KITSAULT

"Heaven on Earth"

The Geology, Ecology, and History of Kitsault, B.C.

Kitsault Resort Ltd.

The Ghost Town of Kitsault, B.C.

Over the two decades that the townsite of Kitsault sat empty, lawns were mowed and buildings were heated. The only occupants, two caretakers, carried on a constant battle to keep trees from reclaiming the townsite and roads.

Ghost Town of Kitsault in 2004
Photo: LandQuest Realty Corp.

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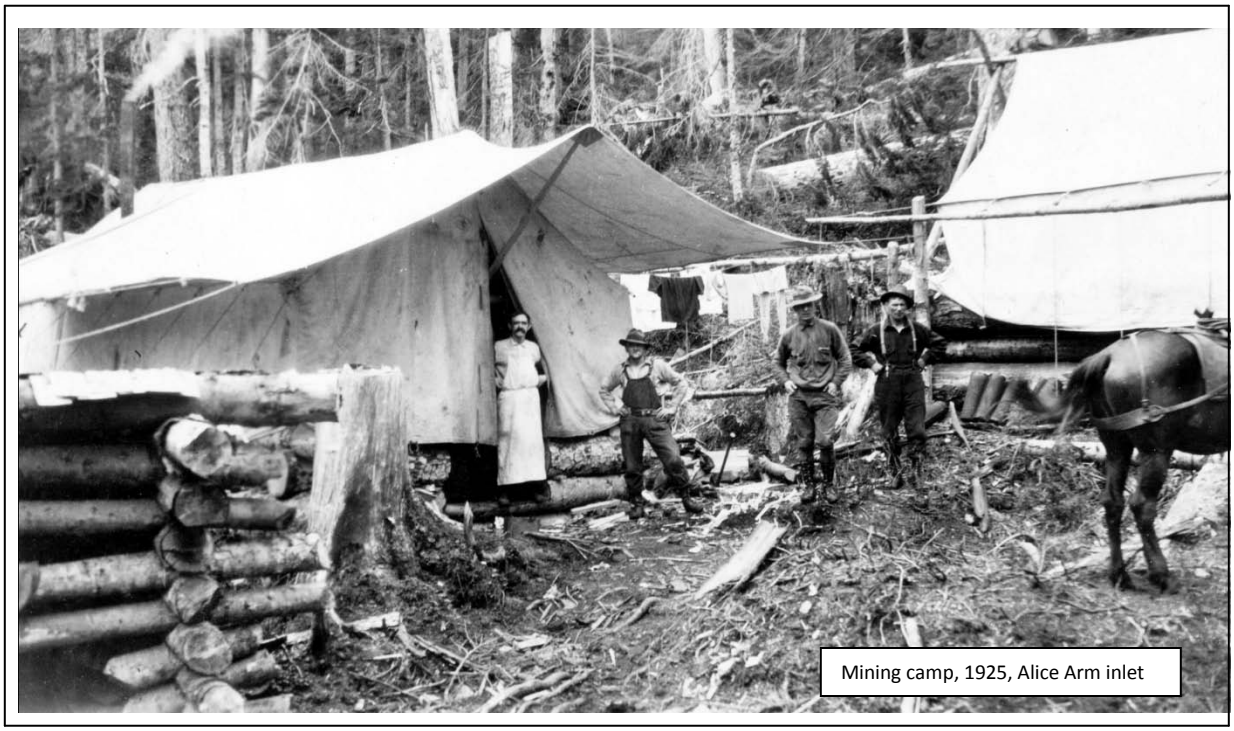
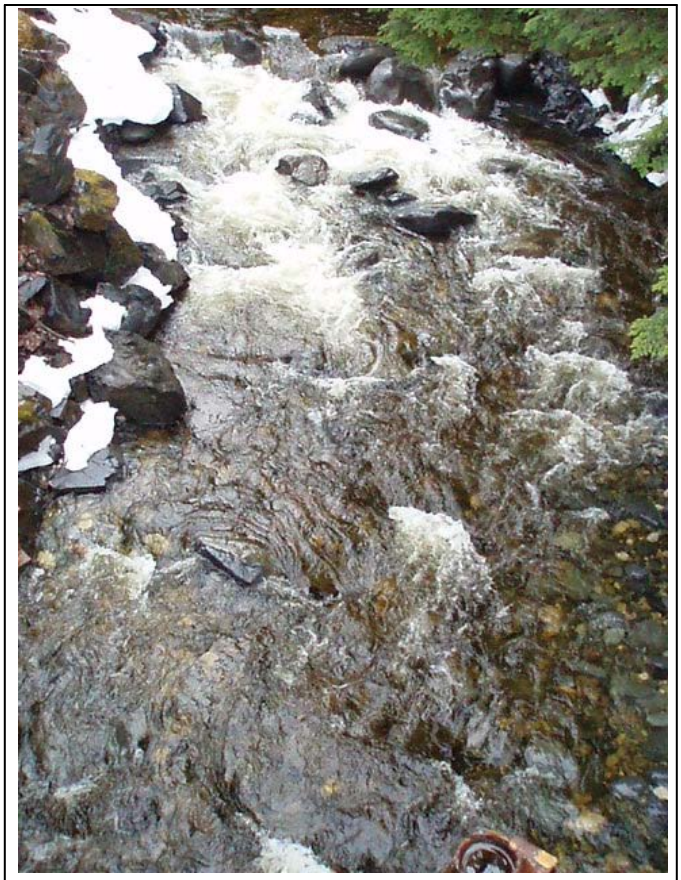
Cover: View of Alice Arm Inlet from townsite. Photo: K. Mathew Inside back: Lime Creek. Photo: N.Kerby
Inside back: Mining camp, Alice Arm Inlet, 1925 - Image I-67707 courtesy Royal BC Museum, BC Archives
Back Cover: Alice Arm Inlet and views of the townsite of Kitsault, B.C. Photos: Kitsault Resort Ltd.



Mining camp, 1925, Alice Arm inlet



Lime Creek

Silver claims were first staked in 1911 on the east side of the inlet along Lime Creek (today's location of the townsite of Kitsault). The claims were worked during the 1920's and early 1930's. Some rich molybdenite ore was taken out during World War I, but interest was not strong in this odd mineral. The rich deposit of molybdenum in the upper watershed of Lime Creek sat untouched until 1956 when a mining subsidiary of Kennecott Copper Corporation discovered a large deposit of porphyry molybdenum at Widdzech Mountain. In 1979 -1980, Amax of Canada Ltd. built the townsite of Kitsault and opened the Kitsault Molybdenum Mine. It closed in 1983 after 18 months of operations due to low metal prices.
Mining camp, 1925 - Image I-67707 courtesy of Royal BC Museum, BC Archives
Lime Creek photo: N. Kerby

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Kitsault:

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Construction of Apartment Buildings at Kitsault, 1979 - town of Alice Arm in upper right.
Photo: Kitsault Resort Ltd.

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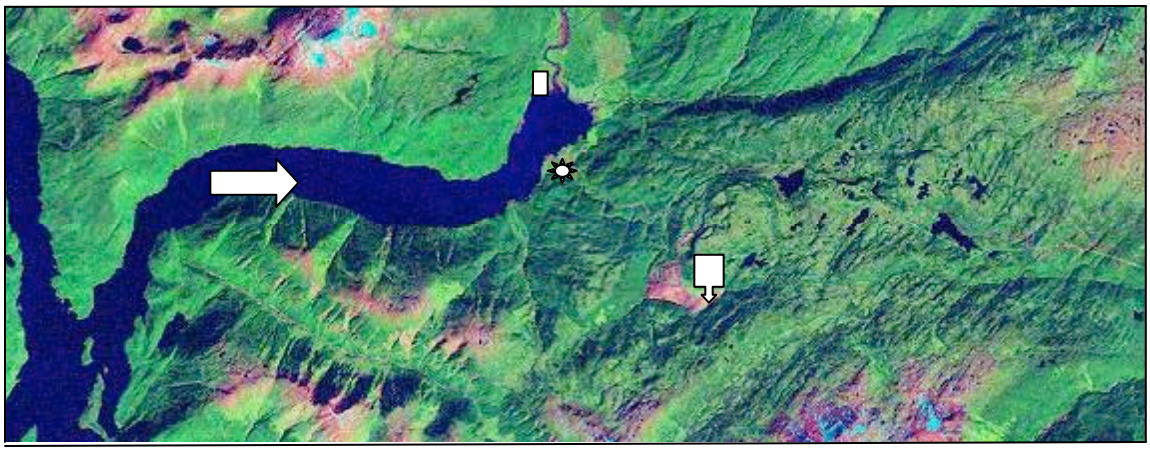


Satellite image of Observatory Inlet with Hastings Arm to the left and Alice Arm inlet to the right.
☼ Kitsault ▯ Alice Arm town ⇩ Proposed Kitsault Mine ⇨ Alice Arm Inlet

Introduction

Kitsault, British Columbia, Canada, is a Cinderella story. Once described as one of B.C.'s most famous ghost towns, it has risen up again to become 'Heaven on Earth', a proposed modern resort in a spectacular location. Located within the traditional territory of the Nisga'a and the Nass Wildlife Area of the Nisga'a Treaty, eco-sustainability and human well-being are the goals of this revived community.

Situated on British Columbia's rugged north coast, Kitsault is found at the head of Alice Arm, the eastern extension of Observatory Inlet. By air, the unincorporated townsite of Kitsault is 140 km northeast of Prince Rupert, 115 km northwest of Terrace, and 850 km north of Vancouver. The border of Alaska is only 35 km west of Kitsault, with the long, narrow Portland Canal forming the boundary between British Columbia and Alaska. Stewart, at the head of the Portland Canal, is 60 km NNW by air from Kitsault over the rugged Coast Mountains and the extensive Cambria Icefield. Kitsault's closest neighbour is the tiny mining village of Alice Arm, 2.5 km NW across the inlet. To the east of Kitsault, an 820 meter high pass through the Boundary Mountain Ranges separates Kitsault from the Nass Valley, 38 km away. The four Nisga'a communities of Gitlakdamix (New Aiyansh), Gitwinksihlkw (Canyon City), Laxgalts'ap (Greenville), and Gingolx (Kincolith) are within 60 km by air from Kitsault. By road, Kitsault is 52 km from Gitlakdamix and 200 km or 3.5 hours north from Terrace via the Nisga'a Highway 113, then a series of Forest Service and private industrial roads into the townsite of Kitsault.

The story of Kitsault is the tale of mineral-rich mountains at the edge of North America, rainforests, salmon streams, and an isolated mining company town put into storage then resurrected again. We hope that this book will provide an insight into the spectacular surroundings of this unusual community and an understanding of the unique natural and historical attributes of the region.

Kitsault, B.C.: Located in Northwestern British Columbia at 55°27.5'N 129°28.5'W

Areal View of the Townsite of Kitsault

Photo: LandQuest Realty Corp.

Key

Kitsault Townsite - center of photo showing residential loop in foreground; dock area at top center; in 1981-1982, large docks were located here for shipping of molybdenum ore to world markets.

Lime Creek - exits into marine water just above the townsite; its valley is steep, with bedrock canyons; the large molybdenum deposit on Lime Creek is upslope 5 km to the left (SSW of the townsite) on top of Widdzech Mountain; a large tailings pipe from the Kitsault Molybdenum Mine (1981-1982) brought tailings down slope to be dumped into the inlet at 50 meters depth.

Roundy Creek - exits into Alice Arm inlet south of Lime Creek along the left side of the inlet; site of another large porphyry molybdenum ore deposit that may be developed by the proposed Kitsault Mine.

Alice Arm inlet - foreground and disappearing around Pearson Point to the upper right; enters Observatory Inlet to the top right; note green colour of marine waters from inflow of glacial runoff.

Dawson Ridge - mountain ridge to top background; this is part of the Tsi Galsgiist Biodiversity, Mining, and Tourism Area that excludes both commercial timber harvesting and commercial hydro-electric sites.

Alice Arm Townsite - to the immediate right of the photo at the head of Alice Arm inlet where the Kitsault and Illiance Rivers enter marine water in a large shallow estuary (see page 5).

North - to right of photo

PART 1:

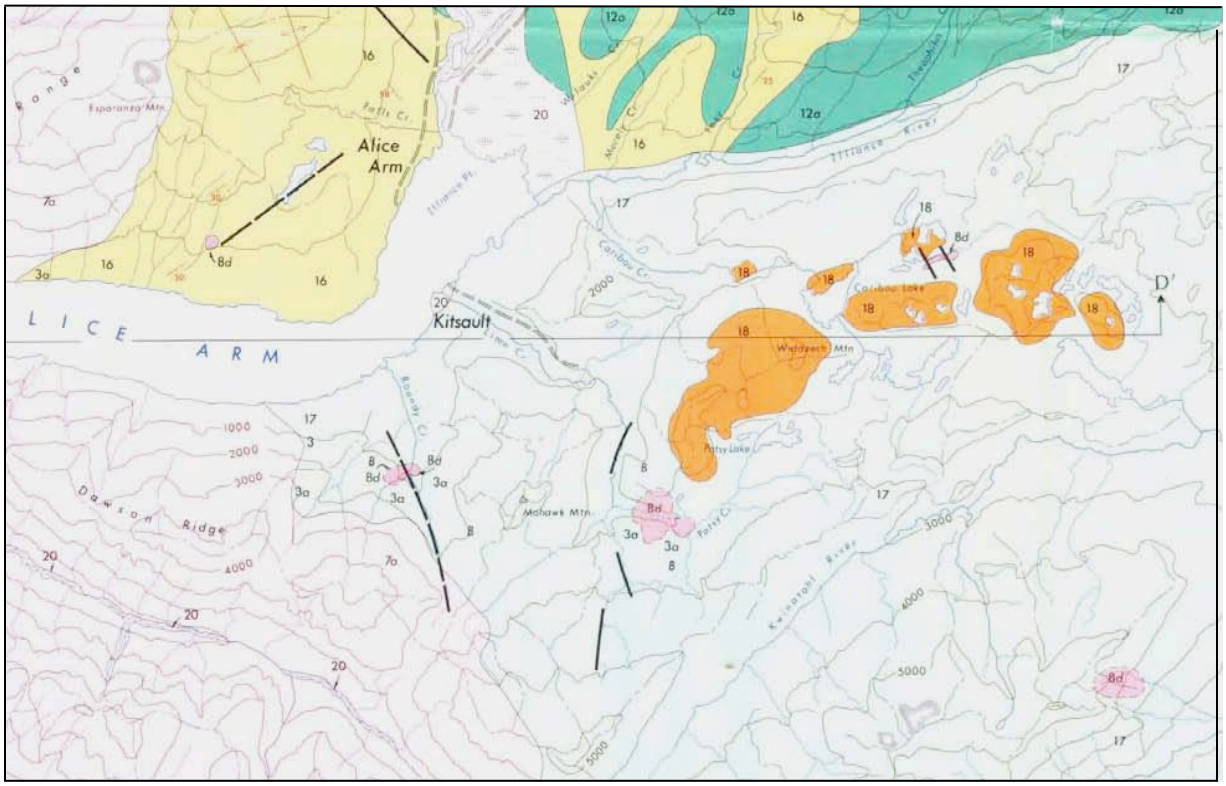
THE NORTH COAST

AND

KITSAULT AREA

Head of Alice Arm inlet: Kitsault in lower right; village of Alice Arm in mid-left; estuary of the Illiance River (to mid-right) and Kitsault River (valley to upper left); the Dak River joins the Kitsault River mid-photo; the Nisga'a community of Gits'oohl was located at the mouth of the Kitsault River; the Gits'oohl BMT biodiversity area is located mid-photo. ***Photo: LandQuest Realty Corp.***

GEOLOGY OF THE KITSAULT AREA



Map 2: Geological Map of the Kitsault area, excerpt as per Grove, E., 1986. " Geology and Mineral Deposits of the Unuk River-Salmon River-Anyox Area". Bulletin 63, B.C. Ministry of Mines and Energy.

Key:	(map number in brackets) mya = millions of years ago
dark line	= fault where bedrock has slid past adjourning bedrock
(20)	= active floodplain and/or estuary; modern watercourses depositing gravel and silt
orange	= Pleistocene Epoch (est.1.6 and 0.6 mya); basaltic plateau lava flows (18) which may have emerged under thick Ice Age icesheets, forming flat topped lava deposits.
dark pink	= Eocene Epoch (Tertiary Period) (64 to 54 mya); crystalline quartz diorite intrusions (8)
pale pink	= Tertiary Period (64 to 54 mya); igneous crystalline Coast Plutonic complex (7)
Jurassic Period	= 195 to 136 million years ago in the Mesozoic Era, Age of the Dinosaurs
pale green	= Upper Jurassic sedimentary and volcanic rocks (17)
yellow	= middle Jurassic sedimentary rocks (16)
deep green	= Lower to Middle Jurassic sedimentary and volcanic rocks (12)

GEOLOGICAL GLOSSARY

[1]greywackes - mud rocks with poorly sorted angular sediments [2]argellites - fine grained shales primarily made from clay minerals
[3]greenschist facies - metamorphic greenish-coloured flakey rocks [4]lithified - dewatered, compressed, and solidified as rock
[5]felsic - refers to rocks composed largely of quartz and feldspar
[6]quartz diorite - half black, half white crystalline rocks rich in black hornblende and white plagioclase/sodium feldspar
[7] quartz monzonite - greyish to greenish crystalline rocks, rich in potassium and sodium feldspar, but with less quartz, black hornblende and black biotite mica than true granite [8]bitotie hornfels - metamorphic rock with large mineral structures, including large crystals of black mica
[9]lamprophyre - greyish feldspar-rich rocks, with large crystals, often biotite mica, set into a finer matrix

Geology of the Kitsault area

Kitsault is located at the head of Alice Arm inlet, the eastern of two arms arising from Observatory Inlet. Observatory Inlet is the NE/SW trending 80 km long eastern branch of Portland Inlet, a major inlet on the northern most section of the west coast of Canada. The west branch of Portland Inlet forms the narrow Portland Canal, boundary between British Columbia and Alaska. The eastern arm of Observatory Inlet, Alice Arm, is a deep, 2 km wide, 25 km long fjord, with both the townsite of Kitsault and its companion small community of Alice Arm located at the head of the inlet, close to where the Kitsault and Illiance Rivers enter marine water.

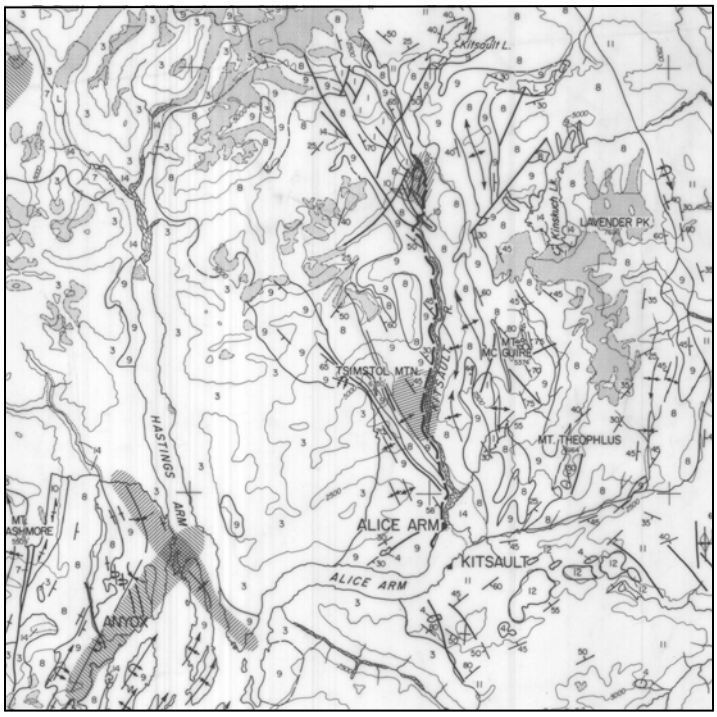
The unusual geology of Kitsault is related to its location along the western edge of the sedimentary and volcanic rocks of the interior of northwestern British Columbia and the eastern edge of the igneous Coast Mountains of the coastal inlets. The region around Kitsault is rich in ore deposits of silver, gold, lead, zinc, and copper. Kitsault itself is famous for a large porphyry molybdenum deposit found on the mountain slopes above the town.

The story of the geology of Kitsault started 175 million years ago when the supercontinent of Pangaea began to split into continental-sized plates. One of these pieces, the Laurasian plate (which ultimately split into North America/Greenland and Eurasia) started moving northwestward. As it ran into the crust of the Pacific Ocean, it picked up (accreted) bits and pieces of land and islands from the surface of the oceanic plate. The heavier Pacific crust was pushed under and melted beneath the lighter Laurasian plate, generating a band of volcanoes in the zone of subduction. Where Kitsault is now located was once the edge of an arch of volcanic islands, similar to Japan today. These islands were offshore to the western edge of the continental plate, which, at that time, was close to where Vanderhoof is now located. Thick deposits of marine and volcanic sediments built up in the sheltered marine sea to the east of the island arc, forming what became the Bowser Basin sedimentary and volcanic rocks of the Stikine Terrane.

Kitsault is located on the far western edge of these sedimentary and volcanic rocks. Underlying the townsite of Kitsault are sedimentary [1]greywackes and [2]argillites which heat and pressure have mostly changed to metamorphic [3]greenschist rocks. The original sedimentary rocks were formed from marine deposits of upper Jurassic to lower Cretaceous age (approx. 140 to 130 million years ago) in an active volcanic environment. At that time, many species of dinosaurs would have roamed the continental plate to the east of this marine basin. Over the next 70 million years, the oceanic deposits of the Bowser Basin were [4]lithified and uplifted as Laurasia continued its grinding journey northwestward. By 60 million years ago, the continent of North America had separated from Eurasia.

From 64 to 54 million years ago, during the Tertiary Period, molten magma protruded underneath the western edge of what became North America. When this underground magma cooled, massive cores of crystalline igneous rock were left behind. These are the Coast Plutonic complex, which, exposed by erosion over millions of years, now form the Coast Mountains of British Columbia. In the Kitsault area, the predominantly [5]felsic magma became coarse crystalline granitic rocks ranging from [6]quartz diorite to [7]quartz monzonite . These are hard rocks, eroding very slowly compared to the sedimentary rocks of the Bowser Basin deposits. Looking west down Alice Arm, the U-shaped slopes of Dawson Ridge are crystalline granitic rocks (page 11), whereas the slopes of Mt. Theophilus (page 12) are sedimentary, with large slopes of broken talus.

KEY MINERAL FEATURES IN THE ALICE ARM REGION



Map 3

Excerpt as per N. Carter and E. Grove, 1971. "Preliminary Map No. 8: Geological Compilation Map of the Stewart, Anyox, Alice Arm, and Terrace Areas (parts of 103I + 103P)".

Key: (Map #'s in brackets) speckled areas= icefields

- (8/9/11) = Jurassic sedimentary and volcanic rocks; (12) - Quaternary (Pleistocene) lava flows
- (3) = intrusive igneous granitic rocks: Coast Mountains Plutonic belt
- hatched areas = intrusive dyke swarms (many dykes in one area; sites of high mineralization); note hatched areas at Anyox copper mine and Torbrit/ Dolly Varden silver mines (top centre).
- Kitsault River sits in a syncline (downward folding of rocks); the mountains either side of the Kitsault Valley are anticlines or upwards folds of rocks; the dark lines are faults where bedrock has moved relative to each side of the fault line; faults are often associated with mineralization.

Drill cores from the Kitsault Mine - left: Tertiary intrusive crystalline granitic rock; right: black Mesozoic Bowser Basin host rock.

In the Alice Arm area, numerous intrusive stocks of granitic materials protruded in discontinuous knobs into the sedimentary rock. Contact with the hot magma metamorphosed the zone of contact with the host rocks, forming [8]biotite hornfels. Twenty million years later, other molten materials subsequently intruded into the bedrock at Kitsault as dyke swarms of feldspar-rich [9]lamprophyre.

In the outer zone of one of these outlying granitic intrusions, on the south side what eventually became Mt. Widdzech, molybdenum in the form of MoS_2 or molybdenite, was deposited in the contact layer between the igneous and sedimentary rocks. A molybdenite-rich shell was formed at the top of the granitic stock. In subsequent geological episodes, movement of hot mineral-rich hydrothermal water through this shell led to the deposit of polymetallic sulphides such as galena (a lead sulphide ore), pyrite (an iron sulphide ore), and sphalerite (a zinc iron sulphide ore). Very unusual sulphate minerals were also deposited. **Neyite**, a silver-copper-lead-bismuth sulphate was first discovered in 1969 in the Kitsault area. Similarly, **Nuffieldite** , a lead-copper-bismuth sulphate, was first found in the Lime Creek/Kitsault molybdenum deposit. Together, these rich polymetallic sulphates and porphyry molybdenum deposits in the Lime Creek drainage make it an exceptional area for metal ore deposits.

Tectonic activity in northwestern B.C. did not end with the Tertiary Period. The Kitsault/Alice Arm area is part of the Northern Cordilleran volcanic province. The Northern Cordilleran volcanic region is an active tectonic tear zone associated with extension and faulting along the west side of North America. During the Quaternary (last 2.2 million years), there has been a series of basaltic lava flows and volcanic eruptions in the region around and north of Kitsault. Pleistocene (Ice Age) lava flows close to Kitsault include a series of small 1.6 to 0.6 million year old volcanic deposits in the form of plateaus along the top of Mt. Widdzech (see map, page 6). These plateaus are basaltic lava flows that most likely emerged underneath ice sheets, forming flat-topped lava deposits. The Northern Cordilleran volcanic zone is still undergoing tectonic activity, as evidenced by 250 year old cinder cones and basaltic lava flows 45 km south of Kitsault in the Nass Valley.

Surficial geology in the Kitsault area was heavily influenced by massive Cordilleran ice movement southwestward during the last ice advances. Throughout the Pleistocene, which ended approximately 10,000 years ago in this region, glaciers overran the mountains more than once to depths estimated in excess of 2 km. Valleys were scraped and steepened by ice, forming the steep walls of the inlet fjords. Other surficial features resulting from severe glaciation included thin layers of glacial till over mountain slopes and thick glaciofluvial deposits of gravels and sands in the broader river valleys.

Glaciation is still very active in the Kitsault area. The Cambria Icefield, 40 km north of Kitsault, and the Nass Icefield, 15 km to the south, are massive modern accumulations of ice. Nunataks (exposed rocky peaks and ridges) emerge from these icefields at elevations of 1675m (5500 feet) to 2300m (7500 feet). The massive amounts of runoff resulting from glacial melt and the high precipitation levels in the Alice Arm region have led to large amounts of glacial and erosion sediments being deposited into Alice Arm inlet. The 2 km wide estuary at the head of Alice Arm is the result of deposition of this type of material. The Kitsault River, entrenched within canyons for much of its 260 km^2 watershed, has a significant and active floodplain for its last 3 km. This floodplain is shared with three other major watercourses, the Dak River, Wilauks Creek, and the Illiance River, all depositing large amounts of glacial silt and eroded materials into the head of Alice Arm inlet.

Ecological Features of the Kitsault Area

Photo: LandQuest Realty Corp.

Alice Arm Inlet: the cloudy green colour of the water is due to the large amount of glacial silt washed into the inlet; often a layer of freshwater sits overtop of the denser marine water; the end of the inlet can freeze over in the winter, in some years as far as the docks at Kitsault; the estuary and shallow bays at the head of the inlet have thick deposits of silt; the light green colour along the banks is eel grass, covered during high tide and an important rearing environment for young salmon smolts.

Regeneration: forest cover grows rapidly in disturbed sites close to the ocean; at the bottom left of the picture, red alder plus other vigorous shrubs such as thimbleberry and salmonberry, have taken over an area that was not maintained after 1983; within two decades, the red alder trees were over 10 meters high; red alder has symbiotic bacteria in its roots that fix nitrogen, allowing alder to grow vigorously on disturbed mineral soils.

Forests: the dark green forests surrounding Kitsault and on the mountain sides are mature to old growth forests dominated by evergreen coniferous trees adapted to the cold, nutrient poor soils found along the North Coast of British Columbia; these conifers are very long lived - old growth forests have trees from 350 to 1000 years or more old; the main species of tree is the western hemlock, a large, robust tree with small, multi-length needles; other species include amabilis fir, Sitka spruce, and western red cedar. Cedar was essential to the First Nations cultures of the region, who used it for everything from their elaborate longhouses, war canoes, totem poles, mortuary poles, storage boxes, utensils, and tools, to woven cedar bark clothing and hats that were light, warm, and waterproof.

Ecology of the Kitsault area

The ecosystems of coastal northwestern British Columbia have evolved in a very wet mid-latitude climate within a mountainous landscape. Located in the zone of easterly moving low pressure cyclonic storms from the North Pacific, the mid-west coast of North America receives large amounts of precipitation each year, ranging from 3 to 4 meters (10 to 13 feet) of rain on the outer west coast of Haida Gwaii (Queen Charlotte Islands) to 1.5 to 2 meters of precipitation (rain and snowfall) in the inland valleys of the marine inlets. On the windward side of the coastal mountain ranges, slopes are subjected to heavy orographic precipitation as the moisture-laden Pacific maritime air masses cool when they rise over mountain barriers. Precipitation levels can be astounding at higher elevations. North Coast inland coastal mountains can receive 10 to 20 meters or more of heavy, wet snowfall in a winter.

Prevailing Westerly winds of the North Pacific force moisture-rich air over coastal mountain ranges.

Kitsault, at the head of a long marine inlet, is drier than an outer coast location at the same latitude, but wetter than the rainshadow climates on the eastern side of the Boundary Ranges. The closest permanent climatic records to Kitsault are from the community of Stewart, located 60 km away. Stewart, similar to Kitsault, sits close to sea level at the head of a long, inland valley inlet. On average, Stewart receives 130 cm of rainfall and 570 cm of snowfall per year, with an average annual precipitation of 185 cm. Normally, 184 days of the year in Stewart have rainfall, with a further 60 days per year with snow. As it can rain and snow on the same day on the North Coast, on average, Stewart has 215 days per year with precipitation. The season with heaviest precipitation is during fall rainstorms. Deepest snowfalls occur in January and February. The most extreme snowfall recorded in one day in Stewart was over 1 meter (3 feet) deep. The most extreme rainfall in one day was 12 cm (almost 5 inches). Extreme snow depth on the ground was 240 cm (95 inches) in January, 1989.

With heavy precipitation and glaciers, the Kitsault area is full of year-round streams, rivers, and fish.

The impacts on the landscape by these high amounts of precipitation are dramatic. Where elevations are highest, precipitation falls as snowfall, which accumulates into glaciers and icefields. This region has some of the largest icefields in British Columbia, such as the Cambria Icefield which caps the mountain ranges between Alice Arm and Stewart. This gigantic icefield, reminiscent of the Ice Ages, covers an area of 900 sq km. The southern edge of the icefield drains into the Kitsault River valley/Alice Arm to the SE and the Sutton River valley/Hastings Arm to the SW. The Nass Icefield, north of Gitwinksihlkw (Canyon City), covers an area of 250 sq km, with the northeastern edge of the icefield draining into the Kwinatahl River, whose drainage forms the eastern portion of the pass used by the road to Kitsault. On either side of the Kitsault River valley north of Alice Arm, the mountain ranges are heavily glaciated. Ice sits at elevations from 1400 to 2100 m (4500 to 7000 feet). Glacial tongues can extend to elevations as low as 600 m (2000 feet). Both the icefields and the glaciers cool the landscape around them and are the source of cold adiabatic winds that blow down drainage valleys. In recent years, to the delight of the mining companies, these glaciers have been in dramatic retreat, exposing new bedrock for exploration.

Below the firn line (level at which snow permanently accumulates), the heavy snowpack of the Boundary Ranges has an overwhelming impact on flora and fauna. In the treeless alpine tundra zone, referred to as maritime alpine tundra due to the large amount of precipitation, deep snow lasts until July or August, or, in some years, does not entirely melt. The alpine tundra of the Kitsault area has both the shelter of deep snow, but also a shortened growing season due to delayed snowmelt in the summer. Plants, often exposed for less than two months in a year, are subjected to bitter winds, frosts, and shallow cold soils during the thaw season. Where snow does not accumulate on exposed ridges and high elevation steep slopes, the vegetation cover is very sparse, limited to lichens and rock mosses between chunks of shattered bedrock (felsenmeer) or in seepage zones from melting snow and ice. In more sheltered sites, the alpine tundra is dominated by dwarf woody shrubs, such as the mountain heathers (Cassiope mertensiana and Phyllodoce empetriformis) and dwarf willows such as Salix arctica.

Alpine tundra zone on Mt. Theophilus north of Kitsault - note summer snowpatches and exposed rock.

Due to the depth of snow on the mountains around Alice Arm inlet, the maritime alpine tundra zone is not good winter habitat for mammals such as mountain caribou or wolves. Some permanent residents, such as the hoary marmot, spend winter hibernating in burrows dug deep into mountain slopes. Others, such as mountain goats, move to winter ranges below the treeline. During the short thaw season of summer, more animals move up into the alpine, especially into areas of S-facing lush meadows associated with melting snowpatches. Summer wildlife in the mountain ranges near Kitsault include wolverines, grizzly bears, black bears, wolves, voles and lemmings, snowshoe hares, hoary marmots, and occasionally moose. Birds include ravens, ptarmigan, snow buntings, rosy finches, longspurs, and the odd robin that chooses to nest at higher elevations.

At the treeline on these mountains, which ranges from 1200 m (4000 feet) average elevation to as low as 1100 m (3600 feet) on N-facing slopes, trees such as the mountain hemlock are twisted and sculpted by breakage from the massive depths of snow, severe winds and bitter cold. These stunted trees, which hug the ground in hollows and between boulders, are referred to as krummholz, important habitat for subalpine wildlife and birds. Between krummholz patches, tongues of treeless alpine tundra extend deep into the subalpine zone along avalanche tracks and adjacent to glaciers that spill down mountain valleys from higher icefields. Lush meadows grow in more hospitable sites - favourite summer salad bowls for grizzly bears.

The band of maritime subalpine forest, between 640 and 1200 m (2100 to 4000 feet) elevation along the road into Kitsault, is known as the Mountain Hemlock Biogeoclimatic Zone, a vegetation zone found the length of the Coast Mountains in B.C. on the windward snowy side of the mountain ranges. The dominant tree is mountain hemlock (Tsuga mertensiana), a wiry tree adapted to the pressing weight of deep snow. In the lower subalpine near Kitsault, where trees can reach heights above 10 meters, other tree species include amabilis fir (Abies amabilis) in drained sites, and occasionally yellow cedar (Chamaecyparis nootkatensis), Sitka spruce (Picea sitchensis), or subalpine fir (Abies lasiocarpa). Shrubs are well developed and are primarily members of the heather family (Ericaceae) such as false azalea (Menziesia ferruginea), plus blueberries and black huckleberries (Vaccinium species), loved by the local bear populations in the late summer and fall. With the large amounts of moisture in summer from both rainfall and thick fog, the subalpine forests of the Alice Arm region are rich in moss and lichen species.

The Mountain Hemlock subalpine zone is often covered with clouds during the summer season.

Subjected to long, snowy winters and heavy snow cover, the species of wildlife that can utilize the mountain hemlock subalpine zone are restricted during the snow season. Wintering mountain goats use steep, south-facing old growth subalpine forests adjacent to avalanche tracks for shelter and food. Some species of grouse or ptarmigan, such as the blue grouse and willow ptarmigan, will overwinter at these elevations. Other permanent residents, such as voles (small, short-eared, mouse-like rodents), live deep under the snow cover. Grizzly bears often hibernate in dens in the subalpine.

In summer, use of the subalpine increases, with coastal black-tailed Sitka deer, black bears, wolves, snowshoe hares, red squirrels, and a number of vole and mouse species living or feeding in the subalpine. Bird species are numerous, including various species of owls, ptarmigan, grouse, woodpeckers, chickadees, nuthatches, kinglets, and warblers. It is not known if the tailed frog, a rare amphibian species at risk, occurs in the subalpine or upper elevation forests of the Kitsault area.

Due to the deep winter snow and wet summers, subalpine forests at higher elevations or in snow accumulation pockets near Kitsault can form open parklands - widely spaced trees in a mosaic of ponds, lush herbaceous meadows of alpine flowers, mossy seepage areas, sedge fens, and pockets of heather heath. A good example of mountain hemlock parkland vegetation can be seen along the Kitsault Road before the turnoff to the proposed Kitsault molybdenum mine. These are sensitive ecosystems, easily damaged due to the wet, saturated soils. Subalpine insects, such as mosquitoes, blackflies, deerflies, beetles, dragonflies, and some species of butterflies, thrive in these parkland habitats.

Mountain Hemlock parkland ecosystems - good habitat for summer breeding populations of subalpine dragonflies and biting insects.

Below the subalpine, the marine inlets of the inland North Coast are clothed in thick rainforests of western hemlock (Thuja plicata), amabilis fir (Abies amabilis), western red cedar (Thuja plicata), and Sitka spruce (Picea sitchensis) at lower elevations. Mild coastal air penetrating along the inlets warms the forests compared to the continental winter conditions on the other side of the mountain ranges. Daily average air temperatures close to sea level are between 0^{o} and -5^{o} C for December to February, and summers are warmer and drier than the outer coasts, averaging above 10^{o} C from May to September.

Despite the milder weather of a maritime location, severe temperature conditions can also occur in these inland valleys, significantly impacting species diversity compared to the mild maritime coasts. The coldest temperature recorded at Stewart, a similar climatic location to Kitsault, was -24^{o} C in January, 1997. Low temperatures such as this are often accompanied by severe outflow winds from the frigid interior or adiabatic winds descending from icefields above the inland valleys. Outflow winds blast freezing air down inland inlets, often at speeds in excess of 80 to 100 km/hr. In contrast, the warmest temperature on record for Stewart was 33^{o}C in July, 1991. Hot temperatures can arise during prolonged dry high pressure systems in the summer, with increased risk of forest fires, normally a rare event within the inland valleys of the coastal zone.

In any specific winter or summer, the inland valleys at the heads of the maritime inlets may have more coastal-type weather or may fall under stronger continental climate influences. During the Little Ice Age between approximately 1450 and 1850 A.D., the climate in this area was significantly colder, and alpine glaciation was more extensive. Since 1900, there has been a pronounced increase in temperatures in the region, and a visible retreat of mountain glaciers and icefields. Under natural conditions, organisms living in the Kitsault area must be able to adapt to these fluctuations in climate or they are replaced by other species, more adapted to continental or maritime conditions, depending upon the climatic trends.

South side of Alice Arm - thick coniferous forests cover the lower elevations of Dawson Ridge.

In today's mild climate of the sub-maritime inland valleys at low elevations, the growing season is long - 230 days or more per year with daily temperatures greater than 0^{o} C. Most of the growing season is cool and wet, perfect conditions for coniferous trees, lichens, mosses, and salmon fry rearing in mountain streams. In these damp, cool conditions, fallen trees rot slowly. The forest floor is deep with decaying wood of many ages, all covered with spongy mats of mosses and lichens. The thick layers of rotting wood are storehouses of nutrients for regeneration of trees in a wet climate where nutrients rapidly leach away through mineral soils. Often a fallen log will act as a nurse tree, and new seedlings will grow in a straight row along the rotting trunk. When the heavy rains of fall come, thick organic layers over mineral soils act like a sponge, absorbing enormous amounts of water and slowly releasing it into the soil and groundwater table. Where mineral soils are exposed, erosion is rapid in the pounding fall storms. On steep slopes with underlying bedrock close to the surface, the forest mat can become saturated and landslides sweep soil, forest, and mud down slope into the valley bottom or into the inlet.

Kitsault is located in the Coastal Western Hemlock CWH biogeoclimatic zone, the band of temperate coniferous rainforest found at low elevations along the windward side of the Coast Mountain of British Columbia. Due to the distance from the open ocean waters of Hecate Strait, the head of Alice Arm inlet is found within the wet submaritime subzone of the CWH, meaning that the forests around Kitsault are drier than the very wet hypermaritime shorelines of the outer sections of Portland Inlet, or the wet maritime slopes of Observatory Inlet and the west end of Alice Arm inlet. Dominant tree species on undisturbed stable slopes at the head of Alice Arm inlet are western hemlock, amabilis fir, Sitka spruce, and western red cedar, with black cottonwood (Populus balsamifera ssp. trichocarpa) growing in floodplains and red alder (Alnus rubra) dominant in disturbed sites. Seepages in old forests support luxurious thickets of Devil's club (Oplopanax horridus), a thorny, painful shrub often 2 meters or more in height. As drainages become wetter, smelly skunk cabbage (Lysichiton americanum) swamps may occur, or, in very wet locations, open bogs of water-saturated Sphagnum moss. Closer to the ocean edge, ferns such as sword fern (Polystichum munitum), lady fern (Athyrium filix-femina), and deer fern (Blechnum spicant), provide a rich green understory in combination with various types of blueberry species (Vaccinium sp.). Where the forest has been disturbed by floodplains or forest removal, salmonberry (Rubis spectabilis), red elderberry (Sambucus racemosa), and Nootka rose (Rosa nutkana) grow in thickets along the banks.

The understory beneath old growth hemlock forests at Kitsault is full of delicate ferns, liverworts, and mosses that are able to grow in the faint light and moist environment beneath the evergreen canopy of 30 to 50 meter high conifers.

Everywhere close to the ocean, like a green invasion, are mosses and alders. Alders are able to fix their own nitrogen fertilizer due to bacteria that live in nodules in their roots. They are able to grow almost anywhere on mineral soils. If an open space is left abandoned, within 15 years it has disappeared into a thicket of red alder. If the lawns of the townsite of Kitsault had not been mowed, in two decades, the community would have vanished into a forest of alder trees over 10 meters high. Where light is less available, moss smothers exposed surfaces. Pieces of old mining equipment left along the edges of the forests have long since disappeared under covers of green.

Where the caretakers of Kitsault did not mow or chop trees, alder rapidly formed thickets of regrowth.

In this high precipitation environment, disturbance leads to rapid erosion unless the surface is protected by vegetation . The heavily leached natural soils, or "podzols", are nutrient poor and the biochemical cycles that move essential materials within the ecosystems are most effective within the living organisms or the thick layers of decaying plant materials. Old growth forests are a dynamic equilibrium between living trees and rotting wood. In old growth forests, trees range in age from individuals greater than 350 years old, to seedlings regrowing in patches where an old tree has blown down or died of disease. Big gaps in the forest cover are rare in the natural rainforest. Characteristic of the old growth forests of the Kitsault area are tall standing snags and crumbling stumps as trees rot down. Often, the roots of adjacent trees will grow upward into a stump to catch the nutrients released by decomposition. Once the vegetation cover is removed, soils in the Kitsault area are highly erodable.

The low elevation forests of the Kitsault area, in particular those along spawning streams for salmon, have a complex ecology. The deep organic layers of rotting wood support a complicated web of fungi, invertebrates, and bacteria that recycle essential nutrients without these ions being leached away from the wet soils. Most temperate rainforest trees capture these nutrients through close symbiotic associations with certain fungal species known as mycorrhizae. Other plants, such as some of the west coast orchids, cheat and steal nutrients from the fungi, which they in turn had received from the trees. Some mycorrhizae, such as truffle-forming species, are spread by red squirrels which eat the mushrooms, then spread spores in their droppings, expelled high above in the forest canopy.

Salmon play an interesting role in nutrient availability in temperate rainforests. Returning from the nutrient-rich ocean, salmon are full of essential materials that plants need. When predators kill salmon, they often drag the carcasses back into the forests to eat. The rotting remains of these fish provide 'fertilizer' for the trees along the sides of streams and rivers. The enormous sizes of mature trees in the riparian zone, such as the huge old growth Sitka spruce and red cedars of the Kitsault area, reflect this important source of nutrients.

How many salmon use the swift glacial rivers at the head of Alice Arm? Although commercial fishing and habitat losses, due to development and forest harvesting, have dramatically reduced salmon stocks on the North Coast of B.C., the Kitsault River, Illiance River, and hundreds of small streams and springs along Alice Arm still support important numbers of chinook, pink, chum, and coho salmon, as well as steelhead and resident populations of Dolly Varden char and cutthroat trout. Steelhead, the royalty of sports fishes, has been noted as a unique, high value recreation resource in the Kitsault River, and recommended for protection.

Coho salmon are an important commercial and sports fish that will travel as far as possible up watersheds to spawn. Coho return to the Illiance River at an average of 500 fish per year up to a maximum run of 3500 fish recorded in a 50 year period between 1950 and 2001. The same river supports a limited run of pinks, the smallest of the Pacific salmon, with a mean escapement of 1000 fish per year and a maximum return of 6000 fish. Chum or dog salmon, which spawn close to the estuary, return to the Illiance River in higher numbers, with an average of 3,700 chum per year and a maximum of 22,000 fish on record since the 1950's.

The Kitsault River nearby has average escapement runs of 4,900 chum in a year, with maximum values up to 15,000 fish. The coho escapement into the Kitsault River averages 1000 fish a year, with a maximum record of 3000 fish. Similar to the Illiance River, the pink run is small, 500 fish, up to a maximum of 3400 fish in one year. Unfortunately, the giant chinook salmon of the Kitsault River are greatly diminished compared to historical values, with a mean return of 300 fish per year, and a maximum on record of 1000 in one year. During the 1990's, returning chinook were only 50 or fewer fish per year.

Kitsault River: home to four species of spawning salmon and an important steelhead run. Above the lower 3 km of wide braided channels, the river is entrenched in a narrow valley and rocky canyons. Four km long Kitsault Lake and the Cambria icefield are located in the headwaters of the Kitsault River.

The Kitsault area has many attributes for international level eco-tourism.

Photo: K. Mathew

Photos: N. Kerby

The thousands of salmon, returning each year to these rivers and the large number of small watercourses tributary to Alice Arm inlet, are critical to the survival of large predators in the region. Grizzly bears and black bears need salmon in order to consume enough calories to successfully hibernate over winter and complete pregnancies. Other mammalian predators in the food cycles associated with salmon streams, or nearby forests fertilized by the salmon, include wolves, red foxes, wolverines, martins, and fishers. Loss of the salmon resources would impact significantly on the populations of predators as other types of edible prey in the mountainous landscape of the Kitsault area are limited.

In the mossy, coniferous forests around Kitsault, herbivores (animals that eat plants) are dominated by tiny consumers of the edible parts of trees and shrubs, such as bark beetles and budworms. In comparison, the rotting organic layers at the top of the soil support by far the largest number of consumers of plant biomass, with complex food webs of fungi, bacteria, and invertebrates. Large plant eaters are limited to black-tailed deer, a small deer well adapted to the dark forests of the coast, and moose, which are assumed to have only arrived into the coastal zone within the last 100 years and are the favourite winter prey for local wolves. Smaller vertebrate plant eaters also include red squirrels (which mostly eat seeds and buds), porcupines (who prefer the cambium growth layer under the bark of trees), voles and mice species (which eat roots, tubers, and seeds), beaver (which prefer the bark of deciduous tree and shrub species) and a host of bird species which eat seeds and insects throughout the forest canopy and understory layers.

The most productive interfaces of the forests with the ocean are the estuaries and deltas of the watercourses that flow into Alice Arm inlet. The brackish estuary of the Kitsault and Illiance Rivers is very important for a number of animals, including rearing salmon fry. Harbour seals are frequent visitors and will follow returning salmon into the lower reaches of the rivers. Bird species associated with the estuary and head of Alice Arm include bald-headed eagles, ducks, and Canada geese during migration. Along the edges of the estuary, a thick growth of eel grass is full of myriads of small fish when the tide returns. Above that, a rich meadow of lupines, sedges, and grasses forms a lush vegetable bowl for bears. To the west side of the estuary, in the tiny community of Alice Arm, openings around buildings support a luxurious growth of fireweed, lupines, and thimbleberry bushes, with red alders, as always, trying to overgrow any abandoned space.

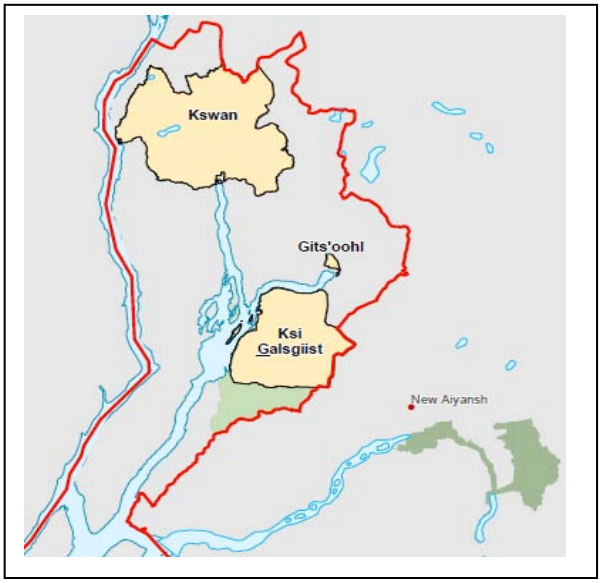
The marine environment at the head of Alice Arm is affected by the large amount of freshwater entering the inlet. Brackish (less salty) conditions in the estuary and where streams enter the inlet reduce the numbers of shellfish that occur along the shoreline. Even more significantly, during heavy runoff from the many tributaries flowing into Alice Arm, an upper layer of freshwater can form over the salt water underneath. Marine plankton and fish are excluded from this layer, but beneath it, in the nutrient rich marine waters of Alice Arm, a wide array of species can be found, including tanner crab, Dungeness crab, golden and red King crab, Pacific cod, Pacific halibut, sole, herring, and sculpins. Sea mammals using the inlet include killer whales, harbour porpoises, and harbour seals. Bird species using the inlet include gulls, terns, cormorants, grebes, surf scooters, murres, murrelets, and loons.

Rare and endangered species also occur in the Alice Arm area. Some North Coast species may never have had large populations or have always lived best in undisturbed environments. Identified species at risk that may occur in the Alice Arm area include the Great Blue Heron (Ardea herodias subspecies fannini), sooty grouse (Dendragapus fuliginosus), northern Goshawk (Accipiter gentilis

subspecies laingi), fisher (Martes pennanti), grizzly bear (Ursus arctos), Keen's long-eared bat (Myotis keenii), and wolverine (Gulo gulo subspecies luscus). These species have a BC conservation status of red or blue, red meaning that they are endangered, blue meaning that they are threatened from survival. The only recorded amphibians living in the Kitsault area are western toads, although the blue-listed Pacific tailed frog (Ascaphus truei), an ancient species of frog that breeds and lives in swift, cold mountain streams, may also occur in the Kitsault area.

The Alice Arm region is located within the Nass Wildlife Area of the Nisga'a treaty. The Nisga'a have special interests and rights in the management of wildlife species in the area around Kitsault. The Kitsault area has significance to the Nisga'a for traditional food and cultural materials and any activities affecting wildlife species has direct impacts upon the Nisga'a communities. Potential environmental issues associated with industrial development at the head of Alice Arm inlet include possible metal contamination from previous mining activities; movement of shipping traffic using Alice Arm inlet; possible contamination at the docking areas at Alice Arm and Kitsault; use of sub-marine tailings disposal by the former Kisault molybdenum mine, with suspected leakage of heavy metals; impacts of proposed run-of-the-river hydroelectric projects which affect fish stocks; and reopening of the Kitsault molybdenum mine.

Some efforts have been made to recognize the fragile ecology of the Alice Arm region. Under the North Coast Land and Resource Management Plan, three types of land use zones were designated in 2009 for the North Coast - Protected areas in the form of conservancies where industrial or commercial activities will not be allowed; Ecosystem-based Management Operating areas, where logging, mining, and other industrial or commercial activities are permitted; and biodiversity management in areas known as BMTA's (Biodiversity, Mining, and Tourism Areas). The head of Observatory Inlet has had three large BMTA's designated. Land uses within BMTA's are restricted, including exclusion of commercial timber harvesting and exclusion of commercial hydro-electric power projects. Mining and tourism activities are permitted. The boundaries of these BMTA's were established after extensive consultation with First Nations and other stakeholder groups. In the North Coast Plan, some BMTA's have been designated next to conservancy areas to extend the size of the area set aside for biodiversity management.



Map 4 : Location of BMTA's in Observatory Inlet region
Three large BMTA management areas (shown in yellow on map) were set aside at the head of Observatory Inlet. In addition, two conservancies have been delineated. The Ksi Xts'at'kw /Stagoo Conservancy (light green) is south of the Ksi Galsgiist BMTA, and the Larcom Lagoon Conservancy is located in Observatory Inlet to the west of the same BMTA. Ministry of Natural Resource Operations, 2011.

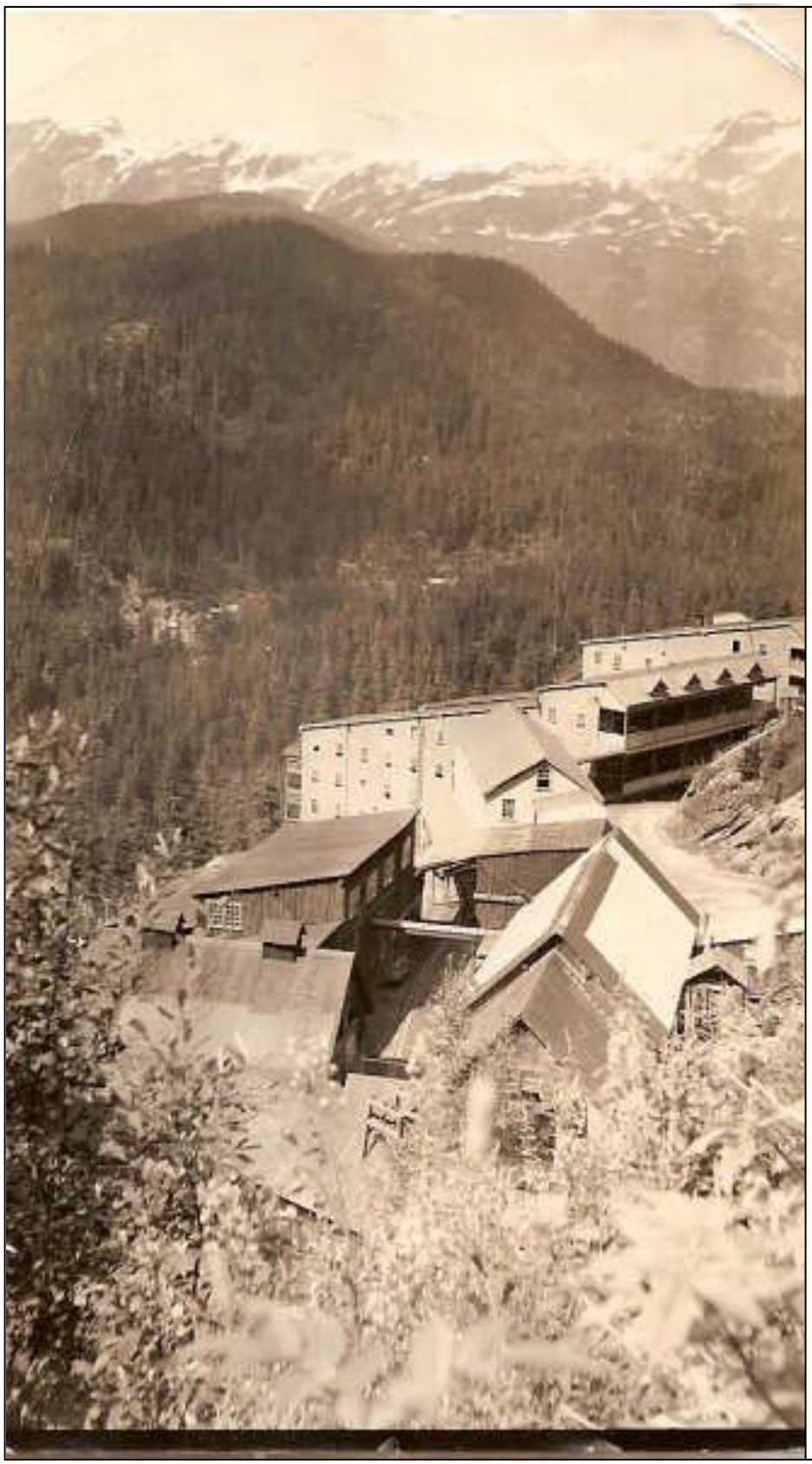
Based on the important natural ecology of the lower Kitsault and Dak Rivers, the Gits'oohl BMTA was established at the head of Alice Arm. The boundary of the Gits'oohl BMT abutts on the Nisga'a lands of the former Gitzault Reserve 27 and includes the valley bottom one half kilometer in from the shoreline to almost 3 kilometers north up the Kitsault Valley, encompassing 560 hectares of rich bottomlands mostly in floodplain (see page 5 for aerial view of the Gits'oohl BMTA).

The Ksi Galsgiist BMTA south of Kitsault is large and extends along the south side of Alice Arm inlet following Dawson Ridge. A total of 31,617 hectares (78,094 acres), of mostly rugged mountainous landscape from sealevel to alpine elevations, has been put under BMTA biodiversity management. Immediately to the south of this BMTA is located the 11,555 ha (28,541 acres) Ksi Xts'at'kw/Stagoo Conservancy. This conservancy includes the spiritually important valley of Kelskiist Creek, preserved for traditional use by the Nisga'a. Both the BMTA and the conservancy are included in the Nisga'a Wildlife Area of the Nisga'a Lisims Government and the Nisga'aTreaty.

View of Ksi Galsgiist BMTA or Biodiversity, Mining, and Tourism area - upper left of photo; Dawson Ridge is the mountain range along the left side of Alice Arm inlet; across the inlet is Pearson Point; Alice Arm townsite is to the right of the photo.

A third BMTA in the Observatory Inlet area, the 56,037 ha (138,411 acre) Kswan BMTA, is located at the head of Hastings Arm to the west of Alice Arm. This BMTA includes a number of glacial tongues extending off the Cambria Icefield and extensive areas of alpine and subalpine ecosystems. It is also an area of intensive mineral exploration based out of nearby Stewart, B.C.

The Nisga'a name for Hastings Arms is K'ialii Kswan. The name comes from the cold glacial water that flows into the inlet. This area is the location of K'ipmats'iskw, which, in the oral history of the Nisga'a, was the mountain where the ancestors of the Nisga'a took refuge from the Great Flood at the end of the Ice Age. The inlet and estuary were so rich in resources that they were used in common by all of the Nisga'a prior to the arrival of Europeans. The Kswan BMTA is an amazing area of retreating glaciers, high biodiversity, and cultural importance to the Nisga'a.



THE GOLDEN TRIANGLE

Kitsault is located in a region of world-class mineral deposits. The Premier Gold Mine, located 65 km NE of Kitsault, operated from 1918 to 1953. An 18 km (11 mile) tramline carried the ore from the mine to the port at Stewart. Over 240 km (150 miles) of tunnels were built to remove the rich gold/silver ore. In 35 years, the mine produced 51 million grams of gold and 1.16 billion grams of silver. In today's dollars, the gold would have been worth over $3 billion dollars. The Premier mine site in the 1920's and 1930's was it's own small village. All of the workers and some families lived full-time at the mine site.

Photo: www. stewartbc.com

History of the North Coast and Kitsault

Human settlement on the north coast of British Columbia dates back close to the end of the Pleistocene Ice Age 10,000 years ago, when the massive ice sheets retreated and land became inhabitable again. Before European explorers reached this rugged, mountainous region over 200 years ago, the Haisla, Tsimshian and Nisga'a First Nations had many thriving communities built along the deep fjords that penetrated the rugged Coast Mountains.

The north coast of British Columbia was rich in sea life. Marine inlets reached deep into the glacier-studded mountains, allowing large numbers of spawning salmon to access the streams and rivers flowing out into the channels. These ocean inlets warmed the adjacent land. Lush rainforests thrived on the mountain slopes. For First Nations of the north coast, resources to support their complex cultures were bountiful.

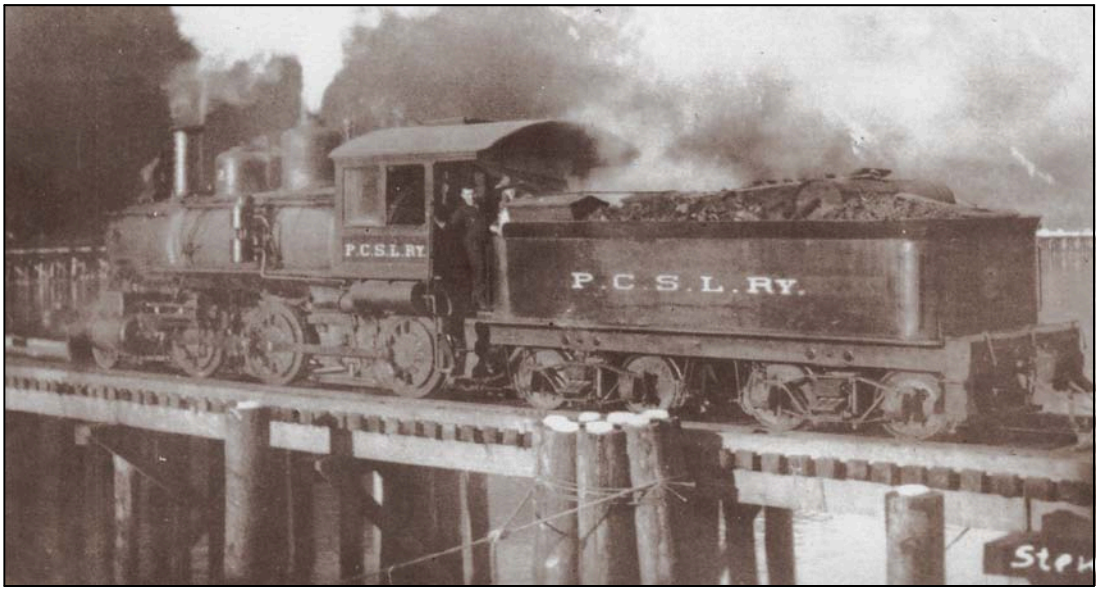
Kitsault is situated within the traditional territory of the Nisga'a First Nations. Villages and fishing sites were located throughout the Observatory Inlet region, including the Nisga'a community of Ts'im Gits'oohl (meaning 'a ways in behind') at the head of Alice Arm inlet near the mouth of the Kitsault River. The smallpox epidemics of the late 1700's and 1860's did much to depopulate the villages of the North Coast. By the turn of the 19th century, the site at Gits'oohl was unoccupied. Gitzault Indian Reserve #24 was designated at Gits'oohl in 1888 by Peter O'Reilly, B.C. Indian Reserve Commissioner. In an agreement between the Province of B.C. and the Federal Government, reserve lands on the west side of Kitsault River were tranferred in 1912, then sold in 1929 for building lots within the mining town of Alice Arm. In 2000, the remaining land of Gits'oohl became part of the Nisga'a titled land holdings resulting from the Nisga'a Treaty.

European contact with the mid-west coast of North America (what is now British Columbia) increased in the late 1700's when explorers and fur traders discovered the rich natural resources of the region. During the 1780's and 1790's, a brisk maritime fur trade was conducted along the Queen Charlotte Islands (Haida Gwaii) and the adjacent mainland, but few traders ventured inland beyond the outer shores of these coasts. In the 1790's, the British Navy began an organized effort to map the coastline between the mouth of the Columbia River and Russian America north of Dixon Entrance. Observatory Inlet was named in 1793 by the west coast explorer, Captain George Vancouver, in honour of the observatory that he established on the shore of the inlet to calibrate his chronometers. By 1834, the Hudson's Bay Company established Fort Simpson (later Port Simpson) at the site of a traditional Tsimpsean camping area known as Lax-Kw'alaams near today's City of Prince Rupert, but it wasn't until the mid-1800's that Europeans began to explore Observatory Inlet in any detail.

Alice Arm, the eastern branch of Observatory Inlet, was named in 1868 by Captain Daniel Pender after Alice Mary Tomlinson, wife of Reverend Robert Tomlinson. Tomlinson was the Anglican minister in charge of the mission at Gingolx (Kincolith), a Nisga'a village at the mouth of the Nass River. Captain Pender was a Royal Navy commander who, from 1857 to 1870, conducted detailed coastline surveys of the British colonies of Vancouver Island and British Columbia. The amalgamated colony of British Columbia was formed in 1866 from these two colonies and British Columbia joined the country of Canada in 1871. In 1867, Russian America, including the islands and coastline north of the Queen Charlotte Islands (Haida Gwaii). was purchased by the United States and became the territory of Alaska.

By the late 1890's, rich mineral deposits in the Portland Canal and Observatory Inlet areas were attracting attention. In 1898, during the excitement of the Klondike Gold Rush, a group of 64 prospectors from Seattle landed at the head of the Portland Canal (60 km NNW from the head of Alice Arm inlet) and explored upriver into the Bear River Valley. The first mineral claims in the region were staked that year by three prospectors who remained behind after the rest of the group left. There was confusion, though, as to which country owned the land at the head of Portland Canal, as no-one was certain where the boundary between Alaska and British Columbia was located. With the Klondike gold discoveries and the frantic activities of prospectors throughout the B.C./Alaskan coastline from the Skeena River northward, legal settlement of the Alaska boundary dispute became an urgent matter. In 1903, the Hay-Herbert Treaty was signed and the Alaska Boundary Tribunal established. Surveying and marking of the boundary commenced, often with joint American and Canadian crews. By 1910, the boundary for southeast Alaska had been finalized and mineral claims in the borderlands around Portland Inlet were determined as to whether or not they were located in Canada or the U.S.A.

During this time, twin boom towns were established at the head of Portland Canal - Portland City (later Hyder), Alaska, and Stewart, B.C. Significant mineral deposits, including high grade silver and gold ores, were found throughout the region, including Bitter Creek, American Creek, Glacier Creek, and Red Cliff mines. Speculation and land development heated up even further when, in 1910, a railway charter was granted to build a full-gauge line from the Port of Stewart through the Bear Pass to provide a northern "trans-continental" railway. The population of Stewart soared to 10,000 people. The continental railway never happened, but a short, 21 km railline was built up the Bear Valley to the Red Cliff mine.



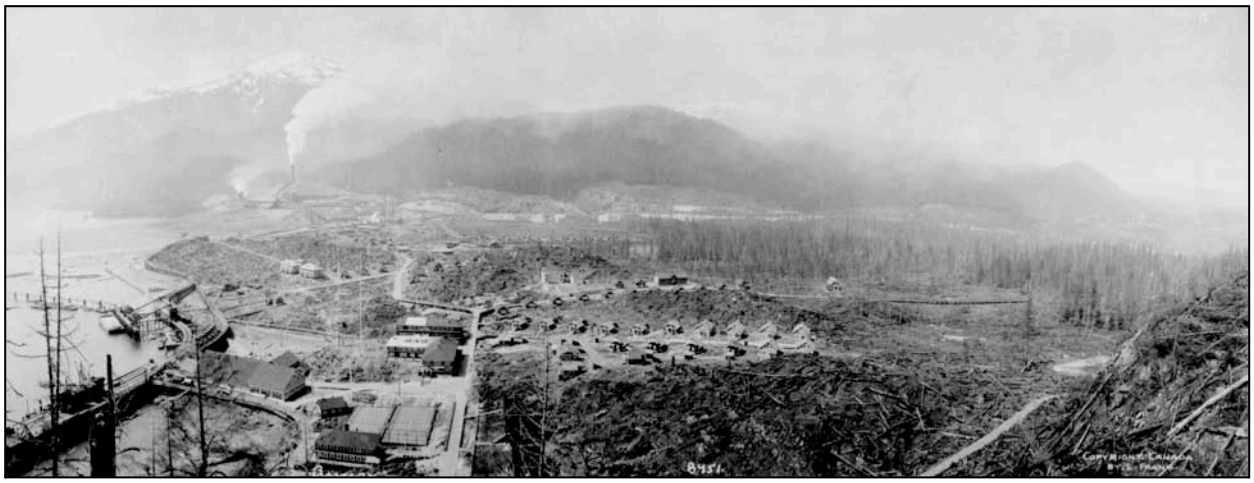
Stewart docks, 1910, Portland Canal Short Line Railway. A trans-northern B.C. railway was never built due to costs and logistics. Bear Pass to the Nass Valley, at that time, was filled by a valley glacier and construction in the avalanche-prone valley would have been very difficult.

Photo: www.stewartbc.com.

After the early boom years, Stewart had an erratic history of mining activity. The most successful mine in the Stewart area was the Premier gold mine, located 22 km north of Stewart. Discovered in 1910, the Premier Mine (Silbak Premier Mine after 1936) operated continuously from 1918 to 1953. During this period of time, mine produced over 4,700,000 tons of ore. After 1953, the mine operated at a lesser scale until 1968, and then again in the 1990's as the Westmin gold mine. The ore at the Premier mine, hosted in Jurassic volcanic rocks, was so rich that 51 million grams of gold (1.8 million ounces), 1.16 billion grams of silver (41 million ounces), 1.9 million kilograms of copper (4.2 million pounds), 28 million kilograms of lead (62 million pounds), and 9.1 million kilograms of zinc (20 million pounds) were produced in the 35 years between 1918 and 1953.

The Premier gold mine was not the only successful mine near Stewart. Stewart is located in what is referred to as the "Golden Triangle" of metal ores, mostly deposits of massive sulphides rich in precious and industrial metals. In the 1970's through to the 1980's, the profitable Granduc copper mine operated 40 km northwest of Stewart. A total of 15.2 million tonnes of ore was produced, grading 1.79% copper, with additional silver, gold, lead and zinc values. The Eskay Creek mine northeast of Stewart ran from 1994 to 2008. At full production, the mine had an average production of 320,784 ounces (9 million grams) of gold and 15.5 million ounces (440 million grams) of silver per year! With the prices for gold and silver rising to all time highs, Stewart, with a 2011 population of 500 people, is again undergoing another big surge in mining exploration throughout the surrounding region.

Other significant mineral discoveries were made in the region around Portland Inlet at the turn of the 19th century. Where Observatory Inlet branches into Hastings Arm and Alice Arm (23 km southwest of Kisault), a massive sulphide copper deposit, dominantly chalcopyrite ($CuFeS_2$), was discovered in 1898 at Hidden Creek by William Collinson, George Rudge, and H.B. Fluein from Port Simpson. When the Granby Consolidated Mining and Smelting Company Ltd. bought out this discovery, millions of dollars of investment were placed into developing the large copper discovery. Copper is a lower value industrial metal. It was considered good business practice at that time to smelt the ore close to the location of extraction, rather than to ship it to a distant smelter. The Granby Company constructed a huge smelter, port, and support facilities at Granby Bay, including an extensive narrow gauge railway system.



Anyox smelter and town, 1917: Image HP038989 courtesy Royal BC Museum, BC Archives; photo - L. Frank

The company also built a townsite called Anyox to house the 2500 to 3000 workers and their families. The community had all of the services - stores, schools, churches, housing, recreation facilities, and even electricity. A large hydroelectric development, including dams, pipelines, and powerhouse, had been constructed in 1910 to provide power for both the smelter and the town. The enormous buttressed dam, built on Anyox Creek, was the tallest in Canada at that time.

Over the mining lifespan of the Anyox mines from 1914 to 1936, 321.5 million kilograms (707 million pounds) of copper, 3.8 million grams (134,000 ounces) of gold, and 206.3 million grams (7 million ounces) of silver were produced. During the 1920's, Anyox was considered one of the most lucrative copper smelters in the British Empire. The smelter, operating from 1914 to 1936, generated large amounts of slag and spewed out sulphur oxide gases into the surrounding atmosphere, killling the forests for hundreds of square kilometers surrounding Anyox.

Anyox operated until 1936, when, as a result of the global recession in the 1930's, it was faced with a stewpot of problems - falling prices for metals, a miner's strike, depletion of the richest sections of ore, and cancellation of contracts. The mine and smelter shut down. Workers moved away. Most of the equipment was sold off and removed, and the storage dam was breached in several spots for safety reasons. By 1939, the post office closed. In 1942, a forest fire destroyed most of the remaining wooden buildings in the community. Anyox became a ghost town.

Anyox Creek Dam in 2004 - note the breaches at the base of the dam to avoid overtopping by high water.

Photo: LandQuest Realty Corp.

In recent years, some new activity has occured at Anyox. Starting in 1990, devitrified glass slag has been mined from the Anyox smelter's slag pile to be used as sandblasting abrasive. The primary purchaser of this material has been the U.S. Military, who uses the abrasive during repainting of their submarines and ships. Anyox is also the location of a proposed 30 MW commercial hydroelectric development, including proposed reclamation of the large concrete buttressed dam on Anyox Creek. The power would be moved by underwater cable to the Provincial power grid at Kitsault.

With possible redevelopment of the Anyox area, the Regional District of Kitimat-Stikine recently put the historically significant Anyox powerhouse on their Heritage Registry for important heritage sites.

During the excitement of the Granby Anyox project in the early 1900's, prospectors spread out into adjacent inlets and valleys. The first claims at the head of Alice Arm inlet were staked in 1903 by Frank Roundy (Roundy Creek is just south of Kitsault). Several claim groups were staked and small mines started. Most propsects were located within 2 kilometeres of the inlet as rough terrain and thick forests made it difficult to search any distance beyond the edge of the water.

Esperanza silver mine, 1910's, 2 km from Alice Arm: Image HP059368 courtesy of Royal BC Museum, BC Archives

In 1908, two prospectors, Joe Wells and William Dilworth, hiked up the rugged Kitsault Valley and over the pass into the Nass River Valley. They staked two claims in the Kitsault headwaters area in 1909. In 1910, rich silver deposits were discovered by four Scandinavian prospectors, Ole Evindsen, Ludwig Eik, Ole Pearson, and E. Carlson, in the middle section of the Kitsault River watershed, 23 km north of the head of Alice Arm inlet. The discoveries, called the Dolly Varden claims, proved to be exceptionally rich in pyrite, galena, silver ore, and native silver.

The rich mineral deposits in the Alice Arm area led to a rapid influx of prospectors, miners, laborers, and the usual assortment of characters that follow mining booms. To avoid the shallow tidal flats at the mouth of the Kitsault River, docks were constructed along the rocky, west side of the bay. The townsite of Alice Arm, with cabins, stores, cafes, storage sheds, and a large hotel, was located on the upper mudflats and hillsides 2 km further north. As the prospectors spread out, mineral claims were staked throughout the valleys at the head of Alice Arm inlet.

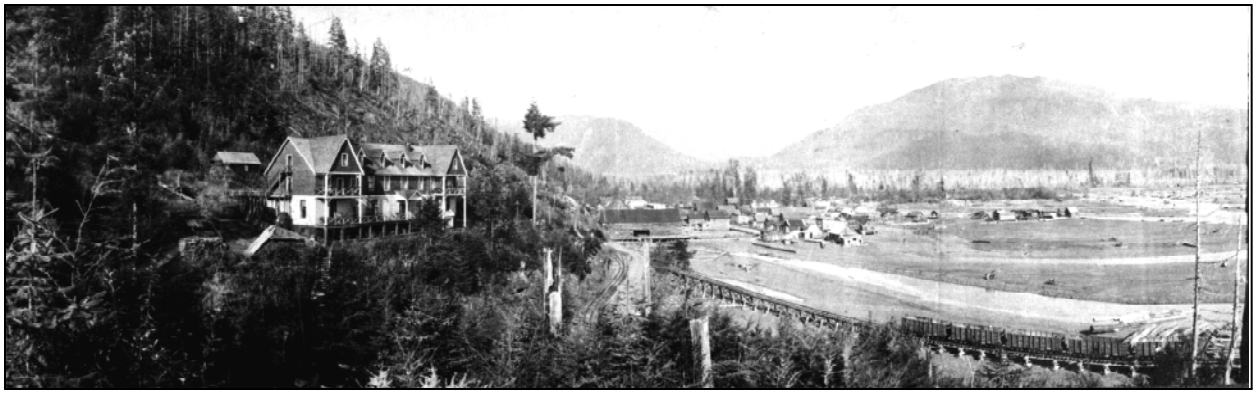
Another small mining community, called Silver City, sprung up on the east side of the inlet at the mouth of Lime Creek (where Kitsault is located today). In 1911, silver prospects were being pursued in the Lime Creek watershed, but they never materilaized into mines as large as the Dolly Varden mine.

Dolly Varden Mine camp, 1910's, 23 km from Alice Arm:Image I-68491 courtesy of Royal BC Museum, BC Archives

By 1917, the very rich Dolly Varden silver mine, half way up the rugged Kitsault valley, was ready to start production. Pockets of native silver brought the ore value in the Dolly Varden mine up to unbelievable amounts. One vein of ore, nicknamed the "Glory Hole", assayed out at 75 to 80% pure silver. Four hundred sacks of this high-graded ore were valued at more than half a million dollars in that era's dollars.

The American-based Dolly Varden Mining Company, which had bought out the Dolly Varden claims, obtained a railroad charter to move ore from the mine to tidewater for shipping to smelters at Anyox and Tacoma, Washington. Between 1917 and 1919, a 23 km long narrow gauge railway was constructed up the Kitsault valley. The construction costs of the railway, with an elevational gain of 500 meters along the narrow rocky canyons of the Kitsault River, bankrupted the mining company. After a messy legal battle and the involvement of the British Columbia legislature, both the mine ownership and the railway were turned over to the engineering firm building the railroad, the Taylor Engineering Company.

The Taylor Mining Company only operated for three years, when it too went bankrupt. Despite the very rich silver deposits in the mine, the high costs of completing the railway, followed by severe difficulties in maintaining the tracks, coupled with heavy, impassible winter snowfalls, proved to be too much financially. The Dolly Varden mine then operated sporatically under a series of different owners until 1940, when the mine was closed and most of the equipment was abandoned in place. Over 33,500 tonnes of ore, with an average grade of 1300 grams (46 ounces) of silver per tonne, 0.1% copper and 0.5% lead, were mined from the rich east side of the Dolly Varden deposit. Total production of ore from both the west and east Dolly Varden deposits over these 20 years was estimated at 1,284,882 tonnes averaging 484 grams (17 ounces) of silver per tonne, 0.38 % lead, and 0.02% zinc. With recent high prices in silver, there has been renewed interest in opening the Dolly Varden deposits again.



Alice Arm ca. 1920 showing the Alice Arm Hotel, owned by Ole Evindsen, one of the discoverers of the Dolly Varden Mine. A siding of the Dolly Varden Mines Railway, operational between 1919 and 1921, is below the hotel, with the main track to the right leading to the docks. The community of Alice Arm is on the flats. The valley of the Kitsault River swings to the left behind the first hill. Image HP039574 courtesy of Royal BC Museum, BC Archives.

Although the Taylor Mining Company ran the narrow gauge Dolly Varden Mines Railway for only three years between 1919 and 1921, the railway was subsequently utilized by miners, prospectors, and trappers until removal of the rails in 1946-1947. Gas speeders, small gas locomotives, four-wheeled trailers, handcars, and other make-shift machinery transported passengers and freight up the railroad to the mid-Kitsault Valley, where packers or packtrains took over. The Grandby Logging Company operated on the lower line between 1924 and 1927, and the Toric Mine ran its own locomotive and freight cars up to Camp 8 until the late 1930's.

1927 - Grandby Consolidated Mining Company leased the DVMR train and flatdecks to haul the huge old growth timber logged from Kitsault Flats.Image FS01877-0 BC Forest Service; courtesy Royal BC Museum, BC Archives.

View from the east side of Alice Arm inlet, just south of the mouth of Lime Creek (Silver City). Across the inlet, where roofs are visible, would have been the location of the terminus of the Dolly Varden Mines Railway (1919 to 1921). Note the flat railroad grade. Ore was dumped on to barges, which were towed to the Anyox smelter on Observatory Inlet. In the winter of 1919, dogsled teams hauled out ore to the docks, due to the very deep wet snow in the Kitsault valley which blocked the railline.

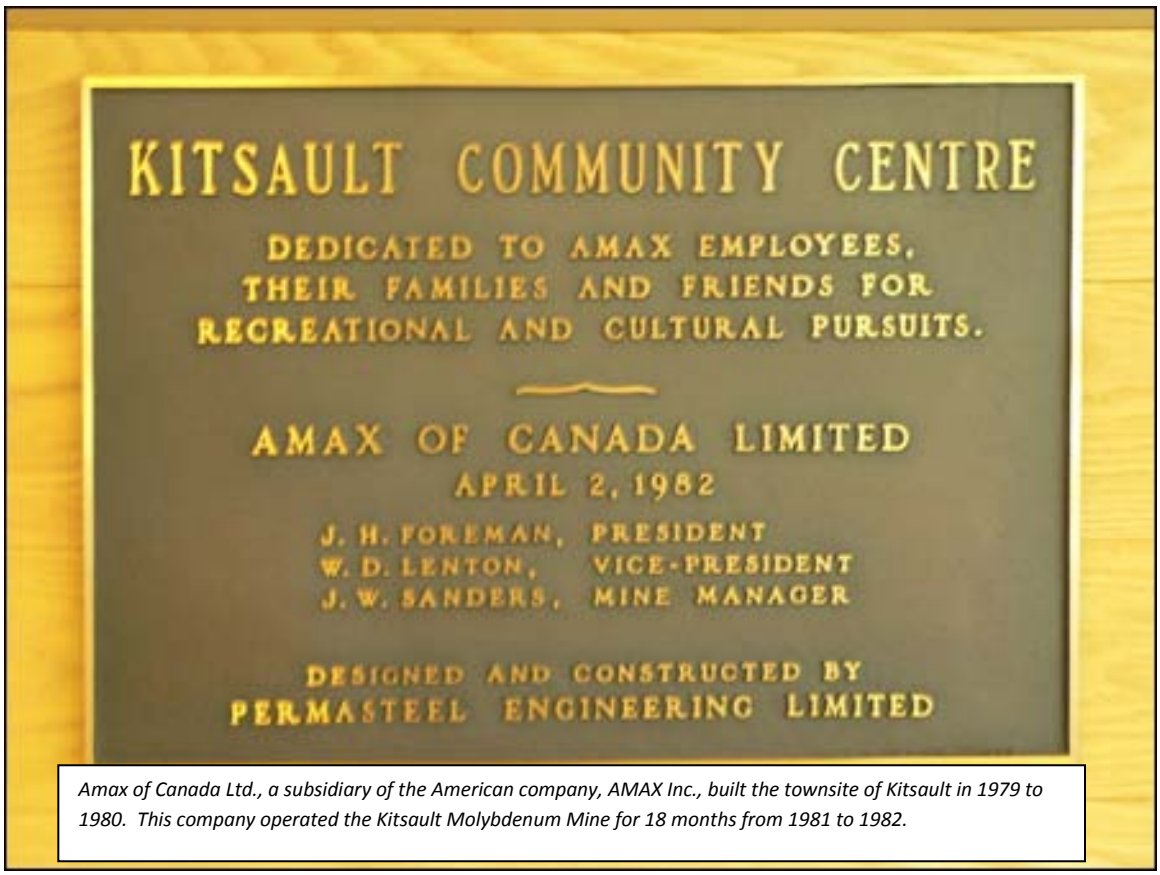
The dense rainforests and thick moss ground cover of the Alice Arm area frustrated prospectors. Most discoveries were made in creek canyons where the bedrock was exposed or on steep cliff faces. Underneath the forest canopy, deep layers of fallen logs lay directly over broken bedrock, making construction of trails, tote roads, and the Dolly Varden Mines railway grade difficult and expensive. The Kitsault valley was also susceptible to massive rainstorms, especially in the autumn. Washouts and landslides were common. These factors, combined with the high cost of maintaining the railway grade and impassable snow depths in the winter months, contributed to the bankruptcy of the Dolly Varden Mines Railway in 1921.

The Torbrit (Toric) Mine, located close to the Dolly Varden mine, operated sporatically from 1916 to the late 1930's. Between 1949 and 1959, the mine was opened on a production scale. In ten years, 1,249,942 tonnes of ore were produced, averaging 464 grams per tonne silver, 0.005 grams per tonne gold, 0.4% lead and 0.05% zine. In 1956, Torbrit Mine was the third largest silver producer in Canada. In order to access the mine, the Dolly Varden Mines Railway grade was converted to a road. Electricity was generated by damming the outlet of Kitsault Lake (headwaters of the Kitsault River) in 1949 with an 8 meter high, rock-filled timber crib dam. Four kilometers away, a powerhouse was constructed at the confluence of the Kitsault River and Homestake Creek. The dam and powerhouse were abandoned after the mine closed. Although the original dam on Kitsault Lake remained intact, it deteriorated rapidly, causing safety concerns regarding overtopping of the dam during high runoff events and possible dam failure, potentially impacting the community of Alice Arm downstream. The powerhouse was removed in 1981 and the historic dam location is now the site of a new replacement dam proposal (in 2010) by Anyox Power Ltd.

Another interesting mining prospect located in the upper Kitsault watershed close to the Kitsault Glacier was the Homestake property. Located on a deposit of massive sulphide ore lenses rich in gold, copper and silver, the Homestake prospect operated erratically until the mid 1930's. Since the 1960's, a number of major mining companies, including Newmont Canada, Noranda, Teck Corporation, and, most recently, the Bravo Venture Group, have undertaken extensive exploration work at Homestake Ridge.

On the east (Kitsault) side of the inlet, upstream of the tiny mining settlement of Silver City, silver deposits were staked in 1911 along Lime Creek. The showings were worked through the 1920's and early 1930's. A small amount of molybdenite was produced from the Lime Creek exposures during World War I, but the ore was not considered significant. Mining interests in these deposits were revitilized in 1956 when Kennco Explorations (Western) Ltd., a subsidiary of the American company, Kennecott Copper Corporation, examined the claims on Lime Creek and optioned the properties in 1957. In the same year, the company mounted an extensive exploration diamond drilling program in the area. In addition to galena (lead ore) and silver ore, they discovered a large deposit of porphyry molybdenum, the metal used in the manufacture of high-quality strengthened steel. At this time, during the Cold War of the 1950's and 1960's, molybdenum was of considerable interest due to its use in the manufacture of armaments, aircraft nose-cones, and equipment for the space industry.

By late 1964, British Columbia Molybdenum Ltd., another subsidiary of Kennecott Copper Corporation, started construction of a $30 million dollar mine at 700 meters elevation on Patsy Creek, the east fork of Lime Creek. Between 1968 and 1972, this open pit mine produced 22.9 million pounds of molybdenum processed from a total of 9.3 million tonnes of ore grading at 0.11% Mo. The mine closed in 1972 due to low molybdenum prices. In 1973, the property was purchased from Kennecott by Climax Molybdenum Corporation of British Columbia, a subsidiary of AMAX Inc. Further exploration work on the large molybdenum deposit was undertaken from 1974 to 1978 by Climax Molybdenum. The property was then transferred to Amax of Canada Ltd., another susidiary of AMAX Inc., in 1979. With the rise in molybdenum prices, Amax of Canada Ltd. re-opened the mine site during that same year and started construction of the company town of Kitsault to be used to house its workers and their families in this remote location. From 1981 to 1982, the company milled 4.1 million tonnes of ore at 0.08% Mo., producing an estimated 8 million pounds of molybdenum.



Amax of Canada Ltd., a subsidiary of the American company, AMAX Inc., built the townsite of Kitsault in 1979 to 1980. This company operated the Kitsault Molybdenum Mine for 18 months from 1981 to 1982.

Similar to other porphyry molybdenum deposits in North America, open pit mining was used at Kitsault to extract the low grade, high tonnage ore. Large volumes of waste rock and tailings were generated. During the operations of the mine for 18 months in 1981 and 1982, tailings from the open pit mine were moved downslope in a large pipe from the refining mill to be deposited at 50 meters depth under the waters of Alice Arm.

Submarine tailings disposal was estimated at that time to be saving the company $25 million per year compared to land disposal of the tailings. A Federal Order in Council permitted the company to dump wastes into the inlet in excess of regulated effluent limits of 25 mg/litre as per the Federal Fisheries Act. Released instead at a rate of 400,000 mg/litre in the form of a thick slurry, an estimated 12,000 tonnes of tailings were dumped per day into the inlet during the 18 months that the mine operated. These tailings included not only waste rock, but also a mixture of metals, including copper, zinc, cadmium, mercury, uranium, radium, and arsenic.

During the 1978 permitting process for the mine, concerns had been expressed about the potential for the heavy metals in the tailings to concentrate in bottom sediments, affecting invertebrates and fish. Serious concerns were also expressed about the turbidty (cloudiness) of the tailings damaging marine ecosystems in the inlet. Subsequent studies of the tailings between 1983 and 1989 showed development of a mid-water turbidity layer over the tailings, negative effects on biodiversity attempting to recolonizing the tailings, and contamination of adjacent water with molybdenum and other heavy metals. The disposal of tailings into Alice Arm was very controversial amongst First Nations and regional residents at the time.

Mining activities at Kitsault ceased in 1982 when world prices for molybdenum collapsed during the global recession of 1982-1984. The molybdenum market was also affected by the development of techniques which allowed cheaper molybdenum recovery from porphyry copper ores already being milled at American mine sites. After the closure of the Kitsault mine, Amax of Canada Ltd. continued to maintain the townsite and monitor the mine and tailings for environmental impacts until the property, including the townsite and three molybdenum deposits in the area - Kitsault, Bell Moly, and Roundy Creek - were transferred to another AMAX subsidiary, Alumax Ltd (see pages 33-34).

When Alumax was purchased in 1998 by the giant American aluminum company, ALCOA Ltd., the reclamation responsibilities were transferred to ALCOA's subsidiary, Aluminerie Lauralco Inc. and shared legally with a subsidiary resulting from the 1999 purchase of AMAX by PHELPS DODGE, another giant American minerals company. All of the infrastructure at the mine site was removed and by 2006, the site was classified as reclaimed. With completion of reclamation, ownership of the Kitsault mining property became 100% under ALCOA's subsidiary, Aluminerie Lauralco Inc.

The townsite was sold in 2005 by Aluminerie Lauralco Inc. to a private company, Kitsault Resort Ltd., which began restoration and reactivation work on the townsite with the goal to develop a world-class eco-resort. The mining properties and mineral tenures were purchased three years later in 2008 by Avanti Mining Inc., which formed a Canadian subsidiary, Avanti Kitsault Mine Ltd. During a world market scenario of high prices for molybdenum, in 2009, Avanti Mining Inc. started the process of planning for a proposed new Kitsault molybdenum mine, with the goal of production by 2014. By 2011, Avanti was fully within the Environmental Assessment review process to obtain Federal and Provincial approvals to open the mine.

The Kitsault Molybdenum Mine: A Maze of Mining Companies

The Kitsault molybdenum deposit has gone through a number of owners since its discovery in 1957. After 1982, each time that the mineral deposit and mine changed ownership, the ownership of the company townsite of Kitsault followed the ownership of the mine until 2005. The following is a chronological overview of these owners and their partent companies or subsidiaries.

Kennco Explorations (Western) Ltd., who optioned the Lime Creek molybdenum properties in 1957, was a subsidiary of the giant American metals company, Kennecott Copper Corporation. British Columbia Molybdenum Ltd., who ran the first molybdenum mine at Kitsault between 1968 and 1972, was another subsidiary of Kennecott. Kennecott Copper Corporation, formed in 1915, remained an independent corporation until the 1980's, when low copper prices led to it be taken over by Standard Oil of Ohio, who was then taken over by BP Minerals America (a subsidiary of British Petroleum), who, in 1989, sold certain mineral assets to Rio Tinto, another American firm. Rio Tinto has since continued to retain ownership of some former Kennecott's properties, such as the Bingham Canyon mine in Utah.

British Columbia Molybdenum Ltd, the subsidiary of Kennecott Copper Corporation, sold the Lime Creek properties (also known as Alice and B.C. Moly) in 1973 to Climax Molybdenum Corporation of British Columbia, a subsidiary of the American company, American Metal Climax Inc. (renamed in 1974 to AMAX Inc.). American Metal Climax Inc. was formed when American Metal Company Ltd (AMCO), an American lead and copper company established in 1887, merged in 1957 with Climax Molybdenum Ltd. (formed in 1917 by a syndicate including American Metal Co.).

In 1979, the Lime Creek properties were transferred from Climax Molybdenum Corporation of B.C. to Amax of Canada Ltd. (or American Metal Climax Can. Ltd.). Amax of Canada Ltd. was another subsiduary of AMAX Inc. In 1982, the Kitsault molybdenum mine was closed. In the late 1980's, AMAX tranferred ownership of the Kitsault mine and townsite from Amax of Canada Ltd. to its profitable aluminum company, Alumax Inc., in order to use the capital losses tax benefits from the mothballed Kitsault mine and townsite against the profits being generated by Alumax. In 1993, AMAX Inc. merged with Cyprus Minerals Company to form Cyprus Amax Minerals Company. Cyprus Amax Minerals Company was acquired in 1999 for $3.4 billion by Phelps Dodge Corporation (a very large American minerals company established in 1837). Phelps Dodge itself was acquired in 2007 for $25.9 billion in cash and stock by Freeport-McMoRan Copper & Gold Inc.

After the merger of AMAX Inc. with Cyprus Minerals Co. in 1993, as part of the merger, AMAX's aluminum subsidiary, Alumax Inc., was spun off to the AMAX shareholders as a publicly held independent company. The Alumax package included the inactive Kitsault mine and townsite. Alumax Inc. was purchased in 1998 by ALCOA Inc., the giant American aluminum producer, a year before Cyprus Amax Minerals Company was purchased by Phelps Dodge. In 1998, ALCOA put the Kitsault holdings under its profitable subsidiary, Aluminerie Lauralco Inc. (another aluminum company). Responsibilities for maintenance of the unoccupied Kitsault townsite were held by Aluminerie Lauralco Inc. Restoration of the inactive Kitsault mine was legally shared between Aluminerie Lauralco Inc. and Climax Molybdenum (a subsidiary of Phelps Dodge after 1999). In 2005, the Kitsault townsite was sold by Aluminerie Lauralco Inc. (the ALCOA subsidiary) to a private owner, who formed Kitsault Resort Ltd. Work was started on the townsite to turn it into an eco-resort.

In 2006, the final reclamation program for the mine site was completed and all legal responsibilities for the mining property were 100% transferred to Aluminerie Lauralco Inc. The molybdenum deposits, including Kitsault (Lime Creek), Bell Moly, and Roundy Creek deposits, were sold in 2008 for $20 million plus concessions by Aluminerie Lauralco Inc., the subsidiary of ALCOA Ltd., to Avanti Mining Inc. of Denver, Colorado. After purchase, a new subsidiary was formed, Avanti Kitsault Mine Ltd., with a Canadian registered office in Vancouver B.C.

Ownership of the townsite of Kitsault and the Kitsault mine and mineral tenures were held sequentially by Amax of Canada Ltd. (a subsidiary of AMAX Inc.) from 1979 to the late 1980's, when the Kitsault properties were transferred to Alumax Inc. (another subsidiary of AMAX Inc.). In 1993, Alumax Inc. became an independent, publicly held company until 1998. In 1998, Alumax Inc. was purchased by ALCOA Ltd. In the same year, ALCOA Ltd. transferred ownership of the Kitsault mine and townsite to its Quebec subsidiary, Aluminerie Lauralco Inc. In 2005, the townsite was purchased by Kitsault Resort Ltd. from Aluminerie Lauralco Inc. In 2008, the mining property and tenures were purchased by Avanti Mining Inc. from Aluminerie Lauralco Inc.

View of open pit and development camp for Avanti Mining Inc., 2010
Photo: permission from Ellsworth Dickson www.resourceworld.com

Current Activities in the Kitsault Area

Following the global recession of 2008 and the dramatic rise in metal prices during 2010 and 2011, the region at the head of Alice Arm has become very busy. In addition to the purchase of the townsite of Kitsault in 2005 and the Kitsault molybdenum mine and mineral tenures in 2008, a number of investments have been made in future economic activities along the marine inlet of Alice Arm and the surrounding rugged mountain ranges.

Across the inlet from Kitsault, the tiny village of Alice Arm is undergoing a resurgence of activity. Although Alice Arm is not connected to the B.C. Hydro power grid or to any roads leading to the rest of the Province, it is the centre for a number of projects in the Kitsault River valley and as far west as Observatory Inlet. A maintained dock, open year round for boats and seaplanes (when the inlet is not frozen), is located 2 km south of Alice Arm, allowing freight and passengers to be shipped or flown into the region. There has been an increase in recreational boaters from BC and Alberta who have restored or built summer cottages in the community.

Alice Arm is also the base of activities for three run-of-the-river hydroelectric projects by Anyox Hydro Ltd. One of these proposals calls for the construction of a new dam at the location of the 60 years old Kitsault dam, built in 1949 at the mouth of Kitsault Lake, which flows into the east branch of the Kitsault River. The other two proposals are run-of-river projects on adjacent Homestake Creek and the west branch of the Kitsault River. The road from Alice Arm north up the Kitsault River (Highway 82) is being upgraded as part of these projects and a powerline will be built to Alice Arm. Anyox Hydro's two projects in the Kitsault area are projected to produce 50 MW of power annually and will tie into the provincial power grid via an underwater cable to the substation at Kitsault. In addition to the power projects, the high prices for silver and gold have generated elevated levels of mineral exploration and evaluation in the mountains surrounding Kitsault Valley and Alice Arm, including gold prospects on Homestake Ridge at the north end of the valley and possible reactivation of the old Dolly Varden mine.

A second set of hydroelectric projects being developed by Anyox Hydro Ltd. will include refurbishing the large multiple-arch buttress dam built in 1910 near Anyox, the former copper mine and smelter community on Observatory Inlet 23 km away by air from Alice Arm. The concrete dam was part of the extensive infrastructure constructed to provide electricity for the large Anyox copper smelter, which ceased operations in 1936. The Anyox projects are proposed to produce 30 MW annually. A 20 km long underwater cable would carry this power to the Provincial grid at Kitsault.

Other energy initiatives are proposed in the region. Two run-of-the-river hydroelectric projects are proposed by Conferation Power Ltd. within 25 km of Kitsault and will connect to the hydro lines at Kitsault. These projects are located on the upper Illiance River north of Kitsault and Gwunya Creek 4 km north of Alice Arm. Together, they are proposed to produce 20 KW of electricity annually.

The ownership of these renewable energy companies shifted in 2010/2011, with Sprott Power Corporation and Observatory Inlet Development Corporation becoming players in the run-of-the-river and "green" hydroelectric projects in the Observatory Inlet/Alice Arm region.

The molybdenum mine and mineral tenures on the mountain above the community of Kitsault, inactive since 1982, were sold in 2008 for $20 million plus concessions to Avanti Mining Inc by Aluminerie Lauralco Inc., a subsidiary of the American aluminum giant, ALCOA Inc. With the resurgence of molybdenum prices, this mine may open again. Avanti Kitsault Mining Ltd. (the Canadian subsidiary of the firm, Avanti Mining Inc.) is at the environmental assessment stage of development. Avanti is proposing an $800 million open pit mine project, with a minimum lifespan of 15 years. Located in the Lime Creek watershed, this mine, at full production, is projected to become one of the top 5 producers of molybdenum in the world. It is projected to produce an estimated 368 million pounds or $1.6 billion in molybdenum over its lifespan. In addition, the polymetallic veins associated with the molybdenum deposit contain significant reserves of silver, lead, zinc and possibly gold. In consideration of the high metal prices in 2011, these reserves could greatly increase profitability of the mine.

With infrastructure already in place, including access to ocean shipping, a road to the Nass Valley, and a power transmission line, the logistics of restarting the molybdenum mine have been simplified. The ore from the Kitsault mine is proposed to be shipped out by truck to Terrace and on to the port in Vancouver. Avanti estimates that 650 jobs will be created during construction of the Kitsault mine, with 330 permanent jobs being generated once the mine is running. The mine will be self-contained, with workers living in a camp close to the mine site. The dammed upper reaches of Patsy Creek (east branch of Lime Creek), including Patsy Lake, are proposed to be used for the tailings pond. Avanti Mining Inc. is proposing to start reactivation and construction of the Kitsault site in 2012, with full mine startup by 2014.

Two other potential molybdenum deposits owned by Avanti are in close proximity to the Kitsault prospect - the Bell Moly deposit to the NE and the Roundy Creek deposit to the SW of the existing open pit mine. In late 2010, Avanti purchased 99 other contiguous mineral tenures, formerly owned by TA Mineral Resources Ltd., extending its holdings by 300% to include much of the S side of Alice Arm, along the height of land on the east side of Observatory Inlet as far south as Kelskiist Creek, and east of Kitsault almost to the Nass Valley. Exploration and evaluation of further molybdenum reserves are being made within Avanti's mining tenures, with the projection that the Kitsault mining activities will extend well beyond the 15 year time frame projected for the Mt. Widdzech deposits.

The rugged slopes of Alice Arm inlet and the Kitsault Valley have significant potential for mineral and hydro-electric development. If and how these developments occur could directly impact other resource values such as eco-tourism, wildlife, and fisheries.

GHOST TOWN OF KITSAULT: 1983 to 2005

PART 2:

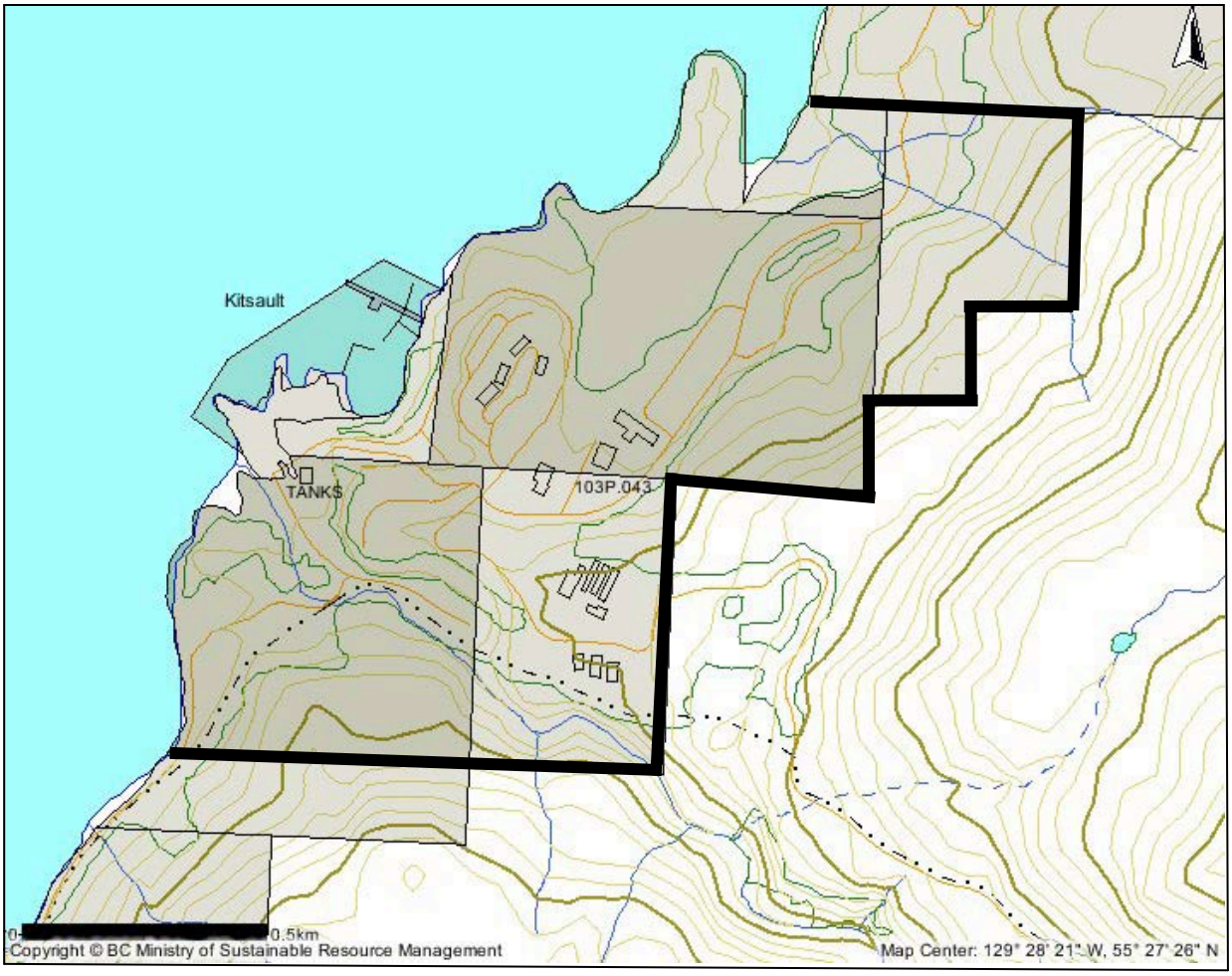
THE COMMUNITY

OF

KITSAULT

Construction of Kitsault in 1979 - 1980: Shopping mall to lower left; community recreation centre with swimming pool, full-sized gymnasium, and library - blue building to centre right; family-oriented subdivision of single detached houses at top centre; the townsite was provided with a community water system, community sewer system, electricity, telephone, fire protection, paved roads, and cablevision.

Photo: Kitsault Resort Ltd.



Map 5: Land Tenures for Townsite of Kitsault Showing Foreshore lease, Private Lands, and Roads

Dock area at Kitsault, 1980. From here to Prince Rupert via Observatory Inlet was a 2.5 hour trip in a fast boat. Before the road was constructed, most of the traffic and freight were moved by water into the new mining town.

Photo: Kitsault Resort Ltd.

From Planned Town to Ghost Town

Embedded in the tales of minerals, railways, and mining companies in northwestern British Columbia is the story of the townsite of Kitsault. In 1979, Amax of Canada Ltd. reactivated the Kitsault molybdenum mine located at 600 meters elevation on Mt. Widdzech at the head of Alice Arm inlet. Although Amax had access to the site via water, this was a remote location , a landscape without roads, electricity, or a workforce. In order to efficiently operate the mine, a powerline was constructed 200 km up the Nass Valley from Terrace, connecting the project to the provincial power grid. Seasonal road access to Kitsault was provided by building a gravel road from the Nass Valley over a 820 m high mountain pass to the ore deposit. With deep winter snowfalls, water access was the most secure method for shipping out the ore and large dock facilities were constructed on the east side of Alice Arm inlet north of the outlet of Lime Creek.

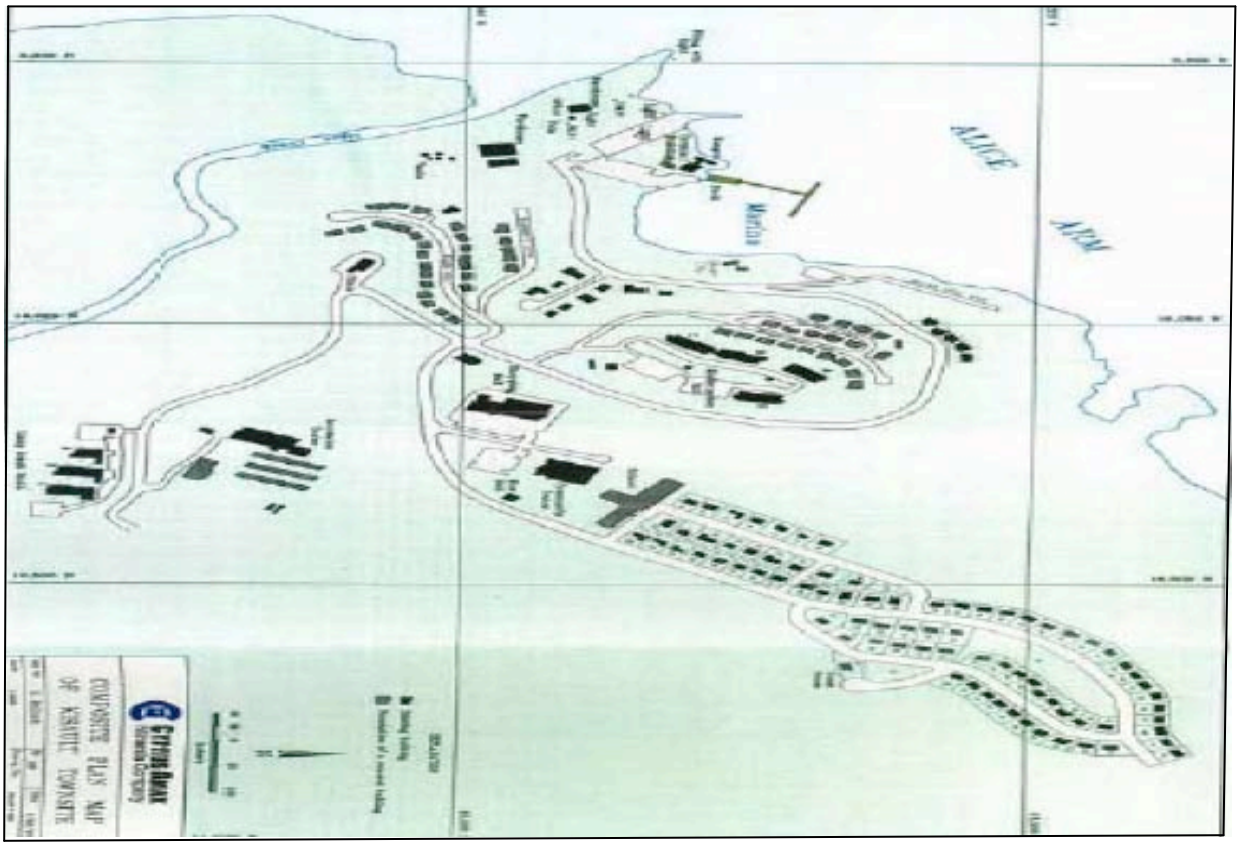
Due to the remoteness of the area, especially in winter, the company set out in 1979 to build a community to house its workers. From the beginning, the townsite of Kitsault was designed to attract and retain a skilled workforce and their families. The architectural plans included wide, paved residential streets with underground wiring, telephone, cablevision, community water, a sewage system, landscaped boulevards, large lots, and easy access to community services. Designed for 1,200 residents, the 130 ha (322 acre) community included seven apartment buildings (with 210 units), 92 detached family homes and duplexes, and 20 foundations for double-wide mobile homes or portable houses. A 2044 square meter (22,000 square foot) shopping centre housed a grocery store, liquor store, bank, hardware store, sportings good store, Sears outlet, restaurant, and post office. The community had full public services including a hospital, firehall, maintenance yard, school, and two recreation centres, complete with swimming pool, sauna, whirlpool, weight rooms, racquetball courts, large gymnasium, library, theatre, four sheet curling rink, bowling alley, and the Maple Leaf Pub. The hospital, fully equipped for a remote location, included a suite to accomodate visiting doctors and dentists, plus equipment for the full range of services from examinations to operations. Typical of the 1970's, the community was focussed on automobiles. Sidewalks and recreational paths were not included. Total cost of the community was estimated at $43,000,000 in 1980 dollars!

With views over the ocean and dramatic mountains in the background, Kitsault seemed to be the ideal location for a community. Then, just as abruptly as the activity had started, the mine closed in 1982 when stock prices for molybdenum dropped dramatically on the world market due to a global economic recession. After just 18 months as a community, the town was emptied of people and the road closed to public access. The last residents moved out in the fall of 1983. Kitsault became a ghost town.

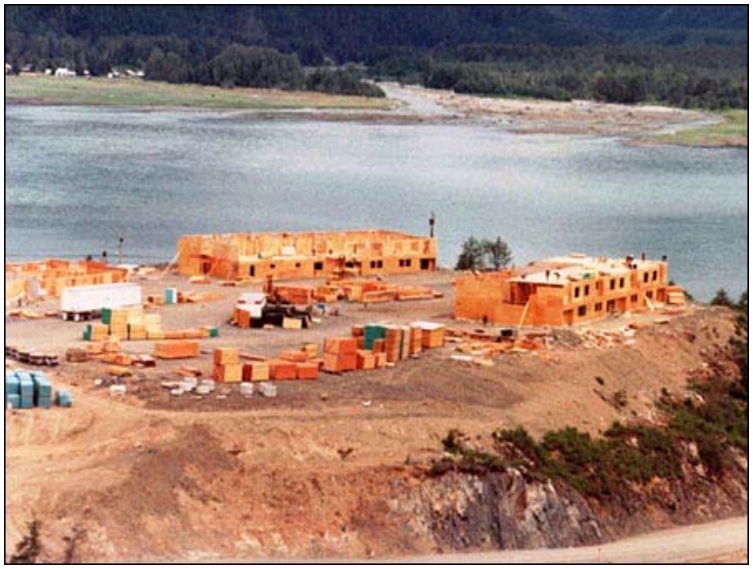
Unlike many B.C. ghost towns, though, Kitsault was not left to disappear back into the forest. Amax hired caretakers and, in the wet, snowy climate of the North Coast, made the decision to leave the power and heat on in the buildings. Lawns were mowed and the relentless rainforest growth of trees was kept at bay. Everything remained intact, as if the residents had suddenly walked out of the buildings and mysteriously disappeared.

For 22 years, Kitsault sat untouched, like a time capsule waiting.

Design Plans for original Kitsault Townsite, 1979

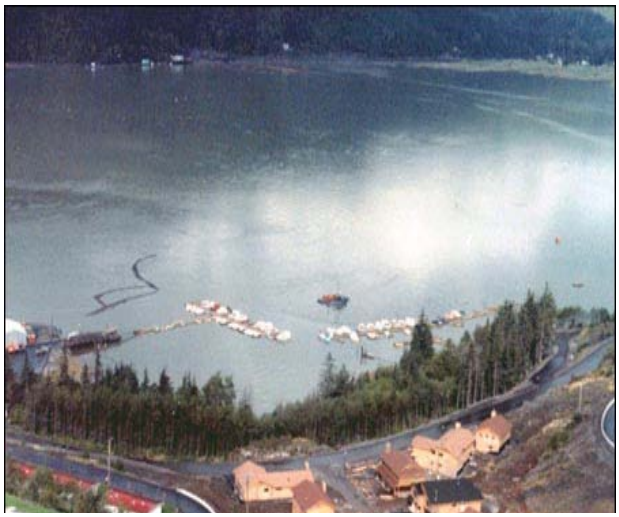


Courtesy: LandQuest Realty Corp., 2004.



Early construction days in 1979 - start of the four apartment blocks shown in the right centre of the town plan. View of the Kitsault River estuary - note Alice Arm to the upper left and the mouth of the Kitsault River to the mid-top of the photo.

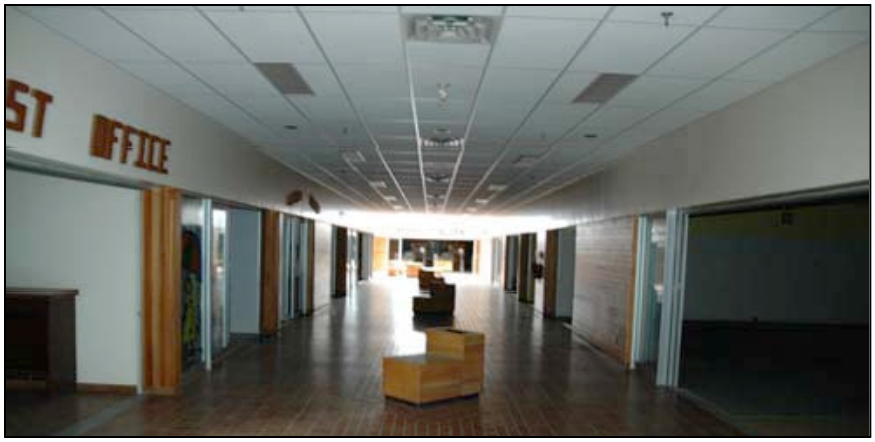
Photo: Kitsault Resort Ltd.



In two years, an entire townsite was created, complete with hospital, shopping centre and two recreation centres containing a four sheet-curling rink, 2 racket ball courts, movie theatre, gymnasium, library, large basketball gymnasium, sauna, sports lounge, whirlpool, swimming pool, and weight rooms. The seven apartment buildings contained 210 suites - bachelor, one bedroom or two bedrooms, fully furnished. (LandQuest Realty Corp., 2004)

Finished apartment blocks in 1981 with paved streets, ornamental trees, and landscaping. These buildings had electrical heat and specially insulated walls to keep the units quiet for shift workers. Note the dock area below the hill. Lime Creek enters the inlet to the top left of the photo.

Photo: Kitsault Resort Ltd.



The 22,000 sq.ft. shopping centre includes a bank with 2 vaults, a grocery store with 1970's shopping carts, a fully equipped restaurant, and a post office.

The Maple Leaf Pub has made-in Canada hard-wood chairs and a dance floor. Even the glasses and ashtrays were left behind in 1983.

Common room in the guest house. Note the white, 1970's furniture, lamp styles, and cabinet TV. One of several small streams in Kitsault flows by the building.

Community Revived

In 2004, Aluminerie Lauralco Inc., a subsidiary of the American firm, ALCOA Inc., and owner of Kitsault, made the decision to sell the unincorporated, unoccupied townsite. The real estate firm, LandQuest Realty Corporation, was engaged to market the property. Advertised for $7 million dollars, the sale attracted worldwide media attention. Here was the unusual opportunity to purchase an entire town in a spectacular natural location. The Kitsault land holdings included millions of dollars worth of buildings and equipment, plus 80 hectares of forest and 2.4 km of ocean frontage.

The spacious 1970's style houses in Kitsault came complete with stone fireplaces, electric heating, walk-in basements, carports, and landscaping.

In 2005, the property was purchased by Krishnan Suthanthiran, a well-known American entrepreneur and owner of Best Medical International. Suthanthiran was visiting Halifax and saw the advertisement for the sale of Kitsault. Born in India, educated at Carleton University and the University of Toronto in Canada, Suthanthiran had built his Virginia-based business, Best Medical and its affiliated companies, into a global enterprise. In Kitsault, Suthanthiran could see a unique opportunity to bring his visions to reality, and purchased the town, sight unseen, for $5.7 million dollars.

Renaming it, "Chandra Krishnan Kitsault - Heaven on Earth", in honour of his mother, Suthanthiran began the process of reactivating the townsite. Suthanthiran felt that Kitsault was an opportunity to put into practice his own philosophy of education and good health. “Education is the most effective way to eliminate poverty and to promote global understanding and peace.” Kitsault, with its intact buildings and remarkable natural location, was envisioned to become an eco-tourist destination with a world-class centre for health care education, including a nursing school and conference facilities.

A team of experts was hired, including Doyletech Corporation from Ottawa, a consulting firm specializing in economic development strategies. Doyletech developed a comprehensive redevelopment plan for Kitsault, evaluating the physical, social, infrastructure, and economic development future of what could become a new, thriving community. After more than two decades without use, it was necessary to upgrade the water and sewage systems, as well as other community services. Siding and roofs were repaired. Roads were mended. Kitsault became a model for green development, with future initiatives including a possible transportation system of electric cars and a network of pathways and sidewalks built to link the community together and encourage healthy activities.

Marketing students from BCIT participated in the project to help bring Kitsault back to life, looking at new, exciting ideas for resurrection of the community.

The townsite of Kitsault has views of the inlet and surrounding mountains - looking north at Mt. Theophilus.

Suthanthiran viewed the redevelopment of Kitsault as an "eco-village" that would provide a natural setting for people wanting to explore new concepts in art and environmental issues. Ideas for economic development of Kitsault included an artist's colony utilizing the spectacular natural scenery of the area, arts festivals, conferences, scientific forums, corporate retreats, weddings, film productions, and a wide range of outdoor and health-promoting activities.

Full-Sized Gymnasium with hardwood floor in the Community Centre at Kitsault - waiting for players. There is a small stage at the front of the gym, complete with chairs and equipment stored underneath the stage.

The whirlpool, wading pool, and large swimming pool have been kept in working order. Even the overhead decorations are still hanging above the pools. The recreation centre also includes a sauna, sports lounge, and weight room, complete with the weights from 1982.

One of the unique opportunities that Suthanthiran wanted to achieve was a global problem-solving centre. Up to 400 of the world's best thinkers would be given the opportunity to spend a year free at Kitsault Resort to work together to solve the world's problems and to be nurtured as leaders for positive change in the world. As part of Suthanthiran's plan, he purchased Vancouver-based film and TV production company, ATV Productions, with the goal to hold an annual Mahatma Gandhi film and television celebration of non-violent entertainment at Kitsault.

Total investments to realize Suthanthiran's visions were expected to exceed $20 million. Eventually the community would be expected to become self-sustaining through income earned from events and activities. Governance of the community was also examined - would it remain a private resort, or, in the future, would it become a community with other owners and investors, and even a mayor and council?

With recent changes in the region, the townsite of Kitsault is not as isolated as before. Kitsault's relationships with its Nisga'a neighbours and the Nisga’a Lisims Government could offer some exciting opportunities in the future as the Nisga'a engage in economic development opportunities, especially in eco-tourism. The impact on Kitsault by its mining neighbour, Avanti Mining Inc. and the proposed Kitsault Molybdenum Mine, 5 km away up the mountain, will also be important in determining the future of the directions that Kitsault can take as an eco-resort .

In the next decade, Kitsault will find itself surrounding by activities determined, for the most part, by the global economy and the prices for metals and energy. As a community guided by the principles of sustainability and eco-compatibility, its role in the region will be an interesting one.

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Keeping Kitsault from disappearing into the forest - 1983 to 2005. Photo: LandQuest Realty Corporation.

Kisault in winter; head of Alice Arm inlet. Photos: K. Mathew