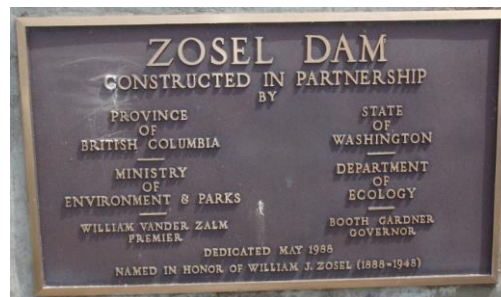


# International Osoyoos Lake Board of Control

## 2014 Annual Report to the International Joint Commission



**Cover:**

*Top two photographs:* Upstream view of Zosel Dam on the Okanogan River near Oroville, Washington, 2009. Photograph by D. Millar, Environment Canada (retired).

*Middle two photographs:* Osoyoos Lake, 2005. Photographs by R. Drzymkowski, U.S. Geological Survey (retired).

*Bottom photograph:* Marker on Zosel Dam, 2009. Photograph by D. Millar, Environment Canada (retired).

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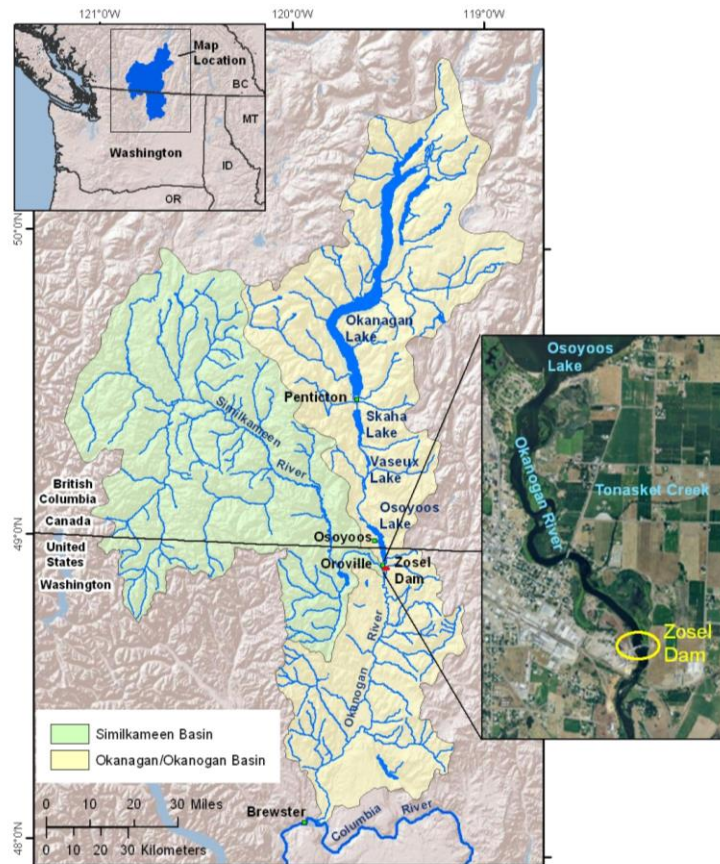
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# International Osoyoos Lake Board of Control

## 2014 Annual Report to the International Joint Commission

The International Osoyoos Lake Board of Control (Board) was established on September 12, 1946, by the International Joint Commission (IJC or Commission) to carry out the provisions of the Commission's Order of Approval. In 2014, the Board operated under the authority of the Commission's Supplementary Order dated January 29, 2013.

To fulfill its mandate, the Board's efforts are focused on water-level management issues related to the operation of Zosel Dam, located on the Okanogan (U.S. spelling) River about 1.6 mi (2.6 km) downstream from the outlet of Osoyoos Lake, a water body that straddles the international boundary between Canada and the United States. (fig. 1). Zosel Dam is owned by Washington State, which is referred to as the Applicant in the IJC Orders and this annual report. The dam is operated by the Oroville-Tonasket Irrigation District under authority of the Washington State Department of Ecology.



**Figure 1** – Location of the Okanogan (Canadian spelling is Okanagan) River watershed.

## ACTIVITIES OF THE BOARD IN 2014

In January, the Board corresponded with a member of the public about the relation between high water levels in Osoyoos Lake and backwater conditions in the Okanogan River due to large inflows from the Similkameen River.

On April 10, the Board announced that drought criteria were not met and that the Board did not plan to issue a drought declaration for 2014.

Throughout the spring and summer, the Board had extensive communications with the Applicant about a variety of issues, such as potential and actual Osoyoos Lake level deviations from the rule curve and operational decisions related to unusually large returns of sockeye salmon in late summer/early fall (fig. 2). As large numbers of salmon were congregating in the Columbia River near the confluence with the Okanogan River while waiting to migrate into the Okanogan/Okanagan River system to spawn, the issues of concern were the need to 1) manage Okanogan River flow and temperatures to control the timing of the migration and 2) provide optimal conditions along the migration route, such as favorable dissolved oxygen concentrations in Osoyoos Lake. To address these issues, the Applicant and the British Columbia Ministry of Forests, Lands and Natural Resource Operations (the Okanagan water-management operator) collaborated closely and simultaneously released larger-than-usual flows from Zosel Dam and Okanagan Lake (fig. 1), respectively. By replenishing Osoyoos Lake with increased flows from Okanagan Lake, a drop in lake levels below the rule curve that could have occurred if only flows from Zosel Dam had been increased was avoided. The increased flows from Okanagan Lake also created dissolved oxygen conditions in Osoyoos Lake more favorable to the migrating salmon.

### 2014: RECORD SOCKEYE NUMBERS IN THE OKANOGAN

12/19/2014 By [Brittany Bowles](#)

#### Record Sockeye Numbers in the Okanogan:

To date, more than 600,000 Sockeye have passed Bonneville in 2014, making this season the highest on record since fish counts began in 1938 at the dam's construction. At Wells Dam, 490,840 sockeye were counted and at Rock Island 581,120.

Favorable ocean conditions, improved juvenile rearing habitat, and improved freshwater migration conditions have all benefited salmon in general this year; however, sockeye returning to the Canadian portion of the Okanagan subbasin have also had the added benefit of the Fish-Water Management Tool (FWMT). The FWMT is an innovative computer model created through a partnership between Douglas County Public Utility District, and the Canadian Okanagan Basin Technical Working Group (COBTWG) which is composed of three organizations; the Okanagan Nation Alliance, Department of Fisheries and Oceans Canada, and the British Columbia Ministry of Water, Land and Air Protection. Together these organizations identified three key limiting factors for Okanagan Sockeye: pre-spawn mortality, mortality from redd scouring, and habitat loss.

Before implementation of the FWMT, inconsistent flow from the Okanagan Lake Dam would often result in high-density mortality events such as redd desiccation/freezing, redd scouring during incubation, and dewatered redds. Additionally, inadequate flow also reduced spawning habitat and caused a high mortality of spawners in the spawning area immediately below McIntire Dam. The COBTWG recognized that better flow management could reduce the frequency and magnitude of these density-independent mortality events. The FWMT is an internet-accessible decision support system used by Canadian fish and water managers to inform water-release decisions incorporating real-time data such as lake levels, stream flows, snowpack, temperature, and dissolved oxygen, and near-real-time biological data. Development and collaborative use of the FWMT has optimized timing of water releases from Okanagan Lake Dam for sockeye production while balancing multiple human objectives and trade-offs. Implementation of FWMT in the Canadian Okanagan has eliminated or at least minimized density-independent mortality factors that had profoundly limited smolt production from the Okanagan Basin in the past. The FWMT has allowed managers to mitigate the oxygen-temperature "squeeze" that previously limited late-summer sockeye habitat availability in Osoyoos Lake. Since the adult sockeye from the first brood year to benefit from the FWMT returned over Wells Dam in 2008, the sockeye count at Wells has averaged 235,766, compared with the 1977-2007 average of 30,202.

**Figure 2** – Article about the record sockeye salmon run in the Okanogan River system in 2014 (Upper Columbia Salmon Recovery Board, 2014).

In a letter dated June 23, 2014, the Board notified the IJC of three episodes of deviations from the rule curve for Osoyoos Lake levels between April 6 and June 10. The Board provided this notification per the April 2013 Directive of the IJC. Section "Osoyoos Lake Levels" in this annual report describes each episode in detail.

On August 28, the Board submitted a proposal for an educational documentary to the IJC for consideration of International Watersheds Initiative (IWI) funding. On October 7, the Board was notified that the proposal was conditionally approved. In follow-up, the Board and IJC liaisons held a conference call to discuss the IJC's comments on the proposal and the Board submitted a revised and expanded version on December 15.

On October 28, the annual Board and public meetings were held in Oroville, Washington. Minutes of both meetings are available on the Board's section of the IJC website. During the public meeting, the Board provided an overview of its mandate and activities, reviewed the Supplementary Order of 2013, described the hydrologic conditions and Osoyoos Lake levels, and discussed deviations from the rule curve in 2014. The Board also reviewed changes to its website, shared that the IJC had conditionally accepted the Board's IWI proposal for an educational documentary, and noted that the IJC is considering expanding membership of the Board for the purpose of increasing local and First Nation/Tribal participation. On October 29, the Board and guests visited Zosel Dam, the Oroville-Tonasket Irrigation District Pumping Plant at Osoyoos Lake, and the cross channel between the Similkameen and Okanogan Rivers (fig. 3). Explanations at all of these sites were provided by staff of the Washington State Department of Ecology, Oroville-Tonasket Irrigation District, Confederated Tribes of the Colville Reservation, and USGS.



**Figure 3** – Fieldtrip participants at Zosel Dam, October 29, 2014. From left to right: Rich Moy (IJC Commissioner, U.S.), Glen Davidson (Board member, Canada), Brian Symonds (Board member, Canada), John Arterburn (The Confederated Tribes of the Colville Reservation), Patrick Miller (USGS), Col. John Buck (Board member, U.S.), Al Josephy (Washington State Dept. of Ecology), Kris Kauffman (Board member, U.S.), Cindi Barton (Board Co-Chair, U.S.), Bruno Tassone (Board Co-Chair, Canada), David Fay (IJC Engineering Advisor, Canada), Marijke van Heeswijk (Board Secretary, U.S.), Gwyn Graham (Board Secretary, Canada), Gordon Walker (IJC co-chair, Canada), Jay O'Brien (Oroville-Tonasket Irrigation District), Mark Colosimo (IJC Engineering Advisor, U.S.), Mark Gabriel (IJC Engineering Advisor, U.S.). Photograph by Amy Reese, U.S. Army Corps of Engineers.

With the approval of the IJC, the Board did not participate in the fall semi-annual IJC meeting (October 20-21) in Ottawa, Ontario, as is customary, due to late scheduling of the 2014 annual Board and public meetings. In a letter dated October 17, 2014, the IJC confirmed that the Board did not need to participate in the fall meeting and asked that the Board Co-Chairs and Secretaries, and preferably all Board members, attend the spring 2015 semi-annual IJC meeting (April 28-29) in Washington, DC, in person. In that same letter, the IJC asked the Board to provide a list of up to four local Board nominees (two from each country) prior to the spring 2015 semi-annual IJC meeting.

Throughout the year, the Board posted a number of documents on the Board’s section of the IJC website, including the Consolidated Orders, the 2014-15 Workplan, and multiple Lake Level and Status and Trends updates. The latter included the announcement of the Board’s decision that drought conditions were not met in 2014.

## HYDROLOGIC CONDITIONS IN 2014

### Drought Criteria

Condition 8 of the Commission's Supplementary Order of Approval dated January 29, 2013, provides three criteria for declaring a year of drought (table 1). In a year of drought, the Osoyoos Lake level during summer may be managed within a wider range as compared to non-drought years (drought year water-level ranges are discussed in the next section). Drought conditions were not in effect in 2014, as indicated by the forecasted values for the drought criteria in table 1.

**Table 1.** Summary of drought criteria and forecasted and actual values in 2014. The Board declares a drought if condition 8(a) and either condition 8(b i) or 8(b ii) are met.

[ac-ft, acre-feet; ft, feet]

Criteria for declaring a drought	Forecasted value in 2014	Drought criterion met?	Actual value in 2014
Condition 8(a) - Volume of flow in the Similkameen River at Nighthawk, WA, for the period April through July as calculated or forecasted by U.S. authorities is less than 1 million ac-ft	1,346,000 ac-ft (50% exceedance forecast on April 8, 2014)	No	1,557,739 ac-ft
Condition 8(b i) - Net inflow to Okanagan Lake for the period April through July as calculated or forecasted by Canadian authorities is less than 195,000 ac-ft	353,300 ac-ft (forecast on April 1, 2014)	No	393,326 ac-ft
Condition 8(b ii) - Level of Okanagan Lake in June or July is less than or is forecasted by Canadian authorities to be less than 1,122.6 ft (Canadian Geodetic Survey Datum)	1,123.28 ft (forecast on April 1, 2014)	No	1,123.29 ft (max. lake level)

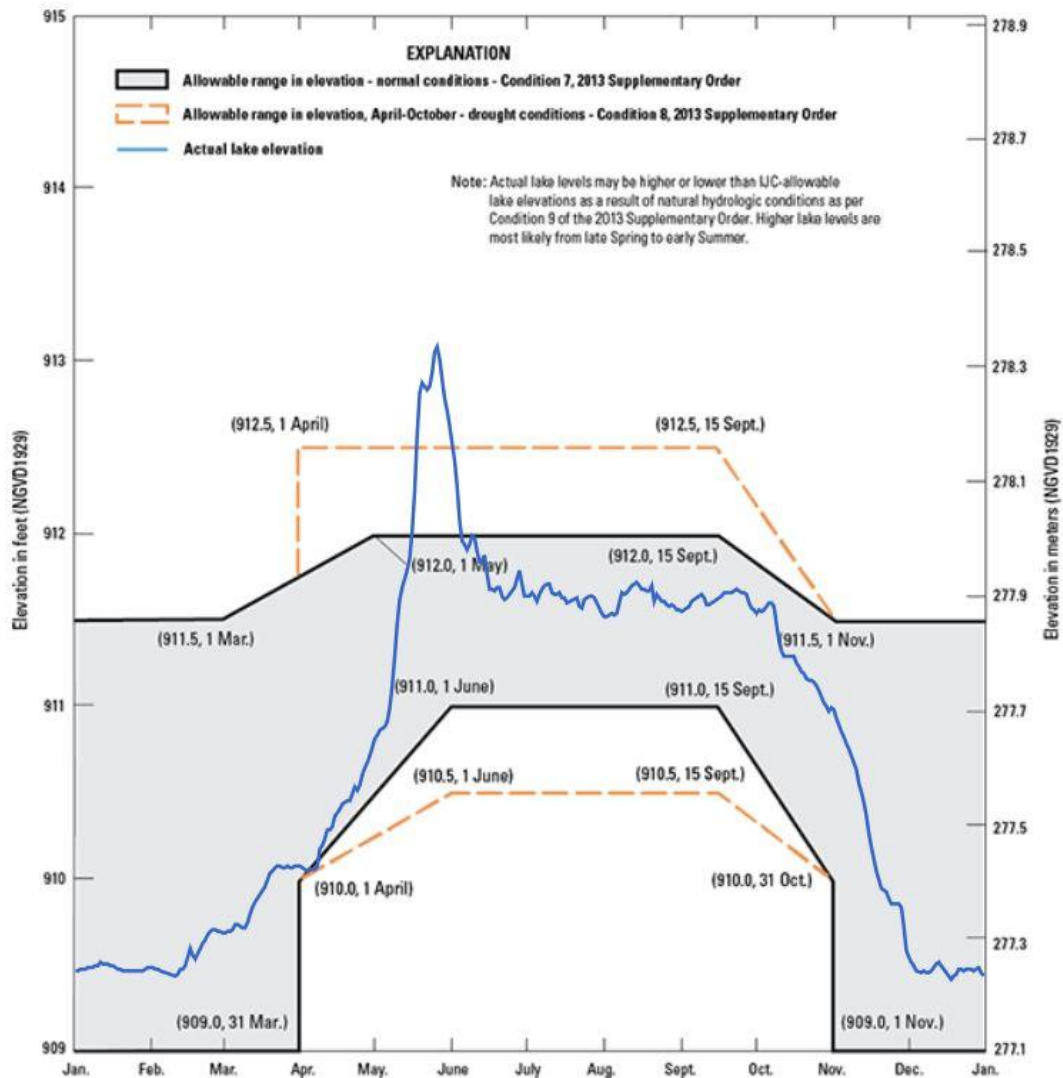
## Osoyoos Lake Levels

Throughout any given year, Osoyoos Lake levels may fluctuate in accordance with criteria specified in the IJC's Supplementary Order of Approval dated January 29, 2013. Lake levels are influenced naturally by discharge in the Okanagan and Similkameen Rivers and by the operation of Zosel Dam (fig. 1).

The gray area in fig. 4 shows the authorized range of normal operating elevations: an upper range of 911.5 ft (277.8 m) on 1 January; 911.5 ft (277.8 m) on 1 March; 912 ft (278.0 m) on 1 May; 912 ft (278.0 m) on 15 September; 911.5 ft (277.8 m) on 1 November and 911.5 ft (277.8 m) on 31 December; and to the extent possible the elevation of Osoyoos Lake does not fall below the NGVD 1929 elevation of 909.0 ft (277.0 m) on 1 January; 909.0 ft (277.0 m) on 31 March; 910.0 ft (277.4 m) on 1 April; 911 ft (277.7 m) on 1 June; 911 ft (277.7 m) on 15 September; 910.0 ft (277.4 m) on 31 October; 909.0 ft (277.0 m) on 1 November and 909.0 ft (277.0 m) on 31 December. Elevation limits are linearly interpolated between dates.

The area between the orange dashed lines in fig. 4 shows the lake elevations authorized by the IJC from April 1 to October 31 if drought criterion 8(a) and either 8(b i) or 8(b ii) in table 1 are declared in effect by the Board. During such conditions, the elevation of Osoyoos Lake may be raised to 912.5 ft (278.1 m) from 1 April to 15 September, after which the lake level shall be decreased to reach an elevation 911.5 ft (277.8 m) by 1 November. To the extent possible, during the April 1 to October 31 period, the elevation of Osoyoos Lake should not fall below 910.0 ft (277.4 m) on 1 April; 910.5 ft (277.5 m) on 1 June; 910.5 ft (277.5 m) on 15 September; and 910.0 ft (277.4 m) on 31 October. Between dates, elevation limits are linearly interpolated. Condition 9 of the 1982 Order recognizes that backwater from high flow in the Similkameen River and (or) excessive flow in the Okanagan River may cause Osoyoos Lake levels to rise above the authorized range.





**Figure 4** – Allowable Osoyoos Lake elevations per IJC Supplementary Order of Approval dated January 29, 2013, and the actual daily mean lake elevations recorded at USGS Station no. 12439000 in 2014.

During 2014, the maximum instantaneous Osoyoos Lake elevation was 913.11 ft (278.32 m), which occurred from 22:30 PDT on May 25 through 19:30 PDT on May 26 (fig. 4). The maximum daily mean elevation occurred on May 26 and was 913.11 ft (278.32 m). The minimum instantaneous elevation was 909.42 ft (277.19 m), which occurred on December 18. The minimum daily mean elevation was 909.43 ft (277.19 m) occurred on that same day.

Osoyoos Lake levels deviated from the rule curve established in the IJC’s 2013 Supplementary Order of Approval three times during 2014, as described below.

Deviations from the rule curve April 6 to 8

Lake levels at Osoyoos Lake were below the lower limit of the rule curve from 00:00 PDT on April 6 through 21:00 PDT on April 8. During this time of the year, the lower limit of the rule curve increases 0.016 ft (4.9 mm) per day (from 910.0 ft on April 1 to 911.0 ft on June 1). The maximum deviation from the rule curve was 0.045 ft (14 mm) from 00:00 through 04:00 PDT on April 8. As soon as the Applicant noticed the deviation from the rule curve on Sunday, April 6, dam operations were adjusted in consideration of changing inflows to Osoyoos Lake from the Okanagan River. Shortly after 04:00 PDT on Tuesday, April 8, the water levels of

Osoyoos Lake were back in compliance. It is the Board's assessment that the cause of the small deviation below the lower limit of the rule curve resulted from rapidly changing natural conditions that were not anticipated by the Applicant. To decrease the risk of similar non-compliance during the same time period in the future, the Applicant intends to maintain Osoyoos Lake levels slightly more above the lower limit of the rule curve than it did immediately prior to this episode. The Board does not consider this episode to be a significant issue of non-compliance with the 2013 Supplementary Order of Approval.

#### Deviations from the rule curve May 16 to June 5

Lake levels at Osoyoos Lake exceeded the upper limit of the rule curve (912.0 ft) from 08:15 PDT on May 16 through 05:45 PDT on June 5. The maximum deviation from the rule curve during this time was 1.1 ft (0.34 m) from 22:30 PDT on May 25 through 19:30 PDT on May 26. All flow-control gates at Zosel Dam had been fully open since May 6, allowing maximum flows across the dam. Thus, these lake levels reflected naturally high inflows to the lake as a result of the spring freshet. It is the Board's assessment that by keeping all flow-control gates fully open until the lake levels decreased to the upper limit of the rule curve, the Applicant was in compliance with Condition 9 of the 2013 Supplementary Order of Approval during this period.

#### Deviations from the rule curve June 9 to June 10

Following the decrease of the high Osoyoos Lake levels caused by the spring freshet to below the upper limit of the rule curve, the lake levels briefly exceeded the upper limit of the rule curve (912.0 ft) from 11:15 PDT on June 9 through 12:45 PDT on June 10. The maximum deviation from the rule curve was 0.03 ft (9 mm) from 21:15 PDT on June 9 through 02:45 PDT on June 10. Flows into Osoyoos Lake were changing rapidly during this time due to a change in the release of water from upstream Okanogan Lake in response to a significant change in the regional water-supply forecast by the Province of British Columbia. It is the assessment of the Board that the Applicant took all possible steps to keep the lake levels as close as possible to being within compliance with the rule curve given the rapidly changing flows into Osoyoos Lake. Furthermore, the Applicant was proactive in notifying the Board of a possible rule curve deviation upon receiving information regarding changes in upstream flow conditions. The Board does not consider this episode to be a significant issue of non-compliance with the 2013 Supplementary Order of Approval.

### **River Discharges**

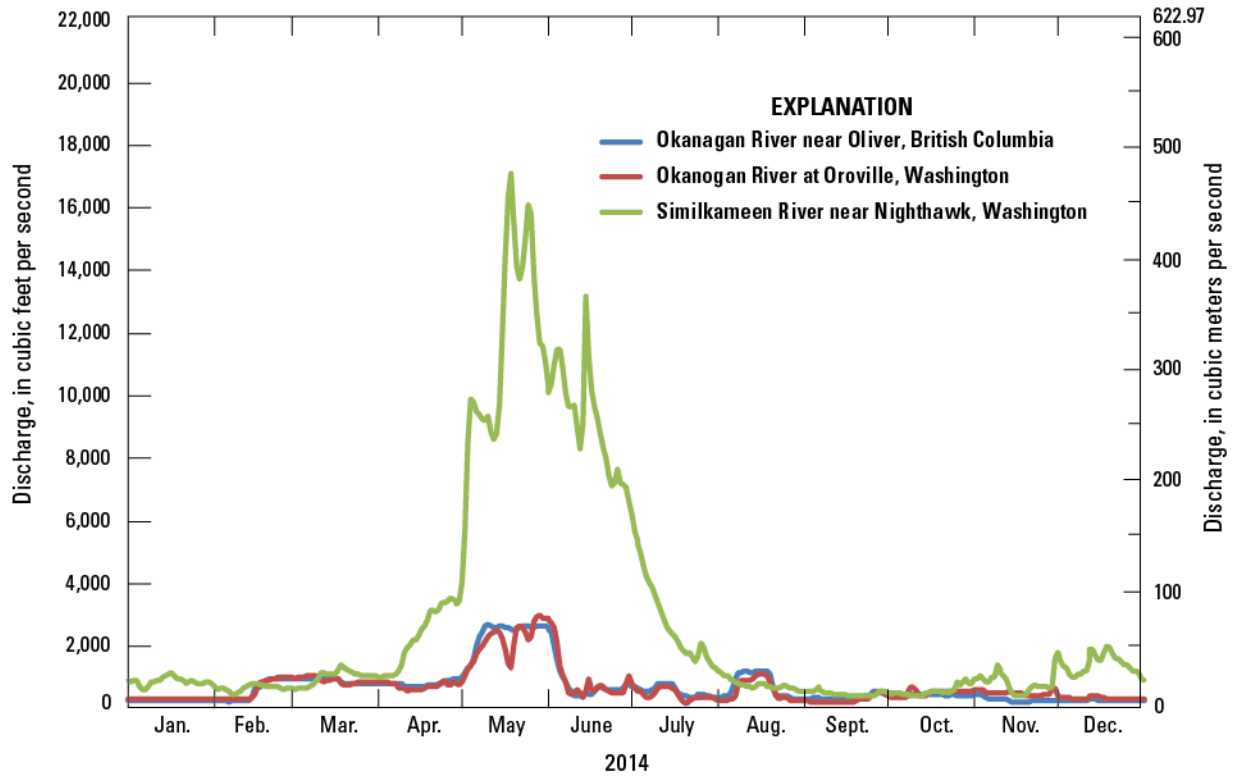
The maximum instantaneous discharge of the Okanogan River at Oroville (downstream from Zosel Dam) occurred on May 28 and was 3,050 cubic feet per second (cfs) (86.4 cubic meters per second [cms]) with a corresponding Osoyoos Lake elevation of 912.94 ft (278.26 m).

The maximum instantaneous discharge of the Similkameen River occurred on May 18 and was 17,700 cfs (501 cms). The maximum daily mean discharge of 17,100 cfs (484 cms) occurred on the same day. High flow in the Similkameen River created variable backwater at the Okanogan River at Oroville gaging station for the period May 2-July 1. The annual mean flow in the Similkameen River was 2,710 cfs (76.7 cms) in 2014, which is 117 percent of the 86-year average flow.

Conditions 3 and 4 of the IJC Order of 1982 specify that the flow capacity of the Okanogan River channel between the outlet of Osoyoos Lake up to and including Zosel Dam be at least 2,500 cfs (70.8 cms) when the elevation of Osoyoos Lake is 913.0 ft (278.3 m) and there is no appreciable backwater effect from the Similkameen River. Hydrologic conditions in 2014 did not allow testing of compliance with these conditions. In 2014, during the period when Osoyoos Lake levels were at or above 913.0 ft (278.3 m), there were appreciable backwater effects from the Similkameen River and therefore it was not possible to verify compliance with

these conditions. In 2013, however, hydrologic conditions were such that compliance with these conditions was confirmed. In addition, no significant sediment-input events that may have reduced the channel capacity were observed in 2014.

Data on Osoyoos Lake elevation and relevant river flows for 2014 are summarized in the appendix; the river hydrographs for 2014 are depicted in fig. 5.



**Figure 5.** Hydrographs of daily mean discharge for the Similkameen and Okanogan (Okanagan in Canada) Rivers, 2014.

## APPENDIX: OSOYOOS LAKE LEVELS, INFLOWS, AND OUTFLOWS IN 2014

### A. International gaging stations in operation throughout the year:

#### (1) For Stage Records

Osoyoos Lake near Oroville, Washington  
Okanogan River at Oroville, Washington (auxiliary gage)

#### (2) For Discharge Records

Okanagan River near Oliver, British Columbia  
Okanogan River at Oroville, Washington (base gage)  
Similkameen River near Nighthawk, Washington

#### (3) Reports

Monthly summary reports of stage and discharge data were forwarded to the International Joint Commission and to the Board of Control members.

### B. Compliance with the lake levels specified in the Orders of Approval is measured at the station "Osoyoos Lake near Oroville," where elevations are expressed in terms of the National Geodetic Vertical Datum of 1929 (NGVD 1929).

### C. Osoyoos Lake (USGS station no. 12439000)

Maximum instantaneous elevation	913.11 ft (278.32 m) – May 25 & 26
Minimum instantaneous elevation	909.42 ft (277.19 m) – Dec. 18
Maximum daily mean elevation	913.11 ft (278.32 m) – May 26
Minimum daily mean elevation	909.43 ft (277.19 m) – Dec. 18

Lake elevation at time of peak flow for Okanogan River at Oroville	912.94 ft (278.26 m) – May 28
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### D. Okanogan River at Oroville (USGS station no. 12439500)

Maximum instantaneous discharge	3,050 cfs (86.4 cms) – May 28
Maximum daily mean discharge	2,980 cfs (84.4 cms) – May 28
Annual mean discharge	698 cfs (19.8 cms)

The annual mean discharge was 103 percent of the 72-year average of 676 cfs (19.1 cms).

### E. Similkameen River near Nighthawk (USGS station no. 12442500)

Maximum instantaneous discharge	17,700 cfs (501 cms) – May 18
Maximum daily mean discharge	17,100 cfs (484 cms) – May 18
Annual mean discharge	2,710 cfs (76.7 cms)

The annual mean discharge was 117 percent of the 86-year average of 2,310 cfs (65.4 cms).

High Similkameen River discharges created variable backwater at the Okanogan River at Oroville gaging station for the period May 2-July 1.