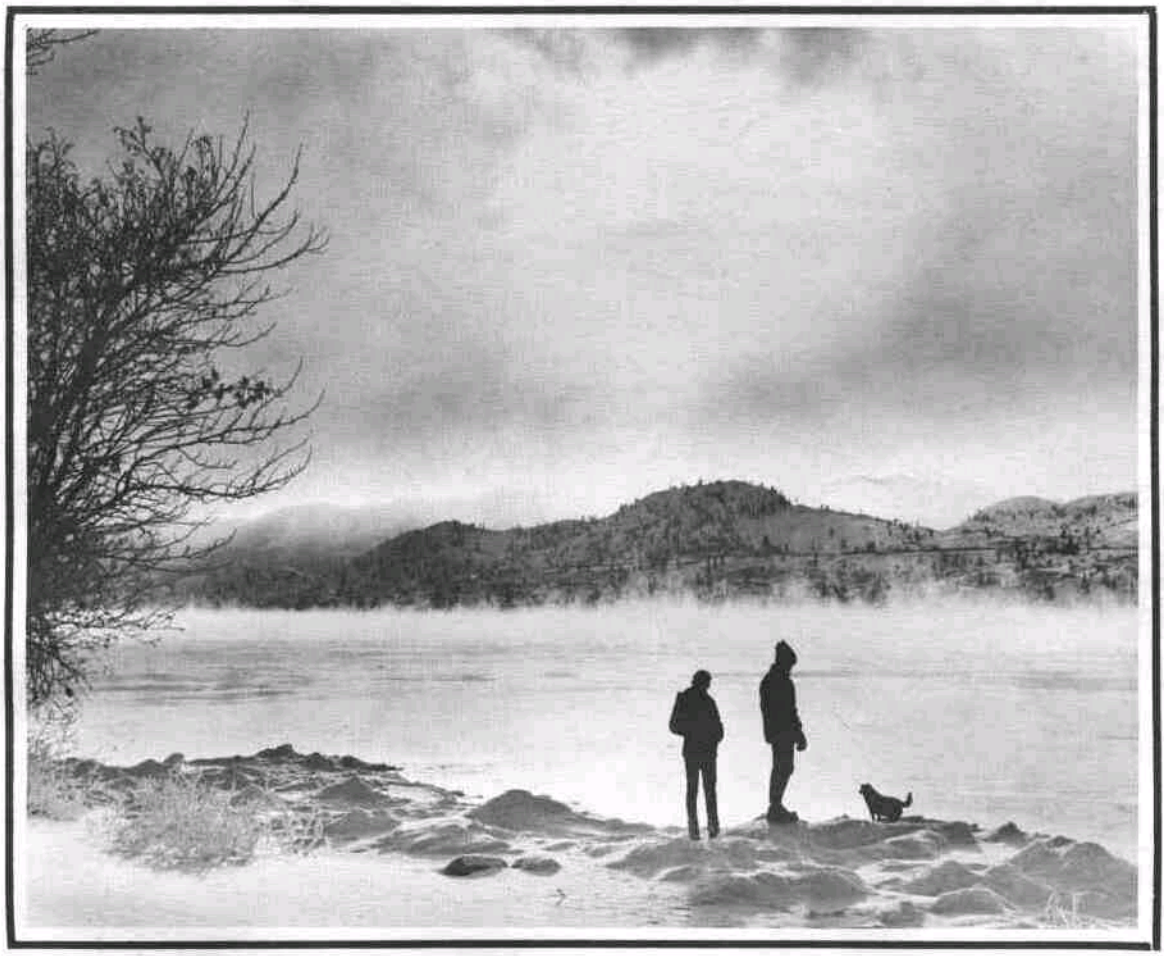
SUMMARY REPORT

of the
CONSULTATIVE BOARD



"to everything there is a season
and a time for every purpose"

including
THE COMPREHENSIVE FRAMEWORK PLAN
prepared under the

CANADA BRITISH COLUMBIA
OKANAGAN BASIN AGREEMENT

MARCH 1974

FINAL PUBLICATIONS IN THIS SERIES

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2. **THE MAIN REPORT OF THE CONSULTATIVE BOARD**
3. **TECHNICAL SUPPLEMENTS TO THE MAIN REPORT**

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Cover Photo by Tom W. Hall

- *'Winter Scene on Okanagan Lake'*

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SUMMARY REPORT

Of The Consultative Board

including

THE COMPREHENSIVE FRAMEWORK PLAN

prepared under the

Canada-British Columbia
Okanagan Basin Agreement

March 31,1974

CANADA-BRITISH COLUMBIA CONSULTATIVE BOARD
(OKANAGAN BASIN AGREEMENT)

LETTER OF TRANSMITTAL **MARCH 31, 1974**

HONORABLE ROBERT WILLIAMS
MINISTER
DEPARTMENT OF LANDS, FORESTS
AND WATER RESOURCES
VICTORIA, BRITISH COLUMBIA

HONORABLE JACK DAVIS
MINISTER
DEPARTMENT OF THE ENVIRONMENT
OTTAWA, CANADA

SIRS:

The Consultative Board is pleased to present the main report containing the 'Comprehensive Framework Plan' resulting from the study undertaken in accordance with the Canada-British Columbia Okanagan Basin Agreement signed in October, 1969.

The comprehensive plan outlined has taken into account the consensus of public opinion as required in the terms of reference of the Agreement, including the views obtained following the release of a draft of this report in November, 1973. The Board is very appreciative of this public involvement in developing the framework plan, and in particular, the dedicated efforts of public involvement Task Force members.

In presenting these Findings and Recommendations the Board recognizes that they are based on the present state of the art using best judgement, and that the science involved in such areas as waste treatment is still imperfect. However, the framework plan developed is sufficiently flexible to encompass changes with time.

We would particularly draw your attention to Recommendations I and II, which concern the implementation of the plan. The deteriorating quality of water in the main valley lakes, and the water quantity problems that may arise should a prolonged drought period occur are continuing problems that require immediate consideration. Even assuming that a start is made on implementation of the plan in 1974, it will take two to three years to design, finance and construct appropriate works during which some further decline in water quality may be anticipated. This is the heart of the Board's conclusions; namely, that the future of the Valley rests primarily in the hands of local residents, with the support and assistance of senior governments.

The Board appreciates the continuing support given to it by the Ministers and their respective Departments along with the assistance rendered by other departments and organizations. The Board is particularly appreciative of the major contribution made by the Study Committee and the Study Director.

Respectively submitted,

B.E. MARR
Provincial Co-Chairman
Consultative Board

A.T. PRINCE
Federal Co-Chairman
Consultative Board

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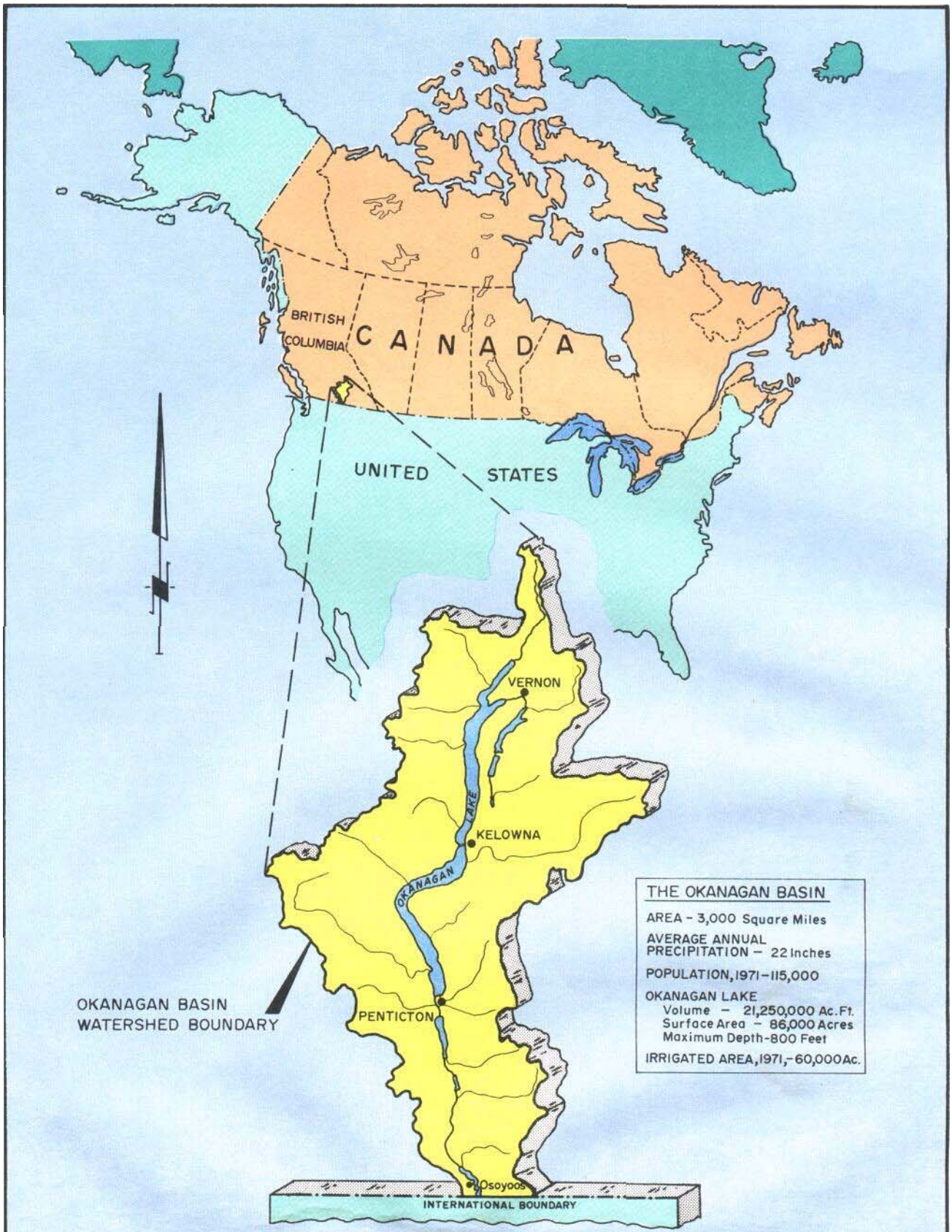


THE OKANAGAN BASIN
IN
BRITISH COLUMBIA – CANADA

Figure A

INTRODUCTION

The Canada-British Columbia Consultative Board has completed a four-year study of water resource management in the Okanagan Basin with the objective of preparing a comprehensive framework plan for the development and management of water resources for the social and economic betterment of the Okanagan community to the year 2020.

The Okanagan Basin Study represents a new approach to water management, bringing together the combined skills of many experts in the fields of water quantity, water quality, waste treatment, socio-economics, limnology and fisheries. Information on health, wildlife, forestry and land use was also included in the development of the plan. As the plan was specifically designed to provide for the social betterment of the valley residents, a sincere attempt was made by the study both to educate the public about water management problems in the Okanagan and to receive and consider ideas from citizens regarding their preferred future life-style.

Being a pilot project in basin planning, many new approaches were developed, and many new problems encountered during the development of the framework plan. Within the limited terms of reference of the Okanagan Basin Agreement, the Board has endeavoured to produce a plan that represents a consenus of members of the community and study staff for good water management over the next fifty years.

As it is the essence of good planning to obtain maximum public input, a draft of the comprehensive framework plan was released publicly on November 28, 1973, together with a draft of the main report. This was followed by public discussions to ensure that the plan reflected the desires of the public, or where necessary to amend the plan in view of comments and criticisms received. This publication incorporates those changes desired by the majority of the public based on comments received and represents the final summary publication of the Consultative Board on the Okanagan Basin Study. Other more detailed publications that will be available later in 1974 are listed on the inside front cover of this report.

GENERAL FINDINGS OF THE OKANAGAN STUDY

The Okanagan Valley at present has a strong economic base and a generally high quality natural environment. Continuation of the recent rapid pace of economic growth could threaten this desirable balance and lead to a decline in the quality of natural and urban environments. Only through careful planning and integrated management of the basin's water, land and human resources can the present economic and environmental harmony of the basin continue.

Due to the recent program of industrial incentive, the Okanagan economy is well diversified and can be expected to grow steadily over the next fifty years. However, as there is some uncertainty about the rate of growth, the Study developed three alternative projections of economic growth to the year 2020. One projection involved the continuation of existing economic policies, a second assumed that the rate of economic growth would be quickened through new industrial incentive programs after 1980 and a third projected a slowing down in the rate of economic growth, compared to that expected under current economic policies, through controls on industrial expansion. The main features of these three projections (to 2020) are compared to present (1970) conditions in the following table, which indicate that all economic indices such as population, employment, tourism and valley income should increase between 2.5 and 3.5 times during this planning period.

Examples of the Range of Economic Growth That May Occur in the Okanagan Basin to 2020

PROJECTION	DESCRIPTION	POPULATION	EMPLOYMENT	IRRIGATED ACRES	NUMBER OF TOURISTS
PRESENT SITUATION		115,000	29,800	60,000	700,000
PROJECTION I	CONTINUATION OF PRESENT ECONOMIC POLICIES	391,000	105,000	59,600	2,300,000
PROJECTION II	HIGH ECONOMIC GROWTH	430,000	118,000	56,600	2,300,000
PROJECTION III	LOW ECONOMIC GROWTH	290,000	76,000	73,700	1,800,000

Under good water management there is enough water in the basin to supply all projected withdrawals and meet proposed fishery and recreation requirements in the main valley and in the tributary sub-basins. This assumes the withdrawal of larger volumes of water from Okanagan Lake during prolonged drought periods, than has occurred in the past. Additional headwater storages will be required, and in selected streams reservoir operations will be modified to serve the multiple uses of sport fisheries and irrigation. There is no need for the large scale importation of water under any of the economic growth projections made in this study, provided that a greater range of operating levels is recognized for Okanagan Lake.

This range should normally not exceed four feet in any one year, but a total variation of nine feet may occur between an extreme flood level in one year and an extreme low lake level following a succession of drought years.

Phosphorus has been identified as one of the major nutrients promoting undesirable algal blooms and rooted aquatic plant growth in the main valley lakes, and also as the nutrient which can be most successfully controlled to reduce this growth and improve or maintain the quality of water in these lakes. Major waste management programs are therefore proposed over the next ten years to ensure the maintenance of lake water quality by reducing these phosphorus loadings. The capacity of tributary streams to assimilate pollutants is considered even more limited, due to extreme variations in flows, and complete removal of all direct polluting discharges to stream waters will be necessary if stream water quality is to be improved. With appropriate waste management, the quality of all major surface waters in the basin can be maintained to support both withdrawal and recreational requirements.

Water-based recreation - swimming, boating, fishing - is dependent upon good water quality in the lakes and shoreline planning. It will continue to play an important role in the economic and social life-style of tourist and residents of the valley. The preservation of crown and public lands around the shorelines of the main lakes will allow the development of public beaches to meet projected recreation demands with little need to obtain private properties.

Water resources management, though an important component in planning the valley's future, will not by itself ensure that the present desirable balance between economic growth and high environmental quality will continue over the next fifty years. Other resources should also be carefully managed, on a valleywide basis, as forecast population growth will undoubtedly place pressure on such important factors as land, transportation and urban environments. In particular, land use will have a significant impact on future water quality, water-based recreation and fisheries. Planning these resources must be integrated with water management to ensure a continuation of the current prosperous economic and environmental balance in the basin.

A number of citizen 'task forces' representing a wide range of public interests were established during the Okanagan Study to develop a consensus regarding the preferred future 'life-style' for the valley community. In their final report to the Okanagan Study Committee (entitled "To Our Children's Children"), these task forces unanimously supported Projection III involving a lower pace of economic growth, protection of agricultural lands and maintenance of a high quality environment. The primary recommendation of this valley consensus is that:

"Future planning in the Okanagan should place primary emphasis on environmental protection, giving due emphasis to maintaining the economic viability of the valley."

Consequently, it is upon this premise, in concert with Projection III, (Low Economic Growth Rate) that the framework plan outlined in this report is recommended.

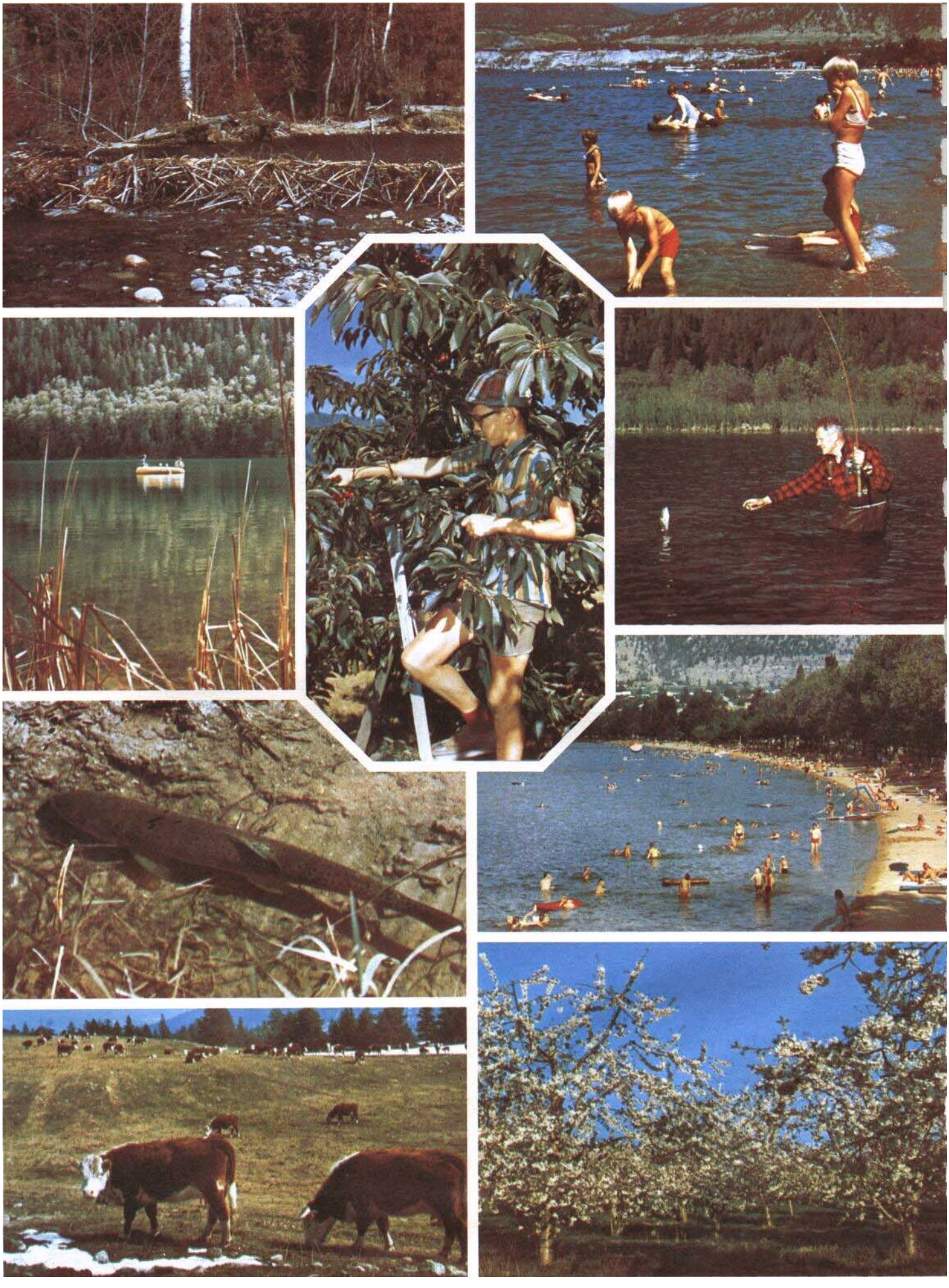
Economic benefits (or costs) in this report refer to those that can be expressed directly in monetary terms such as increased or more efficient agricultural and industrial production, land value enhancement, expenditures of recreationists, etc. Social and environmental benefits refer to those benefits that do not have a market value, such as employment opportunities, availability and enjoyment of beaches, water quality, etc. Some of these can be expressed in quantitative units however, and have been assigned dollar values based on opinion surveys.

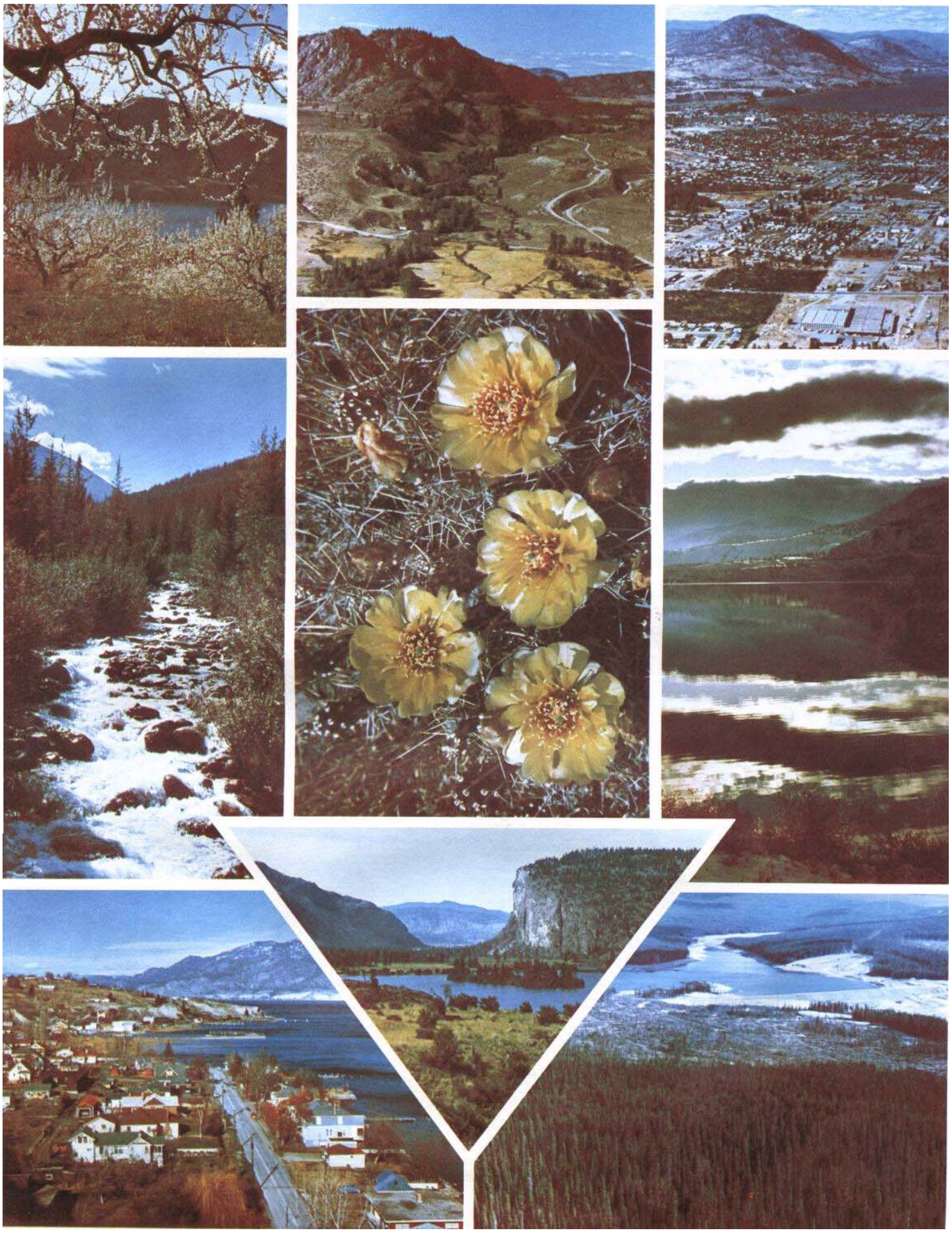
It should be emphasised that the framework plan is designed to improve the social and economic well-being of the Okanagan community. Consequently, not all the recommendations can be justified on the basis of economic benefits only, though the plan does become viable when quantifiable social and environmental benefits are included. This reflects the high value placed by the valley community on such benefits. Because the inclusion of social and economic values is a relatively new concept in comprehensive basin planning, it has not been possible to quantify all such values associated with various components of the plan. Attempts at expressing values placed on a day at the beach or a day fishing were made through the use of questionnaire surveys. However, values associated with benefits that may accrue from such factors as aesthetic enhancement, landscape diversity and decreased health hazards have not been assessed.

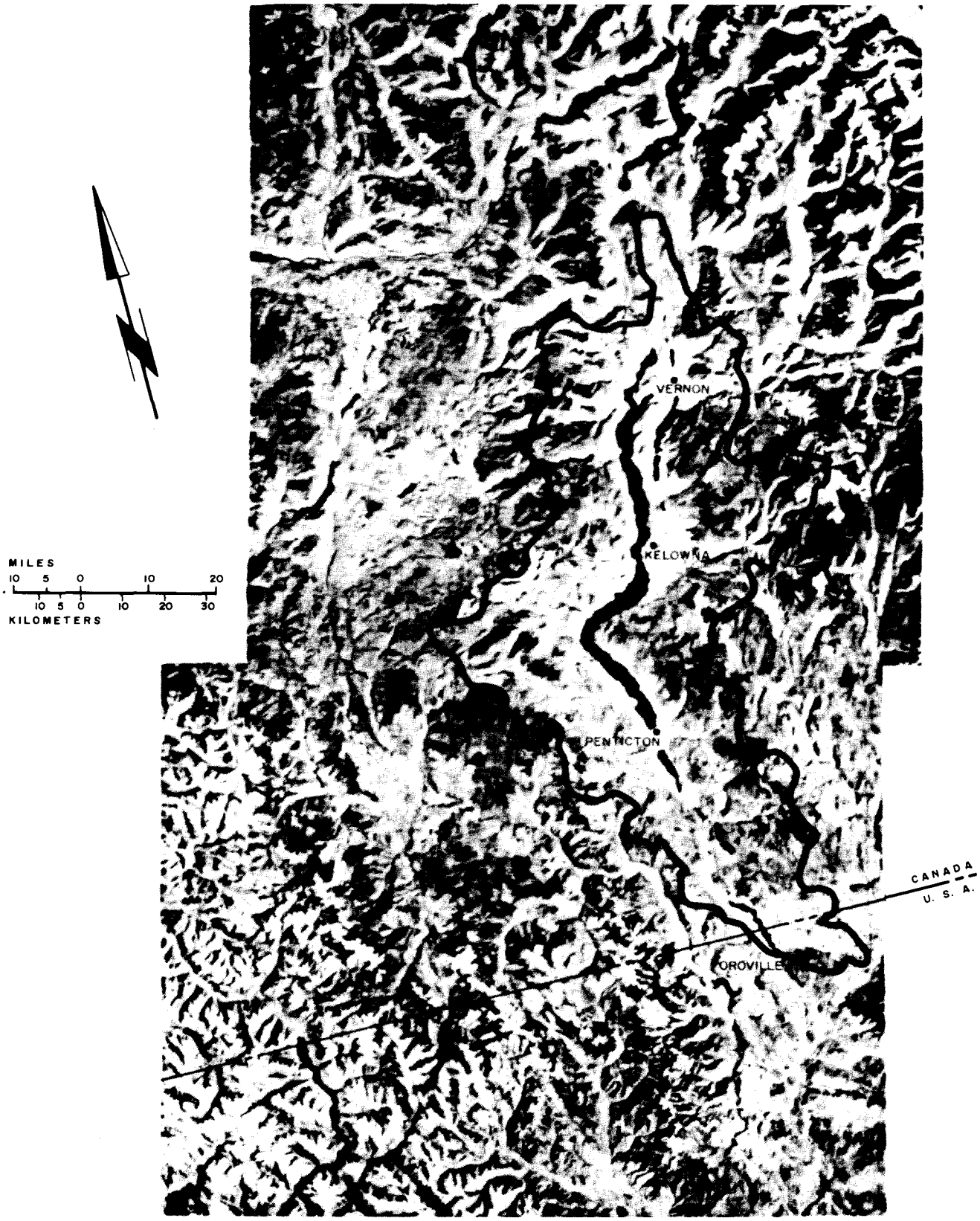
It is not possible to total all benefits and costs of the framework plan as the implementation of some components is somewhat uncertain being dependent upon economic projections over 20 years into the future. However, a number of recommendations require immediate action (prior to 1980) to maintain good water resource management in the Okanagan. The major costs and benefits of these recommendations are summarized below and have been discounted to present (1970) values for comparison purposes. Phosphorus removal is only effective where sanitary sewers and conventional waste treatment facilities have been established. The costs of these have not been included in the following table as such facilities are required to protect the health of the valley communities. The additional capital cost of this program to 1985 has been estimated at $17 to $22 million dollars.

SUMMARY TABLE OF COSTS & BENEFITS FOR IMMEDIATE ACTIONS
All values Discounted to 1970 Dollars

ACTION	CAPITALIZED COST	ECONOMIC BENEFITS	SOCIAL AND ENVIRONMENTAL BENEFITS
1. WATER QUANTITY - STRUCTURAL IMPROVEMENTS IN MAINSTEM SYSTEM	$ 1,000,000	$ 500,000	(SIGNIFICANT VALUES NOT QUANTIFIABLE)
2. WASTE TREATMENT - PHOSPHORUS REMOVAL FACILITIES TO 1985	$ 3,800,000	$4,100,000	$9,200,000
3. SPORT FISHERY MANAGEMENT - TRIBUTARY STORAGE AND REPRODUCTION REQUIREMENTS	$ 1,140,000	$ 500,000	$ 800,000







SATELLITE IMAGERY OF OKANAGAN BASIN

THE EARTH RESOURCES TECHNOLOGY SATELLITE LAUNCHED BY NASA ON JULY **23,** 1972, ORBITS AT AN ALTITUTE OF APPROXIMATELY 600 MILES. AN ORBITAL PATH 115 MILES WIDE IS SCANNED CONTINUOUSLY AS THE SATELLITE ORBITS THE GLOBE 14 TIMES A DAY. THE CYCLE OF OBSERVATIONS PERMITS ANY GIVEN POINT ON THE EARTH'S SURFACE TO BE IMAGED AT 18-DAY INTERVALS.

BASIC RECOMMENDATIONS

The following basic recommendations are made to establish a framework for developing the comprehensive plan for water resource management in the Okanagan Basin. More detailed recommendations are outlined in the subsequent section.

One Regional District For Basin

1. *"That the boundaries of the present Regional Districts of North Okanagan Central Okanagan and Okanagan-Similkameen be redrawn to create a single Okanagan Basin Regional District having boundaries coincident with those of the watershed, to be responsible for those water resource management functions that pertain to the Valley as a whole and in particular the implementation of those recommendations in this report that are Valley-wide in scope, especially waste treatment, the orderly development of shoreline recreation facilities, and floodplain zoning."*

Good water management is essential to the maintenance of desirable lifestyles of the Okanagan community. Because all parts of the basins are linked by the flowing nature of water, it is important to avoid actions in one part that will adversely affect the environment in another or reduce the future potential of valley-wide economic activities, for example the attraction of tourists. As this feature of common interest throughout the valley affects many aspects of planning, a number of recommendations in this report cut across existing jurisdictions and apply to the basin as a whole.

This valley-wide approach applies in particular to recommended upgrading of existing waste treatment facilities, and the provision of new ones where the benefits of improved lake quality are valley-wide and treatment on a regional basis is feasible in meeting objectives. It is considered unfair that under a particular scheduling program, certain communities could be asked to bear the major portion of the costs of a waste management program which benefits the basin as a whole.

It appears to be the consenus of the Okanagan Community that a single authority be established to coordinate the implementation of the framework plan. As much use as possible should be made of existing institutions, for neither the public nor the senior governments desire the creation of a new intervening level of government. The success of the task forces during the study in bringing together people from all parts of the basin verifies that valley-wide consensus on water management problems is possible.

Provincial legislation is available to establish a regional district for the watershed. While the process of setting up such an authority normally provides for the assignment of a number of functions, it is felt that certain characteristics and functions essential to the success of this new body should be identified in the documents establishing it, for example, in the letters patent. These are:

(i) that all residents within the watershed be required to share in the burden of costs, or to undertake necessary common actions, that clearly affect the valley as a whole, for example, upgrading the quality of the main lakes.

(ii) that standards set by governments for such things as water quality be considered as minimum standards for the Basin and may need upgrading to provide a superior quality of the environment, in specific locations.

(iii) that the Regional District should be supported by a technical resource advisory committee representing the resource agencies concerned. The establishment of such a group is now provided for in provincial legislation.

(iv) that continuing public participation, which has been a principal feature of this study, be imbedded in the future planning process and be built into the institutional arrangements proposed herein.

Finally, this study has not examined all the implications outside the Valley that would be incurred in creating a single valley authority for the Okanagan watershed. A wider examination may reveal other alternatives for the boundaries of a Regional District more suitable for this broader multiple watershed region. In working out these boundaries, however, it is important to keep in mind the four characteristics listed above. To repeat, it is the opinion of the Board and the results of opinion surveys in the valley that a single valley authority is clearly the best option for the Okanagan Basin itself.

The above recommendation was the subject of considerable discussion after release of the DRAFT report with local political leaders, in particular, taking the position that such a major re-organization of local government was at least premature and would raise very difficult administrative problems.

The Board has reconsidered this matter and now puts forward two alternatives to recommendation #1, either of which could achieve the same objectives.

Alternative 1 (a) takes care of certain local administrative problems arising from separation of certain communities, by selecting an appropriate boundary for the new Regional District.

Alternative 1 [a]:

Alternatives to Recommendation 1. *"That the boundaries of the present Regional Districts of North Okanagan, Central Okanagan and Okanagan--Similkameen be redrawn to create a single Regional District, including within it's boundaries the total area of Okanagan Basin watershed in Canada; to be responsible for those water resource management functions that pertain to the Valley as a whole and in particular, the implementation of the recommendations in this report that are Valley-wide in scope, especially Waste Treatment, the orderly development of shoreline recreational facilities and flood plain zoning."*

The second alternative based on a proposal developed by the three Regional Districts is as follows:

Alternative 1 [b]: *"That the Okanagan Basin Water Board be reconstructed and Letters Patent amended to give the Board authority to carry out water resource management functions described above, in Alternative 1 [a]."*

The success of this alternative would depend upon the willingness of the Regional Districts to delegate powers to the Water Board and to work together in achieving Valley-wide aims clearly defined in this report.

Implementation Task Force 2.*"That to ensure continuity from planning to implementation of the framework* plan*, Canada and British Columbia establish - on or before 31 March 1974 – an Implementation Task Force which has local representation."*

The Task Force is to advise and recommend to the federal and provincial governments and to local governments, actions required to implement the comprehensive plan and to submit on or before 30 June 1974 a draft implementation agreement. This agreement shall take into consideration the actions on recommendation of this report that may be taken by local government, and by either senior government. Where joint action is required the agreement shall include provisions for equitable cost-sharing as developed by the senior governments.

Nothing in this recommendation should inhibit on-going programs presently in progress and the implementation of recommendations where responsibilities are clear.

Water Quantity Management Mainstem System

3. *"That the water available be managed such that, without large scale importation of water, all present and projected future water uses around Okanagan Lake and along Okanagan River are satisfied; recognizing that during a prolonged drought cycle, increased drawdown of Okanagan Lake and some cut-back in releases to Okanagan River for non-consumptive uses may be necessary."*

Through implementation of water conservation measures within the Okanagan, all water requirements can be met. Large scale importation of water into the Okanagan is not necessary based on present studies. In extreme drought conditions Okanagan Lake would have to be drawn down from time to time below the present minimum elevation of 1118.8 feet and fishery flows for sockeye salmon reduced. Such drawdowns should not create severe problems provided that a program of adjustments to water intakes around Okanagan Lake and along Okanagan River is undertaken immediately and the public is made fully aware of the consequences of such lake drawdowns.

Water Quantity Management Tributary Streams

4. *"That major conflicts in water use between irrigation and fishery requirements in tributary streams be avoided by managing Mission, Equesis and Trepanier Creeks for fisheries and irrigation purposes, and developing other major creeks primarily for domestic and agricultural water use.*

Some 4,300 acre-feet of headwater storage should be licenced and developed to meet fishery requirements on Mission and Equesis Creeks. An additional 25,000 acre-feet of headwater storage are available on these and other major tributaries to meet a possible expansion of 9,000 acres of agricultural land. Such agricultural expansion was given high priority by the valley community to enhance the economic and social environment of the basin. On certain creeks additional water will have to be obtained from other sources to supply potential agricultural demands, (e.g. Kelowna Creek).

Capital costs of this storage development for agriculture, exclusive of water distribution costs are estimated and 6.9 million dollars, with capitalized economic benefits of 3.25 million dollars. The social benefits related to agricultural development have not been estimated. The costs and benefits of a sport fishery program are included in Recommendation 10.

Water Quantity Floods

Flooding in the Okanagan, other than on Osoyoos Lake occurs about once every

5. *"That potential flood damage around Okanagan and Osoyoos Lakes and along Okanagan River be minimized through the institution of flood plain zoning and emergency protection measures."*

15 years. On Osoyoos Lake major floods occur about once every 10 years. Large scale structural measures for flood control cannot be economically justified in Canada alone and thus occasional flooding will continue to occur around these two lakes. Flood plain zoning will avoid potential increases in shoreline property damage while implementation of protective measures on an emergency basis will reduce flood damage to existing properties.

On Okanagan Lake the 200 year flood elevation has been estimated at 1125.5 feet and on Osoyoos Lake at 919.25 feet. Two feet of freeboard over and above this maximum flood elevation is also required for protection against wave action.

It is therefore recommended that the flood plain zone for all undeveloped areas shall include all lands up to an elevation of 1127.5 feet for Okanagan Lake and up to elevation 921 feet for Osoyoos Lake. Land use within these flood plain zones would be limited to agricultural cropland, parkland for recreation and wildlife sanctuaries.

An information brochure on emergency protective measures and flood proofing should be issued to all occupants on the flood plain as a measure of reducing the damage to properties already existing in the flood plain zone.

I.J.C. Reference Osoyoos Lake

6. *"That the Government of Canada and British Columbia immediately take the necessary steps to refer a study of Osoyoos Lake level regulations to the International Joint Commission."*

Adjustments to intakes along Okanagan River will allow reductions in flows in the river to conserve water but these flow reductions may create problems of maintaining desirable lake levels on Osoyoos Lake during drought periods unless control at the outlet of Osoyoos Lake is improved. Thus, this study should determine what measures need to be taken either in Canada or the United States to:

(a) maintain Osoyoos Lake levels during drought periods.
(b) reduce flood damage around the lake.

Water Quality Tributary Streams

7. *"That a program of pollution control for tributary streams be established by instituting strict regulations on feedlot and septic tank developments, removing all direct discharges to streams of industrial and municipal wastes causing pollution and protecting streams with appropriate green strips in areas where logging or cultivation is practiced or where there are concentrations of cattle, horses, or livestock."*

High coliform counts, oxygen deficiencies, turbidity and concentrations of iron, manganese and phosphorus in certain tributary creeks affect the quality of water supplies for drinking, fish propagation and other uses. The origin of these pollutants is primarily from industrial and municipal waste effluents, septic tank sources, concentrations of livestock, and erosion. The prevention of pollution from these sources through appropriate pollution control programs (see Detailed Recommendations 21 to 24) is required to improve the quality of water in tributary streams to meet the standards outlined in the final report.

Water Quality Main Valley Lakes

8. *"That a waste management program aimed at reducing phosphorus loadings to control rooted aquatic plant and algae growth in the main valley lakes be undertaken immediately by the regional authority."*

Phosphorus was identified as one of the key nutrients promoting undesirable aquatic plant and algal growth in the main valley lakes, and the nutrient which may be most successfully controlled to reduce this growth and the resulting deterioration in water quality. The valley consenus stated that it is of prime importance to arrest this decline and reverse the process wherever possible. Consequently, the framework plan has established a waste management program for reducing the amount of phosphorus discharged from municipal, industrial and domestic sources, to control the growth of algae and rooted plants in the main valley lakes. The capital costs of this program over and above that required to protect the health of the valley community is estimated at 2.0 to 2.3 million dollars by 1985, with annual costs estimated at $490,000. In comparison, economic benefits associated with the maintenance of a high level of quality in the main valley lakes total $265,000 annually with social benefits estimated at $1,100,000 annually.

Phosphorus removal is possible only where conventional waste treatment facilities are available. The additional capital cost of conventional treatment to 1985, including sanitary sewers and secondary treatment plants, has been estimated at 17 to 22 million dollars. The year 1985 was considered the limit to which meaningful projections could be made for waste treatment costs based on existing technology and water quality data.

Programs for financial assistance to local governments for implementing waste management projects are available under the following acts:
Federal National Housing Act
Provincial Municipal Treatment Plant Assistance Act
British Columbia Taxation Act.

Water Based Recreation

9. *"That shoreline recreation be enhanced through the protection and development of shorelines for beach recreation and maintenance of high levels of water quality."*

Due to trends towards increased leisure time and the unique recreation potential of the Okanagan, the valley community placed second priority (after human and agricultural consumptive use) in water and related resource management, to recreation planning. To meet the expected four-fold increase in demands for beach recreation, all public and Crown lands with good recreational potential should be preserved for that use. Some 40,000 linear feet of additional shoreline must be developed for public recreation by 2020 together with 4,000 linear feet of additional public access to the lakeshore and 10 to 12 new boat launching facilities. The economic value of these additional facilities totalled over the fifty year planning horizon is estimated at $13 million with social values totalling $47 million.

Fisheries

10. *"That sport fishery resources [kokanee and rainbow trout] be enhanced by protecting existing habitat and improving both natural and artificial reproductive facilities."*

The valley community supports a sport fishery enhancement program for the headwater and main valley lakes. In addition to supplying water in selected tributaries, spawning beds should be rehabilitated and artificial stocking of headwater lakes increased. The total costs of this program are estimated at $3 million by 2020 (including the storage shown in Recommendation 4) with minimum economic and social benefits of $2.9 million and $4.6 million respectively for sport fisheries.

Monitoring the Framework Plan

11. *"That the response of water resources to management measures implemented under the framework plan be monitored continuously, with a full review of the undertaken by 1980 to ensure that the plan continues to meet the social and economic goals of the valley community."*

Despite the large investment involved in preparing the comprehensive plan, there are many uncertainties in the development of water management alternatives, especially in waste treatment requirements to reduce phosphorus loadings to the main lakes (for example, technological advances in waste treatment may improve opportunities for waste management in the future). Consequently, it is important to monitor how the water resource responds to management measures implemented under the plan on a continuing basis, with a full review by 1980 to make necessary corrections to the plan.

INSTITUTIONAL AND LEGAL CONSIDERATIONS

In examining the legal and institutional aspects of water resource management in the Okanagan, it is apparent that certain deficiencies have hindered effective planning and utilization in the past. These weaknesses are summarized below.

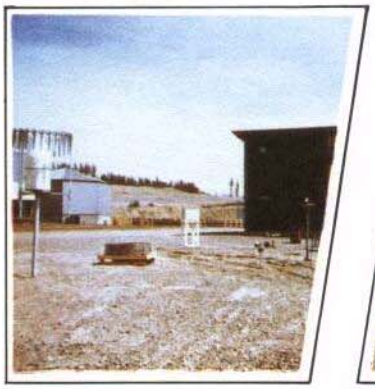
(a) No single agency has regulatory control over all pollutants from sanitary waste discharges to the ground of less than 5,000 gallons per day.

(b) No one agency is impowered to enforce waste management, flood plain zoning and green belt measures recommended under the framework plan on all Indian Lands in the Okanagan.

(c) There is a lag in the enforcement of legislation, regulations and guidelines affecting water resource management.

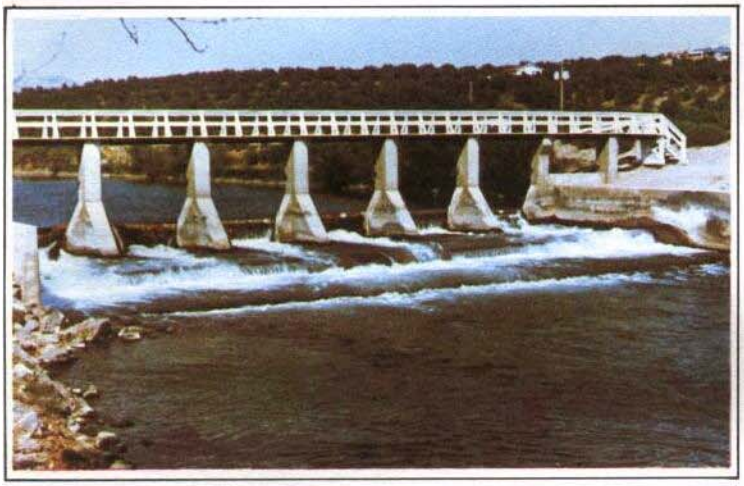
(d) Prior to this study, the public has had no opportunity for participation in the planning process.

The common thread in these weaknesses is the lack of a basin-wide approach to managing water and water related resources at the local level. The Board believes that a regional authority could, with the benefit of direct experience gained over time, solve most of the problems. It could, for example, develop plans for the orderly use or phase-out of septic tanks that have both health hazard and nutrient loading problems; it could work directly with the Indian bands to help them solve their problems in a harmonious way; it could identify deficiencies in enforcement programs; and, it could be the focal point for continuing public participation. Specific answers to these problems are not proposed here. Indeed it is the Board's view that a single regional authority will in time become more capable of providing effective and acceptable solutions. This is the heart of the Board's conclusions; namely, that the future of the Valley rests primarily in the hands of local residents, with the support and assistance of senior governments.

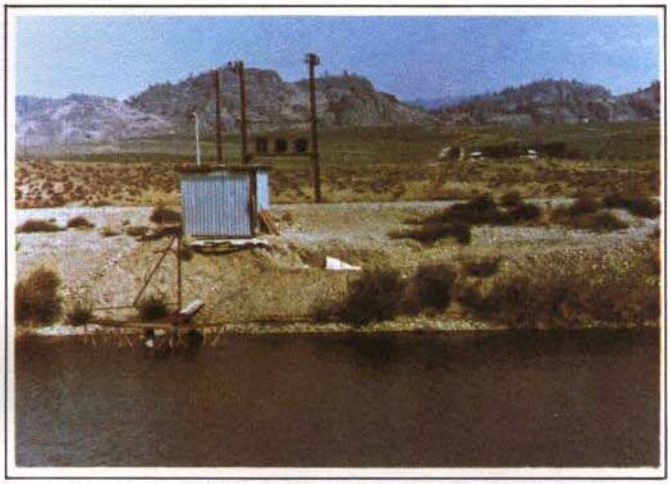


CLIMATIC GAUGING STATIONS AT BRENDA MINES AND ISINTOK MOUNTAIN

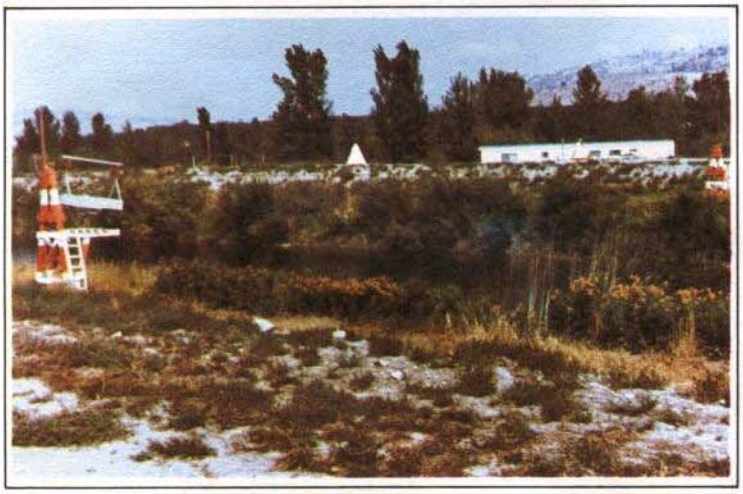
OKANAGAN FLOOD CONTROL CHANNEL BETWEEN SKAHA AND OSOYOOS LAKES



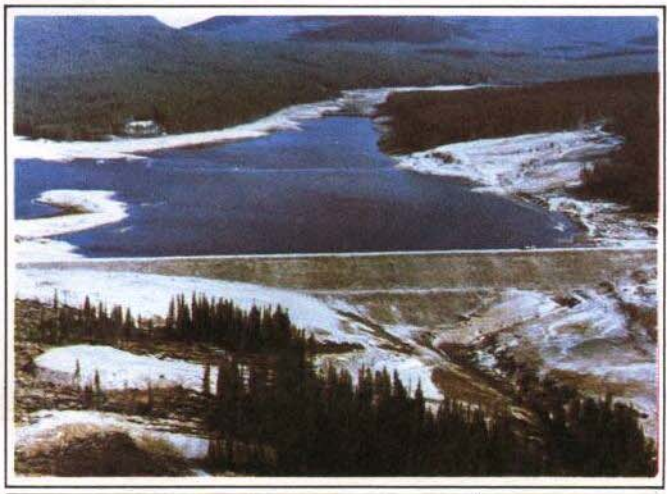
DROP STRUCTURE ON OKANAGAN RIVER TO REDUCE FLOW VELOCITIES



IRRIGATION INTAKE AND PUMPHOUSE ON OKANAGAN RIVER



WATER QUANTITY GAUGING STATION ON OKANAGAN RIVER



STORAGE DAM ON THE HEADWATERS OF PENTICTON CREEK

KALAMALKA LAKE NEAR OYAMA.
NOTE LITTORAL ZONE [LIGHTBLUE]
IS RELATIVELY FREE OF WEED GROWTH

OKANAGAN LAKE AT SUMMERLAND. NOTE
HEAVY WEED GROWTH IN
SHORELINE AREAS

SKAHA LAKE AT PENTICTON. NOTE HEAVY
WEED GROWTH IN LITTORAL ZONE BELOW
ROCK GROIN AT BOTTOM OF PICTURE

SEWAGE LAGOON AT OSOYOOS

OKANAGAN RIVER ENTERING OSOYOOS LAKE
NOTE THE NATURAL DELTA FORMATION
FROM SEDIMENTS DEPOSITED BY
OKANAGAN RIVER

DETAILED RECOMMENDATIONS

In the previous section, basic recommendations were presented dealing with broad management programs, institutions and processes affecting water resource development throughout the Valley. In the following section, a more detailed set of recommendations, in some cases with associated costs and benefits, is presented under general headings such as water quantity, water quality, fisheries, etc. Some of these detailed recommendations therefore duplicate the previous basic recommendations, but in a more specific manner. Hopefully, they will permit the reader to see in a concrete way, the set of actions proposed to improve or protect the environment while maintaining the economic viability of the Valley.

A. WATER QUANTITY

Based on economic growth projections, future requirements for water in both consumptive and non-consumptive uses are only expected to increase by about 10% from 312,000 acre-feet in 1970 to about 345,000 acre-feet in 2020. With proper management, the existing water supplies within the Basin should be able to meet these requirements. During prolonged drought periods, such as has occurred once in the last 50 years, Okanagan Lake would have to be drawn down below its present minimum water elevation of 1118.8 feet, and certain non-consumptive water uses may have to be restricted.

At the other extreme, flood conditions around Okanagan Lake are expected to occur about once every 13 years on an average. Provided Okanagan Lake elevations do not exceed 1124.8 feet*, i.e. one foot above normal high water elevation, flood damage will be relatively small and can be reduced by effective flood plain zoning policies. Although flooding around Osoyoos Lake is more frequent (once every 10 years on an average), resulting economic damage is too small to justify improved structural controls by Canada alone. Again, improved emergency protective measures and flood plain zoning to 921 feet can help reduce this flood damage over the next 50 years.

In the eight major tributaries around Okanagan Lake, additional storage reservoir capacities should be developed if increased demands for water in irrigation, domestic use and fisheries are to be met. Only two tributary basins-Vernon and Kelowna- would require supplemental water from outside their watersheds to meet potential water requirements for consumptive uses, while Trepanier Creek would require water pumped from Okanagan Lake to meet fishery requirements. Through use of multiple purpose management on Mission and Equesis Creeks, the more serious conflicts in water use between fisheries and irrigation should be resolved.

To meet the water quantity planning objectives set out under the basic recommendations, the following components of the framework plan are recommended:

Normal Operating Conditions Okanagan Lake

12. *"That Okanagan Lake be regulated within its normal four foot range [elevation 1119.8 to 1123.8 feet] in all but anticipated extreme flood years [net inflows to Okanagan Lake exceeding 500,000 acre-feet], and successive drought years [net inflows less than 200,000 acre-feet per year]."*

* Estimated maximum elevation of Okanagan Lake under 200 year flood is approximately 1125.5 feet.

13. To minimize the impact of flooding around Okanagan and Osoyoos Lake and along Okanagan River, the following steps should be taken:

Lake Operation Under Flood Conditions

I "Okanagan *Lake should be drawn down below its normal low water elevation of 1119.8 feet prior to freshet, in an anticipated flood year, by up to one foot,*

II *that flood plan zoning be implemented and enforced by a regional water management authority up to 1127.5 feet elevation around Okanagan Lake. Further development on this flood plain should be limited to recreation, parks and agricultural activities [See also Recommendation 5].*

III *that the gates on Okanagan and Skaha Lakes be improved to avoid icing during the winter and erosion and bank protection works be built around some drop structures and along Okanagan River."*

With these improvements the channel discharge capacity in Okanagan River at Penticton can be increased by 15% or 12,000 acre-feet a month, in flood years. This will have little effect on Osoyoos Lake where flooding is caused largely from backwater of the Similkameen River (see also Recommendation 6 on I.J.C. Referral).

These works should be implemented jointly by the Federal and Provincial Governments. Their capital cost has been estimated at $739,000 with accumulated flood control benefits to 2020 (economic) of $90,000. No estimate was made of the social or environmental values of these improvements.

IV *"That flood plain zoning around Osoyoos Lake be implemented by the Regional authority to 921 feet as soon as possible" [See also Recommendation 5.]*

V *"That emergency protection measures and flood warning systems be further developed for Osoyoos Lake as soon as possible by the British Columbia Water Resources Service. These measures should be described in an information booklet and made available to all residents around the lake."*

14. To minimize the impact of droughts in the mainstem, the following steps should be taken:

Lake Operation Under Drought Conditions

I *"That the level of Okanagan Lake be maintained at as high an elevation as possible during drought years, recognizing that in single drought years, all consumptive and non-consumptive water requirements should be met. Under prolonged drought conditions, the lake level may reach a low of 1116.8 feet."*

The accumulated recreational benefits associated with this type of operation have been estimated at $140,000 to the year 2020.

II *"That irrigation and domestic intakes along Okanagan River channel be lowered or altered so that they are fully operative under a base flow of 100 cubic feet per second [c.f.s.] in drought years."*

A base flow of 100 c.f.s. is required to support ecological and aesthetic resources. Water for consumptive uses and evaporation along Okanagan River and on Osoyoos Lake would be supplied in addition to this flow. This work will conserve 40,000 acre-feet in drought years and save an estimated $30,000 annually by removing the need to place stop-logs in the drop structures. This program should be undertaken jointly by the Federal and Provincial Governments.

OLD IRRIGATION FLUME - THESE HAVE NOW LARGELY BEEN REPLACED WITH UNDER-GROUND PIPE DISTRIBUTION SYSTEMS

METEOROLOGICAL STATION ON BRENDA MOUNTAIN

PRECIPITATION GAUGE ON BRENDA MOUNTAIN

TRIBUTARY STORAGE DAM [POSTILL LAKE] WATER IS RELEASED FROM SUCH DAMS TO MEET IRRIGATION DEMANDS DURING THE SUMMER MONTHS

OKANAGAN RIVER FLOOD CONTROL CHANNEL AND DROP STRUCTURE. NOTE OLD RIVER OXBOW BEHIND DYKE, MANY OF THESE OXBOWS STILL HAVE IRRIGATION INTAKES ON THEM.

FLOODING CAUSED BY
HEAVY SPRING RUNOFF
OSOYOOS LAKE 1972

EMERGENCY FLOOD PROTECTION
USING SANDBAGS

CONTROL DAM AT OUTLET OF
OKANAGAN LAKE, PROVIDES
340,000 ACRE-FEET OF STORAGE
TO MEET LOCAL AND DOWNSTREAM
WATER REQUIREMENTS

ONE OF THE MAJOR USES OF WATER IN THE
OKANAGAN IS FOR IRRIGATION

The estimated capital cost of this work is $143,000 with capitalized savings in operation costs of $410,000.

III *"That once the intakes have been lowered or altered, water requirements for sockeye salmon in Okanagan River should be met in all years except consecutive drought years as follows:*

	FLOWS MEASURED AT OLIVER HYDROMETRIC STATION
August 1-September 15	*300-400 c.f.s.*
September 26-October 31	*350-550 c.f.s.*
November 1-April 30	*275 c.f.s.*

In two or more consecutive drought years, these flows may have to be reduced."

IV *That all irrigation and domestic intakes around Okanagan Lake be adjusted as required to be operable at a minimum lake elevation of 1116.8 feet."*

The cost of these necessary adjustments is estimated at $100,000 and should be shared jointly by the Federal and Provincial Governments.

Structural Requirements RE Lake Levels

15. *"That all future intakes, wharves, boat ramps and other structures around Okanagan Lake be built to operate with a lake elevation range of 1116.8 to 1125.5 feet. Similar structures around Osoyoos Lake must operate with a lake elevation range of 909 to 919 feet, with possible revisions resulting from the proposed I.J.C. review."*

Kelowna Floating Bridge

16. *"That contingency plans and costs be prepared by the Province of British Columbia for possible adjustments to the Kelowna Floating Bridge, so that the bridge can function within an operating range of 1116.8 to 1125.5 feet on Okanagan Lake."*

Tugulnuit Lake

17. *"That the existing improved channel way used to maintain Tugulnuit Lake be supplemented by the addition of a pumping unit."*

The improvement will allow sufficient flexibility to control the lake within the desirable range and in the event of a mechanical failure still provide some inflow or outflow as required.

Monitoring to Improve Inflow Forecasts

18. *"That the stream monitoring program in the tributary streams to Okanagan Lake and the mainstem should be continued to improve inflow forecasts to Okanagan Lake and the major tributaries."*

This program, supported by soil moisture sampling should help to improve the accuracy of forecasts, thereby allowing for better regulation of both tributary stream storages and Okanagan Lake.

Multiple Water Use In Tributaries

19. *"That multiple purpose water management be practiced in selected tributary basins to meet present and future consumptive and non-consumptive uses."*

Studies indicate that the planned storages (see also Recommendation 4), will supply future consumptive and non-consumptive uses in all major tributary watersheds except Kelowna Creek.

The British Columbia Water Resources Service, in cooperation with the present water licence holders, will work out modified releases from

headwater storages in Mission and Equesis Creeks to improve flows for fisheries at the mouths of these streams. The British Columbia Department of Recreation and Conservation will arrange and finance additional water storages for fisheries at the sites indicated below, by 1980, while the development of additional storages for consumptive uses will be undertaken as required by the Municipalities, Improvement Districts or individual water users. The above agencies in consultation with the Regional authority, will be responsible for planning and coordinating future water resource development in tributary watersheds.

Existing and planned storage on the eight most heavily utilized tributaries in the basin are as follows.

PLANNED TRIBUTARY STORAGE FOR CONSUMPTIVE USE AND FISHERIES

TRIBUTARY	RESERVOIR STORAGE IN 1972 (ACRE-FEET)	PROPOSED NEW STORAGE (ACRE-FEET)	
		CONSUMPTIVE USE	FISHERIES
TROUT CREEK	10,300	1,700	–
PEACHLAND CREEK	9,500	–	–
POWERS CREEK	3,700	1,100	–
EQUESIS CREEK	2,200	–	700
VERNON CREEK	46,700	15,800	
KELOWNA CREEK	5,700	1,600	
MISSION CREEK	18,000	7,200	3,600
PENTICTON CREEK	9,800	–	–
TOTALS	105,900	27,400	4,300

The estimated capital cost of constructing these proposed storages is 1.1 million dollars for fisheries and 6.9 million dollars for consumptive use purposes, with annual costs of $110,000 and $730,000 respectively. The annual economic and social benefits accruing from sport fishery enhancement have been estimated at $500,000 and $800,000 respectively. Benefits were not estimated for consumptive use storage.

Pumped Diversion to Vernon Creek

20. "That the pumped diversion from Okanagan Lake to Vernon Creek be continued."

This diversion, currently being made to meet industrial demands for water, returns the flow in lower Vernon Creek to historical levels (prior to agricultural development in the area), could provide sufficient water if operated continuously to eliminate consumptive use deficiencies along the lower reach of Vernon Creek, including fishery flow deficits.

The development of some 16,000 acre-feet of storage on Vernon Creek would be used for the development of an additional 4,000 acres of irrigated land. Such development should be carefully considered because other available water supplies are located at some distance from potentially irrigable lands.

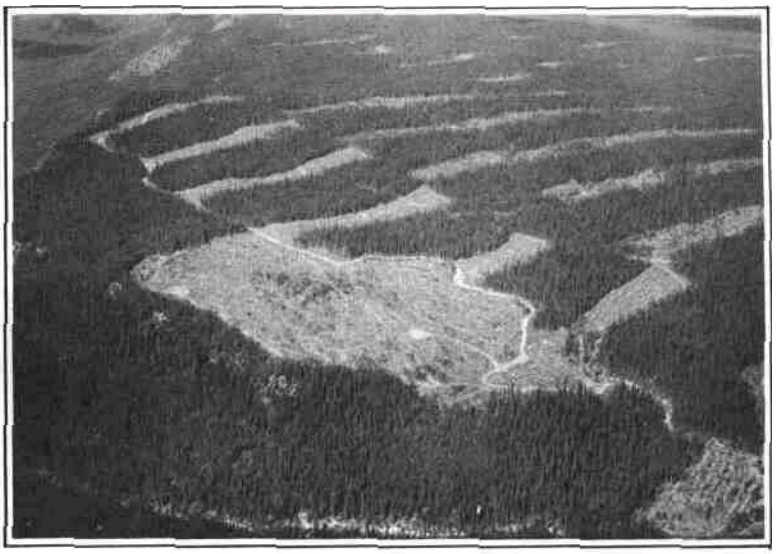
Further recommendations for the Vernon Creek Basin are anticipated under the Provincial Kalamalka-Wood Lake Study.

WEEDS BEING HARVESTED FROM THE SHORELINE OF OKANAGAN LAKE NEAR VERNON

HIGH DENSITY HOUSING DEVELOPMENTS ON LOW LYING AREAS ADJACENT TO THE MAIN VALLEY LAKES CONTRIBUTE SIGNIFICANT AMOUNTS OF NUTRIENTS VIA GROUNDWATER TRANSPORT

THE PROTECTION OF THE WATER QUALITY OF EXISTING BEACHES IS A HIGH PRIORITY OF VALLEY RESIDENTS

DEFORESTATION OF HEADWATER AREAS CAN CONTRIBUTE TO EROSION AND NUTRIENT LOADINGS TO TRIBUTARY STREAMS



SURFACE RUNOFF FROM CATTLE AND OTHER LIVESTOCK OPERATIONS CAN ADD BOTH NUTRIENTS AND BACTERIA TO THE STREAMS AND MAIN VALLEY LAKES

ONE OF THE MAJOR SOURCES OF NUTRIENTS TO THE LAKES ARE THE WASTE PRODUCTS OF MAN

B. WATER QUALITY

I. Tributary Streams

Generally accepted water quality standards for consumptive and non-consumptive uses are outlined in the main report of the Consultative Board. These are standards established by government agencies, particularly the B.C. Department of Health, and apply to specific uses of water such as for drinking purposes, aquatic life including fisheries, and water contact sports.

Most streams do not meet water quality standards for drinking water purposes in one or more parameters, particularly color and turbidity, but of most concern are those pollutants which are harmful to the health of man or injurious to sport fish, including coliform, high turbidity levels, oxygen deficiencies and in some cases, high nutrient levels. Since most of the undesirable constituents in streams are also a major source of pollutants to the main valley lakes, any improvement in stream quality will also enhance lake water quality.

Recommendations to meet water quality objectives in tributary streams are as follows:

Municipal & Industrial Discharges to Tributaries

21. "That all municipal and industrial waste discharges causing pollution be prevented from entering tributary streams."

Because the amount of waste material that various streams can assimilate varies from creek to creek, day to day, and month to month, depending on the size of the sub-basin and streamflow, it is impractical to establish meaningful receiving water standards. Few streams in the basin carry sufficient water on a year-round basis to assimilate any waste products other than natural pollutants from the basin itself. Therefore, the removal of all municipal and industrial discharges containing pollutants is required to achieve established water quality standards in most streams. However, where such waste discharges can be proven acceptable and free of pollutants, the additional water provided by such discharges is often beneficial, and should be encouraged. Community or regional treatment plants would be the most suitable in achieving the above objective, particularly with respect to industrial waste discharges.

Erosion Management

22. "That forest management and agricultural practices be reviewed by the B.C. Forest Service and the B.C. Department of Agriculture, and greenbelts established where necessary to reduce nutrient loadings from erosion."

Logging road construction and land cultivation adjacent to streams are major sources of soil erosion from surface runoff. Eroded soils greatly increase the turbidity of water, and provide a base in lakebeds for rooted aquatic vegetation. They also contribute a substantial amount of nutrients and other chemical elements to the main valley lakes. Improved land use management over a period of time may reduce such erosion, but continued monitoring and surveillance of stream water quality may also indicate the need for appropriate green belts (strips of permanent vegetation), along the entire course of streams where logging and cultivation are practiced. Such green belts must be maintained to ensure their effectiveness in minimizing soil erosion and stream pollution.

Drainage Waters From Livestock Operations

23. "That regulations controlling surface drainage from cattle feed lots, and other livestock operations be established and enforced by-British Columbia Water Resources Service by 1975."

Fertilizers and Sprays

24. *"That future regulations controlling fertilizers and sprays be reviewed by the B.C. Department of Agriculture following the completion and release of the report of the Royal Commission currently studying the matter."*

II. Main Valley Lakes

Algal blooms and rooted aquatic vegetation have become visually evident in many parts of all the main valley lakes in recent years. These conditions will continue to worsen under existing waste loading levels, and will have an increasingly detrimental effect on the enjoyment of these lakes from an economic, recreational and aesthetic viewpoint. The major cause of this type of pollution has been identified as nutrient loadings in excess of those which lakes can assimilate.

In the Okanagan Basin, phosphorus has been identified as the nutrient which may be most successfully controlled to reduce this plant growth and resulting deterioration in water quality, and phosphorus loading objectives have been established for each of the main valley lakes. These objectives are related to an assimilative capacity for each lake that will provide a level of water quality consistent with maximum recreational and aesthetic benefits.

Nutrient sources are many and varied, but one source, municipal outfalls, currently contributes approximately 50% of the total phosphorus loading to the main valley lakes. The immediate control of this one source has therefore been given priority over other sources, which are more difficult to manage. Because waste treatment technology and methods for the removal of phosphorus are dependent on conventional treatment facilities, the requirements and costs for such treatment have been included in the evaluations. The benefits obtained from the removal of phosphorus, a decrease in rooted aquatic plant growth and algal blooms, should however only be compared to the costs of phosphorus removal itself. Primary and secondary waste treatment processes are normally required for protecting the health of the valley community.

Urban developments serviced by septic tanks also represent a significant source of phosphorus to the main valley lakes. The soils of the Okanagan Valley are generally poor in respect to nutrient removal, and in densely populated areas, high percentages of nutrients can return to surface waters from these diffuse sources. Such sources can affect a lake as a whole - e.g. Wood, Kalamalka and Osoyoos, or in the case of Okanagan Lake, shoreline areas which may have high recreational values.

Therefore, the next priority for nutrient control is sewage collection and waste treatment in urban areas serviced by septic tanks adjacent to the main valley lakes. The rapid growth of some of these unsewered areas appears to have created serious localized weed and algal problems rather than health problems.

In rural areas with low density populations located at a distance from surface waters, septic tanks will continue to be the most economical means for treating household wastes.

In presenting the following specific recommendations to reduce phosphorus loadings to each of the main valley lakes within the limits of the established objectives, the relative accuracy of loading data and uncertainty involved in the establishment of loading objectives, requires that the effect of implementation of these recommendations should be carefully monitored to ensure the desired results are being realized. Further, while the projected loadings are shown to the year 2020, the costs and benefits of phosphorus control are shown for only the immediate future.

[a] Wood Lake

The present condition of this lake is very poor with almost continuous algal blooms in the summer months and heavy aquatic plant growth along the shorelines. The current phosphorus loading has been estimated at a minimum of 3300 pounds per year of which approximately 50% is attributed to septic tank sources.

Future loadings based on low economic growth projections for this area are as follows:

YEAR	PROJECTED AVERAGE ANNUAL PHOSPHORUS LOADINGS (POUNDS)	MINIMUM REDUCTION REQUIRED TO MEET ESTABLISHED OBJECTIVES (POUNDS)
1980	5000	3000
2000	8200	6200
2020	11900	9900

The acceptable limits for phosphorus loading to this lake have been established at 2000 to 3000 pounds per year. Because of the existing high internal loading of phosphorus in this lake a significant decrease in phosphorus loadings is required to effect any change in its condition. Therefore, the lower loading objective of 2000 pounds has been used in estimating minimum phosphorus reductions for Wood Lake. Due to its physical characteristics (volume, mean depth, and low volume of inflow) and uncontrollable sources of nutrients, the lake will continue to be biologically productive but clarity and oxygen levels will be improved and fisheries enhanced, if the above reductions are achieved.

Recommendations to meet established loading objectives are as follows:

Wood Lake

25. *"That a sewage collection treatment system at the urban center of Winfield, with facilities for 80% phosphorus removal, be installed by 1977."*

The estimated capital cost of this facility which would meet treatment requirements to 1985 based on projected population growth is shown below. (1970 Dollar Values)

– SANITARY SEWERS	$530,000
– SECONDARY TREATMENT	$280,000
– PHOSPHORUS REMOVAL FACILITIES	$ 70,000
TOTAL	**$880,000**

The annual expenditures for phosphorus removal only, including the amortization of capital and operating costs, have been estimated at $10,000 to $15,000. Annual economic and social benefits to be derived from improving this lake quality have been estimated at $36,000 and $69,000 respectively to 1985.

One alternative to the above would be to transport wastes to a central treatment plant at Kelowna, thus achieving 100% phosphorus removal from sewered areas at Winfield. The capital cost of a trunk main and phosphorus removal at Kelowna is estimated at approximately $680,000.

Increased phosphorus removal either by spray irrigation or other means may be required by the year 2000 to meet established criteria. The exact amount of removal will depend on monitoring results to and beyond 1985.

These cost figures and those shown for the other lakes are very preliminary and primarily for comparison purposes. Detailed studies and plans for a particular center should be carried out under the direction of the Regional authority to determine the most suitable treatment method and cost of such works prior to actual implementation.

[b] Kalamalka Lake

The relative fertility of this lake is high, but good quality conditions have been preserved by a natural self-cleansing system. Some weed growth is now occurring at the mouth of Coldstream Creek and in the south end of the lake. The present (1971) phosphorus loading to this lake has been estimated at 5200 pounds per year, of which approximately 20% is from septic tanks. These septic tank installations are nearly all located in the Coldstream area at the north end of the lake, and along with nutrients from Coldstream Creek itself are the main reasons for weed problems in this area. Future loadings based on a low economic growth projection are as follows:

YEAR	PROJECTED AVERAGE ANNUAL PHOSPHORUS LOADINGS (POUNDS)	MINIMUM REDUCTION REQUIRED TO MEET ESTABLISHED OBJECTIVES (POUNDS)
1980	7000	–
2000	8300	600
2020	9300	1600

The acceptable range for phosphorus loading to Kalamalka Lake has been established at 6600 to 8800 pounds of phosphorus per year. Provided annual loadings are kept within this range, the quality of water in the lake as a whole should remain in excellent condition, particularly for recreation and aesthetic purposes. This will not however, protect the shoreline areas from declining in quality due to local nutrient inputs from such sources as septic tanks. The loading objectives for this lake are more stringent than for the other lakes because of the small volume of inflow and relatively long retention time of water in this lake.

While total present loadings are below established objectives, curtailment of local sources of nutrients from septic tanks is considered necessary to protect beach and other recreational areas at the north end of the lake. Recommendations are therefore as follows:

Kalamalka Lake

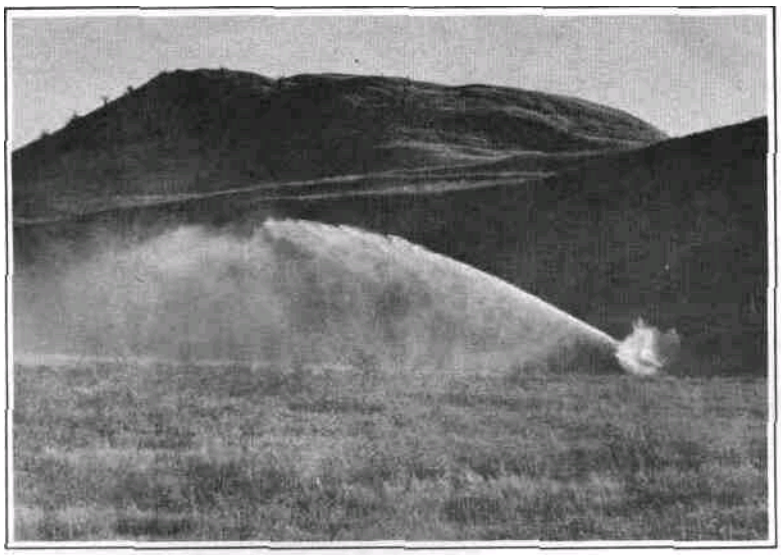
26. *"That sewage collection for the urban center of Coldstream with a main pipeline to the treatment plant at Vernon be implemented by 1977. This would effect 100% phosphorus removal in serviced areas and reduce local phosphorus loadings to the Kalamalka Beach area."*

The estimated capital cost of this to meet treatment requirements to 1985 would be as follows:

– SANITARY SEWERS	$1,190,000
– PUMPING STATION AND PIPELINE TO VERNON REGIONAL TREATMENT PLANT (WOULD SERVE BEYOND 1990).	250,000
– CAPITAL COST OF PHOSPHORUS REMOVAL FACILITIES INCLUDED UNDER VERNON PLANT. COLDSTREAM CONTRIBUTION IS APPROXIMATELY 10%	35,000 TO 45,000
TOTAL	**$1,520,000**

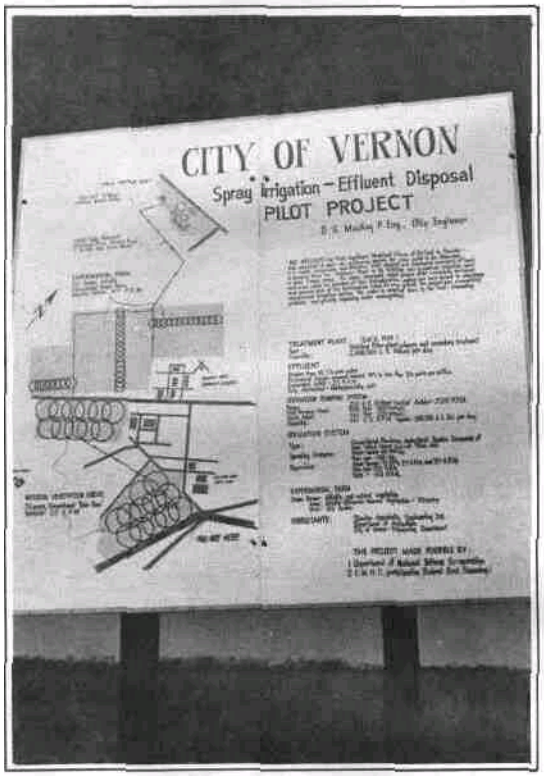
The annual expenditures for phosphorus removal only have been estimated at $10,000. The annual economic and social benefits associated with the removal of phosphorus, and resulting high quality of water for recreational pursuits, are $12,000 and $60,000 respectively.

The above measure along with improved standards for new septic tank installations should reduce phosphorus loadings to within established objectives beyond the year 1985.

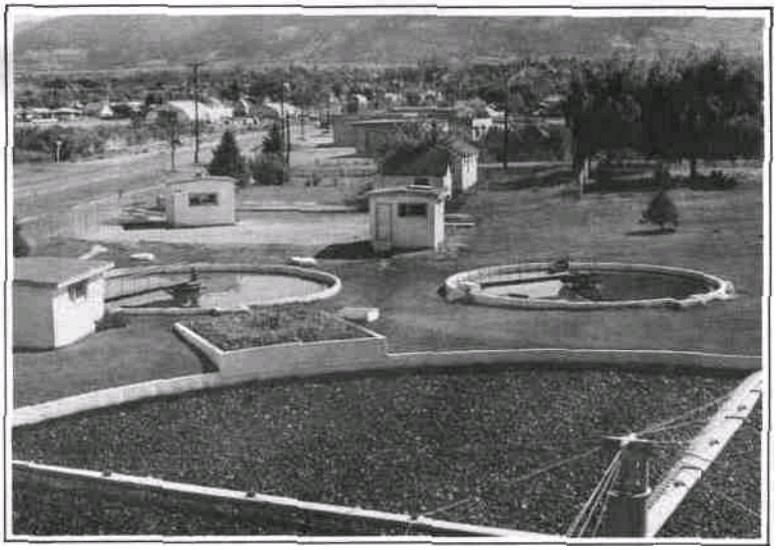


ONE OF THE PILOT STUDIES FOR THE ADVANCED TREATMENT OF *WASTEWATER INVOLVED THE SPRAY* IRRIGATION OF FORAGE CROPS AT VERNON, B.C.

TEST INSTALLATIONS [LYSIMETERS] USED TO MEASURE THE EFFECTIVENESS OF DIFFERENT CROPS AND SOIL TYPES *IN REMOVING NUTRIENTS FROM* TREATED MUNICIPAL WASTEWATERS [PENTICTON, B.C.]



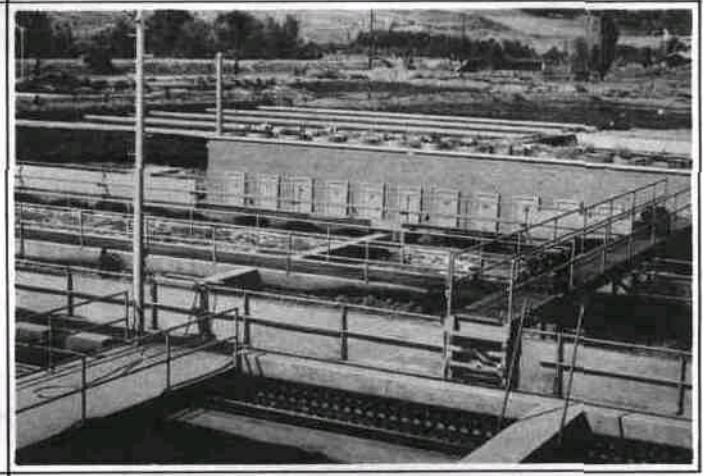
SIGN AT THE ENTRANCE OF THE VERNON SPRAY IRRIGATION *EFFLUENT DISPOSAL PILOT PROJECT*

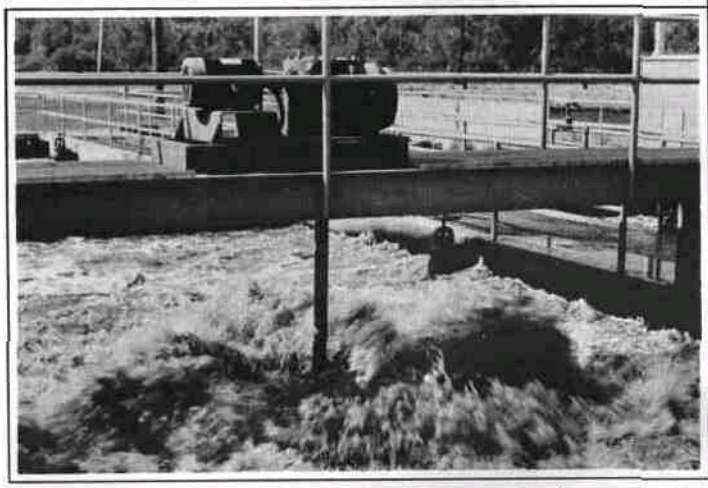


THE MUNICIPAL TREATMENT PLANT AT VERNON, B.C. WITH TRICKLING FILTER IN FOREGROUND AND SETTLING PONDS IN CENTER OF PICTURE

CITY OF PENTICTON
MUNICIPAL
TREATMENT
PLANT

TREATMENT AND SETTLING BASINS
AT PENTICTON
SEWAGE TREATMENT
CENTER





AERATION AND MIXING
POND

AERIAL VIEW -
PENTICTON TREATMENT PLANT -
CIRCULAR UNITS IN TOP CENTER
ARE FOR THE REMOVAL OF THE
NUTRIENT PHOSPHORUS BEFORE
THE TREATED WASTEWATER IS
DISCHARGED INTO
OKANAGAN RIVER

[c] Okanagan Lake

The main water mass of Okanagan Lake is still in excellent condition, but deterioration has occurred around shoreline areas served by septic tanks or affected by wastewater outfalls.

Projected loadings to Okanagan Lake are as follows:

YEAR	PROJECTED AVERAGE ANNUAL PHOSPHORUS LOADINGS POUNDS	MINIMUM REDUCTION REQUIRED TO MEET ESTABLISHED OBJECTIVES POUNDS
1980	225,000	65,000
2000	280,000	120,000
2020	310,000	150,000

Over 40% of the current (1971) phosphorus loading comes from the two municipal outfalls of Vernon and Kelowna, while an additional 10% may be attributed to septic tank sources.

The acceptable range for phosphorus loadings to Okanagan Lake has been established at 135,000 to 185,000 pounds of phosphorus per year.

Providing annual loadings are kept within this range, excellent water quality should be maintained in the main body of the lake. Additional measures however, may be required for localized problems in shoreline areas.

A high quality of water in Okanagan Lake is the key to good water quality in the downstream lakes and maximum loadings for the south basin have therefore been set lower than the rest of the lake to provide an increased margin of safety against water quality degradation. The present (1971) loadings in all three areas either exceed or equal these established objectives. The removal of 80% of the phosphorus loading from the two municipal outfalls (Kelowna and Vernon) will reduce these loadings within acceptable limits beyond 1985, but local areas may still exhibit eutrophic characteristics due to local phosphorus loadings from shoreline development.

Recommendations to meet established objectives for phosphorus loadings to Okanagan Lake, and to control weed growth in local shoreline areas are as follows:

Okanagan Lake

27. *[i] "That the city of Vernon remove all sanitary and industrial wastes causing pollution, from Vernon creek by implementing one of the two wastewater management options detailed below:*

OPTION A — Removal of 80% of phosphorus by 1977 with discharge of treated effluent into Vernon Creek.

This option assumes a discharge effluent which will not degrade the quality of Vernon Creek water. Should continued monitoring indicate this discharge to contain pollutants which affect the quality of Vernon Creek and the North Arm of Okanagan Lake, an outfall sewer between the Vernon Sewage Treatment Plant and the main body of Okanagan Lake may be required. The cost of such an outfall sewer has been estimated at 1 million dollars.

OPTION B — Spray irrigation of secondary treated effluent by 1977. This measure would achieve over 90% phosphorus removal.

[ii] "That sewage collection and treatment with 80% phosphorus removal for the urban center of Okanagan Landing be started by 1977 to reduce loadings to the Vernon Arm of the lake. The option of constructing a trunk line to the central plant at Vernon should be investigated."

[iii] "That 80% phosphorus removal from City of Kelowna waste effluents be implemented by 1977 to reduce loadings within acceptable limits beyond the year 1980 under a law economic growth rate. The inclusion of Rutland and new areas in the city Of Kelowna sewer system should be undertaken immediately. Increased phosphorus removal may be required by the year 2000."

[iv] "That phosphorus removal at Westbank, Armstrong, Naramata, Summerland, Peachland and other urban shoreline developments be implemented as required by the B.C. Water Resources Service to improve water quality in local shoreline areas of Okanagan Lake."

The capital cost of the first three recommendations to meet treatment requirements to 1985 has been estimated as follows (1970 dollar values):

Vernon - Option A

Sanitary Sewers	$1,270,000
Renovation of Existing Plant and New Activated Sludge Plant	1,100,000
Phosphorus Removal Facilities	410,000
TOTAL	2,780,000
Annual cost of Phosphorus Removal	$ 100,000

Vernon - Option B

While spray irrigation of secondary effluent has been studied and found to be an effective means of wastewater disposal, the health implications and costs of this type of treatment for phosphorus removal have not been fully evaluated for a specific center or site.

Okanagan Landing	
Sanitary Sewers	$155,000
Batch Lagoon (to 1985)	90,000
Phosphorus Removal Facilities	3,000
TOTAL	248,000
Annual cost of Phosphorus Removal	$ 2,500

Kelowna [including Rutland]

Sanitary Sewers	$7,390,000
Activated Sludge Plant excluding available facilities (good to 1985)	2,250,000
Phosphorus Removal Facilities	880,000
TOTAL	10,520,000
Annual cost of Phosphorus Removal	$ 200,000

Annual economic and social benefits, derived from maintaining a high water quality in Okanagan Lake through phosphorus removal at the above centers, have been estimated at $136,000 and $710,000 respectively.

[d] Skaha Lake

This lake has the highest relative fertility and biological growth rate of the main valley lakes, and its quality has deteriorated the most rapidly. High quality inflows from Okanagan Lake, and annual renewal of water in this lake have prevented a more rapid deterioration. The estimated phosphorus loading in 1971 was 48,000 pounds. This figure takes into account the average efficiency of the tertiary unit at the City of Penticton Sewage Treatment Plant at that time. (Note: Subsequent improvement in the efficiency of this treatment unit has provided an average phosphorus removal efficienty of 84% for the period September to December 1973).

Projected loadings are as follows:

YEAR	PROJECTED AVERAGE ANNUAL PHOSPHORUS LOADINGS (POUNDS)	MINIMUM REDUCTION REQUIRED TO MEET ESTABLISHED OBJECTIVES (POUNDS)
1980	58,000	23,000
2000	71,000	36,000
2020	78,000	53,000

Acceptable limits for phosphorus loadings to Skaha Lake have been established at 30,000 to 40,000 pounds per year. These somewhat high values take into account the very short retention time of water in this lake (one year) and the excellent source of good quality water flowing into Skaha from Okanagan Lake. If this objective is met, a good quality water should be achieved for recreation and body contact sports.

Recommendations to reduce loadings within these limits are as follows:

Skaha Lake

28. *[i] "That 80% phosphorus removal at the City of Penticton Sewage Treatment Plant be achieved and/or maintained."*

Increased removal of phosphorus may be necessary after 1980 as indicated by further monitoring.

The estimated capital cost of this to meet treatment requirements to 1985 is as follows (1970 dollar values).

Sanitary Sewers	$1,330,000
Additional Activated Sludge Treatment Facilities	230,000
(Good to 1990)	(existing)
Phosphorus Removal Facilities	11,560,000
TOTAL	$ 84,000
Annual cost of Phosphorus Removal	

The annual economic and social benefits associated with phosphorus removal are $48,000 and $135,000 respectively.

[ii] ***"That treatment and phosphorus removal at Okanagan Falls and other urban shoreline developments be implemented as required by the B.C. Water Resources Service to improve local shoreline areas, based on the results of monitoring programs."***

[e] Vaseux Lake

Vaseux has always been a productive lake with its quality dependent on the quality of water from Skaha Lake and Okanagan River. The only applicable recommendation for this lake is that all septic tank system installations or equivalent, adjacent to the lake, be constructed to standards ensuring 80% phosphorus removal, where soil conditions are such that special measures are required in keeping with valley-wide recommendations. The cost of such installations has been estimated at $1,000 to $4,000 depending on the soil condition. The quality of Vaseux Lake waters may be expected to improve somewhat with improvements in Skaha and Okanagan River water, but the shoreline areas will continue to exhibit heavy aquatic growth due to the shallow nature of most of the lake and rich bottom sediments. This habitat is considered suitable for Vaseux Lake, as it has been established as a wildlife (bird) sanctuary.

[f] Osoyoos Lake

Approximately 60% of the nutrient loadings to Osoyoos Lake come from outflows from Skaha Lake and nutrient additions to Okanagan River between Skaha and Osoyoos Lake including the village of Oliver, drainage waters from agricultural lands and septic tank sources. The remaining loadings come primarily from groundwater return flows to the lake itself. The 1971 loading has been estimated at 37,500 pounds, which takes into account the 1972-73 effect of the tertiary treatment unit at Penticton.

Projected loadings to Osoyoos Lake are as follows:

YEAR	PROJECTED AVERAGE ANNUAL PHOSPHORUS LOADINGS (POUNDS)	MINIMUM REDUCTION REQUIRED TO MEET ESTABLISHED OBJECTIVES (POUNDS)
1980	51,700	20,000
2000	70,200	38,000
2020	78,200	47,000

Acceptable phosphorus loadings to Osoyoos Lake have been established at 26,000 to 37,000 pounds. These values allow for the very rapid water renewal rate of less than one year which prevents the accumulation of large amounts of nutrients. The maintenance of phosphorus loadings below 31,000 pounds per year should provide a reasonably good water quality for recreation and body contact sports but somewhat lower than that of Skaha Lake and Okanagan Lakes.

The attainment of 80% phosphorus removal at Penticton will not be sufficient to maintain loadings within the above limits, and the following additional recommendations are therefore made which will ensure these local objectives are achieved:

Osoyoos Lake

29. *[i] "That 80% phosphorus removal at Oliver is required by 1980 to reduce loadings to Osoyoos Lake."*

[ii] "That 80% phosphorus removal at Osoyoos is required by 1977. Urban areas in Osoyoos adjacent to Osoyoos Lake and serviced by septic tanks should be sewered and included in the Osoyoos waste treatment program by 1980."

The estimated capital cost of treatment at Oliver and Osoyoos to meet treatment requirements to 1985 (1970 dollar value) is as follows:

Oliver	
Sanitary Sewers	$30,000
Present Treatment Facilities to 1985 (exclusive of Sun Rype plant effluent	---
Phosphorus Removal Facilities	70,000
TOTAL	100,000
Annual cost of Phosphorus Removal	$ 9,000
Osoyoos	
Sanitary Sewers	$75,000
Extension of Lagoon Treatment Facilities	90,000
Phosphorus Removal by Spray Irrigation	Not estimated
Annual cost of Phosphorus Removal	Not estimated

Annual economic and social benefits associated with phosphorus removal for improving the quality of Osoyoos Lake are estimated at $33,000 and $95,000 respectively.

III Waste Management

Two general recommendations concerning waste management are included in the comprehensive plan as being necessary, if the objective for good water quality in the main valley lakes is to be achieved.

Regional Waste Treatment

30. *"That the Regional authority for water resource management be given the responsibility for the construction, operation, maintenance and financing of all solid waste and sewage treatment plants in the basin, subject to permits issued by the Government of British Columbia."*

Septic Tanks

31. *"That all new septic tank installations be constructed to standards than ensure 80% phosphorus removal where soil conditions are such that special measures are required to control nutrients from this source."*

C. FISHERY MANAGEMENT

Some 158,000 angling days were recorded in the Okanagan in 1971, and this total is expected to increase to 450,000 by 2020. Factors limiting sport fishery resources in Okanagan Lakes are hatchery stocking capacities for headwater lakes and adequate stream spawning habitats in the main valley lakes. Failure to protect and enhance the existing sport fishery will result in a decline in numbers of harvestable fish available and a rapid reduction in the number of fish caught as angling demands increase. This could result in an estimated economic loss of 2.8 million dollars and a social loss of 4.6 million dollars over the next fifty years (present values).

The objective of the sport fishery management program is to maintain or enhance existing angling success rates in all Okanagan lakes to 2020. It appears that the lakes have sufficient capacity to support the increased populations offish required to meet this objective.

Okanagan River supports an average of 19,000 Sockeye salmon spawners annually, which produced 70% of the present United States Columbia River Sockeye salmon catch. This resource is also an important source of food for Indians along Okanagan River. Adoption of water conservation measures in Okanagan River will maintain the fishery at current population levels.

The total cost of the recommended sport fishery management program is expected to exceed $3 million by 2020 (in 1970 dollars). According to the surveys of resident and non-resident anglers, this investment should be justified through increased participation and satisfaction by anglers in the Okanagan. It is recommended:

Fishery Management

32. "That the fishery resource continue to be managed on a valley-wide basis by the British Columbia Department of Recreation and Conservation but a number of alternative means of financing this program should be investigated by this agency in cooperation with the Regional District. Moreover, additional programs related to zoning various particular lakes for restricted or specialized sport fishing should be evaluated."

The following components of the framework plan to enhance the sport fishery to meet future angling demands are recommended:

1. Headwater Lakes

Trout Stocking

33. "That the rainbow trout stocking program should be increased from 1,7 million fry annually at present [1971], to 2.1 million fry by 1980, using existing hatchery facilities."

Fish Hatchery

34. "That studies be undertaken by the British Columbia Department of Recreation and Conservation by 1975 for locating and designing a new fish hatchery in the Southern Interior of the province."

This hatchery should be in production by 1985 and, though it would probably serve other locations in the interior of British Columbia, it should be able to supply an additional 1.7 million fry annually by 2020 in Okanagan headwater lakes. Total costs of supplying these fish in the Okanagan are estimated at $1.3 million with minimum estimate of capitalized economic and social benefits of $1.6 million and $2.6 million respectively. (1970 dollar values).

Boating Regulations

35. "That federal boating regulations in headwater lakes be extended and enforced by the British Columbia Department of Recreation and Conservation in cooperation with the Regional Authority."

These regulations should be administered to provide a wide range of angling experience from wilderness angling to family angling with power boats.

11. Okanagan Lake

Okanagan Lake supports over 80% of all angling in the main valley lakes and this proportion could increase over the next fifty years as the smaller lakes in the main valley system become relatively more crowded. The Okanagan Lake fishery is supported by spawning areas in the tributaries and Okanagan River and these areas are considered a part of this resource.

In addition to maintaining present levels of production from all tributary streams, the first — but essential — step in a total fishery habitat management program is the provision of adequate minimum flows for fish propagation on Mission, Equesis and Trepanier Creeks in all but drought years. Without adequate water supplies, stream bed improvements for spawning purposes are valueless. In addition, green belts must be preserved along the entire spawning areas of these creeks to provide shade and erosion control.

Consequently, the framework plan sets out the following recommendations to enhance sport fishery resources in the Basin:

Mission Creek

Modified Operation Of Existing Storage

36. [i] That a modified operation of headwater storage releases be established by 1975 by the British Columbia Water Resources Service in cooperation with the irrigation districts.

Such a system of multiple use water management could support 4,000 harvestable trout annually.

New Storage Mission Creek

[ii] That 3,600 acre-feet of headwater storage be licenced and developed for fisheries by 1980.

This measure would have a capital cost of an estimated $900,000 and would support an additional 80,000 harvestable kokanee and 28,000 trout annually.

Stream Bed Spawning Habitat

[iii] That rehabilitation of the streambed spawning habitat be undertaken after assured water supplies are available.

This measure is estimated to cost approximately $440,000 and would support an additional 120,000 harvestable kokanee and 90,000 rainbow trout annually.

Equesis Creek

New Storage on Equesis Creek

37. That an additional 700 acre-feet of storage be made available to support the fishery in Equesis Creek.

This storage can be obtained through modified operation of Pinaus Lake reservoir to meet fishery flows, the development of approximately 700 acre-feet of additional storage and, if necessary, compensation to existing water licencees. Total capital costs of these measures, together with rehabilitation of the streambed, are estimated at $175,000 to $200,000. The combined investment would support an additional 43,000 harvestable kokanee and should be undertaken prior to 1985.

Trepanier Creek

Pumped water - Trepanier Creek

38. [i] That 2200 acre-feet of water be pumped from Okanagan Lake to the lower reaches of Trepanier Creek by 1985.

There is no available headwater storage in this creek and water must be pumped from Okanagan Lake. The cost of this system is estimated at $173,000 with rehabilitation of spawning beds costing an additional $100,000. The combined investment would support an additional 83,000 and 1,000 harvestable kokanee and Rainbow trout respectively.

Other Creeks

Incubation Channel

39. That further consideration should be given to the development of an incubation channel in one of the tributary creeks to South Okanagan Lake.

The fishery enhancement program set out above should satisfy angling demands in the north and central basins of Okanagan Lake until at least the year 2000, but angler success rates will continue to be low in the south basin of the lake. Because of limited water supplies in the southern tributaries to Okanagan Lake, development of an incubation channel, which requires less water than natural spawning beds was considered. One such project was examined in Trout Creek, but the problems of siltation resulting from a natural slide in Trout Creek Canyon may prohibit the success of such a venture. These studies should be undertaken by the British Columbia Department of Recreation and Conservation, with cooperation from the Regional District and recommendations prepared by the time of the full review of the Okanagan Basin Study, in 1980.

Okanagan Lake Shore Spawning

Shore Spawning

40. "That due consideration be given to shore spawning kokanee when regulating Okanagan Lake water levels over the winter months."

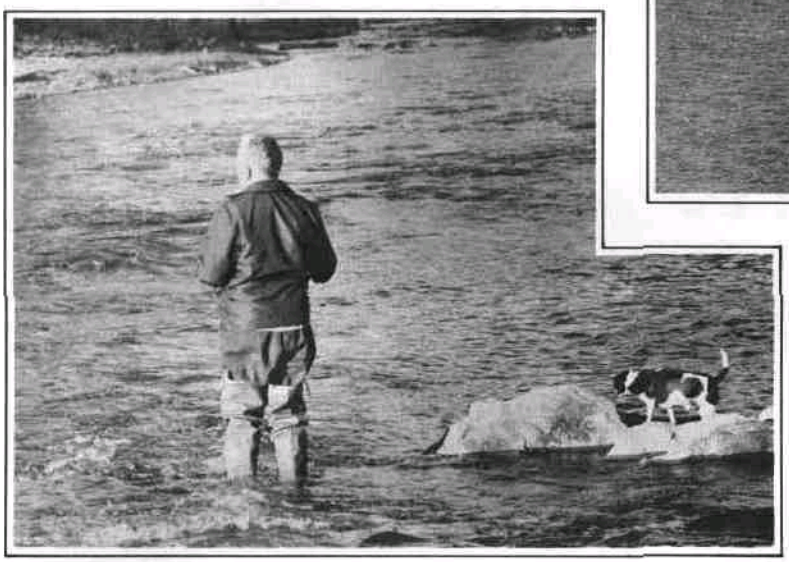
To minimize damage to shore spawning kokanee during the fall and winter months, the drawdown of Okanagan Lake between October 1 and February 28 should not normally exceed six inches. In anticipated flood years however, greater drawdowns may be necessary to accommodate the spring runoff. Harvest potential of the shore spawning kokanee should be further assessed to determine the value of this resource more accurately.

D WATER BASED RECREATION

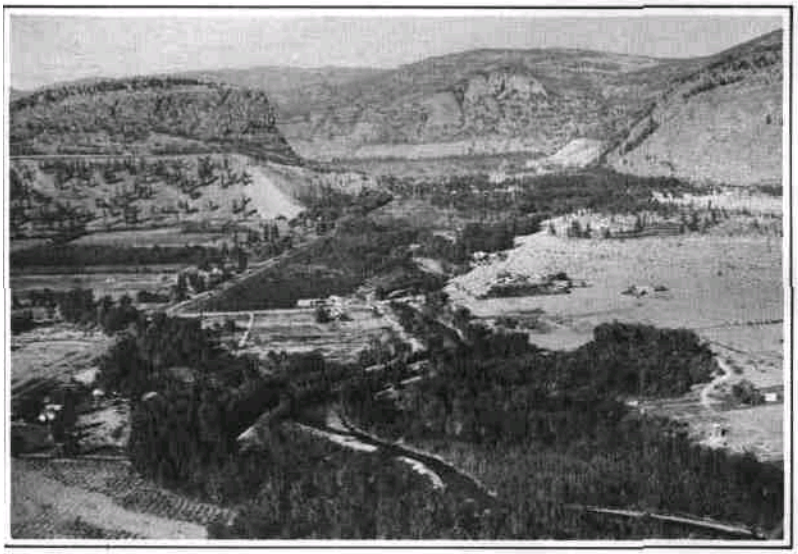
The importance of Okanagan beaches to the life styles of both residents and tourists was clearly demonstrated by the frequency of participation in shoreline recreation. Over 60% of summer holiday tourists spend part or all of each day in their visits, on the beaches, while residents on an average, spent 20 days during the summer months on the beach. Based on projected increases in tourism, and residents for Projection 111, the current total of 4 million beach days is expected to more than double to 10 million by 2020. The economic value of this resource was estimated at $4.5 million in 1970 and is expected to increase to $27.4 million annually (1970 dollars) by 2020.

The value and demand for shoreline recreation is closely related to maintenance of high water quality in the main valley lakes, good access and opportunities to enjoy uncrowded conditions. All public beaches were declared safe from a health viewpoint in 1972, although Kinsman (Kin) Beach near Vernon exceeded coliform standards in some samples. Several public beaches were affected by aquatic plant growth and occasional algae blooms.

FAMILY FISHING IN ONE OF THE HEADWATER LAKES IN THE OKANAGAN

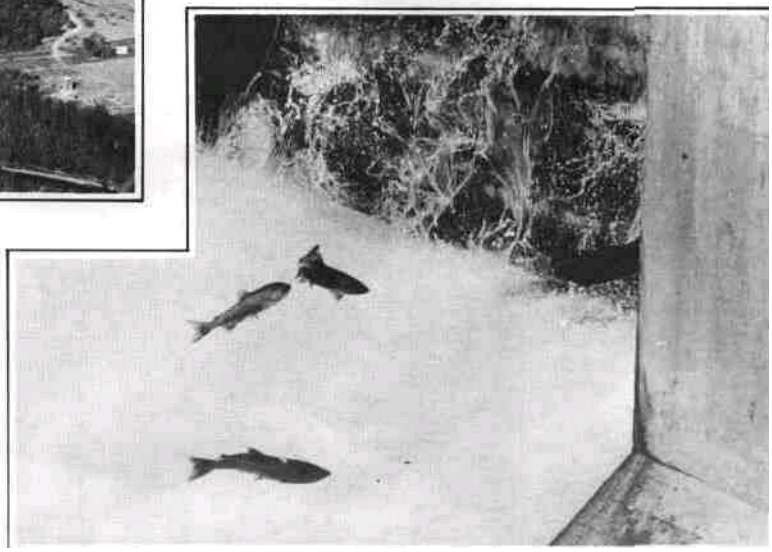


STREAM FISHING IN OKANAGAN RIVER



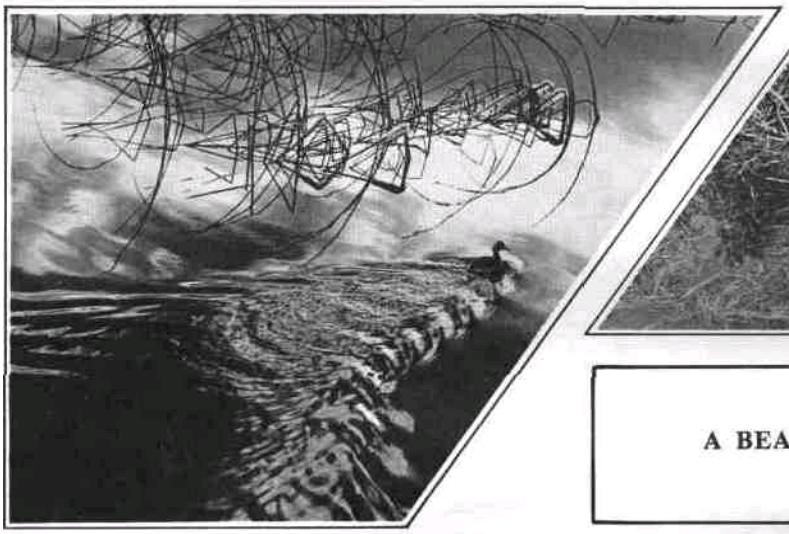
THE UNIMPROVED SECTION OF OKANAGAN RIVER ABOVE OLIVER WHICH PROVIDES ONE OF THE FEW REMAINING SPAWNING AREAS FOR COLUMBIA RIVER SOCKEYE SALMON

SALMON AND KOKANEE TRAVERSING ONE OF THE DROP STRUCTURES DURING THEIR MIGRATION UPSTREAM



WILDLIFE ARE ALSO DEPENDENT ON ADEQUATE SUPPLIES OF CLEAN WATER

WATER FOWL NESTING IS EXTREMELY LIMITED DUE TO EXPOSED NATURE OF MOST OF LAKE SHORELINES



A BEAVER DAM IN AN OLD OXBOW

SOME AREAS, PARTICULARLY THE NORTH ARM OF OKANAGAN LAKE AND VASEUX LAKE PLAY HOST TO LARGE NUMBERS OF MIGRATING WATERFOWL

Existing public and private beaches will basically meet projected demands to 1980, but substantial increases in the area of public beaches will be required beyond that date.

In view of the economic and social values placed on shoreline recreation, it is important that this component of the framework plan be carefully managed over the next fifty years.

Consequently, it is recommended:

Coordination of Water-Based Recreation Facilities

41. *"That the Regional authority be responsible for coordinating the various responsible agencies at the Provincial and Municipal levels in the implementation of recommendations involving shoreline recreation management in the framework plan. Specifically, the Regional authority should perform the following duties by 1975 –*

[i] Preparation of detailed shoreline recreation landuse plans for all main valley lakes.

[ii] Collect recreation data such as the number of summer holiday visitors, number of beach days enjoyed by residents and visitors annually, preferences and attitudes of beach users for shoreline landuse management and other pertinent data.

[iii] Manage recreation use conflicts through implementation of boating regulations on main valley and headwater lakes.

[iv] Undertake a full review of water-based recreation management needs as part of the reassessment of the Okanagan Study in 1980."

The following recommendations are made as components of the framework plan:

42. *"That water quality objectives for water-based recreation be met at all public and private beaches in all the main valley lakes, based on the following criteria:*

[i] Total mean coliform count not to exceed a most probable number [M.P.N.] of 240 organisms per 100 millimeters, based on a minimum of 10 samples per beach.

[ii] Fecal mean coliform count not to exceed a most probable number [M.P.N.] of 100 organisms per 100 millimeters, based on a minimum of 10 samples per beach.

[iii] Dissolved oxygen not be less than 5 parts per million.

[iv] The water be free from floating debris, scum, weeds, oil slicks, and other objectionable material that detract from its quality and appearance."

43. *"That further alienation of public or crown owned shorelines with moderate or high capability be prohibited. These areas which will be required to support future recreation demands are illustrated on the landuse plans accompanying the final report."*

Future beaches and recreation facilities should be developed by the Regional District in cooperation with local municipalities as follows:

REGION	YEAR REQUIRED BY	ADDITIONAL PUBLIC BEACH FEET	ADDITIONAL PUBLIC ACCESS FEET	ADDITIONAL BOAT LAUNCHING FACILITIES	COMMENTS
OSOYOOS	1980 2020	1,500 14,000 TO 19,000	45 350	1 2	2400 feet of beach available near Osoyoos. Large potential on Indian Lands.
PENTICTON	1980 2020	4,000 14,000 TO 24,000	– 600	– 4	Beach Area Available near Penticton, Summerland and Naramata, shoreline reclamation on Skaha Lake possible.
KELOWNA	1980 2020	3,600 8,000 TO 18,000	300 1,800	1 5	Limited Natural Beach Area still Available. Development of beaches near Kelowna possible.
VERNON	1980 2020	2,000 5,000 TO 10,000	200 1,100	– 4	Cozen's Bay on Kalamalka Lake. Development of Kinsmen Beach on Vernon Arm.

Public Access

44. *"That all existing public access points to the main valley lakes be inspected, maintained and clearly marked. This should be undertaken by 1975, by the responsible agencies at the provincial and local levels of government."*

Boat Launching Facilities

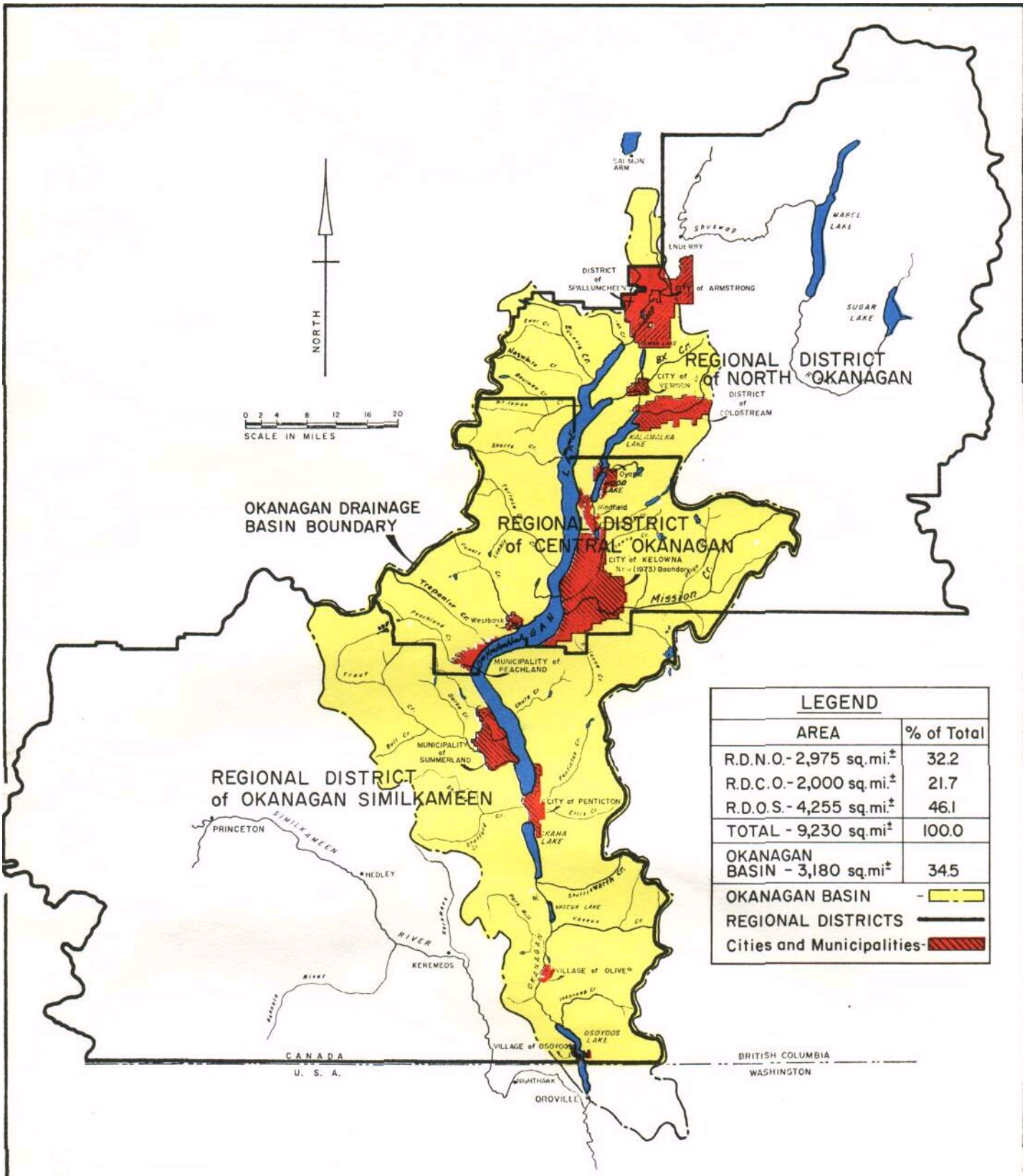
45. *"That additional boat launching facilities be built near Kelowna and Osoyoos by 1975, and others built as indicated in the table above. All such facilities on Okanagan Lake should be constructed to accommodate a 9-foot lake level fluctuation from 1116.8 feet to 1125.5 feet, and on Osoyoos Lake a 9-foot fluctuation from 909 feet to 918 feet."*

SAILING IS A POPULAR PASTIME FOR OKANAGAN RESIDENTS

BOATING IS POPULAR FOR FISHING, WATER SKIING AND SIGHT-SEEING

SWIMMING AND SUN-BATHING ON OKANAGAN BEACH PENTICTON

A PROVINCIAL GOVERNMENT CAMPSITE ON OKANAGAN LAKE IN JULY



REGIONAL DISTRICT and MUNICIPAL BOUNDARIES OKANAGAN DRAINAGE BASIN