Background and History
of
Water Management of Okanagan Lake and River

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Since the early 1900's people have regulated the level and discharge of Okanagan Lake. These efforts have led to the development of the current system of dams and channelized reaches of river which control the waters from Okanagan Lake to Osoyoos Lake.

The management of lake levels and flows has been controversial from the outset. Although early efforts at controlling Okanagan Lake were exclusively directed at improving navigation capability between Okanagan and Skaha Lakes, others interests soon surfaced. The first of these interests included the maintenance of minimum lake levels for navigation in shallow areas around the lake and a desire to reduce flood levels in Kelowna and other low lying areas. Following a prolonged drought between 1929-1931 the value of the lake as a storage reservoir to support irrigation was also recognized. Still later fisheries, tourism and recreational interest began to receive consideration in the development of water management strategies.

Even now, some 90 years since the initial efforts were made to manage Okanagan Lake and River and despite several attempts at consultation to reach agreement on the management of the lake, the regulation of the system remains controversial.

Pre-Development Lake Levels:

Very little data is available on the natural range of Okanagan Lake levels and outflows prior to regulation, although there are some anecdotal observations.

About 1908 a request was made to the federal government for improvements to the channel of Okanagan River to permit small shallow draught vessels to operate between Skaha Lake and Okanagan Lake. In response this request the Department of Public Works of Canada carried out a survey of the outlet of Okanagan Lake and Okanagan River between the two lakes in the winter of 1908-1909.

This survey determined the elevation of the outlet bar which formed a natural control to the low water level of the lake to be 98.6 feet, local datum (341.16 metres, GSC). The same survey also established the low level for the lake as 98.75 feet (341.21 metres). The highest recorded natural lake level was determined to be 107.0 feet (343.72 metres) in 1904, although there were reports of higher levels in both 1894 and 1896.

River Improvements for Navigation:

Prior to 1909 there had been no alterations made to either Okanagan River or the natural bar which existed across the outlet of Okanagan Lake. The natural river between Okanagan and Skaha Lakes consisted of numerous winding channels through the floodplain.

Starting in the spring of 1910, the first efforts were made to improve the channel for navigation purposes. These efforts included dredging of the outlet bar, restricting the river to a single circuitous channel chosen to reduce velocities, and clearing, widening and deepening of the channel. The sole purpose of this work was to permit navigation.

As a result of the channel improvements made by dredging, bank protection, wharf construction, etc., navigation of the river between the two lakes began in 1914.

The navigation improvements and maintenance activities continued yearly until 1917, when, with the improvement of area roads and the coming of the Kettle Valley Railway, river transport ceased and dredging was discontinued.

First Control Dam on Okanagan Lake:

The first dam on Okanagan Lake was constructed during the winter of 1914-1915 as an experiment at regulating the flow of Okanagan River for navigation purposes, while maintaining the natural minimum lake level. The experimental dam was 200 feet wide with a 50 feet wide main opening, and nine 8 feet wide openings. Each of the openings were fitted with stop logs to assist with the regulation. The sill of the dam was set at 97.0 feet (340.7 metres), and the top at 101.0 feet (341.9 metres) above which the lake level of was not controlled.

Immediately after completion, complaints were received regarding the structural integrity of the dam and that the minimum lake level was too low. In 1918, the City of Kelowna, the Municipality of Penticton and other communities around the lake protested that lake control should not be solely for navigation purposes and that steps should be taken to lower the maximum lake levels to reduce the flooding of low lands in high runoff years.

Second Control Dam:

In 1920, the experimental dam was replaced with a second control dam. This dam had the same sill elevation of 97.0 feet (340.7 metres) although the top elevation was one foot higher at 102.0 feet (342.2 metres).

In 1921 a rapid spring melt raised the peak lake elevation to 103.6 feet (342.69 metres), flooding numerous low lying areas around the lake. Following the flood more discussions ensued regarding the control range. As result of these discussions an agreement was reached where the range was established as 99.5 to 102.5 feet (341.44 to

342.35 metres). In 1922 the dam was raised to permit control up to 102.59 feet (342.38 metres).

Flood of 1928:

In June 1928, another high runoff brought the level of Okanagan Lake up to 104.5 feet (342.96 metres). With the level of the lake exceeding the top of the dam, outflows were controlled by the KVR river crossing, approximately 2.7 kilometres downstream of the outlet. Flows through Penticton were reported to have exceeded 2400 cfs (68 m3/s) for a period of approximately seven weeks. Damage was reported from Okanagan Lake to Osoyoos Lake.

In response to the serious and widespread damage caused by the flood the Department of Public Works of Canada held an inquiry into the regulation of Okanagan Lake. The July 1928 report of the Board of Inquiry made a number of recommendations, including replacing the control dam, river improvements between Okanagan and Skaha Lake, modification to the outlet of Skaha Lake and the collection of additional precipitation records. No recommendations were made with respect to Okanagan River below Okanagan Falls as this was determined to be outside the Department's jurisdiction.

As a result of these recommendations the following works were undertaken:

1. Four additional high level precipitation stations were established and a former station revived.
2. A new control dam on Okanagan Lake was constructed in the winter of 1928-1929.
3. Following a complete survey of Okanagan River between the two lakes a dredging program was undertaken to eliminate certain meanders.
4. The rock crest of Okanagan Falls was removed in August 1928 and replaced with a concrete wall once the flood waters had subsided.

Third Control Dam:

The third control dam, constructed in the winter of 1928-1929, was a rock filled timber structure. The sill was set at 96.0 feet (340.37 metres) and the top of the timber piers at 105.0 feet (343.11 metres). The recommended operating range for the lake was established to be 98.6 feet to 102.5 feet (341.16 to 342.35 metres). Discharges through the dam were regulated by hand operated stoplogs.

Snow Surveys:

In 1935 the Provincial Water Rights Branch initiated snow surveys at five locations in the Okanagan watershed to assist with runoff forecasting. The sites chosen were Trout Creek, Summerland Reservoir, McCulloch, Mission Creek and Aberdeen Lake.

1935 Inquiry:

In 1935 the Kelowna Board of Trade requested the federal government reduce the authorized high water level of Okanagan Lake from 102.5 feet to 101.5 feet. This prompted an inquiry by the District Engineer, Public Works Canada into this request.

The inquiry held hearings in Kelowna, where there was unanimous support for a lowering of the high water level, and in Penticton, where there was opposition to any reduction in the operating range. Opponents argued that an increase, not a decrease, in the operating range was desirable to minimize the risk of flooding in the South Okanagan. An argument was also presented by the Manager of the South Okanagan Lands Project that increasing the range would be beneficial for supporting irrigation during low runoff years.

Following consideration of all the information presented, recommendations were made to maintain the authorized high level and to enable an additional 1 foot of emergency drawdown to 97.0 feet (340.67 metres) during periods of severe drought. A recommendation was also made to further modify the outlet of Skaha Lake.

The Joint Board of Engineers:

Throughout the late 1930's and early 1940's there were increasing concerns expressed by ranchers, farmers and other residents downstream of Okanagan Lake that higher winter releases were causing flooding downstream of Okanagan and Skaha Lakes. Then in 1942 widespread floods occurred which impacted numerous properties throughout the Okanagan. The management of Okanagan Lake levels again became the center of controversy.

Conflicting opinions were raised as to how the control dam was operated during the flood. A notable complication during the 1942 flood was a dam failure on Ellis Creek which had deposited material in Okanagan River below Okanagan Lake, obstructing channel capacity and causing flooding in Penticton.

The controversy surrounding the 1942 flood prompted a meeting on August 24, 1942 between representatives from several local governments and the two senior levels of government to consider what actions could be taken to avoid a recurrence of such flood damage. The meeting unanimously adopted a resolution to request a joint board of engineers be appointed by the federal and provincial governments to "study all matters relating to the problem of lake and river control in the Okanagan Valley and to recommend remedial measures." The Joint Board of Engineers, Okanagan Flood Control, was appointed in May 1943 to study and report on these matters.

The objectives of the studies undertaken by the Joint Board were stated as:

1. To provide adequate control of flood waters in order to prevent damage to lands adjacent to the Okanagan Waterway.

2. Combined with flood control, to provide, annually, adequate water for irrigation purposes.
3. To ensure satisfactory water levels for navigation.

In 1946 the Joint Board submitted their report. The report included several key recommendations:

1. Selection of suitable control range and control limits for Okanagan Lake water levels. Considerations in establishing the range were flood control, irrigation and navigation.
2. Construction of new dams at the outlets of Okanagan and Skaha Lakes to provide flood control and irrigation storage of 4 feet (5 feet in extreme drought years) and 2 feet in the two lakes respectively. For Okanagan Lake the recommended range in normal years was 98.5 to 102.5 feet (341.13 to 342.35 metres).
3. Construction of a more efficient Okanagan River channel from Okanagan Lake to Osoyoos Lake which would have the capacity adequate to carry the maximum anticipated river discharge necessary to keep the Okanagan and Skaha Lakes within the specified ranges. The channelization included diking, and the introduction of 4 vertical drop structures between Skaha and Vaseux Lakes and 13 vertical drop structures between Vaseux and Osoyoos Lakes.
4. Modifications to the South Okanagan Lands Project Dam which controls Vaseux Lake.

In 1948, prior to implementation of the Joint Board's recommendations, a major flood hit the Okanagan Valley. This time Okanagan Lake reached a maximum level of 1126.25 feet (343.28 metres). Again, widespread damage occurred throughout the valley prompting calls for action on the Board's recommendations.

Construction of Okanagan Lake Regulation System:

On August 8, 1950, a "Memorandum of Agreement" was signed between the Federal and Provincial governments, under which the two governments agreed to implement the recommendations of the Joint Board. The costs of implementation were to be shared equally between the two senior levels of government.

Work on the project commenced in 1950 and was completed in 1958. The approximate cost of the project upon completion was $4,930,000.

It is noteworthy that, in recognition of the importance of Okanagan River as a salmon spawning stream, the VDS's were designed to have a minimum of impedance to migrating fish.

Operation and Maintenance of the Works:

In 1960 another Federal-Provincial agreement was signed under which the Province undertook responsibility for the operation and maintenance of the works, with the cost again shared equally.

Canada-British Columbia Okanagan Basin Study:

In October 1969 the Canada-British Columbia Okanagan Basin Agreement was signed. This Agreement set out the purpose and terms of reference of a four-year preliminary study of the water resources of the Okanagan with the stated purpose of developing "a comprehensive framework plan for the development and management of water resources for the social betterment and economic growth of the Okanagan community."

In March 1974 the Canada-British Columbia Consultative Board for the Okanagan Basin Agreement issued their main report which included the "Comprehensive Framework Plan." The stated goals of the plan were:

1. Economic development: To develop water and related resources as required to ensure a viable economic base in the Okanagan.
2. Environmental Quality: To maintain and enhance the quality of the natural environment through management and protection of water and related resource systems such as fisheries, wildlife and recreational areas.
3. Social Betterment: To enhance social betterment in the Okanagan by creating a more equitable distribution of income, employment and opportunity between regions within the basin.

The plan was to "achieve a desirable balance between these goals." It recognized that a balance would only be struck after detailed consultation with a broad representation of public opinion based on discussions of water management alternatives.

The report contained a number of recommendations regarding the management of the water resources of the Okanagan Valley. Recommendation 3, which addressed Water Quantity Management of the Mainstem System stated:

"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."

Okanagan Basin Implementation Agreement:

On February 9, 1976, the Okanagan Basin Implementation Agreement was signed between the two senior levels of government. This Agreement provided for the implementation of a number of the Consultative Board's recommendations including the recommendation that Okanagan Flood Control System to be brought up to standard in conjunction with the transfer of the works and their ongoing operation and maintenance costs to British Columbia. The recommended repair and upgrading of the works was undertaken between 1976 and 1981.

In 1982 the Okanagan Basin Implementation Board issued a report on the results of the Agreement. The Water Quantity section of the report included the following specific recommendation regarding the management of the Okanagan Flood Control System:

"That the mainstem system be operated by the Ministry of Environment, British Columbia, in accordance with the operating plan as set out in the Report on the Okanagan Basin Implementation Agreement. In summary, this states that the available water be managed to meet existing and projected needs and uses around Okanagan Lake and along Okanagan River as follows:

i. Okanagan Lake will be regulated within its normal range of 341.3 metres to 342.5 metres (1119.8 feet to 1123.8 feet) in all but anticipated extreme flood years and successive drought years;

ii. In anticipation of very high volume runoff (forecast freshet volume to Okanagan Lake greater than 617 million cubic metres), the lake may be drawn down by up to 0.3 metres below its normal low water level. When extremely high volume runoff occurs, Okanagan Lake may unavoidably exceed its normal upper level;

iii. Under prolonged drought conditions (a number of successive years with inflows less than 247 million cubic metres) Okanagan Lake may be drawn down below its normal low water level by up to 0.9 metres (to elevation 340.4 metres) to provide water for consumptive and non-consumptive uses. In two or more consecutive drought years flows for non-consumptive uses such as fisheries may have to be reduced;

iv. To enhance shore spawning kokanee conditions over the fall and winter months, Okanagan Lake will be regulated such that, when possible, the lake level is not greater than 341.9 metres on October 15, subject to flow restrictions for sockeye salmon;

v. Water requirements for sockeye salmon in Okanagan River will be met in all years except consecutive drought years as follows:

Period	Flow Measured at Oliver Hydrometric Station
Migration (approx. Aug 1 to Sept 15)	8.5 – 28.3 cubic metres per second
Spawning periods (approx. Sept 16 to Oct 31)	9.9 – 15.6 cubic metres per second
Incubation and emergence periods (approx. Nov 1 to Apr 30)	5.0 – 28.3 cubic metres per second, but not less than 50% of Sept 16 to Oct 31 flow

After February 1, flood control requirements are given priority over fishery flows and it may on occasion be necessary to exceed the 28.3 c.m.s. upper limit."

Current Operations:

In September 1982, management responsibilities for Okanagan Flood Control System were transferred to the regional office of the Ministry of Environment in Penticton. The regional Water Management Program continues to hold this responsibility to manage the system in accordance with the recommendations of the Okanagan Basin Implementation

Board. Operation of the system continues to be controversial, particularly in years with abnormally low or high runoff.

Recently, successive record inflows in 1996 and 1997 provided an extreme test of the system's capability. Although flooding proved to be unavoidable, the system again demonstrated its value by significantly reducing the overall impacts and costs of the floods. Experience gained in these and other years has provided managers with a greater understanding of the system and its operational sensitivities. In addition, new models have been developed to improve inflow forecasts. It is expected that this experience and improved forecasting capability will enable fine tuning of future annual management plans to better address specific issues, such as flood control, fisheries concerns, etc., within the limits of the 1982 operating plan.

Conclusion:

As society's values have changed so too have the Okanagan Lake management objectives and practices. Still, despite some 90 years of experience, the management of the system remains controversial. Competing and conflicting interests and objectives of the different areas in the valley, resource users and the environment, combine with the variability of natural events, continue to challenge the managers' ability to fairly accommodate the diversity of interests. Therefore, it is clear technical knowledge, experience and professional judgement will all remain key elements in the management of the system for the foreseeable future.

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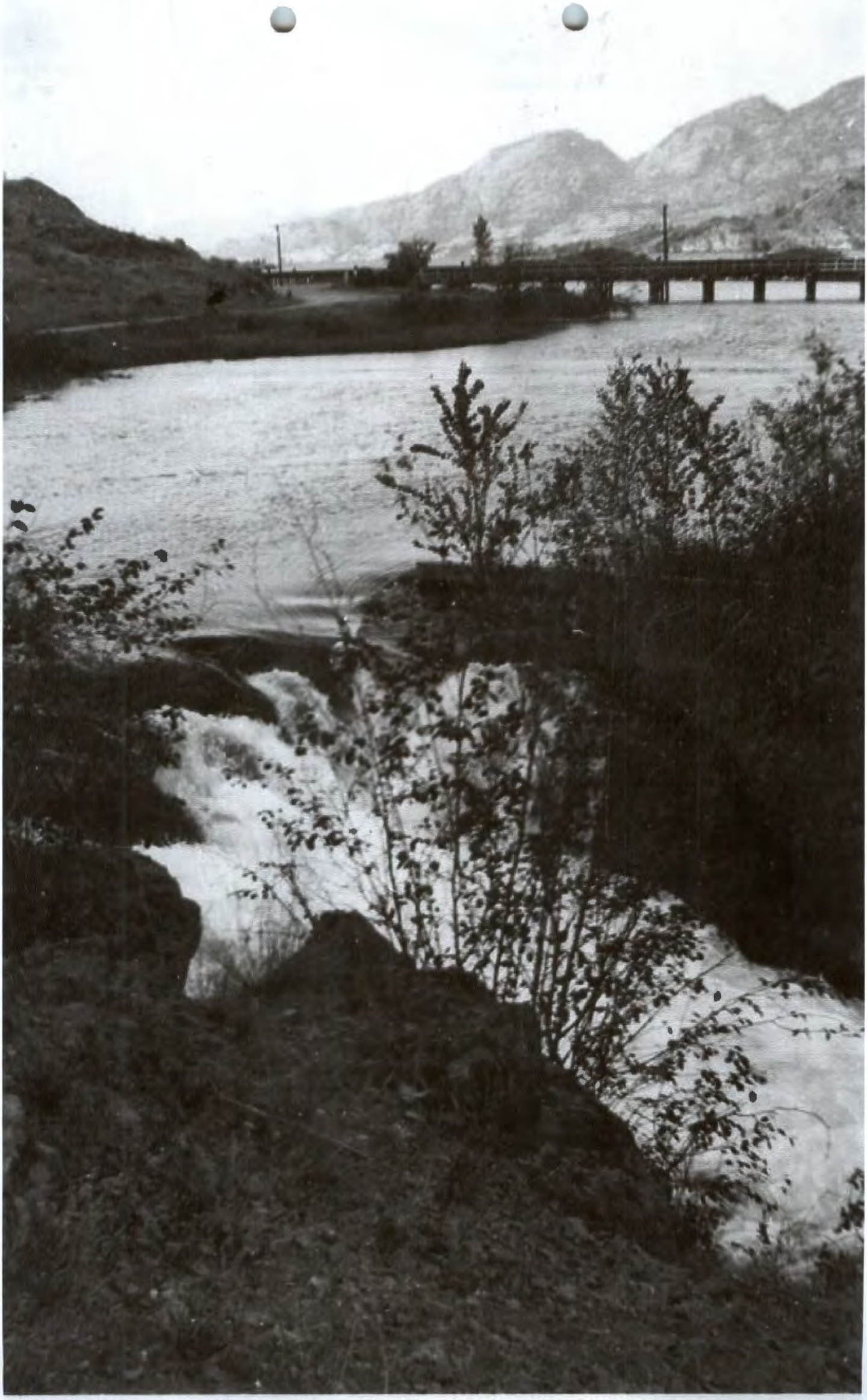

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