PROVINCE OF BRITISH COLUMBIA
MINISTRY OF ENVIRONMENT, LANDS AND PARKS
VANCOUVER ISLAND REGION

ALBERNI INLET

WATER ALLOCATION PLAN

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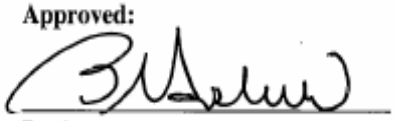

Regional Water Manager
Vancouver Island Region

Date:

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1.0 INTRODUCTION

The Water Management Program's goals are to sustain a healthy water resource through anticipating and planning for water uses. Water Allocation Plans are a means of identifying water demands and ensuring that water use is compatible with the goals of a sustainable environment. The advantages are:

1. Water Management's position on water allocation decisions is available to applicants and public.

2. Response time is reduced.

3. Eliminates the need for individual studies and reports on each application.

4. Consistency of decisions are improved.

5. Specific allocation directions and decisions are defined.

6. Plans are more comprehensive.

7. Eliminates the need for referrals on individual applications.

The Vancouver Island Region developed the following policy to provide water allocation direction:

Regional Policy:

> **The region shall be subdivided into watershed areas and a water allocation plan shall be prepared for each watershed area. Water licence decisions will be made in accordance with approved plans.**

Assessments undertaken as part of the water allocation planning process include identifying the surface water resources available, the instream requirements for fish, the existing and potential licencable water demands and providing direction regarding further water licence allocations.

Input may be sought from other agencies. Referrals go to Federal and Provincial Fisheries agencies and to Water Management in Victoria.

2.0 GENERAL WATERSHED INFORMATION

2.1 Geography

The Alberni Inlet Water Allocation Plan area (Figure 1) is located on the west coast of central Vancouver Island. The plan area encompasses from Bamfield to an area east of Ucluelet. From this southern boundary the area stretches north to Kiltsa Mountain and Port Alberni. Nahmint Mountain, in the northern portion of the plan area, is the highest point at 1568 m. The elevation of the land decreases toward the coast where drainages empty into the sea.

2.2 Climate

The Alberni Inlet Water Allocation Plan area is characterized by warm, relatively dry summers and mild wet winters. Climatic normals from Environment Canada Atmospheric Environment Service (AES) stations located throughout the west coast of Vancouver Island are detailed in Appendix A. The average of these stations show August as the warmest month at 14.9^{o}C and January as the coolest at 3.6^{o}C with the mean annual temperature at 9.0^{o}C.

2.3 Geology

The geological history of the Alberni Inlet Water Allocation Plan area has been shaped by the occurrences of structural, erosion, and deposition processes. Glaciation during the Pleistocene epoch along with marine tidal fluctuations have greatly influenced the local landscape.

Predominant features of the shoreline in Barkley Sound are rocky, headlands islands and reefs, with abundant caves, tide pools, blow holes and surge channels. The area is geologically diverse with sedimentary, metamorphic, and igneous rocks ranging in age from Pennsylvanian (200 million years) to Quaternary (present). The majority of the rock is part of the early Mesozoic or late Paleozoic West Coast Crystalline Complex. (URL: http://bms.bc.ca/general.html)

2.4 History

The first people to inhabit the Alberni Inlet Water Allocation Plan area were the Toquaht, Tseshaht, Huu-ay-aht (Ohiat), Uchucklesaht, Opetchesaht, and Ucluelet bands of the Nuu-Chah-Nulth Tribal Council. In the 1880's Commissioner O'Reilly allotted reserves

for these various bands. Today several of these reserves support small communities throughout the plan area.

Two of the larger communities associated with the plan area include Bamfield along the coast and Port Alberni just north of the plan area. Nestled in the Alberni Valley is Port Alberni, gateway to the west coast. While traditionally the main stays of the community have been forestry and fishing, tourism is gaining ground. Several tours originate in Port Alberni and travel down Alberni Inlet enroute to Bamfield and Ucluelet taking tourists through Barkley Sound and the Pacific Rim National Park Reserve's Broken Islands.

Bamfield started as a fishing community in the late 1800's. In 1902 the Bamfield Cable station was constructed which served as the site where an underwater cable left Canada to resurface at Fanning Island in the mid-Pacific (6400 km). From there the cable ran to Fiji, New Zealand and Australia. Bamfield now serves as a centre for people to hike, dive, kayak, and fish. Another feature of Bamfield is the Marine Biology Station established to fill a need for a permanent base for marine-oriented field operations on the west coast of Canada.

2.5 Significant Drainage Areas

Several drainage areas were reviewed in this report for the purpose of assessing water supplies. These areas were digitized using 1:50 000 NTS maps. The following table and Figure 2 illustrate these drainage areas.

Alberni Inlet Water Allocation Plan Significant Drainage Areas	
Drainage	**Area (km^2)**
Carnation Creek	10.10
China Creek	112.86
Nahmint River	191.49
Sarita River	186.20

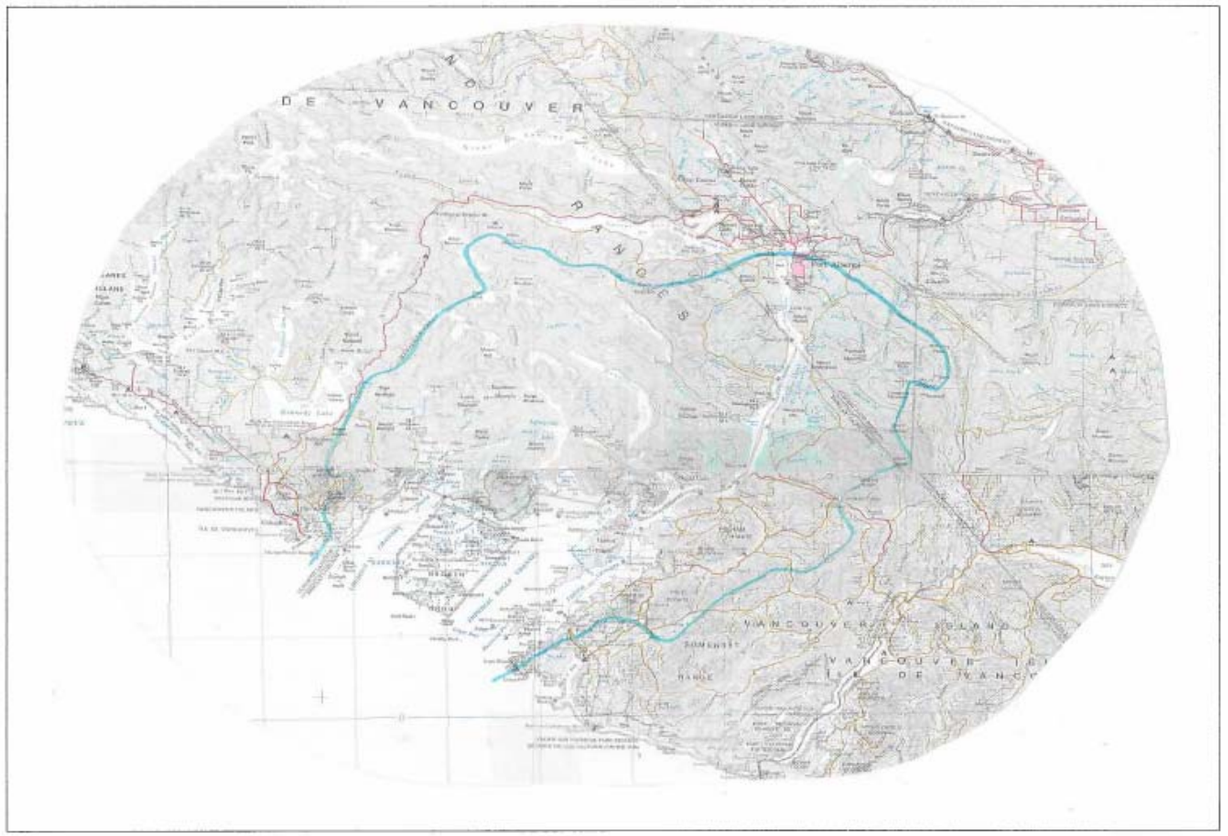


Figure 1

Alberni Inlet
Water Allocation Plan Area

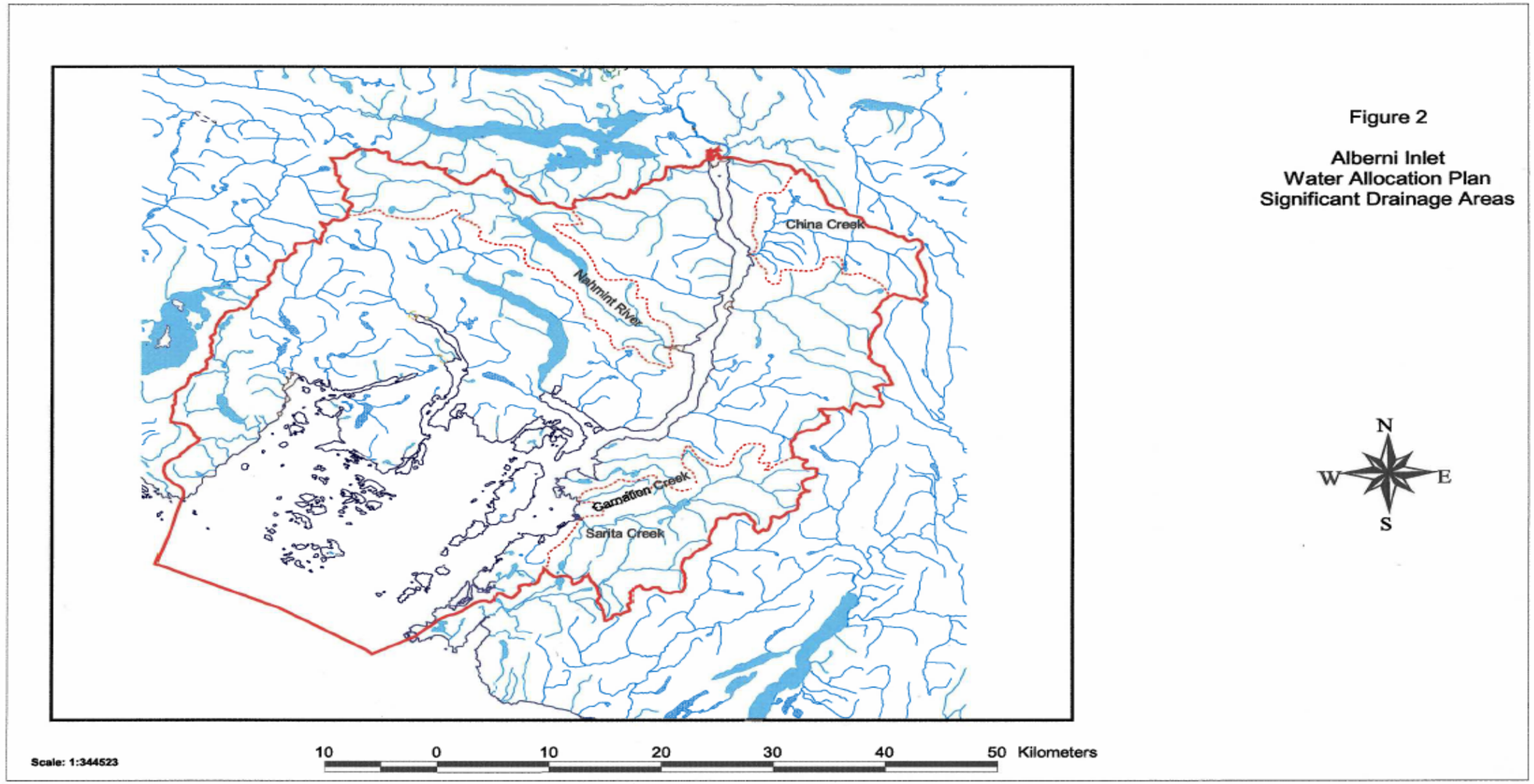


Figure 2

Alberni Inlet
Water Allocation Plan
Significant Drainage Areas

3.0 HYDROLOGY

3.1 Precipitation

The average of the mean monthly precipitation normals from Bamfield East, Kildonan, Tahsis, Estevan Point, Kyuquot, Tofino, Amphitrite Point, Gold River Townsite, Cape Scott, Port Alice, and Holberg Fire Dept. Atmospheric Environment Service (AES) stations are documented in Appendix A. These stations were used to indicate overall climatic conditions for the west coast of Vancouver Island from an area around Alberni Inlet to Cape Scott. The following graph illustrates these precipitation averages.

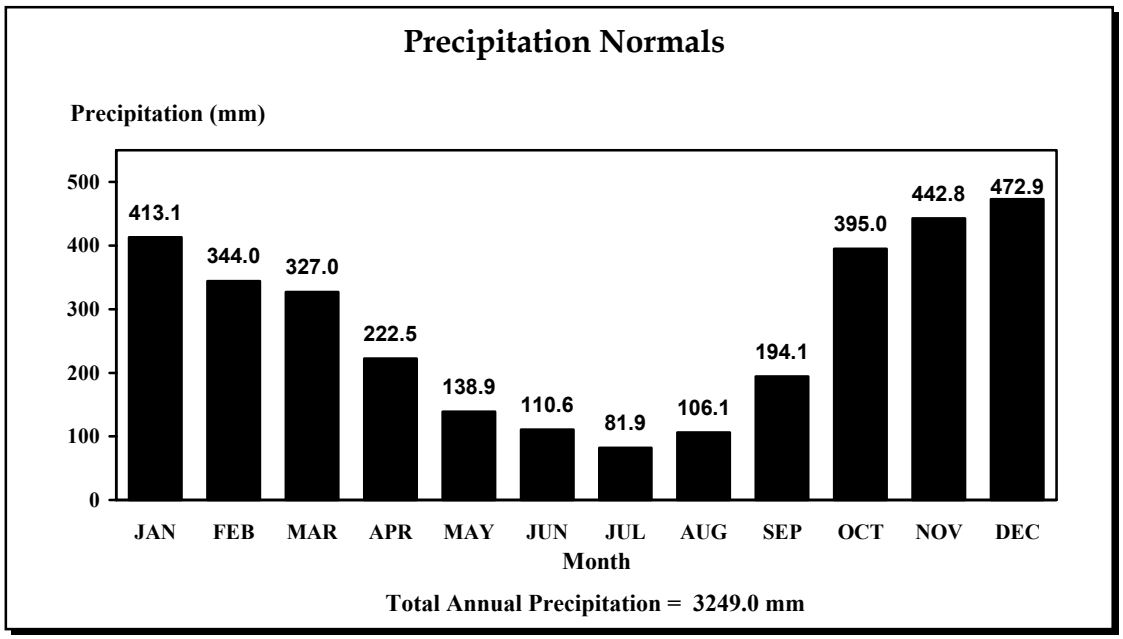


Figure 3: Precipitation Normals

The total annual precipitation in the region is 3249.0 mm. This precipitation is unevenly distributed throughout the year. As illustrated in Figure 3, precipitation levels are low during the summer months and higher throughout the winter. The minimum mean monthly precipitation is 81.9 mm in July. The maximum mean monthly precipitation is 472.9 mm in December. The average number of days with measurable precipitation is 209.

Precipitation information used in this report is based upon data available at the time of writing. A number of new stations on the west coast are anticipated to provide site specific information useful for future revisions of the Alberni Inlet Water Allocation Plan.

3.2 Hydrometric Information

The hydrology of the Alberni Inlet Water Allocation Plan area is similar to hydrologic patterns along the entire west coast of Vancouver Island. Two hydrologic scenarios have been established. Smaller, low elevation drainages tend to have higher peak flows and smaller low flows relative to their overall discharge volumes. Larger, high elevation drainages, while having similar discharge trends, have higher low flows and smaller peak flows relative to their overall discharge volumes. Appendix B and C describe in further detail how mean monthly and mean annual discharge estimates are derived.

3.2.1 Carnation Creek Drainage

Water Survey of Canada has estimated the drainage area of Carnation Creek where it flows into salt water (Trevor Channel) at the mouth as 10.1 km^2.

Carnation Creek flows are based on WSC hydrometric station 08HB048, noted in Appendix C. The mean monthly and mean annual discharge flows are in the following table.

Carnation Creek Mean Monthly and Mean Annual Discharge (litres/second)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
1500	1450	1000	700	380	250	130	150	190	840	1710	1570	820

3.2.2 China Creek Drainage

The estimated drainage area of China Creek where it flows into salt water (Alberni Inlet) at the mouth is 112.86 km^2. This drainage serves as a community watershed for Port Alberni.

China Creek flow estimates are based on Large, High Elevation Watershed-Discharge Runoff per Square Kilometre averages, noted in Appendix B. The mean monthly and mean annual discharge flow estimates are in the following table.

China Creek Mean Monthly and Mean Annual Discharge (litres/second)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
18170	16703	11625	12640	13543	11173	5982	4176	5530	16929	20202	20315	12753

3.2.3 Nahmint River Drainage

The estimated drainage area of Nahmint River where it flows into salt water (Alberni Inlet) at the mouth is 191.49 km^2.

Nahmint River flow estimates are based on Large, High Elevation Watershed-Discharge Runoff per Square Kilometre averages, noted in Appendix B. The mean monthly and mean annual discharge flow estimates are in the following table.

Nahmint River Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
30830	28341	19723	21447	22979	18958	10149	7085	9383	28724	34277	34468	21638

3.2.4 Sarita River Drainage

The estimated drainage area of Sarita River where it flows into salt water (Trevor Channel) at the mouth is 186.2 km^2.

Sarita River flows were adjusted from WSC hydrometric station 08HB014 in order to account for the size of the watershed at the mouth, rather than the size of the watershed from the location of the hydrometric station. The mean monthly and mean annual discharge flows are in the following table.

Sarita River Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
40287	37805	26851	21644	11287	7138	3828	3379	6414	26621	41724	44575	22574

3.2.5 Other Drainages

Flow in other drainages not identified above may be calculated from the average Larger, High or Smaller, Low Elevation Watershed-Discharge Runoff per Square Kilometre tables, noted in Appendix B, and multiplied by the drainage area.

3.3 Lakes

The following table summarizes the available data for some of the lakes within the Alberni Inlet Water Allocation Plan area.

Lakes				
Lake	**Surface Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**	**Volume (dam^3)**
Draw	27	25	-	-
Ellswick	9.9	-	-	-
Frederick	40.9	22.9	13	5313
Gracie	38.5	42.7	19.1	7344
Hawthorn	9.75	-	-	-
Henderson	1545	250	97	1498 650
Kite	21.99	-	-	-
Lizard Pond	24.97	4	0.7	175
Nahmint	70.99	-	-	-
Sarita	133	28.7	14.6	19 418
Sugsaw*	56.2	31	10.8	6070
Toquart	117.9	37.5	19.9	23 480

* Sugsaw Lake serves as a community watershed by the Regional District of Alberni-Clayoquot for Bamfield.

During the summer months approximately 0.3 m (1 ft) of water may be lost over the surface of a water body due to evaporation.

4.0 INSTREAM FLOW REQUIREMENTS

Maintaining the natural stream environment and instream uses are of paramount importance for present and future generations. Maintaining water for the fisheries resource is a key factor in maintaining instream flow requirements for water quality, wildlife, recreational, aesthetic and cultural values. Where instream flow for the fisheries resource is not a factor, economic and environmental concerns are to be considered. These considerations may be addressed on an individual basis based on water availability assessed against the natural 7-day average low flow for a 1 in 5 year recurrence interval.

The Ministry of Environment Provincial policy is:

> **Water allocations shall not be committed beyond the resource capability to replenish itself and maintain the natural amenities for present and future generations. Water allocations must be based upon reasonable expectations that water will be available for the period**

required without significantly impacting existing allocations or instream flow requirements.

In situations where a water allocation decision will significantly impact instream uses of water, the comptroller or regional water manager may refuse the application or include water licence conditions to protect the instream use.

Instream fisheries flow requirements are based on a Provincially modified version of the Tennant (Montana) Method. The following table outlines the modified version used within the Alberni Inlet Water Allocation Plan area.

Modified Tennant (Montana) Method Instream Flow Requirements	
Flows	**Description**
30-60% MAD	Excellent spawning/rearing
20-30% MAD	Good spawning/rearing
10-20% MAD	Fair spawning/rearing
5-10% MAD	Poor spawning/rearing
>5% MAD	Severely degraded spawning/rearing

In drainages where fish are present the minimum flow required to sustain the fisheries resource for fair spawning and rearing habitat is 10% of the Mean Annual Discharge (MAD). The Regional policies to implement Provincial policy are:

The minimum flow required to sustain the fisheries resources for spawning and rearing is 10% of the Mean Annual Discharge (MAD); unless a more rigorous analysis indicates a different minimum flow requirement.

For streams where the natural mean monthly flow falls below 10% of the MAD, extractive licenced demands should only be allowed for the period of months when the mean monthly flow is above 60% of the MAD.

For streams where the mean 7-day average low flow falls below 10% of the MAD, extractive demands should only be allowed for the period of months when the mean monthly flow is above 60% of the MAD. Where the mean 7-day average low flow remains above 10%, then the 7-day low flow amount above 10% MAD is available.

Withdrawals from natural water bodies (lakes, ponds, swamps and marshes) supporting natural fisheries resources shall not reduce the shoal area more than 10%.

Within the Alberni Inlet Water Allocation Plan area large, high elevation watersheds have mean monthly flows >20% MAD. Small, low elevation watersheds have monthly flows during the low flow period between 10% and 20% MAD. The 7-day average low flows are <10% MAD. Therefore, water may be available from large, high elevation watersheds throughout the year in varying monthly quantities, while small, low elevation watersheds are limited to the high flow period above 60% MAD, October through April.

Figure 4 illustrates fish habitat within the Alberni Inlet Water Allocation Plan area.

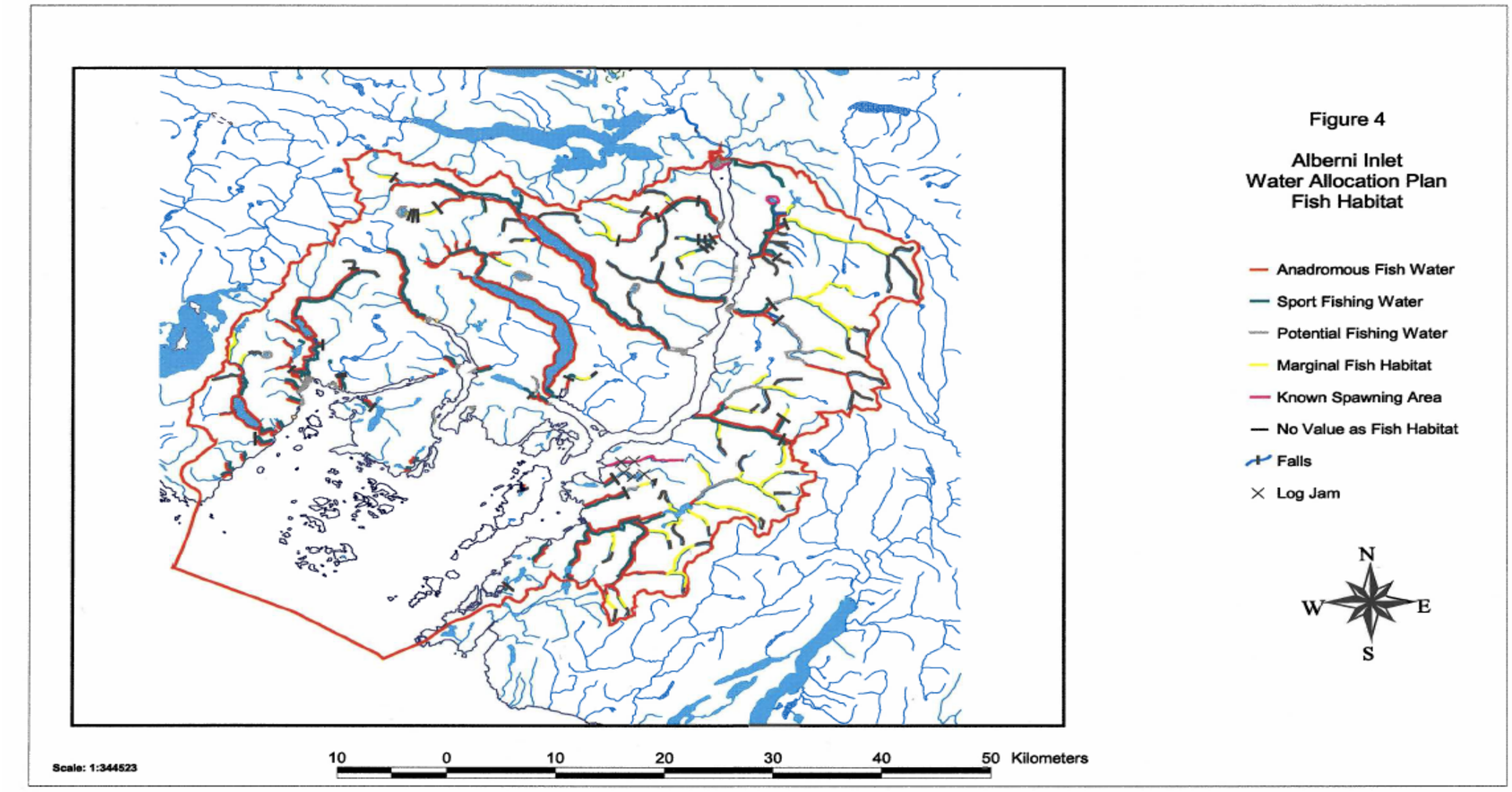


Figure 4
Alberni Inlet
Water Allocation Plan
Fish Habitat
Anadromous Fish Water
Sport Fishing Water
Potential Fishing Water
Marginal Fish Habitat
Known Spawning Area
No Value as Fish Habitat
Falls
Log Jam
N
W
E
S
Scale: 1:344523
10 0 10 20 30 40 50 Kilometers

4.1 Carnation Creek Instream Requirements

There are fish present in the Carnation Creek drainage area.

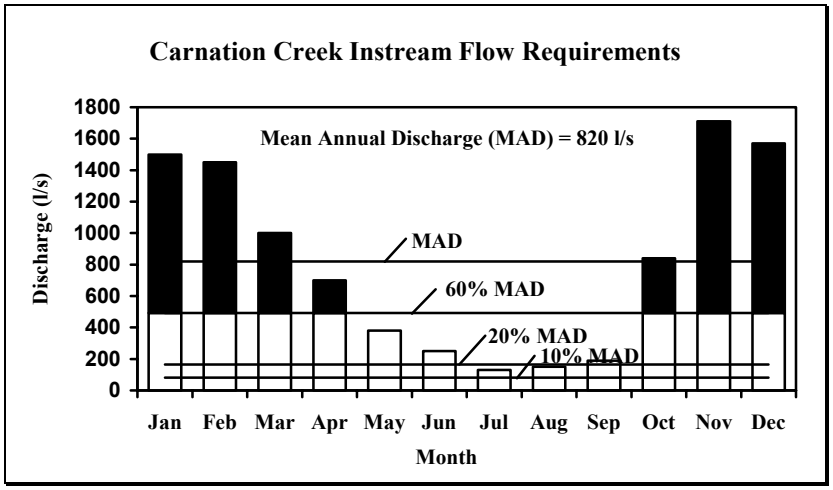


Figure 5: Carnation Creek Instream Fish Requirements

Figure 5 illustrates that the estimated mean monthly flows in Carnation Creek are between 10% and 20% of the MAD for the months of July and August. However, the mean 7-day average low flow is below 10% MAD. The mean monthly flows are less than 60% MAD for May through September. Water is only available for extractive use during months when the mean monthly discharge is greater than 60% MAD (492 l/s).

Therefore, no water is available for extractive demands during the May through September low flow period. Water is only available from Carnation Creek during the months of October through April. The estimated volume of water available for this period is 13 894 dam^3.

4.2 China Creek Instream Requirements

There are fish present in the China Creek drainage area.

Figure 6 illustrates that the estimated mean monthly flows in China Creek do not fall below 20% MAD (2551 l/s). This allows for extractive use of water throughout the year. The amount of water available in months where the discharge is above 60% MAD (7652 l/s), October to June, is 189 840 dam^3. For months where the discharge is less than 60% MAD, July to September, the water that may be considered for licencing is the difference between the minimum mean monthly flow and 10% MAD. Water available from this low flow period is 23 056 dam^3. The estimated volume of water available for extractive demands, therefore, is 212 896 dam^3.

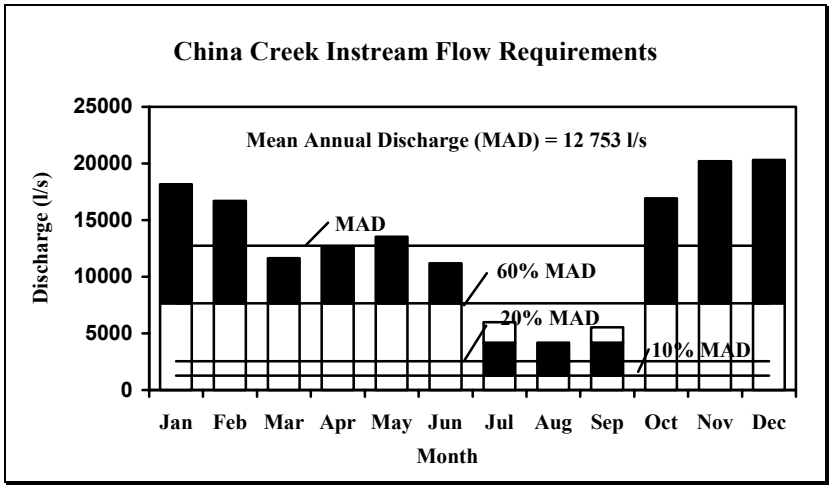


Figure 6: China Creek Instream Flow Requirements

4.3 Nahmint River Instream Requirements

There are fish present in the Nahmint River drainage area.

Figure 7 illustrates that the estimated mean monthly flows in Nahmint River do not fall below 20% MAD (4328 l/s). This allows for extractive use of water throughout the year. The amount of water available in months where the discharge is above 60% MAD (12 983 l/s), October to June, is 322 103 dam^3. For months where the discharge is less than 60% MAD, July to September, the water that may be considered for licencing is the difference between the minimum mean monthly flow and 10% MAD. Water available from this low flow period is 39 118 dam^3. The estimated volume of water available for extractive demands, therefore, is 361 221 dam^3.

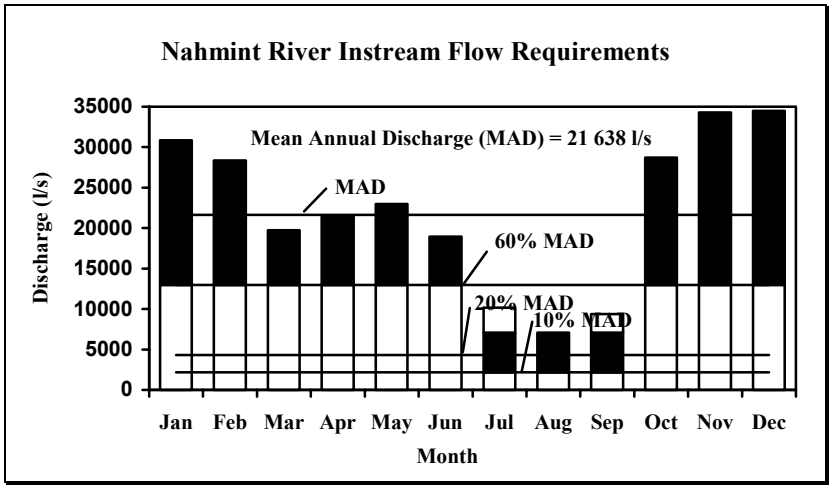


Figure 7: Nahmint River Instream Flow Requirements

4.4 Sarita River Instream Requirements

There are fish present in the Sarita River drainage area.

Figure 8 illustrates that the estimated mean monthly flows in Sarita River are between 10% and 20% of the MAD for the months of July and September. However, the mean 7-day average low flow is below 10% MAD. The mean monthly flows are less than 60% MAD for May through September. Water is only available for extractive use during months when the mean monthly discharge is greater than 60% MAD (22 586 l/s).

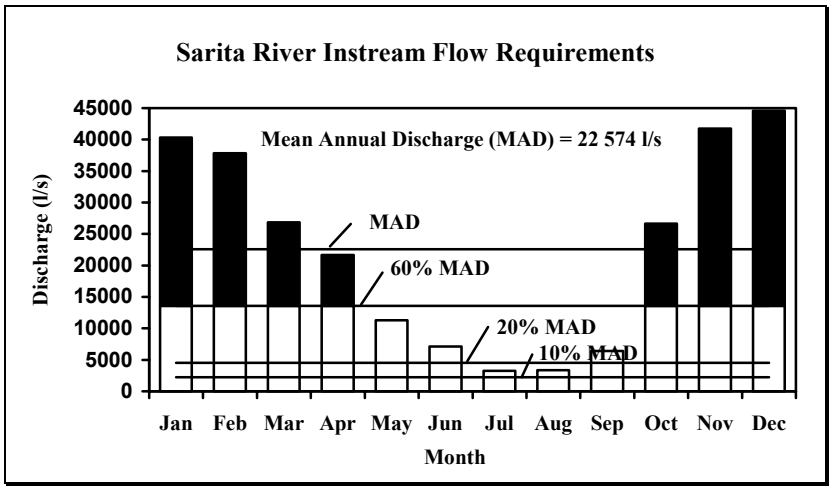


Figure 8: Sarita River Instream Flow Requirements

Therefore, if fish are present, no water is available for extractive demands during the May through September low flow period. Water is only available from Sarita River during the months of October through April. The estimated volume of water available for this period is 378 311 dam^3.

4.5 Other Drainages

Various other drainages not identified above may support fish populations. Where fish are identified, water will only be available from those drainages based upon hydrometric measurements or calculated as described in Appendix B.

5.0 WATER DEMAND

5.1 Licenced Demand

There are 70 water licences currently (September 1997) within the Alberni Inlet plan area. Figure 9 illustrates the number of water licences issued for each purpose for the water within the plan area. The largest number of water licences, 26, support domestic demands. There are 4 water licences for irrigation, 6 for power, 1 for land improvement, 5 for storage, and 8 for waterworks. The 20 licences for industrial demand include 2 for brake cooling, 1 for dust control, 6 for enterprise, 1 for fire protection, 1 for a fish hatchery, 3 for ponds, 2 for processing, 3 for work camps, and 1 for wharf purposes.

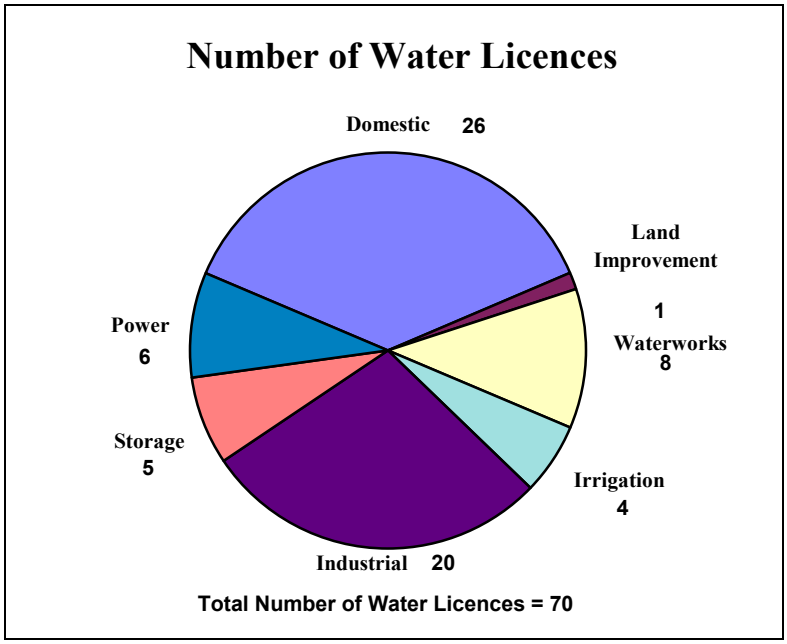


Figure 9: Number of Water Licences

Of greater significance is the estimated average annual licenced water demand and low flow water demand. The total estimated average annual licenced water demand for the plan area is 34 728.48 dam^3. Figure 10 illustrates the estimated average annual licenced water demand for each purpose under which water licences have been issued within the plan area.

Industrial is the largest water demand (53.13%) in the plan area. The second largest annual water demand is waterworks (18.79%) followed by power (18.72%) and storage (9.11%). The remaining

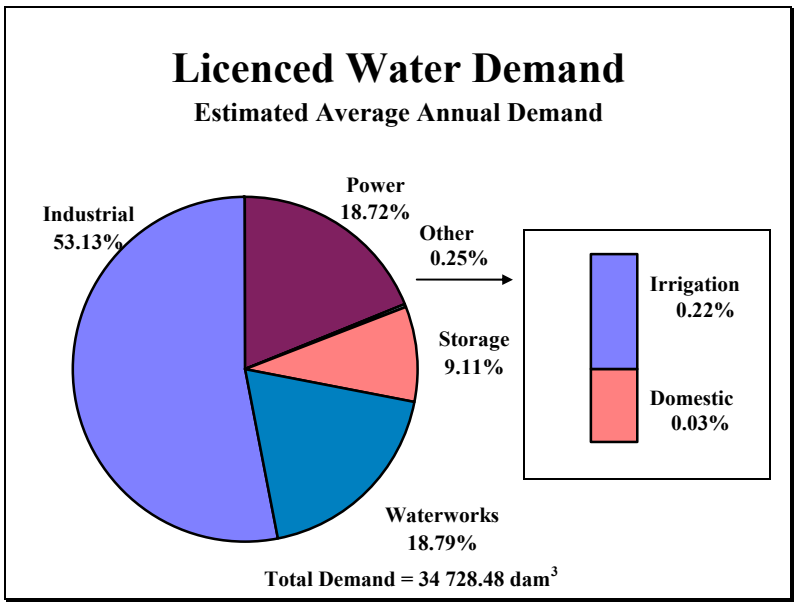


Figure 10: Licenced Water Demand

0.25% is irrigation (0.22%) and domestic (0.03%). A water licence for land improvement exists, however, there is no demand assigned to the licence.

Annual licenced water demands within the Alberni Inlet Water Allocation Plan area are detailed in Appendix D and summarized in the following table.

Estimated Average Annual Licenced Water Demand			
Purpose	**Number of Licences**	**Quantity Licenced**	**Annual Demand (dam^3)***
Industrial			
Brake Cooling	2	2000 gpd	3.32
Dust Control	1	20 000 gpd	33.19
Enterprise	6	12 250 gpd	20.33
Fire Protection	1	5000 gpd	8.30
Fish Hatchery	1	0.002 cfs	1.79
Ponds	3	20.4 cfs	18 217.20
Processing	2	74 000 gpd	122.79
Wharf	1	6 000 gpd	9.96
Work Camps	3	21 000	34.85
Waterworks			
Local Authority	5	2851 562 500 gal/yr	6481.73
Other	3	51 000 gpd	42.31
Power			
Commercial	2	2.11 cfs	1884.23
Residential	4	5.17 cfs	4616.81
Storage	5	2564 acft	3162.65
Irrigation	4	62.75 acft	77.4
Land Improvement	1	0	0
Domestic	26	14 000 gpd	11.62

* Assumes that domestic and waterworks are the authorized maximum daily licenced amount divided by 2 to estimate the average daily demand, then multiplied by 365.25 days to determine the annual demand. Industrial, storage, power, and irrigation represent total annual licenced volumes.

The low flow licenced water demand may be critical between competing water uses and instream flow requirements. The estimated low flow licenced demand for each identified drainage area and for other drainages in the Alberni Inlet Water Allocation Plan area are summarized in Appendix E and the following table.

Low Flow Licenced (Consumptive) Water Demand per Drainage Area		
Significant Drainage Area	**Low Flow Water Demand***	
	litres/second	**dam^3**
China Creek	195.24	1518.19
Sarita River	0.53	4.09
Other Areas	0.15	1.16
Drainages to Salt Water	-172.02	-1337.66

* Based on an estimated licenced water demand assuming that: irrigation and industrial demands are totally withdrawn over the 90 day period; domestic and waterworks demand are the authorized licenced maximum daily for 90 days; storage balances demand, and therefore, is a negative demand over the 90 days; conservation and power are non-consumptive, and, therefore have no demand.

5.2 Projected Demand

There are 14 water licence applications pending as of September 1997. The potential annual water demand and the purposes of these existing applications are detailed in Appendix F and summarized in the following table.

Water Licence Applications			
Purpose	**Number of Licences**	**Quantity Licenced**	**Annual Demand (dam^3)***
Domestic	6	3300 gpd	2.74
Industrial			
Brake Cooling	2	3000 gpd	4.98
Enterprise	1	600	1
Ponds	1	0.25 (any)	**
Irrigation	2	14 acft	17.27
Power			
Commercial	1	1 kW	**
General	1	1 kW	**

* Assumes that domestic and waterworks are the authorized maximum daily licenced amount divided by 2 to estimate the average daily demand, then multiplied by 365.25 days to determine the annual demand. Industrial, power, and irrigation represent total annual licenced volumes.
**Demand will be clarified subject to licencing approval.

Future water demands are anticipated to be similar to existing licenced water demands. Waterworks, domestic, industrial, irrigation and land improvement licences will increase in number as the population of the plan area expands. Conservation purpose demands will increase as conservation groups and fish agencies attempt to preserve and protect wildlife and fish habitat.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The Alberni Inlet Water Allocation Plan area is sparsely populated. Most people live in either small First Nation communities, Bamfield or are located in the north eastern portion of the plan area near Port Alberni.

Hydrometric watercourse flow information has been generalized for the west coast of Vancouver Island. Hydrometric stations to the north of the plan area were used along with stations within the plan area to calculate instream flow estimates. As more hydrometric stations are established specific watercourse flow measurements will become available. Based upon available information, watercourse flow estimates have been extrapolated for the west coast extending over four water allocation plan areas. For larger, high elevation watersheds the low flow period occurs from July-September; for smaller, low elevation watersheds the low flow period occurs from May-September.

The flows in the larger, high elevation drainages do not fall below 20% MAD throughout the year. Water during these low flow periods, therefore, may be available for extractive use, subject to licencing approval.

Small, low elevation drainages fall to between 10% and 20% MAD during the low flow period. The 7-day average low flow falls below 10% MAD. Water during the low flow period, therefore, may not be available for extractive use.

Fisheries maps of the plan area show several drainages supporting fish and fish habitat. Although not all drainages show the presence of fish it is important to note that a watercourse could support fish and fish habitat now or in the future. Therefore, water extraction from these drainages during the low flow period may be limiting to instream fish habitat and fish production. The high flow periods, when water is greater than 60% MAD, have considerable amounts of water available for storage. In turn, this water can be used to meet a licencees demands during the low flow period.

The licenced water demands within the Alberni Inlet Water Allocation Plan area consists of industrial, waterworks, power, irrigation, land improvement, domestic, and storage purposes.

The following table summarizes the water available for the identified significant drainage areas, exclusive of existing licenced water demands.

Alberni Inlet Water Allocation Plan - Water Availability			
Drainages	**Drainage Area (km^2)**	**Water Volume Available (dam^3)**	
		High Flow Period*	**Low Flow Period****
Carnation Creek	10.10	15 021	0
China Creek	112.86	206 433	13 965
Nahmint River	191.49	375 891	23 442
Sarita River	186.20	366 238	0

*High Flow Period is the total volume of water available for storage and use above 60% MAD. Smaller, low elevation drainages the high flow period is from October-April. Larger, high elevation drainages have high flow periods from October-June.
**Low Flow Period is when the mean monthly discharge falls below 60% MAD. For smaller, low elevation drainages there is no water available during the low flow period, May-September. Larger, high elevation drainages have low flow periods from July-September. The total volume of water available for larger, high elevation drainages during the low flow period is the amount between 10% MAD and the minimum mean monthly flow above 20% MAD.

Fish and debris screens are part of good intake design and shall be required on all intake or diversion works within identified fish habitat areas. Fish passage provisions for both juvenile and adult fish will be required on all storage dams or diversion works constructed on sources frequented by fish. Appendix G contains information on fish screening requirements. Instream works are to be constructed only during the period specified by the fisheries agencies to minimize impacts on fish resources.

6.1 Domestic

A domestic water licence shall be 2273 litres/day (500 gpd) for each rural dwelling as indicated on the plan attached to the water licence application. This amount will allow for the maintenance of 0.10 hectares (0.25 acres) of garden area associated with the dwelling. It is not appropriate, where the primary source of domestic water supply is insufficient, to issue additional water licences for the maintenance of green lawns and gardens.

Domestic water licences shall not be issued to provide evidence to subdivision approval authorities of an "adequate potable water supply" for subdivision development. Residential land subdivisions shall be encouraged to connect to existing community water supply systems.

To ensure an adequate domestic water supply for household uses, applicants should be prepared to develop storage or to use naturally stored water from lakes or marshes. For the average daily demand of 1136.5 litres/day (250 gpd) for a four month period (June-September; 122 days) a volume of 0.139 dam^3 (4900 ft^3) is required. This requires a reservoir or dugout approximately 8 m (26 ft) long by 5.5 m (18 ft) wide, with an average depth of 3.5 m (11.5 ft), allowing 0.3 m (1 ft) for evaporation loss over the surface of the reservoir.

Dimple springs or springs that are not directly connected by a surface channel to a stream may not require supporting storage if the spring can supply at least 2273 litres/day (500 gpd) during the months of May through September. The applicant shall provide adequate

pump tests and measurements during this period to determine the safe flow yield. Multiple domestic water licences on a spring will only be allowed if the applicant can provide assurances that adequate water is available by determining the safe flow yield near the end of the low flow period (i.e. pump test in August or September) and by satisfying any written concerns and objections of any existing water licencees. Springs with a surface channel connecting to a stream should be prepared to develop storage.

A water licence for domestic use shall not be issued to a residence within a community water supply area unless written leave to do so is obtained from the community water supply agency.

Measuring or regulating (i.e. metering) is not usually necessary with domestic water usage. An adequate screen shall be installed on the intake to prevent fish or debris from entering the works.

6.2 Waterworks

Waterworks purpose in the Water Act is the carriage or supply of water by a municipality, improvement district, regional district or private utility for the purpose of providing water to a residential area.

Applicants for a waterworks licence shall be required to assess the supply for a ten year projected demand and provide evidence that the projected demand is not excessive in comparison with adjoining community demands, that water conservation is being promoted (i.e. residential meters, pricing practices, education), and that adequate system balancing storage (i.e. volume difference between maximum hour and maximum daily demands) will be constructed or is available for peak hour demands.

Water utilities, pursuant to the Water Utilities Act, will also have to provide evidence that the appropriate requirements for a Certificate of Public Convenience and Necessity (CPCN) have been met and a CPCN will be obtained.

Licenced allocations will be limited to a 10 year projected demand except where the applicant can provide satisfactory evidence that a longer projection period is required (i.e. because the cost of construction of works must be amortized over a period).

The licencee shall be required to meter and record the water diverted from the source stream.

The licencee shall be required to treat the water supply in accordance with the Ministry of Health requirements.

Waterworks licences in small, low elevation drainages will require storage to support demand. Waterworks licences in large, high elevation drainages may not require storage to support demand.

Storage and diversion structures must be capable of maintaining or improving existing low flows during the low flow period and maintaining fish passage where required.

6.3 Irrigation

The soil type, crop rooting depth, and climatic characteristics determine the water requirements for irrigation. The irrigation demands for different crops and their rooting depths along with the water availability coefficient are classified into two categories, shallow (0.5 m) and deep (1.0 m) effective rooting depths. The available water storage capacity (AWSC) can be estimated for shallow and deep root zone depth for the soil types present within the plan area.

If the applicant for a water licence can provide more specific soil assessment and irrigation requirement information for a given area, that soil assessment and irrigation requirement may be used to assess irrigation demands.

Irrigation gun or flood irrigation systems may require greater irrigation quantities and should be discouraged. In the case where irrigation gun or flood irrigation practices are to be used suitable meters shall be installed and water withdrawals limited to the equivalent annual irrigation requirements for sprinkler systems. As the equivalent annual irrigation water requirements for sprinkler systems may not be adequate to sustain crops using these less efficient methods of irrigation, the applicant may be required to reduce crops, limit the acreage irrigated or convert to a more efficient irrigation system. Trickle irrigation can reduce water requirements by 35% and should be encouraged where practical.

Irrigation water demands in small, low elevation drainages must be supported by off-stream storage development. Storage required to support irrigation demands is the total required amount as per crop and soils, plus an additional allowance for evaporation and other losses from the storage reservoir. Diversion into storage will be authorized for the period that the mean monthly flows are above 60% MAD. Irrigation water demands in large, high elevation drainages may not require storage to support demand.

The maximum allowable rate of withdrawal shall not exceed 47.2 litres per minute per hectare (4.2 imperial gallons per minute per acre) of land to be irrigated. Irrigators are encouraged to employ good agricultural practices (field size, system selection and farm management) to conserve water. The authorized period of use for irrigation shall be from April 1 to September 30.

As noted above, all intake works in fish bearing waters shall be screened to prevent fish and debris from entering the intake.

6.4 Industrial

Industrial water licences and water licence applications within the plan area are demands associated with brake cooling, enterprise, ponds, dust control, fire protection, fish hatchery, processing, wharf, and workcamps.

Commercial fish hatcheries and/or rearing purposes shall require an industrial water licence; Use of water by government and non-profit organizations will be licenced as conservation purpose. Information on fish species and size, water temperature requirements, and operating methods will be required in support of an application for water licence. Fish Farm and Waste Management Permits will also be required. Offstream storage is required for fish ponds associated with commercial fish farming.

Golf course watering is essentially an irrigation water demand except that the watering is not limited to the irrigation period of April to September. The quantity of water required should be determined as previously stated in the irrigation section. Except for the period of water withdrawal, which shall be the whole year, the same requirements and conditions as irrigation demands shall apply. Water demands in small, low elevation will require offstream storage. Water demands in large, high elevation drainages may not require offstream storage. Diversion into storage will be authorized for the period that the mean monthly flows are above 60% MAD.

Cattle or livestock watering requiring more than 450 litres/day (100 gpd) are to be considered an Industrial (Agricultural/Stockwatering) demand. Cattle or livestock requiring 450 litres/day (100 gpd) or less will be considered a Domestic (Livestock) demand. Estimated amounts of water required for livestock watering demands are listed in the following table.

Recommended Livestock Water Requirements		
Livestock	**Water Requirements**	
	litres/day	**gallons/day**
Cattle (beef) per animal	45	10
Cattle (dairy) per animal	132	29
Chickens per 100 animals	27	6
Turkeys per 100 animals	55	12

Industrial demands related to commercial and resort development should be handled similar to multiple domestic demands with the same requirements.

6.5 Storage

Storage purpose is the impoundment of water, either onstream or offstream in a dugout or behind a dam. In the event that a large storage development to support a major water demand (i.e. hydro power, pulp and paper, community works) is proposed a more specific supply versus demand and environmental impact assessment will be required.

The storage quantity required to support the smaller water demands of domestic, industrial and irrigation uses shall be the low flow period volume of the water demand plus an additional allowance of 0.3 m (1 ft) depth over the surface area of the storage reservoir for evaporation and other losses. Offstream storage in a dugout will be required for these demands in most cases. Storage in swamps or natural depressions may be considered where fish and wildlife are not adversely impacted or where the natural habitat is enhanced.

The water licence applicant will be required to complete an adequate report form entitled "Schedule 2 - Dam & Reservoir Information". If the required report is not provided the application will be refused.

Diversion of water into offstream storage in small, low elevation drainages will be during the high flow period. Provision to maintain flows during the low flow period shall be required for instream storage reservoirs.

Water demands in large, high elevation drainages may not require storage to support demand.

The applicant must obtain written agreement, a right of way or an easement for works or flooding of other lands.

Fish passage is required, for both juvenile and adult fish, at all dams in fish bearing streams. Design of storage dams must consider fish ladders and provide adequate flow release to maintain fish passage where required. Loss of spawning areas and modification of fish habitat due to storage development may require mitigation work in the affected stream.

Design plans must be submitted and accepted in writing before construction commences on any proposed dam over 3 m (10 ft) in height or on storage 12 dam^3 (10 acft) or more in volume.

All water licencees that develop storage greater than 100 dam^3 (80 acft) shall be required to record and report the water level of the reservoir and flows from the reservoir as directed by the "Engineer" as defined in the Water Act of BC.

6.6 Land Improvement

Land improvement purpose is the diversion of water to improve drainage, to protect from flooding, to prevent erosion, or to divert and use water for aesthetic purposes. No significant water quantity is removed from the stream. Land improvement water demands are non-consumptive uses of water resources.

Water used to facilitate the development of park is usually maintained in a dammed lake for recreation (i.e. boating, fishing, swimming, golf course water traps) and aesthetics. The dammed lake is usually filled during the high flow period and the water levels maintained or gradually lowered during the low flow period. Golf courses also acquire water licences to construct and maintain dugouts or to control the volume of water in small ponds for water traps and aesthetics. Property owners may acquire a water licence to construct and maintain dugouts or to control the volume of small ponds for aesthetics. These water demands are essentially storage developments that do not support an extractive use. Therefore, all the requirements noted for storage development shall be required for land improvement development where applicable. The water quantity required to facilitate the development of a park or to create an aesthetic pond shall be the volume of the impoundment.

Constructing ditches to drain swamps or marshes, confining or straightening the meandering of stream channels and relocating a stream channel adjacent to a property line is sometimes proposed to accommodate subdivision or building development. Streams should be maintained as near as possible to pre-development flow conditions. The development of land improvement detention dugouts or the control of water in natural ponds, swamps, and marshes to reduce flood flow and increase low flow releases will be encouraged. Proposed construction of works on streams that drain swamps or marshes or increase high flow conditions and reduce low flow conditions will not be authorized.

6.7 Conservation

Conservation purpose is the use and storage of water or the construction of works in and about a stream for the enhancement of fish and wildlife for non-profit purposes.

Salmon enhancement proposals that would significantly increase fish stocks in stream channels will require the development of supporting storage to maintain required low flows.

6.8 Power

The water licence applicant will be required to complete “Schedule 2-Dam & Reservoir Information” and “Schedule 3-Power Information” reports. If the required reports are not provided the application will be refused.

In the event that a large power development is proposed a more specific supply versus demand and environmental impact assessment will be required. For a small power development the following assessments shall be used to determine the required water demand.

Flow requirements for power:

$$Q = \frac{P}{h * e * k}$$

Q = volume rate of flow (m^3/s)
P = power required at the generator (kW)
h = gross head from the pipeline intake to the tailwater (m)
e = total efficiency of the plant considering head loss in the penstock, pipeline, turbine and generator expressed by a decimal (use 0.65 for pumps, 0.70 for turbines)
k = specific gravity constant (9.81 m/s^2)

Electric Load Requirements	
Type of Establishment	**Maximum Electrical Demand per Residences (kW)**
Cabin	4
Single Family Residence:	
Lighting and appliances	6
Lighting, appliances, and water heating	10
Lighting, appliances, water, and space heating	26
Hotel or Motel	0.16 per m^2
Camp:	
Combined space heating electric and propane	1.5
All electric space heating	2

Water returned to the stream after generation of hydro power may be licenced for subsequent compatible water demands. Hydro power use that diverts water away from subsequent use should be discouraged.

Fish passage is required, for both juvenile and adult fish, at all power diversion works in fish bearing streams. Fish and debris screens may be required at both intake and outlet works to ensure that fish are not lost due to operation of the power plant. Loss of spawning areas and modification of fish habitat due to power development may require mitigation work in the affected stream.

6.9 Allocation Plan Revision

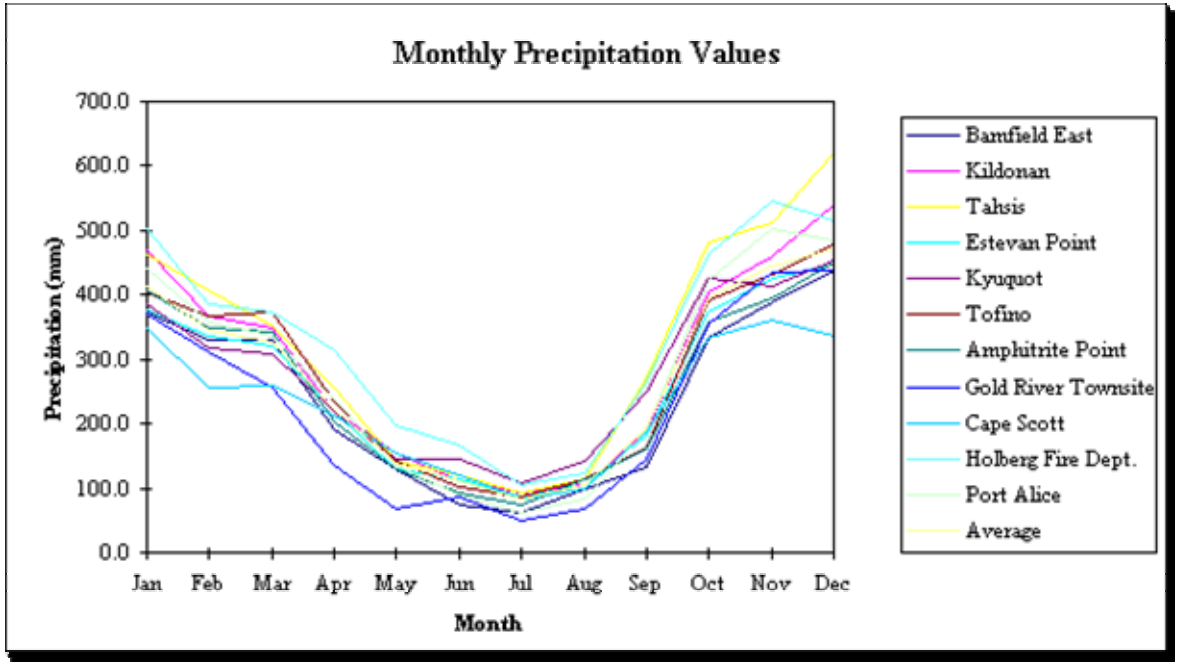
The Alberni Inlet Water Allocation Plan should be reviewed and updated on or before January 1, 2003.

APPENDIX A: Atmospheric Environment Service

Climatic Normals

Precipitation Averages (mm)

Station Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Bamfield East	372.2	330.5	328.7	191.5	129.1	74.7	62.1	98.3	133.2	334.4	387.1	437.0	2878.8
Kildonan	468.7	365.5	347.8	220.4	152.9	111.4	93.4	106.0	187.3	403.1	459.5	539.1	3455.1
Tahsis	464.0	406.0	350.8	254.7	142.1	119.6	91.0	114.5	269.9	482.4	513.4	620.4	3828.8
Estevan Point	376.9	337.4	321.7	220.4	129.3	113.2	87.7	103.5	183.1	373.9	426.3	446.5	3119.9
Kyuquot	386.1	318.4	309.6	220.3	144.6	143.7	108.5	143.2	249.8	426.7	413.1	454.5	3318.5
Tofino	404.3	366.4	372.4	233.8	143.0	101.7	86.1	114.1	163.2	391.8	432.3	479.2	3288.3
Amphitrite Point	407.5	347.3	342.8	204.3	130.0	92.1	72.6	113.1	161.0	359.1	395.8	451.7	3077.3
Gold River Townsite	371.0	312.4	256.9	136.7	69.3	85.2	48.8	68.1	144.8	354.5	434.9	438.1	2720.7
Cape Scott	348.1	254.5	259.4	211.4	154.5	120.6	82.9	100.2	187.2	334.3	360.6	335.6	2749.1
Holberg Fire Dept.	504.1	386.5	372.4	315.6	195.9	165.5	105.3	123.8	264.1	463.7	545	514.5	3956.5
Port Alice	441	358.8	334.9	238.3	137.2	89.1	62.8	82.5	192	421.1	502.7	485.3	3345.7
Average	**413.1**	**344.0**	**327.0**	**222.5**	**138.9**	**110.6**	**81.9**	**106.1**	**194.1**	**395.0**	**442.8**	**472.9**	**3249.0**



BAMFIELD EAST

Location: 48° 50'N 125° 7'W
Elevation: 4 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	4.0	5.6	5.8	7.5	9.9	12.2	14.0	14.3	13.2	10.3	6.8	5.0	9.1
Rainfall (mm)	360.0	329.0	326.4	191.5	129.1	74.7	62.1	98.3	133.2	334.4	386.3	428.7	2853.7
Snowfall (cm)	12.2	1.5	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	8.4	25.2
Total Precipitation (mm)	372.2	330.5	328.7	191.5	129.1	74.7	62.1	98.3	133.2	334.4	387.1	437.0	2878.8
Days with:													
Measurable Rainfall	20	19	19	17	14	10	8	10	11	18	21	22	189
Measurable Snowfall	3	< 0.5	1	0	0	0	0	0	0	0	< 0.5	2	6
Measurable Precipitation	21	19	20	17	14	10	8	10	11	18	22	23	193

KILDONAN

Location: 49° 0'N 125° 0'W
Elevation: 3 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)													
Rainfall (mm)	445.6	361.7	342.1	219.6	152.9	111.4	93.4	106.0	187.3	403.1	458.6	526.8	3408.5
Snowfall (cm)	28.3	6.9	8.5	0.1	0.0	0.0	0.0	0.1	0.0	0.2	1.9	21.6	67.6
Total Precipitation (mm)	468.7	365.5	347.8	220.4	152.9	111.4	93.4	106.0	187.3	403.1	459.5	539.1	3455.1
Days with:													
Measurable Rainfall	18	17	18	17	14	13	9	10	11	17	20	20	184
Measurable Snowfall	3	1	1	0	0	0	0	0	0	0	0	2	7
Measurable Precipitation	21	18	18	17	14	13	9	10	11	17	20	21	189

TAHSIS

Location: 49° 55'N 126° 39'W

Elevation: 5 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)													
Rainfall (mm)	436.1	396.4	341.2	252.4	142.1	119.6	91.0	114.5	269.9	482.4	509.1	605.0	3759.7
Snowfall (cm)	27.9	9.6	9.6	2.3	0.0	0.0	0.0	0.0	0.0	0.0	4.2	15.4	69.0
Total Precipitation (mm)	464.0	406.0	350.8	254.7	142.1	119.6	91.0	114.5	269.9	482.4	513.4	620.4	3828.8
Days with:													
Measurable Rainfall	18	18	19	17	13	12	9	11	13	19	21	21	191
Measurable Snowfall	4	2	3	1	0	0	0	0	0	0	1	2	13
Measurable Precipitation	21	18	19	17	13	12	9	11	13	19	21	22	195

GOLD RIVER TOWNSITE

Location: 49° 47'N 126° 3'W

Elevation: 117 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	0.3	3.0	4.5	7.7	11.5	14.6	17.2	17.4	14.4	9.5	4.3	1.5	8.8
Rainfall (mm)	295.6	262.9	228.2	119.0	67.5	67.9	48.0	71.2	149.5	379.5	381.6	423.9	2494.8
Snowfall (cm)	78.3	25.5	22.5	0.1	0.0	0.0	0.0	0.0	0.0	0.2	8.5	28.9	164.0
Total Precipitation (mm)	371.0	312.4	256.9	136.7	69.3	85.2	48.8	68.1	144.8	354.5	434.9	438.1	2720.7
Days with:													
Measurable Rainfall	15	17	18	16	14	12	8	11	12	19	19	21	182
Measurable Snowfall	8	5	4	0	0	0	0	0	0	0	2	4	23
Measurable Precipitation	20	17	19	16	15	12	9	11	13	19	20	23	194

ESTEVAN POINT

Location: 49° 23'N 126° 33'W
Elevation: 7 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	4.5	5.5	5.5	7.4	9.9	12.1	13.7	14.1	13.0	10.2	7.2	5.6	9.1
Rainfall (mm)	359.0	329.5	313.7	216.9	129.2	113.2	87.7	103.5	183.1	373.9	422.7	434.3	3066.7
Snowfall (cm)	16.3	6.2	6.2	2.8	0.1	0.0	0.0	0.0	0.0	0.1	3.5	9.6	44.8
Total Precipitation (mm)	376.9	337.4	321.7	220.4	129.3	113.2	87.7	103.5	183.1	373.9	426.3	446.5	3119.9
Days with:													
Measurable Rainfall	22	19	20	18	14	12	10	11	13	20	22	24	205
Measurable Snowfall	4	2	2	1	< 0.5	0	0	0	0	< 0.5	1	3	13
Measurable Precipitation	23	19	21	18	14	12	10	11	13	20	22	24	207

KYUQUOT

Location: 50° 2'N 127° 22'W
Elevation: 3 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)													
Rainfall (mm)	367.0	315.4	304.4	218.3	144.6	143.7	108.5	143.2	249.8	427.2	411.2	443.8	3277.1
Snowfall (cm)	16.7	3.7	5.2	2.1	0.0	0.0	0.0	0.0	0.0	0.0	1.7	10.5	39.9
Total Precipitation (mm)	386.1	318.4	309.6	220.3	144.6	143.7	108.5	143.2	249.8	426.7	413.1	454.5	3318.5
Days with:													
Measurable Rainfall	21	20	21	20	17	14	12	12	16	21	23	23	220
Measurable Snowfall	5	1	2	1	0	0	0	0	0	0	1	3	13
Measurable Precipitation	24	20	22	20	17	14	12	12	16	21	23	25	226

TOFINO

Location: 49° 5'N 125° 46'W

Elevation: 20 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	3.8	5.3	5.5	7.2	9.9	12.4	14.2	14.4	13.1	9.9	6.6	4.9	8.9
Rainfall (mm)	382.7	357.3	361.2	231.4	143.0	101.7	86.1	114.1	163.2	391.8	429.3	464.2	3226.0
Snowfall (cm)	20.5	6.0	8.6	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	13.2	53.0
Total Precipitation (mm)	404.3	366.4	372.4	233.8	143.0	101.7	86.1	114.1	163.2	391.8	432.3	479.2	3288.3
Days with:													
Measurable Rainfall	20	18	19	18	13	11	9	11	13	19	22	22	195
Measurable Snowfall	4	2	2	1	0	0	0	0	0	0	1	3	13
Measurable Precipitation	21	19	20	18	13	11	9	11	13	19	22	23	199

AMPHITRITE POINT

Location: 48° 55'N 125° 32'W

Elevation: 11 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	4.7	6.1	6.2	8.0	10.4	12.4	13.9	14.3	13.4	10.6	7.4	5.5	9.4
Rainfall (mm)	393.1	344.2	338.1	203.5	130.0	92.1	72.6	113.1	161.0	359.1	393.6	440.3	3040.7
Snowfall (cm)	14.5	3.1	4.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0	2.2	11.4	36.5
Total Precipitation (mm)	407.5	347.3	342.8	204.3	130.0	92.1	72.6	113.1	161.0	359.1	395.8	451.7	3077.3
Days with:													
Measurable Rainfall	20	19	19	17	14	11	9	12	12	19	21	22	195
Measurable Snowfall	2	1	1	< 0.5	0	0	0	0	0	0	< 0.5	2	6
Measurable Precipitation	21	19	19	17	14	11	9	12	12	19	21	23	197

CAPE SCOTT
Location: 50° 47'N 128° 26'W
Elevation: 70m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	4.5	5.1	5.9	7	9.2	11.3	13.1	13.7	12.5	9.8	6.9	4.8	8.6
Rainfall (mm)	327.3	242.8	248.7	206.5	154.4	120.6	82.6	100.2	187.2	334	356.1	323	2683.4
Snowfall (cm)	20.5	11.4	10.6	4.8	0.0T	0	0	0	0.0T	0.3	4.6	12.6	64.8
Total Precipitation (mm)	348.1	254.5	259.4	211.4	154.5	120.6	82.9	100.2	187.2	334.3	360.6	335.6	2749.1
Days with:													
Measurable Rainfall	23	20	23	20	19	17	16	17	17	24	24	24	245
Measurable Snowfall	6	3	3	2	*	0	0	0	0	*	2	4	21
Measurable Precipitation	25	21	23	20	19	17	16	17	17	24	24	25	250

HOLBERG FIRE DEPT
Location: 50° 39'N 127° 59'W
Elevation: 46m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	3.2	4.2	5.6	7.1	9.9	12.2	14.5	15	13.2	9.7	5.5	3.5	8.6
Rainfall (mm)	471.2	366.6	358.6	311.7	195.9	165.5	105.3	123.8	264.1	463.7	536.9	492.5	3855.9
Snowfall (cm)	32.9	20	13.9	3.9	0	0	0	0	0	0	8.1	21.1	99.8
Total Precipitation (mm)	504.1	386.5	372.4	315.6	195.9	165.5	105.3	123.8	264.1	463.7	545	514.5	3956.5
Days with:													
Measurable Rainfall	22	19	23	22	20	18	13	14	16	22	24	23	234
Measurable Snowfall	6	5	4	1	0	0	0	0	0	0	2	4	22
Measurable Precipitation	25	20	24	22	20	18	13	14	16	22	24	25	242

PORT ALICE
Location: 50° 23'N 127° 27'W
Elevation: 21m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	3.7	4.9	6	7.6	10.8	13.5	15.9	16.1	13.7	10	6.2	N	N
Rainfall (mm)	421.3	350.4	328.5	237.6	137.2	89.1	62.8	82.5	192	421	499.5	474.6	3296.5
Snowfall (cm)	22.5	8.2	5.9	0.6	0	0	0	0	0	0.1	3	10.9	51.4
Total Precipitation (mm)	441	358.8	334.9	238.3	137.2	89.1	62.8	82.5	192	421.1	502.7	485.3	3345.7
Days with:													
Measurable Rainfall	20	18	21	18	16	14	9	12	13	21	22	20	204
Measurable Snowfall	3	2	1	*	0	0	0	0	0	*	*	2	10
Measurable Precipitation	22	19	21	18	16	14	9	12	13	21	22	21	207

APPENDIX B: Hydrometric Estimation Methodology

West Coast of Vancouver Island

The west coast of Vancouver Island, from an area southeast of Alberni Inlet stretching northwest to Cape Scott, has similar physiographic characteristics such as slope, aspect, and surface water storage. With similar precipitation, evapotranspiration, infiltration, and vegetation characteristics, the nature of watershed dynamics can be generalized to include four water allocation plan areas. These include the Alberni Inlet, Long Beach, Gold-Tahsis-Zeballos, and Quatsino Sound plans.

The monthly hydrologic regime, however, between smaller, low elevation and larger, high elevation watersheds vary throughout the year. Generally, watersheds less than 100 km^2 are considered smaller and those more than 100 km^2 are considered larger. As well, watersheds of high elevation generally accumulate a snowpack, while low elevation watersheds may not have a snowpack. It is important to note that in some cases a watershed may be considered large in size, but, due to its topography, low in elevation or vice versa. In cases such as these, a more rigorous analysis of the watershed may need to be undertaken to determine the appropriate hydrologic regime.

The following tables, while sharing similar Mean Annual Discharges (MAD) demonstrate variations in Mean Monthly Discharges (MMD). The appropriate table, depending on a watersheds size and relative elevation, should be used in estimating watercourse flows. In order to calculate monthly and yearly flow estimates the watershed size is multiplied by the averages for each MMD or the MAD average.

Small, Low Elevation Watershed - Discharge Runoff per Square Kilometre (litres/second/km^2)													
WSC Station	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**MAD**
08HB048 (Carnation)	149	144	99	69	38	25	13	15	19	83	169	155	81
08HB014 (Sarita)	216	203	144	116	60	38	20	18	35	143	224	240	121
08HF006 (San Josef)	178	149	138	122	45	38	18	27	42	168	209	200	121
Average	181	165	127	102	48	34	17	20	32	131	201	198	108
% of MAD	168	153	118	94	44	31	16	19	30	121	186	183	100

Large, High Elevation Watershed - Discharge Runoff per Square Kilometre (litres/second/km^2)													
WSC Station	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**MAD**
08HC001 (Gold)	116	93	76	84	97	79	38	19	32	109	137	133	82
08HE006 (Zeballos)	212	173	126	122	117	104	71	51	93	201	236	217	143
08HC002 (Ucona)	124	109	83	89	110	106	63	34	42	113	148	142	95
08HB012 (Nahmint)	206	204	138	128	156	119	54	28	60	242	207	233	148
08HE003 (Benson)	114	124	110	96	92	71	37	19	30	103	116	181	87
08HC004 (Bedwell)	191	186	84	153	146	116	55	68	36	132	232	173	125
Average	161	148	103	112	120	99	53	37	49	150	179	180	113
% of MAD	142	131	91	99	106	88	47	33	43	133	158	159	100

Methodology

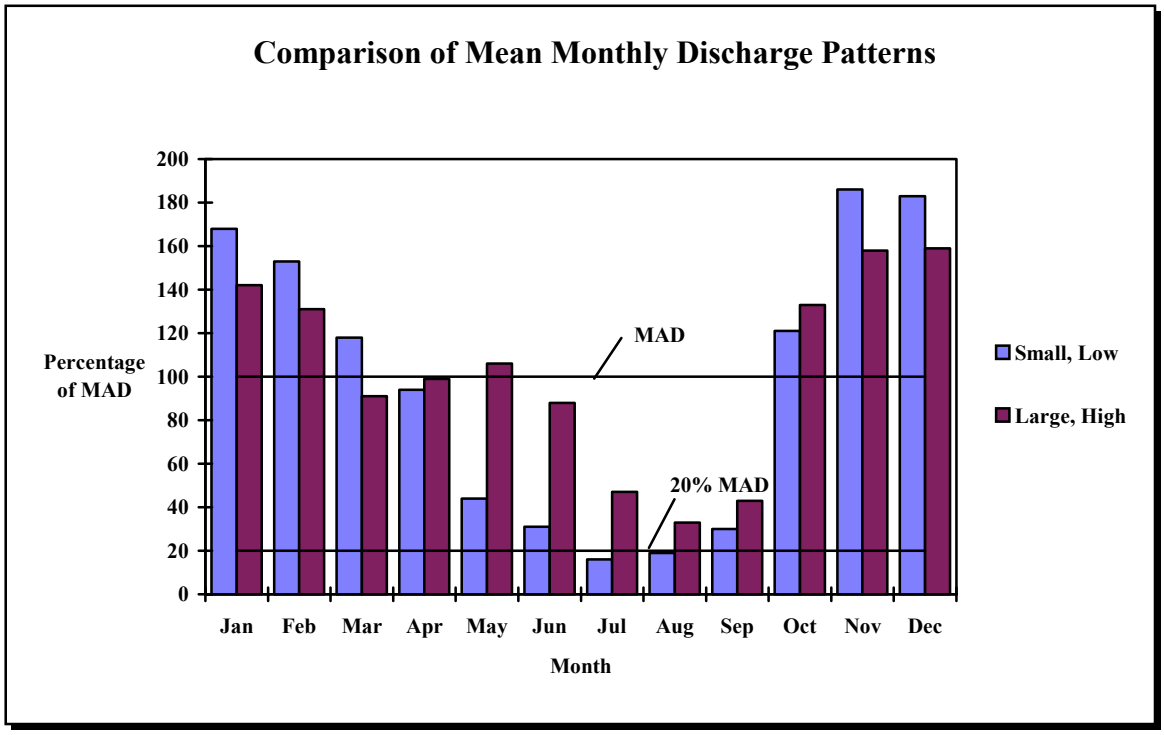
There are a number of Water Survey of Canada (WSC) hydrometric stations located on the west coast of Vancouver Island with varying years of operation. Stations with natural flows and in operation throughout the year for several years were selected to establish hydrologic averages on the west coast. The following table identifies WSC stations by name, number, the years of operation, and the size of the watershed, which were used for flow estimate calculations in this report.

Water Survey of Canada Hydrometric Stations			
Station Name	**Station Number**	**Watershed Size (km^2)**	**Operation Period Used in Methodology**
San Josef River below Sharp Creek	08HF006	64.5	1990, 1993-1996
Carnation Creek at the Mouth	08HB048	10.1	1972-1996
Sarita River near Bamfield	08HB014	162.0	1948-1996
Ucona River at the Mouth	08HC002	185.0	1957-1996
Gold River below Ucona River	08HC001	1010.0	1956-1996
Nahmint River near Port Alberni	08HB012	140.0	1924-1931
Benson River near Port Alice	08HE003	228.0	1925-1931
Zeballos River near Zeballos	08HE006	181.0	1960-1996
Bedwell River above Ursus Creek	08HC004	114.0	1990-1996

A small difference between the MADs was calculated between small, low elevation and large, high elevation drainage basins. The significant difference between these two drainage types lies

in the mean monthly flows throughout the year represented as percentages of MAD. These values are shown in the following table and graph.

Percentage of MAD												
Drainages	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Small, Low Elevation	168	153	118	94	44	31	16	19	30	121	186	183
Large, High Elevation	142	131	91	99	106	88	47	33	43	133	158	159



The variation between the monthly flows justifies the need for addressing individual watersheds relative to their size and elevation. Refer to the tables at the beginning of this section to estimate mean monthly and annual discharges for either of the watershed types. For detailed summarizations of WSC hydrometric stations refer to Appendix C.

Hydrometric information used in this report is based upon data available at the time of writing. A number of provincial hydrometric stations are planned to be in operation within the next few years. Data from these stations will compliment the existing data.

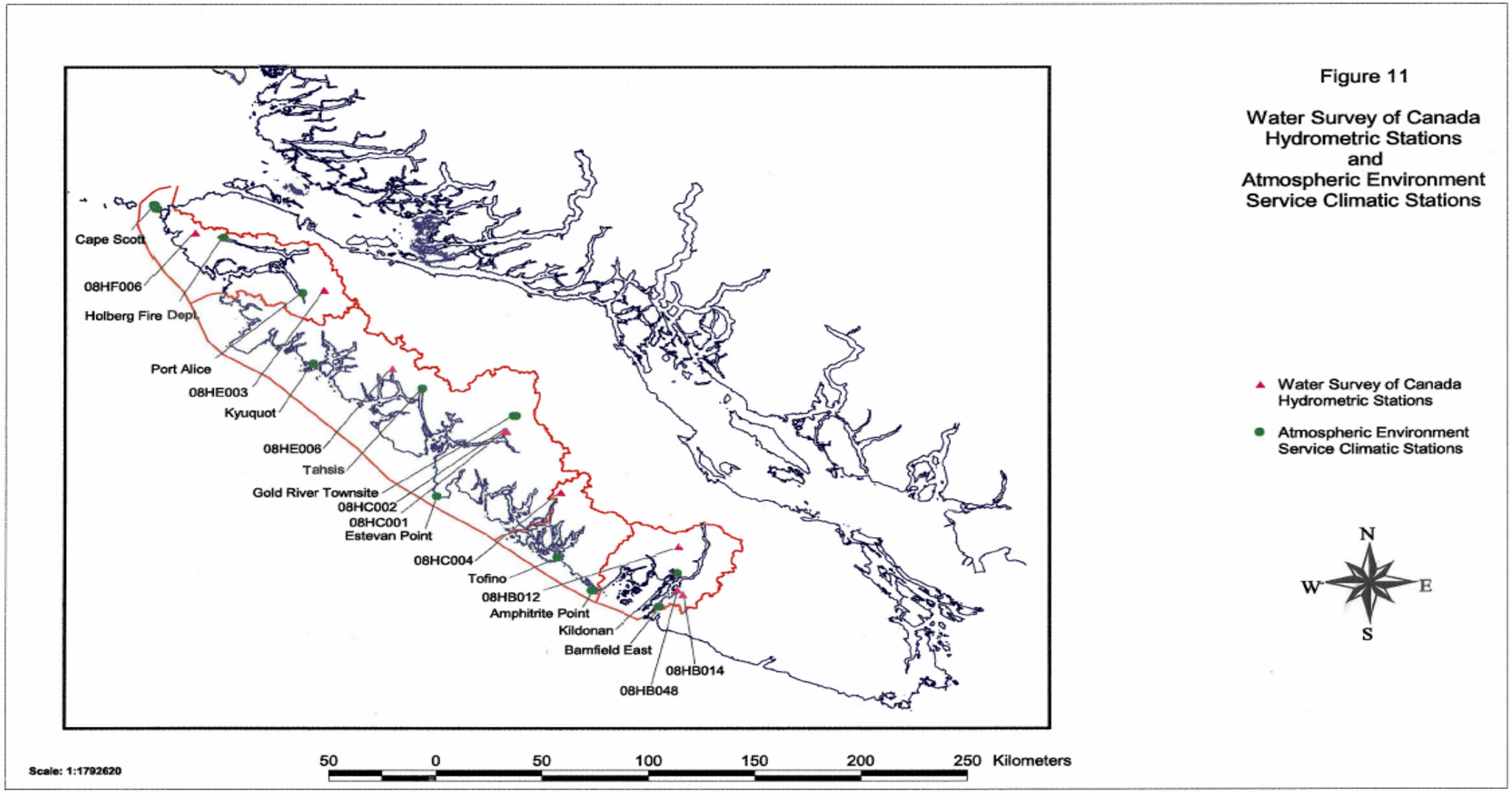
Low Flows

Watercourses where the minimum monthly discharges are above 20% MAD may allow for extractive use of water throughout the year. During the high flow period water above 60% MAD may be available, however, when discharges fall below 60% MAD the water that may be available for use is the difference between 10% MAD and the least mean monthly flow during the low flow period.

If there are fisheries concerns Regional Policy dictates that drainages with monthly flows between 10% and 20% MAD must refer to 7-day average low flows to determine water availability. The 7-day average low flow data for small, low elevation hydrometric stations on the west coast of Vancouver Island are less than 10% MAD. Therefore, water available for extractive use in small, low elevation watersheds are limited to months where the discharge is above 60% MAD.

In watersheds were there are no fisheries concerns then a natural 7-day average low flow for a recurrence interval of 1 in 5 years is used to assess water supplies available from streams.

APPENDIX C: Water Survey of Canada Hydrometric Stations


Cape Scott
08HF006
Holberg Fire Dept.
Port Alice
08HE003
Kyuquot
08HE006
Tahsis
Gold River Townsite
08HC002
08HC001
Estevan Point
08HC004
Tofino
08HB012
Amphitrite Point
Kildonan
Bamfield East
08HB014
08HB048
Scale: 1:1792620
50 0 50 100 150 200 250 Kilometers
Figure 11
Water Survey of Canada Hydrometric Stations and Atmospheric Environment Service Climatic Stations
Water Survey of Canada Hydrometric Stations
Atmospheric Environment Service Climatic Stations
N
W
E
S

Station Name: **CARNATION CREEK AT THE MOUTH**
Station Number: **08HB048**
Natural or Regulated: N
Drainage Area (sq.km.): 10.10
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	48	54	56
Longitude	124	59	52

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1972												2.34	
1973	2.03	0.74	0.97	0.29	0.50	0.46	0.07	0.03	0.03	0.86	1.62	2.53	0.85
1974	2.10	2.09	2.41	1.11	0.73	0.37	0.27	0.08	0.09	0.26	1.89	1.97	1.11
1975	1.22	0.71	0.91	0.43	0.51	0.23	0.11	0.62	0.14	2.31	3.14	2.24	1.05
1976	1.68	1.51	1.24	0.55	0.50	0.30	0.19	0.17	0.24	0.49	0.60	1.50	0.75
1977	0.73	1.56	1.16	0.46	0.37	0.19	0.11	0.12	0.19	0.89	1.80	1.22	0.73
1978	0.72	0.74	0.83	0.49	0.28	0.20	0.06	0.59	0.84	0.33	0.72	0.87	0.55
1979	0.23	1.86	0.90	0.34	0.22	0.09	0.25	0.04	0.58	0.74	0.47	2.38	0.67
1980	0.88	1.36	0.87	0.80	0.15	0.15	0.29	0.08	0.51	0.22	2.28	2.61	0.85
1981	0.58	1.38	0.43	1.45	0.40	0.59	0.11	0.07	0.52	1.54	1.55	1.46	0.83
1982	1.98	1.89	0.69	0.78	0.20	0.04	0.05	0.02	0.07	1.83	1.11	1.94	0.88
1983	2.50	2.67	1.28	0.33	0.20	0.20	0.62	0.04	0.08	0.46	2.80	0.68	0.98
1984	2.35	1.57	0.95	0.90	0.90	0.15	0.18	0.03	0.29	1.81	1.61	0.85	0.97
1985	0.18	0.70	0.58	0.77	0.30	0.10	0.01	0.01	0.15	1.32	0.57	0.49	0.43
1986	1.88	2.03	1.41	0.65	0.95	0.26	0.19	0.02	0.08	0.25	1.34	1.80	0.90
1987	2.05	1.18	1.43	0.74	0.62	0.44	0.05	0.01	0.01	0.04	1.09	1.50	0.76
1988	0.91	0.96	0.99	0.96	0.59	0.28	0.05	0.04	0.15	0.39	2.01	1.00	0.69
1989	1.58	0.52	1.01	0.85	0.06	0.04	0.21	0.07	0.03	0.91	2.39	0.91	0.72
1990	1.81	2.15	0.81	0.22	0.16	0.77	0.09	0.04	0.03	1.60	4.04	1.91	1.13
1991	1.44	3.04	0.39	0.66	0.21	0.06	0.06	1.34	0.09	0.03	1.98	1.83	0.91
1992	3.36	1.27	0.28	0.88	0.10	0.05	0.03	0.07	0.22	1.05	1.22	0.72	0.77
1993	1.37	0.18	1.31	1.26	0.64	0.41	0.05	0.04	0.01	0.14	0.54	1.78	0.65
1994	1.36	1.80	1.37	0.31	0.08	0.34	0.07	0.01	0.06	0.46	1.44	1.95	0.76
1995	1.61	1.70	1.34	0.47	0.08	0.10	0.05	0.07	0.03	1.11	4.02	1.72	1.02
1996	1.54	1.19	0.46	1.12	0.32	0.09	0.02	0.01	0.15	1.03	0.94	0.95	0.65
MEAN	1.50	1.45	1.00	0.70	0.38	0.25	0.13	0.15	0.19	0.84	1.71	1.57	0.82
% MAD	184 %	178%	122%	86%	46%	30 %	16%	18%	23%	102%	210%	192%	100%

Station Name: **CARNATION CREEK AT THE MOUTH**
Station Number: **08HB048**

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
16-Sep-73	0.013	16-Sep-73	0.013
04-Sep-74	0.057	04-Sep-74	0.057
03-Aug-75	0.091	03-Aug-75	0.091
09-Aug-76	0.045	09-Aug-76	0.045
19-Aug-77	0.035	19-Aug-77	0.035
04-Aug-78	0.037	04-Aug-78	0.037
29-Aug-79	0.037	29-Aug-79	0.037
13-Aug-80	0.069	13-Aug-80	0.069
24-Aug-81	0.06	24-Aug-81	0.06
03-Sep-82	0.006	03-Sep-82	0.006
24-Aug-83	0.016	12-Oct-83	0.015
29-Aug-84	0.024	29-Aug-84	0.024
03-Aug-85	0.004	03-Aug-85	0.004
07-Sep-86	0.015	07-Sep-86	0.015
31-Aug-87	0.009	25-Oct-87	0.007
11-Aug-88	0.018	11-Aug-88	0.018
13-Sep-89	0.022	13-Sep-89	0.022
12-Aug-90	0.02	12-Aug-90	0.02
11-Jul-91	0.029	31-Oct-91	0.013
01-Aug-92	0.014	01-Aug-92	0.014
25-Sep-93	0.007	08-Oct-93	0.006
30-Aug-94	0.004	30-Aug-94	0.004
21-Jul-95	0.013	21-Jul-95	0.013
MEAN	**0.028**		**0.027**
% MAD	**3.43%**		**3.33%**

Station Name: **SAN JOSEF RIVER BELOW SHARP CREEK**
Station Number: **08HF006**
Natural or Regulated: N
Drainage Area (sq.km.): 64.50
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	50	40	11
Longitude	128	9	51

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1990					1.77	1.77	0.94	0.57	0.41				
1993					4.98	1.82	0.89	0.95	0.72	1.89	8.52	10.00	
1994	10.90	10.00	11.20	5.36	2.85	3.22	1.52	2.31	7.87	11.80	18.70	16.90	8.54
1995	6.91	10.30	7.18	6.13	1.00	0.91	1.01	3.14	0.77	18.10	19.10	11.80	7.18
1996	16.70	8.47	8.28	12.20	4.02	4.61	1.29	1.64	3.73	11.60	7.60	12.90	7.75
MEAN	11.50	9.59	8.89	7.90	2.92	2.47	1.13	1.72	2.70	10.85	13.48	12.90	7.82
% MAD	147%	123 %	114%	101%	37%	32 %	14 %	22%	35%	139%	172%	165%	100%

Station Name: **SAN JOSEF RIVER BELOW SHARP CREEK**
Station Number: **08HF006**

7-Day Average Low Flow (m^3/sec)			
Date of	Period:	Date of	Period:
Occurrence	Apr 1 to Sep 30	Occurrence	Jan 1 to Dec 31
15-Aug-93	0.598	09-Oct-93	0.573
26-Jul-94	0.855	26-Jul-94	0.855
21-Jul-95	0.539	21-Jul-95	0.539
MEAN	**0.664**		**0.655**
% MAD	**8.48%**		**8.38%**

Station Name: **SARITA RIVER NEAR BAMFIELD**

Station Number: **08HB014**

Natural or Regulated: N

Drainage Area (sq.km.): 162.00

Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	48	53	34
Longitude	124	57	54

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1948			21.30	29.20	15.40	4.25							
1949				18.10	11.20	3.88	4.37	4.84				31.30	
1950	13.70	46.60	45.30	35.90	12.50	5.48	1.83	1.93	3.12	39.20	30.40	57.90	24.40
1951	39.30	36.80	12.80	9.91	7.69	1.82	0.76	0.48	5.88	20.30	40.30	26.00	16.70
1952	21.40	47.40	15.60	26.30	14.50	16.70	1.61	5.57	2.77	3.08	25.00	45.90	18.70
1953	68.50	39.20	33.50	15.20	12.50	3.47	3.59	4.07	11.50	42.20	56.90	53.80	28.70
1954	26.10	70.30	12.30	23.10	4.92	7.15	6.89	2.05	5.26	30.60	61.00	40.60	23.80
1955	17.10	14.60	8.96	27.90	37.10	20.80	4.31	5.04	3.84	23.80	27.90	34.40	18.80
1956	42.50	14.50	29.30	19.40	11.10	14.00	3.40	1.02	6.17	37.20	21.60	62.70	22.00
1957	10.60	18.20	23.20	17.30	5.56	3.24	4.92	5.73	5.73	10.60	13.20	45.30	13.60
1958	64.80	46.20	13.80	15.10	2.11	1.01	0.54	0.69	5.42	27.30	16.60	60.20	21.00
1959	29.30	15.60	26.40	25.80	6.89	7.47	2.61	1.38	8.39	17.90	16.80	44.20	16.90
1960	46.20	30.00	18.30	32.60	15.40	9.71	1.02	1.76	6.39	26.70	45.50	32.70	22.10
1961	106.00	55.80	34.60	18.60	12.00	4.59	1.72	0.77	5.61	20.90	22.50	33.90	26.30
1962	19.30	17.80	10.30	24.70	10.20	8.28	2.89	7.60	3.63	25.10	71.80	58.30	21.60
1963	5.89	52.80	28.70	16.70	9.42	1.08	3.87	3.54	1.46	46.40	50.50	34.40	21.00
1964	40.20	17.90	26.40	12.90	8.99	6.48	11.80	5.23	11.30	14.30	19.00	16.60	16.00
1965	31.90	27.90	8.76	17.80	10.80	2.01	0.74	1.27	0.88	32.70	35.70	44.00	17.80
1966	52.70	20.00	31.30	9.67	5.26	5.89	3.46	2.15	5.55	24.20	39.70	60.90	21.80
1967	35.80	24.40	28.90	9.80	6.06	2.29	1.05	0.59	4.15	69.20	23.40	47.80	21.20
1968	64.80	34.30	33.40	14.30	6.30	4.85	3.93	6.08	10.60	38.30	38.00	36.90	24.30
1969	12.90	19.50	20.00	26.70	15.00	4.09	1.39	3.34	27.50	17.40	30.40	41.60	18.30
1970	23.00	15.00	16.50	22.20	4.16	1.01	0.91	1.29	5.41	17.80	32.90	38.50	14.90
1971	31.10	29.30	30.40	17.20	13.20	9.87	3.41	2.68	5.48	29.80	57.50	11.30	20.00
1972	33.20	41.70	41.40	27.20	6.38	1.45	11.10	1.09	4.65	2.95	29.10	57.80	21.50
1973	56.70	28.40	22.00	7.29	11.10	14.60							
1976				16.60	13.60	7.26	6.25	4.00	4.98	12.20	15.70	29.20	
1977	13.30	31.50	26.60	13.50	10.60	6.33	1.81	2.59	5.78	25.50	42.20	29.90	17.40

Station Name: **SARITA RIVER NEAR BAMFIELD continued**
Station Number: **08HB014**

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1978	20.30	18.20	22.00	12.20	8.18	4.43	1.13	11.30	21.40	9.01	14.00	20.60	13.50
1979	6.59	49.90	21.90	13.30	11.50	6.64	10.20	1.94	12.90	19.20	11.90	58.70	18.50
1980	18.00	33.10	17.30	20.50	3.64	2.60	6.33	1.18	8.71	6.70	48.80	51.40	18.10
1981	12.50	31.10	8.21	22.60	5.37	7.72	1.95	0.84	7.63	35.00	44.30	45.20	18.40
1982	40.80	48.70	17.40	20.50	7.71	2.15	1.79	0.98	2.24	48.20	28.20	48.40	22.10
1983	62.30	65.90	37.40	9.87	5.48	7.01	12.40	2.10	3.30	12.10	70.00	18.40	25.20
1984	41.60	35.60	21.40	15.10	10.80	2.86	2.67	2.09	3.41	40.80	52.20	21.30	20.80
1985	5.90	17.20	14.80	19.30	7.90	2.41	0.63	0.51	2.85	27.00	12.70	14.10	10.40
1986	48.30	31.10	36.90	19.60	21.10	7.08	3.41	0.83	1.55	7.51	35.40	37.60	20.80
1987	48.20	29.10	34.90	15.90	14.40	16.80	1.48	0.45	0.54	0.60	26.10	35.80	18.60
1988	27.10	23.30	26.70	23.50	17.70	8.40	2.01	0.96	2.43	7.67	47.20	22.90	17.40
1989	31.80	23.20	20.70	19.00	2.22	2.06	5.74	1.43	0.63	21.10	45.70	24.60	16.50
1990	34.30	35.90	21.20	7.08	4.05	14.50	2.09	1.00	0.94	32.60	72.10	38.50	21.90
1991	30.50	54.70	7.80	14.80	7.21	2.17	1.58	24.20	3.57	0.94	37.60	40.50	18.60
1992	69.30	32.40	5.88	16.30	3.34	1.17	0.67	0.99	4.63	22.20	24.70	19.60	16.70
1993	22.00	7.66	28.90	29.30	14.80	7.78	1.63	1.85	0.89	5.49	14.30	41.70	14.80
1994	34.20	42.40	40.30	10.30	3.80	10.90	2.03	0.76	2.19	14.20	40.70	51.60	21.00
1995	40.10	38.50	33.00	11.40	2.09	2.90	1.03	1.53	0.84	27.60	83.20	49.10	24.20
1996	42.30	33.40	14.60	33.70	10.20	3.27	0.95	0.44	3.48	25.30	24.60	29.00	18.40
MEAN	35.05	32.89	23.36	18.83	9.82	6.21	3.33	2.94	5.58	23.16	36.30	38.78	19.64
% MAD	178%	167 %	119%	96%	50%	32%	17%	15%	28%	118%	185%	197%	100%

Station Name: **SARITA RIVER NEAR BAMFIELD continued**
Station Number: **08HB014**

7-Day Average Low Flow (m^3/sec)			
Date of	Period:	Date of	Period:
Occurrence	Apr 1 to Sep 30	Occurrence	Jan 1 to Dec 31
06-Aug-78	0.881	06-Aug-78	0.881
28-Aug-79	1.75	28-Aug-79	1.75
13-Aug-80	1.06	13-Aug-80	1.06
24-Aug-81	0.659	24-Aug-81	0.659
01-Sep-82	0.699	01-Sep-82	0.699
24-Aug-83	1.1	24-Aug-83	1.1
27-Aug-84	2.03	27-Aug-84	2.03
26-Aug-85	0.33	26-Aug-85	0.33
15-Sep-86	0.396	15-Sep-86	0.396
29-Aug-87	0.342	21-Oct-87	0.329
15-Sep-88	0.393	15-Sep-88	0.393
23-Sep-89	0.477	01-Oct-89	0.458
12-Aug-90	0.543	12-Aug-90	0.543
11-Jul-91	0.791	31-Oct-91	0.694
24-Aug-92	0.349	24-Aug-92	0.349
27-Sep-93	0.710	02-Oct-93	0.681
04-Aug-94	0.692	04-Aug-94	0.692
22-Sep-95	0.631	22-Sep-95	0.631
MEAN	**0.867**		**0.863**
% MAD	**4.41%**		**4.40%**

Station Name: **SARITA RIVER NEAR BAMFIELD continued**
Station Number: **08HB014**

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
06-Aug-78	0.881	06-Aug-78	0.881
28-Aug-79	1.75	28-Aug-79	1.75
13-Aug-80	1.06	13-Aug-80	1.06
24-Aug-81	0.659	24-Aug-81	0.659
01-Sep-82	0.699	01-Sep-82	0.699
24-Aug-83	1.1	24-Aug-83	1.1
27-Aug-84	2.03	27-Aug-84	2.03
26-Aug-85	0.33	26-Aug-85	0.33
15-Sep-86	0.396	15-Sep-86	0.396
29-Aug-87	0.342	21-Oct-87	0.329
15-Sep-88	0.393	15-Sep-88	0.393
23-Sep-89	0.477	01-Oct-89	0.458
12-Aug-90	0.543	12-Aug-90	0.543
11-Jul-91	0.791	31-Oct-91	0.694
24-Aug-92	0.349	24-Aug-92	0.349
27-Sep-93	0.710	02-Oct-93	0.681
04-Aug-94	0.692	04-Aug-94	0.692
22-Sep-95	0.631	22-Sep-95	0.631
MEAN	**0.867**		**0.863**
% MAD	**4.41%**		**4.40%**

Station Name: **GOLD RIVER BELOW UCONA RIVER**
Station Number: **08HC001**
Natural or Regulated: N
Drainage Area (sq.km.): 1010
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	49	42	21
Longitude	126	6	22

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1956				137	190	158	66.9	15.5	45	138		208	
1957	29.7	23	47.3	78.7	99.3	49.1	36.7	31	68.5	55.9	63.2	203	65.8
1958	211		67.6	71.7	110	51.4	13.6	8.85	63.4	213	92.6	262	
1959		56.7	74.5	130	105	110	58	13.8	27.2	64.9	111	152	86.6
1960	32.2	107	57.9	146	150	123	39.8	20.1	32.2	168	109	128	92.7
1961	275	168	87.4	103	77.8	66.2	30	13.1	29.3	96	81.6	106	94.2
1962	169	101	22.6	97.7	70.3	50.6	21.4	41.9	25.9	150			
1963			76.5	48	62.8	44.4	48.6	16.1	22	205	190	197	
1964	87.3	65.4	58.6	78.8	106	147	88.4	47.6			98.2	81.3	
1965	68.1	91.2	54.6	68.5	75.5	42.9	17	7.55	6.14	297	105	167	83.7
1966	127	65.8	130	103	97.8	106	58	19.8	43.3	163	116	251	107
1967	116	88.1	55	40.9	133	127	32.9	11.5	29.6	270	93.8	163	97.1
1968	306	128	96.1	62.3	89.8	55.1	36.9	16.3	49.7	198	192	101	111
1969		66.6	67.2	128	205	147	35.7	26.6	80.3	75.6	185	108	
1970	56.7	69	57.3	93.4	92.5	54.2	21.1	12.6	23.3	55.8	61.8	45.7	53.4
1971	172	131	44.5	71	133	134	61.5	33.7	84.8	97.2	188	28.3	97.8
1972	28.3	62.5	188	77.9	156	156	78.2	21.6	63.8	12.5	96.5	155	91.4
1973	168	48.5	46	56.4	95.2	107	34.9	11.4	9.52	115	51.8	161	75.8
1974	162	73	101	107	114	153	94.5	34.4	22.3	26.5	146	167	100
1975	54.8	35.5	48.5	52	110	96.1	37.6	38.7	19.1	138	354	175	96.7
1976	108	53.1	58.5	65.7	140	122	85.5	38.8	38.2	64.2	95.9	180	87.7
1977	48.8	114	69.1	89.8	55.7	49.1	24.7	11.2	20	108	163	115	72
1978	50	67.9	106	39.3	50.1	50.1	18.1	28.7	81.1	69.4	82.7	47.2	57.4
1979	23.5	82.4	142	71.8	94.5	54.4	35	8.77	81.1	88.2	51.1	201	77.9
1980	50.4	98.1	60.6	88.2	68.8	43.2	29.3	8.87	43	36.1	184	261	80.8
1981	89.1	85.5	27	103	71.7	54.4	17.3	5.61	46.1	151	151	87.2	73.8
1982	67.7	111	47.3	42.1	99.5	111	36.1	13.9	22.8	179	80.8	105	76.1
1983	194	182	91.8	54.9	72.1	61.2	59.5	15.1	17.8	83.5	180	38.8	86.9

Station Name: **GOLD RIVER BELOW UCONA RIVER continued**
Station Number: **08HC001**

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1984	163	103	94.2	72.9	90.5	70.4	47.4	16.8	40.5	157	105	63.7	85.4
1985	46	46.8	32.4	105	96.5	45	15.9	5.99	4.78	66.2	42.8	34.3	45.1
1986	184	116	147	55.8	124	60.6	30.4	7.82	6.13	20.7	156	150	88.2
1987	175	154	136	92.9	98.8	113	28.2	8.47	19.3	13.3	155	99.8	90.6
1988	82	114	87.9	120	128	91.3	48.2	18.3	17.9	53.7	166	87.8	84.3
1989	100	36.2	39	128	85.4	56.3	24.8	10.7	5.05	78.3	172	123	71.7
1990	104	73.3	70.1	86.8	53.1	52.8	17.5	6.53	5.3	179	333	127	92.2
1991	88.1	221	24.3	53.3	52.3	30.3	20.2	60.4	18.3	6.63	197	183	78.5
1992	248	152	47.2	47.1	42.1	22.1	9.58	6.59	17.7	128	125	50.7	74.5
1993	48.8	65.6	129	75.1	115	59.5	20.9	19.6	7.79	21.1	86.7	148	66.5
1994	116	73.3	144	97.3	50.1	51.9	18.7	8.68	15.5	72.1	80	160	74.1
1995	112	160	91.8	74.3	102	63.5	31.8	23.3	13.5	197	330	171	114
1996	176	88.2	55.2	171	56	40.5	17.8	9	19.3	107	92	60.7	74.2
MEAN	117.23	94.15	77.03	85.01	98.03	80.01	37.77	18.91	32.16	110.47	137.55	133.84	83.00
% MAD	141%	113 %	93%	102%	118%	96%	46%	23%	39%	133%	166%	161%	100%

Station Name: **GOLD RIVER BELOW UCONA RIVER**
Station Number: **08HC001**

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
16-Sep-56	8.35	16-Sep-56	8.35
01-Sep-57	12.50	06-Feb-57	9.59
25-Aug-58	5.26	25-Aug-58	5.26
23-Aug-59	10.70	23-Aug-59	10.70
12-Aug-60	14.50	12-Aug-60	14.50
26-Aug-61	7.50	26-Aug-61	7.50
12-Sep-62	8.54	12-Sep-62	8.54
09-Sep-63	8.41	09-Sep-63	8.41
26-Sep-65	5.16	26-Sep-65	5.16
05-Sep-66	13.30	05-Sep-66	13.30
28-Aug-67	8.75	28-Aug-67	8.75
07-Sep-68	9.36	07-Sep-68	9.36
10-Sep-69	14.10	10-Sep-69	14.10
31-Aug-70	6.18	31-Aug-70	6.18
25-Sep-71	17.60	28-Dec-71	16.40
14-Sep-72	7.47	14-Sep-72	7.47
17-Sep-73	5.20	17-Sep-73	5.20
27-Sep-74	11.50	27-Sep-74	11.50
26-Sep-75	9.89	29-Sep-75	9.55
27-Sep-76	16.70	02-Oct-76	13.90
20-Aug-77	9.21	20-Aug-77	9.21
08-Aug-78	8.55	08-Aug-78	8.55
13-Aug-79	7.54	13-Aug-79	7.54
23-Aug-80	6.65	23-Aug-80	6.65
22-Aug-81	3.76	22-Aug-81	3.76
03-Sep-82	9.47	03-Sep-82	9.47
24-Aug-83	8.05	13-Oct-83	6.23
25-Aug-84	12.50	25-Aug-84	12.50
27-Sep-85	3.57	02-Oct-85	3.42

Station Name: **GOLD RIVER BELOW UCONA RIVER continued**
Station Number: **08HC001**

7 Day Average Low Flow (m^3/sec)

Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
19-Sep-86	4.25	19-Sep-86	4.25
10-Sep-87	5.10	10-Sep-87	5.10
15-Sep-88	6.42	15-Sep-88	6.42
22-Sep-89	3.80	05-Oct-89	3.63
27-Sep-90	4.27	27-Sep-90	4.27
27-Sep-91	7.11	12-Oct-91	4.59
26-Aug-92	4.47	26-Aug-92	4.47
27-Sep-93	4.83	11-Oct-93	4.18
31-Aug-94	6.01	31-Aug-94	6.01
25-Sep-95	8.37	25-Sep-95	8.37
MEAN	**8.33**		**8.01**
% MAD	**10.04%**		**9.65%**

Station Name: **BEDWELL RIVER ABOVE URSUS CREEK**
Station Number: **08HC004**
Natural or Regulated: N
Drainage Area (sq.km.): 114
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	49	24	16
Longitude	125	44	51

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1990					18	19.8	7.27	3.77	1.77				
1991	12.1	38.3	4.39	11.4	16.5	11.5	8.5	21.8	3.37	1.74	34.9	28.9	15.9
1992	51.3	30.1	8.53	19	9.99	7.83	3.37	2.76	8.06	26.2	17.6	7.61	16
1993	10.1	10.4	19.9	17	27.1	14.7	5.68	6.86	1.53	6.97	17.7	23.3	13.5
1994	21.8												
1995										20.6	44.6	29.7	
1996	13.8	5.94	5.49	22	12.1	12.4	6.78	3.59	5.94	20.1	17.9	8.84	11.2
MEAN	21.82	21.19	9.58	17.35	16.74	13.25	6.32	7.76	4.13	15.12	26.54	19.67	14.15
% MAD	154 %	150%	68%	123%	118%	94%	45 %	55%	29%	107%	188%	139%	100%

Station Name: **BEDWELL RIVER ABOVE URSUS CREEK**
Station Number: **08HC004**

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
23-Sep-90	1.14	02-Oct-90	1.04
27-Sep-91	1.64	06-Oct-91	1.14
25-Aug-92	1.32	25-Aug-92	1.32
24-Sep-93	0.95	10-Oct-93	0.94
22-Sep-95	1.82	22-Sep-95	1.82
MEAN	**1.37**		**1.25**
% MAD	**9.71%**		**8.84%**

Station Name: **ZEBALLOS RIVER NEAR ZEBALLOS**
Station Number: **08HE006**
Natural or Regulated: N
Drainage Area (sq.km.): 181
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	50	0	52
Longitude	126	50	33

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1960	17.2	24.6	17.6	29.3	29	27.1	11.4	11.9	12.1	46.4	31.9	31.8	24.2
1961	63	51	25.5	24.3	15.1	15	9.78	7.01	12.2	22.8	20.8	31.3	24.7
1962	38.8	23.2	8.08	22.7	14.3	12.5	6.72	13.9	16.8	30.9			
1963	21.1	56.8	18.7	18.1	19.1	11.6	15.2	6.52	18.2	52.4	47.5	53.8	28
1964	26.7	27.6	17.9	20.2	20.1	24.8	29	16.3	16.8	33.2	30.3	24.6	23.9
1965	26.2	27.1	13.4	17	17.6	11.9	7.27	4.75	3.39		37.1	56.8	
1966	53.3	30.9	42.5				14.9	12.4	48.6	43.4	26.2	91.8	
1967	139	77.4	43.1	20.8	26.2	23.2	17.4	7.72	70.4	115	33	74.5	54
1968	109	41.6	32.6	27.2	19.6	19.4	19.9	9.62	51.8	244	140	68.6	65.5
1969		13.1	24.3	34.2	33.4	25.9	10.7	15.3	25.8	18.5	50.6	34.1	
1970	19.6	20	19.1	19.4	28.1	13.3	9.14	8.98	13.8	15.1	16.1	17.8	16.7
1971			16.5	19.2	25.5	28.2	17.1	20.6	30.2	43.5	66.4	12	
1972	11.2	24.9	46.4	28	31	30.3	21.4	8.1	13.4	7.75	25.2	42.6	24.2
1973	46.3	18.5	13.6	15.6	22.1	20.2	12.6	6.17	11.2	33.7	17.1	44.6	21.9
1974	40.7	27.3	28.1	24.3	26.7	29.9	23	11.1	10.8	14.4	32	43.1	25.9
1975	21.7	15.8	13.1	11.8	21.7	19.8	12	16.1	7.49	38.9	109	43	27.5
1976	34.2	16.9	18.8	18.1	35.7	29.6	27.5	16.4	17.3	22.5	28.9	64.9	27.7
1977	18	34	25.3	24.5	19.4	15	12	6.55	8.23	32.6	43.1	31.6	22.4
1978	18.3	21.2	26.8	11.2	13.3	11.8	6.08	10.3	27.2	22	35.3	19.4	18.5
1979	11.9	23.3	26.5	14	18.9	15.4	13.5	5.19	23.8	22	15.4	54	20.3
1980	19.1	26.8	17.8	23.2	17.8	12.1	11.7	5.89	22.7	12.3	48	71.6	24
1981	34.3	40.7	14	32.4	19.9	25.9	8.33	5.21	18.9	40.5	39.3	24.4	25.1
1982	24.7	32.5	13.2	11.9	19.3	21.1	12.8	8.33	15.3	38	26.8	29.8	21.1
1983	49.9	50.5	24.6	14	13.7	19.2	19.8	9.15	11.1	21.6	43.7	17.8	24.4
1984	40.8	31	23.6	22.2	24.6	17.2	16.2	9.88	23.3	38.9	31	19.2	24.8
1985	16.2	16.5	10.2	24.1	19.3	12.2	7.2	4.29	3.16	29.8	16	12.3	14.3
1986	56.5	33.2	36.4	18.6	32.6	16.7	14.2	4.66	4.35	8.94	39.2	37.8	25.2
1987	55.7	41	34.8	28.1	24.5	38.3	9.45	5.58	15.2	11.6	46.7	31.1	28.4

Station Name: **ZEBALLOS RIVER NEAR ZEBALLOS continued**
Station Number: **08HE006**

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1988	27.5	31.7	24	27.4	29.1	22.8	14.5	8.79	15.6	19.1	45.5	23.9	24.1
1989	33.4	10.3	14.3	26.6	17.6	15.4	11.7	5.95	4.23	22.8	45.8	36.4	20.4
1990	33.5	24	19.5	18.5	13.1	15	8.19	5.6	4.06	49.6	96.8	41.7	27.4
1991	28.4	64	9.06	13.1	13.8	8.62	6.96	21.3	6.59	4.83	55.4	53.8	23.5
1992	75.7	39.7	9.71	16.1	12.9	6.6	4.48	4.53	9.45	34.9	26.8	17	21.5
1993	15.3	16.6	36.3	22.2	25.1	16.4	8.5	10.1	4.42	9.68	26.4	38.1	19.1
1994	27.7	26.6	38.1	23.1	13.9	16.1	7.96	5.65	10.6	28	35.3	54.5	24
1995	29.4	39.5	21.1	15.8	13.7	12.4	7.97	10.2	4.96	54.1	83.2	44.6	28
1996	58.1	28	20.1	58.3	16.8	16.5	6.51	4.84	8.29	26.2	25.3	20.9	24.1
MEAN	38.35	31.33	22.83	22.10	21.24	18.82	12.78	9.32	16.80	36.39	42.70	39.31	25.78
% MAD	149 %	122%	89%	86%	82%	73%	50%	36%	65%	141%	166%	153%	100%

Station Name: **ZEBALLOS RIVER NEAR ZEBALLOS**
Station Number: **08HE006**

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
12-Aug-60	7.22	12-Aug-60	7.22
26-Aug-61	4.90	26-Aug-61	4.90
24-Sep-62	4.68	24-Sep-62	4.68
08-Sep-63	4.34	08-Sep-63	4.34
10-Sep-64	8.76	10-Sep-64	8.76
10-Sep-65	3.12		
22-Aug-66	9.50	22-Aug-66	9.50
16-Aug-67	5.48	16-Aug-67	5.48
05-Aug-68	6.13	05-Aug-68	6.13
08-Sep-69	5.39	08-Sep-69	5.39
30-Aug-70	4.79	30-Aug-70	4.79
27-Sep-71	8.43	27-Dec-71	7.31
14-Sep-72	4.73	14-Sep-72	4.73
14-Sep-73	4.89	14-Sep-73	4.89
27-Sep-74	6.36	27-Sep-74	6.36
24-Sep-75	5.95	29-Sep-75	5.90
27-Sep-76	9.59	20-Oct-76	7.77
15-Sep-77	4.33	15-Sep-77	4.33
07-Aug-78	4.09	07-Aug-78	4.09
28-Aug-79	4.32	28-Aug-79	4.32
22-Aug-80	4.94	22-Aug-80	4.94
21-Aug-81	3.80	21-Aug-81	3.80
02-Sep-82	5.62	02-Sep-82	5.62
24-Aug-83	6.03	13-Oct-83	6.01
25-Aug-84	8.11	25-Aug-84	8.11
27-Sep-85	2.73	06-Oct-85	2.58

Station Name: **ZEBALLOS RIVER NEAR ZEBALLOS continued**
Station Number: **08HE006**

Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
19-Sep-86	2.97	19-Oct-86	2.75
10-Sep-87	4.32	10-Sep-87	4.32
15-Sep-88	5.37	15-Sep-88	5.37
27-Sep-89	3.90	30-Sep-89	3.84
25-Sep-90	3.73	25-Sep-90	3.73
27-Sep-91	4.21	12-Oct-91	3.48
01-Aug-92	3.37	01-Aug-92	3.37
25-Sep-93	3.88	10-Oct-93	3.61
03-Sep-94	3.88	03-Sep-94	3.88
24-Sep-95	3.95	24-Sep-95	3.95
MEAN	**5.22**		**5.15**
% MAD	**20.24%**		**19.98%**

Station Name: **NAHMINT RIVER NEAR PORT ALBERNI**
Station Number: **08HB012**
Natural or Regulated: N
Drainage Area (sq.km.): 140
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	49	47	22
Longitude	124	59	24

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	MAD
1924								3.03	15.8	67	43.9	27.4	
1925	29.1	39.2	16	18.5	23.5	13.4	7.8	4.88	3.18	1.2	25.8	53	19.5
1926	15.6	47.5	15.3	13.9	19.1	10.1	4.78	5.79	1.93	45.3	31.1	44.1	21.1
1927	35.6	22.6	23.9	17.9	28.1	26.3	13.6	5.13	21.4	49.4	36.9	14.5	24.6
1928	48.2	24.3	29.1	15.2	28.9	12.1	4.2	1.53	5.97	25.6	35.6	29.6	21.7
1929	9.04	3.19	11.5	15.5	19.3	22.3	9.73	5.18	2.31		6.26	33.7	
1930	9.59	45.6	12.8	28.2	12.7	16.1	5.04	1.97	8.2	14.7	23.2	25.6	16.7
1931	54.8	18.1	26.5	16.1									
MEAN	28.8	28.6	19.3	17.9	21.9	16.7	7.53	3.93	8.40	33.9	29.0	32.6	20.7
% MAD	139 %	138%	93%	86%	106%	81%	36%	19%	41%	163%	140%	157%	100%

Station Name: **NAHMINT RIVER NEAR PORT ALBERNI**
Station Number: **08HB012**

7-Day Average Low Flow (m^3/sec)			
Date of	Period:	Date of	Period:
Occurrence	Apr 1 to Sep 30	Occurrence	Jan 1 to Dec 31
13-Aug-24	1.23	13-Aug-24	1.23
27-Sep-25	1.82	24-Oct-25	1.01
24-Sep-26	1.37	24-Sep-26	1.37
23-Aug-27	3.54	23-Aug-27	3.54
09-Sep-28	0.98	09-Sep-28	0.98
21-Sep-30	1.24	21-Sep-30	1.24
MEAN	**1.70**		**1.56**
% MAD	**8.19%**		**7.54%**

Station Name: **UCONA RIVER AT THE MOUTH**
Station Number: **08HC002**
Natural or Regulated: N
Drainage Area (sq.km.): 185
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	49	42	32
Longitude	126	5	52

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	MAD
1957				15.8	21.3	14.7	11.8	9.92	16.7	9.7	10.5	39.1	
1958	41.7	39.8	12.9	12.1	22.1	15.9	5.99	2.61	14.5	40.4	23	61.2	24.3
1959	25.3	9.25	16.1	23.4	23.8	26.3	18.6	4.49	12.7	13.1	19.8	31.7	18.8
1960	6.12	26	11.6	29.6	27.8	23.2	12.6	6.03	6.53	34.7			
1961	57	36.4	19.4	20.1	18.6	18.9	10.9	4.48	6.55	17	13.7	19.2	20.1
1962	26	17.7	5.24	19.7	14.9	14.6	7.99	8.7	6.37	25.1			
1963		48.6	16.7	11.4	15.7	15	14.7	5.44	5.4	45.4	33.4	38.4	
1964	20	15.9	11.7	14.3	19.4	32.5	24.9	11.5	6.58		16.9	13.8	
1965	12.5	16.9	9.31	11.4	13.8	11.7	6.42	4.18	1.86	48.3	24.1	28.7	15.8
1966	28.5	15.2	23.5	19.1	17.7	22.8	17	8.34	11.9	25.9	25.7		
1967		16.8	11.2	7.52	21.8	27.7	11.8	4.93	7.05	47.2	21.3	37	
1968	62.6	21.2	18	9.4	17.6	15.5	11.5	5.38	9.6	48.8	33.9	18.5	22.7
1969		10.4	14.2	23.1	34.1	30.8	12	7.8	17.4	14.5	31.6	22.5	
1970	11	12.6	10.4	15.6	17.9	17.2	7.98	4.61	6.63	11.8	13.1	10	11.5
1971			10.4	13.9	25.7	28	19.9	12.8	14.2	20.1	34.8	5.88	
1972	6.28	15	33.2	16.7	24.9	25.3	17.3	6.31	9.46	4.08	16	27.1	16.8
1973	26.5	11.2	10.6	10.5	23.8	20.6	14	5.4	2.85	21.5	13.6	34.1	16.3
1974	28.3					31.6	25.5	15.3	9.48	7.41	26.2	28.9	
1975	13.2	7.43	11.4	12.3	23.6	24.8	15.1	12.1	6.53	30.2	79	27.9	22
1976	21.5	12.2	11.9	12.8	26	24.8	22.6	13.5	10.3	12.5	19.5	31	18.3
1977	9.97	23.4	14.6	18	14.7	16.7	7.26	3.99	7.13	22.9	30.1	20.1	15.6
1978	13.2	16.6	22.1	9.36	14.5	18.8	9.63	10.6	20.5	15.1	20.1	12.3	15.2
1979	4.9	18.7	22.9	11.8	20.5	14.4	11.5	2.09	17.5	16.4	10.4	40.2	15.9
1980	12.4	23	13.3	17.7	17.3	15.6	11	3.33	8.08	8.13	33.1	51.2	17.8
1981	28.8	26.5	8.72	20.9	19.6	15.9	5.59	2.13	10.6				
1984									7.63	30.2	19.2	11.1	
1985	10.5	9.31	6.59	18.4	21.1	14.3	6.89						
1986	36.6	22.3	28.7	11.6	28.4	21.3	9.58	3.14	1.84	5.65	28.6	27.8	18.8

Station Name: **UCONA RIVER AT THE MOUTH continued**
Station Number: **08HC002**

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	MAD
1987	33	28	25.6	16.4	23	26.2	10.7	3.88	4.86	2.5	28.8	18	18.3
1988	16.1	19.1	16.4	22.6	27.5	22.5	15.5	6.76	4.18	9.71	31.1	17.6	17.4
1989	17.4	8.49	9.86	24.8	19.1	17	7.48	3.2	1.45	16.9	34.2	20.9	15.1
1990	19.6	13.2	13	16.7	13.5	17.2	5.83	1.38	1.17	29.8	64.8	24.8	18.4
1991	14.9	40	4.8	10.8	14.4	11.3	7.16	15.2	4.79	1.74	33.1	29.9	15.5
1992	44.3	27.9	10.2	14.3	10.8	9.33	4.23	2.63	3.63	25	23.7	11.2	15.6
1993	10.3	13.6	22.6	16.3	26.6	16.3	5.91	4.82	1.63	3.74	15.6	27.3	13.7
1994	23	14.7	28.3	18.2	13.5	16	6.88	2.88	4.02	13.1	21	36.7	16.6
1995	24	30.2	18.7	12.8	23.1	20	12	5.27	3.21	33.6	59	30.1	22.6
1996	27.7	19.4	14	31.4	13.9	13.1	7.2	2.47	5.25	20.8	19	12.6	15.5
MEAN	22.9	20.2	15.4	16.4	20.3	19.7	11.7	6.3	7.8	20.9	27.3	26.3	17.5
% MAD	131%	115%	88%	94%	116%	112%	67%	36%	45%	119%	156%	150%	100%

Station Name: **UCONA RIVER AT THE MOUTH**
Station Number: **08HC002**

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
01-Sep-57	3.48	09-Oct-57	2.68
26-Aug-58	1.70	26-Aug-58	1.70
23-Aug-59	3.28	23-Aug-59	3.28
14-Sep-60	3.49	20-Jan-60	3.15
23-Sep-61	2.16	23-Sep-61	2.16
12-Sep-62	2.25	12-Sep-62	2.25
08-Sep-63	2.87	08-Sep-63	2.87
11-Sep-64	3.93	11-Sep-64	3.93
26-Sep-65	1.15	26-Sep-65	1.15
05-Sep-66	4.12	05-Sep-66	4.12
26-Sep-67	2.13	26-Sep-67	2.13
07-Sep-68	2.82	07-Sep-68	2.82
09-Sep-69	4.46	30-Jan-69	3.39
30-Aug-70	2.27	30-Aug-70	2.27
25-Sep-71	5.07	25-Sep-71	5.07
14-Sep-72	2.74	21-Oct-72	2.24
17-Sep-73	1.63	17-Sep-73	1.63
27-Sep-74	4.63	01-Nov-74	2.90
27-Sep-75	3.20	29-Sep-75	3.03
27-Sep-76	5.81	20-Oct-76	3.61
14-Sep-77	3.35	04-Oct-77	3.33
08-Aug-78	3.37	08-Aug-78	3.37
13-Aug-79	1.48	13-Aug-79	1.48
23-Aug-80	2.70	23-Aug-80	2.70
21-Aug-81	1.67	21-Aug-81	1.67
19-Sep-86	1.09	21-Oct-86	0.76
10-Sep-87	2.12	24-Oct-87	0.85
15-Sep-88	2.21	15-Sep-88	2.21
22-Sep-89	1.04	05-Oct-89	1.00

Station Name: **UCONA RIVER AT THE MOUTH continued**
Station Number: **08HC002**

7-Day Average Low Flow (m^3/sec)

Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
23-Aug-90	0.73	23-Aug-90	0.73
27-Sep-91	1.88	12-Oct-91	1.08
02-Sep-92	1.28	02-Sep-92	1.28
27-Sep-93	1.07	11-Oct-93	0.82
30-Aug-94	1.86	10-Oct-94	1.58
26-Sep-95	2.08	26-Sep-95	2.08
MEAN	**2.60**		**2.32**
% MAD	**14.84%**		**13.24%**

Station Name: **BENSON RIVER NEAR PORT ALICE**
Station Number: **08HE003**
Natural or Regulated: N
Drainage Area (sq.km.): 228
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	50	24	4
Longitude	127	17	52

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	MAD
1925						12.6	6.18	2.71	2.72	3.56	32	46.4	
1926	16.9	42.9	18.6	9.99	21.1	8.54	9.78	5.62	2.15	22.2	17.3	46.8	18.4
1927	24.7	26.5	21.9	19.1	22.8	28.2	13.4	3.58	19.1	37.1	27.6	15.7	21.6
1928	40.1	18.7	27.8	13.6	29	9.22	4.45	3.26	3.31	30.2	40	41.8	21.9
1929	10.1	3.5	23.5	14.5	20.3	15.2	12	9.41	3.58	31.5	11.6	34.3	15.9
1930	7.41	52.2	16.9	26.4	11.6	23.1	4.31	1.98	10.4	15.8	30.2	62.2	21.6
1931	56.4	25.2	41.5	48.6									
MEAN	25.9	28.2	25.0	22.0	21.0	16.1	8.35	4.43	6.88	23.4	26.5	41.2	19.9
% MAD	130%	142%	126%	111%	105%	81 %	42%	22%	35%	118%	133%	207%	100%

Station Name: **BENSON RIVER NEAR PORT ALICE**
Station Number: **08HE003**

7-Day Average Low Flow (m^3/sec)			
Date of	Period:	Date of	Period:
Occurrence	Apr 1 to Sep 30	Occurrence	Jan 1 to Dec 31
21-Aug-25	1.71	19-Oct-25	1.29
24-Sep-26	1.73	24-Sep-26	1.73
23-Aug-27	2.65	23-Aug-27	2.65
09-Sep-28	0.87	09-Sep-28	0.87
27-Sep-29	2.12	29-Sep-29	1.93
12-Sep-30	1.38	12-Sep-30	1.38
MEAN	**1.74**		**1.64**
% MAD	**8.77%**		**8.26%**

APPENDIX D: Licenced Water Demand

by Purpose

LICENCE NUMBER	FILE NUMBER	PRIORITY DATE	SOURCE	QUANTITY		DEMAND (dam^3/yr) *
C017944	0167719	19470603	Eager Creek	500.00	gpd	0.41
C030034	0210312	19551213	Braine Brook	1000.00	gpd	0.83
C035822	0290109	19690804	Hurn Creek	500.00	gpd	0.41
C037420	0300188	19700903	Spruce Creek	500.00	gpd	0.41
C039750	0309545	19720105	Cass Creek	1000.00	gpd	0.83
C040265	0309575	19720118	Eager Creek	500.00	gpd	0.41
C045097	0328120	19741120	Brown Brook	500.00	gpd	0.41
C055404	0367408	19790830	Gorki Creek	500.00	gpd	0.41
C055449	0355249	19790830	Gorki Creek	500.00	gpd	0.41
C055521	0341371	19770603	Hurn Creek	500.00	gpd	0.41
C061474	1000409	19840913	Frajim Spring	750.00	gpd	0.62
C063942	1000506	19850912	Cass Creek	500.00	gpd	0.41
C063960	1000505	19850801	Chelli Brook	500.00	gpd	0.41
C063963	1000613	19860605	Cass Creek	500.00	gpd	0.41
C063964	1000601	19860516	MacKenzie Spring	500.00	gpd	0.41
C065733	1000603	19860516	Epps Creek	1000.00	gpd	0.83
C067365	0296028	19700210	Cass Creek	1000.00	gpd	0.83
C069015	0355315	19790912	Garland Creek	500.00	gpd	0.41
C110364	1000606	19860521	Sweetwater Creek	250.00	gpd	0.21
C110752	1000624	19860623	Ridgway Brook	250.00	gpd	0.21
C110753	1000307	19860623	Ridgway Brook	250.00	gpd	0.21
C110754	1000308	19860623	Ridgway Brook	250.00	gpd	0.21
C110755	1000309	19860623	Ridgway Brook	250.00	gpd	0.21
C110756	1000310	19860623	Ridgway Brook	250.00	gpd	0.21
C110757	1000311	19860623	Ridgway Brook	250.00	gpd	0.21
F005967	0067122	19260311	Marchant Creek	1000.00	gpd	0.83
			Total =	**14000.00**	**gpd**	**11.62**
C035396	0290242	19690828	Jones Creek	1000.00	gpd	1.66
C035397	0290244	19690828	Martin Creek	1000.00	gpd	1.66
			Total =	**2000.00**	**gpd**	**3.32**
C055259	0366721	19800610	China Creek	20000.00	gpd	33.19
			Total =	**20000.00**	**gpd**	**33.19**
C058920	0369231	19810908	Yacht Creek	1500.00	gpd	2.49
C072272	1000810	19880125	McAlpine Creek	250.00	gpd	0.41
C100783	1001155	19891109	Vernon Creek	8000.00	gpd	13.27
C107581	1000556	19860131	Nairne Spring	500.00	gpd	0.83
C107583	1000557	19860131	Nairne Creek	500.00	gpd	0.83
C109766	0364222	19780612	Homer Creek	1500.00	gpd	2.49
			Total =	**12250.00**	**gpd**	**20.33**

LICENCE NUMBER	FILE NUMBER	PRIORITY DATE	SOURCE	QUANTITY		DEMAND (dam^3/yr) *
Industrial - Fire Protection: 1 licence						
C061480	1000226	19830926	China Creek	5000.00	gpd	8.30
			Total =	**5000.00**	**gpd**	**8.30**
Industrial - Fish Hatchery: 1 licence						
C100779	1000826	19880229	Jensen Creek	0.002	cfs	1.79
			Total =	**0.002**	**cfs**	**1.79**
Industrial - Ponds:3 licences						
C047715	0328192	19741213	May Creek	2.00	cfs	1786.00
C056791	0364470	19780731	Hood Creek	0.40	cfs	357.20
C065783	1000569	19860311	Maggie Lake	18.00	cfs	16074.00
			Total =	**20.40**	**cfs**	**18217.20**
Industrial - Processing: 2 licences						
C049997	0340898	19770303	China Creek	24000.00	gpd	39.82
C059695	0368537	19810501	North McFarland Creek	50000.00	gpd	82.97
			Total =	**74000.00**	**gpd**	**122.79**
Industrial - Wharf: 1 licence						
C061480	1000226	19830926	China Creek	6000.00	gpd	9.96
			Total =	**6000.00**	**gpd**	**9.96**
Industrial - Work Camps: 3 licences						
C045288	0328647	19750415	Frederick Lake	10000.00	gpd	16.59
C045290	0328285	19750124	Snug Creek	1000.00	gpd	1.66
C070995	0290245	19690828	Coleman Creek	10000.00	gpd	16.59
			Total =	**21000.00**	**gpd**	**34.85**
Irrigation: 4 licences						
C030034	0210312	19551213	Braine Brook	0.50	acft	0.62
C059606	366328	19800409	Hyne Spring	1.25	acft	1.54
C059695	0368537	19810501	North McFarland Creek	60.00	acft	74.01
C100783	1001155	19891109	Vernon Creek	1.00	acft	1.23
			Total =	**62.75**	**acft**	**77.40**
Land Improvement: 1 licence						
C037967	0300748	19710209	North McFarland Creek	0.00	acft	0.00
			Total =	**0.00**	**acft**	**0.00**
Power - Commercial: 2 licences						
C056788	0365712	19790605	May Creek	1.50	cfs	1339.50
C100758	1000946	19880928	Epps Creek	0.61	cfs	544.73
			Total =	**2.110**	**cfs**	**1884.23**
Power - Residential: 4 licences						
C026851	0238052	19610823	Marchant Creek	0.42	cfs	375.06
C039751	0309545	19720105	Cass Creek	2.00	cfs	1786.00
C063961	1000600	19860516	Cass Creek	1.75	cfs	1562.75
C110363	0063199	19250810	Sweetwater Creek	1.00	cfs	893.00
			Total =	**5.170**	**cfs**	**4616.81**

LICENCE NUMBER	FILE NUMBER	PRIORITY DATE	SOURCE	QUANTITY		DEMAND (dam^3/yr) *
Storage: 5 licences						
C027217	0239010	19611025	McFarland Creek	840.00	acft	1036.12
C047716	0328192	19741213	May Creek	400.00	acft	493.39
C053008	0364274	19780620	Cousteau Creek	1.00	acft	1.23
C061373	1000243	19831228	Lizard Lake	523.00	acft	645.11
C070322	1000711	19870407	May Creek	800.00	acft	986.79
			Total =	**2564.00**	**acft**	**3162.65**
Waterworks* - Other: 3 licneces						
C070327	1000829	19880304	Tillotson Creek	5000.00	gpd	4.15
C100782	1001049	19890328	Mack Creek	11500.00	gpd	9.54
C109206	0368699	19810529	Haggard Lake	34500.00	gpd	28.62
			Total =	**51000.00**	**gpd**	**42.31**
Waterworks* - Local Authority: 5 licences						
C018903	0265120	19120724	China Creek	1965525000	gal/yr	4467.73
C027216	0239010	19611025	McFarland Creek	786210000	gal/yr	1787.09
C053007	0364274	19780620	Cousteau Creek	7482500	gal/yr	17.01
C055723	0365962	19790719	Sugsaw Lake	91250000	gal/yr	207.42
C055881	0367022	19800729	Cousteau Creek	1095000	gal/yr	2.49
			Total =	**2851562500**	**gal/yr**	**6481.73**

* Assumes that domestic and waterworks are the authorized maximum daily licenced amount divided by 2 , to estimate the average daily demand, then multiplied by 365 days, to determine the annual demand. All other licences represent total annual licenced volumes.

APPENDIX E: Low Flow Licenced Water Demand

by Drainage Area

DRAINAGE AREA	PURPOSE	LICENCED QUANTITY		LOW FLOW WATER DEMAND (litres/second)	(dam^3/yr) *
Sarita River	Industrial	10000.00	gpd	0.53	4.09
			Total Consumption =	**0.53**	**4.09**
China Creek	Waterworks	2751735000	gal/yr	396.41	3082.46
	Industrial	105000.00	gpd	5.52	42.96
	Storage	1363.00	acft	-216.21	-1681.24
	Irrigation	60.00	acft	9.52	74.01
	Land Improvement	0.00	acft	0.00	0.00
			Total Consumption =	**195.24**	**1518.19**
Salt Water	Irrigation	2.75	acft	0.44	3.39
	Industrial	8000.00	gpd	0.42	3.27
	Domestic	12250.00	gpd	0.64	5.01
	Waterworks	99827500	gal/yr	14.38	111.83
	Waterworks	51000.00	gpd	2.68	20.87
	Power	6.67	cfs	0.00	0.00
	Storage	1201.00	acft	-190.51	-1481.41
			Total Consumption =	**-171.94**	**-1337.04**
Other	Power	0.61	cfs	0.00	0.00
	Domestic	1750.00	gpd	0.09	0.72
	Industrial	0.002	cfs	0.06	0.44
			Total Consumption =	**0.15**	**1.16**

* Based on an estimated 90 day period demand assuming that: irrigation and industrial demands are totally withdrawn over the 90 day period; domestic and waterworks demand are the authourized licenced maximum daily for 90 days; storage balances demand, and therefore, is a negative demand over the 90 days; conservation and power are non-consumptive and, therefore, have no demand.

APPENDIX F: Pending Water Licence Application by Purpose

LICENCE NUMBER	FILE NUMBER	PRIORITY DATE	SOURCE	QUANTITY		DEMAND (dam^3/yr)*
Domestic*: 6 licences						
Z100760	1000488	19850603	Hyne Spring	500.00	gpd	0.41
Z104813	1001574	19920526	ZZ Creek (65875)	500.00	gpd	0.41
Z105763	1001634	19921030	Tillotson Creek	500.00	gpd	0.41
Z106475	1001665	19930312	ZZ Creek (67671)	300.00	gpd	0.25
Z107344	1001736	19931102	ZZ Creek (68449)	1000.00	gpd	0.83
Z108089	1001777	19940503	ZZ Creek (69264 & 69268) & ZZ Spring (69259)	500.00	gpd	0.41
			Total =	**3300.00**	**gpd**	**2.74**
Industrial - Brake Cooling: 2 licences						
Z107485	1001741	19931216	ZZ Creek (68623)	2000.00	gpd	3.32
Z111537	1001958	19960918	ZZ Creek (72659)	1000.00	gpd	1.66
			Total =	**3000.00**	**gpd**	**4.98**
Industrial - Eneterprise: 1 licence						
Z107832	1001761	19940310	ZZ Stream (69004)	600.00	gpd	1.00
			Total =	**600.00**	**gpd**	**1.00**
Industrial - Ponds: 1 licence						
Z108089	1001777	19940503	ZZ Creek (69264 & 69268) & ZZ Spring (69259)	0.25	any	**
			Total =	**0.25**	**any**	**
Irrigation: 2 licences						
Z100760	1000488	19850603	Hyne Spring	5.00	acft	6.17
Z108089	1001777	19940503	ZZ Creek (69264 & 69268) & ZZ Spring (69259)	9.00	acft	11.10
			Total =	**14.00**	**acft**	**17.27**
Power - Commercial: 1 licence						
Z106475	1001665	19930312	ZZ Creek (67671)	1.00	kW	**
			Total =	**1.00**	**kW**	**
Power - General: 1 licence						
Z100784	1000614	19860605	ZZ Pond (14981)	1.00	kW	**
			Total =	**1.00**	**kW**	**

* Assumes that domestic is the authorized maximum daily licenced amount divided by 2, to estimate the average daily demand, then multiplied by 365 days, to determine the annual demand. All other licences represent total annual licenced volumes.

**Demand will be clarified subject to licencing approval.

APPENDIX G: Fish Screening Requiremen

FISH SCREENING DIRECTIVE

Government of Canada
Department of Fisheries and Oceans

WATER INTAKE FISH PROTECTION FACILITIES

The Department of Fisheries and Oceans has prepared this document as a guide to assist in the design and installation of water intakes and fish screening in British Columbia and the Yukon Territory to avoid conflicts with anadromous fish. Additional precautions must be taken at marine intake locations where entrainment of fish larvae, such as eulachon and herring larvae, is a possibility. The screening criteria constitutes the Department's policy regarding the design and construction requirements pursuant to Section 28 of the Fisheries Act.

PROVISIONS OF THE FISHERIES ACT - SECTION 28

Every water intake, ditch, channel or canal in Canada constructed or adapted for conducting water from any Canadian fisheries waters for irrigating, manufacturing, power generation, domestic or other purposes, shall, if the Minister deems it neccessary in the public interest, be provided at its entrance or intake with a fish guard or a screen, covering or netting, so fixed as to prevent the passage of fish from any Canadian fisheries waters into such water intake, ditch, channel or canal.

The fish guard, screen, covering or netting shall have meshes or holes of such dimensions as the Minister may prescribe, and shall be built and maintained by the owner or occupier of the water intake, ditch, channel or canal subject to the approval of the Minister or such officer as the Minister may appoint to examine it.

The owner or occupier of the water intake, ditch, channel or canal shall maintain the fish guard, screen, covering or netting in a good and efficient state of repair and shall not permit its removal except for renewal or repair, and during the time such renewal or repair is being effected, the sluice or gate at the intake or entrance of the water intake, ditch, channel or canal shall be closed in order to prevent the passage of fish into the water intake, ditch, channel or canal.

PROCEDURES FOR INSPECTION AND APPROVAL OF INTAKE STRUCTURES

Diversions less than 0.0283 cms (one cubic foot per second): The intake structure shall be constructed in accordance with specifications indicated herein. Upon completion of construction and prior to operation the owner shall contact a local representative of the Department of Fisheries and Oceans to arrange for on-site inspection and approval of the installation. Permanently submerged screens must be inspected prior to installation.

Diversons greater than 0.0283 cms (one cubic foot per second): The owner shall submit to the Department of Fisheries and Oceans 2 sets of detailed plans of the proposed installation for review and approval prior to fabrication. Design drawings are required whenever the diversion quantity exceeds 0.0283 cms (1.0 cfs) or 817,200 L/day (180,000 Igpd) for industrial diversions (calculated on the basis of 8 hours/day) or 123,350 cmy (100 ac.- ft./year) for irrigation diversions (calculated on the basis of 100 days/year and 12 hours/day). The plans shall contain the following information:

1. Intake structure location and dimensions.
2. Maximum discharge capacity of diversion.
3. Screen dimensions.
4. Mesh size.
5. Screen material.
6. Fabrication details.
7. Minimum and maximum water levels at the intake site.
8. Provision for bypassing fish.

The intake structure shall then be constructed in accordance with the approved plans. Upon completion of construction and prior to operation, the owner shall contact the local representative of the Department of Fisheries and Oceans to arrange for on-site inspection and approval of the installation. Permanently submerged screens must be inspected prior to installation.

SPECIFICATIONS FOR INTAKE STRUCTURES WITHOUT PROVISION FOR AUTOMATIC CLEANING

1. Screen Material: The screen material shall be either stainless steel, galvanized steel, aluminum, brass, bronze, or monel metal. Stainless steel is preferred since corrosion is greatly reduced.

2. Screen Mesh Size: Clear openings of the screen (the space between strands) shall not exceed 2.54 mm (0.10 inch). The open screen area shall not be less than 50% of the total screen area. The following square-mesh wire cloth screens are recommended:

   - 7 mesh, 1.025 mm (0.041 inch) wire, 51% open, 2.54 mm (0.10 inch) openings; or
   - 8 mesh, 0.875 mm (0.035 inch) wire, 52% open, 2.25 mm (0.09 inch) openings; or
   - 8 mesh, 0.700 mm (0.028 inch) wire, 60% open, 2.54 mm (0.10 inch) openings.

3. Screen Area: A minimum unobstructed screen area (gross area) of 0.93 square metre (10 square feet) shall be provided for each 0.0283 cms (1cfs) of water entering the intake. The required screen area shall be installed below minimum water level. Screen area lost by framing shall not be included as part of the unobstructed screen area.

4. Screen Support: The screen shall be adequately supported with stiffeners or back-up material to prevent excessive sagging.

5. Screen Protection: The intake structure shall, where necessary, be equipped with a trash rack or similar device to prevent damage to the screen from floating debris, ice, etc.

6. Screen Accessibility: The screen shall be readily accessible for cleaning and inspection. Screen panels or screen assemblies must be removable for cleaning, inspection and repairs.

7. Allowable Openings: The portion of the intake structure which is submerged at maximum water level shall be designed and assembled such that no openings exceed 2.54 mm (0.10 inch) in width.

8. Design and Location: The design and location of the intake structure shall be such that a uniform flow distribution is maintained through the total screen area.

9. Fish Bypass: The intake shall be designed to provide a transverse velocity (the component of the velocity parallel and adjacent to the screen face) to lead fish to a bypass or past the screens before they become fatiqued. In no case should the transverse velocity be less than double the velocity through the screen.

SPECIFICATIONS FOR INTAKE STRUCTURES WITH PROVISIONS FOR AUTOMATIC CLEANING

The specifications are identical to those for intake structures without provisions for automatic cleaning except that the minimum unobstructed screen area (gross area) of 0.23 square metre (2.5 square feet) need only be provided for each 0.0283 cms (1 cfs) of water entering the intake. However, a regular cleaning and maintenance schedule is required to ensure seals and screen panels remain in good repair preventing impingement and entrainment of fish and debris.

For these self-cleaning intake structures, the location, design and juvenile fish avoidance system all affect operating characteristics. The final design, therefore, may incorporate modifications reflecting the best current technology available for minimizing adverse impact upon the fisheries resource.

ALTERNATE FISH PROTECTION FACILITIES

Enquiries concerning the Department's requirements for indirect intakes, such as infiltration galleries and wells, for salt water ocean intakes, and for new methods or devices for screening intake structures should be directed to the Department of Fisheries and Oceans, Senior Habitat Management Biologist.

Conversion Factors:

1 cubic foot per second (cfs) = 449 U.S. gallons per minute (U.S. gpm).
= 374 Imperial gallons per minute (Igpm).
= 1.98 acre feet per day (Ac.-Ft./day).
= 28.3 litres per second (L/sec.).
= 0.0283 cubic metres per second (cms)

0.10 inch = 3/32" (approx.) = 2.54 millimetres

Addresses for Correspondence and Approvals

1. Senior Habitat Management Biologist
   Fraser River, Northern B.C. and Yukon Division
   Department of Fisheries and Oceans
   Room 330, 80 - 6th Street
   New Westminster, B.C. V3L 5B3 Phone: 666-6479

2. Senior Habitat Management Biologist
   South Coast Division
   Department of Fisheries and Oceans
   3225 Stephenson Point Road
   Nanaimo, B.C. V9T 1K3 Phone: 756-7270

3. Senior Habitat Management Biologist
   North Coast Division
   Department of Fisheries and Oceans
   Room 109, 417 - 2nd Avenue West
   Prince Rupert, B.C. V6J 1G8 Phone: 624-9385

Other Federal and Provincial agencies having jurisdiction in water withdrawals and construction pertaining to watercourses in British Columbia include:

1. Transport Canada
   Canadian Coast Guard.

2. B.C. Ministry of Environment
   Fish and Wildlife Management.

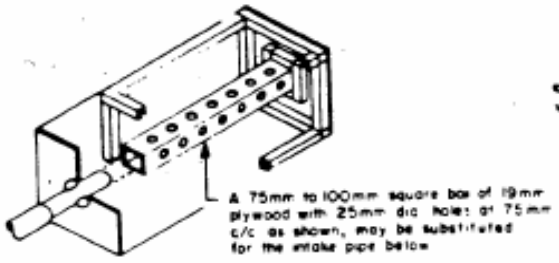
3. B.C. Ministry of Environment
   Water Management.

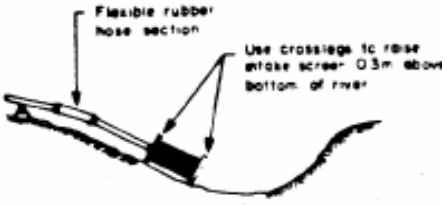
4. B.C. Ministry of Agriculture and Food.

5. B.C. Ministry of Lands, Parks and Housing.

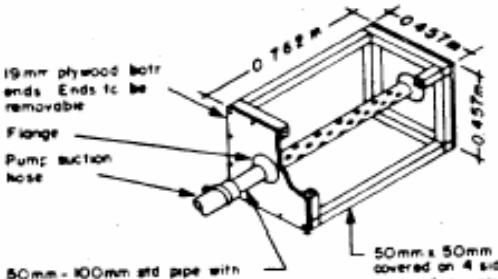
It may be necessary that several or all these agencies also be solicited for approvals prior to the installation of a water intake.

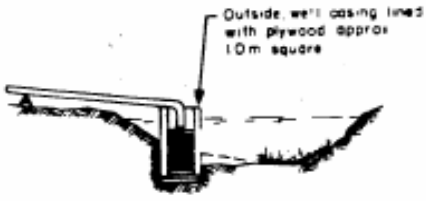
Revised January, 1986



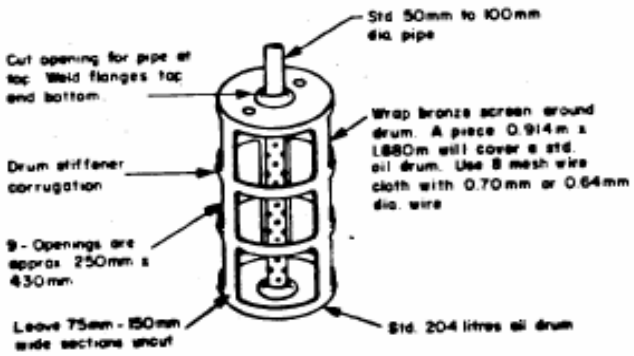


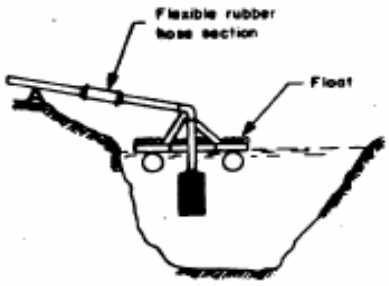
STANDARD INSTALLATION





INSTALLATION IN SHALLOW WATER MUDDY OVERGROWN BOTTOM





INSTALLATION IN DEEP WATER

NOTE

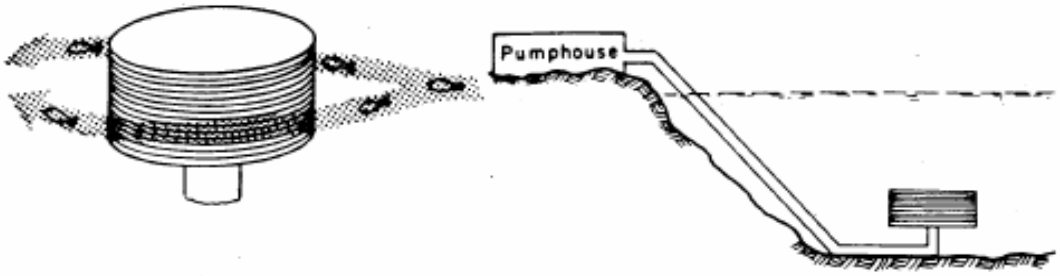
1. Oil drum shall be thoroughly washed out or steam cleaned before cutting openings
2. All loose rust shall be removed and the drum coated with metal primer. Two coats of machinery enamel or epoxy paint shall be applied before covering with wire cloth.

NOTE

All screens shall be installed below minimum water level, shall be easily accessible for cleaning, and shall be cleared of debris at regular intervals

SMALL STATIONARY WATER INTAKE SCREENS

(For pumps of a capacity less than 28.3 L/sec [1 cfs, 449 U.S. or 374 Igpm])



DEEP WATER WELL SCREEN

May be installed in lakes and the ocean.

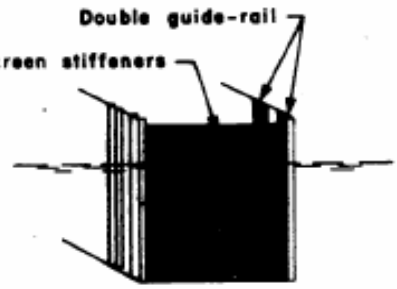
SHALLOW WATER WELL SCREEN

May be installed in lakes, pools, and stable areas in rivers.

Totally submerged cylindrical shaped stainless steel well screens provide for high intake capacity and large percentage of open area permitting water to enter at low velocities. Slot opening shall not exceed 2.54 mm (0.10 inch).

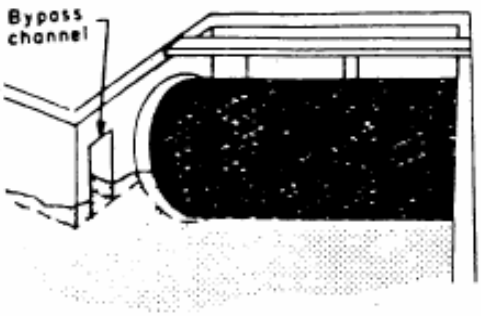
VERTICAL PANEL SCREENS

May be installed in rivers, lakes and the ocean. Generally, requires coarse trashracks, a sluice gate in river installations, double sets of guide-rails, and standby screen panels to allow for cleaning and repairs.



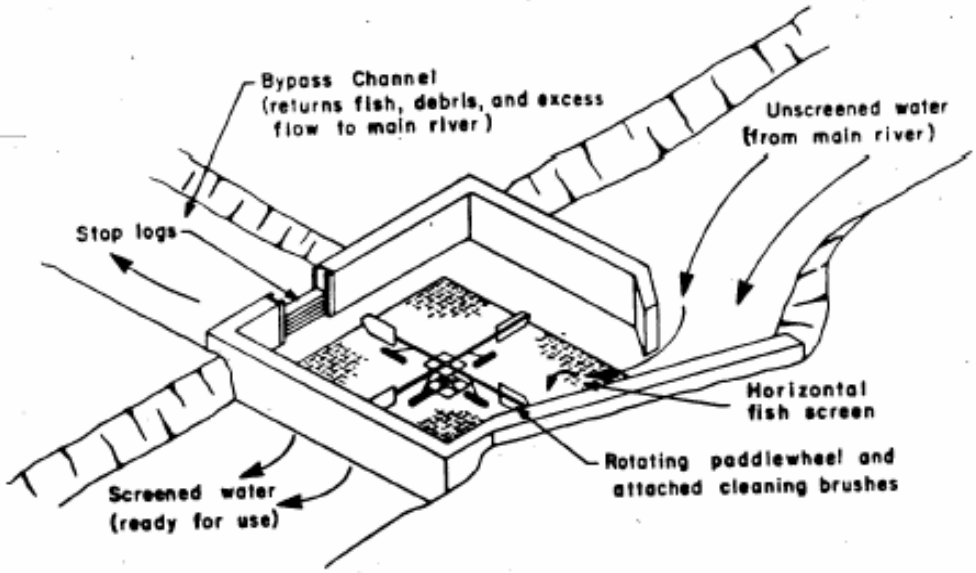
LARGE STATIONARY WATER INTAKE SCREENS

(For pumps of a capacity more than 28.3 L/sec [1 cfs, 449 U.S. or 374 Igpm])



REVOLVING DRUM SCREEN, HORIZONTAL AXIS

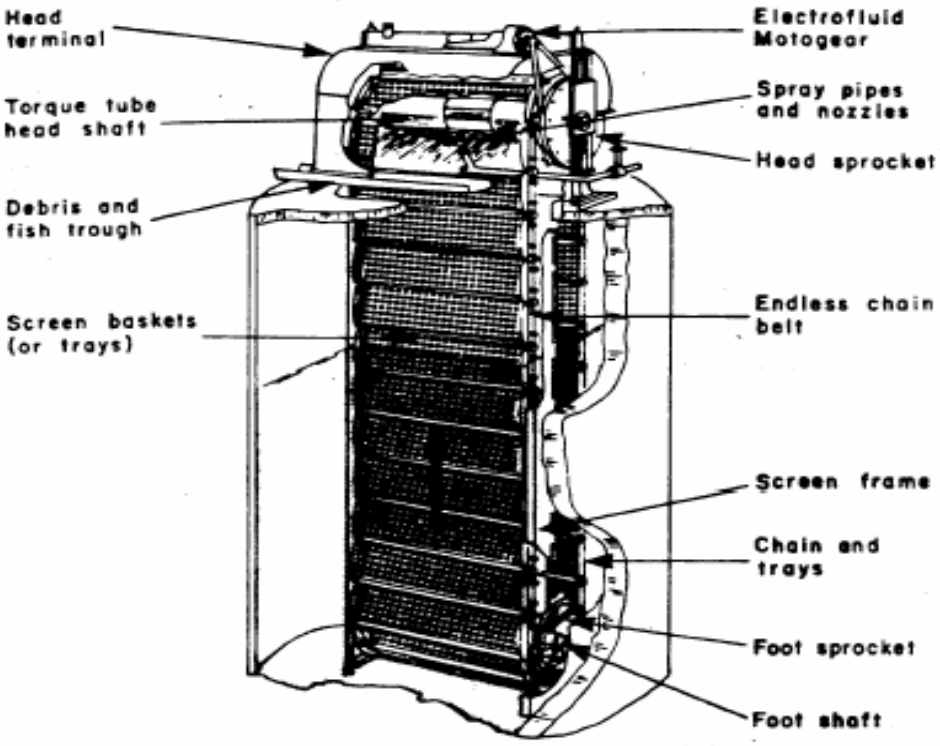
Generally, installed to divert fish from irrigation canals. Can be driven by a small motor or by a paddle wheel. To avoid juvenile fish impingement, a bypass channel is required near the front of the screen. Rubber seals are necessary along the base and sides.



FINNIGAN SCREEN

The horizontal, self-cleaning Finnigan Screen is another concept, generally installed to divert fish from irrigation or enhancement projects. The stationary horizontal screen is kept clean by a set of brushes attached to a revolving paddle wheel powered by the water current entering the structure. A portion of the flow, the suspended debris, and fish are directed to the bypass channel. The remainder of the flow passes through and below the screen for use as required.

IRRIGATION INTAKE SCREENS



CONVENTIONAL VERTICAL TRAVELLING SCREEN

May be installed in rivers, lakes and the ocean. A common screening method utilized by industry, these self-cleaning mechanical screens with modifications can prevent impact upon fish. Mounted flush to the stream bank (shoreline) or as pier intakes within streams and provided with an opening on the downstream end between the intake screens and trashracks, juvenile fish can generally escape entrapment. Rubber panel, side, and boot seals are required to prevent juvenile fish from gaining entry into the pumpwell. A safe bypass system is essential to return juvenile fish with debris back to the watercourse. Automatic controls are also necessary to ensure operation at a specific minimum head differential.

LARGE INDUSTRIAL AND DOMESTIC WATER INTAKE SCREEN