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

OUTER GULF ISLANDS

WATER ALLOCATION PLAN

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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 is 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 licensable water demands and providing direction regarding further water licence allocations.

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

2.0 GENERAL WATERSHED INFORMATION

2.1 Geography and Morphology

The Outer Gulf Islands Water Allocation Plan includes Galiano Island, Mayne Island, Saturna Island, North and South Pender Islands, Moresby Island, Portland Island and the surrounding minor islands. The plan area is illustrated in Figure 1.

Located off the east cost of Vancouver Island, the plan area lies mid-way between Victoria and Vancouver. The total land area is approximately 164 km^2. The following table displays the areas of the individual islands and their percentage of the entire plan area.

Outer Gulf Islands Water Allocation Plan Land Area		
Islands	**Area (km^2)**	**% Area**
Galiano	57.9	35.3
Mayne	23.3	14.2
Saturna	30.4	18.5
North Pender	27.3	16.7
South Pender	9.3	5.7
Moresby	6.1	3.7
Portland	2.2	1.3
Other Islands	7.4	4.5
TOTAL AREA	**164**	**100.0**

Galiano Island, with a total land area of 57.9 km^2, is the largest island within the plan area. It is approximately 25 km long and 2 km wide. Polier Pass to the north separates Galiano Island from Valdes Island and Active Pass in the south separates it from Mayne Island. Trincomali Channel to the west and Strait of Georgia to the east separate this island from Saltspring Island and Vancouver on the mainland. Mount Galiano is the highest peak on Galiano Island at 311 metres above sea level. There are few natural bodies of water on Galiano Island. Most ponds on the island are man-made. All of the streams on the island are seasonal, with no year-round flow.

Mayne Island has a total area of 23.3 km^2. It is approximately 10 km long and 3.5 km wide. Mount Parke is the highest peak on the island at 280 metres above sea level. All of the streams on Mayne Island are seasonal; as well there are two small lakes on the island.

Saturna Island has a total area of 30.4 km^2. Saturna Island is approximately 12.5 km long and 4.5 km wide. Mount Warburton Pike is the highest peak on Saturna Island at an elevation of 400 metres above sea level. There are three small lakes on Saturna Island, Money Lake #1, Money Lake #2 and Lyall Lake, drained by small seasonal streams.

North and South Pender Islands were originally one island. These islands were joined together by a narrow isthmus until the year 1903 when a canal was dug to allow for boat passage between

the islands. North Pender Island is the larger of the two islands with a total area of 27.3 km^2. North Pender Island is approximately 10 km long and 4 km wide. There are three lakes and numerous ponds on North Pender Island. Mount Menzies is the highest peak on the island at an elevation of 160 metres above sea level.

South Pender Island has a total area of 9.3 km^2. South Pender Island is approximately 5 km long and 2 km wide. Greenburn Lake is the only lake on the island. Mount Norman is the highest peak at 220 metres above sea level.

Ferry service links Victoria (Swatrz Bay) and Vancouver (Tsawwassen) to Galiano, Mayne, Saturna and Pender Islands, providing passenger and vehicle service.

2.2 Climate

The Outer Gulf Islands Water Allocation Plan area has a temperate climate characterized by warm, relatively dry summers and mild wet winters. The average mean annual daily temperatures is 10^oC (see Appendix A). The islands within the plan area experience a moisture deficit in the summer due to low precipitation and high evaporation.

2.3 Geology and Groundwater

The Outer Gulf Islands are located within the southern portion of the large depression area of the Strait of Georgia in the Nanaimo Basin. This geological feature is characterized by sedimentary formations, which were deposited during the late Cretaceous Period. The Fraser Glaciation of the late Pleistocene Period influenced the formation of these islands by depositing various unconsolidated materials as the ice melted. This resulted in a thin layer of compact till which has a low potential for ground water development and use (Mordaunt, 1983).

2.4 History and Development

Galiano Island was used by the Penelakut Band of the Cowichan First Nation during the summer for hunting and gathering. Shell middens have been found along the shores of the island (Galiano Island Official Community Plan, 1995). European settlement of Galiano Island began in the late 19th century. Settlers grew fruits and vegetables, raised sheep for wool and hunted deer and fish. Contemporary activities are strongly influenced by the growing tourism industry (Sweet, 1988). The 1991 census indicated that there were 952 people on Galiano Island.

Native artifacts found on Saturna Island indicate that Salish Indians once used the island's beaches and forests as campgrounds. The first European settlers arrived to Saturna Island in 1869. Land near Winter Cove and Lyall Harbour was purchased in 1959 to mine the shale rock (Sweet, 1988). The 1991 census reported 271 residents on Saturna Island.

Mayne Island was settled by native people 6,000 years ago. Europeans began settling on Mayne Island in the 1850's. Gold mining began at Miner's Bay on the island in 1858 (Sweet, 1988). The 1991 census reported 743 residents on Mayne Island.

The Coast Salish Natives used the narrow isthmus that once joined North and South Pender Island as a summer camp. The first Europeans to visit North and South Pender Islands were Spanish naval explorers who visited the area between 1592 and 1792. In the 1840's the British settlers began farming on North and South Pender Islands (North Pender Island Official Community Plan, 1993). North Pender Island has the highest population density of the islands within the plan area with population of 1,509 in 1991. South Pender Island has the smallest population of these islands with 137 people in the 1991 census.

The following table indicates the population for the major islands within the plan area.

Island	Population Growth		
	1986 Census	1991 Census	1996 Estimate*
Galiano	775	952	1,061
Mayne	628	743	812
Saturna	252	271	282
North Pender	1,119	1,509	1,772
South Pender	104	137	159

* Based on 1/2 of 1986-1991 real growth
Sources: Statistic Canada, 1991 Census, Islands Trust

2.5 Significant Drainage Areas

For the purpose of assessing water supplies for allocation demands the significant drainage areas in the following table were identified and are illustrated in Figures 2, 3, 4 and 5.

Significant Drainage Areas	
Drainage	**Area (km^2)**
Galiano Island	
Murcheson Creek	5.95
Jack Creek	3.02
Putter Brook	2.84
Greig Creek	1.51
Georgeson Creek	1.33
Mayne Island	
Hunt Brook	2.60
Village Bay Creek	1.69
Deacon Creek	1.65
Saturna Island	
Lyall Creek	6.28
Money Creek	1.49
Unnamed Creek from Money Lake No. 2	1.03
North Pender Island	
Standen Creek	1.83
Shingle Creek	0.94
Unnamed Creek from Pender Lake	0.91
Bryant Creek	0.89
Unnamed Creek from Roe Lake	0.61
South Pender Island	
Greenburn Creek	0.80

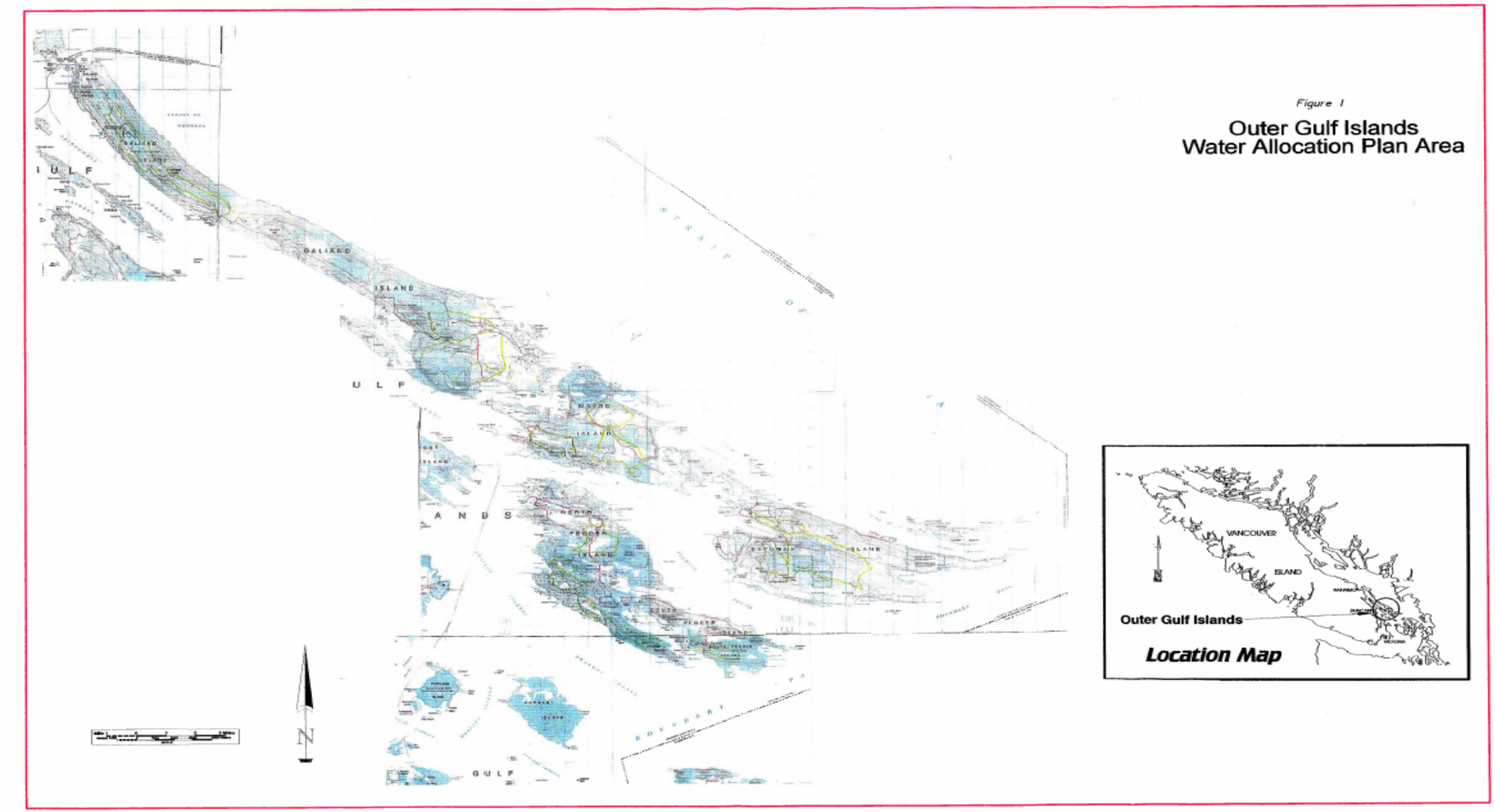


Figure 1
Outer Gulf Islands
Water Allocation Plan Area
GALIANO
ISLAND
MAYNE
ISLAND
PENDER
ISLANDS
SATURNA
ISLAND
GULF
VANCOUVER
ISLAND
Outer Gulf Islands
Location Map

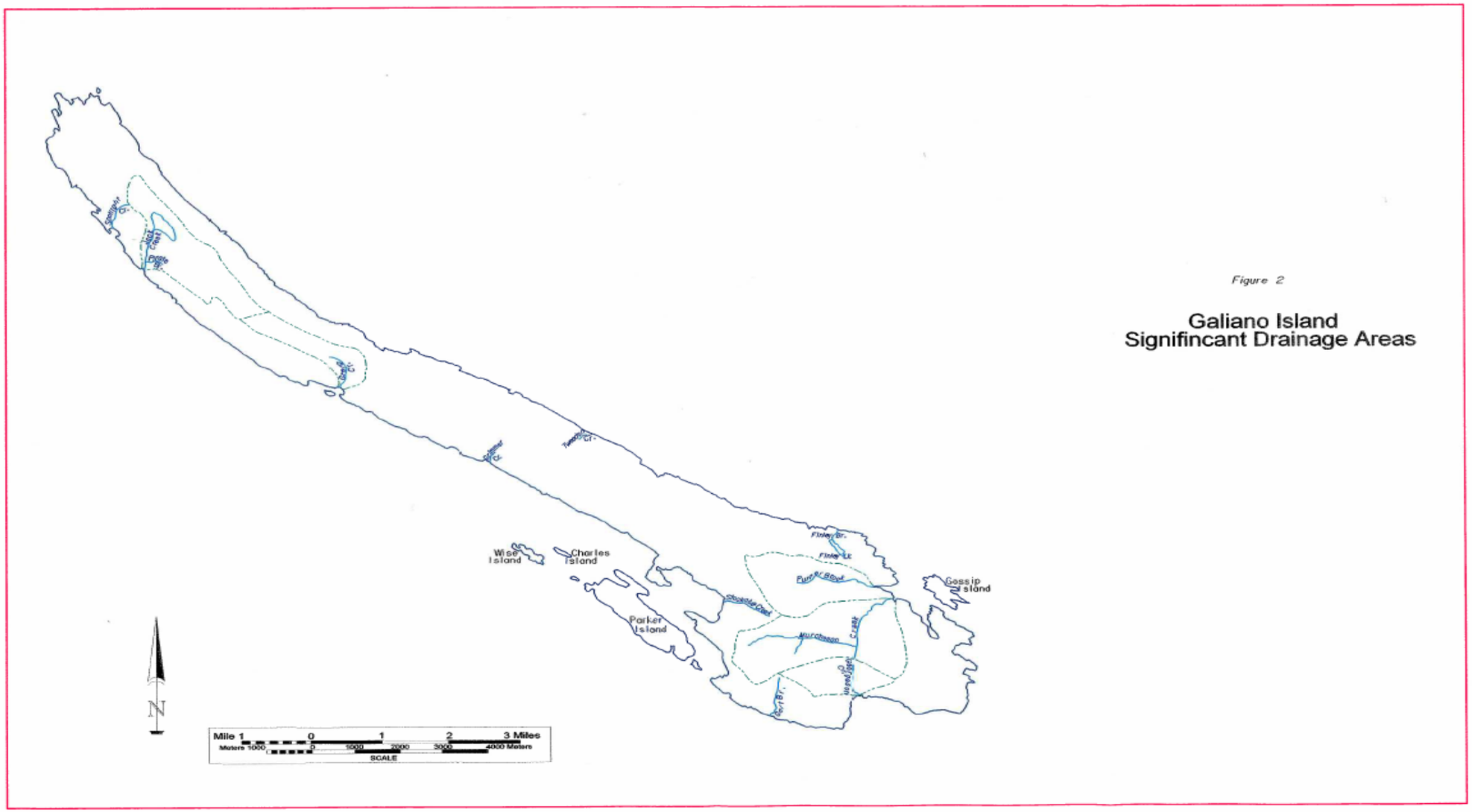


Figure 2

Galiano Island
Signifincant Drainage Areas

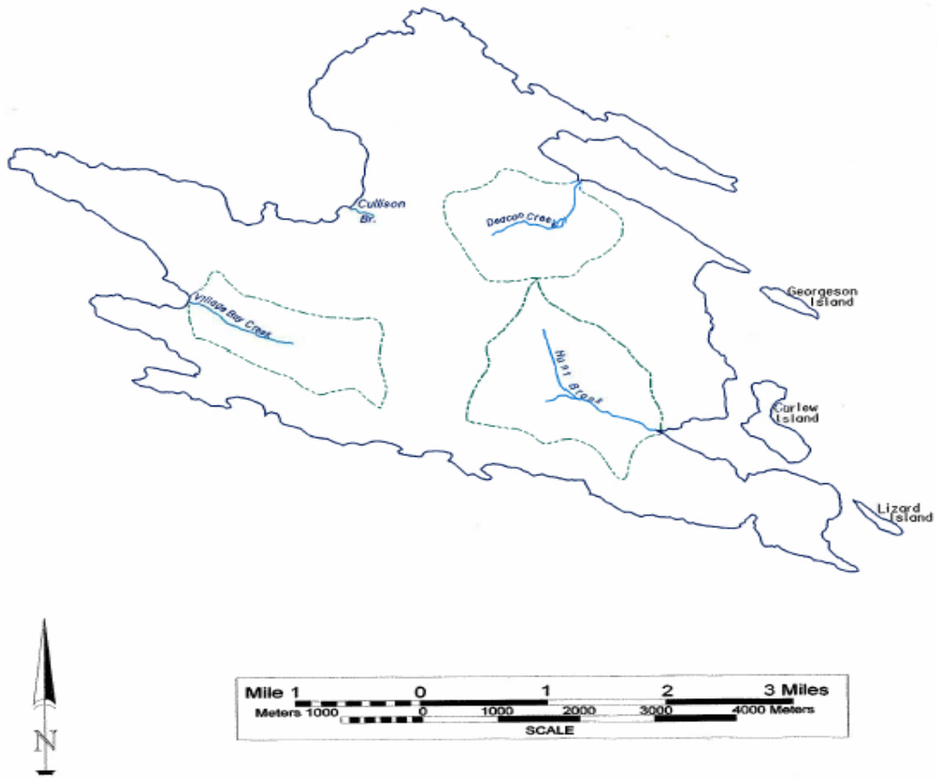


Figure 3

Mayne Island
Signifincant Drainage Areas

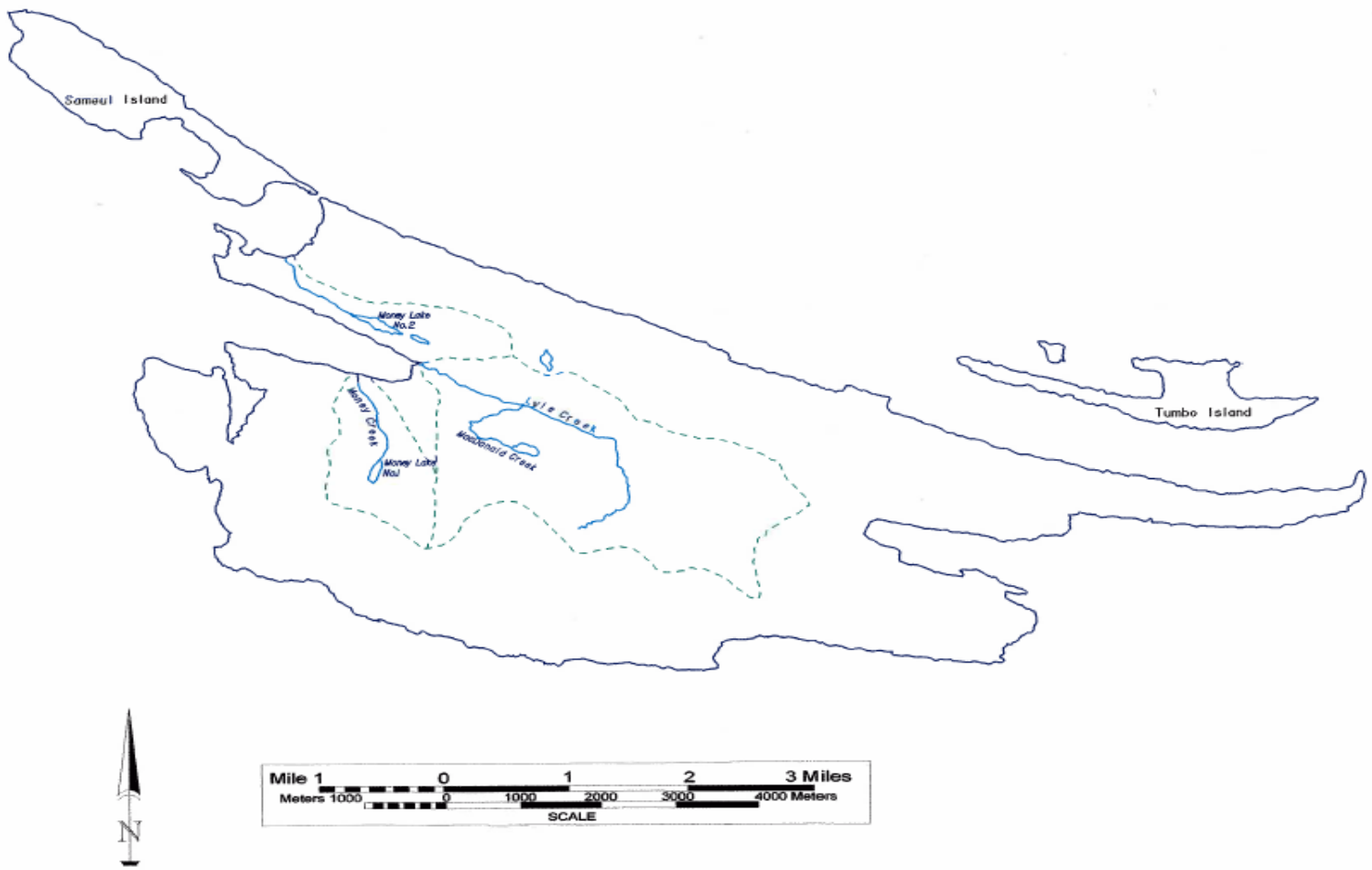


Figure 4

Saturna Island
Significant Drainage Areas

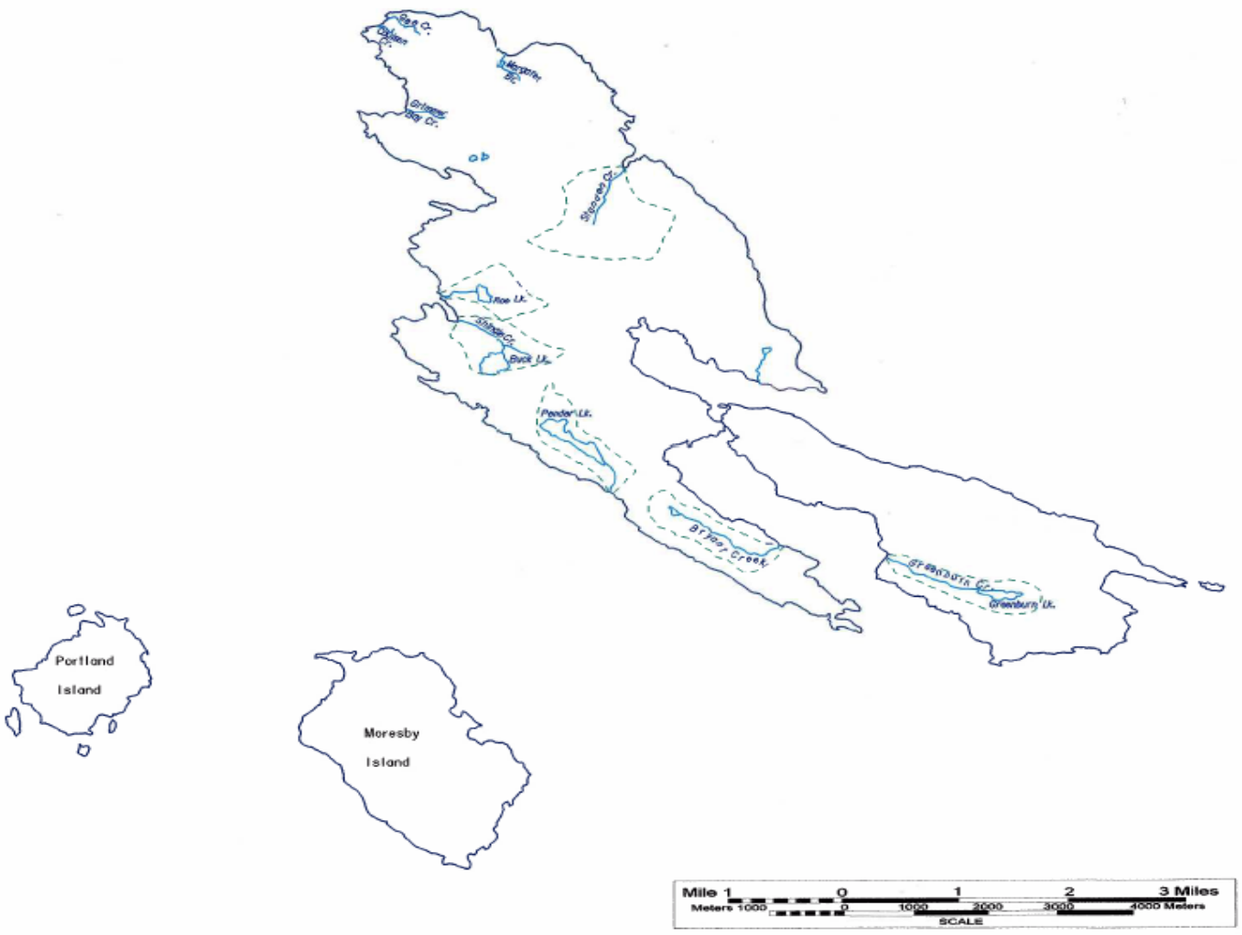


Figure 5

North and South
Pender Islands
Signifincant Drainage Areas

3.0 HYDROLOGY

3.1 Precipitation

There are two Atmospheric Environment Service (AES) stations located within the Outer Gulf Islands Water Allocation Plan area with climate normals for 1951-1980; namely Mayne Island (45°50' N, 123°16' W) and Pender Island (48°49' N, 123°17' W).

The mean total annual precipitation for Mayne Island is 787.4 mm (31.0 inches). The minimum mean monthly precipitation is 23.0 mm (0.9 inch) in July. The maximum mean monthly precipitation is 131.6 mm (5.2 inches) in December. The mean number of days of the year with measurable precipitation is 143; with 139 mean days of rain and 7 mean days of snow. The monthly precipitation normals are illustrated in the following graph (Figure 6).

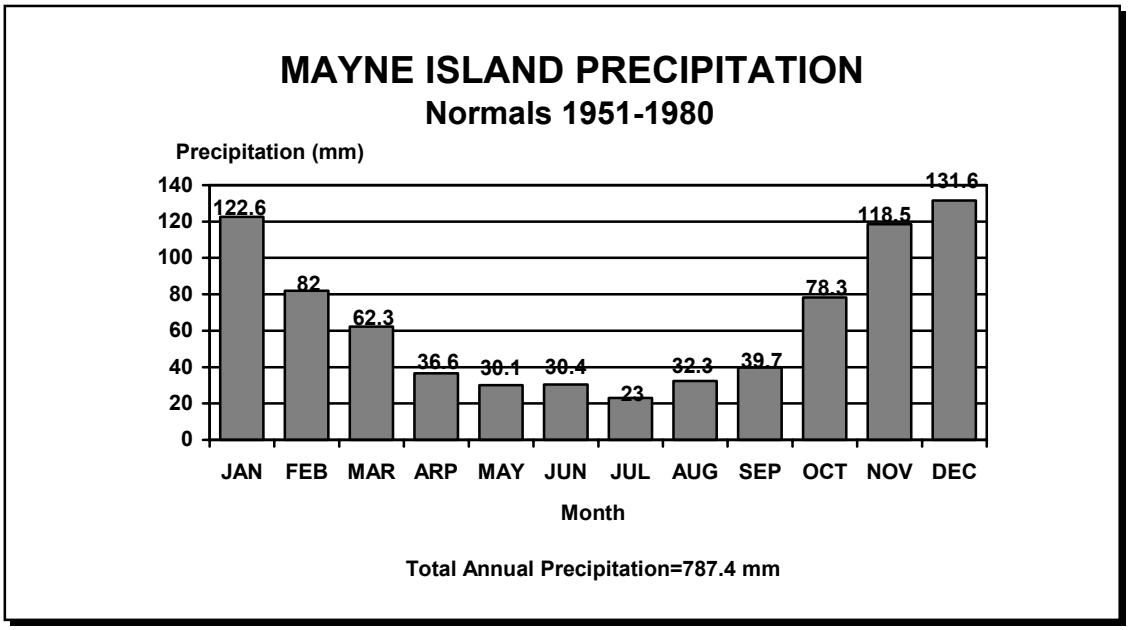


Figure 6

The mean annual total precipitation for Pender Island is 790.7 mm (31.1 inches). The minimum mean monthly precipitation is 16.6 mm (0.7 inch) in July. The maximum mean monthly precipitation is 143.2 mm (5.6 inches) in December. The mean number of days of the year with measurable precipitation is 119; with 115 mean days of rain and 4 mean days of snow. The monthly precipitation normals are illustrated in the following graph (Figure 7).

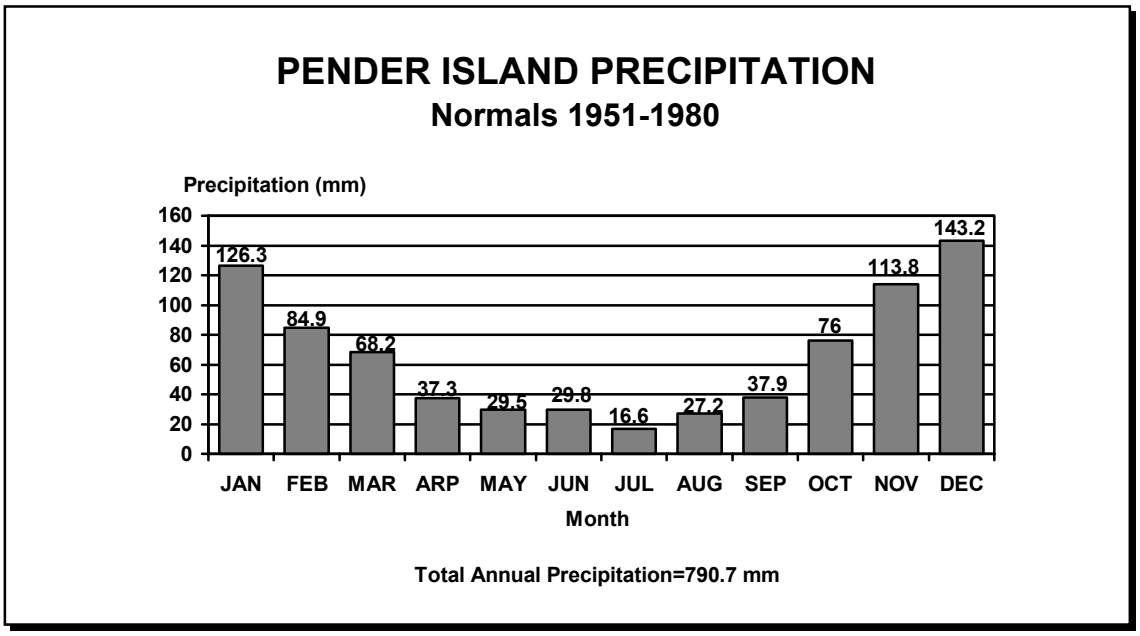


Figure 7

The locations of the Atmospheric Environment Service (AES) stations are illustrated in Figure 8.

3.2 Hydrometric Information

There are no Water Survey Canada (WSC) hydrometric stations within the Outer Gulf Islands Water Allocation Plan area. Therefore, the WSC hydrometric station Cusheon Creek at Outlet of Cusheon Lake (1970-1993) located on Saltspring Island was used to estimate the streamflow within the plan area. The location of WSC hydrometric station Cusheon Creek at Outlet of Cusheon Lake is illustrated in Figure 8. The WSC hydrometric station Cusheon Creek at Outlet of Cusheon Lake record is summarized below and in Appendix B.

Water Survey of Canada Hydrometric Station **Cusheon Creek at Outlet of Cusheon Lake (08HA026)**				
Station Number	Period of Record	Drainage Area (km^2)	Mean Annual Discharge (m^3/sec)	Mean 7-Day Avg. Low Flow (m^3/sec)
08HA026	1970-1993	7.24	0.113	0.0002

Most of the significant drainages within the Outer Gulf Islands Water Allocation Plan area do not have lake storage that will modify and extend the flow in the low flow period. Therefore an estimated correction was made to discount for the precipitation, evaporation and storage in Cusheon Lake. The corrected estimates were used to determine the flow within watersheds without significant lake storage.

Mean Monthly and Mean Annual Discharge

Cusheon Creek at Outlet of Cusheon Lake (litres/second)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
08HA026	334	365	235	98	37	11	2	0	1	1	62	261	113
*Correction	322	349	221	97	34	11	0	0	0	0	82	287	117

*Corrected for precipitation, evaporation and storage in lake.

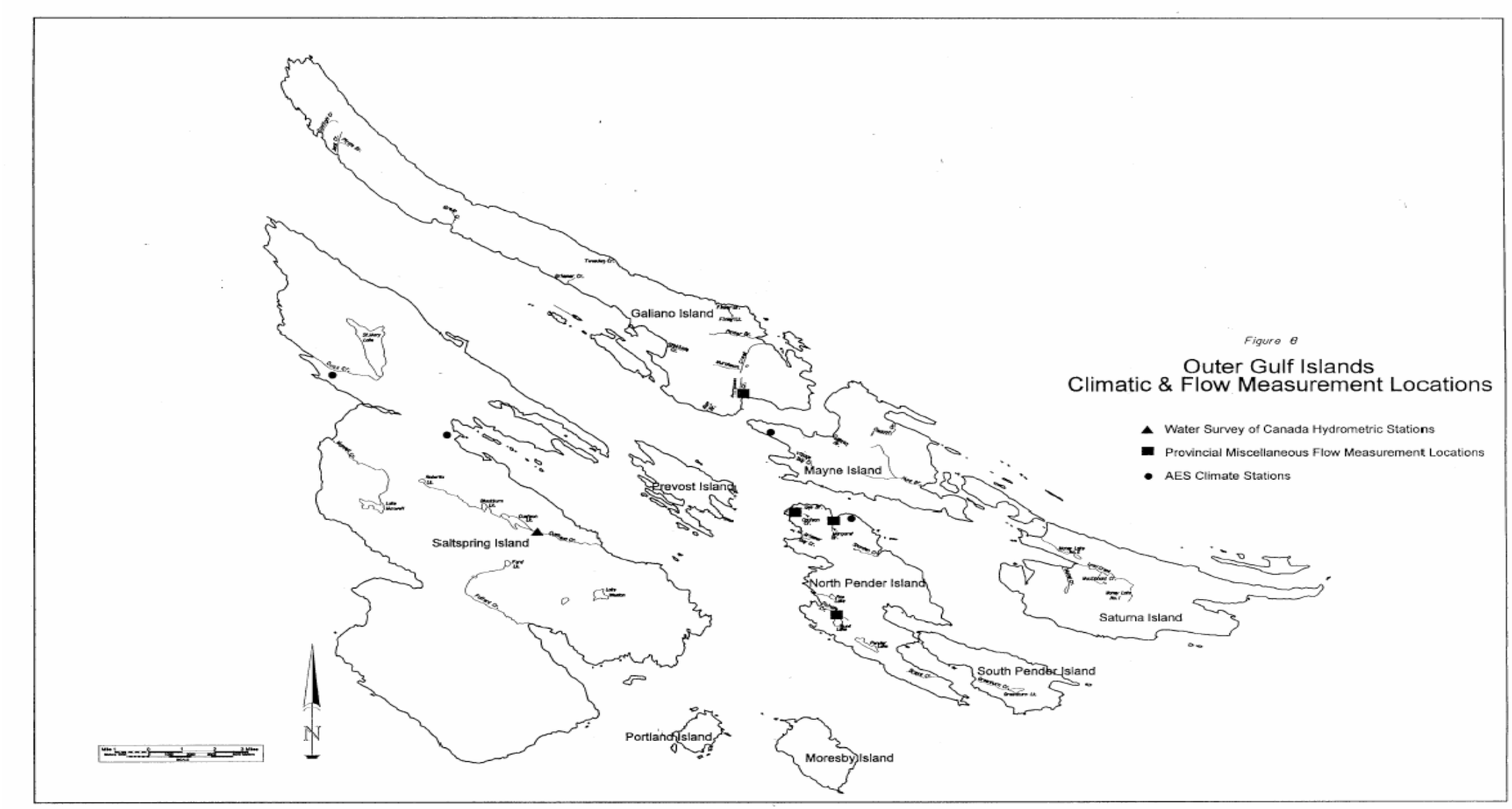
The drainage area of Cusheon Creek at Outlet of Cusheon Lake is 7.24 km^2. The mean monthly and mean annual discharge runoffs per square kilometre are in the following table.

Discharge per Square Kilometre (litres/second/km^2)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
08HA026	46.1	50.4	32.5	13.5	5.1	1.5	0.3	0	0.1	0.1	8.6	36.1	15.6
Corrected flow	44.5	48.2	30.5	13.4	4.7	1.5	0	0	0	0	11.3	39.6	16.2
%MAD	274	298	188	83	29	9	0	0	0	0	70	244	100%

The mean monthly discharges (MMD) and mean annual discharge (MAD) discharge runoffs per square kilometre were used to estimate the discharge in all identified significant drainages within the Outer Gulf Islands Water Allocation Plan area. For each identified significant drainage area the above discharge runoffs per square kilometre were multiplied by the drainage area to obtain an estimate of the Mean Monthly Discharge (MMD) and the Mean Annual Discharge (MAD).

Miscellaneous streamflow measurements related to water licence applications and other investigations were used to confirm or modify the estimated mean monthly discharges (MMD) and mean annual discharge (MAD). The locations of these miscellaneous streamflow measurements are illustrated in Figure 8 and summarized in Appendix C.


Galiano Island
Mayne Island
Prevost Island
Saltspring Island
North Pender Island
Saturna Island
South Pender Island
Portland Island
Moresby Island
N
Figure 8
Outer Gulf Islands
Climatic & Flow Measurement Locations
Water Survey of Canada Hydrometric Stations
Provincial Miscellaneous Flow Measurement Locations
AES Climate Stations

3.2.1 Murcheson Creek Drainage

Murcheson Creek on Galiano Island drains from an elevation of approximately 120 m. (390 ft.) above sea level. The creek flows in a north-easterly direction to Murcheson Bay (Ocean). The total watershed area of Murcheson Creek is 5.95 km^2 (1,470 acres). The flow in Murcheson Creek was estimated using the corrected mean monthly and mean annual discharge runoff per square kilometre of Cusheon Creek at Outlet of Cusheon Lake. The following table indicates the estimated mean monthly and mean annual discharge of Murcheson Creek.

Murcheson Creek Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
265	287	181	80	28	8.9	0	0	0	0	67	236	96

3.2.2 Jack Creek Drainage

Jack Creek on Galiano Island drains from a bog located on an ecological reserve at an elevation of approximately 100 m. (330 ft.) above sea level. Jack Creek flows in a southerly direction to Trincomali Channel. Pirate Brook is tributary to Jack Creek. The total watershed area of Jack Creek is 3.02 km^2 (750 acres). The following table indicates the estimated mean monthly and mean annual discharges of Jack Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Jack Creek Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
134	146	92	41	14	4.5	0	0	0	0	34	120	49

3.2.3 Putter Brook Drainage

Putter Brook on Galiano Island flows in an easterly direction from an elevation of approximately 80 m. (260 ft.) above sea level. The total watershed area of Putter Brook is 2.84 km^2 (700 acres).

The following table indicates the estimated mean monthly and mean annual discharges of Putter Brook based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Putter Brook Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
126	137	87	38	13	4.3	0	0	0	0	32	112	46

3.2.4 Greig Creek Drainage

Greig Creek on Galiano Island drains from a swamp at an elevation of approximate 200 m. (660 ft.) above sea level. The creek flows in a southerly direction into Retreat Cove. The total watershed area of Greig Creek is 1.51 km^2 (370 acres). The following table indicates the estimated mean monthly and mean annual discharges of Greig Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Greig Creek Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
67	73	46	20	7.1	2.3	0	0	0	0	17	60	24

3.2.5 Georgeson Creek Drainage

Georgeson Creek on Galiano Island drains from an elevation of approximately 40 m (130 ft.) above sea level. The creek flows in a southerly direction and discharges into Georgeson Bay (Ocean). The total watershed areas of Georgeson Creek is 1.33 km^2 (330 acres). There are three Provincial miscellaneous flow measurements on Georgeson Creek (see Appendix C). The following table indicates the estimated mean monthly and mean annual discharges of Georgeson Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Georgeson Creek Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
59	64	41	18	6.3	2.0	0	0	0	0	15	53	22

3.2.6 Hunt Brook Drainage

Hunt Brook on Mayne Island flows in a south-easterly direction into Horton Bay (Ocean). The brook has a drainage area of 2.6 km^2 (640 acres). The following table indicates the estimated mean monthly and mean annual discharges of Hunt Brook based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Hunt Brook Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
116	125	79	35	12	3.9	0	0	0	0	29	103	42

3.2.7 Village Bay Creek Drainage

Village Bay Creek on Mayne Island flows in a westerly direction into Village Bay (Ocean). The total watershed area of Village Bay Creek is 1.69 km^2 (420 acres). The following table indicates the estimated mean monthly and mean annual discharges of Village Bay Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Village Bay Creek Mean Monthly and Mean Annual Discharge (litres/second))												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
75	81	52	23	7.9	2.5	0	0	0	0	19	67	27

3.2.8 Deacon Creek Drainage

Deacon Creek on Mayne Island drains in a north-easterly direction into Campbell Bay (Ocean). The total watershed area of Deacon Creek is 1.65 km^2 (410 acres). The following table indicates the estimated mean monthly and mean annual discharges of Deacon Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Deacon Creek Mean Monthly and Mean Annual Discharge (litres/second))												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
73	79	50	22	7.8	2.5	0	0	0	0	19	65	27

3.2.9 Lyall Creek Drainage

Lyall Creek on Saturna Island flows into the ocean at Lyall Harbour. South Lyall Creek and MacDonald Creek are tributaries to Lyall Creek. The total watershed area of Lyall Creek is 6.28 km^2 (1,550 acres). The following table indicates the estimated mean monthly and mean annual discharges of Lyall Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Lyall Creek Mean Monthly and Mean Annual Discharge (litres/second))												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
279	303	192	84	30	9.4	0	0	0	0	71	249	102

3.2.10 Money Creek Drainage

Money Creek on Saturna Island discharges into Lyall Harbour. Money Lake No. 1 is a man made lake that flows into Money Creek. Money Lake No. 1 has a surface area of 2.18 hectares (5.39 acres). The watershed area above the lake outlet is 94 hectares (232 acres). The total watershed area of Money Creek is approximately 1.49 km^2 (370 acres). The following table indicates the estimated mean monthly and mean annual discharges of Money Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Money Creek and Lake No. 1 Mean Monthly and Mean Annual Discharge) (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
66	72	45	20	7.0	2.2	0	0	0	0	17	59	24

3.2.11 Unnamed Creek from Money Lake No. 2 Drainage

The unnamed creek from Money Lake No. 2 on Saturna Island has a total watershed area of 1.03 km^2 (250 acres). Money Lake No. 2 is a man-made lake with a surface area of 2.1 hectares (5.19 acres). The following table indicates the estimated mean monthly and mean annual discharges of the Unnamed Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Unnamed Creek from Money Lake No. 2 Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
46	50	31	14	4.8	1.5	0	0	0	0	12	41	17

3.2.12 Standen Creek Drainage

Standen Creek on North Pender Island flows in a northern direction into Hop Bay (Ocean). The total watershed area is 1.83 km^2 (450 acres). The following table indicates the estimated mean

monthly and mean annual discharges of Standen Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Standen Creek Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
81	88	56	26	8.6	2.7	0	0	0	0	21	72	30

3.2.13 Shingle Creek Drainage

Shingle Creek on North Pender Island flows into Shingle Bay (Ocean). Buck Lake is a man made lake, which drains into Shingle Creek. Buck Lake has a surface area of 10.24 hectares (25.3 acres). The watershed area above the lake outlet is 78 hectares (192 acres). Shingle Creek has a total watershed area of 94 hectares (230 acres). The following table indicates the estimated mean monthly and mean annual discharges of Shingle Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Shingle Creek Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
42	45	29	13	4.4	1.4	0	0	0	0	11	37	15

3.2.14 Unnamed Creek from Pender (Magic) Lake Drainage

The Unnamed Creek drains from Pender (Magic) Lake on North Pender Island and flows in a southern direction into Swanson Channel (Ocean). The surface area of Pender Lake is 16.19 hectares (40 acres). The total watershed area of the Pender Lake drainage is approximately 91 hectares (225 acres). The following table indicates the estimated mean monthly and mean annual discharges of the Unnamed Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Unnamed Creek from Pender (Magic) Lake Mean Monthly and Mean Annual Discharge (litres/second))												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
40	44	28	12	4.3	1.4	0	0	0	0	10	36	15

3.2.15 Bryant Creek Drainage

Bryant Creek on North Pender Island flows in a south-easterly direction and drains into Bedwell Harbour. The total watershed area of Bryant Creek is 89 hectares (220 acres). The following table indicates the estimated mean monthly and mean annual discharges of Bryant Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Bryant Creek Mean Monthly and Mean Annual Discharge (litres/second))												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
40	43	27	12	4.1	1.3	0	0	0	0	10	35	14

3.2.16 Unnamed Creek from Roe Lake Drainage

The Unnamed Creek drains from Roe Lake on North Pender Island and discharges into Shingle Bay. The watershed area above the outlet of the lake is 17.9 hectares (44.23 acres). The surface area of Roe Lake is 6.09 hectares (15 acres). The Unnamed Creek has a watershed area of 61 hectares (150 acres). The following table indicates the estimated mean monthly and mean annual discharges of the Unnamed Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Unnamed Creek from Roe Lake Mean Monthly and Mean Annual Discharge (litres/second))												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
27	29	18	8.2	2.9	0.9	0	0	0	0	6.9	24	9.9

3.2.17 Greenburn Creek Drainage

Greenburn Creek on South Pender Island drains westerly from Greenburn Lake into Bedwell Harbour. Greenburn Lake has a surface area of 6.94 hectares (17.15 acres). The watershed area of Greenburn Creek is 80 hectare (200 acres). The following table indicates the estimated mean monthly and mean annual discharges of Greenburn Creek based on the corrected discharge runoffs per square kilometre of Cusheon Creek at Outlet of Cusheon Lake.

Greenburn Creek and Lake Mean Monthly and Mean Annual Discharge (litres/second))												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
36	39	24	11	3.8	1.2	0	0	0	0	9	32	13

3.3 Lakes and Evaporation

The following table summarizes information on lakes within the plan area.

Lakes					
Lake	Location	Surface Area (ha)	Volume (dam^3)	Maximum Depth (m)	Mean Depth (m)
Finlay Lake*	Galiano Isl.	2.27	-	-	-

Pender (Magic) Lake	N. Pender	16.19	-	-	-
Buck Lake	N. Pender	10.24	370	9.75	3.61
Roe Lake	N. Pender	6.09	91	9.95	1.49
Greenburn Lake	S. Pender	6.94	88	8.06	1.27
Money Lake No.1	Saturna Isl.	2.18	70	5.80	3.21
Money Lake No. 2*	Saturna Isl.	2.10	-	-	-

* Planimetered area from 1:1320 maps.

An estimated average of 0.3 m (1 ft.) net per annum of water may be lost over the surface of the water body due to evaporation.

4.0 INSTREAM FLOW REQUIREMENTS

Maintaining the natural stream environment and instream uses is 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. The Ministry of Environment Provincial policy is:

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 summarizes the modified Tennant (Montana) Method used within the Outer Gulf Islands Water Allocation Plan.

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). Therefore, the Regional policies to implement the 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 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%.

The instream flow requirements have been determined for the following drainages:

4.1 Murcheson Creek Instream Requirements

The Murcheson Creek watershed supports fish populations. Figure 9 illustrates the estimated mean monthly flow in Murcheson Creek falls below 10% of the mean annual discharge (MAD) during the months of June, July, August, September and October. Therefore, water is only available for extractive use during the months of November through April when the mean monthly discharge is above 60% MAD. No water is available from Murcheson Creek when the flow is below 60% MAD or 57.6 litres/second. Thus, the estimated volume of water available from November through April is 2,000 dam^3.

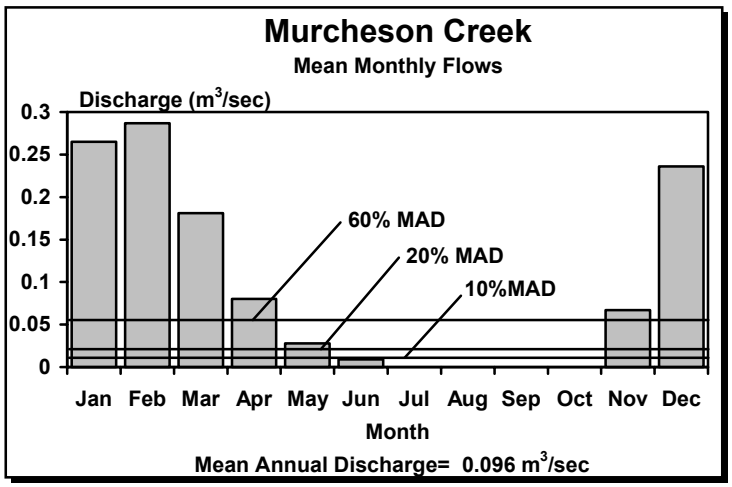


Figure 9

4.2 Jack Creek Instream Requirements

The Jack Creek watershed supports fish populations. Figure 10 illustrates the estimated mean monthly flow in Jack Creek falls below 10% of the mean annual discharge (MAD) during the months of June, July, August, September and October. Therefore, water is only available for extractive use during the months of November through April when the mean monthly discharge is above 60% MAD. No water is available from Jack Creek when the flow is below 60% MAD or 29.4 litres/second.

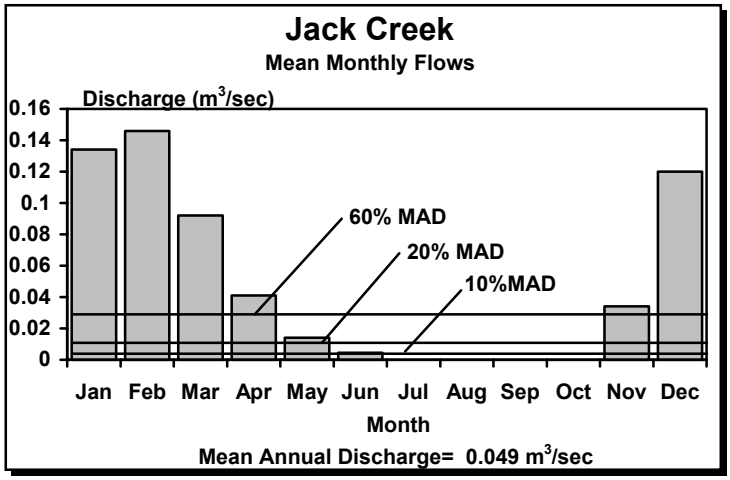


Figure 10

Thus, the estimated volume of water available from November through April is 1,000 dam^3.

4.3 Putter Brook Instream Requirements

The Putter Brook watershed supports fish species. Figure 11 illustrates the estimated mean monthly flow in Putter Brook falls below 10% of the mean annual discharge (MAD) during the months of June, July, August, September and October. Therefore, water is only available for extractive use during the period of November through April when the mean monthly discharge is above 60% MAD. No water is available from Putter Brook when the flow is below 60% MAD or 27.6 litres/second. Thus, the estimated volume of water available from November through April is 950 dam^3.

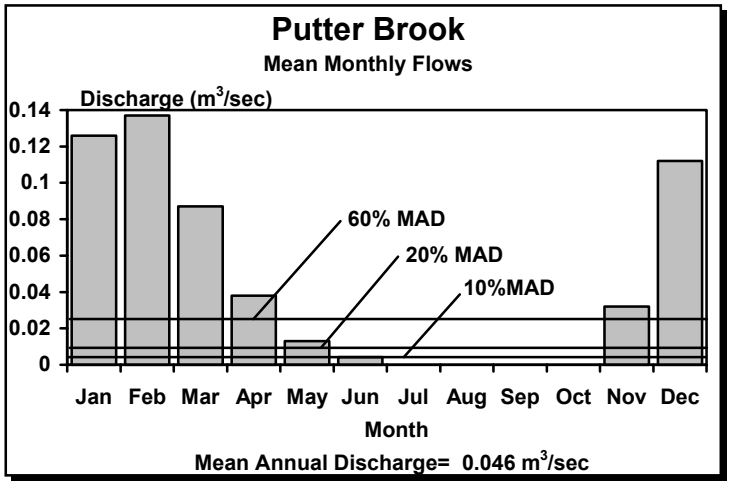


Figure 11

4.4 Greig Creek Instream Requirements

The Greig Creek watershed supports fish species. Figure 12 illustrates the estimated mean monthly flow in Greig Creek falls below 10% of the mean annual discharge (MAD) during the months of June, July, August, September and October. Therefore, water is only available for extractive use during the period of November through April when the mean monthly discharge is above 60% MAD. No water is available from Greig Creek when the flow is below 60% MAD or 14.4 litres/second. Thus, the estimated volume of water available from November through April is 510 dam^3.

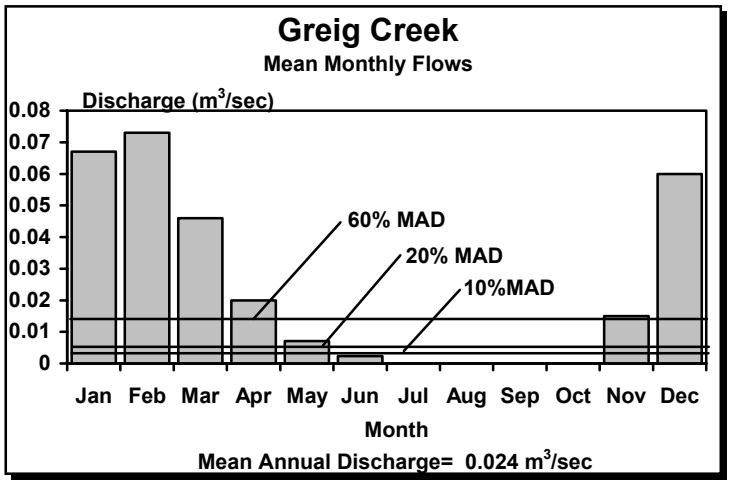


Figure 12

4.5 Georgeson Creek Instream Requirements

The Georgeson Creek watershed supports fish species. Figure 13 illustrates the estimated mean monthly flow in Georgeson Creek falls below 10% of the mean annual discharge (MAD) during the months of June, July, August, September and October. Therefore, water is only available for extractive use during the period of November through April when the mean monthly discharge is above 60% MAD. No water is available from Georgeson Creek when the flow is below 60% MAD or 13.2 litres/second. Thus, the estimated volume of water available from November through April is 440 dam^3.

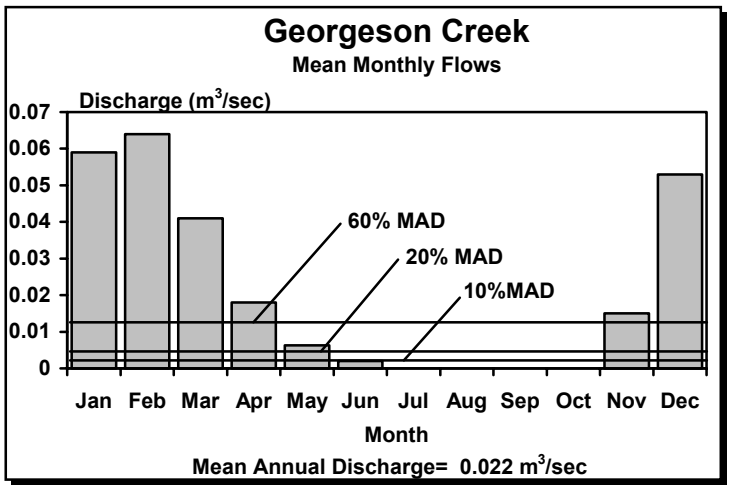


Figure 13

4.6 Hunt Brook Instream Requirements

The Hunt Brook drainage supports fish species. Figure 14 illustrates the estimated mean monthly flow in Hunt Brook falls below 10% of the mean annual discharge (MAD) during the months of June, July, August, September and October. Therefore, water is only available for extractive use during the period of November through April when the mean monthly discharge is above 60% MAD. No water is available from Hunt Brook when the flow is below 60% MAD or 25.2 litres/second. Thus, the estimated volume of water available from November through April is 870 dam^3.

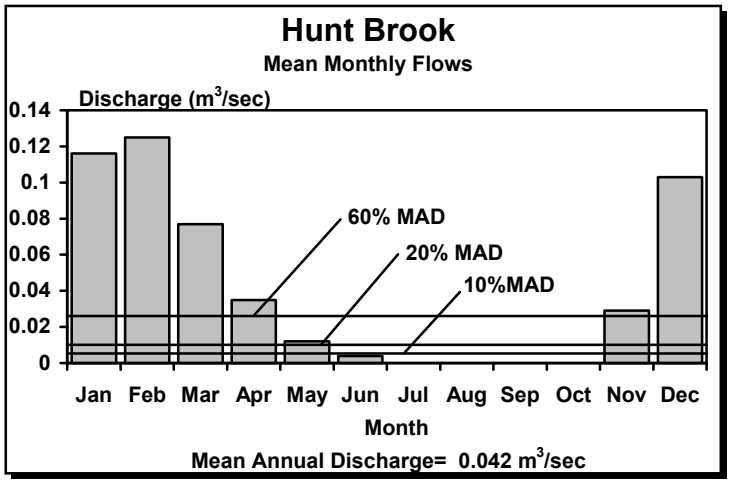


Figure 14

4.7 Deacon Creek Instream

The Deacon Creek watershed supports fish species. Figure 15 illustrates the estimated mean monthly flow in Deacon Creek falls below 10% of the mean annual discharge (MAD) during the months of June, July, August, September and October. Therefore, water is only available for extractive use during the period of November through April when the mean monthly discharge is above 60% MAD. No water is available from Deacon Creek when the flow is below 60% MAD or 16.2 litres/second. Thus, the estimated volume of water available from November through April is 550 dam^3.

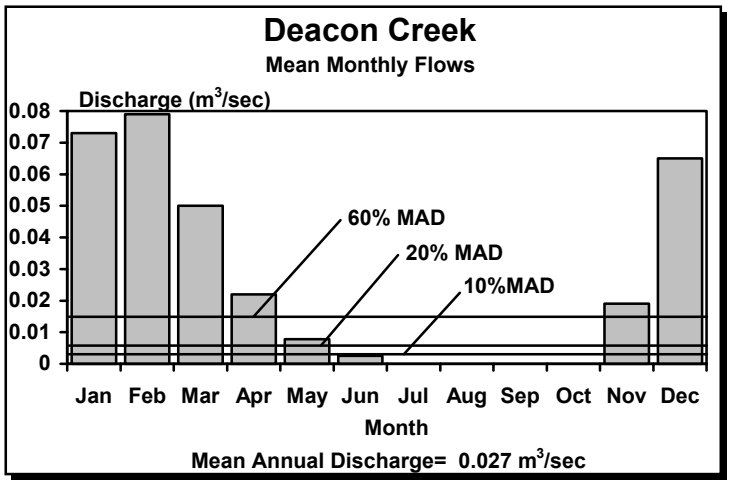


Figure 15

4.8 Lyall Creek Instream Requirements

The Lyall Creek watershed supports fish species. Figure 16 illustrates the estimated mean monthly flow in Lyall Creek falls below 10% of the mean annual discharge (MAD) during the months of June, July, August, September and October. Therefore, water is only available for extractive use during the period of November through April when the mean monthly discharge is above 60% MAD. No water is available from Lyall Creek when the flow is below 60% MAD or 61.2 litres/second. Thus, the estimated volume of water available from November through April is 2,100 dam^3.

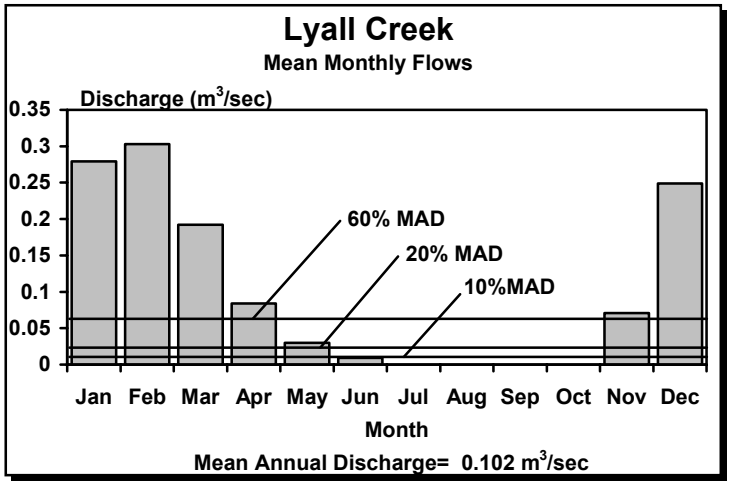


Figure 16

4.9 Money Creek Instream Requirements

The Money Creek and Money Lake No. 1 watershed supports fish species. Figure 17 illustrates the estimated mean monthly flow in Money Creek and Money Lake No. 1 drainage falls below 10% of the mean annual discharge (MAD) during the months of June, July, August, September and October. Therefore, water is only available for extractive use during the period of November through April when the mean monthly discharge is above 60% MAD. No water is available from Money Creek or Money Lake No. 1 when the flow is below 60% MAD or 14.4 litres/second. Thus, the estimated volume of water available from November through April is 500 dam^3.

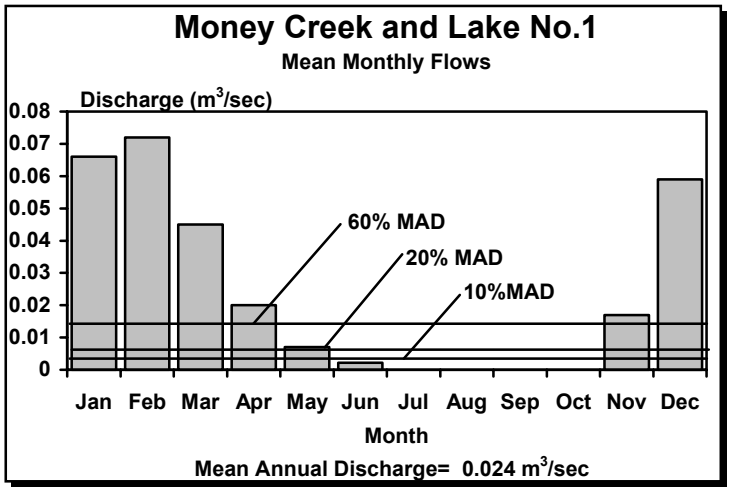


Figure 17

4.10 Money Lake No. 2 Instream Requirements

The Money Lake No. 2 watershed supports fish species. Figure 18 illustrates the estimated mean monthly flow in the Money Lake No. 2 watershed falls below 10% of the mean annual discharge (MAD) during the months of June, July, August, September and October. Therefore, water is only available for extractive use during the period of November through April when the mean monthly discharge is above 60% MAD. No water is available from Money Lake No. 2 when the flow is below 60% MAD or 10.2 litres/second. Thus, the estimated volume of water available from November through April is 340 dam^3.

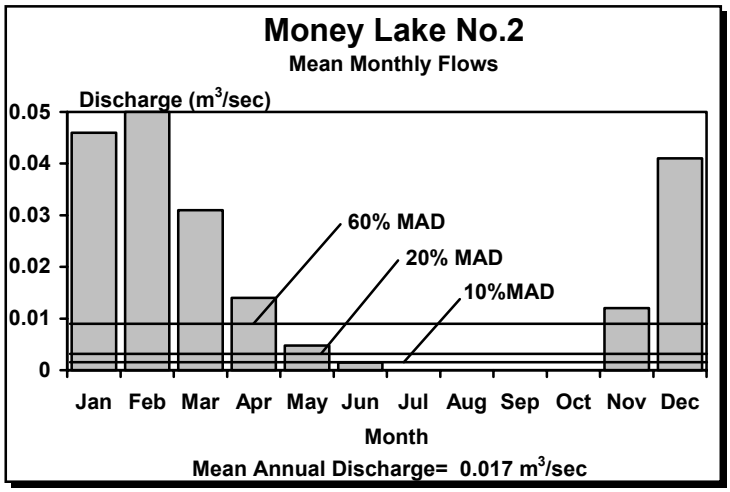


Figure 18

4.11 Standen Creek Instream Requirements

The Standen Creek watershed supports fish species. Figure 19 illustrates the estimated mean monthly flow in Standen Creek falls below 10% of the mean annual discharge (MAD) during the months of June, July, August, September and October. Therefore, water is only available for extractive use during the period of November through April when the mean monthly discharge is above 60% MAD. No water is available from Standen Creek when the flow is below 60% MAD or 18 litres/second. Thus, the estimated volume of water available from November through April is 610 dam^3.

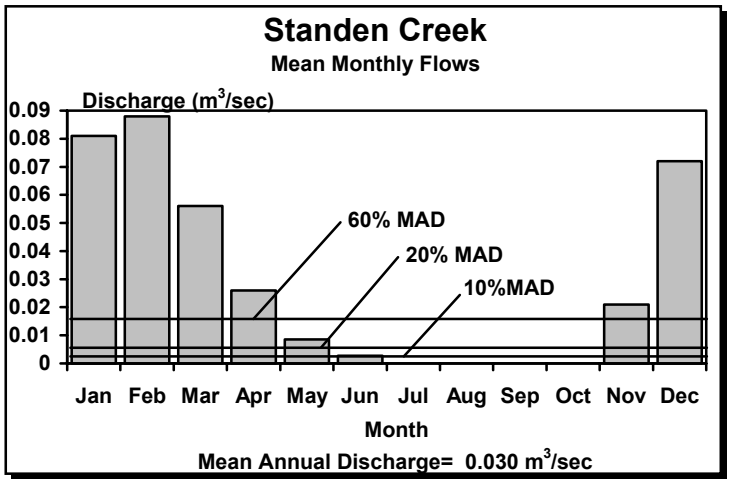


Figure 19

4.12 Pender Lake Instream Requirements

The Pender Lake watershed supports fish species. Figure 20 illustrates the estimated mean monthly flow in the Pender Lake drainage area falls below 10% of the mean annual discharge (MAD) during the months of July, August, September and October. Therefore, water is only available for extractive use during the period of November through April when the mean monthly discharge is above 60% MAD. No water is available from Pender Lake when the flow is below 60% MAD or 8.8 litres/second. Thus, the estimated volume of water available from November through April is 306 dam^3.

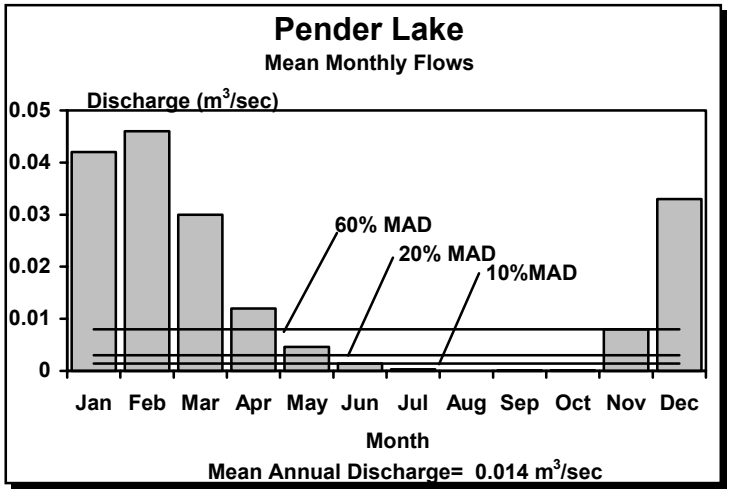


Figure 20

4.13 Roe Lake Instream Requirements

The Roe Lake watershed supports fish species. Figure 21 illustrates the estimated mean monthly flow in the Roe Lake watershed falls below 10% of the mean annual discharge (MAD) during the months of June, July, August, September and October. Therefore, water is only available for extractive use during the period of December through April when the mean monthly discharge is above 60% MAD. No water is available from Roe Lake when the flow is below 60% MAD or 5.9 litres/second. Thus, the estimated volume of water available from December through April is 205 dam^3.

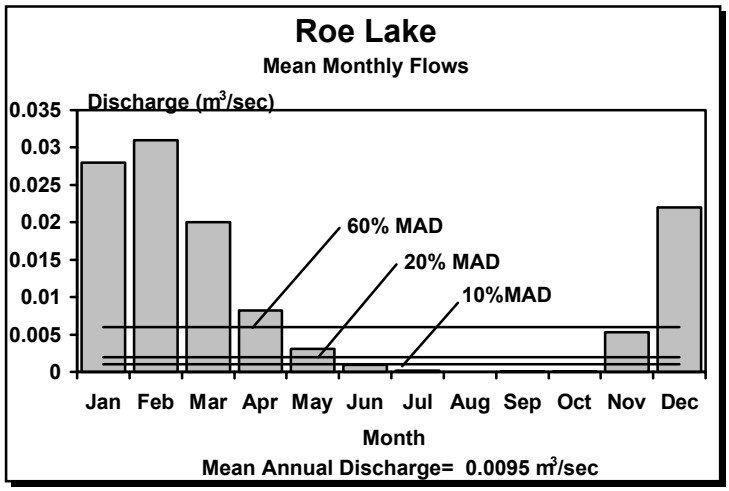


Figure 21

5.0 WATER DEMAND

5.1 Licensed Demand

There are 146 water licences currently (March 1999) within the Outer Gulf Islands Water Allocation Plan area. Figure 22 illustrates the number of water licences issued for each purpose for the water within the plan area. The largest number of water licences support rural residential domestic demands (69 water licences) and Storage demands (29 water licences). There are 24 water licences for Irrigation purposes, 10 water licences for Land Improvement purposes, 7 water licences for Waterworks purposes, 6 water licences for Industrial purposes, and 1 water licence for Conservation purposes.

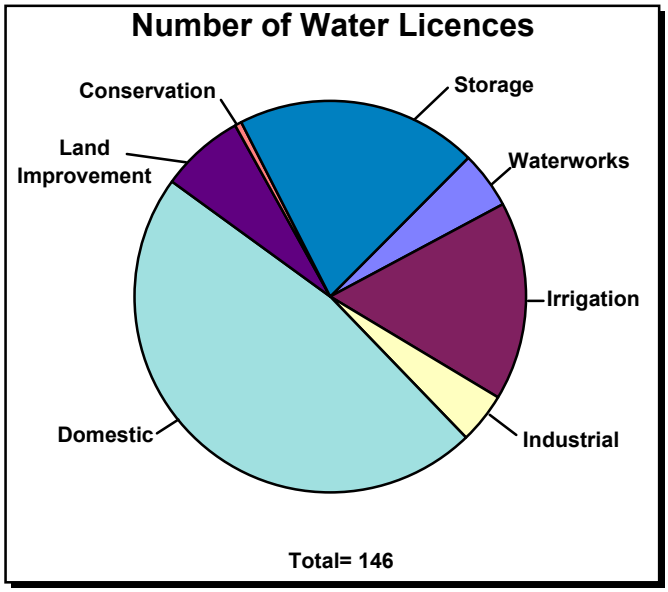


Figure 22

Of greater significance for water management is the estimated average annual licensed water demand. The total estimated average annual licensed water demand for the plan area is 2,250 dam^3. Figure 23 illustrates the estimated average annual licensed water demand for each purpose under which water licences have been issued. At 36.5% of the total annual demand, Land Improvement purposes support the largest annual water demand in the plan area. The second largest demand is for Storage purposes (26.3%), followed by Municipal Waterworks purposes (21.5%), Irrigation purposes (11.7%), Domestic purposes (2%), and finally Industrial purposes (2%).

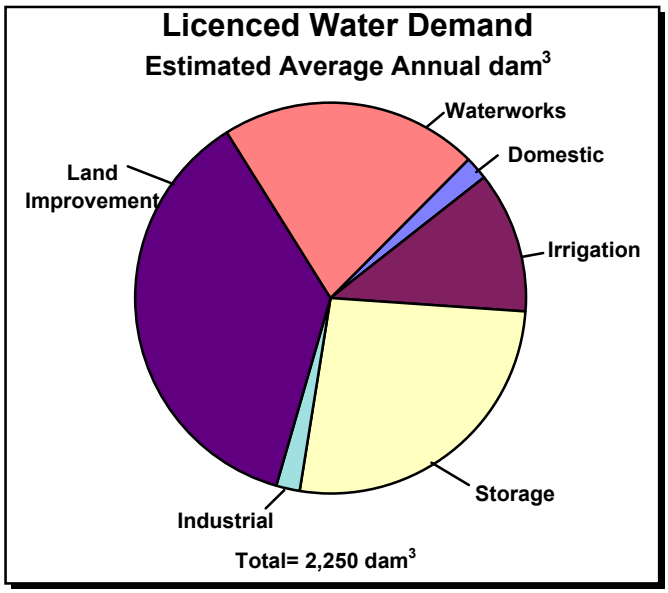


Figure 23

The following table summarizes the annual water demands for each purpose for the Outer Gulf Islands Water Allocation Plan area (see also Appendix D).

Estimated Average Annual Licensed Water Demand			
PURPOSE	**NUMBER OF LICENCES**	**QUANTITY LICENSED**	**ANNUAL DEMAND (dam^3)**
Municipal Waterworks	7	581,700 gpd	482.60
Domestic	69	55,000 gpd	45.63
Industrial			
(Ponds)	1	10,000 gpd	8.30
(Enterprise)	1	50,000 gpd	20.46
(Stockwatering)	1	200 gpd	0.08
(Fire Protection)	2	3 acft	3.70
		500 gpd	0.20
(Watering)	1	10 acft	12.34
Sub-total	6	60,210 gpd	29.04
		13.7 acft	16.04
Irrigation	24	213.86 acft	263.90
Storage	29	478.75 acft	590.78
Land Improvement	10	665.85 acft	821.66
Conservation	1	0 total flow	0
Total	**146**	**-**	**2,249.65**

The low flow licensed demand by drainage area is summarized in the following table and is further detailed in Appendix E.

Low Flow Licensed (Consumptive) Water Demand per Drainage Area		
DRAINAGE AREA	LOW FLOW WATER DEMAND*	
	litres/second	dam^3
Murcheson Creek	3.43	26.73
Jack Creek	0.07	0.52
Putter Brook	1.59	12.34
Greig Creek	0.05	0.41
Georgeson Creek	0.08	0.61
Hunt Brook	0.03	0.20
Village Bay Creek	-1.30	-10.08
Deacon Creek	0.11	0.82
Lyall Creek	0.16	1.23
Money Creek & Lake No.1	-3.24	-25.21
Money Lake No.2	0	0
Standen Creek	0	0
Shingle Creek	-2.69	-20.99
Pender Lake	-4.26	-33.13
Bryant Creek	0	0
Roe Lake	0.03	0.20
Greenburn Creek	-0.70	-9.37
Other	3.65	28.23

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

5.2 Projected Demand

There are 16 water licence applications pending as of March 1999. The potential annual water demand of these existing applications totals 276 dam^3. A summary of the pending applications within the plan area is listed in the following table and is detailed in Appendix F.

Water Licence Applications			
Purpose	**No. of Licences**	**Quantity**	**Average Annual Demand (dam^3)**
Domestic	2	3,000 gpd	2.48
Industrial (Fish Culture)	1	0	0
Irrigation	4	75 acft	92.55
Storage	4	99 acft	122.17
Land Improvement	5	47.5 acft	58.62
Total	**16**	**-**	**275.82**

The conclusions and recommendations found in the following sections outline the requirements, limitations and acceptance criteria necessary for approval of the applications discussed above.

6.0 CONCLUSIONS and RECOMMENDATIONS

Most of the significant drainage areas within the Outer Gulf Islands Water Allocation Plan area experience a six month low flow period from May through October. The minimum mean monthly flow occurs during the July through October dry period in all of the identified drainages.

The high flow period, in which the mean monthly flows are greater than 60% of the Mean Annual discharge, generally occur from November through April within the Outer Gulf Islands Water Allocation Plan area. Therefore, during this six month period there is water available to develop storage to support water demands during the low flow months. The maximum mean monthly flow occurs in February and ranges form 31 litres/second within the Roe Lake drainage to 303 litres/ second in Lyall Creek.

Numerous streams within the Outer Gulf Islands Water Allocation Plan area support the spawning and rearing of anadromous fish such as salmon and sea-run Cutthroat trout. As well, there are resident fish in many of the streams and lakes within the plan area.

Fish and debris screens shall be required on all intake or diversion works within the identified fish habitat areas. Fish and debris screens are part of good intake design and should be encouraged on all intake or diversion works. Fish passage provisions for both adult and juvenile

fish are 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 June through September period specified by the fisheries agencies to minimize impacts on the fish resources.

The licensed water demand within the Outer Gulf Island Water Allocation Plan area consist of Domestic, Waterworks, Industrial, Irrigation, Storage, Land Improvement and Conservation purpose licences. Domestic purposes hold the largest number of water licences within the area, yet these demands do not significantly impact other water interests, except where there is a local competing water demand conflict. The largest existing annual licensed water demands are for Land Improvement and Storage purposes.

The following table summarizes the water available for the identified drainages, not accounting for existing water demand.

OUTER GULF ISLANDS WATER AVAILABILITY			
DRAINAGE	**DRAINAGE AREA (km^2)**	**WATER VOLUME AVAILABLE**	
		HIGH FLOW (dam^3)*	**LOW FLOW (l/s)****
Murcheson Creek	6.0	2,000	0
Jack Creek	3.0	1,000	0
Putter Brook	2.8	950	0
Greig Creek	1.5	510	0
Georgeson Creek	1.3	440	0
Hunt Brook	2.6	870	0
Village Bay Creek	1.7	570	0
Deacon Creek	1.7	550	0
Lyall Creek	6.3	2,100	0
Money Creek & Lake No.1	1.5	500	0
Money Lake No.2	1.0	340	0
Standen Creek	1.8	610	0
Shingle Creek	0.9	320	0
Pender Lake	0.9	313	0
Bryant Creek	0.9	300	0
Roe Lake	0.6	209	0
Greenburn Creek and Lake	0.8	270	0

* High Flow is the quantity of water available above 60% MAD during the period from November through April. (Roe Lake drainage area has a high flow period from December through April)
** Low Flow is the minimum mean monthly flow of water available during the low flow period.

6.1 Domestic

A domestic water licence shall be 2,300 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 hectare (0.25 acres) of garden 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.

Domestic demands are not significant and will not affect the water volume or flow from most lakes, ponds, and swamps. To ensure adequate domestic water supply for household uses from creeks and brooks, applicants should be prepared to develop storage or use naturally stored water from lakes or marshes. For the average daily demand of 1,100 litres/day (250 gpd) for a five month period (150 days) a volume of 170 m^3 (6,000 ft^3) is required. This requires a reservoir or dugout approximately 9 metres (30 ft) long by 6 metres (20 ft) wide, with an average depth of 3.5 metres (11 feet), allowing 0.3 metres (1 ft) for evaporation loss over the surface of the reservoir.

A spring (dimple spring) that has no surface connection to a stream with downstream licensees or fish values may be licensed for 500 gpd domestic water supply providing the applicant determines 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 licensees.

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 (Regional District, Public Utility).

Measuring or regulating (e.g. 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 or private utility for the purpose of providing water to a residential area.

The demand for waterworks will increase in the future, as the Gulf Islands are further developed and the population expands.

Applicants for a waterworks demand 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 (e.g. volume difference between maximum hour and maximum daily demands) will be constructed or is available for peak hour demands. Water Utilities will also be required 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. Licensed 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 longer period).

The licensee shall be required to meter and record the water diverted from the source stream. The licensee shall be required to treat the water supply in accordance with the Ministry of Health requirements.

All waterworks licences will require storage. Storage and diversion structures must be capable of maintaining or improving existing low flows during the five month low flow period and maintaining fish passage where required.

6.3 Irrigation

The soil type, crop rooting depth, and climate characteristics determine the water requirements for irrigation. The soils on the Outer Gulf Islands that are suitable for agriculture are generally silty clay loam to gravelly sandy loam. These soils require an annual irrigation water requirement of approximately 430 millimetres (17 inches) for crops with a shallow rooting depth (< 0.5 metres) and 300 milimetres (12 inches) for crops with a deep rooting depth (< 1.0 metres). If the applicant for a water licence can provide more specific soil assessment and irrigation demand information for a given area, this may be used to assess irrigation demands.

The maximum rate of water withdrawal is 0.6 l/sec per hectare (3.3 Igpm per acre) of land to be irrigated. Users must be 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 April 1 to September 30. It should be noted that these irrigation water requirements are for sprinkler irrigation systems only.

Irrigation gun or flood irrigation systems 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 sprinkler irrigation system. Trickle irrigation can reduce water requirements by 35% and should be encouraged where practical.

All irrigation water demands 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 from November 1 to April 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 and Commercial

The Industrial water licences within the Outer Gulf Islands Water Allocation Plan area are demands associated with golf course maintenance, stockwatering, fire protection, fish culture and hotel/resort water use.

Commercial fish hatcheries and/or rearing purposes shall require an industrial water licence. Use of water by government and non-profit organizations will be licensed as conservation purpose. Information on fish species and size, water temperature requirements and operating methods will be required in support of an application for a water licence. Fish Farm and Waste Management Permits will also be required. Off-stream 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 through 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. Off-stream storage is required to support these demands. Diversion into storage will be authorized from November 1 to April 30.

Cattle or livestock watering requiring more than 450 litres/day (100 gpd) are to be considered Industrial (Agricultural/ Stockwatering) demand. Cattle or livestock watering 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		
	Water Requirements	
Livestock	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 on-stream or off-stream in a dugout or behind a dam. In the unlikely event that a large storage development to support a major water demand (e.g. BC Hydro power, pulp and paper, large waterworks) is proposed, a more specific supply versus demand and environmental impact assessment will be required.

The storage quantity required to support the smaller demands anticipated to support domestic, industrial and irrigation uses shall be the volume of the water demand for 6 months plus an additional allowance of 0.3 metres (1 foot) depth over the surface area of the storage reservoir for evaporation and other losses.

The applicant will be required to complete an adequate report for "Dam and Reservoir Information Required in Support of a Water Licence Application for Storage Purpose Schedule 2)" with the water licence application. If the requested report is not provided the application will be refused.

Diversion of water into off-stream storage will be authorized for the period from November (December for Roe Lake drainage area) through April during the high flow period. All in-stream storage water licensees will be required to release at the outflow the estimated mean monthly inflow to the reservoir during the low flow period of May through October.

The applicant must obtain written agreement, right-of-way or 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 area and modification of fish habitat due to storage development may require mitigation work in the affected stream.

The design plans must be submitted to Water Management and accepted in writing before construction commences on any proposed dam over 3 metres (10 feet) in height or on storage 12 dam^3 (10 acre feet) or more in volume.

6.6 Land Improvement

Land improvement purpose is the impoundment of water on a stream or the diversion of water from a stream to facilitate the development of a park, to construct and maintain an aesthetic pond, to protect property from erosion, or to drain and reclaim land. No significant water quantity is removed from the stream. Land improvement water demands are non-consumptive uses of the water resources.

Water used to facilitate the development of a park is usually maintained in a dammed lake or reservoir for recreation (i.e. boating, fishing, swimming, golf course water traps) and aesthetics. The dammed lake or reservoir 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, likewise, may acquire a water licence to construct and maintain dugouts or to control the volume of small ponds for aesthetics and to increase the property value. 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. No supporting storage is required. 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 not be relocated to accommodate development. Post-development flow conditions should be maintained as near as possible to the 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 release will be encouraged.

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 or wildlife for non-profit purposes.

Salmon enhancement proposals that would increase fish stocks in the stream channels will require the development of supporting storage to maintain required low flow. All the requirements noted for storage development shall be required for conservation development where applicable.

6.8 Allocation Plan Revision

The Outer Gulf Islands Water Allocation Plan should be reviewed and updated on or before February 2005.

References

Islands Trust. Galiano Island Official Community Plan. 1995.

Islands Trust. North Pender Island Official Community Plan. 1993.

Mordaunt, B. A Review of Groundwater Conditions on Galiano Island. Ministry of Environment. 1983.

Sweet, Arthur F. Islands in Trust. Oolichan Books, Lantzville, B.C. 1988.

APPENDIX A

Saltspring Island-Ganges & Vesuvius
Mayne & Pender Islands
1951-1980

Environment Canada
Atmospheric Environment Service

6 km

BRITISH COLUMBIA/COLOMBIE-BRITANNIQUE

SALT SPRING ISLAND
48° 51'N 123° 30'W 73 m

	JAN JAN	FEB FEV	MAR MAR	APR AVR	MAY MAI	JUN JUIN	JUL JUIL	AUG AOÛT	SEP SEPT	OCT OCT	NOV NOV	DEC DÉC	YEAR ANNÉE	CODE CODE	
Daily Maximum Temperature	5.6	7.9	9.2	12.9	16.8	19.3	22.3	21.9	19.5	13.9	9.0	6.5	13.7	2	Température Maximale Quotidienne
Daily Minimum Temperature	0.2	1.8	2.0	4.2	7.2	9.8	11.7	11.7	10.1	6.6	3.3	1.5	5.8	2	Température Minimale Quotidienne
Daily Temperature	**2.9**	**4.8**	**5.6**	**8.6**	**12.0**	**14.6**	**17.0**	**16.9**	**14.8**	**10.3**	**6.2**	**4.0**	**9.8**	**2**	**Température Quotidienne**
Standard Deviation, Daily Temperature	1.7	1.5	1.2	0.9	1.2	1.5	1.3	1.3	1.2	1.1	1.3	1.4	0.7	2	Écart Type de la Température Quotidienne
Extreme Maximum Temperature	14.4	17.2	20.6	27.8	31.7	35.0	38.3	35.6	31.7	26.1	18.9	14.4	38.3		Température Maximale Extrême
Years of Record	68	67	67	67	67	67	66	66	66	66	68	67			Années de Relèves
Extreme Minimum Temperature	−15.0	−15.0	−10.0	−5.6	−0.6	0.6	3.9	3.9	−0.6	−6.7	−13.3	−14.4	−15.0		Température Minimale Extrême
Years of Record	68	67	67	67	67	67	65	65	66	66	67	67			Années de Relèves
Rainfall	159.0	99.9	94.8	49.4	36.8	34.2	23.5	33.3	44.1	97.9	146.4	170.9	990.2	2	Chutes de Pluie
Snowfall	31.8	9.7	7.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	3.2	22.9	75.0	2	Chutes de Neige
Total Precipitation	**190.8**	**109.6**	**101.9**	**49.7**	**36.8**	**34.2**	**23.5**	**33.3**	**44.1**	**97.9**	**149.6**	**193.8**	**1065.2**	**2**	**Précipitations Totales**
Standard Deviation, Total Precipitation	85.2	45.7	42.5	26.2	17.1	19.8	17.8	32.4	30.3	62.9	69.3	51.9	148.8	2	Écart Type des Précipitations Totales
Greatest Rainfall in 24 hours	93.2	52.8	40.1	50.8	46.5	40.1	40.1	78.5	59.9	53.5	85.1	79.8	93.2		Chute de Pluie Record en 24 heures
Years of Record	73	73	73	73	74	74	73	72	72	73	73	73			Années de Relèves
Greatest Snowfall in 24 hours	52.1	57.2	35.6	3.8	0.0	0.0	0.0	0.0	0.0	2.0	36.8	47.0	57.2		Chute de Neige Record en 24 heures
Years of Record	74	73	73	74	74	74	73	72	72	73	74	74			Années de Relèves
Greatest Precipitation in 24 hours	93.2	57.2	40.1	50.8	46.5	40.1	40.1	78.5	59.9	53.5	85.1	79.8	93.2		Précipitation Record en 24 heures
Years of Record	72	73	73	73	74	74	73	72	72	73	73	73			Années de Relèves
Days with Rain	17	14	14	12	9	9	6	7	8	14	16	18	144	2	Jours de Pluie
Days with Snow	4	1	1	*	0	0	0	0	0	0	*	2	8	2	Jours de Neige
Days with Precipitation	19	15	15	12	9	9	6	7	8	14	16	19	149	2	Jours de Précipitation

SALT SPRING I VESUVIUS
48° 53'N 123° 34'W 7 m

Daily Maximum Temperature	5.8	8.1	9.7	13.1	17.2	19.8	22.9	22.3	19.2	14.0	8.9	7.0	14.0	8	Température Maximale Quotidienne
Daily Minimum Temperature	0.6	1.8	2.2	4.4	7.7	10.3	12.0	12.0	9.7	6.6	3.2	2.0	6.0	8	Température Minimale Quotidienne
Daily Temperature	**3.3**	**4.9**	**6.0**	**8.8**	**12.5**	**15.0**	**17.3**	**17.2**	**14.5**	**10.4**	**6.1**	**4.6**	**10.1**	**8**	**Température Quotidienne**
Standard Deviation, Daily Temperature	1.7	1.4	0.9	0.7	0.8	1.2	1.0	1.2	1.3	1.2	1.8	1.5	0.5	4	Écart Type de la Température Quotidienne
Extreme Maximum Temperature	15.0	16.7	17.2	23.3	27.8	32.2	32.2	33.9	28.9	23.3	15.6	13.9	33.9		Température Maximale Extrême
Years of Record	18	19	18	19	20	19	19	19	19	19	20	19			Années de Relèves
Extreme Minimum Temperature	−12.8	−10.6	−6.1	−1.7	0.0	5.6	6.7	6.1	0.0	−2.2	−15.6	−14.4	−15.6		Température Minimale Extrême
Years of Record	18	18	18	19	20	19	19	19	19	19	20	19			Années de Relèves
Rainfall	135.6	93.7	78.8	46.3	32.1	31.5	16.7	28.1	40.5	83.0	130.6	153.6	870.5	8	Chutes de Pluie
Snowfall	14.2	4.8	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	11.2	34.8	8	Chutes de Neige
Total Precipitation	**151.4**	**100.0**	**82.5**	**46.3**	**32.1**	**31.5**	**16.7**	**28.1**	**40.5**	**83.0**	**132.5**	**164.6**	**908.8**	**8**	**Précipitations Totales**
Standard Deviation, Total Precipitation	51.7	45.9	47.1	26.8	13.7	19.3	14.6	19.8	26.5	43.0	55.5	48.6	143.8	4	Écart Type des Précipitations Totales
Greatest Rainfall in 24 hours	80.3	47.0	37.3	53.1	26.4	23.4	17.3	29.7	25.7	52.6	87.1	56.6	87.1		Chute de Pluie Record en 24 heures
Years of Record	19	19	19	20	20	19	18	19	19	18	20	19			Années de Relèves
Greatest Snowfall in 24 hours	31.8	21.6	27.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.4	33.0	33.0		Chute de Neige Record en 24 heures
Years of Record	19	19	19	20	20	19	19	19	19	19	20	19			Années de Relèves
Greatest Precipitation in 24 hours	80.3	47.0	37.3	53.1	26.4	23.4	17.3	29.7	25.7	52.6	87.1	52.7	87.1		Précipitation Record en 24 heures
Years of Record	19	19	19	20	20	19	18	19	19	18	20	19			Années de Relèves
Days with Rain	17	14	15	11	8	8	5	7	9	13	16	18	142	8	Jours de Pluie
Days with Snow	3	1	1	0	0	0	0	0	0	0	1	2	8	8	Jours de Neige
Days with Precipitation	19	15	15	11	9	8	5	7	9	13	17	19	147	8	Jours de Précipitation

MAYNE ISLAND
48° 50'N 123° 16'W 30 m

Daily Maximum Temperature														Température Maximale Quotidienne
Daily Minimum Temperature														Température Minimale Quotidienne
Daily Temperature														**Température Quotidienne**
Standard Deviation, Daily Temperature														Écart Type de la Température Quotidienne
Extreme Maximum Temperature														Température Maximale Extrême
Years of Record														Années de Relèves
Extreme Minimum Temperature														Température Minimale Extrême
Years of Record														Années de Relèves
Rainfall	112.4	76.9	58.3	36.4	30.1	30.4	23.0	32.3	39.7	78.3	116.0	120.4	754.2	8 Chutes de Pluie
Snowfall	11.5	4.9	1.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	2.0	9.7	30.0	8 Chutes de Neige
Total Precipitation	**122.6**	**82.0**	**62.3**	**36.8**	**30.1**	**30.4**	**23.0**	**32.3**	**39.7**	**78.3**	**118.5**	**131.6**	**787.4**	**8 Précipitations Totales**
Standard Deviation, Total Precipitation	44.8	32.5	35.0	19.6	14.5	27.7	13.2	32.2	25.0	51.8	62.4	52.7	126.8	5 Écart Type des Précipitations Totales
Greatest Rainfall in 24 hours	33.3	41.4	34.8	20.1	19.8	26.5	20.3	72.1	25.1	58.9	45.0	55.4	72.1	Chute de Pluie Record en 24 heures
Years of Record	10	10	10	11	11	11	11	11	11	11	10	11		Années de Relèves
Greatest Snowfall in 24 hours	14.5	16.3	4.6	0.0	0.0	0.0	0.0	0.0	0.0	T	9.7	16.5	16.5	Chute de Neige Record en 24 heures
Years of Record	10	10	10	11	11	11	11	11	11	11	11	11		Années de Relèves
Greatest Precipitation in 24 hours	33.3	41.4	34.8	20.1	19.8	26.5	20.3	72.1	25.1	58.9	45.0	55.4	72.1	Précipitation Record en 24 heures
Years of Record	10	10	10	11	11	11	11	11	11	11	10	11		Années de Relèves
Days with Rain	17	14	14	10	10	8	5	6	8	12	17	18	139	8 Jours de Pluie
Days with Snow	3	1	1	0	0	0	0	0	0	0	0	2	7	8 Jours de Neige
Days with Precipitation	18	15	15	10	10	8	5	6	8	12	17	19	143	8 Jours de Précipitation

PENDER ISLAND
48° 49'N 123° 17'W 15 m

Daily Maximum Temperature														Température Maximale Quotidienne
Daily Minimum Temperature														Température Minimale Quotidienne
Daily Temperature														Température Quotidienne
Standard Deviation, Daily Temperature														Écart Type de la Température Quotidienne
Extreme Maximum Temperature														Température Maximale Extrême
Years of Record														Années de Relèves
Extreme Minimum Temperature														Température Minimale Extrême
Years of Record														Années de Relèves
Rainfall	114.2	83.1	65.0	37.3	29.5	29.8	16.6	27.2	37.9	76.0	113.5	133.0	753.1	8	Chutes de Pluie
Snowfall	11.4	3.4	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	7.0	25.4	8	Chutes de Neige
Total Precipitation	**126.3**	**84.9**	**68.2**	**37.3**	**29.5**	**29.8**	**16.6**	**27.2**	**37.9**	**76.0**	**113.5**	**143.2**	**790.7**	**8**	**Précipitations Totales**
Standard Deviation, Total Precipitation	67.8	41.3	29.4	16.7	15.2	26.0	16.1	21.6	23.9	49.1	64.0	41.7	60.1	5	Écart Type des Précipitations Totales
Greatest Rainfall in 24 hours	72.4	51.1	31.5	31.2	36.8	32.8	30.5	33.3	30.7	51.1	76.5	63.5	76.5		Chute de Pluie Record en 24 heures
Years of Record	38	38	40	39	39	40	40	40	41	37	39	38			Années de Relèves
Greatest Snowfall in 24 hours	40.6	27.9	15.2	T	0.0	0.0	0.0	0.0	0.0	0.0	25.4	25.4	40.6		Chute de Neige Record en 24 heures
Years of Record	37	40	41	40	39	40	40	40	41	38	39	40			Années de Relèves
Greatest Precipitation in 24 hours	72.4	51.1	31.5	31.2	36.8	32.8	30.5	33.3	30.7	51.1	76.5	63.5	76.5		Précipitation Record en 24 heures
Years of Record	38	39	40	39	39	40	40	40	41	37	39	38			Années de Relèves
Days with Rain	14	11	11	9	7	6	4	6	7	11	14	15	115	8	Jours de Pluie
Days with Snow	2	1	0	0	0	0	0	0	0	0	0	1	4	8	Jours de Neige
Days with Precipitation	15	12	11	9	7	6	4	6	7	11	15	16	119	8	Jours de Précipitation

APPENDIX B

Water Survey of Canada
Mean Monthly and Annual Discharges
and
7-day Low Flows

Cusheon Creek-Saltspring Island

CUSHEON CREEK (08HA026) MEAN MONTHLY DISCHARGE m^3/sec													
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN ANNUAL
1970				0.084	0.026	0.002	0	0	0				
1971				0.098	0.016	0.005	0.001	0	0				
1976									0	0.001	0.002	0.004	
1977	0.066	0.08	0.409	0.052	0.01	0.002	0	0	0.001	0.001	0.051	0.441	0.094
1978	0.376	0.275	0.151	0.083	0.033	0.003	0.001	0	0.001	0	0.001	0.026	0.078
1979	0.034	0.366	0.238	0.048	0.015	0.001	0	0	0	0	0.001	0.43	0.093
1980	0.449	0.464	0.329	0.115	0.028	0.011	0.008	0.001	0.001	0	0.111	0.587	0.175
1981	0.238	0.553	0.152	0.163	0.048	0.019	0.003	0	0	0.001	0.198	0.554	0.158
1982	0.687	0.462	0.202	0.066	0.019	0.002	0.001	0	0	0.001	0.001	0.263	0.141
1983	0.358	0.588	0.316	0.101	0.016	0.002	0.001	0					
1984			0.283	0.094	0.121	0.048	0.006	0	0	0.001	0.237	0.482	
1985	0.156	0.245	0.142	0.113	0.043	0.01	0	0	0	0	0.001	0.039	0.061
1986	0.402	0.45	0.248	0.107	0.071	0.014	0.001	0	0	0	0.02	0.147	0.12
1987	0.302	0.318	0.261	0.05	0.016	0.002	0.001	0.001	0	0	0	0.103	0.087
1988	0.303	0.08	0.147	0.169	0.04	0.011	0.003	0.001	0.001	0.001	0.154	0.329	0.104
1989	0.352	0.21	0.335	0.123	0.021	0.005	0.001	0	0	0	0.001	0.051	0.091
1990	0.273	0.44	0.162	0.061	0.042	0.035	0.001	0.001	0.001	0	0.166	0.59	0.146
1991	0.417	0.553	0.269	0.193	0.045	0.008	0.001	0.002	0.003	0.001	0.081	0.189	0.144
1992	0.557	0.637	0.117	0.035	0.034	0.004	0.002	0.001	0	0	0.03	0.102	0.125
1993	0.367	0.123	0.226	0.116	0.062	0.017	0.004	0.001	0.002	0.002	0.002	0.094	0.085
MEAN	0.334	0.365	0.235	0.098	0.037	0.011	0.002	0.000	0.001	0.001	0.062	0.261	0.113
%of MAD	294	322	207	86.8	32.7	9.3	1.6	0.4	0.5	0.5	54.8	230	100

ESTIMATE OF CUSHEON LAKE INFLOW, CORRECTING FOR LAKE STORAGE (m^3/second)											
JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC
0.322	0.349	0.221	0.097	0.034	0.011	0.000	0.000	0.000	0.000	0.082	0.287

CUSHEON CREEK (08HA026) 7-Day Average Low Flow (m^3/sec)				
	Period: Apr 1- Sept 30		Period: Jan 1- Dec 31	
YEAR	Date of Occurrence	7-Day Average m^3/sec	Date of Occurrence	7-Day Average m^3/sec
1970	6/22/70	0	6/22/70	0
1971	7/25/71	0	7/25/71	0
1976	8/30/76	0	8/30/76	0
1977	7/13/77	0	7/13/77	0
1978	7/22/78	0	7/22/78	0
1979	7/16/79	0	7/16/79	0
1980	9/21/80	0	9/21/80	0
1981	8/13/81	0	8/13/81	0
1982	8/07/82	0	8/07/82	0
1983	8/01/83	0	8/01/83	0
1984	8/18/84	0	8/18/84	0
1985	7/10/85	0	7/10/85	0
1986	8/06/86	0	8/06/86	0
1987	9/14/87	0	9/14/87	0
1988	7/30/88	0.001	7/30/88	0.001
1989	7/29/89	0	7/29/89	0
1990	7/08/90	0.001	10/04/90	0
1991	7/19/91	0.001	7/19/91	0.001
1992	9/17/92	0.000	9/17/92	0.000
1993	8/07/93	0.001	8/07/93	0.001
	MEAN	0.0002	MEAN	0.0002

APPENDIX C

Miscellaneous Flow Measurements

Miscellaneous Flow Measurements					
Stream	**Location**	**Date**	**Method***	**Flow**	**Litres/ sec.**
Coulson Creek	Trib. to Unnamed Creek-ocean	09/11/82	-	0	0
Georgeson Creek	Active Pass Road culvert	04/18/85	BS	5,280 gpd	0.3
Georgeson Creek	Active Pass Road culvert	08/22/85	-	0	0
Georgeson Creek	Active Pass Road culvert	10/31/85	BS	2,800 gpd	0.15
Craddock Spring	Trib. to Weston Creek	09/05/69	-	0	0
Margaret Brook	Trib. to sea	09/27/73	-	0	0
Shingle Cr., Buck Lk.	Trib. to sea	10/11/67	-	0	0

*BS= Bucket and Stopwatch

APPENDIX D

Licensed Water Demand by Purpose

LICENCE NUMBER	FILE NUMBER	SOURCE	QUANTITY/ UNIT	LITRES/ SECOND	DEMAND (dam^3/year)
GALIANO ISLAND					
Domestic Purpose[o]					
C037072	0296842	Brammall Spring	1,000 gpd	0.05	
F015134	0175791	Dalrymple Spring	500 gpd	0.03	
C030366	0262790	Farrell Spring	500 gpd	0.03	
C034804	0285292	Finlay Brook	500 gpd	0.03	
C037292	0222417	Finlay Brook	4,500 gpd	0.24	
C037294	0285146	Finlay Brook	500 gpd	0.03	
C028801	0253054	Georgeson Creek	500 gpd	0.03	
F021493	0224391	Georgeson Creek	500 gpd	0.03	
F021515	0244255	Greig Creek	500 gpd	0.03	
F021516	0244256	Greig Creek	500 gpd	0.03	
C028692	0251567	Grimmer Creek	500 gpd	0.03	
C072287	1001158	Grimmer Creek	500 gpd	0.03	
F015237	0171647	Morgan Creek	500 gpd	0.03	
C018027	0167557	Murcheson Creek	1,000 gpd	0.05	
C021704	0200924	Murcheson Creek	1,000 gpd	0.05	
F052334	0270351	Murcheson Creek	500 gpd	0.03	
C023050	0210765	Pochin Spring	500 gpd	0.03	
C105537	1001620	Pottinger Spring	500 gpd	0.03	
C028082	0247528	Robbins Spring	500 gpd	0.03	
F015284	0172829	Sater Spring	2,000 gpd	0.11	
F044344	0285025	Scarrow Spring	1,000 gpd	0.05	
C058557	0368726	Spotlight Creek	500 gpd	0.03	
C106042	0221011	Stemo Spring	150 gpd	0.01	
C057660	0369221	Stockade Creek	500 gpd	0.03	
C105609	1001642	Tweeden Creek	500 gpd	0.03	
		Sub-total	**19,650 gpd**	**1.10**	**16.30**
Industrial Purpose (Fire Protection)[oo]					
C107779	1001756	Galt Swamp	3 acft	0.48	
		Sub-total	**3 acft**	**0.48**	**3.70**
Industrial Purpose (Stockwatering)[oo]					
C059667	0370103	Pirart Brook	200 gpd	0.01	
		Sub-total	**200 gpd**	**0.01**	**0.08**
Industrial Purpose (Watering)[oo]					
C064053	0270107	Putter Brook	10 acft	1.59	12.34
		Sub-total	**10 acft**	**1.59**	**12.34**
Irrigation Purpose[oo]					
C034713	0285025	Davidson Brook	10 acft	1.59	
C037605	0300357	Finlay Brook	2 acft	0.32	

LICENCE NUMBER	FILE NUMBER	SOURCE	QUANTITY/ UNIT	LITRES/ SECOND	DEMAND (dam^3/year)
C049245	0330857	Finlay Lake	0.25 acft	0.04	
C054056	0340882	Fish Pond	15 acft	2.38	
C054056	0340882	Fishbein Pond	15 acft	2.38	
C064058	0197006	Jack Creek	0.66 acft	0.10	
C102558	1001478	McDowell Brook	0.5 acft	0.08	
C021704	0200924	Murcheson Creek	20 acft	3.17	
C059667	0370103	Pirart Brook	5.2 acft	0.83	
		Sub-total	**68.61 acft**	**10.89**	**84.66**
Storage Purpose[oo]					
C037293	0222417	Finlay Brook	3.6 acft	0.57	4.44
C037295	0285146	Finlay Brook	0.4 acft	0.06	0.49
C037606	0300357	Finlay Brook	2 acft	0.32	2.47
C049246	0330857	Finlay Brook	0.25 acft	0.04	0.31
C054057	0340882	Fish Pond	15 acft	2.38	18.51
C054057	0340882	Fishbein Pond	15 acft	2.38	18.51
C107779	1001756	Galt Swamp	3 acft	0.48	3.70
C072287	1001158	Grimmer Creek	0.33 acft	0.05	0.41
C059668	0370103	Pirart Brook	5.5 acft	0.87	6.79
		Sub-total	**45.08 acft**	**-7.15**	**55.63**
Land Improvement Purpose					
C101581	1001446	Crabtree Swamp	0.4 acft	0.06	
C059666	0370102	Jack Creek	0.2 acft	0.03	
C102558	1001478	McDowell Brook	10.5 acft	1.67	
		Sub-total	**11.10 acft**	**1.76**	**13.70**
Conservation Purpose					
C110682	1000490	Georgeson Creek	0 total flow	0	0
		Sub-total	**0 total flow**	**0**	**0**
Waterworks Purpose[o]					
C034800	0273905	Lindsay Springs	3,000 gpd	0.16	
C034801	0273905	Trinco Spring	3,000 gpd	0.16	
		Sub-total	**6,000 gpd**	**0.32**	**4.98**
		GALIANO ISLAND TOTAL	**-**	**16.15**	**191.39**
MAYNE ISLAND					
Domestic Purpose[o]					
C037602	0300219	Bellamy Spring	500 gpd	0.03	
F060615	0235985	Bennett Spring No. 2	500 gpd	0.03	
C107425	0277281	Cullison Brook	500 gpd	0.03	
C107426	1001451	Cullison Brook	500 gpd	0.03	

LICENCE NUMBER	FILE NUMBER	SOURCE	QUANTITY/ UNIT	LITRES/ SECOND	DEMAND (dam^3/year)
C041472	0316568	Cullison Springs	750 gpd	0.04	
C062626	0316569	Cullison Springs	500 gpd	0.03	
F039421	0256058	Cullison Springs	500 gpd	0.03	
C026430	0235061	Deacon Creek	1,000 gpd	0.05	
C052832	0329482	Dundas Spring	500 gpd	0.03	
F052487	0281338	Flick Creek	500 gpd	0.03	
C034394	0281210	Foye Spring	500 gpd	0.03	
C034556	0281652	Hunt Brook	500 gpd	0.03	
C028285	0249274	John Spring	1,000 gpd	0.05	
C031419	0269078	Mary Spring	500 gpd	0.03	
F015238	0161528	Norminton Spring	500 gpd	0.03	
C046266	0329996	Piggott Spring	125 gpd	0.01	
C046267	0250744	Piggott Spring	375 gpd	0.02	
F021552	0261503	Piggott Spring	500 gpd	0.03	
F021480	0258650	Tyrwhitt-Drake Spring	500 gpd	0.03	
		Sub-total	**10,250 gpd**	**0.59**	**8.50**
Irrigation Purpose[oo]					
C028393	0250384	Aitken Springs	5 acft	0.79	
C034556	0281652	Hunt Brook	2.5 acft	0.40	
C055737	0366433	Village Bay Creek	30 AF	4.76	
		Sub-total	**37.5 acft**	**5.95**	**46.28**
Storage Purpose[oo]					
C059679	0366644	Goodall Spring No. 1,2,3	13.5 acft	2.14	16.66
C070323	1000964	Hunt Brook	2.5 acft	0.40	3.09
C055738	0366433	Village Bay Creek	30 acft	4.76	37.02
		Sub-total	**46 acft**	**-7.3**	**56.76**
Land Improvement Purpose					
C072282	1001136	Village Bay Creek	0.9 acft	0.14	1.11
		Sub-total	**0.9 acft**	**0.14**	**1.11**
		MAYNE ISLAND TOTAL	**-**	**6.68**	**112.65**
NORTH PENDER ISLAND					
Domestic Purpose[o]					
F047429	0222431	Active Spring	500 gpd	0.03	
F021494	0261247	Allan Spring	1,000 gpd	0.05	
C045304	0317419	Bayens Spring	500 gpd	0.03	
C034238	0281439	Brackett Pond	3,000 gpd	0.16	
C058486	0368373	Coulson Creek	500 gpd	0.03	
F047430	0290573	Grimes Spring	500 gpd	0.03	

LICENCE NUMBER	FILE NUMBER	SOURCE	QUANTITY/ UNIT	LITRES/ SECOND	DEMAND (dam^3/year)
C101206	1001355	Grimmer Bay Creek	500 gpd	0.03	
C101233	1001357	Grimmer Bay Creek	500 gpd	0.03	
C052448	0364161	Hope Spring	1,000 gpd	0.05	
C058753	0368057	Mitchell Pond	1,000 gpd	0.05	
C062085	0178124	Roe Lake	500 gpd	0.03	
C058485	0369947	Willey Spring	500 gpd	0.03	
		Sub-total	**10,000 gpd**	**0.53**	**8.30**
Industrial Purpose (Ponds)[oo]					
C064070	1000581	Jose Brook	10,000 gpd	0.53	
		Sub-total	**10,000 gpd**	**0.53**	**8.30**
Irrigation Purpose[oo]					
C104412	1001554	Bryant Creek	0.5 acft	0.08	
C101073	1001178	Gee Brook	0.6 acft	0.10	
C052448	0364161	Hope Spring	9.1 acft	1.44	
C042507	0317119	Margaret Brook	15 acft	2.38	
C058753	0368057	Mitchell Pond	14 acft	2.22	
C104323	1001548	Standen Creek	10.6 acft	1.68	
		Sub-total	**49.8 acft**	**7.90**	**61.45**
Storage Purpose[oo]					
C104412	1001554	Bryant Creek	0.5 acft	0.08	
C058487	0368373	Coulson Creek	0.67 acft	0.11	
C101073	1001178	Gee Brook	0.6 acft	0.10	
C101206	1001355	Grimmer Bay Creek	0.25 acft	0.04	
C101233	1001357	Grimmer Bay Creek	0.25 acft	0.04	
C052449	0364161	Hope Spring	10.5 acft	1.67	
C042508	0317119	Margaret Brook	15 acft	2.38	
C058754	0368057	Mitchell Pond	15.3 acft	2.43	
C060492	0273806	Pender Lake	60 acft	9.52	
C060490	0285235	Shingle Creek	143 acft	22.69	
C104323	1001548	Standen Creek	10.6 acft	1.68	
		Sub-total	**256.67 acft**	**-40.74**	**316.73**
Land Improvement Purpose					
C101067	1001147	Bradley Brook	2.6 acft	0.41	
C101064	1001027	Coulson Creek	1.25 acft	0.20	
C060488	0254162	Pender Lake	190 acft	30.15	
C060493	0273976	Shingle Creek	435 acft	69.03	
		Sub-total	**628.85 acft**	**99.79**	**776.00**
Waterworks Purpose[o]					

LICENCE NUMBER	FILE NUMBER	SOURCE	QUANTITY/ UNIT	LITRES/ SECOND	DEMAND (dam^3/year)
C060491	0273806	Pender Lake	100,000 gpd	5.26	
C060489	0285235	Shingle Creek	380,000 gpd	19.99	
		Sub-total	**480,000 gpd**	**25.25**	**398.23**
		NORTH PENDER ISLAND TOTAL		**93.26**	**1,569.01**
SATURNA ISLAND					
Domestic Purpose[o]					
C017332	0161569	Lyall Creek	2,000 gpd	0.11	
C062341	0323967	MacDonald Creek	500 gpd	0.03	
F018079	0217173	Millicent Spring	1,500 gpd	0.08	
C059017	0367724	Money Creek	2,500 gpd	0.13	
F015246	0184013	South Lyall Creek	500 gpd	0.03	
C024127	0218110	Stafford Spring	3,000 gpd	0.16	
		Sub-total	**10,000 gpd**	**0.54**	**8.30**
Irrigation Purpose[oo]					
C058645	0369234	MacDonald Creek	15 acft	2.38	
C059017	0367724	Money Creek	6 acft	0.95	
		Sub-total	**21 acft**	**3.33**	**25.91**
Storage Purpose[oo]					
C058646	0369234	MacDonald Creek	15 acft	2.38	
C059018	0367724	Money Creek	7 acft	1.11	
C054808	0364945	Money Lake No. 1	23.5 acft	3.73	
C061500	1000259	Money Lake No. 1	23.5 acft	3.73	
		Sub-total	**69 acft**	**-10.95**	**85.15**
Land Improvement Purpose					
C026480	0230589	Money Lake No. 1	10 acft	1.59	
C026481	0230589	Money Lake No. 2	15 acft	2.38	
		Sub-total	**25 acft**	**3.97**	**30.85**
Waterworks Purpose[o]					
C054807	0364945	Money Lake No. 1	13,700 gpd		
C061499	1000259	Money Lake No. 1	67,000 gpd		
		Sub-total	**80,700 gpd**	**4.25**	**66.95**
		SATURNA ISLAND TOTAL	**-**	**12.09**	**217.16**
SOUTH PENDER ISLAND					
Domestic Purpose[o]					
C035287	0285875	Craddock Spring	1,500 gpd	0.08	
F021517	0260160	Fowler Spring	500 gpd	0.03	
C042358	0317223	Greenburn Lake	1,000 gpd	0.05	
C052447	0330838	Gill Spring	600 gpd	0.32	

LICENCE NUMBER	FILE NUMBER	SOURCE	QUANTITY/ UNIT	LITRES/ SECOND	DEMAND (dam^3/year)
C101042	1000817	Greenburn Lake	500 gpd	0.03	
C101044	1000845	Greenburn Lake	500 gpd	0.03	
C107137	1001721	Henderson Swamp	500 gpd	0.03	
		Sub-total	**5,100 gpd**	**0.57**	**4.23**
Industrial Purpose (Enterprise)[oo]					
C047893	0323918	Greenburn Lake	50,000 gpd	2.63	
		Sub-total	**50,000 gpd**	**2.63**	**20.46**
Industrial Purpose (Fire Protection)[oo]					
C065776	1000773	Greenburn Lake	500 gpd	0.03	
		Sub-total	**500 gpd**	**0.03**	**0.20**
Irrigation Purpose[oo]					
C055240	0355486	Emerald Pond	2 acft	0.32	
C041936	0170676	Greenburn Lake	15 acft	2.38	
C041938	0317526	Greenburn Lake	15 acft	2.38	
C107137	1001721	Henderson Swamp	4.7 acft	0.75	
C058484	0368448	Lancelot Spring	0.25 acft	0.04	
		Sub-total	**36.95 acft**	**5.87**	**45.60**
Storage Purpose[oo]					
C055241	0355486	Emerald Pond	2 acft	0.32	
C041937	0170676	Greenburn Lake	15 acft	2.38	
C041939	0317526	Greenburn Lake	15 acft	2.38	
C047894	0328987	Greenburn Lake	25 acft	3.97	
C107137	1001721	Henderson Swamp	5 acft	0.79	
		Sub-total	**62 acft**	**-9.84**	**76.51**
Waterworks Purpose[o]					
C026600	0234973	Longe Springs	15,000 gpd	0.80	
		Sub-total	**15,000 gpd**	**0.80**	**12.44**
		SOUTH PENDER ISLAND TOTAL	**-**	**9.9**	**159.44**
		OUTER GULF ISLANDS TOTAL		**138.08**	**2,249.65**

[o] Based upon the assumption that the demands is the authorized maximum daily licensed divided by 2 to estimate the average demand and then multiplied by 365 days to determine the annual demand.

[oo] The rate (litres/second) is based on an estimated 90 day period demand assuming that storage, industrial and irrigation demands are totally withdrawn over the 90 day period.

APPENDIX E

Low Flow Licensed Water Demand by Drainage Area

DRAINAGE/ PURPOSE	LICENSED QUANTITY	LOW FLOW WATER DEMAND[o]	
		(litres/second)	(dam^3)
GALIANO ISLAND			
Murcheson Creek			
Domestic	3,500 gpd (max. day)	0.18	1.43
Irrigation	20.5 acft	3.25	25.30
Land Improvement	10.5 acft	**Non-Consumptive**	
	Total Consumption	**3.43**	**26.73**
Jack Creek			
Industrial	200 gpd	0.01	0.08
Irrigation	5.86 acft	0.93	7.23
Storage	5.5 acft	-0.87	-6.79
Land Improvement	0.2 acft	**Non-Consumptive**	
	Total Consumption	**0.07**	**0.52**
Putter Brook			
Industrial	10 acft	1.59	12.34
	Total Consumption	**1.59**	**12.34**
Greig Creek			
Domestic	1,000 gpd (max. day)	0.05	0.41
	Total Consumption	**0.05**	**0.41**
Georgeson Creek			
Domestic	1,500 gpd (max. day)	0.08	0.61
Conservation	0	0	0
	Total Consumption	**0.08**	**0.61**
Other Areas			
Domestic	13,650 gpd (max. day)	0.72	5.58
Industrial	3 acft	0.48	3.70
Irrigation	42.25 acft	6.71	52.14
Storage	39.58 acft	-6.28	-48.84
Land Improvement	0.4 acft	0.06	0.49
Waterworks	6,000 gpd	**Non-Consumptive**	
	Total Consumption	**1.69**	**13.07**
MAYNE ISLAND			
Hunt Brook			
Domestic	500 gpd (max. day)	0.03	0.20
Irrigation	2.5 acft	0.40	3.09
Storage	2.5 acft	-0.40	-3.09
	Total Consumption	**0.03**	**0.20**
Village Bay Creek			
Domestic	1,000 gpd (max. day)	0.05	0.41
Irrigation	35 acft	5.55	43.19
Storage	43.5 acft	-6.90	-53.68

DRAINAGE/ PURPOSE	LICENSED QUANTITY	LOW FLOW WATER DEMAND[o]	
		(litres/second)	(dam^3)
Land Improvement	0.9 acft	**Non-Consumptive**	
	Total Consumption	**-1.30**	**-10.08**
Deacon Creek			
Domestic	2,000 gpd (max. day)	0.11	0.82
	Total Consumption	**0.11**	**0.82**
Other Areas			
Domestic	6,750 gpd (max. day)	0.36	2.76
	Total Consumption	**0.36**	**2.76**
SATURNA ISLAND			
Lyall Creek			
Domestic	3,000 gpd (max. day)	0.16	1.23
Irrigation	15 acft	2.38	18.51
Storage	15 acft	-2.38	-18.51
	Total Consumption	**0.16**	**1.23**
Money Creek & Lake No.1			
Domestic	2,500 gpd (max. day)	0.13	1.02
Irrigation	6 acft	0.95	7.40
Storage	54 acft	-8.57	-66.64
Land Improvement	10 acft	**Non-Consumptive**	
Waterworks	80,700 gpd (max. day)	4.25	33.01
	Total Consumption	**-3.24**	**-25.21**
Money Lake No. 2			
Land Improvement	15 acft	**Non-Consumptive**	
	Total Consumption	**0**	**0**
Other Areas			
Domestic	4,500 gpd (max. day)	0.24	1.84
	Total Consumption	**0.24**	**1.84**
NORTH PENDER ISLAND			
Standen Creek			
Irrigation	10.6 acft	1.68	13.08
Storage	10.6 acft	-1.68	-13.08
	Total Consumption	**0**	**0**
Shingle Creek			
Storage	143 acft	-22.69	-176.46
Land Improvement	435 acft	**Non-Consumptive**	
Waterworks	380,000 gpd (max. day)	20.0	155.47
	Total Consumption	**-2.69**	**-20.99**
Pender Lake			

DRAINAGE/ PURPOSE	LICENSED QUANTITY	LOW FLOW WATER DEMAND[o]	
		(litres/second)	(dam^3)
Storage	60 acft	-9.52	-74.04
Land Improvement	190 acft	**Non-Consumptive**	
Waterworks	100,000 gpd (max. day)	5.26	40.91
	Total Consumption	**-4.26**	**-33.13**
Bryant Creek			
Irrigation	0.5 acft	0.08	0.62
Storage	0.5 acft	-0.08	-0.62
	Total Consumption	**0**	**0**
Roe Lake			
Domestic	500 gpd (max. day)	0.03	0.20
	Total Consumption	**0.03**	**0.20**
Other Areas			
Domestic	9,500 gpd (max. day)	0.50	3.89
Industrial	10,000 gpd (max. day)	0.53	4.09
Irrigation	38.70 acft	6.14	47.76
Storage	42.57 acft	-6.76	-52.53
Land Improvement	3.85 acft	**Non-Consumptive**	
	Total Consumption	**0.41**	**3.21**
SOUTH PENDER ISLAND			
Greenburn Lake			
Domestic	2,000 gpd (max. day)	0.11	0.82
Industrial	50,500 gpd (max. day)	2.66	20.66
Irrigation	30 acft	4.76	37.02
Storage	55 acft	-8.23	-67.87
	Total Consumption	**-0.70**	**-9.37**
Other Areas			
Domestic	3,100 gpd (max. day)	0.16	1.27
Irrigation	6.95 acft	1.10	8.58
Storage	7 acft	-1.11	-8.64
Waterworks	15,000 gpd (max. day)	0.80	6.14
	Total Consumption	**0.95**	**7.35**

[o] Based on an estimated 90 day period demand assuming that: irrigation and industrial demands are totally withdrawn over the 90 day period; domestic and municipal waterworks demand are the authorized licensed maximum daily for 90 days; storage balances demand, and therefore, it is a negative demand over the 90 days; land improvement is non-consumptive and therefore has no demand.

APPENDIX F

Pending Water Licence Applications

LICENCE NUMBER	FILE NUMBER	SOURCE	QUANTITY /UNITS	LITRES/ SECOND	DEMAND (dam^3/year)
MAYNE ISLAND					
Domestic Purpose[o]					
Z109223	1001818	McConnell Spring	500 gpd	0.03	
		Sub-total	**500 gpd**	**0.03**	**0.41**
		MAYNE ISLAND TOTAL	**-**	**0.03**	**0.41**
NORTH PENDER ISLAND					
Irrigation Purpose[oo]					
Z101090	1001141	Grimmer Bay Creek	28 acft	4.44	
Z101143	1001348	ZZ Lake (62244)	20 acft	3.17	
		Sub-total	**48 acft**	**7.61**	**59.23**
Land Improvement Purpose					
Z109231	1001819	Fowlie Creek	7.5 acft	1.19	
Z109506	1001836	Gardom Pond	10 acft	1.59	
Z109507	1001837	Gardom Pond	10 acft	1.59	
Z109510	1001838	Gardom Pond	10 acft	1.59	
Z109511	1001839	Gardom Pond	10 acft	1.59	
		Sub-total	**47.5 acft**	**7.55**	**58.62**
Industrial Purpose (Fish Culture)[oo]					
Z101143	1001348	ZZ Lake (62244)	0 total flow		
		Sub-total	**0 total flow**	**0**	**0**
Storage Purpose[oo]					
Z101090	1001141	Grimmer Bay Creek	22 acft	3.49	
Z101143	1001348	ZZ Lake (62244)	50 acft	0.64	
		Sub-total	**72 acft**	**11.43**	**88.85**
		NORTH PENDER ISLAND TOTAL	**-**	**26.59**	**206.70**
SATURNA ISLAND					
Domestic Purpose[o]					
Z109304	1001824	ZZ Spring (70549)	2,500 gpd	0.13	
		Sub-total	**2,500 gpd**	**0.13**	**2.07**
Irrigation Purpose[oo]					
Z108758	1001804	ZZ Creek (70111)	15 acft		
Z109304	1001824	ZZ Creek (70551)	12 acft	4.28	
		Sub-total	**27 acft**	**4.28**	**33.31**
Storage Purpose[oo]					
Z108758	1001804	ZZ Creek (70111)	15 acft		
Z109304	1001824	ZZ Creek (70551)	12 acft		
		Sub-total	**27 acft**	**4.28**	**33.31**
		SATURNA ISLAND TOTAL	**-**	**8.69**	**68.71**
OUTER GULF ISLANDS TOTAL			**-**	**35.31**	**275.82**

APPENDIX G

Fish Screening Requirements

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.

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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.

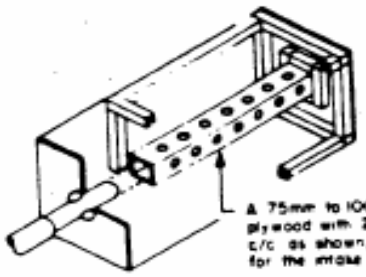
3. B.C. Ministry of Environment
   Water Management.

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

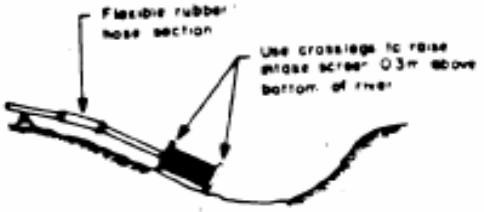
5. B.C. Ministry of Lands, Parks and Housing.

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

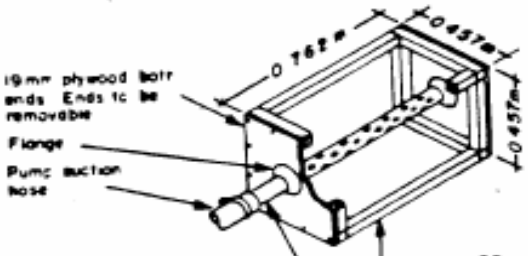
Revised January, 1986



A 75mm to 100mm square box of 19mm plywood with 25mm dia. holes at 75mm c/c as shown, may be substituted for the intake pipe below

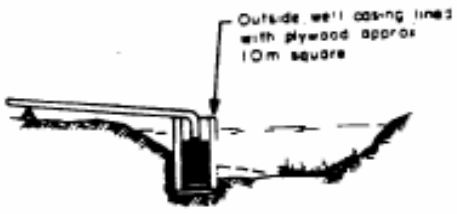


STANDARD INSTALLATION

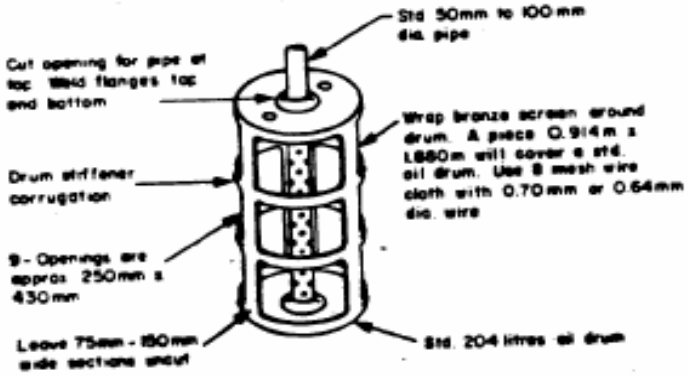


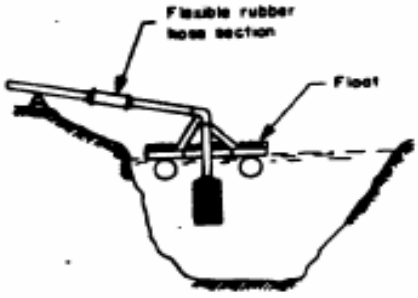
50mm - 100mm std pipe with the section inside the screen box perforated with 16mm dia holes at 50mm to 100mm c/c staggered

50mm x 50mm painted framing covered on 4 sides with bronze screen (wire cloth) stretched tight and fastened to the framing only. Plywood ends to be removable Use 8 mesh wire cloth with 0.70mm or 0.64mm dia. wire



INSTALLATION IN SHALLOW WATER MUDDY OVERGROWN BOTTOM





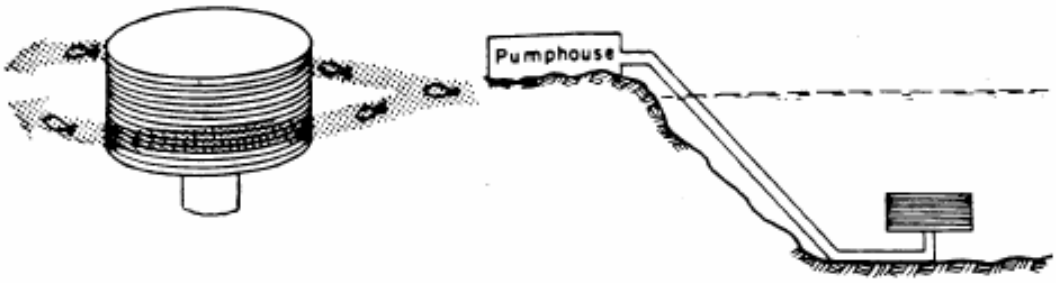
INSTALLATION IN DEEP WATER

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 [1cfs, 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).

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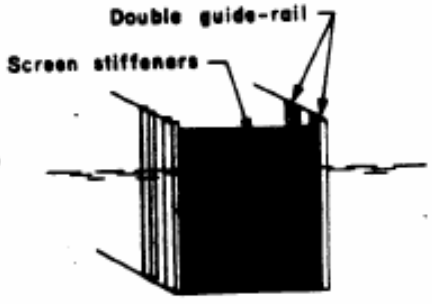
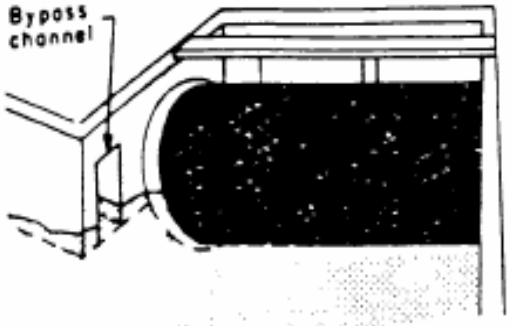
VERTICAL PANEL SCREENS

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.



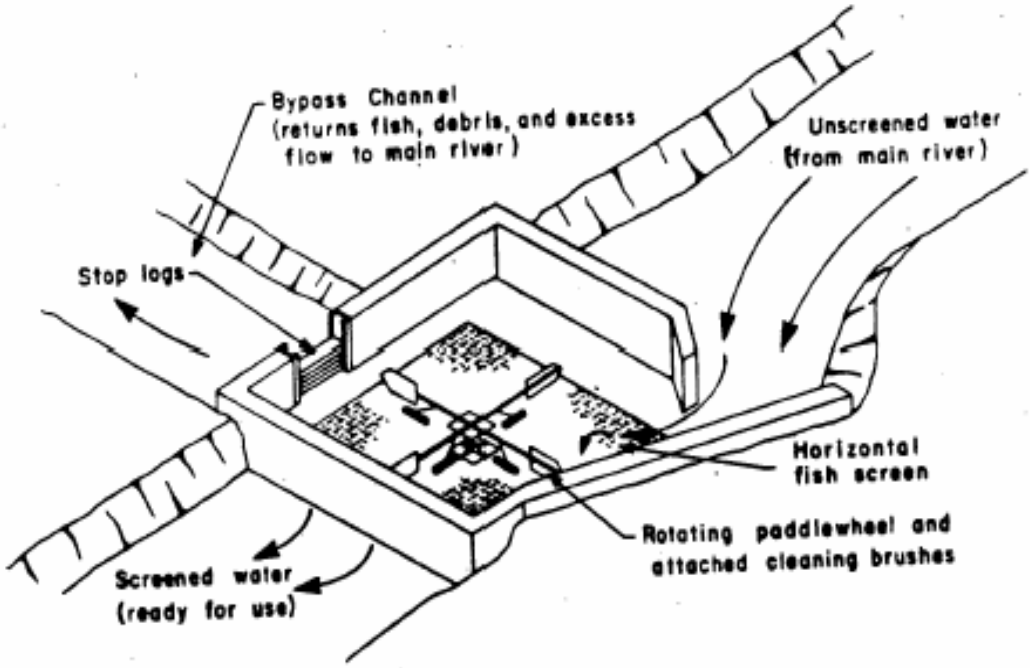
LARGE STATIONARY WATER INTAKE SCREENS

(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.

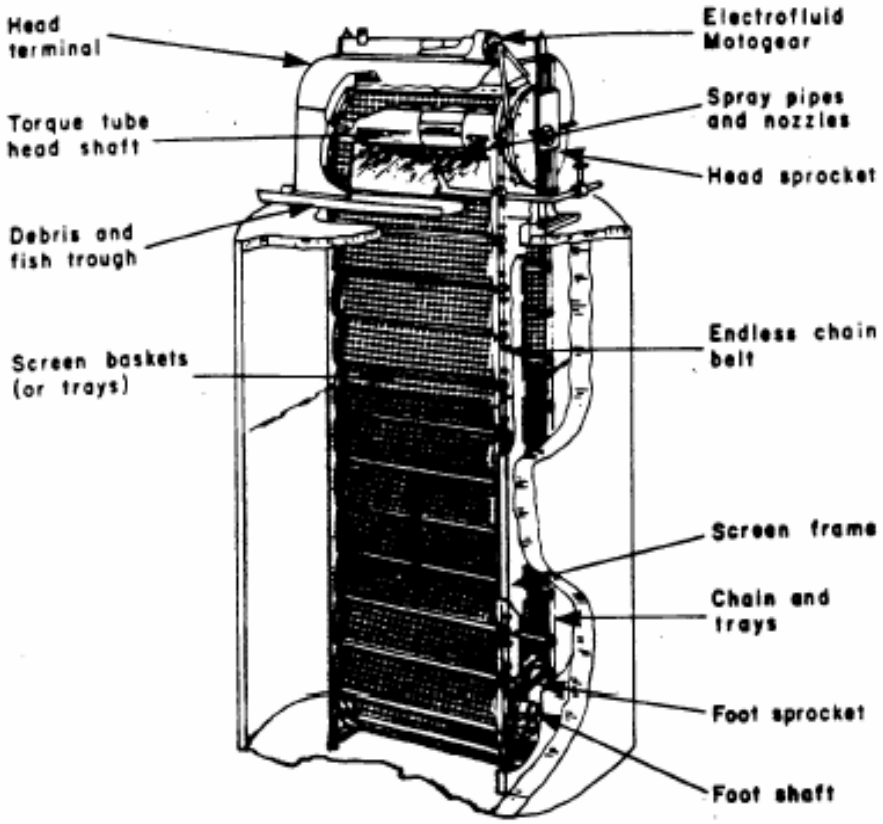


FINNIGAN SCREEN

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

- 8 -



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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