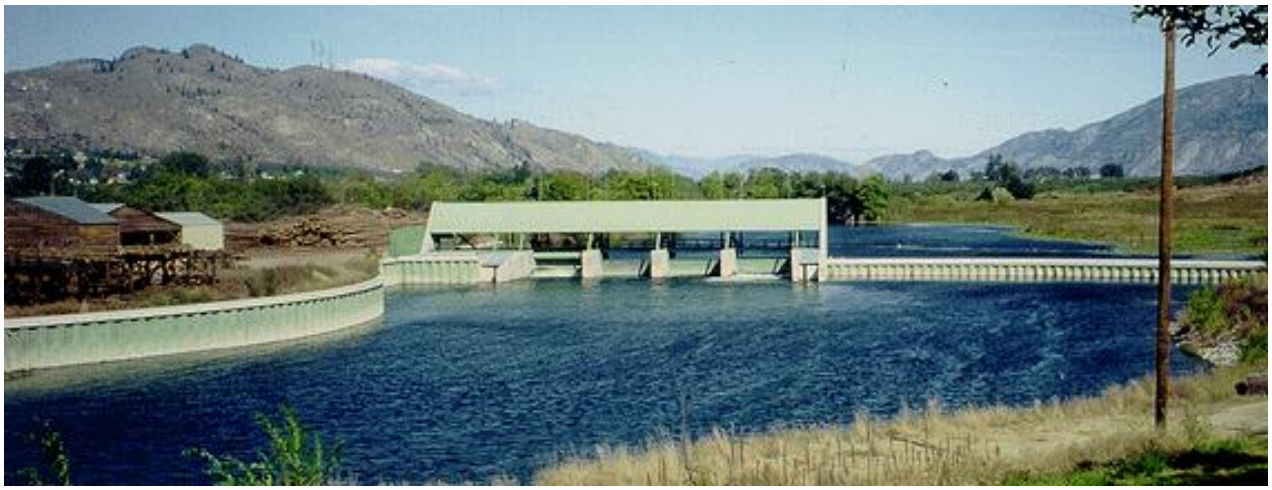
Recommendations for Renewal of the International Joint Commission's Osoyoos Lake Order

Prepared by the

International Osoyoos Lake Board of Control

June 21, 2012



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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	0.4047	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
cubic foot (ft^3)	0.02832	cubic meter (m^3)
acre-foot (acre-ft)	1,233	cubic meter (m^3)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

Temperature in °F may be converted to degrees °C as follows: °C=(°F-32)/1.8

SI to Inch/Pound

Multiply	By	To obtain
	Length	
millimeter (mm)	0.03937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
	Area	
hectare (ha)	2.471	acre
square kilometer (km^2)	0.3861	square mile (mi^2)
	Volume	
cubic meter (m^3)	35.31	cubic foot (ft^3)
cubic meter (m^3)	0.0008107	acre-foot (acre-ft)
cubic hectometer (hm^3)	810.7	acre-foot (acre-ft)
	Flow rate	
cubic meter per second (m^3/s)	35.31	cubic foot per second (ft^3/s)

Temperature in °C may be converted to °F as follows: °F=(1.8×°C)+32

June 21, 2012

Recommendations for Renewal of the International Joint Commission's Osoyoos Lake Order

Executive Summary

Osoyoos Lake, an international body of water, is located on the Okanogan (U.S. spelling) River from Oroville, Washington, to about 3.7 mi (6 km) north of Osoyoos, British Columbia. The lake is impounded by Zosel Dam located in the United States and owned by the State of Washington. The International Joint Commission (IJC or the Commission) issued its first Order of Approval for Zosel Dam and Osoyoos Lake in 1946. Zosel Dam was replaced in 1988 and since that time the dam and Osoyoos Lake levels have been managed with IJC Orders of Approval issued in 1982 and 1985. The current Orders are set to expire on February 22, 2013, unless renewed. This report presents recommendations from the International Osoyoos Lake Board of Control (Osoyoos Board or the Board) for renewing the Osoyoos Lake Orders. The Board's recommendations draw from the results of eight hydrologic studies commissioned by the IJC, discussions with the State of Washington and British Columbia, and from public consultation gathered at Board meetings, through letters and emails, and at two Osoyoos Lake Water Science Forums.

Under the Boundary Waters Treaty the IJC is required to provide all interested parties with a convenient opportunity to be heard on matters before the Commission that might affect their interests. Before making any decisions on the future regulation of levels and flows the IJC will schedule public hearings in the Okanagan Basin so that the Commissioners can hear directly from stakeholders throughout the basin.

It is the Board's position that since the completion of the current Zosel Dam, the 1982 and 1985 Orders have adequately facilitated control of water levels in Osoyoos Lake, to the extent possible and with the exception of the 913 foot maximum lake elevation during drought years, primarily for the benefit of agricultural, tourism, municipal interests, and fisheries protection. In addition, British Columbia and the State of Washington have acknowledged that the Orders in combination with informal cooperative agreements between the two governments have worked well for managing water levels in Osoyoos Lake. As such, the Board recommends retaining the scope of the renewed Order to management of lake levels with only minor modifications that are primarily related to a revised lake-level rule curve. The Commission should encourage the continued cooperation between British Columbia and the State of Washington to balance flow needs across the International Border and downstream of Zosel Dam while respecting goals for Osoyoos Lake elevations and limits on releases that are possible from Okanagan Lake.

The Board recommends for public review a revised rule curve proposed by the State of Washington that addresses many of the comments made by lake stakeholders and the findings of eight IJC Osoyoos Lake Studies. The proposed rule curve provides additional seasonal flexibility in achieving targeted lake levels, and accommodates multiple uses and users associated with Osoyoos Lake. The proposed rule curve also eliminates the drought/non-drought declaration and limits summer maximum lake levels to 912.5 ft.

The current Board is comprised equally of members from Canada and the United States with members being from respective Federal and Provincial/State interests with primary water resource management mandates of relevance to the Okanagan/Okanogan Basin. Local membership could be added to the Board while maintaining the neutral decision-making balance of the Board in providing oversight of the Applicant's duties under the IJC Orders of Approval.

While the Board's current mandate pertains primarily to the management of water levels in Osoyoos Lake, the lake is a relatively small component of the much larger international basin that extends northward from the confluence of the Okanogan and Columbia Rivers in Washington State into Canada. An International Watershed Initiative (IWI) for the Okanagan/Okanogan Basin could encourage a greater level of integration and local participation though an ecosystem-based approach to transboundary watershed issues. The Board recommends conducting an IWI feasibility study for the basin. Using the example of the St. Croix IWI, a State of the Watershed report for the Okanagan/Okanogan Basin could be helpful in compiling water-resources information on both sides of the border in an integrated fashion, and identifying the current state of transboundary watershed and ecosystem data harmonization efforts, while providing a basis for further development of various IWI elements.

Provided the Commission continues to maintain its jurisdiction over the Zosel Dam, it is expected that an Order of Approval will rely on a Board of Control for oversight of the duties and responsibilities of the Applicant. The composition and reporting relationship of the Board of Control with an International Watershed Board would need further examination should an IWI appear feasible for the Okanagan/Okanogan Basin. The Board recommends that the current structure and operating procedures of the Board remain in place until such time as an alternative becomes a feasible option.

Introduction

Description of Physical Setting

Osoyoos Lake, an international body of water, is located on the Okanogan (U.S. spelling) River from Oroville, Washington, to about 3.7 mi (6 km) north of Osoyoos, British Columbia. The lake is impounded by Zosel Dam on the Okanogan River at Oroville, about 1.6 mi (2.6 km) downstream from the outlet of Osoyoos Lake. Inflow to Osoyoos Lake is produced principally by the regulated outflow from Okanagan (Canadian spelling) Lake in British Columbia.

Physiography

The Okanogan River Basin (figure 1) is tributary to the Columbia River. It covers about 8,400 mi^2 (21,750 km^2) and most of it (74%) lies within British Columbia (Glenfir Resources, 2006). At Zosel Dam, the drainage area is 3,195 mi^2 (8,275 km^2). The Similkameen River, which is the single largest tributary, enters the Okanogan River about 3 mi (4.8 km) downstream from Zosel Dam.

The Okanagan valley in Canada is a long, north-south trench in the Interior Plateau of British Columbia. It extends north from the Columbia Plateau, in Washington State, to the height of land separating the drainage basins of the Columbia and Fraser Rivers. The valley and the included lakes are an artifact of repeated periods of glacial activity which ended about 10,000 years ago (Roed, 2001).

The valley is wide, has a gentle slope and is defined by mountains on either side that rise to 8,200 ft (2,500 m). The Okanagan River runs about 33 mi from the outlet of Okanagan Lake (elevation 1,122 ft (342 m)) at Penticton, B.C. through Skaha and Vaseux Lakes to Osoyoos Lake (elevation 911 ft[1] (277 m)). The Okanogan River continues on south from the outlet of Osoyoos Lake for about 79 mi (127 km) to Brewster, Washington where it joins the Columbia River.

Osoyoos Lake is approximately 10 mi (16.1 km) long and typically about 1 mi (1.6 km) wide. The total surface area is 5,756 acres (2,329 ha) with approximately 2/3 lying in Canada. Average depth is about 50 ft (15.2 m); maximum depth is 208 ft (63.4 m). The natural minimum lake elevation is controlled to about 906 ft (NGVD 1929 datum) by a sill at the lake outlet, which is also the Zosel Dam gate sill elevation. Zosel Dam located downstream of the natural lake outlet, controls the lake between elevation 906 ft and 913 ft. The active storage between elevation 909 ft and 913 ft is 22,110 acre-ft (27.3 million m^3) (Tran and others, 2011).

Tonasket Creek, with a drainage area 60.1 mi^2 (156 km^2) enters the river from the east between the lake outlet and Zosel Dam about 1.2 mi (1.9 km) downstream of the lake outlet and about 0.4 mi (0.6 km) upstream of Zosel Dam. Historically, unusually high discharge from Tonasket Creek carried an accumulation of rocks, sand, and gravel sufficient to block the natural channel of the Okanogan River. Information gathered in the 1943 International Joint Commission (IJC or the Commission) hearings established that blockages of this type occurred in 1916 and 1939.

[1] Note: All Osoyoos Lake elevations in this report are expressed in feet referenced to the United States Coast and Geodetic Survey Datum (USCGS) which is equivalent to National Geodetic Vertical Datum of 1929 (NGVD 1929).

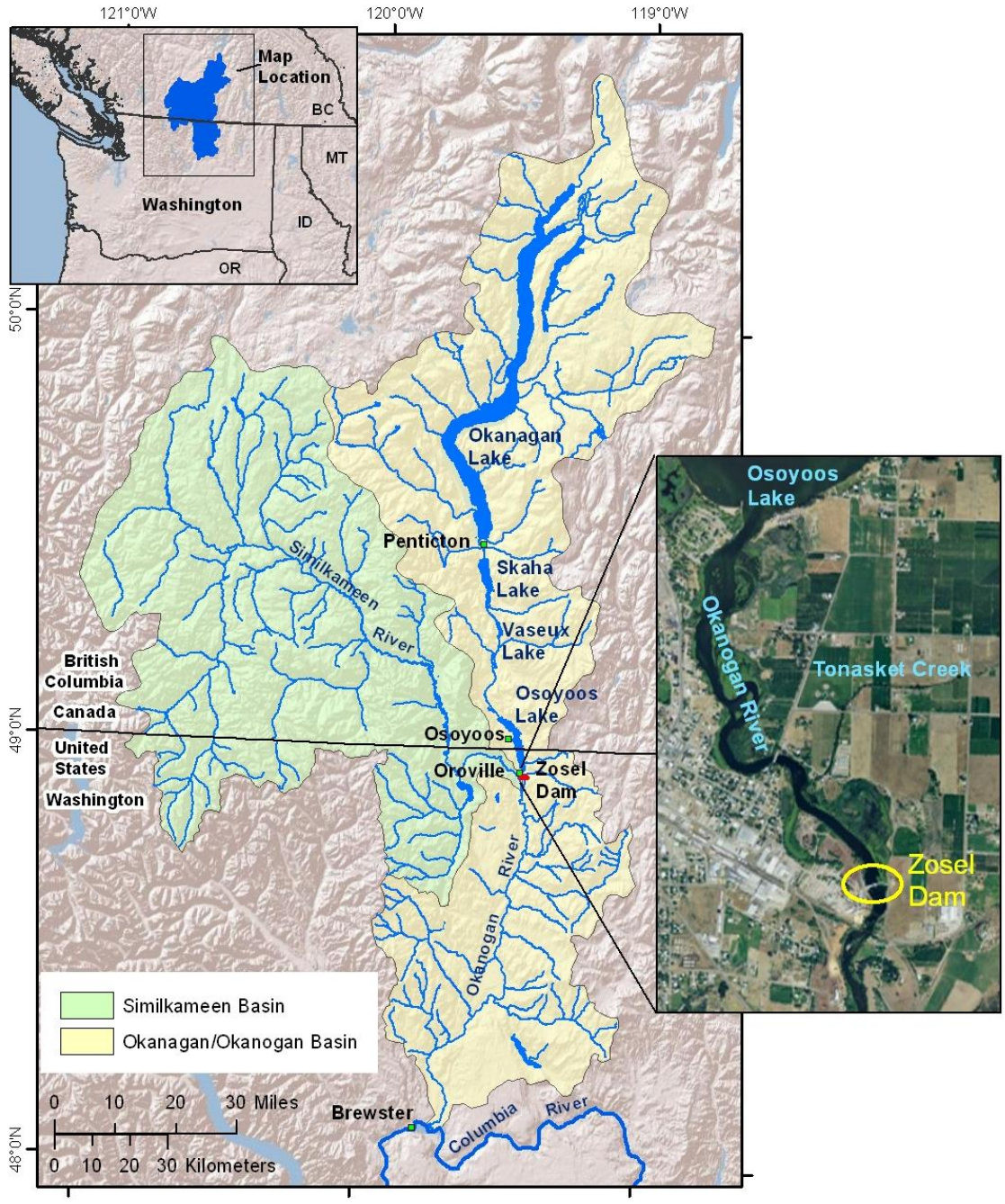

Figure 1. Okanogan River Basin.
(Spelled Okanagan in Canada. Similkameen River sub-basin shown in green).

Climate

The Okanagan Valley is located in the rain shadow of the Coast Mountains and receives westerly air masses that have been modified in two ways to give distinct climatic features. First, as moist Pacific air masses are forced up and over the Coast and Cascade Mountains, they are cooled and their moisture falls as rain or snow on the windward side of the mountains. Second, as these air masses are forced down the leeward side of the mountains they are warmed and become more stable. In turn, the dried, warmer air promotes further evaporation from the surrounding landscape.

The rain shadow effect leads to the lowest annual precipitation in Canada. Total precipitation at Osoyoos (Environment Canada Climate Station: Osoyoos West; 1971 – 2000 normals) averages 12.5 inches (317.6 mm), of which 1.95 inches (49.6 mm) (water equivalent) falls as snow, between the months of October and March (Summit Environmental Consultants, 2010a).

The Okanagan Valley is not only very dry but also has unusually high summer temperatures. In the Osoyoos Lake area, the July mean daily high is 84.7 °F (29.3 °C). On July 16, 1941 temperature at Oliver reached 111 °F (43.9 °C). Mean daily temperatures at Osoyoos range from a high of 71.1 °F (21.7 °C) in July to a low of 28.2 °F (-2.1 °C) in January (Environment Canada, Climate Data for Stations: Osoyoos West and Oliver STP).

The warm, dry climate of the Okanagan coupled with the large scenic lakes has made the valley an attractive place to live, work, and play with consequent increased population during recent decades, principally in British Columbia.

Hydrology

Snowmelt between April and June is the primary source of runoff in the Okanagan Basin (and Osoyoos Lake). In addition, high intensity thunderstorms and late fall rainstorms are common, recharging soil moisture and producing short-duration peak flows. Low flows generally occur from the end of November to March, and in the hot summer months, with the lowest flows commonly occurring in January or February. Osoyoos Lake water levels follow the Okanagan Basin runoff regime; however, they are also governed by the Okanagan Lake Regulation System, in which flows are partially controlled via dams on Okanagan, Skaha, and Vaseux Lakes and by the operation of Zosel Dam (Summit Environmental Consultants, 2010a).

Average discharge in the Okanogan River is 2.2 million acre-ft per year (measured at USGS streamgage “Okanogan River near Malott”, 17 mi upstream of the confluence with the Columbia River). The Similkameen River, with an average discharge of 1.6 million acre-ft per year (measured at USGS streamgage “Similkameen River at Nighthawk”, 16 mi upstream of the confluence with the Okanogan River), is the source of most of the flow in the Okanogan River. Average discharge in the Okanogan River just downstream of Osoyoos Lake is 0.5 million acre-ft per year (USGS streamgage “Okanogan River at Oroville”).

The Similkameen River joins the Okanogan River just below Zosel Dam. Because the peak flow of the Similkameen can be up to 10 times greater than that of the Okanogan River and because the land at the confluence is relatively flat, high water levels in the Similkameen River actually slow or block the flow out of the Okanogan River and Osoyoos Lake. With extreme high water in the Similkameen River (greater than 10,000 ft^3/s (283 m^3/s)), flow in the Okanogan River may reverse and flow upstream into Osoyoos Lake, although this reversal is a rare occurrence. This phenomenon is referred to as Similkameen backwater. A more common scenario is for flows into Osoyoos Lake to exceed its outflow capacity when combined with limited outflow capacity due to high water in the Similkameen River. Either Similkameen backwater or extreme Okanagan River inflow can exceed the capability of Zosel Dam to control lake levels which can temporarily rise above elevation 913.0 (Summit Environmental Consultants, 2010a).

Osoyoos Lake water levels and Okanagan River discharges are also influenced by water extractions from Osoyoos Lake and the Okanagan River, by the Town of Osoyoos and the Oroville Tonasket Irrigation District (OTID). The total annual Osoyoos Lake extraction demand for residential, commercial, municipal, and agricultural is approximately 22,000 acre-ft (27.1 million m^3) (Tran and others, 2011a).

History and Purpose of Zosel Dam, Project Background and International Joint Commission Involvement

The original Zosel dam was constructed of timber in 1927 by the Zosel Lumber Company to create a log storage pond in the Okanogan River.

In March 1938, the Canadian Government, Department of Public Works complained to the State of Washington, Department of Conservation and Development alleging that Zosel Dam was causing backwater, raising the level of Osoyoos Lake and causing damage in Canada. The U.S. Geological Survey (USGS) did investigations in March 1938 and April 1939 to ascertain hydraulic conditions between the lake outlet and Zosel Dam (Thayer, 1939). Additionally, the State of Washington submitted an application to the IJC through the U.S. Government requesting IJC give consideration to the perceived causes, if any, of higher Osoyoos Lake levels above the International Boundary. In response the IJC held hearings on the matter on July 10, 1943 in Penticton, British Columbia and on July 12, 1943 in Oroville, Washington (International Joint Commission, 1943a, 1943b).

Conclusions from the USGS studies and testimony at the IJC hearings were that high Osoyoos Lake levels were affected by several phenomenon including high lake inflows. During periods of high spring snowmelt runoff, high water surface levels in the Similkameen River at the confluence with the Okanogan River cause backwater that raises the level of Osoyoos Lake. Also, unusual high discharge in Tonasket Creek such as occurred in 1916 and March 1939 caused large accumulation of rocks, gravel, and sand at the mouth of Tonasket Creek that caused backwater in Osoyoos Lake part of the year. Osoyoos Lake was controlled by Zosel Dam during the low flow period of the year. Additionally, the previously mentioned backwater effects and other factors caused channel accretion at the lake outlet reducing hydraulic capacity and resulting in higher lake levels, especially during the summer, fall, and winter periods of low runoff. Accretion in the channel between the lake Outlet and Zosel Dam and low elevation discharge limitations at the dam restricted the natural erosion of the channel and limited lake drawdown. As evidenced by comments at the 1943 IJC hearings, these channel restrictions were

causing unacceptably high Osoyoos Lake levels which were causing damage especially to sewer and domestic water systems.

On July 12, 1943, IJC, acting in response to an application by the State of Washington, appointed a Special Board of Engineers to study the relationship between water levels in the storage pond and in Osoyoos Lake. Based upon information from the 1939 Thayer Report, the 1943 IJC Hearings, and the findings of the Special Board of Engineers (Webb & Veatch, 1946), the IJC, on September 12, 1946, issued an Order that the dam be structurally altered with spillways of sufficient capacity that the pond elevation would not exceed 911.0 ft while discharging 2,500 ft^3 /s (70.8 m^3/s) (International Joint Commission, 1946). The principal effect was to facilitate erosion of the lake outlet and the channel between the outlet and the dam permitting control of the lake to lower elevations. Also, by that Order; the IJC created an International Osoyoos Lake Board of Control to ensure that provisions of the Order would be carried out.

Despite a number of repairs and alterations over the years, the structural condition of the timber dam deteriorated, and in 1978, the U.S. Army Corps of Engineers (USACE) concluded that the dam was overstressed at lake elevations of 911.0 ft (USACE, 1978). In May 1979, the USACE completed a concept plan for a new control structure to replace the aging Zosel Dam (USACE, 1979). In October 1980, the State of Washington and the Province of British Columbia developed a cooperation plan for Osoyoos Lake levels and transborder flows, and on December 24, 1980, the Governor of the State of Washington (the Applicant) submitted an Application to the IJC through the U.S. Government for an Order of Approval to construct a new dam.

Following public hearings in December 1981, the IJC issued an Order on April 28, 1982 which was revised on December 9, 1982, granting an Order of Approval for construction of a new dam and stipulating 17 conditions regarding construction, operation, and maintenance of the structure (International Joint Commission, 1982). One provision of the 1982 Order is that the new structure be constructed such that Osoyoos Lake levels during high inflow periods would be no more extreme than would have occurred with the old dam operating in accord with the 1946 Order. Subsequent to the 1982 Order, a preliminary design study made evident that several of the conditions in the 1982 Order could not be met. Consequently, the IJC held further hearings in September 1985, and a Supplementary Order of Approval was granted on October 17, 1985 (International Joint Commission, 1985).

The principal changes to the 1982 Order facilitated by the 1985 Order were:

- to remove the requirement that the new dam be located approximately 300 ft (91 m) downstream of the Cherry Street bridge in Oroville, Washington and thus permit the dam location to be moved further downstream, near the location of the old Zosel dam,

- and to remove specification of the physical configuration of the Tonasket Creek confluence with the Okanogan River and substitute a requirement that the State of Washington maintain a channel capacity upstream and downstream of the dam of 2500 ft^3/s (70.8 m^3/s) at an Osoyoos Lake elevation 913.0.

Design and Construction of New Zosel Dam

In March 1985, the State of Washington and the Province of British Columbia developed a Memorandum of Understanding for design and construction of the new control works. The essence of that agreement was that the costs of design and construction would be borne equally, that operation and maintenance would be the sole responsibility of the State of Washington as owner, and that British Columbia would undertake design of the dam.

Plans and specifications were reviewed by the Board of Control during late 1985 and early 1986, and on April 24, 1986, the Board advised the IJC that the design would meet the requirements of the Orders. Construction began on that same date, the old timber dam was removed on August 30, 1986, and commissioning tests of the new concrete and steel dam were completed in October 1987. The Board, by letter dated April 20th, 1988, notified IJC that the final phase of project construction, dredging of the upstream and downstream channel, was completed on February 22, 1988. The structure was named Zosel Dam at a dedication ceremony on May 14, 1988. Figure 2 is a photograph of the dam.

Description of Zosel Dam

Figure 2. Aerial view of Zosel Dam showing the control structure and overflow weir. (After Summit Environmental Consultants, 2010a).

The reconstructed Zosel Dam was completed in 1987 and included a control structure, manual controls, and overflow weir (figure 2). The overflow weir is 198 ft (60.4 m) long and has a concrete top elevation of 913.0 ft. The control structure is 171 ft (52.1 m) long and consists of four spillways (each with a gate), two fishways, and other associated infrastructure (e.g. a control room, a stoplog storage vault, a dewatering pump vault, a gear actuator gallery, and an emergency generator room) (Washington Department of Ecology, 1990). The spillways are 25 ft (7.6 m) wide and have an upstream floor elevation of 906.0 ft and a downstream floor elevation of 901.0 ft; the spillways are designed to pass 2,500 ft^3/s (70.8 m^3/s) with 3 of the 4 gates available at an Osoyoos Lake elevation of 913.0 ft. The gates are each 25 ft (7.6 m) wide, 7.5 ft (2.3 m) tall, and can travel 13.5 ft (4.1 m) from fully open to closed; the fishways are located on either side of the spillway section and are 8 ft (2.4 m) wide, 73 ft (22.3 m) long, and each are designed to pass 45 ft^3/s (1.27 m^3/s) (Washington Department of Ecology, 1990).

Summary of Current Orders

Applicant and Board Roles and Responsibilities

The Applicant, the State of Washington, owns Zosel Dam and delegates responsibility for operation of the project to their Department of Ecology (WADOE). The WADOE directs the operation through a local contract with the Oroville Tonasket Irrigation District. Generally it is the Applicant's responsibility to operate the project in compliance with the 1982 and 1985 Orders of Approval. The principal duties and responsibilities of the Applicant are to:

- Direct the day-to-day operation of Zosel Dam with latitude to operate Osoyoos Lake within the limits of the Orders and to provide levels on Osoyoos Lake no more extreme than would have occurred with the old Zosel Dam in place.

- Coordinate operation of the project with the Province of British Columbia and with consideration of the benefits to agriculture, fisheries, domestic use, tourism, and other interests.

- Coordinate with the Board to seek relief if local requirements are in conflict with the Orders.

- Maintain the project in a manner satisfactory to the Board.

- Maintain channel capacity of at least 2,500 ft^3/s with the elevation of Osoyoos Lake 913.0 and no appreciable backwater effect from the Similkameen River.

- Be responsible for the disposition of claims for physical injury or damage to persons or property occurring in Canada in connection with the construction, maintenance and operation of the works and for the satisfaction of any such claims that are valid.

- During the period April 1 through October 31 and when Osoyoos Lake elevation is at or below elevation 910.5, suspend any diversions upstream of Zosel Dam that were authorized after issuance of the 1982 Order.

The general responsibility of the International Osoyoos Lake Board of Control is to monitor the Applicant's activities to ensure the Applicant's compliance with IJC's 1982 and 1985 Orders of Approval and to perform other activities delegated to the Board in the Orders and by the Commission. The principal Board duties are to:

- Maintain communication with the Applicant, monitor Osoyoos Lake operations to assure lake operation within the limits specified by the Orders, and inform the Commission of any violation of the provisions of the Orders.

- Provide the Commission with an annual report of Board activity and reports of other pertinent information.

- Declare droughts in accord with the provisions of Condition 8 of the 1982 Order and terminate drought declarations when none of the three drought criteria exist.

- Facilitate public involvement including holding annual public meetings.

- Provide advice and recommendations to the Commission on decisions of temporary deviation from prescribed water levels to accommodate circumstances including (but not restricted to) prolonged drought, milfoil destruction or underwater construction.

Osoyoos Lake Elevation Rule Curve

Figure 3 is a graphical illustration (rule curve) of the lake elevation limits as prescribed in the 1982 Order. Zosel Dam controls lake levels except when Similkameen River backwater or exceptionally high lake inflow sometimes force lake elevation above the rule curve.

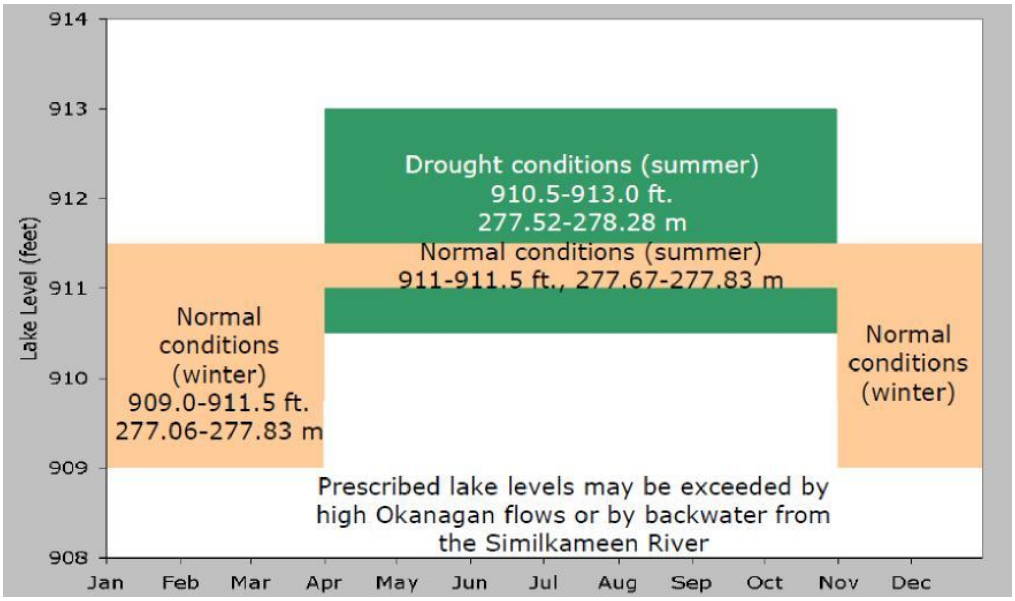

Figure 3. Rule curve for Osoyoos Lake as prescribed in the 1982 Order of Approval.

Condition 7 of the Order specifies that the lake will normally be operated between elevations 909.0 ft and 911.5 ft; however, elevation will be limited from 911.0 ft to 911.5 ft from April 1 through October 31 and 909.0 ft to 911.5 ft from November 1 through March 31 (figure 3).

During drought years, the 1982 Order of Approval allows for the level of Osoyoos Lake to be lowered to 910.5 ft and raised to 913.0 ft beginning April 1 to allow for additional storage for domestic use, irrigation use, and fish flows (figure 3). Lake elevation must be returned to below 911.5 ft by October 31. A drought year is declared when any of the following criteria (Conditions 8a, 8b, and 8c of the 1982 Order of Approval) are met.

- The volume of flow in the Similkameen River at Nighthawk, WA for the period April-July as calculated or forecasted is less than 1.0 million acre-ft (1.2 billion m^3); or

- The net inflow to Okanagan Lake for the period April through July as calculated or forecasted is less than 195,000 acre-ft (240 million m^3)or is forecasted to fail to reach an elevation of 1122.8 ft (342.23 m) Canadian Geodetic Survey Datum during the months of June or July.

- The level of Okanagan Lake fails to reach an elevation of 1122.8 ft (342.23 m) Canadian Geodetic Survey Datum during the months of June or July.

At the discretion of the Osoyoos Board of Control and when the conditions are no longer met, drought declarations can be rescinded.

Requirement to Renew Orders

The current Order specifies that approval will terminate 25 years after completion of dam construction unless renewed. The Commission received an April 20, 1988 letter from the Board stating that all construction for the control works was completed on February 22, 1988 when the last remaining work of dredging the river channel between the lake outlet and dam was finished. Thus the Order will terminate February 22, 2013, unless renewed.

Process for Renewing Orders

The Commission's powers under Articles III, IV and VIII of the Boundary Waters Treaty (*http://bwt.ijc.org/index.php?page=home&hl=eng*) give it a continuing obligation of oversight and review of its orders to assure that the Commission's actions are in conformity with the Treaty in light of all relevant circumstances. The Commission retains continuing jurisdiction over the subject matter of an application so that it can, at its own initiative or the initiative of others, amend the Order as appropriate. Rule 12(3) of the IJC Rules of Procedure states that any government or person entitled to request the issuance of further orders may present to the Commission a request setting forth the facts upon which it is based and the nature of the further order desired (IJC, 2012). The provisions of Article VIII that the Commission is bound to observe in the exercise of its jurisdiction over Article III or IV matters apply to both the original consideration of matters and to the continuing jurisdiction of the Commission in any particular matter. If the Commission initiates a process of amendment, it would proceed consistent with the provisions of the Treaty and its Rules of Procedure, with adequate opportunities afforded for public review and comment.

Under the Boundary Waters Treaty the IJC is required to provide all interested parties with a convenient opportunity to be heard on matters before the Commission that might affect their interests. Before making any decisions on the future regulation of levels and flows the IJC will schedule public hearings in the Okanagan Basin so that the Commissioners can hear directly from stakeholders throughout the basin.

Summary of Order Renewal Process

The Order renewal process officially began in October 2000 when the Commission requested the Osoyoos Lake Board of Control to develop a list of the various components of a work plan that would lead to a consideration of a renewal of the Orders. In September 2002, the Board provided the Commission with a list of studies and components of a renewal work plan, and in March 2003, the Commission proposed the idea of developing a Plan of Study for a review of the Orders. In August 2005, a contract was awarded for the development of a Plan of Study and the final plan was delivered in August 2006 (Glenfir Resources, 2006). The Plan of Study recommended eight issues pertinent to Order renewal for formal consideration. The Board cooperated with the Commission to award contracts to study these issues. In 2010-11, the eight studies identified in the Plan of Study were completed by various U.S. and Canadian contractors (herein referred to as the IJC Osoyoos Lake studies).

This report brings us to the current step in the Order renewal process. With this report, the Board presents its recommendations for renewal of the Commission's Osoyoos Lake Order. Our recommendations draw from information received from the eight IJC Osoyoos Lake studies, the State of Washington and British Columbia, and from public consultation gathered at Board meetings, through letters and emails, and at two Osoyoos Lake Water Science Forums.

Description of the IJC Osoyoos Lake Studies

The following are a brief descriptions of the eight IJC Osoyoos Lake studies (individual studies referred to as Study 1, 2, etc.). The study reports can be found on the IJC website at http://www.ijc.org under the Osoyoos Lake Board of Control.

1. An assessment of the most suitable water levels for Osoyoos Lake (Tran and others, 2011a)

The focus of Study 1was to examine the projected 2040 water demand from Osoyoos Lake and explore ranges of lake levels that could potentially be used to meet the demand.

2. Evaluation of Criteria to Declare Drought (Urban Systems, 2011)

The annual elevation regime of the lake is significantly affected by Condition 8 of the 1982 Order, the drought declaration requirements. The focus of Study 2 was to evaluate the current criteria for declaring drought and review other common drought indices.

3. Review of Dates for Summer & Winter Operation (Urban Systems, 2011)

Study 3 evaluated the fixed dates for changing between summer and winter operation when considering the impacts of flood risk, biological processes, and other interests.

4. Effects of Zosel Dam Water Regulation on Osoyoos Lake Water Quality (Tran and others, 2011b)

Study 4 investigated whether or not operation of Zosel Dam has significant potential to affect Osoyoos Lake water quality and, if so, to what extent.

5. An Investigation of Methods for Including Ecosystem Requirements in Order of Approval (Tran and others, 2011c)

Study 5 addressed the environmental considerations pertinent to Osoyoos Lake operation. It considered how plant and animal species are affected, and if potential exists to mitigate the impacts of dam discharge and lake elevation fluctuation.

6. Climate Change and its Implications for Managing Water Levels in Osoyoos Lake (Summit Environmental Consultants, 2011)

The focus of Study 6 was to provide an understanding of the current state of knowledge of climate change science in the Okanagan/Okanogan Basin and to determine how robust the current Orders are with respect to a changing climate.

7. Part 1, Demonstration of Factors that Govern Osoyoos Lake Levels During High Water Periods (Summit Environmental Consultants, 2010a), and Part 2, Outreach Campaign: Public Consultation and Stakeholder Engagement on Lake Level Management (Sequoia Mediation, 2010).

Part 1 of Study 7 investigated the potential of Zosel Dam to provide improved Osoyoos Lake flood damage reduction. Part 2 of Study 7 focused on creating an outreach campaign for increasing stakeholder engagement with lake level management.

8. Review of Methods to Monitor Channel Capacity of the Okanogan River Downstream of Osoyoos Lake ((Summit Environmental Consultants, 2010b).

Condition 4 of the Order requires that the dam and the channel in the vicinity of the dam be capable of passing at least 2,500 ft^3/s (70.8 m^3/s) with a lake elevation of 913.0 ft. The objective of Study 8 was to review the present monitoring methods for detecting potential reduction in channel capacity and identifying the most practical, cost effective and risk adverse method for measuring channel capacity.

Input by the State of Washington

At the time of preparation of this report, the State of Washington had not yet submitted an application to the International Joint Commission. However, in a letter dated April 9, 2012, the State of Washington provided the Osoyoos Board with recommendations for the renewed Order and a proposed rule curve for Osoyoos Lake (figure 1). The letter followed recent discussions between the State and British Columbia regarding operations of Zosel Dam and issues important to both governments. In preparing their technical recommendations, the State considered the eight IJC Osoyoos Lake studies, their involvement with the Osoyoos Board, British Columbia and State of Washington staff as well as consulting teams from both Countries. The State of Washington's recommendations are further

informed by some 24 years of experience in operating Zosel Dam in Washington State and maintaining the hydraulic capacity of the approach channel flowing out of Osoyoos Lake to the dam.

The State recommends at a minimum the consideration of including in these renewed Orders the following provisions:

1. Remove the drought/ non-drought designation currently in the existing orders. Include operational criteria that would be followed in all years.
2. Adjust the existing rule curve to more accurately reflect the actual work of filling and maintaining Lake Osoyoos in coordination with the natural flow of the Okanogan River. This will allow the State more flexibility in operations and allow the State to adaptively manage for other needs in the watershed.
3. Allow for reaching the fill maximum after May 1, in order to allow the operator to follow the seasonal water availability and not artificially deplete water in the Okanogan River below the dam.
4. Set the operating range for lake levels in the summer between 910.5 and 912.5 ft to allow for maximum flexibility in maintaining downstream water rights.
5. Redesign the rule curve to recognize the actual operations over the past 25 years in terms of ramping the lake level up and down.
6. The renewed Orders should not include a termination date. The State recommends no termination date, while suggesting the renewed Orders allow the State to reopen the agreement at their request with written notice.
7. The renewed Orders should incorporate language to encourage adaptive management be applied to ongoing operations through the Orders.
8. The existing Orders recognized the existence of a Cooperation Plan that was authored prior to the 1982 Order. The State recommends this Plan be updated and be specifically incorporated by reference in the new Order.

The State also recommends the new Orders incorporate the State of Washington's commitment to shared values, including enhancement of fisheries, maintenance of water rights and water quality as well as maintenance of public safety concerns in the watershed. To promote these values, the State recommends the Orders should include a statement on the importance of local engagement in the process of managing the facility.

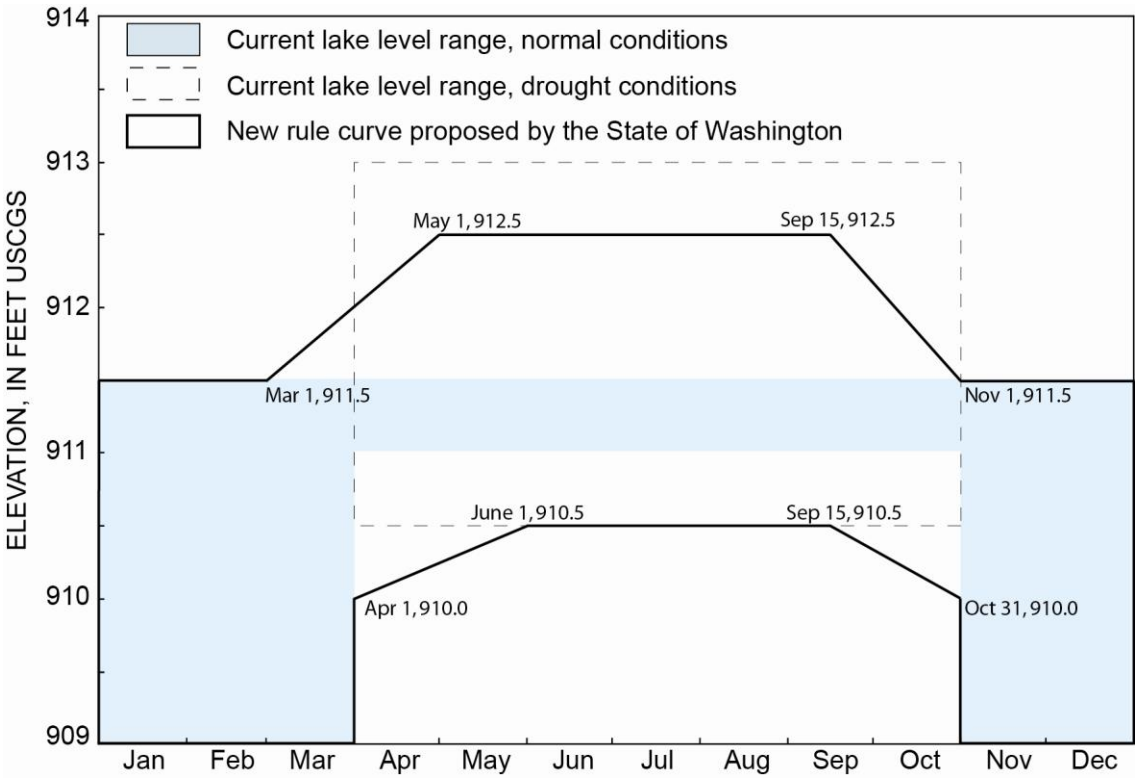

Figure 4. New rule curve for Osoyoos Lake proposed by the State of Washington, with existing rule curves for normal and drought conditions.

Summary of Public Input to Date

Since the beginning of the Orders renewal process in 2000, the Board has received feedback from the public, Tribes and First Nations, and local governments on issues associated with the operation of Zosel Dam and Osoyoos Lake. Most of the major concerns are those that are addressed in the eight IJC Osoyoos Lake studies; appropriate water levels, seasonal operations, drought declaration, water quality, ecosystem health, effects of climate change on lake levels, and flooding. New issues have arisen as the results of the IJC Osoyoos Lake studies having been made available through online postings, and presentations at public board meetings and the most recent Osoyoos Lake Water Science Forum held in Osoyoos in September, 2011.

One theme present in a few of the studies and in public feedback is that there is concern between the basic water balance for Osoyoos Lake and sovereignty over water. Studies 1, 2, 3 and 5 identified that instream fisheries flow requirements downstream from Zosel Dam account for nearly 90% of the total water demand from Osoyoos Lake and on numerous occasions these flow requirements have not been met. The authors of Study 5 reinforced the importance of downstream flows by stating "*discharge, and not lake level, is the most important criteria for maintaining healthy salmonid populations*." The crux of the issue is that Osoyoos Lake has limited storage capacity and lake levels and lake outflow are constrained by the available inflow, which during periods of low flow is almost completely dictated by

releases from Okanagan Lake located upstream of Osoyoos Lake. Study 3 demonstrated that in order to meet downstream flow requirements, Osoyoos Lake levels would need to frequently be drawn down below 909.0 ft which is not a practical or acceptable solution. Therefore, in order to meet the downstream criteria, there would need to be additional storage and subsequent releases from Okanagan Lake. Similarly, the authors of Study 7 identified that the only feasible way to add additional control over high (and low) Osoyoos Lake levels (and related outflows) is to manage storage and water releases from Okanagan Lake.

Given these constraints, there is a concern held by some that the Commission may attempt to extend its current mandate of lake level management to include the management of lake inflows and outflows to achieve downstream flow needs in Washington State.

Board Recommendations for Order Renewal

Recommendations to Maintain Elements of Current Orders

It is the Board's position that since completion of construction of the current Zosel Dam on February 22, 1988, the 1982 and 1985 Orders have adequately facilitated control of water levels in Osoyoos Lake, to the extent possible and with the exception of the 913 foot maximum lake elevation during drought years, primarily for the benefit of agricultural, tourism, municipal interests, and fisheries protection. In addition, British Columbia and the State of Washington have acknowledged that the Orders in combination with informal cooperative agreements between the two governments have worked well for managing water levels in Osoyoos Lake. As such, the Board recommends continuing to focus the Order on lake level management with some modifications to the lake-level rule curve.

The 1982 Order acknowledges the 1980 cooperation agreement between British Columbia and the State of Washington for transborder flows that has worked well for both governments. Moreover, the 1982 Order acknowledges Article II of the Boundary Waters Treaty in which the Parties reserved to themselves "or to the several State Governments on the one side and the Dominion or Provincial Governments on the other" … the exclusive jurisdiction and control over the use and diversion, whether temporary or permanent, of all waters on its own side of the line which in their natural channels would flow across the boundary," subject to the redress mechanism provided in Article II for any injury on the other side of the boundary. Consequently, the Commission should encourage the continued cooperation between the two governments to balance flow needs across the International Border and downstream of Zosel Dam while respecting goals for Osoyoos Lake elevations and limits on releases that are possible from Okanagan Lake.

The Zosel Dam was designed, constructed and is to be operated such that Osoyoos Lake levels during high inflow periods would be no higher than would have occurred with the old dam operating in accord with the IJC's 1946 Order. Consequently, the Board recommends making no changes to the Zosel Dam facility, including the control structure with four spillways, the two fishways, the overflow weir, and associated infrastructure (e.g. a control room, a stoplog storage vault, a dewatering pump vault, a gear actuator gallery, and an emergency generator room). These are reflected in Conditions 3 and 11 in the 1982 Order, and Condition 1 and 2 in the 1985 Order.

Given that a 1.6 mile reach of the Okanogan River exists between the outlet of Osoyoos Lake and Zosel Dam, there is potential for sediment to build up in this reach of the river to a level where the control point for lake levels could be shifted from the dam to the river. To monitor this potential situation, the Board recommends retaining the requirement for the Applicant to ensure the flow capacity of this reach of the Okanogan River enables Zosel Dam to pass at least 2,500 cubic ft per second when the elevation of Osoyoos Lake is 913.0 ft USCGS and there is no appreciable backwater effect from the Similkameen River. This is reflected in Condition 3 in the 1985 Order.

The Board recommends for public review the rule curve presented in the State of Washington's letter to the Board dated April 9, 2012. The rule curve proposed by the State retains certain aspects of the current rule curve while also incorporating some modifications that address comments from lake stakeholders and some of the Osoyoos Lake Study conclusions. The similarities are discussed below and the differences in the next section of the report.

The proposed rule curve retains the same winter operating range of 909.0 – 911.5 ft. Having the ability to draw the reservoir down to 909.0 ft in winter helps to prevent ice damage to infrastructure located at the shoreline (Ray Newkirk, WA Dept. of Ecology, verbal communication, 2008).

Study 5 indicates that drawdown in winter has been effective with freezing milfoil in other lakes. Study 5 also indicated that summer drawdown has been used in other lakes to desiccate milfoil during hot weather. However, the low levels required for this method in Osoyoos Lake are likely to cause serious problems for fish and shoreline plants, and will also be in conflict with other criteria for lake-level. Using lake-level management for invasive species control is not considered practical. Therefore, the Board does not recommend modifying the rule curve to permit routine drawdown below 909.0 ft.

Although Study 6 on climate change recommends changes to the rule curve, the study supports retaining flexibility to allow winter lake levels as high as elevation 9ll.5. This provides an option to store water in winter if warmer temperatures in the future lead to more winter precipitation falling as rain instead of snow. The benefit of higher lake levels vs. potential for ice damage to shoreline infrastructure would be resolved by adaptive management.

Several IJC Osoyoos Lake studies concluded that there is no compelling reason to make major modifications to the existing rule curve. For example, Study 1 concluded that it is not necessary to alter the current lake level management regime to meet current or future water demand because the storage capacity of the lake (22,100 acre-ft) is so small compared to water demand (estimated annual demand ranging from 303,900 acre-ft in 2011 to 314,700 acre-ft in 2040).

From a water-quality perspective, Study 4 concluded that Zosel Dam exerts no control on lake inflow and only effects lake elevation and water depth minimally from year to year (i.e. differences of a few ft). Therefore, Study 4 was unable to suggest changes in dam operation or water-level management that would directly and purposely affect water quality in Osoyoos Lake.

Condition 9 of the 1982 Order provides that during appreciable backwater conditions caused by flows in the Similkameen River and during excessive flows in the Okanagan River, Zosel Dam should be operated so as to maintain the level of Osoyoos Lake as near as possible to the rule curve in effect. It provides that in such an event every effort shall be made to lower the level of Osoyoos Lake in the shortest practicable time. The Board recommends continuation of this requirement, with the Applicant

considering the possible deleterious effects of high ramping rates on ecosystems when reducing lake levels in the shortest practicable time.

Condition 13 of the 1982 Order specifies the means of measuring and recording the level of Osoyoos Lake. This condition should be continued to maintain continuity of records for the Lake.

Condition 16 of the 1982 Order specifies that the State of Washington require that all water licenses (rights) issued subsequent to December 9, 1982 (the date of the Order) for the diversion of water upstream from the control structure contain the condition that the diversion be terminated when the elevation of Osoyoos Lake drops below elevation 910.5 feet USCGS during the period April 1 to October 31 each year. This Condition was intended to prevent new additional water rights from compromising the achievement of the Osoyoos Lake elevations specified in the 1982 Order. (Tran and others, 2011a) have indicated in Study 1 that rights for water during the summer period are already fully appropriated. In light of the water right precedent in the 1982 Order and the already full appropriation of rights to water during summer, it is recommended that this Condition continue for the period April 1 to October 31 each year, notwithstanding the proposed revisions to the rule curve.

Condition 17 of the 1982 Order provides that the Applicant shall be responsible for the disposition of claims for physical injury or damage to persons or property occurring in Canada in connection with the construction, maintenance and operation of the works and for the satisfaction of any such claims that are valid. The Applicant is responsible and accountable for maintaining and operating the works in keeping with the prudent and sound practices of any owner of such a facility and within the bounds of the conditions provided in the Order by the International Joint Commission. Previous Orders for the Zosel Dam have provided the Applicant some flexibility in operations, the rule curve proposed by the State of Washington provides for a somewhat greater flexibility in lake levels, and there are suggestions that the new Order should provide for adaptive management of the lake levels. The Applicant should continue to be responsible and accountable for physical injury or damage to persons or property arising from the works, so this condition should be retained. In the renewed Order, the Applicant should continue to be responsible for the maintenance and operation of the works, but the responsibility for construction of the works should be dropped since construction was completed 25 years ago.

The Commission should continue to retain jurisdiction over the subject matter of the Orders, and retain the right to make further order or orders relating thereto as the Commission deems necessary in judgment of the Commission.

Recommendations for Changes to Current Orders

The rule curve proposed by the State of Washington incorporates several of the recommendations made in the IJC Osoyoos Lake studies. One of the major changes is the elimination of drought criteria and the distinction between normal and drought years. The proposed rule curve has a single set of water-level ranges for all years. Study 2 concluded that the current drought approach is working but has limitations and may be signaling drought more often than would be considered by most common definitions of drought. In addition, the value of two criteria (Okanagan Lake level and inflow) as a drought index may be reduced because they are associated with a regulated system. Studies 3 and 6

also recommended eliminating drought declarations for managing lake levels and using a single flexible management regime for both normal and drought years.

One of the most common complaints the Board has received in the past has been with regard to water levels above 912.5 ft in drought years. Studies 1, 3 and 6 also mentioned this issue. The concern has been so pointed that in many recent drought years, British Columbia and the State of Washington have agreed to hold Osoyoos Lake to a maximum level of 912.5 and store the additional half-foot equivalent of water in Okanagan Lake until needed. At levels above 912.5 ft, waves from storms and boat wakes cause erosion that affects lakeside property and sandy beach areas desirable for summer recreation are excessively diminished. Minor flooding occurs in some areas leaving some grassy areas soggy, restricting use and creating mosquito breeding areas. To help alleviate this issue, the proposed rule curve has a maximum water level in summer of 912.5, which is less than the maximum of 913.0 ft that is currently allowed during drought years. Because the maximum lake level has been 912.5 ft in recent years, in part due to the episodic informal arrangements between British Columbia and the State of Washington, Study 5 concludes that wetland plants have adjusted to this level and it is a reasonable target for future management until more vegetation mapping can be conducted.

The Washington State Department of Ecology's *Zosel Dam International Osoyoos Lake Control Structure Operating Procedures Plan* (1990) indicates (page 14) that "Flood damage will begin at 914.0 ft elevation on Osoyoos Lake. At Osoyoos Lake, 913.0 ft elevation will cause all of the beaches to be covered."

The proposed rule curve allows water levels to be lower in April and May as compared to the existing rule curve. This modification was found to be advantageous by two studies. Study 3 concluded that the current procedure of raising the lake from its winter level to a minimum of 911.0 ft by April 1 in normal years is not consistent with the hydrology of the watershed where the unregulated spring freshet typically commences in late April and peaks in early June. They conclude that raising the lake from its winter level prior to the spring freshet has negative consequences on the availability of adequate fisheries flows in late winter downstream of Zosel Dam. They demonstrated that this is the period when fisheries flow requirements typically have not been met downstream of Zosel Dam. The proposed rule curve addresses this concern by allowing water levels to be less than 910.5 ft until June 1 (figure 4).

Study 7 reported that during large spring freshets, high water levels within the Similkameen River can restrict the flow within the Okanogan River and outflow of Osoyoos Lake, causing the lake level to rise above the authorized range. This backwater makes lake level management extremely difficult, especially since it is a natural phenomenon that would occur whether or not Zosel Dam was present. Even though the magnitude of peak lake level cannot be reduced through dam management, the time at which lake levels are above the authorized range can be reduced by maintaining lake elevation at a low level prior to a large spring freshet. Allowing for lower water levels in April and May (figure 4) will help mitigate this issue.

A related concern expressed about the current rule curve has been the use of fixed dates for switching between winter and summer operations. This issue currently forces water-level compliance to occur within a half-foot range on April 1 and November 1 in normal years and within a 2.5 foot range in drought years. The proposed rule curve allows for more flexibility for transitioning between winter and summer operation modes; in the spring, the range in authorized water level is never less than 2 ft and in the fall, never less than 1.5 ft (figure 4).

A consequence of permitting water elevations below 910.5 feet in April and May, and from 15 September until the end of October, as proposed by the State and supported by Study 3 and Study 7, would be the termination of any diversions of water granted in water rights by the State subsequent to the approval of the 1982 Orders (December 9, 1982). Study 1 reported some concerns that the suspension of diversions from Osoyoos Lake might be applicable to all water rights granted by the State subsequent to July 14, 1976. Washington State Department of Ecology (1990, p 15) reports that Chapter 173-549 of the Washington Administrative Code requires that any water rights filed after 1976 for waters from Osoyoos Lake or from ground waters determined to be in significant hydraulic continuity with Osoyoos Lake shall be subject to maintenance of a water surface elevation of 910.5 ft USCGS on Osoyoos Lake.

The 1982 Order indicated that "the minimum level for the satisfactory operation of pumps in British Columbia supplying water from Osoyoos Lake for irrigation is 910.3 USCGS." While no current comprehensive study of irrigation intake elevations is available, any new British Columbia licences or licences resulting from the amendment of an existing licence on Osoyoos Lake include a clause requiring intakes to be operable over a range of lake levels from 908.5 – 919 ft (Brian Symonds, B.C. Ministry of Natural Resource Operations, verbal communication, 2011). This requirement appears to have begun to be included in licenses about the time of approval of the Commission's 1982 Order, or shortly before. Moreover, the Board has received anecdotal reports that some of the shallower intakes have been extended further out into the lake over time.

On balance, the Board favors a transition or ramping of the rule curve in spring and fall, rather than the fixed dates of April 1 and October 31 used in the 1982 Order.

With regard to changes in the hydrologic cycle that could potentially occur with climate change, Study 6 suggested allowing more flexibility in filling the lake earlier in the year since at some point in the future increased flows are projected through winter, and the spring freshet is expected to begin earlier. Earlier storage may be required to take advantage of the available water in winter and early spring. The proposed rule curve addresses this concern by allowing lake levels to increase above 911.5 ft starting March 1, which is one month earlier than the current rule curve.

While the proposed rule curve follows the general recommendation of Study 2 for a single, flexible management regime for both normal and drought years, the range of "acceptable levels" is larger than the +/- 0.5 feet around a target level suggested by Study 2. One reason is to provide for and communicate increased flexibility for adaptive management of lake levels in response to changing interests and climatic conditions over time. A second key consideration is the provision of reservoir storage on Osoyoos Lake to satisfy water rights for irrigation. (Tran and others, 2011a)

An analysis of daily mean lake elevations since completion of construction of Zosel Dam (1988) indicates the range of water levels since construction of the current Dam are primarily contained within the proposed rule curve (figure 5). For drought years (figure 5A), all minimum and median lake elevations fall within the proposed rule curve while several maximum levels exceed the proposed 912.5 ft maximum. Most of the regulated lake levels greater than 912.5 ft in summer drought years occurred in 1992 prior to British Columbia and the State of Washington having agreements for limiting lake levels to 912.5 ft in drought years. For normal (non-drought) years (figure 5b), all minimum and median lake elevations fall within the proposed rule curve but maximum levels have been much higher than the

proposed 912.5 ft maximum on several days. Most lake levels greater than 912.5 ft in normal years result from a combination of high inflow and high Similkameen flow impeding lake outflow.

The ability of the Zosel Dam to control flood waters caused by high inflow or the impediment of lake outflows by high Similkameen flow, or both, is limited. Consequently condition 9 of the 1982 Order refers to operation of the Dam to maintain "the level of Osoyoos Lake as near as possible" to the levels in the Order. The analysis of lake levels since 1966 in Figure 6 reminds that lake elevations over 917 ft have been observed during the past 46 years. In 10 percent of the years (P90) lake elevations have exceeded 913.5 ft during the spring runoff months between May and July. In 20 percent of the years the lake elevations have exceeded 913 feet during the first half of June. In 25 percent of the years the lake elevations have exceeded 912.5 feet between the 20th of May and the 21st of June.

The overflow weir of Zosel Dam is at an elevation of 913 feet, and Dam operating procedures are to remove all of the gates from the water when spring melt causes Osoyoos Lake level to exceed 911.5 ft (Washington State Department of Ecology, 1990, p 58). Zosel Dam is designed and operated to not impede flows or levels when natural conditions are outside the control range of the facility, as provided for under Condition 9 of the 1982 Order.

Consequently, the future Orders should continue to refer to management of lake levels "to the extent possible" or "as near as possible." The Orders should also note the likelihood of lake elevations beyond which the Zosel Dam has no control, to ensure that residents around Osoyoos Lake continue to appreciate the flood risk.

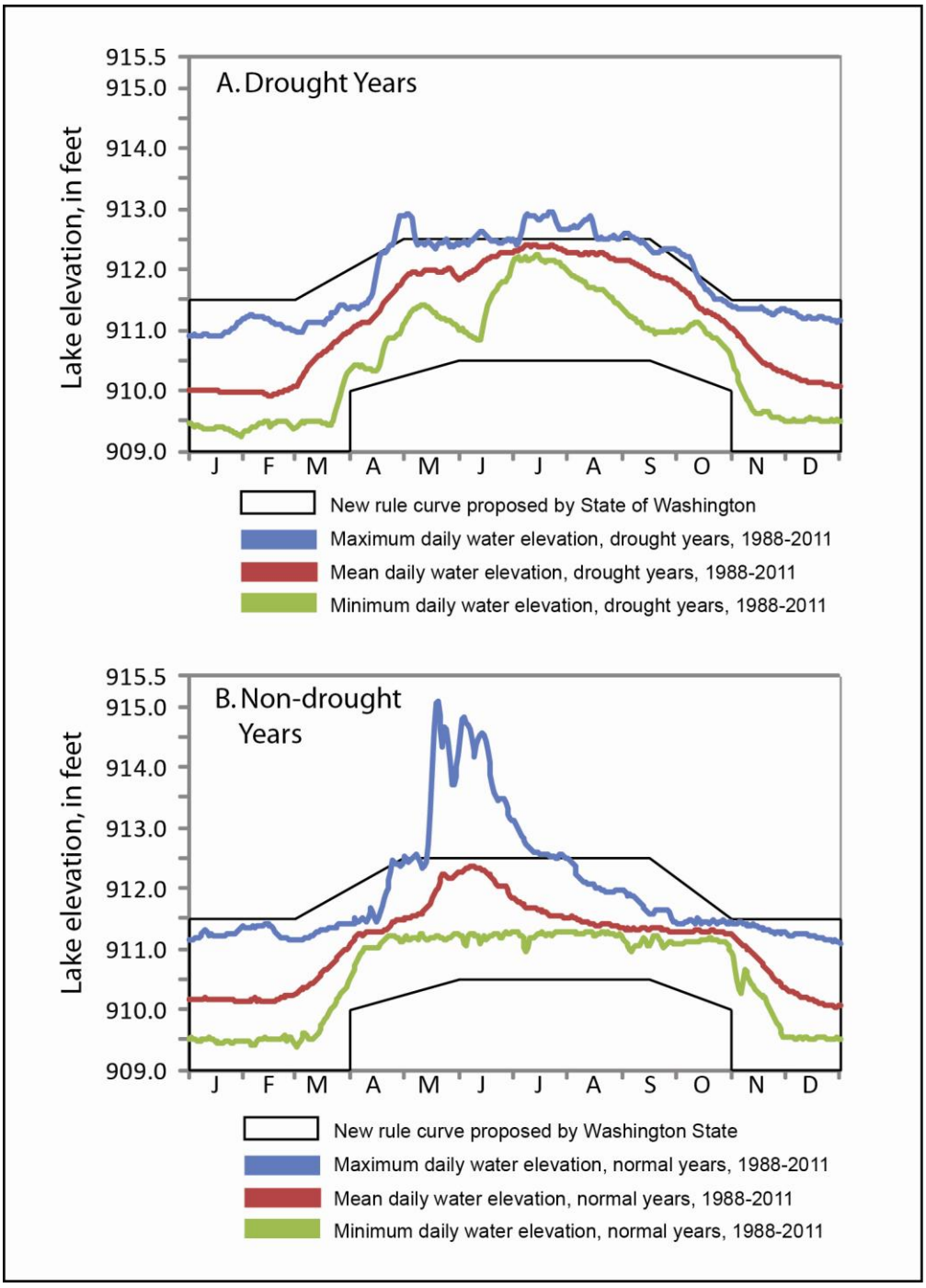

Figure 5. Maximum, mean, and minimum daily water elevations in Osoyoos Lake, 1988-2011, for A) drought years, and B) non-drought years.
(Water-level data since existing Zosel Dam was completed in 1988).

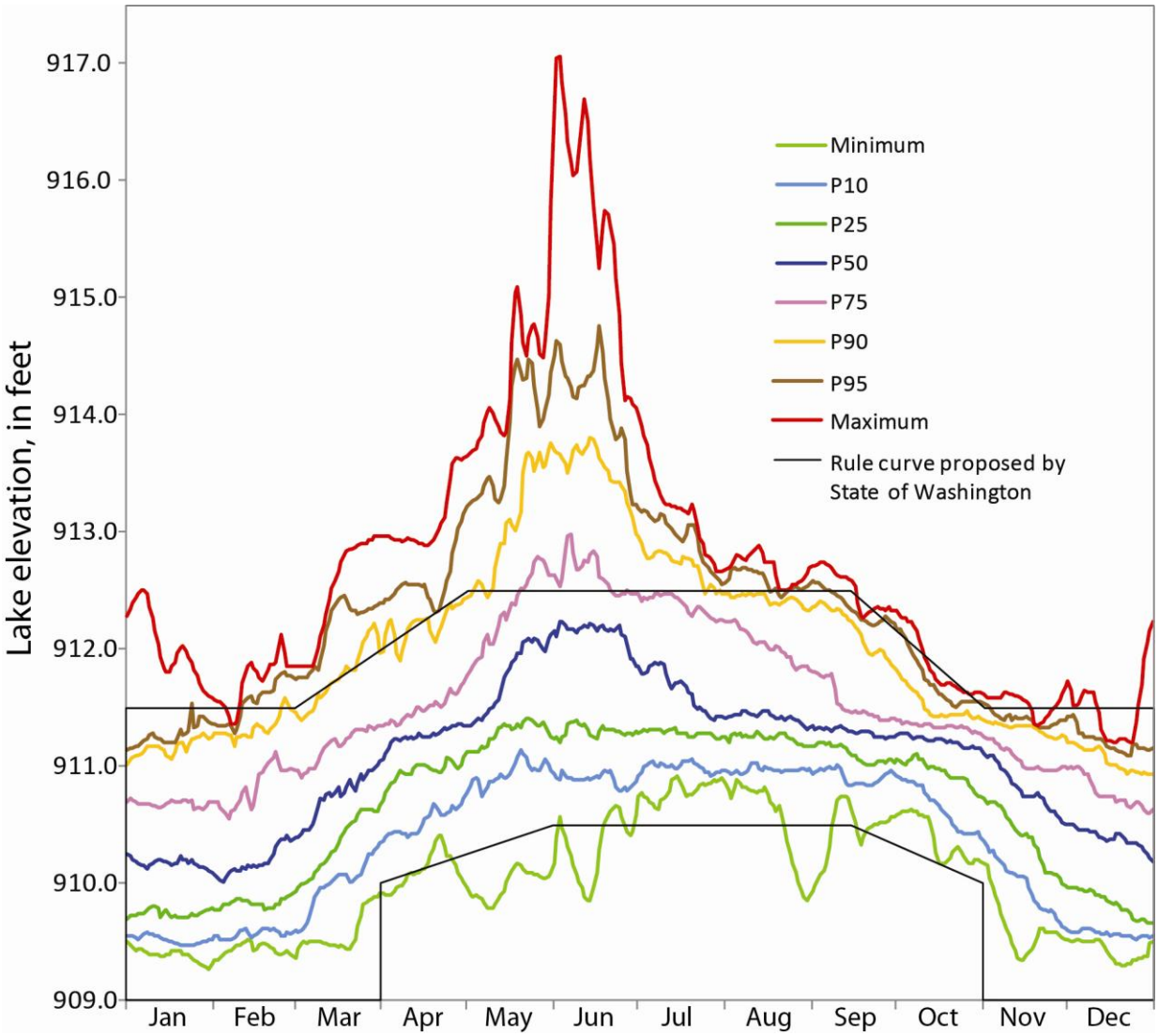

Figure 6. Osoyoos Lake elevations, 1966-2011, with proposed rule curve.
(P10, P25, P50, P75, P90, P95 are the elevations of the 10th, 25th, 50th, 75th, 90th and 95th percentiles).

Condition 15 of the 1982 Order specifies that the Applicant shall maintain the works in a manner satisfactory to the Board of Control. The Board recommends that this Condition be expanded to require that the Applicant maintain the works in keeping with all applicable dam safety procedures and requirements, including seismic requirements.

Condition 10 of the 1982 Order provides that on the written recommendations of the Board of Control, the Commission may allow a temporary deviation from the levels prescribed in Conditions 7 and 8 (of the 1982 Order). Condition 10 cites several examples that while perhaps intended to be illustrative rather than restrictive, do tend to be limiting and the Condition appears to put the onus on the Board of Control to conduct what could be resource intensive investigations into proposed temporary variations from the ordered lake levels. The Board recommends that the provision for the Commission to authorize temporary variations from the rule curve continue without the limiting examples. However, any proposed temporary variations must be sponsored by the Applicant or other recognized entity that has prepared a detailed proposal outlining the benefits and potential consequences of the variance and demonstrated that potentially interested parties have been informed of the proposed temporary variance, been provided a reasonable opportunity to offer comment, and that comments and concerns have been considered in the development of the proposal for a variance from the Order.

Because of potential changes to the hydrologic cycle in the future, Study 6 recommends incorporating an adaptive management strategy that includes an evaluation of water-level management performance under the Order, with an objective of periodic refinement of the Order. The Board recommends that language addressing adaptive management be included in the renewed Order. Proposals for adaptive management measures should also be sponsored by the Applicant or other recognized entity that has prepared a proposal and offered potentially interested parties an opportunity to influence the changes proposed. The Order should make provision for the Board to intervene if the Board is not satisfied with the Applicant's response.

The Commission's approval in it's 1982 and 1985 Orders "will terminate" twenty-five years after construction of the Zosel Dam and associated works. On one hand, twenty-five years is quite short considering the investment in the design, construction, maintenance and operation of the Dam and associated works, and the financial and time investment in the renewal of the Order. On the other hand, it's probably fair to say that it would have been unlikely that a proposal to amend the summer drought lake elevation of 913 feet in the Order would be under consideration if the current Orders did not have a termination and renewal clause. And the Board recommends favorable consideration of the implementation of an adaptive management approach to the future Order. The Board recommends that the new Order not include a termination clause. Rather, the Order should include a statement that proposals for revision to the Order shall be submitted to the Commission.

As the operator of the facility, the Applicant carries a duty to communicate with the public and relevant agencies on plans and operations, and to respond to public and stakeholder comments and concerns. Local-area water resource operators and the Applicant may see value in exploring the formation of a water management advisory committee to inform the Applicant's decisions on operations within the bounds of the Commission's Order. The Applicant could arrange a report on the proceedings of an advisory committee to the Board at the annual public meeting. The Board recommends consideration of including a condition that the Applicant form and operate an advisory committee with representatives of relevant interests from both the United States and Canada.

Comments and Recommendation on Potential Changes to Osoyoos Board Structure and Responsibilities

In accordance with the 1982 Order of Approval, the current Osoyoos Board is comprised equally of members from Canada and the U.S.A. (3 from each country) with additional secretariat support of one person from both Canada and U.S.A. More specifically, the Commission has selected Board members from respective Federal and Provincial/State interests with primary water resource management mandates of relevance to the region and within relevant areas of professional expertise. The Order of Approval does not specify the exact number of Board members, nor their affiliations, only that the Board will have an equal number of members from each country.

The past experience of the Board suggests that the current Board configuration is sufficient in providing balanced and effective execution of Board responsibilities as they primarily pertain to oversight of the Applicant's duties under the Order of Approval and Supplementary Order of Approval. For reasons of efficiency, the Board suggests that such an oversight role can continue to be performed by a relatively small Board with equal membership from both countries.

While the current Order does not specifically bring local members into Board meetings, the requirement to hold annual public meetings does provide a venue for local concerns and interests to be communicated to the Commission via the annual Board reports and the attendance of meetings by Commissioners. Additionally, Board members receive correspondence on local concerns or issues on an ad-hoc basis and provide a liaison role between the Commission and such local interests (typically conducted by the Board Co-Chairs). Local community and stakeholder interest and concerns are actively considered in the course of Board decisions and recommendations.

Given the direct linkage of Board responsibilities to the Order of Approval, local membership could be added to the Board while maintaining the neutral decision-making balance of the Board in providing oversight of the Applicant's duties under the IJC Orders of Approval. While there may be advantage to the Board in having a greater degree of local knowledge within the membership, it also raises the challenge of ensuring members are prepared to accept a role of representing interests in the prevention and resolution of issues to the benefit of both countries versus representation of specific local interests. Maintaining efficiency in fulfilling the mandate specified in the Orders may be challenged if the size of the Board gets too large or members take on issues outside the scope of the Orders.

Expressions of interest in a greater level of local community input into Osoyoos Lake management decisions were heard during the 2011 Osoyoos Lake Water Science Forum (Alexander and Garcia, 2012). Board members felt that there was a general misperception over the mandate and powers of the Board in effecting a broad range of decisions over the management of Osoyoos Lake rather than the specific responsibilities of the Board as mandated in the Order of Approval. In this sense it is not clear that there is strong local-level interest in participating in specific Board duties and responsibilities as they pertain to the current Order of Approval. This is an issue that could be explored in subsequent annual public meetings in addition to specific consultation activities that might be undertaken by the Commission. As previously mentioned, a different transboundary Osoyoos Lake advisory committee for the Applicant might be an option to explore with relevant water resource operators and related stakeholders, ensuring a reporting relationship to the Commission via the Board of Control.

Implementation of an International Watershed Initiative in the Okanagan/Okanogan Basin

Board Comments Regarding International Watershed Initiative Implementation

The Osoyoos Board has undertaken discussion on the potential application of an International Watershed Initiative (IWI) to the Okanagan/Okanogan watershed, as requested by the Commission and understanding that the Commission has received expressions of interest following the recent 2011 Osoyoos Lake Water Science Forum and previous events (2008 "One Watershed-One Water" regional conference held in Kelowna, BC, and the 2007 Osoyoos Lake Water Science Forum). Furthermore, it is the Board's understanding that an IWI is intended to encourage a greater level of integration and local participation though an ecosystem-based approach to issues in transboundary water basins. Board members have considered examples of existing IJC pilot international watershed initiatives (St. Croix River, Red River and Souris/Rainy River Basins) where the nature of the transboundary watershed issues, as well as the high level of interaction between the existing IJC Boards and local organization, made them IWI candidates. Furthermore, in putting this report together, there has been an assessment of the specific activities and organizational models employed in these pilot IWI cases, specifically in the case of the St. Croix IWI (the most advanced of the three examples, having received official International Watershed Board status in 2007).

Through the course of the Board's annual public meetings and regional water forum/conference events, the Board is aware of a range of water management issues that would need to be addressed as part of a feasibility assessment for an IWI in the Okanagan/Okanogan Basin, as follow:

Scope of the Transboundary Basin

Osoyoos Lake is a relatively small component of a much larger basin that extends northward from the confluence of the Okanogan and Columbia Rivers in Washington State into Canada, with Okanagan Lake being the most significant sub-basin watershed area in terms of the overall water balance above Zosel Dam. It is likely that the Similkameen River Basin would also need to be considered in the context of an Okanagan/Okanogan IWI given the significance of the Similkameen River in terms of water use in the region (e.g. Zosel Dam is operated under contract by the Oroville-Tonasket Irrigation District and one of the drought declaration criteria is specific to water supply from the Similkameen River) as well as the river being the major source of flow in the Okanogan River downstream of Zosel Dam, and its hydrologic effect on Osoyoos Lake levels during some high-water periods.

Transboundary Water Issues

The Board is aware of a range of issues and concerns regarding the Okanagan/Okanogan watersheds which could be considered in the context of an IWI. These include concerns over water quality, invasive species (and related control methods), ecosystem preservation and enhancement (e.g. Oxbow lake restoration, etc.), aquatic habitat preservations and enhancement (particularly temperature and dissolved oxygen conditions for fish), the interests of First Nations and Tribes, recreational values, land development and the overall sustainability of lake water supplies, including climate change impact considerations. There is little evidence of current transboundary collaboration on watershed issues at

the local community level. The Board recommends that the range of transboundary watershed issues that could be considered under an IWI for this basin be further explored through an IWI feasibility study including consultation with relevant stakeholders and communities throughout the basin.

Using the example of the St. Croix IWI, there may be some initial steps that could be considered for an Okanagan/Okanogan/Similkameen basin IWI feasibility study. A State of the Watershed report could be helpful in the context of compiling information on both sides of the border in an integrated fashion, identifying the current state of transboundary watershed and ecosystem data harmonization and potential, while providing a basis for further development of various IWI elements. A State of the Watershed project would however require staff and financial support of a range of agencies and organizations at various levels. Further work is necessary to ascertain the level of support to engage in this type of a project.

Support for an International Watershed Initiative

To determine the level of support for an IWI for this transboundary basin the Board recommends consultation with First Nations and Tribes, Provincial (BC) and State (WA) governments, the regional district of Okanagan-Similkameen, the Okanagan Basin Water Board and Okanagan Country, the municipal governments of Osoyoos and Oroville, as well as relevant federal agencies involved in Fisheries, Environment and Water Resource management.

The Board recommends that as part of a feasibility assessment, the Commission engage with appropriate senior officials in relevant Provincial and State agencies to ensure that Provincial and State agency staff have the support of their agencies to engage in a process to explore the feasibility of pursuing an IWI and/or related local-level transboundary water committees. While it may be possible to develop local-level transboundary water working groups or committees such as the Bilateral Okanagan Basin Technical Working Group to engage on specific issues, a lack of Provincial and/or State agency support would likely limit the effectiveness of such groups.

Comments on Future of the Osoyoos Board in the Context of an International Watershed Initiative

Provided the Commission continues to maintain its jurisdiction over the Zosel Dam, it is expected that an Order of Approval will rely on a Board of Control for oversight of the duties and responsibilities of the Applicant. The composition and reporting relationship of the Board of Control vis-à-vis an International Watershed Board would need further examination should an IWI appear feasible for the Okanagan/Okanogan/Similkameen basin. The Board recommends that the current structure and operating procedures remain in place until such time as an alternative becomes a feasible option. The conduct of an IWI feasibility study and potential State of the Watershed study are considered to be beyond the capacity of the current Board's resources, and current members would need explicit mandate and direction from their agencies to undertake such initiatives. These are potential initiatives that could be undertaken by the Commission with the support of the Board where possible.

Summary and Conclusions

The current IJC Orders of Approval for Osoyoos Lake are set to expire on February 22, 2013, unless renewed. This report presents recommendations from the International Osoyoos Lake Board of Control for renewing the Osoyoos Lake Orders. The Board's recommendations draw from the results of eight hydrologic studies commissioned by the IJC, discussions with the State of Washington and British Columbia, and from public comment gathered at Board meetings, through letters and emails, and at two Osoyoos Lake Water Science Forums. The Board's experience and continuity with providing oversight in the operation of Zosel Dam over the past several decades also contributed to the Board's recommendations.

Since the completion of the current Zosel Dam in 1988, the 1982 and 1985 Orders have adequately facilitated control of water levels in Osoyoos Lake, to the extent possible and with the exception of the 913 foot maximum lake elevation during drought years, primarily for the benefit of agricultural, tourism, municipal interests, and fisheries protection. In addition, British Columbia and the State of Washington have acknowledged that the Orders in combination with informal cooperative agreements between the two governments have worked well for managing water levels in Osoyoos Lake. As such, the Board recommends retaining the scope of the renewed Order to management of lake levels with only minor modifications that are primarily related to a revised lake-level rule curve.

The Board recommends for public consultation a revised rule curve proposed by the State of Washington. This rule curve retains certain aspects of the current rule curve while also incorporating modifications that address concerns and recommendations received from lake stakeholders and from the eight IJC Osoyoos Lake Studies. The proposed rule curve provides additional seasonal flexibility in achieving targeted lake levels, and accommodates multiple uses and users associated with Osoyoos.

The Board's key recommendations for the revised Order are as follows:

- Continue to limit the scope of the Order to lake level management and encourage the continued cooperation between British Columbia and the State of Washington to balance flow needs across the International Border and downstream of Zosel Dam while respecting goals for Osoyoos Lake elevations and limits on releases that are possible from Okanagan Lake.

- Retain the Zosel Dam facility as presently constructed.

- Retain the requirement for the Applicant to periodically document the flow capacity of the Okanogan River between the lake and Zosel Dam

- Keep the same winter operating range of 909.0 – 911.5 ft. Having the ability to draw the lake down to 909.0 ft will help prevent ice damage to shoreline infrastructure. Allowing levels of up to 911.5 ft in winter provides the ability to store water in the winter if warmer temperatures in the future lead to more winter precipitation falling as rain instead of snow.

- Eliminate the drought/ non-drought designation and replace it with a single set of operational criteria that would be followed in all years.

- Limit maximum lake regulated levels to 912.5 ft to minimize shoreline erosion and inundation of lakeside property.

- Allow for lower lake levels in April and May to better match the current timing of the Spring freshet. This will help with providing late winter fisheries flows downstream from Zosel Dam and will help to reduce the duration of naturally high lake levels during high snowmelt runoff years.

- Eliminate the use of fixed dates for switching between winter and summer operations and allow for more flexibility for transitioning lake levels between seasons.

- Maintain flexibility for filling the lake earlier in the year in anticipation of climate change causing more winter precipitation falling as rain instead of snow.

- Incorporate an adaptive management strategy in the renewed Order that enables an evaluation of water-level management performance under the Order

The current Board is comprised equally of members from Canada and the United States with members being from respective Federal and Provincial/State interests with primary water resource management mandates of relevance to the region and within relevant areas of professional expertise. The Board suggests that the current configuration of three members from each country is sufficient in providing balanced and effective execution of Board responsibilities as they primarily pertain to oversight of the Applicant's duties under the IJC Orders of Approval. The Board recommends that the current structure and operating procedures of the Board remain in place until such time as other requirements such as an International Watershed Initiative are further developed.

The Board recommends conducting an IWI feasibility study that would consider issues identified such as geographic scope, status and nature of concerns in the watershed, the level of support for an International Watershed Initiative, and the terms of reference of a governance mechanism such as a watershed board. Such a feasibility study should be developed in consultation with First Nations and Tribes, relevant government agencies, stakeholders and communities throughout the basin. Using the example of the St. Croix IWI, a State of the Watershed report for the Okanagan/Okanogan Basin could be a helpful first step in compiling information on both sides of the border in an integrated fashion, and identifying the current state of transboundary watershed and ecosystem data harmonization efforts, while providing a basis for further development of various IWI elements.

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Supplemental Data

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Data for Figures 5 and 6

Table 1. Statistics for daily mean water elevation in Osoyoos Lake, 1988-2011, summarized by drought and non-drought condition years.

(Drought condition years; ’88, ’92, ’93, ’94, ’01, ’03, ’05, ’09. Non-drought condition years; ’89, ’90, ’91, ’95, ’96, ’97, ’98, ’99, ’00, ’02, ’04, ’06, ’07, ’08, ’10, 11. Data are in feet)

Day	Drought condition years				Non-drought condition years			
	Days used	Max	Mean	Min	Days used	Max	Mean	Min
1-Jan	8	910.93	910.04	909.50	16	911.16	910.17	909.53
2-Jan	8	910.93	910.04	909.48	16	911.16	910.18	909.54
3-Jan	8	910.93	910.03	909.46	16	911.17	910.18	909.53
4-Jan	8	910.94	910.03	909.43	16	911.18	910.18	909.51
5-Jan	8	910.93	910.03	909.44	16	911.19	910.17	909.49
6-Jan	8	910.93	910.03	909.44	16	911.20	910.17	909.48
7-Jan	8	910.93	910.03	909.43	16	911.22	910.18	909.49
8-Jan	8	910.93	910.03	909.41	16	911.25	910.18	909.50
9-Jan	8	910.94	910.03	909.40	16	911.29	910.19	909.51
10-Jan	8	910.94	910.03	909.39	16	911.31	910.19	909.53
11-Jan	8	910.94	910.03	909.40	16	911.27	910.18	909.53
12-Jan	8	910.93	910.03	909.39	16	911.23	910.17	909.54
13-Jan	8	910.93	910.02	909.38	16	911.24	910.16	909.53
14-Jan	8	910.93	910.02	909.38	16	911.23	910.16	909.52
15-Jan	8	910.93	910.02	909.40	16	911.22	910.16	909.49
16-Jan	8	910.93	910.02	909.40	16	911.21	910.17	909.46
17-Jan	8	910.93	910.01	909.42	16	911.21	910.17	909.47
18-Jan	8	910.93	910.00	909.43	16	911.22	910.17	909.44
19-Jan	8	910.92	909.99	909.43	16	911.22	910.17	909.45
20-Jan	8	910.95	909.99	909.42	16	911.22	910.17	909.46
21-Jan	8	910.97	909.99	909.40	16	911.23	910.17	909.47
22-Jan	8	910.97	909.98	909.39	16	911.24	910.17	909.47
23-Jan	8	910.98	909.98	909.39	16	911.24	910.17	909.47
24-Jan	8	911.01	909.98	909.37	16	911.24	910.16	909.46
25-Jan	8	911.03	909.98	909.35	16	911.24	910.16	909.46
26-Jan	8	911.05	909.98	909.33	16	911.25	910.15	909.47
27-Jan	8	911.09	909.99	909.32	16	911.26	910.15	909.48
28-Jan	8	911.13	909.99	909.30	16	911.29	910.14	909.47
29-Jan	8	911.15	909.99	909.28	16	911.32	910.13	909.47
30-Jan	8	911.17	909.99	909.27	16	911.34	910.13	909.48
31-Jan	8	911.20	909.99	909.31	16	911.37	910.13	909.48
1-Feb	8	911.22	910.00	909.34	16	911.34	910.13	909.48
2-Feb	8	911.24	909.99	909.35	16	911.34	910.13	909.47

Table 1. Continued.

Day	Drought condition years				Non-drought condition years			
	Days used	Max	Mean	Min	Days used	Max	Mean	Min
3-Feb	8	911.25	910.00	909.37	16	911.34	910.13	909.48
4-Feb	8	911.26	910.00	909.39	16	911.35	910.15	909.44
5-Feb	8	911.26	910.00	909.41	16	911.36	910.16	909.42
6-Feb	8	911.25	910.00	909.42	16	911.37	910.18	909.43
7-Feb	8	911.25	910.00	909.43	16	911.36	910.20	909.43
8-Feb	8	911.25	909.99	909.46	15	911.37	910.15	909.48
9-Feb	8	911.24	909.99	909.47	15	911.38	910.16	909.52
10-Feb	8	911.24	909.99	909.47	15	911.39	910.15	909.53
11-Feb	8	911.23	909.98	909.49	15	911.39	910.14	909.53
12-Feb	8	911.22	909.97	909.50	15	911.40	910.14	909.54
13-Feb	8	911.20	909.96	909.52	15	911.40	910.14	909.53
14-Feb	8	911.19	909.94	909.51	15	911.40	910.13	909.53
15-Feb	8	911.17	909.93	909.43	15	911.39	910.13	909.53
16-Feb	8	911.15	909.94	909.45	15	911.37	910.14	909.52
17-Feb	8	911.14	909.95	909.47	15	911.34	910.14	909.52
18-Feb	8	911.12	909.96	909.49	15	911.30	910.15	909.52
19-Feb	8	911.11	909.98	909.50	15	911.26	910.16	909.51
20-Feb	8	911.10	909.98	909.50	15	911.22	910.18	909.52
21-Feb	8	911.10	909.99	909.50	15	911.19	910.19	909.52
22-Feb	8	911.08	910.01	909.50	15	911.19	910.21	909.54
23-Feb	8	911.06	910.01	909.50	15	911.20	910.22	909.57
24-Feb	8	911.05	910.03	909.50	15	911.20	910.22	909.52
25-Feb	8	911.04	910.03	909.48	15	911.19	910.23	909.49
26-Feb	8	911.03	910.05	909.46	15	911.17	910.23	909.54
27-Feb	8	911.01	910.06	909.43	15	911.16	910.24	909.55
28-Feb	8	911.00	910.08	909.40	15	911.16	910.25	909.49
1-Mar	8	910.99	910.10	909.42	15	911.16	910.27	909.37
2-Mar	8	910.98	910.16	909.46	15	911.16	910.30	909.45
3-Mar	8	910.98	910.21	909.49	15	911.16	910.33	909.49
4-Mar	8	910.97	910.26	909.50	15	911.16	910.35	909.56
5-Mar	8	911.04	910.31	909.49	15	911.17	910.37	909.61
6-Mar	8	911.11	910.36	909.50	15	911.19	910.37	909.60
7-Mar	8	911.14	910.40	909.50	15	911.20	910.38	909.57
8-Mar	8	911.14	910.42	909.50	15	911.20	910.39	909.53
9-Mar	8	911.14	910.46	909.51	15	911.21	910.42	909.51
10-Mar	8	911.15	910.50	909.52	15	911.22	910.45	909.51
11-Mar	8	911.14	910.53	909.51	15	911.24	910.48	909.54
12-Mar	8	911.13	910.56	909.50	15	911.27	910.51	909.57

Table 1. Continued.

Day	Drought condition years				Non-drought condition years			
	Days used	Max	Mean	Min	Days used	Max	Mean	Min
13-Mar	8	911.13	910.58	909.50	15	911.29	910.54	909.61
14-Mar	8	911.13	910.61	909.51	15	911.31	910.57	909.69
15-Mar	8	911.13	910.63	909.49	15	911.31	910.60	909.73
16-Mar	8	911.12	910.65	909.48	15	911.31	910.63	909.79
17-Mar	8	911.16	910.67	909.47	15	911.31	910.65	909.84
18-Mar	8	911.21	910.70	909.46	15	911.33	910.67	909.89
19-Mar	8	911.22	910.71	909.45	15	911.35	910.71	909.95
20-Mar	8	911.24	910.73	909.44	15	911.36	910.74	910.00
21-Mar	8	911.29	910.75	909.47	15	911.35	910.77	910.04
22-Mar	8	911.31	910.78	909.53	15	911.35	910.80	910.08
23-Mar	8	911.31	910.81	909.63	15	911.36	910.83	910.14
24-Mar	8	911.33	910.83	909.73	15	911.37	910.87	910.18
25-Mar	8	911.38	910.86	909.83	15	911.40	910.90	910.22
26-Mar	8	911.42	910.89	909.94	15	911.41	910.93	910.27
27-Mar	8	911.42	910.92	910.06	15	911.40	910.96	910.31
28-Mar	8	911.42	910.94	910.15	16	911.41	910.99	910.35
29-Mar	8	911.39	910.96	910.24	16	911.42	911.01	910.37
30-Mar	8	911.36	910.97	910.31	16	911.41	911.04	910.47
31-Mar	8	911.35	910.99	910.35	16	911.42	911.08	910.53
1-Apr	8	911.38	911.01	910.38	16	911.41	911.13	910.59
2-Apr	8	911.41	911.04	910.40	16	911.42	911.17	910.66
3-Apr	8	911.39	911.06	910.43	16	911.52	911.20	910.72
4-Apr	8	911.38	911.08	910.44	16	911.46	911.22	910.79
5-Apr	8	911.38	911.10	910.43	16	911.46	911.24	910.85
6-Apr	8	911.40	911.11	910.42	16	911.49	911.24	910.91
7-Apr	8	911.43	911.13	910.43	16	911.51	911.24	910.96
8-Apr	8	911.44	911.14	910.41	16	911.49	911.25	911.02
9-Apr	8	911.45	911.14	910.39	16	911.46	911.27	911.02
10-Apr	8	911.46	911.14	910.36	16	911.53	911.28	911.01
11-Apr	8	911.51	911.15	910.37	16	911.62	911.27	911.02
12-Apr	8	911.56	911.17	910.36	16	911.67	911.27	911.01
13-Apr	8	911.63	911.20	910.35	16	911.61	911.28	911.02
14-Apr	8	911.79	911.23	910.34	16	911.52	911.29	911.03
15-Apr	8	911.93	911.26	910.35	16	911.45	911.30	911.03
16-Apr	8	912.09	911.29	910.37	16	911.51	911.29	911.02
17-Apr	8	912.22	911.33	910.44	16	911.62	911.30	911.08
18-Apr	8	912.28	911.39	910.57	16	911.72	911.30	911.13
19-Apr	8	912.30	911.45	910.71	16	911.84	911.30	911.15

Table 1. Continued.

Day	Drought condition years				Non-drought condition years			
	Days used	Max	Mean	Min	Days used	Max	Mean	Min
20-Apr	8	912.28	911.49	910.80	16	911.93	911.31	911.20
21-Apr	8	912.33	911.53	910.86	16	912.02	911.34	911.22
22-Apr	8	912.38	911.57	910.89	16	912.14	911.36	911.23
23-Apr	8	912.40	911.59	910.89	16	912.28	911.39	911.21
24-Apr	8	912.41	911.62	910.89	16	912.45	911.43	911.22
25-Apr	8	912.48	911.65	910.90	16	912.43	911.46	911.21
26-Apr	8	912.65	911.70	910.92	16	912.40	911.47	911.20
27-Apr	8	912.77	911.73	910.94	16	912.39	911.48	911.20
28-Apr	8	912.88	911.75	910.96	16	912.38	911.49	911.13
29-Apr	8	912.90	911.78	911.01	16	912.40	911.49	911.12
30-Apr	8	912.91	911.83	911.10	16	912.45	911.49	911.17
1-May	8	912.91	911.86	911.14	16	912.54	911.50	911.20
2-May	8	912.92	911.90	911.20	16	912.49	911.51	911.21
3-May	8	912.92	911.93	911.25	16	912.44	911.52	911.15
4-May	8	912.90	911.95	911.29	16	912.47	911.53	911.16
5-May	8	912.86	911.98	911.32	16	912.49	911.54	911.20
6-May	8	912.64	911.98	911.35	16	912.52	911.55	911.20
7-May	8	912.47	911.96	911.37	16	912.56	911.56	911.18
8-May	8	912.42	911.94	911.41	16	912.51	911.56	911.15
9-May	8	912.43	911.93	911.40	16	912.43	911.58	911.25
10-May	8	912.45	911.95	911.44	16	912.32	911.59	911.26
11-May	8	912.45	911.97	911.42	16	912.35	911.61	911.23
12-May	8	912.42	912.00	911.42	16	912.35	911.63	911.20
13-May	8	912.44	912.00	911.40	16	912.43	911.66	911.17
14-May	8	912.49	912.00	911.39	16	912.72	911.70	911.17
15-May	8	912.45	912.00	911.37	16	913.27	911.76	911.19
16-May	8	912.41	912.01	911.33	16	913.96	911.83	911.18
17-May	8	912.38	912.01	911.31	16	914.63	911.90	911.18
18-May	8	912.36	912.00	911.31	16	915.05	911.97	911.21
19-May	8	912.43	911.98	911.25	16	915.09	912.02	911.23
20-May	8	912.44	911.98	911.23	16	914.86	912.09	911.20
21-May	8	912.45	911.97	911.21	16	914.62	912.17	911.20
22-May	8	912.45	911.97	911.20	16	914.34	912.23	911.18
23-May	8	912.47	911.99	911.20	16	914.66	912.22	911.16
24-May	8	912.50	912.01	911.18	16	914.62	912.19	911.17
25-May	8	912.44	912.03	911.16	16	914.40	912.16	911.18
26-May	8	912.40	912.03	911.17	16	914.09	912.16	911.20
27-May	8	912.43	912.01	911.14	16	913.70	912.18	911.23

Table 1. Continued.

Day	Drought condition years				Non-drought condition years			
	Days used	Max	Mean	Min	Days used	Max	Mean	Min
28-May	8	912.40	911.95	911.12	16	913.72	912.21	911.27
29-May	8	912.43	911.90	911.11	16	913.83	912.22	911.26
30-May	8	912.44	911.87	911.08	16	914.00	912.24	911.25
31-May	8	912.43	911.85	911.00	16	914.21	912.25	911.25
1-Jun	8	912.44	911.86	911.02	16	914.51	912.26	911.23
2-Jun	8	912.46	911.89	911.03	16	914.78	912.27	911.22
3-Jun	8	912.48	911.92	910.99	16	914.82	912.30	911.10
4-Jun	8	912.44	911.93	910.98	16	914.72	912.32	911.06
5-Jun	8	912.43	911.93	910.95	16	914.68	912.35	911.21
6-Jun	8	912.48	911.96	910.93	16	914.61	912.36	911.24
7-Jun	8	912.47	911.97	910.92	16	914.46	912.35	911.25
8-Jun	8	912.51	911.99	910.90	16	914.28	912.35	911.25
9-Jun	8	912.55	912.01	910.87	16	914.18	912.35	911.23
10-Jun	8	912.57	912.04	910.86	16	914.36	912.34	911.21
11-Jun	8	912.61	912.07	910.86	16	914.46	912.34	911.21
12-Jun	8	912.64	912.09	910.86	16	914.52	912.32	911.10
13-Jun	8	912.63	912.11	911.01	16	914.57	912.32	911.14
14-Jun	8	912.61	912.15	911.17	16	914.52	912.29	911.23
15-Jun	8	912.57	912.17	911.30	16	914.43	912.26	911.17
16-Jun	8	912.54	912.19	911.43	16	914.26	912.23	911.19
17-Jun	8	912.51	912.20	911.50	16	914.07	912.22	911.22
18-Jun	8	912.49	912.21	911.56	16	913.87	912.21	911.23
19-Jun	8	912.49	912.22	911.61	16	913.71	912.17	911.22
20-Jun	8	912.48	912.22	911.66	16	913.59	912.12	911.25
21-Jun	8	912.47	912.24	911.69	16	913.51	912.08	911.27
22-Jun	8	912.46	912.26	911.74	16	913.46	912.05	911.26
23-Jun	8	912.46	912.28	911.77	16	913.49	912.03	911.19
24-Jun	8	912.46	912.29	911.80	16	913.49	912.03	911.20
25-Jun	8	912.47	912.29	911.81	16	913.48	912.03	911.25
26-Jun	8	912.49	912.28	911.82	16	913.40	912.02	911.27
27-Jun	8	912.51	912.29	911.86	16	913.31	911.98	911.26
28-Jun	8	912.51	912.29	911.90	16	913.23	911.93	911.26
29-Jun	8	912.47	912.29	912.02	16	913.16	911.88	911.25
30-Jun	8	912.50	912.30	912.14	16	913.13	911.85	911.27
1-Jul	8	912.49	912.31	912.19	16	913.11	911.84	911.28
2-Jul	8	912.43	912.31	912.20	16	913.05	911.81	911.28
3-Jul	8	912.44	912.32	912.21	16	913.00	911.78	911.27
4-Jul	8	912.54	912.34	912.17	16	912.94	911.77	911.22

Table 1. Continued.

Day	Drought condition years				Non-drought condition years			
	Days used	Max	Mean	Min	Days used	Max	Mean	Min
5-Jul	8	912.65	912.37	912.16	16	912.87	911.75	911.21
6-Jul	8	912.79	912.39	912.19	16	912.81	911.73	911.18
7-Jul	8	912.90	912.42	912.21	16	912.78	911.71	911.02
8-Jul	8	912.92	912.43	912.16	16	912.74	911.69	910.95
9-Jul	8	912.91	912.41	912.16	16	912.70	911.69	911.03
10-Jul	8	912.89	912.40	912.20	16	912.66	911.68	911.19
11-Jul	8	912.90	912.40	912.20	16	912.62	911.68	911.19
12-Jul	8	912.90	912.40	912.21	16	912.61	911.68	911.20
13-Jul	8	912.89	912.41	912.23	16	912.60	911.67	911.22
14-Jul	8	912.86	912.41	912.24	16	912.59	911.65	911.24
15-Jul	8	912.84	912.40	912.26	16	912.56	911.64	911.26
16-Jul	8	912.84	912.39	912.20	16	912.55	911.63	911.28
17-Jul	8	912.86	912.40	912.17	16	912.56	911.62	911.27
18-Jul	8	912.88	912.39	912.15	16	912.56	911.60	911.25
19-Jul	8	912.88	912.37	912.14	16	912.56	911.60	911.23
20-Jul	8	912.91	912.37	912.16	16	912.55	911.58	911.24
21-Jul	8	912.96	912.39	912.15	16	912.54	911.56	911.24
22-Jul	8	912.96	912.41	912.16	16	912.54	911.55	911.22
23-Jul	8	912.95	912.41	912.16	16	912.52	911.54	911.25
24-Jul	8	912.90	912.40	912.15	16	912.51	911.54	911.28
25-Jul	8	912.81	912.37	912.14	16	912.50	911.54	911.27
26-Jul	8	912.72	912.35	912.13	16	912.54	911.53	911.27
27-Jul	8	912.67	912.34	912.12	16	912.56	911.53	911.28
28-Jul	8	912.66	912.34	912.08	16	912.55	911.53	911.28
29-Jul	8	912.66	912.33	912.05	16	912.53	911.53	911.28
30-Jul	8	912.66	912.32	912.03	16	912.51	911.53	911.27
31-Jul	8	912.66	912.30	912.01	16	912.49	911.52	911.27
1-Aug	8	912.68	912.30	911.98	16	912.47	911.53	911.27
2-Aug	8	912.70	912.30	911.94	15	912.43	911.54	911.28
3-Aug	8	912.71	912.29	911.91	15	912.41	911.53	911.28
4-Aug	8	912.72	912.29	911.90	16	912.37	911.51	911.27
5-Aug	8	912.71	912.29	911.89	16	912.24	911.50	911.27
6-Aug	8	912.71	912.27	911.87	16	912.21	911.49	911.26
7-Aug	8	912.74	912.26	911.84	16	912.18	911.47	911.25
8-Aug	8	912.76	912.26	911.83	16	912.15	911.46	911.24
9-Aug	8	912.79	912.26	911.82	16	912.11	911.46	911.25
10-Aug	8	912.82	912.28	911.80	16	912.09	911.44	911.27
11-Aug	8	912.84	912.28	911.76	16	912.08	911.44	911.27

Table 1. Continued.

Day	Drought condition years				Non-drought condition years			
	Days used	Max	Mean	Min	Days used	Max	Mean	Min
12-Aug	8	912.87	912.27	911.73	16	912.07	911.43	911.28
13-Aug	8	912.89	912.27	911.72	16	912.06	911.43	911.28
14-Aug	8	912.82	912.28	911.71	16	912.06	911.42	911.25
15-Aug	8	912.69	912.28	911.70	16	912.06	911.41	911.23
16-Aug	8	912.57	912.26	911.67	16	912.00	911.40	911.23
17-Aug	8	912.50	912.26	911.67	16	912.00	911.39	911.25
18-Aug	8	912.52	912.28	911.68	16	911.99	911.40	911.26
19-Aug	8	912.53	912.30	911.68	16	911.98	911.40	911.27
20-Aug	8	912.50	912.29	911.67	16	911.97	911.41	911.28
21-Aug	8	912.50	912.27	911.65	16	911.95	911.42	911.27
22-Aug	8	912.50	912.25	911.63	16	911.94	911.42	911.28
23-Aug	8	912.51	912.23	911.59	16	911.94	911.42	911.25
24-Aug	8	912.53	912.21	911.56	16	911.93	911.40	911.25
25-Aug	8	912.55	912.19	911.54	16	911.94	911.39	911.25
26-Aug	8	912.56	912.18	911.50	16	911.95	911.39	911.25
27-Aug	8	912.53	912.17	911.47	16	911.96	911.39	911.23
28-Aug	8	912.51	912.16	911.45	16	911.97	911.38	911.22
29-Aug	8	912.52	912.17	911.44	16	911.97	911.37	911.25
30-Aug	8	912.55	912.17	911.39	16	911.97	911.35	911.22
31-Aug	8	912.58	912.17	911.35	16	911.96	911.34	911.16
1-Sep	8	912.60	912.16	911.32	16	911.94	911.33	911.11
2-Sep	8	912.60	912.15	911.29	16	911.92	911.33	911.10
3-Sep	8	912.60	912.15	911.27	16	911.89	911.33	911.06
4-Sep	8	912.59	912.15	911.25	16	911.90	911.33	911.00
5-Sep	8	912.54	912.13	911.24	16	911.89	911.33	910.97
6-Sep	8	912.53	912.12	911.22	16	911.87	911.34	911.03
7-Sep	8	912.51	912.10	911.20	16	911.85	911.33	911.04
8-Sep	8	912.50	912.08	911.15	16	911.82	911.33	911.04
9-Sep	8	912.48	912.07	911.14	16	911.77	911.33	911.05
10-Sep	8	912.46	912.06	911.13	16	911.74	911.34	911.11
11-Sep	8	912.47	912.04	911.07	16	911.71	911.35	911.19
12-Sep	8	912.45	912.03	911.06	16	911.67	911.35	911.19
13-Sep	8	912.41	912.01	911.05	16	911.63	911.34	911.14
14-Sep	8	912.38	911.99	911.03	16	911.60	911.33	911.07
15-Sep	8	912.35	911.98	911.02	16	911.57	911.33	911.04
16-Sep	8	912.32	911.95	911.02	16	911.57	911.34	911.13
17-Sep	8	912.30	911.93	911.00	16	911.59	911.34	911.22
18-Sep	8	912.29	911.90	910.96	16	911.65	911.35	911.22

Table 1. Continued.

Day	Drought condition years				Non-drought condition years			
	Days used	Max	Mean	Min	Days used	Max	Mean	Min
19-Sep	8	912.28	911.90	910.98	16	911.66	911.35	911.21
20-Sep	8	912.30	911.90	910.99	16	911.66	911.34	911.14
21-Sep	8	912.32	911.88	910.99	16	911.66	911.34	911.12
22-Sep	8	912.33	911.88	910.98	16	911.65	911.32	911.08
23-Sep	8	912.35	911.87	910.99	16	911.64	911.30	911.03
24-Sep	8	912.36	911.86	910.99	16	911.65	911.30	911.05
25-Sep	8	912.35	911.85	910.98	16	911.65	911.31	911.08
26-Sep	8	912.35	911.84	910.99	16	911.60	911.30	911.11
27-Sep	8	912.34	911.83	911.00	16	911.50	911.29	911.12
28-Sep	8	912.36	911.81	910.99	16	911.45	911.29	911.08
29-Sep	8	912.34	911.79	910.99	16	911.44	911.29	911.09
30-Sep	8	912.33	911.77	911.00	16	911.43	911.28	911.08
1-Oct	8	912.33	911.75	911.00	16	911.41	911.28	911.08
2-Oct	8	912.29	911.73	911.00	16	911.42	911.27	911.08
3-Oct	8	912.27	911.70	910.99	16	911.43	911.28	911.09
4-Oct	8	912.27	911.67	911.00	16	911.43	911.28	911.10
5-Oct	8	912.24	911.65	911.02	16	911.44	911.29	911.11
6-Oct	8	912.23	911.63	911.05	16	911.45	911.29	911.12
7-Oct	8	912.21	911.60	911.07	16	911.47	911.29	911.13
8-Oct	8	912.15	911.57	911.10	16	911.47	911.29	911.13
9-Oct	8	912.09	911.54	911.12	16	911.45	911.29	911.13
10-Oct	8	912.00	911.51	911.14	16	911.44	911.31	911.13
11-Oct	7	911.94	911.43	911.15	16	911.43	911.31	911.12
12-Oct	7	911.87	911.40	911.15	16	911.53	911.31	911.11
13-Oct	7	911.82	911.38	911.12	16	911.48	911.31	911.12
14-Oct	7	911.79	911.35	911.08	16	911.43	911.30	911.14
15-Oct	7	911.74	911.33	911.03	16	911.44	911.30	911.16
16-Oct	7	911.69	911.30	910.99	16	911.45	911.30	911.15
17-Oct	8	911.67	911.32	910.96	16	911.45	911.30	911.17
18-Oct	8	911.65	911.30	910.94	16	911.43	911.30	911.18
19-Oct	8	911.62	911.29	910.92	16	911.44	911.31	911.19
20-Oct	8	911.57	911.27	910.90	16	911.45	911.30	911.17
21-Oct	8	911.52	911.26	910.90	16	911.48	911.30	911.16
22-Oct	8	911.51	911.24	910.88	16	911.46	911.29	911.14
23-Oct	8	911.53	911.22	910.86	16	911.43	911.29	911.14
24-Oct	8	911.52	911.21	910.81	16	911.45	911.28	911.13
25-Oct	8	911.51	911.18	910.78	16	911.46	911.28	911.12
26-Oct	8	911.48	911.16	910.75	16	911.48	911.27	911.11

Table 1. Continued.

Day	Drought condition years				Non-drought condition years			
	Days used	Max	Mean	Min	Days used	Max	Mean	Min
27-Oct	8	911.48	911.14	910.72	16	911.45	911.27	911.11
28-Oct	8	911.45	911.11	910.71	16	911.42	911.27	911.08
29-Oct	8	911.44	911.09	910.67	16	911.42	911.27	911.06
30-Oct	8	911.43	911.05	910.59	16	911.44	911.25	911.00
31-Oct	8	911.41	911.03	910.49	16	911.44	911.25	910.96
1-Nov	8	911.40	911.01	910.39	16	911.42	911.21	910.90
2-Nov	8	911.38	910.98	910.34	16	911.41	911.17	910.65
3-Nov	8	911.36	910.95	910.28	16	911.42	911.14	910.47
4-Nov	8	911.35	910.93	910.19	16	911.44	911.11	910.34
5-Nov	8	911.36	910.91	910.13	16	911.44	911.08	910.28
6-Nov	8	911.36	910.88	910.06	16	911.42	911.06	910.46
7-Nov	8	911.36	910.84	910.00	16	911.42	911.05	910.66
8-Nov	8	911.36	910.80	909.94	16	911.39	911.03	910.62
9-Nov	8	911.37	910.77	909.88	16	911.40	911.00	910.55
10-Nov	8	911.37	910.73	909.82	16	911.39	910.98	910.50
11-Nov	8	911.36	910.69	909.77	16	911.39	910.95	910.44
12-Nov	8	911.37	910.65	909.71	16	911.40	910.92	910.39
13-Nov	8	911.37	910.62	909.67	16	911.37	910.89	910.34
14-Nov	8	911.35	910.58	909.65	16	911.37	910.86	910.31
15-Nov	8	911.36	910.55	909.65	16	911.36	910.82	910.28
16-Nov	8	911.37	910.53	909.65	16	911.34	910.78	910.25
17-Nov	8	911.39	910.51	909.65	16	911.34	910.75	910.23
18-Nov	8	911.36	910.48	909.66	16	911.33	910.73	910.22
19-Nov	8	911.33	910.46	909.66	16	911.32	910.69	910.20
20-Nov	8	911.32	910.45	909.66	16	911.32	910.66	910.11
21-Nov	8	911.30	910.43	909.66	16	911.33	910.62	910.03
22-Nov	8	911.29	910.43	909.61	16	911.30	910.59	909.96
23-Nov	8	911.28	910.39	909.59	16	911.27	910.54	909.89
24-Nov	8	911.27	910.37	909.58	16	911.26	910.51	909.84
25-Nov	8	911.29	910.37	909.59	16	911.27	910.48	909.79
26-Nov	8	911.32	910.36	909.58	16	911.27	910.45	909.73
27-Nov	8	911.32	910.34	909.58	16	911.26	910.43	909.69
28-Nov	8	911.35	910.33	909.56	16	911.27	910.40	909.62
29-Nov	8	911.36	910.32	909.54	16	911.28	910.38	909.56
30-Nov	8	911.35	910.31	909.53	16	911.27	910.36	909.56
1-Dec	8	911.34	910.30	909.52	16	911.25	910.33	909.55
2-Dec	8	911.34	910.29	909.51	16	911.23	910.31	909.56
3-Dec	8	911.33	910.28	909.50	16	911.22	910.30	909.54

Table 1. Continued.

Day	Drought condition years				Non-drought condition years			
	Days used	Max	Mean	Min	Days used	Max	Mean	Min
4-Dec	8	911.31	910.26	909.52	16	911.23	910.29	909.53
5-Dec	8	911.29	910.24	909.53	16	911.25	910.28	909.52
6-Dec	8	911.30	910.23	909.52	16	911.26	910.27	909.51
7-Dec	8	911.27	910.22	909.51	16	911.25	910.25	909.52
8-Dec	8	911.25	910.20	909.51	16	911.25	910.23	909.55
9-Dec	8	911.24	910.20	909.51	16	911.26	910.22	909.54
10-Dec	8	911.22	910.19	909.51	16	911.26	910.21	909.53
11-Dec	8	911.21	910.18	909.53	16	911.24	910.19	909.53
12-Dec	8	911.21	910.17	909.54	16	911.24	910.19	909.53
13-Dec	8	911.23	910.16	909.56	16	911.23	910.18	909.51
14-Dec	8	911.25	910.17	909.57	16	911.22	910.17	909.51
15-Dec	8	911.21	910.15	909.56	16	911.22	910.16	909.53
16-Dec	8	911.22	910.15	909.55	16	911.21	910.15	909.53
17-Dec	8	911.21	910.14	909.55	16	911.21	910.14	909.53
18-Dec	8	911.21	910.14	909.54	16	911.20	910.13	909.54
19-Dec	8	911.23	910.14	909.54	16	911.18	910.12	909.54
20-Dec	8	911.23	910.14	909.53	16	911.18	910.11	909.54
21-Dec	8	911.24	910.14	909.53	16	911.18	910.10	909.55
22-Dec	8	911.22	910.14	909.51	16	911.16	910.09	909.54
23-Dec	8	911.21	910.12	909.50	16	911.15	910.07	909.52
24-Dec	8	911.21	910.12	909.52	16	911.15	910.06	909.51
25-Dec	8	911.21	910.11	909.53	16	911.14	910.06	909.50
26-Dec	8	911.17	910.10	909.54	16	911.14	910.06	909.53
27-Dec	8	911.16	910.10	909.52	16	911.13	910.06	909.53
28-Dec	8	911.16	910.10	909.53	16	911.14	910.05	909.53
29-Dec	8	911.15	910.09	909.54	16	911.12	910.06	909.53
30-Dec	8	911.16	910.08	909.52	16	911.11	910.06	909.52
31-Dec	8	911.18	910.08	909.51	16	911.09	910.07	909.50

Table 2. Statistics for daily mean water elevation in Osoyoos Lake, 1966-2011.

(P10, P25, P50, P75, P90 are elevations of the 10, 25, 50, 75, and 90 percentiles; Data are in feet).

Day	Days used	Max year	Min Year	Min	Max	P10	P25	P50	P75	P90	P95
1-Jan	46	1969	2009	909.50	912.29	909.55	909.70	910.25	910.69	911.02	911.14
2-Jan	46	1969	2009	909.48	912.35	909.56	909.73	910.23	910.73	911.06	911.15
3-Jan	46	1969	2009	909.46	912.40	909.55	909.73	910.21	910.72	911.08	911.16
4-Jan	46	1969	2009	909.43	912.44	909.54	909.73	910.19	910.70	911.09	911.17
5-Jan	46	1969	2009	909.44	912.47	909.53	909.74	910.17	910.68	911.09	911.18
6-Jan	46	1969	2009	909.44	912.50	909.55	909.75	910.15	910.68	911.11	911.20
7-Jan	45	1969	2009	909.43	912.51	909.57	909.74	910.15	910.68	911.13	911.22
8-Jan	44	1969	2009	909.41	912.47	909.58	909.77	910.12	910.68	911.17	911.24
9-Jan	44	1969	2009	909.40	912.37	909.57	909.79	910.15	910.68	911.18	911.27
10-Jan	44	1969	2009	909.39	912.27	909.57	909.81	910.18	910.67	911.18	911.29
11-Jan	44	1969	2009	909.40	912.16	909.56	909.81	910.19	910.66	911.18	911.26
12-Jan	44	1969	2009	909.39	912.04	909.55	909.79	910.21	910.65	911.17	911.23
13-Jan	44	1969	2009	909.38	911.93	909.54	909.72	910.21	910.65	911.15	911.24
14-Jan	44	1969	2009	909.38	911.84	909.53	909.76	910.19	910.66	911.14	911.21
15-Jan	44	1969	2009	909.40	911.81	909.52	909.77	910.19	910.68	911.09	911.20
16-Jan	44	1969	2009	909.40	911.81	909.51	909.73	910.17	910.70	911.08	911.20
17-Jan	44	1969	2009	909.42	911.85	909.50	909.72	910.16	910.71	911.07	911.20
18-Jan	44	1969	2009	909.43	911.89	909.49	909.73	910.17	910.70	911.12	911.21
19-Jan	44	1969	2003	909.43	911.96	909.49	909.72	910.18	910.70	911.19	911.23
20-Jan	44	1969	2003	909.42	912.02	909.48	909.71	910.23	910.70	911.20	911.32
21-Jan	44	1969	2003	909.40	912.03	909.48	909.72	910.21	910.72	911.20	911.27
22-Jan	44	1969	2003	909.39	911.99	909.48	909.72	910.21	910.72	911.13	911.28
23-Jan	44	1969	2003	909.39	911.93	909.48	909.72	910.18	910.70	911.18	911.30
24-Jan	45	1969	2003	909.37	911.88	909.48	909.75	910.20	910.72	911.23	911.54
25-Jan	44	1969	2003	909.35	911.83	909.48	909.73	910.17	910.64	911.24	911.33
26-Jan	44	1969	2003	909.33	911.78	909.49	909.73	910.15	910.65	911.25	911.35
27-Jan	44	1969	2003	909.32	911.71	909.49	909.74	910.14	910.65	911.26	911.43
28-Jan	44	1969	2003	909.30	911.65	909.50	909.76	910.14	910.64	911.28	911.42
29-Jan	44	1969	2003	909.28	911.61	909.51	909.77	910.13	910.66	911.26	911.39
30-Jan	44	1969	2003	909.27	911.60	909.52	909.78	910.11	910.69	911.23	911.38
31-Jan	44	1969	2003	909.31	911.58	909.53	909.79	910.09	910.69	911.26	911.37
1-Feb	44	1969	2003	909.34	911.57	909.56	909.78	910.07	910.69	911.28	911.36
2-Feb	44	1969	1973	909.35	911.56	909.55	909.77	910.05	910.69	911.28	911.35
3-Feb	44	1969	2003	909.37	911.55	909.53	909.77	910.03	910.65	911.29	911.34
4-Feb	45	1969	2003	909.39	911.53	909.53	909.82	910.02	910.62	911.29	911.34

Table 2. Continued

Day	Days used	Max year	Min Year	Min	Max	P10	P25	P50	P75	P90	P95
5-Feb	45	1969	2003	909.41	911.50	909.52	909.82	910.04	910.60	911.28	911.35
6-Feb	45	1969	2003	909.42	911.43	909.53	909.82	910.10	910.56	911.27	911.36
7-Feb	45	1989	2000	909.43	911.36	909.53	909.84	910.11	910.62	911.27	911.35
8-Feb	45	1989	2003	909.46	911.37	909.54	909.86	910.12	910.64	911.18	911.29
9-Feb	45	1989	2003	909.47	911.38	909.56	909.87	910.11	910.66	911.26	911.32
10-Feb	45	1975	2003	909.47	911.56	909.60	909.87	910.11	910.71	911.26	911.43
11-Feb	45	1975	2003	909.49	911.72	909.60	909.86	910.14	910.77	911.27	911.54
12-Feb	45	1975	2003	909.50	911.81	909.61	909.86	910.13	910.82	911.27	911.57
13-Feb	45	1975	2003	909.52	911.86	909.59	909.85	910.15	910.75	911.26	911.58
14-Feb	45	1975	1988	909.51	911.88	909.54	909.83	910.14	910.63	911.25	911.60
15-Feb	45	1975	1988	909.43	911.84	909.55	909.82	910.15	910.67	911.33	911.55
16-Feb	45	1975	1988	909.45	911.81	909.57	909.82	910.14	910.84	911.36	911.54
17-Feb	45	1975	1988	909.47	911.76	909.59	909.82	910.15	910.94	911.35	911.60
18-Feb	45	1975	1988	909.49	911.73	909.61	909.82	910.16	910.95	911.33	911.64
19-Feb	45	1984	1973	909.49	911.76	909.61	909.78	910.17	910.98	911.30	911.64
20-Feb	45	1984	1973	909.48	911.83	909.61	909.80	910.18	911.03	911.28	911.64
21-Feb	45	1984	1973	909.46	911.87	909.60	909.79	910.21	911.04	911.31	911.63
22-Feb	45	1984	1973	909.44	911.87	909.61	909.80	910.26	911.08	911.34	911.65
23-Feb	45	1974	1973	909.41	911.89	909.60	909.82	910.32	911.12	911.36	911.74
24-Feb	45	1974	1973	909.39	912.05	909.59	909.83	910.36	911.01	911.42	911.77
25-Feb	45	1974	1973	909.39	912.12	909.56	909.87	910.38	910.96	911.51	911.80
26-Feb	45	1974	1973	909.41	911.97	909.56	909.87	910.38	910.97	911.58	911.81
27-Feb	45	1984	1992	909.43	911.85	909.59	909.88	910.41	910.97	911.56	911.78
28-Feb	45	1984	1992	909.40	911.86	909.57	909.91	910.37	910.98	911.49	911.77
1-Mar	45	1972	2000	909.37	911.86	909.60	909.93	910.40	910.97	911.46	911.75
2-Mar	45	1972	2000	909.45	911.86	909.59	909.97	910.40	910.97	911.43	911.76
3-Mar	45	1972	1992	909.49	911.86	909.60	910.00	910.42	910.91	911.40	911.76
4-Mar	45	1972	1988	909.50	911.86	909.62	910.00	910.46	910.93	911.41	911.76
5-Mar	45	1972	1988	909.49	911.86	909.66	910.02	910.46	910.95	911.44	911.76
6-Mar	45	1972	1988	909.50	911.86	909.72	910.03	910.46	910.98	911.46	911.80
7-Mar	45	1972	1988	909.50	911.86	909.83	910.05	910.50	910.99	911.47	911.83
8-Mar	45	1983	1988	909.50	911.91	909.88	910.09	910.56	910.98	911.51	911.85
9-Mar	45	1983	1988	909.51	912.01	909.93	910.13	910.67	911.05	911.61	911.82
10-Mar	45	1983	1979	909.51	912.11	909.96	910.15	910.73	911.10	911.58	911.90
11-Mar	45	1983	1979	909.49	912.21	909.96	910.17	910.72	911.15	911.62	912.03
12-Mar	45	1983	1979	909.49	912.30	909.98	910.19	910.76	911.18	911.64	912.16
13-Mar	45	1983	1979	909.48	912.42	910.00	910.24	910.77	911.21	911.69	912.26
14-Mar	45	1983	1979	909.47	912.52	910.02	910.27	910.75	911.22	911.72	912.34
15-Mar	45	1983	1979	909.47	912.59	910.05	910.29	910.78	911.23	911.73	912.38

Table 2. Continued

Day	Days used	Max year	Min Year	Min	Max	P10	P25	P50	P75	P90	P95
16-Mar	45	1983	1979	909.46	912.67	910.08	910.35	910.83	911.17	911.75	912.42
17-Mar	45	1983	1988	909.47	912.74	910.07	910.39	910.75	911.17	911.78	912.45
18-Mar	45	1983	1988	909.46	912.81	910.07	910.44	910.77	911.21	911.81	912.46
19-Mar	45	1983	1988	909.45	912.84	910.07	910.47	910.82	911.23	911.85	912.43
20-Mar	45	1983	1988	909.44	912.85	910.01	910.50	910.88	911.25	911.83	912.35
21-Mar	45	1983	1988	909.47	912.86	910.02	910.52	910.84	911.29	911.82	912.33
22-Mar	45	1983	1988	909.53	912.87	910.04	910.54	910.80	911.32	911.83	912.33
23-Mar	45	1983	1988	909.63	912.89	910.06	910.58	910.85	911.32	911.91	912.30
24-Mar	45	1983	1988	909.73	912.91	910.08	910.63	910.94	911.32	912.00	912.31
25-Mar	45	1983	1988	909.83	912.91	910.12	910.63	910.89	911.32	912.07	912.32
26-Mar	45	1983	1987	909.84	912.90	910.20	910.63	910.94	911.30	912.11	912.33
27-Mar	45	1983	1987	909.86	912.93	910.25	910.63	910.96	911.34	912.16	912.35
28-Mar	46	1983	1987	909.87	912.94	910.26	910.64	910.96	911.33	912.19	912.35
29-Mar	46	1983	1987	909.88	912.96	910.28	910.62	910.98	911.31	912.22	912.37
30-Mar	46	1983	1987	909.89	912.97	910.31	910.62	911.02	911.34	912.13	912.38
31-Mar	46	1983	1980	909.92	912.97	910.35	910.67	911.04	911.34	911.96	912.39
1-Apr	46	1983	1980	909.92	912.96	910.37	910.71	911.07	911.35	911.99	912.40
2-Apr	46	1983	1980	909.91	912.97	910.39	910.77	911.11	911.36	912.12	912.42
3-Apr	46	1983	1980	909.90	912.97	910.42	910.82	911.16	911.36	912.24	912.43
4-Apr	46	1983	1980	909.90	912.95	910.43	910.86	911.20	911.39	912.25	912.44
5-Apr	46	1983	1980	909.94	912.93	910.44	910.87	911.24	911.38	912.12	912.48
6-Apr	46	1983	1980	909.97	912.93	910.44	910.90	911.23	911.35	911.97	912.51
7-Apr	46	1983	1980	909.98	912.93	910.44	910.97	911.22	911.36	911.90	912.54
8-Apr	46	1983	1980	909.98	912.92	910.42	910.95	911.24	911.39	911.98	912.56
9-Apr	46	1983	1980	910.03	912.94	910.42	910.94	911.26	911.42	912.09	912.57
10-Apr	46	1983	1980	910.08	912.95	910.40	910.93	911.24	911.44	912.17	912.56
11-Apr	46	1983	1973	910.09	912.94	910.42	910.93	911.26	911.43	912.22	912.55
12-Apr	46	1983	1973	910.07	912.94	910.43	910.99	911.24	911.45	912.24	912.56
13-Apr	46	1983	1973	910.10	912.92	910.43	911.01	911.26	911.50	912.26	912.56
14-Apr	46	1983	1973	910.10	912.91	910.45	911.01	911.28	911.51	912.26	912.55
15-Apr	46	1983	1973	910.12	912.90	910.50	911.01	911.26	911.48	912.26	912.54
16-Apr	46	1983	1973	910.13	912.89	910.55	911.02	911.25	911.47	912.25	912.55
17-Apr	46	1983	1973	910.18	912.89	910.57	911.00	911.25	911.51	912.27	912.45
18-Apr	46	1983	1973	910.24	912.90	910.59	910.98	911.26	911.52	912.15	912.42
19-Apr	46	1983	1973	910.30	912.93	910.68	910.97	911.29	911.53	912.09	912.33
20-Apr	46	1983	1973	910.37	912.97	910.67	910.96	911.27	911.55	912.07	912.31
21-Apr	46	1983	1973	910.41	913.03	910.62	910.95	911.29	911.52	912.15	912.33
22-Apr	46	1983	1978	910.41	913.08	910.58	910.95	911.30	911.50	912.19	912.39
23-Apr	46	1983	1975	910.31	913.13	910.59	911.00	911.33	911.54	912.29	912.50

Table 2. Continued

Day	Days used	Max year	Min Year	Min	Max	P10	P25	P50	P75	P90	P95
24-Apr	46	1983	1975	910.24	913.25	910.60	911.08	911.32	911.59	912.33	912.59
25-Apr	46	1983	1975	910.23	913.46	910.62	911.06	911.33	911.66	912.39	912.67
26-Apr	46	1983	1975	910.20	913.59	910.66	911.05	911.34	911.64	912.35	912.83
27-Apr	46	1983	1975	910.15	913.64	910.64	911.00	911.35	911.61	912.38	912.94
28-Apr	46	1983	1975	910.09	913.63	910.65	910.99	911.36	911.63	912.38	913.03
29-Apr	46	1983	1975	910.05	913.62	910.68	911.01	911.36	911.69	912.40	913.09
30-Apr	46	1983	1975	910.01	913.64	910.73	911.08	911.35	911.72	912.42	913.15
1-May	46	1983	1975	909.96	913.65	910.78	911.12	911.35	911.77	912.45	913.22
2-May	46	1983	1975	909.90	913.68	910.84	911.12	911.35	911.82	912.46	913.26
3-May	46	1983	1975	909.89	913.70	910.89	911.13	911.37	911.86	912.49	913.27
4-May	46	1983	1975	909.90	913.72	910.91	911.13	911.39	911.90	912.55	913.28
5-May	46	1983	1975	909.88	913.77	910.89	911.12	911.41	911.92	912.59	913.30
6-May	46	1983	1975	909.87	913.82	910.75	911.17	911.40	911.94	912.56	913.34
7-May	46	1983	1975	909.84	913.93	910.78	911.16	911.42	912.07	912.50	913.40
8-May	46	1983	1975	909.80	914.03	910.83	911.17	911.46	912.12	912.45	913.46
9-May	46	1983	1975	909.79	914.06	910.87	911.24	911.49	912.05	912.48	913.48
10-May	46	1983	1975	909.79	914.02	910.87	911.24	911.51	912.05	912.52	913.39
11-May	46	1983	1975	909.82	913.96	910.88	911.25	911.54	912.09	912.70	913.29
12-May	46	1983	1975	909.87	913.91	910.90	911.33	911.57	912.21	912.84	913.26
13-May	46	1983	1975	909.91	913.85	910.93	911.33	911.64	912.29	912.91	913.28
14-May	46	1983	1975	909.94	913.82	910.91	911.36	911.76	912.31	912.91	913.39
15-May	46	1983	1975	910.01	913.85	910.90	911.35	911.79	912.26	913.08	913.60
16-May	46	1972	1975	910.07	914.12	910.93	911.34	911.84	912.35	913.11	913.94
17-May	46	1997	1975	910.11	914.63	910.97	911.32	911.88	912.39	913.06	914.25
18-May	46	1997	1975	910.15	915.05	911.03	911.33	911.92	912.38	913.01	914.42
19-May	46	1997	1975	910.18	915.09	911.08	911.36	911.96	912.46	913.07	914.47
20-May	46	1997	1975	910.16	914.86	911.14	911.33	911.97	912.53	913.18	914.37
21-May	46	1997	1975	910.12	914.62	911.11	911.38	912.06	912.51	913.50	914.30
22-May	46	1972	1975	910.10	914.51	911.08	911.41	912.08	912.56	913.66	914.32
23-May	46	1991	1975	910.10	914.66	911.01	911.41	912.10	912.60	913.68	914.47
24-May	46	1972	1975	910.10	914.76	910.97	911.40	912.06	912.65	913.63	914.45
25-May	46	1972	1975	910.08	914.77	910.98	911.38	912.09	912.75	913.53	914.26
26-May	46	1972	1975	910.08	914.66	910.96	911.35	912.08	912.79	913.62	914.04
27-May	46	1972	1975	910.06	914.53	910.96	911.35	912.04	912.77	913.68	913.91
28-May	46	1972	1975	910.05	914.49	911.03	911.38	912.00	912.76	913.55	913.97
29-May	46	1972	1975	910.04	914.63	911.06	911.35	911.99	912.73	913.57	914.04
30-May	46	1972	1975	910.06	915.02	911.02	911.28	912.09	912.64	913.71	914.18
31-May	45	1972	1975	910.10	915.79	910.96	911.26	912.12	912.64	913.76	914.37
1-Jun	46	1972	1975	910.18	916.62	910.94	911.24	912.16	912.63	913.69	914.50

Table 2. Continued

Day	Days used	Max year	Min Year	Min	Max	P10	P25	P50	P75	P90	P95
2-Jun	46	1972	1975	910.40	917.05	910.90	911.26	912.11	912.60	913.68	914.63
3-Jun	46	1972	1976	910.57	917.06	910.89	911.21	912.23	912.54	913.66	914.60
4-Jun	46	1972	1976	910.47	916.84	910.96	911.26	912.24	912.60	913.63	914.46
5-Jun	46	1972	1976	910.39	916.57	910.92	911.27	912.21	912.85	913.59	914.33
6-Jun	46	1972	1976	910.32	916.33	910.91	911.37	912.17	912.96	913.51	914.31
7-Jun	46	1972	1976	910.23	916.15	910.90	911.38	912.17	912.98	913.61	914.24
8-Jun	46	1972	1976	910.15	916.05	910.89	911.38	912.17	912.82	913.70	914.16
9-Jun	46	1972	1976	910.07	916.08	910.88	911.39	912.14	912.68	913.75	914.14
10-Jun	46	1972	1976	910.02	916.24	910.88	911.37	912.17	912.68	913.69	914.24
11-Jun	46	1972	1976	909.96	916.54	910.88	911.35	912.19	912.72	913.66	914.26
12-Jun	46	1972	1976	909.89	916.69	910.89	911.37	912.20	912.76	913.69	914.26
13-Jun	46	1972	1976	909.86	916.51	910.91	911.32	912.19	912.75	913.75	914.34
14-Jun	46	1972	1976	909.85	916.20	910.88	911.27	912.22	912.81	913.81	914.33
15-Jun	46	1972	1976	909.96	915.79	910.90	911.25	912.20	912.84	913.79	914.38
16-Jun	46	1972	1976	910.10	915.45	910.92	911.24	912.16	912.79	913.72	914.58
17-Jun	46	1974	1976	910.29	915.26	910.90	911.30	912.19	912.62	913.64	914.76
18-Jun	46	1974	1973	910.48	915.62	910.95	911.34	912.20	912.60	913.59	914.54
19-Jun	46	1974	1973	910.52	915.74	910.97	911.32	912.17	912.58	913.55	914.31
20-Jun	46	1974	1973	910.58	915.72	910.95	911.31	912.16	912.56	913.52	914.12
21-Jun	46	1974	1973	910.61	915.62	910.97	911.31	912.17	912.50	913.44	913.97
22-Jun	46	1974	1973	910.65	915.46	910.89	911.31	912.15	912.48	913.42	913.86
23-Jun	46	1974	1973	910.66	915.17	910.82	911.30	912.18	912.46	913.43	913.80
24-Jun	46	1974	1978	910.65	914.85	910.79	911.30	912.20	912.46	913.43	913.82
25-Jun	46	1974	1978	910.57	914.44	910.80	911.28	912.13	912.47	913.40	913.88
26-Jun	46	1972	1978	910.49	914.13	910.82	911.27	912.11	912.48	913.35	913.80
27-Jun	46	1972	1978	910.44	914.15	910.79	911.28	912.05	912.50	913.25	913.52
28-Jun	46	1972	1978	910.41	914.14	910.82	911.28	911.92	912.48	913.18	913.32
29-Jun	46	1972	1978	910.44	914.10	910.84	911.27	911.92	912.47	913.12	913.24
30-Jun	46	1972	1978	910.58	914.06	910.87	911.30	911.85	912.48	912.99	913.23
1-Jul	45	1972	1978	910.75	914.01	910.92	911.29	911.85	912.47	912.97	913.20
2-Jul	45	1972	1975	910.77	913.91	910.95	911.30	911.79	912.41	912.90	913.17
3-Jul	45	1972	1975	910.75	913.83	911.00	911.32	911.80	912.44	912.84	913.19
4-Jul	45	1972	1975	910.73	913.74	911.02	911.30	911.81	912.42	912.78	913.17
5-Jul	45	1972	1975	910.70	913.64	911.03	911.32	911.86	912.45	912.77	913.14
6-Jul	45	1972	1975	910.68	913.53	911.05	911.32	911.87	912.45	912.80	913.11
7-Jul	45	1972	1975	910.65	913.44	911.02	911.31	911.88	912.47	912.83	913.10
8-Jul	45	1972	1975	910.64	913.36	911.00	911.31	911.87	912.48	912.84	913.11
9-Jul	45	1972	1975	910.71	913.31	911.03	911.31	911.89	912.46	912.84	913.15
10-Jul	45	1983	1967	910.73	913.25	911.02	911.29	911.87	912.47	912.83	913.14

Table 2. Continued

Day	Days used	Max year	Min Year	Min	Max	P10	P25	P50	P75	P90	P95
11-Jul	45	1983	1967	910.74	913.24	911.00	911.30	911.79	912.48	912.82	913.08
12-Jul	45	1983	1967	910.80	913.24	911.00	911.31	911.69	912.48	912.80	913.05
13-Jul	45	1983	1967	910.88	913.22	911.01	911.32	911.67	912.48	912.76	913.03
14-Jul	45	1983	1967	910.91	913.22	910.98	911.33	911.71	912.44	912.75	912.99
15-Jul	45	1983	1966	910.92	913.20	910.98	911.29	911.72	912.44	912.74	912.97
16-Jul	45	1983	1966	910.86	913.20	911.02	911.29	911.73	912.41	912.73	912.94
17-Jul	45	1983	1966	910.82	913.19	911.04	911.29	911.72	912.39	912.79	912.92
18-Jul	45	1983	1966	910.75	913.17	911.04	911.29	911.68	912.37	912.78	912.99
19-Jul	45	1982	1966	910.76	913.15	911.05	911.26	911.64	912.32	912.78	913.07
20-Jul	45	1982	1966	910.76	913.23	911.07	911.26	911.61	912.29	912.76	913.06
21-Jul	46	1982	1966	910.77	913.19	911.03	911.25	911.53	912.32	912.72	913.06
22-Jul	46	1983	1966	910.81	913.05	911.01	911.28	911.49	912.36	912.71	912.97
23-Jul	46	1992	1966	910.84	912.95	911.00	911.29	911.51	912.36	912.67	912.84
24-Jul	46	1992	1966	910.86	912.90	910.98	911.29	911.48	912.34	912.54	912.74
25-Jul	46	1992	1979	910.84	912.81	910.95	911.29	911.48	912.32	912.47	912.73
26-Jul	46	1972	1979	910.85	912.79	910.95	911.28	911.42	912.29	912.52	912.70
27-Jul	46	1972	1979	910.86	912.78	910.92	911.28	911.41	912.27	912.55	912.66
28-Jul	46	1972	1979	910.88	912.73	910.94	911.26	911.40	912.26	912.52	912.64
29-Jul	46	1972	1979	910.87	912.67	910.95	911.24	911.42	912.23	912.48	912.61
30-Jul	46	1992	1979	910.88	912.66	910.95	911.23	911.43	912.26	912.50	912.59
31-Jul	46	1992	1971	910.90	912.66	910.96	911.25	911.43	912.25	912.48	912.56
1-Aug	46	1992	1971	910.85	912.68	910.96	911.26	911.41	912.23	912.48	912.57
2-Aug	45	1992	1971	910.79	912.70	910.95	911.21	911.43	912.24	912.48	912.60
3-Aug	45	1992	1971	910.73	912.71	910.94	911.27	911.43	912.24	912.45	912.68
4-Aug	46	1982	1971	910.82	912.78	910.95	911.28	911.44	912.25	912.45	912.69
5-Aug	46	1982	1975	910.89	912.81	910.96	911.27	911.45	912.24	912.46	912.68
6-Aug	46	1982	1975	910.85	912.80	910.94	911.28	911.45	912.17	912.46	912.68
7-Aug	46	1982	1975	910.83	912.77	910.94	911.26	911.47	912.17	912.47	912.70
8-Aug	46	1992	1975	910.82	912.76	910.95	911.27	911.48	912.15	912.46	912.70
9-Aug	46	1992	1975	910.81	912.79	910.97	911.26	911.46	912.14	912.47	912.68
10-Aug	46	1992	1975	910.80	912.82	911.03	911.26	911.44	912.10	912.48	912.68
11-Aug	46	1992	1975	910.80	912.84	911.03	911.26	911.44	912.07	912.46	912.67
12-Aug	46	1992	1975	910.78	912.87	911.03	911.30	911.43	912.05	912.47	912.66
13-Aug	46	1992	1975	910.79	912.89	910.99	911.29	911.45	912.06	912.48	912.65
14-Aug	46	1992	1975	910.80	912.82	910.96	911.26	911.47	912.07	912.48	912.65
15-Aug	46	1982	1975	910.82	912.75	911.00	911.24	911.47	912.07	912.47	912.62
16-Aug	46	1982	1980	910.76	912.75	910.99	911.24	911.48	912.01	912.41	912.54
17-Aug	46	1982	1980	910.69	912.75	910.98	911.25	911.45	912.00	912.38	912.49
18-Aug	46	1982	1980	910.66	912.74	910.97	911.24	911.42	912.00	912.40	912.50

Table 2. Continued

Day	Days used	Max year	Min Year	Min	Max	P10	P25	P50	P75	P90	P95
19-Aug	46	1982	1980	910.62	912.63	910.96	911.26	911.41	912.03	912.39	912.52
20-Aug	46	2003	1980	910.66	912.50	910.96	911.29	911.41	912.02	912.38	912.46
21-Aug	46	2003	1974	910.60	912.50	910.95	911.29	911.42	911.99	912.40	912.45
22-Aug	46	1992	1974	910.46	912.50	910.96	911.29	911.40	911.96	912.41	912.48
23-Aug	46	2003	1974	910.36	912.51	910.96	911.25	911.41	911.94	912.42	912.49
24-Aug	46	1992	1974	910.26	912.53	910.96	911.24	911.42	911.93	912.44	912.52
25-Aug	46	1992	1974	910.17	912.55	910.97	911.23	911.41	911.87	912.45	912.52
26-Aug	46	1992	1974	910.09	912.56	910.96	911.21	911.39	911.82	912.43	912.54
27-Aug	46	1982	1974	910.01	912.57	910.97	911.19	911.39	911.84	912.41	912.53
28-Aug	46	1982	1974	909.94	912.59	910.98	911.19	911.37	911.86	912.38	912.51
29-Aug	46	1982	1974	909.88	912.60	910.98	911.18	911.35	911.86	912.35	912.52
30-Aug	46	1982	1974	909.86	912.65	910.97	911.18	911.32	911.86	912.34	912.54
31-Aug	46	1982	1974	909.89	912.69	910.98	911.18	911.33	911.82	912.34	912.56
1-Sep	46	1982	1974	909.93	912.71	910.94	911.18	911.34	911.81	912.36	912.58
2-Sep	46	1982	1974	909.99	912.72	910.95	911.18	911.31	911.81	912.37	912.57
3-Sep	46	1982	1974	910.04	912.73	910.97	911.20	911.33	911.79	912.39	912.57
4-Sep	46	1982	1974	910.08	912.75	910.99	911.21	911.33	911.77	912.41	912.55
5-Sep	46	1982	1974	910.11	912.74	910.96	911.21	911.32	911.76	912.40	912.52
6-Sep	46	1982	1974	910.15	912.73	910.98	911.19	911.33	911.77	912.38	912.51
7-Sep	46	1982	1974	910.31	912.71	911.00	911.20	911.32	911.78	912.35	912.50
8-Sep	46	1982	1974	910.47	912.69	910.99	911.18	911.30	911.79	912.34	912.49
9-Sep	46	1982	1974	910.62	912.65	910.99	911.17	911.33	911.66	912.34	912.48
10-Sep	46	1982	1974	910.72	912.63	911.01	911.18	911.33	911.54	912.35	912.46
11-Sep	46	1982	1974	910.75	912.61	910.99	911.19	911.34	911.52	912.33	912.45
12-Sep	46	1982	1974	910.75	912.62	910.93	911.17	911.33	911.49	912.30	912.43
13-Sep	46	1982	1974	910.75	912.62	910.86	911.15	911.32	911.48	912.29	912.38
14-Sep	46	1982	1972	910.73	912.60	910.84	911.12	911.30	911.47	912.25	912.36
15-Sep	46	1982	1972	910.61	912.59	910.84	911.09	911.30	911.46	912.23	912.34
16-Sep	46	1982	1972	910.52	912.54	910.85	911.09	911.28	911.47	912.19	912.31
17-Sep	46	1982	1972	910.42	912.39	910.85	911.06	911.29	911.46	912.18	912.30
18-Sep	46	2001	1972	910.33	912.29	910.86	911.04	911.30	911.46	912.13	912.25
19-Sep	46	2001	1972	910.39	912.27	910.85	911.03	911.30	911.47	912.06	912.26
20-Sep	46	2009	1972	910.46	912.30	910.84	911.02	911.30	911.46	912.00	912.23
21-Sep	46	2009	1981	910.48	912.32	910.84	911.01	911.30	911.44	911.97	912.22
22-Sep	46	2009	1981	910.49	912.33	910.84	911.01	911.29	911.44	911.95	912.20
23-Sep	46	2009	1981	910.50	912.35	910.86	911.01	911.26	911.43	911.97	912.20
24-Sep	46	2009	1981	910.51	912.36	910.87	911.04	911.25	911.43	911.99	912.22
25-Sep	46	2009	1981	910.52	912.35	910.89	911.05	911.26	911.40	912.00	912.23
26-Sep	46	2009	1981	910.52	912.35	910.92	911.05	911.26	911.39	911.98	912.26

Table 2. Continued

Day	Days used	Max year	Min Year	Min	Max	P10	P25	P50	P75	P90	P95
27-Sep	46	2001	1981	910.53	912.34	910.93	911.03	911.24	911.40	911.94	912.28
28-Sep	46	2001	1981	910.54	912.36	910.95	911.06	911.26	911.40	911.91	912.25
29-Sep	46	2001	1981	910.57	912.34	910.96	911.07	911.26	911.41	911.87	912.23
30-Sep	46	2001	1981	910.57	912.33	910.93	911.03	911.26	911.41	911.84	912.22
1-Oct	46	2002	1982	910.58	912.33	910.92	911.06	911.27	911.39	911.82	912.18
2-Oct	46	2002	1982	910.60	912.29	910.91	911.05	911.29	911.40	911.78	912.17
3-Oct	46	2010	1982	910.61	912.27	910.89	911.03	911.29	911.37	911.75	912.14
4-Oct	46	2010	1982	910.62	912.27	910.88	911.02	911.29	911.38	911.73	912.09
5-Oct	46	2010	1982	910.61	912.24	910.87	911.04	911.28	911.38	911.70	912.04
6-Oct	46	2010	1983	910.63	912.23	910.87	911.06	911.26	911.37	911.67	911.99
7-Oct	46	2010	1983	910.62	912.21	910.87	911.09	911.24	911.37	911.65	911.95
8-Oct	46	2010	1983	910.61	912.15	910.84	911.11	911.25	911.37	911.63	911.91
9-Oct	46	2010	1983	910.59	912.09	910.84	911.06	911.25	911.34	911.60	911.87
10-Oct	46	2010	1983	910.58	912.00	910.84	911.06	911.26	911.35	911.57	911.83
11-Oct	45	2010	1983	910.57	911.94	910.78	911.03	911.23	911.36	911.49	911.75
12-Oct	45	2010	1983	910.57	911.87	910.74	910.99	911.22	911.36	911.48	911.73
13-Oct	45	2010	1976	910.53	911.82	910.72	911.00	911.22	911.36	911.44	911.70
14-Oct	45	2010	1976	910.39	911.79	910.71	911.00	911.22	911.33	911.42	911.69
15-Oct	45	1978	1976	910.27	911.74	910.70	910.99	911.23	911.33	911.42	911.66
16-Oct	45	1978	1976	910.17	911.72	910.67	910.99	911.24	911.33	911.43	911.62
17-Oct	46	1978	1976	910.17	911.70	910.63	910.97	911.23	911.33	911.44	911.62
18-Oct	46	1978	1976	910.18	911.70	910.60	910.96	911.22	911.33	911.43	911.59
19-Oct	46	1978	1976	910.19	911.71	910.59	910.93	911.21	911.34	911.43	911.57
20-Oct	46	1978	1976	910.22	911.71	910.55	910.91	911.22	911.34	911.44	911.55
21-Oct	46	1978	1976	910.27	911.70	910.51	910.91	911.21	911.34	911.44	911.52
22-Oct	46	1978	1976	910.30	911.68	910.47	910.91	911.20	911.33	911.45	911.50
23-Oct	46	1978	1982	910.31	911.66	910.45	910.91	911.20	911.33	911.44	911.53
24-Oct	46	1978	1982	910.27	911.65	910.45	910.91	911.18	911.34	911.44	911.55
25-Oct	46	1978	1982	910.23	911.63	910.43	910.90	911.16	911.33	911.45	911.56
26-Oct	46	1978	1982	910.19	911.63	910.42	910.88	911.15	911.33	911.47	911.56
27-Oct	46	1978	1982	910.17	911.62	910.42	910.84	911.15	911.31	911.44	911.55
28-Oct	46	1969	1982	910.18	911.61	910.42	910.81	911.17	911.29	911.41	911.55
29-Oct	46	1978	1982	910.20	911.63	910.43	910.78	911.15	911.30	911.41	911.55
30-Oct	46	1978	1982	910.21	911.64	910.44	910.74	911.15	911.28	911.42	911.56
31-Oct	46	1978	1982	910.19	911.64	910.40	910.74	911.15	911.29	911.41	911.55
1-Nov	46	1978	1982	910.17	911.61	910.36	910.73	911.11	911.26	911.40	911.54
2-Nov	46	1978	1982	910.15	911.59	910.31	910.68	911.08	911.24	911.38	911.52
3-Nov	46	1969	1976	910.05	911.59	910.27	910.69	911.09	911.23	911.38	911.50
4-Nov	46	1969	1976	909.97	911.58	910.28	910.69	911.09	911.23	911.37	911.46

Table 2. Continued

Day	Days used	Max year	Min Year	Min	Max	P10	P25	P50	P75	P90	P95
5-Nov	46	1969	1976	909.90	911.58	910.24	910.70	911.06	911.20	911.38	911.44
6-Nov	46	1969	1976	909.82	911.59	910.21	910.66	911.03	911.19	911.36	911.43
7-Nov	46	1969	1976	909.75	911.59	910.19	910.66	910.99	911.15	911.36	911.41
8-Nov	46	1969	1976	909.67	911.63	910.15	910.62	910.97	911.14	911.35	911.40
9-Nov	46	1969	1976	909.62	911.64	910.11	910.57	910.95	911.15	911.34	911.43
10-Nov	46	1969	1976	909.56	911.61	910.09	910.54	910.90	911.14	911.33	911.44
11-Nov	46	1969	1976	909.49	911.61	910.10	910.50	910.85	911.11	911.33	911.40
12-Nov	46	1969	1976	909.42	911.60	910.07	910.46	910.84	911.08	911.34	911.42
13-Nov	46	1969	1976	909.37	911.60	910.06	910.44	910.83	911.06	911.35	911.41
14-Nov	46	1969	1976	909.35	911.58	910.06	910.41	910.80	911.04	911.35	911.41
15-Nov	46	1969	1976	909.35	911.57	910.06	910.41	910.75	911.00	911.35	911.41
16-Nov	46	1969	1976	909.39	911.56	910.04	910.42	910.75	910.99	911.35	911.42
17-Nov	46	1969	1976	909.41	911.54	909.96	910.39	910.75	910.99	911.34	911.41
18-Nov	46	1969	1976	909.44	911.48	909.90	910.39	910.75	910.99	911.34	911.39
19-Nov	46	1969	1976	909.48	911.37	909.86	910.33	910.74	910.98	911.33	911.37
20-Nov	46	1977	1976	909.56	911.35	909.82	910.30	910.78	911.00	911.32	911.34
21-Nov	46	1979	1976	909.62	911.36	909.79	910.22	910.75	910.99	911.30	911.33
22-Nov	46	1979	2004	909.61	911.38	909.78	910.15	910.73	910.96	911.29	911.33
23-Nov	46	1979	2004	909.59	911.41	909.77	910.10	910.68	910.96	911.27	911.33
24-Nov	46	1979	2004	909.58	911.44	909.76	910.09	910.63	910.97	911.25	911.33
25-Nov	46	1979	2010	909.59	911.48	909.78	910.09	910.62	910.96	911.26	911.35
26-Nov	46	1979	2010	909.58	911.51	909.74	910.08	910.61	910.96	911.24	911.37
27-Nov	46	1979	2010	909.58	911.52	909.70	910.08	910.58	910.97	911.24	911.37
28-Nov	46	1979	2010	909.56	911.57	909.66	910.05	910.56	910.98	911.26	911.40
29-Nov	46	1979	2010	909.54	911.62	909.63	910.00	910.53	911.00	911.27	911.39
30-Nov	46	1979	2010	909.53	911.68	909.61	909.99	910.51	911.00	911.26	911.39
1-Dec	46	1979	2010	909.52	911.73	909.60	909.97	910.51	910.99	911.21	911.42
2-Dec	46	1979	2010	909.51	911.65	909.59	909.97	910.51	911.00	911.20	911.42
3-Dec	46	1979	2010	909.50	911.53	909.59	909.96	910.51	910.99	911.20	911.45
4-Dec	46	1988	2010	909.52	911.53	909.58	909.96	910.47	911.00	911.19	911.38
5-Dec	46	1988	2011	909.52	911.54	909.59	909.95	910.46	911.00	911.18	911.29
6-Dec	46	1988	2011	909.51	911.61	909.62	909.95	910.46	910.97	911.15	911.29
7-Dec	46	1988	2010	909.51	911.65	909.62	909.94	910.46	910.93	911.14	911.26
8-Dec	46	1988	2010	909.51	911.63	909.62	909.94	910.46	910.94	911.14	911.25
9-Dec	46	1988	2010	909.51	911.63	909.61	909.95	910.45	910.89	911.14	911.25
10-Dec	46	1988	2010	909.51	911.63	909.60	909.94	910.45	910.82	911.14	911.25
11-Dec	46	1988	2010	909.53	911.56	909.59	909.91	910.44	910.77	911.16	911.23
12-Dec	46	1988	2012	909.53	911.46	909.59	909.90	910.40	910.75	911.17	911.24
13-Dec	46	1988	2012	909.51	911.32	909.57	909.89	910.39	910.75	911.16	911.23

Table 2. Continued

Day	Days used	Max year	Min Year	Min	Max	P10	P25	P50	P75	P90	P95
14-Dec	46	1989	1976	909.46	911.25	909.57	909.88	910.38	910.74	911.11	911.21
15-Dec	46	1990	1976	909.42	911.22	909.58	909.86	910.37	910.75	911.03	911.18
16-Dec	46	1989	1976	909.38	911.22	909.56	909.84	910.38	910.75	911.02	911.16
17-Dec	46	1989	1976	909.35	911.21	909.57	909.83	910.38	910.75	911.02	911.15
18-Dec	46	1989	1976	909.32	911.21	909.57	909.84	910.42	910.70	911.02	911.14
19-Dec	46	1989	1976	909.31	911.23	909.57	909.81	910.43	910.71	910.99	911.13
20-Dec	46	1989	1976	909.30	911.23	909.56	909.78	910.41	910.71	910.98	911.12
21-Dec	46	1989	1976	909.30	911.24	909.56	909.77	910.38	910.71	910.96	911.11
22-Dec	46	1989	1976	909.31	911.22	909.56	909.77	910.35	910.67	910.93	911.10
23-Dec	46	1989	1976	909.32	911.21	909.55	909.74	910.35	910.65	910.97	911.10
24-Dec	46	1969	1976	909.35	911.21	909.54	909.70	910.35	910.66	910.96	911.19
25-Dec	46	1969	1976	909.35	911.38	909.53	909.68	910.34	910.70	910.95	911.19
26-Dec	46	1969	1976	909.36	911.53	909.54	909.68	910.33	910.69	910.95	911.16
27-Dec	46	1969	1976	909.37	911.70	909.55	909.69	910.31	910.66	910.94	911.15
28-Dec	46	1969	1976	909.38	911.92	909.55	909.70	910.29	910.63	910.95	911.15
29-Dec	46	1969	1976	909.38	912.07	909.55	909.67	910.25	910.60	910.94	911.14
30-Dec	46	1969	1976	909.49	912.16	909.54	909.67	910.22	910.60	910.94	911.14
31-Dec	46	1969	2009	909.50	912.23	909.56	909.67	910.19	910.64	910.94	911.15