with* glaciers.

(SITE 6) GITANMAAX: LIVING ON A STAIRCASE OF ANCIENT RIVER PLAINS

Anyone arriving for the first time in Gitanmaax and Hazelton might be surprised by the "staircase" of flat benches that these communities are built on. Geologists call these surfaces "terraces" and the City of Terrace was named after a prominent bench above the town. In fact many river-side towns in BC could have been called "Terrace". Gitanmaax, Hazelton, Kispiox, Kitwanga, and Gitanyow are all built on a series of terraces.

Figure 19. *Downtown Hazelton is built on a flat surface that was once a river plain. Two flat-topped benches of Gitanmaax visible in the background are even older river plain surfaces now left "high-and-dry" as the Skeena River has continued to cut down into the valley floor.*

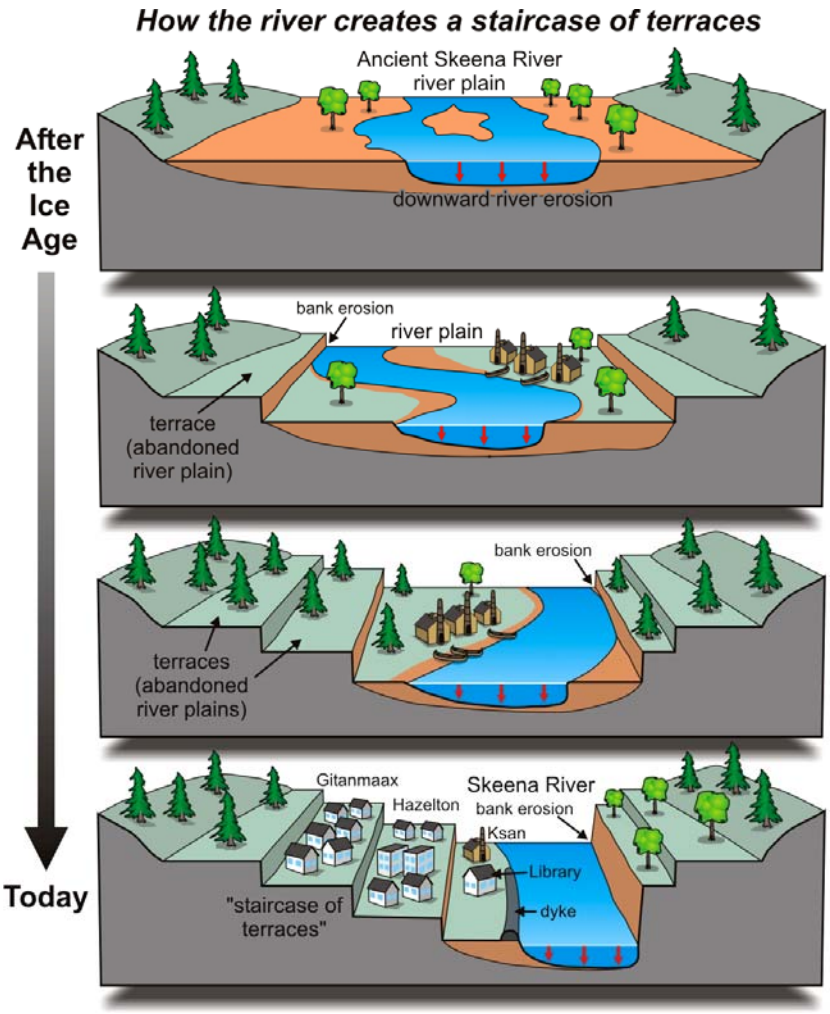


Figure 20. *A flat river plain is created by the river as it migrates back and forth, eroding banks into the older surfaces. This flat plain is so close to the river level that during periods of very high river levels, parts or all of this plain can be flooded. So we call these plains, "flood plains". Flooding deposits fine sand and silt that forms rich soils on the river plains.*

As the river cuts downwards, it leaves behind a series of river plain surfaces. The benches or terraces that result are the remnants of ancient river plains that once extended across the entire valley. The terraces often have rich soils good for farming. These soils were deposited by floodwaters when the terrace was an active river plain.

(SITE 7) HAZELTON: LIVING WITH THE FLOODS OF THE SKEENA RIVER

So, let's head to Hazelton. If you take a walk down to the riverfront near the sternwheeler "Hazelton", you will notice that the land along the Skeena River is very flat. The riverbank is covered with large blocks of rock (rip-rap). This sloping wall of rock has been built to form a long riverside ridge or "dyke". The dyke has been designed to protect the waterfront from erosion by the Skeena River, as well as to protect it from most floods. The lowest land along the river in Hazelton has a history of flooding. This area is on the floodplain of the Skeena River. The last major flood occurred in 1979 but there were many previous to that.

Figure 21. *A flood-protection dyke along the Skeena River at Hazelton*

Figure 22. *The view of Hazelton from the Kispiox Road. Hazelton sits on the floodplain of the Skeena River and higher benches. On the opposite shore, the river is eroding into sediments underlying a flat bench of sediments that represents an ancient river plain surface. The bench extends inland to a cliff that was once eroded by the Skeena River.*

(SITE 8) KSAN: ANCIENT VILLAGE WHERE TWO GREAT RIVERS MEET

Ksan sits at the site of an abandoned Gitxsan village built on the floodplain where the Bulkley and Skeena rivers meet. After a devastating flood, the village was moved up onto the benches of Gitanmaax. The modern Ksan village was built on a gravel pad several metres thick to raise it above the height of floods.

Figure 23. *View of Ksan village from across the Bulkley River.*

Figure 24. *View of Ksan campground built on the Skeena River floodplain. The campground area can flood and so the road ways and campsites have been built up so they rise above the expected flood water levels.*

Figure 25. (Left) *The junction of the Bulkley (foreground) and Skeena (background) rivers. The current of the Bulkley River slows where it meets the Skeena River. Gravel that the river's swift current has pushed through the canyons comes to a temporary rest here, forming large gravel bars.*

(SITE 9) GITSEGUKLA: RIVER GRAVELS - READING LOCAL GEOLOGY

Let's hit the road and head to Gitsegukla. River bars such as those at Gitsekugla are a great place to look at gravels, at least when the river levels are low (not during spring runoff and during heavy rains!). These river gravels are a sampling of the diverse types of rock that underlie the region. Gravels are fragments of rock that are worn smooth by bumping, grinding, and sand blasting as they are rolled down the floor of a river. Gravels may be eroded from rock, or from older deposits of glacial gravels and glacial tills. River gravels reflect the many rock types that underlie the drainage areas of the Skeena river and its tributary. Their smooth surfaces, particularly when wetted, reveal detailed textures and colours that greatly assists in their identification.

Figure 26. *A large gravel bar has formed where the Gitsegukla River meets the Skeena River. This gravel bar is a great place to inspect gravels.*

Try to give each rock type a name based your observations of its colour, lustre, or texture. For example, you might decide you would call one type the "grey dull swiss cheese rock" because it is full of holes, another "white, shiny, harder than knife rock", and another "grey salt and pepper" rock". Good luck! Here is what a geologist might call those same rocks.

- Light grey and dark grey layered rock = sandstone (light grey) and mudstone (dark grey) of Bowser Basin
- Rock made up of gravel = conglomerate of Bowser Basin
- Brick red and purple rock, with white crystal specks = volcanic lava
- white, shiny, harder than knife = quartz from quartz veins
- Grey green to pistachio green rock = metamorphosed volcanic rock
- Purple-brown or red-brown shiny speckled rock = volcanic lava
- Grey and black speckled "salt and pepper" rock = granitic rock
- Grey dull swiss cheese rock = volcanic lava

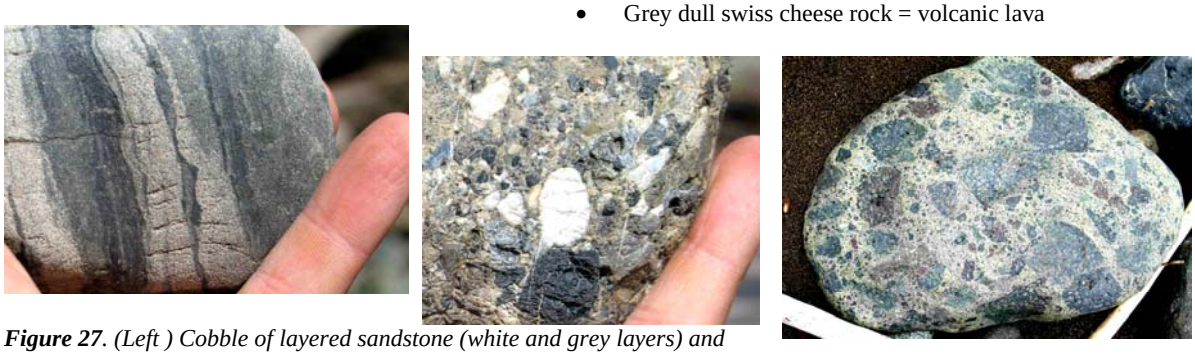


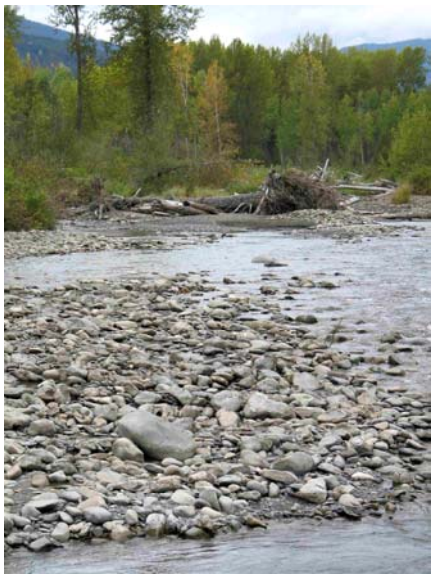
Figure 27*. (Left) Cobble of layered sandstone (white and grey layers) and shale (black layers) eroded from the Bowser Basin rocks. (Middle) Ancient gravel or "conglomerate" eroded from the Bowser Basin rocks. (Right) A cobble containing fragments of volcanic rock erupted from an ancient volcano.*

(SITE 10) GITANYOW: A TALE OF TWO STREAMS

Let's get back in the car and head to Gitanyow. Gitanyow lies on a flat terrace surface between the Kitwanga River and Kitwancool Creek. What is curious is that the two streams are very different in character. Why would this be?

First, let's look at Kitwanga River. Follow road north out of Gitanyow to the bridge that crosses the Kitwanga River. The road follows the flat valley of the Kitwanga River. At the bridge, take the trail to the gravel and sand bar just downstream of the bridge. The river is flowing gently, and the gravel bar is covered with small pebbles and sand. The river has enough energy to carry small gravel and sand, but not enough energy to move big gravel. If we followed the river upstream, we would come to Kitwanga Lake.

Figure 28. (Above) *The slow-flowing Kitwanga River at the bridge north of Gitanyow with a bar of small gravel and sand.*



Now lets head back through Gitanyow and out the access road south towards Highway 37. Just after the bridge there is a pull out beside some large blocks on the river bank of the Kitwanga River that road engineers have placed to protect the road from erosion by the river. Across the Kitwanga River is the mouth of Kitwancool Creek, where it joins the Kitwanga River. Kitwancool Creek flows across bars of large boulders, much larger than the gravel we saw at the bridge above. Why is this so? It's because Kitwancool Creek flows directly from steep mountain slopes. It has lots of energy to carry large boulders. During rainstorms, the water rushes down the mountain slopes with energy to carry large boulders. Kitwanga River on the other hand, flows in a flat valley. It too is fed by streams flowing from steep mountain slopes. But most of these streams flow into Kitwanga Lake, where they lose all their energy. The Kitwanga River gets none of this "mountain energy". So it moves what it can, mostly small pebbles and sand.

Figure 29. (Above) *The Kitwancool Creek south of Gitanyow has gravel bars made of large boulders.*

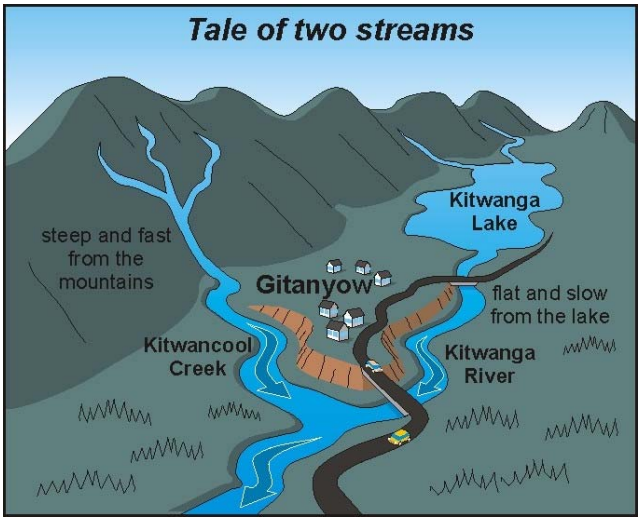


Figure 30. (Right) *A comparison between the Kitwanga River and Kitwancool Creek. Kitwanga River is lower energy because it flows from the lake across a flat valley. Kitwancool Creek is a high energy stream that often floods because it flows down a steep mountain slope.*

(SITE 11) KITWANGA: THE PUZZLING ORIGINS OF BATTLE HILL

Figure 31. *Battle Hill from the Kitwanga River.*

Okay, we are almost finished our tour. Let jump in the car and head down Highway 37 to Kitwanga Fort National Historic Site. This conical hill is a puzzle. Is it a natural feature? Was it built by early Gitxsan peoples? Or is it perhaps a combination of both? Let's take a look for evidence.

From the top of parking lot stairs, take a look at the view. You are looking down into the valley of the Kitwanga River. Battle Hill or Kitwanga Fort is a small hill in the valley. The hill looks like a flat-topped cone. Beyond the hill is the Kitwanga River. Start down the stairs. We are at top of curving cliff above a flat floor to the right that looks like an old river terrace, now left high and dry by the Kitwanga River as it has cut down into the valley. As we walk down the stairs, to left is another, slightly higher terrace. These terraces are old river floodplains, so the river once flowed on this side of Battle Hill. Walk the trail across the flat terrace to the stairs up the hill. The hill is surrounded by steep slopes, like the one we came down. Could this slope be a cliff cut by the river? Climb the stairs to the top. The hill is completely surrounded by old river terraces to the east and south. The present river and its floodplain flows around the hill on the north and west sides. This evidence indicates the river has flowed on all sides of Battle Hill at some time in the past. So it could have carved away all the material around it. We are guessing here, but we have good evidence to base our guess on. So it likely that the river has had a large part in the origin of Battle Hill.

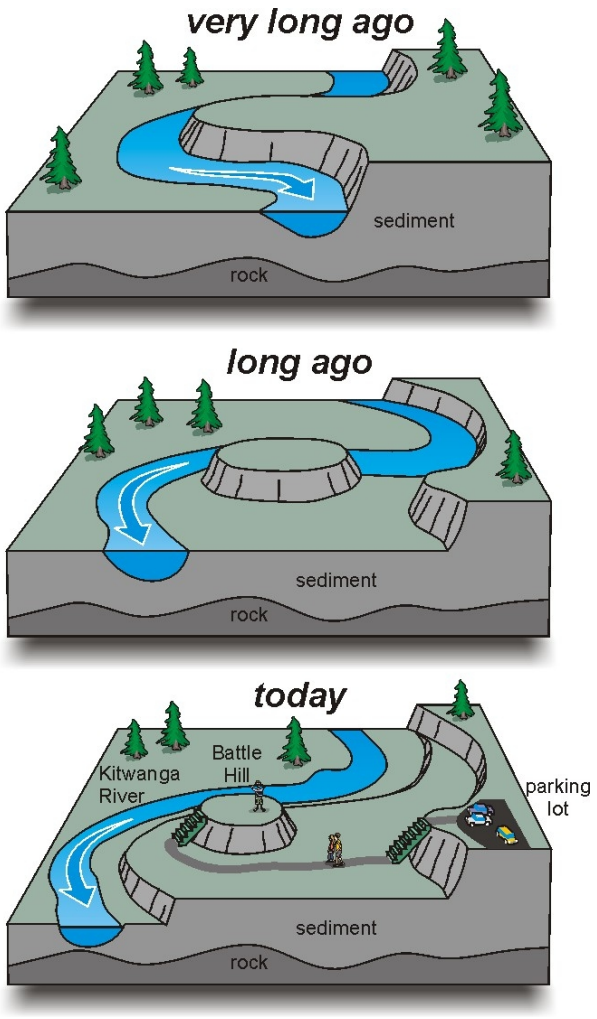


Figure 31*. An interpretation of the origin of Battle Hill.*

(SITE 12) SOUTH HAZELTON: TREATING OUR WASTEWATER

***Figure 32**. A secondary treatment lagoon at the Anderson Flats wastewater treatment plant.*

So, where does our sewage go when we drain the sink or flush the toilet? The answer for Hazelton, New Hazelton, and South Hazelton is the wastewater treatment plant on Anderson Flats along the Skeena River below South Hazelton. So let's head there. The facility includes both primary and secondary treatment and the treated water is discharged into the Skeena River.

This treatment plant is very important! The health of the Skeena River depends on our efforts to properly treat our waste water before draining it to the river. Wastewater treatment combines three steps. First, solids, rags, sticks, plastics and other large objects are removed using a screen, bagged and sent to the landfill. After screening, the remaining sewer flow enters and flows through two aerated lagoons that provide bacterial breakdown of organic matter in the sewage. Air bubbled from a pipe system on the floor of the lagoon, and surface water sprays ensure the bacteria have sufficient oxygen. The wastewater is held within the two lagoons for approximately 21 days. Once treated, the sewer flow is discharged into the Skeena River through an outfall pipe.

(SITE 13) KISPIOX: WATER SUPPLIED FROM UNDERGROUND

Kispiox is like Hazelton/Gitanmaax in several ways. Both are situated at the confluence of major rivers. At Kispiox, the Kispiox River meets the Skeena. Another similarity is that both occupy a staircase of benches that represent old river floodplain surfaces that have been left high and dry as the river has continued to cut downwards. But the communities differ in where they draw their water supply. While Hazelton draws water from a reservoir on a stream, Kispiox gets its water from underground. Two village wells are located near the Skeena River and just east of the totem poles towards the Kispiox River. The wells are less than 100 feet deep, and tap groundwater that lies within buried gravels and sands that underlie Kispiox.

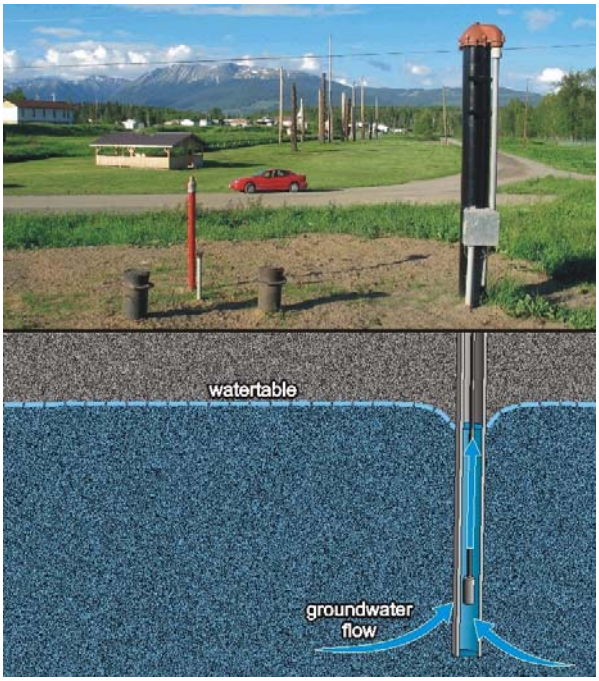


***Figure 33.** Well head of a Kispiox community well.*

However, because Kispiox is built on top of its water supply, it is possible that some spill of gasoline or other substance could someday could infiltrate down to the aquifer and contaminate the town water supply. Once contaminated, it takes many years to decades to "flush out" an aquifer. Therefore, it is important that community members use "best practices" to protect this water supply.

(SITE 14) FARM ON THE KISPIOX ROAD: RICH SOILS FROM THE RIVER

The Kispiox Road crosses a bench just south of Kispiox where the Farleigh farm tills the rich soil. These soils were deposited from ancient river floods when this bench was a river plain. River plains are also called floodplains because rivers regularly overtop their banks and spread their waters across the floodplain, forming a slow-moving lake. Several centimeters of fine mud can settles out from flood waters, as anyone who has had to clean up house after a flood will well know. So not only does the Skeena and Bulkley River provide salmon and steelhead, but also it has left a legacy of rich agricultural soils on the riverside benches. So, next time you go, admire the fine soil as well as the fine vegetables.

(SITE 15) WHEN THE EARTH MOVES: LANDSLIDES

Figure 35. (Left) *An exposure of till composed of clay-sand matrix with scattered stones. This is debris left behind by the Ice Age glaciers that once filled the valleys. Thick deposits of glacial till, sand, and gravel fill most the Bulkley and Skeena river valleys. Where rivers or streams have carved steep slopes in till, landslides can occur, particularly during wet spring weather.* (Right) *Collapse of Two Mile Road where it is built on a steep till slope.*

(SITE 16) NATURAL GAS. GASOLINE. DIESEL. HEATING OIL. PROPANE. WHERE DOES IT COME FROM?

Figure 36*. The gas station in Gitanmaax. So where does the gasoline come from?*

Gasoline, other petroleum products, propane, and natural gas ducts are vital energy sources for transportation, industry, and homes. They reach the Hazeltons in a variety of ways. Natural gas travels by pipeline from gas plants in northeastern BC. Gasoline, diesel fuels, heating oil, aviation and jet fuel are transported to Terrace by rail car and truck from refineries in Prince George and Edmonton. These are part of a broad range of products that along with asphalt and plastics are refined from oil and natural gas.

Oil and gas come from the Earth. Most natural gas used in British Columbia comes from deep reservoirs below northeastern BC. These reservoirs are tapped by drilling, often to depths of 1000 to 2000 metres below the surface. The gas occurs in tiny spaces millimetres to centimeters in size that occur within sandstone or limestone layers. Oil, which may occur with natural gas, largely comes from reservoirs that lie under various parts of Alberta, or as is increasingly the case, from the giant tar sands deposits in northeastern Alberta.

UH, OH. WHAT ABOUT CLIMATE CHANGE?

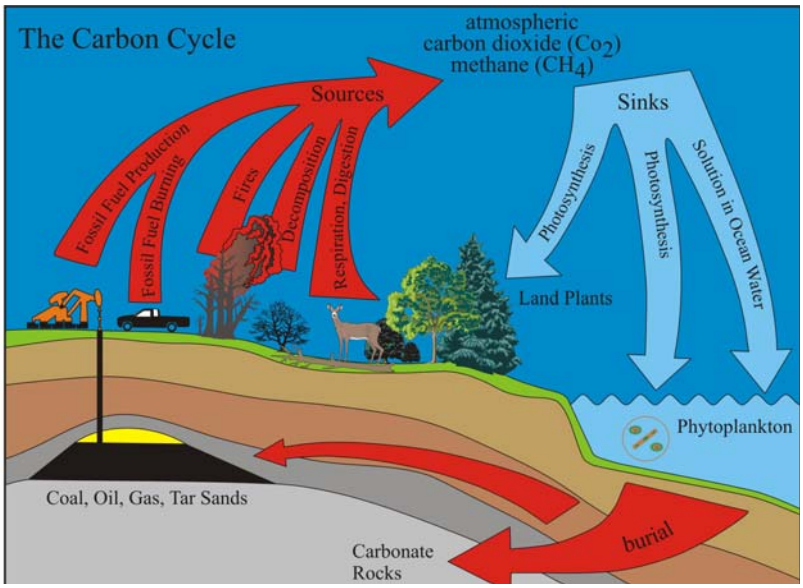


Figure 37. *The carbon cycle. Fossil fuel production and burning is rapidly adding carbon that was long ago stored in the Earth. This is upsetting the natural balance developed by nature.*

In spite of the tremendous benefits and convenience of fossil fuels, a consensus has developed in the scientific community that the greenhouse gases produced from use of oil and natural gas are dramatically changing the composition of our atmosphere, and producing very worrying global climate change.

Northern BC has warmed significantly in the last 100 years, and direct evidence of this is seen in the widespread and rapid retreat of glaciers in the Coast Mountains around Terrace.

GET INFORMED

What are the likely impacts of climate change to British Columbia and the rest of Canada? Visit the Government of Canada websites **www.adaptation.nrcan.gc.ca** and **www.climatechange.gc.ca** that describe the science behind climate change, and likely impacts.

WANT TO KNOW MORE?

Geology of the Northwest Mainland. The geology and paleontology of the Skeena, Nass and Kitimat drainages of British Columbia. Published by Kitimat Centennial Museum Association in 1985 and written by Allen Gottesfeld. An excellent reference on geology, fossils, mines, and geological history of northwestern BC.

Northern British Columbia Geological Landscapes Highway Map
Published by Geological Survey of Canada, Popular Geoscience 94E (British Columbia Geological Survey, Geofile 2007-1) in 2007. A geological map of northern BC with explanations and illustrations of geological features along major roads.

GeoTour guide for Terrace, British Columbia. Published by Geological Survey of Canada, as Open File 5558, and British Columbia Geological Survey, as Geofile 2007-10. A popular guide to sites of local geological interest, earth and water resources, and other features in the Terrace area.

GeoTour guide for Prince George, British Columbia. Published by Geological Survey of Canada, as Open File 5559, and British Columbia Geological Survey, as Geofile 2010-2. A popular guide to sites of geological interest, earth and water resources, and other features in the Prince George area.