ABSTRACTS

OF

ENVIRONMENTAL INVESTIGATIONS
PROPOSED HIGH ROSS RESERVOIR IN CANADA

CITY OF SEATTLE
DEPARTMENT OF LIGHTING

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F. F. SLANEY & COMPANY LIMITED
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CLIMATE REPORT

ABSTRACT

Weather data from the Lower Skagit Valley in Canada were collected and analyzed. These data were an aid in understanding the distribution of wildlife and in assessing the recreational potential of various sites within the valley.

The Dominion Meteorology Branch recorded temperature and precipitation data within the proposed reservoir site during the period 1937 to 1955. These data provided a base line for comparing conditions measured during 1970-71-72 with long term averages.

Three recording hygrothermographs and numerous snow gauges were established in the lower valley in October 1970 to monitor climatic conditions throughout the Lower Skagit Valley. As in most inter-mountain valleys, the climatic patterns within the Skagit Valley are predictably variable. The high mountains, the narrow side valleys, the large lake, thermal winds and the varied exposures of side slopes combine to create a wide range of microclimates.

The area near the United States/Canada border is measurably warmer and drier than the area 10 miles to the north near the confluence of the Klesilkwa with the Skagit River. The snow pack on the valley floor near the north end of the Study Area is nearly double the snow pack at the south end.

During the winter, deer avoid even the shallowest snows of the valley floor and congregate mostly on the southwesterly slopes where snows are quickly dissipated by wind and sun.

ABSTRACT

First snows in the fall usually occur about the third week in November.

Although loggers operated throughout the winter of 1970-71 and 1971-72, the road into the Lower Skagit Valley is hazardous and deep snows in the valley restrict use by the public during the period mid-December to mid-April.

Snow melt begins during early March on exposed rocky outcrops of the lower south facing slopes throughout the valley, followed by the drawdown area of Ross Lake in early April, and gradually extends northward up the valley to the 26-Mile Bridge where patches of snow were found to persist under the forest cover until about mid-May.

The growth of grass commences about 10 days after the snow leaves the ground and follows the same northerly progression as the snow melt.

The spring months are characterized by warm days and cool nights. Summer months are usually hot and the water in the shallows of Ross Reservoir become sufficiently warm sites for swimming.

The influence of Ross Reservoir on the overall climate appears negligible. A microclimatic condition related to the water surface of Ross Lake, the dark-coloured, exposed drawdown area and the combined influence of wind and sun causes a rapid melt of snow and an early growth of grass along the fringes of the reservoir site. These areas attract the first deer to the lowlands each spring.

SOILS REPORT

ABSTRACT

The soil survey report presents information obtained during a reconnaissance soil survey of the Lower Canadian Skagit Valley.

In general, the soils of the Lower Skagit Valley are typical of those found in mountain valleys of southwestern British Columbia. Soils were formed primarily from materials originally deposited by glaciers. The glacial till has been reworked and redeposited by alluvial and colluvial forces to form deposits of distinctive and sorted composition. Soil development on these deposits is related to the ages of the deposits, the climatic and organic influences and to the distribution and movement of moisture through the deposits.

Mapping units (Soil Series) are a homogeneous combination of soil occurring on a distinctive land form comprised of a particular parent material and supporting particular plant communities. Soil development of each series was studied and classified according to the Canadian System of Soil Classification on the basis of their morphological, physical and chemical properties. Eight Soil Series and two Complexes were recognized in the Lower Skagit Valley as outlined in the following table:

Soil Series	Great Group	Parent Material	Texture
International	Regosol	Recent alluvial deposits	Gravelly sandy loam
Whitworth	Regosol	Recent alluvial floodplain	Silt loam
Ponderosa	Eutric Brunisol	Reworked alluvium	Gravelly sandy loam
St. Alice	Eutric Brunisol	Recent alluvial fans	Gravelly sandy loam
Shawatum	Gray Luvisol	Recent alluvial fans over outwash terrace	Silt over gravel
Silvertip	Humo-Ferric Podzol	Mixed till and colluvium	Stoney and gravelly sandy loam
Klesilkwa	Humo-Ferric Podzol	Outwash gravel terrace	Gravelly sandy loam
Nepopekum	Humo-Ferric Podzol	Alluvial and eroded alluvial fans	Gravelly sandy loam
Northeast Complex Southwest Complex		Glacial till, talus, colluvium, and bedrock outcrop	Stoney and gravelly sandy loam

Adverse soil texture, topography and climate make the valley generally unsuitable for most agricultural purposes.

The St. Alice deep phase, the Nepopekum gently sloping phase and the Whitworth series are imperfectly to poorly drained. Cottonwood and cedar are the dominant tree species on these soils. Capability of these soils to withstand recreational uses such as camping, picnicking and trails is severely limited by their poor drainage properties.

The Klesilkwa, Nepopekum steeply sloping phase, Northeast Complex and International soil series are all well or rapidly drained and are developed on gravelly and stoney materials. These series have moderate capability for forestry, supporting mostly Douglas fir, cedar and hemlock. These gravelly soils have high trafficability properties and are capable of sustaining heavy recreational use.

The capillary rise of water into the forest rooting zone is physically limited in most soils above the 1725-foot level. The Klesilkwa soils in the northern portion of the valley are formed on outwash terrace deposits, and are sufficiently stoney and gravelly to prevent further capillary influence than currently results from the presence of the Skagit River. The Nepopekum moderately to steeply sloping phase, the Northeast Complex and the International series are developed on coarse outwash and alluvial materials, thereby minimizing capillary effects.

The varied topography of the Northeast and Southwest Complexes supports a variety of forest communities. Drainage conditions are quite variable. With careful route location, hiking trails could be established through these units on soils with suitable drainage and trafficability properties.

The very steeply sloping Silvertip soils are difficult to manage. Severe erosional problems would probably result from logging or recreational activity.

The remaining soils on flat or gently sloping lands are easily managed for recreation or forestry.

Areas of soils suitable for developing meadows, ponds and other habitat developments occur both above and below elevation 1725 feet in the Lower Skagit Valley in Canada.

VEGETATION REPORT

ABSTRACT

Vegetation of the Lower Skagit Valley in Canada was studied and mapped to assess the quantity and quality of merchantable timber, the ecological and botanical significance of the plant communities, and the recreational and aesthetic aspects of the sites as a basis for predicting the consequences of creating the proposed High Ross Reservoir in Canada.

The proposed High Ross Reservoir site contains an estimated 11 million cubic feet of merchantable timber. The growth potential of the proposed reservoir site is about 60 cubic feet per acre per year on about 3,800 acres of productive forest land.

The area is managed by the B.C. Forest Service and is scheduled to be logged prior to development of the proposed reservoir. Logging in the lower valley commenced about 1947 and is active to this date. About 25 per cent of the forested area of the proposed reservoir site is committed for selective logging during the period 1971-72.

The plants of the Lower Skagit Valley are primarily coastal forest species. The valley lies within an ecotone and some species found here are more common to the forests east of the Cascade Mountains. All species occurring within the proposed High Ross Reservoir site also occur in other valleys both east and west of the reservoir site.

The vegetation communities are important as wildlife habitat. Projected decreases in some wildlife populations bear a direct relationship to their dependence on habitats that would be partially lost. Sufficient areas of suitable habitat occur above elevation 1725 feet to accommodate all species of animals that presently breed in the Lower Skagit Valley.

Logging operations beginning some 20 years ago created a mosaic of successional stages of plant growth in the proposed High Ross Reservoir site that was beneficial to the build-up of some wildlife populations. Much of the land has now reverted to coniferous forest. Current logging is concentrated in major tributaries along the slopes of the Skagit Valley above 1725 feet, particularly in the vicinity of the Klesilkwa River drainage. This logging will produce habitats favorable to deer, ruffed grouse and other animals which thrive in the early successional stages which follow logging disturbances. Concentrations of these wildlife species in the valley would tend to shift to these more productive habitats.

Ranching, logging and the reservoir development have contributed to the general mosaic of plant communities now present in the proposed reservoir site.

The presence of [redacted] rhododendron (Rhododendron macrophyllum) and an azonal stand of Ponderosa pine in a Coastal Forest Zone are an unusual occurrence in British Columbia with some scientific significance. Both the rhododendron and the Ponderosa pine are most abundant outside the limits of the proposed High Ross Reservoir site. Two ecological reserves have been established in the Lower Skagit Valley to preserve examples of these species. Both reserves lie above elevation 1725 feet.

The communities of rhododendron that are currently developed with observation trails are situated above elevation 1725 feet and would not be affected by developing High Ross Reservoir. Some of the most vigourous communities of rhododendron presently occur in a relatively inaccessible area on the west side of the Lower Skagit Valley. These would become highly visible from boats on High Ross Reservoir.

The presence of meadows in the valley is primarily the result of man's disturbance of the sites for agricultural purposes. New meadows could also be created by deliberate manipulation.

The wide diversity of plant material present in the valley is a good indicator of a stable ecological community. Such communities can withstand disturbances with minimum of harm.

DEER REPORT

ABSTRACT

Several herds of deer utilize various portions of the Lower Skagit Valley in Canada. The resident herds are predominantly black-tails and the major migratory herds are predominantly mule deer.

Except for about 12 deer that wintered along the banks of the Skagit River, the wintering herds, totalling some 230 to 300 animals, range between elevation 2000 and 3500 feet mostly on the eastern slopes of the valley.

As soon as the grasses and forbs on the drawdown area and adjacent meadows commence growth in the spring some of the herds wintering on the slopes both in the U.S. and in Canada descend to the valley floor to graze and browse these desirable meadows and adjacent brush lands.

A herd of about 360 deer utilize the lowland meadows near the U.S. - Canada border for a period of about 6 weeks before moving generally south and east to summer ranges. An estimated 50 deer utilized the north half of the Study Area during the spring of 1971. Most of the does leave the meadows in early June about two weeks prior to fawning.

The deer generally prefer the upland ranges during the summer. Of the estimated 100 deer which spend the summer in the Lower Skagit Valley a maximum of 50 of these animals utilize the proposed Reservoir Site. An unusual aspect of the deer utilizing the meadows was the high incidence (43 percent) of malformed fetuses found in four females. The significance of the malformations to the population is not known, but is thought to be an anomaly of sampling.

Reproductive rates of both the does utilizing the lowlands and the animals restricted to the slopes for spring range are similar to those of other populations of black-tailed and mule deer. Survival rates of both young and adult animals appear to be the key factor in regulating the populations of deer in the Skagit Valley.

The loss of the lowland meadows could be expected to reduce the herd by a maximum of 150 animals. However the other herds, particularly those in the north part of the Study Area, are able to find sufficient spring range above elevation 1725 feet. Further analysis of existing spring ranges combined with programs to create alternate meadow lands may reduce the projected losses to less than 50 animals.

The animals that are hunted in the fall do not appear to be the same animals that utilize the meadows in the spring. The loss of the logging roads within the reservoir site would reduce the accessibility of deer to hunters. The average sustained harvest is expected to decrease from a potential 40 animals per year to 25 animals per year with High Ross Reservoir.

Continuing studies are centered on monitoring the migration patterns of deer, checking fawn survival, measuring the amount and quality of existing spring range above elevation 1725 feet and developing alternate sources of spring range.

LARGE CARNIVOROUS AND FURBEARING ANIMALS

ABSTRACT

Large mammals including carnivores and furbearers were censused in a Two Part Study Area encompassing the Lower Skagit Valley in Canada.

The interrelationships of each species with its food supply, shelter and space requirements were investigated to provide a basis for assessing the probable effects of High Ross Reservoir.

The table below shows the estimated numbers of 13 resident large carnivores and furbearers censused in the lower Canadian Skagit Valley and the estimated numbers which would remain after construction of the proposed High Ross Dam.

	ESTIMATED POPULATIONS	
Species	Without High Ross	With High Ross
Coyote	13	6
Cougar	13-15	10-12
Bobcat	16-21	10-15
Raccoon	16-17	1-2
Marten	45-56	40-50
Mink	16-25	6-10
River Otter	7	2- 4
Beaver	160	25-35
Fox	2	1
Black Bear	25-50	10-20
Weasel	80-100	50-70
Muskrat	2-4	unknown
Spotted Skunk	1	unknown

All of the large carnivores and furbearers found in the proposed reservoir site are found elsewhere in the Skagit Valley, and in other areas of Southwestern British Columbia. No unusual distribution records or population dnesities were recorded.

Probable reductions are not commercially or economically significant. Among the furbearers, only beaver are trapped consistently in the Lower Skagit Valley. The potential yield from the trapline in the Lower Skagit Valley is approximately $1200 annually. Over the past seven years the actual yield has averaged about $275 per year. Both bear and cougar are hunted for sport but the harvest is light.

In terms of the Lower Skagit Valley the effects of the High Ross Dam will vary with each species. The following additional comments are necessary for three of the more important species.

Black Bear

While the number of black bear resident in the proposed reservoir site is probably about 10-15, the loss incurred by this species may be somewhat greater due to their use of bottomland for food in the spring and early summer.

Cougar

The number of cougar recorded in the Lower Skagit in 1971 is probably higher than in past years. The populations of cougar throughout B. C. appear to be currently at a high level. A total of three cougar appeared to be dependent on the reservoir site in 1970-71.

Beaver

The beaver population of the Lower Skagit Valley would be reduced by about 125. About 25-35 beavers would remain above 1725 feet elevation.

The number of beavers in the Lower Skagit is probably declining naturally due to forest succession which is eliminating deciduous species. Evidence suggests that the population was recently at least 25 percent higher.

The number of beavers lost may be reduced by developing new habitats near the outlet of streams.

SMALL MAMMALS REPORT

ABSTRACT

Small mammals were studied as an integral part of the ecosystem of the Two Part Study Area. A program of trapping and recording observations was undertaken to achieve an estimate of relative densities and distribution of small mammal species on the Two Part Study Area.

The estimated numbers of small mammals censused in the summer of 1970-71 in the Lower Skagit Valley and the number which would remain after construction of the proposed High Ross Dam is shown by species groups.

Species Group	Estimated Numbers in Two Part Study Area	
	Without High Ross Dam	With High Ross Dam
Insectivores (shrews and shrew moles)	17,250	13,000
Myomorphs (mice and voles)	47,725	34,470
Chipmunks	2,470	1,300
Squirrels	13,500	11,500
Hares and Pikas	20,600	14,300

Species include:

Insectivores - wandering shrew, cinereus (masked shrew), navigator shrew, shrew mole.

Myomorphs - white-footed deer mouse, red-backed vole, long-tailed vole, Oregon creeping vole, Townsend vole, northwestern chipmunk, Cascade mantled ground squirrel.

Squirrels - chickaree, red squirrel, northern flying squirrel.

Hares - snowshoe hare, Rocky Mountain pika.

All 18 species of small mammals recorded are found in other parts of the Skagit Valley and elsewhere in British Columbia. No unusual distribution records or population densities were recorded for most species. The Townsend vole had not previously been recorded east of Chilliwack, B. C. These voles are rare in the Skagit (75 animals).

None of the small mammals found have particular commercial or economic significance. Hares are rarely shot by hunters. In the past, the squirrels were trapped for their pelts, but little market has existed for the past several years.

The major significance of most small mammals is that they serve as a basic link in the ecological food chain. In this respect shrews are less important than hares and rodents. Most small mammals have very restricted ranges and thus, almost all those within the reservoir site would be lost. Predators which rely on these mammals as prey would also be affected.

None of the small mammal populations above elevation 1725 feet would be affected by the proposed project and they would continue to serve as prey species for carnivores and raptors in the valley.

There are indications of interbreeding between the two species of tree squirrels in the Lower Skagit Valley. Interbreeding between these two species has been previously recorded in Manning Park. The chance of interbreeding would remain with High Ross Reservoir.

GAME BIRD REPORT

ABSTRACT

Thirty species of game birds were recorded and their status and habitat use determined. The probable effect of the High Ross Reservoir project was estimated for each species.

All species of game birds found within the proposed reservoir site are found elsewhere in the Skagit Valley and generally have widespread distribution. No unusual distribution records or densities were found.

Between 50 and 150 waterfowl are harvested annually in the Lower Skagit Valley. The potential for waterfowl hunting will remain approximately the same or possibly increased slightly with the proposed project.

Among the upland game birds, only ruffed grouse are hunted consistently. About 30 ruffed grouse were harvested on the proposed High Ross Reservoir Site in 1970 and about 45 in 1971.

The ruffed grouse population was estimated to be about 50 breeding birds in 1971. Approximately 60 percent of some 1100 acres of ruffed grouse breeding habitat would be lost through inundation, reducing the breeding populations to approximately 20 breeding birds. The potential annual harvest of ruffed grouse would be reduced from an estimated 50 to 70 birds to about 20 to 30 birds. Ruffed grouse populations are known to fluctuate widely and unexplicably.

The important blue grouse habitat is above elevation 1725 feet and as such these grouse are not expected to be significantly affected by the proposed project.

A few Franklin (spruce) grouse and white-tailed ptarmigan are found in the Lower Skagit Valley. Neither species would incur measurable losses from the construction of High Ross Reservoir.

Approximately 200-300 waterfowl utilize Ross Lake and adjacent aquatic habitats during fall migrations. About 50 birds use beaver ponds within the reservoir site which would be lost unless some mitigation in creating small ponds is undertaken. The lake type habitat would be similar with the new reservoir.

The inundation of some 10 miles of river type habitat would result in a loss of about eight pairs of common mergansers and two pairs of harlequin ducks.

About two pairs of mallards that nest in beaver ponds within the reservoir site would be lost unless substitute ponds were created.

Proposed mitigation projects as part of the High Ross Reservoir development should result in a net gain of waterfowl use.

Common snipe and rails depend on wet meadow and marsh type habitat. This type of habitat would be reduced from 160 acres to about 60 acres. These birds would incur small losses with the proposed project. Neither species is important as a game bird. Both occur in low densities at the present time. Habitat development projects along the edge of the proposed lake could restore most of the lost habitat.

Band-tailed pigeons and American coots would not be adversely affected by the proposed project. Coots utilize the open water of the reservoir during migration. Band-tailed pigeons mostly utilize the semi-open mature forests along the slopes and are not dependent upon the valley bottomlands.

BIRD REPORT

ABSTRACT

Songbirds in the Lower Skagit Valley were monitored throughout the study period. A total of 173 species of birds was observed. Of these, 79 species were recorded as nesting. The remaining species were transients and most would not be significantly affected by the proposed project.

The following table shows the estimated number of pairs of breeding birds presently in the Lower Skagit Valley and the numbers which would occur with High Ross Reservoir. Estimates of the numbers of pairs are based on the densities of breeding birds in the various habitats.

NUMBER OF PAIRS OF BREEDING BIRDS IN LOWER SKAGIT VALLEY

Average Level of Breeding Density	Without High Ross	With High Ross
High Density: six birds per acre	4,200	1,200
Medium Density: three birds per acre	18,000	10,500
Low Density: 1.75 birds per acre	20,100	17,500
	42,300	29,200

Of the 79 species of breeding birds, 67 nest in habitats found throughout the valley. Of the 12 species which nested only in the proposed reservoir site, 11 species apparently nested there because of habitats created by man, such as the Ross Lake shallows and bushy vegetation. These types of habitat would be present with High Ross Reservoir. The remaining species, the sparrow hawk, is abundant and widely distributed and is expected to find suitable habitat elsewhere in the Skagit Valley.

The observation of two species, the American redstart and veery are of special interest as breeding populations had not been recorded west of the Cascades in Washington. Although their breeding habitat will be reduced, suitable habitat for these species will remain with High Ross Dam.

The Skagit Valley appears to be a spring-fall migration for at least 29 species of birds. Thrushes, hummingbirds and many sparrows occurred in large numbers. The valley's usefulness as a migration route would not be appreciably changed by the project.

Many species of birds owe their presence in the valley to the reservoir proper. A few semi-water-based species, are year-round residents on seepages within the Ross Lake drawdown area.

The valley's geographical position and the presence of open habitats influences the migration of some species of birds more common to the interior. Eighteen species of birds observed on the Study Area are usually not found in coastal areas. About 90 percent of the species observed are also seen regularly in coastal British Columbia.

The existing meadows in the Lower Skagit Valley would be inundated by High Ross Reservoir. Most species observed in the meadows also utilized the drawdown area of the lake. The loss of meadows would cause a decline in the observability of transient species such as meadowlarks, poor-will, boblink and some sparrows.

Wide ranging predatory birds such as the red-tailed hawk, which nest outside the reservoir site but utilize prey within the reservoir site may be reduced somewhat. The loss of prey species is estimated to cause a loss of about two pairs of red-tailed hawks.

HABITAT REPORT

ABSTRACT

Meadows and ponds are attractive to both man and wildlife. Data obtained from the studies of climate, soils, vegetation, wildlife and recreation provide positive evidence of both the desirability and practicality of developing such habitats.

An examination of current literature regarding response of deer to fertilized ranges and planted grasses indicates that the technology exists to create artificial openings for deer spring range. Some openings should be developed for human enjoyment even if further studies indicate that such developments are not absolutely necessary for deer range.

Furthermore, methods are available to increase the attractiveness of the artificial openings to deer by selective logging of adjacent stands to improve production of other browse species adjacent to the opening.

Basic data regarding fertilizer tests collected in the Lower Skagit Valley indicate that native vegetation would respond favourably to application of fertilizers. Possible sites for development of deer spring range were selected. Soil samples collected on these areas were analyzed. These results show that soils in natural meadow development areas could support grasses, forbs and shrubs if appropriate fertilizers were applied.

Techniques for transplanting sod are well developed and selected strips from the original meadows could be lifted and placed on new meadow lands to maintain a nucleus of indigenous plant communities.

The initial phase of developing spring habitat would involve clearing, selective logging, seeding and fertilizing. Such development appears to

be quite feasible and would be budgeted as part of the clearing costs for the reservoir site.

Studies were undertaken to determine the feasibility of stabilizing the aquatic environment around the reservoir edge. A small pond was constructed on a seepage in the present impoundment area to obtain basic data on methods and types of vegetation that would be required to establish stable wildlife habitats.

The results of the impoundment study indicate that the technique is a feasible method of providing interesting and varied aquatic and marsh habitats.

The locations of areas for such pond development were analysed and mapped. Approximately 70 acres of this habitat could be developed. This type of development would require little maintenance and is considered economically feasible.

Methods of manipulating the shoreline vegetation were investigated. It is feasible to clear the reservoir edge in such a manner that vegetation desirable from a wildlife standpoint is retained and the appearance of the shoreline is improved. A few large cedar trees could be left in certain sites to be flooded to provide perching and nesting sites for certain aquatic birds. Any habitat development projects along the shoreline would be reconciled with recreation requirements.

RECREATION REPORT

ABSTRACT

The Lower Skagit Valley in Canada is a semi-wilderness valley about 3½ hours driving time from Vancouver, B. C. The valley is being managed by the Provincial Government for both forest and recreational resources. Formal recreational facilities are not developed.

The valley is primarily used by recreationalists from about May to October. The warm, dry summer months of July, August and September are particularly attractive. Camping, fishing, swimming, hiking and hunting are the basic recreational pursuits. Dangerous winter snow conditions effectively discourage all but a token number of recreationalists from using the valley during the winter season.

Recreationalists spent an estimated 22,700 activity days in the Lower Skagit Valley in Canada during the 12 month period from October, 1970 to November, 1971. An estimated 18,295 activity days were centered on camping, picnicking, boating, swimming and sight-seeing. The remaining 4405 days comprised the activities of anglers and hunters.

Logging is active throughout the year and three operators regularly log in the Lower Skagit Valley. About 25 percent of the public lands of the proposed High Ross Reservoir site are actively being logged.

The Skagit Valley is one of dozens of interesting valleys that lie within a 100 mile radius of Vancouver. Most of the side valleys of the Fraser Canyon between Hope and Lytton have similar climates and the Pemberton drainage provides yet another system of warm, dry, semi-wilderness mountain valleys.

Of special note is the Chilliwack Lake system which lies parallel to and some 15 miles west of the Lower Skagit Valley. Chilliwack Lake lies in a north-south valley as does the Lower Skagit. Logging activity and recreational pursuits are similar in both valleys and the timber types and topography affords similar semi-wilderness experiences to the visitor. The pressure of recreational use in the Chilliwack Valley exceeds that of the Skagit and recreational facilities are similarly underdeveloped. Chilliwack Lake is a natural lake containing fish, and is about $2\frac{1}{2}$ hours driving time from Vancouver.

The Chilliwack drainage is an integral part of the Lower Mainland Regional Parks System. The timing and extent of recreational development in the Chilliwack Valley would influence the timing and extent of recreational development required for the Skagit Valley. Prior development of recreational facilities in the Chilliwack system is anticipated.

Schedules of development for some 30 other valleys with recreational potential would also influence the need for recreational development in the Lower Skagit Valley.

The Lower Skagit Valley faces two futures: <u>with High Ross Reservoir</u>
<u>and without High Ross Reservoir.</u>

The relative merit of each alternative has been analyzed for recreational use and projections of future demands and capacities are summarized in the following table.

POTENTIAL RECREATIONAL CAPACITY WITH DEVELOPMENT

LOWER SKAGIT VALLEY IN CANADA

ITEM	POTENTIAL RECREATIONAL DEVELOPMENT	
PHYSICAL ASSETS	WITH HIGH ROSS RESERVOIR	WITHOUT HIGH ROSS RESERVOIR
Beaches	21,000 lineal feet	4,000 lineal feet
Picnic Sites	245 acres	90 acres
Camping Areas	645 acres	200 acres
Trails	10 miles	30 miles
Reservoir Area	5,200 acres	500 acres
River Length	10 miles	20 miles
Wildland (includes higher slopes)	40,000 acres	45,200 acres
ACTIVITY	EXPECTED DEVELOPMENT CAPACITY	
Fishing	Angler-days/year	Angler-days/year
River	1,000	1,300
Reservoir	2,600	400
	Hunter-days/year	Hunter-days/year
* Hunting	1,000	3,000
	Peak Visitors/Day	Peak Visitors/Day
Camping	4,328	1,896
Picnic-swimming	9,647	3,872
Boating	777	520
Hiking	400	200
Wildland Activities	12,400	3,200
ESTIMATED TOTAL	User Days	User Days
Potential Annual Visitations for all users	1,208,000	502,000
Date at which demand would exceed recreational capacity. Calculated on basis that the Skagit Valley would have priority of development over other similar valleys	year 2024	year 1995

* The maximum capacity of the wildlife to support hunting is estimated at 2500 hunter days with High Ross and 4000 hunter days without High Ross. Intensive non-consumptive use of the valley is expected to restrict hunting in the future.

Hunters and anglers are a minor, but significant, component of the recreationalists utilizing the River and Reservoir in the Lower Skagit Valley. The activities of these segments of the recreationalists were monitored during 1970 and 1971.

A summary of results of these surveys is shown below.

Anglers (Creel Census - 1971; 2021 Anglers Interviewed)

During 1971 river anglers spent an estimated 1295 user days fishing the Skagit River and lake anglers spent 425 days fishing the Canadian portion of Ross Lake.

The total catch was about 4000 legal-size fish from the Skagit River and some 1500 legal-size fish from the Canadian portion of Ross Lake. (By comparison an estimated 35,200 legal-size fish were caught in Ross Lake on the U.S. side.) The average angler caught about three fish per day.

Most of the fish were caught with bait (usually worms). During 1971 an estimated 130 user-days of angler activity was attributed to fly fishermen.

The waters near the mouth of the Skagit River were the center of angler activity in Canada. Most of the fish taken from the Skagit River were rainbow trout that migrate up the river from Ross Lake to spawn and feed.

ANGLERS RATING OF QUALITY OF FISHING

Angler Rating of Quality of Fishing	SKAGIT RIVER		ROSS LAKE	
	Number Anglers	Percent Anglers	Number Anglers	Percent Anglers
Excellent	39	9	84	11
Good	91	21	362	47
Poor	301	70	300	42
TOTAL:	431	100%	766	100%

The data indicates that angler's satisfaction is lower for users of the Skagit River than for users of Ross Lake.

ANGLERS STATED: PREFERENCES: RIVER FISHING VERSUS LAKE FISHING

STATED PREFERENCE (U.S. & Canadian Anglers)	NUMBER OF ANGLERS	PERCENT
Lake Fishing	687	55
River Fishing	371	30
No Preference	177	15
TOTAL:	1,235	100%

The data indicates that the majority of the anglers fishing the Skagit River-Ross Lake System prefer Lake fishing to River fishing.

Hunting

During the 1970 season, hunters spent an estimated 2600 user-days seeking deer, grouse, and waterfowl in the Lower Skagit Valley. During the 1971 hunting season, hunter activity had dropped to 1000 user-days.

An estimate of the harvest of game species taken from the Lower Skagit Valley obtained from road check surveys during 1970 and 1971 is shown below.

	Estimated Total Harvest from Lower Skagit Valley in Canada			
Hunting Season	* Deer	Ruffed Grouse	Blue Grouse	Waterfowl
1970	30	50	5	140
1971	30	70	0	50

* The deer were coastal blacktail or hybrid type deer.

A comparative harvest of deer and grouse taken in the 1970 hunting season is summarized to illustrate the relative significance of the game harvest from the Lower Skagit Valley.

	Estimated Harvest: 1970 Hunting Season	
Area	Deer	Grouse
Total British Columbia	65,830	567,958
Game Management Area #2 (Lower Mainland Region)	2,800	14,169
Lower Skagit Valley in Canada	30	55
Proposed High Ross Reservoir Site	15	30

The Lower Skagit Valley in Canada provides a semi-wilderness recreational experience within a reasonable day-trip distance from the Vancouver area.

The logging and recreation activities are apparently comparable at the present scale of usage.

Wilderness advocates would probably deem the existing river valley more appealing that the valley with developed recreational sites associated with the proposed High Ross Reservoir.

However, the valley with High Ross Reservoir would probably appeal to greater numbers of people, because the majority of recreational use in this region is centered on water based activities.

Projections of future recreational requirements of the rapidly increasing populations of the Lower Mainland Region indicate that the ultimate capacity of the Skagit Valley with High Ross Reservoir could provide the type of recreational experiences demanded by a greater number of people than would the existing valley.

ECONOMIC VALUES THAT WOULD ACCRUE TO CANADIANS
DURING INITIAL FIVE YEAR PERIOD

WITH HIGH ROSS

Estimated expenditures for labour and for equipment for construction in Canada (5 year period)

1. Clearing and Mitigation Canadian portion of High Ross	$2,250,000
2. Log transport and Clean-up in Canada of material from U.S. side of Reservoir	2,500,000
3. Relocation of Public Road	350,000
4. Recreational Expenditure (in place of road)	140,000
5. Continuing environmental studies	250,000
TOTAL	$5,490,000

Taxes and Fees (Initial 5 year period)

Land Taxes

Lot 1103 ($2,000/yr) (5 years)	10,000
(1971) Lots 221 and 222 ($1,000/yr) (5 years)	5,000

Water Storage Fee

Ross Reservoir in Canada ($35,000/yr) (5 years)	175,000
TOTAL	$190,000

Values of Indicated Recreational Opportunities for Canadians

On basis that no Canadian funds are expended for further recreational development (initial five year Period).

Fishing

River	(1,000 Angler days)	(5 yrs)	($6.00/day)	$ 30,000
Reservoir	(2,600 Angler days)	(3 yrs)	($6.00/day)	47,000

ECONOMIC VALUES THAT WOULD ACCURE TO CANADIANS
WITHOUT HIGH ROSS RESERVOIR

First Five Year Period

Estimated Water Storage Fee		
for 525 acres (Ross Lake in Canada) ($4,000)(5 yrs)	$	20,000
Estimated Land Rental		
for 525 acres ($1,000) (5 yrs)		5,000
TOTAL	$	25,000

Values of Indicated Recreational Opportunities Available to Canadians

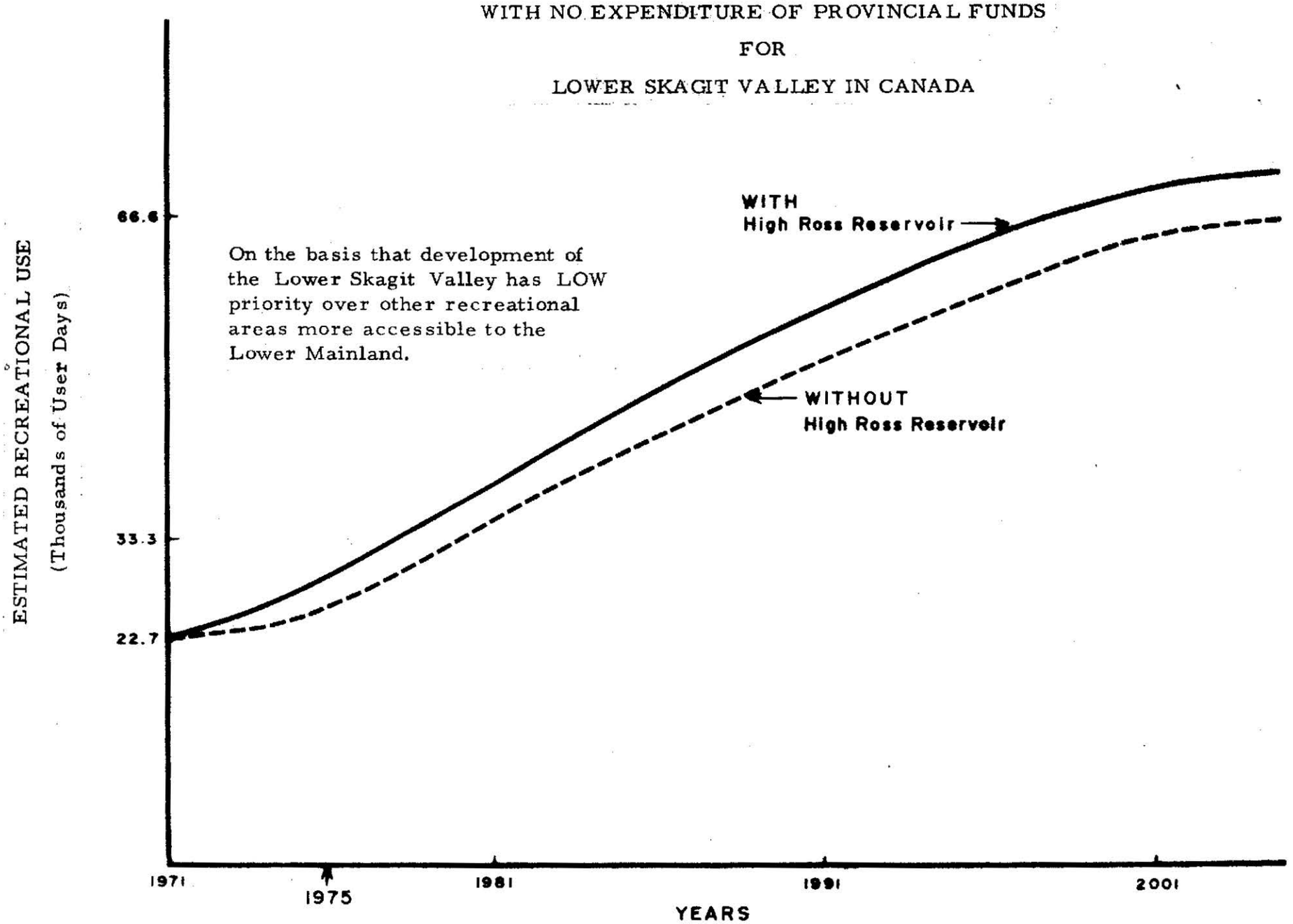
On basis that no Canadian funds are expended for further recreational development.

Fishing		
River (1300 Angler days) (5 yrs) ($6.00/day)	$	39,000
Reservoir (400 Angler days) (5 yrs) ($6.00/day)		12,000
Hunting		
(4000 Hunter days) (5 yrs) ($6.00/day)		120,000
General Recreation		
(20,000 User days) (5 yrs) ($4.00/day)		400,000
TOTAL	$	561,000

Future development and use of private lots 221 and 222 would require negotiation. These lands would probably be leased or sold to Canadians and therefore would be a debit rather than a credit.

GRAND TOTAL	$	586,000

PROJECTED POTENTIAL RECREATIONAL USE
WITH NO EXPENDITURE OF PROVINCIAL FUNDS
FOR
LOWER SKAGIT VALLEY IN CANADA



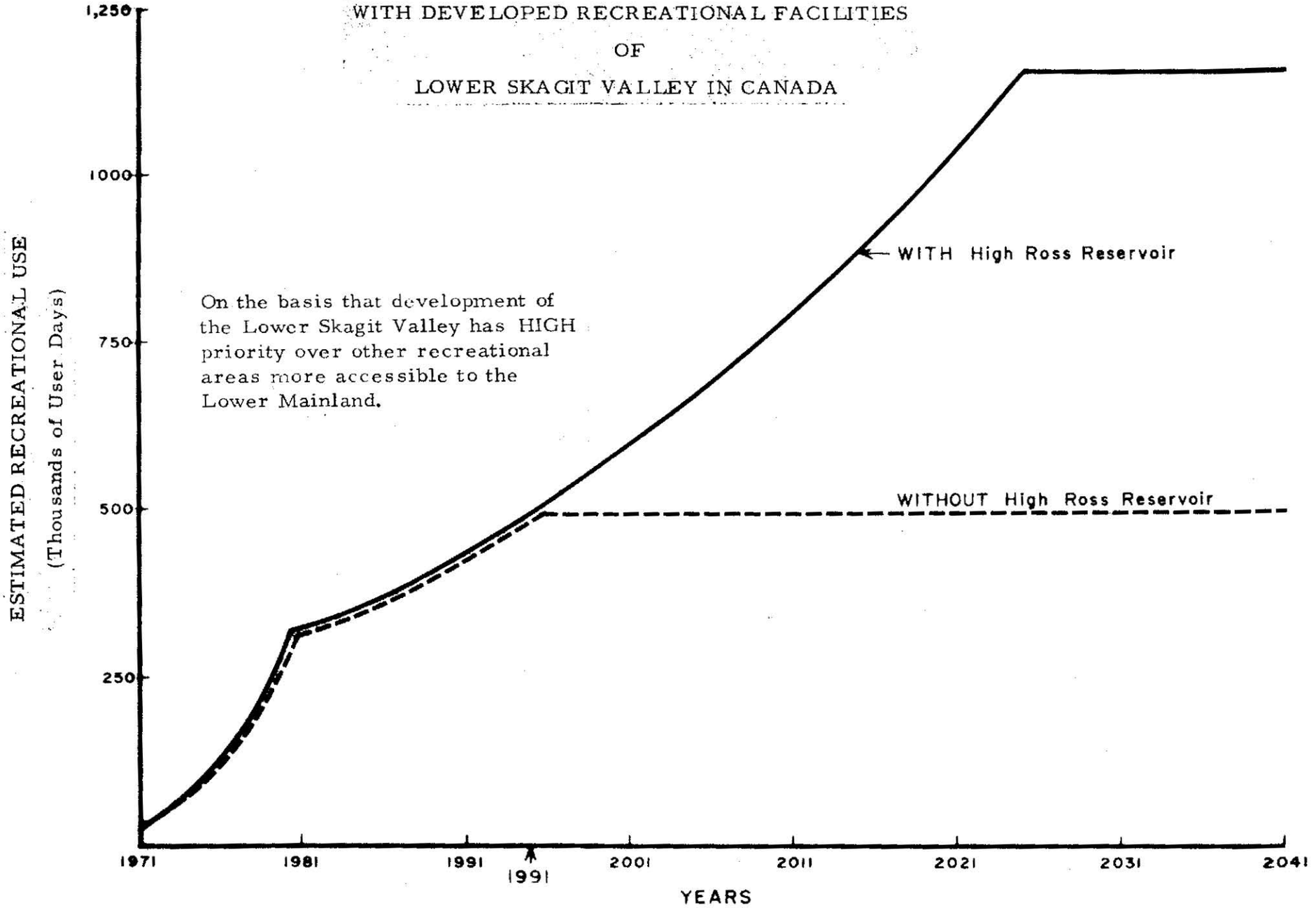
POTENTIAL RECREATIONAL USE OF THE LOWER SKAGIT VALLEY IN CANADA

ASSUMING NO EXPENDITURE OF FUNDS FOR RECREATIONAL FACILITIES BY CANADIANS

ACTIVITY	ACTUAL USER DAYS 1971 *	ESTIMATES OF POTENTIAL RECREATIONAL USE (user days per year by years)									
		WITH HIGH ROSS RESERVOIR					WITHOUT HIGH ROSS RESERVOIR				
		1975	1981	2001	2016	2024	1975	1981	2001	2016	2024
Fishing											
[illegible] River	1,295	1,000	1,000	1,000	1,000	1,000	1,300	1,300	1,300	1,300	1,300
[illegible] Creek	425	---	2,600	2,600	2,600	2,600	400	400	400	400	400
Hunting	2,600	2,500	2,500	2,500	2,500	2,500	2,000	4,000	4,000	4,000	4,000
Sightseeing, Picnicking, Boating, Hiking, Swimming, Sightseeing	18,380	29,500	31,900	62,900	62,900	62,900	21,300	28,800	58,600	58,600	58,600
TOTALS	22,700	33,000	38,000	69,000	69,000	69,000	25,000	34,500	64,300	64,300	64,300

* [illegible] 1970 to November 1971

PROJECTED POTENTIAL RECREATIONAL USE
WITH DEVELOPED RECREATIONAL FACILITIES
OF
LOWER SKAGIT VALLEY IN CANADA



POTENTIAL RECREATIONAL USE OF THE LOWER SKAGIT VALLEY IN CANADA WITH DEVELOPED RECREATIONAL FACILITIES

	ACTUAL USER DAYS 19[illegible]	ESTIMATES OF POTENTIAL RECREATIONAL USE (user days per year by years)									
		WITH HIGH ROSS RESERVOIR					WITHOUT HIGH ROSS RESERVOIR				
		197[illegible]	1981	2001	2016	2024	1975	1981	2001	2016	2024
[illegible]	[illegible],27[illegible]	1,000	1,000	1,000	1,000	1,000	1,300	1,300	1,300	1,300	1,[illegible]00
[illegible]	425	---	2,600	2,600	2,600	2,600	400	400	400	400	400
[illegible]	[illegible]	1,000	1,000	1,000	1,000	1,000	2,000	3,000	3,000	3,000	3,000
[illegible]	18,280	212,600	317,600	595,400	925,400	1,203,400	210,900	317,500	497,300	497,300	497,300
[illegible]	[illegible]	214,600	322,200	600,000	930,000	1,208,000	214,600	322,200	502,000	502,000	502,000

[illegible] November [illegible]

[illegible] basis that recreational facilities would be fully developed by 1981)