

APPLICATION FOR ECOLOGICAL RESERVE

1. Legal description of the area (or general "Metes and bounds" description) The Rupert/Holberg Inlet area includes the seabed with an overlying 36 feet of water column, below a depth of 20 fathoms, in Holberg Inlet and Rupert Inlet. In Rupert Inlet, between Hankin Point (127°33.2'W longitude) and 127°26.4'W longitude, the area also includes the seabed, water column and shoreline below the extreme spring high water to a depth of 36 feet and the seabed and overlying 36 feet of water column from a depth of 36 feet to the 20 fathom contour of Rupert Inlet.
2. Geographical location (relate to nearest settlement, mountain, river, etc.)

Rupert and Holberg Inlets are located at the northern end of Vancouver Island, B.C., at approximately 50.5°N latitude and 127.5°W longitude.

3. Indicate the biogeoclimatic zone of which the reserve is representative.

The land surrounding Rupert and Holberg Inlet belongs to the Coastal Western Hemlock Zone.

4. Approximate total acreage.

18 square miles

5. Purpose of the reserve.

To study the effects on, and later the recovery of, the Rupert/Holbert Inlet ecosystem from the tailing discharge of the Island Copper Mine.

(a) Primary (state acreage)

(i) To determine the effects on the benthic fauna of depths greater than 20 fathoms.

(ii) To determine the effects on the intertidal life forms in the immediate vicinity of the mine.

(b) Others if any (state acreage)

(c) Buffer areas (state acreage)

6. Attach a map and indicate: (a) the perimeters and acreage of the areas detailed in 5 above, and
(b) indicate the species and total timber volumes in these areas.

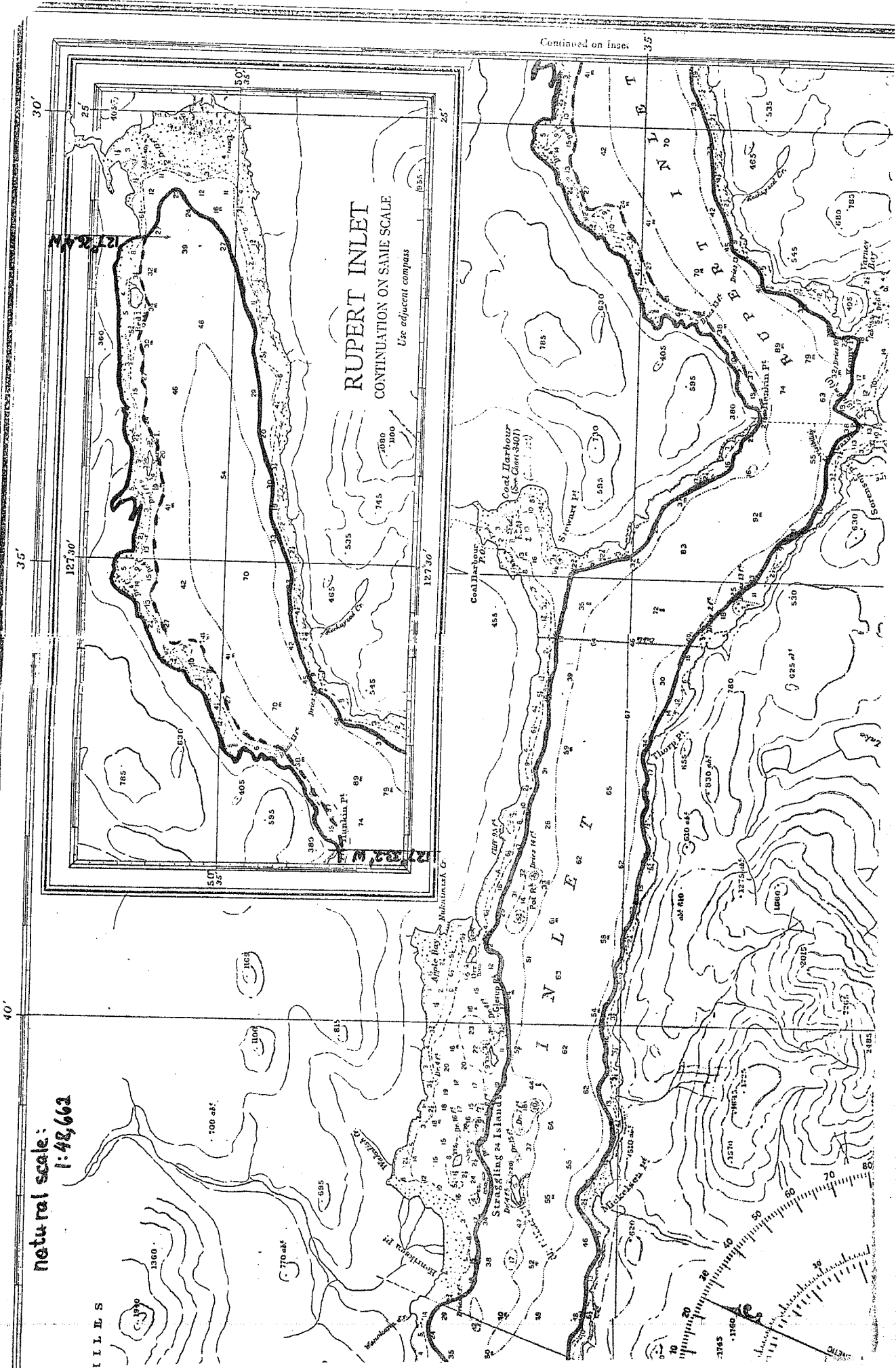
Benthic and intertidal species of significance, found in the area, are listed in Attachment I.

N.B. IBP Check sheet not completed since there is no above-surface component to this Reserve application.

Signature D.V. Ellis and D.J. Steele
I.B.P. Surveyor

Proposed Ecological Reserve Boundary
Inshore Area

natural scale:
1:48,662



Continued on Inset

RUPERT INLET

CONTINUATION ON SAME SCALE
Use adjacent compass

127° 30' W

127° 30' W

127° 30' W

30'

35'

40'

25'

25'

50° 35'

50° 35'

50° 35'

50° 35'

50° 35'

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127° 30' W

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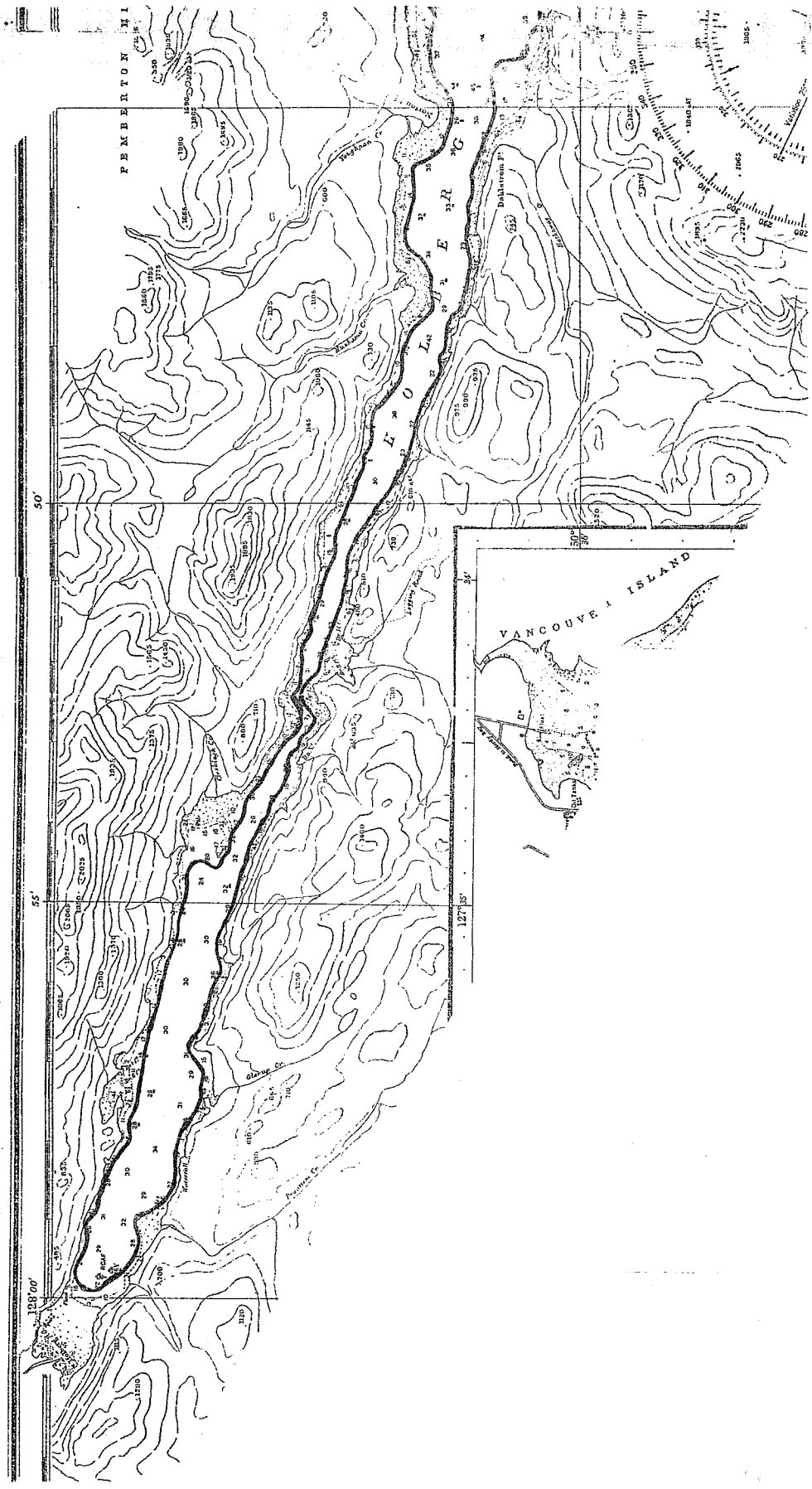
127° 30' W

127° 30' W

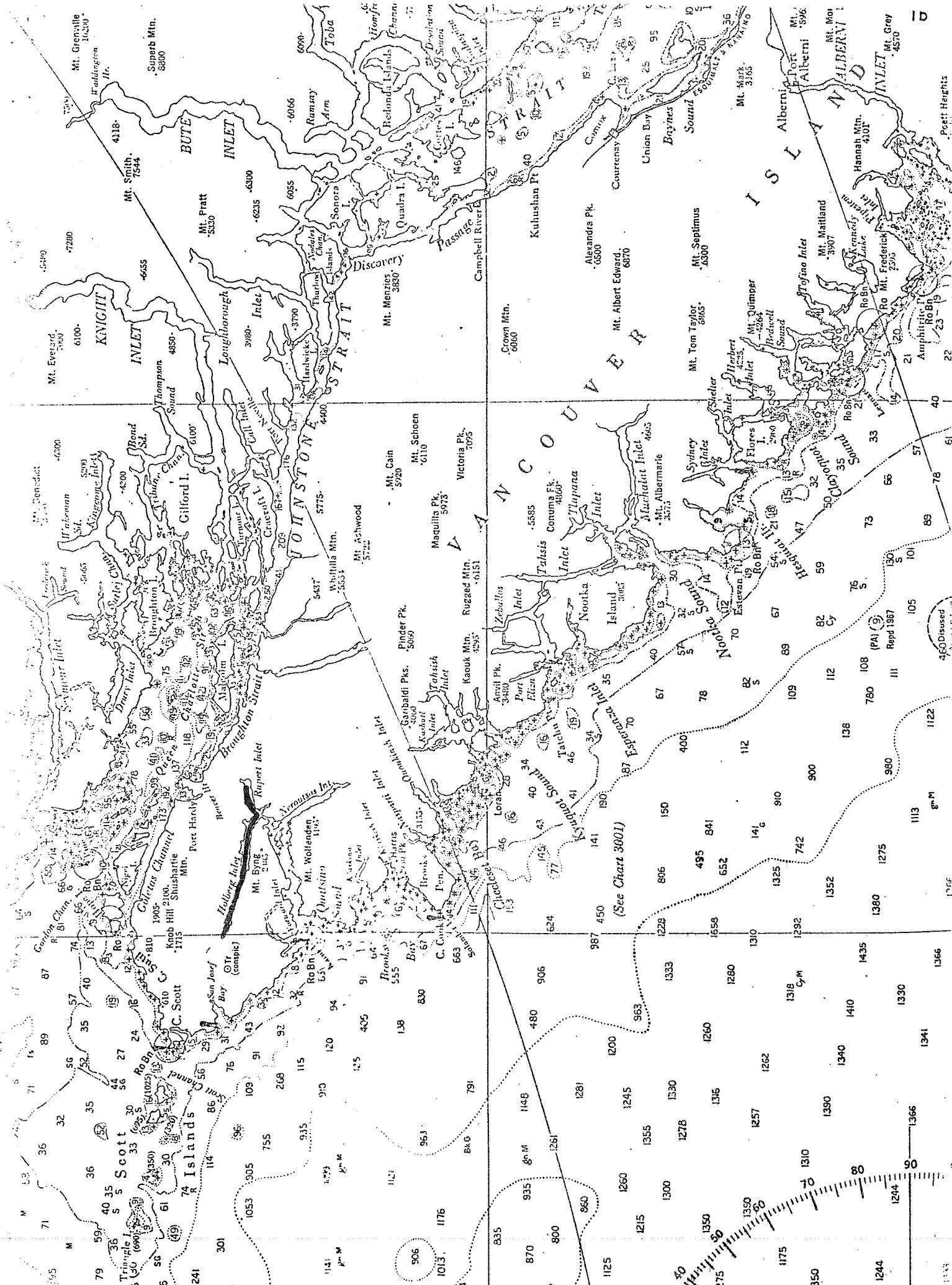
127° 30' W

127° 30' W

127° 30' W



General location of Rupert and Holberg Inlet



Attachment I

1. Benthic marine species (identified by A. Jones, University of Victoria).

Polychaeta errantia

Amphroditoidea (2 species)
Dorvillea sp
Eteone longa
Glycera capitata
Glycera sp
Goniada annulata
Luibrinereis spp (2 species)
Ninæ gemmea
Onuphis sp
Phyllodocidae (1 species)
Phyllodoce sp
Podarke pugettensis
Pilargis berkeleyi
Syllis sp

Pelecypoda

Acila castrensis
Axinopsis sericatus
Axinopsis viridis
Composomyax subdiaphana
Hiatella sp
Lucinoma annulatus
Lucinoma tenuisculpta
Macoma carlottensis
Hiatella sp

Gastropoda

Acmaea sp
Bittium eschrichtii
Mitrella sp

Polychaeta sedentaria

Ammotrypane aulogaster
Ampharete sp
Aricidea sp
Asychis sp
Capitella capitata
Chaetozone setosa
Gimatulidae (1 species)
Cossuridae (1 species)
Decomastus gracilis
Heteromastus filobranchus
Isocirrus sp
Laonice currata
Maldanidae (1 species)
Pista cristata
Pista fasciola
Prionospio cirrifera
Sabellidae (1 species)
Tharynx sp
Trichobranchus glacialis
Terebellides stroemi

Macoma elimata
Nucula sp
Pandora bilirata
Psephidia lordi
Rochefortia sp
Tellina sp
Thyasira sp
Venericardia paucicostata

Foraminifera

Daitrona sp
Phainogullmia sp

Crustacea

Amphipoda (3 species)
Cumacea (1 species)
Isopoda
Pinnixia faba

Zooplankton

Calanus glacialis
Calanus plumchrus
Euphausia pacifica
Euphausiacea
Tanaidacea
Thyssaonessa sp.

Miscellaneous Groups

Echiuroidea (1 species)
Holothuroidea (1 species)
Molpadia intermedia
Nemertea (several species)
Ophiuroidea (1 species)
Priapulida (1 species)
Pycnogonida (1 species)

2. Intertidal Species (Primary parameter measured in these samplings is heavy metal content.)

(i) Intertidal Fish

Tidepool sculpin - *Oligocottus maculosus*
Staghorn sculpin - *Leptocottus armatus*

(ii) Dogfish - *Squalus acanthias*

(iii) Other Fish - Skates, ratfish, anchovies, etc.

(iv) Dungeness crab - *Cancer magister*

(v) Edible Clams

Cockle -	<i>Clinocardium nuttalli</i> ; <i>Clinocardium</i> sp
Bentnose clam -	<i>Macoma secta</i> ; <i>Macoma nasuta</i> ; <i>Macoma</i> sp
Mussel -	<i>Mytilus californianus</i> ; <i>Mytilus</i> sp
Snail -	<i>Ocenebra interfossa</i>
Butter clam -	<i>Saxidomus giganteus</i>
Littleneck clam -	<i>Protothaca staminea</i>
<i>Schizothoerus nuttalli</i>	
Softshell clam -	<i>Mya arenaria</i> ; <i>Mya</i> sp
Horse clam -	<i>Tresus nuttalli</i>

3. Zooplankton

*Microcalanus pygmaeus**
*Pseudocalanus minutus**
*Oithona helgolandica**
Paracalanus parvus
Parathemisto pacifica
Metridia lucens
Acartia longiremis
Acartia clausi
Oikopleura dioica
Calanus pacificus
Calanus glacialis
Aetidius armatus
Cyphocaris challengerii
Sagitta elegans
Metridia pacifica

*most abundant species

Rupert and Holberg Inlets represent an ecosystem which has been modified by mine tailing deposition. Biological samples are being analyzed to determine shifts in distribution and diversity of marine organisms as a result of the mine effluent discharge. If this area is preserved as an Ecological Reserve it will offer an opportunity to determine the mine-derived influence on the ecosystem, as well as the recovery of the Rupert-Holberg Inlet ecosystem from such a modification.

The following quotation summarizes tailings effects to September, 1973:

"Tailings are depositing in the trough of Rupert Inlet, generally below 100 feet depth. The deposits extend some six miles along the trough of Holberg Inlet. Some tailings may remain in suspension. Sea-bed organisms have been obliterated by tailings deposition in the Rupert Inlet trough to a distance of about 2 miles from the outfall. There is a fringe of lesser effects on these organisms consisting of a reduction in species diversity and abundance, and a reduction in growth rates. The fringe effects noted to date extend about one mile further down Rupert Inlet".

Reference (Ellis, 1974).

Table I.1 gives an outline of the environmental monitoring program for the area during the initial discharge year. Monitoring of most of these parameters is still continuing at present. Figures 1 and 2 show the spread of tailings and benthic obliteration from March, 1972 (6 months after discharge commenced) to September, 1973, when tailings were deposited approximately 6 miles into Holberg Inlet.

Sub oblitative studies of the benthos are underway at the University of Victoria by Mr. A. Jones, B.Sc. and indicate a reduction in species diversity and abundance.

TABLE NO. 1.1
 OUTLINE OF ENVIRONMENTAL CONTROL MONITORING PROGRAM, ISLAND COPPER MINE
 INITIAL PRODUCTION YEAR OCTOBER 1971 to SEPTEMBER 1972

	<u>DESCRIPTION</u>	<u>FREQUENCY</u>	<u>OBJECTIVE</u>
<u>Marine Program</u>			
Seismic Survey	Bottom profile and sediment distribution	Sept. 1972	Determine tailing distribution
Bottom Coring	Cores at 23 stations - log, determine heavy metals in particulates & preserve cores.	Sept. 1972	Determine tailing composition
Bottom Grabs	Sample at stations where organisms present in last sampling - log, sort to Polychaetes & others, count & weigh (Biomass) preserve samples.	Quarterly	Visual inspection of tailing & monitor of benthic organisms
Water Column	At 6 stations profile temperature, turbidity, color, transparency & suspended solids	Monthly	Record water column phys. props
	At 6 stations salinity, alkalinity, pH, dissolved O ₂ , spent sulphite, "total" As, cyanide and Hg, and "dissolved" Cd, Co, Cr, Cu, Fe, Mo, Mn, Ni, Pb & Zn.	Quarterly	Record water column chem. props
	At specific depths on 6 stations sample for chlorophyll "a", identify & preserve phytoplankton, determine biomass and preserve zooplankton, and from vertical hauls at night determine zooplankton heavy metals and preserve samples.	Quarterly	Record water column organisms
<u>Intertidal</u>	From 16 plates identify resident species, estimate growth rate and preserve	Quarterly	Record of intertidal organisms
	From 8 selected sites collect particular species of clams and fish, determine population, growth rates, heavy metal contents and preserve tissue		
<u>Edible Species</u>	At specific sites, collect fish by lines and nets and crabs by traps; identify, measure, weigh, determine heavy metal contents and preserve tissue	Quarterly	Monitor fish and crab population
<u>Fresh Water Program</u>	At 7 mid-stream locations obtain temperature, pH, "total" cyanide and Hg, "dissolved" As, Cd, Co, Cu, Fe, Mo, Mn, Ni, and Pb and retain samples	Quarterly	Record of fresh water parameters
<u>Meteorological Program</u>	At the mine site record temperature, wind, precipitation, cloud cover, sea water surface appearance	Hourly	Record of meteorological conditions
<u>Tailing Discharge</u>	From weekly composites of daily samples taken from the thickener underflow determine pH, % solids, "total" cyanide and Hg, "dissolved" heavy metals and retain samples	Weekly	Record of tailing composition
	From samples taken of tailing/sea water mix conduct 96-hr. ILM b10-assays	Fortnightly	Record of tailing toxicity
	Determine tailing flow rate continuously, study composition and settling rates.	Continuous	Research activity

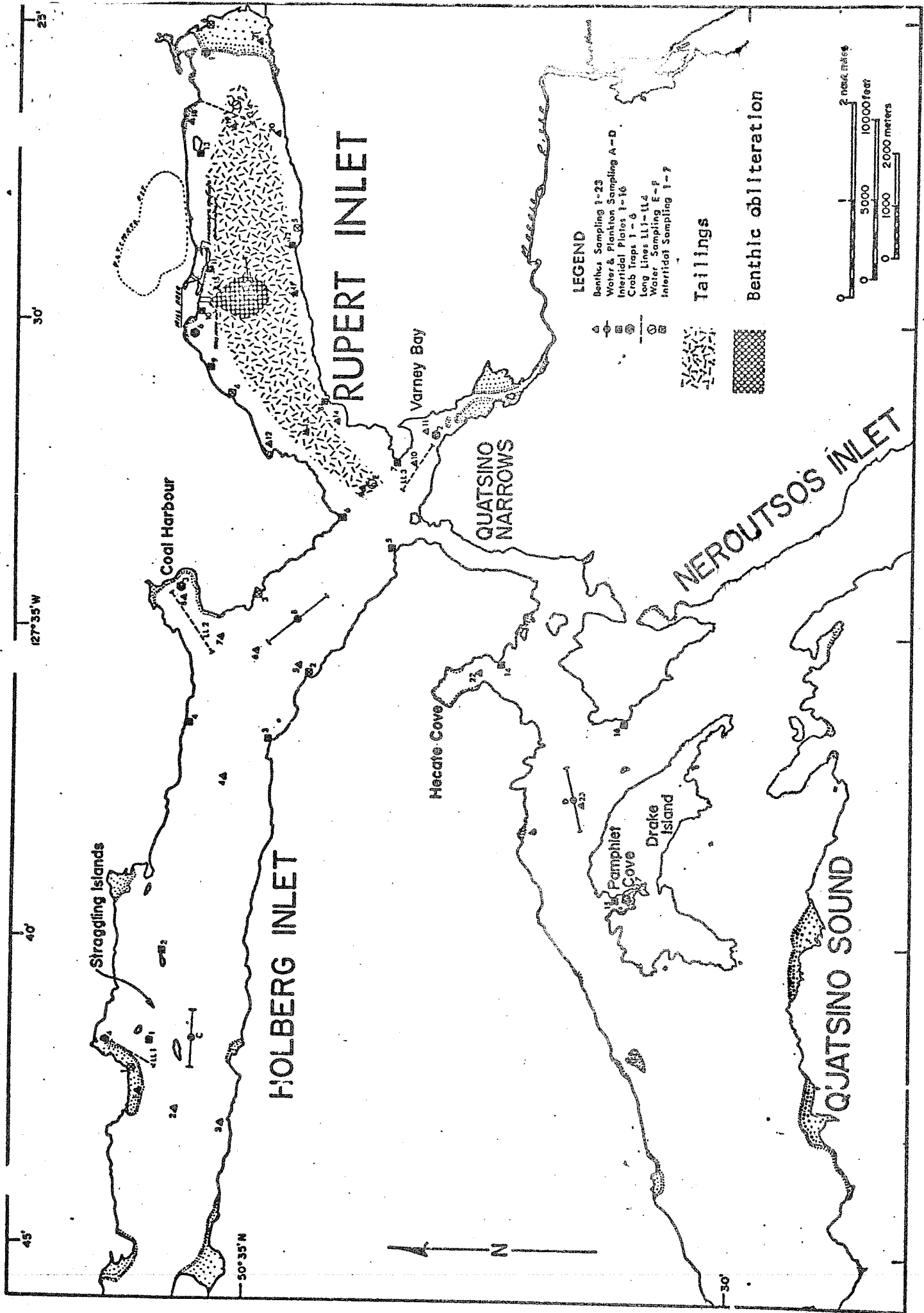


Figure 1. Distribution of tailings and area with obliterated benthos in March, 1972.

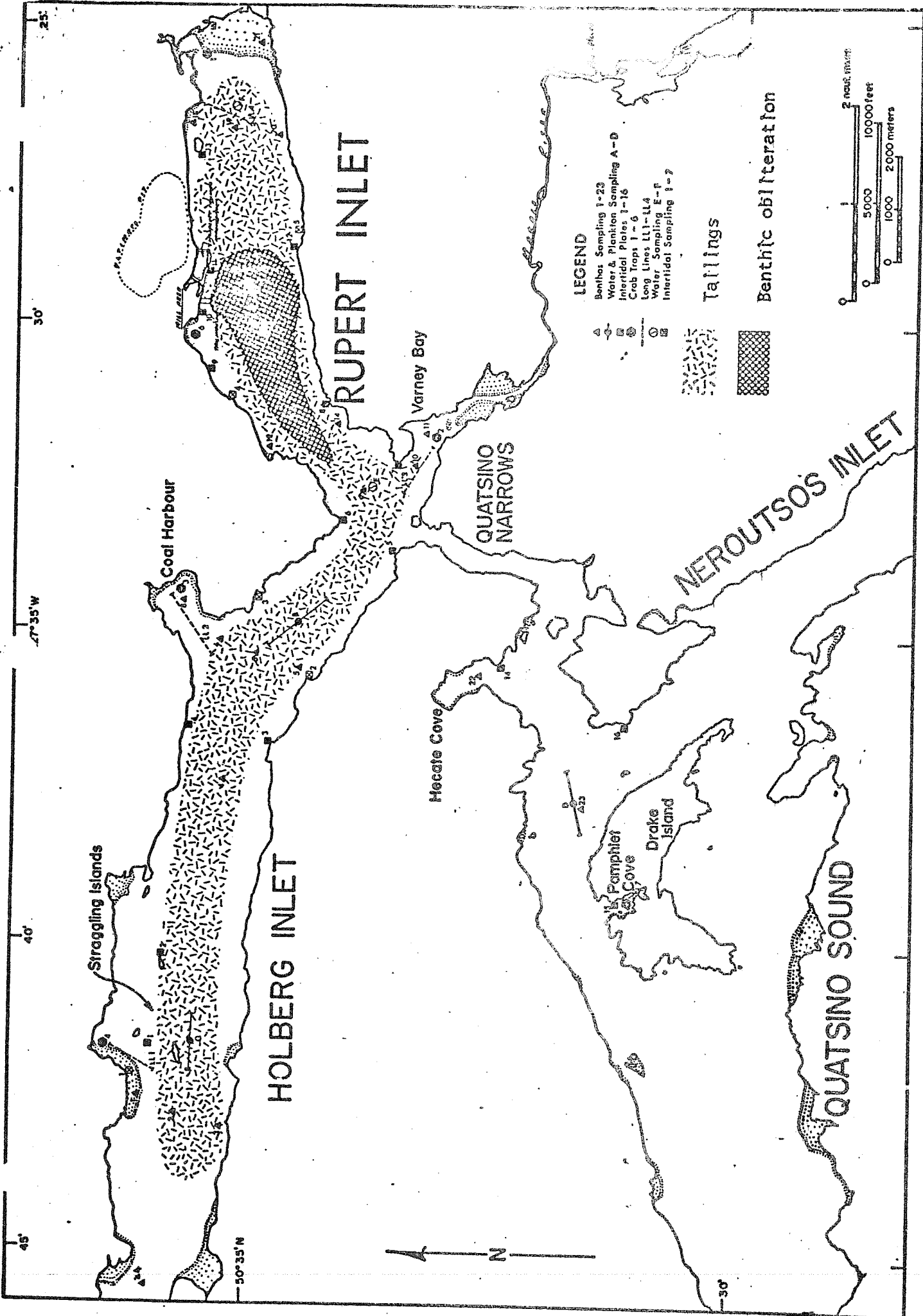


Figure 2. Distribution of tallings and area with obliterated benthos in Sept, 1973.

References

1. Drinkwater, K.F. 1973. The Role of Tidal Mixing in Rupert and Holberg Inlets, M.Sc. Thesis, U.B.C.
2. University of British Columbia, 1973. Summary Report. Initial Production Year, October 1971 - September 1972. Environmental Control Program, Island Copper Mine, Rupert Inlet, B.C. and accompanying appendices 1-3.
3. Ellis, D.V. 1974. The Island Copper Mine Marine Monitoring Program Annual Review 1973, Selected Biological Components.